MAYSER®

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Control unit SG-EFS 104/2W

EN | Operating instructions

Version 0.9

1005196 SG-EFS 104/2W AC/DC 24 V

Original instructions

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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

CE

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.

UK CA

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.

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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 *Installation*)	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 sensors with monitoring resistor 8k2 or 10k. 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 d. 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**
Before working on electrical systems, disconnect them from the power supply and secure them to prevent them being switched back on to avoid electrical injuries.

➔ **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 Y1, Y2 and Y3 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.

➔ **Protect against strong electromagnetic pulses**
Protect the control unit from excessive incoming electromagnetic radiation. Strong electromagnetic pulses are capable of triggering a safe OFF on the control unit.

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

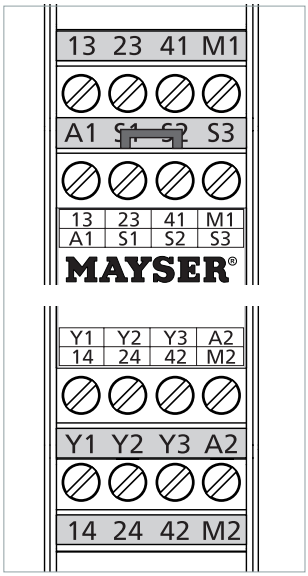
Storage

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

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

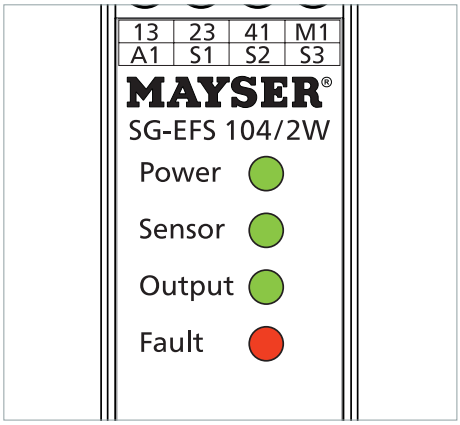
Product overview

Connections



Terminals:	**Connections:**
A1, A2	Supply voltage
	Sensor input:
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	Manual reset button

LED information



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

Function

The single-fault-safe electronics module has dual channels (redundant design). Each channel controls a force-guided relay (OSSD 1 and 2), with each one also responsible for monitoring the other. The electronic system monitors the electrical resistance of the sensor with a defined closed-circuit current.

Terminology: ON state, OFF state according to ISO 13856

Ready for operation

The control unit is operated with a voltage of 24 V AC/DC. When the supply voltage is connected, the green "Power" LED is lit up.
When the sensor is not activated, and after a reset, OSSDs 1 and 2 are in the ON state. The green "Sensor" and "Output" LEDs are lit up and the M1 and M2 signal outputs are set to HIGH. The signal circuit is in the OFF state.

Sensor activated

If the sensor is actuated, OSSDs 1 and 2 switch from the ON state to the OFF state. The green "Sensor" and "Output" LEDs go out, the M1 signal output is set to LOW and the M2 signal output is set to HIGH. The signal circuit is in the ON state.

Sensor cable break

In the event of a cable break on the sensor, OSSDs 1 and 2 are in the OFF state. The red "Fault" LED lights up. The green "Sensor" and "Output" LEDs go out and the M1 and M2 signal outputs are set to LOW. The signal circuit is in the ON state.

Signal circuit

The signal circuit works the opposite way round to OSSDs 1 and 2.

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.

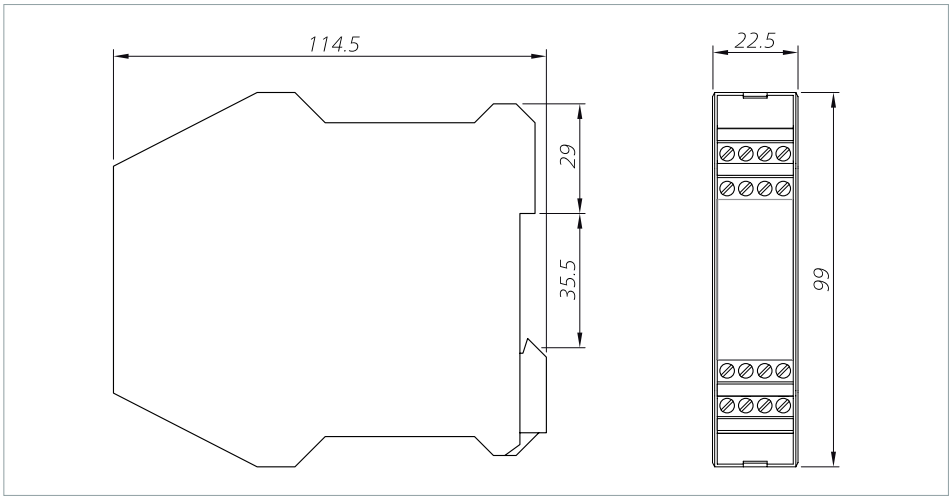
Manual reset
The control unit works with a reset function. If the protective device stops being actuated, the output signal switching devices of the control unit remain in the OFF state. This prevents the machine from restarting. Only a "Reset" command will change the state from OFF to ON.
If the reset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

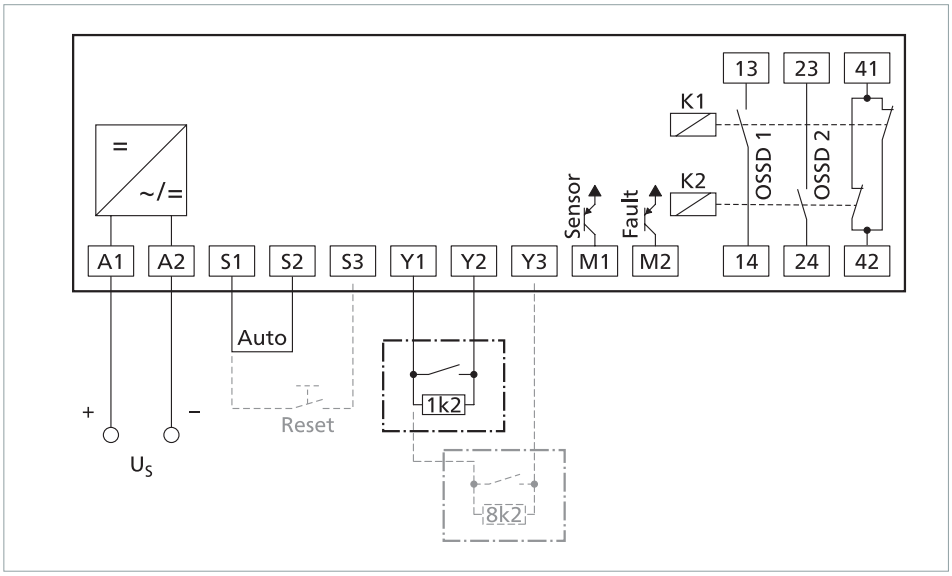
- Disconnect from the power supply all devices and live parts that are located in the immediate vicinity.
- Secure them to prevent them being switched back on.
- Check that they are de-energised.

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, relay contacts and supply voltage to the cable terminals.



Reset

Automatic reset
A bridge must be inserted to trigger an automatic reset (without the reset function). The unit is supplied with a bridge already connected between cable terminals S1 and S2.

➔ Check whether the bridge is connected 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 between cable terminals S1 and S3. The control unit reacts when the button changes from "activated" to "not activated", i.e. if the button sticks, no reset function is initiated.

➔ 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
Signal outputs M1 and M2 are semiconductor outputs and are short-circuit-proof. In the HIGH state, a voltage of 20 to 29 V DC is applied, depending on the load and supply voltage.
Cable terminal S1 forms the second connection to the signal outputs. To prevent damage to the device, never use cable terminal A2 in conjunction 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
Signal outputs M1 and M2 are semiconductor outputs and are short-circuit-proof. In the HIGH state, a voltage of 18 to 22 V DC is applied, depending on the load and supply voltage.
Cable terminal A2 forms the second connection to the signal outputs.

Signal output M1: sensor

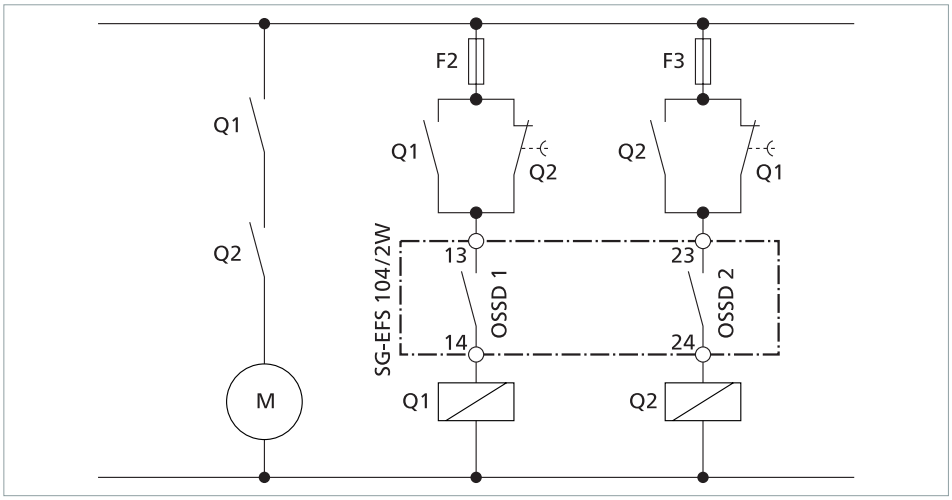
➔ Wire the load between cable terminals M1 and A2.

Signal output M2: fault

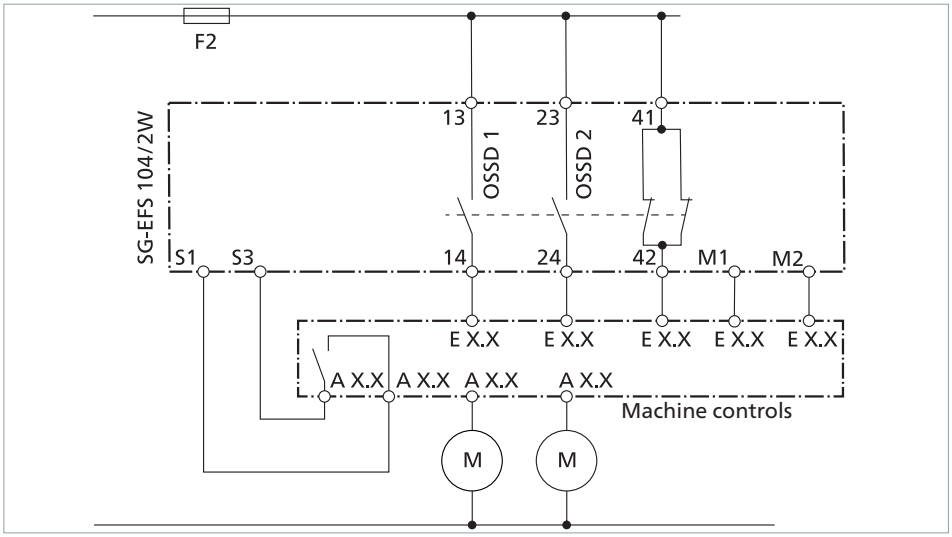
➔ Wire the load between cable terminals M2 and A2.

Connection examples

Connection example 1



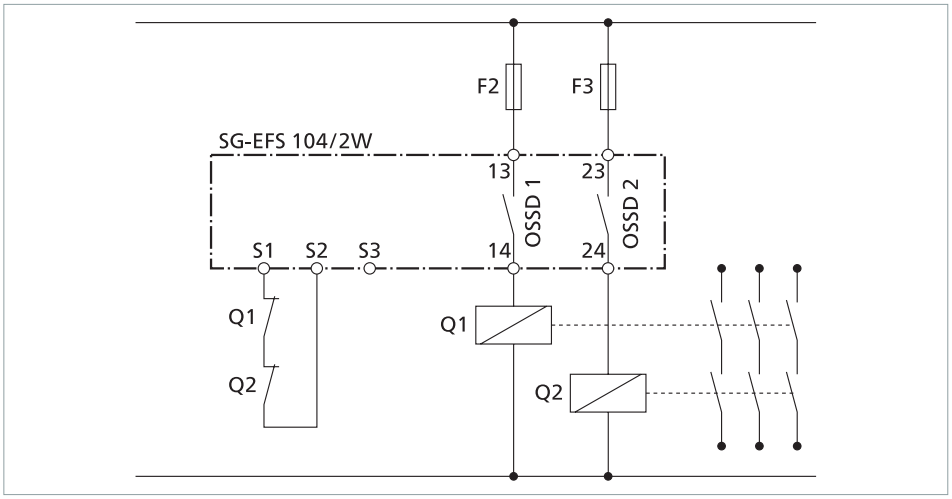
Connection example 2



Connection example 3

Automatic reset

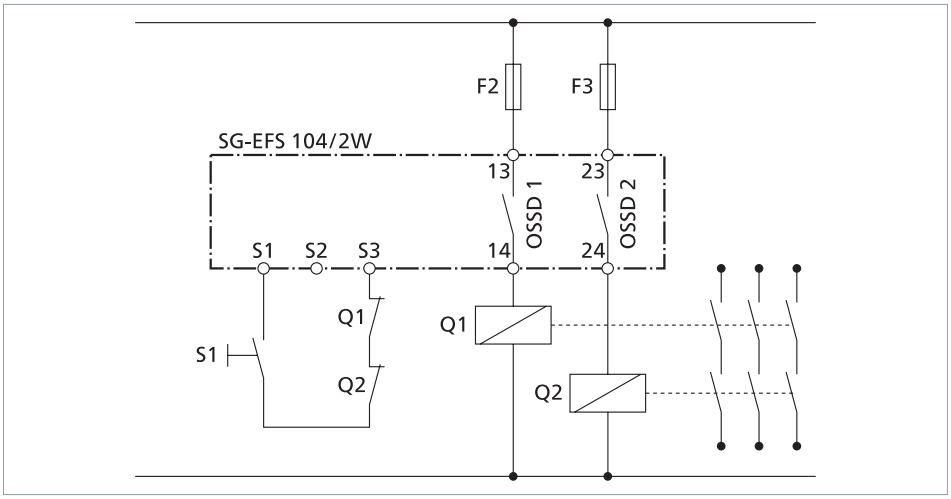
Contact multiplication



Connection example 4

Manual reset

Contact multiplication



Commissioning

1. Make sure the plug connections are firmly attached.

2. Connect the supply voltage.

⚠ **WARNING Danger of injury from electric shock**
➔ Never unplug plug-in connectors while live.

Testing the function

Automatic reset

1. Make sure no sensors are activated.
   - Green "Power", "Sensor" and "Output" LEDs light up
   - OSSDs 1 and 2 are closed
   - Signal circuit open
   - Signal outputs M1 and M2 are set to HIGH

2. Activate the sensor.
   - Green "Sensor" and "Output" LEDs go out
   - OSSDs 1 and 2 are open
   - Signal circuit closed
   - Signal output M1 is set to LOW and M2 is set to HIGH

3. Repeat step 1.

4. Disconnect the sensor.
   - Green "Sensor" and "Output" LEDs go out
   - Red "Fault" LED lights up
   - OSSDs 1 and 2 are open
   - Signal circuit closed
   - Signal outputs M1 and M2 are set to LOW

5. Repeat step 1.

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*.

Manual reset

1. Make sure no sensors are activated.
   - Green "Power" and "Sensor" LEDs light up
   - OSSDs 1 and 2 are open
   - Signal circuit closed
   - Signal outputs M1 and M2 are set to HIGH

2. Activate the reset button.
   - Green "Power", "Sensor" and "Output" LEDs light up
   - OSSDs 1 and 2 are closed
   - Signal circuit open
   - Signal outputs M1 and M2 are set to HIGH

3. Activate the sensor (the described state is only visible while the sensor is being activated).
   - Green "Sensor" and "Output" LEDs go out
   - OSSDs 1 and 2 are open
   - Signal circuit closed
   - Signal output M1 is set to LOW, M2 is set to HIGH

4. Repeat steps 1 and 2.

5. Disconnect the sensor.
   - Green "Sensor" and "Output" LEDs go out
   - Red "Fault" LED lights up
   - OSSDs 1 and 2 are open
   - Signal circuit closed
   - Signal outputs M1 and M2 are set to LOW

6. Repeat steps 1 and 2.

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 green	Sensor green	Output green	Fault red	13, 14 23, 24	41, 42	M1	M2	LED off: ○ LED on: ●
○	○	○	○	Open	Closed	LOW	LOW	No supply voltage
●	●	○	○	Open	Closed	HIGH	HIGH	Supply voltage connected; sensor not activated; no reset signal
●	●	●	○	Closed	Open	HIGH	HIGH	Control unit ready for operation
●	○	○	○	Open	Closed	LOW	HIGH	Sensor activated
●	○	○	●	Open	Closed	LOW	LOW	Fault on sensor (cable break)

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
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
Green "Sensor" LED does not light up **and** signal output M1 is set to LOW	Incorrect monitoring resistor on the sensor	➔ Connect sensor to monitoring resistor 1k2 or 8k2
	Sensor incorrectly connected	➔ Check terminal assignment ➔ 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 "Sensor" LED lights up **and** green "Output" LED does not light up	Manual reset: reset button not activated	➔ Activate reset button
	Manual reset: connection to button interrupted	➔ Check connection to button
	Manual reset: button jammed/sticking	➔ Replace buttons on S1 and S3
	Automatic reset: bridge missing	➔ Connect bridge between S1 and S2
	Control unit is faulty	➔ Replace control unit
Green "Power", "Sensor" and "Output" LEDs light up **and** switch channel K2 is open	Control unit is faulty	➔ Replace control unit
Red "Fault" LED lights up **and** signal output M2 is LOW	Incorrect monitoring resistor on the sensor	➔ Connect sensor to monitoring resistor 1k2 or 8k2
	Sensor incorrectly connected	➔ Check terminal assignment ➔ Sensor with 1k2 connected to Y1 and Y2? ➔ Sensor with 8k2 connected to Y1 and Y3?
	Cable break	➔ Replace sensor

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 control units 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 104/2W	AC 24 V		DC 24 V	
Testing basis	EN 12978, EN 61000-6-3, 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	70 mA		60 mA	
Nominal frequency	50 to 60 Hz		–	
External fuse protection	200 mA time-lag		200 mA time-lag	
Power consumption	< 4 VA		< 3 W	
Times				
Reaction time t_a	< 15 ms		< 15 ms	
Restart 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} (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	Y1, Y2	Y1, Y3	Y1, Y2	Y1, Y3
Monitoring resistor	1k2 Ohm	8k2 Ohm	1k2 Ohm	8k2 Ohm
Short-circuit resistance	≤ 400 ohms	≤ 400 ohms	≤ 400 ohms	≤ 400 ohms
Line resistance	≤ 10 ohms	≤ 10 ohms	≤ 10 ohms	≤ 10 ohms
Line length (max.)	100 m	100 m	100 m	100 m
Switching thresholds				
Sensor activated	< 0.6 kiloohms	< 4 kiloohms	< 0.6 kiloohms	< 4 kiloohms
Cable break	> 1k8 ohms	> 12 kiloohms	> 1k8 ohms	> 12 kiloohms
Reset				
Automatic	S1, S2		S1, S2	
Manual	S1, S3		S1, S3	
Line length (max.)	30 m		30 m	

SG-EFS 104/2W	AC 24 V		DC 24 V	
Outputs				
OSSDs 1 and 2 (NO contact)	13, 14 and 23, 24		13, 14 and 23, 24	
Signal circuit (NC contact)	41, 42		41, 42	
Utilisation category	AC-12: 250 V / 4 A		AC-12: 250 V / 4 A	
in accordance with IEC 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)	
External contact fuse protection	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
Signal type	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-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	
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 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	