

# Solid-State Relay

PSSRN S 24VDC 1M K 600VAC 30A T 2986920000



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# 1 About this documentation

This document is intended for all persons handling the product during its life cycle.

- Read this document completely before you install and start using the product.
- Keep this document after reading.

## 1.1 Applicable documents

- Installation instructions

All documents can be downloaded from the Weidmüller website [www.weidmueller.com](http://www.weidmueller.com).

## 1.2 Illustrations and icons

- Action step
- Numbered lists



Sections of text next to this arrow contain notices which are not related to safety, but which provide important information regarding correct and effective work.

### **WARNING!**

A note with the signal word “**WARNING!**” warns against a danger that can result in serious injury or death if it is not avoided.

### **CAUTION!**

A note with the signal word “**CAUTION!**” warns against a danger that can result in injuries if it is not avoided.

### **ATTENTION!**

A note with the signal word “**ATTENTION!**” warns against a danger that can result in damage to property or malfunctions of the product if it is not avoided.



Note for an electrician



Note referring to further documentation



Note for required tool

## 2 For your safety

### 2.1 Intended use

The device is used to switch alternating current loads and ensures galvanic isolation between the input (control side) and output (load side). The device is intended for heating load applications and can monitor various malfunctions on the heater or on the relay itself, e.g. partial load failure, heater failure, open circuit and short circuit on the device, as well as overtemperature. The product may only be used in industrial environments within the technical specifications provided.

### 2.2 Personnel



The product must only be installed, put into operation, removed and maintained by qualified electricians who are familiar with national and international laws, provisions and standards.

### 2.3 Safety information

- The device is only intended for the application described in this document. Any other use is not permitted and may result in accidents or damage to the device.
- Before commencing work, disconnect the power supply to the device and secure it against being switched on again.
- Never touch the connections of the device if voltage is present at the connections. The output connections may continue to carry voltage when switched off, e.g. leakage current or in the event of a fault in the device.
- A blown fuse may indicate a fault. To reduce the risk of fire or electric shock, the conductive parts of the device should be inspected and damaged parts – or, if necessary, the entire device – should be replaced. The device must not be opened. The device must be replaced if it is damaged due to a current overload.
- The metal housing serves as a heat sink. For this reason, the housing temperature must not exceed 90 °C. The extent to which the device heats up depends on various influencing factors:
  - Continuous load current
  - Operating time
  - Switch-on frequency / duty cycle
  - Inrush current / pulse current
  - Ambient temperature
  - Thermal shadowing of the device by other switch cabinet components (e.g. wiring ducts)
  - Installation distances
- When using end brackets, a metal design is recommended, e.g. MEW 35/1 (1805610000).
- The heat sink may still have high temperatures even after the device has been switched off.

- The inputs and outputs of the device must be protected with an effective suppressor circuit, e.g. protective devices, filters or air gaps. The permissible rated impulse withstand voltage must not be exceeded:
  - Max. 2.5 kV at the input
  - Max. 6 kV at the output
  - The protection must be tested in accordance with the UL 1449 standard for surge voltage arresters and must be able to withstand the short-circuit current that occurs.
- A1 and A2 must be supplied from a secondary power supply circuit that is limited by a transformer, rectifier, voltage divider or similar component. This device must derive the power from the primary circuit. In the event of a short circuit, a maximum of 1500 VA may occur between the conductors of the secondary circuit or between the conductors and the earth. The volt-ampere short-circuit limit is the product of the open-circuit voltage and the short-circuit current.
- The relay was developed for Class A devices. External filters may be required. Use of the product in residential environments may cause radio interference. Under these circumstances, the user may be required to take additional remedial action.

### 3 Derating behaviour

The ambient temperature, the device distance and the installation height exert an influence on the derating behaviour of the device. For details on the derating behaviour as a function of the device distance, see Figure 3.1.

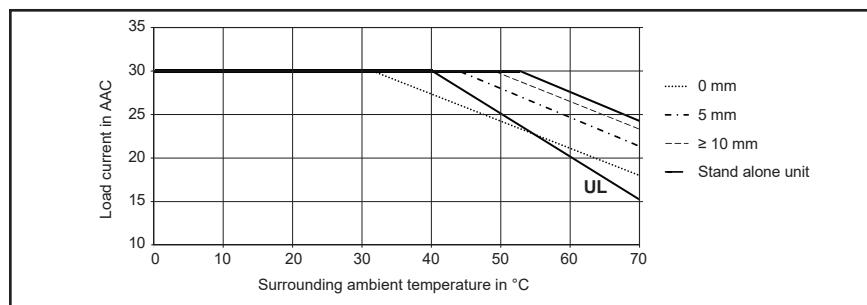


Figure 3.1 Derating behaviour at different temperatures

From 1000 m, linear derating occurs by 1% per 100 m up to a maximum installation height of 2000 m. Figure 3.2 shows the derating behaviour at a device distance of 20 mm and an ambient temperature of 45 °C for various installation heights.

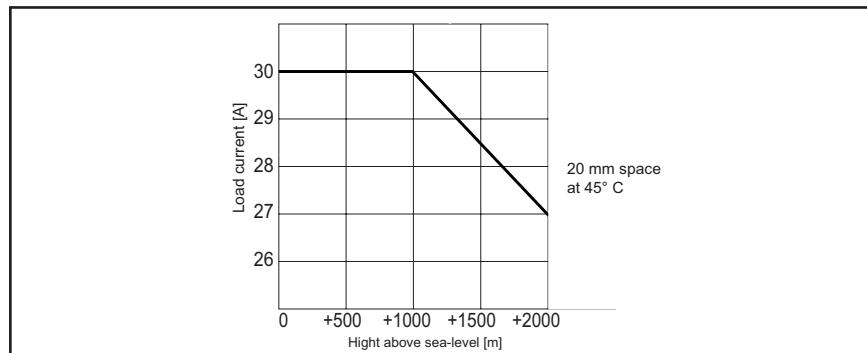


Figure 3.2 Derating behaviour at different installation heights

The height derating from an installation height of 1000 m is calculated as follows:

$x$  = Maximum current as a function of the device distance and the ambient temperature (see Figure 3.1)

$y$  = Installation height above sea level in metres

$$x - \frac{x}{100} \times \frac{y - 1000}{100} = \text{Maximum switching current}$$

#### Example calculation for derating in Figure 3.2

Ambient temperature: 45 °C

Device distance to other products: 20 mm

$x = 30$  A (maximum current from Figure 3.1)

$y = 2000$  m (installation height above sea level)

$$30 - \frac{30}{100} \times \frac{2000 - 1000}{100} = 27 \text{ A}$$

The maximum current at 2000 metres above sea level at 45 °C and a device distance of 20 mm is 27 A.

## 4 Short-circuit protection

### ATTENTION!

#### Product damage or faults

The device may be damaged by short circuits.

- Secure the device using semiconductor fuses.

The output circuits of the PSSR can be protected with the options described here.

**Protection coordination type 1:** The PSSR is no longer functional after a short circuit and must be replaced.

**Protection coordination type 2:** The PSSR is still functional after a short circuit.

#### Coordination – Type 1 (UL508)

Current	Max Voltage	Max. size	Class
100 kA	600 V AC	40 A	J

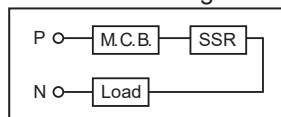
#### Coordination – Type 2 (IEC/EN 60947-4-3)

Current	Max Voltage	Mersen (Ferraz Shawmut)		Siba	
		Max. size	Item No.	Max. size	Item No.
10 kA	600 V AC	40 A	6.9xx CP GRC 22x58 /40	32 A	50 142 06.32
100 kA			6.6xx CP URD 22x58 /40		

#### Coordination – Type 2 with circuit breaker (M.C.B.s)

Order no. ABB Z tripping characteristic (rated current)	Order no. ABB B tripping characteristic (rated current)	Max. cable cross-section	Min. cable length <sup>1</sup>
<b>1 phase</b>			
S201 - Z20 (20 A)	S201 - B1 (10 A)	1.5 mm <sup>2</sup>	4.2 m
		2.5 mm <sup>2</sup>	7.0 m
		4.0 mm <sup>2</sup>	11.2 m
S201 - Z32 (32 A)	S201 - B16 (16 A)	2.5 mm <sup>2</sup>	13.0 m
		4.0 mm <sup>2</sup>	20.8 m
		6.0 mm <sup>2</sup>	31.2 m
<b>2 phases</b>			
S202 - Z20 (20 A)	S202 - B1 (10 A)	1.5 mm <sup>2</sup>	1.8 m
		2.5 mm <sup>2</sup>	3.0 m
		4.0 mm <sup>2</sup>	4.8 m
S202 - Z32 (32 A)	S202 - B16 (16 A)	2.5 mm <sup>2</sup>	5.0 m
		4.0 mm <sup>2</sup>	8.0 m
		6.0 mm <sup>2</sup>	12.0 m
		10.0 mm <sup>2</sup>	20.0 m

1. Minimum cable length between circuit breaker and load including the return line leading back to the mains.





The specifications given in the tables apply for an expected short-circuit current of 6 kA through the PSSR and for a 230 / 400 V power supply. In the event of deviations from the cable cross-sections or cable lengths listed, please contact Weidmüller Support.

 **WARNING!**

**Risk of death due to electric shock!**

There is a risk of electric shock if the device is put into operation without checking it after a short circuit.

- ▶ Ensure that the short-circuit has ended.
- ▶ Ensure that the fuse between the supply voltage and the switch cabinet has not tripped.
- ▶ Check the device and the cables, including the insulation, for visible damage, e.g. cracks, breaks, deformation or discolouration.
- ▶ Ensure that no parts can be ejected and that there is no risk of fire.

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## 5 Connection examples

### 5.1 Connection example for separate alarm outputs

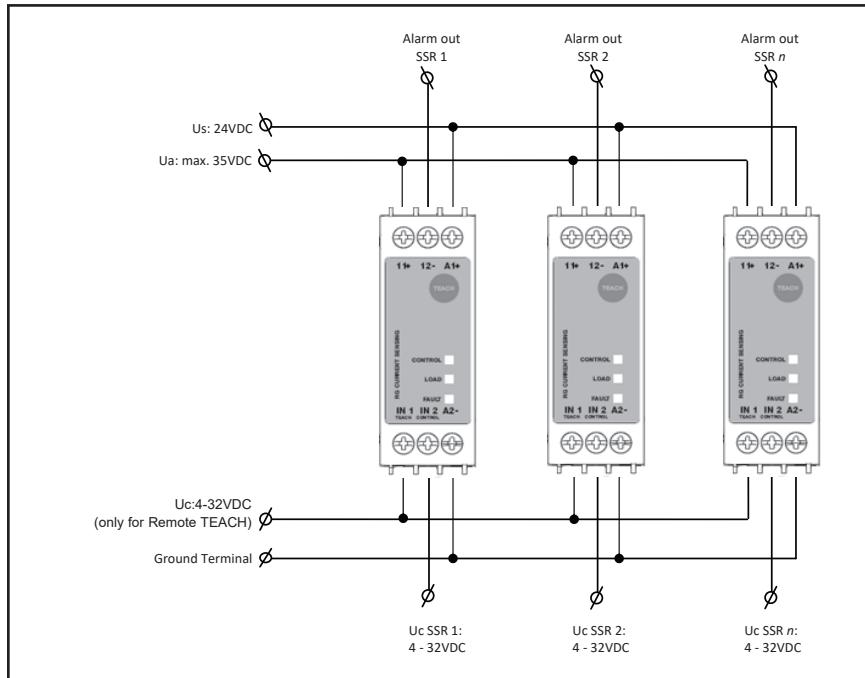


Figure 5.1 Connection example for separate alarm outputs

### 5.2 Connection example for alarm outputs connected in series

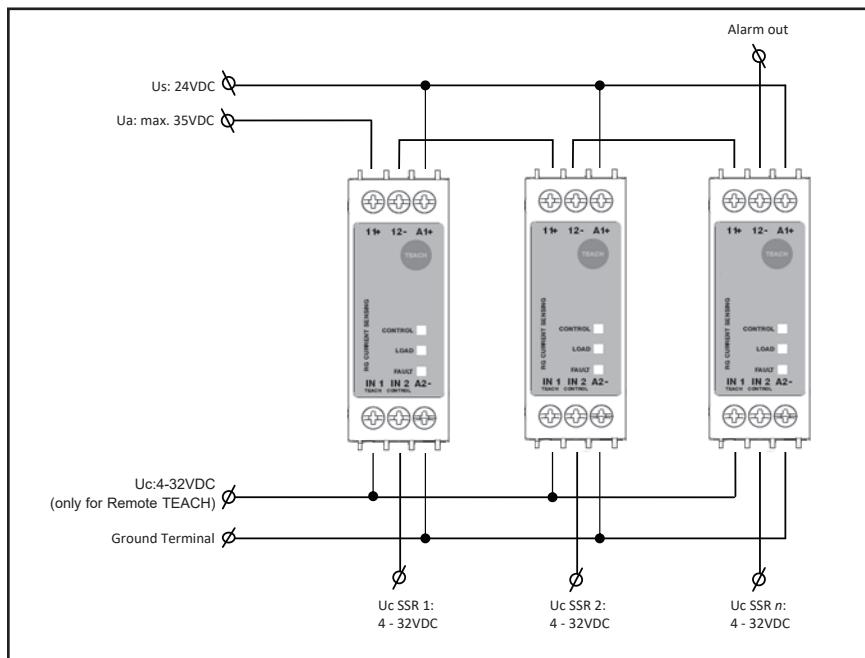


Figure 5.2 Connection example for alarm outputs connected in series

## 6 Modes of operation and TEACH process

Two different modes of operation are possible for the device:

- Operation without monitoring function
- Operation with monitoring function

For operation with monitoring function, a current setpoint must be stored in the device. The current setpoint is the rated operating current of a heater in normal operation. No current setpoint is stored in the device upon delivery. The current setpoint is saved by means of a TEACH process. An incorrect current setpoint is set if the load of the heater is faulty or the supply voltage at 1/L1 deviates from the operating voltage at 1/L1 during the TEACH process.

If no load is connected to terminal 2 / T1 during initial commissioning, the current setpoint is set to 0 during the TEACH process.



## 6.1 Operation without monitoring function

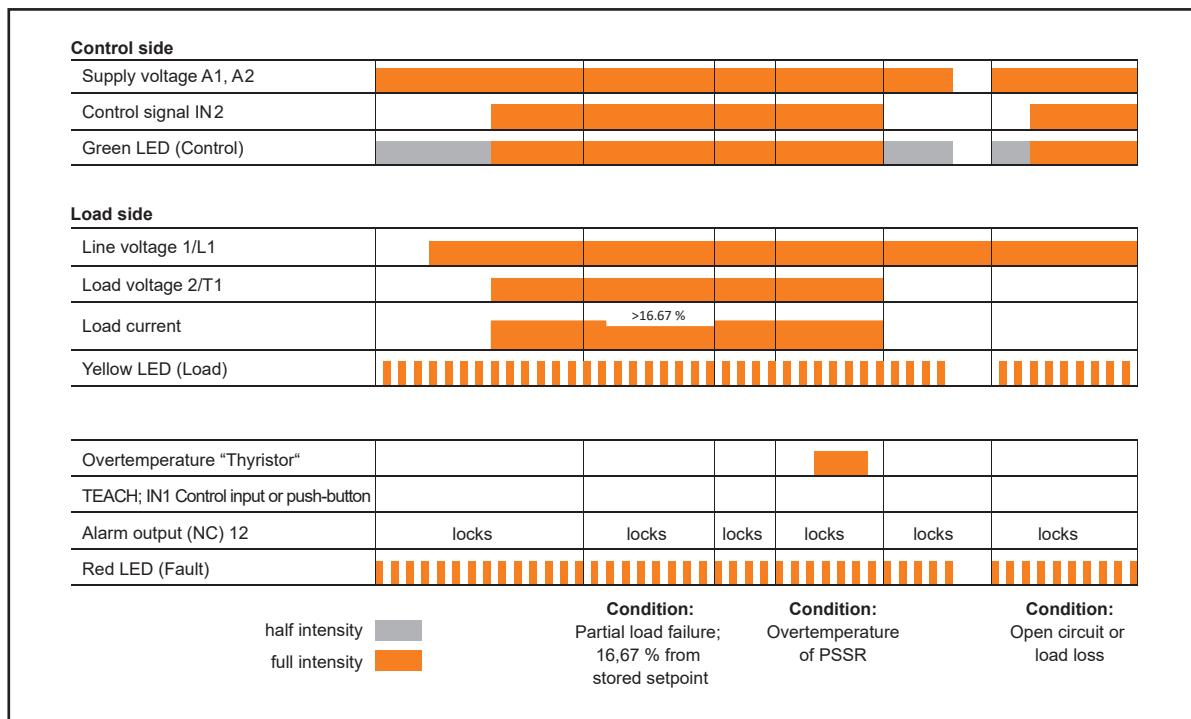


Figure 6.1 Behaviour during operation without monitoring function

### **WARNING!**

#### **Risk of death due to electric shock!**

There is a risk of electric shock when working on the electrical installation.

- Before commencing work, disconnect the power supply to the device and secure it against being switched on again.

- Apply the supply voltage to terminals A1 and A2.

The yellow and red LEDs flash continuously in the same sequence as in the case of **no TEACH setpoint**.

The green LED lights up at half intensity. The supply voltage is present. The alarm output (11, 12) locks to indicate that no setpoint is set.



Normally, if no error conditions are met, the alarm output is closed.

- Apply the control signal to IN 2.

The green LED lights up at full intensity. The control signal is present.

The relay activates output 1/L1, 2/T1 even without a current setpoint. The monitoring function remains inactive if the relay is activated without a current setpoint. The monitoring function only becomes active as soon as the TEACH process has been completed.

The supply voltage must be applied to terminals A1 and A2 for the relay to switch after the control signal is applied.

## 6.2 Operation with monitoring function

Control side										
Supply voltage A1, A2	■	■	■	■	■	■	■	■	■	
Control signal IN2	■	■	■	■	■	■	■	■	■	
Green LED (Control)	■	■	■	■	■	■	■	■	■	
Load side										
Line voltage 1/L1	■	■	■	■	■	■	■	■	■	
Load voltage 2/T1	■	■	■	■	■	■	■	■	■	
Load current	■	■	■	■	■	■	■	■	■	
Yellow LED (Load)	■	■	■	■	■	■	■	■	■	
TEACH; IN1 Control input or push-button	■	■	■	■	■	■	■	■	■	
Alarm output (NC) 12	■	locks	■	locks	■	locks	■	locks	■	locks
Red LED (Fault)	■	■	■	■	■	■	■	■	■	
half intensity ■ full intensity ■										
		Condition: Partial load failure	Condition: Overtemperature		Condition: Thyristor short-circuit		Condition: Open circuit between L1 and T1 or load loss		Condition: Failure of a phase/ mains voltage	

Figure 6.2 Behaviour during operation with monitoring function

### **WARNING!**

#### **Risk of death due to electric shock!**

There is a risk of electric shock when working on the electrical installation.

- Before commencing work, disconnect the power supply to the device and secure it against being switched on again.

- Apply the supply voltage to terminals A1 and A2.

The yellow and red LEDs are off. The green LED lights up at half intensity. The supply voltage is present. The alarm output (11, 12) activates to show that a setpoint has been set and there is no fault.

- Apply the control signal to IN 2.

The green LED lights up at full intensity. The control signal is present.

The relay activates output 1/L1, 2/T1.

The supply voltage must be applied to terminals A1 and A2 for the relay to switch after the control signal is applied.

The monitoring properties are activated.

#### **Alarm states**

For all alarm states described, the LED sequence and the alarm output are automatically reset as soon as the alarm state is no longer present. No manual reset is necessary.

### Partial load current error

A partial load current error occurs if the load current falls more than 16.67 % below the stored setpoint. During the fault state, the relay remains activated, but the alarm output locks and gives an alarm signal. The red LED (Fault) lights up continuously. If the load current rises to a normal level again, the alarm output changes to the normal state (activated).

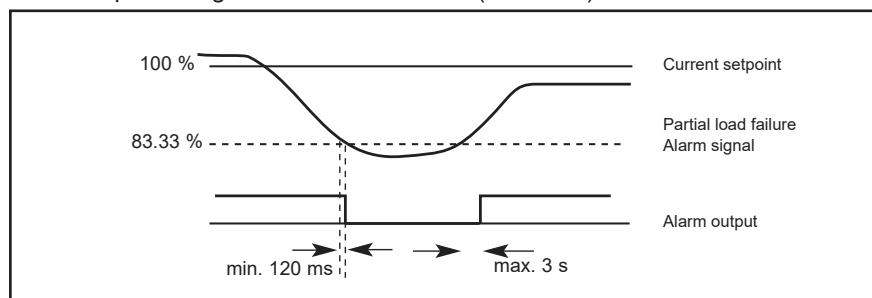


Figure 6.3 Partial load current error

### Thyristor overtemperature protection

If the thyristor of the devices exceeds the maximum permissible temperature during normal operation, an overtemperature is detected and the device switches off the load. The red LED flashes 3 times and the alarm output locks. The alarm is automatically reset as soon as the overtemperature is no longer present.

### Thyristor short-circuit

The thyristor short-circuit is detected if a load current (approx. < 800 mA) flows although no control signal is present. The red LED (Fault) flashes 4 times and the alarm output locks. The yellow LED (Load) lights up while the green LED (Control) lights up at half intensity (no control signal) to indicate the switching status of the load.

### Open load circuit on the device, failure of the heating circuit or mains voltage

The device locks although a control signal is present at terminal IN 2. The red LED (Fault) flashes twice and the alarm output locks.

## 6.3 Red LED display in alarm status

Flashing sequence	Description of error	Tripping time diagram
1	TEACH locked	
2	Open load circuit	
3	Thyristor overtemperature	
4	Thyristor short-circuit	
50%	No TEACH setpoint	
100%	Partial load current failure	

## 6.4 TEACH process

The TEACH process can be carried out locally or via the TEACH control input. For the local TEACH process, the TEACH button must be pressed for at least 3 seconds, but less than 5 seconds. For teaching via the TEACH control input, a high signal must be applied to IN 1 for at least 3 seconds, but less than 5 seconds. If a signal is present for longer than 5 seconds, the PSSR cancels the TEACH process. The supply voltage must be applied to terminals A1 and A2 during the TEACH process.

The monitoring function is only activated once the TEACH process has been completed.

### TEACH process without applied control signal

Control side			
Supply voltage A1, A2		full intensity	
Control signal IN2			full intensity
Green LED	half intensity	full intensity	half intensity
Load side			
Line voltage 1/L1		full intensity	
Load voltage 2/T1		full intensity	full intensity
Load current		full intensity	full intensity
Yellow LED	full intensity	full intensity	full intensity
TEACH; IN1 Control input or push-button	full intensity	full intensity	
Alarm output (NC) 12	locks		locks
Red LED	full intensity	full intensity	
Condition:			
half intensity		Initial teach-in	
full intensity		(TEACH) without	
		control signal	
		Condition:	
		Failure of	
		supply voltage	

Figure 6.4 Behaviour during a TEACH process without an applied control signal

If the current setpoint is not saved (factory setting), the red and yellow LEDs flash. The alarm output at terminals 11 and 12 locks.

As soon as the TEACH process is triggered, the TEACH time starts.

The device activates for 5 seconds. The yellow LED lights up and the green LED lights up at full intensity. After the 5 seconds, the current setpoint is set. After a successful TEACH process, the red and yellow LEDs flash 3 times simultaneously.

The alarm output activates and signals that the device is functioning normally.

If the TEACH process was not successful, the red and yellow LEDs flash alternately, signalling that no current setpoint has been set. An unstable load current during the TEACH process can result in no current setpoint being set. The TEACH process must be repeated.

### TEACH process with applied control signal

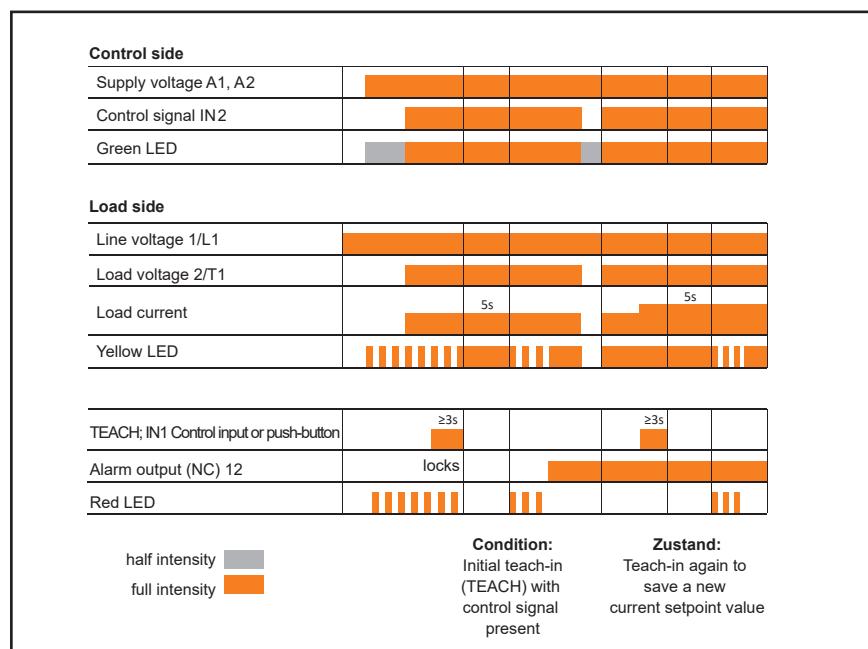


Figure 6.5 Behaviour during TEACH process with an applied control signal

In this case, the TEACH process is identical to the process without a control signal.

During the 5-second TEACH phase, the state of the load circuit does not differ from the state without TEACH, as the load was already switched on before the TEACH process. The load remains switched on as long as the control signal is present.

If the device is locked, no new TEACH process can be performed. The relay must first be unlocked.

### Locking and unlocking the TEACH function

The TEACH button on the front of the device can be locked to prevent an unintentional local TEACH.

- Send a pulse between 1 and 1.5 seconds via terminal IN 1 (remote TEACH).

On delivery and after removing the supply voltage (A1, A2), the TEACH input is unlocked.



## 7 Conformity

### 7.1 Electromagnetic compatibility

- The cables for the control circuit must be laid together to ensure that the product is immune to high-frequency interference. If necessary, shielded cables must be used.
- Depending on the application and load current, the use of AC semiconductor relays may cause conducted radio interference. If EMC regulations must be complied with, mains filters may have to be used in certain circumstances. The capacitance values given in the filter specification table are for guidance only. The filter attenuation depends on the specific application.
- This product was developed for Class A devices. Use of the product in residential environments may cause radio interference. Under these circumstances, additional remedial action may be required.

PC1	Reductions in performance or loss of function are not permitted if the product is operated as intended.
PC2	Reductions in performance or partial loss of function are permitted during the test. After completion of the test, however, the product must automatically switch over to its intended use.
PC3	Temporary loss of function is permissible if it can be restored by manual operation of the control elements.

#### Electromagnetic compatibility – interference immunity

##### EN 60947-4-3

Susceptibility to static electricity discharge	EN/IEC 61000-4-2 8 kV air discharge, 4 kV contact (PC1)
Immunity to high-frequency electromagnetic fields	EN/IEC 61000-4-3 10 V/m, from 80 MHz to 1 GHz (PC1) 10 V/m, from 1.4 to 2 GHz (PC1) 3 V/m, from 2 to 2.7 GHz (PC1)
Immunity to fast transient electrical interference / BURST	EN/IEC 61000-4-4 Load circuit: 2 kV, 5 kHz (PC1) Control circuit: 1 kV, 5 kHz (PC1)
Immunity to conducted interference induced by high-frequency fields	EN/IEC 61000-4-6 10 V/m, from 0.15 to 80 MHz (PC1)
Immunity to interference voltages	EN/IEC 61000-4-5 Load circuit, cable to cable: 1 kV (PC1) Load circuit, cable to earth: 2 kV (PC1) Control circuit, cable to cable: 500 V (PC2) Control circuit, cable to earth: 500 V (PC2) Signal connections, cable to earth: 1 kV (PC2)
Immunity to voltage dips	EN/IEC 61000-4-11 0% for 0.5, 1 cycle (PC2) 40% for 10 cycles (PC2) 70% for 25 cycles (PC2) 80% for 250 cycles (PC2)
Immunity to short interruptions	EN/IEC 61000-4-11 0% for 5000 ms (PC2)

**Electromagnetic compatibility – emitted interference**  
**EN 60947-4-3**

ISM devices – Radio disturbance characteristics; limits and methods of measurement (radiated)	EN/IEC 55011 Class A: from 30 to 1000 MHz
ISM devices – Radio disturbance characteristics; limits and methods of measurement (conducted)	EN/IEC 55011 Class A: from 0.15 to 30 MHz (External filter may be required; see "Filters" section)

## 7.2 Filters

The following filters are permitted in accordance with IEC/EN 55011 Class A:

Type	Recommended filters	Maximum heating current
PSSRN S 24VDC 1M K 600VAC 30AT	220 nF / 760V / X1	30 AAC

### Filter connection diagram

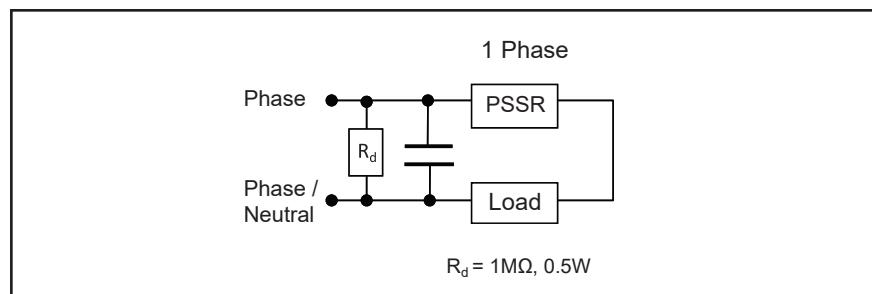


Figure 7.1 Filter connection diagram, 1-phase

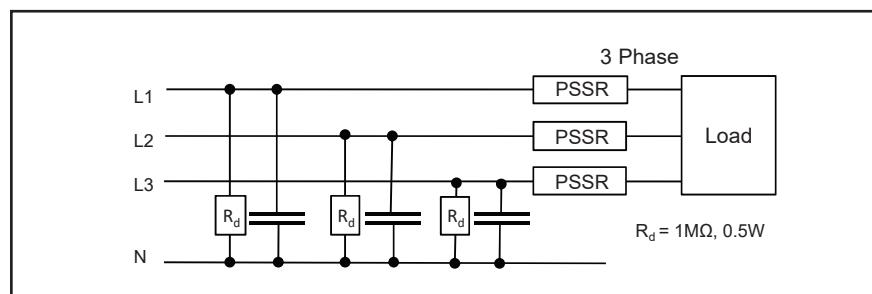


Figure 7.2 Filter connection diagram, 3-phase

The filter must be mounted above the load and relay.



### 7.3 Conformity for railway applications

Conformity for railway applications	
Shock resistance	15/11 g/ms EN 50155 EN 61373
Vibration resistance	2 g per axle 2–100 Hz IEC 60068-2-6 EN 50155 EN 61373
UL flammability rating (enclosure)	UL 94 V0 Glow wire ignition temperature, Glow wire flammability index Complies with DIN EN 60335-1 requirements
Vibration and shock	2–100 Hz IEC 60068-2-6 EN 50155 EN 61373
Immunity to high-frequency electromagnetic fields	IEC/EN 61000-4-3 10 V/m, 80 MHz – 1 GHz (PC1) 10 V/m, 1.4–2 GHz (PC1) 3 V/m, 2–2.7 GHz (PC1)
Grid quality measurement	IEC/EN 61000-4-30 50 Hz – 2 kHz, < 8% THD (fulfilled)

## 8 Disposal



The product contains substances that may be harmful to the environment and human health. In addition, it also contains substances that can be reused through targeted recycling.

Observe the instructions for proper disposal of the product. The instructions can be found at [www.weidmueller.com/disposal](http://www.weidmueller.com/disposal).

