

System Manual Non-contact safety system EC-S2/EC-S4 (Unicode)



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Correct Use

The Coded Electronic Safety switches series EC-S Series are safety devices for monitoring movable safety guards.

In combination with a separating safety guard, this safety component prevents dangerous machine movements from being performed for as long as the safety guard is open. A stop command is triggered if the safety guard is opened during the dangerous machine function.

Before safety switches are used, a risk assessment must be performed on the machine in accordance with:

- EN ISO 13489-1, Safety of machinery. Safety related parts of control systems. General principles for design
- EN ISO 14121-1, Safety of machinery. Risk assessment. Principles
- IEC 62061, Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems.

Correct use includes compliance with the relevant requirements for installation and operation, in particular

- EN ISO 13489-1, Safety of machinery. Safety related parts of control systems. General principles for design
- EN 1088, Safety of machinery. Interlocking devices associated with guards. Principles for design and selection
- EN 60204-1, Safety of machinery. Electrical equipment of machines. General requirements
- EN 60947-5-3 Specification for low-voltage switchgear and controlgear. Control circuit devices and switching elements. Requirements for proximity devices with defined behaviour under fault conditions (PDF)

The following EC-S series switches can be connected to the Control unit EC-S2 and EC-S4 control units:

- EC-S1PC Series and the EC-S1PCC switch

For further information, refer to the operating instructions of the corresponding component.

Important!

- The devices permit a safety-related stop function, initiated by a safety guard according to Table 8 - DIN EN ISO 13849-1:2008-12.
- The safety-related function of the PDF is the opening of at least one of the output contacts (13/14, 23/24) when the actuator is absent.
- The user is responsible for safe integration of the device in a safe overall system. For this purpose the overall system must be validated, e.g. in accordance with EN ISO 13849-2.
- The permissible operating parameters must be observed for correct use (see Technical data).
- If a product data sheet is included with the product, the information on the data sheet applies in case of discrepancies with the operating instructions.
- Only components may be used that are permissible in accordance with the table below.

Exclusion of Liability and Warranty

In case of failure to comply with the conditions for correct use stated above, or if the safety instructions are not followed, or if any servicing is not performed as required, liability will be excluded and the warranty void.

General Safety Instructions

Safety switches fulfill personal protection functions. Incorrect installation or tampering can lead to severe injuries to personnel.

The number of teaching and switching operations is saved in the internal memory in the Control unit. If necessary, this memory can be read by the manufacturer.

Check the safe function of the safety guard particularly

- after any setup work
- after the replacement of a EC-S series component
- after an extended period without use
- after every fault

Independent of these checks, the safe function of the safety guard should be checked at suitable intervals as part of the maintenance schedule.

Warning!

Danger of fatal injury in the event of incorrect connection or incorrect use.

- Safety switches must not be bypassed (bridging of contacts), turned away, removed or otherwise rendered ineffective.

On this topic pay attention in particular to the measures for reducing the possibility of bypassing from EN 1088:1995+A2:2008, section 5.7.

The device is only allowed to be installed and placed in operation by authorized personnel

- who are familiar with the correct handling of safety components
- who are familiar with the applicable EMC regulations
- who are familiar with the applicable regulations on health and safety
- who have read and understood the operating instructions and the system manual

Important!

Prior to use, read the operating instructions and the system manual of the EC-S series components used, and keep these in a safe place. Ensure the operating instructions and the system manual are always available during mounting, setup and servicing. If you should lose the operating instructions or the system manual, you can download these documents from www.sti.com.

Function

The safety system EC-S Series complies with the following safety requirements:

- Category 4, PLe according to EN ISO 13849-1
- Proximity device with self-monitoring type PDF-M according to EN 60947-5-3.
- Redundant design of the circuit in the Control unit with self-monitoring. As a result, the safety system is still effective even if a component fails.
- When the safety guard is opened and closed, it is checked whether the safety system re-lays open and close correctly.

The EC-S series non-contact safety system consists of three components:

- Coded actuator
- Read head
- Control unit

Up to 2 read heads can be connected to the EC-S2 Control unit and up to 4 read heads can be connected to the EC-S4 Control unit.

It is also possible to connect a start button (monitoring of the falling edge) and a feedback loop for monitoring external relays and contactors.

The individual configuration is defined by a setup procedure.

Each delivered actuator possesses a unique electronic coding and so is a unique element in the system used. The code in an actuator cannot be reprogrammed.

The read heads are fastened to the fixed part of the safety guard and are each connected to the Control unit via a two-core screened cable.

The actuator fastened to the movable part of the safety guard is moved towards the read head by closing the door. When the switch-on distance is reached, power is supplied to the actuator by the read head by induction and data can be transferred.

The bit pattern read is compared with the code saved in the Control unit. If the data match, the door monitoring output O1...O2 or O1...O4 (semiconductor output) on the related read head is set HIGH. If all data for all read heads activated match, the safety outputs (relay outputs) are then enabled. The OUT LED illuminates.

Optionally, a feedback loop can be connected to the Control unit. Then the Control unit can only be started with the feedback loop closed. A welded contactor contact in the release path will thus be detected when a start request is made.

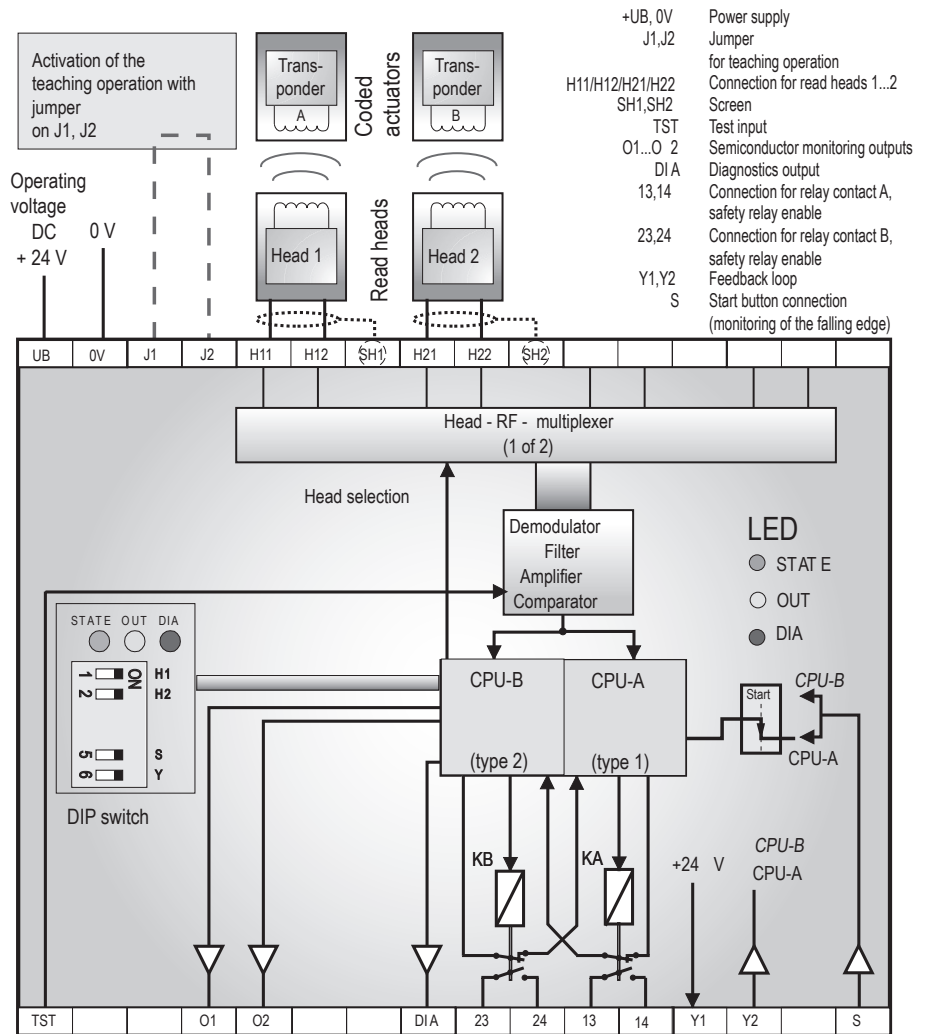
Due to the combination of dynamic polling of the actuators and the redundant, diverse design of the safety electronics with two safety outputs, the Control unit will enter the safe state with every detectable fault.

When a safety guard is opened, the safety outputs switch off the safety circuit and the OUT LED goes out. The state of the safety outputs is monitored internally by positively driven NC contacts (relay output).

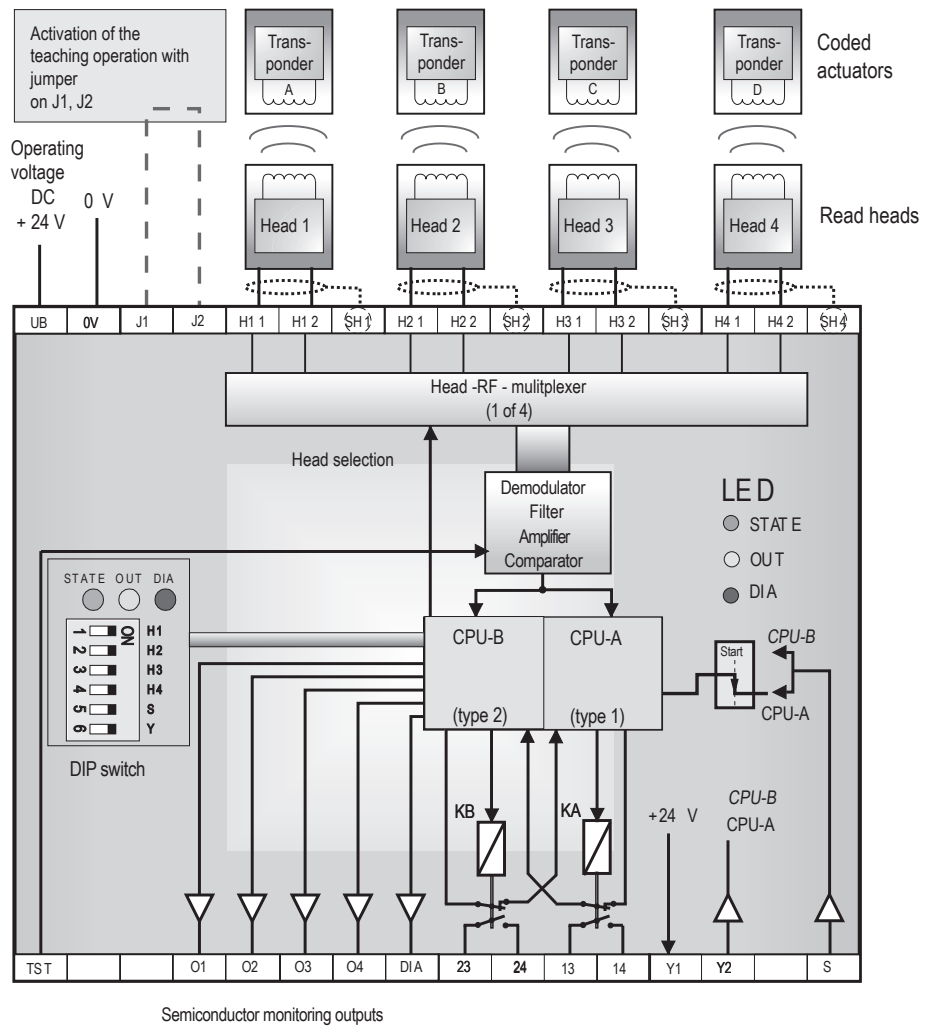
Independent of the switching state of the safety circuit, the position of all safety doors can be polled via the outputs O1...O2 or O1...O4.

If an internal fault occurs in the Control unit, the safety circuit is switched off, the diagnostic output (DIA) is set HIGH and the DIA LED illuminates red.

Block diagram EC-S2



Block diagram EC-S4



- +UB, 0V Power supply
- J1, J2 Jumper for teaching operation
- H11/H12..H41/H42 Connection for read heads 1..4
- SH1,SH2,SH3,SH4 Screen
- TST Testinput
- O1..O4 Semiconductor monitoring outputs
- DIA Diagnostics output
- 13,14 Connection for relay contact A, safety relay enable
- 23,24 Connection for relay contact B, safety relay enable
- Y1, Y2 Feedback loop
- S Start button connection (monitoring of the falling edge)

Installation

Caution!

Safety switches must not be bypassed (bridging of contacts), turned away, removed or otherwise rendered ineffective.

- On this topic pay attention in particular to the measures for reducing the possibility of bypassing according to EN 1088:1995.A2:2008, sec. 5.7.
- The Control unit must be mounted in a control cabinet with a minimum degree of protection of IP 54. A snap-in element on the rear of the device is used for fastening to standard rails.
- If several evaluation units are mounted side by side in a control cabinet without air circulation (e.g. fan), a minimum distance of 10 mm must be maintained between the evaluation units. The distance enables heat from the Control unit to dissipate.

Caution!

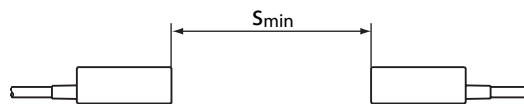
Risk of damage to equipment as a result of incorrect installation. Read heads or actuators must not be used as a mechanical end stop.

- Fit an additional end stop for the movable part of the safety guard.

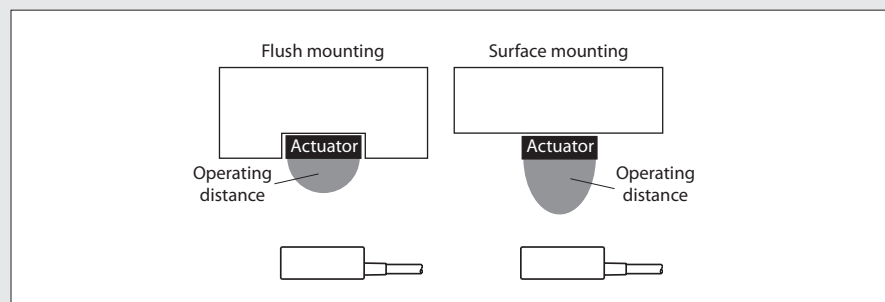
Important!

- From the assured switch-off distance S_{ar} the safety outputs are safely shut down.
- When mounting several read heads, observe the stipulated minimum distance to avoid mutual interference.

- For EC-S1PCC $s_{min} = 50 \text{ mm}$



- If the actuator is installed flush, the switching distance changes as a function of the installation depth and the safety guard material.



Note the following points:

- Actuator and read head must be easily accessible for inspection and replacement.
- The switching operation must only be triggered by the specific actuator designated for this purpose.
- Actuator and read head must be fitted so that
 - the front faces are at the minimum switch-on distance $0.8 \times S_{ao}$ or closer (see section Operating distances). To avoid entering the area of possible side lobes, a minimum distance is to be maintained in case of a side approach direction. See section Typical operating distance for the related actuator.
 - when the safety guard is open up to the distance S_{ar} (assured switch-off distance), a hazard is excluded.
 - the actuator is positively mounted on the safety guard, e.g. by using the safety screws included.
 - they cannot be removed or tampered with using simple means.
- Pay attention to the maximum tightening torque for the read head or safety switch and actuator mountings of 1 Nm. For read heads/actuators made of PE-HD, the maximum tightening torque is only 0.5 Nm.

Electrical Connection

Warning!

- In case of an error, loss of the safety function through incorrect connection is possible.
- To ensure safety, both safety outputs (13/14 and 23/24) must always be evaluated.
 - The monitoring output OUT must not be used as a safety output.
 - Lay the connection cables with protection to prevent the risk of short circuits.

Caution!

Risk of damage to equipment or malfunctions as a result of incorrect connection.

- All the electrical connections must either be isolated from the mains supply by a safety transformer according IEC 61558-2-6 with limited output voltage in the event of a fault, or by other equivalent isolation measures.
- For use and operation as per the UL requirements, a power supply with the feature "for use in class 2 circuits" must be used. The same requirement applies to the safety outputs.
Alternative solutions must comply with the following requirements:
 - a) Electrically isolated power supply unit with a max. open-circuit voltage of 30 V/DC and a limited current of max. 8 A.
 - b) Electrically isolated power supply unit in combination with fuse as per UL248. This fuse should be designed for max. 3.3 A and should be integrated into the 30 V/DC voltage section.
- All electrical outputs must have an adequate protective circuit for inductive loads. The outputs must be protected with a free-wheeling diode for this purpose.
- Use cable material made of copper with a temperature resistance of at least 75 °C.
- The tightening torque for the screws on the connection terminals must be 0.6 ... 0.8 Nm.
- The connection cable for the read heads must only be extended using OMRON STI plug connectors and adequate consideration must be given to EMC. Intermediate terminals must not be used.
- The screen on the connection cable for the read head must be connected to the appropriate terminal SH1 ... 4 on the Control unit. The portion of cable from which insulation is stripped should be kept as short as possible (max. 3 cm).

Important!

If the device does not appear to function when operating voltage is applied (e.g. green STATE LED does not illuminate or flash), the safety switch must be returned unopened to the manufacturer.

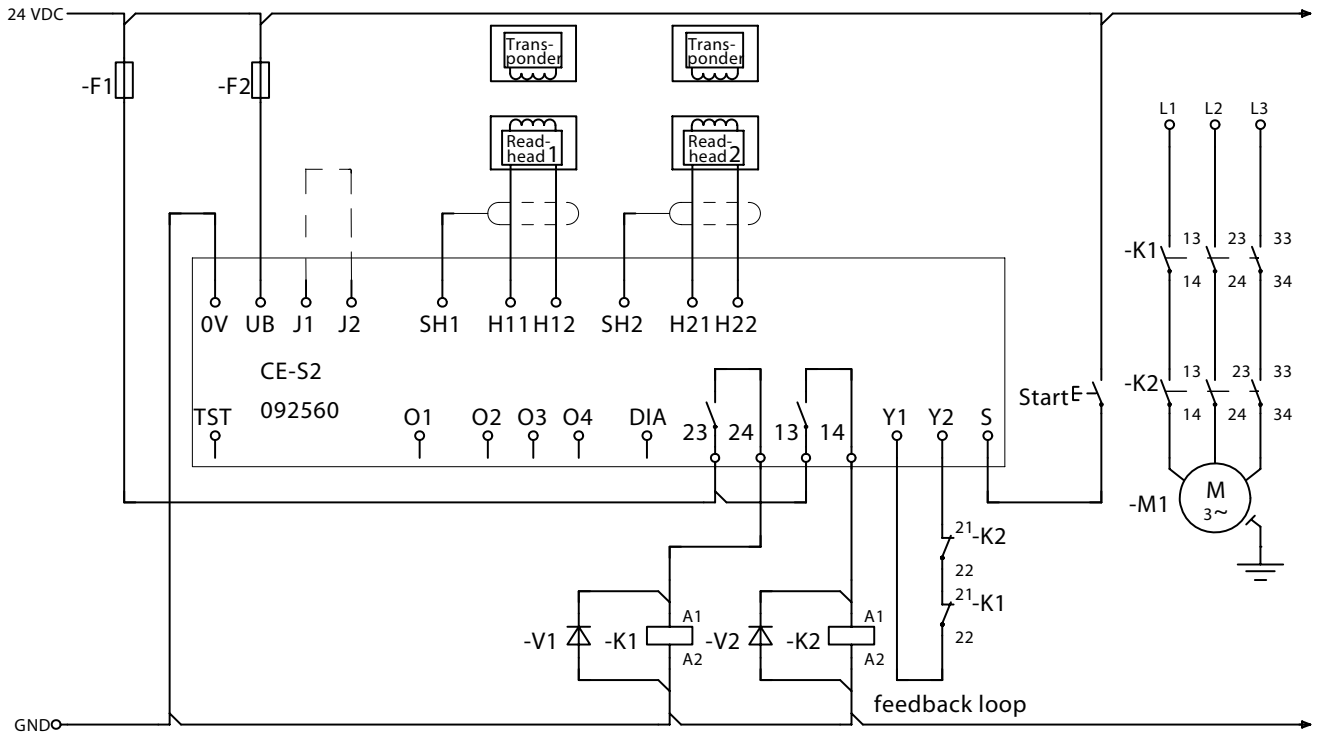
Safety in case of faults

- The operating voltage U_B is reverse polarity protected.
- The connections for the read heads are not short circuit-proof.
- A short circuit between 13/14 and 23/24 can be detected only by means of external pulsing.
- A short circuit in the cable can be excluded by laying the cable with protection.

Fusing of the power supply and the safety contacts

- Provide external contact fuses (6 A gG fuse or 6 A circuit breaker, characteristic B or C) for relay outputs.
- The power supply must be protected with a max. 8 A fuse before terminal U_B .

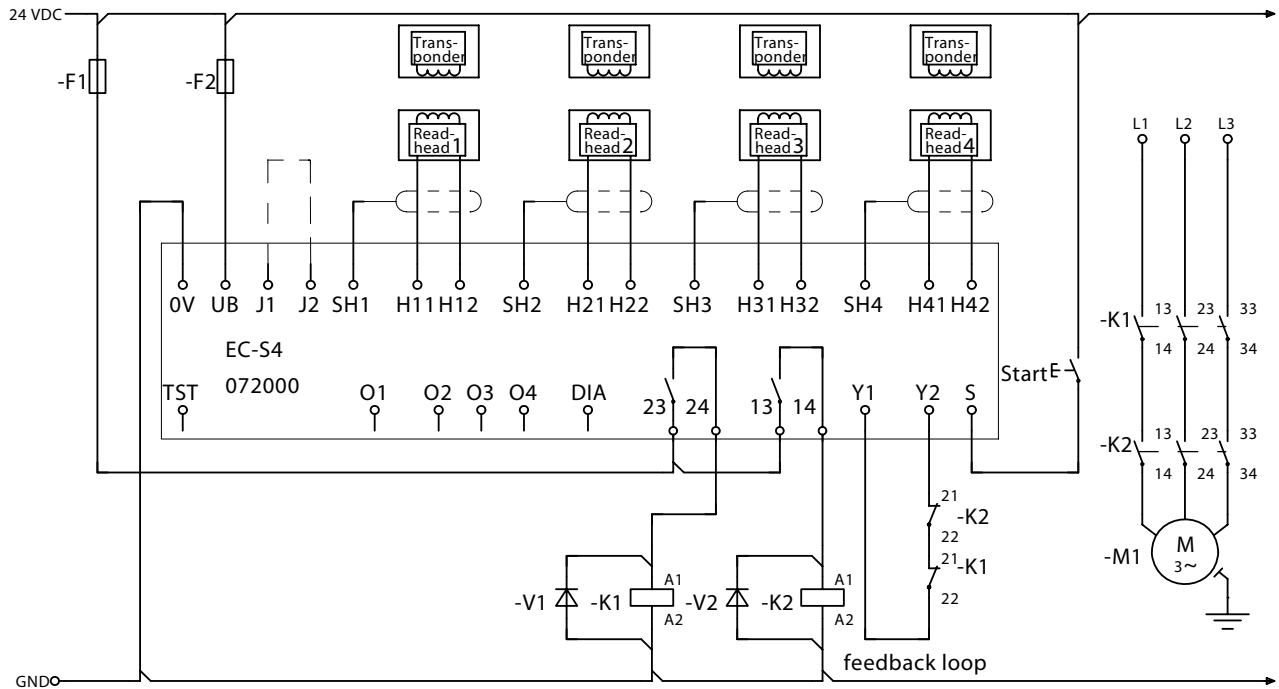
Connection example EC-S2



Important!

To achieve category 4 according to EN ISO 13849-1, it is necessary to monitor the downstream contactors (here contacts of K1 and K2 in the feedback loop). This example shows only an excerpt that is relevant for connection of the EC-S2 system. The example illustrated here does not show complete system planning. The user is responsible for safe integration in the overall system.

Connection example EC-S4



Important!

To achieve category 4 according to EN ISO 13849-1, it is necessary to monitor the downstream contactors (here contacts of K1 and K2 in the feedback loop). This example shows only an excerpt that is relevant for connection of the EC-S4 system. The example illustrated here does not show complete system planning. The user is responsible for safe integration in the overall system.

Setup

LED indicators

| | | |
|-------|------------|---|
| STATE | LED green | State display (multifunction display using flashing modes) |
| OUT | LED yellow | Safety circuit closed |
| DIA | LED red | - Operating error or - External fault (fault in the feedback loop) or - Teaching process not valid or - Internal device fault or - TST input activated (function test active) |

Teaching operation

Before the system forms a function unit, the parameters are set in the evaluation unit in a teaching operation (number of connected read heads, assignment of the actuators to the read heads, with or without automatic start, with or without feedback loop). In this process, the read heads are activated and the actuator code is learned.

These configuration parameters are saved in the non-volatile memory in the Control unit.

The safety outputs are open during the teaching operation. The system is in a safe state.

Important!

During the teaching operation the following conditions must be met:

- There must be no state change, e.g. opening a safety guard or closing a further safety guard or a change in the signal on the terminals for the start button and the feedback circuit.
- The power supply must not be switched off.
- If these conditions are not met, the Control unit switches to the safe fault state (diagnostics LED illuminates) and signals this operating fault with the STATE LED by 3 short flashes that are repeated every second. The teaching operation must be repeated.
- The number of teaching operations is unlimited. The Control unit can be re-configured as often as required.
- Actuators cannot be interchanged without a renewed teaching operation.
- An actuator that has not been subjected to teaching will not be detected by the related read head.
- Even if only one new actuator needs to be taught, a complete new teaching operation must be carried out as described in the section Setup.
- Do not change DIP switches during operation.

To trigger a teaching operation, the user must perform the following actions in the stipulated order:

1. Prepare for teaching operation
 - Switch off power supply U_B
 - Fit a jumper between terminals J1 and J2
2. Set required configuration on DIP switches

| Switch designation | Switch position left (OFF) | Switch position right (ON) |
|--------------------|--|---|
| 1 | No read head connected to terminals H11, H12, SH1 connected | Read head connected to terminals H11, H12, SH1 connected |
| 2 | No read head connected to terminals H21, H22, SH2 connected | Read head connected to terminals H21, H22, SH2 connected |
| 3 | No read head connected to terminals H31, H32, SH3 connected | Read head connected to terminals H31, H32, SH3 connected |
| 4 | No read head connected to terminals H41, H42, SH4 connected | Read head connected to terminals H41, H42, SH4 connected |
| 5 | Automatic start (No start button connected) | Manual start (Start button connected) |
| 6 | No feedback loop connected | Feedback loop connected |

3. Set required configuration on machine
 - Close all doors to be monitored (the actuators must be in the operating distance of the related read head)
 - For Manual start operating mode: connect terminal S to 24 V (or keep start button pressed)
 - For With feedback loop operating mode: keep feedback loop closed
4. Start teaching operation
 - Switch on operating voltage
 - Wait for self-test (STATE LED flashes for approx. 10 seconds at 15 Hz)
 - Teaching operation starts (STATE LED flashes at approx. 1 Hz)
 - Wait for acknowledgement of the teaching operation (STATE LED goes out after approx. 10 seconds)
5. End teaching operation
 - Remove jumper between J1 and J2
 - For Manual start operating mode: connect start button to terminal S
 - For With feedback loop operating mode: connect feedback loop
 - Interrupt operating voltage for at least 10 seconds
 - Wait for self-test (STATE LED flashes for approx. 10 seconds at 15 Hz)
6. Check all safety guards for effectiveness

Changing the configuration / learning new actuator

The Control unit can be re-configured as often as required. For this purpose you must proceed as per the first teaching operation according to the Setup procedure section.

Faulty actuators can be replaced. Then a complete teaching operation must be performed as per the section Setup. The number of teaching operations is unlimited.

Functional check

After installation and any fault, the safety function must be fully checked. Proceed as follows:

Warning!

Danger of fatal injury as a result of faults in installation and functional check.

- Before carrying out the functional check, make sure that there are no persons in the danger area.
- Observe the valid accident prevention regulations.

1. Switch on operating voltage.

- The safety switch carries out a self-test.
The green STATE LED flashes up to three times.
The STATE LED then lights up continuously.
The OUT and ERROR LEDs do not light up.

2. Close all safety guards.

- The machine must not start automatically.
- The green STATE LED and the yellow OUT LED light up continuously.

3. Enable operation in the control system.

4. Open the safety guard.

- The machine must switch off and it must not be possible to start it as long as the safety guard is open.
- The green STATE LED lights up continuously; the OUT and ERROR LEDs do not light up.

Repeat steps 2-4 for each safety guard.

Self-test with test input TST

On electromechanical safety switches or magnetic switches, the function test can be performed by cyclically opening the safety guard.

From Category 2 according to EN ISO 13849-1 and in accordance with EN 60204-1 : 1997 (sec. 9.4.2.4), a function test must be performed on the entire safety system on start-up or after defined intervals.

Testing of the internal function of the safety switch EC-S Series is not necessary because the device monitors itself in real time. Welding of an output contact (relay output) is detected by the device at the latest the next time the safety guard is opened. A short circuit in the output cable is not detected by the device.

In addition, the entire safety circuit can be tested without opening the safety guard. For this purpose, opening of the safety guard can be simulated by applying 24 V DC to the test input TST.

The safety outputs are switched off, enabling testing of the complete safety circuit. The diagnostic output DIA of the Control unit is also set HIGH as a monitoring function.

When the test input TST is reset, the Control unit resets the diagnostic output DIA to LOW, the red LED switches off and normal operation is continued.

In Manual start operating mode, the start button must be pressed again to start the system.

This permits self-testing of the safety system without opening the safety guard.

Important!

After the self-test, test input TST must be reconnected to 0 V or disconnected.

System Status Table

| Operating mode | LED | | | State |
|------------------|---------------|--------------|-----------|---|
| | STATE (green) | OUT (yellow) | DIA (red) | |
| Setup | 4 Hz | ○ | ○ | Initial setup after delivery without jumper connected to J1, J2. |
| | 1 Hz | ○ | ○ | Teaching operation |
| | ○ | ○ | ○ | Acknowledgement of completion of teaching operation. |
| Normal operation | 15 Hz (10 s) | ○ | ○ | Self-test, duration approx. 10 seconds, is performed after the application of the operating voltage U _B |
| | | ○ | ○ | Normal operation, not all monitored doors are closed. |
| | | | ○ | Normal operation, all monitored doors are closed (after pressing the start button, for Manual start operating mode) |
| Function test | | | | Function test active (TST input = 24 V) |
| Fault display | ○ | ○ | | Internal component failure or excessively high external interference (EMC) |
| Operating fault | 3 x | ○ | | Configuration fault: Teaching operation must be performed again Possible causes: - State change during the teaching operation - None of the DIP switches in ON position - The DIP switch setting and the configuration did not match during the teaching operation - DIP switch setting has been changed without teaching operation - The teaching jumper (J1, J2) was fitted with power supply switched on - Closed feedback loop (Y1, Y2) present, although a feedback loop was not present during teaching - 24 V signal present at the start button input (S) although teaching was performed with "Automatic start" operating mode. |
| | 4 x | ○ | | Fault in feedback loop Possible causes: - Malfunction of the monitored contactor - Following removal from the operating distance, actuator is not outside the operating distance long enough. As a result the feedback loop cannot be closed in this short time. Note the release time for the monitored contactor. - Feedback loop was not closed when the evaluation unit was started. |

| | | |
|----------------|---|---|
| Key to symbols | N | 0 Volt or not connected |
| | 1 | 24 Volt |
| | 0 | 0 Volt |
| | ○ | LED is not lit |
| | | LED is lit |
| | | LED flashes for 10 seconds with 15 Hz |
| | | LED flashes three times and then lights up continuously |
| | | LED flashes three times, and this is then repeated |
| | X | Any state |

Important!

If you cannot find the displayed device status in the system status table, this indicates that there is an internal device fault. In this case, you should contact the manufacturer.

Technical Data

Note!

If a product data sheet is included with the product, the information on the data sheet applies in case of discrepancies with the operating instructions.

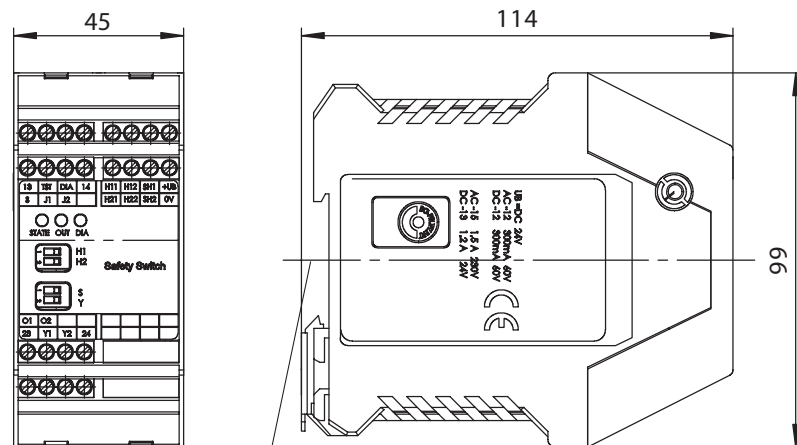
Control unit EC-S2

Approvals



- Housing for DIN rail mounting, IP 20
- Relay output
- 2 read heads can be connected

Dimension drawing

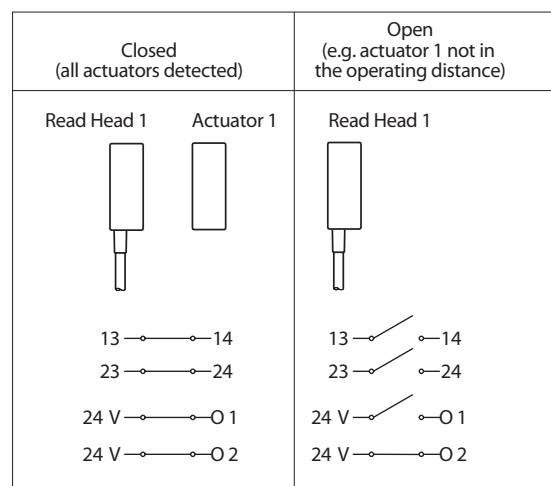


Suitable for 35-mm DIN rail according to EN60715

Safety Guard

Switching characteristics

- 2 safety outputs (relay outputs)
- 2 door monitoring outputs (semiconductor outputs, not safety outputs)



Operating Instructions Non-Contact Safety Switches with EC-S2 and EC-S4 Controls

Technical Data

| Parameter | Value | | | Unit |
|---|---|---------|------------------------|-----------------|
| | min. | typ. | max. | |
| Housing material | Plastic PA6.6 | | | |
| Dimensions | 114 x 99 x 45 | | | mm |
| Weight | 0.25 | | | kg |
| Ambient temperature at $U_B = DC 24 V$ | -20 | - | +55 | °C |
| Atmospheric humidity, not condensing | - | - | 80 | % |
| Degree of protection | IP20 | | | |
| Degree of contamination | 2 | | | |
| Installation | DIN rail 35 mm according to EN 60715 | | | |
| Number of read heads | Max. 2 read heads per Control unit | | | |
| Connection (screw terminals) | 0.14 | - | 2.5 | mm ² |
| Operating voltage U_B (regulated, residual ripple < 5 %) | 21 | 24 | 27 | V DC |
| For the approval according to UL the following applies | Operation only with UL Class 2 power supply, or equivalent measures | | | |
| Current consumption I_B (with relay energized) ¹⁾ | - | 220 | 270 | mA |
| External fuse (operating voltage U_B) | 0.4 | - | 8 | A |
| Safety contacts | 2 (relays with internally monitored contacts) | | | |
| Switching current (relay outputs) | | | | |
| - At switching voltage AC/DC 1 ... 60 V | 1 ²⁾ | - | 300 | mA |
| - At switching voltage AC/DC 17 ... 30 V | 15 | - | 6000 | |
| - At switching voltage AC 17 ... 230 V | 15 | - | 1500 | |
| Switching load according to UL | Max. AC 30 V, class 2 / max. DC 60 V, class 2 | | | |
| External fuse (safety circuit) according to EN 60269-1 | 6 A gG or 6 A circuit breaker (characteristic B or C) | | | |
| Utilization category to EN 60947-5-1 | AC-12 60V 300mA 50Hz / DC-12 60V 300mA AC-12 30V 6A / DC-12 30V 6A AC-15, 230V 1.5A 50Hz / DC-13 24V 1.2A | | | |
| Classification according to EN 60947-5-3 | PDF-M | | | |
| Rated insulation voltage U_i | 250 | | | V |
| Rated impulse withstand voltage U_{imp} | 4 | | | kV |
| Rated conditional short-circuit current | 100 | | | A |
| Resilience to vibration | According to EN 60947-5-2 | | | |
| Mechanical operating cycles (relays) | 10 x 10 ⁶ | | | |
| Switching delay from state change ³⁾ | | | | |
| - 2 activated actuators | - | - | 290 | ms |
| - 1 activated actuator | - | - | 210 | |
| Time difference between the switching points of the two relays (with 2 activated actuators) | - | - | 240 | ms |
| Manual start operating mode | | | | |
| - Duration of operation of start button | 250 | - | - | ms |
| - Start button response delay | - | 200 | 300 | |
| Current via feedback loop Y1/Y2 | 5 | 8 | 10 | mA |
| Permissible resistance via feedback loop | - | - | 600 | W |
| Ready delay ⁴⁾ | - | 10 | 12 | s |
| Dwell time ⁵⁾ | 3 | - | - | s |
| Switching frequency max. ⁶⁾ | - | - | 0.25 | Hz |
| Monitoring outputs (diagnostics DIA, release 01...02, semiconductor output, p-switching, short circuit-protected) | | | | |
| - Output voltage | 0.8 x U_B | - | U_B | V DC |
| - Max. load | - | - | 20 | mA |
| Start button input S, test input TST | | | | |
| - Input voltage LOW | 0 | - | 2 | V DC |
| HIGH | 15 | - | U_B | |
| - Input current HIGH | 5 | 8 | 10 | mA |
| EMC protection requirements | In acc. with EN 60947-5-3 | | | |
| Reliability values according to EN ISO 13849-1 | | | | |
| Switching current at 24 V DC | ≤ 0.1 A | ≤ 1 A | ≤ 3 A | |
| Category | 4 | | | |
| PL | e | | | |
| PFH _B | 1.3 x 10 ⁻⁸ | | 1.5 x 10 ⁻⁸ | |
| Mission time | 20 | | | years |
| Number of switching cycles/year | 506 000 | 100 000 | 23 000 | |

- 1) Without taking into account the load currents on the monitoring outputs.
- 2) If a switching current > 300 mA in conjunction with a switching voltage > 15 V or an inductive or capacitive load is switched once using the relay outputs, it is no longer possible to reliably switch small currents (< 15 mA) due to the contact erosion on the gold contacts.
- 3) Corresponds to the risk time according to EN 60947-5-3. This is the maximum switch-off delay for the safety outputs following removal of the actuator. In case of EMC interference in excess of the requirements in accordance with EN 60947-5-3, the switch-off delay can increase to max. 430 ms. After a brief actuation < 0.4 s, the switch-on delay can increase to max. 3 s if this is followed immediately by further actuation.
- 4) After the operating voltage is switched on, the relay outputs are switched off and the monitoring outputs are set LOW during the ready delay. For the visual indication of the delay, the green STATE LED flashes at a frequency of approx. 15 Hz.
- 5) The dwell time is the time that the actuator must be inside or outside the operating distance.
- 6) In case of monitoring with feedback loop, the actuators must remain outside the operating distance, e.g. with a door open, until the feedback circuit is closed.

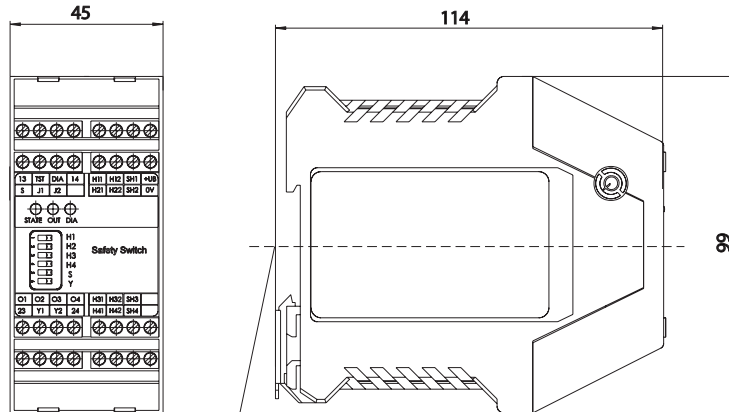
Control unit EC-S4

Approvals



- › Housing for DIN rail mounting, IP 20
- › Relay output
- › 4 read heads can be connected

Dimension drawing



Suitable for 35-mm DIN rail according to EN60715

Safety Guard

Switching characteristics

- › 2 safety outputs (relay outputs)
- › 4 door monitoring outputs (semiconductor outputs, not safety outputs)

| Closed (all actuators detected) | | Open (e.g. actuator 1 not in the operating distance) |
|------------------------------------|------------|---|
| Read Head 1 | Actuator 1 | Read Head 1 |
| | | |
| 13 ——— 14 | | 13 ——— 14 |
| 23 ——— 24 | | 23 ——— 24 |
| 24 V ——— 0 1 | | 24 V ——— 0 1 |
| 24 V ——— 0 2 | | 24 V ——— 0 2 |
| 24 V ——— 0 3 | | 24 V ——— 0 3 |
| 24 V ——— 0 4 | | 24 V ——— 0 4 |

Operating Instructions Non-Contact Safety Switches with EC-S2 and EC-S4 Controls

Technical Data

| Parameter | Value | | | Unit |
|---|--|---------|------------------------|-----------------|
| | min. | typ. | max. | |
| Housing material | Plastic PA6.6 | | | |
| Dimensions | 114 x 99 x 45 | | | mm |
| Weight | 0.25 | | | kg |
| Ambient temperature at $U_B = DC 24 V$ | -20 | - | +55 | °C |
| Atmospheric humidity, not condensing | - | - | 80 | % |
| Degree of protection | IP20 | | | |
| Degree of contamination | 2 | | | |
| Installation | DIN rail 35 mm according to EN 60715 | | | |
| Number of read heads | Max. 4 read heads per Control unit | | | |
| Connection (screw terminals) | 0.14 | - | 2.5 | mm ² |
| Operating voltage U_B (regulated, residual ripple < 5 %) | 21 | 24 | 27 | V DC |
| For the approval according to «UL» the following applies | Operation only with UL Class 2 power supply, or equivalent measures | | | |
| Current consumption I_B (with relay energized) ¹⁾ | - | 220 | 270 | mA |
| External fuse (operating voltage U_B) | 0.4 | - | 8 | A |
| Safety contacts | 2 (relays with internally monitored contacts) | | | |
| Switching current (relay outputs) | | | | |
| - At switching voltage AC/DC 1 ... 60 V | 1 ²⁾ | - | 300 | mA |
| - At switching voltage AC/DC 17 ... 30 V | 15 | - | 6000 | |
| - At switching voltage AC 17 ... 230 V | 15 | - | 1500 | |
| Switching load according to «UL» | Max. AC 30 V, class 2 / max. DC 60 V, class 2 | | | |
| External fuse (safety circuit) according to EN 60269-1 | 6 A gG or 6 A circuit breaker (characteristic B or C) | | | |
| Utilization category to EN 60947-5-1 | AC-12 60V 300mA 50Hz / DC-12 60V 300mA AC-12 30V 6A / DC-12 30V 6A AC-15,230V 1.5A 50Hz / DC-13 24V 1.2A | | | |
| Classification according to EN 60947-5-3 | PDF-M | | | |
| Rated insulation voltage U_i | 250 | | | V |
| Rated impulse withstand voltage U_{imp} | 4 | | | kV |
| Rated conditional short-circuit current | 100 | | | A |
| Resilience to vibration | According to EN 60947-5-2 | | | |
| Mechanical operating cycles (relays) | 10 x 10 ⁶ | | | |
| Switching delay from state change ³⁾ | | | | |
| - 4 activated actuators | - | - | 450 | ms |
| - 3 activated actuators | - | - | 370 | |
| - 2 activated actuators | - | - | 290 | |
| - 1 activated actuator | - | - | 210 | |
| Time difference between the switching points of the two relays (with 4 activated actuators) | - | - | 400 | ms |
| Manual start operating mode | | | | |
| - Duration of operation of start button | 250 | - | - | ms |
| - Start button response delay | - | 200 | 300 | |
| Current via feedback loop Y1/Y2 | 5 | 8 | 10 | mA |
| Permissible resistance via feedback loop | - | - | 600 | W |
| Ready delay ⁴⁾ | - | 10 | 12 | s |
| Dwell time ⁵⁾ | 3 | - | - | s |
| Switching frequency max. ⁶⁾ | - | - | 0.25 | Hz |
| Monitoring outputs (diagnostics DIA, release 01...02, semiconductor output, p-switching, short circuit-protected) | | | | |
| - Output voltage | 0.8 x U_B | - | U_B | V DC |
| - Max. load | - | - | 20 | mA |
| Start button input S, test input TST | | | | |
| - Input voltage LOW | 0 | - | 2 | V DC |
| HIGH | 15 | - | U_B | |
| - Input current HIGH | 5 | 8 | 10 | mA |
| EMC protection requirements | In acc. with EN 60947-5-3 | | | |
| Reliability values according to EN ISO 13849-1 | | | | |
| Switching current at 24 V DC | ≤ 0.1 A | ≤ 1 A | ≤ 3 A | |
| Category | 4 | | | |
| PL | e | | | |
| PFH _r | 1.3 x 10 ⁻⁸ | | 1.5 x 10 ⁻⁸ | |
| Mission time | 20 | | | years |
| Number of switching cycles/year | 506 000 | 100 000 | 23 000 | |

1) Without taking into account the load currents on the monitoring outputs.

2) If a switching current > 300 mA in conjunction with a switching voltage > 15 V or an inductive or capacitive load is switched once using the relay outputs, it is no longer possible to reliably switch small currents (< 15 mA) due to the contact erosion on the gold contacts.

3) Corresponds to the risk time according to EN 60947-5-3. This is the maximum switch-off delay for the safety outputs following removal of the actuator. In case of EMC interference in excess of the requirements in accordance with EN 60947-5-3, the switch-off delay can increase to max. 750 ms. After a brief actuation < 0.8 s, the switch-on delay can increase to max. 3 s if this is followed immediately by further actuation.

4) After the operating voltage is switched on, the relay outputs are switched off and the monitoring outputs are set LOW during the ready delay. For the visual indication of the delay, the green STATE LED flashes at a frequency of approx. 15 Hz.

5) The dwell time is the time that the actuator must be inside or outside the operating distance.

6) In case of monitoring with feedback loop, the actuators must remain outside the operating distance, e.g. with a door open, until the feedback circuit is closed.

Read head EC-S1PC.

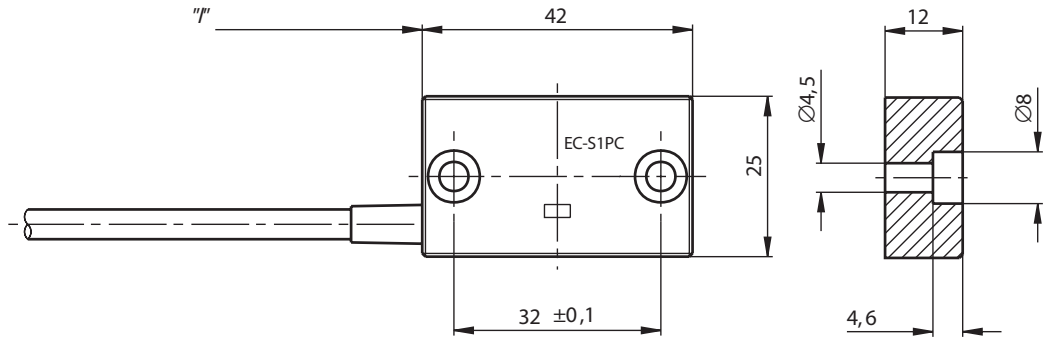
Approvals

Cube-shaped design 42 x 25 mm

▸ Hard-wired cable

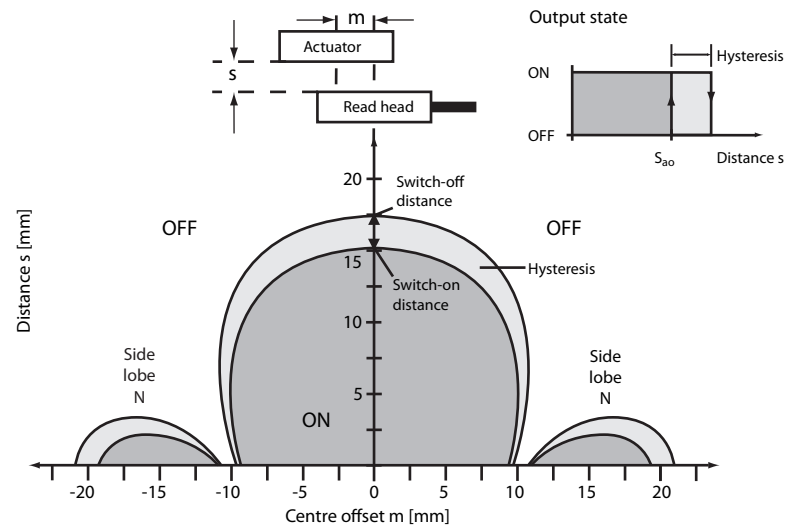


Dimension drawing



Typical operating distance

With Control unit EC-S Control Unit. and actuator EC-S1A

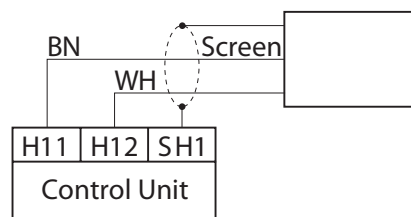


Note

For a side approach direction for the actuator and read head, a minimum distance of $s = 3$ mm must be maintained so that the operating distance of the side lobes is not entered.

Pin assignment

Read head with connection cable



Operating Instructions Non-Contact Safety Switches with EC-S2 and EC-S4 Controls

Technical Data

| Parameter | Value | | | Unit |
|--|--|------|------|------|
| | min. | typ. | max. | |
| Housing material | Fortron, reinforced thermoplastic, fully encapsulated | | | |
| Dimensions | 42 x 25 x 12 | | | mm |
| Weight (incl. 10 m cable) | 0.3 | | | kg |
| Ambient temperature | -25 | - | +70 | °C |
| Degree of protection | IP67/IP69K | | | |
| Installation position | Any | | | |
| Method of operation | Inductive | | | |
| Power supply | Via Control unit | | | |
| Operating distance for center offset $m = 0$ ¹⁾ (Control unit CES-A-AEA... with CES-A-BBA) | | | | mm |
| - Assured switch-off distance S_{ar} | - | - | 32 | |
| Cable length $l = 0$ to 25 m | | | | |
| - Switch-on distance | - | 15 | - | |
| - Assured switch-on distance S_{ao} | 10 | - | - | |
| - Switching hysteresis | 0.5 | 2 | - | |
| Connection cable | Hard-wired encapsulated connection cable, with crimped ferrules PVC, \square 4,6 mm | | | |
| Cable length | See ordering table | | 25 | m |

1) These values apply for surface installation of the read head and the actuator.

Ordering table

| Series | Cable/connection type | Cable length "l" [m] | Order no. / item |
|---------|-----------------------|----------------------|--------------------------|
| EC-S1PC | V Cable PVC | 5 | EC-S1PC5 44537-0105 |
| | | 10 | EC-S1PC510 44537-0110 |
| | | 15 | EC-S1PC15 44537-0115 |
| | | 25 | EC-S1PC25 44537-0125 |

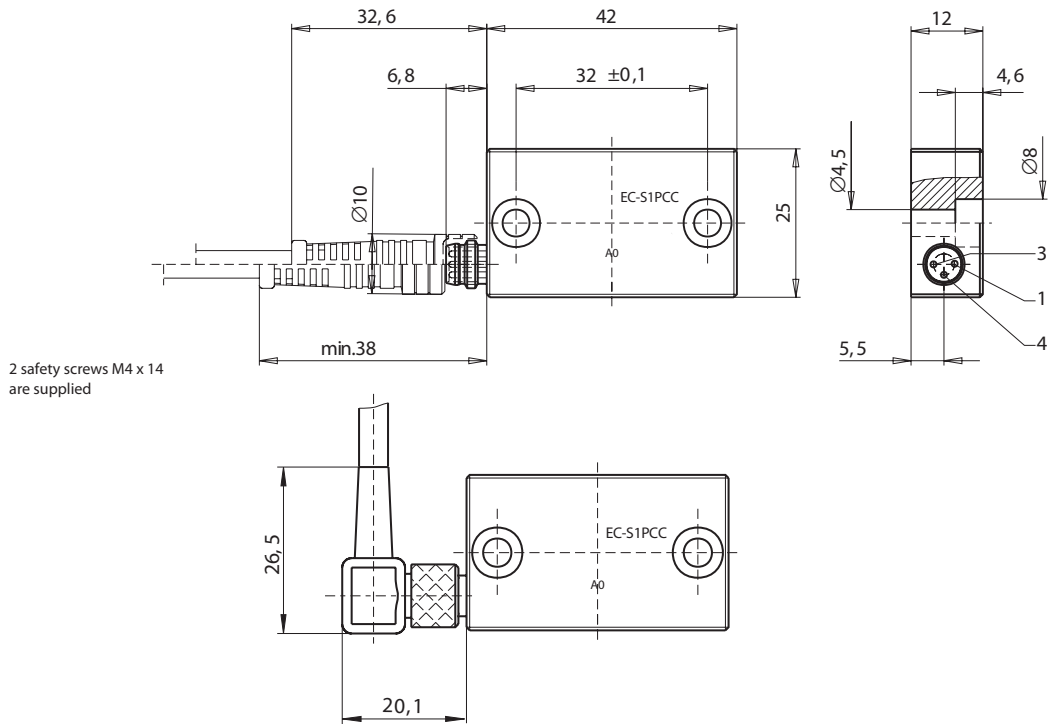
Read head EC-S1PCC

Approvals



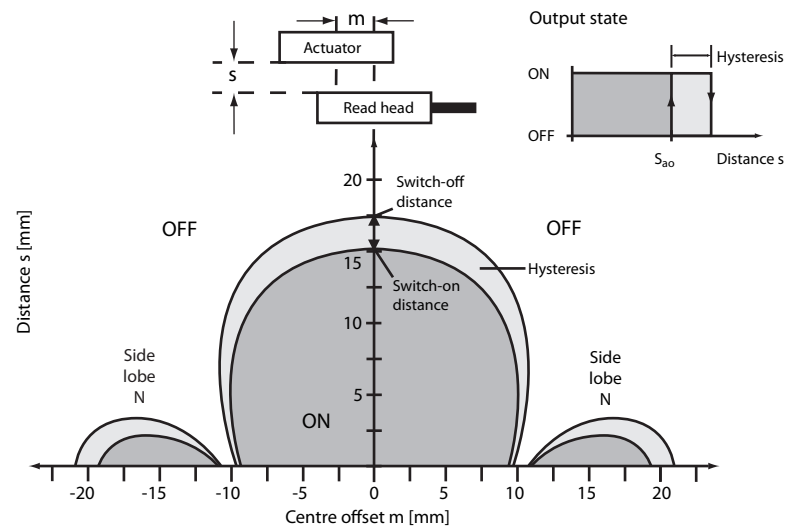
- Cube-shaped design 42 x 25 mm
- M8 plug connector (snap-action and screw terminals)

Dimension drawing



Typical operating distance

With Control unit EC-S. and actuator EC-S1A

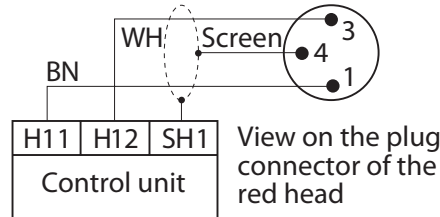


Note

For a side approach direction for the actuator and read head, a minimum distance of $s = 3$ mm must be maintained so that the operating distance of the side lobes is not entered.

Pin assignment

Read head with plug connector



Technical Data

| Parameter | Value | | | Unit |
|---|--|------|------|------|
| | min. | typ. | max. | |
| Housing material | Fortron, reinforced thermoplastic, fully encapsulated | | | |
| Dimensions | 42 x 25 x 12 | | | mm |
| Weight (incl. 10 m cable) | 0.3 | | | kg |
| Ambient temperature | -25 | - | +70 | °C |
| Degree of protection | IP67/IP69K | | | |
| Installation position | Any | | | |
| Method of operation | Inductive | | | |
| Power supply | Via Control unit | | | |
| Operating distance for center offset $m = 0$ ¹⁾ (Control unit EC-S4 with CES-A-BBA) | | | | mm |
| - Assured switch-off distance S_{ar} | - | - | 32 | |
| Cable length $l = 0$ to 25 m | | | | |
| - Switch-on distance | - | 15 | - | |
| - Assured switch-on distance S_{ao} | 10 | - | - | |
| - Switching hysteresis | 0.5 | 2 | - | |
| Connection | M8 plug connector (snap-action and screw terminals), 3-pin | | | |
| Connection cable | - | - | 25 | m |

1) These values apply for surface installation of the read head and the actuator.

Inspection and Service

Warning!

Loss of the safety function because of damage to the device.
In case of damage, the related safety component must be replaced. The replacement of individual parts in a safety component is not permitted.

Regular inspection of the following is necessary to ensure trouble-free long-term operation:

- › Check the switching function (see section Functional check)
- › Check the secure fastening of the devices and the connections
- › Check for soiling
- › Check for tightness of the plug connector on the read head
- › Check for loose cable connections on the plug connector
- › Check of the switch-off distance

No servicing is required. Repairs to the device are only allowed to be made by the manufacturer.

Note!

The year of manufacture can be seen on the rating plate in the lower right corner.

Declaration of Conformity

The manufacturer named below herewith declares that the product fulfills the provisions of the directive(s) listed below and that the related standards have been applied.

OMRON Scientific Technologies Inc.
6550 Dumbarton Circle
Fremont, CA 94555, U.S.A.

Directives applied:

- › Machinery directive 2006/42/EC
- › EMC directive 2004/108/EC

Standards Applied:

- › EN 60947-5-3: 1999 + A1:2005
- › EN1088: 1995 + A2:2008
- › EN ISO 13849-1:2008
- › EN ISO 13849-2:2008

Fremont, June 10, 2011

Marty Krikorian
Director, Quality Control

The signed EC Declaration of Conformity is included with the product.

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