

# PSR-PC50

## SIL 3 coupling relay for safety-related switch on



Data sheet  
105818\_en\_01

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### 1 Description

The PSR-PC50 SIL coupling relay can be used for power adaptation and electrical isolation in Safe-State-ON applications up to SIL 3 according to IEC 61508 as well as IEC 61511.

By filtering the controller test pulses, premature failure of the safety relays is prevented.

The contact side is fully monitored for open circuit and short circuit as well as load and diagnostics supply voltage.

If an error occurs, the internal device input impedance is affected. As such, the test pulses sent from the controller are disrupted and the error is reported to the corresponding digital output without additional wiring effort.

### Features

- SIL 3 coupling relays for safety-related switch on
- Applications: Energized-to-Safe
- Complete monitoring of the load side for:
  - Open circuit
  - Short circuit
  - Presence of supply voltage for diagnostics and loads
- Error message output through interrupting test pulses of the higher-level controller
- Easy proof test
- Integrated DCS test pulse filter
- Low inrush current
- One undelayed enabling channel
- Optional plug-in screw or spring-cage terminal blocks
- Special design for avoiding spurious trips
- Housing width 17.5 mm
- Compatible with EMERSON DeltaV SIS SLS1508 and CSL5 (further controller cards on request)

**WARNING: Risk of electric shock**

Observe the safety instructions in the corresponding section!



Make sure you always use the latest documentation.  
It can be downloaded from the product at [phoenixcontact.net/products](http://phoenixcontact.net/products).



This data sheet is valid for all products listed on the following pages.

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### 3 Ordering data

Description	Type	Order No.	Pcs. / Pkt.
Coupling relay for SIL 3 low demand applications, couples digital output signals to the periphery, 1 enabling current path, module for F&G applications, test pulse filter, plug-in screw connection, 17.5 mm width	PSR-PC50-1NO-1DO-24DC-SC	2904664	1
Coupling relay for SIL 3 low demand applications, couples digital output signals to the periphery, 1 enabling current path, module for F&G applications, test pulse filter, plug-in spring-cage connection, 17.5 mm width	PSR-PC50-1NO-1DO-24DC-SP	2904665	1

## 4 Technical data

Input data	
Nominal input voltage $U_N$	24 V DC -15 %; +10 % (A1/A2 and 24V/A2)
Input voltage range (factor)	0.85 ... 1.1
Typical input current	65 mA (A1/A2) 15 mA (24V/A2; depending on load M1 +100 mA)
Typical inrush current	$\leq 200$ mA (A1/A2) 2.5 A (24V/A2; for 10 $\mu$ s) 200 mA (Inputs TP1, TP2 and TP3)
Current consumption	typ. 20 mA (Input TP1) typ. 18 mA (Input TP2) typ. 35 mA (Input TP3)
Input filter time	< 2 ms (Test pulse duration) $\geq 100$ ms (Test pulse rate)
Max. permissible overall conductor resistance (Input and reset circuit at $U_N$ )	< 10 $\Omega$ (LO/LO' and NI/NI' and load resistance in the event of a short circuit)
Typical pick-up time	30 ms
Recovery time	1 s
Operating voltage display	Yellow LED
Status display	Green LED
Indication	Red LED
Protective circuit	Overload protection Suppressor diode
Output data	
Contact type	1 enabling current path
Contact material	AgNi, gold-flashed
Minimum switching voltage	15 V AC/DC (without diagnostics) 20 V AC/DC (with diagnostics)
Maximum switching voltage	250 V AC 125 V DC
Limiting continuous current	5 A (N/O contact)
Diagnostic threshold	20 $\Omega$ / 18 k $\Omega$ (lower/upper)
Maximum inrush current	5 A
Inrush current, minimum	100 mA
Switching capacity min.	1.5 W
Mechanical service life	Approx. $5 \times 10^7$ cycles
Alarm outputs	
Number of outputs	1 (digital)
Nominal voltage $U_N$	23 V DC
Limiting continuous current	100 mA
General data	
Relay type	Electromagnetic dust-proof relay
Nominal operating mode	100% operating factor
Degree of protection	IP20
Min. degree of protection of inst. location	IP54
Mounting position	vertical or horizontal
Mounting type	DIN rail mounting
Air and creepage distances between the power circuits	DIN EN 50178
Rated insulation voltage	250 V AC

**General data**

Rated surge voltage / insulation	6 kV/safe isolation (through protective impedance)
Pollution degree	2
Surge voltage category	III

**Dimensions**

	<b>Screw connection</b>	<b>Spring-cage connection</b>
W x H x D	17.5 x 112.2 x 114.5 mm	17.5 x 117.4 x 114.5 mm

**Connection data**

	<b>Screw connection</b>	<b>Spring-cage connection</b>
Conductor cross section, solid	0.2 mm <sup>2</sup> ... 2.5 mm <sup>2</sup>	0.2 mm <sup>2</sup> ... 1.5 mm <sup>2</sup>
Conductor cross section, stranded	0.2 mm <sup>2</sup> ... 2.5 mm <sup>2</sup>	0.2 mm <sup>2</sup> ... 1.5 mm <sup>2</sup>
Conductor cross section AWG/kcmil	24 ... 12	24 ... 16
Stripping length	7 mm	8 mm

**Ambient conditions**

Ambient temperature (operation)	-20 °C ... 55 °C
Ambient temperature (storage/transport)	-40 °C ... 65 °C
Max. permissible relative humidity (operation)	75 % (on average, 85% infrequently, non-condensing)
Max. permissible humidity (storage/transport)	75 % (on average, 85% infrequently, non-condensing)
Maximum altitude	max. 2000 m (Above sea level)
Shock	15g
Vibration (operation)	2g

**Certification / Approvals**

Approvals	applied for
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**Safety parameters for IEC 61508 - Low demand**

SIL	3 (15 % of total SIL)
PFD <sub>avg</sub>	1,49 x 10 <sup>-4</sup>
Proof test interval	120 Months
Duration of use	240 Months

**Alternative illustration of the device as 1001 structure for process customers**

Calculation basis	Application example 1 - SIL 3
Equipment type	Type A
HFT	0
SIL	3 (15 % of total SIL)
Safe Failure Fraction (SFF)	99.6 %
λ <sub>SD</sub>	4.27 FIT
λ <sub>SU</sub>	849 FIT
λ <sub>DD</sub>	4.21 FIT
λ <sub>DU</sub>	3.40 FIT
λ <sub>Total</sub>	860.88 FIT
MTBF	110.5 Years
PFD <sub>avg</sub>	1,49 x 10 <sup>-5</sup> (For T1 = 1 year)

## 5 Safety notes



### **WARNING: Risk of electric shock**

During operation, parts of electrical switching devices carry hazardous voltages.

Before working on the switching device, disconnect the power.

Please observe the safety regulations of electrical engineering and industrial safety and liability associations!

Disregarding these safety regulations may result in death, serious personal injury or damage to equipment.

Startup, mounting, modifications, and upgrades should only be carried out by a skilled electrical engineer!



### **WARNING: Danger due to faulty devices!**

The devices may be damaged following an error and correct operation can no longer be ensured.

In the event of an error, replace the device immediately.

Repairs to the device, especially if the housing must be opened, may only be carried out by the manufacturer or authorized persons. Otherwise the warranty is invalidated.



### **WARNING: risk of electric shock!**

The safety relay may only be connected to devices which meet the requirements of EN 60950.

Suitable devices are available online at [phoenixcontact.net/products](http://phoenixcontact.net/products).



### **WARNING: Loss of safety function**

When an error is detected by the higher-level controller, it is assumed that the safety function can no longer be performed.

The error must be removed within 72 hours or within the process safety time if required by the application.



### **NOTE: Risk of damage to equipment due to incorrect installation**

For reliable operation, the safety relay must be installed in housing protected from dust and humidity (IP54).

Carry out wiring according to the application. Refer to the "Application examples" section for this.



### **NOTE: Risk of damage to equipment due to noise emissions**

When operating relay modules the operator must meet the requirements for noise emission for electrical and electronic equipment (EN 61000-6-4) on the contact side and, if required, take appropriate measures.

## 6 Basic circuit diagram

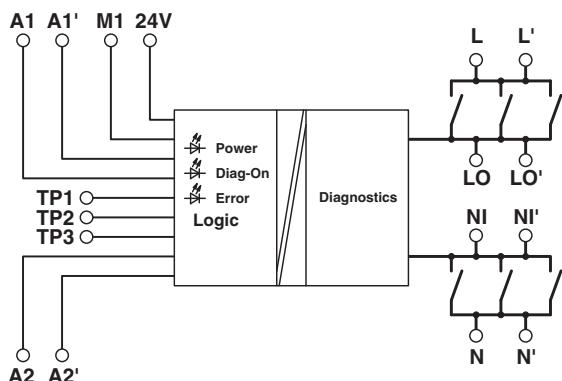


Figure 1 Block diagram

### Key:

Designation	Explanation
A1/A2	Safety relay input voltage
A1'/A2'	Safety relay input voltage for optionally redundant wiring
M1	Semiconductor alarm output
24 V	Supply voltage for connectable load monitoring
TP1/TP2/TP3	Test point for proof test
L/L'	On-load voltage input
N/N'	0 V
LO/LO'	Load input
NI/NI'	Load output



Contacts A1', A2', L', N', LO', NI' are **not** suitable for further wiring. These contacts may only be used for optional redundant wiring.

## 7 Derating

### 7.1 Vertical mounting position

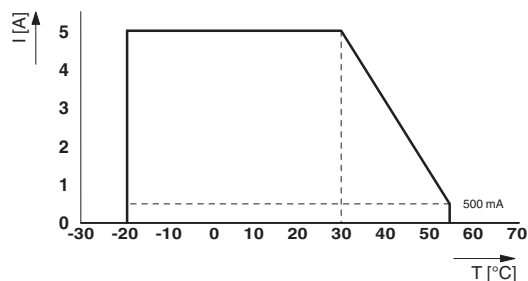


Figure 2 Vertical installation derating curve

### 7.2 Horizontal mounting position

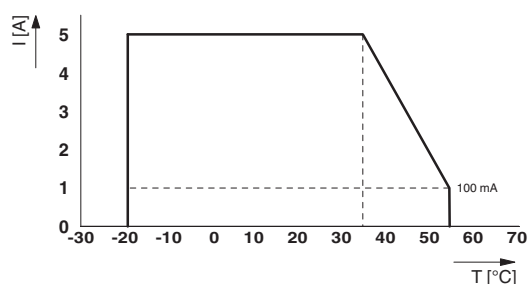


Figure 3 Horizontal installation derating curve

## 8 Load curve

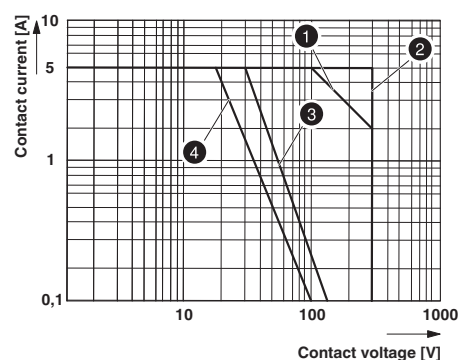


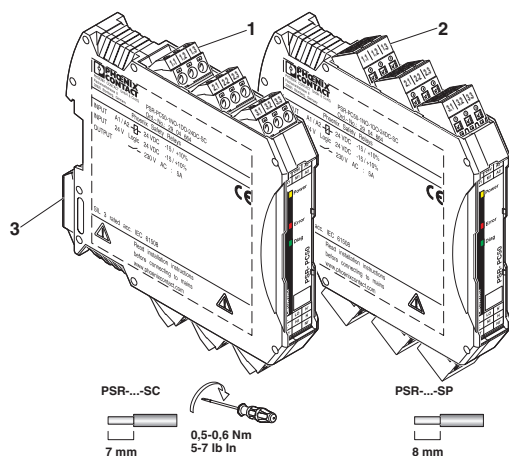
Figure 4 Relay load curve

### Key:

No.	Explanation
1	AC inductive load $\cos \varphi = 0.4$
2	AC resistive load
3	DC resistive load
4	DC inductive load $L/R = 7 \text{ ms}$

## 9 Operating and indication elements

### 9.1 Connection versions

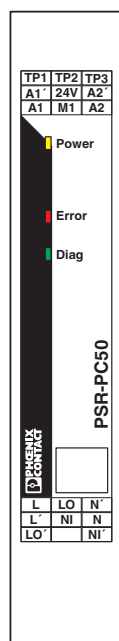


- 1 COMBICON plug-in screw terminal block
- 2 COMBICON plug-in spring-cage terminal block
- 3 Metal lock for fixing to DIN rail

Figure 5 Connection versions

### 9.2 Connection assignment

Figure



Designation	Explanation
TP1/TP2/TP3	Test point for proof test
A1/A2	Safety relay input voltage
A1'/A2'	Safety relay input voltage for optionally redundant wiring
24 V	Supply voltage for connectable load monitoring
M1	Semiconductor alarm output
Power	LED status indicator, yellow - contacts on the load side are closed
Error	LED status indicator, red - error
Diag	LED status indicator, green - diagnostics are active
L/L'	On-load voltage input
N/N'	0 V
LO/LO'	Load input
NI/NI'	Load output



Contacts A1', A2', L', N', LO', NI' are **not** suitable for further wiring. These contacts may only be used for optional redundant wiring.



## 10 Startup

Once the nominal input voltage of 24 V DC has been enabled at terminals **A1** and **A2** (as well as **A1'** and **A2'** for optionally redundant wiring), the Power LED lights up.

The contacts **L**, **L'**, **LO**, **LO'** as well as **NI**, **NI'** and **N**, **N'** close.

The **24 V** connection should only be activated if the diagnostic function is to be used, and should be set to **A2**.

The minimum diagnostic threshold value is **20 Ω**, the maximum value is **18 kΩ**.

Diagnostics is performed for open circuit and short circuit of the load as well as for a loss of on-load voltage, load supply voltage and supply voltage for diagnostics.

The activation of diagnostic functions is indicated by the **Diag** LED.

If the diagnostics respond, the minimum current consumption is pushed and a **bad channel** is generated **via A1** (depending on the controller).

Additionally the **Error** LED illuminates and the semiconductor alarm output **M1** is active.

The load is not monitored when the contacts are closed on the output side.

The diagnostic function is not suitable for semiconductor loads.

- Perform a full function and diagnostic test during start-up.

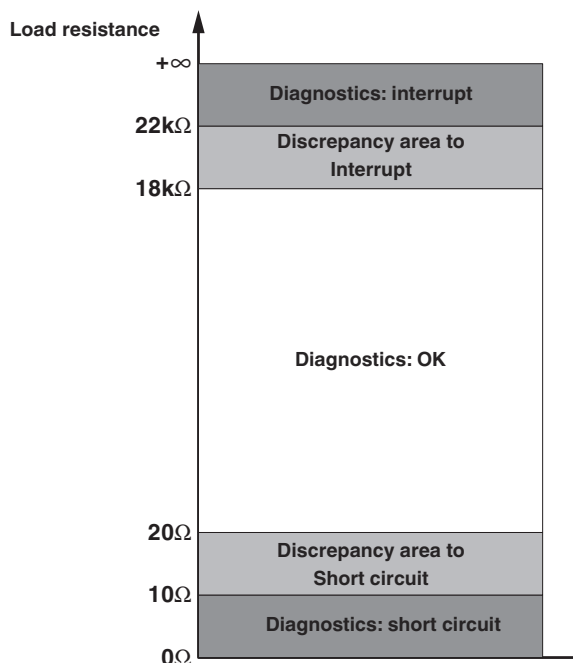


Figure 6 Diagnostic thresholds

## 11 Proof test

The Proof test checks the individual relay channels and device diagnostics to ensure proper functioning.



**CAUTION:** The enabling contacts are closed during the Proof test!

### 11.1 Testing of relay channels

1. Disconnection of A1/A1'
2. Apply 24 V DC to TP1 (set to A2/A2'). Check whether the load is activated/whether the contacts L to LO to N to NI have continuity. Then disconnect TP1 again.
3. Repeat step 2 for TP2 and TP3
4. Restore the original configuration so that the reference configuration and the physical configuration are the same again.
5. Check switchability by the controller!



**CAUTION:** If during step 2 or 3 the load is not activated or no continuity can be measured, the device is faulty. Replace the device!

### 11.2 Testing diagnostics

1. Interrupt the load path then close it again.
2. Interrupt the load path briefly then restore this to the operating state.
3. Interrupt the supply voltage of the load before connection L or after connection N. Then restore the supply voltage.



**CAUTION:** If during this diagnostics test no error (ERROR) is displayed, the device is faulty. Replace the device!

## 12 Application examples

### Key:

- SIS = Safety Instrumented System (safe control)
- DC = Diagnostic Coverage according to IEC 61508  
(line/load diagnostics at DO)
- DI = Digital input
- DO = Digital output

### Connection options:

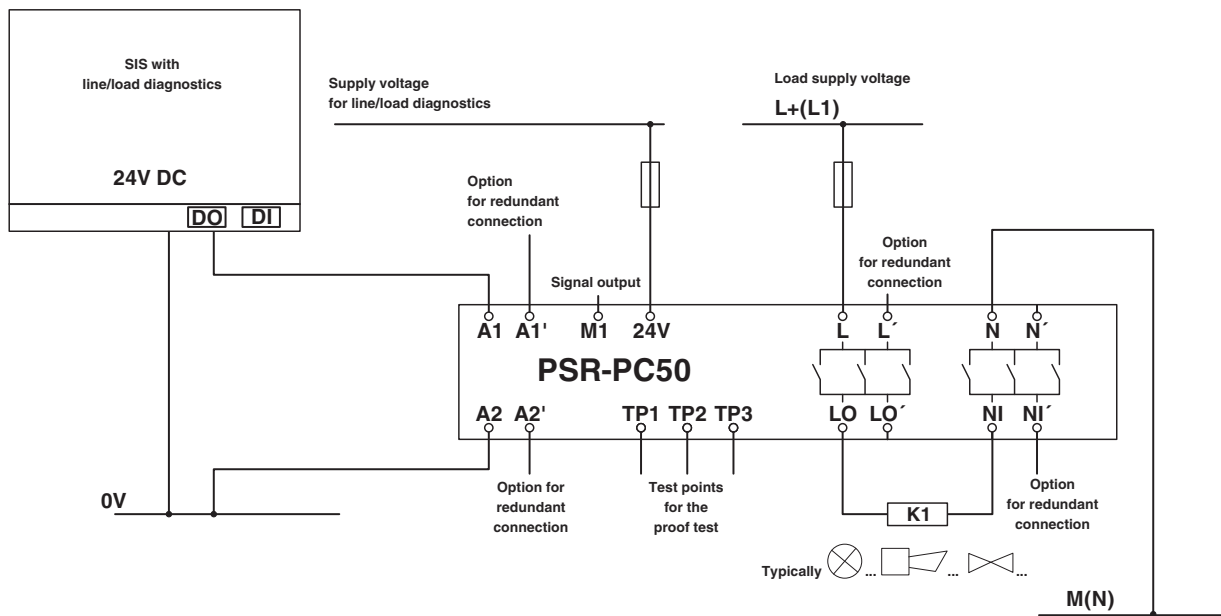


Figure 7 Connection options

### 12.1 Application example 1 - SIL 3

#### Assumptions, information, and marginal conditions

- The DC of the digital output is 90%.
- Diagnostics of PSR-PC50 are active.
- The test pulses of the controller are activated and evaluated.
- A potential error is indicated accordingly.

**i** A fault e.g., open circuit or short circuit of the load is reported by detuning the test pulse of the safe controller.

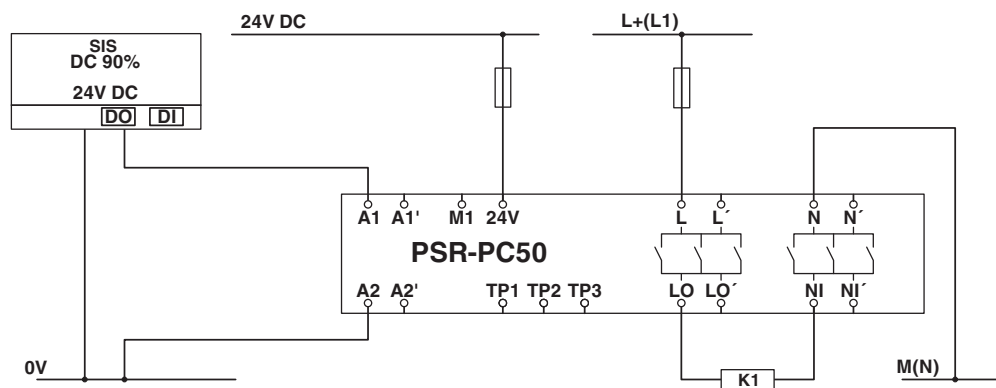


Figure 8 Application example 1 - SIL 3