

ELECTRONIC FUSE
8x 24 V, 2x 1-12 A, 6x 1-10 A

- Eight current controlled outputs
- Adjustable output currents for each channel
- Selective tripping of overloaded channels
- Compatible even with large capacitive loads
- Output currents displayed live on LED matrix
- Remote reset or reset via push buttons
- Configurable reset and alarm signals
- Parameter settings can be locked by PIN code
- ON / OFF feature for each individual output
- Easy wiring - distribution terminals for negative pole
- 3 year warranty

PRODUCT DESCRIPTION

The PISA-B devices are DIN rail mountable eight channel protection modules with integrated electronic fuses for 24V systems. They distribute the current of a large power source to eight output channels each of lower current and therefore allowing for smaller wires to be used.

The output current of each channel can be set individually. Channel 1 and 2 are optimized for loads with large input capacitances. Connect such loads to these channels to avoid false tripping or unexpected switch-off such loads.

The PISA-B-812-B1 is equipped with a common tripping signaling relay contact that reports tripped channels or channels manually turned off, while the PISA-B-812-B4 supports multiple, user-selectable, signaling and communication methods, allowing the selection of simple alerts and reset function.

All PISA-B devices are equipped with push-in terminals, which are optimized for automated wiring.

The mechanically robust housing is made of a high-grade, reinforced molded material on the front and of an aluminum body, which permits surrounding temperatures up to +70 °C.

SHORT-FORM DATA

Input voltage	DC 24 V	-20 % / +25 %
Required input voltage for turning-on of outputs	19.6 Vdc	
Input current	max. 40 A	
Internal consumption	40 mA	PISA-B-812-B1
	35 mA	PISA-B-812-B4
Nominal output current		adjustable
	1/2/3/4/6/8/10/12 A	CH1 and CH2
	1/2/3/4/6/8/10 A	CH3 to CH8
Sum current all channels	40 A	up to +60 °C ambient
	30 A	at +70 °C ambient
	Derate between +60 °C and +70 °C	
Current limitation		
CH1-CH2	200 %	for 1 A setting
	150 %	for 2 - 8 A settings
	130 %	for 10 - 12 A settings
CH3-CH8	50 A	
Tripping characteristics	Slow or Fast	selectable
Tripping delay		
CH1-CH2	2 ms – 2 s	at short circuit
CH3-CH8	<10 ms	at short circuit
CH1-CH8	1.1 s	for slow tripping at 1.5x nominal current
CH1-CH8	0.22 s	for fast tripping at 1.5x nominal current
Max load capacitance capability		
CH1-CH2	100 mF	per channel
CH3-CH8	20 mF	per channel
Voltage drop per channel		
CH1-CH2	125 mV	for 10 A load
CH3-CH8	165 mV	for 10 A load
Standby losses	1 W	
Power losses	10.8 W	at 8x 5 A load
Temperature range	-25 °C to +70 °C	
Size (w x h x d)	52x124x130 mm	without DIN rail
Weight	370 g	

ORDER NUMBERS

Electronic Fuse:

PISA-B-812-B1	Common signaling relay contact
PISA-B-812-B4	Digital coded signal output

Accessories:

BUS-BAR1-L102:	A set for 2 modules
BUS-BAR1-L155:	A set for 3 modules
BUS-BAR1-L500:	Single piece L = 500 mm

MAIN APPROVALS

For details and a complete approval list, see chapter 22.

UL 2367 | UL 61010-2-201 | IEC 62368

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All parameters are specified at 24 Vdc input voltage, 8x5 A output currents, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

Index

1 Intended Use..... 3
2 Installation Instructions..... 3
3 Typical Wiring Scheme..... 4
4 DC Input..... 5
5 Output..... 5
6 Output Tripping Characteristics..... 7
7 Control and Monitoring Features..... 8
8 Error Codes..... 11
9 Fail-Safe Master Switch..... 11
10 Device Overcurrent Protection..... 11
11 Signal Status Output and Control Input..... 12
12 Digital Coded Interface (PISA-B-812-B4)..... 14
13 Efficiency and Power Losses..... 15
14 Functional Diagram..... 16
15 Front Side And User Elements..... 17
16 Terminals And Wiring..... 17
17 Lifetime Expectancy..... 18
18 MTBF..... 18
19 EMC..... 19
20 Environment..... 20
21 Safety Features and Protection Features..... 21
22 Approved, Fulfilled or Tested Standards..... 22
23 Regulatory Product Compliance..... 22
24 Physical Dimensions And Weight..... 23
25 Accessories..... 24
25.1 Power Connection - Power-Bus-Bars..... 24

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Packaging and packaging aids can and should always be recycled. The product itself may not be disposed of as domestic refuse.

Terminology and Abbreviations

DC 24 V	A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances (usually ±15 %) included.
24 Vdc	A figure with the unit (Vdc) at the end is a momentary figure without any additional tolerances included.
may	A key word indicating flexibility of choice with no implied preference.
shall	A key word indicating a mandatory requirement.
should	A key word indicating flexibility of choice with a strongly preferred implementation.

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1. Intended Use

This device is designed for installation in an enclosure and is intended for commercial use, such as in industrial control, process control, monitoring and measurement equipment or the like.

Do not use this device in equipment, where malfunctioning may cause severe personal injury or threaten human life without additional appropriate safety devices, that are suited for the end-application.

If this device is used in a manner outside of its specification, the protection provided by the device may be impaired.

2. Installation Instructions

⚠ DANGER **Risk of electrical shock, fire, personal injury or death.**

- Turn power off before working on the device. Protect against inadvertent re-powering.
- Do not open, modify or repair the device.
- Use caution to prevent any foreign objects from entering the housing.
- Do not use in wet locations or in areas where moisture or condensation can be expected.
- Do not touch during power-on, and immediately after power-off. Hot surfaces may cause burns.

Obey the following installation instructions:

This device may only be installed and put into operation by qualified personnel. This device does not contain serviceable parts. If damage or malfunction should occur during installation or operation, immediately turn power off and send unit to the factory for inspection.

Install the device in an enclosure providing protection against electrical, mechanical and fire hazards. Install the device onto a DIN rail according to EN 60715 with the input terminals on top of the unit.

Up to eight devices can be connected via two power-bus-bars, where only one device is connected to the power supply. The power-bus-bars must be long enough to make a connection to all contacts of the devices.

Use an appropriately sized 24 V power supply, which can deliver the peak current required to trip the load channels. If peak currents are too low, the supply voltage for the protection module can no longer be maintained, which results in a malfunctioning of the protection module.

Make sure that the wiring is correct by following all local and national codes. Use appropriate copper cables that are designed for a minimum operating temperature of +60 °C for ambient temperatures up to +45 °C, +75 °C for ambient temperatures up to +60 °C and +90 °C for ambient temperatures up to +70 °C. Ensure that all strands of a stranded wire enter the terminal connection.

The device is designed for pollution degree 2 areas in controlled environments. No condensation or frost is allowed. The enclosure of the device provides a degree of ingress protection of IP20. The housing does not provide protection against spilled liquids.

The isolation of the devices is designed to withstand impulse voltages up to 1.5 kV according to IEC 60664-1.

The input can be powered from a regulated power supply or a similar DC source.

The input must be powered from a PELV or SELV source in order to maintain a SELV or PELV output. Check for correct input polarity. The device will not operate when the voltage is reversed.

A disconnecting means shall be provided for the input of the device.

The device is designed as “Class of Protection III” equipment according to IEC 61140.

The device is designed for convection cooling and does not require an external fan. Do not obstruct airflow and do not cover ventilation grid!

Keep the following minimum installation clearances: 40 mm on top, 20 mm on the bottom, 5 mm left and right side. Increase the 5 mm to 15 mm in case the adjacent device is a heat source. Between multiple PISA-B modules, no clearance is needed.

The device is designed for altitudes up to 5000 m.

The maximum surrounding air temperature is +70 °C. The operational temperature is the same as the ambient or surrounding air temperature and is defined 2 cm below the device. The device is designed to operate in areas between 5 % and 95 % relative humidity.

External freewheeling diodes shall be used for large inductive loads.

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3. Typical Wiring Scheme

One fuse module is suitable to distribute the current to 8 consumers. If there are more than eight consumers, up to eight fuse modules can be used (64 consumers). The supply of the individual fuse modules can be done by means of power-bus-bars, which are available as accessory parts. The supply of the 24 V is then only done by one fuse module, preferably in the middle, because the current is then better distributed in both directions and the permissible current of the power-bus-bar of 32 A is not exceeded.

Fuse modules can be lined up on the DIN rail without spacing. The power-bus-bars can be plugged in from the front and must have a length that all plug contacts of the modules make a contact.

The (+) pole terminals of the loads must be connected to the outputs of the fuse module. The fuse module also has a distribution for the (-) pole connection. This internal distribution can be used and reduces the wiring effort. However, an external distribution of the (-) pole connection may also be used, as shown in Fig. 3-2.

The channels 1 and 2 are optimized for loads with large input capacitances. Connect such loads to these channels to avoid a false tripping or unexpected switch-off of these channels.

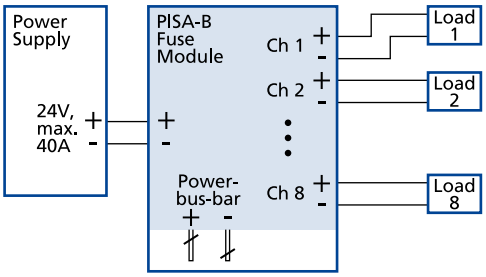


Fig. 3-1: Typical wiring scheme for one fuse module (8 loads)

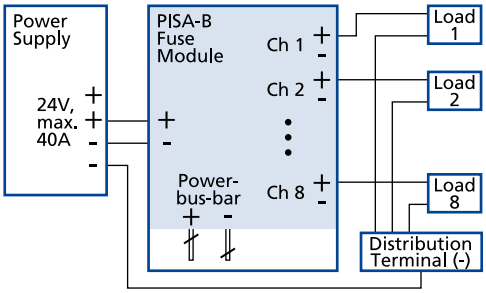


Fig. 3-2: Typical wiring scheme utilizing an external distribution terminal for the negative pole

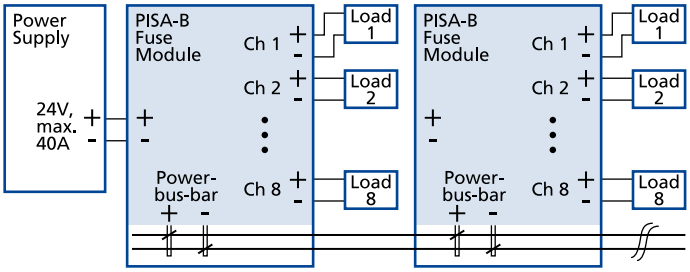


Fig. 3-3: Typical wiring scheme for multiple modules

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4. DC Input

The input can be powered from a regulated power supply or a similar DC source. Use an appropriately sized power supply, which can deliver the required output current.

If a power supply with a continuous output current greater than 50 A is used, a fuse or circuit breaker with 63 A (B- or C-Characteristic) must be connected between the power supply and the electronic fuse module.

The continuous voltage between the input and ground must not exceed 60 Vdc.

The input must be powered from a PELV or SELV source or an “Isolated Secondary Circuit” in order to maintain SELV or PELV outputs.

Check for correct input polarity. The device will not operate when the voltage is reversed.

Input voltage Input voltage range	nom.	DC 24 V 19.2-30 Vdc	-20 % / +25 %
Input voltage required to switch on the outputs	typ. max.	19 Vdc 19.6 Vdc	
Input current	max.	40 A	The input current corresponds to the sum output current and the internal current consumption.
Internal current consumption			stand-by current with no load current on the outputs
	typ.	40 mA	for PISA-B-812-B1
	typ.	35 mA	for PISA-B-812-B4

5. Output

The output can supply any kind of loads, including inductive and capacitive loads. The maximum size of capacitive loads is specified in the table below. Larger load capacitors might result in an unintended turn-off of the channel. More detailed information regarding allowable capacitive loads is available on request. If in doubt or when you do not know the input capacitance of your load, we recommend to perform tests with the real load.

Output channels can be switched on and off separately by pushing the corresponding control button for longer than 50 ms. A switched off channel is displayed with the uppermost red LED of the LED bar graph. Factory setting is that all channels are switched on.

When the sum of the output currents is greater than 40 A, the device turns off the output channels one by one, starting with the overloaded channels and followed by CH8 to CH1, until the sum current is less than 40 A.

Channels 1 and 2 have a current limited output, while channels 3 to 8 have an overcurrent shutdown behaviour only.

- Do not apply reverse voltages from the load to the output terminals that are higher than 30 V.
- Do not apply reverse voltages from the load to the output terminals that are higher than the input voltage and last longer than 1 s.
- Do not parallel outputs for higher output currents.
- Do not connect outputs in a series connection for higher output voltages.
- Do not connect batteries for charging purposes to the output of the device.

In order to avoid too high peak currents on the 24 V supply when applying the 24 V supply voltage, the output channels are switched on in delayed steps. Channel 1 switches on after 50 ms followed by the remaining channels with a delay of 100 ms each. This scheme applies when all channels are switched on. Channels that are switched off are skipped.

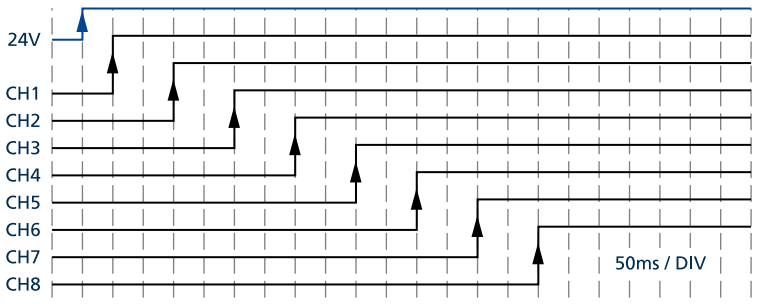


Fig. 5-1: Turn-On sequence after applying an input voltage

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Output voltage	nom.	DC 24 V	The output voltage is equal to the input voltage minus the voltage drop of the module.
Voltage drop per channel	typ.	125 mV	for CH1 or CH2 at 10 A load when all other channels are not loaded
	typ.	190 mV	for CH1 or CH2 when all channels are loaded with 5 A
	typ.	165 mV	for CH3 to CH8 at 10 A load when all other channels are not loaded
	typ.	210 mV	for CH3 to CH8 when all channels are loaded with 5 A
Sum current for all channels	max.	40 A	up to +60 °C ambient
	max.	30 A	at +70 °C ambient
	Derate between +60 °C and +70 °C ambient		
Current settings per channel	nom.	1/2/3/4/6/8/10/12 A	for CH1 and CH2
	nom.	1/2/3/4/6/8/10 A	for CH3 to CH8
Factory setting		1 A	for all channels
Current limitation	typ.	200 %	for CH1 and CH2 in 1 A setting
	typ.	150 %	for CH1 and CH2 in 2 A to 8 A settings
	typ.	130 %	for CH1 and CH2 in 10 A and 12 A settings
	typ.	50 A	for CH3 to CH8, independent of the settings
	Channels 1 and 2 have a current limited output, while channels 3 to 8 have an overcurrent shutdown behaviour only.		
Load capacitance capability	max.	100 mF	for CH1 and CH2 per channel, in slow mode
	max.	20 mF	for CH3 to CH8 per channel, in slow mode
Output leakage current	max.	2 mA	per channel, when CH1 and CH2 are switched off
	typ.	1.2 mA	per channel, when CH1 and CH2 are switched off
	max.	50 µA	per channel, when CH3 to CH8 are switched off
Turn-on delay of outputs	typ.	750 ms	Period between applying the input voltage and turning on all output channels.

Do not load the individual channels with higher average currents depending on the ambient temperature.
Examples of maximal average output current per channel depending on the ambient temperature:

Ambient Temperature	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	Max. sum currents of all channels
-25 °C to +40 °C	12 A	12 A	10 A	10 A	10 A	10 A	10 A	10 A	40 A
+41 °C to +50 °C	10 A	10 A	10 A	10 A	8 A	8 A	8 A	8 A	40 A
+51 °C to +55 °C	12 A	12 A	8 A	8 A	8 A	8 A	8 A	8 A	40 A
+51 °C to +55 °C	10 A	10 A	2 A	10 A	2 A	10 A	2 A	2 A	40 A
+56 °C to +60 °C	8 A	8 A	8 A	8 A	8 A	8 A	8 A	8 A	40 A
+56 °C to +60 °C	12 A	12 A	6 A	6 A	6 A	8 A	8 A	8 A	40 A
+61 °C to +70 °C	12 A	12 A	6 A	6 A	6 A	6 A	6 A	6 A	30 A

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6. Output Tripping Characteristics

The tripping current can be set individually for all channels and the tripping characteristic can be set to Slow or Fast as a common parameter for all channels.

Tripping characteristics		Slow / Fast	selectable, factory setting is Fast
Tripping delay	typ.	1.1 s	for all channels in Slow mode at 1.5x nominal current
	typ.	0.22 s	for all channels in Fast mode at 1.5x nominal current
	typ.	2 ms – 2 s	for CH1 and CH2 in short circuit
	max.	10 ms	for CH3 to CH8 in short circuit

The following curves show the let-through current areas, which are located to the left of the curves, and the tripping areas, which are located to the right of the curves.

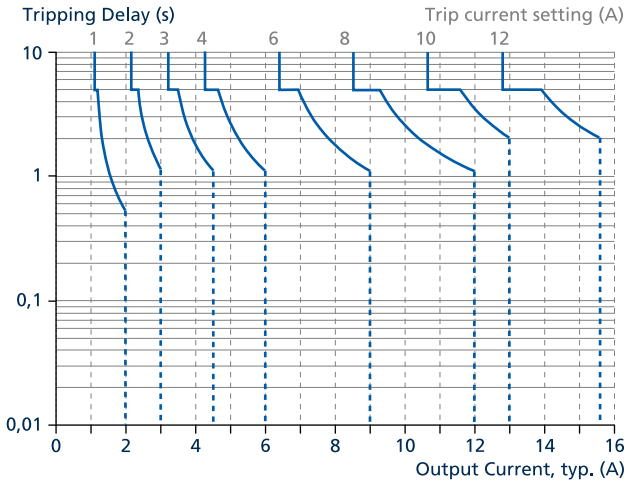


Fig. 6-1: CH1 and CH2 tripping diagrams in Slow mode

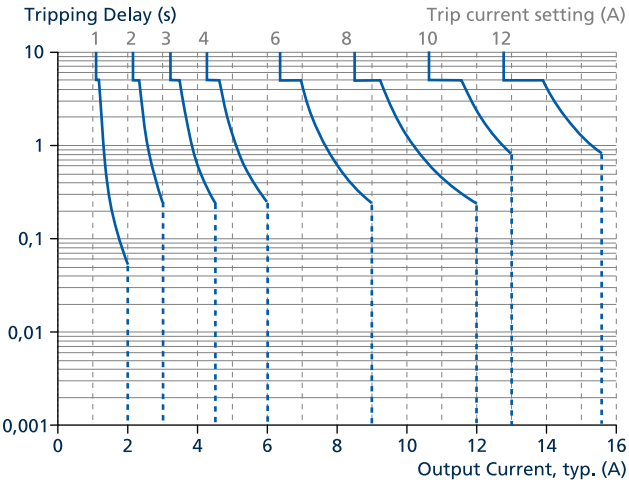


Fig. 6-2: CH1 and CH2 tripping diagrams in Fast mode

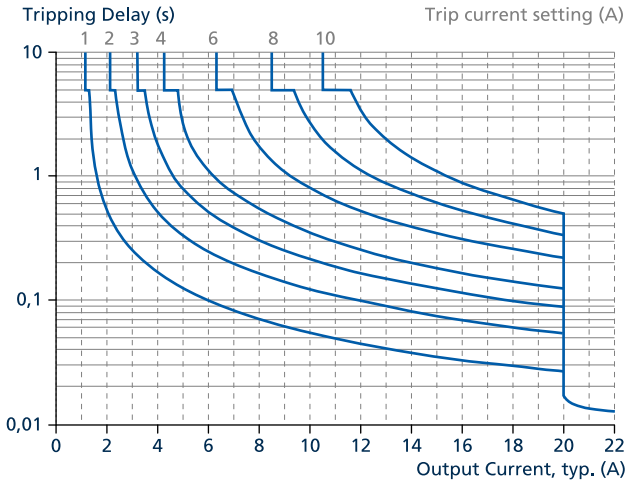


Fig. 6-3: CH3 to CH8 tripping diagrams in Slow mode

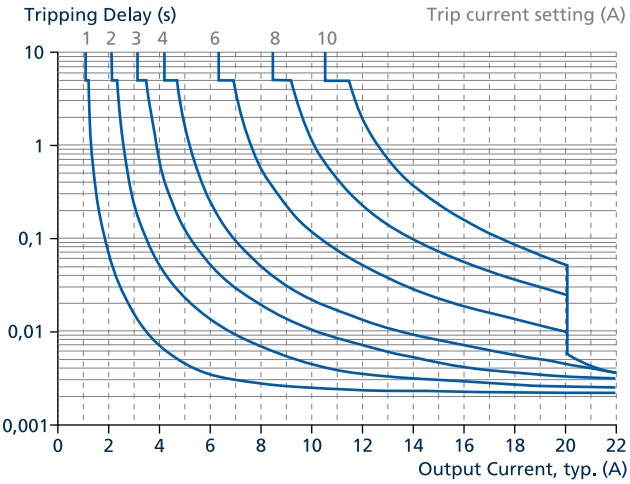


Fig. 6-4: CH3 to CH8 tripping diagrams in Fast mode

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7. Control and Monitoring Features

The LED matrix display provides information about measurement, set parameters and errors and contains two modes. To switch between the two modes, the measurement mode and the parameter mode, push the SET button and the channel control button 4.

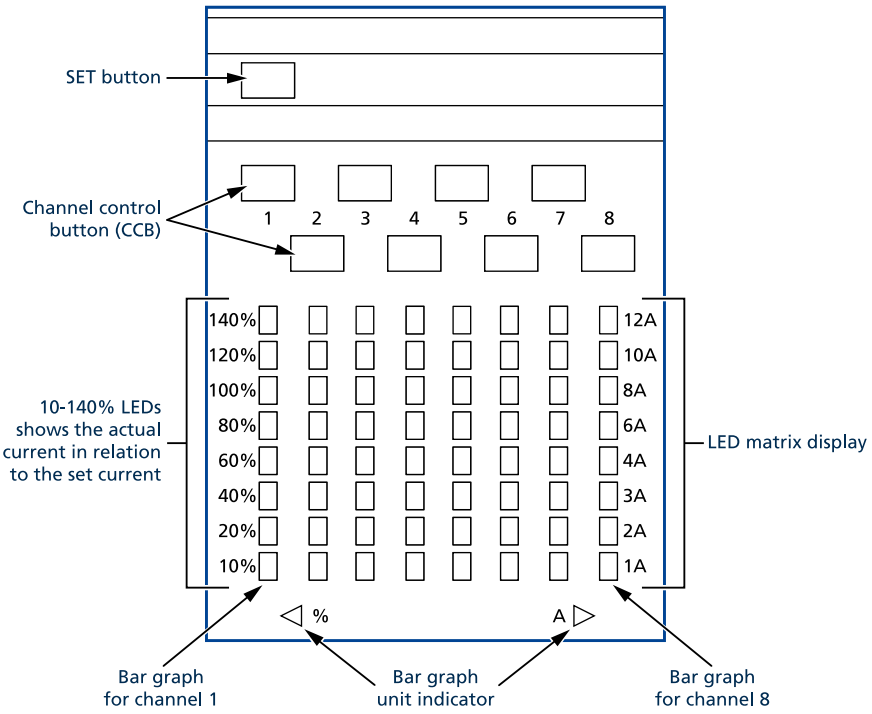


Fig. 7-1: Control and monitoring elements

Special Key Combinations

Special shortcuts allow quick access to certain information:

Press **SET + CCB1** button: Lock / Unlock setting with PIN

Press **SET + CCB2** button: Show FW version

Press **SET + CCB3** button: Slow / Fast mode

Press **SET + CCB4** button: Measurement / Parameter mode

Press **SET + CCB5** button: Change Signaling port function

Measurement Mode

The "%" scale on the left side of the LED Matrix is used in this mode, which is also indicated by the triangular LED below the LED matrix display. In this mode the actual current values are shown and the LED matrix display also shows, if a channel has switched off due to a too high current or on purpose.

- One or more green / yellow LEDs are on: These LEDs indicate the actual channel current in percent of the set value. Peak values are stored in a peak detector and are additionally shown with one LED for a short period of time.
- Uppermost LED is red: This indicates a switched off channel. To switch the channel back on, the corresponding channel control button must be pressed for at least 50 ms. A further push switches the channel off again.
- Uppermost LED is single flashing in red (2 Hz): This indicates that a channel has switched off due to too high current. A restart can be done either by a button on the unit or by a control signal. To do so, push the corresponding channel control button for longer than 1 s or apply a voltage between 10 and 30 Vdc (max. 6 mA current consumption) for longer than 1 s to the reset input. The reset input is galvanically isolated from the rest of the device.
- Uppermost LED is double flashing in red: This indicates that a channel has switched off because the total current of the module exceeds 40 A. In such cases, first the overloaded channels are switched off, then channels 8 to 1 in descending order.
- Display of the settings for tripping currents and tripping characteristic: Push the SET button for more than 50 ms. First the tripping currents are displayed, followed by the tripping characteristic with the letter "F" (for fast tripping) or "S" (for slow tripping). This function ends automatically after 5 s.

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Parameter Mode

The “A” scale on the right side of the LED Matrix is used in this mode, which is also indicated by the triangular LED below the LED matrix display. In this mode the set values for the tripping currents for each individual channel are displayed and the LED matrix display also shows if a channel has switched off due to a too high current or on purpose.

– Displaying of the set current: The green LED shows the set current of the individual channel.
– Displaying of the tripping characteristic: Push the SET button. The selected characteristic is shown on the LED matrix for 2 s. Letter “F” indicates the fast and the letter “S” the slow tripping characteristic.
– Red LEDs: These indicate a switched off or overloaded channel and include the same LED blinking pattern and push-button behaviour as in the measurement mode. If a channel is set to 12 A, the LED below the uppermost LED will display this switched-off information.

Changing of Trip Currents and Trip Characteristic

Factory settings are that all channels are turned on with a 1 A setting in a fast tripping characteristic and in measurement mode. Parameters can be changed in the measurement mode as well as in the parameter mode. Parameters can be changed regardless of whether a channel is switched off or not.

– Changing the current settings: Press and hold the SET button for at least 1 s. The triangular green “A” LED starts flashing. After that, shortly tap the channel control button multiple times to adjust the current step by step. When the desired setting is found, press the SET buttons for more than 50 ms to save the setting. This mode ends automatically 10 s after no more buttons are pushed. In case the settings are not saved by pressing the SET button, changes of tripping currents are not stored.
– Changing of the tripping characteristic (Slow or Fast): To change the characteristic for all channels push the SET and the channel control button 3 at the same time. The selected characteristic is shown on the LED matrix for 2 s and stored automatically. Letter “F” indicates the fast and “S” the slow tripping characteristic.

Tripping currents and characteristic setting can be protected against changes with a PIN code. To lock the settings push the SET and channel control button 1 until the unit shows a moving text “PIN TO LOCK”. Enter a 4-digit PIN by pushing any combination of channel control buttons 1-8. Push the SET button to save the PIN, the unit shows a moving text “LOCKED”. To unlock settings push the SET and channel control button 1, the unit shows a moving text “PIN TO UNLOCK” and enter the 4-digit PIN you selected and confirm it by pushing the SET button.

For LED pattern examples, please refer to Fig. 7-2 and Fig. 7-3.

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LED pattern example

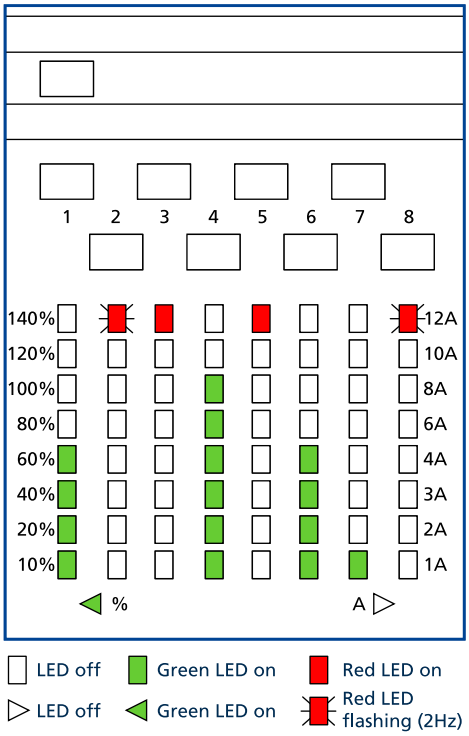


Fig. 7-2: LED Light pattern in measurement mode

Description:
Channel 1 is loaded with 40-60 % of the set current
Channel 2 has tripped due to overcurrent
Channel 3 is turned off on purpose (with push-button)
Channel 4 is loaded with 80-100 % of the set current
Channel 5 is turned off on purpose (with push-button)
Channel 6 is loaded with 40-60 % of the set current current
Channel 7 is loaded with 0-10 % of the set current current
Channel 8 has tripped due to overcurrent

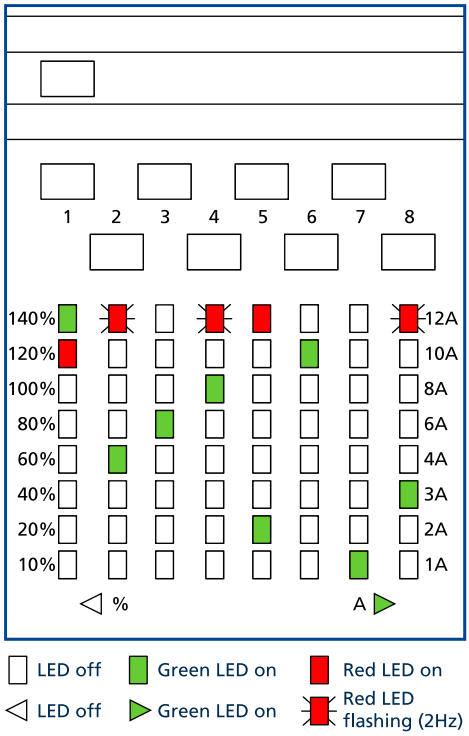


Fig. 7-3: LED Light pattern in parameter mode

Description:
Channel 1 is set to 12 A but turned off with push-button
Channel 2 is set to 4 A but has tripped due to overcurrent
Channel 3 is set to 6 A and output is on
Channel 4 is set to 8 A, but has tripped due to overcurrent
Channel 5 is set to 2 A but turned off with push-button
Channel 6 is set to 10 A and output is on
Channel 7 is set to 1 A and output is on
Channel 8 is set to 3 A but has tripped due to overcurrent

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8. Error Codes

Common behaviour:

After detecting an error state, all outputs are switched off, the Alarm relay contact is closed (Alarm is active) or the respective signal of the electronic status output switch is set according to the selected option, and the buttons (incl. SET button) are blocked. The error message is flashing (2 Hz). This state is permanent until the device is turned off and on. Then the device starts as usual, but all outputs are off (not tripped) until they are switched on with the push-buttons.

Error Code E1

E1 can be caused by back feeding (supplying one of the outputs with more than 1 A for longer than 1 s) while other outputs are loaded.

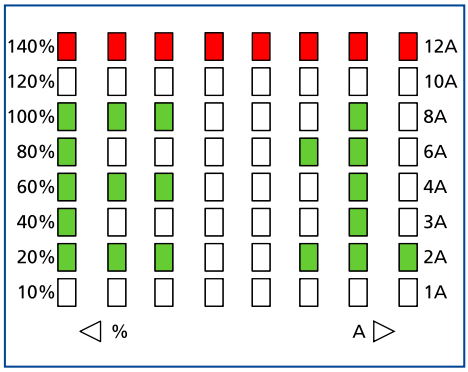


Fig. 8-1: LED pattern error code E1

Error codes E2 - E6

For error codes E2 - E6 please contact your PULS representative.

9. Fail-Safe Master Switch

The electronic circuit breakers from PULS do not include built-in melting fuses as fail-safe backup, but an intelligent fail-safe master switch.

The fail-safe master switch is continuously monitoring the total input current and all output currents.
If a deviation of ≥ 1 A is detected between total output and input current for more than 1 s, a fault is detected and the fail-safe master switch disables the PISA-B unit.

The benefits of the fail-safe master switch are the accuracy and protection of lines and devices, as the deviation detection is related to the actual currents and tripping limitations set by the user. Thus, the effective maximum current for each output channel in a device failure is limited to the selected tripping limitation + 1 A.

10. Device Overcurrent Protection

The PISA-B comes with a built-in safeguard mechanism to prevent overcurrent. It constantly monitors all output channel currents. If the total current exceeds the rated maximum of 40 A for 2 s or more, the device will reduce the total output current by switching off output channels, starting with overloaded output channels (after 2 s), then continuing with CH8 to CH1 (100 ms delay) until the total output current is 40 A or less.

This protection sequence is handled independently from selected fast or slow tripping characteristic or configured current limit.

All output channels tripped by this device protection mechanism will be indicated by continuous red double-flashing of the output channel status LED.

Over current protection limit	min. 40 A
	typ. 42.6 A

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All parameters are specified at 24 Vdc input voltage, 8x5 A output currents, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

11. Signal Status Output and Control Input

The device is equipped with two signal ports: Signal control input (pins 11 - 12) and signal status output (pins 13 - 14).

The ports are galvanically isolated from the power circuits via optocouplers / relays. See functional diagrams, Fig. 14-1 and Fig. 14-2.

Signal Control Input, pins 11 - 12

The device is equipped with a control input for resetting all tripped output channels remotely. To do so, apply a voltage between 10 and 30 Vdc for longer than 1 s to the status control input.

Reset voltage	min. max.	10 Vdc 30 Vdc
Reset delay	min.	1 s - apply the reset voltage for at least this time to restart switched-off channels
Signal voltage	min. max.	-35 Vdc +35 Vdc
Signal current	max.	6 mA, current limited
Isolation voltage		see chapter 21

Note: the first tripped channel is switched on immediately after valid reset signal (1 s). Remaining tripped channels are switched on with 100 ms delay, similar to the turn-on sequence described in Fig. 5-1.

Signal Status Output – Alarm Relay Contact (PISA-B-812-B1), pins 13 - 14

The device is equipped with an alarm contact. The normally closed (NC) contact closes as soon as one output channel has tripped / switched off (common signaling) or the input voltage is lower than 19 Vdc.

Contact ratings	max. min.	60 Vdc 0.3 A, 30 Vdc 1 A, 30 Vac 0.5 A, resistive load permissible load: 1 mA at 5 Vdc
Isolation voltage		see chapter 21

The alarm relay contact can be configured with options:

Option S1: Switch closes if one or more output channels are tripped by overcurrent (factory setting).

Option S3: Switch closes if one or more output channels are tripped or turned off manually.

Press SET + CCB5 button to change the signaling port function, displayed options are S1 and S3.

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Signal Status Output – Electronical Status Output Switch (PISA-B-812-B4), pins 13 - 14

The device is equipped with an electronical status output switch which provides information about the output channel status of the PISA-B.

Threshold value for start	typ.	0.7 V at 1 mA, 1.1 V at 5 mA
Signal voltage	max.	+35 Vdc
Signal current	max.	10 mA
Isolation voltage		see chapter 21

The electronical status switch can be configured with options:

Option S1: Switch closes if one or more output channels are tripped by overcurrent.

Option S2: Digital Coded Interface, see chapter 12 (factory setting).

Option S3: Switch closes if one or more output channels are tripped or turned off manually.

Option S4: Switch closes if no output channel has tripped and all output channels are turned on.

Press SET + CCB5 button to change the signaling port function, displayed options are S1, S2, S3 and S4.

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12. Digital Coded Interface (PISA-B-812-B4)

PISA-B features an easy and efficient communication via Digital Coded Interface (DCI), which allows a unidirectional and bidirectional communication via digital I/O of a PLC.
Note: The communication mode needs to be configured to DCI.

Unidirectional Communication (factory setting)

Unidirectional communication transmits the status of each individual output channel. The status only differentiates between tripped output channels (high level) and not tripped output channels (low level). Not tripped output channels can be either on or off.
Each data sequence starts with a 200 ms start bit, followed by a 100 ms pause and 100 ms status signal. The statuses of the output channels 1 to 8 are transmitted in order, resulting in a total sequence duration of 1900 ms.

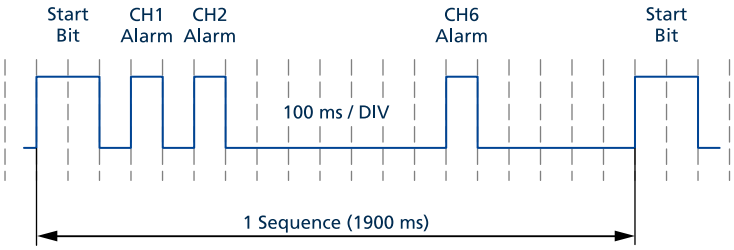


Fig. 12-1: Digital Coded Sequence (unidirectional) PISA-B to PLC

Bidirectional Communication

The bidirectional communication mode enables extended functions. In addition to transmitting tripped output channels, the channels can also be remotely turned off and on. This also expands the scope of information transmitted by the device in the data sequence.

To enable the bidirectional mode, a data sequence as defined in Fig. 12-2 must be transmitted to the PISA-B. The module autonomously identifies incoming communication and switches to bidirectional mode.

Note: The PISA-B switches directly to bidirectional mode after receiving the first sequence. Power shortages or switching the power off and on will reset the DCI back to unidirectional mode. Sending a correct data sequence to the PISA-B will enable the bidirectional mode again.

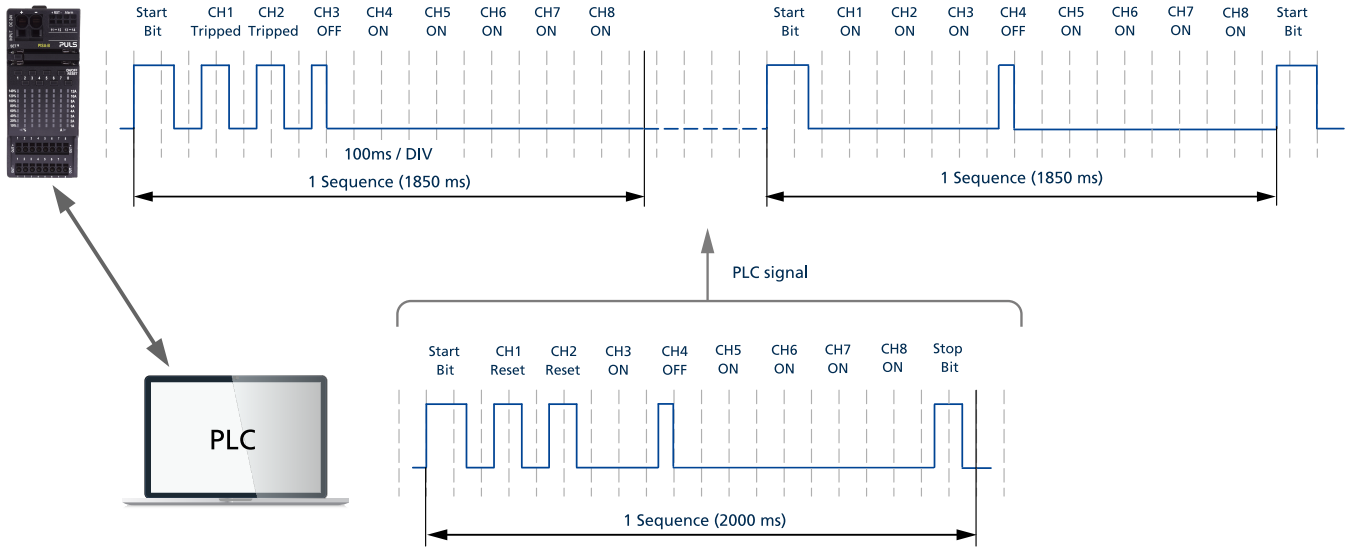


Fig. 12-2: Digital Coded Sequence (bidirectional) PISA-B to PLC (top) and PLC to PISA-B (bottom)

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Input (received sequence, pins 11-12)

- The transmitted data sequence starts with a 150 ms start bit followed by a 100 ms pause.
- High-level state lasting 100 ms resets a tripped channel.
- High-level state lasting 50 ms followed by 50 ms low level state turns the channel off.
- Low-level state lasting 100 ms turns the channel on.
- Low-level state pause lasting 100 ms follows every on/off/reset command.
- 100 ms lasting high-level stop bit followed by 50 ms pause ends every sequence.
- Total sequence duration is 2000 ms.

Output (transmitted sequence, pins 13-14)

- The transmitted data sequence starts with a 150 ms start bit followed by a 100 ms pause.
- Tripped output channels are indicated by a high-level state lasting 100 ms.
- Output channels that are turned off are signalled with a high-level state lasting 50 ms followed by 50 ms low level state.
- Conversely, output channels that are turned on are indicated by a low-level state lasting 100 ms.
- Low-level state pause lasting 100 ms follows every channel status signal.
- Total sequence duration is 1850 ms.

13. Efficiency and Power Losses

Efficiency	typ.	98.9 %	at 8x 5 A output load
Power losses	typ.	1 W	at no output loads
	typ.	10.8 W	at 8x 5 A output load

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All parameters are specified at 24 Vdc input voltage, 8x5 A output currents, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

14. Functional Diagram

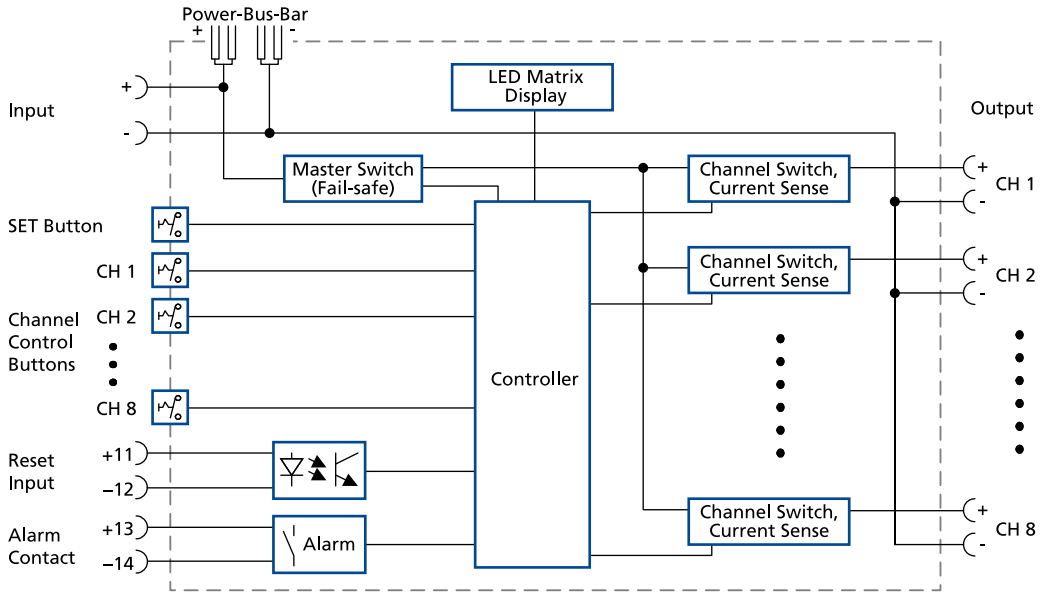


Fig. 14-1: Functional diagram PISA-B-812-B1

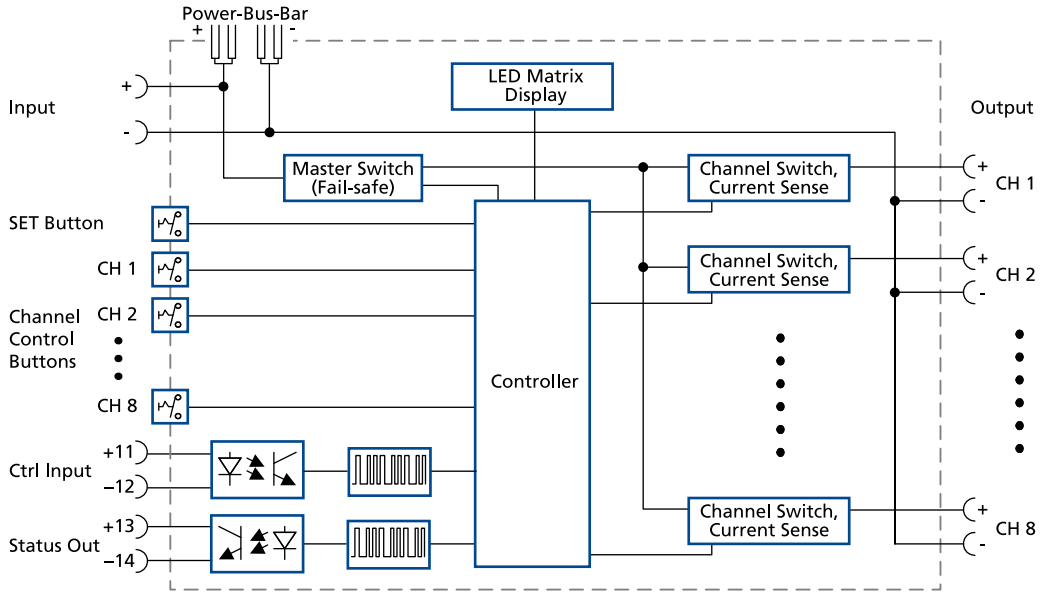


Fig. 14-2: Functional diagram PISA-B-812-B4

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All parameters are specified at 24 Vdc input voltage, 8x5 A output currents, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

15. Front Side And User Elements

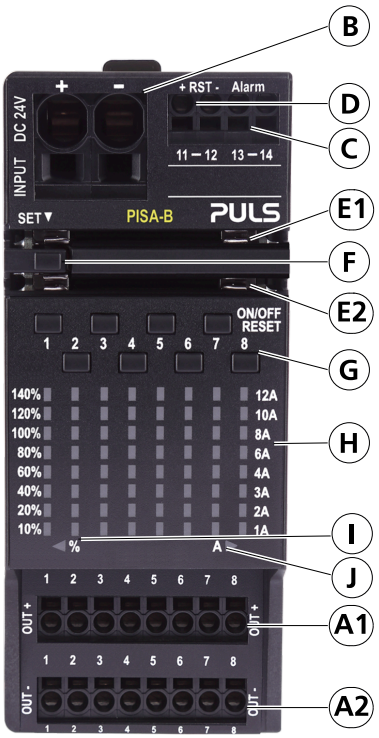


Fig. 15-1: Front side

A **Output terminals CH1 – CH8**
- **A1: (+)** Positive output poles
- **A2: (–)** Negative (return) output poles

B **Input terminals**
- **(+)** Positive input pole
- **(–)** Negative (return) input pole

C **Alarm signal** (pin 13-14)
PISA-B-812-B1: Relay contact
PISA-B-812-B4: Digital coded signal

D **Signal input to restart switched-off channels** (pin 11-12)

E **Slot for interconnecting power-bus-bar for supply voltage**
E1: Interconnection for positive input power-bus-bar
E2: Interconnection for negative (return) input power-bus-bar

F **Set button required for controlling the unit**

G **Channel control buttons**

H **LED matrix display**

I **LED which indicates percentage values of the LED matrix**

J **LED which indicates ampere values of the LED matrix**

16. Terminals And Wiring

The terminals are IP20 finger safe constructed and suitable for field- and factory wiring.

	Input Terminals	Output Terminals	Signal Terminals
Type	Push-in terminals	Push-in terminals	Push-in terminals
Solid wire	max. 16 mm²	max. 2.5 mm²	max. 2.5 mm²
Stranded wire	max. 16 mm²	max. 2.5 mm²	max. 2.5 mm²
Stranded wire with ferrules	max. 10 mm²	max. 1.5 mm²	max. 1.5 mm²
American Wire Gauge	AWG 20-4	AWG 24-12	AWG 24-12
Max. wire diameter (including ferrules)	6.1 mm	2.3 mm	2.3 mm
Wire stripping length	19 mm	10 mm	10 mm
Screwdriver	5 mm slotted to open the spring	3 mm slotted to open the spring	3 mm slotted to open the spring

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All parameters are specified at 24 Vdc input voltage, 8x5 A output currents, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

17. Lifetime Expectancy

The lifetime expectancy shown in the table indicates the minimum operating hours (service lifetime) and is determined by the lifetime expectancy of the built-in electrolytic capacitors. Lifetime expectancy is specified in operational hours and is calculated according to the capacitor's manufacturer specification.

Please note: The manufacturer of the electrolytic capacitors only guarantees a maximum life of up to 15 years (131 400 h). Any number exceeding this value is a calculated theoretical lifetime which can be used to compare devices.

Lifetime expectancy		
PISA-B-812-B1	220 000 h	at 24 V, 8x 5 A and +40 °C
	402 000 h	at 24 V, 8x 2.5 A and +25 °C
PISA-B-812-B4	199 000 h	at 24 V, 8x 5 A and +40 °C
	396 000 h	at 24 V, 8x 2.5 A and +25 °C

18. MTBF

MTBF stands for **M**ean **T**ime **B**etween **F**ailures, which is calculated according to statistical device failures, and indicates reliability of a device. It is the statistical representation of the likelihood of a unit to fail and does not necessarily represent the lifetime of a product.

An MTBF figure of e.g. 1 000 000 h means that statistically one unit out of 10 000 installed units will fail every 100 h. However, it can not be determined if the failed unit has been running for 50 000 h or only for 100 h.

For these types of units the MTTF (**M**ean **T**ime **T**o **F**ailures) value is the same value as the MTBF value.

MTBF SN 29500, IEC 61709	512 000 h	at 24 V, 8x 5 A and +40 °C
	930 000 h	at 24 V, 8x 5 A and +25 °C
MTBF MIL HDBK 217F	223 000 h	at 24 V, 8x 5 A and +40 °C; Ground Benign GB40
	309 000 h	at 24 V, 8x 5 A and +25 °C; Ground Benign GB25
	47 000 h	at 24 V, 8x 5 A and +40 °C; Ground Fixed GF40
	62 000 h	at 24 V, 8x 5 A and +25 °C; Ground Fixed GF25

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19. EMC

The EMC behaviour of the device is designed for applications in industrial environment as well as in residential, commercial and light industry environment without any restrictions.

The device complies with EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4.

The device complies with FCC Part 15 rules. Operation is subjected to following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The chassis of the device is earthed through the DIN rail mounting connection to a grounded metal plate.

EMC Immunity	**Power lines and housing**			
Electrostatic discharge	EN 61000-4-2	Contact discharge	8 kV	Criterion A
		Air discharge	8 kV	Criterion A
Electromagnetic RF field	EN 61000-4-3	80 MHz - 6 GHz	10 V/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	Input lines	2 kV	Criterion A
		Output lines	2 kV	Criterion A
Surge voltage on input lines	EN 61000-4-5	(+) → (–)	500 V	Criterion B
		(+) / (–) → housing	1 kV	Criterion B
Surge voltage on output lines	EN 61000-4-5	(+) → (–)	500 V	Criterion B
		(+) / (–) → housing	1 kV	Criterion B
Conducted disturbance	EN 61000-4-6	0.15 - 80 MHz	10 V	Criterion A

EMC Immunity	**Signals lines and housing**			
Electromagnetic RF field	EN 61000-4-3	80 MHz - 6 GHz	10 V/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	With coupling clamp	2 kV	Criterion A
Surge	EN 61000-4-5	Signal lines → housing	1 kV	Criterion A
Conducted disturbance	EN 61000-4-6	0.15 - 80 MHz	10 V	Criterion A

Performance Criterions:
A: The device shows normal operation behaviour within the defined limits.
B: The device operates continuously during and after the test. During the test minor temporary impairments may occur, which will be corrected by the device itself.

EMC Emission			
Conducted emission	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	Input lines	Limits for local DC power networks fulfilled.
	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	Output lines	Limits for local DC power networks fulfilled.
	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	Signal lines	Limits for wired network ports fulfilled.
Radiated emission	EN 55011, EN 55032, CISPR 11, CISPR 32		Class B

Switching Frequencies		
Microcontroller	8 MHz	Fixed frequency
Internal communication bus	400 kHz	Fixed frequency
Internal auxiliary voltage	100 kHz	Fixed frequency

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All parameters are specified at 24 Vdc input voltage, 8x5 A output currents, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

20. Environment

Operational temperature	-25 °C to +70 °C	The operational temperature is the ambient or surrounding temperature and is defined as the air temperature 2 cm below the device.
Storage temperature	-40 °C to +85 °C	for storage and transportation
Output derating	1 A / °C	between +60 °C and +70 °C, see Fig. 20-1
	2.5 A / 1000 m or 5 °C / 1000 m	for altitudes >2000 m, see Fig. 20-2
	The derating is not hardware controlled. The user has to take this into consideration to stay below the derated current limits in order not to overload the unit.	
Humidity	5 to 95% r.h.	according to IEC 60068-2-30
Atmospheric pressure	110-54 kPa	see Fig. 20-2 for details
Altitude	Up to 5000 m	see Fig. 20-2 for details
Overvoltage category	II	according to IEC 61010-1 up to 5000 m
Impulse withstand voltages	1.5 kV	between input and chassis (according to IEC 60664-1 overvoltage category II)
Degree of pollution	2	according to IEC 60664-1, not conductive
Vibration sinusoidal	2-17.8 Hz: ±1.6 mm; 17.8-500 Hz: 2 g 2 hours / axis	according to IEC 60068-2-6
Shock	30 g 6 ms, 20 g 11 ms 3 bumps per direction, 18 bumps in total	according to IEC 60068-2-27
	Shock and vibration is tested in combination with DIN rails according to EN 60715 with a height of 15 mm and a thickness of 1.3 mm.	

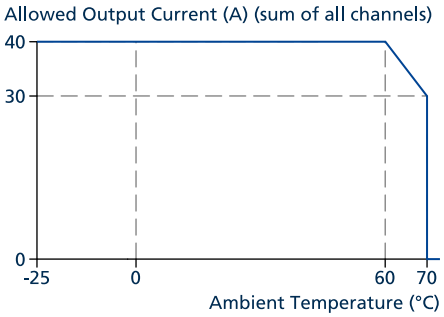


Fig. 20-1: Output current vs. ambient temp.

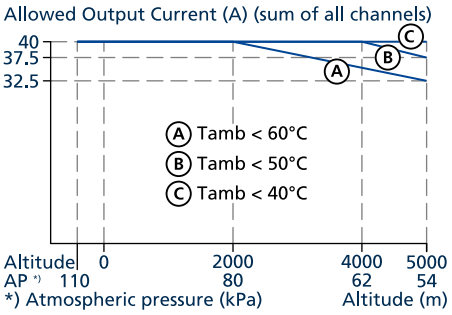


Fig. 20-2: Output current vs. altitude

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All parameters are specified at 24 Vdc input voltage, 8x5 A output currents, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

21. Safety Features and Protection Features

Isolation resistance		>10 MOhm	at delivered condition between power port and signals, measured with 500 Vdc
		>10 MOhm	at delivered condition between power port and housing, measured with 500 Vdc
		>10 MOhm	at delivered condition between signals and housing, measured with 500 Vdc
Isolation voltage	max.	500 Vac	power port to signal port
	max.	500 Vac	power port / signal port to housing
Class of protection		III	a PE (Protective Earth) connection is not required
Degree of protection		IP20	according to EN/IEC 60529
Overtemperature protection		not included	
Internal input fuse		not included	
Internal output fuses		not included	
Input overvoltage protection	max.	31.4 Vdc	no harm or defect of the unit
Reverse input polarity protection		not included	Make sure that the input voltage polarity is correct before applying the input voltage.
Touch current (leakage current)		The leakage current which is produced by the module itself depends on the input voltage ripple and need to be investigated in the final application. For a smooth DC input voltage, the produced leakage current is less than 100 µA.	

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All parameters are specified at 24 Vdc input voltage, 8x5 A output currents, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

22. Approved, Fulfilled or Tested Standards

IEC 61010	Safety	Manufacturer's Declaration IEC 61010-2-201 - Electrical Equipment for Measurement, Control and Laboratory Use - Particular requirements for control equipment
IEC 62368 planned	CB Report	CB Scheme Certificate IEC 62368-1 - Audio / video, information and communication technology equipment - Safety requirements Output safety level: ES1
UL 61010	c UL US LISTED	UL Certificate Listed equipment for category NMTR - UL 61010-2-201 - Electrical equipment for measurement, control and laboratory use - Particular requirements for control equipment Applicable for US and Canada E-File: E198865
UL 2367		UL Certificate Recognized component for category QVRQ - UL 2367 Standard for Solid State Overcurrent Protectors Applicable for US E-File: E342020
VDMA 24364	LABS VDMA 24364-C1-L/W	Paint Wetting Impairment Substances Test (or LABS-Test) Tested for Zone 2 and Test Class C1 according to VDMA 24364-C1-L/W for solvents and water-based paints

23. Regulatory Product Compliance

EU Declaration of Conformity	CE	The CE mark indicates conformance with the European – EMC directive – RoHS directive
REACH Regulation	REACH	Manufacturer's Declaration EU Regulation regarding the Registration, Evaluation, Authorisation and Restriction of Chemicals EU Regulation 1907 / 2006
WEEE Regulation		Manufacturer's Declaration EU Directive on Waste Electrical and Electronic Equipment Registered in Germany as business to business (B2B) products. EU Directive 2012/19/EU WEEE-Reg.-Nr. DE 55837529
RoHS (China RoHS 2)	25	Manufacturer's Statement Administrative Measures for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products 25 years

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All parameters are specified at 24 Vdc input voltage, 8x5 A output currents, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

24. Physical Dimensions And Weight

Width	52 mm
Height	124 mm
Depth	130 mm The DIN rail depth must be added to the unit depth to calculate the total required installation depth.
Weight	370 g
DIN rail	Use 35 mm DIN rails according to EN 60715 or EN 50022 with a height of 7.5 or 15 mm.
Housing material	Body: Aluminium alloy Cover: High-grade polycarbonate material
Installation clearances	see chapter 2.
Penetration protection	small parts like screws, nuts, etc. with a diameter larger than 3.6 mm

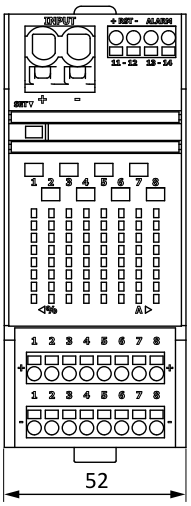


Fig. 24-1: Front view

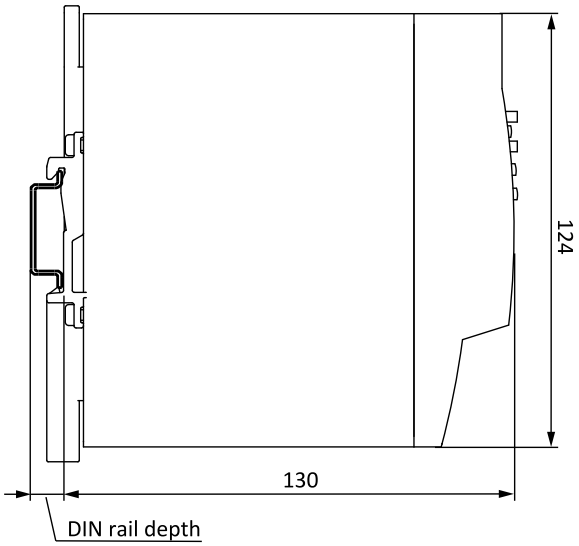


Fig. 24-2: Side view

All dimensions in mm unless otherwise noted.

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25. Accessories

25.1. Power Connection - Power-Bus-Bars

These power-bus-bars are used to connect several PISA-B modules electrically together. The power-bus-bars distribute the 24 V supply voltage of the PISA-B modules.

The length of 102 mm is suitable to connect two PISA-B modules together. The length of 155 mm is suitable to connect three PISA-B modules together. If more than three modules need to be connected to another, appropriate pieces can be cut from the 500 mm long rail.

The supply of the 24 V is then only done by one fuse module, preferably in the middle, because the current is then better distributed in both directions and the permissible current of the power-bus-bars of 32 A is not exceeded.

Fuse modules can be lined up on the DIN rail without spacing. The power-bus-bars can be plugged in from the front of the PISA-B modules and must have a length that all plug contacts of the modules make a contact.

Order number	**BUS-BAR1-L102**	**BUS-BAR1-L155**	**BUS-BAR1-L500**
Order number contains	2 pcs (for + and - pole)	2 pcs (for + and - pole)	1 pc
Colour	grey	grey	grey
Size (l x w x h)	**102** x 3.3 x 11.4 mm	**155** x 3.3 x 11.4 mm	**500** x 3.3 x 11.4 mm
Weight	9 g per pc	13 g per pc	43 g
Suitable for	2x PISA-B modules	3x PISA-B modules	up to 8x PISA-B modules (2 pcs needed)
Max. current	32 A	32 A	32 A

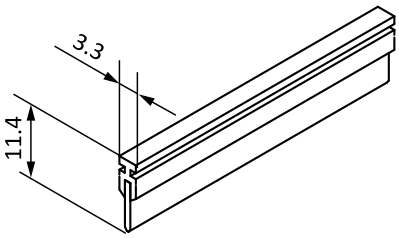


Fig. 25-1: Mechanical dimensions

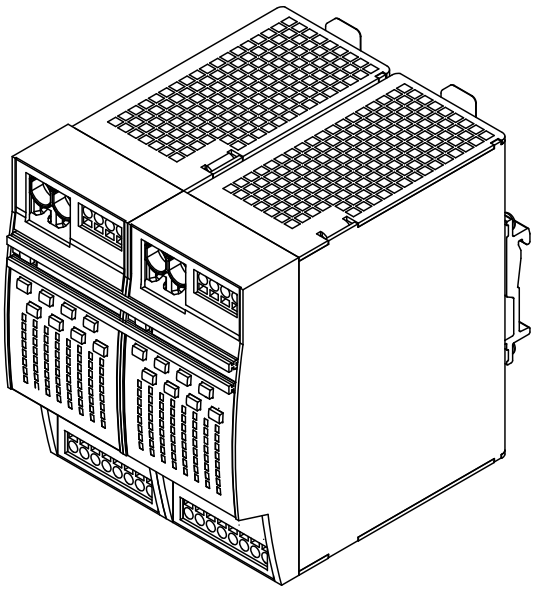


Fig. 25-2: Mounting example

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All parameters are specified at 24 Vdc input voltage, 8x5 A output currents, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.