
Manual



The 24V single-channel circuit breaker system



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1. General notes

1.1 Safety information

Please read the warnings and safety information carefully before using the device. The unit must only be installed by qualified staff with the right expertise. If malfunctions or any damage should occur, turn off the supply voltage immediately and mail the unit to us for inspection. The unit does not contain serviceable parts. If an internal fuse trips, this is most likely due to an internal defect. The information given is only for the purposes of describing the product and is not legally binding.

1.2 Qualified staff

The product associated with this document should only be handled by qualified staff who make use of the relevant documents for the task - especially any safety instructions or warnings. Due to their training and experience, qualified staff can ensure that the product described here is used in compliance with all safety requirements and all applicable regulations, provisions, norms and laws.

1.3 Intended use

This unit is suited for installation into the housing of general electrical devices such as industrial controllers, office devices, communications devices or measuring devices. Do not use this device in the control systems of airplanes, trains or nuclear facilities, where a malfunction could lead to serious injury or fatalities.

1.4 Disclaimer

The contents of this document was compiled with the greatest care to ensure it reflects the described hardware and software. Nevertheless, deviations between the product and document may occur. Such deviations may be due to the product's continuous development.

We are therefore unable to guarantee that the document matches the product in every regard. If this document should contain errors, we reserve the right to make corrections without notice.

2. Product description

2.1 Description of the full system

The EasyB single-channel circuit breaker series are available both with and without current limiting. For comprehensive system monitoring, we also offer variants that connect to an EasyB communication module, which interfaces with a higher-level control system. The modules can be combined as required, depending on the application and number of the intended channels. When we developed the electronic circuit breaker, the aim was to create a particularly flexible system. For this reason, you can run the circuit breaker units individually or stacked to form an electrical as well as mechanical, functional system. The 24V supply enables up to 40A of current to flow through the power contact of your chosen circuit breaker channel. If you require a stronger current, you can add more power contacts. The current is distributed to the individual fail-safe channels via a universal power bus bar that can carry a current of up to 80A. The resulting setup is suitable both for protecting smaller facilities and their smaller load circuits as well as large facilities, where you may need to secure up to 40 circuits.

When setting up the system, the builder can mount the required circuit breaker module on a DIN rail, depending on the application. This automatically connects the signal contacts as well, ensuring a fast and easy installation. The advantage of the 1-channel concept is that you match the system size to the current need, which you can still extend later. If each circuit breaker channel has more than two electric loads to service, there are output distribution modules available with eight further outputs each. You can connect up to three of these output distributors to each of these circuit breaker channels, ensuring a maximum of 24 further output contacts.

If you require the potentials to combine when returning to the power supply, you can do so easily and quickly using the EB-GNDx modules.

The standard 12mm-wide electronic circuit breakers offers different possibilities for communications: A message output can retrieve a collective message from all connected modules, enabling the monitoring of up to 40 stacked circuit breakers. There are further variants available for a comprehensive evaluation, which can interface with the fieldbus level together with an equally daisy-chain-able communication module, offering up both dynamic data like channel status, actual current and input voltage as well as static data like series number and nominal current. This means you can, for example, set the nominal current of a module digitally. Given that one module can cover all nominal current values, less storage space is required. When you switch them on, the channels find their addresses automatically, meaning no more time-consuming manual address allocation.

2.2 Variant overview

The circuit breakers can be divided into three groups, depending on their type of protection and their functionality:

EB-27: Electronic circuit breaker with thermomagnetic characteristic and status signal relay for tripped and turned off channels to adjacent channels. Entry-level variant for electronic protection of 24V loads.

EB-28: Electronic circuit breaker with current-limiting characteristic and status signal relay for tripped and turned off channels to adjacent channels. Entry-level variant for electronic protection of 24V loads, if an active current-limit is required.

EB-08, EB-18, EB-38: Electronic circuit breaker with current-limiting characteristic and comprehensive communication with adjacent modules. Suitable for advanced protection of 24V loads and the ability to actively control detailed power supply parameters and channels.

2.2.1 Equipment

	EB-2724-XX0-0	EB-2824-XX0-0	EB-0824-100-0	EB-1824-XX0-0	EB-3824-100-0	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Thermomagnetic characteristic
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Current limiting 1,25 x tripping current
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Communication interface
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Automatic addressing of channels
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Common reset
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Selective switch-on at $U_{in} > 18V$, load-dependent
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Current detection and display > 90% of tripping current
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Inrush capacity > 40 000 μF
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Inrush capacity > 70 000 μF
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Preset tripping currents
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Tripping currents adjustable via rotary switch or interface
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Tripping currents adjustable via interface
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Second load output
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Undervoltage switch-off as group
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Undervoltage switch-off on individual basis
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	ON/OFF button
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Labeling option
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Coloured status indicator on button
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Common message for tripped/switched off channels
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Lever orange
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Lever red
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lever blue

Figure 2-1: Equipment overview

2.2.2 Item number system

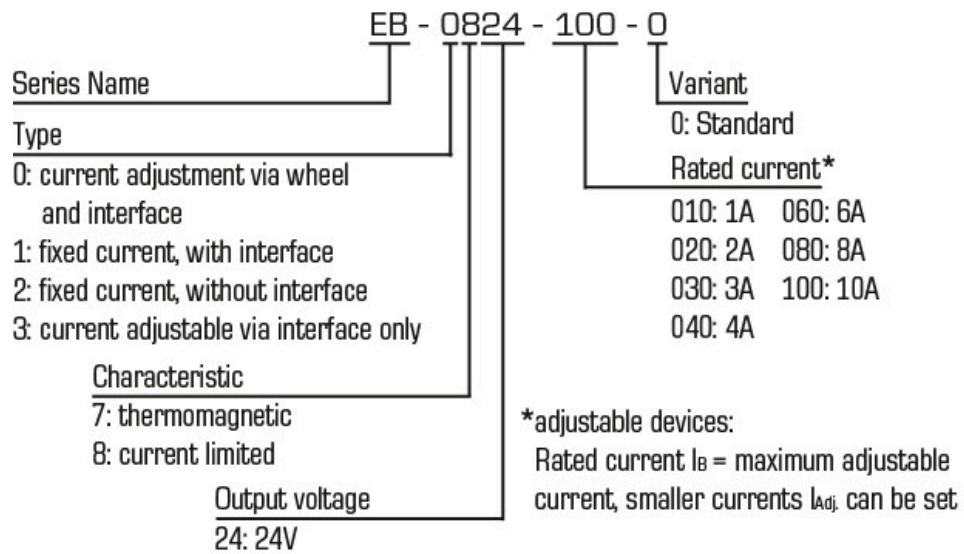


Figure 2-2: Item number system

2.3 Communication module

Communication modules enable communication between the electronic EasyB-circuit breaker system and the higher-level control system (PLC, PC). Different communication modules are available/being developed to ensure compatibility with different and widespread bus systems and communication standards. Some of the modules offer additional contacts such as a group reset input and multiple potential-free group message contacts. To connect the communication module, mount it on the left side of the circuit breaker. The use of multiple communication modules with one circuit breaker connection is not permitted. For more detailed information on each communication module, go to the downloads section of the relevant communication module on the BLOCK homepage www.block.eu.

2.4 Connectors and control elements

2.4.1 EB-27, EB-28

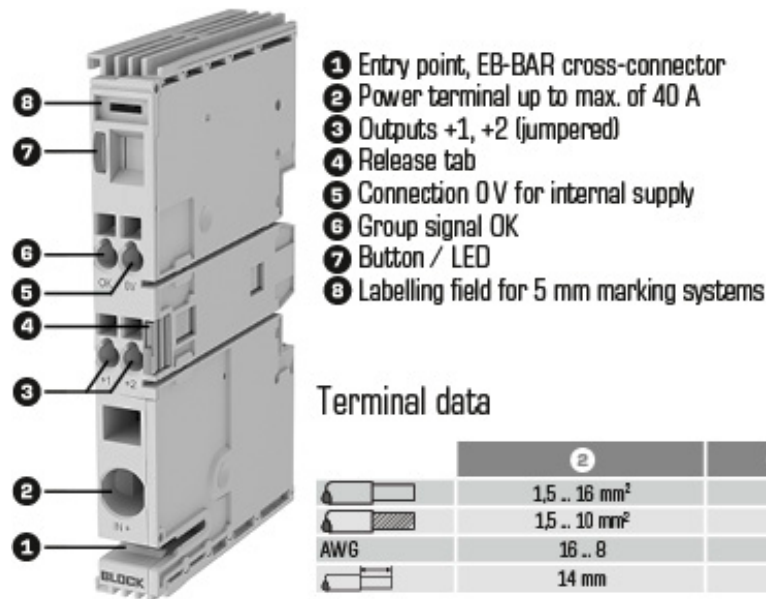


Figure 2-3: Connectors, control elements EB-27, EB-28

2.4.2 EB-08, EB-18, EB-38

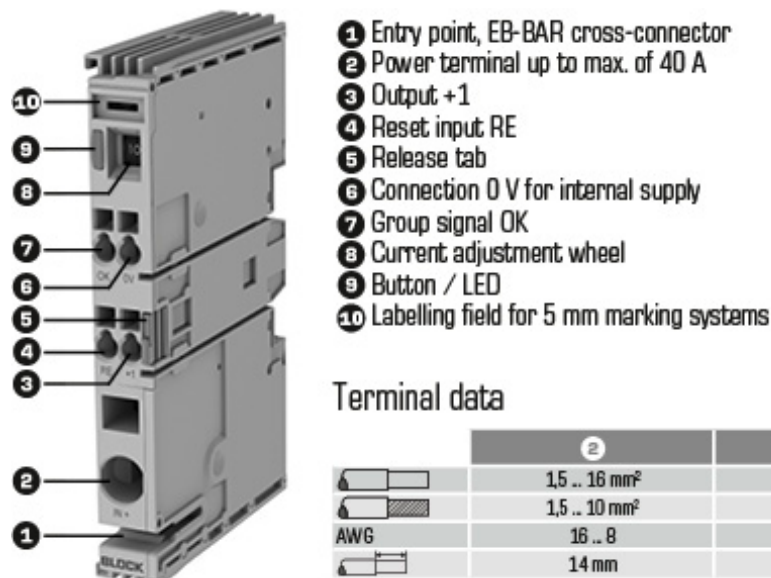


Figure 2-4: Connectors, control elements EB-08, EB-18, EB-38

2.5 Operating conditions, signalling, reactions

2.5.1 Operating conditions, normal operation signalling

	Operational status / Description	Output	LED	Signal output (group signal)	Button is pressed => switch to ...
Z 0	Module initialisation ¹⁾	off	off	0 V	---
Z 1	Output activated, function OK	on	green	24V	Z 3
Z 2	Output current > 90% of rated current ²⁾	on	green flashing	24V	Z 3
Z 2	Output current > 1.25 x rated current (EB 2824)	on	green flashing	24V	Z 3
Z 3	Output is shut down	off	red	0 V	Z 1
Z 4	Output shut down because of an overcurrent, thermal discharge active ⁴⁾	off	red flashing	0 V	---
Z 5	Output shut down because of an overcurrent, thermal discharge is complete	off	orange flashing	0 V	Z 3
Z 6	Device fault (defective fuse detected)	off	red flashing fast	0 V	---

¹⁾ The outputs are activated once the modules have been initialised.

²⁾ The output is shut down automatically in the event of any overcurrent as per the tripping characteristic.

Following shutdown, there is a switch to operational status Z 4.

³⁾ The status of the output is saved when the device is shut down.

⁴⁾ Once a wait time has elapsed (thermal discharge), there is a switch to operational status Z 5. When the device is shut down, the remaining wait time is saved and observed when the device is activated again. This provides a reliable means of preventing overloading of the switching element, even if the device is reactivated immediately.

2.5.2 Start-up behaviour

2.5.2.1 EB-27:

As soon as the input current reaches the turn-on threshold of $17.5V \pm 0.7V$, the channels will turn on after an initialization period of around 27ms. Each channel acts on its own and switches on independently of the other connected channels.

2.5.2.2 EB-28:

See 2.5.2.1. The module initialization period is around 52ms.

2.5.2.3 EB-08, EB-18, EB-38:

When the circuit breakers are stacked, it creates a communicative chain. When the supply voltage is applied and reaches a turn-on threshold of $17.7V \pm 0.7V$ with a slew rate of at least $8V/s$, channel 1 (far left) turns on after an initialization period of 52ms. Channel 2 is located to the right of channel 1 and turns on after 85ms, when the current flowing in channel 1 is smaller than the nominal current. If the current in channel 1 should exceed the nominal value, the turning on of channel 2 is delayed until the current in channel 1 is smaller than the nominal value. Only then is channel 2 turned on with a delay of 85ms. If the current in channel 1 continues to be lower than the nominal current, channel 2 is turned on after a maximum waiting period of 5 seconds.

This process is repeated with any subsequent channels. Only then is the signal contact "OK" set.

2.6 Automatic addressing

The circuit breakers with extended communication characteristics (EB-08, EB-18, EB-38) are automatically addressed when the power supply is turned on. A visual process is used here, where the installed modules are allocated a number in a sequence, one after the other. The module furthest to the left is allocated number 1. The time sequence is described in section 2.5.2.3.

For a reliable address allocation process, it is necessary to ensure that all stacked circuit breakers are supplied with current simultaneously.

2.7 Undervoltage switch-off

2.7.1 EB-27, EB-28

If the operating input current falls below the turn-off threshold of $16.7V \pm 0.7V$, the circuit breaker channel turns off and blocks the current. Each channel acts independently and due to tolerances they each have a slightly different turn-off voltage.

When turning on again, if the turn-on threshold is exceeded (section 2.5.2), the last status is produced again.

2.7.2 EB-08, EB-18, EB-38

If the input voltage of the communicating circuit breakers sinks below the turn-off threshold of $17.45V \pm 0.7V$, the channels with a current exceeding 100% of the nominal current are initially turned off with a memorized protection characteristic. The turn-off process is carried out one channel at a time. The intermediate delay time for this is 16ms.

If the input voltage continues to sink, the remaining channels are turned off.

2.8 Accessories

2.8.1 Required accessories

2.8.1.1 EB-BARx power bus bar

The EB-BARx power bus bar enables the supply voltage to be passed on through all modules that are stacked. Its current carrying capacity is 80A. The standard option power bus bar is 492mm long and can connect 41 modules. We also offer shorter power bus bars, if required.



2.8.1.2 EB-COV left side cover

The EB-COV left side cover acts both as a cover and protector against unintended connection with the contacts exiting the modules on the left.



2.8.2 Optional accessories

2.8.2.1 Communications module

A range of communications modules are available/being developed to connect the communications-ready EasyB circuit breaker channels to higher-level control systems. The communications modules are stacked on the left via the circuit breaker connector. For more detailed information on the individual communications modules, go the products page on www.block.eu.

2.8.2.2 EB-PMM output distribution module

If you require more output contacts than are available on the circuit breaker channel so as to distribute output current, you can connect up to three EB-PMM output distribution modules on the right of the circuit breaker channel. This offers up to 24 additional output contacts. The connection between the output distribution module and the circuit breaker channel happens automatically.



2.8.2.3 EB-GNDx Ground distribution module

The EB-GND4 and EB-GND8 modules act as a 0V collective terminal with four or eight contacts. The 2.5mm² contacts can carry up to 10A. This amounts to a total maximum current of 40A. The current is distributed via EB-BAR power bus bar and can then be led back to the supply power via the 16mm² contact of the EB-GND4.



2.8.2.4 Labelling options

The EasyB modules are labelled with standard 5 or 6mm labels.

2.9 Functional circuit diagram

2.9.1 EB-27, EB-28

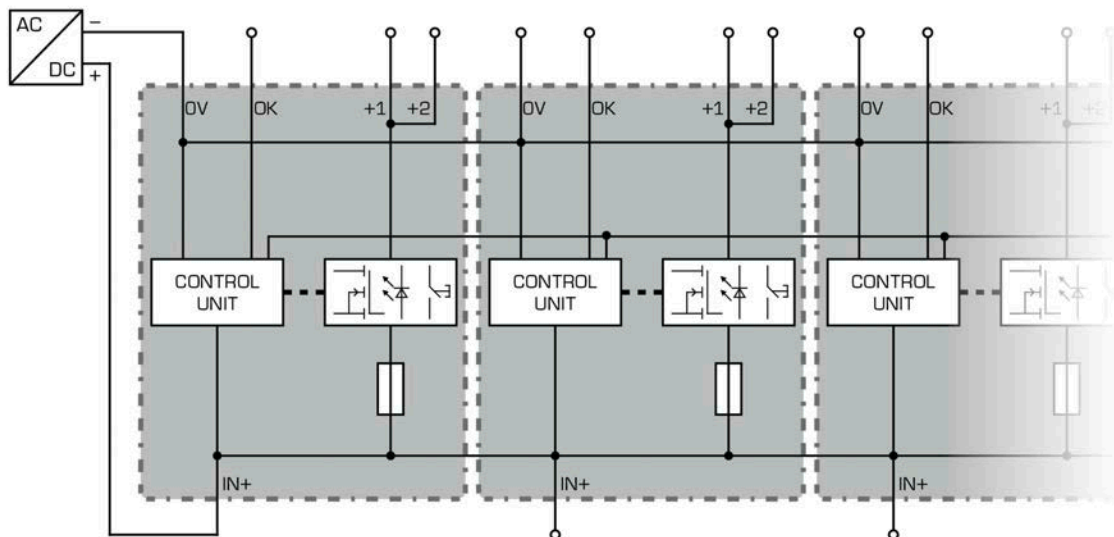


Figure 2-5: Functional circuit diagram EB-27, EB-28

2.9.2 EB-08, EB-18, EB-38

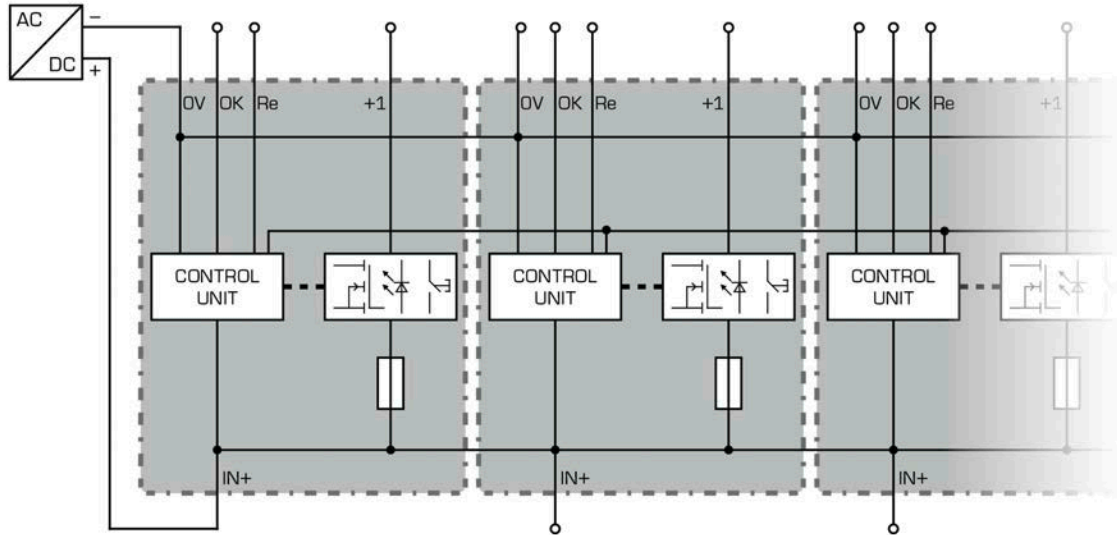


Figure 2-6: Functional circuit diagram EB-08, EB-18, EB-38

3. Installation

3.1 Installation schematic diagram

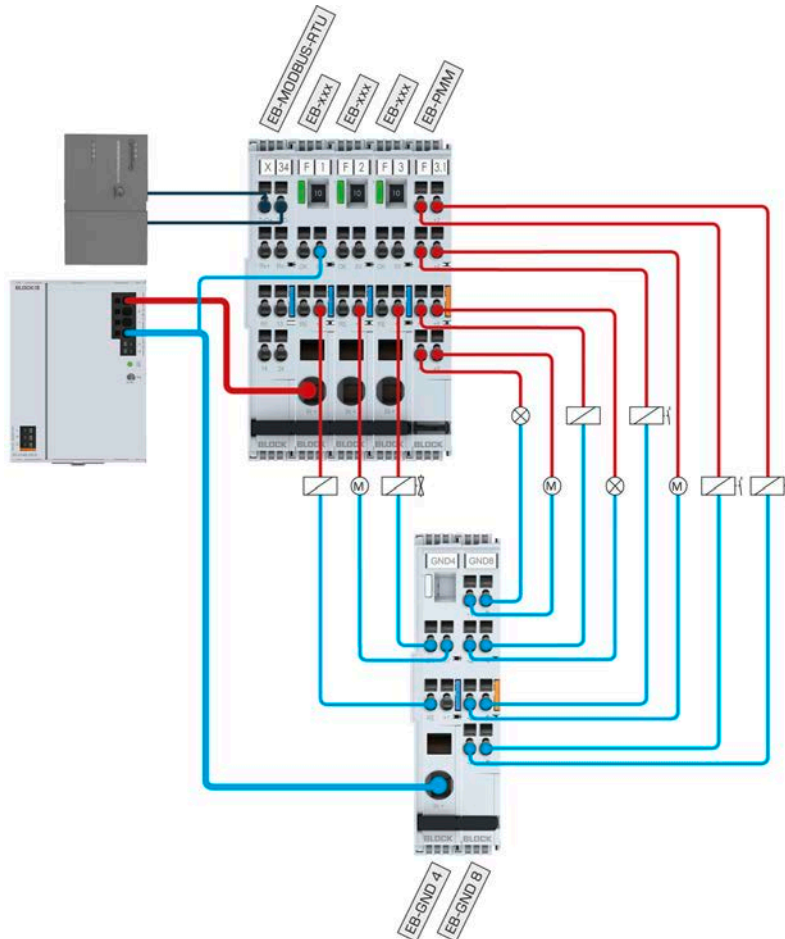
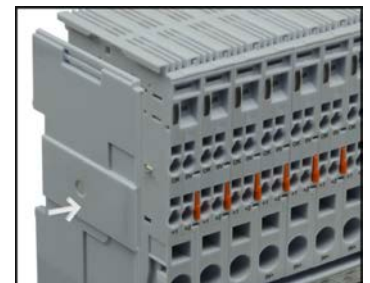


Figure 3-1: EasyB schematic diagram

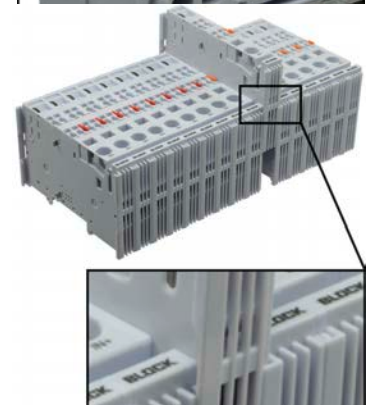
3.2 Assembly

The unit should be mounted to the TH 35-15/7.5 standard mounting rail (EN 60715). Ensure the unit is fitted such that the ventilation slots sit above and below. Keep a minimum distance of 30mm between above and below. Additional modules are slotted on from the side. The secure positioning and connection is ensured by a tongue and groove system. The left module on the left housing side requires the EB-COV covering.



3.3 Connection

The cable dimensions should be selected according to the maximum input and output current. The permitted cable sizes can be viewed in figure 2-3 and figure 2-4. Connect the +24V supply voltage to the feed-in terminal. The +24V



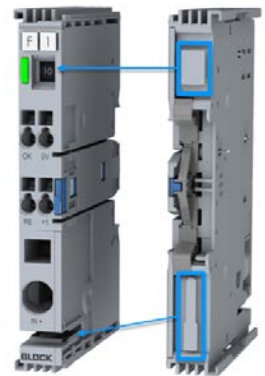
supply voltage is bridged over all modules via the EB-BAR power bus bar. The additional signal connections are automatically bridged through the stacking. Use multiple feed-in terminals for currents of >40 A. Select and configure the feed-in terminals such that the current in the power bus bar does not exceed 80A.

3.4 Using different model variants

It is possible to connect circuit breaker channels with different model variants. Ensure that the communication capacity of the circuit breaker (EB-08, EB-18, EB-38) is deactivated when connecting to circuit breakers of model variants EB-27 and EB-28. Only the group status signal function should be active.

3.5 Breakable housing parts

On the underside of the housing there are two plastic components, which even light tugging can break off. The lower part is designed to close the housing aperture of the cross-connector on the module to the right. The upper breakable part is designed to close off the current selector aperture of the EB-08.



3.6 Demounting

Remove the EB-BAR power bus bar and all connected cables from the EasyB module you wish to dismantle. Use the release tab to disconnect the module from the connection.

4. Technical data

4.1 Input

	EB-2724	EB-2824	EB-1824	EB-0824 EB-3824
Rated input voltage	24V			
Input voltage range	18 - 30Vdc			
Maximum residual ripple of the input current	3%			
Turn-on threshold	17.5V ± 0.7V		17.7V ± 0.7V	
Turn-on period	27ms	52ms	min. 52ms; see 2.5.2.3	
Turn-off threshold	16.7 ± 0.7V		17.45 ± 0.7V	
Maximum continuous current per contact (0)	10A			
Maximum continuous current per contact (In +)	40A			
Overvoltage protection	33V			
Power dissipation idle @ 24V	0.3W	0.5W	1.17W	

4.2 Output

	EB-2724	EB-2824	EB-1824	EB-0824 EB-3824
Rated output voltage	24Vdc			
Rated output current	see section 2.2.2			
Current limiting	-	1.25 × I _{Nominal current}		
Maximum voltage drop between input and output	< 140mV (10A)			
Module initialization period	27ms		52ms	
Turn-on delay of channels	-		Load-dependent, min. 85ms, max. 5s	
Waiting period after turning off the output (thermal stress relief)	500ms (short circuit) - 5s (overload)			
Maximum power dissipation	< 1.2W	< 1.8W	< 2.5W	
Maximum load capacity per output (@24V)	> 40mF		> 70mF	
Integrated output fuses	15AT			
Feedback stability	max. 35V			
Parallel connection of outputs	Not permitted			
Series connection of outputs	Not permitted			

4.3 Tripping characteristics

4.3.1 EB-27

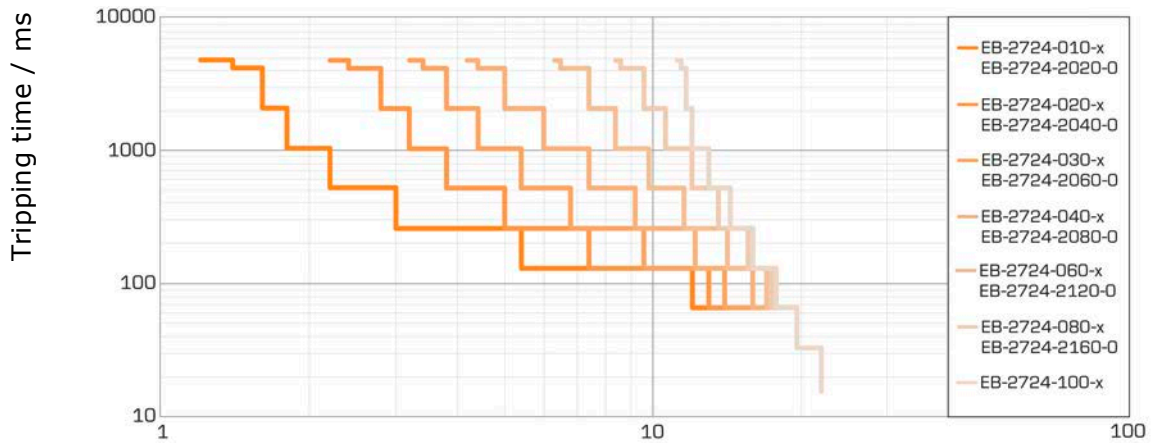


Figure 4-1: Tripping characteristics EB-27

Output current / A

EB-28

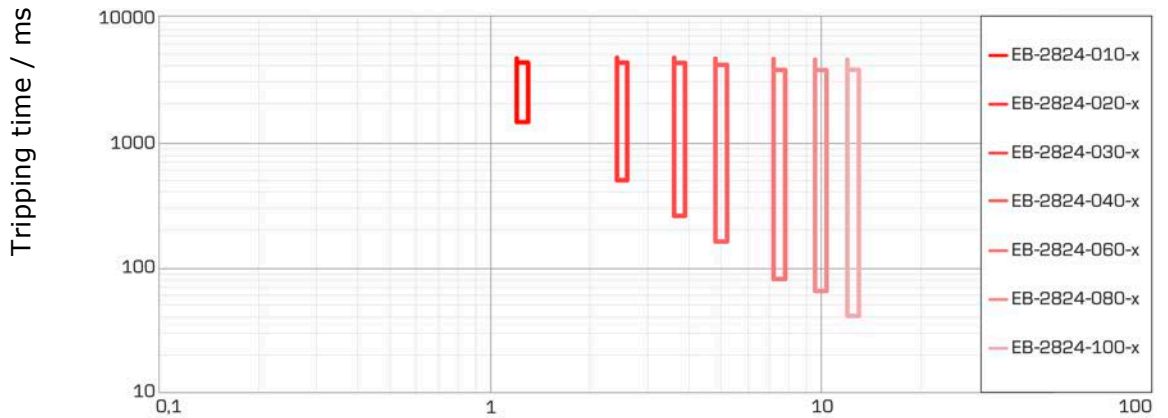


Figure 4-2: Tripping characteristics EB-28

Output current / A

4.3.2 EB-08, EB-18, EB-38

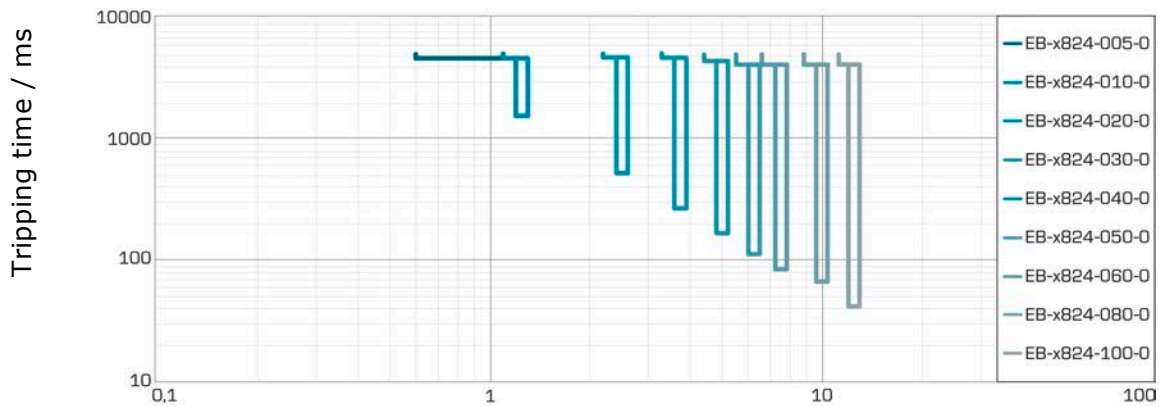


Figure 4-3: Tripping characteristics EB-08, EB-18, EB-38

Output current / A

4.4 MTBF

	EB-2724	EB-2824	EB-1824	EB-0824 EB-3824
Mean Time Between Failures	> 500.000 h at 40°C, nominal load			

4.5 EMC, safety

	EB-2724	EB-2824	EB-1824	EB-0824 EB-3824
Norm for safety	EN 60950-1, EN 50178, EN/IEC 60204-1			
CE	In accordance with 2014/30/EU (EMC directive)			
Safety class	III			
Degree of protection	IP 20			
EMC interference immunity	EN 61204-3			
EMC emitted interference	EN 61204-3			

4.6 Environmental conditions

	EB-2724	EB-2824	EB-1824	EB-0824 EB-3824
Ambient temperature up to 6A nominal current	-25°C ... +70°C			
Ambient temperature 8A nominal current	-25°C ... +60°C			
Ambient temperature 10A nominal current	-25°C ... +55°C			
Storage temperature	-25°C ... +85°C			
Degree of pollution	II			
Humidity	5 ... 96%, no condensation			
Climatic category (EN 60721)	3K3			

4.7 Dimensions, weights

	EB-2724	EB-2824	EB-1824	EB-0824 EB-3824
Dimensions	see figure 4-4			
Weight	39g	40g	42g	

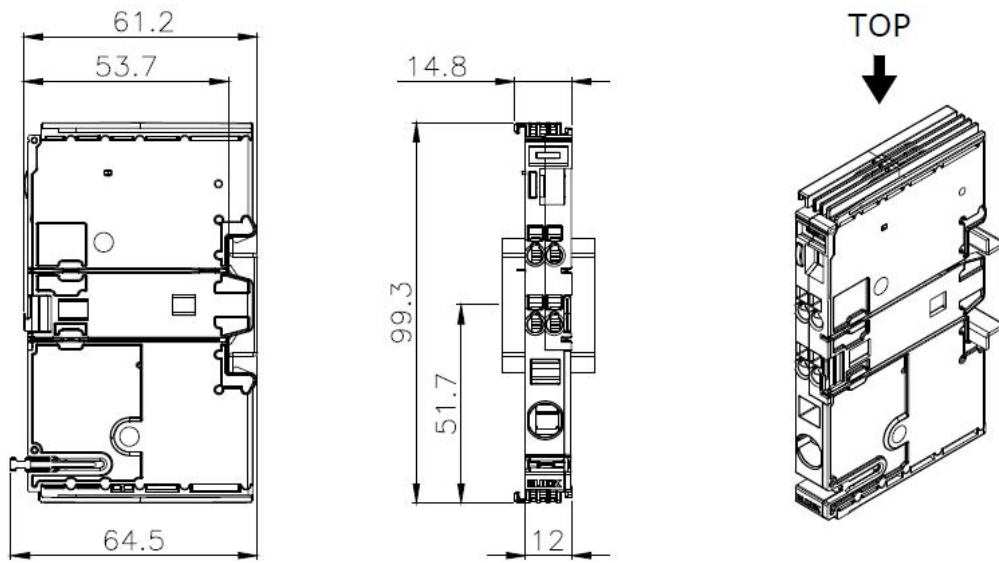


Figure 4-4: EasyB dimensions