Safety

Total solutions for industrial safety

Safety light curtains

Safety relay units

Safety network systems

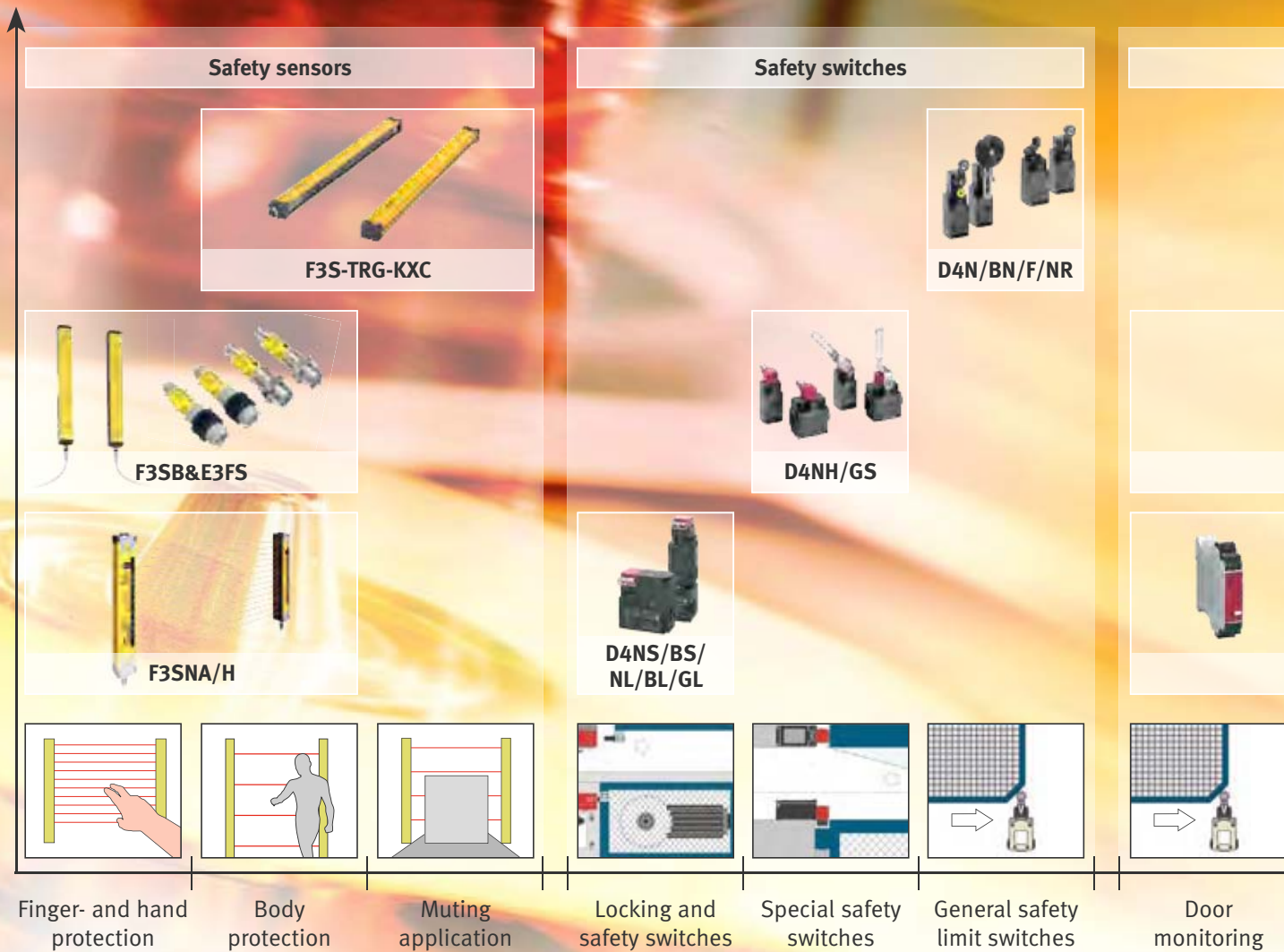Safety switches

Emergency stop buttons

General-purpose limit switches

Services for machine safety

OMRON

Safety sensors			Safety switches			

F3S-TRG-KXC

D4N/BN/F/NR

F3SB&E3FS

D4NH/GS

F3SNA/H

D4NS/BS/ NL/BL/GL

Finger- and hand protection	Body protection	Muting application	Locking and safety switches	Special safety switches	General safety limit switches	Door monitoring

CREATING A SAFE INDUSTRIAL WORLD

Nowadays, all responsible industries recognise the duty of care they owe their employees.

Taking all possible measures to avoid accidents in the workplace is not only a moral obligation, it also makes sound financial sense. Accidents are expensive – not only in lost working days, compensation for injury and higher insurance premiums, but also in other costs less easy to quantify like disrupted production, and the costs of accident investigations and of training new personnel to replace those injured in industrial accidents.

In every way, therefore, creating a safe industrial environment is a wise investment. And your choice of supplier of safety systems is an important one. Here's where Omron can help. A major supplier of industrial automation systems, Omron has many years' experience working closely with the world's leading machine manufacturers and with governing bodies that define today's international safety standards. That experience is embodied in one of the broadest ranges of safety products in the industry. All offering the highest levels of compatible with each other to provide you with total solutions for industrial safety that meet today's
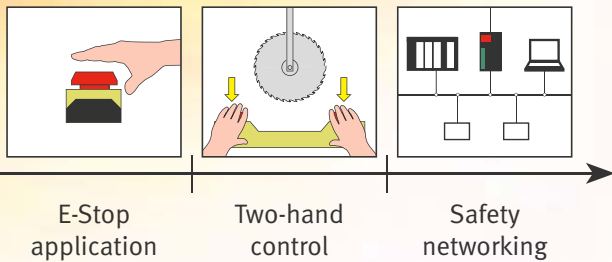
Safety networks and units

DeviceNet Safety controller/IO-terminals

G9SA/B/X

E-Stop application | Two-hand control | Safety networking

most demanding standards. Guaranteeing you not only maximum production efficiency and return on your investment in industrial plant, but also more contented, more motivated personnel, who are confident that their employer makes no compromises on their safety at work.

The following pages give an overview of our current solutions for industrial safety.

For more information on Omron's safety products and services, please call one of the contact numbers on the back of this brochure.

Safety Systems

General information

3

FROM FINGER TO FULL BODY PROTECTION (TYPE 4)

F3SN – Safety light curtain, F3SH – Multi-beam sensor

Omron's F3SN is a Type 4 sensor that provides finger, hand, limb and body protection in areas where access to dangerous machine parts is required while systems are still operating. The F3SH is a multi-beam safety sensor that can detect a person entering a dangerous zone and automatically shut off hazardous equipment within that zone. Both of these Type 4 safety sensors are invaluable in areas where operation, maintenance and repair work are necessary in an industrial environment. Their slim profile makes these sensors highly attractive prospects when installation space is limited. The field of operation is extensive: protection heights vary from 189 mm to 1822 mm, with a detection distance of up to 10 metres. In addition, the modular construction of these sensors ensures that there is a wide variety of optical resolutions to choose from.

Features F3SN

- Finger, hand, limb and body protection
- Operating range 0.2 to 10 m
- Protective height 189 to 1822 mm
- Minimum cross-sectional dimension 30 x 30 mm
- Non-dead zone (hand protection devices)
- Complies with EN 61496-1 Type 4
- Multi-functional: fixed or floating blanking of beams, autostart, EDM, interlock
- Can operate as master-slave System
- Accessories: setting console, Plug & Play controller, slim size controller, connection cable, series connection cable, protective covers, mirrors, muting controller

Features F3SH

- Beam distance 300 mm
- Protective height 900 mm
- Operating range 0.2 to 10 m
- Can be used in master-slave connection with F3SN

Type 4 safety sensor range

- F3SN safety light curtain
- F3SH multi-beam sensor
- F3SL safety light curtain 20 m sensing distance
- F3SS safety single-beam sensor (60 m)
- F3SP-U2P-TGR: muting controller
- F39-MDG: mirrors for perimetric guarding

4 resolutions,
162 standard products
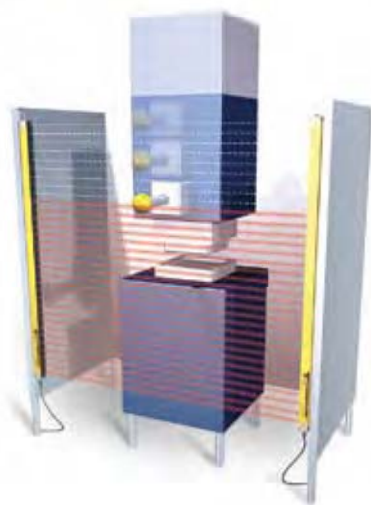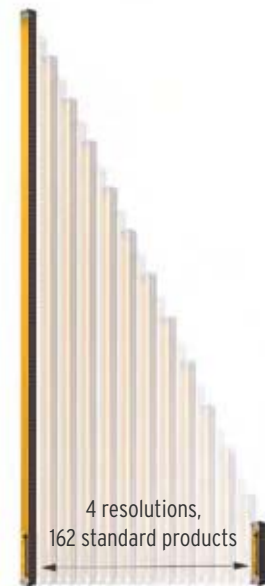
▲ Floating blanking: this function disables the detection for 1, 2, or 3 non-specific beams. This function is ideal where, for example, a work-piece often needs to pass through the safety detection zone.

▲ All optional functions can be configured via the unique setting console.

▲ Protects finger, hands, limb and body.

SAFETY SENSING FOR PALLETISING APPLICATIONS (TYPE 2 & TYPE 4)

F3S-TGR-SBX-KXC – Safety light curtains

▲ Made by TechnoGR

Omron's latest development in safety light curtains, the F3S-TGR-SBx-KxC series is the perfect choice for palletising applications. The series features both Type 2 and Type 4 safety products and is distinguished by the transmitter and receiver being integrated into a single unit, creating an active-passive system with a simple reflector forming the second unit of the light curtain.

This greatly simplifies installation and reduces costs. The series also embodies a fully integrated muting function that prevents automatic machine shutdown when palletised products pass through the light beams. This further simplifies installation by cutting the amount of wiring needed and eliminating the need for a separate muting control box.
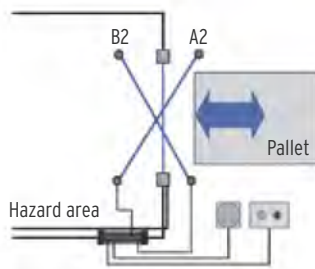
Features F3S-TGR-SBx-KxC

- Limb and body protection
- Complies with EN 61496 Type 2 and Type 4 safety standard
- Active-passive 2, 3 and 4 beam systems
- Fully-integrated muting function
- Detection distance up to 6 m
- Protective height 500, 800 and 900 mm
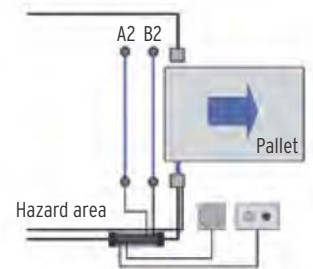- Beam pitch 500 mm (2 beam), 400 mm (3 beam), 300 mm (4 beam)

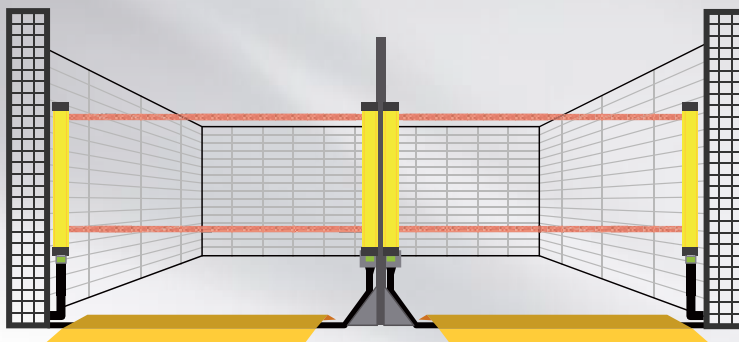▼ Parallel muting and two way direction.
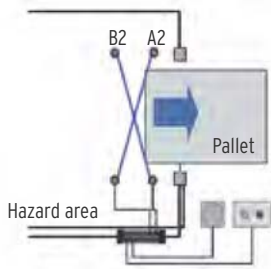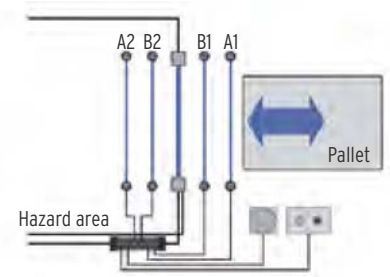
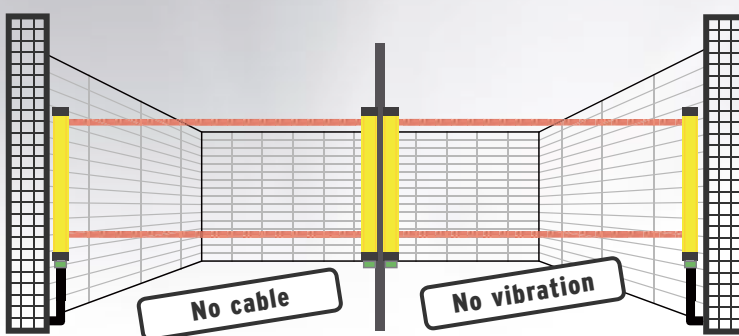▲ Cross muting and one way direction.

▲ Cross muting and two way direction.

▲ Parallel muting and one way direction.

◄ Through beam type.

◄ Active-passive type: No cabling to the post in the middle, no protection of cables necessary, no vibration.

SAFETY SENSORS FOR HAZARDOUS AREAS (TYPE 2)

F3S-B – Safety light curtain, E3FS – Single-beam sensor

The F3S-B safety light curtain is ideal for hand, limb and body protection. The single-beam E3FS sensor is designed to protect unauthorised entry into a hazardous area by using 2 to 4 single beams in combination with the F3SP-U1P-TGR controller. These Type 2 safety sensors meet all of the relevant safety requirements. They can be used to safeguard personnel in all applications corresponding to category 2 (EN954-1). When used in combination with the F3SP-U2P-TGR multi-functional muting controller, up to two F3S-B safety light curtains can be used in a muting application. The E3FS controller has an integrated muting function.

Features F3S-B

- Hand, limb and body protection

- Sensing distance 0.3 to 5 m

- Protective height 300 mm to 1650 mm

- Space saving; 30 x 40 mm cross-sectional dimension

- Complies with EN 61496-1 Type 2

- Can operate as master-slave system

- Multifunctional: blanking function integrated, autostart, EDM interlock

- Configuration software for easy parameter setting

- Accessories: connection cable, mirrors, optional function kit, muting controller

▼ Optional function kit for easy parameter setting with the setting software.

Features E3FS

- Area protection with 2, 3 or 4 beams

- Sensing distance 10 m

- Space saving M18 housing brass and plastic types are available

- Complies with EN 61496-1 Type 2 (with controller F3SP-U1P-TGR)

- Multifunctional controller for up to 4 sensors with integrated muting

- Accessories: cables, mirrors

9

▲ Safeguarding of bread handling machine.

◄ Multifunctional muting controller for safe control material handling.

EMERGENCY STOP AND MACHINE CONTROL
SYSTEM SAFEGUARDING

G9SX – Safety relay unit

The G9SX is an innovative and flexible safety unit for partial or complete safeguarding of a machine control system. Using microprocessor technology, the unit provides a transparent, logical connection throughout a machine to allow individual parts of the machine to be shut down. This allows a faulty process within a machine to be isolated without having to switch off the entire system, significantly reducing production losses and downtime.

The G9SX-BC is the basic unit that performs an emergency stop function to shut down the entire machine. The G9SX-AD and G9SX-ADA are advanced units that can be connected to the basic unit to shut down individual sections in a machine without affecting the total process. The G9SX-EX is an expansion unit with four relay outputs. Up to five expansion units can be connected together to one advanced unit to provide up to 25 outputs.

Features G9SX-BC basic unit

- 1 two-channel safety input
- E-Stop applications
- 2 solid state safety outputs (instantaneous)
- 2 logical "AND" outputs
- 2 auxiliary outputs
- 6 LED indicators
- 22.5 mm wide housing

Features G9SX-EX expansion unit

- 4 safety relay outputs (instantaneous) or 4 safety relay outputs (OFF-delayed, OFF-delay is controlled by connected advanced unit)
- Combination of up to 5 expansion units is possible to give 25 safety outputs in total
- 1 auxiliary output
- 3 LED indicators
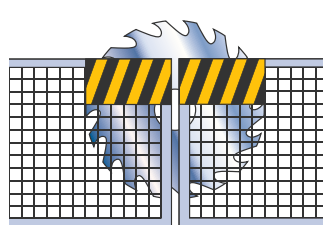- 22.5 mm wide housing

Safety Relay family

- G9SA
- G9SB

Features G9SX-AD and G9SX-ADA advanced units

- 1 two-channel safety input
- Up to 3 solid state safety outputs (instantaneous) and 2 solid state safety outputs (OFF-delayed up to 15 sec or 150 sec)
- 1 logical "AND" input for G9SX-AD
- 2 logical "AND" inputs for G9SX-ADA
- 1 logical "AND" output for G9SX-AD
- 2 logical "AND" outputs for G9SX-ADA
- 2 auxiliary outputs
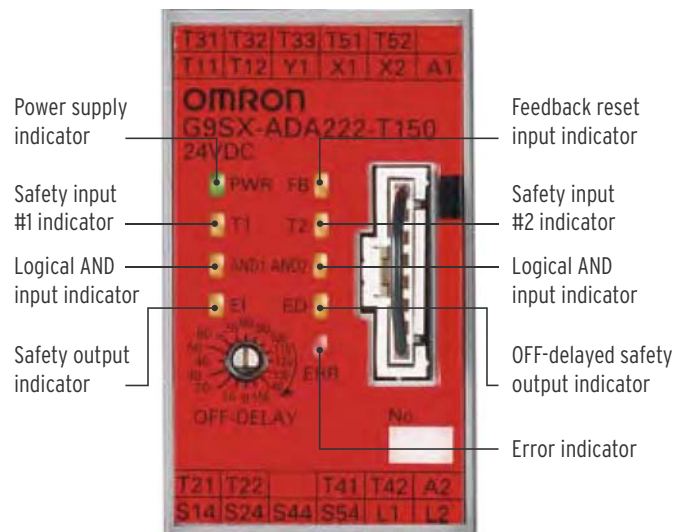- 8 LED indicators
- 35 mm wide housing
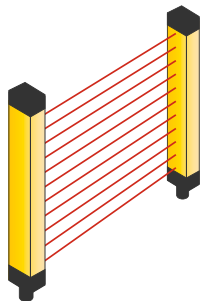
▲ Controller for safety light curtains Type 2 and 4.

▲ Monitor safeguarding of a safety door.

▶ G9SX LEDs.

Power supply indicator

Feedback reset input indicator

Safety input #1 indicator

Safety input #2 indicator

Logical AND input indicator

Logical AND input indicator

Safety output indicator

OFF-delayed safety output indicator

Error indicator

OMRON
G9SX-ADA222-T150
24VDC

SAFETY NETWORKING

DeviceNet Safety

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

Omron's DeviceNet Safety Network Controller (SNC) with built-in DeviceNet Safety interface features programmable safety control circuits that allow easier modifications and additions to safety circuits whenever equipment design changes are required. The SNC's networking capabilities also provide added flexibility for system expansion with minimal increase in inter-circuit wiring.

Omron's DeviceNet Safety terminals have been designed to provide the highest flexibility for all industrial installations. They offer mixed-mode operation in which all inputs and outputs can be flexibly assigned to the safety or standard part of the control system. They also fully support smart-slave functions such as operation counters and monitoring of ON-time or operation time.

Unique features of all Omron DeviceNet Safety products include test pulse outputs to ensure crosstalk and short-circuit detection and bulb-current monitoring remotely via a dedicated test output on the safety terminals.

## Features DeviceNet Safety network controller

- Hosts the safety application program

- Predefined and certified function blocks

- Monitors the safety inputs

- Controls the safety outputs

- Advanced diagnostics

- Provides easy troubleshooting and predictive maintenance via DeviceNet

- Detachable cage clamp terminals

- Certified for applications up to safety category 4 (EN 954-1) and SIL 3 (IEC 61508)

Features DeviceNet Safety terminals

- Safe solid state and safety relay outputs available

- Detachable cage clamp terminals

- I/O-Modules support standard and safety mode on one module

- Certified for applications up to safety category 4 (EN 954-1) and SIL 3 (IEC 61508)

Features DeviceNet Safety network system

- Based on open communication standard

- Fast and easy installation

- Future-ready for easy additions as needs change

- Designed for easy network additions to save your investment

- Predictive maintenance and self diagnosis

- Smart, seamless and flexible
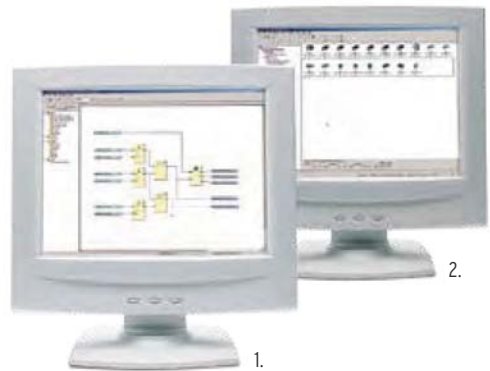
▲ 1. Predefined and certified function blocks for transparent setup of the machine safety function.

2. Windows based user interface to program the safety application.
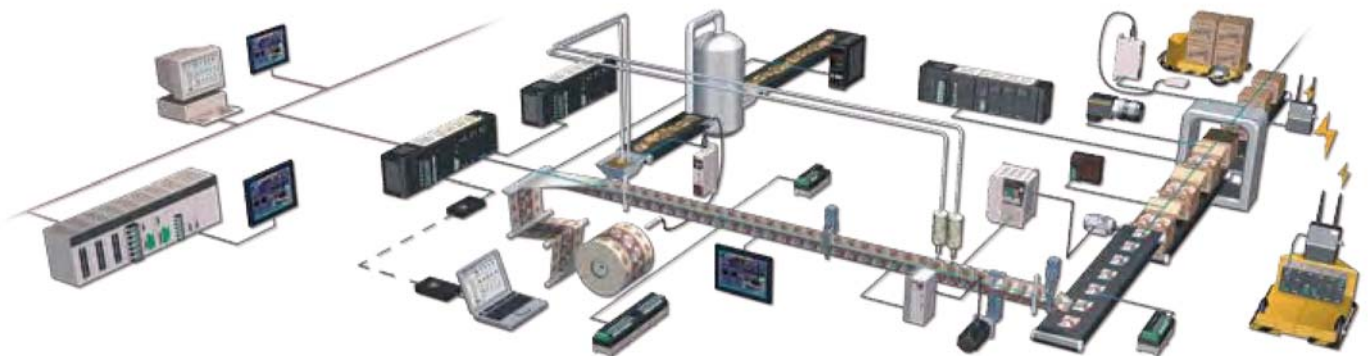
SAFETY DOOR MONITORING AND INTERLOCKING

D4BL, D4BS, D4NS, D4GL & D4NL – Interlocking and safety switches

The D4BL, D4GL and D4NL guard-locking safety switches ensure that movable guards are locked during operation and cannot be opened until dangerous conditions have been removed. These switches are intended for use, for example, where the stopping time of a dangerous movement is longer than the time that a person needs to reach the hazardous area (machines with large amounts of inertia for instance), and for ovens, which may present a danger of burning to personnel.

The D4BS and D4NS safety door interlocking switches are intended for machines with fast shut-down time. They prevent the machine from starting until the guard is closed and automatically stop the machine if the guard is opened during operation, protecting the operator against possible danger.

All these switches comply with EN 1088.

- D4BL – robust aluminium die-cast housing complying with IP 67

- D4NL – shockproof plastic housing, IP67, square shape, 1300 N locking force

- D4GL – shockproof plastic housing, IP67, slim shape, 1000 N locking force

- Approvals UL/CSA, TÜV, BIA, SUVA

- Positive opening contacts for safety applications

- Flexible contact configuration:
  D4BL: 2 switching and 1 feedback
  D4NL: up to 3 switching contacts and 2 feedback contacts
  D4GL: up to 3 switching contacts and 2 feedback contacts

- Operating indicator

- Special release keys are available for D4GL and D4NL

- Rotatable operating head provides flexibility in mounting

- All standard conduits are available (M20, PG13,5)

- Coil voltages of the solenoid: 24 V DC, 110 V AC, 230 V AC

- G9SX flexible safety relay unit

- DeviceNet Safety Bus system

- G9SA safety relay unit

- G9SB slim size unit

- D4GS slim size key switch

- D4N, D4BN, D4NR and D4NH safety switches

- D4F slim size safety switch

Hazard area
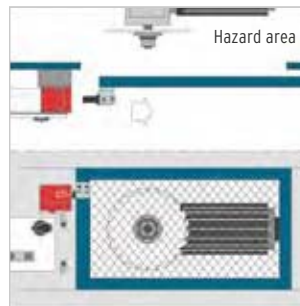
◄ Interlocking of sliding safety doors.

15

Hazard area
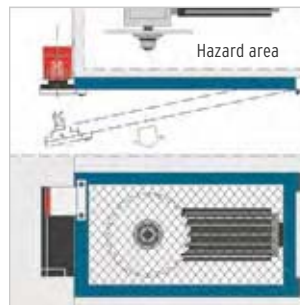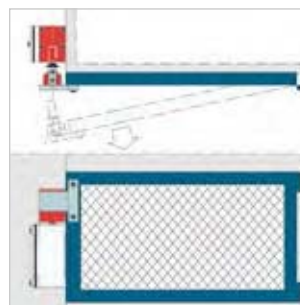
◄ Interlocking of a rotating safety door.

- D4BS – robust aluminium die-cast housing complying with IP 67

- D4NS – shockproof plastic housing complying with IP 65

- Approvals UL, TÜV, BIA

- Positive opening slow-action contacts

- 2 contacts: 2 NC or 1 NC /1 NO

- Rotatable operating head provides flexibility in mounting

- Wide operating temperature range
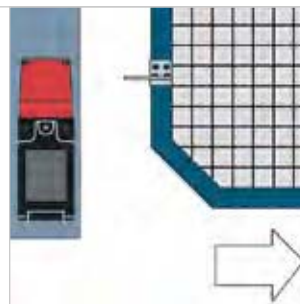
◄ Safeguarding using a D4NS or D4BS.

◄ Safeguarding a rotating door without interlocking.

POSITION GUARDING WITH SPECIAL SOLUTIONS

D4NH & D4GS – Hinge safety switches

The D4NH hinge safety switch and the D4GS miniature safety key switch are designed for use with safety doors that form the entrance to protected areas in production systems and machines. The heads of both switches can be mounted in different positions for installation flexibility.

The D4GS has a special third contact that enables it to be used as a cross-fault safety switch for category 4 applications. Its very compact dimensions make the D4GS ideal for use where space is limited, and its IP67 rating makes it suitable for operating in extreme environmental conditions.

Features D4GS

- Miniature safety key switch for safety doors in machinery with limited space and with higher IP rating

- Only 17 mm wide

- IP 67 approved; both switch and pre-assembled cable are highly water-resistant (3 m and 5 m cable available on request)

- Approvals UL/CSA, TÜV, BIA

- Direct open slow-action contacts
  2 or 3 contacts
  2 NC or 1 NC/1 NO
  3 NC or 2NC/1 NO

- Actuator with rubber damper to absorb shocks and vibrations

Dedicated safety products

- D4NS, D4BS safety key switch

- D4NL, BL, GL safety guard lock switches

- D4F: miniature safety limit switch

- D4NR: manual reset switch

- D4N, D4BN: general-purpose limit switch

- G9SA safety relay unit

- G9SB slim size unit

- G9SX Flexible safety relay unit

- DeviceNet Safety Bus system

Features D4NH

- Hinge switch to safeguard hinged door

- Corresponds to EN 60947-5-1, EN 50041 and GS-ET-15

- Direct open slow-action contact

- 2 NC or 1 NC/1 NO

- Rotatable operating head provides mounting flexibility

- 1 or 2 conduits (PG13, 5, M20)

- Operating temperature range -30° to 70° C

- Plastic housing, shockproof, IP 65

▼ D4NH attachment to the door.

Hazard area
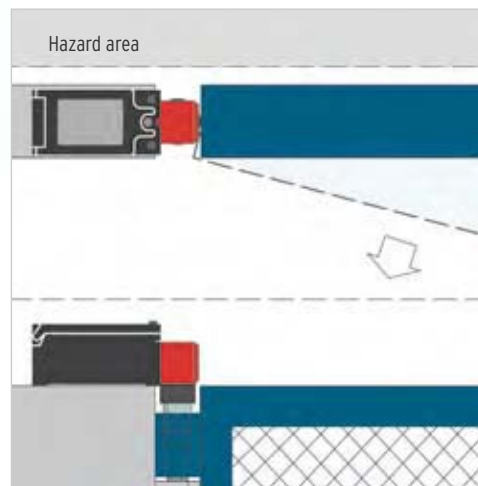
▼ D4NH attachment in the swivel axis.

Hazard area
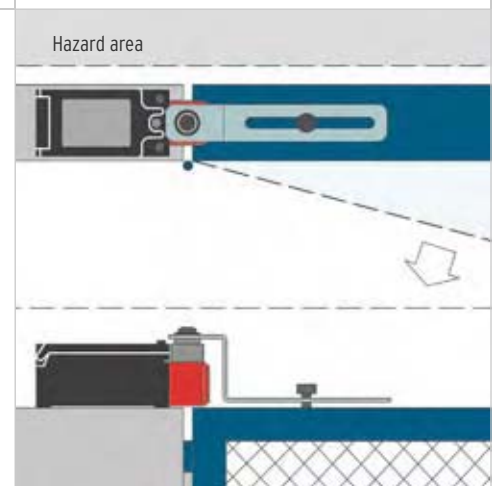
POSITION GUARDING AND SECURE SIGNALLING

D4BN, D4N, D4NR & D4F – General safety limit switches

Omron's D4BN, D4N and D4NR are general-purpose limit switches with a range of actuators for object over-travel and guard detection. Typical application areas for these switches include elevators, escalators and conveyors. Enclosed in a metal housing, the miniaturised D4F features up to 4 contacts and occupies a minimum of space. The switches are equipped with direct opening contacts as defined in EN 60947-5-1 'low voltage switch-gear', and the D4NR is equipped with a manual reset, which is ideal for situations where a visual check of the problem is required prior to resetting the switch.
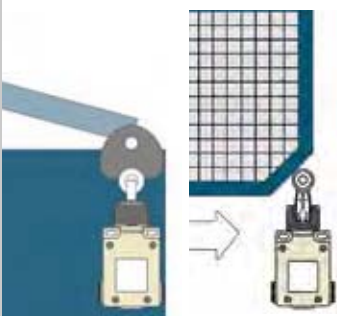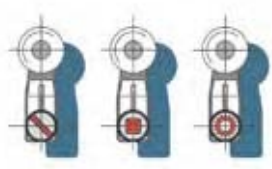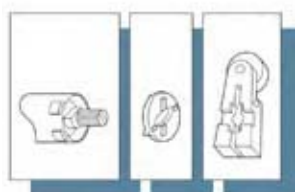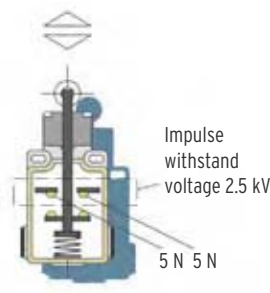
- D4BN, D4F: metal housing IP 67

- D4N, D4NR: plastic housing IP 65 (D4NR with reset)

- Approvals UL/CSA, TÜV, BIA

- Direct opening slow-action and snap-action contacts

- 2NC or 1NC/1NO contacts in D4N, D4NR
  (BN 4NC or 2NC/2NO contacts in D4F)

- Head can be mounted in different positions

- 1, 2 or 3 cable conduits (pre-assembled cable in D4F)

- Modular system comprising switch element
  and actuator head

- Actuator shapes:
  Roller lever (shape A)
  Rounded plunger (shape B)
  Roller plunger (shape C) [D4N, BN, NR]
  Roller lever arm, adjustable (shape D) [D4N, BN, NR],
  no safety function
  Roller lever, adjustable [D4N, BN, NR], no safety function
  One-way roller lever (D4N & D4NR)
  Wobble stick (D4B-N), no safety function

- D4NS, D4BS safety key switch

- D4NL, BL, GL safety guard
  lock switches

- D4GS: miniature key switch

- D4NH: safety hinge switch

- G9SA safety relay unit

- G9SB slim size unit

- G9SX flexible safety relay unit

- DeviceNet Safety Bus system

19

▼ Direct opening actuation.	▼ Form-fitting actuator options.	▼ Form-fitting of the Omron actuators, e.g. the D4B.	▼ Details of positive break mechanism.

Stifting Square Toothed

Axis of rotation   Plastic disk   Actuator

Impulse withstand voltage 2.5 kV

5 N 5 N

MEETING SAFETY REQUIREMENTS

Safety – Total solutions for industrial safety

The EU machinery directive 98/37/EC underpins machine safety of machinery within The European Union. Since 1995 these documents have had a major impact on safety for workers and work equipment. The directive refers to more than 400 harmonised EN standards. To meet these requirements, familiarity and know-how is required to ensure that safety is combined with good ergonomic and economic principles. Therefore efficient and innovative safety sensors and components are invaluable.

Omron works closely with many leading machinery manufacturers and end users to develop practical solutions for industrial safety. These solutions include products for emergency-stop applications, safety guard door monitoring and interlocking as well as safety sensors for finger, hand, limb and body protection. Our aim is to make the workplace a safer environment using cost-effective and ergonomically designed products.

Resolution
Minimum size of an object that can still be detected by electrically-sensitive protective device.

AOPD
Active Opto-electronic Protective Device = electrically sensitive protective device in the form of a through-beam.

Blanking
Suppression of light beams for a light curtain or sensor.

Electrically-sensitive protective device
A collection of parts and/or components that work together to ensure access protection or presence detection and containing at least the following components: a sensor component, control/monitoring components, output switch elements. For example, these can be opto-electronic protective equipment such as light sensors or a curtain.

Hazard area
The area within and/or around the machine in which the safety or health of individuals is endangered.

Muting
The temporary, automatic and safe bypassing of an electrically-sensitive protective device while material transport takes place within a hazard area.

Emergency stop device
The emergency stop must take priority over all other functions and actuations and may not present any kind of danger. No restart may occur after resetting of the emergency stop. Design principles for emergency stop devices are specified in EN 418.

Position switches with safety function
Position switches with positive opening contacts.

Cross-fault protection
If different voltages are applied to both channels of a two-channel control unit, a short circuit, also called a cross fault, can occur upon connection of the two channels, for instance through cutting of the cable.

Redundancy
Applications with more than one device or system to ensure that another is available to perform this function if the first device or system fails.

Risk evaluation
Determination of hazards, hazardous situations and events that could cause damage in a machine as well as the probability of their occurrence.

Protective equipment
A safety measure applied to protect individuals from immediate or threatening danger.

Safety category
A categorisation of the safety-related parts of a control unit with respect to their resistance to faults and their behaviour in the event of a fault that results from the structural arrangement of the components and/or their reliability.

Separating protective equipment
Part of a machine that is used specifically as a guard or physical barrier for protection purposes. Depending on the design, this may be a housing, shield, door, panelling, flap or hood.

Locking device with 'interlocking'
Separating protective equipment with a lock such that
• The dangerous machine function cannot be executed while the protective equipment is not closed, locked and held closed.
• The separating protective equipment will remain closed, locked and held closed until the risk of injury has passed.

Locking device without 'interlocking'
Separating protective equipment in combination with a guarding device such that
• The dangerous machine function cannot be executed while the protective equipment is not closed.
• A halt command is given if the protective equipment is opened during dangerous machine functions.

Access time
The time required for access to dangerous machine parts after triggering of the halt command by the locking mechanisms; calculation based on a speed approximation, the value for which can be selected for individual cases, taking into consideration the parameters in EN 999.
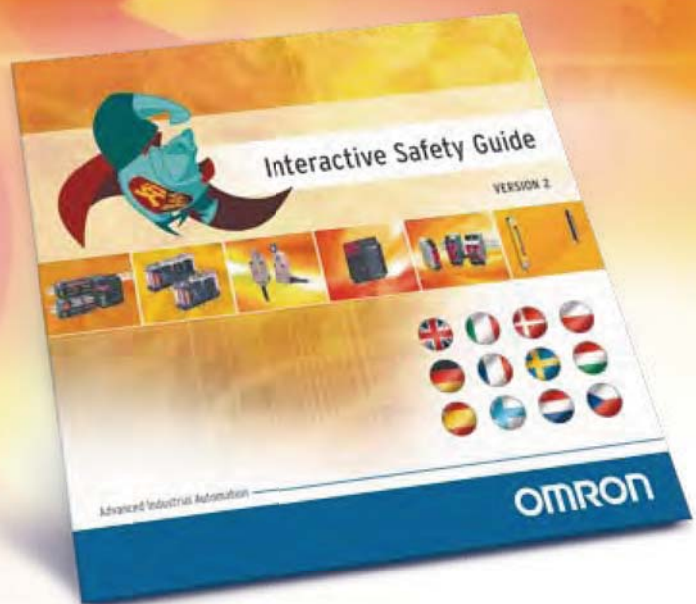
Linked contact
NC and NO contacts mechanically linked together in a device so that they can never be closed at the same time.

Positive opening
The forced contact separation as a direct result of a specified movement of the operating part of the switch over non-springing parts.

Machine Safety clear and transparent

Unveiling the safety-chain by...

End-users and engineers must increase production performance with every new generation of machinery. State-of-the-art machinery therefore defines one unchangeable requirement to the engineers: Make my machine never stop, keep it run without problems. Machine builders and their engineers set up powerful control systems to fulfill this requirement by applying state-of-the-art systems and motion control.

Looking at machine safety, the situation is not always the same. In daily work engineers sometimes struggle with applications and sometimes with the relevant international standards and regulations. Modern safety equipment already covers the demand for efficiently

working machines. Workers are protected without disturbance of the production process. Everybody is aware that machine safety is really important – but compared to standard machine control systems, the safety part is sometimes not so easy to understand. To comply with the demands for CE marking, engineers start.

...browsing all possible sources for information

Finding, reading comparing and understanding all the information provided from different sources in printed and electronic form takes a lot of engineer's time and finally absorb a lot of resources. OMRON now presents the latest version of the safety guide that is featuring the manga-style character "AN SEN MAN".

...AN SEN MAN – strong, competent and transparent

Who and what is AN SEN MAN? "AN SEN" is Japanese and the expression for safety. The Kanji-characters on AN SEN MAN's shirt highlight his strong expertise in machine safety. AN SEN MAN is your safety consultant, the mascot for Omron expertise in machine safety and guides you through the contents of the new Omron safety guide.

AN SEN MAN speaks your language. You do not need to worry, all information in the guide is available in up to 12 European main languages – and all information is provided in a way to "draw the curtain" that sometimes hide safety transparency. The guide conveys expertise from specialist to users considering the demands of their daily work.

AN SEN MAN provides safety related information for end-users or operators of machines efficiently. Engineers, having questions when they have to

safeguard a new machine design or refurbish a used machine will also find the right answers easily. Basic information about safety of machinery for interested people is also included, e.g. background of European regulation like machine directive.

AN SEN MAN also has expertise in international standards like OSHA standards from the US. Omron's global activities in machine safety ensure knowledge about the relevant international standards to support machine builders when exporting machines to any region in the world.

Find the Omron European partner network to support your application. Our partners are also specialists in all kinds of safety questions like risk estimation or calculation of safety distances.
Make yourself more familiar with machine safety, order your free version of the new Omron safety guide and finally help AN SEN MAN to find a safe route in Factory Frenzy.

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