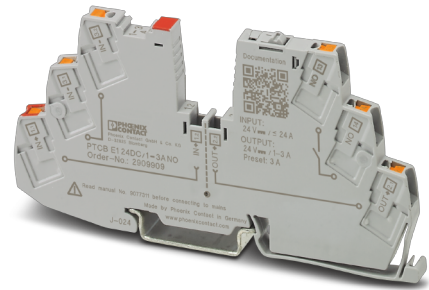


PTCB device circuit breaker

Circuit breaker, bridgeable and compatible with CLIPLINE complete



Application Note
108344_en_03

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1 Description

PTCB electronic circuit breakers offer protection against overload and short-circuit at the 24 V DC control voltage level.

You can match the circuit breakers precisely to the required number of circuits to be fused. The adjustments can be made in applications with one channel or more.

The circuit breakers can be interconnected via the standard FBD plug-in bridges. The plug-in bridges are to be found in the CLIPLINE complete terminal block range.

Distribute the potential on the fused side to multiple loads using the standard terminal blocks placed directly next to the circuit breaker.

The circuit breakers have an overall width of 6.2 mm.

Choose between versions with floating remote indication contact and versions with non-isolated status output and reset input.



Make sure you always use the latest documentation.

For the technical data, please refer to the relevant product at phoenixcontact.net/products.

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3 Ordering data

Description	Type	Order No.	Pcs./Pkt.
Adjustable from 1 A to 3 A NEC Class 2 approval	PTCB E1 24DC/1-3A NO	2909909	1
Adjustable from 1 A to 4 A	PTCB E1 24DC/1-4A NO	2908261	1
Adjustable from 1 A to 8 A	PTCB E1 24DC/1-8A NO	2908262	1
Fixed setting at 1 A NEC Class 2 approval	PTCB E1 24DC/1A NO	2909902	1
Fixed setting at 2 A NEC Class 2 approval	PTCB E1 24DC/2A NO	2909903	1
Fixed setting at 3 A NEC Class 2 approval	PTCB E1 24DC/3A NO	2909904	1
Fixed setting at 4 A	PTCB E1 24DC/4A NO	2909906	1
Fixed setting at 6 A	PTCB E1 24DC/6A NO	2909908	1
Fixed setting at 8 A	PTCB E1 24DC/8A NO	2909910	1
Fixed setting at 1 A NEC Class 2 approval	PTCB E1 24DC/1A SI-R	1135751	1
Fixed setting at 2 A NEC Class 2 approval	PTCB E1 24DC/2A SI-R	1135749	1
Fixed setting at 4 A NEC Class 2 approval	PTCB E1 24DC/4A SI-R	1135745	1
Fixed setting at 6 A	PTCB E1 24DC/6A SI-R	1135740	1
Fixed setting at 8 A	PTCB E1 24DC/8A SI-R	1135734	1
Adjustable from 1 A to 4 A NEC Class 2 approval	PTCB E1 24DC/1-4A SI-R	1135753	1
Adjustable from 1 A to 8 A	PTCB E1 24DC/1-8A SI-R	1135752	1
Accessories	Type	Order No.	Pcs./Pkt.



Optional accessories and a selection of compatible products can be found at the end of this document.

4 Connection and operation

4.1 Safety notes

The installation and startup of this device may only be performed by an authorized (electrically) skilled person. The relevant country-specific regulations must be observed.



WARNING: Risk of electric shock and fire

Check the device for external damage. If the device is defective, it must not be used.



Ensure that the system's maximum operating voltage does not exceed the highest operating voltage for the device.

Ensure that the maximum rated current I_N of the circuit breaker is not exceeded in operating mode.

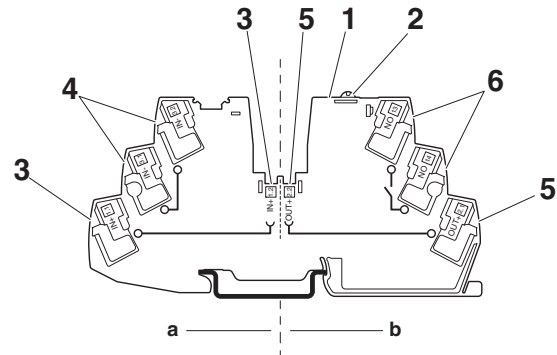
In order to enable the protection function to be activated, the system must allow a higher current to flow for a short period of time in the case of an overload or short circuit. This can be achieved in a number of ways, such as by using an appropriate power reserve for the power supply providing the feed (see tripping characteristic figure 19, Section 4.7).

4.2 Connection assignment



The two bridge shafts of the circuit breaker are isolated and conduct different potentials.

Figure 1 Connection points on the PTCB, split bridge shaft



Connection points on the PTCB

- 1 Status LED
- 2 Channel button
- 3 +24 V DC supply
- 4 Negative pole (0 V DC)
- 5 Protected outputs
- 6 Signals
- a unprotected side (inlet)
- b protected side (outlet)

Figure 2 Connection data

	mm ²	AWG	L [mm]
	0,2 - 4	24-12	8
	0,2 - 2,5		

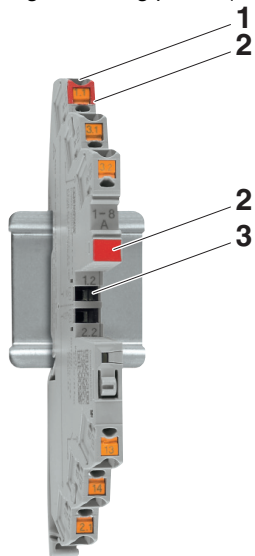
The upper bridge shaft IN+ [1.2] in the mounting position is connected with the terminal point IN+ [1.1]. The +24 V DC from the power supply is fed in here.

Use the following:

- When connecting to the terminal point [1.1], use a conductor with a maximum cross-section of 2.5 mm².
- For larger conductor cross-sections, use an adjacent terminal block with a larger cross-section and a plug-in bridge to connect to the upper bridge shaft [1.2].

Both feeding points are marked with a red marking.

Figure 3 Marking of feeding points (+24V DC)



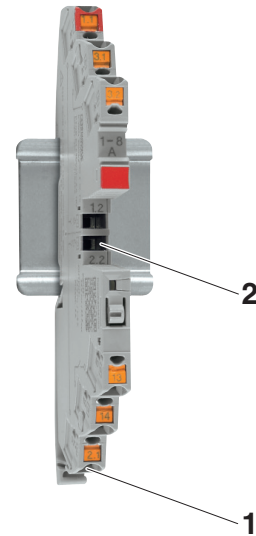
- 1 Terminal point IN+ [1.1]
- 2 Marking
- 3 Bridge shaft IN+ [1.2]

The lower bridge shaft OUT+ [2.2] in the mounting position is connected with the terminal point OUT+ [2.1]. Connect the load here.

Use the following:

- Use one conductor when connecting to terminal point [2.1].
- Use one plug-in bridge and one or more adjacent terminal blocks to for potential distribution to multiple loads.

Figure 4 Protected output for bridging (+24 V DC)



- 1 Terminal point OUT+ [2.1]
- 2 Bridge shaft OUT+ [2.2]



It is recommended that the two potentials (IN+ and OUT+) be assembled with different colored plug-in bridges.

For example:

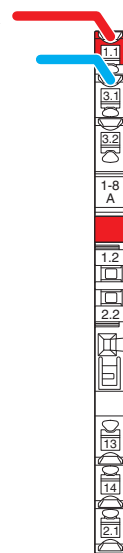
- Red plug-in bridge for unfused +24 V DC [IN+]
- Gray plug-in bridge for fused +24 V DC [OUT+]

4.3 Service Entrance

Feed, single device

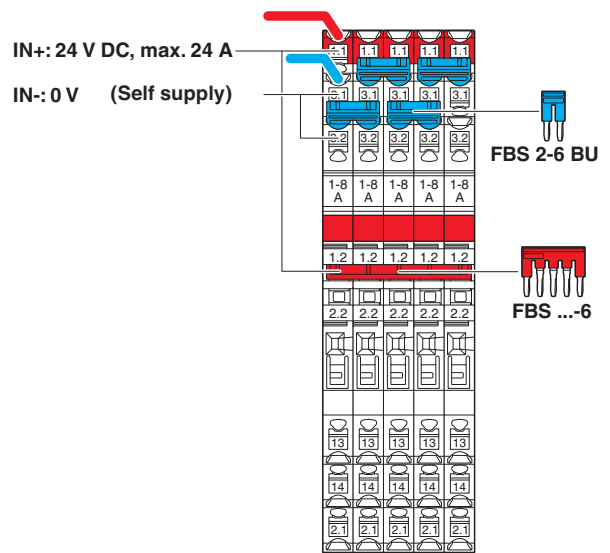
Figure 5 Feed, use as a single device

IN+: 24 V DC, max. 24 A
 IN-: 0 V (Self supply)



The maximum channel current at the output corresponds to the fixed or adjustable rated current I_N .

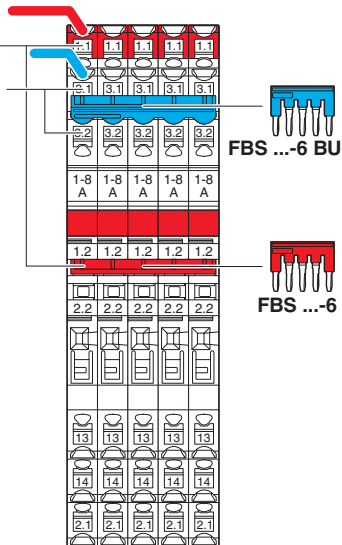
Figure 7 Option for bridging the GND internal supply using 2-pos. bridges



Feed, bridging with parallel PTCBs

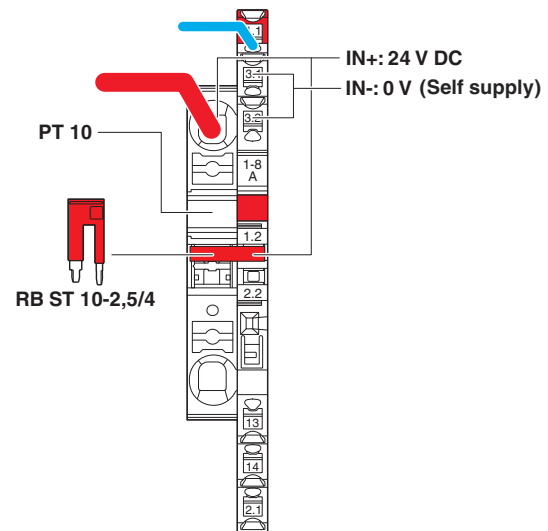
Figure 6 Distribution of the feed to multiple PTCBs, continuous GND bridge

IN+: 24 V DC, max. 24 A
 IN-: 0 V (Self supply)



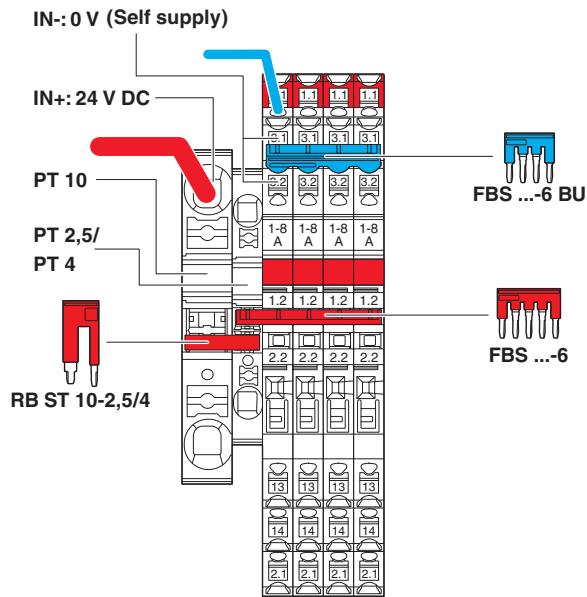
Feed, bridging with long supply line

Figure 8 Feed with cable cross-sections $>2.5 \text{ mm}^2$ (e.g., in the case of long supply cables), single device



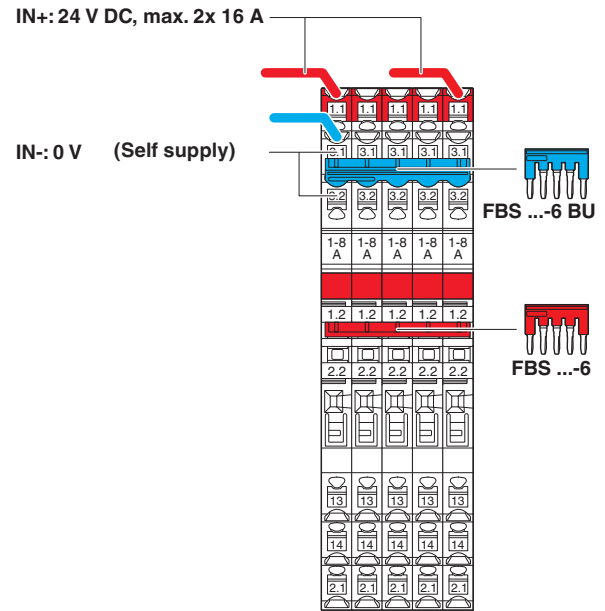
Feed, bridging with parallel PTCBs and long supply line

Figure 9 Feed with cable cross-sections $>2.5 \text{ mm}^2$ (e.g., in the case of long supply cables), multiple adjacent PTCBs



Alternative feed with two positive cables

Figure 10 Feed with maximum 32 A over two cables each with 2.5 mm^2 cable cross-section




When using PT 2.5 (FBS...-5 plug-in bridge), up to 24 A can be supplied over the (e.g. red) bridges.
 When using PT 4 (FBS...-6 plug-in bridge), up to 32 A can be supplied over the (e.g. red) bridges.


4.4 Bridging to the fused potential distribution

Set up the potential distribution of the fused potential +24 V DC (OUT+) to multiple loads directly next to the circuit breaker. Use the standard terminal blocks from our CLIPLINE complete product range for this.

Use the size 2.5 and 4 terminal blocks from the PT or ST families or the size 1.5 and 2.5 terminal blocks from the QTC family.

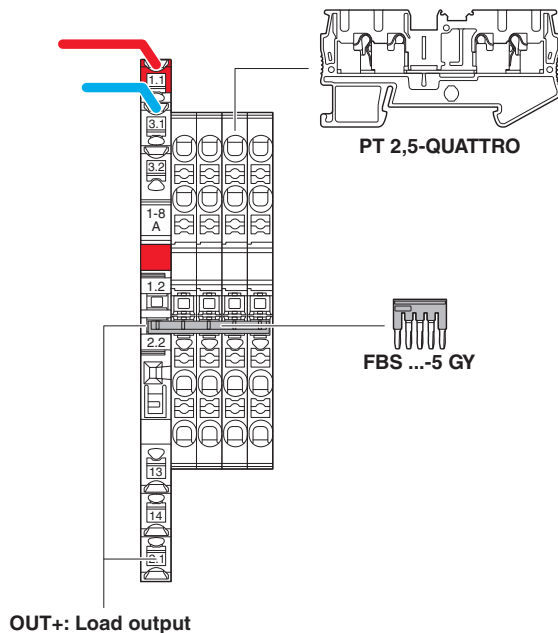
Bridge using the plug-in bridges FBS...-5 or FBS...-6, depending on the pitch of the terminal blocks being used.

 **NOTE:** Only use the lower bridge shaft for the connection between the PTCB and the terminal blocks for potential distribution.

 For the bridging, it is advisable to use a different color for the plug-in bridges than that used for the feed (e.g. gray).

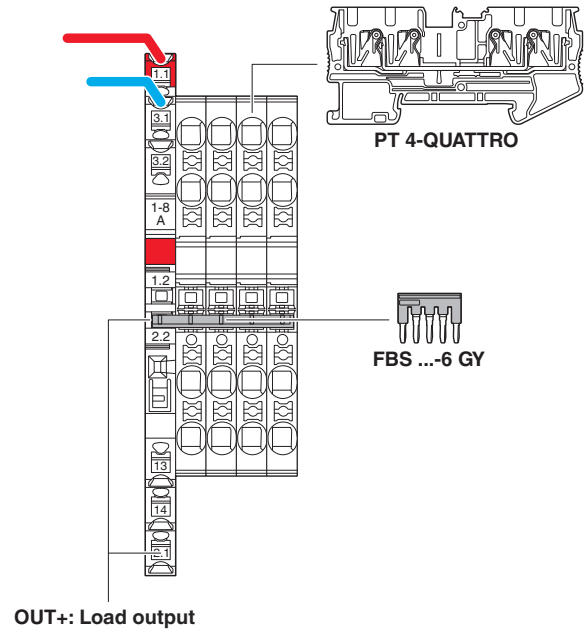
Bridging for fused potential distribution, 2.5 mm² connection cross-section

Figure 11 Fused potential distribution (+24 V DC) with connection cross-section 2.5 mm²



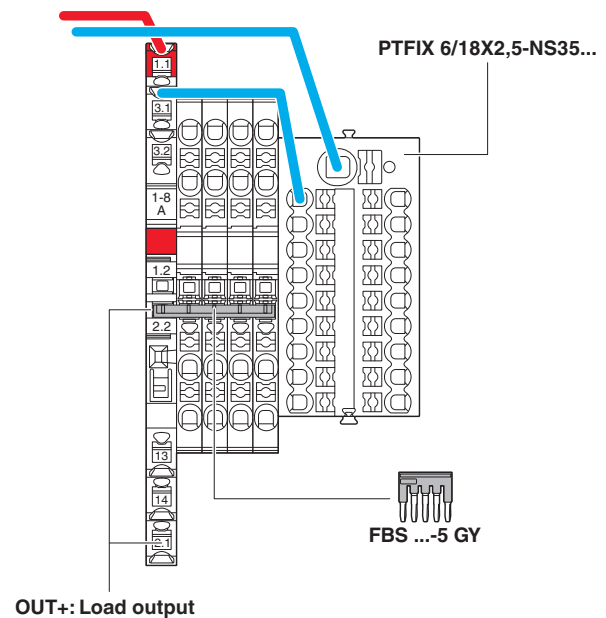
Bridging for fused potential distribution, 4 mm² connection cross-section

Figure 12 Fused potential distribution (+24 V DC) with connection cross-section 4 mm²



Bridging the potential distribution with a PTFIX distribution block

Figure 13 0 V potential distribution to load with PTFIX distribution block



4.5 Communication

4.5.1 PTCB ... NO

The PTCB ... NO device circuit breaker is equipped with a floating signal contact (13 ... 14).

Remote signaling

The floating signal contact (13 ... 14) is closed if

- there is no fault on the channel and the operating voltage is ok
- the channel has been switched off manually

The floating signal contact (13 ... 14) is open if

- the channel is switched off due to a fault
- the voltage is outside the operating range
- there is an installation or bridging fault

Remote signaling, single-point information

Figure 14 Individual monitoring of a fused channel

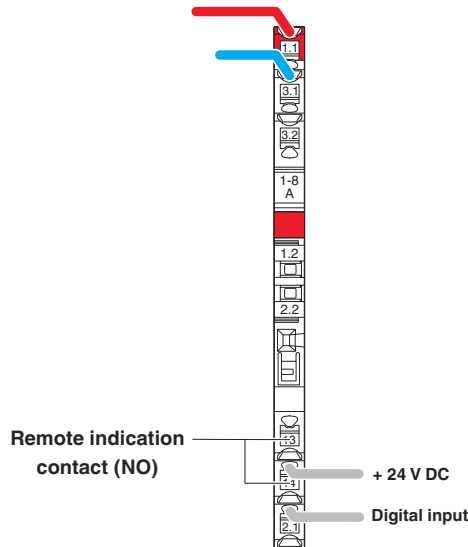
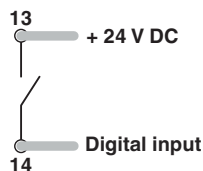


Figure 15 Individual monitoring circuit diagram



Bridging for remote signaling, group message

Figure 16 Group monitoring of multiple channels with only one digital input on the PLC

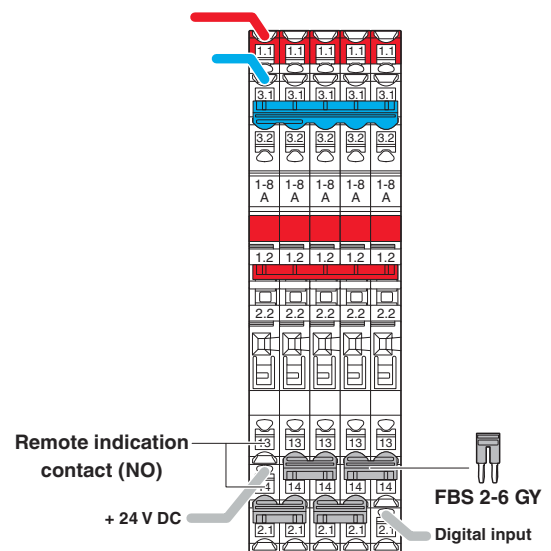
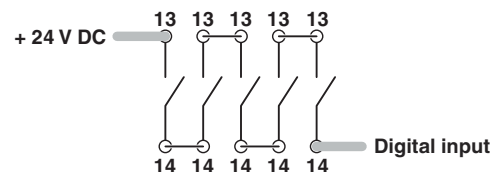


Figure 17 Group monitoring circuit diagram



4.5.2 PTCB ... SI-R

The PTCB ... SI-R device circuit breaker is equipped with a signal output SI (4) and a reset input RST (5).

Signal output SI

The signal output is non-isolated. It is short-circuit-proof and has a voltage of 24 V and a current of 15 mA.

The signal is inverted. The output voltage is 0 V DC, or the output switches to LOW when

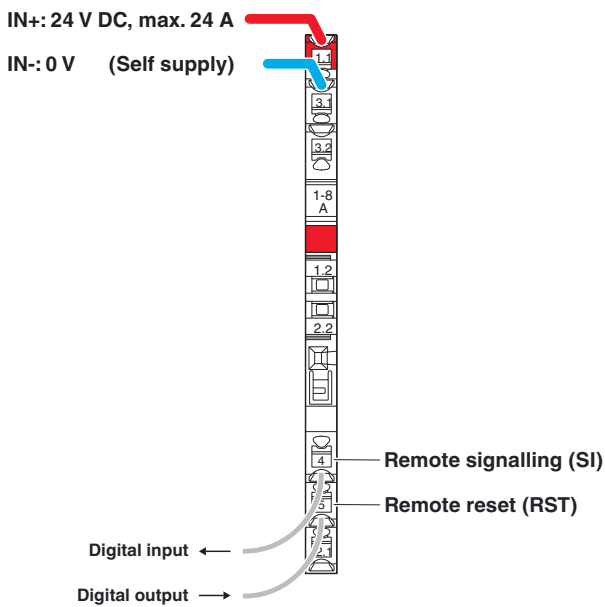
- there is no fault on the channel and the operating voltage is ok
- the channel has been switched off manually
- no operating voltage is applied

The signal output voltage is the same as the input voltage (normally 24 V DC), or switches to HIGH when a

- the channel is switched off due to a fault
- the voltage is outside the operating range
- there is an installation or bridging fault

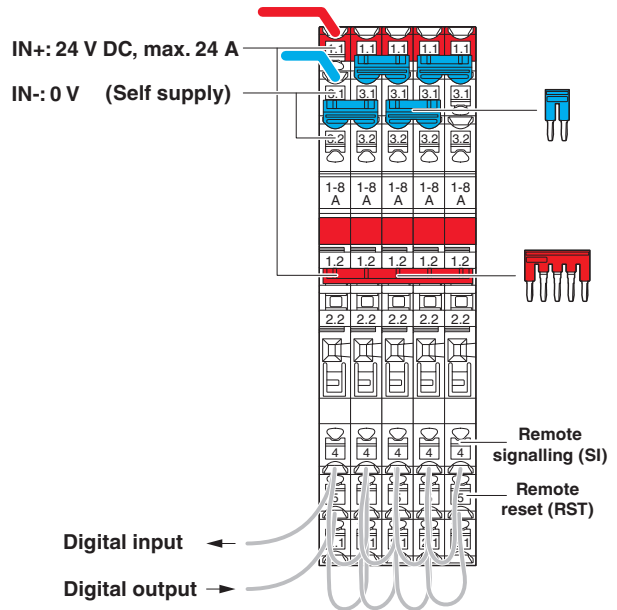
Remote signaling, single-point information

Figure 18 Individual monitoring of the signal output (SI)



Bridging for remote signaling, group message

Figure 19 Group monitoring of multiple channels with only one digital input on the PLC



Reset input (RST)

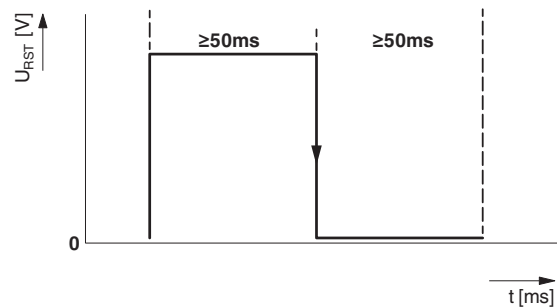
Reset a triggered PTCB remotely. To do so, use the reset input RST (5).

The maximum input voltage at the reset input is 30 V DC. Reset a triggered circuit breaker via a falling edge. Circuit breakers that have been switched off manually are not affected.

The following must be taken into consideration for performing a reset:

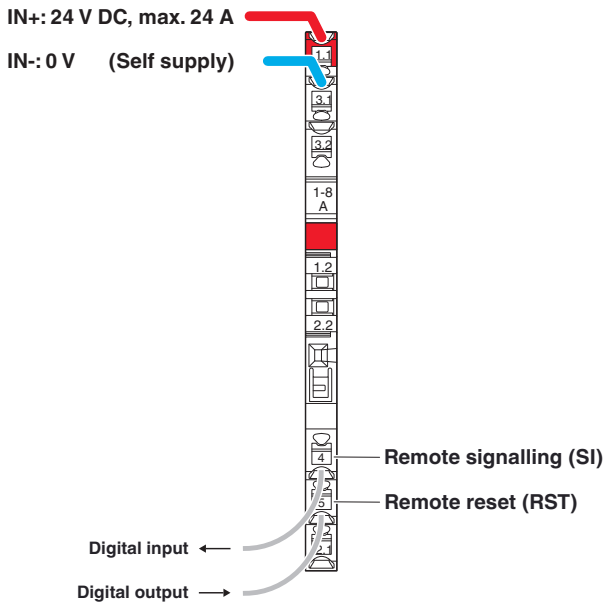
- a HIGH level (>8 V DC) must be applied for at least 50 ms
- following this, a LOW level (<5 V DC) must also be applied for at least 50 ms

Figure 20 Diagram: Reset through falling edge



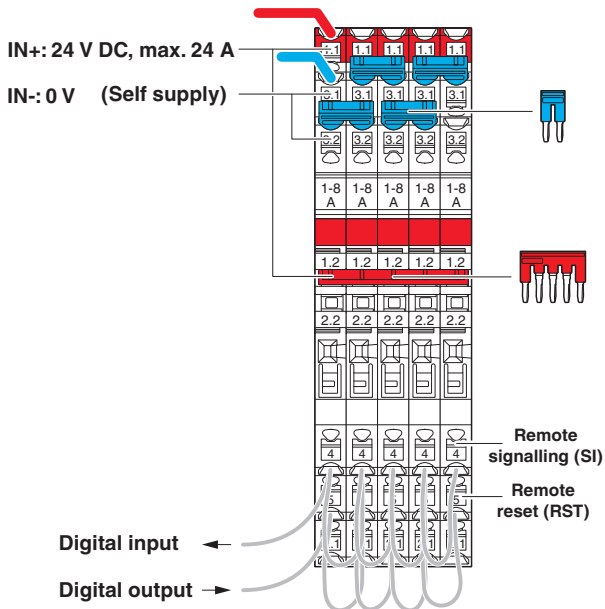
Remote reset, individual

Figure 21 Individual reset of a triggered PTCB



Remote reset bridging, group contact

Figure 22 Bus connection for remote reset with just one digital output on the PLC



4.6 Operation

- The channel is switched off at the factory.
- The channel can be switched on and off via the channel button.
- For the adjustable PTCB versions, the most recent current value setting is applied when the device is switched on again.
- The adjustable PTCB 1-4A and PTCB 1-8A are preset at the factory to 4 A.
- The adjustable PTCB 1-3A is preset at the factory to 3 A.
- The PTCB versions with fixed settings are set to the indicated nominal current.

Adjusting channel current

i The channel current can only be adjusted with the adjustable PTCB versions (PTCB 1-...A).

- Start the programming mode by pressing and holding the channel button (>2 seconds). The LED shows the preset nominal current via a yellow flashing rhythm (e.g., at 2 A: two flashes, pause, two flashes, pause ...).
- Set the required nominal current by repeatedly pressing the button (e.g. press twice for 2 A).
- Press and hold the channel button (for >2 seconds) to store the new current value.

i **NOTE:** After 60 seconds without activity the programming mode automatically switches off.

The original value setting is retained.

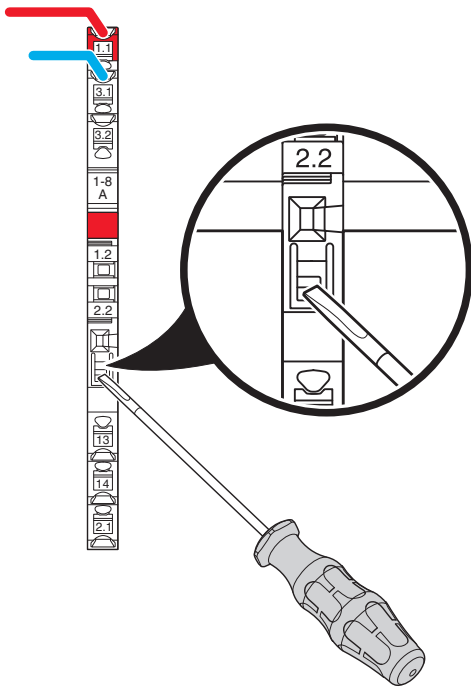
NOTE: initial programming

After the channel has been switched on, it may occur that the channel shuts off and the LED blinks red.

Check whether the current setting matches the expected load current.

Operate the channel button using your finger or a bladed screwdriver.

Figure 23 Operation of the device with screwdriver in the button slot



Meaning of status indicator PTCB ... SI-R

Signaling			Description
Output (SI)	LED		
Low	off	LED OFF	no operating voltage Channel switched off
	green	lit	Channel switched on
	yellow	lit	Channel load > 80%
High		flashing	Display of the nominal current
	red	lit	Short circuit or overload, undervoltage or overvoltage, cooling phase 5 sec.
		flashing (1 Hz)	Restart possible
		flashing quickly (5 Hz)	Installation or bridging error

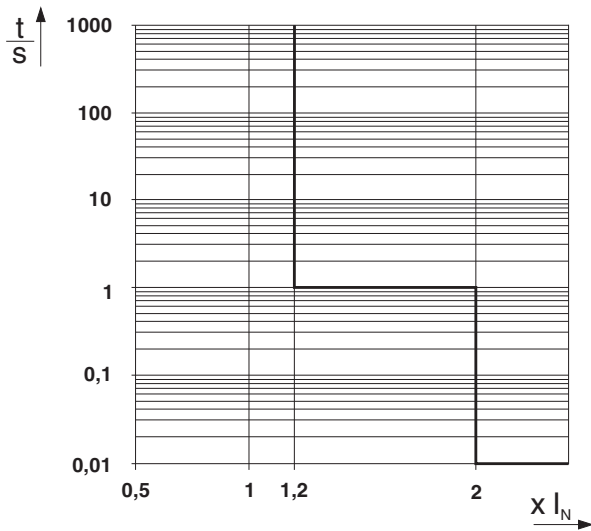
Meaning of status indicator PTCB ... NO

Signaling			Description
13/14	LED		
opened	red	lit	Overvoltage or undervoltage trip
		Flashing (approx. 1 Hz)	Restart possible
		Flashing rapidly (approx. 5 Hz)	Installation or bridging error, unexpected voltage at output, e.g. : input and output reversed ($V_{out} > V_{in}$)
	off	LED OFF	no operating voltage
closed	off	LED OFF	Channel switched off
	green	lit	Channel switched on
	yellow	lit	Channel load > 80%
		flashing	Programming mode active and nominal current displayed

4.7 Technical data

Tripping characteristic

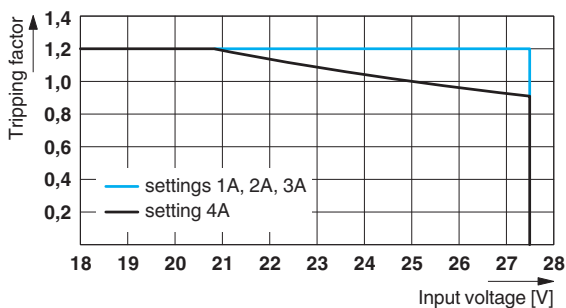
Figure 24 Overload triggered between 1.2 to 2 times the I_N after 1 s; short circuit triggered above 2 times the I_N within 10 ms



Voltage-dependent tripping characteristic

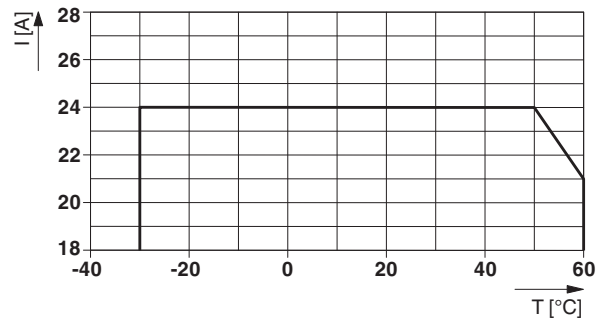
The tripping behavior of versions PTCB E1 24DC/4A SI-R and PTCB E1 24DC/1-4A SI-R are voltage-dependent (PTCB E1 24DC/1-4A SI-R only in the 4 A setting). Therefore, an output power of 100 W cannot be exceeded (NEC Class 2 requirement).

Figure 25 Voltage-dependent tripping characteristic PTCB E1 24DC/1-4A SI-R and PTCB E1 24DC/4A SI-R



Temperature-dependent derating

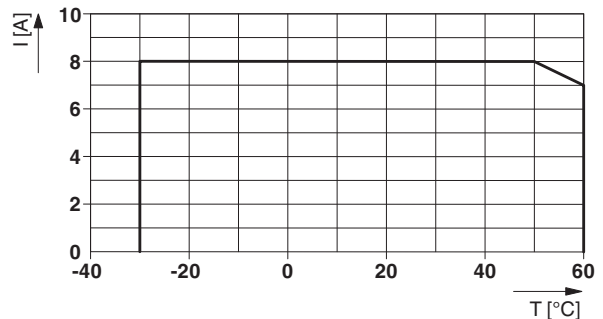
Figure 26 Total current input



The derating applies for direct PTCB feed via the terminal point IN+ [1.1].

When supplying the feed via the bridge shaft IN+ [1.2] with plug-in bridge FBS...-6, the maximum total current is 32 A.

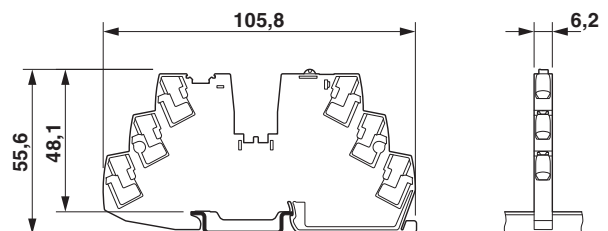
Figure 27 Channel current output



Note: For channel currents <8 A, there is no derating in the operating temperature range - 25 °C ... 60 °C.

Dimensions (in mm)

Figure 28 Dimensional drawing



5 Attachment



The following lists include optional accessories, such as plug-in bridges and standard terminal blocks that can be used for various application solutions.

For additional accessories, visit phoenixcontact.net/products.

5.1 Optional accessories with 5.2 mm pitch or width

Description				Type	Order No.	Pcs./Pck.
Plug-in bridge	red	2-pos.	24 A	FBS 2-5	3030161	50
Plug-in bridge	red	3-pos.	24 A	FBS 3-5	3030174	50
Plug-in bridge	red	4-pos.	24 A	FBS 4-5	3030187	50
Plug-in bridge	red	5-pos.	24 A	FBS 5-5	3030190	50
Plug-in bridge	red	10-pos.	24 A	FBS 10-5	3030213	10
Plug-in bridge	red	20-pos.	24 A	FBS 20-5	3030226	10
Plug-in bridge	red	50-pos.	24 A	FBS 50-5	3038930	10
Plug-in bridge	blue	2-pos.	24 A	FBS 2-5 BU	3036877	50
Plug-in bridge	blue	3-pos.	24 A	FBS 3-5 BU	3036880	50
Plug-in bridge	blue	4-pos.	24 A	FBS 4-5 BU	3036893	50
Plug-in bridge	blue	5-pos.	24 A	FBS 5-5 BU	3036903	50
Plug-in bridge	blue	10-pos.	24 A	FBS 10-5 BU	3036916	10
Plug-in bridge	blue	20-pos.	24 A	FBS 20-5 BU	3036929	10
Plug-in bridge	blue	50-pos.	24 A	FBS 50-5 BU	3032114	10
Plug-in bridge	gray	2-pos.	24 A	FBS 2-5 GY	3038969	50
Plug-in bridge	gray	3-pos.	24 A	FBS 3-5 GY	3038972	50
Plug-in bridge	gray	4-pos.	24 A	FBS 4-5 GY	3038985	50
Plug-in bridge	gray	5-pos.	24 A	FBS 5-5 GY	3038998	50
PT terminal block	2.5 mm ²	2-pos.		PT 2,5	3209510	50
PT terminal block	2.5 mm ²	3-pos.		PT 2,5-TWIN	3209549	50
PT terminal block	2.5 mm ²	4-pos.		PT 2,5-QUATTRO	3209578	50
ST terminal block	2.5 mm ²	2-pos.		ST 2,5	3031212	50
ST terminal block	2.5 mm ²	3-pos.		ST 2,5-TWIN	3031241	50
ST terminal block	2.5 mm ²	4-pos.		ST 2,5-QUATTRO	3031306	50
QTC terminal block	1.5 mm ²	2-pos.		QTC 1,5	3205019	50
QTC terminal block	1.5 mm ²	3-pos.		QTC 1,5-TWIN	3205048	50
QTC terminal block	1.5 mm ²	4-pos.		QTC 1,5-QUATTRO	3205077	50

5.2 Optional accessories with 6.2 mm pitch or width

Description				Type	Order No.	Pcs./Pck.
Plug-in bridge	red	2-pos.	32 A	FBS 2-6	3030336	50
Plug-in bridge	red	3-pos.	32 A	FBS 3-6	3030242	50
Plug-in bridge	red	4-pos.	32 A	FBS 4-6	3030255	50
Plug-in bridge	red	5-pos.	32 A	FBS 5-6	3030349	50
Plug-in bridge	red	10-pos.	32 A	FBS 10-6	3030271	10
Plug-in bridge	red	20-pos.	32 A	FBS 20-6	3030365	10
Plug-in bridge	red	50-pos.	32 A	FBS 50-6	3032224	10
Plug-in bridge	blue	2-pos.	32 A	FBS 2-6 BU	3036932	50
Plug-in bridge	blue	3-pos.	32 A	FBS 3-6 BU	3036945	50
Plug-in bridge	blue	4-pos.	32 A	FBS 4-6 BU	3036958	50
Plug-in bridge	blue	5-pos.	32 A	FBS 5-6 BU	3036961	50
Plug-in bridge	blue	10-pos.	32 A	FBS 10-6 BU	3032198	10
Plug-in bridge	blue	20-pos.	32 A	FBS 20-6 BU	3032208	10
Plug-in bridge	blue	50-pos.	32 A	FBS 50-6 BU	3032211	10
Plug-in bridge	gray	2-pos.	32 A	FBS 2-6 GY	3032237	50
Plug-in bridge	gray	3-pos.	32 A	FBS 3-6 GY	3032240	50
Plug-in bridge	gray	4-pos.	32 A	FBS 4-6 GY	3032279	50
Plug-in bridge	gray	5-pos.	32 A	FBS 5-6 GY	3032266	50
PT terminal block	4 mm ²	2-pos.		PT 4	3211757	50
PT terminal block	4 mm ²	3-pos.		PT 4-TWIN	3211771	50
PT terminal block	4 mm ²	4-pos.		PT 4-QUATTRO	3211797	50
ST terminal block	4 mm ²	2-pos.		ST 4	3031364	50
ST terminal block	4 mm ²	3-pos.		ST 4-TWIN	3031393	50
ST terminal block	4 mm ²	4-pos.		ST 4-QUATTRO	3031445	50
QTC terminal block	2.5 mm ²	2-pos.		QTC 2,5	3206416	50
QTC terminal block	2.5 mm ²	3-pos.		QTC 2,5-TWIN	3206445	50
QTC terminal block	2.5 mm ²	4-pos.		QTC 2,5-QUATTRO	3206446	50

5.3 Other optional accessories

Description			Type	Order No.	Pcs./Pck.
Reducing bridge	10 to 2.5/4		RB ST 10-(2,5/4)	3030873	10
Wire bridge	black	50-pos.	DB 50- 90 BK	2820916	1
Wire bridge	gray	50-pos.	DB 50- 90 GY	2820929	1
Wire bridge	red	50-pos.	DB 50- 90 RD	2864639	1
Wire bridge	blue	50-pos.	DB 50- 90 BU	2821180	1
PT terminal block	10 mm ²	2-pos.	PT 10	3212120	50
ST terminal block	10 mm ²	2-pos.	ST 10	3036110	50
Zack marker strip	Strip	Can be labeled	ZB 6:UNBEDRUCKT	1051003	10
Zack Marker strip, flat	Strip	Can be labeled	ZBF 6:UNBEDRUCKT	0808710	10
Zack marker strip	Sheet	Can be labeled	UCT-TM 6	0828736	10
Zack marker strip	Sheet	Individually labeled	UCT-TM 6 CUS	0829602	1
Adhesive labels	Can be labeled		US-TML (104X3,8)	0830768	10