



Control unit SG-EFS 104/2W



EN | Operating instructions

Version 0.9

1005196 SG-EFS 104/2W 24 V=/~

Mayser GmbH & Co. KG

Örlinger Straße 1-3

89073 Ulm

GERMANY

Phone: +49 731 2061-0

Fax: +49 731 2061-222

E-mail: info.ulm@mayser.com

Internet: www.mayser.com

Original instructions

Contents

| | |
|--|----|
| About these operating instructions..... | 3 |
| Intended use | 4 |
| Safety instructions..... | 4 |
| Parts supplied | 5 |
| Transport and storage..... | 6 |
| Packaging and transport | 6 |
| Storage..... | 6 |
| Product overview..... | 6 |
| Connections..... | 6 |
| LEDs information..... | 6 |
| Function, installation and commissioning | 7 |
| Function..... | 7 |
| Installation | 7 |
| Automatic reset..... | 8 |
| Manual reset | 9 |
| Signal output with U_s AC..... | 9 |
| Signal output with U_s DC | 9 |
| Correlation | 10 |
| Commissioning..... | 10 |
| Test function: automatic reset | 10 |
| Test function: manual reset | 11 |
| Recommissioning..... | 11 |
| Automatic reset..... | 11 |
| Manual reset | 11 |
| Connection examples | 12 |
| Contacts continued in two-channel mode | 12 |
| Contact duplication for automatic reset..... | 12 |
| Contact duplication for manual reset..... | 12 |
| Maintenance and cleaning..... | 13 |
| Maintenance | 13 |
| Cleaning | 13 |
| Troubleshooting and remedies | 13 |
| Replacement parts..... | 14 |
| Disposal | 14 |
| Conformity | 15 |
| EC design test..... | 15 |
| Technical data..... | 15 |

Copyright

The reproduction, distribution and utilization of this document as well as the communication of its contents without express authorization are prohibited. Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

© Mayser Ulm 2017

About these operating instructions

These operating instructions are part of the product.

Mayser accepts no responsibility or warranty claims for damage and consequential damage due to failure to observe the operating instructions.

- ➔ Read the operating instructions carefully before use.
- ➔ Keep the operating instructions for the complete service life of the product.
- ➔ Pass the operating instructions on to every subsequent owner or user of the product.
- ➔ Add any supplement received from the manufacturer to the operating instructions.

Validity

These operating instructions are only valid for the products specified on the title page.

Target group

The target group of these operating instructions are operators and trained specialist personnel who are familiar with installation and commissioning.

Other applicable documents

- ➔ In addition to the manual, observe the following documents:
 - Operating instructions ultrasonic industrial sensor USi

Symbols used

| Symbol | Meaning |
|------------------------------------|--|
| ➔ ... | Action with one or more steps whose order is not relevant. |
| 1. ... 2. ... 3. ... | Action with several steps whose order is relevant. |
| • ... - ... | Bullets first level Bullets second level |
| (see Section <i>Installation</i>) | Cross-reference |

Danger symbols and information

| Symbol | Meaning |
|---|--|
| <p>DANGER</p>  | Immediate danger leading to death or serious injury |
| <p>WARNING</p>  | Imminent danger which may lead to death or serious injury |
| <p>CAUTION</p>  | Possible danger which may lead to minor or moderate injuries |
|  | Information on easier and safer working practices |

Intended use

The control unit is designed for the signal processing of a pressure-sensitive protective device. It evaluates the output signals of sensors with monitoring resistor 1k Ω or 8k Ω . The integrated output signal switching device (OSSD) transmit the evaluated safety signals directly to the downstream control.

The control unit complies with ISO 13849-1:2006 Category 3 PL d. For the safety classification to be retained, the downstream control must be of the same or a higher category.

Safety instructions

→ Do not open the control unit

Never open, alter or tamper with the control unit.

→ Check supply voltage

Check supply voltage. It must correspond with the connecting voltage U_s on the type plate.

→ Observe degree of protection

Only use the control unit in rooms with a minimum degree of protection of IP54 (e.g. switch cabinet).

→ Maintain distance

When installing in the switch cabinet, ensure sufficient distance to heat sources (at least 2 cm).

→ Observe pin assignment

Observe pin assignment when connecting the supply voltage.

➔ **Protect relay contacts**

Risk of welding: protect the relay contacts externally.

➔ **Fit spark absorbers**

When connecting inductive loads, fit spark absorbers (RC modules) to the consumer.

➔ **Do not cross link control unit**

Do not cross link the control unit with other control units.

➔ **Do not overload control unit**

Ensure that the specified switching current is not exceeded.

➔ **Continue redundancy**

Make sure you wire the unit directly in the control circuit or that the downstream control is also in dual channel mode.

➔ **In the event of a fault, put out of operation**

In the event of malfunctions and visible damage, put the control unit out of operation.

➔ **Do not use in ATEX zones**

Do not use the control unit in potentially explosive environments (ATEX). The control unit is not authorised for use in these zones.

Parts supplied

1x Control unit

Enclosure with electronics module.

1x Operating instructions

1x Declaration of conformity

Upon receipt of the parts supplied, check immediately for completeness and good condition.

Transport and storage

Packaging and transport

The control units are packed individually in cardboard boxes. Several control units are stacked in one large cardboard box.

The documents are enclosed separately.

Storage

- ➔ Store the control units in the original packaging in a dry place.
- ➔ Observe the storage temperatures given in the technical specifications.

Product overview

Connections

Connections:

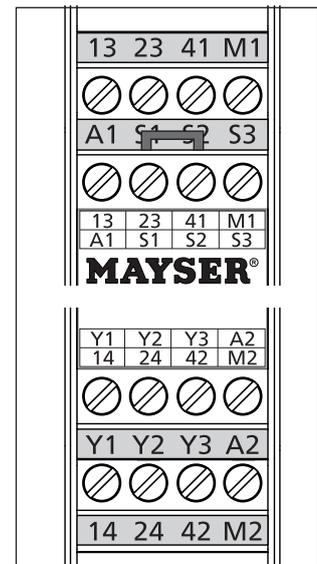
Supply voltage
 Sensor 1k2
or 8k2
 Switching channel 1
 Switching channel 2
 Signal circuit
 Signal output with U_s AC
 Sensor
 Fault
 Signal output with U_s DC
 Sensor
 Fault
 Bridge for automatic reset
 Button for manual reset

Terminals:

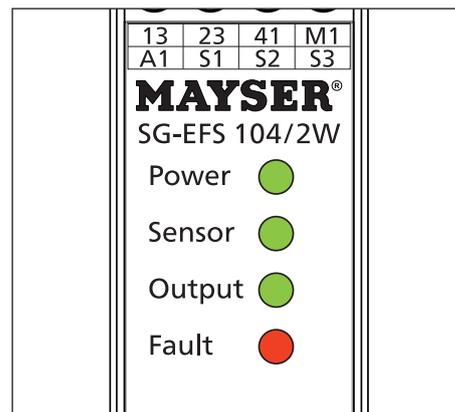
A1, A2
 Y1, Y2
 Y1, Y3
 13, 14
 23, 24
 41, 42

 M1, S1
 M2, S1

 M1, A2
 M2, A2
 S1, S2
 S1, S3



LEDs information



- Green LED "Power":
supply voltage connected
- Green LED "Sensor":
sensor not activated
- Green LED "Output":
control unit ready
- Red LED "Fault":
cable break

Function, installation and commissioning

Function

The single-fault-safe electronics module has dual channels (redundant). Each channel controls a forceguided relay and additionally monitors the relay of the other channel. The electronic system monitors the electrical resistance of the sensor with a defined zero signal current

The control unit is powered with AC/DC 24 V. When the supply voltage is connected, the green "Power" LED is lit. When the sensor is not activated, and after a reset, relays K1 and K2 are energized. The green LEDs "Sensor" and "Output" are lit, switch channels 1 and 2 are closed, and the signal output M1 is HIGH. If the sensor is activated or the cable on the sensor breaks, the K1 and K2 relays are de-energized. The green LEDs "Sensor" and "Output" go out, switch channels 1 and 2 are open, and the signal output M1 is LOW.

The signal circuit functions opposed to the switch channels 1 and 2.

Installation

WARNING



Danger of injury due to electrocution

- ➔ Disconnect the control unit as well as all devices and live parts in the immediate environment of the power supply and protect them against being switched on again (see relevant operating instructions).
- ➔ Check that all devices and parts are disconnected from the power supply.

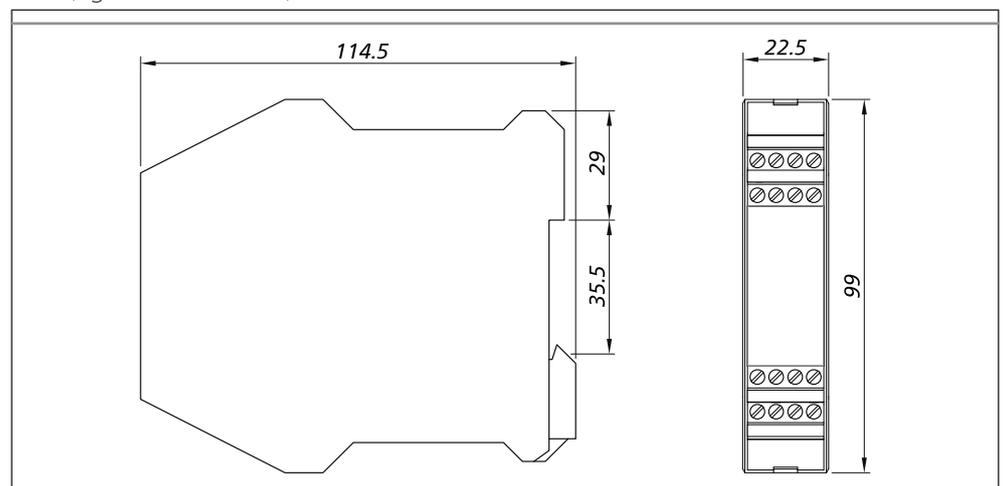
CAUTION



Impaired operation due to overheating or incorrect degree of protection

The operation of the device may be impaired due to overheating of the control unit or due to incorrect choice of degree of protection.

- ➔ When installing in the switch cabinet, ensure sufficient distance to heat sources (at least 2 cm)
- ➔ Only use the control unit in zones that have a min. degree of protection of IP54 (eg. switch cabinet)



1. The enclosure of the control unit can be mounted in any position on a 35 mm IEC 60175 rail.

CAUTION

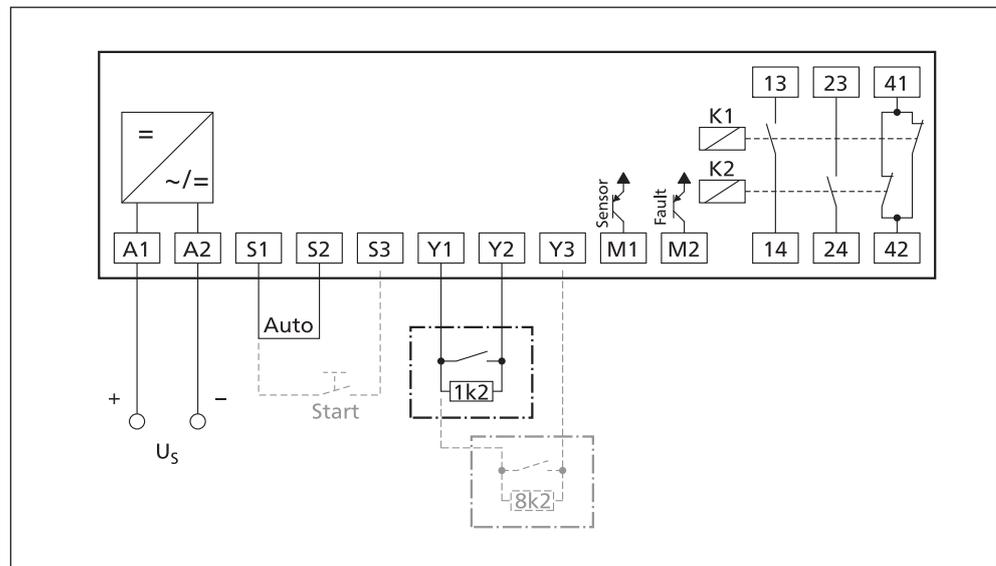


Overall safety at risk

The quality and reliability of the interface between the protective device and the machine affects the overall safety.

- ➔ Take special care when setting up the interface.

2. Wire the sensors, switching channels, signal circuit and supply voltage to the cable terminals.



CAUTION



Malfunctioning due to incorrect sensors

Connecting the incorrect sensor can impair the functioning of the protective device.

- ➔ Decide on one type of sensor: either with monitoring resistor 1k2 or 8k2.
- ➔ Connect a sensor with monitoring resistor 1k2 exclusively to terminals Y1 and Y2.
- ➔ Connect a sensor with monitoring resistor 8k2 exclusively to terminals Y1 and Y3.

Automatic reset

A bridge is necessary for automatic reset (without reset command). The unit is supplied with a bridge already connected between cable terminals S1 and S2.

- ➔ Check if the bridge is set between cable terminals S1 and S2.

Manual reset

For manual reset (with reset command), a button must be connected between cable terminals S1 and S3. The control unit reacts when the button changes from “not activated” to “activated”, i.e. if the button is jammed, the no reset command is initialised.

- ➔ Remove the bridge between cable terminals S1 and S2.
- ➔ Wire up a button between cable terminals S1 and S3.

Signal output with U_s AC

The signal outputs M1 and M2 are semiconductor outputs (PNP) and short-circuit-proof. When they are at HIGH status, they have a voltage of 20 to 29 V, depending on load and supply voltage.

Signal output M1: sensor

- ➔ Wire the load between cable terminals M1 and S1.

Signal output M2: fault

- ➔ Wire the load between cable terminals M2 and S1.

CAUTION



Damage to the unit due to short circuit

- ➔ Ensure a galvanic separation between the systems is connected to the signal outputs and the connecting voltage U_s AC.
-

Signal output with U_s DC

The signal outputs M1 and M2 are semiconductor outputs (PNP) and short-circuit-proof. When they are at HIGH status, they have a voltage of 18 to 22 V, depending on load and supply voltage.

Signal output M1: sensor

- ➔ Wire the load between cable terminals M1 and A2.

Signal output M2: fault

- ➔ Wire the load between cable terminals M2 and A2



In an electromagnetic extreme case (EMC surge), the signal outputs may flicker. This does not affect the safety function.

- ➔ Protect the control unit from excessive EMC radiation.
-

Correlations

| LEDs | | | | Outputs | | | | Remedy |
|-------------|--------------|--------------|-----------|------------------|--------|--------|--------|---|
| Power green | Sensor green | Output green | Fault red | 13, 14 23, 24 | 41, 42 | M1, A2 | M2, A2 | LED off: ○ LED on: ● |
| ○ | ○ | ○ | ○ | open | closed | LOW | LOW | Supply voltage off |
| ● | ● | ● | ○ | open | closed | HIGH | HIGH | Supply voltage is on; Sensor not activated; No reset signal |
| ● | ● | ● | ○ | closed | open | HIGH | HIGH | Control unit ready |
| ● | ○ | ○ | ○ | open | closed | LOW | HIGH | Sensor activated |
| ● | ○ | ○ | ● | open | closed | LOW | LOW | Faulty sensor (cable break) |

Commissioning

1. Make sure the plug connections are firmly attached.
2. Connect the supply voltage.

WARNING



Danger of injury due to electrocution

- ➔ Never disconnect terminals with the power on.
- ➔ Never unplug plug connections with the power on.

Test function: automatic reset

1. Make sure no sensors are activated.
 - green LEDs "Power", "Sensor" and "Output" are lit
 - contacts of switch channels 1 and 2 are closed
 - signal circuit open
2. Activate sensor.
 - green LEDs "Sensor" and "Output" go out
 - contacts of switch channels 1 and 2 are open
 - signal circuit is closed
3. Repeat step 1.
4. Disconnect the sensor.
 - green LEDs "Sensor" and "Output" go out
 - red LED "Fault" is on
 - contacts of switch channels 1 and 2 are open
 - signal circuit is closed

Test function: manual reset

1. Make sure no sensors are activated.
 - green LEDs "Power" and "Sensor" are lit
 - contacts of switch channels 1 and 2 are open
 - signal circuit is closed
2. Activate the reset button.
 - green LEDs "Power", "Sensor" and "Output" are lit
 - contacts of switch channels 1 and 2 are closed
 - signal circuit is open
3. Activate a sensor.
 - green LEDs "Sensor" and "Output" go out
 - contacts of switch channels 1 and 2 are open
 - signal circuit is closed
4. Repeat steps 1 and 2.
5. Disconnect the sensor.
 - green LEDs "Sensor" and "Output" go out
 - red LED "Fault" is on
 - contacts of switch channels 1 and 2 are open
 - signal circuit is closed

Recommissioning

WARNING



Danger of injury

- ➔ Never start your machine as long as the danger remains.
-

Automatic reset

The control unit works without a resetting function. If the sensor is enabled after actuation, relays K1 and K2 re-energise after a delay t_w .

- ➔ Check for proper functioning after recommissioning (see Section *Commissioning*).

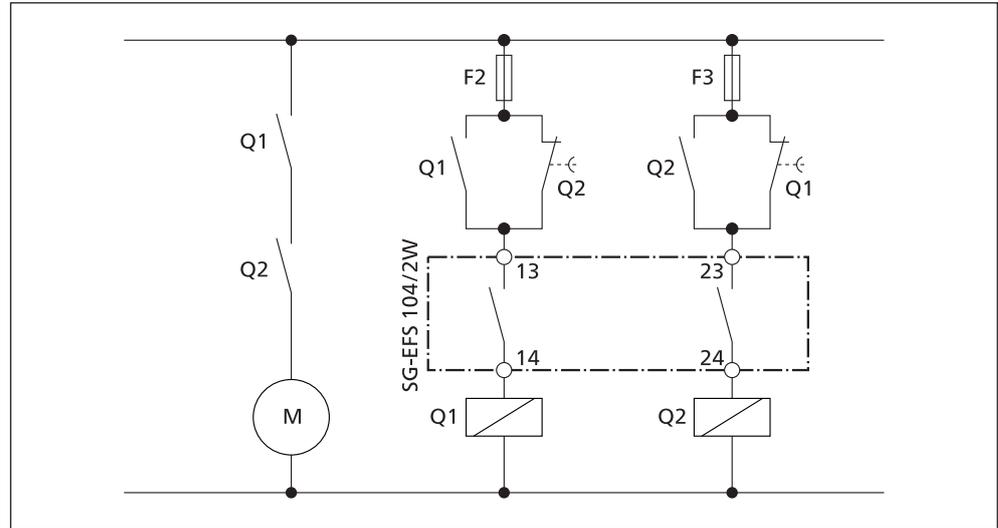
Manual reset

The control unit works with a resetting function. Relays K1 and K2 are energised only after the reset button is actuated.

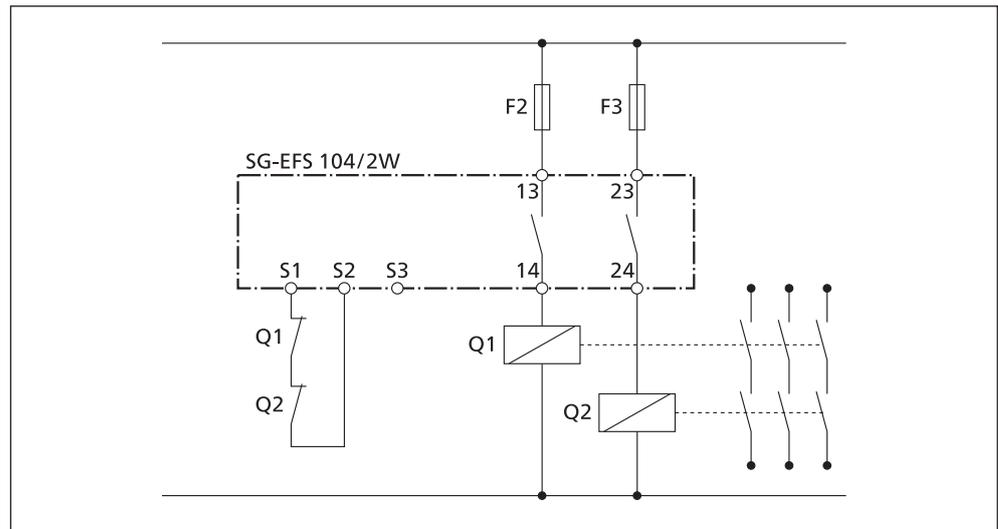
- ➔ Check for proper functioning after recommissioning (see Section *Commissioning*).

Connection examples

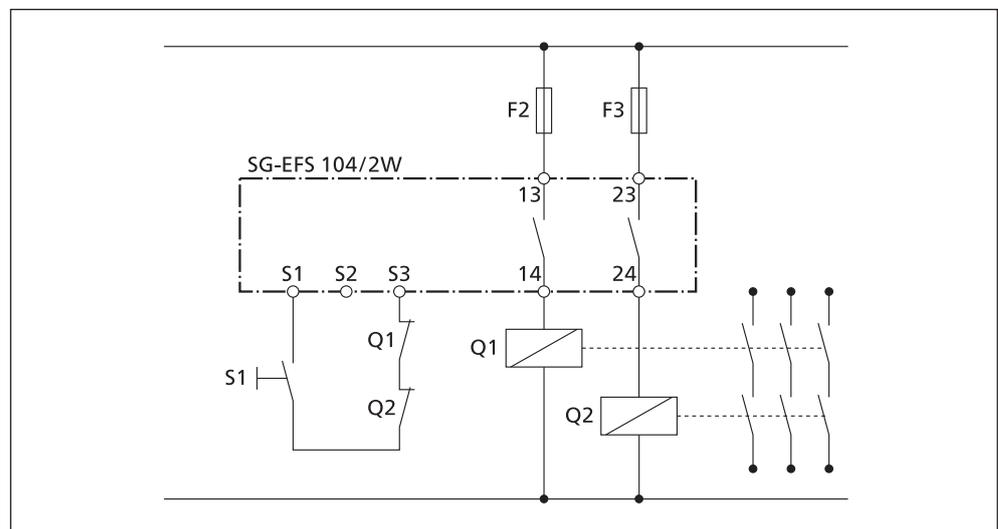
Contacts continued in two-channel mode



Contact duplication for automatic reset



Contact duplication for manual reset



Maintenance and cleaning

Maintenance

The control unit is maintenance-free.

- ➔ Repeat the operational test monthly.

Cleaning

DANGER



Danger of injury due to electrocution

- ➔ Disconnect the control unit as well as all devices and live parts in the immediate environment of the power supply and protect them against being switched on again (see relevant operating instructions).
- ➔ Check that all devices and parts are disconnected from the power supply.

- ➔ Clean the outside of the enclosure with a dry cloth.

Troubleshooting and remedies

Prerequisite: the control unit is connected to the supply voltage and sensor. No sensor is activated.

| Fault display | Possible cause | Remedy |
|---|---|--|
| Green LED „Power“ is off | No or incorrect supply voltage | 1. Check supply voltage, compare with type plate. 2. Check terminal connections |
| | If supply voltage is correctly connected: control unit is faulty. | ➔ Replace control unit. |
| Green LED “Sensor” is off and signal output M1 is LOW | Incorrect monitoring resistor on the sensor | ➔ Connect sensor with monitoring resistor 1k2 or 8k2 |
| | Sensor incorrectly connected | ➔ Check terminal connections ➔ Sensor with 1k2 connected to Y1 and Y2? ➔ Sensor with 8k2 connected to Y1 and Y3? |
| | If monitoring resistor is correct: sensor is faulty | ➔ Replace sensor |
| Green LEDs “Sensor” and “Output” is off | Incorrect monitoring resistor on the sensor | ➔ Connect sensor with monitoring resistor 1k2 or 8k2 |
| | Sensor incorrectly connected | ➔ Check terminal connections ➔ Sensor with 1k2 connected to Y1 and Y2? ➔ Sensor with 8k2 connected to Y1 and Y3? |
| | If monitoring resistor is correct: sensor is faulty | ➔ Replace sensor |

| Fault display | Possible cause | Remedy |
|--|---|--|
| Green LED "Output" is off | Manual reset: reset button not activated | ➔ Activate reset button |
| | Manual reset: connection to button broken | ➔ Check connection to button |
| | Manual reset: jammed button | ➔ Replace buttons on S1 and S3 |
| | Automatic reset: bridge missing | ➔ Connect bridge between S1 and S2 |
| | Control unit is faulty | ➔ Replace control unit |
| Green LEDs "Power", "Sensor" and "Output" are on and switch channel K2 is open | Control unit is faulty | ➔ Replace control unit |
| red LED "Fault" is on and signal output M2 is LOW | No sensor connected | ➔ Connect sensor |
| | Incorrect monitoring resistor on the sensor | ➔ Connect sensor with monitoring resistor 1k2 or 8k2 |
| | Sensor incorrectly connected | ➔ Check terminal connections ➔ Sensor with 1k2 connected to Y1 and Y2? ➔ Sensor with 8k2 connected to Y1 and Y3? |
| | Cable break | ➔ Replace sensor |

The fault can still not be removed?

➔ Contact the Mayser support: phone +49 731 2061-0.

Replacement parts

CAUTION



Overall safety endangered

If the sensor and control unit are not replaced with original Mayser parts, operation of the protective device may be impaired.

➔ Only use original parts from Mayser.

Disposal

The devices produced by Mayser are professional electronic tools exclusively intended for commercial use (so-called B2B devices). Unlike devices mainly used in private households (B2C), they may not be disposed of at the collection centres of public sector disposal organisations (e.g. municipal recycling depots). At the end of their useful life, the devices may be returned to us for disposal.

WEEE reg. no. DE 39141253

Conformity



The design type of the product complies with the basic requirements of the following directives:

- 2006/42/EC (Safety of machinery)
- 2011/65/EC (RoHS)
- 2014/30/EC (EMC)

The Declaration of Conformity is available in the download section of the website:
www.mayser.com

EC design test

The product was tested by an independent institute.
 An EC design type test certificate confirms conformity.

The EC design type test certificate is available in the download section of the website:
www.mayser.com

Technical data

| SG-EFS 104/2W | AC 24 V | DC 24 V |
|--|--|--|
| Test principles | EN 12978, ISO 13849-1, ISO 13856-1, ISO 13856-2, ISO 13856-3 | |
| Supply voltage U_s | | |
| Voltage tolerance | -10 % to +10 % | -10 % to +10 % |
| Nominal current | 70 mA | 60 mA |
| Nominal frequency | 50 to 60 Hz | – |
| External protection | 200 mA slow-acting | 200 mA slow-acting |
| Power consumption | < 4 VA | < 3 W |
| Times | | |
| Reaction time t_a | < 15 ms | < 15 ms |
| Re-start time t_w | < 50 ms | < 50 ms |
| Safety classifications | | |
| EN 1760: reset ISO 13849-1:2006 MTTF _d DC _{avg} B _{10d} (Load: DC 24 V / 1 A) n _{op} (estimate) CCF IEC 60664-1: creep distance and air gap | with/without Category 3 PL d 257 a 60 % 1.8 × 10 ⁶ 52560 per year Requirements fulfilled Contamination level 2, overvoltage category III / 250 V, basic insulation | with/without Category 3 PL d 257 a 60 % 1.8 × 10 ⁶ 52560 per year Requirements fulfilled Contamination level 2, overvoltage category III / 250 V, basic insulation |

| SG-EFS 104/2W | AC 24 V | | DC 24 V | |
|--|--|------------|--|------------|
| Control unit Inputs | | | | |
| Sensor | Y1, Y2 | Y1, Y3 | Y1, Y2 | Y1, Y3 |
| Monitoring resistor | 1k2 Ohm | 8k2 Ohm | 1k2 Ohm | 8k2 Ohm |
| Short-circuit resistance | ≤ 400 Ohm | ≤ 400 Ohm | ≤ 400 Ohm | ≤ 400 Ohm |
| Line resistance | ≤ 10 Ohm | ≤ 10 Ohm | ≤ 10 Ohm | ≤ 10 Ohm |
| Line length (max.) | 100 m | 100 m | 100 m | 100 m |
| Switching thresholds | | | | |
| Sensor activated | < 0.6 kOhm | < 4 kOhm | < 0.6 kOhm | < 4 kOhm |
| Cable break | > 1.8 kOhm | > 12 kOhm | > 1.8 kOhm | > 12 kOhm |
| Reset | S1, S2 | S1, S3 | S1, S2 | S1, S3 |
| Type | automatic | manual | automatic | manual |
| Line length (max.) | 3 m | 30 m | 3 m | 30 m |
| Control unit Outputs | | | | |
| Switching channel 1 and 2 (NO contact) | 13, 14 and 23, 24 | | 13, 14 and 23, 24 | |
| Signal circuit (NC contact) | 41, 42 | | 41, 42 | |
| Utilization category | AC-12: 250 V / 4 A | | AC-12: 250 V / 4 A | |
| as per EN 60947-5-1 | DC-12: 24 V / 4 A | | DC-12: 24 V / 4 A | |
| Switching voltage (max.) | AC 250 V | DC 24 V | AC 250 V | DC 24 V |
| Switching current (max.) | 4 A | 4 A | 4 A | 4 A |
| Switching capacity (max.) | 1000 VA | 96 W | 1000 VA | 96 W |
| Switching operations, mechanical | > 1× 10 ⁷ | | > 1× 10 ⁷ | |
| Switching operations, electrical | > 3.6× 10 ⁵ (DC 24 V / 1 A) | | > 3.6× 10 ⁵ (DC 24 V / 1 A) | |
| Contact fuse protection, external | 6.3 A quick-acting | | 6.3 A quick-acting | |
| Line length (max.) | 30 m | | 30 m | |
| Signal output (PNP) | M1, S1 | M2, S1 | M1, A2 | M2, A2 |
| Type of signal | Sensor | Fault | Sensor | Fault |
| Voltage (DC) | 20 to 29 V | 20 to 29 V | 18 to 22 V | 18 to 22 V |
| Load current (max.) | 100 mA | 100 mA | 100 mA | 100 mA |
| Line length (max.) | 30 m | 30 m | 30 m | 30 m |
| Mechanical operating conditions | | | | |
| Cable terminals | 4× 4-poles | | 4× 4-poles | |
| solid wire | 1× 2.5 mm ² or 2× 1.5 mm ² | | 1× 2.5 mm ² or 2× 1.5 mm ² | |
| strand with sheath | 1× 2.5 mm ² or 2× 1.5 mm ² | | 1× 2.5 mm ² or 2× 1.5 mm ² | |
| Degree of protection as per IEC 60529 | IP20 | | IP20 | |
| max. humidity (23 °C) | 95 % | | 95 % | |
| Operating temperature | -25 °C to +55 °C | | -25 °C to +55 °C | |
| Storage temperature | -25 °C to +55 °C | | -25 °C to +55 °C | |
| Impact resistance in operation | 2.5 g | | 2.5 g | |
| Impact resistance transport | 10 g | | 10 g | |
| Dimensions (W × H × D) | 114.5 × 99 × 22.5 mm | | 114.5 × 99 × 22.5 mm | |
| Weight | 180 g | | 180 g | |