



Control unit SG-EFS 104/2W



EN | Operating instructions

Version 0.9

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

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Safety first!



- Read the manual carefully before use.
- Warning signs in the manual warn of unexpected dangers. Always observe warning signs.
- Retain the manual throughout the service life of the product.
- Pass the manual on to every subsequent owner or user of the product.
- Insert every supplement received from the manufacturer into the manual.
- **Observe chapter on Safety starting on page 5.**

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/en/downloads

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About this manual

This manual is an integral part of the product.
 Mayser will assume no liability and provide no guarantee whatsoever for damages and consequential damages resulting from failure to comply with the manual.

Validity

This manual is valid only for the product specified on the title page.

Target group

This manual is intended for the owner and electricians. The electrician must be familiar with the installation and commissioning.




Other applicable documents

- ➔ Also observe the following documents:
 - Drawing of the sensor system (optional)
 - Wiring diagram (optional)
 - Installation instructions of the sensors used

Symbols used

Symbol	Meaning
➔ ...	Action with one or more steps whose order is not relevant.
1. ...	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
 DANGER	Immediate danger leading to death or serious injury.
 WARNING	Imminent danger which may lead to death or serious injury.
 CAUTION	Possible danger which may lead to minor or moderate injuries.
NOTE	Potential danger of property damage or environmental degradation. Information on easier and safer working practices.

Dimensions in drawings

Unless otherwise indicated, all dimensions are stated in millimetres (mm).

Safety

Intended use

The control unit is designed for the signal processing of a pressure-sensitive protective device. It evaluates the initial state of the sensor 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 product complies with ISO 13849-1:2015 Category 3 PL d. So that the safety classification is retained, the downstream control must be of the same or a higher category.

Safety instructions

For your **own safety** the following safety instructions apply.

➔ **Prevent electric shock**

When working on electrical systems, always disconnect them from the power supply and secure them against being switched on again, to prevent injuries from electric shock.

➔ **Ensure careful configuration of interface**

The quality and reliability of the interface between the safety device and the machine affects the overall safety. Take special care when setting up this interface.

➔ **Prevent restarting of the machine**

As long as a hazard continues to exist, take measures to prevent the machine from restarting, for example by means of a startup lockout.

➔ **Disable in case of error**

Disable the safety device in case of malfunctions or visible damage.

➔ **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.

To prevent irreparable damage to the **product**, the following safety instructions apply.

➔ **Do not open the control unit**

Never open, tamper with or alter the control unit.

➔ **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 from heat sources (at least 2 cm).

→ Check supply voltage

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

→ Observe pin assignment

Observe pin assignment when connecting the supply voltage.

→ Do not exceed the maximum number of sensors

Do not connect more sensors on the control unit, than the number specified in the installation instructions of the sensors.

→ Protect relay contacts

Risk of welding: Protect the relay contacts externally.

→ Do not overload control unit

Ensure that the specified switching current is not exceeded.

→ 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.
Terminals Y1, Y2 and Y3 are not potential-free

→ Continue redundancy

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

→ Protect against strong electromagnetic signals

Protect the control unit against excessive EMC radiation. A strong electromagnetic signal can cause the control unit to switch to a safe OFF state.

Residual dangers

There are no known residual dangers associated with this product.

Parts supplied

1× Control unit

Enclosure with electronics module and plug-in connectors.

1× Operating instructions

1× Declaration of Conformity

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

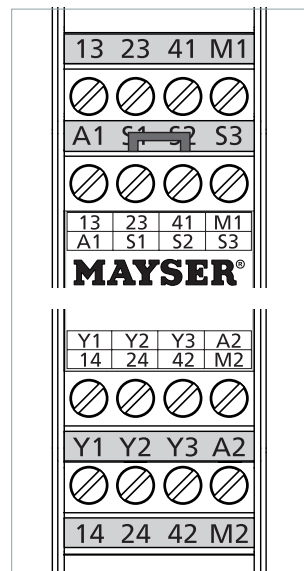
Storage

➔ Store the control units in the original package, in a dry place.

➔ Comply with the storage temperature specified in the technical data.

Product overview

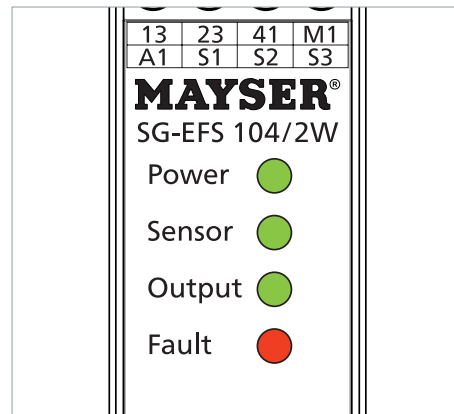
Connections



Connections: Terminals:

A1, A2	Supply voltage
	Input sensor:
Y1, Y2	Sensor 1k2
Y1, Y3	or 8k2
13, 14	OSSD 1
23, 24	OSSD 2
41, 42	Signal circuit
	Signal output with U _s AC
M1, S1	Sensor
M2, S1	Fault
	Signal output with U _s DC
M1, A2	Sensor
M2, A2	Fault
S1, S2	Bridge for automatic reset
S1, S3	Button for manual reset

LED indicators



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

Operation

The single-fault-safe electronics module has dual channels (redundant). Each channel triggers a force-guided relay (OSSD 1 and 2), which additionally monitor each other. The electronic system monitors the electrical resistance of the sensor with a defined zero signal current.

Ready for operation

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 actuated, and after a reset, OSSDs 1 and 2 are closed. The green LEDs "Sensor" and "Output" are lit and the signal outputs M1 and M2 are HIGH. The signal circuit is open.

Sensor activated

If the sensor is actuated, OSSDs 1 and 2 are open. The green LEDs "Sensor" and "Output" go out, the signal output M1 is LOW and the signal output M2 is HIGH. The signal circuit is closed.

Sensor cable break

In the case of a cable break at the sensor, OSSDs 1 and 2 are open. The red LED "Fault" is on. The green LEDs "Sensor" and "Output" go out, the OSSDs 1 and 2 are open and the signal outputs M1 and M2 are LOW. The signal circuit is closed.

Signal output and signal circuit

The signal output M1 and the signal circuit operate opposite to OSSDs 1 and 2.

Reset

Automatic reset

The control unit operates without a reset function. If the pressure-sensitive protection device is no longer actuated, the output signal switching device of the control unit automatically changes from the OFF state to the ON state. Without additional start interlock, the machine would start up again immediately.

Manual reset

The control unit operates with a reset function. If the pressure-sensitive protection device is no longer actuated, the output signal switching device of the control unit is in OFF state. This prevents restart of the machine. Only the manual reset command effectuates the change from the OFF state to the ON state.

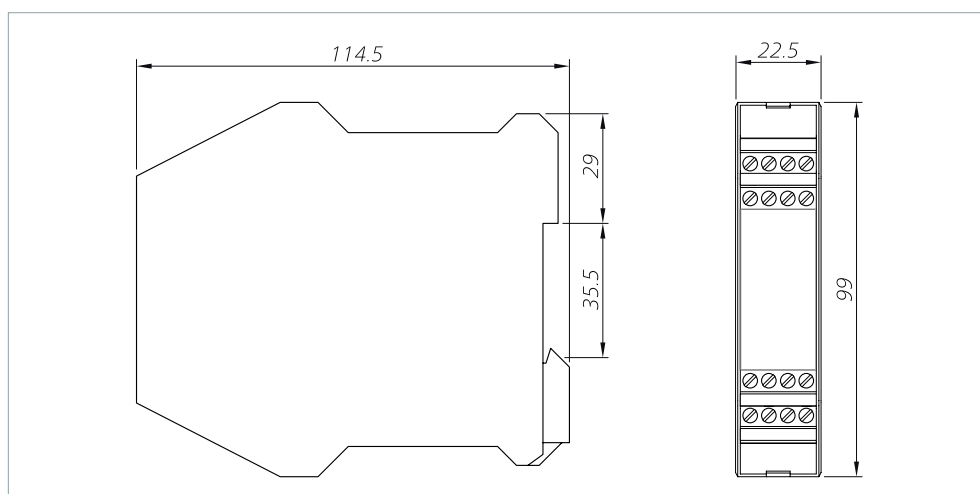
If the reset button is pressed, the OSSDs switch with a delay t_w back to HIGH.

Installation

For your safety, the well-known safety rules also apply for assembly:

- Disconnect all devices and live parts in the immediate vicinity from the power supply.
- Ensure that all devices and live parts cannot be switched back on.
- Test to ensure that all devices and live parts are disconnected from the power supply.

1. Mount the control unit in any position on a 35 mm mounting rail type IEC 60715.

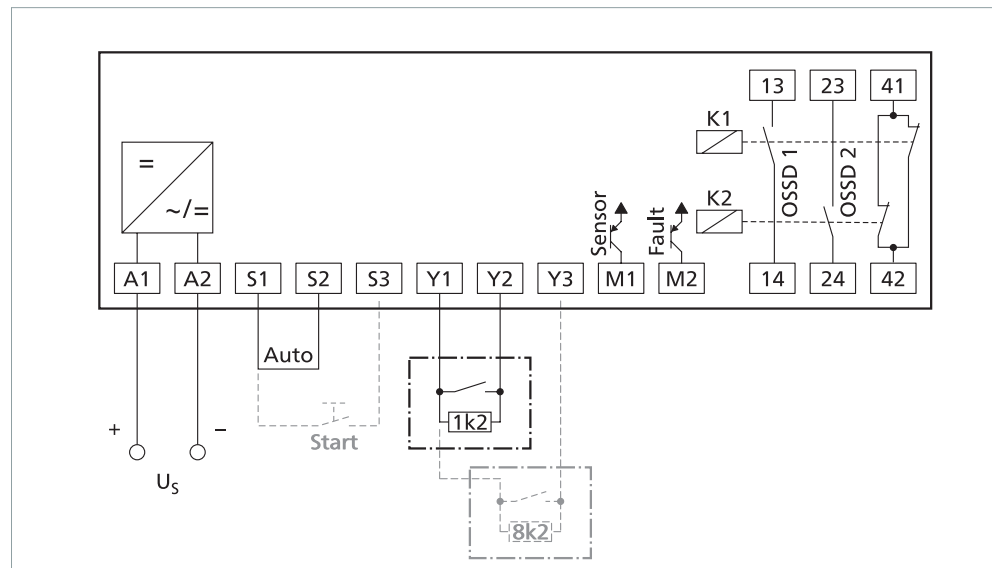


⚠ Caution: Functional impairment due to overheating

If the control unit is overheated due to the effects of external heat, this can result in functional impairment or failure of the pressure-sensitive protection device.

➔ Always ensure sufficient distance from heat sources (at least 2 cm).

2. Wire the sensors, relay contacts and supply voltage to the cable terminals.



Reset

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 outputs

Signal outputs 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.

The second connection to the signal outputs is cable terminal S1. To prevent damage to the device, never use cable terminal A2 with U_s AC.

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.

Signal outputs 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.

The second connection to the signal outputs is cable terminal A2.

Signal output M1: Sensor

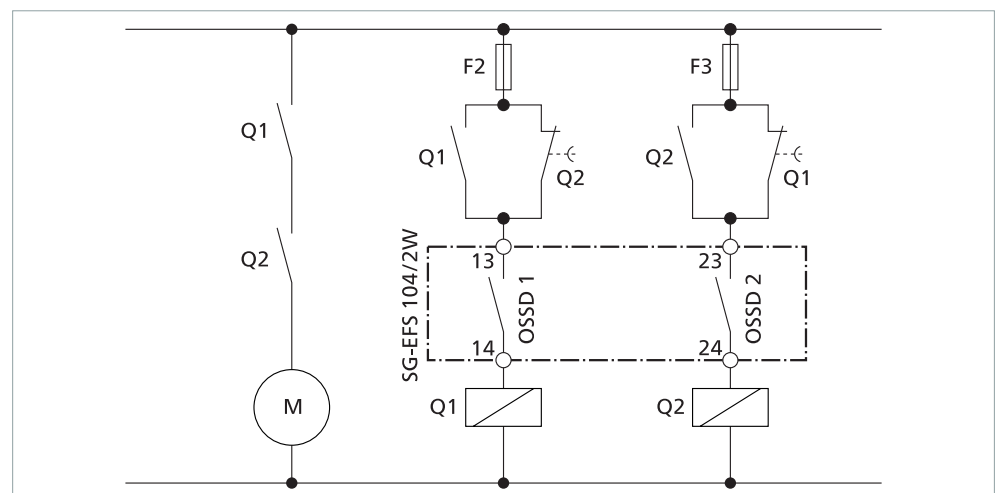
➔ Wire the load between cable terminals M1 and A2.

Signal output M2: Fault

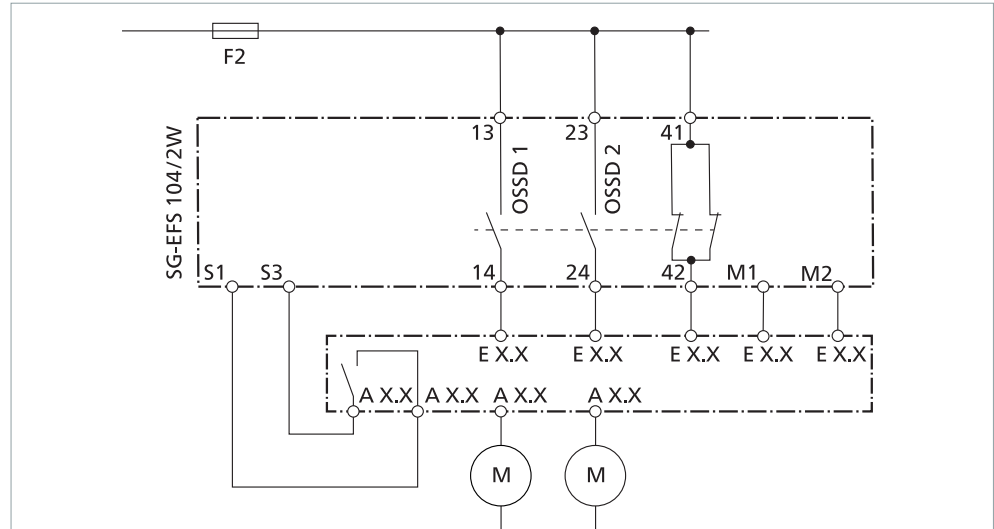
➔ Wire the load between cable terminals M2 and A2

Connection examples

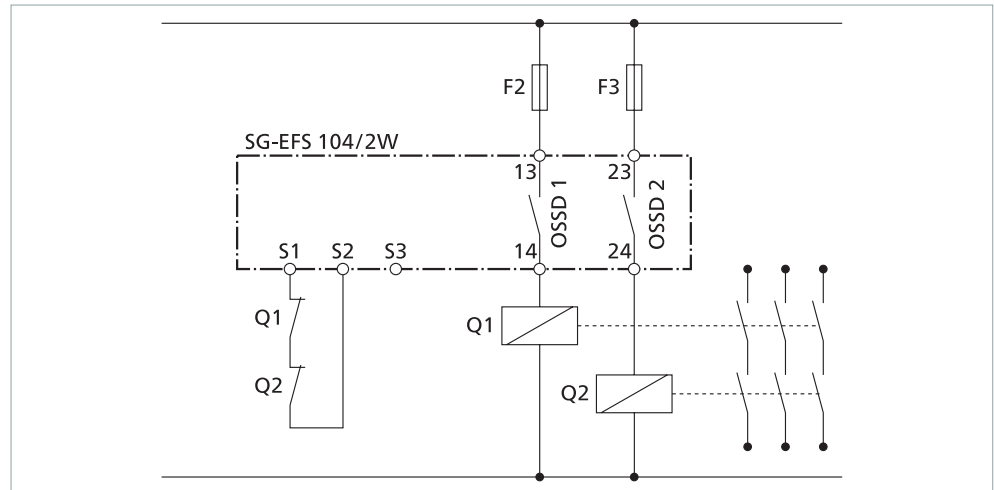
Connection examples 1



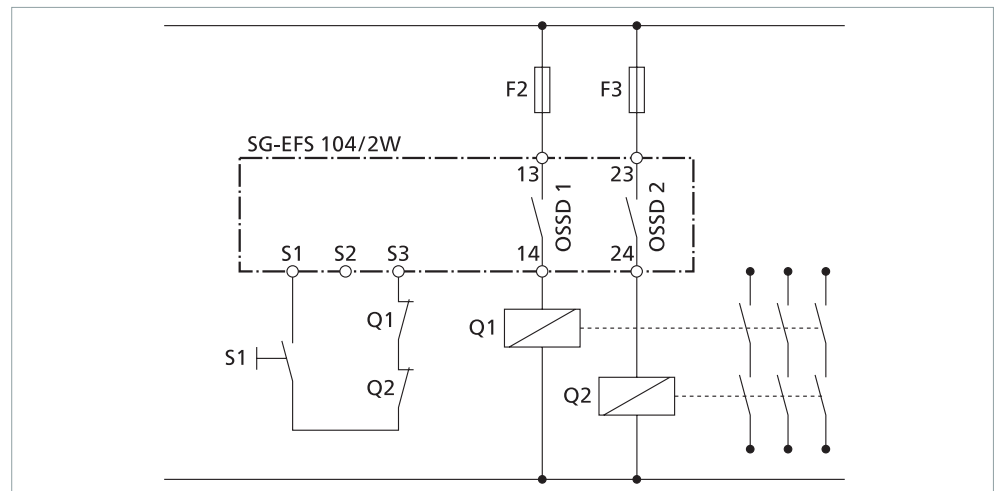
Connection examples 2



Contact duplication with automatic reset



Contact duplication with manual reset



Commissioning

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

⚠ WARNING: Danger of injury due to electrocution
➔ Never unplug plug connections with the power on.

Testing

Automatic reset

1. Make sure no sensors are actuated.
 - green LEDs "Power", "Sensor" and "Output" are lit
 - OSSDs 1 and 2 are closed
 - signal circuit is open
 - signal outputs M1 and M2 are HIGH
2. Actuate sensor.
 - green LEDs "Sensor" and "Output" go out
 - OSSDs 1 and 2 are open
 - signal circuit is closed
 - signal output M1 is LOW and M2 is HIGH
3. Repeat step 1.
4. Disconnect the sensor.
 - green LEDs "Sensor" and "Output" go out
 - red LED "Fault" is on
 - OSSDs 1 and 2 are open
 - signal circuit is closed
 - signal outputs M1 and M2 are LOW
5. Repeat step 1.

When the functional test has been successfully completed the pressure-sensitive protection device is ready for operation.

If the functional test was faulty, see chapter *Troubleshooting and remedies*.

Manual reset

1. Make sure no sensors are actuated.
 - green LEDs "Power" and "Sensor" are lit
 - OSSDs 1 and 2 are open
 - signal circuit is closed
 - signal outputs M1 and M2 are HIGH

2. Activate the reset button.
 - green LEDs "Power", "Sensor" and "Output" are lit
 - OSSDs 1 and 2 are closed
 - signal circuit is open
 - signal outputs M1 and M2 are HIGH

3. Actuate the sensor. (The described state is visible only during actuation of the sensor.)
 - green LEDs "Sensor" and "Output" go out
 - OSSDs 1 and 2 are open
 - signal circuit is closed
 - signal output M1 is LOW and M2 is HIGH

4. Repeat steps 1 and 2.

5. Disconnect the sensor.
 - green LEDs "Sensor" and "Output" go out
 - red LED "Fault" is on
 - OSSDs 1 and 2 are open
 - signal circuit is closed
 - signal outputs M1 and M2 are LOW

6. Repeat steps 1 and 2.

When the functional test has been successfully completed the pressure-sensitive protection device is ready for operation.

If the functional test was faulty, see chapter *Troubleshooting and remedies*.

Pressure-sensitive protection device actuated

As long as the pressure-sensitive protection device remains actuated, the output signal switching devices of the control unit remain in the safe OFF state.

If actuation of the pressure-sensitive protection device ends, different states are possible on the output signal switching devices of the control unit. This depends on the selected reset type (see chapter *Operation*, subchapter *Reset*).

Correlations

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

Decommissioning

- ➔ Switch off the pressure-sensitive protection device and safeguard it from being switched back on unintentionally.
- ➔ Affix a clear warning on the pressure-sensitive protection device warning that states it is temporarily or definitively decommissioned.

Recommissioning

- ➔ Carry out commissioning (see chapter *Commissioning*).

Maintenance and cleaning

Maintenance

The control unit is maintenance-free.

- ➔ Repeat the operational test monthly.

Cleaning

- ➔ 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 LED “Sensor” is on and 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 OSSD 2 is open	Control unit is faulty	➔ Replace control unit
Red LED “Fault” is on and signal output M2 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?
	Cable break	➔ Replace sensor

The fault can still not be removed?

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

➔ In case of queries, have the information on the type plate at hand.

Type plate

A type plate for identification of the control unit is affixed on the side.

Replacement parts

⚠ **CAUTION Overall safety endangered**

If the sensor is not replaced with original Mayser parts, operation of the protective device may be impaired.

➔ Only use original parts from Mayser.

Disposal

Control unit

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

Packaging

- Wood, cardboard, plastics

➔ Observe the following with respect to disposal:

- Comply with the relevant national disposal regulations and legal stipulations for these materials.
- If you engage a disposal firm, make sure that a list of the above materials is included.
- Materials should be recycled or disposed of in an eco-friendly manner.

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				
ISO 13856: Reset function	with/without		with/without	
ISO 13849-1:2015	Category 3 PL d		Category 3 PL d	
MTTF _d	257 a		257 a	
DC _{avg}	60 %		60 %	
B _{10d} (Load: DC 24 V / 1 A)	1.8× 10 ⁶		1.8× 10 ⁶	
n _{op} (estimate)	52560 per year		52560 per year	
CCF	Requirements fulfilled		Requirements fulfilled	
IEC 60664-1: creep distance and air gap	Contamination level 2, overvoltage category III / 250 V, basic insulation		Contamination level 2, overvoltage category III / 250 V, basic insulation	
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
Resistivity	≤ 10 Ohm	≤ 10 Ohm	≤ 10 Ohm	≤ 10 Ohm
Cable 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				
Automatic	S1, S2		S1, S2	
Manual	S1, S3		S1, S3	
Cable length (max.)	30 m		30 m	

SG-EFS 104/2W	AC 24 V	DC 24 V
Outputs		
OSSD 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 as per IEC 60947-5-1	AC-12: 250 V / 4 A DC-12: 24 V / 4 A	AC-12: 250 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 DC 20 to 29 V	DC 18 to 22 V DC 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
IEC 60529: Degree of protection	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
2006/42/EC: Emission sound pressure level	< 70 dB(A)	< 70 dB(A)
Dimensions (W × H × D)	22.5 × 99 × 114.5mm	22.5 × 99 × 114.5mm
Weight	180 g	180 g