POWERSWITCH
Solid-state Relay / - Contactor
With Load Circuit Monitoring PH 9270

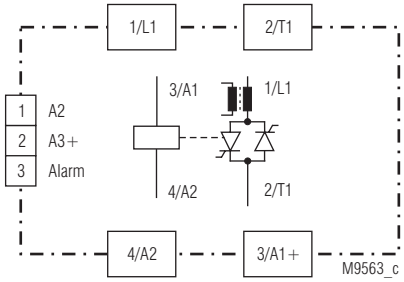
0255163

Solid-state relay
PH 9270.91

Solid-state contactor
PH 9270.91/000/02

- AC solid-state relay /-contactor
- With integrated load circuit monitoring
- Settable load limit value
- According to IEC/EN 60947-4-3
- Load current 40 A, AC 51
- Switching at zero crossing
- 2 anti-parallel thyristors
- DCB technology (direct bonding method) for excellent heat transmission properties
- Two-colours LED status indicator
- Touch protection IP20
- PLC compatible alarm output (PNP; NPN on request)
- As option closed circuit operation or open circuit operation
- As option with optimized heat sink, for DIN rail mounting
- Width 45 mm

Circuit Diagram



PH 9270.91

Approvals and Markings

AE68

Connection Terminals

Terminal designation	Signal description
A1+, A2	Control input
A3+, A2	Operating voltage, load circuit monitoring
Alarm	Solid-state outputs
L1	Network
T1	Load output

Indication

The LED „A1/A2“ shows the state of the control input
yellow: controlled semiconductor relays
off: not controlled semiconductor relays

The LED „Alarm“ shows the state of the unit
green: no failure
red: failure (thyristor defective with open or short circuit, open load, current value to high or to low or supply voltage < 100 V AC)
off: no auxiliary voltage (A3+/A2)

Notes

Overtemperature protection
Optionally, the solid-state relay has an overtemperature protection to monitor the temperature of the heat sink. For this purpose, a thermal switch (NC contact) can be inserted into the respective pocket at the bottom of the solid-state relay. As soon as the temperature of the heat sink exceeds for example 100°C, the thermal switch opens. For thermal protection of the solid-state relay, a thermal switch of *UCHIYA* type UP62 – 100 can beinstalled.

Applications

For high frequency wear free and noiseless switching of
- heating systems
- motors
- valves*
- lighting systems

The semiconductor switches at zero crossing. The integrated load monitoring provides fast fault finding e.g. broken load elements (part load failure), broken load circuit, overcurrent, missing load voltage, blown fuse and thyristor faults.
The PH 9270 is suitable for many applications e. g. extrusion machines for plastic and rubber, packaging machines, solder lines, machines in food industry.

* On overcurrent monitoring a start up delay must be integrated in the control.

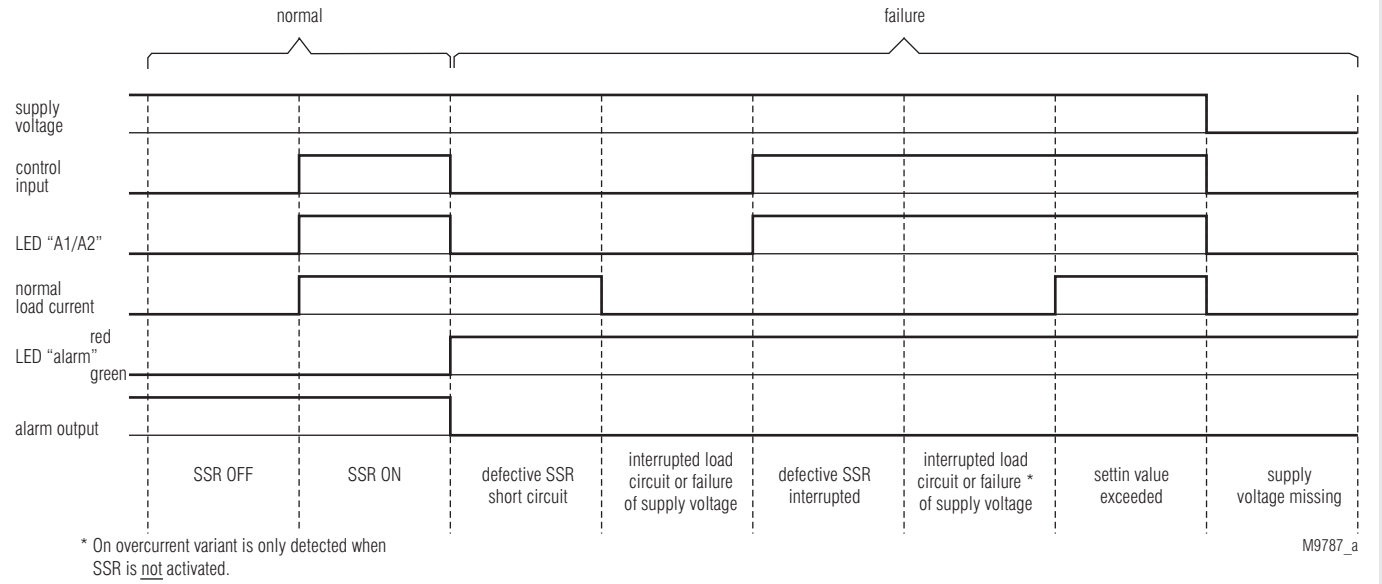
Function

The solid-state relay PH 9270 monitors with applied auxiliary voltage (A3+/A2) the load voltage and the load current. On broken load circuit, deviations of the load current from setting value or defective semiconductor an alarm output is controlled. The failure state is indicated on an 2-color LED (see Function Diagrams).

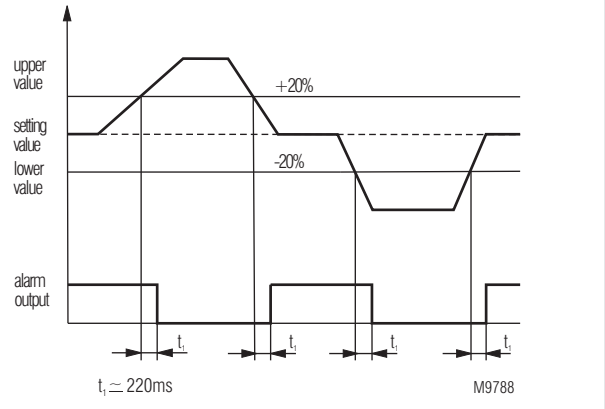
The PH 9270 with 2 antiparallel connected thyristors switches at zero crossing. When connecting the control voltage the semiconductor is switched on with the next zero crossing of the sinusoidal voltage. After disconnecting the control voltage the semiconductor switches off with the next zero crossing of the load current.

As option the PH 9270 is available with heat sink for DIN rail mounting and immediately “ready to use”. In addition the heat dissipation is optimised.

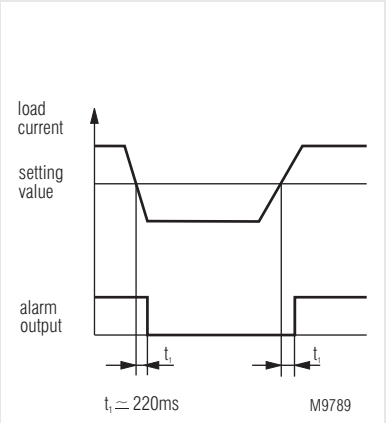
Function Diagram



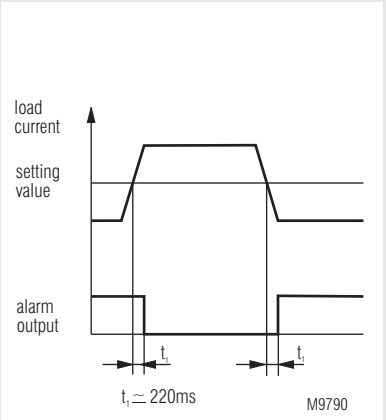
Normal operation and failure status



Over- / Undercurrent detection variant /000



Undercurrent detection variant /001



Overrcurrent detection variant /002

Technical Data

Output

Load voltage AC [V]:	200 ... 480
Frequency range [Hz]:	47 ... 63
Load current [A], (AC 51):	40
Load limit integral I^2t [A^2s]:	1800; 6600*)
Max. overload current [A] t = 10 ms:	600; 1150*)
period. underload current [A] t = 1 s:	120; 150*)
Forward-voltage [V]	
at nominal curren:	1.4
Off-state voltage [V/µs]:	500
Rate of rise of current [A/µs]:	100
Measuring range:	0,5 ... 40 A
Response value:	continously variable
Hysteresis:	2 % of response value
Themperature Data	
Thermal resistance junction - housing [K/W]:	0.5
Thermal resistance housing - ambient [K/W]:	12
Junction temperature [°C]:	≤ 125

*) variant /1_ _

Alarm Output

Auxiliary supply A3+/A2 [V]:	20 ... 32 (DC)
max. input current [mA]:	15 bei 24 V DC
PNP transistor outputs	
max. output current [mA]:	100
Output voltage	
(open) [V]:	0 (DC)
(closed) [V]:	Auxiliary supply -2 V DC (max.)
Time delay [ms]:	220

Control Circuit

Control voltage A1+/A2 [V]:	20 ... 32 (DC)
Switch off voltage [V]:	0 ... 5 (DC)
max. input current [mA]:	10 at 24 V DC
Turn-on delay [ms]:	5 + 1/2 Periode
Turn-off delay [ms]:	20 + 1/2 Periode

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 20 ... 40° C	
storage:	- 20 ... 80° C	
Clearance and creepage distances:		
rated impulse voltage / pollution degree:	6 kV / 3	IEC/EN 60 664-1
EMC:	IEC/EN 61 000-6-4,	IEC/EN 61 000-4-1
Electrostatic discharge (ESD):	8 kV air / 6 kV contact	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class A*)	
	*) The device is designed for the usage under industrial conditions (Class A, EN 55011) When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.	
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz,	IEC/EN 60-068-2-6
Housing material	Fiberglass reinforced polycarbonate Flame resistant: UL 94 V0	
Base plate:	Aluminum, copper nickle-plated	
Potting compound:	Polyurethane	
Mounting screws:	M 5 x 8 mm	

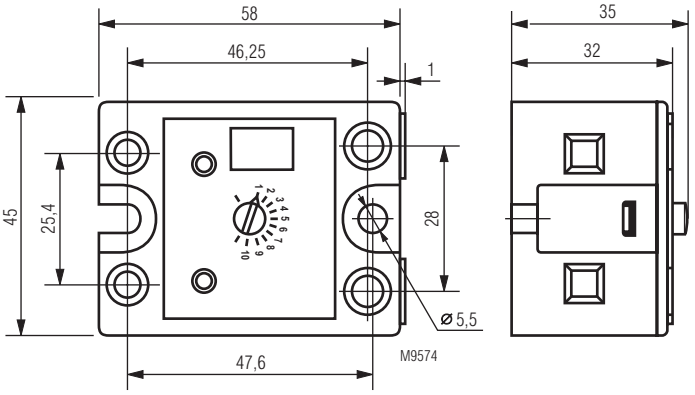
Technical Data

Fixing torque:	2.5 Nm
Connections control input:	Mounting screws M3 Pozidriv 2 PT
Fixing torque:	0.5 Nm
Wire cross section:	1.5 mm^2 Litze
Connections load circuit:	Mounting screws M4 Pozidriv 1 PT
Fixing torque:	1.2 Nm
Wire cross section:	10 mm^2 wire
Connections monitoring circuit:	Weidmüller - Omnimate Range connecting pair BL 3.50/03 (included in delivery)
Nominal insulation voltage	
Control circuit – load circuit:	4 $kV_{eff.}$
Load circuit – base plate:	4 $kV_{eff.}$
Overvoltage category:	II
Weight	
without heat sink:	approx. 100 g
PH 9270.91/_ _ _ /01:	approx. 530 g
PH 9270.91/_ _ _ /02:	approx. 650 g

Dimensions

Width x height x depth	
without heat sink:	45 x 58 x 35 mm
PH 9270.91/_ _ _ /01:	45 x 80 x 127 mm
PH 9270.91/_ _ _ /02:	45 x 100 x 127 mm

Dimensions



Accessories

PH 9260-0-12:	Graphite foil 55 x 40 x 0.25 mm to be fitted between device and heat sink, for better heat transmission Article number: 0058395

Standard Type

PH 9270.91 AC 200 ... 480 V	40 A DC 20 ... 32 V
Article number:	0060425
• Load voltage:	AC 200 ... 480 V
• Load current:	40 A
• Auxiliary voltage:	DC 20 ... 32 V
• Alarm output:	PNP, closed circuit operation
• Monitoring:	Under- and overcurrent
• Width:	45 mm

Variants

PH 9270.91 / _ _ _ / 0 _

- 0 = without heat sink
- 1 = with heat sink 1.5 K / W
- 2 = with heat sink 0.95 K / W

Control via A1/A2

- 0 = with under- and over current monitoring and PNP transistor output with de-energized on trip
- 1 = with under current monitoring and PNP transistor output with de-energized on trip
- 2 = with over current monitoring and PNP transistor output with de-energized on trip
- 5 = with under- and over current monitoring and PNP transistor output with energized on trip
- 6 = with under current monitoring and PNP transistor output with energized on trip
- 7 = with over current monitoring and PNP transistor output with energized on trip

- 0 = Switching at zero crossing

- 0 = Standard
- 1 = With high I^2t-value

Ordering example for variants

PH 9270.91 /1 0 0 / 02 AC 200 ...480 V 40 A DC 20 ... 32 V

- Auxiliary voltage
- Load current
- Load voltage
- With heat sink 0.95 K / W
- with under- and ove current monitoring and PNP semiconductor output with de-energized on trip
- Switching at zero crossing
- With high I^2t-value
- Type

Setting Facilities

Potentiometer to adjust tripping point in the range of 0.5 A up to nominal current.

Setting and Adjustment

Setting for the standard type (over- and undercurrent)

When the SSR is activated to pass the normal load current, start turning the setting knob fully anticlockwise (Alarm LED = Red), then begin to turn it clockwise until the Alarm LED changes to Green. Note the knob setting. Keep turning the knob clockwise until the Alarm LED changes to Red again. Note the knob setting. Take the average of these two settings and set the knob at this value. The SSR is now set up to detect over- and undercurrents of ±20%. The LED should change to Green.

Setting for variant /_01 (undercurrent)

When the SSR is activated to pass the normal load current, start turning the setting knob fully clockwise (Alarm LED = Red), then begin to turn it anticlockwise until the Alarm LED turns Green. The alarm current equals the load current. Note the setting and turn the knob by 10% below the previous setting. The SSR is now set up with the necessary margins to prevent false alarms due to line voltage fluctuations. The LED should remain Green.

Setting for variant /_02 (overcurrent)

When the SSR is activated to pass the normal load current, start turning the setting knob fully anticlockwise (Alarm LED = Red), then begin to turn it clockwise until the Alarm LED turns Green. The alarm current equals the load current. Note the setting and turn the knob by 10% above the previous setting. The SSR is now set up with the necessary margins to prevent false alarms due to line voltage fluctuations. The LED should remain Green.

Notes on Sizing for Selection of a Heat Sink

The heat generated by the load current must be dissipated by a suitable heat sink. It is imperative that the junction temperature of the semiconductor is maintained for all potential environmental temperatures of under 125°C. For this reason, it is important to keep the thermal resistance between the base plate of the solid-state relay and the heat sink to a minimum.

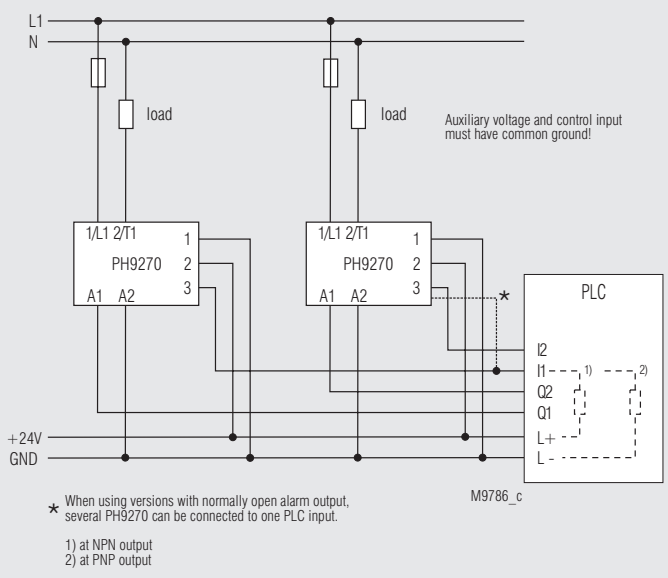
To protect the solid-state relay effectively from excess heating, a thermally conducting paste or a graphit gasket (see Accessories) should be applied before installation to the base plate of the heat sink between solid-state relay and heat sink.

From the table below, select a suitable heat sink with the next lowest thermal resistance. Thus, it is ensured that the maximum junction temperature of 125°C is not exceeded. The load current in relation to the environmental temperature can be seen from the table.

Selection of a Heat Sink

Load current (A)	PH 9270 40 A Thermal resistance (K/W)					
40	1.2	1.0	0.9	0.7	0.5	0.3
35	1.5	1.3	1.0	0.9	0.7	0.5
30	1.9	1.6	1.4	1.1	0.9	0.7
25	2.4	2.0	1.8	1.5	1.2	0.9
20	3.0	2.7	2.4	2.0	1.7	1.3
15	4.4	3.9	3.4	2.9	2.5	2.0
10	6.9	6.0	5.4	4.7	4.0	3.3
5	14.0	12.9	11.5	10.0	8.6	7.2
	20	**30**	**40**	**50**	**60**	**70**
	Ambient-temperature (°C)					

Application Example



* When using versions with normally open alarm output, several PH9270 can be connected to one PLC input.

1) at NPN output
2) at PNP output