

ifm electronic

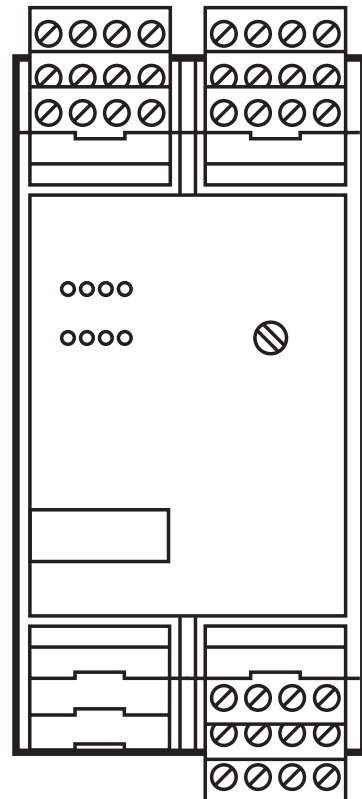


Original operating instructions
Safety relay with relay outputs
with and without delay

UK

efector100[®]
G1502S

80236318 / 00 02 / 2016



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1 Preliminary note

The instructions are part of the unit. They are intended for authorised persons according to the EMC, Low Voltage Directive and Machinery directives and safety regulations.

The instructions contain information about the correct handling of the product. Read the instructions before use to familiarise yourself with operating conditions, installation and operation.

Adhere to the safety instructions.

1.1 Symbols used

▶ Instruction

> Reaction, result

→ Cross-reference

○ LED off

● LED on

☒ LED flashes

☀ LED flashes quickly



Important note

Non-compliance can result in malfunction or interference.



Information

Supplementary note.

2 Safety instructions

- Follow the operating instructions.
- Improper use may result in malfunctions of the unit. This can lead to personal injury and/or damage to property during operation of the machine. For this reason note all remarks on installation and handling given in these instructions. Also adhere to the safety instructions for the operation of the whole installation.
- In case of non-observance of notes or standards, specially when tampering with and/or modifying the unit, any liability and warranty is excluded.
- The unit must be installed, connected and put into operation by a qualified electrician trained in safety technology.
- The applicable technical standards for the corresponding application must be complied with.
- For installation the requirements according to EN 60204 must be observed.
- In case of malfunction of the unit please contact the manufacturer. Tampering with the unit is not allowed.
- Disconnect the unit externally before handling it. Also disconnect any independently supplied relay load circuits.
- After setup the system has to be subjected to a complete function check.
- Use the unit only in specified environmental conditions (→ 11 Technical data). In case of special operating conditions please contact the manufacturer.
- Use only as described below (→ 4).

3 Items supplied

- 1 safety relay G1502S
- 1 copy of the operating instructions safety relay, reference 80236318

If one of the above-mentioned components is missing or damaged, please contact one of the ifm branch offices.

4 Functions and features

The safety relay is a redundant system and suited for use as:

- Safety relay for fail-safe sensors/switches with 2 PNP outputs (e.g. GM701S, → chapter 8.1).
- Safety relay for clocked fail-safe sensors (e.g. GM504S, → chapter 8.2).
- Relay for two-hand control to EN 574, type IIIC, with electronic sensors/switches (→ chapter 8.3).
- Relay for two-hand control to EN 574, type IIIC with mechanical switches / safety relay for mechanical switches or 2-channel fail-safe sensors/switches (e.g. ESPE to EN 61496-1) with contact output with simultaneity monitoring (→ chapter 8.4).
- Safety relay for e-stop, for two-channel fail-safe sensors/switches (e.g. ESPE to EN 61496-1) with contact output without simultaneity monitoring (indefinite simultaneity) or for mechanical switches (→ chapter 8.5).



ifm electronic gmbh assumes no liability for the use of units made by external manufacturers.



The safe state is when the output contacts 13-14, 23-24, 33-34, 43-44, 67-68 or 77-78 are open and the output contact 51-52 is closed.

4.1 Requirements for the hardware configuration

The following requirements must be met when using the G1502S safety relay:

4.1.1 Product-independent requirements

It must be ensured that the safety requirements of the respective application correspond to the requirements stated in these instructions.

The specified technical data indicated in these instructions must be complied with. The principle of normally closed operation must be applied to all external safety circuits connected to the system.

The safety relays type G1502S in operation have to be subjected to a self-test (switching off) within a period of maximum 1 month.

The self-test can be carried out by switching the supply voltage off and on or by a safety request.

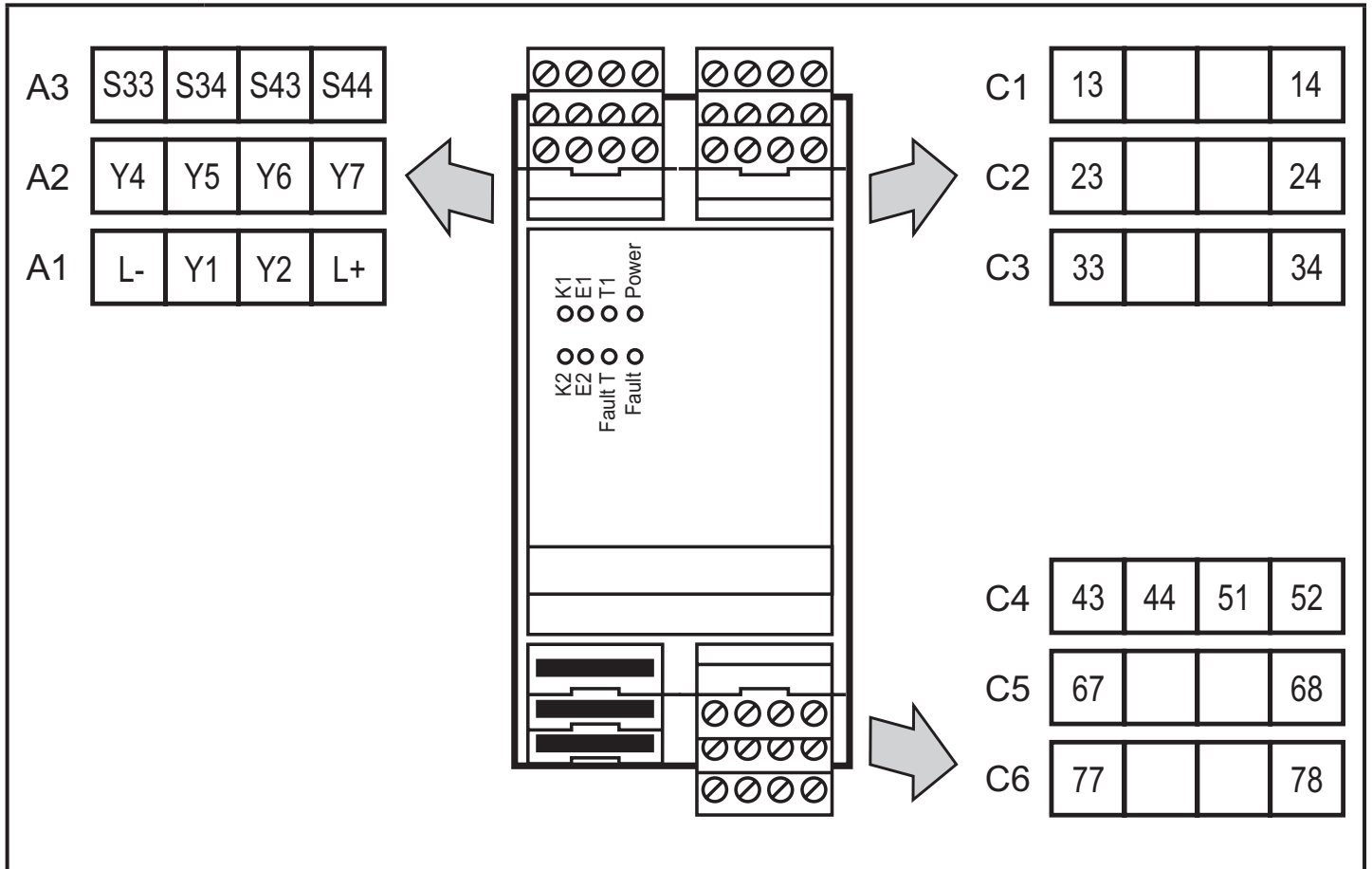
4.1.2 Product-dependent requirements

In case of faults within the safety relay which result in the defined safe state, the safety relay must be replaced.

Any faulty unit should be returned to the manufacturer.

5 Structure and operating principle

5.1 Indicators and connections

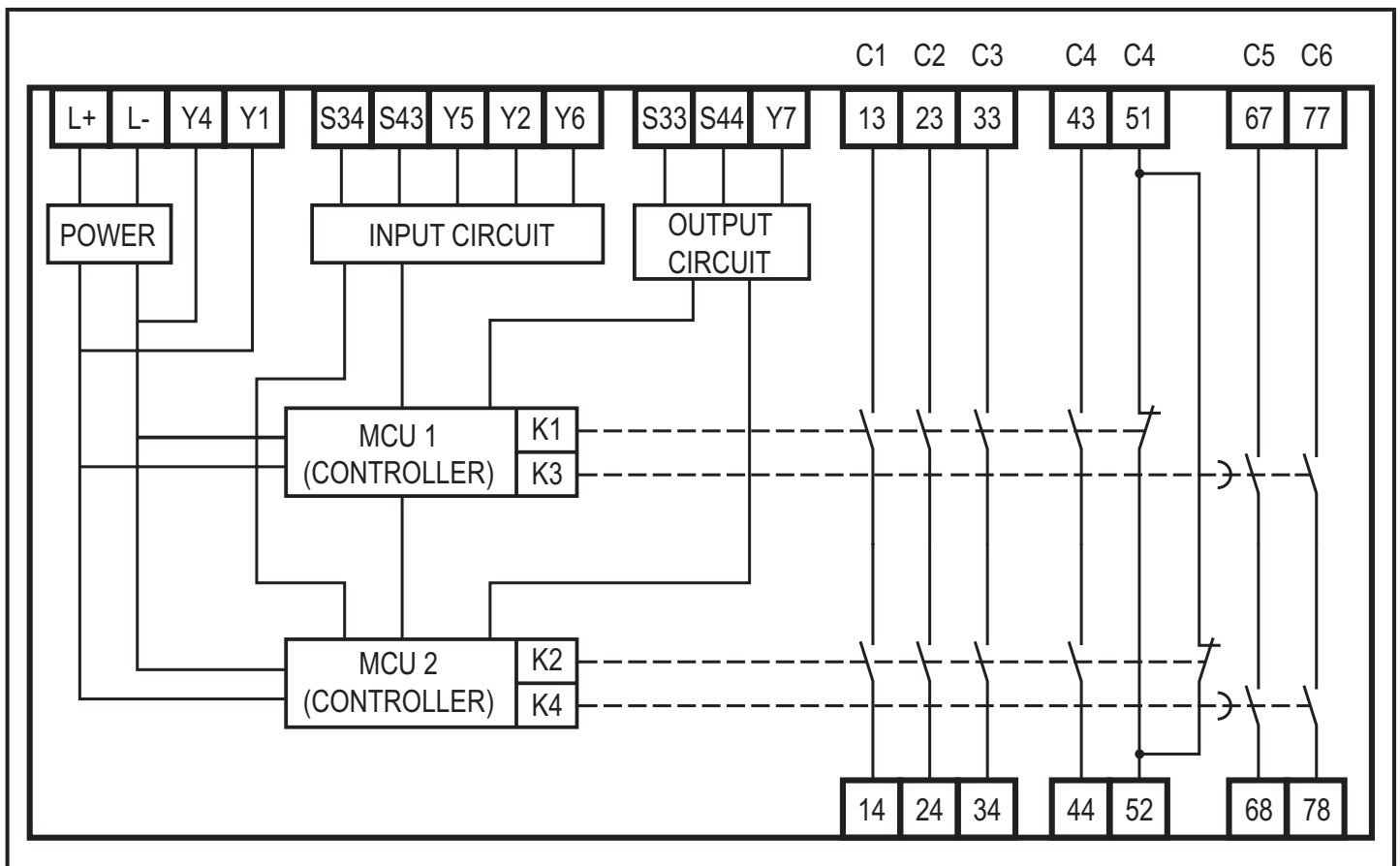


A1	Supply voltage (L-, L+), function terminals (Y1, Y2)
A2	Y4, Y5, Y6, Y7: Operating mode selection, auxiliary output
A3	S33, S34, S43, S44: Connection for safety inputs / output
K1	LED yellow: Triggering the relay outputs channel 1
K2	LED yellow: Triggering the relay outputs channel 2
E1	LED yellow: Input signal channel 1 or TE (for clocked sensor)
E2	LED yellow: Input signal channel 2 or A (for clocked sensor)
Power	LED green: Voltage supply
Fault	LED red: Fault/start-up
Fault T	LED red: Fault / T1
T1	LED yellow: Triggering the relay output with switch-off delay
C1	13, 14: Connection of relay output without delay, 1 x normally open (closed when enabled)

C2	23, 24: Connection of relay output without delay, 1 x normally open (closed when enabled)
C3	33, 34: Connection of relay output without delay, 1 x normally open (closed when enabled)
C4	43, 44: Connection of signal output without delay, 1 x normally open (closed when enabled) 51, 52: Connection of signal output without delay, 1 x normally closed (open when enabled)
C5	67, 68: Connection of relay output with switch-off delay, 1 x normally open (closed when enabled)
C6	77, 78: Connection of relay output with switch-off delay, 1 x normally open (closed when enabled)

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5.2 Block diagram



6 Installation

- ▶ Mount the unit on a DIN rail in a housing protected against dust and humidity (min. IP54 - degree of soiling 2).

7 Electrical connection

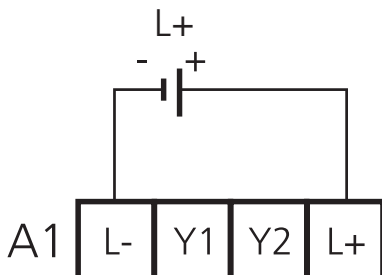
- ▶ Use 60/75°C copper conductors only.

7.1 Supply voltage

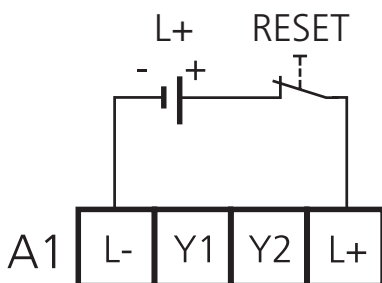


The external supply unit must have a safe separation. In case of a fault the voltage can exceed the value of 60 V DC for a maximum of 200 ms, but must not exceed the value of 120 V DC.

▶ Connect supply voltage



Manual reset

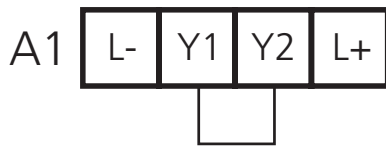


For safety reasons the unit can only be restarted by separation from the supply voltage in case of a fault. It is thus recommended to install a RESET switch in series with the L+ circuit.

After power on or a RESET the unit carries out self diagnostic functions. After this self diagnosis the unit is ready for operation.

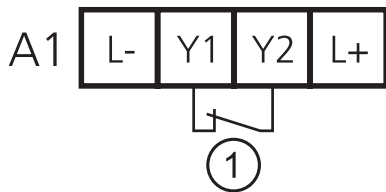
7.2 Feedback contacts / monitored or automatic start

Automatic start



Automatic activation without monitoring.

Monitoring of the feedback contacts (normally closed) for automatic start

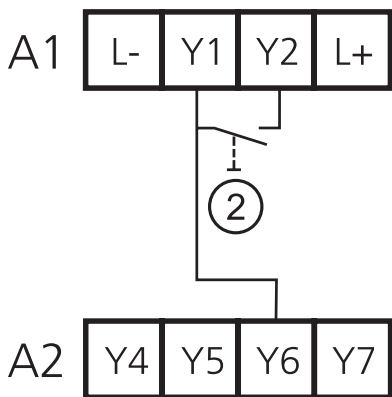


The circuit is enabled when the feedback contacts are closed.

Consider the current flowing through the feedback contacts (→ 11 Technical data).

1: feedback contact

Monitored start



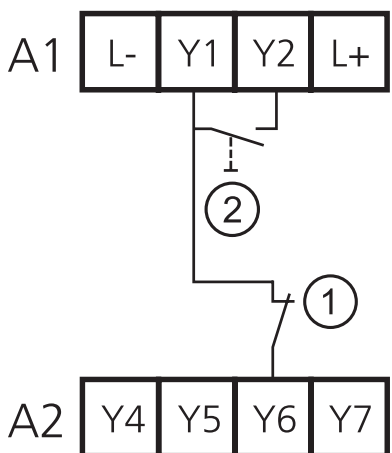
Activate the relay outputs:

- ▶ Press and release the start button (> 50 ms).

This function is not active when used as two-hand control.

2: start button

Monitoring of the feedback contacts (normally closed) for monitored start



Activate the relay outputs:

Feedback contacts are closed

- ▶ Press and release the start button (> 50 ms).

This function is not active when used as two-hand control.

Consider the current flowing through the feedback contacts (→ 11 Technical data).

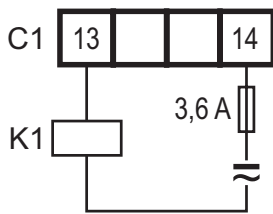
1: feedback contact

2: start button

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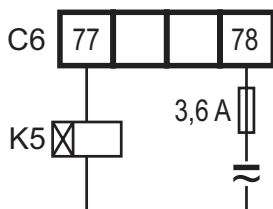
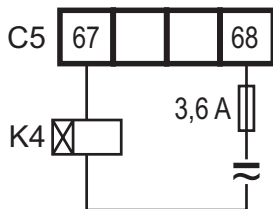
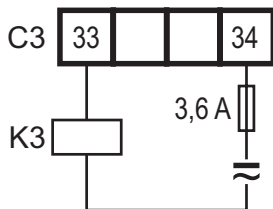
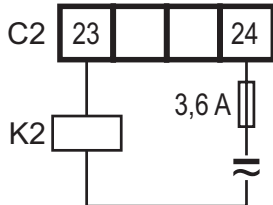
7.3 Output circuit

Last anschließen



► Connect the load to be controlled to the relay outputs on C1 (13, 14), C2 (23, 24), C3 (33, 34), C5 (67, 68) or C6 (77, 78).

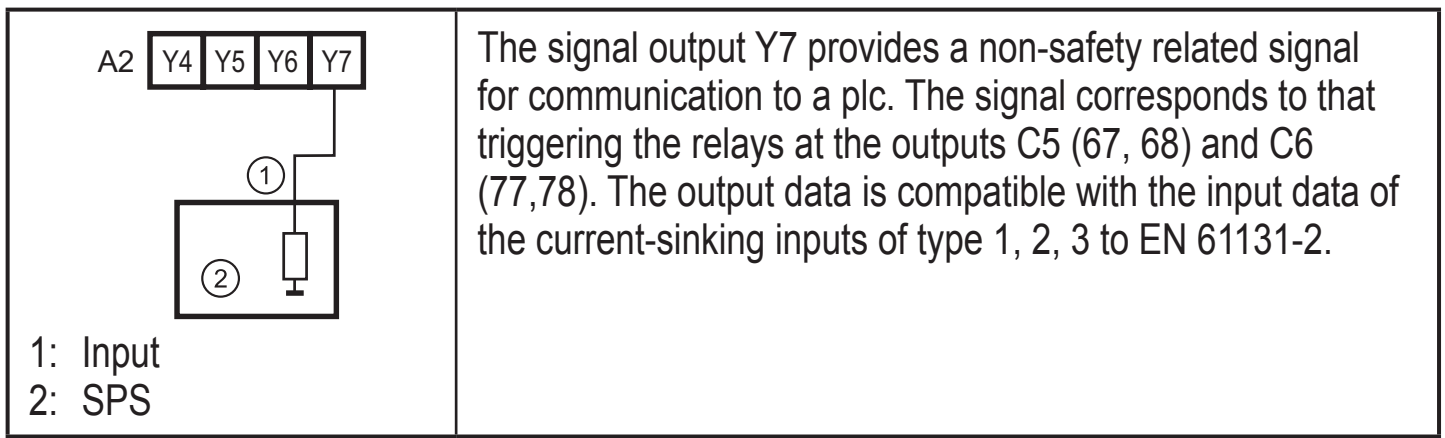
Adhere to max. and min. contact rating (→ 11 Technical data).



The relay outputs C4 (43, 44 and 51, 52) provide a non safety-related signal. The signal corresponds to that triggering the relays at the outputs C1 (13, 14); C2 (23, 24) and C3 (33, 34).



The total current, i.e. the max. current load of all output circuits of the safety relay (C1-C6), must not exceed 12 A.



8 Connection - Function - Fault diagnosis

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The safety relay can be connected or used in different ways:

1. Safety relay for fail-safe sensors/switches with 2 PNP outputs (e.g. GM701S).
2. Safety relay for clocked fail-safe sensors (e.g. GM504S).
3. Relay for two-hand control to EN 574 with electronic sensors.
4. Relay for two-hand control to EN 574 with mechanical switches / safety relay for mechanical switches or 2-channel fail-safe sensors/switches (e.g. ESPE to EN 61496-1) with contact output with simultaneity monitoring.
5. Safety relay for e-stop, for two-channel fail-safe sensors/switches (e.g. ESPE to EN 61496-1) with contact output without simultaneity monitoring (indefinite simultaneity) or for mechanical switches.

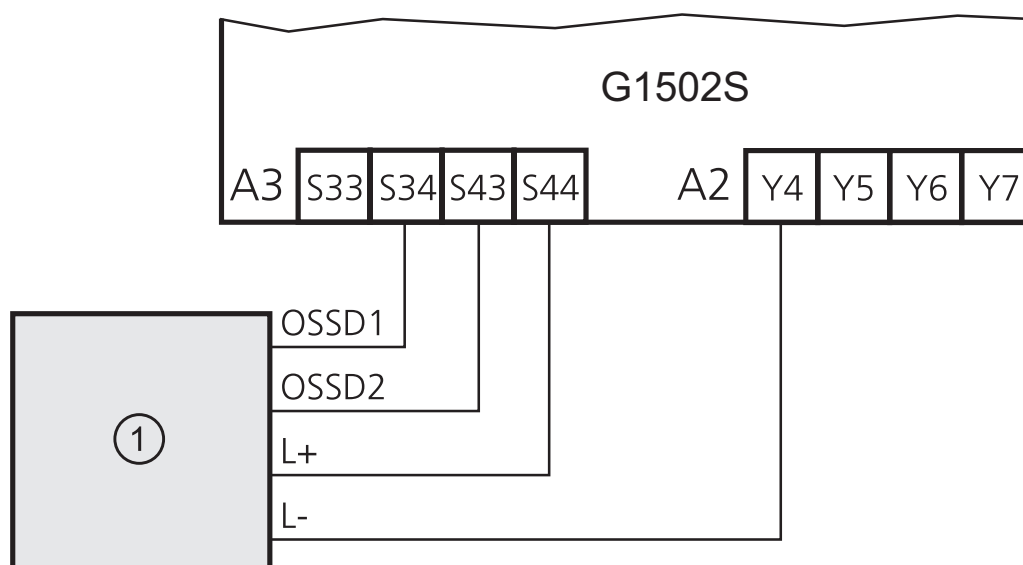
8.1 Safety relay for fail-safe sensors/switches with 2 PNP outputs

Example of fail-safe sensors/switches:

- Fail-safe inductive sensor GM701S
- Light barrier
- Light curtain (ESPE to EN 61496-1)
- Laser scanner

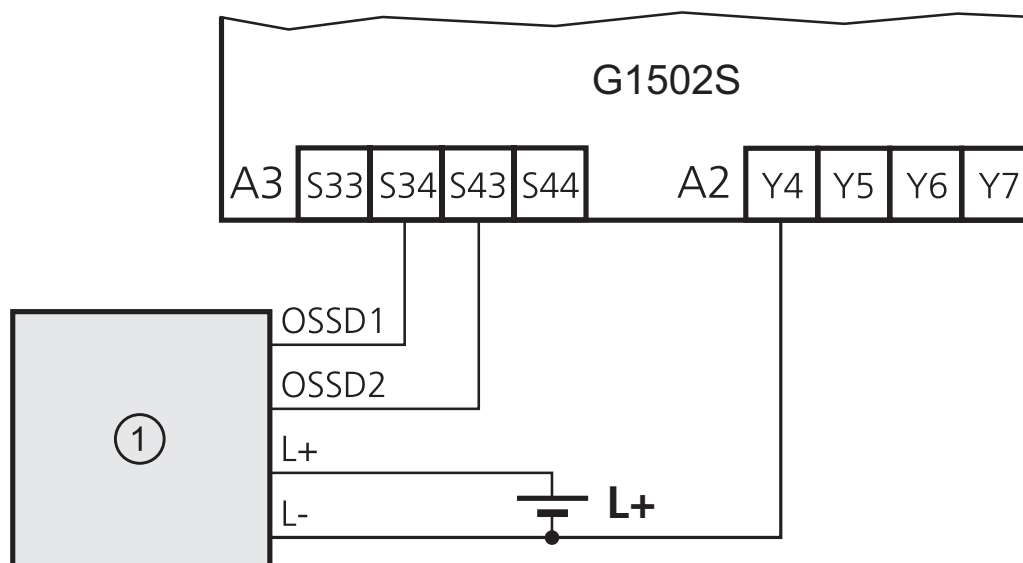
8.1.1 Connection

Fail-safe sensor/switch with a current consumption of ≤ 50 mA:



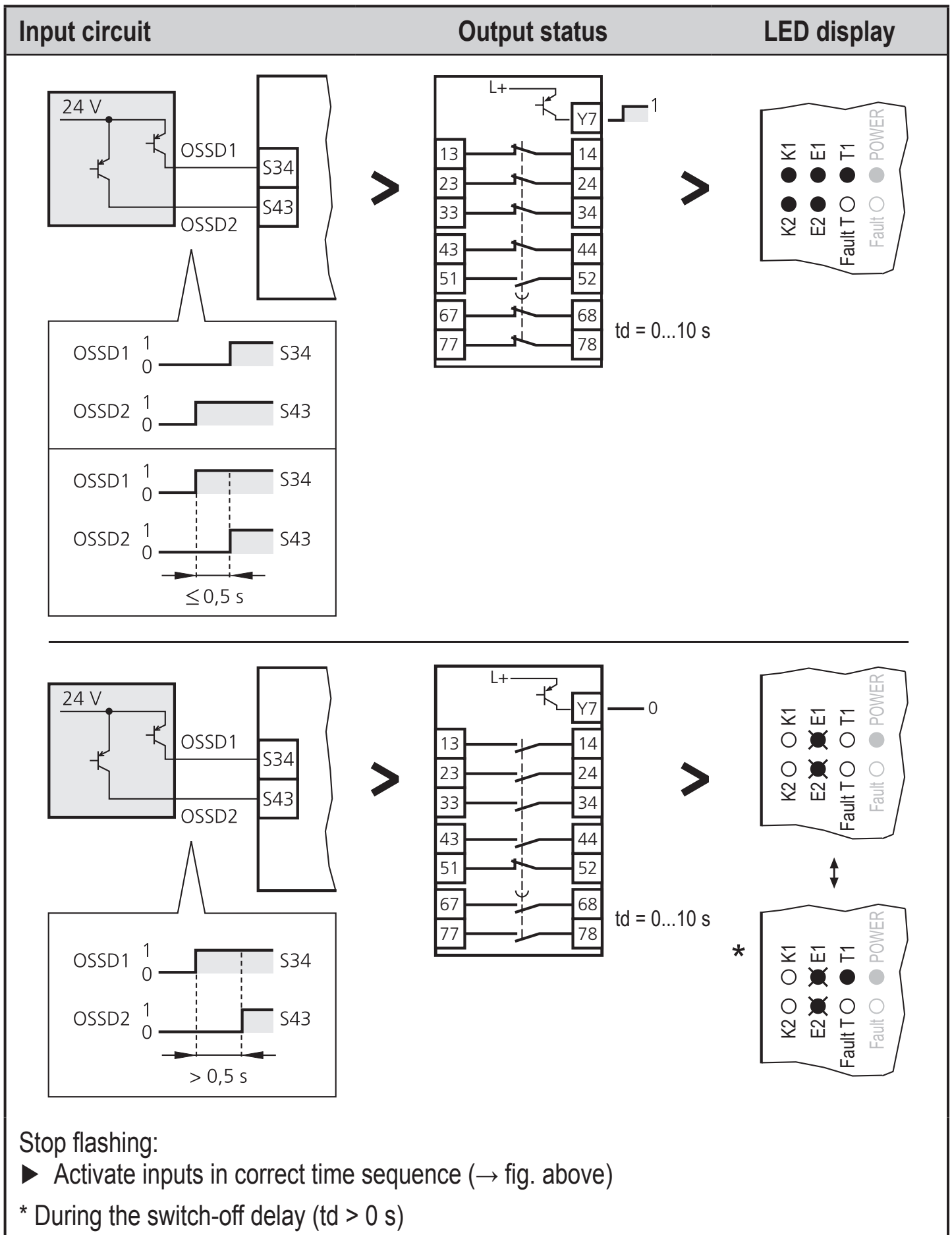
1: Fail-safe sensor/switch

Fail-safe sensor/switch with a current consumption of > 50 mA:



1: Fail-safe sensor/switch

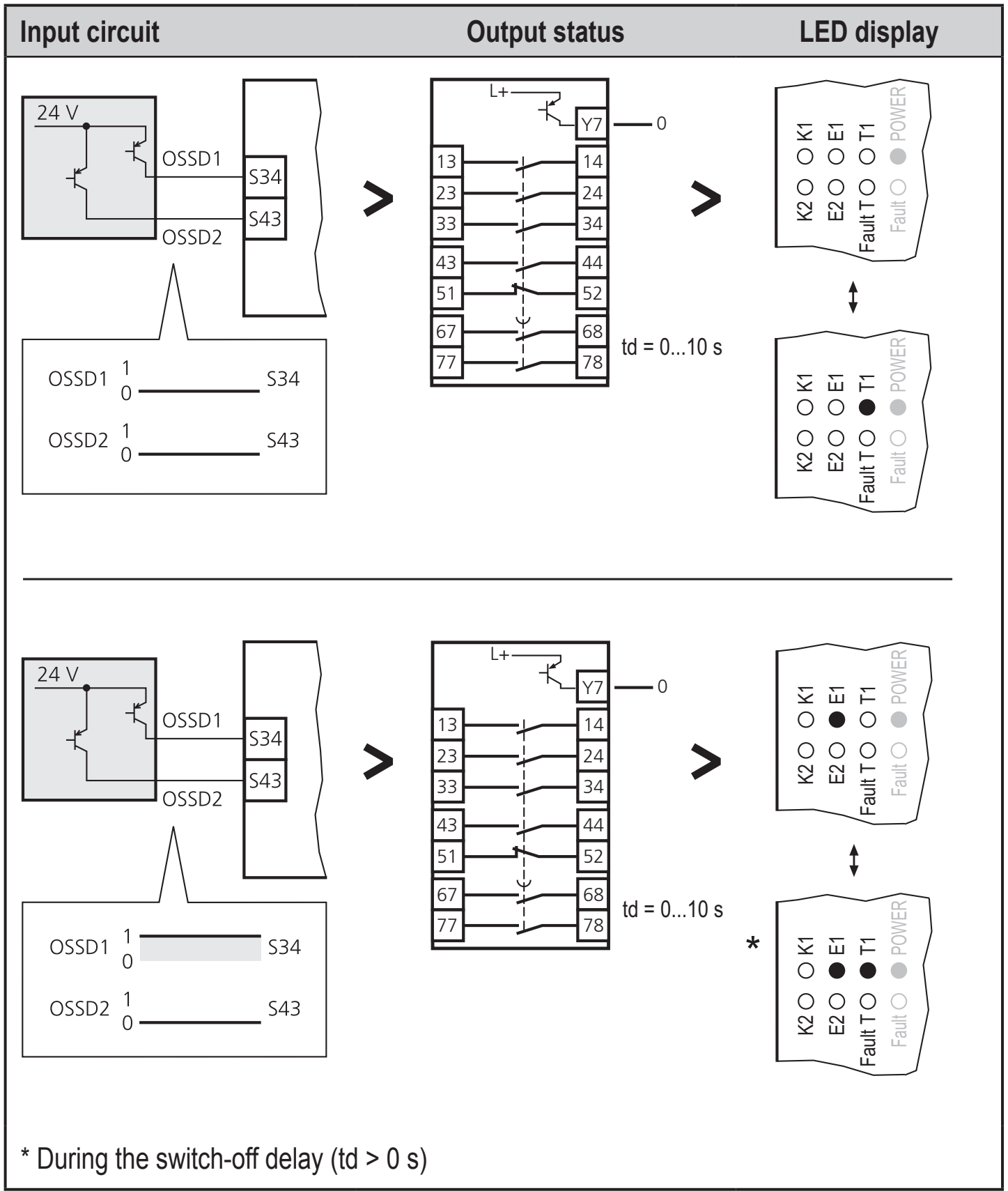
8.1.2 Function



Stop flashing:

► Activate inputs in correct time sequence (→ fig. above)

* During the switch-off delay ($t_d > 0$ s)

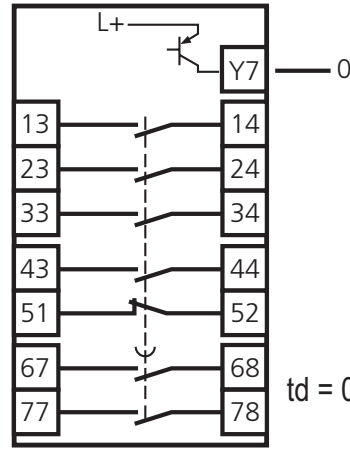
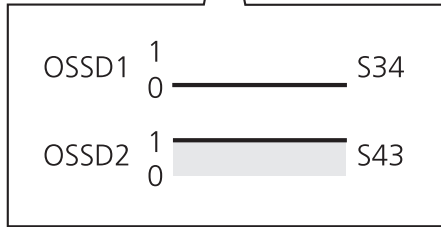
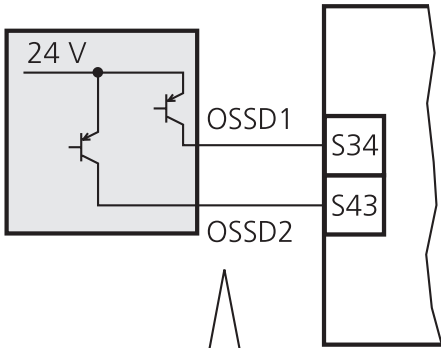


* During the switch-off delay ($t_d > 0$ s)

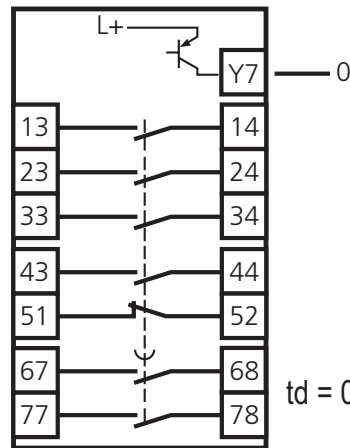
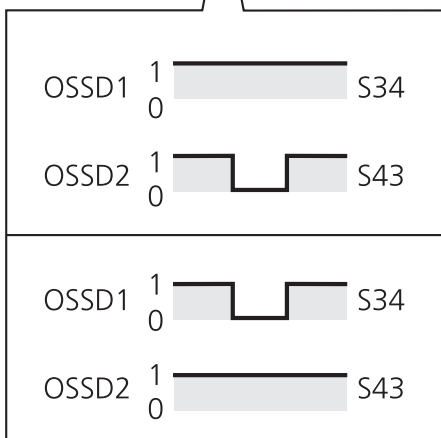
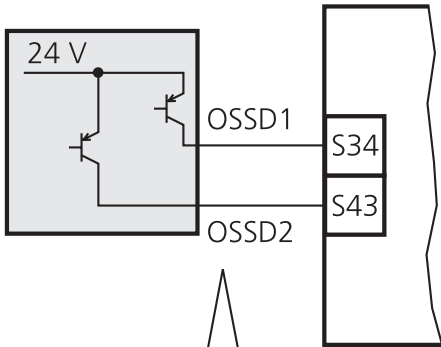
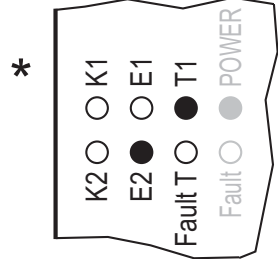
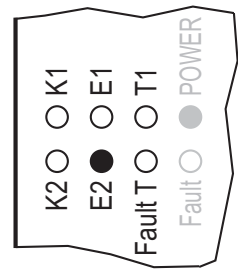
Input circuit

Output status

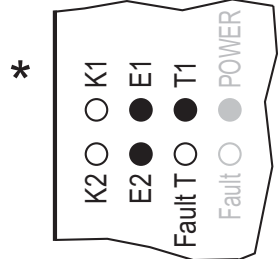
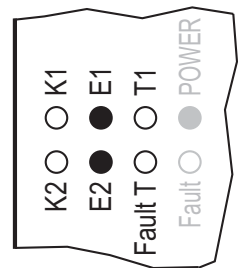
LED display



td = 0...10 s



td = 0...10 s



* During the switch-off delay (td > 0 s)

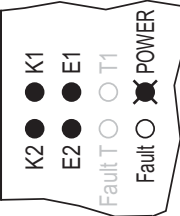

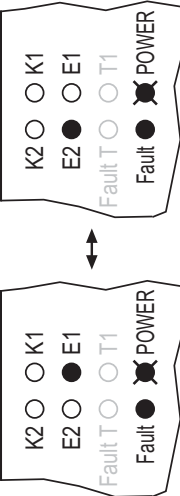
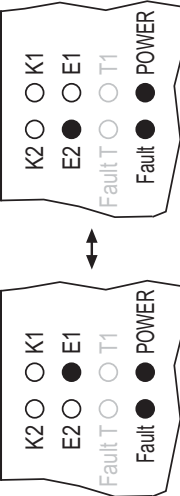

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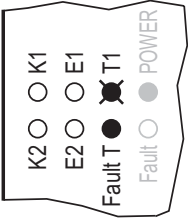
8.1.3 Fault diagnosis



In case of a fault switch the safety relay off and on again!

LED display	Cause of the fault	Troubleshooting
	<ul style="list-style-type: none"> No voltage supply Overvoltage Connection A1/A3 or A1/A2 reversed 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> Wire break Feedback contacts open 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Switch the safety relay off and on again
	<ul style="list-style-type: none"> When voltage is applied: Feedback contacts open 	<ul style="list-style-type: none"> ▶ Check output circuit ▶ Check feedback contacts ▶ Exchange external contactor
	<ul style="list-style-type: none"> Wiring fault Short circuit Inputs S34 and S43 "1" when voltage is applied 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Switch the fail-safe sensor/switch off and on again
	<ul style="list-style-type: none"> Short circuit S33/S43 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> Short circuit S33/S43 	<ul style="list-style-type: none"> ▶ Check wiring

LED display	Cause of the fault	Troubleshooting
	<ul style="list-style-type: none"> • Overvoltage • Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> • Overvoltage • Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> • Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> • Short circuits 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> • Input S43 active more than 0.5 s after input S34 (→ 8.1.2) • Feedback contact error • Short circuit S34/S44 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Switch the fail-safe sensor/ switch off and on again

LED display	Cause of the fault	Troubleshooting
 <p>The diagram shows a control panel with the following indicators:</p> <ul style="list-style-type: none"> K2: Off (represented by an open circle) K1: Off (represented by an open circle) E2: Off (represented by an open circle) E1: Off (represented by an open circle) Fault T: On (represented by a filled circle) Fault: Off (represented by an open circle) POWER: On (represented by a filled circle) 	<ul style="list-style-type: none"> • The rotary switch for programming the switch-off delay was changed • Faulty programming 	<p>► Program it again (→ 9.1)</p>

8.2 Safety relay for clocked fail-safe sensors

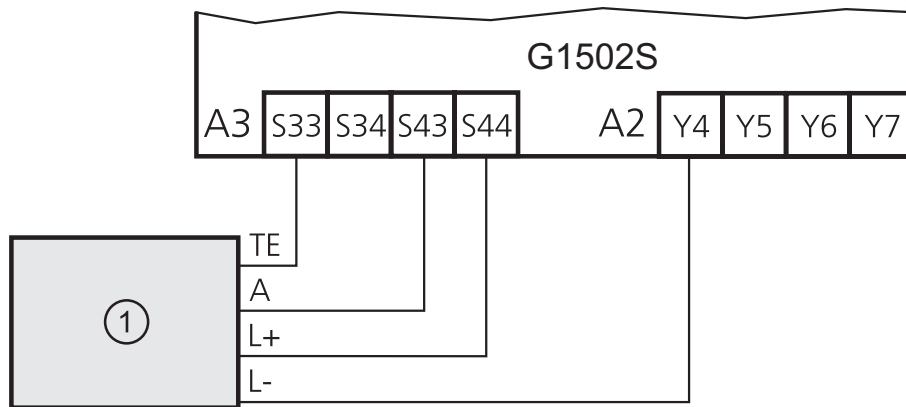
Example of fail-safe sensors/switches:

- Fail-safe inductive sensor GM504S

Up to 10 clocked fail-safe sensors can be connected to one safety relay.

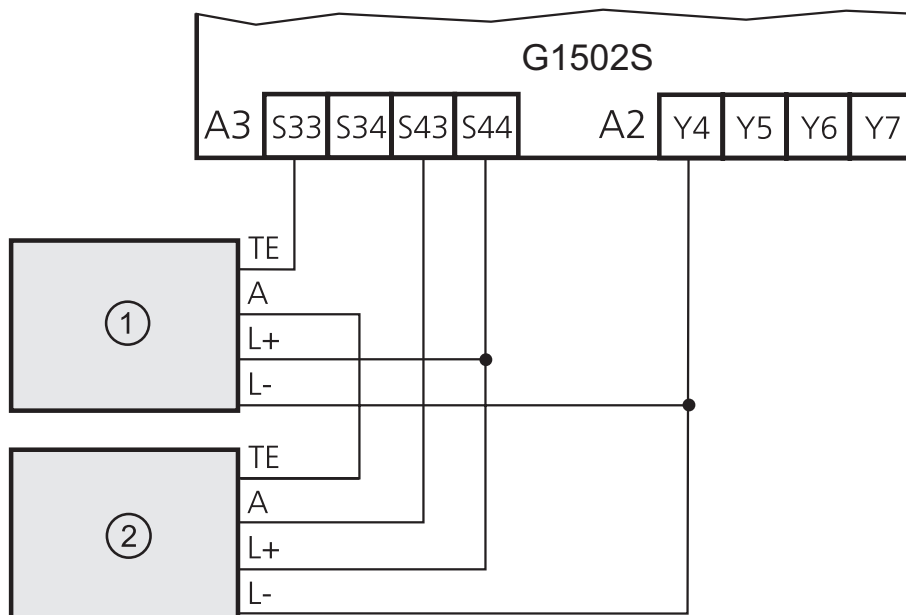
8.2.1 Connection

Connection of one fail-safe sensor/switch:



1: Fail-safe sensor/switch

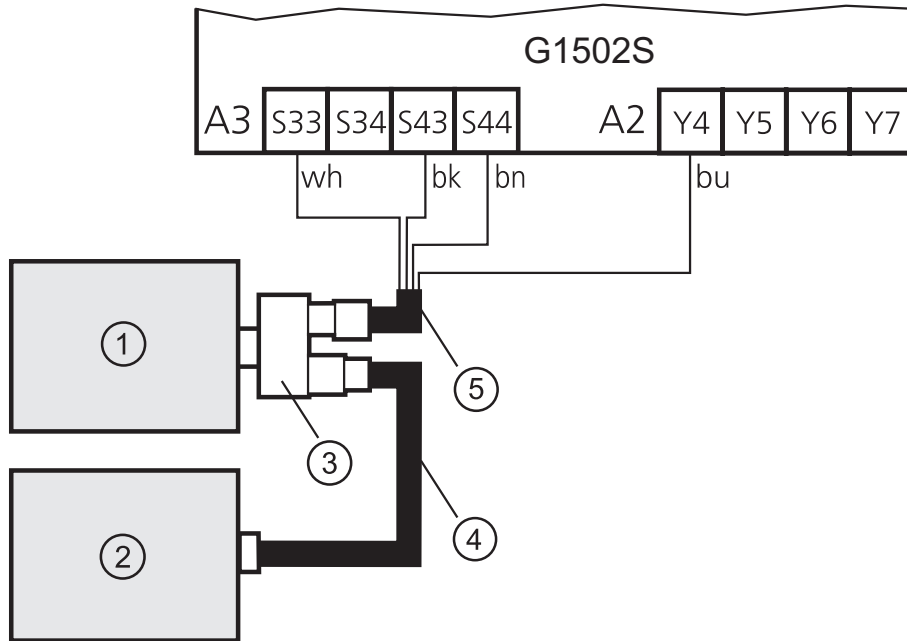
Connection of 2 fail-safe sensors/switches:



1: Fail-safe sensor/switch 1

2: Fail-safe sensor/switch 2

The use of the safety splitter box E11569 is recommended:

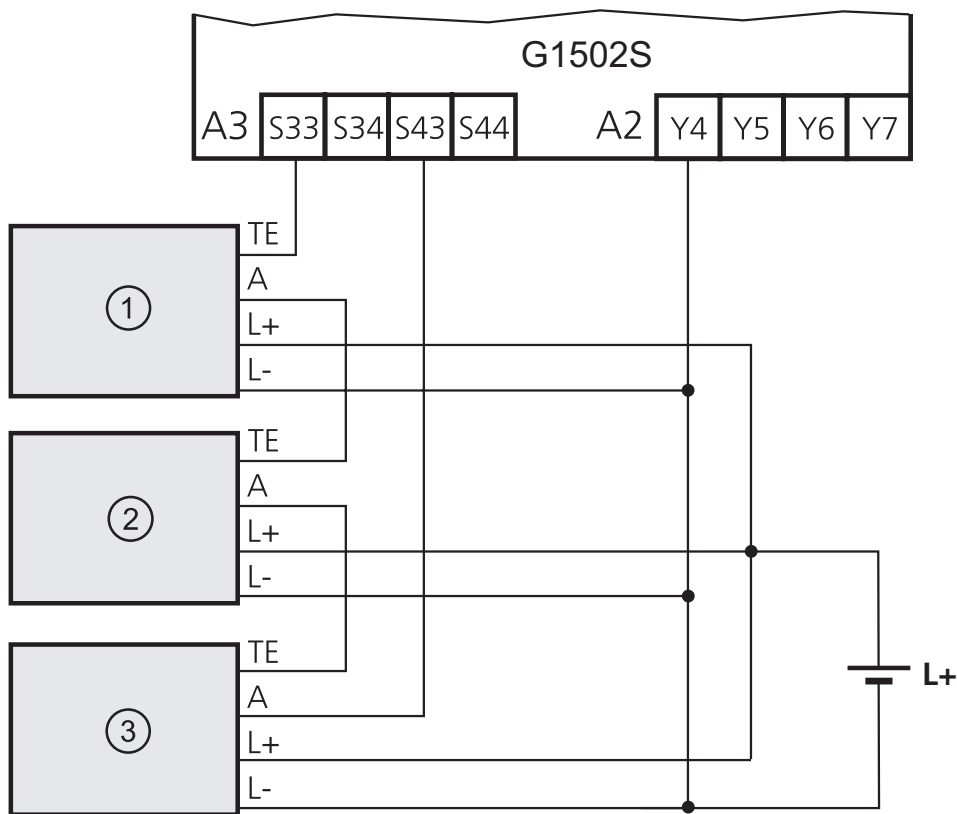


- 1: Fail-safe sensor/switch 1
- 2: Fail-safe sensor/switch 2

- 3: E11569
- 4: e.g. EVC014
- 5: e.g. EVC001

wh = white
 bk = black
 bn = brown
 bu = blue

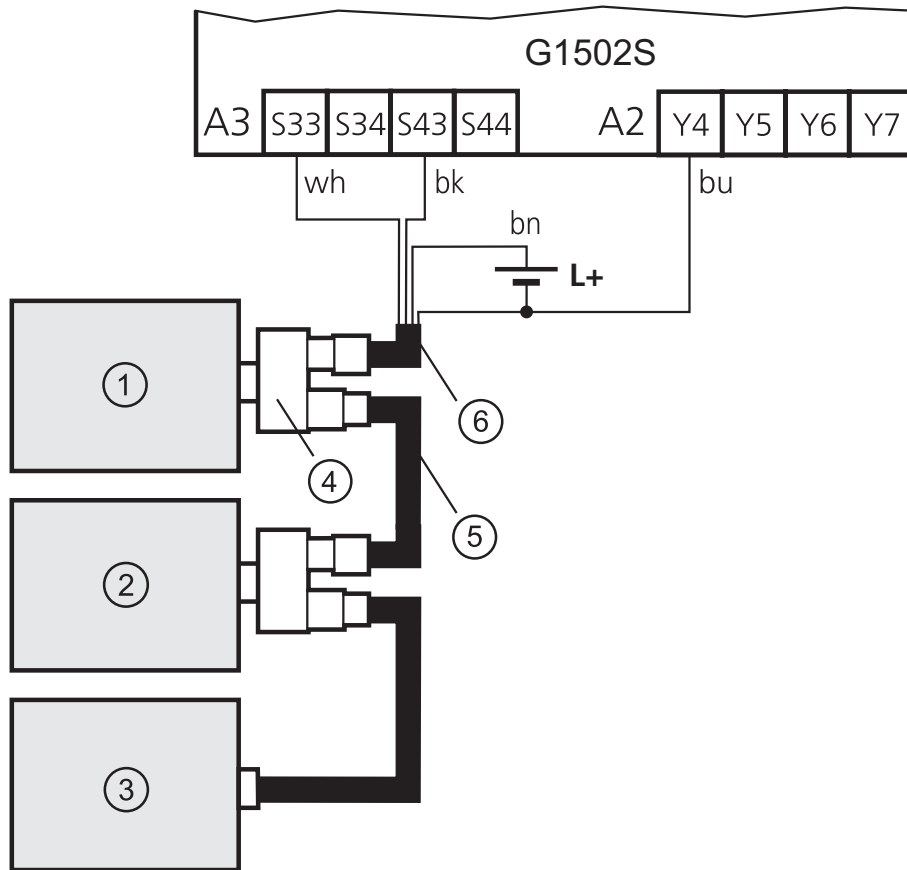
Connection of 3 to 10 fail-safe sensors/switches:



- 1: Fail-safe sensor/switch 1
- 2: Fail-safe sensor/switch 2

- 3: Fail-safe sensor/switch 3

The use of the safety splitter box E11569 is recommended:



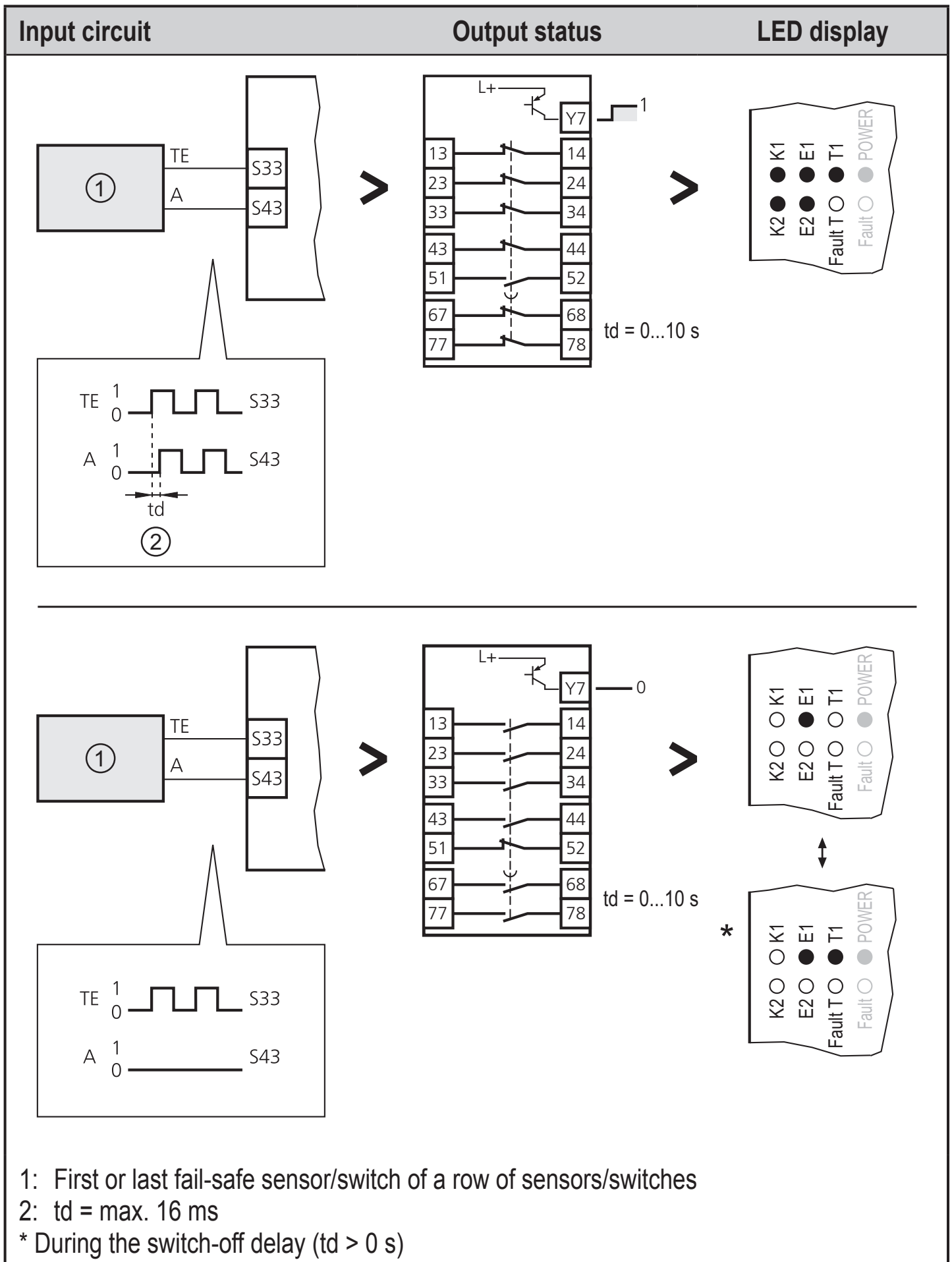
- 1: Fail-safe sensor/switch 1
- 2: Fail-safe sensor/switch 2
- 3: Fail-safe sensor/switch 3

- 4: E11569
- 5: e.g. EVC014
- 6: e.g. EVC001

- wh = white
- bk = black
- bn = brown
- bu = blue

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8.2.2 Function

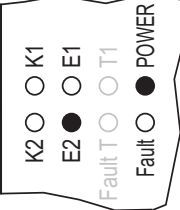


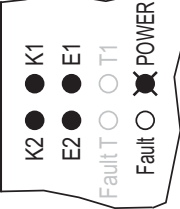
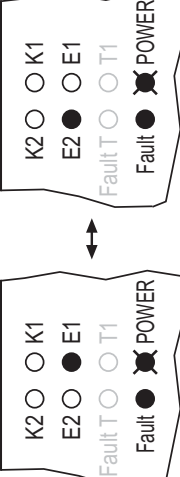


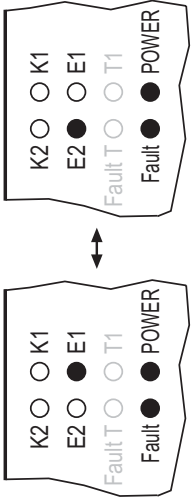
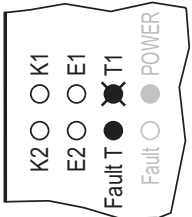
8.2.3 Fault diagnosis



In case of a fault switch the safety relay off and on again!

LED display	Cause of the fault	Troubleshooting
	<ul style="list-style-type: none"> No voltage supply Overvoltage Connection A1/A2 reversed 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> Wire break Feedback contacts open Time-dependent contacts 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Switch the safety relay off and on again
	<ul style="list-style-type: none"> When voltage is applied: Feedback contacts open 	<ul style="list-style-type: none"> ▶ Check output circuit ▶ Check feedback contacts ▶ Exchange external contactor
	<ul style="list-style-type: none"> Short circuit Connection A1/A3 or A2/A3 exchanged 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> Short circuit S43/L+ or S44/L- 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> Short-circuit S34/S44 or S33/S43 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> Short circuit S34/L+ 	<ul style="list-style-type: none"> ▶ Check wiring

LED display	Cause of the fault	Troubleshooting
 <p>Diagram of an LED display with four columns of indicators: K2, E2, Fault, and POWER. Each column has two indicators. In this state, the top indicator of each column is lit (black dot), while the bottom indicator is unlit (white circle).</p>	<ul style="list-style-type: none"> • Short circuit S43/L+ or S34/S44 	<ul style="list-style-type: none"> ▶ Check wiring
 <p>Diagram of an LED display with four columns of indicators: K2, E2, Fault, and POWER. Each column has two indicators. In this state, the top indicator of each column is lit (black dot), while the bottom indicator is unlit (white circle).</p>	<ul style="list-style-type: none"> • Missing clock • Wiring fault • Connection A2/A3 reversed • Short circuit S43/L- 	<ul style="list-style-type: none"> ▶ Check wiring
 <p>Diagram of an LED display with four columns of indicators: K2, E2, Fault, and POWER. Each column has two indicators. In this state, the top indicator of the K2 column is unlit, while the top indicators of the E2, Fault, and POWER columns are lit (black dots). The bottom indicators in all columns are unlit (white circles).</p>	<ul style="list-style-type: none"> • Overvoltage • Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
 <p>Diagram of an LED display with four columns of indicators: K2, E2, Fault, and POWER. Each column has two indicators. In this state, the top indicators of the K2, E2, and Fault columns are lit (black dots), while the top indicator of the POWER column is unlit. The bottom indicators in all columns are unlit (white circles).</p>	<ul style="list-style-type: none"> • Overvoltage • Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
 <p>Two diagrams of the LED display are shown, separated by a vertical double-headed arrow. The top diagram has the top indicators of the E2, Fault, and POWER columns lit. The bottom diagram has the top indicators of the K2, E2, and Fault columns lit. In both diagrams, the bottom indicators are unlit.</p>	<ul style="list-style-type: none"> • Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply

LED display	Cause of the fault	Troubleshooting
	<ul style="list-style-type: none"> • Short circuits 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> • The rotary switch for programming the switch-off delay was changed • Faulty programming 	<ul style="list-style-type: none"> ▶ Program it again (→ 9.1)

8.3 Relay for two-hand control using electronic sensors/switches

Example of electronic sensors/switches:

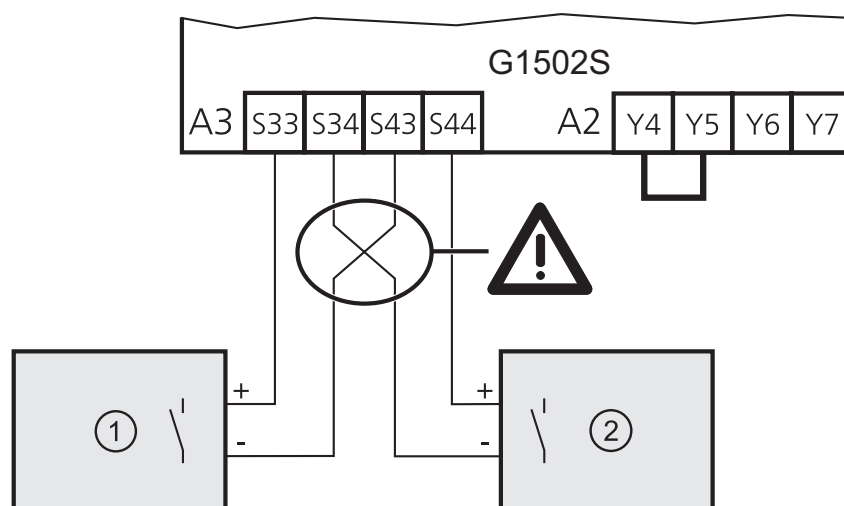
- Capacitive sensors

For product selection see www.ifm.com

This wiring meets the requirements type IIIB to EN 574. Use up to type IIIC is possible using corresponding sensors/switches with two independent switching elements, internal plausibility check and protected or screened wires.

8.3.1 Connection

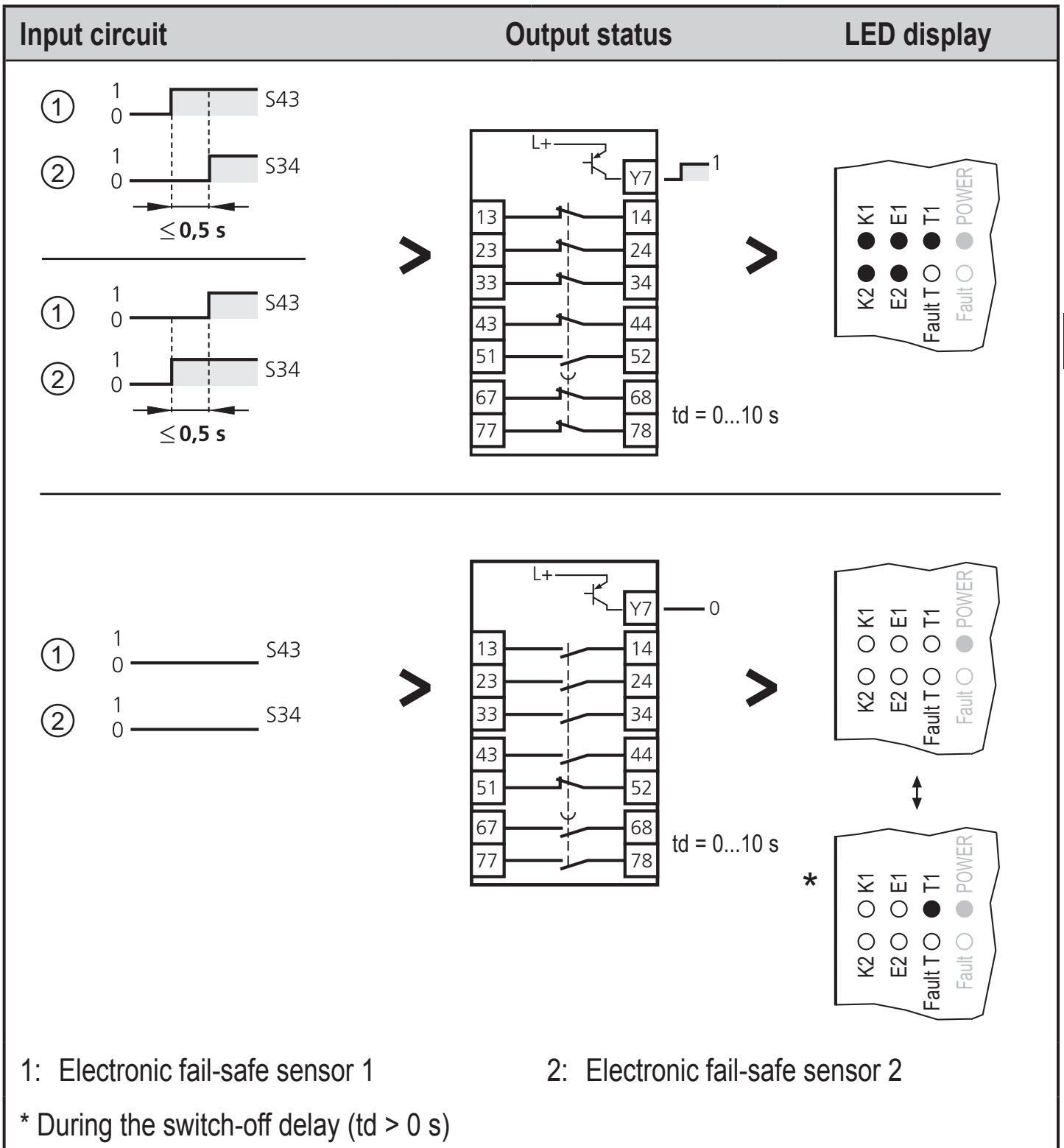
Connection of two 2-wire DC:

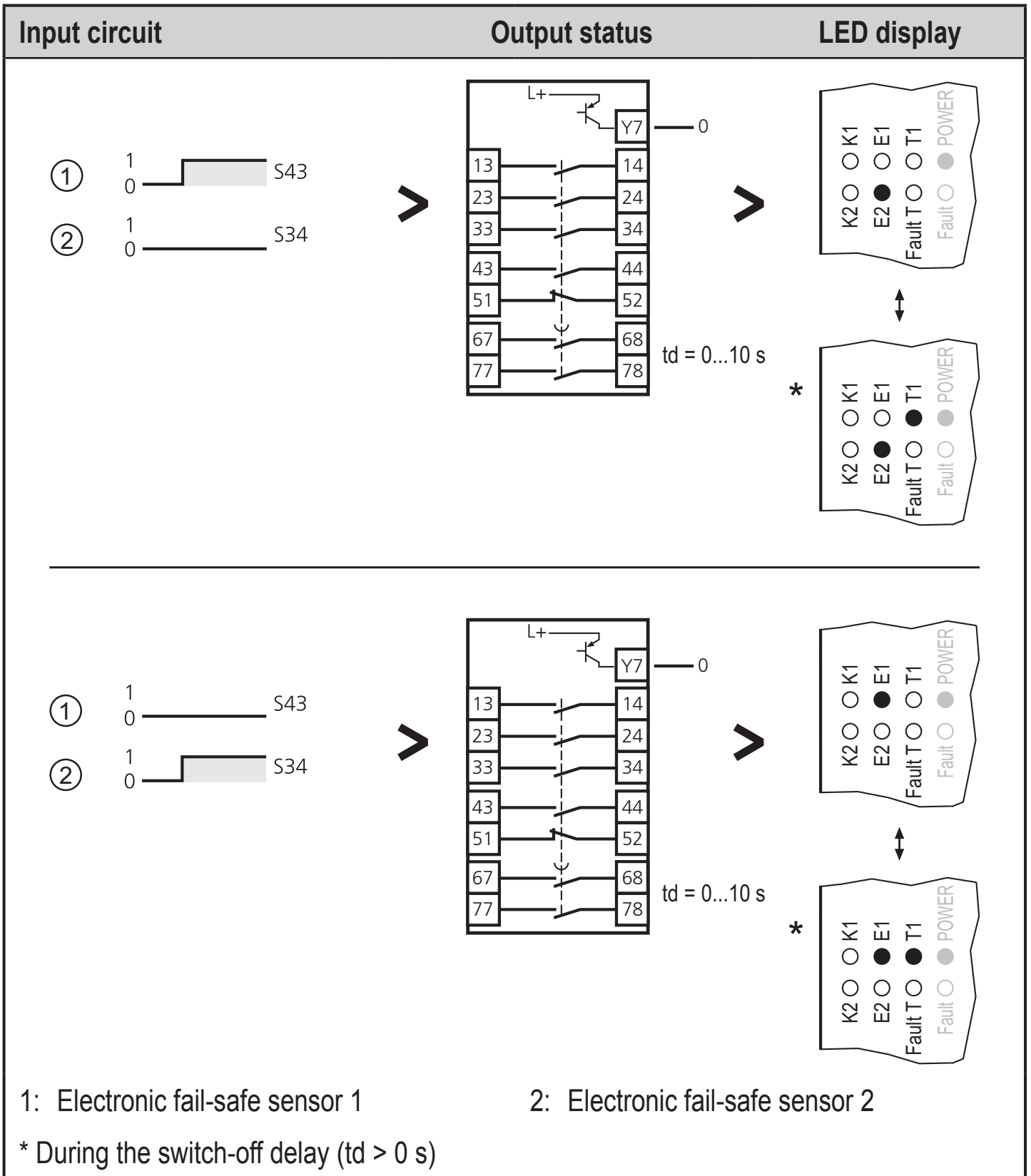


1: Electronic fail-safe sensor 1

2: Electronic fail-safe sensor 2

8.3.2 Function

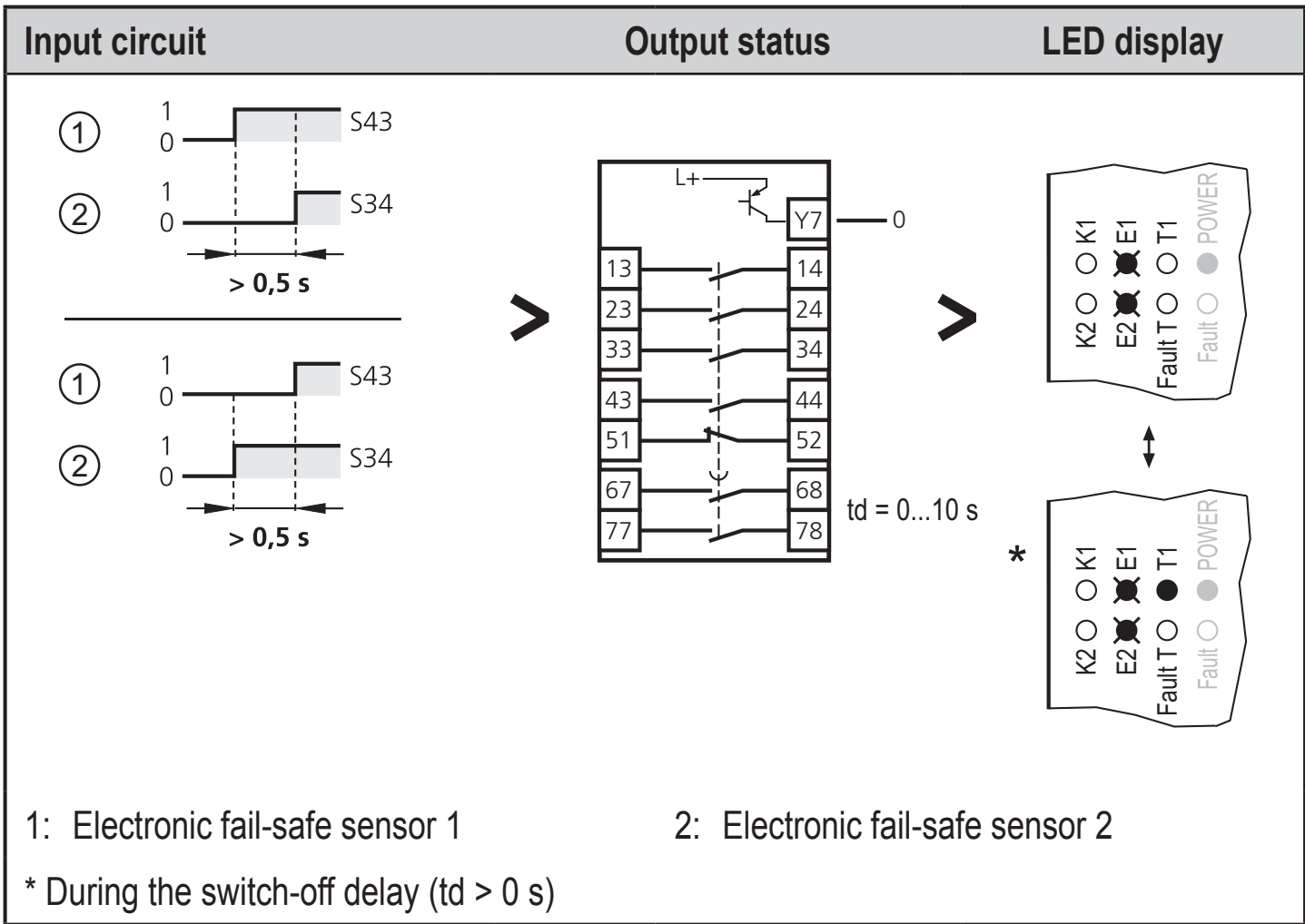




1: Electronic fail-safe sensor 1

2: Electronic fail-safe sensor 2

* During the switch-off delay (td > 0 s)




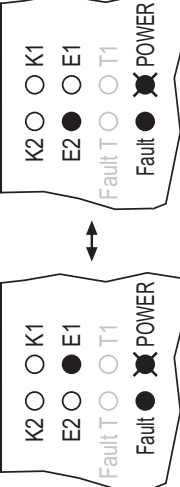
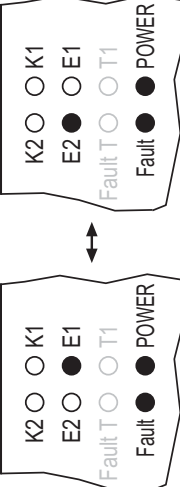


UK

8.3.3 Fault diagnosis



In case of a fault switch the safety relay off and on again!

LED display	Cause of the fault	Troubleshooting
	<ul style="list-style-type: none"> No voltage supply Overvoltage Connection A1/A3 or A1/A2 reversed 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> Wire break Feedback contacts open Time-dependent contacts 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Switch the safety relay off and on again
	<ul style="list-style-type: none"> When voltage is applied: Feedback contacts open 	<ul style="list-style-type: none"> ▶ Check output circuit ▶ Check feedback contacts ▶ Exchange external contactor
	<ul style="list-style-type: none"> Wiring fault Missing link Y4/Y5 Short circuit Inputs S34 and S43 activated when voltage is applied 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Deactivate inputs and RESET or voltage failure
	<ul style="list-style-type: none"> Connections A3/A2 reversed 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> Missing link Y4/Y5 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> Overvoltage Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply

LED display	Cause of the fault	Troubleshooting
	<ul style="list-style-type: none"> • Overvoltage • Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> • Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> • Short circuits 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> • Inputs S34 and S43 not activated within 0.5 s (→ 8.3.2) • Feedback contact error • Short circuit S34/S44 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Deactivate inputs and activate them again
	<ul style="list-style-type: none"> • The rotary switch for programming the switch-off delay was changed • Faulty programming 	<ul style="list-style-type: none"> ▶ Program it again (→ 9.1)

8.4 Relay for two-hand control using mechanical switches with simultaneity monitoring

Two-hand control with mechanical switches / safety relay for mechanical switches or 2-channel fail-safe sensors/switches with contact output with simultaneity monitoring.



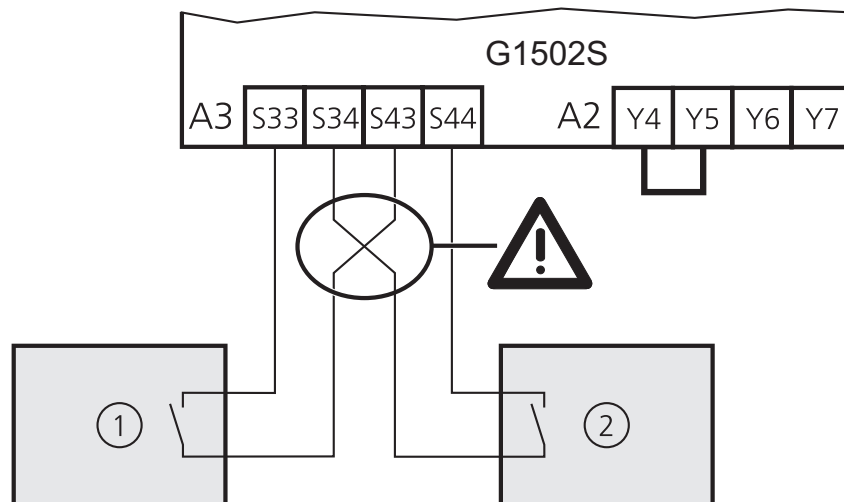
The contacts of the mechanical switches must allow a minimum current of 6 mA.

8.4.1 Connection

Connection of two mechanical fail-safe switches

This wiring (with only one normally open contact per sensor/switch) meets the requirements of type IIIB to EN 574.

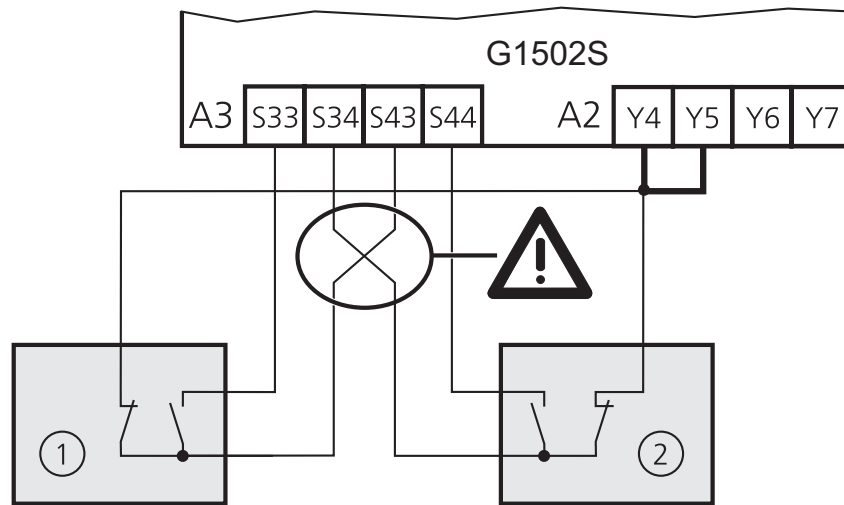
Use up to type IIIC is possible using corresponding sensors/switches approved to EN 60947-5-1 annex K and protected or screened wires.



1: Mechanical fail-safe switch 1

2: Mechanical fail-safe switch 2

Connection of mechanical switches according to type IIC to EN 574

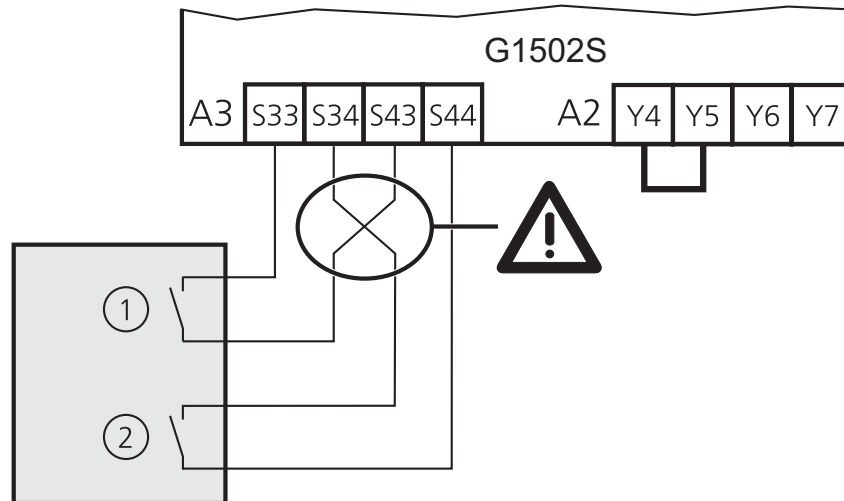


1: Mechanical switch 1 (no positively driven contacts)

2: Mechanical switch 2 (no positively driven contacts)

Connection of a 2-channel fail-safe sensor/switch

e.g. "electro-sensitive protective equipment" (ESPE) to EN 61496-1

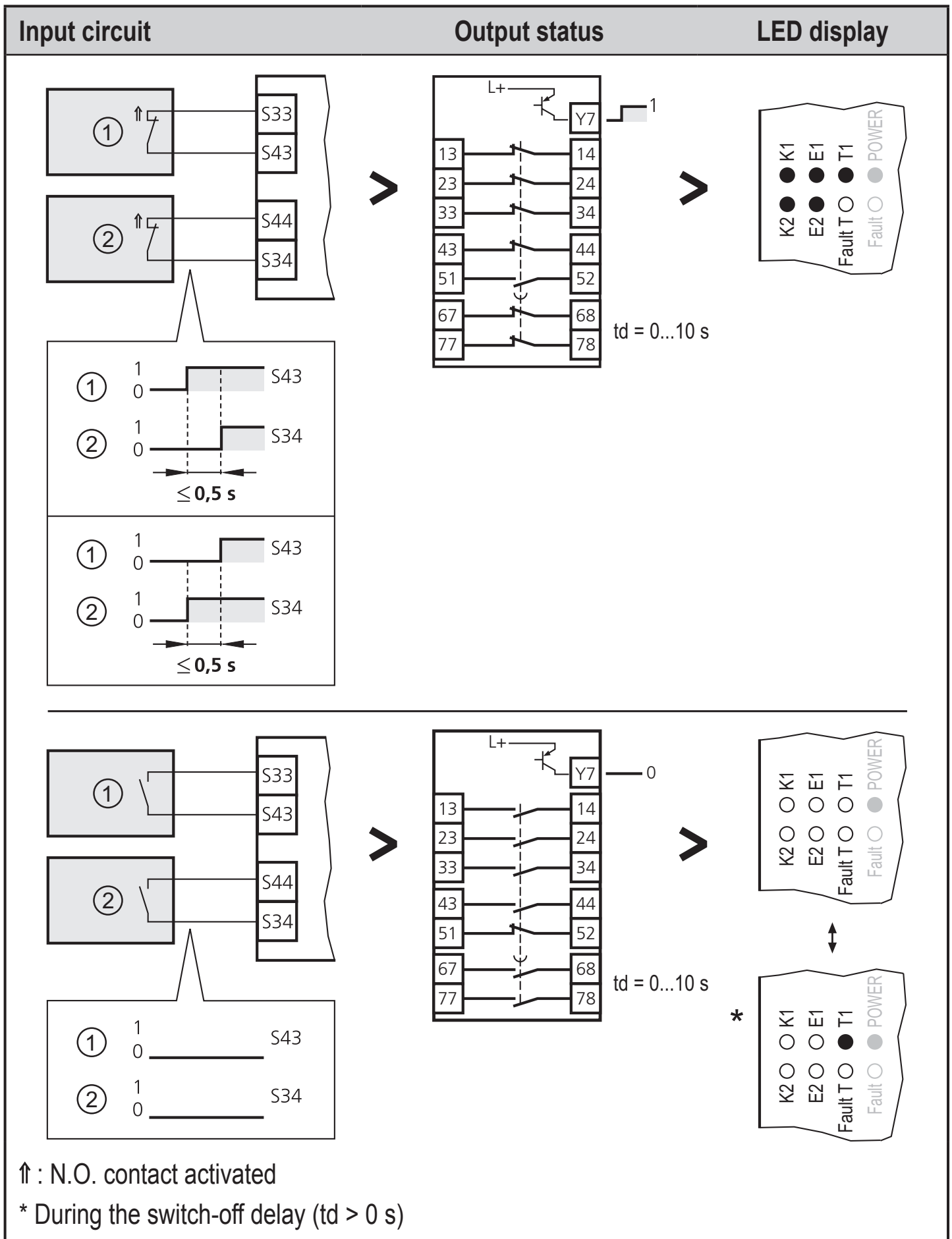


1: Contact 1 of the ESPE

2: Contact 2 of the ESPE

UK

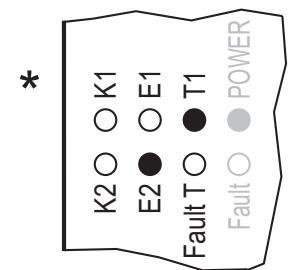
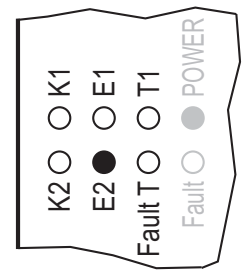
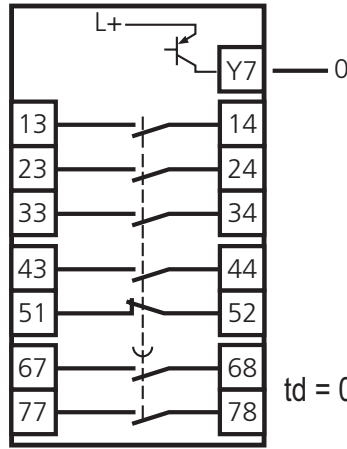
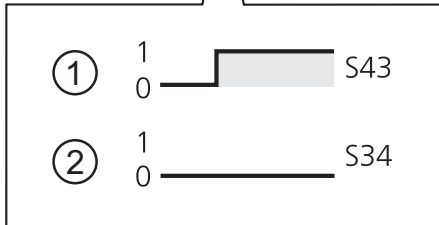
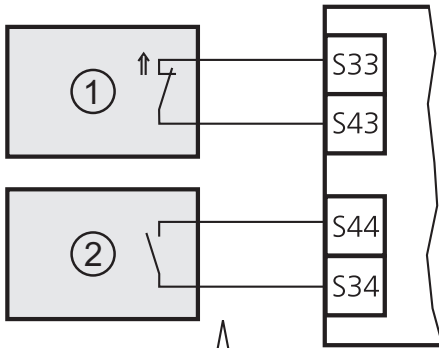
8.4.2 Function



Input circuit

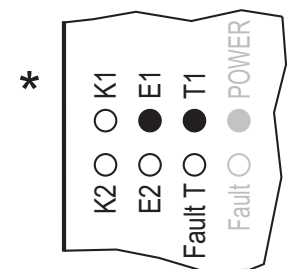
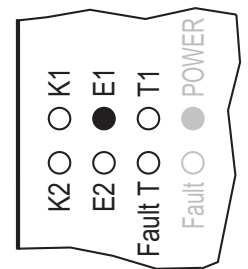
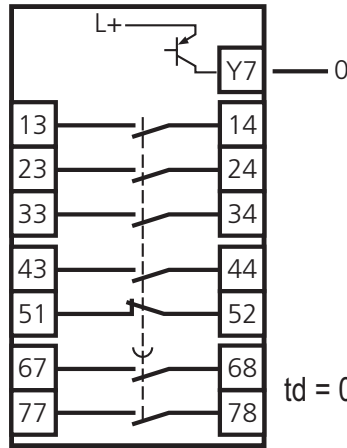
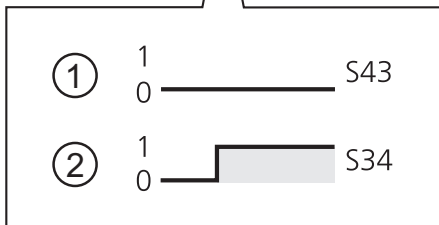
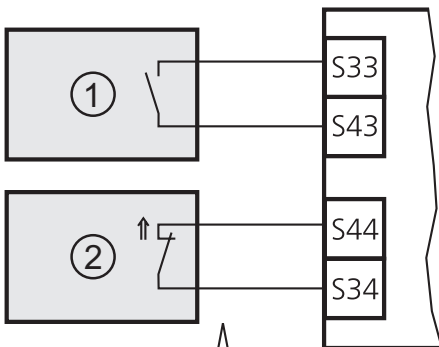
Output status

LED display



td = 0...10 s

*



td = 0...10 s

*

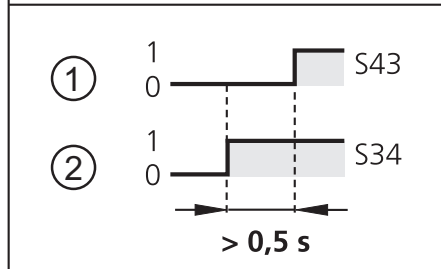
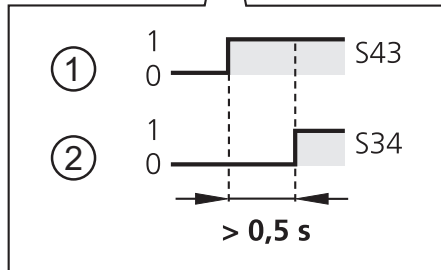
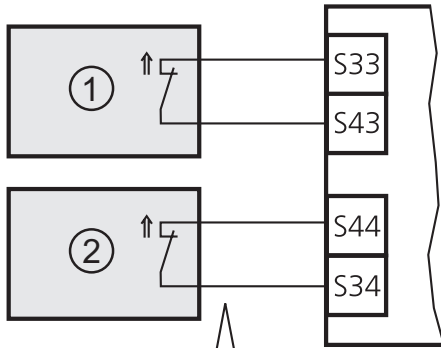
1: Electronic fail-safe sensor 1

2: Electronic fail-safe sensor 1

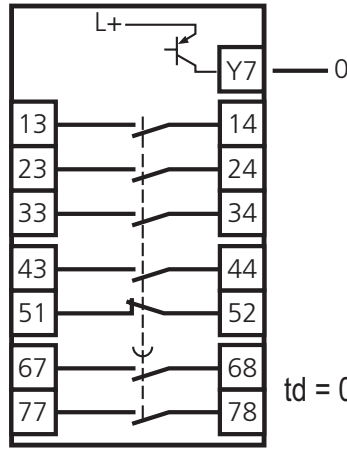
* During the switch-off delay (td > 0 s)

UK

Input circuit

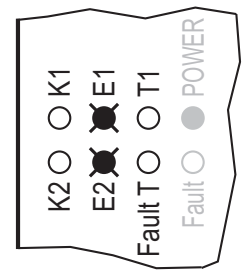


Output status

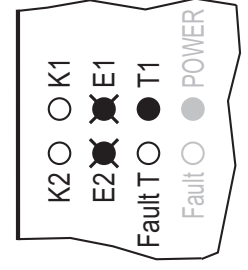


$t_d = 0 \dots 10 \text{ s}$

LED display



*



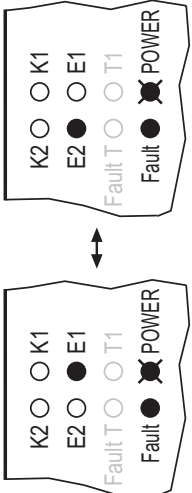
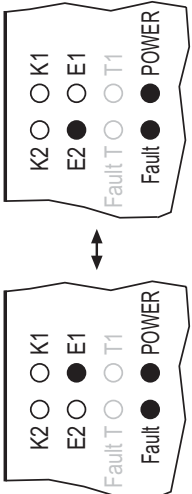
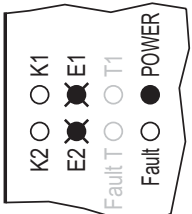
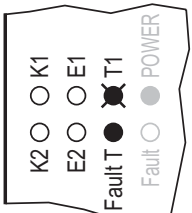
- 1: Electronic fail-safe sensor 1
- 2: Electronic fail-safe sensor 2
- * During the switch-off delay ($t_d > 0 \text{ s}$)
- ↑ : N.O. contact activated

8.4.3 Fault diagnosis



In case of a fault switch the safety relay off and on again!

LED display	Cause of the fault	Troubleshooting
	<ul style="list-style-type: none"> No voltage supply Overvoltage Connection A1/A3 or A1/A2 reversed 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> Wire break Feedback contacts open Time-dependent contacts 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Switch the safety relay off and on again
	<ul style="list-style-type: none"> When voltage is applied: Feedback contacts open 	<ul style="list-style-type: none"> ▶ Check output circuit ▶ Check feedback contacts ▶ Exchange external contactor
	<ul style="list-style-type: none"> Wiring fault Missing link Y4/Y5 Short circuit Contacts closed when voltage is applied 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Open contacts and RESET or voltage failure
	<ul style="list-style-type: none"> Connection A2/A3 reversed 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> Overvoltage Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> Overvoltage Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply

LED display	Cause of the fault	Troubleshooting
	<ul style="list-style-type: none"> • Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> • Short circuits 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> • Inputs S34 and S43 not activated within 0.5 s (→ 8.4.2) • Feedback contact error • Short circuit S34/S44 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Deactivate inputs and activate them again
	<ul style="list-style-type: none"> • The rotary switch for programming the switch-off delay was changed • Faulty programming 	<ul style="list-style-type: none"> ▶ Program it again (→ 9.1)

8.5 Safety relay for e-stop, for 2-channel fail-safe sensors/ switches with contact output or for mechanical switches

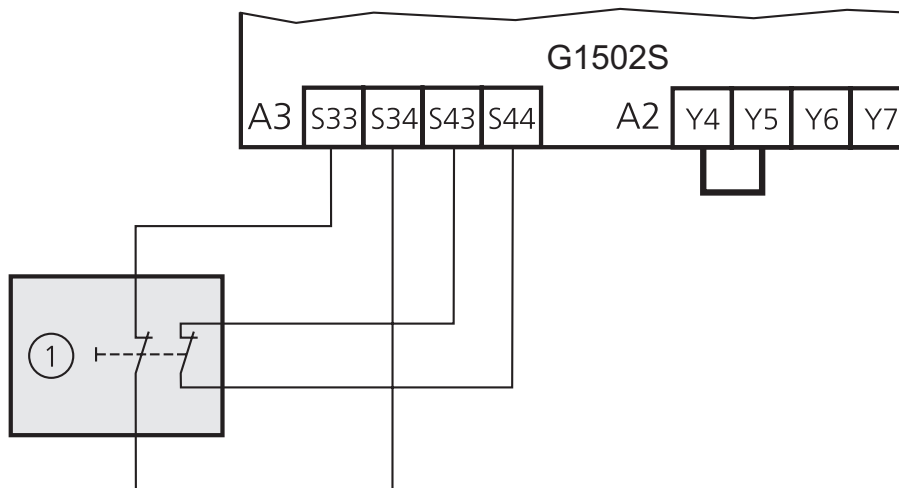
In this operating mode the simultaneity of the contacts is not monitored. The 2-channel fail-safe sensors/switches are for example "electro-sensitive protective equipment" (ESPE) to EN 61496-1.



The contacts of the sensors/switches must allow a minimum current of 6 mA.

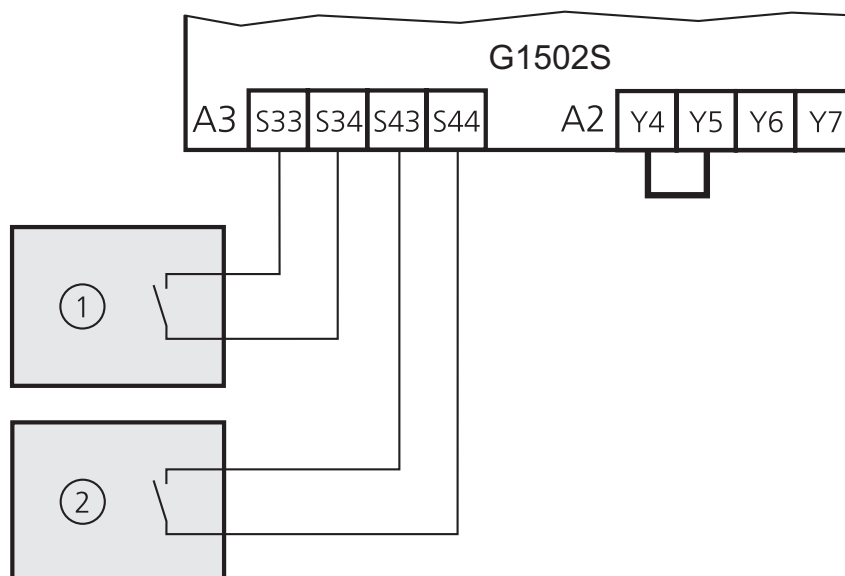
8.5.1 Connection

Connection e-stop / 2-channel fail-safe sensors/switches:



1: Fail-safe sensor/switch

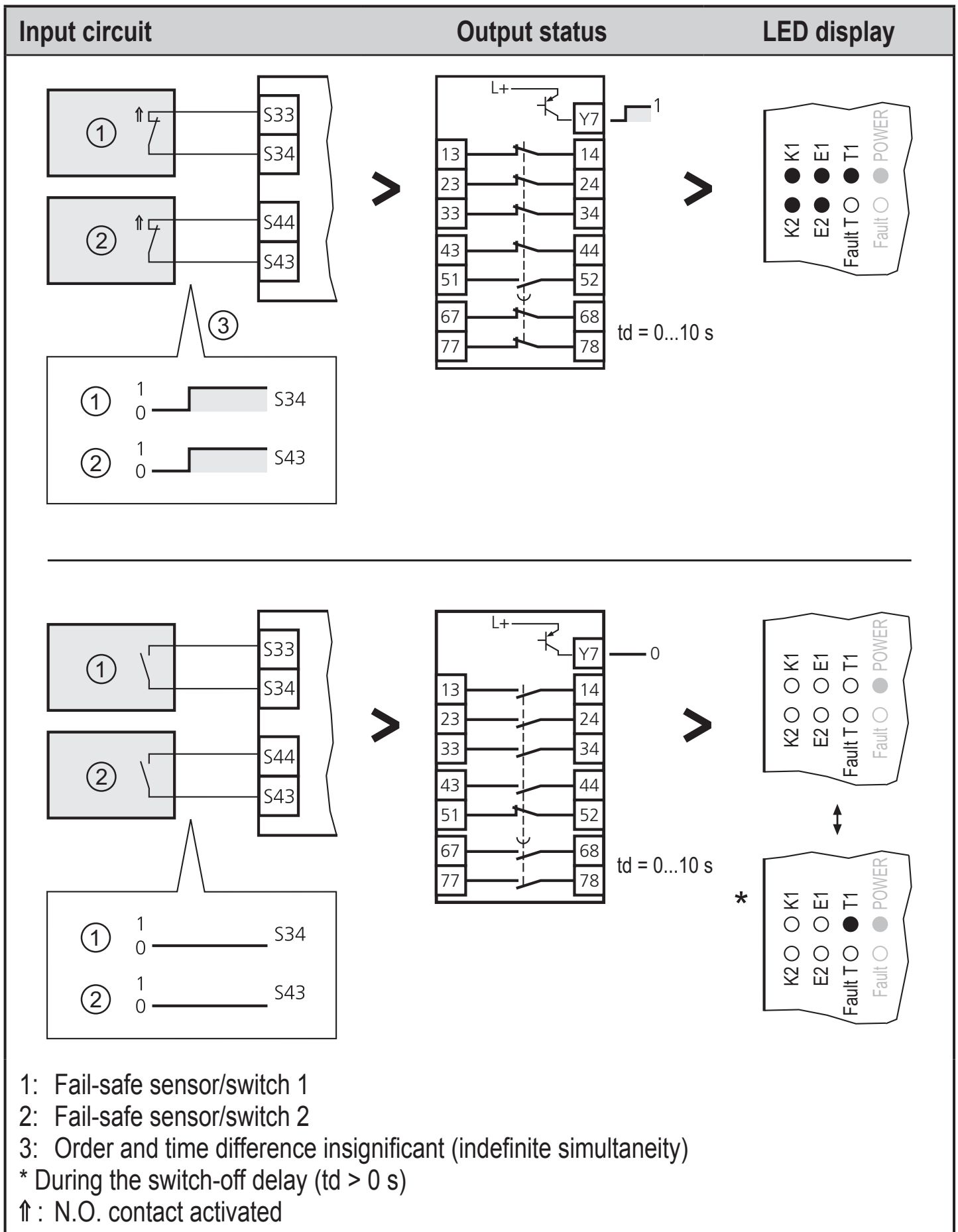
Connection of two mechanical switches:



1: Mechanical switch 1

2: Mechanical switch 2

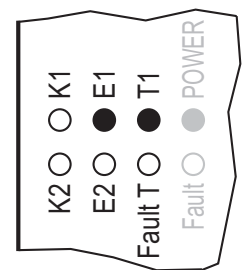
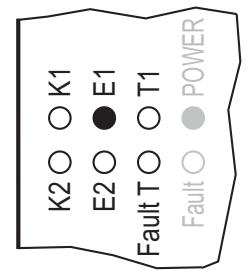
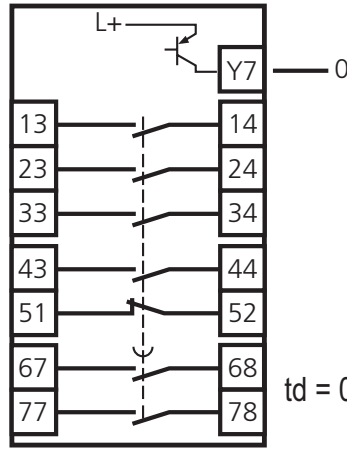
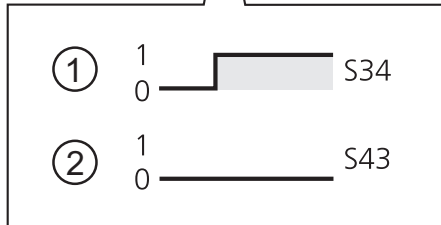
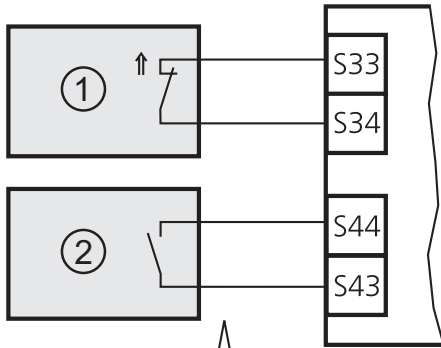
8.5.2 Function



Input circuit

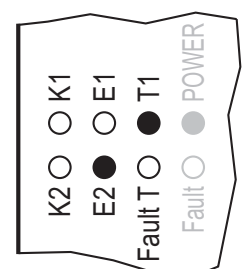
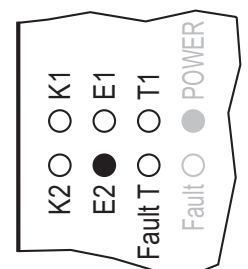
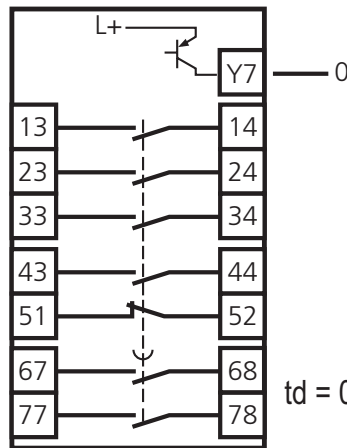
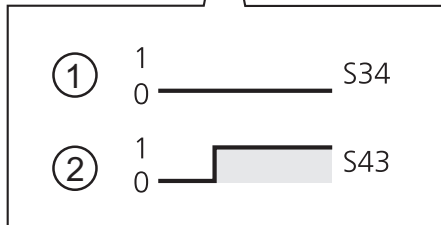
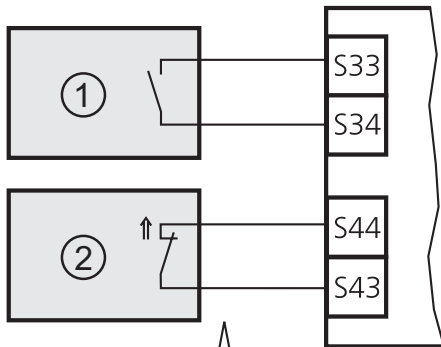
Output status

LED display



td = 0...10 s

*



td = 0...10 s

*


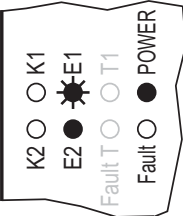
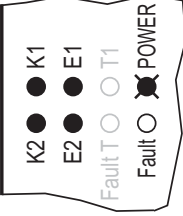

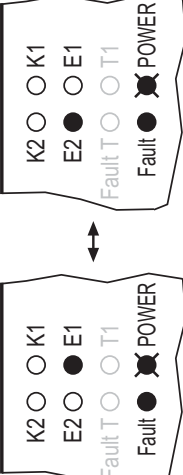
- 1: Fail-safe sensor/switch 1
- 2: Fail-safe sensor/switch 2
- * During the switch-off delay (td > 0 s)
- ↑ : N.O. contact activated

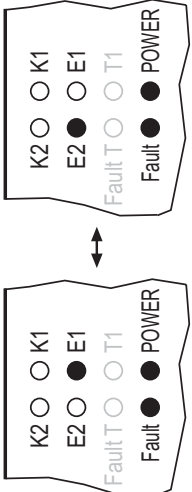
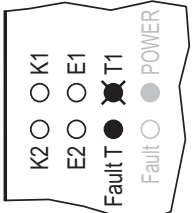
8.5.3 Fault diagnosis



In case of a fault switch the safety relay off and on again!

LED display	Cause of the fault	Troubleshooting
	<ul style="list-style-type: none"> No voltage supply Overvoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> Short circuit Wire break 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> Short circuit Wire break 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> Short circuit Wire break 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> Feedback contacts open Wire break 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> When voltage is applied: Feedback contacts open 	<ul style="list-style-type: none"> ▶ Check output circuit ▶ Check feedback contacts ▶ Exchange external contactor
	<ul style="list-style-type: none"> Wiring fault Missing link Y4/Y5 Short circuit 	<ul style="list-style-type: none"> ▶ Check wiring

LED display	Cause of the fault	Troubleshooting
	<ul style="list-style-type: none"> • Connection A2/A3 reversed 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> • Missing link Y4/Y5 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> • Overvoltage • Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> • Overvoltage • Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply
	<ul style="list-style-type: none"> • Undervoltage 	<ul style="list-style-type: none"> ▶ Check wiring ▶ Check power supply

LED display	Cause of the fault	Troubleshooting
	<ul style="list-style-type: none"> • Short circuits 	<ul style="list-style-type: none"> ▶ Check wiring
	<ul style="list-style-type: none"> • The rotary switch for programming the switch-off delay was changed • Faulty programming 	<ul style="list-style-type: none"> ▶ Program it again (→ 9.1)

9 Programming

In all described operating modes (8.1 - 8.5) a switch-off delay for the relay outputs on terminals C5 and C6 can be set.

9.1 Programming of the switch-off delay

- ▶ Set the rotary switch to position F.
- ▶ Switch the unit off and on again.
- > Yellow LED [T1] flashes quickly: The unit is in the programming mode.
- ▶ Set the rotary switch to the desired position without delay:

Pos.	F	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E
[s]	①	0.25	0.5	1	1.5	2	2.5	3	4	5	6	7	8	9	10	0

① : Programming mode

- > After 2.5 seconds the yellow LED [T1] is permanently lit
- > Programming is completed, the delay is stored permanently.

When the unit is switched on again, it is ready for operation with the new delay.



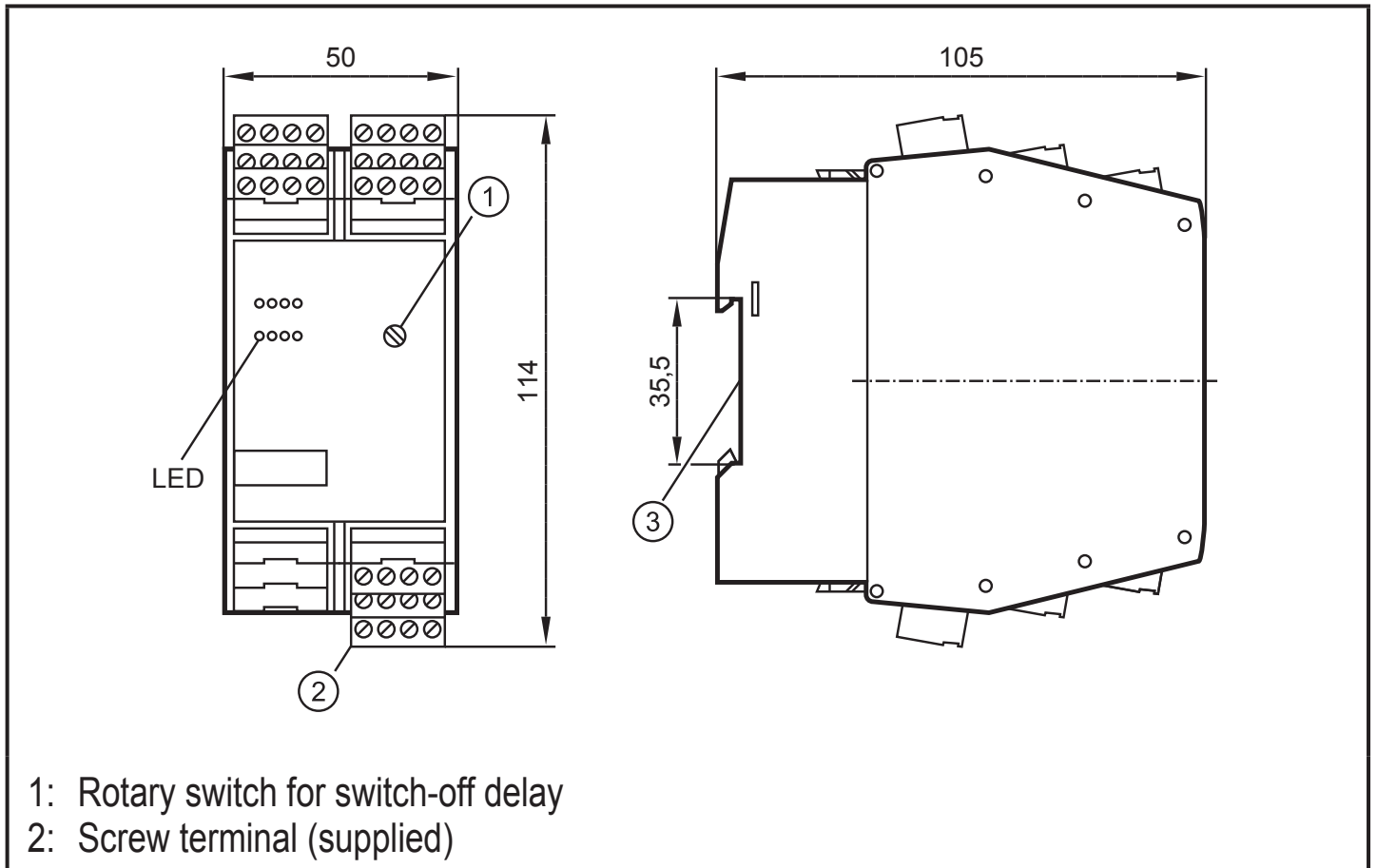
- ▶ Do not change the position of the rotary switch any more.

Protection against defeating: In case of subsequent changes the unit goes into the safe state and the LEDs [T] and [T1] indicate an error (→ fault diagnosis). Program it again.



On delivery the outputs are set without delay, i.e. the rotary switch is at position E.

10 Scale drawing



11 Technical data

G1502S

Safety relay with relay outputs

Terminal block Phoenix Contact MSTBO

Meets the requirements of:

EN ISO 13849-1: 2008+AC2009, category 4 PL e, SIL 3 (IEC 61508)

Electrical design	Relay
Output function	3 safety-related NO contacts (floating) without delay; 2 non safety-related signal outputs without delay (1 x NO, 1 x NC, floating contacts) 2 safety-related NO contacts (floating) with switch-off delay 1 signal output (positive switching) with delay
Operating voltage	24 V DC (19.2...30) incl. 5 % residual ripple

Contact rating	6 A , 250 V AC / 24 V DC (≥ 6 mA) max. total current: 12 A				
Minimum load current of the feedback contacts	10 mA				
Short-circuit protection / overload protection	The contacts are to be protected by means of fuses with a nominal current of < 3.6 A				
Current consumption	< 500 mA				
Function display	voltage (green), error (2 x red), output status (3 x yellow), input (2 x yellow)				
Power-on delay time	< 6 s				
Duration of switch-off test pulses	≤ 500 μ s				
Response time [ms]	acc. to input circuit \rightarrow chapter				
	8.1	8.2	8.3	8.4	8.5
Release	70	160	70	110	110
Safety requirement	30	100	30	30	30
Ambient temperature	$-25...55^{\circ}\text{C}$				
Protection rating	IP 20				
Housing materials	PA				
Input characteristics (S34, S43)	"1": > 11 V, 6 mA "0": < 5 V, < 500 μ A				
Output characteristics	S33 push-pull short-circuit proof "0": $I_{\text{sink}} \sim 30$ mA "1": $I_{\text{source}} \geq 50$ mA, $U > 18$ V S44 "0": $I_{\text{R}} \leq 300$ μ A "1": $I_{\text{source}} \geq 50$ mA, $U > 18$ V Y7 "0": $I_{\text{R}} \leq 300$ μ A "1": $I_{\text{source}} \geq 11$ V @ 30 mA, ≥ 15 V @ 15 mA				
Mission Time (TM)	175 200 h				
PFH _D	$5,86 \times 10^{-9}$ / h *)				
B10 _D	400 000 *)				

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Comments	<p>Additional comments concerning the cULus approval (UL 508):</p> <ul style="list-style-type: none"> • Maximum ambient temperature 55°C (in the control cabinet) • The safety functions were not assessed by UL. The approval has been made according to UL 508 for general applications. • Use 60/75°C copper conductors only. • For use in pollution degree 2 environment • Same polarity (phase) referred to the output contacts <p>*) with $h_{op} = 24 \text{ h}$, $d_{op} = 365 \text{ days}$, $t_{cycle} = 3600 \text{ s}$</p>
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12 Tests/approvals

The G1502S safety relay was tested and certified by TÜV-Nord. The safety relay was developed and tested in accordance with, for example, the following directives and standards:

- 2006/42/EC Machinery Directive
- 2004/108/EC EMC Directive
- 2014/30/EU EMC Directive (effective from 20 April 2016)
- EN 50178 (1997) Electronic equipment for use in power installations
- EN ISO 13849-1: 2008+AC2009 Safety of machinery, safety-related parts of control systems
- DIN EN 60204-1:2006 (where applicable) Electrical equipment of machines
- EN 61496-1 (2013) Non-contact protective equipment - General requirements and tests
- EN 574:1996+A1: 2008 Safety of machinery - Two-hand control devices - Functional aspects - Principles for design
- IEC 61508: 2010 Functional safety of electrical/electronic/programmable electronic safety-related systems
- EN 62061: 2005+A1: 2013 Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems
- UL 508

13 Terms and abbreviations

ESPE		Electro-Sensitive Protective Equipment.
Cat.	Category	Category Classification of the safety-related parts of a controller as regards their resistance to failures.
CCF	Common Cause Failure	Common cause failure
DC	Diagnostic Coverage	Diagnostic coverage.
MTTF	Mean Time to Failure	Mean time to failure.
MTTF _d	Mean Time To Dangerous Failure	Mean time to dangerous failure.
OSSD	Output Signal Switching Device	Output signal switch element, static safety-related output.
PFH (PFH _D)	Probability of (dangerous) Failure per Hour	Probability of a (dangerous) failure per hour.
PL	Performance Level	PL to EN ISO 13849-1
SIL	Safety Integrity Level	SIL 1-4 to IEC 61508
PLC		Programmable Logic Controller

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Technical data and further information at
www.ifm.com