

GENERAL CATALOGUE 2005/2006

Sensing & Safety



Advanced Industrial Automation

OMRON

GENERAL CATALOGUE 2005/2006

Sensing & Safety

Sensing & Safety

Never fail...

This catalogue features products that lead the field in technology by providing new solutions for inspection, measurement, quality assurance and safety issues. What makes our products so special is that they are designed to deliver high performance and total reliability. With Omron's sensing and safety products in your automation system your products never fail, and your production never stops.

The attached CD-ROM contains comprehensive information of our sensing and safety product range. In addition you can find our latest innovations on www.omron-industrial.com or give us a call!



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Omron – a global corporation

...right on your doorstep



- 50 years in industrial automation
- Over 24,000 employees
- Support in every European country
- Over 1,800 employees in 18 European countries
- 8% of turnover invested in R&D
- More than 200,000 products
- More than 6,950 patents registered to date

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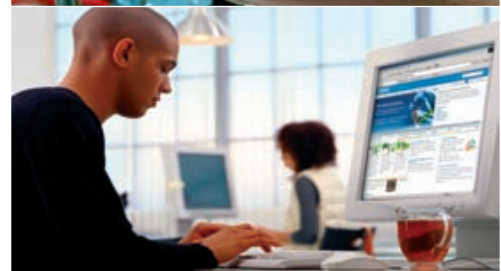
Omron Corporation

Omron Industrial Automation is a leading manufacturer of technologically advanced industrial automation products and worldwide supplier of application expertise. It is part of the global Omron Corporation, which has been anticipating and filling social needs since 1933. With pioneering technology Omron has developed into a \$5 billion global manufacturing company in sensing and control.

Omron continues to make significant contributions in a wide variety of fields such as industrial automation, electronic and automotive components, and healthcare. Omron Industrial Automation technologies can be found in factories and machines all over the world. Our solutions continue to be flexible and innovative, but our standards remain rigid: *never stop, never fail, just create!*

Omron Industrial Automation Europe

In Europe we have maintained a leading position in machine and industrial automation for over 30 years. Our infrastructure is designed to think globally while acting locally. From sales, application knowledge and support to R&D and customised production, we can support your needs wherever you are located, and through every step of your manufacturing process. You'll find Omron's expertise in control systems, motion & drives, sensing, safety and control components.



Application support

As an Omron customer you have unprecedented support from our application engineers, who can advise you on-site anywhere in Europe. We can carry out tests on your design on-site or demonstrate a new product without disturbing or halting your production process.



“From the moment you contact Omron you get direct access to our application expertise, wherever and whenever you need it....”

◀ **European manufacturing**

Omron has manufacturing sites in s'Hertogenbosch, the Netherlands and Nufringen, Germany where, in addition to our standard product offering, we can provide fast and flexible customised solutions using on-site R&D facilities and expertise. Both factories meet very strict quality assurance standards, and are the forefront of meeting global environmental standards. Omron actively welcomes people to come and visit these facilities.

◀ **Online support**

Omron's web-site is designed to provide fast, no-nonsense support, enabling you to quickly find the latest information on manuals, data sheets and brochures, read about our latest product releases, and check out the most frequently asked questions. You can also download our latest software versions or patch upgrades along with 2-D and 3-D CAD drawings. All the support you need is available on www.omron-industrial.com.

◀ **European Repair Centre**

Omron has set up a special repair service with DHL that enables your product to be picked up, repaired and returned within 5 days. This repair service is totally free for products under Omron's warranty conditions, and includes a direct pick up and delivery at your site. You can get more information on this service at www.repair.europe.omron.com.

Competence areas



▲ **Control Systems**



▲ **Motion & Drives**



▲ **Sensing**



▲ **Safety**



▲ **Control & Switching Components**



Experts in sensing and safety

„We speak your languages... talk to us!“



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A strong knowledge match

Omron is renowned in the field of Industrial Automation for making innovative products that offer the highest possible product reliability. Our application knowledge in combination with our sensing technology knowledge, enable us to advise you on the right sensing solution. In almost every case to date we have been able to select a product from our sensor program that offers the best possible solution. With Omron's sensing and safety products in your automation system your products never fail, and your production never stops.

Our products are managed by teams of product experts, who are supported by development and application experts and by manufacturing sites. Together they form

competence centres dedicated to provide unrivalled automation products and customised expert solutions for all industries throughout Europe. This expertise is available "at your door-step" in every country.

Omron's expertise in industrial automation comes from years of product development and accumulated know-how. Our ability to offer customers several options for their application needs is what distinguishes us from competition. We know that you cannot afford defects in your production. That's why we can provide on-site testing of your process with minimal disturbance to your production, so that together we can strive for zero defects. Challenge us!



Sensing & safety competence

The competence centre is the hub for application-specific support and regular product training seminars for our European sales engineers, to train your engineers. It consolidates product, development & application, and production expertise on the very latest technologies. Here, an elaborate network to the national sales organisations and industry specialists is nurtured, which guarantees a thorough understanding of the latest offerings in your local market.

This network enables us to incorporate a fast-track customisation service and to respond quickly to changing trends and future requirements.

At our European sensor and safety manufacturing site in Nufringen, near Stuttgart/Germany, products are tested under severe conditions at several on-site laboratories. ISO-Certifications DIN EN ISO 9001:2000 and DIN EN ISO 14001:1996 guarantee a high standard of quality and environmental protection.

Proven application expertise

Zero defects and total reliability

Omron's in-depth knowledge of many specific industries enables us to offer high-quality products as diverse as the applications they are designed for. Our expertise in machine building means that you can use our sensing and safety solutions in nearly every sector of manufacturing, including the automotive, semiconductor, food, beverage packaging and pharmaceuticals industries.



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◀ Safety solutions

Floating blanking is used when robot's arms have to pass through the light curtain for particular operations - Safety is guaranteed.

Automotive industry

In the automotive industry, complex integrated production processes put enormous demands on production planning, and only a totally reliable assembly process using measurement and inspection technology is acceptable for achieving a zero-error production rate in the sense of Poka-Yoke.

Omron is a well-established provider of advanced technologies in the automotive business. Our optical sensing techniques enable components to be checked directly in the assembly process. This reduces rework rates, as only correctly fitted parts are released to the next production phase.

Our latest generation of intelligent sensors can check for the presence and condition of components, and carry out measurement tasks without interrupting the process.

▲ Fitting a complete pre-assembled cockpit

To achieve a seal between the cockpit mounting plate and the engine compartment a robot first applies the bonding bead around the entire cockpit plate. A sensor head is mounted on the robot arm and focuses directly behind the glue nozzle outlet, measuring the height of the bonding bead continuously.

► **Mega-retailers**

Your packaging should always deliver absolute quality for bulk and multi-packs. That includes zero defect labelling, custom coding for automatic inventories and point-of-sale carton arrangements on pallets.

► **Zero defect**

Tamper evident seals and clear date/lot codes must be in place to maintain customer confidence and protect your company against liability.

▼ **Verify bottle position**

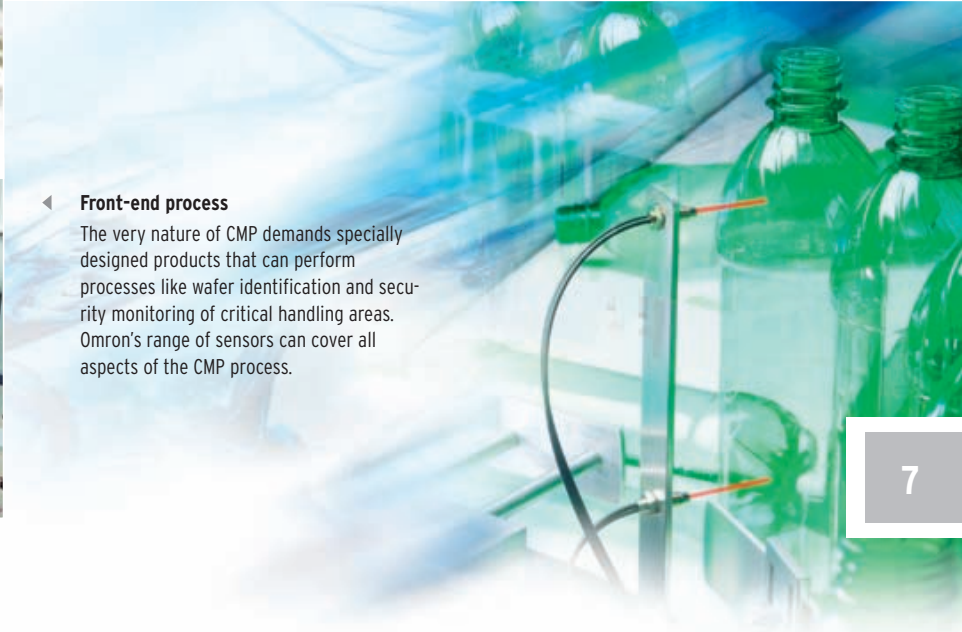
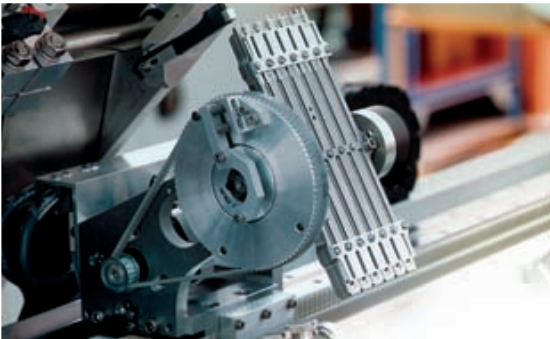
Two independent sensors detect toppled bottles to prevent a jam.

▼ **Back-end process**

ICs are individually tested before shipment to ensure that they meet the required quality levels. Omron's sensing solutions meet the highest demands of testing.

◀ **Front-end process**

The very nature of CMP demands specially designed products that can perform processes like wafer identification and security monitoring of critical handling areas. Omron's range of sensors can cover all aspects of the CMP process.



Semiconductors Industry

In the semiconductor electronics industry, the ever-advancing miniaturisation of electronic products requires smaller, purer and thinner chip technologies. Manufacturers are under continuous pressure to increase their productivity while reducing the costs per chip.

The trend is towards ever-smaller structure widths and the development and manufacturing of silicon wafers with large diameters.

Omron's sensors are designed to cover everything in semiconductor production, from the critical processes like wafer etching and cleaning, to high-precision distance measurement required for the production of 300 mm wafers. Through long-term partnerships with market leaders in machine building and with influential entities such as SEMI, we have developed the knowledge necessary to equip these complex machines with the sensors and safety components needed to successfully develop and market your product.

Food & beverage / packaging industry

In the food & beverage industry a 99.9% success rate in the packaging process simply isn't enough.

With such high throughput speeds, one simple error can lead to pallets of unlabelled or incorrectly labelled products, or damaged packaging.

Omron's highly effective inspection solutions combine vision, measurement and fibre-optic sensors to help you meet the strict quality requirements required in this industry. Our packaging inspection solutions can help boost the quality of your output and reduce waste. With our sensing and safety solutions, your production never fails.



◀ If you would like to know more about Omron's industry knowledge, please order our market segment brochures or download them at www.europe.omron.com.

Smart Platform concept

One software – One connection – One minute



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The launch of Smart Platform, Omron's new fully integrated automation architecture, demonstrates Omron to be one of the most innovative players in the market. Designed to make machine automation easy, the goal of Smart Platform is to allow increasingly complex machines to be developed, commissioned and maintained without the need of automation specialists.

It enables users to mix and match their preferred solutions without the need to worry about hierarchy or other communication issues. Driven by the need to make connectivity as simple and flexible as possible, Omron's Smart Platform creates a harmonious combination of sensing, control, motion and regulation devices.

The Smart Platform concept is built around three major advantages for the user:

- One software
- One connection
- One minute



Easy programming and configuration with Omron's CX-One software.

For a demonstration and to order your 30 days' trial version for free please visit www.smartplatform.info

One software



Omron introduces CX-One, a single programming and configuration environment that enables the user to build, configure and program networks, PLCs, HMIs, motion control systems, drives, temperature controllers and sensors.

The result of a single software is to reduce complexity of the configuration and allow automation systems to be programmed or configured with minimal training.

One connection



From a single connection point either locally, through networks, or from a modem connection the Omron 'Smart Platform' devices on your machine can be programmed or parameterised. This allows remote access or servicing of your complete machine to become a reality.

The same transparent communications architecture also allows Omron devices to easily communicate together, passing and sharing information and enabling more effective modular machine design.

One minute



'Plug & Work' functionality is achievable through Omron's function block library, device profiles and SMART Active Parts, which can be simply 'drag & drop'-configured in contrast to conventional programming.

The SMART Active Parts are pre-defined electronic objects of field devices (e.g. 'read actual speed' of an inverter, view a scene from a vision sensor, represent a temperature controller etc.) that can be dragged and dropped into the HMI screen.

... just create

Why Smart Platform?

Smart Platform can help you increase the flexibility and efficiency of your machines or production lines. It provides:

- A single software environment for your machine covering sensing, regulation, control, motion, and visualisation.
- Easy drag & drop object-based programming and configuration of the complete system.
- Communications and architecture that is network independent.
- Distributed intelligent devices that are self-reporting and self-maintaining to reduce downtime and identify the source of production problems.



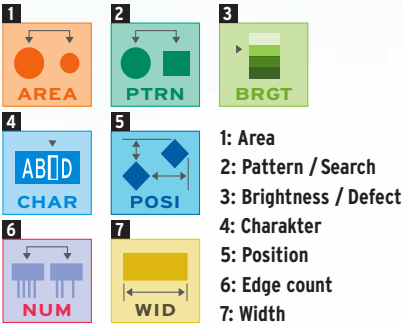
New products

Smart vision sensor ZFV



Main features and benefits

- Brilliant colour display
- Real time result and image display
- Intuitive user interface
- One button teach – teach and go
- Up to seven inspection tools
- Adjustable inspection area and distance
- Integrated, adjustable LED light
- Up to 250 inspections per second



Easy vision – teach & go

Omron’s new ZFV smart vision sensor is an image-processing system in a sensor format. It consists of two separate components, a camera head with an integrated light source and a processing unit.

Parameter settings and lighting control are available at the touch of a button. A “smart” user interface allows parameter setting using a few buttons and the built-in colour LCD monitor.

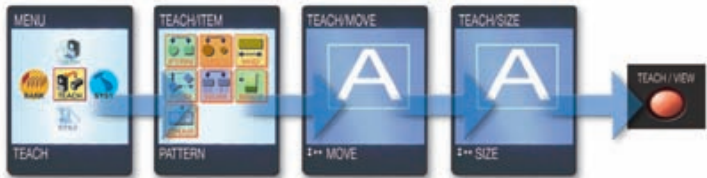
During operation, the display gives direct feedback showing results and images in real time. Easy Vision – teach & go, for applications which can be solved in minutes – not hours or days.



▲ The ZFV verifies the correct position of the cap to secure proper closure of the bottle.



▲ Verifying the printed article information in a high-speed packaging line.



▲ Teach and go...

ZS-L Series – 2-D CMOS measurement displacement sensor



Main features and benefits

Easy to integrate and to operate

- Fast change-over-handling for various products on the same production line
- Easy reconfiguration for latest product trends by using ZS-controller HMI
- Getting started within a minute

More flexibility through scalability

- Tailored ZS configuration to suit your process needs is possible by easy application oriented and user guided menu settings.
- Additional functionality can be easily expanded by adding additional modules to the high speed sensor bus

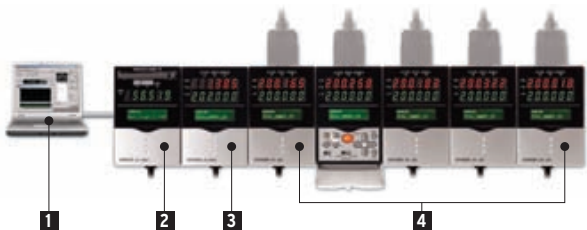
With Omron's ZS-L series, zero defect inspection is assured!

Innovative 2-D CMOS technology

The ZS-L's ability to provide high-speed image processing and high resolution is thanks to Omron's innovative 2-D CMOS image sensor. The sensor features an enhanced controller running a powerful algorithm, which ensures optimal sensitivity, no matter how varied the reflected light. The image is processed in the sensor head and transferred to the controller via a Low Voltage Differential Signal (LVDS). This arrangement results in a high-performance platform that can measure almost any surface.

Measurement Tools:

- Height measurement
- Step measurement
- Thickness measurement
- Gap measurement
- Flatness measurement
- Average measurement
- Excentricity
- Warpage / Evenness

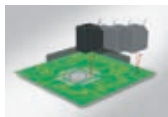


- 1: Monitor** SmartMonitor Professional PC-based user software ZS-SW11E - for set up and monitoring
- 2: Record** Data storage unit ZS-DSU - ideal for ZS series data logging
- 3: Control** Multi-calculation-controller ZS-MDC - enables logical operation and processing for up to 9 gang mounted controllers

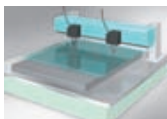
- 4: Operate** Sensor controllers ZS-LDC - enable maximum sensing performance with fully digital processing
- 5: See** Sensor heads ZS-LD - advanced laser CMOS sensing technology with high speed, high resolution, packed into smallest IP67 housing



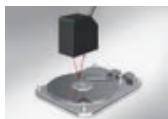
Rubber



PC-Board



Glass



HDD Mirror

New products

DeviceNet safety



DeviceNet™

Main features and benefits

- Open communication standard
- Fast and easy installation
- Predefined and certified function blocks.
- Detachable cage clamp terminals.
- Future-ready for easy additions as your needs change
- DeviceNet Safety is designed for easy network additions to save your investment
- Smart, seamless and flexible
- I/O-Modules support standard and safety mode on one module.
- Reliable and safe
- Predictive maintenance and self diagnosis.
- Certified for applications up to safety category 4 (EN 954-1) and SIL 3 (IEC 61508).

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DeviceNet safety offers more than a safe network

DeviceNet is an innovative industrial network system that enables a wide range of devices to be easily networked and managed remotely.

Everything can be seamlessly integrated into DeviceNet, making it one of the best industrial field busses around.

As a founding member of DeviceNet and specialist for machine safety, Omron is one of the few companies with expertise to combine innovative bus technology and safety to a seamless solution up to safety category 4 (EN 954-1) and SIL 3 (IEC 61508).

Unique features of the DeviceNet Safety products are:

- Test pulse outputs to ensure crosstalk and short circuit detection.
- Mixed mode operation of the DeviceNet Safety Terminals. All in- and outputs can flexibly be assigned to the safety or standard part of the control system. If they are used for safety, the Safety Network Controller

ensures system integrity. Smart slave functions like operation counters and monitoring of ON-time or operation time are fully supported.

- Bulb current monitor function by using a dedicated test output of the remote terminals.

Safety Network Controller

The Safety Network Controller hosts the safety application program, monitors the safety inputs and controls the safety outputs.

The simplest DeviceNet Safety based solution is using the Safety Network Controller stand alone.

Advanced diagnostic is provided by the Safety Network Controller. LED displays, status LEDs for all in- and outputs and the accessibility of the system status data via DeviceNet enables easy troubleshooting and predictive maintenance.

DeviceNet Safety Terminals

The DeviceNet Safety Terminals have been designed to provide highest flexibility for all your installations.

G9SX – Flexible safety unit



The flexible way to design-in safety

Omron’s G9SX is an innovative, flexible safety unit that provides a clever solution for partial and complete safeguarding the machine control. Using microprocessor technology, the G9SX provides a transparent and logical connection throughout your system that enables you to shut down any segmentation according to your machine’s safety layout.

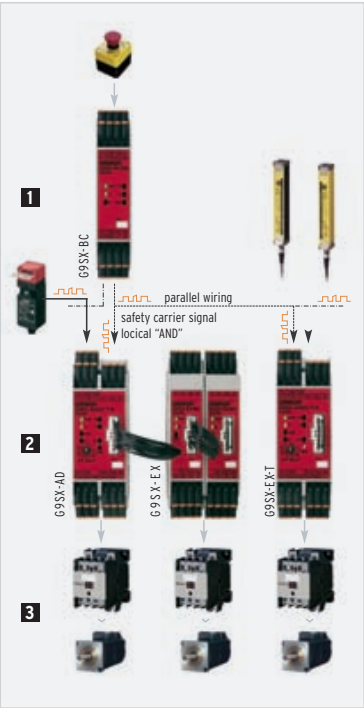
The G9SX increases your productivity by enabling you to isolate a faulty process within your machine instead of having to switch off the entire system, which minimises production losses and downtime. It features LED indicators to reduce troubleshooting time and support diagnostic maintenance. The G9SX lets you expand your system easily without having to completely re-design safety circuits. And while the G9SX uses a hardwired logical connection based on microprocessor technology, there is no programming or special training involved.

The G9SX is the latest segment in Omron’s safety product portfolio and underlines the company’s reputation as a total safety solutions’ provider. Use the G9SX to design a flexible, expandable and reliable safety system in all applications like packaging, semiconductor, moulding and food processing industries.

Main features and benefits

- Unique! Logical connection
- Advanced diagnostics and trouble-shooting functionality
- Extended operating life through solid state outputs
- Expandable with up to 25 outputs per segment
- Choice of terminals
- Meeting all safety requirements

The G9SX flexible safety unit range



1: Basic unit G9SX-BC

The basic unit is used to control the primary safety function like the overall E-Stop.

2: Advanced unit G9SX-AD

This unit can be logically connected to the G9SX-BC and other G9SX-AD to provide precise shutdown of individual sections in a machine. The advanced units give you more precise control over the safety section you want to stop, without affecting the total process.

3: Expansion unit G9SX-EX

This unit is ideal for use in complex machines that require multiple safety output paths (Instantaneous or time delayed).

Product selection table



Standard Photo-electric Sensors



Advanced Photo-electric Sensors



Displacement & Width-Measuring Sensors



Vision Systems



Inductive Sensors

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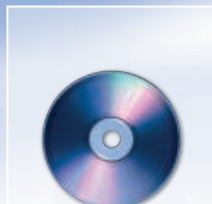
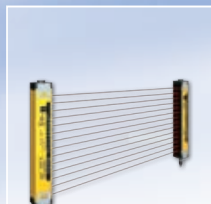
E3F2
E3Z
E3T
E3NT
E3S-C
E3S-CL
E3G
E3M-V
E3MC*
E3S-LS3
E3JK
F3C-AL*
E3G-L1/L3*
E3X-NL*
E3S-CR62/67
F3UV*
E3S-A*
E3S-R*
F3C-AA*

E32
E32-ET16WR-1/2*
E32-ETS/EDS
E32-D82F*
E32-L25T*
E32-V*
E3X-DA-S*
E3X-DA-N*
E3X-MDA*
E3X-NA*
E3X-DRT2*
E3X-SRT21*
E3X-CIF11*
E3C-LD11*
E3C-LD21*
E3C-LD31*
E3C-LDA*

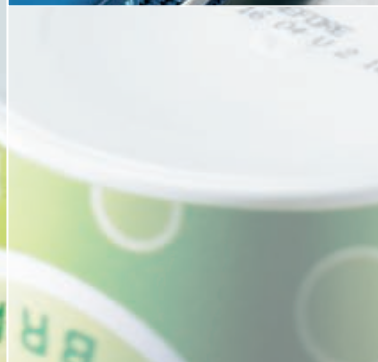
ZX-L
ZS-L
Z300
Z500
Z510
Z550
ZX-E
ZX-T

ZFV
F150
Vision Composer*
F400*
F160
F210
F250
F500
V530-R150*
V530-R160*

E2A
E2F
E2A3
E2E small diameter
TL-W
TL-T*
E2S
E2Q2
E2Q4
E2C-EDA
E2EL
E2EC
TL
E2E
E2AX*
E2AU
E2EZ
E2FQ
E2EQ



E2KQ	E6A2-C	E8F2*	F3SN-A/F3SH-A	*These products are available on the CD-ROM, which is enclosed to this catalogue.
E2K-C	E6B2-C	E8MS/E8M*	F3S-B	
E2K-F	E6C2-C/E6C3-C		F3S-TGR-SB	
E2K-L*	E6F-C		F3SL	
	E6H-C*		E3FS	
	E6C3-A		F3SS*	
	E6F-A		F3SP-U4P	
	E6L*		DeviceNet Safety	
			F3G-C*	
			G9SX	
			G9SA	
			G9SB	
			D4NS	
			D4BS	
			D4GS-N*	
			D4NL	
			D4GL	
			D4BL	
			D40B	
			D4NH	
			D4N-__	
			D4B-__N	
			D4F	
			D4N-__R	
			A22E*	
			A165E	
			G7SA	
			G7S*	
			A4E	
			F3W-D*	
			F3ZN*	



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Sensors

Standard Photoelectric Sensors

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	Ultra small size sensors in plastic housing	E3T A-67
	Harsh environment long distance photoelectric Sensor in metal housing	E3NT A-83
	Oil-resistive, compact photoelectric sensor in metal housing	E3S-C A-101
	Distance setting photoelectric sensor in metal housing	E3S-CL A-111
	Photoelectric switch with built-in amplifier (long distance) in plastic housing	E3G A-119
	Mark sensor	E3M-V A-133
	Color sensor	E3MC (CD)
Special Function	Printed Circuit Board Sensor	E3S-LS3 A-145
	All voltage photoelectric sensors	E3JK A-149
	Distance setting laser photoelectric sensor	F3C-AL (CD)
	Distance-setting Photoelectric Sensor	E3G-L1/L3 (CD)
	Optical Fiber Glossy Object Sensor	E3X-NL (CD)
	Transparent bottle sensor	E3S-CR62/67 A-157
	Ultraviolet power monitor/illumination monitor	F3UV (CD)
	Built-in Amplifier Photoelectric Sensor	E3S-A (CD)
	Transparent Object Detection Sensor	E3S-R (CD)
Special Shape	Distance settable Photoelectric Sensor for conveying applications	F3C-AA (CD)

Advanced Photoelectric Sensors

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	Heat resistant	A-202
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	Mapping sensors	A-211
	Retroreflective	A-212
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	Fiber Unit	E32-ET16WR-1/2 (CD)
	Fiber Unit	E32-ETS / EDS Series A-237
	Fluid level sensor	E32-D82F (CD)
	Fluid level sensor	E32-L25T (CD)
	Vacuum Sensor	E32-V (CD)
	Accessories for E32	A-245

Fiber Optic Amplifier	Digital Fiber Sensors	E3X-DA-S (CD)
	Digital Fiber Amplifier	E3X-DA-N (CD)
	2-Channel Fiber Sensors	E3X-MDA (CD)
	Super Manual Fiber Amplifier	E3X-NA (CD)
	Communication unit for fiber amplifier	E3X-DRT21 E3X-SRT21 (CD) E3X-CIF11
Laser Sensor	Photoelectric Sensors with Separate Digital Amplifiers	E3C-LD11 (CD) E3C-LD21 (CD) E3C-LD31 (CD) E3C-LDA (CD)

Displacement Sensors/Width-measuring Sensors

Laser Sensors	Smart Sensors Laser	ZX-L Series B-3
	2D CMOS Laser Measuring Sensor	ZS-L Series B-25
	High-precision Visual Displacement Measurement System	Z300 B-31
	Profile Measuring System	Z500 B-45
	Welding Bead Sensor	Z510 B-53
	Multi-Dimensional Sensor	Z550 B-57
Inductive Sensors	Smart Sensors	ZX-E Series B-61
Contact Sensors	Smart Sensor High precision contact type	ZX-T Series B-77

Vision Systems

General purpose	Smart Sensors	ZFV Series C-3
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	Integrated control software for F150-3	Vision Composer (CD)
	Color-graying vision sensor	F400 (CD)
	Vision Sensor	F160 C-25
	Vision Sensor	F210 C-37
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	Vision Sensor	F500 C-55
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OMRON

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	Long Distance	E2K-C	D-183
	Flat Type	E2K-F	D-189
	Liquid Level Sensor	E2K-L	(CD)

Rotary Encoders			
Incremental	25 dia.	E6A2-C	E-3
	40 dia.	E6B2-C	E-5
	50 dia.	E6C2-C/E6C3-C	E-7
	60 dia.	E6F-C	E-9
	40 dia. (Hollow Shaft)	E6H-C	(CD)
Absolute	50 dia.	E6C3-A	E-11
	60 dia.	E6F-A	E-13
Easy Scale	Linear Encoder	E6L	(CD)

Pressure Sensors			
		E8F2	(CD)
		E8MS/E8M	(CD)

Safety Sensors / Components

Safety Sensors			
Safety Light Curtain	Safety Light Curtain	F3SN-A	G-3
	Multi-Beam Safety Sensor	F3SH-A	
	Safety Light Curtain	F3S-B	G-31
	Safety sensor for Palletisers	F3S-TGR-SB	G-49
	Safety light curtain for long distance detection	F3SL	G-59
Safety Single Beam	Safety Single Beam Sensor + Controller	E3FS	G-63
	Single beam safety sensor for long distance detection	F3SS	(CD)
Muting Controller	Muting Controller for Safety Light Curtain	F3SP-U4P	G-73
Safety Networks	DeviceNet Safety System	NE1A/DST1	G-77
Safety Laser Scanner	Safety Laser Scanner	F3G-C	(CD)
Safety Units / Relay Units			
Flexible Safety Unit	Safety Relay Unit	G9SX	G-89
Expandable Safety Unit	Safety Relay Unit	G9SA	G-109
Slim Size Safety Unit	Safety Relay Unit	G9SB	G-123
Safety Door / Guard Lock Switches			
Safety Door Switch	Safety-door Switch	D4NS	G-131
		D4BS	G-143
		D4GS-N	(CD)
Safety Guard Lock	Guard Lock Safety-door Switch	D4NL	G-153
		D4GL	G-171
		D4BL	G-185
Non-contact Switch	Compact Non-contact Door Switch	D40B	G-197
Safety-door Hinge Switch	Miniature Safety-door Hinge Switch	D4NH	G-207

Other Safety Switches			
Safety Limit Switch	Safety Limit Switches	D4N-__	G-219
		D4B-__N	G-243
		D4F	G-259
	Manual Reset Limit Switches	D4N-__R	G-267
E-Stop Switch	Emergency Stop Switch	A22E	(CD)
		A165E	G-283
Force Guide Relay / Enabling Switch	Relays with Forcibly Guided Contacts	G7SA	G-291
	Safety Relay	G7S	(CD)
	Enabling Switch	A4E	G-299
Precaution			G-305
Standards			G-318
Approvals			G-321
Non safety line Sensor for picking applications			
	Non Safety Picking Sensor	F3WD	(CD)
	Non Safety Area Sensor	F3ZN	(CD)

Accessories

Selection Guide Power Supplies	(CD)
Accessories	H-3

Contact Information

Index

Common Precautions for safety switch

For the individual precautions for each Switch, refer to the precautions for the Switch.

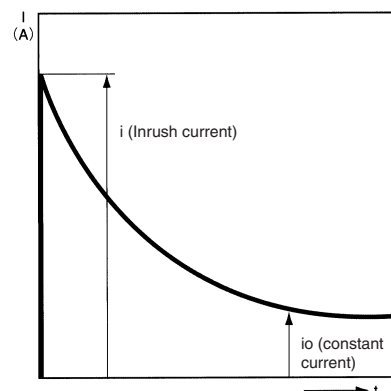
Cautions

- Do not touch the charged switch terminals while the Limit Switch has carry current, otherwise an electric shock may be received.
- Do not assemble the Limit Switch or touch the interior of the Limit Switch while power is connected to the Limit Switch, otherwise an electric shock may be received.

Correct Use

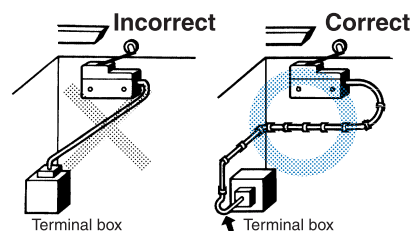
- If the Limit Switch incorporates a ground terminal, be sure to ground it through an appropriate wire, otherwise an electric shock may be received.
- Be sure to connect a fuse with a breaking current 1.5 to 2 times the rated current to the Limit Switch in parallel in order to protect the Limit Switch from damage due to short-circuiting.
- Maintain an appropriate insulation distance between wires connected to the Limit Switch.
- If the Limit Switch has no ground terminal, ground the mounting panel to which the Limit Switch is mounted unless the Limit Switch is of double insulation construction falling under class II. Such models (e.g., the D4D-N, D4D-R or D4DS) ensure good insulation characteristics. Therefore, no ground terminals are incorporated.
- Do not use the Limit Switch in places with flammable or explosive gas without taking any countermeasures taken against explosion or fires. Otherwise switching arcs or heat radiation may cause a fire or explosion.
Be sure to protect the Limit Switch with appropriate explosion-proof barriers or use a Limit Switch of explosion-proof construction. The Explosion-proof Limit Switch is not available for use in all types of gas or locations. Refer to the *Explosion-proof Device General Catalog* for details.
- The life of the Limit Switch greatly varies with switching conditions. Before using the Limit Switch, be sure to test the Limit Switch under actual conditions. Make sure that the number of switching operations is within the permissible range.
If a deteriorated Switch is used continuously, insulation failures, contact weld, contact failures, switch damage, or switch burnout may result.
- Some types of load have a great difference between normal current and inrush current. Make sure that the inrush current is within the permissible value. The greater the inrush current in the closed circuit is, the greater the contact abrasion or shift will be. Consequently, contact weld, contact separation failures, or insulation failures may result. Fur-

thermore, the Limit Switch may become broken or damaged.



Wiring

- If the wiring method is incorrect, the wires may get caught by some object or the lead wires may be pulled excessively. Make sure that the lead wires are connected without extraordinary force and that the wires are supported securely.



- Pay the utmost attention so that each terminal is wired correctly. If the terminal is wired incorrectly, the Limit Switch will not function. Furthermore, not only will the Limit Switch have a bad influence on the external circuit, the Limit Switch itself may become damaged or burnt.

Mounting

- Do not modify the actuator, otherwise the operating characteristics and performance of the actuator will change.
- Do not enlarge the mounting holes of the Limit Switch or modify the Limit Switch, otherwise insulation failures or housing damage may result. If the Limit Switch has a force separation mechanism, a modification of the Limit Switch may cause injury.
- Do not apply oil, grease, or other lubricants to the moving parts of the actuator, otherwise the actuator may not operate correctly. Furthermore, intrusion of oil, grease, or other lubricants inside the Limit Switch may cause failures in the Limit Switch.
- Mount the Limit Switch and secure it with the specified screws tightened to the specified torque along with flat washers and springs. The actuator of the Limit Switch mounted to a panel with excessive tightening torque may not operate correctly if the Limit Switch is a pushbutton model.

- Be sure to wire the Limit Switch so that the conduit opening is free of metal powder or any other impurities.
- If glue or bonding agent is applied, make sure that it does not adhere to the movable parts or intrude inside the Limit Switch, otherwise the Limit Switch may not work correctly or cause contact failure. Some types of glue or bonding agent may generate a gas that may have a bad influence on the Limit Switch. Pay the utmost attention when selecting the glue or locking agent.
- Do not drop or disassemble the Limit Switch, otherwise the Limit Switch will not be capable of full performance. Furthermore, the Limit Switch may become broken or burnt.
- If the contacts are not turned ON or OFF over a long time, the contacts may become oxidized. Consequently, the reliability of the contacts may decrease, which may result in accidents.
- Actuation of the Limit Switch over a long time may deteriorate parts of the Limit Switch and a releasing failure may result. Be sure to check the condition of the Limit Switch regularly.
- Some models allow changes in head directions. When changing the head of such a model, make sure that the head is free of any foreign substance. Tighten each screw of the head to the rated torque.
- Be sure to take measures so that no foreign material, oil, or water will penetrate into the Limit Switch through the conduit opening. Be sure to attach a connector suited to the cable thickness and tighten the connector securely to the rated torque.
- Apply Limit Switch models incorporating a force-separation function, such as the D4BS or D4BL, for safety doors or emergency stop circuits.
- Do not impose shock or vibration on the actuator while it is fully pressed. Otherwise, the actuator will partially abrade and an actuation failure may result.

Limit Switch Operation

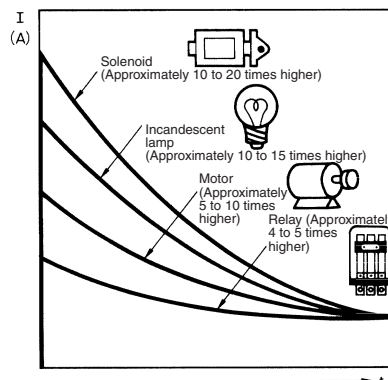
- The Limit Switch in actual operation may cause accidents that cannot be foreseen from the design stage. Therefore, the Limit Switch must be practically tested before actual use.
- When testing the Limit Switch, be sure to apply the actual load condition together with the actual operating environment.
- All the performance ratings in this catalog are provided under the following conditions unless otherwise specified.
Inductive load: A minimum power factor of 0.4 (AC) or a maximum time constant of 7 ms (DC)
Lamp load: An inrush current 10 times higher than the normal current
Motor load: An inrush current 8 times higher than the normal current

The rated values are obtained from tests conducted in accordance with JIS C4508.

1. Ambient temperature: +5° C to 35° C

2. Ambient humidity: 40% to 70%.

Note: An inductive load causes a problem especially in DC circuitry. Therefore, it is essential to know the time constants (L/R) of the load.

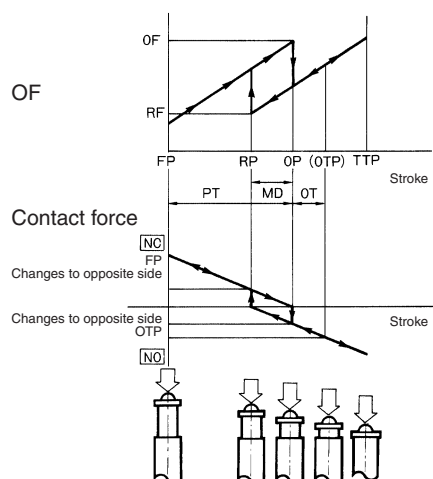


Mechanical Characteristics

Operating Force, Stroke, and Contact Characteristics

- The following graph indicates the relationship between operating force and stroke or stroke and contact force. In order to operate the Limit Switch with high reliability, it is necessary to use the Limit Switch within an appropriate contact force range. If the Limit Switch is used in the normally closed condition, the dog must be installed so that the actuator will return to the FP when the actuator is actuated by the object. If the Limit Switch is used in the normally open condition, the actuator must be pressed to 70% to 100% of the OT (i.e., 60% to 80% of the TT) and any slight fluctuation must be absorbed by the actuator.
- If the full stroke is set close to the OP or RP, contact instability may result. If the full stroke is set to the TTP, the actuator or switch may become damaged due to the inertia of the dog. In that case, adjust the stroke with the mounting panel or the dog. Refer to page G-314, *Dog Design*, page G-315, *Stroke Settings vs. Dog Movement Distance*, and page G-315, *Dog Surface* for details.
- The following graph shows an example of changes in contact force according to the stroke. The contact force near the OP or RP is unstable, and the Limit Switch cannot main-

tain high reliability. Furthermore, the Limit Switch cannot withstand strong vibration or shock.



Mechanical Conditions

- The actuator must be selected according to the operating method.
- Check the operating speed and switching frequency.
 1. If the operating speed is extremely low, the switching of the movable contact will become unstable, thus resulting in incorrect contact or contact weld.
If the operating speed is extremely low or the pushbutton needs to be set between the FP and OP, consult your OMRON representative in advance.
 2. If the operating speed is extremely high, the Limit Switch may break due to shock. If the switching frequency is high, the switching of the contacts cannot catch up with the switching frequency. Make sure that the switching frequency is within the rated switching frequency. If a higher switching frequency is required, use of a proximity sensor is recommended.
- Do not impose excessive force on the actuator, otherwise the actuator may become damaged or not operate correctly.
- Make sure that the stroke is set within the suitable range specified for the model, or otherwise the Limit Switch may break.
- Make sure that the operating direction of the actuator is parallel to the axis of the actuator if the actuator is a pushbutton type. If they are not in parallel, partial abrasion may result and the actuator may soon become damaged. Refer to page G-313, *Operation* for details.

Electrical Characteristics

Electrical Conditions

- The switching load capacity of the Limit Switch greatly varies between AC and DC. Always be sure to apply the rated load. The control capacity will drastically drop if it is a DC load. This is because a DC load has no current zero-cross point, unlike an AC load. Therefore, if an arc is generated,

it may continue comparatively for a long time. Furthermore, the current direction is always the same, which results in a contact relocation phenomena whereby the contacts easily stick to each other and do not separate when the surfaces of the contacts are uneven.

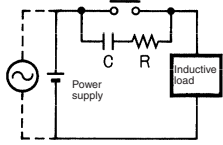
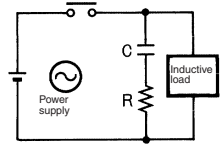
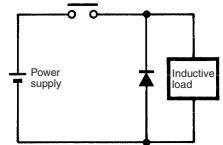
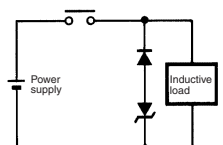
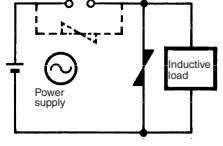
- If the load is inductive, counter-electromotive voltage will be generated. The higher the voltage is, the higher the generated energy will be, which will increase the abrasion of the contacts and contact relocation phenomena. Be sure to use the Limit Switch within the rated conditions.
- If the load is a minute voltage or current load, use a dedicated Limit Switch for minute loads. The reliability of silver-plated contacts, which are used by standard Limit Switches, will be insufficient if the load is a minute voltage or current load.

Contact Protective Circuit

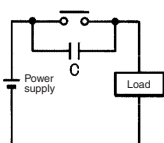
Apply a contact protective circuit to extend the contact life, prevent noise, and suppress the generation of carbide or nitric acid. Be sure to apply the contact protective circuit correctly, otherwise an adverse effect may occur.

The following provides typical examples of contact protective circuits. If the Limit Switch is used in an excessively humid location for switching a load that easily generates arcs, such as an inductive load, the arcs may generate NO_x, which will change into HNO₃ if it reacts with moisture. Consequently, the internal metal parts may corrode and the Limit Switch may fail. Be sure to select the ideal contact preventive circuit from the following.

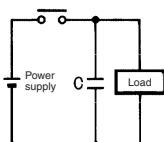
Typical Examples of Contact Protective Circuits

Circuit example	Applicable current		Feature	Element selection
	AC	DC		
CR circuit		*	Yes	<p>*When AC is switched, the load impedance must be lower than the CR impedance.</p> <p>C: 1 to 0.5 μF x switching current (A) R: 0.5 to 1 Ω x switching voltage (V) The values may change according to the characteristics of the load. The capacitor suppresses the spark discharge of current when the contacts are open. The resistor limits the inrush current when the contacts are closed again. Consider the roles of the capacitor and resistor and determine ideal capacitance and resistance values through testing. Use a capacitor that has a low dielectric strength. When AC is switched, make sure that the capacitor has no polarity.</p>
		Yes	Yes	
Diode method		No	Yes	<p>Energy stored in the coil is changed into current by the diode connected in parallel to the load. Then the current flowing to the coil is consumed and Joule heat is generated by the resistance of the inductive load. The reset time delay with this method is longer than that in the CR method.</p>
Diode and Zener diode method		No	Yes	<p>This method will be effective if the reset time delay caused by the diode method is too long.</p>
Varistor method		Yes	Yes	<p>This method makes use of constant-voltage characteristic of the varistor so that no high-voltage is imposed on the contacts. This method causes a reset time delay.</p> <p>Connecting a varistor in parallel to the load is effective when the supply voltage is 24 to 48 V and in parallel to the contacts when the supply voltage is 100 to 200 V.</p>

Do not apply contact protective circuits as shown below.



This circuit effectively suppresses arcs when the contacts are OFF. The capacitor will be charged, however, when the contacts are OFF. Consequently, when the contacts are ON again, short-circuited current from the capacitance may cause contact weld.

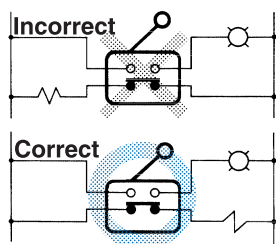


This circuit effectively suppresses arcs when the contacts are OFF. When the contacts are ON again, however, charge current will flow to the capacitor, which may result in contact weld.

Switching a DC inductive load is usually more difficult than switching a resistive load. By using an appropriate contact protective circuit, however, switching a DC inductive load will be as easy as switching a resistive load.

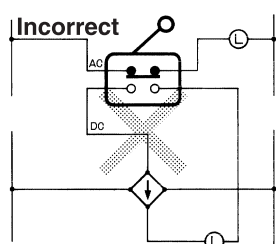
- Do not contact a single Limit Switch to two power supplies that are different in polarity or type.

Power Connection Examples
(Connection of Different Polarities)

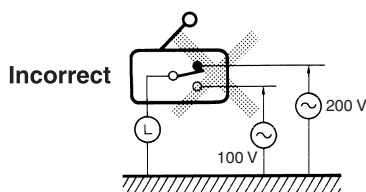


Incorrect Power Connection Example (Connection of Different Power Supplies)

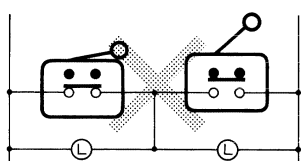
There is a risk of AC and DC mixing.



- Do not design a circuit where voltage is imposed between contacts, otherwise contact weld may result.



- Do not use a circuit that will short-circuit if an error occurs, otherwise the charged part may melt and break off.

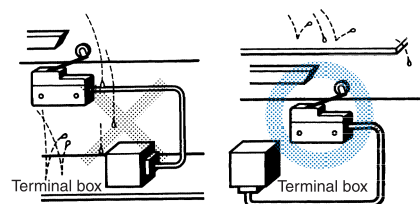


- Application of Limit Switch to a Low-voltage, Low-current Electronic Circuit.
 - If bouncing or chattering of the contacts results and causes problems, take the following countermeasures.
 - Insert an integral circuit.
 - Suppress the generation of pulse from the contact bouncing or chattering of the contacts so that it is less than the noise margin of the load.
 - Conventional silver-plated contacts are not suited to this application. Use gold-plated contacts, which are ideal for handling minute voltage or current loads.
 - The contacts of the Limit Switch used for an emergency stop must be normally open.
- In order to protect the Limit Switch from damage due to circuit short-circuiting, be sure to connect a quick-response

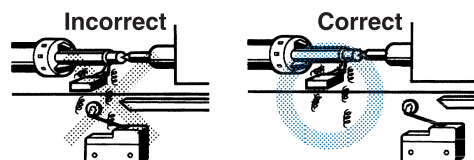
fuse with a breaking current 1.5 to 2 times larger than the rated current to the Limit Switch in parallel. Some models (e.g., the D4B-N and D4BS) specify the types of fuses. In that case, be sure to use the specified fuses.

Operating Environment

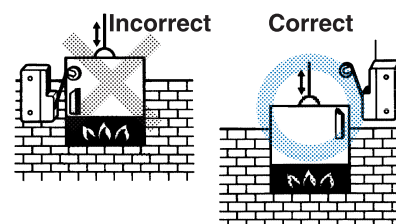
- If the Limit Switch used in locations with oil or water spray or excessive dust is not a water-resistant model or of sealed construction, be sure to protect the Limit Switch with a protective cover so that the Limit Switch will not be directly exposed to them.



- The materials of Limit Switch may change in quality or deteriorate, if the Limit Switch is used outdoors or any other location where the Limit Switch is exposed to special machining oil. Consult your OMRON representative before selecting the model.
- Be sure to install the Limit Switch so that the Limit Switch is free from dust or metal powder. The actuator and the switch casing must be protected from the accumulation of dust or metal powder.

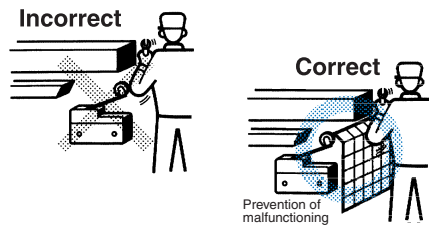


- Do not use the Limit Switch in locations where the Limit Switch is exposed to hot water at a temperature greater than 60°C or steam.
- Do not use the Limit Switch under temperatures or other environmental conditions not within the specified ranges. The rated permissible ambient temperature range varies with the model. Refer to the specifications in this catalog. If the Limit Switch is exposed to radical temperature changes, the thermal shock may deform the Limit Switch and the Limit Switch may malfunction.

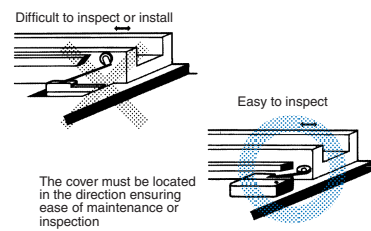


- Be sure to protect the Limit Switch with a cover if the Limit Switch is in a location where the Limit Switch may be actu-

ated by mistake or where the Limit Switch is likely cause an accident.



ideal if the location is dark or does not allow easy inspection or replacement.



- Make sure to install the Limit Switch in locations free of vibration, shock, or resonance. If vibration or shock is continuously imposed on the Limit Switch, contact failure, malfunction, or decrease in service life may be caused by abrasive powder generated from the internal parts. If excessive vibration or shock is imposed on the Limit Switch, the contacts may malfunction or become damaged.
- Do not use the Limit Switch with silver-plated contacts for long periods if the switching frequency of the Limit Switch is comparatively low or the load is minute. Otherwise, sulfuric film will be generated on the contacts and contact failures may result. Use the Limit Switch with gold-plated contacts or use a dedicated Limit Switch for minute loads instead.
- Do not use the Limit Switch in locations with corrosive gas, such as sulfuric gas (H_2S or SO_2), ammonium gas (NH_3), nitric gas (HNO_3), or chlorine gas (Cl_2), or high temperature and humidity. Otherwise, contact failure or corrosion damage may result.
- If the Limit Switch is used in locations with silicone gas, arc energy may create silicon dioxide (SiO_2) on the contacts and a contact failure may result. If there is silicone oil, silicone sealant, or wire covered with silicone close to the Limit Switch, attach a contact protective circuit to suppress the arcing of the Limit Switch or eliminate the source of silicone gas generation.

Storage of Limit Switch

- When storing the Limit Switch, make sure that the location is free of corrosive gas, such as H_2S , SO_2 , NH_3 , HNO_3 , or Cl_2 , or dust and does not have a high temperature or humidity.
- Be sure to inspect the Limit Switch before use if it has been stored for three months or more.

Regular Inspection and Replacement

- If the Limit Switch is normally closed with low switching frequency (e.g., once or less than once a day), a reset failure may result due to the deterioration of the parts of the Limit Switch. Regularly inspect the Limit Switch and make sure that the Limit Switch is in good working order.
- In addition to the mechanical life or electrical life of the Limit Switch described previously, the life of the Limit Switch may decrease due to the deterioration of each part, especially rubber, resin, and metal. Regularly inspect the Limit Switch and replace any part that has deteriorated in order to prevent accidents from occurring.
- Be sure to mount the Limit Switch securely in a clean location to ensure ease of inspection and replacement. The Limit Switch with operation indicator is available, which is

Typical Problems, Probable Causes, and Remedies

Problem		Probable Cause	Remedy
Mechanical failure	1. The actuator does not operate. 2. The actuator does not return to the free position (FP). 3. The actuator has been deformed. 4. The actuator is worn. 5. The actuator has been damaged.	The shape of the cam is incorrect.	<ul style="list-style-type: none"> Change the design of the cam and smooth the contacting surface of the cam. Scrutinize the suitability of the actuator. Make sure that the actuator does not bounce.
		The contacting surface of the dog is rough.	
		The actuator in use is not suitable.	
		The operating direction of the actuator is not correct.	<ul style="list-style-type: none"> Attach a decelerating device or change the mounting position of the Limit Switch.
		The operation speed is excessively high.	
		Excessive stroke.	<ul style="list-style-type: none"> Change the stroke.
		The rubber or grease hardened due to low temperature.	<ul style="list-style-type: none"> Use a cold-resistive switch.
		The accumulation of sludge, dust, or cuttings.	<ul style="list-style-type: none"> Use a drip-proof model or one with high degree of protection. Use a protection cover and change the solvent and materials.
		Dissolution, expansion, or swelling damage to the rubber parts of the driving mechanism.	
	There is a large deviation in operating position (with malfunctioning involved).	Damage to and wear and tear of the internal movable spring.	<ul style="list-style-type: none"> Regularly inspect the Limit Switch. Use a better quality switch. Tighten the mounting screws securely. Use a mounting board.
		Wear and tear of the internal mechanism.	
		The loosening of the mounting screws.	
	The terminal part wobbles. (The mold part has been deformed.)	Overheating due to a long soldering time.	<ul style="list-style-type: none"> Solder the Limit Switch quickly. Change the lead wire according to the carry current and ratings.
		The Limit Switch has been connected to and pulled by thick lead wires with excessive force.	
		High temperature or thermal shock resulted.	<ul style="list-style-type: none"> Use a temperature-resistive switch or change mounting positions.

Problem		Probable Cause	Remedy
Failures related to chemical or physical characteristics	Contact chattering	Vibration or shock is beyond the rated value.	<ul style="list-style-type: none"> • Attach an anti-vibration mechanism. • Attach a rubber circuit to the solenoid. • Increase the operating speed (with an accelerating mechanism).
		Shock has been generated from a device other than the Limit Switch.	
		Too-slow operating speed.	
	Oil or water penetration	The sealing part has not been tightened sufficiently.	<ul style="list-style-type: none"> • Use a drip-proof or waterproof switch. • Use the correct connector and cable. (Use a sealed connector for sealed switches.) • Use a switch with terminals sealed with resin.
		The wrong connector has been selected and does not conform to the cable.	
		The wrong switch has been selected.	
		The terminal part is not molded.	
		The Limit Switch has been burnt or carbonated due to the penetration of dust or oil.	
	Deterioration of the rubber part	The expansion and dissolution of the rubber caused by solvent or lubricating oil.	<ul style="list-style-type: none"> • Use an oil-resistant rubber or PTFE bellows. • Use a weather-resistant rubber or protective cover. • Use a switch with a protective cover or a metal bellows.
		Cracks due to direct sunlight or ozone.	
		Damage to the rubber caused by scattered or heated cuttings.	
	Corrosion (cracks)	The oxidation of metal parts resulted due to corrosive solvent or lubricating oil.	<ul style="list-style-type: none"> • Use an anti-corrosive switch. • Change the lubricating oil. • Change mounting positions. • Use a crack-resistant material.
		The Limit Switch has been operated in a corrosive environment, near the sea, or on board a ship.	
		The electrical deterioration of metal parts of the Limit Switch resulted due to the ionization of cooling water or lubricating oil.	
		The cracking of alloyed copper due to rapid changes in temperature.	
Failures related to electric characteristics	No actuation or no current breakage caused by contact weld.	Inductive interference in the DC circuit.	• Add an erasing circuit.
		Carbon generated on the surface of the contacts due to switching operations.	• Use a switch with a special alloy contact or use a sealed switch.
		A short-circuit or contact weld due to the deformation and relocation of the contacts.	• Reduce the switching frequency or use a switch with a large switching capacity.
		Contact weld due to an incorrectly connected power source.	• Change the circuit design.
		Foreign materials or oil penetrated into the contact area.	• Use a protective box.

Outdoor Use

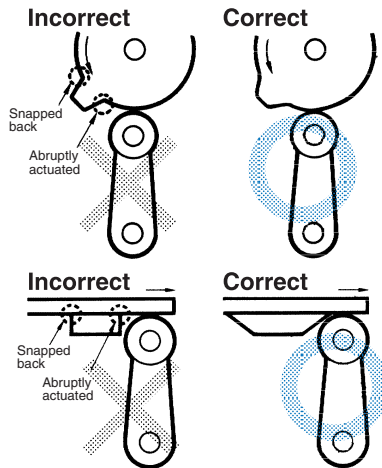
- When using the Limit Switch outdoors, make sure that the Limit Switch is a sealed model. The Limit Switch with IP67 sealing construction does not necessarily mean that the mechanical parts are also of IP67 construction.
- The rubber material exposed to ozone may deteriorate. Check that the rubber parts are environment-resistant, such as chloroprene, silicone, or fluorine rubber.
- If the Limit Switch is used in places with sludge or dust powder sprays, make sure that the mechanical parts are sealed with a rubber cap.
- Due to capillary attraction, rainwater may enter the Limit Switch through the lead wires or sheath. Be sure to cover

the wire connections in a terminal box so that they are not directly exposed to rainwater.

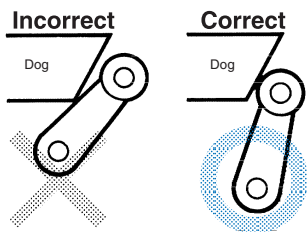
- If the Limit Switch is used outdoors, the steel parts of the Limit Switch (such as the screws and plunger parts) may corrode. Consider the use of outdoor models or proximity sensors in such cases.
- The expression "Limit Switch is used outdoors" refers to an environment where the Limit Switch is exposed directly to rainwater or sunlight (e.g., multi-story parking lots) excluding locations with corrosive gas or salty breezes. The Limit Switch used outdoors may not release due to icing and may not satisfy standards for indoor use.

Operation

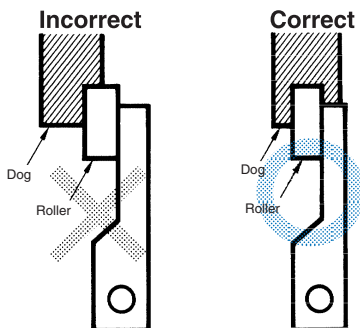
- Carefully determine the position and shape of the cam so that the actuator will not abruptly snap back, thus causing shock. In order to operate the Limit Switch at a comparatively high speed, use an object or cam that keeps the Limit Switch turned ON for a sufficient time so that the relay or valve will be sufficiently energized.
- The shape of the object or cam has a large influence on the life and operating accuracy of the Limit Switch. The cam must be smooth in shape.



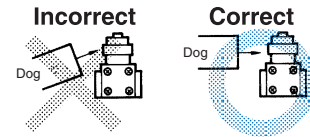
- Appropriate force must be imposed on the actuator by the cam or another object in both rotary operation and linear operation. If the object touches the lever as shown below, the operating position will not be stable.



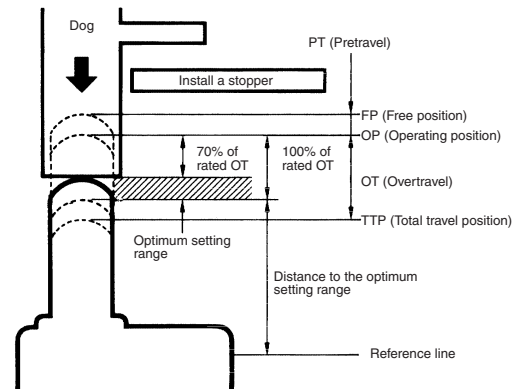
- Unbalanced force must not be imposed on the actuator. Otherwise, wear and tear on the actuator may result.



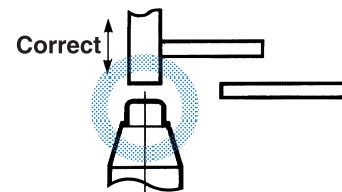
- In the case of a roller-type actuator, the object must touch the actuator at a right angle. Otherwise, the actuator or shaft may deform or break.



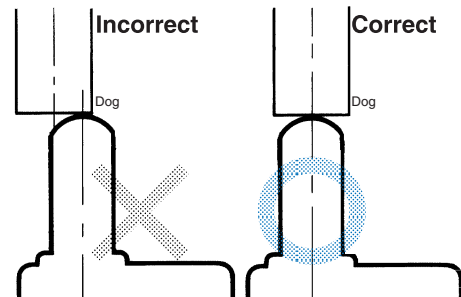
- Make sure that the actuator does not exceed the OT (over-travel) range, otherwise the Limit Switch may malfunction. When mounting the Limit Switch, be sure to adjust the Limit Switch carefully while considering the whole movement of the actuator.



- The Limit Switch may soon malfunction if the OT is excessive. Therefore, adjustments and careful consideration of the position of the Limit Switch and the expected OT of the actuator are necessary when mounting the Limit Switch.

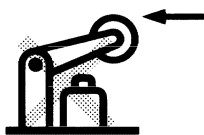


- When using a pin-plunger-type actuator, make sure that the stroke of the actuator and the movement of the object are located along a single straight line.

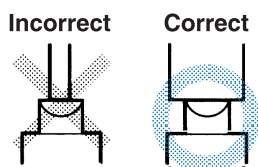


- Be sure to use the Limit Switch according to the characteristics of the actuator. If a roller arm lever actuator is used,

do not attempt to actuate the Limit Switch in the direction shown below.



- Do not modify the actuator to change the OP.
- In the case of a long actuator of an adjustable roller lever type, the following countermeasures against lever shaking are recommended.
 1. Make the rear edge of the object smooth with an angle of 15° to 30° or make it in the shape of a quadratic curve.
 2. Design the circuit so that no error signal will be generated.
 3. Use or set a switch that is actuated in one direction only.
- In the case of a bevel plunger-type actuator, make sure that the width of the object is wider than that of the plunger.



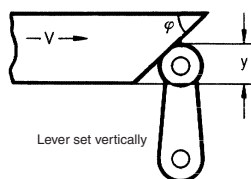
Dog Design

Operating Speed, Dog Angle, and Relationship with Actuator
Before designing a dog, carefully consider the operating speed and angle of the dog and their relationship with the shape of the actuator. The optimum operating speed of a standard dog at an angle of 30° to 45° is 0.5 m/s maximum.

Roller Lever Models

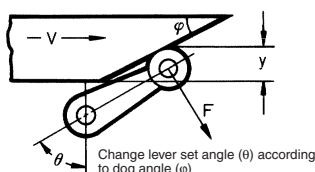
1.Non-overtravel Dog

Dog speed: 0.5 m/s max. (standard speed)



ϕ	$V_{\max.}$ (m/s)	y
30°	0.4	0.8 (TT)
45°	0.25	80% of total travel
60°	0.1	
60° to 90°	0.05 (low speed)	

Dog speed: 0.5 m/s \times V \times 2 m/s

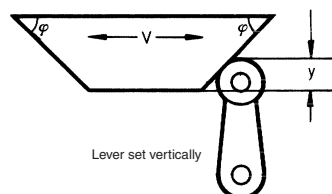


θ	ϕ	$V_{\max.}$ (m/s)	y
45°	45°	0.5	0.5 to 0.8 (TT)
50°	40°	0.6	0.5 to 0.8 (TT)
60° to 55°	30° to 35°	1.3	0.5 to 0.7 (TT)
75° to 65°	15° to 25°	2	0.5 to 0.7 (TT)

Note: The above y values indicate the ratio ranges based on TT (total travel). Therefore, the optimum pressing distance of the dog is between 50% and 80% (or 50% and 70%).

2.Overtravel Dog

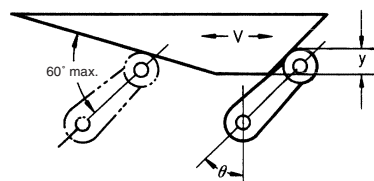
Dog speed: 0.5 m/s max.



ϕ	$V_{\max.}$ (m/s)	y
30°	0.4	0.8 (TT)
45°	0.25	80% of total travel
60°	0.1	
60° to 90°	0.05 (low speed)	

Dog speed: 0.5 m/s min.

If the speed of the overtravel dog is comparatively high, make the rear edge of the object smooth at an angle of 15° to 30° or make it in the shape of a quadratic curve. Then lever shaking will be reduced.



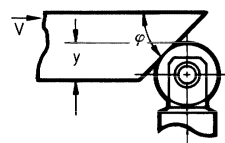
θ	ϕ	$V_{\max.}$ (m/s)	y
45°	45°	0.5	0.5 to 0.8 (TT)
50°	40°	0.6	0.5 to 0.8 (TT)
60° to 55°	30° to 35°	1.3	0.5 to 0.7 (TT)
75° to 65°	15° to 25°	2	0.5 to 0.7 (TT)

Note: The above y values indicate the ratio ranges based on TT (total travel). Therefore, the optimum pressing distance of the dog is between 50% and 80% (or 50% and 70%).

Plunger Models

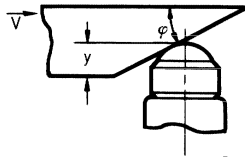
If the dog overrides the actuator, the front and rear of the dog may be the same in shape, provided that the dog is not designed to be separated from the actuator abruptly.

Roller Plunger



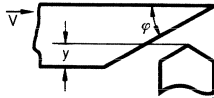
ϕ	$V_{\max.}$ (m/s)	y
30°	0.25	0.6 to 0.8 (TT)
20°	0.5	0.5 to 0.7 (TT)

Ball Plunger



ϕ	$V_{\max.}$ (m/s)	y
30°	0.25	0.6 to 0.8 (TT)
20°	0.5	0.5 to 0.7 (TT)

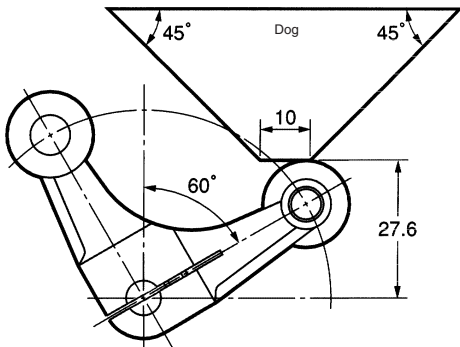
Bevel Plunger



ϕ	$V_{\max.}$ (m/s)	y
30°	0.25	0.6 to 0.8 (TT)
20°	0.5	0.5 to 0.7 (TT)

Note: The above y values indicate the ratio ranges based on TT (total travel). Therefore, the optimum pressing distance of the dog is between 60% and 80% (or 50% and 70%).

Fork Lever Lock Models



Note: Design the shape of the dog so that it does not come in contact with the other roller lever when the actuator is inverted.

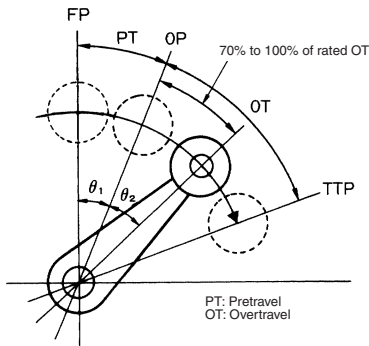
Stroke Settings vs. Dog Movement Distance

- The following provides information on stroke settings based on the movement distance of the dog instead of the actuator angle.

The following is the optimum stroke of the Limit Switch

Optimum stroke: $PT + (\text{Rated OT} \times 0.7 \text{ to } 1.0)$

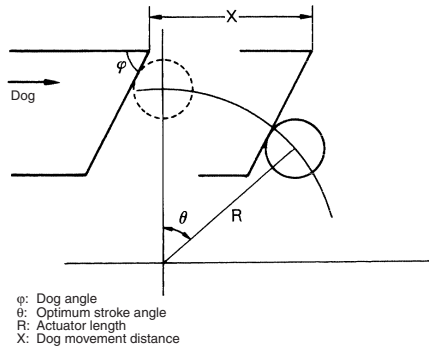
The angle converted from the above: $\theta_1 + \theta_2$



- The movement distance of the dog based on the optimum stroke is expressed by the following formula.

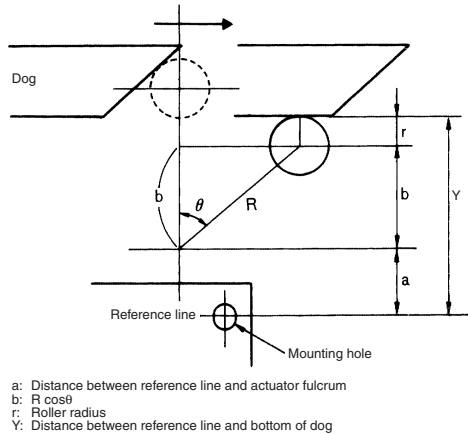
Movement distance of dog

$$X = R \sin \theta + \frac{R(1 - \cos \theta)}{\tan \phi} \text{ (mm)}$$



- The distance between the reference line and the bottom of the dog based on the optimum stroke is expressed by the following formula.

$$Y = a + b + r \text{ (mm)}$$



Dog Surface

- The surface of dog touching the actuator should be 6.3 S in quality and hardened at approximately H450V.
- For smooth operation of the actuator, apply molybdenum disulfide grease to the actuator and the dog touching the actuator. This is ideal for Limit Switches of drip-proof construction and Multiple Limit Switch models.

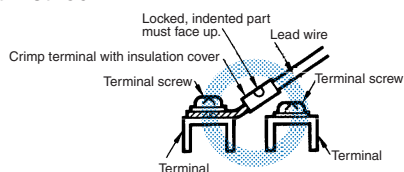
Maintenance and Repairs

- The user must not maintain or repair the system. Consult the manufacturer of the system for maintenance or repairs.

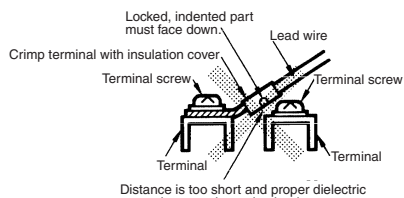
Others

- The Limit Switch has contacts that must be free of silicone gas, otherwise a contact failure may result. Therefore, do not apply cable covered with silicone, silicone sealant, or silicone grease to the Limit Switch.
- The sealing of the standard Limit Switch uses nitrile butadiene rubber (NBR), which is highly oil resistive. The NBR exposed to different types of oil or chemical may, however, deteriorate, swell, or shrink. Contact your OMRON representative for details.
- OMRON shall not guarantee the performance and characteristics of any actuator, plunger, or lever modified by the user.
- When using the Limit Switch with a long lever or long rod lever, make sure that the lever is in the downward direction.
- In order to ensure high contact reliability, the correct Limit Switch must be selected according to the load. For details, refer to the precautions for minute load models in this catalog.
- The leads must be wired as shown below.

Correct Method



Wrong Method



SI Units

To conform to the international standards, this datasheet adopts the SI international system for units (SI: Systeme International d'Unites). Refer to the following tables to convert values indicated in conventional units.

SI Unit Conversion

(Shaded units are non-SI units.)

Acceleration	m/s ²	G
	1	1.01972 10 ⁻¹
	9.80665	1

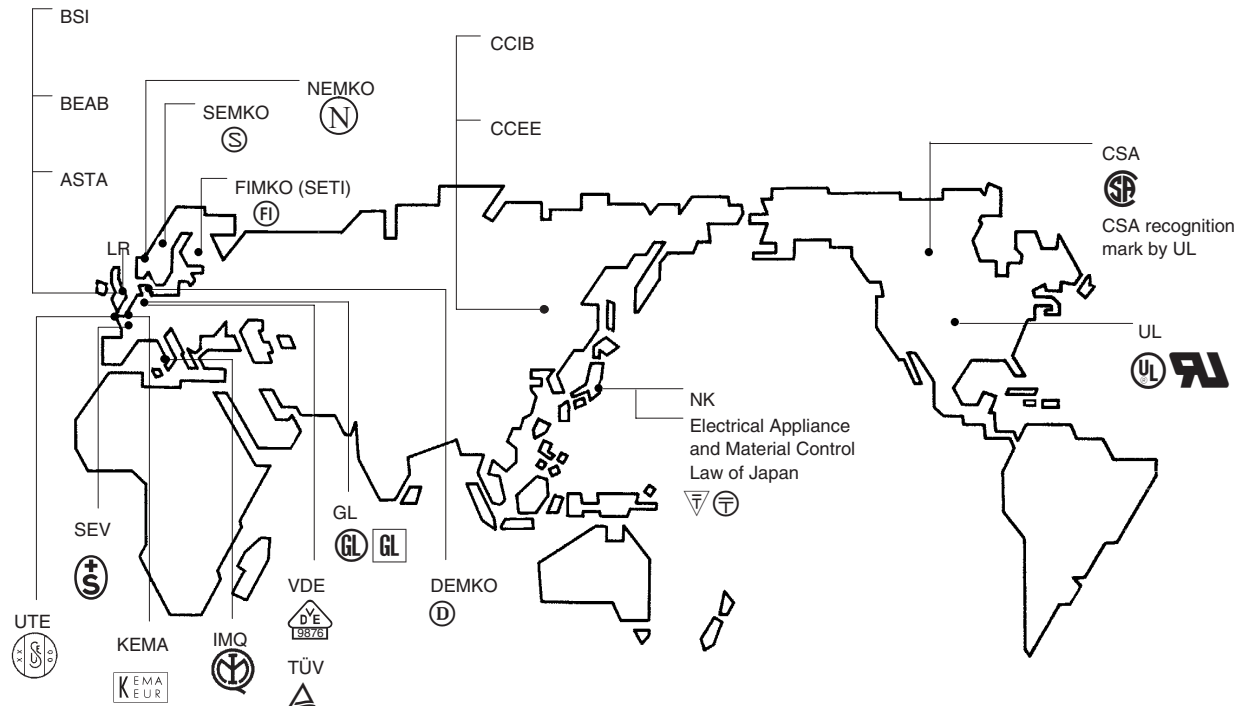
Force	N	kgf
	1	1.01972 10 ⁻¹
	9.80665	1

Torque	Nm	kgf•cm	kgf•m
	1	1.01972 10	1.01972 10 ⁻¹
	9.80665 10 ²	1	1 10 ⁻²
	9.80665	1 10 ²	1

Pressure	Pa	kPa	kgf/cm ²	mmHg (Torr)	mmH ₂ O
	1	1 10 ⁻³	1.01972 10 ⁻⁵	7.50062 10 ⁻³	1.01972 10 ⁻¹
	1 10 ³	1	1.01972 10 ⁻²	7.50062	1.01972 10 ²
	9.80665 10 ⁴	9.80665 10	1	7.35559 10 ²	1 10 ⁴
	1.33322 10 ²	1.33322 10 ⁻¹	1.35951 10 ⁻³	1	1.35951 10

Standards

National Standards



Note: For detailed information about applicable standards, refer to the relevant catalog.

International Standards

IEC (International Electrotechnical Commission)

The IEC is a standardization commission founded in 1908 to promote unification and coordination of international standards relating to electricity. It is headquartered in Geneva, Switzerland.

IEC standards are provided to accomplish the aim of the above. The IEC strongly recommends all the member nations of the IEC to establish domestic standards that conform with those of the IEC.

At present, there are 50 member nations in the IEC. Based on reports from member nations on the latest science technologies in those nations, IEC standards are issued as technological standards relating to electricity. Established international safety standards provided by various countries and accepted worldwide are based on IEC standards.

In order to simplify approval procedures for electrical devices and promote smooth international trade, there is an international scheme called CB Scheme (Certification Body Scheme), which is authorized by IEC standards. Based on the CB Scheme, safety tests on electrical devices are conducted and certificates are issued if the devices are proved to meet IEC standards. Products issued with such certificates are acceptable in 30 countries in the world.

North America

UL Standards (Underwriters Laboratories INC.)

A nonprofit organization established in 1894 by the American association of fire insurance companies.

Underwriters Laboratories (abbreviated to UL hereafter) conducts approval testing on all kinds of electrical products. In many U.S. cities and states, UL approval is legally required on all electrical items sold.

In order to obtain UL approval on an electrical product, all major internal components also require UL approval.

UL offers two classifications of approvals, the listing mark and the recognition mark.

A Listing Mark constitutes a entirely approval of a product. Products display the Listing Mark shown below.



Listing Mark

The Recognition Mark applies to the components used in a product, and therefore constitutes a more conditional approval of a product. Products display the Recognition Mark shown below.



Recognition Mark

The UL and CSA are unifying their standards with the adoption of a mutual approval system. Furthermore, they are adjusting their standards so that they will be in conformity with IEC standards.



Since October 1992, UL has been approved as a CO (council organization) and TO (test organization) by the SCC (Standard Council of Canada). This authorizes UL to conduct safety tests and certify products conforming to Canadian standards. The above marks are UL marks for products certifying that the products meet Canadian standards.

The designs of the listing marks and recognition marks have been revised as shown below. These marks have been effective since November 1998. The previous marks are valid until November 2007.

LISTING MARKS

	Marks for US	Marks for Canada	Marks for US and Canada
Previous mark			
New mark			

RECOGNITION MARKS

	Marks for US	Marks for Canada	Marks for US and Canada
Previous mark			
New mark			

CSA Standards (Canadian Standards Association)

This association descended from a nonprofit, non-government standardization organization established in 1919. In addition to industrial standardization, the association now carries out safety testing on electrical products.

CSA has closer ties to government agencies than UL, so that electrical products not approved by CSA cannot be sold in Canada. Non-approved goods being sold illegally may have to be withdrawn.

CSA approval is known as "certification," and consequently, CSA-approved equipment is referred to as "certified equipment." Products display the mark shown below. For a conditional certification, products display component acceptance mark.

The CSA is adjusting its standards so that they will be in conformity with UL and IEC standards.



Certification Mark

China

GB (Guojia Biaozhun) Chinese National Standards

The GB are established Chinese national standards based on IEC standards.

Products such as home electronics appliances (e.g., televisions, washing machines, and microwave ovens), for which GB standards are obligatory, must be approved by CCIB (China Commodity Inspection Bureau) and CCEE (China Commission for Conformity Certification of Electrical Equipment). The marks shown below are respective marks of recognition.



CCIB Mark



CCEE Mark

Shipping Standards

LR (Lloyd's Register of Shipping)

These are the standards of the Lloyd's Register of Shipping, headquartered in London. All of the OMRON control components approved in LR are UMS ships, the unmanned engine-room ship classification in the Lloyd's Register.

Unlike the safety standards such as UL, the devices are checked to ensure that they can function sufficiently under the environmental conditions when they are used in ships.

When a device is approved, Lloyd's Register doesn't apply the passing mark on the product, but includes it on the list of approved products that it publishes every year.

NK (Nippon Kaiji Kyokai)

Nippon Kaiji Kyokai (NK), which was established in 1899 under a different name for the purpose of ensuring the safety of vessels and the maintenance of maritime environmental conditions, has been using the present name since 1946.

Automation equipment and devices receive tests and inspections based on the provisions of the steel-ship regulations and can be formally approved if the tests are passed.




Testing at the production factory can be partially or entirely omitted when automation equipment and devices that have been formally approved are installed on ships.

As a general rule, manufacturers of approved products indicate that the products being shipped have been approved. (It is also acceptable to affix a label to products which require it.)

Japan

Electrical Appliance and Material Control Law of Japan

The EAMCL was substantially revised in July 1995 in conformity with IEC standards, such as IEC335. Consequently, the previously-used symbol for second-grade appliances was abolished while the symbol for first-grade appliances remained unchanged. Furthermore, the range of applicable products has been greatly revised.

	First-grade appliance	Second-grade appliance
Previous symbol	282 products 	216 products 
Present symbol	165 products 	333 products (no markings)

Europe

EN (European Norm) Standards

As part of EC unification, 18 European countries are going to integrate their national safety standards into EN standards. When EN standards come into effect, they shall apply as the unified standards in Europe in place of the current safety standards.

EN standards related to electricity are based on IEC standards and include requirements relating to countermeasures against electric shocks. EN codes consist of the prefix "EN"

followed by five figures beginning with the figure 6 (e.g., EN60204).

















Industrial products exported to Europe must satisfy IEC standards if the products do not fall under EN standards.

Industrial products exported to European countries from Japan or North America or traded between European countries must satisfy EN standards. Furthermore, 12 types of industrial products, such as machines, low-voltage devices, and EMC equipment, must bear CE markings. CE markings on a product indicate that the product meets safety standards specified by all related EC directives. For example, an industrial machine must satisfy the EC Machinery Directive, Low-voltage Directive (LVD), and EMC requirements.



CE Marking













The following marks of recognition are used in European countries in accordance with EN standards.

VDE (Verband Deutscher Elektrotechniker e.V.) in Germany (applicable to electrical appliances only)		TÜV (applicable to electrical appliances, machines and automobiles)	
			
VDE Mark	Monitoring Mark	TÜV Rheinland	TÜV Product Service
			
DEMKO (Danmarks Elektriske Materielkontroll)		KEMA (Keuring van Electrotechnische Materialen Nederland B.V.)	
			
NEMKO (Norges Elektriske Materielkontroll)		UTE (Union Technique De Electricite)	
			
FIMKO (Finlands Material Kontroll)		IMQ (Istituto Italiano del Marchio di Qualita)	
			
BSI (British Standards Institution) Britain (applicable to industrial products)		SEMKO (Svenska Elektriska Materielkontroll Anstalten)	
			
BEAB (British Electrotechnical Approval Board) Britain (applicable to home electronics products)		SEV (Schweizer Elektrotechnischer Verein)	
			
ASTA (ASTA Certification Services) Britain (applicable to general products)			

List of Approved Models







UL Standards    

Safety Switches

Model	Rating	Standard No.	File No.
D4N	A300 (Carry current: 10 A) Q300 (Carry current: 2.5 A)  	UL508	E76675
D4F	C300 (Carry current: 2.5 A), Q300 (Carry current: 2.5 A) 		
D4B-N	A600 (Carry current: 10 A)		
D4BS	A600 (Carry current: 10 A)		
D4BL	A300 (Carry current: 10 A)		
D4N-R	A300 (Carry current: 10 A) Q300 (Carry current: 2.5 A)  		
D4NS	A300 (Carry current: 10 A) Q300 (Carry current: 2.5 A)  		
D4NL	A300 (Carry current: 10 A)  		
D4GL	C300 (Carry current: 2.5 A), Q300 (Carry current: 2.5 A) 		
D4NH	A300 (Carry current: 10 A) Q300 (Carry current: 2.5 A)  		
D4GS-N	C300 (Carry current: 2.5 A), Q300 (Carry current: 2.5 A)		

Note: 1. Approval on some models may have been given on representative models. For further information on standard approvals, contact your OMRON sales representative.
2. The standard number shown above is the number the applicable standard and the file number is the approval report number.

Pushbutton Switches

Model	Rating	Standard No.
A165E	  5 A, 125 VAC 3 A, 250 VAC 3 A, 30 VDC	UL508
A165E□03U	  1 A, 125 VAC 0.5 A, 250 VAC 1 A, 30 VDC	UL508
A22E	  6 A, 250 VAC 10 A, 105 VAC	UL508

Safety Relay Units

Model	Number of poles	Operating coil	Contact rating	File No.
G9S-2001 G9S-2002	DPST-NO	24 VDC	5 A, 240 VAC (Resistive)	E95399
G9S-301	3PST-NO/ SPST-NC	24 VDC, 24, 100, 120, 240 VAC		
G9S-501	5PST-NO/ SPST-NC			
G9S-321-T□ (see note 1)	3PST-NO/ SPST-NC+ DPST-NO (OFF-delay)			
G9SA-301	3PST-NO/ SPST-NC	24 VDC, 24 VAC	5 A, 250 VAC (Resistive)	E41515
G9SA-501	5PST-NO/ SPST-NC			
G9SA-321-T□ (see note 2)	3PST-NO/ SPST-NC+ DPST-NO (OFF-delay)			
G9SA-TH301	3PST-NO/ SPST-NC			
G9SA-EX301				
G9SA-EX031-T□ (see note 2)	3PST-NO+ SPST-NC (OFF-delay)			
G9SX-EX□	4PST-NO	24 VDC	3 A, 250 VAC (Resistive)	see datasheet

Model	Number of poles	Operating coil	Contact rating	File No.
G9SB-200□-□	DPST-NO	24 VDC, 24 VAC	5 A, 250 VAC (Resistive)	E76675
G9SB-301□-□	3PST-NO/ SPST-NC			
G9SB-3010		24 VDC		
CQM1-SF200 CS1W-SF200	DPST-NO	24 VDC	5 A, 250 VAC (Resistive)	

Note: 1. T□: T01, T015, T03, T04, T05, T06, T10, T30
2. T□: T075, T15, T30

Safety Relays

Model	Number of poles	Operating coil	Contact rating	File No.
G7S-4A2B	4PST-NO/ DPST-NC	24 VDC	6 A per pole, 20 A total, 277 VAC (Re- sistive)	E41515
G7S-3A3B	3PST-NO/ 3PST-NC			
G7SA-3A1B	3PST-NO/ SPST-NC		6 A, 250 VAC (Resistive) 6 A, 30 VDC (Resistive)	
G7SA-2A2B	DPST-NO/ DPST-NC			
G7SA-5A1B	5PST-NO SPST-NC			
G7SA-4A2B	4PST-NO DPST-NC			
G7SA-3A3B	3PST-NO/ 3PST-NC			

Safety Area Sensors (Listing Certified)

Model	File No.	Ratings/remarks
F3SN-A F3SH-A	E199694	Input: 24 VDC Output: PNP open collector, 300 mA (24 VDC) Type 4 ESPE/AOPD
F3S-B	E199694	Input: 24 VDC Output: PNP open collector or NPN open collector, 200 mA (24 VDC) Type 2 ESPE/AOPD
F3SS	NRTL certification by CSA	---
F3SL	E199694	Type 4 ESPE/AOPD

CSA Standards

Safety Switches

Model	Rating	Standard No.	File No.
D4BS	A600 (Carry current: 10 A)	CSA C22.2 No. 14	LR45746
D4DS	A600 (Carry current: 10 A)		
D4BL	A300 (Carry current: 10 A)		
D4DL	A300 (Carry current: 10 A)		
D4DH	A600 (Carry current: 10 A)		

Note: 1. Approval on some models may have been given on representative models. For further information on standard approvals, contact your OMRON sales representative.

2. The standard number shown above is the number the applicable standard and the file number is the approval report number.

Safety Relay Units




Model	Number of poles	Operating coil	Contact rating	File No.
G9S-2001 G9S-2002	DPST-NO	24 VDC	5 A, 240 VAC (Resistive)	LR35535
G9S-301	3PST-NO/ SPST-NC	24 VDC, 24, 100, 120, 240 VAC		
G9S-501	5PST-NO/ SPST-NC			
G9S-321-T□ (see note 1)	3PST-NO/ SPST-NC+ DPST-NO (OFF-delay)			
G9SA-301	3PST-NO/ SPST-NC	24 VDC, 24 VAC	5 A, 250 VAC (Resistive)	
G9SA-501	5PST-NO/ SPST-NC			203880 (LR35535)
G9SA-321-T□ (see note 2)	3PST-NO/ SPST-NC+ DPST-NO (OFF-delay)			
G9SA-TH301 G9SA-EX301	3PST-NO/ SPST-NC			
G9SA-EX031-T□ (see note 2)	3PST-NO+ SPST-NC (OFF-delay)			
G9SB-200□-□ G9SB-301□-□ G9SB-3010	DPST-NO 3PST-NO/ SPST-NC	24 VDC, 24 VAC 24 VDC	5 A, 250 VAC (Resistive)	
CQM1-SF200 CS1W-SF200	DPST-NO	24 VDC	5 A, 250 VAC (Resistive)	see datasheet
G9SX-EX□	4PST-NO	24 VDC	3 A, 250 VAC (Resistive)	

Note: 1. T□: T01, T015, T03, T04, T05, T06, T10, T30

2. T□: T075, T15, T30

3. Approval of G9SA models with AC power supplies is pending (as of June 2001).

Safety Area Sensors

Model	File No.	Rating/remarks
F3SN-A F3SH-A	( listing based on Canadian safety standards) Refer to UL standards.	Input: 24 VDC Output: PNP open collector, 300 mA (24 VDC) Type 4 ESPE/AOPD
F3S-B	( listing based on Canadian safety standards) Refer to UL standards.	Input: 24 VDC Output: PNP open collector or NPN open collector, 200 mA (24 VDC) Type 2 ESPE/AOPD
F3SS	LR90200 (CSA C22.2 No. 205)	---
F3SL	( listing based on Canadian safety standards) Refer to UL standards.	Type 4 ESPE/AOPD

Safety Relays

Model	Number of poles	Operating coil	Contact rating	File No.
G7SA-3A1B	3PST-NO/ SPST-NC	24 VDC	6 A, 250 VAC (Resistive) 6 A, 30 VDC (Resistive)	LR35535 (CSA C22.2 No. 14)
G7SA-2A2B	DPST-NO/ DPST-NC			
G7SA-5A1B	5PST-NO SPST-NC			
G7SA-4A2B	4PST-NO DPST-NC			
G7SA-3A3B	3PST-NO/ 3PST-NC			
G7S-4A2B	4PST-NO/ DPST-NC	24 VDC	6 A per pole, 20 A total, 277 VAC (Resistive)	
G7S-3A3B	3PST-NO/ 3PST-NC			
G7SA-4A2B-E	4PST-NO DPST-NC	24 VDC	NO contact: 10 A per pole, 20 A total, 277 VAC (Resistive) NC contact: 6 A per pole, 20 A total, 277 VAC (Resistive)	
G7SA-3A3B-E	3PST-NO/ 3PST-NC			

Safety Limit Switches

Model	Rating	Standard No.	File No.
D4B-N	A600 (Carry current: 10 A)	CSA C22.2 No. 14	LR45746

VDE Standards



Safety Relays

Model	Number of poles	Operating coil	Contact rating	Approval No.
G7S-4A2B	4PST-NO/ DPST-NC	24 VDC	6 A 240 VDC (Resistive)	No. 6611 (IEC255) (VDE0435) (EN50205)
G7S-3A3B	3PST-NO/ 3PST-NC			
G7SA-3A1B	3PST-NO/ SPST-NC		6 A, 250 VAC (Resistive) 6 A, 30 VDC (Resistive)	No. 125547 (EN61810-1) (EN50205) (EN60255-23)
G7SA-2A2B	DPST-NO/ DPST-NC			
G7SA-5A1B	5PST-NO/ SPST-NC			
G7SA-4A2B	4PST-NO/ DPST-NC			
G7SA-3A3B	3PST-NO/ 3PST-NC			

Note: Applicable standard numbers are given in parentheses.

TÜV Standards



Limit Switches

Model	Rating	Standard No.	Approval No.
D4N-R	AC-15 3 A 240 V 50/60 Hz DC-13 0.27 A 250 V	EN60947-5-1 EN81, EN115 pending	B031139656061
D4BS	AC-15 2 A 400 V 50/60 Hz	EN60947-5-1 IEC947-5-1	R9351022
D4N	AC-15 3 A 240 V 50/60 Hz DC-13 0.27 A 250 V	EN60947-5-1	B031139656061
D4F	AC-15 0.75 A 240 V 50/60 Hz	EN60947-5-1 GS-ET-15	B0203 39656029
D4B-N	AC-15 2 A 400 V 50/60 Hz	EN60947-5-1 IEC947-5-1	Slow-action: R9151643 Snap-action: J9851083
D4NH	AC-15 3 A 240 V 50/60 Hz DC-13 0.27 A 250 V	EN60947-5-1	B031139656061
D4NS	AC-15 3 A 240 V 50/60 Hz DC-13 0.27 A 250 V	EN60947-5-1	B030639656052
D4GL	AC-15 0.75 A 240 V 50/60 Hz DC-13 0.27 A 250 V	EN60947-5-1 GS-ET-19	B0207 39656039
D4NL	AC-15 3 A 240 V 50/60 Hz DC-13 0.27 A 250 V	EN60947-5-1 GS-ET-19	B0207 39656040
D4BL	AC-15 3 A 250 V 50/60 Hz (LED type: AC- 15 6 A 115 V 50/ 60 Hz)	EN60947-5-1 IEC947-5-1 GS-ET-19	R9451050
D4GS-N	AC-15 0.75 A 240 V 50/60 Hz DC-13 0.27 A 250 V	EN60947-5-1	J2051125

BIA Standards

Limit Switches

Model	Models rated	Standard No.	Approval No.
D4B-N	Positive opening models approved except adjustable levers, coils, springs, and plas- tic rods	GS-ET-15, EN60947-5-1	9202158 and 9309655
D4BS	All D4BS models	GS-ET-15, EN60947-5-1	9303323
D4BL	All D4BL models	GS-ET-19, EN60947-5-1	Mechanical: 9402293 Solenoid: 1998, 20462-01

Safety Relay Units

Model	Number of poles	Operat- ing coil	Contact rating	File No.
G9S-2001 G9S-2002	DPST-NO	24 VDC	5 A, 240 VAC (Re- sistive)	R974021 (EN60204-1) (EN954-1)
G9S-301	3PST-NO/ SPST-NC	24 VDC, 24, 100, 120, 240 VAC		
G9S-501	5PST-NO/ SPST-NC			
G9S-321- T□ (see note)	3PST-NO/ SPST- NC+DPST- NO (OFF- delay)			

Note: T□: T01, T015, T03, T04, T05, T06, T10, T30

SUVA Standards

Limit Switches

Model	Models rated	Approved No.
D4B-N	Positive opening models approved except adjustable levers, coils, springs, and plastic rods	E6188.d and E6189.d
D4BS	All D4BS models	E6187.d
D4BL	All D4BL models	E6186/1.d

BG Standards

Safety Relay Units

Model	Number of poles	Operating coil	Contact rating	File No.
G9SA-301	3PST-NO/ SPST-NC	24 VDC, 24 VAC	5A, 250 VAC (Resistive)	000115
G9SA-501	5PST-NO/ SPST-NC			000135
G9SA-321-T□ (see note 1)	3PST-NO/ SPST-NC+ DPST-NO (OFF-delay)			000137
G9SA-TH301	3PST-NO/ SPST-NC			
G9SA-EX301	3PST-NO/ SPST-NC			000135
G9SA-EX031-T□ (see note 1)	SPST-NC+ 3PST-NO (OFF-delay)			000137

Note: 1. T□: T075, T15, T30

List of Models Conforming to EN/IEC Standards

Safety Door Switches

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low-voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS stan- dard No.	Approving agency	File No./ Applicable period
D4BS	YES	up to 4	EN60947-5-1 IEC60947-5-1	---	TÜV, Rheinland	R9351022	Not applicable			
D4BL						R9451050				
D4GS-N						J2051125				
D4N			EN60947-5-1		TÜV, Product Service	B0311396560 61				
D4N-B										
D4NH										
D4NS						B0306396505 2				
D4GL						B0207396560 39				
D4NL						B0207396560 40				

Safety Sensor

Model	CE marking	Safety category	Machinery Directive			Basic requirements of EMC Directive		
			Applicable directive	Approving agency	File No.	Applicable directive	Approving agency	File No.
F3SN-A F3SH-A	YES (EMC Directive)	4	EN61496-1 ESPE Type 4 IEC61496-1 ESPE Type 4 IEC61496-2 AOPD Type 4	DEMKO	Certificate No. 129794-01	89/336/EEC	DEMKO	Certificate No. 129794-02
F3S-B		2	EN61496-1 ESPE Type 2 IEC61496-1 ESPE Type 2 IEC61496-2 AOPD Type 2	TÜV Hannover/Sachsen-Anhalt			TÜV Nord	Certificate 08/205/B1-PM28890
F3SS		4	IEC61496-1 ESPE Type 4 IEC61496-2	TÜV Rheinland	BB9911039	IEC61496-1 compatibility according to TÜV Rheinland. Declaration of conformity to EMC Directive based on certification. Declaration of conformity certificate numbers: MSCS 128A (F3SS) MSCS 129A (F3SL)		
F3SL					BB9910071			
E3FS		2	98/37/EC EN61469-1 prEN91496-2 type2	TÜV Product Service	Z20108426690 01	89/336/EEC	TÜV Product Service	
F3SP-U1P F3SP-U3P F3SP-U5P			98/37/EC IEC61496-1		Z10030718453 015			
F3SP-U2P F3SP-U4P		4	98/37/EC IEC61496-1					
F3SP-P1P			98/37/EC IEC61496-1 IEC61496-2					

Safety Relay Unit

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low-voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
G9SA	YES	4 (see note 1)	EN60204-1 EN954-1	---	BG	(see note 4)	EN55011	EN50082-2	TÜV, Product Service	E8 00 04 39656 001
G9S		4 (see note 2)			BIA	R974021				(see note 5)
G9SA (24 VAC/ VDC)		4 (see note 1)			BG	(see note 6)		EN61000-6-2	TÜV, Rheinland	E8 02 03 39656 035
G9SA (100 to 240 VAC)										Report No. 02062204 002 Registration No. AE2051327 02

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low-voltage Directive				Basic requirements of EMC Directive							
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period				
G9SB-200□-□ G9SB-301□-□	YES	4	EN60204-1 EN954-1	---	TÜV, Rheinland	968/EZ 120.00/01	EN55011	EN61000-6-2	TÜV, Rheinland	Report No. 02160619 002 Registration No. AV2- 50003726				
G9SB-3010		3 (see note 3)				968/EZ 110.00/00					Report No. P2062560E 01 Registration No. AE2051219 01			
CQM1-SF200		4												
CS1W-SF200		see datasheet										EN61000-6	EN61000-6-2	see datasheet J150-E2- Cat04-01
G9SX														

Note: 1. OFF-delay contact of G9SA-321/EX031 falls in Category 3.
2. OFF-delay output of G9S-321 and G9S-2001 falls in Category 3.
3. G9SB-3010 falls in Category 3 with double breaking.
4. G9SA-301: 00115, 501/EX301: 00135, 321/EX031: 00137, TH301: 01013
5. G9S-301/501/321: E8 97 05 22868 026; G9S-2001/2002: E8 98 03 32014 005
6. G9SA-301: 00115, 501/EX301: 00135, 321/EX031: 00137, TH301: 01013 (24 VAC/VDC)
G9SA-301: 02067, 501: 02063, 321: 02065, TH301: 01013 (100 to 240 VAC)

Safety Relays

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low-voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
G7SA	Not applicable	For Systems up to cat. 4	EN61810-1	EN50205	VDE	No. 125547	Not applicable			
G7S			IEC60255 (VDE0435)	prEN50205		No. 6611				

Safety Limit Switches

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low-voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
D4B-□N	Snap-action	YES	4	EN60947-5-1 IEC60947-5-1	TÜV, Rheinland	J9851083	Not applicable			
D4D-□N	Snap-action					JJ9950233				
D4B-□N	Slow-action					R9151643				
D4N-□R					TÜV, Product Service	Pending				
D4F						B02033965 6029				

Emergency Stop Switches

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low-voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
A165E Series (separate construction)	YES	4	EN60947-5-1	---	TÜV, Product Service	B021039656 044	Not applicable			
A22E Series						B021039656 043				
A165E-□-03U (one-body construction)						B021039656 045				

Accessories

Selection Guide Power Supply
Accessories


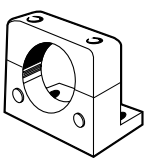



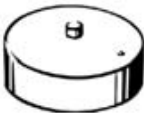

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H-3

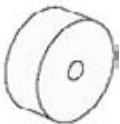
Accessories

Accessories for photoelectric, inductive and capacitive sensors

For cylindrical shapes

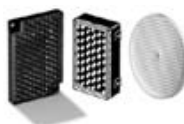



Mounting accessories, covers and slits

Shape	Product group	Type	Housing material	Features	Order reference	Applicable sensors
	Mounting brackets	general purpose - screw fix	plastic	<ul style="list-style-type: none"> - cost efficient mounting bracket - for M8, M12, M18, M30 - surface mounting 	Y92E-B	<ul style="list-style-type: none"> - E3F2 - E2A - E2F
				for dia 34 mm	Y92E-A34	E2K-C
		quick access - snap fix	stainless steel	<ul style="list-style-type: none"> - snap fix for quick sensor access - for M8, M12, M18, M30 - surface mounting 	Y92E-BC	<ul style="list-style-type: none"> - E3F2 (metal housing) - E2A (metal housing)
		quick access - clamp fix		<ul style="list-style-type: none"> - clamp fix for quick sensor access with exact repositioning - for M8, M12, M18, M30 - through mounting 	Y92E-G	
	Protective covers	general purpose sensor head protection	polyarylate	<ul style="list-style-type: none"> - for M8, M12, M18, M30 - for shielded and unshielded 	Y92E-E	<ul style="list-style-type: none"> - E2A (- E2F)
		sputter protection for sensor head	silicone rubber	<ul style="list-style-type: none"> - increased protection in weld fields - for M12, M18, M30 - for shielded 	Y92E□-2	
		general purpose lens protection	metal rim with glass cover		E39-F31	E3F2





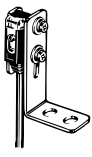
Shape	Product group	Type	Housing material	Features	Order reference	Applicable sensors
	Slits	slit cover	polyarylate	<ul style="list-style-type: none"> - slit cover for precision detection and positioning with through beam photo sensors - for M18 	Y92E-ES18	E3F2-10


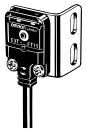





Accessories for photoelectric sensors









For all shapes

Shape	Type	Housing material			Order reference	Applicable Sensors
	General purpose reflectors	<ul style="list-style-type: none"> - ABS - acrylic surface 	<ul style="list-style-type: none"> - square or round shapes - plate or tape reflectors - direct reflective or polarizing - direct mount or bracket mount 	<ul style="list-style-type: none"> - size from 23 x 14 mm up to 100 x 100 mm - IP67 	E39-R	<ul style="list-style-type: none"> - retroreflective photo electric sensors - non polarizing - retroreflective photo electric sensors - polarizing (MSR)
	Harsh environment reflectors	<ul style="list-style-type: none"> - mounting plate stainless steel - reflector acrylic 	<ul style="list-style-type: none"> - direct mount or bracket mount 	<ul style="list-style-type: none"> - size 14 x 13 x 1 mm - IP67 	E39-R37	<ul style="list-style-type: none"> - E3F2-R□-S - E3S-CR
	Non-fogging reflector	<ul style="list-style-type: none"> - ABS - acrylic surface 	<ul style="list-style-type: none"> - anti-fogging coating 	<ul style="list-style-type: none"> - size 40 x 60 x 7.5 mm - IP67 	E39-R1K	
	Adjustment aid for sensitivity adjuster	Polycarbonate			E39-G2	<ul style="list-style-type: none"> - photo electric sensors with adjustable potentiometers







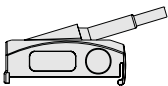
For square shapes
Mounting and protection

Shape	Type	Housing material	Features	Mounting type	Order reference	Applicable Sensors
	General purpose mounting	Stainless steel (SUS 304)	inclination angle adjustment	side wall mounting	E39-L43	E3Z
				back wall mounting	E39-L44	
			horizontal and inclination angle adjustment	surface mounting	E39-L104	
				back wall mounting	E39-L117	E3T-S
				surface mounting	E39-L116	





Shape	Type	Housing material	Features	Mounting type	Order reference	Applicable Sensors
	General purpose mounting	Stainless steel (SUS 304)		side wall mounting	E39-L120	E3T-F
				back wall mounting	E39-L119	
			horizontal angle adjustment		E39-L132	E3G-R
			inclination angle adjustment	side and back wall mounting	E39-L131	
				surface mounting	- E39-L139 - E39-L140	E3G-L
				surface and back wall mounting (depending on sensor model)	- E39-L87 - E39-L102 - E39-L103	E3S-C
	Side protection			protective side wall mounting	E39-L118	E3T-S





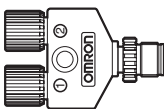
Shape	Type	Housing material	Features	Mounting type	Order reference	Applicable Sensors
	Full protection	Stainless steel (SUS 304)	inclination angle adjustment	protective side wall mounting	E39-L142	E3Z (pre-wired types)
					E39-L144	
			horizontal angle adjustment	protective surface mounting	E39-L98	- E3Z - E3S-C (horizontal)
					E39-L97	E3S-C (vertical)
	Telescope mounting	Stainless steel (SUS 304)	- 360° horizontal rotation - max telescope length	side and back wall mounting	- E39-L150 - E39-L151	- E3Z - E39-R3
			3D rotation around x, y, and z-axis	side wall, back wall and surface mounting	E39-L93	
			Extension pipe with XY joint	pipe mounting	E39-L93XY	E39-L93
			Reflector adapter for E39-L93	telescope mounting	E39-L96	- E39-R1 - E39-R1S

Slit, filters and other accessories

Shape	Type	Features	Mounting type	Order reference	Applicable Sensors
	Precision detection slit cover	- slit width from dia 0.5 mm for min object size detection of dia 0.2 mm	snap on	E39-S65	E3Z-T
				- E39-S63 - E39-S64	E3T-□T
				E39-S61	E3S-CT
	Mutual interference prevention	polarizing filter for close mounting of multiple sensors		E39-E11	E3Z-T□A
	Adjustment aid	adjustment aid for sensitivity adjustment		E39-E10	E3T-ST1
	Laser aid	beam adjustment aid with laser pointer	snap on	E3NT-AP1	E3NT
	IR data interface	- IR data interface for PC programming - via RS232 or USB		E3NT-AL232	

Cable connectors and wiring accessories

Shape	Product group	Type	Housing material	Features	Key specifications	Order reference	Applicable Sensors
	Cable connectors	General purpose M12 connector	- PVC cable - brass nut	available resistance levels: - standard cable - vibration proof robotic cable - fire retardant cable - screw nut	- 3 A rated current - AC or DC - 4 or 5 pin - IP67	XS2	- sensors with built in M12 4-pin connector (-M1) - sensors with M12 4-pin cable end connector (-M1J) - E3NT (5-pin cable connector)
			- PVC cable - ZnAl Cu, optionally V2A or V4A nut	- silicone-free - screw nut - optional LED (screw nut models) - halogene-free - silicone-free - oil resistant - screw nut	- 4 A rated current - AC or DC - 4 or 5 pin - IP67, IP68, IP69k	Y92E-M12	- sensors with built in M12 4-pin connector (-M1) - sensors with M12 4-pin cable end connector (-M1J) - E3NT (4-pin and 5-pin cable connector)
		Small size M8 4-pin connector	- PVC cable - brass nut	- screw nuts or snap-in - reduced outer diameter for space saving - standard or vibration proof cable	- 1 A rated current - 125 V DC - 4 pin - IP67	XS3	- sensors with built in M8 4-pin connector (-M3) - sensors with M8 4-pin cable end connector (-M3J)
		General purpose M8 connector	- PVC or PVC/PUR cable - brass nuts	- screw nuts or snap-in - optional LED (screw nut angled models)	- 4 A rated current - 60 V DC - 3 to 4 pin - IP67, IP68	Y92E-M08	- 4-pin or 3-pin connector (-M3 or -M5) - sensors with M8 4-pin or 3-pin cable end connector (-M3J or -M5J)

Shape	Product group	Type	Housing material	Features	Key specifications	Order reference	Applicable Sensors
	Extended wiring accessories	M12 I/O connector terminal boxes	- PBT case - brass connectors	- flat size - for M12 connectors - 4, 6 or 8 contacts per box	- 4 A / port - 10 or 30 V DC - 4 or 5-pin - IP67	XW3B	for all sensors connected via M12 4-pin connections & cables
		Waterproof cover for M12 I/O connector	brass	water proof cover for IP67 rating of X3WB		XS2Z-12	
		M8 I/O connector terminal boxes	- PA 6 case - brass connectors	- cable and connector box connection - for M8 connectors - 4, 6, 8, 10 or 12 contacts per box	- 2 A / port - 10 to 30 V DC - 3 or 4-pin - IP67	934 47	for all sensors connected via M12 3-pin or 4-pin connections & cables
		M12 T-joint and Y-joint plugs	- PVC cable - brass nut	- daisy chain model for 'AND' configurations (T-joint) - direct wiring models for 'OR' configurations (Y-joint) - bifurcate models for signal splitting - aggregate models for reduced wiring	- 3 A rated current - DC - 4-pin - IP67	XS2R	- sensors with built-in M12 4-pin connector (-M1) - sensors with M12 4-pin cable end connector (-M1J)
		M8 Y-joint plugs	- PBT case - brass connectors	- direct wiring models for 'OR' configurations - aggregate models for reduced wiring	- 1 A rated current - 125 V DC - 4-pin - IP67	XS3R	- sensors with built-in M8 4-pin connector (-M3) - sensors with M8 4-pin cable end connector

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.