



Control unit SG-EFS 104/4L



EN | Operating instructions

Version 2

1004128 SG-EFS 104/4L AC/DC 24 V

Mayser GmbH & Co. KG

Örlinger Strasse 1–3

89073 Ulm

GERMANY

Tel.: +49 731 2061-0

Fax: +49 731 2061-222

E-mail: info.ulm@mayser.com

Website: www.mayser.com

Original instructions

Safety first!



- Read the instructions carefully before use.
- The warnings in the instructions are there to warn you of any unexpected dangers. Always heed the warnings.
- Keep the instructions somewhere safe so you can refer to them throughout the product's entire service life.
- Pass the instructions on to every subsequent owner or user of the product.
- Add any supplement received from the manufacturer to the instructions.
- **Observe the information under "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/EU (RoHS)
- 2014/30/EU (EMC)

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

EC type examination

The product was tested by an independent institute.

There is an EC type examination certificate to confirm conformity.

The EC type examination certificate is stored in the Downloads section of our website: www.mayser.com.



The design type of the product complies with the basic requirements of the following UK Statutory Instruments:

- 2008 No. 1597 (Machinery)
- 2012 No. 3032 (RoHS)
- 2016 No. 1091 (EMC)

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

UL certification



The design type of the product complies with the basic requirements of UL certification:

- UL 508

Table of contents

About these instructions	4
Safety.....	5
Intended use	5
Safety instructions.....	5
Residual dangers	6
Parts supplied	7
Storage	7
Product overview.....	7
Connections.....	7
LED information.....	8
Function	8
Reset.....	9
Automatic reset.....	9
Controlled reset and manual reset	9
Installation.....	9
Reset.....	11
Automatic reset.....	11
Controlled reset.....	11
Manual reset	11
Signal output.....	11
Connection examples	12
Commissioning.....	13
Testing the function.....	13
Automatic reset.....	13
Controlled reset and manual reset	14
Protective device activated	14
Correlations	15
Decommissioning	15
Recommissioning	15
Maintenance and cleaning.....	15
Maintenance	15
Cleaning	15
Troubleshooting and remedies	16
Replacement parts	17
Disposal	17
Technical data.....	18

Copyright

The reproduction, distribution and utilisation of this document as well as the communication of its contents without express authorisation is 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 2023

About these instructions

These instructions are part of the product.
 Mayser accepts no responsibility or warranty claims for damage and consequential damage due to failure to observe the instructions.

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

Target group These instructions are intended for the operating company and for electrically skilled persons. The electrically skilled person must be familiar with installation and commissioning.

Other applicable documents → Please also observe the following documents:

- Drawing of the sensor system (optional)
- Wiring diagram (optional)
- Installation instructions for the sensors used

Symbols used

Symbol	Meaning
→ ...	Action with one step or with more than one step where the order is not relevant.
1. ...	Action with more than one step where the order is relevant.
• ... - ...	Bullets first level Bullets second level
(See <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 risk of damage to property or the environment. Information on easier and safer working practices.

Measurements used in drawings

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

Safety

Intended use

The control unit is designed for processing the signals of a pressure-sensitive protection device (PSPD). It evaluates the output signals of BK-type sensors. The integrated output signal switching devices (OSSDs) transmit the evaluated safety signals directly to the downstream control.

The product complies with ISO 13849-1:2015 category 3 PL e. To prevent any reduction in the safety classification, the downstream control must be of the same category or higher.

Safety instructions

For your **own safety**, you must adhere to the following safety instructions.

➔ **Avoid electric shocks**

To avoid electrical injuries, disconnect electrical systems from the power supply and secure them to prevent them being switched back. Do this before you start working on them.

➔ **Take care when setting up the interface**

Overall safety is affected by the quality and reliability of the interface between the protection device and the machine. Take particular care when setting up the interface.

➔ **Prevent the machine from restarting**

Prevent the machine from restarting while a hazard exists, e.g. by using a starting lockout.

➔ **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 by decommissioning it.

➔ **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**, you must observe the following safety instructions.

➔ **Do not open the control unit**

Never open, tamper with or alter the control unit.

→ Observe protection class

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

→ Ensure sufficient clearance

When installing the product in a switch cabinet, ensure sufficient clearance from heat sources (at least 2 cm).

→ Check supply voltage

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

→ Observe correct terminal assignment

Observe the correct terminal assignment when connecting the supply voltage.

→ Do not exceed maximum number of sensors

Do not connect more sensors to the control unit than the maximum number specified in the sensor installation instructions.

→ Protect relay contacts

Risk of contact welding: provide the relay contacts with external fuse protection.

→ 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 circuits) to the consumer.

→ Do not interconnect control units

Do not combine control units by interconnecting them.
Terminals Y11, Y12 and Y21, Y22 are not voltage-free.

→ Continue redundancy

Make sure you wire the unit directly in the control circuit or that two channels continue to be used in the downstream control.

Residual dangers

There are no known residual dangers associated with this product.

Parts supplied

1x control unit

Enclosure with electronics module and terminal cover.

1x operating instructions

1x Declaration of Conformity

➔ Upon receipt, immediately check the parts supplied to ensure they are complete and in good condition.

Storage

➔ Store control units in a dry place inside the original packaging.

➔ Observe the storage temperature in accordance with the technical data.

Product overview

Connections

Connections:

Supply voltage

BK-type sensor

OSSD 1

OSSD 2

OSSD 3

Signal output

Bridge for automatic reset

Manual reset button

Terminals:

A1, A2

Y11, Y12

Y21, Y22

13, 14

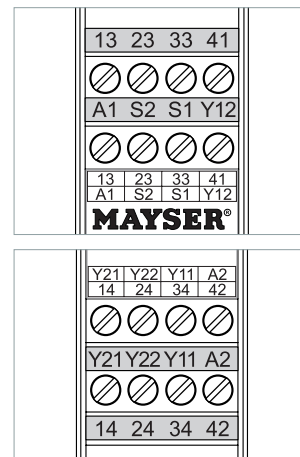
23, 24

33, 34

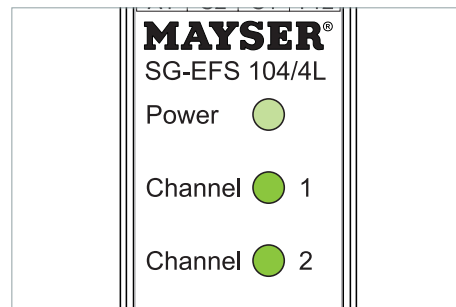
41, 42

S1, S2

S1, S2



LED information



- Light-green "Power" LED: supply voltage connected
- Green "Channel 1" LED: relay K1 picked up
- Green "Channel 2" LED: relay K2 picked up

Function

The single-fault-safe electronics module has dual channels (redundant design). Each channel controls a force-guided relay and additionally monitors the relay of the other channel. The relays control OSSD 1 (terminals 13, 14), OSSD 2 (terminals 23, 24) and OSSD 3 (terminals 33, 34). The electronic system monitors the connected BK-type sensors.

Ready for operation

The control unit is operated with a voltage of 24 V AC/DC. When the supply voltage is connected, the light-green "Power" LED lights up.

**Terminology: ON state,
OFF state according to
ISO 13856**

When the sensor is not activated, and after a reset, OSSDs 1, 2 and 3 are in the ON state and the signal output is open. The green "Channel 1" and "Channel 2" LEDs light up.

Sensor activated

If the sensor is activated, then OSSDs 1, 2 and 3 are in the OFF state; the signal output is closed. The green "Channel 1" and "Channel 2" LEDs go out.

Sensor cable break

In the event of a cable break on the sensor, OSSDs 1, 2 and 3 are in the OFF state; the signal output is closed. The green "Channel 1" and "Channel 2" LEDs go out.

Signal output

The signal output (terminals 41, 42) works the opposite way round to OSSDs 1, 2 and 3.

Reset

Automatic reset

The control unit works without a reset function. If the protective device stops being actuated, the output signal switching device of the control unit automatically switches from the OFF state to the ON state after a delay t_w . Without an additional starting lockout, the machine would start up again immediately.

Controlled reset and manual reset

The control unit works with a reset function. If the protective device stops being actuated, the output signal switching devices of the control unit remain in the OFF state. This prevents the machine from restarting. Only a "Reset" command will change the state from OFF to ON.

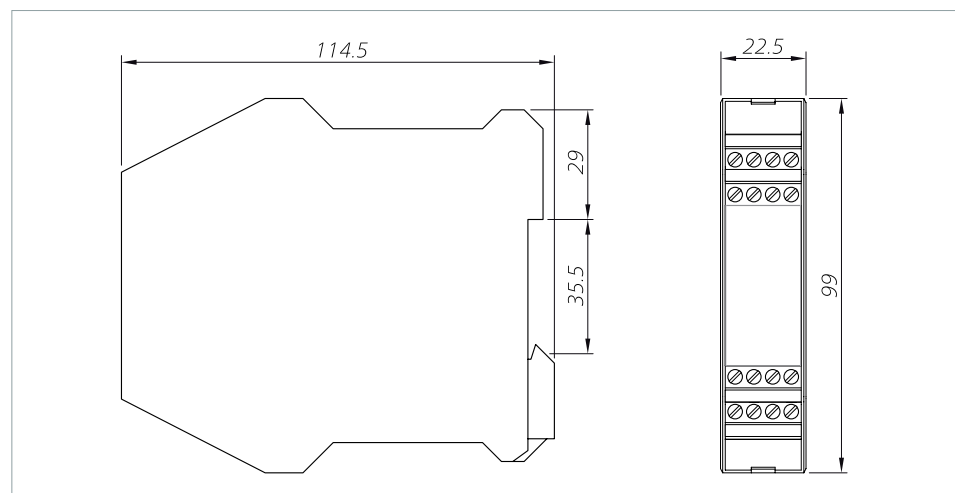
If the machine controls send a reset command or if the reset button is pressed, the OSSDs switch from the OFF state to the ON state after a delay t_w .

Installation

For your own safety, you must also adhere to the following familiar rules during installation:

- Disconnect from the power supply all devices and live parts that are located in the immediate vicinity.
- Secure them to prevent them being switched back on.
- Check that they are de-energised.

1. Fix the control unit in any position on a 35°mm mounting rail acc. to IEC 60715.

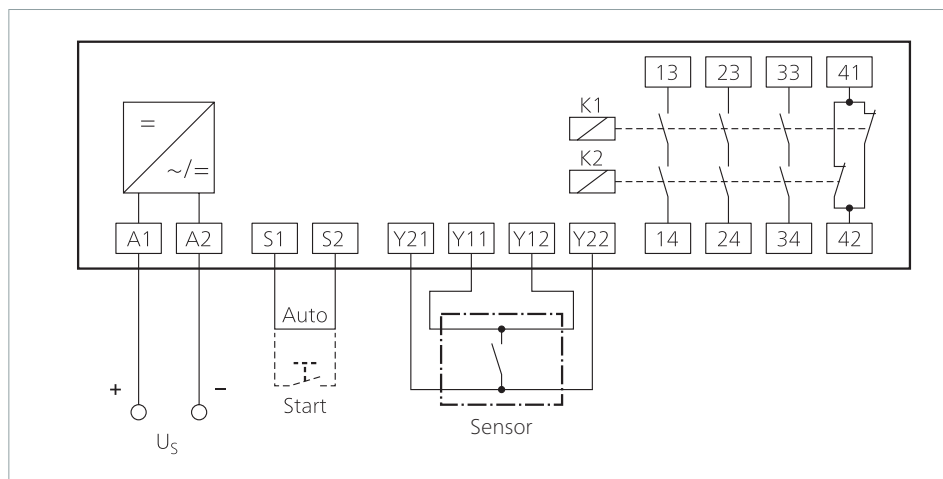


⚠ Caution Impaired operation due to overheating

If the control unit overheats as a result of external heat, operation of the protective device may be impaired or it may fail completely.

➔ It is absolutely essential to ensure sufficient clearance from heat sources (at least 2 cm).

2. Wire the sensors, OSSDs and supply voltage to the cable terminals.
(UL: use 60/75 °C copper wire only)



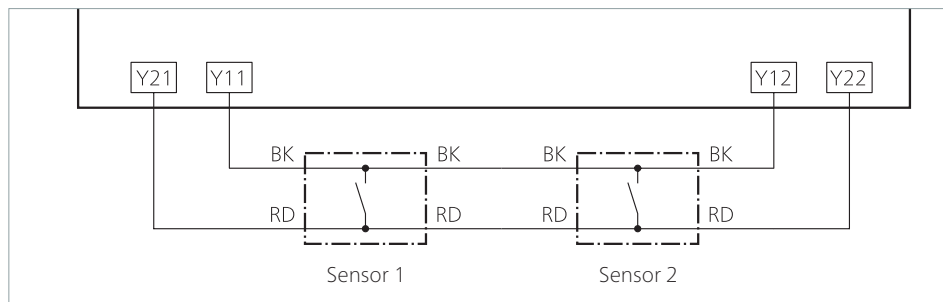
➔ Tighten the screws of the cable terminals to a torque of between 0.5 and 0.6 Nm.

(UL: overtightening may cause enclosure breakage.)

The two contact surfaces of the sensor act as bridges between connections Y11 and Y12 and connections Y21 and Y22 respectively. This is the only way to ensure proper monitoring of the sensor and detection of a cable break.

➔ Pay careful attention to paths that are supposed to have single-colour wiring from end to end, e.g. red wires at both Y21 and Y22.

➔ Always connect multiple sensors in series:



Colour coding:

BK	Black
BU	Blue
BN	Brown
RD	Red
WH	White

Cable	Sensor	Y21	Y11	Y12	Y22
2× 2-core	SM8, SL	WH	BN	BN	WH
2× 2-core	SM, SP, SL, SB	RD	BK	BK	RD
2× 2-core	SM11	BU	BN	BN	BU
1× 4-core	SM, SB	BU	BK	BN	WH

Reset

Automatic reset

A bridge must be inserted to trigger an automatic reset (without the reset function).

- ➔ Insert a bridge between cable terminals S1 and S2.

Controlled reset

In order for a controlled reset to be performed via the machine controls (with the reset function), a NO contact of the controls must be connected.

- ➔ Connect the wiring for the NO contact of the machine controls between cable terminals S1 and S2.

Manual reset

In order for a manual reset to be performed (with the reset function) a button must be connected.

- ➔ Wire up a button between cable terminals S1 and S2.

Integrate the circuits for enabling the machine

- ➔ Connect the NC contacts of the external contactors to the reset button at cable terminals S1 and S2, ensuring they are connected in series (see *Connection examples*).

Caution Automatic reset due to jammed/sticking reset button

If the protective device stops being actuated, the OSSDs automatically switch from the OFF state to the ON state. Risk of injury or property damage due to unexpected restart.

- ➔ It is essential to use a high-quality button.
- ➔ Test the function of the button regularly (at least once a month).

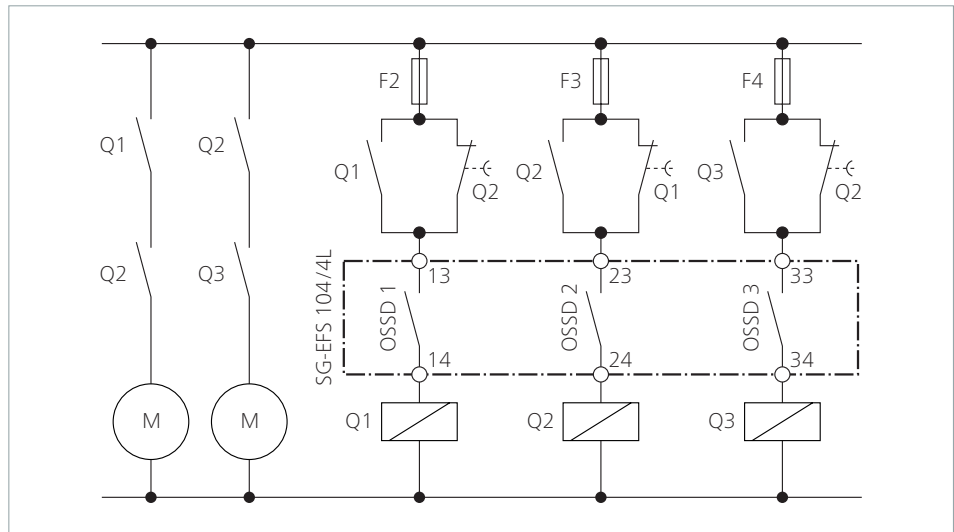
Signal output

The signal output is a voltage-free relay contact (NC contact). Its operation is inverted compared to OSSDs 1, 2 and 3.

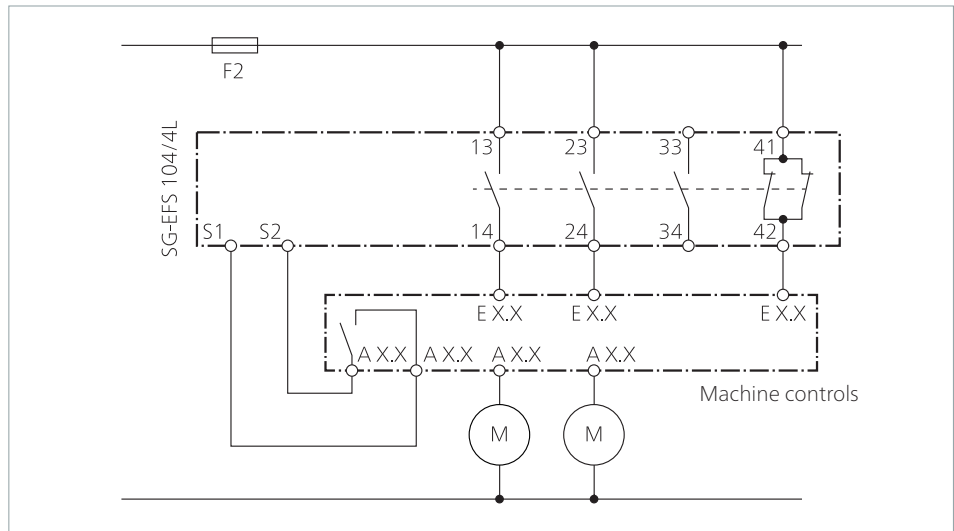
- ➔ Wire the load between cable terminals 41 and 42.

Connection examples

Connection example 1

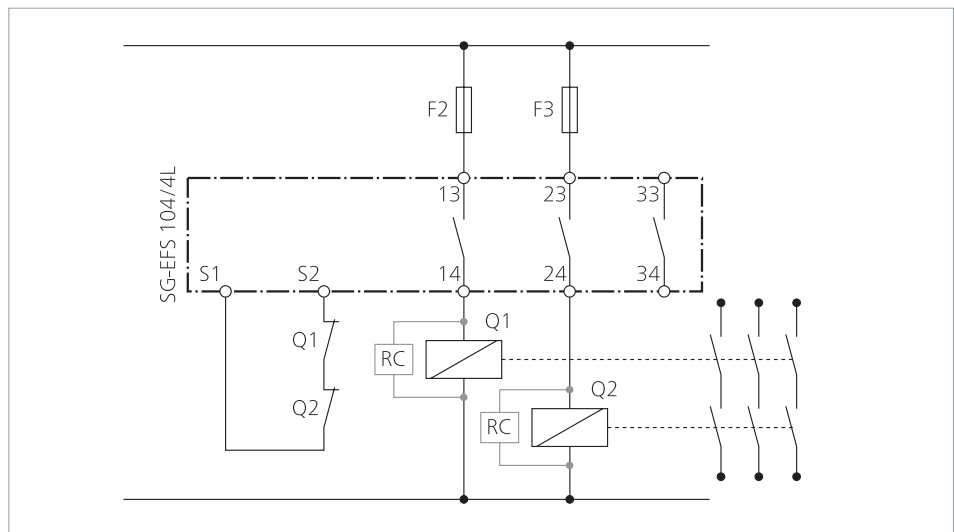


Connection example 2



Connection example 3

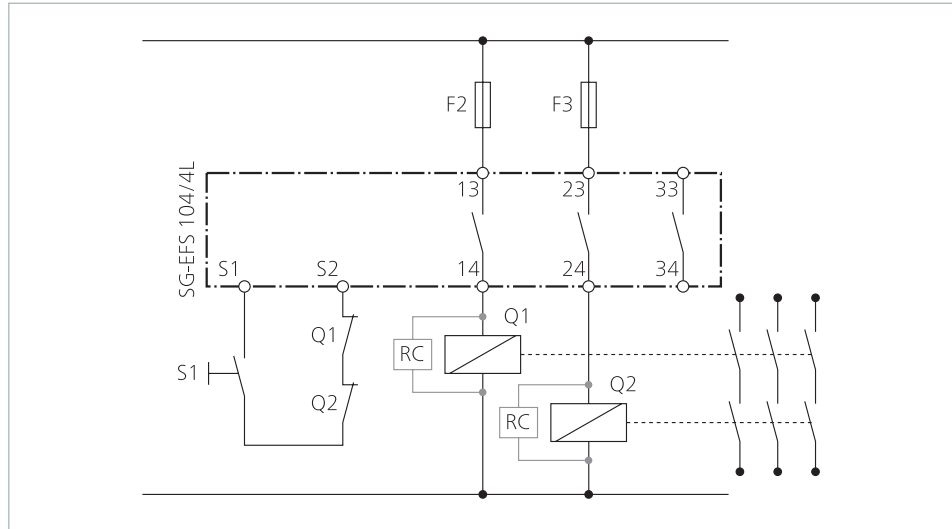
Automatic reset
Contact multiplication



Connection example 4

Manual reset

Contact multiplication



Commissioning

➔ Connect the supply voltage.

Testing the function

Automatic reset

1. Make sure no sensors are activated.
 - The green "Power", "Channel 1" and "Channel 2" LEDs light up
 - OSSDs 1, 2 and 3 are in the ON state
 - The signal output is open
2. Activate the sensor.
 - The green "Channel 1" and "Channel 2" LEDs go out
 - OSSDs 1, 2 and 3 are in the OFF state
 - The signal output is closed
3. Disconnect the sensor.
 - The green "Channel 1" and "Channel 2" LEDs go out
 - OSSDs 1, 2 and 3 are in the OFF state
 - The signal output is closed

Once the functional test has been successfully completed, the protective device is ready for operation.

If the functional test could not be completed correctly, see *Troubleshooting and remedies*.

Controlled reset and manual reset

1. Make sure no sensors are activated.
 - The green "Power" LED lights up
 - OSSDs 1, 2 and 3 are in the OFF state
 - The signal output is closed
2. Trigger a reset command via the machine controls or press the reset button.
 - The green "Power", "Channel 1" and "Channel 2" LEDs light up
 - OSSDs 1, 2 and 3 are in the ON state
 - The signal output is open
3. Activate the sensor.
 - The green "Channel 1" and "Channel 2" LEDs go out
 - OSSDs 1, 2 and 3 are in the OFF state
 - The signal output is closed
4. Repeat step 2.
5. Disconnect the sensor.
 - The green "Channel 1" and "Channel 2" LEDs go out
 - OSSDs 1, 2 and 3 are in the OFF state
 - The signal output is closed

Once the functional test has been successfully completed, the protective device is ready for operation.

If the functional test could not be completed correctly, see *Troubleshooting and remedies*.

Protective device activated

Throughout the entire time the protective device remains activated, the OSSDs stay in the OFF state.

If the protective device stops being activated, various states are possible for the OSSDs. This depends on which reset type is selected (see *Function, Reset*).

Correlations

LEDs			Outputs		Meaning
Power light green	Channel 1 green	Channel 2 green	13, 14 23, 24 33, 34	41, 42	LED off: ○ LED on: ●
○	○	○	OFF	OFF	No supply voltage
●	○	○	OFF	ON	Supply voltage connected; sensor not activated; no reset signal
●	●	●	ON	OFF	Control unit ready for operation
●	○	○	OFF	ON	Sensor activated or fault on sensor (cable break)
●	●	○	OFF	ON	Incorrect supply voltage or faulty control unit
●	○	●	OFF	ON	Incorrect supply voltage or faulty control unit

Decommissioning

- ➔ Disconnect the protective device and secure it to prevent unintentional reconnection.
- ➔ Attach a clear notice to the protective device stating that it is temporarily or permanently out of service.

Recommissioning

- ➔ Carry out the commissioning process (see *Commissioning*).

Maintenance and cleaning

Maintenance

The control unit is maintenance-free.

- ➔ Repeat the functional test monthly.

Cleaning

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

Troubleshooting and remedies

Prerequisites:

- The sensor system has passed the latest test (see sensor installation instructions).
- The control unit is connected to the supply voltage and sensor.
- No sensor is activated.

Fault indication	Possible cause	Remedy
Light-green "POWER" LED does not light up	No or incorrect supply voltage	1. Check supply voltage, compare with type plate 2. Check terminal assignment
	If supply voltage is correctly connected: control unit is faulty	➔ Replace control unit
The green "Channel 1" and "Channel 2" LEDs do not light up	Manual reset: reset button not activated	➔ Press reset button
	Manual reset: connection to button interrupted	➔ Check connection to button
	Manual reset: button jammed/sticking	➔ Replace buttons on S1 and S2
	Automatic reset: bridge missing	➔ Connect bridge between S1 and S2
	Sensor faulty or connection to sensor interrupted	1. Disconnect sensor 2. Bridge connections Y11, Y12 and Y21, Y22 3. Press reset button 4. If LEDs light up: replace sensor
	Control unit faulty	➔ Replace control unit
Only one green channel LED lights up: "Channel 1" or "Channel 2"	Incorrect supply voltage	➔ Check supply voltage, compare with type plate
	Control unit faulty	➔ Replace control unit

Still unable to resolve the fault?

➔ Contact Mayser-Support: Tel. +49 731 2061-0.

➔ In the event of enquiries, have the information from the type plate to hand.

Type plate There is a type plate on the side of the control unit for identification purposes.

Replacement parts

CAUTION Overall safety at risk

Failure to use original Mayser parts when replacing parts of the product can impair the function of the protective device.

➔ Only use original Mayser parts.

Disposal

Control unit The devices produced by Mayser are professional electronic tools exclusively intended for commercial use (known as B2B devices). Unlike the B2C (business-to-consumer) devices mainly used in private households, they must not be disposed of at the collection centres of public waste management 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
- ➔ When disposing of the product:
- Ensure compliance with the relevant national disposal regulations and statutory requirements.
 - Ensure that any disposal company you use receives a list of the aforementioned materials along with the product.
 - Ensure that the materials are recycled or disposed of in an environmentally friendly way.

Technical data

SG-EFS 104/4L	AC 24 V	DC 24 V
Testing basis	EN 12978, ISO 13849-1, ISO 13856-1, ISO 13856-2, ISO 13856-3	
Connecting voltage U_s		
Nominal voltage	AC 24 V	DC 24 V
Voltage tolerance	-10 to +10%	-10 to +10%
Nominal current	280 mA	86 mA
Nominal frequency	50 to 60 Hz	-
External fuse protection	-	-
Power consumption	< 5 VA	< 3 W
Times		
Reaction time t _a	< 50 ms	< 30 ms
Restart time t _w	< 500 ms	< 500 ms
Safety classifications		
ISO 13856: reset function	With/without	With/without
ISO 13849-1:2015	Category 3 PL e	Category 3 PL e
MTTF _D	100 a	100 a
DC _{avg}	90%	90%
B _{10D} (load: DC 24 V / 2 A)	4x 10 ⁵	4x 10 ⁵
n _{op} (assumption)	52560/a	52560/a
CCF	Requirements met	Requirements met
IEC 60664-1: creep distance and air gap	Pollution degree 2, overvoltage category III / 250 V, basic insulation	Pollution degree 2, overvoltage category III / 250 V, basic insulation
Inputs		
Sensor	Y11, Y12 and Y21, Y22	Y11, Y12 and Y21, Y22
Short-circuit resistance	≤ 400 ohms	≤ 400 ohms
Line resistance	≤ 10 ohms	≤ 10 ohms
Line length (max.)	100 m	100 m
Switching thresholds		
Sensor activated	< 1k3 ohms	< 1k3 ohms
Cable break	-	-
Reset	S1, S2	S1, S2
Line length (max.)	30 m	30 m
Outputs		
OSSDs 1, 2 and 3 (NO contact)	13, 14 and 23, 24 and 33, 34	13, 14 and 23, 24 and 33, 34
Signal output (NC contact)	41, 42	41, 42
EN 60947-5-1: utilisation category	AC-12: 250 V / 5 A DC-12: 30 V / 5 A	AC-12: 250 V / 5 A DC-12: 30 V / 5 A
Switching voltage (max.)	AC 230 V DC 24 V	AC 230 V DC 24 V
Switching current (max.)	5 A 5 A	5 A 5 A
Total current (max.)	13.8 A 13.8 A	13.8 A 13.8 A
Switching capacity (max.)	1150 VA 120 W	1150 VA 120 W
Switching operations, mechanical	> 1x 10 ⁷	> 1x 10 ⁷
Switching operations, electrical	> 1x 10 ⁵ (DC 24 V / 2 A)	> 1x 10 ⁵ (DC 24 V / 2 A)
External contact fuse protection		
NO contact	6.3 A quick-acting	6.3 A quick-acting
NC contact	4 A Neozed gL/gG	4 A Neozed gL/gG

SG-EFS 104/4L	AC 24 V	DC 24 V
Mechanical operating conditions		
Cable terminals	4× 4-pin	4× 4-pin
Solid wire	1× 2.5 mm ² or 2× 1.5 mm ²	1× 2.5 mm ² or 2× 1.5 mm ²
Wire with sleeve	1× 2.5 mm ² or 2× 1.5 mm ²	1× 2.5 mm ² or 2× 1.5 mm ²
Tightening torque	0.5 to 0.6 Nm	0.5 to 0.6 Nm
IEC 60529: degree of protection	IP20	IP20
Max. humidity (23 °C)	95%	95%
Operating temperature	–25 to +55 °C (UL: up to +40 °C)	–25 to +55 °C (UL: up to +40 °C)
Storage temperature	–25 to +55 °C	–25 to +55 °C
Impact resistance in operation	2 g	2 g
2006/42/EC and UK S.I. 2008 No. 1597: Emission sound pressure level	< 70 dB(A)	< 70 dB(A)
Dimensions (W × H × D)	22.5 × 99 × 114.5 mm	22.5 × 99 × 114.5 mm
Weight	180 g	180 g