OMRON
AUTOMATION & SAFETY

Machine & Process Safeguarding

Solution Selection Guide

2015-2016





- » Expert Area
- » Light Curtains
- » Laser Scanners
- » Programmable Safety Systems
- » Mats and Edges
- » Door Switches
- » Emergency Stop Devices
- » Switches and Operator Controls
- » Monitoring Relays
- » Safeguard Integration Services

SYSMAC
STI SAFETY, TECHNOLOGY & INNOVATION

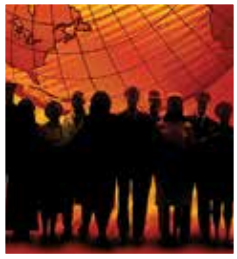
Making Safety Simple—Omron's Concept for the Future

Today, forward-thinking manufacturers clearly realize the new role of increased safety on the factory floor.

» Recently adopted international safety standards have shifted the way systems are evaluated.

» Safety is a corporate responsibility, not an obstruction to productivity.

» Safety is essential to increased productivityand profitability.





"The modern user of safety products demands a new vision."

Poised at the leading-edge of safety solutions worldwide, Omron's STI safety products focus on making safety work. We are aware of the many demands of automation safeguarding. Consequently, our automation safety products meet or exceed local and international safety standards.

Omron is committed to providing safeguarding solutions that meet your needs for safety and productivity. We design and engineer our products by listening to and working closely with our customers and authorized distributors. We also provide you with:

» Experienced assistance

» Expert guidance in application, integration and maintenance

» World-class support through Omron's global network of 250 sales locations in 65 countries

Welcome to OMRON Automation & Safety

Solutions from Components to Consulting for Enhanced Worker Safety



F3SJ-A

1 Safety Light Curtains

Models are simple to install, and available in a wide selection of protected heights and resolutions.

NEW



F3SJ-B



F3SG-RA



F3SJ-E



MS4800



A4EG

8 Enabling Switches

Provides the additional protection needed during set-up, programming and servicing of robotic and automatic equipment.

- Has distinct clicks for three easily discernible positions

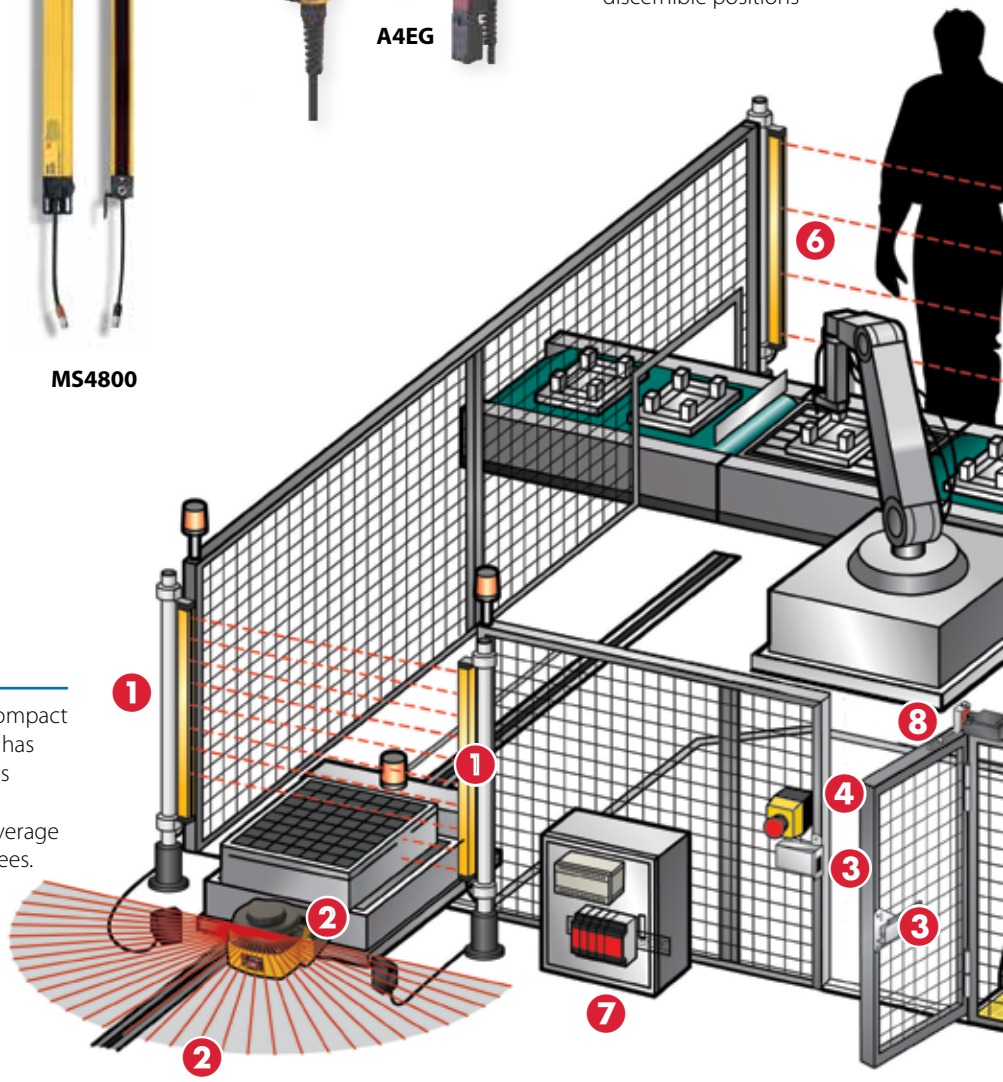


OS32C

2 Safety Laser Scanners

Our OS32C is a very compact safety laser scanner. It has 70 zone configurations for complex guarding parameters. Safety coverage up to 4 m at 270 degrees.

Industry First!
EtherNet/IP capable of status and measurement data reporting.



3 Safety Switches & Operator Controls

Tamper resistant switches enhance mechanical guarding methods.

- Guardlocking switches
- Hinge pin switches
- Non-contact switches
- Limit switches
- Tongue switches
- Explosion-proof versions



7 Safety Programmable Safety Systems

7 Safety Monitoring Relays

The NX-S series of controller offers Safety over EtherCAT, our first to offer integrated safety functionality into the Sysmac platform, suitable for mid to large sized applications; now with stand-alone capabilities.

The G9SP stand-alone programmable safety controller for mid-sized applications supports direct connection to safety mats and non-contact switches.
The NE1A DeviceNet safety network controller is well-suited for large complex applications, while safety monitoring relays are ideal for ensuring control reliability in smaller applications.

NEW



NX-S



NE1A

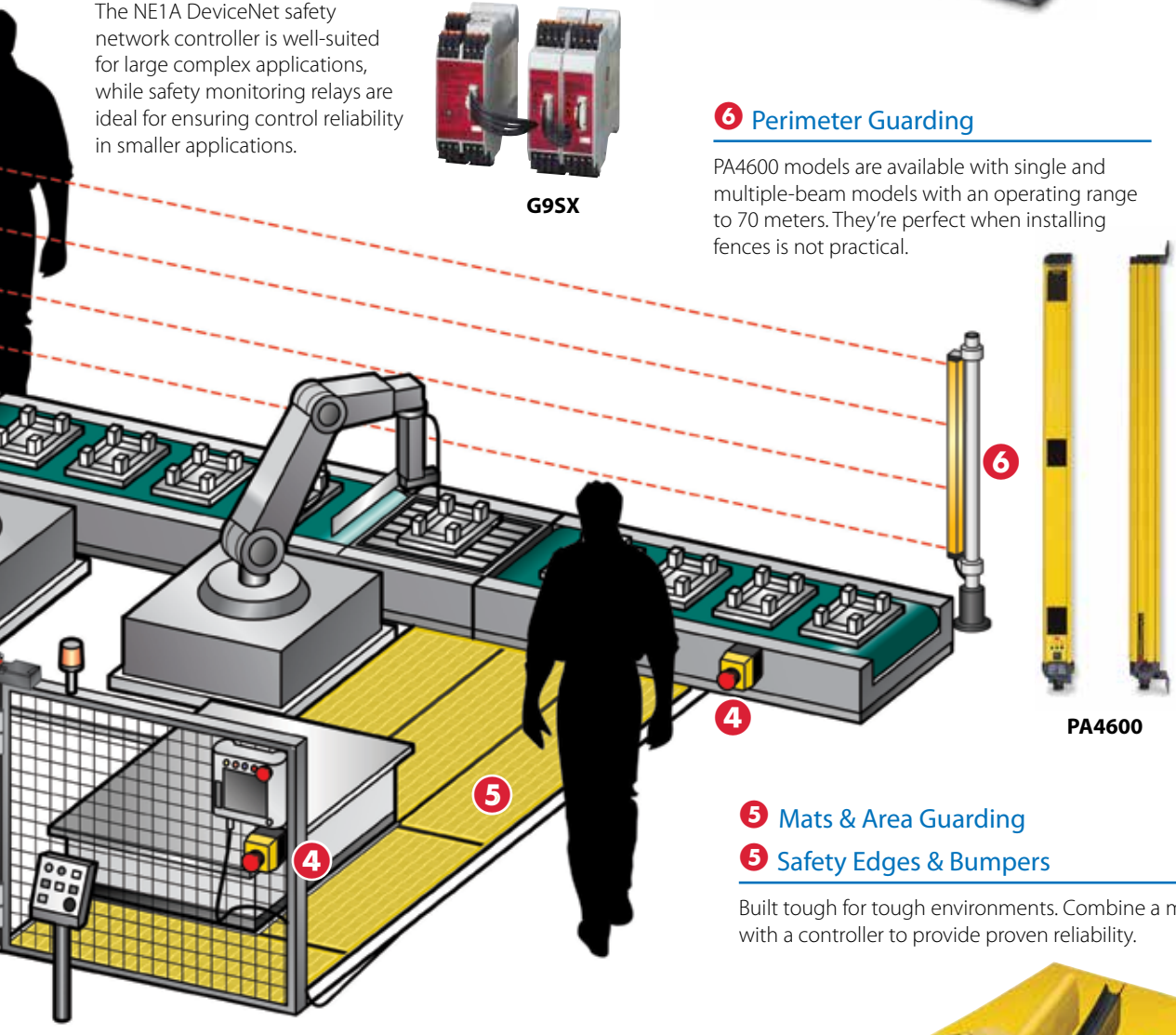


G9SP

G9SX

6 Perimeter Guarding

PA4600 models are available with single and multiple-beam models with an operating range to 70 meters. They're perfect when installing fences is not practical.



PA4600

5 Mats & Area Guarding

5 Safety Edges & Bumpers

Built tough for tough environments. Combine a mat with a controller to provide proven reliability.







4 Emergency Stop Devices

- Enclosed and panel-mounted models available with key-operated reset.
- Combination rope and push button actuated emergency stop switches.
- Heavy duty housing offering rope spans to 200 meters

NEW PRODUCTS!

What's new and hot this year? Check out our latest additions!

Safety Light Curtains

F3SG-RA

Our newest light curtain brings a new standard, offering both robustness in severe environments and global reliability

Omron's new F3SG-4RA global light curtain advanced series features a rugged housing with optical synchronization and advanced safety functions such as muting, blanking and reduced resolution to solve every application. This new series also includes productivity improvements with easy mount brackets, SmartClick™ cables and smart phone trouble-shooting guide and more indicators to expedite installation and reduce maintenance downtime.



Programmable Safety Systems

NX-S

Now with Stand-Alone Safety System Capabilities

The NX-S allows connection of up to 32 safety I/O units, standard digital inputs and outputs can be directly mapped into the NX-SL3300 safety CPU according to the project needs. Monitor with EtherNet/IP.



Contents

Section	Products
A	Expert Area
B	Safety Light Curtains
C	Safety Laser Scanners
D	Programmable Safety Systems
E	Safety Mats & Edges
F	Safety Door Switches
G	Emergency Stop Devices
H	Safety Switches & Operator Controls
I	Safety Monitoring Relays
J	Safeguard Integration Services

The applications described in this catalog are for informational and instructional purposes only, and may not represent actual usage. This publication has been carefully checked for accuracy and is thought to be fully consistent with the product it describes. However, OMRON Automation and Safety does not assume liability for the contents of this publication or the use of any products described herein. OMRON Automation and Safety reserves the right to make changes to the products and/or documentation without further notification.

© 2015 by OMRON Electronics LLC.
All rights reserved.

Omron conforms to ISO 9001:2008 requirements, as certified by TUV America Inc.

The OMRON Automation and Safety Difference



Customer Focused for Continued Success

Adding value beyond the basics means that we are committed to our customers. Our knowledge and experience adds value. We are focused on their needs. OMRON Automation and Safety provides innovative engineering and system solutions to our customer's evolving application problems. We provide technical assistance in the field, and by phone.

Instant Information — Call us or go to www.omron247.com

OMRON Automation and Safety is easy to reach, technical support is easy to contact, and critical information accessible 24 hours a day via our website. Support engineers are also available to answer technical questions and provide application assistance. For a complete list of support phone numbers, visit www.omron247.com.



Find Information Fast — Quick Link Shortens Your Search

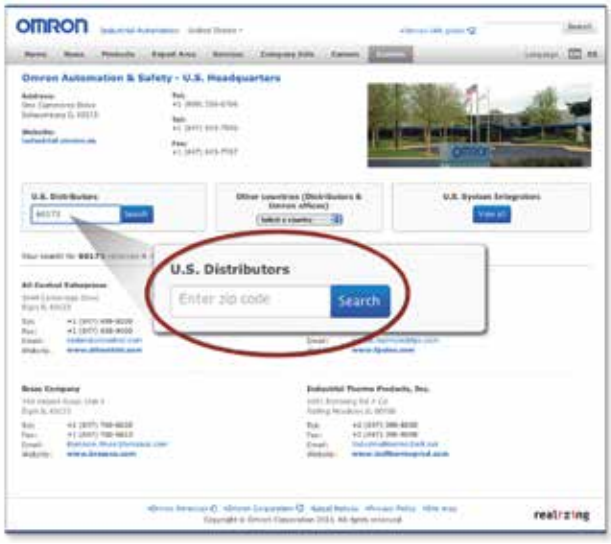
Quick Links are unique codes assigned to Omron products listed in this catalog. Enter these codes in the Search box on omron247.com to access detailed information on products in this catalog:

- Datasheets
- Manuals
- Brochures
- CAD, EDS and ESI Files
- Application Examples
- ... and more!



Finding Automation & Safety Expertise

To find an authorized Omron Automation and Safety Distributor in your area, simply use our Distributor Lookup on www.omron247.com.



Global Solutions with Local Support

Keeping You Current on Safety Requirements

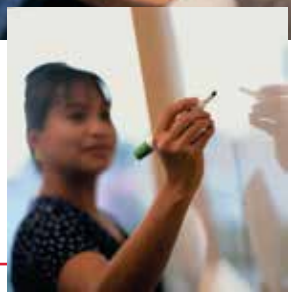
In today's marketplace, it is important to keep our customers up-to-date on the latest technology advances and safety trends. Omron offers full-day seminars, on-site workshops, and Safety & Sandwiches Sessions. These training sessions provide you with theory, hands-on demonstrations, and examples of real applications that may be helpful in determining your own safety needs.



Authorized Distributors: Uniquely Qualified to Offer Solutions

We have found that the best way to respond quickly and effectively to our customers' needs is through our extensive network of distributors. Through this network, we are able to offer immediate local service and support.

To be a distributor, an organization must commit to a set of stringent requirements, including factory training of sales engineers. Sales engineers continue to receive training throughout the year through in-house seminars and on-line classes. This effort guarantees that when you have a safety problem, the sales engineer you work with will have the knowledge to help analyze your situation, aid you in selecting products, and support you through installation. This commitment to training and safety expertise ensures the best solution for your application, from start to finish.



Unbiased, Single-Source Solutions

Everything you need for a complete safety system is available through one source — OMRON Automation and Safety. Supplying an extensive array of safety solutions guarantees that we will give you an unbiased recommendation for what will work best in your particular situation. Our wide product line means we don't have to force your application to fit our products. OMRON Automation and Safety has the correct product for the job.



Globally Approved Products

The majority of our products have been agency approved to a variety of international standards including UL, CSA, CE, DIN, IEC, and EN. In the U.S., our safety products meet ANSI and OSHA standards.

Services Offered* and What to Expect

Many companies appreciate the value of outsourcing special services such as engineering, purchasing and maintenance to partners who specialize in these areas. Omron is uniquely equipped to be your partner when it comes to machine safety compliance.

We provide all the necessary machine safeguarding services, including machine guarding assessment, risk level identification, risk reduction planning, documentation, review of safety system and circuit designs, and complete safety system integration.

Turn-key Safety Integration

OMRON Automation and Safety specializes in offering safeguarding systems for industrial fabrication equipment, manufacturing systems, and robot cells compliant with all applicable North American safety standards. Our service includes an on-site project manager to monitor quality and ensure that the safety measures are installed properly. Expert installers fabricate custom guards on-site and our specially trained electricians ensure that control reliability requirements of safety circuitry are met.

Safeguarding Assessment/ Risk Level Identification/ Risk Reduction Planning

OMRON Automation and Safety offers detailed risk level identification including risk reduction recommendations to bring your equipment into compliance with applicable OSHA Regulations and/ or ANSI, RIA, NFPA, NEC, CSA, EN, IEC, and ISO standards. We inspect perimeter and point of operation guarding in addition to power isolation, including pneumatic, hydraulic and electrical lockout. Our detailed report provides you with the initial risk level, written recommendations for compliance, a plan view drawing of the equipment with recommended safeguards, the estimated risk level achieved after all recommended safeguards are properly installed, photos and an estimate to properly safeguard the machine or process.



*Machine Safeguarding Services are available in North America, Europe, South America and South East Asia.

Safety Project Engineering/Design

After complete risk level identification, any gaps in compliance need to be filled. If you prefer, we can engineer and design the required safeguards and provide you with the materials and components necessary to complete the project yourself. Our engineers will design control reliable circuitry as required and custom fabricate guards to meet your needs.

Safety Standards Writing

Let us help you create or improve your corporate safety standard. Our active participation on OSHA, ANSI, and RIA standards writing committees provides us with a wealth of information to share. We can write your standard for you or review and edit your existing standards for compliance with the most current regulations and standards.

Machine Safety Seminars

OMRON Automation and Safety offers on and off-site training. The seminars vary from half-day to 2-day sessions and may include topics such as:

- Risk Level Identification/Risk Reduction Process
- Introduction to Safeguarding Technologies
- Control Reliability (circuit requirements)
- Requirements for Barrier Guards
- Stop Time and Safety Distance Measurement
- Stop/E-Stop/Safety Stop Summary
- Lockout/Tagout & Alternative Methods to Control Hazardous Energy
- General Requirements for Machine Tools

These seminars are targeted for EH&S Managers, Safety Personnel, Single Point Accountable Person(s) for Machine Safeguarding, and Safety Engineers.

Justifying the Cost of Safeguarding Equipment

Machinery safeguarding represents one of the best investments on the plant floor. For example, in a study conducted by the Liberty Mutual Group for the US, 61 percent of executives say they save $3 for every dollar invested in safety equipment and programs. This is just one example of many worldwide studies that show the importance of investing in machinery safety.

No one discounts the impact that an accident has on plant operations. However, the cost of an accident can be staggering. In addition to the emotional cost to employees and managers, the direct and indirect costs of an accident accelerate quickly. Direct medical expenses and workers' compensation benefits are just the tip of the iceberg. The indirect costs of lost production, OSHA fines, replacing damaged goods and machinery, and paying higher workers' compensation premiums can represent a larger portion of the total cost of an accident.

The same survey of executives indicates that executives figure to spend $3 to $5 of indirect costs for every dollar of direct costs of an accident. For example, an accident with direct costs of $10,000 has additional indirect costs of $30,000 to $50,000. The impact of just this one accident becomes even more significant when a company realizes that the bulk of these costs are not covered by insurance.

OSHA offers a software program, $AFETY PAYS, as part of its eTools and Electronic Products for Compliance Assistance. This interactive package helps employers determine the potential impact of occupational injuries by estimating both direct and indirect costs.

A user supplies information about company profit margins, and the program calculates the additional sales needed to cover the cost of an injury. The program uses real insurance company claim data and an expert software system. It can be found on the OSHA web site at: http://www.osha.gov/dcsp/smallbusiness/safetypays/estimator.html.



Perimeter guarding system to guard aluminum coil slitting line.

Why You Should Partner with Omron

Because..

- The expertise required in all phases of the safeguarding process is not a core competency of most manufacturers or maintenance personnel.
- EH&S personnel have to be involved with every area of Environmental, Health & Safety. They are too busy to get involved with required details of guarding systems and safety interfaces.
- It needs to get done right the first time.
- We have an established history of providing companies with safe work environments.
- Our employees stay up-to-date with industry-related trends by participating with and contributing to standards committees.
- Our employees are members of various industry trade organizations.

Peace of Mind...

- Knowing that your machines or process lines are safeguarded correctly to the current standards.
- With 100% compliance – not 90% or less.
- Having documented risk level identification and risk reduction strategy.
- Knowing machine operators are trained on the safety systems installed.
- By saving money because it only needs to be done once.

Our Wide Selection Guarantees You'll Get Exactly What You Need

Safety Light Curtains



Powerful Solutions for Today's Tough Automation Guarding Obstacles

OMRON Automation and Safety provides safety light curtains to solve your optical guarding needs. From compact models designed for machine locations where space is tight, to larger, robust light curtains powerful enough to guard large perimeters. Omron offers you a choice, because when it comes to automation safeguarding, one size does not fit all.

NEW

■ F3SG-RA

Our newest light curtain brings a new standard, offering both robustness in severe environments and global reliability

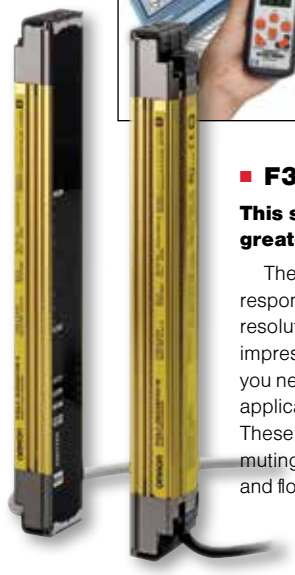
Omron's new F3SG-4RA global light curtain advanced series features a rugged housing with optical synchronization and advanced safety functions such as muting, blanking and reduced resolution to solve every application. This new series also includes productivity improvements with easy mount brackets, SmartClick™ cables and smart phone trouble-shooting guide and more indicators to expedite installation and reduce maintenance downtime.



From tight spaces to perimeter guarding,
when it comes to machine safeguarding,
Omron knows that ...

One size
DOES NOT fit all.





■ F3SJ-A

This small profile, safety light curtain offers the greatest number of possible configurations.

The F3SJ-A safety light curtain combines fast response time with 14, 20, 25, 30 or 55 mm object resolutions. The protected heights of the F3SJ-A are impressive, and Omron allows you to buy just what you need. The F3SJ-A is easy to use for your basic applications and feature rich for the more advanced. These features include a warning zone function, partial muting and position detection muting in addition to fixed and floating blanking.

■ F3SJ-E and F3SJ-B

The "EASY" and "BASIC" type light curtains are ideal for easy, simple and affordable protection.

The F3SJ-E "EASY type" light curtain is recommended for those who need simple and affordable hand protection.

The F3SJ-B "BASIC" type light curtain offers simple hand protection, series connection and muting functions.



MS4800 Series

The MS4800 light curtain family is an all-purpose light curtain available in three distinct versions.

These versions are identified as the Advanced (MS4800A), the Basic (MS4800B) and the Standard (MS4800S). All versions can be cascaded, are available in resolutions of 14, 20, 30 and 40 mm, and have the Omron patented Individual Beam Indicators. Just another way we offer the right solution for your application.

"Two-Box" Solution

The F3SJ, MS4800, and PA4600 are several examples of a "two-box" safety light curtain. Safety output connections to these models are all made at the receiver and a separate control box is not required.





PA4600

Our perimeter guarding devices are designed to meet your integration needs. With a wide choice of operating ranges, we're sure to have the right beam configuration to fit your application.

Omron offers the PA4600 series in single and multiple safety beam configurations. The PA4600 may be configured with up to six beams, meeting the ANSI/RIA R15.06-1999 (R2009) and EN999:1998 optical configuration requirements.

Area Guarding and Detection

OS32C Safety Laser Scanner

The Compact OS32C Safety Laser Scanner Now with EtherNet/IP Connectivity for Status and Measurement Data Reporting

The OS32C-DM safety laser scanner is the industry's first to feature Ethernet/IP communications, capable of reporting both status and measurement data. Additionally, its class-leading small size; Individual Sector Indicators; light weight and low power consumption; two-hundred seventy degree detection area; and up to seventy sets of safety and warning zone combinations provide the versatility to tackle many guarding situations.

Industry Best!
Flexible zone configurations

Industry First!
Integrated Monitoring and Analysis via Ethernet

EtherNet/IP™



Lowest Profile

Small Size **104.5 mm**
Compact and versatile safety laser scanner

Lightweight **1.3 kg**
Lightweight body for easy handling and installation

Low Power Consumption **5 W**
Low power consumption reduces battery load on AGVs (3.75 W in standby mode)

4 m Safety Range Models!



270° detection angle

Easy handling and installation

SIMPLE and **VERSATILE**
to solve many applications.

Power consumption savings up to 50%

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Low profile allows installation in small spaces

For collision avoidance of AGVs (Automated Guided Vehicles)

For intrusion detection through an entrance

For presence detection within a machine's hazardous area

Collision Avoidance

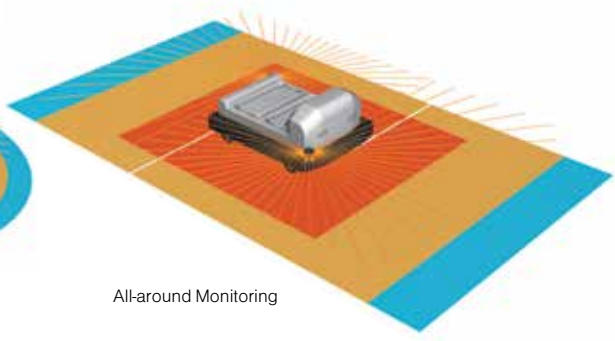
Small, light & compact body provides for easy installation on an AGV.

Low power consumption (5 W reduces battery load on the AGV (3.75 W in standby mode)

Up to 70 zone set combinations support complex AGV tracks.



Front/Rear Monitoring



All-around Monitoring

Intrusion Detection

Reference Boundary Monitoring function supports intrusion detection without physically blocking the entrance.

Supports various operation patterns by switching zone sets.



Intrusion detection with vertical installation

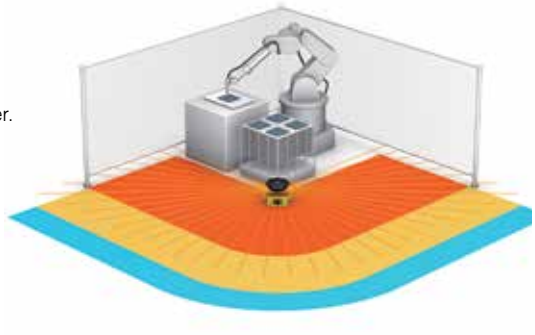


Safety zone can be selected

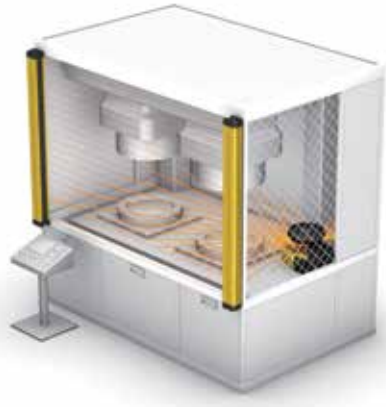
Presence Detection

Compact body allows for use inside the machine.

Detection angle of 270° provides coverage of two sides with one scanner.



Presence detection of 270°



Guarding inside the machine

Area Guarding and Detection

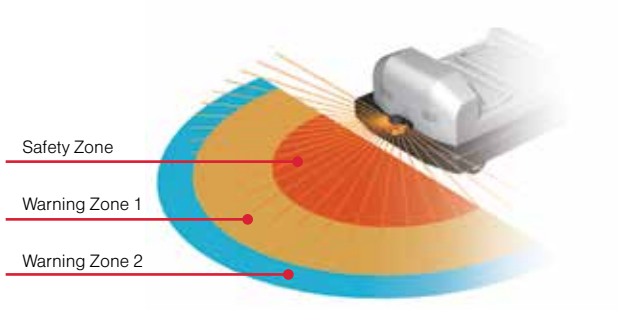
OS32C Safety Laser Scanner (continued)

Convenient and Easy-to-Use Functions

Industry Best!

Flexible zone configurations

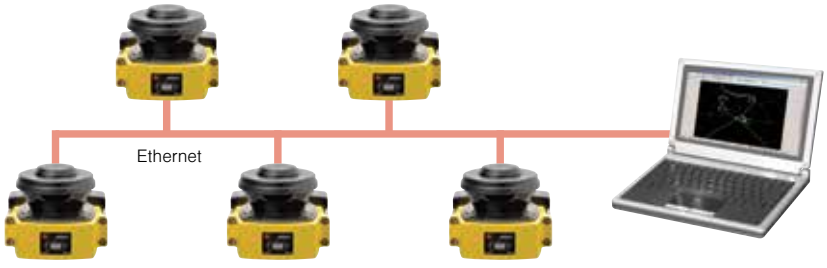
For complex AGV applications, up to 70 combinations can be set – each with one safety zone and two warning zones. The two warning zones can be set to support various purposes such as warning sound and speed control.



Industry First!

Integrated monitoring and analysis via Ethernet

Industry's first Ethernet-compliant Safety Laser Scanner allows the user to check operating state and analyze the cause of an emergency stop via LAN even in large-scale applications using multiple scanners.



Simplified wiring

Omron's innovative I/O method requires fewer inputs when configuring multiple zones. Only 4 inputs are required to select from 6 zone sets. If all 8 inputs are used, up to 70 zone sets are available.

Response time can be set from 80 ms to 680 ms

Response time adjustment can filter out erroneous detections (machine stoppage) caused by pollutants in the environment.



Individual sector indicators*
*US patent No.: US 6, 753, 776



Status Diagnostic Display:
Status/Error Codes, Run, Stop, Interlock and Warning Output Indicators

Operating state can be determined at a glance

Eight sector indicators show the direction of intrusion. Front display shows operating state and error codes.

Replaceable sensor, no reprogramming needed

No reprogramming needed, the configuration is stored in the I/O block. Replacing a damaged sensor is fast and easy.



Cable access options

To tailor the OS32C to your installation, eight options are available for the location of the power and ethernet connections.

Model	Range (m)	EIP & Measurement Data	Cable Access
OS32C-BP	3	No	Back
OS32C-SP1	3	No	Left side
OS32C-BP-DM	3	Yes	Back
OS32C-SP1-DM	3	Yes	Left side
OS32C-BP-4M	4	No	Back
OS32C-SP1-4M	4	No	Left side
OS32C-BP-DM-4M	4	Yes	Back
OS32C-SP1-DM-4M	4	Yes	Left side

These can be selected according to the needs of AGV or facilities design.



OS32C with cable access on the back (OS32C-BP)

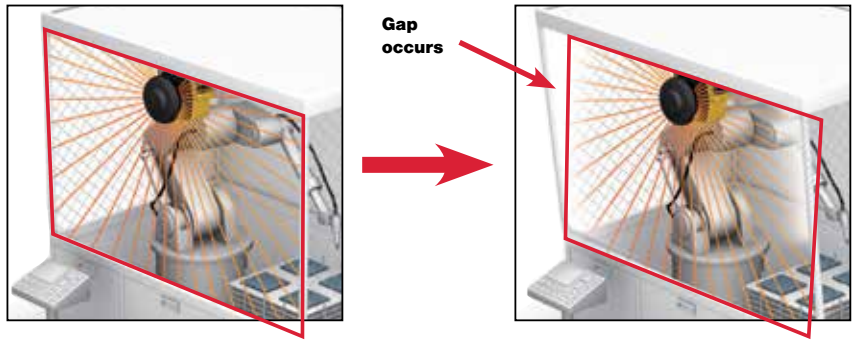


OS32C with cable access on the left side (OS32C-SP1)

Reference boundary monitoring function

The OS32C constantly monitors reference points and turns OFF the safety outputs when a shift in its position is detected.

(Per international standard IEC 61496-3, area scanners used in applications where the angle of approach exceeds ±30° with respect to the detection plane, must use Reference Boundary Monitoring in the detection zone.)

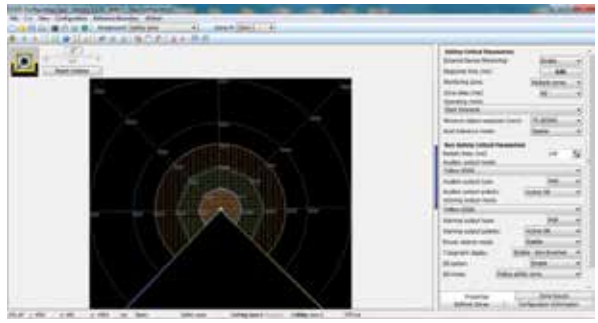


Safety Output ON

Safety Output OFF

Free software for easy configuration

The configuration of the safety zone and warning zones can be done in real time using a PC. Configurations can also be created or modified offline.



Making Safety Simple

Programmable Safety Systems

System Setup Made Simple

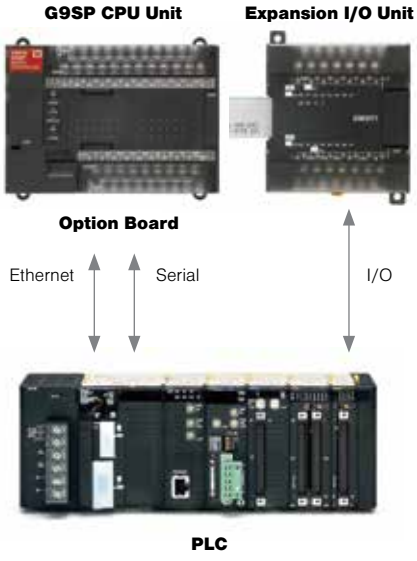
Omron's line-up of Programmable Safety Controllers reshape previous thinking about safety systems. Until now, safety control circuit design was cumbersome. The process involved tedious wiring and any changes required direct modification of the wiring. Programmable safety circuits simplify the design process. Safety I/O terminals make system modifications easy and allow the safety I/O capacity to be increased without extensive rewiring.

The new NX Safety System is integrated into the architecture of Omron's EtherCAT controller platform; this allows direct access to the status and monitoring of all safety I/O through the PLC making programming and monitoring more simple and powerful than ever before.

G9SP Compact Programmable Controllers

- Direct connection to non-contact switches and safety mats
- Programmable via PC or removable memory cassette
- Easily monitored by PLCs via Ethernet (FINS), EtherNet I/P, or serial (RS-232C) connection
- Ideal for small to mid-size applications
- EN ISO 13849-1 (PL e)









Transparent diagnosis
Connect to PC/PLC via Ethernet makes the Omron G9SP fully accessible. Diagnosis, troubleshooting and program modification is simple, thanks to the USB programming interface and removable memory card.

Simple Unit Replacement
Because the Omron G9SP is a software-based controller, replacement is effortless. All settings, parameters and function blocks can be saved on a PC or stored on the Memory Cassette for easy transfer from one unit to another.

NB Human Machine Interface

- Simple plug-n-play touchscreen for the G9SP to easily view the status of safety inputs and outputs

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

NX-S Integrated Safety Controller: Safety Over EtherCAT

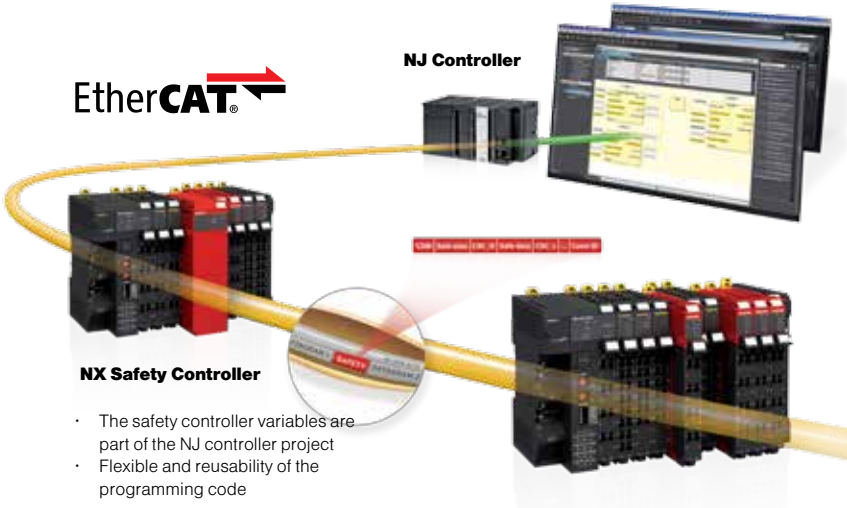
NEW

Now with Stand-Alone Safety System Capabilities

The NX-S allows connection of up to 32 safety I/O units, standard digital inputs and outputs can be directly mapped into the NX-SL3300 safety CPU according to the project needs.

- Monitor with EtherNet/IP



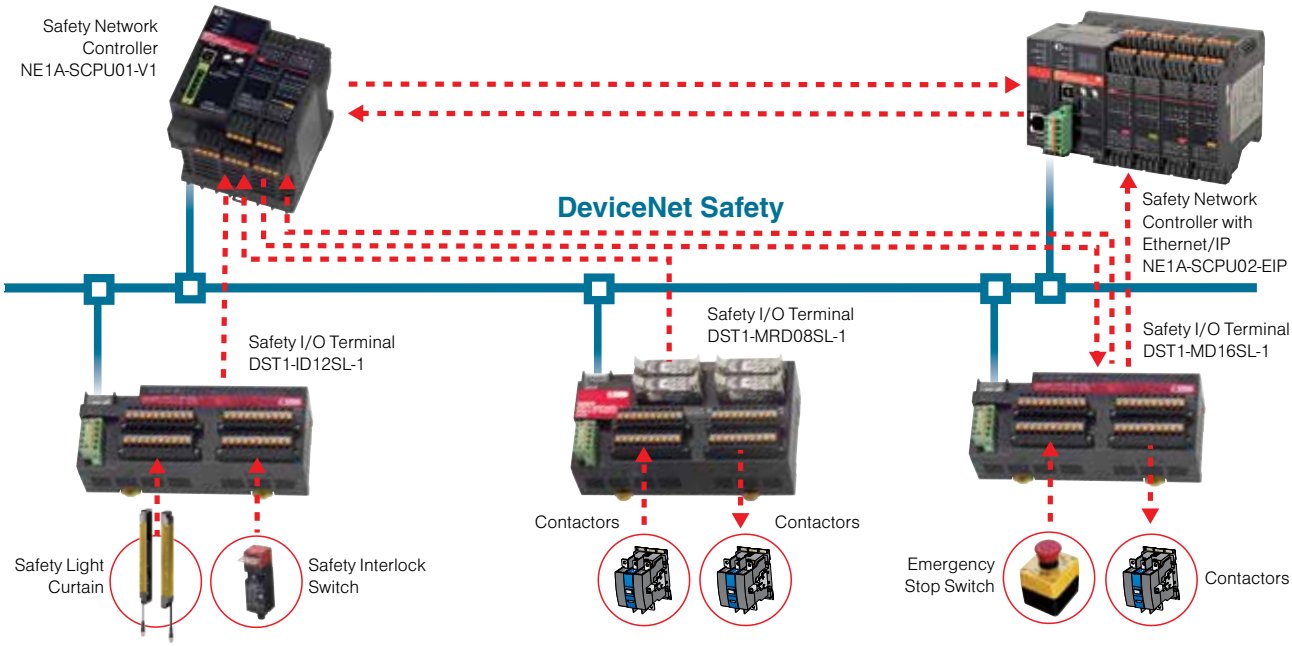


- The safety controller variables are part of the NJ controller project
- Flexible and reusability of the programming code

- Up to 8 safety input points per unit
- Flexible connectivity to a wide selection of safety devices
- I/O data monitoring in the NJ controller project

NE1A Safety Network Controllers

- Eliminates long runs of complicated wiring
- Compatible with the DeviceNet Open Network
- Provides individual I/O status and error indicators
- Minimizes the need to rewire when making machine modifications
- Conforms to global safety standards
- Meets IEC 61508 SIL3



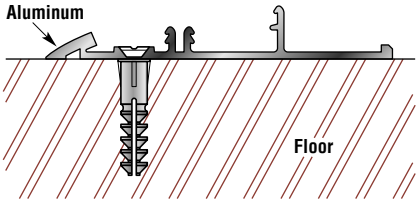
Built Tough for Tough Treatment

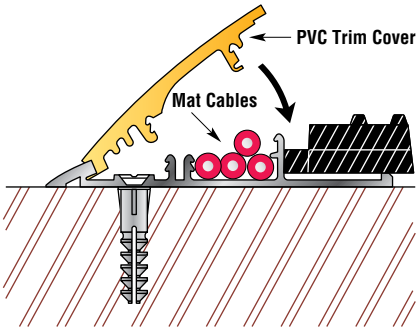
Pressure Sensitive Mats & Edges

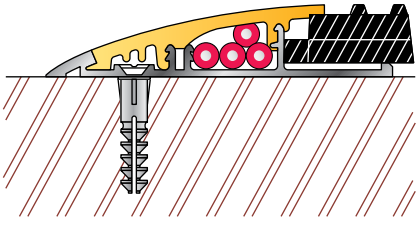


Omron Universal Safety Mats and MC3, MC4, or MC6 Controllers

Rugged Omron Universal Safety Mats guard machine operators against some of the potential hazards and dangers of a modern manufacturing environment. Compared with other guarding methods, such as mechanical barriers, sliding gates or pull back restraints, safety mats offer operators freedom of movement and flexibility that not only provides enhanced safety, but may also reduce the occurrence of cumulative trauma disorders. When combined with an MC3, MC4, or MC6 controller and trim, the Omron Universal Safety Mats form a mat system which complies with standard ISO 13856-1:2001, ANSI B11.19-2010, ANSI/RIA 15.06-1999 (R2009), CSA Z432-04, and EN1760-1: 1998 and is entitled to display the CE mark.







Two Safety Mat Trims to Choose From

Omron offers two types of safety mat trim, the industry standard 6063-T5 aluminum and a safety yellow PVC trim in an aluminum mounting base with an integrated wiring channel. In addition to the PVC cover for the 2-part trim, an aluminum cover is available (see the mat section for drawings and details on this trim). In multiple mat applications, our patented joining trim (also with an integrated wiring channel) provides a fully active mat area even at 3 and 4 mat intersections.

Standard Mat Features:

- Heavy-duty PVC for impact resistant construction
- Available in many standard and metric sizes
- Single piece molded construction will not delaminate
- Exceptional chemical and abrasion resistance including excellent resistance to acids, alkalies and salts
- Expected life of over one million actuations
- Standard with 4-wire quick disconnect cable
- Traction dot pattern allows configuration in any orientation

UMQ Series Quick-Disconnect Mat

The Omron UMQ Series Safety Mats incorporates a design that features a quick disconnect located on the mat. The cables can be attached after the mat is in place to minimize damage during mat installation. The patented connector is designed and tested to meet IP67 requirements. The quick disconnect has been designed to be backward compatible with the current mat cable location.



Safety Mat Controllers Provide Proven Reliability

Omron Safety Mat Controllers are used in conjunction with four-wire, normally open, safety mats where perimeter guarding is required. Their control reliable design sends a stop signal to the guarded machine whenever an object with sufficient weight is detected on the active mat surface. Also, when the controller detects any of the mat wires are missing, broken, or misconnected a stop signal is generated.

When combined with a four-wire safety mat these controllers improve productivity while providing access guarding. Full visibility of and accessibility to the work area is always maintained.



MC3



MC4



MC6

What are Pressure Sensitive Safety Edges?

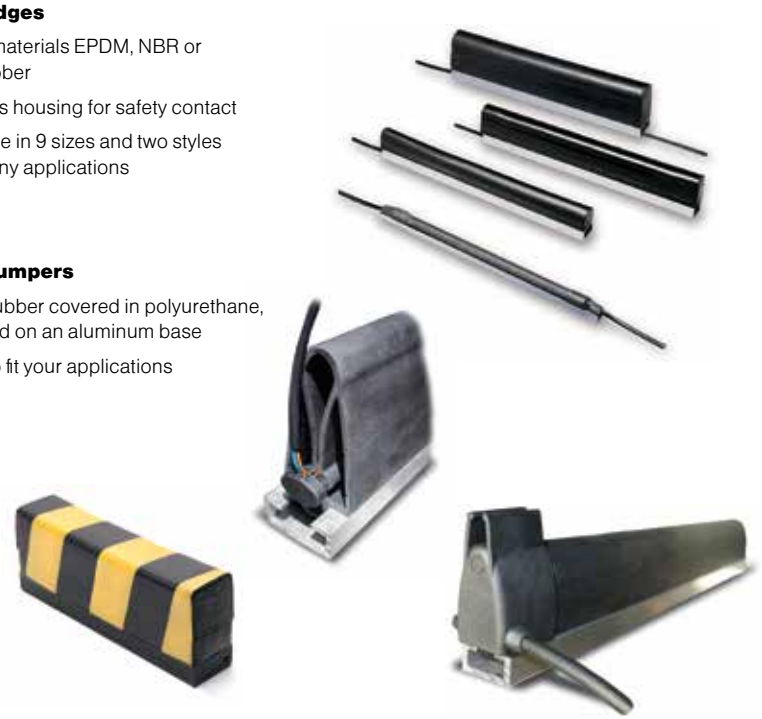
Omron Safety Edges are rubber profiles enclosing a pressure sensitive safety contact. These products can be used to protect pinch points on scissors lifts, automatic gates, and other applications. Nine different profiles are available in lengths up to 6100 mm. When combined with the available controllers, the system complies with standard EN954.

Safety Edges

- Profile materials EPDM, NBR or TPE rubber
- Provides housing for safety contact
- Available in 9 sizes and two styles to fit many applications

Safety Bumpers

- Foam rubber covered in polyurethane, mounted on an aluminum base
- Sized to fit your applications





SCC Safety Edge Controllers

- 120 VAC or 24 VDC power

Ensuring Operator Safety

Mechanical Guarding Systems



Tamper Resistant Safety Interlock Switches and Emergency Stop Devices Enhance Mechanical Guarding Methods

Omron Safety Interlock Switches and Emergency Stop Devices are available in a wide variety of models to satisfy most machine guarding applications. Models range from rope-operated emergency stop switches and non-contact magnetic and hinge-pin-operated interlocks, to solenoid-actuated guard-door locking switches that restrict access until safe conditions exist.



D40Z





D4NL

D4SL-N





A165E



Force-Guided Relays

Force-guided (or positively-guided) relays have contacts that are mechanically interlocked such that two contacts on the relays will not contradict each other, even in the event that the relay welds. Force-guided relays have contacts that are mechanically linked and conform to IEC60947-1-1 as required for use in safety-related control systems.



The G7Z multi-pole power contactor with mirror contacts is capable of carrying and switching 40 A at 440 VAC

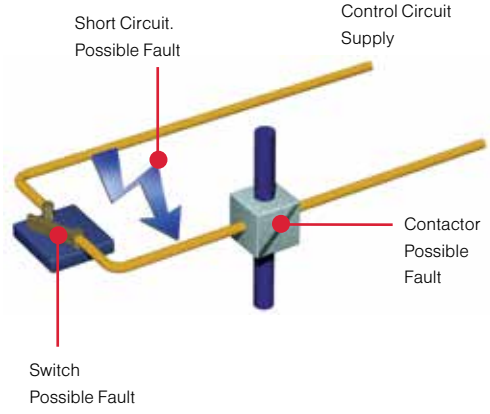
Monitoring Safety Relays Ensure the Highest Level of Circuit Integrity

Safety Monitoring Relays are designed to provide higher levels of reliability for any safety circuit through better diagnostics in fault detection, longer life expectancy, and redundancy. Whether designing circuits to meet European and International Performance Level requirements (ISO 13849-1) or North American control reliability requirements (ANSI B11.19), Omron safety monitoring relays offer preconfigured and tested circuits to meet your most demanding needs. Products range in function from simple single channel relays to specialty relays including time-delayed outputs, two-hand control, and stop-motion detection. All safety relays meet North American and, European requirements and carry one or more of the following designations: CE, UL, CSA, C-UL, UR and TUV. In addition, some relays carry markings and ratings for specific countries such as China, Korea and Germany.

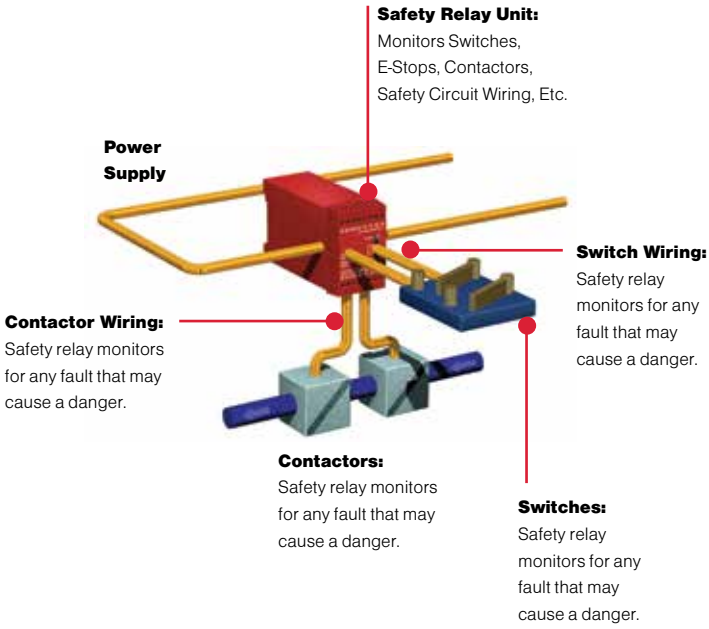


G9SA G9SX

Without Safety Relay



With Safety Relay



Maintaining Safety in
Hazardous Environments

Safeguarding a Hazardous Location... No Problem

The Omron line of process safeguarding products extends to hazardous locations, or flammable environments, as well. An advantage of mechanical trapped key systems is that they can be designed to isolate all electrical energy sources in and around hazardous areas. With key exchange system and mechanical locks, the energy can be isolated in a "safe area" and the key transferred to a mechanical lock in the "hazardous area."

Safety Light Curtains for Hazardous Locations

OMRON Automation and Safety offers enclosures for use in hazardous locations for the MS4800 and PA4600 safety light curtains. These enclosures are rugged cast-aluminum, designed to contain an ignition of explosive gas. This allows for the automatic safeguarding of machinery in explosive atmospheres, such as paint booths, chemical production and distilling.



The MS4800 and PA4600 safety light curtains are available with enclosures for use in hazardous areas.

Safeguarding Machine Operators
Special Safety Devices

An Ergonomic Alternative to a Mechanical Palm Button Switch

The Omron TouchStart is a capacitive palm button designed to detect the presence of an operator's hand and provides a machine start signal with a mere touch of a button.





Safety at All Times

The A4EG Enabling Switch Device provides the margin of safety needed during troubleshooting, set-up, programming, or servicing of robotic or automated machinery when no other safety devices are possible or practical. It has distinct clicks for three easily discernible positions.

Expert Area

Contents

REGULATIONS & DIRECTIVES	
OSHA Regulations	A-2
North American Safety Standards	A-3
Harmonized European Standards	A-6
SAFETY STRATEGY & RISK ASSESSMENT	
Safety Strategy — Hazard Identification & Risk Evaluation	A-8
Machine Safeguarding Checklist	A-15
CONTROL RELIABLE CIRCUITS & WIRING DIAGRAMS	
Safety-Related Control Systems	A-16
Common Circuit Examples	A-27
TYPES OF PROTECTIVE MEASURES	
Choice of Protective Measures	A-41
Safety Light Curtains	
Type 2 vs. Type 4 Light Curtains	A-45
Light Curtains — Installation Requirements & Calculating the Minimum Safe Distance	A-49
Sample Checkout Procedure Log	A-67
Sample Test Procedure	A-68
Safely Muting an Industrial Process	A-69
Safety Mats	
Safety Mats — Theory of Operation, Selection & Installation	A-71
Safety Interlock Switches & Monitoring Relays	
Understanding IP Ratings	A-73
Emergency Stop Devices	
Proper Installation of Rope or Wire Pull Emergency Stop Devices	A-74

OSHA Regulations

In the United States, machine safeguarding is governed by OSHA, the Occupational Safety and Health Administration. OSHA's mission is to assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance.

While OSHA regulations cover many aspects of health and safety the area of machine safeguarding s addressed by the regulations in Part 1910 Subpart O - Machinery and Machine Guarding.



The regulations for machine guarding are:

1910.211 - Definitions.
1910.212 - General requirements for all machines. This section governs the guarding of all machines that are not called out specifically in one of the sections below.
1910.213 - Woodworking machinery requirements. Includes all saws and other machines used for woodworking
1910.214 - Reserved
1910.215 - Abrasive wheel machinery. Includes requirements for Grinders
1910.216 - Mills and calenders in the rubber and plastics industries.
1910.217 - Mechanical power presses.
1910.218 - Forging machines.
1910.219 - Mechanical power-transmission apparatus.

In addition, OSHA specifies regulations for lockout/tagout In 29 CFR 1910.147

The entire text of these regulations can be downloaded for free from the OSHA web site www.osha.gov. This site also has a wealth of explanatory and training materials relating to machine safeguarding.

These federal regulations may be supplanted by state OSHA requirements, as long as the state has an approved state plan. In all cases state plans are at least as stringent as the federal plan but may be more so, as state plans have a tendency to be more frequently reviewed and updated.

Because Federal OSHA requirements are not frequently updated the use of ANSI B11 Standards are often used to demonstrate compliance to the OSHA regulations.

North American Safety Standards

Application vs. Construction Standards

Safety standards fall into two categories: application standards and construction standards.

Application Standards

Application standards reference how to use a light curtain for machine guarding, for example, how to calculate the safe mounting distance. Although some may give condensed construction information, often the main thrust of an application standard is how to apply a light curtain for the type of machine covered by the standard. For example, ANSI/RIA R15.06 discusses the use of presence-sensing devices (light curtains) for robot guarding. ANSI B11.1 provides information on how to use presence-sensing devices on mechanical power presses.

Construction Standards

Construction standards provide design, construction and testing information on presence sensing devices. In North America, ANSI/UL 61496 entitled “Safety of Machinery - Electrosensitive Protective Equipment” is the construction standard for light curtains.

ANSI/UL 61496 covers specific items such as the number of outputs required, the need for a key-operated switch, transformer construction, and failure conditions. Test specifications require that the equipment be subject to a battery of tests including moisture and dust intrusion, power supply transients, electrical interferences, electrostatic discharges, component failure mode analysis and object sensing capabilities.



Machine Guarding

In the United States, installation and use of machine guarding is regulated by the Occupational Safety and Health Administration (OSHA). Some states have their own safety organizations with regulations that must be at least as strict as the federal OSHA standards.

In addition to OSHA, other organizations provide information on proper machine guarding. The American National Standards Institute (ANSI) publishes the B11 standards to provide information on the construction, care and use of machine tools. Certain standards are developed for specific types of machine tools.

Standards in the B11 series include:

B11.0 - Safety of Machinery - applies to new, modified or rebuilt power driven machines, not portable by hand, used to shape and/or form metal or other materials

B11.1 - Mechanical Power Presses – applies to only to those mechanically-powered machine tools commonly referred to as mechanical power presses

B11.2 - Hydraulic Power Presses - applies to only to those machine tools, commonly referred to as hydraulic power presses

B11.3 - Power Press Brakes - applies to those machine tools classified as power press brakes (hereinafter referred to simply as press brakes)

B11.4 – Shears - applies to those mechanically, hydraulically, hydra-mechanically, or pneumatically powered shears used to cut material by shearing

B11.5 – Ironworkers - applies to those combination, multipurpose powered machines that punch, shear, notch, cope and form metal

B11.6 - Safety Requirements for Manual Turning Machines with or without Automatic Control - specifies safety requirements for the design, construction, operation and maintenance

B11.7 - Cold Headers - applies to only those mechanically-powered machines commonly referred to as cold headers and cold formers

B11.8 - Manual Milling, Drilling - specifies safety requirements for the design, construction, operation and maintenance

B11.9 - Grinding Machines - applies to all stationary grinding machines

B11.10 - Metal Sawing Machines - specifies safety requirements for the design, construction, modification, operation and maintenance

B11.11 - Gear (Spline) Cutting Machines - specifies safety requirements for the design, construction, operation and maintenance

B11.12 - Roll Forming and Roll Bending Machines - applies to any power-driven metal-forming machine that changes the shape or the direction, or both, of materials

B11.13 - Automatic Bar and Chucking Machines - applies to single and multiple spindle automatic bar and chucking machines in which all tool movement is controlled by the machine.

B11.15 - Pipe, Tube and Shape Bending Machines - applies to any power-driven machine designed for bending pipe, tube, and shapes by means of dies

B11.16 - Powder/Metal Compacting Presses - applies to those mechanically or hydraulically powered machine tools that are designed, modified, or converted for metal compacting

B11.17 - Horizontal Hydraulic Extrusion Presses - applies to those horizontal hydraulically powered presses that extrude metals

B11.18 - Coil Processing and Coil Slitting Machine - applies to machines, and groups of machines arranged in production systems, for processing strip, sheet, or plate metal from a coil

B11.19 - Performance Criteria for Safeguarding - provides performance requirements for the design, construction, installation, operation and maintenance of the safeguarding

B11.20 - Integrated Manufacturing Systems - specifies the safety requirements for the design, construction, set-up, operation and maintenance

B11.21 - Machine Tools Using Lasers - applies to machine tools using a laser for processing materials, and its associated equipment.

B11.22 - Turning Centers and Automatic Numerically - specifies the safety requirements for the design, construction, operation and maintenance

B11.23 - Safety Requirements for Machining Centers and Automatic, Numerically Controlled Milling, Drilling and Boring Machines - specifies the safety requirements for the design, construction, operation and maintenance

B11.24 - Transfer Machines - specifies the safety requirements for the design, construction, operation and maintenance

B11.TR1 - Ergonomic Guidelines - this guideline provides a uniform approach to ergonomic considerations for machine tools within the workplace.

B11.TR2 - Mist Control Considerations - provides guidelines for a uniform approach to the control of airborne contaminants generated by stationary machine tools

B11.TR3 - Risk Assessment and Risk Reduction - provides a means to identify hazards associated with a particular machine or system

B11.TR4 - Selection of Programmable Electronic Systems - provides guidance for the design or selection, integration, and validation of PESs

B11.TR5 - Sound (Noise) Level Measurement Guideline - provides methods for measuring, evaluating and documenting sound levels emitted by a machine

B11.TR6 - Safety Control Systems for Machines - provides guidance in understanding and implementing safety-related control functions

B11.TR7 - Designing for Safety and Lean Manufacture - provides guidance on the practical application and integration of safety and lean manufacturing principles to machinery and manufacturing

Integrated Manufacturing Systems/Cells

An integrated manufacturing system is defined as a group of two or more industrial machines working together in a coordinated manner normally interconnected with and operated by a supervisory controller or controllers capable of being reprogrammed for the manufacturing of discrete parts or assemblies. This definition is provided by ISO 11161, ***Safety of Integrated Manufacturing Systems***, an international standard covering requirements for the safe installation, programming, operation, maintenance or repair of these systems. A similar standard is ANSI B11.20, entitled ***Manufacturing Systems/Cells - Safety Requirements for Construction, Care and Use.***

Both of these standards cover the safety of multiple machines under some type of common control. When machines in an integrated system operate separately or individually, or the safeguards are muted or suspended, the safety standards for the individual machines should be used as a supplement.

Robots and Robot Systems

Safety guidelines for applications using industrial robots result from the joint effort of ANSI and the Robotics Industries Association (RIA). In standard ANSI/RIA R15.06, an industrial robot is defined as a reprogrammable multifunctional manipulator designed to move material, parts, tools, or other devices. This standard does not apply to numerically controlled machine tools.

Ontario Regulation 7

Each Canadian province has created, or is developing its own specific safety regulations. The province of Ontario may have the most complete set. Of particular interest to users of industrial machinery is Regulation 7 of the ***Regulations for Industrial Establishments***.

Regulation 7 outlines the requirements for a ***Pre-Start Health and Safety Review (PHSR)***. The intent of a PHSR is three-fold:

1. Provide for a timely professional review to identify specific standards.
2. Ensure hazards are removed or controlled before start-up.
3. Ensure that worker protection as required under the applicable provisions of the ***Regulations for Industrial Establishments*** is provided.

What is a Pre-Start Health and Safety Review?

A PHSR is conducted upon the construction, addition or installation of a new machine, structure or protective element, or the modification of an existing installation.

The end result of a PHSR is a written report. This report details the actions, steps or engineering controls required to bring the subject application into compliance with the provisions of the ***Regulations for Industrial Establishments.***

Benefits of a PHSR include:

- Prevention of hazardous incidents
- Assurance of uniform quality inspections
- Reduced cost of protection
- Assurance that high risk areas are addressed
- Raises standards for OEM manufacturers

Although specific to the Canadian province of Ontario, Regulation 7 and the resulting PHSR report incorporate the risk assessment principals found elsewhere in the Expert Area.

The Canadian Standards Association (CSA)

CSA is a Canadian laboratory that tests and certifies the electrical integrity and safety of products. CSA is accredited by OSHA as a Nationally Recognized Test Laboratory (NRTL) which covers testing of all products under OSHA's jurisdiction.

The NRTL/C mark (Canadian/US certification) on our products indicates certification for Canada as well as the United States and is considered to comply with applicable CSA and UL requirements.

The NRTL/C mark is a counterpart to the Underwriter's Laboratory C-UL mark. Both marks indicate that a product is in compliance with both CSA and UL standards.

The NRTL/C mark on our products precludes the necessity of having both CSA and UL agency logos. All STI safety light curtains are CSA listed (file number LR90200).

Corporate Standards

In order to provide employees with a safe work environment, many corporations have authored their own standards for safety light curtains and personnel protection. These standards are frequently more stringent than those required by OSHA and can only be met by the most technically advanced products. Omron listens closely to industry requirements and has responded with such patented features as the FlexSafe and Individual Beam Indicator lights. The MPCE and MTS feature were also originally engineered at the request of a customer.

Harmonized European Standards

These standards are common to all EC and EFTA countries and are produced by the European Standardization bodies CEN and CENELEC. Their use is voluntary but designing and manufacturing equipment to them is the most direct way of demonstrating compliance with the EHSRs. They are divided into 3 groups: A, B and C standards.

A Standards

Cover aspects applicable to all types of machines.

B Standards

Subdivided into 2 groups.

- B1 STANDARDS - Cover particular safety and ergonomic aspects of machinery.
- B2 STANDARDS - Cover safety components and devices.

C Standards

Cover specific types or groups of machines.

It is important to note that complying with a C Standard gives automatic presumption of conformity with the EHSRs. In the absence of a suitable C Standard, A and B Standards can be used as part or full proof of EHSR conformity by pointing to compliance with relevant sections.

Agreements have been reached between CEN and CENELEC and with other world-wide Standardization Bodies. This should ultimately result in common world-wide standards.

This section lists some of the relevant A and B Standards

EN ISO 12100 (EN 292) PARTS 1 & 2 - Safety of machinery — Basic concepts, general principles for design.

This A standard outlines all the basic principles including risk assessment, guarding, interlocking, emergency stops, trip devices, safety distances and much more. It references other standards and also includes the essential safety requirements from the Machinery Directive.

EN 60204-1 — Safety of machinery — Electrical equipment of machines — Pt 1 General requirements.

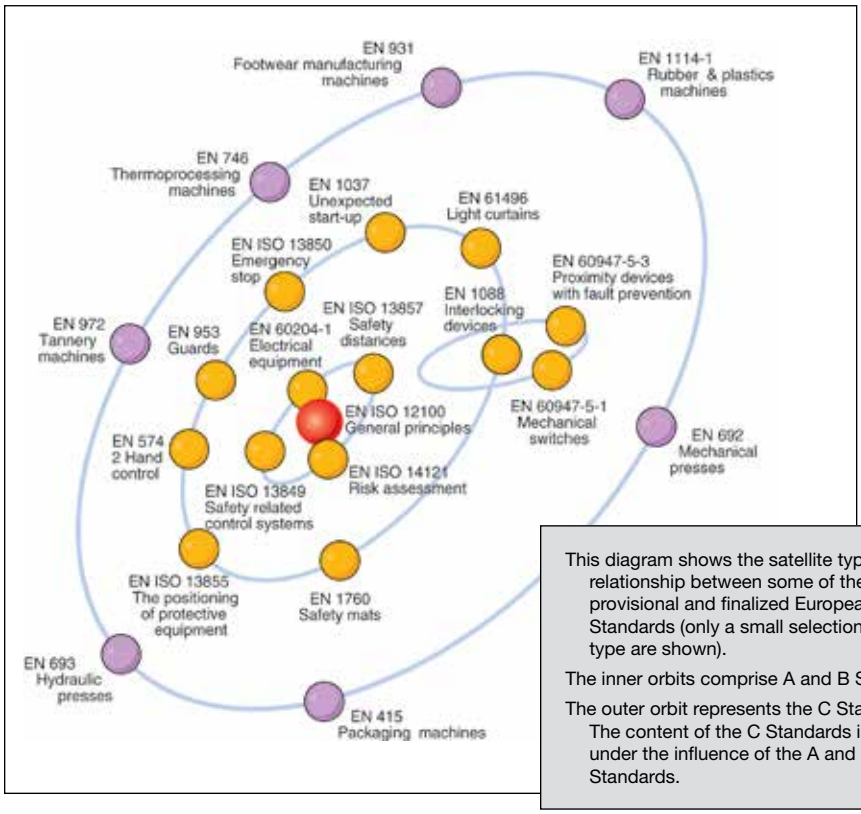
This standard gives general and specific recommendations for Safety-Related aspects of wiring and electrical equipment on machines.

EN ISO 13857 (EN 294) — Safety of machinery —Safety distances to prevent danger zones being reached by the upper and lower limbs.

Gives data for calculation of safe aperture sizes and positioning for guards etc.

EN 349 — Safety of machinery — Minimum distances to avoid crushing parts of the human body.

Gives data for calculation of safe gaps between moving parts etc.



This diagram shows the satellite type relationship between some of the various provisional and finalized European Standards (only a small selection of each type are shown).

The inner orbits comprise A and B Standards

The outer orbit represents the C Standards. The content of the C Standards is formed under the influence of the A and B Standards.

EN 1088 — Safety of machinery — Interlocking devices associated with guards — Principles for design and selection.

Gives principles for the design and selection of interlocking devices associated with guards.

In order to verify mechanical switches it refers to ***EN 60947-5-1 — Electromechanical control circuit devices.***

In order to verify non-mechanical switches it refers to ***EN 60947-5-3 — Particular requirements for proximity devices with fault prevention measures or defined behavior under fault conditions.***

EN ISO 13849 — Safety of machinery — Safety-Related parts of control systems — Pt 1: General principles for design.

This standard outlines requirements for safety critical parts of machine control systems. It is important to achieve a working knowledge of this document as its categories are the common "language" for describing the performance of Safety-Related control systems.

EN ISO 13855 (EN 999) — Safety of machinery — The positioning of protective equipment in respect of approach speeds of parts of the human body.

Provides methods for designers to calculate the minimum safety distances from a hazard for specific safety devices. In particular for electro sensitive devices (eg: light curtains), pressure sensitive mats/floors and two-hand controls.

EN ISO 14121-1 (EN 1050) — Safety of machinery — Principles for risk assessment.

Outlines the process of assessing the risks during the life of the machinery.

EN 574 — Safety of machinery — Two-hand control devices — Functional aspects — Principles for design.

Provides requirements and guidance on the design and selection of two-hand control devices, including the prevention of defeat and the avoidance of faults.

EN ISO 13850 (EN 418) — Safety of machinery — Emergency Stop devices, functional aspects — Principles for design.

Gives design principles and requirements.

EN 61496-1&2 — Safety of machinery — Electro sensitive protective equipment Pt 1: General requirements and tests. Pt 2: Particular requirements for equipment using active opto-electronic protective devices.

Part 1 gives requirements and test procedures for the control and monitoring aspects of electro sensitive protective equipment. Subsequent parts deal with aspects particular to the sensing side of the system.

Part 2 gives particular requirements for safety light curtains.

EN 1760-1 — Safety of machinery — Pressure Sensitive Safety Devices — Pt 1: Mats & Floors.

Gives requirements and test procedures.

EN 1760-2 — Safety of machinery — Pressure Sensitive Safety Devices — Pt 2: Edges & Bars.

Gives requirements and test procedures.

EN 953 - Safety of machinery — General Requirements for the Design and Construction of Guards.

Gives definitions, descriptions and design requirements for fixed and movable guards.

EN 1037 — Safety of machinery — Isolation and energy dissipation — Prevention of unexpected start-up.

Defines measures to isolate machines from power supplies and dissipate stored energy to prevent unexpected machine start-up and allow safe intervention in danger zones.

NOTE: Many of these European Standards are being revised and adopted as international standards with new number designations. During the transition period, the documents may carry an IEC/ISO number or an EN number or both.

Safety Strategy - Hazard Identification & Risk Evaluation

From a functional point of view the more efficiently a machine performs its task of processing material the better it is. Life, however, is not that simple and in order for a machine to be viable it must also be safe. Safety must be regarded as a prime consideration.

To achieve a proper safety strategy there must be:

1. Risk Assessment based on a clear understanding of the **machine limits and functions which must be analyzed to identify** which ones pose a potential hazard. The degree of risk due to the hazard is then **estimated** in order to provide a basis for judgement at later stages. A **risk evaluation** is then required to determine if existing safety measures are satisfactory or whether additional measures are required to reduce the risk.

2. Risk Reduction is then performed if necessary and safety measures are selected based on the information derived from the risk assessment stage.

After the implementation of these measures the risk assessment is repeated to determine whether safety has in fact been achieved.

The manner in which this is done is the basis of the **Safety Strategy** for the machine.

A checklist should be followed to ensure that all aspects are considered and that the overriding principle does not become lost in the detail.

The first step is to ensure that the whole process is documented. This ensures a more thorough job and makes the results available for review by other parties. In Europe, the documented risk assessment is usually included in the technical file which supports the Declaration of Conformity for the Machinery Directive. Because the process is likely to be repeated, documenting the results means that needless repetition can be avoided.

If a machine is designed in conformity with a product standard specific to that machine, the standard should already incorporate most of the measures necessary for its safety. It is strongly recommended however, that a risk assessment is still performed to ensure that everything is considered.

Although this section may only seem to apply to machine manufacturers it is also relevant to machine users as machines are often used in circumstances unforeseen by the manufacturer. The user (or employer) has a legal requirement to provide a safe working environment. Regulations make it clear that the safety of work equipment is addressed from three aspects :

1. its initial integrity
2. the place where it is used
3. the purpose for which it is used.

For example, a milling machine used in a school workshop will need additional considerations compared to one which is used in an industrial tool room.

Remember that if a user acquires two or more independent machines and integrates them into one process they are, technically speaking, the manufacturer of the resulting combined machine.

Now let's consider the essential steps to a proper safety strategy. The following can be applied to an existing factory installation or a single new machine.

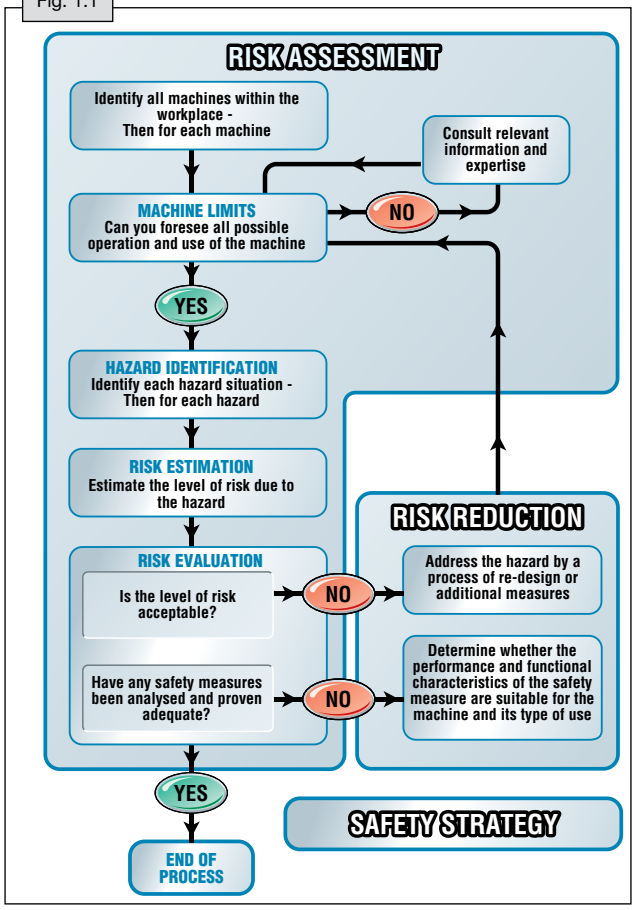
Risk Assessment

Why is a risk assessment necessary?

One reason is obvious - in the European Community it is a legal requirement. Most of the directives and regulations regarding machinery safety state that a formal risk assessment should be performed. Most of the harmonized European standards refer to it and the subject itself is covered by standard — ISO 14121-1 "Principles for Risk Assessment". Additionally, in North America ANSI has developed a technical report B11.TR3-2000. While not a "standard", this technical report provides guidance on how to estimate, evaluate and reduce risks associated with machine tools. People concerned with the safety of machinery know that risk assessment is an integral part of a complete safety strategy.

Risk assessment is a helpful process which provides vital information and allows the user or designer to make logical decisions about safeguarding methods.

Fig. 1.1



Machine Limit Determination and Hazard Identification

A complete list of all machines should be made. Where separate machines are linked together, either mechanically or by control systems, they should be considered as a single machine. Each machine is then considered to see if it presents any sort of hazard and the list marked accordingly.

It is important to consider all stages in the life of a machine including installation, commissioning, maintenance, de-commissioning, correct use and operation. Also consider the consequences of reasonably foreseeable misuse or malfunction.

All hazards must be considered including crushing, shearing, entanglement, part ejection, fumes, radiation, toxic substances, heat, noise etc.

If a machine relies on anything other than its intrinsic nature for its safety it should be indicated as a hazard source. A machine with exposed gears has an obvious and direct hazard. But if the gears are protected by an interlocked access panel they are a potential hazard which may become an actual hazard in the event of failure of the interlocking system.

Each machine with a hazard should be identified and marked on the list together with the types of hazard present. At this stage it is only the identity and type of hazard that is of concern. It is tempting to start estimating the degree of risk posed by the hazard but this is a separate process of risk estimation.

Risk Estimation

This is a fundamental aspect of machine safety. There are many ways of tackling this subject and the following pages provide a simple, effective approach. The method should be amended as necessary to suit individual requirements. An understanding of its importance is absolutely essential.

All machines that contain hazards present risk. It is important to be able to describe at which point the risk lies on a relative scale from minimum to maximum. The following pages provide a practical method for achieving this. First, let us look at some of the fundamental points.

1. The risk estimation must always be documented.

It is tempting to make a purely intuitive judgement. While often based on experience, it almost certainly will not take into account all the necessary considerations and cannot be easily checked or passed on to others.

You must follow a logical work pattern, write down the results and get other parties to review it. Remember, it is your evidence that you have shown due diligence in the task.

2. What is risk?

The term risk is often confused with the severity of an accident. Both the severity of potential harm AND the probability of its occurrence must be considered in order to estimate the amount of risk present.

3. It must take into account all foreseeable factors.

As with the Hazard Identification stage it is important to consider all stages of the machine's life including installation, commissioning, maintenance, de-commissioning, correct use and operation as well as the consequences of reasonably foreseeable misuse or malfunction.

4. It is an iterative process but work need not be repeated needlessly.

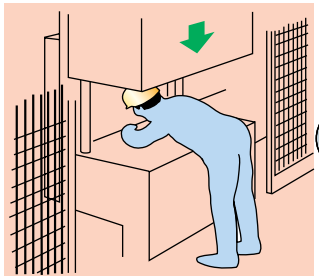
For example: A machine has an interlock guard door which, during an earlier risk evaluation, has been shown to be satisfactory. Provided that there are no changes which affect it, during subsequent risk assessments, no further measures will be required as the risk has been satisfactorily reduced (or eliminated).

But if the machine has never been subjected to a formal risk assessment or its usage circumstances have changed then it cannot be automatically assumed that the interlocking system is satisfactory and the risk estimation should be repeated to verify its suitability.

The suggestion for risk estimation given on the following pages is not advocated as the definitive method. Individual circumstances may dictate a different approach. **It is intended only as a general guideline to encourage a methodical and documented structure.**

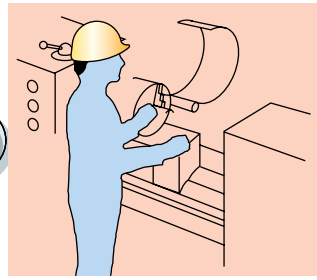
It is intended to explain and complement the risk estimation section in the standard ISO 14121-1"Principles for Risk Assessment". It uses the same well established principles as the standard but has a few minor variations in its approach.

Risk ESTIMATION - Step 1



In this example most severe injury would be "fatal".



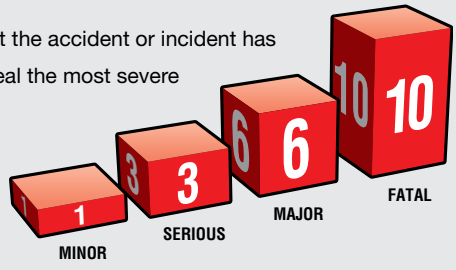


In this example the probable most severe injury would be "serious". With the possibility of bruising, breakage, finger amputation or injury from ejected chuck key etc.

Fig. 1.2 Remember: For this consideration we are presuming that an injury is inevitable and we are only concerned with its severity.

1. THE SEVERITY OF POTENTIAL INJURY.

For this consideration we are presuming that the accident or incident has happened. Careful study of the hazard will reveal the most severe injury that can be reasonably conceived.



The severity of injury should be assessed as:

FATAL

MAJOR - (Normally irreversible) Permanent disability, loss of sight, limb amputation, respiratory damage etc.

SERIOUS - (Normally reversible) Loss of consciousness, burns, breakages etc.

MINOR - Bruising, cuts, light abrasions etc.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Risk ESTIMATION- Step 2

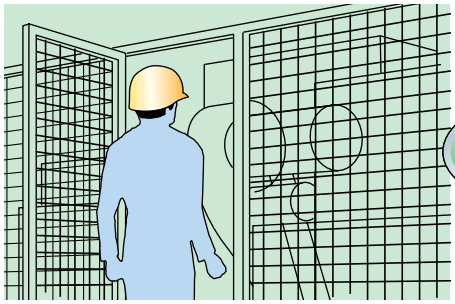


Fig. 1.3

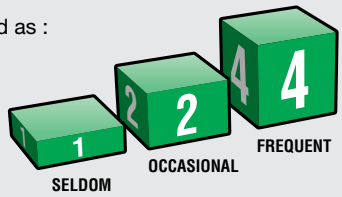
2. FREQUENCY OF EXPOSURE

The frequency of exposure to hazard can be classed as :

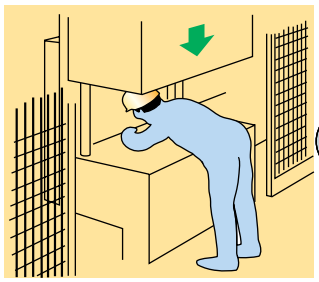
FREQUENT - Several times per day.

OCCASIONAL - Daily.

SELDOM - Weekly or less.

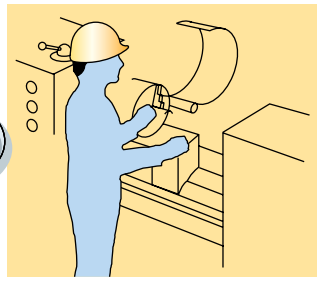


Risk ESTIMATION - Step 3



In this example the probability of injury could be rated as "certain" because of the amount of body in the hazard area and the speed of machine operation.





In this example the probability of injury may be rated as "possible" as there is minimal contact between the hazard and the operator. There may be time to withdraw from the danger.

Fig. 1.4

3. PROBABILITY OF INJURY

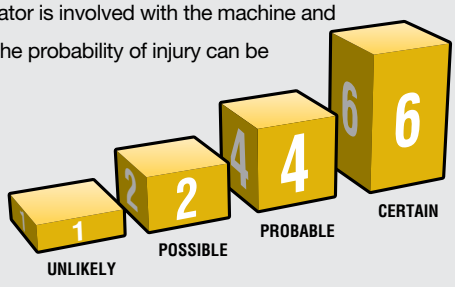
You should assume that the operator is exposed to the hazardous motion or process. By considering the manner in which the operator is involved with the machine and other factors such as speed of start up etc., the probability of injury can be classed as:

CERTAIN

PROBABLE

POSSIBLE

UNLIKELY



The following factors are taken into account:

1. The severity of potential injury.
2. The probability of its occurrence, which is comprised of two factors:
   a. Frequency of exposure.
   b. Probability of injury.

Dealing with each factor independently, values are assigned to these factors.

Make use of any data and expertise available. You are dealing with all stages of machine life so base your decisions on the worst case.

Remember, you should assume that there is no protective system or that it has failed to danger. For example, the machine power may not be isolated when a guard is opened or the machine may even start up unexpectedly while the guard is open.

All headings are assigned a value and they are now added together to give an initial estimate. **For example:**

The next step is to adjust the initial estimate by considering additional factors such as those shown in *Figure 1.6.* Often they can only be properly considered when the machine is installed in its operating location.

Depending on the type and usage of the machine there may be other relevant factors which should also be listed and considered at this stage.



Fig. 1.5 (Note: This is not based on the previous example pictures)

Risk Reduction and Evaluation

Consider each machine and its risks separately and then address all of its hazards.

There are three basic methods to be considered and used in the following order:

1. Eliminate or reduce risks as far as possible by inherently safe machine design.
2. Take the necessary protective measures in relation to risks that cannot be eliminated.
3. Inform users of the residual risks due to the shortcomings of the protective measures adopted, indicate whether any particular training is required and specify the need to provide personal protective equipment.

If the machine is still at the design stage it may be possible to eliminate the hazard by a change of approach.

If design methods cannot provide the answer other action needs to be taken.

The hierarchy of measures to be considered include:

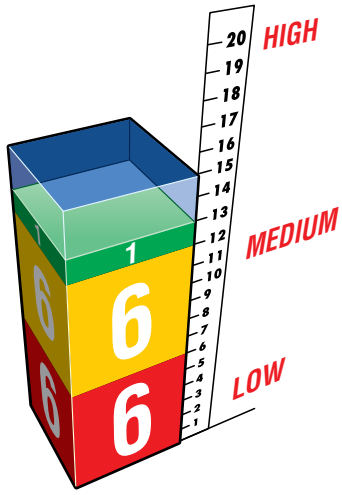
(a) Fixed enclosing guards.

(b) Movable (interlocked) guards or safeguarding devices e.g. light curtains, presence sensing mats, etc.

(c) Protection appliances (jigs, holders, push sticks etc.) used to feed a workpiece while keeping the operators body clear of the hazard zone. These are often used in conjunction with guards.

Fig. 1.6 The results of any additional factors are then added to the previous total as shown.

Additional Factor	Suggested Action
More than one person exposed to the hazard.	Multiply the severity factor by the number of people.
Protracted time in the danger zone without complete power isolation.	If time spent per access is more than 15 minutes, add 1 point to the frequency factor.
Operator is unskilled or untrained.	Add 2 points to the total



(d) Provision of information, instruction, training and supervision. It is important that personnel have the necessary training in the safe working methods for a machine. This does not mean that measures (a), (b) or (c) can be omitted. It is not acceptable merely to tell an personnel that he must not go near dangerous parts (as an alternative to guarding them).

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

In addition to the above measures it may also be necessary for the operator to use equipment such as special gloves, goggles, respirators etc. The machinery designer should specify what sort of equipment is required. The use of personal protective equipment is usually not the primary safeguarding method but complements the measures shown above.

Each measure from the hierarchy should be considered in turn starting from the top and used where practical. This may result in a combination of measures being used.

If access is not required to dangerous parts the solution is to protect them by some type of fixed enclosing guarding.

If access is required then life becomes a little more difficult. It is necessary to ensure that access can only be gained while the machine is safe. Protective measures such as interlocked guard doors and/or trip systems will be required. The choice of protective device or system should be heavily influenced by the operating characteristics of the machine. This is extremely important as a system which impairs machine efficiency is likely to be removed or bypassed.

The safety of the machine in this case will depend on the proper application and correct operation of the protective system even under fault conditions. Once the proper application has been dealt with by the appropriate choice of general type of protective system the correct operation of the system must now be considered.

In an ideal world every protective system would be perfect with absolutely no possibility of failing to a dangerous condition. In the real world however we are constrained by the limits of knowledge and materials. Another constraint is, of course, cost. Because of these factors, a sense of proportion is required. Common sense says that it is ridiculous to insist that the integrity of a safety system on a machine that may cause mild bruising to be the same as that required to keep a jumbo jet in the air. The consequences of failure are drastically different and therefore we need to have some way of relating the extent of

Fig. 1.7

Company - MAYKIT WRIGHT LTD
Facility - **Tool room - East Factory.**
Date - **29/8/95**
Operator profile - **Apprentice / Fully skilled.**

Equipment identity & date	Directive Conformity	Risk Assmnt Report no	Accident history	Notes	Hazard identity	Hazard type	Action required	Implemented & inspected - reference
Bloggs center lathe. Serial no. 8390726 Installed 1978	**None claimed**	**RA302**	**None**	**Electrical equipment complies with BS EN 60204 E stops fitted (replaced 1989)**	**Chuck rotation with guard open**	**Mechanical Entanglement Cutting**	**Fit guard interlock switch**	**25/11/94 J Kershaw Report no 9567**
					Cutting fluid	**Toxic**	**Change to non txic type**	**30/11/94 J Kershaw Report no 9714**
					Swarf cleaning	**Cutting**	**Supply gloves**	**30/11/94 J Kershaw Report no 9715**
Bloggs turret head milling m/c Serial no 17304294 Manuf 1995 Installed May 95	**M/c Dir. EMC Dir**	**RA416**	**None**		**Movement of bed (towards wall)**	**Crushing**	**Move machine to give enough clearance**	**13/4/95 J Kershaw Report no 10064**

the protective measures to the level of risk obtained at the risk estimation stage.

Whichever type of protective device is chosen, it must be remembered that a “safety-related control system” may comprise many elements including the protective device, wiring, power switching device and sometimes parts of the machine’s operational control system. All these system elements should have suitable performance characteristics relevant to their design principle and technology.

The International Standard ISO 13849-1 "Safety-related parts of control systems" describes a process for determining the performance level for safety-related control systems and how to relate risk reduction to required performance level. *Figure 1.8* is a simplified chart that shows the relationship of risk and required performance level. Performance levels will be discussed further in the section on safety-related control systems.

The table shown in *Figure 1.7* is suggested as part of a documented process to account for all safety aspects of the machine being used. It acts as a guide for machine users but the same principle can be used by machine manufacturers or suppliers. It can be used to confirm that all equipment has been considered and it will act as an index to more detailed reports on risk assessment.

The table shows that where a machine carries a mark from a recognized test lab (e.g. UL), it simplifies the process, as the machine hazards have already been considered by the manufacturer and the necessary measures have been taken. Even with equipment that has been approved by a recognized test lab, there may still be hazards due to the nature of its application or material being processed which the manufacturer did not foresee.

After the risk estimate is completed, implement the required safety related control system and performance levels according to the estimated risk level.

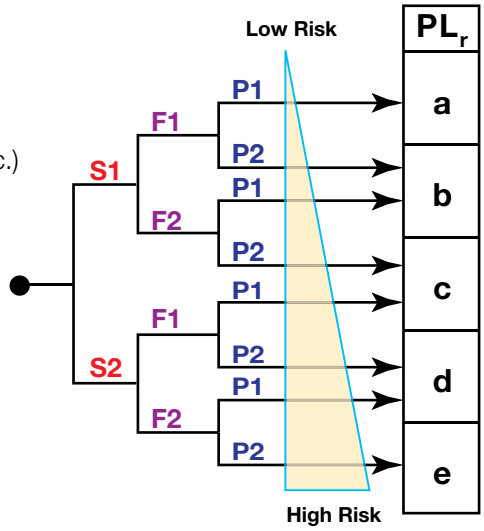
How to Determine Required Performance Level (PL_r) in accordance with ISO 13849-1

Fig. 1.8

S: Severity of Injury
-S1: Slight injury
-S2: Serious injury (amputation, death, etc.)

F: Frequency and/or Exposure to Hazard
-F1: Occurs infrequently or lasts for a short time
-F2: Occurs frequently or lasts for a long time

P: Possibility of Avoiding Hazard or Limiting Harm
-P1: Possible under specific conditions
-P2: impossible



For complete specifications and additional models and accessories visit www.omron247.com

A

Machine Safeguarding Checklist

OMRON STI
Machine Services Division, 4545 East La Palma Avenue, Anaheim, CA 92807-1907 USA

The Machine Safeguarding Checklist MUST be performed by qualified personnel.

Company Name:		Machine Type:	
Location:		Manufacturer:	
Date:		Model #:	
Inspector:		Serial #:	
Department:		Asset / ID #:	

1. Point of operation guard(s) position and/or distance.

- ❑ **Yes** - Point of operation guards appear to be compliant at this time and the safe mounting distance has been calculated and recorded.
- ❑ **No** - Point of operation guards are missing, misapplied, or not securely fastened. Individuals can reach over, under, around or through the guards to the point of operation or the guards are missing or can be easily removed.
- ❑ **May not be compliant** - The safe mounting distance and/or position needs to be checked.
- ❑ **N/A** - Not applicable.

2. Perimeter guards position and/or distance.

- ❑ **Yes** - Perimeter guards appear to be compliant at this time and the safe mounting distance has been calculated and recorded.
- ❑ **No** - Perimeter guards are missing, misapplied, or not securely fastened. Individuals can reach over, under, around or through the guards to the point of operation or the guards are missing or can be easily removed.
- ❑ **May not be compliant** - The safety control system needs to be thoroughly reviewed for compliance with the required level of reliability.
- ❑ **N/A** - Not applicable.

3. Mechanical power transmission apparatus guard(s) position and/or distance.

- ❑ **Yes** - All mechanical power transmission apparatuses below 8 ft. have guards which appear to be compliant at this time.
- ❑ **No** - Mechanical power transmission guards are missing, misapplied, or not securely fastened. Individuals can reach over, under, around or through the guards to the point of operation or the guards are missing or can be easily removed.
- ❑ **May not be compliant** - The safe mountain distance and/or position needs to be checked.
- ❑ **N/A** - Not applicable.

4. Safety control system meets performance requirements.

- ❑ **Yes** - The safety control system has been reviewed by a trained engineer and has been determined to be compliant at this time.
- ❑ **No** - The existing control system does not use safety rated components, such as safety monitoring relays, force guided relays, or a safety rated PLC.
- ❑ **May not be compliant** - The safety control system needs to be thoroughly reviewed for compliance with the required level of reliability.
- ❑ **N/A** - Not applicable.

5. Safeguarding (protective) devices are safety-rated and properly installed.

- ❑ **Yes** - All components of the safety system are rated for human safety and have been tested and listed for such use.
- ❑ **No** - Safeguarding devices are missing, are not safety rated, or are misapplied. The effective protected area is not of adequate height, width, or depth to detect entry of an individual into the hazardous area.
- ❑ **May not be compliant** - The safe mountain distance and/or position needs to be checked.
- ❑ **N/A** - Not applicable.

6. Emergency stop location and compliance with NFPA 79 (when required).

- ❑ **Yes** - The emergency stop devices appear to be compliant at this time.
- ❑ **No** - The emergency stop devices:
  - are missing
  - are not self-latching
  - do not use positive guided contacts: or
  - are not active in all modes: or
  - are not Type 0 or Type 1 stop circuits: or
  - are guarded or not readily accessible

  AND
  - are not mushroom style (for pushbuttons):
  - do not have slack detection or are mounted without springs (for cable pulls).
- ❑ **May not be compliant** - The contact blocks need to be checked for positive guided contacts or the stop circuit needs to be checked for Type 0 or Type 1.
- ❑ **N/A** - Not applicable.

7. Compliant energy isolation device for each source of hazardous energy.

- ❑ **Yes** - All required energy isolation devices appear to be compliant at this time.
- ❑ **No** - All hazardous energy sources are not capable of being controlled.
- ❑ **May not be compliant** - Other potentially hazardous energy sources may exist.
- ❑ **N/A** - Not applicable.

8. Controls have drop-out protection.

- ❑ **Yes** - The control system has been tested for the required drop-out protection.
- ❑ **No** - Machine motion starts automatically when power is restored to the machine.
- ❑ **May not be compliant** - Could not test at time of inspection.
- ❑ **N/A** - Not applicable.

Comments

Safety-Related Control Systems

First of all, what is a safety-related control system (often abbreviated to SRCS)?

It is that part of the machine control system which prevents a hazardous condition from occurring. It can be a separate dedicated system or it may be integrated with the normal machine control system.

Its complexity will vary from a typical simple system, such as a guard door interlock switch and emergency stop switch connected in series to the control coil of power contactor, to a compound system comprising both simple and complex devices communicating through software and hardware.

In order to reliably provide the safety function, the system must continue to operate correctly under all foreseeable conditions.

The International Standard ISO 13849-1 "Safety-Related parts of control systems" gives guidance on the design and analysis of safety-related machine control systems and defines a system of five Performance Levels (PL = a to e) that are quantified in terms of "the average probability of a dangerous failure per hour".

The table shown here is a summary of the 5 Performance Levels and the figures on the next pages show the relationship of the circuit structure (categories B, 1, 2, 3, and 4), diagnostics and reliability in determining Performance Level. Previous versions of ISO 13849-1 considered the structure of the control circuit (e.g. single channel, dual channel, test and monitoring circuits) as sufficient factors to determine safety performance. The new version of ISO 13849-1 adds (in addition to the previous requirements for categories) reliability and diagnostics as factors necessary to determine the safety performance of a control system. The new version of ISO 13849-1 also includes requirements and guidance for the development of software.

The safety-related performance of a machine control system can also be defined in terms of Safety Integrity Levels (SIL = 1, 2 or 3) in accordance with the International Standard IEC 62061 "Functional safety of safety-related electrical, electronic and programmable electronic control systems". This standard provides a process which is most useful for complex control systems based primarily on programmable electronics. However, IEC 62061 is not applicable to non-electrical control systems.

ISO 13849-1 will be more useful for industrial machine control systems because it has requirements for all kinds of machine control technologies regardless of energy used (e.g. electrical, hydraulic, pneumatic, and mechanical). ISO 13849-1 has the additional benefit of continuing the use of the same circuit categories (B, 1, 2, 3 and 4) that machine builders are already familiar with.

Note—In December 2009 the previous version of ISO 13849-1 will be cancelled and the use of categories alone will no longer be adequate to describe the performance level of safety-related control systems.

Control Reliability

Control reliability is defined by ANSI standard B11.19-2010, as ***"The capability of the machine control system, the safeguarding, other control components and related interfacing to achieve a safe state in the event of a failure within their Safety-Related functions."***

The term has been in use for several years but is rapidly becoming obsolete due to the wide acceptance of the International Standards ISO 13849 and IEC 62061 which provide a more complete and verifiable means of specifying the safety performance level of control circuits.

Based on common practice, control reliability corresponds to a minimum of performance level PL d in accordance with ISO 13849-1 or safety integrity level SIL 2 in accordance with IEC 62061.

Performance Levels (PL)

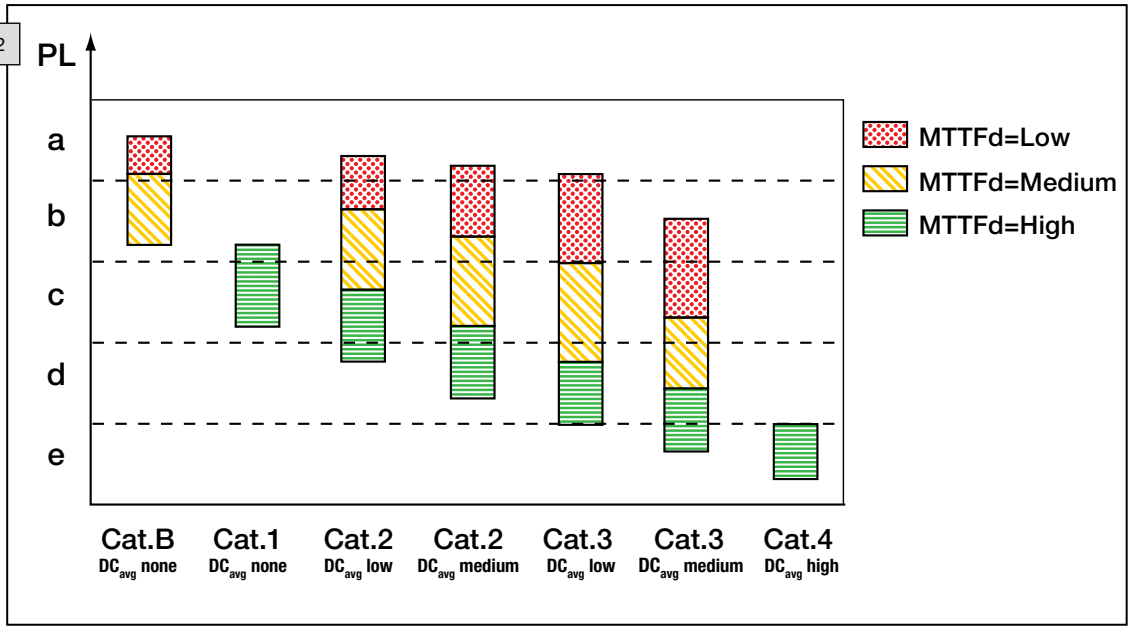
Fig. 2.1

PL	Average probability of dangerous failure per hour (1/h)
a	$\geq 10^{-5}$ to $< 10^{-4}$
b	≥ 3 x 10-6 to < 10-5
c	$\geq 10^{-6}$ to $< 3 \times 10^{-6}$
d	$\geq 10^{-7}$ to $< 10^{-6}$
e	$\geq 10^{-8}$ to $< 10^{-7}$

NOTE: Besides the average probability of dangerous failure per hour, other measures are also necessary to achieve a PL. (e.g. proper installation, maintenance and protection against environmental influences).

Performance Level (PL) is determined from a combination of category, reliability and diagnostic coverage. For compete details, see ISO 13849-1.

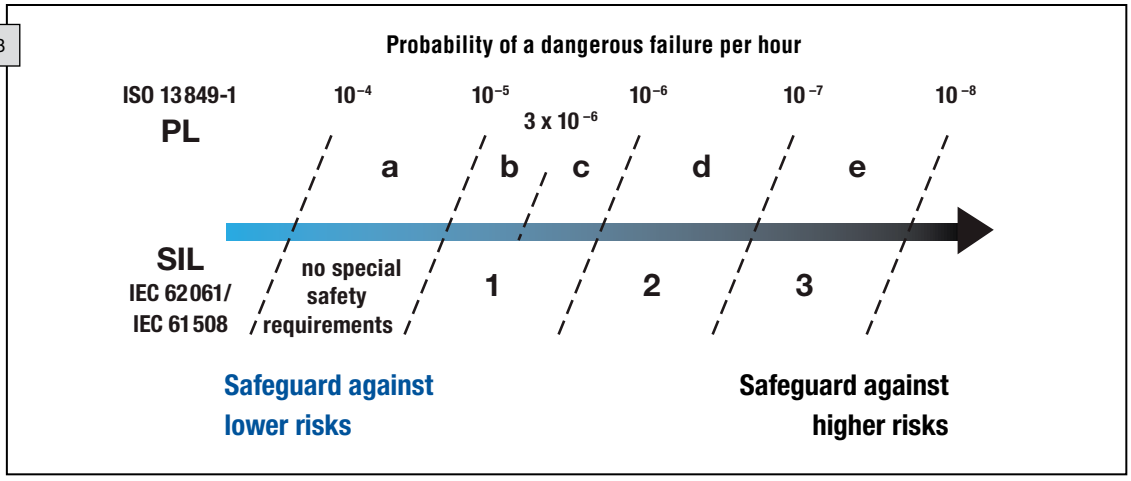
Fig. 2.2



NOTE: Categories 2, 3, and 4 must also be protected against common cause failures (CCF).

Relationship Between Safety Integrity Levels (SIL) and Performance Levels (PL)

Fig. 2.3



Requirements For Categories

Fig. 2.4

Category	Summery of Requirements	Safety Principle
B	Will perform the required safety function. Designed to withstand expected stresses (for example, electrical load, vibration, EMC).	Quality of components Prevention of faults
1	Requirements of Category B and Use well tried safety components and safety principles.	
2	Requirements of Category B and The safety function is tested or inspected at suitable intervals. (NOTE: The safety function can fail in between test intervals.)	
3	Requirements of Category B and Single faults will not prevent the safety function. Single faults are detected whenever practical.	Structure of circuit Detection of faults
4	Requirements of Category 3 and Single faults are detected when or before performing the safety function. Accumulated faults will not prevent the safety function.	

NOTE: For complete descriptions and requirements for categories of circuit structure, see ISO 13849-1.

Mean Time to Dangerous Failure (MTTFd)

Fig. 2.5

• Average time for the system to encounter a dangerous failure
• Classified into three levels: Low, Medium, and High

Low	3 years $\leq$ $MTTF_d$ < 10 years
Medium	10 years $\leq$ $MTTF_d$ < 30 years
High	30 years $\leq$ $MTTF_d$ $\leq$ 100 years

NOTE: Results of more than 100 years are classified as High.

Diagnostic Coverage (DC)

Fig. 2.6

• Diagnostic Coverage is the percentage of all dangerous faults that are detected.
• Classified into four levels: None, Low, Medium, and High.

None	DC < 60%
Low	60% $\leq$ DC < 90%
Medium	90% $\leq$ DC < 99%
High	99% $\leq$ DC

NOTE: For safety-related control systems consisting of several parts, an average value of DC will be used.

So how do you decide on which category to use?

In order to translate these requirements into a system design specification there has to be an interpretation of the basic requirements.

The categories are intended as starting points which describe the structure of different types of safety-related control systems (or their constituent parts).

Categories B and 1 are aimed at the PREVENTION of faults. It is achieved by the use of suitable design principles, components and materials. Simplicity of principle and design together with the use of materials with stable and predictable characteristics are the keys to this category.

Categories 2, 3 and 4 are aimed at the DETECTION of faults (and appropriate action taken). Monitoring and checking are the keys to these categories. The most common (but not the only) method of monitoring is to duplicate the safety critical functions (i.e. redundancy) and compare their operation.

In the following examples, the reliability of the components used and the completeness of the fault detection are critical factors in the final determination of the safety performance level of the control circuit.

The example in *Figure 2.7* is a simple system comprising a guard door interlock switch connected in series to the control coil of a power contactor.

If the goal is toward complete reliability with no possibility of a failure to a dangerous condition, which of the categories is most appropriate?

Figure 2.7 also shows the location and nature of potential dangerous faults.

For this simple case, which circuit structure would be most appropriate? The prevention of faults or the detection of faults?

The first step is to separate the system into its major components and consider their modes of potential failure.

In this example the components are:

- Interlock switch
- Contactor
- Wiring

The interlock switch is a mechanical device. The task which it performs is a simple one i.e. opening the contacts when a guard door is opened. It fulfills the requirements of category 1 and by the use of correct design principles and materials it can be demonstrated that, when used within its stated operating parameters, it will have no failures to a dangerous condition. This is made feasible because the device is relatively simple and has predictable and provable characteristics.

The contactor is a slightly more complex device and may have some theoretical possibilities for failure. Contactors from reputable manufacturers are extremely reliable devices. Statistics show that failures are rare and can usually be attributed to poor installation or maintenance.

Contactors should always have their power contacts protected by an overcurrent cut-out device to prevent welding.

Contactors should be subject to a regular inspection routine to detect excessive contact pitting or loose connections which can lead to overheating and distortion.

The contactor should comply with relevant standards which cover the required characteristics and conditions of use.

By attending to these factors it is possible to keep the possibilities of failure

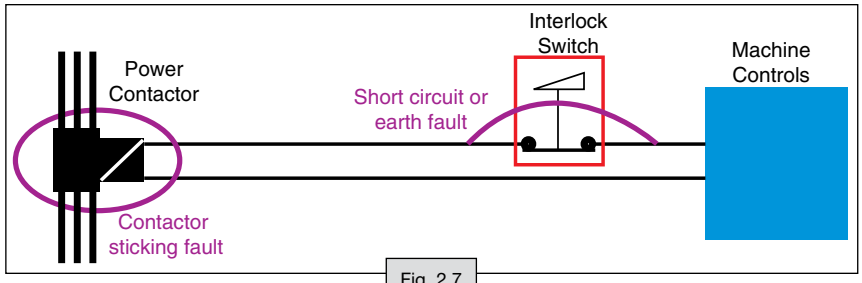


Fig. 2.7

to a minimum. But for some situations even this is unacceptable and in order to increase the level of safety provision we need to use redundancy and monitoring.

The wiring which connects the components together must also be considered. Undetected short circuit and ground faults could lead to a dangerous condition but if it is properly designed and installed using standards such as IEC 60204-1 for guidance then the chances of failure are greatly reduced.

This system can provide a significant level of safety which may be adequate for many situations. However both the contactor and the wiring are prone to unlikely, though theoretically foreseeable faults. In some cases it may be possible, by taking precautions (e.g. with regard to cable protection and routing) to eliminate all fault possibilities. If this is not feasible then techniques relevant to categories 2, 3 and 4 such as redundancy and monitoring are usually both more practical and cost effective.

Figure 2.8 shows a system which fulfills the requirements of category 3. A G9SA safety monitoring relay unit is used to monitor a two-channel control circuit. Any single fault on the wiring or contactors will be detected by the safety monitoring relay at the next demand on the safety function. Although the interlock switch now has double pole contacts it is still a single **device** which fulfills the requirements of category 1 - forming part of a **system** which fulfills the requirements of category 3.

This poses the question of when, and to what degree, do we need to take such measures.

The simple answer is that it depends on the results of the risk assessment.

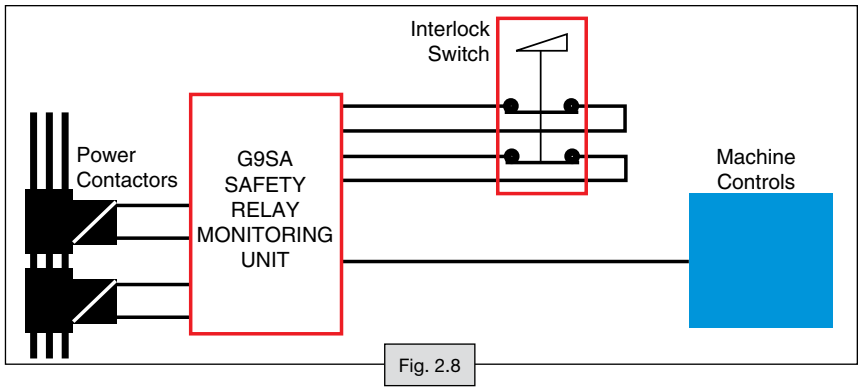


Fig. 2.8

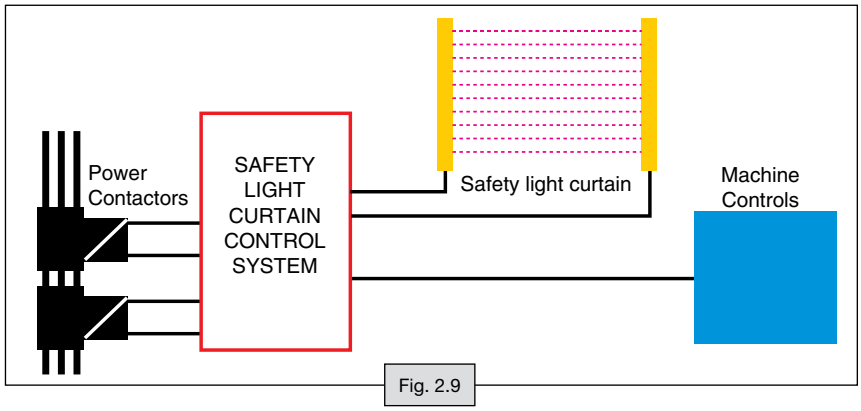


Fig. 2.9

This is the correct approach but we must understand that this includes all factors and not just the level of risk at the hazard point. For example, you may assume that if the risk estimation shows a high level of risk, the interlock switch should be doubled up and monitored. But in many circumstances this device, due to its application, design and simplicity, will not fail to danger and there will be no undetected faults to monitor.

Therefore the situation is becoming clear, **the type of category used will depend on both the required performance level (PL) and the nature and complexity of the device or system**. It is also clear that where a total system meets the requirements of category 3, it may include devices to category 1 if the reliability of the category 1 device is sufficiently high.

If faults are possible, then the higher the degree of risk, the greater the justification for measures to prevent or detect faults and the circuit category should be chosen to give the most suitable and efficient method of doing this. Remember, the level of risk is one factor but the nature of the protective device or system and the machine's operating characteristics must also be taken into account.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Figure 2.9 shows the same basic circuit but the interlock switch is replaced by a safety light curtain.

The safety light curtain is a complex device. Even in its simplest form it will have a relatively large number of electronic components including integrated circuits. More sophisticated types, with more features, may also depend on programmable devices and software.

To anticipate and eliminate all dangerous faults in an electronic but non-programmable device would be a huge task and with a programmable device it would be virtually impossible. Therefore we must accept that faults will be possible and the best answer is to detect them and ensure that the necessary protective action is taken (e.g. locking out to a safe state). So we would need a device that satisfies the requirements of category 2, 3 or 4. With a simple circuit such as in Figure 2.9 the light curtain will also monitor the wiring and contactors. As all light curtains are relatively complex, the choice of circuit category and performance level will depend primarily on the results of the risk assessment. This does not preclude the fact that it may be possible to work to a different category if a device uses an unconventional but provable approach.

We can see from the last two examples that the **same level** of protection is provided by two types of systems using devices satisfying **different** categories.

Hopefully these examples will encourage a pattern of logic to enable the correct decision to be made.

Further Considerations and Examples

In this section we will give examples of Safety-Related control circuits with reference to recommended practices and the Safety-Related control system categories where appropriate.

General Requirements

The system must be capable of withstanding all expected influences. These will include temperature, environment, power loading, frequency of use, airborne interference, vibration etc. The standard IEC 60204-1 “Safety of machinery - Electrical equipment of machines - Specification for general requirements” provides detailed guidance on such things as electric shock protection, wiring practices, insulation, equipment, power supplies, control circuits and functions, etc. A knowledge of this standard is essential for those concerned with the design and maintenance of Safety-Related control systems.

Circuits and Monitoring Safety Relay Units

The examples given below are based on the use of an interlock switch but the same principle can be applied to other switching device (e.g. emergency stop or trip devices).

Category 1 (PL = b or c)

Figure 2.10 shows a simple Safety-Related control circuit. The interlock device has positive mode operation and satisfies the requirements of category 1. The contactor is correctly selected for its duty and is designed and manufactured to specific standards. The part of the system most prone to a fault is the connecting wiring. In order to overcome this it should be installed in accordance with the relevant clauses of standard IEC 60204-1. It should be routed and protected in a manner which prevents any foreseeable short circuits or earth faults. This system will satisfy the requirements of category 1.

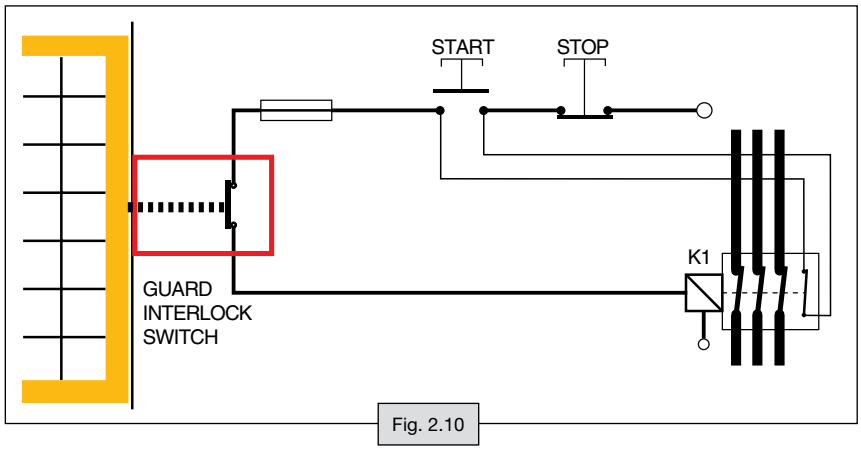


Fig. 2.10

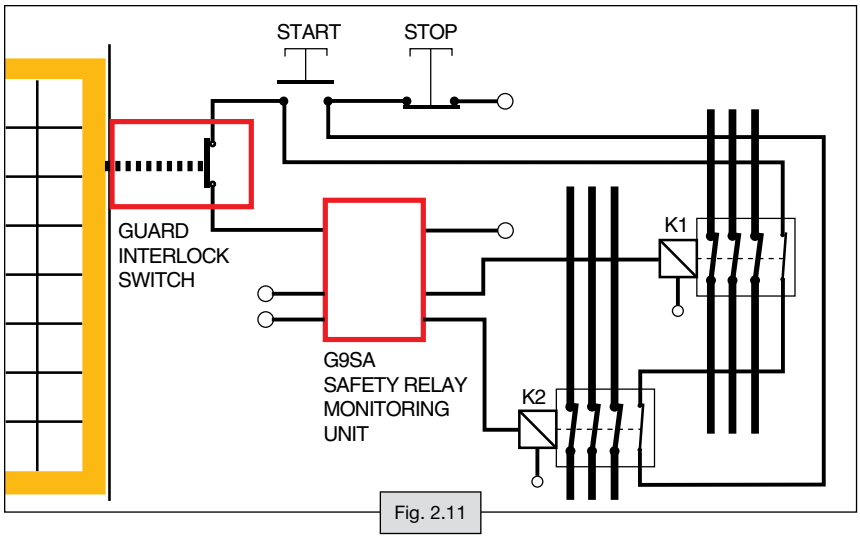


Fig. 2.11

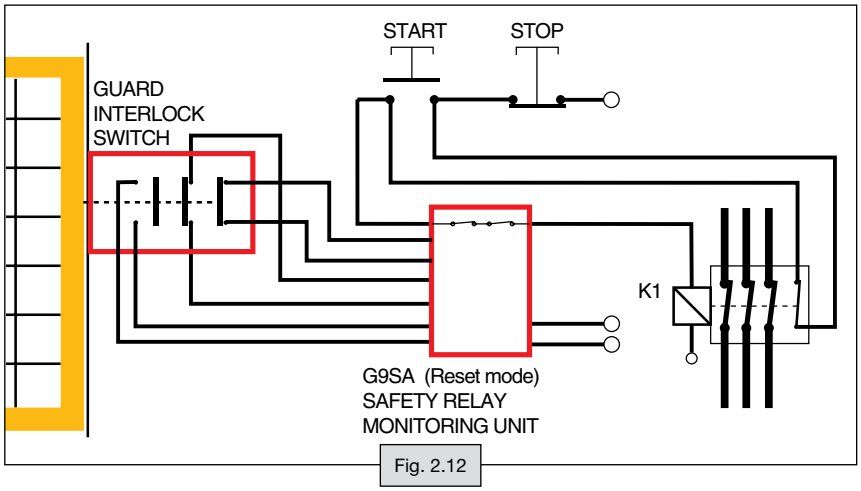


Fig. 2.12

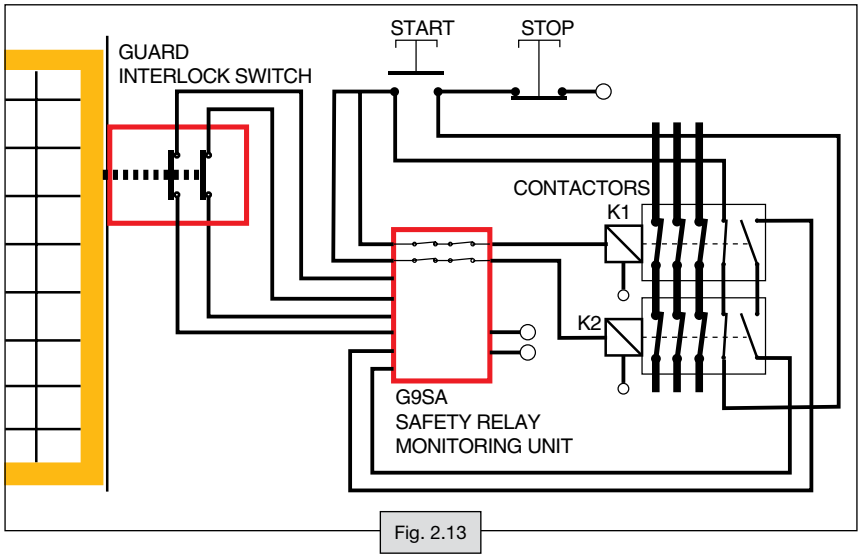


Fig. 2.13

Figure 2.11 shows a slightly more complex circuit. In this case there is a requirement for the interlock switch to control more than one contactor, each being on a different power circuit. Its component parts must be given the same considerations.

With a non-Safety-Related circuit an ordinary relay could be used to "split" the signal but where safety is concerned this would definitely not be acceptable as they can (and sometimes do) stick. Therefore a monitoring safety relay unit such as the G9SA is used to provide an ensured switching action. This system will satisfy the requirements of category 1.

Category 2 (PL = b, c, or d)

Figure 2.12 shows a system which satisfies the requirements of category 2 and therefore must undergo a test of the safety function before the machine can be started. It must also be tested during operation at suitable intervals determined by the risk assessment.

At initial power up the safety monitoring relay will not allow switching of power to the contactor until the guard is opened and closed. This initiates a check for any single faults in the circuit from the switch to the safety monitoring relay. Only when this check is successful will the contactor be energized. At every subsequent guard operation the circuit will be similarly checked.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Category 3 (PL = b to e)

Figure 2.13 shows a system which satisfies the requirements of category 3 and is often suitable for applications with higher risk estimations. It is a dual channel system which is fully monitored including the two contactors. On opening and closing the guard, any single dangerous fault will cause the safety monitoring relay to lock off power to the contactors until the fault is rectified and the safety monitoring relay is reset.

Category 4 (PL = e)

Category 4 requires that the safety function is always provided even with an accumulation of undetected faults. The most practical way of achieving this is to employ continuous testing or monitoring techniques. This is not feasible with most mechanical or electro-mechanical components (e.g. mechanical switches, relays, contactors) which are used in interlocking and emergency stop systems.

These techniques are viable (and often used) to monitor solid-state electronic components because a high frequency change of state is possible and does not substantially degrade the life of the component. Therefore the category 4 approach is often found in self contained "sub-systems" such as light curtains.

P.E.S. (Programmable Electronic Systems)

In the Safety-Related circuits shown, the protective device is directly connected to the contactor(s) using only wiring and simple or fully monitored electro-mechanical devices. This is the normally recommended "hard wired" method. Its simplicity means that it is reliable and relatively easy to monitor.

Increasingly, the operational control of machinery is handled by programmable equipment. With the advances in technology, programmable and complex electronic control systems could be regarded as the "central nervous system" of many machines. Whatever happens in the control system will affect the machine action and conversely whatever happens to the machine action will affect the control system. Stopping one of these machines by any source other than its control system may result in severe tool and machine damage as well as program loss or damage. It is also possible that, upon restarting, the machine may behave in an unpredictable manner due to "scrambling" of its control command sequence.

Unfortunately most programmable electronic systems have too many failure modes (due to their complexity) to allow their use as the only way of stopping the machine on command from a guard door interlock or emergency stop button.

In other words we can stop it without machine damage **or** stop it **safely but not both**. So what do we do? Three possible solutions are given below:

1. Safety-Related Programmable Systems

In theory it is possible to design a programmable system which has a safety integrity level high enough for Safety-Related use. In practice this would normally be achieved by using special measures such as duplication and diversity with cross monitoring. In some situations this may be possible but it is important to realize that these special measures will need to be applied to all aspects including the writing of software.

The basic question is, can you prove that there will be no (or sufficiently few) failures? A full failure mode analysis for even relatively simple programmable equipment may, at best, be excessively time consuming and expensive or, at worst, impossible.

The standard IEC 61508 deals with this subject in great detail. Anyone concerned with Safety-Related programmable systems is advised to study it.

The development costs of these systems are justifiable in applications where they have significant advantages or no other method will work.

2. Monitoring Unit with Time Delayed Override Command (see *Figure 2.14*)

This system has the high integrity level of hard wiring and also allows a correctly sequenced shut-down which protects the machine and program.

The G9SA primary outputs are connected to inputs at the programmable device (e.g. PLC) and the delayed outputs are connected to the contactor. When the guard interlock switch is actuated, the primary outputs on the safety monitoring relay switch immediately. This signals the programmable system to carry out a correctly sequenced stop. After sufficient time has elapsed to allow this process the delayed output on the safety monitoring relay switches and isolates the main contactor.

Note: Any calculations to determine the overall stopping time must take account of the safety monitoring relay output delay period. This is particularly important when using this factor to determine the positioning of devices in accordance with standard ISO 13855.

3. Programmable System Controlled Guard Locking Devices (see *Figure 2.15*)

This system again provides the high integrity level of hard wiring combined with the ability to give a correctly sequenced shut down but it is only applicable where the hazard is protected by a guard.

In order to allow opening of the guard door the D4GL solenoid must receive a release signal from the PLC. This signal will only be given after a stop command sequence has been completed. This ensures there is no tool damage or program loss.

When the solenoid is energized the door can be opened which causes the control circuit contacts on the D4GL to isolate the machine contactor.

To overcome machine run-down or spurious release signals, it may be necessary to use a G9SX-SM stopped motion detector in conjunction with the PLC. (Either a D4GL or D4NL switch can be used in this application.)

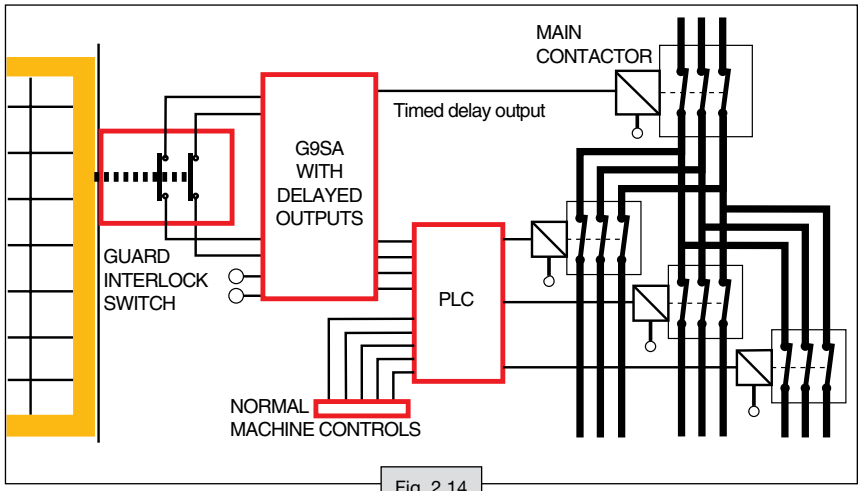


Fig. 2.14

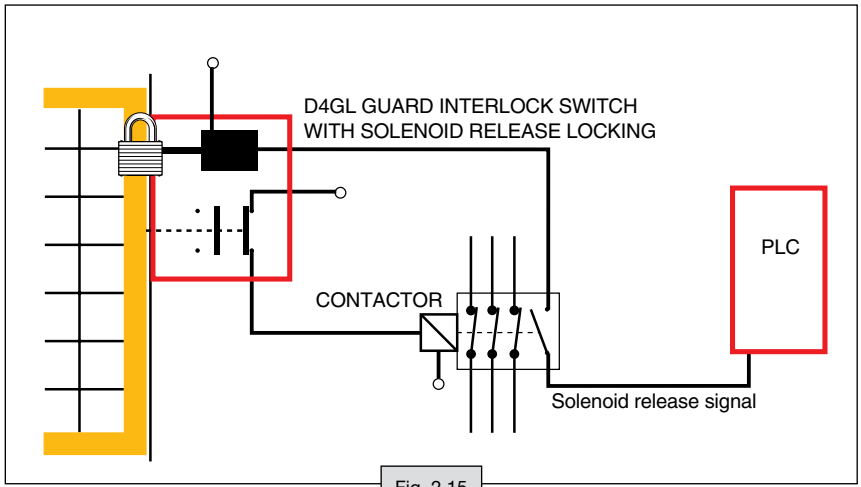


Fig. 2.15

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Other Considerations

Machine Restart - Manual/Auto Reset and Control Guards

If (for example) an interlocked guard is opened on an operating machine, the safety interlock switch will send a stop signal to that machine. In most circumstances the machine must not restart immediately when the guard is closed. The most common way of achieving this is to rely on a latching contactor start arrangement as shown in *Figure 2.16* (an interlocked guard door is used as an example here but the requirements apply to other protection devices and emergency stop systems).

Pressing and releasing the start button momentarily energizes the contactor control coil which closes the power contacts. As long as power is flowing through the power contacts the control coil is kept energized (electrically latched) via the contactor's auxiliary contacts which are mechanically linked to the power contacts. Any interruption to the main power or control supply results in the de-energizing of the coil and opening of the main power and auxiliary contacts. The guard interlock is wired into the contactor control circuit. This means that restart can only be achieved by closing the guard and then switching "ON" at the normal start button which resets the contactor and starts the machine. For additional information, see ANSI B11.19-2010, 7.2.6 and ANSI/RIA R15.06-1999 (R2009), 11.2.2 b) 5-6.

Many machines already have either single or double contactors which operate as described above (or have a system which achieves the same result). When fitting an interlock to existing machinery it is necessary to determine whether the power control arrangement meets this requirement and take additional measures if necessary.

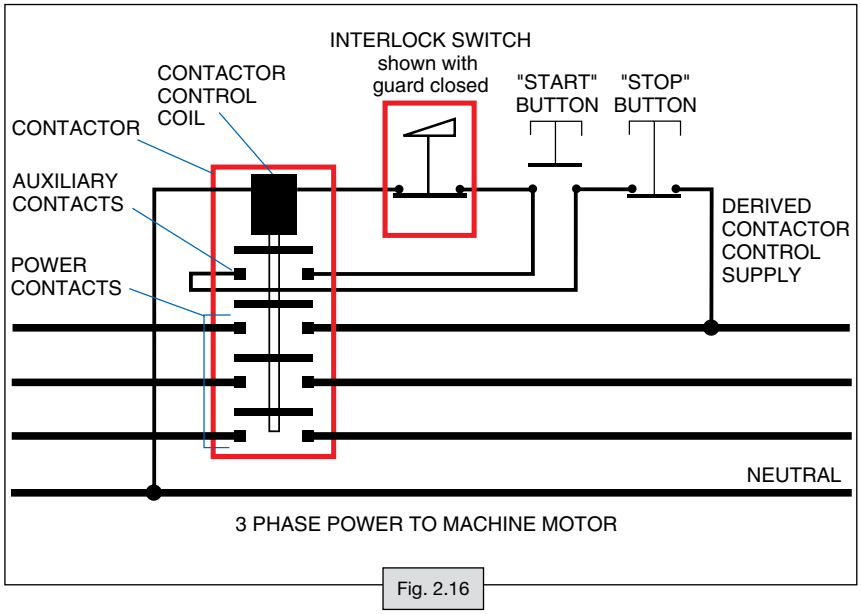


Fig. 2.16

Auto/Manual Reset

On some types of protective devices, after actuation of the safety function, the output will remain off until the device has been reset.

Some devices are available in either manual reset or auto-reset versions.

A **manual reset** depends on a manual switching action after the de-actuation of the device and may also trigger a system integrity check before the safety system is reset to render the machine capable of being started. It will require the operation of a button or key-operated switch which may be either on the device, the control unit or at a remote location. Wherever it is, it must provide a good view of the hazard so that the operator can check that the area is clear before operation.

In *Figure 2.17*, after the guard has been opened and closed again the safety monitoring relay will not allow the machine to be restarted until the reset button has been pressed and released. When this is done the safety monitoring relay checks that both contactors are OFF and that both interlock circuits (and therefore the guard) are closed. If these checks are successful the machine can then be restarted from the normal controls.

An **auto-reset device** does not require a manual switching action but after de-actuation it will always conduct a system integrity check before resetting the system.

An auto-reset system should not be confused with a device without reset facilities. In the latter the safety system will be enabled immediately after de-actuation but there will be no system integrity check.

Control Guards

A **control guard** stops a machine when the guard is opened and directly starts it again when the guard is closed.

The use of control guards is only allowed under certain stringent conditions because any unexpected start-up or failure to stop would be extremely dangerous. The interlocking system must have the highest possible reliability (it is often advisable to use guard locking).

The use of control guards can ONLY be considered on machinery where there is NO POSSIBILITY of an operator or part of his body staying in or reaching into the danger zone while the guard is closed.

The control guard must be the only access to the hazard area.

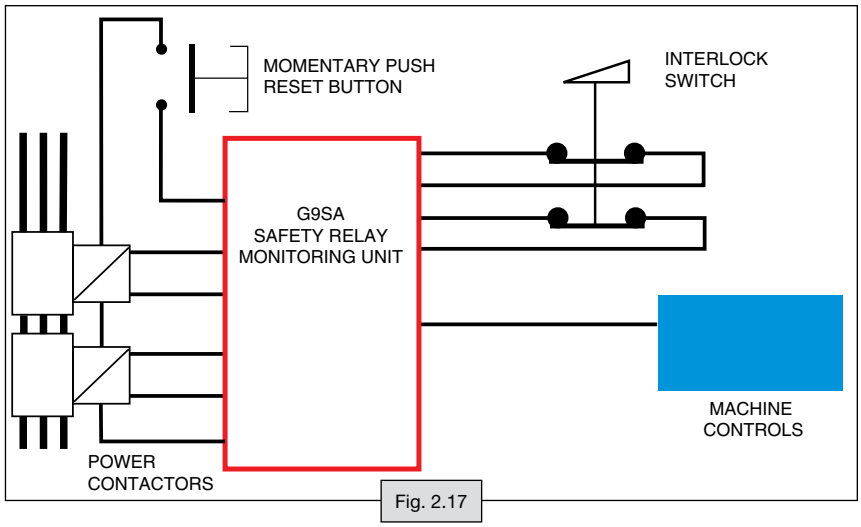


Fig. 2.17

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

A

Common Circuit Examples

Notes on Circuit Examples A-28

Section 1 – Listing by Product Name

A22E Series A-29, A-32, A-33, A-34, A-35, A-36, A-37, A-38
D4BL, D4JL, D4SL A-35, A-37, A-38
D4N-R Series A-33
D4NL A-34
ER6022 ..... A-39
G9SA A-35, A-39
G9SA-TH301 ..... A-40
G9SA-321T A-31
MA Series A-32
SR101A A-32
SR103AM A-30, A-33, A-38
SR125SMS45 ..... A-38
SR209AD A-35, A-36
T4012 ..... A-30
T5009 ..... A-29, A-31
TL4019 ..... A-36

Section 2 – Listing by Product Type

Emergency Stop Switches
E-Stop ..... All (except A-30, A-31, A-39, A-40)
Rope Pull A-39

Interlock Switches
Guard Door Locking A-36
Magnetic A-32
Mechanical Tongue A-29, A-30, A-31
Limit A-33

Monitoring Relays & Control Units
Controls for Two-hand Palm Switches A-40
Relays A-30, A-31, A-32, A-35, A-36, A-38, A-39, A-40
Relay with PLC Interfacing A-31

Solenoid Latching Interlock Switches
Mechanical Tongue A-34, A-35, A-36, A-37, A-38
PLC Interfacing A-31

Two Hand Palm Switches
Mechanical A-40

Notes on Circuit Examples

Note 1

In the following circuits the type of device is shown as an example to illustrate the circuit principle. For specific applications the choice of device type should be based on the suitability of its characteristics for its intended use.

Note 2

In most of the following examples showing dual channel applications, one interlock switch, is shown switching both channels (one contact set per channel). If it is foreseeable that damage to the guard (i.e. at the actuator mounting point) could allow it to be opened without operating the switch, then two separate switches may be required. The electrical principle of the circuit will remain the same as shown.

Note 3

In most cases the circuits are shown with the guard door closed and ready for motor starting by operating the normal start control.

It must be possible to start the machine only by voluntary actuation of the control provided for the purpose (see ISO 12100 and IEC 60204-1). For the purposes of these examples, the use of a conventional contactor latching circuit has been assumed. If this is not the case, then a restart interlock will be required to prevent an automatic or unintended starting of the motor when the guard is closed. A safety monitoring relay with a momentary action push button installed in the output monitoring circuit can be used to achieve this.

If the guard is designated as a Control Guard (see ISO 12100, 5.3.2.5), these requirements do not apply. The use of Control Guards is only allowed under certain conditions including:

- A Control Guard can only be used where there is no possibility of an operator or part of his body staying in or reaching into the danger zone while the guard is closed.
- The Control Guard must be the only access to the hazard area.
- The interlocking system must have the highest possible reliability. It is often advisable to use a solenoid locking switch such as the D4JL, D4GL, D4NL, TL4024 or TL4019.

Note 4

This note applies to all monitoring devices which use the technique of comparing the signal at the change of state of dual channels, safety monitoring relay units used in dual channel circuits with infrequent operation, or with more than one switching device connected.

Certain faults are only detected at a change of state of the input switching device (interlock switch or E-stop switch). If there are long periods (i.e. months as opposed to days) between switching actions, it may be possible for multiple faults to accumulate which could lead to a dangerous situation. Therefore, a regular check should be performed on the system in order to detect single faults before an accumulation occurs. This check may be manual or initiated by part of the machine's control system.

If, for example, three interlock switches are connected to the monitoring unit, certain faults will only be detected at the switch on the first guard to be opened and the switch on the last guard to be closed. This is because any switching between the first opening/last closing will not change the state of the monitoring unit input circuits. Therefore, in some applications, it may be necessary to use one monitoring device per switch.

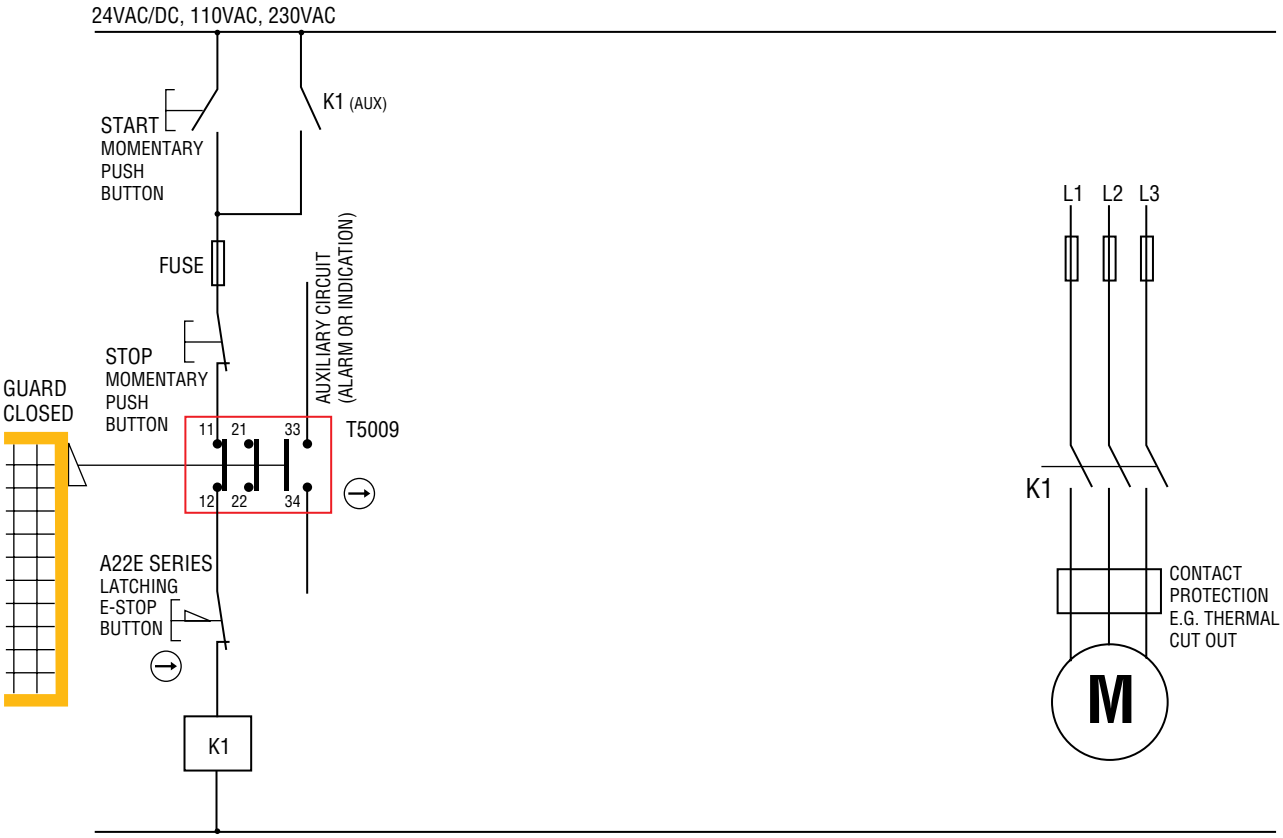
Most of the following examples show an interlock switch and an emergency stop switch combined in the circuit. When a safety monitoring relay is used for fault detection, it is important to note the following:

- All safety critical single faults, except for certain faults over the contact sets at the E-Stop, will be detected at the next opening of the guard.
- All safety critical single faults, except for certain faults over the contact sets at the interlock switch, will be detected at the next operation of the E-Stop.
- Because the E-Stop device is not likely to be operated frequently, it is recommended that its function is checked (with the guard closed) on a regular basis (start of shift or daily) to enable the safety monitoring relay to detect single faults. If the guard is rarely opened, the interlock switch should be checked in a similar manner.



Note 5

Where this symbol is used in the following example circuits, it indicates that the component or device indicated operates in the positive mode. (i.e. where two or more components are intended to move together, they are connected by direct contact or rigid links). Typical examples of this are mechanical guard interlock switches and force guided relays.



Guard Door Interlock and E-Stop

- **Single Channel**
- **Non Monitored**

Circuit status

Circuit shown with guard door closed and ready for motor starting.

Operating principle

Opening the guard or operating the E-Stop device will cause the contactor to isolate the motor power.

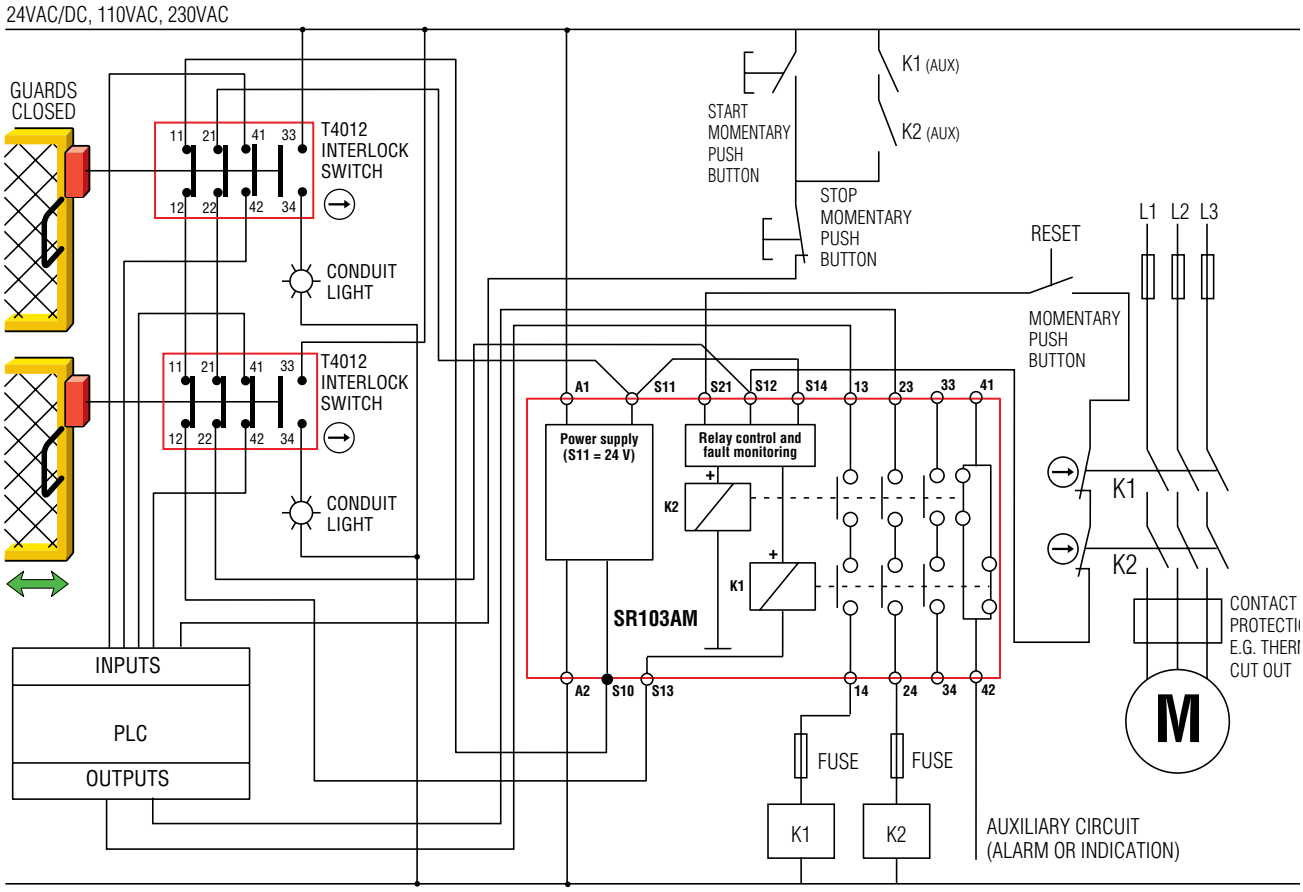
Fault behavior

The integrity of the circuit depends on the suitability of the components (conformity with standards, tried and tested principles, etc.) and the nature of the wiring installation (use of protective conduit, short wiring runs, no movement of wiring, etc.).

Comments

This type of arrangement is widely used in applications which have low risk and where the wiring can be properly protected.

Refer to notes starting on page A-28.



Two Guard Door Interlocks with PLC Control

- **Dual Channel (2 x N/C)**
- **Single Fault Monitored**
- **Manual Auto Reset**

Circuit status

Circuit shown with guard doors closed and ready for motor starting after closing Reset.

Operating principle

This is a dual channel system with monitoring of the two contactors. It uses two interlock switches each with four poles. Three poles are positive mode N/C and one pole is N/O.

Opening the guard will open the input circuits (S11-S12 & S10-S13) to the safety monitoring relay unit. The safety monitoring relay output circuits (13-14 & 23-24) will open and cause the contactors to isolate the motor power. After operation of the guard, the reset button must be closed before the motor can be restarted. Auto reset may be implemented by removing the reset switch.

The PLC is notified of Start and Stop commands via the Start button, Stop button, or the safety switches contacts. The PLC handles the non-safety machine control functions whereas the safety interlocks and monitoring safety relay handle the safety functions.

Fault detection

Any single fault will not cause a loss of safety function.

If either contactor K1 or K2 sticks ON, the motor will stop on command due to the other contactor, but the safety monitoring relay cannot be reset (thus the fault is revealed to the operator).

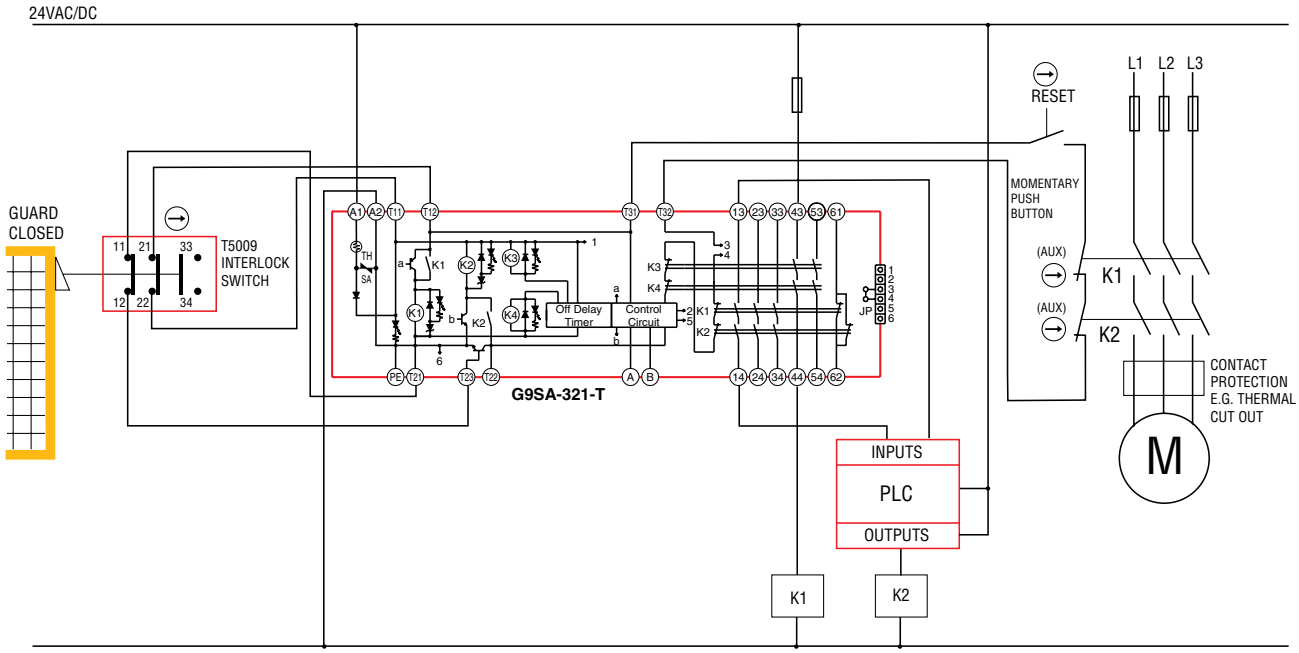
Any single fault detected on the safety monitoring relay input circuits will result in the lock-out of the system to a safe state (OFF) at the next operation of the respective input device (see Note 4 on page *A-28.*).

Comments

This type of system is widely used on machines with medium to high risk and in applications where the wiring cannot be fully protected against all potential damage.

Refer to notes starting on page A-28.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY



PLC Control with T5009 and G9SA-321-T

- Monitored Manual Reset

Circuit status

Circuit shown with guard door closed, ready for motor starting (via signals from the PLC).

Operating principle

The G9SA-321-T immediate action outputs at 13-14 are connected to inputs at the PLC and the delayed outputs at 33, 44 are connected to the contactor K1. The relevant PLC outputs are connected to contactor K2. If the guard is opened the safety monitoring relay contacts 13-14 immediately signal the PLC to stop the motor. The PLC then has a pre-set time limit (adjustable at the G9SA-321-T) to execute its shut down sequence and switch OFF contactor K2. After this time period has elapsed, the delayed action outputs 43, 44 will switch off contactor K1, thus ensuring isolation even if there is a hardware, program or systematic fault in the PLC.

Fault detection

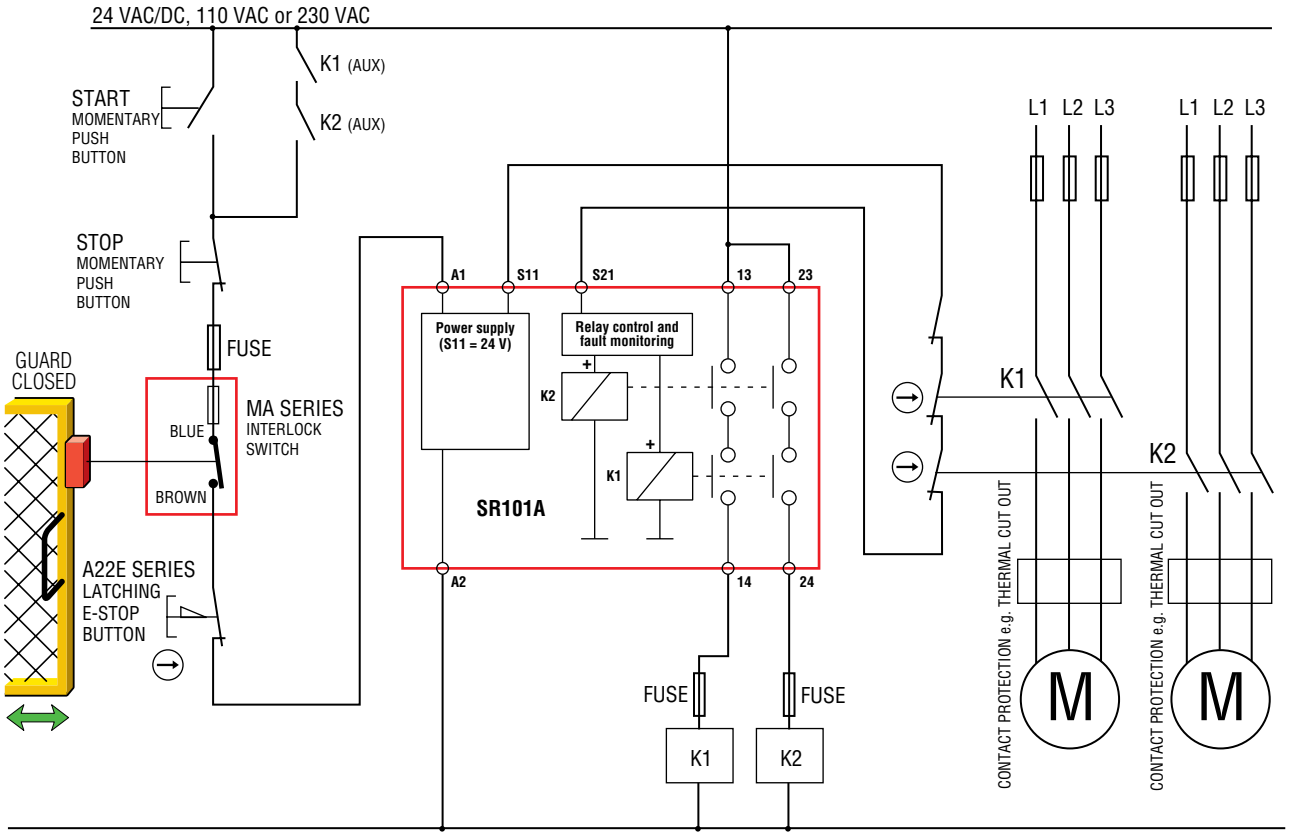
If either contactor K1 or K2 sticks ON, the motor will stop on command but the safety monitoring relay cannot be reset (thus the fault is revealed to the operator).

Any single fault detected on the safety monitoring relay input and output circuits will result in the lock-out of the system to a safe state (OFF). All safety critical single faults will be detected at the next opening of the guard.

Comment

This system has the high integrity of hard wiring and also allows a correctly sequenced shut-down which protects the machine and program.

Refer to notes starting on page A-28.



Guard Door Interlock and E-Stop

- **Single Channel**
- **Monitored Output**
- **Auto Reset**

Circuit status

Circuit shown with guard door closed and ready for motor starting.

Operating principle

This is a single channel system with monitoring of the contactors. It uses an SR101A monitored safety relay to distribute the signal from the interlock and E-Stop switches to two contactors.

Opening the guard or operating the E-Stop device will open the input circuits (A1-A2) to the SR101A. The output circuits (13-14 & 23-24) will open and cause the contactors to isolate power to the respective motors.

The SR101A requires a 24 V AC/DC supply.

Fault behavior and detection

The integrity of the circuit depends on the suitability of the components (conformity with standards, tried and tested principles etc.) and the nature of the wiring installation (use of protective conduit, short wiring runs, no movement of wiring etc.).

The SR101A provides an ensured switching action. Contactor monitoring is provided via terminals S11-S21. When more than one contactor is used, if one of the contacts stick ON, the restarting of the other two will be prevented by the safety monitoring relay.

The SR101A can be configured with two contactors in series to control one motor and if either contactor sticks ON, the motor will stop on command due to the other contactor but the SR101A will not reset.

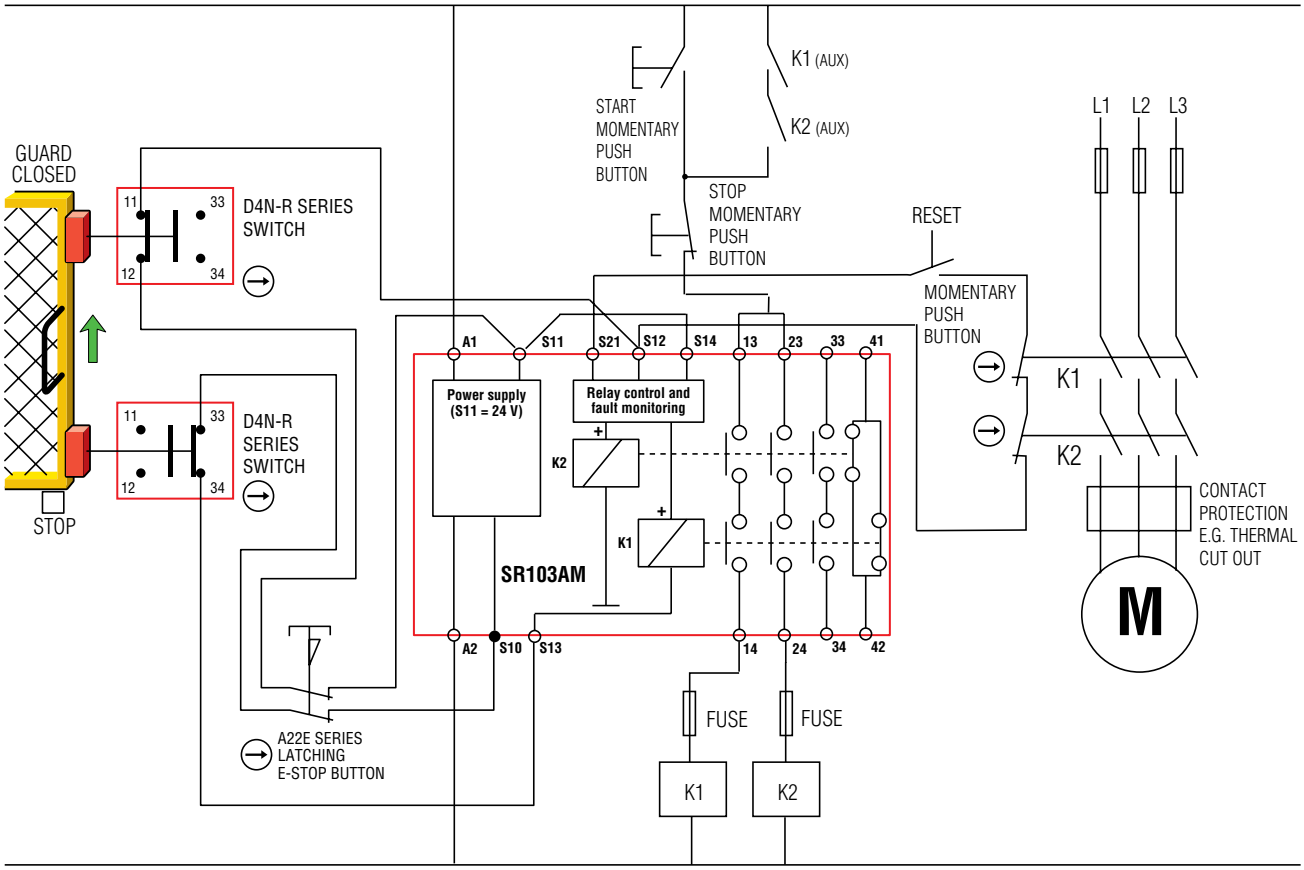
All safety critical single faults within the SR101A itself will be detected. **It does not detect some faults at its input circuit and therefore it is possible for a single fault to cause a loss of safety function.**

Comments

This type of system is widely used where an intermediate relay is required between the Interlock switch or E-Stop device and the contactor(s). An ordinary relay would not be suitable for this purpose because of its failure modes. This is typically the case where multiple motors are being switched or a higher current switching capacity is required. It is suitable in applications which have low to medium risk and where the wiring can be properly protected.

Refer to notes starting on page A-28.

24VAC/DC, 110VAC, 230VAC



Guard Door Interlock and E-Stop

- **Dual Channel**
- **Single Fault Monitored**
- **Manual Auto Reset**

Circuit status

Circuit shown with guard door closed and ready for motor starting after closing Reset.

Operating principle

Opening the guard or operating the E-Stop device will switch the input circuits (S11-S12 & S10-S13) to the safety monitoring relay unit. The SR103AM output circuits (13-14 & 23-24) will open and cause the contactor to isolate the motor power.

The reset switch must be closed before the motor can be restarted. Auto reset may be implemented by removing the reset switch.

Fault detection

Any single fault will not cause a loss of safety function.

If either contactor K1 or K2 sticks ON - The motor will stop on command due to the other contactor, but the safety monitoring relay cannot be reset.

Any single fault detected on the safety monitoring relay input circuits will result in the lock-out of the system to a safe state (OFF) at the next operation of the respective input device (see Note 4 on page A-28).

Comments

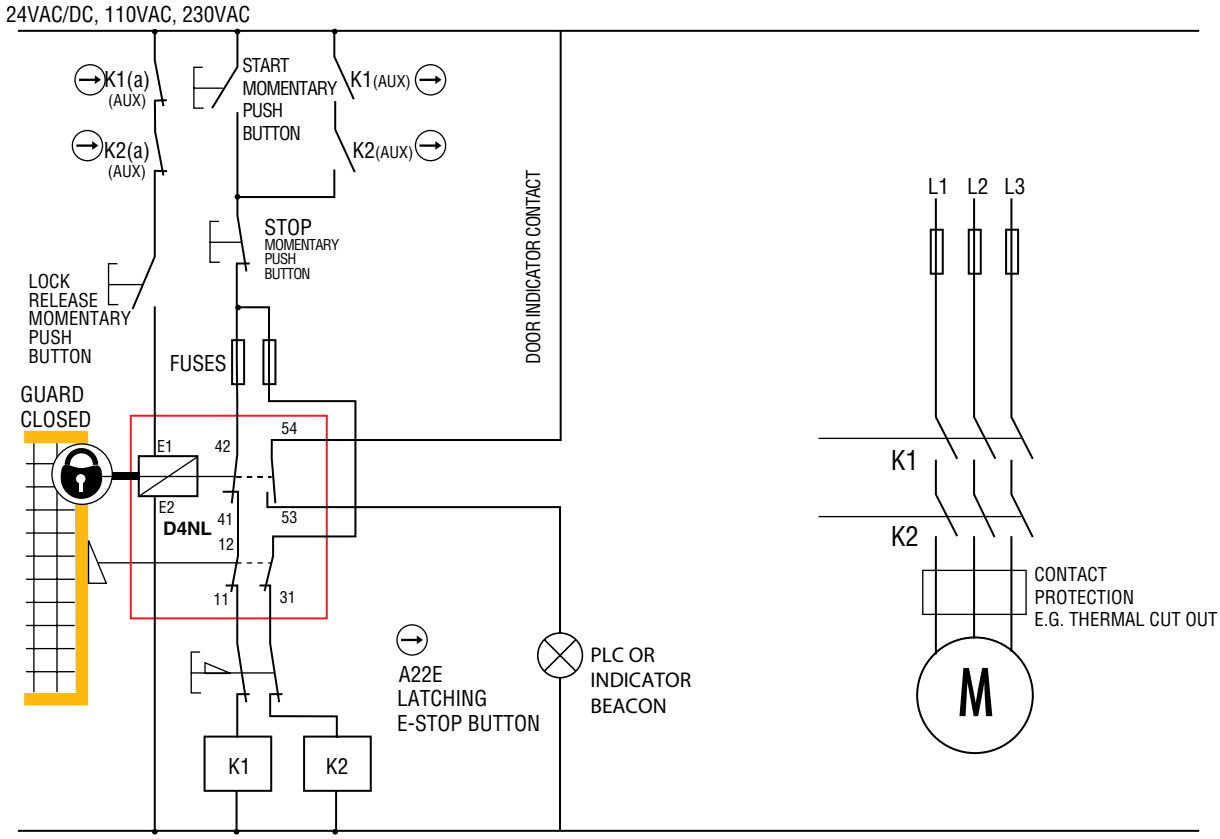
This type of system will also detect simultaneous short circuit faults over both contact sets of the switches. The SR103AM is therefore suitable for applications where short circuit or earth faults are more likely to occur than open circuit faults (this may be due to hot surfaces, chafing, etc.).

Because this circuit uses two opposite actuation modes it ensures that excessive wear at the guard cam or switch is detected.

It is suitable for some medium to high risk applications and where the wiring cannot be fully protected against all potential damage.

Note – It should not be possible to remove or lift the guard otherwise the switches can be easily defeated.

Refer to notes starting on page A-28.



D4NL (Solenoid Locking Switch) and E-Stop

- **Dual Channel (two contactors in series)**
- **Push Button Lock Release**

Circuit status

Circuit shown with guard door closed and locked (solenoid not energized), ready for motor starting (push start button) or lock release (push lock release button).

Operating principle

In this system the guard is locked closed until the solenoid is energized. The solenoid can only be energized when the auxiliary contacts at K1(a) and K2(a) are closed. Therefore power contacts at K1 & K2 are open and the lock release button is pushed. When the locking mechanism is released, monitoring contacts 41-42 are opened. These contacts are in series with the contactor (K1) control circuit and will therefore prevent restart while the D4NL is in the unlocked mode. If the guard is opened, contacts 11-12 and 31, 32 are opened and will prevent restart while the guard is open regardless of the lock status.

Fault detection

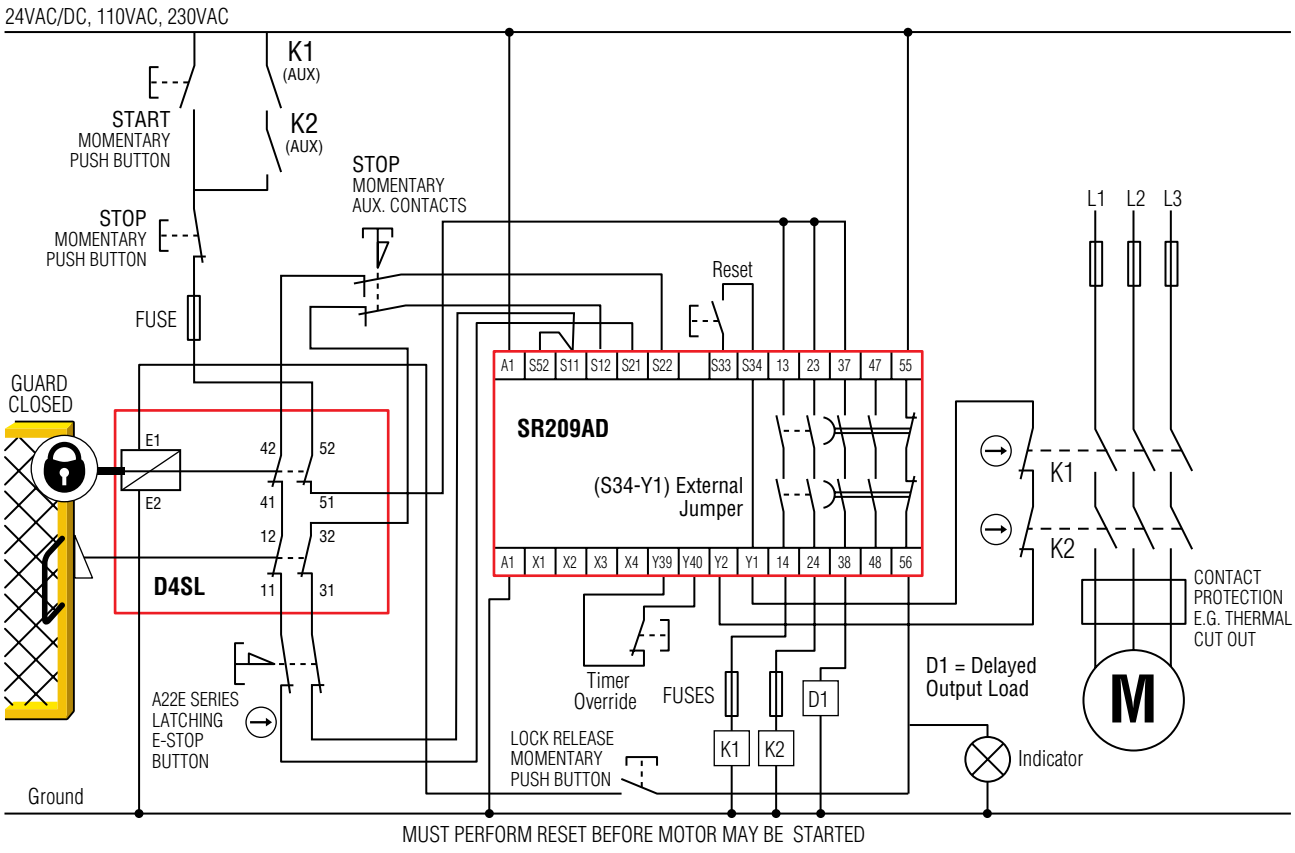
If either contactor K1 or K2 sticks ON - The motor will stop but the guard cannot be opened (thus the fault is revealed to the operator).

A short circuit fault on the solenoid energization circuit will initiate a STOP via contacts 41-42. A short circuit fault across either terminals 11-42 or terminals 31, 32 will not be detected, but the motor cannot be started while the guard is open. A single short circuit fault across the E-Stop device will not be detected but will not prevent emergency stopping. An open circuit fault on the solenoid energization circuit will prevent guard opening (other than by the emergency release points on the D4NL).

Comments

This system is a practical and effective method of providing an interlock function of enhanced integrity. **The inclusion of the lock release push button means that the solenoid is only energized when guard opening is required.** This prevents guard doors from swinging open whenever the control stop button is pressed. It also means that the solenoid is not left energized for long periods which can cause efficiency loss. The solenoids used in the D4NL is continuously rated but, as with any solenoid, their action will be more positive when they are working at maximum possible efficiency.

Refer to notes starting on page A-28.



D4SL (Solenoid Locking Switch) and E-Stop Switch

- **SR209AD Dual Channel (single fault monitored)**
- **Push Button Lock Release**
- **Manual Auto Reset**

Circuit status

Circuit shown with guard door closed and locked (solenoid not energized), ready for motor starting (push start button) after closing Reset or lock release (momentary push button).

Operating principle

In this system the guard is locked closed until the solenoid is energized.

The solenoid can only be energized when the normally closed Delayed Outputs 55, 56 are closed. This time delay would be set to allow sufficient time for the load to come to a stop. Therefore power contacts at K1 & K2 are open and the lock release button may be pressed. When the solenoid goes to the unlocking mode and the guard is opened which opens the input circuit to terminals S11-S12 & S21-S22 at the SR209AD which isolates the contactor control circuits between its open terminals 13-14 and 23-24. When the guard is opened, the guard operated contact sets at 11, 12 and 31, 32 are opened, thus ensuring that the safety monitoring relay outputs remain in the OFF state while the guard is open. After the guard has been closed the Reset button must then be pressed to close the output circuit to the contactors which can then be started by the control start button.

Fault detection

If either contactor K1 or K2 sticks ON - the motor will stop on command but the guard cannot be opened (thus the fault is revealed to the operator).

Any single fault within the SR209AD will prevent the closing of its outputs.

Any single fault on the SR209AD input and output circuits will be detected and will result in the lock-out of the system to a safe state (OFF) at the next operation of the respective input device.

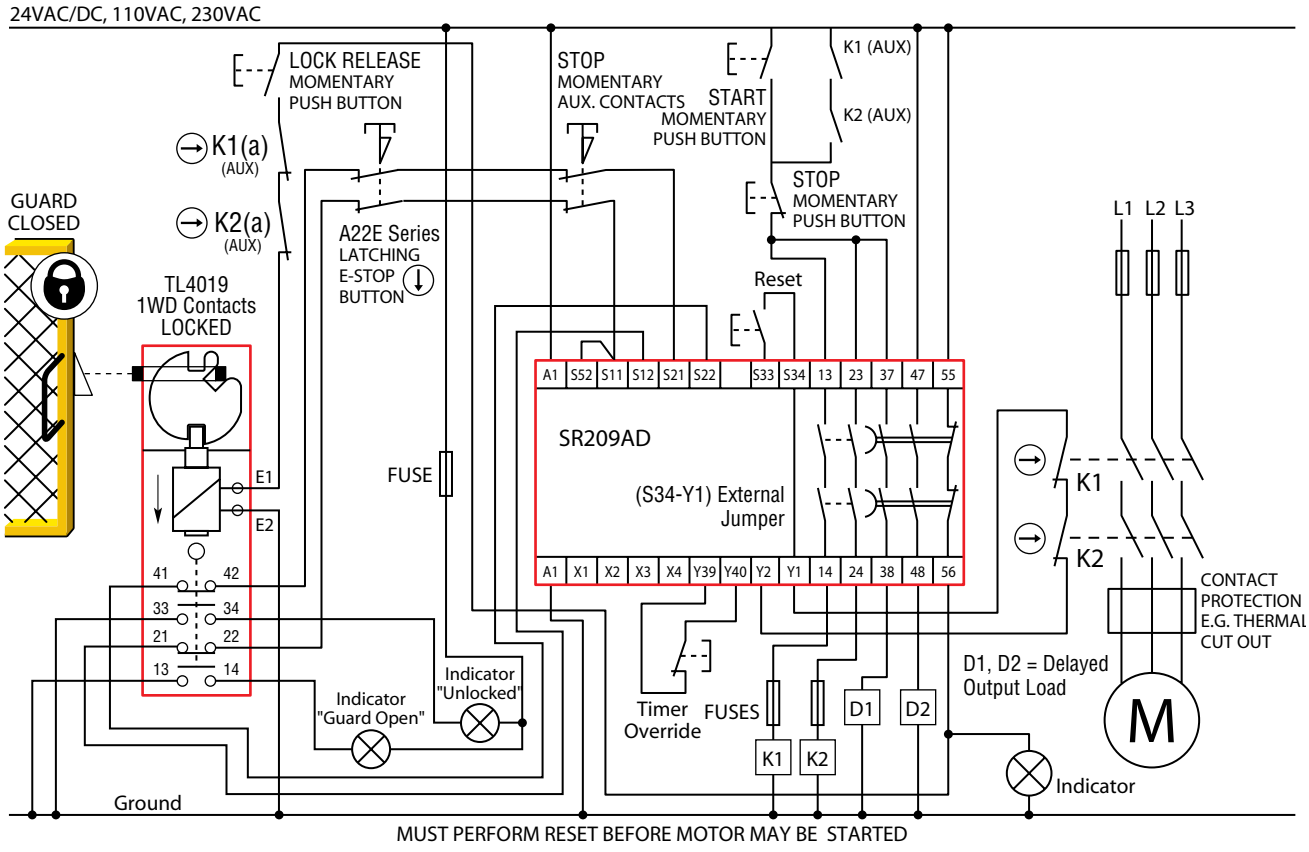
An open circuit fault across the solenoid energization circuit will prevent guard opening (other than by the emergency release points on the D4GL).

Comments

This system provides an interlock function of high integrity and is suitable for many high risk applications.

The solenoid is only energized when guard opening is required.

Refer to notes starting on page A-28.



TL4019 (Solenoid Locking Switch)

- **SR209AD (timed delayed unit)**
- **Dual Channel**
  (single fault monitored)
- **2 Contactors**
- **Push Button Lock Release**
- **Manual Auto Reset**

Circuit status

Circuit shown with guard door closed and locked (solenoid not energized), ready for Reset Input Signal (push reset switch) and Motor Start (push start button), or Lock Release (push lock release button).

Operating principle

In this system the guard is locked closed until the solenoid is energized. The solenoid can only be energized when:

• the auxiliary contacts at K(a)1 and K2(a) are closed. Therefore power contacts at K1 & K2 are open.

• the SR209AD control unit has timed out for a pre-set period. At this stage the Delayed Output Indicator Light will show that the guard can now be opened by operating the lock release push button. When the locking mechanism is released, the guard door may be opened. Unlocking the guard door opens contacts 21-22 & 41-42 of the TL4019 Interlock Switch, thus opening the monitoring circuit of the SR209AD. This assures that the motor power circuit is disabled while the guard door is open. In order for the motor circuit to be started, the guard door must be shut and the TL4019 must be locked. The SR209AD must be manually reset just prior to sending the start signal.

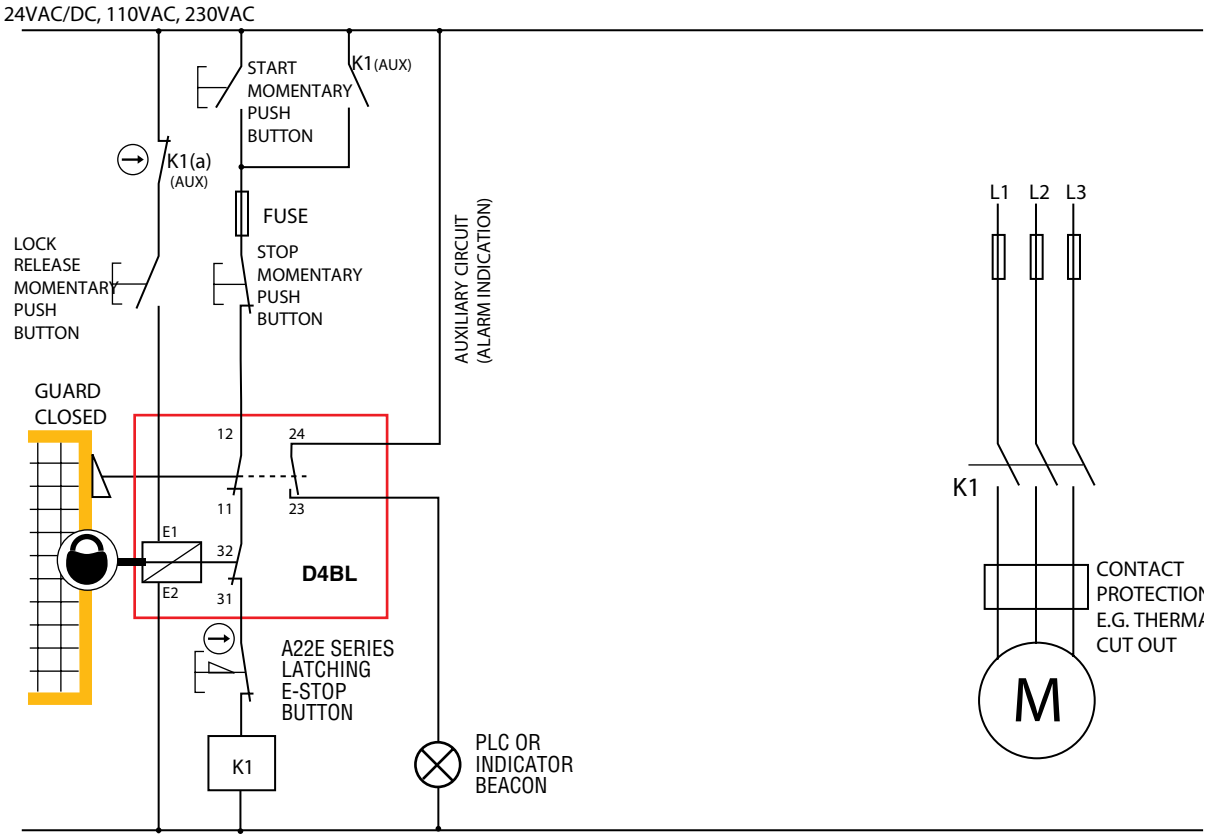
Fault detection

If either contactor K1 or K2 sticks ON - the motor will stop and the guard may be opened, but the SR209AD will not reset. The External Device Monitoring circuit Y1-Y2 of the SR209AD must detect the proper contact state before the reset signal will be accepted. Any single fault within the SR209AD will prevent the closing of its outputs.

Comments

This system is a practical and effective method of providing an interlock function of increased integrity. It is suitable for applications where motion overruns after the stop command and the time taken to run down to a stop is predictable, consistent and less than approximately 30 minutes. The inclusion of the lock release push button means that the solenoid is only energized when guard opening is required. This prevents guard doors from swinging open whenever the control stop button is pressed. It also means that the solenoid is not left energized for long periods which can cause efficiency loss. The solenoids used in the TL4019, TL4024, TL5019, TL8012-S, and TL8018-5 are continuously rated but, as with any solenoid, their action will be more positive when they are working at maximum possible efficiency.

Refer to notes starting on page A-28.



D4BL (Solenoid Locking Switch) and E-Stop

- **Single Channel**
- **Push Button Lock Release**

Circuit status

Circuit shown with guard door closed and locked (solenoid not energized), ready for motor starting (push start button) or lock release (push lock release button).

Operating principle

In this system the guard is locked closed until the solenoid is energized. The solenoid can only be energized when the auxiliary contacts at K1(a) are closed. Therefore power contacts at K1 are open and the lock release button is pushed. When the locking mechanism is released, monitoring contacts D4BL are opened. These contacts are in series with the contactor (K1) control circuit and will therefore prevent restart while the D4BL is in the unlocked mode. If the guard is opened, contacts 11, 12 are opened and will also prevent restart while the guard is open regardless of the lock status.

Fault detection

If contactor K1 sticks ON the motor will continue to run but the guard cannot be opened (thus the fault is revealed to the operator). A short circuit fault on the solenoid energization circuit will initiate a STOP via contacts 31, 12.

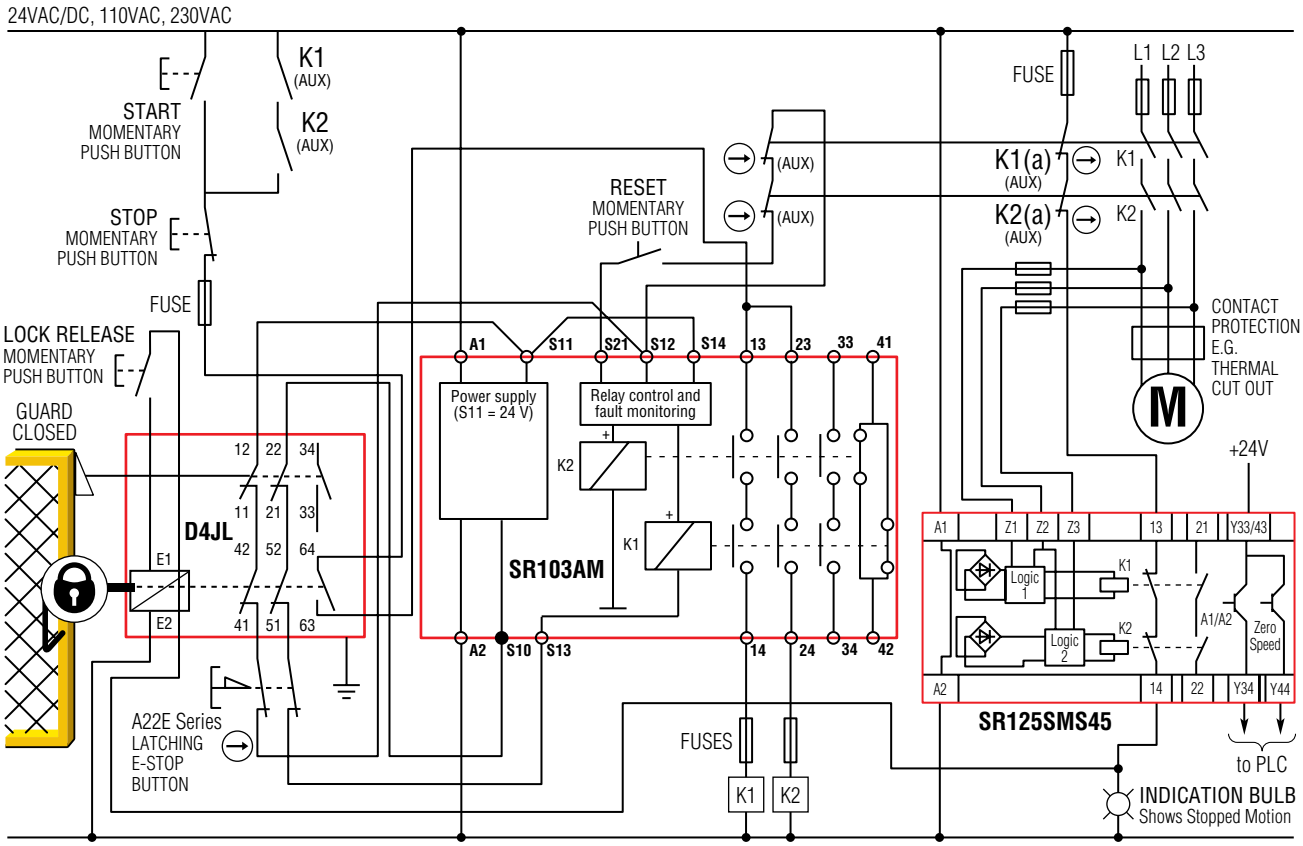
A short circuit fault across terminals 31,12 will not be detected. A short circuit fault across the E-Stop device will not be detected.

An open circuit fault on the solenoid energization circuit will prevent guard opening (other than by the emergency release points on the D4BL).

Comments

This system is a practical and effective method of providing an interlock function of enhanced integrity. **The inclusion of the lock release push button means that the solenoid is only energized when guard opening is required.** This prevents guard doors from swinging open whenever the control stop button is pressed. It also means that the solenoid is not left energized for long periods which can cause efficiency loss. The solenoids used in the D4BL is continuously rated but, as with any solenoid, their action will be more positive when they are working at maximum possible efficiency.

Refer to notes starting on page A-28.



D4JL (Solenoid Locking Switch) and E-Stop Switch

- **SR103AM**
- **SR125SMS45**
  (stopped motion detection system)
- **Dual Channel**
  (single fault monitored)
- **Push Button Lock Release**
- **Manual Auto Reset**

Circuit status

Circuit shown with guard door closed and locked (solenoid not energized) after closing Reset, ready for motor starting (push start button) or lock release (push lock release button).

Operating principle

In this system the guard is locked closed until the solenoid is energized. The solenoid can only be energized when:-

- the auxiliary contacts at K1(a) & K2(a) are closed (therefore power contacts at K1 & K2 are open).
- the SR125SMS45 senses stopped motion and closes its output circuit at terminals 13-14.
- the lock release button is pressed. The monitoring contacts 63, 64 isolate power to the contactor control circuits when the solenoid is in the unlocked mode. The guard operated contact sets at 11,12 and 21, 22 are opened whenever the guard is not fully closed. The output contacts at 13-14 and 23-24 on the SR103AM will only be closed (allowing power to the control circuit) when both input circuits (S10-S13 & S11-S12) are closed. Therefore the motor can only be started when the guard is in the closed and locked position and the reset is closed. Auto reset may be implemented by removing the reset switch.

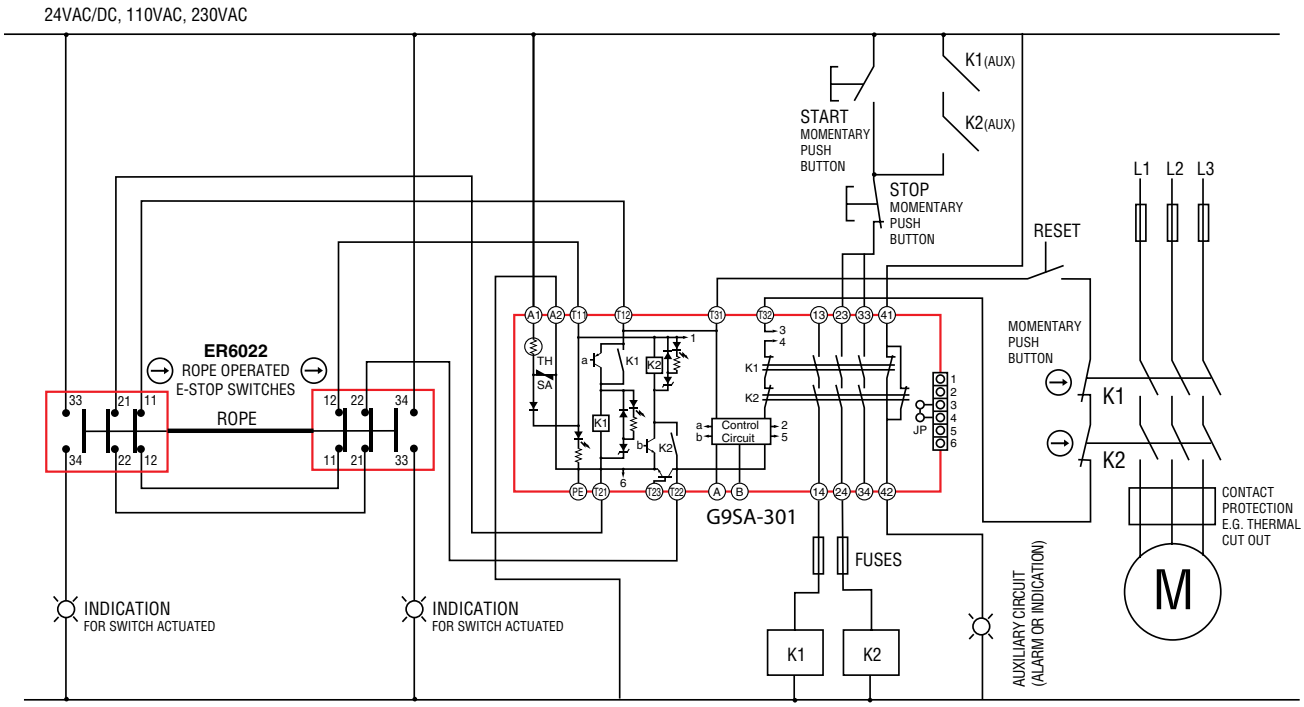
Fault detection

If either contactor K1 or K2 sticks ON - The motor will stop on command but the guard cannot be opened (thus the fault is revealed to the operator). Any single fault which causes solenoid energization will initiate a STOP via contacts 63, 64. Any single fault within the SMD125SMS45 will prevent the closing of its outputs (preventing solenoid energization). Any single fault detected on the SR103AM input and output circuits will result in the lock-out of the system to a safe state (OFF) at the next operation of the respective input device. An open circuit fault across the solenoid energization circuit will prevent guard opening (other than by the manual emergency release points on the D4JL).

Comments

This system provides an interlock function of high integrity and will be suitable for many high risk applications. It is suitable for applications where motion overruns after the stop command and the time taken to run down to a stop is not predictable, consistent or more than approximately 30 minutes.

Refer to notes starting on page A-28.



ER6022 (Rope Operated E-Stop Devices)

- **G9SA-301**
- **Dual Channel**
- **Single Fault Monitored**
- **Monitored Manual Reset**

Circuit status

Circuit shown with rope under correct tension (not pulled) and ready for motor starting.

Operating principle

When the rope is pulled it will open the contacts 11-12 and 21-22 on one of the switches. This opens the G9SA-301 input circuits T11, T12 and T21, T22. The G9SA-301 output circuits (13, 14 and 23, 24) will open and cause the contactors to isolate the motor power. After operation, the ER6022 must be reset. **The reset button connected to the G9SA-301 must be pushed and released before the motor can be restarted. This is a monitored manual reset.**

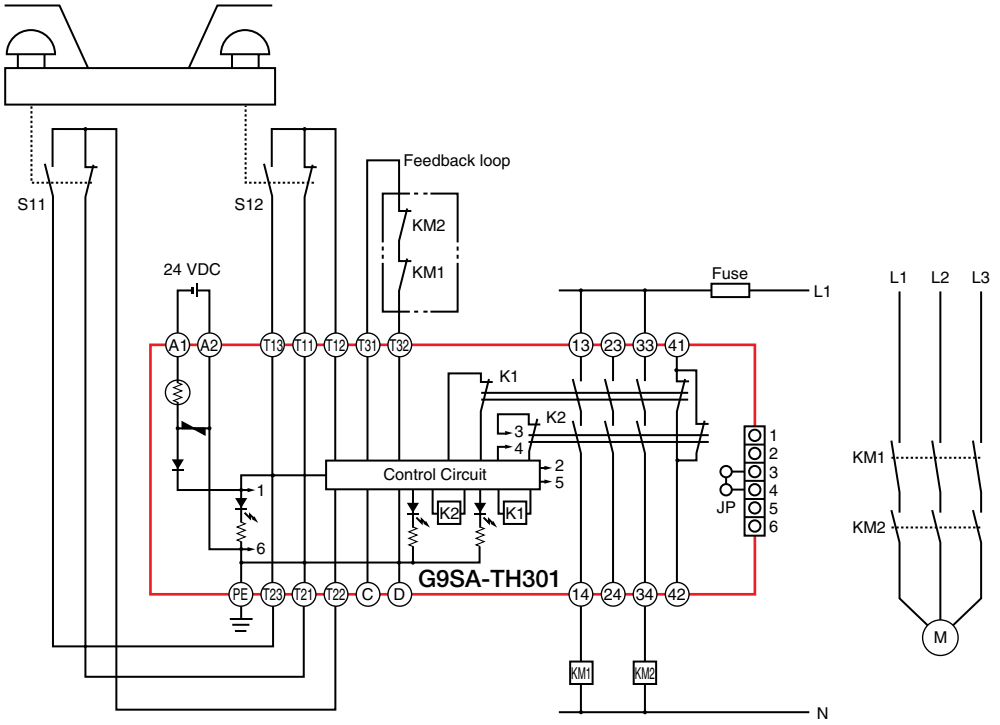
Fault behavior

Any single fault will not cause a loss of safety function. If either contactor K1 or K2 sticks ON - the motor will stop on command due to the other contactor, but the G9SA-301 cannot be reset (thus the fault is revealed to the operator). Any single fault detected on the safety monitoring relay input circuits will result in the lock-out of the system to a safe state (OFF) at the next operation of the respective switch.

Comments

This type of arrangement is suitable for many applications which have medium to high risk or where the wiring cannot be fully protected against all potential damage. **Because the E-Stop device is not likely to be operated frequently, it is recommended that its function is checked, by operating and resetting each switch in turn, on a regular basis (start of shift or daily) to enable the G9SA-301 to detect single faults.**

Refer to notes starting on page A-28.



2 Hand Control with the G9SA-TH301 2 Hand Unit

Circuit status

The 2 hand control buttons are not pressed and the motor is OFF.

Operating principle

This is a dual channel system with monitoring of the contactors. It uses 2 double pole (N/C + N/O) positive mode momentary action push switches.

The motor can only be started when both buttons are pushed synchronously (within 0.5 sec.). If either or both buttons are released, the outputs at the safety monitoring relay are opened.

Fault detection

Any single fault will not cause a loss of safety function. The single fault will be detected either immediately or at the next operation of the control buttons.

Refer to notes starting on page A-28.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Choice of Protective Measures

When a risk assessment shows that a machine or process carries a risk of injury the hazard must be eliminated or contained. How this is done will depend on the nature of the machine and the hazard. In basic terms this means preventing any access to the relevant parts while they are in a dangerous condition. The best choice of protective measure is a device or system that provides the maximum protection with the minimum impact on normal machine operation. It is important that all aspects of machine use are considered. Experience shows that a safety system which is difficult to use is more likely to be removed or by-passed.

To achieve this, choose either:

1. **Preventing access** during dangerous motion, or
2. **Preventing dangerous motion** during access.

The following pages give a brief overview of the characteristics of the most commonly used devices.

Preventing Access

Fixed Enclosing Guards

If the hazard is on a part of the machinery which does not require access it should be permanently guarded with fixed enclosing guards.

Movable Guards with Interlocking Switches

If access is required there needs to be a movable guard which is interlocked with the power source of the hazard in a manner which ensures that whenever the guard door is open the hazard power will be switched off. This approach involves the use of an interlock switch fitted to the guard door. The control of the hazard's power is routed through the safety contacts of the switch. The power source is usually electrical but it could also be pneumatic or hydraulic. When guard door movement (opening) is detected the interlock switch will isolate the hazard power supply either directly or via a power contactor (or valve).

Some interlock switches also incorporate a locking device which locks the guard door closed and will not release it

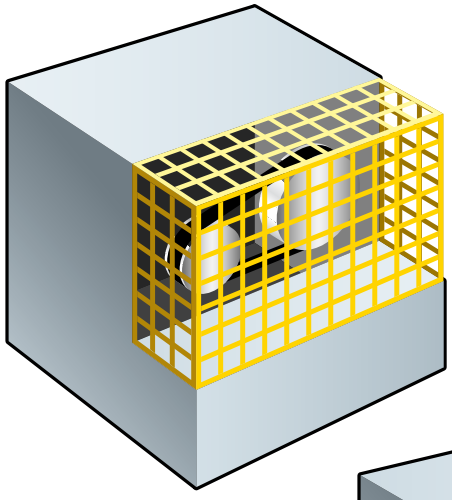


Fig. 3.1 Fixed enclosing guards.

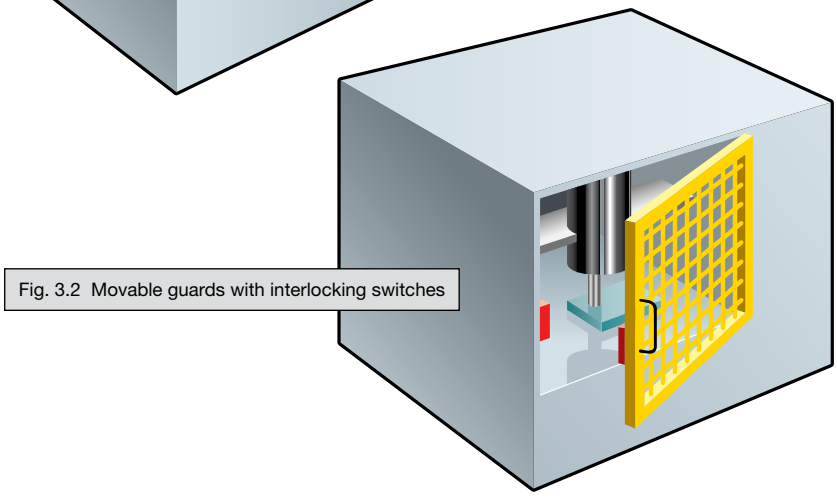


Fig. 3.2 Movable guards with interlocking switches

until the machine is in a safe condition. For many applications the combination of a movable guard and an interlock switch with or without guard locking is a reliable and cost effective solution.

Two-Hand Controls

There are other ways of preventing access while the machine is in a dangerous condition. The use of two-hand controls is common on certain types of machinery. Two start buttons have to be operated at the same time to run the machine. This ensures that both hands of the operator are occupied in a safe position (i.e. at the controls) and therefore cannot be in the hazard area.

Note: ***This type of measure only protects the operator and does not give protection to other personnel.***

A two-hand control system depends heavily on the integrity of its control and monitoring system to detect any faults, so it is important that this aspect is designed to the correct specification.

The physical design should prevent improper operation (e.g. by hand and elbow). The installation must also meet the safety distance requirements from the hazardous location.

The machine should not go from one cycle to the next without the releasing and pressing of both buttons. This prevents the possibility of both buttons being blocked, leaving the machine running continuously.

Releasing of either button must cause the machine to stop.

The use of two-hand control should be considered with caution as it usually leaves some form of risk exposed.

It is very useful however on applications such as teach mode pendants and inching controls because it can give enhanced levels of protection when used in conjunction with other protective devices.

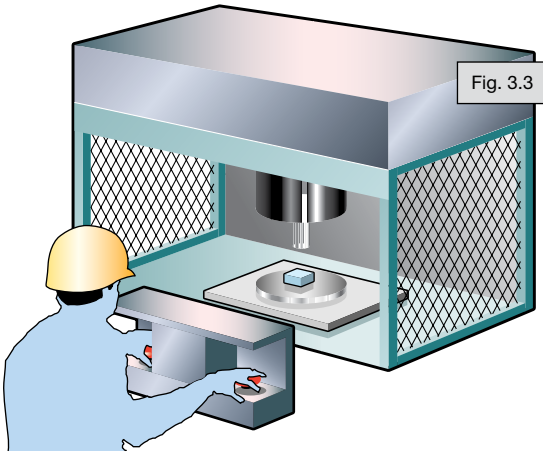


Fig. 3.3 Two hand controls

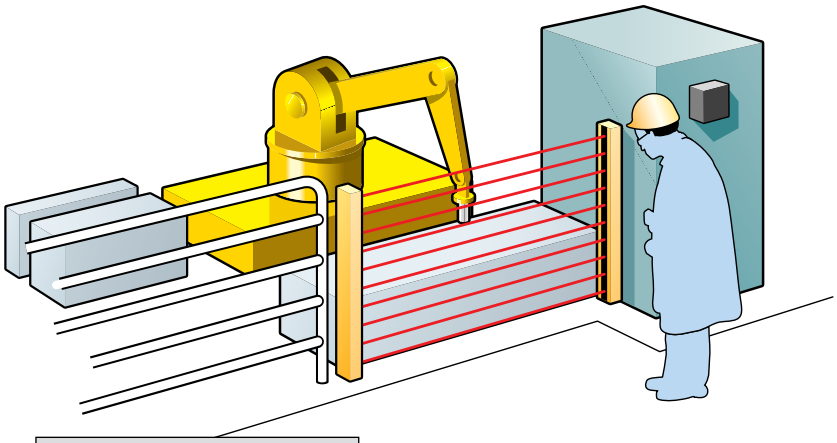


Fig. 3.4 Photoelectric light curtains

Preventing Dangerous Motion

When frequent access is required physical guarding at the hazard is sometimes too restrictive. In this situation a device is required which prevents dangerous motion while allowing unrestricted access by sensing the presence of the operator and sending a stop signal.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Infrared Light Curtains

These devices emit a “curtain” of harmless infrared light beams in front of the hazard area. When any of the beams are blocked the light curtain control circuit sends a stop signal to the guarded machine. There are many factors which affect the type and positioning of a light curtain and these are dealt with in the standard ISO 13855 “The positioning of protective equipment in respect of approach speeds of parts of the human body”.

Light curtains are extremely versatile and can guard areas many meters wide. By the use of mirrors the light beams can be diverted round corners to enclose a machine. They are available with different light beam spacings making them suitable for many applications ranging from totally enclosing perimeter guards for industrial robots, to point of access guard for certain types of presses.

Pressure Sensitive Safety Mats

These devices are used to guard the floor area around a machine. A matrix of inter-connected mats is laid around the hazard area and the proper amount of pressure (e.g. an operator’s footstep) will cause the mat control unit to send a stop signal to the guarded machine.

Pressure sensitive mats are often used within an enclosed area containing several machines e.g. flexible manufacturing or robotics cells. When access is required into the cell (for setting or robot “teaching” for example) they prevent dangerous motion if the operator strays from the safe area.

The size and positioning of the mats should be calculated using the formulae from the standard ISO 13855 “Positioning of safeguards with respect to the approach speeds of parts of the human body.”

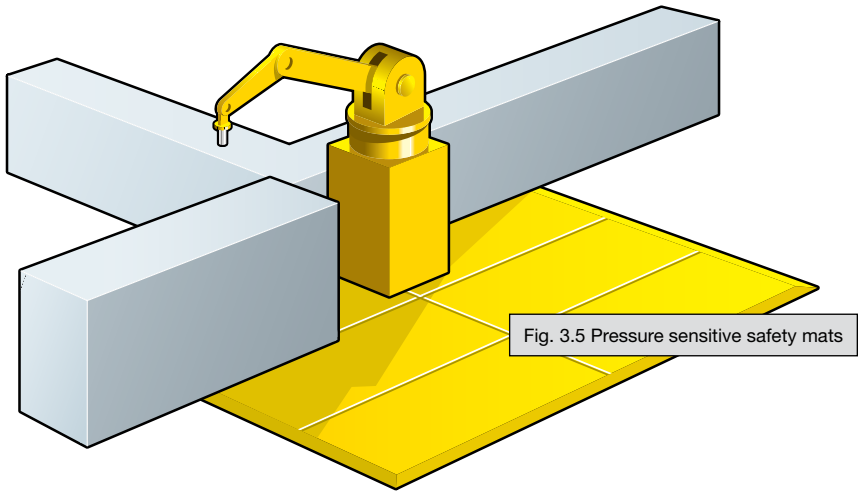


Fig. 3.5 Pressure sensitive safety mats

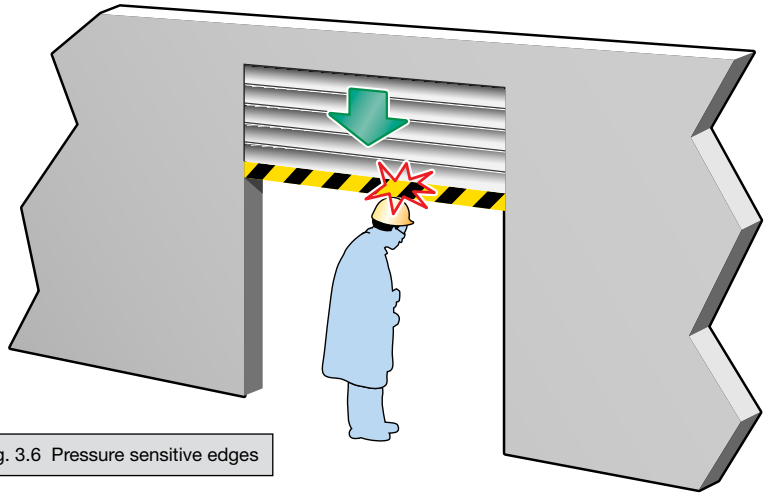


Fig. 3.6 Pressure sensitive edges

Pressure Sensitive Edges

These devices are flexible edging strips which can be fixed to the edge of a moving part such as a machine table or powered door where there is a risk of a crushing or shearing hazard.

If the moving part strikes the operator (or vice versa) the flexible sensitive edge is depressed and will send a stop signal to the power source. Sensitive edges can also be used to guard machinery where there is a risk of operator entanglement. If an operator becomes caught up and dragged by the machine he will be pulled onto the sensitive edge thereby tripping its switching action.

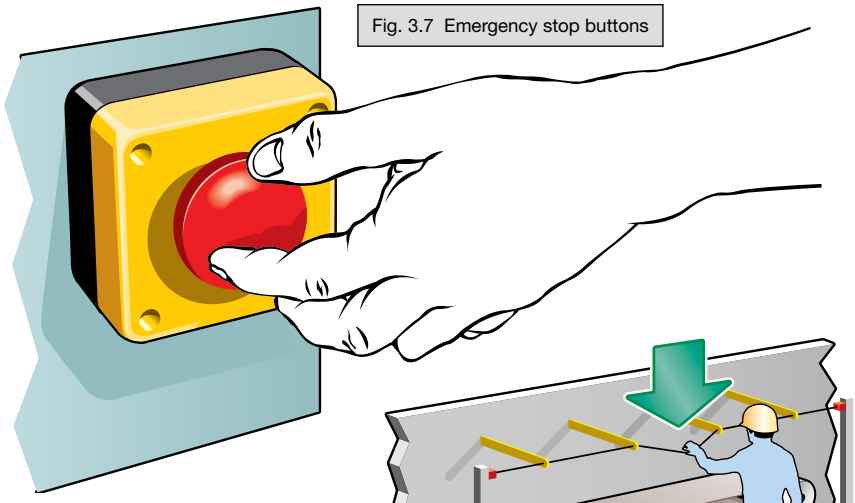


Fig. 3.7 Emergency stop buttons

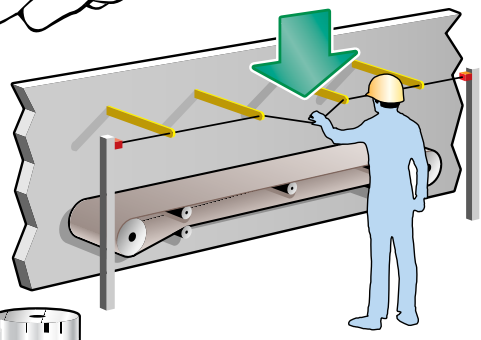


Fig. 3.8 Grabwire switches

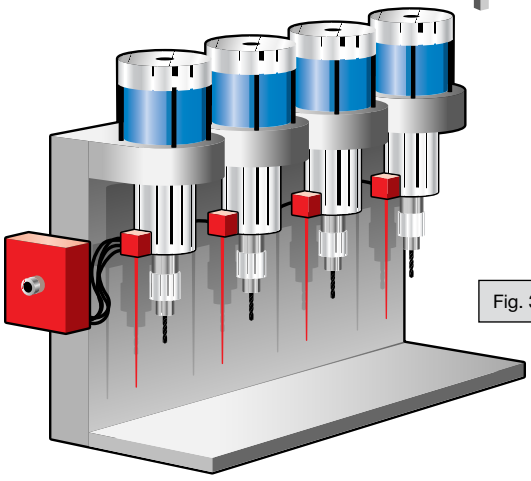


Fig. 3.9 Telescopic trip switches

Light curtains, safety mats and pressure sensitive edges can all be classed as “trip devices”. They do not restrict access but only “sense” it. They rely entirely on their ability to both sense and switch for the provision of safety therefore it is important that their control circuit be control reliable. Also they must only be used in correct applications. In general they are only suitable on machines which stop quickly after removal of power. Because an operator can walk or reach directly into the hazard area it is necessary that the time taken for the motion to stop is less than that required for the operator to reach the hazard after tripping the device.

Emergency Stops

For the possibility that an operator might get into trouble in spite of the safeguarding, a manual means of stopping the machine must be readily available. This is called an **Emergency Stop function**.

Emergency Stop Buttons

The usual way of providing this is in the form of a mushroom headed push button which the operator strikes in the event of an emergency. They must be strategically placed in sufficient quantity around the machine to ensure that there is always one in reach at a hazard point.

Grabwire Switches

For machinery such as conveyors, it is often more convenient and effective to use a grabwire device along the hazard area. These devices use a steel wire rope connected to latching pull switches so that pulling on the rope will operate the switch and cut off the machine power.

Telescopic Trip Switches

Other variations include telescopic antenna switches where deflection of the antenna causes the switch to cut off the machine power. These devices are more commonly used as trip devices on machinery such as pillar drills. The switch is mounted on the drill and the antenna is extended down next to the drill bit. In the event of the operator becoming entangled with the drill he will be pulled onto the antenna which operates the switch.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Type 2 vs. Type 4 Light Curtains

As machinery safety standards and safety light curtains evolve to meet new application demands, users are faced with more choices and responsibilities than ever before.

A new breed of light curtain is gaining recognition in the United States. Developed in Europe and classified as "Type 2," it is a lower-cost, reduced-capability alternative to the more robust "Type 4" high safety performance level light curtains typically used to safeguard machinery in the United States. The terms and definitions of the product "Type" are derived from the international standard for light curtains, IEC 61496. Understanding the capabilities and differences between these two types of machine safeguarding devices will help users determine which is right for their application.

Three Differences

In most instances, Type 2 and Type 4 safety light curtains ***look*** much the same. However, these photoelectric safeguards are designed to satisfy vastly different safety requirements. Essentially, Type 2 products are designed to a lower level of safety integrity and must not be used in applications where a Type 4 control is the appropriate choice. Although the differences are technical and based on various industry standards, these devices differ in three significant areas:

1. Fault Detection Circuits

Type 2 light curtains lack the redundant automatic self-checking circuits employed in Type 4 light curtains. As a result, the Type 2 light curtain does not meet the OSHA or ANSI standard for the highest safety performance level. Type 4 safety light curtains are designed to immediately detect the failure of a single component within a defined response time. This is not true of Type 2 light curtains.

2. Optical Angle

Traditional Type 4 safety light curtains have an effective optical angle of ±2.5 degrees, while Type 2 devices have an

Application Examples – Type 2 or Type 4?

Determining when to use a Type 2 or Type 4 safety light curtain may best be demonstrated by reviewing a couple of examples. While it is essential to perform a complete risk assessment on all machines, the severity of the potential injury is the overriding factor when deciding between a Type 2 and Type 4 safety light curtain.

First, a pharmaceutical company's packaging department uses index tables, conveyors, filling and labeling equipment and a multitude of moving parts.

In the assessment process, the user determined that the size and force of the motors used on the index table and conveyor was insufficient to cause serious injury. The worst-case injury was defined as a potential bruise requiring simple first aid.

In this application, a Type 2 light curtain is the light curtain of choice. It serves as an appropriate safeguarding device, while doubling as a process control device.

In our second example, the assembly department of a gas and pneumatic regulator manufacturer requires that an operator continuously interface with the assembly equipment. The workstation consists of a small pneumatic press and an automatic self-feeding screwdriver. The operator must insert a multitude of parts that need to be compressed while the driver inserts screws.

The worst-case injury would require off-site medical attention. In this application a Type 2 device is not an appropriate safeguarding choice, but rather a Type 4 light curtain is recommended.

effective optical angle of ±5 degrees. The wider optical angle increases the possibility of reflective surface interference, where a reflective object near the sensing field of the light curtain causes an optical "short circuit." As a result, an object in the sensing field may not be detected, as the light "bends" or reflects around the object. This possibility demands users take great care during installation and alignment to ensure proper operation of the Type 2 device. Fortunately, there are simple tests to detect this potential hazard. The tests must be performed during installation and periodically afterwards for any light curtain.

3. Price

The third difference is price. Type 2 devices are typically 15% to 30% less expensive when compared to an equivalent Type 4 device. The cost difference stems from the less precise optical angle and fewer fault detection circuits. In addition, Type 2 light curtains typically have fewer available features, such as exact channel select, floating blanking, MPCE (Machine Primary Control Element) monitoring and MTS (Machine Test Signal).

Safety Performance

The Occupational Health & Safety Act (OSHA) and the American National Standards Institute (ANSI) both require the highest level of safety performance for safety-related machine control systems when serious injuries can occur.

Examples of machines that require the highest safety performance level include machine tools, such as power presses, shears, press brakes, robots, etc.

A Type 4 safety light curtain employs self-checking circuitry to monitor itself for internal faults. If it detects an internal fault, the Type 4 safety light curtain immediately sends a stop signal to the guarded machine and the light curtain enters a ***lockout*** condition. Only after replacement of the failed component, and an appropriate system reset, will the Type 4 light curtain and the guarded machine be restored to operating condition.

Because Type 2 light curtains lack the redundancy of internal fault detection circuits, they cannot achieve a sufficiently high safety performance level and therefore are not suitable as a safeguarding option on machinery where OSHA or ANSI requirements or risk assessments require control reliability. Remember also that a Type 2 light curtain is not protected against dangerous failures when exposed to extreme levels of electrical interference sometimes found in industrial environments.

Don't Roll the Dice — Perform a Risk Assessment

Conducting a thorough risk assessment requires the user follow a formal procedure that considers many factors when looking at machinery hazards. A risk assessment must be applied in a consistent manner across all plant machinery. This will enable the user to logically evaluate safety hazards and hazard-guarding solutions. The process considers all hazards and each type of safety hazard on a given machine.

The risk assessment analyzes each hazard and estimates the risk level by breaking it down into three components: Frequency of exposure, Probability of injury, and Severity of the potential injury.

An operator, for instance, typically has a high level of exposure, while someone performing maintenance does not. Probability considers machinery speed, and compares it to a person's typical reaction time - so a fast-cycling machine will have a higher probability of injury than one that is a relatively slow. The user must also estimate the type of potential injury in terms of severity, ranging from a simple pinch on the low end, to loss of a digit or even life at the other extreme.

Severity of injury should always dictate the assessed risk level. If the severity of potential injury is high, but exposure and probability are low, a Type 2 device is not an appropriate safeguarding option. Type 2 devices are not intended for use where ANSI B11.19, OSHA 1910.212 or 217 apply, and should never be used on a mechanical power press. Type 2 devices are not and cannot be made Control Reliable.

A Question of Interpretation

Because of these differences, Type 2 light curtains are intended for use in machine-guarding applications where the worst-case injury resulting from an accident may be remedied by simple first aid.

The social, legal and political cultures of Europe and the United States are distinct, resulting in different interpretations of "simple first aid." These differing interpretations impact a user's decision as to whether to apply a Type 2 or Type 4 device in a given application.

In Europe, first aid is measured, in part, on the amount of time an employee misses from work. For example, if a worker is injured and must go to the hospital for stitches or other medical procedures, yet returns to work the same day or the next day, it would be considered simple first aid.

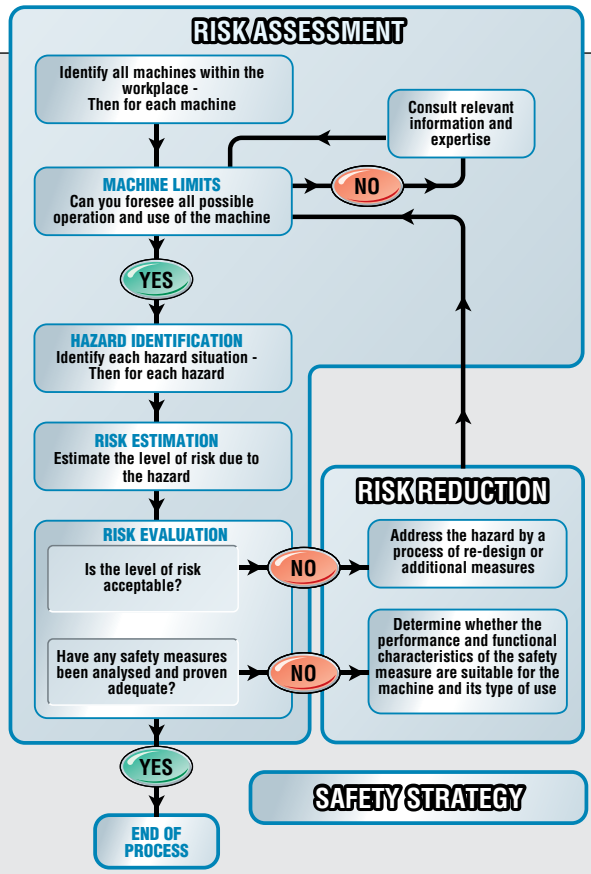
In the U.S. these injuries would be considered much more serious due to the nature of the injury itself, lost machine and worker productivity (the "gawk" factor, lower employee morale, investigating the cause of the injury, etc.), required injury reports, preparing insurance claims and so on.

In the U.S., first aid is defined in OSHA 1904.12. as any one-time treatment, and any follow-up visit for the purpose of observation of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care. Such one-time treatments and follow-up visits are considered first aid, even though they are provided by a physician or registered professional personnel.

Based on the risk assessment results and the type of hazard, the user can work with a safety expert to determine the most appropriate machinery safeguards for each application.

Remember that a light curtain, whether Type 2 or Type 4, may not be right for every machine safety application. Other safety equipment, such as safety mats, safety switches, hard guards or a combination of equipment may offer the optimum solution.

Machine users should reference ANSI B11.TR3, ANSI/RIA R15.06-1999 (R2009), and/or ISO 14121-1 prior to beginning their formal risk assessment.



Application Considerations

Both Type 2 and Type 4 devices have a role to play in keeping workers and their machinery safe and productive. But it is important to review each application, and its potential for injury, when applying these, or any other machine safeguard.

Differences in safety performance demand that the decision to use a Type 2 or Type 4 safeguard be based on a thorough and complete risk assessment for each machine. Users must also consider the interpretation of an injury based on the type of first aid required and possibilities of infrequent exposure, as described in The American National Standard for Industrial Robots and Robot Systems ANSI/RIA R15.06 and ANSI Technical Report for Machine Tools ANSI B11.TR3.

Type 2 light curtains offer an effective, low-cost safety solution in applications where a thorough and complete risk assessment determines that injuries can be remedied by simple first aid and require no professional medical attention.

After low risk has been assessed, Type 2 light curtains have a number of potential safety and non-safety applications, including semiconductor equipment, storage and conveying equipment, small textile equipment, packaging equipment (with the exception of palletizers), process protection, parts counting, tooling guarding and inspection equipment.

As a general rule, if a risk analysis determines that the severity of the potential injury is high, regardless of its probability, a Type 2 device is never an appropriate machine safeguard. In addition, a Type 2 device must not be used where regulations require the use of control reliability circuits. Any potential for an accident that will result in a severe injury should be treated with the most conservative approach to safety equipment selection and application.

Finally and simply, when considering the application of a Type 2 light curtain, ask “Would I think twice about putting my hand in this area?” If the answer is yes, then by U.S. standards any resulting accident would require more than simple first aid, and should qualify the use of a Type 4 safety light curtain in the application.

© Copyright 2003 *Occupational Hazards*, a Penton publication. Reprinted with permission.

Type 2 and Type 4 Comparison

A side-by-side comparison of the MP2100 (Type 2) protective light curtain and the MiniSafe MS4800 (Type 4) safety light curtain demonstrates that Type 4 devices deliver superior performance and additional operating features. Type 4 devices typically cost 15% to 30% more than Type 2 devices.

Specifications	MP2100	MS4800
ESPE* Type	Type 2	Type 4
Resolution	30 mm	14, 20, 30, or 40 mm
Coverage Height	147 – 1470 mm	280 - 2040 mm
Max. Operating Range	15 m	7 m (14 mm) 20 m (20, 30, & 40 mm)
Safety Outputs	2 PNP, 500 mA @ 24 VDC	2 PNP 625 mA @ 24 VDC
Auxiliary Outputs	NONE	1 PNP 100 mA @ 24 VDC

* Electro-sensitive protection equipment

Features	MP2100	MS4800
Performance Level PL = e	NO	YES
Channel Select	NO	YES
Floating Blanking	NO	YES
MPCE	NO	YES
MTS	NO	YES

Light Curtains — Installation Requirements & Calculating the Minimum Safe Distance

It is important that the user be familiar with the installation requirements, safe mounting distance, controls and features before using a safety light curtain.

Omron has found that light curtain installation is most easily accomplished if it broken down into discrete steps. These steps include:

1. Understanding the usage requirements for a safety light curtain.
2. Calculating the minimum safe distance.
3. Physically mounting the light curtain.
4. Preparation of the control enclosure.
5. Configuring the features of the light curtain.
6. Connection of power and termination of outputs.
7. Application of power and safety light curtain alignment.
8. Testing of the safety light curtain for proper operation.

Step 1. Usage Requirements

A safety light curtain is a safety device, designed to protect operators and other personnel working around a potentially dangerous machine. **Before installing or using a safety light curtain the following requirements must be met**:

- The machine on which a safety light curtain is installed **must be capable of stopping motion anywhere in its stroke or cycle**. For example, do not use a light curtain on a power press with a full-revolution clutch.
- Do not use a light curtain on any device with an inconsistent stopping time or inadequate control devices or mechanisms.
- Do not use a light curtain where the environment; such as severe smoke, particulate matter or corrosive chemicals; may degrade the efficiency of the light curtain.
- Be aware - light curtains do not offer protection from flying objects.
- In any installation where the light curtain is used as a safety device, the employer has the responsibility to ensure that all applicable federal, state and local government requirements are satisfied. In addition, the employer must ensure that all machine operators, die setters, maintenance personnel, electricians, supervisors, foremen, etc. are familiar with and understand all instructions regarding the proper use of the light curtain, the machinery on which it is installed and the appropriate safety regulations.
- All safety-related machine control circuit elements, including pneumatic, electric, or hydraulic controls must have a high safety performance level.
- Any power press which uses a light curtain must meet the requirements and inspection procedures of OSHA regulation 1910.217, ANSI standards B11.1 and B11.19, plus any other applicable state and local regulations. All other machinery or equipment must meet OSHA standard 1910.212 on general machine guarding plus any other applicable regulations, codes and standards.
- Do not use a light curtain as a lockout device to satisfy the US Federal OSHA lockout/tagout requirements.
- Additional guarding, such as mechanical guards, may be required if the light curtain does not protect all areas of entry to the point of operation hazard.
- All brakes and other stopping mechanisms and controls must be inspected regularly to ensure proper working order. If the stop mechanisms and associate controls are not working properly, the machine may not stop safely even though the light curtain is functioning properly.
- The test procedure must be performed at installation and after any maintenance, adjustment, repair or modification to the light curtain or the machine. In addition, the tests must also be performed after Channel Select or Floating Blanking is enabled or disabled. Testing ensures that the light curtain and the machine control system work properly to stop the machine. A sample test procedure is included in this section.
- All procedures in the installation and operating manual must be followed for proper operation of the light curtain.

The enforcement of these requirements is beyond Omron's control. The employer has the sole responsibility to follow the preceding requirements and any other procedures, conditions and requirements specific to your machinery.

WARNING: The information provided in this section is general in nature and is written to provide an overview of the safety light curtain installation process. A safety light curtain should only be installed, checked out, and maintained by a **qualified** person. A qualified person is defined as ***"an individual who understands, is trained on, and demonstrates competence with the construction, operation or maintenance of the machinery and the hazards involved."*** (ANSI/PMMI B155.1-2006)

Step 2. Calculating the Safe Distance for Safeguards

Nearly all industrial equipment, especially production machinery, requires some level of human interaction to function, so people need to be protected from potentially dangerous interactions with machines.

To be effective, any safeguard must either prevent an individual from entering a hazardous area or detect the entry of individuals into the hazardous area and eliminate the hazard before it can present a danger. Guards, devices that provide a physical barrier to exposure of a hazard, must be designed to keep individuals from reaching through them to the hazard. On the other hand, devices that protect individuals by detecting entry to or presence within a hazardous area must be mounted at a sufficient distance from the location of the hazard(s) such that the machine will stop before the operator's hand or other body part can reach this hazardous point.

Correctly calculating the minimum safe mounting distance is vital to ensure worker safety, while excessive mounting distances use up valuable floor space and can also increase the time required to service machinery, which in turn reduces throughput. This article will explain how to calculate safe mounting distances for a wide range of safeguards.

Background

Protecting employees against industrial machinery hazards is required to comply with regulations and to protect a company's most valuable assets, its employees. The same equipment that prevents injuries also provides an opportunity to make a positive impact on the bottom line. This is because the cost of a work-related injury goes far beyond hospital and medical costs. Additional costs that commonly result from an accident include rehabilitating and retaining the injured worker, time spent by supervision and management on the incident, machine downtime, and possible litigation.

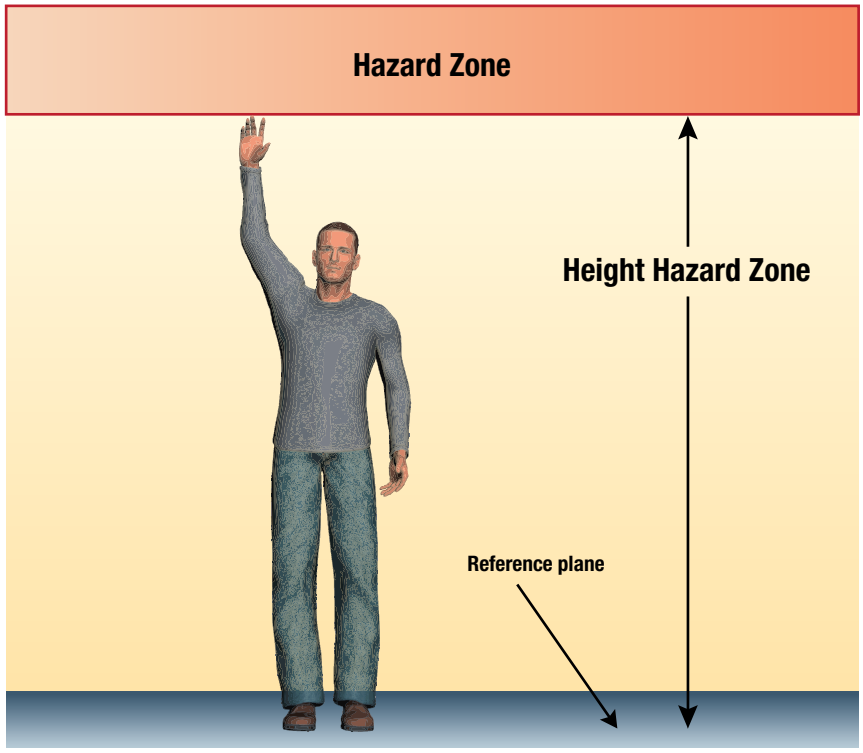


Figure 1: Height of Hazard Zone

Effective safety measures need to minimize the potential for risk of injury while providing access for functions, such as loading and unloading workpieces and maintaining the machinery. The best protection is the device or system that offers the maximum level of safety with minimal impact on machine operations at an affordable cost. A key factor to consider is how often entry is required. For example, with machines that operate at high production rates, operators will frequently need to enter the hazardous area to load and unload parts. On the other hand, low production rate equipment will usually require less frequent entry. Applications that require frequent entry generally require faster and more convenient access in order to maintain throughput at high levels.

Safe-location safeguarding

The first question to consider is the height of the hazard. If the hazard is sufficiently far above the ground or expected working surface then guarding is not required. The relevant OSHA standard, OSHA 29 CFR 1910.219 – Mechanical Power-Transmission Apparatus, says that a hazard that is more than 7 feet from the working surface does not need to be guarded. ANSI B15.1-2000 (R2006) – Safety Standard for Mechanical Power Transmission Apparatus included similar requirements, although the threshold was increased to 8 feet, but has since been withdrawn and replaced in part by ANSI B11.19-2010 – Performance Criteria for Safeguarding. This newer standard requires that a low risk hazard needs to be safeguarded unless it is 2,500 mm (98.4 in.) or more from the working surface and that a high risk standard needs to be safeguarded unless it is 2,700 mm (106.3 in.) or more from the reference plane as shown in Figure 1. This portion of ANSI B11.19-2010 has been harmonized with CSA Z432-04 – Safeguarding of Machinery – Occupational Health and Safety and ISO 13857:2008 – Safety of Machinery.

Barrier guards

Barrier guards, or hard guards, can provide the maximum amount of protection, not only by keeping people out, but also protecting people outside the hazardous area from projected hazards, such as flashes and flying objects. Barrier guards cannot normally be used for the entire perimeter because this would make it very difficult to access the equipment. Typically, a gap in the hard guarding is defined as an entry to the cell and a more flexible guarding solution is provided here to enable personnel and/or material to safely approach the equipment.

One approach to provide access is the use of movable barrier guards with devices interlocked with the machine controls in a manner that controls the hazard(s) whenever the guard door is open. When guard door movement is detected, the interlock device initiates a stop signal to the guarded equipment. Some interlock switches also incorporate a solenoid device that locks the guard door closed and will not release it until the hazardous machine is in a safe state.

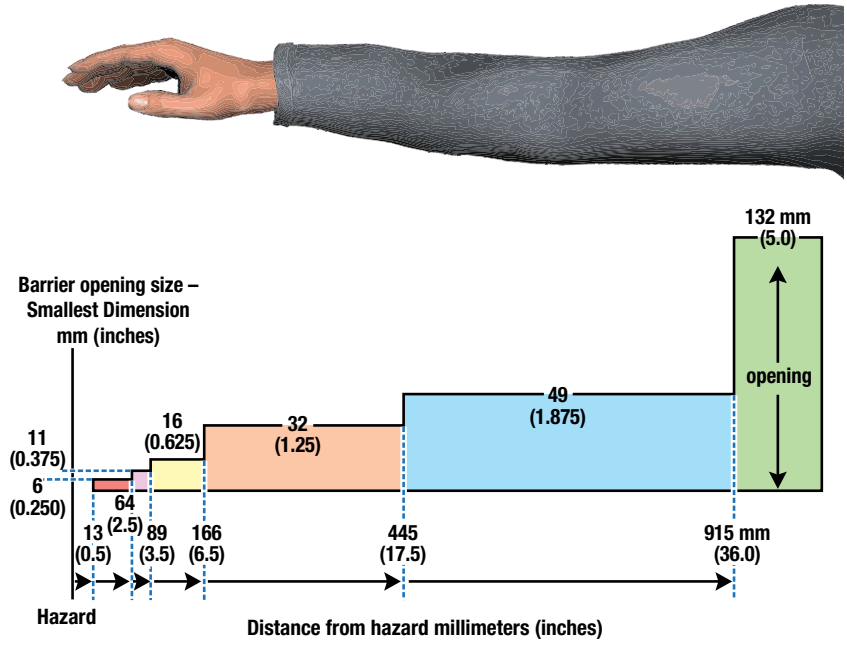


Figure 2: ANSI standard distance for barrier guards

Safe mounting distances for barrier guards

A guard, whether fixed, adjustable, or movable and interlocked, must be designed to ensure individuals cannot reach the hazard by reaching over, under, around or through it. To determine the safe mounting distance for a barrier guard, first consider the largest opening in the guarding material. The current Occupational Safety and Health Administrator (OSHA) standard for safe distance as a function of opening size is set forth in Table O-10 of OSHA 29 CFR 1910.217 – Mechanical Power Presses. This table technically only applies to mechanical power presses operated within OSHA's jurisdiction, although some industry consensus standards also reference this table, such as ANSI B65.1-2005 – Graphic technology – Safety standard – Printing press systems.

A more recent study, "A Review of Machine Guarding Recommendations" by Donald R. Vaillancourt and Stover H. Snook of the Liberty Mutual Research Center for Health and Safety, is the basis for the American National Standards Institute (ANSI) and Canadian Standards Association (CSA) standards. This anthropomorphic study, shown in Figure 2, was published in 1995 and based on the then current U.S. workforce. These recommendations have not officially been adopted by OSHA, but they have been adopted by a number of other consensus standards, including:

- ANSI B11.19-2010 – Performance Criteria for Safeguarding
- ANSI/RIA R15.06-1999 (R2009) – For Industrial Robots and Robot Systems – Safety Requirements
- CSA Z142-10 – Code for Power Press Operation: Health, Safety, and Guarding Requirements
- CSA Z432-04 – Safeguarding of Machinery – Occupational Health and Safety
- CSA Z434-03 – Industrial Robots and Robot Systems – General Safety Requirements

Furthermore, these values are sited through reference by other industry consensus standards, including:

- ANSI O1.1-2004 – American National Standard for Woodworking Machinery – Safety Requirements
- ANSI/PMMI B155.1-2006 – Safety Requirements for Packaging Machinery and Packaging-Related Converting Machinery

Figure 3 shows different domestic and international standards overlaid on top of each other. Note that there are three different charts in the ISO standard, each based on a different opening shape. Note that the ANSI O1.1-1992, represented by the green line above, was withdrawn when the standard was revised in 2004 and the standard reverted to the Liberty Mutual distances. The ANSI and CSA standards are equal to or more conservative than OSHA's Table O-10 except at distances of 6.5 in. to 7.5 in.; at these distances the OSHA table has the more stringent requirements.

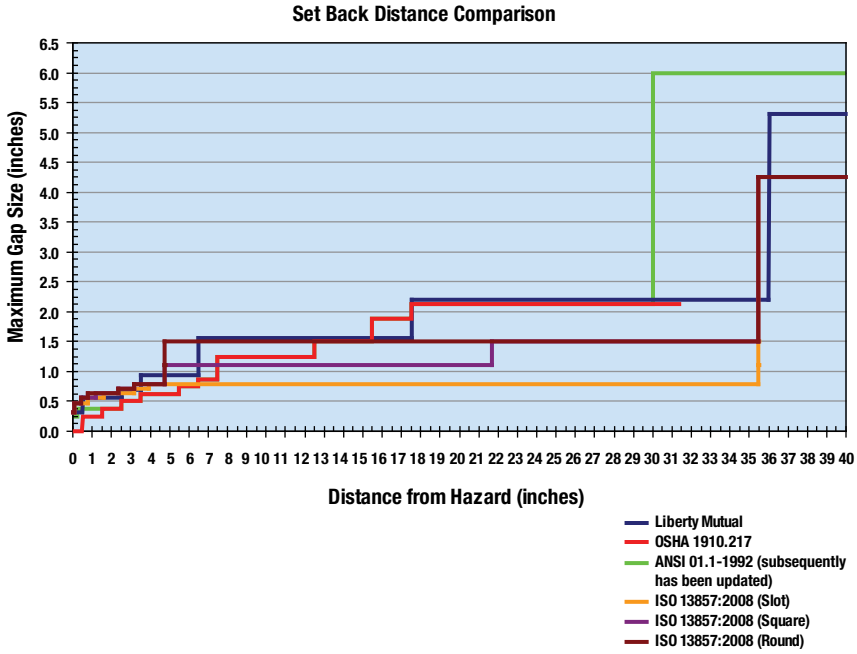


Figure 3: Combination of all safety distance standards
Note: ANSI 0.1.1 has been revised, with the latest revision released in 2004. This current release no longer includes safe mounting distance data for barrier guards, but rather references the Liberty Mutual data.

As previously mentioned, technically the OSHA requirements of Table 0-10 only apply to barrier guards on mechanical power presses within OSHA's jurisdiction; however, users of mechanical power presses in the U.S. and associated territories should apply the most restrictive requirements of all applicable standards, as the OSHA requirements are typically viewed as the 'bare minimum', while ANSI standards are consensus based and represent more current requirements. All other types of equipment in the U.S. are under the scope of one or more of the ANSI consensus standards.

Omron's Gotcha Stick accurately tests the allowable barrier opening size based on the ANSI and CSA standards to ensure that personnel cannot reach through a barrier. The three segment stick features English measurements on one side and Metric measurements on the other. The Gotcha Stick is the easiest way of verifying that openings in barrier guards will not allow the hazards to be accessed by personnel reaching through a barrier guard.

Reach under

To prevent an individual from accessing the hazard by reaching or crawling below the barrier guard, perimeter barrier guards must be designed so that the bottom of the barrier is no more than 300 mm (12 in.) above the adjacent walking surface according to ANSI/RIA R15.06-1999 (R2009). The same standard states that the top of the barrier must be no less than 1,500 mm (60 in.) above the adjacent walking surface. These measurements are more restrictive in Canada, however, with distances of 150 mm (6 in.) and 1,800 mm (71 in.), respectively, according to CSA Z434-03. The equivalent international standard, ISO 10218-2:2011, sets the requirements at 200 mm (7.8 in.) and 1,400 mm (55 in.), respectively.

Reach over

Figure 4 shows how to determine guard height to protect against reaching over a barrier to contact a hazard. In the figure, ***a*** is the height of the danger zone, ***b*** is the height of the protective structure, and ***c*** is the horizontal distance between the guard and the danger zone. Guards or other protective structures less than 1,000 mm (39 in.) high are not considered sufficient on their own for any application because they do not adequately restrict movement of the body, and structures less than 1,400 mm (55 in.) should not be used in high risk applications without additional safety measures. The following guidelines are available to help determine adequate height of constructed guards in relation to the hazard height and the distance of the guard from hazard:

- ANSI B11.19-2010 – Performance Criteria for Safeguarding
- CSA Z432-04 – Safeguarding of Machinery – Occupational Health and Safety
- ISO 13857:2008 – Safety of Machinery – Safety distances to prevent hazard zones being reached by upper and lower limbs

Note that ANSI B15.1-2000 (R2006) – Safety Standard for Mechanical Power Transmission Apparatus included similar requirements, but has since been withdrawn and replaced in part by ANSI B11.19-2010.

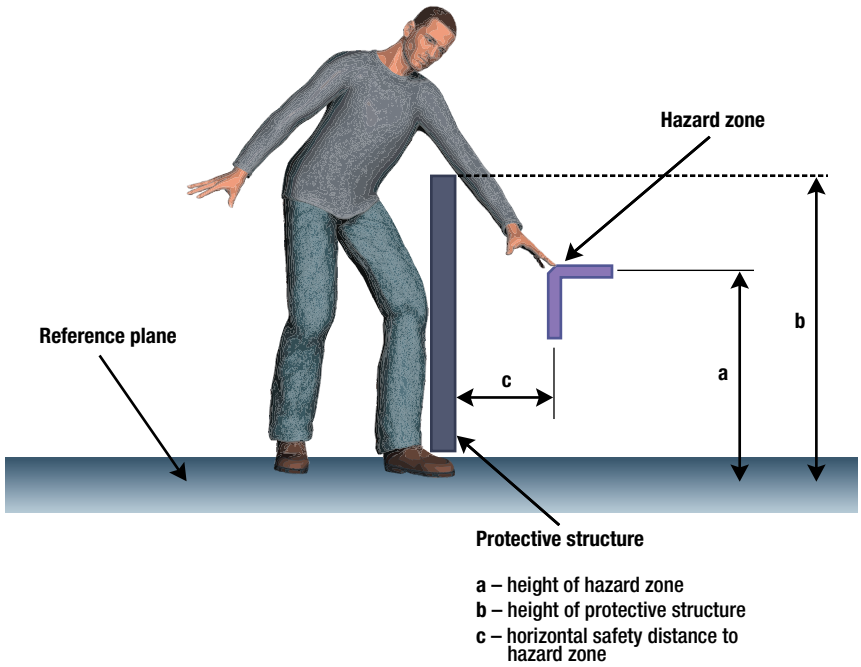


Figure 4: Guard height to protect against reach over

Presence sensing devices

Safety devices that protect individuals by detecting their entrance to or presence within a hazardous area include photoelectric presence sensing devices (including light curtains, single-beam devices and laser area scanners) as well as pressure sensitive devices, such as safety floor mats. Light curtains are often used in conjunction with hard guards to protect people when the machinery is operating, while enabling easy access at other times. Light curtains control access to the hazardous equipment by emitting harmless infrared light beams across a plane, typically the entrance to the hazardous area. When any of the beams are obstructed, the light curtain control circuit initiates a stop signal to the guarded machine. Light curtains are very versatile and can guard areas many meters wide – sometimes as large as 20 meters. Light curtains can be mounted in either a horizontal or vertical plane.

Pressure sensitive safety mats provide another alternative for guarding the entrance to the equipment, and in certain applications they can also be installed to protect the inside of a cell. A matrix of interconnected mats can be laid at the entry area and an operator's footstep causes the mat control unit to initiate a stop signal to the machine. Trim is used around the perimeter of the device to hold the mat in place, protect wiring and either provide a smooth ramped surface to prevent tripping hazards at the edge of the mat or allow the device to be mounted directly against the equipment or other structures to ensure that the entire area is safeguarded.

Safe mounting distance for presence sensing devices

Safeguarding devices that do not prevent an individual from reaching into a hazardous area must be located far enough away from the hazardous area that the machine will stop before the operator's hand or other body part can reach the hazard. The minimum safe distance is based on the stopping time of the machine as well as the reaction time of the safeguarding device and the estimated approach speed of the individual towards the hazard.

A formula is outlined in OSHA 1910.217 and applies to the guarding of mechanical power presses, but also can serve as a guide for other machine applications. A newer formula that takes into consideration more factors in calculating the minimum safe distance is included in American National Standards Institute (ANSI) standards B11.19-2010 and Robotic Industries Association (RIA) R15.06-1999 (R2009), as well as Canadian Standards Association (CSA) Z142-10, Z432-04, and Z434-03.

Omron suggests using this newer formula and presents it here in the form used by ANSI and CSA.

$$D_S = K (T) + D_{PF}$$

where:
D_S = the safety distance
K = the maximum speed that an individual can approach the hazard
T = the total time to stop the hazardous motion
D_{PF} = the depth penetration factor of the safeguarding device

There is a different mounting formula for safeguarding devices used in Europe that is similar to the ANSI formula given above but with some subtle differences. This formula is presented in European Standard (EN) 999:1998 and International Standards Organization (ISO) 13855:2010 is:

$$S = (K \times T) + C$$

where:
S = the safety distance
K = the approach speed of the body or parts of the body
T = the overall system stopping performance
C = an additional distance based on intrusion towards the danger zone prior to actuation of the protective equipment

The factor K is the speed constant and includes hand and body movements of an individual approaching a hazardous area. The determination of K should consider all types of motion that could move the individual towards the hazard, including hand and arm movement, twisting of the body or shoulder, bending at the waist and walking or running.

One of the acceptable values of K is the hand speed constant which is usually defined as the horizontal motion of the hand and arm while seated. The hand speed constant originated in the press industry using two hand controls in the 1930s. A common value for the hand speed constant is 1.6 m/s (63 in/s). The hand speed constant does not include other body movements which can affect the actual approach speed, and is considered the minimum acceptable value. Another acceptable value is 2.0 m/s (78.75 in/s) which is based on an individual walking toward a hazard. This latter value is defined in ISO 13855:2010 – Safety of machinery – Positioning of protective equipment with respect to the approach speeds of parts of the human body.

The factor T is the total time necessary for the hazardous motion to stop or for the hazardous portion of the machine cycle to be completed. Factors that affect T include:

- Reaction time of the safeguarding device, including its interface
- Reaction time of the machine control system
- Type of actuator
- Additional time required for degradation of braking performance

The ANSI and CSA standards use the following method to calculate T:

$$T = T_R + T_C + T_S + T_{SPM}$$

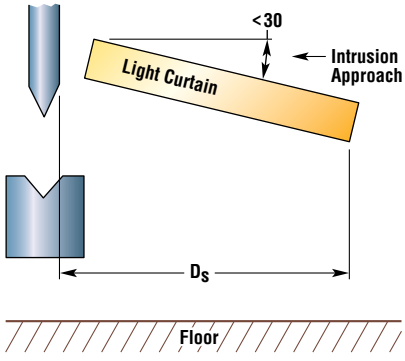
where:
T_R = reaction time of the safeguarding device and its interface (i.e., light curtain and monitoring relay)
T_C = reaction time of the control system
T_S = stopping time of the machine
T_{SPM} = additional stopping time allowed by the stopping performance monitor before it detects stop time deterioration. As used in the press industry, a stopping performance monitor will halt the machine when the stop time of the machinery exceeds the set limit. This indicates that excessive brake wear has occurred.

$T_C + T_S$ are usually measured together by a stopping performance monitor. T_{SPM} is an additional value to allow for braking system wear and is typically a percentage increase factor of the measured stop time ($T_C + T_S$). For example, stopping performance monitors usually add an extra amount from 5% to 20% of the measured stop time. Omron recommends that you contact the manufacturer of your machine for guidance in selecting a percentage increase factor.

The EN and ISO standards use a slightly different method for calculating T:

$$T = T_1 + T_2$$

where:
T_1 = maximum time between the actuation of the sensing function and the output signal switching devices being in the off state (i.e., light curtain and monitoring relay)
T_2 = maximum response time of the machine, i.e. the time required to stop the machine or remove the risks after receiving the output signal from the protective equipment (can be influenced by various factors, e.g. temperature, switching time of valves, ageing of components, etc.)



Intrusion angle of approach less than 30 to the sensing field.

Figure 5: Approach considerations

Depth penetration factor

An additional distance, called the depth penetration factor (D_{PF} or C), needs to be added to the safety distance when using devices that do not detect the presence of an individual at the plane or within the field until an amount of penetration into the field occurs. The expected direction of approach towards the hazard should be considered when calculating the depth penetration factor. If the detection zone is at an angle of greater than 30° to the direction of approach as in Figure 5, it is treated as an orthogonal or perpendicular approach. On the other hand, if the detection zone has been installed so that it is angled less than 30° to the direction of approach, it is treated as a parallel approach.

Model Series	S (mm)	S (in.)	D_{PF} (mm)	D_{PF} (in.)
F3SJA-P14	14	0.6	24	0.9
F3SJA-P20	20	0.8	44	1.8
F3SJA-P25	25	1.0	61	2.4
F3SJA-P30	30	1.2	78	3.1
F3SJA-P55	55	2.2	163	6.4
MS 4600-14	14	0.6	24	0.9
MS 4600-20	20	0.8	44	1.8
MS 4600-30	30	1.2	78	3.1
MS 4800-14	14	0.6	24	0.9
MS 4800-20	20	0.8	44	1.8
MS 4800-30	30	1.2	78	3.1
MS 4800-40	40	1.6	112	4.4

Figure 7: D_{PF} for all Omron STI light curtains

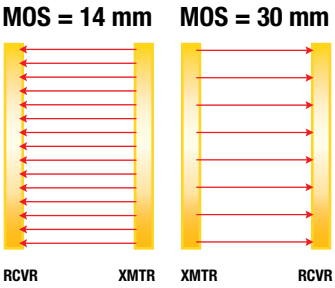


Figure 6: Minimum object sensitivity for two different light curtains

It's also important to address possible tradeoffs between the depth penetration factor and reaction time of different light curtains. In Figure 6, the light curtain on the left yields a smaller depth penetration factor because the individual beams are located closer together as opposed to the light curtain on the right. Yet the light curtain on the left also has a longer reaction time because it takes more time to cycle through the larger number of beams. As an example, a light curtain with 20 mm (0.78 in.) resolution requiring 76 beams to obtain a desired protected height of 760 mm (29.9 in.) results in a depth penetration factor of 44 mm (1.8 in.) and a minimum response time of 32 milliseconds. The same model and size light curtain with 30 mm (1.18 in.) resolution only requires 38 beams, resulting in a depth penetration factor of 78 mm (3.1 in.) and a 23 millisecond minimum response time. When these numbers are plugged into the formula provided earlier for calculating the safe mounting distance, they show that the safety distance is 116 mm (4.549 in.) for the 30 mm resolution light curtain and 97 mm (3.816 in.) for the light curtain with 20 mm resolution. The light curtain with a larger object resolution (fewer beams) thus can be almost 19 mm (0.733 in.) closer to the hazard, proving that minimum object resolution, and by extension the corresponding depth penetration factor, should not be the sole consideration when selecting a point-of-operation light curtain. See Figure 7 for depth penetration factors for various models of safety light curtains available from Omron.

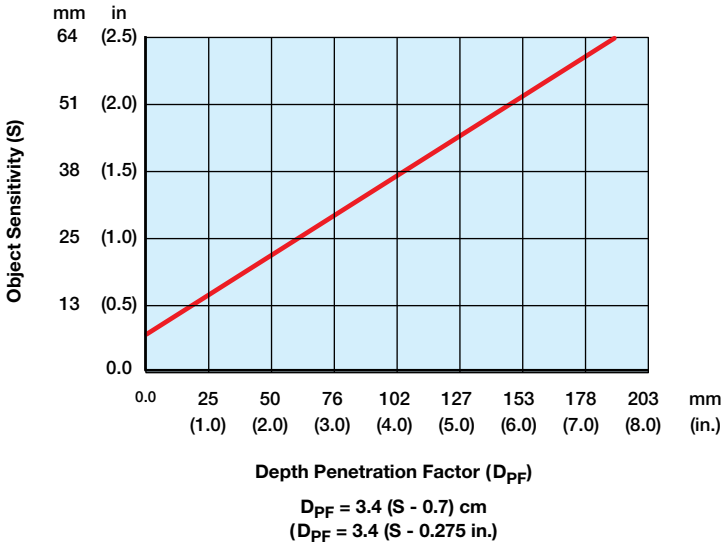


Figure 8: Depth penetration factor for presence sensing devices used in a vertical application with object sensitivity less than 64 mm (2.5 in.)

Devices with perpendicular approach

The depth penetration factor compensates for varying object sensitivities of electro-optical presence sensing devices. Figure 8 can be used to determine D_{PF} when applying the ANSI or CSA formula for presence sensing devices used in vertical applications with object sensitivity less than 64 mm (2.5 in.), considered as point-of-operation safeguarding devices.

When blanking features are used and when the blanked area is not completely filled by the workpiece or part or by supplemental mechanical guarding, the adjusted minimum object sensitivity can be calculated as:

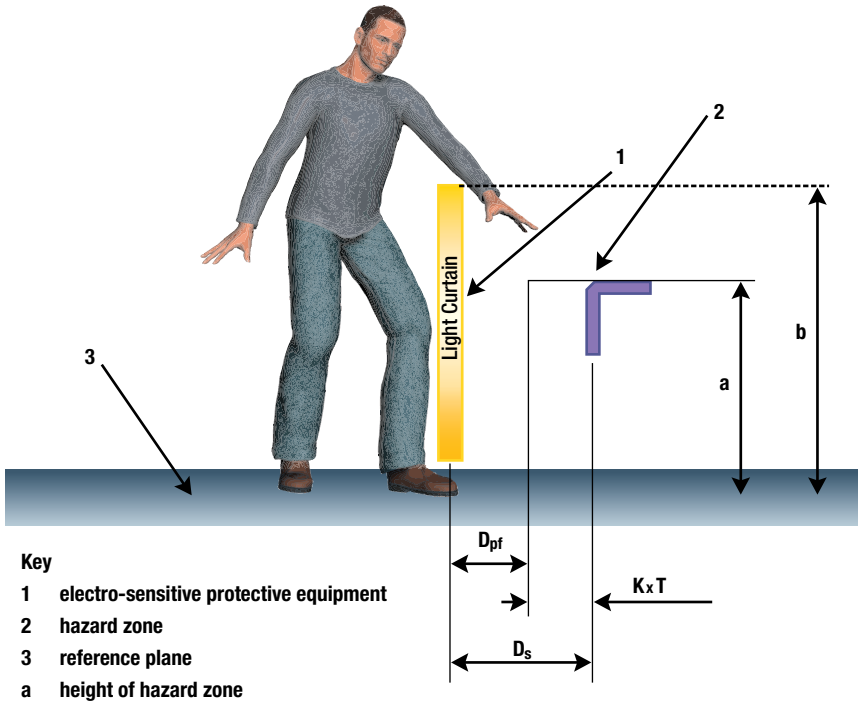
Adjusted depth penetration factor = (minimum object sensitivity without blanking) x (number of beams blanked)

Where minimum object sensitivity without blanking = center-to-center beam spacing + lens diameter

Once this value is found, then determine D_{PF} using Figure 8, as long as the adjusted minimum object sensitivity is still less than 64 mm (2.5 in.). If the entire blanked area is filled with mechanical guarding or other fixed material or guards, use the original object sensitivity of the device to determine the appropriate value for D_{PF}.

Similar to the concept for barrier guards, guidelines are also available in ISO 13855-2010 to determine the minimum height to the top beam of the electro-optical device to protect against reaching over the sensing field to contact a hazard. In Figure 9, ***a*** is the height of the danger zone, ***b*** is the minimum height of the sensing field, and D_S is the horizontal distance between the sensing field and the danger zone.

A different method is used to determine D_{PF} for electro-optical devices with object sensitivities greater than 64 mm (2.5 in.), considered perimeter safeguarding devices, as shown in Figure 10. ANSI and CSA standards set D_{PF} = 900 mm (36 in.) for reach-through applications where the individual cannot reach over the top of the sensing field and the bottom of the sensing field ("A") is no more than 300 mm (12 in.) above the working surface;



Key

1	electro-sensitive protective equipment
2	hazard zone
3	reference plane
a	height of hazard zone
b	height of the upper edge of the detection zone of electro-sensitive protective equipment
D_{pf}	additional distance which a part of the body can be moving towards the hazard zone prior to the actuation of the safegard
D_s	minimum distance for reaching over

Figure 9: Reaching over the vertical direction zone of electro-sensitive protective equipment

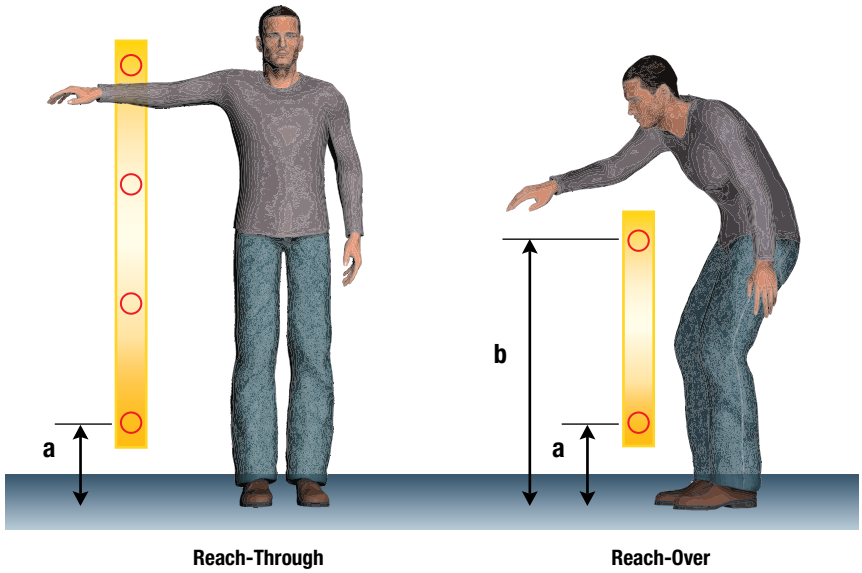


Figure 10: Reach-through and reach-over applications

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

ISO 13855 sets D_{PF} = 850 mm (33.5 in.) for these applications. North American and International standards require D_{PF} to be equal to 1,200 mm (48 in.) for reach-over applications where the top of the sensing field ("B") is between 900 and 1,200 mm (36 and 48 in.) above the reference plane and the bottom of the sensing field ("A") is no more than 300 mm (12 in.) above the working surface.

Devices with parallel approach

Any device installed with parallel approach to the hazard is considered a perimeter safeguarding device. For these applications, the minimum depth-of-field or sensing area must hinder an individual from stepping over the electro-optical presence sensing device or safety mat. In ANSI and CSA standards, this distance is 1,200 mm (48 in.) if an individual can step over and pass unrestricted or 900 mm (36 in.) if supplemental safeguarding or physical barriers are used such that an individual must stand within the sensing area. ISO standards require that distance be calculated as follows, but not less than 850 mm (33.5 in.).

C = 1,200 mm – (0.4 x H)

where:

C = an additional distance based on intrusion towards the danger zone prior to actuation of the protective equipment

H = the height of the detection zone above the reference plane (measured in mm)

Impact of vertical point-of-operation vs. horizontal perimeter safeguarding devices on usage of floor space

Mounting height of devices with parallel approach

Ground level devices that can be reached over, such as safety mats, area scanners and horizontally-mounted light curtains, are approached by individuals parallel to the sensing field. The minimum mounting height (h) for these devices as a function of their object sensitivity can be determined by the following formula and is also shown in Figures 11 and 12.

h = 15 (S – 50) mm
h = 15 (S – 2) inches

where:

S = the minimum object sensitivity.

Allowable Sensing Field Heights in Inches (mm) Ground Level Devices that Can Be Reached Over (30 inches [760 mm] or Less)

Object Sensitivity	Mounting Height	
	Minimum	Maximum
< 2 (50)	0	39 (990)
2.5 (64)	7.5 (190)	39 (990)
3.0 (76)	15 (380)	39 (990)
3.5 (89)	22.5 (570)	39 (990)
4.0 (102)	30 (760)	39 (990)
4.25 (108)	33.75 (860)	39 (990)
4.6 (117)	39 (990)	39 (990)

Figure 12: Allowable sensing field heights for ground level devices

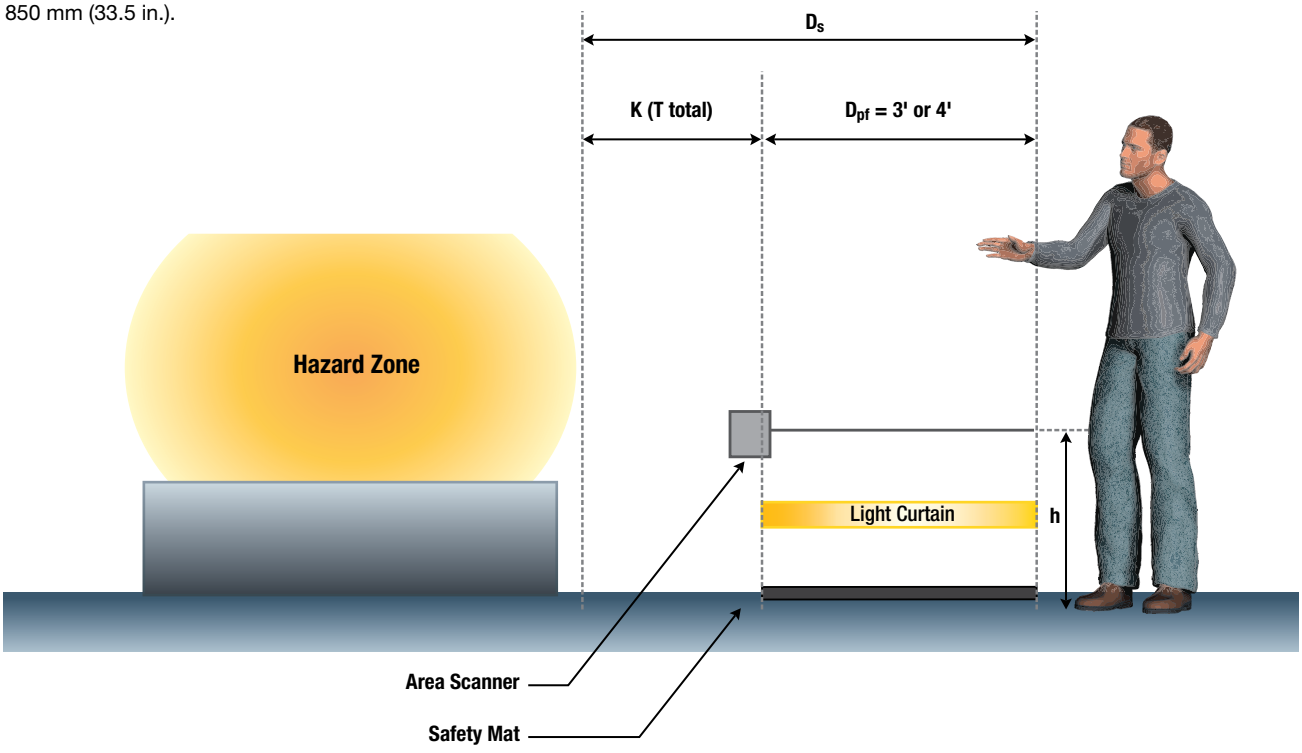


Figure 11: Height of sensing field

The orientation of a safety device can have a major impact on the amount of floor space required to properly safeguard a machine or manufacturing cell. For example, if you use a vertical light curtain as a safeguarding device with a 30 mm (1.18 in.) minimum object sensitivity, the depth penetration factor is 78 mm (3.08 in.), resulting in the use of 5.08 m (16.68 sq. ft.) over a 20 m (65 ft.) range. On the other hand, if you position the same safeguarding device horizontally, the depth penetration factor increases to 1,200 mm (48 in.) and the space usage increases to 24.15 m^2 (260 sq. ft.) over the same 20 m (65 ft.) range. This scenario shows that switching from a horizontal to a vertical orientation in this application can save 22.6 m^2 (243.32 sq. ft). This figure can be multiplied by the cost of space per square foot in the facility to calculate the cost savings.

Two-hand control applications

Two-hand control applications use two operator control devices which are both monitored and initiate a stop signal to the machine when the operator removes one or both hands from the actuating devices. A two-hand control is used when it is necessary to ensure that the operator must be prevented from reaching into the hazardous area during the hazardous portion of the equipment cycle. Two-hand trip applications (such as full revolution machines) still require two operator control devices, but activation of both devices only initiates the hazardous motion; both control devices and are not required to be maintained by the operator throughout the hazardous portion of the cycle. Two-hand control and two-hand trip applications have a D_{PF} of 0 in North America, while ISO requires the additional factor (C) to be 250 mm (9.8 in). The safe mounting distance for these control devices is measured by the closest hand control to the hazard as shown in Figure 13. It is extremely important that the two-hand control and two-hand trip stations are designed, constructed, and arranged such that the actuating devices can only be initiated by the hands of the operator.

One-hand control applications

A single control device can only be used when the operator cannot reach the hazardous area with his/her free hand. As shown in Figure 14, the safe mounting distance (D_S) for a single control device includes a large D_{PF} of 2 meters (6.5 ft) due to the ability of the operator

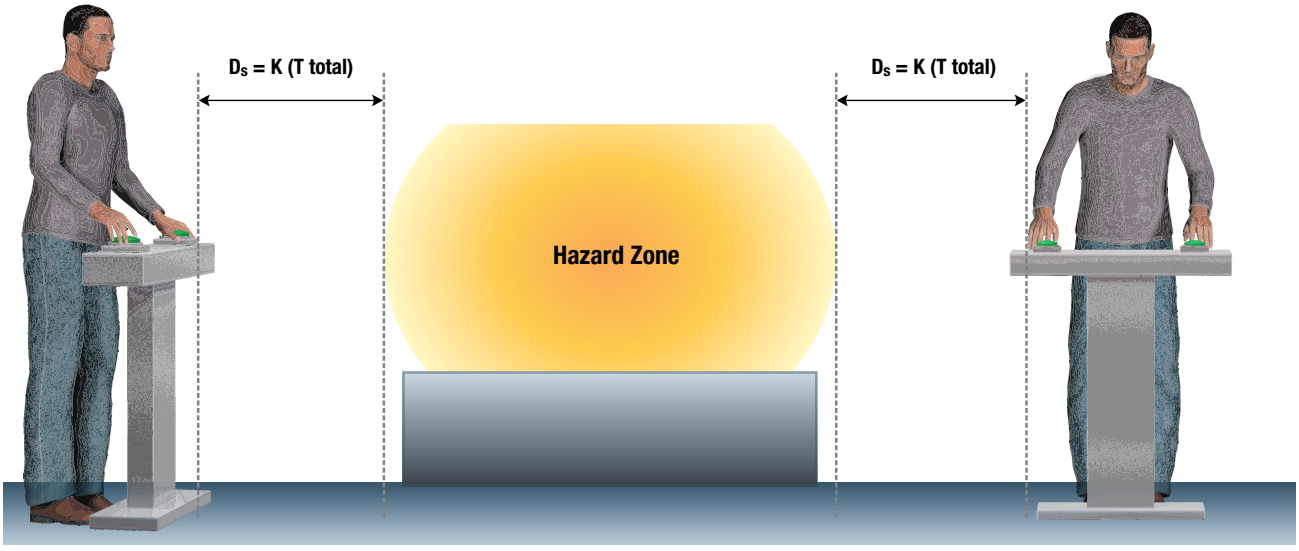


Figure 13: Two-hand control and two-hand trip applications

to stand between the device and reach towards the hazard, where 2 meters is the average human wingspan. Because of the implications on floor space, as well as the fact that this safeguarding measure does not provide adequate protection for other affected individuals, single control is typically not selected as a sole means of safeguarding for most equipment. Furthermore, single control devices are not accepted as a primary safeguarding means in International standards.

Radio frequency (RF) / capacitive devices

The sensing field(s) of radio frequency devices can vary due to many factors, including design of the antenna(e), effects of adjacent equipment, or environmental factors such as temperature or humidity. When used for used for safeguarding applications, determination of the safe mounting distance cannot be dependent on the inevitable fluctuations and variations in the field sensitivity. Therefore, to ensure the sensing field will always prevent individuals from reaching the hazard(s), the measured safe mounting distance of a radio frequency device will unavoidably render addition floor space around the machine as unusable as shown in Figure 15. This negative impact on floor space is the primary reason radio frequency devices are typically not selected as a sole means of safeguarding for most equipment. Additionally, radio frequency devices are not accepted as a primary safeguarding means in International standards.

Interlocked barrier guards

With interlocked barrier guards, it's necessary to consider three different factors in determining the safety distance: the gap size, the height in relation to the distance to the hazard, and the time required to stop the hazard. First determine the safety distance based on the gap size using the appropriate standard shown in Figure 3. Then determine the safety distance based on the height of the guard using the method shown in Figure 4. Finally, calculate the safety distance based on the stopping time of the machine using the formula: $\mathbf{D_s = K (T)}$ **[or S = K (T)** according to the international nomenclature]. Compare the safety distances determined using these three different methods and use the largest figure to determine the appropriate safe mounting distance of the interlocked guard from the hazard(s).

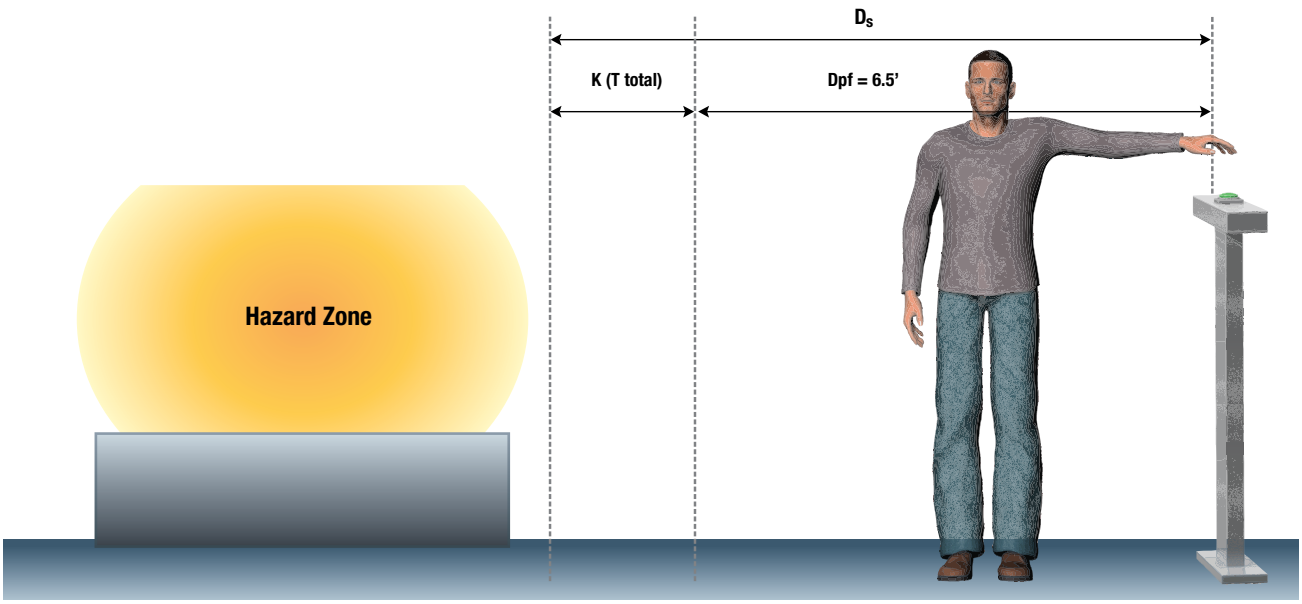


Figure 14: Single control applications

Conclusion

This article has provided an overview of the major considerations involved in determining the minimum safe mounting distance for various safeguarding devices. Accurate calculation of the minimum safe mounting distance can ensure the safety of personnel while conserving floor space and maximizing throughput. In most manufacturing operations, the two most important considerations are safety and productivity. The challenge is that improving one of these factors often has a negative impact on the other. Proper calculation of the required safety distance is necessary to correctly select appropriate safeguarding measures to best optimize both productivity and safety in many manufacturing operations. It should be noted that space limitations make it impossible to address every possible situation or to fully explain every configuration option, so it's important to consult your vendor and the appropriate regulatory and consensus standards to obtain full details on how to optimize safety device implementation for your specific application.

Step 3. Physically Mounting the Light Curtain

Now that the minimum safe distance and reflective surface distance are known, the safety light curtain may now be mounted accordingly on the machine, stands or other mounting fixtures.

Installation of Multiple Light Curtain Units

Installations where two or more light curtains are mounted on machines in close proximity and in alignment with each other, precautions should be taken to avoid one curtain interfering with another. This can occur when the receiver of one unit "sees" the transmitter of another. The first unit will respond with a Red **Machine Stop** condition.

Best practices for installation involve orienting the light curtains such that the transmitters or receivers are mounted back-to-back to each other as shown in *Figure 16*. Contact Omron should you need additional assistance. Additionally, STI safety light curtains offer multiple scan codes to decrease the chance of light curtains interfering with each other.

Mounting Considerations

The transmitter and receiver units must be securely mounted at a distance from the pinch point greater than minimum safe distance. Other items to consider when selecting a mounting location include:

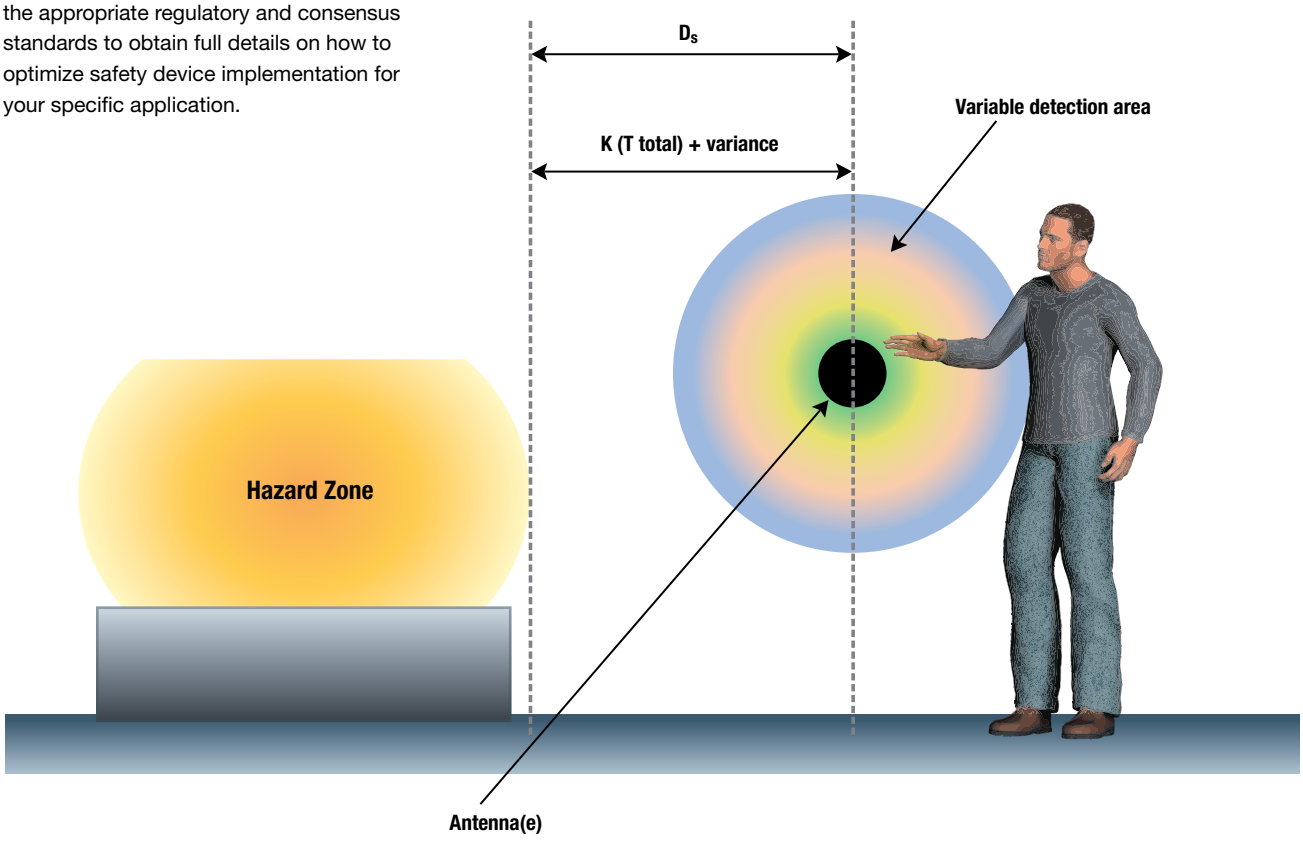


Figure 15: Determination of safety distance for radio frequency devices

1. If the light curtain does not protect all access to the danger point, the unprotected access must be protected by other approved devices or supplemental guarding. An operator must not be able to reach around the light curtain in any way to gain access to a hazardous location of the machine or stand between the machine and the light curtain. A mechanical barrier in front of the hazardous machine area should be used to prevent personnel from standing between the light curtain and the machine.

2. Use caution when installing any light curtain where the perimeter of the sensing field is adjacent to a reflective surface, such as shiny metal, foil, glossy paint, plastic or other similar material. A reflective surface can deflect the optical beam and may cause an obstruction in the sensing field not to be detected. Failure to correct this condition can result in a severe operator injury. Perform the Test Procedure to test for this condition.

3. The sensing field of the light curtain is marked on the transmitter and receiver housings (see installation manual for details). The area between the housing bottom and beginning of the sensing field is not protected. Therefore, you should position the light curtain so access to the pinch point is only through the marked sensing field or provide an alternative means to prevent entry to the hazardous location.

4. The transmitter, receiver and cabling should be out of the way of feedstock, raw material, parts, tool and die changes, fork lifts, etc.

5. Normally the transmitter and receiver are mounted with the cable end down and the plastic bezels facing each other. To install the units "upside down" (cable ends up), **both** transmitter and receiver units must be mounted with their cable connectors in the same orientation. You may also install the light curtain in a horizontal plane, provided that both units are oriented the same. See *Figure 17a*.

6. If you use a mirror, such as a high quality STI mirror, in your installation, do not mount the mirror in a retro-reflective orientation to the transmitter and receiver units as depicted in *Figure 5.17b*. The transmitter and receiver units must also be installed parallel to and in line with each other.

7. All cabling must be installed and routed in accordance with national and local electrical codes and good workmanship practices.

Omron offers a variety of mirrors, stands, mounting kits, and cabling to simplify special installation requirements.

Figure 16: Multiple Light Curtain Installations

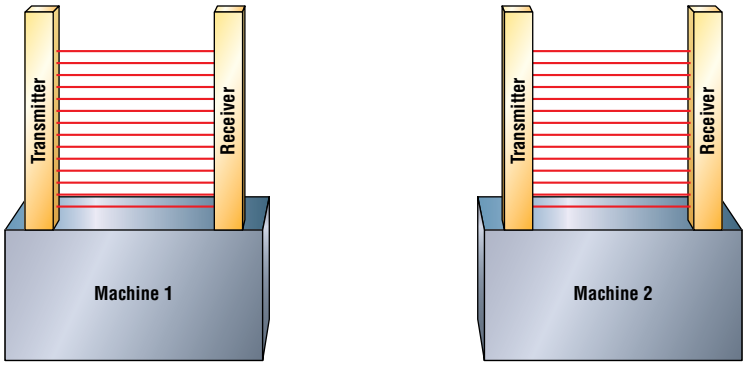


Fig. 16a **Not Recommended.** This arrangement may be subject to interference between the two light curtains.

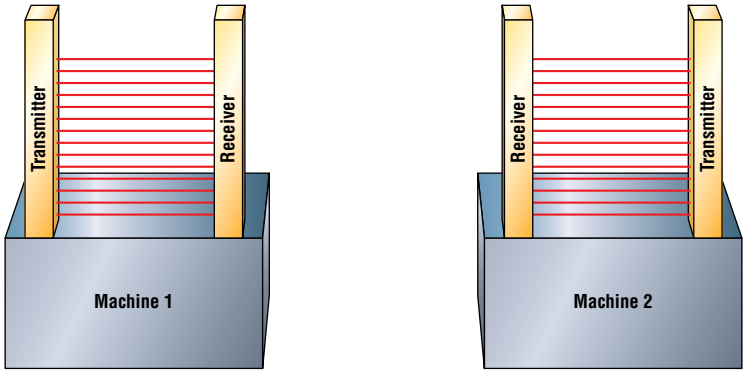


Fig. 16b **Preferred.** The suggested orientation. The receivers are mounted back to back.

Step 4. Preparation of the Light Curtain

Input power, output machine control, and, if used, remote function control must be connected to the light curtain by means of cables protected by conduit.

It is recommended that a clearance of approximately 4 inches (100 mm) be maintained between the receiver or transmitter cables and any AC power lines.

Step 5. Configuring the Features of the Light Curtain

Some light curtains contain installation configuration options which allow flexibility for your specific application needs. Examples of installation selections include Operation Mode, Auxiliary Relay Selection, MPCE Monitoring, MTS, Exact Channel Select, Floating Blanking, Restart Interlock Mode and Range Selection. See your installation manual or contact Omron for further information.

Step 6. Connection of Power and Termination of Outputs

WARNING: All electrical connections must be made by qualified personnel only and in accordance with your local and national electrical codes and regulations.

Input Power Connections

Light curtains are generally powered by 24 VDC. Check the product label to verify the voltage which may be used. Resource modules are available which may allow you to power your light curtain with 115 VAC or 230 VAC.

All light curtains must be connected to a good electrical ground.

It is recommended that the light curtain be dedicated to its own source of input power where possible. Also, do not connect other devices to the internal power supply of the light curtain.

Connecting to the Machine Control Circuit

Light curtains may be connected to your machine circuit in several different configurations, depending on the machine controller design and the light curtain model selected. If you are evaluating an existing light curtain installation, certain models may not have all of the features or output connection options outlined in the following sections. Please contact Omron should you require assistance.

Figure 17: Light Curtain Mounting Orientation

Figure 17a Correct

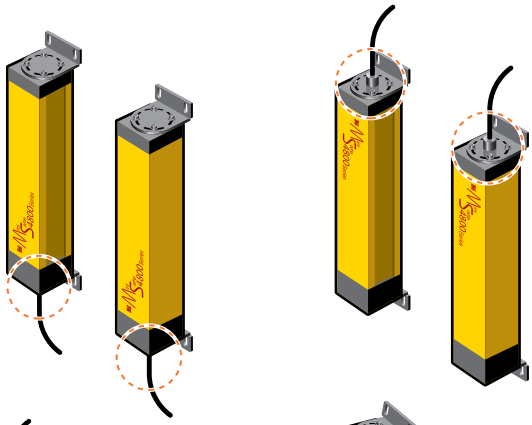
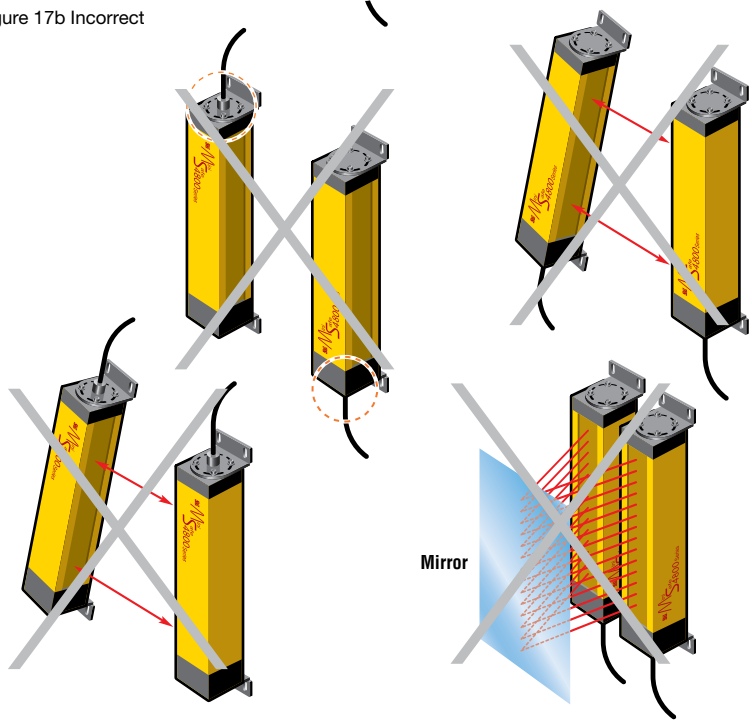


Figure 17b Incorrect



WARNING: Unsafe! Omron Safety light curtains are not designed to be used in a mirror bounce back mode. In this configuration, an object may not be reliably detected and may cause severe operator injury.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

When deciding which method is best for your application, keep in mind the following important points:

- The safety light curtain must be wired to your machine control circuit at a point where a stop signal from the light curtain results in an immediate halt during any point in the machine's cycle or stroke. If the machine is a mechanical power press, never connect a light curtain to the top-stop circuit. The press will be unable to stop at any other point in its stroke.
- Light curtains are general purpose safety devices and are not designed for any specific type, model or brand of machine.
- All safety-related machine control circuit elements, including pneumatic, electric or hydraulic controls must have a high level of safety performance.
- Light curtains may not be used as a tripping means to initiate mechanical power press motion except when used and installed in total conformance with the OSHA PSDI requirements of 1910.217(h).
- You must always use both safety outputs to connect to your machine. Should one output fail, the other is used to stop the machine.
- Omron recommends you contact the machine manufacturer for advice and assistance on the connection of any safety device.
- If a PLC (programmable logic controller) is used as the machine controller, consult the appropriate STI light curtain manual for proper connection information.

The installer must read and understand all instructions provided in the installation manual provided with the safety light curtain.

WARNING: Contact the protected machine manufacturer for assistance on where to wire the light curtain to your machine control circuit. It is critical that the light curtain be properly connected or it will not provide maximum protection to the machine operators and could result in serious injury. The machine control circuit wiring is the sole responsibility of the employer.

PERIMETER GUARDING SPECIAL REQUIREMENTS

Perimeter guarding refers to installations where the light curtain is generally positioned around the outside perimeter of the machine or robot to be guarded. This could leave sufficient space for an operator to stand between the light curtain and the machine. A horizontal mounting of the light curtain may prevent this.

For perimeter guarding installation, the guarded machine or robot must be wired such that any detected interruption of the sensing field will cause an immediate stop of the hazardous motion. The machine or robot must only be restarted by actuation of a reset switch. This reset switch must be located outside the area of hazardous motion and positioned such that the hazardous area can be observed by the switch operator. This would prevent a machine from automatically restarting once the obstruction is no longer detected by the light curtain.

The emergency stop circuit may possibly be used to interconnect a perimeter guard in certain installations where an external reset pushbutton or keyswitch is used. Always contact the machine manufacturer for advice and assistance on the connection of any safety device.

WARNING: Perimeter guarding installations must not allow a machine or robot to restart automatically. Use a reset switch placed outside and within view of the hazard area.

Restart Interlock Mode

Restart Interlock (Guard) Mode allows the light curtain safety outputs to remain in a de-energized state (latch condition) after an object detected by the light curtain is removed from the sensing field.

It may be desirable to employ Restart Interlock Mode when a light curtain is used in perimeter guarding installations.

Restart Interlock and Start Interlock are two separate programming choices, so it is possible to set the system to go to a machine run operating condition when power is applied and the sensing field is clear but to latch whenever a beam is blocked. Omron recommends activating Start Interlock whenever Restart Interlock is enabled.

MACHINE PRIMARY CONTROL ELEMENTS (MPCE)

The monitoring of the machine control elements is an important part of a safety system installation. First, a definition of a machine control element.

Redundant machine control circuits must have two machine primary control elements (MPCE). These are defined by IEC Standards as *"The electrically powered element that directly controls the normal operation of a machine in such a way that it is the last element (in time) to function when machine operation is to be initiated or arrested."* [IEC61496-1].

It is important to note that the methods to arrest hazardous machine motion will include hydraulic, pneumatic, clutch and mechanical braking systems. Thus, there are several variations of MPCEs. For example, your MPCE may consist of relays, contactors, solenoids or electromechanical valves.

The purpose of monitoring the action of each MPCE is to make sure it is responding correctly to the light curtain's safety outputs and to detect any inconsistency between the two MPCEs. Monitoring of the light curtain to machine control interface is necessary to detect a malfunction within the interface that would prevent a stop signal from the light curtain from reaching the machine controller. This is necessary to achieve the high level of safety performance required by OSHA.

If relays, the MPCE **must** use force guided (captive contact) type machine control relays to be effective for the MPCE monitoring wiring.

CONNECTING SOLID-STATE OUTPUTS TO A STI RELAY MODULE

The following connection scheme shows an MS4800 light curtain with solid-state safety outputs interfacing with an RM-1 relay module. The concept is similar for other safety products with solid-state safety outputs.

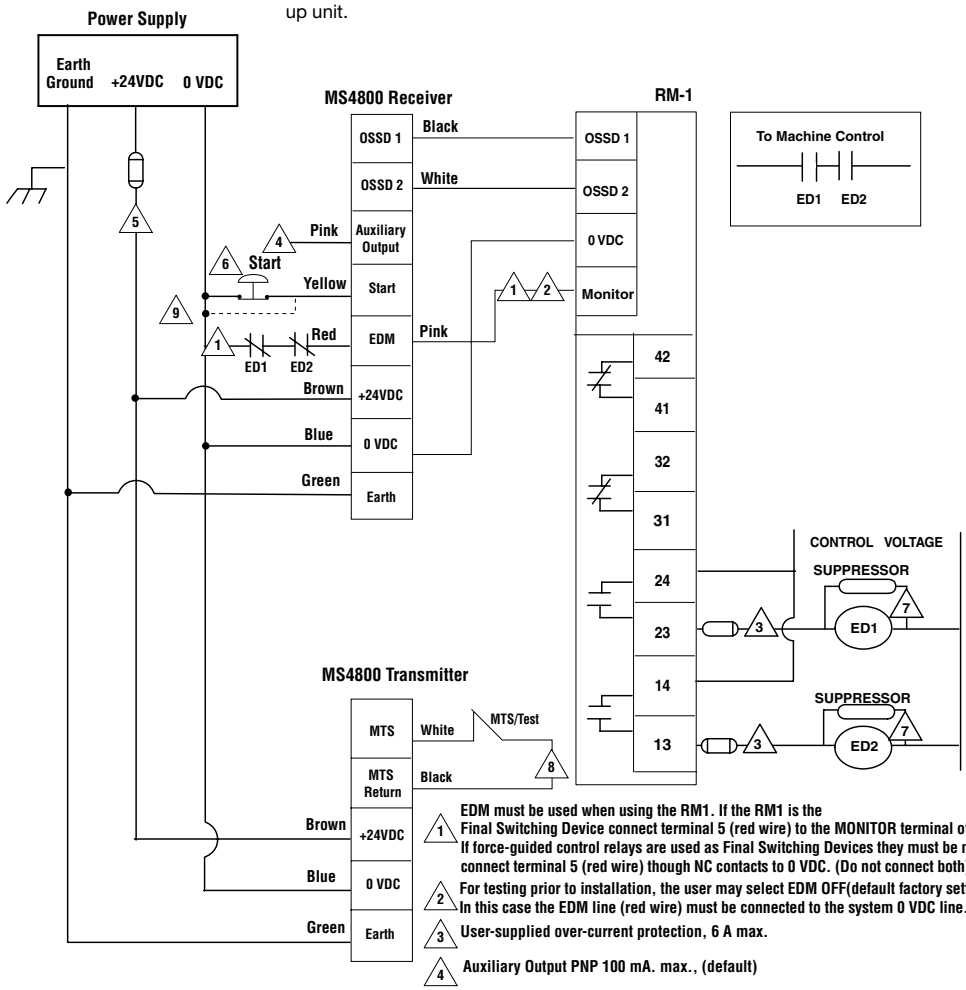
The RM-1 module provides the user with two normally open (NO) safety contacts and two normally closed (NC) monitoring contacts. The NO contacts are connected to two force-guided relays (External Devices), ED1 and ED2. A set of NO contacts from each External Device (in series) should be used to control the machine's hazardous motion. In some control systems, the RM-1 can be used as the External Device. Contact the machine manufacturer for the specifications of the control components.

External Device monitoring is performed on the final switching devices. This consists of a set of NC contacts from ED1 and ED2 connected through the receiver's EDM line to 0 VDC. If no external devices are used, the monitoring should be performed on the resource module in use.

For more information, please consult the appropriate operation and installation manual.

CONNECTING SOLID-STATE OUTPUTS TO A STI RELAY MODULE

Check unit for proper voltage requirements before powering up unit.



1. EDM must be used when using the RM1. If the RM1 is the Final Switching Device connect terminal 5 (red wire) to the MONITOR terminal of the RM1. If force-guided control relays are used as Final Switching Devices they must be monitored, connect terminal 5 (red wire) though NC contacts to 0 VDC. (Do not connect both)
2. For testing prior to installation, the user may select EDM OFF(default factory setting). In this case the EDM line (red wire) must be connected to the system 0 VDC line.
3. User-supplied over-current protection, 6 A max.
4. Auxiliary Output PNP 100 mA. max., (default)
5. User-supplied fuse
6. Start connections are shown with NC (pulled to 0 VDC). (default)
7. Verify that the final switching devices are properly suppressed.
8. MTS requires a NC contact. If MTS is not used, verify that the function is disabled.
9. If EDM select is required the yellow wire should be tied to +24V to enable it, or 0 V to disable it.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

A

CONNECTING SOLID-STATE OUTPUTS TO TWO FORCE-GUIDED RELAYS

The following connection scheme shows a MS4800 light curtain with solid-state safety outputs directly driving two force-guided relays (ED). The concept is similar for other safety products with solid-state safety outputs.

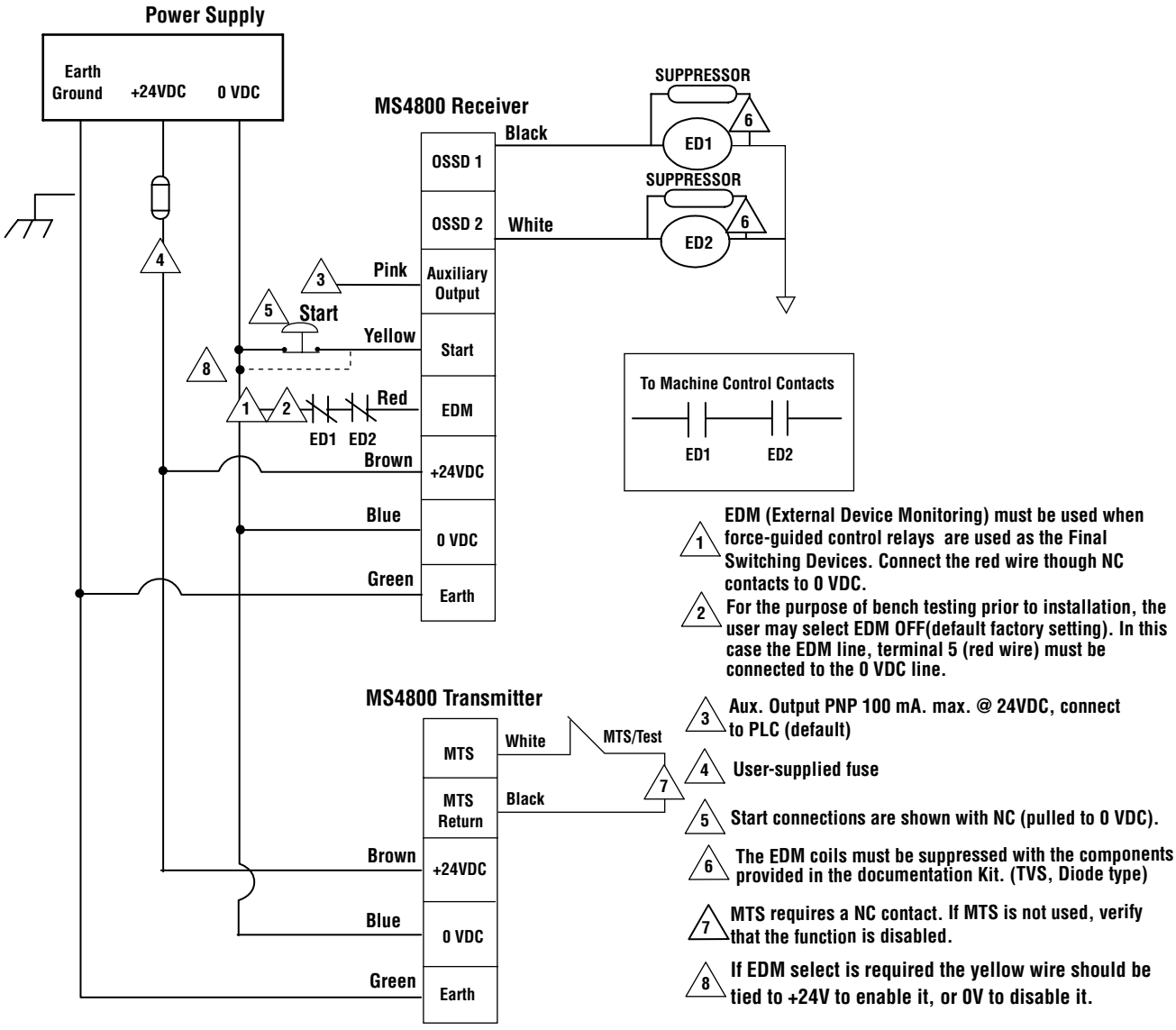
The MS4800 receiver provides the user with 2 PNP solid-state safety outputs capable of sourcing 625 mA @ 24 VDC. These safety outputs are directly connected to the two force-guided relays (External Devices), ED1 and ED2. A set of normally open contacts from each External Device (in series) should be used to control the machine's hazardous motion.

External Device monitoring is performed on the final switching devices. It consists of a series set of NC contacts from ED1 and ED2 tied through the receiver's EDM line to 0 VDC.

In some control systems, the PNP safety outputs can be directly interfaced into a safety PLC. Contact the machine manufacturer for the specifications on the PLC.

CONNECTING SOLID-STATE OUTPUTS TO TWO FORCE-GUIDED RELAYS

Check unit for proper voltage requirements before powering up unit.



Using the External Device Monitoring (EDM) Function

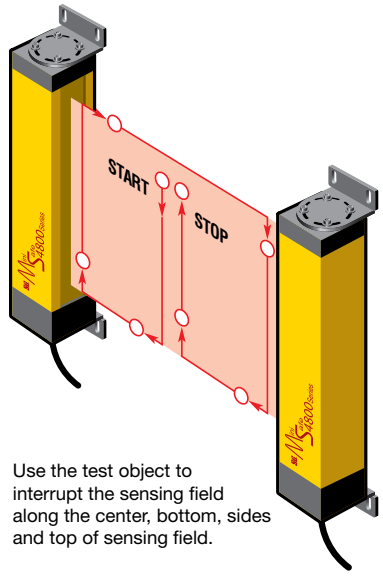
With the EDM function active, if the EDM signal does not close within 300 milliseconds after the light curtain enters a Red ***Beam Blocked*** state, or open when the light curtain returns to a Green ***Beam Clear*** state, then the controller will ***Fault*** into a lockout condition.

The wiring for the External Device Monitoring feature is explained in your light curtain Installation Manual.

External Device Monitoring with an Interposing Relay

In some machine controller designs, the light curtain outputs are connected to two interposing or pilot duty relays. These relays, in turn, drive the External Devices. The monitoring function must monitor the External Device and not the interposing relay.

Figure 18: Using the Test Object



Use the test object to interrupt the sensing field along the center, bottom, sides and top of sensing field.

Step 7. Application of Power and Safety Light Curtain Alignment

This step examines the procedures to align the light curtain and adjust the operating range.

At this point, the transmitter and receiver units have been loosely installed and are approximately aligned. All wiring – to the light curtain transmitter and receiver units, to primary power, and to the machine control system – have been installed. Power, both to the light curtain and to the machine to be controlled, is off.

Alignment

This section is concerned with the physical alignment of the transmitter and receiver heads. Proper setup and alignment is an important part of the installation.

To align a safety light curtain, please follow the procedure outlined in the manual for your model.

WARNING: Before operating the machinery, always perform the Test Procedure shown in *Figure 18* after any maintenance, adjustment or modification to the light curtain or machine. Testing is critical to verify the safe installation of the light curtain. Failure to properly test may result in serious injury to personnel.

Mirror Alignment Hints

If difficulty arises when using the light curtain with mirrors, try using the following steps:

1. The mirrors must be parallel to the transmitter and receiver. If not, the beams will not be reflected evenly to the next mirror or to the receiver. Most light curtains are equipped with Individual Beam Indicators, these serve as an alignment aid. If an indicator is on, that beam is not in alignment or is blocked.

2. Try looking from behind either the transmitter or receiver to locate an image of the corresponding unit reflected in the mirror(s). Have an assistant adjust the mirrors until the other unit is reflected fully in the mirror. Make sure the machinery is disabled before working in a hazardous area!

Step 8. Checkout and Test Procedures

Now your light curtain is mounted, configured, aligned and connected to your machinery. The machine power is off.

The following initial checkout procedure must be performed by ***qualified*** personnel. A copy of the checkout results should be kept with the machine maintenance and inspection records.

A typical Checkout Procedure Log form and Test Procedure form are shown on the following pages.

A

Sample Checkout Procedure Log

The following checkout procedure must be performed by qualified personnel during initial light curtain installation and at least every three months or more frequently depending on a machine usage and company guidelines. Hint: Make a copy of this blank page and use the copy as the checkout log to be kept with the machine records. Use caution when working around hazardous voltages which may be present during these procedures.

Note: This is a sample. Consult your installation manual for instructions specific to your light curtain.

Machine Identification _____ **Date** _____

Item	Condition	Comments
1. Verify the guarded machine is compatible with the type of machine which may be used with the light curtain. See Step 1 – Usage Requirements for further information on incompatible machinery.	❑ Pass ❑ Fail	
2. Verify that the mounting distance of the light curtain is equal to or greater than the minimum safe distance from the point of hazardous operation. Refer to Step 2 – Calculating the Minimum Safe Distance.	❑ Pass ❑ Fail	
3. Determine that all access to the danger point not protected by the light curtain is guarded by other means, such as gates, fencing, wire screening or other approved methods. Verify that all additional guarding devices, interlock switches and mechanical barriers are installed and operating properly.	❑ Pass ❑ Fail	
4. Make sure the operator is not able to stand between the light curtain sensing field and the danger point of the machine. Verify that the light curtain can only be reset from a position outside and within the view of the hazardous machine area	❑ Pass ❑ Fail	
5. Inspect the electrical connections between the guarded machine's control circuitry and the light curtain. Verify that they are properly connected to the machine such that a stop signal from the light curtain results in an immediate halt at any point in the machine cycle or stroke.	❑ Pass ❑ Fail	
6. Inspect the light curtain to ensure that the auxiliary relay is properly configured for your installation.	❑ Pass ❑ Fail	
7. If your control wiring scheme uses the auxiliary relay, press the Test/Store button, if equipped, with the guarded machine controller energized to verify the proper electrical connection of this relay to the machine control. Even if your wiring does not use the auxiliary relay, simulate a light curtain fault condition by pressing the Test/Store button. The light curtain should go into a lockout condition and the output and auxiliary relays de-energize. Press the Reset/Start button to correct from the fault condition.	❑ Pass ❑ Fail	
8. If the MTS feature is not used, proceed to step 9. To test the MTS feature, turn the machine power on. While cycling the machine, verify that the MTS only functions during a safe position of the machine cycle. Without interrupting the sensing field, observe that the Red and Yellow indicators will light and the output relays de-energize when the MTS circuit is open.	❑ Pass ❑ Fail	
9. If the External Device Monitoring (EDM) feature is not used, proceed to step 10. To test the EDM Monitoring feature, activate the EDM monitoring as appropriate for your light curtain. Turn the machine power on. Cycle the machine. Place a temporary jumper wire between the EDM connections. The light curtain should enter a fault condition. Remove the temporary wire. Reset the light curtain to recover from the fault.	❑ Pass ❑ Fail	
10. Record the test results in the machine log. Next, perform the Test Procedure	❑ Pass ❑ Fail	

Comments :

Technician Signature_____

Sample Test Procedure

The following tests must be performed at installation and after any maintenance, adjustment, repair or modification to the light curtain or the machine. In addition, the tests must also be performed after Channel Select is enabled or disabled. Testing ensures that the light curtain and the machine control system work properly to stop the machine. Failure to test properly could result in serious injury to personnel.

The following **Test Procedure** must always be performed by **qualified personnel** after the mounting, alignment and wiring steps are completed and before the light curtain is used to control the machine. To test the light curtain, use the supplied test object or opaque object of the appropriate size.

Note: This is a sample. Consult your installation manual for instructions specific to your light curtain.

Machine Identification _____ **Date** _____

Item	Condition	Comments
1. Disable the machine to be guarded. Turn power on to the light curtain.	❑ Pass ❑ Fail	
2. Visually inspect the machine to ensure that entry to the hazardous area is only through the light curtain sensing field. If not, additional guarding including mechanical barriers may be required. Verify that all additional guarding devices and barriers are installed and operating properly.	❑ Pass ❑ Fail	
3. Verify that the mounting distance of the light curtain is equal to or greater than the calculated maximum safe distance from the point of hazardous operation. See Step 2 – Calculating the Minimum Safe Distance. Ensure that the operator is not able to stand between the safety light curtain sensing field and the point of hazardous operation.	❑ Pass ❑ Fail	
4. Check for signs of external damage to the light curtain, the machine and the electrical cables and wiring. If any damage is found, lockout the machine off and report to the supervisor.	❑ Pass ❑ Fail	
5. Interrupt the sensing field with the proper size test object to check the effectiveness of the light curtain. Move the test object inside the perimeter (along the top, sides and bottom) of the sensing field and up and down through the center of the sensing field. Verify that the Red indicator is ON and the Green indicator is OFF while the test object is anywhere in the sensing field. Also, watch for any unprotected access to the danger point.	❑ Pass ❑ Fail	
6. Start the machine. While the machine is in motion, interrupt the sensing field with the test object. The machine should stop immediately. Never insert the test object into the dangerous parts of the machine. With the machine at rest, interrupt the sensing field with the test object. Verify that the machine will not start with the test object in the sensing field. Note: Some mechanical power presses may use muting, which bypasses the light curtain during the nonhazardous movement of the press, such as the upstroke. Interrupting the sensing field during this portion of the cycle will not stop the machine.	❑ Pass ❑ Fail	
7. Make sure that the braking system is working properly. If the machine does not stop fast enough, adjust the braking system or increase the distance from the sensing field to the point of operation hazard.	❑ Pass ❑ Fail	
8. If the safety devices or the machine fails any of these tests, do not run the machine. Immediately tag and lockout the machine to prevent its use and notify the supervisor.	❑ Pass ❑ Fail	
9. If the Channel Select or Floating Blanking is reprogrammed or disabled, repeat these test procedures.	❑ Pass ❑ Fail	
10. If applicable, remove the key from the keyswitch. Close and lock the controller enclosure door after the testing is completed.	❑ Pass ❑ Fail	

Comments :

Technician Signature_____

WARNING: If the light curtain and machinery did not function exactly as described in the Test Procedure, **do not operate the machinery**. If the machine safety devices, braking systems and controls do not operate properly, they cannot stop hazardous machine motion. Serious injury to personnel could result.

Safely Muting an Industrial Process

Definition

Muting is a temporary bypassing of the protective function of a light curtain and is permitted only during the non-hazardous portion of the machine cycle. Machine control systems which initiate muting must be control reliable.

When used properly, muting can help accelerate industrial processes while protecting personnel from potentially hazardous situations.

Processes where muting applications can be found include, but are not limited to, metal forming, conveying, robotic assembly or palletizing, and automated assembly lines.

ANSI standard B11.19-2010 clearly explains the requirements for muting:

"Muting of the device shall be permitted during the non-hazardous portion of the machine cycle. Muting of the device shall be accomplished such that a single failure of a component, a subassembly or a module of the system/device that affects the performance of the command from being initiated, or shall cause an immediate stop command. In the event of a failure, reinitiation of the machine shall be prevented until the failure is corrected or the system or device is manually reset.

In the presence of a failure, repetitive manual reset of the system or device shall not be used for production.

If the machine has reversing capability where a muting hazard is possible, the control system shall include an automatic means so muting is only permitted in the forward direction.

If an individual can pass through a sensing field when the device is muted, means shall be provided to ensure that the individual is outside the hazard area, or that the machine ceases hazardous motion when the muting is removed."
[clause 8.3.2.5]

Requirements for Use of Muting

Many different standards exist which explain the requirements to consider when implementing a muting system. The following list, while not complete, was compiled from a review of ANSI B11.19-2010, EN692-1994 and IEC 61496-1.

- Muting of a light curtain is permitted only during the non-hazardous portion of the machine cycle.
- If the machine tool has reversing capability where a muting hazard is possible, the control system shall include an automatic means through which muting is permitted only in the forward direction.
- There must be at least two, independent, hard-wired muting signal sources, of the same level of safety integrity as the light curtain. A single, simple, cam-operated limit switch is inadequate as a muting signal source since its failure can remain undetected.
- The position of the muting signal source must be secured against unauthorized adjustment.
- The machine control system and associated muting circuitry must be control reliable.

The list above is not a complete guide to muting standards. The employer must contact the appropriate local safety agencies for specific requirements regarding their machine and safety-related control system. Omron has provided the information above for reference only and makes no claim regarding its accuracy, completeness or effectiveness for a specific application.

The OMRON Automation and Safety Muting Solution

OMRON Automation and Safety offers a selection of control-reliable solutions for muting: the F3SJ-A with built-in muting; the MS4800 with RM-6; and the RM-3 which works with a variety of safety light curtains.

The Real World

So what does the real world look like? Let's take a simple application and illustrate some of the muting options available when using solutions from Omron.

The application involves the safe exit of a full pallet from a palletizing machine where it has just been loaded and shrink wrapped by a fast-moving (and potentially dangerous) robotic system. The robotic work cell is typically guarded by interlocked fencing, while a safety light curtain guards the opening where the full pallet will exit on a conveyor. The goal is to allow the pallet to exit the work cell without tripping the light curtain, stopping the system and slowing the production process. Figure 7.1a illustrates a system where two through-beam sensors, arranged in an "x" pattern, are used as the muting inputs. This system is bidirectional which means that the light curtain will be successfully muted whether the object approaches from the left or the right. Sensor A must be a dark-on type sensor with a PNP-type output or a switch that closes its contacts to provide +24 VDC when it is OK to mute. Sensor B must be a light-on type sensor with a PNP-type output or a switch that opens its contacts when it is OK to mute. In this two-sensor system, the sensors must transition to the on state within 3 seconds of each other for the muting state to occur. Bidirectional systems can also be constructed using four mute sensors.

Fig. 7.1

Fig. 7.1a

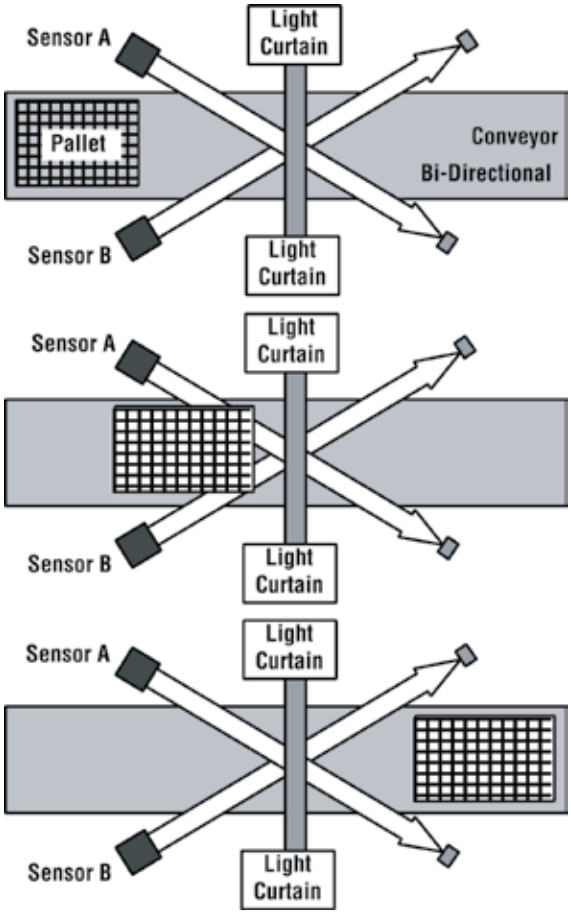
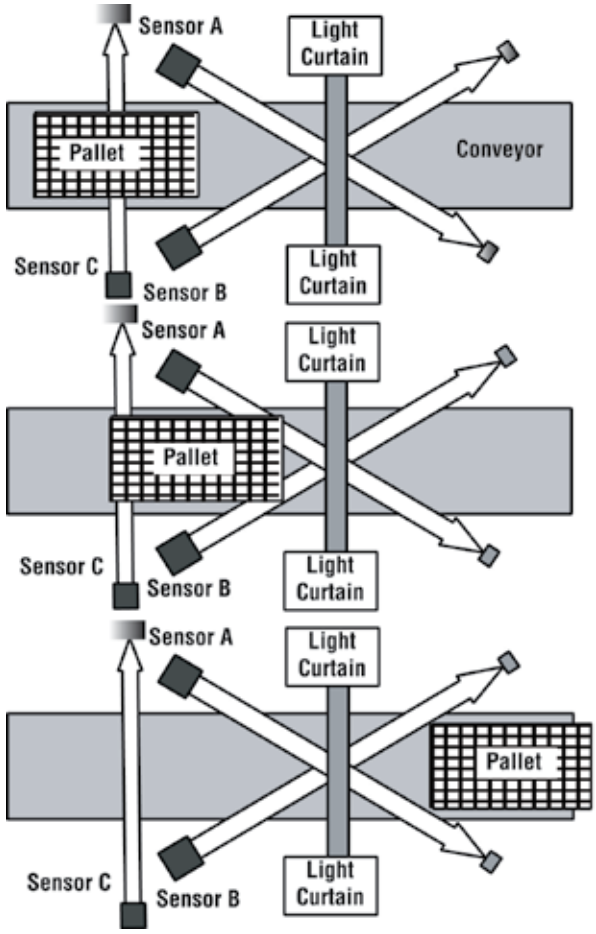


Fig. 7.1b



What if you only want the light curtain to be muted when the pallet approaches the safety light curtain from one direction (unidirectional)? Take a look at Figure 7.1b. Although similar in appearance to the application above, sensor C has been added to detect the pallet's direction of travel. Sensor C must be a dark-on type sensor with a PNP-type output or a switch that closes its contacts to provide +24 VDC when it is OK to mute. Sensor C must transition to the on state at least 0.05 seconds prior to activation of sensors A and B. Sensors A and B must transition to the on state within 3 seconds of each other and sensor C must turn off before sensors A and B turn off.

Bypass-Allowed function

Did a pallet fall off the conveyor? Did the conveyor unexpectedly stop? Did the sequence of processing operations not occur in the correct order to allow an automatic transition to the muted state? When these types of issues are encountered the bypass-allowed function is a real lifesaver. This function allows supervisory personnel to momentarily override the machine stop signal and enter the mute state. While very useful, this feature must be used with appropriate caution and guidelines from ANSI B11.19-2010, EN692-1994 and IEC61496-1

A

Safety Mats — Theory of Operation, Selection & Installation

Presence sensing mats combined with a safety mat controller improve productivity while providing access guarding. Less downtime occurs because it is not necessary to set up or remove mechanical safety barriers during operation and maintenance.

Presence sensing mats and controls are used where perimeter access guarding is required, such as around robots, manufacturing work cells, food processing equipment and automated assembly equipment.

Mats and controllers should be designed to meet the applicable sections of ANSI B11.19-2010, OSHA 1910.212, ISO 13856-1:2001, and RIA 15.06.

Theory of Operation

Multiple safety mats may be wired in series to form a complete floor-level guarding system. Each 4-wire safety mat operates on a low-power DC signal. A signal is transmitted through the upper and lower plates separately via the two wires connected to each plate. The signals through the safety mats are monitored by the mat controller.

When the safety mat is not exposed to sufficient actuating force, the signals are unimpaired. The output relays in the controller are energized permitting the guarded machine to run.

When sufficient pressure is applied to the active mat area, the conductive plates touch causing the output relays in the controller to de-energize and a stop signal is issued to the machine.

If a wire should break, separate from a plate, or become disconnected from the controller, the output relays in the controller will de-energize and a stop signal will be sent. Should the safety mat be punctured and the plates short together in a similar manner as being stepped on, the controller will not restart until the punctured mat is replaced.

Safety Distance Calculation

The first and by far the most important consideration is the calculation of the safety distance. There is a minimum mat size that should be placed between a worker and a hazardous motion. Many users will "eyeball" the application, look at the area where a machine operator would stand and say, "that looks like it needs a 24-inch wide mat." It may not be enough.

In standard B11.19 the American National Standards Institute (ANSI) states that, **"*The safety mat device shall be fixed at a location so that the effective sensing surface prevents individuals from reaching the hazard(s) during the hazardous portion of the machine cycle.*"**

ANSI Minimum Safe Distance Formula

The basis for the following information is ANSI standard B11.19-2010.

The ANSI formula consists of:

$$D_s = K (T_s + T_c + T_r + T_{spm}) + D_{pf}$$

Where:

D_s = The minimum safe distance, in inches, between the outside edge of the safety mat and the nearest point of operation hazard.

K = The maximum speed at which an individual can approach the hazard, expressed in inches per second.

To quote ANSI B11.19-2010, ***"The factor K is the speed constant and includes hand and body movements of an individual approaching a hazard area. The following factors should be considered when determining K:***

a) Hand and arm movement;

b) Twisting of the body or shoulder, or bending at the waist;

c) Walking or running.

One of the accepted values for K is the hand speed constant (it is usually considered as the horizontal motion of the hand and arm while seated). Its common value is 63 in./s although other values (typically higher) are also used. The hand speed constant does not include other body movements, which can affect the actual approach speed. Consideration of the above factors should be included when determining the speed constant for a given application."

T_s = The total time that it takes, in seconds, for the hazardous motion to stop, or for the hazardous portion of the machine cycle to be completed. Note that different machine types have different stopping methods and mechanisms. Informative Annex D of ANSI B11.19-2010 contains excellent information on these considerations and factors.

T_c = The response time, in seconds of the machine control circuit to activate the machine's brake.

NOTE: $T_s + T_c$ are usually measured together by a stopping performance monitor.

T_r = The response time, in seconds, of the safety mat system. This is provided in the installation manual.

T_{spm} = The additional stopping time, in seconds, allowed by the stopping performance monitor before it detects stop time deterioration. A stopping performance monitor will halt the machine when the stop time of the machinery exceeds the set limit. This indicates that excessive brake wear has occurred.

What should you do if your machine does not have a stopping performance monitor? Add a percentage increase factor to the measured stop time ($T_s + T_c$) to allow for braking system wear. For example, stopping performance monitors usually add an extra 20% to the measured stop time. Omron recommends that you contact the manufacturer of your machine for guidance in selecting a percentage increase factor.

D_{pf} = The added distance, in inches, due to the depth penetration factor from according to Annex D of ANSI B11.19-2010, for ground level devices which can be reached over (safety mats) this distance is 48 inches.

Safe Mounting Distance Example

Presume a machine has a stopping time ($T_s + T_c$) of 0.200 seconds. This includes the response time of both the brake mechanism and the control circuits. The brake monitor is set for 0.240 seconds. The response time of the safety mat system is 30 mS.

Determine T_{spm} and D_{pf}. From the stopping performance monitor set point:

T_{spm} = stopping performance monitor set point - ($T_s + T_c$)

T_{spm} = 0.240 sec. - 0.200 sec.

T_{spm} = 0.040 sec.

As given from ANSI B11.19-2010, Annex D, D_{pf} = 48 inches.

Now, everything needed is available. The formula is:

$Ds = K \times (T_s + T_c + T_r + T_{spm}) + Dpf$

Substituting our values:

D_s = 63 in./sec. x (0.200 sec. + 0.010 sec. + 0.040 sec.) + 48 in.

Add the values in the parentheses first:

D_s = 63 in./sec. x (0.250 sec.) + 48 in.

Multiply the result in parentheses by 63:

D_s = 15.75 in. + 48 in.

Add the results:

D_s = 63.75 in. (1620 mm)

Installation

Surface Preparation

The surface on which the safety mat(s) will be placed should be flat, smooth and free of debris. Any debris left under the mat, in time, may work its way through the housing and eventually contact the electrode assembly. This may affect the mechanical switching of the electrode assembly and will provide a path for moisture to enter the mat. These conditions may lead to a mat failure.

Proper Care of the Safety Mat Cables

After the mat is in place, use care in routing the mat cables to prevent damaging the insulation or breaking the internal wires. Make sure that the cable passageways are free of burrs and sharp edges. Where the mat cable is to enter and exit from under the trim, the trim or mounting surface must be grooved or notched so as not to pinch the cable when the trim is tightened down.

Unless extra precautions are taken to make a watertight connection, never make a cable splice at floor level where the presence of moisture is a possibility. Moisture present at a non-watertight connection will work through the cable and into the mat (i.e. capillary action or wicking).

Safety Mat Mounting Trim

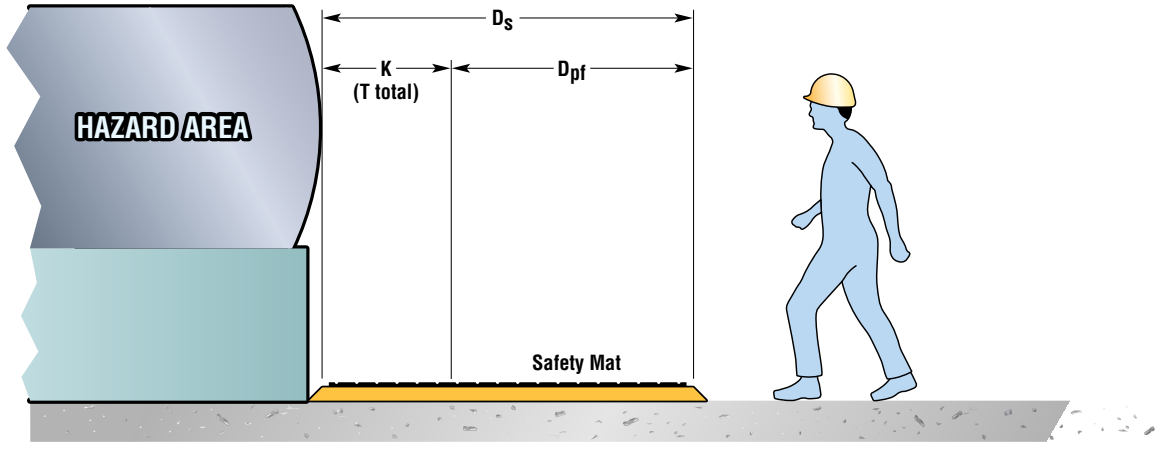
ANSI standard B11.19-2010 also states that, ***"The user shall ensure that only authorized individuals may relocate the safety mat"*** [clause 8.5.2.3]. Further explanatory information for this clause states that, ***"Means to prevent inadvertent movement include, but are not limited to:***

- Secured edging;
- Secured trim;
- Fasteners;
- Recesses;
- Size and weight or large mats"

Perimeter trim can help with this requirement, but users need to be aware that not all perimeter trim is the same. Three of the most optimum types of trim include two-part perimeter ramp trim, blunt trim, and two-part joining trim.

Two-part perimeter ramp trim holds mat in place and simplifies installation by providing an aluminum base with channels for running cables, and a snap-on PVC cover. Blunt trim is used where a mat needs to be secured in place, but the edge being secured does not present a trip hazard. Two-part joining trim is used to create an active area between two adjacent mats.

Fig. 8.1 Safe Mounting Distance



SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

A

Understanding the IP Rating System

How do I judge the enclosure rating of a STI safety interlock switch?

When OMRON Automation and Safety customers look at our safety interlock switches, one of the first questions they ask is - What is the NEMA rating of the enclosure. These switches use an international system which assigns an Ingress Protection or IP rating.

While, most of us are familiar with the NEMA system, we are quick to admit that the numbers used to differentiate the different ratings hardly make logical sense. A summary of the IP system is given below. (For a complete explanation see IEC 60529.) As you can see, the IP system is relative and rational - always two letters (IP) followed by two digits. The first digit indicates the enclosure's degree of protection against solid objects while the second digit indicates a degree of protection against liquids.

First IP Digit	Degree of Protection (contact hazard and foreign object protection)
0	No special protection.
1	Protection against penetration of solid objects larger than 50 mm in diameter (large objects). No protection against intentional access, e.g. by hand, but keeping larger body parts at a distance.
2	Protection against entry of solid objects larger than 12 mm in diameter (medium-size objects). Keeping out fingers and other small objects.
3	Protection against entry of solid objects larger than 2.5 mm in diameter (small objects). Keeping out tools, wires and other objects larger than 2.5 mm in diameter.
4	Protection against entry of solid objects larger than 1 mm in diameter (granular objects). Keeping out tools, wires and similar objects of a thickness exceeding 1 mm.
5	Protection against harmful dust deposits. Ingress of dust is not totally prevented, but dust does not enter in sufficient quantity to interfere with operation of the equipment (dust protected). Full contact protection.
6	Protection against ingress of dust (dust-tight). Full contact protection.

Second IP Digit	Degree of Protection (water protection)
0	No special protection.
1	Protection against dripping water. It must not have any harmful effect (dripping water).
2	Protection against dripping water. Dripping water shall have no harmful effect when the enclosure is tilted at any angle 15° from its normal position (indirect dripping water).
3	Spraying water falling at any angle up to 60° from vertical shall have no harmful effect (spraying water).
4	Water splashed against the enclosure from any direction shall have no harmful effect (spraying water).
5	Water projected by a nozzle against the enclosure from any direction shall have no harmful effect (water jets).
6	Water from heavy seas or water projected in powerful jets shall not enter the enclosure in harmful quantities (flooding).
7	Ingress of water in a harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time (submersion).
8	This equipment suitable for continuous submersion in water under conditions which shall be specified by the manufacturer (submersion).

Conversion of IP and NEMA Enclosure Ratings

(Including but not limited to the following)

IEC	IP10	IP11	IP54	IP14	IP54	IP56	IP52	IP67	IP52	IP54
NEMA	1	2	3	3R	3S	4 and 4X	5	6 and 6P	12 and 12K	13

Proper Installation of Rope or Wire Pull Emergency Stop Devices

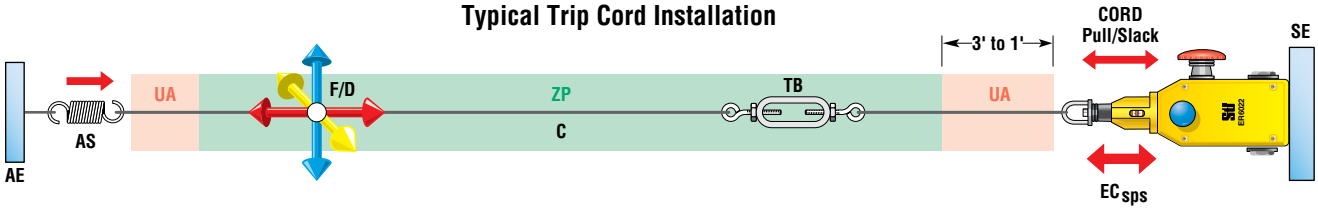
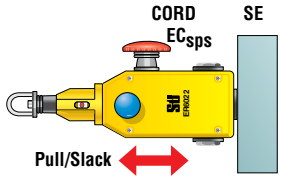


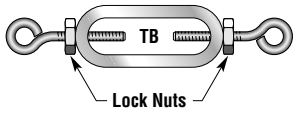
Fig. 9.1

AE = Anchor End AS = Anchor Spring C = Cord EC = E-Stop Device-Cord F/D = Force/Deflection
SE = Switch End TB = Turnbuckle UA = Unknown Action ZP = Zone of Protection

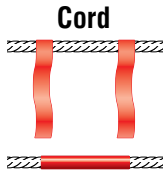
Trip cords (sometimes called rope or wire pulls) are typically cords of braided plastic-coated wire, installed horizontally across the points of hazard generated by rotating machinery, conveyor motion, etc. which, when pulled or cut (made slack) will cause the attached switch to generate an emergency stop. These devices do not prevent injury, but may limit the extent of the injury. They are particularly useful when located at the point of hazard for the involved operator's use, unlike Emergency Stop push-buttons which may be located away from the point of hazard requiring a non-involved operator for their actuation. *Figure 9.1* details a typical installation.



In order to achieve compliance with Canadian and European standards, the rope pull switch must cause its safety contacts to open when either the cord is pulled beyond a designated force/deflection or made to go slack. Further, this activation must be maintained until the cord is once again properly tensioned and manually reset at the switch. When the cable is properly positioned the safety contacts are closed. When the cable moves too far to the left or right, contacts open and are maintained open until reset.



The cable can be properly positioned by adjusting the cord tension using a turnbuckle or other tensioning device. STI rope pull switches provide an indicator to determine when the proper tension has been established. Lock nuts should be provided to keep the turnbuckle from releasing tension and causing nuisance trips.



The cord is typically 1/8 inch diameter steel braided cable which may be plastic coated to protect the operator from steel slivers and provides a better griping surface. The coated cable should be red or provided with red striped flags for rapid identification.

When analyzing the installation for a pull cord, the linear length of cable providing protection must be taken into consideration. As shown in *Figure 9.2* the zone of protection from the anchor end (AE) to the switch end (SE) is not necessarily contiguous; areas of unknown action (UA) may be present. The first of these UA areas is at the point of attachment of the cord to the switch. The switch may or may not operate if the point of force is located less than 1 to 3 feet from the switch. The UA can be reduced to 3 inches if the tensioning device is installed on the opposite side of the vector eyebolt (VE) to the switch. If using a tensioner gripper assembly connected directly to the switch, the UA may be reduced to less than 20 inches.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

A

Vector Eyebolt Trip Cord Installation

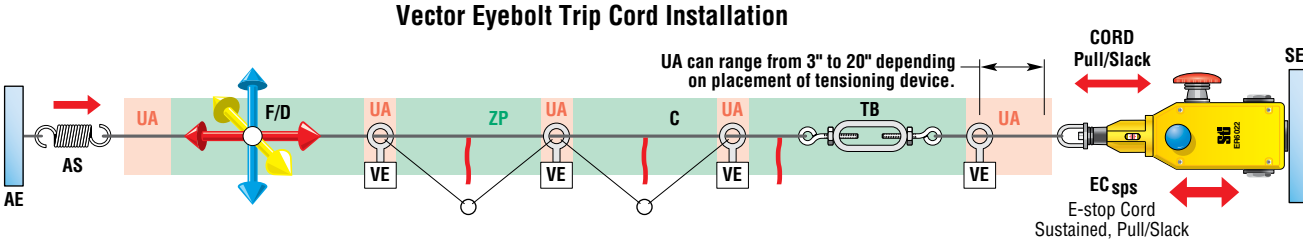
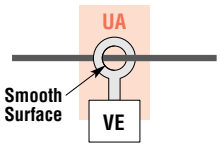


Fig. 9.2

AE = Anchor End AS = Anchor Spring C = Cord EC = E-Stop Device-Cord F/D = Force/Deflection
SE = Switch End TB = Turnbuckle UA = Unknown Action ZP = Zone of Protection

Vector Eyebolt

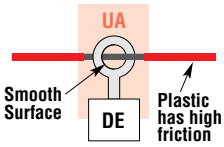


The vector eyebolt is used to resolve a 3-dimensional force for use with a 1-dimensional switch. The unknown action zone for a smooth eyebolt is about 1". All eyebolts should have a smooth inner surface (not notched or dented). The distance placed between vector eyebolts is typically 6 to 10 feet. A long zone of protection will be made up of many such spans.

Some trip cords can operate over 410 feet.

A direction eyebolt is used to change the path of the zone of protection for angles ≤90°. This eyebolt also resolves a 3-dimensional force to 1-dimension. All eyebolts must have a smooth inside surface (not notched or dented). If braided metal cable which is plastic coated (recommended) is used with direction eyebolts, the plastic may have to be removed from the cable where it passes through the eyebolt as this may be a high friction point.

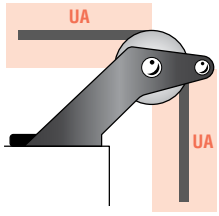
Direction Eyebolt



A directional pulley is a 2-dimensional device. If the force applied by the cable is other than axial to the pulley an unknown action zone may be created, if the entrance and egress of the pulley are not rounded. In extreme friction cases a vector eyebolt may have to precede both sides of the direction pulley. The pulley should rigidly mounted (not swiveled) to avoid friction from side torque. Gritty, goopy, and coating substances should be avoided as they tend to impede pulley action. Open pulleys are not acceptable unless provided with vector eyebolts as non-axial pulls can force the cord from the pulley.

When a trip cord is properly installed, the answer to the following question will be yes. Does the switch activate with reasonable force (5 to 20 lbs.) and reasonable deflection (3 to 6 inches) over the zone of protection?

Direction Pulley



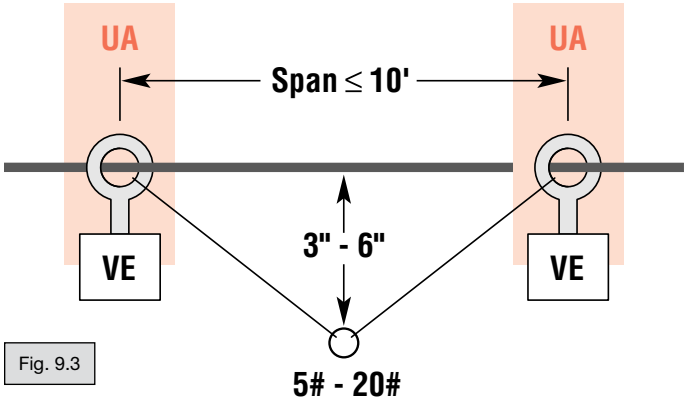


Fig. 9.3

Turning The Corner

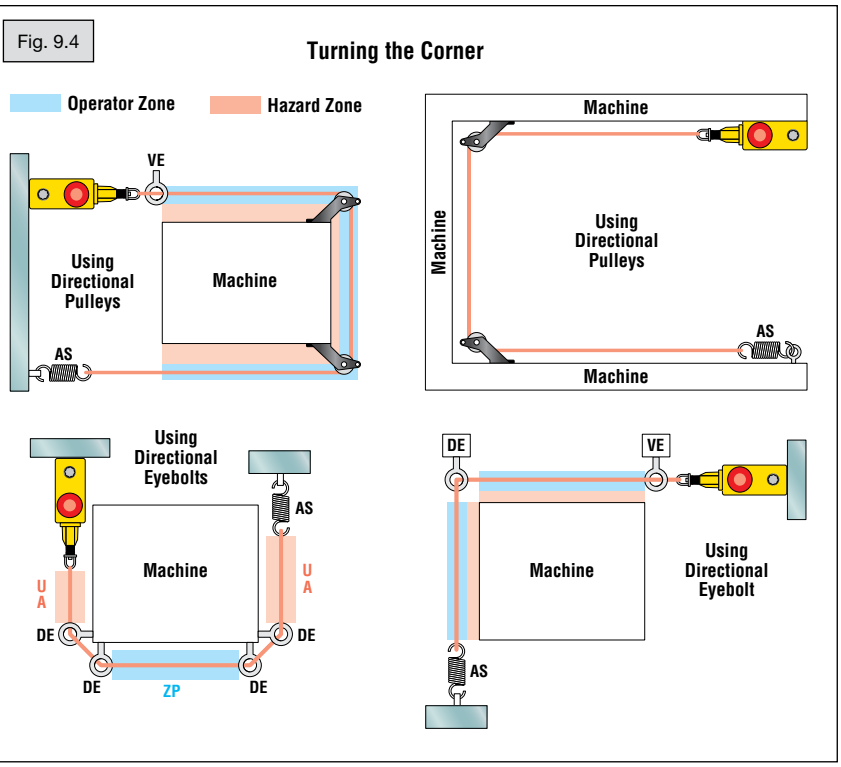
Because of the high tension in a properly installed cord, direction eyebolts and pulleys are subject to additional friction (eyebolts more than pulleys). In general, only one 90˚ change in direction can be made with an eyebolt and possibly two 90˚ changes using pulleys.

Friction may be reduced when using eyebolts to round a corner (make 90° direction change) by mounting a direction eyebolt on both sides of the corner as shown in *Figure 9.4*.

Zones of Unknown Action (UA)

Normally zones of unknown action are small with respect to the zones of protection and there is no particular danger that an operator will pull at a location which may not trip. However, if due to machine architecture, the mounting of the cord between sensor end and anchor end a larger unknown action area is presented to an operator, these UA areas should be guarded from operator access as they become additional points of hazard.

Fig. 9.4



STI Rope Pull Emergency Stop Switches

STI Rope Pull Emergency Stop Switches meet CE mark requirements for use within the European community. All rope pull emergency stop switches are UL or cULus listed. In order to meet the control reliability standards, a safety monitoring relay or equivalent circuitry may be required.



Safety Light Curtains

Contents

Selection Guide	B-2
Safety Light Curtains	
F3SG-RA Overview NEW	B-7
F3SG-RA	B-16
MS4800	B-42
F3SJ-A	B-59
F3SJ-B	B-68
F3SJ-E	B-78
Smart Muting Actuator	
F3W-MA NEW	B-85
Safety Light Curtain Resource Modules	
Resource Modules Overview	B-98
RM-1	B-100
RM-2, RM-2AC & RM-2AC-IP	B-100
RM-3	B-101
RM-4	B-101
RM-6	B-102
RM-X	B-102
Perimeter Access Guarding	
PA4600	B-103
PA4600-BB	B-107
Accessories	B-110

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

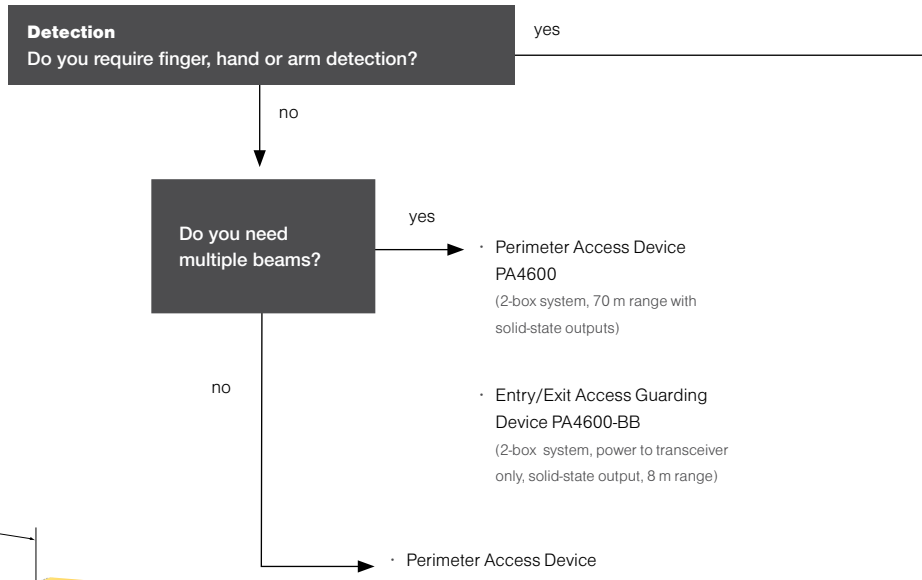
OMRON AUTOMATION & SAFETY

Selection Guide

We Can Simplify Your Light Curtain Selection Needs

OMRON Automation and Safety provides a variety of safety light curtains to solve your optical guarding needs. We offer compact models designed for machine locations where space is tight, and we offer larger robust light curtains powerful enough to guard large perimeters. We offer you a choice because when it comes to automation safeguarding, one size does not fit all.

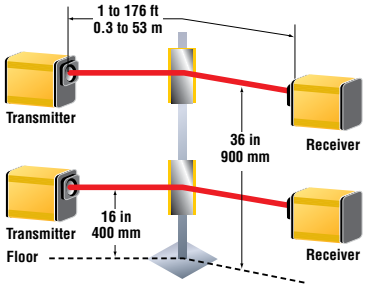
The following questions will guide you to the appropriate models.



PA46-1-000 Single Beam Applications

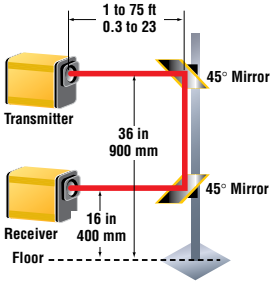
Long-Range Perimeter Guarding

Example shown: Two transmitter/receiver pairs using two mirrors to direct the beam around a corner.

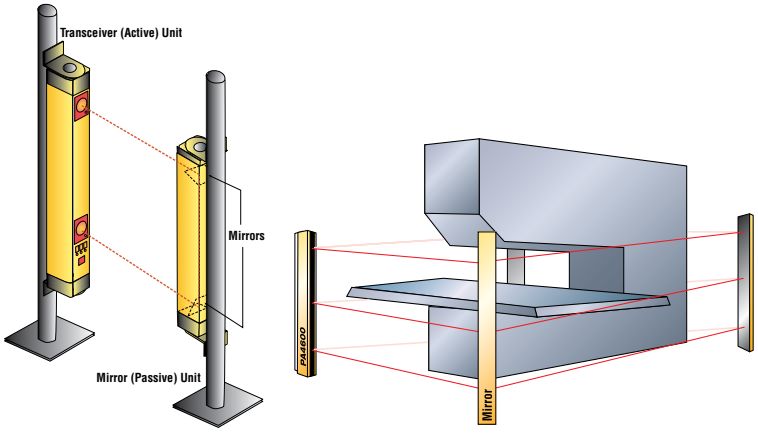


Double Bounce

Example shown: One transmitter/receiver pair using two mirrors to create a two-beam pattern.







PA4600 and PA4600-BB Applications

The cost effective Perimeter Access Guarding Device PA4600 provides guarding of robot centers and large automated machinery. The STI corner mirrors direct the infrared beams to four sides of a machine.

The PA4600-BB provides the most cost effective 2-beam guarding for short range (less than 8 m) applications.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Selection Guide (continued)

Advanced Functions
Do you require a configurable product with more advanced functions?
(i.e. blanking, selectable range, different scan codes)

no → **Muting**
Do you require simple muting or series connection?

Series connection → The "ADVANCED type" is recommended for those who place emphasis on high functionality.

Simple muting → The "BASIC type" is recommended for those who place emphasis on maintainability.

yes → **Application**
Do you require a robust housing for more demanding applications?

no → **Environment**
Is the product being used in a wet environment?

yes → The "EASY type" is recommended for those who place emphasis on ease-of-implementation.

F3SG-RA

- Series-connection: 3 segments
- Rugged and robust
- Dip switch selectable and intelligent muting programing
- Various blanking functions
- Detection capability: 14 and 25 mm
- Operating range: 20 m
- Enclosure rating: IP67



MS4800

- Series-connection: 4 segments
- Rugged and robust
- Various muting functions
- Various blanking functions
- Detection capability: 14, 20, 30, 40 mm
- Operating range: 20 m



F3SJ-A

- Series-connection: 4 segments
- Various muting functions
- Various blanking functions
- PC settings
- Detection capability: 14, 20, 25, 30, 55 mm
- Operating range: 9 m



F3SJ-B

- Series-connection: 3 segments
- Muting
- Detection capability: 25 mm
- Operating range: 7 m



F3SJ-E

- Easy installation
- Less wiring
- Simple functions
- 3 m integrated cables
- Detection capability: 25 mm
- Operating range: 7 m



Selection Guide (continued)

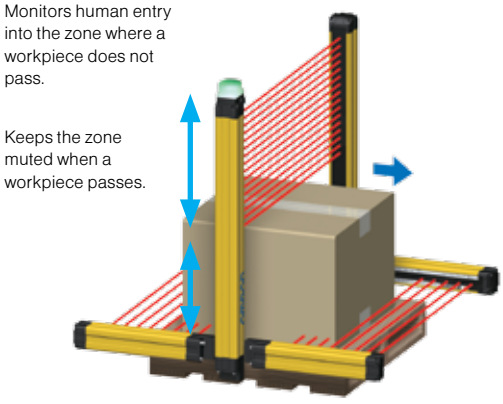
The Muting Function of the new F3SG-RA Increases Productivity and Safety



Automatically minimizes the muting zone according to the workpiece size.

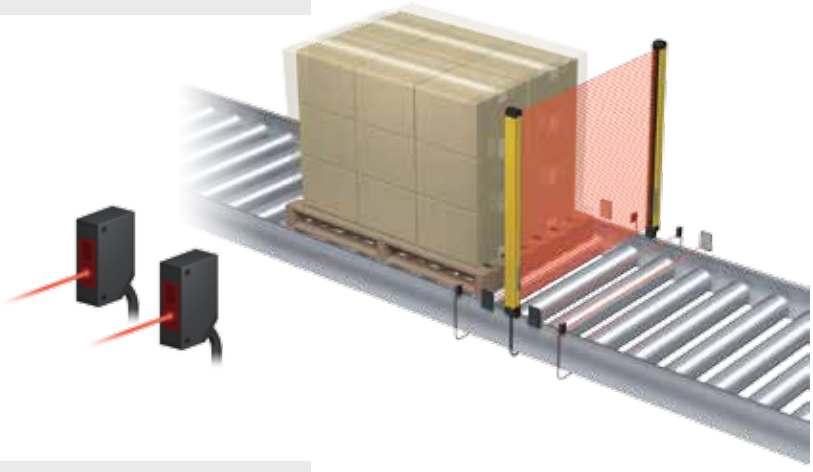
The F3SG-RA provides advanced Muting function that detects the zone where workpieces pass or the position of a machine or robot and disable beams of the detected part. This increases both safety and productivity.

By adding the smart muting actuator, the F3SG-RA provides stable operation even for the production lines where errors occur due to vibration caused by the passing workpiece.



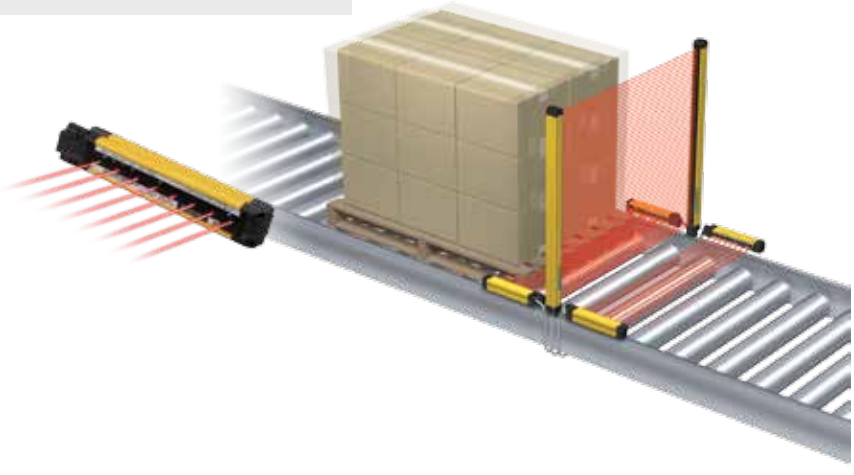
Previously...

The point detection muting sensor mistakenly disabled muting while a workpiece was passing, which led to unexpected machine stops.



Now with Smart Muting Actuator

The muting actuator detects the surface of a passing workpiece. Even if a workpiece moves due to vibration, muting is kept enabled until the workpiece has passed. This prevents unexpected machine stops.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Selection Guide (continued)

Special Application Light Curtain Products



Protective Enclosures for Harsh and Wash Down Applications

Omron has enclosures for mounting selected light curtains in harsh and wash-down applications. These reduce down time and increase the life of the light curtain. They are resistant to many chemicals and compounds. See website for more information on these accessories.

- Weld Slag Protective Cover for Harsh Applications
  (Available for F3SG-RA, F3SJ-A, MS4800 and PA4600)
- IP67 Enclosure for Washdown Applications
  (Available for F3SJ-A and MS4800)



Explosion-Proof for Safety Light Curtains and Perimeter Guarding Devices

Explosion-proof enclosures rated for Class I, Group C and D environments are available for the following products

- MS4800
  (2-box system, rugged design, 24 VDC with solid-state output)
- PA4600
  (2-box system, 30 m range with solid-state output)
- PA4600-BB
  (2-box system, power to transceiver only, solid-state output, 8 m range)

Selection Guide (continued)

Special Application Light Curtain Products



Resource Modules

RM Series resource modules provide the user of Omron solid-state safety light curtains a convenient and reliable method of enhancing and extending the capabilities of these light curtains.



- RM-1
  (one pair N.O. force-guided safety relay outputs and one pair of N.C. auxiliary relay outputs, 55 mm DIN, for use with F3SJ, MS4800, OS32C and PA4600)
- RM-2
  (same as the RM-1, but allows for easier wiring, 100 mm DIN, for use with F3SJ, MS4800, OS32C and PA4600)
- RM-2AC
  (provides power and outputs, one N.O. and one N.O./N.C. force-guided relay output, 150 mm DIN, for use with F3SJ, MS4800, OS32C and PA4600)
- RM-2AC-IP
  (provides power and outputs, one N.O. and one N.O./N.C. force-guided relay output, IP65 metal chassis enclosure, for use with F3SJ-A, MS4800, OS32C and PA4600)
- RM-3
  (mute module - allows for two solid-state-output light curtains to be connected and provides for the wiring input of two to four muting sensors. This unit has solid-state output and is housed in a 100 mm DIN enclosure; for use with MS4800, OS32C and PA4600)
- RM-4
  (provides connections for up to four safety devices, and produces a single pair of solid-state safety outputs, for use with MS4800, OS32C and PA4600)
- RM-6
  (mute module - provides for the wiring input of two to four muting sensors, housed in a 22.5 mm DIN enclosure, for the MSF4800A and MSF4800S)
- RM-X
  (one N.O. and one N.O./N.C. force-guided safety relay output, 22.5 mm DIN, for use with F3SJ, MS4800, OS32C and PA4600)

Optional Light Curtain Products



Accessories

A variety of mirrors, stands, brackets, alignment tools and cables are available to assure easy and quick installation.

Force-Guided Relays

Force-guided relays have contacts that are force-guided/mechanically linked, conforming to IEC60947-1-1 as required for use in safety-related control systems.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

F3SG-RA Overview

Introducing the F3SG-RA

The F3SG-RA is the next generation safety light curtain.

Packed with powerful features for unmatched robustness and reliability.

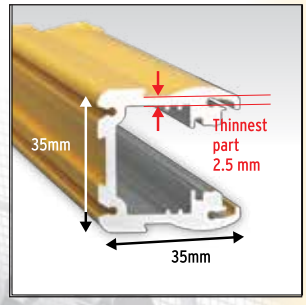
Previously it took time to select the right safety light curtains for the conditions: physical conditions such as size and operating range, ambient environments, and countries.

If just one single safety light curtain can be used in a variety of environments, the time required for selection, installation, and maintenance can be reduced.

COMPACT:
Easy Installation

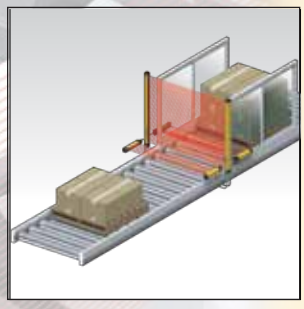
ROBUST:
Even in severe environments

GLOBAL:
Reliable safety solutions



Easy Selection & Design

- **In almost any environment**
  Waterproof and shock-resistant yet compact body. Conforms to major international standards including Chinese standard GB 4585 to be used worldwide.
- **Ensuring safety in various production lines**
  The Muting function to automatically set a minimum muting zone according to workpiece height. Can be used for a variety of production lines.
- **Complete safety measures by detecting presence**
  Distinguishes between small object passing and human entry by changing resolution and response time. This maintains a high level of safety while minimizing unexpected machine downtime.



Easy Set-up

- **Drastically reduced set-up time and wiring**
  The Smartclick connectors and optical synchronization enable smooth set-up of machines.
- **Simple, two-step optical adjustment**
  Quick adjustment by checking beam alignment with the LED indicators and Configuration Tool SD Manager2.
- **Flexible installation**
  More flexible layout by eliminating the need of synchronization wiring and using extension cables.



Operation Stable Operation

- **Quick troubleshooting and predictive maintenance**
  The sticker and error logs stored in the F3SG-RA helps speed troubleshooting. Accumulated log data facilitates systematic maintenance.
- **Mutual interference prevention**
  The DIP switches are used to change emission light intensity to prevent mutual interference with other sensors.

Easy Selection and Design

Robustness

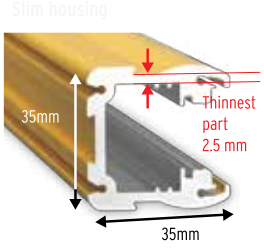
Allows use in a variety of environments

Protects itself and production sites

Robust and Compact

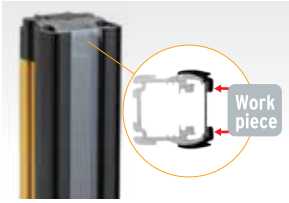
Robust housing

All models are equipped with a robust housing that can be used in harsh conditions and withstand shocks caused by sudden human contact or a dropped tool. The scratch-resistant material is used for the optical surface to prevent unexpected machine stops.



SLIM HOUSING

The housing structure is significantly improved to enhance resistance against shock and vibration and to reduce the thickness of the thinnest part of the housing material from 3 mm to 2.5 mm.



PROTECTED WITH PROTECTION COVER

The optical surface can be protected from contact with workpieces by using the optional protection cover together.

In almost any environment

For global use

The F3SG-RA is designed to be used in a variety of environments around the world, conforming to international standards.

FOR GLOBAL USE



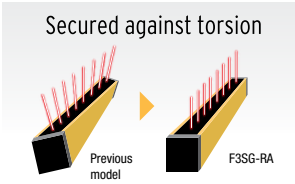


PNP or NPN can be selected with the DIP switch. The same cables are used.



The F3SG-RA conforms to major international standards including Chinese GB standards.

FOR HARSH ENVIRONMENTS



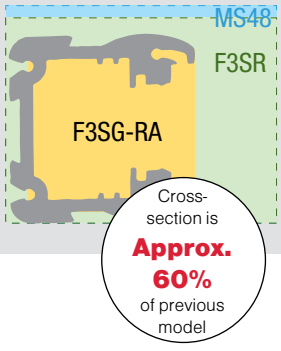
The risk of optical axis misalignment due to vibration or aging can be reduced.



IP67 protection allows use in environments that are subject to water.

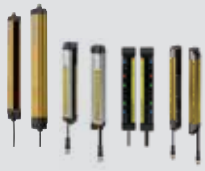
DOWNSIZED

The robust housing can be used in harsh conditions and withstand shocks caused by sudden human contact or a dropped tool. The scratch-resistant material is used for the optical surface to prevent unexpected machine stops.



PREVIOUSLY ...

Mixing several types of safety light curtains with different environmental resistance and functionality were required to suit the installation environment. It took time to select the right models.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Easy Selection & Design

New Muting Functionality

Increases both productivity and safety

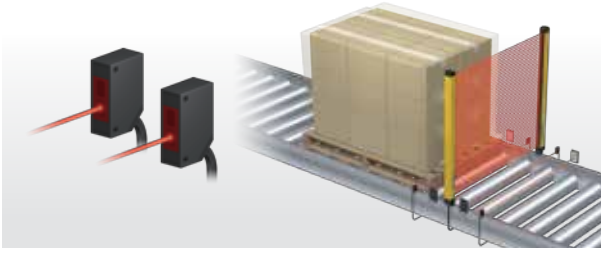
Easily distinguishes between workers and objects

Increasing both productivity and safety

Muting function

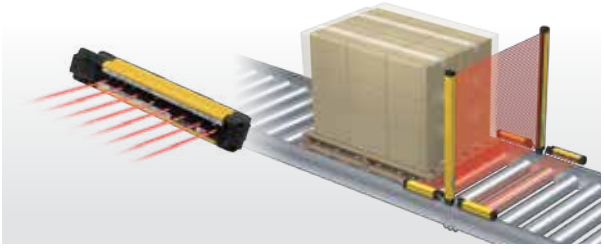
The F3SG-RA provides advanced Muting function that detects the zone where workpieces pass or the position of a machine or robot and disable beams of the detected part. This increases both safety and productivity. By adding the smart muting actuator, the F3SG-RA provides stable operation even for the production lines where errors occur due to vibration caused by the passing workpiece.

PREVIOUSLY ...



The point detection muting sensor mistakenly disabled muting while a workpiece was passing, which led to unexpected machine stops.

SMART MUTING ACTUATOR



The muting actuator detects the surface of a passing workpiece. Even if a workpiece moves due to vibration, muting is kept enabled until the workpiece has passed. This prevents unexpected machine stops.

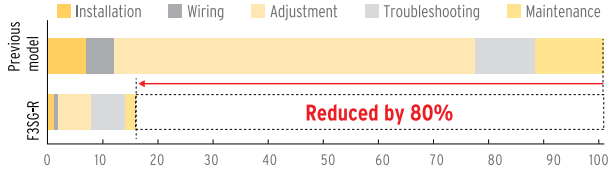
Adjustment time reduced by 80%*

Smart muting actuator

The use of the dedicated actuator can significantly reduce the time required to adjust the sensor to detect workpieces even in unstable conveying conditions

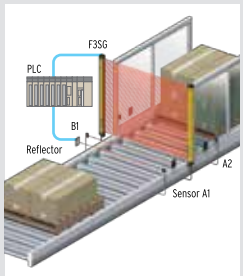
**Compared to the previous model (Based on OMRON investigation in September 2014)*





PREVIOUSLY ...

Many processes including programming and adjustment were required. Since bypass processing to disable the safety light curtain was performed via the PLC, programming before installation required time and work. It also took a lot of time and work to install and adjust many muting sensors (sensors and reflectors).

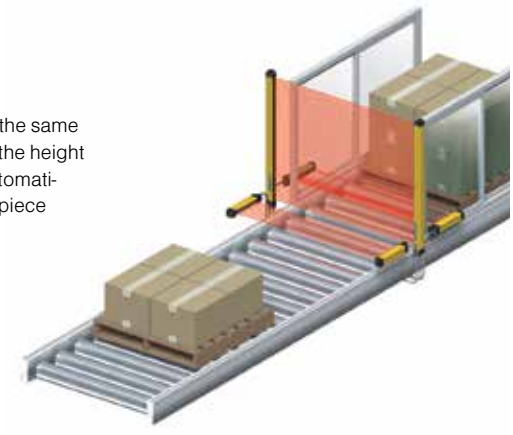


Easy Selection and Design

Powerful Features

Prevent unexpected machine stops

Ensure stable operation



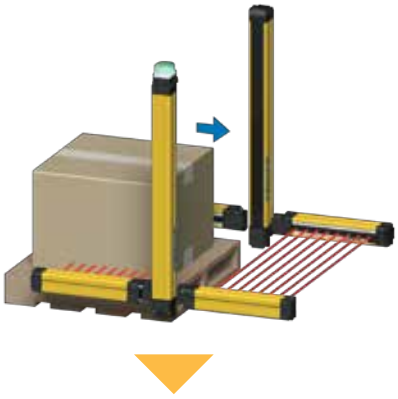
Auto-configuration of muting zone

Dynamic Muting

When workpieces with various heights are conveyed on the same line, partial muting is automatically performed based on the height of the workpiece. This advanced muting function can automatically perform normal detection at the zone where a workpiece does not pass.

AUTOMATICALLY MINIMIZES MUTING ZONE ACCORDING TO WORKPIECE SIZE

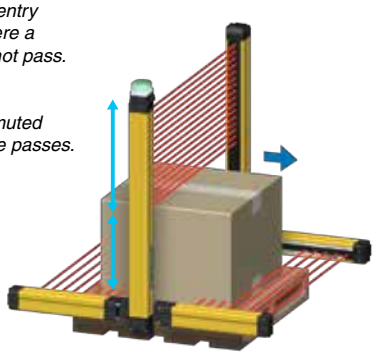
1. *When the muting sensor detects that a workpiece passes, all beams are muted.*



2. *The only beams interrupted by the workpiece are kept muted and other beams are released from the muting state three seconds after the workpiece has passed through the safety light curtain. Muting is disabled after the workpiece has passed.*

Monitors human entry into the zone where a workpiece does not pass.

Keeps the zone muted when a workpiece passes.



Minimizing setting and detection errors

Configuration Tool SD Manager 2

The function to log the muting sensor operating conditions of the F3SG-RA visualizes the installation position and setting conditions of the sensor to achieve reliable configuration. The stop due to the muting error can be analyzed using the data stored in the F3SG-RA. Quick identification of the cause can reduce unexpected machine downtime.

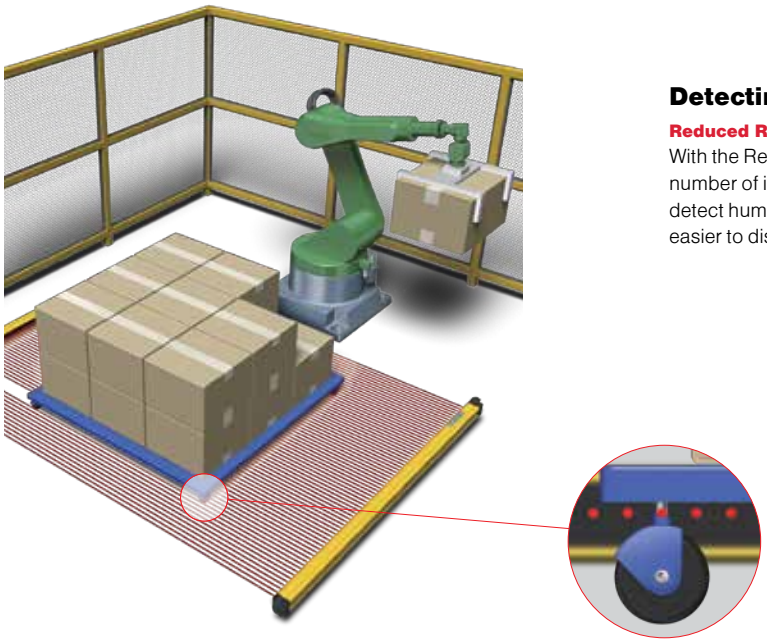


Visualized data makes adjustment smooth!

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Easy Selection & Design



Detecting both objects and workers

Reduced Resolution

With the Reduced Resolution function that is used to change the number of interrupted beams (1 to 3 beams), the F3SG-RA can detect human entry while workability is maintained. This makes it easier to distinguish between objects and workers.

Keep the safety outputs ON even when an object like a transport vehicle (with the size of 1 to 3 beams) is present discontinuously.

Turn safety outputs OFF when an object blocks over 3 beams, like an ankle.

Preventing accidental stops due to insects

Response Time Adjustment

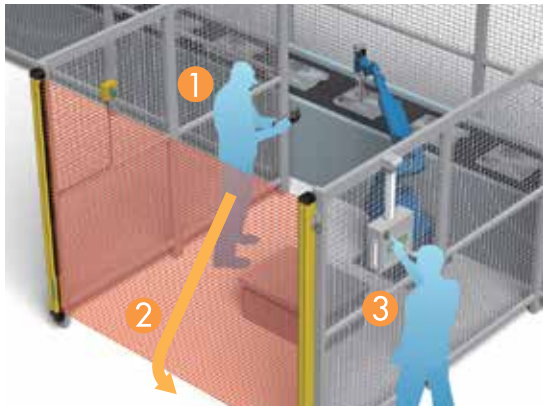
This function is used to distinguish between an instant passing of a small object such as an insect and a human passing by changing the time to respond to the block of the beam. Accidental machine stops can be avoided.

Ensuring safe restart

Pre-reset

The Pre-reset function prevents possible accidents and supports safe restart of machines. Even if a worker presses the reset switch of the safety light curtain without noticing another worker near the robot, restart will not be executed unless certain conditions are met.

HELPS PREVENT WORKERS FROM BEING TRAPPED



1. Press the pre-reset switch in the hazardous zone (safety fence)

2. Get out of the hazardous zone (safety fence)

3. Press the reset switch in the control panel to restart the F3SG-RA. The machine is ready for restart.

The machine cannot be restarted until the pre-reset switch is pressed to restart the F3SG-RA.

Easy Set-up

Smart Wiring, Beam Adjustment, and Operation Check

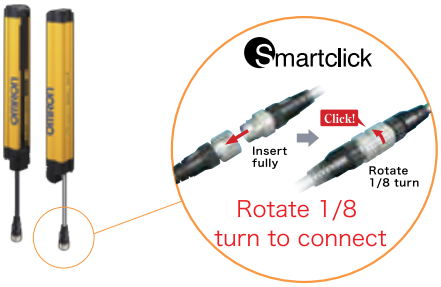
Facilitate Installation

Significant reduction in wiring work

Smartclick

Smartclick connectors are used to connect cables. Connection just by turning the round waterproof M12 connector 1/8 of a turn will prevent machine stop due to faulty connection.

SMARTCLICK



Smartclick is a registered trademark of OMRON Corporation.

This popular connector is used for a variety of OMRON products to reduce time required for wiring and replacement when many devices are connected together.

PREVIOUSLY ...

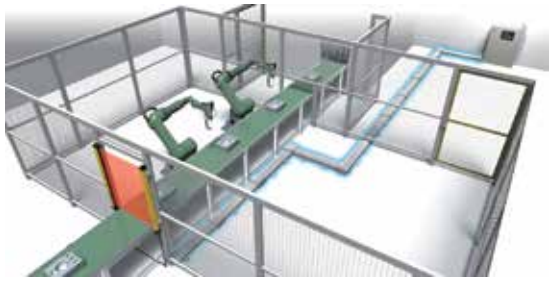
Faulty connection and need of torque control

When many safety light curtains were connected, torque control of connectors was required and delay in set-up occurred due to failure of connection. The Smartclick connector can be connected with the existing screw-type M12 connector.

Flexible wiring

Maximum 100 m cable length

The total extension cable length is up to 100 m. Flexible wiring maximizes long-distance detection and optical synchronization functionality.



No limitation in wiring

Optical synchronization

Optical synchronization eliminates the need of synchronization wiring between the emitter and receiver. Flexible wiring enables reducing disconnection risk and avoiding noise sources.

FLEXIBLE, NEW METHOD

Start-up

Once synchronization is done, the emitter is kept synchronized with the receiver while at least one beam is unblocked.



After sync

The Top or Bottom beam of the emitter starts synchronizing with the corresponding beam of the receiver.



PREVIOUSLY...

Limitations imposed by synchronization wiring

- *Wiring and connection works between the emitter and receiver were required.*
- *With the previous synchronization function, if the Top or Bottom beam was blocked, synchronization was not maintained.*

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Easy Set-up

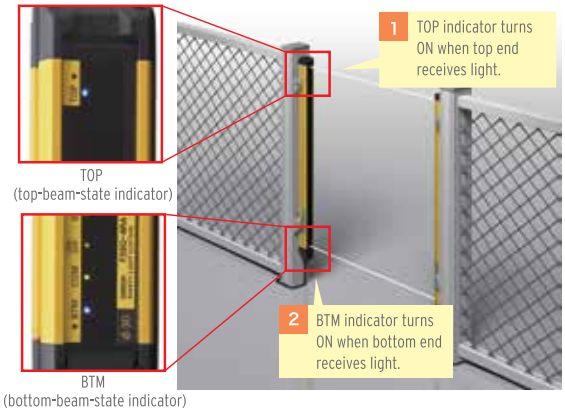
Simple two steps

Beam adjustment

The benefit of robust, torsion-resistant housing contributes to reduce the time required to install the safety light curtain.

SIMPLE ADJUSTMENT: COARSE ADJUSTMENT > POSITIONAL ALIGNMENT

Beam adjustment can be done easily by checking the TOP and BTM LED indicators. The SD Manager 2 helps install the safety light curtain by showing the incident light levels of each beam.



1. *Adjustment is completed when the TOP, BTM, and STB LED indicators turn ON.*



2. *Finer adjustments can be made using the Configuration Tool SB Manager 2*

Easy adjustment after mounting

Mounting bracket

Two types of mounting brackets are available.

STANDARD FIXED BRACKET

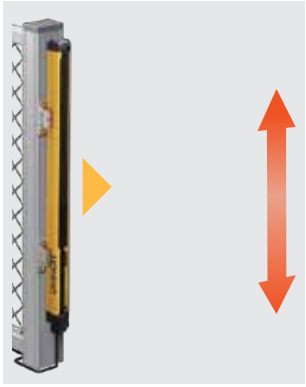


After mounted on a safety fence, the F3SG-RA can be slid vertically to adjust. This means this mounting bracket allows for a wider adjustment range than the existing top/bottom mounting bracket.

STANDARD ADJUSTABLE BRACKET (SOLD SEPARATELY)



In addition to vertical adjustment, the angle can be adjusted up to ±15°.





Standard fixed bracket
The bracket is included in the F3SG-RA.

Protective height	No. of brackets included
Less than 1,280 mm	2 sets
1,280-2,270 mm	3 sets
2,350 mm	4 sets

Stable Operation

Quick Troubleshooting and Predictive Maintenance

Eliminate machine downtime to ensure stable operation



For global operators

Multilingual troubleshooting

Troubleshooting in eight languages is published on the website to find causes and solutions of errors that occur during operation. Operators across the world can check the error details in their local languages, which will help them minimize time to troubleshoot.

TROUBLESHOOTING WEB



Troubleshooting guide sticker

* English, Chinese, Italian, Korean, French, German, Spanish, and Japanese.

* The Interface Unit F39-GIF is required to connect with a personal computer.

Quick troubleshooting

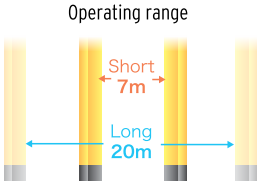
Data logging 1

The error logs stored in the F3SG-RA can be obtained by connecting with a personal computer via the interface unit. The Configuration Tool SD Manager2 analyzes error logs to identify causes of errors and suggest solutions. This helps simplify troubleshooting

Reducing stops due to mutual interference

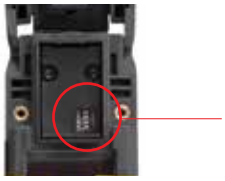
Operating Range Selection

When other sensors are installed near the F3SG-RA, Operating Range Selection helps reduce mutual interference.



*Mutual interference with the other sensor near the F3SG-RA can be reduced by changing the mode from Long * to Short (7 m).*

**Maximum operating range of 20 m for hand/arm protection or 10 m for finger protection*



The mode of Operating Range Selection can be selected with the DIP Switches on the emitter.

Systematic maintenance based on trend management

Data logging 2

By using the Configuration Tool SD Manager2, the data of light intensity, power-ON time, and switching frequency of the F3SG-RA can be collected regularly to predict when systematic and preventive maintenance is required.

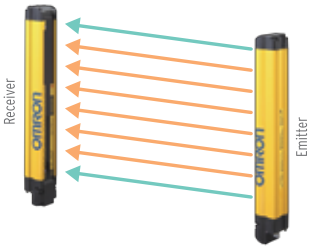
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering

Ordering Guide

Step 1: Select Light Curtain Pair



Resolution	Length
14 mm	160 mm to 2080 mm
30 mm	190 mm to 2510 mm



Standard fixed bracket included.

Step 2: Select Cables

Appearance	Description	Comment
	Single-ended emitter	Order separately, used for panel connection
	Single-ended receiver	Order separately, used for panel connection
	Double-ended emitter	Order separately, used for panel connection or cascade extension
	Double-ended receiver	Order separately, used for panel connection or cascade extension
	Cascading Pair	Comes as a pair, required for cascading

Step 2: Optional Accessories

Covers	Brackets	Programming Interface Unit	Smart Muting Actuator	Lamp
	Standard Adjustable Bracket (2 per set) 			

F3SG-RA

Quick Link
S653
omron247.com

Safety Light Curtain

- New standard of safety light curtain,offering both robustness and reliability
- Robust and compact
- New muting function to increase both productivity and safety
- All models designed for global use. PNP/NPN selection by DIP switch



Legislation and Standards

1. The F3SG-RA does not receive type approval provided by Article 44-2 of the Industrial Safety and Health Act of Japan. When using the F3SG-RA in Japan as a "safety system for pressing or shearing machines" prescribed in Article 42 of that law, the machine control system must receive type approval.
2. The F3SG-RA is electro-sensitive protective equipment (ESPE) in accordance with European Union (EU) Machinery Directive Index Annex V, Item 2.
3. EC Declaration of Conformity
   OMRON declares that the F3SG-RA is in conformity with the requirements of the following EC Directives:
   Machinery Directive 2006/42/EC
   EMC Directive 2004/108/EC
4. Conforming Standards
   (1) European standards
   EN61496-1 (Type 4 and Type 2 ESPE), EN 61496-2 (Type 4 and Type 2 AOPD), EN61508-1 through -4 (SIL 3 for Type 4 and SIL 1 for Type 2), EN ISO 13849-1:2008 (PL e, Category 4 for Type 4 and PL c, Category 2 for Type 2)
   (2) International standards
   IEC61496-1 (Type 4 and Type 2 ESPE), IEC61496-2 (Type 4 and Type 2 AOPD), IEC61508-1 through -4 (SIL 3 for Type 4 and SIL 1 for Type 2), ISO 13849-1:2006 (PL e, Category 4 for Type 4 and PL c, Category 2 for Type 2)
   (3) JIS standards
   JIS B 9704-1 (Type 4 and Type 2 ESPE), JIS B 9704-2 (Type 4 and Type 2 AOPD)
   (4) North American standards
   UL61496-1(Type 4 and Type 2 ESPE), UL61496-2(Type 4 and Type 2 AOPD), UL508, UL1998, CAN/CSA C22.2 No.14, CAN/CSA C22.2 No.0.8
   (5) Chinese standards
   GB4584
5. Third-Party Certifications
   (1) TÜV SÜD
      - EC Type-Examination certificate:
        EU Machinery Directive, Type 4 and Type 2 ESPE (EN61496-1), Type 4 and Type 2 AOPD (EN 61496-2)
      - Certificate:
        Type 4 and Type 2 ESPE (EN61496-1), Type 4 and Type 2 AOPD (EN61496-2), EN 61508-1 through -4 (SIL 3 for Type 4 and SIL 1 for Type 2), EN ISO 13849-1:2008 (PL e, Category 4 for Type 4, and PL c, Category 2 for Type 2)
   (2) UL
      - UL Listing:
        Type 4 and Type 2 ESPE (UL61496-1), Type 4 and Type 2 AOPD (UL61496-2), UL508, UL1998, CAN/CSA C22.2 No.14, CAN/CSA C22.2 No.0.8
   (3) China National Casting and Forging Machines Quality Supervision and Inspection Center
      - Certificate:
        GB4584 (Specification of active opto-electronic protective devices for presses)
6. Other Standards
   The F3SG-RA is designed according to the standards listed below. To make sure that the final system complies with the following standards and regulations, you are asked to design and use it in accordance with all other related standards, laws, and regulations. If you have any questions, consult with specialized organizations such as the body responsible for prescribing and/or enforcing machinery safety regulations in the location where the equipment is to be used.
   - European Standards: EN415-4, EN691-1, EN692, EN693, IEC/TS 62046
   - U.S. Occupational Safety and Health Standards: OSHA 29 CFR 1910.212
   - U.S. Occupational Safety and Health Standards: OSHA 29 CFR 1910.217
   - American National Standards: ANSI B11.1 to B11.19
   - American National Standards: ANSI/RIA R15.06
   - Canadian Standards Association CSA Z142, Z432, Z434
   - SEMI Standards SEMI S2
   - Japan Ministry of Health, Labour and Welfare "Guidelines for Comprehensive Safety Standards of Machinery", Standard Bureau's Notification No. 0731001 dated July 31, 2007.rms and Conditions Agreement
   - Chinese National Standards: GB17120, GB27607

Specifications

Main Units

			F3SG-4RA□□□□-14	F3SG-4RA□□□□-30
Type of ESPE (IEC 61496-1)			Type 4	
Performance	Object Resolution (Detection Capability)		Opaque objects	
			14-mm dia.	30-mm dia.
	Beam Gap		10 mm	20 mm
	Number of Beams		15 to 207	8 to 124
	Lens Size		5.2 3.4 (W H) mm	7-mm dia.
	Protective Height		160 to 2080 mm (6.3 to 81.9 inch)	190 to 2510 mm (7.3 to 98.7 inch)
	Operating Range	Long	0.3 to 10.0 m (1 to 32 ft.)	0.3 to 20.0 m (1 to 65 ft.)
		Short	0.3 to 3.0 m (1 to 10 ft.)	0.3 to 7.0 m (1 to 23 ft.)
	Response Time	ON to OFF	Normal mode: 20 ms max. *1 Slow mode: 40 ms max. *1 *2	
		OFF to ON	100 ms max. *1	
		*1 Response time when used in one segment system or in cascaded connection.		
		*2 Selectable by Configuration Tool.		
	Effective Aperture Angle		±2.5° max., emitter and receiver at operating range of 3 m or greater	
	Light Source		Infrared LEDs, Wavelength: 870 nm	
	Startup Waiting Time		2 s max.	
Electrical	Power Supply Voltage (Vs)		SELV/PELV 24 VDC±20% (ripple p-p 10% max.)	
	Safety Outputs (OSSD)		Two PNP or NPN transistor outputs (PNP or NPN is selectable by DIP Switch.) Load current of 300 mA max., Residual voltage of 2 V max. (except for voltage drop due to cable extension), Capacitive load of 1 μF max., Inductive load of 2.2 H max. *1 Leakage current of 1 mA max. (PNP), 2 mA max. (NPN) *2 *1 The load inductance is the maximum value when the safety output frequently repeats ON and OFF. When you use the safety output at 4 Hz or less, the usable load inductance becomes larger. *2 These values must be taken into consideration when connecting elements including a capacitive load such as a capacitor.	
	Auxiliary Output		One PNP or NPN transistor output (PNP or NPN is selectable by DIP Switch.) Load current of 100 mA max., Residual voltage of 2 V max .	
	Output Operation Mode	Safety Output	Light-ON (Safety output is enabled when the receiver receives an emitting signal.)	
		Auxiliary Output	Muting or Override output (default) (Configurable by Configuration Tool)	
	Input Voltage	ON Voltage	TEST: 24 V Active: 9 V to Vs (sink current 3 mA max.) * 0 V Active: 0 to 3 V (source current 3 mA max.)	MUTE A/B: PNP: Vs to Vs-3 V (sink current 3 mA max.) * NPN: 0 to 3 V (source current 3 mA max.)	RESET: PNP: Vs to Vs-3 V (sink current 5 mA max.) * NPN: 0 to 3 V (source current 5 mA max.)
		OFF Voltage	TEST: 24 V Active : 0 to 1.5 V 0 V Active : 9 to 24V or open	MUTE A/B, RESET: PNP: 0 to 1/2 Vs, or open * NPN: 1/2 Vs to Vs, or open *	
		* The Vs indicates a supply voltage value in your environment.		
	Overvoltage Category (IEC 60664-1)		II	
	Protective Circuit		Output short protection, Power supply reverse polarity protection	
	Insulation Resistance		20 MΩ or higher (500 VDC megger)	
	Dielectric Strength		1,000 VAC, 50/60 Hz (1 min)	
Functional	Mutual Interference Prevention (Scan Code)		This function prevents mutual interference in up to two F3SG-RA systems.	
	Cascade Connection		Number of cascaded segments: 3 max. Total number of beams: 255 max. Total sum of cable lengths between sensors: 10 m max.	
	Test Function		Self-test (at power-on, and during operation) External test (light emission stop function by test input)	
	Safety-Related Functions		Interlock External device monitoring (EDM) Pre-reset Fixed blanking/Floating blanking Reduced resolution	Muting/Override Scan code selection PNP/NPN selection Response time adjustment

B

Specifications (continued)

			F3SG-4RA□□□□-14	F3SG-4RA□□□□-30
Environmental	Ambient Temperature	Operating	-10 to 55°C (14 to 131°F) (non-icing)	
		Storage	-25 to 70°C (-13 to 158°F)	
	Ambient Humidity	Operating	35% to 85% (non-condensing)	
		Storage	35% to 95%	
	Ambient Illuminance		Incandescent lamp: 3,000 lx max. on receiver surface Sunlight: 10,000 lx max. on receiver surface	
	Degree of Protection (IEC 60529)		IP65/IP67	
	Vibration Resistance (IEC 61496-1)		10 to 55 Hz, Multiple amplitude of 0.7 mm, 20 sweeps for all 3 axes	
	Shock Resistance		(IEC 61496-1) 100 m/s2, 1000 shocks for all 3 axes	
	Pollution Degree (IEC 60664-1)		Pollution Degree 3	
Connections	Power cable	Type of Connection	M12 connectors: 5-pin emitter and 8-pin receiver, IP67 rated when mated, Cables prewired to the sensors	
		Number of Wires	Emitter: 5, Receiver: 8	
		Cable Length	0.3 m	
		Cable Diameter	6 mm	
		Minimum Bending Radius	R5 mm	
	Cascading cable	Type of Connection	M12 connectors: 5-pin emitter and 8-pin receiver, IP67 rated when mated	
		Number of Wires	Emitter: 5, Receiver: 8	
		Cable Length	0.2 m	
		Cable Diameter	6 mm	
		Minimum Bending Radius	R5 mm	
	Extension cable - Single-ended cable - Double-ended cable	Type of Connection	M12 connectors: 5-pin emitter and 8-pin receiver, IP67 rated when mated	
		Number of Wires	Emitter: 5, Receiver: 8	
		Cable Diameter	6.6 mm	
		Minimum Bending Radius	R36 mm	
	Extension of Power Cable		100 m max.	
Material	Material		Housing: Aluminum Cap: PBT Front window: PMMA Cable: Oil resistant PVC Mounting Bracket: ZDC2 FE plate: SUS	
	Included Accessories		Safety Precautions, Quick Installation Manual, Standard Fixed Bracket*, Troubleshooting Guide, Sticker, Warning Zone Label * The quantity of Standard Fixed Brackets included varies depending on the protective height. [F3SG-□RA□□□□-14] - Protective height of 0160 to 1200: 2 sets - Protective height of 1280 to 2080: 3 sets [F3SG-□RA□□□□-30] - Protective height of 0190 to 1230: 2 sets - Protective height of 1310 to 2270: 3 sets - Protective height of 2350 to 2510: 4 sets	
Conformity	Performance Level (PL)/Safety category	Type 4	PL e/Category 4 (EN ISO 13849-1:2008)	
		Type 2	PL c/Category 2 (EN ISO 13849-1:2008)	
	PFHd		≤ 9.9 10-8 (IEC 61508)	
	Proof test interval TM		Every 20 years (IEC 61508)	
	SFF		99% (IEC 61508)	
	HFT		1 (IEC 61508)	
	Classification		Type B (IEC 61508-2)	

Specifications

List of Models/Response Time/Current Consumption/Weight

F3SG-4RA□□□□-14

Model	Number of Beams	Protective Height [mm]	Response Time [ms]			Current Consumption [mA]		Weight [kg]*2
			ON → OFF*1	OFF (Synchronized) → ON	OFF (Not synchronized) → ON	Emitter	Receiver	
F3SG-4RA0160-14	15	160	8	40	140	40	75	1.8
F3SG-4RA0240-14	23	240	8	40	140	45	75	2.0
F3SG-4RA0320-14	31	320	8	40	140	55	75	2.2
F3SG-4RA0400-14	39	400	8	40	140	60	80	2.7
F3SG-4RA0480-14	47	480	13	65	165	50	80	2.9
F3SG-4RA0560-14	55	560	13	65	165	55	80	3.1
F3SG-4RA0640-14	63	640	13	65	165	60	85	3.3
F3SG-4RA0720-14	71	720	13	65	165	65	85	3.9
F3SG-4RA0800-14	79	800	13	65	165	65	90	4.1
F3SG-4RA0880-14	87	880	13	65	165	70	90	4.3
F3SG-4RA0960-14	95	960	13	65	165	75	90	4.5
F3SG-4RA1040-14	103	1040	13	65	165	80	95	4.7
F3SG-4RA1120-14	111	1120	13	65	165	85	95	4.8
F3SG-4RA1200-14	119	1200	13	65	165	90	100	5.0
F3SG-4RA1280-14	127	1280	13	65	165	95	100	5.2
F3SG-4RA1360-14	135	1360	13	65	165	95	105	5.6
F3SG-4RA1440-14	143	1440	18	90	190	85	105	5.8
F3SG-4RA1520-14	151	1520	18	90	190	90	105	6.0
F3SG-4RA1600-14	159	1600	18	90	190	90	110	6.6
F3SG-4RA1680-14	167	1680	18	90	190	95	110	6.8
F3SG-4RA1760-14	175	1760	18	90	190	100	115	7.0
F3SG-4RA1840-14	183	1840	18	90	190	100	115	7.2
F3SG-4RA1920-14	191	1920	18	90	190	105	120	7.3
F3SG-4RA2000-14	199	2000	18	90	190	105	120	7.5
F3SG-4RA2080-14	207	2080	18	90	190	110	125	8.1

*1 The response times are values when Scan Code is set at Code B. The response times for Code A are 1 ms shorter than these values.
*2 The weight includes an emitter, a receiver and included brackets in a product package.

Specifications (continued)

F3SG-4RA□□□□-30

Model	Number of Beams	Protective Height [mm]	Response Time [ms]			Current Consumption [mA]		Weight [kg]*2
			ON → OFF*1	OFF (Synchronized) → ON	OFF (Not synchronized) → ON	Emitter	Receiver	
F3SG-4RA0190-30	8	190	8	40	140	35	75	1.8
F3SG-4RA0270-30	12	270	8	40	140	35	75	2.0
F3SG-4RA0350-30	16	350	8	40	140	40	75	2.2
F3SG-4RA0430-30	20	430	8	40	140	45	75	2.7
F3SG-4RA0510-30	24	510	8	40	140	50	75	2.9
F3SG-4RA0590-30	28	590	8	40	140	50	75	3.1
F3SG-4RA0670-30	32	670	8	40	140	55	75	3.3
F3SG-4RA0750-30	36	750	8	40	140	60	80	3.9
F3SG-4RA0830-30	40	830	8	40	140	65	80	4.0
F3SG-4RA0910-30	44	910	13	65	165	50	80	4.2
F3SG-4RA0990-30	48	990	13	65	165	50	80	4.4
F3SG-4RA1070-30	52	1070	13	65	165	55	80	4.6
F3SG-4RA1150-30	56	1150	13	65	165	55	85	4.8
F3SG-4RA1230-30	60	1230	13	65	165	55	85	4.9
F3SG-4RA1310-30	64	1310	13	65	165	60	85	5.1
F3SG-4RA1390-30	68	1390	13	65	165	60	85	5.6
F3SG-4RA1470-30	72	1470	13	65	165	65	85	5.8
F3SG-4RA1550-30	76	1550	13	65	165	65	90	6.0
F3SG-4RA1630-30	80	1630	13	65	165	70	90	6.5
F3SG-4RA1710-30	84	1710	13	65	165	70	90	6.7
F3SG-4RA1790-30	88	1790	13	65	165	70	90	6.9
F3SG-4RA1870-30	92	1870	13	65	165	75	90	7.1
F3SG-4RA1950-30	96	1950	13	65	165	75	95	7.3
F3SG-4RA2030-30	100	2030	13	65	165	80	95	7.4
F3SG-4RA2110-30	104	2110	13	65	165	80	95	8.0
F3SG-4RA2190-30	108	2190	13	65	165	85	95	8.2
F3SG-4RA2270-30	112	2270	13	65	165	85	100	8.4
F3SG-4RA2350-30	116	2350	13	65	165	85	100	8.8
F3SG-4RA2430-30	120	2430	13	65	165	90	100	8.9
F3SG-4RA2510-30	124	2510	13	65	165	90	100	9.1

*1 The response times are values when Scan Code is set at Code B. The response times for Code A are 1 ms shorter than these values.
The maximum speed of movement of a test rod up to which the detection capability is maintained is 2.0 m/s.

*2 The weight includes an emitter, a receiver and included brackets in a product package.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Indicator

Emitter

Name of Indicator		Color	Illuminated	Blinking
Test	TEST	Green		External Test is being performed
Operating range	LONG	Green	Long range mode is selected by DIP Switch	Lockout state due to DIP Switch setting error
Power	POWER	Green	Power is ON.	
Lockout	LOCKOUT	Red		Lockout state due to error in emitter
Receiver				

Receiver

Name of Indicator		Color	Illuminated	Blinking
Top-beam-state	TOP	Blue	The top beam is unblocked	Muting/Override state, or Lockout state due to Cap error or Other sensor error
PNP/NPN mode	NPN	Green	NPN mode is selected by DIP Switch	
Response time	SLOW	Green	Response Time Adjustment is enabled	
Sequence error	SEQ	Yellow		Sequence error in Muting or Pre-reset mode
Blanking	BLANK	Green	Blanking, Warning Zone or Reduced Resolution is enabled	Teach-in mode, or Blanking Monitoring error
Configuration	CFG	Green		Teach-in mode, zone measurement being performed by Dynamic Muting, or Lockout state due to Parameter error or Cascading Configuration error
Interlock	INT-LK	Yellow	Interlock state	Pre-reset mode
External device monitoring	EDM	Green	RESET input is in ON state	Lockout state due to EDM error
Internal error	INTERNAL	Red		Lockout state due to Internal error
Lockout	LOCKOUT	Red		Lockout state due to error in receiver
Stable-state	STB	Green	Incident light level is 170% or higher of ON-threshold	Safety output is instantaneously turned OFF due to ambient light or vibration
ON/OFF	ON/OFF	Green	Safety output is in ON state	
		Red	Safety output is in OFF state, or the sensor is in Setting state	Lockout state due to Safety Output error
Communication	COM	Green	Synchronization between emitter and receiver is maintained	Lockout state due to Communication error
Bottom-beam-state	BTM	Blue	The bottom beam is unblocked	Muting/Override state, or Lockout state due to DIP Switch setting error

Interface Unit

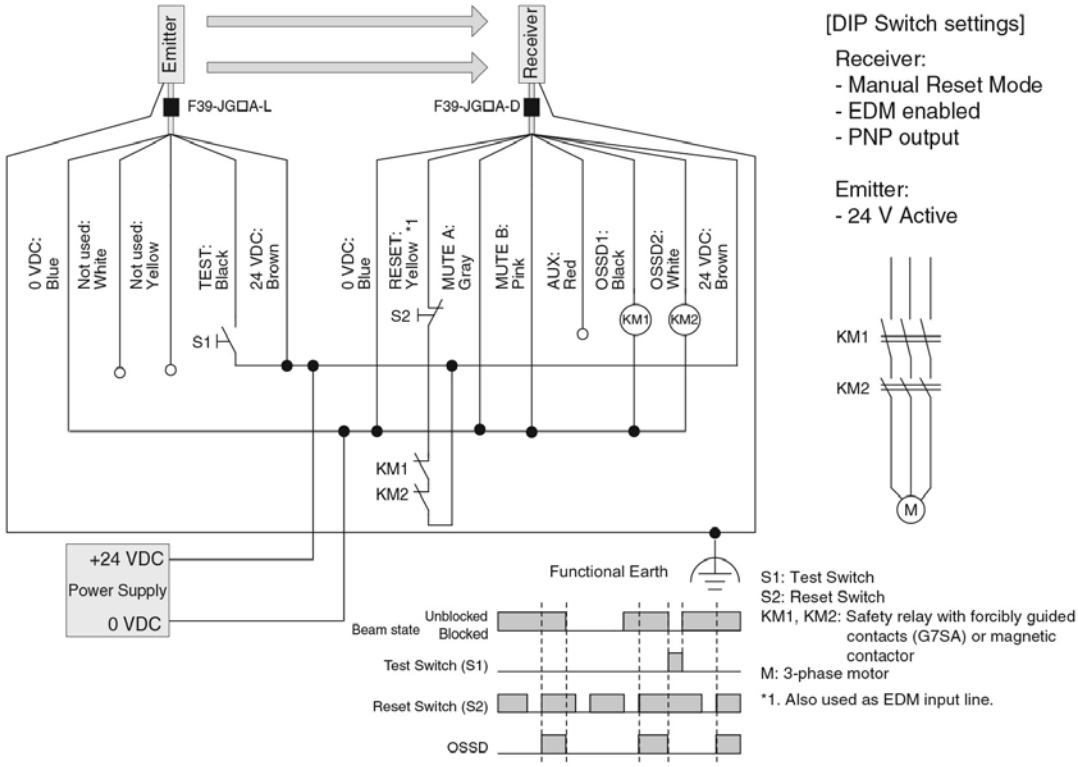
Main unit	PC/AT compatible machine (computer that runs Microsoft Windows)
Operating system (OS)	Windows 7 (32-bit/64-bit), Windows 8 (32-bit/64-bit)
Communication port	USB port 1
Ambient temperature	Operating: -10 to 55°C, Storage: -30 to 70°C(non-icing and non-condensing)
Ambient humidity	Operating: 35% to 85%, Storage: 35% to 95%(non-condensing)

Lamp

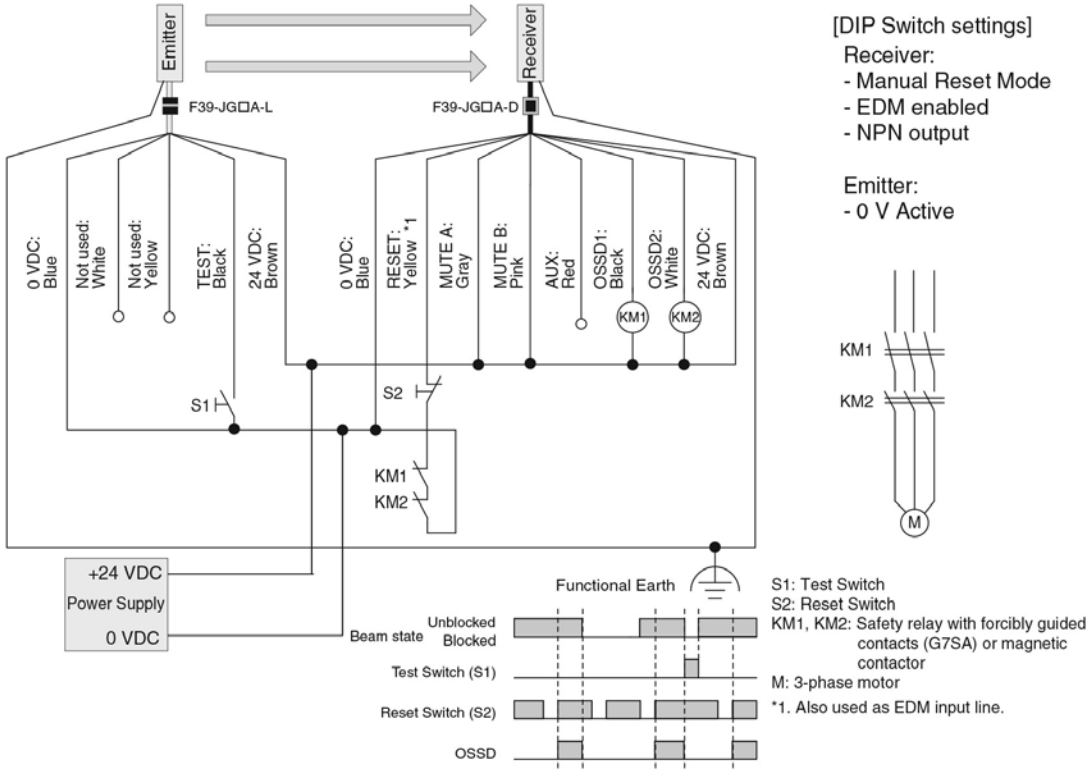
Item	F39-LP
Applicable Sensor	F3SG-□RA Series Safety Light Curtain (Receiver)
LED Light Color	Red/Green/Orange
Power Supply Voltage	24 VDC±20%, ripple p-p 10% max.(shares sensor's power supply)
Current Consumption	25 mA max. (shares sensor's power supply.)
Ambient Temperature	Operating: -10 to 55°C, Storage: -25 to 70°C (non-icing and non-condensing)
Ambient Humidity	Operating: 35% to 85%, Storage: 35% to 95% (non-condensing)
Vibration Resistance	10 to 55 Hz, Multiple amplitude of 0.7 mm,20 sweeps for all 3 axes
Shock Resistance	100 m/s2 , 1000 shocks for all 3 axes
Degree of Protection	IP65, IP67
Type of Connection	Connectable to F3SG-RA's terminal connector
Material	Lighting element: PC, Other body parts: PBT
Weight	45 g (when packaged)

Connections (Basic Wiring Diagram)

Standalone F3SG-RA using PNP Outputs

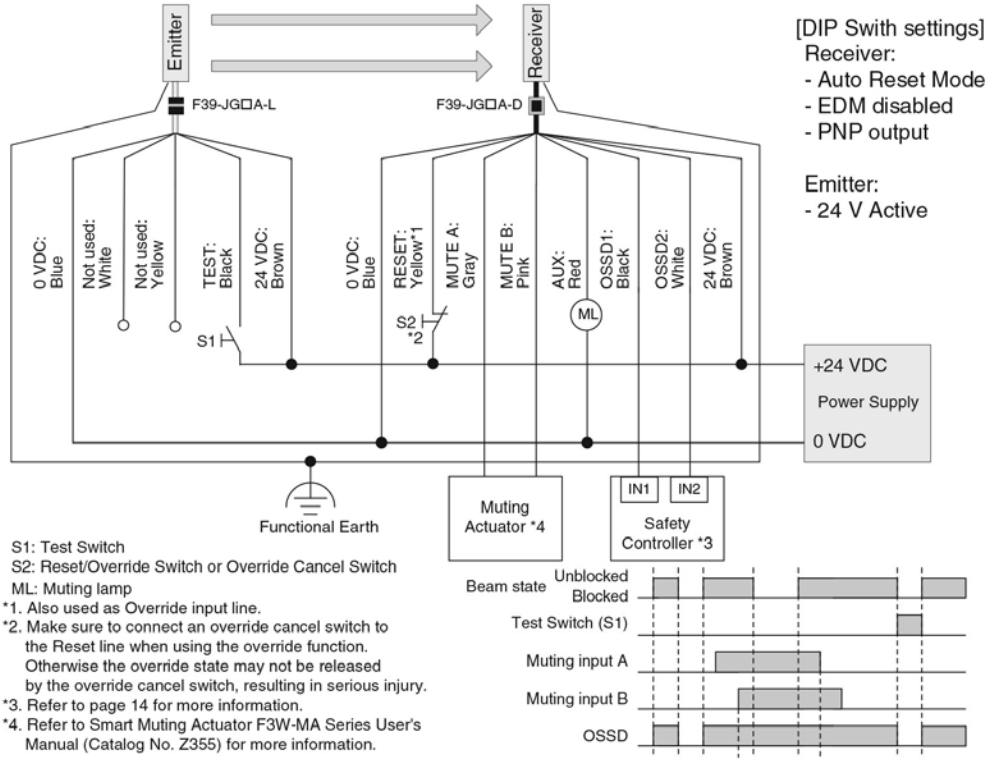


Standalone F3SG-RA using NPN Outputs



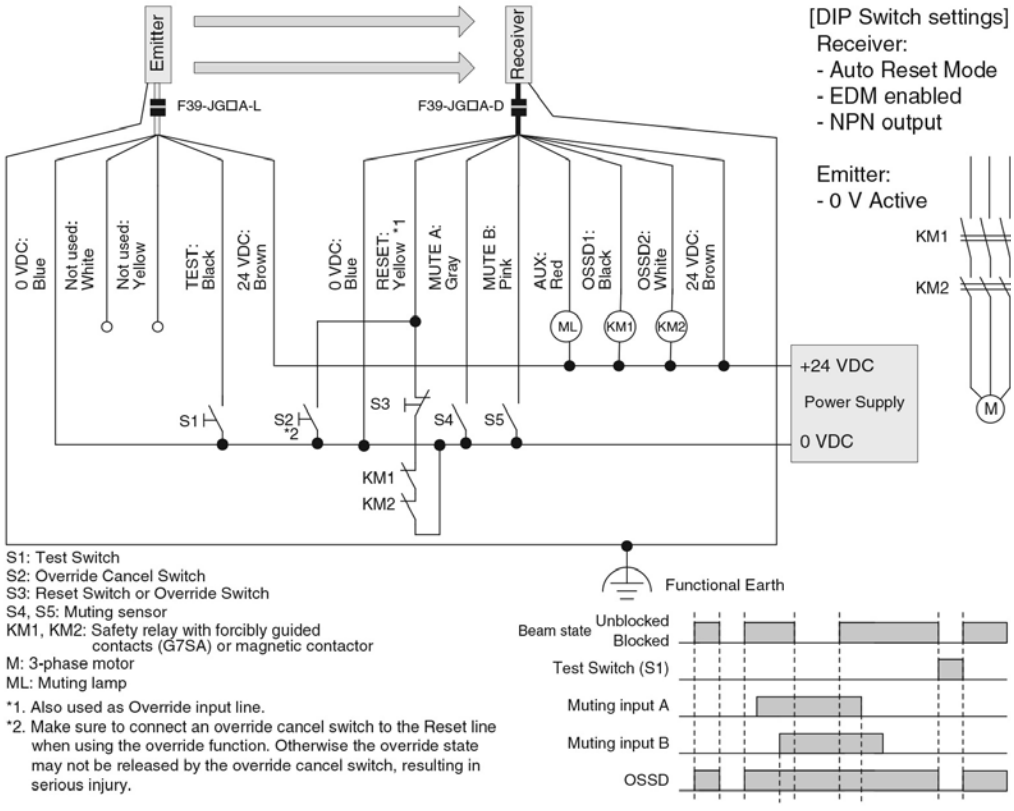
Connections (Basic Wiring Diagram) (continued)

Standard Muting Mode/Exit-Only Muting Mode using PNP Outputs



S1: Test Switch
S2: Reset/Override Switch or Override Cancel Switch
ML: Muting lamp
*1. Also used as Override input line.
*2. Make sure to connect an override cancel switch to the Reset line when using the override function. Otherwise the override state may not be released by the override cancel switch, resulting in serious injury.
*3. Refer to page 14 for more information.
*4. Refer to Smart Muting Actuator F3W-MA Series User's Manual (Catalog No. Z355) for more information.

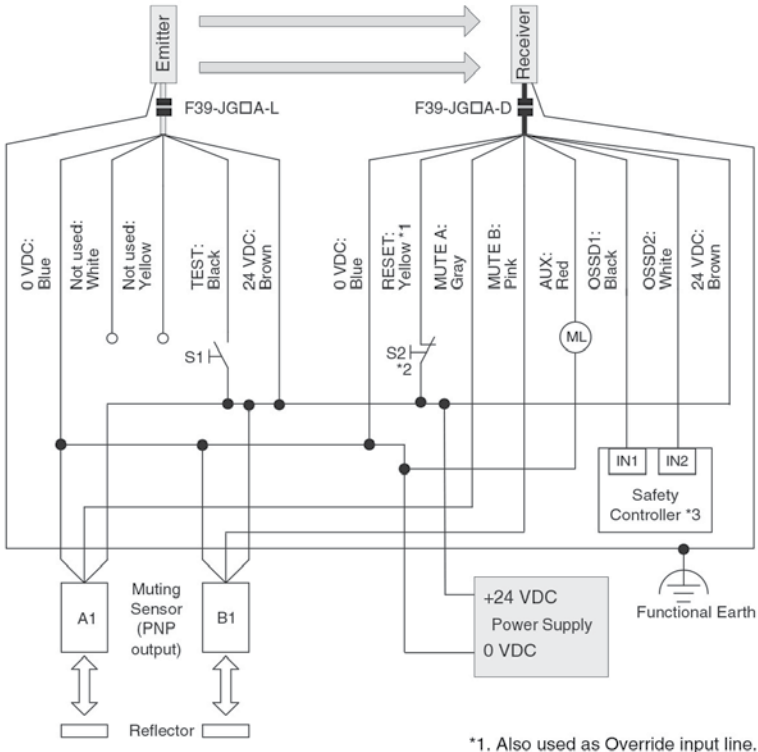
Standard Muting Mode/Exit-Only Muting Mode using NPN Outputs



S1: Test Switch
S2: Override Cancel Switch
S3: Reset Switch or Override Switch
S4, S5: Muting sensor
KM1, KM2: Safety relay with forcibly guided contacts (G7SA) or magnetic contactor
M: 3-phase motor
ML: Muting lamp
*1. Also used as Override input line.
*2. Make sure to connect an override cancel switch to the Reset line when using the override function. Otherwise the override state may not be released by the override cancel switch, resulting in serious injury.

Connections (Basic Wiring Diagram) (continued)

Standard Muting Mode/Exit-Only Muting Mode with two Muting Sensors using PNP Outputs

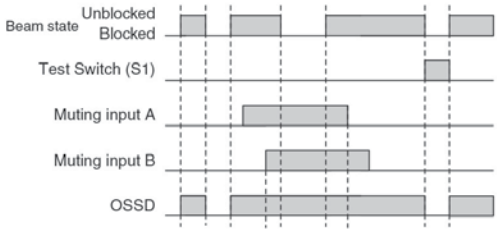


[DIP Switch settings]
Receiver:
- Auto Reset Mode
- EDM disabled
- PNP output

Emitter:
- 24 V Active

S1: Test Switch
S2: Reset/Override Switch or Override Cancel Switch
ML: Muting lamp
A1, B1: Muting sensor

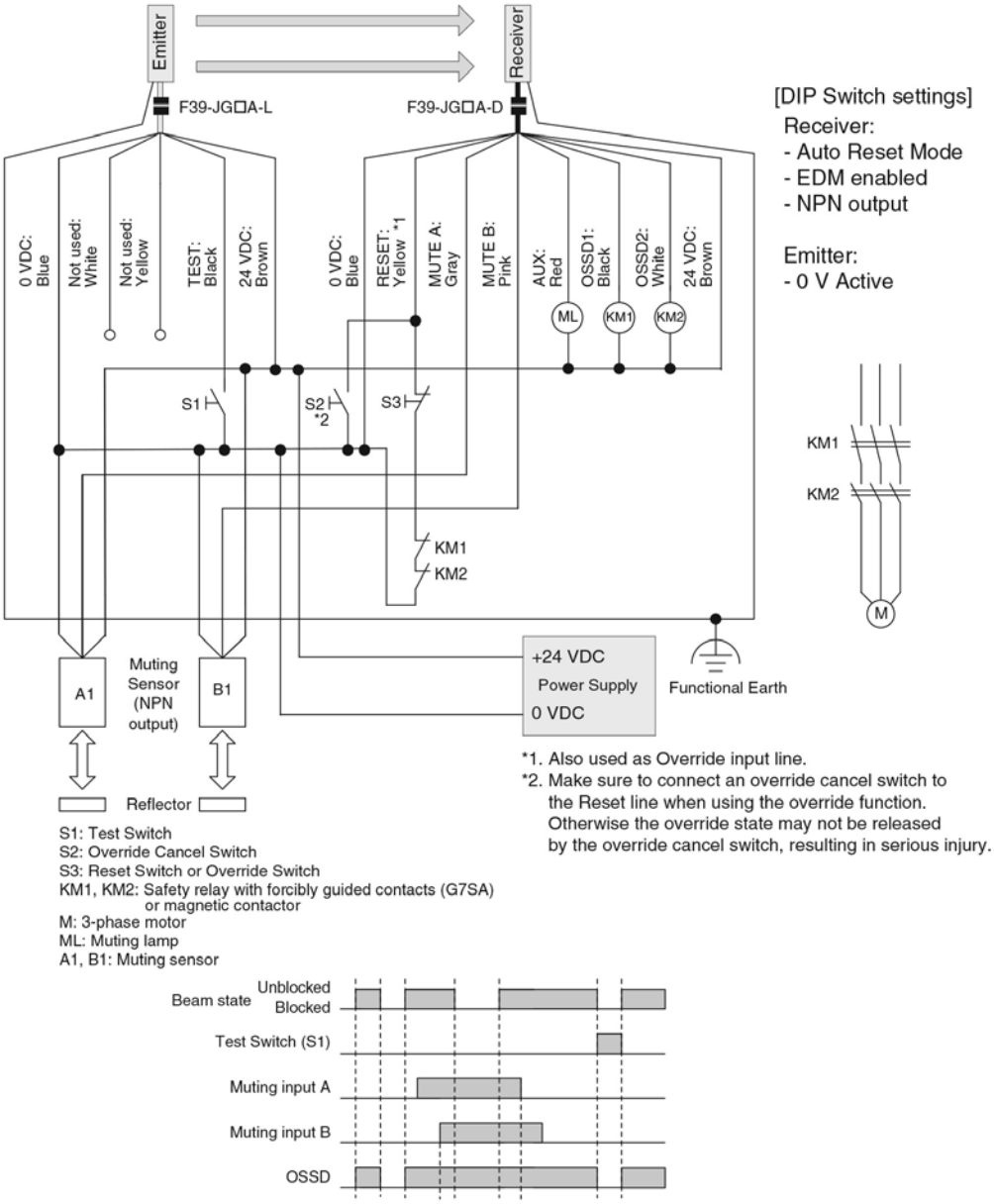
*1. Also used as Override input line.
*2. Make sure to connect an override cancel switch to the Reset line when using the override function. Otherwise the override state may not be released by the override cancel switch, resulting in serious injury.



For complete specifications and additional models and accessories visit www.omron247.com

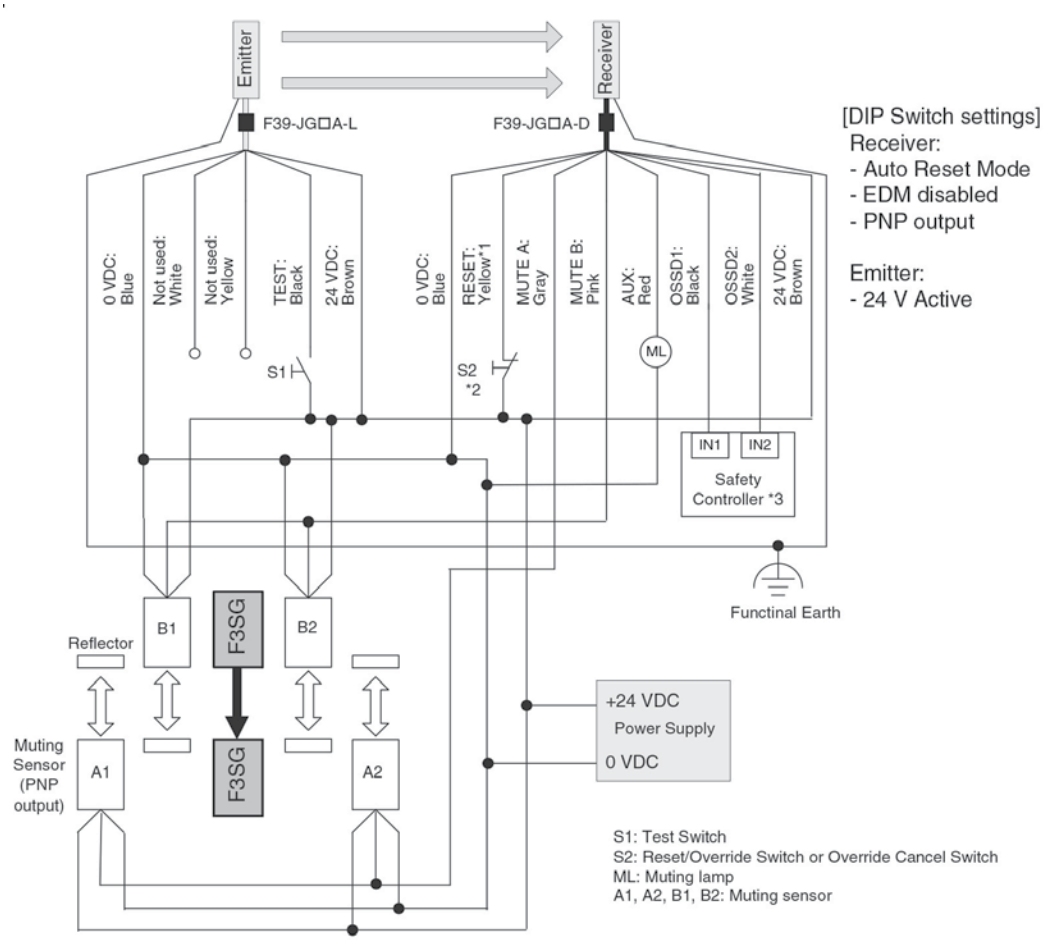
Connections (Basic Wiring Diagram) (continued)

Standard Muting Mode/Exit-Only Muting Mode with two Muting Sensors using NPN Outputs

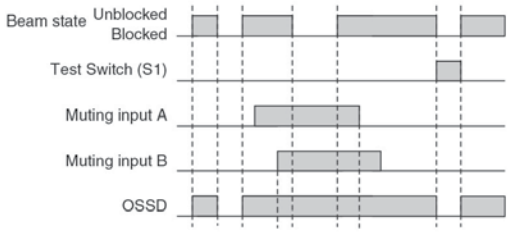


Connections (Basic Wiring Diagram) (continued)

Standard Muting Mode/Exit-Only Muting Mode with four Muting Sensors using PNP Outputs



*1. Also used as Override input line.
*2. Make sure to connect an override cancel switch to the Reset line when using the override function. Otherwise the override state may not be released by the override cancel switch, resulting in serious injury.



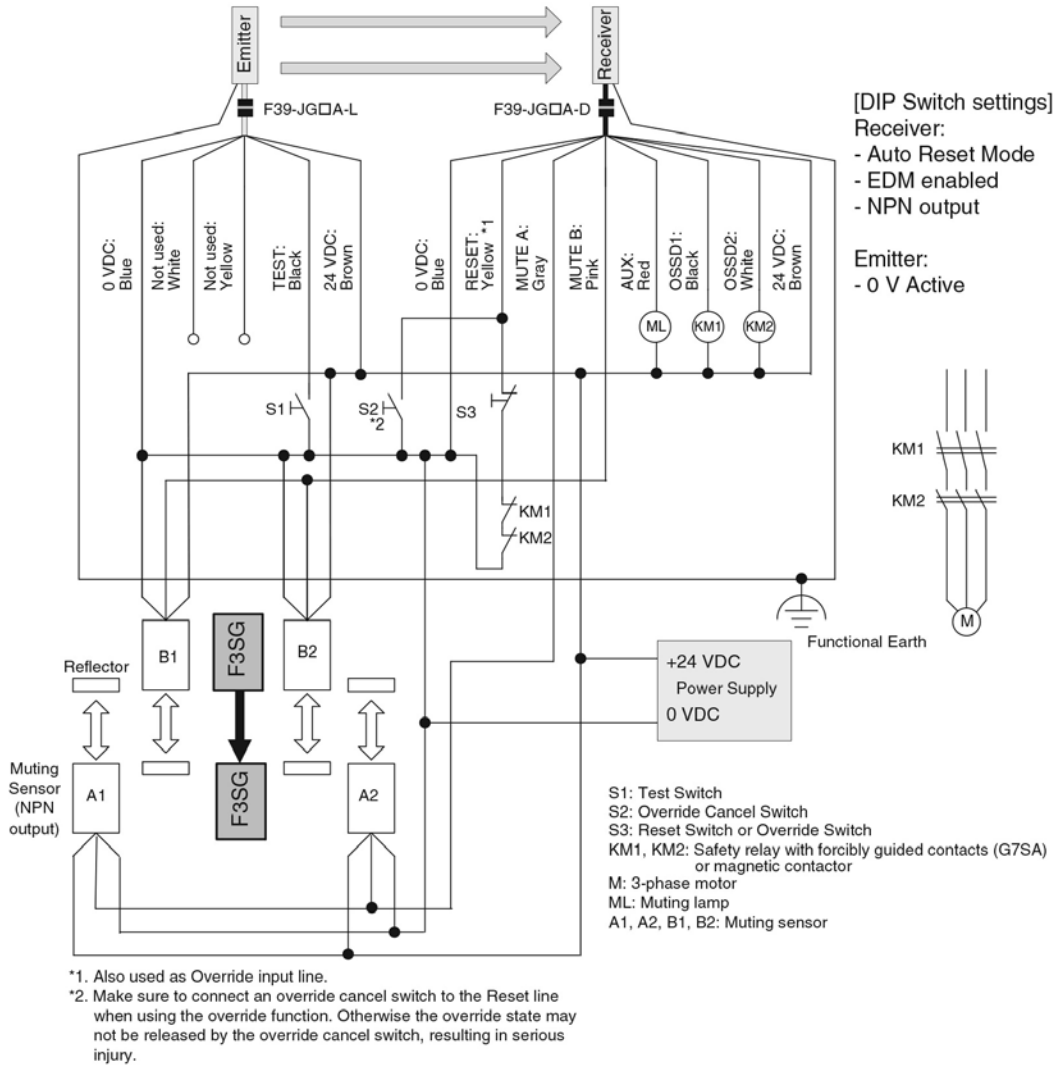
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

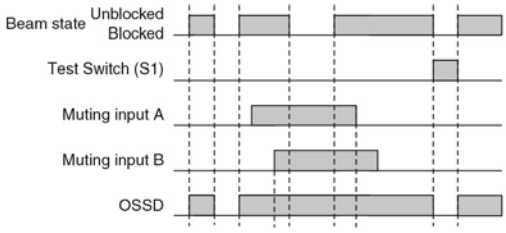
OMRON AUTOMATION & SAFETY

Connections (Basic Wiring Diagram) (continued)

Standard Muting Mode/Exit-Only Muting Mode with four Muting Sensors using NPN Outputs

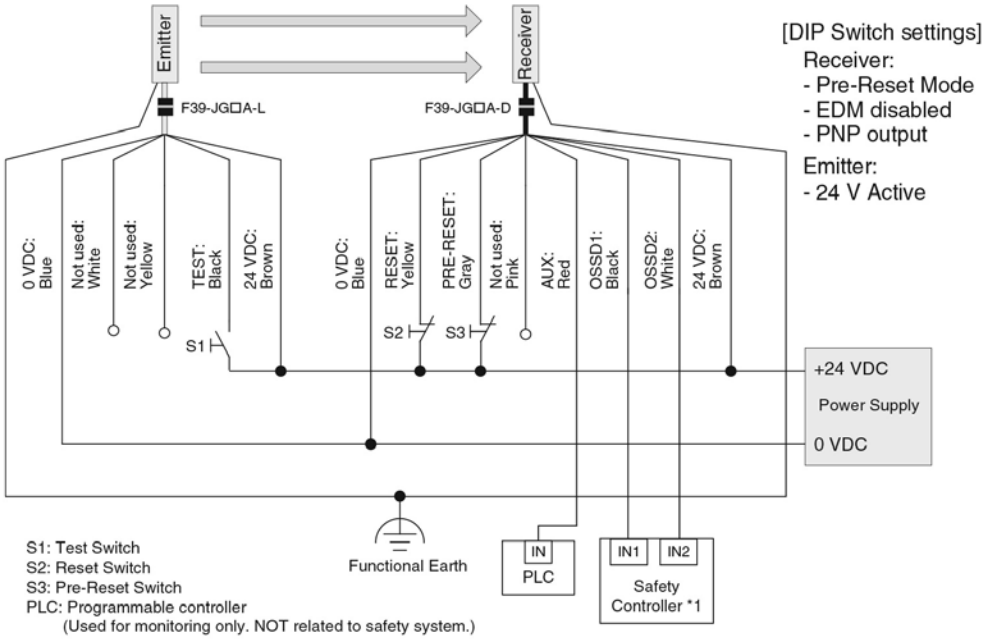


*1. Also used as Override input line.
*2. Make sure to connect an override cancel switch to the Reset line when using the override function. Otherwise the override state may not be released by the override cancel switch, resulting in serious injury.

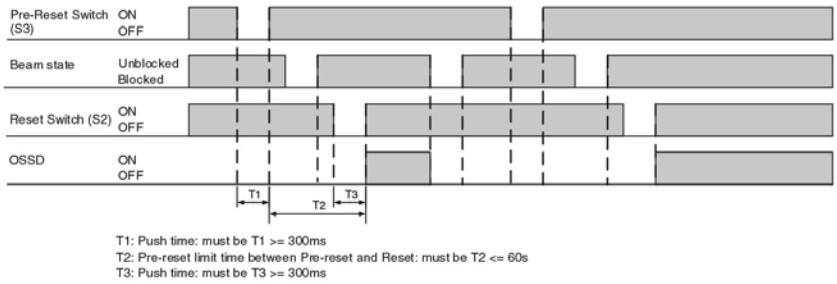


Connections (Basic Wiring Diagram) (continued)

Pre-Resest Mode using PNP Output



Refer to the following list "Connectable Safety Control Units" on this page.



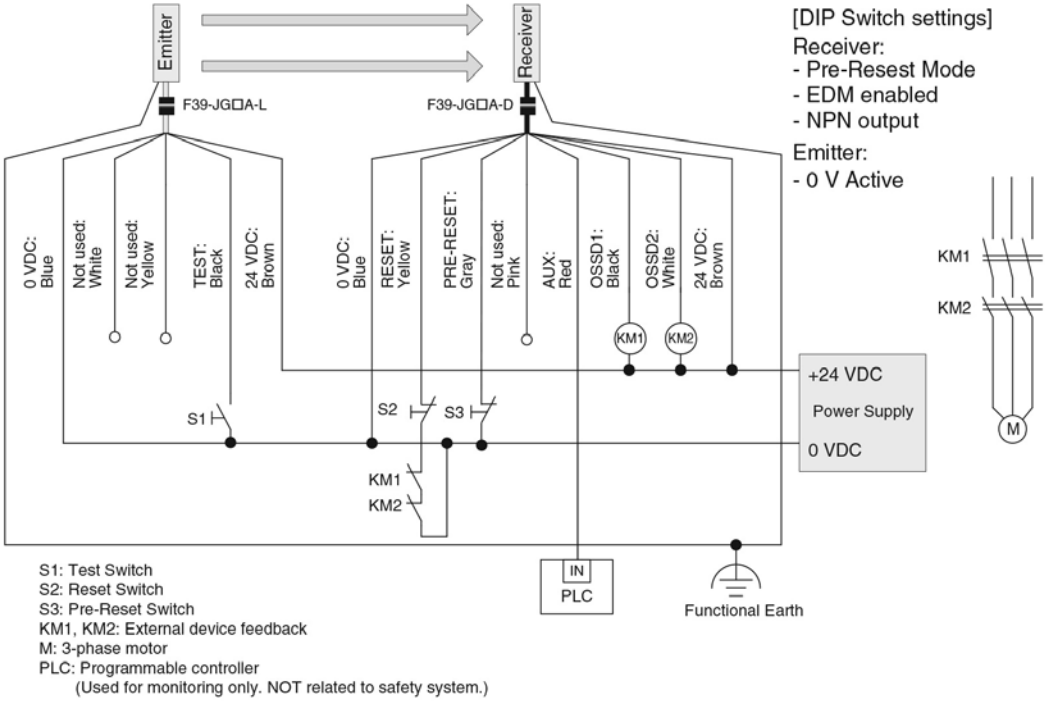
Connectable Safety Control Units)

The F3SG-RA with PNP output can be connected to the safety control units listed in the table below.

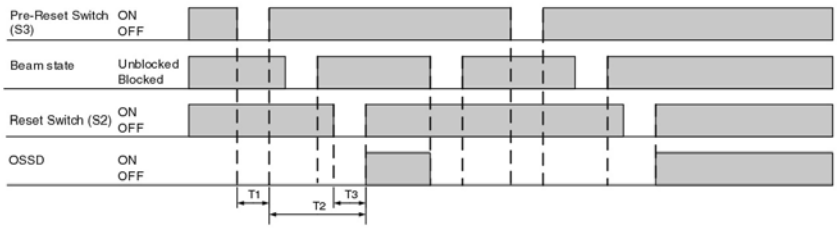
Connectable Safety Control Units (PNP output)		
G9SA-301 G9SA-321 G9SA-501 G9SB-200-B G9SB-200-D G9SB-301-B G9SB-301-D	G9SX-AD322-T G9SX-ADA222-T G9SX-BC202 G9SX-GS226-T15	G9SP-N10S G9SP-N10D G9SP-N20S NE0A-SCPU01 NE1A-SCPU01 NE1A-SCPU02 DST1-ID12SL DST1-MD16SL DST1-MRD08SL NX-SIH400 NX-SID800 F3SP-T01

Connections (Basic Wiring Diagram) (continued)

Pre-Resest Mode using NPN Output



S1: Test Switch
S2: Reset Switch
S3: Pre-Reset Switch
KM1, KM2: External device feedback
M: 3-phase motor
PLC: Programmable controller
(Used for monitoring only. NOT related to safety system.)



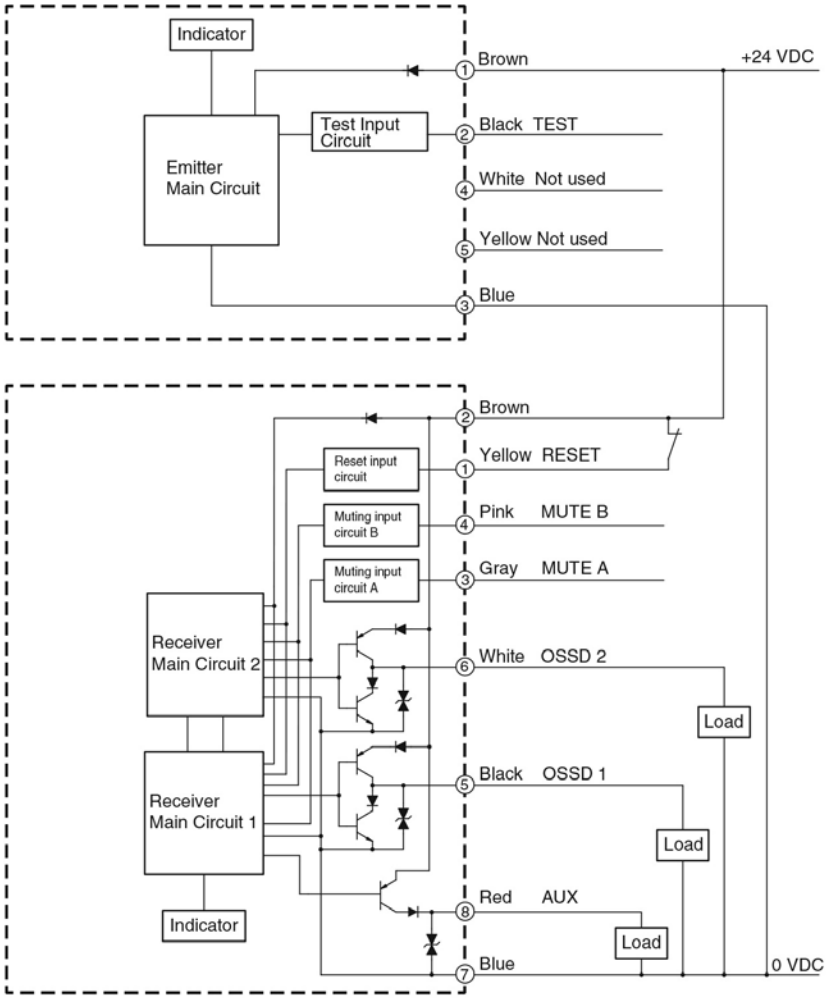
T1: Push time: must be T1 >= 300ms
T2: Pre-reset limit time between Pre-reset and Reset: must be T2 <= 60s
T3: Push time: must be T3 >= 300ms

Input/Output Circuit

Entire Circuit Diagram

The entire circuit diagram of the F3SG-RA is shown below.
The numbers in the circles indicate the connector's pin numbers.

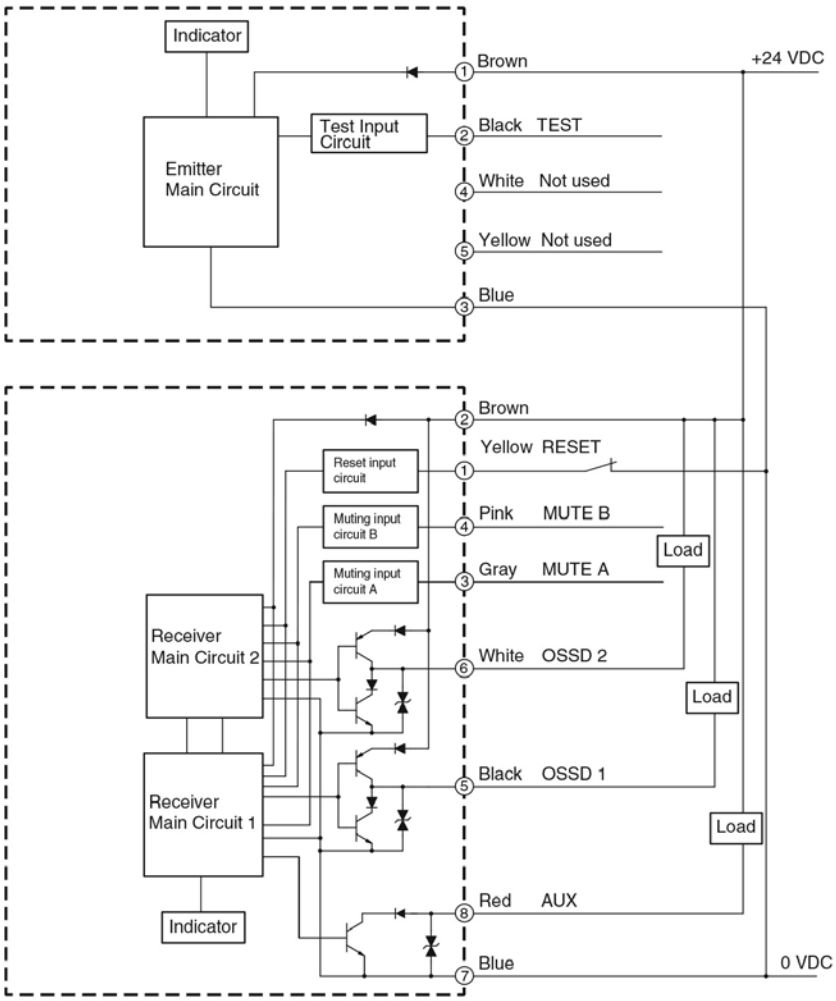
PNP Output



For complete specifications and additional models and accessories visit www.omron247.com

Input/Output Circuit (continued)

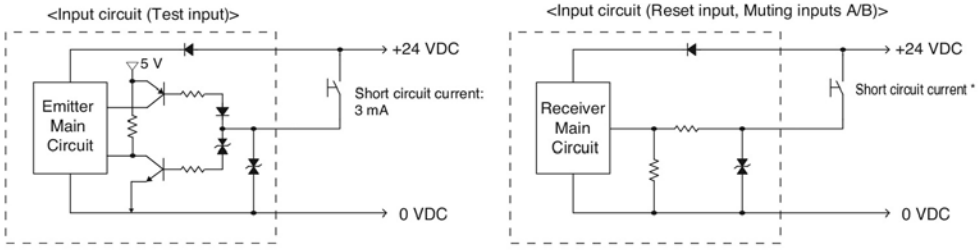
NPN Output



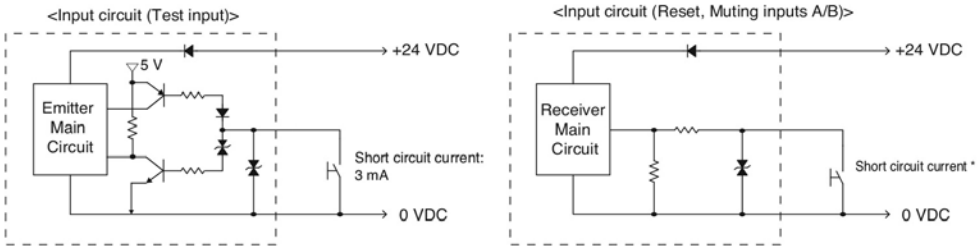
Input Circuit Diagram by Function

The input circuit diagrams of by function are shown below.

PNP Output



NPN Output



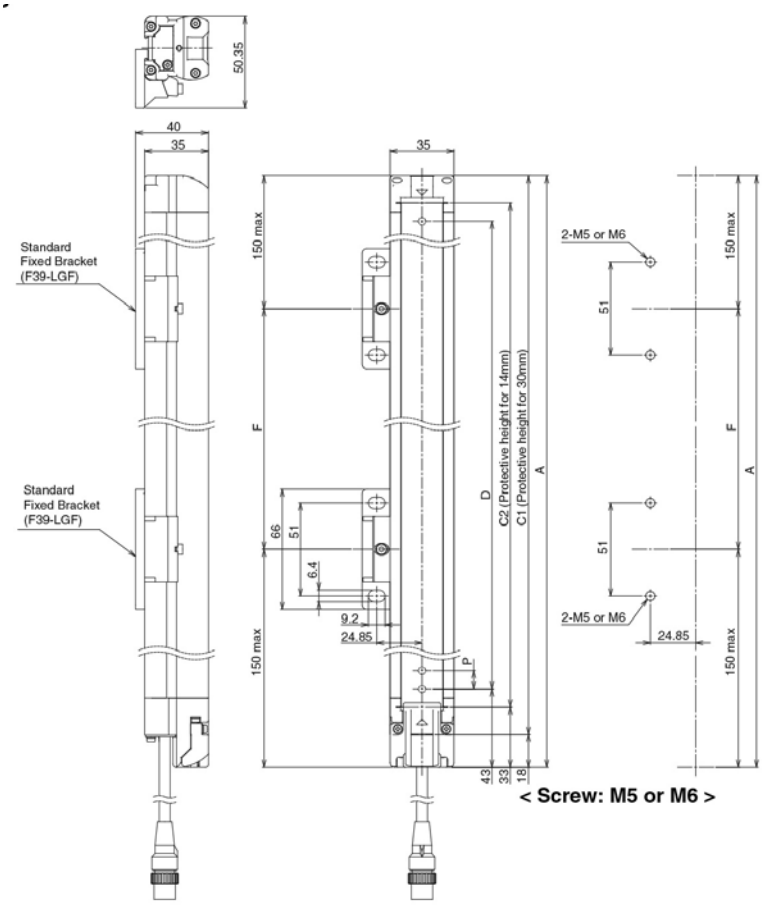
*Short circuit current: 5mA (Reset input), 3mA (Muting inputs A/B)

Dimensions

(mm)

Mounted with Standard Fixed Brackets (F39-LGF)

Backside Mounting



F3SG-□RA□□□□-30 Series

Dimension A	C1+18
Dimension C1	4-digit number of the type name (Protective height)
Dimension D	C1-50
Dimension P	20

Protective height (C1)	Number of Standard Fixed Brackets	Dimension F
0190 to 1230	2	1000 mm max.
1310 to 2270	3	1000 mm max.
2350 to 2510	4	1000 mm max.

F3SG-□RA□□□□-14 Series

Dimension A	C2+48
Dimension C2	4-digit number of the type name (Protective height)
Dimension D	C2-20
Dimension P	10

Protective height (C2)	Number of Standard Fixed Brackets	Dimension F
0160 to 1200	2	1000 mm max.
1280 to 2080	3	1000 mm max.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

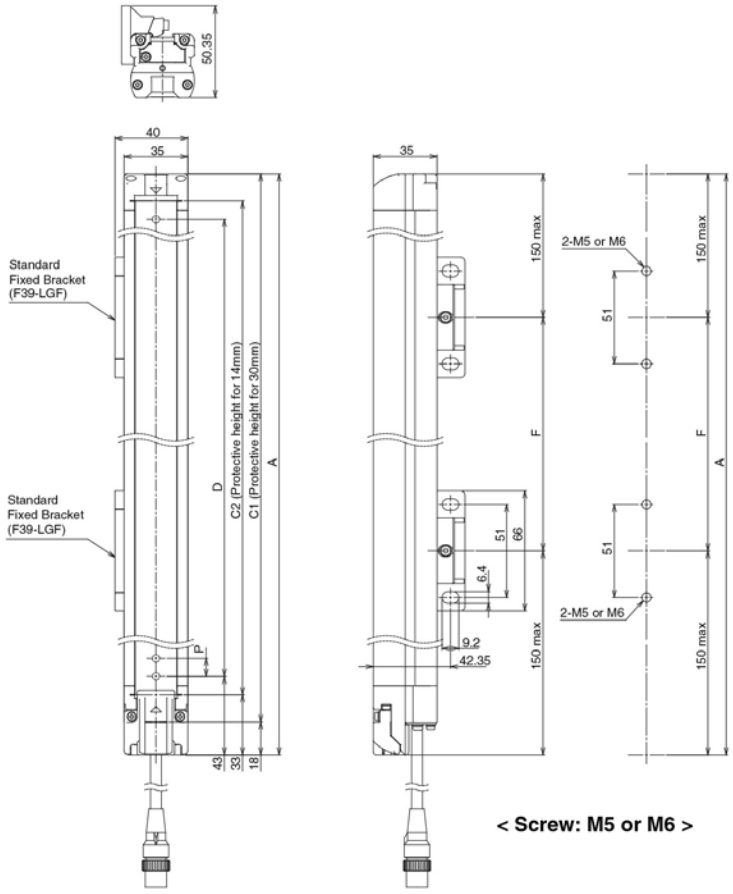
For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Dimensions (continued)

(mm)

Side Mounting



F3SG-□RA□□□□-30 Series

Dimension A	C1+18
Dimension C1	4-digit number of the type name (Protective height)
Dimension D	C1-50
Dimension P	20

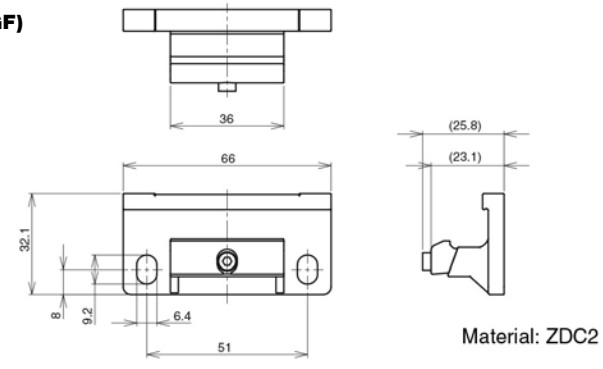
Protective height (C1)	Number of Standard Fixed Brackets	Dimension F
0190 to 1230	2	1000 mm max.
1310 to 2270	3	1000 mm max.
2350 to 2510	4	1000 mm max.

F3SG-□RA□□□□-14 Series

Dimension A	C2+48
Dimension C2	4-digit number of the type name (Protective height)
Dimension D	C2-20
Dimension P	10

Protective height (C2)	Number of Standard Fixed Brackets	Dimension F
0160 to 1200	2	1000 mm max.
1280 to 2080	3	1000 mm max.

Standard Fixed Bracket (F39-LGF)

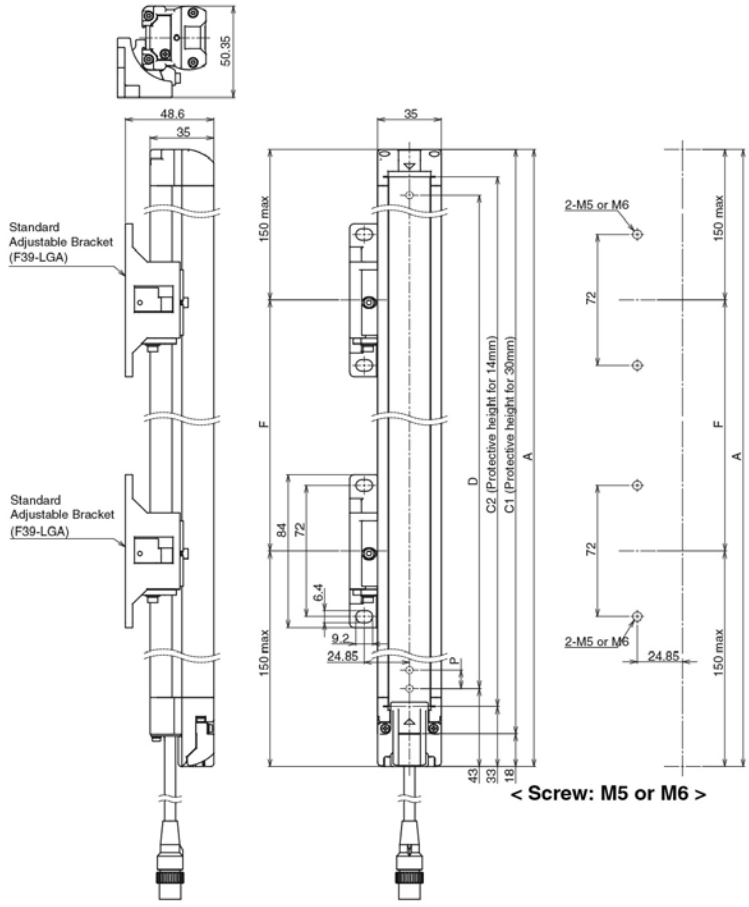


Dimensions (continued)

(mm)

Mounted with Standard Adjustable Brackets (F39-LGA)

Backside Mounting



F3SG-□RA□□□□-30 Series

Dimension A	C1+18
Dimension C1	4-digit number of the type name (Protective height)
Dimension D	C1-50
Dimension P	20

Protective height (C1)	Number of Standard Fixed Brackets	Dimension F
0190 to 1230	2	1000 mm max.
1310 to 2270	3	1000 mm max.
2350 to 2510	4	1000 mm max.

F3SG-□RA□□□□-14 Series

Dimension A	C2+48
Dimension C2	4-digit number of the type name (Protective height)
Dimension D	C2-20
Dimension P	10

Protective height (C2)	Number of Standard Fixed Brackets	Dimension F
0160 to 1200	2	1000 mm max.
1280 to 2080	3	1000 mm max.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

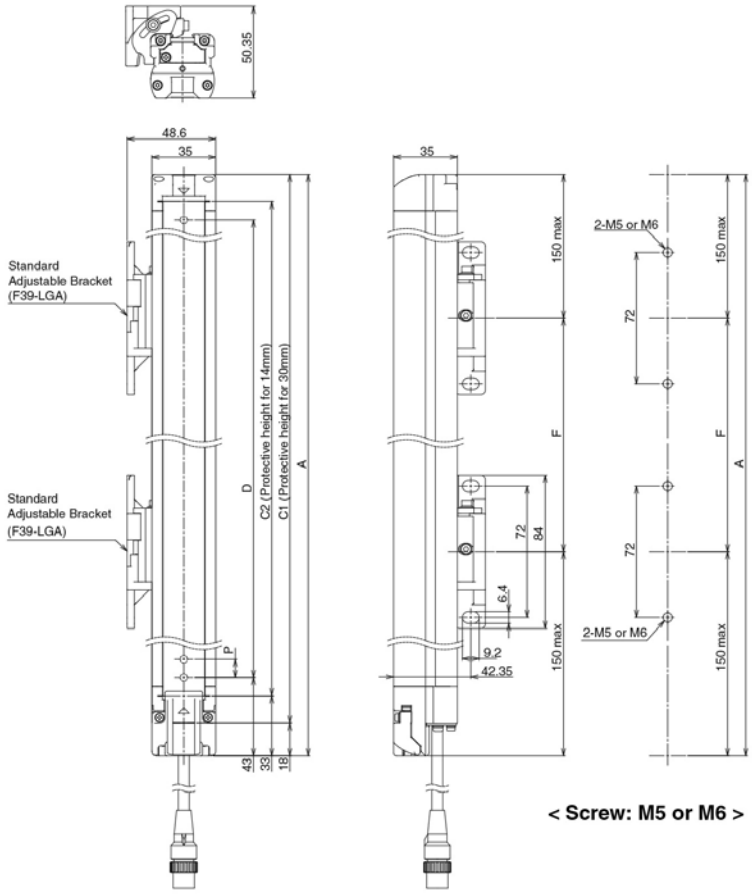
For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Dimensions (continued)

(mm)

Side Mounting



F3SG-□RA□□□□-30 Series

Dimension A	C1+18
Dimension C1	4-digit number of the type name (Protective height)
Dimension D	C1-50
Dimension P	20

Protective height (C1)	Number of Standard Fixed Brackets	Dimension F
0190 to 1230	2	1000 mm max.
1310 to 2270	3	1000 mm max.
2350 to 2510	4	1000 mm max.

F3SG-□RA□□□□-14 Series

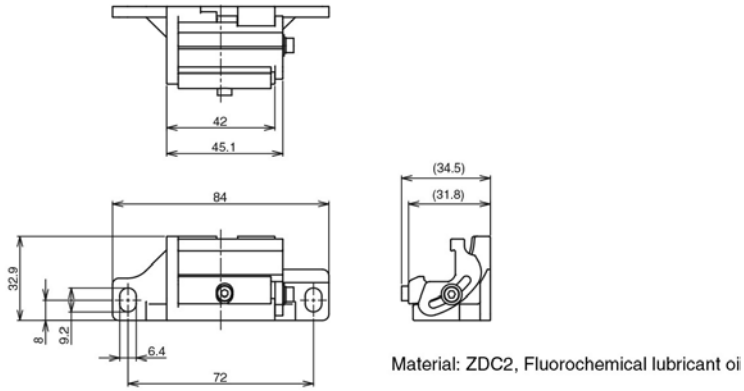
Dimension A	C2+48
Dimension C2	4-digit number of the type name (Protective height)
Dimension D	C2-20
Dimension P	10

Protective height (C2)	Number of Standard Fixed Brackets	Dimension F
0160 to 1200	2	1000 mm max.
1280 to 2080	3	1000 mm max.

Dimensions (continued)

(mm)

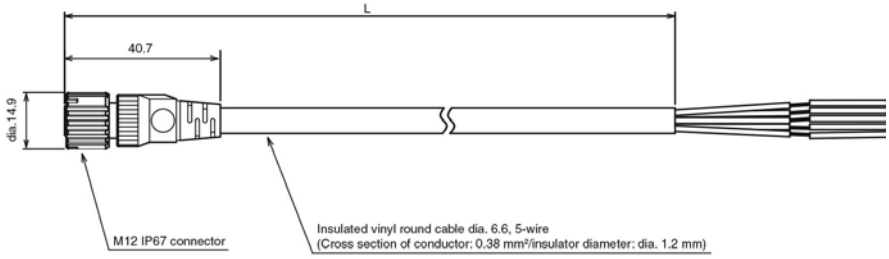
Standard Adjustable Bracket (F39-LGA)



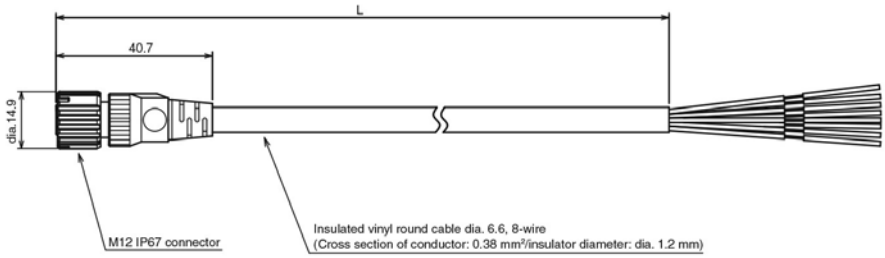
Material: ZDC2, Fluorochemical lubricant oi

Accessories

Single-Ended Cable for Emitter (F39-JG□A-L, sold separately)

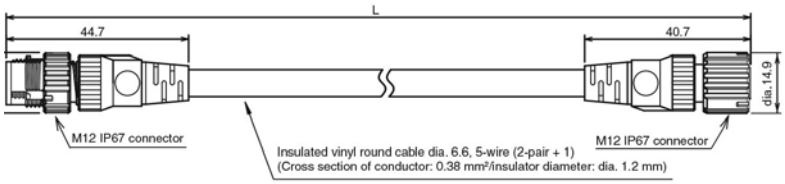


Single-Ended Cable for Receiver (F39-JG□A-D, sold separately)



Emitter cable (Gray)	Receiver cable (Black)	L (m)
F39-JG3A-L	F39-JG3A-D	3
F39-JG7A-L	F39-JG7A-D	7
F39-JG10A-L	F39-JG10A-D	10
F39-JG15A-L	F39-JG15A-D	15
F39-JG20A-L	F39-JG20A-D	20

Double-ended Cable for Emitter: Cable for extension (F39-JG□B-L, sold separately)



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

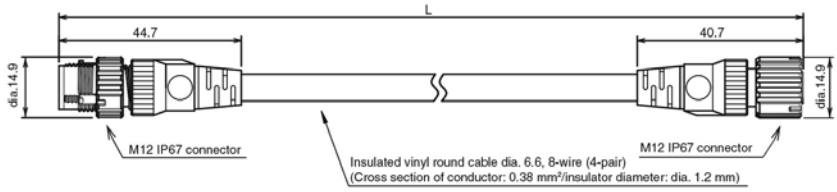
For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Dimensions (continued)

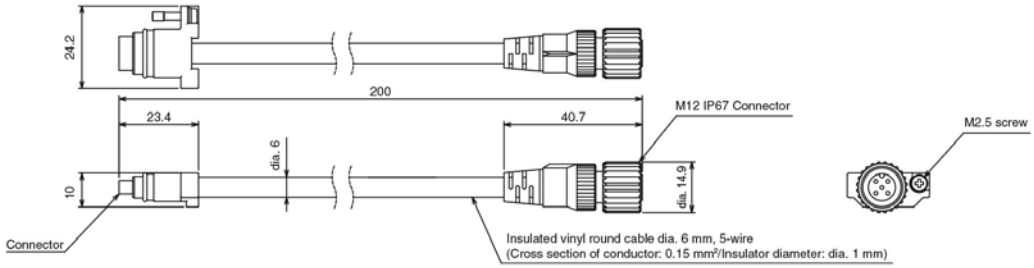
(mm)

Double-Ended Cable for Receiver: Cable for extension (F39-JG□B-D, sold separately)

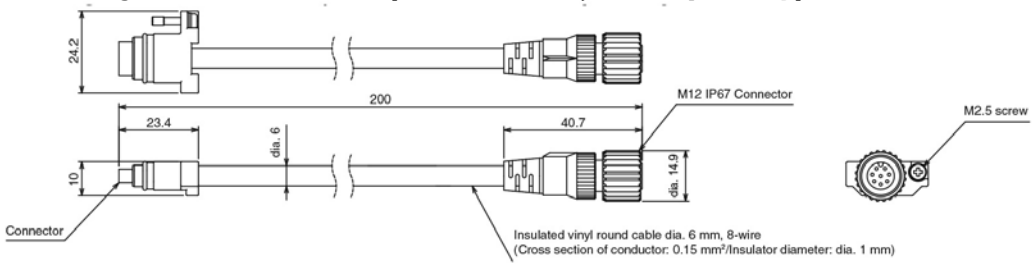


Emitter cable (Gray)	Receiver cable (Black)	L (m)
F39-JGR5B-L	F39-JGR5B-D	0.5
F39-JG1B-L	F39-JG1B-D	1
F39-JG3B-L	F39-JG3B-D	3
F39-JG5B-L	F39-JG5B-D	5
F39-JG7B-L	F39-JG7B-D	7
F39-JG10B-L	F39-JG10B-D	10
F39-JG15B-L	F39-JG15B-D	15
F39-JG20B-L	F39-JG20B-D	20

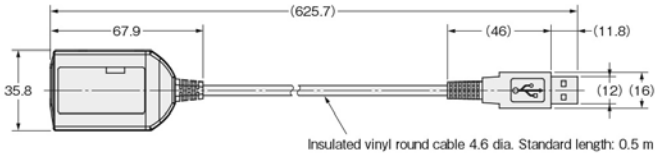
Cascading Cable for Emitter (F39-JGR2W-L, sold separately)



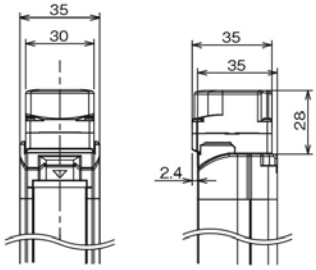
Cascading Cable for Receiver (F39-JGR2W-D, sold separately)



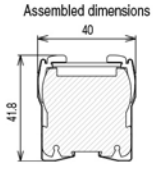
Interface Unit (F39-GIF)



Lamp (F39-LP)



Spatter Protection Cover (F39-HGA)



Model	Total length
F39-HGA□□□□	□□□□+4
F39-HGA0550	558

Related Manuals

ManNo.	Model	Manual name
Z352	F3SG-□R□□□□□-□□	Safety Light Curtain F3SG-□R□□□□□-□□ Series User's Manual

Ordering (continued)

Main Units

Safety Light Curtains

Finger Protection

Model	Number of beams	Protective height [mm]
F3SG-4RA0160-14	15	160
F3SG-4RA0240-14	23	240
F3SG-4RA0320-14	31	320
F3SG-4RA0400-14	39	400
F3SG-4RA0480-14	47	480
F3SG-4RA0560-14	55	560
F3SG-4RA0640-14	63	640
F3SG-4RA0720-14	71	720
F3SG-4RA0800-14	79	800
F3SG-4RA0880-14	87	880
F3SG-4RA0960-14	95	960
F3SG-4RA1040-14	103	1,040
F3SG-4RA1120-14	111	1,120
F3SG-4RA1200-14	119	1,200
F3SG-4RA1280-14	127	1,280
F3SG-4RA1360-14	135	1,360
F3SG-4RA1440-14	143	1,440
F3SG-4RA1520-14	151	1,520
F3SG-4RA1600-14	159	1,600
F3SG-4RA1680-14	167	1,680
F3SG-4RA1760-14	175	1,760
F3SG-4RA1840-14	183	1,840
F3SG-4RA1920-14	191	1,920
F3SG-4RA2000-14	199	2,000
F3SG-4RA2080-14	207	2,080

Hand and Arm Protection

Model	Number of beams	Protective height [mm]
F3SG-4RA0190-30	8	190
F3SG-4RA0270-30	12	270
F3SG-4RA0350-30	16	350
F3SG-4RA0430-30	20	430
F3SG-4RA0510-30	24	510
F3SG-4RA0590-30	28	590
F3SG-4RA0670-30	32	670
F3SG-4RA0750-30	36	750
F3SG-4RA0830-30	40	830
F3SG-4RA0910-30	44	910
F3SG-4RA0990-30	48	990
F3SG-4RA1070-30	52	1,070
F3SG-4RA1150-30	56	1,150
F3SG-4RA1230-30	60	1,230
F3SG-4RA1310-30	64	1,310
F3SG-4RA1390-30	68	1,390
F3SG-4RA1470-30	72	1,470
F3SG-4RA1550-30	76	1,550
F3SG-4RA1630-30	80	1,630
F3SG-4RA1710-30	84	1,710
F3SG-4RA1790-30	88	1,790
F3SG-4RA1870-30	92	1,870
F3SG-4RA1950-30	96	1,950
F3SG-4RA2030-30	100	2,030
F3SG-4RA2110-30	104	2,110
F3SG-4RA2190-30	108	2,190
F3SG-4RA2270-30	112	2,270
F3SG-4RA2350-30	116	2,350
F3SG-4RA2430-30	120	2,430
F3SG-4RA2510-30	124	2,510

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering (continued)

Accessories (sold separately)

Single-end Connector Cable

Appearance	Type	Cable length	Model	Specifications
	For emitter	3 m	F39-JG3A-L	Emitter cable: M12 connector (5-pin), 5 wires Color: Gray
		7 m	F39-JG7A-L	
		10 m	F39-JG10A-L	
		15 m	F39-JG15A-L	
		20 m	F39-JG20A-L	
	For receiver	3 m	F39-JG3A-D	M12 connector (8-pin), 8 wires Color: Black
		7 m	F39-JG7A-D	
		10 m	F39-JG10A-D	
		15 m	F39-JG15A-D	
		20 m	F39-JG20A-D	

Double-ended Cable

Appearance	Type	Cable length	Model	Specifications
	For emitter	0.5 m	F39-JGR5B-L	M12 connector (5-pin) on both ends Color: Gray
		1 m	F39-JG1B-L	
		3 m	F39-JG3B-L	
		5 m	F39-JG5B-L	
		7 m	F39-JG7B-L	
		10 m	F39-JG10B-L	
		15 m	F39-JG15B-L	
		20 m	F39-JG20B-L	
	For receiver	0.5 m	F39-JGR5B-D	M12 connector (8-pin) on both ends Color: Black
		1 m	F39-JG1B-D	
		3 m	F39-JG3B-D	
		5 m	F39-JG5B-D	
		7 m	F39-JG7B-D	
		10 m	F39-JG10B-D	
		15 m	F39-JG15B-D	
		20 m	F39-JG20B-D	

Cascading Cable (Two cables per set, for emitter and receiver)

Appearance	Cable Length	Model	Specifications
	For emitter	F39-JGR2W	Emitter cable: Cap (5-pin), M12 connector (5-pin) Receiver cable: Cap (8-pin), M12 connector (8-pin)

Ordering (continued)

Sensor Mounting Brackets

Appearance	Specification	Model	Application	Remarks
	Standard Fixed Bracket	F39-LGF	Bracket to mount the F3SG-RA. Side mounting and backside mounting possible. (Included in the F3SG-RA product package)	Two brackets per set
	Standard Adjustable Bracket	F39-LGA	Bracket to mount the F3SG-RA. Beam alignment after mounting possible. The angle adustment range is ±15°. Side mounting and backside mounting possible.	Two brackets per set.

Interface Unit

Appearance	Model	Application
	F39-GIF	The Configuration Tool SD Manager2 is available to download from our website at http://www.ia.omron.com/f3sg-r_tool.

Lamp

Appearance	Model
	F39-LP

End Cap

Appearance	Model	Specification
	F39-CNM	Housing color: Black For both emitter and receiver (Attached to the F3SG-RA. The End Cap can be purchased if lost.)

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering (continued)

Splatter Protection Cover (Two covers per set, for emitter and receiver)
For Safety Light Curtain models of the protective height of 2,000 mm or longer, use two Spatter Protection Covers of different lengths.

Appearance	Safety Light Curtain Model		Model	
	Finger Protection	Hand and Arm Protection		
	F3SG-☐RA0160-14	F3SG-☐RA0190-30	F39-HGA0200	–
	F3SG-☐RA0240-14	F3SG-☐RA0270-30	F39-HGA0280	–
	F3SG-☐RA0320-14	F3SG-☐RA0350-30	F39-HGA0360	–
	F3SG-☐RA0400-14	F3SG-☐RA0430-30	F39-HGA0440	–
	F3SG-☐RA0480-14	F3SG-☐RA0510-30	F39-HGA0520	–
	F3SG-☐RA0560-14	F3SG-☐RA0590-30	F39-HGA0600	–
	F3SG-☐RA0640-14	F3SG-☐RA0670-30	F39-HGA0680	–
	F3SG-☐RA0720-14	F3SG-☐RA0750-30	F39-HGA0760	–
	F3SG-☐RA0800-14	F3SG-☐RA0830-30	F39-HGA0840	–
	F3SG-☐RA0880-14	F3SG-☐RA0910-30	F39-HGA0920	–
	F3SG-☐RA0960-14	F3SG-☐RA0990-30	F39-HGA1000	–
	F3SG-☐RA1040-14	F3SG-☐RA1070-30	F39-HGA1080	–
	F3SG-☐RA1120-14	F3SG-☐RA1150-30	F39-HGA1160	–
	F3SG-☐RA1200-14	F3SG-☐RA1230-30	F39-HGA1240	–
	F3SG-☐RA1280-14	F3SG-☐RA1310-30	F39-HGA1320	–
	F3SG-☐RA1360-14	F3SG-☐RA1390-30	F39-HGA1400	–
	F3SG-☐RA1440-14	F3SG-☐RA1470-30	F39-HGA1480	–
	F3SG-☐RA1520-14	F3SG-☐RA1550-30	F39-HGA1560	–
	F3SG-☐RA1600-14	F3SG-☐RA1630-30	F39-HGA1640	–
	F3SG-☐RA1680-14	F3SG-☐RA1710-30	F39-HGA1720	–
	F3SG-☐RA1760-14	F3SG-☐RA1790-30	F39-HGA1800	–
	F3SG-☐RA1840-14	F3SG-☐RA1870-30	F39-HGA1880	–
	F3SG-☐RA1920-14	F3SG-☐RA1950-30	F39-HGA1960	–
	F3SG-☐RA2000-14*	F3SG-☐RA2030-30*	F39-HGA1480	F39-HGA0550
	F3SG-☐RA2080-14*	F3SG-☐RA2110-30*	F39-HGA1560	F39-HGA0550
	–	F3SG-☐RA2190-30*	F39-HGA1640	F39-HGA0550
	–	F3SG-☐RA2270-30*	F39-HGA1720	F39-HGA0550
	–	F3SG-☐RA2350-30*	F39-HGA1800	F39-HGA0550
	–	F3SG-☐RA2430-30*	F39-HGA1880	F39-HGA0550
	–	F3SG-☐RA2510-30*	F39-HGA1960	F39-HGA0550

Note: The operating range of the Safety Light Curtain attached with the product is 10% shorter than the rating.

Test Rod

Specification	Model
14 mm dia.	F39-TRD14
30 mm dia.	F39-TRD30

MS4800

Quick Link
S633
omron247.com

MiniSafe Light Curtains

- Resolutions: 14 mm (0.55 in.), 20 mm (0.79 in.), 30 mm (1.18 in.), and 40 mm (1.57 in.)
- Ranges: 7 m (23 ft.) for 14 mm resolution systems; and 20 m (65 ft.) for 20, 30 and 40 mm resolution systems
- Protected Heights: 280 to 2120 mm (11 to 83.5 in.)
- Compact size: 50 x 38 mm (2 x 1.5 in.)
- "Two-box" design — no separate control box; no cable between transmitter and receiver
- Individual Beam Indicators
- Quick and easy fixed blanking programming option "SB1"
- Simple cascading models



Feature Set Comparison

The MS4800 light curtain family is an all-purpose light curtain available in three distinct versions. These versions are identified as the MS4800A, MS4800B and the MS4800S. The MS4800A and MS4800B feature set (configuration) can be changed through the use of an external device called the Programming Diagnostic Module (PDM) and on the MS4800S through selector switches.

Feature Set Comparison	MS4800A	MS4800B	MS4800S
Flex Bus, Multi-Segmented Head Configurations	■	■	■
Scan Code for Cross-Talk Mitigation	■*	■*	■
EDM External Device Monitoring (MPCE Monitoring)	■**	■**	■
PDM (Programming and Diagnostic Module)	■	■	
Adjustable Mounting Brackets and T-Slots	■	■	■
Non-Shielded Main Cables	■	■	■
2-Box Design	■	■	■
Two PNP Safety Outputs	■	■	■
Operating Modes	■*	■*	■
Machine Test Signal (MTS)	■*	■*	■
Auxiliary Output (PNP or NPN)	■*	■***	■***
Muting Through RM-6 Resource Module (only with MSF4800)	■*		■****
Floating Blanking	■*		■
Fixed Blanking	■*		■
Monitored Blanking	■*		
Reduced Resolution	■*		
Range Selection	■*	■*	■
Start Input Type	■*		
Response Time Adjustment	■*		

Note: The MS4800S can be configured with the quick fixed blanking programming option "SB1".
*Configured via use of the Programming Diagnostic Module (PDM)
**Configured via PDM and wiring configuration
***PNP/Follow only
****Simple two-sensor muting

Specifications

Performance	
Protected Height:	14 & 20 mm — 280 to 1800 mm (11.0 to 70.9 in.) 30 mm — 280 to 2120 mm (11.0 to 83.5 in.) 40 mm — 360 to 2040 mm (14.1 to 80.3 in.)
Object Resolution:	14, 20, 30 and 40 mm
Range:	14 mm Resolution — 0.3 to 7 m (1 to 23 ft.) default; 0.3 to 3 m (1 to 10 ft.) 20, 30 40 mm Resolutions — 0.3 to 20 m (1 to 65 ft.) default; 0.3 to 8 m (1 to 26 ft.)
Effective Aperture Angle:	±2.5° maximum, transmitter and receiver at operating range greater than 3 m (10 ft.) per IEC 61496-2
Safety Output:	Two 24 VDC PNP, each output sourcing 625 mA @ 24 VDC, short circuit protected (see Note 1)
Response Time:	See response time tables
Auxiliary (Non-Safety) Output:	MS4800A – One 24 VDC PNP sourcing 100 mA (follow mode) default, or one sinking NPN and alarm modes configured via PDM MS4800B and MS4800S — One PNP sourcing 100 mA (follow mode)
EDM Monitor:	50 mA @ 24 VDC (See Note 2)
Start/Restart Input (10 mA Consumption):	MS4800A — N.C. to 0 VDC default; N.O. and 24 VDC modes configured via PDM MS4800B and MS4800S — N.C. to 0 VDC only
Light Source:	Infrared light emitting diode, 880 nm
Transmitter Indicator Light:	Active (yellow)
Receiver Indicator Light:	Machine Run/Stop (green/red), Interlock/Alarm (yellow), Blanking (amber)
Electrical	
Power Input Transmitter:	24 VDC ±20% 285 mA max.
Power Input Receiver:	24 VDC ± 20%, 1.8 A max. (receiver 450 mA + OSSD1 625 mA max. + OSSD2 625 mA max. + auxiliary 100 mA max.)
Muting Option (RM-6):	24 VDC ± 20%, 115 mA max.
Power Supply:	Must meet requirements of IEC 60204-1 and IEC 61496; STI part number 42992 or equivalent (see Note 1)
Mechanical	
Construction:	Polyester powder painted aluminum
Cable Length:	Available in 10, 15 and 30 m (33, 49 and 99 ft.) lengths, unshielded
Wire Connections:	M12 connections; 8-pin receiver & 5-pin transmitter
Environmental	
Enclosure Rating:	IP65
Operating Temperature:	-10 to 55°C (14 to 131°F)
Storage Temperature:	-25 to 75°C (-13 to 167°F)
Relative Humidity:	95% maximum, non-condensing
Shock:	10 g for 0.016 seconds; 1,000 shocks for each of three axis
Approvals	ESPE Type 4 (IEC 61496-1/ -2) Category 4 / PL e (EN ISO 13849-1) SIL3 / SIL3 CL3 (IEC 61508 / EN 62061) UL508, UL1998, CAN/CSA-C22.2 No. 14, CAN/CSA-C22.2 No. 0.8, CAN/CSA-C22.2 No 0, CAN/CSA-C22.2 No 205

Specifications are subject to change without notice.

Note 1: Total current required by two solid-state safety outputs and the auxiliary output should not exceed 1.35 A. Total system current requirements is the sum of transmitter (285 mA), receiver (450 mA), OSSD1 (625 mA), OSSD2 (625 mA) and Aux. Output (100 mA).

Note 2: 24 VDC is nominal. Actual voltage is dependant upon supply, V = Vsupply - 2 V.

Response Time Tables

One Segment System

Response Time (ms)		Beam Count	
Normal	**Slow***	**Min.**	**Max.**
14	23	12	16
23	38	17	71
32	53	72	126
41	68	127	180
50	83	181	235
59	99	236	256

Two Segment System

Response Time (ms)		Beam Count	
Normal	**Slow***	**Min.**	**Max.**
23	38	24	65
32	53	66	120
41	68	121	174
50	83	175	229
59	99	230	256

Three Segment System

Response Time (ms)		Beam Count	
Normal	**Slow***	**Min.**	**Max.**
23	38	36	59
32	53	60	114
41	68	115	168
50	83	169	223
59	99	224	256

Four Segment System

Response Time (ms)		Beam Count	
Normal	**Slow***	**Min.**	**Max.**
23	38	48	53
32	53	54	108
41	68	109	162
50	83	163	217
59	99	218	256

*Response time adjustment is only available on the MS4800A.

B

PDM Functions

The PDM is used to program, configure and troubleshoot MS4800A and MS4800B systems.

A qualified person simply plugs the PDM cable into a mating connector on either the transmitter or receiver. The PDM draws power from the curtain and allows quick display of the light curtain's status for troubleshooting purposes.

After log-in, all configuration settings can be accessed and programmed.

The PDM has five function buttons that allow navigation through the set-up menus.



Programming Diagnostic Module (PDM)



MS4800A & MS4800B PDM Port



MS4800S Function Switches

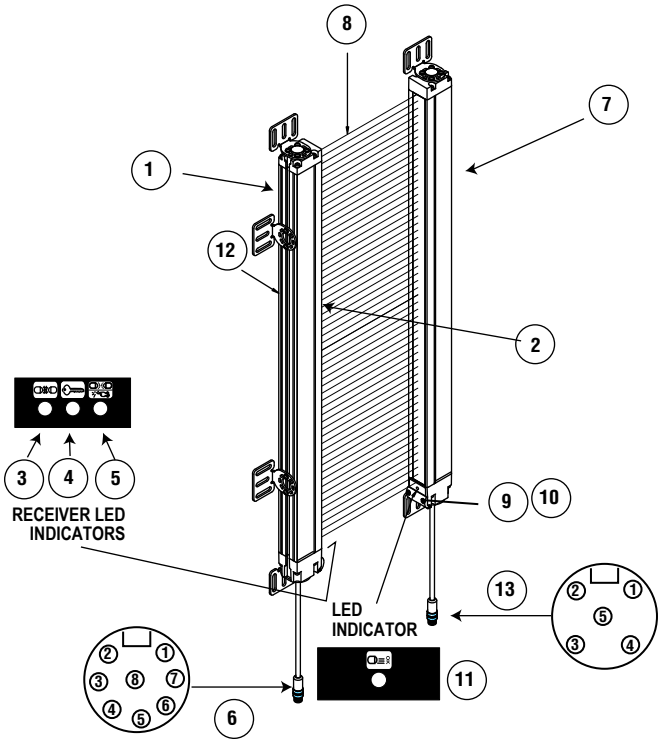


PDM Connected to Port on MS4800

Wiring

System Configuration

ID	Components & Indicators	
1	Receiver	
2	Individual Beam Indicators (one for each beam) — Red	
3	Blanking Active — Amber	
4	Interlock or Alarm Indicator — Yellow	
5	Machine Run/Stop Indicator — Green/Red	
6	Receiver Connections M–12	
	1	+24 VDC — Brown Wire
	2	0 VDC — Blue Wire
	3	Earth — Green Wire
	4	OSSD 2 — White Wire
	5	Start or EDM (Mode Select) — Yellow Wire
	6	EDM — Red Wire
	7	Auxiliary Output — Pink Wire
	8	OSSD 1 — Black Wire
7	Transmitter	
8	Detection Zone	
9	Flip Door, Access to Configuration Switches (on both receiver and transmitter) — MS4800S version	
10	Programming Port for PDM (on both receiver and transmitter) — MS4800A and MS4800B versions	
11	Status Indicator — Yellow	
12	Side Mounting T-Slot	
13	Transmitter Connections M–12	
	1	0 VDC — Blue Wire
	2	+24 VDC — Brown Wire
	3	MTS — White Wire
	4	MTS Return — Black Wire
	5	Earth — Green Wire



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

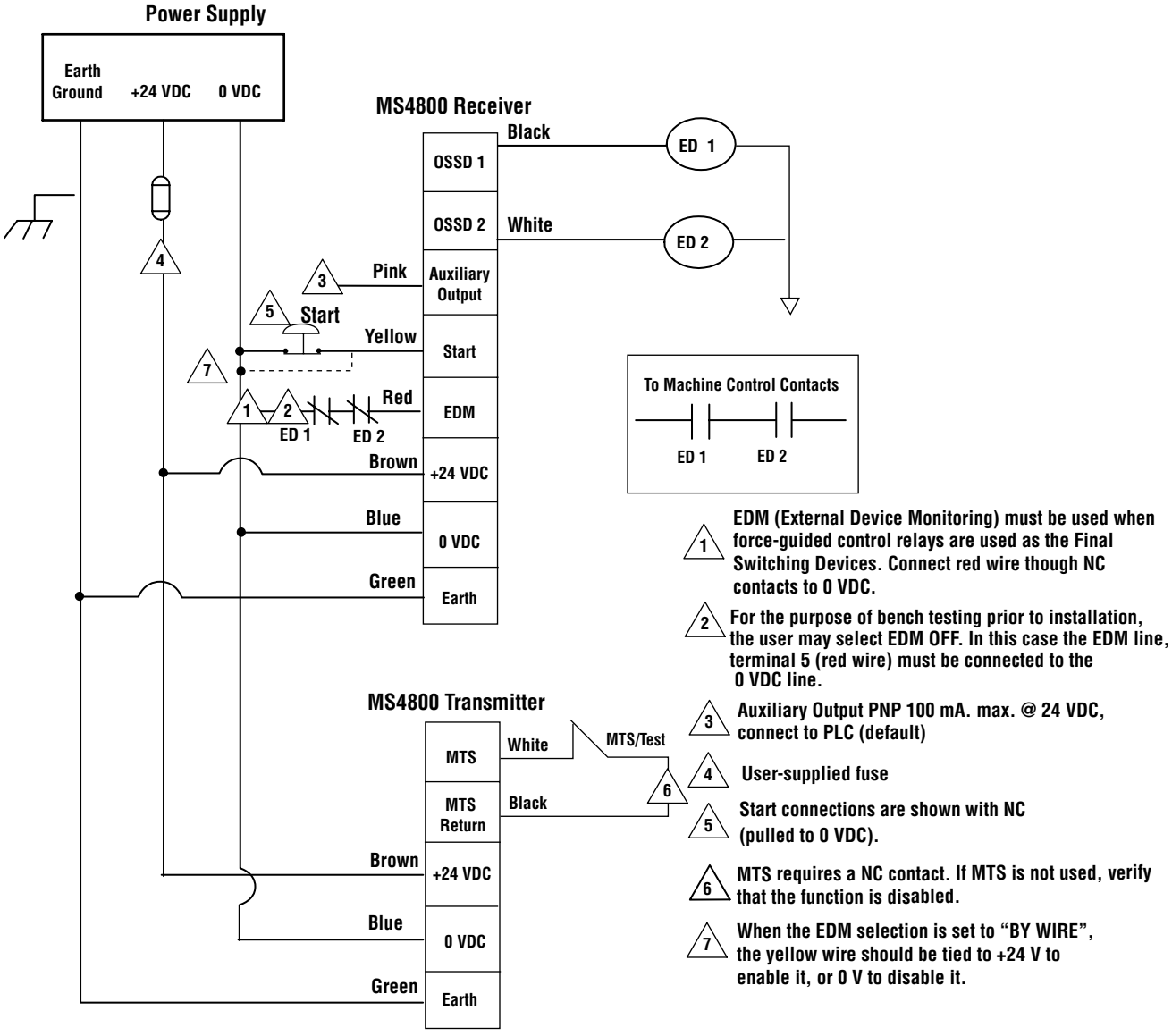
OMRON AUTOMATION & SAFETY

Wiring (continued)

Using Solid-State Outputs

Connecting Via Two Force-Guided Relays

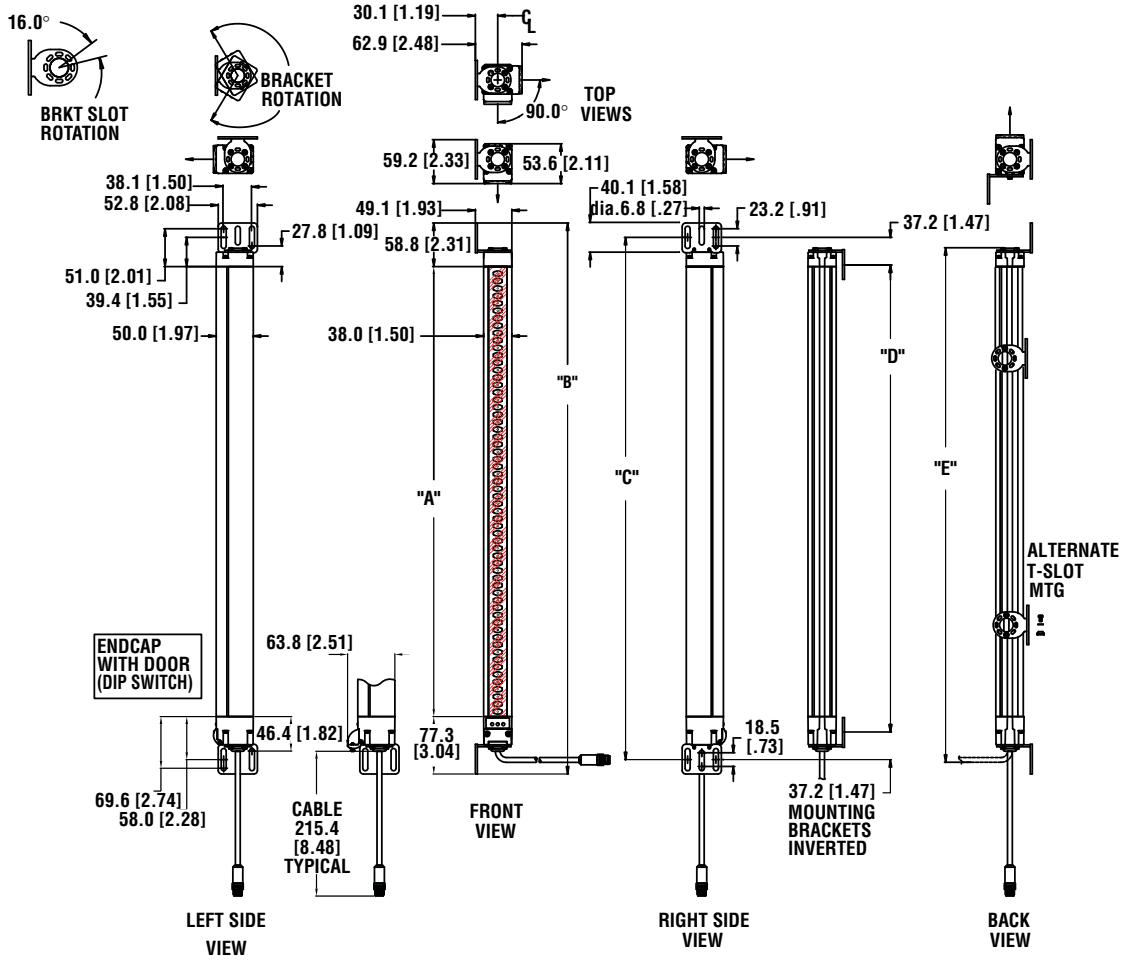
FGR series relays provide force-guided outputs for machine control.

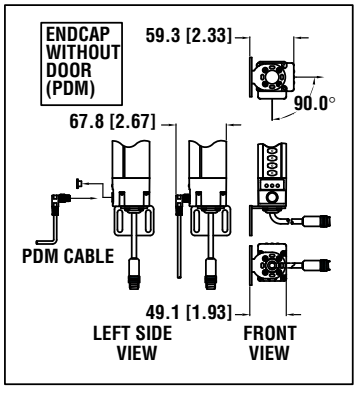


Dimensions

(mm/in.)

MS4800





How to Calculate System Dimensions:

Example: MS4800S-30-0720

0720 represents a sensing field of 720 mm

Dimension A = sensing field
Dimension B = A + 136.0 mm
Dimension C = A + 97.3 mm
Dimension D = A + 22.9 mm
Dimension E = A + 86.9 mm

MS4800 Series	A (mm)	A (in)
MS48-X/R-0280	284.4	11.19
MS48-X/R-0320	324.8	12.79
MS48-X/R-0360	364.5	14.35
MS48-X/R-0400	404.2	15.91
MS48-X/R-0440	443.9	17.48
MS48-X/R-0480	484.3	19.07
MS48-X/R-0520	523.4	20.61
MS48-X/R-0560	563.7	22.19
MS48-X/R-0600	604.1	23.78
MS48-X/R-0640	643.9	25.35
MS48-X/R-0680	683.6	26.91
MS48-X/R-0720	724.0	28.50
MS48-X/R-0760	763.0	30.04
MS48-X/R-0800	803.5	31.63
MS48-X/R-0840	843.8	33.22
MS48-X/R-0880	882.8	34.76

MS4800 Series	A (mm)	A (in)
MS48-X/R-0920	922.5	36.32
MS48-X/R-0960	963.6	37.94
MS48-X/R-1000	1002.6	39.47
MS48-X/R-1040	1042.9	41.06
MS48-X/R-1080	1083.9	42.67
MS48-X/R-1120	1122.3	44.19
MS48-X/R-1160	1162.7	45.78
MS48-X/R-1200	1203.8	47.39
MS48-X/R-1240	1242.1	48.90
MS48-X/R-1280	1281.8	50.47
MS48-X/R-1320	1323.6	52.11
MS48-X/R-1360	1362.0	53.62
MS48-X/R-1400	1401.7	55.18
MS48-X/R-1440	1443.4	56.83
MS48-X/R-1480	1481.8	58.34
MS48-X/R-1520	1521.5	59.90

MS4800 Series	A (mm)	A (in)
MS48-X/R-1560	1563.3	61.55
MS48-X/R-1600	1600.9	63.03
MS48-X/R-1640	1641.3	64.62
MS48-X/R-1680	1683.1	66.26
MS48-X/R-1720	1720.8	67.75
MS48-X/R-1760	1760.5	69.31
MS48-X/R-1800	1802.9	70.98
MS48-X/R-1840	1840.6	72.46
MS48-X/R-1880	1880.3	74.03
MS48-X/R-1920	1922.8	75.70
MS48-X/R-1960	1960.4	77.18
MS48-X/R-2000	2000.1	78.75
MS48-X/R-2040	2042.6	80.42
MS48-X/R-2080	2079.6	81.87
MS48-X/R-2120	2120.0	83.46

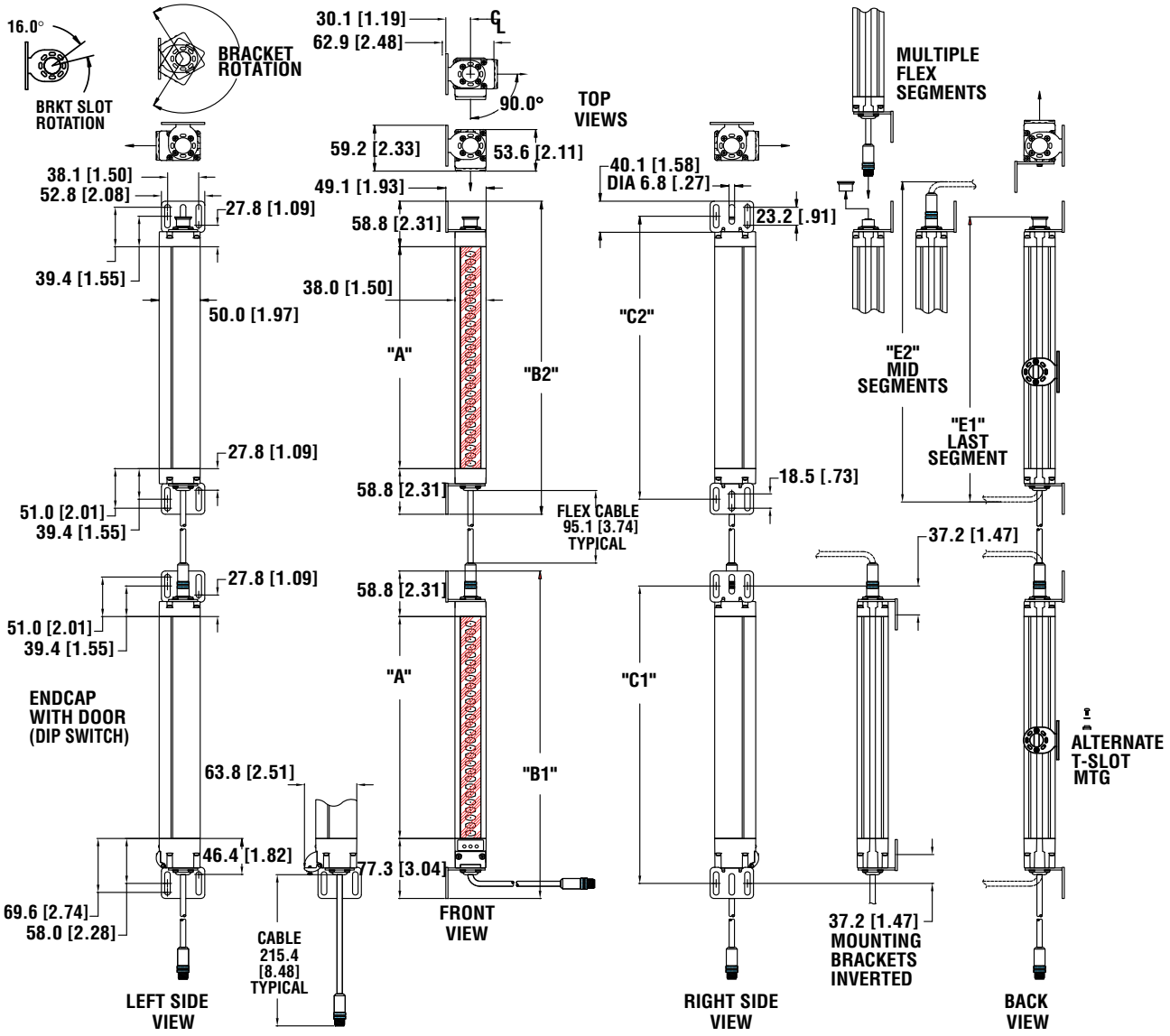
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Dimensions (continued)

(mm/in.)

MSF4800



How to Calculate System Dimensions:

Example: MSF4800-S-30-0720

0720 represents a sensing field of 720 mm

Dimension A = sensing field
Dimension B1 = A + 136.0 mm
Dimension B2 = A + 117.5 mm
Dimension C1 = A + 97.3 mm
Dimensions C2 = A + 78.7 mm
Dimension D = A + 155.6 mm
Dimension E1= A + 83.3 mm
Dimension E2 = A + 137.0 mm

MSF4800 Series	A (mm)	A (in)
MSF48-X/R-0240	244.6	9.63
MSF48-X/R-0280	284.4	11.19
MSF48-X/R-0320	324.8	12.79
MSF48-X/R-0360	364.5	14.35
MSF48-X/R-0400	404.2	15.91
MSF48-X/R-0440	443.9	17.48
MSF48-X/R-0480	484.3	19.07
MSF48-X/R-0520	523.4	20.61
MSF48-X/R-0560	563.7	22.19
MSF48-X/R-0600	604.1	23.78
MSF48-X/R-0640	643.9	25.35
MSF48-X/R-0680	683.6	26.91
MSF48-X/R-0720	724.0	28.50
MSF48-X/R-0760	763.0	30.04
MSF48-X/R-0800	803.5	31.63
MSF48-X/R-0840	843.8	33.22

MSF4800 Series	A (mm)	A (in)
MSF48-X/R-0880	882.8	34.76
MSF48-X/R-0920	922.5	36.32
MSF48-X/R-0960	963.6	37.94
MSF48-X/R-1000	1002.6	39.47
MSF48-X/R-1040	1042.9	41.06
MSF48-X/R-1080	1083.9	42.67
MSF48-X/R-1120	1122.3	44.19
MSF48-X/R-1160	1162.7	45.78
MSF48-X/R-1200	1203.8	47.39
MSF48-X/R-1240	1242.1	48.90
MSF48-X/R-1280	1281.8	50.47
MSF48-X/R-1320	1323.6	52.11
MSF48-X/R-1360	1362.0	53.62
MSF48-X/R-1400	1401.7	55.18
MSF48-X/R-1440	1443.4	56.83
MSF48-X/R-1480	1481.8	58.34

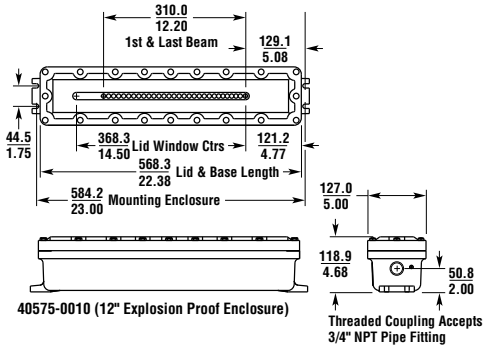
MSF4800 Series	A (mm)	A (in)
MSF48-X/R-1520	1521.5	59.90
MSF48-X/R-1560	1563.3	61.55
MSF48-X/R-1600	1600.9	63.03
MSF48-X/R-1640	1641.3	64.62
MSF48-X/R-1680	1683.1	66.26
MSF48-X/R-1720	1720.8	67.75
MSF48-X/R-1760	1760.5	69.31
MSF48-X/R-1800	1802.9	70.98
MSF48-X/R-1840	1840.6	72.46
MSF48-X/R-1880	1880.3	74.03
MSF48-X/R-1920	1922.8	75.70
MSF48-X/R-1960	1960.4	77.18
MSF48-X/R-2000	2000.1	78.75
MSF48-X/R-2040	2042.6	80.42
MSF48-X/R-2080	2079.6	81.87
MSF48-X/R-2120	2120.0	83.46

Dimensions (continued)

(mm/in.)

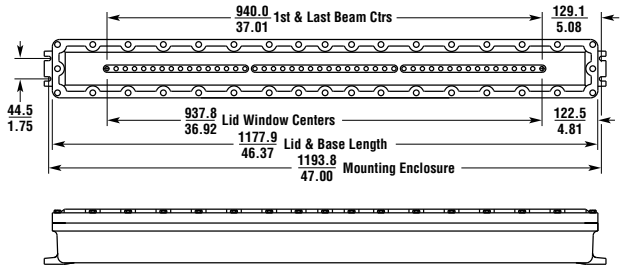
MS4800 Explosion-Proof Enclosures

MS4800-EPKT-0320
(Use with MS48-14/20/30/40-0320)



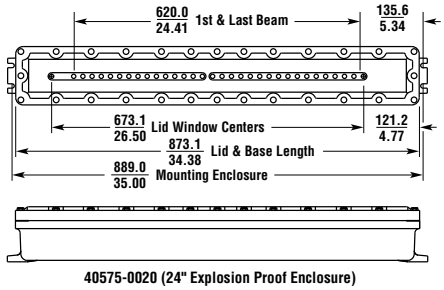
40575-0010 (12" Explosion Proof Enclosure)

MS4800-EPKT-0960
(Use with MS48-30-0960)



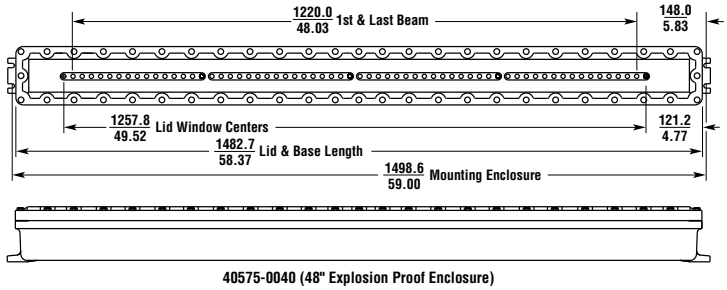
40575-0030 (36" Explosion Proof Enclosure)

MS4800-EPKT-0640
(Use with MS48-30-0640)



40575-0020 (24" Explosion Proof Enclosure)

MS4800-EPKT-1240
(Use with MS48-30-1240)



40575-0040 (48" Explosion Proof Enclosure)

Additional Components to Complete Your System

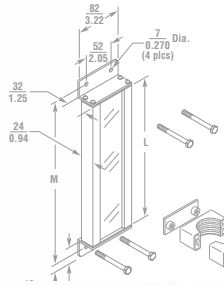
To complete your system, we offer a complete range of accessories, including:

- Mirrors
- Shock Mount Kits
- Laser Alignment Tool
- Power Supplies
- Reset Switches
- Heavy Duty Floor Stands
- Light Duty Floor Stands
- Test Objects
- Weld Slag Protective Shields
- IP67 Enclosures

We offer a COMPLETE Line of Accessories



Floor Stands



Mirrors and Mounting Brackets

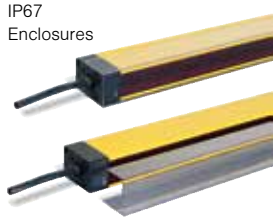


Reset Switches

IP67 Enclosures



Laser Alignment Tool



Weld Slag Protective Shields

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering

To order a MiniSafe MS4800 system, simply fill in the fields by matching each number to the following tables and selecting the parameters right for your application.

No new kit configurations will be created after May 15, 2014. After May 15, new kit configurations will need to be ordered by the individual part numbers as per the De-configured Parts List examples. Individual model numbers for all parts are listed in the tables. All pre-existing kits will continue to be available.

MS4800 Sequence:

____-____-____-____X-____R-____-____

❶ ❷ ❸ ❹ ❹ ❻ ❼

Example: MS4800A-30-0600-10X-10R-RMX-P

This 4800 has: 30 mm resolution, 600 mm coverage height, 10 m transmitter and receiver cables, RM-X resource module, and a PDM module.

De-configured Parts List:

MS4800A-30-0600	RM-X
MS4800-CBLTX-10M	MS4800-PDM
MS4800-CBLRX-10M	

MSF4800 Sequence:

____-____-____-____-____-____X-____R-____XI-____RI-____-____

❶ ❷ ❸ ❷ ❸ ❹ ❹ ❺ ❺ ❻ ❼

Example: MSF4800A-20-0600-30-0440-10X-10R-010XI-030RI-RM610-P

This 4800 has: 20 mm resolution, 600 mm coverage height on 1st segment, 30 mm resolution, 440 mm coverage height on 2nd segment, 10 m transmitter and receiver cables, one 1 m and one 3 m interconnect cables, RM-6 muting module with 10 m cable, and a PDM module.

De-configured Parts List:

MSF4800A-20-0600	MS4800-CBLMT-10M
MSF4800-30-0440-XR2	MS4800-RM6
MS4800-CBLTX-10M	MS4800-PDM
MS4800-CBLRX-10M	
MS4800-CBLTXIC-01M	
MS4800-CBLRXIC-03M	

❶ Information required. Represents the system type.

Designator	Description
MS4800A	Advanced, PDM configured
MS4800B	Basic, PDM configured
MS4800S	Standard, switch configured
MSF4800A	Advanced-Cascadable, PDM configured
MSF4800B	Basic-Cascadable, PDM configured
MSF4800S	Standard-Cascadable, switch configured

Note 1: The MSF4800A and MSF4800S cascaded versions are required for use with RM-6 muting modules, a second segment is not required.
Note 2: MSF4800 cascaded versions are limited to a maximum of four segments or 256 beams. The interconnect cables are limited to 10 m between segments.

❷ Information required. Represents the minimum object resolution of the system.

Designator	Minimum Object Resolution
14	14 mm (0.55 in.)
20	20 mm (0.79 in)
30	30 mm (1.18 in.)
40	40 mm (1.57 in.)

Ordering (continued)

❸ Information required. Represents coverage heights of the light curtain in millimeters. Coverage heights available are a function of minimum object resolution. Designators are described below and divided into three sections, those for 12 & 14 mm resolutions, 30 mm resolutions, and 40 mm resolutions.

14 mm & 20 mm Minimum Object Resolution Systems

Designator	Coverage Height	No. of Beams
0240**	240 mm (9.4 in.)	24
0280	280 mm (11.0 in.)	28
0320	320 mm (12.6 in.)	32
0360	360 mm (14.1 in.)	36
0400	400 mm (15.7 in.)	40
0440	440 mm (17.3 in.)	44
0480	480 mm (18.9 in.)	48
0520	520 mm (20.5 in.)	52
0560	560 mm (22.0 in.)	56
0600	600 mm (23.6 in.)	60
0640	640 mm (25.2 in.)	64
0680	680 mm (26.8 in.)	68
0720	720 mm (28.3 in.)	72
0760	760 mm (29.9 in.)	76
0800	800 mm (31.5 in.)	80
0840	840 mm (33.0 in.)	84
0880	880 mm (34.6 in.)	88
0920	920 mm (36.2 in.)	92
0960	960 mm (37.8 in.)	96
1000	1000 mm (39.4 in.)	100
1040	1040 mm (40.9 in.)	104
1080	1080 mm (42.5 in.)	108
1120	1120 mm (44.1 in.)	112
1160	1160 mm (45.8 in.)	116
1200	1200 mm (47.2 in.)	120
1240	1240 mm (48.8 in.)	124
1280	1280 mm (50.4 in.)	128
1320*	1320 mm (52.0 in.)	132
1360*	1360 mm (53.5 in.)	136
1400*	1400 mm (55.1 in.)	140
1440*	1440 mm (56.7 in.)	144
1480*	1480 mm (58.3 in.)	148
1520*	1520 mm (59.8 in.)	152
1560*	1560 mm (61.4 in.)	156
1600*	1600 mm (63.0 in.)	160
1640*	1640 mm (64.6 in.)	164
1680*	1680 mm (66.1 in.)	168
1720*	1720 mm (67.7 in.)	172
1760*	1760 mm (69.3 in.)	176
1800*	1800 mm (70.9 in.)	180

*Not available for X2/R2 mid-segment configurations.
**Only available as an X2/R2 mid-segment.

30 mm Minimum Object Resolution Systems

Designator	Coverage Height	No. of Beams
0240**	240 mm (9.4 in.)	12
0280	280 mm (11.0 in.)	14
0320	320 mm (12.6 in.)	16
0360	360 mm (14.1 in.)	18
0400	400 mm (15.7 in.)	20
0440	440 mm (17.3 in.)	22
0480	480 mm (18.9 in.)	24
0520	520 mm (20.5 in.)	26
0560	560 mm (22.0 in.)	28
0600	600 mm (23.6 in.)	30
0640	640 mm (25.2 in.)	32
0680	680 mm (26.8 in.)	34
0720	720 mm (28.3 in.)	36
0760	760 mm (29.9 in.)	38
0800	800 mm (31.5 in.)	40
0840	840 mm (33.0 in.)	42
0880	880 mm (34.6 in.)	44
0920	920 mm (36.2 in.)	46
0960	960 mm (37.8 in.)	48
1000	1000 mm (39.4 in.)	50
1040	1040 mm (40.9 in.)	52
1080	1080 mm (42.5 in.)	54
1120	1120 mm (44.1 in.)	56
1160	1160 mm (45.8 in.)	58
1200	1200 mm (47.2 in.)	60
1240	1240 mm (48.8 in.)	62
1280	1280 mm (50.4 in.)	64
1320	1320 mm (52.0 in.)	66
1360	1360 mm (53.5 in.)	68
1400	1400 mm (55.1 in.)	70
1440	1440 mm (56.7 in.)	72
1480	1480 mm (58.3 in.)	74
1520	1520 mm (59.8 in.)	76
1560	1560 mm (61.4 in.)	78
1600	1600 mm (63.0 in.)	80
1640	1640 mm (64.6 in.)	82
1680	1680 mm (66.1 in.)	84
1720	1720 mm (67.7 in.)	86
1760	1760 mm (69.3 in.)	88
1800	1800 mm (70.9 in.)	90
1840	1840 mm (72.4 in.)	92
1880	1880 mm (74.0 in.)	94
1920	1920 mm (75.6 in.)	96
1960	1960 mm (77.2 in.)	98
2000	2000 mm (78.7 in.)	100
2040	2040 mm (80.3 in.)	102
2080	2080 mm (81.9 in.)	104
2120	2120 mm (83.5 in.)	106

40 mm Minimum Object Resolution Systems

Designator	Coverage Height	No. of Beams
0360	360 mm (14.1 in.)	12
0480	480 mm (18.9 in.)	16
0600	600 mm (23.6 in.)	20
0720	720 mm (28.3 in.)	24
0840	840 mm (33.0 in.)	28
0960	960 mm (37.8 in.)	32
1080	1080 mm (42.5 in.)	36
1200	1200 mm (47.2 in.)	40
1320	1320 mm (52.0 in.)	44
1440	1440 mm (56.7 in.)	48
1560	1560 mm (61.4 in.)	52
1680	1680 mm (66.1 in.)	56
1800	1800 mm (70.9 in.)	60
1920	1920 mm (75.6 in.)	64
2040	2040 mm (80.3 in.)	68

❹ Information optional. Represents transmitter (X) and receiver (R) cable lengths. Cables can be shortened in the field.

Designator	Description
10	10 m (33 ft.)
15	15 m (49 ft.)
30	30 m (99 ft.)
(Blank)	No cables

❺ Information optional. Represents transmitter and receiver interconnect cable length for MSF4800 systems. Each segment comes with a 6-inch "pigtail." If additional cable is needed, it can be ordered in the lengths given below. MSF4800 transmitters and receivers use identical quick-disconnect cables. Be sure to specify the length for each cable you need. For example, "-050XI-100RI" specifies one 5 m transmitter and one 10 m receiver interconnect cable.

Designator	Description
003	0.3 m (12 in.)
005	0.5 m (20 in.)
010	1 m (3.3 ft.)
020	2 m (6.6 ft.)
030	3 m (10 ft.)
050	5 m (16 ft.)
100	10 m (33 ft.)
(Blank)	No cables

❻ Information optional. Indicates optional Quick fixed blanking option (only applicable to MS/MSF4800S versions).

Designator	Description
SB1	Quick fixed blanking option (for MS/MSF4800S only)
(Blank)	No option

❼ Information optional. Indicates optional RM resource module. (Note: Multiple modules may be selected.)

Designator	Description
RMX	Include RM-X resource module
RM2A	Include RM-2AC resource module
RM2AP	Include RM-2AC-IP resource module
RM-2APB	Include RM-2AC-IP-SB1 resource module (for use with SB1 option)
RM610	Include RM-6 muting module and 10 m cable for MSF4800
RM615	Include RM-6 muting module and 15 m cable for MSF4800
RM630	Include RM-6 muting module and 30 m cable for MSF4800
P	Include PDM (Programming Diagnostic Module only for MS/MSF4800 A and B)
(Blank)	No RM series resource module

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering (continued)

Model Numbers

ADVANCED PDM (Programming Diagnostic Module) CONFIGURED

14 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MS4800A-14-0280	28	280 (11.0)
MS4800A-14-0320	32	320 (12.6)
MS4800A-14-0360	36	360 (14.1)
MS4800A-14-0400	40	400 (15.7)
MS4800A-14-0440	44	440 (17.3)
MS4800A-14-0480	48	480 (18.9)
MS4800A-14-0520	52	520 (20.5)
MS4800A-14-0560	56	560 (22.0)
MS4800A-14-0600	60	600 (23.6)
MS4800A-14-0640	64	640 (25.2)
MS4800A-14-0680	68	680 (26.8)
MS4800A-14-0720	72	720 (28.3)
MS4800A-14-0760	76	760 (29.9)
MS4800A-14-0800	80	800 (31.5)
MS4800A-14-0840	84	840 (33.0)
MS4800A-14-0880	88	880 (34.6)
MS4800A-14-0920	92	920 (36.2)
MS4800A-14-0960	96	960 (37.8)
MS4800A-14-1000	100	1000 (39.4)
MS4800A-14-1040	104	1040 (40.9)
MS4800A-14-1080	108	1080 (42.5)
MS4800A-14-1120	112	1120 (44.1)
MS4800A-14-1160	116	1160 (45.8)
MS4800A-14-1200	116	1200 (47.2)
MS4800A-14-1240	120	1240 (48.8)
MS4800A-14-1280	128	1280 (50.4)
MS4800A-14-1320	132	1320 (52.0)
MS4800A-14-1360	136	1360 (53.5)
MS4800A-14-1400	140	1400 (55.1)
MS4800A-14-1440	144	1440 (56.7)
MS4800A-14-1480	148	1480 (58.3)
MS4800A-14-1520	152	1520 (59.8)
MS4800A-14-1560	156	1560 (61.4)
MS4800A-14-1600	160	1600 (63.0)
MS4800A-14-1640	164	1640 (64.6)
MS4800A-14-1680	168	1680 (66.1)
MS4800A-14-1720	172	1720 (67.7)
MS4800A-14-1760	176	1760 (69.3)
MS4800A-14-1800	180	1800 (70.9)

20 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MS4800A-20-0280	28	280 (11.0)
MS4800A-20-0320	32	320 (12.6)
MS4800A-20-0360	36	360 (14.1)
MS4800A-20-0400	40	400 (15.7)
MS4800A-20-0440	44	440 (17.3)
MS4800A-20-0480	48	480 (18.9)
MS4800A-20-0520	52	520 (20.5)
MS4800A-20-0560	56	560 (22.0)
MS4800A-20-0600	60	600 (23.6)
MS4800A-20-0640	64	640 (25.2)
MS4800A-20-0680	68	680 (26.8)
MS4800A-20-0720	72	720 (28.3)
MS4800A-20-0760	76	760 (29.9)
MS4800A-20-0800	80	800 (31.5)
MS4800A-20-0840	84	840 (33.0)
MS4800A-20-0880	88	880 (34.6)
MS4800A-20-0920	92	920 (36.2)
MS4800A-20-0960	96	960 (37.8)
MS4800A-20-1000	100	1000 (39.4)
MS4800A-20-1040	104	1040 (40.9)
MS4800A-20-1080	108	1080 (42.5)
MS4800A-20-1120	112	1120 (44.1)
MS4800A-20-1160	116	1160 (45.8)
MS4800A-20-1200	116	1200 (47.2)
MS4800A-20-1240	120	1240 (48.8)
MS4800A-20-1280	128	1280 (50.4)
MS4800A-20-1320	132	1320 (52.0)
MS4800A-20-1360	136	1360 (53.5)
MS4800A-20-1400	140	1400 (55.1)
MS4800A-20-1440	144	1440 (56.7)
MS4800A-20-1480	148	1480 (58.3)
MS4800A-20-1520	152	1520 (59.8)
MS4800A-20-1560	156	1560 (61.4)
MS4800A-20-1600	160	1600 (63.0)
MS4800A-20-1640	164	1640 (64.6)
MS4800A-20-1680	168	1680 (66.1)
MS4800A-20-1720	172	1720 (67.7)
MS4800A-20-1760	176	1760 (69.3)
MS4800A-20-1800	180	1800 (70.9)

30 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MS4800A-30-0280	14	280 (11.0)
MS4800A-30-0320	16	320 (12.6)
MS4800A-30-0360	18	360 (14.1)
MS4800A-30-0400	20	400 (15.7)
MS4800A-30-0440	22	440 (17.3)
MS4800A-30-0480	24	480 (18.9)
MS4800A-30-0520	26	520 (20.5)
MS4800A-30-0560	28	560 (22.0)
MS4800A-30-0600	30	600 (23.6)
MS4800A-30-0640	32	640 (25.2)
MS4800A-30-0680	34	680 (26.8)
MS4800A-30-0720	36	720 (28.3)
MS4800A-30-0760	38	760 (29.9)
MS4800A-30-0800	40	800 (31.5)
MS4800A-30-0840	42	840 (33.0)
MS4800A-30-0880	44	880 (34.6)
MS4800A-30-0920	46	920 (36.2)
MS4800A-30-0960	48	960 (37.8)
MS4800A-30-1000	50	1000 (39.4)
MS4800A-30-1040	52	1040 (40.9)
MS4800A-30-1080	54	1080 (42.5)
MS4800A-30-1120	56	1120 (44.1)
MS4800A-30-1160	58	1160 (45.8)
MS4800A-30-1200	60	1200 (47.2)
MS4800A-30-1240	62	1240 (48.8)
MS4800A-30-1280	64	1280 (50.4)
MS4800A-30-1320	66	1320 (52.0)
MS4800A-30-1360	68	1360 (53.5)
MS4800A-30-1400	70	1400 (55.1)
MS4800A-30-1440	72	1440 (56.7)
MS4800A-30-1480	74	1480 (58.3)
MS4800A-30-1520	76	1520 (59.8)
MS4800A-30-1560	78	1560 (61.4)
MS4800A-30-1600	80	1600 (63.0)
MS4800A-30-1640	82	1640 (64.6)
MS4800A-30-1680	84	1680 (66.1)
MS4800A-30-1720	86	1720 (67.7)
MS4800A-30-1760	88	1760 (69.3)
MS4800A-30-1800	90	1800 (70.9)
MS4800A-30-1840	92	1840 (72.4)
MS4800A-30-1880	94	1880 (74.0)
MS4800A-30-1920	96	1920 (75.6)
MS4800A-30-1960	98	1960 (77.2)
MS4800A-30-2000	100	2000 (78.7)
MS4800A-30-2040	102	2040 (80.3)
MS4800A-30-2080	104	2080 (81.9)
MS4800A-30-2120	106	2120 (83.5)

40 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MS4800A-40-0360	12	360 (14.1)
MS4800A-40-0480	16	480 (18.9)
MS4800A-40-0600	20	600 (23.6)
MS4800A-40-0720	24	720 (28.3)
MS4800A-40-0840	28	840 (33.0)
MS4800A-40-0960	32	960 (37.8)
MS4800A-40-1080	36	1080 (42.5)
MS4800A-40-1200	40	1200 (47.2)
MS4800A-40-1320	44	1320 (52.0)
MS4800A-40-1440	48	1440 (56.7)
MS4800A-40-1560	52	1560 (61.4)
MS4800A-40-1680	56	1680 (66.1)
MS4800A-40-1800	60	1800 (70.9)
MS4800A-40-1920	64	1920 (75.6)
MS4800A-40-2040	68	2040 (80.3)

Ordering (continued)

Model Numbers (continued)

BASIC PDM (Programming Diagnostic Module) CONFIGURED

14 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MS4800B-14-0280	28	280 (11.0)
MS4800B-14-0320	32	320 (12.6)
MS4800B-14-0360	36	360 (14.1)
MS4800B-14-0400	40	400 (15.7)
MS4800B-14-0440	44	440 (17.3)
MS4800B-14-0480	48	480 (18.9)
MS4800B-14-0520	52	520 (20.5)
MS4800B-14-0560	56	560 (22.0)
MS4800B-14-0600	60	600 (23.6)
MS4800B-14-0640	64	640 (25.2)
MS4800B-14-0680	68	680 (26.8)
MS4800B-14-0720	72	720 (28.3)
MS4800B-14-0760	76	760 (29.9)
MS4800B-14-0800	80	800 (31.5)
MS4800B-14-0840	84	840 (33.0)
MS4800B-14-0880	88	880 (34.6)
MS4800B-14-0920	92	920 (36.2)
MS4800B-14-0960	96	960 (37.8)
MS4800B-14-1000	100	1000 (39.4)
MS4800B-14-1040	104	1040 (40.9)
MS4800B-14-1080	108	1080 (42.5)
MS4800B-14-1120	112	1120 (44.1)
MS4800B-14-1160	116	1160 (45.8)
MS4800B-14-1200	116	1200 (47.2)
MS4800B-14-1240	120	1240 (48.8)
MS4800B-14-1280	128	1280 (50.4)
MS4800B-14-1320	132	1320 (52.0)
MS4800B-14-1360	136	1360 (53.5)
MS4800B-14-1400	140	1400 (55.1)
MS4800B-14-1440	144	1440 (56.7)
MS4800B-14-1480	148	1480 (58.3)
MS4800B-14-1520	152	1520 (59.8)
MS4800B-14-1560	156	1560 (61.4)
MS4800B-14-1600	160	1600 (63.0)
MS4800B-14-1640	164	1640 (64.6)
MS4800B-14-1680	168	1680 (66.1)
MS4800B-14-1720	172	1720 (67.7)
MS4800B-14-1760	176	1760 (69.3)
MS4800B-14-1800	180	1800 (70.9)

20 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MS4800B-20-0280	28	280 (11.0)
MS4800B-20-0320	32	320 (12.6)
MS4800B-20-0360	36	360 (14.1)
MS4800B-20-0400	40	400 (15.7)
MS4800B-20-0440	44	440 (17.3)
MS4800B-20-0480	48	480 (18.9)
MS4800B-20-0520	52	520 (20.5)
MS4800B-20-0560	56	560 (22.0)
MS4800B-20-0600	60	600 (23.6)
MS4800B-20-0640	64	640 (25.2)
MS4800B-20-0680	68	680 (26.8)
MS4800B-20-0720	72	720 (28.3)
MS4800B-20-0760	76	760 (29.9)
MS4800B-20-0800	80	800 (31.5)
MS4800B-20-0840	84	840 (33.0)
MS4800B-20-0880	88	880 (34.6)
MS4800B-20-0920	92	920 (36.2)
MS4800B-20-0960	96	960 (37.8)
MS4800B-20-1000	100	1000 (39.4)
MS4800B-20-1040	104	1040 (40.9)
MS4800B-20-1080	108	1080 (42.5)
MS4800B-20-1120	112	1120 (44.1)
MS4800B-20-1160	116	1160 (45.8)
MS4800B-20-1200	116	1200 (47.2)
MS4800B-20-1240	120	1240 (48.8)
MS4800B-20-1280	128	1280 (50.4)
MS4800B-20-1320	132	1320 (52.0)
MS4800B-20-1360	136	1360 (53.5)
MS4800B-20-1400	140	1400 (55.1)
MS4800B-20-1440	144	1440 (56.7)
MS4800B-20-1480	148	1480 (58.3)
MS4800B-20-1520	152	1520 (59.8)
MS4800B-20-1560	156	1560 (61.4)
MS4800B-20-1600	160	1600 (63.0)
MS4800B-20-1640	164	1640 (64.6)
MS4800B-20-1680	168	1680 (66.1)
MS4800B-20-1720	172	1720 (67.7)
MS4800B-20-1760	176	1760 (69.3)
MS4800B-20-1800	180	1800 (70.9)

30 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MS4800B-30-0280	14	280 (11.0)
MS4800B-30-0320	16	320 (12.6)
MS4800B-30-0360	18	360 (14.1)
MS4800B-30-0400	20	400 (15.7)
MS4800B-30-0440	22	440 (17.3)
MS4800B-30-0480	24	480 (18.9)
MS4800B-30-0520	26	520 (20.5)
MS4800B-30-0560	28	560 (22.0)
MS4800B-30-0600	30	600 (23.6)
MS4800B-30-0640	32	640 (25.2)
MS4800B-30-0680	34	680 (26.8)
MS4800B-30-0720	36	720 (28.3)
MS4800B-30-0760	38	760 (29.9)
MS4800B-30-0800	40	800 (31.5)
MS4800B-30-0840	42	840 (33.0)
MS4800B-30-0880	44	880 (34.6)
MS4800B-30-0920	46	920 (36.2)
MS4800B-30-0960	48	960 (37.8)
MS4800B-30-1000	50	1000 (39.4)
MS4800B-30-1040	52	1040 (40.9)
MS4800B-30-1080	54	1080 (42.5)
MS4800B-30-1120	56	1120 (44.1)
MS4800B-30-1160	58	1160 (45.8)
MS4800B-30-1200	60	1200 (47.2)
MS4800B-30-1240	62	1240 (48.8)
MS4800B-30-1280	64	1280 (50.4)
MS4800B-30-1320	66	1320 (52.0)
MS4800B-30-1360	68	1360 (53.5)
MS4800B-30-1400	70	1400 (55.1)
MS4800B-30-1440	72	1440 (56.7)
MS4800B-30-1480	74	1480 (58.3)
MS4800B-30-1520	76	1520 (59.8)
MS4800B-30-1560	78	1560 (61.4)
MS4800B-30-1600	80	1600 (63.0)
MS4800B-30-1640	82	1640 (64.6)
MS4800B-30-1680	84	1680 (66.1)
MS4800B-30-1720	86	1720 (67.7)
MS4800B-30-1760	88	1760 (69.3)
MS4800B-30-1800	90	1800 (70.9)
MS4800B-30-1840	92	1840 (72.4)
MS4800B-30-1880	94	1880 (74.0)
MS4800B-30-1920	96	1920 (75.6)
MS4800B-30-1960	98	1960 (77.2)
MS4800B-30-2000	100	2000 (78.7)
MS4800B-30-2040	102	2040 (80.3)
MS4800B-30-2080	104	2080 (81.9)
MS4800B-30-2120	106	2120 (83.5)

40 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MS4800B-40-0360	12	360 (14.1)
MS4800B-40-0480	16	480 (18.9)
MS4800B-40-0600	20	600 (23.6)
MS4800B-40-0720	24	720 (28.3)
MS4800B-40-0840	28	840 (33.0)
MS4800B-40-0960	32	960 (37.8)
MS4800B-40-1080	36	1080 (42.5)
MS4800B-40-1200	40	1200 (47.2)
MS4800B-40-1320	44	1320 (52.0)
MS4800B-40-1440	48	1440 (56.7)
MS4800B-40-1560	52	1560 (61.4)
MS4800B-40-1680	56	1680 (66.1)
MS4800B-40-1800	60	1800 (70.9)
MS4800B-40-1920	64	1920 (75.6)
MS4800B-40-2040	68	2040 (80.3)

Ordering (continued)

Model Numbers (continued)

STANDARD SWITCH CONFIGURED

14 mm Object Resolution		
Model	No. of Beams	Protective Height, in. (mm)
MS4800S-14-0280	28	280 (11.0)
MS4800S-14-0320	32	320 (12.6)
MS4800S-14-0360	36	360 (14.1)
MS4800S-14-0400	40	400 (15.7)
MS4800S-14-0440	44	440 (17.3)
MS4800S-14-0480	48	480 (18.9)
MS4800S-14-0520	52	520 (20.5)
MS4800S-14-0560	56	560 (22.0)
MS4800S-14-0600	60	600 (23.6)
MS4800S-14-0640	64	640 (25.2)
MS4800S-14-0680	68	680 (26.8)
MS4800S-14-0720	72	720 (28.3)
MS4800S-14-0760	76	760 (29.9)
MS4800S-14-0800	80	800 (31.5)
MS4800S-14-0840	84	840 (33.0)
MS4800S-14-0880	88	880 (34.6)
MS4800S-14-0920	92	920 (36.2)
MS4800S-14-0960	96	960 (37.8)
MS4800S-14-1000	100	1000 (39.4)
MS4800S-14-1040	104	1040 (40.9)
MS4800S-14-1080	108	1080 (42.5)
MS4800S-14-1120	112	1120 (44.1)
MS4800S-14-1160	116	1160 (45.8)
MS4800S-14-1200	116	1200 (47.2)
MS4800S-14-1240	120	1240 (48.8)
MS4800S-14-1280	128	1280 (50.4)
MS4800S-14-1320	132	1320 (52.0)
MS4800S-14-1360	136	1360 (53.5)
MS4800S-14-1400	140	1400 (55.1)
MS4800S-14-1440	144	1440 (56.7)
MS4800S-14-1480	148	1480 (58.3)
MS4800S-14-1520	152	1520 (59.8)
MS4800S-14-1560	156	1560 (61.4)
MS4800S-14-1600	160	1600 (63.0)
MS4800S-14-1640	164	1640 (64.6)
MS4800S-14-1680	168	1680 (66.1)
MS4800S-14-1720	172	1720 (67.7)
MS4800S-14-1760	176	1760 (69.3)
MS4800S-14-1800	180	1800 (70.9)

20 mm Object Resolution		
Model	No. of Beams	Protective Height, in. (mm)
MS4800S-20-0280	28	280 (11.0)
MS4800S-20-0320	32	320 (12.6)
MS4800S-20-0360	36	360 (14.1)
MS4800S-20-0400	40	400 (15.7)
MS4800S-20-0440	44	440 (17.3)
MS4800S-20-0480	48	480 (18.9)
MS4800S-20-0520	52	520 (20.5)
MS4800S-20-0560	56	560 (22.0)
MS4800S-20-0600	60	600 (23.6)
MS4800S-20-0640	64	640 (25.2)
MS4800S-20-0680	68	680 (26.8)
MS4800S-20-0720	72	720 (28.3)
MS4800S-20-0760	76	760 (29.9)
MS4800S-20-0800	80	800 (31.5)
MS4800S-20-0840	84	840 (33.0)
MS4800S-20-0880	88	880 (34.6)
MS4800S-20-0920	92	920 (36.2)
MS4800S-20-0960	96	960 (37.8)
MS4800S-20-1000	100	1000 (39.4)
MS4800S-20-1040	104	1040 (40.9)
MS4800S-20-1080	108	1080 (42.5)
MS4800S-20-1120	112	1120 (44.1)
MS4800S-20-1160	116	1160 (45.8)
MS4800S-20-1200	116	1200 (47.2)
MS4800S-20-1240	120	1240 (48.8)
MS4800S-20-1280	128	1280 (50.4)
MS4800S-20-1320	132	1320 (52.0)
MS4800S-20-1360	136	1360 (53.5)
MS4800S-20-1400	140	1400 (55.1)
MS4800S-20-1440	144	1440 (56.7)
MS4800S-20-1480	148	1480 (58.3)
MS4800S-20-1520	152	1520 (59.8)
MS4800S-20-1560	156	1560 (61.4)
MS4800S-20-1600	160	1600 (63.0)
MS4800S-20-1640	164	1640 (64.6)
MS4800S-20-1680	168	1680 (66.1)
MS4800S-20-1720	172	1720 (67.7)
MS4800S-20-1760	176	1760 (69.3)
MS4800S-20-1800	180	1800 (70.9)

30 mm Object Resolution		
Model	No. of Beams	Protective Height, in. (mm)
MS4800S-30-0280	14	280 (11.0)
MS4800S-30-0320	16	320 (12.6)
MS4800S-30-0360	18	360 (14.1)
MS4800S-30-0400	20	400 (15.7)
MS4800S-30-0440	22	440 (17.3)
MS4800S-30-0480	24	480 (18.9)
MS4800S-30-0520	26	520 (20.5)
MS4800S-30-0560	28	560 (22.0)
MS4800S-30-0600	30	600 (23.6)
MS4800S-30-0640	32	640 (25.2)
MS4800S-30-0680	34	680 (26.8)
MS4800S-30-0720	36	720 (28.3)
MS4800S-30-0760	38	760 (29.9)
MS4800S-30-0800	40	800 (31.5)
MS4800S-30-0840	42	840 (33.0)
MS4800S-30-0880	44	880 (34.6)
MS4800S-30-0920	46	920 (36.2)
MS4800S-30-0960	48	960 (37.8)
MS4800S-30-1000	50	1000 (39.4)
MS4800S-30-1040	52	1040 (40.9)
MS4800S-30-1080	54	1080 (42.5)
MS4800S-30-1120	56	1120 (44.1)
MS4800S-30-1160	58	1160 (45.8)
MS4800S-30-1200	60	1200 (47.2)
MS4800S-30-1240	62	1240 (48.8)
MS4800S-30-1280	64	1280 (50.4)
MS4800S-30-1320	66	1320 (52.0)
MS4800S-30-1360	68	1360 (53.5)
MS4800S-30-1400	70	1400 (55.1)
MS4800S-30-1440	72	1440 (56.7)
MS4800S-30-1480	74	1480 (58.3)
MS4800S-30-1520	76	1520 (59.8)
MS4800S-30-1560	78	1560 (61.4)
MS4800S-30-1600	80	1600 (63.0)
MS4800S-30-1640	82	1640 (64.6)
MS4800S-30-1680	84	1680 (66.1)
MS4800S-30-1720	86	1720 (67.7)
MS4800S-30-1760	88	1760 (69.3)
MS4800S-30-1800	90	1800 (70.9)
MS4800S-30-1840	92	1840 (72.4)
MS4800S-30-1880	94	1880 (74.0)
MS4800S-30-1920	96	1920 (75.6)
MS4800S-30-1960	98	1960 (77.2)
MS4800S-30-2000	100	2000 (78.7)
MS4800S-30-2040	102	2040 (80.3)
MS4800S-30-2080	104	2080 (81.9)
MS4800S-30-2120	106	2120 (83.5)

40 mm Object Resolution		
Model	No. of Beams	Protective Height, in. (mm)
MS4800S-40-0360	12	360 (14.1)
MS4800S-40-0480	16	480 (18.9)
MS4800S-40-0600	20	600 (23.6)
MS4800S-40-0720	24	720 (28.3)
MS4800S-40-0840	28	840 (33.0)
MS4800S-40-0960	32	960 (37.8)
MS4800S-40-1080	36	1080 (42.5)
MS4800S-40-1200	40	1200 (47.2)
MS4800S-40-1320	44	1320 (52.0)
MS4800S-40-1440	48	1440 (56.7)
MS4800S-40-1560	52	1560 (61.4)
MS4800S-40-1680	56	1680 (66.1)
MS4800S-40-1800	60	1800 (70.9)
MS4800S-40-1920	64	1920 (75.6)
MS4800S-40-2040	68	2040 (80.3)

Quick Fixed Blanking
Add "–SB1" suffix to any MS/MSF4800S version that requires Quick Fixed Blanking. i.e. MSF4800S-40-2040-SB1.

B

Ordering (continued)

Model Numbers (continued)

CASCADABLE — ADVANCED 1ST SEGMENT PDM (Programming Diagnostic Module) CONFIGURED

(Maximum of four segments or 256 total beams)

14 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MSF4800A-14-0280	28	280 (11.0)
MSF4800A-14-0320	32	320 (12.6)
MSF4800A-14-0360	36	360 (14.1)
MSF4800A-14-0400	40	400 (15.7)
MSF4800A-14-0440	44	440 (17.3)
MSF4800A-14-0480	48	480 (18.9)
MSF4800A-14-0520	52	520 (20.5)
MSF4800A-14-0560	56	560 (22.0)
MSF4800A-14-0600	60	600 (23.6)
MSF4800A-14-0640	64	640 (25.2)
MSF4800A-14-0680	68	680 (26.8)
MSF4800A-14-0720	72	720 (28.3)
MSF4800A-14-0760	76	760 (29.9)
MSF4800A-14-0800	80	800 (31.5)
MSF4800A-14-0840	84	840 (33.0)
MSF4800A-14-0880	88	880 (34.6)
MSF4800A-14-0920	92	920 (36.2)
MSF4800A-14-0960	96	960 (37.8)
MSF4800A-14-1000	100	1000 (39.4)
MSF4800A-14-1040	104	1040 (40.9)
MSF4800A-14-1080	108	1080 (42.5)
MSF4800A-14-1120	112	1120 (44.1)
MSF4800A-14-1160	116	1160 (45.8)
MSF4800A-14-1200	116	1200 (47.2)
MSF4800A-14-1240	120	1240 (48.8)
MSF4800A-14-1280	128	1280 (50.4)
MSF4800A-14-1320	132	1320 (52.0)
MSF4800A-14-1360	136	1360 (53.5)
MSF4800A-14-1400	140	1400 (55.1)
MSF4800A-14-1440	144	1440 (56.7)
MSF4800A-14-1480	148	1480 (58.3)
MSF4800A-14-1520	152	1520 (59.8)
MSF4800A-14-1560	156	1560 (61.4)
MSF4800A-14-1600	160	1600 (63.0)
MSF4800A-14-1640	164	1640 (64.6)
MSF4800A-14-1680	168	1680 (66.1)
MSF4800A-14-1720	172	1720 (67.7)
MSF4800A-14-1760	176	1760 (69.3)
MSF4800A-14-1800	180	1800 (70.9)

20 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MSF4800A-20-0280	28	280 (11.0)
MSF4800A-20-0320	32	320 (12.6)
MSF4800A-20-0360	36	360 (14.1)
MSF4800A-20-0400	40	400 (15.7)
MSF4800A-20-0440	44	440 (17.3)
MSF4800A-20-0480	48	480 (18.9)
MSF4800A-20-0520	52	520 (20.5)
MSF4800A-20-0560	56	560 (22.0)
MSF4800A-20-0600	60	600 (23.6)
MSF4800A-20-0640	64	640 (25.2)
MSF4800A-20-0680	68	680 (26.8)
MSF4800A-20-0720	72	720 (28.3)
MSF4800A-20-0760	76	760 (29.9)
MSF4800A-20-0800	80	800 (31.5)
MSF4800A-20-0840	84	840 (33.0)
MSF4800A-20-0880	88	880 (34.6)
MSF4800A-20-0920	92	920 (36.2)
MSF4800A-20-0960	96	960 (37.8)
MSF4800A-20-1000	100	1000 (39.4)
MSF4800A-20-1040	104	1040 (40.9)
MSF4800A-20-1080	108	1080 (42.5)
MSF4800A-20-1120	112	1120 (44.1)
MSF4800A-20-1160	116	1160 (45.8)
MSF4800A-20-1200	116	1200 (47.2)
MSF4800A-20-1240	120	1240 (48.8)
MSF4800A-20-1280	128	1280 (50.4)
MSF4800A-20-1320	132	1320 (52.0)
MSF4800A-20-1360	136	1360 (53.5)
MSF4800A-20-1400	140	1400 (55.1)
MSF4800A-20-1440	144	1440 (56.7)
MSF4800A-20-1480	148	1480 (58.3)
MSF4800A-20-1520	152	1520 (59.8)
MSF4800A-20-1560	156	1560 (61.4)
MSF4800A-20-1600	160	1600 (63.0)
MSF4800A-20-1640	164	1640 (64.6)
MSF4800A-20-1680	168	1680 (66.1)
MSF4800A-20-1720	172	1720 (67.7)
MSF4800A-20-1760	176	1760 (69.3)
MSF4800A-20-1800	180	1800 (70.9)

30 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MSF4800A-30-0280	14	280 (11.0)
MSF4800A-30-0320	16	320 (12.6)
MSF4800A-30-0360	18	360 (14.1)
MSF4800A-30-0400	20	400 (15.7)
MSF4800A-30-0440	22	440 (17.3)
MSF4800A-30-0480	24	480 (18.9)
MSF4800A-30-0520	26	520 (20.5)
MSF4800A-30-0560	28	560 (22.0)
MSF4800A-30-0600	30	600 (23.6)
MSF4800A-30-0640	32	640 (25.2)
MSF4800A-30-0680	34	680 (26.8)
MSF4800A-30-0720	36	720 (28.3)
MSF4800A-30-0760	38	760 (29.9)
MSF4800A-30-0800	40	800 (31.5)
MSF4800A-30-0840	42	840 (33.0)
MSF4800A-30-0880	44	880 (34.6)
MSF4800A-30-0920	46	920 (36.2)
MSF4800A-30-0960	48	960 (37.8)
MSF4800A-30-1000	50	1000 (39.4)
MSF4800A-30-1040	52	1040 (40.9)
MSF4800A-30-1080	54	1080 (42.5)
MSF4800A-30-1120	56	1120 (44.1)
MSF4800A-30-1160	58	1160 (45.8)
MSF4800A-30-1200	60	1200 (47.2)
MSF4800A-30-1240	62	1240 (48.8)
MSF4800A-30-1280	64	1280 (50.4)
MSF4800A-30-1320	66	1320 (52.0)
MSF4800A-30-1360	68	1360 (53.5)
MSF4800A-30-1400	70	1400 (55.1)
MSF4800A-30-1440	72	1440 (56.7)
MSF4800A-30-1480	74	1480 (58.3)
MSF4800A-30-1520	76	1520 (59.8)
MSF4800A-30-1560	78	1560 (61.4)
MSF4800A-30-1600	80	1600 (63.0)
MSF4800A-30-1640	82	1640 (64.6)
MSF4800A-30-1680	84	1680 (66.1)
MSF4800A-30-1720	86	1720 (67.7)
MSF4800A-30-1760	88	1760 (69.3)
MSF4800A-30-1800	90	1800 (70.9)
MSF4800A-30-1840	92	1840 (72.4)
MSF4800A-30-1880	94	1880 (74.0)
MSF4800A-30-1920	96	1920 (75.6)
MSF4800A-30-1960	98	1960 (77.2)
MSF4800A-30-2000	100	2000 (78.7)
MSF4800A-30-2040	102	2040 (80.3)
MSF4800A-30-2080	104	2080 (81.9)
MSF4800A-30-2120	106	2120 (83.5)

40 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MSF4800A-40-0360	12	360 (14.1)
MSF4800A-40-0480	16	480 (18.9)
MSF4800A-40-0600	20	600 (23.6)
MSF4800A-40-0720	24	720 (28.3)
MSF4800A-40-0840	28	840 (33.0)
MSF4800A-40-0960	32	960 (37.8)
MSF4800A-40-1080	36	1080 (42.5)
MSF4800A-40-1200	40	1200 (47.2)
MSF4800A-40-1320	44	1320 (52.0)
MSF4800A-40-1440	48	1440 (56.7)
MSF4800A-40-1560	52	1560 (61.4)
MSF4800A-40-1680	56	1680 (66.1)
MSF4800A-40-1800	60	1800 (70.9)
MSF4800A-40-1920	64	1920 (75.6)
MSF4800A-40-2040	68	2040 (80.3)

Ordering (continued)

Model Numbers (continued)

CASCADABLE –BASIC 1ST SEGMENT PDM (Programming Diagnostic Module) CONFIGURED

(Maximum of four segments or 256 total beams)

14 mm Object Resolution		
Model	No. of Beams	Protective Height, in. (mm)
MSF4800B-14-0280	28	280 (11.0)
MSF4800B-14-0320	32	320 (12.6)
MSF4800B-14-0360	36	360 (14.1)
MSF4800B-14-0400	40	400 (15.7)
MSF4800B-14-0440	44	440 (17.3)
MSF4800B-14-0480	48	480 (18.9)
MSF4800B-14-0520	52	520 (20.5)
MSF4800B-14-0560	56	560 (22.0)
MSF4800B-14-0600	60	600 (23.6)
MSF4800B-14-0640	64	640 (25.2)
MSF4800B-14-0680	68	680 (26.8)
MSF4800B-14-0720	72	720 (28.3)
MSF4800B-14-0760	76	760 (29.9)
MSF4800B-14-0800	80	800 (31.5)
MSF4800B-14-0840	84	840 (33.0)
MSF4800B-14-0880	88	880 (34.6)
MSF4800B-14-0920	92	920 (36.2)
MSF4800B-14-0960	96	960 (37.8)
MSF4800B-14-1000	100	1000 (39.4)
MSF4800B-14-1040	104	1040 (40.9)
MSF4800B-14-1080	108	1080 (42.5)
MSF4800B-14-1120	112	1120 (44.1)
MSF4800B-14-1160	116	1160 (45.8)
MSF4800B-14-1200	116	1200 (47.2)
MSF4800B-14-1240	120	1240 (48.8)
MSF4800B-14-1280	128	1280 (50.4)
MSF4800B-14-1320	132	1320 (52.0)
MSF4800B-14-1360	136	1360 (53.5)
MSF4800B-14-1400	140	1400 (55.1)
MSF4800B-14-1440	144	1440 (56.7)
MSF4800B-14-1480	148	1480 (58.3)
MSF4800B-14-1520	152	1520 (59.8)
MSF4800B-14-1560	156	1560 (61.4)
MSF4800B-14-1600	160	1600 (63.0)
MSF4800B-14-1640	164	1640 (64.6)
MSF4800B-14-1680	168	1680 (66.1)
MSF4800B-14-1720	172	1720 (67.7)
MSF4800B-14-1760	176	1760 (69.3)
MSF4800B-14-1800	180	1800 (70.9)

20 mm Object Resolution		
Model	No. of Beams	Protective Height, in. (mm)
MSF4800B-20-0280	28	280 (11.0)
MSF4800B-20-0320	32	320 (12.6)
MSF4800B-20-0360	36	360 (14.1)
MSF4800B-20-0400	40	400 (15.7)
MSF4800B-20-0440	44	440 (17.3)
MSF4800B-20-0480	48	480 (18.9)
MSF4800B-20-0520	52	520 (20.5)
MSF4800B-20-0560	56	560 (22.0)
MSF4800B-20-0600	60	600 (23.6)
MSF4800B-20-0640	64	640 (25.2)
MSF4800B-20-0680	68	680 (26.8)
MSF4800B-20-0720	72	720 (28.3)
MSF4800B-20-0760	76	760 (29.9)
MSF4800B-20-0800	80	800 (31.5)
MSF4800B-20-0840	84	840 (33.0)
MSF4800B-20-0880	88	880 (34.6)
MSF4800B-20-0920	92	920 (36.2)
MSF4800B-20-0960	96	960 (37.8)
MSF4800B-20-1000	100	1000 (39.4)
MSF4800B-20-1040	104	1040 (40.9)
MSF4800B-20-1080	108	1080 (42.5)
MSF4800B-20-1120	112	1120 (44.1)
MSF4800B-20-1160	116	1160 (45.8)
MSF4800B-20-1200	116	1200 (47.2)
MSF4800B-20-1240	120	1240 (48.8)
MSF4800B-20-1280	128	1280 (50.4)
MSF4800B-20-1320	132	1320 (52.0)
MSF4800B-20-1360	136	1360 (53.5)
MSF4800B-20-1400	140	1400 (55.1)
MSF4800B-20-1440	144	1440 (56.7)
MSF4800B-20-1480	148	1480 (58.3)
MSF4800B-20-1520	152	1520 (59.8)
MSF4800B-20-1560	156	1560 (61.4)
MSF4800B-20-1600	160	1600 (63.0)
MSF4800B-20-1640	164	1640 (64.6)
MSF4800B-20-1680	168	1680 (66.1)
MSF4800B-20-1720	172	1720 (67.7)
MSF4800B-20-1760	176	1760 (69.3)
MSF4800B-20-1800	180	1800 (70.9)

30 mm Object Resolution		
Model	No. of Beams	Protective Height, in. (mm)
MSF4800B-30-0280	14	280 (11.0)
MSF4800B-30-0320	16	320 (12.6)
MSF4800B-30-0360	18	360 (14.1)
MSF4800B-30-0400	20	400 (15.7)
MSF4800B-30-0440	22	440 (17.3)
MSF4800B-30-0480	24	480 (18.9)
MSF4800B-30-0520	26	520 (20.5)
MSF4800B-30-0560	28	560 (22.0)
MSF4800B-30-0600	30	600 (23.6)
MSF4800B-30-0640	32	640 (25.2)
MSF4800B-30-0680	34	680 (26.8)
MSF4800B-30-0720	36	720 (28.3)
MSF4800B-30-0760	38	760 (29.9)
MSF4800B-30-0800	40	800 (31.5)
MSF4800B-30-0840	42	840 (33.0)
MSF4800B-30-0880	44	880 (34.6)
MSF4800B-30-0920	46	920 (36.2)
MSF4800B-30-0960	48	960 (37.8)
MSF4800B-30-1000	50	1000 (39.4)
MSF4800B-30-1040	52	1040 (40.9)
MSF4800B-30-1080	54	1080 (42.5)
MSF4800B-30-1120	56	1120 (44.1)
MSF4800B-30-1160	58	1160 (45.8)
MSF4800B-30-1200	60	1200 (47.2)
MSF4800B-30-1240	62	1240 (48.8)
MSF4800B-30-1280	64	1280 (50.4)
MSF4800B-30-1320	66	1320 (52.0)
MSF4800B-30-1360	68	1360 (53.5)
MSF4800B-30-1400	70	1400 (55.1)
MSF4800B-30-1440	72	1440 (56.7)
MSF4800B-30-1480	74	1480 (58.3)
MSF4800B-30-1520	76	1520 (59.8)
MSF4800B-30-1560	78	1560 (61.4)
MSF4800B-30-1600	80	1600 (63.0)
MSF4800B-30-1640	82	1640 (64.6)
MSF4800B-30-1680	84	1680 (66.1)
MSF4800B-30-1720	86	1720 (67.7)
MSF4800B-30-1760	88	1760 (69.3)
MSF4800B-30-1800	90	1800 (70.9)
MSF4800B-30-1840	92	1840 (72.4)
MSF4800B-30-1880	94	1880 (74.0)
MSF4800B-30-1920	96	1920 (75.6)
MSF4800B-30-1960	98	1960 (77.2)
MSF4800B-30-2000	100	2000 (78.7)
MSF4800B-30-2040	102	2040 (80.3)
MSF4800B-30-2080	104	2080 (81.9)
MSF4800B-30-2120	106	2120 (83.5)

40 mm Object Resolution		
Model	No. of Beams	Protective Height, in. (mm)
MSF4800B-40-0360	12	360 (14.1)
MSF4800B-40-0480	16	480 (18.9)
MSF4800B-40-0600	20	600 (23.6)
MSF4800B-40-0720	24	720 (28.3)
MSF4800B-40-0840	28	840 (33.0)
MSF4800B-40-0960	32	960 (37.8)
MSF4800B-40-1080	36	1080 (42.5)
MSF4800B-40-1200	40	1200 (47.2)
MSF4800B-40-1320	44	1320 (52.0)
MSF4800B-40-1440	48	1440 (56.7)
MSF4800B-40-1560	52	1560 (61.4)
MSF4800B-40-1680	56	1680 (66.1)
MSF4800B-40-1800	60	1800 (70.9)
MSF4800B-40-1920	64	1920 (75.6)
MSF4800B-40-2040	68	2040 (80.3)

Ordering (continued)

Model Numbers (continued)

CASCADABLE –STANDARD 1ST SEGMENT SWITCH CONFIGURED

(Maximum of four segments or 256 total beams)

14 mm Object Resolution		
Model	No. of Beams	Protective Height, in. (mm)
MSF4800S-14-0280	28	280 (11.0)
MSF4800S-14-0320	32	320 (12.6)
MSF4800S-14-0360	36	360 (14.1)
MSF4800S-14-0400	40	400 (15.7)
MSF4800S-14-0440	44	440 (17.3)
MSF4800S-14-0480	48	480 (18.9)
MSF4800S-14-0520	52	520 (20.5)
MSF4800S-14-0560	56	560 (22.0)
MSF4800S-14-0600	60	600 (23.6)
MSF4800S-14-0640	64	640 (25.2)
MSF4800S-14-0680	68	680 (26.8)
MSF4800S-14-0720	72	720 (28.3)
MSF4800S-14-0760	76	760 (29.9)
MSF4800S-14-0800	80	800 (31.5)
MSF4800S-14-0840	84	840 (33.0)
MSF4800S-14-0880	88	880 (34.6)
MSF4800S-14-0920	92	920 (36.2)
MSF4800S-14-0960	96	960 (37.8)
MSF4800S-14-1000	100	1000 (39.4)
MSF4800S-14-1040	104	1040 (40.9)
MSF4800S-14-1080	108	1080 (42.5)
MSF4800S-14-1120	112	1120 (44.1)
MSF4800S-14-1160	116	1160 (45.8)
MSF4800S-14-1200	116	1200 (47.2)
MSF4800S-14-1240	120	1240 (48.8)
MSF4800S-14-1280	128	1280 (50.4)
MSF4800S-14-1320	132	1320 (52.0)
MSF4800S-14-1360	136	1360 (53.5)
MSF4800S-14-1400	140	1400 (55.1)
MSF4800S-14-1440	144	1440 (56.7)
MSF4800S-14-1480	148	1480 (58.3)
MSF4800S-14-1520	152	1520 (59.8)
MSF4800S-14-1560	156	1560 (61.4)
MSF4800S-14-1600	160	1600 (63.0)
MSF4800S-14-1640	164	1640 (64.6)
MSF4800S-14-1680	168	1680 (66.1)
MSF4800S-14-1720	172	1720 (67.7)
MSF4800S-14-1760	176	1760 (69.3)
MSF4800S-14-1800	180	1800 (70.9)

20 mm Object Resolution		
Model	No. of Beams	Protective Height, in. (mm)
MSF4800S-20-0280	28	280 (11.0)
MSF4800S-20-0320	32	320 (12.6)
MSF4800S-20-0360	36	360 (14.1)
MSF4800S-20-0400	40	400 (15.7)
MSF4800S-20-0440	44	440 (17.3)
MSF4800S-20-0480	48	480 (18.9)
MSF4800S-20-0520	52	520 (20.5)
MSF4800S-20-0560	56	560 (22.0)
MSF4800S-20-0600	60	600 (23.6)
MSF4800S-20-0640	64	640 (25.2)
MSF4800S-20-0680	68	680 (26.8)
MSF4800S-20-0720	72	720 (28.3)
MSF4800S-20-0760	76	760 (29.9)
MSF4800S-20-0800	80	800 (31.5)
MSF4800S-20-0840	84	840 (33.0)
MSF4800S-20-0880	88	880 (34.6)
MSF4800S-20-0920	92	920 (36.2)
MSF4800S-20-0960	96	960 (37.8)
MSF4800S-20-1000	100	1000 (39.4)
MSF4800S-20-1040	104	1040 (40.9)
MSF4800S-20-1080	108	1080 (42.5)
MSF4800S-20-1120	112	1120 (44.1)
MSF4800S-20-1160	116	1160 (45.8)
MSF4800S-20-1200	116	1200 (47.2)
MSF4800S-20-1240	120	1240 (48.8)
MSF4800S-20-1280	128	1280 (50.4)
MSF4800S-20-1320	132	1320 (52.0)
MSF4800S-20-1360	136	1360 (53.5)
MSF4800S-20-1400	140	1400 (55.1)
MSF4800S-20-1440	144	1440 (56.7)
MSF4800S-20-1480	148	1480 (58.3)
MSF4800S-20-1520	152	1520 (59.8)
MSF4800S-20-1560	156	1560 (61.4)
MSF4800S-20-1600	160	1600 (63.0)
MSF4800S-20-1640	164	1640 (64.6)
MSF4800S-20-1680	168	1680 (66.1)
MSF4800S-20-1720	172	1720 (67.7)
MSF4800S-20-1760	176	1760 (69.3)
MSF4800S-20-1800	180	1800 (70.9)

30 mm Object Resolution		
Model	No. of Beams	Protective Height, in. (mm)
MSF4800S-30-0280	14	280 (11.0)
MSF4800S-30-0320	16	320 (12.6)
MSF4800S-30-0360	18	360 (14.1)
MSF4800S-30-0400	20	400 (15.7)
MSF4800S-30-0440	22	440 (17.3)
MSF4800S-30-0480	24	480 (18.9)
MSF4800S-30-0520	26	520 (20.5)
MSF4800S-30-0560	28	560 (22.0)
MSF4800S-30-0600	30	600 (23.6)
MSF4800S-30-0640	32	640 (25.2)
MSF4800S-30-0680	34	680 (26.8)
MSF4800S-30-0720	36	720 (28.3)
MSF4800S-30-0760	38	760 (29.9)
MSF4800S-30-0800	40	800 (31.5)
MSF4800S-30-0840	42	840 (33.0)
MSF4800S-30-0880	44	880 (34.6)
MSF4800S-30-0920	46	920 (36.2)
MSF4800S-30-0960	48	960 (37.8)
MSF4800S-30-1000	50	1000 (39.4)
MSF4800S-30-1040	52	1040 (40.9)
MSF4800S-30-1080	54	1080 (42.5)
MSF4800S-30-1120	56	1120 (44.1)
MSF4800S-30-1160	58	1160 (45.8)
MSF4800S-30-1200	60	1200 (47.2)
MSF4800S-30-1240	62	1240 (48.8)
MSF4800S-30-1280	64	1280 (50.4)
MSF4800S-30-1320	66	1320 (52.0)
MSF4800S-30-1360	68	1360 (53.5)
MSF4800S-30-1400	70	1400 (55.1)
MSF4800S-30-1440	72	1440 (56.7)
MSF4800S-30-1480	74	1480 (58.3)
MSF4800S-30-1520	76	1520 (59.8)
MSF4800S-30-1560	78	1560 (61.4)
MSF4800S-30-1600	80	1600 (63.0)
MSF4800S-30-1640	82	1640 (64.6)
MSF4800S-30-1680	84	1680 (66.1)
MSF4800S-30-1720	86	1720 (67.7)
MSF4800S-30-1760	88	1760 (69.3)
MSF4800S-30-1800	90	1800 (70.9)
MSF4800S-30-1840	92	1840 (72.4)
MSF4800S-30-1880	94	1880 (74.0)
MSF4800S-30-1920	96	1920 (75.6)
MSF4800S-30-1960	98	1960 (77.2)
MSF4800S-30-2000	100	2000 (78.7)
MSF4800S-30-2040	102	2040 (80.3)
MSF4800S-30-2080	104	2080 (81.9)
MSF4800S-30-2120	106	2120 (83.5)

40 mm Object Resolution		
Model	No. of Beams	Protective Height, in. (mm)
MSF4800S-40-0360	12	360 (14.1)
MSF4800S-40-0480	16	480 (18.9)
MSF4800S-40-0600	20	600 (23.6)
MSF4800S-40-0720	24	720 (28.3)
MSF4800S-40-0840	28	840 (33.0)
MSF4800S-40-0960	32	960 (37.8)
MSF4800S-40-1080	36	1080 (42.5)
MSF4800S-40-1200	40	1200 (47.2)
MSF4800S-40-1320	44	1320 (52.0)
MSF4800S-40-1440	48	1440 (56.7)
MSF4800S-40-1560	52	1560 (61.4)
MSF4800S-40-1680	56	1680 (66.1)
MSF4800S-40-1800	60	1800 (70.9)
MSF4800S-40-1920	64	1920 (75.6)
MSF4800S-40-2040	68	2040 (80.3)

Quick Fixed Blanking

Add "–SB1" suffix to any MS/MSF4800S version that requires Quick Fixed Blanking. i.e. MSF4800S-40-2040-SB1.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering (continued)

Model Numbers (continued)

CASCADABLE SEGMENT EXTENSIONS (For use with all 1st segment models)

(Maximum of four segments or 256 total beams)

14 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MSF4800-14-0240-XR2	24	240 (9.4)
MSF4800-14-0280-XR2	28	280 (11.0)
MSF4800-14-0320-XR2	32	320 (12.6)
MSF4800-14-0360-XR2	36	360 (14.1)
MSF4800-14-0400-XR2	40	400 (15.7)
MSF4800-14-0440-XR2	44	440 (17.3)
MSF4800-14-0480-XR2	48	480 (18.9)
MSF4800-14-0520-XR2	52	520 (20.5)
MSF4800-14-0560-XR2	56	560 (22.0)
MSF4800-14-0600-XR2	60	600 (23.6)
MSF4800-14-0640-XR2	64	640 (25.2)
MSF4800-14-0680-XR2	68	680 (26.8)
MSF4800-14-0720-XR2	72	720 (28.3)
MSF4800-14-0760-XR2	76	760 (29.9)
MSF4800-14-0800-XR2	80	800 (31.5)
MSF4800-14-0840-XR2	84	840 (33.0)
MSF4800-14-0880-XR2	88	880 (34.6)
MSF4800-14-0920-XR2	92	920 (36.2)
MSF4800-14-0960-XR2	96	960 (37.8)
MSF4800-14-1000-XR2	100	1000 (39.4)
MSF4800-14-1040-XR2	104	1040 (40.9)
MSF4800-14-1080-XR2	108	1080 (42.5)
MSF4800-14-1120-XR2	112	1120 (44.1)
MSF4800-14-1160-XR2	116	1160 (45.8)
MSF4800-14-1200-XR2	116	1200 (47.2)
MSF4800-14-1240-XR2	120	1240 (48.8)
MSF4800-14-1280-XR2	128	1280 (50.4)

20 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MSF4800-20-0280-XR2	28	280 (11.0)
MSF4800-20-0320-XR2	32	320 (12.6)
MSF4800-20-0360-XR2	36	360 (14.1)
MSF4800-20-0400-XR2	40	400 (15.7)
MSF4800-20-0440-XR2	44	440 (17.3)
MSF4800-20-0480-XR2	48	480 (18.9)
MSF4800-20-0520-XR2	52	520 (20.5)
MSF4800-20-0560-XR2	56	560 (22.0)
MSF4800-20-0600-XR2	60	600 (23.6)
MSF4800-20-0640-XR2	64	640 (25.2)
MSF4800-20-0680-XR2	68	680 (26.8)
MSF4800-20-0720-XR2	72	720 (28.3)
MSF4800-20-0760-XR2	76	760 (29.9)
MSF4800-20-0800-XR2	80	800 (31.5)
MSF4800-20-0840-XR2	84	840 (33.0)
MSF4800-20-0880-XR2	88	880 (34.6)
MSF4800-20-0920-XR2	92	920 (36.2)
MSF4800-20-0960-XR2	96	960 (37.8)
MSF4800-20-1000-XR2	100	1000 (39.4)
MSF4800-20-1040-XR2	104	1040 (40.9)
MSF4800-20-1080-XR2	108	1080 (42.5)
MSF4800-20-1120-XR2	112	1120 (44.1)
MSF4800-20-1160-XR2	116	1160 (45.8)
MSF4800-20-1200-XR2	116	1200 (47.2)
MSF4800-20-1240-XR2	120	1240 (48.8)
MSF4800-20-1280-XR2	128	1280 (50.4)

30 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MSF4800-30-0280-XR2	14	280 (11.0)
MSF4800-30-0320-XR2	16	320 (12.6)
MSF4800-30-0360-XR2	18	360 (14.1)
MSF4800-30-0400-XR2	20	400 (15.7)
MSF4800-30-0440-XR2	22	440 (17.3)
MSF4800-30-0480-XR2	24	480 (18.9)
MSF4800-30-0520-XR2	26	520 (20.5)
MSF4800-30-0560-XR2	28	560 (22.0)
MSF4800-30-0600-XR2	30	600 (23.6)
MSF4800-30-0640-XR2	32	640 (25.2)
MSF4800-30-0680-XR2	34	680 (26.8)
MSF4800-30-0720-XR2	36	720 (28.3)
MSF4800-30-0760-XR2	38	760 (29.9)
MSF4800-30-0800-XR2	40	800 (31.5)
MSF4800-30-0840-XR2	42	840 (33.0)
MSF4800-30-0880-XR2	44	880 (34.6)
MSF4800-30-0920-XR2	46	920 (36.2)
MSF4800-30-0960-XR2	48	960 (37.8)
MSF4800-30-1000-XR2	50	1000 (39.4)
MSF4800-30-1040-XR2	52	1040 (40.9)
MSF4800-30-1080-XR2	54	1080 (42.5)
MSF4800-30-1120-XR2	56	1120 (44.1)
MSF4800-30-1160-XR2	58	1160 (45.8)
MSF4800-30-1200-XR2	60	1200 (47.2)
MSF4800-30-1240-XR2	62	1240 (48.8)
MSF4800-30-1280-XR2	64	1280 (50.4)
MSF4800-30-1320-XR2	66	1320 (52.0)
MSF4800-30-1360-XR2	68	1360 (53.5)
MSF4800-30-1400-XR2	70	1400 (55.1)
MSF4800-30-1440-XR2	72	1440 (56.7)
MSF4800-30-1480-XR2	74	1480 (58.3)
MSF4800-30-1520-XR2	76	1520 (59.8)
MSF4800-30-1560-XR2	78	1560 (61.4)
MSF4800-30-1600-XR2	80	1600 (63.0)
MSF4800-30-1640-XR2	82	1640 (64.6)
MSF4800-30-1680-XR2	84	1680 (66.1)
MSF4800-30-1720-XR2	86	1720 (67.7)
MSF4800-30-1760-XR2	88	1760 (69.3)
MSF4800-30-1800-XR2	90	1800 (70.9)
MSF4800-30-1840-XR2	92	1840 (72.4)
MSF4800-30-1880-XR2	94	1880 (74.0)
MSF4800-30-1920-XR2	96	1920 (75.6)
MSF4800-30-1960-XR2	98	1960 (77.2)
MSF4800-30-2000-XR2	100	2000 (78.7)
MSF4800-30-2040-XR2	102	2040 (80.3)
MSF4800-30-2080-XR2	104	2080 (81.9)
MSF4800-30-2120-XR2	106	2120 (83.5)

40 mm Object Resolution

Model	No. of Beams	Protective Height, in. (mm)
MSF4800-40-0360-XR2	12	360 (14.1)
MSF4800-40-0480-XR2	16	480 (18.9)
MSF4800-40-0600-XR2	20	600 (23.6)
MSF4800-40-0720-XR2	24	720 (28.3)
MSF4800-40-0840-XR2	28	840 (33.0)
MSF4800-40-0960-XR2	32	960 (37.8)
MSF4800-40-1080-XR2	36	1080 (42.5)
MSF4800-40-1200-XR2	40	1200 (47.2)
MSF4800-40-1320-XR2	44	1320 (52.0)
MSF4800-40-1440-XR2	48	1440 (56.7)
MSF4800-40-1560-XR2	52	1560 (61.4)
MSF4800-40-1680-XR2	56	1680 (66.1)
MSF4800-40-1800-XR2	60	1800 (70.9)
MSF4800-40-1920-XR2	64	1920 (75.6)
MSF4800-40-2040-XR2	68	2040 (80.3)

Ordering (continued)

Accessories

Receiver Cables	
MS4800-CBLRX-10M	Receiver cable, 10 m (32.8 ft.)
MS4800-CBLRX-15M	Receiver cable, 15 m (49.2 ft.)
MS4800-CBLRX-30M	Receiver cable, 30 m (98.5 ft.)
Transmitter Cables	
MS4800-CBLTX-10M	Transmitter cable, 10 m (32.8 ft.)
MS4800-CBLTX-15M	Transmitter cable, 15 m (49.2 ft.)
MS4800-CBLTX-30M	Transmitter cable, 30 m (98.5 ft.)
Transmitter Interconnect Cables (for Cascading)	
MS4800-CBLTXIC-003M	Transmitter interconnect cable, 0.3 m (12 in.)
MS4800-CBLTXIC-005M	Transmitter interconnect cable, 0.5 m (20 in.)
MS4800-CBLTXIC-01M	Transmitter interconnect cable, 1 m (3.3 ft.)
MS4800-CBLTXIC-02M	Transmitter interconnect cable, 2 m (6.6 ft.)
MS4800-CBLTXIC-03M	Transmitter interconnect cable, 3 m (10 ft.)
MS4800-CBLTXIC-05M	Transmitter interconnect cable, 5 m (16 ft.)
MS4800-CBLTXIC-10M	Transmitter interconnect cable, 10 m (33 ft.)
Receiver Interconnect Cables (for Cascading)	
MS4800-CBLRXIC-003M	Receiver interconnect cable, 0.3 m (12 in.)
MS4800-CBLRXIC-005M	Receiver interconnect cable, 0.5 m (20 in.)
MS4800-CBLRXIC-01M	Receiver interconnect cable, 1 m (3.3 ft.)
MS4800-CBLRXIC-02M	Receiver interconnect cable, 2 m (6.6 ft.)
MS4800-CBLRXIC-03M	Receiver interconnect cable, 3 m (10 ft.)
MS4800-CBLRXIC-05M	Receiver interconnect cable, 5 m (16 ft.)
MS4800-CBLRXIC-10M	Receiver interconnect cable, 10 m (33 ft.)
RM-6 (Mute) Cables	
MS4800-CBLMT-10M	MSF4800 to RM-6 cable, 10 m (33 ft.)
MS4800-CBLMT-15M	MSF4800 to RM-6 cable, 15 m (49.2 ft.)
MS4800-CBLMT-30M	MSF4800 to RM-6 cable, 30 m (98.5 ft.)
Double-Ended Transmitter Cables	
MS4800-CBLTXT-05M	Double-ended, quick disconnect, 5 m (16.4 ft.)
MS4800-CBLTXT-10M	Double-ended, quick disconnect, 10 m (32.8 ft.)
MS4800-CBLTXT-15M	Double-ended, quick disconnect, 15 m (49.2 ft.)
MS4800-CBLTXT-25M	Double-ended, quick disconnect, 25 m (82.0 ft.)
Double-Ended Receiver Cables	
MS4800-CBLRXT-05M	Double-ended, quick disconnect, 5 m (16.4 ft.)
MS4800-CBLRXT-10M	Double-ended, quick disconnect, 10 m (32.8 ft.)
MS4800-CBLRXT-15M	Double-ended, quick disconnect, 15 m (49.2 ft.)
MS4800-CBLRXT-25M	Double-ended, quick disconnect, 25 m (82.0 ft.)
Bulkhead Connectors	
MS4800-PMCTX-01M	Transmitter bulkhead connector, 1 m (3.28 ft.) leads
MS4800-PMCTX-05M	Transmitter bulkhead connector, 5 m (16.4 ft.) leads
MS4800-PMCRX-01M	Receiver bulkhead connector, 1 m (3.28 ft.) leads
MS4800-PMCRX-05M	Receiver bulkhead connector, 5 m (16.4 ft.) leads

Adapter Connectors	
MS4800-ADPT-TXS	Transmitter (standard) cable adapter MS46 to MS48
MS4800-ADPT-TXM	Transmitter (mts) cable adapter MS46 to MS48
MS4800-ADPT-RX	Receiver cable adapter MS46 to MS48
Mounting Bracket Kits	
MS4800-SDM-KT1	MS48 Middle support bracket kit, 2 heads
MS4800-SDM-KT2	MS48 T-slot mounting kit, 2 heads
MS4800-MKT1	End bracket kit, 1 head
MS4800-MKT2	End bracket kit, 2 heads
Resource Modules	
RM-1	RM-1 resource module
RM-2	RM-2 resource module
RM-2AC	RM-2AC resource module/power supply
RM-2AC-IP	RM-2AC resource module/power supply, IP65
RM-2AC-IP-SB1	RM-2AC-IP with SB1 quick fixed blanking option
RM-3	RM-3 mute module
RM-X	RM-X safety relay, 22.5 mm DIN enclosure
MS4800-RM6	RM-6 mute module (only for MSF4800)
Mute Lamp Kits	
MTLEDC-RM3	LED clear mute lamp kit for RM-3
MTLEDA-RM3	LED amber mute lamp kit for RM-3
SB12-CLED00	LED clear mute lamp for RM-6
SB12-ALED00	LED amber mute lamp for RM-6
Programming and Diagnostics Module	
MS4800-PDM	Programming and diagnostic module for the MS/MSF4800A and B
MS4800-PDM-HDR	Mounting holder for mounting the PDM
Explosion-Proof Enclosures, Aluminum Cast Housing (sold as singles)	
MS4800-EPKT-0320	EP enclosure for MS4800-14/20/30/40-0320 (320 mm)
MS4800-EPKT-0640	EP enclosure for MS4800-30-0640 (640 mm)
MS4800-EPKT-0960	EP enclosure for MS4800-30-0960 (960 mm)
MS4800-EPKT-1240	EP enclosure for MS4800-30-1240 (1240 mm)

Safety Standards and Precautions

All models of the MiniSafe meet ANSI/RIA R15.06-1999 (R2009) and ANSI B11.19-2010. When used with mechanical power presses, OSHA industrial safety standards apply, as stated in OSHA 1910.217(c). For other applications, the machine guarding requirements found in OSHA 1910.212 apply. The MiniSafe meets ANSI and CSA requirements for control reliability requirements for point-of-operation presence sensing devices. All controllers have CSA-CUS acceptance and are designed to meet UL508.

MiniSafe MS4800 systems have been EC type examined to the requirements of category 4, EN 954-1 (type 4, IEC 61496).

The MiniSafe should only be used on machinery that can consistently and immediately stop anywhere in its cycle or stroke. Never use a MiniSafe on a full revolution clutched power press or machine. If the light curtain does not protect all access to the point of operation, the unprotected access must be guarded by other appropriate devices such as mechanical guards.

The purchaser, installer and employer have the responsibility to meet all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See the Installation and Operation Manual for additional information.

All application examples described are for illustration purposes only. Actual installations will differ from those indicated.

F3SJ-A

Quick Link
S634
omron247.com

Safety Light Curtains

- Resolution: 14 mm (0.55 in.), 20 mm (0.79 in.), 25 mm (1.01 in.) 30 mm (1.18 in.), or 55 mm (2.17 in.)
- Range: 7 m (23 ft.) or 9 m (29.5 ft.) dependent on minimum object resolution and protected height
- Protected heights: 14 mm protected heights from 245 to 1631 mm (9.6 to 64 in.), 20 mm, 25 mm and 30 mm protected heights from 245 to 2495 mm (9.6 to 98 in.), 55 mm from 270 to 2470 mm (10.6 to 97 in.)
- Very compact size – 30 x 24 mm (1.18 x 0.94 in.)
- Cascaded designs possible – 4 segments, up to 400 beams
- Partial muting and position detection muting
- Cross-talk prevention



B

Description

Position Detection Muting Function

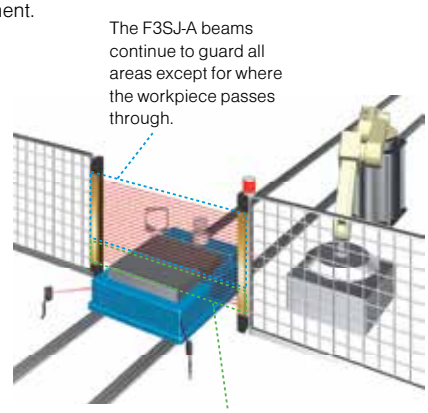
Position Detection Muting Function is used in applications where the workpiece is set in position each time by an operator, and a turntable or positioning robot then moves the workpiece to the area where the work is performed. A limit switch or other means is used to detect when the robot is in a safe position and muting is then applied.



Partial Muting Function

Muting temporarily disables the F3SJ-A when an object must pass through the detection zone, such as when supplying a workpiece to your equipment.

Partial muting increases the level of safety by only muting the beams of the safety light curtain where the workpiece passes through, while preventing muting in all other areas.

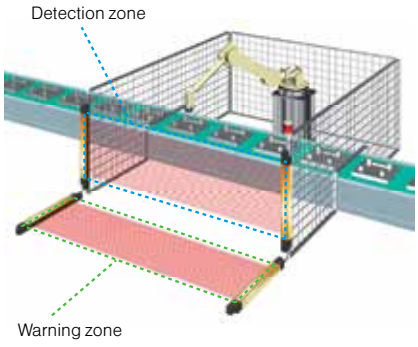


Warning Zone Function

With the F3SJ-A, part of the detection zone can be used as warning zone to generate an alarm when someone approaches the danger zone. If the person then enters the danger zone the F3SJ-A will send a stop signal to the guarded machine. In addition, the auxiliary output can be used to activate a flashing lamp to alert the person in the warning zone.

The detection zone for a single F3SJ-A can be divided into two zones or set a single warning zone for multiple, cascaded F3SJ-A units.

Dividing the zone between series-connected sensors



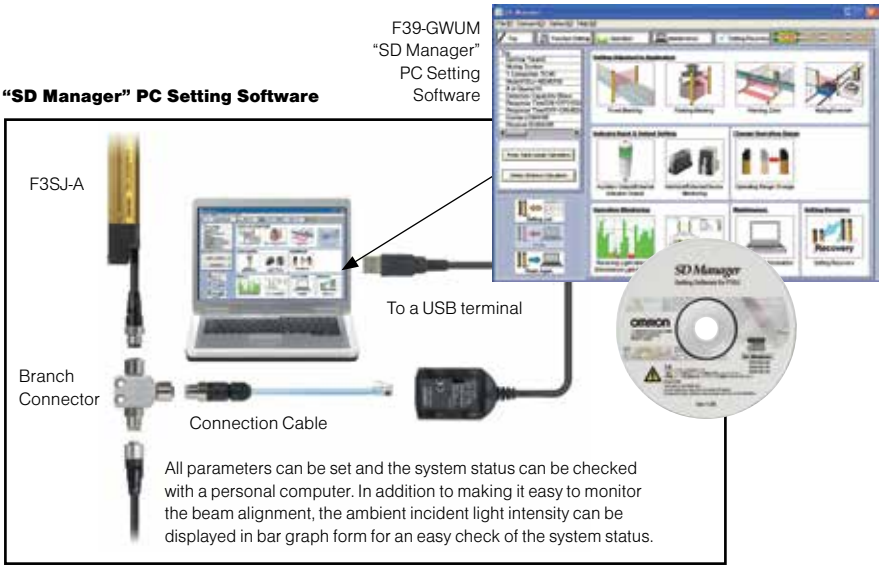
SD Manager Software

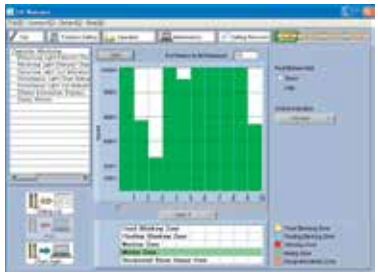
Using the SD Manager software, all features of the F3SJ-A can be set and checked. Features include:

- Display of system specifications:
  - Model
  - Number of beams
  - Minimum object resolution
  - Response time
- Settings for:
  - Fixed blanking
  - Floating blanking
  - Warning zone configuration
  - Muting – Both partial and position detection
  - External indicator function
  - Auxiliary outputs
  - EDM parameters
  - Operating range
- Monitoring of received and ambient light intensity
- Maintenance information:
  - Power on time
  - OSSD switching frequency
- Recovery of settings
- Safety distance calculations based on parameters for connected system

Setting Console
When you don't want to take a computer into the field with you the F39-MC21 setting console is a convenient way to set parameters and check the system status.

"SD Manager" PC Setting Software





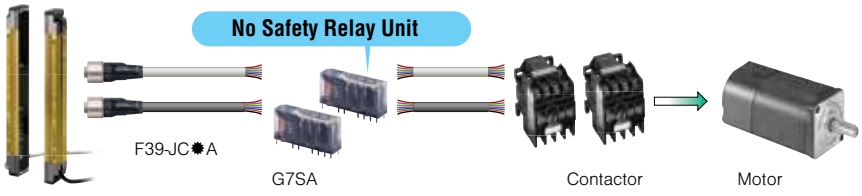
Beam Alignment is Easier
The incident light level can be displayed in a bar graph for each beam.

Applications

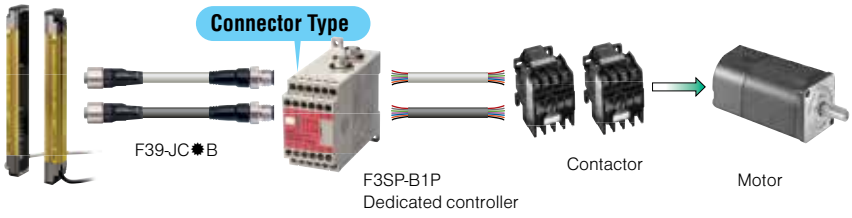
With built-in muting and blanking functions, the F3SJ-A can be employed in a wide variety of applications from robotic work cells to small machines. The potential for cascaded design and a broad selection of minimum object resolutions adds to this versatility.

Selecting the Best Configuration

Space Efficient and Low Cost
The built-in external device monitoring function eliminates the need for a safety relay unit.



Reduced Wiring and Easy Maintenance
Cables with connectors on both ends simplify connections and prevent wiring errors.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Specifications

Performance	
Resolution:	14 mm, 20 mm, 25 mm, 30 mm, 55 mm
Protected Height:	14 mm – 245 to 1631 mm (9.6 to 64.2 in.) 20 mm, 25 mm and 30 mm – 245 to 2495 mm (9.6 to 98.2 in.) 55 mm – 270 to 2470 mm (10.6 to 97.2 in.)
Operating Range:	0.2 to 9 m for all protective heights up to 1640 mm (64.6 in.)
	0.2 to 7 m for all protective heights longer than 1640 mm (64.6 in.):
Effective Aperture Angle:	±2.5° maximum, transmitter and receiver at operating range greater than 3 m (9.8 ft.)
Response Time:	For 14 mm resolution systems up to 983 mm (38.7 in.) protected height ≤17.5 ms For 14 mm resolution systems above 983 mm (38.7 in.) protected height ≤25 ms
	For 20 mm resolution systems up to 1205 mm (47.4 in.) protected height ≤15 ms For 20 mm resolution systems above 1205 mm (47.4 in.) protected height ≤22.5 ms
	For 25 mm resolution systems up to 1600 mm (63.0 in.) protected height ≤15 ms For 25 mm resolution systems above 1600 mm (63.0 in.) protected height ≤20.0 ms
	For 30 mm resolution systems, all protected heights ≤17.5 ms
	For 55 mm resolution systems, all protected heights ≤13 ms
Safety Output Rating:	Two 24 VDC PNP outputs sourcing 300 mA max.
Auxiliary (Non-Safety) Output Ratings:	One 24 VDC PNP output sourcing 300 mA max.
Light Source:	Infrared LED, 870 nm
Indicators:	Transmitter: 5 LED Light Level Indicators, 3 LED Error Indicators, Power, Interlock, EDM, Blanking/Test Receiver: 5 LED Light Level Indicators, 3 LED Error Indicators, Machine Run, Machine Stop
Mechanical	
Enclosure:	Anodized aluminum housing
Cable Length:	Optional cables are available up to 20 m (65.6 ft.) in length
Transmitter and Receiver Cable Connections:	M12, 8-pin
Electrical	
Power Supply:	24 VDC ± 20%
Environmental	
Protection Rating:	IP65
Operating Temperature:	-10 to 55°C (14 to 131°F)
Storage Temperature:	-30 to 70°C (-22 to 158°F)
Relative Humidity:	35 to 85% non-condensing
Vibration:	10 to 55 Hz, double amplitude of 0.7 mm, 20 sweeps in X, Y, and Z directions
Shock:	100 m/s^2, 1000 times each in X, Y and Z directions
Approvals	ESPE Type 4 (IEC 61496-1/ -2) Category 4 / PL e (EN ISO 13849-1) SIL3 / SIL3 CL3 (IEC 61508)UL508, UL1998, CAN/CSA-C22.2 No. 14, CAN/CSA-C22.2 No. 0.8

Specifications are subject to change without notice.

F3SP-B1P Control Unit

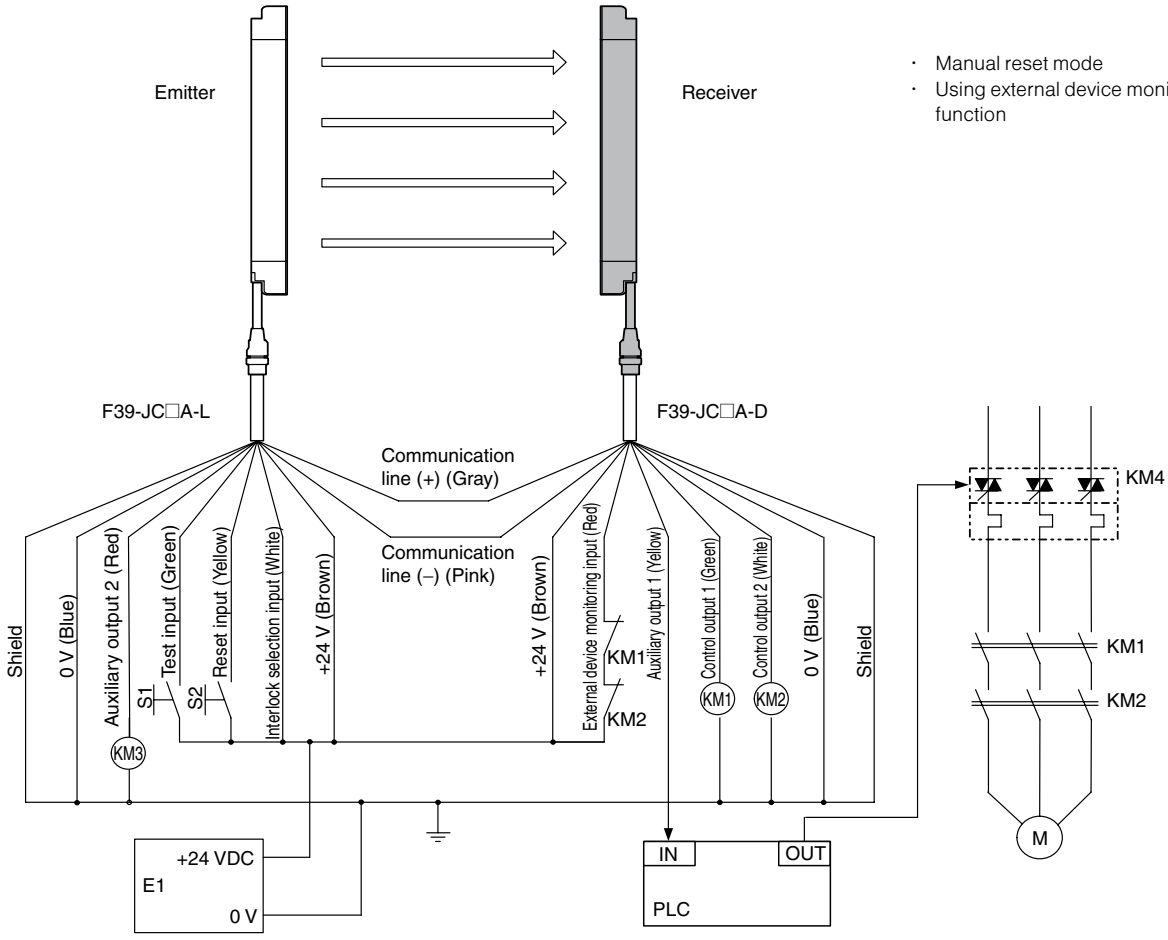
Power Supply Voltage:	24 VDC ±10%
Power Consumption:	DC1.7 W max (not including sensor's current consumption)
Operation Time:	100 ms max. (not including the sensor's response time)
Response Time:	10 ms max. (not including the sensor's response time)
Relay Output	
Number of Contacts:	3 N.O., 1 N.C.
Rated Load:	250 VAC 5 A (cos = 1); 30 VDC 5 A L/R = 0 ms
Rated Current:	5 A
Connection Type	
Between Sensors:	M12 connector (8-pin)
Others:	Terminal block
Weight:	Approx. 280 g (9.9 oz.)

Specifications are subject to change without notice.

Wiring

Wiring for Single F3SJ-A Application

Detection of a welded relay contact is possible without a controller relay unit.



- Manual reset mode
- Using external device monitoring function

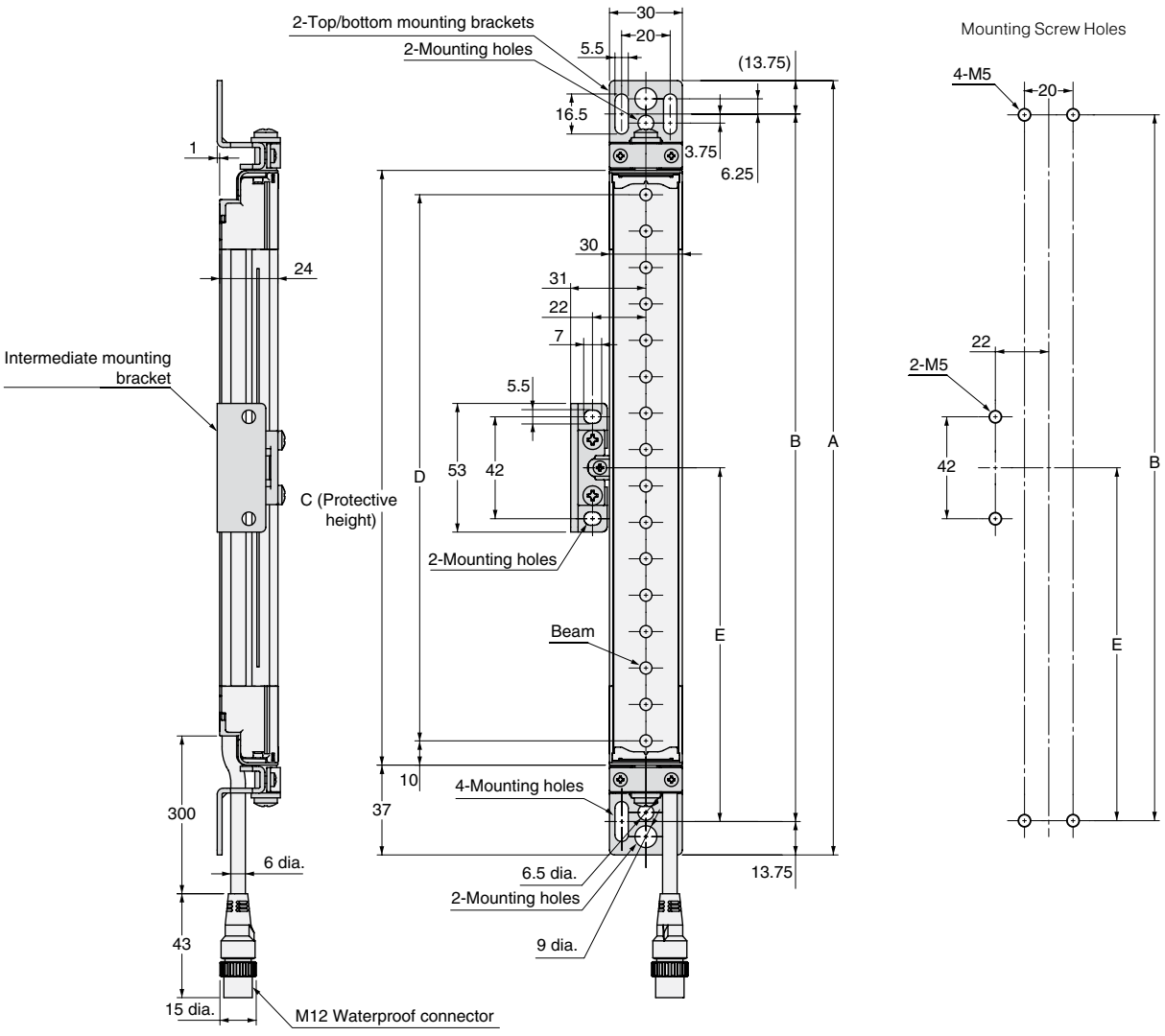
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

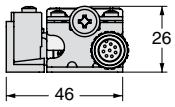
For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Dimensions

(mm)





How to Calculate Your System Dimensions:

C (protective height) = 4-digit number in the table

A = C + 74

B = C + 46.5

D = C - 20

E = see chart below

Protective Height	Number of Intermediate Brackets	E*
245 to 596 mm (9.6 to 23.5 in.)	0	—
600 to 1130 mm (23.6 to 44.5 in.)	1	E = B/2
1136 to 1658 mm (44.7 to 65.3 in.)	2	E = B/3
1660 to 2180 mm (65.4 to 85.8 in.)	3	E = B/4
2195 to 2500 mm (86.4 to 98.4 in.)	4	E = B/5

*Use E = 530 or less when none of the E values shown above are used.

Ordering

The minimum components required for an F3SJ-A system are an emitter receiver set and a set of single or double-ended connector cables. See the table below for an overview of the versions available.

Safety Light Curtain F3SJ-A

Designator	Protection	Detection	Beam Gap	Operating Range	No. of Beams	Protective Height
F3SJ-A□□□□P14[1]	Finger	14 mm	9 mm	0.2 to 9 m (0.7 to 29.5 ft.)	26 to 197	245 to 1784 mm (9.6 to 70.2 in.)
F3SJ-A□□□□P20[1]	Finger/Hand	20 mm	15 mm	0.2 to 9 m (0.7 to 29.5 ft.)	16 to 100	245 to 1505 mm (9.6 to 59.3 in.)
F3SJ-A□□□□P20[1]	Finger/Hand	20 mm	15 mm	0.2 to 7 m (0.7 to 23.0 ft.)	110 to 166	1655 to 2495 mm (65.2 to 98.2 in.)
F3SJ-A□□□□P20-TS[2]	Finger/Hand	20 mm	15 mm	0.2 to 9 m (0.7 to 29.5 ft.)	16 to 100	245 to 1505 mm (9.6 to 59.3 in.)
F3SJ-A□□□□P20-TS[2]	Finger/Hand	20 mm	15 mm	0.2 to 7 m (0.7 to 23.0 ft.)	110 to 166	1655 to 2495 mm (65.2 to 98.2 in.)
F3SJ-A□□□□P25[1]	Hand	25 mm	20 mm	0.2 to 9 m (0.7 to 29.5 ft.)	13 to 79	260 to 1580 mm (10.2 to 62.2 in.)
F3SJ-A□□□□P25[1]	Hand	25 mm	20 mm	0.2 to 7 m (0.7 to 23.0 ft.)	87 to 125	1740 to 2500 mm (68.5 to 98.4 in.)
F3SJ-A□□□□P25-TS[2]	Hand	25 mm	20 mm	0.2 to 9 m (0.7 to 29.5 ft.)	13 to 79	260 to 1580 mm (10.2 to 62.2 in.)
F3SJ-A□□□□P25-TS[2]	Hand	25 mm	20 mm	0.2 to 7 m (0.7 to 23.0 ft.)	87 to 125	1740 to 2500 mm (68.5 to 98.4 in.)
F3SJ-A□□□□P30[1]	Hand/arm	30 mm	25 mm	0.2 to 9 m (0.7 to 29.5 ft.)	10 to 65	245 to 1620 mm (9.6 to 63.8 in.)
F3SJ-A□□□□P30[1]	Hand/arm	30 mm	25 mm	0.2 to 7 m (0.7 to 23.0 ft.)	70 to 100	1745 to 2495 mm (68.7 to 98.2 in.)
F3SJ-A□□□□P55[1]	Leg/body	55 mm	50 mm	0.2 to 9 m (0.7 to 29.5 ft.)	6 to 33	270 to 1620 mm (10.6 to 63.8 in.)
F3SJ-A□□□□P55[1]	Leg/body	55 mm	50 mm	0. 2 to 7 m (0.7 to 23.0 ft.)	36 to 50	1770 to 2470 mm (69.7 to 97.2 in.)

Notes: Connection cables are not included with the products and must be purchased separately as needed.

Specific Model Numbers

Model	No. of Beams	Protective Height (mm)
F3SJ-A14 Series		
F3SJ-A0245P14	26	245
F3SJ-A0254P14	27	254
F3SJ-A0263P14	28	263
F3SJ-A0281P14	30	281
F3SJ-A0290P14	31	290
F3SJ-A0299P14	32	299
F3SJ-A0308P14	33	308
F3SJ-A0317P14	34	317
F3SJ-A0335P14	36	335
F3SJ-A0353P14	38	353
F3SJ-A0371P14	40	371
F3SJ-A0389P14	42	389
F3SJ-A0407P14	44	407
F3SJ-A0425P14	46	425
F3SJ-A0443P14	48	443
F3SJ-A0452P14	49	452
F3SJ-A0461P14	50	461
F3SJ-A0479P14	52	479
F3SJ-A0497P14	54	497
F3SJ-A0515P14	56	515
F3SJ-A0533P14	58	533
F3SJ-A0551P14	60	551
F3SJ-A0569P14	62	569
F3SJ-A0578P14	63	578
F3SJ-A0587P14	64	587
F3SJ-A0605P14	66	605
F3SJ-A0623P14	68	623
F3SJ-A0659P14	72	659
F3SJ-A0695P14	76	695
F3SJ-A0731P14	80	731
F3SJ-A0767P14	84	767
F3SJ-A0803P14	88	803
F3SJ-A0839P14	92	839
F3SJ-A0875P14	96	875
F3SJ-A0911P14	100	911
F3SJ-A0920P14	101	920
F3SJ-A0983P14	108	983
F3SJ-A1055P14	116	1055
F3SJ-A1127P14	124	1127
F3SJ-A1199P14	132	1199
F3SJ-A1235P14	136	1235
F3SJ-A1271P14	140	1271
F3SJ-A1325P14	146	1325
F3SJ-A1343P14	148	1343
F3SJ-A1415P14	156	1415
F3SJ-A1487P14	164	1487
F3SJ-A1559P14	172	1559
F3SJ-A1631P14	180	1631
F3SJ-A1784P14	197	1784
F3SJ-A2117P14	234	2117
F3SJ-A20, F3SJ-A20-TS* Series		
F3SJ-A0245P20	16	245
F3SJ-A0260P20	17	260
F3SJ-A0275P20	18	275
F3SJ-A0290P20	19	290
F3SJ-A0305P20	20	305
F3SJ-A0335P20	22	335
F3SJ-A0350P20	23	350
F3SJ-A0365P20	24	365
F3SJ-A0380P20	25	380
F3SJ-A0395P20	26	395
F3SJ-A0410P20	27	410
F3SJ-A0425P20	28	425
F3SJ-A0440P20	29	440
F3SJ-A0455P20	30	455
F3SJ-A0470P20	31	470
F3SJ-A0485P20	32	485
F3SJ-A0500P20	33	500
F3SJ-A0515P20	34	515
F3SJ-A0530P20	35	530
F3SJ-A0545P20	36	545
F3SJ-A0560P20	37	560
F3SJ-A0575P20	38	575
F3SJ-A0590P20	39	590
F3SJ-A0605P20	40	605
F3SJ-A0620P20	41	620
F3SJ-A0635P20	42	635
F3SJ-A0665P20	44	665
F3SJ-A0695P20	46	695
F3SJ-A0710P20	47	710
F3SJ-A0725P20	48	725
F3SJ-A0740P20	49	740
F3SJ-A0755P20	50	755
F3SJ-A0785P20	52	785
F3SJ-A0800P20	53	800
F3SJ-A0815P20	54	815
F3SJ-A0830P20	55	830
F3SJ-A0845P20	56	845
F3SJ-A0875P20	58	875
F3SJ-A0890P20	59	890
F3SJ-A0905P20	60	905
F3SJ-A0920P20	61	920
F3SJ-A0935P20	62	935
F3SJ-A0965P20	64	965
F3SJ-A0980P20	65	980
F3SJ-A0995P20	66	995
F3SJ-A1010P20	67	1010
F3SJ-A1025P20	68	1025
F3SJ-A1040P20	69	1040
F3SJ-A1055P20	70	1055
F3SJ-A1070P20	71	1070
F3SJ-A1085P20	72	1085
F3SJ-A1100P20	73	1100
F3SJ-A1115P20	74	1115
F3SJ-A1145P20	76	1145
F3SJ-A1175P20	78	1175
F3SJ-A1205P20	80	1205
F3SJ-A1220P20	81	1220
F3SJ-A1235P20	82	1235
F3SJ-A1250P20	83	1250
F3SJ-A1265P20	84	1265
F3SJ-A1310P20	87	1310
F3SJ-A1325P20	88	1325
F3SJ-A1355P20	90	1355
F3SJ-A1385P20	92	1385
F3SJ-A1445P20	96	1445
F3SJ-A1460P20	97	1460
F3SJ-A1475P20	98	1475
F3SJ-A1490P20	99	1490
F3SJ-A1505P20	100	1505
F3SJ-A1595P20	106	1595
F3SJ-A1655P20	110	1655
F3SJ-A1715P20	114	1715
F3SJ-A1790P20	119	1790
F3SJ-A1805P20	120	1805
F3SJ-A1955P20	130	1955
F3SJ-A2105P20	140	2105
F3SJ-A2255P20	150	2255
F3SJ-A2405P20	160	2405
F3SJ-A2495P20	166	2495

(Continued on next page)

Notes: Connection cables are not included with the products and must be purchased separately as needed.

* The suffix "-TS" is attached to the model number of models with fixed auto reset.

[1] Models with S-mark certification have an "-S" at the end of the model number. S-mark certification is for equipment sold in South Korea. Example: F3SJ-A0245P14-S.

[2] Models with fixed auto reset (-TS). Parameters cannot be set using the F39-MC21 Setting Console or F39-GWUM "SD Manager" Support Software for F3SJ-A.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering (continued)

Model	No. of Beams	Protective Height (mm)
F3SJ-A25, F3SJ-A25-TS* Series		
F3SJ-A0260P25	13	260
F3SJ-A0300P25	15	300
F3SJ-A0340P25	17	340
F3SJ-A0380P25	19	380
F3SJ-A0400P25	20	400
F3SJ-A0460P25	23	460
F3SJ-A0480P25	24	480
F3SJ-A0500P25	25	500
F3SJ-A0540P25	27	540
F3SJ-A0600P25	30	600
F3SJ-A0620P25	31	620
F3SJ-A0660P25	33	660
F3SJ-A0700P25	35	700
F3SJ-A0740P25	37	740
F3SJ-A0760P25	38	760
F3SJ-A0780P25	39	780
F3SJ-A0860P25	43	860
F3SJ-A0880P25	44	880
F3SJ-A0900P25	45	900
F3SJ-A0940P25	47	940
F3SJ-A0960P25	48	960
F3SJ-A0980P25	49	980
F3SJ-A1020P25	51	1020
F3SJ-A1060P25	53	1060
F3SJ-A1100P25	55	1100
F3SJ-A1180P25	59	1180
F3SJ-A1220P25	61	1220
F3SJ-A1260P25	63	1260
F3SJ-A1280P25	64	1280
F3SJ-A1340P25	67	1340
F3SJ-A1420P25	71	1420
F3SJ-A1500P25	75	1500
F3SJ-A1580P25	79	1580
F3SJ-A1740P25	87	1740
F3SJ-A1820P25	91	1820
F3SJ-A1900P25	95	1900
F3SJ-A2060P25	103	2060
F3SJ-A2220P25	111	2220
F3SJ-A2380P25	119	2380
F3SJ-A2420P25	121	2420
F3SJ-A2500P25	125	2500

Model	No. of Beams	Protective Height (mm)
F3SJ-A30 Series		
F3SJ-A0245P30	10	245
F3SJ-A0270P30	11	270
F3SJ-A0295P30	12	295
F3SJ-A0320P30	13	320
F3SJ-A0345P30	14	345
F3SJ-A0370P30	15	370
F3SJ-A0395P30	16	395
F3SJ-A0420P30	17	420
F3SJ-A0445P30	18	445
F3SJ-A0470P30	19	470
F3SJ-A0495P30	20	495
F3SJ-A0520P30	21	520
F3SJ-A0545P30	22	545
F3SJ-A0570P30	23	570
F3SJ-A0595P30	24	595
F3SJ-A0620P30	25	620
F3SJ-A0645P30	26	645
F3SJ-A0670P30	27	670
F3SJ-A0695P30	28	695
F3SJ-A0720P30	29	720
F3SJ-A0745P30	30	745
F3SJ-A0770P30	31	770
F3SJ-A0795P30	32	795
F3SJ-A0820P30	33	820
F3SJ-A0845P30	34	845
F3SJ-A0870P30	35	870
F3SJ-A0895P30	36	895
F3SJ-A0920P30	37	920
F3SJ-A0945P30	38	945
F3SJ-A0970P30	39	970
F3SJ-A0995P30	40	995
F3SJ-A1020P30	41	1020
F3SJ-A1045P30	42	1045
F3SJ-A1070P30	43	1070
F3SJ-A1095P30	44	1095
F3SJ-A1120P30	45	1120
F3SJ-A1145P30	46	1145
F3SJ-A1170P30	47	1170
F3SJ-A1195P30	48	1195
F3SJ-A1220P30	49	1220
F3SJ-A1245P30	50	1245

Model	No. of Beams	Protective Height (mm)
F3SJ-A1270P30	51	1270
F3SJ-A1295P30	52	1295
F3SJ-A1320P30	53	1320
F3SJ-A1345P30	54	1345
F3SJ-A1395P30	56	1395
F3SJ-A1420P30	57	1420
F3SJ-A1445P30	58	1445
F3SJ-A1470P30	59	1470
F3SJ-A1495P30	60	1495
F3SJ-A1520P30	61	1520
F3SJ-A1545P30	62	1545
F3SJ-A1570P30	63	1570
F3SJ-A1620P30	65	1620
F3SJ-A1695P30	68	1695
F3SJ-A1745P30	70	1745
F3SJ-A1770P30	71	1770
F3SJ-A1795P30	72	1795
F3SJ-A1820P30	73	1820
F3SJ-A1870P30	75	1870
F3SJ-A1895P30	76	1895
F3SJ-A1920P30	77	1920
F3SJ-A1995P30	80	1995
F3SJ-A2120P30	85	2120
F3SJ-A2245P30	90	2245
F3SJ-A2370P30	95	2370
F3SJ-A2495P30	100	2495
F3SJ-A55 Series		
F3SJ-A0270P55	6	270
F3SJ-A0320P55	7	320
F3SJ-A0370P55	8	370
F3SJ-A0420P55	9	420
F3SJ-A0470P55	10	470
F3SJ-A0520P55	11	520
F3SJ-A0570P55	12	570
F3SJ-A0620P55	13	620
F3SJ-A0670P55	14	670
F3SJ-A0720P55	15	720
F3SJ-A0770P55	16	770
F3SJ-A0820P55	17	820
F3SJ-A0870P55	18	870
F3SJ-A0920P55	19	920
F3SJ-A0970P55	20	970

Model	No. of Beams	Protective Height (mm)
F3SJ-A1020P55	21	1020
F3SJ-A1070P55	22	1070
F3SJ-A1120P55	23	1120
F3SJ-A1170P55	24	1170
F3SJ-A1220P55	25	1220
F3SJ-A1270P55	26	1270
F3SJ-A1320P55	27	1320
F3SJ-A1370P55	28	1370
F3SJ-A1420P55	29	1420
F3SJ-A1470P55	30	1470
F3SJ-A1520P55	31	1520
F3SJ-A1570P55	32	1570
F3SJ-A1620P55	33	1620
F3SJ-A1670P55	34	1670
F3SJ-A1720P55	35	1720
F3SJ-A1770P55	36	1770
F3SJ-A1820P55	37	1820
F3SJ-A1870P55	38	1870
F3SJ-A1920P55	39	1920
F3SJ-A1970P55	40	1970
F3SJ-A2020P55	41	2020
F3SJ-A2070P55	42	2070
F3SJ-A2120P55	43	2120
F3SJ-A2170P55	44	2170
F3SJ-A2220P55	45	2220
F3SJ-A2270P55	46	2270
F3SJ-A2320P55	47	2320
F3SJ-A2370P55	48	2370
F3SJ-A2420P55	49	2420
F3SJ-A2470P55	50	2470

Notes: Connection cables are not included with the products and must be purchased separately as needed.

* The suffix "-TS" is attached to the model number of models with fixed auto reset.

[1] Models with S-mark certification have an "-S" at the end of the model number. S-mark certification is for equipment sold in South Korea. Example: F3SJ-A0245P14-S.

[2] Models with fixed auto reset (-TS). Parameters cannot be set using the F39-MC21 Setting Console or F39-GWUM "SD Manager" Support Software for F3SJ-A.

Ordering (continued)

Accessories

Model	Description
Single-End Connector Cable (2 cables per set, for emitter and receiver) For wiring with safety circuit such as single safety relay, safety relay unit, and safety controller	
F39-JC3A	M12 connector (8-pin), 3 m (9.8 ft.)
F39-JC7A	M12 connector (8-pin), 7 m (23.0 ft.)
F39-JC10A	M12 connector (8-pin), 10 m (32.8 ft.)
F39-JC15A	M12 connector (8-pin), 15 m (49.2 ft.)
F39-JC20A	M12 connector (8-pin), 20 m (65.6 ft.)
Double-End Connector Cable (2 cables per set, for emitter and receiver) For connection with F3SP-B1P control unit, and for extension when series-connected. Note: To extend the cable length under series connection, use F39-JJR3W and F39-JC□B in combination.	
F39-JCR5B	M12 connector (8-pin), 0.5 m (1.6 ft.)
F39-JC1B	M12 connector (8-pin), 1 m (3.3 ft.)
F39-JC3B	M12 connector (8-pin), 3 m (9.8 ft.)
F39-JC5B	M12 connector (8-pin), 5 m (16.4 ft.)
F39-JC7B	M12 connector (8-pin), 7 m (23.0 ft.)
F39-JC10B	M12 connector (8-pin), 10 m (32.8 ft.)
F39-JC15B	M12 connector (8-pin), 15 m (49.2 ft.)
F39-JC20B	M12 connector (8-pin), 20 m (65.6 ft.)
Series Connection Cable (2 cables per set, for emitter and receiver)	
F39-JJR3W	Series connection cable[3] or when using water-resistant case[4], 0.3 m (1.0 ft.)
F39-JC□B	Extension cable, 0.5 to 15 m (1.6 to 49.2 ft.) To change series connection length in combination with F39-JJR3W
F39-JJR06L	Side-by-side series connection cable, 0.06 m (2.4 in.) Dedicated series connection cable with minimum length, used in place of the sensor's cable with connector
F39-JJR15L	Side-by-side series connection cable, 0.15 m (5.9 in.) Dedicated series connection cable with minimum length, used in place of the sensor's cable with connector
Sensor Mounting Brackets (spare parts)	
F39-LJ1	Standard mounting bracket (for top/bottom), included with F3SJ system, 2 for emitter and 2 for receiver (total of 4 per set)
F39-LJ2	Flat side mounting bracket, Use these small-sized brackets when performing side mounting with standard mounting brackets so that they do not protrude from the detection surface, 2 for emitter and 2 for receiver (total of 4 per set)
F39-LJ3	Free-location mounting bracket (also used as standard intermediate bracket), Use these brackets for mounting any place without using standard bracket, 1 set with 2 pieces
Key Cap for Muting	
F39-CN6	Cap attaches to the main unit to enable muting function, attach to either an emitter or a receiver, orange case
Setting Tools[5]	
F39-GWUM	SD Manager Software Accessories: SD Manager CD-ROM, F39-CN1 Branch Connector, Connector Cap, 2 m Dedicated Cable, 0.3 m Dedicated Cable with Plug, Instruction Manual
F39-MC21	Setting Console Accessories: F39-CN1 Branch Connector, Connector Cap, 2 m Dedicated Cable, 0.3 m Dedicated Cable with Plug, Instruction Manual
F39-JC2M	Spare cable for F39-GWUM and F39-MC21


F39-JC7A


F39-JC15B


F39-JJR3W


F39-JJR06L
F39-JJR15L


F39-LJ1 F39-LJ2


F39-LJ3 F39-CN6

[3] Total cable length of series connection is 0.6 m to connect to connector cable of the main sensor unit. For series connection with minimum length, use the F39-JJR06L or F39-JJR15L.

[4] When using the F39-EJ□□□□-L/D water-resistant case in series connection configurations, use the special series connection cables for the water-resistant case.

(Continued on next page)

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering (continued)

Accessories (continued)

Model	Description
Setting Tools[5]	
F39-GWUM	SD Manager Software Accessories: SD Manager CD-ROM, F39-CN1 Branch Connector, Connector Cap, 2 m Dedicated Cable, 0.3 m Dedicated Cable with Plug, Instruction Manual
F39-MC21	Setting Console Accessories: F39-CN1 Branch Connector, Connector Cap, 2 m Dedicated Cable, 0.3 m Dedicated Cable with Plug, Instruction Manual
F39-JC2M	Spare cable for F39-GWUM and F39-MC21
Control Unit	
F3SP-B1P	Relay, 3 N.O. + 1 N.C. output, for connection with F3SJ-A, use an F39-JC□B double-end connector cable
Force-Guided Relays	
G7SA-2A2B	4 contacts, 2 N.O. + 2 N.C., Rated switch load: 250 VAC 6 A, 30 VDC 6 A
G7SA-3A1B	4 contacts, 3 N.O. + 1 N.C., Rated switch load: 250 VAC 6 A, 30 VDC 6 A
G7S-4A2B-E	6 contacts, 4 N.O. + 2 N.C., Rated switch load: 250 VAC 10 A, 30 VDC 10 A
G7S-3A3B-E	6 contacts, 3 N.O. + 3 N.O., Rated switch load: 250 VAC 10 A, 30 VDC 10 A
Dedicated External Indicator Set (Can be connected to either an emitter or a receiver)	
F39-A01PR-PAC	Indicator (red), mounting bracket (1 set), and dedicated connection cable (0.1 m)
F39-A01PG-PAC	Indicator (green), mounting bracket (1 set), and dedicated connection cable (0.1 m)
F39-A01PY-PAC	Indicator (yellow), mounting bracket (1 set), and dedicated connection cable (0.1 m)
General External Indicator Cable	
F39-JJ3N	Cable to connect top of the main unit and an off-the-shelf external indicator (2-wire), 3 m (9.8 ft.)
Spatter Protection Cover	
F39-HJ□□□□	For F3SJ-A series sensor, reduces operating range by 10%, includes two pieces for emitter and receiver
Water-Resistant Case (Set of 1 tube, packing, and dedicated connector cable) When using for both emitter and receiver, order two sets.	
F39-EJ□□□□-L	Water-resistant case for emitter, includes gray cable for emitter
F39-EJ□□□□-D	Water-resistant case for receiver, includes black cable for receiver
F39-EJ-R[6]	Rear mounting brackets, top/bottom 1 each, total of 2
F39-EJ-S[6]	Side mounting brackets, top/bottom 1 each, total of 2
F39-JJR3WE-L	Series connection cable for emitter, purchase additionally for series connection when using the water-resistant case
F39-JJR3WE-D	Series connection cable for receiver, purchase additionally for series connection when using the water-resistant case
Branch Connector for F3SX (F39-JC□T to F39-JC□B)	
F39-CN5	Branch connector for F3SX
Wire-Saving Devices	
F39-CN8	Short-circuit connector
F39-TC5P01	Connector terminal box with muting sensor output mode (PNP)
F39-TC5P02	Connector terminal box with override mode (PNP)
F39-TC5N01	Connector terminal box with muting sensor output mode (NPN)
F39-TC5N02	Connector terminal box with override mode (NPN)
F3SP-T01	Safety terminal relays for F3SJ-A_-B_
Laser Alignment Tool	
F39-PTJ	Laser alignment tool for the F3SJ

[5] The setting tools described above can be connected only to F3SJ-A models with built-in software of Ver. 2 or later. Note that the setting tools cannot be used with products shipped prior to December 2005. The setting tools cannot be used for setting parameters on the F3SJ-A□-TS series, but the monitoring function can be used.

[6] Be sure to purchase brackets with the case to match the mounting direction (rear or side).


F39-GWUM


F39-MC21

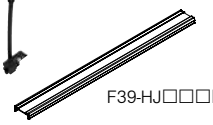

F3SP-B1P


G7SA


G7S


F39-A01-PR-PAC


F39-JJ3N


F39-HJ□□□□

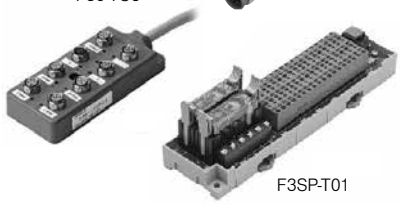

F39-EJ□□□□-L/D


F39-EJ-R


F39-EJ-S


F39-CN5

F39-TC5


F3SP-T01


F39-PTJ

F3SJ-B

Quick Link
S645
omron247.com

Safety Light Curtains

- Fast and easy installation
- Resolution: 25 mm (1.01 in.)
- Range: 7 m (23 ft.)
- Protected heights: 185 to 2065 mm (7.28 to 81.26 in.)
- Very compact size: 30 x 30 mm (1.18 x 1.18 in.)
- Cascaded designs possible – 3 segments
- Simple muting
- Cross-talk prevention



Description

In addition to the simple functions inherited from the EASY type, such as global support, easy-to-view indicators, the BASIC type includes series connection and simple muting functions . This enables the BASIC type to satisfy installations that require multiple safety light curtains.

Up to three sets connected in a series

It is possible to connect up to three sets of safety light curtains in a series. These sensors can be placed in a U-shaped or L-shaped pattern with a single power line, thus requiring less wiring.



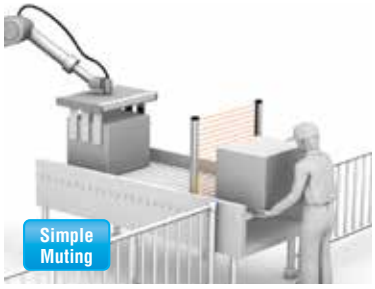
Functions inherited from the EASY type

Simple functions such as universal power voltage specification, easy-to-view diagnostics, a fixed response time have been inherited from the EASY type. As a result, expect reduced work-hours at each stage of use, from design and installation to operation.



Instant visibility of process trouble during muting

The BASIC type includes a muting function which temporarily disables the safety light curtain when a workpiece passes through. In the event of any trouble occurring, the error can be instantly recognized from the pattern of the LED indicators, allowing for a fast solution.



Specifications

Main Units

F3SJ-B□□□□P25

Sensor type		Type 4 safety light curtain
Setting tool connection *1		Parameter settings: Not available
Safety category		Safety purpose of category 4, 3, 2, 1, or B
Detection capability		Opaque objects 25 mm in diameter
Beam gap (P)		20 mm
Number of beams (n)		8 to 102
Protective height (PH)		185 to 2,065 mm
Lens diameter		Diameter 5 mm
Operating range *2		0.2 to 7 m
Response time (under stable light incident condition)	ON to OFF	15 ms max. (response time at 1 set connection, series connection of 2 sets or 3 sets)
	OFF to ON	70 ms max. (response time at 1 set connection, series connection of 2 sets or 3 sets)
Startup waiting time		2 s max.
Power supply voltage (Vs)		SELV/PELV 24 VDC±20% (ripple p-p 10% max.)
Consumption current (no load)	Emitter	Up to 22 beams: 52 mA max., 26 to 42 beams: 68 mA max., 46 to 62 beams: 75 mA max., 66 to 82 beams: 88 mA max., 86 to 102 beams: 101 mA max.
	Receiver	Up to 22 beams: 45 mA max., 26 to 42 beams: 50 mA max., 46 to 62 beams: 46 mA max., 66 to 82 beams: 61 mA max., 86 to 102 beams: 67 mA max.
Light source (emitted wavelength)		Infrared LED (870 nm)
Effective aperture angle (EAA)		Based on IEC 61496-2. Within ±2.5° for both emitter and receiver when the detection distance is 3 m or over
Safety outputs (OSSD)		Two PNP transistor outputs, load current 200 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension), Leakage current 1 mA max., load inductance 2.2 H max. *3 Maximum capacity load 1 μF *4
Auxiliary output 1		Two PNP transistor outputs, load current 100 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension), leak current 1 mA max.
Output operation mode		Safety output: On when receiving light Auxiliary output: – Reverse output of safety output for a basic system – ON when muting/override for a muting system
Input voltage		ON voltage: Vs-3 V to Vs *5 OFF voltage: 0 V to 1/2 Vs or open
Mutual interference prevention function		Mutual interference prevention algorithm prevents interference in up to 3 sets.
Series connection		Time division emission by series connection · Number of connections: up to 3 sets (between F3SJ-Bs only) Other models cannot be connected. · Total number of beams: up to 192 beams · Maximum cable length for 2 sets: no longer than 7 m
Test function		· Self test (at power-ON and at power distribution) · External test (emission stop function by test input)
Safety-related functions		· Interlock (basic system) · External device monitoring (basic system) · Muting (muting system) · Override (muting system)
Connection type		Connector method (M12, 8-pin)
Protection circuit		Output short-circuit protection, and power supply reverse polarity protection
Ambient temperature		Operating: -10 to 55°C (non-freezing), Storage: -25 to 70°C
Ambient humidity		Operating: 35% to 85% (no condensation), Storage: 35% to 95% RH
Operating ambient light intensity		Incandescent lamp: 3,000 lx max., Sunlight: 10,000 lx max.
Insulation resistance		20 MΩ min. (at 500 VDC)
Dielectric strength		1,000 VAC 50/60 Hz, 1 min
Degree of protection		IP65 (IEC 60529)
Vibration resistance		Malfunction: 10 to 55 Hz, Multiple amplitude of 0.7 mm, 20 sweeps in X, Y, and Z directions
Shock resistance		Malfunction: 100 m/s2, 1,000 times each in X, Y, and Z directions
Pollution degree		Pollution degree 3 (IEC 60664-1)

(Continued on next page)

*1. Do not use the Support Software and Setting Console for F3SJ-A. Operation cannot be guaranteed.
*2. Use of the Spatter Protection Cover causes a 10% maximum sensing distance attenuation.
*3. The load inductance is the maximum value when the safety output frequently repeats ON and OFF. When you use the safety output at 4 Hz or less, the usable load inductance becomes larger.
*4. These values must be taken into consideration when connecting elements including a capacitive load such as capacitor.
*5. The Vs indicates a voltage value in your environment.
*7. Mounting brackets are sold separately.

Specifications (continued)

Main Units

F3SJ-B□□□□P25 (continued)

Power cable	Connection method: Prewired connector cable, cable length 0.3 m, connector type (M12, 8-pin), connector: IP67 rated (when mated) Number of wires: Emitter: 8 wires Cable diameter: Dia. 6 mm Allowable bending radius: R5 mm
Extension cable	30 m max.
Material	Case: Aluminum Cap: ABS resin, PBT Optical cover: PMMA resin (acrylic) Cable: Oil resistant PVC
Weight (packed state)	Weight (g) = (protective height) x 2.7 + 500
Accessories	Test rod, User's Manual (CD-ROM) *7
Applicable standards	IEC 61496-1, EN 61496-1 UL 61496-1, Type 4 ESPE (Electro-Sensitive Protective Equipment) IEC 61496-2, CLC/TS 61496-2, UL 61496-2, Type 4 AOPD (Active Opto-electronic Protective Devices) IEC 61508-1 to -3, EN 61508-1 to -3 SIL3 IEC 13849-1: 2006, EN ISO 13849-1: 2008 (PLe, Cat.4) UL 508, UL 1998, CAN/CSA C22.2 No.14, CAN/CSA C22.2 No.0.8

Accessories

Control Unit

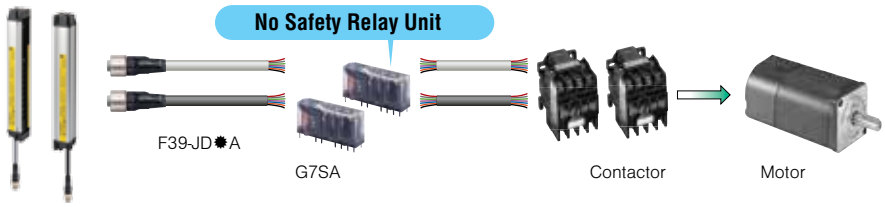
		F3SP-B1P
Applicable sensor		F3SJ-B/A (Only for PNP output type)*
Power supply voltage		24 VDC ±10%
Power supply consumption		DC1.7 W max. (not including sensor's current consumption)
Operation time		100 ms max. (not including sensor's response time)
Response time		100 ms max. (not including sensor's response time)
Relay output	Number of contacts	3NO + 1NC
	Rated load	250 VAC 5 A (cos = 1), 30 VDC 5 A L/R = 0 ms
	Rated current	5 A
Connection type	Between sensors	M12 connector (8-pin)
	Others	Terminal block
Weight (packed state)		Approx. 280 g
Accessories		Instruction manual

*NPN output type cannot be connected. Also, the system cannot be used as a muting system.

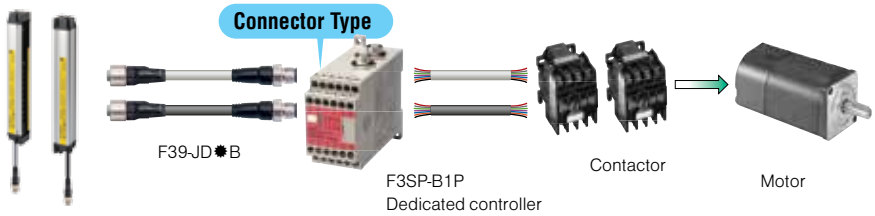
Applications

Selecting the Best Configuration

Space Efficient and Low Cost
The built-in external device monitoring function eliminates the need for a safety relay unit.



Reduced Wiring and Easy Maintenance
Cables with connectors on both ends simplify connections and prevent wiring errors.

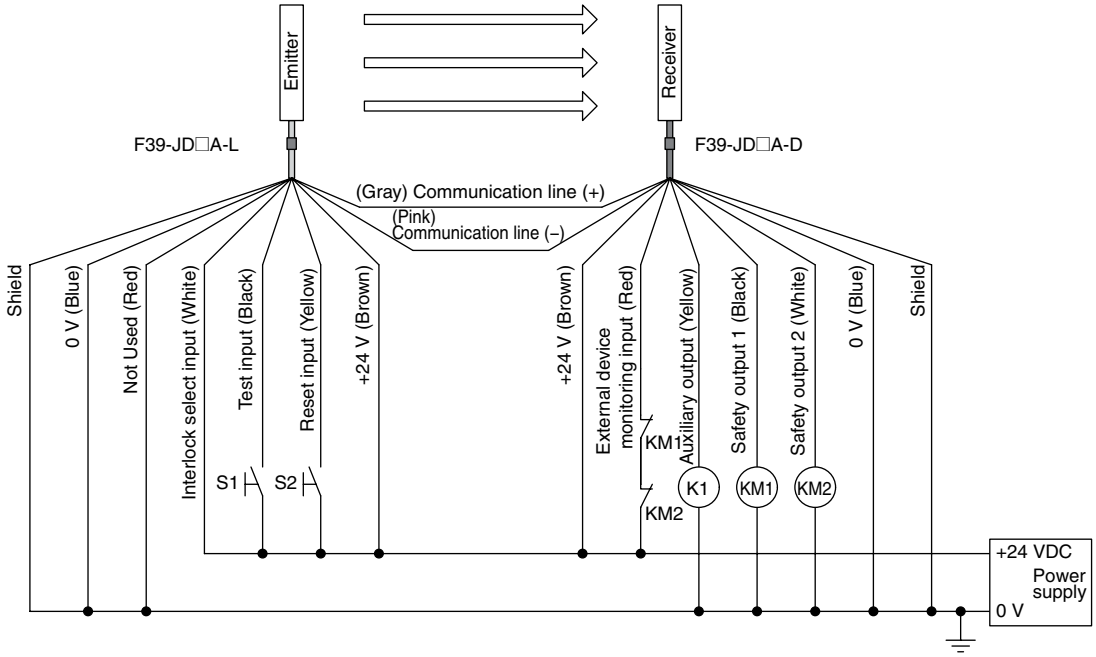


SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Wiring

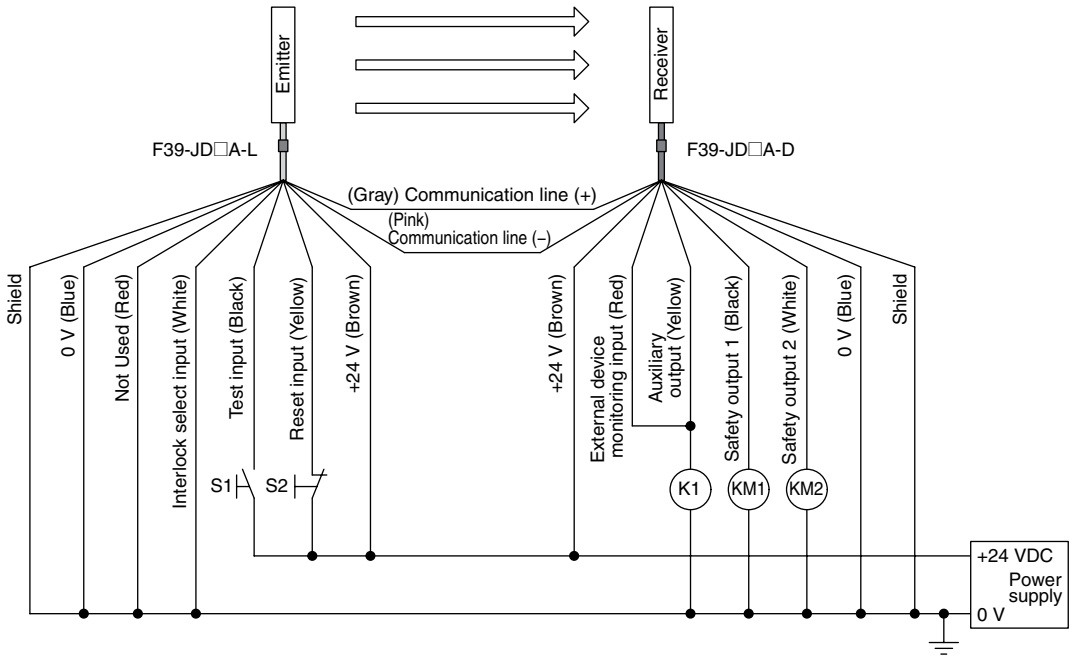
Basic Wiring Diagram

Wiring when using manual reset mode, external device monitoring



S1 : External test switch (connect to 0 V if a switch is not required)
S2 : Interlock/lockout reset switch
KM1, KM2 : Safety relay with force-guided contact (G7SA) or magnetic contactor
K1 : Load or PLC, etc. (for monitoring)

Wiring for auto reset mode and deactivated external device monitoring



S1 : External test switch (connect to 0 V if a switch is not required)
S2 : Lockout reset switch
KM1, KM2 : Safety relay with force-guided contact (G7SA) or magnetic contactor
K1 : Load or PLC, etc. (for monitoring)

Dimensions

(mm)

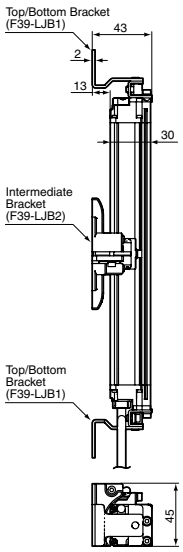
F3SJ-B/F3SJ-E Dimensions

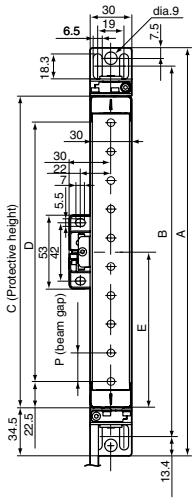
The dimensions of the F3SJ-B and F3SJ-E are the same except for connector cables and cable leads.

Main Units

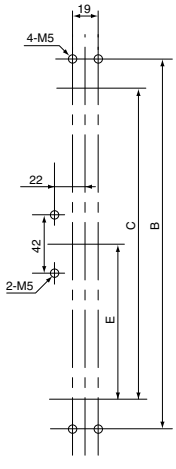
Mounting Top/Bottom and Intermediate Brackets

Backside mounting

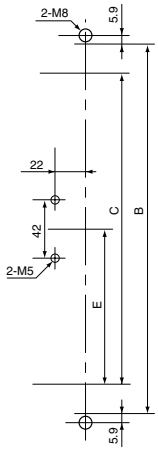




Mounting screw holes



<M5 screw fixed>

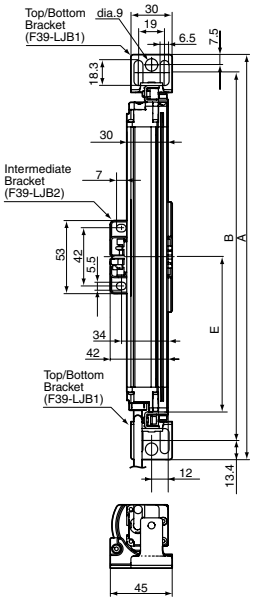


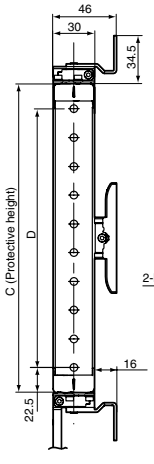
<M8 screw fixed>

C (protective height): 4-digit number in the table
A = C + 69, B = C + 42.2
D = C - 45, E = See table below, P = 20

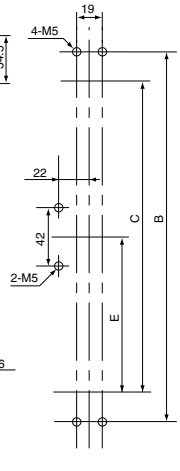
Protective height	Number of intermediate brackets	E
185 to 1,105	0	—
1,185 to 1,345	1	C/2 max.
1,425 to 2,065	2	C/3 max.

Side mounting

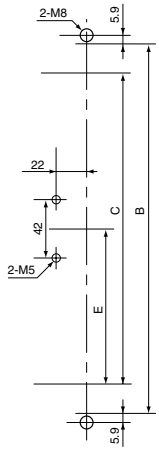




Mounting screw holes



<M5 screw fixed>

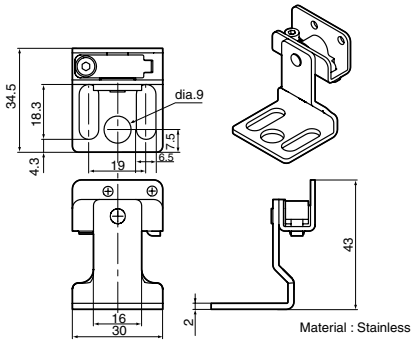


<M8 screw fixed>

C (protective height): 4-digit number in the table
A = C + 69, B = C + 42.2
D = C - 45, E = See table below, P = 20

Protective height	Number of intermediate brackets	E
185 to 1,105	0	—
1,185 to 1,345	1	C/2 max.
1,425 to 2,065	2	C/3 max.

Dimensions of top/bottom bracket for F39-LJB1



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

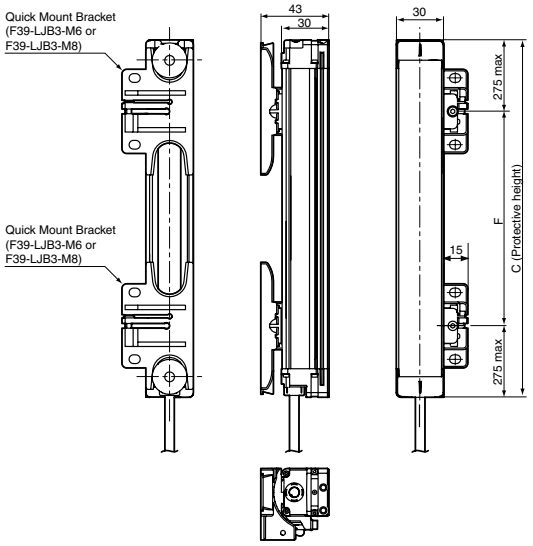
Dimensions (continued)

(mm)

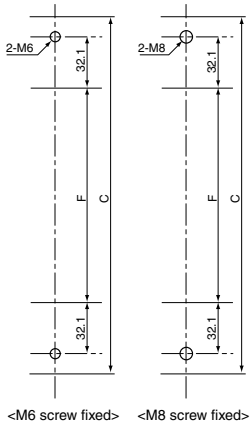
Main Units

When Using Quick Mount Brackets

Backside mounting



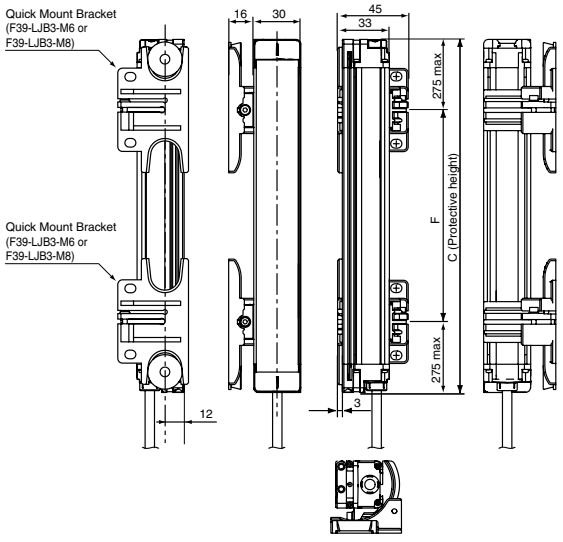
Mounting screw holes



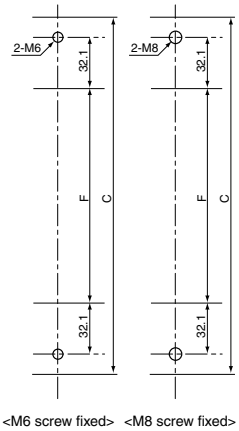
C (protective height): 4-digit number in the table
F = See the table below.

Protective height	Number of intermediate brackets	F
185 to 1,105	2	555 mm max.
1,185 to 1,585	3	555 mm max.
1,665 to 2,065	4	555 mm max.

Side mounting



Mounting screw holes

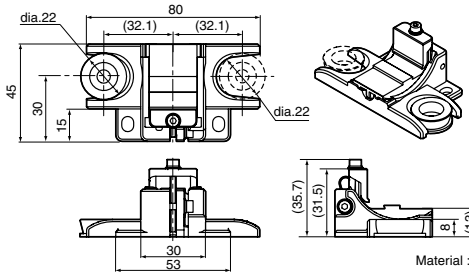


C (protective height): 4-digit number in the table
F = See the table below.

Protective height	Number of intermediate brackets	F
185 to 1,105	2	555 mm max.
1,185 to 1,585	3	555 mm max.
1,665 to 2,065	4	555 mm max.

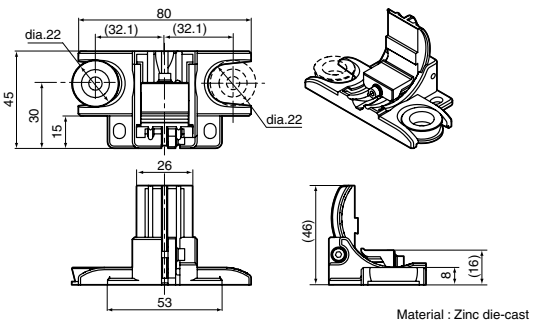
Dimensions of quick mount bracket for F39-LJB3

Backside mounting



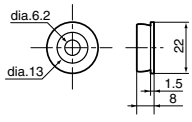
Material : Zinc die-cast

Side mounting



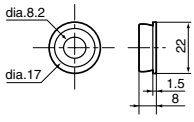
Material : Zinc die-cast

Quick mount M6 bracket



Material : Stainless

Quick mount M8 bracket



Material : Stainless

Ordering

Main Units

Safety Light Curtains

Application	Detection capability	Beam gap	Operating range	Protective height (mm)	Model
					PNP output
Hand protection	Dia. 25 mm	20 mm	0.2 to 7 m	185 to 2,065	F3SJ-B□□□□P25

Safety Light Curtain Model List

Please contact our sales representatives.

F3SJ-B Series (20 mm pitch)

Model	Number of beams	Protective height [mm] *
F3SJ-B0185P25	8	185
F3SJ-B0225P25	10	225
F3SJ-B0305P25	14	305
F3SJ-B0385P25	18	385
F3SJ-B0465P25	22	465
F3SJ-B0545P25	26	545
F3SJ-B0625P25	30	625
F3SJ-B0705P25	34	705
F3SJ-B0785P25	38	785
F3SJ-B0865P25	42	865
F3SJ-B0945P25	46	945
F3SJ-B1025P25	50	1,025
F3SJ-B1105P25	54	1,105

Model	Number of beams	Protective height [mm] *
F3SJ-B1185P25	58	1,185
F3SJ-B1265P25	62	1,265
F3SJ-B1345P25	66	1,345
F3SJ-B1425P25	70	1,425
F3SJ-B1505P25	74	1,505
F3SJ-B1585P25	78	1,585
F3SJ-B1665P25	82	1,665
F3SJ-B1745P25	86	1,745
F3SJ-B1825P25	90	1,825
F3SJ-B1905P25	94	1,905
F3SJ-B1985P25	98	1,985
F3SJ-B2065P25	102	2,065

*Protective height (mm) = Total sensor length

Accessories (sold separately)

Single-end Connector Cable (2 cables per set, for emitter and receiver)

For wiring with safety circuit such as single safety relay, safety relay unit, and safety controller.

Appearance	Cable length	Specifications	Model
	3 m	M12 connector (8-pin)	F39-JD3A
	7 m		F39-JD7A
	10 m		F39-JD10A
	15 m		F39-JD15A
	20 m		F39-JD20A

Double-end Connector Cable (2 cables per set, for emitter and receiver)

Control unit for connection with F3SP-B1P, to extend the length under series connection.*

Appearance	Cable length	Specifications	Model
	0.5 m	M12 connector (8-pin)	F39-JDR5B
	1 m		F39-JD1B
	3 m		F39-JD3B
	5 m		F39-JD5B
	7 m		F39-JD7B
	10 m		F39-JD10B
	15 m		F39-JD15B
	20 m		F39-JD20B

*To extend the cable length under series connection, use F39-JBR2W and F39-JD□B in combination. Also, the cable length 10 to 20 m cannot be used.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering (continued)

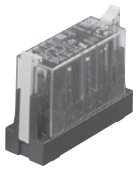
Accessories (sold separately) (continued)

Series-connection Cable (2 cables per set, for emitter and receiver)

Type	Appearance	Cable length	Model	Application
Series connection cable for extension		0.2 m	F39-JBR2W *1	For series connection *2
Extension cable		0.5 to 7 m	F39-JD□B	To change series connection length in combination with F39-JBR2W

*1. This product is for F3SJ-B only.
*2. Total cable length of series connection is 0.5 m to connect to connector cable of the main sensor unit.

Relays with Forcibly Guided Contacts

Type	Appearance	Specifications	Model
G7SA Relays with Forcibly Guided Contacts		· Nodes: 4 · Contact type: 2A2B · Rated switch load: 250 VAC 6A, 30 VDC 6A	G7SA-2A2B
		· Nodes: 4 · Contact type: 3NO+1NC · Rated switch load: 250 VAC 6A, 30 VDC 6A	G7SA-3A1B
G7S-□-E Relays with Forcibly Guided Contacts		· Nodes: 6 · Contact type: 4NO+2NC · Rated switch load: 250 VAC 10 A, 30 VDC 10 A	G7S-4A2B-E
		· Nodes: 6 · Contact type: 3NO+3NC · Rated switch load: 250 VAC 10 A, 30 VDC 10 A	G7S-3A3B-E

Laser Pointer

Appearance	Description	Model
	Laser Pointer for F3SJ	F39-PTJ

Key Cap for Muting

Appearance	Description	Model
	Muting key cap for F3SJ-B	F39-CN10

Ordering (continued)

Accessories (sold separately) (continued)

Sensor Mounting Bracket (sold separately)

Appearance	Specifications	Model	Application	Remarks
	Top/bottom bracket	F39-LJB1	Top/bottom bracket for F3SJ-E/B	2 for the emitter, 2 for the receiver, total of 4 per set
	Intermediate bracket	F39-LJB2 *1 *2	In combination use with top/bottom bracket for F3SJ-E/B Can be used as free-location bracket.	1 set with 2 pieces
	Quick mount bracket	F39-LJB3-M6 *1	Quick mount bracket for F3SJ-E/B Supports M6 slide nut for aluminum frame.	1 set with 2 pieces
		F39-LJB3-M8 *2	Quick mount bracket for F3SJ-E/B Supports M8 slide nut for aluminum frame.	
	M6 slide nut	F39-LJB3-M6K *1	Spare slide nut for use with Quick mount bracket.	Hexagon socket head cap screws (M6 x 10) are included.
	M8 slide nut	F39-LJB3-M8K *2		Hexagon socket head cap screws (M8 x 14) are included.
	Compatible mounting bracket	F39-LJB4	Mounting bracket used when replacing existing area sensors (F3SJ-A or F3SN) with the F3SJ-E/B.	2 for the emitter, 2 for the receiver, total of 4 per set

Note: All the sensor mounting brackets for the F3SJ-E are sold separately.
*1. Combining F39-LJB2 and F39-LJB3-M6K makes F39-LJB3-M6.
*2. Combining F39-LJB2 and F39-LJB3-M8K makes F39-LJB3-M8.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

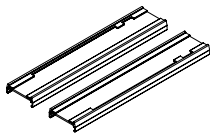
For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering (continued)

Accessories (sold separately) (continued)

Spatter Protection Cover (2 cables per set, common for emitter/receiver)

Appearance	Model
	F39-HB□□□□*1 *2

*1. The same 4-digit numbers as the protective heights (□□□□ in the light curtain model names) are substituted in the model names.
*2. It cannot be mounted to the models with the suffix "-02TS".

Protective Bar

Appearance	Model	Remarks
	F39-PB□□□□*1	· 2 light curtain brackets · 4 mounting brackets · 0 to 4 intermediate brackets for backside mounting (quantity required for the sensing width) · 0 to 4 intermediate brackets for mounting to the sides (quantity required for the sensing width)
	F39-PB□□□□-S *1 *2	· 1 light curtain bracket · 2 mounting brackets · 0 to 2 intermediate brackets for backside mounting (quantity required for the sensing width) · 0 to 2 intermediate brackets for mounting to the sides (quantity required for the sensing width)

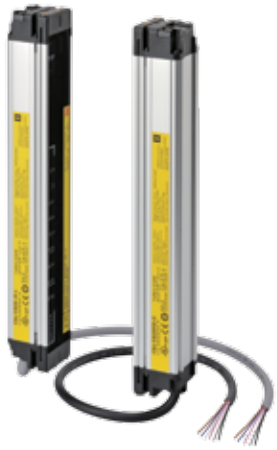
Note: The following are not provided with the protective bars: Safety Light Curtain, Safety Light Curtain Top/Bottom Brackets, Wall Mounting Screw Unit
*1. The same 4-digit numbers indicating the protective height that is used in the Sensor model number (□□□□) are used in the part of the Protector model number.
*2. Purchase the F39-PB□□□□ (which contains two sets of brackets) to use Protective Bars for both the Emitter and Receiver.

F3SJ-E

Quick Link
S646
omron247.com

Safety Light Curtains

- Fast and easy installation
- Resolution: 25 mm (1.01 in.)
- Range: 7 m (23 ft.)
- Protected heights: 185 to 1105 mm (7.28 to 43.50 in.)
- Very compact size: 30 x 30 mm (1.18 x 1.18 in.)
- Cross-talk prevention
- 3 m integrated cables



Description

The EASY type safety light curtain is well suited for straight-forward on/off detection applications.

By carefully selecting the available functions, we have reduced man hours necessary for installation by approximately 1/2 when compared with existing models.

Reduced installation time means added savings to your project's budget.

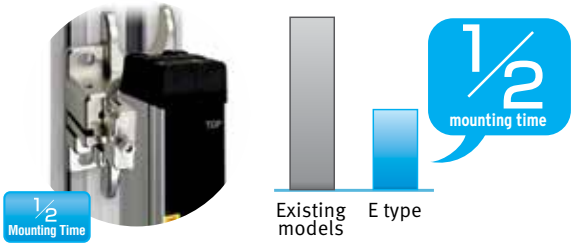
Machine safety first, narrowed down to the simplest functions:

Upon detection of personnel, the machine stops. Simple yet very optimal.



1/2 the mounting time. Fixed response time makes calculation of the safety distance easier.

Reduced wiring, quick mount brackets and easy-to-view alignment beams all add up to cost savings. Additionally, with one fixed response time, it is now easier to calculate the safety distance.



Global Support

Omron will support you through the our global network.



Easy-to-view Diagnostics

These indicators enable you to intuitively know the status and cause of any error. This allows faster installation while reducing machine down time.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Specifications

Main Units

F3SJ-E□□□□P25

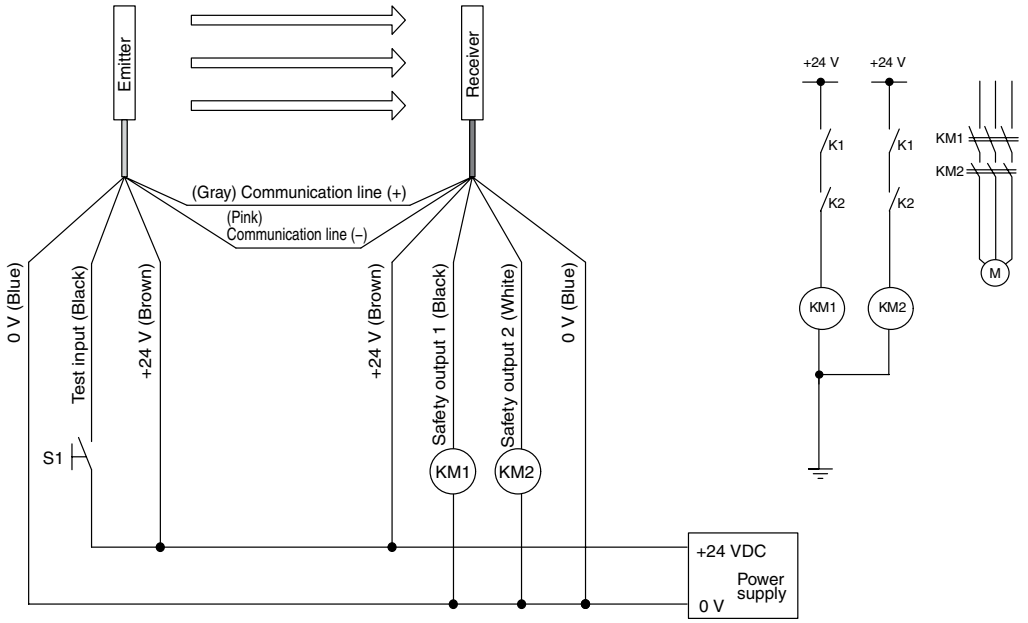
Sensor type		Type 4 safety light curtain
Setting tool connection *1		Parameter settings: Not available
Safety category		Safety purpose of category 4, 3, 2, 1, or B
Detection capability		Opaque objects 25 mm in diameter
Beam gap (P)		20 mm
Number of beams (n)		8 to 54
Protective height (PH)		185 to 1,105 mm
Lens diameter		Diameter 5 mm
Operating range *2		0.2 to 7 m
Response time (under stable light incident condition)	ON to OFF	15 ms max.
	OFF to ON	70 ms max.
Startup waiting time		2 s max.
Power supply voltage (Vs)		SELV/PELV 24 VDC±20% (ripple p-p 10% max.)
Consumption current (no load)	Emitter	Up to 22 beams: 41 mA max., 26 to 42 beams: 57 mA max., 46 to 54 beams: 63 mA max.
	Receiver	Up to 22 beams: 42 mA max., 26 to 42 beams: 47 mA max., 46 to 54 beams: 51 mA max.
Light source (emitted wavelength)		Infrared LED (870 nm)
Effective aperture angle (EAA)		Based on IEC 61496-2. Within ±2.5° for both emitter and receiver when the detection distance is 3 m or over
Safety outputs (OSSD)		Two PNP transistor outputs, load current 200 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension), Leakage current 1 mA max., load inductance 2.2 H max. *3 Maximum capacity load 1 μF *4
Output operation mode		Safety output: On when receiving light
Input voltage		ON voltage: Vs-3 V to Vs *5 OFF voltage: 0 V to 1/2 Vs or open
Mutual interference prevention function		Mutual interference prevention algorithm prevents interference in up to 3 sets.
Test function		Self test (at power-ON and at power distribution) External test (emission stop function by test input)
Protection circuit		Output short-circuit protection, and power supply reverse polarity protection
Ambient temperature		Operating: -10 to 55°C (non-freezing), Storage: -25 to 70°C
Ambient humidity		Operating: 35% to 85% (no condensation), Storage: 35% to 95% RH
Operating ambient light intensity		Incandescent lamp: 3,000 lx max., Sunlight: 10,000 lx max.
Insulation resistance		20 MΩ min. (at 500 VDC)
Dielectric strength		1,000 VAC 50/60 Hz, 1 min
Degree of protection		IP65 (IEC 60529)
Vibration resistance		Malfunction: 10 to 55 Hz, Multiple amplitude of 0.7 mm, 20 sweeps in X, Y, and Z directions
Shock resistance		Malfunction: 100 m/s2, 1,000 times each in X, Y, and Z directions
Pollution degree		Pollution degree 3 (IEC 60664-1)
Power cable		Connection method: Pull-out type, cable length 3 m Number of wires: Emitter: 5 wires, receiver: 6 wires Cable diameter: Dia. 6 mm Allowable bending radius: R5 mm
Extension cable		30 m max. *6
Material		Case: Aluminum Cap: ABS resin, PBT Optical cover: PMMA resin (acrylic) Cable: Oil resistant PVC
Weight (packed state)		Weight (g) = (protective height) x 2.6 + 800
Accessories		Test rod, User's Manual (CD-ROM) *7
Applicable standards		IEC 61496-1, EN 61496-1 UL 61496-1, Type 4 ESPE (Electro-Sensitive Protective Equipment) IEC 61496-2, CLC/TS 61496-2, UL 61496-2, Type 4 AOPD (Active Opto-electronic Protective Devices) IEC 61508-1 to -3, EN 61508-1 to -3 SIL3 IEC 13849-1: 2006, EN ISO 13849-1: 2008 (PLe, Cat.4) UL 508, UL 1998, CAN/CSA C22.2 No.14, CAN/CSA C22.2 No.0.8

*1. Do not use the Support Software and Setting Console for F3SJ-A. Operation cannot be guaranteed.
*2. Use of the Spatter Protection Cover causes a 10% maximum sensing distance attenuation.
*3. The load inductance is the maximum value when the safety output frequently repeats ON and OFF. When you use the safety output at 4 Hz or less, the usable load inductance becomes larger.
*4. These values must be taken into consideration when connecting elements including a capacitive load such as capacitor.
*5. The Vs indicates a voltage value in your environment.
*6. To extend a cable of the F3SJ-E, refer to "Chapter 3 Wiring (Extension Cable)" in the User's Manual.
*7. Mounting brackets are sold separately.

Wiring

Basic Wiring Diagram

Wiring when using a test input line



S1 : External test/lockout reset switch (connect to 0 V if a switch is not required)
KM1, KM2 : Safety relay with force-guided contact (G7SA) or magnetic contactor

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Dimensions

(mm)

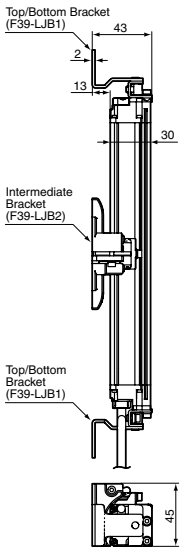
F3SJ-E/F3SJ-B Dimensions

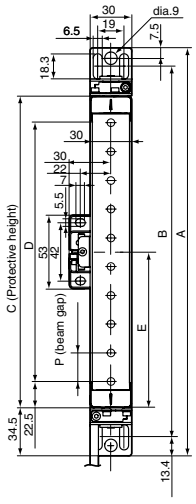
The dimensions of the F3SJ-E and F3SJ-B are the same except for connector cables and cable leads.

Main Units

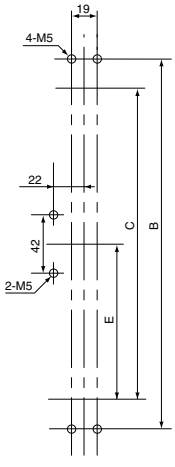
Mounting Top/Bottom and Intermediate Brackets

Backside mounting

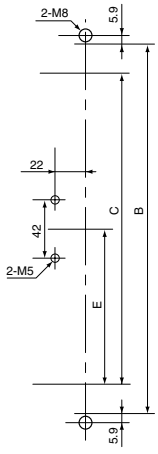




Mounting screw holes



<M5 screw fixed>

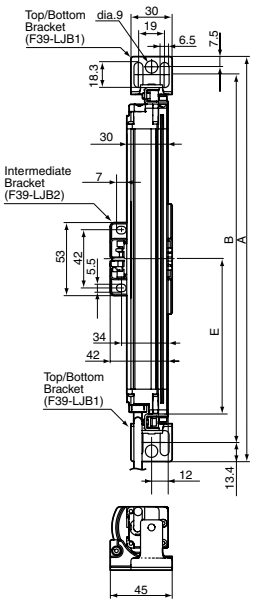


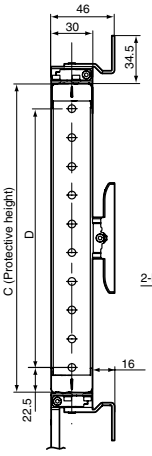
<M8 screw fixed>

C (protective height): 4-digit number in the table
A = C + 69, B = C + 42.2
D = C - 45, E = See table below, P = 20

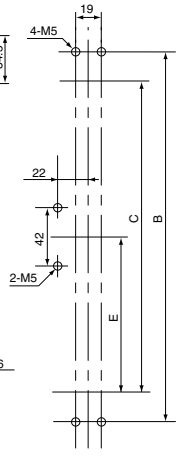
Protective height	Number of intermediate brackets	E
185 to 1,105	0	—
1,185 to 1,345	1	C/2 max.
1,425 to 2,065	2	C/3 max.

Side mounting

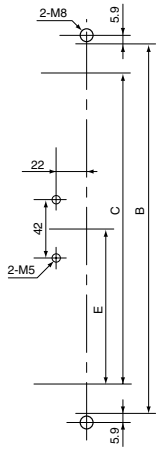




Mounting screw holes



<M5 screw fixed>

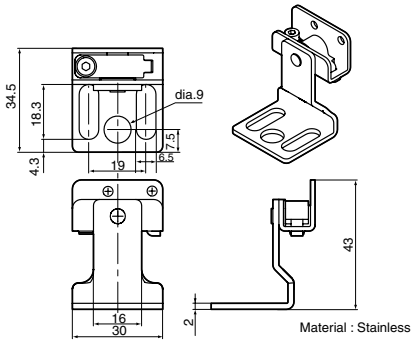


<M8 screw fixed>

C (protective height): 4-digit number in the table
A = C + 69, B = C + 42.2
D = C - 45, E = See table below, P = 20

Protective height	Number of intermediate brackets	E
185 to 1,105	0	—
1,185 to 1,345	1	C/2 max.
1,425 to 2,065	2	C/3 max.

Dimensions of top/bottom bracket for F39-LJB1



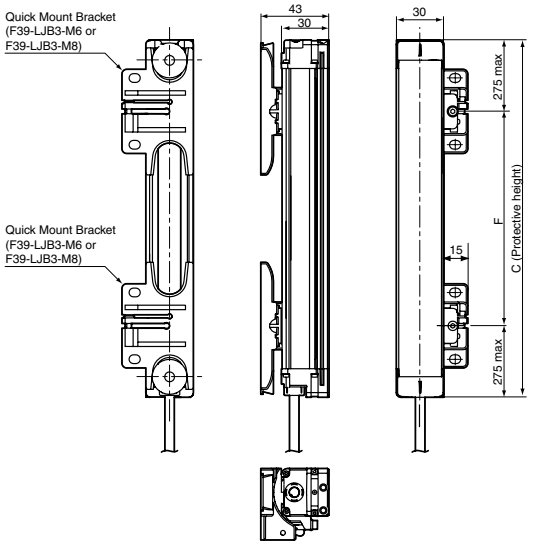
Dimensions (continued)

(mm)

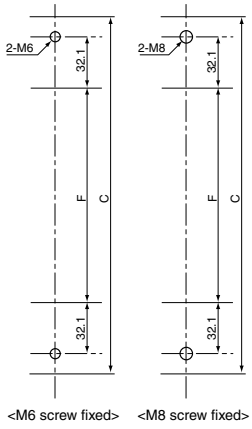
Main Units

When Using Quick Mount Brackets

Backside mounting



Mounting screw holes

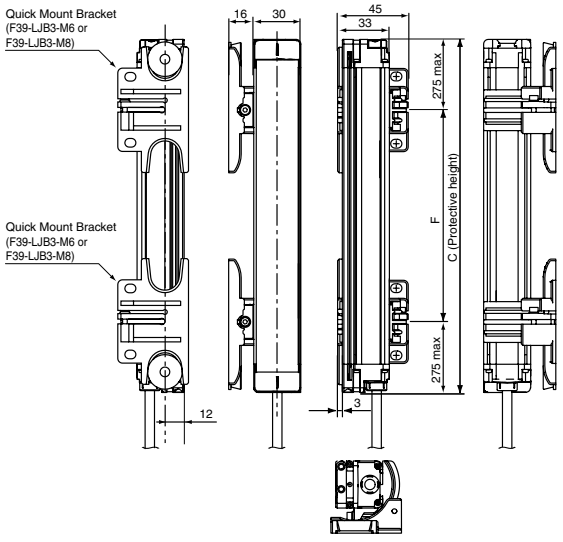


<M6 screw fixed> <M8 screw fixed>

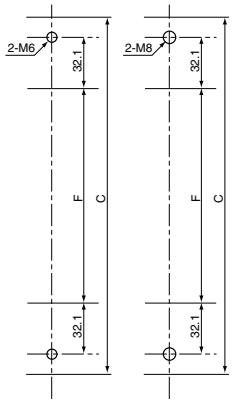
C (protective height): 4-digit number in the table
F = See the table below.

Protective height	Number of intermediate brackets	F
185 to 1,105	2	555 mm max.
1,185 to 1,585	3	555 mm max.
1,665 to 2,065	4	555 mm max.

Side mounting



Mounting screw holes



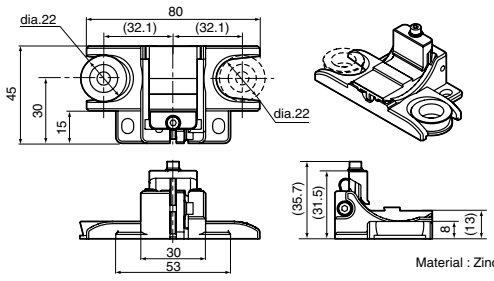
<M6 screw fixed> <M8 screw fixed>

C (protective height): 4-digit number in the table
F = See the table below.

Protective height	Number of intermediate brackets	F
185 to 1,105	2	555 mm max.
1,185 to 1,585	3	555 mm max.
1,665 to 2,065	4	555 mm max.

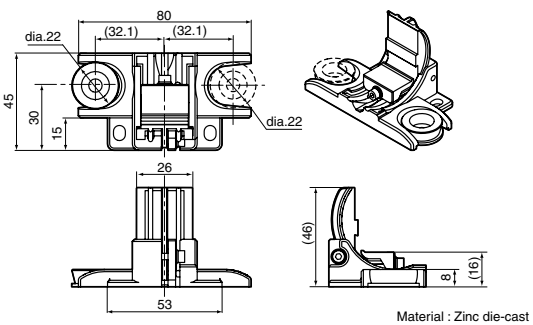
Dimensions of quick mount bracket for F39-LJB3

Backside mounting



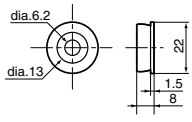
Material : Zinc die-cast

Side mounting



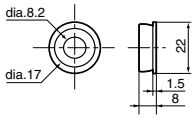
Material : Zinc die-cast

Quick mount M6 bracket



Material : Stainless

Quick mount M8 bracket



Material : Stainless

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering

Main Units

Safety Light Curtains

Application	Detection capability	Beam gap	Operating range	Protective height (mm)	Model
					PNP output
Hand protection	Dia. 25 mm	20 mm	0.2 to 7 m	185 to 1,105	F3SJ-E□□□□P25

Safety Light Curtain Model List

Please contact our sales representatives.

F3SJ-E Series (20 mm pitch)

Model	Number of beams	Protective height [mm] *
F3SJ-E0185P25	8	185
F3SJ-E0225P25	10	225
F3SJ-E0305P25	14	305
F3SJ-E0385P25	18	385
F3SJ-E0465P25	22	465
F3SJ-E0545P25	26	545
F3SJ-E0625P25	30	625

Model	Number of beams	Protective height [mm] *
F3SJ-E0705P25	34	705
F3SJ-E0785P25	38	785
F3SJ-E0865P25	42	865
F3SJ-E0945P25	46	945
F3SJ-E1025P25	50	1,025
F3SJ-E1105P25	54	1,105

*Protective height (mm) = Total sensor length

Accessories (sold separately)

Relays with Forcibly Guided Contacts

Type	Appearance	Specifications	Model
G7SA Relays with Forcibly Guided Contacts		· Nodes: 4 · Contact type: 2A2B · Rated switch load: 250 VAC 6A, 30 VDC 6A	G7SA-2A2B
		· Nodes: 4 · Contact type: 3NO+1NC · Rated switch load: 250 VAC 6A, 30 VDC 6A	G7SA-3A1B
G7S-□-E Relays with Forcibly Guided Contacts		· Nodes: 6 · Contact type: 4NO+2NC · Rated switch load: 250 VAC 10 A, 30 VDC 10 A	G7S-4A2B-E
		· Nodes: 6 · Contact type: 3NO+3NC · Rated switch load: 250 VAC 10 A, 30 VDC 10 A	G7S-3A3B-E

Laser Pointer

Appearance	Output	Model
	Laser Pointer for F3SJ	F39-PTJ

(Continued on next page)

Ordering (continued)

Accessories (sold separately) (continued)

Sensor Mounting Bracket (sold separately)

Appearance	Specifications	Model	Application	Remarks
	Top/bottom bracket	F39-LJB1	Top/bottom bracket for F3SJ-E/B	2 for the emitter, 2 for the receiver, total of 4 per set
	Intermediate bracket	F39-LJB2 *1 *2	In combination use with top/bottom bracket for F3SJ-E/B Can be used as free-location bracket.	1 set with 2 pieces
	Quick mount bracket	F39-LJB3-M6 *1	Quick mount bracket for F3SJ-E/B Supports M6 slide nut for aluminum frame.	1 set with 2 pieces
		F39-LJB3-M8 *2	Quick mount bracket for F3SJ-E/B Supports M8 slide nut for aluminum frame.	
	M6 slide nut	F39-LJB3-M6K *1	Spare slide nut for use with Quick mount bracket.	Hexagon socket head cap screws (M6 x 10) are included.
	M8 slide nut	F39-LJB3-M8K *2		Hexagon socket head cap screws (M8 x 14) are included.
	Compatible mounting bracket	F39-LJB4	Mounting bracket used when replacing existing area sensors (F3SJ-A or F3SN) with the F3SJ-E/B.	2 for the emitter, 2 for the receiver, total of 4 per set

Note: All the sensor mounting brackets for the F3SJ-E are sold separately.
*1. Combining F39-LJB2 and F39-LJB3-M6K makes F39-LJB3-M6.
*2. Combining F39-LJB2 and F39-LJB3-M8K makes F39-LJB3-M8.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

F3W-MA

Quick Link
S330
omron247.com

Smart Muting Actuator

- Integrated muting sensor based on multi-beam photoelectric sensor
- A muting system can be configured easily in combination with the safety light curtain.
- Muting functions can be stably performed even when work-pieces with holes pass.



B

CE

LED Indicator Status

Shown below are indication statuses of F3W-MA LED indicators when you purchased.

Emitter

Name of Indicator		Color	Illuminated	Blinking
Operating range	LONG	Green	Long range mode is selected by DIP Switch	
Running	RUN	Green	Power is ON.	
Error	ERR	Red		Error in emitter. Generic error happens.

Receiver

Name of Indicator		Color	Illuminated	Blinking
Top-beam-state	TOP	Blue	The top beam is unblocked	
Muting output A	MUTE A	Green	Muting Output A is activated.	
Muting output B	MUTE B	Green	Muting Output B is activated.	
Off-Delay	DELAY	Yellow	Off-Delay function is enabled by DIP Switch.	
Chattering/Void Space	CHAT	Green	Chattering and Void Space Prevention mode is selected by DIP Switch.	
Muting Enable	MUTE DISABLE	Red	The Muting Enable function is enabled and Muting Enable input is turned OFF by DIP Switch.	
Error	ERR	Red		Error in receiver. Generic error happens.
Stable-state	STB	Green	Incident light level is 170% or higher of ON-threshold	
Running	RUN	Green	Power is ON.	
Communication	COM	Green	Synchronization between emitter and receiver is maintained	[Primary sensor] - Start-up (for approx. 3 s) - Synchronization between emitter and receiver is lost
Bottom-beam-state	BTM	Blue	The bottom beam is unblocked	

Specifications

			F3W-MA0100P	F3W-MA0300P
Performance	Beam Gap Between Muting Trigger Beams		100 mm	300 mm
	Number of Beams		8	20
	Standard Detection Object		30 mm	
	Operating Range	Long	0.3 to 20.0 m (1 to 65 ft.)	
		Short	0.3 to 7.0 m (1 to 23 ft.)	
	Response Time	Operation	13 ms max.	
		Reset	26 ms max. (Synchronized) 78 ms max. (Not synchronized)	
	Effective Aperture Angle		±2.5° max., emitter and receiver at operating range of 3 m or greater	
	Light Source		Infrared LEDs, Wavelength: 870 nm	
	Startup Waiting Time		2 s max.	
Electrical	Power Supply Voltage (Vs)		SELV/PELV 24 VDC±20% (ripple p-p 10% max.)	
	Current Consumption	Emitter	35 mA	45 mA
		Receiver	75 mA	75 mA
	Muting Outputs		Two PNP transistor outputs. Load current of 300 mA max., Residual voltage of 2 V max. (except for voltage drop due to cable extension)	
	Output Operation Mode	Muting Output A	Dark-On (Muting Output B is enabled when MuteB trigger beam is blocked.)	
		Muting Output B	Dark-On (Muting Output A is enabled when MuteA trigger beam is blocked.)	
	Input Voltage	ON Voltage	[MuteEnable] Vs to Vs-3 V (sink current 5 mA max.)*	
		OFF Voltage	[MuteEnable] 0 to 1/2 Vs, or open *	
		* The Vs indicates a supply voltage value in your environment.		
	Protective Circuit		Output short protection, Power supply reverse polarity protection	
	Insulation Resistance		20 MΩ or higher (500 VDC megger)	
	Dielectric Strength		1,000 VAC, 50/60 Hz (1 min)	
Functional	Functions		- Scan Code Selection - Operation Mode Selection (Point to Point Detection/ Chattering and Void Space Prevention) - Off-Delay - Muting Enable - Muting Trigger Beam Allocation - Operating Range Selection	
Environ-metal	Ambient Temperature	Operating	-10 to 55°C (13 to 131°F) (non-icing)	
		Storage	-25 to 70°C (-13 to 158°F)	
	Ambient Humidity	Operating	35% to 85% (non-condensing)	
		Storage	35% to 95%	
	Ambient Illuminance		Incandescent lamp: 3,000 lx max. on receiver surface Sunlight: 10,000 lx max. on receiver surface	
	Degree of Protection (IEC 60529)		IP65/IP67	
	Vibration Resistance (IEC 61496-1)		10 to 55 Hz, Multiple amplitude of 0.7 mm, 20 sweeps for all 3 axes	
	Shock Resistance (IEC 61496-1)		100 m/s2, 1000 shocks for all 3 axes	
	Pollution Degree (IEC 60664-1)		Pollution Degree 3	
Connections	Extension of Power Cable		100 m max. Note: For T-Shaped configuration with COM lines, the length of cable extension is 30m max.	
Material			Housing: Aluminum, Cap: PBT, Front Window: PMMA, Cable: Oil resistant PVC, FE plate: SUS	
Weight (packaged)			1.8 kg max.	2.8 kg max.
Included Accessories			Instruction Sheet	

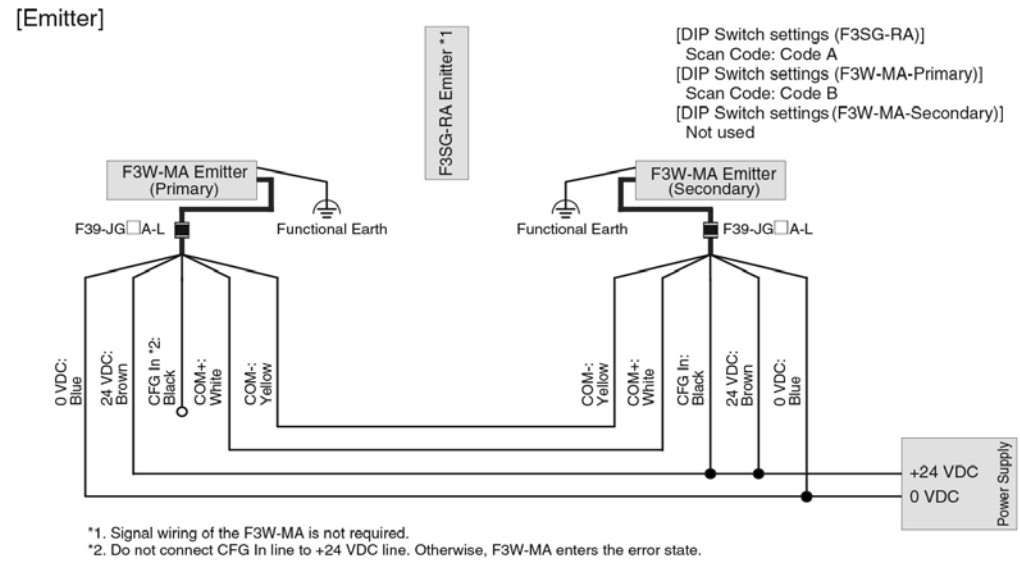
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

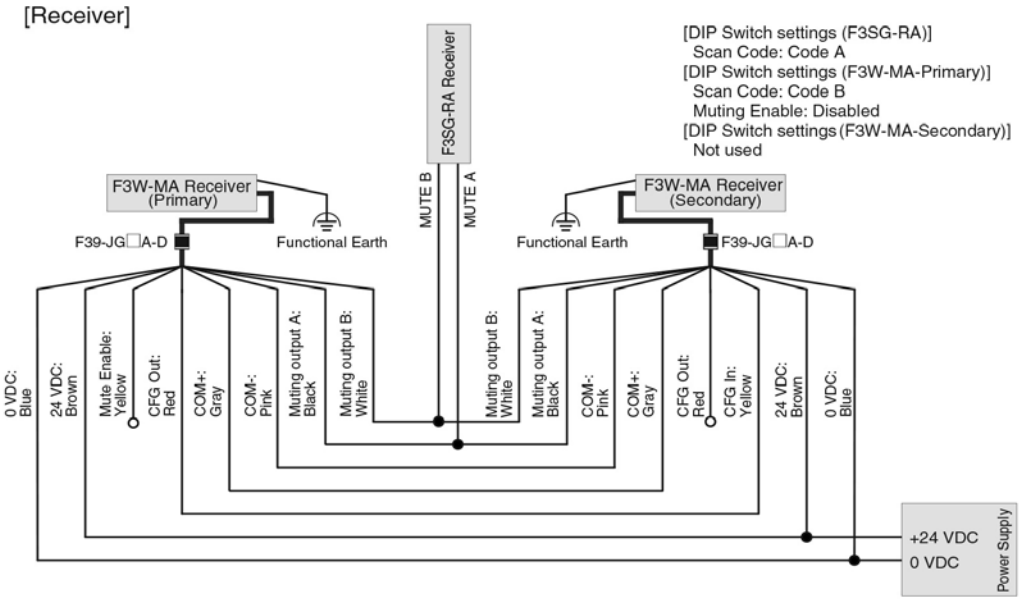
OMRON AUTOMATION & SAFETY

Wiring

Standard Muting Mode with F3SG-RA (T-Shaped Configuration with COM lines)



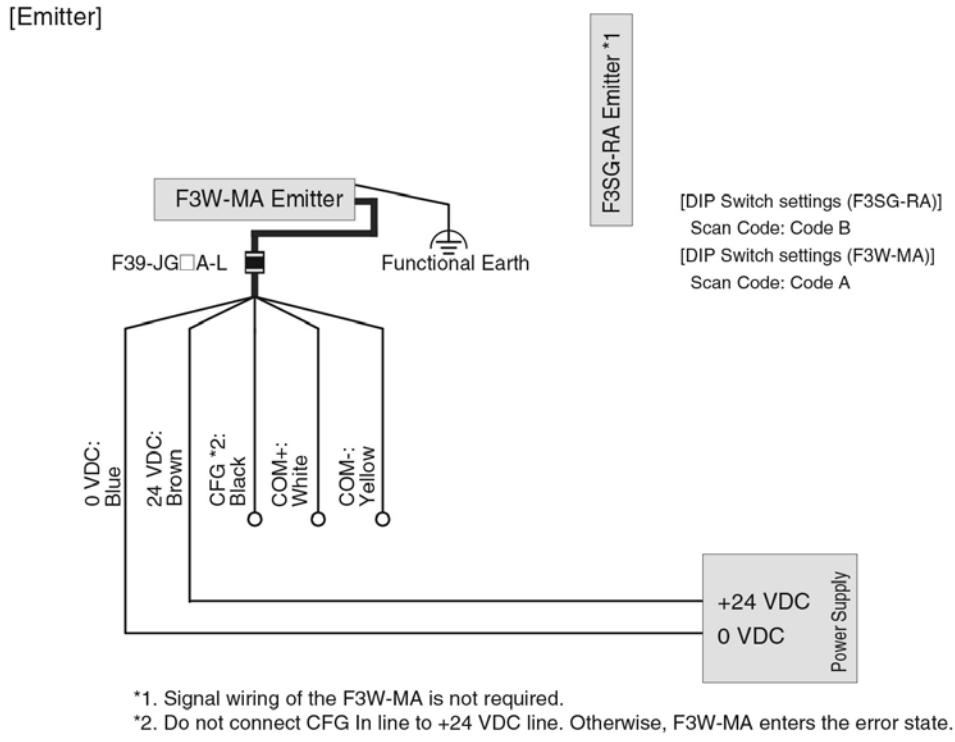
*1. Signal wiring of the F3W-MA is not required.
*2. Do not connect CFG In line to +24 VDC line. Otherwise, F3W-MA enters the error state.



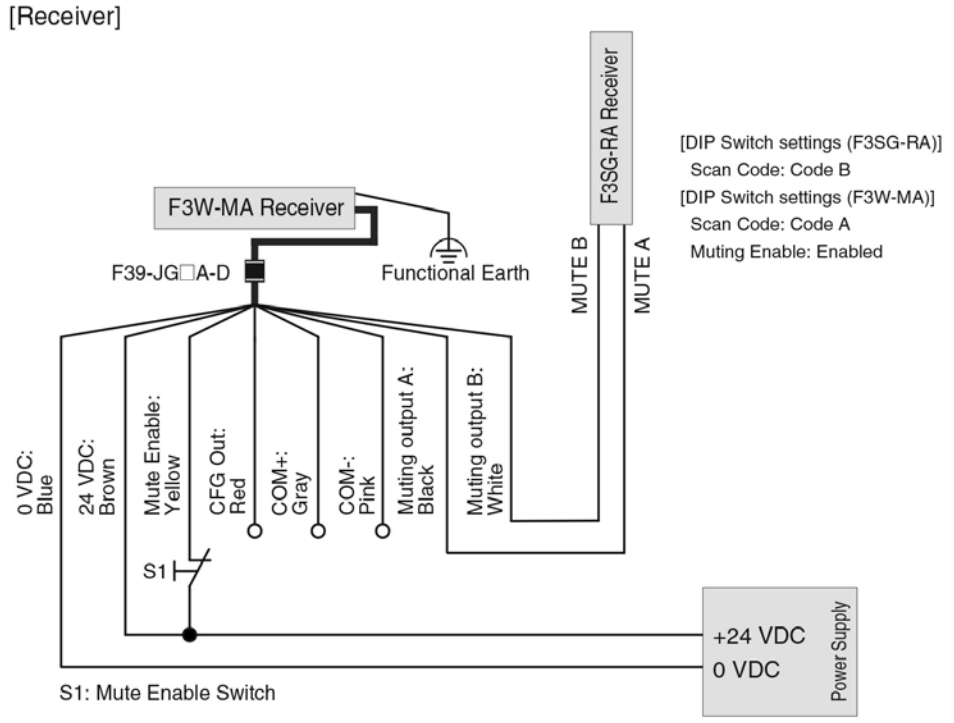
Note 1. For the wiring of safety light curtains such as F3SG-R, refer to the applicable user's manual separately.
Note 2. For devices connecting to the F3W-MA, the same power supply must be used.

Wiring (continued)

Exit-Only Muting Mode with F3SG-RA (L-Shaped Configuration)



*1. Signal wiring of the F3W-MA is not required.
*2. Do not connect CFG In line to +24 VDC line. Otherwise, F3W-MA enters the error state.

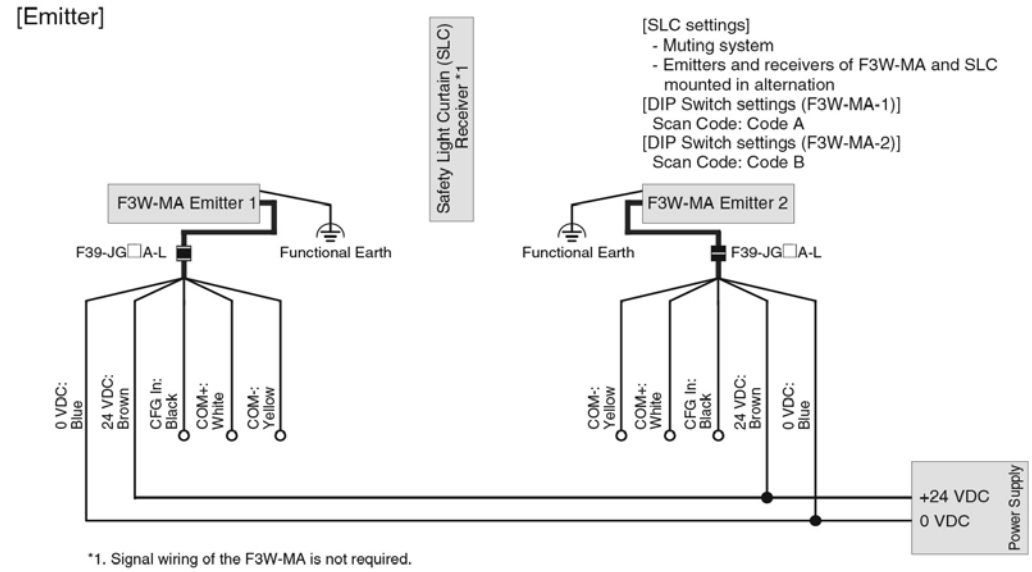


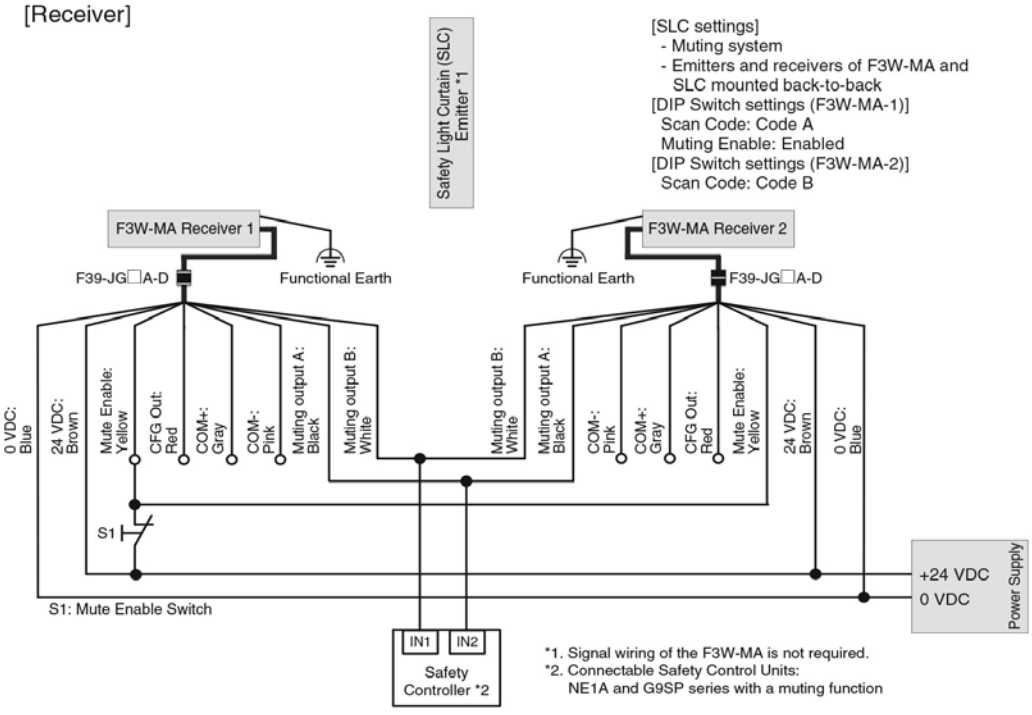
Note 1. For the wiring of safety light curtains such as F3SG-R, refer to the applicable user's manual separately.
Note 2. For devices connecting to the F3W-MA, the same power supply must be used.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Wiring (continued)

Standard Muting Mode with Other Safety Component(T-Shaped Configuration)

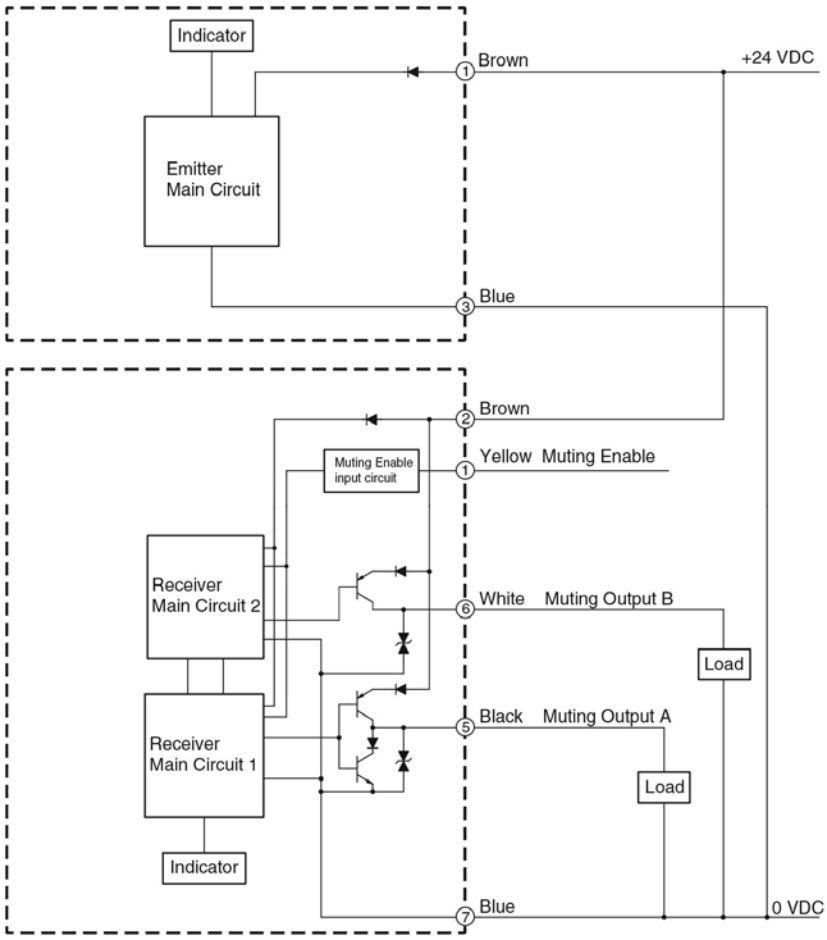




Note 1. For the wiring of safety light curtains such as F3SG-R, refer to the applicable user's manual separately.
Note 2. For devices connecting to the F3W-MA, the same power supply must be used.

Input/Output Circuit

The entire circuit diagram of the F3W-MA is shown below.
The numbers in the circles indicate the connector's pin numbers.



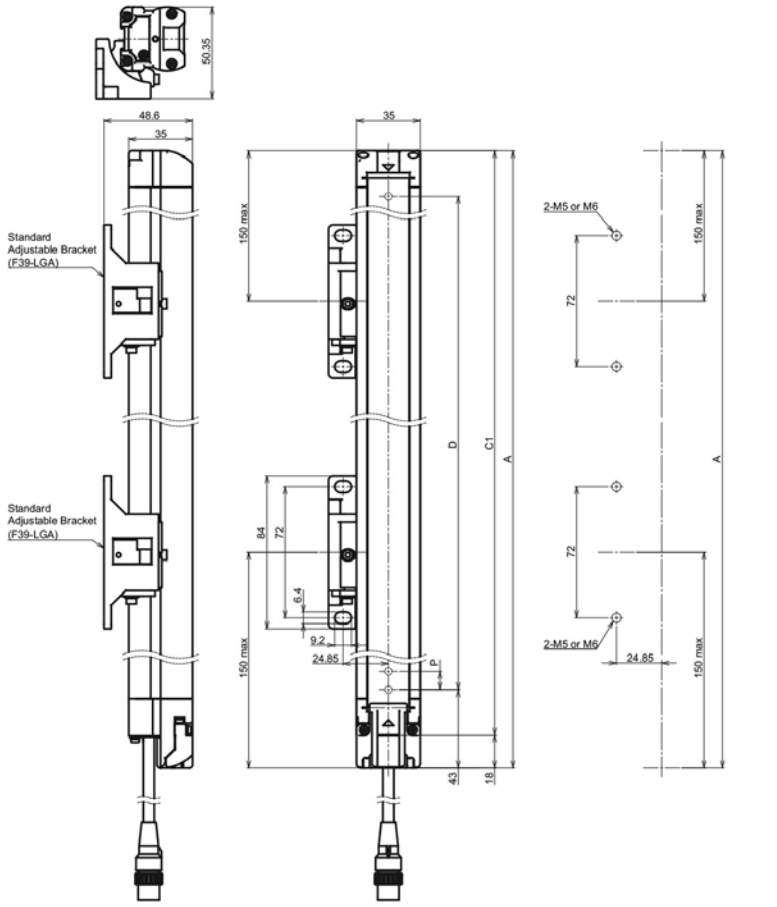
For complete specifications and additional models and accessories visit www.omron247.com

Dimensions

(mm)

Mounted with Standard Fixed Brackets (F39-LGA)

Backside Mounting



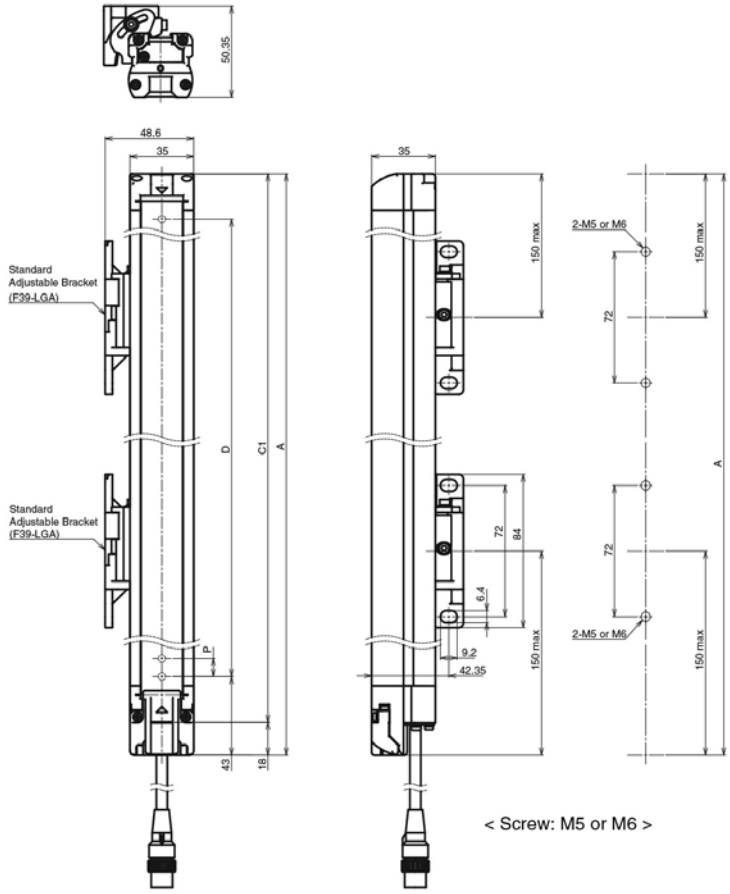
< Screw: M5 or M6 >

Model	F3W-MA0100P	F3W-MA0300P
Dimension A	208	478
Dimension C1	190	430
Dimension D	140	410
Dimension P	20	20
Number of Standard Adjustable Brackets	2	2

Dimensions (continued)

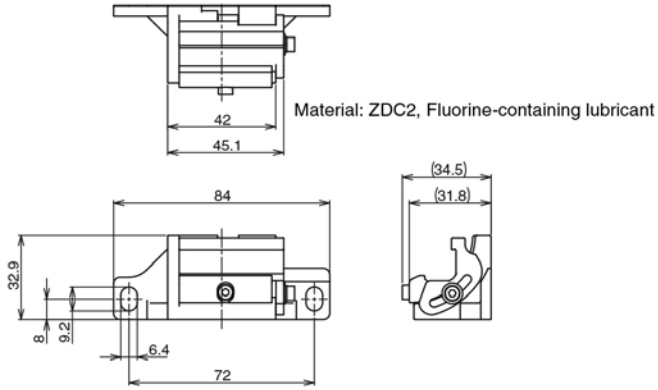
(mm)

Side Mounting



Model	F3W-MA0100P	F3W-MA0300P
Dimension A	208	478
Dimension C1	190	430
Dimension D	140	410
Dimension P	20	20
Number of Standard Adjustable Brackets	2	2

Standard Fixed Bracket (F39-LGA)



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

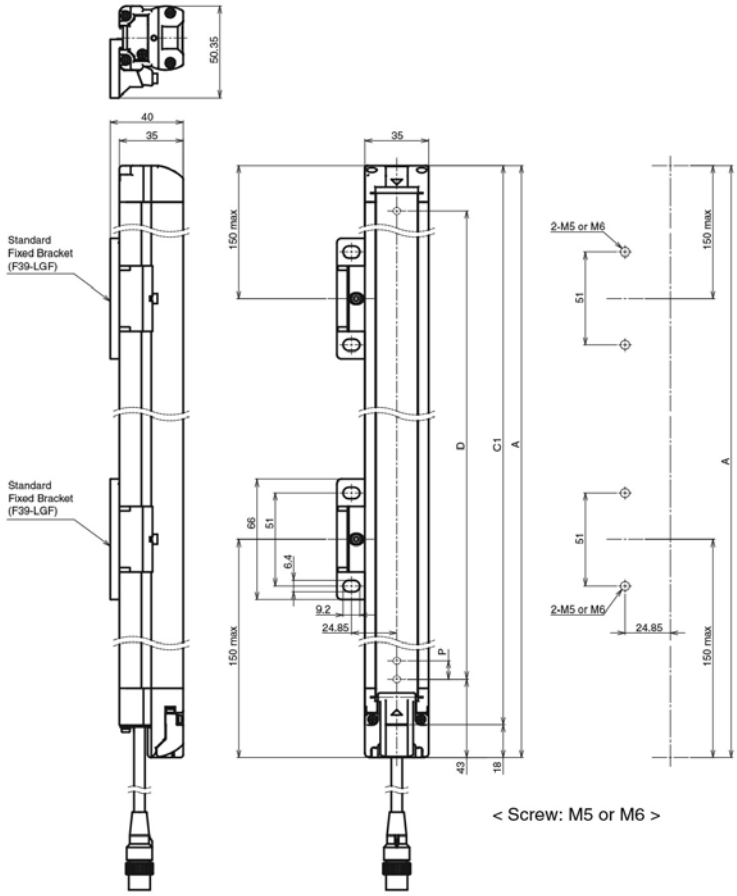
OMRON AUTOMATION & SAFETY

Dimensions (continued)

(mm)

Mounted with Standard Fixed Brackets (F39-LGF)

Backside Mounting

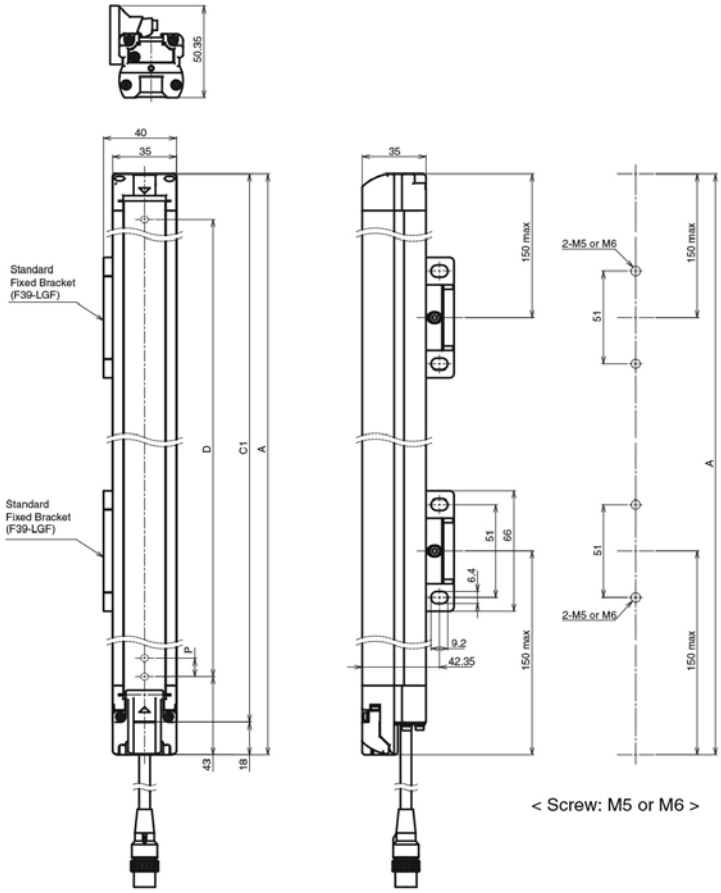


Model	F3W-MA0100P	F3W-MA0300P
Dimension A	208	478
Dimension C1	190	430
Dimension D	140	410
Dimension P	20	20
Number of Standard Adjustable Brackets	2	2

Dimensions (continued)

(mm)

Side Mounting



Model	F3W-MA0100P	F3W-MA0300P
Dimension A	208	478
Dimension C1	190	430
Dimension D	140	410
Dimension P	20	20
Number of Standard Adjustable Brackets	2	2

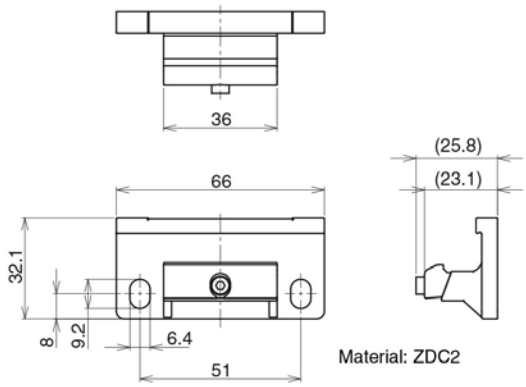
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Dimensions (continued)

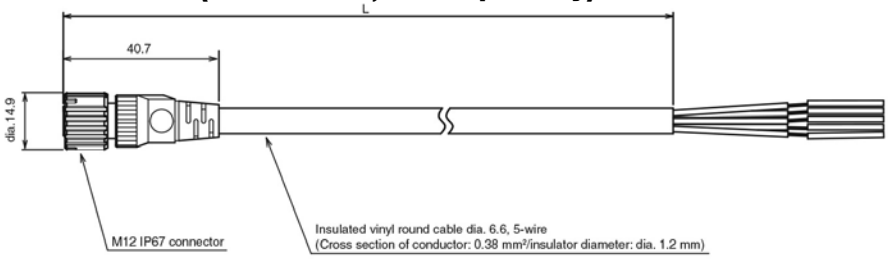
(mm)

Standard Adjustable Bracket (F39-LGF)

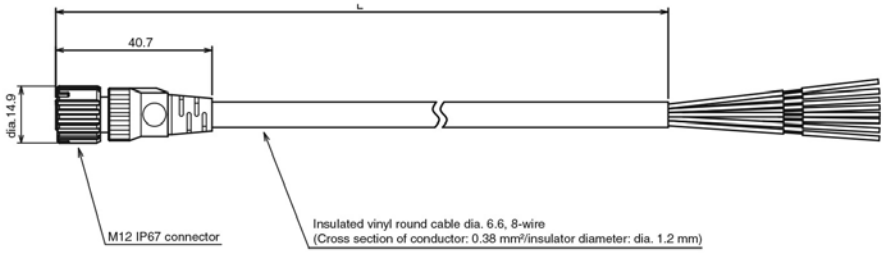


Accessories

Single-Ended Cable for Emitter (F39-JG□A-L, sold separately)



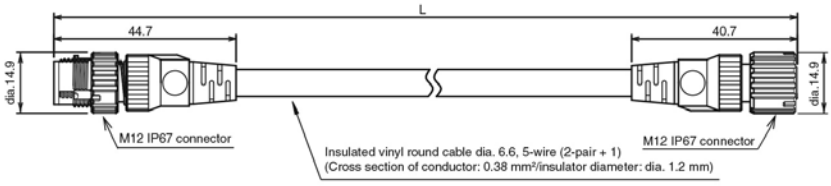
Single-Ended Cable for Receiver (F39-JG□A-D, sold separately)



Emitter cable (Gray)	Receiver cable (Black)	L (m)
F39-JG3A-L	F39-JG3A-D	3
F39-JG7A-L	F39-JG7A-D	7
F39-JG10A-L	F39-JG10A-D	10
F39-JG15A-L	F39-JG15A-D	15
F39-JG20A-L	F39-JG20A-D	20

Ordering (continued)

Double-Ended Cable for Receiver: Cable for extension (F39-JG□B-D, sold separately)



Emitter cable (Gray)	Receiver cable (Black)	L (m)
F39-JGR5B-L	F39-JGR5B-D	0.5
F39-JG1B-L	F39-JG1B-D	1
F39-JG3B-L	F39-JG3B-D	3
F39-JG5B-L	F39-JG5B-D	5
F39-JG7B-L	F39-JG7B-D	7
F39-JG10B-L	F39-JG10B-D	10
F39-JG15B-L	F39-JG15B-D	15
F39-JG20B-L	F39-JG20B-D	20

Related Manuals

ManNo.	Model	Manual name
Z352	F3SG-□R□□□□□-□□	Safety Light Curtain F3SG-□R□□□□□-□□ Series User's Manual

Ordering

Smart Muting Actuator

Appearance	Model	Beam Gap between Muting Trigger Beams	Number of Beams
	F3W-MA0100P	100mm	8
	F3W-MA0300P	300mm	20

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering (continued)

Accessories (sold separately)

Single-end Connector Cable

Appearance	Type	Cable length	Model	Specifications
	For emitter	3 m	F39-JG3A-L	Emitter cable: M12 connector (5-pin), 5 wires Color: Gray
		7 m	F39-JG7A-L	
		10 m	F39-JG10A-L	
		15 m	F39-JG15A-L	
		20 m	F39-JG20A-L	
	For receiver	3 m	F39-JG3A-D	M12 connector (8-pin), 8 wires Color: Black
		7 m	F39-JG7A-D	
		10 m	F39-JG10A-D	
		15 m	F39-JG15A-D	
		20 m	F39-JG20A-D	

Double-ended Cable

Appearance	Type	Cable length	Model	Specifications
	For emitter	0.5 m	F39-JGR5B-L	M12 connector (5-pin) on both ends Color: Gray
		1 m	F39-JG1B-L	
		3 m	F39-JG3B-L	
		5 m	F39-JG5B-L	
		7 m	F39-JG7B-L	
		10 m	F39-JG10B-L	
		15 m	F39-JG15B-L	
		20 m	F39-JG20B-L	
	For receiver	0.5 m	F39-JGR5B-D	M12 connector (8-pin) on both ends Color: Black
		1 m	F39-JG1B-D	
		3 m	F39-JG3B-D	
		5 m	F39-JG5B-D	
		7 m	F39-JG7B-D	
		10 m	F39-JG10B-D	
		15 m	F39-JG15B-D	
		20 m	F39-JG20B-D	

Sensor Mounting Brackets

Appearance	Specification	Model	Application	Remarks
	Standard Fixed Bracket	F39-LGF	Bracket to mount the F3SG-RA. Side mounting and backside mounting possible. (Included in the F3SG-RA product package)	Two brackets per set.
	Standard Adjustable Bracket	F39-LGA	Bracket to mount the F3SG-RA. Beam alignment after mounting possible. The angle adustment range is ±15°. Side mounting and backside mounting possible.	Two brackets per set.

Resource Modules Overview

Overview to the RM Series

STI RM Series resource modules provide the user of STI solid-state output safety light curtains a convenient and reliable method for enhancing and extending the capabilities of these light curtains.



Converts Solid-State Outputs to Force-Guided Relay Outputs

RM-1

This unit accepts the solid-state outputs from a single safety light curtain and provides one pair of N.O. force-guided safety relay outputs and one pair of N.C. auxiliary relay outputs. The RM-1 operates on 24 VDC which is supplied from the light curtain's safety outputs. A single connection between the STI safety light curtain and the RM-1 provides monitoring of the RM-1's output contacts.

RM-2

The RM-2 includes all the features the RM-1 has, but also serves as a central point for terminating all signals to and from a solid-state safety device including MPCE monitoring and 24 VDC.

RM-2AC

The RM-2AC module operates on 100-240 VAC voltage; it supplies DC voltage to the safety light curtain. It provides one N.O. and one N.O./N.C. force-guided safety contacts. In addition it serves as a centralized point for easy interfacing, offering removable terminal blocks and a DIN-rail mount enclosure.

RM-2AC-IP

The RM-2AC-IP module operates on 100-240 VAC voltage; it supplies DC voltage to the light curtain. It provides one N.O. and one N.O./N.C. force-guided safety contacts. In addition, it serves as a centralized point for easy interfacing, offering removable terminal blocks and an IP65 metal enclosure.
A custom version is also available for the MS4800S-SB1. This "RM-2AC-IP-SB1" is equipped with key switches for Quick fixed blank programming.

RM-X

The RM-X converts the solid-state safety outputs of an Omron device to relay outputs. It provides one N.O. and one N.O./N.C. safety relay output.

RM-3

The RM-3 mute module is a microprocessor-controlled "Type 4" safety device. The purpose of

Connects up to Four Independent Safety Devices

user-selectable NPN or PNP non-safety, auxiliary output. Additionally, connections are provided for the auxiliary output of each safety device. The RM-4 facilitates installation as all standard safety device functions are wired through its removable terminal blocks. All wiring of the safety device transmitters and receivers, as well as the 24 VDC power supply and MPCE contact monitoring are connected to the RM-4. Status indicator lights as well as a two-digit, seven-segment LED diagnostic displays make system monitoring and troubleshooting extremely easy.

Mute Module

the RM-3 is to furnish a temporary, automatic suspension of the safety function(s) provided by a safety light curtain. The RM-3 is a control accessory that provides this safety muting feature for one or two safety light curtains and is housed in a DIN box.

RM-6

The RM-6 mute module is for use with the MSF4800A and MSF4800S only. It provides for the wiring output of two to four muting sensors, housed in a 22.5 mm DIN enclosure.

RM-4

Up to four STI solid-state output safety devices in any combination can be connected to the RM-4. It provides two PNP safety outputs and one

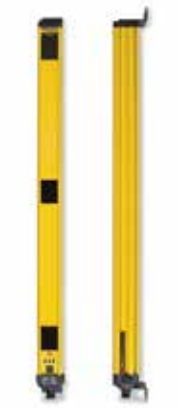
Compatibility

The RM Series is compatible with the following products:



OS32C
Safety Laser Scanner

The OS32C is a very compact safety laser scanner. It features small size (104.5 mm profile), lightweight (1.3 kg) and low power consumption (5 W). It has 70 flexible zone configurations, simplified wiring and integrated management via Ethernet.



Perimeter Access Guarding Device PA4600

The PA4600 is a long-range, multiple-beam safeguarding control system. It differs from a conventional safety light curtain in that it provides a much longer operating range and a wider beam spacing. It is an excellent choice for safeguarding the perimeter of a hazardous area. It is suited to detect the torso of personnel entering into a hazardous area rather than detection of hands and fingers.



F3SJ-A

The F3SJ-A Light Curtain is a compact “two box” light curtain with available minimum object resolutions of 14, 20, 25, 30 and 55 mm (0.55, 0.79, 1.01, 1.18 or 2.17 in.), operating range up to 7 m (23 ft.) or 9 m (29.5 ft.), and protective heights from 245 to 2495 mm (9.6 to 98 in.) depending on the protective height.



MiniSafe MS4800

The MiniSafe MS4800 Light Curtain is a “two box” light curtain with available minimum object resolutions of 14, 20, 30 and 40 mm (0.55, 0.79, 1.18 and 1.57 in.), operating range up to 20 m (65 ft.) and protective heights from 280 to 2120 mm (11 to 83 in.). It provides one pair of PNP solid-state safety outputs and one non-safety auxiliary output.

Safety Light Curtain Resource Modules

RM-1

Quick Link
S922
omron247.com

Resource Module — Converts Solid-State Outputs to Force-Guided Relay Outputs

- Converts the solid-state safety outputs of one STI safety device to electro-mechanical force-guided safety relay outputs
- Compatible with MS4800, F3SJ, PA4600, OS3101 and OS32C
- CE approved
- 55 mm DIN enclosure
- Removable terminal blocks



Safety Light Curtain Resource Modules

RM-2, RM-2AC & RM-2AC-IP

Quick Link
S923
omron247.com

Resource Module — Converts Solid-State Outputs to Force-Guided Relay Outputs

- Converts the solid-state safety and auxiliary outputs of one STI safety device to electro-mechanical force-guided safety relay outputs
- Available for DC or AC input power
- Provides connection points for all safety device functions including MPCE monitoring and 24 VDC power
- Compatible with MS4800, F3SJ, PA4600, OS3101 and OS32C
- CE approved
- Enclosures —
  RM-2: 100 mm DIN, IP20
  RM-2AC: 150 mm DIN, IP20
  RM-2AC-IP: metal chassis, IP65
- Removable terminal blocks



Safety Light Curtain Resource Modules

RM-3

Quick Link
S924
omron247.com

Resource Module — Mute Module

- Type 4 safety product, when used in combination with a Type 4 safety light curtain
- Provides muting controls for up to two light curtains
- Diagnostic display
- Solid-state safety outputs
- 100 mm DIN box enclosure
- Removable terminal blocks
- DeviceNet option
- Compatible with MS4800, F3SJ, PA4600, OS3101 and OS32C



B

Input Signals
- Input Power +24 VDC
- Two independent channels, each channel is comprised of one light curtain and up to four mute sensors
- Start
- EDM (MPCE monitoring)
- Mute enable

Output Signals
- Two independent PNP safety outputs
- NPN & PNP auxiliary outputs
- Mute lamp drivers (2)
- Mute auxiliary (NPN)
- Mute armed (NPN)

Indicators
- Diagnostic display
- Machine Run
- Machine Stop
- Interlock
- OSSD input active (light curtains)
- Sensor input active (sensors)
- Mute Enable active

Safety Light Curtain Resource Modules

RM-4

Quick Link
S925
omron247.com

Resource Module — Connects up to Four Independent Safety Devices

- Type 4 safety product when used in combination with a Type 4 safety light curtain
- Provides centralized connections for solid-state safety outputs from up to four safety devices and produces a single pair of solid-state safety outputs
- Diagnostic display
- 150 mm DIN enclosure
- Diagnostic display
- Removable terminal blocks
- Compatible with MS4800, F3SJ, PA4600, OS3101 and OS32C



Safety Light Curtain Resource Modules

RM-6

Quick Link
S926
omron247.com

Resource Module — Mute Module

- Type 4 safety product when used with the MSF4800 series
- Provides muting controls for one MSF4800
- 22.5 mm DIN box enclosure
- Compatible only with the MSF4800A and MSF4800S



Safety Light Curtain Resource Modules

RM-X

Quick Link
S927
omron247.com

Resource Module — Converts Solid-State Outputs to Force-Guided Relay Outputs

- Converts the solid-state safety outputs of one STI safety device to electro-mechanical force-guided safety relay outputs
- Compatible with MS4800, F3SJ, PA4600, OS3101 and OS32C
- CE approved
- 22.5 mm DIN enclosure



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

PA4600

Quick Link
S647
omron247.com

Perimeter Access Guarding Device

- 1 to 6 beams available
- Operating range of 70 m
- Compact size — 46 x 55 mm (1.81 x 2.17 in.)
- Simple "two-box" design — no separate control box required
- Individual Beam Indicators



B

Specifications

Performance	
Protective Height:	Variable
Operating Range:	0.8 to 70 m
Response Time:	Transmit Code A: <24 ms; Transmit Code B: <20 ms; Transmit Code C: <16 ms
Electrical	
Input Voltage (V_{in}):	24 VDC ± 20%
Input Power:	8.4 watts (without load on the outputs)
Safety Output Ratings:	Two PNP outputs sourcing 625 mA max @ V_{in} (see note 1). Short circuit protected.
Auxiliary (non-safety) Output Rating:	One NPN output sinking 100 mA max @ V_{in} or one PNP output sourcing 100 mA @ V_{in} (see notes 1 and 2)
Power Supply:	24 VDC ± 20%. The rating depends on the current requirement of the loads attached to the outputs (see note 3). The power supply must meet the requirements of IEC 60204-1 and 61496-1. STI part number 42992 or equivalent.
External Device Monitoring:	50 mA @ 24 VDC steady state
Start/Restart:	N.O. input. Momentary contact (10 mA consumption)
Effective Aperture Angle:	± 2.5° maximum, transmitter and receiver at operating range greater than 3 m per IEC 61496-2
Light Source:	Infrared light emitting diode, 880 nm
Transmitter Indicator Light:	Active (yellow)
Receiver Indicator Lights:	Machine run (green), machine stop (red), interlock/fault (yellow), individual beams and two 7-segment displays (red)
Mechanical	
Construction:	Polyester powder-painted aluminum
Cable Length:	Available in 10, 15 and 30 m lengths, unshielded.
Minimum Cable Gauge:	22 AWG (0.32 mm^2) for user-supplied cables
Cable Connections:	8-pin terminal block Optional Receiver Connector: M-12, 8-pin connector Optional Transmitter Connector: M-12, 5-pin connector
Environmental	
Enclosure Rating:	IP67
Operating Temperature:	0 to 55°C (32 to 131°F)
Relative Humidity:	95% maximum, non-condensing
Vibration:	5-60 Hz maximum on all 3 axis
Shock:	10 g of 0.016 seconds; 1,000 shocks for each axis on two axis
Approvals	ESPE Type 4 (IEC 61496-1/ -2) Category 4 / PL e (EN ISO 13849-1) SIL3 / SIL3 CL3 (IEC 61508 / EN 62061) UL508, UL1998, CAN/CSA-C22.2 No. 14, CAN/CSA-C22.2 No. 0.8, CAN/CSA-C22.2 No 0, CAN/CSA-C22.2 No 205

Specifications subject to change without notification.

Note 1: Voltage available at the outputs is equal to V_{in} - 2.0 VDC.

Note 2: Total current required by the two solid-state outputs and the aux. output should not exceed 1.35 A.

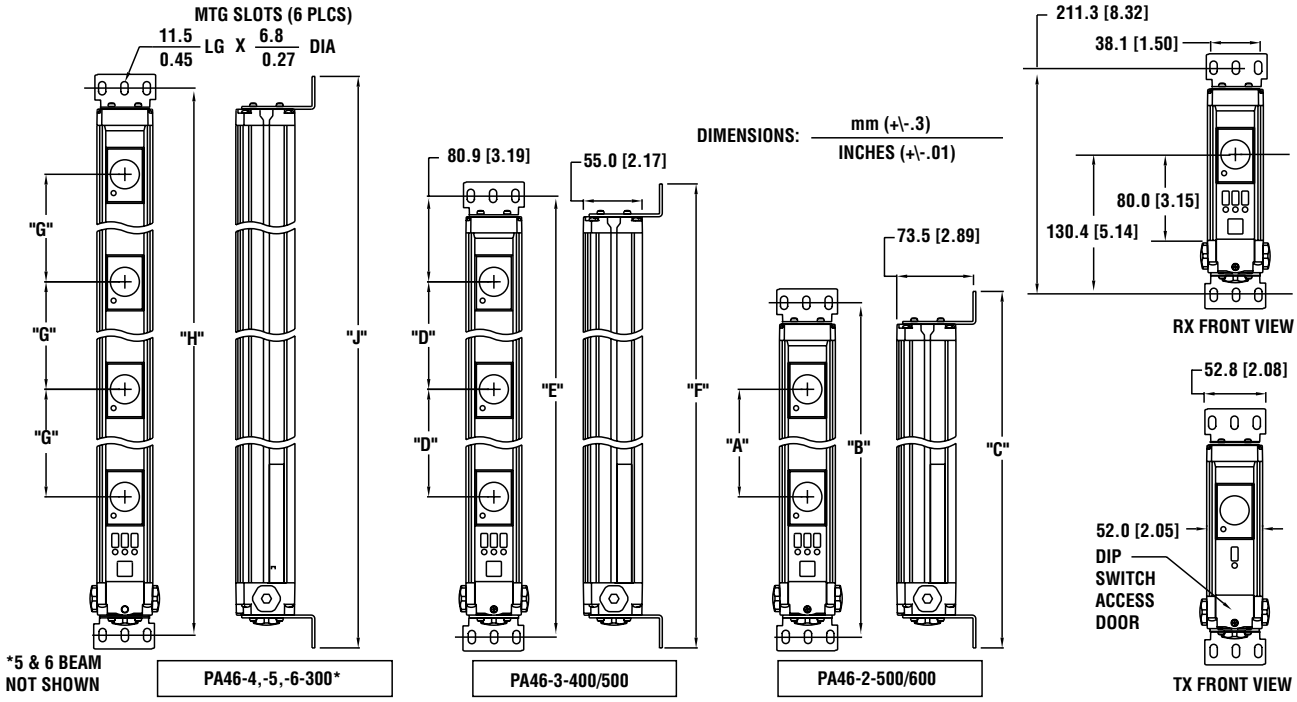
Note 3: Total system current requirement is the sum of the transmitter 100 mA and receiver 1.6 A max. (receiver 250 mA + OSSD1 load + OSSD2 load + aux. output load)

Description

The Perimeter Access PA4600 is a long-range, multi-beam safeguarding device. It is suited to detect the torsos of personnel entering a hazardous area. Installation and alignment is simplified with Individual Beam Indicators, which glow red when the beam is out of alignment or blocked. The separate Scan Codes allow the installer to select unique scan frequencies that eliminate cross-talk with adjacent PA4600 systems. Diagnostics are greatly enhanced with the LED status indicators and numeric displays.

Dimensions

(mm/in.)



PA4600 Dimensions and Shipping Weights

	Beam Spacing mm/in.	Mounting Holes mm/in.	Overall Height mm/in.	System Shipping Weights kg/lb.
PA46-1-000	N/A	211.3/8.32	231.6/9.12	4.5/10
PA46-2-500**	A = 500/19.69	B = 711.3/28.00	C = 731.6/28.80	6.3/14
PA46-2-600*	A = 600/23.62	B = 811.3/31.94	C = 831.6/32.74	6.7 /15
PA46-3-400**	D = 400/15.75	E = 1011.3/39.81	F = 1031.6/40.61	7.2 /16
PA46-3-500*	D = 500/19.69	E = 1211.3/47.68	F = 1231.6/48.49	8.6/19
PA46-4-300**	G = 300/11.81	H = 1111.3/43.75	J = 1131.6/44.55	8.2 /18
PA46-5-300	G = 300/11.81	H = 1411.3/55.56	J = 1431.6/56.36	9.5/21
PA46-6-300	G = 300/11.81	H = 1711.3/67.37	J = 1731.6/68.17	10.4/23

*Meets ANSI/RIA R15.06-1999 (R2009)

**Meets EN999: 1998

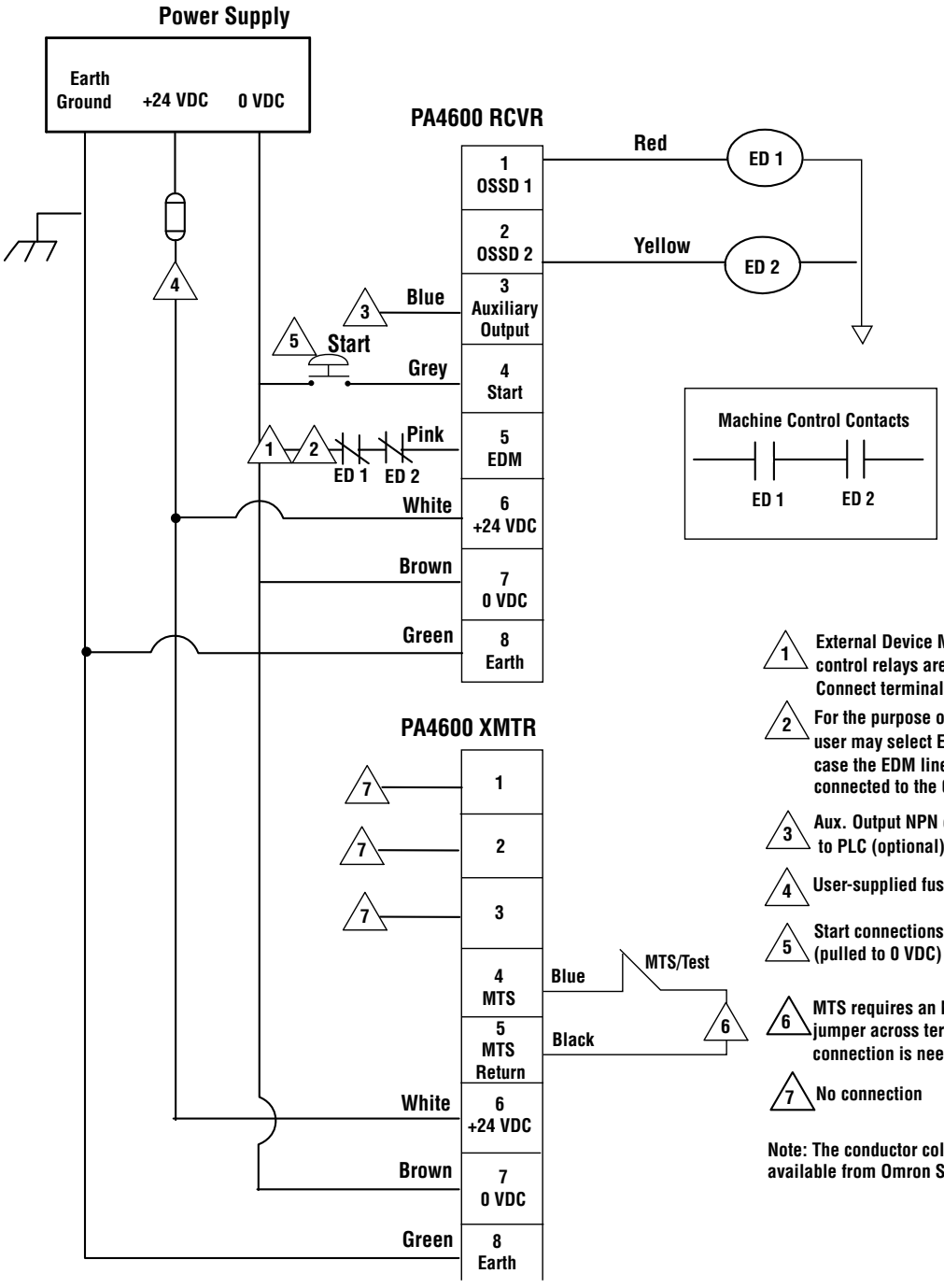
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Wiring

Connecting to Machine Control System Via Two Force-Guided Relays



1. External Device Monitoring must be used when force-guided control relays are used as the Final Switching Devices. Connect terminal 5 (pink wire) though N.C. contacts to 0 VDC.
2. For the purpose of bench testing prior to installation, the user may select EDM OFF(default factory setting). In this case the EDM line, terminal 5 (pink wire) must be connected to the 0 VDC line.
3. Aux. Output NPN or PNP 100 mA. max. @ 24VDC, connect to PLC (optional)
4. User-supplied fuse
5. Start connections are shown with option N01 – normally open (pulled to 0 VDC)
6. MTS requires an N.C. contact. If MTS is not used, install a jumper across terminals 4 & 5. MTS is an option, no connection is needed if the option is not ordered.
7. No connection

Note: The conductor colors are reference to the optional cables available from Omron STI.

Ordering

Model	Number of Beams	Overall Height
Perimeter Access PA4600		
PA46-1-000-Q2-NO1-PN	1	231.6 mm (9.12 in.)
PA46-2-500-Q2-NO1-PN	2	731.6 mm (28.80 in.)
PA46-2-600-Q2-NO1-PN	2	831.6 mm (32.74 in.)
PA46-3-400-Q2-NO1-PN	3	1031.6 mm (40.61 in.)
PA46-3-500-Q2-NO1-PN	3	1231.6 mm (48.49 in.)
PA46-4-300-Q2-NO1-PN	4	1131.6 mm (44.55 in.)
PA46-5-300-Q2-NO1-PN	5	1431.6 mm (56.36 in.)
PA46-6-300-Q2-NO1-PN	6	1731.6 mm (68.17 in.)

Accessories (sold separately)

Part Number	Description
Transmitter Cables	
CBL-LCTX-10M	Transmitter Cable, 10 m (32.8 ft)
CBL-LCTX-15M	Transmitter Cable, 15 m (49.3 ft)
CBL-LCTX-30M	Transmitter Cable, 30 m (98.5 ft)
PMC-PA46TX	M12 Transmitter Connector
Receiver Cables	
CBL-LCRX-10M	Receiver Cable, 10 m (32.8 ft)
CBL-LCRX-15M	Receiver Cable, 15 m (49.3 ft)
CBL-LCRX-30M	Receiver Cable, 30 m (98.5 ft)
PMC-PA46RX	M12 Receiver Connector
Explosion Proof Enclosures	
PA4600-EPKT-0300	350 mm protected height enclosure, each
PA4600-EPKT-0600	520 and 610 mm Protected Height Enclosure, each
PA4600-EPKT-0900	870 mm Protected Height Enclosure, each
PA4600-EPKT-1200	1215 mm Protected Height Enclosure, each
Resource Modules	
RM-1	RM-1 Resource Module
RM-2	RM-2 Resource Module
RM-2AC	RM-2AC Resource Module/Power Supply
RM-2AC-IP	RM-2AC-IP Resource Module/Power Supply
RM-3	RM-3 Resource Mute Module
RM-X	RM-X Safety Relay, 22.5 mm DIN enclosure

Safety Standards and Precautions

The PA4600 is a presence sensing device used only for perimeter access guarding applications, such as around robots and workcells. The PA4600 meets ANSI/RIA R15.06-1999 (R2009) and EN999:1998 optical configuration requirements for perimeter access guarding presence-sensing devices. PA4600 systems have been EC type examined to the requirements of IEC 61496-1, -2 for a Type 4 ESPE. The PA4600 also meets the control reliability requirements of ANSI/RIA R15.06-1999 (R2009).

The optical design and detection capability of the PA4600 are optimized for torso detection of personnel entering a hazardous area from the perimeter, also called perimeter access guarding. It is not intended to be used for the detection of hands and fingers. It is not designed for, nor should it be used as, a high-resolution point-of-operation safety light curtain. The safety beams have been positioned to meet ANSI/RIA R15.06-1999 (R2009) and EN999:1998 perimeter guarding requirements. These documents are an excellent reference for the application of perimeter guarding optical devices such as the PA4600.

The PA4600 should only be used on machinery that can consistently and immediately stop anywhere in its cycle or stroke. Never use a PA4600 to guard the perimeter of a full revolution clutched power press or machine. If the PA4600 does not protect all access to the hazardous area, other appropriate devices such as mechanical guards must guard the unprotected access.

The purchaser, installer and employer have the responsibility to meet all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See the Installation and Operation Manual for additional information.

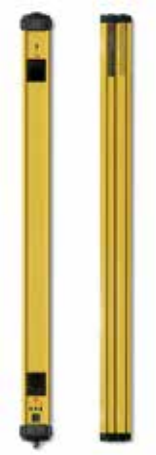
All application examples described are for illustration purposes only. Actual installations will differ from those indicated.

PA4600-BB

Quick Link
S648
omron247.com

Entry/Exit Access Guarding Device

- 2 beams available
- Operating range of 8 m
- Compact size — 46 x 55 mm (1.81 x 2.17 in.)
- Simple "one-box" — active/passive design
- Individual Beam Indicators
- Simplified wiring - electrical connections only required at transceiver



Specifications

Performance	
Protective Height:	500 and 600 mm
Operating Range:	0.8 to 8 m
Response Time:	Transmit Code A: <24 ms; Transmit Code B: <20 ms; Transmit Code C: <16 ms
Safety Output:	Two PNP, each output sourcing 625 mA @ 24 VDC, short circuit protected (See note 1 below)
Auxiliary (Non-Safety) Output:	One NPN output sinking 100 mA @ 24 VDC or PNP output sourcing 100 mA @ 24 VDC. Both available in follow or fault operating modes.
External Device Monitoring:	50 mA @ 24 VDC steady state (See note 2 below)
Start/Restart:	N.O. input. Momentary contact (10 mA consumption)
Effective Aperture Angle:	± 2.5° maximum, transmitter and receiver at operating range greater than 3 m per IEC 61496-2
Light Source:	Infrared light emitting diode, 880 nm
Transceiver Indicator Lights:	Machine run (green), machine stop (red), interlock/fault (yellow), active (yellow), individual beam and two 7-segment displays (red)
Electrical	
Power Input:	Transceiver: 24 VDC ± 20% 1.6 A max. (transceiver 250 mA + OSSD1 625 mA max. + OSSD2 625 mA max. + auxiliary 100 mA max.). (See note 1 below.) Power Supply must meet requirements of IEC 60204-1 and IEC 61496. STI part number 42992 or equivalent. (See note 1 below.)
Mechanical	
Construction:	Polyester powder-painted aluminum
Cable Length:	Available in 10, 15 and 30 m lengths, unshielded.
Minimum Cable Gauge:	22 AWG (0.32 mm^2) for user-supplied cables
Connection Type:	M-12, 8-pin connector
Environmental	
Enclosure Rating:	IP67
Operating Temperature:	0 to 55°C (32 to 131°F)
Relative Humidity:	95% maximum, non-condensing
Approvals	ESPE Type 4 (IEC 61496-1 / -2) Category 4 / PL e (EN ISO 13849-1) SIL3 / SIL3 CL3 (IEC 61508 / EN 62061) UL508, UL1998, CAN/CSA-C22.2 No. 14, CAN/CSA-C22.2 No. 0.8, CAN/CSA-C22.2 No 0, CAN/CSA-C22.2 No 205

Specifications subject to change without notification.

Note 1: Total system current requirement is the sum of transceiver (250 mA), OSSD1 (625 mA max.), OSSD2 (625 mA max.) and Aux. output (100 mA max.).

Note 2: 24 VDC is nominal. Actual voltage is dependent upon supply, V = Vsupply - 2V.

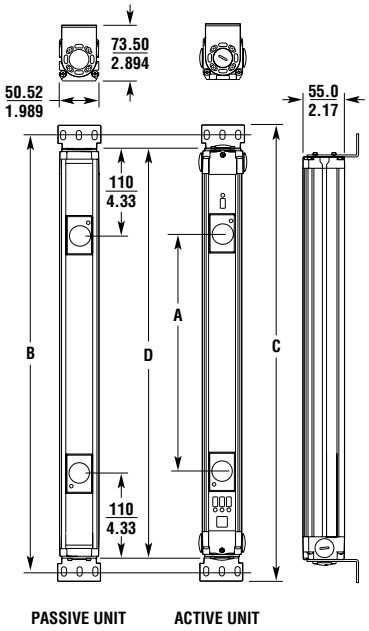
Description

The Entry Exit

PA4600-BB is a short range, two-beam safeguarding device. It is suited to detect the torsos of personnel entering a hazardous area. Installation and alignment is simplified with Individual Beam Indicators, which glow red when the beam is out of alignment or blocked. The separate Scan Codes allow the installer to select unique scan frequencies that eliminate cross-talk with adjacent PA4600 systems. Diagnostics are greatly enhanced with the LED status indicators and numeric displays. The active-passive design simplifies the electrical connections, as no connections are needed at the Passive (mirror) assembly.

Dimensions

(mm/in.)



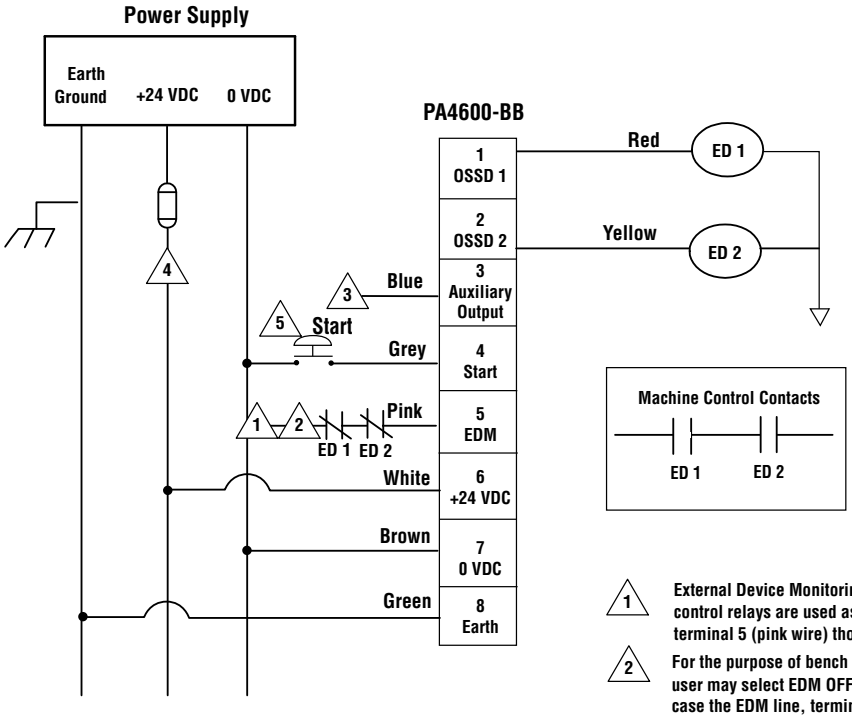
PA4600-BB Dimensions and Shipping Weights

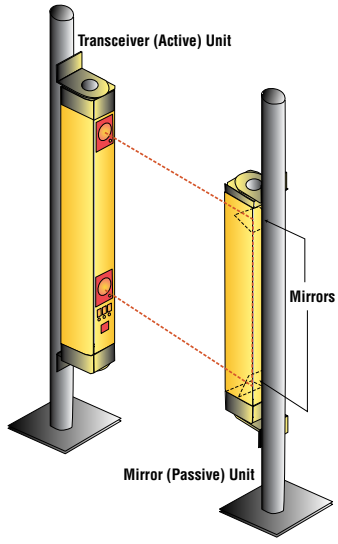
	A Beam Spacing mm/in.	B Mounting Holes mm/in.	C Overall Height mm/in.	D Sensor Height mm/in.	System Shipping Weights kg/lb.
PA46-BB-2-500**	500/19.69	760.84/29.95	781.09/30.75	720/28.34	6.3/14
PA46-BB-2-600*	600/23.62	860.84/33.90	881.09/34.70	820/32.28	6.7/15

*Meets ANSI/RIA R15.06-1999 (R2009)

**Meets EN999: 1998

Wiring





1. External Device Monitoring must be used when force-guided control relays are used as the Final Switching Devices. Connect terminal 5 (pink wire) though N.C. contacts to 0 VDC.
2. For the purpose of bench testing prior to installation, the user may select EDM OFF(default factory setting). In this case the EDM line, terminal 5 (pink wire) must be connected to the 0 VDC line.
3. Aux. Output NPN or PNP 100 mA. max. @ 24VDC, connect to PLC
4. User-supplied fuse (2 A time lag type)
5. Start connections are shown with option N01 – normally open (pulled to 0 VDC)

Note: The conductor colors are reference to the optional cables available from Omron STI.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering

To order a Perimeter Access PA4600-BB system, simply choose from the selection below.

Model	Part No.	Description
Perimeter Access PA4600-BB		
PA46-BB-2-500	40386-1001	2 beams with 500 mm spacing**
PA46-BB-2-600	40386-1009	2 beams with 600 mm spacing*

*Meets ANSI/RIA R15.06-1999 (R2009)

**Meets EN999: 1998

Accessories (sold separately)

Part Number	Description
Transceiver Cables	
CBL-LCRX-10M	Receiver Cable, 10 m (32.8 ft)
CBL-LCRX-15M	Receiver Cable, 15 m (49.3 ft)
CBL-LCRX-30M	Receiver Cable, 30 m (98.5 ft)
Resource Modules	
RM-1	RM-1 Resource Module
RM-2	RM-2 Resource Module
RM-2AC	RM-2AC Resource Module/Power Supply
RM-2AC-IP	RM-2AC-IP Resource Module/Power Supply
RM-3	RM-3 Resource Mute Module
RM-X	RM-X Safety Relay, 22.5 mm DIN enclosure

Safety Standards and Precautions

The PA4600-BB is a presence sensing device used only for perimeter access guarding applications, such as around robots and workcells. The PA4600-BB meets ANSI/RIA R15.06-1999 (R2009) and EN999:1998 optical configuration requirements for perimeter access guarding presence-sensing devices. PA4600-BB systems have been EC type examined to the requirements of IEC 61496-1, -2 for a Type 4 ESPE. The PA4600-BB also meets the control reliability requirements of ANSI/RIA R15.06-1999 (R2009).

The optical design and detection capability of the PA4600-BB are optimized for torso detection of personnel entering a hazardous area from the perimeter, also called perimeter access guarding. It is not intended to be used for the detection of hands and fingers. It is not designed for, nor should it be used as, a high-resolution point-of-operation safety light curtain. The safety beams have been positioned to meet ANSI/RIA R15.06-1999 (R2009) and EN999:1998 perimeter guarding requirements. These documents are an excellent reference for the application of perimeter guarding optical devices such as the PA4600-BB.

The PA4600-BB should only be used on machinery that can consistently and immediately stop anywhere in its cycle or stroke. Never use a PA4600-BB to guard the perimeter of a full revolution clutched power press or machine. If the PA4600-BB does not protect all access to the hazardous area, other appropriate devices such as mechanical guards must guard the unprotected access.

The purchaser, installer and employer have the responsibility to meet all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See the Installation and Operation Manual for more information.

All application examples described are for illustration purposes only. Actual installations will differ from those indicated.

Accessories

Accessories and Spare Parts for Safety Light Curtains

Power Supplies

For use with the STI safety products such as the F3SJ and the MS4800, CE marked, DIN-rail mountable, Input: 115 or 230 VAC.

Part Number	Description
S8JX-G05024CD	24 VDC power supply, 50 W, 2.1 A
S8JX-G10024CD	24 VDC power supply, 100 W, 4.2 A

Reset Switches

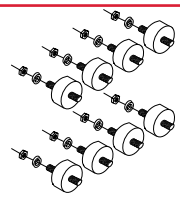
These switches can be mounted remotely and used to perform the reset function on all STI safety light curtains.

Part Number	Description
RK-1	Key Switch Assembly, Panel Mount
RK-2	Push Button Switch Assembly, Panel Mount



Shock Mount Kits

These kits are used to isolate light curtain receivers and transmitters from possible sources of vibration. They can also be used to shock-mount controllers/ power supplies and mirrors. Each kit consists of eight mounts.



MS/MSF4800 Series	
MS/MSF4800 Lengths 280-960	2
MS/MSF4800 Lengths 1000-1400	3
MS/MSF4800 Lengths 1440-2120	4

PA4600 Series	
PA46-2-500	3
PA46-2-600	3
PA46-3-400	3
PA46-3-500	4
PA46-4-300	3
PA46-5-300	4
PA46-6-300	4

Part Number	Description
SHMS-18	Shock mounting kit for weight class 2
SHP4-18	Shock mounting kit for weight class 3 and 4

Test Objects

Replacement test objects can be ordered by part number. Make sure to order the test object for the correct light curtain model.

Part Number	Description
STI-TO20	Test object, 19.1 mm (0.75 in.) for F3SJ-A_P20 and MS4800-20
STI-TO30	Test object, 30 mm (1.18 in.) for F3SJ-A_P30 and MS4800-30
STI-TO14	Test object, 14 mm (0.55 in.) for F3SJ-A_P14 and MS4800-14
STI-TO40	Test object, 40 mm (1.57 in.) for MS4800-40
STI-TO24	Test object, 24 mm (0.94 in.) for F3SJ-A_P14, amd MS4800-14 (with floating blanking 1-beam)
STI-TO34	Test object, 34 mm (1.34 in.) for F3SJ-A_P14 and MS4800-14 (with floating blanking 2-beam)

Laser Alignment Tool

To assist with long-range alignment of installations.

Model Number	Description
46LA	Laser alignment tool for use with PA4600 and MS4800



46LA

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Mirrors

The correct mirror is important in maintaining the integrity of a safety light curtain system. Whenever an infrared beam strikes a mirror a certain percentage of the signal will be lost. In order to minimize this loss, glass and stainless steel mirrors from Omron use materials of the highest optical quality.

Mirror Material

Mirror Material	Percentage of range lost per mirror
Front Reflective Surface Glass	12%
Polished Stainless Steel	18%

Net Range Using Mirrors (percentage of maximum range)

Material	No. of Mirrors Used			
	1	2	3	4
Glass	88%	77%	68%	60%
Stainless Steel	82%	67%	55%	45%

Glass mirrors are built with front reflective surface glass. This material provides the minimum possible signal loss. For applications where the possibility of broken glass cannot be tolerated, wide, polished stainless steel mirrors are available.

STI mirrors are available in both a narrow and a wide package. If space permits, the wide mirrors are recommended for ease of alignment. Narrow mirrors have 51 mm (2 in.) wide reflective surfaces and can be used on applications where space is limited or the range between the light curtain transmitter and receiver is short. Wide mirrors have 108 mm (4.25 in.) wide reflective surfaces and ease alignment on applications with a large perimeter or where there are no space limitations.

NOTE: Mirrors can only be mounted using the MIRS-xx Series Heavy Duty Floor Stands.

B

Length	Model Number Narrow Glass	Weight kg/lb.	Model Number Wide Glass	Weight kg/lb.	Model Number Wide Stainless Steel*	Model Number Narrow Stainless Steel*†
102 mm (4 in.)	MIRN-04FG	0.8/1.74	MIRW-04FG	1.0/2.3	MIRW-04SS	MIR-04SS-ESD
152 mm (6 in.)			MIRW-06FG	1.3/2.8	MIRW-06SS	
203 mm (8 in.)	MIRN-08FG	1.0/2.36	MIRW-08FG	1.5/3.3	MIRW-08SS	MIR-08SS-ESD
305 mm (12 in.)	MIRN-12FG	1.4/2.98	MIRW-12FG	1.9/4.2	MIRW-12SS	MIR-12SS-ESD
406 mm (16 in.)	MIRN-16FG	1.6/3.60	MIRW-16FG	2.4/5.2	MIRW-16SS	MIR-16SS-ESD
457 mm (18 in.)			MIRW-18FG	2.5/5.6	MIRW-18SS	
508 mm (20 in.)	MIRN-20FG	1.9/4.22	MIRW-20FG	2.8/6.1	MIRW-20SS	MIR-20SS-ESD
610 mm (24 in.)	MIRN-24FG	2.2/4.84	MIRW-24FG	3.2/7.1	MIRW-24SS	MIR-24SS-ESD
711 mm (28 in.)	MIRN-28FG	2.5/5.46	MIRW-28FG	3.7/8.1	MIRW-28SS	MIR-28SS-ESD
762 mm (30 in.)			MIRW-30FG	3.8/8.5	MIRW-30SS	
813 mm (32 in.)	MIRN-32FG	2.8/6.08	MIRW-32FG	4.0/9.0	MIRW-32SS	MIR-32SS-ESD
913 mm (36 in.)	MIRN-36FG	3.0/6.70	MIRW-36FG	4.5/9.9	MIRW-36SS	MIR-36SS-ESD
1016 mm (40 in.)	MIRN-40FG	3.3/7.32	MIRW-40FG	5.0/10.9	MIRW-40SS	MIR-40SS-ESD
1067 mm (42 in.)			MIRW-42FG	5.2/11.4	MIRW-42SS	
1118 mm (44 in.)	MIRN-44FG	3.6/7.94	MIRW-44FG	5.4/11.9	MIRW-44SS	MIR-44SS-ESD
1219 mm (48 in.)	MIRN-48FG	3.9/8.56	MIRW-48FG	5.9/12.9	MIRW-48SS	MIR-48SS-ESD
1321 mm (52 in.)			MIRW-52FG	5.3/13.8	MIRW-52SS	
1372 mm (54 in.)			MIRW-54FG	6.5/14.3	MIRW-54SS	
1422 mm (56 in.)			MIRW-56FG	6.7/14.8	MIRW-56SS	
1524 mm (60 in.)			MIRW-60FG	7.2/15.8	MIRW-60SS	
1626 mm (64 in.)			MIRW-64FG	7.6/16.8	MIRW-64SS	
1830 mm (72 in.)			MIRW-72FG	8.5/18.6	MIRW-72SS	
2134 mm (84 in.)			MIRW-84FG	9.8/21.5	MIRW-84SS	
2440 mm (96 in.)			MIRW-96FG	11.0/24.3	MIRW-96SS	

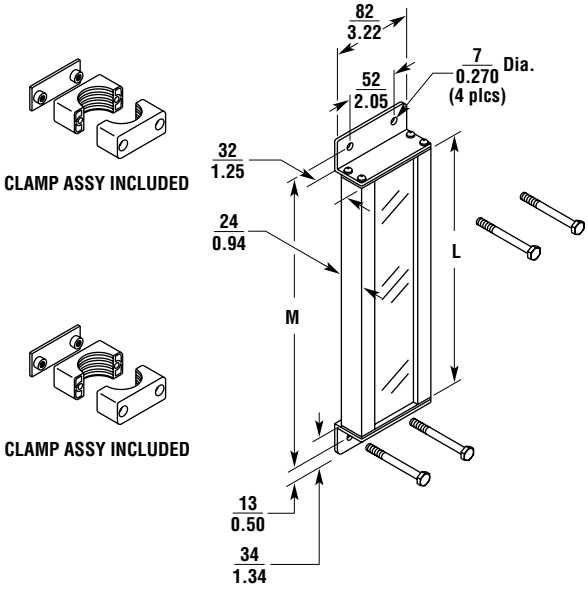
* Consult factory for weights.
† Use for ESD applications

Mirrors (continued)

Narrow Mirror Package (MIRN)

Narrow Mirror Dimensions—
Front Reflective Surface Glass

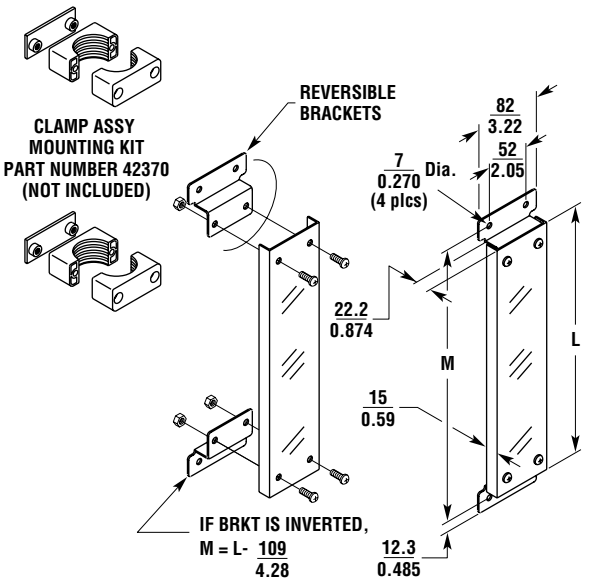
Part Number	Dimension L mm/in.	Dimension M mm/in.
MIRN-04FG	152/6.0	195/7.68
MIRN-08FG	254/10.0	297/11.68
MIRN-12FG	356/14.0	398/15.68
MIRN-16FG	457/18.0	500/19.68
MIRN-20FG	559/22.0	601/23.68
MIRN-24FG	660/26.0	703/27.68
MIRN-28FG	762/30.0	805/31.68
MIRN-32FG	864/34.0	906/35.68
MIRN-36FG	965/38.0	1008/39.68
MIRN-40FG	1067/42.0	1109/43.68
MIRN-44FG	1168/46.0	1211/47.68
MIRN-48FG	1270/50.0	1313/51.68



Narrow Mirror Dimensions—
Stainless Steel Reflective Surface

Part Number	Dimension L mm/in.	Dimension M mm/in.
MIR-04SS-ESD	203/8.0	236/9.28
MIR-08SS-ESD	305/12.0	337/13.28
MIR-12SS-ESD	406/16.0	439/17.28
MIR-16SS-ESD	508/20.0	541/21.28
MIR-20SS-ESD	610/24.0	642/25.28
MIR-24SS-ESD	711/28.0	744/29.28
MIR-28SS-ESD	813/32.0	845/33.28
MIR-32SS-ESD	914/36.0	947/37.28
MIR-36SS-ESD	1016/40.0	1049/41.28
MIR-40SS-ESD	1118/44.0	1150/45.28
MIR-44SS-ESD	1219/48.0	1252/49.28
MIR-48SS-ESD	1321/52.0	1353/53.28

Notes: Use for ESD applications.
Use mounting kit Model Number 42370 to mount to STI stands.

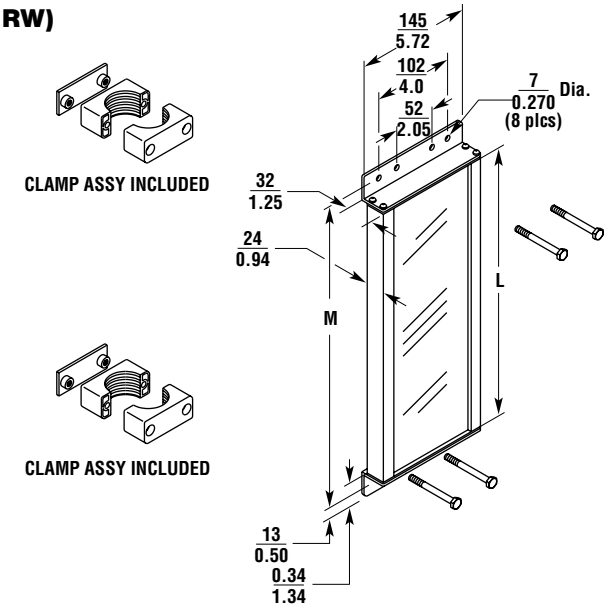


SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Mirrors (continued)

Wide Mirror Package (MIRW)



Wide Mirror Dimensions—
Front Reflective Surface Glass

Part Number	Dimension L mm/in.	Dimension M mm/in.
MIRW-04	140/5.5	182/7.18
MIRW-06	191/7.5	233/9.18
MIRW-08	241/9.5	284/11.18
MIRW-12	343/13.5	386/15.18
MIRW-16	445/17.5	487/19.18
MIRW-18	495/19.5	538/21.18
MIRW-20	546/21.5	589/23.18
MIRW-24	648/25.5	690/27.18
MIRW-28	749/29.5	792/31.18
MIRW-30	800/31.5	843/33.18
MIRW-32	851/33.5	894/35.18
MIRW-36	953/37.5	995/39.18
MIRW-40	1054/41.5	1097/43.18
MIRW-42	1105/43.5	1148/45.18
MIRW-44	1156/45.5	1198/47.18
MIRW-48	1257/49.5	1300/51.18
MIRW-52	1359/53.5	1402/55.18
MIRW-54	1410/55.5	1452/57.18
MIRW-56	1461/57.5	1503/59.18
MIRW-60	1562/61.5	1605/63.18
MIRW-64	1664/65.5	1706/67.18
MIRW-72	1867/73.5	1910/75.18
MIRW-84	2172/85.5	2214/87.18
MIRW-96	2477/97.5	2519/99.18

Wide Mirror Dimensions—
Stainless Steel Reflective Surface

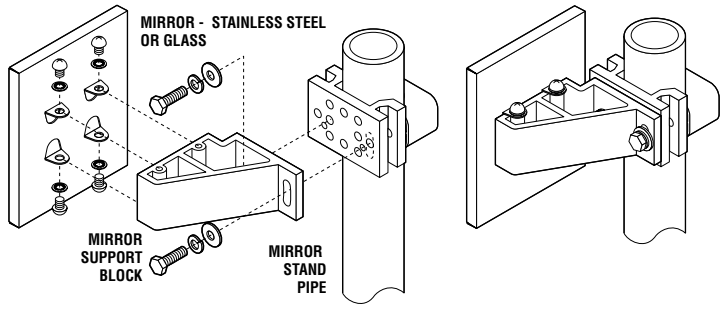
Part Number	Dimension L mm/in.	Dimension M mm/in.
MIRW-04SS	140/5.5	182/7.18
MIRW-06SS	191/7.5	233/9.18
MIRW-08SS	241/9.5	284/11.18
MIRW-12SS	343/13.5	386/15.18
MIRW-16SS	445/17.5	487/19.18
MIRW-18SS	495/19.5	538/21.18
MIRW-20SS	546/21.5	589/23.18
MIRW-24SS	648/25.5	690/27.18
MIRW-28SS	749/29.5	792/31.18
MIRW-30SS	800/31.5	843/33.18
MIRW-32SS	851/33.5	894/35.18
MIRW-36SS	953/37.5	995/39.18
MIRW-40SS	1054/41.5	1097/43.18
MIRW-42SS	1105/43.5	1148/45.18
MIRW-44SS	1156/45.5	1198/47.18
MIRW-48SS	1257/49.5	1300/51.18
MIRW-52SS	1359/53.5	1402/55.18
MIRW-54SS	1410/355.5	1452/57.18
MIRW-56SS	1461/57.5	1503/59.18
MIRW-60SS	1562/61.5	1605/63.18
MIRW-64SS	1664/65.5	1706/67.18
MIRW-72SS	1867/73.5	1910/75.18
MIRW-84SS	2172/85.5	2214/87.18
MIRW-96SS	2477/97.5	2519/99.18

45° Mirror and Bracket

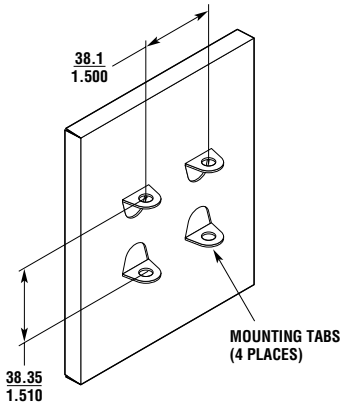
Use with PA4600 applications using a "double-bounce" arrangement.

Part Number	Description
MIR45-FG	4 in. front reflective surface glass mirror for use with MIR45BKT
MIR45-SS	4 in. polished stainless steel mirror for use with MIR45BKT
MIR45BKT	Bracket for mounting MIR45 to STI stand at 45° angle

MIR45BKT



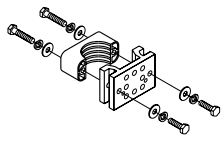
MIR45-FG and MIR45-SS



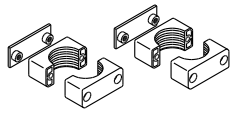
Mounting Accessories

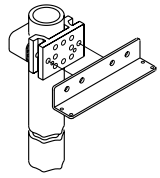
Model Number	Description
LCMK-4	Allows a transmitter/receiver pair of any model STI light curtain to be mounted to STI stands.
MIR-BKT	Mirror mounting brackets, will mount to STI MIRS stands

LCMK-4



MIRROR MOUNTING BRACKETS
MODEL MIR-BKT





SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

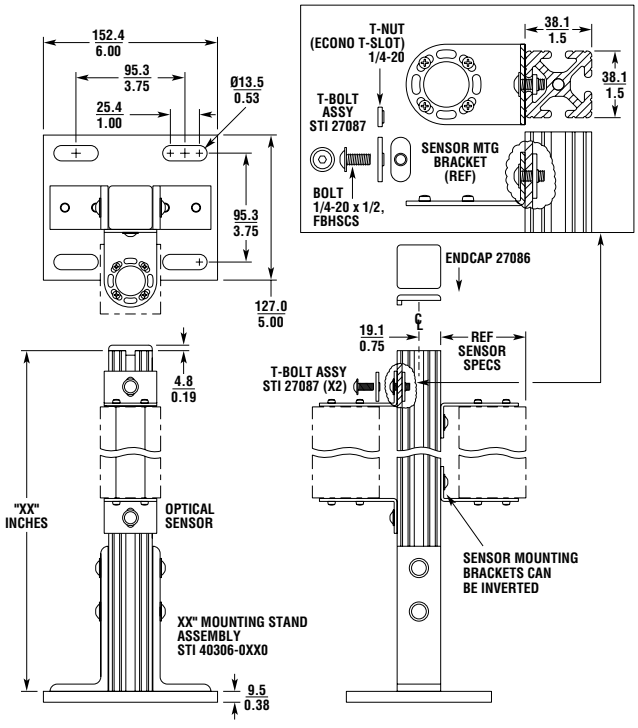
Floor Stands

Light Duty Floor Stands

Light curtains and perimeter guards used to detect the torso of personnel have specific mounting requirements per ANSI/RIA R15.06 and other standards. These light duty stands are ideal for mounting the bottom beam of the light curtain or perimeter guard within the required 0.3 m (12 in.) from the floor. The Light Duty Floor Stand is a cost effective alternative to our more robust heavy duty stand, and mounting hardware is included.

NOTE: Mirrors cannot be mounted using the Light Duty Floor Stands. Use the MIRS-xx Series Heavy Duty Floor Stands when mounting mirrors.

Model Number	Description	Height m/in.
PA-STAND-40	Light-Duty Floor Stand	1.0/40
PA-STAND-44	Light-Duty Floor Stand	1.1/44
PA-STAND-48	Light-Duty Floor Stand	1.2/48
PA-STAND-52	Light-Duty Floor Stand	1.3/52
PA-STAND-56	Light-Duty Floor Stand	1.4/56
PA-STAND-64	Light Duty Floor Stand	1.6/64
PA-STAND-72	Light Duty Floor Stand	1.8/72



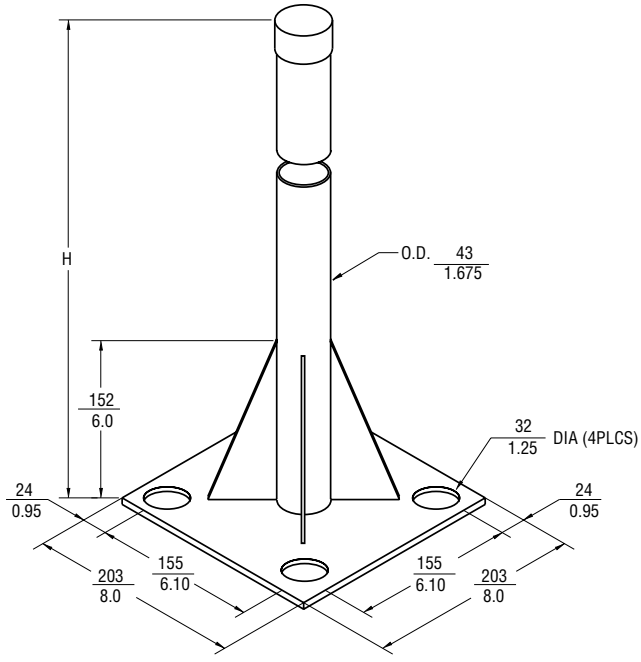


Heavy Duty Floor Stands

STI stands provide a stable, secure method for mounting both safety light curtains and mirrors. Hardware for mounting stand to concrete floor is included.

NOTE: Mirrors can only be mounted using the MIRS-xx Series Heavy Duty Floor Stands.

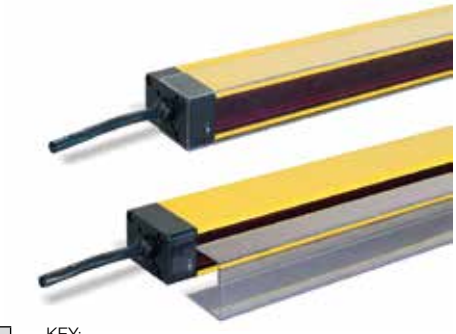
Model Number	Height m/ft.	Weight kg/lb.
MIRS-04	1.2/4	8.8/19.3
MIRS-06	1.8/6	11.2/24.7
MIRS-07	2.1/7	12.5/27.4
MIRS-08	2.4/8	13.7/30.1
MIRS-10	3.1/10	16.1/35.4



Weld Slag Protective Shields

- Available for the PA4600, F3SJ, and MS4800 families
- Reduces down time and increases the life of the curtain
- Resistant to many chemicals and compounds
- Easy to install and replace
- Lexan construction

These protective shields are designed to protect the light curtains, when used in harsh applications. In many cases, welding cell applications produce hot weld slag that over time may damage the lens (filter) and degrade the light curtain's performance. These covers offer the user the ability to easily and inexpensively reduce machine down time. The covers are available to fit all sizes.



Chemical Resistance of Lexan

Chemical Class		Effects
Acids	R	No significant effect under most typical conditions of concentration and temperature.
Alcohols	LR	Generally compatible at low concentration and room temperature. Higher concentrations and elevated temperatures can result in etching and attack evidenced by decomposition.
Alkalis	LR	Generally compatible at low concentration and room temperature. Higher concentrations and elevated temperatures can result in etching and attack evidenced by decomposition.
Aliphatic Hydrocarbons	R	Generally compatible.
Amines	NR	Surface crystallization and chemical attack.
Aromatic Hydrocarbons	NR	Partial solvents and severe stress cracking agents (i.e. xylene, toluene).
Detergents and Cleaners	LR	Mild soap solutions are generally compatible.
Detergents and Cleaners, with Alkaline Materials	NR	
Esters	NR	Cause severe crystallization. Partial solvents.
Greases and Oils	LR	Pure petroleum types generally compatible.
Halogenerated Hydrocarbons	NR	Solvents.
Ketones	NR	Cause severe crystallization and stress cracking. Partial solvents.
Silicone Oil and Greases	LR	Generally compatible up to 85°C (185°F).
Silicone Oil and Greases, with Alkaline Materials	NR	

KEY:
R - Resistant
LR - Limited Resistance
NR - Not Resistant

Notes:

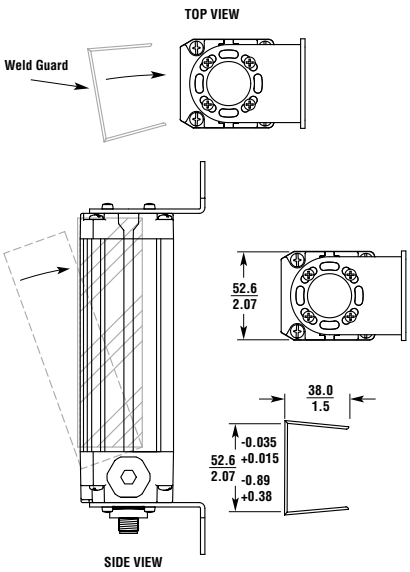
Lexan is a registered trademark of G.E. General Electric Corp.

Certain combinations of chemical environments, temperature and stress can adversely affect thermoplastic parts made from LEXAN resin. For this reason, lubricants, gaskets, O-rings, cleaning solvents, or any other material which may come in contact with the finished part must be carefully evaluated under end-use conditions for compatibility. You should also follow the use and compatibility recommendations of the manufacturer of any such material.

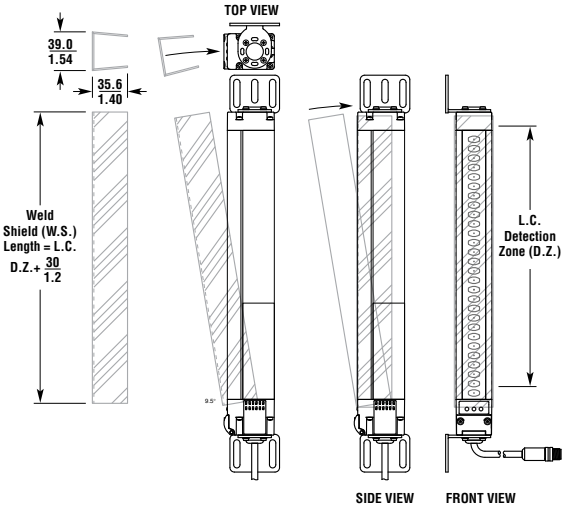
LEXAN resin generally is stable to water, mineral acids and organic acids. Crazing and/or embrittlement may occur if a part molded from LEXAN resin is highly stressed and exposed to hot water or a moist high-temperature environment. As a result, a temperature limit of 60 to 71°C (140 to 160°F) is recommended under these conditions.

Dimensions—mm/in.

PA4600 Perimeter Access Guarding Device



MS4800 Light Curtain (L.C.)



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Weld Slag Protective Shields (continued)

Model Number	Description	mm/in.
Lexan Weld Shield Kit for PA4600		
PA4600WS-1	PA4600-1-000 weld shield kit (1 pair)	135/5.3
PA4600WS-2	PA4600 weld shield kit (1 pair)	180/7.1
PA4600WS-4	PA4600 weld shield kit (2 pairs)	180/7.1
Lexan Weld Shield Kit for MS4800*		
MS4800WS-0240	240 mm Kit	270/10.63
MS4800WS-0280	280 mm Kit	310/12.21
MS4800WS-0320	360 mm Kit	350/13.78
MS4800WS-0360	360 mm Kit	390/15.35
MS4800WS-0400	400 mm Kit	430/16.93
MS4800WS-0440	440 mm Kit	470/18.50
MS4800WS-0480	480 mm Kit	510/20.08
MS4800WS-0520	520 mm Kit	550/21.65
MS4800WS-0560	560 mm Kit	590/23.23
MS4800WS-0600	600 mm Kit	630/24.80
MS4800WS-0640	640 mm Kit	670/26.38
MS4800WS-0680	680 mm Kit	710/27.95
MS4800WS-0720	720 mm Kit	750/29.53
MS4800WS-0760	760 mm Kit	790/31.10
MS4800WS-0800	800 mm Kit	830/32.68
MS4800WS-0840	840 mm Kit	870/34.25
MS4800WS-0880	880 mm Kit	910/35.83
MS4800WS-0920	920 mm Kit	950/37.40
MS4800WS-0960	960 mm Kit	990/38.98
MS4800WS-1000	1000 mm Kit	1030/40.55
MS4800WS-1040	1040 mm Kit	1070/42.13

Model Number	Description	mm/in.
MS4800WS-1080	1080 mm Kit	1110/43.70
MS4800WS-1120	1120 mm Kit	1150/45.28
MS4800WS-1160	1160 mm Kit	1190/46.85
MS4800WS-1200	1200 mm Kit	1230/48.43
MS4800WS-1240	1240 mm Kit	1270/50.00
MS4800WS-1280	1280 mm Kit	1310/51.57
MS4800WS-1320	1320 mm Kit	1350/53.15
MS4800WS-1360	1360 mm Kit	1390/54.72
MS4800WS-1400	1400 mm Kit	1430/56.30
MS4800WS-1440	1440 mm Kit	1470/57.87
MS4800WS-1480	1480 mm Kit	1510/59.45
MS4800WS-1520	1520 mm Kit	1550/61.02
MS4800WS-1560	1560 mm Kit	1590/62.60
MS4800WS-1600	1600 mm Kit	1630/64.17
MS4800WS-1640	1640 mm Kit	1670/65.75
MS4800WS-1680	1680 mm Kit	1710/67.32
MS4800WS-1720	1720 mm Kit	1750/68.90
MS4800WS-1760	1760 mm Kit	1790/70.47
MS4800WS-1800	1800 mm Kit	1830/72.05
MS4800WS-1840	1840 mm Kit	1870/73.62
MS4800WS-1880	1880 mm Kit	1910/75.20
MS4800WS-1920	1920 mm Kit	1950/76.77
MS4800WS-1960	1960 mm Kit	1990/78.35
MS4800WS-2000	2000 mm Kit	2030/79.92
MS4800WS-2040	2040 mm Kit	2070/81.50
MS4800WS-2080	2080 mm Kit	2110/83.07
MS4800WS-2120	2120 mm Kit	2150/84.65

*MS4800 weld shield kits consist of one pair.

IP67 Enclosures for Mounting Safety Light Curtains in Wash-down Applications

- Available in the full range of sizes
- Reduces down time and increases the life of the light curtain
- Resistant to many chemicals and compounds (see tables on subsequent pages)
- Improved mounting system
- Reinforced stainless steel brackets

The IP67 Enclosure is designed for washdown applications. The enclosure is constructed with an acrylic tube. The brackets are made of stainless steel. The radial seal prevents fluids from coming in contact with the safety light curtain.

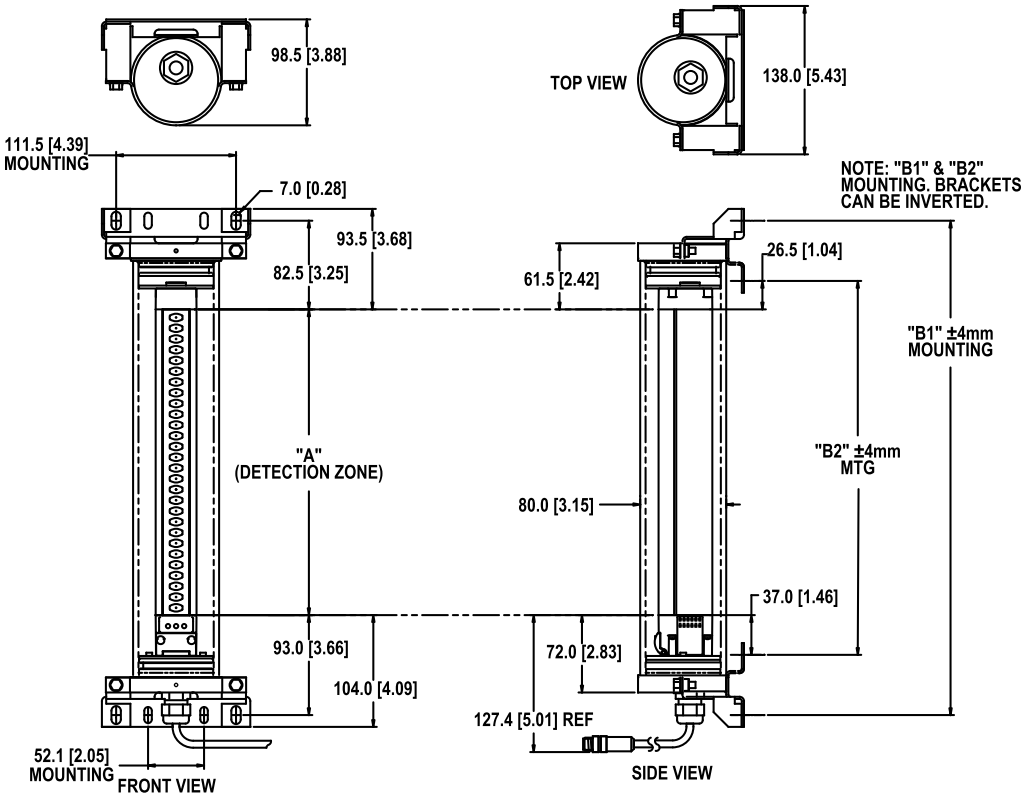
Operating characteristics of the light curtain are affected by the enclosure. The range is reduced by 10% and the effective aperture angle changes to less than ±3°.



IP67 Enclosures (continued)

Dimensions—mm/in.

MS4800 IP67 Enclosure



IP67 Enclosures for MS4800 (non-cascaded versions)

Model Number	
MS4800-IP67-0240	Kit for MS4800 240 mm
MS4800-IP67-0280	Kit for MS4800 280 mm
MS4800-IP67-0320	Kit for MS4800 320 mm
MS4800-IP67-0360	Kit for MS4800 360 mm
MS4800-IP67-0400	Kit for MS4800 400 mm
MS4800-IP67-0440	Kit for MS4800 440 mm
MS4800-IP67-0480	Kit for MS4800 480 mm
MS4800-IP67-0520	Kit for MS4800 520 mm
MS4800-IP67-0560	Kit for MS4800 560 mm
MS4800-IP67-0600	Kit for MS4800 600 mm
MS4800-IP67-0640	Kit for MS4800 640 mm
MS4800-IP67-0680	Kit for MS4800 680 mm
MS4800-IP67-0720	Kit for MS4800 720 mm
MS4800-IP67-0760	Kit for MS4800 760 mm
MS4800-IP67-0800	Kit for MS4800 800 mm
MS4800-IP67-0840	Kit for MS4800 840 mm

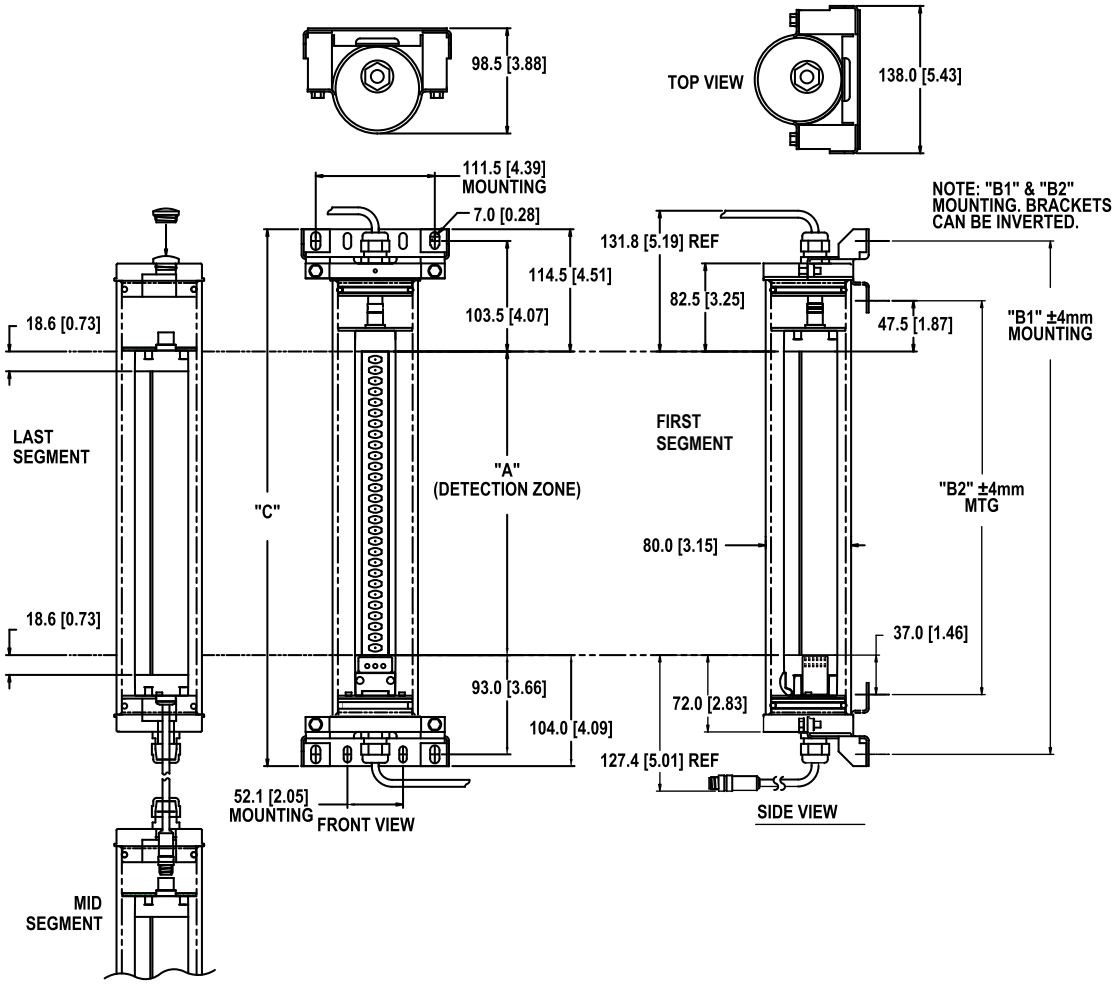
Model Number	
MS4800-IP67-0880	Kit for MS4800 880 mm
MS4800-IP67-0920	Kit for MS4800 920 mm
MS4800-IP67-0960	Kit for MS4800 960 mm
MS4800-IP67-1000	Kit for MS4800 1000 mm
MS4800-IP67-1040	Kit for MS4800 1040 mm
MS4800-IP67-1080	Kit for MS4800 1080 mm
MS4800-IP67-1120	Kit for MS4800 1120 mm
MS4800-IP67-1160	Kit for MS4800 1160 mm
MS4800-IP67-1200	Kit for MS4800 1200 mm
MS4800-IP67-1240	Kit for MS4800 1240 mm
MS4800-IP67-1280	Kit for MS4800 1280 mm
MS4800-IP67-1320	Kit for MS4800 1320 mm
MS4800-IP67-1360	Kit for MS4800 1360 mm
MS4800-IP67-1400	Kit for MS4800 1400 mm
MS4800-IP67-1440	Kit for MS4800 1440 mm
MS4800-IP67-1480	Kit for MS4800 1480 mm

Model Number	
MS4800-IP67-1520	Kit for MS4800 1520 mm
MS4800-IP67-1560	Kit for MS4800 1560 mm
MS4800-IP67-1600	Kit for MS4800 1600 mm
MS4800-IP67-1640	Kit for MS4800 1640 mm
MS4800-IP67-1680	Kit for MS4800 1680 mm
MS4800-IP67-1720	Kit for MS4800 1720 mm
MS4800-IP67-1760	Kit for MS4800 1760 mm
MS4800-IP67-1800	Kit for MS4800 1800 mm
MS4800-IP67-1840	Kit for MS4800 1840 mm
MS4800-IP67-1880	Kit for MS4800 1880 mm
MS4800-IP67-1920	Kit for MS4800 1920 mm
MS4800-IP67-1960	Kit for MS4800 1960 mm
MS4800-IP67-2000	Kit for MS4800 2000 mm
MS4800-IP67-2040	Kit for MS4800 2040 mm
MS4800-IP67-2080	Kit for MS4800 2080 mm
MS4800-IP67-2120	Kit for MS4800 2120 mm

IP67 Enclosures (continued)

Dimensions—mm/in.

MSF4800 IP67 Enclosure



IP67 Enclosures for MSF4800 (cascaded versions)

Model Number	
MSF4800-IP67-0240	Kit for MSF4800 240 mm
MSF4800-IP67-0280	Kit for MSF4800 280 mm
MSF4800-IP67-0320	Kit for MSF4800 320 mm
MSF4800-IP67-0360	Kit for MSF4800 360 mm
MSF4800-IP67-0400	Kit for MSF4800 400 mm
MSF4800-IP67-0440	Kit for MSF4800 440 mm
MSF4800-IP67-0480	Kit for MSF4800 480 mm
MSF4800-IP67-0520	Kit for MSF4800 520 mm
MSF4800-IP67-0560	Kit for MSF4800 560 mm
MSF4800-IP67-0600	Kit for MSF4800 600 mm
MSF4800-IP67-0640	Kit for MSF4800 640 mm
MSF4800-IP67-0680	Kit for MSF4800 680 mm
MSF4800-IP67-0720	Kit for MSF4800 720 mm
MSF4800-IP67-0760	Kit for MSF4800 760 mm
MSF4800-IP67-0800	Kit for MSF4800 800 mm
MSF4800-IP67-0840	Kit for MSF4800 840 mm

Model Number	
MSF4800-IP67-0880	Kit for MSF4800 880 mm
MSF4800-IP67-0920	Kit for MSF4800 920 mm
MSF4800-IP67-0960	Kit for MSF4800 960 mm
MSF4800-IP67-1000	Kit for MSF4800 1000 mm
MSF4800-IP67-1040	Kit for MSF4800 1040 mm
MSF4800-IP67-1080	Kit for MSF4800 1080 mm
MSF4800-IP67-1120	Kit for MSF4800 1120 mm
MSF4800-IP67-1160	Kit for MSF4800 1160 mm
MSF4800-IP67-1200	Kit for MSF4800 1200 mm
MSF4800-IP67-1240	Kit for MSF4800 1240 mm
MSF4800-IP67-1280	Kit for MSF4800 1280 mm
MSF4800-IP67-1320	Kit for MSF4800 1320 mm
MSF4800-IP67-1360	Kit for MSF4800 1360 mm
MSF4800-IP67-1400	Kit for MSF4800 1400 mm
MSF4800-IP67-1440	Kit for MSF4800 1440 mm
MSF4800-IP67-1480	Kit for MSF4800 1480 mm

Model Number	
MSF4800-IP67-1520	Kit for MSF4800 1520 mm
MSF4800-IP67-1560	Kit for MSF4800 1560 mm
MSF4800-IP67-1600	Kit for MSF4800 1600 mm
MSF4800-IP67-1640	Kit for MSF4800 1640 mm
MSF4800-IP67-1680	Kit for MSF4800 1680 mm
MSF4800-IP67-1720	Kit for MSF4800 1720 mm
MSF4800-IP67-1760	Kit for MSF4800 1760 mm
MSF4800-IP67-1800	Kit for MSF4800 1800 mm
MSF4800-IP67-1840	Kit for MSF4800 1840 mm
MSF4800-IP67-1880	Kit for MSF4800 1880 mm
MSF4800-IP67-1920	Kit for MSF4800 1920 mm
MSF4800-IP67-1960	Kit for MSF4800 1960 mm
MSF4800-IP67-2000	Kit for MSF4800 2000 mm
MSF4800-IP67-2040	Kit for MSF4800 2040 mm
MSF4800-IP67-2080	Kit for MSF4800 2080 mm
MSF4800-IP67-2120	Kit for MSF4800 2120 mm

IP67 Enclosures (continued)

Chemical Resistance of Acrylic Tube

KEY:
R - Resistant
LR - Limited Resistance
NR - Not Resistant

PAINT	
Acrylic paints and lacquers	LR
Aromatic-free hydrocarbons	R
Nitrocellulose	NR
Oil paints, pure	R
Thinners, general	NR
CHEMICAL PROCESS BATHS	
Electroplating baths	R
Photographic baths	R
BUILDING MATERIALS AND PROTECTIVE AGENTS FOR BUILDINGS	
Bituminous emulsion	NR
Cement	R
Hot bitumen	LR
Mortar	R
Plaster of paris	R
Red lead	R
CHEMICALS, SOLVENTS, ETC.	
Acetic acid, glacial	NR
Acetic acid, to 25%	LR
Acetone	NR
Alum	R
Aluminium chloride	R
Aluminium oxalate	R
Aluminium sulphate	R
Ammonia, aqueous solution	R
Ammonium sulphate	R
Amyl acetate	NR
Aniline	NR
Arsenic	R
Arsenic acid	R
Battery acid	R
Benzaldehyde	NR
Benzene	NR
Bromine	NR
Butanol	LR
Butyl lactate	NR
Butyric acid, to 5%	R
Calcium chloride	R
Calcium hypochlorite	R
Carbon disulfide	NR
Carbon tetrachloride	NR
Chlorinated hydrocarbons	NR
Chlorine, liquid	NR
Chlorine, water	LR
Chloroethyl acetate	NR
Chlorophenol	NR
Chromic acid	LR
Citric acid, to 20%	R
Copper sulphate	R
Cresol	NR
Cyclohexane	R
Diacetone alcohol	NR
Diamyl phthalate	LR
Dibutyl phthalate	NR
Diethylene glycol	R
Dioxan	NR
Ether	NR
Ethyl acetate	NR
Ethyl alcohol, absolute	NR
Ethyl alcohol, to 30%	LR
Ethyl bromide	NR
Ethyl butyrate	NR
Ethylene bromide	NR
Ferric chloride	R
Ferrous chloride	R
Ferrous sulphate	R
Formic acid, to 2%	R
Formic acid, to 40%	LR
Glycerol	R
Glycol	R
Heptane	R
Hexane	R
Hydrochloric acid	R
Hydrogen peroxide, over 40%	LR
Hydrogen peroxide, to 40%	R
Iodine	R
Isopropyl alcohol, to 50%	LR
Lactic acid, to 80%	LR
Magnesium chloride	R
Magnesium sulphate	R
Manganese sulphate	R
Mercury	R
Methanol, absolute	NR
Methanol, to 30%	LR
Methyl ethyl ketone	NR
Methylated spirits	NR
Milk of lime	R
Monobromonaphthalene	R
Motor fuel benzene-free	R
Motor fuel, with benzene	NR
Nickel sulphate	R
Nitric acid, to 20%	R
Nitric acid, 20 - 70%	LR
Nitric acid, over 70%	NR
Oxalic acid	R
Paraffin	LR
Perchloroethylene	NR
Petroleum ether	R
Phenols	NR
Phosphoric acid, to 10%	R
Phosphorus trichloride	NR
Phosphorus, yellow	NR
Picric acid, 1% in water	R
Potassium bichromate	R
Potassium carbonate	R
Potassium chloride	R
Potassium cyanide	R
Potassium hydroxide	R
Potassium nitrate	R
Potassium permanganate	R
Silicon tetrachloride	NR
Silver nitrate	R
Soap solution	R
Soda	R
Sodium bisulfite	R
Sodium carbonate	R
Sodium chlorate	R
Sodium chloride	R
Sodium hydroxide	R
Sodium hypochlorite	R
Sodium sulphate	R
Sodium sulphide	R
Stearic acid	R
Sulphur	R
Sulphur dioxide, liquid	NR
Sulfuric acid, to 30%	R
Sulphurous acid, conc	LR
Sulphurous acid, to 5%	R
Sulfuryl chloride	R
Tartaric acid, to 50%	R
Thionyl chloride	NR
Tin chloride	R
Toluene	NR
Triethylamine	R
Trichloroacetic acid	NR
Tricresyl phosphate	R
Turpentine	LR
Turpentine substitute	LR
Urea, to 20%	R
Xylene	NR
Zinc sulphate, aqueous	R
Zinc sulphate, solid	R
DISINFECTANTS	
Bleaching powder	R
Carbolic acid	NR
Hydrogen peroxide, to 40%	R
Hydrogen peroxide, over 40%	LR
Iodine tincture, 5%	NR
Lugol solution	R
Mercuric chloride	R
Surgical spirit	NR
GREASES, OILS, WAXES	
Animal	R
Mineral	R
Silicone oil	LR
Vegetable	LR
PLASTICS	
Foams	R
Foams, containing plasticizer	NR
Polyamide	R
Polyethylene	R
PVC	R
PVC, plasticized	NR
Rubber	R
Rubber, containing plasticizer	NR
FOODSTUFFS, SPICES	
Aniseed, bay, nutmeg	R
Cloves	NR
Honey, pure	R
Ice cream	R
Marinades	R
Meat and fish	R
Pepper, cinnamon, onions	R
Salt	R
GASES AND VAPORS	
Ammonia	R
Bromine vapor (dry)	LR
Carbon dioxide	R
Carbon monoxide	R
Chloride vapor (dry)	LR
Exhaust gases, containing HCl	R
Exhaust gases, containing HF	R
Exhaust gases, containing Sulfuric acid	R
Hydrogen sulphide	R
Methane	R
Nitric oxide	R
Nitrogen peroxide	R
Oxygen	R
Ozone	R
Sulphur dioxide (dry)	R
Natural Gas (Butane)	R
FREON TG* trichlorotrifluoroethane	NR
FREON TF* trichlorotrifluoroethane	R
BEVERAGES, etc.	
Beer, wine	R
Camomile extract	R
Chocolate	R
Fruit juice, milk, coffee	R
Spirits, to 30%	R
Vinegar	R
Water, mineral waters	R
Glycerol	R
Hair setting lotion	R
Nail varnish	NR
Nail varnish remover	NR
Ointments	R
Peat water	R
Sea water	R
Soaps	R
Sprays	LR
CLEANING AGENTS	
Acids, see under chemicals	
Alcohol, absolute	NR
Alcohol, to 30%	R
Alkalis, see under chemicals	
Ammonia	R
Aqueous hypochlorite solution	R
Carbon tetrachloride	NR
Methylated spirits	NR
Paraffin	LR
Perchloroethylene	NR
Petrol, pure	R
Petrol mixture, containing benzene	NR
Petroleum ether	R
Soap solution	R
Soda solution	R
Solvent stain removers	NR
Trichloroethylene	NR
Turpentine	LR
Turpentine substitute	LR
PEST CONTROL AGENTS	
Aqueous solutions of pesticides	LR
Stable spray-new	R
Sprays (for direct spraying)	LR
PROTECTIVE (strippable) COATINGS	
Sign Strip** strippable masking	LR
MISCELLANEOUS	
Urine	R

* Trademark of E.I. duPont deNemours & Company, Inc.

** Trademark of Spraylat Corp., Mt. Vernon, NY

Safety Laser Scanners

Contents

Selection Guide	C-2
OS32C Overview	C-3
OS32C	C-6

Selection Guide

Selecting the Proper Safety Laser Scanner for Your Application

1 Does your application need stationary guarding or mobile guarding?

- Mobile Guarding → **2** Do you need status or measurement data?
  - Yes → · **OS32C-DM**
    - Same features as OS32C, plus: EtherNet IP connectivity for status monitoring and measurement data
  - No → · **OS32C**
    - Very Compact
    - 3 m range
    - 70 zone sets (each: 1 safety & 2 warning)
    - Ethernet connectivity
    - Individual Sector Indicators
    - Easy set-up software tool
    - Configuration memory block
- Stationary Guarding → **3** What size area do you need to guard?
  - Less than 3 m → · **OS32C** – p. C-6
    - Very Compact
    - 3 m range
    - 70 zone sets (each: 1 safety & 2 warning)
    - Ethernet connectivity
    - Individual Sector Indicators
    - Easy set-up software tool
    - Configuration memory block
  - More than 3 m → **4** Do you need status or measurement data?
    - Yes → · **OS32C-DM-4M**
      - Same features as OS32C-4M plus: EtherNet/IP connectivity for status monitoring and measurement data
    - No → · **OS32C-4M**
      - Very Compact
      - 4 m range
      - 70 zone sets (each: 1 safety & 2 warning)
      - Ethernet connectivity
      - Individual Sector Indicators
      - Easy set-up software tool
      - Configuration memory block



OS32C Overview

Quick Link
S224
omron247.com

The OS32C is Now EtherNet/IP Capable

Compact Safety Laser Scanner

Industry First!
EtherNet/IP Capable for Status and Measurement Data Reporting



EtherNet/IP™

Small Size: Low Profile 104.5 mm
Compact and versatile safety laser scanner

Lightweight: 1.3 kg
Lightweight body for easy handling and installation

Low Power Consumption: 5 W
Low power consumption reduces battery load on the AGV (3.75 W in standby mode)



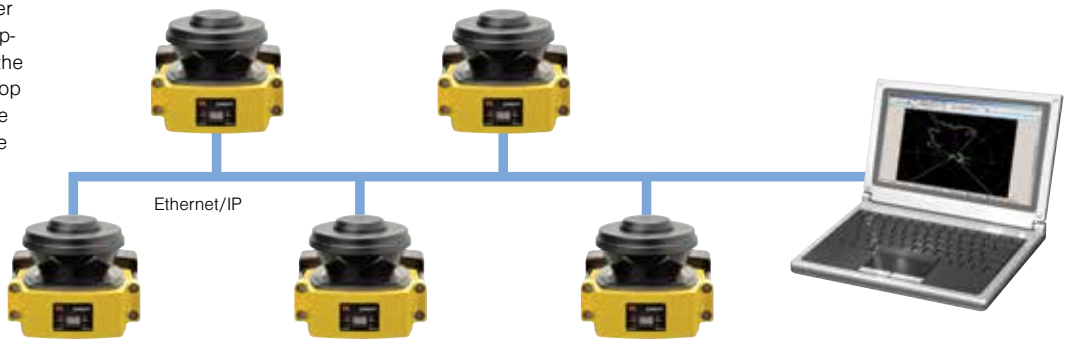
4 m Safety Range Models!



Integrated Management via EtherNet/IP

Industry First!

Industry's first Ethernet-compliant Safety Laser Scanner allows the user to check operating state and analyze the cause of an emergency stop via LAN even in large-scale applications using multiple scanners.



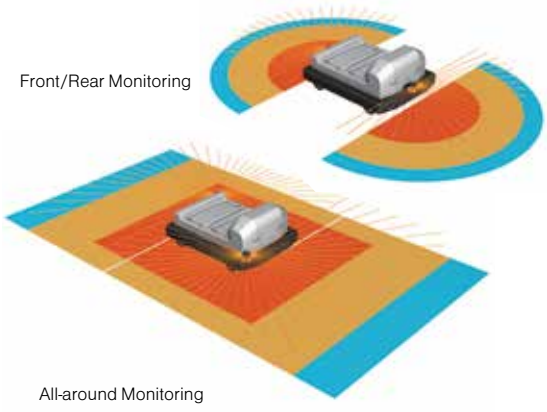
Simple and Versatile to Solve Many Application Needs

Collision Avoidance

Small, light & compact body provides for easy installation on an AGV.

Low power consumption (5 W reduces battery load on the AGV (3.75 W in standby mode)

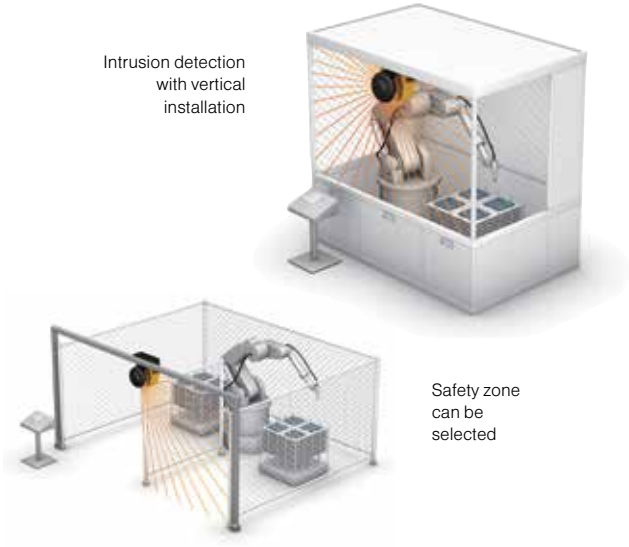
Up to 70 zone set combinations support complex AGV tracks.



Intrusion Detection

Reference Boundary Monitoring function supports intrusion detection without physically blocking the entrance.

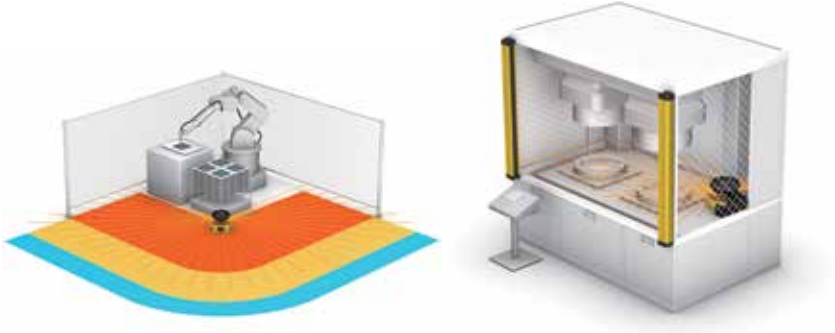
Supports various operation patterns by switching zone sets.



Presence Detection

Compact body allows for use inside the machine.

Detection angle of 270° provides coverage of two sides with one scanner.



Presence detection of 270°

Guarding inside the machine

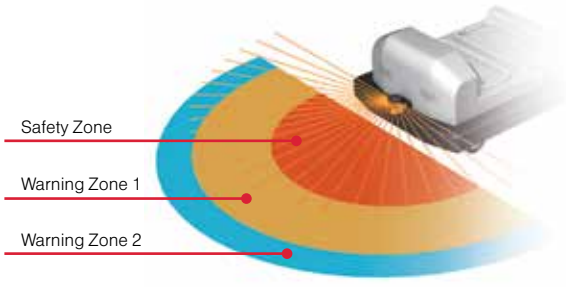
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Unprecedented, Innovative Features

Flexible zone configurations Industry Best!

For complex AGV applications, up to 70 combinations – each with one safety zone and two warning zones – can be set. The two warning zones can be set to support various purposes such as warning sound and speed control

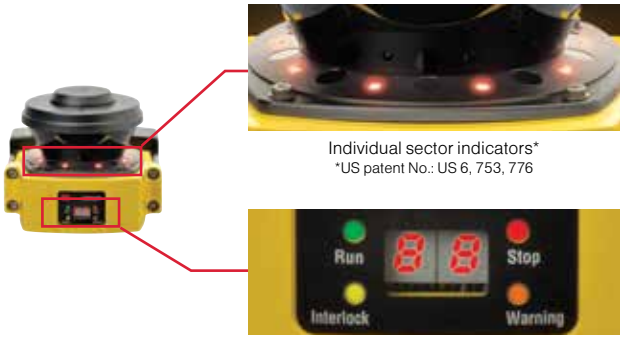


Simplified wiring

Omron's innovative I/O method requires fewer inputs when configuring multiple zones. Only 4 inputs are required to select from 6 zone sets. If all 8 inputs are used, up to 70 zone sets are available. This simplified wiring offers the most selection and flexibility!

Operating state can be determined at a glance

Eight sector indicators show the direction of intrusion. Front display shows operating state and error codes. The unit can also be configured to show selected zone and response time.



Individual sector indicators*
*US patent No.: US 6, 753, 776

Status Diagnostic Display:
Status/Error Codes, Run, Stop, Interlock and Warning Output Indicators

Convenient and easy-to-use functions

Replaceable sensor, no reprogramming needed

No reprogramming needed, the configuration is stored in the I/O block. Replacing a damaged sensor is fast and easy.



Cable access options

To tailor the OS32C to your installation, eight options are available for the location of the power and ethernet connections.

Model	Range	EIP and Measurement Data	Cable Access
OS32C-BP	3 m	No	Back
OS32C-SP1	3 m	No	Left side
OS32C-BP-DM	3 m	Yes	Back
OS32C-SP1-DM	3 m	Yes	Left side
OS32C-BP-4M	4 m	No	Back
OS32C-SP1-4M	4 m	No	Left side
OS32C-BP-DM-4M	4 m	Yes	Back
OS32C-SP1-DM-4M	4 m	Yes	Left side

These can be selected according to the needs of AGV or facilities design.



OS32C with cable access on the back (OS32C-BP)



OS32C with cable access on the left side (OS32C-SP1)

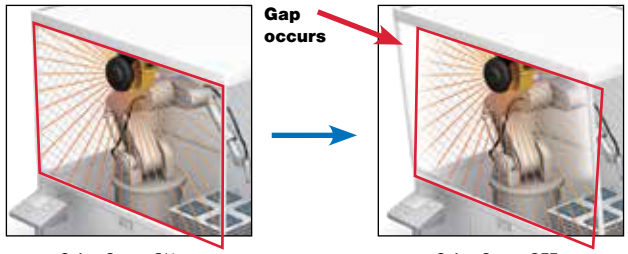
Response time can be set from 80 ms to 680 ms

Response time adjustment can filter out erroneous detections (machine stoppage) caused by pollutants in the environment.

Reference Boundary Monitoring Function

The OS32C constantly monitors reference points and turns OFF the safety outputs when a shift in its position is detected.

(Per international standard IEC 61496-3, area scanners used in applications where the angle of approach exceeds ±30° with respect to the detection plane, must use Reference Boundary Monitoring in the detection zone.)

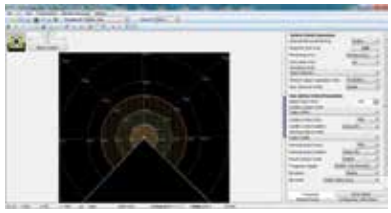


Safety Output ON

Safety Output OFF

Free Software for Easy Configuration

The configuration of the safety zone and warning zones can be done in real time using a PC. Configurations can also be created or modified offline.



OS32C

Quick Link
S224
omron247.com

Compact Safety Laser Scanner

Industry First!
EtherNet/IP Capable for Status and Measurement Data Reporting

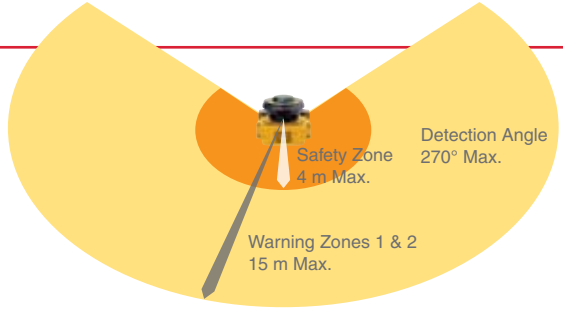
- 4 m safety range models
- Pollution tolerance modes provide improved performance in dusty environments
- Compact size (104.5 mm height), power efficient (5 W) and light weight (1.3 kg) for longer AGV battery life
- 70 sets of safety zone and warning zone combinations, for complex changes in zone guarding parameters
- Configuration memory and I/O block, no need to reprogram after sensor replacement, minimal down time
- Configurable minimum object resolution of 30, 40, 50 or 70 mm, for hand and arm detection applications
- 8 Individual Sector Indicators and LED indicators, determine scanner status at a glance
- Easy-to-use Software Tool simplifies creation of complex zone combinations



EtherNet/IP™

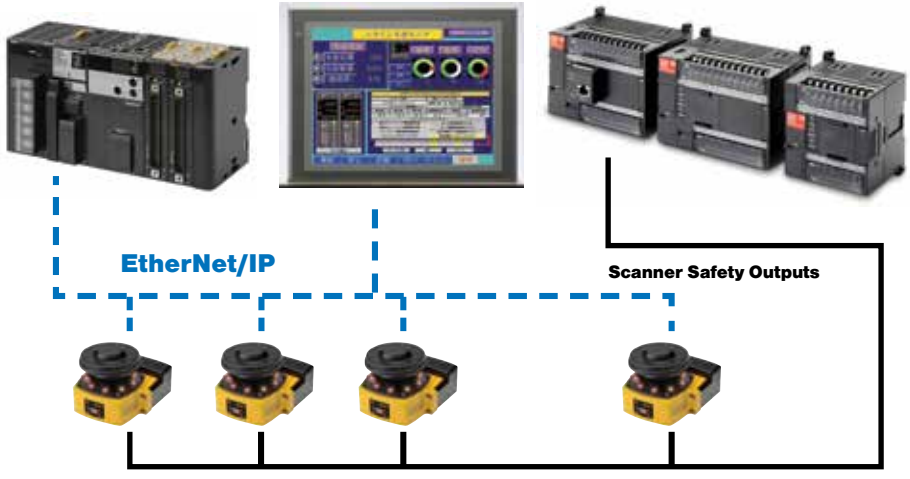
4 m Safety Range Models

4 m Safety Zone
15 m Warning Zone



EtherNet/IP for Status and Measurement Data

The OS32C with EtherNet/IP can be monitored by ODVA EtherNet/IP compliant products such as PLCs and HMIs. System status, zone status, and measurement data can all be monitored over EtherNet/IP.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

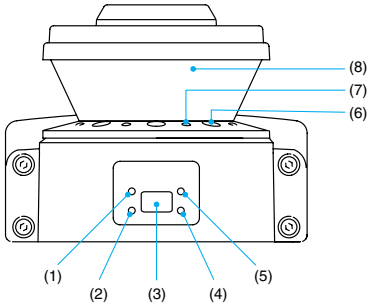
OMRON AUTOMATION & SAFETY

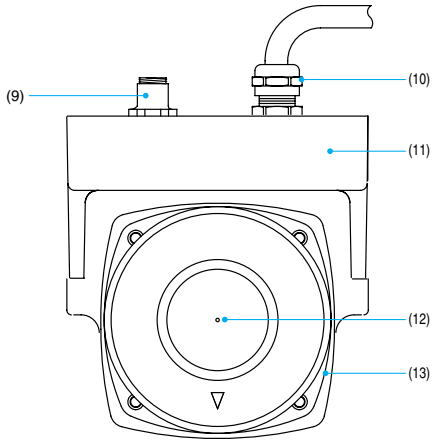
Specifications

Sensor Type		Type 3 Safety Laser Scanner
Safety Category		Category 3, Performance Level d (ISO13849-1: 2008)
Detection Capability		Configurable; Non-transparent with a diameter of 30, 40, 50 or 70 mm (1.8% reflectivity or greater)
Monitoring Zone		Monitoring Zone Set Count: (Safety Zone + 2 Warning Zones) x 70 sets
Operating Range	OS32C-XX	Safety zone: 1.75 m (min. object resolution of 30 mm), 2.5 m (min. object resolution of 40 mm), 3.0 m (min. object resolution of 50 mm or 70 mm); Warning Zone: 10 m
	OS32C-XX-4M	Safety zone: 1.75 m (min. object resolution of 30 mm), 3.0 m (min. object resolution of 50 mm or 70 mm), 4.0 m (min. object resolution 70 mm); Warning Zone: 15 m
Maximum Measurement Error		100 mm (at less than 3 m distance); 110 mm (at greater than 3 m distance) *1
Detection Angle		270°
Angular Resolution		0.4°
Laser Beam Diameter		6 mm at optics cover, 14 mm at 3 m.
Laser Scan Plane Height		67 mm from the bottom of the scanner (see dimensional drawings for more detail)
Response Time		Response time from ON to OFF: From 80 ms (2 scans) to 680 ms (up to 17 scans) *8 Response time from OFF to ON: Response time from ON to OFF + 100 ms to 60 s (configurable)
Zone Switching Time		20 to 320 ms
Line Voltage		24 VDC +25%/-30% (ripple p-p 2.5 V max.) *2
Power Consumption		Normal operation: 5 W max., 4 W typical (without output load) *3 Standby mode: 3.75 W (without output load)
Emission Source (Wavelength)		Infrared Laser Diode (905 nm)
Laser Protection Class		Class 1: IEC/EN60825-1 (2007); Class 1: JIS6802 (2005); Class I: CFR21 1040.10, 1040.11
Safety Output (OSSD)		PNP transistor x 2, load current of 250 mA max., residual voltage of 2 V max., load capacity of 2.2 µf max., leak current of 1 mA max. *3, *4, *5
Auxiliary Output (Non-Safety)		NPN/PNP transistor x 1, load current of 100 mA max., residual voltage of 2 V max., leak current of 1 mA max. *4, *5, *7
Warning Output (Non-Safety)		NPN/PNP transistor x 1, load current of 100 mA max., residual voltage of 2 V max., leak current of 1 mA max. *4, *5, *7
Output Operation Mode		Auto Start, Start Interlock, Start/Restart Interlock
Input	External Device Monitoring (EDM)	ON: 0 V short (input current of 50 mA), OFF: Open
	Start	ON: 0 V short (input current of 20 mA), OFF: Open
	Zone Select	ON: 24 V short (input current of 5 mA), OFF: Open
	Stand-by	ON: 24 V short (input current of 5 mA), OFF: Open
Connection Type		Power Cable: 18-pin mini-connector (pigtail); Communication Cable: M12, 4-pin connector
Connection with PC *6		Communication: Ethernet OS Supported: Windows 2000, Windows XP, Windows Vista, or Windows 7
Indicators		RUN indicator: Green, STOP indicator: Red, Interlock Indicator: Yellow, Warning Output Indicator: Orange, Status/Diagnostic Display: 2 x 7-segment LEDs, Intrusion Indicators: Red LED x 8
Protective Circuit		Protection against output load short and reverse power connection
Ambient Temperature		Operation: -10 to 50°C, Storage: -25 to 70°C
Ambient Humidity		Operation & Storage: 95% RH max., non-condensing
Ambient Operation Illumination		Incandescent lamp: Illumination on receiving surface 1500 lx max. (an angle of laser scanning plane and disturbance light must be ±5 degrees or more)
Enclosure Rating		IP65 (IEC60529)
Enclosure		Sensor head: Die-cast aluminum, optical cover: Polycarbonate, I/O block: Die-cast aluminum
Dimensions (W x H x D)		133.0 x 104.5 x 142.7 mm (except cable)
Dielectric Withstand Voltage		350 VAC, 50/60 Hz, 1 minute
Insulation Resistance		20 mega-ohm or higher (500 VDC)
Impact Resistance		98 m/s^2 1,000 times for each of X, Y, and Z directions (IEC 60068-2-29)
Vibration		10 to 55 Hz double-amplitude of 0.7 mm, 20 sweepings for X, Y, and Z directions (IEC60068-2-6)
Weight (Main Unit only)		1.3 kg
Power Cable		Up to 30 m
Communication Cable		Up to 100 m for 100 BASE-T Cat 5 cable
Accessories		CD-ROM (User's Manual and Configuration Tool)
Approvals		EN61496-1 (Type 3 ESPE), EN61496-3 (Type 3 AOPDDR), EN61508 (SIL2), IEC61496-1 (Type 3 ESPE), IEC61496-3 (Type 3 AOPDDR), IEC61508 (SIL2), UL508, UL1998, CAN/CSA-C22.2 No. 14, -CAN/CSA-C22.2 No. 0.8

*1. An additional measurement error may need to be added due to reflective backgrounds.
*2. For power source specification, contact OMRON Automation and Safety.
*3. Rated current of OS32C is 1.025 A max. (OS32C 210 mA + OSSD A load + OSSD B load + Auxiliary output load + Warning output load + Functional Inputs). Where functional inputs are: EDM input – 50 mA, Start input– 20 mA, Standby input –5 mA, Zone X input – 5 mA x 8 (8 zone set select inputs)
*4. Output voltage is Input voltage - 2.0 VDC.
*5. Total consumption current of 2 OSSDs, auxiliary output, and warning output must not exceed 700 mA.
*6. An Ethernet cable with an M12, 4-pin connector is required.
*7. Output polarity (NPN/PNP) is configurable via the configuration tool.
*8. Pollution tolerance model will add 6 m/sec. to each scan time.

System Components and Functions





Number	Component	Function
(1)	RUN indicator (green)	Will turn ON when safety zone is clear and OSSDs are ON.
(2)	Interlock Indicator (yellow)	Will turn ON when in interlock state, blink under lockout, and blink in case of a failure.
(3)	Status/Diagnostic Display	The scanner status, configuration/operation, or failure is displayed.
(4)	Warning Output Indicator (orange)	Will turn ON when the warning output is ON.
(5)	STOP indicator (red)	Will turn ON when safety zone is blocked, OSSDs are OFF or under interlock state.
(6)	Dust Ring	Dust detection cover with reflective surface, for dust accumulation detection
(7)	Individual Sector Indicators	Will turn ON when an intrusion is detected in the safety zone, 8 sectors total. Each sector = 33.75°.
(8)	Scan window	The window where the laser light is emitted and received.
(9)	Ethernet Cable	Used for Ethernet cable connection. *
(10)	Power Connector	18-pin connector (pigtail). *
(11)	I/O Block	Connector module
(12)	Center of rotation	Indicates the location of the axis around which the laser emits.
(13)	Sensor block	Sensor head; field replaceable.

*For OS32C-SP1, each connector is located on the left as viewed from the back of the I/O block.

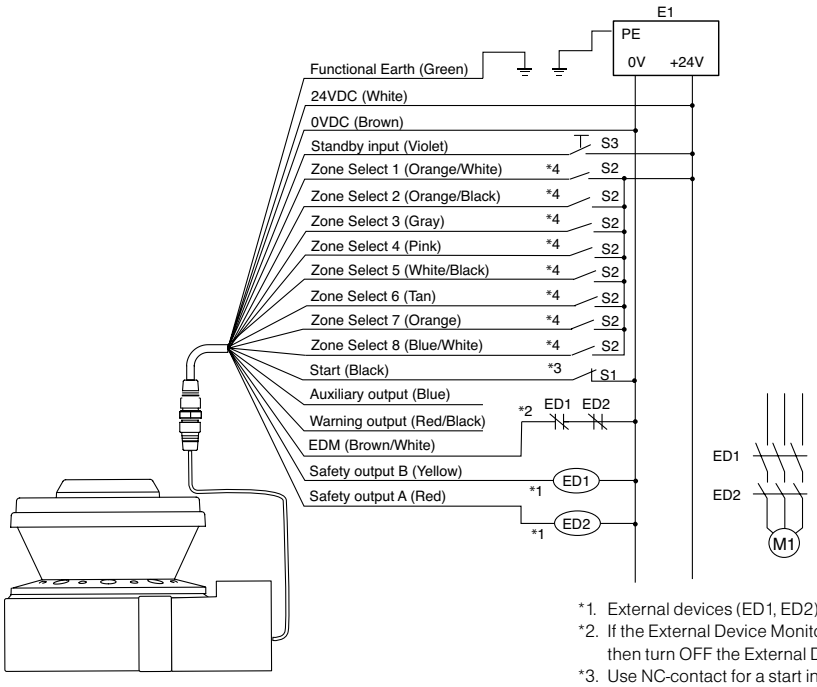
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Wiring

Basic Connection with Single OS32C Unit
Category 3, Performance Level d (ISO13849-1)



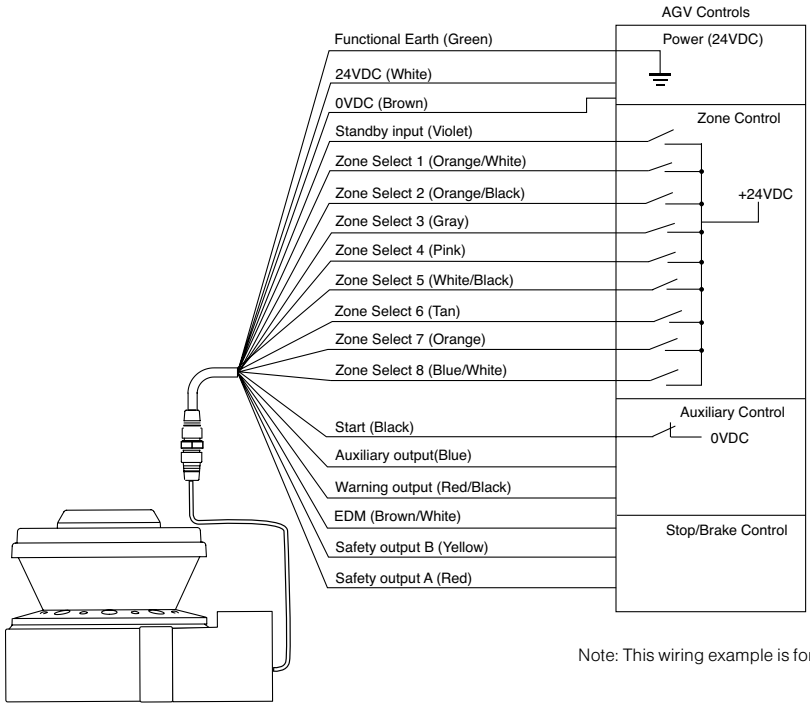
S1 : Start Input
S2 : Zone Select Switch
S3 : Standby Switch
ED1, ED2: Forced guided relay
M1 : 3-Phase Motor
E1 : 24 VDC Power

OS32C Configuration
- External Device Monitoring Enabled
- Start/Restart Interlock

*1. External devices (ED1, ED2) are forced guide relays. (G7Z, G7SA, G7S, etc)
*2. If the External Device Monitoring is not used, connect brown/white wires to 0 V, and then turn OFF the External Device Monitoring with the configuration software.
*3. Use NC-contact for a start input.
*4. For zone select switch setting, refer to OS32C Series User's Manual. When using only one zone, no connection is needed for the zone select inputs.

Note: This wiring example is for category 3.

Connection to AGV Controls
Category 3, Performance Level d (ISO13849-1)

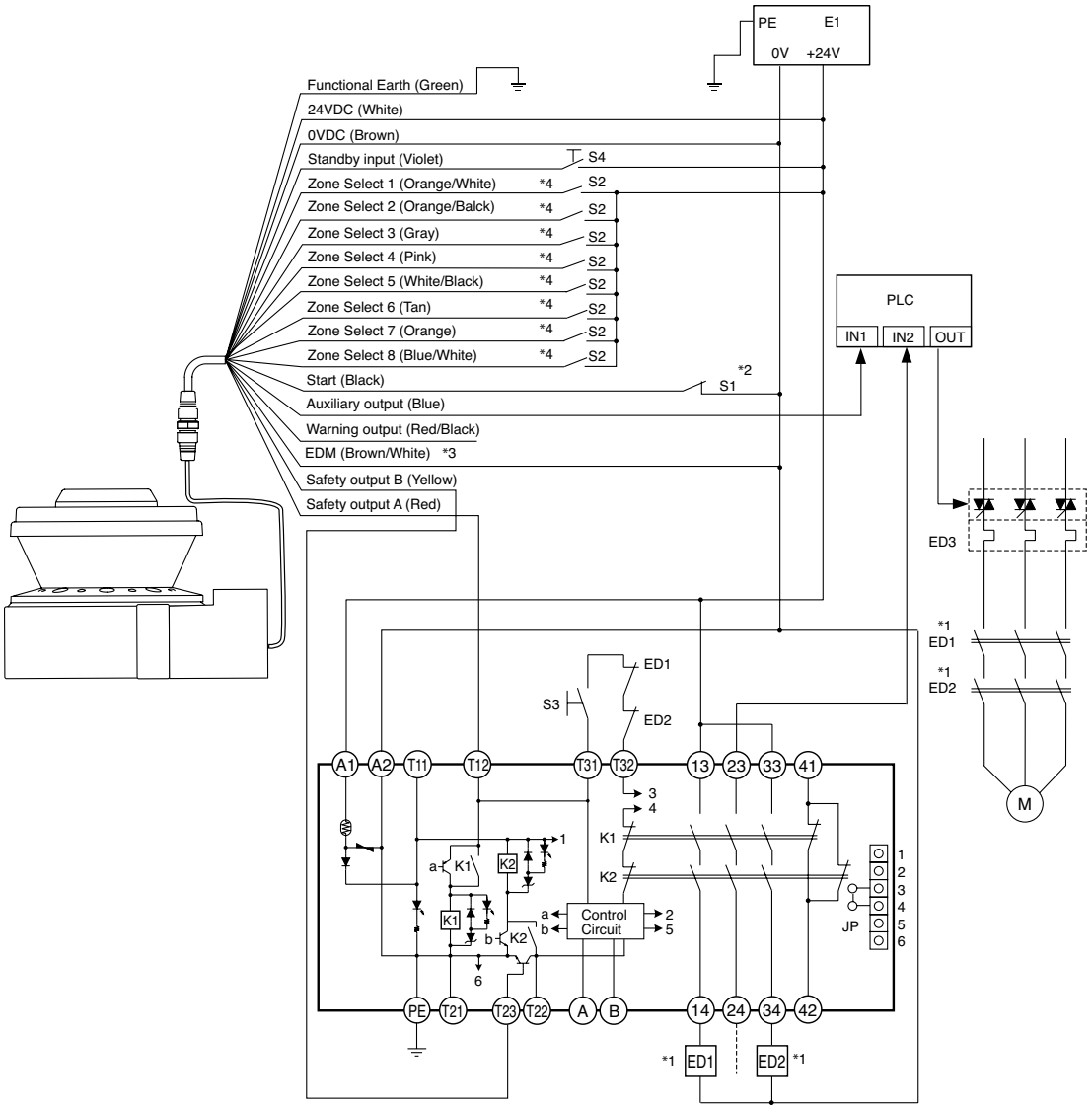


Note: This wiring example is for category 3.

OS32C Configuration
- External Device Monitoring Disabled
- Automatic Start

Wiring (continued)

Connecting to the Controller G9SA-301
Category 3, Performance Level d (ISO13849-1)



ED1, ED2: Forced guided relay
ED3 : Solid state contactor (G3J)
M : 3-Phase Motor
S1 : Start Input
(use for releasing lockout)
S2 : Zone Select Switch
S4 : Standby Switch
S3 : Reset Switch
E1 : 24 VDC Power
PLC : Programmable Controller
(This is for monitoring only and unrelated to a safety system)

*1. External devices (ED1, ED2) are forced guide relays. (G7Z, G7SA, G7S, etc)
*2. Use NC-contact for a start input.
*3. If the External Device Monitoring is not used, connect brown/white wires to 0V, and then turn OFF the External Device Monitoring with the configuration software.
*4. For zone select switch setting, refer to OS32C Series User's Manual. When using only one zone, no connection is needed for the zone select inputs.
Note: This wiring example is for category 3.

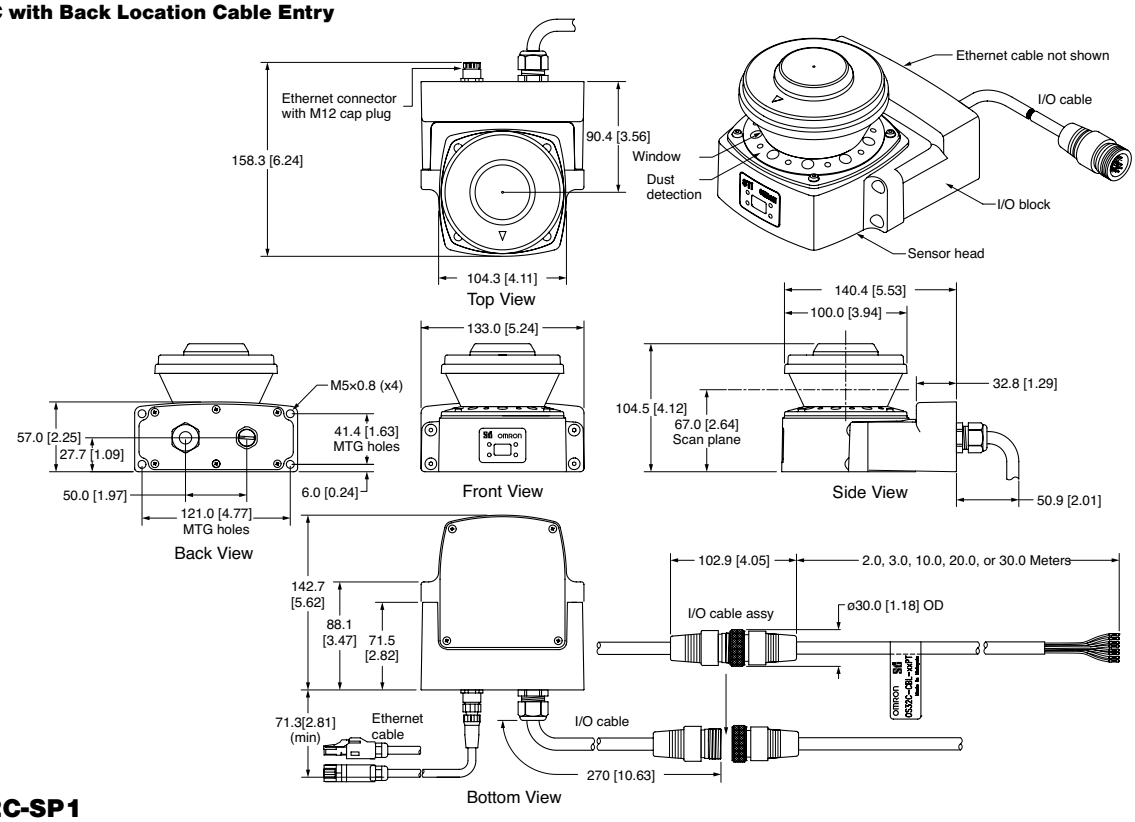
SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Dimensions

mm (in.)

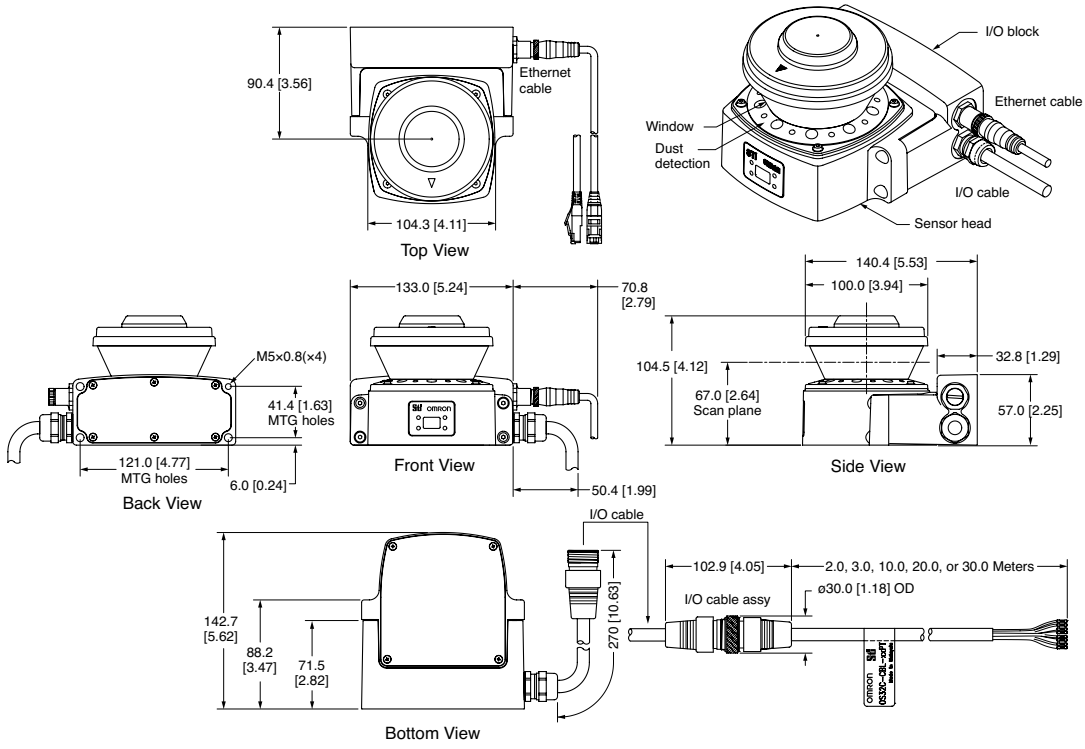
OS32C-BP

OS32C with Back Location Cable Entry



OS32C-SP1

OS32C with Side Location Cable Entry



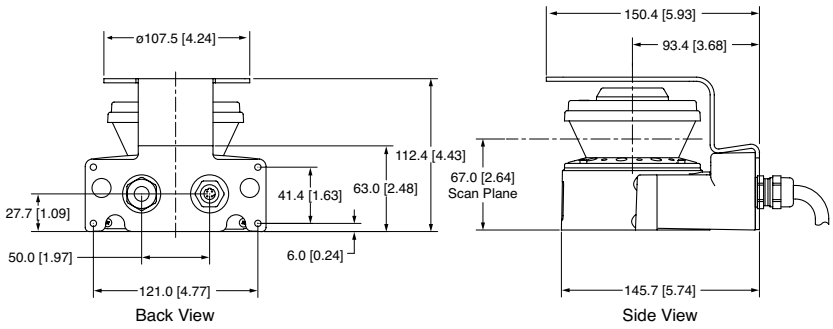
C

Dimensions (continued)

mm (in.)

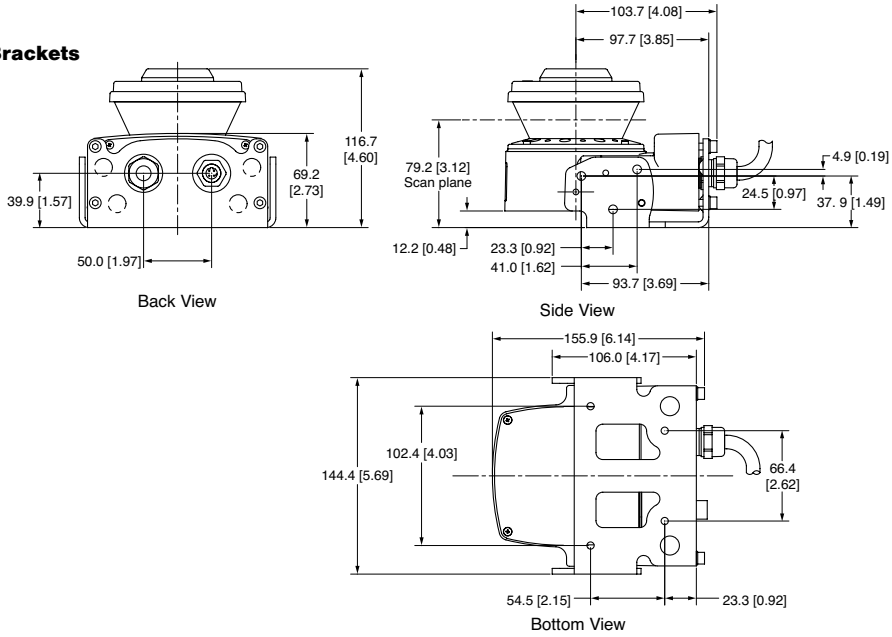
OS32C-BP + OS32C-BKT4

OS32C with Top Guard Kit



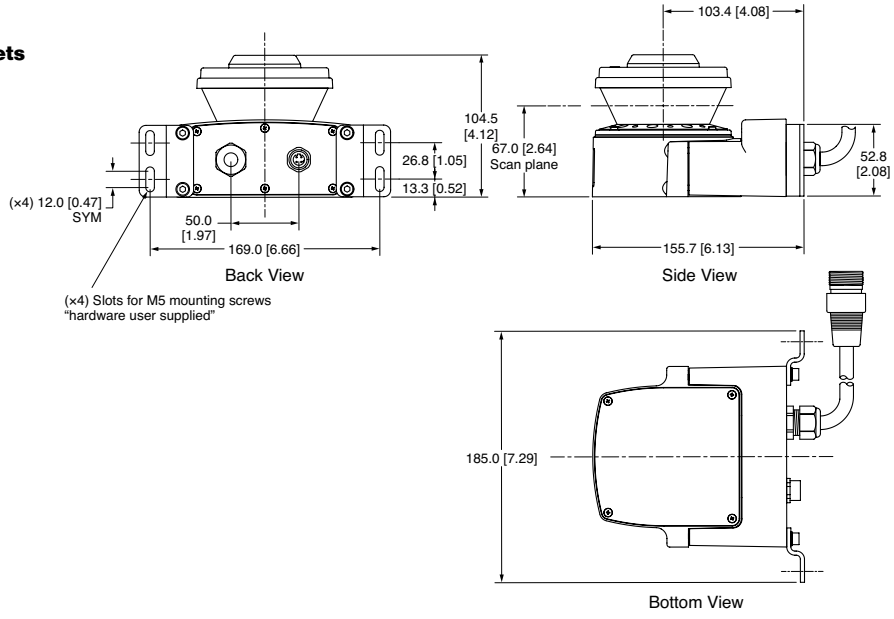
OS32C-BP + OS32C-BKT1

OS32C with Bottom/Side Mounting Brackets



OS32C-BP + OS32C-BKT3

OS32C with Simple Mounting Brackets



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

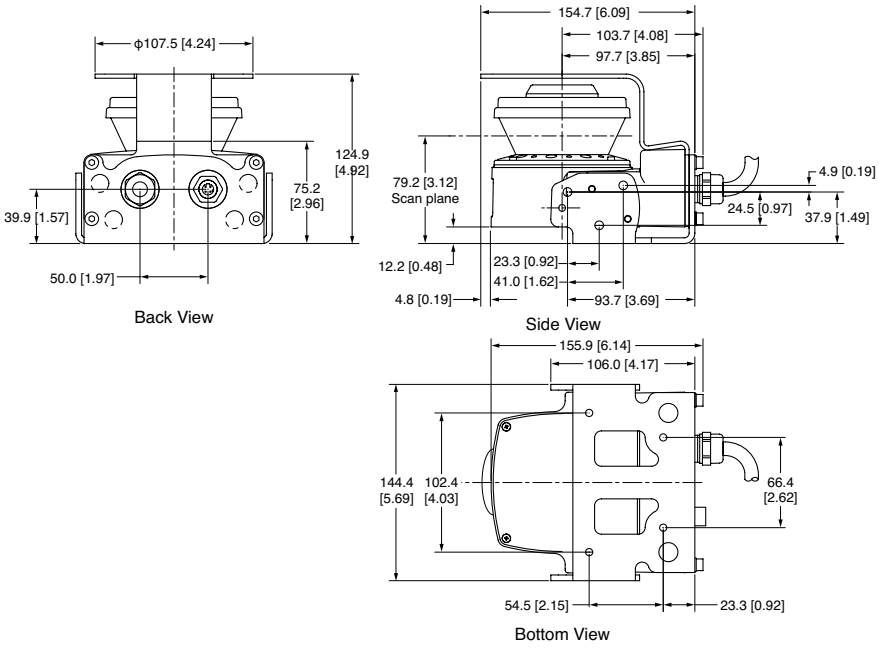
OMRON AUTOMATION & SAFETY

Dimensions (continued)

mm (in.)

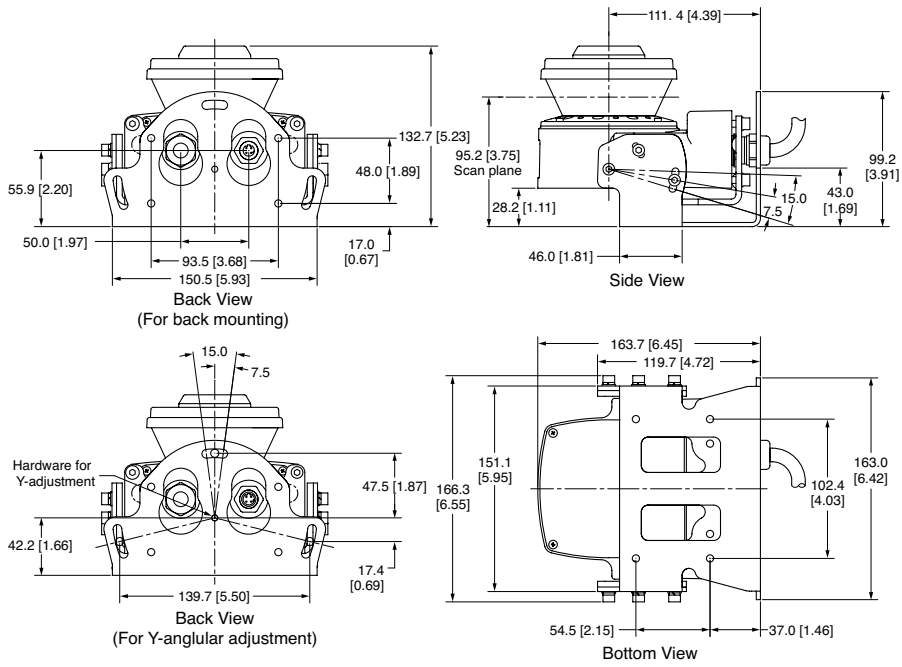
OS32C-BP + OS32C-BKT1 + OS32C-BKT4

OS32C with Bottom/Side Mounting Brackets and Top Guard Kit



OS32C-BP + OS32C-BKT1 + OS32C-BKT2

OS32C with XY Axis Rotation Mounting Kit



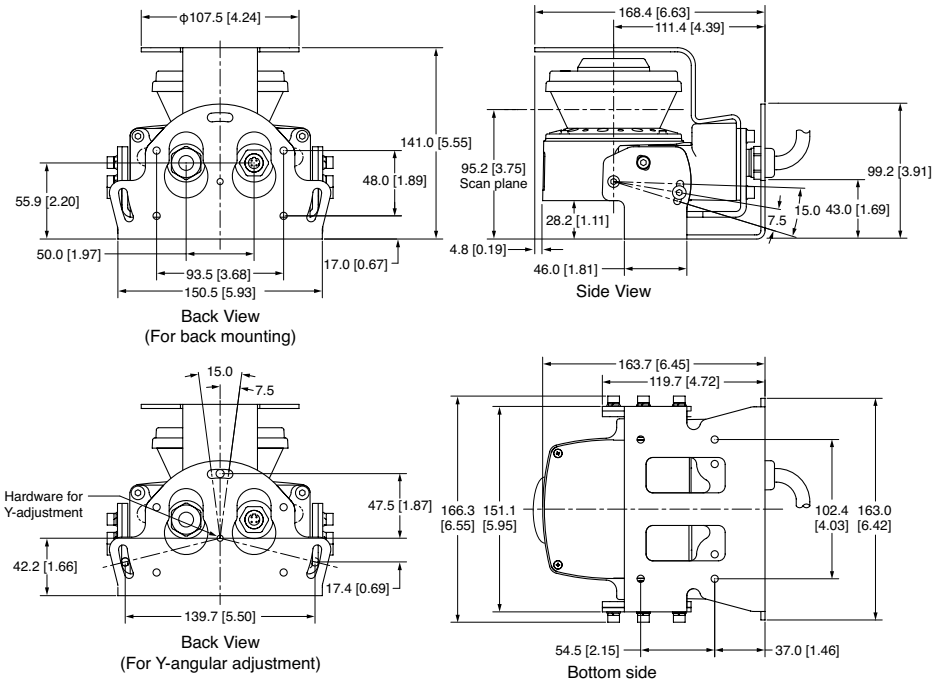
C

Dimensions (continued)

mm (in.)

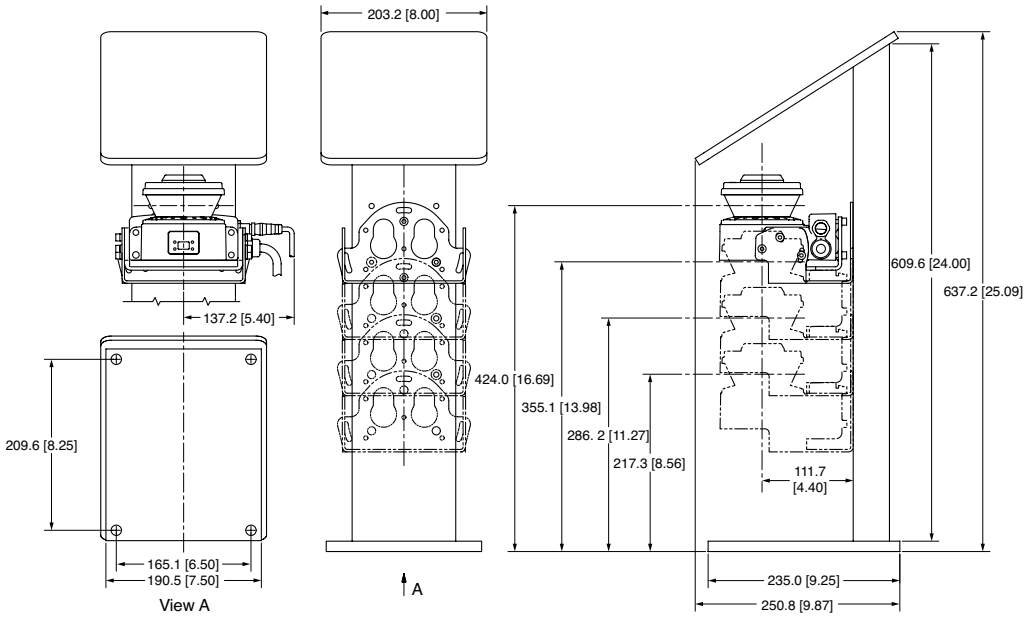
OS32C-BP + OS32C-BKT1 + OS32C-BKT2 + OS32C-BKT4

OS32C with Bottom/Side Mounting Brackets and XY Axis Rotation Mounting Kit and Top Guard Kit



OS32C-SP1 + OS32C-BKT1 + OS32C-BKT2 + OS32C-MT + OS32C-HDT

OS32C with Bottom/Side Mounting Brackets and XY Axis Rotation Mounting Kit and Mounting Stand and Mounting Stand Hardware Kit



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

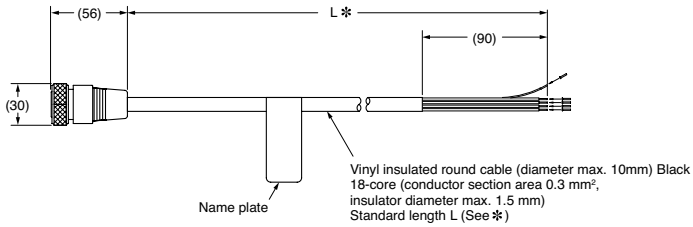
OMRON AUTOMATION & SAFETY

Dimensions (continued)

(mm)

OS32C-CBL-□□M

Power Cable

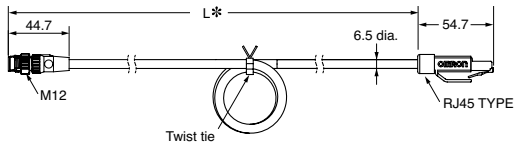


✻ Sizes are as below

Model Number	L
OS32C-CBL-03M	3m
OS32C-CBL-10M	10m
OS32C-CBL-20M	20m
OS32C-CBL-30M	30m

OS32C-ECBL-□□M

Ethernet Cable



✻ Sizes are as below

Model Number	L
OS32C-ECBL-02M	2m
OS32C-ECBL-05M	5m
OS32C-ECBL-15M	15m

Ordering

OS32C (Power cable is sold separately)

Appearance	Description	Model	Remarks
	OS32C laser scanner with 3 m range and back location cable entry EtherNet capable for configuration and monitoring	OS32C-BP	CD-ROM (Configuration software) OS supported: Windows 2000, Windows XP, Windows Vista Windows 7
	OS32C laser scanner with 4 m range and back location cable entry EtherNet capable for configuration and monitoring	OS32C-BP-4M	
	OS32C laser scanner with 3 m range, back location cable entry EtherNet/IP capable for status measurement data reporting	OS32C-BP-DM	
	OS32C laser scanner with 4 m range, back location cable entry EtherNet/IP capable for status measurement data reporting	OS32C-BP-DM-4M	
	OS32C laser scanner with 3 m range and side location cable entry*, EtherNet capable for configuration and monitoring	OS32C-SP1	
	OS32C laser scanner with 4 m range and side location cable entry*, EtherNet capable for configuration and monitoring	OS32C-SP1-4M	
	OS32C laser scanner with 3 m range, side location cable entry*, EtherNet/IP capable for status measurement data reporting	OS32C-SP1-DM	
	OS32C laser scanner with 4 m range, side location cable entry*, EtherNet/IP capable for status measurement data reporting	OS32C-SP1-DM-4M	

*For OS32C-SP1, each connector is located on the left as viewed from the back of the I/O block.

Ordering (continued)

Power Cable

Appearance	Description	Model	Remarks
	Cable length: 3 m	OS32C-CBL-03M	One cable is required per sensor.
	Cable length: 10 m	OS32C-CBL-10M	
	Cable length: 20 m	OS32C-CBL-20M	
	Cable length: 30 m	OS32C-CBL-30M	

Ethernet Cable

Appearance	Description	Model	Remarks
	Cable length: 2 m	OS32C-ECBL-02M	Required for configuration and monitoring.
	Cable length: 5 m	OS32C-ECBL-05M	
	Cable length: 15 m	OS32C-ECBL-15M	

Note: An EtherNet cable with an M12, 4-pin connector is required.

Mounting Brackets

Appearance	Description	Model	Remarks
	Bottom/side mounting bracket	OS32C-BKT1	Bottom/side mounting bracket x 1, unit mounting screws x 4 sets
	XY axis rotation mounting bracket	OS32C-BKT2	XY axis rotation mounting bracket x 1, unit mounting screws x 6 sets, bracket mounting screws x 1 set (must be used with OS32C-BKT1)
	Simple mounting bracket	OS32C-BKT3	Simple mounting brackets x 2, unit mounting screws x 4 sets *
	Protective cover for window	OS32C-BKT4	
	Mounting stand	OS32C-MT	When using a mounting stand, use an OS32C with side location cable entry (OS32C-SP1). The OS32C with back location cable entry (OS32C-BP) cannot be mounted. Use with mounting brackets (OS32C-BKT1 and OS32C-BKT2).
	Hardware kit for mounting stand	OS32C-HDT	Mounting screws x 3 sets Use this when mounting a bracket to the mounting stand.

*There are eight OS32C mounting screws for singular use, and four screws for protective cover for window.

Ordering (continued)

Accessories

Appearance	Description	Model	Remarks
	Scan window	OS32C-WIN-KT	Spare for replacement
	Spare sensor with 3 m range, without I/O block, EtherNet capable for configuration and monitoring	OS32C-SN	Spare for replacement
	Spare sensor with 4 m range, without I/O block, EtherNet capable for configuration and monitoring	OS32C-SN-4M	Spare for replacement
	Spare sensor with 3 m range, EtherNet/IP, without I/O block, EtherNet/IP capable for status and measurement data reporting	OS32C-SN-DM	Spare replacement for EtherNet/IP
	Spare sensor with 4 m range, EtherNet/IP, without I/O block, EtherNet/IP capable for status and measurement data reporting	OS32C-SN-DM-4M	Spare replacement for EtherNet/IP
	I/O block with cable access from the back	OS32C-CBBP	Spare for replacement
	I/O block with cable access from the left side	OS32C-CBSP1	Spare for replacement
	Window cleaning kit, anti-static cleaner	WIN-CLN-KT	Accessory

C

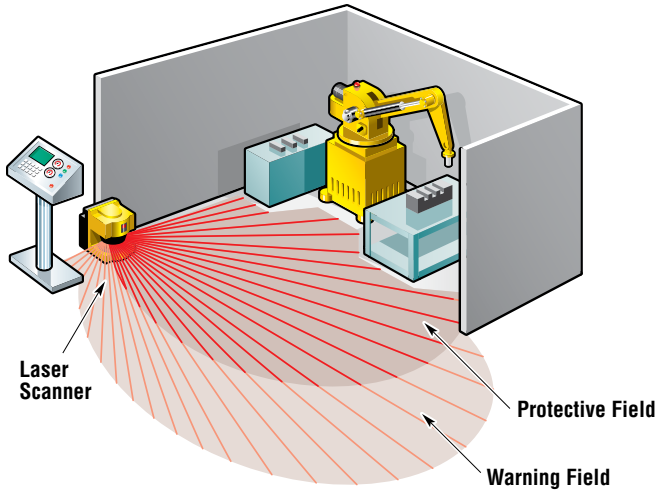
OMRON Automation and Safety offers ...

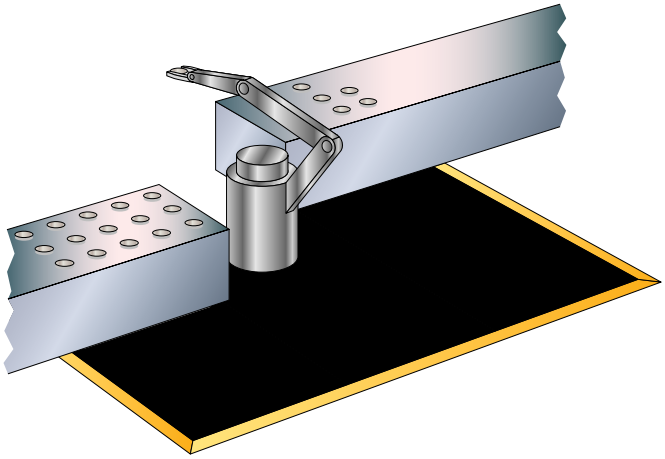
Application Solutions

Area Scanning

Area scanning devices, typically employing laser light, can be used to guard the area of a robotic work cell. When properly programmed, an area scanner will detect an intrusion into the defined area. Area scanning devices have the advantage of being able to be reprogrammed should the configuration of the robot welding cell change.

Additionally, area scanning devices frequently include a programmable "warning zone" which can be set to warn an intruder from entering into the work cell without stopping the robot. Intruding farther will block the safety zone and stop the robot.



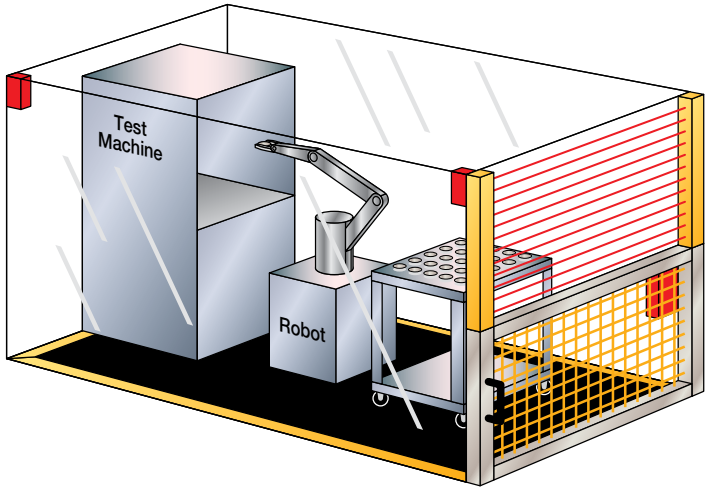


Transfer Robot Guarding

This large industrial robot is used to transfer work in process from one conveyor to another. Moving quickly, it has the potential to seriously injure personnel. STI Universal Safety Mats in conjunction with STI safety mat controllers are designed to protect workers by sending a stop signal to the robot to cease hazardous motion.

Silicon Wafer Quality Control Stand

Full wafer trays are placed in the work cell by the operator reaching through a safety light curtain. Access to the hazardous robot is additionally guarded by hard guarding on three sides which has been interlocked with magnetically coded safety switches. In order to assure that the robot will not start with someone in the enclosure, STI Universal Safety Mats are used inside the perimeter. The hinged guard below the safety light curtain is interlocked using an D4NH hinge-pin operated safety switch.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Programmable Safety Systems

Contents

Selection Guide	D-2
Modular Safety I/O System	
NX-S	D-4
Compact Programmable Controllers	
G9SP	D-18
Compact Safety I/O	
NE1A	D-28
NE1A-EIP	D-32
DST1	D-32
NE1A-EDR01	D-33
WS02-CFSC1-E	D-33
Accessories for NE1A and DST1	D-34

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Selection Guide

Controller and Hardware Selection

Do you need a stand-alone controller or a stand-alone controller without remote safety I/O?

- Up to 256 I/O → · G9SP
- Up to 256 I/O → · NX-S (Stand-alone Operation)





Standalone controller without safety remote I/O

Do you require an integrated safety and control solution over EtherCAT?

- Up to 256 I/O → · NX-SL3300
- Up to 1024 I/O → · NX-SL3500

no, DeviceNet is needed

Do you need to monitor the safety network over Ethernet/IP?

yes → **How many inputs do you need?**

- Up to 16 → · NE1A-SCPU01-EIP
- Up to 40 → · NE1A-SCPU02-EIP
- More than 40 → · Select a NE1A-SCPU0□-EIP plus any additional hardware needed from the table below.

no

How many inputs do you need?

- Up to 16 → · NE1A-SCPU01-V1
- Up to 40 → · NE1A-SCPU02
- More than 40 → · Select a NE1A (required) plus any additional hardware needed from the table to the right

Up to 12

Does your application require muting or 2-hand control?

yes → · NE1A-SCPU01-V1

no

· NE0A — see website

The G9SP Controller

- Direct connection to non-contact switches and safety mats
- Easily monitored by PLCs via Ethernet (FINS), Ethernet I/P, or serial connection
- Programmable via PC or removable memory cassette
- Ideal for small to mid-size applications
- EN ISO 13849-1 (PL e)

NX-S (Stand-alone Operation) Safety Controller with up to 256 I/O using the NX-SL3300 CPU

- Stand-alone operation with a single node
- New Stand-alone programming software
- Ethernet/IP monitoring

NX-S Integrated Safety Controller: Safety over EtherCAT

- EtherCAT™ single communication system for control and safety information
- Mixed standard and safety I/O on the same backplane
- Status information readily accessible
- One Software: Sysmac Studio
- Auto configuration restart

Model	Part No.	Description
NE1A Safety Network Controller		
NE1A-SCPU01-V1	11061-0004	16 inputs 8 outputs
NE1A-SCPU02	11061-0005	40 inputs, 8 outputs
NE0A Safety Network Controller		
NE0A-SCPU01	11075-0001	12 inputs, 6 outputs
DST1 Safety I/O Terminals		
DST1-ID12SL-1	11062-0001	Slave I/O unit, 12 inputs
DST1-MD16SL-1	11062-0002	Slave I/O unit, 8 inputs, 8 outputs
DST1-MRD08SL-1	11062-0003	Slave I/O unit, 4 inputs, 4 relay outputs
DST1-XD0808SL-1	11062-0014	DST1 with simple logic, 8 inputs, 8 outputs

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

NX-S Integrated Safety Controller: Safety Over EtherCAT

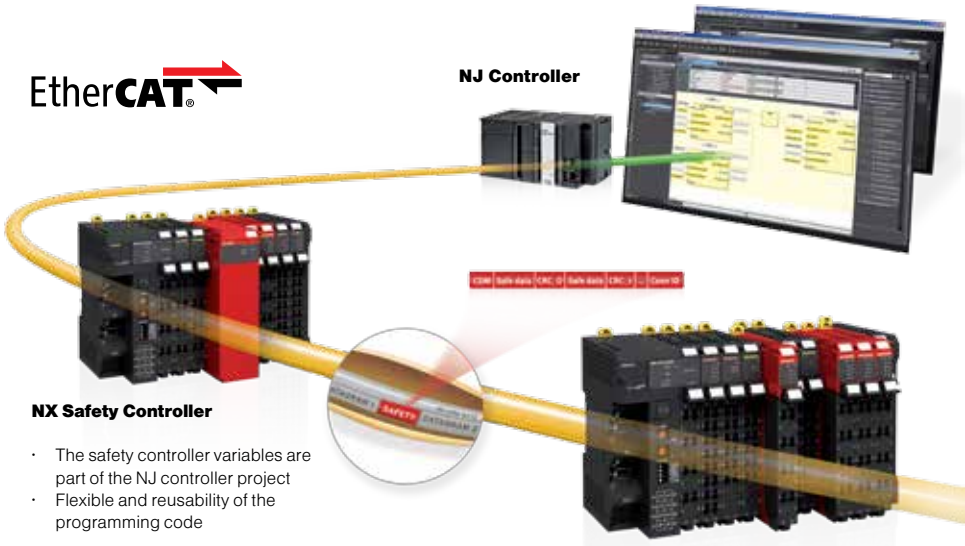
NEW

Now with Stand-Alone Safety System Capabilities

The NX-S allows connection of up to 32 safety I/O units, standard digital inputs and outputs can be directly mapped into the NX-SL3300 safety CPU according to the project needs.

- Monitor with EtherNet/IP





- The safety controller variables are part of the NJ controller project
- Flexible and reusability of the programming code

- Up to 8 safety input points per unit
- Flexible connectivity to a wide selection of safety devices
- I/O data monitoring in the NJ controller project

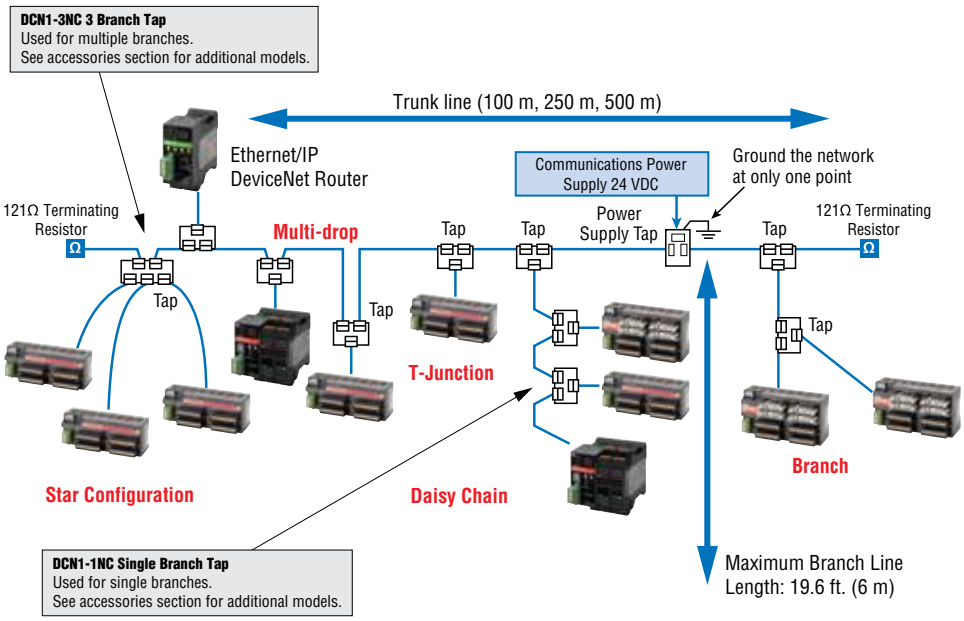
D

Network Layout if using the NE1A

NE1A Safety DeviceNet Controller

- Eliminates long runs of complicated wiring
- Compatible with the DeviceNet Open Network
- Provides individual I/O status and error indicators
- Minimizes the need to rewire when making machine modifications
- Conforms to Global Safety Standards
- Meets IEC 61508 SIL3





Integration of Safety Into Machine Automation Enables Simple, Flexible System Configuration

- EN ISO13849-1 (PLe/Safety Category4), IEC 61508 (SIL3) certified.
- One connection using Safety over EtherCAT (FSoE) * protocol enables flexible configuration by mixing the Safety Units with standard NX I/O.
- Now supports stand-alone operation with EtherNet/IP monitoring up to 256 I/O.
- Hardware and safety circuits can be configured using the Sysmac Studio software (Ver. 1.07)
  - Full License Sysmac Studio - supports EtherCAT integration and EtherNet/IP Stand-alone configurations
  - Safety License Version - supports only EtherNet/IP Stand-alone configurations

* Safety over EtherCAT (FSoE): The open protocol Safety over EtherCAT (abbreviated with FSoE "FailSafe over EtherCAT") defines a safety related communication layer for EtherCAT. Safety over EtherCAT meets the requirements of IEC 61508 SIL 3 and enables the transfer of safe and standard information on the same communication system without limitations with regard to transfer speed and cycle time.



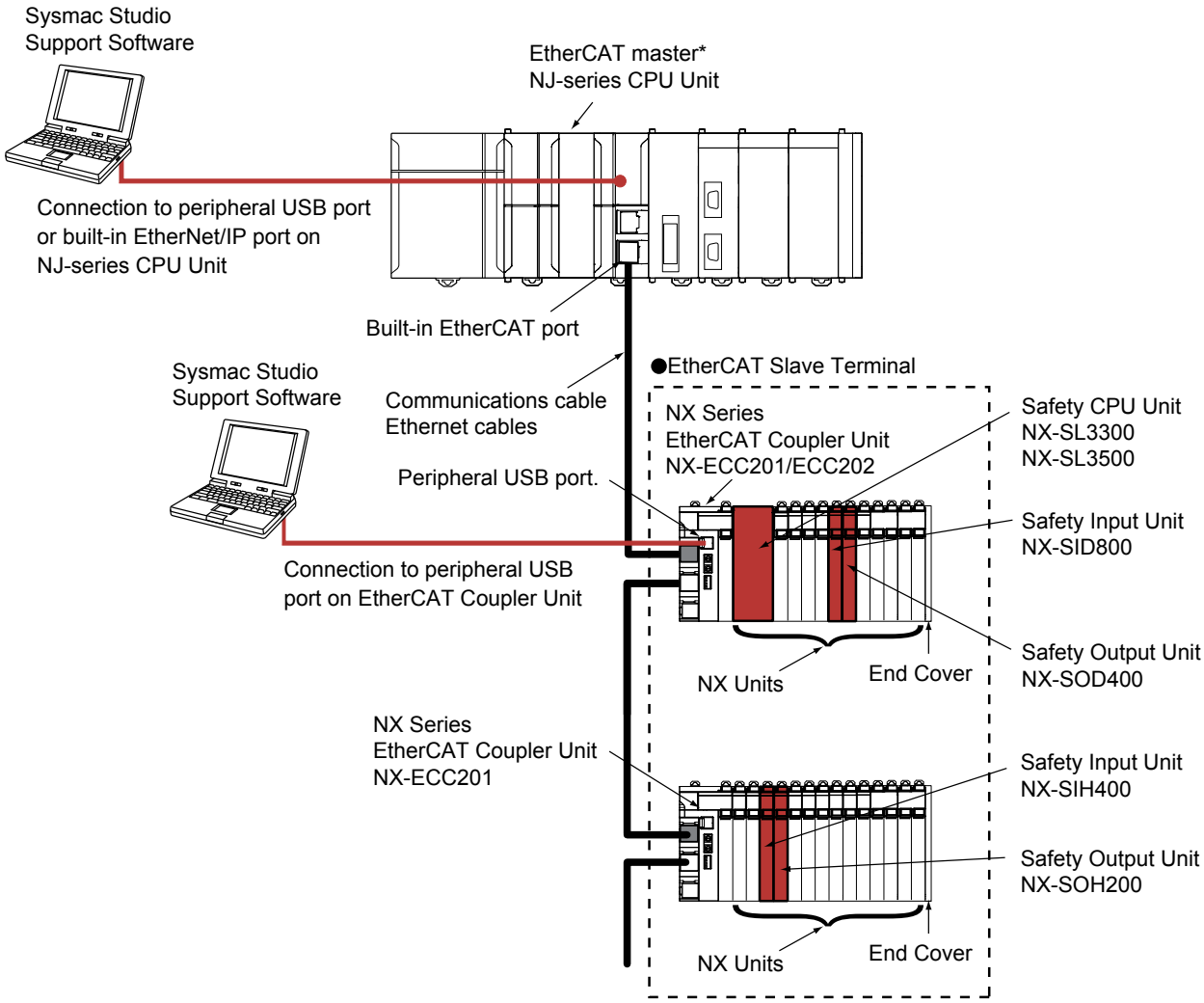
Features

- Integrated safety into machine automation possible by connecting with the NX-series EtherCAT Coupler.
- The Safety CPU Unit controls up to 128 Safety I/O Units.
- 4 or 8 points per Safety Input Unit. The 4-point Safety Input Unit can be directly connected with Omron Non-contact Switches and Singlebeam Sensors.
- 2 or 4 points per Safety Output Unit. The 2-point Safety Output Unit is characterized by large output breaking current of 2.0 A.
- The Safety Units can be freely allocated in any combination with standard NX I/O.
- Compliant with IEC61131-3
- Safety programs can be standardized and reused efficiently by using POUs for design and operation.

Sysmac is a trademark or registered trademark of OMRON Corporation in Japan and other countries for OMRON factory automation products.
EtherCAT is registered trademark and patented technology, licensed by Beckhoff Automation Gmbh, Germany.
Safety over EtherCAT is registered trademark and patented technology, licensed by Beckhoff Automation Gmbh, Germany.
Other company names and product names in this document are the trademarks or registered trademarks of their respective companies.

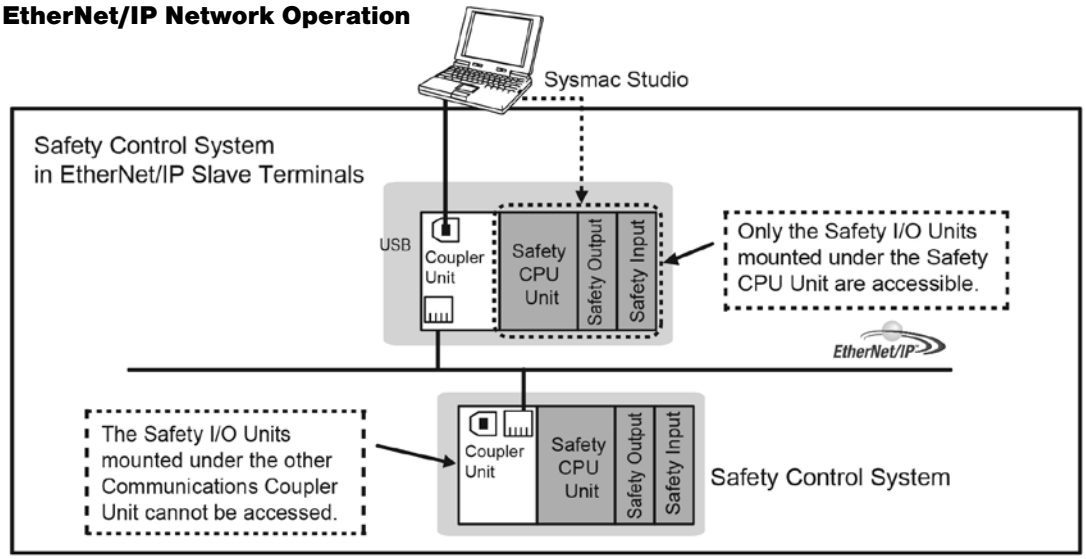
System Configuration

EtherCAT Network Operation



*OMRON CJ1W-NC□81/□82 Position Control Units cannot be connected to the EtherCAT Slave Terminal even though they support EtherCAT.

Stand-alone EtherNet/IP Network Operation



D

Specifications

Regulations and Standards

Certification body	Standard	
TÜV Rheinland*	· EN ISO 13849-1: 2008 + AC: 2009 · EN ISO 13849-2: 2012 · IEC 61508 parts 1-7: 2010 · EN 62061: 2005 · EN 61131-2: 2007 · EN ISO 13850: 2008 · EN 60204-1: 2006 + A1: 2009 + AC: 2010	· EN 61000-6-2: 2005 · EN 61000-6-4: 2007 · NFPA 79: 2012 · ANSI RIA 15.06-1999 · ANSI B11.19-2010 · UL1998 · IEC 61326-3-1: 2008
UL	cULus: Listed (UL508) and ANSI/ISA 12.12.01	

*Certification was received for applications in which OMRON FSoE devices are connected to each other.

The NX-series Safety Control Units allow you to build a safety control system that meets the following standards.

- Requirements for SIL 3 (Safety Integrity Level 3) in IEC 61508, EN 62061, Safety Standard for Safety Instrumented Systems (Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems)
- Requirements for PLe (Performance Level e) and for safety category 4 in EN ISO13849-1

The NX-series Safety Control Units are also registered for C-Tick and KC compliance.

General Specifications

Enclosure		Mounted in a panel (open)
Grounding method		Ground to 100 Ω or less.
Operating environment	Ambient operating temperature	0 to 55°C (The upper limit of the ambient operating temperature is restricted by the installation orientation.)
	Ambient operating humidity	10% to 95% (with no condensation or icing)
	Atmosphere	Must be free from corrosive gases.
	Ambient storage temperature	25 to 70°C (with no condensation or icing)
	Altitude	2,000 m max.
	Pollution degree	2 or less: Conforms to JIS B3502 and IEC 61131-2.
	Noise immunity	Conforms to IEC 61131-2.2 kV on power supply line (Conforms to IEC 61000-4-4.)
	Insulation class	Class III (SELV)
	Overvoltage category	Category II: Conforms to JIS B3502 and IEC 61131-2.
	EMC immunity level	Zone B
	Vibration resistance	Conforms to IEC 60068-2-6. 5 to 8.4 Hz with 3.5-mm amplitude, 8.4 to 150 Hz, acceleration of 9.8 m/s^2, 100 minutes each in X, Y, and Z directions (10 sweeps of 10 min each = 100 min total)
	Shock resistance	Conforms to IEC 60068-2-27.147 m/s^2, 3 times each in X, Y, and Z directions
	Insulation resistance	20 MΩ between isolated circuits (at 100 VDC)
	Dielectric strength	510 VAC for 1 min between isolated circuits, leakage current: 5 mA max.
Installation method		DIN Track (IEC 60715 TH35-7.5/TH35-15)
Applicable standards		IEC 61508: 2010 SIL 3, EN 62061: 2005 SIL CL3 EN ISO 13849-1, 13849-2: 2008 PL e/Safety Category 4 UL 1998c ULus: Listed UL508, ANSI/ISA 12.12.01 EN 61131-2, C-Tick, KC: KC Registration

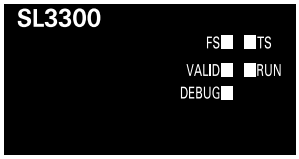
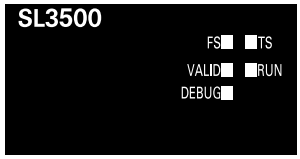
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Specifications of Individual Units

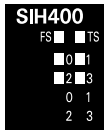
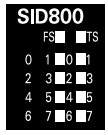
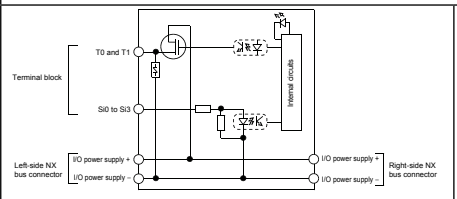
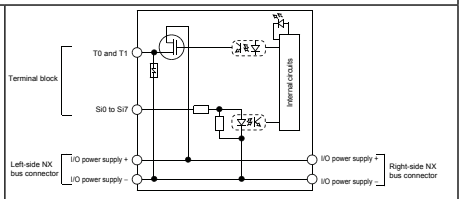
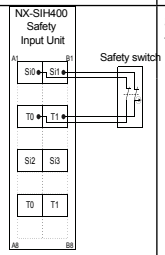
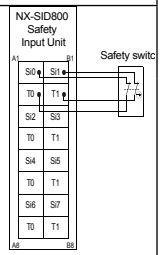
Safety CPU Unit NX-SL3300/SL3500

Unit name	Safety CPU Unit	
Model	NX-SL3300	NX-SL3500
Maximum number of safety I/O points	256 points	1024 points
Program capacity	512 KB	2048 KB
Number of safety master connections	32	128
I/O refreshing method	Free-Run refreshing	
External connection terminals	None	
Indicators	FS indicator, VALID indicator, DEBUG indicator, TS indicator, and RUN indicator 	FS indicator, VALID indicator, DEBUG indicator, TS indicator, and RUN indicator 
Dimensions	30 100 71 mm (W H D)	
I/O power supply method	Not supplied.	
Current capacity of I/O power supply terminals	No I/O power supply terminals	
NX Unit power consumption	0.90 W max.	
Current consumption from I/O power supply	No consumption	
Weight	75 g max.	
Installation orientation and restrictions	Installation orientation: 6 possible orientations Restrictions: None	

D

Specifications of Individual Units (continued)

Safety Input Units NX-SIH400/SID800

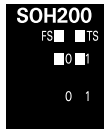
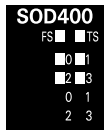
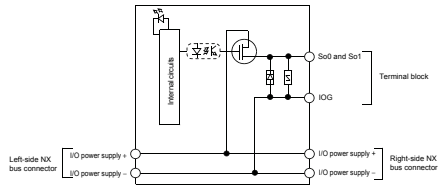
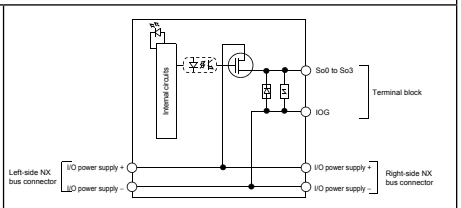
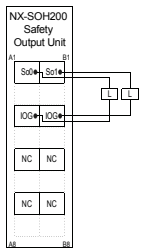
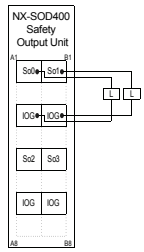
Unit name	Safety Input Unit	
Model	NNX-SIH400	NX-SIH800
Number of safety input points	4 points	8 points
Number of test output points	2 points	2 points
Internal I/O common	PNP (sinking inputs)	
Rated input voltage	24 VDC (20.4 to 28.8 VDC)	
I/O refreshing method	Free-Run refreshing	
OMRON special safety input devices	Can be connected.	Cannot be connected.
Number of safety slave connections	1	
I/O refreshing method	Free-Run refreshing	
External connection terminals	Screwless clamping terminal block (8 terminals)	Screwless clamping terminal block (16 terminals)
Indicators	TS indicator, FS indicator, input indicators (yellow), and input error indicators (red) 	TS indicator, FS indicator, input indicators (yellow), and input error indicators (red) 
Safety input current	4.5 mA typical	3.0 mA typical
Safety input ON voltage	11 VDC min.	15 VDC min.
Safety input OFF voltage/OFF current	5 VDC max., 1 mA max.	
Test output type	Sourcing outputs (PNP).	
Test output load current	25 mA max.	50 mA max.
Test output residual voltage	1.2 V max. (Between IOV and all output terminals.)	
Test output leakage current	0.1 mA max.	
Dimensions	12 100 71 mm (W H D)	
Isolation method	Photocoupler isolation	
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	
Dielectric strength	510 VAC for 1 min between isolated circuits, leakage current: 5 mA max.	
I/O power supply method	Power supplied from the NX bus	
Current capacity of I/O power supply terminals	No applicable terminals	
NX Unit power consumption	0.70 W max.	0.75 W max
Current consumption from I/O power supply	20 mA max.	
Weight	70 g max.	
Circuit layout		
Terminal connection diagram	Si0 to Si3: Safety input terminals T0 and T1: Test output terminals  Refer to User's manual (Z930-E1) for details.	Si0 to Si7: Safety input terminals T0 and T1: Test output terminals  Refer to User's manual (Z930-E1) for details.
Installation orientation and restrictions	Installation orientation: 6 possible orientations. Restrictions: Maximum ambient temperature is 50°C for any orientation other than upright installation.	
Protective functions	Overvoltage protection circuit and short detection (test outputs)	

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Specifications of Individual Units (continued)

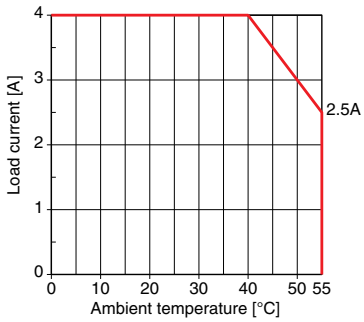
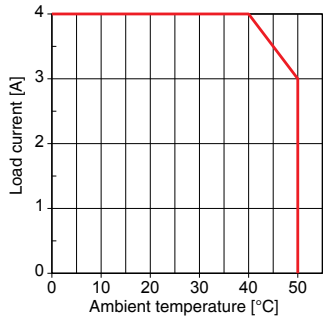
Safety Output Units NX-SOH200/SOD400

Unit name	**Safety Input Unit**	
Model	NNX-SOH200	NX-SOD400
Number of safety output points	2 points	4 points
Internal I/O common	PNP (sourcing outputs)	
Maximum load current	2.0 A/point 4.0 A/Unit at 40°C 2.5 A/Unit at 55°C The maximum load current depends on the installation orientation and ambient temperature	0.5 A/point and 2.0 A/Unit
Rated voltage	24 VDC (20.4 to 28.8 VDC)	
Rated number of safety slave connections	1	
I/O refreshing method	Free-Run refreshing	
External connection terminals	Screwless clamping terminal block (8 terminals)	
Indicators	TS indicator, FS indicator, output indicators (yellow), and output error indicators (red) 	TS indicator, FS indicator, output indicators (yellow), and output error indicators (red) 
Safety output ON residual voltage	1.2 V max. (Between IOV and all output terminals)	
Safety output OFF residual voltage	2 V max. (Between IOG and all output terminals)	
Safety output leakage current	0.1 mA max.	
Dimensions	12 100 71 mm (W H D)	
Isolation method	Photocoupler isolation	
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	
Dielectric strength	510 VAC for 1 min between isolated circuits, leakage current: 5 mA max.	
I/O power supply method	Power supplied from the NX bus	
Current capacity of I/O power supply terminals.	IOG: 2 A max./terminal	IOG (A3 and B3): 2 A max./terminal IOG (A7 and B7): 0.5 A max./terminal
NX Unit power consumption.	0.70 W max.	0.75 W max
Current consumption from I/O power supply	40 mA max.	60 mA max.
Weight	65 g max.	
Circuit layout		
Terminal connection diagram	So0 and So1: Safety output terminals IOG: I/O power supply 0 V  Refer to User's manual (Z930-E1) for details.	So0 to So3: Safety output terminals IOG: I/O power supply 0 V  Refer to User's manual (Z930-E1) for details.

D

Specifications of Individual Units (continued)

Safety Input Units NX-SOH200/SOD400 (continued)

Unit name	Safety Input Unit	
Model	NNX-SOH200	NX-SOD400
Installation orientation and restrictions	Installation orientation: 6 possible orientations Restrictions: For upright installation, the ambient temperature is restricted as shown below depending on the total Unit load current.  For all installation orientations other than upright installation, the ambient temperature is restricted as shown below according to the total Unit load current.  	Installation orientation: 6 possible orientations Restrictions: None
Protective functions	Overvoltage protection circuit and short detection	

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Version Information

The combinations that can be used of the unit versions of the Safety Control Units, NJ-series CPU Units, and NX-series EtherCAT Coupler Unit, and the version of the Sysmac Studio

NX Unit		Corresponding unit versions/version		
Model number	Unit version	EtherCAT Coupler Unit NX-ECC201/ECC202 *	NJ-series CPU Units (NJ501-□□□□) (NJ301-□□□□)	Sysmac Studio
NX-SL3300	1.0	1.1 or later*	1.06 or later	1.07 or later
	1.1			1.10 or later
NX-SL3500	1.0	1.2 or later*	1.07 or later	1.08 or later
	1.0			1.10 or later
NX-SIH400	1.0	1.1 or later	1.06 or later	1.07 or later
	1.1			1.10 or later
NX-SID800	1.0			1.07 or later
NX-SOH200				
NX-SOD400				

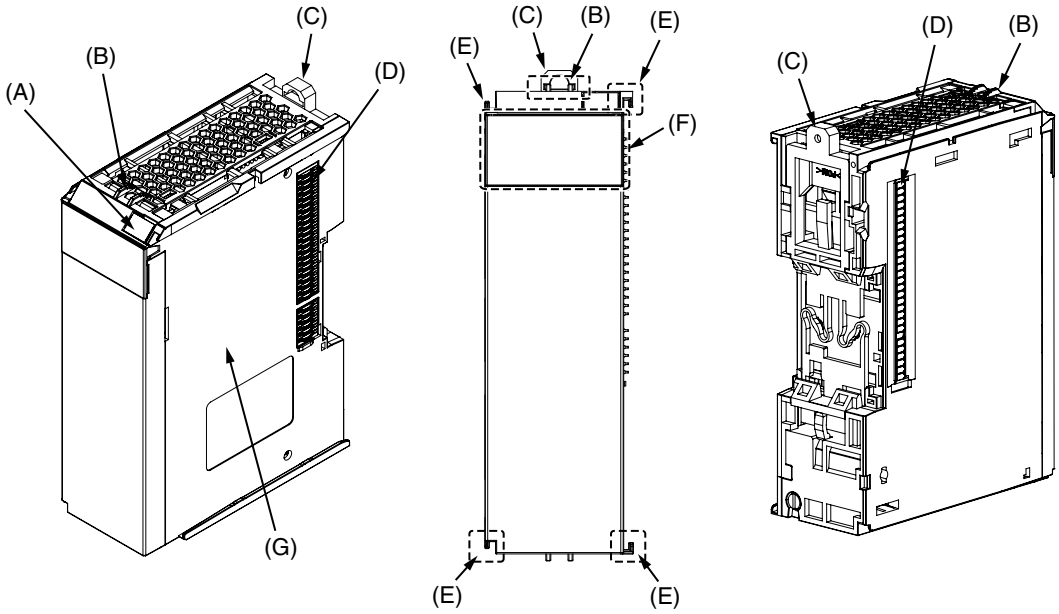
*Some models do not have all of the versions given in the above table.
For those models, the oldest version applies. Refer to the user's manuals for the specific Units for the relation between models and versions.

D

External Interface

Safety CPU Unit

NX-SL3300/SL3500



Letter	Item	Specification
(A)	Marker attachment locations	The locations where markers are attached. The markers made by OMRON are installed for the factory setting. Commercially available markers can also be installed. For details, refer to User's Manual (Z930-E1).
(B)	Protrusions for removing the Unit	The protrusions to hold when removing the Unit.
(C)	DIN Track mounting hooks	These hooks are used to mount the NX Unit to a DIN Track.
(D)	NX bus connector	This is the NX-series bus connector. It is used to connect an NX-series Safety I/O Unit or other NX Unit.
(E)	Unit hookup guides	These guides are used to connect two Units.
(F)	Indicators	The indicators show the current operating status of the NX Unit or signal I/O status. Refer to User's Manual (Z930-E1).
(G)	Unit specifications	The specifications of the NX Unit are given here.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

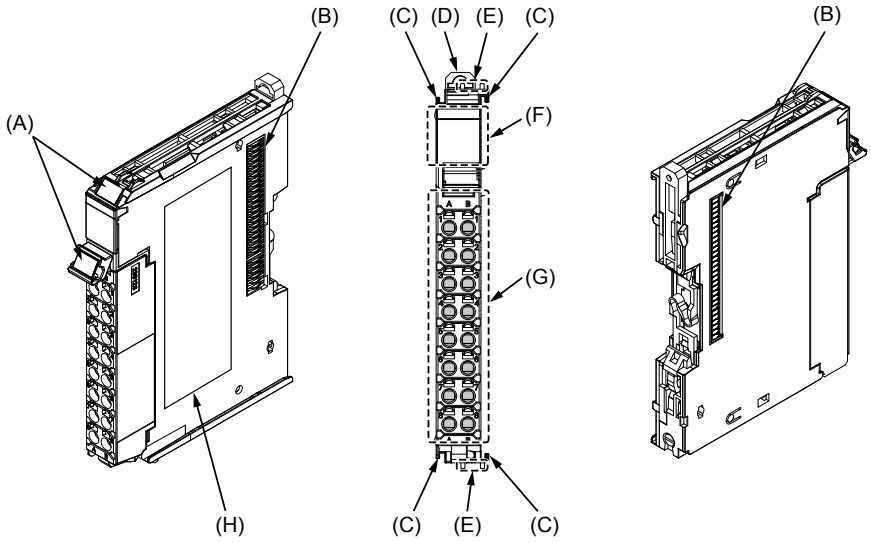
For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

External Interface (continued)

Safety Input Unit
NX-SIH400/SID800

Safety Output Unit
NX-SOH200/SOD400

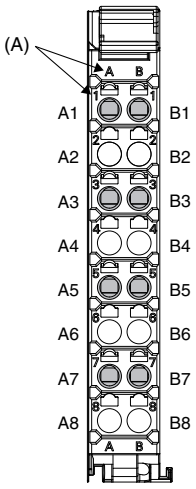


Letter	Item	Specification
(A)	Marker attachment locations	The locations where markers are attached. The markers made by OMRON are installed for the factory setting. Commercially available markers can also be installed. For details, refer to User's Manual (Z930-E1).
(B)	NX bus connector	This is the NX-series bus connector. Connect this connector to another Unit, such as the NX-series Safety CPU Unit or a Safety I/O Unit.
(C)	Unit hookup guides	These guides are used to connect two Units.
(D)	DIN Track mounting hooks	These hooks are used to mount the NX Unit to a DIN Track.
(E)	Protrusions for removing the Unit	The protrusions to hold when removing the Unit.
(F)	Indicators	The indicators show the current operating status of the NX Unit or signal I/O status. Refer to User's Manual (Z930-E1).
(G)	Terminal block	The terminal block is used to connect to external devices. It connects the safety outputs. The number of terminals depends on the NX Unit.
(H)	Unit specifications	The specifications of the NX Unit are given here.

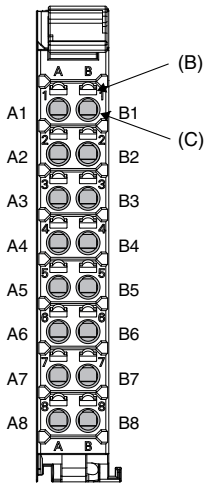
D

Terminal Blocks

Letter	Item	Specification
(A)	Terminal number indications	The terminal numbers are given by column letters A and B, and row numbers 1 to 8. The combination of the column and row gives the terminal numbers from A1 to A8 and B1 to B8. The terminal number indicators are the same regardless of the number of terminals on the terminal block, as shown above.
(B)	Release holes	Insert a flat-blade screwdriver into these holes to connect and remove the wires.
(C)	Terminal holes	The wires are inserted into these holes.



8-terminal type



16-terminal type

External Interface (continued)

Applicable Terminal Blocks for Each Unit Model

Unit model number	Terminal Blocks				
	Model	No. of terminals	Terminal number indications	Ground terminal mark	Terminal current capacity
NX-SIH400	NX-TBA082	8	A/B	None	10 A
NX-SID800	NX-TBA162	16	A/B	None	10 A
NX-SOH200	NX-TBA082s	8	A/B	None	10 A
NX-SOD400	NX-TBA082	8	A/B	None	10 A

Applicable Wires

Using Ferrules

If you use ferrules, attach the twisted wires to them.
Observe the application instructions for your ferrules for the wire stripping length when attaching ferrules.
Always use one-pin ferrules. Do not use two-pin ferrules.

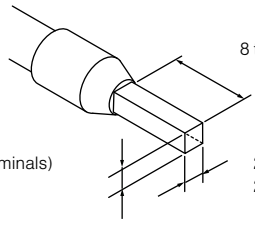
The applicable ferrules, wires, and crimping tool are given in the following table.

Terminal types	Manufacturer	Ferrule model number	Applicable wire (mm^2 (AWG))	Crimping tool
Terminals other than ground terminals	Phoenix Contact	AI0,34-8	0.34 (#22)	Phoenix Contact (The figure in parentheses is the applicable wire size.) CRIMPFOX 6 (0.25 to 6 mm^2, AWG24 to 10)
		AI0,5-8	0.5 (#20)	
		AI0,5-10		
		AI0,75-8	0.75 (#18)	
		AI0,75-10		
		AI1,0-8	1.0 (#18)	
		AI1,0-10		
		AI1,5-8	1.5 (#16)	
		AI1,5-10		
Ground terminals		AI2,5-10	2.0*	
Terminals other than ground terminals	Weidmuller	H0.14/12	0.14 (#26)	Weidmuller (The figure in parentheses is the applicable wire size.) PZ6 Roto (0.14 to 6 mm^2, AWG 26 to 10)
		H0.25/12	0.25 (#24)	
		H0.34/12	0.34 (#22)	
		H0.5/14	0.5 (#20)	
		H0.5/16		
		H0.75/14	0.75 (#18)	
		H0.75/16		
		H1.0/14	1.0 (#18)	
		H1.0/16		
		H1.5/14	1.5 (#16)	
		H1.5/16		

* Some AWG 14 wires exceed 2.0 mm^2 and cannot be used in the screwless clamping terminal block.

When you use any ferrules other than those in the above table, crimp them to the twisted wires so that the following processed dimensions are achieved.

Finished Dimensions of Ferrules



1.6 mm max. (except ground terminals)
2.0 mm max. (ground terminals)

2.4 mm max. (except ground terminals)
2.7 mm max. (ground terminals)

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

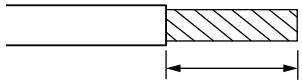
External Interface (continued)

Applicable Wires (continued)

Using Twisted Wires/Solid Wires

If you use the twisted wires or the solid wires, the applicable wire range and conductor length (stripping length) are as follows.
Use the twisted wires to connect the ground wire to a ground of 100 Ω or less. Do not use the solid wires.

Terminal types	Applicable wires	Conductor length (stripping length)
Ground terminals	2.0 mm^2	9 to 10 mm
Terminals other than ground terminals	0.08 to 1.5 mm^2 AWG28 to 16	8 to 10 mm

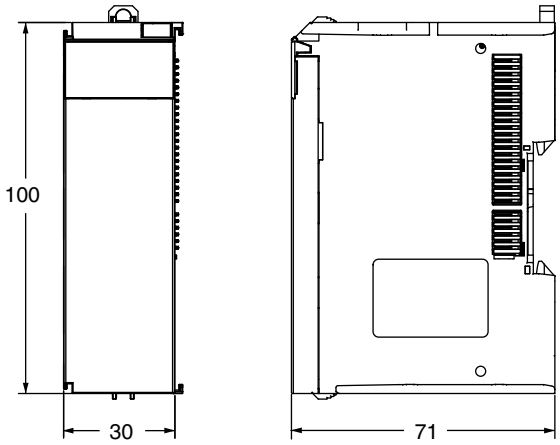


Conductor length (stripping length)

Dimensions

Safety CPU Unit

NX-SL3300/SL3500

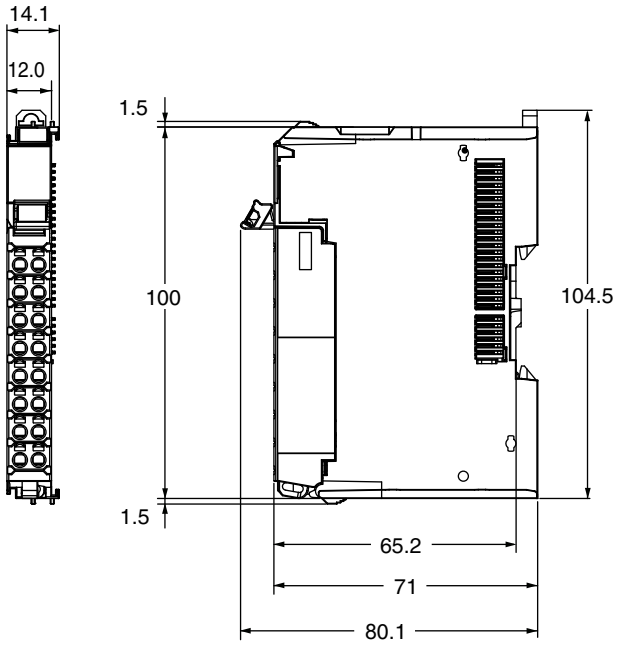


Safety Input Unit

NX-SIH400/SID800

Safety Output Unit

NX-SOH200/SOD400



Related Manuals

Cat. No.	Model number	Manual name	Application	Description
Z930	NX-SL□□□□ NX-SI □□□□ NX-SO □□□□	NX-series Safety Control Unit User's Manual	Learning how to use NX-series Safety Control Units	Describes the hardware, setup methods, and functions of the NX-series Safety Control Units.
Z931	NX-SL □□□□	NX-series Safety Control Unit Instructions Reference Manual	Learning about the specifications of instructions for the Safety CPU Unit.	Describes the instructions for the Safety CPU Unit. When programming, use this manual together with the NX-series Safety Control Units User's Manual (Cat. No. Z930).

Ordering

Safety CPU Units

Unit type	Appearance	Specifications				Unit Version	Model
		Maximum number of safety I/O points	Program capacity	Number of safety master connections	I/O refreshing method		
Safety CPU Units		256 points	512 KB	32	Free-Run refreshing	Ver. 1.1	NX-SL3300
		1024 points	2048 KB	128	Free-Run refreshing	Ver. 1.1	NX-SL3500

Safety Input Units

Unit type	Appearance	Specifications							Unit Version	Model
		Maximum number of safety input points	Number of test output points	Internal I/O common	Rated input voltage	OMRON special safety input devices	Number of safety slave connections	I/O refreshing method		
Safety Input Units		4 points	2 points	Sinking inputs (PNP)	24 VDC	Can be connected*	1	Free-Run refreshing	Ver. 1.1	NX-SIH400
		8 points	2 points	Sinking inputs (PNP)	24 VDC	Can be connected*	1	Free-Run refreshing	Ver. 1.0	NX-SID800

*The following OMRON special safety input devices can be connected directly without a special controller.
For detail of connectable OMRON special safety input devices,refer to NX-series Safety Control Units User's Manual(No.Z930-E1).

Type	Model and corresponding PL and safety category
OMRON Single-beam Safety Sensors	E3ZS and E3FS
OMRON Non-contact Door Switches	D40Z and D40A
OMRON Safety Mats	UM
OMRON Safety Edges	SGE (4-wire connection)

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering (continued)

Safety Output Units

Unit type	Appearance	Specifications						Unit Version	Model
		Maximum number of safety output points	Internal I/O common	Maximum load current	Rated voltage	Number of safety slave connections	I/O refreshing method		
Safety Output Units		2 points	Sourcing outputs (PNP)	2.0 A/point, 4.0 A/Unit at 40°C, and 2.5 A/Unit at 55°C The maximum load current depends on the installation orientation and ambient temperature.	24 VDC	1	Free-Run refreshing	Ver. 1.0	NX-SOH200
		4 points	Sourcing outputs (PNP)	0.5 A/point and 2.0 A/Unit	24 VDC	1	Free-Run refreshing	Ver. 1.0	NX-SOD400

Options

Product Name	Specifications	Model
Unit/Terminal Block Coding Pins	For 10 Units (Terminal Block: 30 pins, Unit: 30 pins)	NX-AUX02

Product Name	Specifications				Model
	Number of terminals	Terminal number indications	Ground terminal mark	Terminal current capacity	
Terminal Block	8	A/B	None	10 A	NX-TBA082
	16	A/B	None	10 A	NX-TBA162

Accessories

Not included.

G9SP

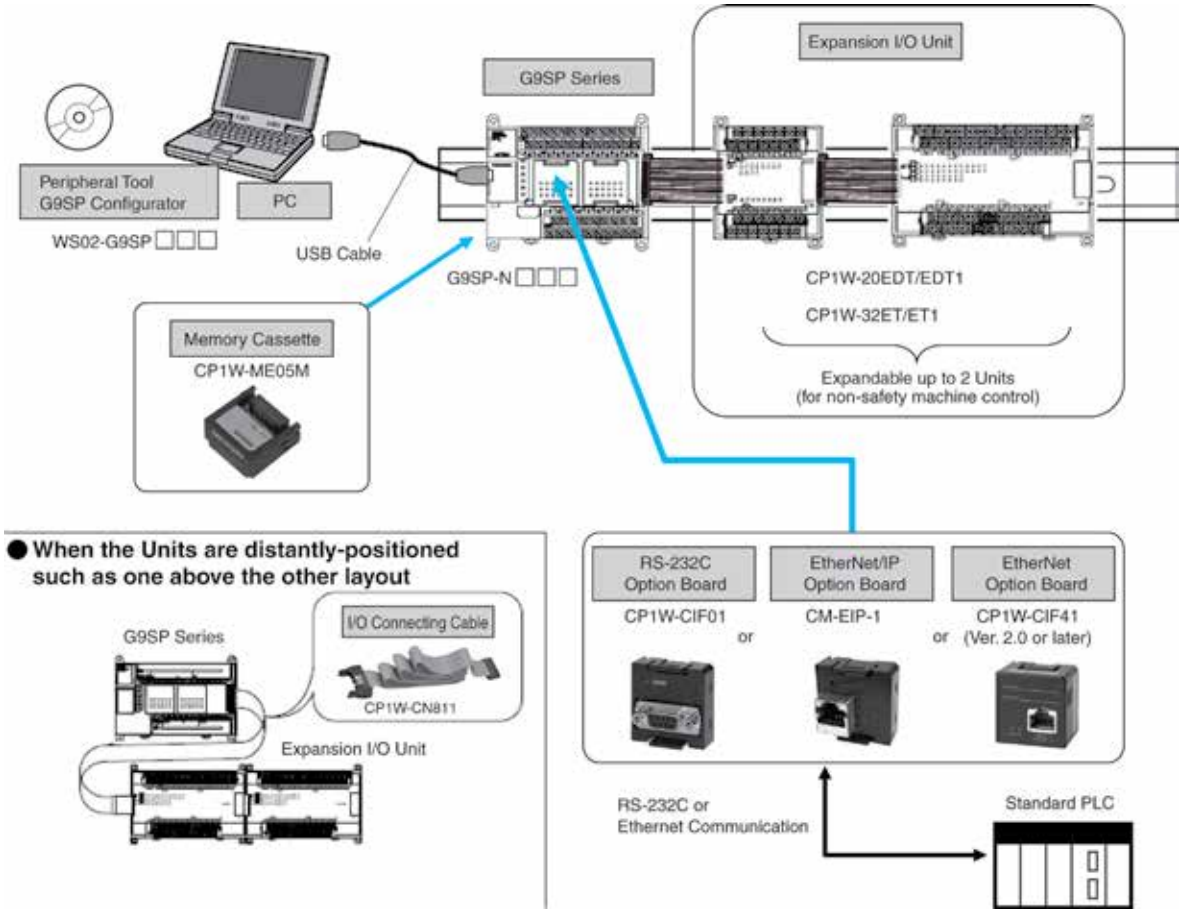
Quick Link
S356
omron247.com

Compact Stand-Alone Programmable Safety Controllers

- Stand-alone safety controller for small and mid-sized machinery
- Easy programming for complex safety control
- Three types of CPU with different I/O size to suit the application
- Four types of Expansion I/O Units for hard-wired diagnosis or standard non-safety signals
- Clear diagnosis and monitoring via Ethernet (Omron FINS protocol), Ethernet/IP, or serial (RS-232) connection
- Supports direct connection with non-contact switches and safety mats
- Easy design, verification, standardization and reusage of safety control by unique programming software
- ISO 13849-1(PLe), IEC61508(SIL3) certified



Example of System Configuration



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Specifications

G9SP Series

General Specifications

Power supply voltage	24 VDC (20.4 to 26.4 VDC -15% +10%)
Current consumption*	G9SP-N10S: 400 mA (V1: 300 mA, V2: 100 mA) G9SP-N10D: 500 mA (V1: 300 mA, V2: 200 mA) G9SP-N20S: 500 mA (V1: 400 mA, V2: 100 mA)
Isolation class	Class III (SELV)
Overvoltage category	II
Noise immunity	Conforms to IEC61131-2
Vibration resistance	5 to 8.4 Hz: 3.5 mm, 8.4 to 150 Hz: 9.8 m/s^2
Shock resistance	147 m/s^2: 11 ms
Mounting	DIN track mounting (IEC60715 TH35-7.5/TH35-15) or M4 screws
Ambient operating temperature	0 to +55°C
Ambient operating humidity	10% to 90% (with no condensation)
Ambient storage temperature	-20°C to +75°C
Atmosphere	No corrosive gas
Degree of protection	IP20 except terminal blocks
Terminal screws	M3 self-rising screws

*Not including the current consumption of external devices.

	G9SP-N10S	G9SP-N10D	G9SP-N20S
Safety inputs	10	10	20
Safety outputs	4	16	8
Test outputs	4	6	6
Standard outputs	4	–	–
Weight	290 g max.	440 g max.	430 g max.

Safety Input Specifications

Input type	Sinking inputs (PNP)
Input current	6 mA
ON voltage	11 VDC min. (between each input terminal and G1)
OFF voltage	5 VDC max. (between each input terminal and G1)
OFF current	1 mA max.

Test Output Specifications

Output type	Sourcing outputs (PNP)	
Rated Output Current	G9SP-N10S	
	T0, T1	: 60 mA max.
	T2	: 30 mA max. *1
	T3	: 300 mA max. *2
	T0-2 total	: 60 mA max.
	G9SP-N10D	
	T0, T1, T2	: 60 mA max.
	T3	: 300 mA max. *2
	T4, T5	: 30 mA max. *1
	Total of T0-2 and T4-5	: 60 mA max.
	G9SP-N20S	
	T0, T1, T2	: 100 mA max.
	T3	: 300 mA max. *2
	T4, T5	: 30 mA max. *1
	Total of T0-2 and T4-5	: 120 mA max.

Safety Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.8 A max./output 1.6 A max./4 outputs (G9SP-N10S/-N20) *1 1.2 A max./4 outputs (G9SP-N10D) *2
ON residual voltage	1.2 V max. (between each output terminal and V2)
OFF residual voltage	2 V max.
Leakage current	0.1 mA max.

*1. Total current for So0 to So3 and So4 to So7
*2. Total current for So0 to So3, So4 to So7, So8 to So11 and So12 to So15
Note: When a safety output is set as a pulse output, make sure that the connected devices do not malfunction due to the OFF pulse (pulse width: 640 μs).

Standard Output Specifications (G9SP-N10S)

Output type	Sourcing outputs (PNP)
ON residual voltage	1.5 V max. (between each output terminal and V2)
Rated output current	100 mA max.

*1 Connection to OMRON D40A Non-contact Door Switch is possible.
*2 With the Muting Lamp Output (open circuit detection)

D

Specifications (continued)

Configurator

General Specifications

Applicable PC	DOS/V PC (Refer to the attached file for the operating environment of G9SP tool.)	
CD-ROM or DVD-ROM drive	One or more	
Applicable OS	Windows 2000 (Service Pack 3 or later), Windows XP (Service Pack 2 or later)	Windows Vista (32-bit & 64-bit), Windows 7 (32-bit & 64-bit)
CPU processing speed	Pentium II 333 MHz or faster (Pentium III 1GHz or faster is recommended.)	Pentium III 1GHz or faster is recommended.
Memory (RAM)	256 MB min. (512 MB or more is recommended.)	512 MB min. (1 Gbyte or more is recommended.)
Hard disk	200 MB or more	
Monitor	High-intensity display of SVGA (800 x 600) or more Required min. 256 colors display	
Communication port to connect with G9SP Series	USB 1.1	

Certified Standards

Certification body	Standard
TÜV Rheinland	EN ISO 13849-1: 2008 EN ISO 13849-2: 2008 IEC 61508 parts 1-7: 2010 IEC/EN 62061: 2005 IEC 61131-2: 2007 EN ISO 13850: 2008 (EN418: 1992) EN 60204-1: 2006 EN 61000-6-2: 2005 EN 61000-6-4: 2007 NFPA 79-2007 ANSI RIA 15.06-1999 (R2009) ANSI B11.19-2010 UL1998
UL	UL508 CSA22.2 No.142

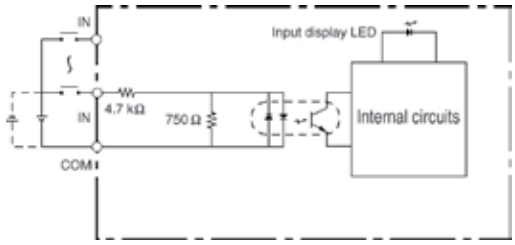
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Specifications (continued)

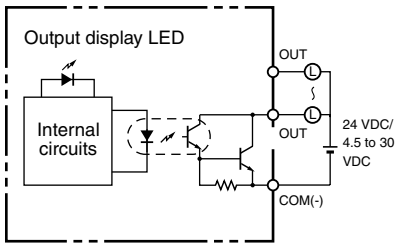
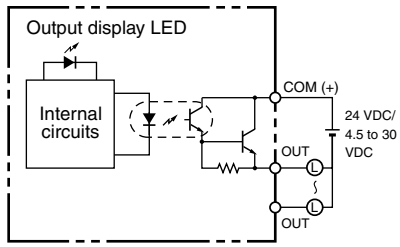
Expansion I/O Unit

Input Specifications (CP1W-20EDT/20EDT1)

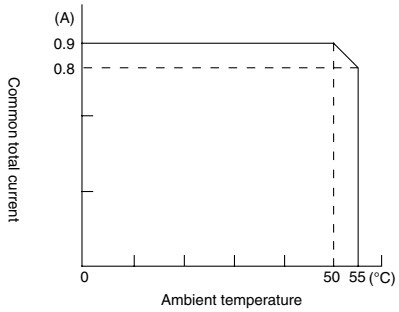
Input voltage	24 VDC, -15% +10%
Input impedance	4.7 kΩ
Input current	5 mA TYP
ON voltage	14.4 VDC min.
OFF voltage	5.0 VDC max.
ON delay	1 ms max. *
OFF delay	1 ms max. *
Circuit configuration	

*ON/OFF delay represents the hardware delay time.

Output Specifications (Transistor outputs: sinking/sourcing type))

	CP1W-20EDT/EDT1	CP1W-32ET/32ET1
Maximum switching capacity *1	24 VDC -5% +10% 0.3 A/output	4.5 to 30 VDC 0.3 A/output
	0.9 A/common 1.8 A/unit	0.9 A/common 7.2 A/unit
Leakage current	0.1 mA max.	0.1 mA max.
Residual voltage	1.5 V max.	1.5 V max.
ON delay	0.1 ms max.	0.1 ms max.
OFF delay	1 ms max. 24 VDC, -5% +10%, when 5 to 300 mA	1 ms max. 24 VDC, -5% +10%, when 5 to 300 mA
Maximum number of outputs for simultaneous ON	8 outputs (100% load)	24 outputs (75% load)
Fuse *2	1/common	1/common
Circuit configuration	Sinking type (CP1W-20EDT, CP1W-32ET) 	Sourcing type (CP1W-20EDT1, CP1W-32ET1) 

*1. A maximum of 0.9 A per common can be switched at an ambient temperature of 50°C.



*2. User cannot replace fuses. Replace the unit if a fuse blows due to short circuit, etc.

Specifications (continued)

Option Unit
RS-232C Option Board (CP1W-CIF01)

Communication Specifications

Connection method	D-SUB 9P (female)
Maximum transmission distance	15 m
Communication protocol	Non-procedural
Maximum data length	Refer to the Users Manual for details.

Ethernet Option Board (CP1W-CIF41 unit ver. 2.0 or later)

Ethernet Communication Specifications

Name		CP Series Ethernet Option Board	
Model		CP1W-CIF41	
Type		100 BASE-TX (applicable as a 10 BASE-T)	
Transmission specifications	Media access method	CSMA/CD	
	Modulation method	Baseband	
	Transmission path type	Star form	
	Baud rate	100 Mbps (100 BASE-TX)	10 Mbps (10 BASE-T)
		Internal transmission speed between G9SP and Ethernet Option Board is of 115.2 kbps.	
	Transmission media	Unshielded twisted-pair (UDP) cable Categories: 5, 5e Shielded twisted-pair (STP) cable Categories: 100 Ω at 5, 5e	Unshielded twisted-pair (UDP) cable Categories: 3, 4, 5, 5e Shielded twisted-pair (STP) cable Categories: 100 Ω at 3, 4, 5, 5e
	Transmission distance	100 m (distance between hub and node)	
	Number of cascade-connectable units	No limit when a switching hub is used.	
Weight		23 g max.	
Dimensions		36.4 (W) x 36.4 (H) x 28.2 (D) mm	

Ethernet/IP Option Board (CM-EIP-1)

Communication Specifications

Communications protocol		Ethernet/IP
Type		100 BASE-TX (See note)
Transmission specifications	Media access method	CSMA/CD
	Modulation method	Baseband
	Transmission path type	Star form
	Baud rate	100 Mbps (100 BASE-TX)
	Transmission media	Shielded twisted-pair (STP) cable Categories: 100 Ω at 5, 5e or higher
	Transmission distance	100 m (distance between hub and node)
	Number of cascade-connectable units	No limit when a switching hub is used.

Note: If tag data links are being used, use 100 BASE-TX.

*Please note when communicating with the H-T40M-P Status Display Touchscreen, network communication over Ethernet is not possible.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Functions

Function Blocks

Logic Functions

Function Block Name	Notation on Function List	Icon	Details
NOT	NOT		Outputs the logical complement of the input condition.
AND	AND		Outputs the logical AND of the input conditions.
OR	OR		Outputs the logical OR of the input conditions.
NAND	NAND		Outputs the logical NAND of the input conditions.
NOR	NOR		Outputs the logical NOR of the input conditions.
Exclusive OR	EXOR		Outputs the exclusive OR of the input conditions.
Exclusive NOR	EXNOR		Outputs the exclusive NOR of the input conditions.
RS-FF (Reset Set Flip-Flop)	RS-FF		When the input signal turns ON, RS-FF holds the ON status in the function block and continuously connects to the output.
Comparator	Comparator		Compares the input signals to the set value and turns ON the output if they match.
Comparator 2	Comparator2		Compares the input signals to the set value and outputs the comparison result.

Timer/Counter Functions

Function Block Name	Notation on Function List	Icon	Details
Off-Delay Timer	Off-Delay Timer		Operates an OFF-delay timer.
On-Delay Timer	On-Delay Timer		Operates an ON-delay timer.
Pulse Generator	Pulse Generator		Cyclically outputs ON/OFF pulses on the Output Enable while the input signal is ON.
Counter	Counter		Counts the number of input signals and turns ON the output when the count reaches the specified number.
Up-Down Counter	Up-Down Counter		Increments the counter on the leading edge of an up count input and decrements the counter on the leading edge of a down count input.
Serial-Parallel Converter	Serial-Parallel Converter		Counts the number of input signals and outputs the count value.

D

Functions (continued)

Safety Device Function Blocks

Function Block Name	Notation on Function List	Icon	Details
External Device Monitoring	EDM		Evaluates the input signal and external device status and sends a safety output to the external device. This function block is used to detect fused contacts or external wiring problems (disconnected lines) for safety relays, contactors, and other safety devices.
Enable Switch Monitoring	Enable Switch		Monitors the status of an Enable Switch device.
Emergency Stop Switch Monitoring	E-Stop		Monitors the status of an Emergency Stop Switch.
Light Curtain Monitoring	Light Curtain Monitoring		Monitors the input signal from a Safety Light Curtain.
Muting	Muting		Temporarily disables the input signals for a Light Curtain when the muting signal is detected.
Safety Gate Monitoring	Safety Gate Monitoring		Monitors the status of a safety door (Safety-door Switch or Safety Limit Switch). This function block can be used to set function tests for Safety Category 2.
Two Hand Controller	Two Hand Controller		Monitors the status of a Two-hand Switch.
User Mode Switch Monitoring	User Mode Switch		Monitors the operating mode switch for a user system or device.
Redundant Input Monitoring	Redundant Input		Monitors for discrepancies in two input signals.
Single Beam Safety Sensor	Single Beam Safety Sensor		Monitors the input signal of an OMRON E3ZS/E3FS Single-beam Safety Sensor.
Non-Contact Door Switch Monitoring	Non-Contact Door Switch		Monitors a Omron D40A Non-contact Door Switch.
Safety Mat Monitoring	Safety Mat		Monitors a Omron UM Safety Mat.

Reset and Restart Function Blocks

Function Block Name	Notation on Function List	Icon	Details
Reset	Reset		Outputs ON if the reset signal is correctly input while the input condition is ON. This function block can be used to prevent equipment from starting automatically.
Restart	Restart		Performs the same operation as a Reset function block. The icon is different.

Connector Function Blocks

Function Block Name	Notation on Function List	Icon	Details
Multi Connector	Multi Connector		Outputs the status of the input signals.
Routing	Routing		Distributes an input signal to multiple signals.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Wiring

Terminal Arrangement

G9SP-N10S

Top (17 pin)	V1	G1	Si1	Si3	Si5	Si7	Si9	T1	T3
	NC	Si0	Si2	Si4	Si6	Si8	T0	T2	
Bottom (14 pin)	NC	So0	So2	O0	O2	NC	NC		
	V2	G2	So1	So3	O1	O3	NC		

G9SP-N10D

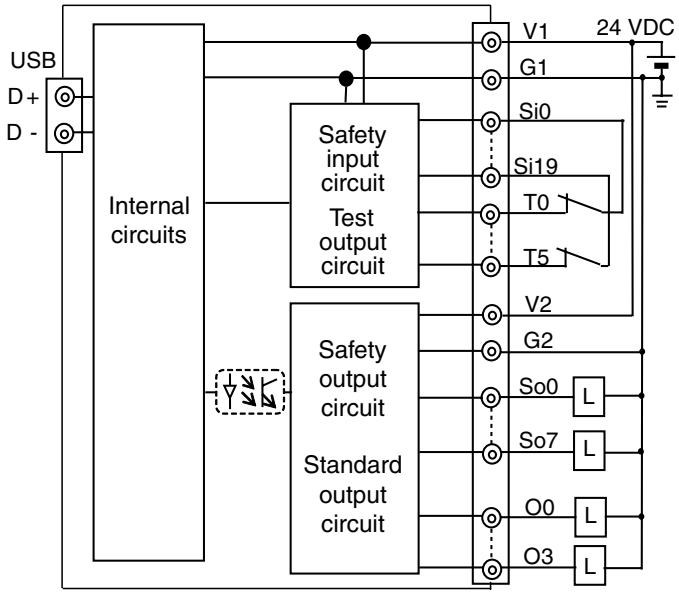
Top (24 pin)	V1	G1	Si1	Si3	Si5	Si7	Si9	NC	NC	T1	T3	T5
	NC	Si0	Si2	Si4	Si6	Si8	NC	NC	T0	T2	T4	NC
Bottom (19 pin)	NC	So0	So2	So4	So6	So8	So10	So12	So14			
	V2	G2	So1	So3	So5	So7	So9	So11	So13	So15		

G9SP-N20S

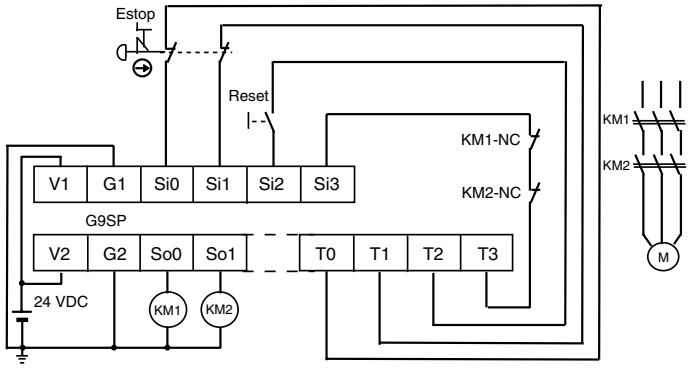
Top (24 pin)	V1	G1	Si1	Si3	Si5	Si7	Si9	Si11	Si13	Si15	Si17	Si19
	NC	Si0	Si2	Si4	Si6	Si8	Si10	Si12	Si14	Si16	Si18	NC
Bottom (19 pin)	NC	So0	So2	So4	So6	NC	T0	T2	T4			
	V2	G2	So1	So3	So5	So7	NC	T1	T3	T5		

Terminals	Function
V1/G1	Power supply terminals for Internal/Input circuits (24 VDC)
V2/G2	Power supply terminals for output circuits (24 VDC)
NC	Not used (Do not connect.)
Si0 - Si19	Safety input terminals
T0 - T5	Test output terminals
So0 - So15	Safety output terminals
O0 - O3	Standard output terminals

Internal Circuits and Wiring Example



I/O Wiring Example: Emergency Stop (Dual Channel) with Manual Reset



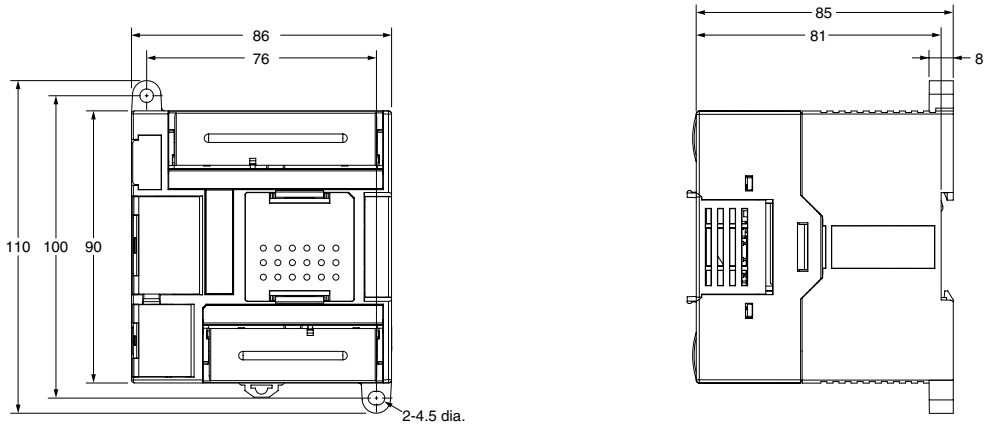
D

Dimensions

(mm)

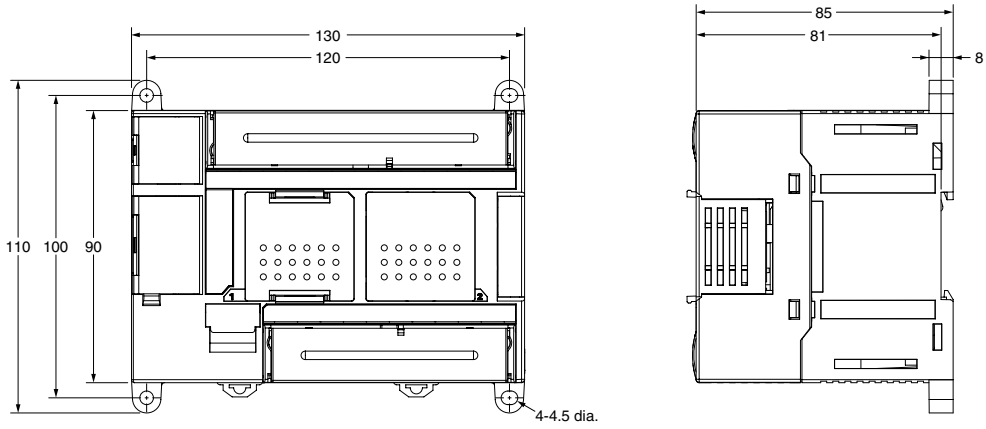
Safety Controller

G9SP-N10S



Safety Controller

G9SP-N10D
G9SP-N20S



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering

G9SP Series

Name	Number of I/O				Unit version	Model
	Safety inputs	Test outputs	Safety outputs	Standard outputs		
Safety Controller	10	4	Solid-state outputs: 4	4	Ver.1.0	G9SP-N10S
	10	6	Solid-state outputs: 16	—		G9SP-N10D
	20	6	Solid-state outputs: 8	—		G9SP-N20S
Safety Controller Kit with EIP Communication Module (includes controller and CM-EIP-1)	10	4	Solid-state outputs: 4	4	Ver.1.0	G9SP-N10S-EIP (KIT)
	10	6	Solid-state outputs: 16	—		G9SP-N10D-EIP (KIT)
	20	6	Solid-state outputs: 8	—		G9SP-N20S-EIP (KIT)
Safety Controller Kit with Status Display Touchscreen (includes controller, CP1W-CIF01, H-T40M-P, 2m/6 ft. RS232C cable)	10	4	Solid-state outputs: 4	4	Ver.1.0	G9SP-N10S-SDK (KIT)
	10	6	Solid-state outputs: 16	—		G9SP-N10D-SDK (KIT)
	20	6	Solid-state outputs: 8	—		G9SP-N20S-SDK (KIT)

Expansion I/O Unit (for standard non-safety machine control)

Name	Type	Number of I/O		Model
		Inputs	Outputs	
Expansion I/O Unit	Sinking type	12	Solid-state outputs: 8	CP1W-20EDT
	Sourcing type			CP1W-20EDT1
	Sinking type	—	Solid-state outputs: 32	CP1W-32ET
	Sourcing type			CP1W-32ET1

Note:CP1W-CN811 I/O Connecting Cable is available.
Refer to the Catalog of CP1H/CP1L Programmable Controller (Cat. No. P057-E1) for details.

I/O Connecting Cable

Name	Specifications	Model
I/O Connecting Cable	80 cm (for the distantly-positioned units connection)	CP1W-CN811

Note: An I/O Connecting Cable (approx. 6 cm) for alongside setting is included in the Expansion I/O Unit package.

Option Unit

Name	Model
RS-232C Option Board	CP1W-CIF01
Ethernet/IP (EIP) Option Board	CM-EIP-1
Ethernet Option Board (Unit Ver. 2.0 or later) (FINS protocol)	CP1W-CIF41
Memory Cassette	CP1W-ME05M
Status Display Touchscreen for G9SP	H-T40M-P

Note: Refer to the Catalog of CP1H/CP1L Programmable Controller (Cat. No. P057-E1) for details.

Configurator

Name	Media	Applicable OS	Model
G9SP Configurator	Setup Disk (CD-ROM: 1 license)	Windows 2000 (Service Pack 3 or advanced) Windows XP Windows Vista Windows 7	WS02-G9SP01-V1
	Setup Disk (CD-ROM: 10 licenses)		WS02-G9SP10-V1
	Setup Disk (CD-ROM: 50 licenses)		WS02-G9SP50-V1
	Setup Disk (CD-ROM: Site license)		WS02-G9SPXX-V1

D

NE1A

Quick Link
S322
omron247.com

Compact Safety Network Controllers

- NE1A Series helps to reduce wiring within a safety network and delivers a high degree of flexibility.
- NE1A-SCPU01-V1 provides 16 built-in safety inputs and 8 built-in safety outputs.
- NE1A-SCPU02 provides 40 built-in safety inputs and 8 built-in safety outputs.
- For lines with various levels of distributed safety devices up to 64 controllers can be connected to the network.
- Complicated safety systems are greatly simplified with 23 safety-certified function blocks and easy Drag and drop hardware configuration.
- Monitor the safety system from standard controllers across the network.
- EN 954-1/ISO13849-1 CAT4 and IEC 61508 SIL3 certification.



Specifications

Certified Standards

Certification body	Standard
TÜV Rheinland	NFPA 79-2002 ISO13849-1: 1999 IEC61508 part1-7/12.98-05.00 IEC61131-2: 2003 EN ISO13849-2: 2003 EN954-1: 1996 EN61000-6-4: 2007 EN61000-6-2: 2005 EN60204-1: 2006 EN418: 1992 ANSI RIA15.06-1999 (R2009) ANSI B11.19-2010
UL	UL508 UL1604 UL1998 NFPA79 IEC61508 CSA22.2 No.142 CSA22.2 No.213

Specifications

Item		NE1A-SCPU01-V1	NE1A-SCPU02
Communications power supply voltage		11 to 25 VDC supplied via communications connector	
Internal circuit power supply voltage (V0) *		20.4 to 26.4 VDC (24 VDC -15%/+10%)	
I/O power supply voltage (V1, V2) *			
Current consumption	Communications power supply	24 VDC, 15 mA	
	Internal circuit power supply	24 VDC, 230 mA	24 VDC, 280 mA
Overvoltage category		II	
Noise immunity		Conforms to IEC61131-2.	
Vibration resistance		10 to 57 Hz: 0.35 mm, 57 to 150 Hz: 50 m/s^2	
Shock resistance		150 m/s^2: 11 ms	
Mounting method		DIN Track (IEC 60715 TH35-7.5/TH35-15)	
Ambient operating temperature		-10 to 55°C	
Ambient operating humidity		10% to 95% (with no condensation)	
Ambient storage temperature		-40 to 70°C	
Degree of protection		IP20	
Serial interface		USB version 1.1	
Weight		460 g max.	690 g max.

* V0-G0: Internal control circuit
V1-G1 (G): For external input device, test output
V2-G2 (G): For external output device
The two ground terminals on the NE1A-SCPU02 are internally connected.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Specifications (continued)

Safety Input Specifications

Input type	Sinking inputs (PNP)
ON voltage	11 VDC min. between each terminal and ground
OFF voltage	5 VDC min. between each terminal and ground
OFF current	1 mA max.
Input current	4.5 mA

Safety Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.5 A max./output
ON residual voltage	1.2 V max. between each output terminal and V2
Leakage current	0.1 mA max.

Test Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.7 A max./output *
ON residual voltage	1.2 V max. between each output terminal and V1
Leakage current	0.1 mA max.

*The maximum current for simultaneously ON outputs is 1.4 A.
(T0 to T3: NE1A-SCPU01-V1, T0 to T7: NE1A-SCPU02)
A 15 to 400 mA, 24 VDC external indicator can be connected to T3 and T7.

Function Blocks

NE1A-SCPU-series Controller support the following logic functions and function blocks. Support depends on the unit version.

Logic Functions

Name	Function list entry	Supporting unit versions
NOT	NOT	All
AND	AND	
OR	OR	
Exclusive OR	EXOR	
Exclusive NOR	EXNOR	
RS Flip-flop	RS-FF	1.0 or later
Comparator	Comparator	

Function Blocks

Name	Function list entry	Supporting unit versions
Reset	Reset	All
Restart	Restart	
Emergency Stop Monitoring	E-STOP	
Light Curtain Monitoring	Light Curtain Monitoring	
Safety Gate Monitoring	Safety Gate Monitoring	
Two-hand Controller	Two Hand Controller	
Off-Delay Timer	Off-Delay Timer	
On-Delay Timer	On-Delay Timer	
User Mode Switch Monitoring	User Mode Switch	
External Device Monitoring	EDM	
Routing	Routing	
Muting	Muting	1.0 or later
Enable Switch Monitoring	Enable Switch	
Pulse Generator	Pulse Generator	
Counter	Counter	
Multi Connector	Multi Connector	

DeviceNet Communications Specifications

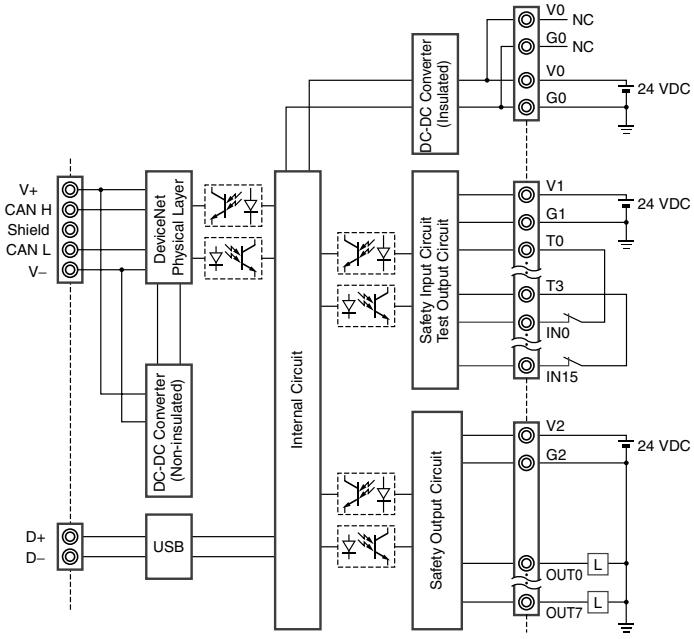
Communications protocol	DeviceNet compliant
Connection form	Multi-drop system and T-branch system can be combined (for trunk line and branch lines)
Communications speed	500/250/125 kbps
Communications media	Special cable, 5 conductors (2 for communications, 2 for power supply, 1 for shielding)
Communications distance	See table below
Communications power supply	11 to 25 VDC
No. of connectable nodes	63
Safety I/O communications (unit version 1.0 or later)	Safety Master function ・ Max. no. of connections: 32 ・ Max. data size: Input 16 bytes or output 16 bytes (per connection) ・ Connection type: Single-cast, multi-cast Safety Slave function ・ Max. no. of connections: 4 ・ Max. data size: Input 16 bytes or output 16 bytes (per connection) ・ Connection type: Single-cast, multi-cast
Standard I/O communications (all unit versions)	Standard Slave function ・ Max. no. of connections: 2 ・ Max. data size: Input 16 bytes or output 16 bytes (per connection) ・ Connection type: Poll, bit-strobe, COS, cyclic
Message communications	Max. message length: 552 bytes

Communications speed	Max. network length	Branch length	Total branch length
500 kbps	100 m max. (100 m max.)	6 m max.	39 m max.
250 kbps	250 m max. (100 m max.)		78 m max.
125 kbps	500 m max. (100 m max.)		156 m max.

Note: Figures in parentheses ( ) indicate values when a thin cable is used.

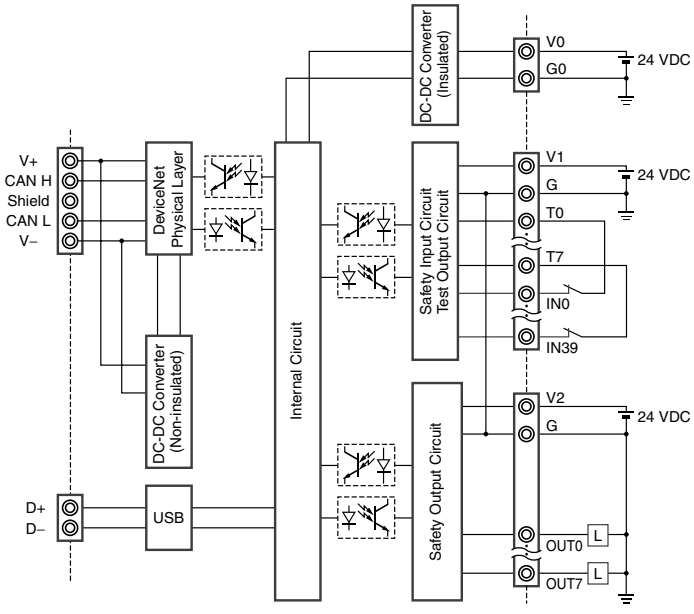
Wiring

NE1A-SCPU01-V1



Terminal name	Description
V0	Power supply terminal for internal circuit The two V0 terminals are internally connected.
G0	Power supply terminal for internal circuit The two G0 terminals are internally connected.
V1	Power supply terminal for external input device and test output
G1	Power supply terminal for external input device and test output
V2	Power supply terminal for external output device
G2	Power supply terminal for external output device
IN0 to IN15	Safety input terminal
T0 to T3	Test output terminal Connected to IN0 to IN15 safety inputs. Each test output terminal outputs a different test pulse pattern. Terminal T3 also supports a current monitoring function for the output signal. Example: Muting lamp
OUT0 to OUT7	Safety output terminals

NE1A-SCPU02



Terminal name	Description
V0	Power supply terminal for internal circuit The two V0 terminals are internally connected.
G0	Power supply terminal for internal circuit The two G0 terminals are internally connected.
V1	Power supply terminal for external input device and test output
G	Power supply terminal for external input device and test output
V2	Power supply terminal for external output device
G	Power supply terminal for external output device
IN0 to IN39	Safety input terminal
T0 to T3	Test output terminal Connected to IN0 to IN19 safety inputs. Each test output terminal outputs a different test pulse pattern. Terminal T3 also supports a current monitoring function for the output signal. Example: Muting lamp
T4 to T7	Test output terminal Connected to IN20 to IN39 safety inputs. Each test output terminal outputs a different test pulse pattern. Terminal T7 also supports a current monitoring function for the output signal. Example: Muting lamp
OUT0 to OUT7	Safety output terminals

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

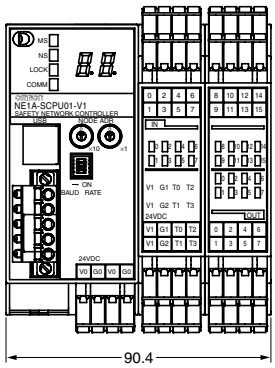
For complete specifications and additional models and accessories visit www.omron247.com

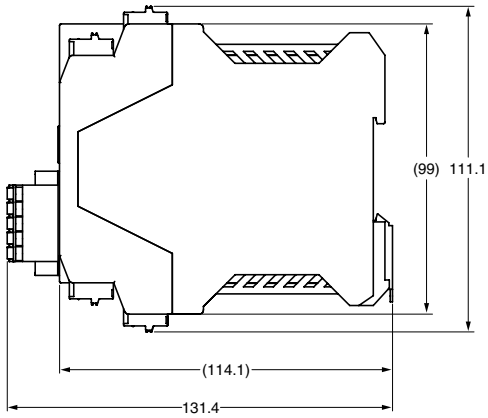
OMRON AUTOMATION & SAFETY

Dimensions

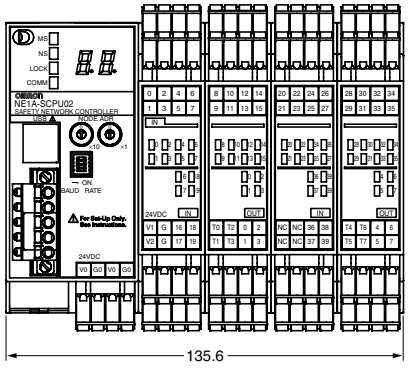
(mm)

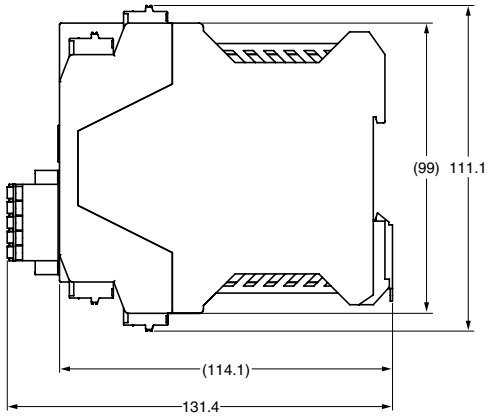
NE1A-SCPU01-V1





NE1A-SCPU02





Ordering

Name	No. of I/O points			Model	Unit version
	Safety inputs	Test outputs	Safety outputs		
Safety Network Controllers	16	4	8	NE1A-SCPU01-V1	2.0
	40	8	8	NE1A-SCPU02	2.0

Note: The standard NE1A Controllers are equipped with spring-cage terminal blocks, but screw terminal blocks are available if desired, e.g., to replace previous terminals.

D

Programmable Safety Systems

NE1A-EIP

Quick Link
S327
omron247.com

Safety Network Controllers with Built-in Ethernet/IP

- Enables monitoring of DeviceNet safety system via Ethernet from a machine controller or monitor computer that does not support a DeviceNet interface.
- Can be used to easily add a DeviceNet Safety control system to an existing system.
- Powerful combination with Omron Ethernet/IP compatible PLCs (SYSMAC CS/CJ/CP Series)
- Functions as a DeviceNet Safety master
- No additional devices required for Ethernet/IP connection

EtherNet/IP™



Programmable Safety Systems

DST1

Quick Link
S328
omron247.com

Safety I/O Terminals

- Distributed safety terminals that reduce wiring
- Lineup includes four models to accommodate various I/O types and number of I/O points
- Monitor the safety system from Standard Controllers across the network
- EN 954-1/ISO13849-1 CAT4 and IEC 61508 SIL3 certification
- The DST1-XD0808SL-1 supports logic operation functions for high-speed processing in applications requiring partial stopping of the safety system.



Programmable Safety Systems

NE1A-EDR01

Quick Link
S324
omron247.com

Ethernet/IP-DeviceNet Router

- Allows a safety system to be monitored via Ethernet
- The safety system can be remotely programmed and monitored using a personal computer
- The safety system can also be monitored by an Ethernet-compatible PLC
- UDP packet messages are supported



D

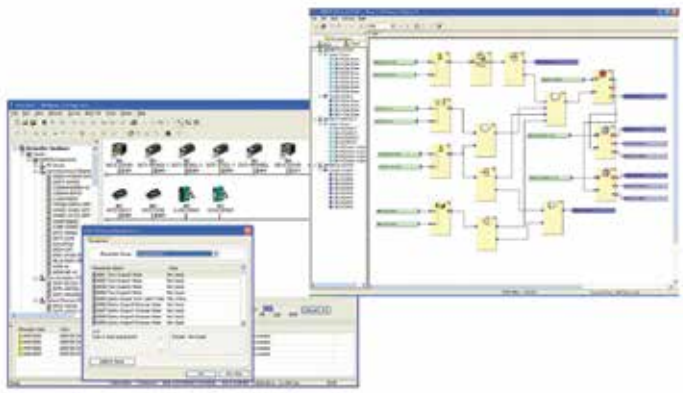
Programmable Safety Systems

WS02-CFSC1-E

Quick Link
L439
omron247.com

Network Configurator

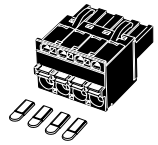
- Programming software for creating safety circuits
- Used to configure Safety Network Controllers and Safety I/O Terminals
- Provides safety circuit programming functions
- Provides monitoring functions for safety circuits
- Includes DeviceNet Configurator functions



Accessories and Peripheral Devices for DeviceNet Communications

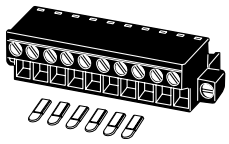
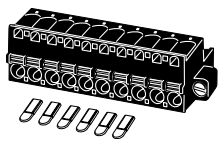
Accessories

Terminal Blocks for the NE1A

Appearance	Specification	Applicable Controllers	Model	Remarks
	Screw terminal blocks (4 pins)	NE1A-SCPU01 NE1A-SCPU01-V1 NE1A-SCPU02 NE1A-EDR01	Y9S-04T1B-02A	A set including two screw terminal blocks (black) and six code marks to prevent incorrect insertion
	Spring-cage terminal blocks (4 pins)		Y9S-04C1B-02A	A set including two spring-cage terminal blocks (black) and six code marks to prevent incorrect insertion

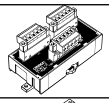
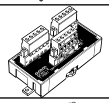
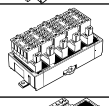
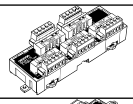
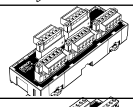
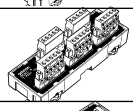
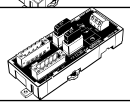
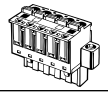
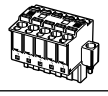
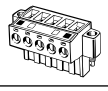
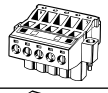
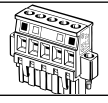
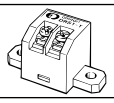
Note: The standard NE1A Controllers are equipped with spring-cage terminal blocks. Screw terminal blocks can be ordered if desired, e.g., to replace previous terminals.

Terminal Blocks for the DST1

Appearance	Specification	Applicable Safety I/O Terminals	Model	Remarks
	Screw terminal blocks (10 pins)	DST1-ID12SL-1 DST1-MD16SL-1 DST1-XD0808SL-1 DST1-MRD08SL-1	Y9S-10T1B-04B	A set including four screw terminal blocks (black), six code marks to prevent incorrect insertion, one set of terminal labels.*, and code mark instructions
	Spring-cage terminal blocks (10 pins)		Y9S-10C1B-04B	A set including four spring-cage terminal blocks (black), six code marks to prevent incorrect insertion, one set of terminal labels*, and code mark instructions

*The set of terminal labels is one sheet containing four sets of labels required for one Terminal Block, i.e., [1, 2 ... 10], [11, 12 ... 20], [21, 22 ... 30] and [31, 32 ... 40].
Note: The standard DS1T Safety I/O Terminals are equipped with spring-cage terminal blocks. Screw terminal blocks can be ordered if desired, e.g., to replace previous terminals.

Peripheral Devices for DeviceNet Communications

Product	Appearance	Model	Specification	
T-branch Tap for 1 branch line		DCN1-1NC	Cable wiring direction: Toward top Cable lock direction: From top Connector screw direction: From top	Provided with 3 parallel connectors with clamps (XW4G-05C1-H1-D), standard terminating resistor
		DCN1-1C	Cable wiring direction: Toward side Cable screw direction: From top Connector screw direction: From side	Provided with 3 parallel connectors with screws (XW4B-05C1-H1-D), standard terminating resistor
		DCN1-2C	Cable wiring direction: Toward top Cable screw direction: From side Connector screw direction: From top	
		DCN1-2R	Cable wiring direction: Toward side Cable screw direction: From top Connector screw direction: From top	Provided with 3 orthogonal connectors with screws (XW4B-05C1-VIR-D), standard terminating resistor
T-branch Tap for 3 branch lines		DCN1-3NC	Cable wiring direction: Toward top Cable lock direction: From top Connector screw direction: From top	Provided with 5 parallel clamp connectors with screws (XW4G-05C1-H1-D), standard terminating resistor
		DCN1-3C	Cable wiring direction: Toward side Cable screw direction: From top Connector screw direction: From side	Provided with 5 parallel connectors with screws (XW4B-05C1-H1-D), standard terminating resistor
		DCN1-4C	Cable wiring direction: Toward top Cable screw direction: From side Connector screw direction: From top	
		DCN1-4R	Cable wiring direction: Toward side Cable screw direction: From top Connector screw direction: From top	Provided with 5 orthogonal clamp connectors with screws (XW4B-05C1-VIR-D), standard terminating resistor
Power Supply Tap		DCN1-1P	One-branch tap provided with 2 connectors, standard terminating resistor, and fuse	
Connectors		XW4G-05C1-H1-D	Parallel clamp connector with screws Connector insertion and wiring both performed horizontally.	
		XW4G-05C4-TF-D	Parallel multi-branching clamp connector with screws Connector insertion and wiring performed in same direction.	
		XW4B-05C1-H1-D	Parallel connector with screws Connector insertion and wiring performed in same direction.	
		XW4B-05C4-T-D	Parallel, screw-less, multi-branching connector Connector insertion and wiring performed in same direction.	
		XW4B-05C4-TF-D	Parallel, multi-branching connector with screws Connector insertion and wiring performed in same direction.	
		XW4B-05C1-VIR-D	Orthogonal connector with screws Connector insertion and wiring performed at a right angle.	
DeviceNet Cables		DCA1-5C10 (-B)	Thin cable length: 100 m DCA1-5C10-B: Cable color: Blue DCA1-5C10: Cable color: Gray	
		DCA2-5C10 (-B)	Thick cable length: 100 m DCA2-5C10-B: Cable color: Blue DCA2-5C10: Cable color: Gray	
Terminal-block Terminator		DRS1-T	Resistance of 121 Ω	

D

Safety Mats & Edges

Contents

Safety Mats	
UMQ Series	E-2
MC Controllers	E-12
Safety Edges & Bumpers	
Safety Edges	E-25
Safety Bumpers	E-32
Safety Edge Controllers	E-33

UMQ Series

Quick Link
S822
omron247.com

Quick-Disconnect Universal Safety Mat System

Heavy-Duty Four-Wire Presence Sensing Mats with Removable Cable, Category 3 Controllers and Perimeter Trim

System

- When UMQ series mats are combined with an MC3, MC4 or MC6 controller (with complete diagnostics), the result is a system that meets the standard EN 1760-1:1998 and is entitled to display the CE mark. See below for an overview of the various components.

UMQ Series Mat

- Fork lift traffic of 270 lbs. per square inch
- IP67 rated
- Mat flammability self extinguishing, meets UL94VO
- Single-piece molded construction
- Black or yellow color
- Damage to cables during installation is eliminated by positioning the cables after mat installation
- Easy cable replacement
- Six cable location options offer the ability to configure where cable exits

Controllers

- Safety category 3 devices
- DIN-rail mount (MC3)
- NEMA controllers (MC4, MC6)
- 24 VDC or with universal power supply 100 to 240 VAC

Trim

- Two-part perimeter and joining trim simplifies installation and provides a custom appearance
- Two options for trim kit corners: Mitered and molded



Patented Connector

2009 design news GOLDEN MOUSETRAP BEST PRODUCT AWARDS Winner

Description

An Omron Quick-Disconnect Universal Mat system (UMQ series mat combined with an MC3, MC4 or MC6) offers a simple method for guarding personnel around hazardous machines. A Quick-Disconnect Universal Mat system offers freedom, flexibility, and reduced operator fatigue when compared with traditional guarding methods such as interlocked fences, pullback restraints or perimeter barriers.

Full visibility and access to the work area is maintained. There is no need to worry about personnel forgetting to replace mechanical barriers or close gates.

UMQ Series safety mat incorporates a design that features a cable quick disconnect located on the mat. This allows the cable to be attached after the mat is installed in order to minimize damage to the cable during installation. The patented connector is designed and tested to meet IP67 requirements.

How the System Works

The operation of a Quick-Disconnect Universal Mat system is easy to understand. The mat is a simple, normally open switch. When a specified minimum weight is applied to the mat the "switch" closes. This sends a signal to the controller which, in turn, sends a stop signal to the guarded machine.

Each mat presents four wires to the controller. This provides the redundancy required to monitor the wiring for open circuits due to incorrect wiring or physical damage to the wires.

In order to meet many national safety regulations, Omron offers trim to secure the mat to the floor so that it cannot be easily relocated and therefore become ineffective.

Mat Specifications

Mechanical		
Mat Cover Material:	PVC	
Mat Type:	Normally open SPST, four-wire	
Mode:	Pressure Sensitive	
Activation Force:	Detects adults > 30 kg (66 lbs) (8.5 lbs/in.^{2})	
Maximum Load:	Static Load: 122.5 kg/in.^{2} (270 lbs/in.^{2})	
	Rolling Load: 122.5 kg/in.^{2} (270 lbs/in.^{2})	
Mechanical Life:	1 x 10^6 operations	
Mat Cable:	18-gauge, 4-conductor, 16-strand, 300 VAC, with MC12DC male single key connector; 5 m or 10 m long	
Mat Weight:	Approx. 24.4 kg/m^2 (5 lbs/ft.^{2})	
Environmental		
Protection:	IP67	
Operating Temperature:	-37 to 66°C (-35 to 150° F)	
Mat Flammability:	Self extinguishing, meets UL 94VO	
Operating Humidity:	0-100% RH	
Mat Chemical Resistance*:	Water:	Excellent
	Mineral Acids:	Good/Excellent
	Organic Acids:	Good/Excellent
	Alcohols:	Good
	Aldehydes:	Good/Excellent
	Caustics:	Good/Excellent
	Petroleum Solvents:	Good
	Organic Solvents:	Poor
	Chlorinated Solvents:	Poor
	*40 minute exposure at 23°C (74°F)	
Compliance		
Conforming to Standards:	ANSI/RIA 15.06-1999 (R2009), ANSI B11.19-2010, OSHA 1910.21(b), CSA Z432-04	
Approvals:	When used with an MC3, MC4 or MC6 controller the UMQ series safety mats comprise a system which has been EC type examined to the requirements of category 3, EN 13849-1 and EN1760-1:1998.	

Specifications are subject to change without notice.

Mat Selection

Multiple UMQ series mat sizes are offered. A system can easily be configured to meet almost any guarding requirement.

Standard Mat Sizes	
Widths	12 to 48 in.
Lengths	12 to 72 in.
Metric Mat Sizes	
Widths	500 to 1200 mm
Lengths	500 to 1800 mm
Custom Mat Sizes	
Widths	From 8 in. up to 48 in. (0.5 in. increments)
Lengths	From 8 in. up to 72 in. (0.5 in. increments)

E

Trim Selection

Several choices are available in trim selection and can be customized to a specific application.

Two-Part Ramp Trim with Yellow PVC Cover

This trim simplifies routing of cables and replacement of damaged mats. To position the mats correctly, place all of the mats in the approximate position, place the joining trim between the mats, then temporarily place the cover on the joining trim. Square the mats by sliding the ramp trim under the mats. When all of the mats are correctly positioned, anchor the perimeter trim to the floor. After the wires have been routed, a rugged cover of highly visible, safety yellow PVC is snapped into place. Corners can either be mitered or be our exclusive molded corners. (See illustrations on this page.)

Two-Part Ramp Trim with Aluminum Cover

This trim is the same as above except that the PVC cover is replaced with an aluminum cover that is attached by screws to the base. (See the Dimensions Section of this datasheet for details.)

Two-Part Active Joining Trim

Similar in concept to the two-part ramp trim, this trim provides an "active" joint where the perimeters of two mats adjoin each other. When a person steps on the surface cover of the active joining trim, the Universal Mat system will detect their presence and send a stop signal to the guarded machine.

Aluminum Blunt Trim

Used to finish off the edge of a mat installation near a wall or machine. Helps hold mats in place.

Aluminum Ramp Trim

This single part aluminum ramp trim is available for areas where the two part ramp trim may not be suitable.

Molded Corners

Eliminates the need to miter the corners of perimeter trim. Designed to mate with Omron two-part ramp trim.

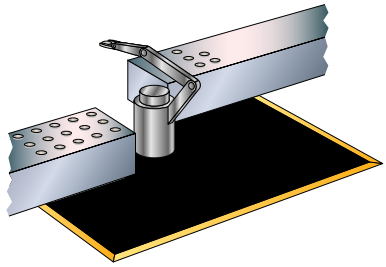
Applications

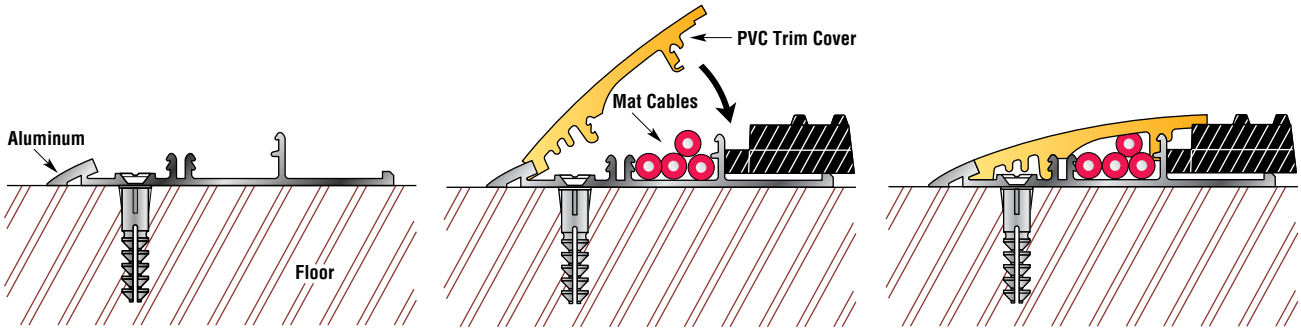
Presence sensing safety mats are used to monitor an entire hazardous area. They offer flexibility, quick access and may frequently be the most economic choice. Other options for perimeter guarding include interlocked barrier guards and safety light curtains. However, personnel can become trapped inside a barrier guard and safety light curtains only monitor the perimeter, not the hazardous area inside.

Additionally, mats can also simplify routine tasks such as machine setup, maintenance and repair.

Applications can be found throughout industry and typically include the following areas:

- Welding Robots
- Assembly Machinery
- Material Handling
- Packaging Machinery
- Punches
- Presses
- Robotic Work Cells





SYSMAC SAFETY, TECHNOLOGY & INNOVATION

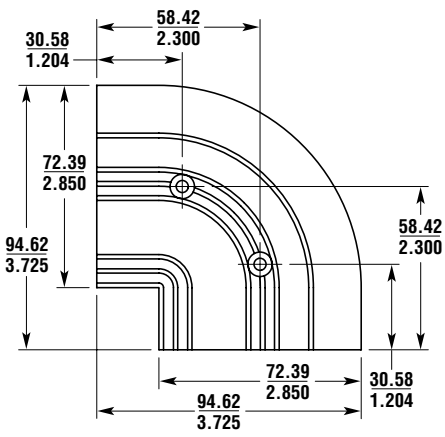
OMRON AUTOMATION & SAFETY

Trim Dimensions

(mm/in.)

Outside Molded Corner Trim

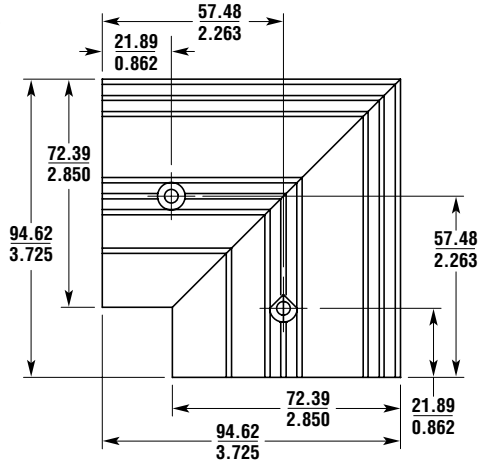
Model UMOC



Molded Outside Corner: PN 25836

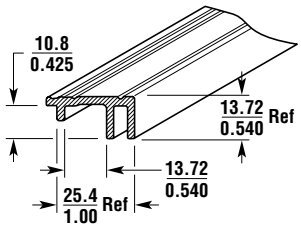
Inside Molded Corner Trim

Model UMIC



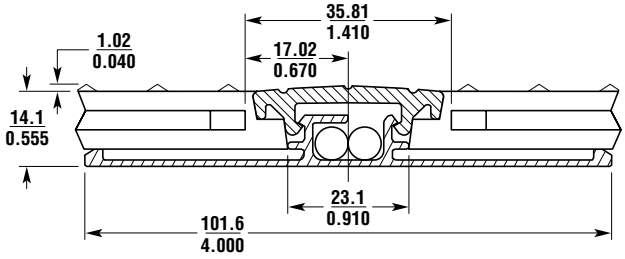
Molded Inside Corner: PN 25837

Blunt Trim



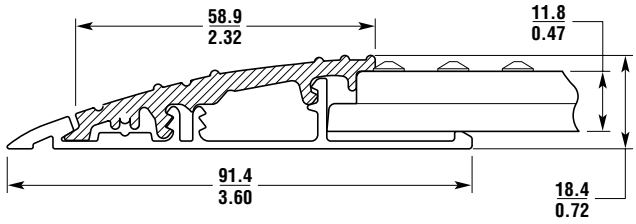
Blunt Trim: PN 43223-0096

2-Part Joining Trim (Base and Cover)



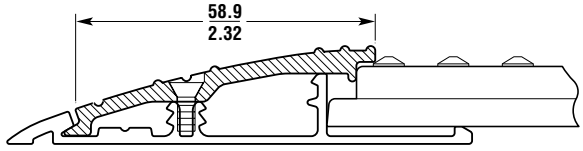
2-Part Joining Trim: PN 43222-0096
Joining Trim Aluminum Base: PN 32592
Joining Trim Cover Black: PN 32591
Joining Trim Cover Yellow: PN 32591-0010

2-Part Ramp Trim with PVC Cover (TKM)



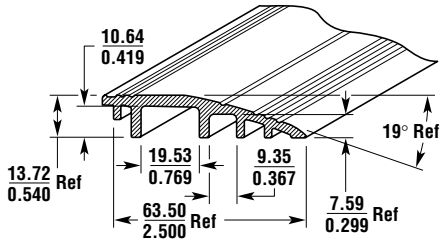
Aluminum Base & PVC Cover: PN 43123-0096
Aluminum Base: PN 32667
PVC Cover: PN 32668

2-Part Ramp Trim with Aluminum Cover (TKAT)



Aluminum Base & Aluminum Cover: PN 43123-1096
Aluminum Base: PN 32667
Aluminum Cover: PN 26441

Aluminum Single Part Ramp Trim (TKA)



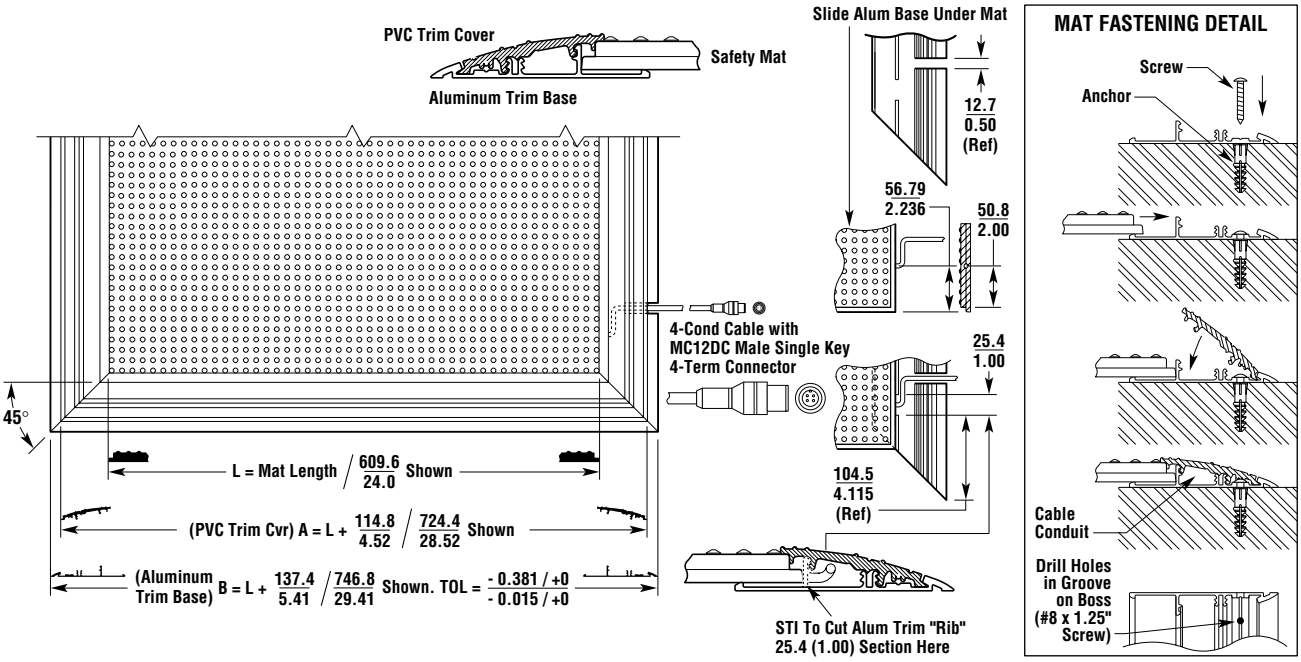
Aluminum Ramp Trim: PN 43224-0096

E

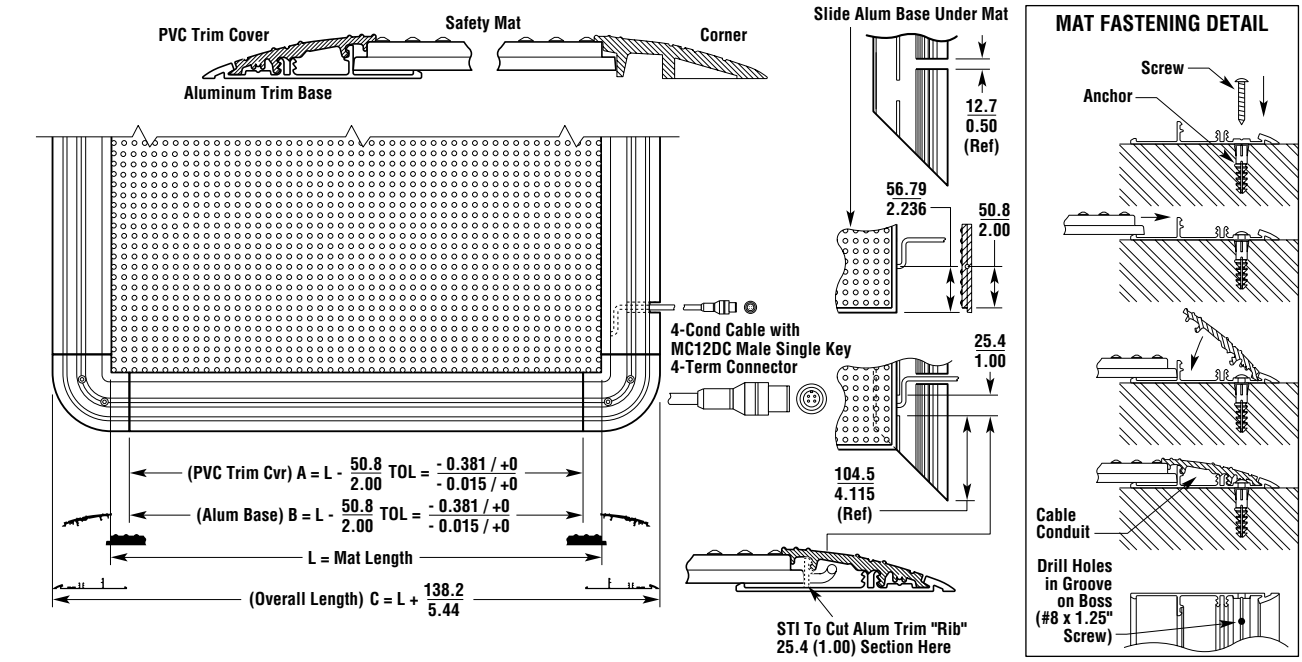
Mat Dimensions

(mm/in.)

Two-Part Trim with PVC Cover and Mitered Corners (TKM)



Two-Part Trim with PVC Cover and Molded Corners (TKC)



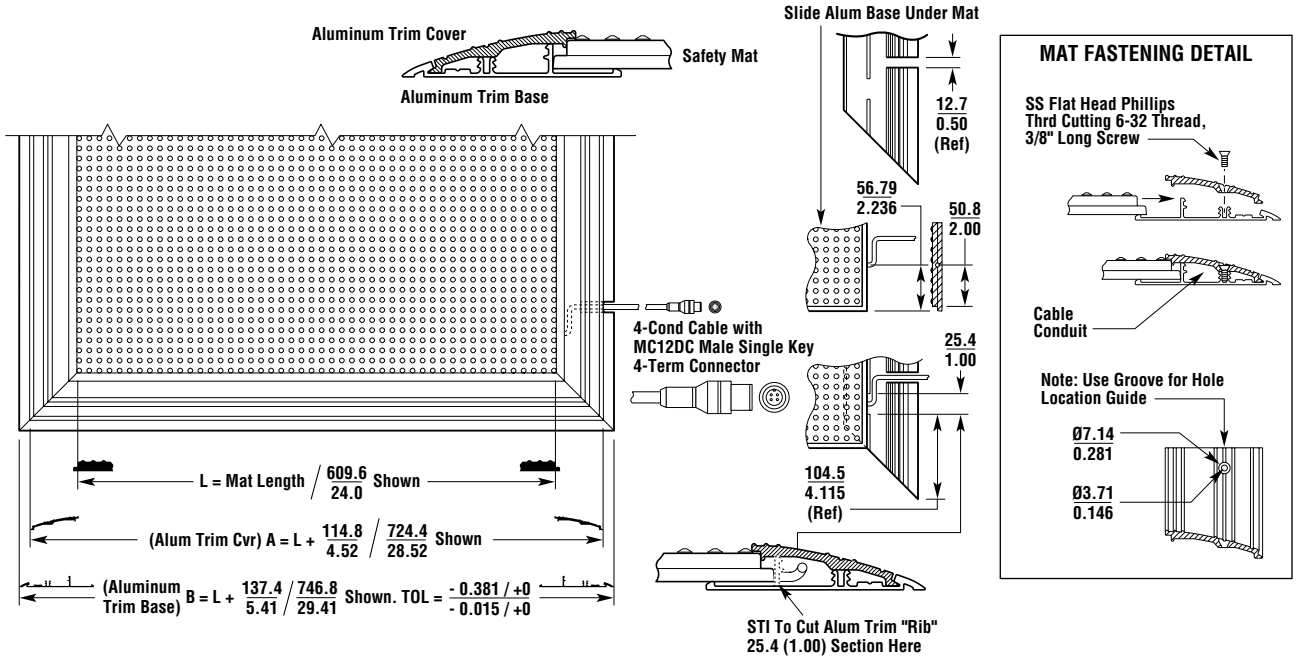
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

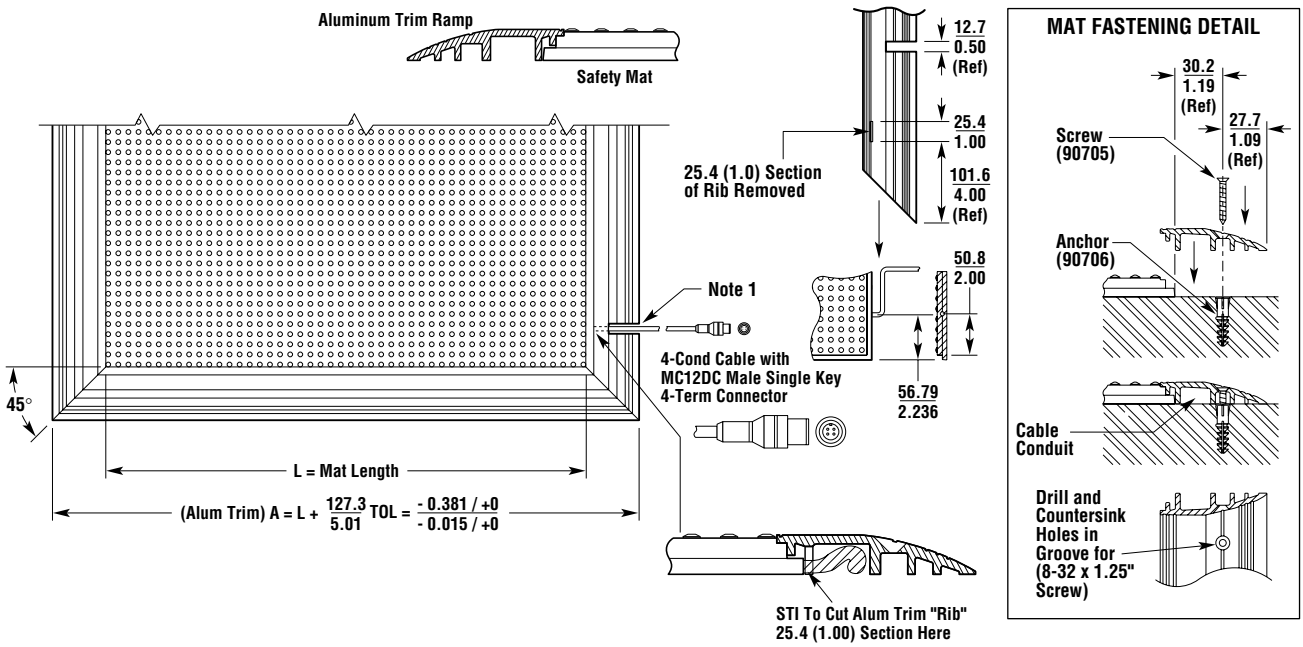
Mat Dimensions (continued)

(mm/in.)

Two-Part Trim with Aluminum Cover and Mitered Corners (TKAT)

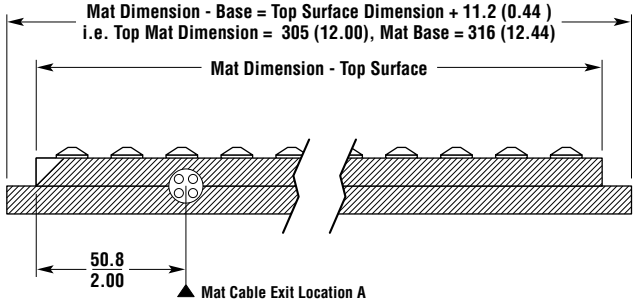


Single-Part Trim Aluminum Trim (TKA)



E

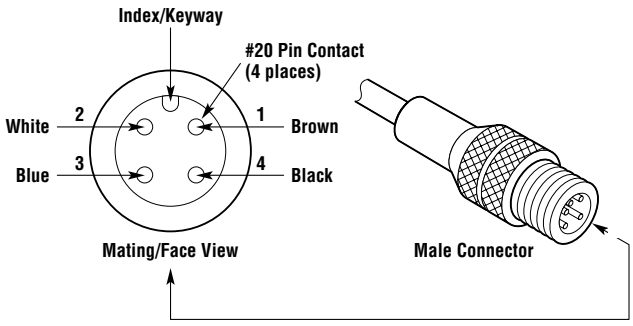
Mat Measurement



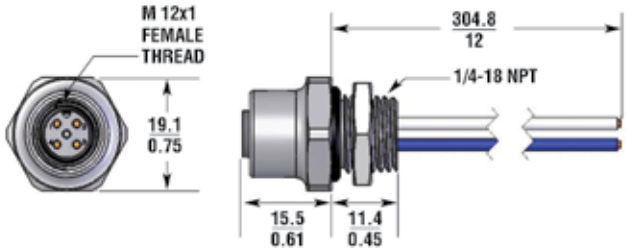
Mat Cable exits on the side indicated by the first dimension in the model number
i.e. UM5-1254, Cable exits 12" dimension
i.e. UM5-4824, Cable exits 48" dimension

Pin Out Connector

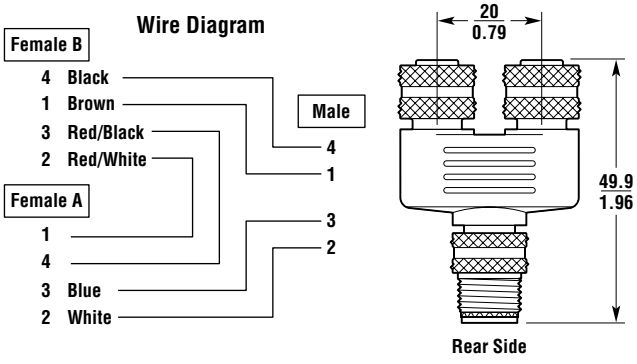
UMQ5, UMQ10, Integral UM Mat Cables



UMPMC



UM-Y-2-1 "Y" Connector



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

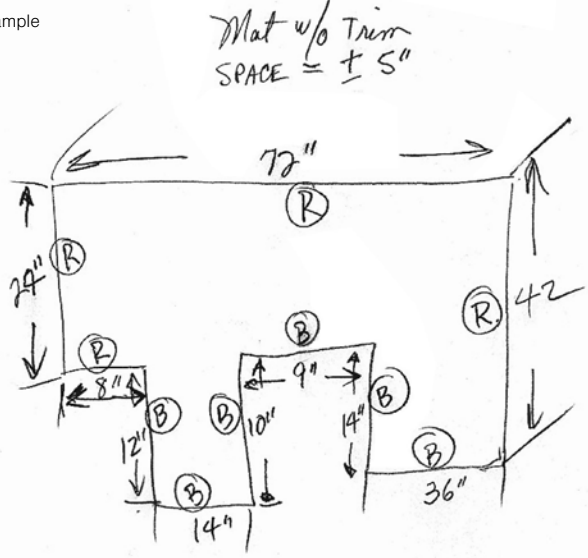
OMRON AUTOMATION & SAFETY

Custom Mats and Trims

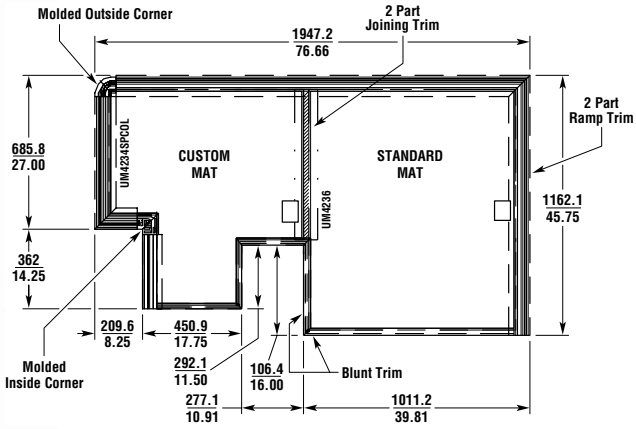
Omron makes ordering custom mats and trims easy. Simply send us a sketch of your layout including dimensions. Make note of where you want ramp trim or blunt trim. We'll work from your sketch to create a detailed drawing of your specifications.

Step 1: Customer Sends a Sketch

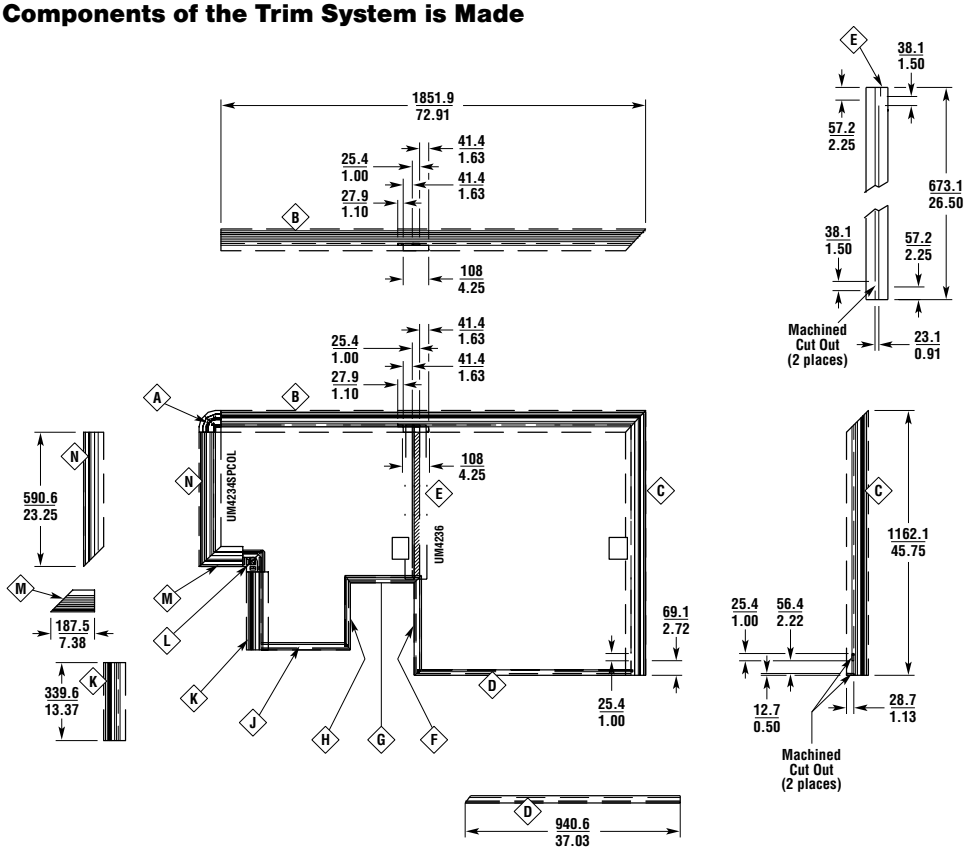
Example



Step 2: A Quote Drawing with Dimensions is Created



Step 3: When the Order is Placed, A Detailed Layout Showing all Components of the Trim System is Made



Ordering

Ordering a UMQ Mat System

A Quick Disconnect Universal Mat System contains at least one mat, a 5 m or 10 m cable, sufficient perimeter and joining trim and a controller. For multiple mat installations using the MC3 controller, the mats are connected in series to the controller. This may be done using the UMDB-6 wiring accessory. When using the MC4 or MC6 controllers, six mats may be connected directly to the controller.

Each component of Quick Disconnect Universal Mat system must be ordered individually

Mats are available in black or yellow. Yellow mats are denoted by placing a "Y" in the ordering code. The cable location is specified by letter code at the end of the ordering number. Cables must be ordered separately.

To order a Quick-Disconnect Universal Mat System, simply fill in the fields in the model number sequence given.

UM Mats vs. UMQ Mats

Prior to the development of the UMQ Mat with Quick-Disconnect cable, the **UM Series Mat** was the standard mat supplied by Omron. The UM Mats are available with integral cables in 5 m or 10 m lengths. These integral cables are not removable. UM mats are still available and can be ordered in black or yellow with required perimeter and joining trim.



For detailed specifications and ordering information on the Universal Mat System, please visit our website.

Standard Mat Ordering Code:

___ - ___ ___ - ___
❶ ❷ ❸ ❻

Example: UMQ-2460-A
This example is a 24 x 60 in. standard black mat with cable location A.

Metric Mat Ordering Code:

___ - ___ - ___ - ___
❶ ❹ ❺ ❻

Example: UMMQ-0500-0500-B
This example is a 500 x 500 mm black metric quick disconnect mat with cable coming out at location B.

❶ Information required. Represents mat type and color.

Designator	Description
UMQ	Standard black mat
UMYQ	Standard yellow mat*
UMMQ	Metric black mat
UMMYQ	Metric yellow mat*

Notes: *Mats will take the largest dimension as the first dimension up to the 48 in. width (i.e. a mat ordered as 36 x 48 will be made as 48 x 36).

❷❸❹❺ Information required. Represents the mat size. Dimensions are for active mat area. Mats are an additional 0.5 in. (12 mm) in each dimension. Choose one value from each column.

❷ Standard Mat Widths in Inches Designator	❸ Standard Mat Lengths in Inches Designator
12	12
18	18
24	24
30	30
36	36
42	42
48	48
	54
	60
	66
	72
Special Standard Sizes*	
Special inch sizes are available in increments of 0.5 in., with a minimum width or length of 8 in.	

❹ Metric Mat Widths in mm Designator	❺ Metric Mat Lengths in mm Designator
0500 (500 mm/19.7 in.)	0500 (500 mm/19.7 in.)
0750 (750 mm/29.5 in.)	0750 (750 mm/29.5 in.)
1000 (1000 mm/39.4 in.)	1000 (1000 mm/39.4 in.)
1200 (1200 mm/47.2 in.)	1250 (1250 mm/49.2 in.)
	1500 (1500 mm/59.1 in.)
	1750 (1750 mm /68.9 in.)
	1800 (1800 mm/70.9 in.)

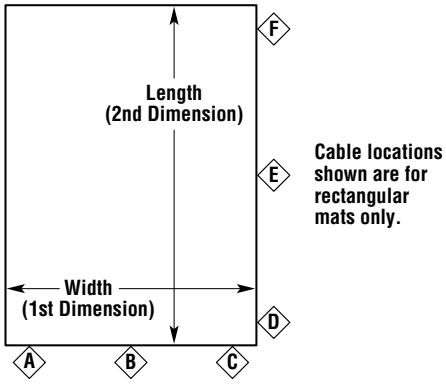
*Please consult Omron for mat sizes not listed in the above tables.

Ordering (continued)

❻ Information required. Represents cable location. See diagram below.

Cable Location	Description
A	Bottom left corner of first mat dimension, 2 in. from top surface of the left edge to center of cable exit
B	Bottom center of first mat dimension
C	Bottom right corner of first mat dimension, 2 in. from top surface of the right edge to center of cable exit
D	Bottom right corner of second mat dimension, 2 in. from top surface of the bottom edge to center of cable exit
E	Center of second mat dimension
F	Top right corner of second mat dimension, 2 in. from top surface of the top edge to center of cable exit

Notes: Mats with both dimensions equal will only have "A", "B", and "C" cable locations available.



Ordering Perimeter Trim for a Single Mat**

To order Perimeter Trim for a single mat, simply fill in the fields in the model number sequence given below.

Standard Perimeter Trim Ordering Code:

___ - ___ ___ - ___
❼ ❷ ❸ ❻

Example: TKM-1266-E
This example is a trim kit with mitered corners to fit a 12 x 66 in. standard mat with cable coming out at location E.

Metric Perimeter Trim Ordering Code:

___ - ___ - ___ - ___
❼ ❹ ❺ ❻

Example: MTKM-0500-0500-E
This example is a trim kit with mitered corners to fit a 500 x 500 mm metric quick disconnect mat with cable coming out at location E.

❼ Information required. Represents the corner style used on the trim kits.

Designator	Description
TKM	Standard trim kit, 2-part mitered corners with PVC top cover
TKAT	Standard trim kit, 2-part mitered corners with aluminum top cover
TKC	Standard trim kit, 2-part with molded corners with PVC top cover
TKA	Standard trim kit, single part aluminum ramp trim (mitered only)
MTKM	Metric trim kit with mitered corners
MTKC	Metric trim kit with molded corners

MTKAT is available upon request.

Accessories for Standard and Metric Sized Mats

Model Number	Description	Weight
UMRT4	Bulk two-part ramp trim with yellow PVC cover 1.22 m (48 in.) length	1.5 kg (3.3 lb.)
UMRT8	Bulk two-part ramp trim with yellow PVC cover 2.44 m (96 in.) length	3.0 kg (6.6 lb.)
UMRT8A	Bulk two-part ramp trim with aluminum top 2.44 m (96 in.) length	3.2 kg (7.0 lb.)
UMJS4	Bulk two-part active joining trim 1.22 m (48 in.) length	1.4 kg (3.0 lb.)
UMJS8	Bulk two-part active joining trim 2.44 m (96 in.) length	2.7 kg (6.0 lb.)
UMJTC8Y	Bulk joining trim cover yellow 2.44 m (96 in.)	0.5 kg (1.0 lb.)
UMBT4	Bulk blunt trim 1.22 m (48 in.) length	1.1 kg (2.5 lb.)
UMBT8	Bulk blunt trim 2.44 m (96 in.) length	2.3 kg (5.0 lb.)
UMAL	Bulk aluminum ramp trim 2.44 m (96 in.)	2.9 kg (6.5 lb.)
UMOC	Molded outside corner	
UMIC	Molded inside corner	
UMDB-6	Universal Safety Mat distribution box with 6 mat input connectors and one output connection to the controller	
UMEC-03	3 m (9 ft.) extension cable for mat or UMDB-6	
UMEC-05	5 m (16 ft.) extension cable for mat or UMDB-6	
UMEC-10	10 m (32 ft.) extension cable for mat or UMDB-6	
UMEC-15	15 m (49 ft.) extension cable for mat or UMDB-6	
UMPMC	Panel-mount connector. Allows the controller to accept quick disconnect cable from UM series mats.	
UM4PRC	4-pin male QD field replacement connector for mat cables	
UM-Y-2-1	"Y" connector, internally connected to allow 2 mats to 1 input to controller or connector	
UMQ5	5 m quick-disconnect cable	
UMQ10	10 m quick-disconnect cable	

E

MC Controllers

Quick Link
S823
omron247.com

MC3, MC4 and MC6 Series Safety Mat Controllers

The MC Series safety mat controllers are used in conjunction with a four-wire, normally open, safety mat where perimeter guarding is required. These control reliable controllers send a stop signal to the guarded machine when an object of sufficient weight is detected on the active mat area.

The MC Series controllers, when combined with a four-wire UM or UMQ series mat, provide access guarding and improved productivity. The work area is fully visible and accessible.

The controller meets the requirement of EN 1760-1:1998, EN 13849-1, ANSI/RIA 15.06-1999 (R2009), ANSI B11.19-2010, OSHA 1910-217C. CSA and UL508.



MC6

- Universal power input
- Up to 6 mat zone inputs
- Six mat zone status indicator LEDs
- Select from Automatic Start, Start/Restart Interlock or Start Interlock operating modes
- MPCE monitoring
- Remote access to reset functions
- 2-digit numeric display for fault diagnostics
- Surface mount, lockable metal enclosure

Options

- Lid-mounted reset key switch
- Quick disconnect for incoming power and relay outputs
- Quick disconnects up to 6 mat zone inputs
- Solid-state safety output module
- Safety relay output module

Description

MC3

The MC3 DIN mount controller may be used in applications that do not require the feature set of the MC6 controller. The MC3 single zone mat controller has removable terminal blocks and operates only on 24 VDC.

MC4

The MC4 is a NEMA 4, 12 rated single zone mat controller. This controller may be used in applications when the diagnostic features of the MC6 may not be required. The MC4 may be ordered in either 24 VDC or the universal auto-selecting power supply for 100-240 VAC.

MC6

The MC6 is a NEMA 4, 12 controller with six individual mat zone indicators and is designed to be backward compatible with the MC4. Both units are dimensionally identical. This is where the similarities stop: The MC6 has full featured diagnostics with a 24 VDC and an optional universal power supply (100-240 VAC auto-selecting). It is a controller that can be used anywhere in the world.

Additional Guarding Requirements

A safety mat system is often only one part of a machine guarding solution. If the safety mat does not protect all access to the point of operation, additional guarding must be used. Safety mat systems should only be used to detect the presence, not the absence, of a force.

Perimeter Guarding Requirements

For perimeter guarding installations, the guarded machine or robot controller must be wired such that any stop signal generated by the safety mat system will cause an immediate stop of the hazardous motion. The machine or robot must only be restarted by the actuation of a manual reset switch. This reset switch must be located outside the area of hazardous motion and positioned such that the hazardous area can be observed by the switch operator. The purpose of this arrangement is to prevent a machine or robot from automatically restarting once the sensing weight is no longer detected by the safety mat sensing area.

Specifications

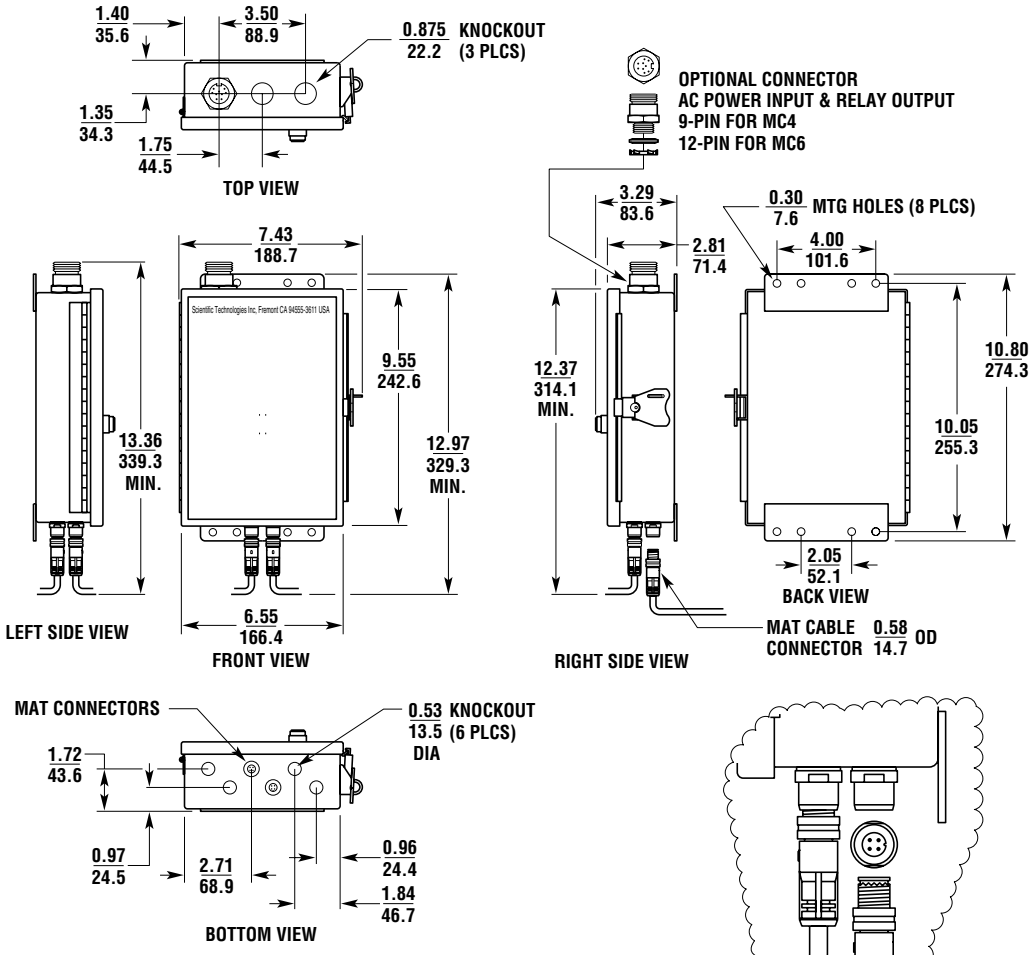
Controller Specifications	MC3	MC4	MC6
Performance			
Category 3 Safety Device:	Yes		
Max Input Resistance:	8 ohm per input channel		
Response Time:	< 30 msec		
Indications:	1 - Green = Run 1 - Red = Stop 1 - Green = Mat Clear		1 - 2 Digit Diagnostic Display 1 - Green = Run 1 - Red = Stop 1 - Green = Mat Clear 1 - Yellow = Interlock 6 - Red = Mat Zones
Operational Modes: (Selectable)	Automatic Start, Start/Restart Interlock		DIP Switch Selected, Automatic Start, Start/Restart Interlock Start Interlock
Electrical			
Power Input:	24 VDC ± 15% < 3 watts	24 VDC ± 10% < 3 watts or Autoselecting, 100 - 240 VAC ± 10%, 20 watts	24 VDC ± 10% 10 watts (Relay), 24 VDC ± 10% 50 watts (Solid-State), or Autoselecting, 100 - 240 VAC ± 10%, 20 watts
Safety Inputs:	One - 4-wire UM Safety Mat, or group series as one input. Approximately 12 multiple mats may be connected to a single zone in series; Do not exceed 8 ohms per input channel	Connections for up to six, - 4-wire UM Safety Mats Approximately 12 multiple mats may be connected to a single zone in series Do not exceed 8 ohms per input channel	
Safety Output Relays:	2 NO and 2 NC		2 NO and 1 NC
Maximum Switched Current:	230 VAC, 6 A, 1500 watts 24 VDC - 2 A Inductive, 6 A Resistive		230 VAC, 7 A, 1600 watts 24 VDC - 2 A Inductive, 6 A Resistive
MPCE:	n/a		DIP Switch -
Aux. Output Relay:	None (NC may be used as Aux)		1 NO and 1 NC
Maximum Switched Current:	230 VAC, 6 A, 1500 watts 30 VDC, 1.0 A	230 VAC, 6 A, 1500 watts	125 VAC, 0.5 A
Relay Life:	Mechanical = 10M operations		
Terminal Blocks:	Removable Pressure point screw	Cage clamp terminal strip	Cage clamp terminal strip & 2-part terminal blocks
Options			
Solid-State Outputs			
Solid-State Safety Outputs:	n/a		2 Current Sourcing 24 VDC (PNP)
Maximum Switched Current:	n/a		0.625 A @ 24 VDC
Solid-State Aux. Outputs:	n/a		1 Current Sourcing (PNP) and 1 Current Sinking (NPN)
Maximum Switched Current:	n/a		Current Sourcing Max: 0.5 A @ 24 VDC Current Sinking Max: 0.1 A @ 24 VDC
Reset Function			
Key-switch (factory installed):	n/a	Yes	
Remote:	user supplied, Key-switch, or Pushbutton		
Mat Input Connectors:	n/a	Up to six quick-disconnect connectors	
Power Input and Safety Output Connector:	n/a	Yes	
Enclosure:	Polycarbonate	Polyurethane-painted 14 ga. steel	
Mounting:	35 mm DIN rail	Surface Mount	
Environmental			
Protection Rating:	IP20	IP65/NEMA 4, 12	
Operating Temperature:	0 to 55°C (32 to 131° F)	0 to 55°C (32 to 131° F)	
Relative Humidity:	90%		
Vibration:	5-60 Hz at 5 g max on three axis	10-55 Hz at 5 g max on three axis	
Shock:	10 g for 0.016 sec., 1000 shocks for each axis on 3 axis		
Electromagnetic Compatibility (EMC)			
Electrostatic Discharge (ESD):	±8 kV (air discharge), ±6 kV (contact discharge)		
Radiated RF Field:	10 V/m, 80 to 1,000 MHz		
Electrical Fast Transients (EFT):	±2 kV (all power and I/O ports)		
Surge:	± 2 kV (all power and I/O ports)		
Shipping Wt.:	0.22 kg (0.8 lbs.)	Approx 4 kg (9.0 lbs.)	
Standards of Conformity:	TUV, CE, cCSAus CE Certificate # BB9910347 01 cCSAus Certificate # LR90200-14	TUV, CE, cCSAus CE Certificate # BB9910347 02 cCSAus Certificate # LR90200-14	TUV, CE, cCSAus CE Certificate # BB2110242 01 cCSAus Certificate # LR90200-14
Designed to Meet or Exceed:	EN1760-1998, EN13849, ANSI/RIA15.06-1999 (R2009), ANSI B11.19-2010, OSHA 1910-217C, CSA AND UL508		

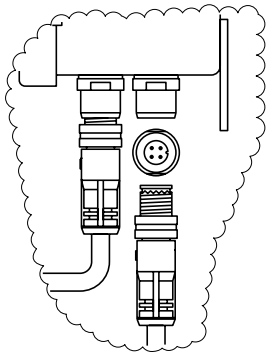
Specifications are subject to change without notice.

Dimensions

(in./mm)

MC4, MC6





SYSMAC SAFETY, TECHNOLOGY & INNOVATION

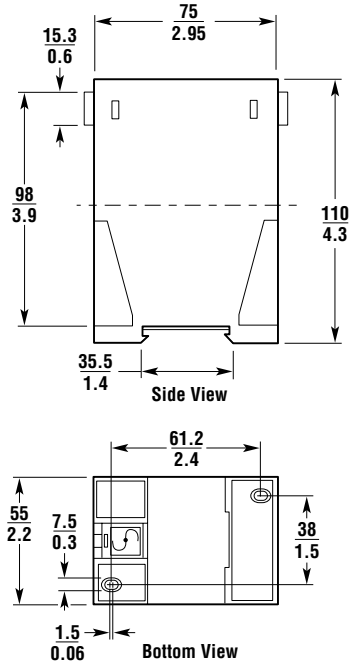
For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

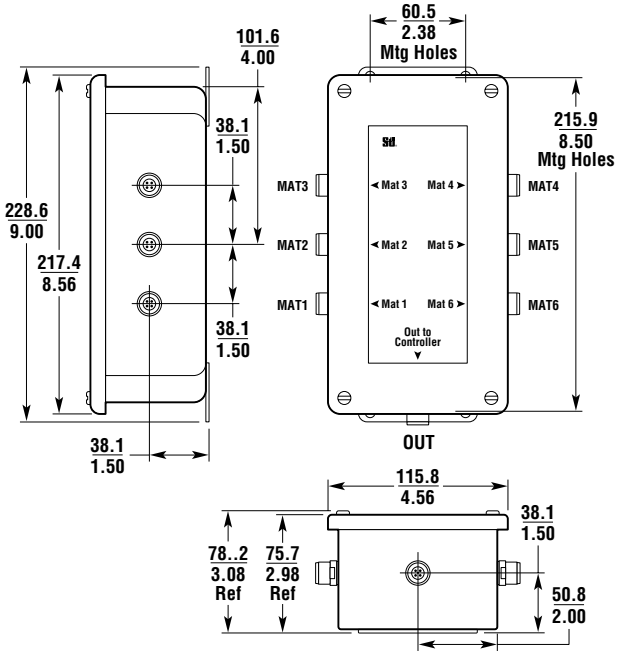
Dimensions (continued)

(mm/in.)

MC3



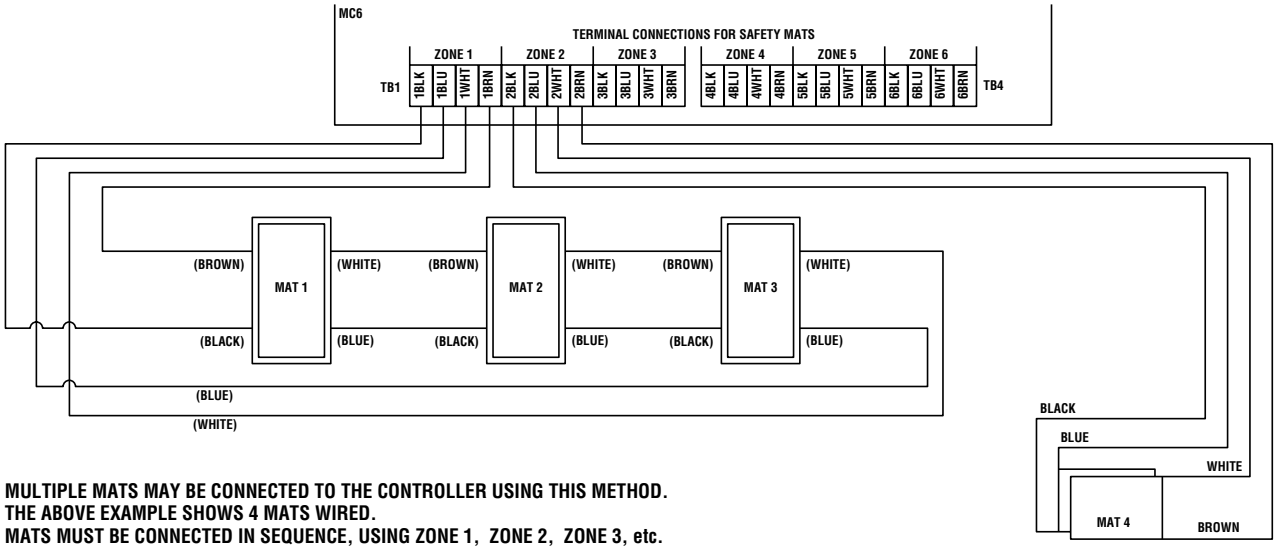
UMDB-6



E

Wiring

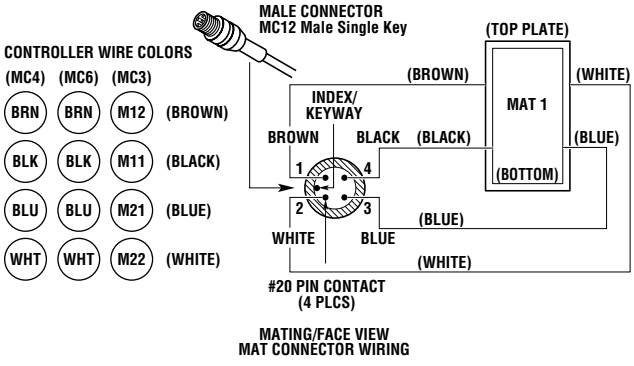
MC6 with Multiple Mats Connected to One Zone



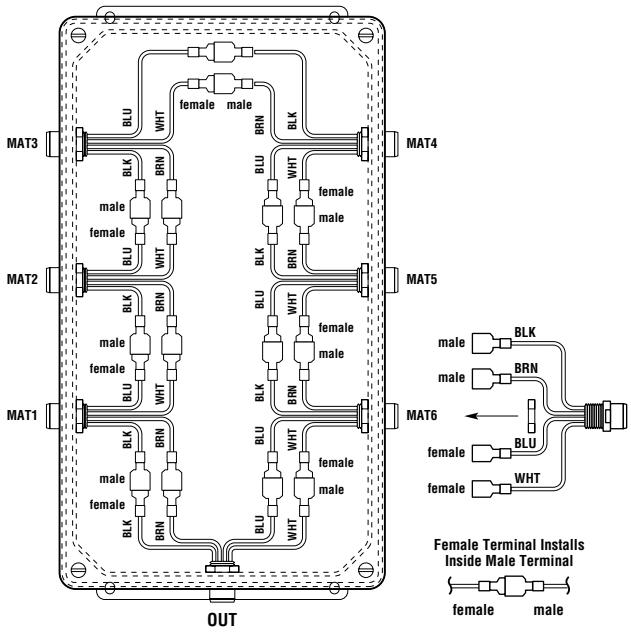
MULTIPLE MATS MAY BE CONNECTED TO THE CONTROLLER USING THIS METHOD.
THE ABOVE EXAMPLE SHOWS 4 MATS WIRED.
MATS MUST BE CONNECTED IN SEQUENCE, USING ZONE 1, ZONE 2, ZONE 3, etc.
DIP SWITCHES MUST BE SET TO THE NUMBER OF ZONES BEING USED.

Mat Connections for Listed Controllers

- The MC4 and MC6 controllers may be ordered with up to 6 mat connectors (part #60477) installed.
- When using the MC3 controller, part #60477 may be ordered for mounting in customer enclosure.



UMDB-6

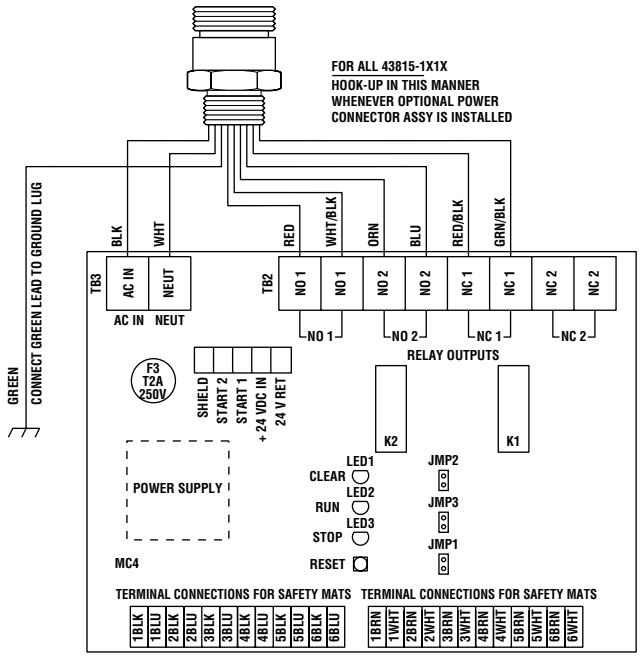


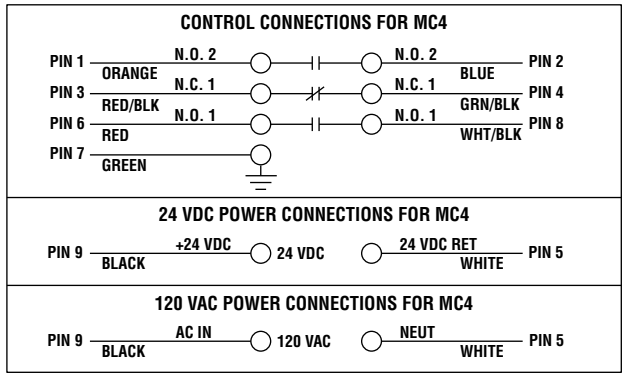
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

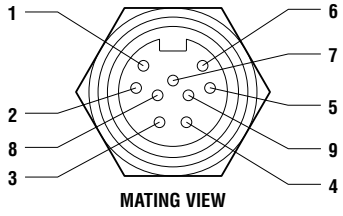
OMRON AUTOMATION & SAFETY

Wiring (continued)

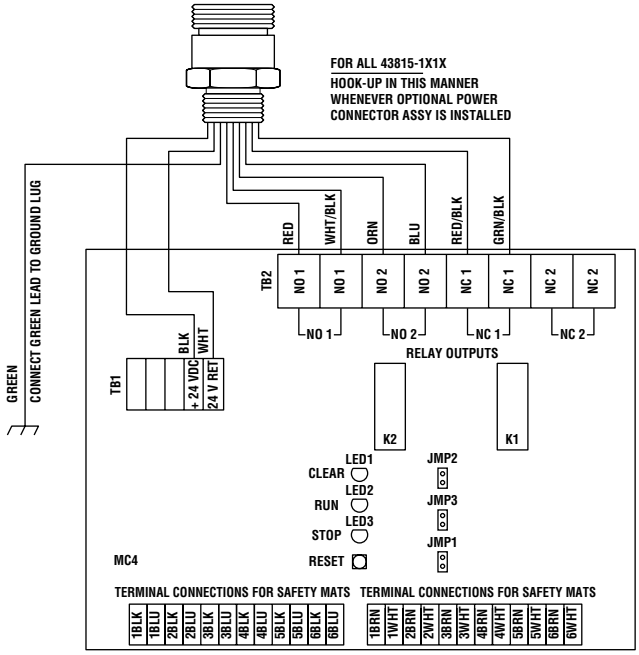
MC4 AC Power, 9-Pin Connector

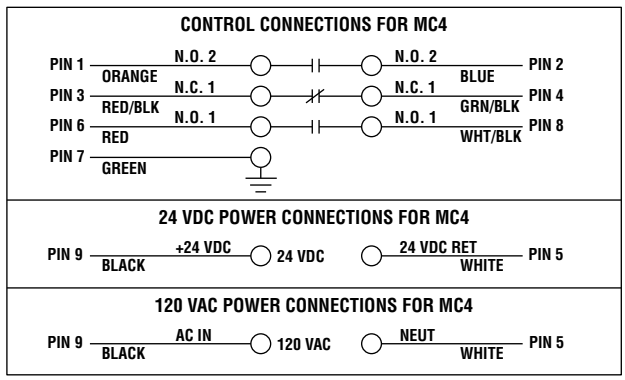


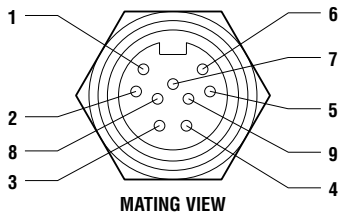




MC4 DC Power, 9-Pin Connector



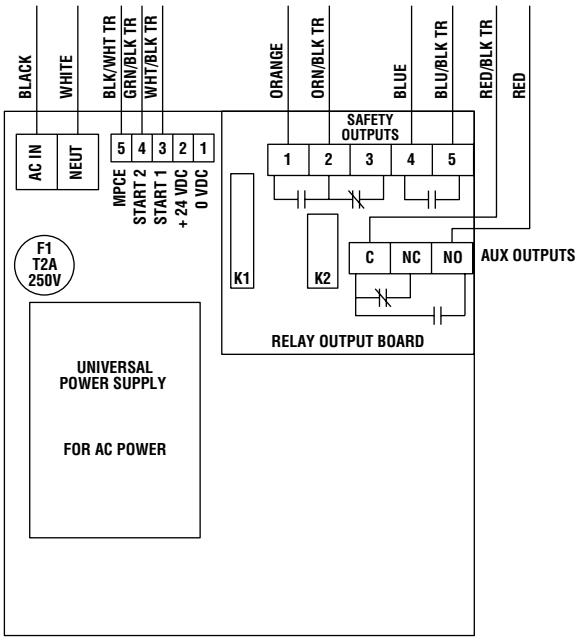


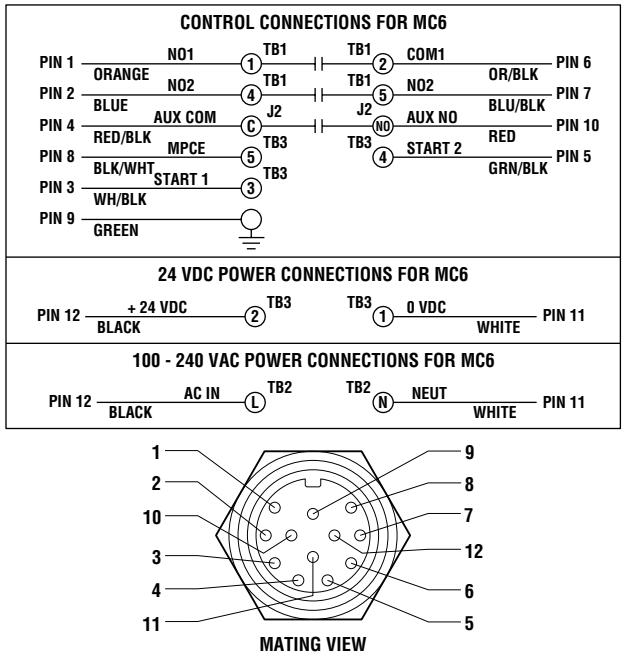


E

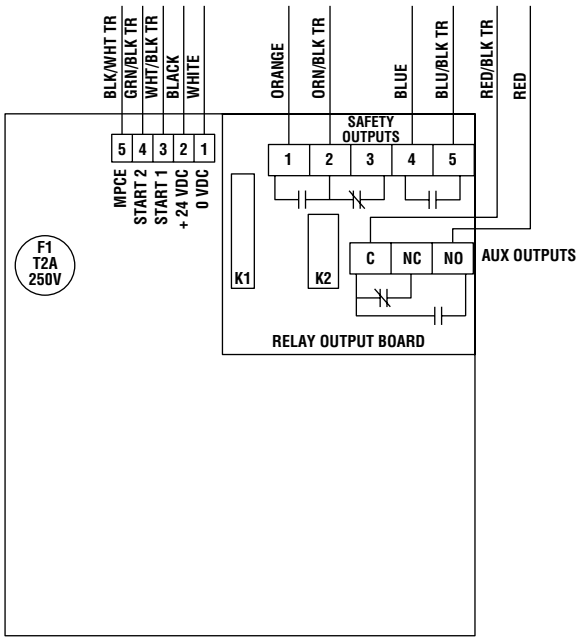
Wiring (continued)

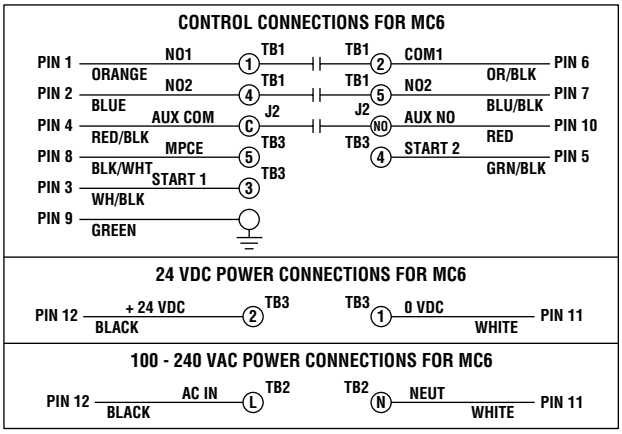
MC6 AC Power, 12-Pin Connector

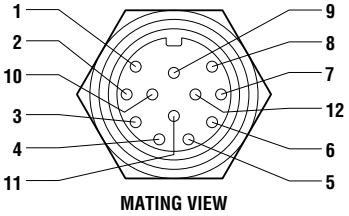




MC6 DC Power, 12-Pin Connector





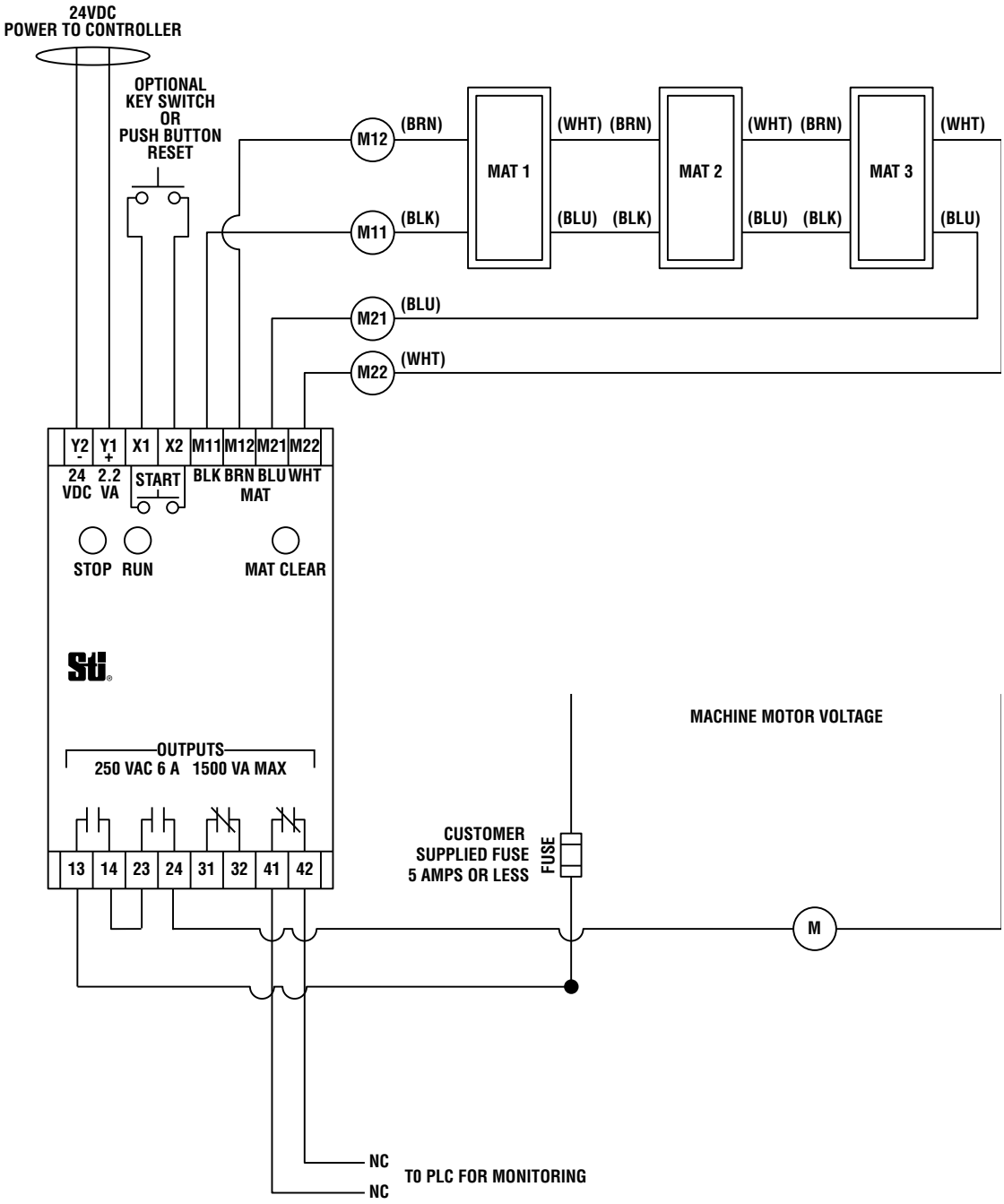


SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Suggested Machine and PLC Connections

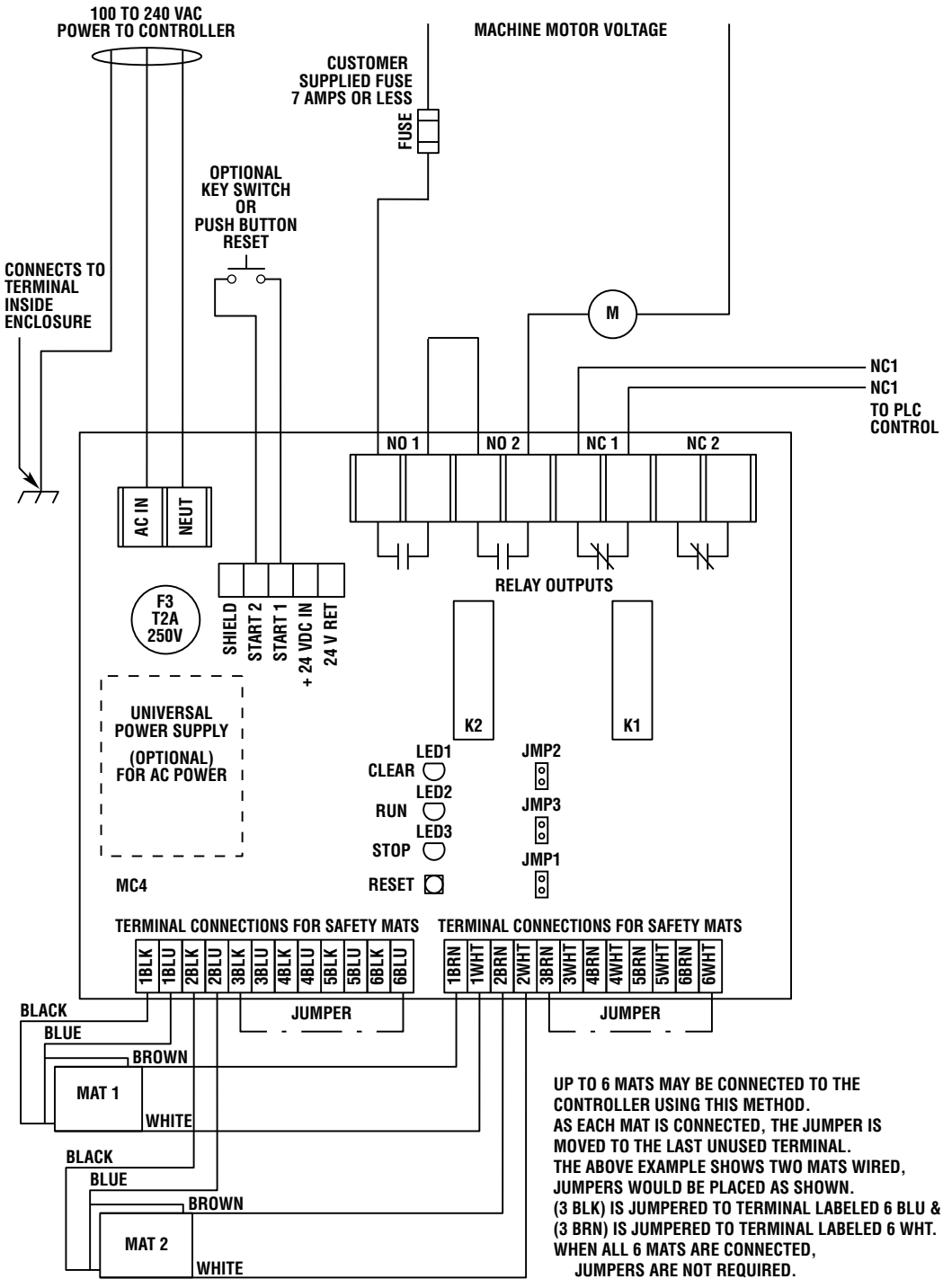
MC3, Two Normally Open Safety Relay Outputs



E

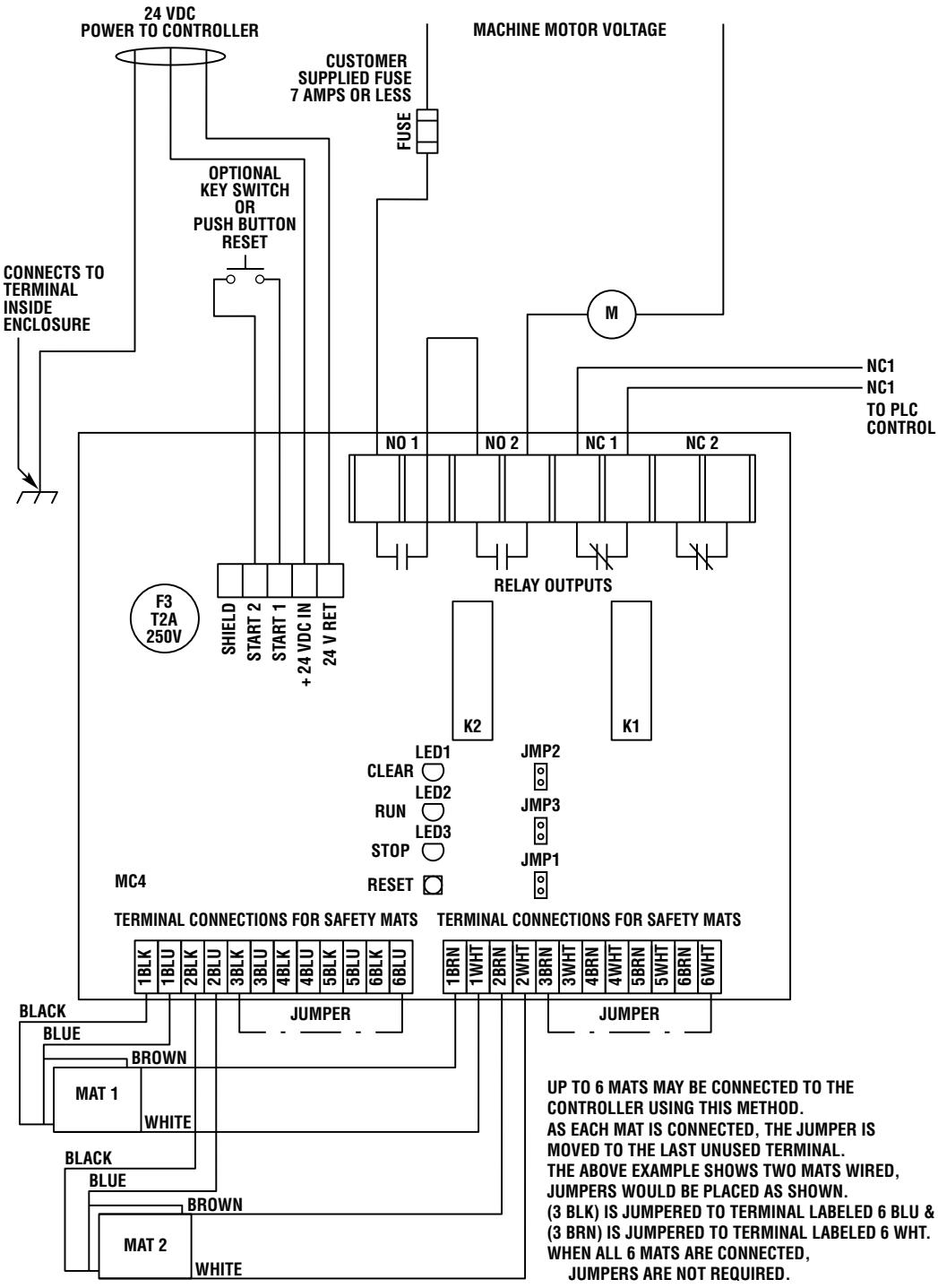
Suggested Machine and PLC Connections (continued)

MC4, Two Normally Open Safety Relay Outputs, 100 to 240 VAC Power



Suggested Machine and PLC Connections (continued)

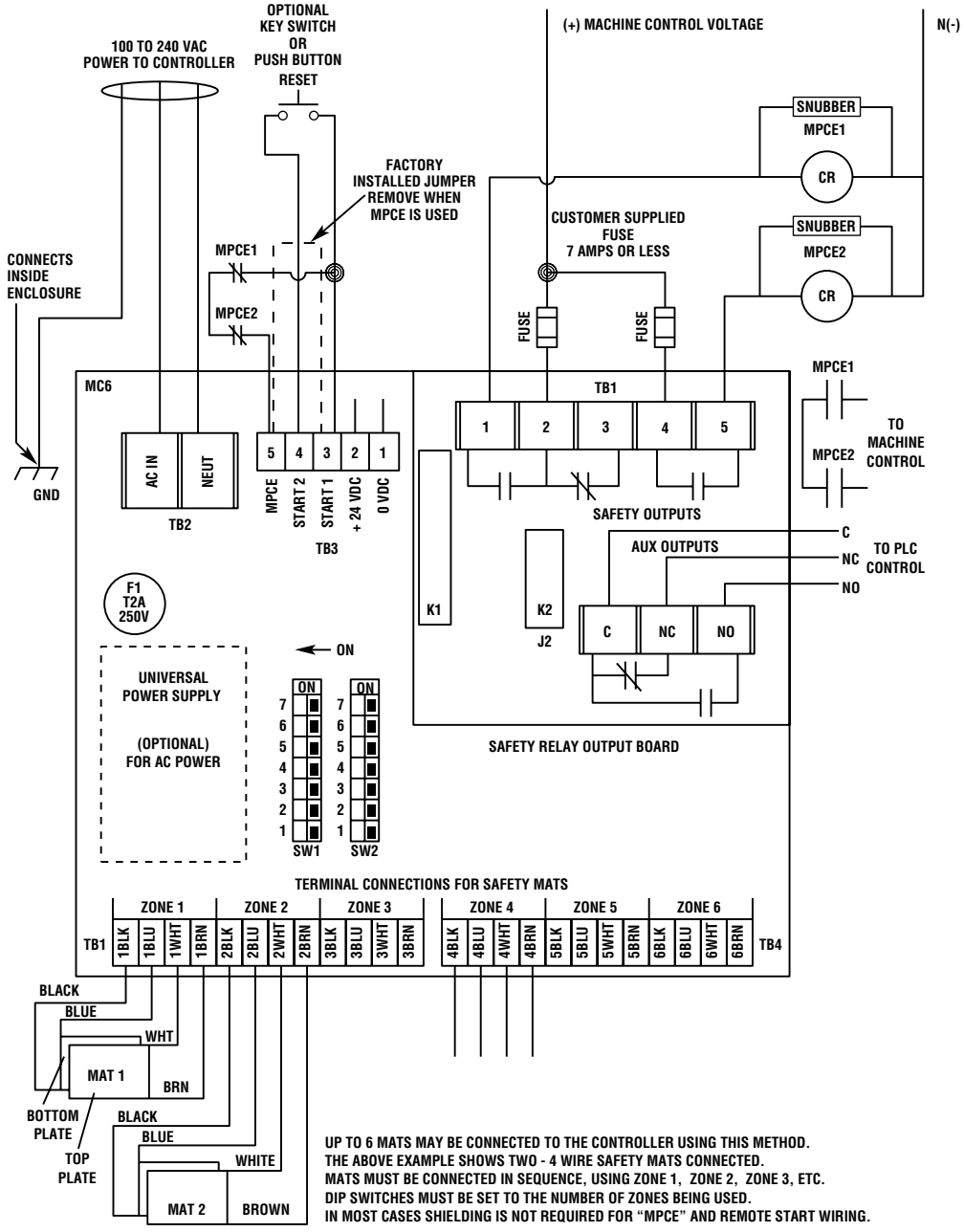
MC4, Two Normally Open Safety Relay Outputs, 24 VDC Power



E

Suggested Machine and PLC Connections (continued)

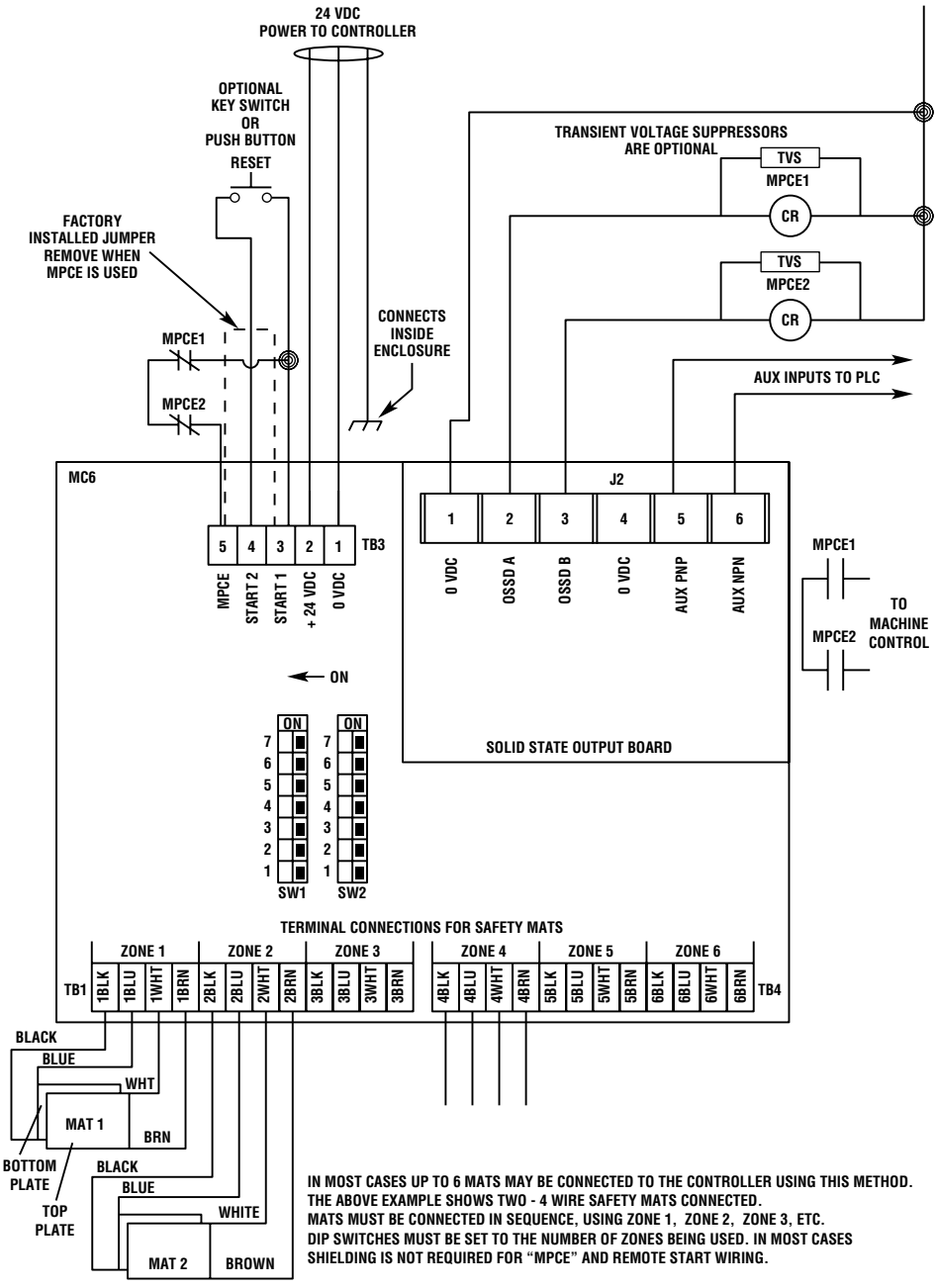
MC6, Two Normally Open Safety Relay Outputs, 100 to 240 VAC Power



UP TO 6 MATS MAY BE CONNECTED TO THE CONTROLLER USING THIS METHOD.
THE ABOVE EXAMPLE SHOWS TWO - 4 WIRE SAFETY MATS CONNECTED.
MATS MUST BE CONNECTED IN SEQUENCE, USING ZONE 1, ZONE 2, ZONE 3, ETC.
DIP SWITCHES MUST BE SET TO THE NUMBER OF ZONES BEING USED.
IN MOST CASES SHIELDING IS NOT REQUIRED FOR "MPCE" AND REMOTE START WIRING.

Suggested Machine and PLC Connections (continued)

MC6, Two Solid-State Safety Outputs, 24 VDC Power



IN MOST CASES UP TO 6 MATS MAY BE CONNECTED TO THE CONTROLLER USING THIS METHOD.
THE ABOVE EXAMPLE SHOWS TWO - 4 WIRE SAFETY MATS CONNECTED.
MATS MUST BE CONNECTED IN SEQUENCE, USING ZONE 1, ZONE 2, ZONE 3, ETC.
DIP SWITCHES MUST BE SET TO THE NUMBER OF ZONES BEING USED. IN MOST CASES
SHIELDING IS NOT REQUIRED FOR "MPCE" AND REMOTE START WIRING.

E

Ordering

MC-3

MC3

MC3 Series Safety Mat Controller

No options are available

MC-4

MC4 – □ □ □ □

Power Input Connector

0 No power input & safety output connector

1 Power input & safety output connector

Lid Mounted Key-switch

0 No key-switch

1 Factory installed lid mounted key-switch

Power Input Voltage

0 24 VDC

1 100-240 VAC auto-selecting

Mat Input Connectors

0 No mat connectors

__ Please specify a number between 1 & 6

MC-6

MC6 □ – □ □ □ □

Input Voltage

AC AC power

DC DC power

Power Input Connector

0 No power input & safety output connector

1 Power input & safety output connector

Lid Mounted Reset Keyswitch

0 No reset keyswitch

1 Factory installed lid mounted reset keyswitch

Safety Output Module

1 Safety relay

2 Solid-state (not available with AC input)

Mat Input Connectors

0 No mat connectors

__ Please specify a number between 1 & 6

Safety Standards and Precautions

A Safety Mat controller is a general purpose, safety mat control device and is not designed for any specific type, model or brand of machine. All safety-related functions of the guarded machine controls including pneumatic, electric, logic or hydraulic controls must be control reliable.

A Safety Mat controller when combined with a four-wire safety mat meets ANSI/RIA R15.06-1999 (R2009), ANSI B11.19-2010 and the following applicable OSHA standards. When used with mechanical power presses, OSHA standard 1910.217(c) applies. For other applications the requirements of section 1910.212 apply.

Only use a Safety Mat controller and four-wire safety mat system on machinery that stops consistently and immediately anywhere in its cycle or stroke. Never use a Safety Mat controller and four-wire safety mat system on a full-revolution clutched press or machine. Access to the point of operation or hazardous machine area not protected by the Safety Mat controller and four-wire safety mat system must be guarded by fencing, barriers or other appropriate methods.

The purchaser, installer and employer are responsible for meeting all local state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See Installation and Operation Manual for details.

All application examples described are for illustration purposes only. Actual installations may differ from those indicated.

Safety Edges

Quick Link S824 omron247.com

Safety Edges (SGE & SCS Series Profiles)

- Profile materials NBR (SCS series only), EPDM or TPE
- Available in six sizes for SGE Series and two sizes for SCS Series

Applicable Controllers

- SCC-1224 Single-Channel Controller
- SCC-1224ND Single-Channel Controller



SCS Quick Link S825 omron247.com

Description

Safety edges are used on edges of guards and gates at possible crushing or shearing points. They are used on gates, machines, and handling equipment to protect people and equipment. Our SGE Series safety edges use the innovative design of co-extruded safety contact as an integral part of the safety edge. A complete unit consists of an aluminum mounting channel, the safety contact, and the safety edge. The special shapes of the EPDM, TPE, or NBR rubber profiles protect the safety contact from damage and allows actuation angles to exceed 90 degrees.

The last safety edge in a serial connection is terminated with a resistor, which is continuously monitored by the controller. This allows the entire circuit to be monitored for shorts and wire breaks.

The SGE Design

SGE series profiles are patented and offer improved technical characteristics with fewer components. Inside the safety edge is the co-extruded switching unit, which consists of two conductive rubber extrusions inside the chamber and a high-isolating material EPDM or TPE outer. Inside of each conductive rubber extrusion is a copper wire with low-resistance evaluation. The molded wiring plug at each end ensures the constant contact of the two conductive rubber extrusions of the switching unit. The end caps seal and protect the safety contact from dirt and water ingression. This innovative design significantly reduces assembly time, saving both time and money.

Important features of the SGE profile:

- Fast, accurate response even during lateral application of force
- Fewer components required for complete assembly
- Fast and easy assembly
- Integrated water drain (some models)
- Reduced weight

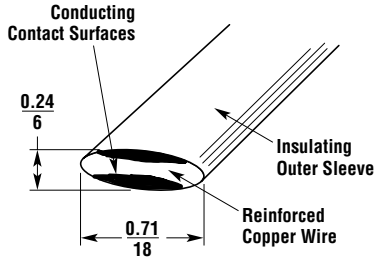
The SGE profile is currently available in six sizes from 8 mm to 65 mm in height. Profiles are available with sealing lips for applications such as doors.



The SCS Design

In SCS series safety edges, the safety contact is inserted into the switching chamber of the safety edge. The two ends are then sealed with a permanently elastic adhesive and end caps to keep the unit watertight.

All SCS series safety edges are available in NBR only.



E

Specifications

	SGE-88	SGE-1510	SGE-125	SGE-225	SGE-245/ SGE-245L	SGE-365 (Black)	SGEY-365 (Yellow)	SCS-2525	SCS-2540
Material:	EPDM	TPE	TPE	EPDM	EPDM	EPDM	TPE	NBR	NBR
Mounting:	DBL Side Tape	Integrated Angle on Profile or SCA-15-9	SCA-15-9	SCA-25/25L	SCA-25/25L	SCA-35/35L	SCA-35/35L	SCA-25/25L	SCA-25/25L
Material Hardness:	68 Shore A	65 Shore A	65 Shore A	68 Shore A	68 Shore A	68 Shore A	68 Shore A	68 Shore A	68 Shore A
Max. Length of a Single Safety Edge:	6.1 m								
Weight:	0.05 kg/m	0.11 kg/m	0.18/0.20 kg/m	0.51/0.5 kg/m	0.77/0.82 kg/m	1.10 kg/m	1.10 kg/m	0.37 kg/m	0.48 kg/m
Enclosure:	IP65								
Mechanical Stability*1:	500 N								
Actuation Distance:	2.1 mm	4.23 mm	7.6 mm	4.5 mm	9.4 mm	5.16 mm	5.16 mm	5.4 mm	4.1 mm
Actuation Force:	70 N with 10 mm/s	88 N with 50 mm/s	76 N	87 N	118 N	72.1 N	72.1 N	134 N	70 N
Maximum Deformation at 400 N:	4.4 mm	4.7 mm	8.6 mm	6.7 mm	17.7 mm	33.78 mm	33.78 mm	11.8 mm	24 mm
Switching Cycles:	10^4								
Switching Angle:	2 x 10°	2 x 20°	2 x 30°	2 x 30°	2 x 45°	2 x 45°	2 x 45°	2 x 45°	2 x 30°
Electrical Capacity:	24 V 100 mA								
Operating Temperature:	-10 to 55°C							+5 to 55°C	0 to 55°C
Storage Temperature:	-25 to 75°C								
Max. Series Connection on the Safety Edges:	5 Connections								
Inactive End Region:	20 mm	25 mm	20 mm	40 mm	20 mm				
Connecting Cable:	2 Conductors, 34 mm^2								

*Actuation forces and distances are tested according to EN 1760-2, Speed 200 mm/s.
*1 Maximum operating force without damaging the edge.
Specifications are subject to change without notice.

Chemical Resistance

Features	TPE*	EPDM**	NBR***
Tear Strength (Resistance)	3	3	2
Ultimate Tensile Strength	3	3	2
Rebound Elasticity at 20°C	2	2	
Resistance Against Permanent Deformation	3-4	2	
Abrasion	3	3	2
Elongation at Tear	4-5	3	3
Cold Flexibility	2	2	3
Heat Stability	4	2	2
Oxidation Stability	1	1	3
UV Stability	1	1	3
Weather/Ozone Resistance	1	1	3
Flame Resistance	6	6	6
Gas Permeability	3	4	2

KEY:
1 = very good
6 = insufficient

*TPE: Thermoplastic Elastomer
Models include: SGE-125, SGEY-365

**EPDM: Ethylene Propylene Rubber: Good resistance to ozone and weathering. Particularly suitable for aggressive chemicals
Models include: SGE-88, SGE-1510, SGE-225, SGE-245, SGE-365

***NBR: Nitrile Butadiene Rubber: Good resistance to petroleum oils, aromatic hydrocarbons, mineral oils, and vegetable oils.
Models include: SCS-2525, SCS-2540

Features	TPE*	EPDM**	NBR***
Water Resistance	1	1-2	1
Diluted Acids	1	2	3
Diluted Bases	1	2	2
Non-Oxidizing Acids	2	2	3
Oxidizing Acids	2	4	5
ASTM Oil #3	2	6	1
Vegetable Oils	1-2	5	1
Organic Solvents		2	5
Ester Solvents	2-3	2	
Ketone Solvents (Containing Oxygen)	2-3	3	5
Aliphatic Hydrocarbons (Gasoline)		5	1
Aromatic Hydrocarbons		6	2-3
Hydrogen Hydrocarbons		6	5
Hydrocarbons	2-3	5-6	
Alcohol	1	1	5

KEY:
1 = No Effects, Permanent Contact
2 = Few Effects, Some Contact
3 = Medium Effects, Some Contact
4 = Noticeable Effects, Reduced Contact
5 = Severe Effects, Very Brief Contact
6 = Extreme Effects, Avoid Contact

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Force Distance

SGE-125:

Characteristic Values for Test Speed v=10 mm/s

Test Temperature	+20°C
Actuating Force Fa (N)	27.3
Actuating Distance Sb (mm)	1.8
Overtravel Distance Sv @ 250N in MM	8.3
Overtravel Distance Sv @ 400N in MM	10.6
Overtravel Distance Sv @ 600N in MM	11.5

Tested according to EN 1760-2, test unit round 80 mm, actuating point C3.

SGE-125:

Characteristic Values for Test Speed v=100 mm/s

Test Temperature	+20°C
Actuating Force Fa (N)	33
Actuating Distance Sb (mm)	1.9
Overtravel Distance Sv @ 250N in MM	10.1
Overtravel Distance Sv @ 400N in MM	11.1
Overtravel Distance Sv @ 600N in MM	12.2

Tested according to EN 1760-2, test unit round 80 mm, actuating point C3.

SGE-225:

Characteristic Values for Test Speed v=10 mm/s

Test Temperature	+20°C
Actuating Force Fa (N)	56.7
Actuating Distance Sb (mm)	3.9
Overtravel Distance Sv @ 250N in MM	2.3
Overtravel Distance Sv @ 400N in MM	6.7
Overtravel Distance Sv @ 600N in MM	12.0

Tested according to EN 1760-2, test unit round 80 mm, actuating point C3.

SGE-225:

Characteristic Values for Test Speed v=100 mm/s

Test Temperature	+20°C
Actuating Force Fa (N)	62.7
Actuating Distance Sb (mm)	4.4
Overtravel Distance Sv @ 250N in MM	2.7
Overtravel Distance Sv @ 400N in MM	7.2
Overtravel Distance Sv @ 600N in MM	12.0

Tested according to EN 1760-2, test unit round 80 mm, actuating point C3.

SGE-245:

Characteristic Values for Test Speed v=10 mm/s

Test Temperature	+20°C
Actuating Force Fa (N)	67.7
Actuating Distance Sb (mm)	7.4
Overtravel Distance Sv @ 250N in MM	15.8
Overtravel Distance Sv @ 400N in MM	18.3
Overtravel Distance Sv @ 600N in MM	21.7

Tested according to EN 1760-2, test unit round 80 mm, actuating point C3.

SGE-245:

Characteristic Values for Test Speed v=100 mm/s

Test Temperature	+20°C
Actuating Force Fa (N)	82.7
Actuating Distance Sb (mm)	7.8
Overtravel Distance Sv @ 250N in MM	15.2
Overtravel Distance Sv @ 400N in MM	17.7
Overtravel Distance Sv @ 600N in MM	21.9

Tested according to EN 1760-2, test unit round 80 mm, actuating point C3.

SGE-365:

Characteristic Values for Test Speed v=10 mm/s

Test Temperature	+20°C
Actuating Force Fa (N)	78.2
Actuating Distance Sb (mm)	5.16
Overtravel Distance Sv @ 250N in MM	29.82
Overtravel Distance Sv @ 400N in MM	33.78
Overtravel Distance Sv @ 600N in MM	36.51

Tested according to EN 1760-2, test unit round 80 mm, actuating point C3.

SGE-365:

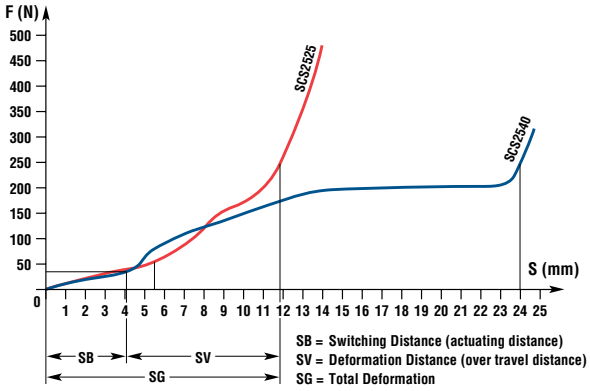
Characteristic Values for Test Speed v=100 mm/s

Test Temperature	+20°C
Actuating Force Fa (N)	107.7
Actuating Distance Sb (mm)	6.23
Overtravel Distance Sv @ 250N in MM	28.37
Overtravel Distance Sv @ 400N in MM	32.76
Overtravel Distance Sv @ 600N in MM	35.34

Tested according to EN 1760-2, test unit round 80 mm, actuating point C3.

Force Distance (continued)

SCS-2525 and SCS-2540



Bending Angles and Radii

The flat aluminum mounting channel must be prepared at the factory if it has to be bent. To order bending safety edges, please consult OMRON Automation and Safety.

Bending angles for different assembly arrangements:

Type	Bending Angle		
	A	B	C
SGE-88	45°	30°	30°
SGE-125	45°	20°	20°
SGE-1510	45°	20°	15°
SGE-225	45°	20°	30°
SGE-245	45°	10°	20°
SGE-245L	45°	10°	20°
SGE-365	45°	10°	15°

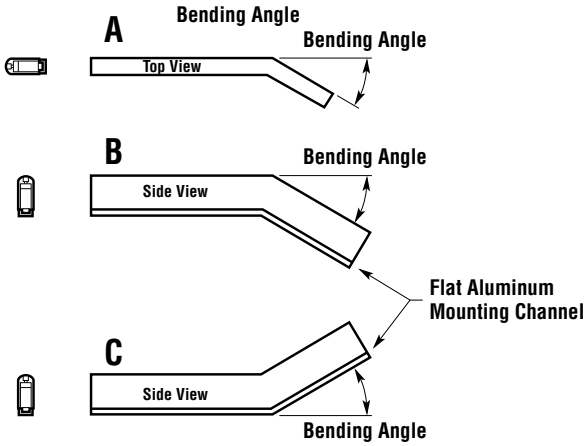


Figure 1

Notes:
By bending the safety edges, the profiles with sealing lip becomes compressed and corrugated.
Bending angle and radii are not part of the tests complying with EN1760-2 and EN12978.

Bending radii for different assembly arrangements:

Type	Bending Radius (mm)		
	Fig. 2	Fig. 3	Fig. 4
SGE-88	200	200	50
SGE-125	200	200	200
SGE-1510	200	200	200
SGE-225	300	400	200
SGE-245	400	500	200
SGE-365	800	800	500

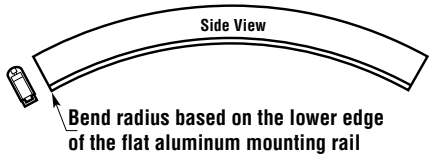


Figure 2

Flat Aluminum
Mounting Channel

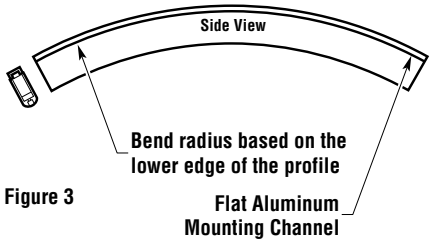


Figure 3

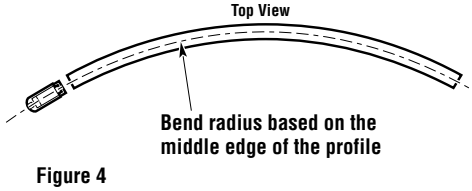


Figure 4

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

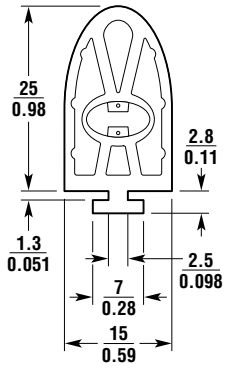
OMRON AUTOMATION & SAFETY

Dimensions

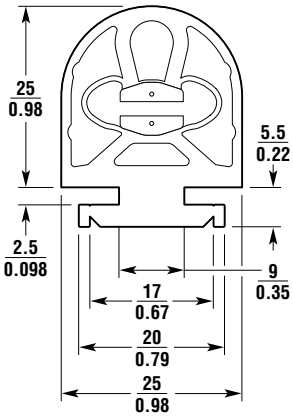
(mm/in.)

Safety Edges

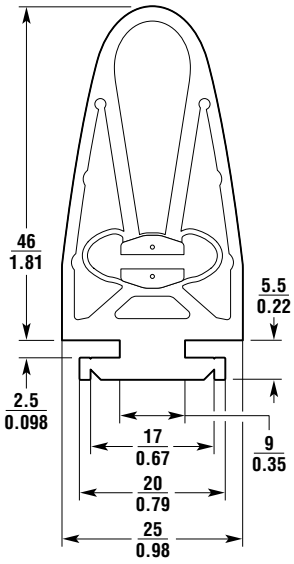
SGE-125



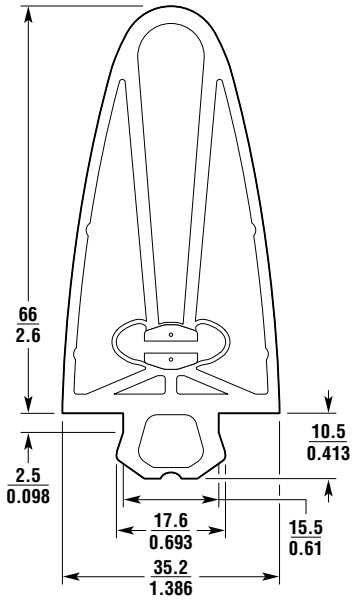
SGE-225



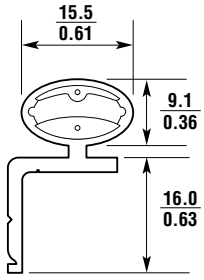
SGE-245



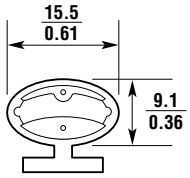
SGE/SGEY-365



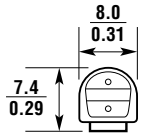
SGE-1510 with "L" Mounting



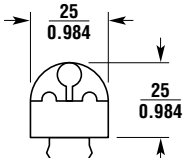
SGE-1510 with "A" Aluminum Mounting



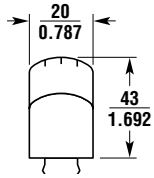
SGE-88



SCS2525

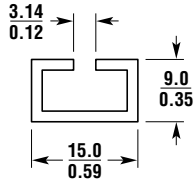


SCS2540

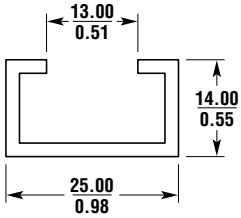


Aluminum Fastening Profiles

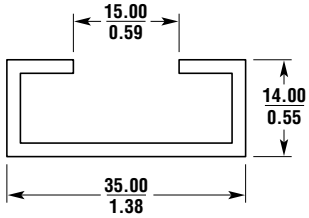
SCA-15-9
(for SGE-1510 and SGE-125)



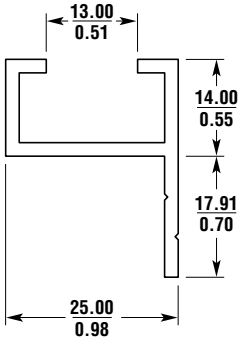
SCA-25
(for SCS/SGE-2xxx)



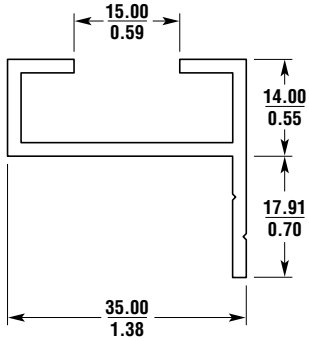
SCA-35
(for SGE-3xxx)



SCA-25L
(for SCS/SGE-2xxx)

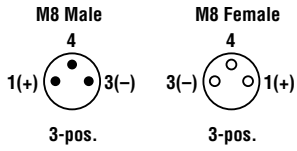


SCA-35L
(for SGE-3xxx)

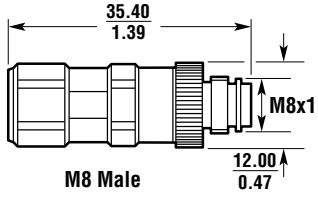


Cable Connectors

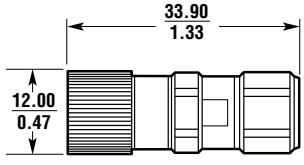
Pin Assignment



Overall Dimension:



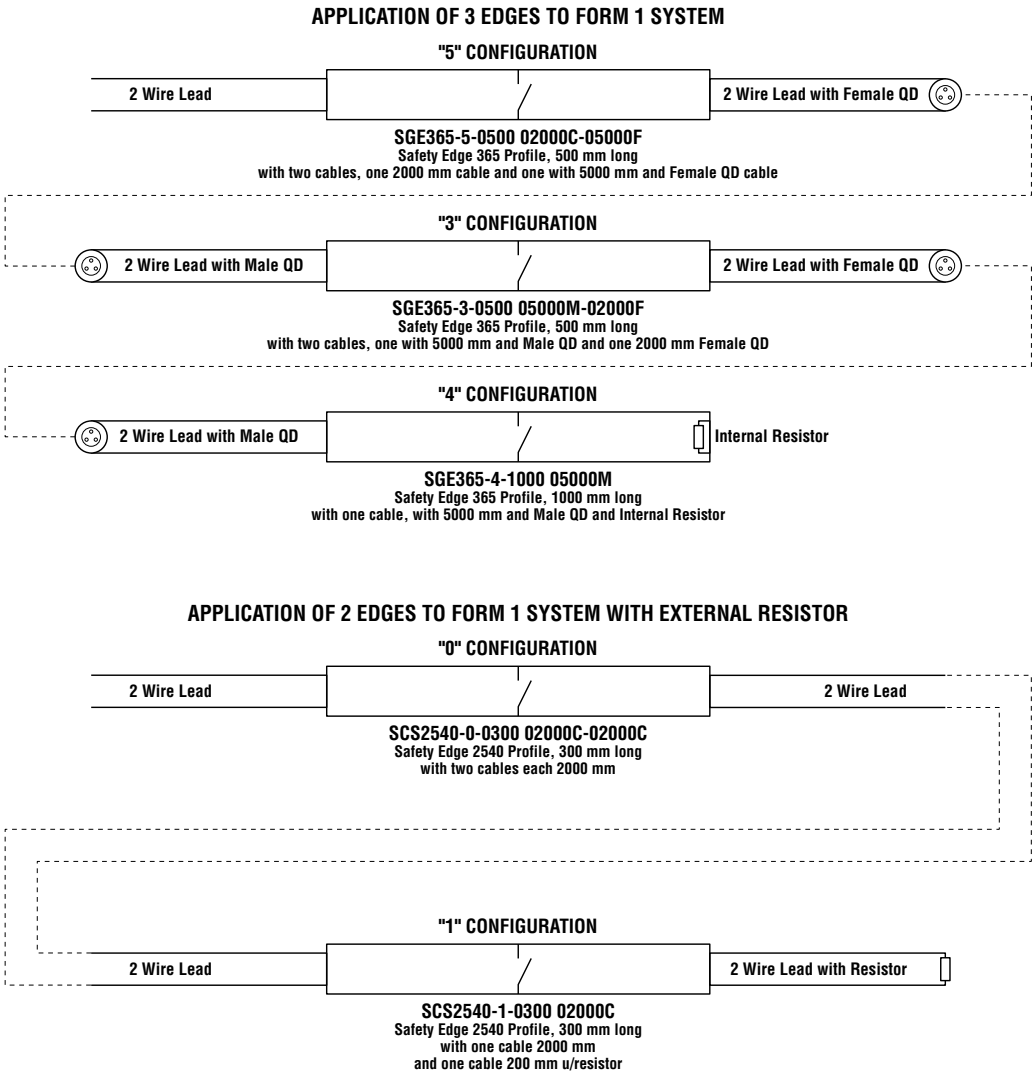
M8 Male



M8 Female

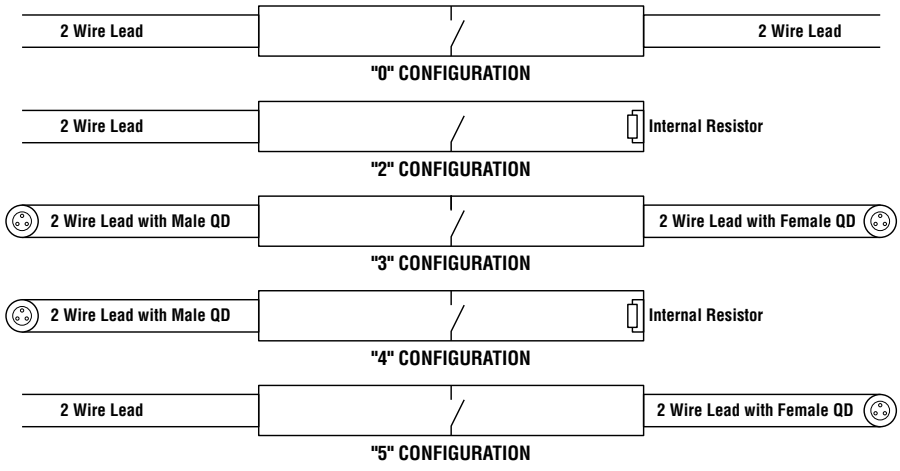
E

Typical Installation



Wiring

Available Configurations



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering

SGE Series

SGE – □ – □ – □ – □ – □ – □

Safety Edge Configuration*

88	8 mm x 8 mm
1510	15 mm x 10 mm
125	15 mm x 25 mm
225	25 mm x 25 mm
245	25 mm x 45 mm
245L	25 mm x 45 mm, with Sealing Lip
365	35 mm x 65 mm, black
Y365	35 mm x 65 mm, yellow

Wiring Configuration

0	Two 2-wire connections
2	One 2- wire connection and one internal resistor connection
3	One quick-disconnect male and one quick-disconnect female connector
4	One quick-disconnect male and one internal resistor connection
5	One quick-disconnect female and 2-wire connection

Length

____ Specify length in increments of 10 mm, from 150 mm up to 6100 mm, use 4-digits

Mounting**

(blank)	Standard Mounting (all except 1510)
L	Angle aluminum mounting channel (all except 1510 and 125)
L	Rubber lip mounting for ONLY SGE-1510
A	Aluminum mounting for ONLY SGE 1510
N	No mounting channel supplied

First Cable Length

____ Specify length in mm from 100 to 10,000 using 5 digits***
End with "C" for wiring configurations 0, 2 or 5.
End with "M" for wiring configurations 3 or 4.
Cables exit bottom of profile, except 125 that exits on right side looking at end.

Second Cable Length

____ Specify length in mm from 100 to 10,000 using 5 digits***
End with "C" for wiring configuration 0.
End with "F" for wiring configurations 3 or 5.
Cables exit bottom of profile, except 125 that exits on left side looking at end.

SCS Series

SCS – □ – □ – □ – □ – □ – □

Safety Edge Configuration*

2525	25 mm x 25 mm (Available in NBR only)
2540	25 mm x 40 mm (Available in NBR only)

Wiring Configuration

0	Two 2-wire connections
1	One 2-wire connection and one external resistor connection
2	One 2- wire connection and one internal resistor connection
3	One quick-disconnect male and one quick-disconnect female connector
4	One quick-disconnect male and one internal resistor connection
5	One quick-disconnect female and 2-wire connection

Length

____ Specify length in increments of 10 mm up to 6100 mm, use 4-digits

Mounting**

(blank)	Standard Mounting
L	Angle aluminum mounting channel
N	No mounting channel supplied

First Cable Length

____ Specify length in mm from 100 to 10,000 using 5 digits***

Second Cable Length

____ Specify length in mm from 100 to 10,000 using 5 digits***

* Standard material for most configurations is EPDM (Exception: Standard material for the SGE-125 and SGEY-365 are TPE; SCS-2525; and SCS-2540 are available in NBR only).

** Angle mounting channel is available for all profiles except the SGE-125 and SGE-1510

*** Examples: SGE-125-2-0150 05000C
SGE-125-3-0150 05000M-05000F
150 mm cable with Male QD = 00150M

**** For non-standard cable exit contact factory

E

Safety Bumpers

Quick Link
S826
omron247.com

Safety Bumpers

- Foam rubber covered in polyurethane, mounted on an aluminum base
- Available in lengths up to 3000 mm;
  Standard sizes:
  53 mm x 100 mm
  100 mm x 200 mm
  150 mm x 300 mm
  200 mm x 400 mm



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Safety Edge Controllers

Quick Link
S827
omron247.com

Single-Channel Safety Edge Controllers

for use with All Safety Edges and Safety Bumpers

- Power requirements
  - 120 VAC or 24 VDC is acceptable for the SCC-1224 single channel units
- Input
  - Single channel units accept a single two-wire edge or bumper system
- Output
  - Single channel units have two safety outputs and one auxiliary output for signaling
- External Device Monitoring –EDM is provided on all units with a N/C loop between Z1 and Z2
- Monitored Reset Modes
  - Monitored manual reset mode that requires closure of the reset circuit followed by opening of the circuit is available on all units
  - Automatic reset mode that occurs upon closure of the reset circuit is available on all units
- Delayed Auxiliary Output – Delayed opening of the auxiliary output for reversal of a door or gate may be selected on all units except SCC1224ND



CE TÜV

Specifications

	SCC-1224 & SCC-1224ND DIN Mount, 115 VAC or 24 VAC/DC Single Input, Safety Output and Aux.
Performance	
Category 3 Safety Device:	Yes
Operating Area:	Up to 5 sensing devices with a total cable length of max. 25 m in series
Response Time:	< 13 msec.
Indications:	Power – Main power supply = Green Actuate – Edge is depressed = Yellow Fault – Detect an irregular signal = Red Aux. Actuate – Activate Aux. output = Orange
Operational Modes (Selectable):	Automatic Start, Start/Restart Interlock
Electrical	
Power Input:	115 VAC, 50/60 Hz, 3 VA or 24 VAC/DC ± 10%, 1.5 W
Safety Output: Maximum Switched Current:	2 N/O Relay 4 A, 250 VAC / 4 A, 30 VDC
Auxiliary Relay Output: Maximum Switched Current:	SCC-1224: Activates after approx. 1 s for approx. 3 s if the sensing device is actuated or faulty; SCC-1224ND: Activates if the sensing device is actuated or if a sensing device fault is detected 4A, 250 VAC / 4A, 30 VDC
Terminal Blocks:	Cage Clamp Terminal Strip, Wire Size 0.75-1.5 mm^2
Input Connections:	1-2 wire edge sensor circuit
Input Resistance:	8.2 K ohm
Input Voltage:	6 V ±2%
Input Current:	1 mA
Mechanical	
Enclosure:	Polyamide PA6.6, Self-extinguishing in accordance with UL-94-V2
Mounting:	35 mm DIN rail
Environmental	
Protection Rating:	IP20
Operating Temperature:	-20 to 55°C (-4 to 131°F)
Shipping Weight:	210 g (7.4 oz.)
Standards Conformity:	CE, TUV
Designed to Meet or Exceed:	Category 3, EN13849-1

Specifications are subject to change without notice.

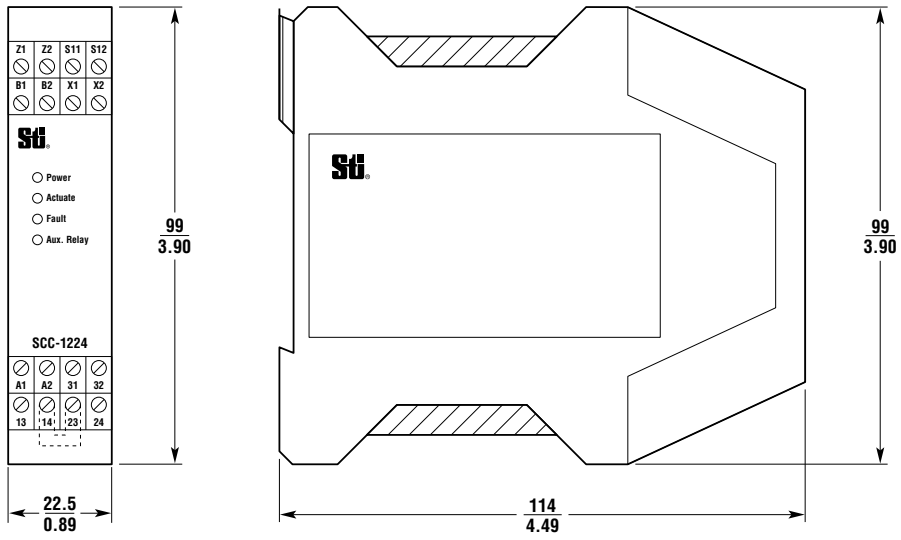
Specifications

	SCC-1224 & SCC-1224ND DIN Mount, 115 VAC or 24 VAC/DC Single Input, Safety Output and Aux.
Performance	
Category 3 Safety Device:	Yes
Operating Area:	Up to 5 sensing devices with a total cable length of max. 25 m in series
Response Time:	< 13 msec.
Indications:	Power – Main power supply = Green Actuate – Edge is depressed = Yellow Fault – Detect an irregular signal = Red Aux. Actuate – Activate Aux. output = Orange
Operational Modes (Selectable):	Automatic Start, Start/Restart Interlock
Electrical	
Power Input:	115 VAC, 50/60 Hz, 3 VA or 24 VAC/DC ± 10%, 1.5 W
Safety Output:	2 N/O Relay
Maximum Switched Current:	4 A, 250 VAC / 4 A, 30 VDC
Auxiliary Relay Output:	SCC-1224: Activates after approx. 1 s for approx. 3 s if the sensing device is actuated or faulty; SCC-1224ND: Activates if the sensing device is actuated or if a sensing device fault is detected
Maximum Switched Current:	4A, 250 VAC / 4A, 30 VDC
Terminal Blocks:	Cage Clamp Terminal Strip, Wire Size 0.75-1.5 mm^2
Input Connections:	1-2 wire edge sensor circuit
Input Resistance:	8.2 K ohm
Input Voltage:	6 V ±2%
Input Current:	1 mA
Mechanical	
Enclosure:	Polyamide PA6.6, Self-extinguishing in accordance with UL-94-V2
Mounting:	35 mm DIN rail
Environmental	
Protection Rating:	IP20
Operating Temperature:	-20 to 55°C (-4 to 131°F)
Shipping Weight:	210 g (7.4 oz.)
Standards Conformity:	CE, TUV
Designed to Meet or Exceed:	Category 3, EN13849-1

Specifications are subject to change without notice.

Dimensions

(mm/in.)



Installation

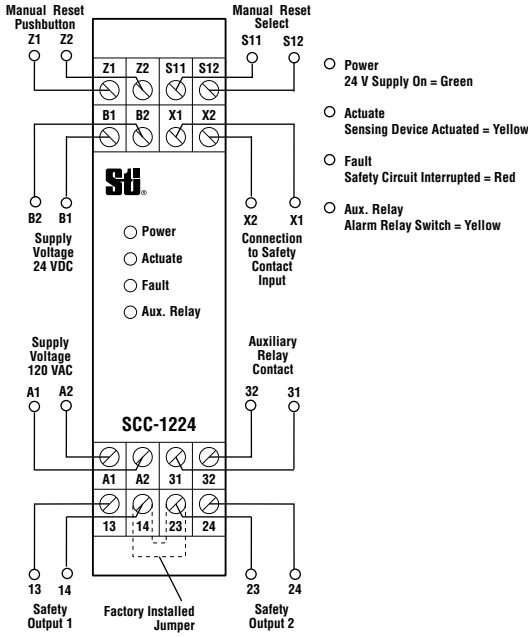
Mounting

The SCC controllers are DIN rail mounted.

Wiring

As with any electrical apparatus, caution must be used when installing, connecting and operating the SCC controllers and safety edges. Please observe all local electrical codes.

SCC-1224 and SCC-1224ND



Ordering

Description	Model Number	Part Number
Single-Channel Safety Edge Din-Mount Controller for use with all safety edges, 120 VAC or 24 VDC; Auxiliary contact closes on activation of safety edge for 2 to 3 seconds then opens (even if edge remains activated)	SCC-1224	43872-0020
Single-Channel Safety Edge Din-Mount Controller for use with all safety edges, 120 VAC or 24 VDC; Auxiliary contact closes when the edge is activated and remains closed as long as the edge is activated	SCC-1224ND	43872-0021

E

Safety Door Switches

Contents

Selection Guide	F-2
Tongue Switches	
D4NS	F-6
T5009 & T5009-6	F-14
T4012	F-20
T4016	F-20
T2008	F-21
D4GS-N	F-26
Guardlocking Switches	
D4SL-N	F-27
D4NL	F-45
TL4019	F-55
TL4024	F-63
D4JL	F-64
Non-Contact Switches	
CM Series	F-73
MA Series	F-85
D40Z/D40A/G9SX-NS	F-91
EC Series	F-108
MA-S Series	F-108
MFS	F-109
Hinged Door Switches	
D4NH	F-109
Explosion-Proof Switch	
XT5009	F-110
Accessories	
D4NS-SK/D4JL-SK	F-110
Accessories	F-111

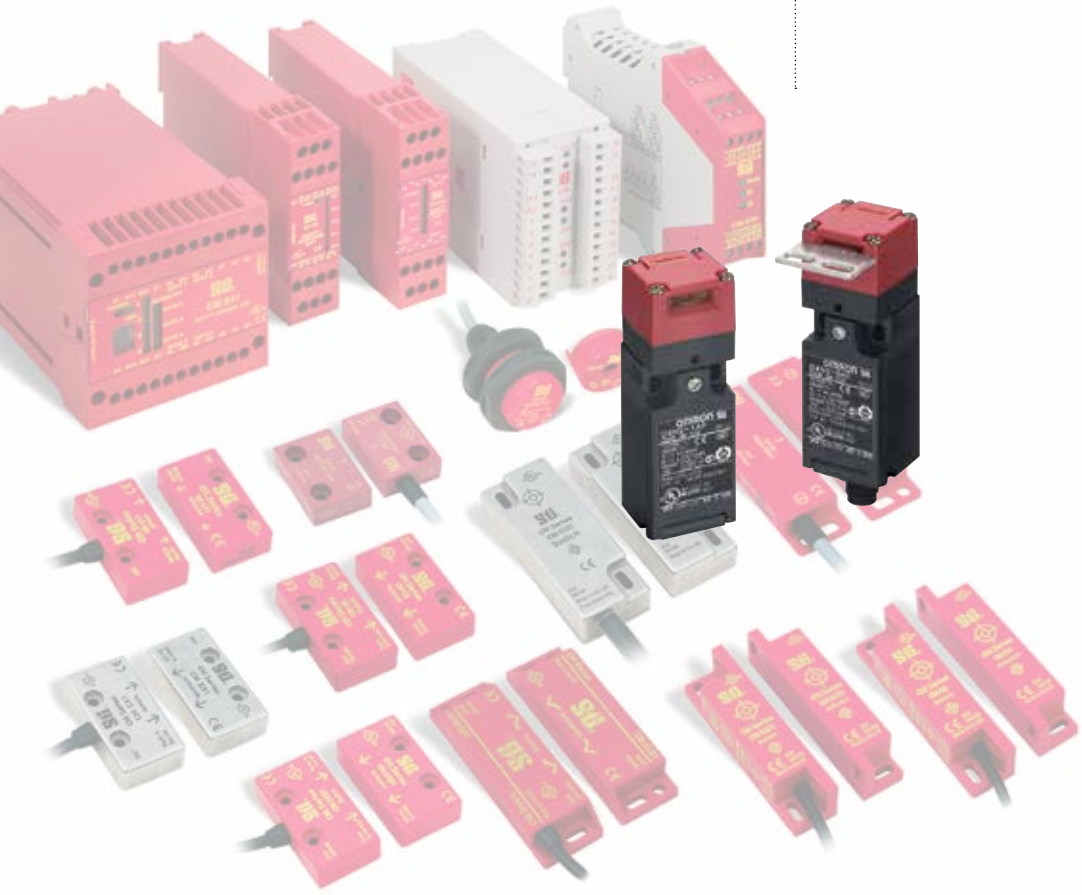
Selection Guide

Selecting the Proper Safety Door Switch for Your Application

Selecting the Correct Safety Door Switch is Easy

Our selection guide will help you with the selection process. First, determine if your application will include the use of mechanical guards. If not, please review the Safety Light Curtain, Safety Mat, or Two-Hand Control products in this catalog.

The following questions will guide you to the appropriate models. Contact OMRON Automation and Safety for assistance.



1 Does it need to operate in an explosive atmosphere?

no → **2** Do you require a safety selector switch?

no

yes ↓

Tongue (Key) Operated

- XT5009

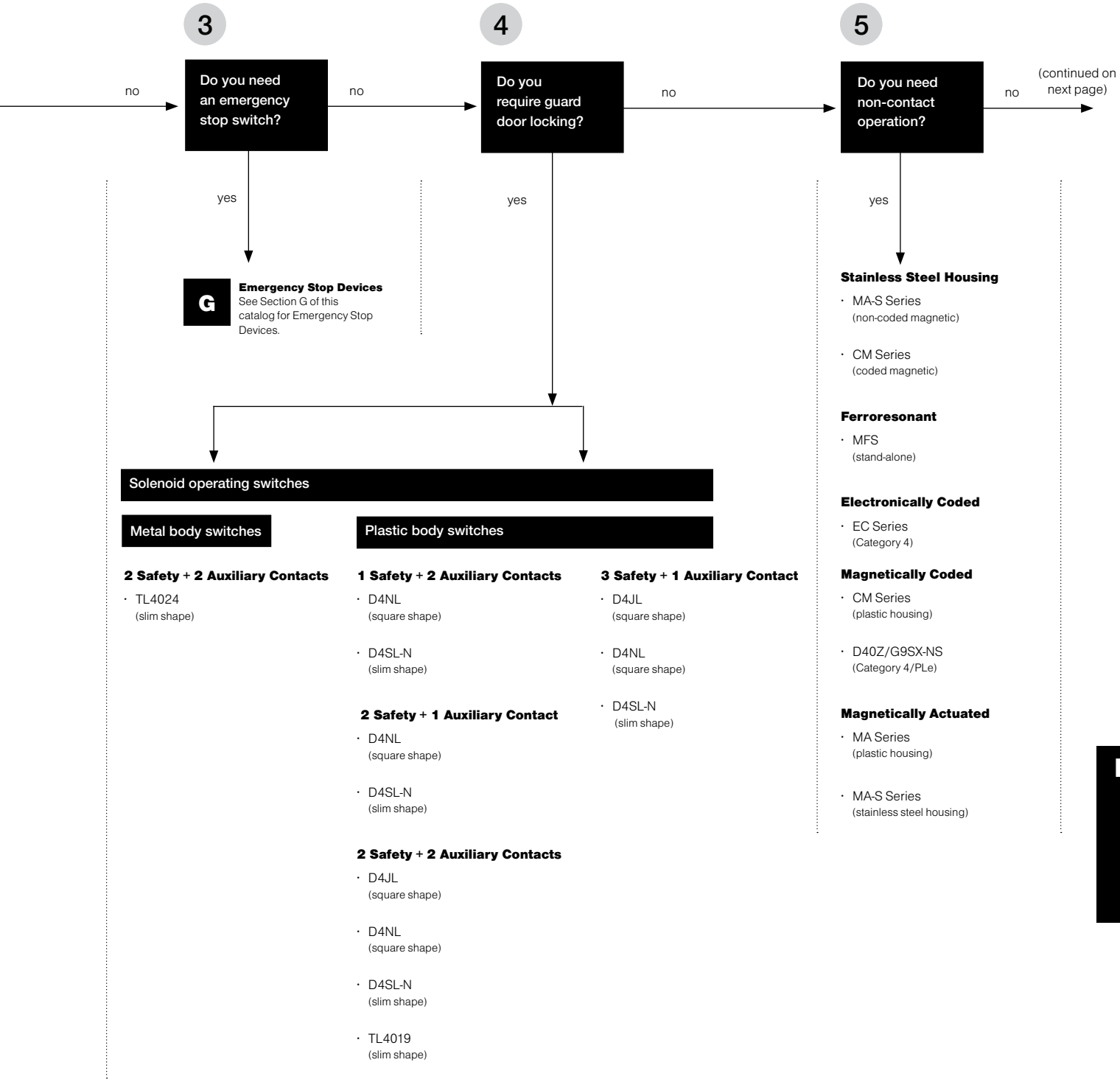
yes ↓

H **Safety Switches and Operator Controls**
See Section H of this catalog for Safety Selector Switches.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Selection Guide (continued)



F

Selection Guide (continued)

6

(continued from previous page)

Do you need tongue (key) operated?

no

7

Do you need hinge operated?

no

8

Do you need limit type?

yes

1 Safety + 1 Auxiliary Contact

- D4GS-N (plastic, 30 x 80 mm)
- D4NS (plastic, 30 x 50 mm)
- T2008 (plastic, 20 x 80 mm)
- T4012 (plastic, 40 x 80 mm)

2 Safety + 0 Auxiliary Contacts

- D4GS-N (plastic, 30 x 80 mm)
- D4NS (plastic, 30 x 50 mm)
- T2008 (plastic, 20 x 80 mm)
- T4012 (plastic, 40 x 80 mm)

2 Safety + 1 Auxiliary Contact

- D4GS-N (plastic, 30 x 80 mm)
- D4NS (plastic, 30 x 50 mm)
- T5009 (plastic, 50 x 90 mm)

2 Safety + 2 Auxiliary Contacts

- D4NS (plastic, 30 x 50 mm)
- T4012 (plastic, 40 x 120 mm)
- T4016 (metal, 40 x 160 mm)
- T5009-6 (plastic, 50 x 90 mm)

3 Safety + 0 Auxiliary Contacts

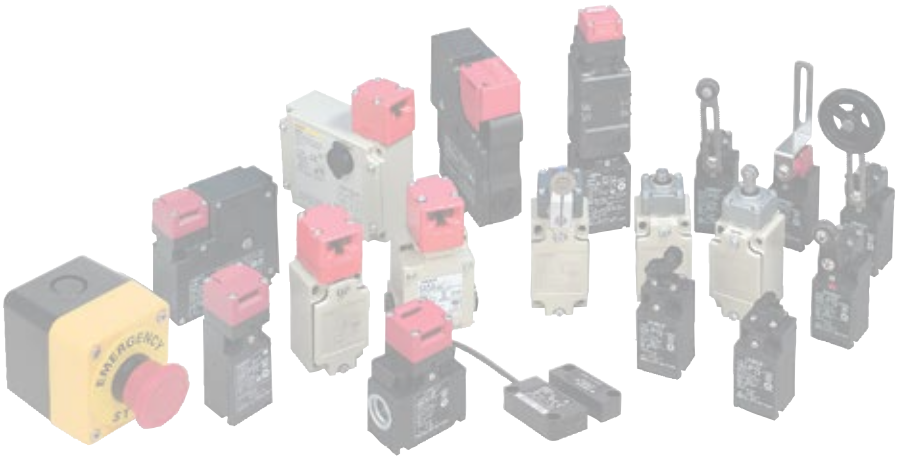
- D4NS (plastic, 30 x 50 mm)

yes

- D4NH (plastic 30 x 80 mm)

yes

H **Safety Switches and Operator Controls**
See Section H of this catalog for Plastic and Metal Safety Limit Switches.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Optional Safety Door Switch Products

Several of our safety interlocks switches can be customized to suit specific application requirements.

Status Indication

The following switches are available with LED status indicators. The indicator lights provide a visual indication of whether the switch is open or closed. LED Conduit Beacons may also be installed as an alternative means of providing status indication to most all switches with conduit openings.

Guard-Locking Switches

- D4JL
  (solenoid operating, plastic, square shape)
- D4NL
  (solenoid operating, plastic, square shape)
- D4SL-N
  (solenoid operating, plastic, slim shape)
- TL4019
  (solenoid operating, plastic, slim shape)
- TL4024
  (solenoid operating, metal, slim shape)

Tongue Switches

- T4016
  (metal, 40 x 160 mm)

Non-Contact Switches

- D40Z/D40A/G9SX-NS
  (magnetically coded, plastic housing)
- MFS
  (stand-alone)



T4016 with
LED Indication

Slide Bolt Assemblies

The following switches may be installed with a slide bolt assembly. The use of a slide bolt assembly simplifies the installation of the switch on many machine guarding applications and provides an integral handle for operation of the guard door.



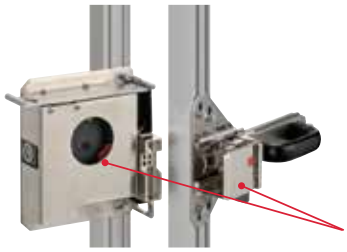
TL4019 with
Metal Slide Bolt

Guard-Locking Switches

- D4JL
  (solenoid operating, plastic, square shape)
- D4SL-N
  (solenoid operating, plastic, slim shape)
- TL4019
  (solenoid operating, plastic, slim shape)
- TL4024
  (solenoid operating, metal, slim shape)

Tongue Switches

- D4NS
  (plastic, 30 x 50 mm)
- T2008
  (plastic, 20 x 80 mm)
- T4012
  (plastic, 40 x 120 mm)
- T4016
  (metal, 40 x 160 mm)



D4JL
Slide Bolt Assembly
with special slide key

Additional Accessories

From spare actuators to our switch locking devices, OMRON Automation and Safety has you covered when it comes to outfitting your safety interlocking needs.

- Slide Mounting Key for D4SL-N
- Slide Mounting Key for D4NS or D4JL
- Replacement Contact Blocks
- Micro Style Cables
- Cabling Components
- Conduit LED Beacons
- Conduit Lights and Remote Indicator
- Security Bits/Drives
- Universal Mounting Brackets
- Switch Locking Devices



Switch Locking Devices



Conduit LED Beacons



Universal Mounting Brackets

F

D4NS

Quick Link
S244
omron247.com

Safety-Door Switch

- Multi-contact, labor-saving, environment-friendly, next-generation safety-door switch
- Lineup includes three contact models with 2NC/1NO and 3NC contact forms and MBB models in addition to the previous contact forms 1NC/1NO, and 2NC
- M12-connector models are available, saving on labor and simplifying replacement.
- Standardized gold-clad contacts provide high contact reliability. Applicable to both standard loads and microloads.
- Variety of metallic heads available



Specifications

Standards and EC Directives

Conforms to the following EC Directives:

- Machinery Directive
- Low Voltage Directive
- EN50047
- EN 1088
- EN 60204-1
- GS-ET-15

Certified Standards

Certification body	Standard	File No.
TÜV SÜD	EN 60947-5-1 (certified direct opening)	Consult your representative for details.
UL *1	UL 508, CSA C22.2 No.14	E76675
CQC (CCC)	GB14048.5	2003010305077330
KOSHA *2	EN60947-5-1	2005-197

*1. Certification for CSA C22.2 No. 14 is authorized by the UL mark.
*2. Only certain models have been certified.

Certified Standard Ratings

TÜV (EN 60947-5-1), CCC (GB14048.5)

Item Utilization category	AC-15	DC-13
Rated operating current (Ie)	3 A	0.27 A
Rated operating voltage (Ue)	240 V	250 V

Note: Use a 10 A fuse type gI or gG that conforms to IEC 60269 as a short-circuit protection device. This fuse is not built into the Switch.

UL/CSA (UL 508, CSA C22.2 No. 14)
A300

Rated voltage	Carry current	Current (A)		Volt-amperes (VA)	
		Make	Break	Make	Break
120 VAC	10 A	60	6	7,200	720
240 VAC		30	3		

Q300

Rated voltage	Carry current	Current (A)		Volt-amperes (VA)	
		Make	Break	Make	Break
125 VDC	2.5 A	0.55	0.55	69	69
250 VDC		0.27	0.27		

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Specifications (continued)

Characteristics

Degree of protection *1		IP67 (EN60947-5-1)
Durability *2	Mechanical	1,000,000 operations min.
	Electrical	500,000 operations min. (3 A resistive load at 250 VAC) *3 300,000 operations min. (10 A resistive load at 250 VAC)
Operating speed		0.05 to 0.5 m/s
Operating frequency		30 operations/minute max.
Direct opening force *4		60 N min.
Direct opening travel *4		10 mm min.
Contact resistance		25 mΩ max.
Minimum applicable load *5		1 mA resistive load at 5 VDC (N-level reference value)
Rated insulation voltage (Ui)		300 V
Rated frequency		50/60 Hz
Protection against electric shock		Class II (double insulation)
Pollution degree (operating environment)		3 (EN60947-5-1)
Impulse withstand voltage (EN60947-5-1)	Between terminals of same polarity	2.5 kV
	Between terminals of different polarity	4 kV
	Between each terminals and non-current carrying metallic parts.	6 kV
Insulation resistance		100 MΩ min.
Contact gap		2 x 2 mm min.
Vibration resistance		10 to 55 Hz, 0.75 mm single amplitude
Shock resistance	Destruction	1,000 m/s^2 min.
	Malfunction	300 m/s^2 min.
Conditional short-circuit current		100 A (EN60947-5-1)
Conventional free air thermal current (Ith)		10 A (EN60947-5-1)
Ambient operating temperature		-30 to +70°C (with no icing)
Ambient operating humidity		95% max.
Weight		Approx. 96 g (D4NS-1CF)

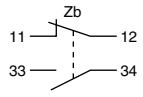
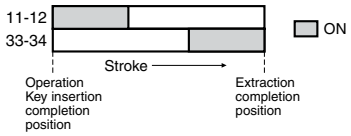
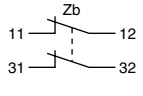
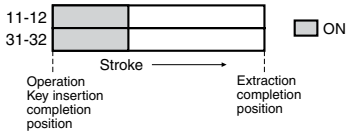
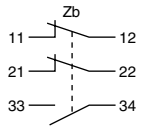
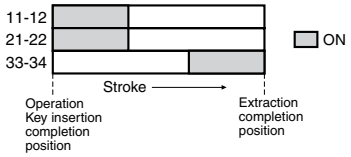
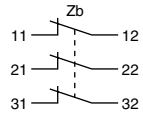
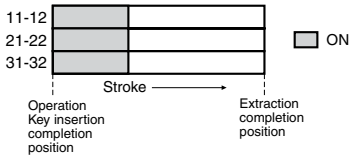
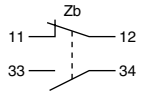
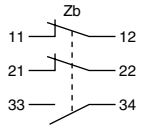
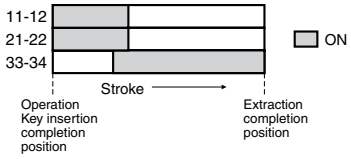
Notes: The above values are initial values.
The Switch contacts can be used with either standard loads or microloads. Once the contacts have been used to switch a load, however, they cannot be used to switch smaller loads. The contact surfaces will become rough once they have been used and contact reliability for smaller loads may be reduced.
*1. The degree of protection is tested using the method specified by the standard (EN60947-5-1). Confirm that sealing properties are sufficient for the operating conditions and environment beforehand. Although the switch box is protected from dust or water penetration, do not use the D4NS in places where foreign material may enter through the key hole on the head, otherwise Switch damage or malfunctioning may occur.
*2. The durability is for an ambient temperature of 5 to 35°C and an ambient humidity of 40% to 70%. For further conditions, consult your sales representative.
*3. Do not pass a 3 A, 250 VAC load through more than two circuits.
*4. These figures are minimum requirements for safe operation.
*5. This value will vary with the switching frequency, environment, and reliability level. Confirm that correct operation is possible with the actual load beforehand.

F

Connections

Contact Form

Diagrams show state with key inserted.

Model	Contact	Contact form	Operating pattern	Remarks
D4NS-☐A☐	1NC/1NO			Only NC contacts 11-12 have a certified direct opening mechanism. (→) The terminals 11-12 and 33-34 can be used as unlike poles.
D4NS-☐B☐	2NC			NC contacts 11-12 and 31-32 have a certified direct opening mechanism. (→) The terminals 11-12 and 31-32 can be used as unlike poles.
D4NS-☐C☐	2NC/1NO			NC contacts 11-12 and 21-22 have a certified direct opening mechanism. (→) The terminals 11-12, 21-22, and 33-34 can be used as unlike poles.
D4NS-☐D☐	3NC			NC contacts 11-12, 21-22, and 31-32 have a certified direct opening mechanism. (→) The terminals 11-12, 21-22, and 31-32 can be used as unlike poles.
D4NS-☐E☐	1NC/1NO MBB*			Only NC contacts 11-12 have a certified direct opening mechanism. (→) The terminals 11-12 and 33-34 can be used as unlike poles.
D4NS-☐F☐	2NC/1NO MBB*			NC contacts 11-12 and 21-22 have a certified direct opening mechanism. (→) The terminals 11-12, 21-22 and 33-34 can be used as unlike poles.

*MBB (Make Before Break) contacts have an overlapping structure, so that before the normally closed contact (NC) opens, the normally open contact (NO) closes.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

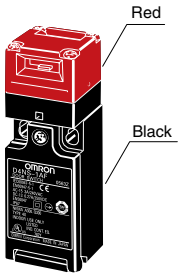
OMRON AUTOMATION & SAFETY

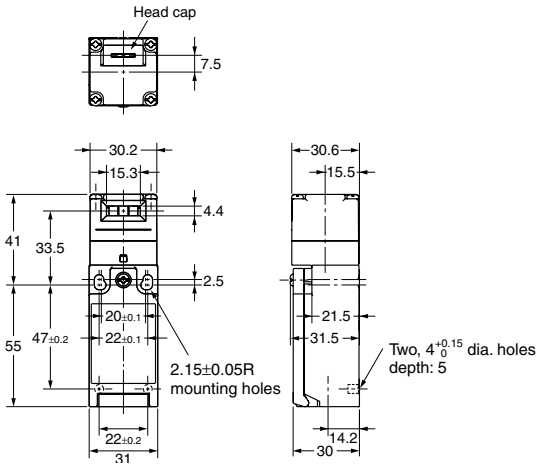
Dimensions and Operating Characteristics

(mm)

1-Conduit Models

D4NS-1□F
D4NS-2□F
D4NS-4□F



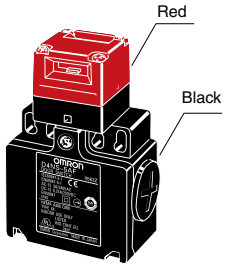


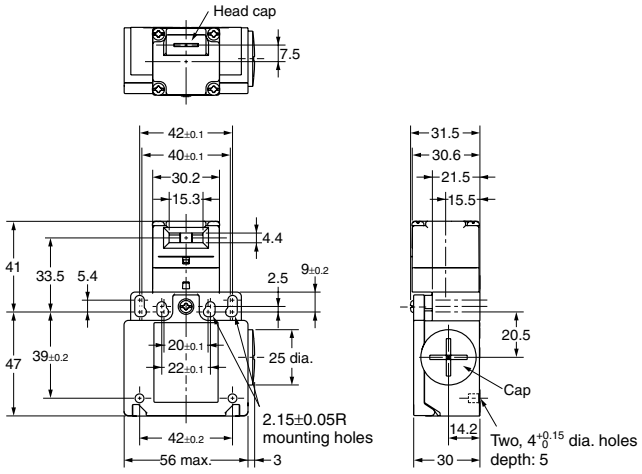
Model / Operating characteristics	D4NS-1@F D4NS-2@F D4NS-3@F D4NS-4@F
Key insertion force Key extraction force	15 N max. 30 N max.
Pretravel (PT)	6±3 mm
Total travel (TT)	(28 mm)
Direct opening force * Direct opening stroke *	60 N min. 10 mm min.

* Always maintain the above operating characteristics for safe use.

2-Conduit Models

D4NS-6□F
D4NS-8□F



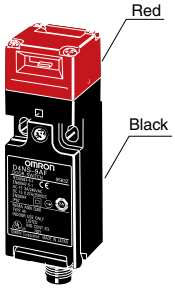


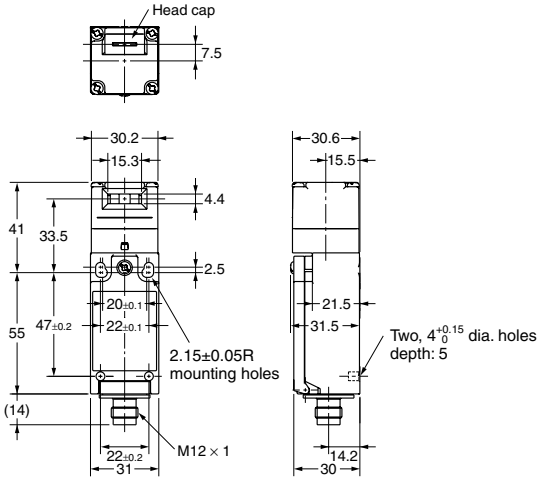
Model / Operating characteristics	D4NS-5@F D4NS-6@F D4NS-7@F D4NS-8@F
Key insertion force Key extraction force	15 N max. 30 N max.
Pretravel (PT)	6±3 mm
Total travel (TT)	(28 mm)
Direct opening force * Direct opening stroke *	60 N min. 10 mm min.

* Always maintain the above operating characteristics for safe use.

1-Conduit Connector Models

D4NS-9□F





Model / Operating characteristics	D4NS-9□F
Key insertion force Key extraction force	15 N max. 30 N max.
Pretravel (PT)	6±3 mm
Total travel (TT)	(28 mm)
Direct opening force ✻ Direct opening stroke ✻	60 N min. 10 mm min.

✻ Always maintain the above operating characteristics for safe use.

Notes:
1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. There are fluctuations in the contact ON/OFF timing for Switches with multiple poles (2NC, 2NC/1NO, or 3NC). Confirm performance before application.

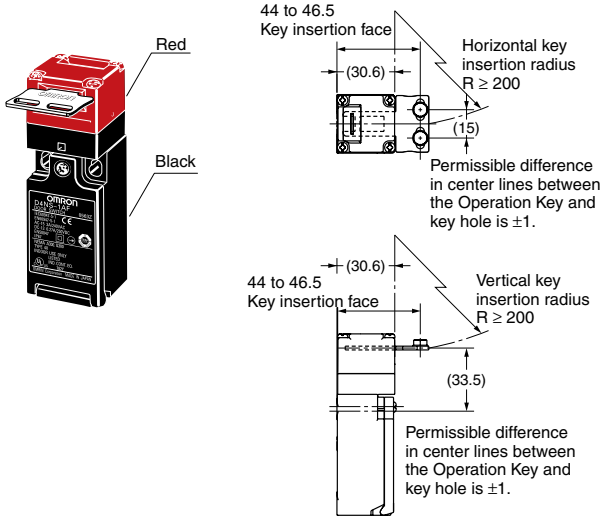
F

Dimensions and Operating Characteristics (continued)

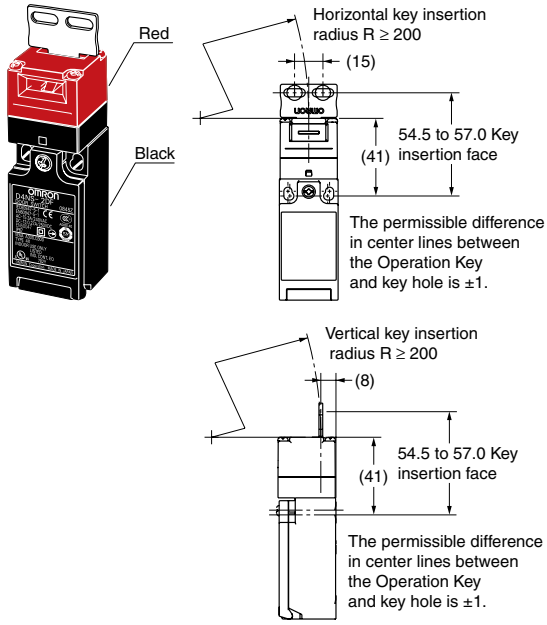
(mm)

With Operation Key Inserted (Relationship between Insertion Radius and Key Hole)

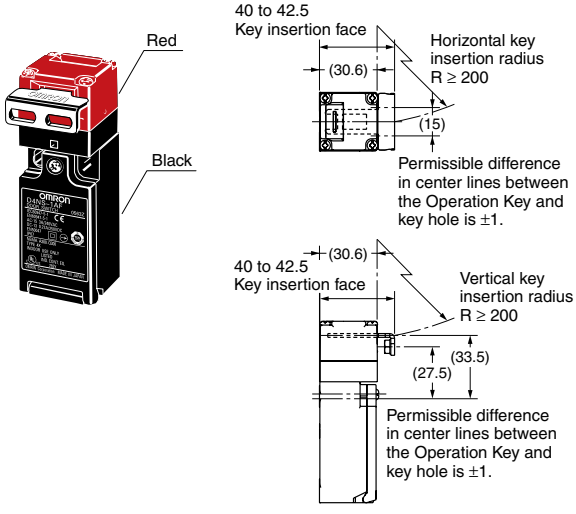
D4NS-1□F + D4DS-K1 (with Front-inserted Operation Key)



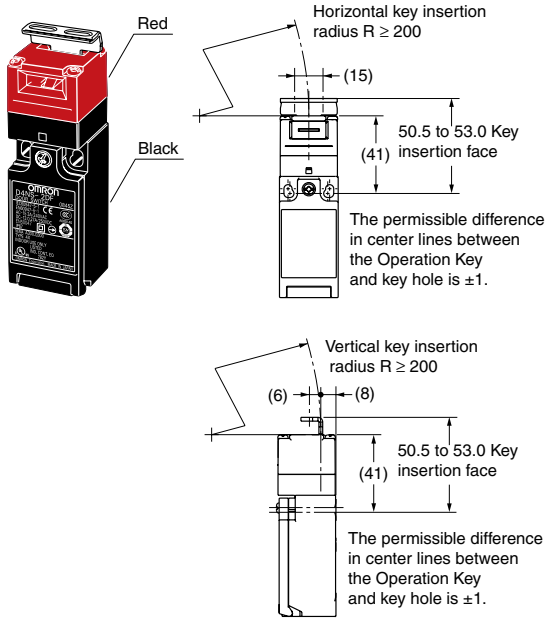
D4NS-1□F + D4DS-K1 (with Top-inserted Operation Key)



D4NS-1□F + D4DS-K2 (with Front-inserted Operation Key)



D4NS-1□F + D4DS-K2 (with Top-inserted Operation Key)



Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

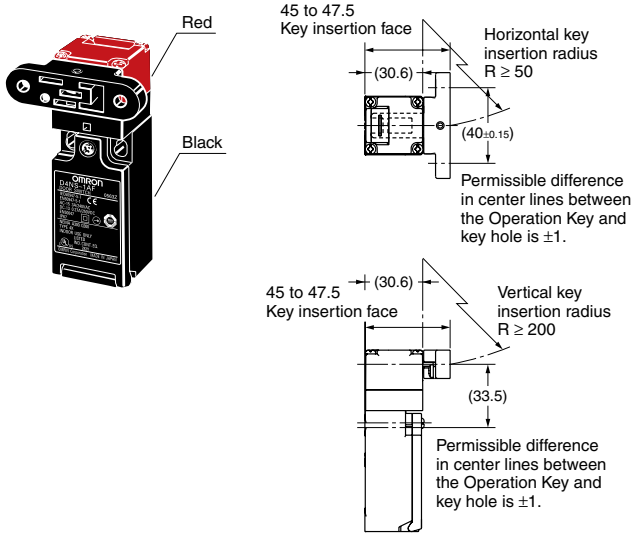
For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

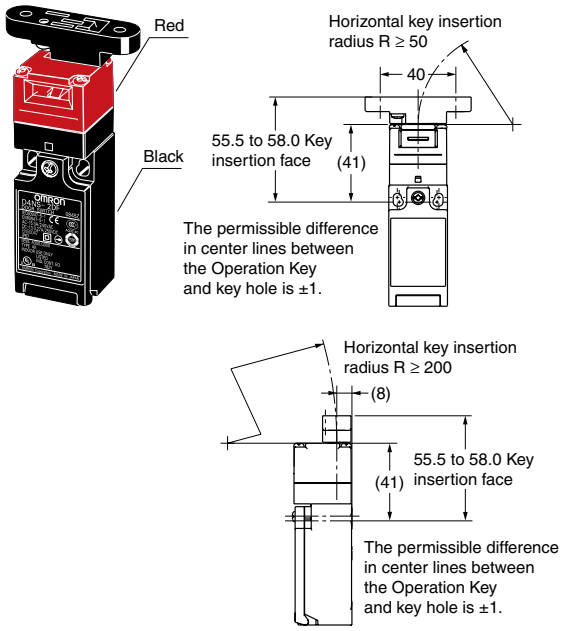
Dimensions and Operating Characteristics (continued)

(mm)

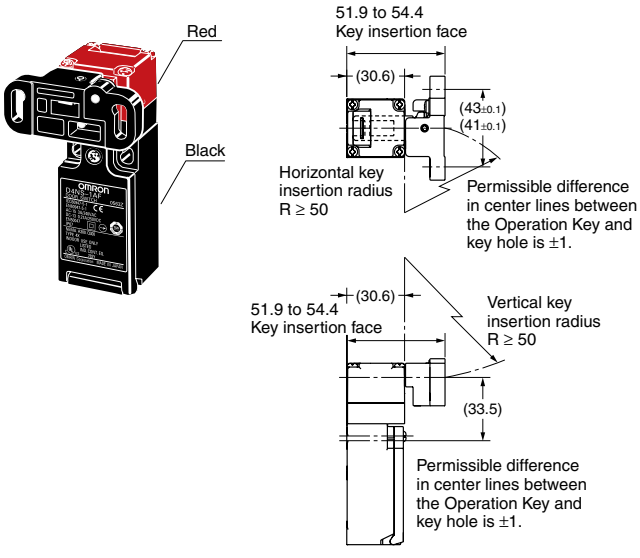
D4NS-1□F + D4DS-K3 (with Front-inserted Operation Key)



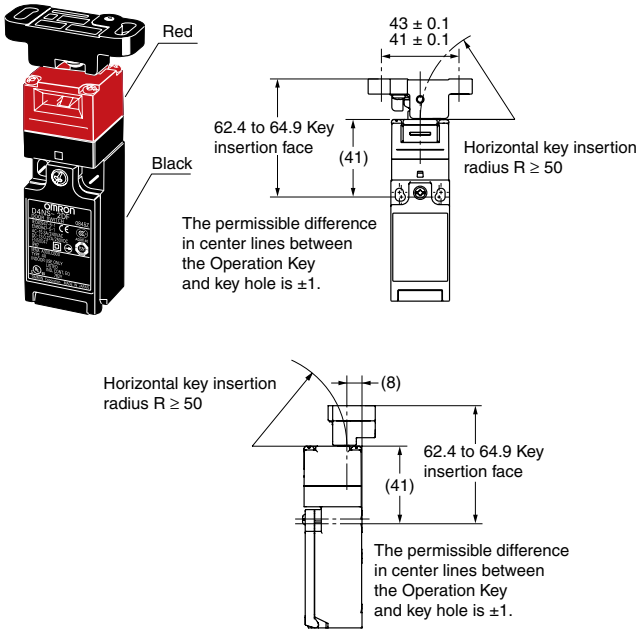
D4NS-1□F + D4DS-K3 (with Top-inserted Operation Key)



D4NS-1□F + D4DS-K5 (with Front-inserted Operation Key)



D4NS-1□F + D4DS-K5 (with Top-inserted Operation Key)



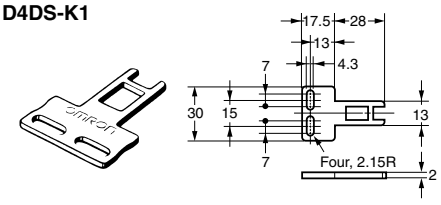
F

Dimensions and Operating Characteristics (continued)

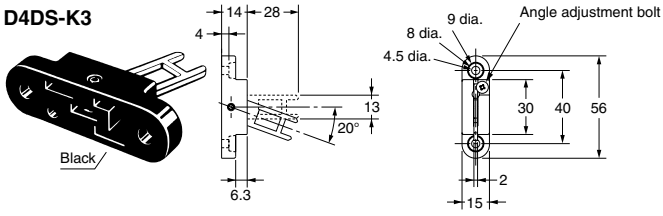
(mm)

Operation Keys

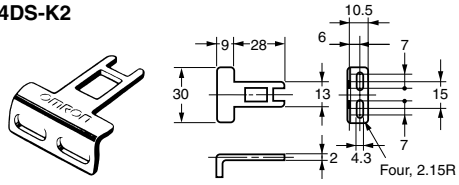
D4DS-K1



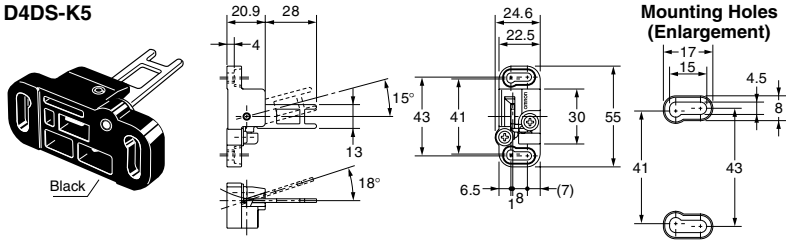
D4DS-K3



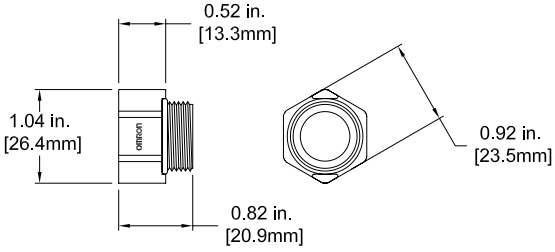
D4DS-K2



D4DS-K5



M20-NPT Adapter



Ordering

Model Number Structure

Switch

D4NS – ☐ ☐ ☐ – ☐

❶ ❷ ❸ ❹

❶ Conduit Size
- 1: Pg13.5 (1-conduit)
- 2: G1/2 (1-conduit)
- 4: M20 (1-conduit)
- 6: G1/2 (2-conduit)
- 8: M20 (2-conduit)
- 9: M12 connector (1-conduit) (only 4-pin is available)

❷ Built-in Switch (with Door Open/Closed Detection Switch and Lock Monitor Switch Contacts)
- A: 1NC/1NO (slow-action)
- B: 2NC (slow-action)
- C: 2NC/1NO (slow-action)
- D: 3NC (slow-action)
- E: 1NC/1NO (MBB contact)
- F: 2NC/1NO (MBB contact)

❸ Head Mounting Direction
- F: Four mounting directions possible (Front-side mounting at shipping)/ plastic
- D: Four mounting directions possible (Front-side mounting at shipping)/ metal

❹ M20-to-NPT Adapter
Blank: Adapter is not included
NPT: Adapter is included*

Note: An order for the head part or the switch part alone cannot be accepted. (The operation key is sold separately.)

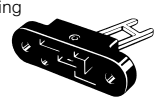
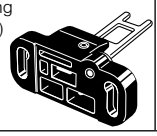
*Not available with 2-conduit models.

Operation Key

D4DS-K ☐

❶

❶ Operation Key Type
- 1: Horizontal mounting
- 2: Vertical mounting
- 3: Adjustable mounting (horizontal)
- 5: Adjustable mounting (horizontal/ vertical)

Type	Model
Horizontal mounting 	D4DS-K1
Vertical mounting 	D4DS-K2
Adjustable mounting (horizontal) 	D4DS-K3
Adjustable mounting (horizontal/vertical) 	D4DS-K5

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering (continued)

List of Models

Switches with certified direct opening mechanisms (Operation Keys are sold separately)

Type	Contact configuration		Conduit opening/Connector	Model
1-Conduit	Slow-action	1NC/1NO	Pg13.5	D4NS-1AF *
			G1/2	D4NS-2AF *
			NPT	D4NS-4AF-NPT
			M20	D4NS-4AF
		2NC	Pg13.5	D4NS-1BF *
			G1/2	D4NS-2BF *
			NPT	D4NS-4BF-NPT
			M20	D4NS-4BF
		2NC/1NO	Pg13.5	D4NS-1CF *
			G1/2	D4NS-2CF *
			NPT	D4NS-4CF-NPT
			M20	D4NS-4CF
		3NC	Pg13.5	D4NS-1DF *
			G1/2	D4NS-2DF *
			NPT	D4NS-4DF-NPT
			M20	D4NS-4DF
	Slow-action MBB contact	1NC/1NO	Pg13.5	D4NS-1EF
			G1/2	D4NS-2EF
			NPT	D4NS-4EF-NPT
			M20	D4NS-4EF
		2NC/1NO	Pg13.5	D4NS-1FF
			G1/2	D4NS-2FF
			NPT	D4NS-4FF-NPT
			M20	D4NS-4FF
2-Conduit	Slow-action	1NC/1NO	G1/2	D4NS-6AF
			M20	D4NS-8AF
		2NC	G1/2	D4NS-6BF
			M20	D4NS-8BF
		2NC/1NO	G1/2	D4NS-6CF
			M20	D4NS-8CF
		3NC	G1/2	D4NS-6DF
			M20	D4NS-8DF
	Slow-action MBB contact	1NC/1NO	G1/2	D4NS-6EF
			M20	D4NS-8EF
		2NC/1NO	G1/2	D4NS-6FF
			M20	D4NS-8FF
1-Conduit, with connector	Slow-action	1NC/1NO	M12 connector	D4NS-9AF
		2NC		D4NS-9BF
	Slow-action MBB contact	1NC/1NO		D4NS-9EF

1. The recommended models for equipment and machinery being exported to Europe are those with an M20 or Pg13.5 conduit sizes, and for North America, the recommended models are those with a NPT conduit sizes.
2. Resin is used as the material for the D4NS housing and head. Use the metal D4BS Safety-door Switch for applications requiring greater mechanical strength.

*Models with Korean S-mark certification.

F

T5009 & T5009-6

Quick Link
S249
omron247.com

Universal Tongue-Operated Safety Interlock Switch

- Strong and versatile—the compact size of the strong, glass-filled polyester housing and metal reinforced cam allows this popular switch to be used in most applications
- NEMA 6 enclosure enables these switches to withstand water washdown cleaning.
- Rotatable head gives four possible actuator entry points for versatile installation. A blanking plug is supplied for the unused entry.
- Small swing radius allows use on doors with a swing radius as small as 2.5 in. when using the optional flexible actuators
- Hi-Hold models reduce nuisance rips and allow the switch to also serve as the gate catch without the need to mount any additional hardware.
- The 4 contact poles provide 2 poles for dual channel safety monitoring and 2 additional poles for status monitoring
- Optional connector makes installation easy
- An optional stainless steel head is available



Conforms to EN1088, EN292, EN60947-5-1, EN60204-1
UL and C-UL listed

Specifications

Electrical	All Models	T5009	T5009-6
Contact Configurations:		2 N/C + 1 N/O	2 N/C + 2 N/O, 3 N/C + 1 N/O, 4 N/C
Safety Contacts:	2 N/C positive break		
Switching Ability	AC: 500 V–1 A, 240 V–3 A, 120 V–6 A		
	DC: 250 V–0.5 A, 24 V–2.5 A		
Safety Contact Gap:	> 2 mm (0.079 in.)		
Auxiliary Contacts:		1 N/O	1 N/C + 1 N/O, 2 N/C, 2 N/O
Max Switching Current/Volt/Amp:	500 V/500 VA		
Minimum Current:	5 V 5 mA DC		
Electrical Life:	1 x 10^6 minimum		
Mechanical			
Mounting:	Any position		
Mounting Hardware:	2 x M5 screws		
Actuator Travel for Positive Opening:	7 mm (0.275 in.)		
Min Operating Radius:	60 mm (2.5 in.) with Flex 1 actuator; 175 mm (6.89 in.) with standard actuator		
Break Contact Min Force:	12 N (2.7 lb.); Hi-Hold models are 50 N (11.2 lbs.)		
Max Actuation Speed:	160 mm/sec (6.30 in./sec)		
Max Actuation Frequency:	2 cycles/sec		
Case Material:	UL listed, glass-filled polyester, optional stainless steel head		
Actuator Material:	Stainless steel		
Wiring Entry:	M20 with 1/2 in. NPT adapter included, 1/2 in. NPT, 6-pin micro AC connector 1/2 in.– 20		
Weight:	160 g (5.6 oz.)		
Color:	Red		
Mechanical Life:	1 x 10^6 minimum		
Environmental			
Protection:	IP67 (NEMA 6)		
Operating Temperature:	-25 to 80°C (-13 to 176°F)		
Cleaning:	Water washdown		
Compliance			
Standards:	EN1088, EN292, EN60947-5-1, EN60204-1, UL508		
Approvals/Listings:	CE marked for all applicable directives, UL and C-UL		

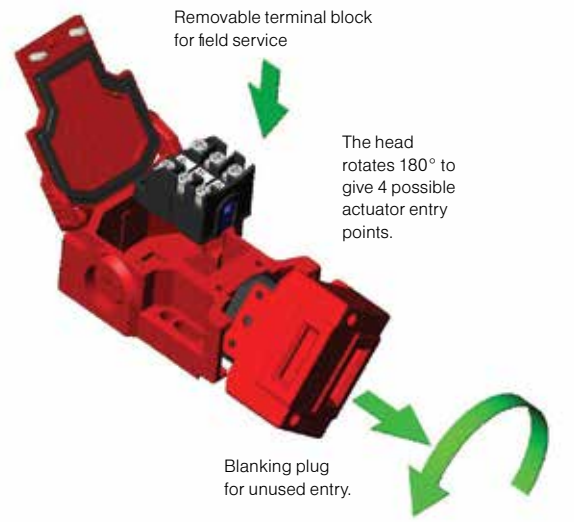
Specifications are subject to change without notice.

Note: The safety contacts of the STI switches are described as normally closed (N/C)—i.e., with the guard closed, actuator in place, and the machine able to be started.

SYSMAC
SAFETY, TECHNOLOGY & INNOVATION

OMRON
AUTOMATION & SAFETY

Operation





Flex 1
15° flexibility in
any direction.



Flex 2
15° flexibility in
two directions.



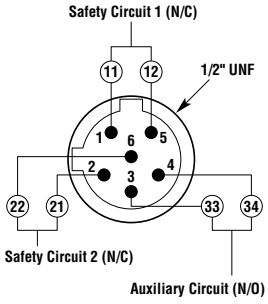
Optional SLD Series

Optional switch locking devices are available. See accessories section for details.

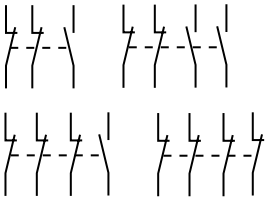


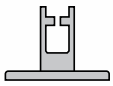
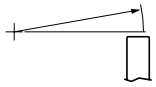
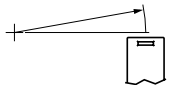
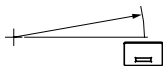
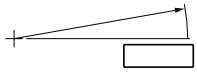
Optional Connector for 3-Pole Switches

6-Pin Male, Micro AC, 1/2-20 UN2A

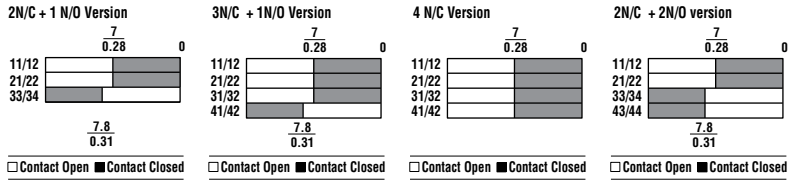


Contact Arrangements



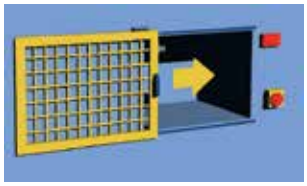
Minimum Allowable Radius for Actuator Entry				
				
44501-0755	175 mm	175 mm	175 mm	175 mm
44501 -0785	175 mm	175 mm	175 mm	175 mm
44501-0790	175 mm	175 mm	175 mm	175 mm
44501-0765	175 mm	50 mm	60 mm	175 mm
44501-0760	60 mm	60 mm	60 mm	60 mm

Contact Block Operation at Withdrawl of Actuator

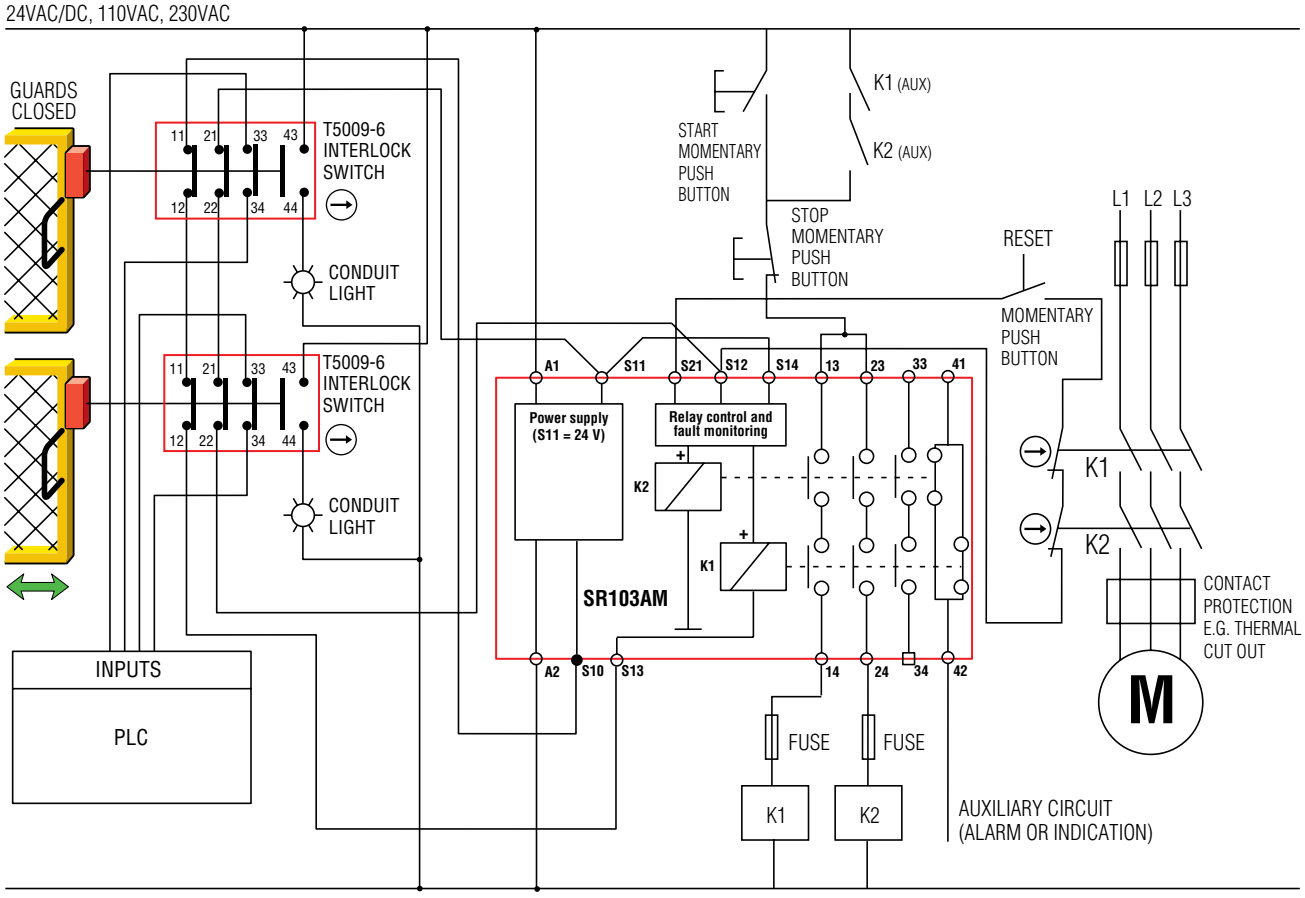


Applications

Typical applications are on sliding guard doors or swinging guard doors with a 2.5 in. minimum swing radius when using the flexible actuators.







For a full explanation of the circuit operating principle and fault detection, see “Common Circuit Examples” in the Expert Area Section of this catalog on page A-27

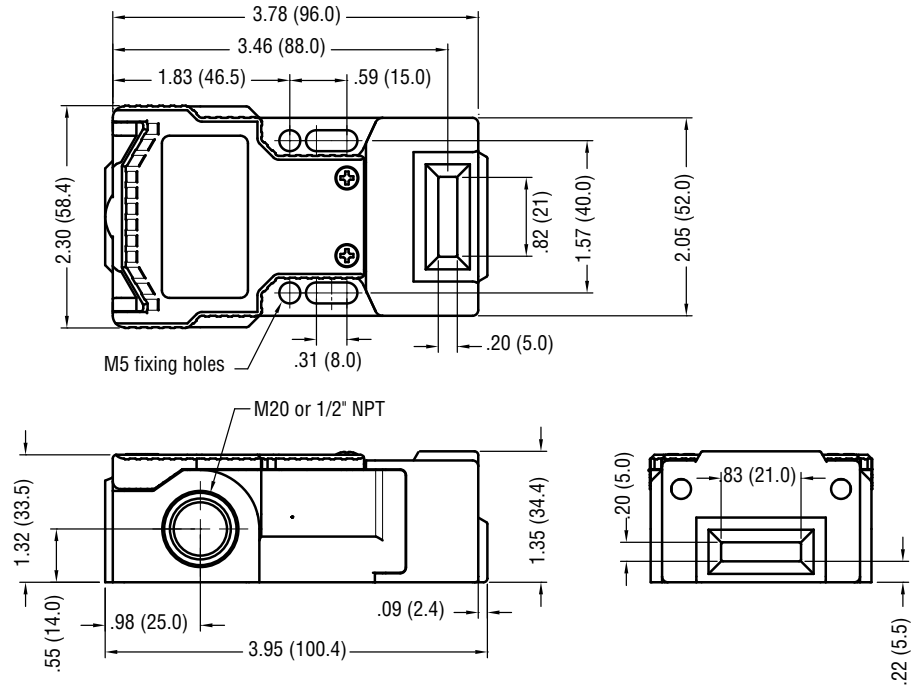
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

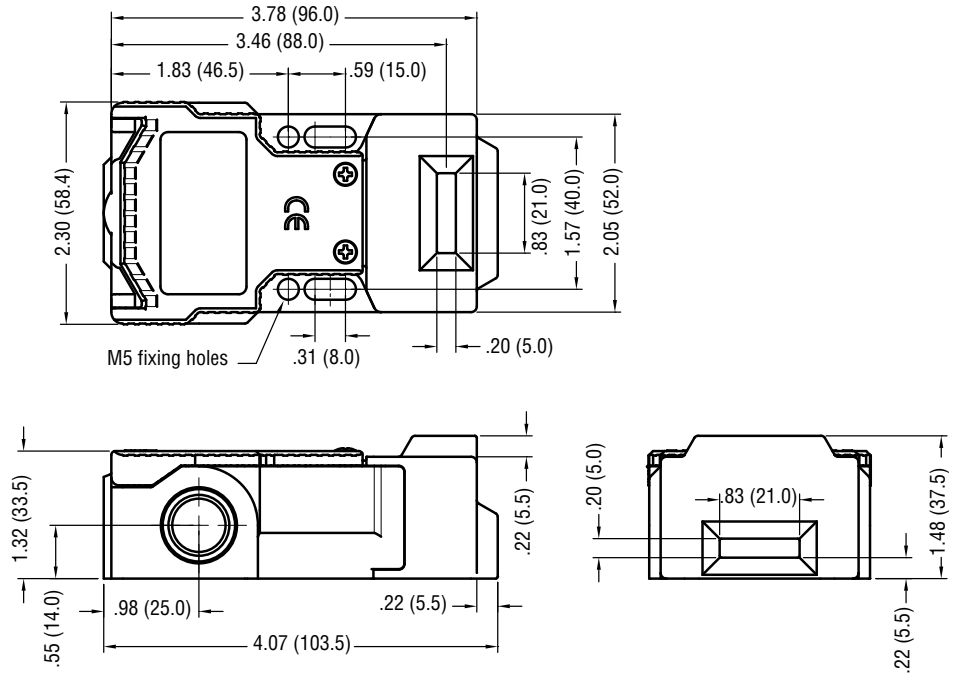
Dimensions

(mm/in.)

T5009, T5009-6 Switch with Plastic Head



T5009, T5009-6 Switch with Stainless Steel Head



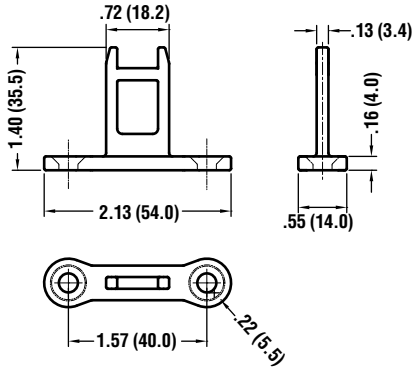
F

Dimensions (continued)

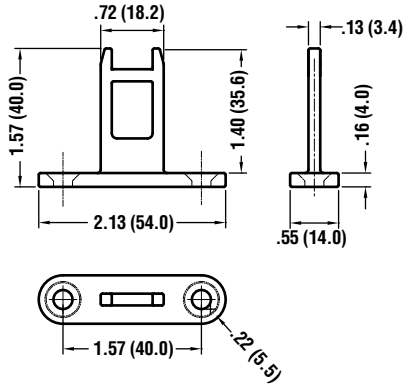
(mm/in.)

Standard & Flat Actuator Selections

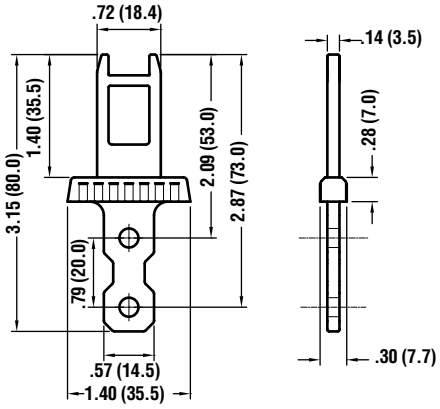
SA01-STD
44501-0755 (for use with plastic headed switches)



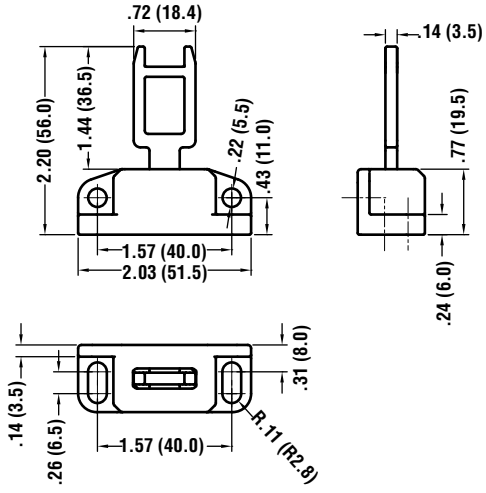
SA01-SSTD
44501-0785 (for use with stainless steel headed switches)



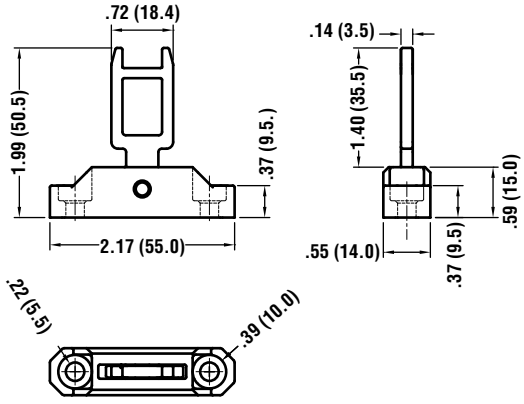
SA01-FSTD
44501-0790 (for use with plastic or stainless steel headed switches)



SA01-FLX1
44501-0760 (for use with plastic or stainless steel headed switches)



SA01-FLX2
44501-0765 (for use with plastic or stainless steel headed switches)



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering

Model	Contacts	Wiring Entry	Part No.
T5009 Switch Only			
T5009-021M	2NC+1NO BBM	3 x M20/NPT	44501-0010
T5009-021MHH (High-Hold Model)	2NC+1NO BBM	3 x M20/NPT	44501-5010
T5009-021N	2NC+1NO BBM	3 X 1/2 NPT	44501-0020
T5009-021NHH (High-Hold Model)	2NC+1NO BBM	3 x 1/2 NPT	44501-5020
T5009-021QD	2NC+1NO BBM	6-pin Micro AC Conn.	44501-0030
T5009-021QDHH (High-Hold Model)	2NC+1NO BBM	6-pin Micro AC Conn.	44501-5030
T5009-021SSM (Stainless Steel Head)	2NC+1NO BBM	3 x M20/NPT	44501-0040
T5009-021SSMHH (Stainless Steel Head, High-Hold Model)	2NC+1NO BBM	3 x M20/NPT	44501-5040
T5009-021SSN (Stainless Steel Head)	2NC+1NO BBM	3 X 1/2 NPT	44501-0050
T5009-021SSNHH (Stainless Steel Head, High-Hold Model)	2NC+1NO BBM	3 x 1/2 NPT	44501-5050
T5009-021SSCC (Stainless Steel Head)	2NC+1NO BBM	6-pin Micro AC Conn.	44501-0060
T5009-021SSCCHH (Stainless Steel Head, High-Hold Model)	2NC+1NO BBM	6-pin Micro AC Conn.	44501-5060
T5009 Standard Actuator			
T5009-021SM	2NC+1NO BBM	3 x M20/NPT	44501-0110
T5009-021SMHH (High-Hold Model)	2NC+1NO BBM	3 x M20/NPT	44501-5110
T5009-021SN	2NC+1NO BBM	3 X 1/2 NPT	44501-0450
T5009-021SCC	2NC+1NO BBM	6-pin Micro AC Conn.	44501-0410
T5009-021FSSM (Stainless Steel Head)	2NC+1NO BBM	3 x M20/NPT	44501-0500
T5009-021FSSN (Stainless Steel Head)	2NC+1NO BBM	3 X 1/2 NPT	44501-0520
T5009 Flex 1 Actuator			
T5009-021F1M	2NC+1NO BBM	3 x M20/NPT	44501-0120
T5009-021F1MHH (High-Hold Model)	2NC+1NO	3 x M20/NPT	44501-5120
T5009-021F1N	2NC+1NO BBM	3 X 1/2 NPT	44501-0170
T5009 Flex 2 Actuator			
T5009-021F2M	2NC+1NO BBM	3 x M20/NPT	44501-0440
T5009-021F2N	2NC+1NO BBM	3 X 1/2 NPT	44501-0470
T5009-6 Switch Only			
T5009-6022M	2NC+2NO BBM	3 x M20/NPT	44501-1020
T5009-6022N	2NC+2NO BBM	3 X 1/2 NPT	44501-1025
T5009-6031M	3NC+1NO BBM	3 x M20/NPT	44501-1030
T5009-6031N	3NC+1NO BBM	3 X 1/2 NPT	44501-1035
T5009-6040M	4NC BBM	3 x M20/NPT	44501-1040
T5009-6040N	4NC BBM	3 X 1/2 NPT	44501-1045
T5009-6022SSM (Stainless Steel Head)	2NC+2NO BBM	3 x M20/NPT	44501-2020
T5009-6022SSN (Stainless Steel Head)	2NC+2NO BBM	3 X 1/2 NPT	44501-2025
T5009-6031SSM (Stainless Steel Head)	3NC+1NO BBM	3 x M20/NPT	44501-2030
T5009-6031SSN (Stainless Steel Head)	3NC+1NO BBM	3 X 1/2 NPT	44501-2035
T5009-6040SSM (Stainless Steel Head)	4NC BBM	3 x M20/NPT	44501-2040
T5009-6040SSN (Stainless Steel Head)	4NC BBM	3 X 1/2 NPT	44501-2045
T5009-6 Standard Actuator			
T5009-6022SM	2NC+2NO BBM	3 x M20/NPT	44501-3020
T5009-6022SN	2NC+2NO BBM	3 X 1/2 NPT	44501-3025
T5009-6031SM	3NC+1NO BBM	3 x M20/NPT	44501-3030
T5009-6031SN	3NC+1NO BBM	3 X 1/2 NPT	44501-3035
T5009-6040SM	4NC BBM	3 x M20/NPT	44501-3040
T5009-6040SN	4NC BBM	3 X 1/2 NPT	44501-3045
Actuators For Plastic Headed T5009, T5009-6 Switches			
SA01-STD, Standard Actuator T5009, T5009-6, Plastic Head Switches			44501-0755
Actuators For Stainless Steel Headed T5009, T5009-6 Switches			
SA01-SSTD, Standard Actuator for T5009, T5009-6 Stainless Steel Head Switches			44501-0785
Actuators Compatible with both Plastic and Stainless Steel Headed T5009, T5009-6 Switches			
SA01-FLX1, Flex 1 Actuator T5009, T5009-6, Plastic or SS Headed Switches			44501-0760
SA01-FSTD, Flat Actuator T5009, T5009-6, Plastic or SS Headed Switches			44501-0790
SA01-FLX2, Flex 2 Actuator T5009, T5009-6, Plastic Head Switches			44501-0765
Accessories			
Spare M20 to 1/2" NPT Adapter			44512-0110
M20 Cord Grip			44512-0090

BBM = Break Before Make Contacts

F

T4012

Quick Link
S252
omron247.com

Universal Tongue-Operated Safety Interlock Switch

- Strong and versatile—the compact size of the strong, glass-filled thermoplastic housing allows this switch to be used in most applications
- NEMA 6 enclosure enables these switches to withstand water washdown cleaning
- Rotatable head gives eight possible actuator entry points for versatile installation. A blanking plug is supplied for the unused entry.
- Long life—these switches, with their stainless steel actuators, are designed for a minimum of two million actuations
- Available in 2 or 4 contact pole versions. The 4 contact pole version provides 2 poles for dual channel safety monitoring and 2 additional poles for status monitoring.
- An optional stainless steel guide is available for demanding applications



T4016

Quick Link
S253
omron247.com

Heavy-Duty Metal-Body Safety Interlock Switch

- Rugged enclosure—the all metal housing and stainless steel actuator of the T4016 makes it suitable for harsh environments
- NEMA 6/IP67 enclosure enables these switches to withstand water washdown cleaning.
- Rotatable head gives eight possible actuator entry points for versatile installation. A blanking plug is supplied for the unused entry.
- Long life—these switches, with their stainless steel actuators, are designed for a minimum of two million actuations
- A variety of 4 contact pole versions provides 2 poles for dual channel safety monitoring and 2 additional poles for status monitoring



T2008

Quick Link
S254
omron247.com

Small Tongue-Operated Safety Interlock Switch

- Small size—these switches are ideal for guarding applications with space restrictions. Fits on 1 inch square tubing.
- NEMA 6 (IP67) enclosure enables these switches to withstand water washdown cleaning
- Rotatable head gives eight possible actuator entry points for versatile installation. A blanking plug is supplied for the unused entry.
- Long life—these switches, with their stainless steel actuators, are designed for a minimum of one million actuations
- Available with two contact poles. Contact configurations of 1 N/O and 1 N/C or 2 N/C are available to meet requirements of dual channel safety monitoring
- An optional stainless steel guide is available for demanding applications



Conforms to EN60947-5-1, EN1088,
EN ISO 13849-1
UL and C-UL listed
DGUV approved

Specifications

Electrical	All Models
Contact Configurations:	1 N/O + 1 N/C, 2 N/C
Safety Contacts:	1 N/C positive break, 2 N/C positive break
Switching Ability:	AC: 230 V, 4 A DC: 24 V, 4 A
Contact Material:	Silver alloy, gold flashed
Auxiliary Contacts:	1 N/O (T2008-11 models only)
Minimum Switching Voltage:	12 V at 10 mA
Minimum Switching Current:	1 mA at 24 V
Mechanical	
Mounting:	Any position
Mounting Hardware:	2 x M4 screws (not supplied)
Min Operating Radius:	150 to 200 mm based upon orientation of actuator to switch
Break Contact Min Force:	6 N (0.23 lb.)
Max Actuation Speed:	20 m/min.
Max Actuation Frequency:	7000 cycles/hour
Case Material:	Glass-fibre reinforced thermoplastic
Actuator Material:	Stainless steel
Wiring Entry:	1 x M16
Weight:	55 g (1.8 oz.)
Color:	Black with red lid
Mechanical Life:	1 x 10^6 minimum
Environmental	
Protection:	IP67 (NEMA 6)
Operating Temperature:	-20 to 80°C (-4 to 176°F)
Cleaning:	Water washdown
Compliance	
Standards:	EN60947-5-1, EN1088, EN ISO 13849-1
Approvals/Listings:	CE marked for all applicable directives, UL and C-UL, DGUV

Specifications are subject to change without notice.

Note: The safety contacts of the STI switches are described as normally closed (N/C)—i.e., with the guard closed, actuator in place, and the machine able to be started.

Actual Size



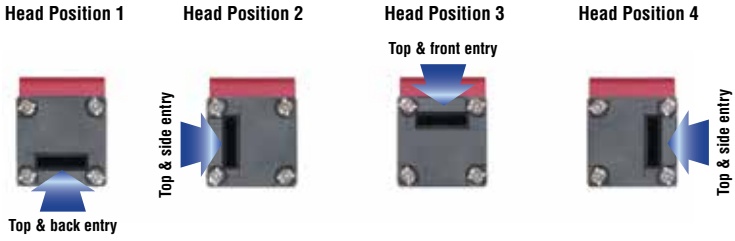
F

Operation



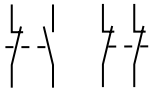
Optional Slide Bolts

- Allows easy installation of switch on machine guards
- Actuator included (order switch separately)
- Integral handle included
- Metal construction is suitable for demanding applications
- Yellow color for easy recognition





Contact Arrangements



Optional Alignment Guide

Optional stainless steel alignment guide aids actuator entry and is easily installed.



Optional SLD Series

Optional switch locking devices are available. See accessories section for details.





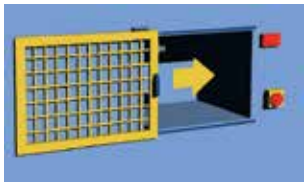
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

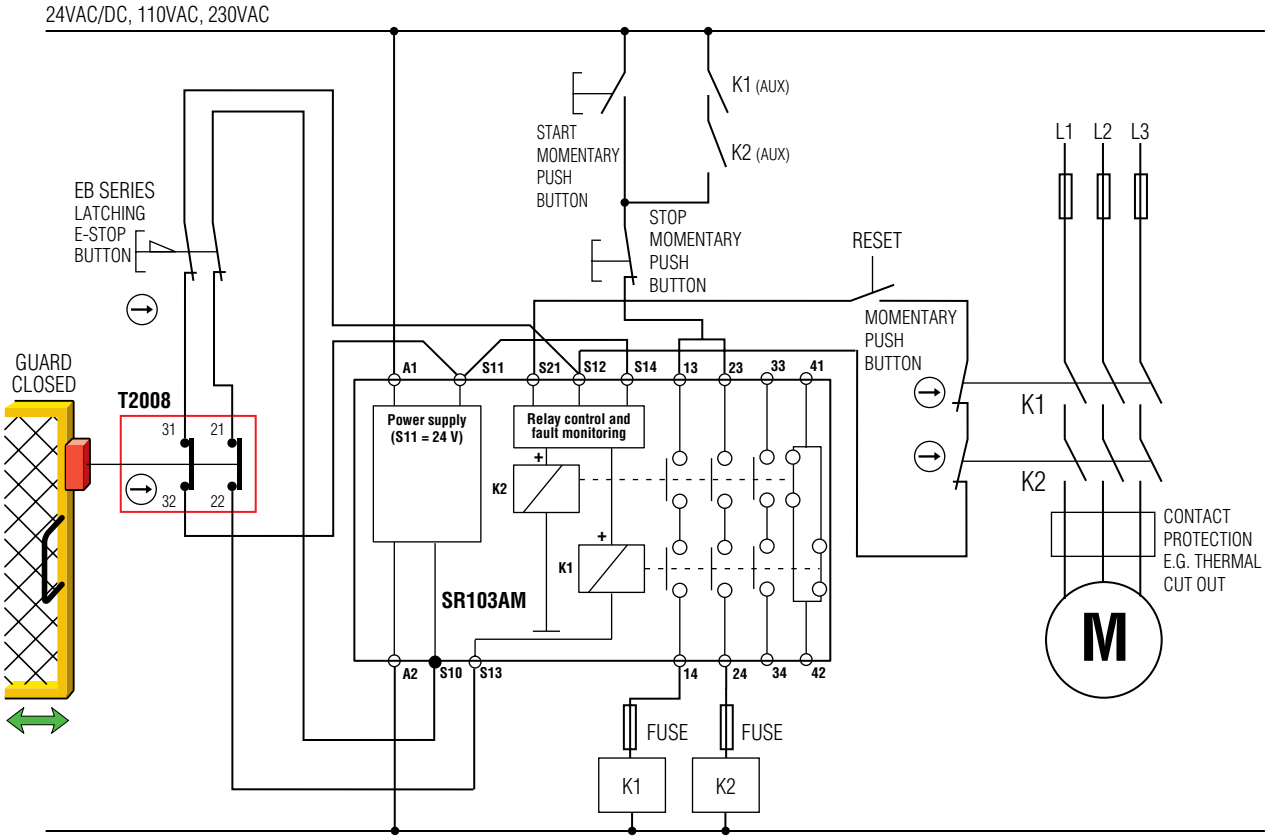
OMRON AUTOMATION & SAFETY

Applications

Typical applications are on sliding guard doors or swinging guard doors.



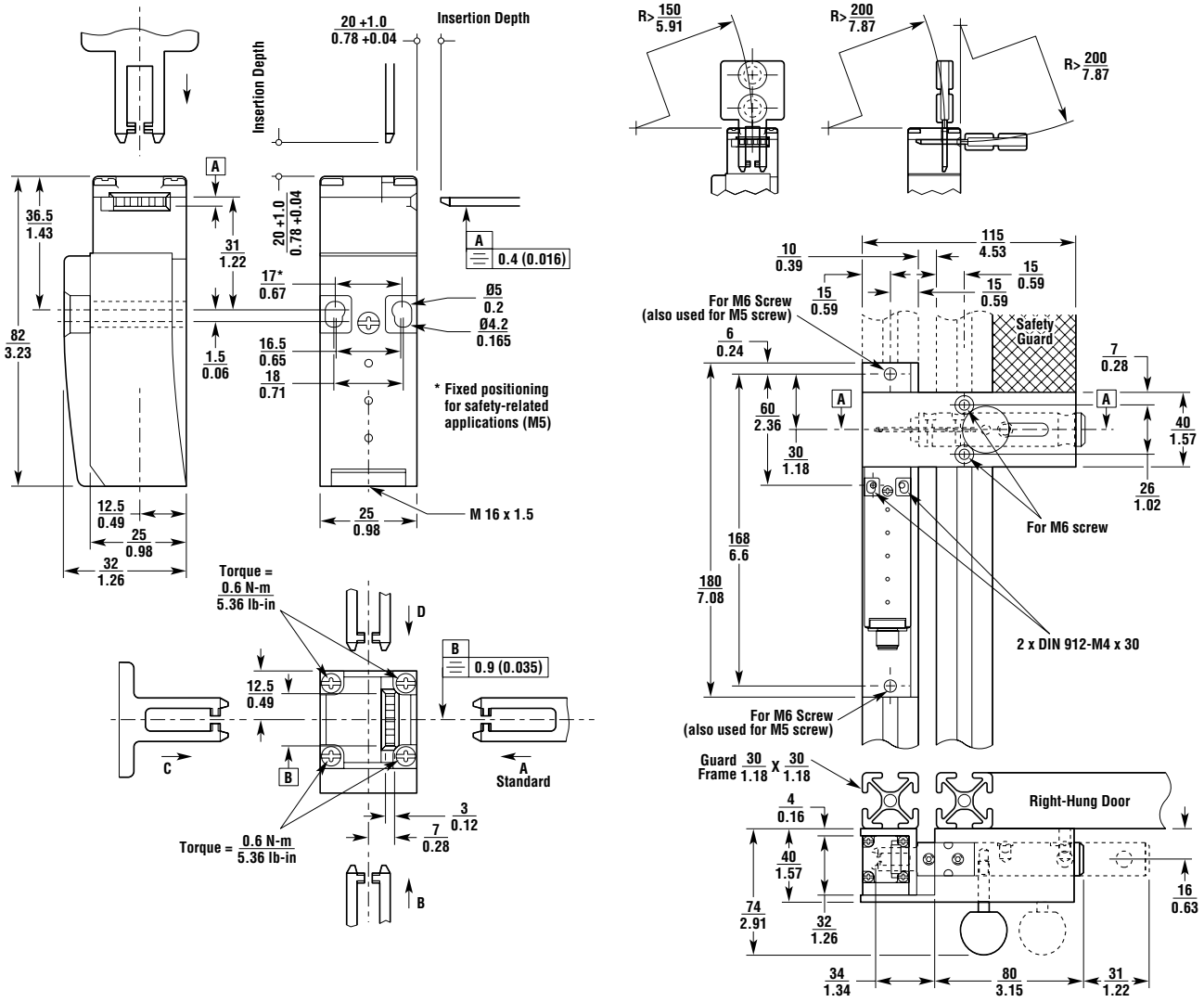




F

Dimensions

(mm/in.)



Flat Actuator

90-Degree Actuator

Flat Actuator w/Rubber Bushing

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering

Model	Contacts	Wiring Entry	Part No.
T2008 90-Degree Actuator			
T2008-11SM	1 N/C + 1 N/O	1 x M16 + NPT adapter	44540-0010
T2008-02SM	2 N/C	1 x M16 + NPT adapter	44540-0020
T2008 Flat Actuator			
T2008-11TM	1 N/C + 1 N/O	1 x M16 + NPT adapter	44540-0110
T2008-02TM	2 N/C	1 x M16 + NPT adapter	44540-0120
T2008 Flat Actuator with Rubber Bushing			
T2008-11TRM	1 N/C + 1 N/O	1 x M16 + NPT adapter	44540-0210
T2008-02TRM	2 N/C	1 x M16 + NPT adapter	44540-0220
T2008 Switch Only (no actuators and no adapters included)			
T2008-11	1 N/C + 1 N/O	1 x M16	44540-2010
T2008-02	2 N/C	1 x M16	44540-2020
Accessories			
Spare Actuators			
SA40-S00 90-degree actuator			44540-0700
SA40-T10 flat actuator			44540-0710
SA40-TR20 flat actuator with rubber bushings			44540-0720
Stainless Steel Guide			
SM40-SG50 stainless steel guide			44540-0750
Slide Bolt			
SB40-M00 slide bolt left or right hand door with bracket			44540-8000
Mounting Bracket			
SB40-M10 right angle bracket only for mounting T2008/T2011 switches			44540-8010
Adapter			
SC12-M16A00 M16 to 1/2 in. NPT adapter			44512-0300

F

D4GS-N

Quick Link
S237
omron247.com

Slim Safety Door Switches with IP67 Rating

- Slim design with a width of only 17 mm (three-contact models).
- Reversible design allowing either front or rear mounting.
- Built-in Switches with two- or three-terminal contact construction are available.
- Operation Key with rubber mounting hole to absorb vibration and shock.
- IP67 degree of protection.



D4SL-N

Quick Link
S245
omron247.com

Super Small Class 6-Contact Guard Lock Safety-Door Switch

D4SL-N Guard Lock Safety-door Switch

- Wiring time is reduced with two types of wiring methods capable of one-touch attachment and removal.
- A wide variety of built-in switches can be used for various devices. (4-, 5-, and 6-contact models are available)
- Key holding force of 1,300 N.
- It is possible to change the key insertion point without detaching the head.
- Drive solenoids directly from the Controller.

D4SL-NSK10-LK□ Slide Key

- Lockout Key to prevent workers from becoming trapped inside the hazardous area.
- The vertical D4SL Guard Lock Safety-door Switch can be easily mounted on 40 x 40 mm aluminum frames.
- The plastic material makes the Key suitable for lightweight doors.



Terminal Block Type | Connector Type | Slide Key

Specifications

Standards and EC Directives

Conforms to the following EC Directives:

- Machinery Directive
- Low Voltage Directive
- EMC Directive
- EN 1088
- EN 60204-1
- GS-ET-19

Certified Standards

Certification body	Standard	File No.
TÜV SÜD	EN 60947-5-1 (certified direct opening)	Consult your representative for details.
UL *1	UL 508, CSA C22.2 No.14	E76675
CQC (CCC)	GB14048.5	pending
KOSHA *2	EN60947-5-1	

*1. Certification has been obtained for UL CSA C22.2 No. 14.

Certified Standard Ratings

TÜV (EN 60947-5-1)

Utilization category	AC-15	DC-13
Rated operating current (Ie)	1.5 A *1 1 A *2	0.22 A
Rated operating voltage (Ue)	120 V	125 V

Note: Use a 4 A fuse that conforms to IEC 60127 as a short-circuit protection device. This fuse is not included with the switch.

*1. 11-42, 21-42, 21-22

*2. Other terminals

UL/CSA (UL 508, CSA C22.2 No. 14)

C150

Rated voltage	Carry current	Current (A)		Volt-amperes (VA)	
		Make	Break	Make	Break
120 VAC	2.5 A	15	1.5	1,800	180

R150

Rated voltage	Carry current	Current (A)		Volt-amperes (VA)	
		Make	Break	Make	Break
125 VDC	1.0 A	0.22	0.22	28	28

Solenoid Coil Characteristics

Item	24 VDC
Rated operating voltage (100% ED)	24 VDC $^{+10\%}_{-15\%}$
Current consumption*	Power ON: 6-contact type Approx. 6.4 W at 0.26 A 4-contact/5-contact type Approx. 4.8 W at 0.2 A Constant: Approx. 2.6 W (average) at 0.2 A (max.)
Insulation Class	Class E (120°C max.)

*A starting current is applied to the solenoid for approx. 10 seconds. After this, the internal circuit switches to constant current.

Indicator

Item	LED Type
Rated voltage	24 VDC
Current consumption	Approx. 10 mA
Color (LED)	Orange

F

Specifications (continued)

Characteristics

Degree of protection *1		IP67 (EN60947-5-1)
Durability *2	Mechanical	1,000,000 operations min.
	Electrical	150,000 operations min. (1 A resistive load at 125 VAC) *3
Operating speed		0.05 to 1 m/s
Operating frequency		5 operations/minute max.
Direct opening force *4		60 N min. (EN60947-5-1)
Direct opening travel *4		15 mm min. (EN60947-5-1)
Holding force *5		1,300 N min.
Contact resistance		200 mΩ max.
Minimum applicable load *6		1 mA resistive load at 5 VDC (N-level reference value)
Rated insulation voltage (Ui)		150 V (EN60947-5-1)
Rated frequency		50/60 Hz
Protection against electric shock		Class II (double insulation)
Pollution degree (operating environment)		3 (EN60947-5-1)
Impulse withstand voltage (EN60947-5-1)	Between terminals of same polarity	1.5 kV
	Between terminals of different polarity	1.5 kV
	Between other terminals and non-current carrying metallic parts.	2.5 kV
Insulation resistance		100 MΩ min. (at 500 VDC)
Vibration resistance	Malfunction	10 to 55 Hz, 0.35 mm single amplitude
Shock resistance	Malfunction	80 m/s^2 min.
	Destruction	1,000 m/s^2 min.
Conditional short-circuit current		100 A (EN60947-5-1)
Conventional free air thermal current (Ith)		2.5 A (11-42, 21-52, 21-22) 1A (Others)
Ambient operating temperature		-10 to +55°C (with no icing)
Ambient operating humidity		95% max.
Weight		Head: Resin Approx. 290 g (Connector model) Approx. 330 g (Terminal block model) Head: Metal Approx. 370 g (Connector model) Approx. 410 g (Terminal block model)

Notes: 1. The above values are initial values.
2. The Switch contacts can be used with either standard loads or microloads. Once the contacts have been used to switch a load, however, they cannot be used to switch smaller loads. The contact surfaces will become rough once they have been used and contact reliability for smaller loads may be reduced.

*1 The degree of protection is tested using the method specified by the standard (EN60947-5-1). Confirm that sealing properties are sufficient for the operating conditions and environment beforehand. Although the switch box is protected from dust, oil or water penetration, do not use the D4SL in places where cutting chips, oil, water or chemicals may enter through the key hole on the head, otherwise Switch damage or malfunctioning may occur.

*2 The durability is for an ambient temperature of 5 to 35°C and an ambient humidity of 40% to 70%. For more details, consult your OMRON representative.

*3 Do not pass the 1 A, 125 VAC load through more than 3 circuits.

*4 These figures are minimum requirements for safe operation.

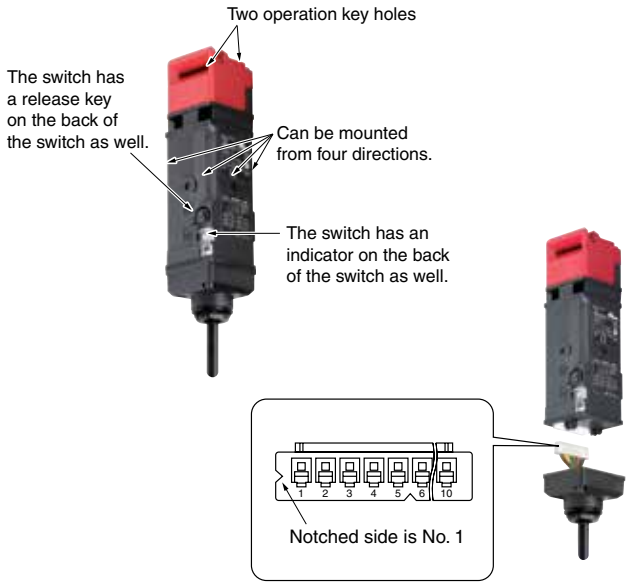
*5 This figure is based on the GS-ET-19 evaluation method.

*6 This value will vary with the switching frequency, environment, and reliability level. Confirm that correct operation is possible with the actual load beforehand.

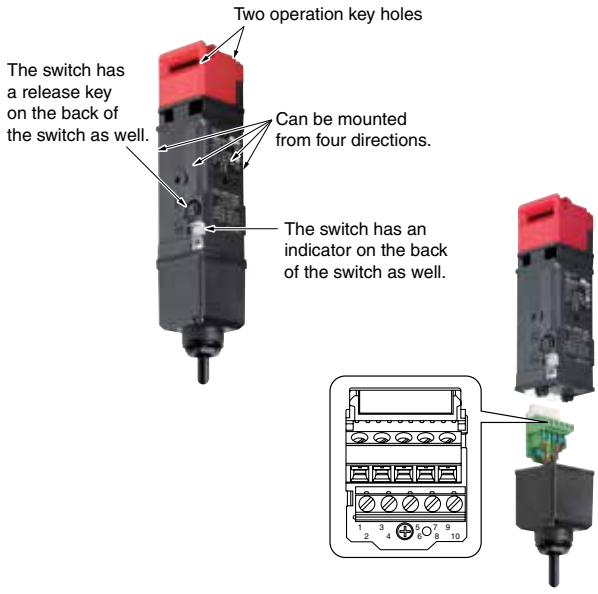
Structure

Structure

D4SL-N□□□□D-□N Connector Type

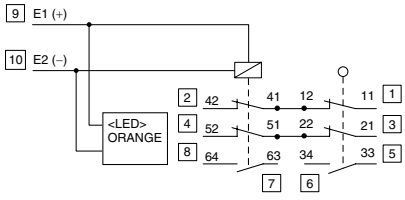


D4SL-N□□□□D-□ Terminal Block Type



Terminal Arrangement

D4SL-N□N□□-D□



Note: Numbers inside the boxes are terminal numbers printed on the product.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

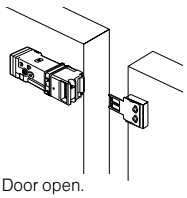
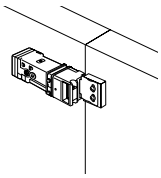
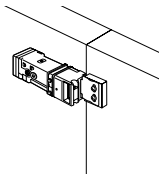
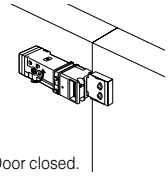
For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Structure (continued)

Operating Cycle Examples for Standard Models

D4SL-N□□□A-□ (Mechanical Lock Models)

Terminal No. and Contact No.	Function	Condition 1	Condition 2	Condition 3	Return to condition 1	Turning the special release key
		 Door open. The door will lock when the door closes.	 Door closed. The door is locked.	 Door closed. The door can be opened.		 Door closed. No power is supplied to the solenoid. The door is unlocked manually.
[9]E1-[10]E2	Solenoid ON					
[2]42-[1]11 (NC) [4]52-[3]21 (NC)	Door open/ closed detection and lock monitor contacts					
[3]21-[4]22 (NC) [5]31-[6]32 (NC)	Door open/ closed detection contact					
[5]33-[6]34 (NO)	Door open/ closed detection contact					
[1]41-[2]42 (NC) [7]61-[8]62 (NC)	Lock monitor contact					
[7]63-[8]64 (NO)	Lock monitor contact					

D4SL-N□□□G-□ (Solenoid Lock Models)

Terminal No. and Contact No.	Function	Even when the door is closed, it does not lock until power is supplied to the solenoid.	Door closed. The door is locked.	Door closed. The door can be opened.
[9]E1-[10]E2	Solenoid ON			
[2]42-[1]11 (NC) [4]52-[3]21 (NC)	Door open/ closed detection and lock monitor contacts			
[3]21-[4]22 (NC) [5]31-[6]32 (NC)	Door open/ closed detection contact			
[5]33-[6]34 (NO)	Door open/ closed detection contact			
[1]41-[2]42 (NC) [7]61-[8]62 (NC)	Lock monitor contact			
[7]63-[8]64 (NO)	Lock monitor contact			

The shaded areas indicate the contact is closed and power is supplied to the solenoid.

Door open/closed detection and lock monitor contacts:
Can be used in safety circuits because of the direct opening mechanisms.

Door open/closed detection contact:
Can be used to confirm whether the key is inserted and to monitor the open/ closed status of a door.

Lock monitor contact:
Can be used to confirm whether power is supplied to the solenoid and to monitor whether or not a door can be opened or closed.

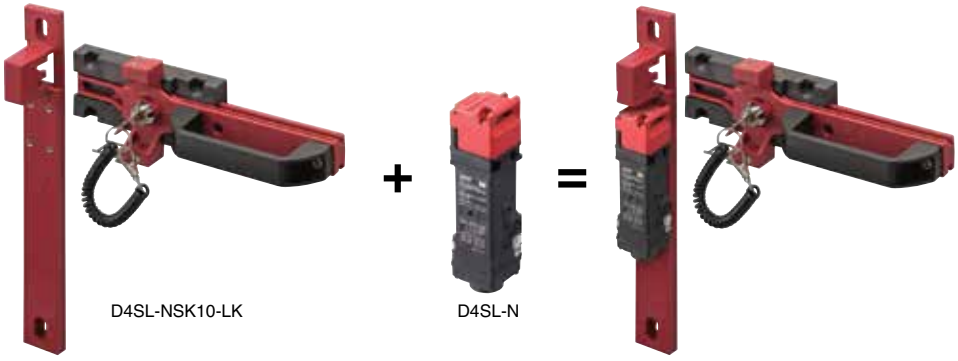
Note: The door open/closed detection and lock monitor contact configuration depends on the model.

Caution!: For solenoid-to-lock 6-contact models (contact configuration: N,P,Q,R), if a current is detected in the solenoid before the door is closed, the door might remain unlocked. Apply power to the solenoid AFTER the door is closed to ensure proper locking function.

F

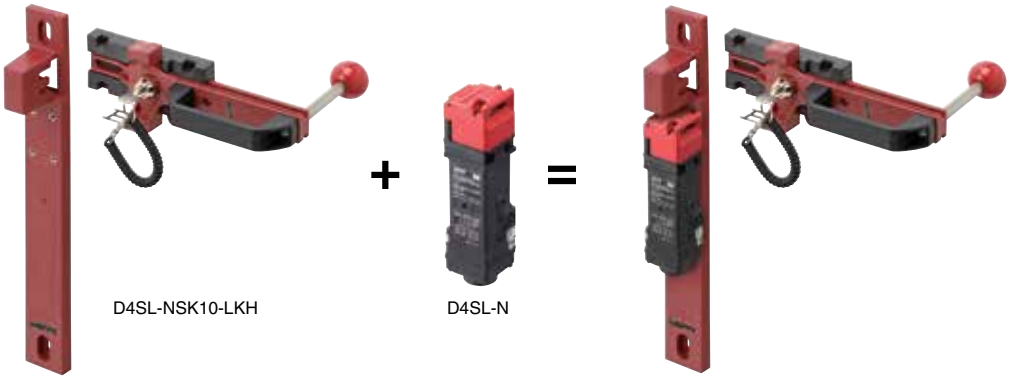
Applicable Door Switches

D4SL-NSK10-LK



D4SL-NSK10-LK D4SL-N

D4SL-NSK10-LKH



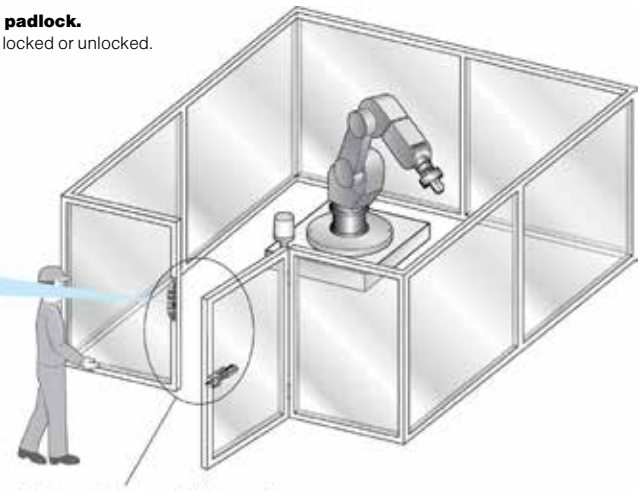
D4SL-NSK10-LKH D4SL-N

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Door Switch Features

The lockout key prevents workers from becoming trapped without using a padlock.
Note: Using LEDs of D4SL-N enables confirming whether the door is open or closed and locked or unlocked.



The handle-shaped fixture makes it easy to use the Door Switch.

Close door
Locked (power not supplied to solenoid) The slide handle is closed.



Close door
Unlocked (power supplied to solenoid) The slide handle is closed.



The slide handle can be pulled.



Attach the supplied caution labels for display.

Lockout Key



Do not turn the key as in the figure above if the slide handle is closed.

Left door
Door Opening to the Left.



Open door
The slide handle is open.



When the slide handle is open, the lockout key can be pulled regardless of whether power is being supplied to the solenoid or not.

Open door
The slide handle is open.



The slide handle is secured at the position shown in the figure.
A worker holding the lockout key will not be trapped locked inside the hazardous area by another person.

Open door
The slide handle is open.



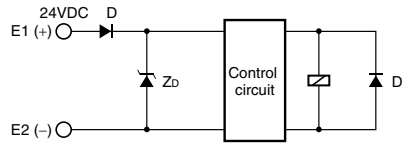
If the lockout key is not mounted, the slide handle will not move and the door will not close.

F

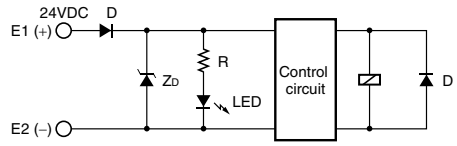
Connections

Internal Circuit Diagram

Without Indicator



With Indicator

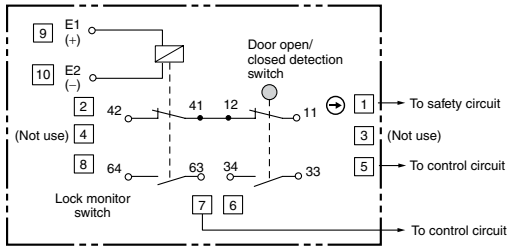


Circuit Connection Example

- Direct opening contacts used as safety-circuit input are indicated with the mark.
- Do not switch circuits for three or more standard loads at the same time. Doing so may adversely affect insulation performance.
- DC solenoids have polarity. (E1: Positive, E2: Negative) Confirm terminal polarity before wiring.
- If a lock is required for safety, design the system so that the closing of the NC contacts on both the door open/closed detection switch and the lock monitor switch is detected.

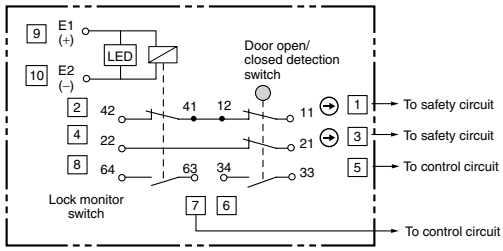
Connection Example for D4SL-N□AF□-□

Contacts 12 and 41 are internally connected.



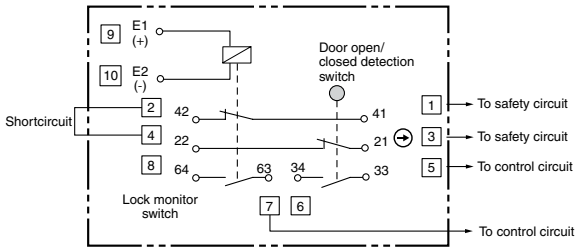
Connection Example for D4SL-N□EF□-D□

Contacts 12 and 41 are internally connected.



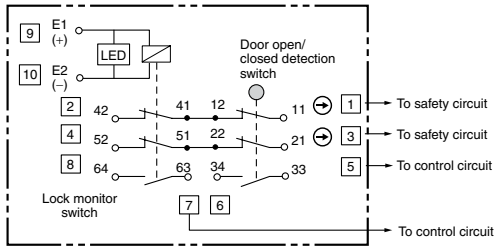
Connection Example for D4SL-N□SF□-□

There is no internal connection, so connect contacts 22 and 42 externally.



Connection Example for D4SL-N□NF□-D□

Contacts 12 and 41 and contacts 22 and 51 are internally connected.



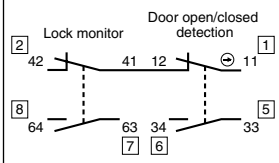
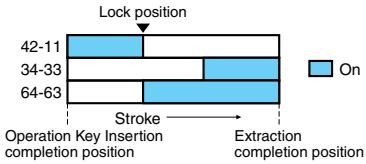
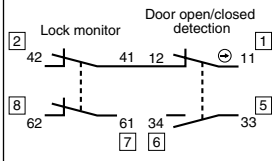
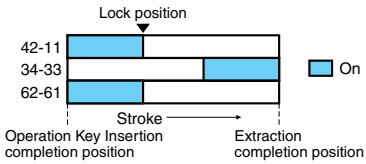
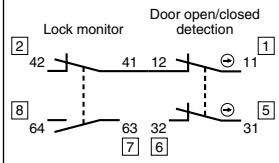
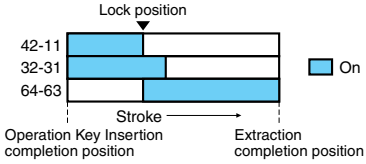
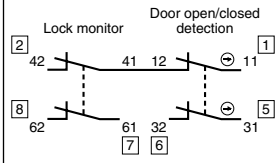
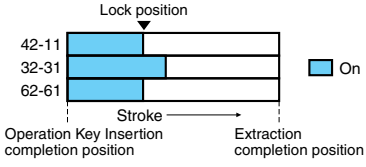
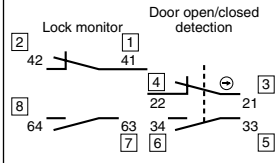
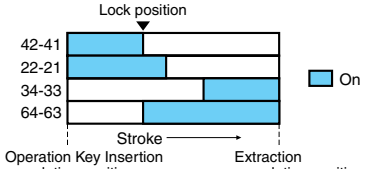
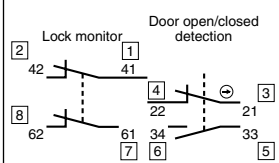
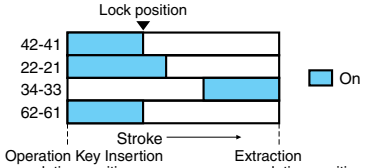
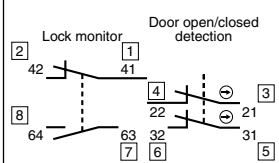
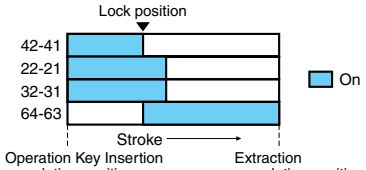
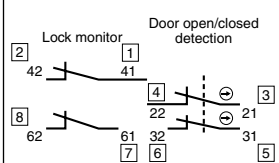
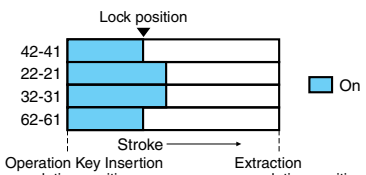
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Connections (continued)

Contact Form

Indicates conditions where the Key is inserted and the lock is applied.

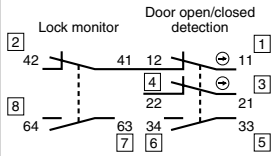
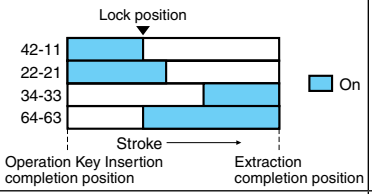
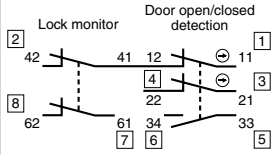
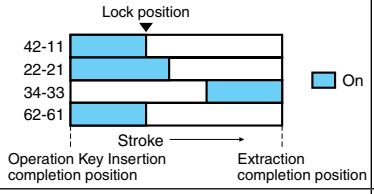
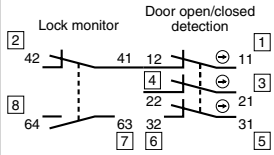
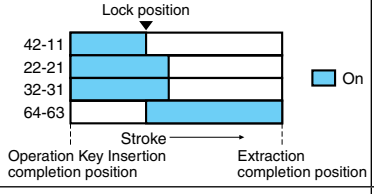
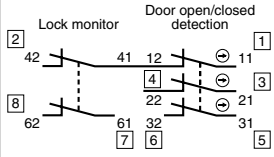
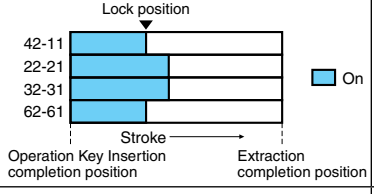
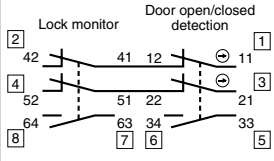
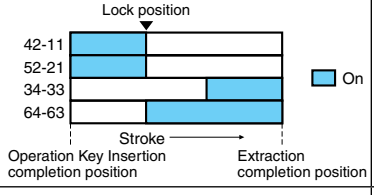
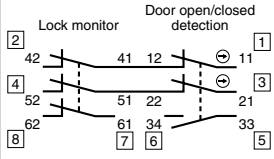
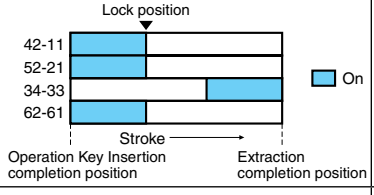
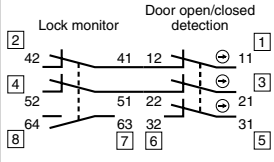
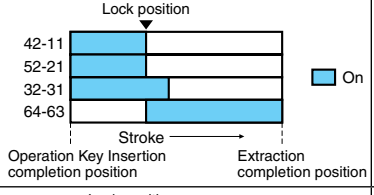
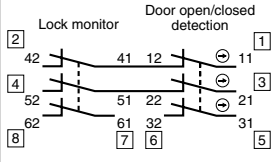
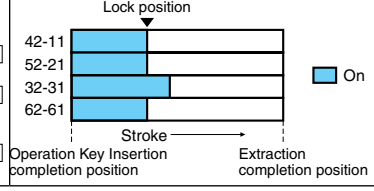
Model	Contact (door open/ closed detection and lock monitor)	Contact form		Operating pattern	Remarks
		Lock monitor	Door open/ closed detection		
D4SL-N□A□□-□	1NC/1NO+ 1NC/1NO				Only NC contact 11-12 has a certified direct opening mechanism. ⊖ The terminals 42-11, 34-33, and 64-63 can be used as unlike poles.
D4SL-N□B□□-□	1NC/1NO+2NC				Only NC contact 11-12 has a certified direct opening mechanism. ⊖ The terminals 42-11, 34-33, and 62-61 can be used as unlike poles.
D4SL-N□C□□-□	2NC+1NC/1NO				Only NC contact 11-12 and 31-32 have a certified direct opening mechanism. ⊖ The terminals 42-11, 32-31, and 64-63 can be used as unlike poles.
D4SL-N□D□□-□	2NC+2NC				Only NC contact 11-12 and 31-32 have a certified direct opening mechanism. ⊖ The terminals 42-11, 32-31, and 62-61 can be used as unlike poles.
D4SL-N□S□□-□	1NC/1NO+ 1NC/1NO				Only NC contact 21-22 has a certified direct opening mechanism. ⊖ The terminals 42-41, 22-21, 34-33, and 64-63 can be used as unlike poles.
D4SL-N□T□□-□	1NC/1NO+2NC				Only NC contact 21-22 has a certified direct opening mechanism. ⊖ The terminals 42-41, 22-21, 34-33, and 62-61 can be used as unlike poles.
D4SL-N□U□□-□	2NC+1NC/1NO				Only NC contact 21-22, and 31-32 have a certified direct opening mechanism. ⊖ The terminals 42-41, 22-21, 32-31, and 64-63 can be used as unlike poles.
D4SL-N□V□□-□	2NC+2NC				Only NC contact 21-22, and 31-32 have a certified direct opening mechanism. ⊖ The terminals 42-41, 22-21, 32-31, and 62-61 can be used as unlike poles.

F

Connections (continued)

Contact Form (continued)

Indicates conditions where the Key is inserted and the lock is applied.

Model	Contact (door open/ closed detection and lock monitor)	Contact form		Operating pattern	Remarks
		Lock monitor	Door open/ closed detection		
D4SL-N□E□□-□	2NC/1NO+ 1NC/1NO				Only NC contact 11-12 and 21-22 has a certified direct opening mechanism. ⊖ The terminals 42-11, 22-21, 34-33, and 64-63 can be used as unlike poles.
D4SL-N□F□□-□	2NC/1NO+2NC				Only NC contact 11-12 and 21-22 has a certified direct opening mechanism. ⊖ The terminals 42-11, 22-21, 34-33, and 62-61 can be used as unlike poles.
D4SL-N□G□□-□	3NC+1NC/1NO				Only NC contact 11-12, 21-22, and 31-32 has a certified direct opening mechanism. ⊖ The terminals 42-11, 22-21, 32-31, and 64-63 can be used as unlike poles.
D4SL-N□H□□-□	3NC+2NC				Only NC contact 11-12, 21-22, and 31-32 has a certified direct opening mechanism. ⊖ The terminals 42-11, 22-21, 32-31, and 62-61 can be used as unlike poles.
D4SL-N□N□□-□	2NC/1NO+ 2NC/1NO				Only NC contact 11-12 and 21-22 has a certified direct opening mechanism. ⊖ The terminals 42-11, 52-21, 34-33, and 62-61 can be used as unlike poles.
D4SL-N□P□□-□	2NC/1NO+3NC				Only NC contact 11-12 and 21-22 has a certified direct opening mechanism. ⊖ The terminals 42-11, 52-21, 34-33, and 62-61 can be used as unlike poles.
D4SL-N□Q□□-□	3NC+2NC/1NO				Only NC contact 11-21, 21-22, and 31-32 have a certified direct opening mechanism. ⊖ The terminals 42-11, 52-21, 32-31, and 64-63 can be used as unlike poles.
D4SL-N□R□□-□	3NC+3NC				Only NC contact 11-12, 21-22, and 31-32 have a certified direct opening mechanism. ⊖ The terminals 42-11, 52-21, 32-31, and 62-61 can be used as unlike poles.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

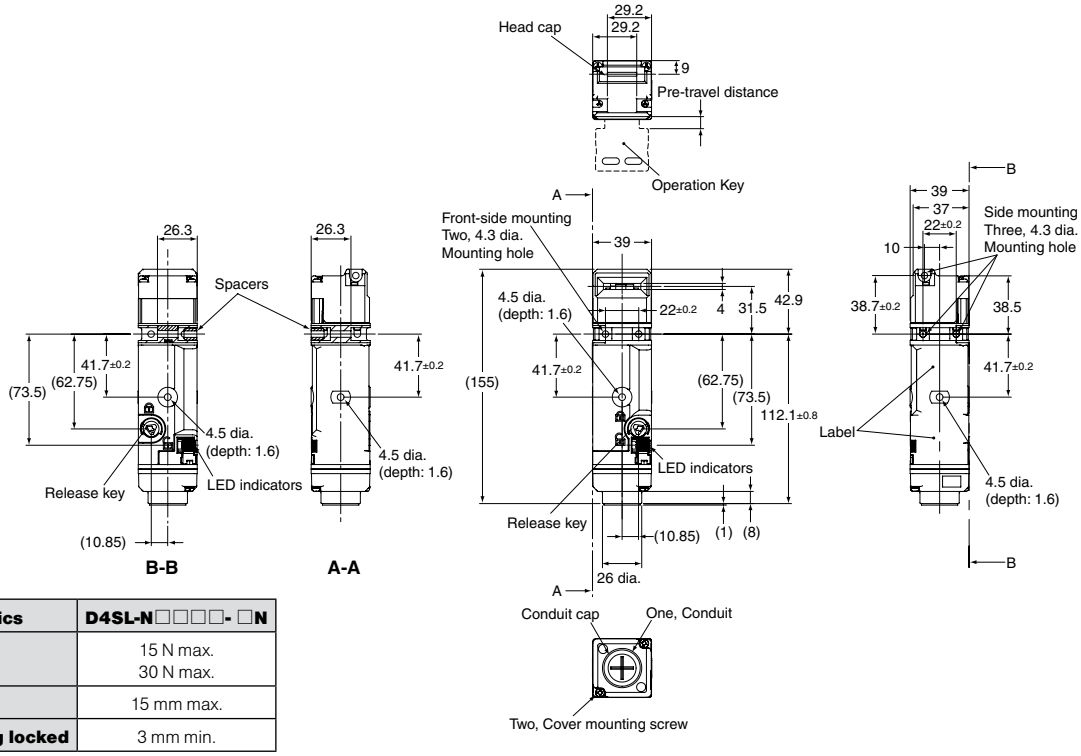
Dimensions and Operating Characteristics

(mm)

Switches

D4SL-N□□□□-□N (Connector Type)

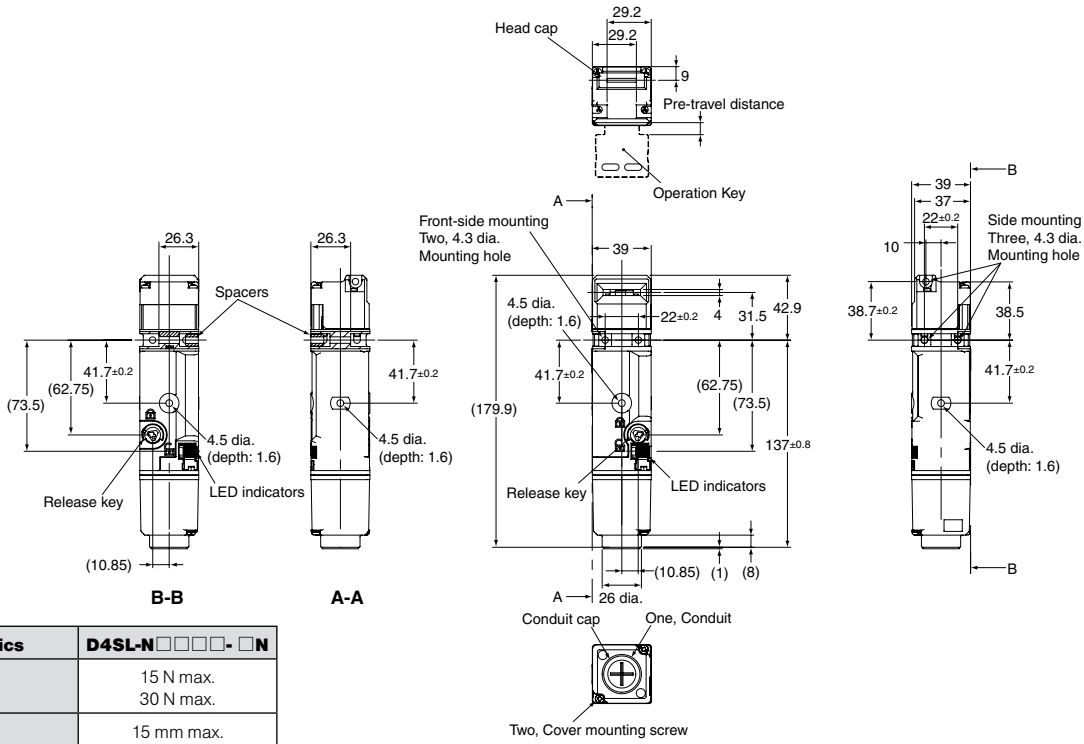




Operating characteristics	D4SL-N□□□□- □N
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	15 mm max.
Movement before being locked	3 mm min.

D4SL-N□□□□-□ (Terminal Block Type)





Operating characteristics	D4SL-N□□□□- □N
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	15 mm max.
Movement before being locked	3 mm min.

Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

F

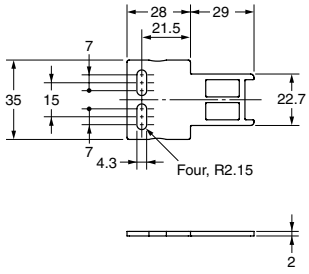
Dimensions and Operating Characteristics (continued)

(mm)

Operation Keys

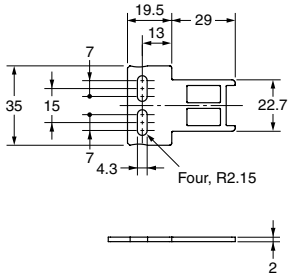
D4SL-NK1





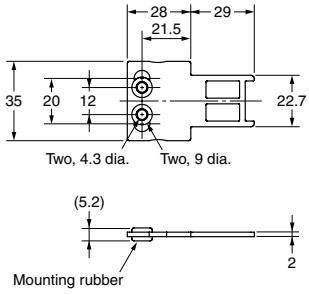
D4SL-NK1S





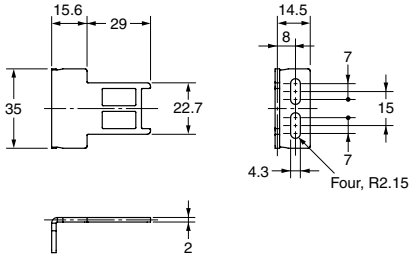
D4SL-NK1G





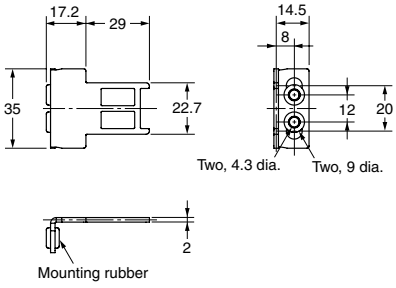
D4SL-NK2





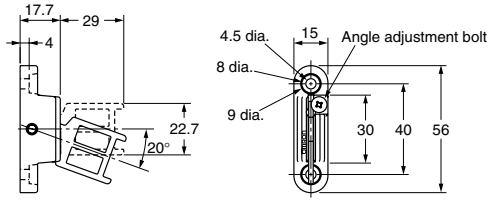
D4SL-NK2G





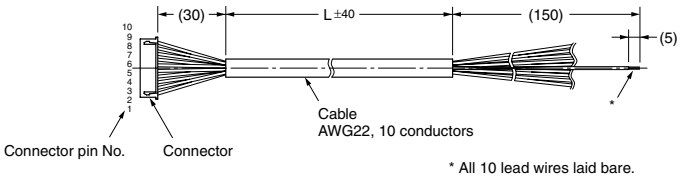
D4SL-NK3





Connector Cable

D4SL-CN□

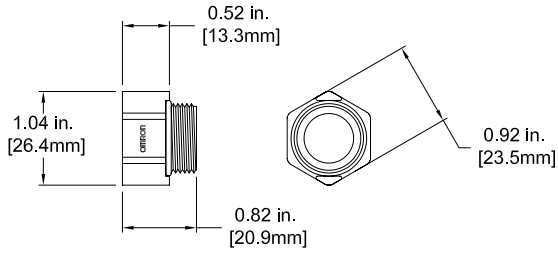


Model	L size
D4SL-CN1	1 m
D4SL-CN3	3 m
D4SL-CN5	5 m

Connector No.	Lead wire color
1	Black
2	Black/White
3	Red
4	Red/White
6	Green

Connector No.	Lead wire color
6	Green/White
7	Yellow
8	Yellow/White
9	Brown
10	Brown White

M20-NPT Adapter



Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

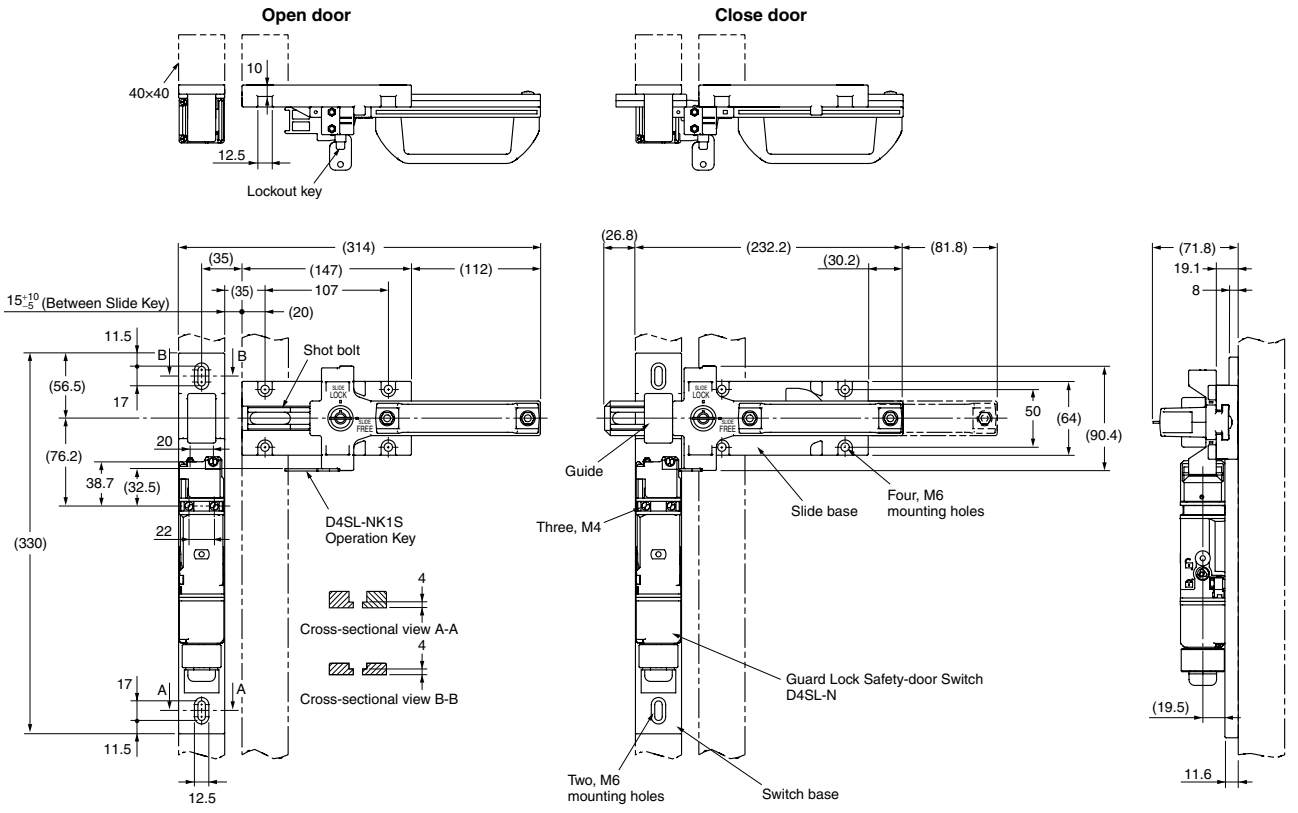
OMRON AUTOMATION & SAFETY

Dimensions and Operating Characteristics

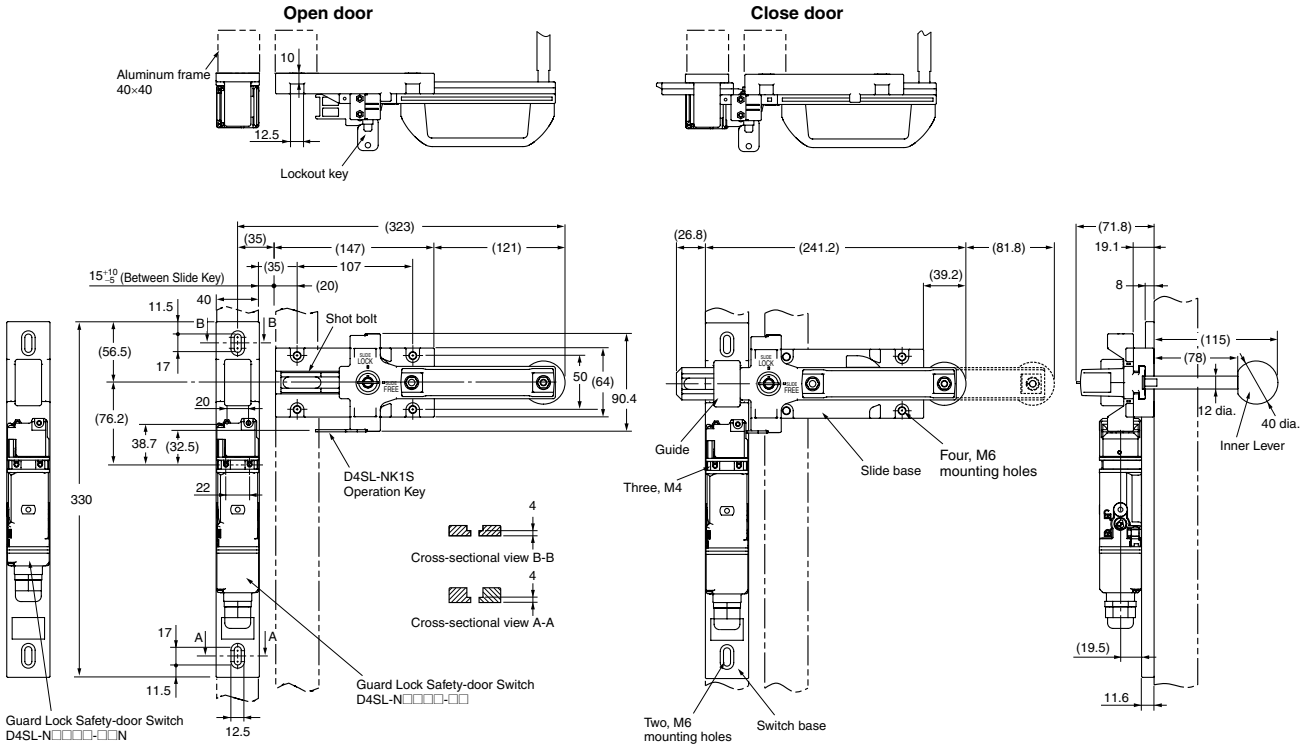
(mm)

Slide Key

D4SL-NSK10-LK



D4SL-NSK10-LKH



F

Dimensions and Operating Characteristics (continued)

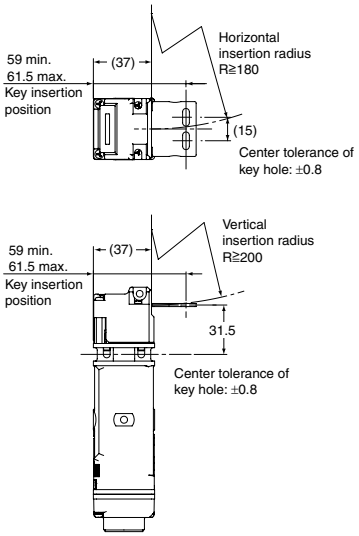
(mm)

Operating Key Mounting

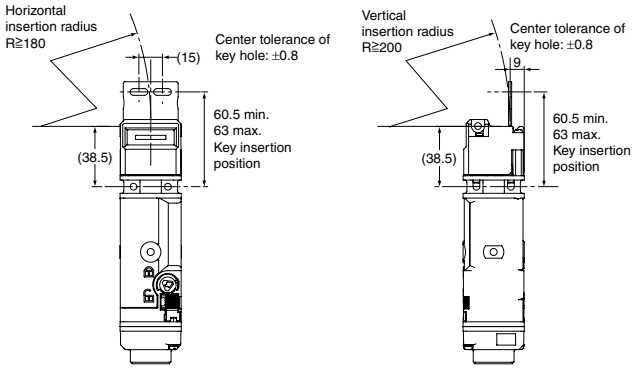
D4SL-N+D4SL-NK1



With Front-inserted Operation Key



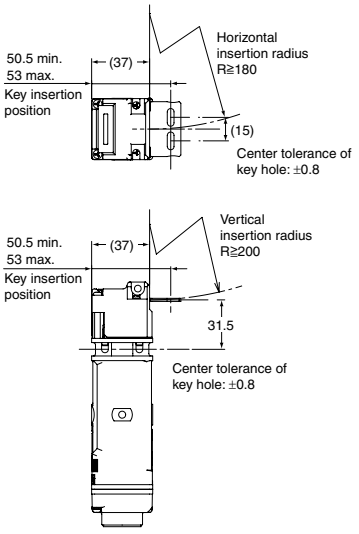
With Top-Inserted Operation Key



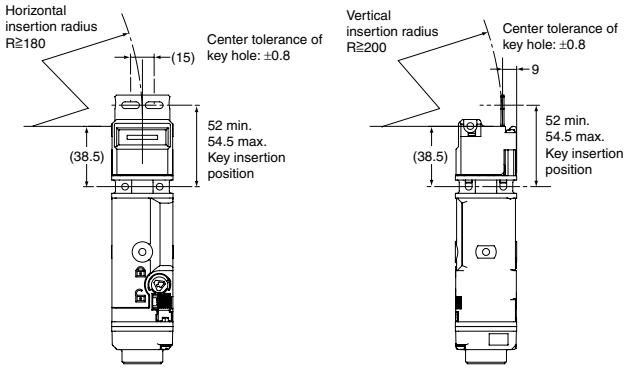
D4SL-N+D4SL-NK1S



With Front-inserted Operation Key



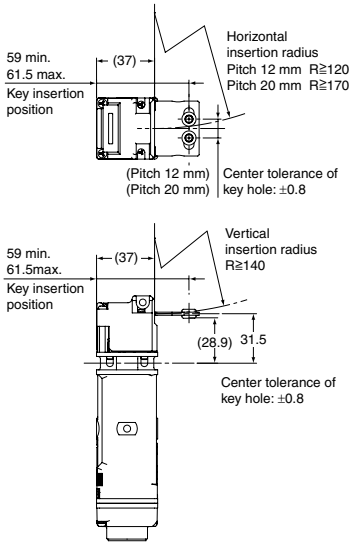
With Top-Inserted Operation Key



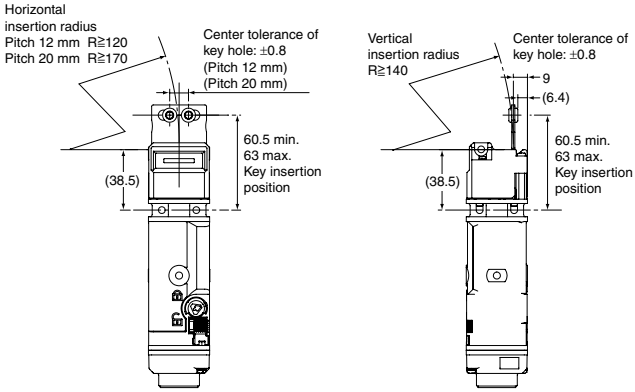
D4SL-N+D4SL-NK1G



With Front-inserted Operation Key



With Top-Inserted Operation Key



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Dimensions and Operating Characteristics (continued)

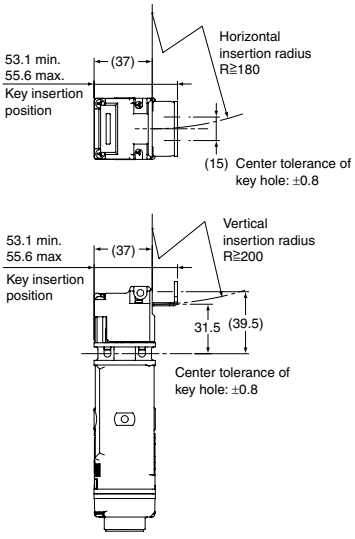
(mm)

Operating Key Mounting (continued)

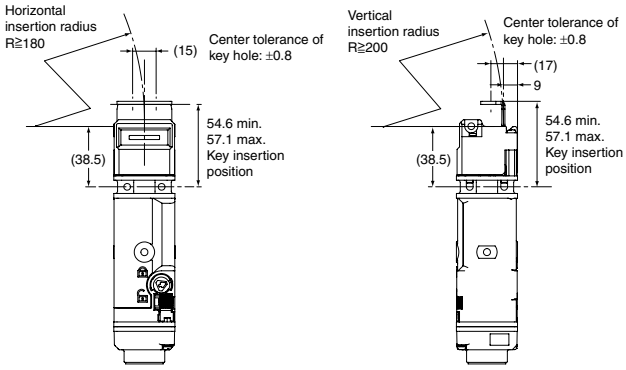
D4SL-N+D4SL-NK2



With Front-inserted Operation Key



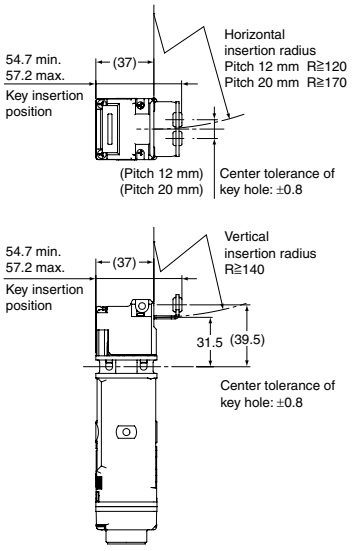
With Top-Inserted Operation Key



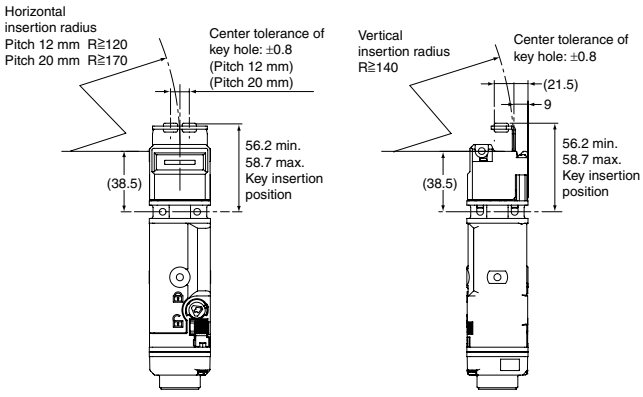
D4SL-N+D4SL-NK2G



With Front-inserted Operation Key



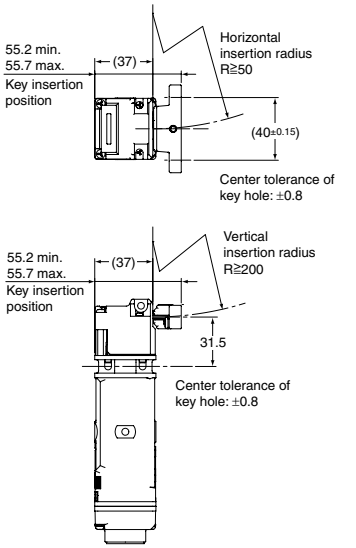
With Top-Inserted Operation Key



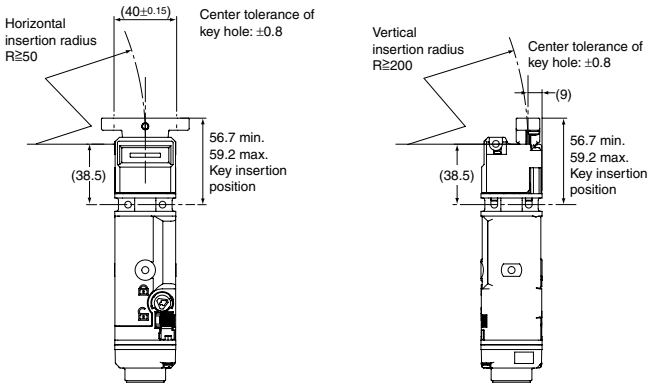
D4SL-N+D4SL-NK3



With Front-inserted Operation Key



With Top-Inserted Operation Key



F

Application Examples

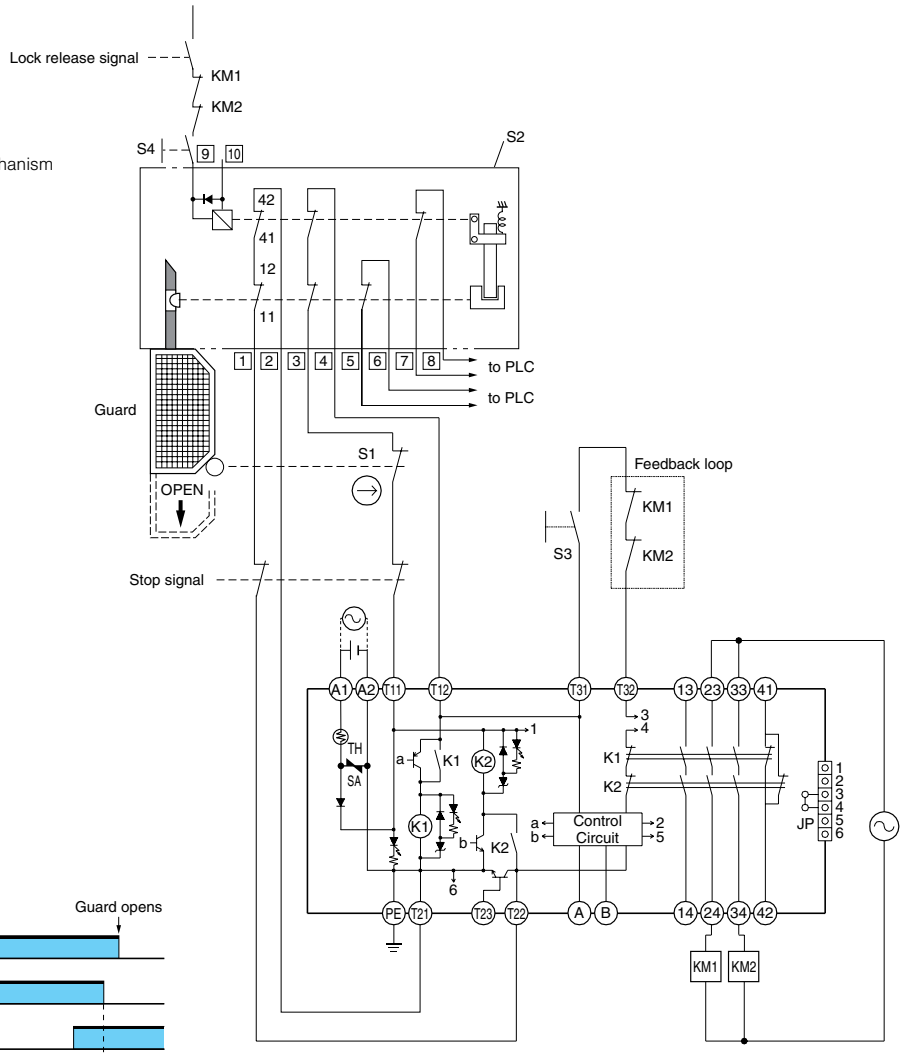
D4SL-N Application Example

PL/Safety Category	Applied models	Stop category	Reset method
Equivalent to PLe/4	D4SL-N☐R☐A-☐ Compact Safety Door Switch with Magnetic Lock (mechanical lock) G9SA-301 (24 VAC/DC) Safety Relay Unit	0	Manual

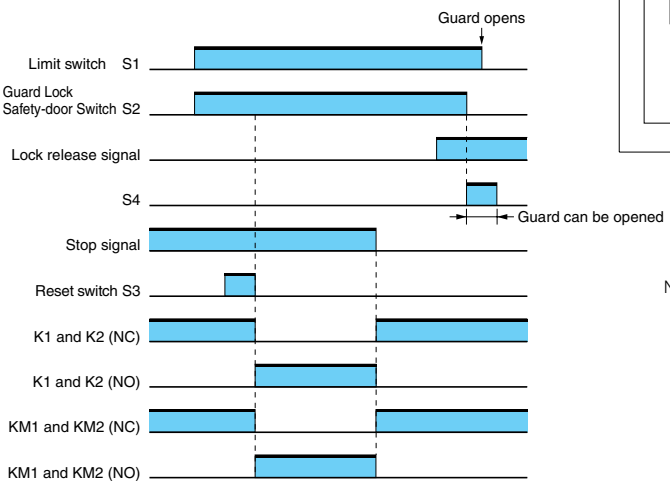
Application Overview

- If the guard is opened, it is detected with S2 and the power supply to the motor (M) is shut OFF.
- When the guard is closed, the lock status can be detected and the power supply to the motor (M) remains shut OFF until limit switch S3 is pressed.

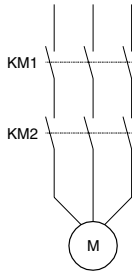
S1: Safety Limit Switch with direct opening mechanism (D4B-N, D4N, D4F)
S2: D4SL-N
S3: Reset switch
S4: Lock release switch
KM1 and KM2: Magnetic Contactor
M: 3-phase motor



Timing Chart



Notes: 1. The above circuit diagram is for Category 3.
2. Numbers inside the boxes are terminal numbers printed on the product.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering

Model Number Structure

Switch

D4SL – N ☐ ☐ ☐ ☐ – ☐ ☐ ☐
❶ ❷ ❸ ❹ ❺ ❻ ❼

❶ Conduit Size
2: G1/2 (conduit)
3: 1/2-14 NPT (M20, includes M20-to-1/2-14NPT conversion adapter)
4: M20

❷ Built-in Switch
4-contact Model: Door monitor and lock monitors are connected in series internally
A: 1NC/1NO + 1NC/1NO
B: 1NC/1NO + 2NC
C: 2NC + 1NC/1NO
D: 2NC + 2NC

4-contact Model: Door monitor and lock monitors are NOT connected in series internally
S: 1NC/1NO + 1NC/1NO
T: 1NC/1NO + 2NC
U: 2NC + 1NC/1NO
V: 2NC + 2NC

5-contact Model
E: 2NC/1NO + 1NC/1NO
F: 2NC/1NO + 2NC
G: 3NC + 1NC/1NO
H: 3NC + 2NC

6-contact Model
N: 2NC/1NO + 2NC/1NO
P: 2NC/1NO + 3NC
Q: 3NC + 2NC/1NO
R: 3NC + 3NC

❸ Head Material
4-contact Model
F: Resin

5- or 6-contact Model (common)
F: Resin
D: Metal

❹ Door Lock and Release
A: Mechanical lock/24 VDC solenoid release
G: 24 VDC solenoid lock/mechanical release

❺ Indicator
4-contact Model
Blank: None

5- or 6-contact Model (common)
D: 24 VDC (orange LED indicator)

❻ Release Key Type
4-contact Model
Blank: Standard release key (metal)

5- or 6-contact Model (common)
Blank: Special release key (metal)
4: Special release key (resin) (Note: Release keys are provided)

❼ Connection Method
Blank: Terminal block
N: Connector *1

Operation Key

D4SL-NK ☐ ☐
❶ ❷

❶ Operation Key Type
1: Horizontal mounting
2: Vertical mounting
3: Adjustable mounting (horizontal)

❶ Key Type
Blank: No cushion rubber
G: Cushion rubber
S: No cushion rubber, short type

Note:

*1. Connector cables are not included with the connector type and are to be purchased separately.

Caution!: For solenoid-to-lock 6-contact models (contact configuration: N,P,Q,R), if a current is detected in the solenoid before the door is closed, the door might remain unlocked. Apply power to the solenoid AFTER the door is closed to ensure proper locking function.

F

Ordering (continued)

List of Models

Release Key Type	Wiring method	Solenoid voltage/ Indicator	Lock and release type	Contact configuration (door open/closed detection switch and lock monitor switch contacts)	Conduit size (See Note.)	Model
Standard (metal) 	Connector	24 VDC (Orange)	Mechanical lock Solenoid release	6-contact Model Insert the built-in switch (N, P, Q or R) into the blank ☐.	G1/2	D4SL-N2☐FA-DN
					1/2-14NPT	D4SL-N3☐FA-DN
					1/2-14NPT	D4SL-N3NFA-DN
					M20	D4SL-N4☐FA-DN
				5-contact Model Insert the built-in switch (E, F, G or H) into the blank ☐.	G1/2	D4SL-N2☐FA-DN
					1/2-14NPT	D4SL-N3☐FA-DN
					M20	D4SL-N4☐FA-DN
		24 VDC (without indicator)		4-contact Model Insert the built-in switch (A, B, C, D, S, T, U or V) into the blank ☐.	G1/2	D4SL-N2☐FA-N
					1/2-14NPT	D4SL-N3☐FA-N
					M20	D4SL-N4☐FA-N
	Terminal block	24 VDC (Orange)		6-contact Model Insert the built-in switch (N, P, Q or R) into the blank ☐.	G1/2	D4SL-N2☐FA-D
					1/2-14NPT	D4SL-N3☐FA-D
					1/2-14NPT	D4SL-N3NFA-D
					1/2-14NPT	D4SL-N3QFA-D
					M20	D4SL-N4☐FA-D
				5-contact Model Insert the built-in switch (E, F, G or H) into the blank ☐.	G1/2	D4SL-N2☐FA-D
					1/2-14NPT	D4SL-N3☐FA-D
					M20	D4SL-N4☐FA-D
		24 VDC (without indicator)		4-contact Model Insert the built-in switch (A, B, C, D, S, T, U or V) into the blank ☐.	G1/2	D4SL-N2☐FA
					1/2-14NPT	D4SL-N3☐FA
					M20	D4SL-N4☐FA
	Connector	24 VDC (Orange)	Solenoid lock Mechanical release	6-contact Model Insert the built-in switch (N, P, Q or R) into the blank ☐.	G1/2	D4SL-N2☐FG-DN
					1/2-14NPT	D4SL-N3☐FG-DN
					1/2-14NPT	D4SL-N3NFG-DN
					M20	D4SL-N4☐FG-DN
				5-contact Model Insert the built-in switch (E, F, G or H) into the blank ☐.	G1/2	D4SL-N2☐FG-DN
					1/2-14NPT	D4SL-N3☐FG-DN
					1/2-14NPT	D4SL-N3HFG-DN
					M20	D4SL-N4☐FG-DN
		24 VDC (without indicator)		4-contact Model Insert the built-in switch (A, B, C, D, S, T, U or V) into the blank ☐.	G1/2	D4SL-N2☐FG-N
					1/2-14NPT	D4SL-N3☐FG-N
					M20	D4SL-N4☐FG-N
	Terminal block	24 VDC (Orange)		6-contact Model Insert the built-in switch (N, P, Q or R) into the blank ☐.	G1/2	D4SL-N2☐FG-D
					1/2-14NPT	D4SL-N3☐FG-D
					1/2-14NPT	D4SL-N3NFG-D
					M20	D4SL-N4☐FG-D
				5-contact Model Insert the built-in switch (E, F, G or H) into the blank ☐.	G1/2	D4SL-N2☐FG-D
					1/2-14NPT	D4SL-N3☐FG-D
					M20	D4SL-N4☐FG-D
		24 VDC (without indicator)		4-contact Model Insert the built-in switch (A, B, C, D, S, T, U or V) into the blank ☐.	G1/2	D4SL-N2☐FG
					1/2-14NPT	D4SL-N3☐FG
					M20	D4SL-N4☐FG

Note: The recommended models for equipment and machinery being exported to Europe are those with an M20 conduit sizes, and for North America, the recommended models are those with a 1/2-14NPT conduit sizes.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering (continued)

List of Models (continued)

Release Key Type	Wiring method	Solenoid voltage/ Indicator	Lock and release type	Contact configuration (door open/closed detection switch and lock monitor switch contacts)	Conduit size (See Note.)	Model
Special (resin) 	Connector	24 VDC (Orange)	Mechanical lock Solenoid release	6-contact Model Insert the built-in switch (N, P, Q or R) into the blank ☐.	G1/2	D4SL-N2☐FA-D4N
					1/2-14NPT	D4SL-N3☐FA-D4N
					M20	D4SL-N4☐FA-D4N
				5-contact Model Insert the built-in switch (E, F, G or H) into the blank ☐.	G1/2	D4SL-N2☐FA-D4N
					1/2-14NPT	D4SL-N3☐FA-D4N
					M20	D4SL-N4☐FA-D4N
	Terminal block			6-contact Model Insert the built-in switch (N, P, Q or R) into the blank ☐.	G1/2	D4SL-N2☐FA-D4
					1/2-14NPT	D4SL-N3☐FA-D4
					1/2-14NPT	D4SL-N3NFA-D4
					M20	D4SL-N4☐FA-D4
				5-contact Model Insert the built-in switch (E, F, G or H) into the blank ☐.	G1/2	D4SL-N2☐FA-D4
					1/2-14NPT	D4SL-N3☐FA-D4
					M20	D4SL-N4☐FA-D4
	Connector		Solenoid lock Mechanical release	6-contact Model Insert the built-in switch (N, P, Q or R) into the blank ☐.	G1/2	D4SL-N2☐FG-D4N
					G1/2	D4SL-N2NFG-D4N
					1/2-14NPT	D4SL-N3☐FG-D4N
					M20	D4SL-N4☐FG-D4N
				5-contact Model Insert the built-in switch (E, F, G or H) into the blank ☐.	G1/2	D4SL-N2☐FG-D4N
					1/2-14NPT	D4SL-N3☐FG-D4N
					M20	D4SL-N4☐FG-D4N
	Terminal block			6-contact Model Insert the built-in switch (N, P, Q or R) into the blank ☐.	G1/2	D4SL-N2☐FG-D4
					1/2-14NPT	D4SL-N3☐FG-D4
					1/2-14NPT	D4SL-N3NFG-D4
					M20	D4SL-N4☐FG-D4
				5-contact Model Insert the built-in switch (E, F, G or H) into the blank ☐.	G1/2	D4SL-N2☐FG-D4
					1/2-14NPT	D4SL-N3☐FG-D4
					M20	D4SL-N4☐FG-D4

Note: The recommended models for equipment and machinery being exported to Europe are those with an M20 conduit sizes, and for North America, the recommended models are those with a 1/2-14NPT conduit sizes.

F

Ordering (continued)

Operation Keys

Type	Model
Horizontal mounting 	D4SL-NK1
Horizontal mounting (Short) 	D4SL-NK1S
Horizontal mounting (Cushion rubber) 	D4SL-NK1G
Vertical mounting 	D4SL-NK2
Vertical mounting (Cushion rubber) 	D4SL-NK2G
Adjustable (Horizontal) 	D4SL-NK3

Notes:
D4SL-NK☐☐ actuators are compatible with both D4SL & D4SL-N switches
D4SL-K☐☐ actuators are also compatible with both D4SL & D4SL-N switches

Connector Cables

Type	Model
1 m	D4SL-CN1
3 m	D4SL-CN3
5 m	D4SL-CN5

Slide Key

Type	Specifications	Contents	Model	Applicable Door Switch
	Weight: Approx. 0.6 kg Mechanical durability: 20,000 operations min.	Slide Key: 1 (not yet mounted) D4SL-N mounting plate: 1 Door Switch special mounting screws: 3 D4SL-NK1 (operation key): 1 D4SL-NK1 special mounting screws: 2 Lockout keys: 2 Lockout key strap: 1 Caution labels (stickers): 2 sheets (English and Japanese)	D4SL-NSK10-LK	D4SL-N
	Weight: Approx. 0.1 kg	Inner Lever: 1	D4SL-SK10H *	–
	Weight: Approx. 0.7 kg Mechanical durability: 20,000 operations min.	Slide Key: 1 (not yet mounted) Inner Lever: 1 D4SL-N mounting plate: 1 Door Switch special mounting screws: 3 D4SL-NK1 (operation key): 1 D4SL-NK1 special mounting screws: 2 Lockout keys: 2 Lockout key strap: 1 Caution labels (stickers): 2 sheets (English and Japanese)	D4SL-NSK10-LKH	D4SL-N

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

D4NL

Quick Link
S243
omron247.com

Guard Lock Safety-Door Switch

- Best-selling guard lock safety-door switch available in several compact, multi-contact models
- Selectable Operation Key insertion direction and adjustable mounting ensure installation flexibility
- Built-in switches with multiple-contact construction are available
- Key holding force of 1,300 N minimum
- Can be used for either standard loads or microloads
- Lineup includes models with a conduit size of M20
- IP67 degree of protection
- Variety of metallic heads available



Specifications

Standards and EC Directives

Conforms to the following EC Directives:

- Machinery Directive
- Low Voltage Directive
- EN 1088
- EN 60204-1
- GS-ET-19

Certified Standards

Certification body	Standard	File No.
TÜV SÜD	EN 60947-5-1 (certified direct opening)	Consult your representative for details.
UL *1	UL 508, CSA C22.2 No.14	E76675
CQC (CCC)	GB14048.5	2003010305064267
KOSHA *2	EN60947-5-1	2005-196

*1. Certification for CSA C22.2 No. 14 is certified by the UL mark.
*2. Only certain models have been certified.

Certified Standard Ratings

TÜV (EN 60947-5-1), CCC (GB14048.5)

Item / Utilization category	AC-15	DC-13
Rated operating current (Ie)	3 A	0.27 A
Rated operating voltage (Ue)	240 V	250 V

Note: Use a 10 A fuse type gI or gG that conforms to IEC 60269 as a short-circuit protection device. This fuse is not built into the Switch.

UL/CSA (UL 508, CSA C22.2 No. 14)

A300

Rated voltage	Carry current	Current (A)		Volt-amperes (VA)	
		Make	Break	Make	Break
120 VAC	10 A	60	6	7,200	720
240 VAC		30	3		

Q300

Rated voltage	Carry current	Current (A)		Volt-amperes (VA)	
		Make	Break	Make	Break
125 VDC	2.5 A	0.55	0.55	69	69
250 VDC		0.27	0.27		

Solenoid Coil Characteristics

Item / Type	24 VDC	110 VAC	230 VAC
Rated operating voltage (100% ED)	24 VDC $^{+10\%}_{-15\%}$	110 VAC ±10%	230 VAC ±10%
Current consumption	Approx. 200 mA	Approx. 50 mA	Approx. 30 mA
Insulation Class	Class F (130°C max.)		

Indicator Characteristics

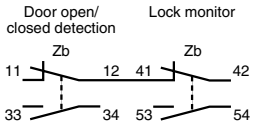
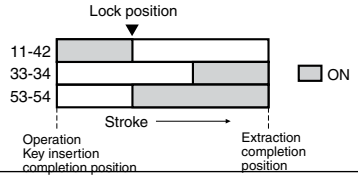
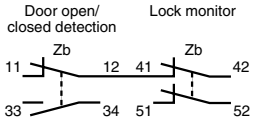
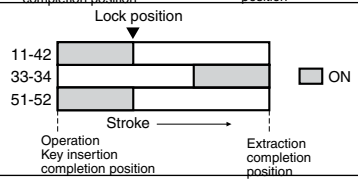
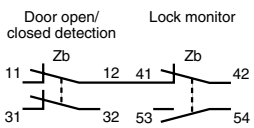
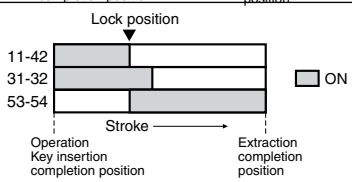
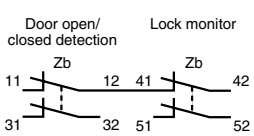
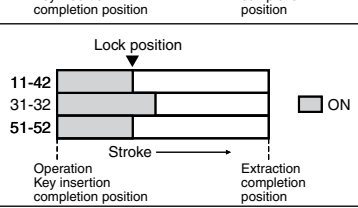
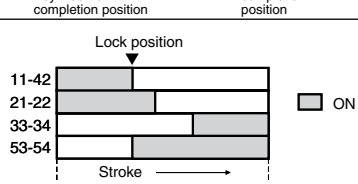
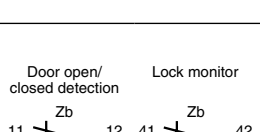
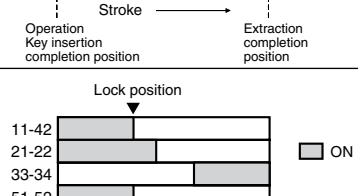
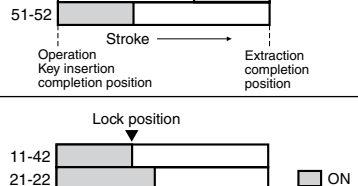
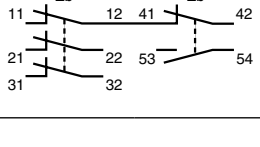
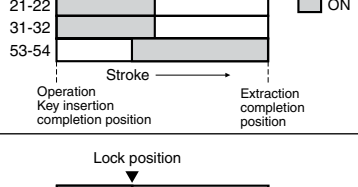
Item / Type	LED
Rated voltage	10 to 115 VAC/VDC
Current consumption	Approx. 1 mA
Color (LED)	Orange

F

Connections

Contact Form

Indicates conditions where the Key is inserted and the lock is applied. Terminals 12 and 41 are connected internally (as per GS-ET-19).

Model	Contact (door open/closed detection and lock monitor)	Contact form		Operating pattern	Remarks
		Door open/closed detection	Lock monitor		
D4NL-□AF□-□	1NC/1NO + 1NC/1NO				Only NC contacts 11-12 have a certified direct opening mechanism. (→) The terminals 11-42, 33-34, and 53-54 can be used as unlike poles.
D4NL-□BF□-□	1NC/1NO + 2NC				Only NC contacts 11-12 have a certified direct opening mechanism. (→) The terminals 11-42, 33-34, and 51-52 can be used as unlike poles.
D4NL-□CF□-□	2NC + 1NC/1NO				Only NC contacts 11-12 and 31-32 have a certified direct opening mechanism. (→) The terminals 11-42, 31-32, and 53-54 can be used as unlike poles.
D4NL-□DF□-□	2NC + 2NC				Only NC contacts 11-12 and 31-32 have a certified direct opening mechanism. (→) The terminals 11-42, 31-32, and 51-52 can be used as unlike poles.
D4NL-□EF□-□	2NC/1NO + 1NC/1NO				Only NC contacts 11-12 and 21-22 have a certified direct opening mechanism. (→) The terminals 11-42, 21-22, 33-34, and 53-54 can be used as unlike poles.
D4NL-□FF□-□	2NC/1NO + 2NC				Only NC contacts 11-12 and 21-22 have a certified direct opening mechanism. (→) The terminals 11-42, 21-22, 33-34, and 51-52 can be used as unlike poles.
D4NL-□GF□-□	3NC + 1NC/1NO				Only NC contacts 11-12, 21-22, and 31-32 have a certified direct opening mechanism. (→) The terminals 11-42, 21-22, 31-32, and 53-54 can be used as unlike poles.
D4NL-□HF□-□	3NC + 2NC				Only NC contacts 11-12, 21-22, and 31-32 have a certified direct opening mechanism. (→) The terminals 11-42, 21-22, 31-32, and 51-52 can be used as unlike poles.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

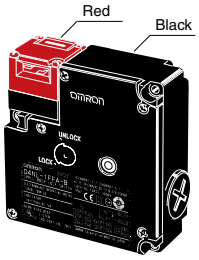
OMRON AUTOMATION & SAFETY

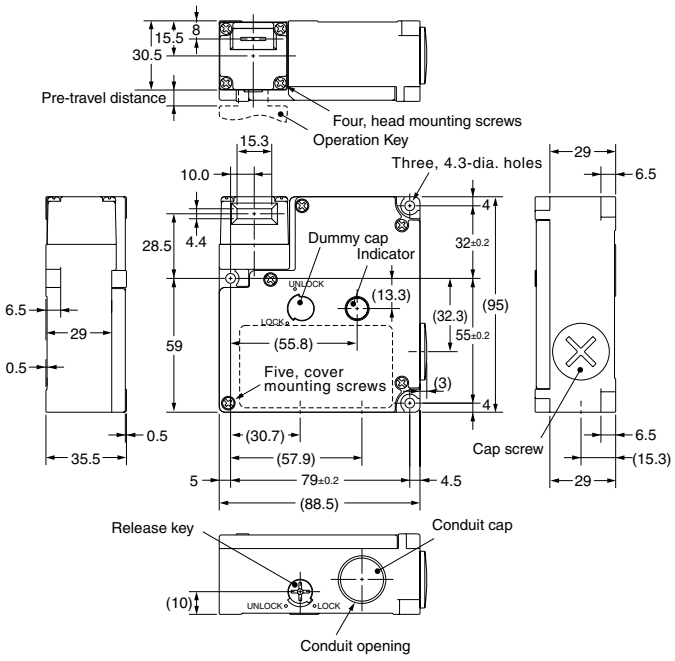
Dimensions and Operating Characteristics

(mm)

Switches

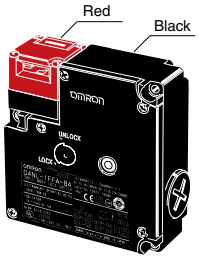
D4NL-□□□□-B

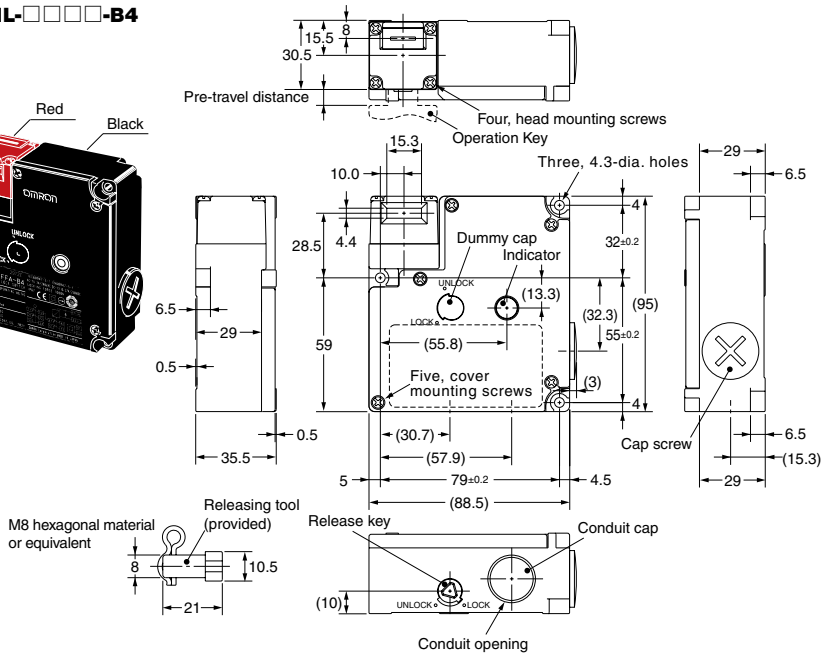




Operating characteristics	D4NL-□□□□-BS
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

D4NL-□□□□-B4





Operating characteristics	D4NL-□□□□-B4
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

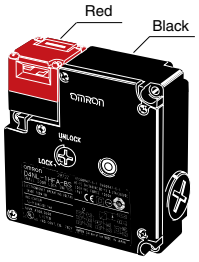
Notes:
1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. There are fluctuations in the contact ON/OFF timing for Switches with multiple poles (2NC, 2NC/1NO, or 3NC). Confirm performance before application.

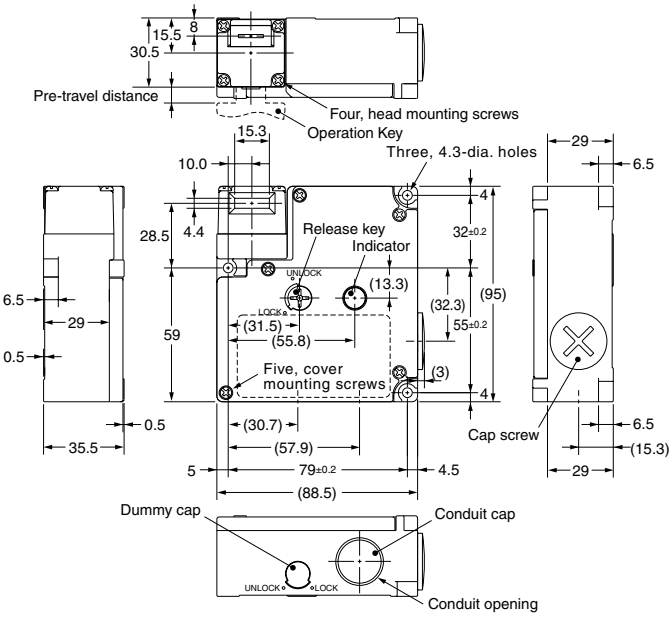
F

Dimensions and Operating Characteristics (continued)

(mm)

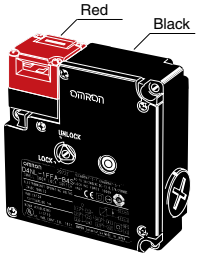
D4NL-□□□□-BS

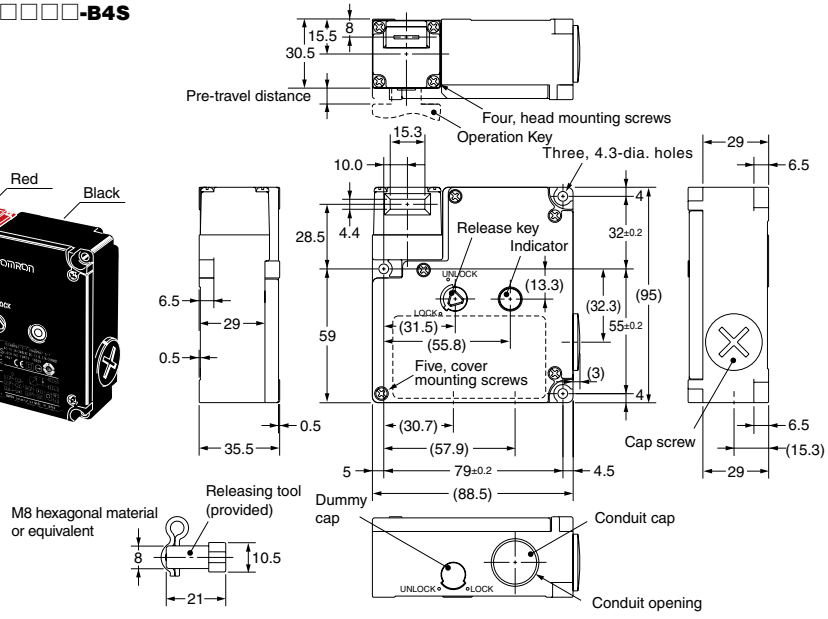




Operating characteristics	D4NL-□□□□-BS
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

D4NL-□□□□-B4S



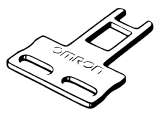


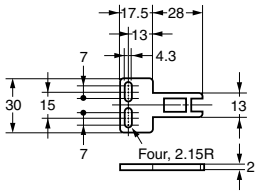
Operating characteristics	D4NL-□□□□-B4S
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

Notes:
1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. There are fluctuations in the contact ON/OFF timing for Switches with multiple poles (2NC, 2NC/1NO, or 3NC). Confirm performance before application.

Operation Keys

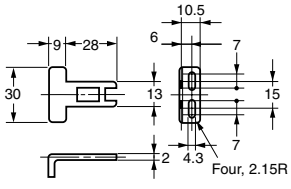
D4DS-K1



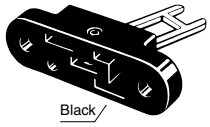


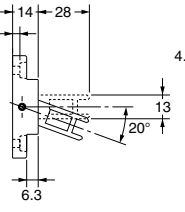
D4DS-K2

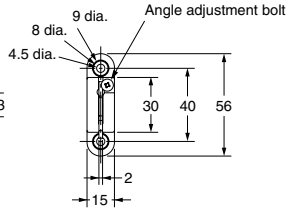




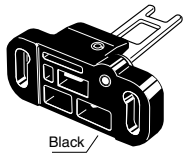
D4DS-K3

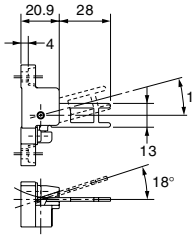


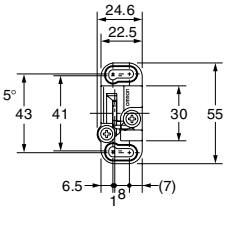




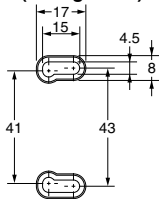
D4DS-K5







Mounting Holes (Enlargement)



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

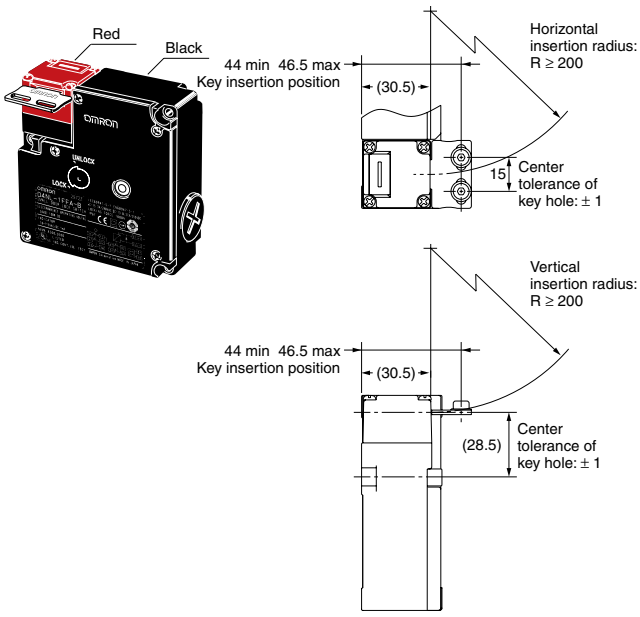
OMRON AUTOMATION & SAFETY

Dimensions and Operating Characteristics (continued)

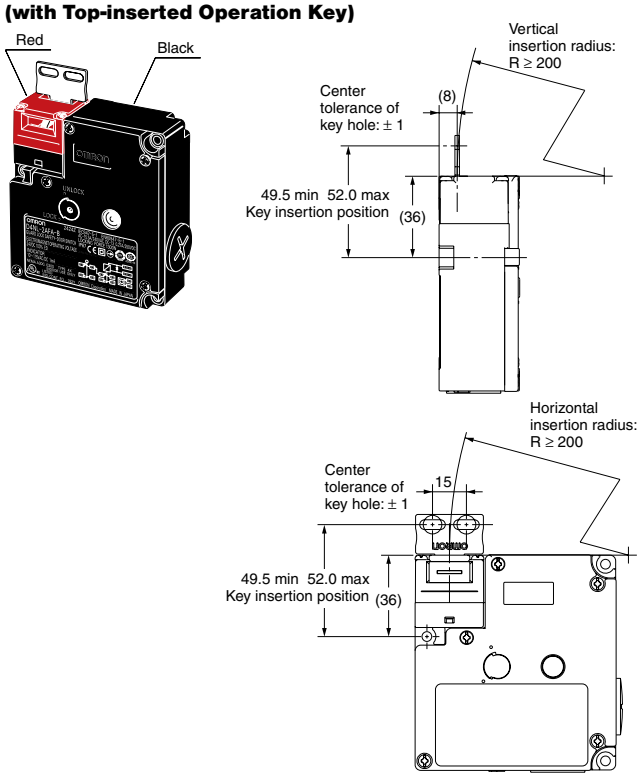
(mm)

With Operating Key Inserted

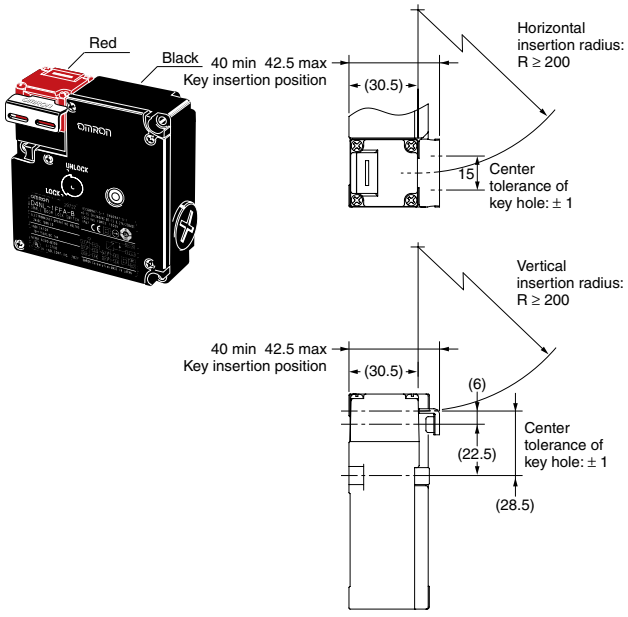
D4NL + D4DS-K1
(with Front-inserted Operation Key)



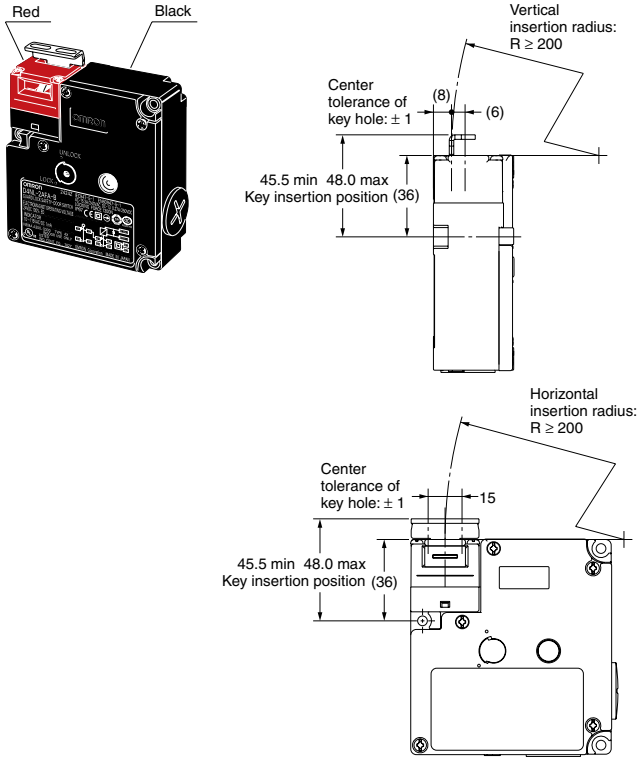
D4NL + D4DS-K1
(with Top-inserted Operation Key)



D4NL + D4DS-K2
(with Front-inserted Operation Key)



D4NL + D4DS-K2
(with Top-inserted Operation Key)

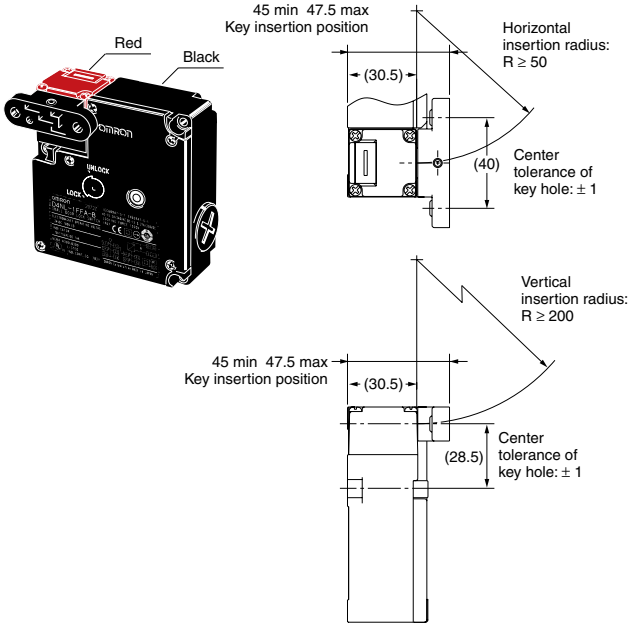


F

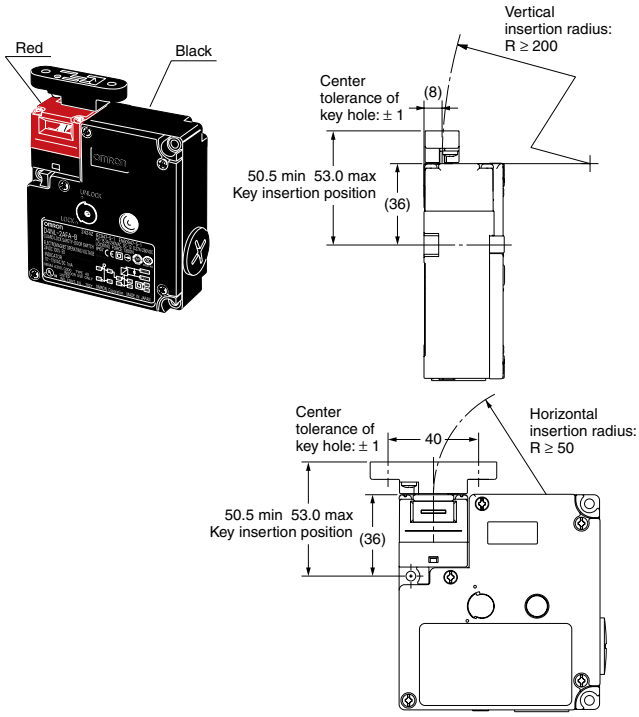
Dimensions and Operating Characteristics (continued)

(mm)

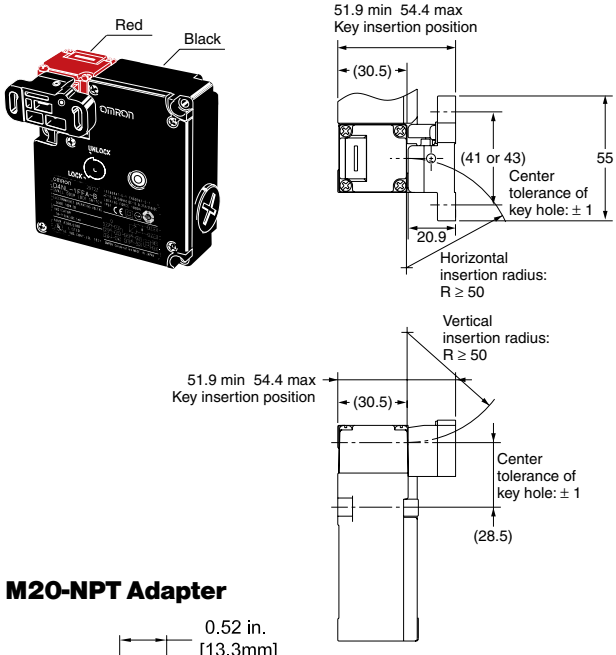
D4NL + D4DS-K3 (with Front-inserted Operation Key)



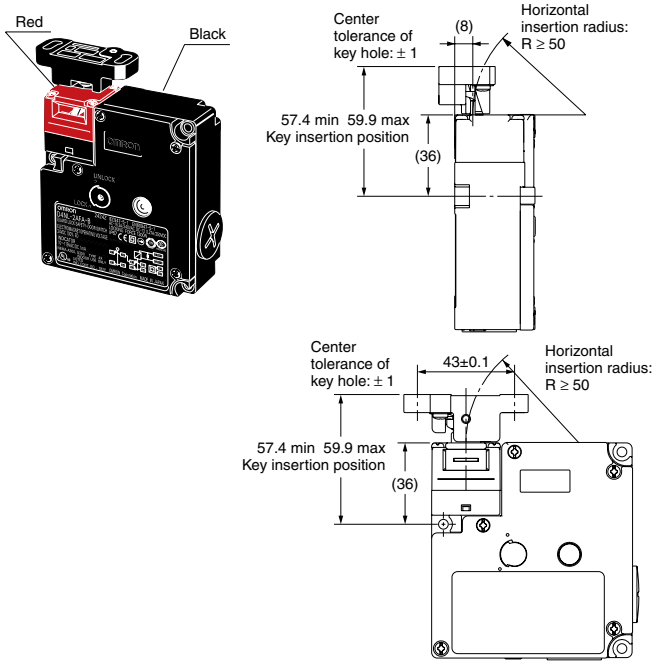
D4NL + D4DS-K3 (with Top-inserted Operation Key)



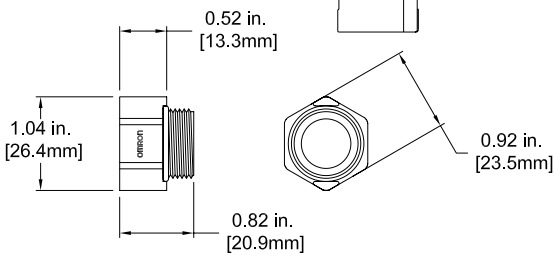
D4NL + D4DS-K5 (with Front-inserted Operation Key)



D4NL + D4DS-K5 (with Top-inserted Operation Key)



M20-NPT Adapter



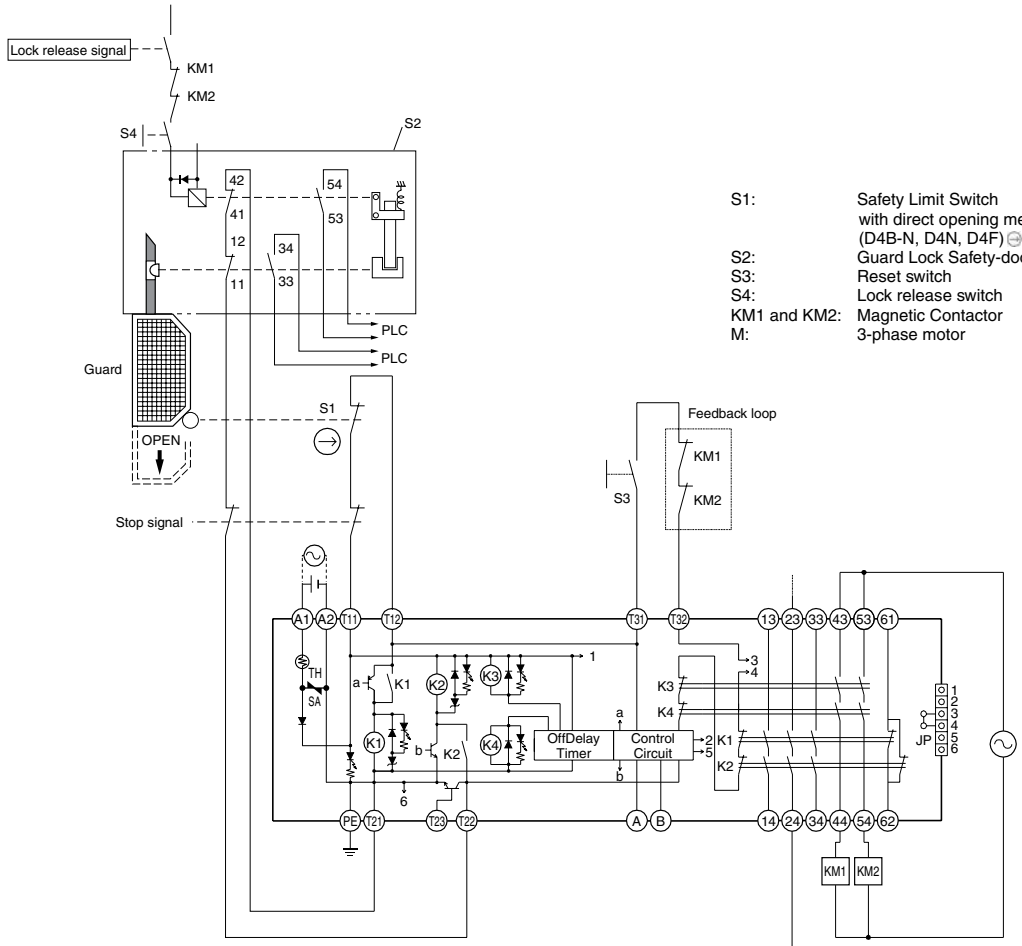
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

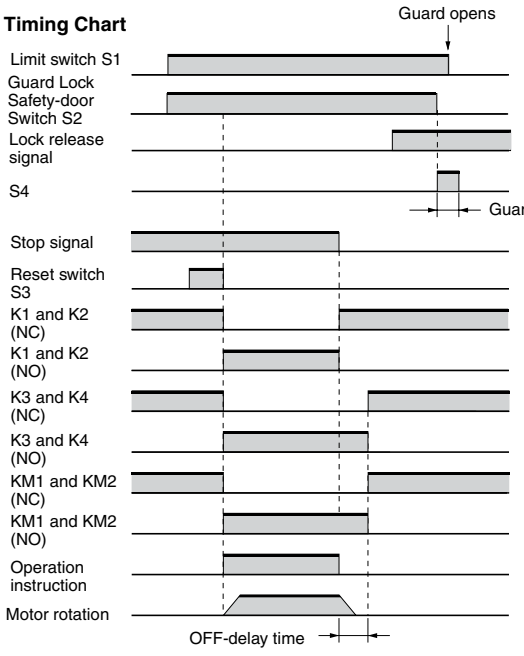
Application Examples

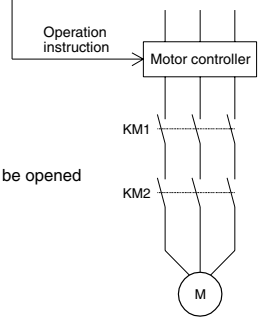
G9SA-321-T□ (24 VAC/VDC) + D4NL-□A□A-□, -□A□B-□, -□A□C-□ (Mechanical Lock Type) Circuit Diagram (Manual Reset)



S1: Safety Limit Switch with direct opening mechanism (D4B-N, D4N, D4F)
S2: Guard Lock Safety-door Switch
S3: Reset switch
S4: Lock release switch
KM1 and KM2: Magnetic Contactor
M: 3-phase motor

Timing Chart





Note: The above example circuit is for Category 3.

F

Ordering

Model Number Structure

Switch

D4NL – ☐ ☐ ☐ ☐ – ☐ ☐ ☐ – ☐
❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽

❶ Conduit Size
1: Pg13.5
2: G1/2
4: M20

❷ Built-in Switch (with Door Open/Closed Detection Switch and Lock Monitor Switch Contacts)
A: 1NC/1NO (slow-action contacts) + 1NC/1NO (slow-action contacts)
B: 1NC/1NO (slow-action contacts) + 2NC (slow-action contacts)
C: 2NC (slow-action contacts) + 1NC/1NO (slow-action contacts)
D: 2NC (slow-action contacts) + 2NC (slow-action contacts)
E: 2NC/1NO (slow-action contacts) + 1NC/1NO (slow-action contacts)
F: 2NC/1NO (slow-action contacts) + 2NC (slow-action contacts)
G: 3NC (slow-action contacts) + 1NC/1NO (slow-action contacts)
H: 3NC (slow-action contacts) + 2NC (slow-action contacts)

❸ Head Mounting Direction and Material
F: Four mounting directions possible (Front-side mounting at shipping)/plastic
D: Four mounting directions possible (Front-side mounting at shipping)/metal

❹ Door Lock and Release
A: Mechanical lock/24 VDC solenoid release
B: Mechanical lock/110 VAC solenoid release*
G: 24 VDC solenoid lock/mechanical release
H: 110 VAC solenoid lock/mechanical release*

❺ Indicator
B: 10 to 115 VAC/VDC (orange LED indicator)

❻ Release Key Type
Blank: Standard
4: Special release key

❼ Release Key Position
Blank: Bottom
S: Front

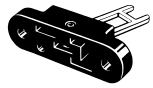
❽ M20-to-NPT Adapter
Blank: Adapter is not included
NPT: Adapter is included

* 110 VAC version is not available for -4☐-NPT models.

Operation Key

D4DS-K ☐
❶

❶ Operation Key Type
1: Horizontal mounting
2: Vertical mounting
3: Adjustable mounting (horizontal)
5: Adjustable mounting (horizontal/vertical)

Type	Model
Horizontal mounting 	D4DS-K1
Vertical mounting 	D4DS-K2
Adjustable mounting (horizontal) 	D4DS-K3
Adjustable mounting (horizontal/vertical) 	D4DS-K5

Special Release Key

Type	Model
Special Release Key for D4GL, D4JL, D4NL, and D4SL Switches 	D4NL-RK

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering (continued)

List of Models

Switches with direct opening mechanisms (Operation Keys are sold separately)

Head material	Release key position	Release key type	Solenoid voltage/ indicator	Lock and release types	Contact configuration (door open/closed detection switch and lock monitor switch contacts) (slow-action) Certified direct opening NC contact	Conduit opening	Model
Plastic	Bottom	Standard	Solenoid: 24 VDC Orange LED: 10 to 115 VAC/VDC	Mechanical lock Solenoid release	1NC/1NO+1NC/1NO	M20	D4NL-4AFA-B
						M20 with 1/2" NPT adaptor	D4NL-4AFA-B-NPT
					1NC/1NO+2NC	M20	D4NL-4BFA-B
						M20 with 1/2" NPT adaptor	D4NL-4BFA-B-NPT
					2NC+1NC/1NO	M20	D4NL-4CFA-B
						M20 with 1/2" NPT adaptor	D4NL-4CFA-B-NPT
					2NC+2NC	M20	D4NL-4DFA-B
						M20 with 1/2" NPT adaptor	D4NL-4DFA-B-NPT
					2NC/1NO+1NC/1NO	M20	D4NL-4EFA-B
						M20 with 1/2" NPT adaptor	D4NL-4EFA-B-NPT
					2NC/1NO+2NC	M20	D4NL-4FFA-B
						M20 with 1/2" NPT adaptor	D4NL-4FFA-B-NPT
					3NC+1NC/1NO	M20	D4NL-4GFA-B
						M20 with 1/2" NPT adaptor	D4NL-4GFA-B-NPT
					3NC+2NC	M20	D4NL-4HFA-B
						M20 with 1/2" NPT adaptor	D4NL-4HFA-B-NPT
				Solenoid lock Mechanical release	1NC/1NO+1NC/1NO	M20	D4NL-4AFG-B
						M20 with 1/2" NPT adaptor	D4NL-4AFG-B-NPT
					1NC/1NO+2NC	M20	D4NL-4BFG-B
						M20 with 1/2" NPT adaptor	D4NL-4BFG-B-NPT
					2NC+1NC/1NO	M20	D4NL-4CFG-B
						M20 with 1/2" NPT adaptor	D4NL-4CFG-B-NPT
					2NC+2NC	M20	D4NL-4DFG-B
						M20 with 1/2" NPT adaptor	D4NL-4DFG-B-NPT
					2NC/1NO+1NC/1NO	M20	D4NL-4EFG-B
						M20 with 1/2" NPT adaptor	D4NL-4EFG-B-NPT
					2NC/1NO+2NC	M20	D4NL-4FFG-B
						M20 with 1/2" NPT adaptor	D4NL-4FFG-B-NPT
					3NC+1NC/1NO	M20	D4NL-4GFG-B
						M20 with 1/2" NPT adaptor	D4NL-4GFG-B-NPT
					3NC+2NC	M20	D4NL-4HFG-B
						M20 with 1/2" NPT adaptor	D4NL-4HFG-B-NPT

(Continued on next page)

F

Ordering (continued)

List of Models (continued)

Switches with direct opening mechanisms (Operation Keys are sold separately)

Head material	Release key position	Release key type	Solenoid voltage/ indicator	Lock and release types	Contact configuration (door open/closed detection switch and lock monitor switch contacts) (slow-action) Certified direct opening NC contact	Conduit opening	Model
Plastic	Bottom	Special release key	Solenoid: 24 VDC Orange LED: 10 to 115 VAC/VDC	Mechanical lock Solenoid release	1NC/1NO+1NC/1NO	M20	D4NL-4AFA-B4
						M20 with 1/2" NPT adaptor	D4NL-4AFA-B4-NPT
					1NC/1NO+2NC	M20	D4NL-4BFA-B4
						M20 with 1/2" NPT adaptor	D4NL-4BFA-B4-NPT
					2NC+1NC/1NO	M20	D4NL-4CFA-B4
						M20 with 1/2" NPT adaptor	D4NL-4CFA-B4-NPT
					2NC+2NC	M20	D4NL-4DFA-B4
						M20 with 1/2" NPT adaptor	D4NL-4DFA-B4-NPT
					2NC/1NO+1NC/1NO	M20	D4NL-4EFA-B4
						M20 with 1/2" NPT adaptor	D4NL-4EFA-B4-NPT
					2NC/1NO+2NC	M20	D4NL-4FFA-B4
						M20 with 1/2" NPT adaptor	D4NL-4FFA-B4-NPT
					3NC+1NC/1NO	M20	D4NL-4GFA-B4
						M20 with 1/2" NPT adaptor	D4NL-4GFA-B4-NPT
					3NC+2NC	M20	D4NL-4HFA-B4
						M20 with 1/2" NPT adaptor	D4NL-4HFA-B4-NPT
				Solenoid lock Mechanical release	1NC/1NO+1NC/1NO	M20	D4NL-4AFG-B4
						M20 with 1/2" NPT adaptor	D4NL-4AFG-B4-NPT
					1NC/1NO+2NC	M20	D4NL-4BFG-B4
						M20 with 1/2" NPT adaptor	D4NL-4BFG-B4-NPT
					2NC+1NC/1NO	M20	D4NL-4CFG-B4
						M20 with 1/2" NPT adaptor	D4NL-4CFG-B4-NPT
					2NC+2NC	M20	D4NL-4DFG-B4
						M20 with 1/2" NPT adaptor	D4NL-4DFG-B4-NPT
					2NC/1NO+1NC/1NO	M20	D4NL-4EFG-B4
						M20 with 1/2" NPT adaptor	D4NL-4EFG-B4-NPT
					2NC/1NO+2NC	M20	D4NL-4FFG-B4
						M20 with 1/2" NPT adaptor	D4NL-4FFG-B4-NPT
					3NC+1NC/1NO	M20	D4NL-4GFG-B4
						M20 with 1/2" NPT adaptor	D4NL-4GFG-B4-NPT
					3NC+2NC	M20	D4NL-4HFG-B4
						M20 with 1/2" NPT adaptor	D4NL-4HFG-B4-NPTt
Metal				Mechanical lock Solenoid release	2NC/1NO+1NC/1NO	M20 with 1/2" NPT adaptor	D4NL-4EDA-B4-NPT
					3NC+1NC/1NO	M20 with 1/2" NPT adaptor	D4NL-4GDA-B4-NPT
				Solenoid lock Mechanical release	2NC/1NO+1NC/1NO	M20 with 1/2" NPT adaptor	D4NL-4EDG-B4-NPT
					3NC+1NC/1NO	M20 with 1/2" NPT adaptor	D4NL-4GDG-B4-NPT

Note: Consult factor for models with Korean S-mark certification.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

TL4019

Quick Link
S256
omron247.com

Safety Interlock Switch with Guard Door Locking

- High locking force of 1,200 N (270 lb.) locks guard door shut until machine is safe to enter
- IP67 (NEMA 6) enclosure enables the TL4019 to withstand water washdown
- Door and lock monitoring—the TL4019 has a total of 4 contacts: 2 N/C safety + 1 contact for door position monitoring + 1 contact for lock monitoring
- Rear manual release—allows unlocking of switch from inside of guarded area per ANSI/RIA R15.06
- Narrow profile enables mounting to 2 in. square tubing or in applications with space restrictions
- Rotatable head—the rotatable head of the TL4019 provides 8 actuator entry positions to satisfy most installation requirements
- Optional key release—this option on power-to-unlock models allows manual unlocking of the guard door
- Optional slide bolt with integral door handle aids installation on sliding and swinging guard doors



Conforms to EN60947-5-1, EN1088, EN ISO 13849-1
UL and C-UL listed
DGUV approved

Specifications

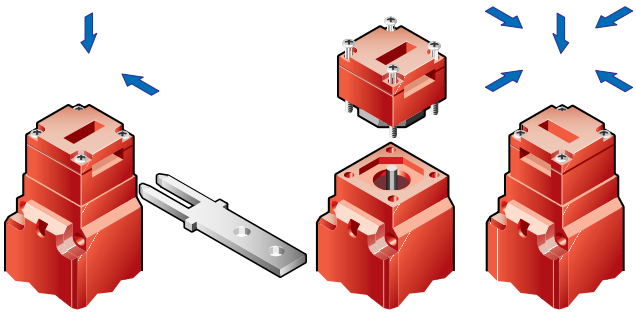
Electrical	All Models	TL4019-1 & -2	TL4019-3 & -4	TL4019-5
Safety Contacts:		2 N/C	2 N/C	1 N/C
Auxiliary Contacts:		2 N/O	1 N/O + 1 N/O 1 N/O + 1 N/C 1 N/C + 1 N/O	1 N/C + 1 N/O
Switching Ability	AC: 230 V – 4 A			
	DC: 24 V – 4 A			
Safety Contact Material:	Silver alloy with gold flash			
Minimum Current:	24 V 1 mA			
Solenoid Supply Voltage:	24 VAC/DC or 110 VAC (all -15% / +10%)			
Solenoid Power:	8 W			
Solenoid Rating:	100% duty			
Mechanical				
Mounting:	Any position			
Mounting Hardware:	4 x M5 screws (not supplied)			
Min Operating Radius:	Approximately 100 mm (3.9 in.) with flex actuators			
	Approximately 1000 mm (39 in.) with flat and 90-degree actuators			
Max Holding Force:	1200 N (270 lb.)			
Max Actuation Speed:	20 m/min.			
Case Material:	Reinforced thermoplastic			
Actuator Material:	Stainless steel			
Wiring Entry:	3 x M20 conduit with 0.5 in. NPT adapter			
Weight:	500 g (17 oz.)			
Color:	Red			
Mechanical Life:	1 x 10^6 minimum			
Environmental				
Protection:	IP67 (NEMA 6)			
Operating Temperature:	-20 to 55°C (-4 to 131°F)			
Cleaning:	Water washdown			
Compliance				
Standards:	EN60947-5-1, EN1088, EN ISO 13849-1			
Approvals/Listings:	CE marked for all applicable directives, UL and C-UL, DGUV			

Specifications are subject to change without notice.

Note: The safety contacts of the STI switches are described as normally closed (N/C)—i.e., with the guard closed, actuator in place, and the machine able to be started.

F

Operation



Optional Slide Bolts

- Allows easy installation of switch on machine guards
- Actuator included (order switch separately)
- Integral handle included
- Metal is ideal for heavy doors; plastic is suitable for smaller and lighter doors
- Slotted hole in bolt permits attaching multiple padlocks
- Yellow color for easy recognition



Metal Slide Bolt



Plastic Slide Bolt

Alignment Guide

Optional stainless steel alignment guide aids actuator entry and is easily installed.



Flat Actuator

Available with and without rubber bushings.



90-Degree Actuator

Available with and without rubber bushings.



Optional Rear Release

- Allows manual rear release of a locked switch from inside a guarded area per ANSI/RIA R15.06
- May be installed on switch in conjunction with or without the use of a slide bolt
- Must use with Rear Release Switch Models only

Optional Key Release

A key release unit is easily attached to the TL4019 to provide emergency override of the switch locking mechanism by a qualified, responsible person.



Flexible 1 Actuator

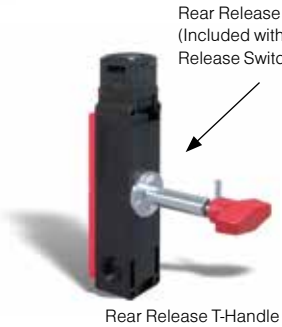
15 degree flexibility may be adjusted with the set screw.



Flexible 2 Actuator

15 degree flexibility may be adjusted with the set screw.





Rear Release Actuator (Included with Rear Release Switches)

Rear Release T-Handle (Order separately)



Optional SLD Series

Optional switch locking devices are available. See accessories section for details.

Optional LED Lid Kit

Provides red and green LED indicators with user-configured operation.



Optional Interior Lever Kit

Use with metal rear release slide bolts.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

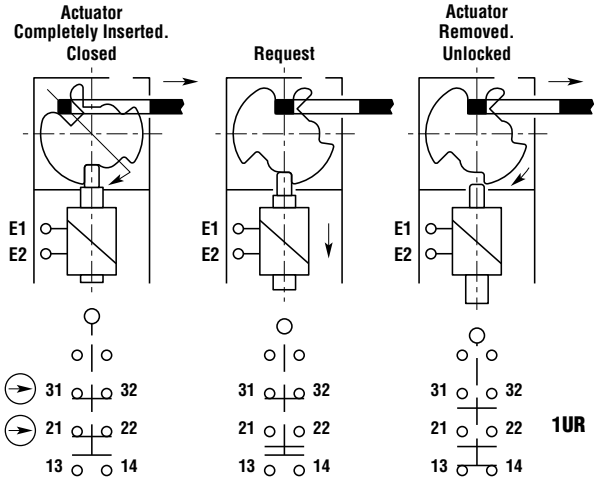
OMRON AUTOMATION & SAFETY

Operation (continued)

Contact Arrangements

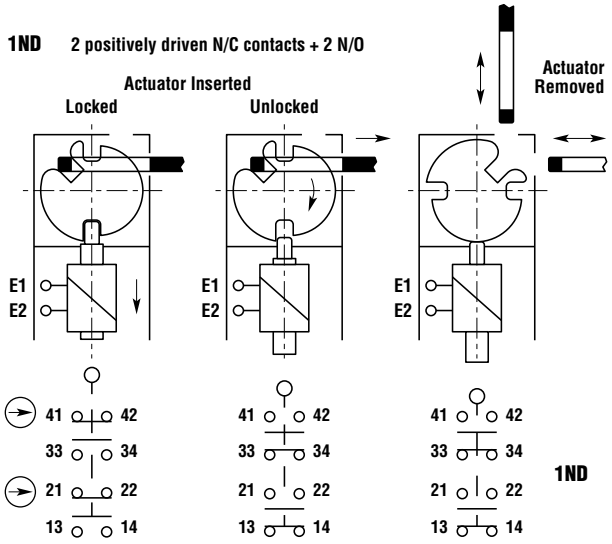
With Unlock Request Contact

1UR 1 positively driven N/C contact as door unlock request contact
1 positively driven N/C contact + 1 N/O (without door contact)



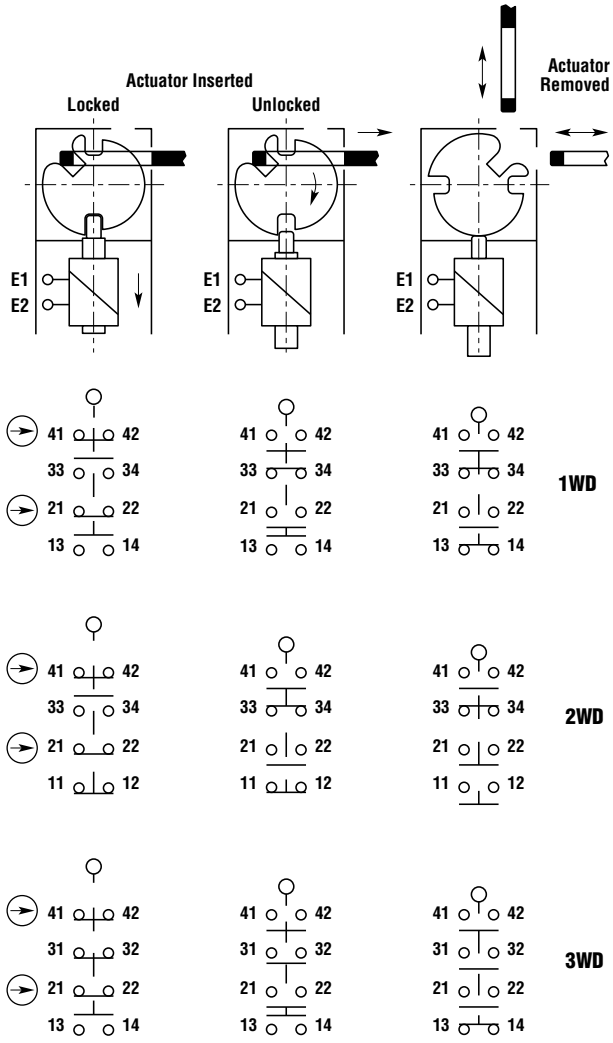
Without Door Contact

1ND 2 positively driven N/C contacts + 2 N/O



With Door Contact

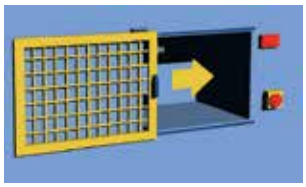
1WD 2 positively driven N/C contacts + 1 N/O + 1 N/O as door contact
2WD 2 positively driven N/C contacts + 1 N/O + 1 N/C as door contact
3WD 2 positively driven N/C contacts + 1 N/C + 1 N/O as door contact



F

Applications

Typical applications are on sliding guard doors and swinging guard doors that must remain locked until a signal is applied to the internal solenoid that unlocks the guard door.





For a wiring example of the TL4019 switch with a SR209AD delayed output safety monitoring relay see "Common Circuit Examples" in the Expert Area Section of this catalog.

Application Monitoring Units



SR223SMT Timer Unit

Used with the TL4019 for machines with constant overrun. Gives a timed delay to the lock/release signal. Failsafe and adjustable to a range of times from 1.0 seconds up to 31 seconds.



SR125SMS45 Stop Motion Sensing Unit

Used with the TL4019 for machines with inconstant or variable overrun. Senses back EMF of AC or DC motors. Failsafe and adjustable to a range of 0.01 V to 0.10 V.



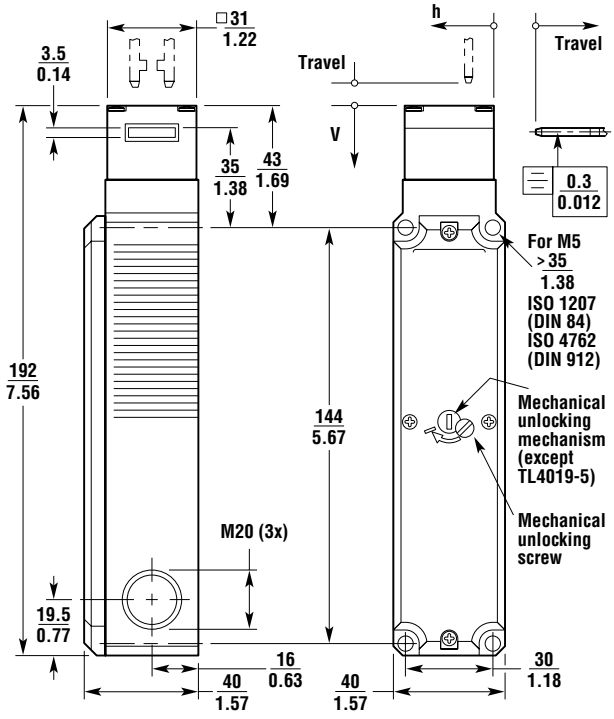
Safety Monitoring Relay Units

Safety monitoring relays ensure a maximum level of safety by monitoring all wiring in the safety circuit, including switches and contactors. Any fault and the power to the machine is switched off. A variety of safety monitoring relay units are available.

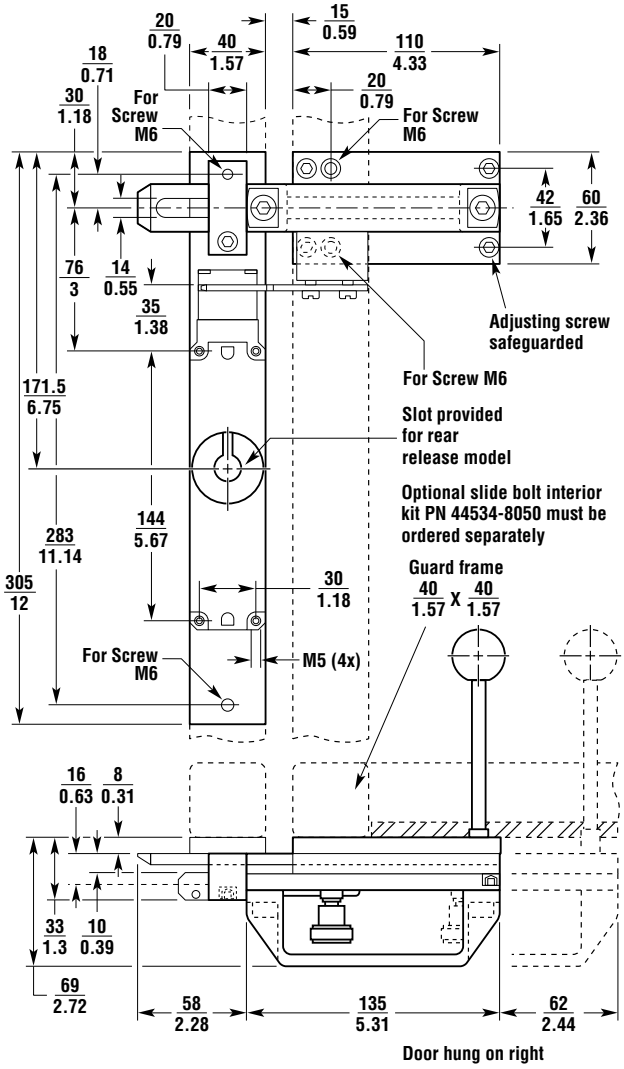
Dimensions

(mm/in.)

TL4019

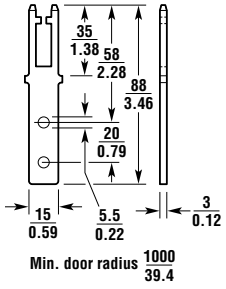


Optional Metal Slide Bolt for TL4019

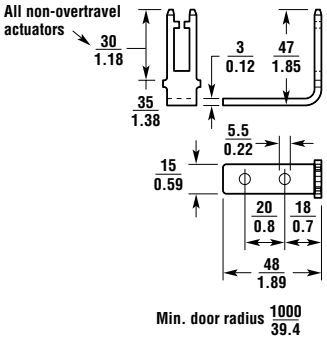


See website for the optional Plastic Slide Bolt Dimensions

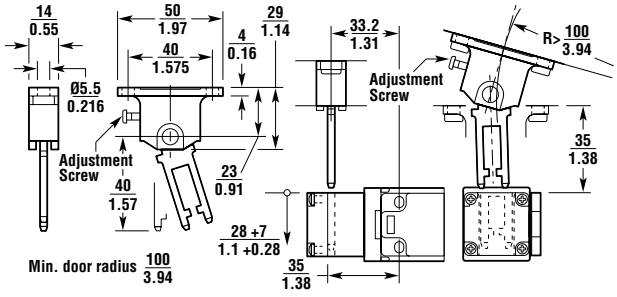
Overtravel Flat Actuator



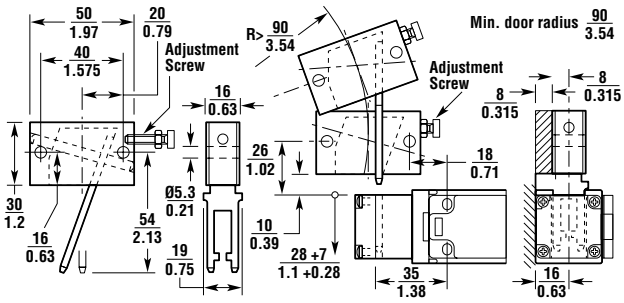
Overtravel 90-Degree Actuator



Flexible 1 Actuator



Flexible 2 Actuator



F

Ordering

Model	Solenoid	Contacts	Wiring Entry	Part No.
Power to Lock (without door contact)				
TL4019-20241TM (flat actuator)	24 VAC/DC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0030
TL4019-20241SM (90-degree actuator)	24 VAC/DC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0130
TL4019-20241F2M (flex 2 actuator)	24 VAC/DC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0230
TL4019-20241F1M (flex 1 actuator)	24 VAC/DC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0330
TL4019-21101TM (flat actuator)	110 VAC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0040
TL4019-21101SM (90-degree actuator)	110 VAC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0140
TL4019-21101F2M (flex 2 actuator)	110 VAC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0240
TL4019-21101F1M (flex 1 actuator)	110 VAC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0340
Power to Lock (with door contact)				
TL4019-40241TM (flat actuator)	24 VAC/DC	2 N/C + 1 N/O +1 N/O	3 x M20 with NPT adapter	44534-0410
TL4019-40241SM (90-degree actuator)	24 VAC/DC	2 N/C + 1 N/O +1 N/O	3 x M20 with NPT adapter	44534-0510
TL4019-40241F2M (flex 2 actuator)	24 VAC/DC	2 N/C + 1 N/O +1 N/O	3 x M20 with NPT adapter	44534-0610
TL4019-40241F1M (flex 1 actuator)	24 VAC/DC	2 N/C + 1 N/O +1 N/O	3 x M20 with NPT adapter	44534-1710
TL4019-41101TM (flat actuator)	110 VAC	2 N/C + 1 N/O +1 N/O	3 x M20 with NPT adapter	44534-0420
TL4019-41101SM (90-degree actuator)	110 VAC	2 N/C + 1 N/O +1 N/O	3 x M20 with NPT adapter	44534-0520
TL4019-41101F2M (flex 2 actuator)	110 VAC	2 N/C + 1 N/O +1 N/O	3 x M20 with NPT adapter	44534-0620
TL4019-41101F1M (flex 1 actuator)	110 VAC	2 N/C + 1 N/O +1 N/O	3 x M20 with NPT adapter	44534-1720
TL4019-40242TM (flat actuator)	24 VAC/DC	2 N/C + 1 N/O +1 N/C	3 x M20 with NPT adapter	44534-0430
TL4019-40242SM (90-degree actuator)	24 VAC/DC	2 N/C + 1 N/O +1 N/C	3 x M20 with NPT adapter	44534-0530
TL4019-40242F2M (flex 2 actuator)	24 VAC/DC	2 N/C + 1 N/O +1 N/C	3 x M20 with NPT adapter	44534-0630
TL4019-40242F1M (flex 1 actuator)	24 VAC/DC	2 N/C + 1 N/O +1 N/C	3 x M20 with NPT adapter	44534-1730
TL4019-41102TM (flat actuator)	110 VAC	2 N/C + 1 N/O +1 N/C	3 x M20 with NPT adapter	44534-0440
TL4019-41102SM (90-degree actuator)	110 VAC	2 N/C + 1 N/O +1 N/C	3 x M20 with NPT adapter	44534-0540
TL4019-41102F2M (flex 2 actuator)	110 VAC	2 N/C + 1 N/O +1 N/C	3 x M20 with NPT adapter	44534-0640
TL4019-41102F1M (flex 1 actuator)	110 VAC	2 N/C + 1 N/O +1 N/C	3 x M20 with NPT adapter	44534-1740
TL4019-40243TM (flat actuator)	24 VAC/DC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-0450
TL4019-40243SM (90-degree actuator)	24 VAC/DC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-0550
TL4019-40243F2M (flex 2 actuator)	24 VAC/DC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-0650
TL4019-40243F1M (flex 1 actuator)	24 VAC/DC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-1750
TL4019-41103TM (flat actuator)	110 VAC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-0460
TL4019-41103SM (90-degree actuator)	110 VAC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-0560
TL4019-41103F2M (flex 2 actuator)	110 VAC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-0660
TL4019-41103F1M (flex 1 actuator)	110 VAC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-1760
Power to Unlock (without door contact)				
TL4019-10241TM (flat actuator)	24 VAC/DC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0010
TL4019-10241SM (90-degree actuator)	24 VAC/DC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0110
TL4019-10241F2M (flex 2 actuator)	24 VAC/DC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0210
TL4019-10241F1M (flex 1 actuator)	24 VAC/DC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0310
TL4019-11101TM (flat actuator)	110 VAC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0020
TL4019-11101SM (90-degree actuator)	110 VAC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0120
TL4019-11101F2M (flex 2 actuator)	110 VAC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0220
TL4019-11101F1M (flex 1 actuator)	110 VAC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-0320
TL4019-10241SKM w/key (90-degree actuator)	24 VAC/DC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-1110
TL4019-11101SKM w/key (90-degree actuator)	110 VAC	2 N/C + 2 N/O	3 x M20 with NPT adapter	44534-1120
Power to Unlock (with door contact)				
TL4019-30241TM (flat actuator)	24 VAC/DC	2 N/C + 1 N/O +1 N/O	3 x M20 with NPT adapter	44534-0050
TL4019-30241SM (90-degree actuator)	24 VAC/DC	2 N/C + 1 N/O +1 N/O	3 x M20 with NPT adapter	44534-0150
TL4019-30241F2M (flex 2 actuator)	24 VAC/DC	2 N/C + 1 N/O + 1N/O	3 x M20 with NPT adapter	44534-0250
TL4019-30241F1M (flex 1 actuator)	24 VAC/DC	2 N/C + 1 N/O + 1N/O	3 x M20 with NPT adapter	44534-0350
TL4019-31101TM (flat actuator)	110 VAC	2 N/C + 1 N/O + 1N/O	3 x M20 with NPT adapter	44534-0060
TL4019-31101SM (90-degree actuator)	110 VAC	2 N/C + 1 N/O + 1N/O	3 x M20 with NPT adapter	44534-0160
TL4019-31101F2M (flex 2 actuator)	110 VAC	2 N/C + 1 N/O + 1N/O	3 x M20 with NPT adapter	44534-0260
TL4019-31101F1M (flex 1 actuator)	110 VAC	2 N/C + 1 N/O + 1N/O	3 x M20 with NPT adapter	44534-0360
TL4019-30242TM (flat actuator)	24 VAC/DC	2 N/C + 1 N/O + 1N/C	3 x M20 with NPT adapter	44534-0070
TL4019-30242SM (90-degree actuator)	24 VAC/DC	2 N/C + 1 N/O + 1N/C	3 x M20 with NPT adapter	44534-0170
TL4019-30242F2M (flex 2 actuator)	24 VAC/DC	2 N/C + 1 N/O + 1N/C	3 x M20 with NPT adapter	44534-0270
TL4019-30242F1M (flex 1 actuator)	24 VAC/DC	2 N/C + 1 N/O + 1N/C	3 x M20 with NPT adapter	44534-0370

(Continued on next page)

Ordering (continued)

Model	Solenoid	Contacts	Wiring Entry	Part No.
TL4019-31102TM (flat actuator)	110 VAC	2 N/C + 1 N/O + 1N/C	3 x M20 with NPT adapter	44534-0080
TL4019-31102SM (90-degree actuator)	110 VAC	2 N/C + 1 N/O + 1N/C	3 x M20 with NPT adapter	44534-0180
TL4019-31102F2M (flex 2 actuator)	110 VAC	2 N/C + 1 N/O + 1N/C	3 x M20 with NPT adapter	44534-0280
TL4019-31102F1M (flex 1 actuator)	110 VAC	2 N/C + 1 N/O + 1N/C	3 x M20 with NPT adapter	44534-0380
TL4019-30243TM (flat actuator)	24 VAC/DC	2 N/C + 1 N/C + 1N/O	3 x M20 with NPT adapter	44534-0090
TL4019-30243SM (90-degree actuator)	24 VAC/DC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-0190
TL4019-30243F2M (flex 2 actuator)	24 VAC/DC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-0290
TL4019-30243F1M (flex 1 actuator)	24 VAC/DC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-0390
TL4019-31103TM (flat actuator)	110 VAC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-0400
TL4019-31103SM (90-degree actuator)	110 VAC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-0500
TL4019-31103F2M (flex 2 actuator)	110 VAC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-0600
TL4019-31103F1M (flex 1 actuator)	110 VAC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-1700
TL4019-30241SKM w/key (90-degree actuator)	24 VAC/DC	2 N/C + 1 N/O +1 N/O	3 x M20 with NPT adapter	44534-1150
TL4019-31101SKM w/key (90-degree actuator)	110 VAC	2 N/C + 1 N/O +1 N/O	3 x M20 with NPT adapter	44534-1160
TL4019-30242SKM w/key (90-degree actuator)	24 VAC/DC	2 N/C + 1 N/O +1 N/C	3 x M20 with NPT adapter	44534-1170
TL4019-31102SKM w/key (90-degree actuator)	110 VAC	2 N/C + 1 N/O +1 N/C	3 x M20 with NPT adapter	44534-1180
TL4019-30243SKM w/key (90-degree actuator)	24 VAC/DC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-1190
TL4019-31103SKM w/key (90-degree actuator)	110 VAC	2 N/C + 1 N/C +1 N/O	3 x M20 with NPT adapter	44534-1500
Power to Unlock (with unlock request contact) (mechanical unlocking is not available on these switches)				
TL4019-50241TM (flat actuator)	24 VAC/DC	1 N/C + 1 N/C + 1 N/O	3 x M20 with NPT adapter	44534-0470
TL4019-50241SM (90-degree actuator)	24 VAC/DC	1 N/C + 1 N/C + 1 N/O	3 x M20 with NPT adapter	44534-0570
TL4019-50241F2M (flex 2 actuator)	24 VAC/DC	1 N/C + 1 N/C + 1 N/O	3 x M20 with NPT adapter	44534-0670
TL4019-50241F1M (flex 1 actuator)	24 VAC/DC	1 N/C + 1 N/C + 1 N/O	3 x M20 with NPT adapter	44534-1770
Switch Only (no actuators or adapters included)				
Power to Unlock (without door contact)				
TL4019-10241	24 VAC/DC	2 N/C + 2 N/O	3 x M20	44534-2010
TL4019-11101	110 VAC	2 N/C + 2 N/O	3 x M20	44534-2020
Power to Unlock (with door contact)				
TL4019-30241	24 VAC/DC	2 N/C + 1 N/O + 1 N/O	3 x M20	44534-2050
TL4019-31101	110 VAC	2 N/C + 1 N/O + 1 N/O	3 x M20	44534-2060
TL4019-30242	24 VAC/DC	2 N/C + 1 N/O +1 N/C	3 x M20	44534-2070
TL4019-31102	110 VAC	2 N/C + 1 N/O +1 N/C	3 x M20	44534-2080
TL4019-30243	24 VAC/DC	2 N/C + 1 N/C +1 N/O	3 x M20	44534-2090
TL4019-31103	110 VAC	2 N/C + 1 N/C + 1 N/O	3 x M20	44534-2100
Power to Unlock (with unlock request contact)				
TL4019-50241	24 VAC/DC	1 N/C + 1 N/C + 1 N/O	3 x M20	44534-2170
Power to Lock (without door contact)				
TL4019-20241	24 VAC/DC	2 N/C + 2 N/O	3 x M20	44534-2030
TL4019-21101	110 VAC	2 N/C + 2 N/O	3 x M20	44534-2040
Power to Lock (with door contact)				
TL4019-40241	24 VAC/DC	2 N/C + 1 N/O + 1 N/O	3 x M20	44534-2110
TL4019-41101	110 VAC	2 N/C + 1 N/O + 1 N/O	3 x M20	44534-2120
TL4019-40242	24 VAC/DC	2 N/C + 1 N/O +1 N/C	3 x M20	44534-2130
TL4019-41102	110 VAC	2 N/C + 1 N/O +1 N/C	3 x M20	44534-2140
TL4019-40243	24 VAC/DC	2 N/C + 1 N/C +1 N/O	3 x M20	44534-2150
TL4019-41103	110 VAC	2 N/C + 1 N/C +1 N/O	3 x M20	44534-2160
Rear Release (no actuators or adapters included; rear release actuator included; order T-handle separately)				
Power to Unlock (without door contact)				
TL4019-10241RR	24 VAC/DC	2 N/C + 2 N/O	3 x M20	44534-3010
Power to Unlock (with door contact)				
TL4019-30241RR	24 VAC/DC	2 N/C + 1 N/O + 1 N/O	3 x M20	44534-3050
TL4019-30242RR	24 VAC/DC	2 N/C + 1 N/O +1 N/C	3 x M20	44534-3070
TL4019-30243RR	24 VAC/DC	2 N/C + 1 N/C +1 N/O	3 x M20	44534-3090
Power to Lock (without door contact)				
TL4019-20241RR	24 VAC/DC	2 N/C + 2 N/O	3 x M20	44534-3030
Power to Lock (with door contact)				
TL4019-40241RR	24 VAC/DC	2 N/C + 1 N/O + 1 N/O	3 x M20	44534-3110
TL4019-40242RR	24 VAC/DC	2 N/C + 1 N/O +1 N/C	3 x M20	44534-3130
TL4019-40243RR	24 VAC/DC	2 N/C + 1 N/C +1 N/O	3 x M20	44534-3150

(Continued on next page)

F

Ordering (continued)

Accessories				Part No.
Standard Actuators				
Replacement flat actuator for TL4019				44534-0700
Replacement 90-degree actuator for TL4019				44534-0710
Replacement flex 2 actuator for TL4019				44534-0720
Replacement flex 1 actuator for TL4019				44534-0730
Standard Actuators with Rubber Bushing				
Replacement flat actuator RB for TL4019				44534-0740
Replacement 90-degree actuator RB for TL4019				44534-0750
Overtravel Actuators				
Replacement flat actuator OT for TL4019				44534-0701
Replacement 90-degree actuator OT for TL4019				44534-0711
Replacement flex 2 actuator OT for TL4019				44534-0721
Replacement flex 1 actuator OT for TL4019				44534-0731
Overtravel Actuators with Rubber Bushing				
Replacement flat actuator OTRB for TL4019				44534-0741
Replacement 90-degree actuator OTRB for TL4019				44534-0751
Slide Bolts				
Bolt for right-hung door for TL4019 with/without rear release (yellow metal)				44534-8130
Bolt for left-hung door for TL4019 with/without rear release (yellow metal)				44534-8140
Plastic slide bolt for right or left-hung door for TL4019 (yellow) (okay for rear release switches)				44534-8070
Slide bolt interior lever kit (use with rear release slide bolts only)				44534-8050
Rear release T-handle (use with rear release switches only)				44534-8060
Bracket for TL4019 (galvanized)				44534-8020
Handle without snap-in (use with 44534-8020 bracket) (galvanized)				44534-8000
Handle with snap-in (use with 44534-8020 bracket) (galvanized)				44534-8010
Miscellaneous				
Stainless steel alignment guide for TL4019 (must use with Overtravel Actuator)				44534-0780
Latch spring for TL4019 (provides greater retention force for actuator)				44534-0760
Lockout bar for TL4019 (prevents insertion of actuator into switch)				44534-0770
Key lock release for TL4019 (2 keys included) (Do not use with TL4019-5)				44534-0802
Spare keys for key lock above (44534-0802) for TL4019				44534-0812
Spare keys for key lock (44534-0800, no longer available)				44534-0810
Unique key lock release for TL4019 (2 unique keys included) (Do not use with TL4019-5)				44534-0820
Replacement head for TL4019				44534-0790
LED lid kit (for 24 VAC/DC switches only)				44534-0761

TL4024

Quick Link
S257
omron247.com

Safety Interlock Switch with Guard Door Locking

- High locking force of 1,500 N (337 lb.) locks guard door shut until machine is safe to enter
- IP67 (NEMA 6) enclosure withstands water washdown
- Door and lock monitoring—the TL4024 has a total of 4 contacts: 2 N/C safety + 1 contact for door position monitoring + 1 contact for lock monitoring
- Unlocking is possible with a back load on the door to satisfy the demands of high cycle time applications
- Narrow profile enables mounting to 2 in. square tubing or in applications with space restrictions
- Rotatable head—the rotatable head provides 8 actuator entry positions to satisfy most installation requirements
- Optional key release—this option on power-to-unlock models allows manual unlocking of the guard door
- Optional slide bolt with integral door handle aids installation on sliding and swinging guard doors
- Two LED (red/green) status indicators on the lid may be wired to suit the application



Conforms to EN60947-5-1, EN1088, EN ISO 13849-1
UL and C-UL listed
DGUV approved

Specifications

Electrical	
Safety Contacts:	2 N/C
Auxiliary Contacts:	1 N/O + 1 N/C 1 N/O + 1 N/O
Switching Ability	AC: 230 V – 4 A
	DC: 24 V – 4 A
Safety Contact Material:	Silver alloy with gold flash
Minimum Current:	12 V 10 mA, 24 V 1 mA
Solenoid Supply Voltage:	24 VAC/DC or 110 VAC (all -15% / +10%)
Solenoid Power:	8 W
Solenoid Rating:	100% duty
Mechanical	
Mounting:	Any position
Mounting Hardware:	4 x M5 screws (not supplied)
Min Operating Radius:	Approximately 300 mm (12 in.) with 90-degree actuator
Max Holding Force:	1500 N (337 lb.)
Max Actuation Speed:	20 m/min.
Case Material:	Anodized die-cast alloy
Actuator Material:	Stainless steel
Wiring Entry:	3 x 0.5 in. NPT
Weight:	800 g (28 oz.)
Color:	Red
Mechanical Life:	1 x 10^6 minimum
Environmental	
Protection:	IP67 (NEMA 6)
Operating Temperature:	-20 to 80°C (-4 to 176°F)
Cleaning:	Water washdown
Compliance	
Standards:	EN60947-5-1, EN1088, EN ISO 13849-1
Approvals/Listings:	CE marked for all applicable directives, UL and C-UL, DGUV

Specifications are subject to change without notice.
Note: The safety contacts of the STI switches are described as normally closed (N/C)—i.e., with the guard closed, actuator in place, and the machine able to be started.

F

D4JL

Quick Link
S247
omron247.com

Guard Lock Safety-Door Switch

- Holding force of 3,000 N
- Two safety circuits and two monitor contacts provide an array of monitoring patterns.
- Standard gold-clad contacts enable use with ordinary loads and microloads.
- Models with trapped keys prevent workers from being locked in hazardous work areas.
- Models with rear release buttons allow people to unlock the Switch and escape if they are locked into hazardous areas.
- IP67 degree of protection



Features

Plastic Guard Lock Safety-door Switches Rank Among the Strongest in the World

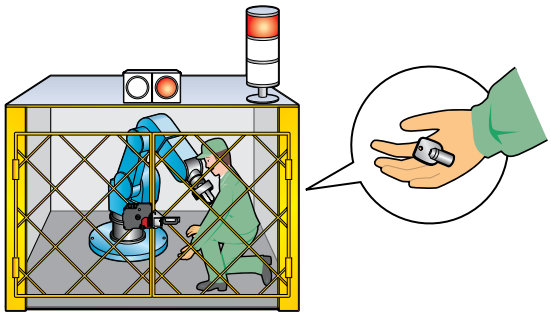
A holding force of 3,000 N makes these Switches suitable for large, heavy doors.

Models with Trapped Keys

OMRON Automation and Safety also offers Trapped Key Switches (on mechanical lock models only).

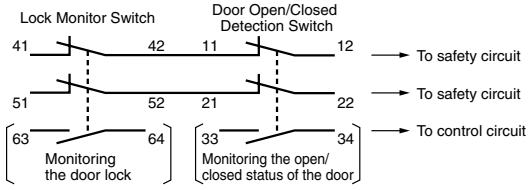
As long as a person has the trapped key when he enters a hazardous area, he does not have to worry about somebody locking the door and trapping him inside. The door can be opened only by supplying power to the solenoid and then turning the trapped key to unlock the D4JL.

There are thirty different types of trapped keys available for use in applications with adjacent hazardous areas.



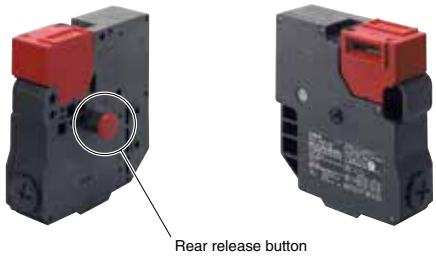
Two Safety Circuits and Two Monitor Contacts

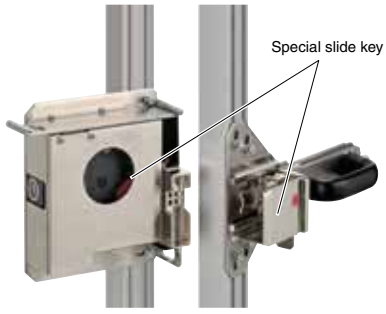
The D4JL has two safety circuits. It also has two contacts to separately monitor the open/closed status of the door and the status of the lock.



Models with Rear Release Buttons

A Switch with a rear release button allows the door to be unlocked from inside a hazardous area in an emergency. STI also offers Switches with Special Slide Keys. Refer to the D4NS-SK/D4JL-SK for details.





SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Specifications

Standards and EC Directives

Conforms to the following EC Directives:

- Machinery Directive
- Low Voltage Directive
- EN 1088
- EN 60204-1
- GS-ET-19
- CCC

Certified Standards

Certification body	Standard	File No.
TÜV Product Service	EN 60947-5-1 (certified direct opening)	Consult your representative for details.
UL *1	UL 508, CSA C22.2 No.14	
CQC (CCC)	GB14048.5	2005010305167533
KOSHA *2	EN60947-5-1	2005-196

*1. CSA C22.2 No. 14 was certified by UL.
*2. Only certain models have been certified.

Certified Standard Ratings

TÜV (EN 60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (Ie)	3 A	0.27 A
Rated operating voltage (Ue)	240 V	250 V

Note: Use a 10 A fuse type gI or gG that conforms to IEC 60269 as a short-circuit protection device. This fuse is not built into the Switch.

UL/CSA (UL 508, CSA C22.2 No. 14)

A300

Rated voltage	Carry current	Current (A)		Volt-amperes (VA)	
		Make	Break	Make	Break
120 VAC	10 A	60	6	7,200	720
240 VAC		30	3		

Q300

Rated voltage	Carry current	Current (A)		Volt-amperes (VA)	
		Make	Break	Make	Break
125 VDC	2.5 A	0.55	0.55	69	69
250 VDC		0.27	0.27		

Solenoid Coil Characteristics

Item	Type	24 VDC
Rated operating voltage (100% ED)		24 VDC $^{+10\%}_{-15\%}$
Current consumption		Approx. 200 mA
Insulation Class		Class F (130°C max.)

Indicator Characteristics

Item	Type	LED	
Rated voltage		24 VDC	24 VDC
Current consumption		Approx. 1 mA	Approx. 8 mA
Color (LED)		Orange	Green

Characteristics

Degree of protection *1		IP67 (EN60947-5-1)
Durability *2	Mechanical	1,000,000 operations min. (trapped key: 10,000 operations min., rear release button: 3,000 operations min.)
	Electrical	500,000 operations min. (3 A resistive load at 250 VAC) *3
Operating speed		0.05 to 0.5 m/s
Operating frequency		30 operations/minute max.
Direct opening force *4		60 N min. (EN60947-5-1)
Direct opening travel *4		15 mm min. (EN60947-5-1)
Holding force *5		3,000 N min.
Contact resistance		25 mΩ max. (per contact)
Minimum applicable load *6		1 mA resistive load at 5 VDC (N-level reference value)
Rated insulation voltage (Ui)		300 V (EN60947-5-1)
Rated frequency		50/60 Hz
Protection against electric shock		Class II (double insulation)
Pollution degree (operating environment)		3 (EN60947-5-1)
Impulse withstand voltage (EN60947-5-1)	Between terminals of same polarity	2.5 kV
	Between terminals of different polarity	4 kV
	Between other terminals and non-current carrying metallic parts.	6 kV
Insulation resistance		100 MΩ min. (at 500 VDC)
Contact gap		2 x 2 mm min.
Vibration resistance	Malfunction	10 to 55 Hz, 0.75 mm single amplitude
Shock resistance	Destruction	1,000 m/s^2 min.
	Malfunction	80 m/s^2 min.
Conditional short-circuit current		100 A (EN60947-5-1) *7
Conventional free air thermal current (Ith)		10 A (between terminals 12 and 41), 3 A (between all other terminals) (EN60947-5-1)
Ambient operating temperature		-10 to +55°C (with no icing)
Ambient operating humidity		95% max.
Weight		Approx. 650 g (D4JL-4NFA-C7-01)

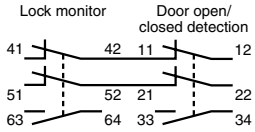
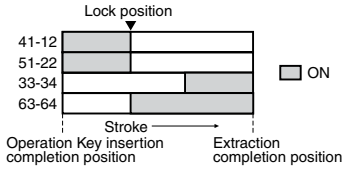
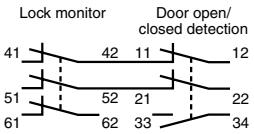
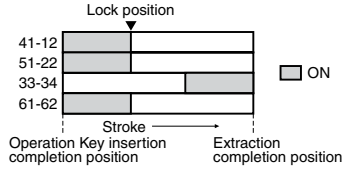
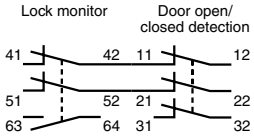
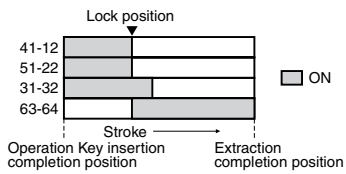
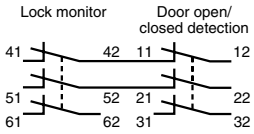
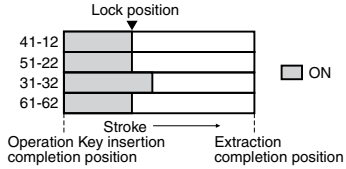
Notes: The above values are initial values.
*1. The degree of protection is tested using the method specified by the standard (EN60947-5-1). Confirm that sealing properties are sufficient for the operating conditions and environment beforehand. Although the switch box is protected from dust or water penetration, do not use the D4JL in places where foreign material may enter through the key hole on the head, otherwise Switch damage or malfunctioning may occur.
*2. The durability is for an ambient temperature of 5 to 35°C and an ambient humidity of 40% to 70%. For further conditions, consult your sales representative.
*3. Do not pass a 3 A, 250 VAC load through more than two circuits.
*4. These figures are minimum requirements for safe operation.
*5. This figure is based on the GS-ET-19 evaluation method.
*6. This value will vary with the switching frequency, environment, and reliability level. Confirm that correct operation is possible with the actual load beforehand.
*7. Use a 10 A fuse type gI or gG that conforms to IEC 60269 as a short-circuit protection device.

F

Connections

Contact Forms

Indicates conditions where the Key is inserted and the lock is applied. Terminals 42-11 and terminals 52-21 are connected internally (as per BIA GS-ET-19).

Model	Contact (door open/closed detection and lock monitor)	Contact form		Operating pattern	Remarks
		Lock monitor	Door open/ closed detection		
D4JL-☐NF☐-☐	2NC/1NO+2NC/1NO				NC contacts 11-12 and 21-22 have a certified direct opening mechanism ([]). The terminals 41-12, 51-22, 33-34, and 63-64 can be used as unlike poles.
D4JL-☐PF☐-☐	2NC/1NO+3NC				NC contacts 11-12 and 21-22 have a certified direct opening mechanism ([]). The terminals 41-12, 51-22, 33-34, and 61-62 can be used as unlike poles.
D4JL-☐QF☐-☐	3NC+2NC/1NO				NC contacts 11-12, 21-22 and 31-32 have a certified direct opening mechanism ([]). The terminals 41-12, 51-22, 31-32, and 63-64 can be used as unlike poles.
D4JL-☐RF☐-☐	3NC+3NC				NC contacts 11-12, 21-22, and 31-32 have a certified direct opening mechanism ([]). The terminals 41-12, 51-22, 31-32, and 61-62 can be used as unlike poles.

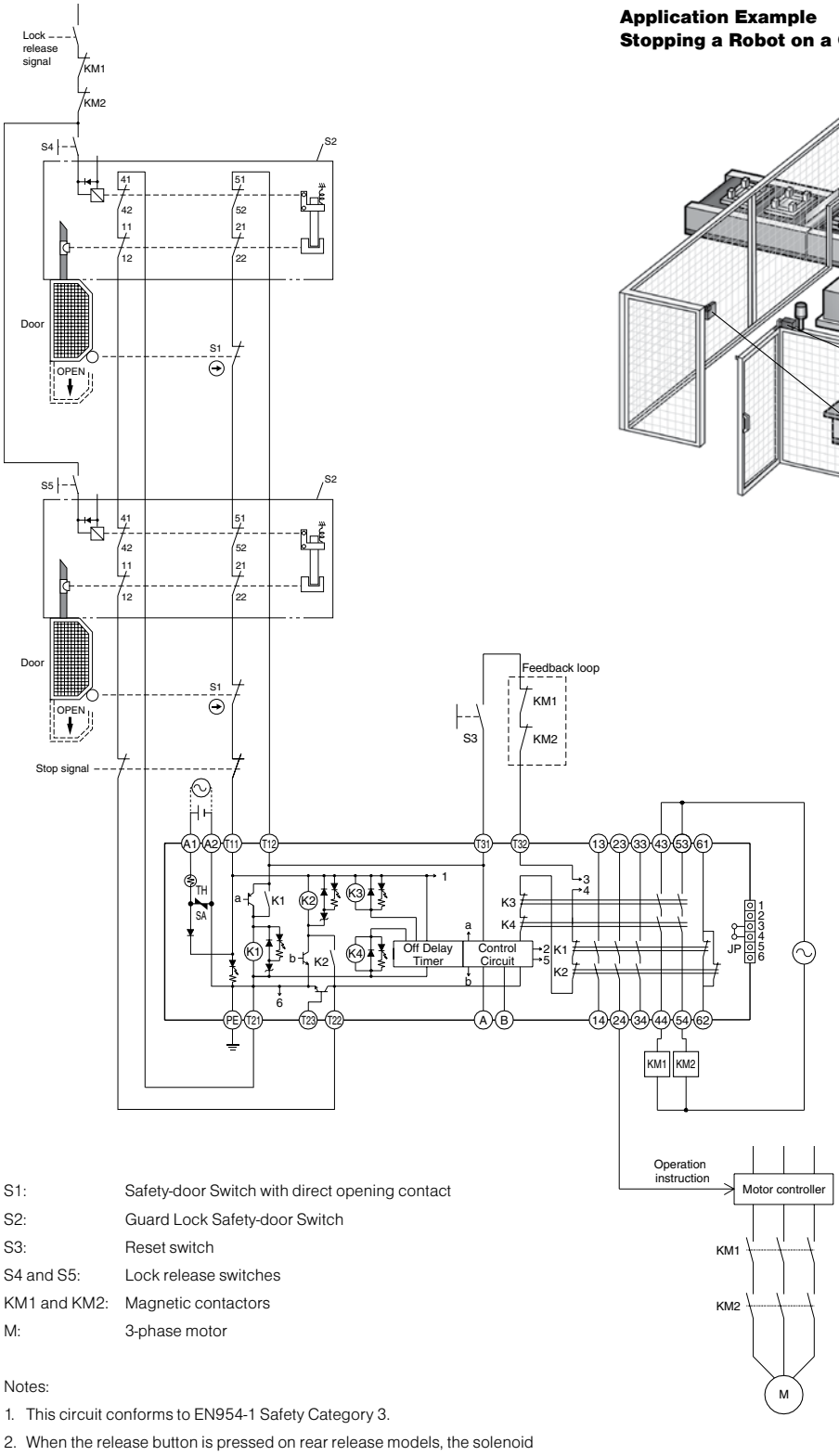
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

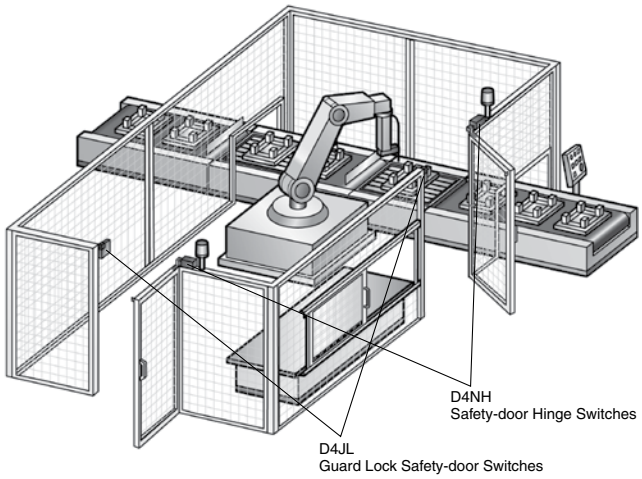
OMRON AUTOMATION & SAFETY

Application Examples

G9SA-321-T□ (24 VAC/VDC) + D4JL-□□□A-□□ (Mechanical Lock Models)/Manual Reset



Application Example
Stopping a Robot on a Conveyor Line



S1:	Safety-door Switch with direct opening contact
S2:	Guard Lock Safety-door Switch
S3:	Reset switch
S4 and S5:	Lock release switches
KM1 and KM2:	Magnetic contactors
M:	3-phase motor

Notes:

1. This circuit conforms to EN954-1 Safety Category 3.
2. When the release button is pressed on rear release models, the solenoid contacts are turned OFF.
3. With Trapped Key Models, the door will not lock when it is closed with the trapped key removed.

F

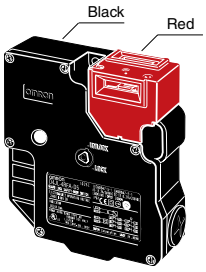
Dimensions and Operating Characteristics

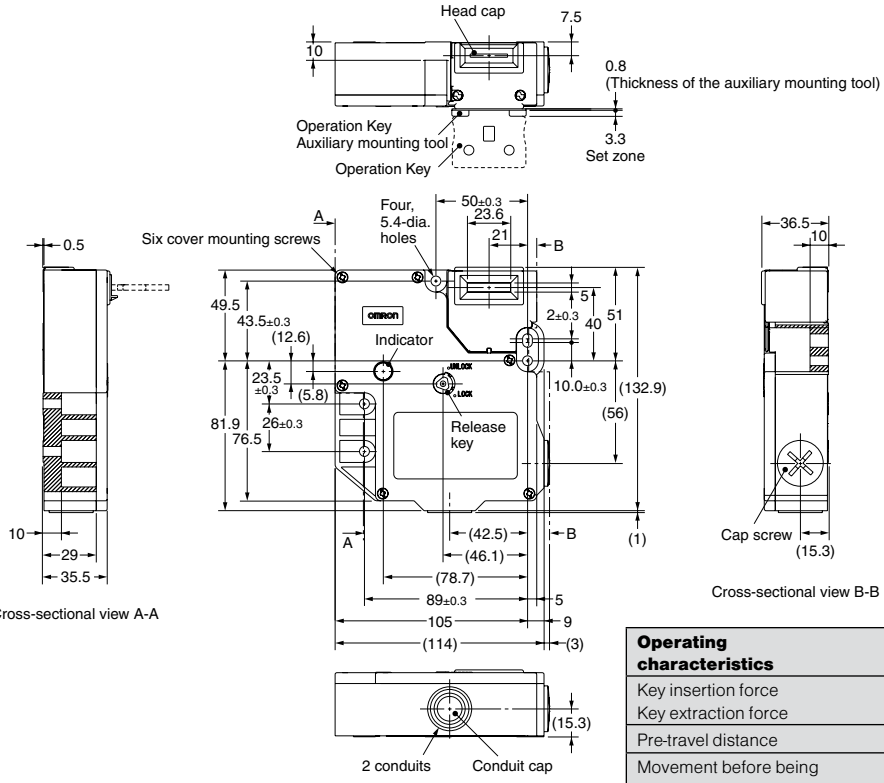
(mm)

Dimensions and Operating Characteristics

Switches

D4JL-□□F□-C5
D4JL-□□F□-D5



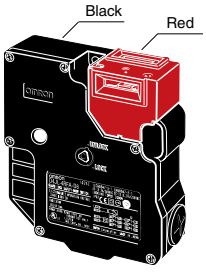


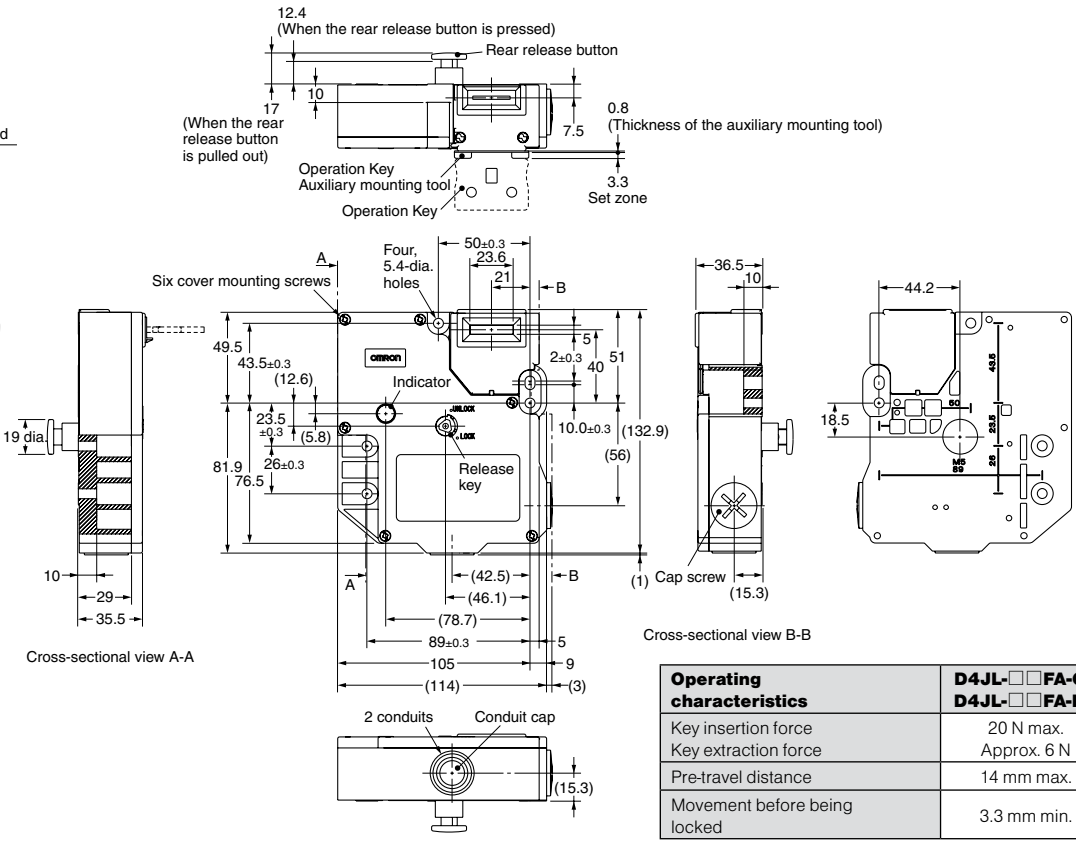
Cross-sectional view A-A

Cross-sectional view B-B

Operating characteristics	D4JL-□□F□-C5 D4JL-□□F□-D5
Key insertion force Key extraction force	20 N max. Approx. 6 N
Pre-travel distance	14 mm max.
Movement before being locked	3.3 mm min.

D4JL-□□FA-C6
D4JL-□□FA-D6





Cross-sectional view A-A

Cross-sectional view B-B

Operating characteristics	D4JL-□□FA-C6 D4JL-□□FA-D6
Key insertion force Key extraction force	20 N max. Approx. 6 N
Pre-travel distance	14 mm max.
Movement before being locked	3.3 mm min.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

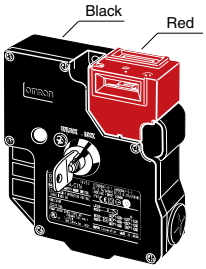
Dimensions and Operating Characteristics (continued)

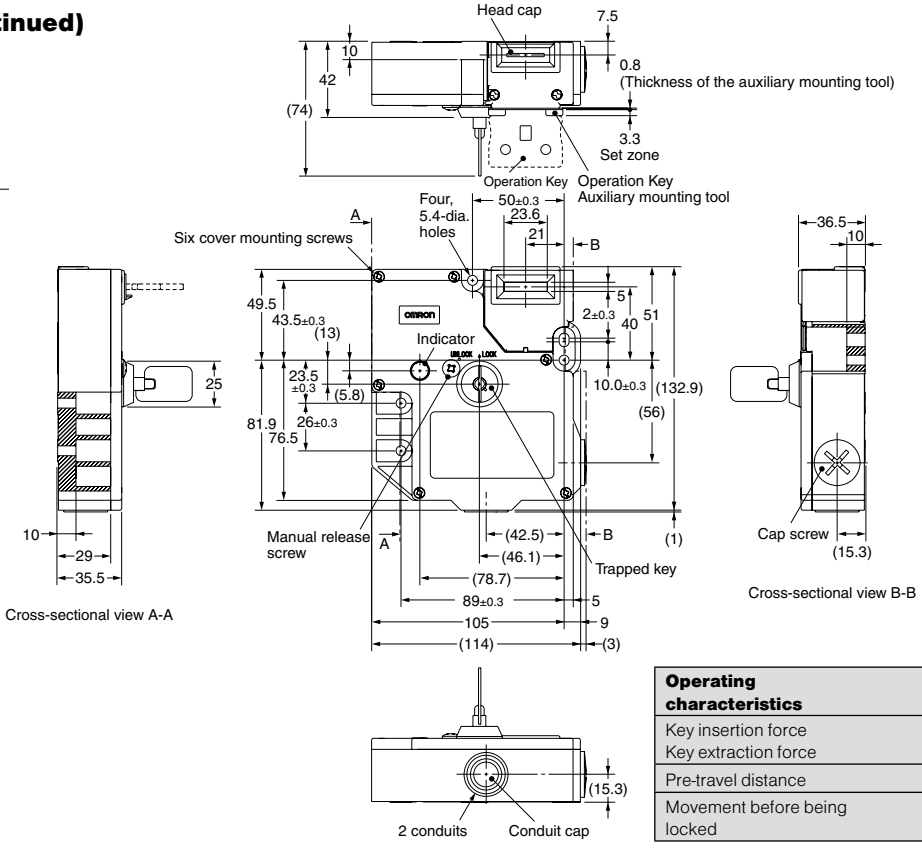
(mm)

Dimensions and Operating Characteristics

Switches (continued)

D4JL-□□FA-C7
D4JL-□□FA-D7

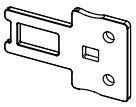


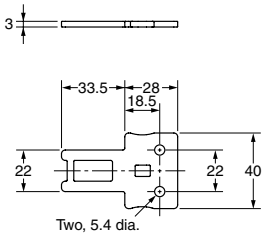


Operating characteristics	D4JL-□□FA-C7 D4JL-□□FA-D7
Key insertion force Key extraction force	20 N max. Approx. 6 N
Pre-travel distance	14 mm max.
Movement before being locked	3.3 mm min.

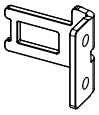
Operation Keys

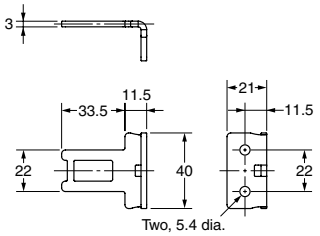
D4JL-K1





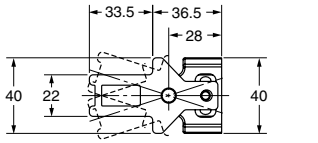
D4JL-K2

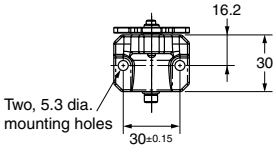


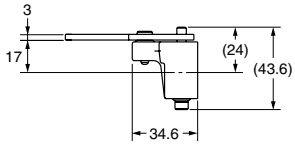


D4JL-K3

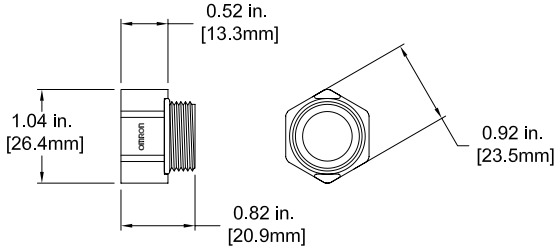








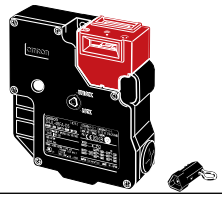
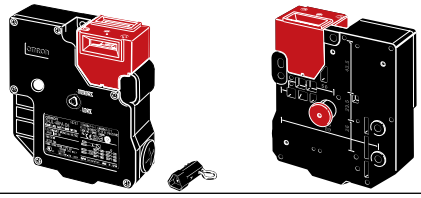
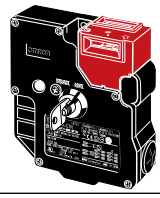
M20-NPT Adapter



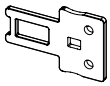
Note: Unless otherwise specified, a tolerance of ±0.8 mm applies to all Switch dimensions and a tolerance of ±0.4 mm applies to Operation Key dimensions.

F

Ordering

Release key position	Front	Front and rear release button	Front
Release key type	Special release key	Special release key	Trapped key
Switch appearance		Front Rear 	

Operation Keys

Type	Model
Horizontal mounting 	D4JL-K1
Vertical mounting 	D4JL-K2
Adjustable mounting (horizontal) 	D4JL-K3

Special Release Key

Type	Model
Special Release Key for D4GL, D4JL, D4NL, and D4SL Switches 	D4NL-RK

Model Number Structure

Switch

D4JL – ☐ ☐ ☐ ☐ – ☐ ☐ – ☐☐ – ☐
❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽

❶ Conduit Size
2: G1/2
4: M20

❷ Built-in Switch
N: 2NC/1NO + 2NC/1NO (slow-action contacts)
P: 2NC/1NO + 3NC (slow-action contacts)
Q: 3NC + 2NC/1NO (slow-action contacts)
R: 3NC + 3NC (slow-action contacts)

❸ Head Material
F: Plastic

❹ Door Lock and Release
A: Mechanical lock/24 VDC solenoid release
G: 24 VDC Solenoid lock/Mechanical release

❺ Indicator
C: 24 VDC (green LED indicator)
D: 24 VDC (orange LED indicator)

❻ Release Key Type
5: Special release key. *1
6: Special release key + rear release button. *1
7: Trapped key

❼ Trapped Key Type
01 to 30: 30 types *2

❽ M20-to-NPT Adapter
Blank: Adapter is not included
NPT: Adapter is included

Operation Key

D4JL-K ☐
❶

❶ Operation Key Type
1: Horizontal mounting
2: Vertical mounting
3: Adjustable mounting (horizontal)

Notes:
A 24 VDC solenoid lock cannot be combined with a trapped key.
A 24 VDC solenoid lock cannot be combined with a special release key and rear release button.
*1. Release keys are provided.
*2. Thirty types of trapped keys can be manufactured. Specify the trapped key type in numerical order starting from 01 when ordering.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Ordering (continued)

Switches (Operation keys are sold separately.)

Standard Models with certified direct opening mechanisms

Release key type	Indicator	Lock and release types	Contact configuration (door open/closed detection switch and lock monitor switch contacts)	Conduit opening	Model
Special release key	Green	Mechanical lock Solenoid release	2NC/1NO+2NC/1NO	NPT	D4JL-4NFA-C5-NPT
				M20	D4JL-4NFA-C5
			2NC/1NO+3NC	NPT	D4JL-4PFA-C5-NPT
				M20	D4JL-4PFA-C5
			3NC+2NC/1NO	NPT	D4JL-4QFA-C5-NPT
				M20	D4JL-4QFA-C5
			3NC+3NC	NPT	D4JL-4RFA-C5-NPT
				M20	D4JL-4RFA-C5
		Solenoid lock Mechanical release	2NC/1NO+2NC/1NO	NPT	D4JL-4NFG-C5-NPT
				M20	D4JL-4NFG-C5
			2NC/1NO+3NC	NPT	D4JL-4PFG-C5-NPT
				M20	D4JL-4PFG-C5
			3NC+2NC/1NO	NPT	D4JL-4QFG-C5-NPT
				M20	D4JL-4QFG-C5
			3NC+3NC	NPT	D4JL-4RFG-C5-NPT
				M20	D4JL-4RFG-C5
	Orange	Mechanical lock Solenoid release	2NC/1NO+2NC/1NO	NPT	D4JL-4NFA-D5-NPT
				M20	D4JL-4NFA-D5
			2NC/1NO+3NC	NPT	D4JL-4PFA-D5-NPT
				M20	D4JL-4PFA-D5
			3NC+2NC/1NO	NPT	D4JL-4QFA-D5-NPT
				M20	D4JL-4QFA-D5
			3NC+3NC	NPT	D4JL-4RFA-D5-NPT
				M20	D4JL-4RFA-D5
		Solenoid lock Mechanical release	2NC/1NO+2NC/1NO	NPT	D4JL-4NFG-D5-NPT
				M20	D4JL-4NFG-D5
			2NC/1NO+3NC	NPT	D4JL-4PFG-D5-NPT
				M20	D4JL-4PFG-D5
			3NC+2NC/1NO	NPT	D4JL-4QFG-D5-NPT
				M20	D4JL-4QFG-D5
			3NC+3NC	NPT	D4JL-4RFG-D5-NPT
				M20	D4JL-4RFG-D5
	Green	Mechanical lock Solenoid release	2NC/1NO+2NC/1NO	NPT	D4JL-4NFA-C6-NPT
				M20	D4JL-4NFA-C6
			2NC/1NO+3NC	NPT	D4JL-4PFA-C6-NPT
				M20	D4JL-4PFA-C6
			3NC+2NC/1NO	NPT	D4JL-4QFA-C6
				M20	D4JL-4QFA-C6
			3NC+3NC	NPT	D4JL-4RFA-C6-NPT
				M20	D4JL-4RFA-C6
	Orange		2NC/1NO+2NC/1NO	NPT	D4JL-4NFA-D6-NPT
				M20	D4JL-4NFA-D6
			2NC/1NO+3NC	NPT	D4JL-4PFA-D6-NPT
				M20	D4JL-4PFA-D6
			3NC+2NC/1NO	NPT	D4JL-4QFA-D6-NPT
				M20	D4JL-4QFA-D6
			3NC+3NC	NPT	D4JL-4RFA-D6-NPT
				M20	D4JL-4RFA-D6

(Continued on next page)

F

Ordering (continued)

Switches (continued) (Operation keys are sold separately.)

Models with Trapped Keys and certified direct opening mechanisms

Release key type	Indicator	Lock and release types	Contact configuration (door open/closed detection switch and lock monitor switch contacts)	Conduit opening	Model
Trapped key *1	Green	Mechanical lock Solenoid release	2NC/1NO+2NC/1NO	NPT	D4JL-4NFA-C7-01-NPT
				M20	D4JL-4NFA-C7-01
			2NC/1NO+3NC	NPT	D4JL-4PFA-C7-01-NPT
				M20	D4JL-4PFA-C7-01
			3NC+2NC/1NO	NPT	D4JL-4QFA-C7-01-NPT
				M20	D4JL-4QFA-C7-01
			3NC+3NC	NPT	D4JL-4RFA-C7-01-NPT
				M20	D4JL-4RFA-C7-01
	Orange		2NC/1NO+2NC/1NO	NPT	D4JL-4NFA-D7-01-NPT
				M20	D4JL-4NFA-D7-01
			2NC/1NO+3NC	NPT	D4JL-4PFA-D7-01-NPT
				M20	D4JL-4PFA-D7-01
			3NC+2NC/1NO	NPT	D4JL-4QFA-D7-01-NPT
				M20	D4JL-4QFA-D7-01
			3NC+3NC	NPT	D4JL-4RFA-D7-01-NPT
				M20	D4JL-4RFA-D7-01

*1. Thirty types of trapped keys can be manufactured. Specify the trapped key type in numerical order starting from 01 when ordering.

CM Series

Quick Link
S282
omron247.com

Most Diverse and Flexible Line of Coded Magnetic Safety Interlock Switches and Controllers

- Combine door switch monitoring and E-stop monitoring by using the CM-S41 controller
- Monitor is single switch to CAT4 with the CM-S30 controller
- Monitor multiple switches to CAT3 using CM-S4 or CM-S30 controllers
- Monitoring multiple switches on individual channels can be achieved by using the CM-S21 or CM-S41 controllers. Easily expand your system by using the CM-SE expansion module.
- All CM switches are rated IP67
- Stainless steel switches are available for harsh environments



Conforms to EN292, EN60204-1, EN954-1, EN1088, EN60947-5-3, EN947-5-3, EN50081, EN50082, EN61000-6-2, ISO 13849-1
UL and C-UL listed, TUV certified

Description

The CM series of controllers and coded magnetic switches offers the most flexibility and widest range of options available. The CM series is comprised of two basic technologies.

Controller Technologies

2-Wire Single Channel Controllers

The CM-S41 and CM-S21 controllers monitor the 2-wire magnetically coded switches. The CM-S41 and CM-S21 controllers use a patented technology which allows them to monitor the 2-wire or single channel switches up to Category 3. The ability to monitor just a single channel enables the CM-S41 and CM-S21 to easily monitor multiple switches and provide individual status of each channel. Both of these controllers are compatible with the CM-SE expansion module.

Dual Channel Controllers

The CM-S4 and CM-S30 controllers are designed to monitor conventional read-style, magnetically-coded switches with 1 N/O + 1 N/C contacts. The CM-S4 controller can monitor up to four switches to category 3. The CM-S4 controller offers status indication for each individual switch. The CM-S30 controller can monitor one switch to category 4, or two switches to category 3. The CM-S30 control unit is capable of monitoring up to 30 conventional read style switches in series, but does not conform to category 3 when used with more than two switches.

Switch Categories

The CM series of switches are all magnetically coded. The CM series of switches fall into three main categories:

1. 2-wire Coded Magnetic
2. Conventional Read Style 1 N/C + 1 N/O contacts
3. Universal Read Style 2 N/C + 1 N/O contacts

The 2-wire Coded Magnetic Switches are only compatible with the CM-S21, CM-S41 and CM-SE control units and expansion module. The Conventional Read Style Switches are compatible with the CM-S4 and CM-S30 controllers. The Universal Read Style Switches are unique in design, all three contacts are rated for safety. This means that Universal Read Style switches can be used with the CM-S4 or CM-S30 Controllers, or conventional safety monitoring relays such as the G9SA, SR103 or G9SX-AD, -BC. This allows the Universal Read Style Switches to be run in series with E-stop switches or other mechanical door switches. Typically a category 2 rating would be applied to a system that incorporates multiple switches wired in series to a standard safety monitoring relay. A risk assessment should always be performed by properly trained and authorized personnel.

F

Switch Specifications

Electrical	CM-S1, CM-S2, CM-S3	CM-S5, CM-S6	CM-S221, CM-S521, CM-S621	CM-S11	CM-S31	CM-S321, CM-S421
Safety Contacts:	1 N/C + 1 N/O	1 N/C + 1 N/O	2 N/C + 1 N/O	Current Sensing Circuit	Current Sensing Circuit	2 N/C + 1 N/O
N/C Operating Distance:	CM-S1 — On = 3 mm; Off = 8 mm CM-S2 and CM-S3 — On = 6 mm; Off = 13 mm	On = 7 mm; Off = 10 mm	On = 7 mm; Off = 10 mm	On = 5-7 mm; Off = 8-12 m	On = 5-7 mm; Off = 8-12 mm	On = 7 mm; Off = 10 mm
Minimum Gap:	1 mm	1 mm	1 mm	1 mm	1 mm	1 mm
Max Switched Current/Voltage:	500 mA / 24 V	300 mA / 24 V	300 mA / 24 V			300 mA / 24 V
Mechanical						
Mounting:	2 x M4 screws supplied	2 x M4 screws supplied	2 x M4 screws supplied	2 x M4 screws supplied	2 x M4 screws supplied	3 x M4 screws supplied
Case Material:	Glass filled PPS	ABS	ABS	ABS	316 stainless steel	316 stainless steel
Max Wire Size:	Pre-wired cable to 5 m	Pre-wired cable to 10 m	Pre-wired cable to 10 m	Pre-wired cable to 10 m	Pre-wired cable to 10 m	Pre-wired cable to 5 m, 6-pin micro AC connector
Weight:	230 g (8.1 oz.)	207 g (8.1 oz.)	230 g (8.1 oz.)	207 g (7.3 oz.)	265 g (9.3 oz.)	545 g (19.2 oz.)
Color:	Red	Red	Red	Red	Stainless	Stainless
Mechanical Life:	10^6	10^6	10^6	10^6	10^6	10^6
Environmental						
Protection:	IP67 (NEMA 6)	IP67 (NEMA 6)	IP67 (NEMA 6)	IP67 (NEMA 6)	IP67 (NEMA 6)	IP67 (NEMA 6)
Operating Temperature:	-10 to 55°C (14 to 131°F)	-10 to 55°C (14 to 131°F)	-10 to 55°C (14 to 131°F)	-10 to 55°C (14 to 131°F)	-10 to 55°C (14 to 131°F)	Connector Models: -10 to 55°C (14 to 131°F) Integrated Cables: -10 to 95°C (14 to 203°F)
Humidity:	95% RH at 55°C (131°F)					
Compliance						
Standards:	EN292, EN60204-1, EN954-1, EN1088, EN60947-5-3, EN947-5-3, EN50081, EN50082, EN61000-6-2					
Approvals/Listings:	CE marked for all applicable directives, UL and C-UL. TUV certified: CM-S1, CM-S2, CM-S3, CM-S11 and CM-S31.					

Specifications are subject to change without notice.

Note: The safety contacts of the STI switches are described as normally closed (N/C) i.e., with the guard closed, actuator in place, and the machine able to be started.

Control Unit Specifications

Electrical	CM-S4	CM-S30	CM-S41, CM-S21 & CM-SE
Power Supply:	24 VAC/DC ± 10%	24 VAC/DC ± 10%	CM-S41 — 24 VAC/DC, 110/230 VAC CM-S21 & CM-SE — 24 VAC/DC
Power Consumption:	2.4 VA typical, 0.25 A quick acting	120 mA	CM-S41 — 6 VA; CM-S21 & CM-SE — 3 VA
Input Fuse:	500 mA resetable	750 mA resetable	500 mA resetable
Safety Inputs:	1 N/O + 1 N/C	1 N/O + 1 N/C	CM-S41 — 4 CM-S11 or CM-S31 switches CM-S21 — 2 CM-S11 or CM-S31 switches CM-SE — 5 CM-S11 or CM-S31 switches
Max Cable Length:	—	—	100 m (328 ft.)
Max Input Resistance:	Contact factory	Contact factory	Contact factory
Relay Outputs:	1 N/O safety + 1 N/O aux.	2 N/O safety + 1 N/C aux.	CM-S41 & CM-S21 — 2 N/O; CM-SE — N/A
Max Switched Current/Voltage:	4 A / 24 VAC/DC	3 A / 24 VAC/DC	4 A / 230 VAC; 2 A / 24 VDC (resistive)
Min Switched Current/Voltage:	4 mA / 12 V	4 mA / 12 V	10 V / 10 mA
Impulse Withstand Voltage:	250 V	250 V	250 V
Max Drop-Out Time:	18 ms	18 ms	Deactivation by sensor 13 mS
Max Output Fuse:	4 A quick acting	4 A quick acting	AC = 5 A; DC = 2.5 A; quick acting
Reset Mode:	Automatic	Automatic/Manual, monitored	Monitored manual or automatic
External Device Monitoring:	N/C loop between Y1 and Y2	Between Y1, Y2, Y3	N/C loop between X1 and X2
Mechanical			
Mounting:	35 mm (1.38 in.) DIN rail	35 mm (1.38 in.) DIN rail	35 mm (1.38 in.) DIN rail
Case Material:	Polyamid PA6.6	Polyamid PA6.6	Polycarbonate
Max Wire Size:	2 x 2.5 mm^2 (12 AWG)	1 x 2.5 mm^2 (14 AWG)	1 x 2.5 mm^2 stranded, 1 x 4 mm^2 solid
Weight:	240 g (8.5 oz.)	230 g (8.1 oz.)	CM-S41 — 575 g (20.3 oz.) CM-S21 — 183 g (6.5 oz.) CM-SE — 135 g (4.8 oz.)
Color:	Grey	Red/Grey	Red
Indication:	U: Green = On Outputs Open: Red = On Outputs Closed: Green = On D11, D12, D21, D22: Green = Gate closed D31, D32, D41, D42: Red = Gate open	Green = Power On Green = K1 On Green = K2 On	Power = Red Outputs Closed: Green = On Outputs Open: No Light = Off Gate Closed: Yellow = On Gate Open: No Light = Off
Mechanical Life:	3 x 10^7	1 x 10^7	1 x 10^6
Environmental			
Protection:	Housing IP40, Terminals IP20	Housing IP40, Terminals IP20	Housing IP40, Terminals IP20
Operating Temperature:	0 to 50°C (32 to 122°F)	0 to 55°C (32 to 131°F)	10 to 55°C (50 to 131°F)
Humidity:	95%	93%	85%
Compliance			
Standards:	EN292, EN60204-1, ISO 13849-1, EN1088, EN60947-5-3, EN947-5-3, EN50081, EN50082, EN61000-6-2		EN292, EN60204-1, EN954-1,EN1088, EN60947-5-3, EN947-5-3, EN50081, EN50082, EN61000-6-2
Approvals/Listings:	CE marked for all applicable directives, UL and C-UL, TUV (TUV pending for CM-S30)		
Safety Category:	Cat 3 per EN954-1 (internal operation)	Cat 4 per ISO 13894-1 (internal operation)	Cat 3 per EN954-1 (internal operation)

Specifications are subject to change without notice.

Note: The safety contacts of the STI switches are described as normally closed (N/C) i.e., with the guard closed, actuator in place, and the machine able to be started.

F

Applications

2-Wire Single Channel Controllers

CM-S41 Control Unit

The CM-S41 is a combined Safety Switch and E-Stop control unit. Along with the ability to monitor up to four, 2-wire CM Series safety switches, it can also monitor the normally closed contacts of emergency stop buttons or mechanical safety switches in dual channel control circuits.

The CM-S41 has 2 normally open safety contact outputs and 1 normally closed auxiliary output, an external reset/proving circuit and LED indication for “Power”, “Run” and the status of each activated gate switch.

CM-S21 Control Unit

The CM-S21 control unit is a 24 VAC/DC system that can monitor up to 2 CM Series safety switches.

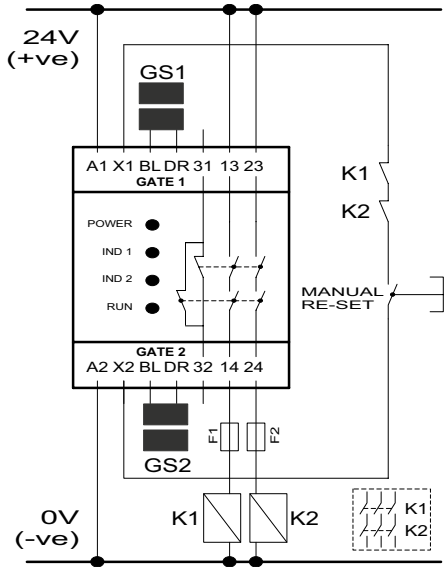
The CM-S21 has 2 normally open safety contact outputs and 1 normally closed auxiliary output, an external reset/proving circuit and LED indication for “Power”, “Run” and the status of each activated gate switch.

CM-SE Extender Module

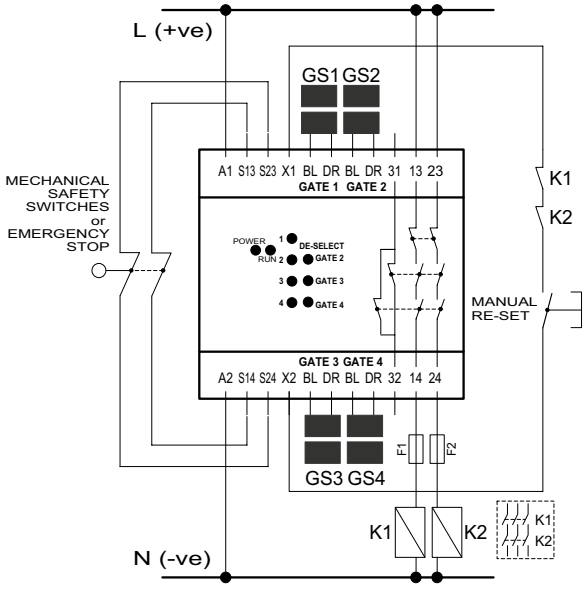
The CM-SE expansion module is a 24 VAC/DC unit that can be added to either the CM-S41 or CM-S21 to monitor an additional 5 CM Series safety switches. Connection to the main control unit is by a simple 2-wire bus connection. The status of each guard switch is shown by the YELLOW LED’s. Additional CMS-E modules can be added to monitor larger systems.



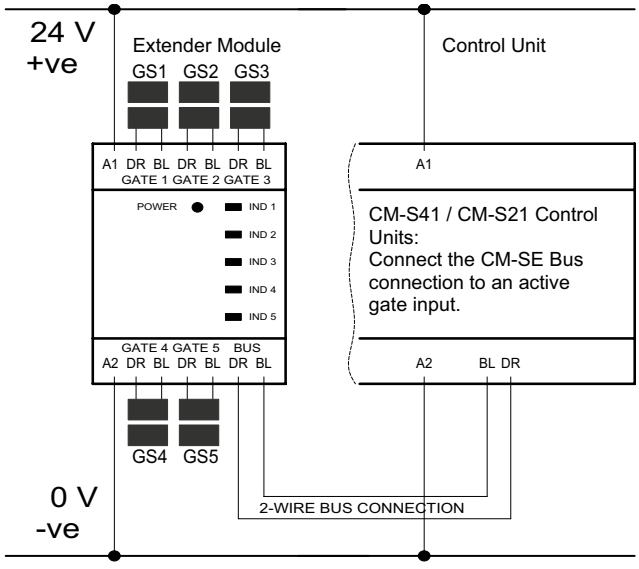
CM-S21 Application Diagram



CM-S41 Application Diagram



CM-SE Application Diagram



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Applications (continued)

Dual Channel Controllers

CM-S4 Control Unit

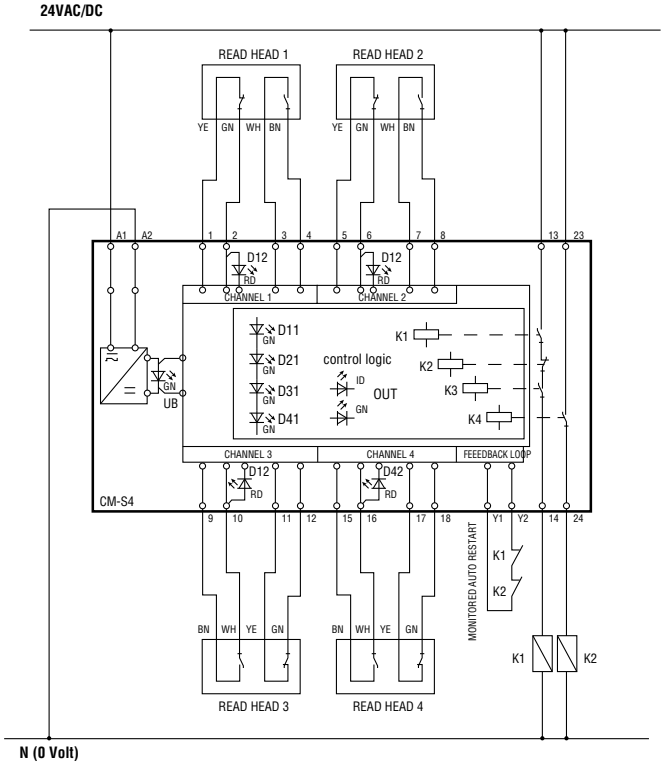
The CM-S4 controller is capable of monitoring up to four, magnetically coded switches with 1 N/O + 1 N/C contacts up to category 3 according to EN954-1. The CM-S4 has a dedicated dual channel input for each switch and has LED status indicators for each channel. The CM-S4 has 1 N/O safety contact and 1 N/O Aux contact. External Device Monitoring (EDM) is available using Y1,Y2 inputs.

CM-S30 Control Unit

The CM-S30 controller is capable of monitoring one magnetically coded switch with 1 N/O + 1 N/C contacts up to category 4, or two switches to category 3 according to ISO 13489-1. The CM-S30 control unit is capable of monitoring up to 30 conventional read style switches in series, but does not conform to category 4 when used with more than two switches. The CM-S30 controller has 2 N/O safety contacts and 1 N/C Auxiliary contact. External Device Monitoring (EDM) is available using Y1,Y2 inputs.

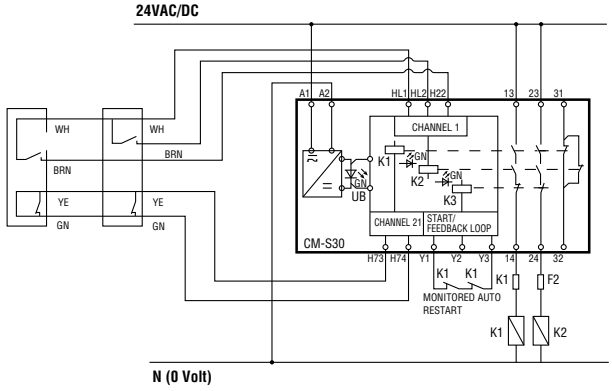


CM-S4 Application Diagram

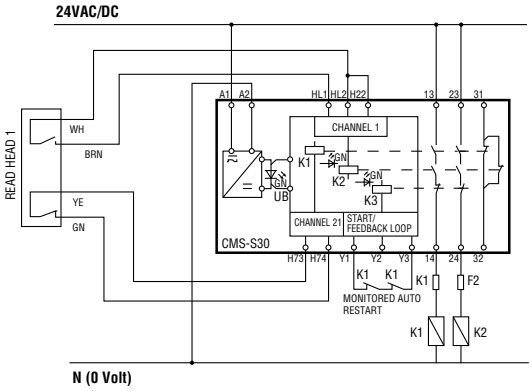


*23-24 should not be used as safety output.

CM-S30 Application Diagram (Cat 3)



CM-S30 Application Diagram (Cat 4)



F

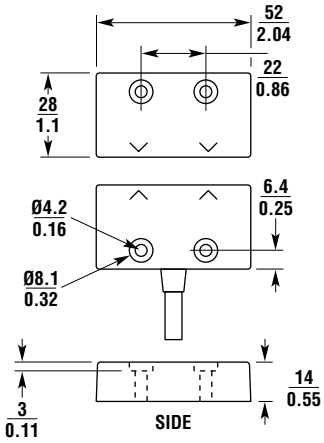
Dimensions

(mm/in.)

2-Wire Coded Magnetic Switches

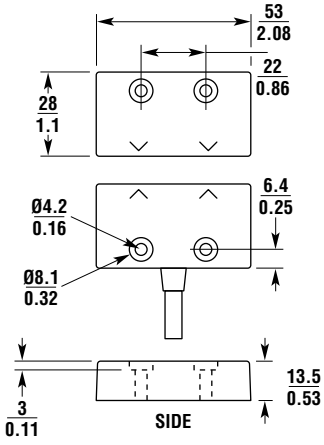
CM-S11





CM-S31





SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

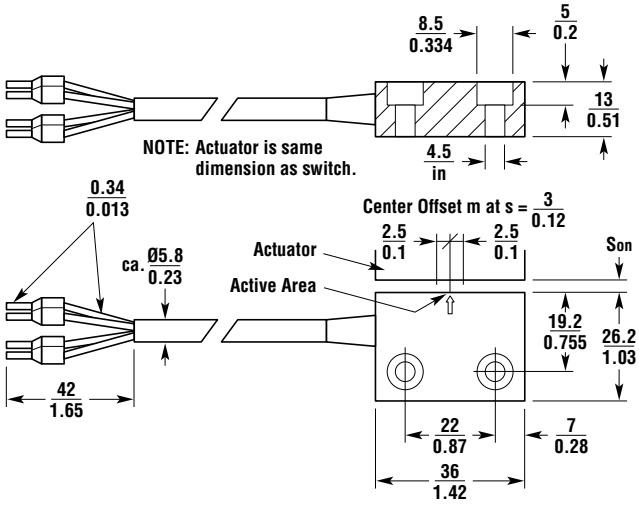
Dimensions (continued)

(mm/in.)

Conventional Read Style Switches

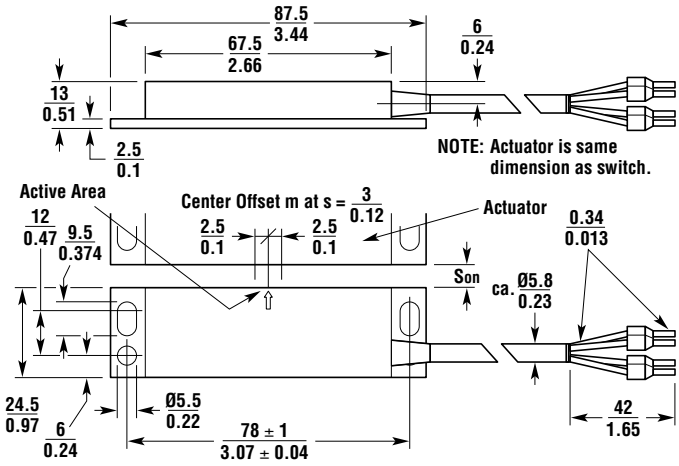
CM-S1





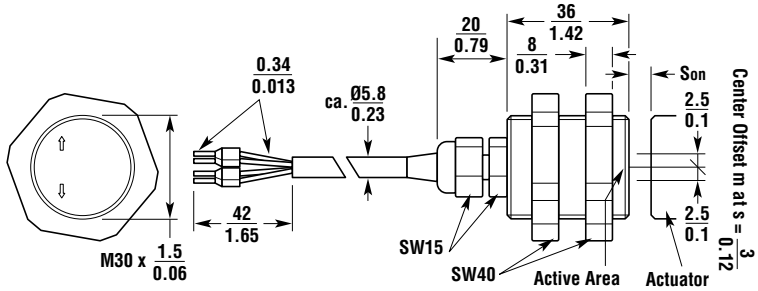
CM-S2





CM-S3





F

Dimensions (continued)

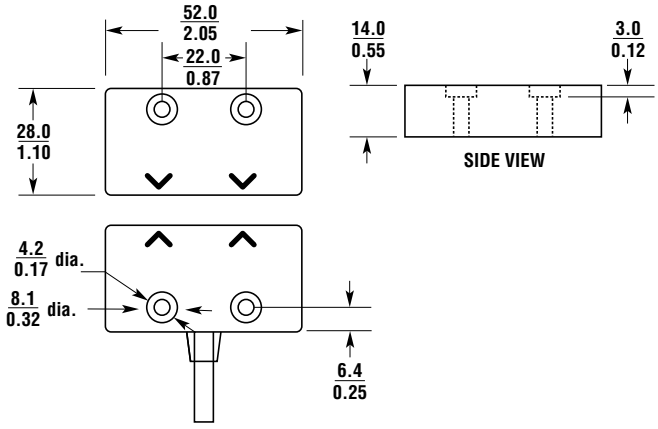
(mm/in.)

Conventional Read Style Switches (continued)

CM-S5



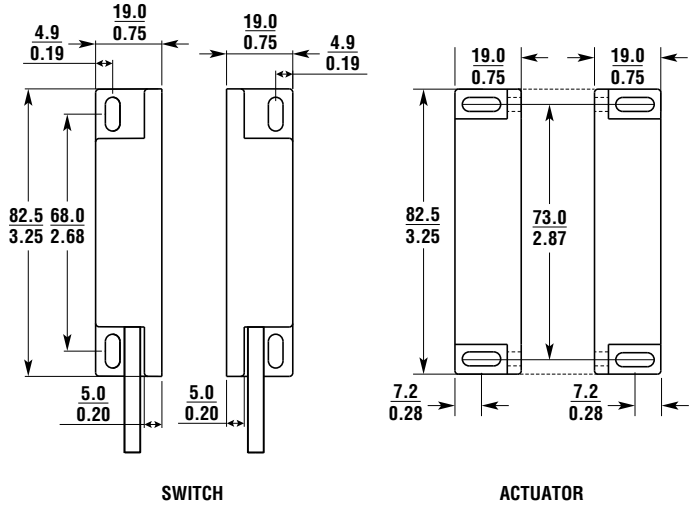
CM-S5 and CM-S521



CM-S6



CM-S6 and CM-S621



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

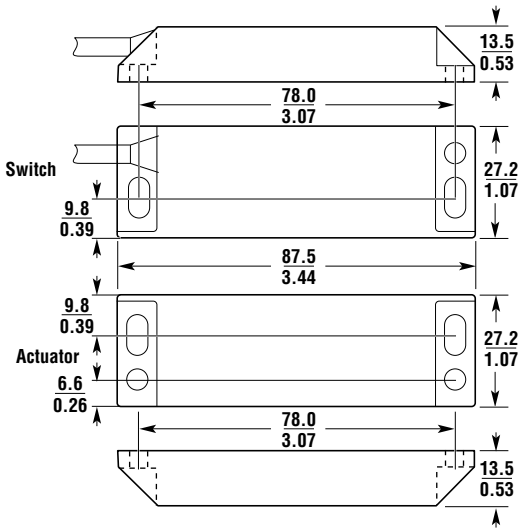
Dimensions (continued)

(mm/in.)

Universal Read Style Switches

CM-S221



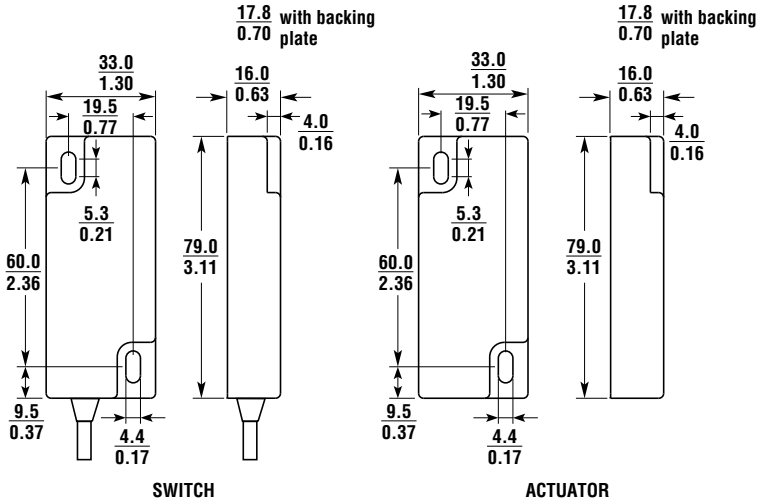


CM-S321/CM-S421



CM-S321 and CM-S421

Note: The CM-S321 includes a backing plate (not shown).



CM-S521



CM-S621



For CM-S521 dimensions, please refer to the CM-S5 dimensions on the previous page.

For CM-S621 dimensions, please refer to the CM-S6 dimensions on the previous page.

F

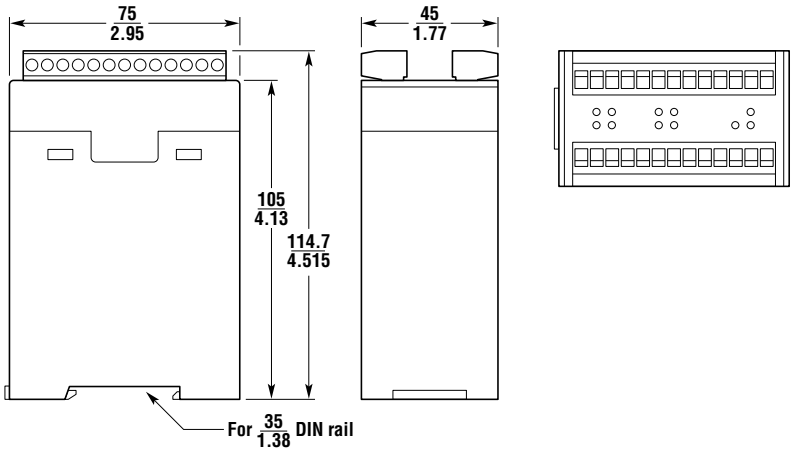
Dimensions (continued)

(mm/in.)

Control Units

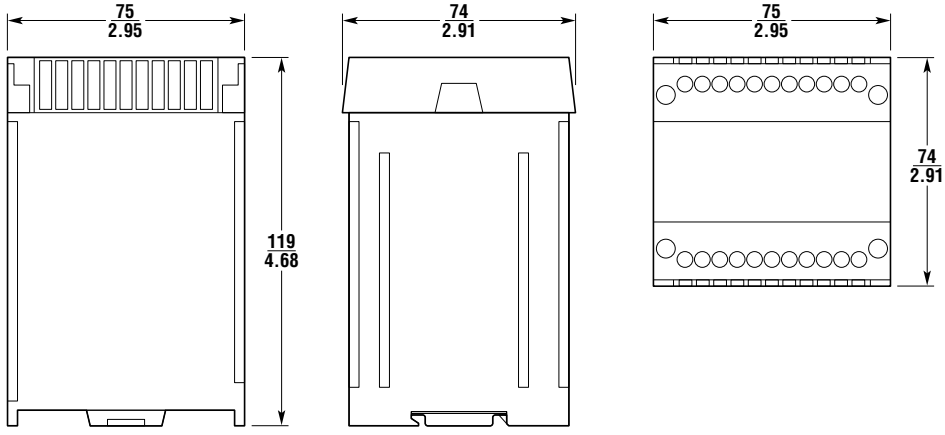
CM-S4





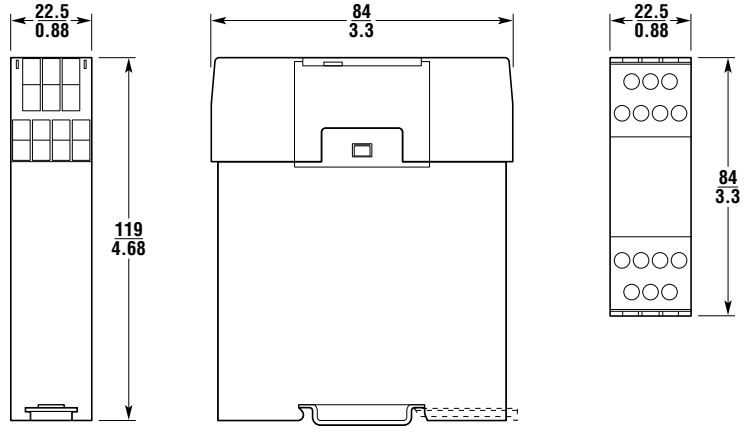
CM-S41





CM-S21 & CM-SE





SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

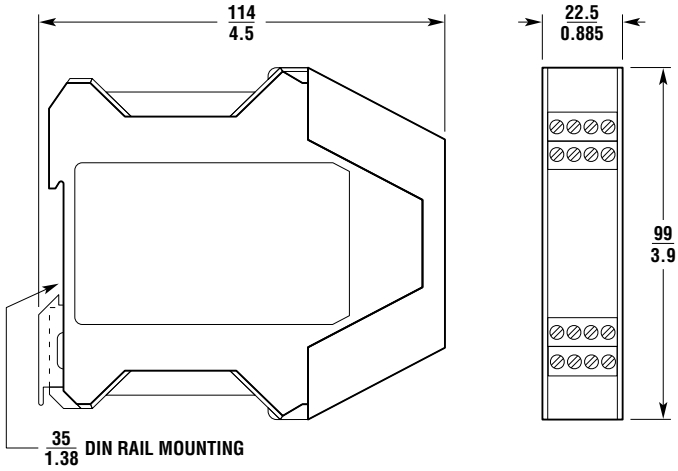
Dimensions (continued)

(mm/in.)

Control Units (continued)

CM-S30





F

Ordering

Model	Switch Construction	Contacts	Wiring Entry	Part No.
Control Units for 2-Wire Switches				
CM-S21-24 (24 VAC/DC)				44536-0120
CM-S41-24 (24 VAC/DC)				44536-0140
CM-S41-110 (110 VAC or 230 VAC)				44536-0141
CM-SE-24 (24 VAC/DC)				44536-0170
2-Wire Switches				
CM-S11-PC3	Plastic	2-wire system	3 m cable	44536-1100
CM-S11-PC5	Plastic	2-wire system	5 m cable	44536-1105
CM-S11-PC10	Plastic	2-wire system	10 m cable	44536-1110
CM-S11-PCC5	Plastic	2-wire system	connector + 5 m cable	44536-1159
CM-S31SC3	Stainless Steel	2-wire system	3 m cable	44536-3100
CM-S31SC5	Stainless Steel	2-wire system	5 m cable	44536-3105
CM-S31SCC5	Stainless Steel	2-wire system	connector + 5 m cable	44536-3159
Control Units for 1 N/C + 1 N/O Reed Style Switches				
CM-S30 (24 VAC/DC)				44536-0030
CM-S4 (24 VAC/DC)				44536-0040
1 N/C + 1 N/O Reed Style Switches				
CM-S1PC3	Plastic	1 N/C + 1 N/O	3 m cable	44536-0100
CM-S1PC5	Plastic	1 N/C + 1 N/O	5 m cable	44536-0105
CM-S2PC3	Plastic	1 N/C + 1 N/O	3 m cable	44536-0200
CM-S2PC5	Plastic	1 N/C + 1 N/O	5 m cable	44536-0205
CM-S3PC3	Plastic	1 N/C + 1 N/O	3 m cable	44536-0300
CM-S3PC5	Plastic	1 N/C + 1 N/O	5 m cable	44536-0305
CM-S5PC5	Plastic	1 N/C + 1 N/O	5 m cable	44536-0505
CM-S5PC10	Plastic	1 N/C + 1 N/O	10 m cable	44536-0510
CM-S6PC5	Plastic	1 N/C + 1 N/O	5 m cable	44536-0605
CM-S6PC10	Plastic	1 N/C + 1 N/O	10 m cable	44536-0610
Universal Reed Style Switches **(can be used with safety monitoring relays that accept 1N/C + 1N/O or 2NC switch contacts except the SR203, SR208, SR209)** *CAUTION! Universal reed switches may be operated with a coded or non-coded actuator when using 2 NC contacts with a safety monitoring relay.*				
CM-S221PC5	Plastic	2 N/C + 1 N/O	5 m cable	44536-0221
CM-S221PCC5	Plastic	2 N/C + 1 N/O	connector + 5 m cable	44536-0225
CM-S221PCC	Plastic	2 N/C + 1 N/O	no cable	44536-0226
CM-S521PC5	Plastic	2 N/C + 1 N/O	5 m cable	44536-0521
CM-S521PC10	Plastic	2 N/C + 1 N/O	10 m cable	44536-1521
CM-S621PC5	Plastic	2 N/C + 1 N/O	5 m cable	44536-0621
CM-S621PC10	Plastic	2 N/C + 1 N/O	10 m cable	44536-1621
CM-S321SC5	Stainless Steel	2 N/C + 1 N/O	5 m cable	44536-3221
CM-S321SCC5	Stainless Steel, backing plate	2 N/C + 1 N/O	M12 connector + 5 m cable	44536-3229
CM-S321SCC	Stainless Steel, backing plate	2 N/C + 1 N/O	M12 connector, no cable	44536-3220
CM-S421SC5	Stainless Steel, No backing plate	2 N/C + 1 N/O	5 m cable	44536-4221
CM-S421SCC5	Stainless Steel, No backing plate	2 N/C + 1 N/O	M12 connector + 5 m cable	44536-4229
Recommended Safety Monitoring Relays for Universal Reed Style Switches				
CM-S4, CM-S30, G9SA series, G9SX-AD, G9SX-BC, SR series				
Spare Actuators/Accessories				
Replacement Actuator for CM-S1, Red ABS Plastic				44536-0710
Replacement Actuator for CM-S2, Red ABS Plastic				44536-0720
Replacement Actuator for CM-S3, Red ABS Plastic				44536-0730
Replacement Actuator for CM-S5,CM-S521 Red ABS Plastic				44536-0750
Replacement Actuator for CM-S6, CM-S621 Red ABS Plastic				44536-0760
Replacement Actuator for CM-S11, Red ABS Plastic				44536-0711
Replacement Actuator for CM-S31, Red ABS Plastic				44536-0731
Replacement Actuator for CM-S221, Red ABS Plastic				44536-0721
Replacement Actuator for CM-S321, Stainless Steel, backing plate				44536-0741
Replacement Actuator for CM-S421, Stainless Steel, No backing Plate				44536-0751
Mounting Bracket for CM-S3				44536-0800

MA Series

Quick Link
S283
omron247.com

Magnetically Actuated Safety Interlock Switches

- Large selection—choose from a large selection of contact configurations housed in plastic to satisfy most application requirements
- NEMA 6 enclosure enables the MA Series switches to satisfy most application requirements (MA 3, 4, 5 are NEMA 4)
- Misalignment tolerant—the non-contact actuation of the switches makes them very tolerant to misalignment of up to 10 mm (0.39 in.)
- Variety of terminations—select various cable lengths or terminal strip termination for easy installation. Cable connector on selected models.
- Long life—the MA Series is designed for a minimum of one million actuations



Conforms to EN1088, EN292, EN60204-1
UL and C-UL listed

Specifications

Electrical	**All Models Unless Indicated**		
Safety Contacts:	AC models	MA-1 thru 5, 10, 12, 13, 16 — 1 N/C	MA-13, 16, 21 — 2 N/C
	DC models	MA-12, 13, 14, 16 — 1 N/C	MA-13, 15, 16, 20, 21 — 2 N/C
Safety Contact Operating Distance:		Make 7-12 mm (0.28-0.47in.); Break 12-25 mm (0.47-0.98 in.)	
Auxiliary Contacts:	MA-2, 4, 12, 13, 14, 15, 16, 21	1 N/O	
	MA-3	1 N/C	
Aux. Contact Operating Distance:	MA-2, 4, 16, 21	Make 8-13 mm (0.39-0.51 in.); Break 8-10 mm (0.31-0.39 in.)	
	MA-3	Make 21 mm (0.83 in.); Break 24 mm (0.94 in.)	
Safety Rated Voltage:	AC models: All except MA-10	230 VAC	
	AC models: MA-10	110 VAC	
	DC models	30 VDC	
Safety Rated Current:	AC models: All except MA-3	2 A, fuse externally 1.6 A quick acting	
	AC model: MA-3	3 A, fuse externally 2.5 A quick acting	
	DC models: All except MA-15	1 A, fuse externally 800 mA quick acting	
	DC model: MA-15	0.3 A max., fuse externally 0.2 A quick acting	
Internal Fuse:	AC models	2 A fast acting	
	DC models	1 A fast acting	
External Fuse (Customer Supplied):	AC models	1.6 A fast acting	
	DC models: All except MA-15	0.8 A fast acting	
Electrical Life:		1×10^6	
Mechanical—Special Safety Reed		**Safety**	**Aux.**
Closing Time:		3.0 mS	0.5 mS
Drop-Out Time:		2.1 mS	0.3 mS
Bounce Time:		0.7 mS	0.7 mS
Shock:		10 G	10 G
Vibration:		10 G, 50 to 100 Hz	
Mechanical			
Mounting:		Any position	
Case & Actuator Material:		Molded ABS	
Wiring Connection:		Various lengths or male M12 micro connector	
Weight:		Approx. 384 g (14 oz.)	
Color:		Red	
Mechanical Life:		10×10^6	
Environmental			
Protection:	All models except MA-3, 4, 5	IP67 (NEMA 6)	
	MA-3, 4, 5	IP65 (NEMA 4)	
Operating Temperature:	All models except MA-3, 4, 5	-10 to 55°C (14 to 131°F)	
	MA-3, 4, 5	-10 to 65°C (14 to 149°F)	
Compliance			
Standards:	EN1088, EN292, EN60204-1		
Approvals/Listings:	CE marked for all applicable directives		
	All models: except MA-3, 4, 5	UL and C-UL	
	MA-3, 4, 5	cCSAus	

Specifications are subject to change without notice. Note: The safety contacts of the STI switches are described as normally closed (N/C) i.e., with the guard closed, actuator in place, and the machine able to be started.

F

Basic Body Styles

MA-1, MA-2, MA-20 and MA-21



MA-10 and MA-16



MA-12 and MA-13





MA-3, MA-4 and MA-5

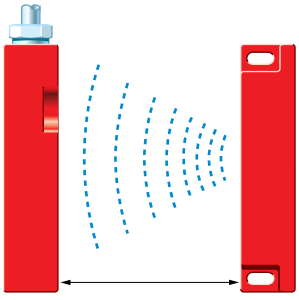


MA-14 and MA-15



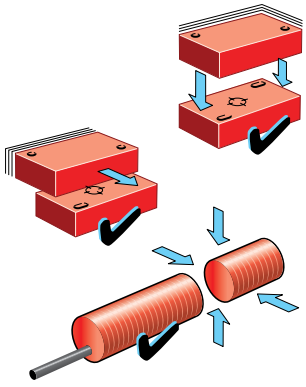
Operation

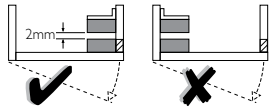
Operating Principle

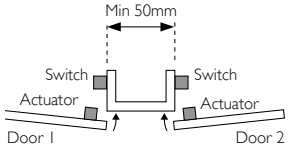


Encapsulated in the MA Series is a unique high-power industrial reed which is de-rated by a non-resetable overload protection circuit depending on switch type. On presenting the actuator to the switch, the high intensity magnetic field from the actuator causes the contacts to close. On removing the actuator (opening the door), the safety contacts open, isolating the machine.

Mounting Examples

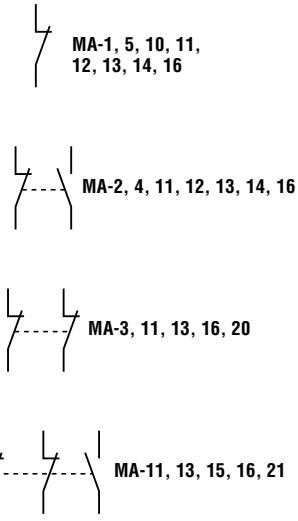


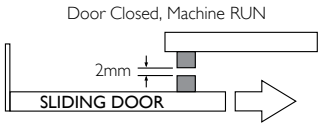


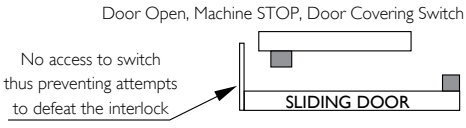


It is advisable, where possible, to mount the switch and actuator on non-ferrous materials otherwise it may affect the operating distances.

Contact Arrangement







Wherever possible the units should be mounted so that no access can be obtained to the switch when the guard door is open, thus preventing attempts to defeat the safety system.

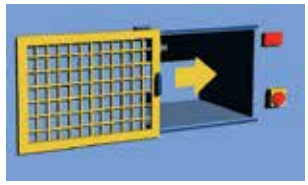
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

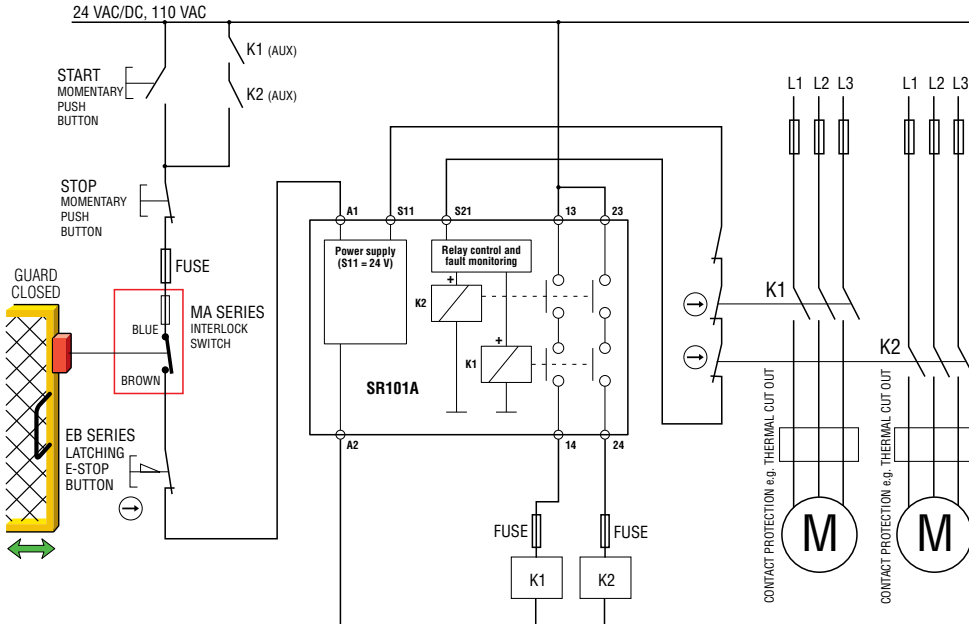
Applications

Typical Application of MA Series with a Safety Monitoring Relay

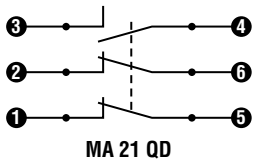
Typical applications are on sliding guard doors or swinging guard doors.

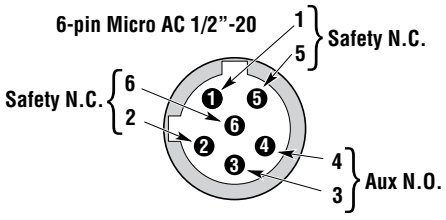


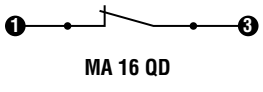


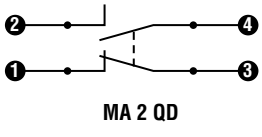


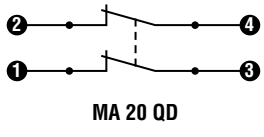
Pin Assignments with Connector Option

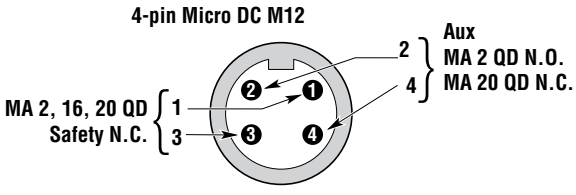










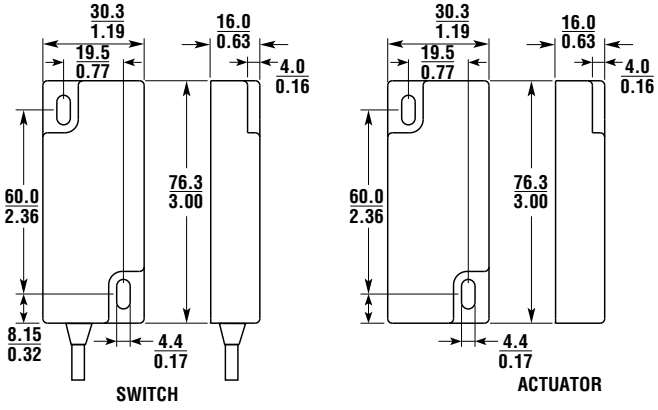


F

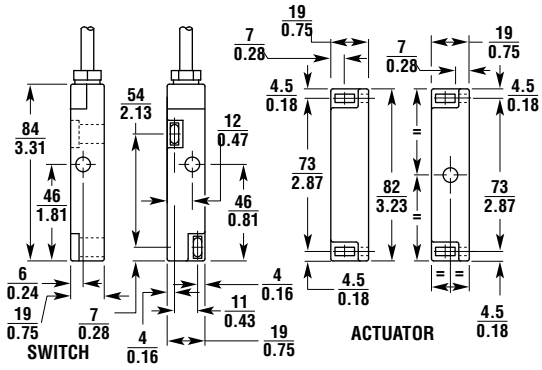
Dimensions

(mm/in.)

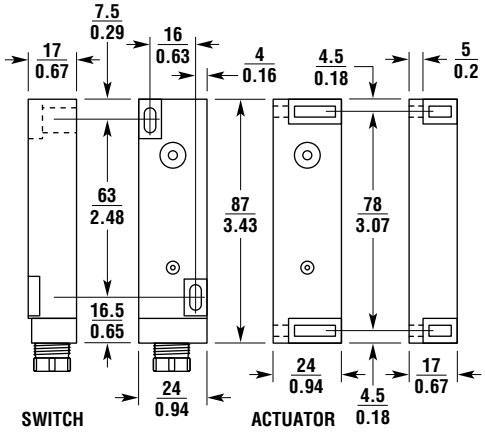
MA-1, 2, 20, 21



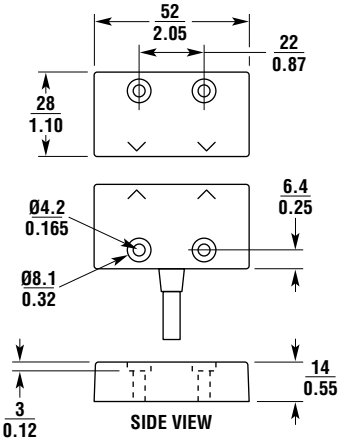
MA-10



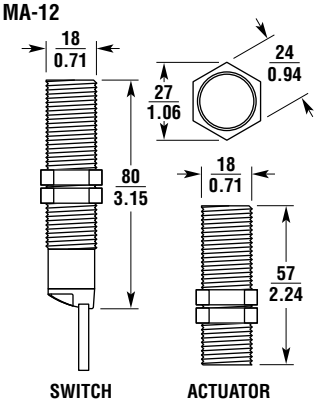
MA-11



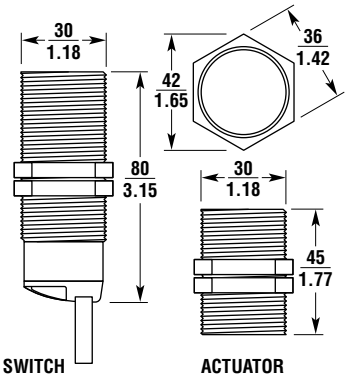
MA-14, 15



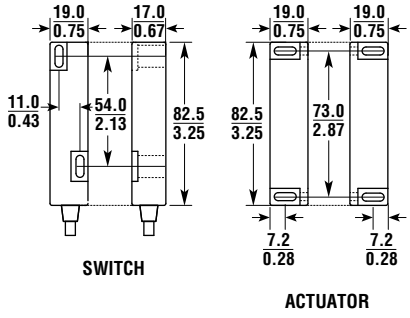
MA-12



MA-13



MA-16



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering

Model	Contacts	Wiring Entry	Part No.
AC Only			
MA-1APC2 (AC only)	1 N/C	2 m cable, pre-wired	44507-0010
MA-1APC4 (AC only)	1 N/C	4 m cable, pre-wired	44507-0020
MA-1APC8 (AC only)	1 N/C	8 m cable, pre-wired	44507-0180
MA-1APCC (AC only)	1 N/C	4 pin micro DC M12	44507-0619
MA-2APC2 (AC only)	1 N/C + 1 N/O	2 m cable, pre-wired	44507-0030
MA-2APC4 (AC only)	1 N/C + 1 N/O	4 m cable, pre-wired	44507-0040
MA-2APC6 (AC only)	1 N/C + 1 N/O	6 m cable, pre-wired	44507-0150
MA-2APC10 (AC only)	1 N/C + 1 N/O	10 m cable, pre-wired	44507-0750
MA-2APC15 (AC only)	1 N/C + 1 N/O	15 m cable, pre-wired	44507-0740
MA-2APCC (AC only)	1 N/C + 1 N/O	4-pin micro DC M12	44507-0600
MA-3APTC (AC only)	1 N/C + 1 N/C	Terminal connections	44507-0050
MA-4APTC (AC only)	1 N/C + 1 N/O	Terminal connections	44507-0060
MA-5APTC (AC only)	1 N/C	Terminal connections	44507-0070
MA-10APC2 (110 VAC, 3A max)	1 N/C	2 m cable, pre-wired	44507-0110
MA-10APC4 (110 VAC, 3A max)	1 N/C	4 m cable, pre-wired	44507-0330
MA-11AP10C3	1 N/C	3 m cable, pre-wired	44507-1150
MA-11AP11C3	1 N/C + 1 N/O	3 m cable, pre-wired	44507-1160
MA-11AP11C10	1 N/C + 1 N/O	10 m cable, pre-wired	44507-1161
MA-11AP20C3	2 N/C	3 m cable, pre-wired	44507-1170
MA-11AP21C3	2 N/C + 1 N/O	3 m cable, pre-wired	44507-1180
MA-12AP10C3	1 N/C	3 m cable, pre-wired	44507-1250
MA-12AP11C3	1 N/C + 1 N/O	3 m cable, pre-wired	44507-1260
MA-13AP10C3	1 N/C	3 m cable, pre-wired	44507-1350
MA-13AP11C3	1 N/C + 1 N/O	3 m cable, pre-wired	44507-1360
MA-13AP20C3	2 N/C	3 m cable, pre-wired	44507-1370
MA-13AP21C3	2 N/C + 1 N/O	3 m cable, pre-wired	44507-1380
MA-16AP10C3 (AC only)	1 N/C	3 m cable, pre-wired	44507-1650
MA-16AP10C6 (AC only)	1 N/C	6 m cable, pre-wired	44507-1651
MA16AP10C10 (AC only)	1 N/C	10 m cable, pre-wired	44507-1659
MA16AP10CC	1 N/C	4-pin micro DC M12	44507-1652
MA-16AP11C3 (AC only)	1 N/C + 1 N/O	3 m cable, pre-wired	44507-1660
MA-16AP11C6 (AC only)	1 N/C + 1 N/O	6 m cable, pre-wired	44507-1661
MA-16AP20C3 (AC only)	2 N/C	3 m cable, pre-wired	44507-1670
MA-16AP20C6 (AC only)	2 N/C	6 m cable, pre-wired	44507-1671
MA-16AP21C3 (AC only)	2 N/C + 1 N/O	3 m cable, pre-wired	44507-1680
MA-16AP21C6 (AC only)	2 N/C + 1 N/O	6 m cable, pre-wired	44507-1681
MA-20APC4 (AC only)	2 N/C	4 m cable, pre-wired	44507-0345
MA-20APCC (AC only)	2 N/C	4-pin micro DC M12	44507-0640
MA-21APC2 (AC only)	2 N/C + 1 N/O	2 m cable, pre-wired	44507-0160
MA-21APC4 (AC only)	2 N/C + 1 N/O	4 m cable, pre-wired	44507-0260
MA-21APC6 (AC only)	2 N/C + 1 N/O	6 m cable, pre-wired	44507-0250
MA-21APC10 (AC only)	2 N/C + 1 N/O	10 m cable, pre-wired	44507-0170
MA-21APC15	2 N//C + 1 N/O	15 m cable, pre-wired	44507-0175
MA-21APCC	2 N/C + 1 N/O	6-pin micro DC M12	44507-0660

(Continued on next page)

F

Ordering (continued)

Model	Contacts	Wiring Entry	Part No.
DC Only			
MA-1DPC2	1 N/C	2 m cable, pre-wired	44507-0022
MA-1DPC4	1 N/C	4 m cable, pre-wired	44507-0024
MA-1DPC8	1 N/C	8 m cable, pre-wird	44507-0028
MA-1DPCC	1 N/C	4p-pin micro DC M12	44507-0629
MA-2DPC2	1 N/C + 1 N/O	2 m cable, pre-wired	44507-0392
MA-2DPC4	1 N/C + 1 N/O	4 m cable, pre-wired	44507-0390
MA-2DPC6	1 N/C + 1 N/O	6 m cable, pre-wired	44507-0396
MA-2DPC10	1 N/C + 1 N/O	10 m cable, pre-wired	44507-0380
MA-2DPC15	1 N/C + 1 N/O	15 m cable, pre-wired	44507-0370
MA-2DPCC	1 N/C + 1 N/O	4-pin micro DC M12	44507-0650
MA-11DP10C3	1 N/C	3 m cable, pre-wired	44507-1110
MA-11DP11C3	1 N/C + 1 N/O	3 m cable, pre-wired	44507-1120
MA-11DP20C3	2 N/C	5 m cable, pre-wired	44507-1130
MA-11DP20C5	2 N/C	3 m cable, pre-wired	44507-1131
MA-11DP21C3	2 N/C + 1 N/O	3 m cable, pre-wired	44507-1140
MA-12DP10C3	1 N/C	3 m cable, pre-wired	44507-1210
MA-12DP11C3	1 N/C + 1 N/O	3 m cable, pre-wired	44507-1220
MA-13DP10C3	1 N/C	3 m cable, pre-wired	44507-1310
MA-13DP11C3	1 N/C + 1 N/O	3 m cable, pre-wired	44507-1320
MA-13DP20C3	2 N/C	3 m cable, pre-wired	44507-1330
MA-13DP21C3	2 N/C + 1 N/O	3 m cable, pre-wired	44507-1340
MA-13DP21C10	2 N/C + 1 N/O	10 m cable, pre-wired	44507-1341
MA-14DP10C3	1 N/C	3 m cable, pre-wired	44507-1410
MA-14DP11C3	1 N/C + 1 N/O	3 m cable, pre-wired	44507-1420
MA-15DP21C3*	2 N/C + 1 N/O	3 m cable, pre-wired (300 mA max.)	44507-1540
MA-15DP21C5*	2 N/C + 1 N/O	5 m cable, pre-wired (300 mA max.)	44507-1541
MA-15DP21CC*	2 N/C + 1 N/O	6-pin micro DC M12	44507-1549
MA-16DP10C3 (DC only)	1 N/C	3 m cable, pre-wired	44507-1610
MA-16DP10C6 (DC only)	1 N/C	6 m cable, pre-wired	44507-1611
MA16DP10C10 (DC only)	1 N/C	10 m cable, pre-wired	44507-1612
MA16DP10CC (DC only)	1 N/C	4-pin micro DC M12	44507-1619
MA-16DP11C3 (DC only)	1 N/C + 1 N/O	3 m cable, pre-wired	44507-1620
MA-16DP11C6 (DC only)	1 N/C + 1 N/O	6 m cable, pre-wired	44507-1621
MA-16DP20C3 (DC only)	2 N/C	3 m cable, pre-wired	44507-1630
MA-16DP20C6 (DC only)	2 N/C	6 m cable, pre-wired	44507-1631
MA-16DP21C3 (DC only)	2 N/C + 1 N/O	3 m cable, pre-wired	44507-1640
MA-16DP21C6 (DC only)	2 N/C + 1 N/O	6 m cable, pre-wired	44507-1641
MA-20DPC4 (24 VDC only)	2 N/C	4 m cable, pre-wired	44507-0340
MA-20DPCC (24 VDC only)	2 N/C	4-pin micro DC M12	44507-0630
MA-21DPC2 (24 VDC only)	2 N/C + 1 N/O	2 m cable, pre-wired	44507-0270
MA-21DPC4 (24 VDC only)	2 N/C + 1 N/O	4 m cable, pre-wired	44507-0280
MA-21DPC6 (24 VDC only)	2 N/C + 1 N/O	6 m cable, pre-wired	44507-0290
MA-21DPC10 (24 VDC only)	2 N/C + 1 N/O	10 m cable, pre-wired	44507-0350
MA-21DPC15 (24 VDC only)	2 N/C + 1 N/O	15 m cable, pre-wired	44507-0360
MA-21DPCC	2 N/C + 1 N/O	6-pin micro DC M12	44507-0670
Accessories			
Spare Actuator (1–5 & 20, 21), Red ABS Plastic			44507-0700
Replacement Actuator for MA-11, Red ABS Plastic			44507-0711
Replacement Actuator for MA-12, Red ABS Plastic			44507-0712
Replacement Actuator for MA-13, Red ABS Plastic			44507-0713
Replacement Actuator for MA-14, Red ABS Plastic			44507-0714
Replacement Actuator for MA-15, Red ABS Plastic			44507-0715
Replacement Actuator for MA-16, -10 Red ABS Plastic			44507-0716

*MA-15 switches are not compatible with the following STI safety relays: SR203M, SR203AM, SR208AD, SR209AD and all Legacy Relays.

D40Z/D40A/G9SX-NS

Quick Link
S222
omron247.com

Compact Non-contact Door Switch/ Flexible Safety Unit



D40Z

D40A

D40Z

- Supports ISO 13849-1 (Safety Category 4/PLe). Can be used on higher risk level applications by connecting to Safety Controllers.
- Supports a wide range of applications in combination with Safety Controller G9SP or G9SX-NS□.
- Up to 30 units can be connected to a single G9SX (15 units with G9SP) Controller and maintain Cat 4/PLe. Ideal for middle to large scale device applications.
- Troubleshooting is made easy with the switch's two-color diagnostic LED display patterns.
- Photocoupler monitor output allows connection to a general-purpose PLC (NPN type).
- Similar size as the D40A allows standardization of machine design.
- Compact non-contact door switch can be mounted from both sides.

D40A

- Stable operation reduces controller errors caused by unstable doors
- Connect up to 30 non-contact door switches with LED indicators to one controller
- Reversible switch provides flexibility in installation
- Two-color LED indicator enables easier maintenance by identification of door status and cable disconnections
- Safety category 3 (EN13849-1)
- Both non-contact door switches and conventional key-type safety-door switches can be input to one controller, saving space
- OFF-delay output provided for stop category 1
- Easily construct partial stop and complete stop systems with the logical AND connection function, using G9SX as the controller

F

Specifications

Ratings and Characteristics (Non-Contact Door Switches)

Item	Model	D40Z-1C□	D40A-1C□
Operating characteristics	Operating distance OFF ➔ ON	5 mm min. *1	
	Operating distance ON ➔ OFF	15 mm max. *1	
	Differential travel	Refer to "Detection Ranges"	
	Influence of temperature	Refer to "Detection Ranges"	±20% of operating distance at 23°C, within temperature range of -10 to 55°C
	Repeat accuracy	±10% of operating distance at 23°C	—
	Response time ON ➔ OFF *2	25 ms max.	—
	Operating time OFF ➔ ON *2	100 ms max. (Distance between the switch and actuator is 5 mm)	—
Ambient operating temperature		-10 to 65°C (with no icing or condensation)	-10 to 55°C (no icing or condensation)
Ambient operating humidity		25% to 85%	
Insulation resistance (between charged parts and case)		50 MΩ max. (at 500 VDC)	
Dielectric strength (between charged parts and case)		1,000 VAC for 1 min	
Degree of contamination		3	—
Dielectric strength (between charged parts and case)		—	1,000 VAC for 1 min
Electromagnetic compatibility		IEC/EN 60497-5-3 compliant	—
Vibration resistance		10 to 55 to 10 Hz (single amplitude: 0.75 mm, double amplitude: 1.5 mm)	
Shock resistance		300 m/s^2 min.	
Degree of protection		IP67	
Material		PBT resin	
Mounting method		M4 screws	
Terminal screw tightening torque		1 N·m	
Power supply voltage		24 VDC +10%/-15%	
Power consumption *3		0.5 W max.	0.6 W max.
Auxiliary monitoring output		Photocoupler output: 24 VDC, load current: 10 mA	24 VDC, 10 mA (PNP open-collector outputs) *4
LED indicators		Actuator not detected (lights in red); error occurred (blinks in red), actuator detected (lights in yellow), actuator detected and Non-contact Door Switch input OFF (blinks in yellow)	Actuator not detected (red); actuator detected (yellow)
Connecting cables		2 m, 5 m	
Number of connectable switches *5		30 max. (wiring length: 100 m max.)	
Weight		Switch: approx. 175 g, actuator: approx. 20 g (D40Z-1C5)	Switch: approx. 145 g, actuator: approx. 20 g (D40A-1C2)

*1. This is the distance where the switch operates from OFF to ON when approaching and the distance where the switch operates from ON to OFF when separating when the switch and actuator target marks are on the same axis, and the sensing surface coincide.

*2. Indicates the value of the non-contact door switch output.

*3. Power to be provided to the load is not included.

*4. Turns ON when the actuator is approaching. The G3R series of the SSR can be driven at an auxiliary output of 10 mA. Contact your Omron representative for details.

*5. For details, contact factory.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Specifications (continued)

Ratings (Non-contact Door Switch Controllers)

Power Inputs

Item	G9SX-NS202-□	G9SX-NSA222-T03-□	G9SX-EX-□
Rated supply voltage	24 V DC		
Operating voltage range	-15% to 10% of rated supply voltage		
Rated power consumption *	3 W max.	4 W max.	2 W max.

* Power consumption of loads not included.

Inputs

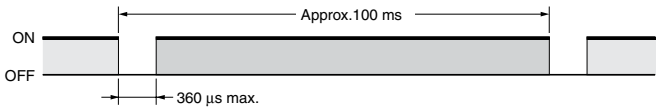
Item	G9SX-NS202-□/G9SX-NSA222-T03-□
Safety input *	Operating voltage: 20.4 VDC to 26.4 VDC, internal impedance: approx. 2.8 kW
Feedback/reset input	

* Only applies to the G9SX-NSA222-T03-□. Refers to input other than that from the Non-contact Door Switch.

Outputs

Item	G9SX-NS202-□/G9SX-NSA222-T03-□
Instantaneous safety output *1 OFF-delayed safety output *1	P channel MOS FET transistor output Load current: 0.8 A DC max. *2
Auxiliary output	PNP transistor output Load current: 100 mA max.

*1. While safety outputs are in the ON state, the following signal sequence is output continuously for diagnosis.
When using the safety outputs as input signals to control devices (i.e. Programmable Controllers), consider the OFF pulse shown below.



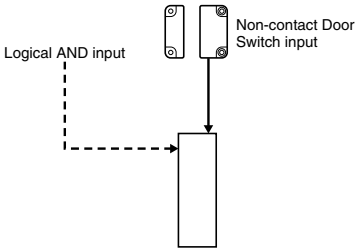
*2. The following derating is required when Units are mounted side-by-side. G9SX-NS202-□/G9SX-NSA222-T03-□: 0.4 A max. load current

Expansion Unit

Item	G9SX-EX-□
Rated load	250 VAC, 3 A/30 VDC, 3 A (resistive load)
Rated carry current	3 A
Maximum switching voltage	250 VAC, 125 VDC

Response Time and Operating Time

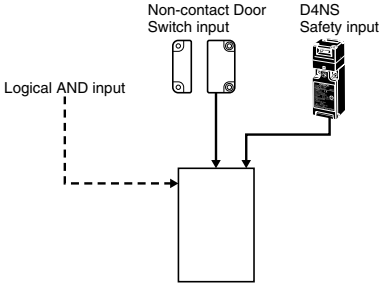
G9SX-NS□



	Max. response time (excluding Expansion Units) *1	Max. operating time (excluding Expansion Units) *2
Non-contact door switch input	45 ms *3	200 ms *4
Logical AND input	15 ms	100 ms

*1. The maximum response time is the time it takes the output to switch from ON to OFF after the input switches from ON to OFF.
*2. The maximum operating time is the time it takes the output to switch from OFF to ON after the input switches from OFF to ON.
*3. The value is the sum of D40Z's response time and G9SX-NS□'s response time.
*4. The value is the sum of D40Z's operating time and G9SX-NS□'s operating time.

G9SX-NSA□



	Max. response time (excluding Expansion Units) *1	Max. operating time (excluding Expansion Units) *2
Non-contact door switch input	45 ms *3	200 ms *4
Safety inputs	15 ms	50 ms
Logical AND input	15 ms	100 ms

*1. The maximum response time is the time it takes the output to switch from ON to OFF after the input switches from ON to OFF.
*2. The maximum operating time is the time it takes the output to switch from OFF to ON after the input switches from OFF to ON.
*3. The value is the sum of D40Z's response time and G9SX-NSA□'s response time.
*4. The value is the sum of D40Z's operating time and G9SX-NSA□'s operating time.

Note: The response time and operating time on the G9SP varies depending on the cycle time. For details, contact factory.

F

Specifications (continued)

Characteristics

Item		G9SX-NS202-□	G9SX-NSA222-T03-□	G9SX-EX-□
Over-voltage category (IEC/EN 60664-1)		II		II (Relay outputs 13 to 43 and 14 to 44: III)
Operating time (OFF to ON state) *1		100 ms max. (Logical AND connection input ON and Non-contact Door Switch input ON)	50 ms max. (Safety input: ON) *2 100 ms max. (Logical AND connection input ON and Non-contact Door Switch input ON) *3	30 ms max. *4
Response time (ON to OFF state) *1		15 ms max. (Logical AND connection input: OFF) 20 ms max. (Non-contact Door Switch input OFF) *6	15 ms max. (Safety input OFF and logical AND connection input OFF) 20 ms max. (Non-contact Door Switch input: OFF) *6	10 ms max. *4
ON-state residual voltage		3.0 V max. (safety output, auxiliary output)		
OFF-state leakage current		0.1 mA max. (safety output, auxiliary output)		
Maximum wiring length of safety input, logical AND connection input, and Non-contact Door Switch input		100 m max. (External connection impedance: 100 Ω max. and 10 nF max.)		
Reset input time (Reset button pressing time)		100 ms min.		
Accuracy of OFF-delay time *5		—	Within ±5% of the set value	Within ±5% of the set value
Insulation resistance	Between logical AND connection terminals, and power supply input terminals and other input and output terminals connected together	20 MΩ min. (at 100 VDC)		—
	Between all terminals connected together and DIN rail			100 MΩ min. (at 500 VDC)
Dielectric strength	Between logical AND connection terminals, and power supply input terminals and other input and output terminals connected together	500 VAC for 1 min.		—
	Between all terminals connected together and DIN rail			1,200 VAC for 1 min
	Between different poles of outputs	—		
	Between relay outputs connected together and other terminals connected together			2,200 VAC for 1 min
Vibration resistance		10 to 55 to 10 Hz, 0.375 mm single amplitude (0.75 mm double amplitude)		
Shock resistance	Destruction	300 m/s²		
	Malfunction	100 m/s²		
Durability	Electrical	—		100,000 cycles min. rated load, switching frequency: 1,800 cycles/hour)
	Mechanical	—		5,000,000 cycles min. (switching frequency: 7,200 cycles/hour)
Ambient operating temperature		-10 to 55°C (no icing or condensation)		
Ambient operating humidity		25% to 85%		
Terminal tightening torque		0.5 N·m (For the G9SX-NS□-RT (with screw terminals) only)		
Weight		Approx. 125 g	Approx. 200 g	Approx. 165 g

*1. When two or more Units are connected by logical AND, the operating time and response time are the sum total of the operating times and response times, respectively, of all the Units connected by logical AND.
*2. Represents the operating time when the safety input turns ON with all other conditions set.
*3. Represents the operating time when the logical AND input and the Non-contact Door Switch input turn ON with all other conditions set.
*4. This does not include the operating time or response time of G9SX-NS□ that are connected.
*5. This does not include the operating time or response time of internal relays in the G9SX-EX-□.
*6. The failure detection time for 24 V short-circuit failure on the input to Non-contact Door Switches is 35 ms max.
If using the Switch for an application other than as a Door Switch, calculate the safe distance using a failure detection time of 35 ms.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Specifications (continued)

Cable with Connector

Ratings and Characteristics

Rated current	3 A
Rated voltage	For DC 125 VDC, for AC 250 VAC
Contact resistance (Connector)	40 mΩ max. (20 mV max., 100 mA max.)
Insulation resistance	1,000 mΩ min (at 500 VDC)
Dielectric strength (Connector)	1,500 VAC for 1 min (leakage current 1 mA max.)
Degree of protection	IP67 (IEC529)
Insertion tolerance	200 times min.
Assembled fixture strength	Tensile: 98 N/15 s Torsion: 0.98 N m/15 s
Cable holding strength	Cable diameter: 6 mm 98 N/15 s
Ambient operating temp range	Operating: -25°C to 70°C
Ambient humidity range	20% to 80%

Materials and Finish

Item		XS2F/H/W
Contacts	Materials	Phosphor bronze
	Finish	Nickel base, 0.4-µm gold plating
Thread bracket	Materials	Brass
	Finish	Nickel plated
Pin block	Materials	PBT resin (UL94V-0)
	Finish	For DC: light gray; for AC: dark gray
O-ring/rubber bushing		Rubber
Cover		PBT resin (UL94V-0)

Logical AND Connection

Item	G9SX-NS202-□	G9SX-NSA222-T03-□	G9SX-EX-□
Number of Units connected per logical AND output	4 Units max.		—
Total number of Units connected by logical AND *1	20 Units max.		—
Number of Units connected in series by logical AND	5 Units max.		—
Max. number of Expansion Units connected *2	—		5 Units max.
Maximum cable length for logical AND input	100 m max.		—

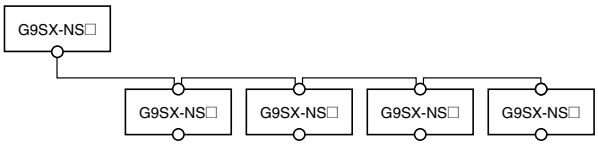
Note: See Logical AND Connection Combinations below for details.

*1. The number of G9SX-EX401-□ Expansion Units or G9SX-EX041-T-□ Expansion Units (OFF-delayed Model) not included.

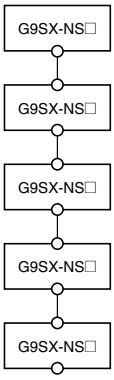
*2. G9SX-EX401-□ Expansion Units and G9SX-EX041-T-□ Expansion Units (OFF-delayed Model) can be mixed.

Logical AND Connection Combinations

1. One logical AND connection output from a G9SX-NS□ Controller can be logical AND connected to up to four Controllers.

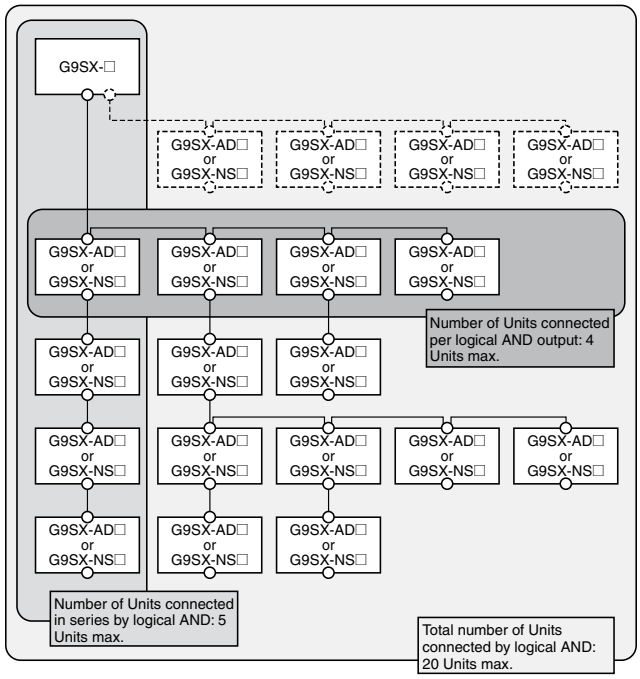


2. Any G9SX-NS□ Controller that receives a logical AND connection input can be logically connected to other Controllers on up to five layers.



Note: The G9SX-NS□ in the above diagram can be replaced by the G9SX-AD□ Advanced Unit.

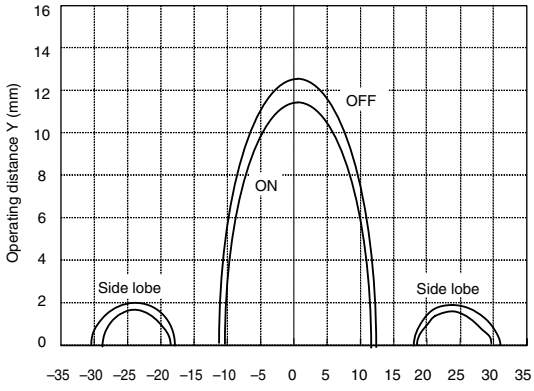
3. The largest possible system configuration contains a total of 20 G9SX-NS□ Controllers, G9SX-AD□ Advanced Units, and G9SX-BC Basic Units. In this configuration, each Controller or Advanced Unit can have up to five Expansion Units.

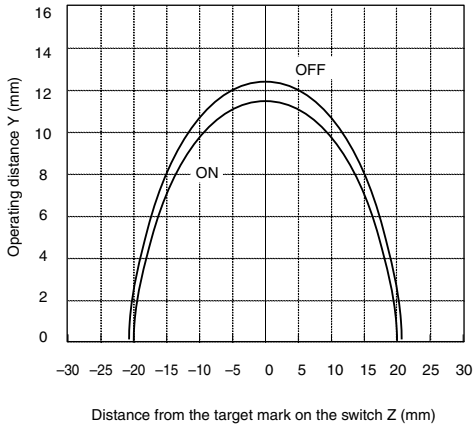


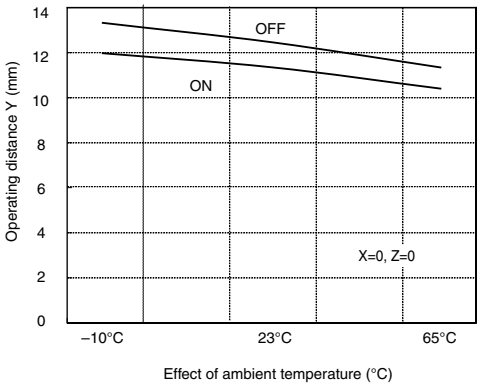
F

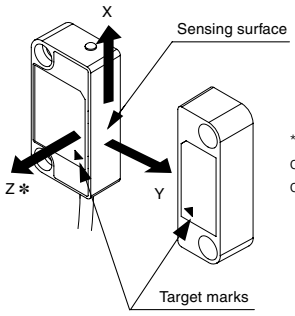
Engineering Data

D40Z Detection Ranges (Typical Characteristics Data)





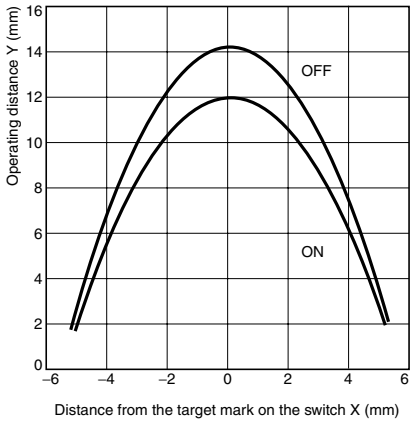


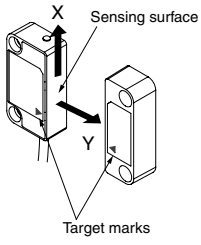


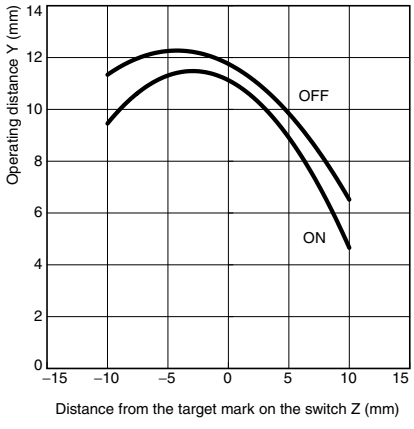
*The movement of the arrow direction indicates the positive direction on the graph.

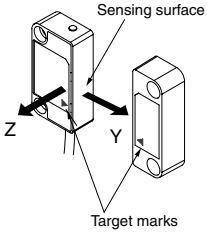
Notes:
1. The operating distance is the distance between the switch and actuator sensing surfaces.
2. Data in the diagram is typical data at an ambient temperature of 23°C. Actual operating values may vary. The operating distance may be affected by ambient metal, magnet catches, and temperature.
3. Detection may occur other than on the detection surfaces of the switch and actuator. Before you use the switch and actuator, refer to manual to set the detection surfaces of the switch and actuator face to face.

D40A Detection Ranges (Typical Characteristics Data)









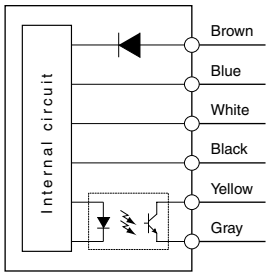
Notes: 1. The operating distance is the distance between the switch and actuator sensing surfaces.
2. Data in the diagram is typical data at an ambient temperature of 23°C. Actual operating values may vary. The operating distance may be affected by ambient metal, magnet catches, and temperature.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

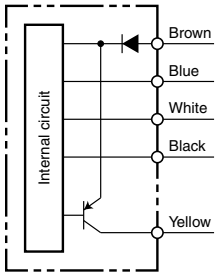
Connections

Internal Connections

D40Z-1C□

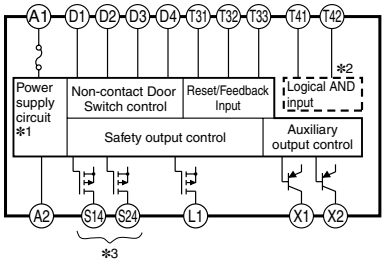


D40A-1C□



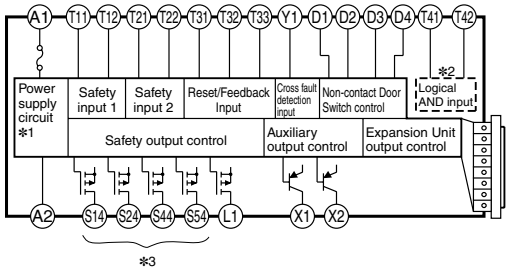
G9SX-NS202-□ (Non-contact Door Switch Controller)

*1. Internal power supply circuit is not isolated.
*2. Logical AND input is isolated.
*3. Outputs S14 to S24 are internally redundant.



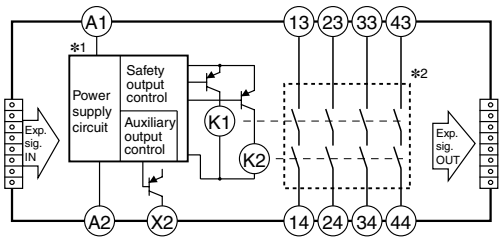
G9SX-NSA222-T03-□ (Non-contact Door Switch Controller)

*1. Internal power supply circuit is not isolated.
*2. Logical AND input is isolated.
*3. Outputs S14 to S54 are internally redundant.



G9SX-EX401-□/G9SX-EX041-T-□ (Expansion Unit/Expansion Unit OFF-delayed Model)

*1. Internal power supply circuit is not isolated.
*2. Relay outputs are isolated.



F

D40Z Troubleshooting

LED indicator	Causes and corrective actions *1	
● OFF	Fault in power supply input (brown/blue)	Power supply input may be improperly wired. Check and correct wiring of brown and blue lines.
		Power supply voltage to D40Z may be insufficient. Check the power supply voltage (between brown and blue lines) of D40Z fills ratings.
		The wiring length or size of the wire may not be to the specification. Check the wiring length and size of the wire..
☼ Red continuously blinking	Noise or D40Z failure	There may be excessive noise. Check and correct ambient noise environment.
		There may be a failure in internal circuit. Replace with a new D40Z.
	Fault in power supply input (brown/blue)	Power supply voltage to D40Z may be insufficient. Check the power supply voltage (between brown and blue cables) of D40Z fills ratings..
		The wiring length or size of the wire may not be to the specification. Check the wiring length and size of the wire.
☼ Red blinks once for 2s	Fault in Non-contact door switch output (black)	Black line may be shorted to other line. Check and correct wiring of black line if the black line is shorted to other lines..
☼ Red blinks twice for 2s	Sensing fault	Invalid actuator may be in a close range to switch. Use the dedicated actuator.
☼ Red blinks thrice for 2s	Fault in Non-contact door switch input (white)	Faulty signal may be input to white line. Check and correct wiring of white line.
☼ Yellow blinking	OFF state of another D40Z	Another D40Z may be in OFF state. Check status of another D40Z connected to the white line and the wiring.
	Fault in Non-contact door switch input (white)	White line may be disconnected. Check and correct wiring of white line..
○ Red Solid-ON *2	Actuator fault	There may be a failure in actuator. Replace with a new D40Z.
○ Yellow Solid-ON *3	Fault in Non-contact door switch input (white)	White line connected to D1 terminal (test output terminal of G9SP) of G9SX-NS□ may be shorted to other line. Check and correct wiring of white line connected to D1 terminal (test output terminal of G9SP) of G9SX-NS□ if the white line is shorted to other lines.
	Fault in Non-contact door switch output (black)	Black line connected to D2 terminal (safety input terminal of G9SP) of G9SX-NS□ may be disconnected. Check and correct wiring of black line connected to D2 terminal (safety input terminal of G9SP) of G9SX-NS□.

*1. Another possible cause is a failure in internal circuit. In this case, replace with a new D40Z. Yet another possible cause is excessive noise. In this case, check and correct ambient noise environment.
*2. The case where the guard door is closed (Switch detects actuator) is indicated.
*3. The case where the system stops though the guard door is closed (Switch detects actuator) is indicated.

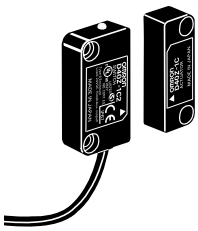
SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

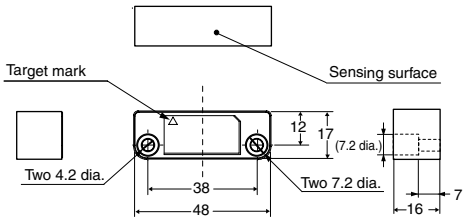
Dimensions and Wiring

(mm)

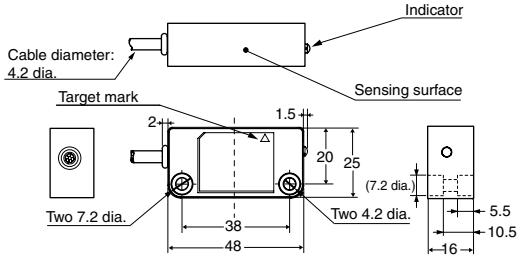
Non-contact Door Switch (Switch/Actuator)

D40Z-1C2
D40Z-1C5





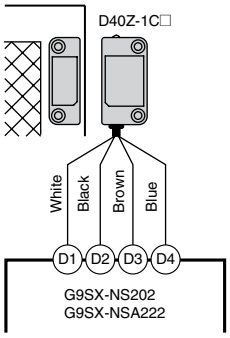
(Actuator)



(Switch)

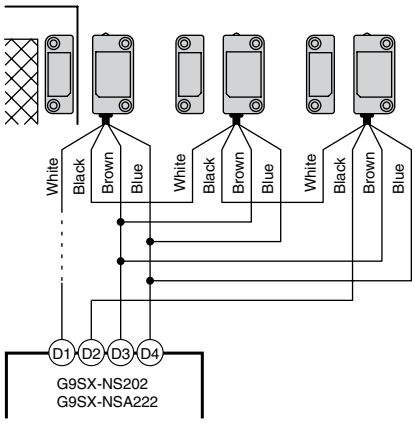
Non-contact Door Switch and Non-contact Door Switch Controller or Safety Controller Wiring

Example of connection to G9SX-NS@ (Single connection)

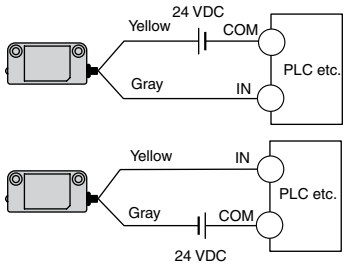


Example of connection to multiple switches

Connect up to 30 non-contact door switches.



Example of auxiliary outputs



Note:
1. The auxiliary output load current must be 10 mA max.
   Wrong connection may lead to a failure of the auxiliary output circuit.
2. For details on other wiring, refer to Application Examples.

Wiring of Inputs and Outputs

Signal name		Cable color	Description of operation
Non-contact Door Switch power supply input	+	Brown	Supplies power to the D40Z.
	-	Blue	
Non-contact door switch input		White	To set non-contact door switch output in ON state, non-contact door switch signal input must be in ON state.
Non-contact door switch output		Black	Output status depends on statuses of actuator and non-contact door switch signal input.
Auxiliary monitoring output		Yellow	Output status depends on status of actuator. When a fault is detected, turns into OFF state regardless of actuator status.
		Gray	

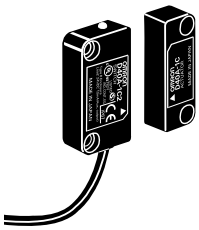
F

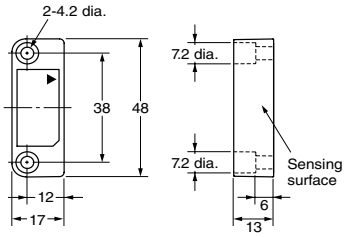
Dimensions and Wiring (continued)

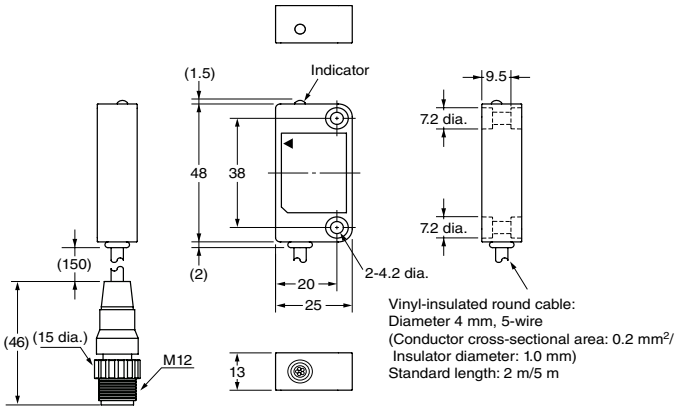
(mm)

Non-contact Door Switch (Switch/Actuator)

D40A-1C2
D40A-1C5
D40A-1C015-F

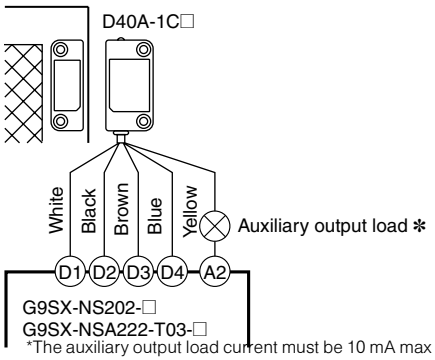






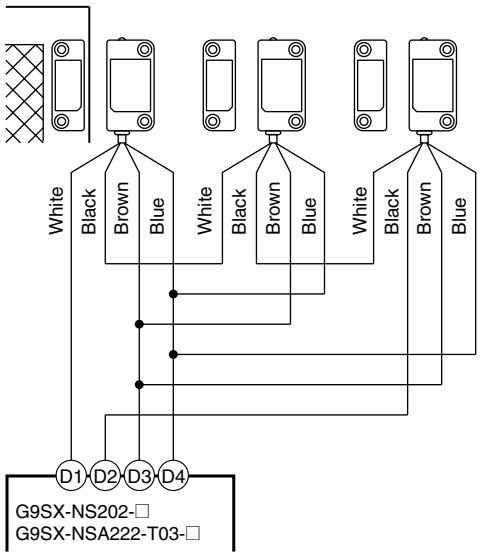
Non-contact Door Switch and Non-contact Door Switch Controller Wiring

Example: Wiring a Single Switch



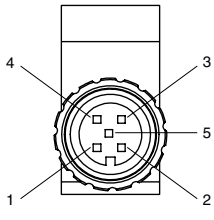
*The auxiliary output load current must be 10 mA max

Example: Wiring Multiple Switches



Wiring of Inputs and Outputs

Signal name	Wire color	Pin No.	Description of operation
Non-contact Door Switch power supply input	Brown	1	Supplies power to the D40A. Connect to the D3 and D4 terminal of the G9SX-NS□.
	Blue	3	
Non-contact Door Switch input	White	2	Inputs signals from the G9SX-NS□. The Non-contact Door Switch input must be ON as a required condition for the Non-contact Door Switch output to be ON.
Non-contact Door Switch output	Black	4	Turns ON and OFF according to actuator detection and the status of the Non-contact Door Switch input.
Auxiliary output	Yellow	5	Turns ON when actuator is detected.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

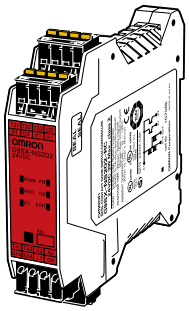
OMRON AUTOMATION & SAFETY

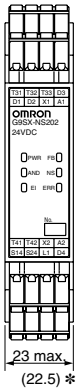
Dimensions and Wiring (continued)

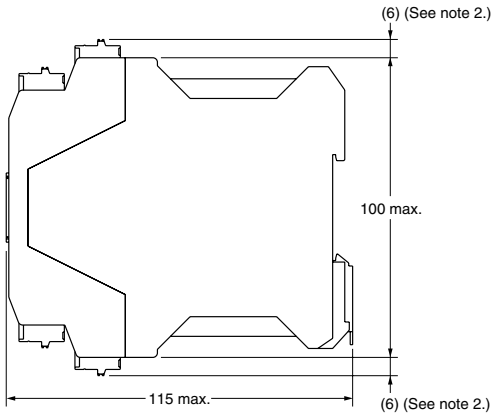
(mm)

Non-contact Door Switch Controller

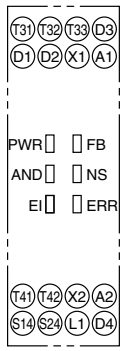
G9SX-NS202-□







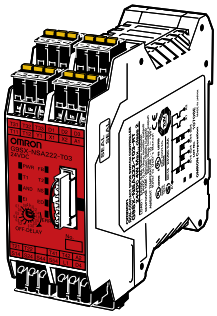
Terminal arrangement

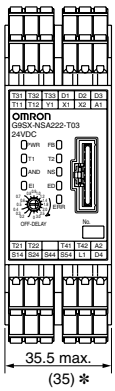


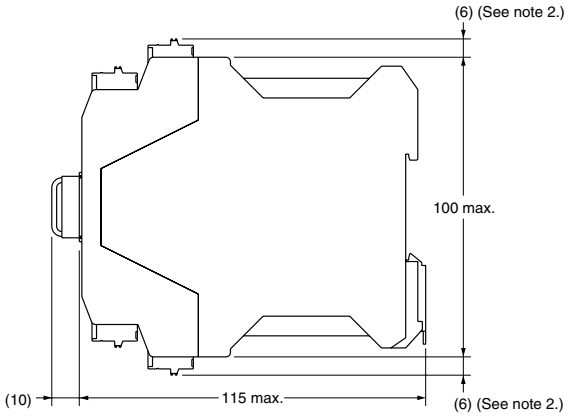
Notes: 1. Above outline drawing is for models with spring-cage terminals (-RC).
2. For models with spring-cage terminals (-RC) only.
*Typical dimension

Non-contact Door Switch Controller

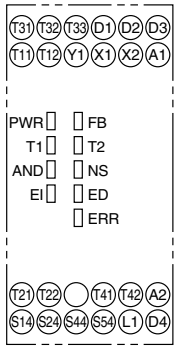
G9SX-NSA222-T03-□







Terminal arrangement



Notes: 1. Above outline drawing is for models with spring-cage terminals (-RC).
2. For models with spring-cage terminals (-RC) only.
*Typical dimension

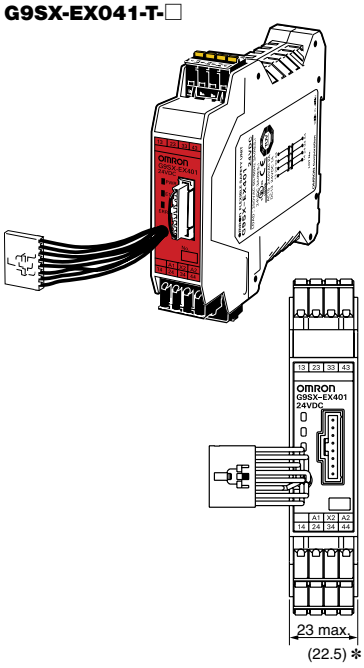
F

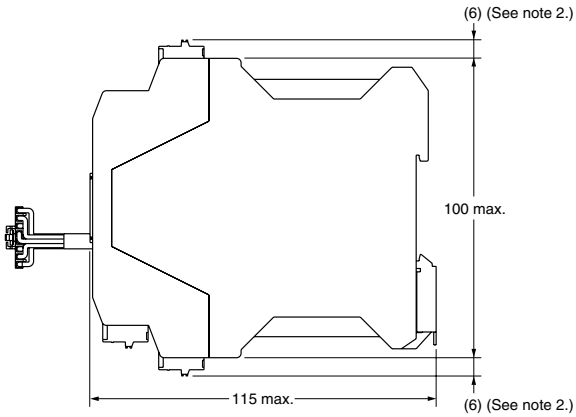
Dimensions and Wiring (continued)

(mm)

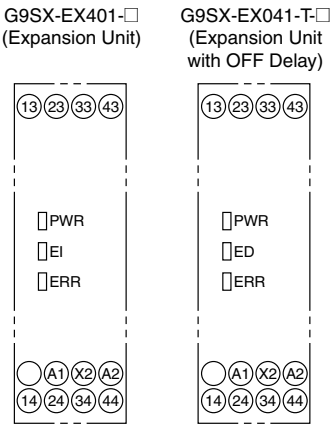
Expansion Unit

G9SX-EX401-□
Expansion Unit (OFF-delayed Model)
G9SX-EX041-T-□





Terminal arrangement

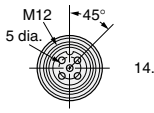


Notes: 1. Above outline drawing is for models with spring-cage terminals (-RC).
2. For models with spring-cage terminals (-RC) only.
*Typical dimension

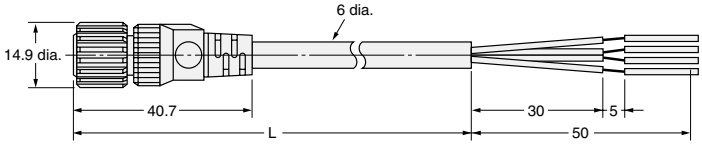
Accessories (sold separately)

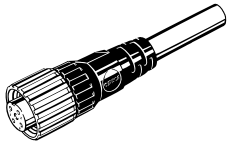
Socket on One Cable End (5-Pole Connectors)

XS2F-D521-DG0-A (L = 2 m)
XS2F-D521-GG0-A (L = 5 m)
XS2F-D521-JG0-A (L = 10 m)
XS2F-D521-KG0-A (L = 15 m)
XS2F-D521-LG0-A (L = 20 m)

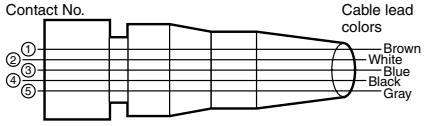


Straight Connectors

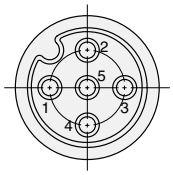




Wiring Diagram

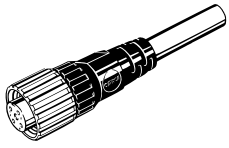


Pin Arrangements (Engagement Side)

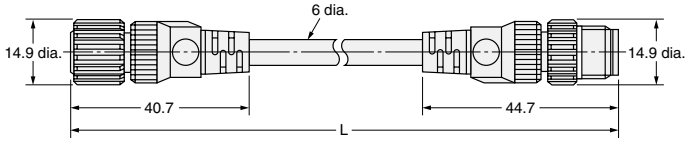


Socket and Plugs on Cable Ends (5-Pole Connectors)

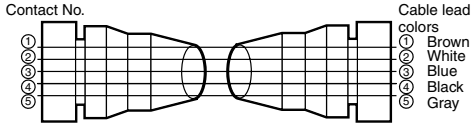
XS2W-D521-DG1-A (L = 2 m)
XS2W-D521-GG1-A (L = 5 m)
XS2W-D521-JG1-A (L = 10 m)
XS2W-D521-KG1-A (L = 15 m)
XS2W-D521-LG1-A (L = 20 m)



Straight/Straight Connectors



Wiring Diagram for 5 Cores



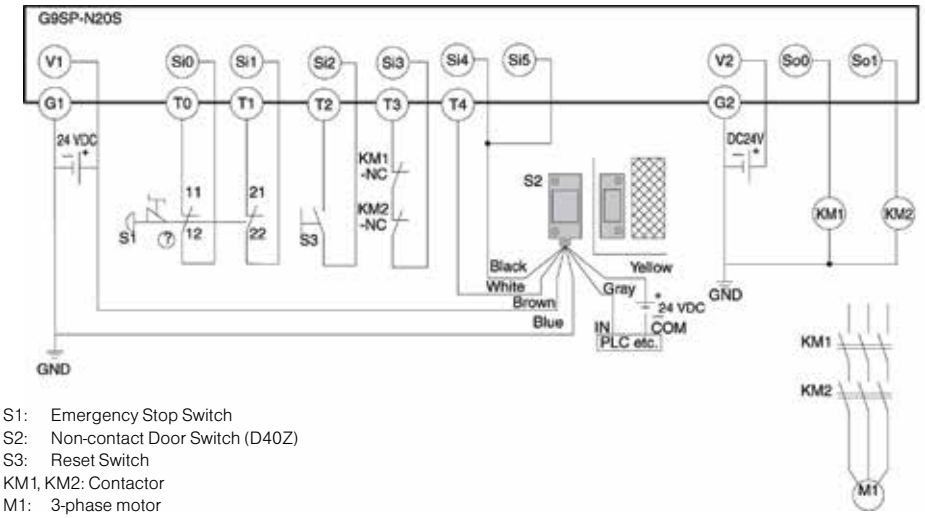
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Application Examples

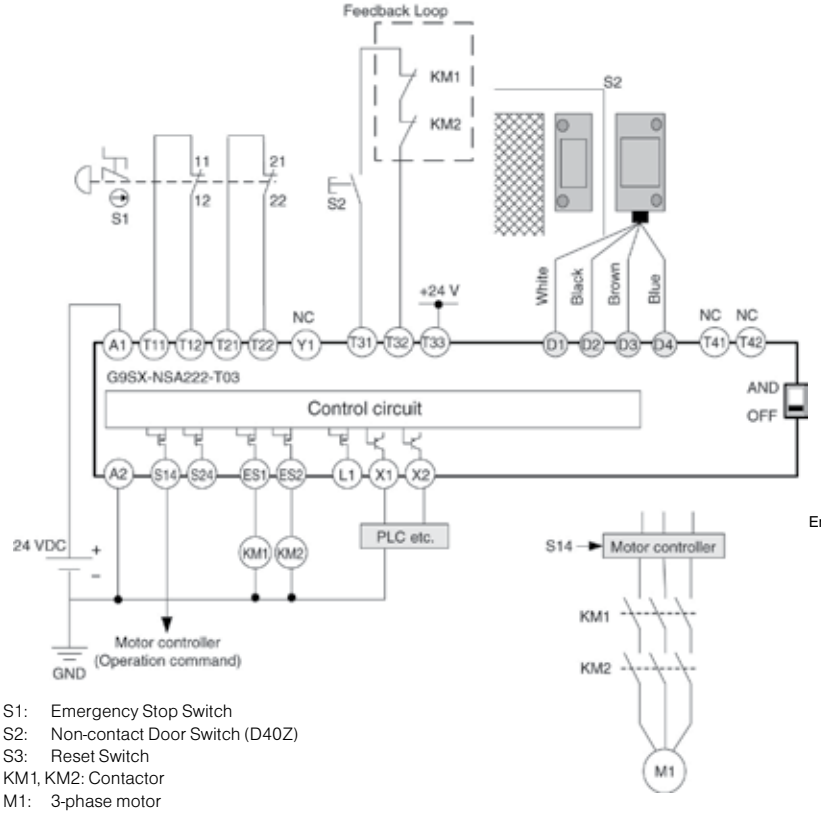
G9SP-N20S (24 VDC)
(2-channel Emergency Stop Switch Inputs + Non-contact Door Switch/Manual Reset)



S1: Emergency Stop Switch
S2: Non-contact Door Switch (D40Z)
S3: Reset Switch
KM1, KM2: Contactor
M1: 3-phase motor

Notes:
1. The PL and category that correspond to this circuit example vary depending on the program configured to the G9SP-N20S. For details, refer to the G9SP Series User's Manual.
2. For details on terminal arrangement, refer to G9SP Series User's Manual.
3. Wire auxiliary outputs correctly. Incorrect wiring may lead to a failure of the auxiliary output circuit.

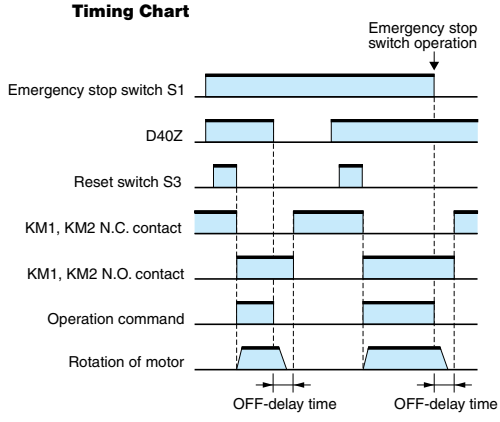
G9SX-NSA222-T03-□ (24 VDC)
(2-channel Emergency Stop Switch Inputs + Non-contact Door Switch/Manual Reset)



S1: Emergency Stop Switch
S2: Non-contact Door Switch (D40Z)
S3: Reset Switch
KM1, KM2: Contactor
M1: 3-phase motor

Notes: 1. This example corresponds to category 4.
2. For details, contact factory.

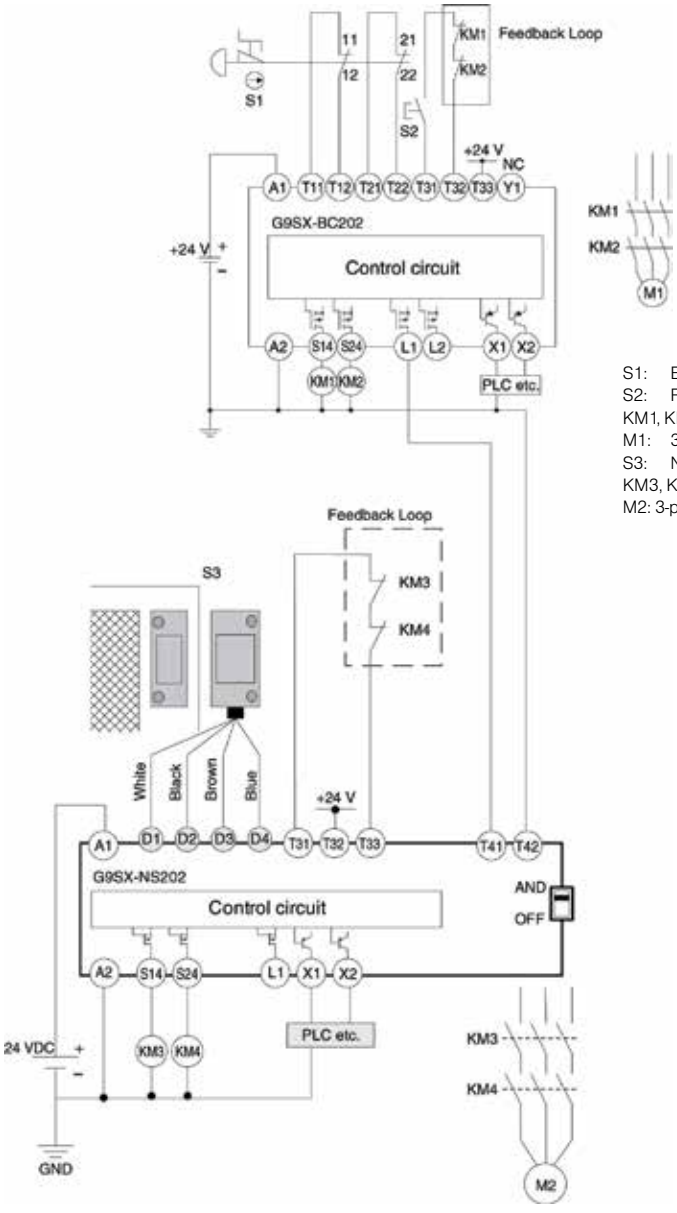
Timing Chart



F

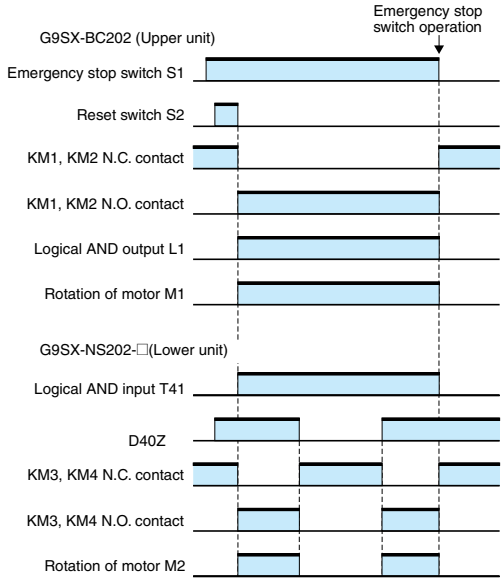
Application Examples (continued)

G9SX-BC202 (24 VDC) (2-channel Emergency Stop Switch Inputs/Manual Reset) + G9SX-NS202-□ (24 VDC) (Non-contact Door Switch/Auto Reset)



S1: Emergency Stop Switch
S2: Reset switch
KM1, KM2: Contactor
M1: 3-phase motor
S3: Non-contact Door Switch (D40Z)
KM3, KM4: Contactor
M2: 3-phase motor

Timing Chart



Notes: 1. This example corresponds to category 4.
2. For details, contact factory.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Ordering

Model Number Structure

D40Z
Non-Contact Door Switch (Switch/Actuator)

D40Z – □ □ □
❶ ❷ ❸

❶ Type
1: Standard model (Switch/Actuator)

❷ Auxiliary Outputs
C: 1 NO (Photocoupler output)

❸ Cable Length
2: 2 m
5: 5 m

Note: Must be used in combination with a G9SP Safety Controller or G9SX-NS□ Non-Contact Door Switch Controller.

D40A
Non-Contact Door Switch (Switch/Actuator)

D40A – □ □ □
❶ ❷ ❸

❶ Type
1: Standard model

❷ Auxiliary Outputs
C: 1NO (PNP transistor output)

❸ Cable Length
2: 2 m
5: 5 m
015-F: connector (cable length 0.15 m)

G9SX
Non-Contact Door Switch Controller

G9SX – □ □ □ □ – □ □
❶ ❷ ❸ ❹ ❺ ❻

❶ Functions
NS/NSA: D40A Controller
EX: Expansion Unit

❷ Output Configuration (Instantaneous Safety Outputs)
2: 2 outputs
4: 4 outputs

❸ Output Configuration (OFF-delayed Safety Outputs)
0: None
2: 2 outputs

❹ Output Configuration (Auxiliary Outputs)
1: 1 output
2: 2 outputs

❺ Max. OFF-delay Time
D40A Controller
T03: 3 s (variable)
Expansion Unit
Blank: No OFF delay
T: OFF delay

❻ Terminal Block Type
RT: Screw terminals
RC: Spring-cage terminal

F

Ordering (continued)

List of Models

D40Z Non-Contact Door Switches (Switch/Actuator)*1

Classification	Appearance	Auxiliary outputs	Cable length	Model
Standard models		Photocoupler outputs *2	2 m	D40Z-1C2
			5 m	D40Z-1C5
Switch only		—	2 m	D40Z-1C2-S
		—	5 m	D40Z-1C5-S
Actuator only		—	—	D40Z-1CA

Note: Must be used in combination with a G9SP Safety Controller or a G9SX-NS☐ Non-contact Door Switch Contact Controller.

D40A Non-Contact Door Switches (Switch/Actuator)*3

Classification	Appearance	Auxiliary outputs	Cable length	Model
Standard models *4		Semiconductor outputs *5	2 m	D40A-1C2
			5 m	D40A-1C5
Connector model			0.15 m	D40A-1C015-F

Note: Must be used in combination with a G9SX-NS☐ Non-contact Door Switch Controller or a G9SP safety controller.

Cable with Connector

Connector Type	Cable Length	Model	Packing Unit
Single End	2 m	XS2F-D521-DG0-A	5
	5 m	XS2F-D521-GG0-A	5
	10 m	XS2F-D521-JG0-A	1
	15 m	XS2F-D521-KG0-A	1
	20 m	XS2F-D521-LG0-A	1

Connector Type	Cable Length	Model	Packing Unit
Double End	2 m	XS2W-D521-DG1-A	5
	5 m	XS2W-D521-GG1-A	5
	10 m	XS2W-D521-JG1-A	1
	15 m	XS2W-D521-KG1-A	1
	20 m	XS2W-D521-LG1-A	1

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering (continued)

List of Models (continued)

G9SX-NS□ Series

Safety outputs *6		Auxiliary monitoring output *8	Logical AND connection input	Logical AND connection output	OFF-delayed Max. OFF-delay time *9	Rated voltage	Terminal block type	Model
Instantaneous	OFF-delayed *7							
2 (Semi-conductors)	0	2 (Semi-conductors)	1	1	—	24 VDC	Screw terminals	G9SX-NS202-RT
							Spring-cage terminals	G9SX-NS202-RC
	2 (Semi-conductors)				3.0 s		Screw terminals	G9SX-NSA222-T03-RT
							Spring-cage terminals	G9SX-NSA222-T03-RC

G9SX-EX Expansion Units

Safety outputs		Auxiliary outputs	OFF-delay time	Rated voltage	Terminal block type	Model
Instantaneous	OFF-delayed					
4PST-NO	—	1 (Semi-conductor) *8	—	24 VDC	Screw terminals	G9SX-EX401-RT
					Spring-cage terminals	G9SX-EX401-RC
—	4PST-NO		*10		Screw terminals	G9SX-EX041-T-RT
					Spring-cage terminals	G9SX-EX041-T-RC

G9SP Series

Name	No. of I/O Points				Unit Version	Model
	Safety Inputs	Test Outputs	Safety Outputs	Standard Outputs		
Safety Controller	10	4	Semiconductor outputs: 4	4	Ver. 1.0	G9SP-N10S
	10	6	Semiconductor outputs: 16	—		G9SP-N10D
	20	6	Semiconductor outputs: 8	—		G9SP-N20S

*1. Must be used in combination with a G9SP Safety Controller or a G9SX-NS□ Non-contact Door Switch Contact Controller.
*2. Photocoupler output. Load current: 10 mA
*3. Must be used in combination with a G9SX-NS□ Non-contact Door Switch Controller.
*4. Contact factory for the connector models.
*5. PNP open-collector semiconductor output.
*6. P channel MOS FET transitor output.
*7. The OFF-delayed output becomes an instantaneous output by setting the OFF-delay time to 0 s.
*8. PNP transistor output
*9. The OFF-delay time can be set in 16 steps as follows: 0/0.2/0.3/0.4/0.5/0.6/0.7/0.8/0.9/1.0/1.2/1.4/1.8/2.0/2.5/3.0 s
*10. The OFF-delay time is synchronized to the OFF-delay time setting in the connected Controller (G9SX-NSA222-T03-□).

F

Safety Door Switches

EC Series

Quick Link
S284
omron247.com

Electrically Coded Interlock Switch & Control Unit

- The EC Series Control Units individually monitor one to four read heads to provide a Category 4 system for applications with up to four guard doors
- Uniquely coded actuators are a highly tamper resistance
- Misalignment of nearly 1/2 inch allows application on machine doors with a high level of vibration or alignment issues
- Manual or automatic start is switch selectable
- External Device Monitoring (EDM) allows the EC Series Control Unit to function as a safety monitoring relay
- The 6 A/24 VDC switching capability of the Control Unit allows connection directly to power contactors
- Individual guard door status may be monitored with the semiconductor outputs from the Control Unit; an additional output gives status of the Control Unit
- Guarding applications with more than four doors may be achieved by combining two or more Control Units in series while continuing to satisfy Category 4 according to EN954-1



Safety Door Switches

MA-S Series

Quick Link
S285
omron247.com

Stainless Steel Magnetically Actuated Safety Interlock Switches and Actuators

- Stainless steel cases—both switch and actuator are housed in stainless steel for applications that require the use of this robust and corrosion resistant material
- Large selection—choose from a variety of contact configurations housed in stainless steel to satisfy the most demanding applications
- NEMA 6 enclosure enables the MA-S Series switches to satisfy most application requirements
- Misalignment tolerant—the non-contact actuation of the MA-S Series switches makes them very tolerant to misalignment of up to 10 mm (0.39 in.)
- High temperature—the MA-S switches and cables are designed to operate in temperatures up to 125°C (257°F)
- Long life—the MA-S Series safety interlock switches are designed for a minimum of one million actuations



Safety Door Switches

MFS

Quick Link
S286
omron247.com

Magnetic Ferroresonant Stand-Alone Safety Interlock Switch

- Tamper resistant—the combination of magnetic and ferroresonant signals required to close the safety contacts makes the MFS very tamper resistant
- Stand-alone—use for lower risk applications as a stand-alone safety switch allowing direct switching of relays and contactors up to 2 A at 230 VAC
- MFS-11 provides a visible LED which illuminates green when the actuator is in range and contacts are closed
- MFS-12 provides a dual color LED indicator. The LED illuminates green when the actuator is in range and the contacts are closed. The LED illuminates Red when the actuator is out of range and contacts are open.
- Compact size—mounts easily on 1-in. square tubing
- Use with safety monitoring relays in applications requiring a higher level of safety reliability
- NEMA 4 enclosure enables water washdown cleaning



Safety Door Switches

D4NH

Quick Link
S242
omron247.com

Safety-door Hinge Switch

- Compact, plastic-body safety-door hinge switch designed for saving space in machines
- Lineup includes three contact models with 2NC/1NO and 3NC contact forms in addition to the previous contact forms 1NC/1NO, and 2NC. Models with MBB contacts are also available
- M12-connector models are available, saving on labor and simplifying replacement
- Standardized gold-clad contacts provide high contact reliability. Can be used with both standard loads and microloads.



F

Safety Door Switches

XT5009

Quick Link
S427
omron247.com

Universal Tongue-Operated Safety Interlock Switch

- Strong and versatile—the compact size of the strong, glass-filled polyester housing allows this popular switch to be used in most applications
- NEMA 6 enclosure enables the XT5009 to withstand water washdown cleaning
- Rotatable head gives four possible actuator entry points for versatile installation. A blanking plug is supplied for the unused entry.
- Small swing radius allows use on doors with a swing radius as small as 2.5 in. when using the optional flexible actuator with alignment guide
- Vibration resistant—preventing unwanted opening of guard doors on vibrating machines
- Long life—the XT5009, with its stainless steel actuator, is designed for a minimum of two million actuations



Safety Door Switches

D4NS-SK/D4JL-SK

Quick Link
S246
omron247.com

D4NS/D4JL-mounting Slide Key

- Safety-door switch attachments fit doors on aluminum frames as small as 20 mm^2 and frames that are large enough to enclose robotics
- Shortens the lead time for safety-door switch mounting design
- Enables applications in compliance with ANSI/RIA U.S. robot standards (excluding the D4NS-SK01)



Note: Safety-door switches are sold separately.

Accessories

OMRON Automation and Safety has a complete line of accessory products for your safety interlock needs. For specific part numbers for replacement actuators or fuses, please refer to the specific product datasheet. Contact Omron for any concerns or questions.

Replacement Contact Blocks

	Part No.
BL6009, 2 N/C + 1 N/O, Rear Mounting	44512-0400
ER6019, 2 N/C + 1 N/O, Side Mounting	44512-0390
ER1022, ER1032, ER5018, ER6022, 2 N/C + 1 N/O terminals (11/12, 21/22, 33/34)	44512-2020
ER1022, ER1032, 2 N/C + 1 N/O terminals (41/42, 51/52, 63/64)	44512-2021
ER5018, ER6022, 3 N/C	44512-2030
ER6022, 2 N/C + 2 N/O	44512-2221
ER6022, 3 N/C + 1 N/O	44512-2311
ER6022, 4 N/C	44512-2400
HP6009, 2 N/C + 1 N/O, Side Mounting	44512-0390
T5009, 2 N/C + 1 N/O	44512-3210
T5009-6, 3 N/C + 1 N/O	44512-3310
T5009-6, 4 N/C	44512-3400





Micro Style Cables

	Part No.
MA-2, 6, 9, 20, MC-S3, HP2007, T2007, Plastic SL Series, D4NS	
5 m Cable with 4-Pin Female Connector Micro DC	44512-0600
10 m Cable with 4-Pin Female Connector Micro DC	44512-0610
CM & MC Series	
5 m Cable with 8-Pin Female Connector	44512-0620
10 m Cable with 8-Pin Female Connector	44512-0630
HP3009, T3009, T5009, MA-21, Plastic SL Series, MA-15, MA-35, MFS	
5 m Cable with 6-Pin Female Connector (Dual Keyway)	44512-0640
10 m Cable with 6-Pin Female connector (Dual Keyway)	44512-0650



Cabling Components

	Part No.
M16 to NPT Adapter	44512-0300
M16 Cord Grip (4-7 mm ID)	44512-0080
M20 to PG11	44512-0120
M20 to NPT Adapter	44512-0110
M20 to NPT Adapter (steel)	44512-0310
M20 Cord Grip (4-5 mm ID)	44512-0090
M20 Cord Grip (7-10 mm ID)	44512-0410
M20 Blanking Plug	44512-0100
M20 Plastic Nut 10-Pack	44512-0105
NPT to M20 Adapter	44512-1010



Conduit LED Beacons (High-Intensity)

	Part No.
Conduit LED, M20, Amber, 24 VDC	44512-0500
Conduit LED, M20, Amber, 110 VAC	44512-0510
Conduit LED, M20, Red, 24 VDC	44512-0520
Conduit LED, M20, Red, 110 VAC	44512-0530
Conduit LED, M20, Green, 24 VDC	44512-0540
Conduit LED, M20, Green, 110 VAC	44512-0550



Conduit LED Beacons

	Part No.
Conduit LED, M20, Amber, 24 VDC	44512-1500
Conduit LED, M20, Red, 24 VDC	44512-1520
Conduit LED, M20, Green, 24 VDC	44512-1540

Conduit Lights and Remote Indicator

	Part No.
Conduit Light, M20, Amber, no bulb	44512-0130
Conduit Light, M20, Red, no bulb	44512-0290
Conduit Light, NPT, Amber, no bulb	44512-0260
Conduit Light, NPT, Red, no bulb	44512-0420
Bulb for Conduit Light, 24 VAC/DC	44512-0200
Bulb for Conduit Light, 110 VAC	44512-0140
Bulb for Conduit Light, 220 VAC	44512-0190



Security Bits/Drives

	Part No.
Spare Bit for Security Screw	44512-0050
Screwdriver for Security Bit	44512-0040
Lockoff Actuator for T4011, T5009, TL5012, TL8012-S	44512-0700



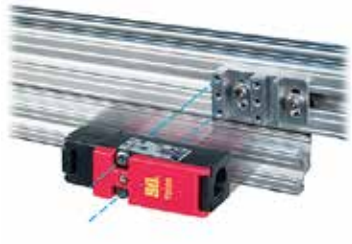
Lockoff Actuator

F

Universal Mounting Brackets

- Quickly and easily mounts non-contact switches and actuators to structural aluminum profiles
- Quickly and easily mounts tongue actuated safety interlock switches to structural aluminum profiles
- Quickly and easily mounts hinge operated safety interlock switches to structural aluminum profiles
- Use the universal mounting brackets to mount non-contact switches to Ferrous metals with minimal loss of range
- Designed to allow for easy alignment of switch to actuator
- Constructed from 6060-T5 aluminum, these brackets are resistant to harsh environments

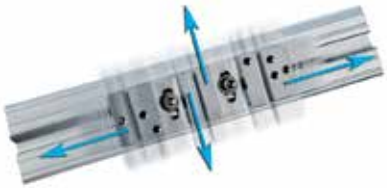




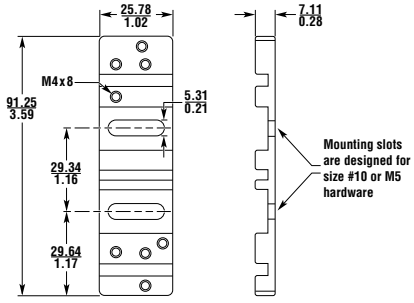
UMB-THP30 mounting bracket kit, being used to mount a T2008 interlock switch.



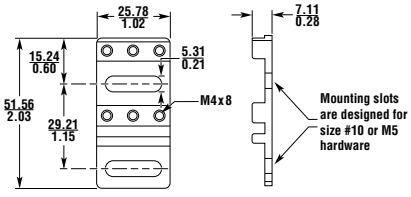
UMB-NC10 mounting bracket kit, being used to mount a CM-S2 switch and actuator.



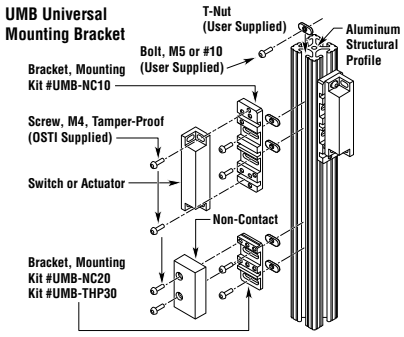
The brackets are designed to allow for movement along two axis.



Long bracket included with kit UMB-NC10



Short bracket included with kits UMB-NC20 and UMB-THP30



Model	Description	Compatible Switches & Actuators	Mounting Capability	Part No.
UMB-NC10	Universal Mounting Bracket Kit for non-contact switches and actuators (Includes long bracket)	CM-S2, CM-S221, CM-S6, CM-S621, MA-6, MA-9, MA-10, MA-11, MA-16, MA-S36, MC-S2, MF-1, MFS-12	Capable of 1 switch and 1 actuator	44512-3010
UMB-NC20	Universal Mounting Bracket Kit for non-contact switches and actuators (Includes short bracket)	CM-S1, CM-S11, CM-S31, CM-S5, CM-S521, MA-14, MA-15, MA-S34, MA-S35, MC-S1, MC-S31	Capable of 1 switch and 1 actuator	44512-3020
UMB-THP30	Universal Mounting Bracket Kit for hinge pins and tongue-actuated switches (Includes short bracket)	HP2011, T2008, T2011 (switches only)	Capable of 1 switch (no actuator)	44512-3030

Note: Tamper-proof hardware is included with each kit to mount the switch or actuator to the Universal Mounting Bracket. No hardware is supplied to mount the Universal Mounting Bracket to the aluminum profile.

SLD Series — Switch Locking Devices

- Allows personnel to quickly lock a safety interlock switch to a safe position allowing for certain types of maintenance
- Intended for use as an alternate control method while performing tasks that are routine, repetitive or integral to the production process (ANSI/ASSE Z244.1-2003 (R2008) section 5.4)
- Robust design and construction blocks all access points to the actuation mechanism of the safety interlock switch
- Designed to accept locks with standard shackle diameters of 5/16" or 7 mm; standard expansion devices may also be used in conjunction with the SLD
- The SLD series will work for designated switches with or without the optional stainless steel guide. If the optional stainless steel guide is used on a switch that is integrated with a slide bolt assembly, it will not be possible to attach a Switch Locking Device







See website for SLD dimensions

Warning: The SLD Series is intended for use as an alternative control method provided for by ANSI/ASSE Z244.1-2003 (R2008) section 5.4. This device does not protect against malicious tampering.

Model	Compatible Interlock Switches	Part No.
SLD26-01*	T4011, T5009, TL8012-S, D4SL-N	44526-0801
SLD34-01**	T2008, T2011, T4012, TL4019	44534-0801
SLD35-01***	T4016, TL4024	44535-0801

Notes:

*The SLD26-01 will not work with optional latch on T4011.

**The SLD34-01 is only compatible with slide bolt assemblies 44534-8130, -8140, -8070.

***The SLD35-01 is not compatible with slide bolt assemblies.

F

Emergency Stop Devices

Contents

Selection Guide	G-2
Rope Pull E-Stop Switches	
ER5018	G-3
ER6022	G-6
ER6022-SS	G-9
ER1022	G-10
ER1032	G-10
E-Stop Pushbutton Switches	
A22E	G-11
A165E	G-24
Rope Pull E-Stop Switches for Explosive Atmospheres	
XER1022	G-30
XER1032	G-30
XER6022 & XER6022-SS	G-31

Selection Guide

Selecting the Proper Emergency Stop Device for Your Application

Selecting the Correct Emergency Stop Device is Easy

Our selection guide will help you with the selection process. Most applications require the use of an Emergency Stop device. On equipment where the operator is within easy reach of a single point, a pushbutton switch is used. When an operator needs access over a larger area, such as on a conveyor, a Trip Cord or Rope Pull switch is typically used.

The following questions will guide you to the appropriate models. Contact OMRON Automation and Safety for assistance.

1

Do you need a Trip Cord/ Rope Pull Switch?

no → **F** or **H**

Safety Door Switches
See Section F of this catalog for guardlocking, non-contact, hinged door, and explosion-proof switches.

Safety Switches and Operator Controls
See Section H of this catalog for safety limit switches, safety selector switches, enabling switches and two-hand control.

yes ↓

2

Does it need to operate in an explosive atmosphere?

no →

E-Stop

- A165E
  (16 mm panel mount, optional light)
- A22E
  (22 mm panel mount, optional light)

Trip Cord (Rope Pull; to 40 m)

- ER5018
  (with E-stop button)

Trip Cord (Rope Pull; over 40 m)

- ER6022
  (to 80 m, optional LED indicator)
- ER1022
  (to 125 m, with LED indicator)
- ER1032
  (to 200 m, with LED indicator)
- ER6022-SS
  (to 100 m, optional LED indicator)

yes ↓

Trip Cord (Rope Pull)

- XER6022
  (to 80 m)
- XER6022-SS
  (to 100 m)
- XER1022
  (to 125 m)
- XER1032
  (to 200 m)



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

ER5018

Quick Link
S424
omron247.com

Compact Rope Pull Emergency Stop Switch

- Compact size allows this switch to be used on smaller machines with a mounting width of 40 mm (1.57 in.) and covering rope spans up to 40 m (131 ft.)
- Tension indicator makes system setup and rope tension maintenance easy
- Contact arrangements of 2 N/C + 1 N/O or 3 N/C
- IP67 (NEMA 6) enclosure enables the ER5018 switch to withstand water washdown cleaning
- Heavy-duty housing—the die-cast housing and stainless steel eye nut makes the ER5018 suitable for demanding industrial applications
- Integral E-Stop—the optional E-stop provides emergency stopping at the extreme end of the installation
- Reset button—the blue reset button must be pushed in order to return to "machine run" condition following switch actuation by a pulled or slacked rope
- Vibration tolerant—the snap-acting switch contacts protect against nuisance tripping due to vibration
- Rubber bellows contain UV inhibitor making the switches suitable for outdoor applications



Conforms to IEC947-5-1, IEC947-5-5, EN418, UL508, BS5304
UL and C-UL listed, TUV certified

Specifications

Electrical	All Models
Contact Configurations:	2 N/C + 1 N/O, 3 N/C
Safety Contacts:	2 N/C, 3 N/C
Switching Ability	AC: 120 V–6 A, 240 V–3 A, Inductive DC: 24 V–2.5 A, Inductive
Auxiliary Contacts:	1 N/O
Max Switching Current/Volt/Amp:	240 V/720 VA
Minimum Current:	5 V 5 mA DC
Electrical Life:	1 x 10^6 minimum
Mechanical	
Mounting:	Any position
Mounting Hardware:	2 x M5 screws
Max Rope Span:	40 m (131 ft.)
Operation Force:	< 125 N (28 lb.)
Tensioning Force to Run Position:	130 N (23 lb.) typical
Case Material:	Die-cast aluminum alloy
Eye Nut Material:	Stainless Steel
Stainless Accessory Items:	304 Stainless Steel
Wiring Entry:	3 x M20 or 3 x 0.5 in. NPT
Weight:	675 g (23.8 oz.)
Color:	Yellow
Mechanical Life:	1 x 10^6 minimum
Environmental	
Protection:	IP67 (NEMA 6)
Operating Temperature:	-25 to 80°C (-13 to 176°F)
Cleaning:	Water washdown
Compliance	
Standards:	IEC947-5-1, IEC947-5-5, EN418, UL508, BS5304
Approvals/Listings:	CE marked for all applicable directives, UL and C-UL, TUV

Specifications are subject to change without notice.

Note: The safety contacts of the STI switches are described as normally closed (N/C)—i.e., with the rope properly tensioned and the machine able to be started.

G

Operation

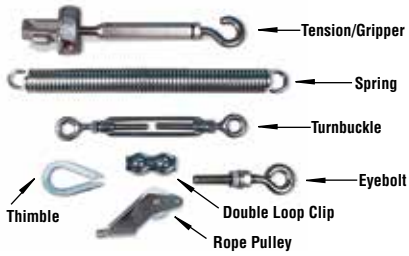


Blue Reset Knob
A blue reset button is provided to easily return the unit back to its machine-run position after actuation.



Emergency Push Button
The emergency push button may be installed or repositioned in the field. The ER5018 has two possible mounting positions for the emergency stop button.

Installation Hardware Available

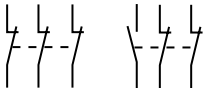


Installation Hardware
Individual hardware items may be purchased for specific installation requirements.



RK Rope Tension Kit
The RK Rope Tension Kit comes with all of the required hardware for most installations. A spring is required as shown in the installation example below.
For up to 50 m rope span, one rope end is terminated with a thimble, permanent clamp, and quick link attached.
For over 50 m rope span, 2 Tension/Gripper assemblies are supplied (no quick link.)

Contact Arrangements

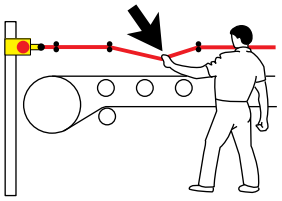


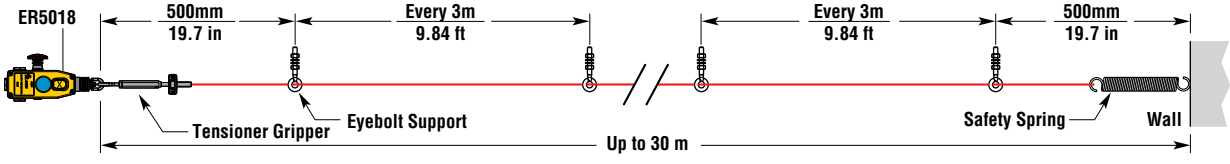
	0 mm / 0 in	3.5 / 0.14		14.5 / 0.57	17.0 / 0.67
2NC + 1NO Versions	Rope Slack		Tension Range		Rope Pulled
11/12			■		
21/22			■		
33/34	■				■

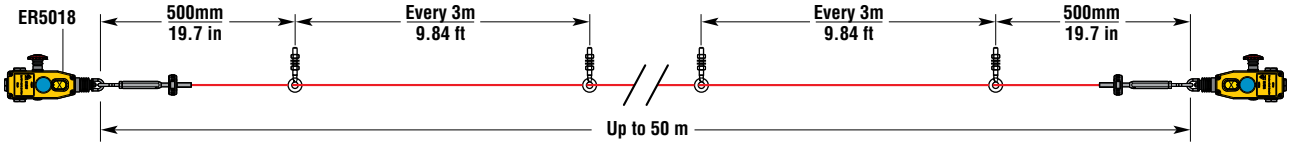
3NC Versions	Rope Slack		Tension Range		Rope Pulled
11/12			■		
21/22			■		
31/32			■		

□ Contact Open ■ Contact Closed

Mounting Specification



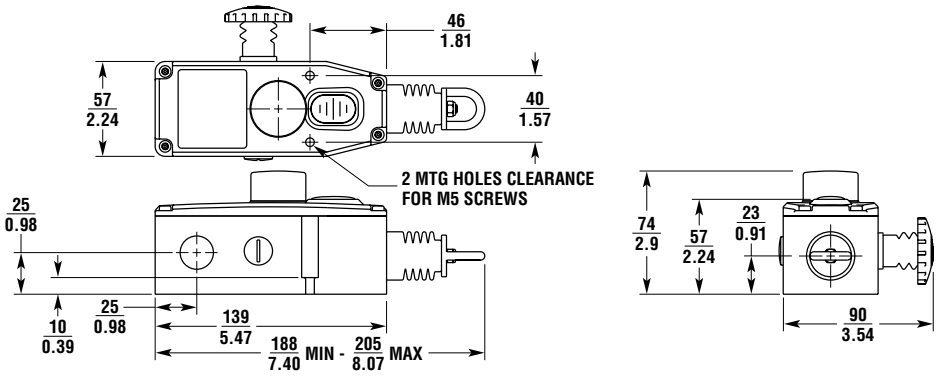




For a guide to installing, see “Proper Installation of Rope or Wire Pull Emergency Stop Devices” in the Expert Area Section of this catalog on page A-74.

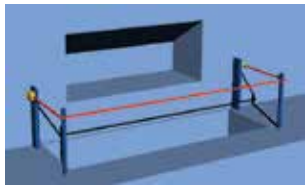
Dimensions

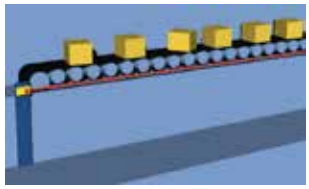
(mm/in.)



Applications

Typical applications are on conveyor systems and across rotating machinery, and around hazardous areas.





Ordering

Model	E-Stop	Contacts	Wiring Entry	Part No.
ER5018-021M	Not included	2 N/C + 1 N/O	3 x M20	44506-4010
ER5018-021N	Not included	2 N/C + 1 N/O	3 x 1/2 in. NPT	44506-4020
ER5018-030M	Not included	3 N/C	3 x M20	44506-4030
ER5018-030N	Not included	3 N/C	3 x 1/2 in. NPT	44506-4040
ER5018-021ME	Included	2 N/C + 1 N/O	3 x M20	44506-4110
ER5018-021NE	Included	2 N/C + 1 N/O	3 x 1/2 in. NPT	44506-4120
ER5018-030ME	Included	3 N/C	3 x M20	44506-4130
ER5018-030NE	Included	3 N/C	3 x 1/2 in. NPT	44506-4140

Accessories					Part No.
Stainless Steel Rope Kits	**Quick Link**	**Eye-bolts**	**Tension/ Gripper Assembly**	**Allen Wrench**	
RK5, 5 m Kit	Yes	3	1	1	44506-2705
RK10, 10 m Kit	Yes	5	1	1	44506-2710
RK15, 15 m Kit	Yes	7	1	1	44506-2715
RK20, 20 m Kit	Yes	9	1	1	44506-2720
RK30, 30 m Kit	Yes	12	1	1	44506-2730
RK50, 50 m Kit	Yes	20	1	1	44506-2750
RK80, 80 m Kit	No	30	2	2	44506-2780
RK100, 100 m Kit	No	37	2	2	44506-2711
RK126, 126 m Kit	No	45	2	2	44505-2726
Rope Only					
R5M, 5 m Rope Only					44506-3705
R10M, 10 m Rope Only					44506-3710
R20M, 20 m Rope Only					44506-3720
R30M, 30 m Rope Only					44506-3730
R50M, 50 m Rope Only					44506-3750
R80M, 80 m Rope Only					44506-3780
R100M, 100 m Rope Only					44506-3711
R126M, 126 m Rope Only					44506-3726

Accessories	Part No.
SM06-SL400, Replacement Lid	44506-3700
SMO6-TK00, Tensioner Kit (Turnbuckle, 8 Rope Grips & 4 Thimbles)	44506-0700
SM06-TG00, Tensioner Gripper, Stainless Steel	44506-4700
SM06-EB10, Eye Bolt, Stainless Steel, 8 per pack	44506-4710
SM06-EB20, Eye Bolt, Galvanized	44506-0720
SM06-DL20, Double Loop Clip, Stainless Steel, 4 per pack	44506-4720
SM06-DL21, Double Loop Clip, Galvanized, 4 per pack	44506-4721
SM06-THSS, Thimble, Stainless Steel, 4 per pack	44506-4770
SM06-THGV, Thimble, Galvanized, 4 per pack	44506-4771
SM06-TB30, Turnbuckle, Stainless Steel	44506-4730
SM06-TB31, Turnbuckle, Galvanized	44506-4731
SM06-SP30, Spring, Galvanized	44506-0730
SM06-SP50, Spring, Stainless Steel	44506-4750
SM06-RPSS, Rope Pulley, Stainless Steel	44506-4780
SM06-ES60, E-Stop Mechanism	44506-4760

G

ER6022

Quick Link
S425
omron247.com

Rope Pull Emergency Stop Switch

- Rope spans up to 80 m (262 ft.) means fewer number of switches required per application
- Tension indicator makes system setup and rope tension maintenance easy
- Contact arrangements of 2 N/C + 1 N/O, 3 N/C + 1 N/O or 2 N/C + 2 N/O
- IP67 (NEMA 6) enclosure enables the ER6022 switch to withstand water washdown cleaning
- Reset button—the blue reset button must be pushed in order to return to "machine run" condition following switch actuation by a pulled or slacked rope
- Indicator beacon—the optional dual indicator beacon, available in 24 VDC or 120 VAC, can be wired to flash red to indicate a tripped switch or glow a constant green to indicate a properly reset switch
- E-stop button—the ER6022 has two mounting positions where the optional E-stop button may be installed; the E-stop button may be added or replaced in the field
- Rubber bellows contain UV inhibitor making the switches suitable for outdoor applications



Conforms to IEC947-5-1, IEC947-5-5, EN418, UL508, BS5304
UL and C-UL listed, TUV certified

Specifications

Electrical	**All Models**
Contact Configurations:	2 N/C + 1 N/O, 3 N/C + 1 N/O, 2 N/C + 2 N/O
Safety Contacts:	2 N/C, 3 N/C
Switching Ability	AC: 240 V–3 A, 120 V–6 A, Inductive, DC: 24 V–2.5 A, Inductive
Auxiliary Contacts:	1 N/O, 2 N/O
Max Switching Current/Volt/Amp:	240 V/720 VA
Minimum Current:	5 V 5 mA DC
Electrical Life:	1 x 10^6 minimum
Mechanical	
LED Indicator Beacon:	24 VDC, 120 VAC
Mechanical	1 million minimum
Mounting:	Any position
Mounting Hardware:	4 x M5 screws
Max Rope Span:	80 m (262 ft.)
Operation Force:	< 125 N (28 lb.)
Tensioning Force to Run Position:	130 N (23 lb.) typical
Case Material:	Die-cast aluminum alloy
Eye Nut Material:	Stainless Steel
Stainless Accessory Items:	304 Stainless Steel
Wiring Entry:	3 x M20 or 3 x 0.5 in. NPT
Weight:	880 g (31 oz.)
Color:	Yellow
Mechanical Life:	1 x 10^6 minimum
Environmental	
Protection:	IP67 (NEMA 6)
Operating Temperature:	-25 to 80°C (-13 to 176°F)
Cleaning:	Water washdown
Compliance	
Standards:	IEC947-5-1, IEC947-5-5, EN418, UL508, BS5304
Approvals/Listings:	CE marked for all applicable directives, UL and C-UL, TUV

Specifications are subject to change without notice.

Note: The safety contacts of the STI switches are described as normally closed (N/C)—i.e., with the rope properly tensioned and the machine able to be started.

Operation



Blue Reset Knob

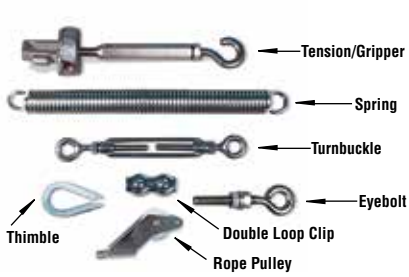
A blue reset button is provided to easily return the unit back to its machine-run position after actuation.



Emergency Push Button

The emergency push button may be installed or repositioned in the field. The ER6022 has two possible mounting positions for the emergency stop button.

Installation Hardware Available



Installation Hardware

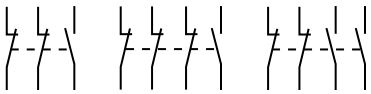
Individual hardware items may be purchased for specific installation requirements.



RK Rope Tension Kit

The RK Rope Tension Kit comes with all of the required hardware for most installations. A spring is required as shown in the installation example below.
For up to 50 m rope span, one rope end is terminated with a thimble, permanent clamp, and quick link attached.
For over 50 m rope span, 2 Tension/Gripper assemblies are supplied (no quick link.)

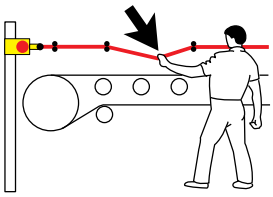
Contact Arrangements



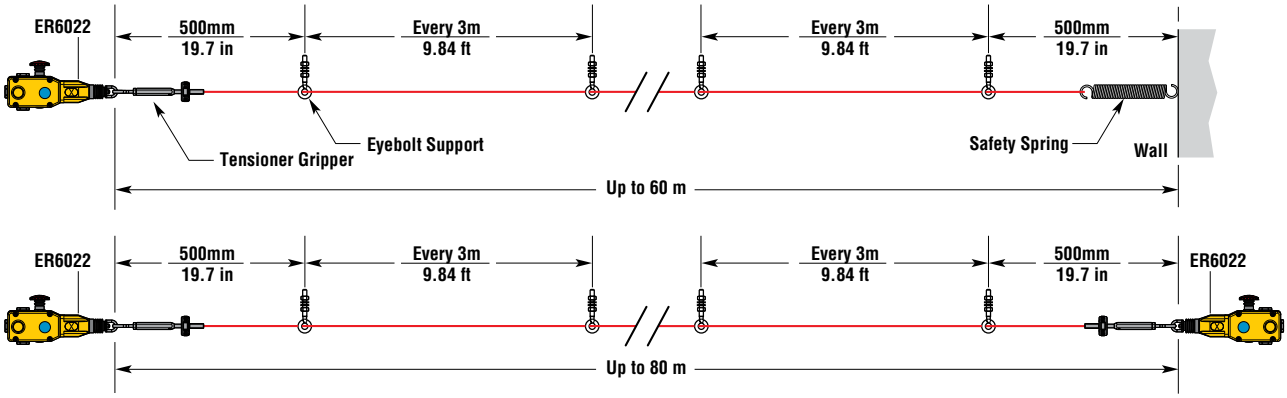
	0 mm / 0 in	3.5 / 0.14		14.5 / 0.57	17.0 / 0.67
2NC + 1NO Versions	Rope Slack		Tension Range		Rope Pulled
11/12			■		
21/22			■		
33/34	■				■
3NC + 1NO Versions	Rope Slack		Tension Range		Rope Pulled
11/12			■		
21/22			■		
33/34			■		
43/44	■				■
2NC + 2NO Versions	Rope Slack		Tension Range		Rope Pulled
11/12			■		
21/22			■		
33/34	■				■
43/44	■				■

□ Contact Open ■ Contact Closed

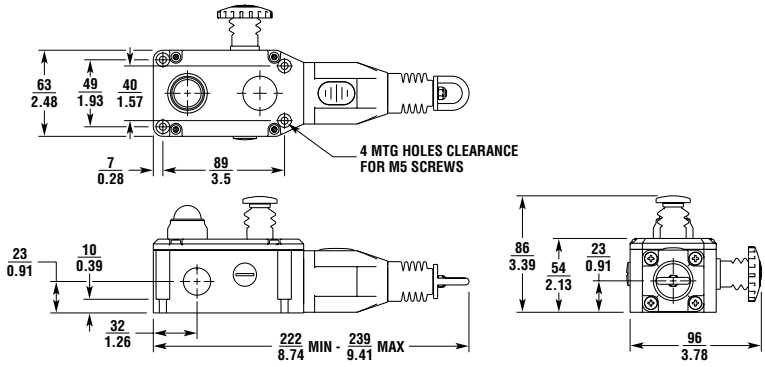
Mounting Specification



For a guide to installing, see “Proper Installation of Rope or Wire Pull Emergency Stop Devices” in the Expert Area Section of this catalog on page A-74

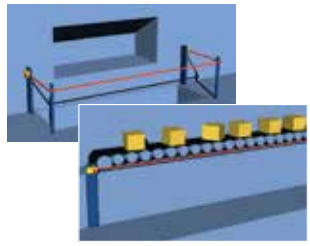


Dimensions (mm/in.)



Applications

Typical applications are on conveyor systems and across rotating machinery, and around hazardous areas.



Ordering

Model	E-stop	Indicator Beacon	Contacts	Wiring Entry	Part No.
ER Switches with 3 pole contact blocks					
ER6022-021M	Not included	Not included	2 N/C + 1 N/O	3 x M20	44506-5010
ER6022-021N	Not included	Not included	2 N/C + 1 N/O	3 x 1/2 in. NPT	44506-5020
ER6022-021ME	Included	Not included	2 N/C + 1 N/O	3 x M20	44506-5210
ER6022-021NE	Included	Not included	2 N/C + 1 N/O	3 x 1/2 in. NPT	44506-5220
ER6022-021MEL	Included	Included	2 N/C + 1 N/O	3 x M20	44506-5410
ER6022-021NEL	Included	Included	2 N/C + 1 N/O	3 x 1/2 in. NPT	44506-5420
ER6022-021NELAC	Included	Included, 120 VAC	2 N/C + 1 N/O	1/2" NPT	44506-5423
ER Switches with 4 pole contact blocks					
ER6022-031M	Not included	Not included	3 N/C + 1 N/O	M20	44506-5050
ER6022-031N	Not included	Not included	3 N/C + 1 N/O	1/2 in. NPT	44506-5060
ER6022-022M	Not included	Not included	2 N/C + 2 N/O	M20	44506-5070
ER6022-022N	Not included	Not included	2 N/C + 2 N/O	1/2 in. NPT	44506-5080
ER6022-031ML	Not included	Included, 24 VDC	3 N/C + 1 N/O	M20	44506-5150
ER6022-031NL	Not included	Included, 24 VDC	3 N/C + 1 N/O	1/2 in. NPT	44506-5160
ER6022-022ML	Not included	Included, 24 VDC	2 N/C + 2 N/O	M20	44506-5170
ER6022-022NL	Not included	Included, 24 VDC	2 N/C + 2 N/O	1/2 in. NPT	44506-5180
ER6022-031ME	Included	Not included	3 N/C + 1 N/O	M20	44506-5250
ER6022-031NE	Included	Not included	3 N/C + 1 N/O	1/2 in. NPT	44506-5260
ER6022-022ME	Included	Not included	2 N/C + 2 N/O	M20	44506-5270
ER6022-022NE	Included	Not included	2 N/C + 2 N/O	1/2 in. NPT	44506-5280
ER6022-031MEL	Included	Included, 24 VDC	3 N/C + 1 N/O	M20	44506-5450
ER6022-031NEL	Included	Included, 24 VDC	3 N/C + 1 N/O	1/2 in. NPT	44506-5460
ER6022-022MEL	Included	Included, 24 VDC	2 N/C + 2 N/O	M20	44506-5470
ER6022-022NEL	Included	Included, 24 VDC	2 N/C + 2 N/O	1/2 in. NPT	44506-5480
ER6022-031NELAC	Included	Included, 120 VAC	3 N/C + 1 N/O	1/2 in. NPT	44506-5463
ER6022-022NELAC	Included	Included, 120 VAC	2 N/C + 2 N/O	1/2 in. NPT	44506-5483

Accessories					Part No.
Stainless Steel Rope Kits	**Quick Link**	**Eye-bolts**	**Tension/ Gripper Assembly**	**Allen Wrench**	
RK5, 5 m Kit	Yes	3	1	1	44506-2705
RK10, 10 m Kit	Yes	5	1	1	44506-2710
RK15, 15 m Kit	Yes	7	1	1	44506-2715
RK20, 20 m Kit	Yes	9	1	1	44506-2720
RK30, 30 m Kit	Yes	12	1	1	44506-2730
RK50, 50 m Kit	Yes	20	1	1	44506-2750
RK80, 80 m Kit	No	30	2	2	44506-2780
RK100, 100 m Kit	No	37	2	2	44506-2711
RK126, 126 m Kit	No	45	2	2	44505-2726
Rope Only					
R5M, 5 m Rope Only					44506-3705
R10M, 10 m Rope Only					44506-3710
R20M, 20 m Rope Only					44506-3720
R30M, 30 m Rope Only					44506-3730
R50M, 50 m Rope Only					44506-3750
R80M, 80 m Rope Only					44506-3780
R100M, 100 m Rope Only					44506-3711
R126M, 126 m Rope Only					44506-3726

Accessories	Part No.
SM06-SL500, Replacement Lid 24 VDC	44506-5700
SM06-SL510, Replacement Lid/LED 24 VDC	44506-5710
SM06-SL510AC, Replacement Lid/LED 120 VAC (consult factory for complete switch with 120 VAC beacon)	44506-5711
SM06-TK00, Tensioner Kit (Turnbuckle, 8 Rope Grips & 4 Thimbles)	44506-0700
SM06-TG00, Tensioner Gripper, Stainless Steel	44506-4700
SM06-EB10, Eye Bolt, Stainless Steel, 8 per pack	44506-4710
SM06-EB20, Eye Bolt, Galvanized	44506-0720
SM06-DL20, Double Loop Clip, Stainless Steel, 4 per pack	44506-4720
SM06-DL21, Double Loop Clip, Galvanized, 4 per pack	44506-4721
SM06-THSS, Thimble, Stainless Steel, 4 per pack	44506-4770
SM06-THGV, Thimble, Galvanized, 4 per pack	44506-4771
SM06-QLSS, Quick Link, Stainless Steel	44506-4772
SM06-TB30, Turnbuckle, Stainless Steel	44506-4730
SM06-TB31, Turnbuckle, Galvanized	44506-4731
SM06-SP30, Spring, Galvanized	44506-0730
SM06-SP50, Spring, Stainless Steel	44506-4750
SM06-RPSS, Rope Pulley, Stainless Steel	44506-4780
SM06-ES60, E-Stop Mechanism	44506-4760
SM06-LF40, Replacement LED Indicator Beacon, 24 VDC	44506-4740
SM06-LF41, Replacement LED Indicator Beacon, 120 VAC	44506-4741

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

ER6022-SS

Quick Link
S426
omron247.com

Stainless Steel Rope Pull Emergency Stop Switch

- Rope spans up to 100 m (328 ft.) means fewer number of switches required per application
- Tension indicator maintains the proper rope tension
- Contact arrangements of 3 N/C + 1 N/O or 2 N/C + 2 N/O
- IP67 (NEMA 6) enclosure withstands water washdown cleaning
- 316 stainless steel cast housing and stainless steel hardware
- Reset button—the blue reset button must be pushed in order to return to "machine run" condition following switch actuation by a pulled or slacked rope
- Vibration tolerant—the snap-acting switch contacts protect against nuisance tripping due to vibration
- Indicator beacon—the dual indicator beacon is optional on the ER6022-SS; the indicator beacon can be wired to flash red to indicate a tripped switch or glow a constant green to indicate a properly reset switch
- Optional E-stop button—may be added or replaced in the field
- Rubber bellows contain UV inhibitor making the switches suitable for outdoor applications
- Extreme Cold Version—for applications down to -40°C



G

ER1022

Quick Link
S422
omron247.com

Rope Pull Emergency Stop Switch



- Rope spans up to 125 m (410 ft.) makes this switch ideal for applications where long rope spans are required
- IP67 (NEMA 6) enclosure enables the ER1022 switch to withstand water washdown cleaning
- Integral E-stop—the E-stop button provides emergency stopping capability at the extreme end of the installation and is field serviceable
- Tension indicator makes system setup and rope tension maintenance easy
- 4 N/C safety contacts and 2 N/O auxiliary contacts satisfy the most demanding applications
- Vibration tolerant—the snap-acting switch contacts protect against nuisance tripping due to vibration
- Indicator beacon—the indicator beacon, available in 24 VDC or 120 VAC, can be wired to flash red to indicate a tripped switch or glow a constant green to indicate a properly reset switch
- Rubber bellows contain UV inhibitor making the switches suitable for outdoor applications

ER1032

Quick Link
S423
omron247.com

Rope Pull Emergency Stop Switch



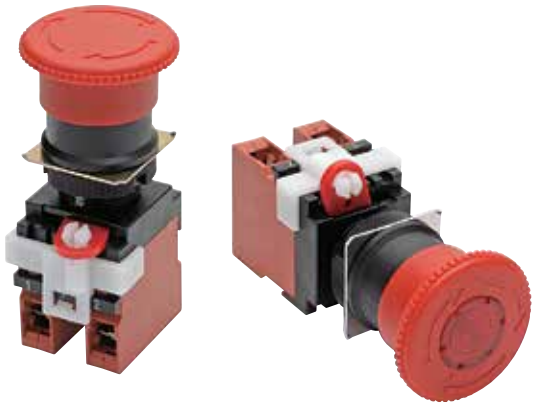
- Rope spans up to 200 m (656 ft.) makes this switch ideal for applications where long rope spans are required
- IP67 (NEMA 6) enclosure enables the ER1032 switch to withstand water washdown cleaning
- Integral E-stop—the E-stop button provides emergency stopping capability at the extreme end of the installation and is field serviceable
- Tension indicator makes system setup and rope tension maintenance easy
- 4 N/C safety contacts and 2 N/O auxiliary contacts satisfy the most demanding applications
- Vibration tolerant—the snap-acting switch contacts protect against nuisance tripping due to vibration
- Indicator beacon—the indicator beacon, available in 24 VDC or 120 VAC can be wired to flash red to indicate a tripped switch or glow a constant green to indicate a properly reset switch
- Rubber bellows contain UV inhibitor making the switches suitable for outdoor applications

A22E

Quick Link
P623
omron247.com

Emergency Stop Switch (22 mm or 25 mm diameter)

- Install in 22-dia. or 25-dia. panel cutout
- Direct opening mechanism to open the circuit when the contact welds ⊖.
- Safety lock mechanism prevents operating errors.
- Easy mounting and removal of Switch Blocks using a lever.
- Mount three Switch Units in series to improve wiring efficiency (with non-lighted Switch Units, three Units can be mounted for multiple contacts).
- Finger protection mechanism on Switch Unit provided as a standard feature.
- Install using either round, or forked crimp terminals.
- Oil-resistant to IP65 (non-lighted models)/IP65 (lighted models)
- A lock plate is provided as a standard feature to ensure that the control box and switch are not easily separated.



Specifications

Certified Standard Ratings

- UL, cUL (File No.E41515)
  6 A at 220 VAC, 10 A at 110 VAC
- TÜV (EN60947-5-1) (Low Voltage Directive)
  3 A at 220 VAC
- CCC (GB14048.5)
  3 A at 240 VAC, 1.5 A at 24 VDC

Certified Standards

Certification body	Standard	File No.
UL *1	UL 508, CSA C22.2 No.14	E41515
TÜV SÜD	EN60947-5-1, EN60947-5-5 (certified direct opening)	Consult your representative for details.
CQC (CCC)	GB14048.5	2003010303070635
KOSHA *2	EN60947-5-1	2004-220, 2007-27

Note: Only models with NC contacts have a direct opening mechanism.
*1. UL-certification for CSA C22.2 No. 14 has been obtained. Certification has been obtained for the Switch Unit and the Lamp Socket.
*2. Some models have been certified.

Ratings

Contacts (Standard Load)

Rated carry current (A)	Rated voltage (V)	Rated current (A)			
		AC15 (inductive load)	AC12 (resistive load)	DC13 (inductive load)	DC12 (resistive load)
10	24 VAC	10	10	—	—
	110 VAC	5	10		
	220 VAC	3	6		
	380 VAC	2	3		
	440 VAC	1	2		
	24 VDC	—	—	1.5	10
	110 VDC			0.5	2
	220 VDC			0.2	0.6
	380 VDC			0.1	0.2

Note:
1. Rated current values are determined according to the testing conditions. The above ratings were obtained by conducting tests under the following conditions.
   (1) Ambient temperature: 20°±2°C
   (2) Ambient humidity: 65±5%
   (3) Operating frequency: 20 operations/minute
2. Minimum applicable load: 10 mA at 5 VDC

LED Indicators without Voltage Reduction Unit

Rated voltage	Rated current	Operating voltage
6 VAC/VDC	8 mA	6 VAC/VDC±5%
12 VAC/VDC		12 VAC/VDC±5%
24 VAC/VDC		24 VAC/VDC±5%

G

Specifications (continued)

Characteristics

Item		Emergency Stop Switch	
		Non-lighted model: A22E	Lighted Model: A22EL
Allowable operating frequency	Mechanical	30 operations/minute max. *3	
	Electrical	30 operations/minute max. *3	
Insulation resistance		100 MΩ min. (at 500 VDC)	
Dielectric strength	Between terminals of same polarity	2,500 VAC, 50/60 Hz for 1 min.	
	Between each terminal and ground	2,500 VAC, 50/60 Hz for 1 min.	
Vibration resistance *2		10 to 55 Hz, 1.5 mm double amplitude (within 1 ms)	
Shock resistance	Destruction	1,000 m/s^2	
	Malfunction *2	250 m/s^2 max.	
Durability	Mechanical	300,000 operations min. *3	
	Electrical	300,000 operations min. *3	
Ambient operating temperature *1		-20 to 70°C	-20 to 55°C
Ambient operating humidity		35% to 85%	
Ambient storage temperature		-40 to 70°C	
Degree of protection		IP65 Oil-resistant *4	IP65 *4
Electric shock protection class		Class II	
PTI (tracking characteristic)		175	
Degree of contamination		3 (EN60947-5-1)	

*1. With no icing or condensation.
*2. Malfunction within 1 ms.
*3. Setting and resetting once is counted as one operation.
*4. Degree of protection from the front of the panel.

Structure and Nomenclature



Operation Unit

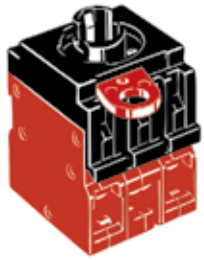
Color: Red
Non-lighted
Lighted

Note: The operation Unit of A22E except models with EMO/EMS indication is red. (The engraved mark is not white.)



Lamp

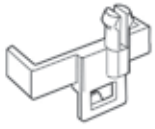
Light Source
· LED Lamp
· Incandescent Lamp



Switch

Contact Ratings
10 A at 110 VAC (resistive load)
10 A at 24 VDC (resistive load)

Lighting Method
Non-lighted
Lighted (without Voltage Reduction Unit)
Lighted (with Voltage Reduction Unit)



Lock Plate
(Attached with the Operation Unit)
(Refer to the Installation Manual)

(The above figures are examples of the lighted model)

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

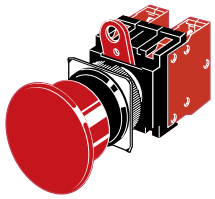
Dimensions

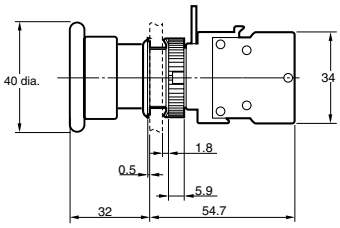
(mm)

Non-lighted Models

A22E-MP

Medium Push-pull (40-dia.)

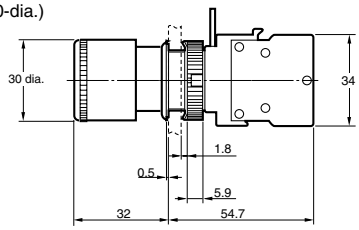




A22E-S

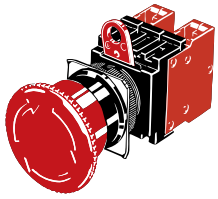
Small Push-lock, Turn-reset (30-dia.)

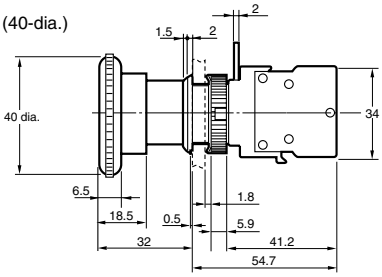




A22E-M

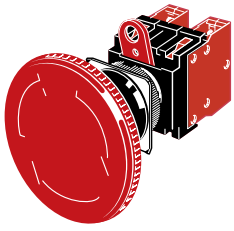
Medium Push-lock, Turn-reset (40-dia.)

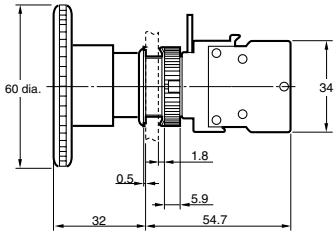




A22E-L

Large Push-lock, Turn-reset (60-dia.)

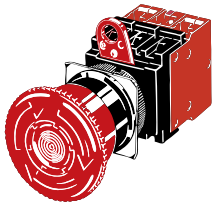


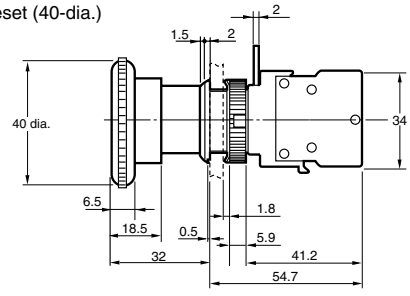


Lighted Models

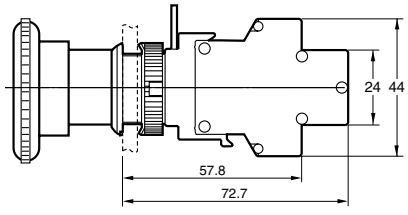
A22EL-M

Medium Push-lock, Turn-reset (40-dia.)





Switch dimensions when mounted to a DPST-NO (or 2NC (1NC + 1 NC)) one-piece Switch Block.



Note: The operation unit is an example for the A22E-M.

Note: The Operation Unit of A22E except models with EMO/EMS indication is red. (The engraved mark is not white.)

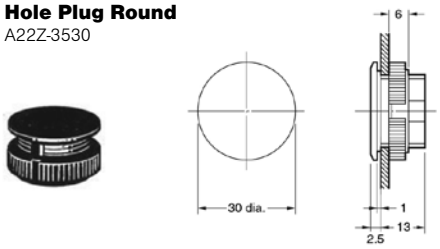
G

Dimensions (continued)

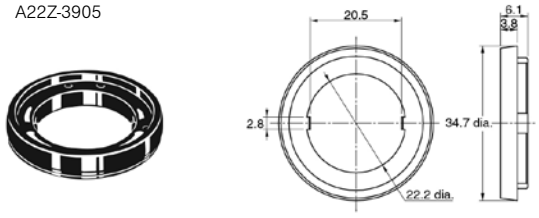
(mm)

Dimensions for Accessories

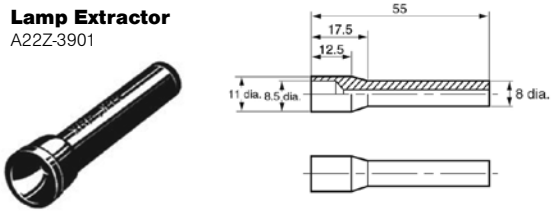
Hole Plug Round
A22Z-3530



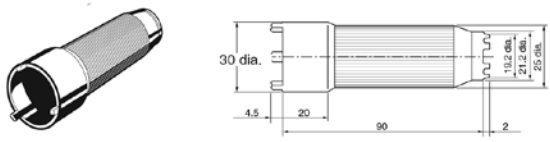
Tightening Tool
A22Z-3905



Lamp Extractor
A22Z-3901

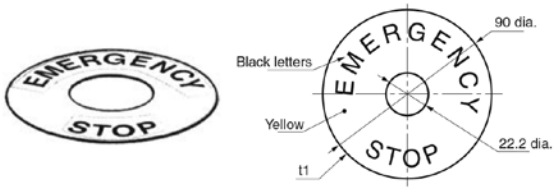


30-Dia. Resin Attachment
A22Z-A30

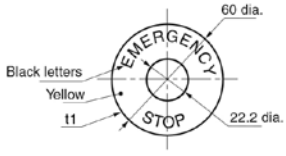


Legend Plates for Emergency Stop

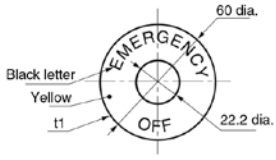
A22Z-3476-1 (90 dia.)



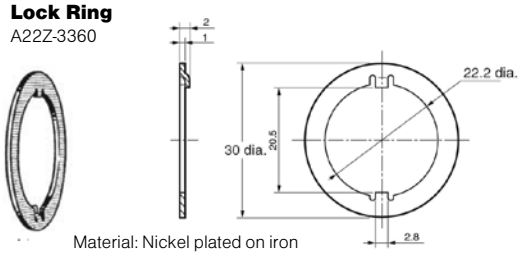
A22Z-3466-1 (60 dia.)



A22Z-3466-2 (60 dia.)

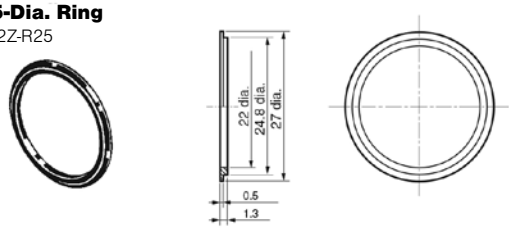


Lock Ring
A22Z-3360



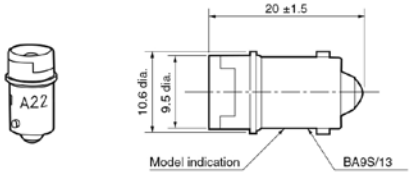
Material: Nickel plated on iron

25-Dia. Ring
A22Z-R25

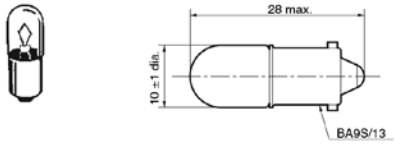


Material: NBR (black)

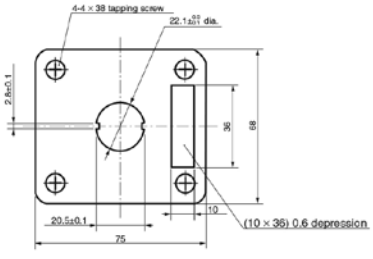
LED Lamp
A22-6☐, 12☐, 24☐



Incandescent Lamp
A22-5, 12, 24, H1

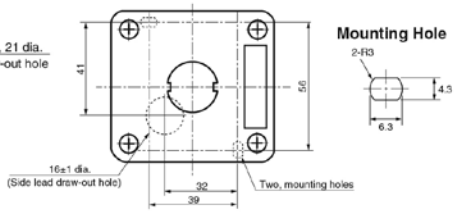


Control Box
A22Z-B101Y (1 hole)





Cable Draw-Out Hole (Top View)



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Dimensions (continued)

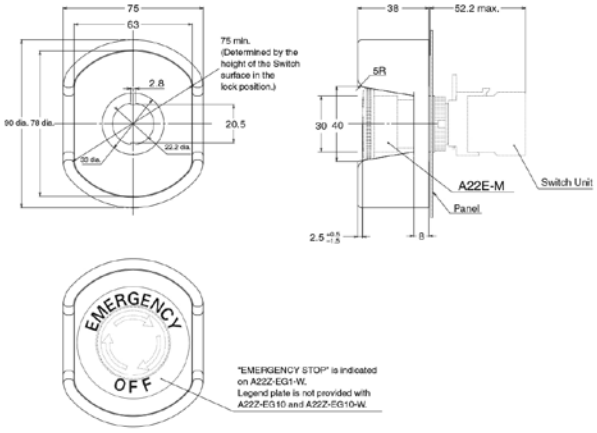
(mm)

Dimensions for Accessories (continued)

E-stop Shroud

A22Z-EG1, A22Z-EG1-W, A22Z-EG10, A22Z-EG10-W



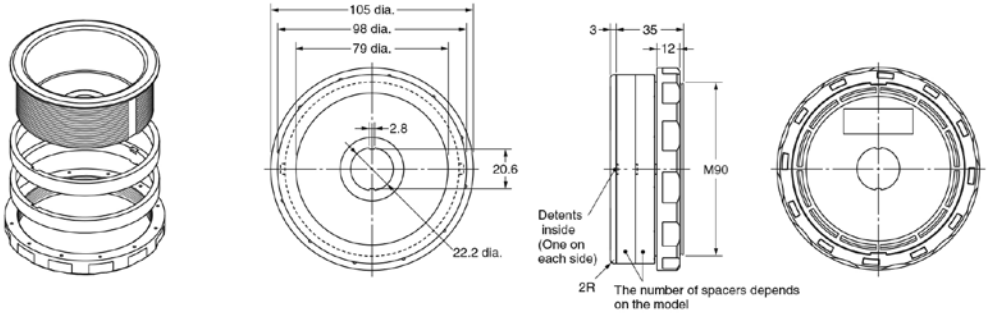


"EMERGENCY STOP" is indicated on A22Z-EG1-W. Legend plate is not provided with A22Z-EG10 and A22Z-EG10-W.

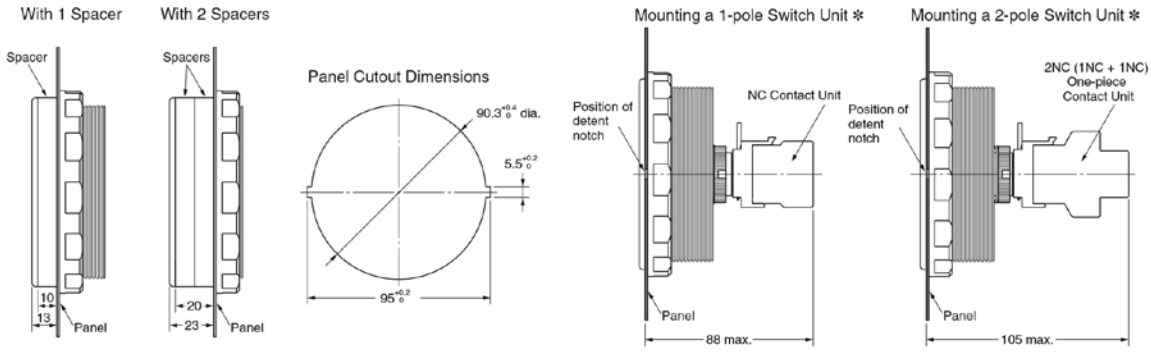
Notes:
1. The dimensions of the Shroud conform to the specifications of the SEMATECH Application Guide for SEMI S2-93.
2. The Shroud is not provided with the Switch.

E-stop Shroud

A22Z-EGs, A22Z-EG21, A22Z-EG22



Mounting with Spacers



Notes:
1. The dimensions of the Shroud conform to the specifications of the SEMATECH Application Guide for SEMI S2-93.
2. The Shroud is not provided with the Switch.
3. Tighten to a torque of 1.96 to 2.94 N·m.
4. The allowable panel thicknesses are as follows:
Without Spacers: t=1.3 to 22.5 mm
With 1 Spacer: t=1.3 to 12.5 mm
With 2 Spacers: t=1.3 to 2.5 mm
* These are the dimension from the front of the panel when the Switch Unit is attached.

G

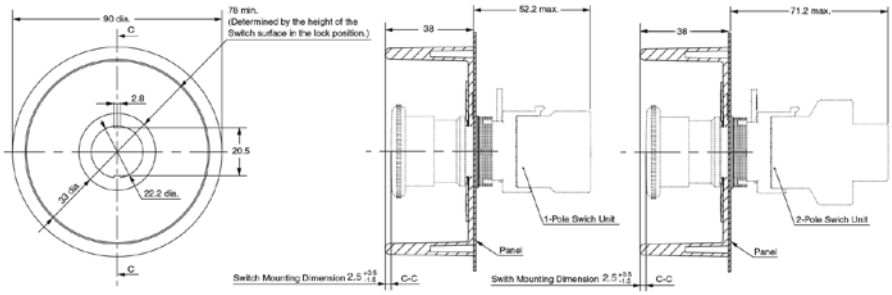
Dimensions (continued)

(mm)

Dimensions for Accessories (continued)

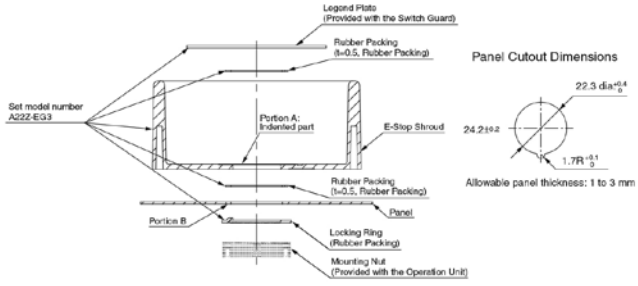
E-stop Shroud
A22Z-EG3





Notes:
1. The dimensions of the Shroud conform to the specifications of the SEMATECH Application Guide for SEMI S2-93.
2. The Shroud is not provided with the Switch.

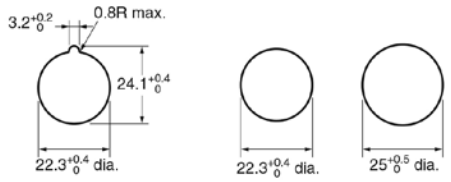




SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Wiring

Panel Cutouts

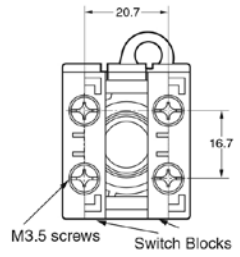
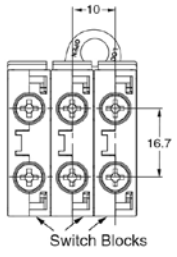
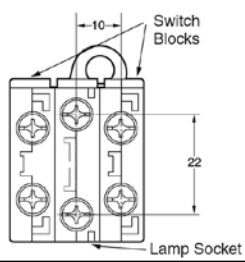


With Lock Fitting **Without Lock Fitting**

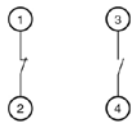
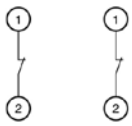
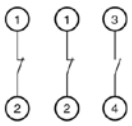
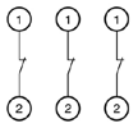
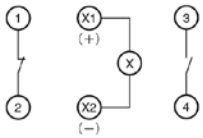
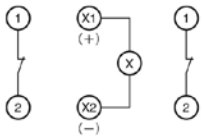
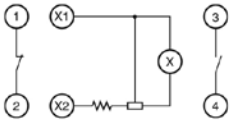
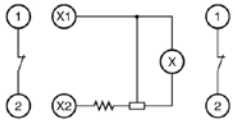
A Lock Ring is provided as a standard feature.

- When painting or coating the panel, make sure that the specified panel dimensions apply to the panel after painting or coating.
- Use an A22Z-R25 Ring when mounting to a panel with a 25-mm diameter hole.

Terminal Arrangement (Bottom View)

Non-lighted (two contacts)	Non-lighted three contacts)	Lighted
		

Terminal Connection

Type	Terminal connection (BOTTOM VIEW			
	1NO+1NC	2NC (1NC+1NC)	1NO+2NC (1NC+1NC)	3NC (1NC+1NC+1NC)
Non-lighted				
Lighted without Voltage Reduction Unit				
Lighted with Voltage Reduction unit				

Note: The above terminal connection diagrams are examples for 1NO + 1NC and 2NC (1NC + 1NC).

G

Ordering

Model Number Structure (Completely Assembled)

Shipped as a set that includes the Operation Unit, Lamp (lighted models only), and Switch.

A22E – ☐ - ☐ - ☐ - ☐ - ☐
❶ ❷ ❸ ❹ ❺

❶ Lighted/Non-lighted
(none): Non-lighted
L: Lighted
*Lighted emergency stop switches are available only for the medium (M) push-lock turn-reset models

❷ Head Size
MP: Medium 40 dia., push-pull
S: Small, 30 dia., push-lock turn-reset
M: Medium, 40 dia., push-lock turn-reset
L: Large, 60 dia., push-lock turn-reset

❸ Light Source Without Voltage Reduction Unit
Without Voltage Reduction Unit —
(none): Non-lighted
6A: LED, 6 VAC/VDC
12A: LED, 12 VAC/VDC
24A: LED, 24 VAC, VDC
With Voltage Reduction Unit —
T1: LED, 100 VAC
T2: LED, 200 VAC
Equipped with 24 VAC/DC LED.

❹ Contacts
01: 1NC
11: 1NO+1NC
02: 2NC (1NC+1NC)
12: 1NO+2NC (1NC+1NC)
03: 3NC (1NC+1NC+1NC)

❺ Configuration
(none): Switch only
B Switch with integrated control box

List of Models (Completely Assembled)

Non-lighted Models

Operating Appearance		Contact Configuration	Set Model	Color of cap
40-dia. head Medium Push-pull A22E-MP		1NC	A22E-MP-01	Red
		1NO+1NC	A22E-MP-11	
		2NC (1NC+1NC)	A22E-MP-02	
30-dia. head Small Push-lock Turn-reset A22E-S		1NC	A22E-S-01 *	
		1NO+1NC	A22E-S-11 *	
		2NC (1NC+1NC)	A22E-S-02 *	
		1NO+2NC (1NC+1NC)	A22E-S12 *	
		3NC (1NC+1NC+1NC)	A22E-S-03 *	
40-dia. head Medium Push-lock Turn-reset A22E-M		1NC	A22E-M-01 *	
		1NO+1NC	A22E-M-11 *	
		2NC (1NC+1NC)	A22E-M-02 *	
		1NO+2NC (1NC+1NC)	A22E-M-12 *	
		3NC (1NC+1NC+1NC)	A22E-M-03 *	
60-dia. head Large Push-lock Turn-reset A22E-L		1NC	A22E-L-01 *	
		1NO+1NC	A22E-L-11 *	
		2NC (1NC+1NC)	A22E-L-02 *	

*Models with Korean S-mark certification.
Notes:
1. Yellow cap models are also available (not for emergency stop use). Contact your representative.
2. The Operation Unit of A22E except models with EMO/EMS indication is red. (The engraved mark is not white.)

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Ordering (continued)

List of Models (Completely Assembled) (continued)

Lighted Models

Appearance	Operating			Push-lock turn-reset system	Color of cap
	Contact configuration	Lighting	Rated voltage	Set Model	
40-dia. head Push-lock Turn-reset without Voltage Reduction Unit A22E 	1NC	LED	6 VAC/6VDC	A22EL-M-6A-01 *	Red
			12 VAC/VDC	A22EL-M-12A-01 *	
			24 VAC/VDC	A22EL-M-24A-01 *	
	1NO+1NC		6 VAC/6VDC	A22EL-M-6A-11 *	
			12 VAC/VDC	A22EL-M-12A-11 *	
			24 VAC/VDC	A22EL-M-24A-11 *	
	2NC (1NC+1NC)		6 VAC/VDC	A22EL-M-6A-02 *	
			12 VAC/VDC	A22EL-M-12A-02 *	
			24 VAC/VDC	A22EL-M-24A-02 *	
40-dia. head Push-lock Turn-reset with Voltage Reduction Unit A22E 	1NC		100 VAC	A22EL-M-T1-01	
			200 VAC	A22EL-M-T2-01	
	1NO+1NC		100 VAC	A22EL-M-T1-11	
			200 VAC	A22EL-M-T2-11	
	2NC (1NC+1NC)		100 VAC	A22EL-M-T1-02	
			200 VAC	A22EL-M-T2-02	

*Models with Korean S-mark certification.
Note: The Operation Unit of A22E except models with EMO/EMS indication is red. (The engraved mark is not white.)

With EMO/EMS Indication

Operating		Set Model	Color of cap
Appearance	Contact Configuration		
40-dia. head Medium Push-lock Turn reset With EMO Indication 	1NC	A22E-M-01-EMO*	Red
	1NO+1NC	A22E-M-11-EMO*	
	2NC (1NC+1NC)	A22E-M-02-EMO*	
	1NO+2NC (1NC+1NC)	A22E-M-12-EMO*	
	3NC (1NC+1NC+1NC)	A22E-M-03-EMO*	
40-dia. head Medium Push-lock Turn reset With EMS Indication 	1NC	A22E-M-01-EMS*	
	1NO+1NC	A22E-M-11-EMS*	
	2NC (1NC+1NC)	A22E-M-02-EMS*	
	1NO+2NC (1NC+1NC)	A22E-M-12-EMS*	
	3NC (1NC+1NC+1NC)	A22E-M-03-EMS*	

*Models with Korean S-mark certification.
Note: The colors of switch blocks are the followings:
1NO: black
1NC: red
The above illustration shows the 2NC (1NC + 1NC) classification.

Switch with Integrated Control Box

Appearance	Contact configuration	Model
	1NC	A22E-M-01B *
	1NO+1NC	A22E-M-11B *
	2NC (1NC+1NC)	A22E-M-02B *

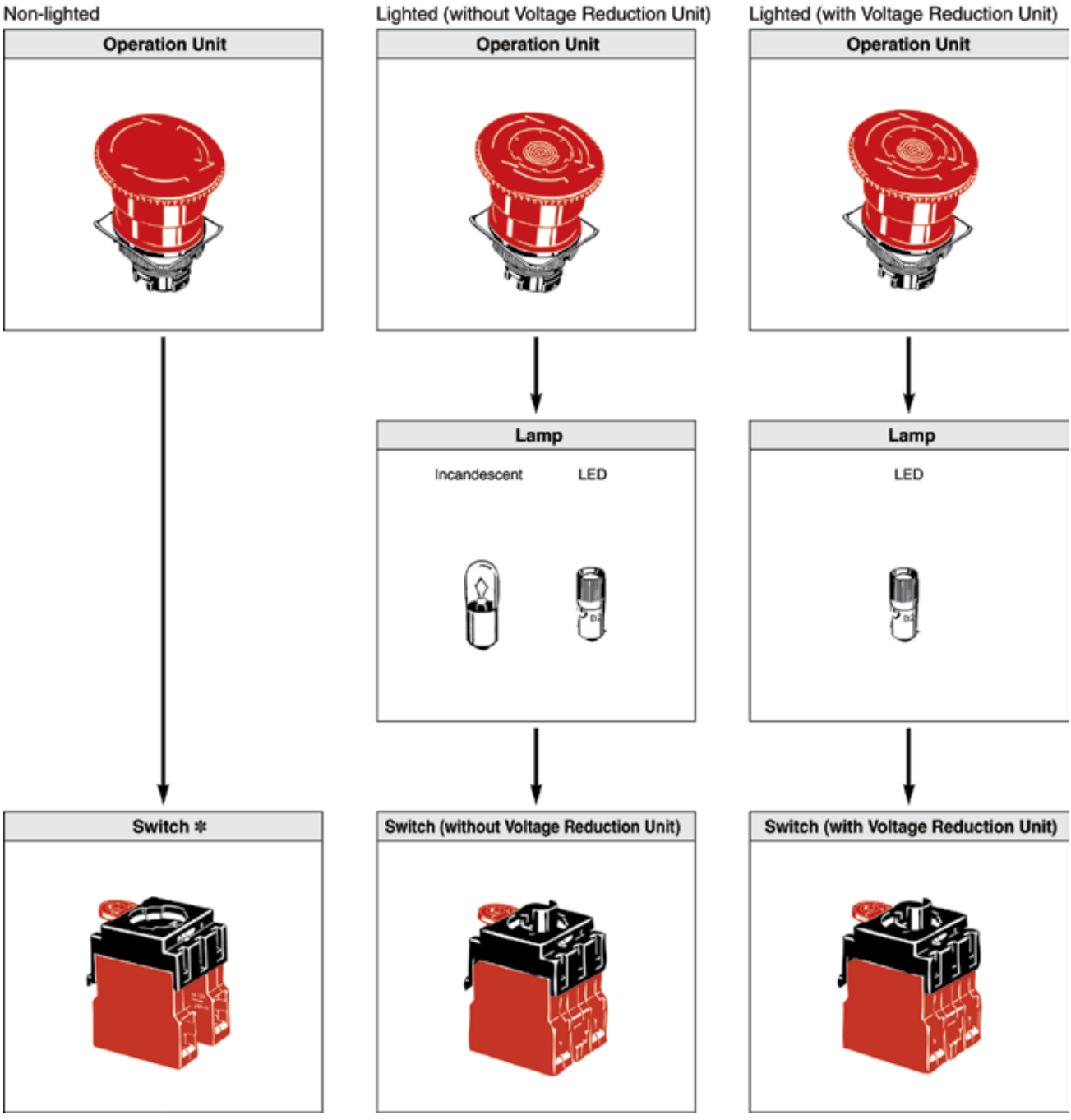
*Models with Korean S-mark certification.

G

Ordering (continued)

Subassembled

The Operation Unit, Lamp, or Switch can be ordered separately. Use them in combination for models that are not available as assembled units. These can also be used as inventory for maintenance parts.



*Note:
1. Up to three Switch Units can be mounted for multiple contacts.
2. The Operation Unit of A22E except models with EMO/EMS indication is red. (The engraved mark is not white.)

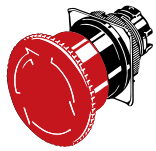
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering (continued)

Operation Units

Non-lighted

Sealing capability	IP65 oil-resistant models		
Function / Size	Small (30 dia.)	Medium (40 dia.)	Large (60 dia.)
Push-pull	—	A22E-MP 	—
Push-lock, turn-reset	A22E-S 	A22E-M 	A22E-L 

The Operation Unit of A22E except models with EMO/EMS indication is red. (The engraved mark is not white.)

Lighted

Sealing capability	IP65
Function / Size	Medium (40 dia.)
Push-lock, turn-reset	A22EL-M 

Switch (Standard Load)

Without Voltage Reduction Unit

Classification / Appearance		Non-lighted 	Lighted 
Switch Action		Momentary	Momentary
Contacts		Model	Model
For standard loads	1NC	A22-01M	A22L-01M
	1NO+1NC	A22-11M	A22L-11M
	2NC (1NC+1NC)	A22-02M	A22L-02M

With Voltage Reduction Unit

Classification / Appearance		Lighted (110 VAC) 	Lighted (220 VAC) 
Switch Action		Momentary	Momentary
Contacts		Model	Model
For standard loads	1NC	A22L-01M-T1	A22L-01M-T2
	1NO+1NC	A22L-11M-T1	A22L-11M-T2
	2NC (1NC+1NC)	A22L-02M-T1	A22L-02M-T2

Note: When using with a Voltage Reduction Unit, use the A22-24AR.

G

Ordering (continued)

Lamp

LED

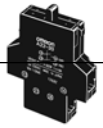
Appearance	LED light		Rated voltage	Model
	Red	Standard	6 VAC/VDC	A22-6AR
			12 VAC/VDC	A22-12AR
			24 VAC/VDC	A22-24AR

Note: For voltage-reduction lighting, use the A22-24AR.

Incandescent

Appearance	Rated voltage	Model
	6 VDC	A22-5
	14 VAC	A22-12
	28 VAC	A22-24
	130 VAC	A22-H1

Accessories (Order Separately)

Item	Appearance	Classification		Model	Remarks
Switch Blocks		1NO	Standard load	A22-10	Provide as standard. Order switch blocks only when adding or replacing them.
			Microload	A22-10S	
		1NC	Standard load	A22-01	
			Microload	A22-01S	
		2NO (1NO+1NO), one piece	Standard load	A22-20	Order switch blocks only when adding or replacing them.
			Microload	A22-20S	
		2NC (1NC+1NC), one piece	Standard load	A22-02	
			Microload	A22-02S	
Lamp Sockets		Direct lighting		A22-TN	Use when changing the lighting method.
		Voltage reduction lighting	100 VAC	A22-T1	
			200 VAC	A22-T2	
Mounting Latches		—		A22-3200	Provide as standard. Order mounting latches only when mounting switch blocks or lamp sockets that are purchased individually.
Legend Plates for Emergency Stop		60-dia. black letters on yellow back-ground		A22Z-3466-1	"EMERGENCY STOP" is indicated on the plate.*2
		90-dia. black letters on yellow back-ground		A22Z-3476-1	
		60-dia. black letters on yellow back-ground		A22Z-3466-2	"EMERGENCY OFF" is indicated on the plate.
Hole Plug		Round		A22Z-3530	Can be plugged into pre-cut panel holes for future expansion. The color is black.
Connectors		Applicable cable diameter	7 to 9 dia.	A22Z-3500-1	Plastic connector used to extend a cable from the switch box.
			9 to 11 dia.	A22Z-3500-2	
25-dia. Ring		—		A22Z-R25	Can be fit into a 25-dia. hole in the panel. Since this is not attached to the main body, order separately.
30-dia. Resin Attachment		—		A22Z-A30	Can be fit into a 30-dia. hole in the panel.
Lock Plate		—		A22Z-3380	Use to fix the lever on the Switch.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering (continued)

Accessories (continued)

Item	Appearance	Classification	Model	Remarks
Control Boxes (Enclosures)		One hole, yellow box (for emergency stop)	A22Z-B101Y	Material: Polycarbonate resin*2
Operation Keys		—	A22K-K	Two keys are provided.
Lock Ring		Round shape	A22Z-3360	The body is equipped with a lock fitting. This lock fitting is used when a more secure lock feature is required.
Lamp Extractor		—	A22Z-3901	Rubber tool used to replace lamps easily.
E-stop Shroud for EMO, Yellow		—	A22Z-3905	Tool used to tighten rings from the back of the panel and to attach caps to lighted models.
E-stop Shroud for EMO, Yellow		Legend plate for EMERGENCY OFF is not included	A22Z-EG1	Provides SEMI-S2/SEMATECH Application Guide for SEMI-S2 compatibility. The SEMI-S2-compatible Shroud and legend plate for EMERGENCY OFF come as a set. Use with an A22E Emergency Stop Switch. (for emergency stop) *1*2
E-stop Shroud for EMO, Yellow		Legend plate for EMERGENCY OFF is not included	A22Z-EG10	Provides SEMI-S2/SEMATECH Application Guide for SEMI-S2 compatibility. The SEMI-S2-compatible Use with an A22E with EMO indication (for emergency off) *2
E-stop Shroud for EMS, White		—	A22Z-EG1-W	Provides SEMI-S2/SEMATECH Application Guide for SEMI-S2 compatibility. The SEMI-S2-compatible Shroud and legend plate for EMERGENCY STOP come as a set. Use with an A22E Emergency Stop Switch. (for emergency stop) *1*2
E-stop Shroud for EMS, White		Legend plate for EMERGENCY STOP is not included	A22Z-EG10-W	Provides SEMI-S2/SEMATECH Application Guide for SEMI-S2 compatibility. The SEMI-S2-compatible Use with an A22E with EMS indication (for emergency off) *2
E-stop Shroud, Yellow		Spacer Unit is not included.	A22Z-EG2	SEMI-S2/SEMATECH Application Guide for SEMI S2-compatible Shroud. (for emergency shutoff). Use together with an A22E Emergency Stop Switch. *1*2
		One Space Unit is included.	A22Z-EG21	
		Two Spacer Units are included.	A22Z-EG3	
E-stop Shroud for EMO, Yellow		—	A22Z-EG3	Provides SEMI-S2/SEMATECH Application Guide for SEMI-S2 compatibility. The SEMI-S2-compatible Shroud and legend plate for EMERGENCY OFF come as a set. Use with an A22E Emergency Stop Switch. (for emergency stop) *1*2

*1. These Shrouds are for use with the equipment only that conforms to SEMI standards. Do not use them for any other applications (e.g. emergency stop switches for machines or devices such as Machine tools, Printing presses, Industrial machinery, etc).
*2. The A22-B101Y cannot be used in combination with the A22Z-3476-1 and the A22Z-EG☐.
Note:
1. Accessories for A22Z-EG1: one "EMERGENCY OFF" label, two rubber washers, and one lock ring
2. Accessories for A22Z-EG10: one rubber washer and one lock ring (without label)

G

A165E

Quick Link
P633
omron247.com

Emergency Stop Switch (16 mm diameter)

- Separate construction with one of the smallest class of depths in the world
- Direct opening mechanism to open contacts in emergencies, such as when they are welded.
- Conforms to EN418.
- Includes a safety lock to prevent misuse.
- Features separate construction that allows the switch to be separated for easier wiring and one-piece-like construction that allows easier handling.
- Models available with 3 contacts built into a single block (A165E-U)



Specifications

Certified Standards

Certification body	Standard	File No.
UL *1	UL 508, CSA C22.2 No.14	E41515
TÜV SÜD	EN 60947-5-1, EN 60947-5-5	Consult your representative for details.
CQC (CCC)	GB14048.5	2003010303070678

*Certification for CSA C22.2 No. 14 is authorized by the mark.

Certified Standard Ratings

UL508, CSA C22.2 No. 14, CCC (GB14048.5)

Models with Separate Construction

Rated Voltage	Resistive Load
125 VAC	5 A
250 VAC	3 A
30 VDC	3 A

Models with One-piece Construction

Rated Voltage	Resistive Load
125 VAC	1 A
250 VAC	0.5 A
30 VDC	1 A

TÜV (EN 60947-5-1)

Models with Separate Construction

Rated Voltage	Resistive Load
250 VAC	3 A
30 VDC	3 A

Models with One-piece Construction

Rated Voltage	Resistive Load
250 VAC	0.5 A
30 VDC	1 A

Switch Ratings

Models with Separate Construction

Rated Voltage	Resistive Load
125 VAC	5 A
250 VAC	3 A
30 VDC	3 A

Note: Minimum applicable load: 5 VDC, 150 mA

Models with One-piece Construction

Rated Voltage	Resistive Load
125 VAC	1 A
250 VAC	0.5 A
30 VDC	1 A

Note: Minimum applicable load: 5 VDC, 1 mA

LED Ratings (Only for models with LEDs)

Rated Voltage	Rated Current	Operation Voltage
24 VAC/VDC	8 mA	24 VAC/DC ±5%

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Specifications (continued)

Characteristics

Item		Emergency Stop Switch		
		Non-lighted A165E-S/A165E-M	Lighted A165E-LS/A165E-LM	Non-lighted, One-piece construction A165E-U
Allowable operating frequency	Mechanical	20 operations/minute max.		
	Electrical	10 operations/minute max.		
Insulation resistance		100 MΩ min. (at 500 VDC)		
Dielectric strength	Between terminals of same polarity	1,000 VAC, 50/60 Hz for 1 min.		
	Between terminals of different polarity	2,000 VAC, 50/60 Hz for 1 min.		
	Between each terminal and ground	2,000 VAC, 50/60 Hz for 1 min.		
	Between lamp terminals	1,000 VAC, 50/60 Hz for 1 min. *1		—
Vibration resistance	Malfunction	10 to 55 Hz, 1.5 mm double amplitude (malfunction within 1 ms)		
Shock resistance	Destruction	500 m/s^2		
	Malfunction	300 m/s^2 max. (malfunction within 1 ms)		150 m/s^2 max. (malfunction within 1 ms)
Durability	Mechanical	100,000 operations min.		
	Electrical	100,000 operations min.		
Degree of protection		IP65 Oil-resistant *2	IP65 *2	IP65 Oil-resistant *2
Electric shock protection class		Class II		
PTI (tracking characteristic)		175		
Degree of contamination		3 (EN60947-5-1)		
Weight		Approx. 16 g (in case of DPST-NC switches)		
Ambient operating temperature		-10 to +55°C (with no icing or condensation)		
Ambient operating humidity		35% to 85%RH		
Ambient storage temperature		-25 to +65°C (with no icing or condensation)		

*1. LED not mounted. (Test them with the LED removed.)
*2. Degree of protection from the front of the panel.

Operating Characteristics

Item		Characteristics of models with separate construction	Characteristics of models with one-piece construction
Operating force	OF max.	14.7 N	14.7 N
Releasing force	RF min.	0.1 N-m	0.1 N-m
Pretravel	PT	3.5±0.5 mm	3.5±0.5 mm

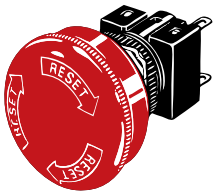
G

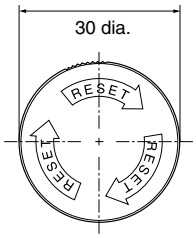
Dimensions

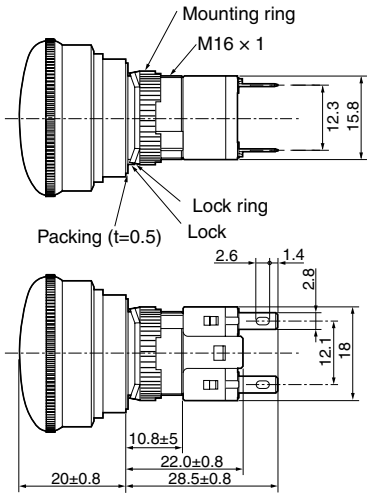
(mm)

A165E-S

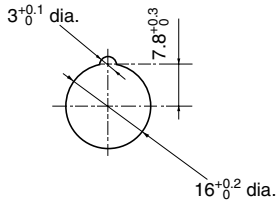
Non-lighted models
30 mm diameter







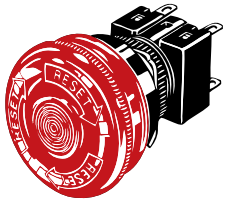
Panel cutout dimensions

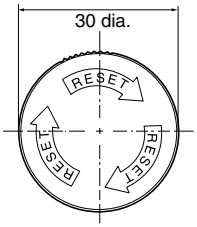


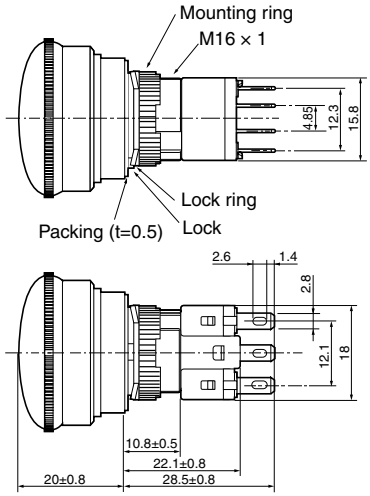
- When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.
- Recommended panel thickness: 0.5 to 3.2 mm.

A165E-LS

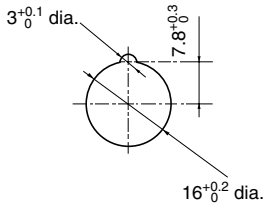
Lighted models
30 mm diameter







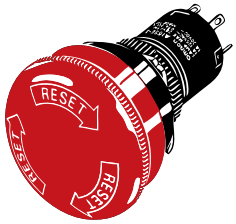
Panel cutout dimensions

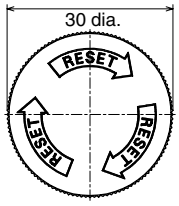


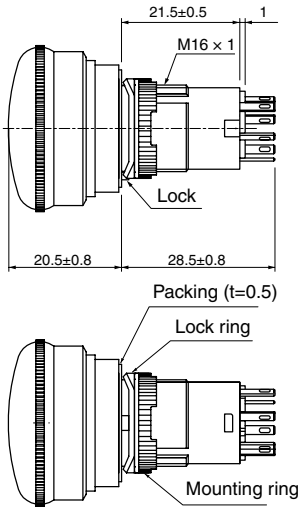
- When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.
- Recommended panel thickness: 0.5 to 3.2 mm.

A165E-S-03U

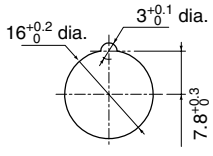
Non-lighted,
One-piece construction models
30 mm diameter







Panel cutout dimensions



- When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.
- Recommended panel thickness: 0.5 to 3.2 mm.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

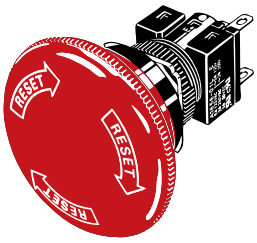
OMRON AUTOMATION & SAFETY

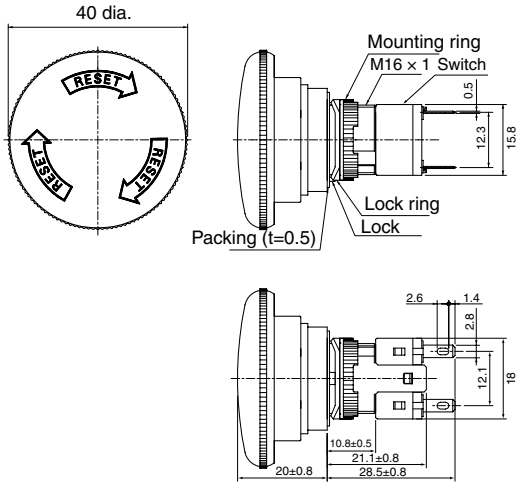
Dimensions (continued)

(mm)

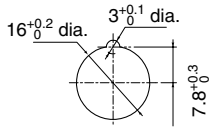
A165E-M

Non-lighted models
40 mm diameter





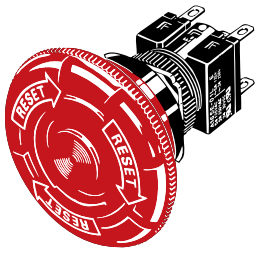
Panel cutout dimensions

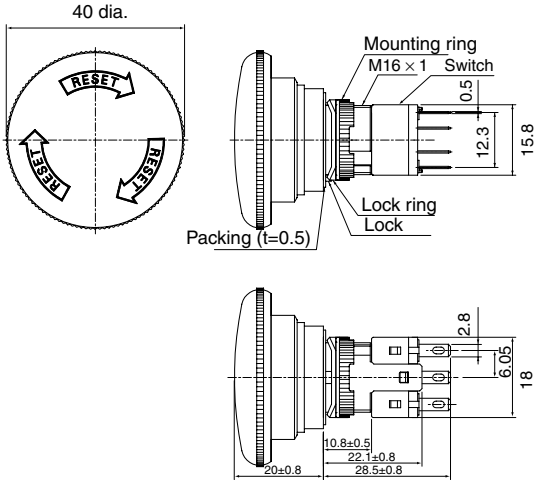


- When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.
- Recommended panel thickness: 0.5 to 3.2 mm.

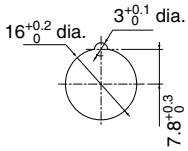
A165E-LM

Lighted models
40 mm diameter





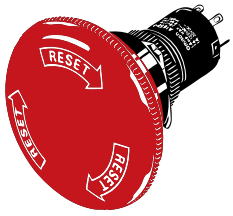
Panel cutout dimensions

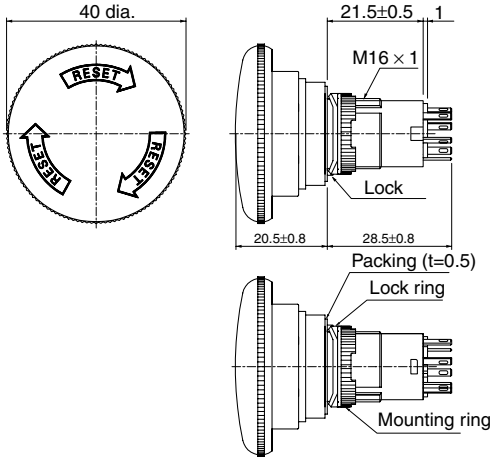


- When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.
- Recommended panel thickness: 0.5 to 3.2 mm.

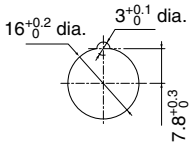
A165E-M-03U

One-piece construction models
40 mm diameter





Panel cutout dimensions



- When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.
- Recommended panel thickness: 0.5 to 3.2 mm.

G

Ordering

Model Number Structure (Completely Assembled)

(Shipped as a set that includes the Operation Unit and light source.)

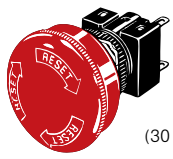
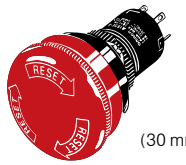
A165E – □ - □ - □
❶ ❷ ❸

❶ Operation Unit Shape and Function
S: Non-lighted, push-lock, turn-reset, 30 dia. pushbutton
LS: Lighted, push-lock, turn-reset, 30 dia. pushbutton
M: Non-lighted, push-lock, turn-reset, 40. dia. pushbutton
LM: Lighted, push-lock, turn-reset, 40 dia. pushbutton

❷ Light Source
None: Non-lighted
24D: LED, 24 VAC/VDC ±5% operation voltage, 24 VAC/VDC rated voltage
Note: Models with separate construction (SPST-NC and DPST-NC) are for normal loads only. One-piece models (TPST-NC) are for either normal loads or microloads.

❸ Contacts
01: SPST-NC
02: DPST-NC
03U: TPST-NC*
*TPST-NC models have once-piece construction with the contact unit. Only non-lighted models are available.

List of Models

Diameter of Operation Unit	Function	Model	Shape	
30 mm models 40 mm models	Push-Lock, turn-reset	A165E	Separate construction	 (30 mm model)
		A165E-□-03U	One-piece construction	 (30 mm model)

List of Sets

Illumination	Rated voltage	Pushbutton color	Pushbutton size	Terminal	Contact form	Model
LED	24 VAC/VDC	Red	30 dia.	Solder terminal	SPST-NC	A165E-LS-24D-01
					DPST-NC	A165E-LS-24D-02
Non-lighted	–				SPST-NC	A165E-S-01
					DPST-NC	A165E-S-02
LED	24 VAC/VDC		40 dia.		SPST-NC	A165E-LM-24D-01
					DPST-NC	A165E-LM-24D-02
Non-lighted	–				SPST-NC	A165E-M-01
					DPST-NC	A165E-M-02
Non-lighted	–		30 dia.		TPST-NC	A165E-S-03U
			40 dia.			A165E-M-03U

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

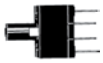
Ordering (continued)

Individual Parts (for Switches with Separate Construction)

Operation Units

Appearance	Illumination	Model
30 dia. 	Non-lighted	A165E-S
	Lighted	A165E-LS
40 dia. 	Non-lighted	A165E-M
	Lighted	A165E-LM

Switches

Appearance	Illumination	Contact form	Model
	Non-lighted	SPST-NC	A165E-01
		DPST-NC	A165E-02
	Lighted	SPST-NC	A165E-01L
		DPST-NC	A165E-02L

Lamps

Appearance	LED color		Rated voltage	Model
	Red	Bright	5 VDC	A16-5DSR
			12 VAC/ VDC	A16-12DSR
			24 VAC/ VDC	A16-24DSR

Switch Units

Appearance	Illumination	Contact form	Model
	Lighted	SPST-NC	A165E-R-24D-01
		DPST-NC	A165E-R-24D-02

Accessories (Order separately)

Item	Appearance	Type	Model	Precautions
Yellow Plate		Yellow, 45 dia.	A16Z-5070	Use this as an emergency stop nameplate.
Panel Plug		Round	A16ZT-3003	Used for covering the panel cutouts for future panel expansion. Degree of protection: IP40 Color: Black
Tightening Tool		—	A16Z-3004	Useful for repetitive mounting. Be careful not to tighten excessively.
Extractor			A16Z-5080	Convenient for extracting the Switch and Lamp.

G

Emergency Stop Devices

XER1022

Quick Link
S428
omron247.com

Rope Pull Emergency Stop Switch



- Rope spans up to 125 m (410 ft.) makes this switch ideal for applications where long rope spans are required
- Heavy-duty housing—the die-cast housing and stainless steel eye nut make the XER1022 suitable for demanding industrial applications
- IP67 (NEMA 6) enclosure enables the XER1022 switch to withstand water washdown cleaning
- Integral E-stop—the optional E-stop button provides emergency stopping capability at the extreme end of the installation and is field serviceable
- Tension indicator makes system setup and rope tension maintenance easy
- Contact arrangement of 1 N/C + 1 N/O
- Vibration tolerant—the snap-acting switch contacts protect against nuisance tripping due to vibration
- Long life—the XER1022 switch is designed for a minimum of one million actuations
- Reset button—the blue reset button must be pushed in order to return to "machine run" condition following switch actuation by a pulled or slacked rope
- Rubber bellows contain UV inhibitor making the switches suitable for outdoor applications

Emergency Stop Devices

XER1032

Quick Link
S429
omron247.com

Rope Pull Emergency Stop Switch



- Rope spans up to 200 m (656 ft.) makes this switch ideal for applications where long rope spans are required
- Heavy-duty housing—the die-cast housing and stainless steel eye nut make the XER1032 suitable for demanding industrial applications
- IP67 (NEMA 6) enclosure enables the XER1032 switch to withstand water washdown cleaning
- Integral E-stop—the optional E-stop button provides emergency stopping capability at the extreme end of the installation and is field serviceable
- Tension indicator makes system setup and rope tension maintenance easy
- Contact arrangement of 1 N/C + 1 N/O
- Vibration tolerant—the snap-acting switch contacts protect against nuisance tripping due to vibration
- Long life—the XER1032 switch is designed for a minimum of one million actuations
- Reset button—the blue reset button must be pushed in order to return to "machine run" condition following switch actuation by a pulled or slacked rope
- Rubber bellows contain UV inhibitor making the switches suitable for outdoor applications

XER6022 & XER6022-SS

Quick Link S432 omron247.com

Explosion-Proof Rope Pull Emergency Stop Switch

- Long Rope spans mean fewer number of switches required per application (80 m spans for XER6022; 100 m spans for XER6022-SS)
- Tension indicator makes system setup and rope tension maintenance easy
- Contact arrangements of 1 N/C + 1 N/O for XER6022
  Contact arrangements of 2 N/C or 1 N/C + 1 N/O for XER6022-SS
- IP67 (NEMA 6) enclosure withstands water washdown cleaning
- Heavy-duty housing is suitable for demanding industrial applications
- Reset button—the blue reset button must be pushed in order to return to "machine run" condition following switch actuation by a pulled or slacked rope
- Vibration tolerant—the snap-acting switch contacts protect against nuisance tripping due to vibration
- Optional E-stop button—may be added or replaced in the field
- Rubber bellows contain UV inhibitor making the switches suitable for outdoor applications
- Long life—designed for a minimum of one million actuations



XER6022-SS Quick Link S433 omron247.com

G

Safety Switches & Operator Controls

Contents

Selection Guide	H-2
Safety Limit Switches Plastic	
D4N	H-4
D4N-□R	H-12
Safety Limit Switches Metal	
D4B-□N	H-13
D4F	H-13
Safety Selector Switch	
A22TK	H-14
Enabling Switches	
A4EG	H-15
A4E	H-22
Two-Hand Control	
TouchStart™	H-23

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Selection Guide

Selecting the Switch & Operating Controls for Your Application

Selecting is Easy

The following questions will guide you to the appropriate models. Contact OMRON Automation and Safety for assistance.

Safety Limit Switch Selection

1 Do you need to detect the position of a sliding guard, robot or other movable device?

yes ↓

2 Do you require up to 4 sets of safety contacts or a compact metal housing?

yes → **Miniature Switch Body**
- D4F
  (30 x 70 mm)

no ↓

3 Do you require a full size metal body with up to 2 sets of contacts?

yes → **Metal Body Switch**
- D4B-□N
  (metal, 40 x 100 mm)

no ↓

4 Do you require a plastic switch with up to 3 sets of contacts?

yes → **Plastic Body Switch**
- D4N
  (plastic, 30 x 80 mm)

no ↓

5 Do you require a plastic switch with up to 3 sets of contacts and a manual reset for applications with over travel detection?

yes → **Pull-Reset Safety Limit Switch**
- D4N-□R
  (metal, 40 x 100 mm)

no ↓

Contact OMRON.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Selection Guide (continued)



Safety Selector Switch

A22TK

- Use for secure machine mode selection
- Trapped Key can be removed in left or right position (model specific)
- Same key as D4SL-NSK and D4JL



Enabling Switches

A4EG/A4E

- Switch is active in the middle position and is inactive when released or gripped
- Provide additional operator protection during setup, programming or servicing
- Available as a grip and switch assembly or just the switch for use with custom pendants



Two-Hand Control

TS - TouchStart

- Capacitive palm switches for two hand control applications
- Actuate with a soft touch, no physical pressure is required
- Sensitive enough to work even when an operator is wearing gloves



D4N

Quick Link
S238
omron247.com

Safety Limit Switch

- Upgraded safety limit switches based on the popular D4D, providing a full lineup conforming to international standards
- Lineup includes three contact models with 2NC/1NO and 3NC contact forms in addition to the previous contact forms 1NC/1NO, and 2NC. Models with MBB contacts are also available.
- M12-connector models are available, saving on labor and simplifying replacement
- Standardized gold-clad contacts provide high contact reliability. Can be used with both standard loads and microloads.
- Conforms to EN115, EN81-1, and EN81-2 (slow-action models only)
- Lineup includes both slow-action and snap-action models with Zb contacts
- Certified standards: UL, EN (TÜV), and CCC



Specifications

Standards and EC Directives

Conforms to the following EC Directives:

- Machinery Directive
- Low Voltage Directive
- EN50047
- EN60204-1
- EN1088
- GS-ET-15

Certified Standards

Certification body	Standard	File No.
TÜV SÜD	EN 60947-5-1 (certified direct opening)	Consult your representative for details.
UL *1	UL 508, CSA C22.2 No.14	E76675
CQC (CCC) *2	GB14048.5	2004010305105973

*1. Certification for CSA C22.2 No. 14 is authorized by the UL mark.
*2. Only certain models have been certified.

Certified Standard Ratings

TÜV (EN 60947-5-1), CCC (GB14048.5)

Item Utilization category	AC-15	DC-13
Rated operating current (Ie)	3 A	0.27 A
Rated operating voltage (Ue)	240 V	250 V

Note: Use a 10 A fuse type gI or gG that conforms to IEC 60269 as a short-circuit protection device. This fuse is not built into the Switch.

UL/CSA (UL 508, CSA C22.2 No. 14)
C300

Rated voltage	Carry current	Current (A)		Volt-amperes (VA)	
		Make	Break	Make	Break
120 VAC	10 A	60	6	7,200	720
240 VAC		30	3		

Q300

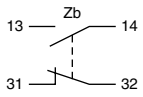
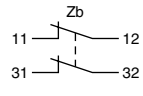
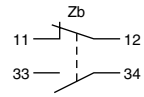
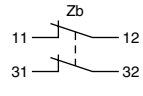
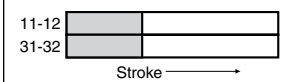
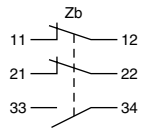
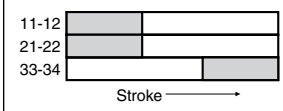
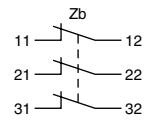
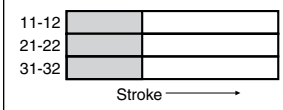
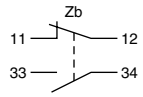
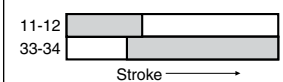
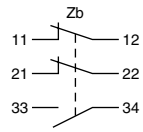
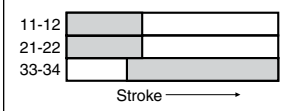
Rated voltage	Carry current	Current (A)		Volt-amperes (VA)	
		Make	Break	Make	Break
125 VDC	2.5 A	0.55	0.55	69	69
250 VDC		0.27	0.27		

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Connections

Contact Form

Model	Contact	Contact form	Operating pattern	Remarks
D4N-□1□	1NC/1NO (Snap-action)			Only NC contacts 31-32 have a certified direct opening mechanism. ⊖ The terminals 13-14 and 31-32 can be used as unlike poles.
D4N-□2□	2NC (Snap-action)			Only NC contacts 11-12 and 31-32 have a certified direct opening mechanism. ⊖ The terminals 11-12 and 31-32 can be used as unlike poles.
D4N-□A□	1NC/1NO (Slow-action)			Only NC contacts 11-12 have a certified direct opening mechanism. ⊖ The terminals 11-12 and 33-34 can be used as unlike poles.
D4N-□B□	2NC (Slow-action)			Only NC contacts 11-12 and 31-32 have a certified direct opening mechanism. ⊖ The terminals 11-12 and 31-32 can be used as unlike poles.
D4N-□C□	2NC/1NO (Slow-action)			Only NC contacts 11-12 and 21-22 have a certified direct opening mechanism. ⊖ The terminals 11-12, 21-22, and 33-34 can be used as unlike poles.
D4N-□D□	3NC (Slow-action)			Only NC contacts 11-12, 21-22, and 31-32 have a certified direct opening mechanism. ⊖ The terminals 11-12, 21-22, and 31-32 can be used as unlike poles.
D4N-□E□	1NC/1NO MBB* (Slow-action)			Only NC contacts 11-12 have a certified direct opening mechanism. ⊖ The terminals 11-12 and 33-34 can be used as unlike poles.
D4N-□F□	2NC/1NO MBB* (Slow-action)			Only NC contacts 11-12 and 21-22 have a certified direct opening mechanism. ⊖ The terminals 11-12, 21-22 and 33-34 can be used as unlike poles.

Terminals are numbered according to EN50013 and the contact forms are according to IEC947-5-1.
*MBB (Make Before Break) contacts have an overlapping structure, so that before the normally closed contact (NC) opens, the normally open contact (NO) closes.

Dimensions

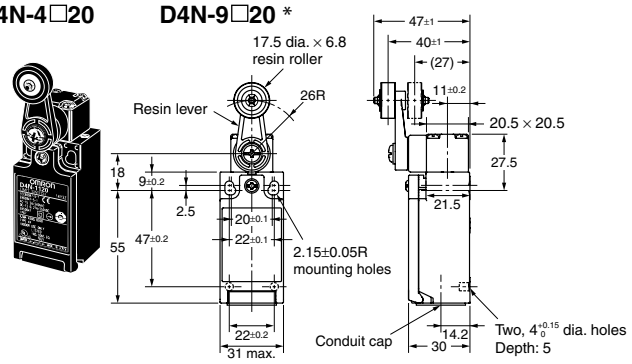
(mm)

Switches

1-conduit Models

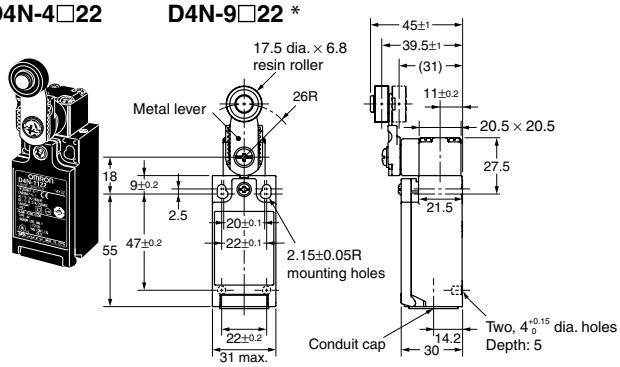
Roller Lever (Resin Lever, Resin Roller)

D4N-1□20 D4N-2□20
D4N-4□20 D4N-9□20 *



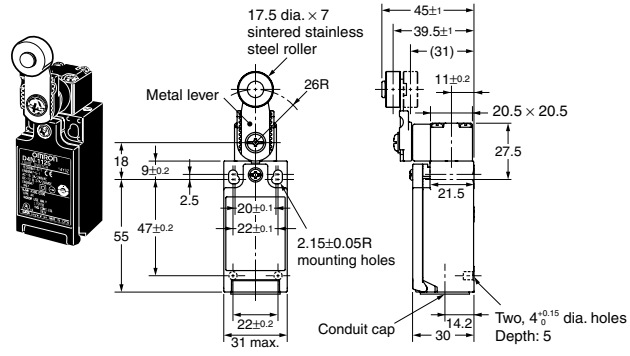
Roller Lever (Metal Lever, Resin Roller)

D4N-1□22 D4N-2□22
D4N-4□22 D4N-9□22 *



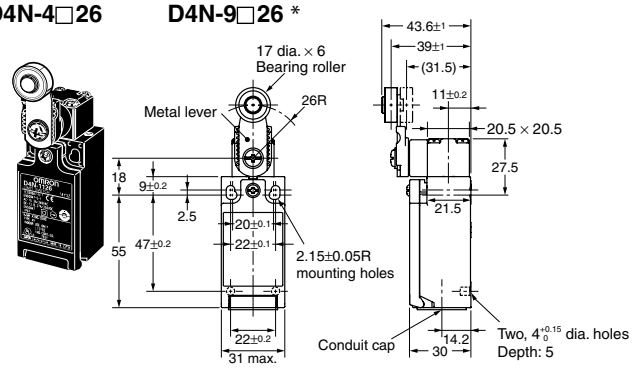
Roller Lever (Metal Lever, Metal Roller)

D4N-1□25 D4N-2□25
D4N-4□25 D4N-9□25 *



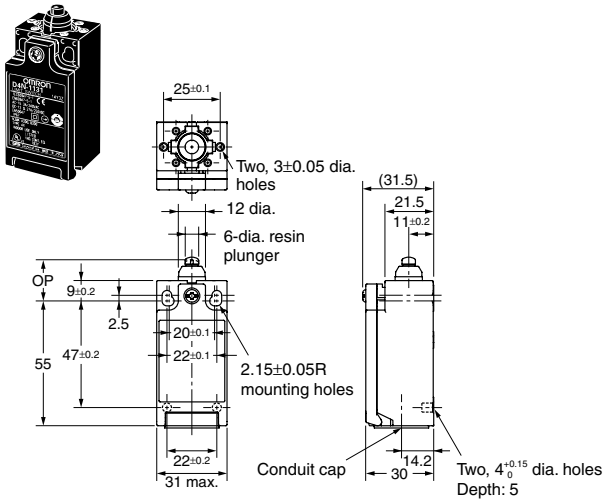
Roller Lever (Metal Lever, Bearing Roller)

D4N-1□26 D4N-2□26
D4N-4□26 D4N-9□26 *



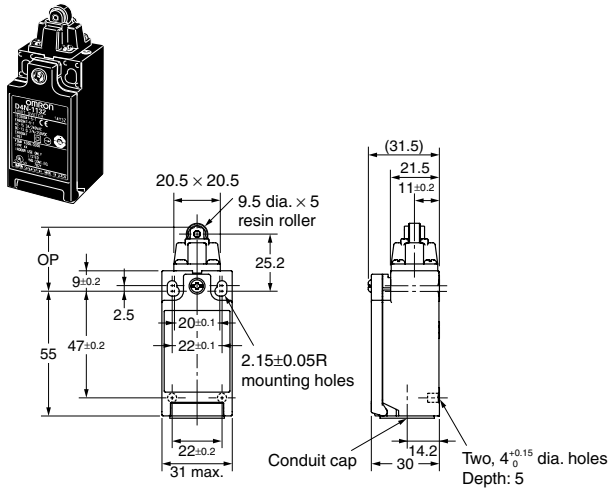
Plunger

D4N-1□31 D4N-2□31
D4N-4□31 D4N-9□31 *



Roller Plunger

D4N-1□32 D4N-2□32
D4N-4□32 D4N-9□32 *



Note: Each dimension has a tolerance of 0.4 mm unless otherwise specified.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

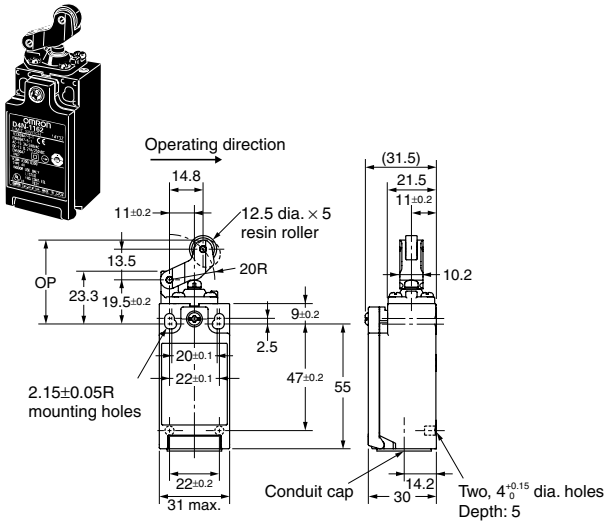
Dimensions (continued)

(mm)

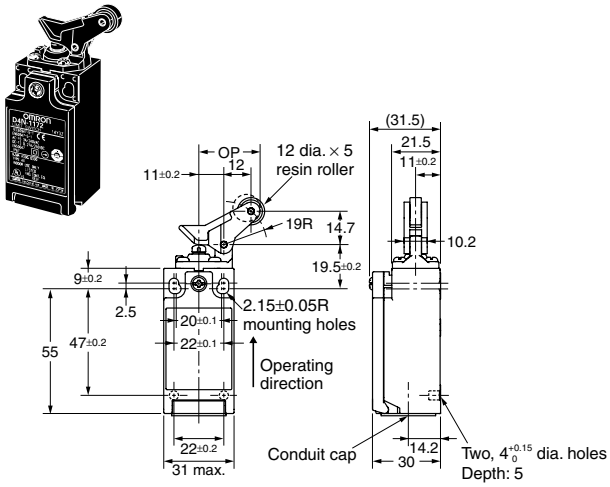
Switches

1-conduit Models

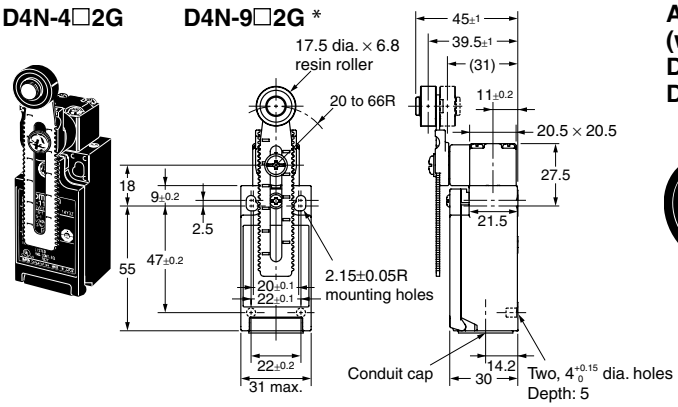
One-way Roller Arm Lever (Horizontal)
D4N-1□62 D4N-2□62
D4N-4□62 D4N-9□62 *



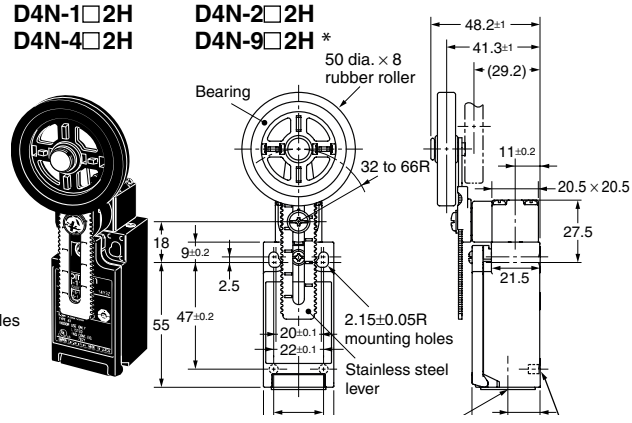
One-way Roller Arm Lever (Vertical)
D4N-1□72 D4N-2□72
D4N-4□72 D4N-9□72 *



Adjustable Roller Lever, Form Lock (with Metal Lever, Resin Roller)
D4N-1□2G D4N-2□2G
D4N-4□2G D4N-9□2G *



Adjustable Roller Lever, Form Lock (with Metal Lever, Rubber Roller)
D4N-1□2H D4N-2□2H
D4N-4□2H D4N-9□2H *



Note: Each dimension has a tolerance of 0.4 mm unless otherwise specified.

Dimensions (continued)

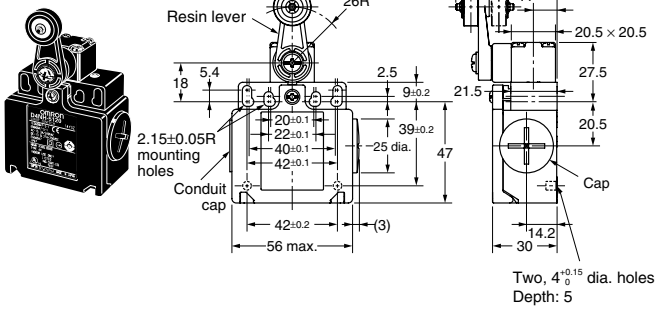
(mm)

Switches

2-conduit Models

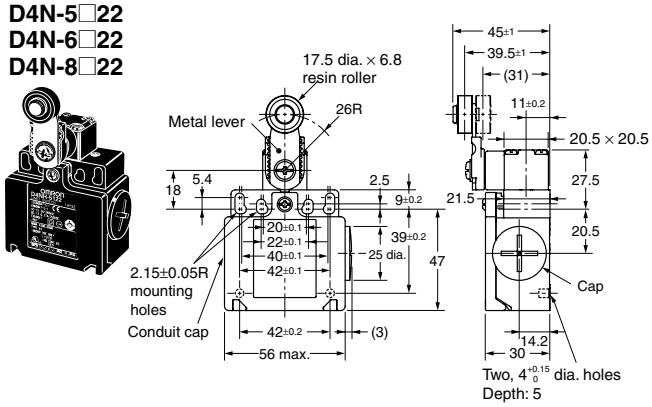
Roller Lever (Resin Lever, Resin Roller)

D4N-5□20
D4N-6□20
D4N-8□20



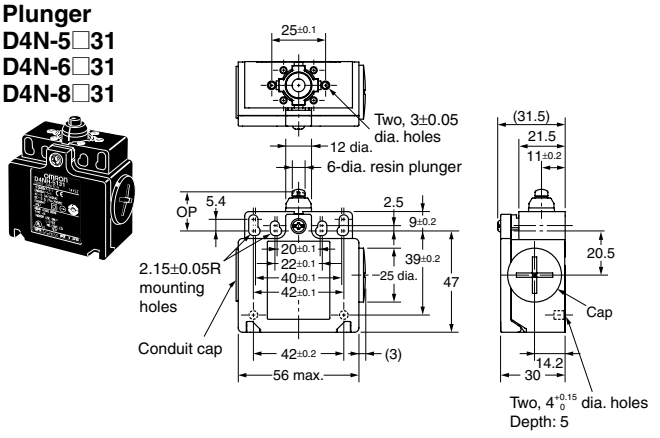
Roller Lever (Metal Lever, Resin Roller)

D4N-5□22
D4N-6□22
D4N-8□22



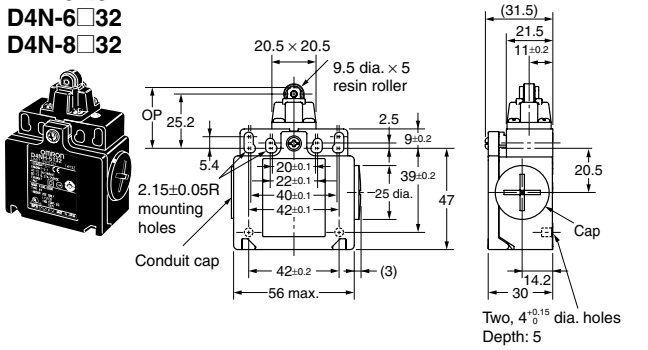
Plunger

D4N-5□31
D4N-6□31
D4N-8□31



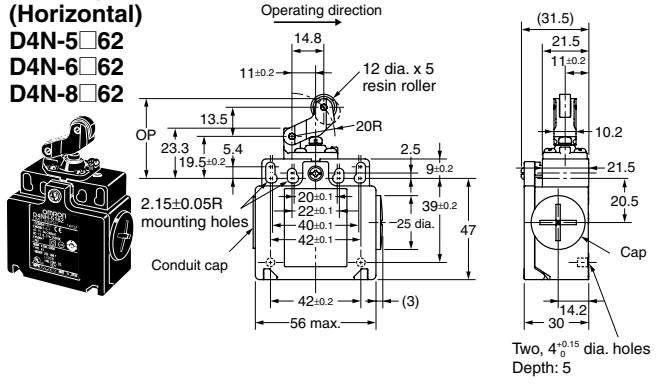
Roller Plunger

D4N-5□32
D4N-6□32
D4N-8□32



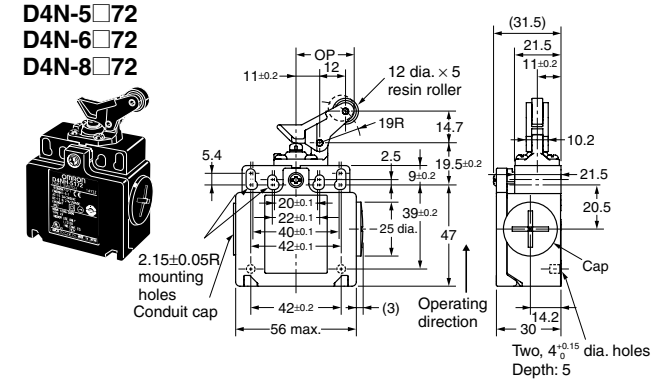
One-way Roller Arm Lever (Horizontal)

D4N-5□62
D4N-6□62
D4N-8□62



One-way Roller Arm Lever (Vertical)

D4N-5□72
D4N-6□72
D4N-8□72



Note: Each dimension has a tolerance of 0.4 mm unless otherwise specified.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

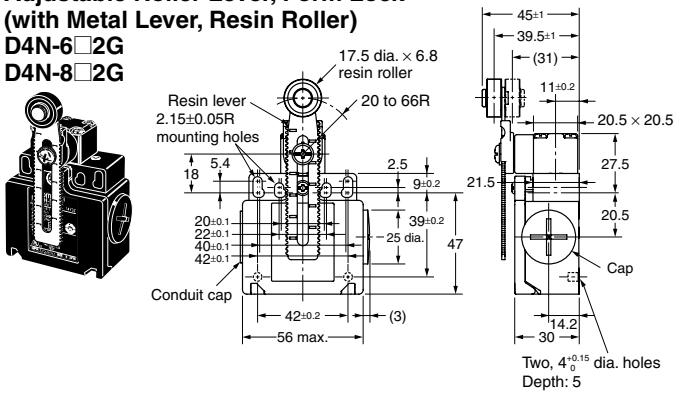
Dimensions (continued)

(mm)

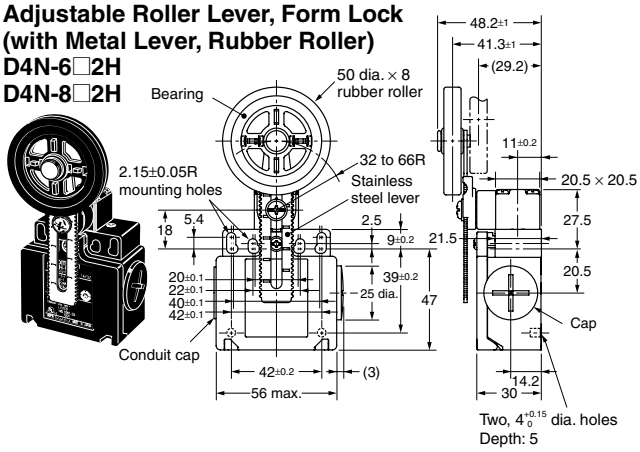
Switches

2-conduit Models

Adjustable Roller Lever, Form Lock (with Metal Lever, Resin Roller)
D4N-6□2G
D4N-8□2G

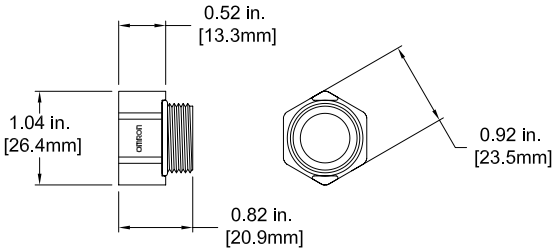


Adjustable Roller Lever, Form Lock (with Metal Lever, Rubber Roller)
D4N-6□2H
D4N-8□2H



Note: Each dimension has a tolerance of 0.4 mm unless otherwise specified.

M20-NPT Adapter



Ordering

Model Number Structure

D4N – □ □ □ - □
❶ ❷ ❸ ❹

❶ Conduit size
- 1: Pg13.5 (1-conduit)
- 2: G1/2 (1-conduit)
- 4: M20 (1-conduit)
- 6: G1/2 (2-conduit)
- 8: M20 (2-conduit)
- 9: M12 connector (1-conduit)

❷ Built-in Switch
- 1: 1NC/1NO (snap-action)
- 2: 2NC (snap-action)
- A: 1NC/1NO (slow-action)
- B: 2NC (slow-action)
- C: 2NC/1NO (slow-action)
- D: 3NC (slow-action)
- E: 1NC/1NO (MBB contact) (slow-action)
- F: 2NC/1NO (MBB contact) (slow-action)

❸ Head and Actuator
- 20: Roller lever (resin lever, resin roller)
- 22: Roller lever (metal lever, resin roller)
- 25: Roller lever (metal lever, metal roller)
- 26: Roller lever (metal lever, bearing roller)
- 2G: Adjustable roller lever, form lock (metal lever, resin roller)
- 2H: Adjustable roller lever, form lock (metal lever, rubber roller)
- 31: Top Plunger
- 32: Top Roller Plunger
- 62: One-way roller arm lever (horizontal)
- 72: One-way roller arm lever (vertical)
- 80: Cat whisker (not available for 2-conduit models)*
- 87: Plastic rod (not available for 2-conduit models)*
- RE: Fork lever lock (right operation) (not available for 2-conduit models)*
- LE: Fork lever lock (left operation) (not available for 2-conduit models)*

❹ M20-to-NPT Adapter
- Blank: Adapter is not included
- NPT: Adapter is included*

*Not available for 2-conduit models

Ordering (continued)

List of Models

Switches with Two Contacts (with Direct Opening Mechanism)

Actuator	Conduit size		Built-in switch mechanism							
			1NC/1NO (Snap-action)		2NC (Snap-action)		1NC/1NO (Slow-action)		2NC (Slow-action)	
			Model	Direct opening	Model	Direct opening	Model	Direct opening	Model	Direct opening
Roller lever (resin lever, resin roller) 	1-conduit	NPT	D4N-4120-NPT	⊖	D4N-4220-NPT	⊖	D4N-4A20-NPT	⊖	D4N-4B20-NPT	⊖
		M20	D4N-4120		D4N-4220		D4N-4A20		D4N-4B20	
		M12 connector	D4N-9120		D4N-9220		D4N-9A20		D4N-9B20	
	2-conduit	M20	D4N-8120	⊖	D4N-8220	⊖	D4N-8A20	⊖	D4N-8B20	⊖
Roller lever (metal lever, resin roller) 	1-conduit	NPT	D4N-4122-NPT	⊖	D4N-4222-NPT	⊖	D4N-4A22-NPT	⊖	D4N-4B22-NPT	⊖
		M20	D4N-4122		D4N-4222		D4N-4A22		D4N-4B22	
		M12 connector	D4N-9122		D4N-9222		D4N-9A22		D4N-9B22	
	2-conduit	M20	D4N-8122	⊖	D4N-8222	⊖	D4N-8A22	⊖	D4N-8B22	⊖
Roller lever (metal lever, metal roller) 	1-conduit	NPT	D4N-4125-NPT	⊖	D4N-4225-NPT	⊖	D4N-4A25-NPT	⊖	D4N-4B25-NPT	⊖
		M20	D4N-4125		D4N-4225		D4N-4A25		D4N-4B25	
		M12 connector	D4N-9125		D4N-9225		D4N-9A25		D4N-9B25	
Roller lever (metal lever, bearing roller) 	1-conduit	NPT	D4N-4126-NPT	⊖	D4N-4226-NPT	⊖	D4N-4A26-NPT	⊖	D4N-4B26-NPT	⊖
		M20	D4N-4126		D4N-4226		D4N-4A26		D4N-4B26	
		M12 connector	D4N-9126		D4N-9226		D4N-9A26		D4N-9B26	
Plunger 	1-conduit	NPT	D4N-4131-NPT	⊖	D4N-4231-NPT	⊖	D4N-4A31-NPT	⊖	D4N-4B31-NPT	⊖
		M20	D4N-4131		D4N-4231		D4N-4A31		D4N-4B31	
		M12 connector	D4N-9131		D4N-9231		D4N-9A31		D4N-9B31	
	2-conduit	M20	D4N-8131	⊖	D4N-8231	⊖	D4N-8A31	⊖	D4N-8B31	⊖
Roller plunger 	1-conduit	NPT	D4N-4132-NPT	⊖	D4N-4232-NPT	⊖	D4N-4A32-NPT	⊖	D4N-4B32-NPT	⊖
		M20	D4N-4132		D4N-4232		D4N-4A32		D4N-4B32	
		M12 connector	D4N-9132		D4N-9232		D4N-9A32		D4N-9B32	
	2-conduit	M20	D4N-8132	⊖	D4N-8232	⊖	D4N-8A32	⊖	D4N-8B32	⊖
One-way roller arm lever (horizontal) 	1-conduit	NPT	D4N-4162-NPT	⊖	D4N-4262-NPT	⊖	D4N-4A62-NPT	⊖	D4N-4B62-NPT	⊖
		M20	D4N-4162		D4N-4262		D4N-4A62		D4N-4B62	
		M12 connector	D4N-9162		D4N-9262		D4N-9A62		D4N-9B62	
	2-conduit	M20	D4N-8162	⊖	D4N-8262	⊖	D4N-8A62	⊖	D4N-8B62	⊖
One-way roller arm lever (vertical) 	1-conduit	NPT	D4N-4172-NPT	⊖	D4N-4272-NPT	⊖	D4N-4A72-NPT	⊖	D4N-4B72-NPT	⊖
		M20	D4N-4172		D4N-4272		D4N-4A72		D4N-4B72	
		M12 connector	D4N-9172		D4N-9272		D4N-9A72		D4N-9B72	
	2-conduit	M20	D4N-8172	⊖	D4N-8272	⊖	D4N-8A72	⊖	D4N-8B72	⊖
Adjustable roller lever, form lock (metal lever, resin roller) 	1-conduit	NPT	D4N-412G-NPT	⊖	D4N-422G-NPT	⊖	D4N-4A2G-NPT	⊖	D4N-4B2G-NPT	⊖
		M20	D4N-412G		D4N-422G		D4N-4A2G		D4N-4B2G	
		M12 connector	D4N-912G		D4N-922G		D4N-9A2G		D4N-9B2G	
	2-conduit	M20	D4N-812G	⊖	D4N-822G	⊖	D4N-8A2G	⊖	D4N-8B2G	⊖
Adjustable roller lever, form lock (metal lever, rubber roller) 	1-conduit	NPT	D4N-412H-NPT	⊖	D4N-422H-NPT	⊖	D4N-4A2H-NPT	⊖	D4N-4B2H-NPT	⊖
		M20	D4N-412H		D4N-422H		D4N-4A2H		D4N-4B2H	
		M12 connector	D4N-912H		D4N-922H		D4N-9A2H		D4N-9B2H	
	2-conduit	M20	D4N-812H	⊖	D4N-822H	⊖	D4N-8A2H	⊖	D4N-8B2H	⊖

Note: It's is recommended that M20 be used for Switches to be exported to Europe and NPT be used for Switches to be exported to North American countries.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering (continued)

List of Models

Switches with Three Contacts and MBB Contacts (with Direct Opening Mechanism)

Actuator	Conduit size		Built-in switch mechanism							
			2NC/1NO (Slow-action)		3NC (Slow-action)		1NC/1NO MBB (Slow-action)		2NC/1NO MBB (Slow-action)	
			Model	Direct opening	Model	Direct opening	Model	Direct opening	Model	Direct opening
Roller lever (resin lever, resin roller) 	1-conduit	NPT	D4N-4C20-NPT	⊖	D4N-4D20-NPT	⊖	D4N-4E20-NPT	⊖	D4N-4F20-NPT	⊖
		M20	D4N-4C20		D4N-4D20		D4N-4E20		D4N-4F20	
		M12 connector	–		–		D4N-9E20		–	
	2-conduit	M20	D4N-8C20	⊖	D4N-8D20	⊖	D4N-8E20	⊖	D4N-8F20	⊖
Roller lever (metal lever, resin roller) 	1-conduit	NPT	D4N-4C22-NPT	⊖	D4N-4D22-NPT	⊖	D4N-4E22-NPT	⊖	D4N-4F22-NPT	⊖
		M20	D4N-4C22		D4N-4D22		D4N-4E22		D4N-4F22	
		M12 connector	–		–		D4N-9E22		–	
	2-conduit	M20	D4N-8C22	⊖	D4N-8D22	⊖	D4N-8E22	⊖	D4N-8F22	⊖
Roller lever (metal lever, metal roller) 	1-conduit	NPT	D4N-4C25-NPT	⊖	D4N-4D25-NPT	⊖	D4N-4E25-NPT	⊖	D4N-4F25-NPT	⊖
		M20	D4N-4C25		D4N-4D25		D4N-4E25		D4N-4F25	
		M12 connector	–		–		D4N-9E25		–	
Roller lever (metal lever, bearing roller) 	1-conduit	NPT	D4N-4C26-NPT	⊖	D4N-4D26-NPT	⊖	D4N-4E26-NPT	⊖	D4N-4F26-NPT	⊖
		M20	D4N-4C26		D4N-4D26		D4N-4E26		D4N-4F26	
		M12 connector	–		–		D4N-9E26		–	
Plunger 	1-conduit	NPT	D4N-4C31-NPT	⊖	D4N-4D31-NPT	⊖	D4N-4E31-NPT	⊖	D4N-4F31-NPT	⊖
		M20	D4N-4C31		D4N-4D31		D4N-4E31		D4N-4F31	
		M12 connector	–		–		D4N-9E31		–	
	2-conduit	M20	D4N-8C31	⊖	D4N-8D31	⊖	D4N-8E31	⊖	D4N-8F31	⊖
Roller plunger 	1-conduit	NPT	D4N-4C32-NPT	⊖	D4N-4D32-NPT	⊖	D4N-4E32-NPT	⊖	D4N-4F32-NPT	⊖
		M20	D4N-4C32		D4N-4D32		D4N-4E32		D4N-4F32	
		M12 connector	–		–		D4N-9E32		–	
	2-conduit	M20	D4N-8C32	⊖	D4N-8D32	⊖	D4N-8E32	⊖	D4N-8F32	⊖
One-way roller arm lever (horizontal) 	1-conduit	NPT	D4N-4C62-NPT	⊖	D4N-4D62-NPT	⊖	D4N-4E62-NPT	⊖	D4N-4F62-NPT	⊖
		M20	D4N-4C62		D4N-4D62		D4N-4E62		D4N-4F62	
		M12 connector	–		–		D4N-9E62		–	
	2-conduit	M20	D4N-8C62	⊖	D4N-8D62	⊖	D4N-8E62	⊖	D4N-8F62	⊖
One-way roller arm lever (vertical) 	1-conduit	NPT	D4N-4C72-NPT	⊖	D4N-4D72-NPT	⊖	D4N-4E72-NPT	⊖	D4N-4F72-NPT	⊖
		M20	D4N-4C72		D4N-4D72		D4N-4E72		D4N-4F72	
		M12 connector	–		–		D4N-9E72		–	
	2-conduit	M20	D4N-8C72	⊖	D4N-8D72	⊖	D4N-8E72	⊖	D4N-8F72	⊖
Adjustable roller lever, form lock (metal lever, resin roller) 	1-conduit	NPT	D4N-4C2G-NPT	⊖	D4N-4D2G-NPT	⊖	D4N-4E2G-NPT	⊖	D4N-4F2G-NPT	⊖
		M20	D4N-4C2G		D4N-4D2G		D4N-4E2G		D4N-4F2G	
		M12 connector	–		–		D4N-9E2G		–	
	2-conduit	M20	D4N-8C2G	⊖	D4N-8D2G	⊖	D4N-8E2G	⊖	D4N-8F2G	⊖
Adjustable roller lever, form lock (metal lever, rubber roller) 	1-conduit	NPT	D4N-4C2H-NPT	⊖	D4N-4D2H-NPT	⊖	D4N-4E2H-NPT	⊖	D4N-4F2H-NPT	⊖
		M20	D4N-4C2H		D4N-4D2H		D4N-4E2H		D4N-4F2H	
		M12 connector	–		–		D4N-9E2H		–	
	2-conduit	M20	D4N-8C2H	⊖	D4N-8D2H	⊖	D4N-8E2H	⊖	D4N-8F2H	⊖

Note: It's is recommended that M20 be used for Switches to be exported to Europe and NPT be used for Switches to be exported to North American countries.

D4N-□R

Quick Link
S239
omron247.com

Pull-reset Safety Limit Switch

- A series of pull-reset models now available
- Lineup includes three contact models with 2NC/1NO and 3NC contact forms in addition to the previous contact forms 1NC/1NO and 2NC.
- M12-connector models are available, saving on labor and simplifying replacement.
- Standardized gold-clad contacts provide high contact reliability. Can be used with both standard loads and microloads.
- Conforms to EN115, EN81-1 and EN81-2.
- Certified standards: UL, EN (TÜV), and CCC

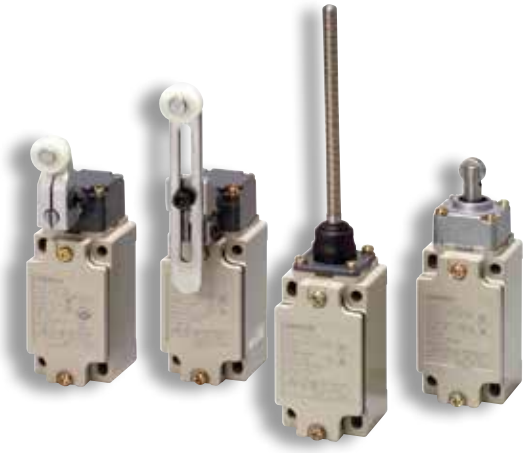


D4B-□N

Quick Link
S232
omron247.com

Safety Limit Switch

- Snap-action contact with certified direct opening operation.
- Direct opening mechanism (NC contacts only) added to enable opening contacts when faults occur, such as fused contacts.
- Safety of lever settings ensured using a mechanism that engages a gear between the operating position indicator plate and the lever.
- Equipped with a mechanism that indicates the applicable operating zone, as well as push-button switching to control left and right motion.
- Head seal structure strengthened to improve seal properties (TÜV: IEC IP67, UL: NEMA 3, 4, 4X, 6P, and 13).
- Wide standard operating temperature range: −40 to 80°C.
- Models with gold-plated contacts to enable handling microloads.
- Certified standards: UL, CSA, EN (TÜV), and CCC.



D4F

Quick Link
S235
omron247.com

Small Safety Limit Switch

- Smallest class of safety limit switches
- Extra small limit switch with a direct opening mechanism (four-contact model)
- High-sensitivity safety limit switch
- Four contacts in either 2NC + 2NO or 4NC versions
- Degree of protection: IP67 (EN60947-5-1)
- Certified standards: UL, EN (TÜV), and CC



A22TK

Quick Link
P655
omron247.com

Safety Key Selector Switch

- Key-type selector switch with direct opening mechanism
- Selector Switch for secure equipment activation during maintenance
- 30 types of exclusive keys make it more difficult to disable.
- The trapped key of the D4JL Guard Lock Safety-door Switch has the same shape as the locking key of the D4SL-SK10-LK Slide Key Unit. Units can be combined to improve safety. (Specify the same key type.)
- Common to the switch part of Emergency Stop Switch A22E. (Non-lighted model only)



Specifications

Ratings

Contacts (Standard Load)

Rated carry current (A)	Rated voltage (V)	Rated current (A)			
		AC15 (inductive load)	AC12 (resistive load)	DC13 (inductive load)	DC12 (resistive load)
10	24 VAC	10	10	—	—
	110 VAC	5	10		
	220 VAC	3	6		
	380 VAC	2	3		
	440 VAC	1	2		
	24 VDC	—	—	1.5	10
	110 VDC			0.5	2
	220 VDC			0.2	0.6
	380 VDC			0.1	0.2

Note:
1. Rated current values are determined according to the testing conditions. The above ratings were obtained by conducting tests under the following conditions.
   (1) Ambient temperature: 20°±2°C
   (2) Ambient humidity: 65±5%
   (3) Operating frequency: 20 operations/minute
2. Minimum applicable load: 10 mA at 5 VDC

Characteristics

Item		A22TK
Allowable operating frequency	Mechanical	30 operations/minute max.
	Electrical	30 operations/minute max.
Insulation resistance		100 MΩ min. (at 500 VDC)
Dielectric strength	Between terminals of same polarity	2,500 VAC, 50/60 Hz for 1 min.
	Between each terminal and ground	2,500 VAC, 50/60 Hz for 1 min.
Vibration resistance *1		10 to 55 Hz, 1.5 mm double amplitude (within 1 ms)
Shock resistance	Destruction	1000 m/s^2
	Malfunction *1	250 m/s^2 max.
Durability	Mechanical	100,000 operations min.
	Electrical	100,000 operations min.
Ambient operating temperature *2		-20 to +70°C
Ambient operating humidity		35% to 85%RH
Ambient storage temperature		-40 to +70°C
Degree of protection		IP65 *3
Electric shock protection class		Class II
PTI (tracking characteristic)		175
Degree of contamination		3 (EN60947-5-1)

*1. Malfunction within 1 ms.
*2. With no icing or condensation.
*3. The degree of protection from the front of the panel.

Note: 1. Do not allow the load current to exceed the rated value.
2. The contact ON/OFF timing is not synchronized. Confirm performance before application.
3. Once the contacts have been used to switch a load, however, they cannot be used to switch smaller loads. The contact surfaces will become rough once they have been used and contact reliability for smaller loads may be reduced.

Ordering

Model	Description
A22TK-2LL-02-K01	A22TK Base Model, 2 N/C, Left Key Release, Left N/C Closed, Key Included
A22TK-2LR-12-K01	A22TK Base Model, 1 N/O + 2 N/C, Left Key Release, Right N/C Closed, Key Included
A22TK-2RL-02-K01	A22TK Base Model, 2 N/C, RIGHT Key Release, Left N/C Closed, Key Included
A22TK-2RL-12-K01	A22TK Base Model, 1 N/O +2 N/C, Right Key Release, Left N/C Closed, Key Included

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

A4EG

Quick Link
P657
omron247.com

H

Enabling Grip Switch with Distinct Feel for Three Easily Discernible Positions

- The difficult task of configuring safety circuits is now easily achieved by combining the A4EG with the G9SX-GS.
- In addition to the standard models, the lineup also includes models with an emergency stop switch and models with a momentary operation switch.
- An optional Holding Key (sold separately) provides a versatile method for selecting modes.
- Equipped with conduit connector.



Specifications

Standards and EC Directives

Compliance with EC Directives and International Standards

- Low Voltage Directive
- GS-ET-22

Certified Standards

Certifying body	Standard	File No.
TÜV SÜD	EN 60947-5-1 (certified direct opening)	Ask your Omron representative.
UL *	UL 508, CSA C22.2 No.14	E76675
CQC (CCC)	GB 14048.5	Pending approval

Certification for CSA C22.2 No. 14 by UL is indicated by the registration mark.

Certified Standard Ratings (Enabling Switch Section)

TÜV (EN 60947-5-1)

Utilization category	AC-15	DC-13
Rated operating current (Ie)	0.75 A	0.55 A
Rated operating voltage (Ue)	240 V	125 V

Note: Use a 10 A fuse type gI or gG that conforms to IEC 60269 as the short-circuit protection device. The fuse is not built into the Switch

UL/CSA (UL 508, CSA C22.2 No.14), CCC (GB 14048.5)

- 24 VDC, 0.3 A (inductive load)
- 125 VAC, 1 A (resistive load)

Ratings

	Enabling switch	Emergency stop switch (A4EG-BE2R041 only)	Pushbutton (A4EG-BM2B041 only)
Rated insulation voltage	250 V		–
Rated ON current	2.5 A	5 A	0.1 A
Rated load	24 VDC, 0.3 A (inductive load) 125 VAC, 1 A (resistive load) EN certification rating: AC-15 0.75 A/240 V DC-13 0.55 A/125 V	General rating: 125 VAC, 5 A (resistive load) 250 VAC, 3 A (resistive load) 30 VDC, 3 A (resistive load) UL and cUL rating: 125 VAC, 5 A (inductive load, power factor: 0.75 to 0.8) 250 VAC, 3 A (inductive load, power factor: 0.75 to 0.8) 30 VDC, 3 A (resistive load) EN certification rating: AC-12 3 A/250 V DC-12 3 A/30 V	General rating: 125 VAC, 0.1 A (resistive load) 8 VDC, 0.1 A (resistive load) 14 VDC, 0.1 A (resistive load) 30 VDC, 0.1 A (resistive load) UL and cUL rating: 125 VAC, 0.1 A (resistive load) 30 VDC, 0.1 A (resistive load) EN certification rating: AC-12 0.1 A/125 V DC-12 0.1 A/30 V
Minimum applicable load	24 VDC, 4 mA		5 VDC, 1 mA

Specifications

Characteristics

	Enabling Switch	Emergency Stop Switch (A4EG-BE2R041 only)	Pushbutton (A4EG-BM2B041 only)
Degree of Protection:	IP66	IP65	IP65
Operating Section Strength:	Operating direction: 200 N, 1 min.	Operating direction: 367 N, 1 min. Rotating direction: 0.49 N-m, 1 min.	Operating direction: 50 N, 1 min.
Cable Pull Strength:	30 N, 1 min.	30 N, 1 min.	30 N, 1 min.
Allowable Operating Frequency			
Electrical:	20 operations/min. max.	10 operations/min. max. (set/reset for one operation)	60 operations/min. max.
Mechanical:	20 operations/min. max.	10 operations/min. max. (set/reset for one operation)	120 operations/min. max.
Electrical Durability (rated load):	100,000 operations min.	100,000 operations min. (set/reset for one operation)	100,000 operations min.
Mechanical Durability:	OFF-ON-OFF (direct opening): 100,000 operations min. OFF-ON: 1,000,000 operations min.	100,000 operations min. (set/reset for one operation)	2,000,000 operations min.
Dielectric Strength:			
Between terminals of the same polarity	2,500 VAC, 50/60 Hz, 1 min. (impulse voltage)	1,000 VAC, 50/60 Hz, 1 min.	1,000 VAC, 50/60 Hz, 1 min.
Between terminals of different polarities	2,500 VAC, 50/60 Hz, 1 min. (impulse voltage)	2,000 VAC, 50/60 Hz, 1 min.	2,000 VAC, 50/60 Hz, 1 min.
Between each terminal and non-current carrying metallic parts	2,500 VAC, 50/60 Hz, 1 min. (impulse voltage)	2,000 VAC, 50/60 Hz, 1 min.	2,000 VAC, 50/60 Hz, 1 min.
Insulation Resistance:	100 MΩ min. (at 500 VDC)		
Vibration Resistance:	Malfunction: 1.5 mm double amplitude, 10 to 55 Hz		
Shock Resistance:	Malfunction: 150 m/s max.		
Ambient Operating Temperature:	-10 to 55°C (with no icing or condensation)		
Ambient Operating Humidity:	35% to 85%		
Ambient Storage Temperature:	-25 to 65°C (with no icing or condensation)		
Protection Against Electric Shock:	Class II (double insulation)		
Pollution Degree (Operating Environment):	3 (EN 60947-5-1)		
Conditional Short-Circuit Current:	100 A (EN 60947-5-1)		

Note: The timing of contact outputs for two or more circuits is not synchronized. Confirm performance before application.
Specifications are subject to change without notice.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

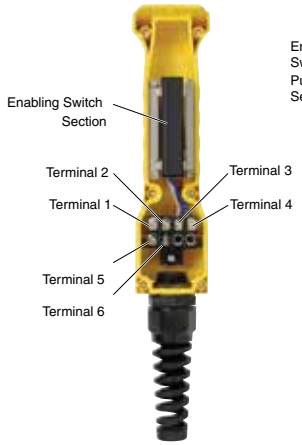
For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

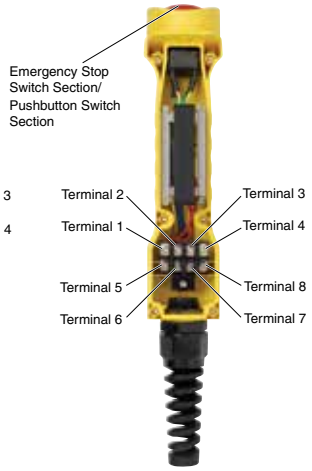
Structure and Nomenclature

Structure

A4EG-C000041



A4EG-BE2R041
A4EG-BM2B041



Contact Forms

Operating Patterns

A4EG-C000041

Operation	Terminal Number	Position 1 ▼	Position 2 ▼	Position 3 ▼
Enable output	1 to 2			□
	3 to 4			□
Grip output	5 to 6			□

A4EG-BE2R041

Operation	Terminal Number	Position 1 ▼	Position 2 ▼	Position 3 ▼
Enable output	1 to 2			□
	3 to 4			□

Pushbutton Switch	Terminal Number	Operation	Contact
Emergency stop switch output	5 to 6 7 to 8	Operation (push)	ON → OFF
		Reset (turn reset)	OFF → ON

A4EG-BM2B041

Operation	Terminal Number	Position 1 ▼	Position 2 ▼	Position 3 ▼
Enable output	1 to 2			□
	3 to 4			□

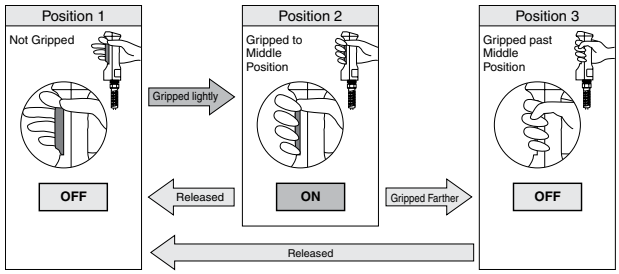
Pushbutton Switch	Terminal Number	Operation	Contact
Pushbutton switch output	5 to 6 (pushbutton switch A)*	Push	OFF → ON
	7 to 8 (pushbutton switch B)*	Push	OFF → ON

*Refer to Dimensions for information on the positions of pushbutton switches A and B.

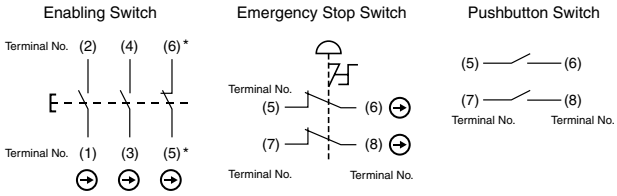
Open ON: Closed
Closed OFF: Open

Notes:
1. The contact ON/OFF timing is not synchronized. Confirm performance before application.
2. Direct opening only during grip.

Three Positions: OFF – ON – OFF



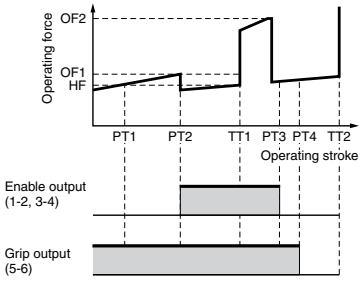
Contact Configurations



*Terminal No. (5), (6): A4EG-C000041 only.

Operating Characteristics

Chart (Enabling Switch Section)



Operating Stroke (Enabling Switch Section)

Operating Characteristics		Specified Value
Enable output (ON)	PT2 max.	3.6 mm
Max. enable holding position	TT1	Approx. 4.2 mm
Enable direct opening position	PT3 max.	6.0 mm
Max. stroke	TT2	Approx. 6.7 mm

Operating Force (Enabling Switch Section: Reference Values)

Operating Characteristics		Specified Value
Enable operating force	OF1 max.	14 N
Enable holding force	HF *	Approx. 8 N
Grip operating force	OF2 max.	40 N

*HF: Holding force

Operating Force (Emergency Stop Switch Section: Reference Values)

Operating Characteristics		Specified Value
Operating force	OF max.	14.7 N
Reset force	RF max.	0.1 N·m

Operating Force (Pushbutton Switch Section: Reference Value)

Operating Characteristics		Specified Value
Operating force	OF max.	4 N

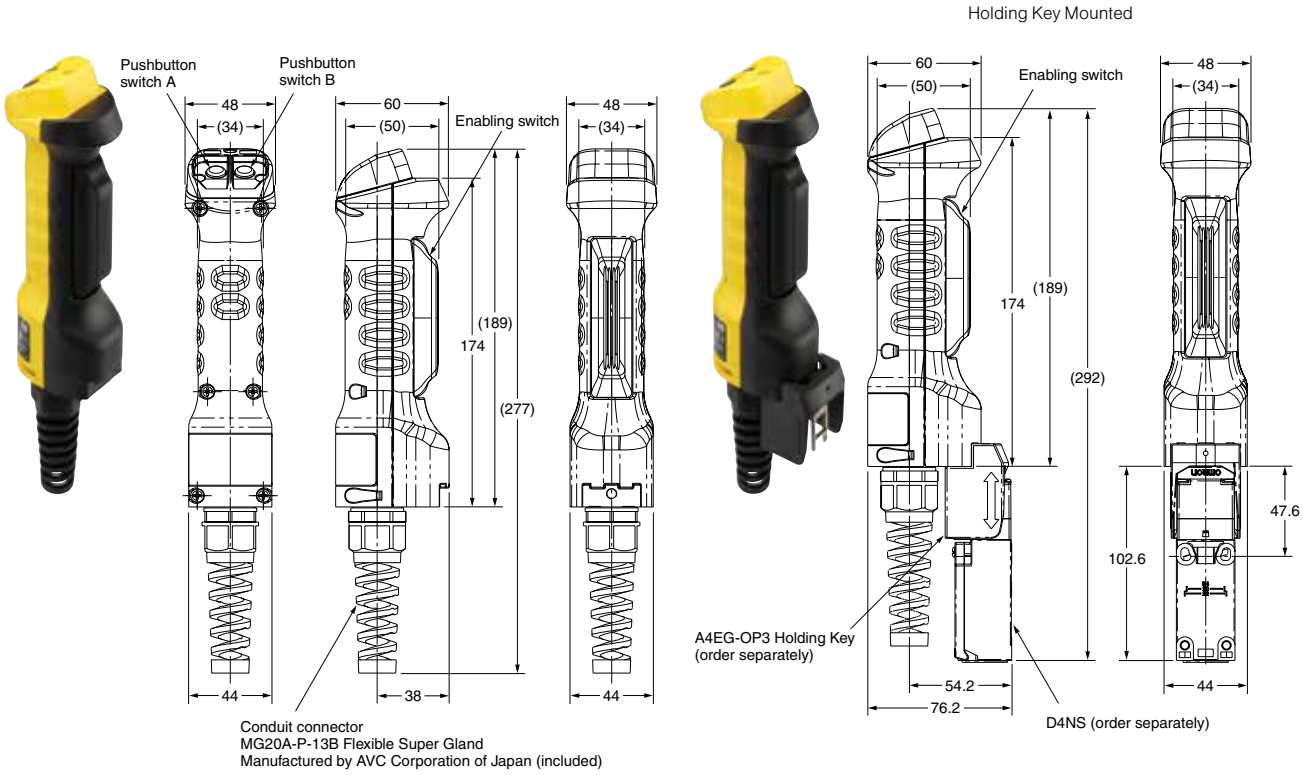
Dimensions

(mm)

Structure (continued)

A4EG-BM2B041

A4EG-C000041: Dimensions are similar to A4EG-BM2B041 without Pushbutton Switch.
A4EG-BE2R041: Dimensions are similar to A4EG-BM2B041. The A4EG-BE2R041 has an Emergency Stop Switch instead of a Pushbutton Switch.
See "Installation Manual" for A4EG-C000041 and A4EG-BE2R041 dimensions.



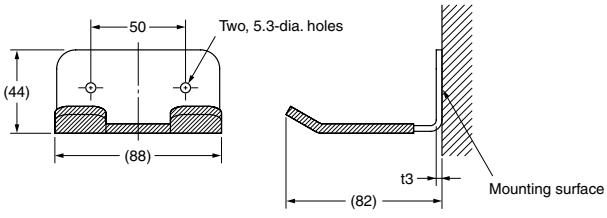
Accessories (Order Separately)

Rubber Cover (Replacement Part)
A4EG-OP1

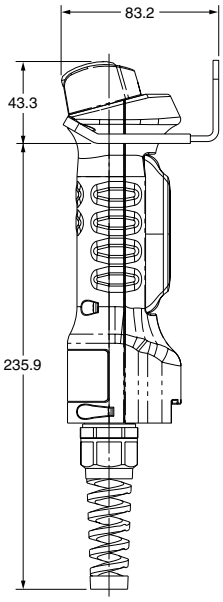


Mounting Bracket (for Securing the A4EG)
A4EG-OP2





Enabling Grip Switch Mounted



Holding Key
A4EG-OP3



Note: The screws are not included.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Application Example

Wiring Example

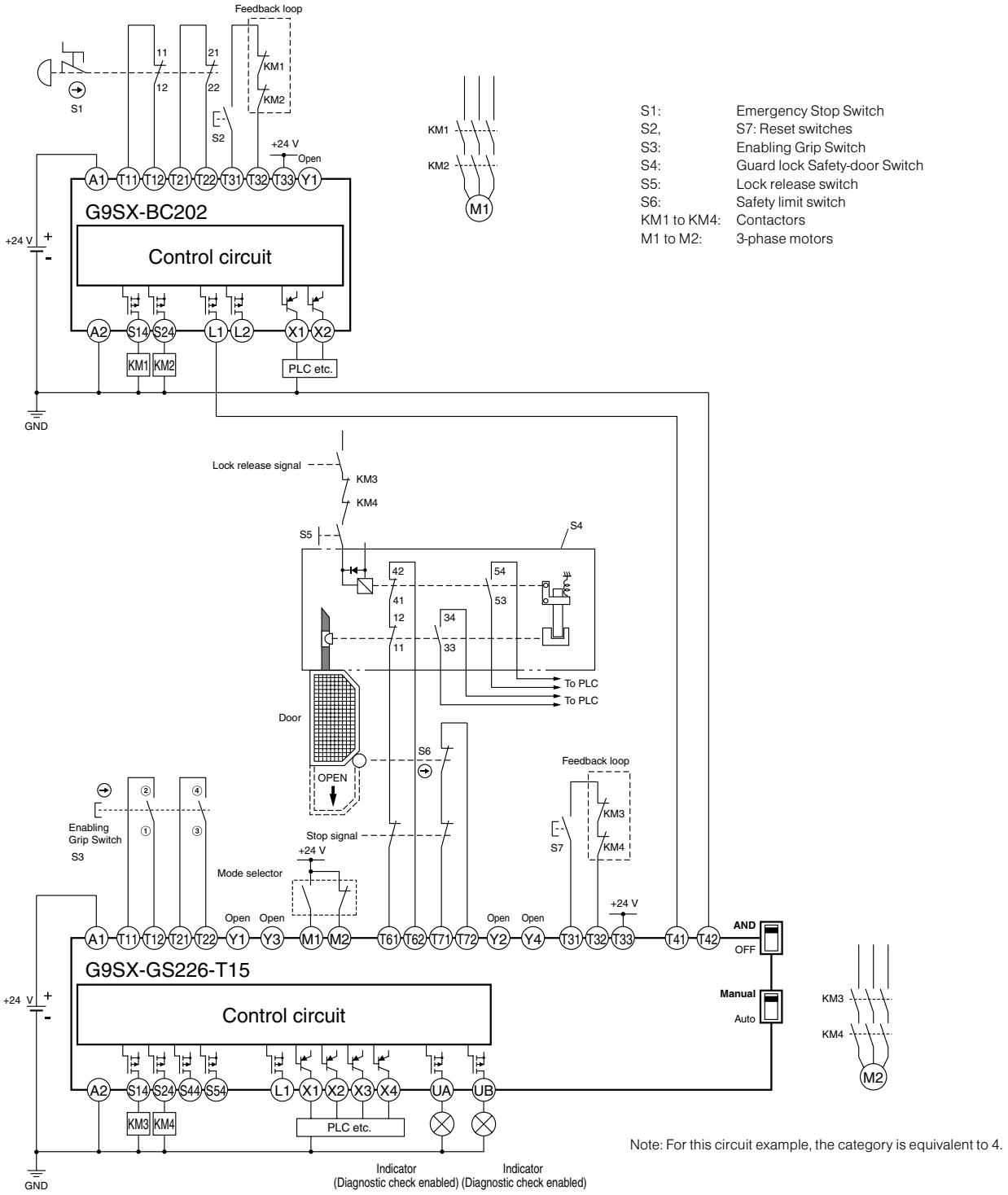
Settings

(For details, refer to section 3 of the G9SX User's Guide (Cat. No. Z255).)

G9SX-BC: Manual reset, cross fault detection: ON (category 4 wiring)

G9SX-GS: Manual reset, cross fault detection: ON (category 4 wiring),
logical AND connection setting: AND
ON-delay time setting: Time is set.
Switching mode: Manual
External indicator diagnosis: Enabled

Wiring Example



Note: For this circuit example, the category is equivalent to 4.

Ordering

Enabling Grip Switches

Appearance	Contact Form			Model
	Enabling Switch	Monitor Switch	Pushbutton Switch	
	Two contacts	1 NC (grip output)	None	A4EG-C000041
	Two contacts	None	Emergency stop switch (2 NC)	A4EG-BE2R041
	Two contacts	None	Momentary operation switch (2 NO)	A4EG-BM2B041

Accessories (Order Separately)

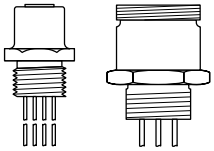
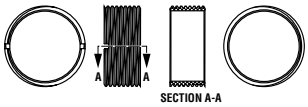
Appearance	Item	Model
	Rubber Cover	A4EG-OP1
	Mounting Bracket (for securing the A4EG)	A4EG-OP2
	Holding Key	A4EG-OP3

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering (continued)

Cabling Accessories (Order Separately)

Appearance	Cables	Model
	SC09-9M340, cable, 4-pin Micro Male, 10 m	44509-0340
	SC09-9M330, cable, 4-pin Mini Male, 10 m	44509-0330
	SC09-9M320, cable, 8-pin Mini Male, 9 m	44509-0320
	SC09-9M310, cable, 10-pin Mini Male, 9 m	44509-0310
	Extension Cables	
	SC09-10M140, Extension cord, 4-pin male mini / 4-pin female mini, 10 m	44509-0140
	SC09-10M142, Extension cord, 4-pin male micro / 4-pin female micro, 10 m	44509-0142
	SC09-10M180, Extension cord, 8-pin male mini / 8-pin female mini, 10 m	44509-0180
	SC09-10M110, Extension cord, 10-pin male mini / 10-pin female mini, 10 m	44509-0110
	Cable Receptacles	
	SC09-10M540, 4-pin Female Mini, 1/2" NPT, 18 AWG, 24 in. leads	44509-0540
	SC09-10M542, 4-pin Female Micro, 1/2" NPT, 18 AWG, 24 in. leads	44509-0542
	SC09-10M580, 8-pin Female Mini, 1/2" NPT, 18 AWG, 24 in. leads	44509-0580
	SC09-10M510, 10-pin Female Mini, 1/2" NPT, 18 AWG, 24 in. leads	44509-0510
	Couplings	
	MIN1-AC, Adapter Coupling (for use with 4-pin mini cables and extension cables)	44509-0210
	MIN2-AC, Adapter Coupling (for use with 8-pin mini cables and extension cables)	44509-0220
	MIN3-AC, Adapter Coupling (for use with 10-pin mini cables and extension cables)	44509-0230
	Shorting Plugs	
	SC09-SP40, 4-pin male mini style shorting plug (pins 1-2 and 3-4 are shorted)	44509-0640
	SC09-SP42, 4-pin male micro style shorting plug (pins 1-2 and 3-4 are shorted)	44509-0642
	SC09-SP80, 8-pin male mini style shorting plug (pins 1-2 and 3-4 are shorted)	44509-0680
	SC09-SP10, 10-pin male mini style shorting plug (pins 1-2 and 3-4 are shorted)	44509-0610

A4E

Quick Link
P658
omron247.com

3-position Enabling Switch for Safer Robot Operation

- Clicking feel
- Conforms to U.S. standards (ANSI/RIA R15.06-1999 (R2009)) for 3-position switches
- Can be mounted in two directions



Specifications

Certified Standards

Certification body	Standard	File No.
UL*	UL508	E76675
TÜV SÜD	EN60947 5-1 (certified direct opening) EN60947-5-8	Inquire
CQC (CCC)	GB14048.5	2003010305070634

*Certification for CSA C22.2 No. 14 by UL is indicated by the registration mark.

Certified Standard Ratings

TÜV (EN60947-5-1)

Utilization category	AC-15	DC-13
Rated operating current (Ie)	0.75 A	0.55 A
Rated operating voltage (Ue)	240 V	125 V

UL/CSA (UL508, CSA C22.2 No.14), CCC (GB 14048.5)
300 mA at 24 VDC (Inductive load)
1 A at 125 VAC (Resistive load)

Ratings

Rated insulation voltage	250 V
Rated ON current	2.5 A
Rated load	24 VDC, 300 mA (inductive load) 125 VAC, 1 A (resistive load)
Minimum applicable load	24 VDC, 4 mA
Impulse withstand voltage	4.0 kV between terminals of different polarity, 2.5 kV between terminals of same polarity
Ambient operating temperature	-10 to 55°C (with no icing)
Ambient operating humidity	35% to 85% (with no condensation)
Ambient storage temperature	-25 to 65°C

Characteristics

Insulation resistance	100 MΩ min. (at 500 VDC)
Contact resistance	100 mΩ max. (initial value)
Vibration resistance	10 to 55 Hz, 0.75 mm single amplitude min.
Shock resistance	150 m/s^2
Mechanical durability	OFF-ON: 1,000,000 operations min. OFF-ON-OFF (direct opening): 100,000 operations min.
Electrical durability	100,000 operations min.
Degree of protection	IP65 (rubber seal type only)

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

TouchStart™

Quick Link
S226
omron247.com

H

Capacitive Palm Button

- No physical pressure required to actuate switch—reduces the likelihood of wrist injury caused by repetitive motion.
- Excellent sensitivity—sensor is designed to operate even if operator is wearing gloves.
- RFI Immunity—special circuitry inhibits output in the presence of RFI that would otherwise cause false triggering of output.
- AC version is UL Recognized—meets the applicable requirements in the proposed first edition of UL 491.
- Saves time and money.
  - Easy mounting in a single hole.
  - Wiring is simplified because terminals are clearly identified and easily accessible.
  - No special power supplies are required because switch is available in either 120 VAC or 24 VDC versions.



Specifications

	TS-10 for 120 VAC; TS-20 for 24 VDC
Max Wiring Size:	14 AWG (1)
Housing Material:	Nory IN190
Weight:	313 g (11 oz.)
Actuation:	Hand sensitive requiring no pressure to initiate, operates with or without gloves
Power Supply TS-10: TS-20:	 120 VAC ±10%, 45 to 60 Hz 24 VDC ±10%
Power Consumption:	≤1 W
Indicator:	Red LED, illuminates when relays are energized
Output:	Two relays provide 1 set of normally open contacts, 1 set of normally closed contacts. Force-guided contacts are used.
Contact Ratings:	1 A at 250 VAC max resistive; 1 A @ 90 VDC max resistive
Mechanical Life:	Greater than 50 million operations
Electrical Life:	Greater than 5 million operations at loads less than 50 VA
Mechanical Shock:	45 g for 2 ms
Vibration:	4 g at f ≤60 Hz and amplitude ≤ 1 mm
Relative Humidity:	≤ 99%
Noise Protection:	Bursts to 2 kV, spikes of 500 V, electrostatic fields to 8 kV*
Weldfield Immunity:	Resistor welding up to 50 kA AC/DC (in suitable enclosure)*
RFI:	≤ 8 V/m
Protection:	IP64
Temperature Range:	-18 to 50°C (0 to 122°F)
Max Response Times:	On = 60 ms; Off = 80 ms
Approvals:	CE marked for all applicable directives, UL and C-UL

Specifications are subject to change without notice.

* If any of these values are exceeded, the TouchStart will default to a safe state (output relays de-energized). The TouchStart automatically resets when conditions fall below the limit.

Safety Monitoring Relays

Contents

Selection Guide	I-2
Safety Monitoring Relays	
G9SA	I-6
SR101A	I-12
SR103AM	I-13
SR104P	I-17
SR105E	I-17
SR106ED	I-21
SR108AD & SR109AD	I-18
SR120MP	I-21
SR125SMS45	I-22
SR131A	I-25
SR201A	I-25
SR203M & SR203AM	I-26
SR208AD & SR209AD	I-26
SR223SMT	I-27
SR231A	I-27
Flexible Safety Units/Dedicated Function	
G9SX	I-28
G9SX-GS	I-38
G9SX-SM	I-48
Force-guided Relays	
G7SA	I-49
G7S-□-E	I-55
Power Contactor with Mirror Contacts	
J7KNA-AR	I-58
G7Z	I-62

Selection Guide

Selecting a Monitoring Relay for Your Application



Choosing the Proper Model in a Few Selection Steps

Safety monitoring relays range in function from two-hand palm button control to dual channel input units with time-delayed outputs that provide conformity to ANSI B11.19-2010, Section 6 for Performance of the Safety Related Function(s).

The following questions and charts will guide you from the various capabilities and features to the proper model number.

1 Does the application require two dual channel inputs?

Yes: See Chart Below
No: Go to Question 2

Relay Model	Terminals	Inputs †	Outputs: Safety N/O	Outputs: Aux. N/C	Outputs: Solid State Aux.	Outputs: Safety Delayed N/O	Outputs: Safety Delayed N/C	Operating Voltage: 24 DC	Operating Voltage: 24 AC	Operating Voltage: 120 AC	Operating Voltage: 200 AC	Operating Voltage: 230 AC	Catalog Page
Safety Monitoring Relays													
SR131A	Fixed	(2) 1 N/C + 1 N/O	2	–	2	–	–	●	–	–	–	–	I-25
SR231A	Removable	(2) 1 N/C + 1 N/O	2	–	2	–	–	●	–	–	–	–	I-27

2 Does the application require one single channel or one dual channel input?

Yes: See Chart Below
No: Go to Question 3

Relay Model	Terminals	Inputs †	Outputs: Safety N/O	Outputs: Aux. N/C	Outputs: Solid State Aux.	Outputs: Safety Delayed N/O	Outputs: Safety Delayed N/C	Operating Voltage: 24 DC	Operating Voltage: 24 AC	Operating Voltage: 120 AC	Operating Voltage: 200 AC	Operating Voltage: 230 AC	Catalog Page
Safety Monitoring Relays													
SR101A	Fixed	1 N/C, Supply Voltage	2	–	–	–	–	●	●	●	–	–	I-12
G9SA-301[1]	Fixed	1 N/C, 2 N/C, PNP	3	1	–	–	–	●	●	●	–	●	I-6
G9SA-501[1]	Fixed	1 N/C, 2 N/C, PNP	5	1	–	–	–	●	●	●	–	●	I-6
SR103AM	Fixed	1 N/C, 2 N/C, PNP	3	1	–	–	–	●	●	●	–	–	I-13
SR201A	Removable	1 N/C, Supply Voltage	3	–	1	–	–	●	●	●	–		I-25
SR203M/AM	Removable	1 N/C, 2 N/C, PNP	3	1	–	–	–	●	●	●	–		I-26

Notes:
† Codes: PNP = light curtain, 2H = two-hand control
[1] Dedicated expansion module available
● = Available ■ = Available on special order

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Selection Guide (continued)

3 Does the application require the ability to accept input from a variety of safety devices such as E-stops, interlocks or light curtains?

Yes: See Chart Below
No: Go to Question 4

Relay Model	Terminals	Inputs †	Outputs: Safety N/O	Outputs: Aux. N/C	Outputs: Solid State Aux.	Outputs: Safety Delayed N/O	Outputs: Safety Delayed N/C	Operating Voltage: 24 DC	Operating Voltage: 24 AC	Operating Voltage: 120 AC	Operating Voltage: 200 AC	Operating Voltage: 230 AC	Catalog Page
Multi-Input Safety Monitoring Relays													
SR120MP	Fixed	1 N/C, 2 N/C, PNP	3	1	4	–	–	●	●	●	–	■	I-21

4 Does the application require single or dual channel inputs with 2 or 3 delayed safety outputs?

Yes: See Chart Below
No: Go to Question 5

Relay Model	Terminals	Inputs †	Outputs: Safety N/O	Outputs: Aux. N/C	Outputs: Solid State Aux.	Outputs: Safety Delayed N/O	Outputs: Safety Delayed N/C	Operating Voltage: 24 DC	Operating Voltage: 24 AC	Operating Voltage: 120 AC	Operating Voltage: 200 AC	Operating Voltage: 230 AC	Catalog Page
Safety Monitoring Relays with Delayed Outputs													
G9SA-321[1]	Fixed	1 N/C, 2 N/C, PNP	3	1	–	2	–	●	●	●	–	■	I-6
SR108AD	Fixed	1 N/C, 2 N/C, PNP	2	–	–	2	–	●	●	–	–	–	I-18
SR109AD	Fixed	1 N/C, 2 N/C, PNP	3	–	–	1	–	●	●	–	–	–	I-18
SR208AD	Removable	1 N/C, 2 N/C, PNP	2	–	–	3	–	●	●	●	–	■	I-26
SR209AD	Removable	1 N/C, 2 N/C, PNP	2	–	–	2	1	●	●	●	–	■	I-26

5 Does the application require the monitoring of two-hand palm buttons?

Yes: See Chart Below
No: Go to Question 6

Relay Model	Terminals	Inputs †	Outputs: Safety N/O	Outputs: Aux. N/C	Outputs: Solid State Aux.	Outputs: Safety Delayed N/O	Outputs: Safety Delayed N/C	Operating Voltage: 24 DC	Operating Voltage: 24 AC	Operating Voltage: 120 AC	Operating Voltage: 200 AC	Operating Voltage: 230 AC	Catalog Page
Two Hand Controls													
G9SA-TH301[1]	Fixed	1 N/C + 1 N/O	3	1	–	–	–	●	●	●	–	●	I-6
SR104P	Fixed	1 N/C + 1 N/O	2	–	–	–	–	●	●	●	–	–	I-17

(Continued on next page)

Notes:
† Codes: PNP = light curtain, 2H = two-hand control
[1] Dedicated expansion module available
● = Available ■ = Available on special order

Selection Guide (continued)

6 Does the application require an expansion module?

Yes: See Chart Below
No: Go to Question 7

Relay Model	Terminals	Inputs †	Outputs: Solid State: Safety N/O	Solid State: Aux. N/C	Solid State: Safety	Solid State: Aux.	Solid State: Safety Delayed	Safety Delayed: N/O	Safety Delayed: N/C	Operating Voltage: 24 DC	24 AC	120 AC	230 AC	Catalog Page
Expansion Units														
G9SA-EX031	Fixed	Dedicated	–	–	–	–	–	3	1	–	–	–	–	I-6
G9SA-EX301	Fixed	Dedicated	3	1	–	–	–	–	–	–	–	–	–	I-6
SR105E	Fixed	1 N/C, PNP	3	1	–	–	–	–	–	●	●	●	–	I-17
SR106ED	Fixed	1 N/C, PNP	–	1	–	–	–	3	–	●	●	●	–	I-21
G9SX-EX041	Removable	Dedicated	–	–	–	1	–	4	–	●	–	–	–	I-28
G9SX-EX401	Removable	Dedicated	4	–	–	1	–	–	–	●	–	–	–	I-28

7 Does the application require stop motion sensing or time “on-delay” after initiation of stop command?

Yes: See Chart Below
No: Go to Question 8

Relay Model	Terminals	Inputs †	Outputs: Solid State: Safety N/O	Solid State: Aux. N/C	Solid State: Safety	Solid State: Aux.	Solid State: Safety Delayed	Safety Delayed: N/O	Safety Delayed: N/C	Operating Voltage: 24 DC	24 AC	120 AC	230 AC	Catalog Page
Stop Motion Sensing Units														
SR125SMS45	Fixed	Back EMF	1 N/O 1 N/C	–	–	2	–	–	–	●	–	●	■	I-22
SR223SMT	Removable	Time Delay	–	–	–	2	–	1	2	●	●	●	■	I-27
G9SX-SM	Removable	Back EMF	–	–	3	2	–	–	–	●	–	–	–	I-48

8 Does the application require a modular safety system?

Yes: See Chart Below
No: Please contact Omron.

Relay Model	Terminals	Inputs †	Outputs: Solid State: Safety N/O	Solid State: Aux. N/C	Solid State: Safety	Solid State: Aux.	Solid State: Safety Delayed	Safety Delayed: N/O	Safety Delayed: N/C	Operating Voltage: 24 DC	24 AC	120 AC	230 AC	Catalog Page
Modular Safety Relays														
G9SX-ADA222[1]	Removable	1 N/C, 2 N/C, PNP	–	–	2	2	2	–	–	●	–	–	–	I-28
G9SX-AD322[1]	Removable	1 N/C, 2 N/C, PNP	–	–	3	2	2	–	–	●	–	–	–	I-28
G9SX-BC202	Removable	1 N/C, 2 N/C, PNP	–	–	2	2	–	–	–	●	–	–	–	I-28
G9SX-GS[1]	Removable	1 N/C, 2 N/C, PNP	–	–	2	6	2	–	–	●	–	–	–	I-38

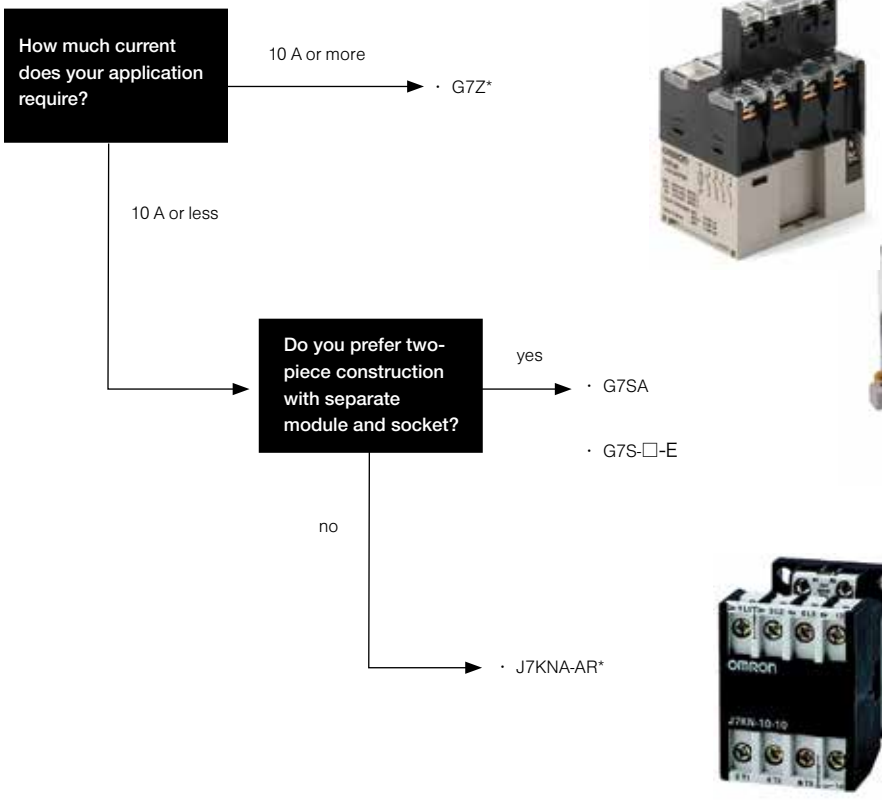
Notes:
† Codes: PNP = light curtain, 2H = two-hand control
[1] Dedicated expansion module available
● = Available ■ = Available on special order

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Selection Guide (continued)

Selecting Force-Guided Relays & Power Contactors





*These are Industrial Control products.

Force-Guided Relays

Relay Series	Construction	Mounting	Poles	Rated Carry Current	Solenoid Voltage	Built in Coil Suppression	LED Indicator	Catalog Page Number
G7SA	Socket & Module	DIN Rail/PCB	4 - 6	6 A	24 VDC	—	Optional	I-49
G7S-□-E	Socket & Module	DIN Rail/PCB	4 - 6	10 A	24 VDC	—	—	I-55

Power Relays with Mirror Contacts

Mirror contacts are approved for monitoring of Safety Circuits.

Relay Series	Construction	Mounting	Poles	Rated Carry Current	Solenoid Voltage	Built in Coil Suppression	LED Indicator	Catalog Page Number
J7KNA-AR	Modules	DIN Rail	5 - 8	10 A	24 VDC, 110 VAC, 230 VAC	24 VDC models only	—	I-58
G7Z	Modules	DIN Rail	6	40 A	12 - 24 VDC	—	—	I-62

G9SA

Quick Link
S354
omron247.com

Safety Relay Unit

- Four kinds of 45-mm wide units are available:
  A 3-pole model, a 5-pole model, and models with 3 poles and 2 OFF-delay poles, as well as a two-hand controller.
  Also available are 17.5 mm wide expansion units with 3 poles and 3 OFF-delay poles.
- Simple expansion connection
- OFF-delay models have 15-step OFF-delay settings
- Conforms to EN standards (BG approval)
- Both DIN track mounting and screw mounting are possible



Specifications

Ratings

Power Input

	G9SA-301/TH301	G9SA-501	G9SA-321-T□
Power supply voltage	24 VAC/VDC:24 VAC, 50/60 Hz, or 24 VDC 100 to 240 VAC:100 to 240 VAC, 50/60 Hz		
Operating voltage range	85% to 110% of rated power supply voltage		
Power consumption *	24 VAC/VDC: 1.8 VA/ 1.7 W max. 100 to 240 VAC: 9 VA max.	24 VAC/VDC: 2.8 VA/ 2.6 W max. 100 to 240 VAC: 11 VA max.	24 VAC/VDC: 3.5 VA/ 3.3 W max. 100 to 240 VAC: 12.5 VA max.

*When an Expansion Unit is connected, the power consumption is increased by 2 VA/2 W max.

Inputs

	G9SA-301/321-T□/TH301	G9SA-501
Input current *	40 mA max.	60 mA max.

* When an Expansion Unit is connected, the input current is increased by 30 mA max.

Contacts

	G9SA-301/501/321-T□/TH301/EX301/EX031-T□
	Resistive load
Rated load	250 VAC, 5 A 30 VDC, 5 A
Rated carry current	5 A

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Specifications (continued)

Characteristics

		G9SA-301/TH301	G9SA-501/321-T□	G9SA-EX301/EX031-T□
Contact resistance *1		100 mΩW		
Operating time *2		30 ms max.		
Response time *3		10 ms max.		
Insulation resistance *4		100 MΩ min. (at 500 VDC)		
Dielectric strength	Between different outputs	2,500 VAC, 50/60 Hz for 1 min		
	Between inputs and outputs			
	Between power inputs and outputs			
	Between power inputs and other inputs (only for 100 to 240-V models)			
Vibration resistance		10 to 55 to 10 Hz, 0.375 mm single amplitude (0.75 mm double amplitude)		
Shock resistance	Destruction	300 m/s²		
	Malfunction	100 m/s²		
Durability *5	Mechanical	5,000,000 operations min. (at approx. 7,200 operations/hr)		
	Electrical	100,000 operations min. (at approx. 1,800 operations/hr)		
Failure rate (P Level) (reference value)		5 VDC, 1 mA		
Ambient operating temperature		-25 to 55°C (with no icing or condensation)		
Ambient operating humidity		35% to 85%		
Terminal tightening torque		0.98 N·m		
Weight *6		Approx. 210 g	Approx. 270 g	Approx. 130 g

*1. The contact resistance was measured with 1 A at 5 VDC using the voltage-drop method.

*2. Not including bounce time.

*3. The response time is the time it takes for the main contact to open after the input is turned OFF. Includes bounce time.

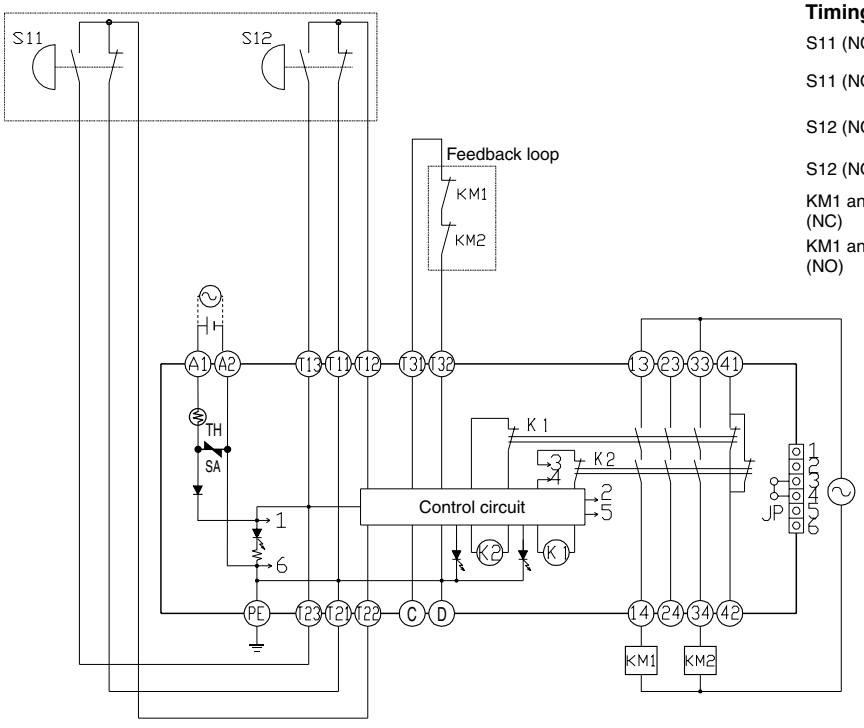
*4. The insulation resistance was measured with 500 VDC at the same places that the dielectric strength was checked.

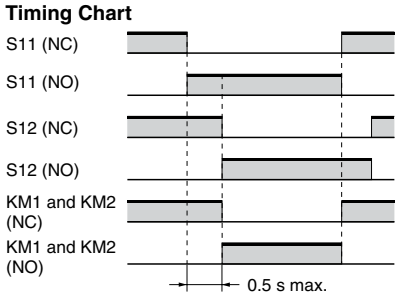
*5. The durability is for an ambient temperature of 15 to 35°C and an ambient humidity of 25% to 75%.

*6. Weight shown is for 24-VAC/VDC type. For 100 to 240 VAC type, add approximately 20 g.

Applications

G9SA-TH301 (24 VDC) with 2-hand Inputs





Input time difference operates only when the difference is 0.5 s max.

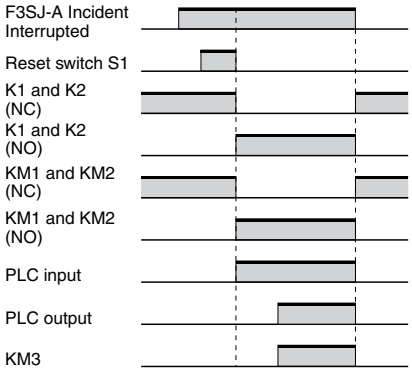
S11, S12: Two-hand pushbutton switches
KM1 and KM2: Magnetic Contactor

Note: 1. Use a 1NC+1NO switch for S11 and S12.
2. This circuit achieves Safety Category 4.

Applications (continued)

G9SA-301 (24 VAC/VDC) with 2-channel Safety Sensor/Manual Reset

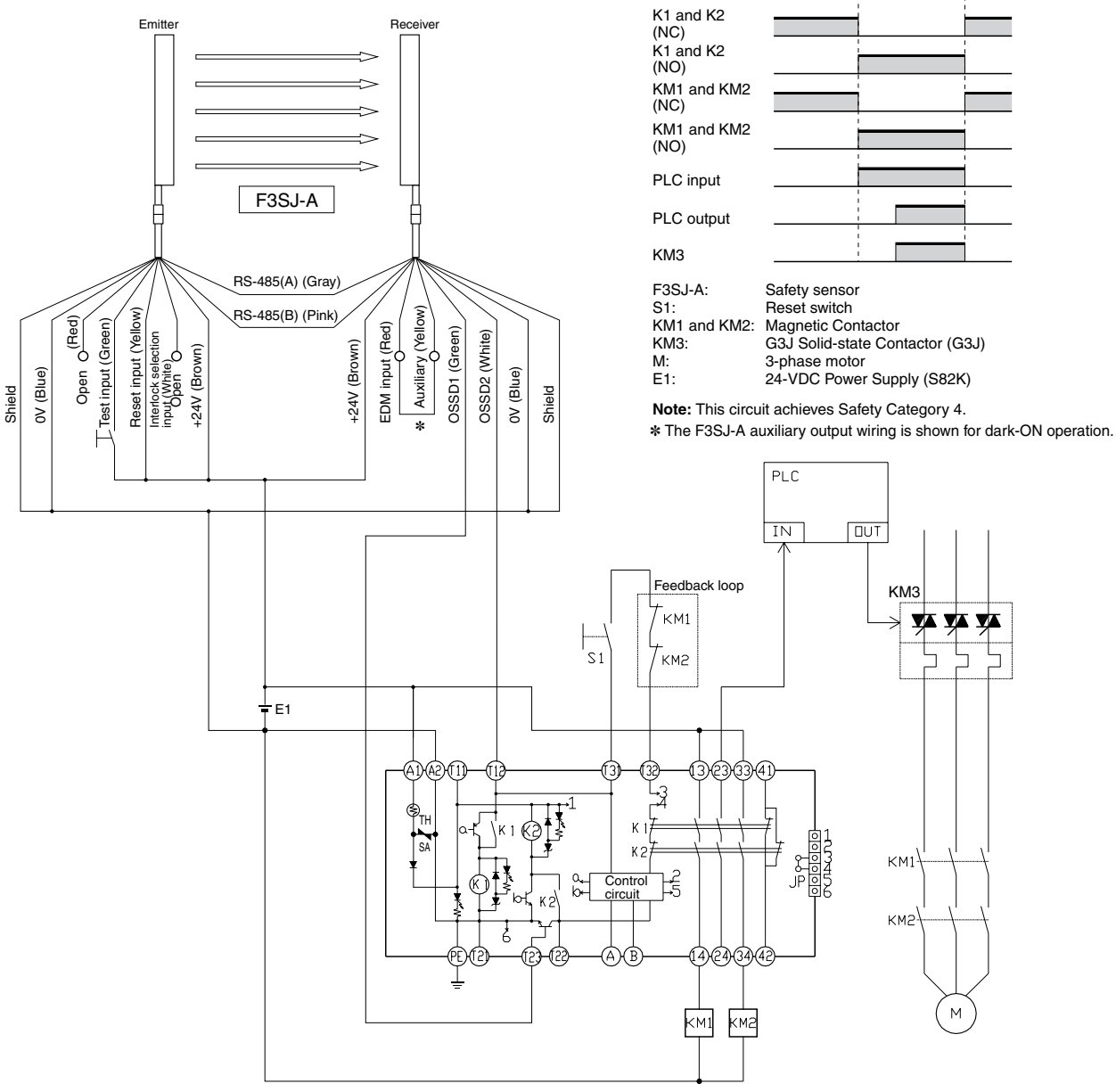
Timing Chart



F3SJ-A: Safety sensor
S1: Reset switch
KM1 and KM2: Magnetic Contactor
KM3: G3J Solid-state Contactor (G3J)
M: 3-phase motor
E1: 24-VDC Power Supply (S82K)

Note: This circuit achieves Safety Category 4.

✻ The F3SJ-A auxiliary output wiring is shown for dark-ON operation.

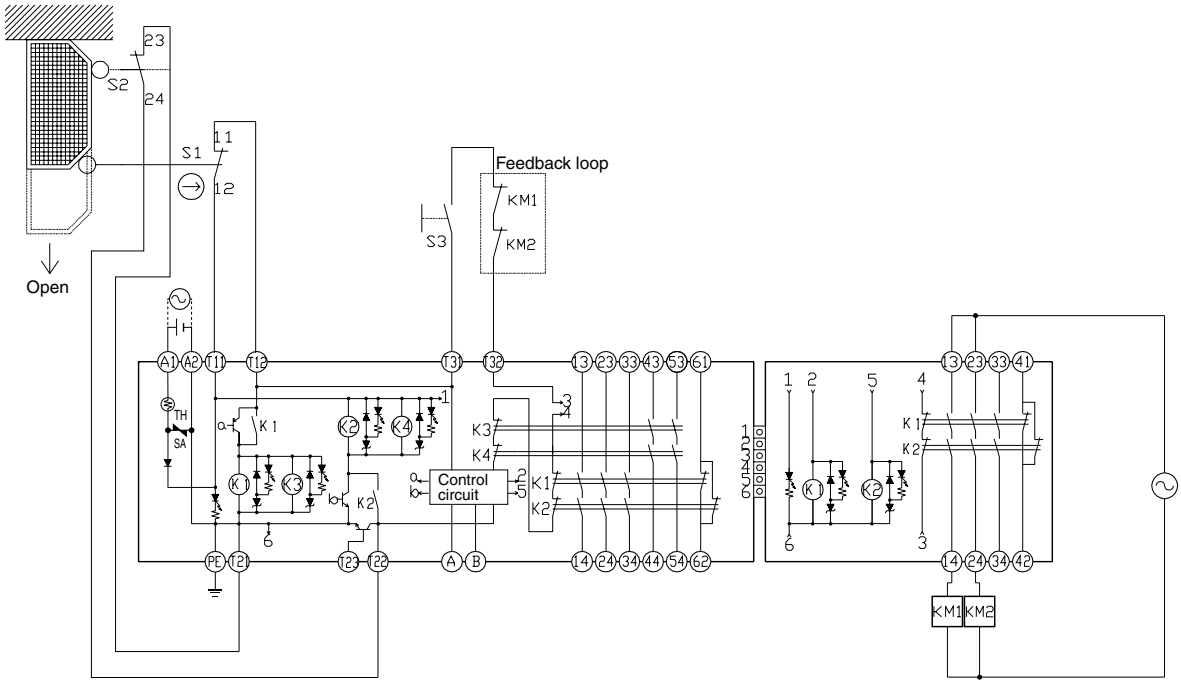


SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

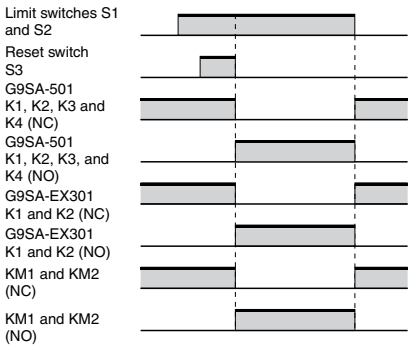
Applications (continued)

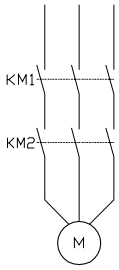
G9SA-501 (24 VAC/VDC) and G9SA-EX301 with 2-channel Limit Switch Input/Manual Reset



S1: Safety Limit Switch with direct opening mechanism (NC) (D4B-N, D4N, D4F)
S2: Limit switch (NO)
S3: Reset switch
KM1 and KM2: Magnetic Contactor
M: 3-phase motor

Timing Chart



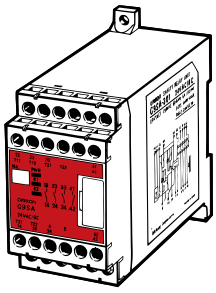


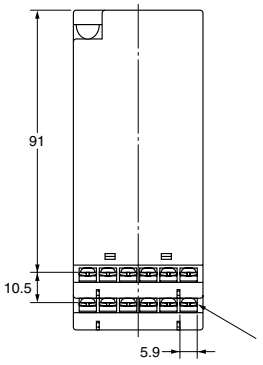
Note: This circuit achieves Safety Category 4.

Dimensions and Terminal Arrangement

(mm)

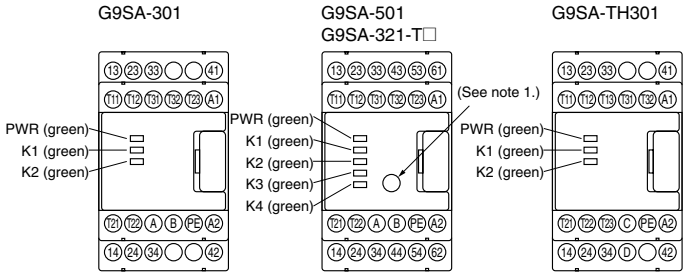
G9SA-301
G9SA-501
G9SA-321-T□
G9SA-TH301

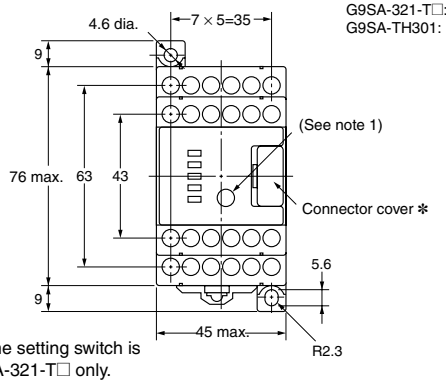


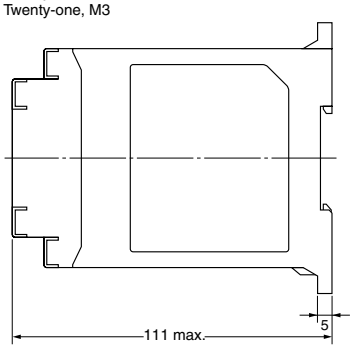


G9SA-301: Twenty, M3
G9SA-501: Twenty-four, M3
G9SA-321-T□: Twenty-four, M3
G9SA-TH301: Twenty-one, M3

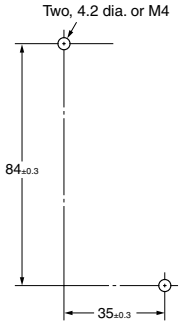
Terminal Arrangement





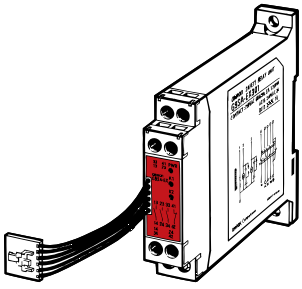


Mounting Holes

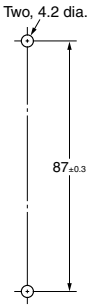


Note 1: The OFF-delay time setting switch is found on the G9SA-321-T□ only.
2: The K1 to K4 indicators light when the NO contacts of internal relays K1 to K4 close.
✻ Do not remove unless an Expansion Unit is being used.

G9SA-EX301
G9SA-EX031-T□

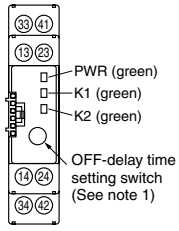


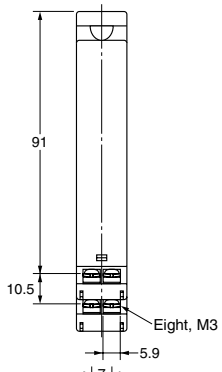
Mounting Holes

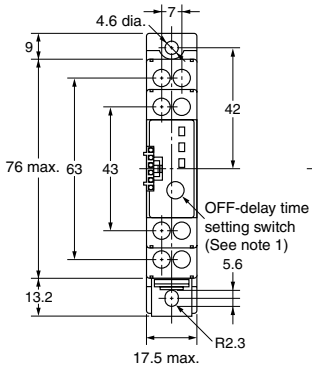


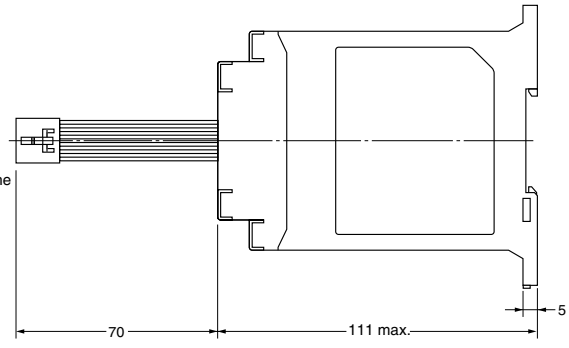
Terminal Arrangement

G9SA-EX301
G9SA-EX031-T□









Note 1: The OFF-delay time setting switch is found on the G9SA-EX031-T□ only.
2: The K1 and K2 indicators light when the NO contacts of internal relays K1 and K2 close.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering

Model Number Legend

G9SA – □ □ □ □ □ – □□□□
❶ ❷ ❸ ❹ ❺ ❻

❶ Function
None: Emergency stop
EX: Expansion Unit
TH: Two-hand Controller

❷ Contact Configuration (Safety Output)
0: None
3: 3PST-NO
5: 5PST-NO

❸ Contact Configuration (OFF-delay Output)
0: None
2: DPST-NO
3: 3PST-NO

❹ Contact Configuration (Auxiliary Output)
0: None
1: SPST-NC

❺ Input Configuration
None: 1-channel or 2-channel input possible

❻ OFF-delay Time (Max. setting time)
None: No OFF-delay
T075: 7.5 seconds
T15: 15 seconds
T30: 30 seconds

Note: Call the factory for G9SA models designed for positive ground system. These are available for 24 VDC only.

Specific Models

Emergency-stop Units

Main contacts	Auxiliary contact	Number of input channels	Rated voltage	Model
3PST-NO	SPST-NC	1 channel or 2 channels possible	24 VAC/VDC	G9SA-301
			100 to 240 VAC	
5PST-NO			24 VAC/VDC	G9SA-501
			100 to 240 VAC	

Emergency-stop OFF-delay Units

Main contacts	OFF-delay contacts	Auxiliary contact	Number of input channels	OFF-delay time	Rated voltage	Model
3PST-NO	DPST-NO	SPST-NC	1 channel or 2 channels possible	7.5 s	24 VAC/VDC	G9SA-321-T075
					100 to 240 VAC	
				15 s	24 VAC/VDC	G9SA-321-T15
					100 to 240 VAC	
				30 s	24 VAC/VDC	G9SA-321-T30
					100 to 240 VAC	

Note: Set to maximum values in the factory.
* The following 15-step OFF-delay time settings are available:
T075: 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, and 7.5 s
T15: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15 s
T30: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, and 30 s

Two-hand Controller

Main contacts	Auxiliary contact	Number of input channels	Rated voltage	Model
3PST-NO	SPST-NC	2 channels	24 VAC/VDC	G9SA-TH301
			100 to 240 VAC	

Expansion Unit

The Expansion Unit connects to a G9SA-301, G9SA-501, G9SA-321, or G9SA-TH301.

Main contacts	Auxiliary contact	Model
3PST-NO	SPST-NC	G9SA-EX301

Expansion Units with OFF-delay Outputs

The Expansion Unit connects to a G9SA-301, G9SA-501, G9SA-321, or G9SA-TH301.

Main contact form	Auxiliary contact	OFF-delay time	Model
3PST-NO	SPST-NC	7.5 s	G9SA-EX031-T075
		15 s	G9SA-EX031-T15
		30 s	G9SA-EX031-T30

Note: Set to maximum values in the factory.
* The following 15-step OFF-delay time settings are available:
T075: 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, and 7.5 s
T15: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15 s
T30: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, and 30 s

SR101A

Quick Link
S367
omron247.com

Single-Channel Safety Monitoring Relay

- Power requirements—the SR101A will accept 24 VAC/DC or 115 VAC
- Inputs—a single N/C input channel, not monitored, is provided
- Outputs—the SR101A has two N/O outputs to route power to the coils of power contactors
- External Device Monitoring (EDM) is provided with a N/C loop between S11 and S21 on the SR101A
- Reset mode—an automatic reset mode is provided with the SR101A



Conforms to EN60439-1, EN60947-1/5/7, EN61000-6, EN62061, EN ISO 13849-1
UL and C-UL listed
TÜV Rheinland approved

Specifications

Electrical	All Models	SR101A01	SR101A02
Power Supply:	±10%, 50-60 Hz	24 VAC/DC	115 VAC
Power Consumption:	Approx. 1 VA		
Safety Inputs:	1 N/C (not monitored)		
Outputs:	2 N/O		
Output Rating AC:	Inductive AC-15, 4 A/230 V		
Output Rating DC:	Inductive DC-13, 2 A/24 V		
Min Switched Current/Voltage:	20 mA/24 V		
Impulse Withstand Voltage:	2500 V		
Max Drop-Out Time:	75 ms		
Max Output Fuse:	6 A quick-acting fuse or 4 A slow-acting		
Reset Mode:	Automatic (S11-S21)		
Contactor Monitoring:	N/C loop S11-S21		
Mechanical			
Mounting:	35 mm (1.38 in.) DIN rail		
Case Material:	Fiber-filled Polyamide PA6.6		
Max Wire Size:	1 x 2.5 mm (14 AWG) stranded		
Weight:	230 g (8.1 oz.)		
Color:	Red		
External Switches:	None		
Indication:	Green = K1 Closed, Green = K2 Closed		
Mechanical Life:	1 x 10^7 operations		
Environmental			
Enclosure Protection:	IP20 terminals, IP40 (NEMA 1) housing		
Operating Temperature:	24 VAC/DC: -15 to 60°C (5 to 140°F) 115 VAC: -15 to 40°C (-5 to 104°F)		
Humidity:	93% RH at 104°C (219°F)		
Compliance			
Standards:	EN60439-1, EN60947-1/5/7, EN61000-6, EN62061, EN ISO 13849-1		
Approvals/Listings:	CE marked for all applicable directives, UL and C-UL, TÜV Rheinland		

Specifications are subject to change without notice.

Note:
The safety contacts of the Omron switches are described as normally closed (N/C)—i.e., with the guard closed, actuator in place, and the machine able to be started.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

SR103AM

Quick Link
S368
omron247.com

Dual-Channel Safety Monitoring Relay

- Power requirements—the SR103AM will accept 24 VAC/DC or 115 VAC
- Inputs—the SR103AM will accept single or dual N/C inputs or dual inputs from a light curtain
- Outputs—the SR103AM has 3 N/O outputs to route power to the coils of power contactors, plus 1 N/C auxiliary output for signaling purposes
- External Device Monitoring (EDM) is provided with a N/C loop between S11/S12 and S21 on the SR103AM
- Monitored manual or automatic/manual reset modes are available on the SR103AM. Monitored manual reset requires closure of the reset circuit followed by opening of the circuit. Reset occurs when circuit is opened. Auto reset requires only closure of the reset circuit as reset occurs when circuit is closed.



Conforms to EN60439-1, EN60947-1/5/7, EN61000-6, EN62061, EN ISO 13849-1
UL and C-UL listed
TÜV Rheinland approved

Specifications

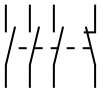
Electrical	All Models	SR103AM01	SR103AM02
Power Supply:	±10%, 50-60 Hz	24 VAC/DC	115 VAC
Power Consumption:	Approx. 1 VA		
Safety Inputs:	1 N/C or 2 N/C or 2 solid state (light curtain)		
Max Input Resistance:	800 Ohms per channel		
Outputs:	3 N/O + 1 N/C auxiliary		
Output Rating AC:	Inductive AC-15, 3 A/230 VAC		
Output Rating DC:	Inductive DC-13, 2 A/24 V		
Min Switched Current/Voltage:	10 mA/10 V		
Impulse Withstand Voltage:	2500 V		
Max Drop-Out Time:	12 ms (75 ms by removing supply voltage)		
Max Output Fuse:	6 A quick-acting or 4 A slow-acting		
Reset Mode:	Monitored manual (S11-S21) or automatic/manual (S12-S21)		
Contactor Monitoring:	N/C loop S11/S12-S21		
Mechanical			
Mounting:	35 mm (1.38 in.) DIN rail		
Case Material:	Fiber-filled Polyamide PA6.6		
Max Wire Size:	1 x 2.5 mm^2 (14 AWG) stranded		
Weight:	230 g (8.1 oz.)		
Color:	Red		
External Switches:	None		
Indication:	Green = K1 Closed, Green = K2 Closed		
Mechanical Life:	1 x 10^7 operations		
Environmental			
Enclosure Protection:	IP20 terminals, IP40 (NEMA 1) housing		
Operating Temperature:	24 VAC/DC: -15 to 40°C (5 to 104°F) 115 VAC: -15 to 40°C (5 to 104°F)		
Storage Temperature:	-25° to 70°C (-13 to 158°F)		
Humidity:	93% RH at 104°C (219°F)		
Compliance			
Standards:	EN60439-1, EN60947-1/5/7, EN61000-6, EN62061, EN ISO 13849-1		
Approvals/Listings:	CE marked for all applicable directives, UL and C-UL, TÜV Rheinland		

Specifications are subject to change without notice.

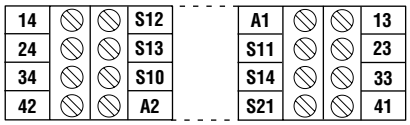
Note:
The safety contacts of the Omron switches are described as normally closed (N/C)—i.e., with the guard closed, actuator in place, and the machine able to be started.

Application

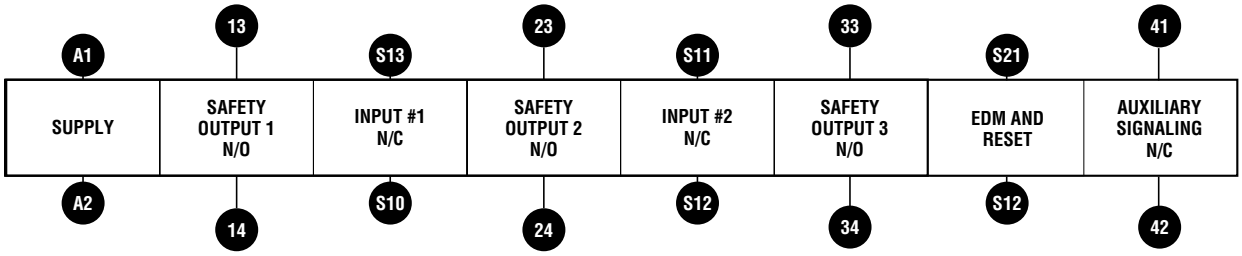
Output Contact Arrangements

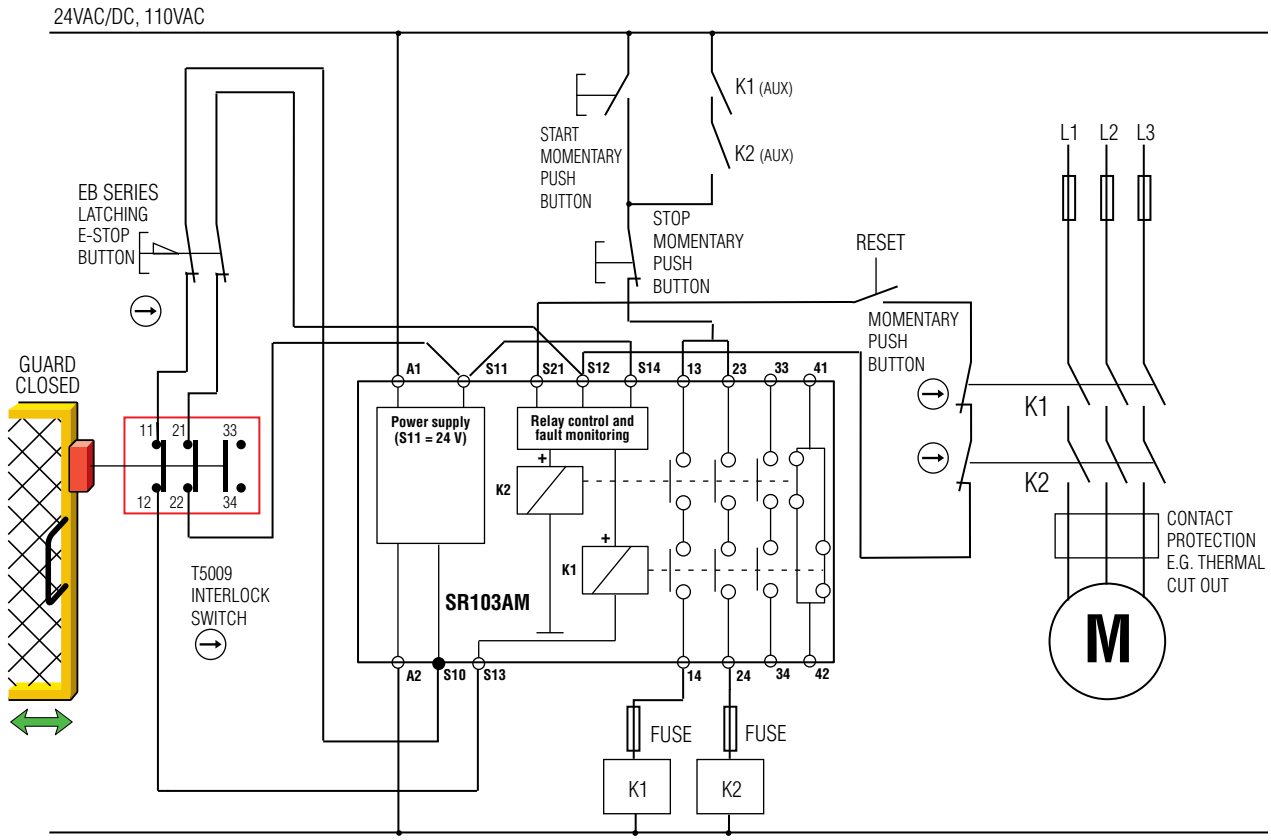


Terminal Pin Assignments



Terminal Connections





For a full explanation of the circuit operating principle and fault detection, see “Common Circuit Examples” in the Expert Area Section of this catalog.

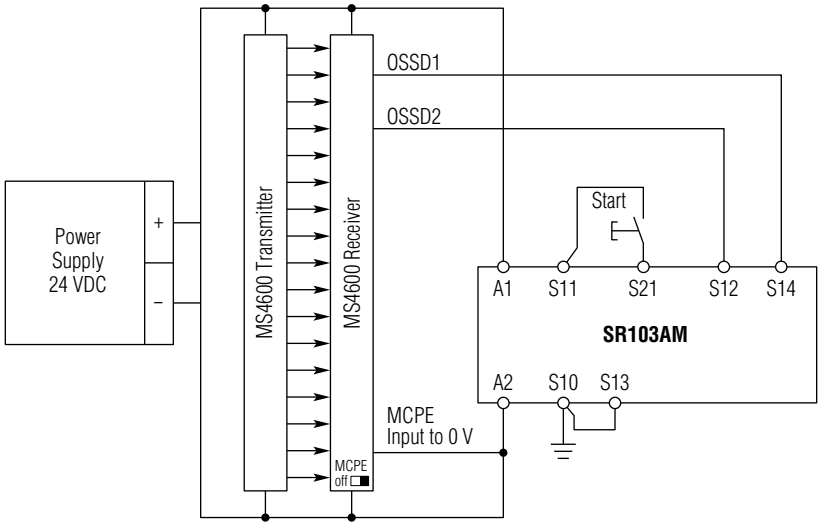
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Application (continued)

MS4600 Connected to SR103AM

(MPCE monitoring disabled)



MPCE Monitoring "Disabled"

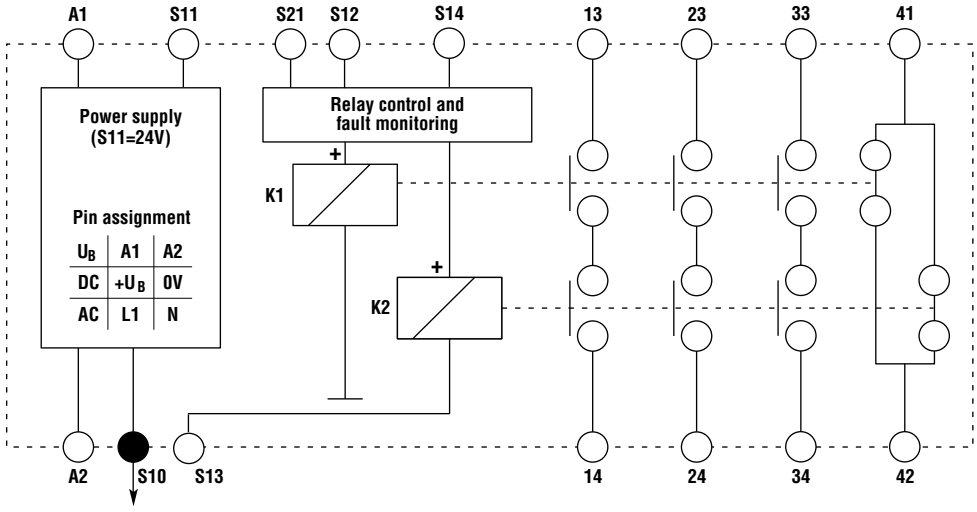
The start switch shown connected between S11 and S21 provides a monitored manual start function. Switch must be closed and then opened to activate a start. For auto-start, connect a wire between S21 and S12 and no connection between S11 and S21.

If the MPCE function is not being used on the MS4600 light curtain, the function must be "disabled", and the MPCE input wire must be connected to 0 V (GND).

MPCE Monitoring "Enabled"

When using an SR103AM with an MS4600 light curtain, MPCE monitoring may be performed through the safety monitoring relay using terminals S12, S21. This method of MPCE monitoring only allows for Auto Restart/Manual Restart Mode of the safety monitoring relay. If Monitored Manual Restart Mode with MPCE Monitoring is desired, the MPCE Monitoring must be enabled and performed through the MS4600 light curtain. Place wire jumper between terminals S12, S21 of the safety monitoring relay. Configure the MS4600 for Start/Restart Interlock Mode. The Monitored Manual Reset is now controlled through the MS4600 light curtain. (See MS4600 Manual for configuration and wiring details of MS4600 light curtain.)

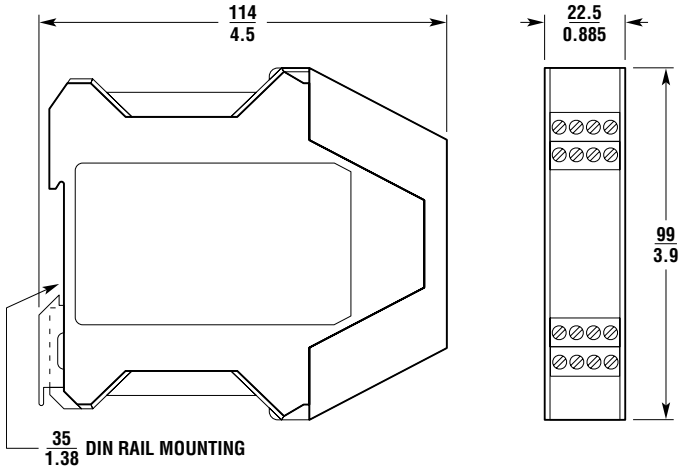
Block Diagram



Dimensions

(mm/in.)

SR103AM



Ordering

Model	Supply	Inputs	Outputs	Auxiliary	Part No.
SR103AM01	24 VAC/DC	2 N/C	3 N/O	1 N/C	44510-1031
SR103AM02	115 VAC	2 N/C	3 N/O	1 N/C	44510-1032

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

SR104P

Quick Link
S369
omron247.com

Two-Hand Control Safety Monitoring Relay

- Power requirements—the SR104P will accept 24 VAC/DC and 115 VAC
- Inputs—controls and monitors two-hand control switches to ensure that both switches are operated within 0.5 seconds of each other
- Outputs—the SR104P has 2 N/O outputs to route power to the coils of power contactors
- External Device Monitoring (EDM) is provided with a N/C loop between X1 and X2 on the SR104P



SR105E

Quick Link
S372
omron247.com

Safety Expansion Unit

- Power requirements—the SR105E will accept 24 VAC/DC
- Outputs—the SR105E has 3 N/O outputs to route power to the coils of power contactors plus 1 N/C auxiliary output for monitoring by the safety monitoring relay
- Expander capability—the SR105E may be used with any other SR Series relay to expand the total available number of N/O outputs to power contactors



SR108AD & SR109AD

Quick Link S374 omron247.com

Dual-Channel Safety Monitoring Relay

- Power requirements—the SR108AD and SR109AD will accept 24 VAC/DC
- Inputs—the SR108AD and SR109AD will accept single or dual N/C inputs or dual PNP solid-state inputs from a light curtain
- Outputs—the SR108AD and SR109AD have a total of 4 N/O outputs with 3, 2 or 1 of the outputs with a time delay of 1-30 sec.
- External Device Monitoring (EDM) is provided with a N/C loop between S12 and S21 on the SR108AD and SR109AD
- Reset mode—a monitored manual start or an auto/manual start may be configured with the SR108AD and SR109AD. Monitored manual reset requires closure of the reset circuit followed by opening of the circuit. Reset occurs when circuit is opened. Auto reset requires only closure of the reset circuit as reset occurs when circuit is closed.
- PLC Compatible—The N/O off delayed outputs make it possible to use the SR108AD and SR109AD on machines with Programmable Logic Controllers that require some time to execute an orderly shutdown



Conforms to EN62061, EN60947-5-1, EN ISO 13849-1, EN ISO 13849-2
UL and C-UL listed
TÜV Rheinland approved

SR109AD Quick Link S375 omron247.com

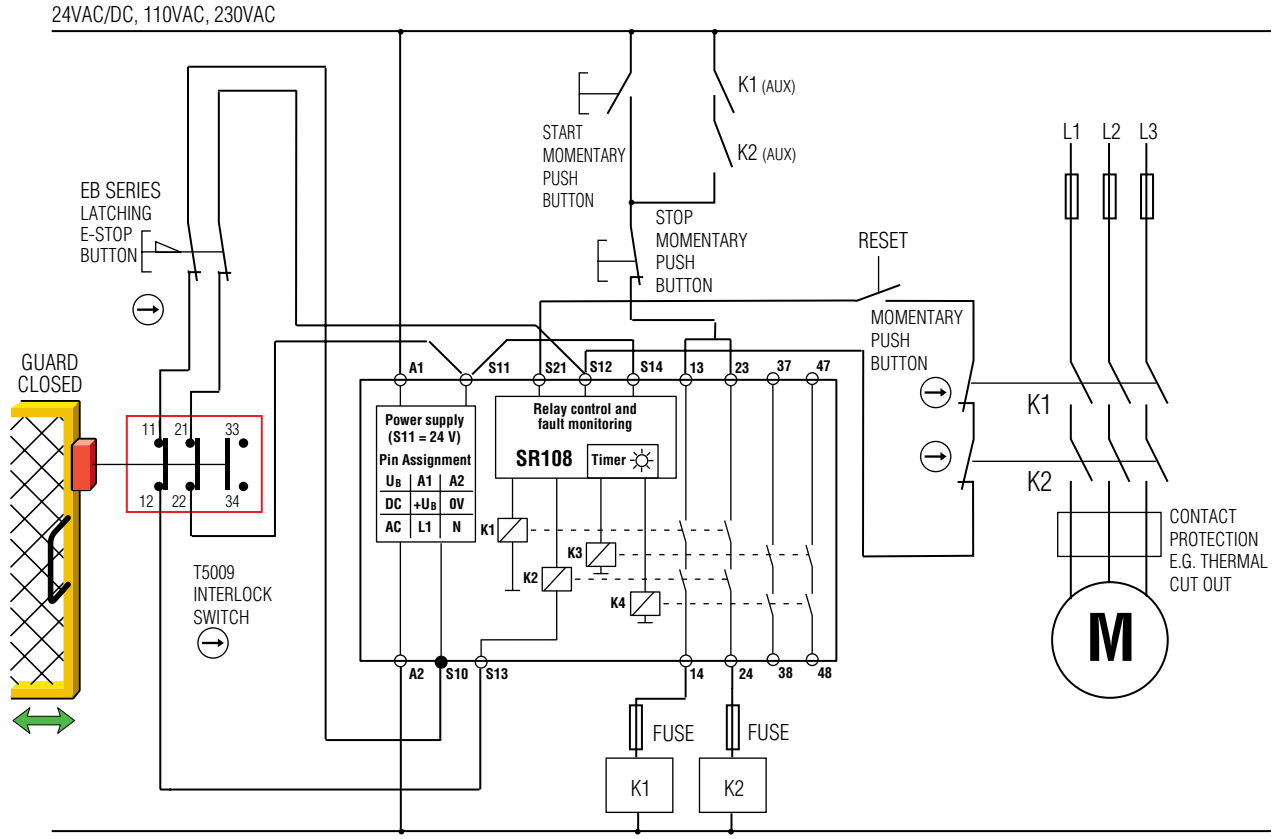
Specifications

Electrical	All Models	SR108AD	SR109AD
Power Supply:	±10%, 50-60 Hz, 24 VAC/DC		
Power Consumption:	4.6 W		
Safety Inputs:	1 N/C or 2 N/C		
Max Input Resistance:	800 Ohms per channel		
Outputs:		2 N/O + 2 N/O delayed	3 N/O + 1 N/O delayed
Auxiliary Outputs:	None		
Max Switched AC:	Inductive AC-15, 3 A/250 VAC; Resistive AC-12, 8 A/250 V		
Max Switched DC:	Inductive DC-13, 3 A/24 VDC; Resistive DC-12, 8 A/50 V		
Min Switched Current/Voltage:	10 mA/24 V		
Impulse Withstand Voltage:	2500 V		
Max Drop-Out Time:	10 ms (75 ms by removing supply voltage)		
Max Output Fuse:	8 A quick-acting fuse or 6 A slow-acting fuse		
Start Mode:	Monitored manual (S11-S21) or auto/manual (S12-S21)		
External Device Monitoring (EDM):	N/C loop between S12 and S21		
Mechanical			
Mounting:	35 mm (1.38 in.) DIN rail		
Case Material:	Polyamide PA6.6		
Max Wire Size:	1 x 2.5 mm^2 (14 AWG) stranded		
Weight:	250 g (8.8 oz.)		
Color:	Red		
External Switches:	Output delay adjustment (1 to 30 sec.)		
Indication:	4, status displays for relays K1 to K4		
Mechanical Life:	1 x 10^6 operations		
Environmental			
Enclosure Protection:	IP20 terminals, IP40 (NEMA 1) housing		
Operating Temperature:	-15 to 40°C (-5 to 140°F)		
Humidity:	93% RH at 104°C (219°F)		
Compliance			
Standards:	EN62061, EN60947-5-1, EN ISO 13849-1, EN ISO 13849-2		
Approvals/Listings:	CE-marked for all applicable directives, UL and C-UL, TÜV Rheinland		

Specifications are subject to change without notice.

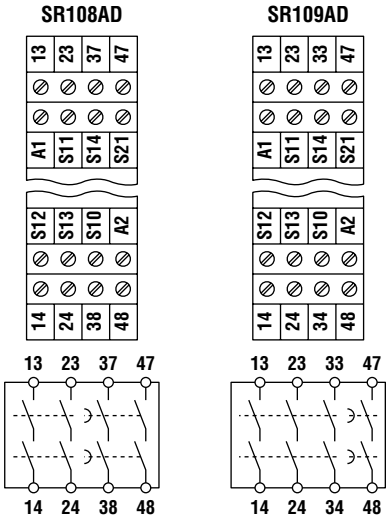
Note: The safety contacts of the Omron switches are described as normally closed (N/C)—i.e., with the guard closed, actuator in place, and the machine able to be started.

Application

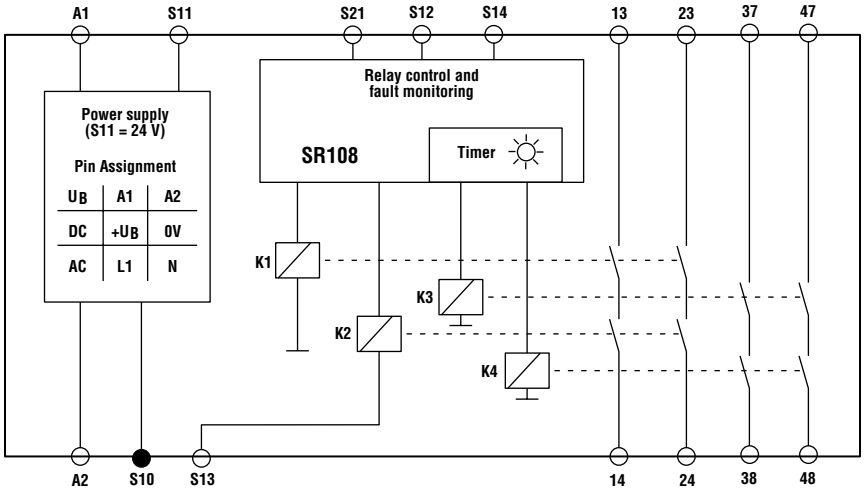


For a full explanation of the circuit operating principle and fault detection, see “Common Circuit Examples” in the Expert Area Section of this catalog.

Terminal Connections and Output Contact Arrangements

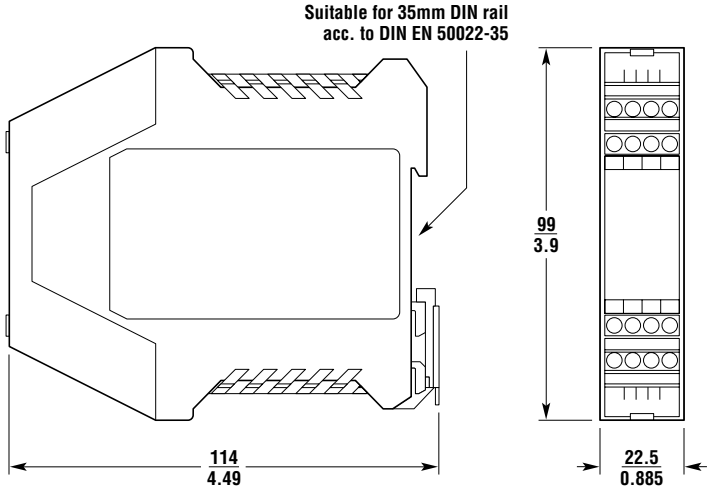


Block Diagram



Dimensions

(mm/in.)



Ordering

Model	Supply	Inputs	Immediate Outputs	Delayed Outputs	Part No.
SR108AD01	24 VAC/DC	2 N/C	2 N/O	2 N/O	44510-1081
SR109AD01	24 VAC/DC	2 N/C	3 N/O	1 N/O	44510-1091

SR106ED

Quick Link
A373
omron247.com

Safety Expansion Unit

- Power requirements—the SR106ED will accept 24 VAC/DC
- Outputs—the SR106ED has 3 N/O delayed outputs to route power to the coils of power contactors (delay selectable from 1 to 30 sec.)
- Auxiliary Output—the SR106ED has 1 N/C auxiliary for monitoring by the safety monitoring relay
- PLC Compatible—The N/O off delayed output makes it possible to use the SR106ED on machines with Programmable Logic Controllers that require some time to execute an orderly shutdown.



SR120MP

Quick Link
S376
omron247.com

Dual-Channel Multi-Purpose Safety Monitoring Relay

- Power requirements—the SR120MP will accept 24 VAC/DC or 110 VAC
- Inputs—the SR120MP provides dual-channel input from a variety of safety devices. The safety devices may be E-stops, interlock switches, or light curtains.
- Outputs—the SR120MP has 3 N/O outputs to route power to the coils of power contactors plus 1 N/C auxiliary output and 4 solid-state outputs for signaling purposes
- External Device Monitoring (EDM) is provided with a N/C loop between S33 and S34 on the SR120MP
- Selectable start modes—monitored manual or automatic start mode is selectable on the SR120MP



SR125SMS45

Quick Link
S377
omron247.com

Stop Motion Sensing Unit

- Power requirements—the SR125SMS45 will accept 24 VDC or 110 VAC
- Motion detection input—the SR125SMS45 detects the stop condition of all types of AC or DC motors by sensing the motor's back EMF across terminals Z1, Z2 and Z3
- Drive compatible—the SR125SMS45 will function with electronic motor control devices such as variable speed controllers, DC injection brakes, etc.
- Selectable speed limit—the SR125SMS45 has 1 N/O and 1 N/C outputs that are switched when motor speed reaches the adjustable preset limit (0.01 to 0.10 V) for the particular output
- Auxiliary output—the SR125SMS45 has 2 solid state auxiliary signaling outputs



Specifications

Electrical	All Models	SR125SMS4501	SR125SMS4502
Power Supply:	±10%	24 VDC	110 VAC
Power Consumption:		≤3.0 W	≤5.2 VA
Internal Fuse:	Electronic		
Safety Inputs:	Back EMF sensing between Z1 and Z2 and Z3		
Maximum Voltage Between Terminal Z1, Z2, Z3:	500 V (RMS)		
Detection Threshold:	0.01 V		
Relay Outputs:	1 N/O + 1 N/C switched at preset detection threshold		
Auxiliary Outputs:	2 solid state for signaling		
Max Switched AC:	Inductive AC-15, 1800 VA inrush, 180 VA maintained		
Max Switched DC:	Inductive DC-13, 1.2-1.5 A/24 V		
Min Switched Current/Voltage:	10 mA/17 V (provided that the contact has never been used with higher loads)		
Impulse Withstand Voltage:	4000 V		
Max Drop-Out Time:	n/a		
Max Output Fuse:	4 A slow-acting or 6 A fast-acting		
Reset Mode:	n/a		
Mechanical			
Mounting:	35 mm (1.38 in.) DIN rail		
Case Material:	Polyamide PA6.6		
Max Wire Size:	2 x 2.5 mm (14 AWG) stranded		
Weight:	AC: 0.33 kg (11.6 oz.); DC: 0.23 kg (8.1 oz.)		
Color:	Red with black body		
External Adjustment:	Motor speed preset via potentiometer		
Indication:	Green = Power On, Green = Channel 1 activated, Green = Channel 2 activated, Green = CH1 + CH2 activated		
Environmental			
Enclosure Protection:	IP20 terminals, IP40 (NEMA 1) housing		
Operating Temperature:	-10 to 55°C (14 to 131°F)		
Compliance			
Standards:	EN60947-1/5, EN61000-6, EN62061, EN62061, EN ISO 12100-2, EN ISO 13849-1/2		
Approvals/Listings:	CE-marked for all applicable directives, UL and C-UL, CSA, TÜV		

Specifications are subject to change without notice.

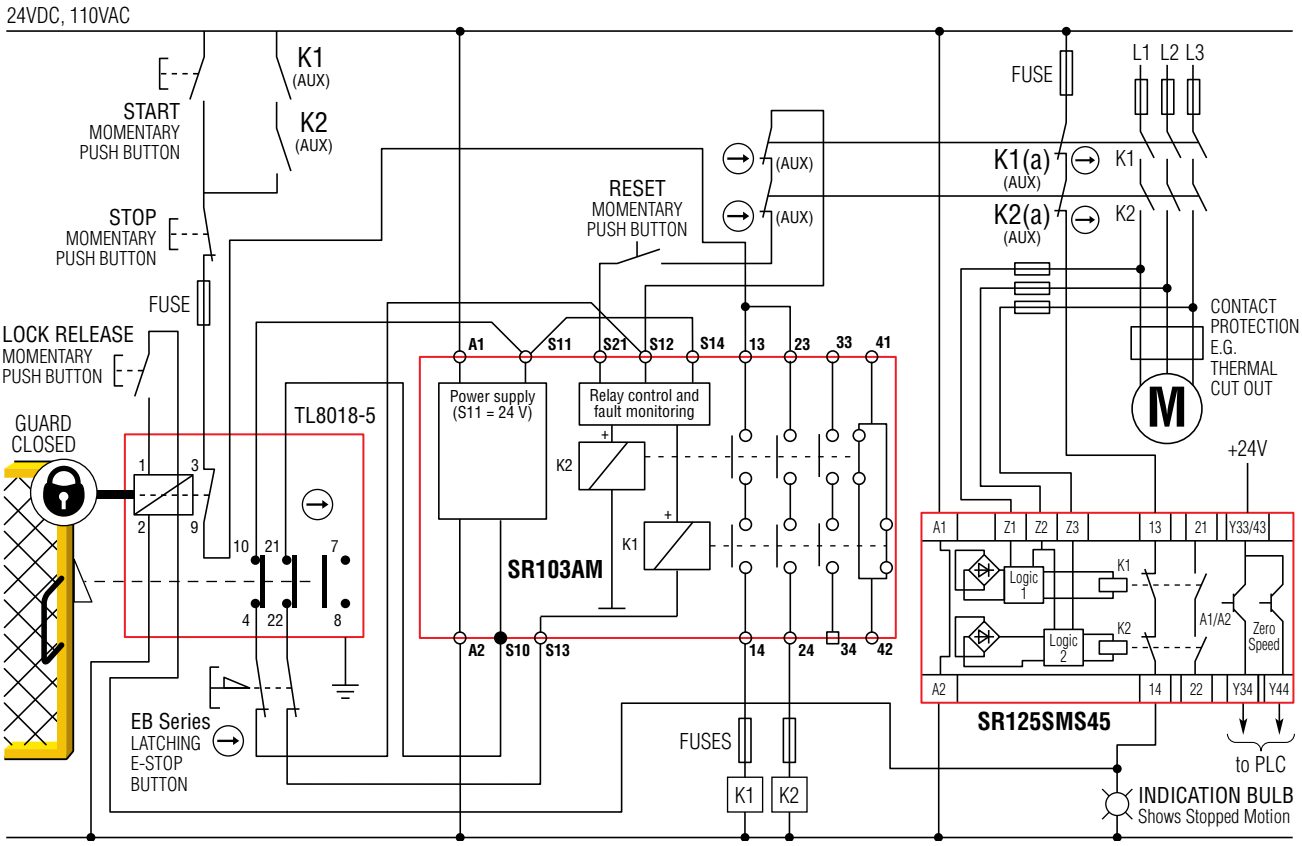
Note:
The safety contacts of the Omron switches are described as normally closed (N/C)—i.e., with the guard closed, actuator in place, and the machine able to be started.

Conforms to EN60947-1/5, EN61000-6, EN62061, EN62061, EN ISO 12100-2, EN ISO 13849-1/2
UL listed
CSA and TÜV Rheinland approved

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

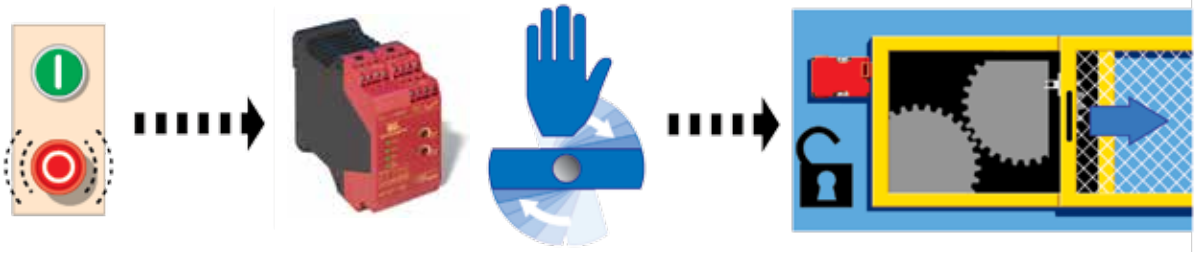
OMRON AUTOMATION & SAFETY

Application



For a full explanation of the circuit operating principle and fault detection, see “Common Circuit Examples” in the Expert Area Section of this catalog.

Operation



Stop signal
to motor

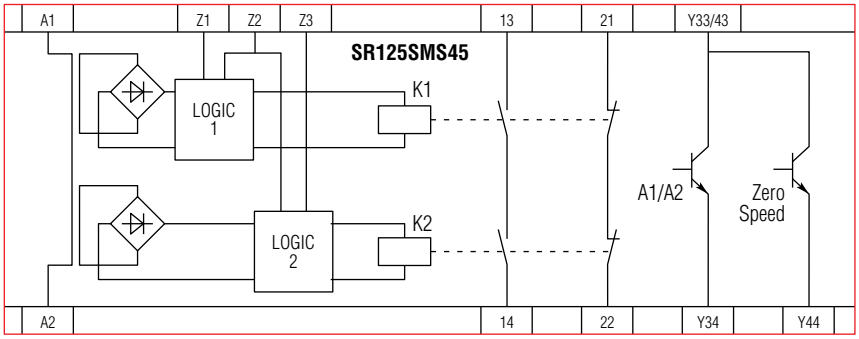
SM125SMS45 detects back EMF of motor and senses when hazardous motion has ceased, then signals guard locking switch to unlock

Guard locking switch unlocks guard allowing safe access to machine

Terminal Connections

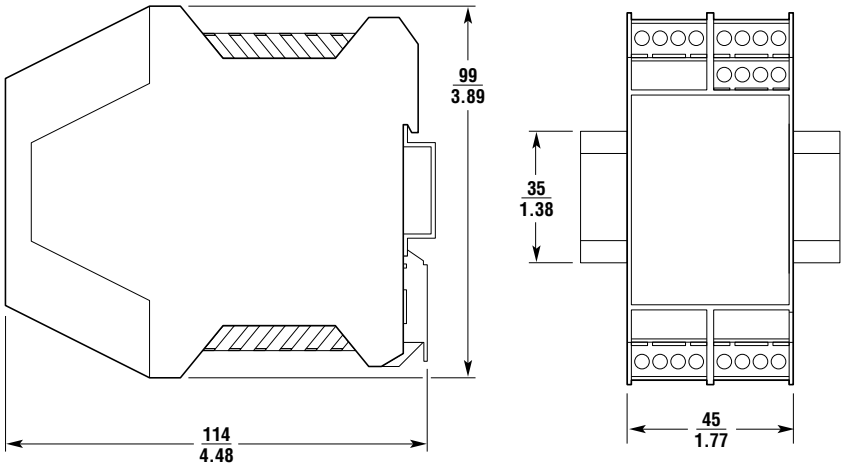
A1	Z1	13	21	Y33/43
POWER	BACK EMF SENSING	SAFETY OUTPUT 1 N/O	SAFETY OUTPUT 2 N/C	AUXILIARY SIGNALING SOLID STATE
A2	Z2 Z3	14	22	Y34 Y44

Block Diagram



Dimensions

(mm/in.)



Ordering

Model	Supply	Inputs	Outputs	Auxiliary	Part No.
SR125SMS4501	24 VDC	Back EMF Sensing	1 N/O + 1 N/C	2 Solid State	44510-1271
SR125SMS4502	110 VAC	Back EMF Sensing	1 N/O + 1 N/C	2 Solid State	44510-1272

SR131A

Quick Link
S378
omron247.com

Dual-Channel Safety Monitoring Relay

- Power requirements—the SR131A will accept 24 VDC
- Inputs—The SR131A is designed to monitor two magnetically encoded non-contact switches with 1 N/C and 1 N/O contacts
- Outputs—the SR131A has 2 N/O outputs to route power to the coils of external device power contactors plus 2 N/C auxiliary solid state outputs for signaling purposes
- External Device Monitoring (EDM) is provided with a N/C loop between Y1 and Y2 on the SR131A
- Selectable reset modes—automatic/manual reset mode is available on the SR131A



SR201A

Quick Link
S379
omron247.com

Single-Channel Safety Monitoring Relay

- Power requirements—the SR201A will accept 24 VAC/DC or 110 VAC
- Inputs—a single N/C input channel, not monitored, is provided
- Outputs—the SR201A has 3 N/O outputs to route power to the coils of power contactors plus 1 N/C auxiliary solid state output for signaling purposes
- External Device Monitoring (EDM) is provided with a N/C loop between Y1 and Y2 on the SR201A
- Selectable reset modes—automatic/manual reset mode is selectable on the SR201A
- The SR201A has removable terminals



Safety Monitoring Relays/Force-guided Relays

SR203M & SR203AM

Quick Link S382 omron247.com

Dual-Channel Safety Monitoring Relay

- Power requirements—the SR203M/A will accept 24 VAC/DC or 115 VAC
- Inputs—the SR203M/A will accept single or dual N/C inputs or dual PNP inputs from a light curtain
- Outputs—the SR203M/A has 3 N/O outputs to route power to the coils of power contactors, plus 1 N/C auxiliary output for signaling purposes
- External Device Monitoring (EDM) is provided with a N/C loop between S12 and S34 on the SR203M/A
- Monitored manual or automatic/manual reset modes are available on the SR203M/A
- The SR203M/A have removable terminal blocks



SR203AM Quick Link S383 omron247.com

Safety Monitoring Relays/Force-guided Relays

SR208AD & SR209AD

Quick Link S384 omron247.com

Dual-Channel Safety Monitoring Relay

- Power requirements—the SR208AD/209AD will accept 24 VAC/DC or 115 VAC,
- Inputs—the SR208AD/209AD will accept single or dual N/C inputs or dual PNP inputs from a light curtain
- Outputs—the SR208AD has 2 N/O immediate outputs plus 3 N/O delayed outputs. The SR209AD has 2 N/O immediate outputs plus 2 N/O and 1 N/C delayed outputs to route power to the coils of power contactors (selectable from 0.5 to 10 sec).
- External Device Monitoring (EDM) is provided with a N/C loop between Y1 and Y2 on the SR208AD/209AD
- Reset mode—monitored manual or automatic/manual reset modes are available on the SR208/209AD
- PLC Compatible—The N/O off delayed outputs make it possible to use the SR208AD/209AD on machines with Programmable Logic Controllers that require some time to execute an orderly shutdown. The N/C on delayed output of the SR209AD may be used to apply power for unlocking a solenoid locking switch.
- The SR208AD/209AD have removable terminal blocks



SR209AD Quick Link S385 omron247.com

SR223SMT

Quick Link
S386
omron247.com

Safety Module Timer Unit

- Power requirements—the SR223SMT will accept 24 VAC/DC or 115 VAC
- Delayed outputs—the SR223SMT has 1 N/O on-delay output, plus 2 N/C off-delay outputs (selectable from 1 second to 31 seconds) to provide delayed unlocking of solenoid locking switches; the delay time begins when power is applied to the SR223SMT
- Monitoring outputs—the SR223SMT has 2 solid-state signaling outputs
- External Device Monitoring (EDM) is provided with a N/C loop between Y1 and Y2 on the SR223SMT
- Diagnostic LEDs provide status inducation of supply power, safety outputs, feedback loop, and time delay



SR231A

Quick Link
S387
omron247.com

Dual-Channel Safety Monitoring Relay

- Power requirements—the SR231A will accept 24 VDC
- Inputs—The SR231A is designed to monitor two magnetically encoded non-contact switches with 1 N/C and 1 N/O contacts
- Outputs—the SR231A has 2 N/O outputs to route power to the coils of external device power contactors plus 2 N/C auxiliary solid state outputs for signaling purposes
- External Device Monitoring (EDM) is provided with a N/C loop between Y1 and Y2 on the SR231A
- Selectable reset modes—automatic/manual reset mode is available on the SR231A
- The SR231A has removable terminal blocks



Quick Link
S357
omron247.com

Flexible Safety Unit

- Logical AND functions adds flexibility to I/O expansion
- Facilitates partial or complete control system setup.
- Solid-state outputs (excluding Expansion Units).
- Detailed LED indications enable easy diagnosis.
- TÜV Product Service certification for compliance with IEC/EN61508 (SIL3) and EN954-1 (Cat. 4).
- Approved by UL and CSA.
- New unit joins the Series with the following two additional features:
  - OFF-delay time of up to 150 seconds
    (The OFF-delay output also complies with Cat. 4.)
  - Two logical AND connection inputs



Specifications

Ratings

Power Input

	G9SX-AD322-□/ADA222-□	G9SX-BC202-□	G9SX-EX-□
Rated supply voltage	24 VDC		
Operating voltage range	-15% to 10% of rated supply voltage		
Rated power consumption*	4 W max.	3 W max.	2 W max.

*Power consumption of loads not included.

Inputs

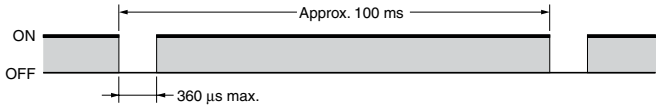
	G9SX-AD322-□/ADA222-□	G9SX-BC202-□
Safety input	Operating voltage: 20.4 VDC to 26.4 VDC, internal impedance: approx. 2.8 kW	
Feedback/reset input		

Outputs

	G9SX-AD322-□/ADA222-□	G9SX-BC202-□
Instantaneous safety output *1 OFF-delayed safety output *1	P channel MOS FET transistor output Load current: Using 2 outputs or less: 1 A DC max. *2 Using 3 outputs or more: 0.8 A DC max.	P channel MOS FET transistor output Load current: Using 1 output: 1 A DC max. *2 Using 2 outputs: 0.8 A DC max.
Auxiliary output	PNP transistor output Load current: 100 mA max.	

*1. While safety outputs are in the ON state, the following signal sequence is output continuously for diagnosis. When using the safety outputs as input signals to control devices (i.e. Programmable Controllers), consider the OFF pulse shown below.

*2. The following derating is required when Units are mounted side-by-side.
G9SX-AD322-□/G9SX-ADA222-□/G9SX-BC202-□: 0.4 A max. load current



Expansion Unit Ratings

	G9SX-EX-□
Rated load	250 VAC, 3A/30 VDC, 3A (resistive load)
Rated carry current	3 A
Maximum switching voltage	250 VAC, 125 VDC

Specifications (continued)

Characteristics

		G9SX-AD322-□/ADA222-□	G9SX-BC202-□	G9SX-EX-□
Overvoltage category (IEC/EN 60664-1)		II		II (Safety relay outputs 13 to 43 and 14 to 44: III)
Operating time (OFF to ON state) (See note 1.)		50 ms max. (Safety input: ON) (See note 2.) 100 ms max. (Logical AND connection input: ON) (See note 3.)	50 ms max. (Safety input: ON)	30 ms max. (See note 4.)
Response Time (ON to OFF state) (See note 1.)		15 ms		10 ms max. (See note 4.)
ON-state residual voltage		3.0 V max. (safety output, auxiliary output)		
OFF-state leakage current		0.1 mA max. (safety output, auxiliary output)		
Maximum wiring length of safety input and logic AND input		100 m max. (External connection impedance: 100 Ω max. and 10 nF max.)		
Reset input time (Reset button pressing time)		100 ms min.		
Accuracy of OFF-delay time (See note 5.)		Within ±5% of the set value	—	Within ±5% of the set value
Insulation resistance	Between logical AND connection terminals, and power supply input terminals and other input and output terminals connected together	20 MΩ min. (by 100 VDC)	—	—
	Between all terminals connected together and DIN track		20 mΩ min. (at 100 VDC)	100 mΩ min. (at 500 VDC)
Dielectric strength	Between logical AND connection terminals, and power supply input terminals and other input and output terminals connected together	500 VAC for 1 min.	—	—
	Between all terminals connected together and DIN track		500 VAC for 1 min.	1,200 VAC for 1 min.
	Between different poles of outputs	—	—	
	Between safety relay outputs connected together and other terminals connected together			2,200 VAC for 1 min.
Vibration resistance		Frequency: 10 to 55 Hz, 0.375-mm single amplitude (0.75-mm double amplitude)		
Shock resistance	Destruction	300 m/s^2		
	Malfunction	100 m/s^2		
Durability	Electrical	—		100,000 cycles min. (rated load, switching frequency: 1,800 cycles/hour)
	Mechanical	—		5,000,000 cycles min. (switching frequency: 7,200 cycles/hour)
Ambient operating temperature		-10 to 55°C (with no icing or condensation)		
Ambient operating humidity		25% to 85%		
Terminal tightening torque (See note 6.)		0.5 N·m		
Weight		Approx. 200 g	Approx. 125 g	Approx. 165 g

Notes:

1. When two or more Units are connected by logical AND, the operating time and response time are the sum total of the operating times and response times, respectively, of all the Units connected by logical AND.
2. Represents the operating time when the safety input turns ON with all other conditions set.
3. Represents the operating time when the logical AND input turns ON with all other conditions set.
4. This does not include the operating time or response time of Advanced Units that are connected.
5. This does not include the operating time or response time of internal relays in the G9SX-EX-□.
6. For the G9SX-□-RT (with screw terminals) only.

Specifications (continued)

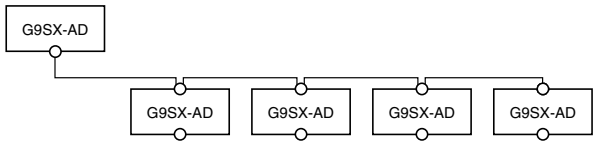
Logical AND Connection

	G9SX-AD322-□/ADA222-□	G9SX-BC202-□	G9SX-EX-□
Number of Units connected per logical AND output	4 Units max.		—
Total number of Units connected by logical AND *1	20 Units max.		—
Number of Units connected in series by logical AND	5 Units max.		—
Max. number of Expansion Units connected *2	—		5 Units max.
Maximum cable length for logical AND input	100 m max.		—

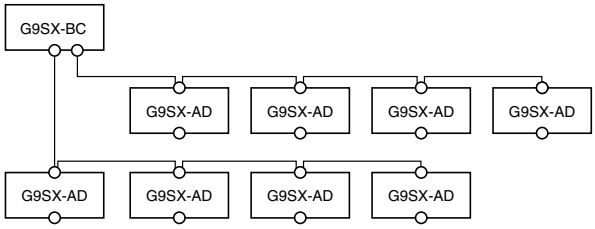
Note: See Logical AND Connection Combinations below for details.
*1. The number of G9SX-EX401-□ Expansion Units or G9SX-EX041-T-□ Expansion Units (OFF-delayed Model) not included.
*2. G9SX-EX401-□ Expansion Units and G9SX-EX041-T-□ Expansion Units (OFF-delayed Model) can be mixed.

Logical AND Connection Combinations

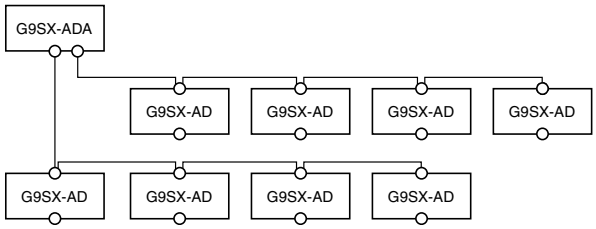
1. One logical AND connection output from an Advanced Unit G9SX-AD can be logical AND connected to up to four Advanced Units.



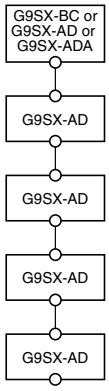
2. Two logical AND outputs from a Basic Unit G9SX-BC can be logical AND connected to up to eight Advanced Units.



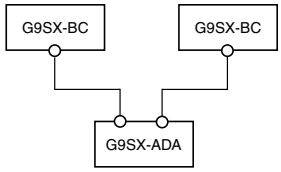
3. Two logical AND outputs from an Advanced Unit G9SX-ADA can be logical AND connected to up to eight Advanced Units.



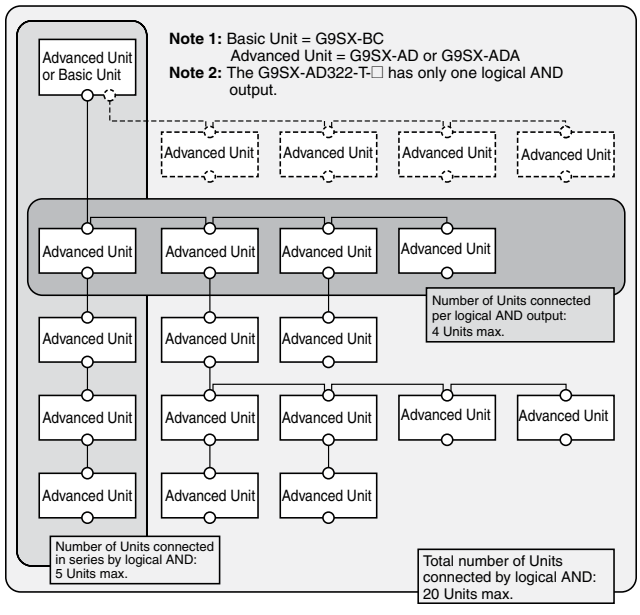
4. Any Advanced Unit with logical AND input can be logical AND connected to Advanced Units on up to five tiers.



5. Two logical AND connection outputs, each from different Advanced/ Basic Units, can be logical AND connected to a single G9SX-ADA Unit.



6. The largest possible system configuration contains a total of 20 Advanced and Basic Units. In this configuration, each Advanced Unit can have up to five Expansion Units.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

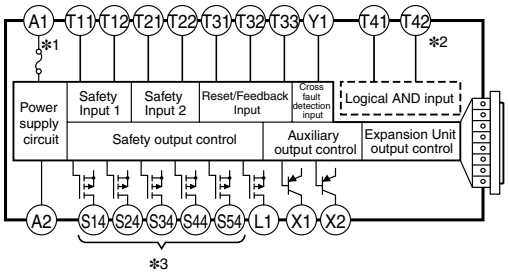
For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Wiring

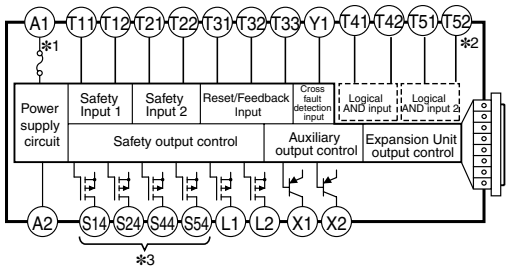
Internal Connection

G9SX-AD322-□ (Advanced Unit)



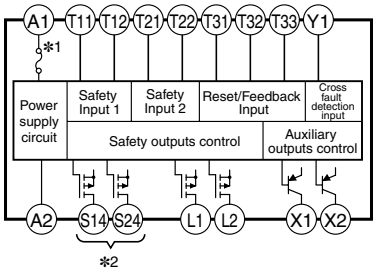
*1. Internal power supply circuit is not isolated.
*2. Logical AND input is isolated.
*3. Outputs S14 to S54 are internally redundant.

G9SX-ADA222-□ (Advanced Unit)



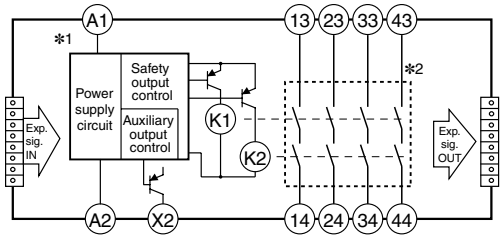
*1. Internal power supply circuit is not isolated.
*2. Logical AND inputs are isolated.
*3. Outputs S14 to S54 are internally redundant.

G9SX-BC202-□ (Basic Unit)



*1. Internal power supply circuit is not isolated.
*2. Outputs S14 and S24 are internally redundant.

G9SX-EX401-□/G9SX-EX041-T-□ (Expansion Unit / Expansion Unit OFF-delayed model)



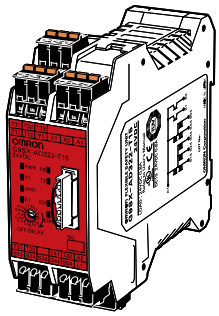
*1. Internal power supply circuit is not isolated.
*2. Relay outputs are isolated.

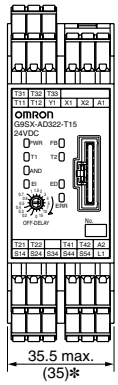
Dimensions

(mm)

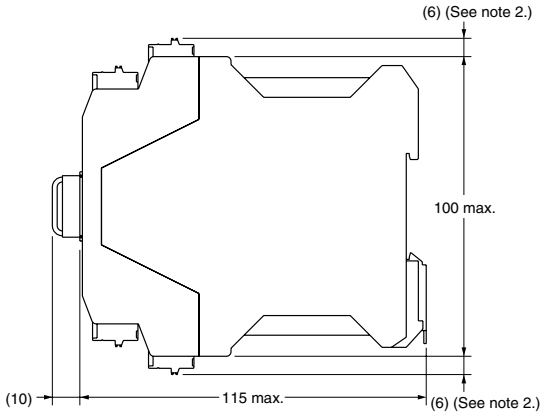
Advanced Unit

G9SX-AD322-□

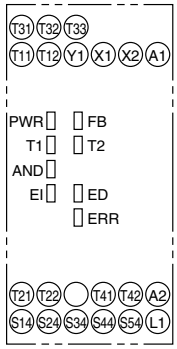




* Typical dimension

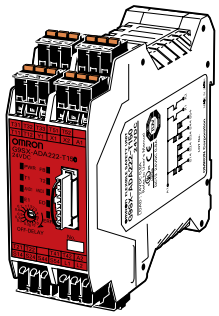


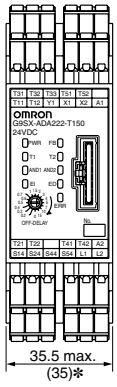
Terminal arrangement



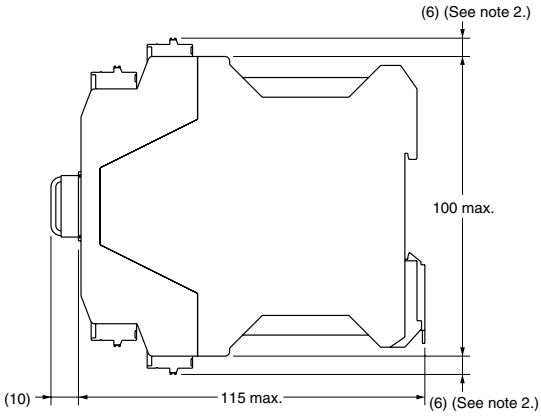
Advanced Unit

G9SX-ADA222-□

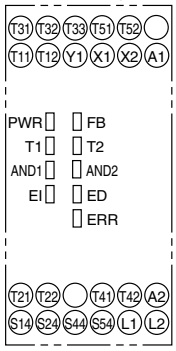




* Typical dimension

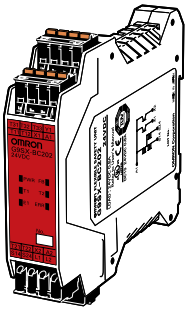


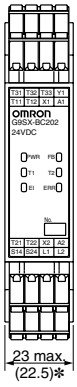
Terminal arrangement



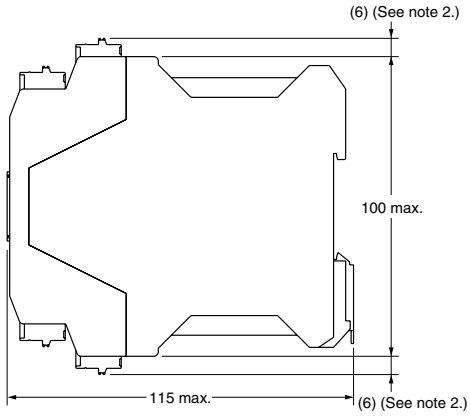
Basic Unit

G9SX-BC202-□

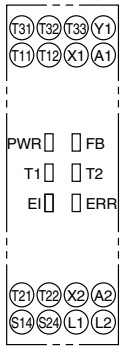




* Typical dimension



Terminal arrangement



Notes:
1. Above outline drawing is for -RC terminal type.
2. For -RC terminal type only.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Dimensions (continued)

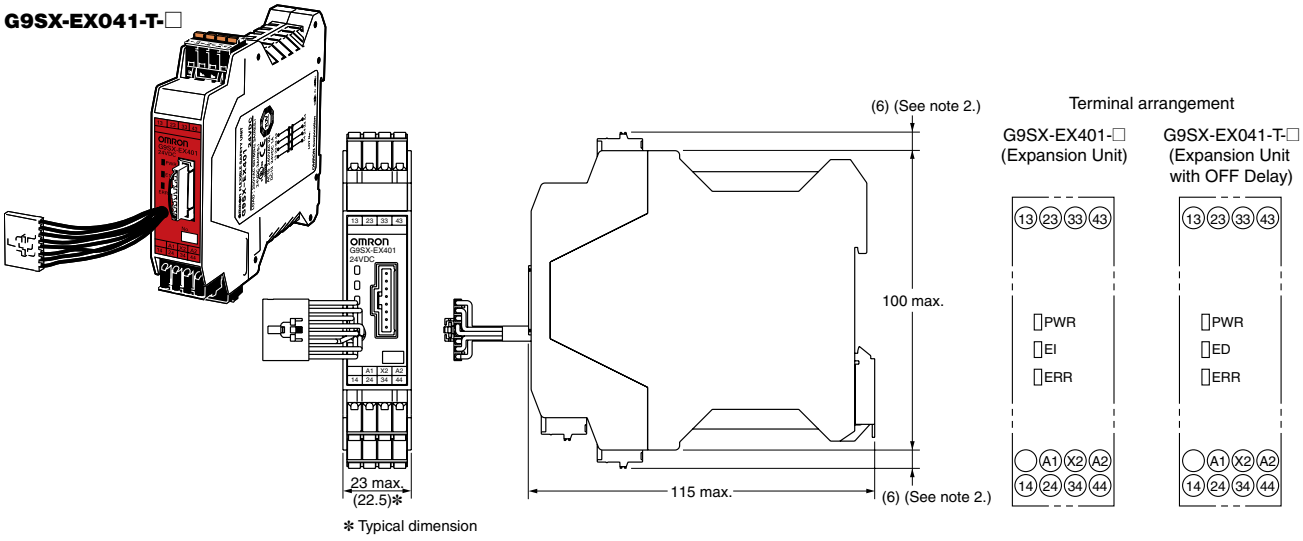
(mm)

Expansion Unit

G9SX-EX401-□

Expansion Unit (OFF-delayed Model)

G9SX-EX041-T-□

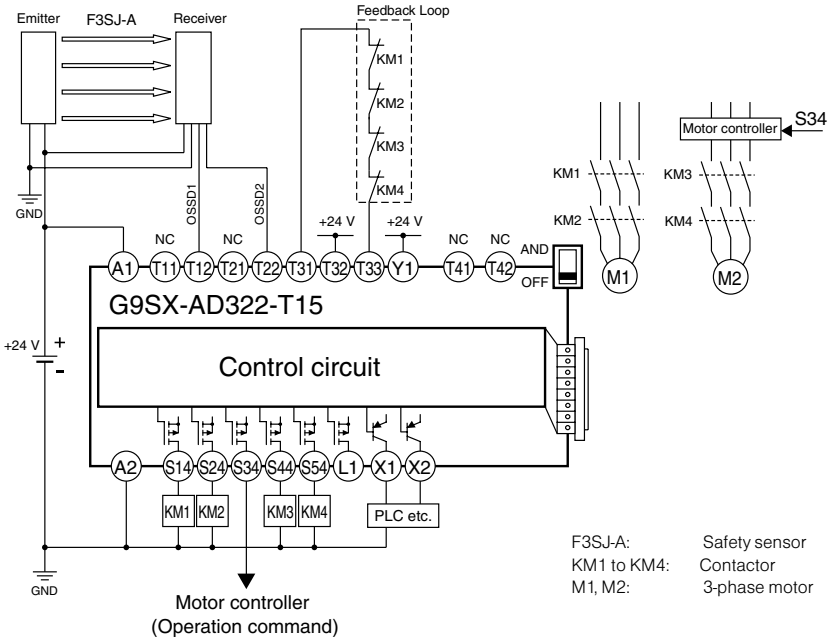


Notes:
1. Above outline drawing is for -RC terminal type.
2. For -RC terminal type only.

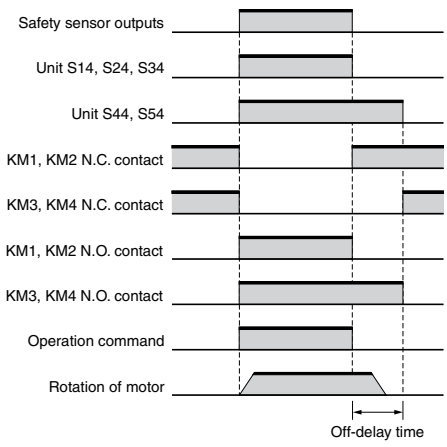
Applications

G9SX-AD322-T15

(24 VDC) (2-channel Safety Sensor / Auto Reset)



Timing chart

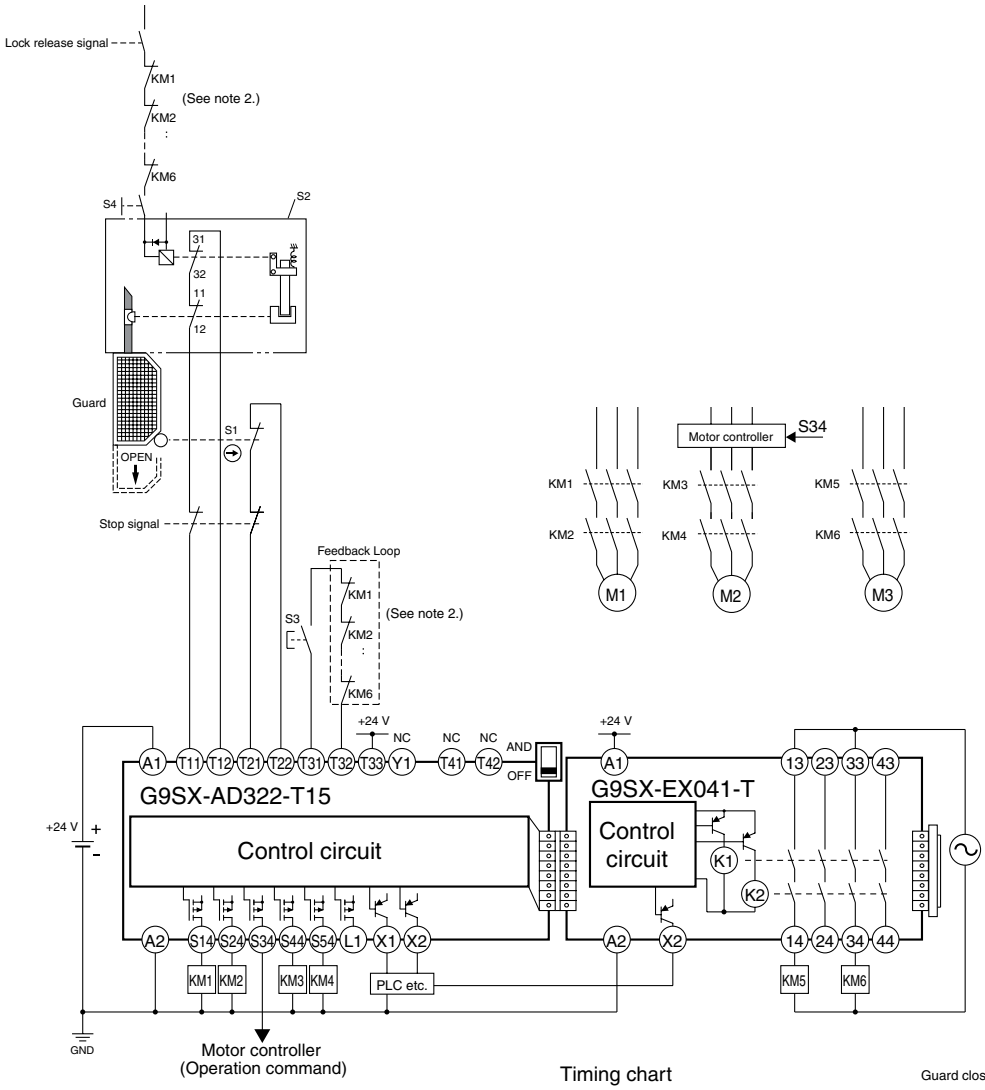


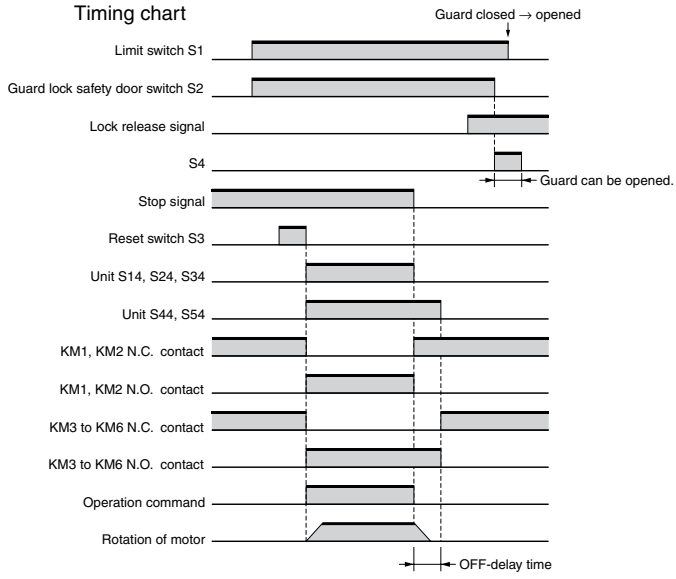
Notes:
1. This example corresponds to category 4.
2. For further information of settings and wiring, refer to the catalog or instruction manual of the connected sensor.
3. Use safety sensors with PNP outputs.

Applications (continued)

G9SX-AD322-T15 (24 VDC) + G9SX-EX041-T

(24 VDC) (Guard Lock Safety Door Switch (Mechanical Lock), (2-channel Safety Limit Switch Inputs / Manual Reset)





S1: Safety limit switch
S2: Guard lock safety door switch
S3: Reset switch
S4: Lock release switch
KM1 to KM6: Contactor
M1 to M3: 3-phase motor

Notes:
1. This example corresponds to category 4.
2. Connect the N.C. contacts of contactors KM1, KM2, KM3, KM4, KM5, and KM6 in series.

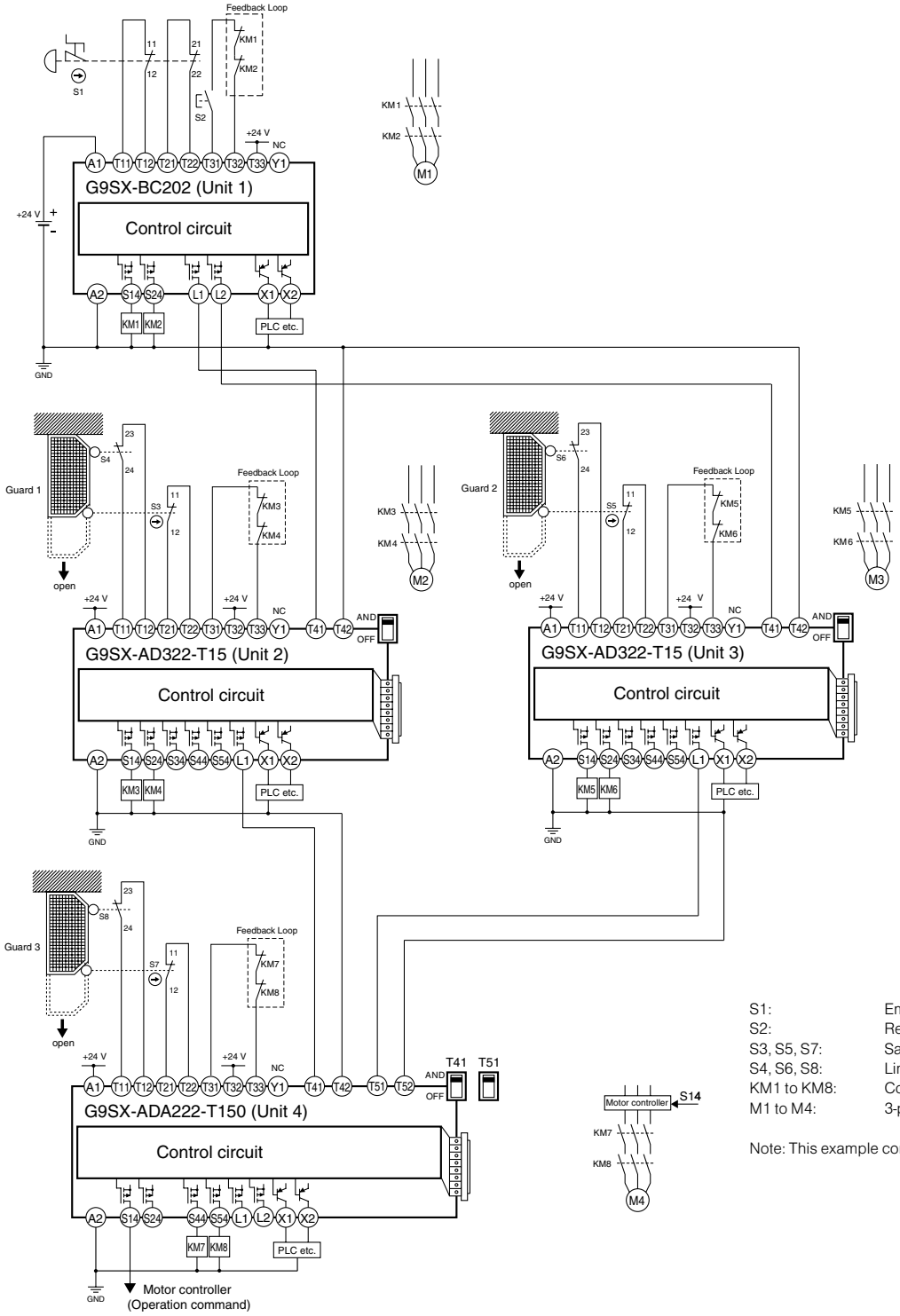
SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Applications (continued)

G9SX-BC202 (24 VDC) (2-channel Emergency Stop Switch Input/Manual Reset)
+ G9SX-AD322-T15 (24 VDC) (2-channel Safety Limit Switch Input/Auto Reset)
+ G9SX-AD322-T15 (24 VDC) (2-channel Safety Limit Switch Input/Auto Reset)
+ G9SX-ADA222-T150 (24 VDC) (2-channel Safety Limit Switch Input/Auto Reset)



S1:	Emergency stop switch
S2:	Reset switch
S3, S5, S7:	Safety limit switch
S4, S6, S8:	Limit switch
KM1 to KM8:	Contactor
M1 to M4:	3-phase motor

Note: This example corresponds to category 4.

Ordering

Model Number Legend

G9SX – □ □ □ □ – □ – □
❶❷❸❹ ❺ ❻

❶ Functions
AD/ADA: Advanced Unit
BC: Basic Unit
EX: Expansion Unit

❷ Output Configuration (Instantaneous Safety Outputs)
0: None
2: 2 outputs
3: 3 outputs
4: 4 outputs

❸ Output Configuration (OFF-delayed Safety Outputs)
0: None
2: 2 outputs
4: 4 outputs

❹ Output Configuration (Auxiliary Outputs)
1: 1 output
2: 2 outputs

❺ Max. OFF-delay Time
Advanced Unit
T15: 15 s
T150: 150 s
Basic Unit
No indicator: No OFF delay
Expansion Unit
No indicator: No OFF delay
T: OFF delay

❻ Terminal Block Type
RT: Screw terminals
RC: Spring-cage terminals

Note: See List of Models below for the actual models that can be ordered.

List of Models

Advanced Unit

Safety outputs *3		Auxiliary outputs *4	Logical AND connection		No. of input channels	Max. OFF-delay time *1	Rated voltage	Terminal block type	Model
Instant-aneous	OFF-delayed *2		Inputs	Outputs					
3 (Semi-conductor)	2 (Semi-conductor)	2 (Semi-conductor)	1 (Semi-conductor)	1 (Semi-conductor)	1 or 2 channels	15 s	24 VDC	Screw terminals	G9SX-AD322-T15-RT
								Spring-cage terminals	G9SX-AD322-T15-RC
						150 s		Screw terminals	G9SX-AD322-T150-RT
								Spring-cage terminals	G9SX-AD322-T150-RC
2 (Semi-conductor)			2 (Semi-conductor)	2 (Semi-conductor)		15 s		Screw terminals	G9SX-ADA222-T15-RT
								Spring-cage terminals	G9SX-ADA222-T15-RC
						150 s		Screw terminals	G9SX-ADA222-T150-RT
								Spring-cage terminals	G9SX-ADA222-T150-RC

*1. The OFF-delay time can be set in 16 steps as follows:
T15: 0/0.2/0.3/0.4/0.5/0.6/0.7/1/1.5/2/3/4/5/7/10/15 s
T150: 0/10/20/30/40/50/60/70/80/90/100/110/120/130/140/150 s
*2. The OFF-delayed output becomes an instantaneous output by setting the OFF-delay time to 0 s.
*3. P channel MOS FET transistor output
*4. PNP transistor output

Basic Unit

Safety outputs *1		Auxiliary outputs *2	No. of input channels	Rated voltage	Terminal block type	Model
Instantaneous	OFF-delayed					
2	—	2 (Semiconductor)	1 or 2 channels	24 VDC	Screw terminals	G9SX-BC202-RT
					Spring-cage terminals	G9SX-BC202-RC

*1. P channel MOS FET transistor output
*2. PNP transistor output

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering (continued)

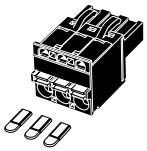
Expansion Unit

Safety outputs		Auxiliary outputs *1	OFF-delay time	Rated voltage	Terminal block type	Model
Instantaneous	OFF-delayed					
4 PST-NO	—	1 (Semiconductor)	—	24 VDC	Screw terminals	G9SX-EX401-RT
					Spring-cage terminals	G9SX-EX401-RC
—	4 PST-NO		*2		Screw terminals	G9SX-EX041-T-RT
					Spring-cage terminals	G9SX-EX041-T-RC

*1. PNP transistor output

*2. The OFF-delay time is synchronized to the OFF-delay time setting in the connected Advanced Unit (G9SX-AD-☐/G9SX-ADA-☐).

Accessories
Terminal Block

Appearance *	Specifications	Applicable units	Model	Remarks
	Terminal Block with screw terminals (3-pin)	G9SX-AD-☐ G9SX-ADA-☐	Y9S-03T1B-02A	Two Terminal Blocks (black) with screw terminals, and a set of six code marks to prevent erroneous insertion.
	Terminal Block with screw terminals (4-pin)	G9SX-BC-☐ G9SX-EX-☐	Y9S-04T1B-02A	Two Terminal Blocks (black) with screw terminals, and a set of six code marks to prevent erroneous insertion.
	Terminal Block with spring-cage terminals (3-pin)	G9SX-AD-☐ G9SX-ADA-☐	Y9S-03C1B-02A	Two Terminal Blocks (black) with spring-cage terminals, and a set of six code marks to prevent erroneous insertion.
	Terminal Block with spring-cage terminals (4-pin)	G9SX-BC-☐ G9SX-EX-☐	Y9S-04C1B-02A	Two Terminal Blocks (black) with spring-cage terminals, and a set of six code marks to prevent erroneous insertion.

Note: The G9SX main unit comes with a terminal block as standard equipment. The accessories shown here can be ordered as a replacement.
*The illustrations show 3-pin types

G9SX-GS

Quick Link
S358
omron247.com

Safety Guard Switching Unit

- A safety measure for hazardous operations that does not lower productivity
- Two functions support two types of application:
  - Auto switching: For applications where operators work together with machines
  - Manual switching: For applications with limited operations
- External indicator outputs enable indicating the switching status of two safety input devices.
- Auxiliary outputs enable monitoring of safety inputs, safety outputs, and errors.
- Detailed LED indications enable easy diagnosis.
- Logical AND connection allows complicated applications in combination with other G9SX-series Units.
- Certification for compliance with IEC/EN 61508 (SIL3), IEC/EN 62061 (SIL3), and EN 954-1 (category 4).



Specifications

Ratings

Power Input

	G9SX-GS226-T15-□	G9SX-EX-□
Rated supply voltage	24 VDC	
Operating voltage range	-15% to 10% of rated supply voltage	
Rated power consumption*	5 W max.	2 W max.

*Power consumption of loads not included.

Inputs

	G9SX-GS226-T15-□
Safety inputs	Operating voltage: 20.4 VDC to 26.4 VDC Internal impedance: Approx. 2.8 kΩ*
Mode selector input	
Feedback/reset input	

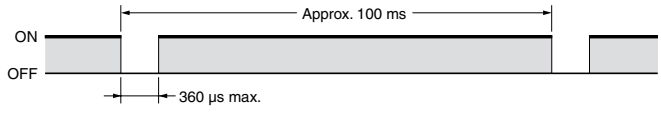
*Provide a current equal to or higher than that of the minimum applicable load of the connected input control device.

Outputs

	G9SX-GS226-T15-□
Instantaneous safety outputs *1 OFF-delayed safety outputs *1	P channel MOS FET transistor outputs Load current: 0.8 A DC max. *2
Auxiliary outputs (for input, output and error monitoring)	PNP transistor outputs Load current: 100 mA max.
External indicator outputs	P channel MOS FET transistor outputs Connectable indicators · Incandescent lamp: 24 VDC, 3 to 7 W · LED lamp: 10 to 300 mA DC

*1. While safety standstill detection outputs are in the ON state, the following signal sequence is output continuously for diagnosis. When using these safety outputs as input signals to control devices (i.e. Programmable Controllers), consider the OFF pulse signal shown at right.

*2. The following derating is required when Units are mounted side-by-side.
G9SX-GS226-T15-□: 0.4 A max. load current



SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Specifications (continued)

Expansion Unit

	G9SX-EX-□
Rated load	250 VAC, 3 A/30 VDC, 3 A (resistive load)
Rated carry current	3 A
Maximum switching voltage	250 VAC, 125 VDC

Logical AND Connection

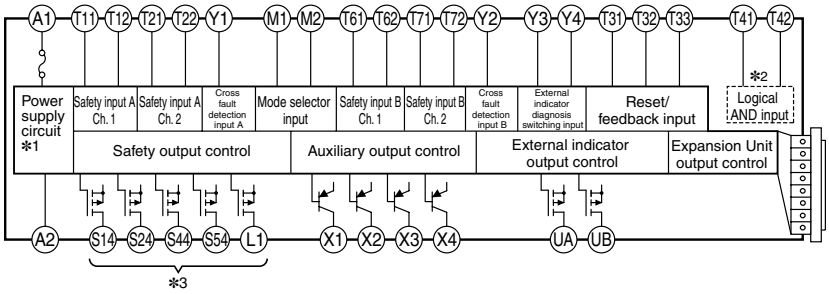
	G9SX-GS226-T15-□	G9SX-EX-□
Number of Units connected per logical AND output	4 Units max.	—
Total number of Units connected by logical AND *1	20 Units max.	—
Number of Units connected in series by logical AND	5 Units max.	—
Max. number of Expansion Units connected *2	—	5 Units max.
Maximum cable length for logical AND input	100 m max.	—

Note: See Logical AND Connection Combinations below for details.
*1. The number of G9SX-EX401-□ Expansion Units or G9SX-EX041-T-□ Expansion Units (OFF-delayed Model) not included.
*2. G9SX-EX401-□ Expansion Units and G9SX-EX041-T-□ Expansion Units (OFF-delayed Model) can be mixed.

Wiring

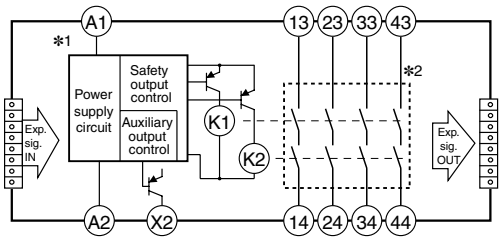
Internal Connection

G9SX-GS226-T15□
(Safety Guard Switching Unit)



*1. Internal power supply circuit is not isolated.
*2. Logical AND input is isolated.
*3. Outputs S14 to S54 and L1 are internally redundant.

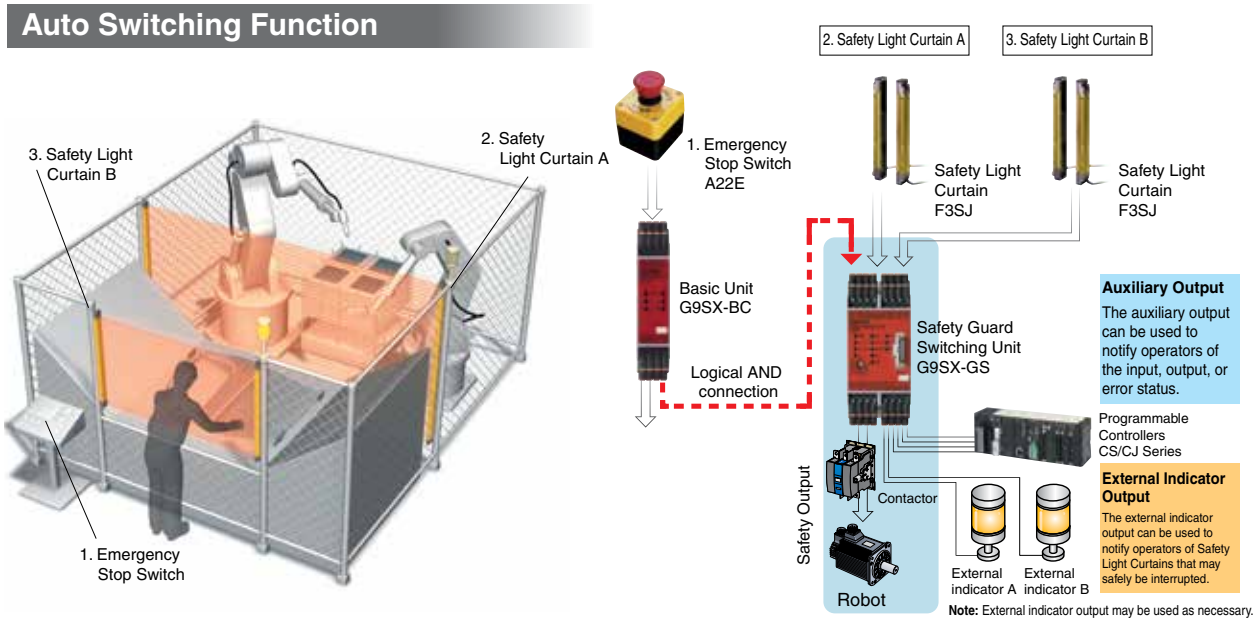
G9SX-EX401-□ / G9SX-EX401-T-□
(Expansion Unit/Expansion Unit with OFF Delay)



*1. Internal power supply circuit is not isolated.
*2. Relay outputs are isolated.

System Configuration Examples

Auto Switching Function

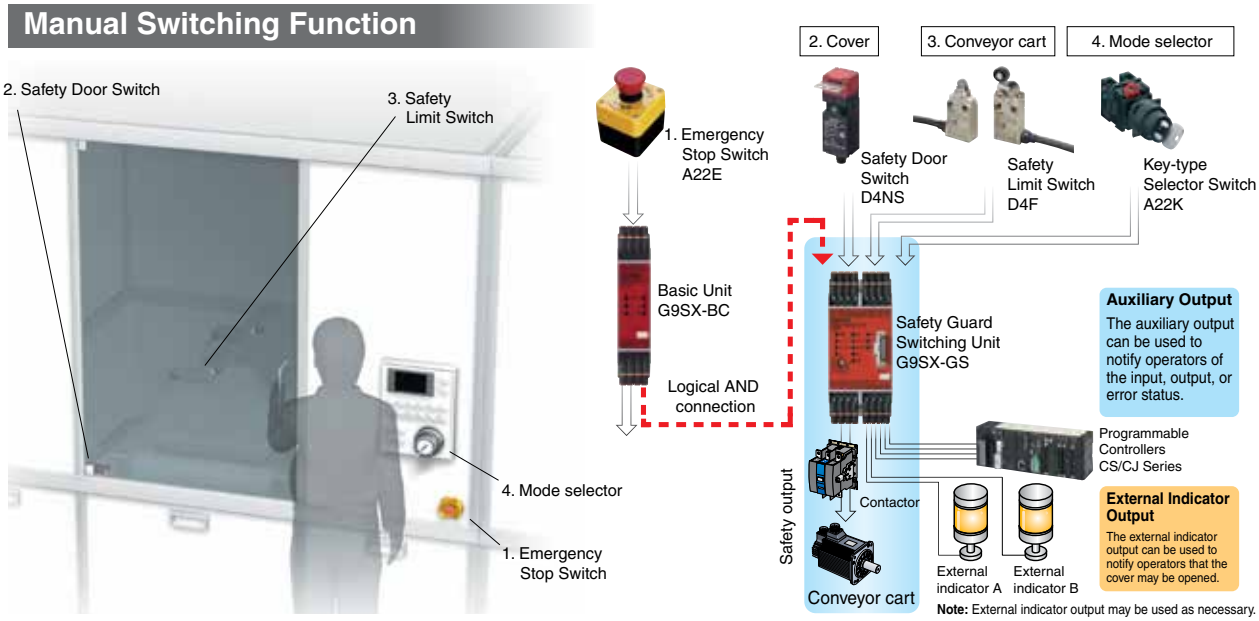


	Working condition	External indicator	G9SX-GS Safety input	G9SX-GS Safety output	G9SX-GS Monitor output	G9SX-GS External indicator
Normal operation	1	OK to work	Safety input A: ON Safety input B: ON	ON Safety output	ON Input A monitor ON Input B monitor	Indicator A Indicator B
Normal operation	2	OK to work	Safety input A: ON Safety input B: OFF	ON Safety output	ON Input A monitor OFF Input B monitor	Indicator A Indicator B
Normal operation	3	Not OK to work	Safety input A: OFF Safety input B: ON	ON Safety output	OFF Input A monitor ON Input B monitor	Indicator A Indicator B
Hazardous condition	4	Not OK to work	Safety input A: OFF Safety input B: OFF	OFF Safety output	OFF Input A monitor OFF Input B monitor	Indicator A Indicator B

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

System Configuration Examples (continued)

Manual Switching Function



	Working condition	External indicator	G9SX-GS Safety input	G9SX-GS Safety output	G9SX-GS Mode selector	G9SX-GS Monitor output	G9SX-GS External indicator
Normal operation	1	Not OK to open	Safety input A: Dis-abled Safety input B: ON	ON Safety output	Normal operating mode	OFF Input A monitor ON Input B monitor	Indicator A Indicator B
Maintenance	2	OK to open	Safety input A: ON Safety input B: Dis-abled	ON Safety output	Maintenance mode	ON Input A monitor OFF Input B monitor	Indicator A Indicator B
Maintenance	3	OK to open	Safety input A: ON Safety input B: Dis-abled	ON Safety output	Maintenance mode	ON Input A monitor OFF Input B monitor	Indicator A Indicator B
Hazardous condition	4	OK to open	Safety input A: OFF Safety input B: Dis-abled	OFF Safety output	Maintenance mode	OFF Input A monitor OFF Input B monitor	Indicator A Indicator B

Functions

Auto Switching Function

The following table shows the relationship between the safety inputs and safety outputs of the G9SX-GS□ when auto switching is selected.

Safety input A	ON	ON	OFF	OFF
Safety input B	ON	OFF	ON	OFF
Safety output	ON	ON	ON	OFF

Notes:
1. If the logical AND connection input is enabled, it must be ON as a necessary condition for the above table.
2. Select either auto reset or manual reset for the reset mode, depending on the operation of the application.

Manual Switching Function

As shown in the following table, the relationship between the safety inputs and safety outputs of the G9SX-GS□ depends on the setting of the connected mode selector when manual switching is selected.

Mode Selector = Normal Operating Mode (M1 = ON, M2 = OFF)

Safety input A	ON	ON	OFF	OFF
Safety input B	ON	OFF	ON	OFF
Safety output	ON	OFF	ON	OFF

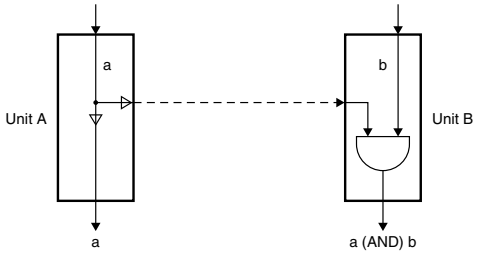
Mode Selector = Maintenance Mode (M1 = OFF, M2 = ON)

Safety input A	ON	ON	OFF	OFF
Safety input B	ON	OFF	ON	OFF
Safety output	ON	ON	OFF	OFF

Notes:
1. If the logical AND connection input is enabled, it must be ON as a necessary condition for the above table.
2. Select either auto reset or manual reset for the reset mode, depending on the operation of the application.

Logical AND Connection

The logical AND connection means that one Unit (Unit A) outputs a safety signal "a" to a subsequent Unit (Unit B) and Unit B calculates the logical AND between safety signal "a" and safety signal "b." In the example shown below, the logical AND connection results in a safety output of "a AND b" for Unit B



Note: For details on the logical AND connection, refer to the G9SX-series Flexible Safety Unit catalog (Cat. No. J150).

External Indicator Outputs

The operator can be notified of two safety input states (enabled/disabled) by connecting external indicator outputs UA and UB to indicators.
External indicator outputs UA and UB turn ON when safety inputs A and B, respectively, are disabled, and turn OFF when safety inputs A and B, respectively, are enabled.
If error monitor output X2 turns ON, UA and UB will both turn OFF.

Auto Switching Selected

External indicator output	Description of operation	Output ON condition
UA	Safety input A is disabled.	Safety input B is ON.
UB	Safety input B is disabled.	Safety input A is ON.

Manual Switching Selected

External indicator output	Description of operation	Output ON condition
UA	Safety input A is disabled.	Mode selector switch must be set to normal operating mode.
UB	Safety input B is disabled.	Mode selector switch must be set to maintenance mode.

Note: Fault of external indicators can be detected.

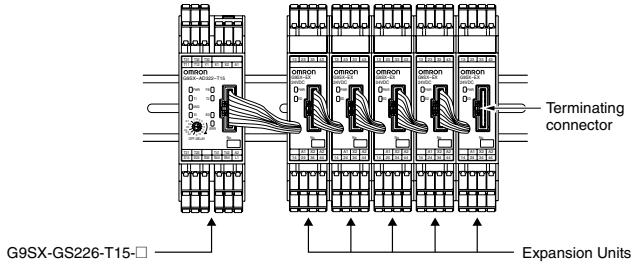
Auxiliary Outputs

Auxiliary outputs X1 to X4 can be used to notify the operator of input, output, and error states, as shown in the following table.

Terminal name	Signal name	Output ON condition
X1	Auxiliary monitor output	X1 is ON when the instantaneous safety output is ON.
X2	Auxiliary error output	X2 is ON when the error LED is lit or flashing.
X3	Input A monitor	X3 is ON when safety input A is ON.
X4	Input B monitor	X4 is ON when safety input B is ON.

Connecting Expansion Units

- The G9SX-EX and G9SX-EX-T Expansion Units can be connected to the G9SX-GS226-T15-□ to increase the number of safety outputs.
- A maximum of five Expansion Units can be connected to one G9SX-GS226-T15-□. This may be a combination of the G9SX-EX Instantaneous Expansion Unit and the G9SX-EX-T OFF-delayed Expansion Unit.
- Remove the terminating connector from the receptacle on the G9SX-GS226-T15-□ and insert the Expansion Unit cable connector into the receptacle. Insert the terminating connector into the receptacle on the Expansion Unit at the very end (rightmost).
- When Expansion Units are connected to the G9SX-GS226-T15-□, make sure that power is supplied to every Expansion Unit. (Refer to the following diagram for actual Expansion Unit connections.)



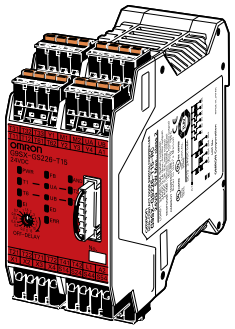
SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

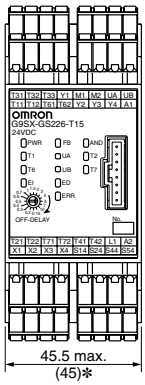
Dimensions and Terminal Arrangements

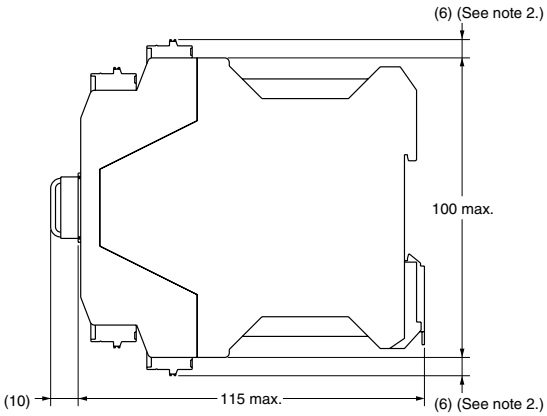
(mm)

Safety Guard Switching Unit

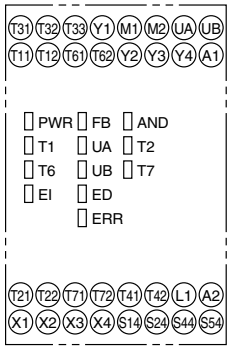
G9SX-GS226-T15-□







Terminal arrangement



* Typical dimension

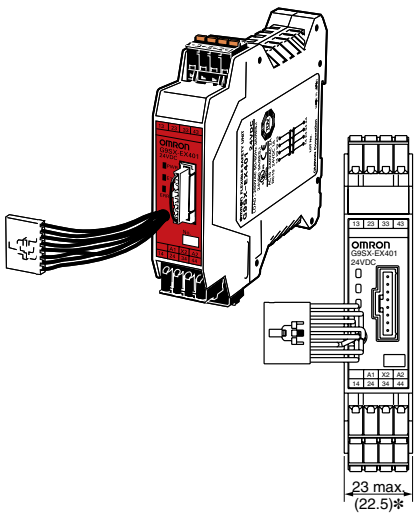
Notes:
1. Above outline drawing is for -RC terminal type.
2. For -RC terminal type only.

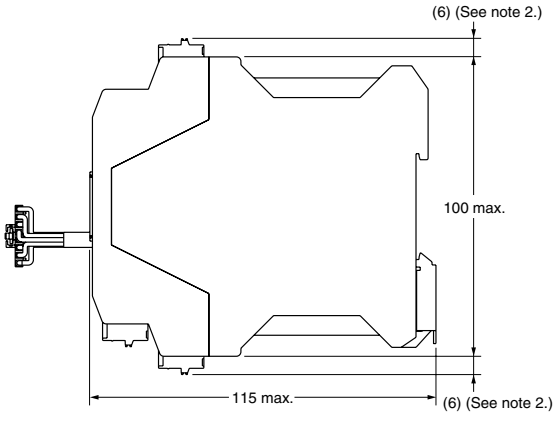
Expansion Unit

G9SX-EX401-□

Expansion Unit (OFF-delayed Model)

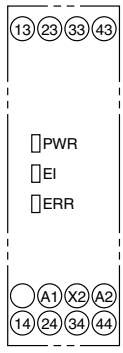
G9SX-EX041-T-□



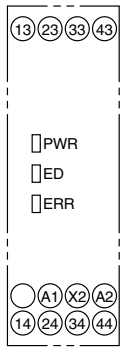


Terminal arrangement

G9SX-EX401-□ (Expansion Unit)



G9SX-EX041-T-□ (Expansion Unit with OFF Delay)



* Typical dimension

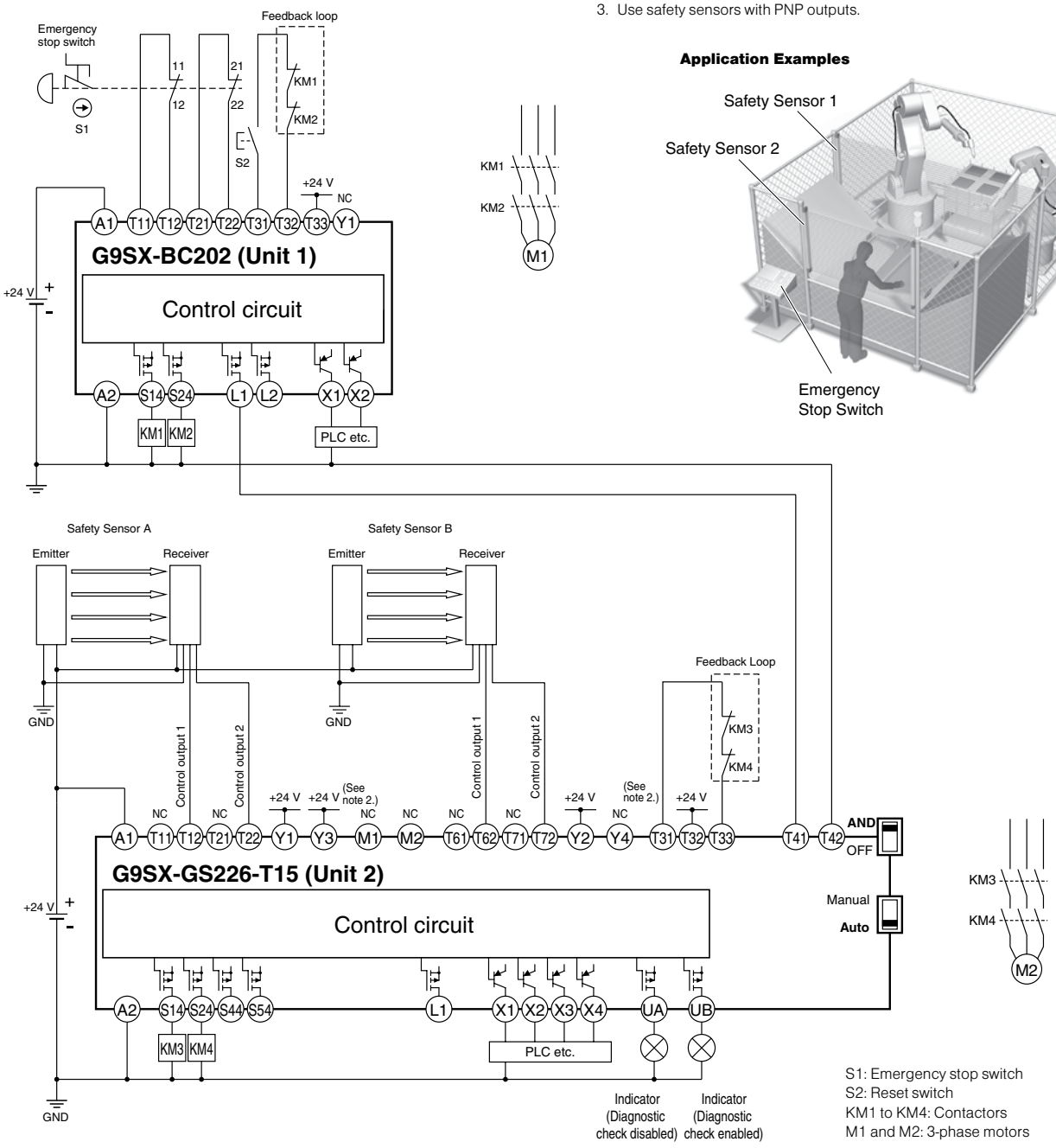
Notes:
1. Above outline drawing is for -RC terminal type.
2. For -RC terminal type only.

Application Examples

G9SX-BC202 (24 VDC) (Guard Lock Safety Door Switch (Mechanical Lock), (2-channel Emergency Stop Switch Input/Manual Reset)

+ G9SX-GS226-T15 (24 VDC) (Two 2-channel Safety Sensor Inputs/Auto Reset/Auto Switching)

Notes:
1. This example corresponds to category 4.
   For details, refer to Safety Categories (EN 954-1).
2. Diagnostic checks of the external indicators connected to external indicator outputs UA and UB can be switched with Y3 and Y4, respectively.
3. Use safety sensors with PNP outputs.



S1: Emergency stop switch
S2: Reset switch
KM1 to KM4: Contactors
M1 and M2: 3-phase motors

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

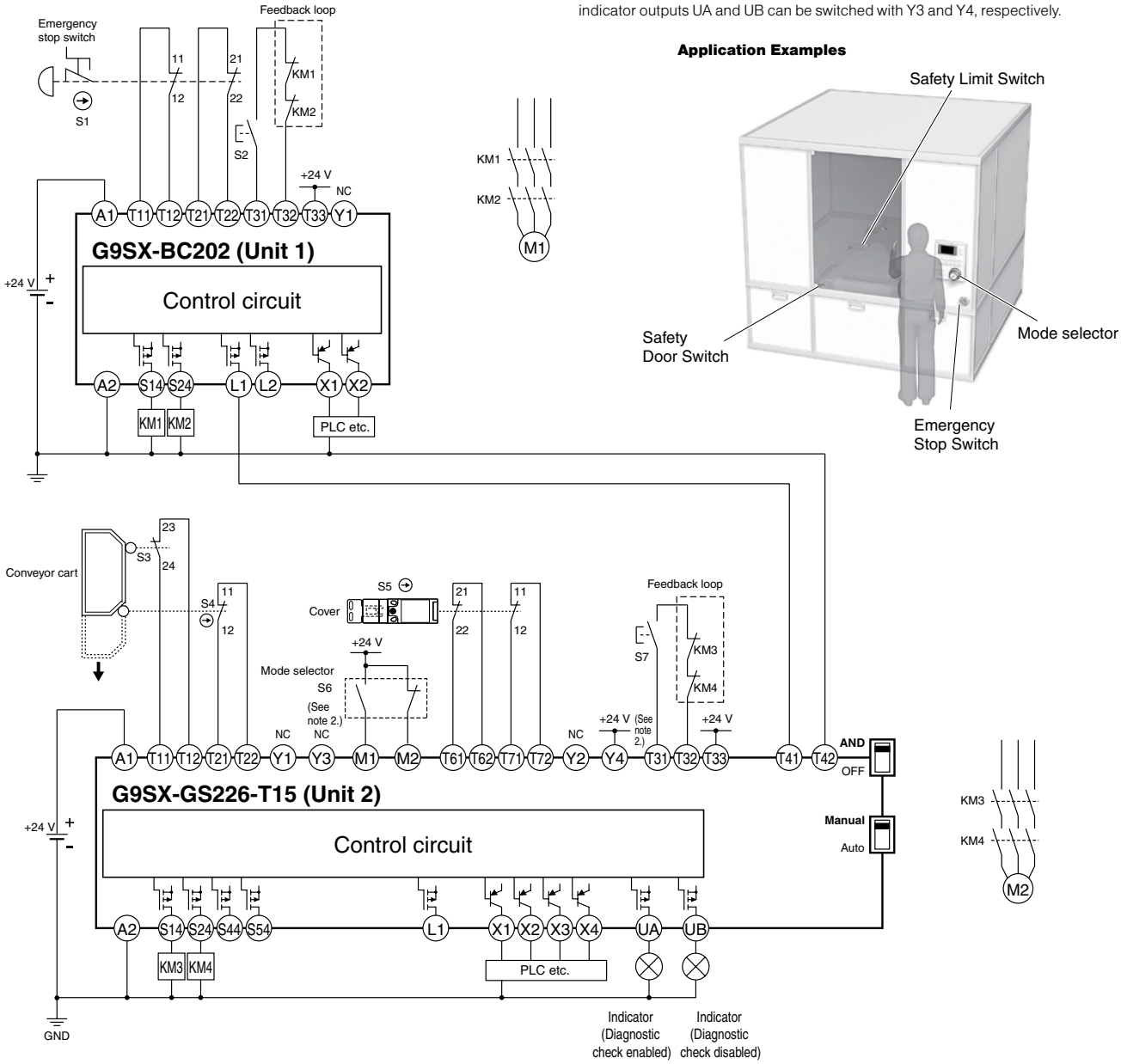
For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Application Examples (continued)

G9SX-BC202 (24 VDC) (2-channel Emergency Stop Switch Input/Manual Reset), + G9SX-GS226-T15 (24 VDC) (Safety Limit Switch, 2-channel Safety Door Switch Inputs/Manual Reset/Manual Switching)

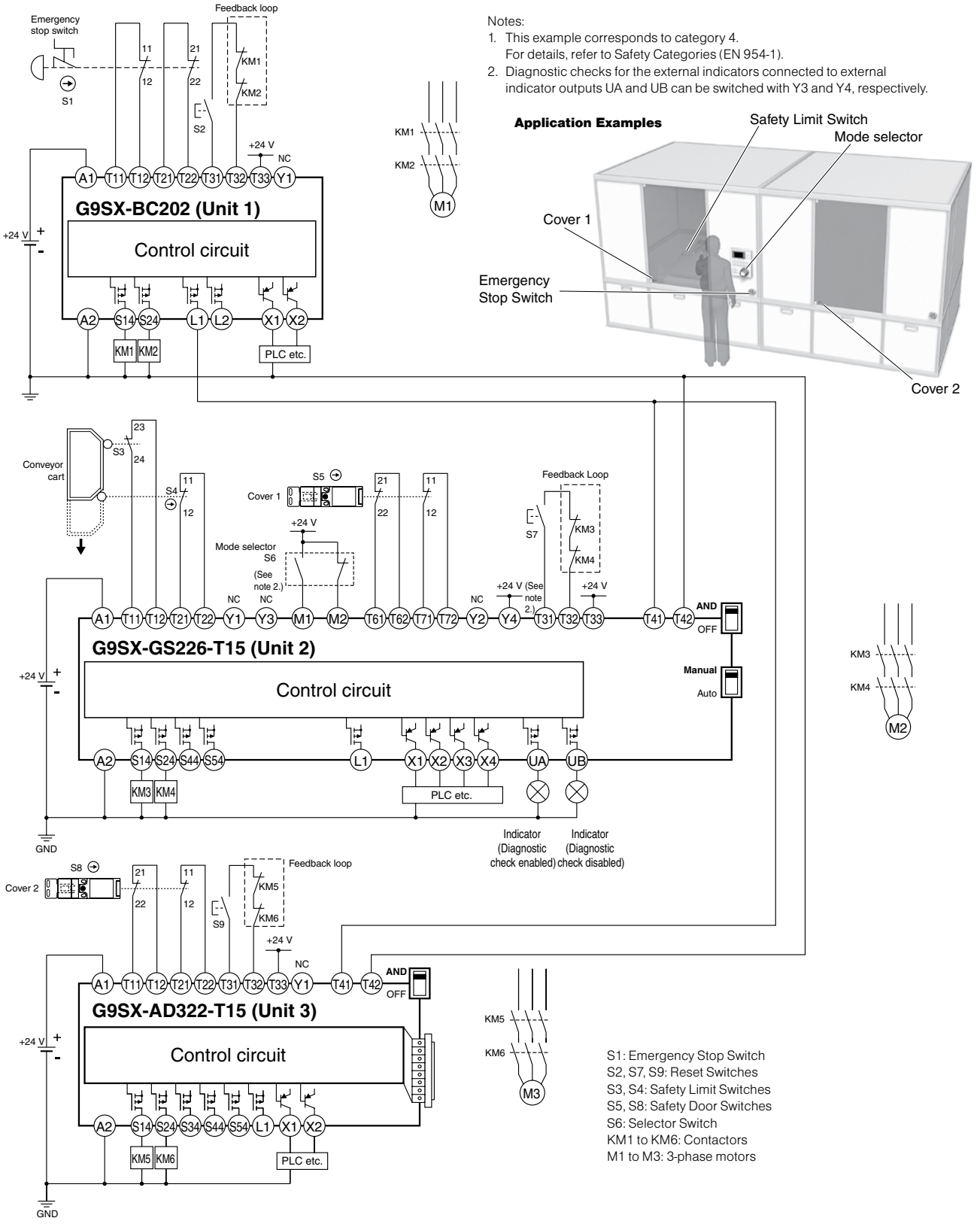
Notes:
1. This example corresponds to category 4.
   For details, refer to Safety Categories (EN 954-1).
2. Diagnostic checks for the external indicators connected to external indicator outputs UA and UB can be switched with Y3 and Y4, respectively.



S1: Emergency Stop Switch
S2, S7: Reset Switches
S3, S4: Safety Limit Switches
S5: Safety Door Switch
S6: Selector Switch
KM1 to KM4: Contactors
M1 and M2: 3-phase motors

Application Examples (continued)

G9SX-BC202 (24 VDC) (2-channel Emergency Stop Switch Input/Manual Reset),
+ G9SX-GS226-T15 (24 VDC) (Safety Limit Switch, 2-channel Safety Door Switch Inputs/Manual Reset/Manual Switching)
+ G9SX-AD322-T15 (24 VDC) (2-channel Safety Door Switch Input/Manual Reset)



Notes:
1. This example corresponds to category 4.
   For details, refer to Safety Categories (EN 954-1).
2. Diagnostic checks for the external indicators connected to external indicator outputs UA and UB can be switched with Y3 and Y4, respectively.

S1: Emergency Stop Switch
S2, S7, S9: Reset Switches
S3, S4: Safety Limit Switches
S5, S8: Safety Door Switches
S6: Selector Switch
KM1 to KM6: Contactors
M1 to M3: 3-phase motors

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering

Model Number Legend

G9SX – □ □ □ □ – □ – □
❶❷❸❹ ❺ ❻

❶ Functions
GS: Safety Guard Switching Unit
EX: Expansion Unit

❷ Output Configuration (Instantaneous Safety Outputs)
0: None
2: 2 outputs
4: 4 outputs

❸ Output Configuration (OFF-delayed Safety Outputs)
0: None
2: 2 outputs
4: 4 outputs

❹ Output Configuration (Auxiliary Outputs)
1: 1 output
6: 6 outputs

❺ Max. OFF-delay Time
Safety Guard Switching Unit
T15: 15 s
Expansion Unit
No indicator: No OFF delay
T: OFF delay

❻ Terminal Block Type
RT: Screw terminals
RC: Spring-cage terminals

Note: See List of Models below for the actual models that can be ordered.

List of Models

Safety Guard Switching Unit

Safety outputs *3		Auxiliary outputs *4	Logical AND connection		Max. OFF-delay time *1	Rated voltage	Terminal block type	Model
Instant-aneous	OFF-delayed *2		Inputs	Outputs				
2 (Semi-conductor)	2 (Semi-conductor)	6 (Semi-conductor)	1 (Semi-conductor)	1 (Semi-conductor)	15 s	24 VDC	Screw terminals	G9SX-GS226-T15-RT
							Spring-cage terminals	G9SX-GS226-T15-RC

*1. The OFF-delay time can be set in 16 steps as follows:
T15: 0/0.2/0.3/0.4/0.5/0.6/0.7/1/1.5/2/3/4/5/7/10/15 s
*2. The OFF-delayed output becomes an instantaneous output by setting the OFF-delay time to 0 s.
*3. P channel MOS FET transistor output
*4. PNP transistor output (except for the external indicator outputs, which are P channel MOS FET transistor outputs)

Expansion Unit

Safety outputs		Auxiliary outputs *1	OFF-delay time	Rated voltage	Terminal block type	Model
Instantaneous	OFF-delayed					
4 PST-NO	—	1 (Semiconductor)	—	24 VDC	Screw terminals	G9SX-EX401-RT
					Spring-cage terminals	G9SX-EX401-RC
—	4 PST-NO		*2		Screw terminals	G9SX-EX041-T-RT
					Spring-cage terminals	G9SX-EX041-T-RC

*1. PNP transistor output
*2. The OFF-delay time is synchronized to the OFF-delay time setting in the connected Unit (G9SX-GS226-T15-□).

Standstill Monitoring Unit

- Sensor-less monitoring of standstill for machines with long inertia
- Standstill is monitored by the motor's back electromotive force (BEMF) signal
- Features a "Standard Configuration", allowing immediate use without sensitivity adjustment
- "User Configuration" also available for fine-tuning of sensitivity
- Detailed LED indications enable easy fault diagnosis
- Safety Category 4 (EN954-1), PLe(ISO13849-1), SIL 3 (IEC/EN 62061) certified



Specifications

Ratings

Power Input

	G9SX-SM032-□
Rated supply voltage	24 VDC
Operating voltage range	-15% to 10% of rated supply voltage
Rated power consumption*	4 W max.

*Power consumption of loads not included.

Inputs

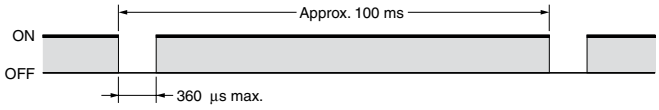
	G9SX-SM032-□
Rated input voltage	Standstill detection input (between Z1 and Z2 and between Z3 and Z4)*1 480 VAC max. (120 Hz max.) *2 Will not accept DC voltage input.
Internal impedance	Standstill detection input: Approx. 660 kΩ*3 EDM input: Approx. 2.8 kΩ*3

*1. Input the motor phase-to-phase voltage between Z1 and Z2 and between Z3 and Z4.
*2. When a motor with AC240V or more is used, connect neutral point of the power supply to earth.
*3. Use a contact that is applicable to microloads (24 VDC, 5 mA) for connection to the EDM input.

Outputs

	G9SX-SM032-□
Safety standstill detection output *1	Source output (PNP), load current: 0.3 A DC max.*2
Auxiliary output (output monitor/error)	Source output (PNP), load current: 100 mA max.

*1. While safety standstill detection outputs are in the ON state, the following pulse signal is output continuously for output circuit diagnosis. When using the safety standstill detection outputs as input signals to control devices (i.e. Programmable Controllers), consider the pulse signal shown below.



*2. The following derating is required when Units are mounted side-by-side.
G9SX-SM032-□: 0.2 A max. load current

G7SA

Quick Link
S353
omron247.com

Compact, Slim Relays Conforming to EN Standards

- Relays with forcibly guided contacts (EN50205 Class A, certified by VDE)
- Supports the CE marking of machinery (Machinery Directive)
- Helps avoid hazardous machine status when used as part of an interlocking circuit
- Four-pole and six-pole Relays are available
- The relay's terminal arrangement simplifies PWB pattern design
- Reinforced insulation between inputs and outputs. Reinforced insulation between some poles of different polarity.



Specifications

Ratings

Coil

Rated Voltage	Rated Current (mA)	Coil Resistance (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Max. Voltage (V)	Power Consumption (mW)
24 VDC	4 poles: 15 6 poles: 20.8	4 poles: 1,600 6 poles: 1,152	75% max.	10% min.	110%	4 poles: Approx. 360 6 poles: Approx. 500

Notes:
1. The rated current and coil resistance are measured at a coil temperature of 23°C with tolerances of ±15%.
2. Performance characteristics are based on a coil temperature of 23°C.
3. The maximum voltage is based on an ambient operating temperature of 23°C maximum.

Contacts

	Resistive Load
Rated load	6 A at 250 VAC, 6 A at 30 VDC
Rated carry current	6 A
Max. switching voltage	250 VAC, 125 VDC
Max. switching current	6 A
Max. drop-out time*	10 ms

*The drop-out time is the time it takes for the N/O contacts to open after the coil voltage is turned OFF.

Certified Standards

- EN Standards, VDE Certified
  EN61810-1 (Electromechanical non-specified time all-or-nothing relays)
  EN50205 (Relays with forcibly guided (linked) contacts)
- UL standard UL508 Industrial Control Devices
- CSA standard CSA C22.2 No. 14 Industrial Control Devices

Forcibly-Guided Contacts (from EN50205)

If an NO contact becomes welded, all NC contacts will maintain a minimum distance of 0.5 mm when the coil is not energized. Likewise if an NC contact becomes welded, all NO contacts will maintain a minimum distance of 0.5 mm when the coil is energized.

Characteristics of Sockets

Model	Continuous Current	Dielectric Strength	Insulation Resistance
P7SA-1☐	6 A *1	2,500 VAC for 1 min. between poles	1,000 MΩ min. *2

Notes:
Use the P7SA-1☐F-ND in the ambient temperature range of -20 to 70°C.
Use the P7SA-1☐F and P7SA-1☐F-ND in the ambient humidity range of 45 to 85%.
*1. When operating the P7SA-1☐F at a temperature between 55 and 85°C, reduce the continuous current (6 A at 55°C or less) by 0.1 A for each degree above 55°C.
When operating the P7SA-1☐F-ND at a temperature between 50 and 70°C, reduce the continuous current (6 A at 50°C or less) by 0.3 A for each degree above 50°C.
*2. Measurement conditions: Measurement of the same points as for the dielectric strength at 500 VDC.

Specifications (continued)

Contact resistance *1		100 mΩ max.
Operating time *2		20 ms max.
Response time *3		10 ms max.
Release time *2		20 ms max.
Must operate voltage		75% max.
Must release voltage		10% min.
Maximum operating frequency	Mechanical	36,000 operation/h
	Rated load	1,800 operation/h
Insulation resistance *4		1,000 MΩ min.
Dielectric strength *5 *6		Between coil contacts/different poles (except for poles 3-4 in 4-pole relays and poles 3-5, 4-6, and 5-6 in 6-pole relays): 4,000 VAC, 50/60 Hz for 1 min. Between different poles (poles 3-4 in 4-pole relays and poles 3-5, 4-6, and 5-6 in 6-pole relays): 2,500 VAC, 50/60 Hz for 1 min. Between contacts of same polarity: 1,500 VAC, 50/60 Hz for 1 min.
Vibration resistance		10 to 55 to 10 Hz, 0.75 mm single amplitude (1.5 mm double amplitude)
Shock resistance	Destruction	1,000 m/s^2
	Malfunction	100 m/s^2
Durability *7	Mechanical	10,000,000 operations min. (at approx. 36,000 operations/h)
	Electrical	100,000 operations min. (at the rated load and approx. 1,800 operations/h)
Inductive load switching capability *8 (IEC60947-5-1)		AC15 AC250V 2A DC13 DC24V 1A
Failure rate (P level) (reference value *9)		5 VDC, 1 mA
Ambient operating temperature *10		12 to 48 VDC: -40 to 85°C (with no icing or condensation)
Ambient operating humidity		5% to 85%
Weight		4 poles: Approx. 22 g 6 poles: Approx. 25 g

Specifications are subject to change without notice.

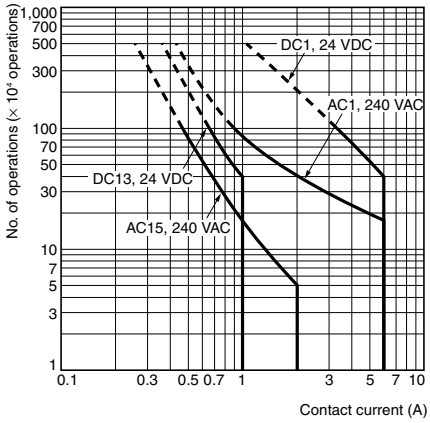
Notes: 1. The above values are initial values.
2. Performance characteristics are based on coil temperature of 23°C.

*1. The contact resistance was measured with 1 A at 5 VDC using the voltage-drop method.
*2. These times were measured at the rated voltage and an ambient temperature of 23°C. Contact bounce time is not included.
*3. The response time is the time it takes for the normally open contacts to open after the coil voltage is turned OFF. Contact bounce time is included. Measurement conditions: Rated voltage operation, Ambient temperature: 23°C.
*4. The insulation resistance was measured with a 500 VDC megohmmeter at the same locations as the dielectric strength was measured.
*5. Pole 3 refers to terminals 31-32 or 33-34, pole 4 refers to terminals 43-44, pole 5 refers to terminals 53-54, and pole 6 refers to terminals 63-64.
*6. When using a P7SA Socket, the dielectric strength between coil contacts/different poles is 2,500 VAC, 50/60 Hz for 1 min.
*7 The durability is for an ambient temperature of 15 to 35°C and an ambient humidity of 25% to 75%. For the durability performance to the load refer to the Durability Curve.
*8. AC15: cosø = 0.3, DC14: L/R = 48 ms.
*9. The failure rate is based on an operating frequency of 300 operations/min.
*10. 12 to 48 VDC: When operating between 70 to 85°C, reduce the rated current of 6 A by 0.1 A for each degree above 70°C.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Engineering Data

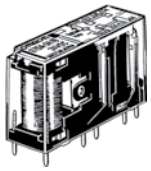
Durability Curve

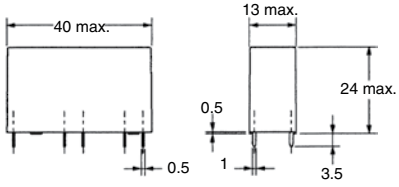


Dimensions

(mm)

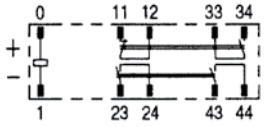
G7SA-3A1B
G7SA-2A2B



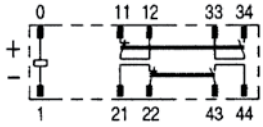


Terminal Arrangement/ Internal Connection Diagram (Bottom View)

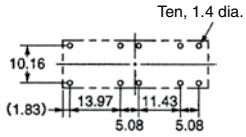
G7SA-3A1B



G7SA-2A2B

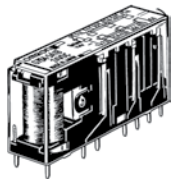


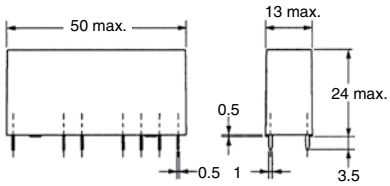
Printed Circuit Board Design Diagram (Bottom View)
(±0.1 tolerance)



Notes:
1. Terminals 23-24, 33-34, and 43-44 are normally open. Terminals 11-12 and 21-22 are normally closed.
2. The colors of the cards inside the Relays are as follows: G7SA-3A1B: Blue and G7SA-2A2B: White.

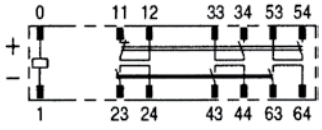
G7SA-5A1B
G7SA-4A2B
G7SA-3A3B



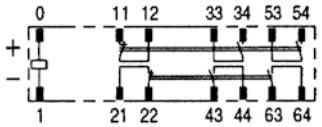


Terminal Arrangement/ Internal Connection Diagram (Bottom View)

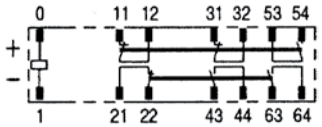
G7SA-5A1B



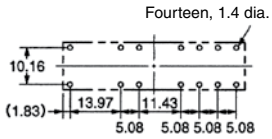
G7SA-4A2B



G7SA-3A3B



Printed Circuit Board Design Diagram (Bottom View)
(±0.1 tolerance)



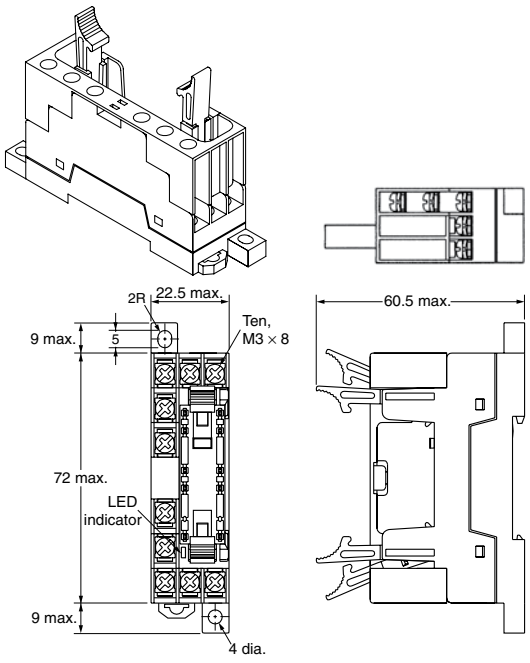
Notes:
1. Terminals 23-24, 33-34, 43-44, 53-54, and 63-64 are normally open. Terminals 11-12, 21-22, and 31-32 are normally closed.
2. The colors of the cards inside the Relays are as follows: G7SA-5A1B: Blue, G7SA-4A2B: White, and G7SA-3A3B: Yellow.

Dimensions (continued)

(mm)

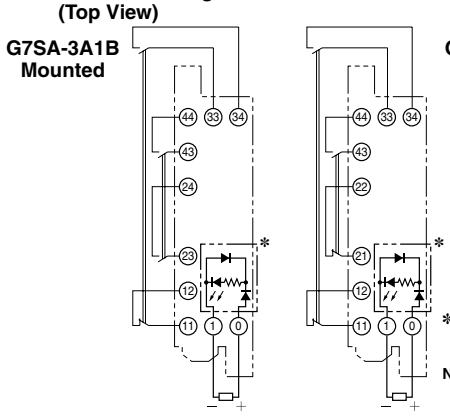
Track-mounting Socket

P7SA-10F, P7SA-10F-ND



Note 1: The socket is shown with the finger cover removed.
2: Only the -ND Sockets have LED indicators (orange)

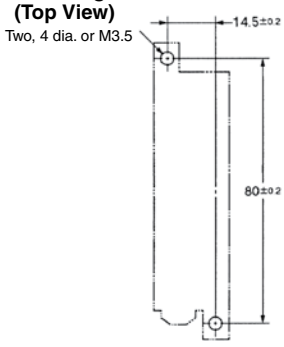
Terminal Arrangement/Internal Connection Diagram (Top View)



* This display circuit is available only for "-ND" models.

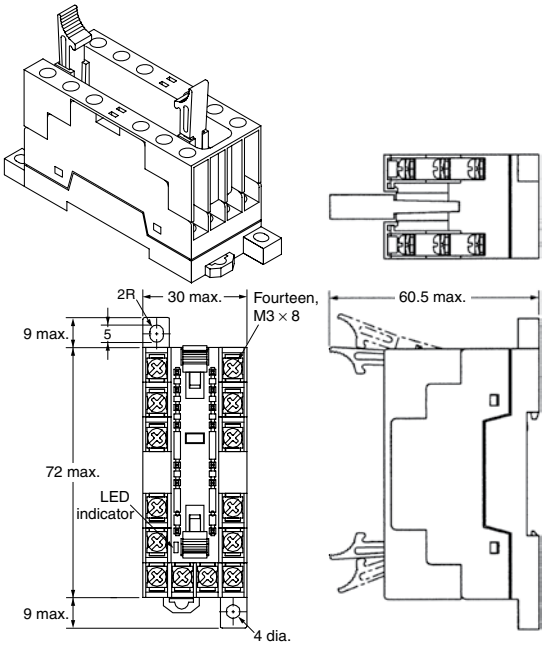
Note: Terminals 23-24, 33-34, and 43-44 are normally open. Terminals 11-12 and 21-22 are normally closed.

Mounting Hole Placement Diagram (Top View)



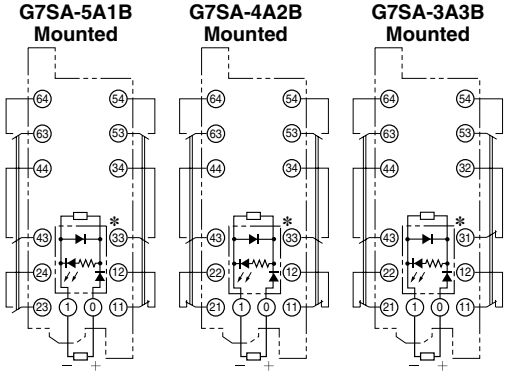
Track-mounting Socket

P7SA-14F, P7SA-14F-ND

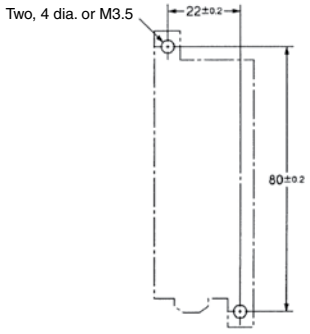


Note 1: The socket is shown with the finger cover removed.
2: Only the -ND Sockets have LED indicators (orange).

Terminal Arrangement/Internal Connection Diagram (Top View)



Mounting Hole Placement Diagram (Top View)



* This display circuit is available only for "-ND" models.

Note: Terminals 23-24, 33-34, 43-44, 53-54, and 63-64 are normally open. Terminals 11-12, 21-22, and 31-32 are normally closed.

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

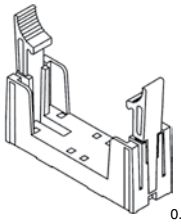
For complete specifications and additional models and accessories visit www.omron247.com

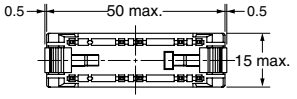
OMRON AUTOMATION & SAFETY

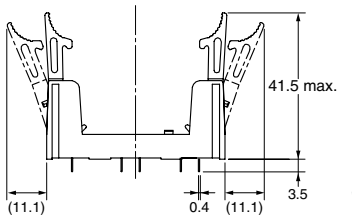
Dimensions (continued)

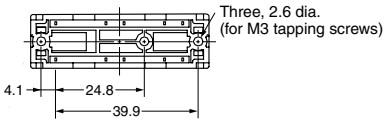
(mm)

Back-mounting Socket (for PCB)
P7SA-10P



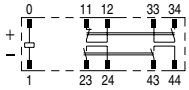




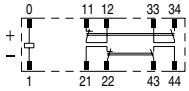


Terminal Arrangement/Internal Connection Diagram (Bottom View)

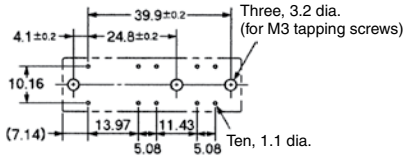
G7SA-3A1B Mounted



G7SA-2A2B Mounted

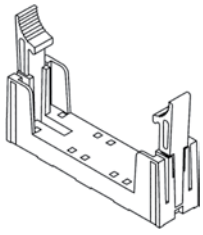


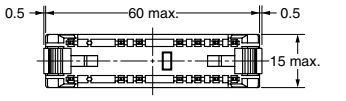
Mounting Hole Placement (Bottom View)
(±0.1 tolerance)

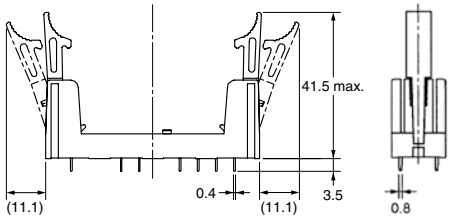


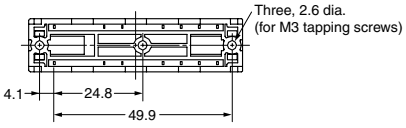
Note: Terminals 23-24, 33-34, and 43-44 are normally open. Terminals 11-12 and 21-22 are normally closed.

Back-mounting Socket (for PCB)
P7SA-14P



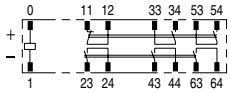




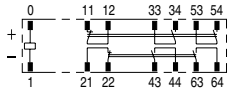


Terminal Arrangement/Internal Connection Diagram (Bottom View)

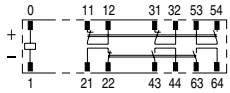
G7SA-5A1B Mounted



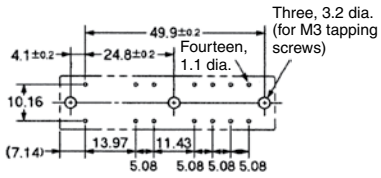
G7SA-4A2B Mounted



G7SA-3A3B Mounted



Mounting Hole Placement (Bottom View)
(±0.1 tolerance)



Note: Terminals 23-24, 33-34, 43-44, 53-54, and 63-64 are normally open. Terminals 11-12, 21-22, and 31-32 are normally closed.

Ordering

Model Number Legend

G7SA – ☐ A ☐ B
❶ ❷

❶ NO Contact Poles
2: DPST-NO
3: 3PST-NO
4: 4PST-NO
5: 5PST-NO

❷ NC Contact Poles
1: SPST-NC
2: DPST-NC
3: 3PST-NC

Relays with Forcibly Guided Contacts

Type	Sealing	Poles	Contact Configuration	Rated Voltage*	Model
Standard	Flux-tight	4 poles	3PST-NO, SPST-NC	24 VDC	G7SA-3A1B DC24
			DPST-NO, DPST-NC		G7SA-2A2B DC24
		6 poles	5PST-NO, SPST-NC		G7SA-5A1B DC24
			4PST-NO, DPST-NC		G7SA-4A2B DC24
			3PST-NO, 3PST-NC		G7SA-3A3B DC24

*Consult your Omron representative for details on rated voltages of 12 VDC, 18 VDC, 21 VDC and 48 VDC.

Sockets

Type		LED Indicator	Poles	Rated Voltage	Model
Track-mounting	Track mounting and screw mounting possible	No	4 poles	–	P7SA-10F
			6 poles		P7SA-14F
		Yes	4 poles	24 VDC	P7SA-10F-ND DC24
			6 poles		P7SA-14F-ND DC24
Back-mounting	PCB terminals	No	4 poles	–	P7SA-10P
			6 poles		P7SA-14P

Relays with Forcibly Guided Contacts and Track Mounting Sockets (assemblies)

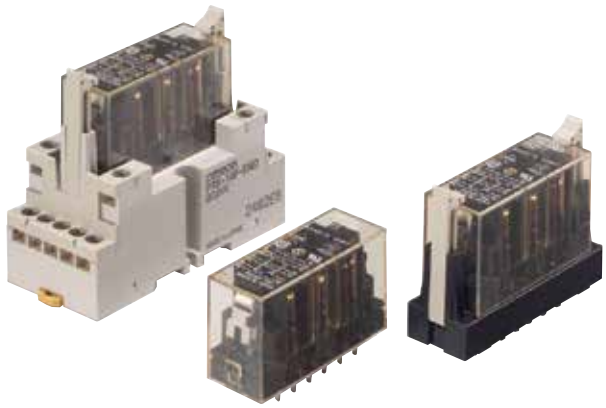
Relay Specifications			Socket Specifications			
Poles	Contact Configuration	Rated Coil Voltage	Type	LED Indicator	LED Rated Voltage	Assembly Model
4 poles	DPST-NO, DPST-NC	24 VDC	Track Mounting and screw mounting possible	No		FGRMS22-24
4 poles	3PST-NO, SPST-NC	24 VDC	Track Mounting and screw mounting possible	No		FGRMS31-24
6 poles	3PST-NO, 3PST-NC	24 VDC	Track Mounting and screw mounting possible	No		FGRMS33-24
6 poles	4PST-NO, 2PST-NC	24 VDC	Track Mounting and screw mounting possible	No		FGRMS42-24
6 poles	5PST-NO, SPST-NC	24 VDC	Track Mounting and screw mounting possible	No		FGRMS51-24
4 poles	DPST-NO, DPST-NC	24 VDC	Track Mounting and screw mounting possible	Yes	24 VDC	FGRMS22-24-LED
4 poles	3PST-NO, SPST-NC	24 VDC	Track Mounting and screw mounting possible	Yes	24 VDC	FGRMS31-24-LED
6 poles	3PST-NO, 3PST-NC	24 VDC	Track Mounting and screw mounting possible	Yes	24 VDC	FGRMS33-24-LED
6 poles	4PST-NO, 2PST-NC	24 VDC	Track Mounting and screw mounting possible	Yes	24 VDC	FGRMS42-24-LED
6 poles	5PST-NO, SPST-NC	24 VDC	Track Mounting and screw mounting possible	Yes	24 VDC	FGRMS51-24-LED

G7S-□-E

Quick Link
S352
omron247.com

Lineup Now Includes 10 A Models

- Relays with forcibly guided contacts (EN50205 Class A, certified by VDE).
- Supports the CE marking of machinery (Machinery Directive).
- Helps avoid hazardous machine status when used as part of an interlocking circuit.
- Track-mounting and Back-mounting Sockets are available.



Specifications

Ratings

Coil

Rated Voltage	Rated Current (mA)	Coil Resistance (Ω)	Must Operate Voltage (V)	Must Release Voltage (V)	Max. Voltage (V)	Power Consumption (W)
24 VDC	30	800	80% max.	10% min.	110%	Approx. 0.8

Notes:
1. The rated current and coil resistance are measured at a coil temperature of 23°C with tolerances of ±15%.
2. Performance characteristics are based on a coil temperature of 23°C.
3. The maximum voltage is based on an ambient operating temperature of 23°C maximum.

Contacts

		Resistive load	Inductive load *
Rated load	NO contact	10 A at 250 VAC 10 A at 30 VDC	AC-15: 5 A at 240 VAC DC-13: 2 A at 24 VDC
	NC contact	6 A at 250 VAC 6 A at 30 VDC	AC-15: 3 A at 240 VAC DC-13: 2 A at 24 VDC
Rated carry current	NO contact	10 A	
	NC contact	6 A	
Maximum switching voltage		250 VAC, 30 VDC	
Maximum switching current	NO contact	10 A	
	NC contact	6 A	

*In the above table, cosø = 0.3 for AC-15 inductive loads and L/R = 96 ms for DC-13 inductive loads.

Certified Standards

- EN Standards, VDE Certified
  EN61810-1 (Electromechanical non-specified time all-or-nothing relays)
  EN60255-23 (Contact performance)
  EN50205 (Relays with forcibly guided (linked) contacts)
- UL standard UL508 Industrial Control Devices
- CSA standard CSA C22.2 No. 14 (Industrial Control Equipment)

Forcibly-Guided Contacts (from EN50205)

If an NO contact becomes welded, all NC contacts will maintain a minimum distance of 0.5 mm when the coil is not energized. Likewise if an NC contact becomes welded, all NO contacts will maintain a minimum distance of 0.5 mm when the coil is energized.

Characteristics of Sockets

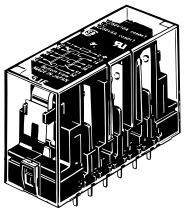
Model	Continuous Current	Dielectric Strength	Insulation Resistance
P7S-14□	10 A	2,000 VAC for 1 min. between poles	1,000 MΩ min. *

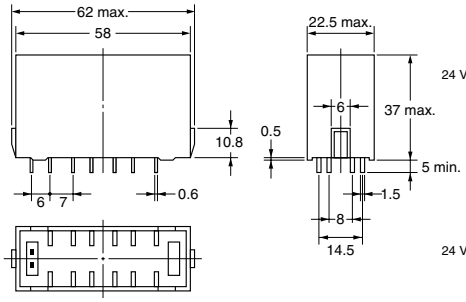
Notes:
Use the P7SA-14F-END in the ambient temperature range of 35 to 85%
*Measurement conditions: Measurement of the same points as for the dielectric strength at 500 VDC.

Dimensions

(mm)

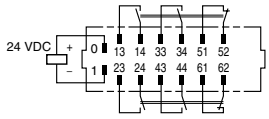
G7S-4A2B-E
G7S-3A3B-E



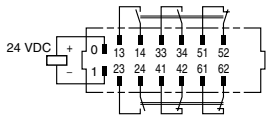


Terminal Arrangement/Internal Connection Diagram (Bottom View)

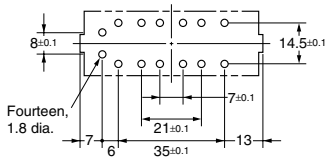
G7S-4A2B-E



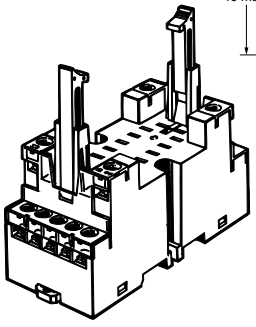
G7S-3A3B-E

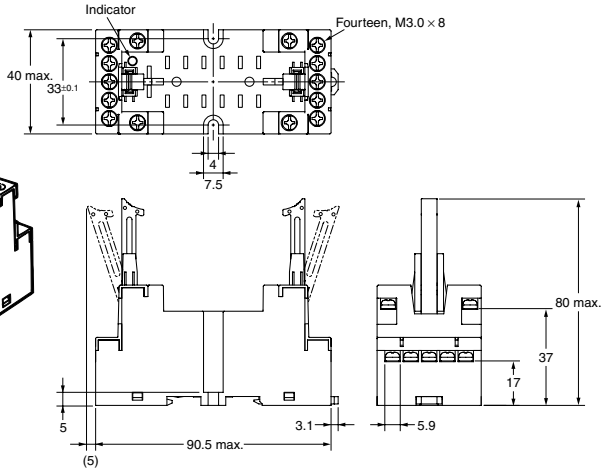


Mounting Hole Dimensions

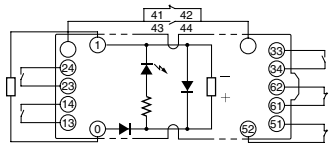


Track-mounting Socket
P7S-14F-END

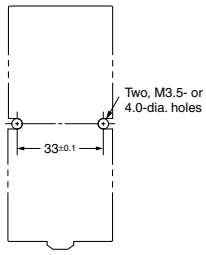




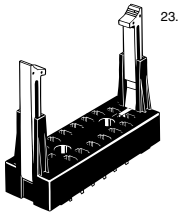
Terminal Arrangement/Internal Connection Diagram (Top View)

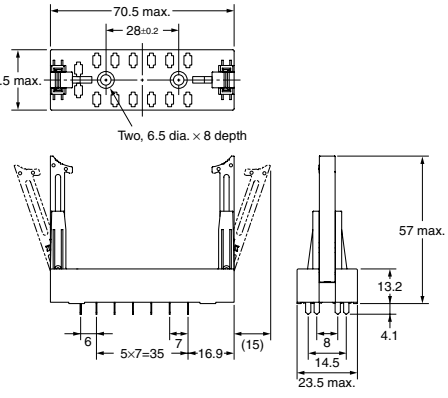


Mounting Hole Dimensions

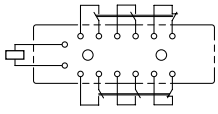


Back-mounting Socket (PCB Terminals)
P7S-14P-E

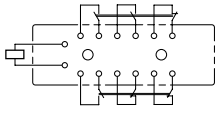




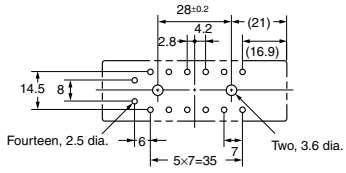
Terminal Arrangement/Internal Connection Diagram (Bottom View) With G7S-4A2B-E mounted



With G7S-3A3B-E mounted



Mounting Hole Dimensions



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Ordering

Model Number Legend

G7S − □ A □ B − E
❶ ❷

❶ NO Contact Poles
3: 3PST-NO
4: 4PST-NO

❷ NC Contact Poles
2: DPST-NC
3: 3PST-NC

Relays with Forcibly Guided Contacts

Type	Poles	Contact Configuration	Rated Voltage*	Model
Standard	6 poles	4PST-NO, DPST-NC	24 VDC	G7S-4A2B-E
		3PST-NO, 3PST-NC		G7S-3A3B-E

Sockets

Type		Rated Voltage	Model
Track-mounting	Common for track mounting and screw mounting	24 VDC	P7S-14F-END
Back-mounting	PCB terminals	—	P7S-14P-E

J7KNA-AR

Quick Link
R724
omron247.com

Mini Contactor Relays 4-Pole

- AC and DC operated
- 4-, 6- and 8-pole versions in different configurations
- Mirrored contacts
- Screw fixing and snap fitting (35 mm DIN rail)
- Rated current = 10 A (I_{th})
- Suitable for electronic devices (DIN 19240)
- Finger proof (VBG 4)

Accessories

- 2- and 4-pole additional auxiliary contacts in different configurations



Specifications

Electrical	
Operating Coil	
Supply Power:	24 VDC, 110 VAC or 230 VAC
Inrush:	25 VA for AC versions 3 W for DC versions
Power Usage:	4.5 VA for AC versions 2.5 W for DC versions
Rated Carry Current:	10 A @ 40C
Switching Capability Inductive Loads (AC-15, DC-13)	
AC:	Break 120 V - 6 A, 240 V - 3 A (continuous 10 A)
DC:	24 V - 3 A
Max. Switching Frequency:	10,000 per hour
Min. Switching Current:	5 mA
Max. Drop-Out Time*:	8-25 ms for AC versions 8-25 ms for DC versions
Mechanical	
Mechanical Life:	1 x 10^7 operations min.
Mounting:	35 mm DIN rail or 4 screw holes for panel mounting
Wire Size:	Screw terminals accept two 14 AWG solid or stranded wires
Weight:	AC versions: 160 g (5 oz.) DC versions: 190 g (6 oz.)
Vibration:	5 to 300 Hz
Environmental	
Vibration Resistance:	2 g with control relay open; 4 g with control relay closed
Operating Temperature:	-40 to 60°C (-40 to 140°F)
Approvals:	IEC947-5-1, VDE 0660, EN60947-5-1, UL508

*The Drop-Out Time is the time it takes for the N/O contacts to open after the coil voltage is turned OFF.

Specifications are subject to change without notice.

Approved Standards

Standard	Guide No. (US,C)
UL NKCR, NKCR7	
ICE 947-5-1	
VDE 0660	
EN 60947-5-1	

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

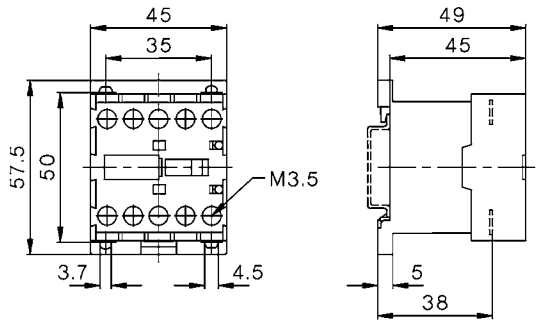
OMRON AUTOMATION & SAFETY

Dimensions

(mm)

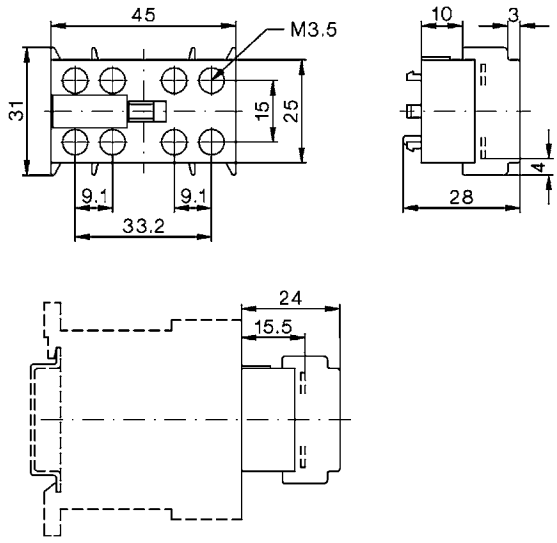
AC and DC Operated with Screw Terminals

J7KNA-AR



Auxiliary Contact Blocks

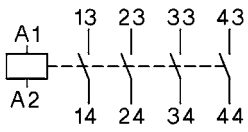
J73KN-A



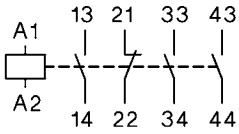
Contact Diagrams

Mini Contactor Relays, 4-Pole

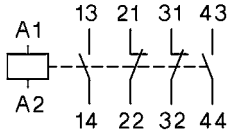
J7KNA-AR-40



J7KNA-AR-31

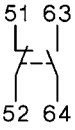


J7KNA-AR-22



Auxiliary Contact Blocks for Contactor Relays J7KNA-AR

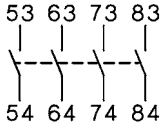
J73KN-A-11



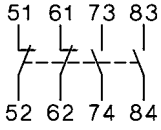
J73KN-A-02



J73KN-A-40



J73KN-A-22



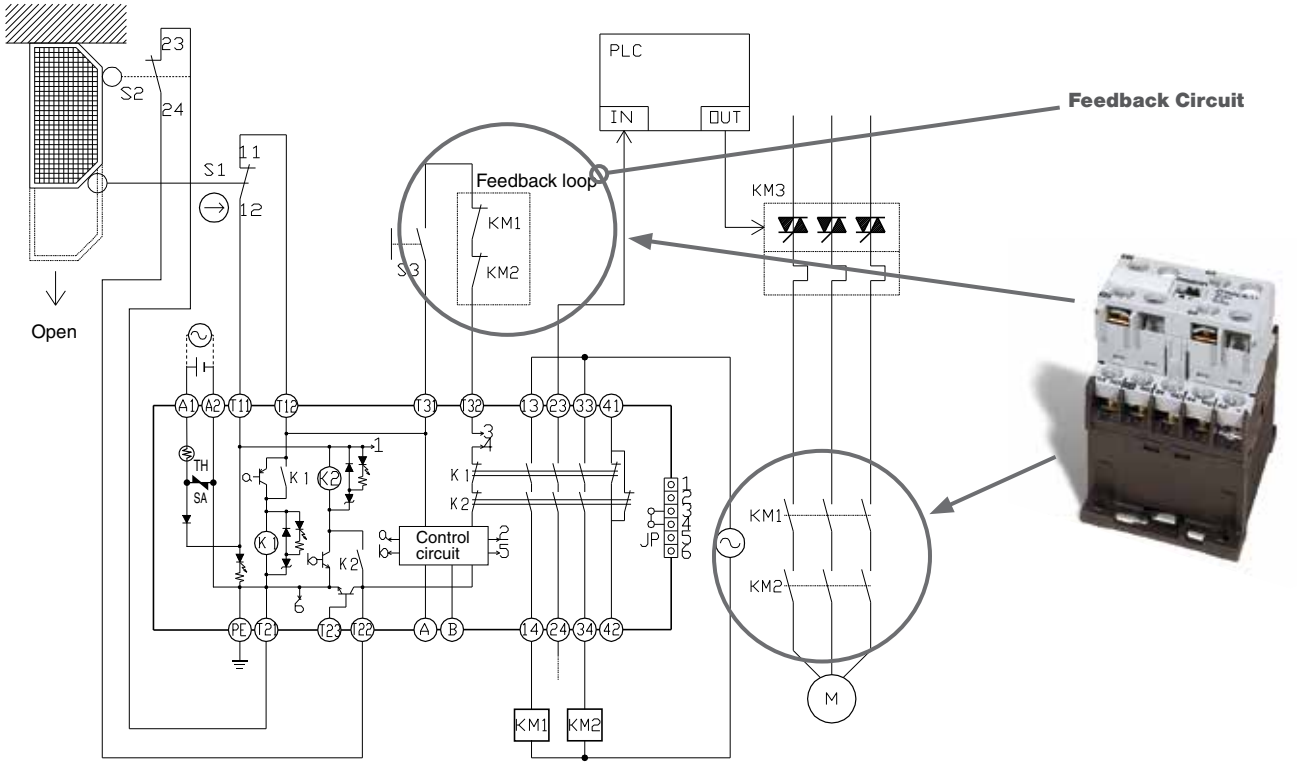
Mirror Contacts

Safety Function with Mirror Contacts

EN 60947-4-1 certification for mirror contact mechanisms has been obtained by using a combination of a relay and auxiliary contact blocks (5 VDC, 1 mA), enabling application in feedback circuits of safety circuits.

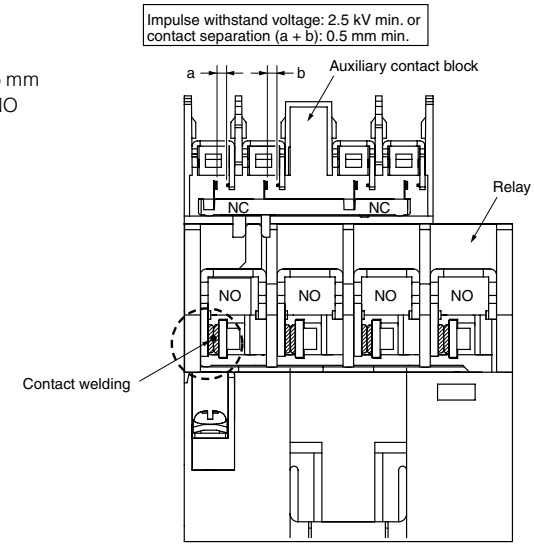
Application Example: General Safety Circuit

G9SA-301 (24 VAC/DC) (two limit switch input channels with manual reset)



Mirror Contact Mechanism

By combining a Relay with an auxiliary contact block, all NC contacts of the auxiliary contact block will satisfy an impulse withstand voltage of 2.5 kV or higher or maintain a gap of 0.5 mm or greater when the coil is de-energized even if at least one NO contact (main contact) of the Relay is welded.



SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Ordering

Model Number Legend

Mini Contactor Relays

J7KNA – AR – □ – □
❶ ❷

❶ Combination of NO/NC Contacts
22: 2 NO/2 NC
31: 3 NO/1 NC
40: 4 NO

❷ Coil Voltage (AC operated)
24: AC 24 V 50/60 Hz
110: AC 110-115 V 50 Hz, AC 120-125 V 60 Hz
230: AC 220-230 V 50 Hz, AC 240 V 60 Hz

Coil Voltage (DC operated)
24VS: 24 VDC with suppression

Auxiliary Contact Modules for Mini Motor Contactor Relays

J73KN – A – □
❶

❶ Combination of NO/NC Contacts
11: 1 NO/1 NC
02: 2 NC
22: 2 NO/2NC
40: 4 NO

Model	Coil Voltage	Contacts	Part No.
AC Operated Relays			
J7KNA-AR-40 24	24 VAC	4 N/O	12010-4140
J7KNA-AR-31 24	24 VAC	3 N/O + 1 N/C	12010-4131
J7KNA-AR-22 24	24 VAC	2 N/O + 2 N/C	12010-4122
J7KNA-AR-40 110	110 VAC	4 N/O	12010-4240
J7KNA-AR-31 110	110 VAC	3 N/O + 1 N/C	12010-4231
J7KNA-AR-22 110	110 VAC	2 N/O + 2 N/C	12010-4222
J7KNA-AR-40 230	230 VAC	4 N/O	12010-4340
J7KNA-AR-31 230	230 VAC	3 N/O + 1 N/C	12010-4331
J7KNA-AR-22 230	230 VAC	2 N/O + 2 N/C	12010-4322
DC Operated Relays (coil suppression built -in)			
J7KNA-AR-40 24VS	24 VDC	4 N/O	12010-4040
J7KNA-AR-31 24VS	24 VDC	3 N/O + 1 N/C	12010-4031
J7KNA-AR-22 24VS	24 VDC	2 N/O + 2 N/C	12010-4022
Auxiliary Contact Modules			
J73KN-A-11		1 N/C + 1 N/O	12010-4411
J73KN-A-02		2 N/C	12010-4402
J73KN-A-40		4 N/O	12010-4440
J73KN-A-22		2 N/O + 2 N/C	12010-4422

Quick Link
R228
omron247.com

Multi-pole Power Relay for Contactor Current Range Capable of Carrying and Switching 40 A at 440 VAC

- One pole, 40 A can be carried and switched.
- The maximum load capacity of 160 A when using 4-pole parallel connections.
- All materials used are compliant with the RoHS Directive
- EN 60947-4-1 certification for mirror contact mechanisms has been obtained by using a combination of the relay and auxiliary contact blocks.
- A design with a small number of openings makes it difficult for dust or foreign matter to enter.
- Ideal for supply power to industrial inverters, servo drivers, and other devices, and switching power to motors and other equipment.



Specifications

Approved Standards

UL Standard: UL508, UL840 (File No. E41643)

Model	Coil Ratings	Contact Ratings		Number of Test Operations
G7Z	12, 24 VDC	NO contact	40 A, 480 VAC, 60 Hz (Resistive)	80,000
			5 A, 120 VDC (Resistive)	100,000
			22 A, 480 VAC, 60 Hz (General Use)	100,000
			D300* (1-A current applied)	—
		NC contact	25 A, 480 VAC, 60 Hz (Resistive) 5 A, 120 VDC (Resistive) 10 A, 480 VAC, 60 Hz (General Use)	100,000
			D300* (1-A current applied)	—

*Auxiliary contact ratings

Model	Contact Ratings	
G73Z	NO contact	D300 (1-A current applied)
	NC contact	

CSA Standard: CSA Certification: CSA C22.2 No. 14

EN Standard/TÜV Certification: EN 60947-4-1 (Certification No. R50079155)

Model	Coil Ratings	Contact Ratings	
G7Z	12, 24 VDC	NO contact	AC-1: 40 A, 440 V, 50/60 Hz AC-3: 16 A, 440 V, 50/60 Hz DC-1: 5 A, 110 V *AC-15: 0.5 A, 440 V, 50/60 Hz *DC-13: 0.5 A, 110 V
		NC contact	AC-1: 25 A, 440 V, 50/60 Hz DC-1: 5 A, 110 V *AC-15: 0.5 A, 440 V, 50/60 Hz *DC-13: 0.5 A, 110 V
G73Z	—	NO contact	AC-15: 0.5 A, 440 V , 50/60 Hz DC-13: 0.5 A, 110 V
		NC contact	

*Auxiliary contact ratings

Reference Information

UL 508:	Industrial control devices
UL 840:	Insulation coordination including clearance and creepage distance for electrical devices
CSA C22.2 No. 14:	Industrial control devices
EN 60947-4-1:	Contactors

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Specifications (continued)

Ratings

Coil

Rated Voltage	Rated Current (mA)	Coil Resistance (Ω)	Must operate Voltage	Must release Voltage	Maximum Voltage	Power Consumption (W)
			Percentage of Rated Voltage			
12 VDC	308	39	75% max.	10% min.	110%	Approx. 3.7
24 VDC	154	156				

Notes:
1. The rated current and coil resistance are measured at a coil temperature of 23°C with tolerances of ±15%.
2. Operating characteristics were measured at a coil temperature of 23°C.
3. The maximum allowable voltage is the maximum value of the fluctuation range from the relay coil operating power supply and was measured at an ambient temperature of 23°C. There is, however, no continuous allowance.

Contacts

Relay

		G7Z-4A-□Z, G7Z-3A1B-□Z, G7Z-2A2B-□Z		
		Resistive load	Inductive load cosø = 0.3	Resistive load L/R = 1 ms
Contact structure		Double break		
Contact material		Ag alloy		
Rated load	NO	40 A at 440 VAC	22 A at 440 VAC	5 A at 110 VDC
	NC	25 A at 440 VAC	10 A at 440 VAC	5 A at 110 VDC
Rated carry current	NO	40 A		
	NC	25 A		
Maximum contact voltage		480 VAC		125 VDC
Maximum contact current	NO	40 A	22 A	5 A
	NC	25 A	10 A	5 A
Maximum switching capacity	NO	17,600 VA	9,680 VA	550 W
	NC	11,000 VA	4,400 VA	550 W
Failure rate P value (reference value)		2 A at 24 VDC		

Note: The ratings for the auxiliary contact block mounted on the G7Z are the same as those for the G73Z auxiliary contact block.

Auxiliary Contact Block

	G73Z-20Z, G73Z-11Z, G73Z-02Z		
	Resistive load	Inductive load cosø = 0.3	Resistive load L/R = 1 ms
Contact structure	Double break		
Contact material	Au clad + Ag		
Rated load	1 A at 440 VAC	0.5 A at 440 VAC	0.5 A at 110 VDC
Rated carry current	1 A		
Maximum contact voltage	480 VAC		125 VDC
Maximum contact current	1 A	0.5 A	
Maximum switching capacity	440 VA	220 VA	55 W
Failure rate P value (reference value)	1 mA at 5 VDC		

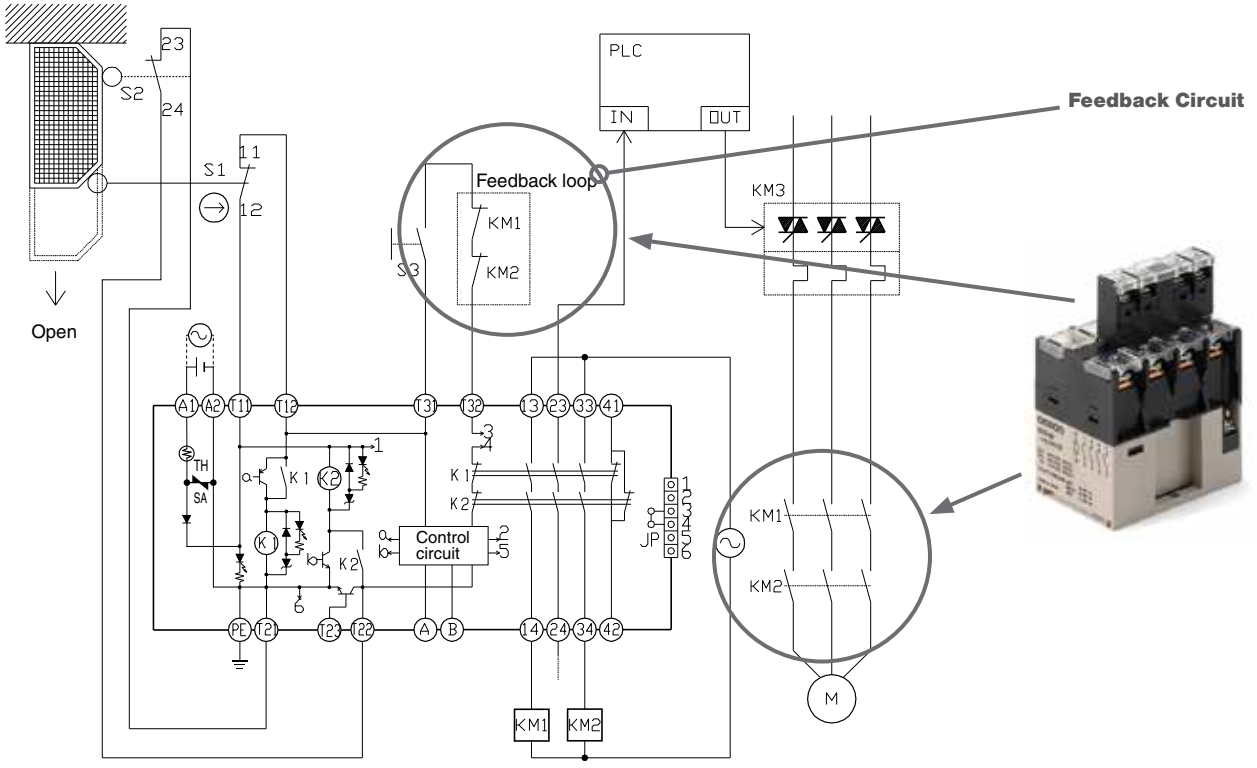
Mirror Contacts

Safety Function with Mirror Contacts

EN 60947-4-1 certification for mirror contact mechanisms has been obtained by using a combination of a relay and auxiliary contact blocks (5 VDC, 1 mA), enabling application in feedback circuits of safety circuits.

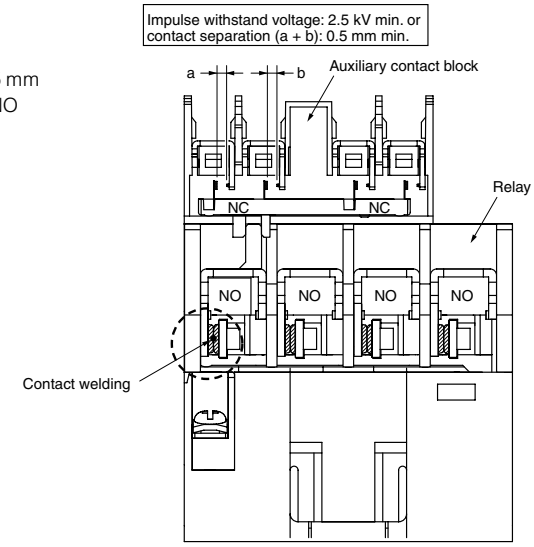
Application Example: General Safety Circuit

G9SA-301 (24-VAC/DC) (two limit switch input channels with manual reset)



Mirror Contact Mechanism

By combining a Relay with an auxiliary contact block, all NC contacts of the auxiliary contact block will satisfy an impulse withstand voltage of 2.5 kV or higher or maintain a gap of 0.5 mm or greater when the coil is de-energized even if at least one NO contact (main contact) of the Relay is welded.



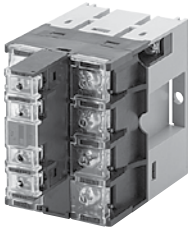
For complete specifications and additional models and accessories visit www.omron247.com

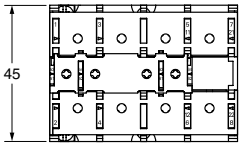
Dimensions

(mm)

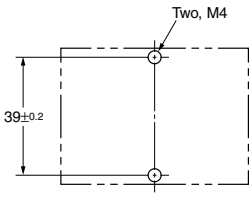
Relay (12 VDC, 24 VDC) with Auxiliary Contact Block

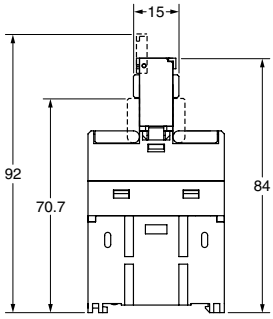
4 Poles

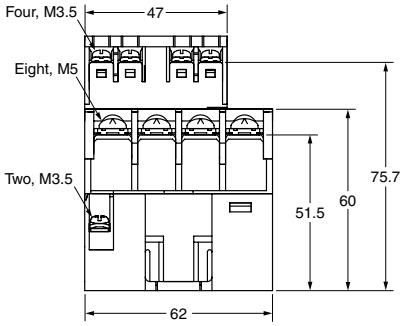




Mounting Hole Dimensions

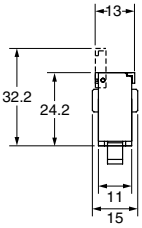


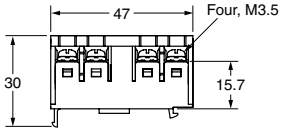




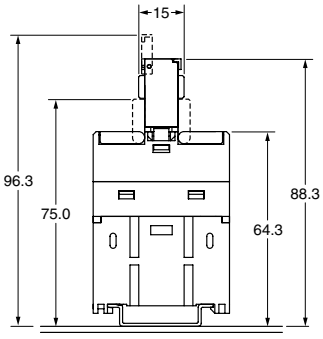
Auxiliary Contact Block







DIN Track Mounting Height (when using PFP-100N or PFP-50N mounting rail)



Note: The dimensions are typical values.

Ordering

Model Number Legend

Relay with Auxiliary Contact Block

G7Z – □ – □ □
❶ ❷❸

❶ Relay Contact Configuration
4A: 4PST-NO
3A1B: 3PST-NO/SPST-NC
2A2B: DPST-NO/DPST-NC

❷ Contact Configuration of Auxiliary Contacts
20: DPST-NO
11: SPST-NO/SPST-NC
02: DPST-NC

❸ Contact Mechanism of Auxiliary Contacts
Z: Bifurcated crossbar contact

Auxiliary Contact Block

G73Z – □ □
❶ ❷

❶ Contact Configuration of Auxiliary Contacts
20: DPST-NO
11: SPST-NO/SPST-NC
02: DPST-NC

❷ Contact Mechanism of Auxiliary Contacts
Z: Bifurcated crossbar contact

Relay with Auxiliary Contact Block

Relay with Auxiliary Contact Block (for Screw Terminals)

Classification		Contact configuration		Rated Voltage	Model
		Relay	Auxiliary Contact Block		
Relay with Auxiliary Contact Block	4 poles + 2 poles	4PST-NO	DPST-NO	12, 24 VDC	G7Z-4A-20Z
			SPST-NO/SPST-NC		G7Z-4A-11Z
			DPST-NC		G7Z-4A-02Z
		3PST-NO/SPST-NC	DPST-NO		G7Z-3A1B-20Z
			SPST-NO/SPST-NC		G7Z-3A1B-11Z
			DPST-NC		G7Z-3A1B-02Z
		DPST-NO/DPST-NC	DPST-NO		G7Z-2A2B-20Z
			SPST-NO/SPST-NC		G7Z-2A2B-11Z
			DPST-NC		G7Z-2A2B-02Z

Notes:
1. Relay contact terminals are M5, and the coil terminals are M3.5.
2. Auxiliary contact block terminals are M3.5

Accessories (Order Separately)

Auxiliary Contact Block

Classification		Contact Configuration	Model
Auxiliary Contact Block	2 poles	DPST-NO	G73Z-20Z
		SPST-NO/SPST-NC	G73Z-11Z
		DPST-NC	G73Z-02Z

SYSMAC SAFETY, TECHNOLOGY & INNOVATION
For complete specifications and additional models and accessories visit www.omron247.com
OMRON AUTOMATION & SAFETY

Safeguard Integration Services

Contents

Omron Qualifications to be Your Safety Expert	J-2
Educating Your Organization	J-3
Machine Safeguarding Skill Builder Seminar	J-4
Assessing the Machine or Process: The Most Critical Step Toward Safety	J-6
Engineering and Design: Implementing Integrated Safety	J-8
Relocation of Existing Equipment	J-10
Supporting Each of Your Plant Locations	J-12
Service and Repair Options	J-14
The Cost of Safety	J-16

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

OMRON AUTOMATION & SAFETY

Omron Qualifications to be Your Safety Expert

Who is Omron?

With over 35 years of experience in industrial machine safety we are a leading resource for machine and process safeguarding services.

Omron provides all necessary machine safeguarding services, including:

- employee education
- machine guarding assessment
- risk level identification
- risk reduction planning and documentation
- review of safety system and circuit designs
- safety product sourcing
- placement and installation
- complete safety system integration
- user training

Why You Should Partner with Omron?

The expertise required in all phases of the safeguarding process is not a core competency of most manufacturers. Their engineering and maintenance personnel are too busy to get involved with required details of guarding systems and safety interfaces.

Omron employees serve as active members or chairmen on more than 20 domestic and international standards committees relating to machine safeguarding issues. This level of involvement and investment of time assures we keep current on all the latest updates to these standards. And we pass our knowledge on to you!

The best part of partnering with Omron is your peace of mind knowing that...

- your machines or process lines are safeguarded correctly to the current standards.
- you are 100% compliant — nothing less.
- you have documented risk level identification and a risk reduction strategy.
- your machine operators are fully and professionally trained on the safety systems installed.
- you are saving money because machine safety improvements only need to be done once.

Machine Safeguarding Services are available in North America, Europe, South America and South East Asia.

What our customers think...

"Creating Safe Workplaces" **by Jim Wille, excerpted from EHS Today**

Most companies in the United States are extremely sensitive about maintaining the safest possible working environment in their plants or mills, and managers are serious about enforcing rules and policies that protect the health and safety of all employees.

In fact, comments made by spokespersons of prominent companies such as Alcoa, indicate that safety comes before productivity and quality. They believe that without a safe workplace, production, quality and financial performance goals are not likely met or sustained.

"Alcoa wants its employees and contractors to be able to work safely in a manner that protects and promotes the health and well-being of the individual and the environment," says Jeff Shockey, Alcoa's director of safety and regional services.

According to Shockey, the following are the four main activities undertaken in support of Alcoa's safety system:

Assessing the risks, aspects and impacts associated with our products, services and operations.

Developing and implementing operational controls with built-in layers of protection.

Monitoring and maintaining the risk assessment, controls and implementation to ensure they are current and effective.

Reacting to correct gaps in our protective systems and continuously improve system stability.

Outside Expertise

The EHS professionals often need to look outside their own organization when peaks in the EHS-related workload exceed internal capacity, or the technical expertise is so complex that it is difficult to maintain in-house proficiency. In order to service plants quickly and efficiently, Alcoa complements the efforts of their full-time health and safety professionals with the expertise of highly specialized external providers.

Finding a Machine Guarding Solution

Such was the case when Alcoa went looking for a machine guarding provider. Alcoa Global Business Services evaluated 10 to 15 companies, giving each a standard package of five or six machines to quote during an online bidding event that also included ranking the prospective providers' capabilities in risk assessment, design, engineering, materials and hardware, fabrication, installation and guarding methodology.

The field was narrowed to three prospective providers for a final interview. The providers were pre-qualified based on their safety performance, customer feedback, staff capabilities and preliminary interviews and discussions.

As a result, Omron was selected as one of Alcoa's machine guarding providers. According to Shockey, Omron offered:

Standardized work methods for conducting the gap assessment. He cited the overall quality of the risk assessment and the clarity of the report as well.

The ability to provide cost-effective and practical solutions by listening to and involving machine operators and maintenance personnel as needed.

Competitive pricing and quality of workmanship.

A willingness to be a full-service partner by supporting training and other needs.

Quick response time by upper management in the rare case when an issue arises.

Provider versus Partner

Omron is more than a provider, it is a partner. Alcoa Safety and Health Services and Omron jointly teach a course on machine safeguarding.

Omron's philosophy is that as a provider/partner, it should develop a close working relationship with the Alcoa personnel who operate and service the equipment. Communicating with the employees on the production floor at the beginning of the program and securing their input and participation was a key factor when implementing machine safeguarding and countermeasures.

Educating Your Organization

Are you looking for support to help you improve machine safety? Omron has a number of machine safeguarding resources to help you create a safer, more productive plant, including:

OSHA Walkthrough

OSHA Walkthrough is a safety and health training software program. Omron has joined forces with eMedia Solutions to sponsor their Safety Animated Machine (S.A.M.™) — an interactive CD produced by a team of experts that makes learning about OSHA regulations efficient and memorable. More than ten hours of safety and health training will help manufacturers reduce workplace injuries, lower training costs, improve safety systems, and prepare for an inspection.

Gotcha Stick

Based on regulatory data, Omron developed the Gotcha Stick safe distance measurement tool. This free tool is a quick and easy way to verify the safe mounting distance of fixed guards with gaps or openings. It includes both metric and English measurements, and its folding design makes it easy to carry.



Safety and Sandwiches

Omron offers free, on-site safety product and application training. We call the program "Safety and Sandwiches" because the sessions are scheduled during the lunch break at your facility. The sessions are tailored for plant safety, maintenance and engineering personnel and provide a better understanding of available machine guarding technology, requirements, and proper application.

Your Area Safety Sales Engineer (ASE) will conduct the training. The ASE is trained on the operation, and application of many safety devices and the interpretation of the applicable regulatory and industry standards.

The following is a sample of Safety and Sandwiches topics:

- Applications and Proper Use of Safety Light Curtains
- Proper Use and Selection of Monitoring Safety Relays
- Application of Safety Interlocks
- Overview of the Safety PLC
- Selection and use of Safety Mats and Mat Controllers
- Applications for Safety Contact Strips, Bumpers and Edges
- Requirements and Uses for E-stops and Rope-Pulls
- Use of Safety Area Laser Scanners
- Safety Circuit Requirements Based on Risk Level

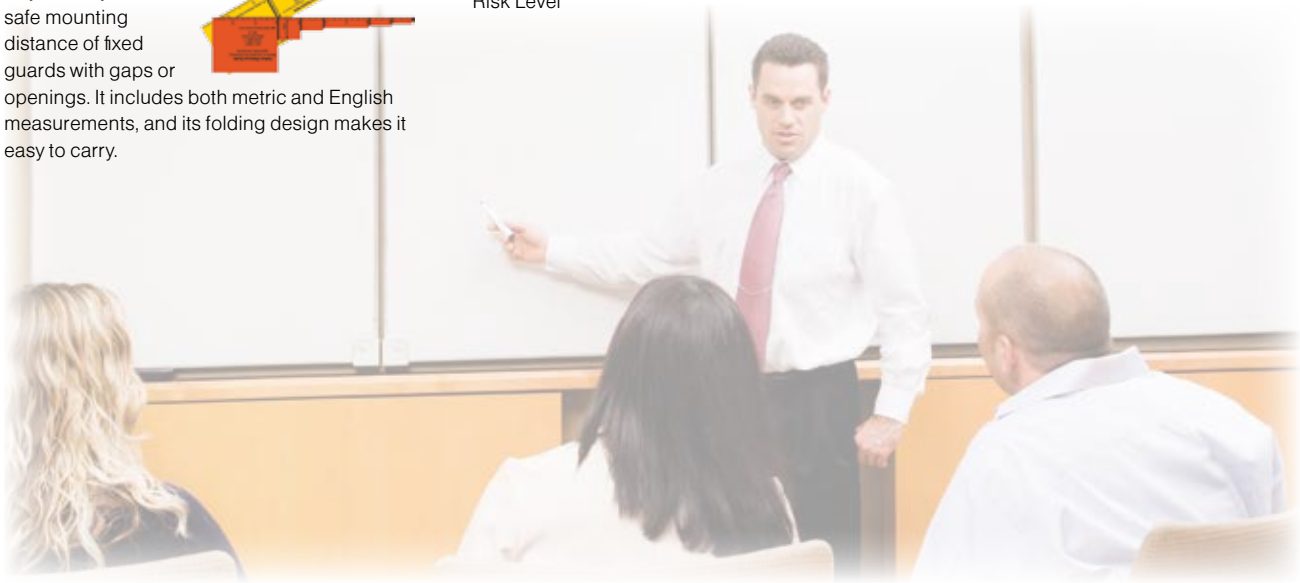
Guest Speaker Program

Need a guest speaker at your upcoming safety conference?

Omron has experienced personnel specifically-trained as guest speakers for regional, national and global safety conferences. These guest speaker appearances are aimed at compliance issues and not products. Omron understands that this is a training venue and not a sales presentation. The only cost to you is our travel expenses.

Omron guest presentations range from 45 to 90 minutes, depending on the subject. Some of the topics that Omron has recently presented at conferences of 20 to 200 attendees include:

- Understanding the Requirements of the Latest Global Robot Safety Standards
- Control Reliability and Safety Circuit Performance
- Category 1, 2, 3, and 4 (performance levels a-e) of ISO 13849 Safety Circuit Requirements
- Requirements and Benefits of Performing a Risk Assessment
- Requirements of the Machine Safety Related Control System Based on Risk Level
- The Importance of Risk Assessment in Determining the Proper Safety Related Control System
- The Primary Challenges of Machine Safeguarding



Machine Safeguarding Services are available in North America, Europe, South America and South East Asia.

Machine Safeguarding Skill Builder Seminar



Are you confident your machines are guarded to the relevant standards?

Are you confident your machines are guarded to the relevant standards?

Have all steps been taken to prevent injuries from process equipment?

Has a documented machine guarding assessment been done to verify compliance?

If you're not sure, or the answer is no to any of these questions, then your facility can benefit from an Omron Machine Safeguarding Skill Builder Seminar.

What is a Skill Builder?

Skill Builders are 1 or 2-day training seminars that educate your personnel on the requirements and methods of machine and process safeguarding. This helps plant personnel to identify, and sometimes correct, machine safeguarding discrepancies. Two Omron professionals will conduct the training at your manufacturing plant.

Who Should Attend?

- EH&S Personnel
- Plant Maintenance
- Plant Engineering
- Production Managers
- All Managers concerned with the safety of plant personnel

The Machine Safeguarding Skill Builder program has the most impact when the corporate EH&S Manager along with the plant-level safety people meet at one plant location. Classes are small with no more than 20 in attendance.

How Do They Benefit?

Attendees will walk away with a greater understanding of methods for machine safeguarding and the correct applications of guarding devices.

Your plant personnel are trained on:

- Identifying machine hazards
- Machine hazard risk assessment
- Machine guarding techniques and the latest safeguarding technologies
- Machine guarding requirements as set by regulatory and consensus standards
- Safety circuit design requirements based on risk level
- Practical application



Machine Safeguarding Services are available in North America, Europe, South America and South East Asia.

Machine Safeguarding Skill Builders are 1 or 2-day training seminars that educate your personnel on the requirements and methods of machine and process safeguarding.

Is it Practical?

After the Skill Builder Training is complete, the group goes to the plant floor to participate in a Machine Guarding Inspection. The purpose of this inspection is to raise awareness of obvious guarding shortcomings so that you can act to prevent injuries to personnel. Attendees will apply skills learned by working side-by-side with a machine guarding specialist to evaluate several machines and their current guarding. Many of these discrepancies may be corrected by plant maintenance personnel; however, some may require additional expertise. After the evaluation, there is a group discussion for a better understanding of the findings. After that, the only thing we ask is that you commit to correcting your safeguarding discrepancies.





Six Steps to a Safe Plant

The proven process for successfully safeguarding a plant is as follows:

1. Educate responsible corporate and plant level personnel through training seminars on machine guarding,
2. Conduct a plant machine guarding evaluation to identify obvious concerns or imminent danger to employees,
3. Conduct a risk level assessment and create a risk reduction plan,
4. Implement the risk reduction plan,
5. Train operators and maintenance personnel on the care and use of the new safeguarding systems, and
6. Periodic machine safety audits to ensure safe mounting distances and proper application of safeguards that may have changed due to a change in the process or the machine's uses.

Assessing the Machine or Process: The Most Critical Step Toward Safety

Five questions to ask:

Why should I have a formal assessment?

In our experience over 90% of machines on the factory floor are not guarded in accordance with relevant regulations and standards. To safeguard a machine correctly and ensure the existing safeguards are adequate requires a documented machine safeguarding assessment.

A proper assessment helps ensure that your machine remains productive after the guarding is installed.

What is the assessment process?

The assessment process has two parts: Risk Level Identification and Risk Reduction.

Risk Level Identification – The process of interacting with your operators and maintenance personnel to understand the intended use of the machine, the required tasks and related hazards, and the level of risk associated with the operation of the equipment.

Risk Reduction – The application of protective measures appropriate for the identified level of risk in a manner that both reduces the risk to a tolerable level and achieves compliance with applicable regulations and standards. The goal is to have a machine that is both safe and productive.

What is the advantage of documented machine safeguarding assessment and risk reduction plan?

A documented machine safeguarding assessment provides a clear plan to reduce risk and bring machines into compliance. The report contains a high level overview and machine-specific risk reduction recommendations based on the identified risk level of the equipment as used in your facility. The report helps communicate the current status of your machine safeguarding program to all levels of your organization.

A documented assessment helps create priorities for safeguarding while taking into account measures that are currently working. This helps target funds where the most benefit will be realized while also planning for future upgrades. The assessment document can also be used to ensure machines *remain* in compliance by comparing the existing guarding system with the detailed guarding recommendations and drawings. This allows any deviations to be identified and addressed.

The assessment/risk reduction report can show government regulators, your insurance company and corporate headquarters what your plan is to achieve compliance.

What information is derived from the assessment report?

Assessment is a two part process and you will want to make sure that the report addresses both. The assessment company should provide you with a written report that contains usable information and includes a specific and detailed strategy on how to guard the machine correctly to achieve maximum safety and productivity. At a minimum, the report should contain the following information and *always* consider the risk level of a given machine:

- Applicable safety standards or regulations considered
- Overview of the process used to determine the risk level for each machine
- Explanation of the risk reduction requirements that apply
- Detailed identification information for each machine
- Types and descriptions of hazards associated with each machine
- Factors and model used to determine the risk level for the machine
- Safety-related control system performance requirements for compliance
- Estimated risk level after guarding using the assessor's detailed recommendations
- Detailed, written, risk reduction recommendations covering the type and location of the safeguarding measures and a description of how they will be applied to reduce the risk to a tolerable level
- A drawing showing the guarding concept and approximate location of the guards and safety devices on the machine

Are there different types of assessments?

Absolutely! And it is important to understand the type of assessment that you will be getting. There are basically four types of assessments:

- Compliance Assessment
- Compliance Assessment with Generalized Recommendations
- Risk Reduction (Product Oriented Solution)
- Machine & Process Safeguarding Assessment and Risk Reduction Solution (Best Value and Most Usable)

These four types of assessments are detailed on the following page.



Machine Safeguarding Services are available in North America, Europe, South America and South East Asia.



Safeguard Integration Services

The best way to safeguard a machine correctly is by conducting a documented machine safeguarding assessment.

Compliance Assessment:

- Identifies compliance issues (typically comprised of intensive documentation)
- Sometimes includes risk level identification
- Provides no solution (risk reduction)

Performed by:

- Safety 'consultants' (typically with regulatory experience or some form of 'safety' certification, not necessarily with a specialization in machine safeguarding)
- Software packages (assign levels of risk/compliance based on static list of questions)

Cost: Relatively high

Value: Low (only identifies mostly obvious deficiencies)

Compliance Assessment with Generalized Recommendations:

In addition to the information supplied by a Compliance Assessment, this report includes:

- General solutions for risk reduction, but not specific enough to be used as a comprehensive guideline for budgeting

Performed by:

- Safety 'consultants'

Cost: Relatively high

Value: Moderate (identifies mostly obvious deficiencies with general solutions, but not enough information to identify an accurate cost of implementation)

Risk Reduction:

- Identifies a possible solution (which typically revolves around product offering of the party conducting assessment)
- Provides no risk assessment

Performed by:

- Safety component manufacturers/ representatives/distributors (typically based on fitting products immediately available to all applications — a "square peg in a round hole.")

Cost: Relatively low ('disguised quote') - sometimes free!

Value: Low (only identifies partial solutions based on capabilities of 3rd party)

Machine & Process Safeguarding Assessment and Risk Reduction Solution:

- Identifies existing risk level based on application and use of equipment
- Determines performance requirements of safeguarding system based on level of identified risk
- Evaluates existing safeguards to performance requirements identified
- Provides solution to achieve required performance level while maintaining productivity
- Prioritizes action list based on combination of risk level and compliant safeguards already in place

Performed by:

- Qualified safety experts specializing in safeguarding industrial machinery
- Experts on applicable regulations, directives, and standards
- True solution providers capable of offering turn-key integration

Cost: Moderate

Value: High (provides required document (risk level assessment) that justifies performance requirements and finds solutions based on achieving high safety and productivity)

How do I qualify a vendor to perform my assessments?

The vendor should:

- Have extensive experience conducting machine safeguarding risk level assessments in accordance with all applicable standards.
- Be willing to provide you with a sample assessment report.
- Provide a reference list of companies and contacts where machine safeguarding assessments were conducted in the last 2 years and equivalent in scope to your requirements.
- Be able to provide proof of Professional Liability or Errors & Omissions insurance.
- Provide a written report of the assessment findings to include identified risk levels that validate the detailed risk reduction strategies.
- Be an active member of various trade organizations and participate on various industry consensus standard committees.



J

Engineering and Design: Implementing Integrated Safety

Select from the following services to tailor a solution that meets your needs

Turn-Key Safeguard Integration

Omron specializes in the installation of safeguarding systems in a wide variety of industries and applications including industrial fabrication equipment, manufacturing systems and robot cells for compliance with applicable safety standards. Our service includes an on-site project manager to monitor quality and ensure that the safety measures are applied properly. Expert installers fabricate custom guards and our trained electricians ensure that the requirements for safety circuitry are met. The integration team will train plant personnel on the care and use of the safeguarding systems.

- Integration services are quoted based on findings and recommendations in an Omron safeguarding assessment and risk reduction report.



Machine Safeguarding Evaluation / Risk Level Identification / Risk Reduction

Omron performs detailed risk level identification services including risk reduction recommendations in accordance with recognized standards to bring machines or process lines into compliance with applicable regulatory requirements and specific ANSI, RIA, NFPA, NEC, CSA, EN, IEC, and ISO standards. During the process, our professionals will inspect perimeter, point-of-operation, and power transmission guarding in addition to power isolation, including pneumatic, hydraulic and electrical lockout.

Our detailed report will provide you with:

- the initial risk level
- written recommendations for compliance
- safeguarding and safety circuit requirements based on risk level
- emergency stop requirements (if applicable)
- a plan view drawing of the equipment identifying recommended protective measures
- the estimated risk level achieved after all recommended safeguards are properly installed
- an estimated cost to properly safeguard the machine(s) or process line(s) on a turn-key basis

Machine Safeguarding Services are available in North America, Europe, South America and South East Asia.

Omron specializes in the installation of safeguarding systems in a wide variety of industries and applications.

Safety System Interface Engineering and Design

Omron will engineer the required safeguarding system based on our assessment. Our engineers will design control circuitry and a guarding strategy appropriate to the identified risk level. This will include applicable interface schematics and a bill of materials. This offering works best when a facility has trained maintenance personnel that will be installing the safeguards.

Machine or Process Safety Consulting

These services can include several machine safety consulting functions. Examples include:

- a review of current safety system and interface drawings for compliance
- perform safe mounting distance calculations for presence sensing safeguard devices
- writing or reviewing of company safety standards for compliance with current safeguarding standards

Safety Project Engineering/Design

After complete risk level identification, any gaps in compliance need to be filled. We can engineer and design the required safeguards and provide you with the materials and components necessary to complete the project yourself. Our engineers will design safety-rated control circuits as required and provide engineering documentation to meet your needs.





Gemba:

A true customer focused approach to manufacturing

We find the best improvement ideas come from being on the front lines and walking the manufacturing floor. This way we can gather data from every source and truly understand the full impact of a problem, spotting waste and uncovering opportunities for practical improvement.

"Gemba" is a Japanese word that refers to the place where value is created for customers.



Technical Resources

We offer free phone support, application engineers
in every market and free training.
Every year we train more than 1,000 engineers, distributors and customers.



Customized Project Consultation

To meet the needs of our customers we provide integrated solutions, project management, and strategic sales consultation in coordination with our global business units. Our advanced technologies and rapid response approach enables customers to reduce development time and leverage our technical expertise and known quality for machine solutions.



Ready When Needed

96% of requests are delivered from existing stock, ready for immediate delivery from our warehouses throughout the Americas.



Our Engineers

Knowledgeable, experienced and above all, involved. Every day, they make a difference. If you have a design challenge, they will find the answer. If you have a safety or control issue, they will help you solve it. If you want to manufacture in a different country, they will connect you with our experts in the field.


Developing innovative machines
365
days a year



Automation Center, Chicago, IL

Making your bright ideas even brighter.
Our expert engineers are ready and eager to try out the latest applications and test your new ideas.



Tsunagi connectivity labs

We've made inter-operability issues a thing of the past.
The specialist engineers in our Tsunagi Labs achieve compliance to open standards, ensuring that multi-vendor solutions are supported. Available in: Chicago, Shanghai, Amsterdam and Kyoto.



Omron247.com

We've gathered everything you'll need to stay informed, increase commission and maintain your equipment, all in one place.
Complete specs, CAD drawings and eLearning—all available in multiple languages for your convenience.

Our customers, distributors and employees have completed more than 12,000 hours of eLearning.



OMRON Automation Centers and technical offices across the World

- Automation Center
- Application Engineer
- Channel Partner



Providing you with the support to operate globally

36,842 employees, 210+ offices

R&D based on worldwide requirements
Global product availability
Global support and services structure

Local support

With our wide network of offices, we are close to your factories and customers. Our knowledgeable and capable engineers provide global scale with local and market knowledge at your command, anywhere.

The Cost of Safety

Estimating the financial costs in advance of an injury is difficult. Fortunately, OSHA's interactive *$afety Pays* website offers assistance.

Using insurance company claims data, the tool calculates the estimated direct and indirect costs of an injury. Also, if you enter your profit margin information, *$afety Pays* will project the additional sales required to recover the costs of the injury.

Consider a simple example: Assume that a company has annual sales of $10 million with an 8% pre-tax profit margin. For a single accident resulting in an amputation, *$afety Pays* estimates the costs of the injury as follows:

Average Direct Cost:	$21,718
Average Indirect Cost:	$23,890
Estimated Total Cost:	$45,608

The additional sales revenue necessary to cover these costs are:

Total Cost:	**$570,100**

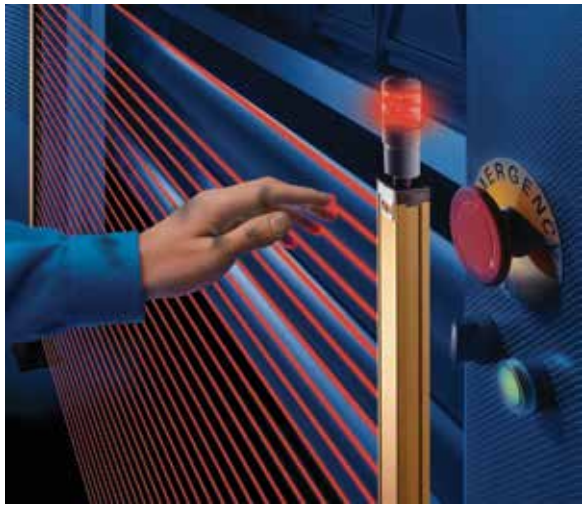
In other words, **the next 5.7% of sales growth will go solely to pay for the total cost of the accident.** If your pre-tax margins are less, the sales impact is even greater.

Indirect costs account for the majority of accident expenses but are not typically covered by insurance.

One final note - the answers returned by *$afety Pays* may be conservative with regard to the ratio of indirect-to-direct costs which is almost 1:1. A poll by Liberty Mutual Group estimates the actual figure may be 5:1 while an American Society of Safety Engineers study suggests a ratio of 8:1.

Who thinks investing in safety equipment and programs impacts the bottom line?

- 61% of executives claim that for every dollar spent on investments in workplace safety $3 are saved (according to a poll by the Liberty Mutual Group).
- 95% of the executives in the poll indicate workplace safety has a positive impact on a company's financial performance.
- OSHA's Office of Regulatory Affairs reports an even more dramatic result; suggesting $4 to $6 are saved for every $1 invested.



Machine and Process Safety Education, Assessment and Risk Identification, Engineering and Design, Integration, and Implementation...

All From a Single Source.

Please call us with any questions or comments. We welcome the opportunity to partner with you for a safer, more productive, and profitable future.

Machine Safeguarding Services are available in North America, Europe, South America and South East Asia.

Purpose, Contents and Request

Security Trade Control (as of May 2006)

Purpose of the Export Controls

To preserve free trade and global security, it is necessary to prevent the proliferation, development, and production of weapons of mass destruction such as nuclear weapons, biological/chemical weapons, and missile systems. It is also necessary to prevent the accumulation of large amounts of conventional weapons or weapons-related materials to prevent regional disputes.



Contents of the Export Controls

The following chart provides a simple summary of export controls.

The 3 Export Controls

Type of Control	Controlled Products/Technologies (List)	Countries Controlled
Non-Proliferation Control	Weapons of mass destruction or manufacturing equipment (including missiles and nuclear, biological, and chemical weapons).	All regions
Wassener Arrangement	Conventional weapons and related materials (including advanced materials, electronics, computers, and communications equipment).	All regions Strict controls are enforced on exports to the 4 special-case countries (Iran, Iraq, Libya, and North Korea).
Catch-All Controls	General purpose products related weapons of mass destruction (in principle, including all products).	All regions (Except those in Attached Table 4-2 (26 countries)).

Development of nuclear weapons

Request to Customers

When exporting a controlled product, check the final application and end user to verify that the product will not be used in a weapon-related application such as a weapon itself or weapon research.

Furthermore, always verify that the Omron safety product will not be used in any case in a nuclear weapon, missile, chemical weapons, other weapon, or equipment used to manufacture these weapons.

The limitations described above will be submitted to Omron or an Omron sales representative as an approval form or contract, so please fully understand and comply with these procedures.

If you have any questions, please contact your Omron representative for further details. These security procedures are based on domestic United States laws and apply to exports from U.S.A.

Terms & Conditions

Terms & Conditions of Sale

1. Offer; Acceptance. These terms and conditions (these "Terms") are deemed part of all quotes, agreements, purchase orders, acknowledgments, price lists, catalogs, manuals, brochures and other documents, whether electronic or in writing, relating to the sale of products or services (collectively, the "Products") by Omron Electronics LLC and its subsidiary companies ("Omron"). Omron objects to any terms or conditions proposed in Buyer's purchase order or other documents which are inconsistent with, or in addition to, these Terms.

2. Prices; Payment Terms. All prices stated are current, subject to change without notice by Omron. Omron reserves the right to increase or decrease prices on any unshipped portions of outstanding orders. Payments for Products are due net 30 days unless otherwise stated in the invoice.

3. Discounts. Cash discounts, if any, will apply only on the net amount of invoices sent to Buyer after deducting transportation charges, taxes and duties, and will be allowed only if (i) the invoice is paid according to Omron's payment terms and (ii) Buyer has no past due amounts.

4. Interest. Omron, at its option, may charge Buyer 1-1/2% interest per month or the maximum legal rate, whichever is less, on any balance not paid within the stated terms.

5. Orders. Omron will accept no order less than $200 net billing.

6. Governmental Approvals. Buyer shall be responsible for, and shall bear all costs involved in, obtaining any government approvals required for the importation or sale of the Products.

7. Taxes. All taxes, duties and other governmental charges (other than general real property and income taxes), including any interest or penalties thereon, imposed directly or indirectly on Omron or required to be collected directly or indirectly by Omron for the manufacture, production, sale, delivery, importation, consumption or use of the Products sold hereunder (including customs duties and sales, excise, use, turnover and license taxes) shall be charged to and remitted by Buyer to Omron.

8. Financial. If the financial position of Buyer at any time becomes unsatisfactory to Omron, Omron reserves the right to stop shipments or require satisfactory security or payment in advance. If Buyer fails to make payment or otherwise comply with these Terms or any related agreement, Omron may (without liability and in addition to other remedies) cancel any unshipped portion of Products sold hereunder and stop any Products in transit until Buyer pays all amounts, including amounts payable hereunder, whether or not then due, which are owing to it by Buyer. Buyer shall in any event remain liable for all unpaid accounts.

9. Cancellation; Etc. Orders are not subject to rescheduling or cancellation unless Buyer indemnifies Omron against all related costs or expenses.

10. Force Majeure. Omron shall not be liable for any delay or failure in delivery resulting from causes beyond its control, including earthquakes, fires, floods, strikes or other labor disputes, shortage of labor or materials, accidents to machinery, acts of sabotage, riots, delay in or lack of transportation or the requirements of any government authority.

11. Shipping; Delivery. Unless otherwise expressly agreed in writing by Omron:

a. Shipments shall be by a carrier selected by Omron; Omron will not drop ship except in "break down" situations.

b. Such carrier shall act as the agent of Buyer and delivery to such carrier shall constitute delivery to Buyer;

c. All sales and shipments of Products shall be FOB shipping point (unless otherwise stated in writing by Omron), at which point title and risk of loss shall pass from Omron to Buyer; provided that Omron shall retain a security interest in the Products until the full purchase price is paid;

d. Delivery and shipping dates are estimates only; and

e. Omron will package Products as it deems proper for protection against normal handling and extra charges apply to special conditions.

12. Claims. Any claim by Buyer against Omron for shortage or damage to the Products occurring before delivery to the carrier must be presented in writing to Omron within 30 days of receipt of shipment and include the original transportation bill signed by the carrier noting that the carrier received the Products from Omron in the condition claimed.

13. Warranties. (a) Exclusive Warranty. Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied. (b) Limitations. OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCTS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. Omron further disclaims all warranties and responsibility of any type for claims or expenses based on infringement by the Products or otherwise of any intellectual property right. (c) Buyer Remedy. Omron's sole obligation hereunder shall be, at Omron's election, to (i) replace (in the form originally shipped with Buyer responsible for labor charges for removal or replacement thereof) the non-complying Product, (ii) repair the non-complying Product, or (iii) repay or credit Buyer an amount equal to the purchase price of the non-complying Product; provided that in no event shall Omron be responsible for warranty, repair, indemnity or any other claims or expenses regarding the Products unless Omron's analysis confirms that the Products were properly handled, stored, installed and maintained and not subject to contamination, abuse, misuse or inappropriate modification. Return of any Products by Buyer must be approved in writing by Omron before shipment. Omron Companies shall not be liable for the suitability or unsuitability or the results from the use of Products in combination with any electrical or electronic components, circuits, system assemblies or any other materials or substances or environments. Any advice, recommendations or information given orally or in writing, are not to be construed as an amendment or addition to the above warranty. See http://www.omron247.com or contact your Omron representative for published information.

14. Limitation on Liability; Etc. OMRON COMPANIES SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY. Further, in no event shall liability of Omron Companies exceed the individual price of the Product on which liability is asserted.

15. Indemnities. Buyer shall indemnify and hold harmless Omron Companies and their employees from and against all liabilities, losses, claims, costs and expenses (including attorney's fees and expenses) related to any claim, investigation, litigation or proceeding (whether or not Omron is a party) which arises or is alleged to arise from Buyer's acts or omissions under these Terms or in any way with respect to the Products. Without limiting the foregoing, Buyer (at its own expense) shall indemnify and hold harmless Omron and defend or settle any action brought against such Companies to the extent based on a claim that any Product made to Buyer specifications infringed intellectual property rights of another party.

16. Property; Confidentiality. Any intellectual property in the Products is the exclusive property of Omron Companies and Buyer shall not attempt to duplicate it in any way without the written permission of Omron. Notwithstanding any charges to Buyer for engineering or tooling, all engineering and tooling shall remain the exclusive property of Omron. All information and materials supplied by Omron to Buyer relating to the Products are confidential and proprietary, and Buyer shall limit distribution thereof to its trusted employees and strictly prevent disclosure to any third party.

17. Export Controls. Buyer shall comply with all applicable laws, regulations and licenses regarding (i) export of products or information; (ii) sale of products to "forbidden" or other proscribed persons; and (iii) disclosure to non-citizens of regulated technology or information.

18. Miscellaneous. (a) Waiver. No failure or delay by Omron in exercising any right and no course of dealing between Buyer and Omron shall operate as a waiver of rights by Omron. (b) Assignment. Buyer may not assign its rights hereunder without Omron's written consent. (c) Law. These Terms are governed by the law of the jurisdiction of the home office of the Omron company from which Buyer is purchasing the Products (without regard to conflict of law principles). (d) Amendment. These Terms constitute the entire agreement between Buyer and Omron relating to the Products, and no provision may be changed or waived unless in writing signed by the parties. (e) Severability. If any provision hereof is rendered ineffective or invalid, such provision shall not invalidate any other provision. (f) Setoff. Buyer shall have no right to set off any amounts against the amount owing in respect of this invoice. (g) Definitions. As used herein, "including" means "including without limitation"; and "Omron Companies" (or similar words) mean Omron Corporation and any direct or indirect subsidiary or affiliate thereof.

Certain Precautions on Specifications and Use

1. Suitability of Use. Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases. NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

2. Programmable Products. Omron Companies shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.

3. Performance Data. Data presented in Omron Company websites, catalogs and other materials is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of Omron's test conditions, and the user must correlate it to actual application requirements. Actual performance is subject to the Omron's Warranty and Limitations of Liability.

4. Change in Specifications. Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

5. Errors and Omissions. Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

Important Safety Notice

Warning! The products described in this publication (hereinafter referred to as "Products") are intended for use in machine and process safeguarding systems. Despite the inclusion of safety design measures, safeguarding and the practice of complementary protective measures by the installer, inherent risks exist in the installation, use, and maintenance of any of these Products. By purchasing Products described in this publication, the purchaser agrees to assume the risks associated with the use, installation, use and maintenance of such devices and that such risks may include severe injury or death.

Ensuring the proper use of these Products is beyond the control of OMRON Automation and Safety and it is the responsibility of the purchaser, installer and employer, to meet all local, state and federal government laws, rules, codes and regulations relating to the proper installation, use, and maintenance of these Products and the guarded machine. Please see the specific Installation and Operation Manual for each of these Products for additional information. Manuals are shipped with the Products and can also be found on our web site at www.omron247.com.

The purchaser is also responsible for the selection and training of qualified personnel* necessary to properly install, operate and maintain the Products and the associated guarded machines.

All application examples described within this publication are for illustration purposes only. Actual installations will differ from those indicated.

Call OMRON Automation and Safety for assistance.

*Qualified personnel is defined as "an individual who, as a result of training and experience, understands and demonstrates competence with the design, construction, operation or maintenance of the machine and the associated hazards." (ANSI B11.19-2010 - Performance Criteria for Safeguarding)

This document contains proprietary information protected by copyright. No part of this document may be reproduced, transmitted, transcribed, stored in a retrieval system or translated into any language, in any form or by any means without prior written permission from OMRON Automation and Safety. OMRON Automation and Safety reserves the right to make changes to the specifications, product and software described within this catalog at any time without obligation of OMRON Automation and Safety to notify any person of such revisions or changes. OMRON Automation and Safety also reserves the right to make changes or revisions to the material contained in this catalog and cannot be held liable for incidental or consequential damages resulting from the furnishing, performance, or use of this material.

© Copyright, 2014 by OMRON Electronics LLC. All rights reserved.

Index by Name

A4E ... H-22
A4EG ... H-15
A22E ... G-11
A22TK ... H-14
A165E ... G-24
Accessories, Light Curtains ... B-110
Accessories, Programmable Controllers ... D-34
Bumpers ... E-32
Capacitive Palm Button ... H-23
CM Series ... F-73
Controllers, Safety Edges ... E-33
Curtains, Safety Light ... B-1
D4B-□N ... H-13
D4F ... H-13
D4GS-N ... F-26
D4JL ... F-64
D4JL-SK/D4NS-SK ... F-110
D4N ... H-4
D4NH ... F-109
D4NL ... F-45
D4N-□R ... H-12
D4NS ... F-6
D4NS-SK/D4JL-SK ... F-110
D4SL-N ... F-27
D40Z/D40A/G9SX-NS ... F-91
Door Switches ... F-1
DST1 ... D-32
EC Series ... F-108
Edges ... E-25
Emergency Stop Devices ... G-1
Enabling Switches ... H-1
ER1022 ... G-10
ER1032 ... G-10
ER5018 ... G-3
ER6022 ... G-6
ER6022-SS ... G-9
Ethernet/IP-DeviceNet Router ... D-33
Explosion-Proof Switch ... F-1
F3SG-RA ... B-16
F3SG-RA Overview ... B-7
F3SJ-A ... B-59
F3SJ-B ... B-68
F3SJ-E ... B-15, B-78
F3W-MA ... B-85
Floor Stands ... B-115
Force-guided Relays ... I-1
G7SA ... I-49
G7S-□-E ... I-55
G7Z ... I-62
G9SA ... I-6
G9SP ... D-18
G9SX ... I-28
G9SX-GS ... I-38
G9SX-NS/D40Z/D40A ... F-91
G9SX-SM ... I-48
Guardlocking Switches ... F-1
Hinged Door Switches ... F-1
I/O Terminals ... D-32
IP67 Enclosures ... B-117
IP-DeviceNet/Ethernet Router ... D-33
J7KNA-AR ... I-58
Laser Alignment Tool ... B-110
Laser Scanners ... C-1
Light Curtain Accessories ... B-110
Light Curtains ... B-1
MA Series ... F-85
MA-S Series ... F-108
Mat Controller, MC ... E-12
Mats & Area Guarding ... E-1
MC Safety Mat Controllers ... E-12
MFS ... F-109
Mirrors, Light Curtains ... B-111
Monitoring Relays ... I-1
MS4800 ... B-42
NE1A ... D-28
NE1A-EDR01 ... D-33
NE1A-EIP ... D-32
Non-Contact Switches ... F-1
NX-S ... D-4
Operator Controls ... H-1
OS32C ... C-6
OS32C Overview ... C-3
PA4600 ... B-103
PA4600-BB ... B-107
Palm Button ... H-23
Power Contactor with Mirror Contacts ... I-1
Power Supplies ... B-110
Programmable Safety Systems ... D-1
Protective Shields, Weld Slag ... B-116
Pushbutton Switches ... G-1
Relays, Safety Monitoring ... I-1
Reset Switches ... B-110
Resource Modules Overview ... B-98
RM-1 ... B-100
RM-2 ... B-100
RM-2AC & RM-2AC-IP ... B-100
RM-3 ... B-101
RM-4 ... B-101
RM-6 ... B-102
RM-X ... B-102
Rope Pull E-Stop Switches ... G-1
Safety Bumpers ... E-32
Safety Controllers, Programmable ... D-1
Safety Door Switches ... F-1
Safety Edge Controllers ... E-33
Safety Edges ... E-25
Safety I/O Terminals ... D-32
Safety Laser Scanners ... C-1
Safety Light Curtains ... B-1
Safety Limit Switches ... H-1
Safety Mats & Area Guarding ... E-1
Safety Monitoring Relays ... I-1
Scanners, Safety Laser ... C-1
Shock Mount Kits ... B-110
Smart Muting Actuator ... B-85
SR101A ... I-12
SR103AM ... I-13
SR104P ... I-17
SR105E ... I-17
SR106ED ... I-21
SR108AD & SR109AD ... I-18
SR120MP ... I-21
SR125SMS45 ... I-22
SR131A ... I-25
SR201A ... I-25
SR203M & SR203AM ... I-26
SR208AD & SR209AD ... I-26
SR223SMT ... I-27
SR231A ... I-27
Stop Devices, Emergency ... G-1
Switches, Safety Interlock ... H-1
T2008 ... F-21
T4012 ... F-20
T4016 ... F-20
T5009 & T5009-6 ... F-14
Test Objects ... B-110
TL4019 ... F-55
TL4024 ... F-63
Tongue Switches ... F-1
TouchStart™ Palm Button ... H-23
UMQ Series Safety Mat System ... E-2
Weld Slag Protective Shields ... B-116
WS02-CFSC1-E ... D-33
XER1022 ... G-30
XER1032 ... G-30
XER6022 & 6022-SS ... G-31
XT5009 ... F-110

SYSMAC SAFETY, TECHNOLOGY & INNOVATION

For complete specifications and additional models and accessories visit www.omron247.com

OMRON AUTOMATION & SAFETY

Index by Product

Safety Light Curtains

Selection Guide B-2

Type 4 Light Curtains

F3SG-RA Overview B-7
F3SG-RA B-16
MS4800 ..... B-42
F3SJ-A B-59
F3SJ-B B-68
F3SJ-E B-78

Smart Muting Actuator

F3W-MA B-85

Light Curtain Resource Modules

Resource Modules Overview B-98
RM-1 ..... B-100
RM-2, RM-2AC & RM-2AC-IP B-100
RM-3 ..... B-101
RM-4 ..... B-101
RM-6 ..... B-102
RM-X B-102

Perimeter Access Guarding

PA4600 ..... B-103
PA4600-BB B-107

Accessories B-110

Safety Laser Scanners

Selection Guide C-2
OS32C Overview C-3
OS32C C-6

Programmable Safety Systems

Selection Guide D-2

Modular Safety I/O System

NX-S D-4

Compact Programmable Controllers

G9SP D-18

Compact Safety I/O

NE1A D-28
NE1A-EIP D-32
DST1 ..... D-32
NE1A-EDR01 ..... D-33
WS02-CFSC1-E D-33
Accessories D-34

Safety Mats & Edges

Safety Mats

UMQ Series E-2
MC Controllers E-12

Safety Edges & Bumpers

Safety Edges E-25
Safety Bumpers E-32
Safety Edge Controllers E-33

Safety Door Switches

Selection Guide F-2

Tongue Switches

D4NS F-6
T5009 & T5009-6 ..... F-14
T4012 ..... F-20
T4016 ..... F-20
T2008 ..... F-21
D4GS-N F-26

Guardlocking Switches

D4SL-N F-27
D4NL F-45
TL4019 ..... F-55
TL4024 ..... F-63
D4JL F-64

Non-Contact Switches

CM Series F-73
MA Series F-85
D40Z/D40A/G9SX-NS F-91
EC Series F-108
MA-S Series F-108
MFS F-109

Hinged Door Switches

D4NH F-109

Explosion-Proof Switch

XT5009 ..... F-110

Accessories

D4NS-SK/D4JL-SK F-110
Accessories F-111

Emergency Stop Devices

Selection Guide G-2

Rope Pull E-Stop Switches

ER5018 ..... G-3
ER6022 ..... G-6
ER6022-SS G-9
ER1022 ..... G-10
ER1032 ..... G-10

E-Stop Pushbutton Switches

A22E G-11
A165E G-24

Rope Pull E-Stop Switches for Explosive Atmospheres

XER1022 ..... G-30
XER1032 ..... G-30
XER6022 & XER6022-SS G-31

Safety Switches & Operator Controls

Selection Guide H-2

Safety Limit Switches Plastic

D4N H-4
D4N-□R H-12

Safety Limit Switches Metal

D4B-□N H-13
D4F H-13

Safety Selector Switch

A22TK H-14

Enabling Switches

A4EG H-15
A4E H-22

Two-Hand Control

TouchStart™ H-23

Safety Monitoring Relays

Selection Guide I-2

Safety Monitoring Relays

G9SA I-6
SR101A I-12
SR103AM I-13
SR104P I-17
SR105E I-17
SR106ED I-21
SR108AD & SR109AD I-18
SR120MP I-21
SR125SMS45 ..... I-22
SR131A I-25
SR201A I-25
SR203M & SR203AM I-26
SR208AD & SR209AD I-26
SR223SMT I-27
SR231A I-27

Flexible Safety Units/Dedicated Function

G9SX I-28
G9SX-GS I-38
G9SX-SM I-48

Force-guided Relays

G7SA I-49
G7S-□-E I-55

Power Contactor with Mirror Contacts

J7KNA-AR I-58
G7Z I-62

SYSMAC
SAFETY, TECHNOLOGY & INNOVATION

OMRON
AUTOMATION & SAFETY

OMRON AUTOMATION AND SAFETY • THE AMERICAS HEADQUARTERS • Chicago, IL USA • 847.843.7900 • 800.556.6766 • www.omron247.com

OMRON CANADA, INC. • HEAD OFFICE
Toronto, ON, Canada • 416.286.6465 • 866.986.6766 • www.omron247.com

OMRON ELECTRONICS DE MEXICO • HEAD OFFICE
México DF • 52.55.59.01.43.00 • 01-800-226-6766 • mela@omron.com

OMRON ELECTRONICS DE MEXICO • SALES OFFICE
Apodaca, N.L. • 52.81.11.56.99.20 • 01-800-226-6766 • mela@omron.com

OMRON ELETRÔNICA DO BRASIL LTDA • HEAD OFFICE
São Paulo, SP, Brasil • 55.11.2101.6300 • www.omron.com.br

OMRON ARGENTINA • SALES OFFICE
Cono Sur • 54.11.4783.5300

OMRON CHILE • SALES OFFICE
Santiago • 56.9.9917.3920

OTHER OMRON LATIN AMERICA SALES
54.11.4783.5300

OMRON EUROPE B.V. • Wegalaan 67-69, NL-2132 JD, Hoofddorp, The Netherlands. • +31 (0) 23 568 13 00 • www.industrial.omron.eu

Authorized Distributor:



Automation Control Systems
• Machine Automation Controllers (MAC) • Programmable Controllers (PLC)
• Operator interfaces (HMI) • Distributed I/O • Software

Drives & Motion Controls
• Servo & AC Drives • Motion Controllers & Encoders

Temperature & Process Controllers
• Single and Multi-loop Controllers

Sensors & Vision
• Proximity Sensors • Photoelectric Sensors • Fiber-Optic Sensors
• Amplified Photomicrosensors • Measurement Sensors
• Ultrasonic Sensors • Vision Sensors

Industrial Components
• RFID/Code Readers • Relays • Pushbuttons & Indicators
• Limit and Basic Switches • Timers • Counters • Metering Devices
• Power Supplies

Safety
• Laser Scanners • Safety Mats • Edges and Bumpers • Programmable Safety Controllers • Light Curtains • Safety Relays • Safety Interlock Switches

Printed on recycled paper.

© 2015 OMRON Electronics LLC

Printed in U.S.A.