

Installation / EMC guide

X20 system - X67 system Power Panels - Power supplies

Version: **1.43 (December 2022)**
Order no.: **MAEMV-ENG**

User's manual

Translation of the original manual

Publishing information

B&R Industrial Automation GmbH

B&R Strasse 1

5142 Eggelsberg

Austria

Telephone: +43 7748 6586-0

Fax: +43 7748 6586-26

office@br-automation.com

Disclaimer

All information in this document is current as of its creation. The contents of this document are subject to change without notice. B&R Industrial Automation GmbH assumes unlimited liability in particular for technical or editorial errors in this document only (i) in the event of gross negligence or (ii) for culpably inflicted personal injury. Beyond that, liability is excluded to the extent permitted by law. Liability in cases in which the law stipulates mandatory unlimited liability (such as product liability) remains unaffected. Liability for indirect damage, consequential damage, business interruption, loss of profit or loss of information and data is excluded, in particular for damage that is directly or indirectly attributable to the delivery, performance and use of this material.

B&R Industrial Automation GmbH notes that the software and hardware designations and brand names of the respective companies used in this document are subject to general trademark, brand or patent protection.

Hardware and software from third-party suppliers referenced in this document is subject exclusively to the respective terms of use of these third-party providers. B&R Industrial Automation GmbH assumes no liability in this regard. Any recommendations made by B&R Industrial Automation GmbH are not contractual content, but merely non-binding information for which no liability is assumed. When using hardware and software from third-party suppliers, the relevant user documentation of these third-party suppliers must additionally be consulted and, in particular, the safety guidelines and technical specifications contained therein must be observed. The compatibility of the products from B&R Industrial Automation GmbH described in this document with hardware and software from third-party suppliers is not contractual content unless this has been separately agreed in individual cases; in this respect, warranty for such compatibility is excluded in any case, and it is the sole responsibility of the customer to verify this compatibility in advance.

1 Foreword	5
2 Basic information	6
2.1 Terms	6
2.2 Interference	6
2.3 Types of couplings	7
2.4 Wiring basics	7
2.5 Application-specific measures	8
3 X20 system	9
3.1 System characteristics	9
3.2 Coated modules	11
3.2.1 X20c standard modules	11
3.2.2 X20c safety modules	11
3.3 Installation	12
3.3.1 Horizontal installation	12
3.3.2 Vertical installation	13
3.3.3 Installation with increased vibration requirements (4 g)	14
3.4 The supply concept	15
3.5 Lightning and surge protection	16
3.5.1 UL/CSA	16
3.6 Wiring	16
3.6.1 Shielding and grounding	17
3.6.2 Shielded lines	18
3.6.2.1 B&R cable recommendations	18
3.6.2.2 Shield connection	19
4 X67 system	26
4.1 System characteristics	26
4.2 Installation	27
4.2.1 Installation on a profile	27
4.2.2 Top-hat rail installation	28
4.2.3 Installation on a mounting plate or directly on the machine	29
4.3 Wiring	30
4.3.1 Basic information	30
4.3.2 Lightning and surge protection	30
4.3.2.1 UL/CSA	30
4.3.3 Shielding and grounding	31
4.3.4 Accessories	32
5 X2X Link settings	33
6 Power Panels	34
6.1 System characteristics	34
6.2 Installation	34
6.3 Wiring	37
6.4 Line filter	39
6.4.1 5AC804.MFLT-00	39
6.4.1.1 General information	39
6.4.1.2 Order data	39
7 Power supplies	40
7.1 System characteristics	40
7.2 Power supplies	41
7.2.1 Single-phase power supplies	41
7.2.2 Three-phase power supplies	41

7.3 Buffer module.....	42
7.3.1 Order data.....	42
7.4 Installation and wiring.....	43
8 General requirements.....	44
8.1 Introduction.....	44
8.2 CE (EU).....	44
8.2.1 Housing requirements.....	44
8.2.2 Environmental characteristics.....	44
8.3 ATEX / HazLoc.....	46
8.3.1 Standards, criteria.....	46
8.4 Condensation, corrosive gas - X20c coated modules.....	46
8.5 Maritime / DNV GL.....	47
8.5.1 Standards, criteria.....	47
8.6 Underwriters Laboratories (UL).....	47
8.7 KC, EAC, RCM.....	47

1 Foreword

This document should serve as a compact guide to the proper installation of the products and the resulting trouble-free operation of the products at their intended location.

For details about the respective modules, see the corresponding user's manuals. These are available in several languages on the B&R website (www.br-automation.com).

2 Basic information

2.1 Terms

Electromagnetic compatibility (EMC)

The ability of equipment or a system to function satisfactorily in its electromagnetic environment without introducing impermissible electromagnetic interference to other equipment in the same environment.

2.2 Interference

Automation systems are generally affected by conducted and radiated electromagnetic interference in their operating locations.

These are then adjusted in test standards and tested for resistance to these disturbances during conformity testing of the products.

Conducted interference via

- Supply lines
- Process wiring
- Communication lines
- Grounding

Radiated interference via

- Openings in metal housings
- Plastic housings (no shielding effect)

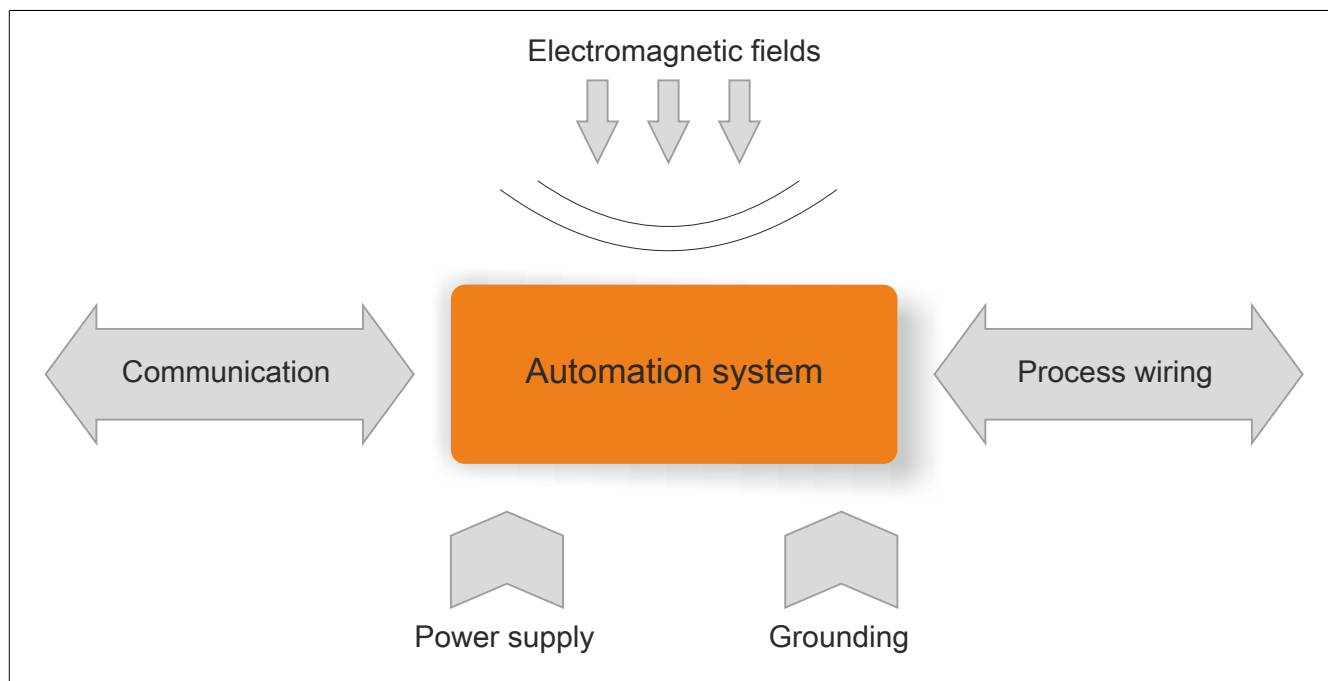


Figure 1: Interference

2.3 Types of couplings

Direct coupling

- Clocked modules
- Startup of a motor
- Differences in potential

Capacitive coupling (electric field)

- Wires running in parallel
- Static discharge

Inductive coupling (magnetic field)

- Mains wires running in parallel, connected wires
- Transformers, motors, etc.

Radiative coupling (electromagnetic field)

- Radio transmitters (mobile telephony, citizens band radio)
- Radio links (welding equipment)

2.4 Wiring basics

Wiring arrangement

- Spatial separation of supply lines and signal lines
- Always cross wires from individual categories at right angles
- Ground unused wires on both sides
- Lay wires along the reference surface as much as possible
- Avoid ground loops as much as possible
- Lay outgoing and return lines together along the entire length
- Lay ground and power supply lines together
- Lay cables in a metallic tray as close to the side walls as possible

Shielded lines

- The cable shield should extend as close as possible to the end of the cable.
- The cable shield should be grounded over as wide an area as possible.
- The cable shield should always be grounded on both sides.
- The cable shield should be grounded when routing into the control cabinet and again directly at the connector.

Grounding

- Good conducting connection of all conductive machine components over a wide area
- Connection to ground potential dimensioned with sufficient strength ($\geq 16 \text{ mm}^2$ to the control cabinet, $\geq 4 \text{ mm}^2$ to the products)
- Centralized star-shaped grounding point (no loops)

2.5 Application-specific measures

When installing X20/X67 system modules, there are basically no additional measures necessary with regard to leakage currents and filters.

They may be required for some specific applications, however:

Switching inductive loads (coils, contactors, relays)

- A load-dependent protective circuit is required for the outputs of various modules. Inductive loads with DC voltage can create voltage reflections that can lead to overshoot. This can cause damage to or shorten the service life of output modules.
- Interference suppression of coils by contactors

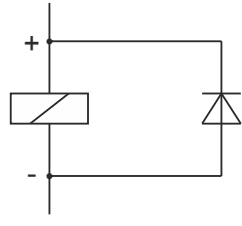
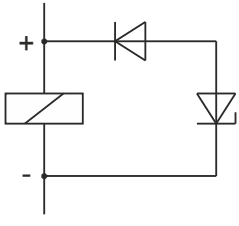
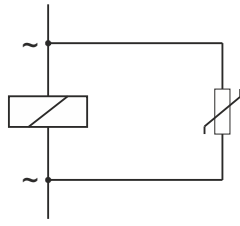
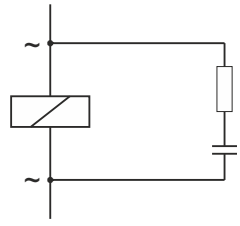
Inductive DC loads		Inductive AC loads	
With diode	With Z-diode	With varistor	With RC element
			

Table 1: Application-specific measures

Notice!

To use UL-certified modules in North or South America, a varistor from UL category "VZCA (surge-protective devices) / Type 2" corresponding to the inductive load is required.

Lighting with fluorescent lamps

- Additionally suppress interference in control cabinet lighting with fluorescent lamps

3 X20 system

3.1 System characteristics

X20 modules consist of three submodules to provide maximum ease of use throughout their entire lifecycle.

This division into bus module, electronics module and terminal block has several advantages.

- **Preconfigured for different machine types**

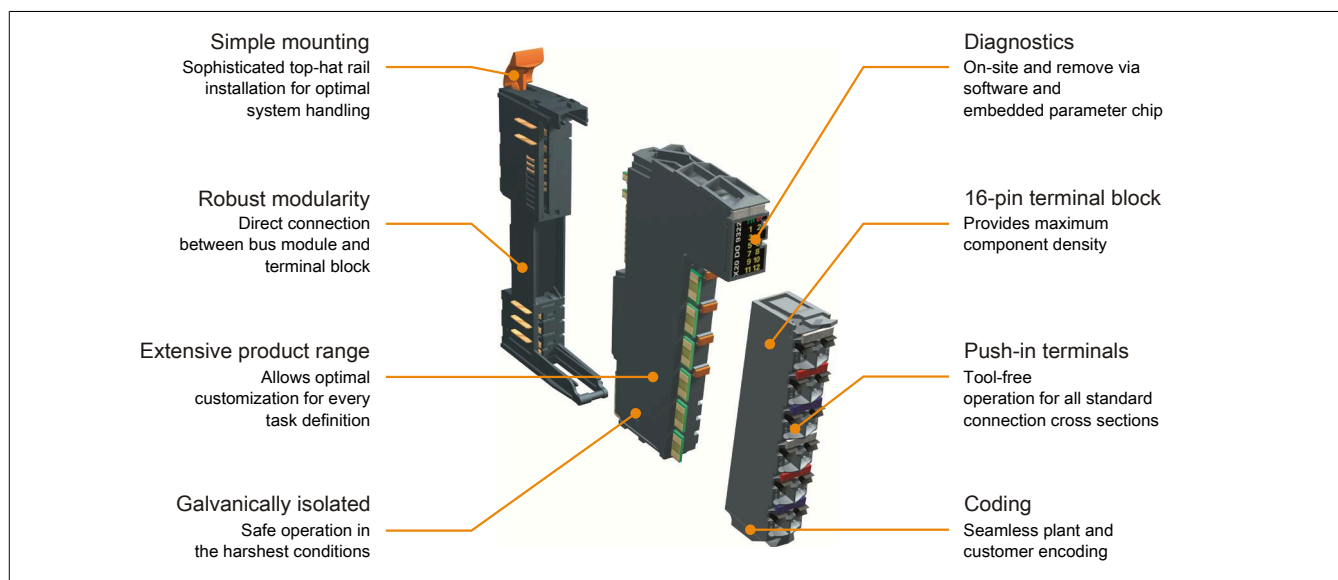
The X20 system bus modules are the basic platform for many machine variations. The electronics modules used determine the machine's degree of expansion. The software automatically detects this degree of expansion and makes the necessary functions available. Handling a range of different machine variants could not be easier.

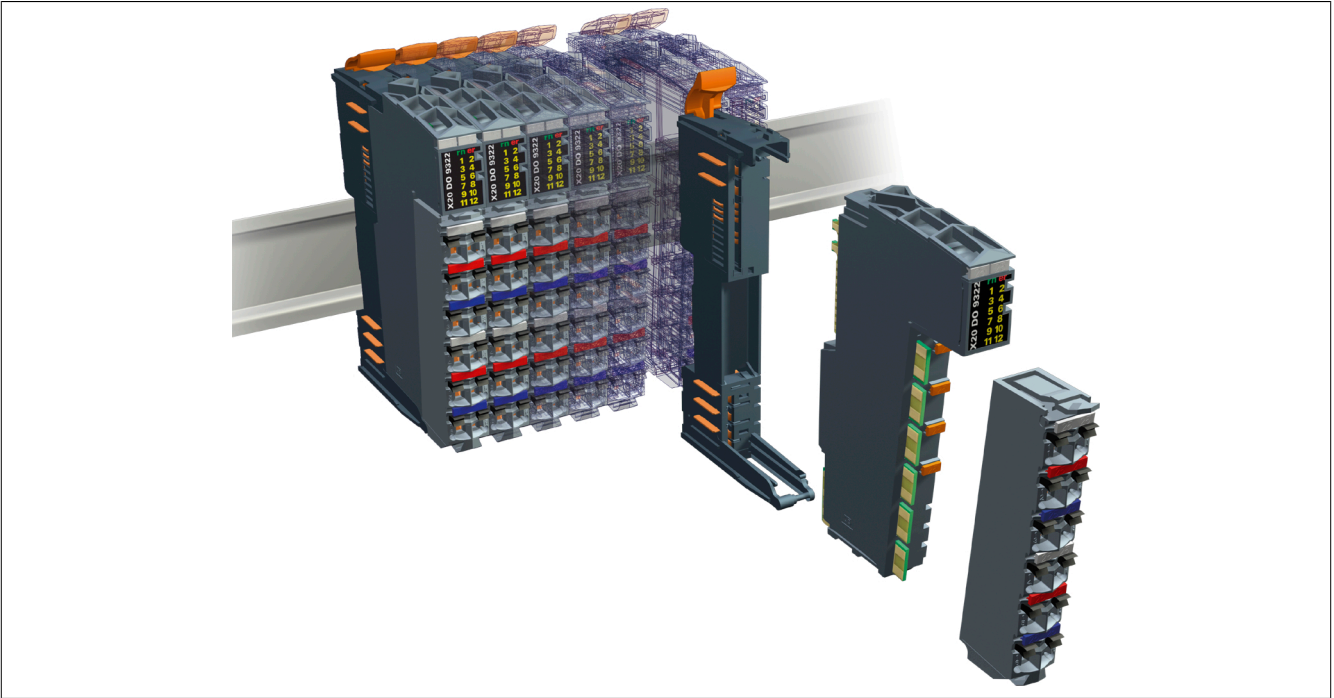
- **Industrial control cabinet construction**

X20 system terminal blocks are separate from the electronics module and make it possible to pre-wire the entire control cabinet. This is especially ideal for series-produced machines.

- **Effortless maintenance**

X20 modules can be easily exchanged to simplify troubleshooting. The electronics modules can be replaced during operation (hot plugging). The wiring remains exactly the same thanks to the separate terminal blocks. This method of quickly exchanging automation components reduces machine and system downtime.





3.2 Coated modules

Coated modules are X20 modules with a protective coating for the electronics component. The modules' electronics are fully compatible with the corresponding X20 modules. From an installation point of view, these modules are treated just the same as standard X20 modules.

3.2.1 X20c standard modules

Differences compared to uncoated X20 modules:

- Suitable for operation in adverse atmospheric conditions
- Suitable for operation in 100% humidity, condensing
- Coated modules have a different module ID than the corresponding uncoated modules.

The protective coating has been certified according to the following standards:

- Simulation of transport and storage: EN 60068-2-14, Test Nb
- Condensation: BMW GL 95011-4
- Corrosive gas: EN 60068-2-60, Method 4, exposure 21 days
- Condensation: BMW GS 95011-4



3.2.2 X20c safety modules

Differences compared to uncoated X20 safety modules:

- Extended temperature range [see "Environmental characteristics" on page 44](#)
- Suitable for operation in 100% humidity, condensing
- Coated modules have a different module ID than the corresponding uncoated modules.

The coating has been certified according to the following standards:

- Condensation: BMW GS 95011-4, 2x 1 cycle
- Corrosive gas: EN 60068-2-60, Method 4, exposure 21 days

Contrary to the specifications for X20 system modules without safety certification and despite the tests performed, X20 safety modules are **NOT suited for applications with corrosive gases (EN 60068-2-60)!**



3.3 Installation

A top-hat rail conforming to standard EN 60715 (TH35-7.5) is required for mounting.

The following points must be taken into account:

- The top-hat rail must exhibit a clean and good conductive surface.
- The top-hat rail must be screwed to the conductive back wall of the control cabinet every 10 cm.
- There must be a good conductive connection to ground for the control cabinet back ($\geq 16 \text{ mm}^2$).

The complete system including all individual modules is hung in the desired location on the top-hat rail with the unlocking mechanisms open and locked in place by closing the unlocking mechanisms.

For additional details, see section "Mechanical handling" of the X20 system user's manual.

Notice!

The module must be installed in a final safety enclosure that meets UL/CSA/IEC 61010-1 and UL/CSA/IEC 61010-2-201 requirements for a fire enclosure.

In all cases, applicable national and international standards, regulations and safety measures must be taken into account and observed.

3.3.1 Horizontal installation

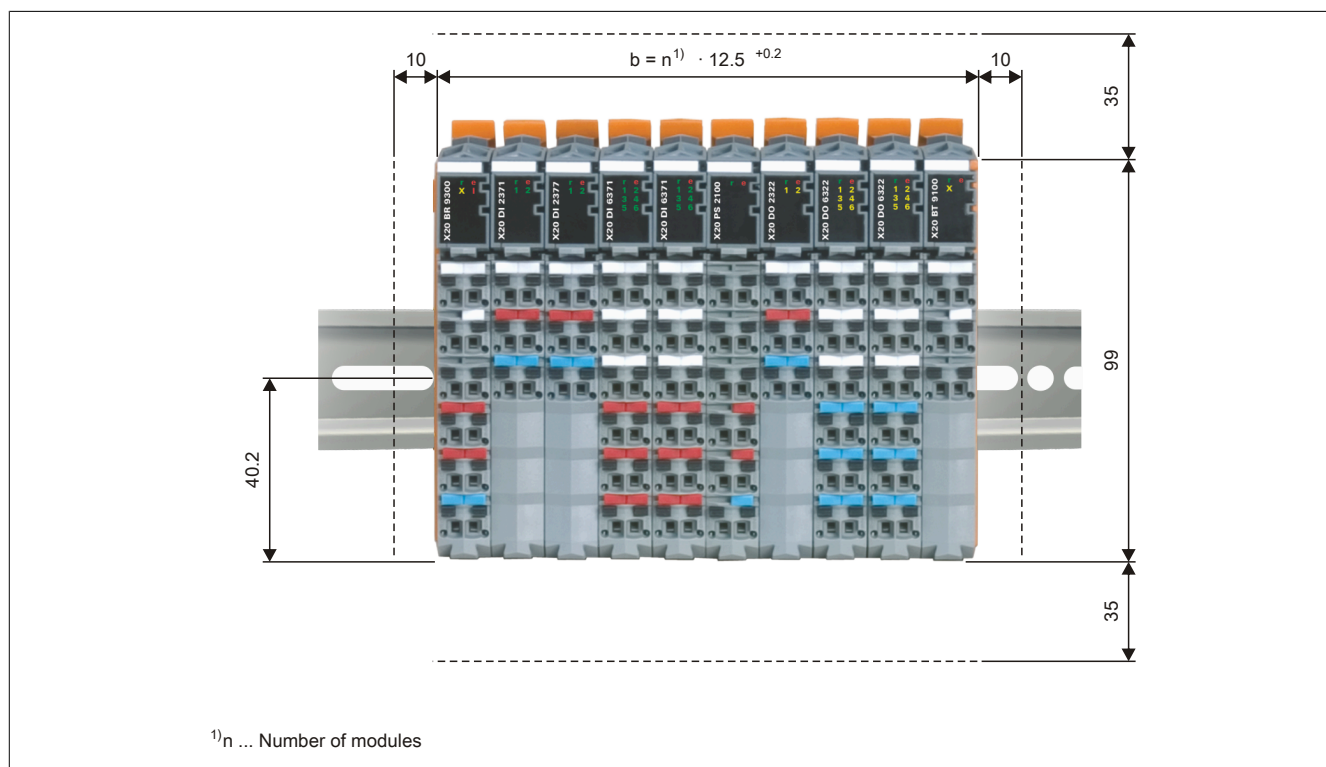


Figure 2: X20 system - Horizontal installation

For optimal cooling and air circulation, there must be at least 35 mm free space above the modules. To the left and right of the X20 system, there must be at least 10 mm of free space. Underneath the modules, 35 mm space must be left free for I/O and power supply cabling.

3.3.2 Vertical installation

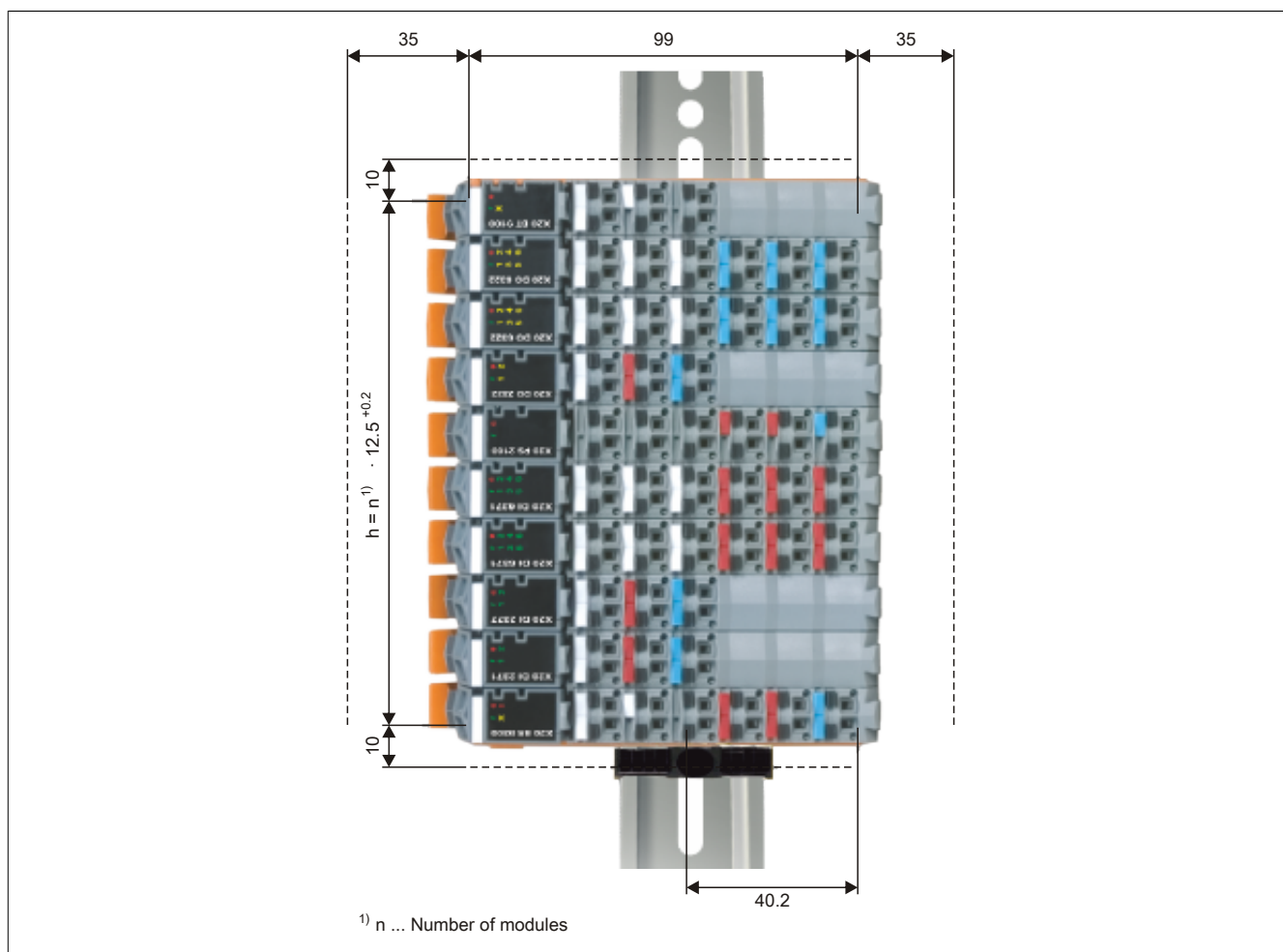


Figure 3: X20 system - Vertical installation

For optimal cooling and air circulation, there must be at least 35 mm free space above the modules. To the left and right of the X20 system, there must be at least 10 mm of free space. Underneath the modules, 35 mm space must be left free for I/O and power supply cabling.

Notice!

The controller must be secured against slipping.

An end bracket or ground terminal can be used for securing.

To fixate mechanically, B&R offers and recommends the use of accessory end clamps:

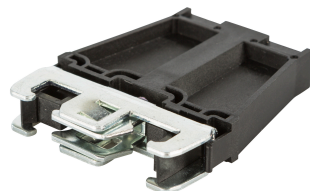


Figure 4: X20ACORF1 set - End clamp for TH35 top-hat rail

3.3.3 Installation with increased vibration requirements (4 g)

The following additional measures are necessary to fulfill increased vibration requirements regardless of whether X20 modules are installed horizontally or vertically:

1. Apply foam tape along the entire length of the module configuration under the top edge.
2. Use special end clamps to the left and right to provide additional fixation (supplement foam tape as shown in the image).
3. For controllers with replaceable battery, foam tape must be applied to the inside of the battery cover to additionally secure the battery in place.
4. If slots are free, use dummy housings to ensure that the controller is held effectively in place.
5. Proper strain relief on all wires

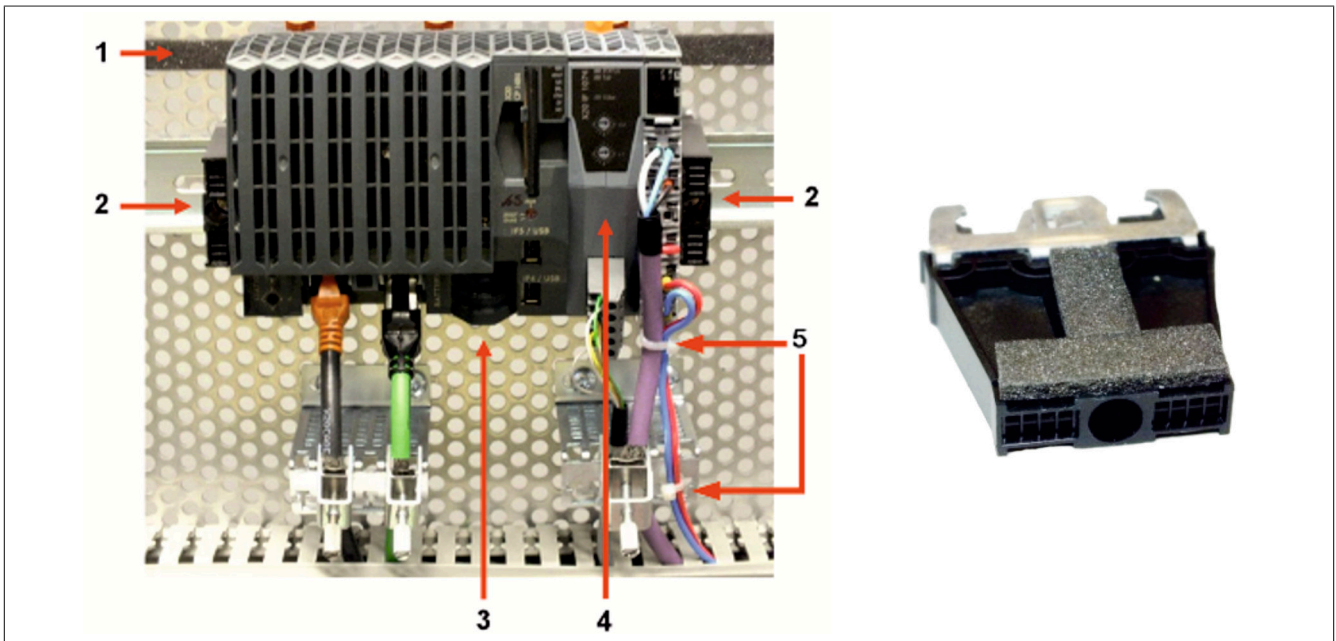


Figure 5: X20 system - Installation with increased vibration requirements (4 g) and end clamp

Notice!

The attachable end cover plates for some X20 modules should be removed for "installation with increased vibration requirements (4 g)"!



Figure 6: X20 system - Removing the end cover plates

Required accessories:

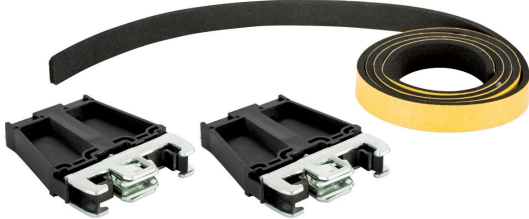


Description	Figure
1x Set X20AC0RF1 comprising 2x end clamps for mounting rail TH35 (add foam tape) and 1x foam tape 12 x 3 x 1000 mm (height x width x length)	
Apply foam tape (L = 15 mm) to the battery cover on controllers.	
Use X20IF0000 dummy module in empty slots	

Table 2: Required accessories

3.4 The supply concept**Danger!**

In order to ensure a defined power supply, a SELV or PELV power supply unit per IEC 61010-2-201 must be used for the bus, SafeIO and SafeLOGIC power supply. This also applies to all digital signal sources that are connected to the modules.

If the power supply is grounded (PELV system), then only a GND connection is permitted for grounding. Grounding types that have ground connected to +24 VDC are not permitted.

Notice!

Primary circuits, from which the connected secondary voltages are derived, must be limited to over-voltage category II and may have a maximum system voltage of 300 V.

All connected circuits must meet the requirements for SELV/PELV circuits (Class III) according to UL/CSA/IEC 61010-1, 61010-2-201.

3.5 Lightning and surge protection

Information:

Provide lines at risk of lightning strike with suitable overvoltage protection.

The circuits must be limited to overvoltage category II per IEC 60664-1 or according to other information in the module data sheet.

For the design of your electrical system, see ABB documentation "[Global guide to surge protection](#)".

3.5.1 UL/CSA

Electrical installations must comply with the relevant requirements of the National Electrical Code® (ANSI/NFPA-70 (NEC®) and, where applicable, Canadian Electrical Code (CEC), CE Code, or CSA C22.1. This applies specifically to electrical communication lines that are routed outside of a building and are considered to be at risk of lightning strike (see ANSI/NFPA-70 (NEC®) 2020 Edition - Part III Protection 805.90 Protective Devices).

3.6 Wiring

In order to achieve secure contact in the terminal blocks, wires must be stripped accordingly.

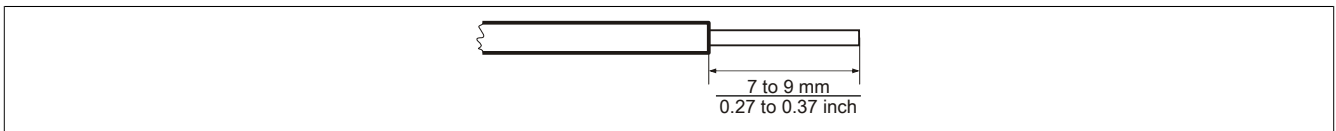


Figure 7: X20 system - Wiring

Connection cross sections

The following table shows the possible wire cross sections and connection types for the various terminal blocks:

	X20TB06 X20TB12	X20TB1E X20TB1F	X20TB32
Single-wire			
mm²	0.08 to 2.50	0.08 to 1.50	0.08 to 2.50
AWG	28 to 14	28 to 16	28 to 14
Fine-stranded			
mm²	0.25 to 2.50	0.25 to 1.50	0.25 to 2.50
AWG	24 to 14	24 to 16	24 to 14
With wire end sleeves			
mm²	0.25 to 1.50	0.25 to 0.75	0.25 to 1.50
AWG	24 to 16	24 to 20	24 to 16
With double wire end sleeves			
mm²	Up to 2x 0.75	-	Up to 2x 0.75
AWG	Up to 2x 21	-	Up to 2x 21

Notice!

The wire stripping length must not be more or less than 7 to 9 mm.

To avoid damaging the push-in terminals, the X20AC0SD1 B&R screwdriver should be used.

Order number	Short description	Figure
	Screwdriver	
X20AC0SD1	B&R screwdriver	

Table 3: X20AC0SD1 - Order data

3.6.1 Shielding and grounding

Schematic diagram

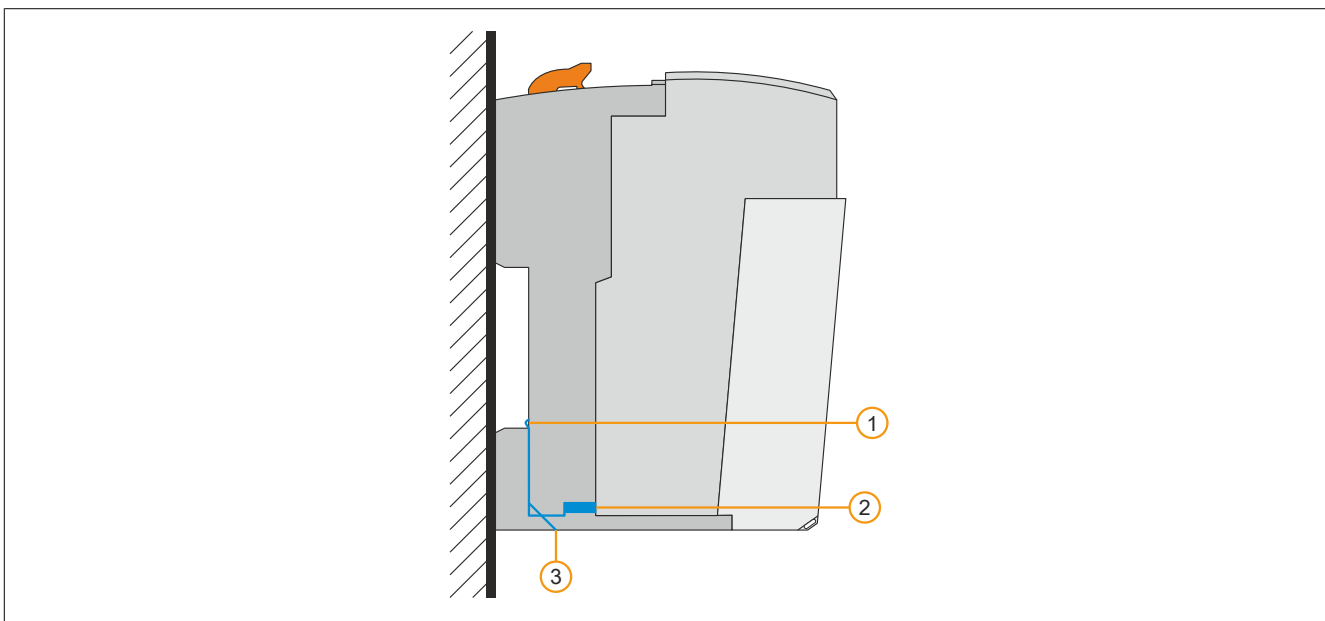
All components of the X20 system carry a ground conductor. The last link in the chain is the bus modules, which make contact with the top-hat rail via the ground connection on the back of the bus module. A good conductive contact between the X20 modules, top-hat rail and control cabinet is mandatory.

The following figure shows schematically the path of the current via the earth leakage. The current path is drawn in orange.



Grounding bracket

The following sketch shows the position of the grounding bracket inside the bus module.



1	Contact to the top-hat rail	2	Contact to the I/O module
3	Contact to the ground connection	-	-

3.6.2 Shielded lines

Shielded lines for guaranteeing disturbance-free operation are essential for many applications, for example:

- Fieldbus modules (Ethernet, POWERLINK, X2X Link, CAN bus, etc.)
- reACTION Technology modules
- Analog modules (inputs and outputs)
- Counter modules/functions
- PWM outputs
- Safety technology (safety modules)
- Temperature measurement modules
- Motor control
- ACOPOSinverter
- etc.

For all details regarding wiring in accordance with regulations, see the respective user's manual. If not described otherwise, grounding on both sides is preferred. A shield connection on both sides generally provides optimal damping of all coupled interference frequencies.

The use of a shield connection on only one side is not permitted with potential differences. Possible potential differences must be prevented using an equipotential bonding conductor.

3.6.2.1 B&R cable recommendations

Cables available from B&R are recommended for wiring. All available designs and lengths can be found in the user's manual or on the B&R website.

For example: Ethernet/POWERLINK

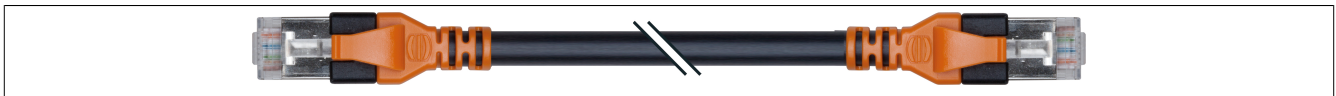


Figure 8: X20 cables

(B&R model number: X20CA0E61.xxxxx, length specifications: 0.2 m (xxxxx = 00020) to 20 m (xxxxx = 02000)).

The following wiring guidelines must be observed:

- Use CAT 5 SF/UTP industrial data cables.
- Observe the minimum cable bend radius (see data sheet for the cable).
- Fasten the cable underneath the bus controller. The cable must be fastened vertically under the female RJ45 connector on the bus controller.
- The customer must implement additional measures in the event of further requirements.

3.6.2.2 Shield connection

The following points must be observed:

- The ground connection should be made as short as possible with good conductivity.
- Shield connection clamps allow the shield to be applied on special shielding brackets underneath the controller.
- Observe the bend radius.
- Clamp to the backplane (optional).

To reduce EMC emissions as much as possible, the area where the wires are stripped must be kept as short as possible (extend the cable shield as far as possible).

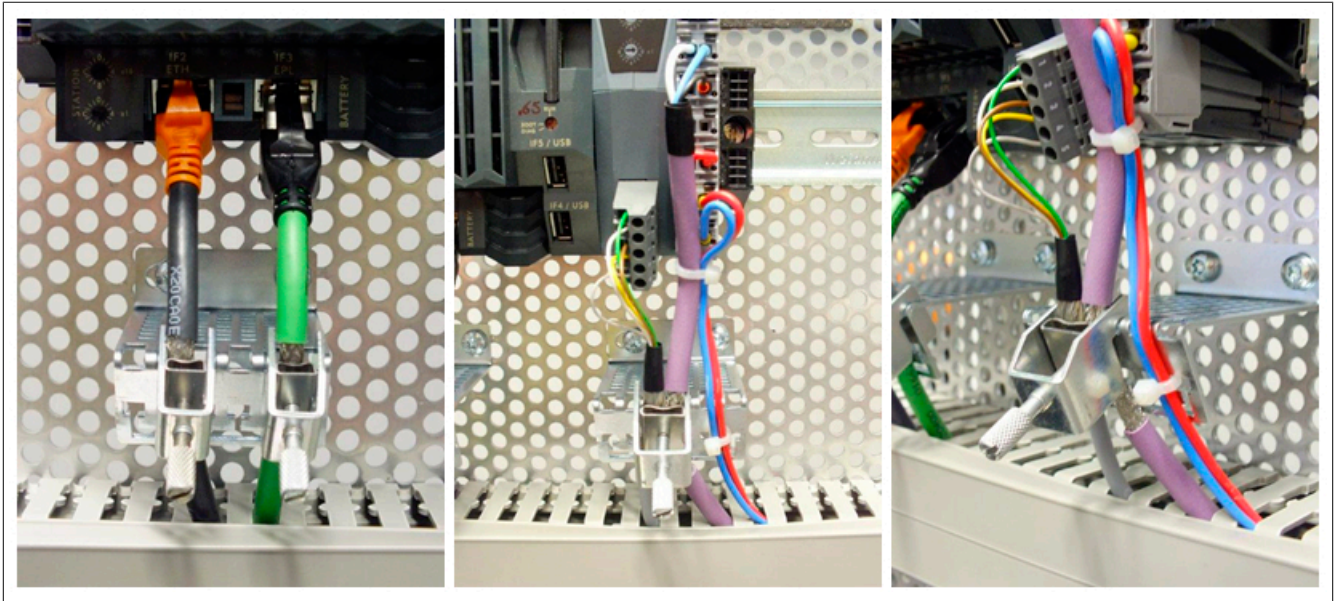


Figure 9: X20 cable shield

B&R recommends always solidly connecting the shield to a well-grounded and good conductive backplane using **shielding clamps** combined with the **X20 shielding brackets** accessories.

3.6.2.2.1 Cable shielding via X20 shielding bracket

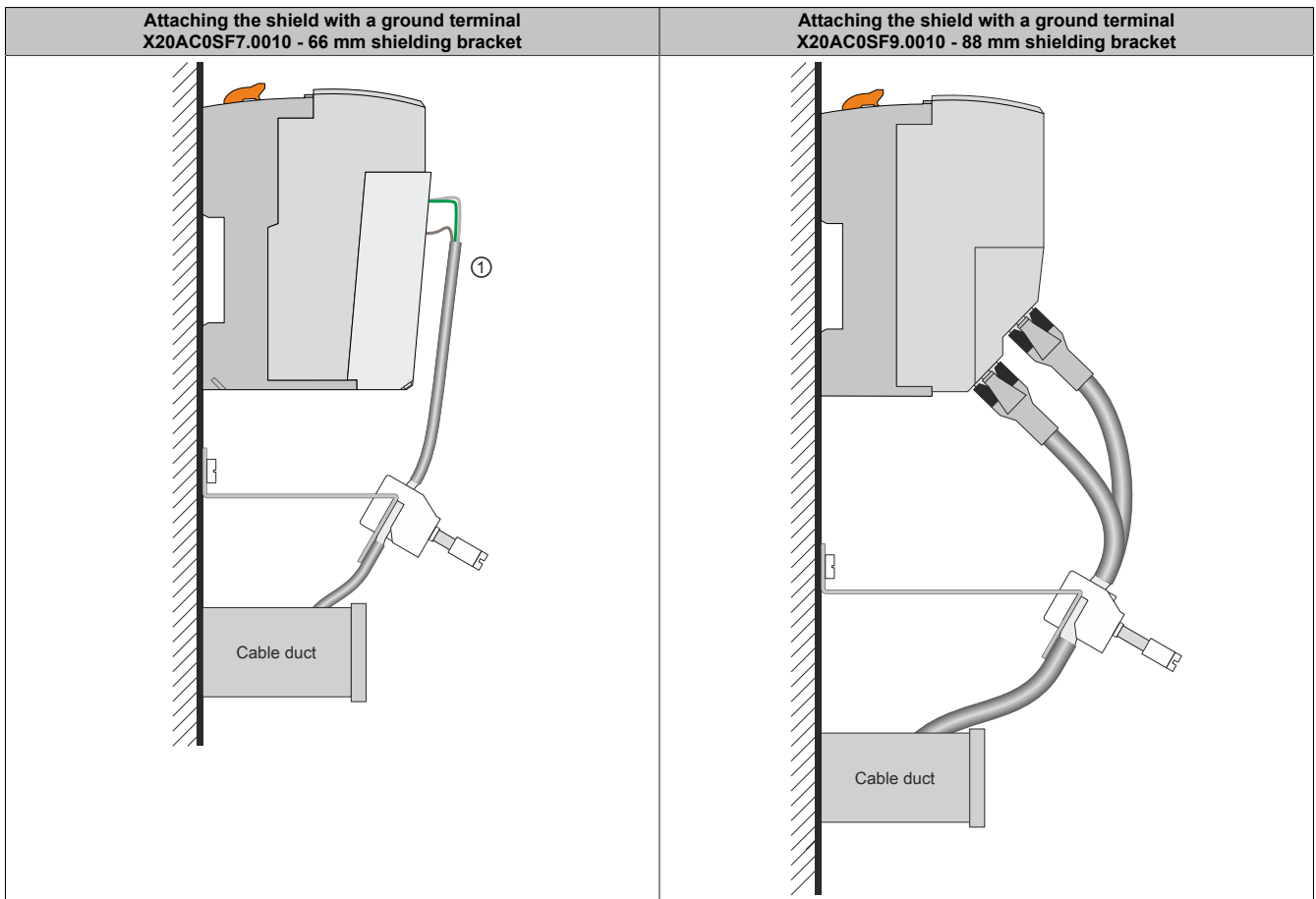


Table 4: Cable shielding via X20 shielding bracket

To reduce EMC emissions as much as possible, the cable shield must reach as high as possible after attaching the cable to the shielding bracket (see ① in the figure above).

Notice!

A minimum spacing of 35 mm between the X20 module and shielding bracket must be observed. Additional spacing may result from the bend radius of the cables.

3.6.2.2.2 X20 cable shield plate

As described in chapter "Shield connection" on page 19, B&R recommends always connecting the shield solidly to the conductive and well-grounded backplane using shielding clamps in combination with the X20 shielding bracket, which is available as an accessory.

The X20 cable shield clamp (model number X20AC0SG1) is latched to the terminal block and connected to the bus module's ground connection using a cable lug. Cable ties are used to press the shield against the grounding plate.

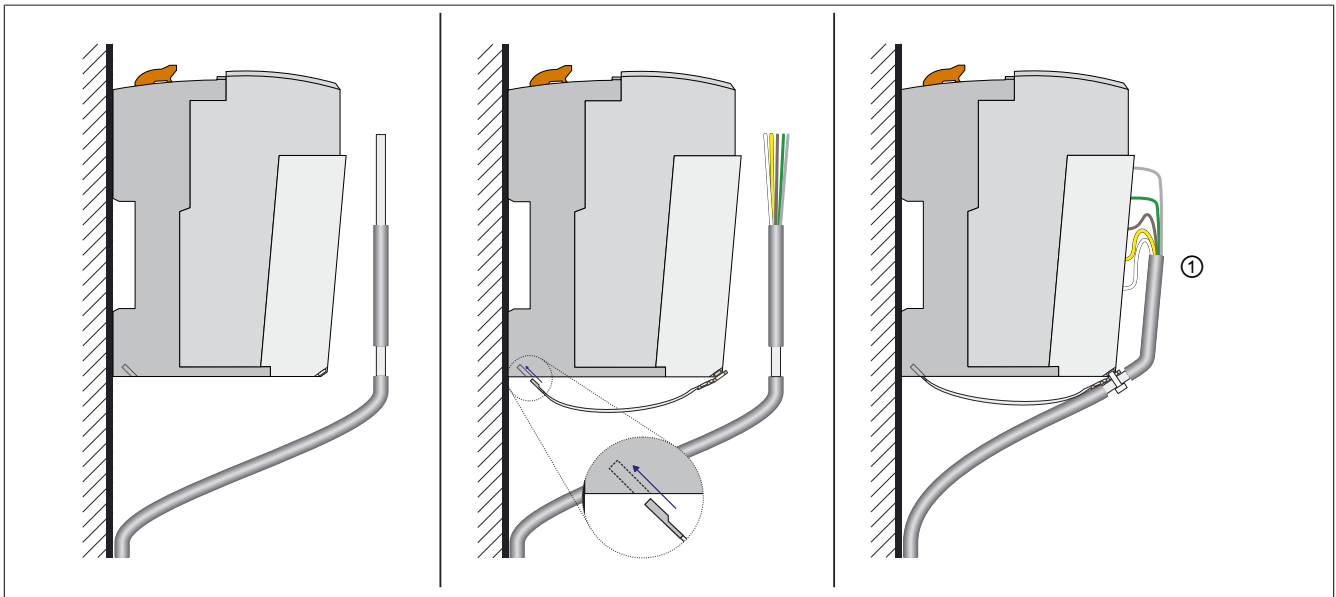


Figure 10: Shielding via X20 cable shield clamp

To reduce the EMC emissions most effectively, the cable shield must be as long as possible after the cable tie (see ① in the diagram above).

3.6.2.2.3 X20 shielding bracket

Order data


	
Order number	Short description
	Shielding bracket
X20AC0SF7.0010	X20 shielding bracket 66 mm 10 pcs.
X20AC0SF9.0010	X20 shielding bracket 88 mm 10 pcs.

Table 5: X20AC0SF7.0010, X20AC0SF9.0010 - Order data

The X20 shielding bracket is installed underneath the X20 system. The shield is pressed against the shielding bracket using ground terminals from another manufacturer (e.g. PHOENIX or WAGO) or a cable tie.

2 lengths are available depending on the application:

Model number	Length	Application
X20AC0SF7.0010	66 mm	<ul style="list-style-type: none"> I/O modules Power supply modules Integrated I/O on X20CP13xx systems Onboard interfaces on controllers
X20AC0SF9.0010	88 mm	<ul style="list-style-type: none"> Interface modules Bus controller modules Controllers in the form of an interface module

3.6.2.2.3.1 Dimensions

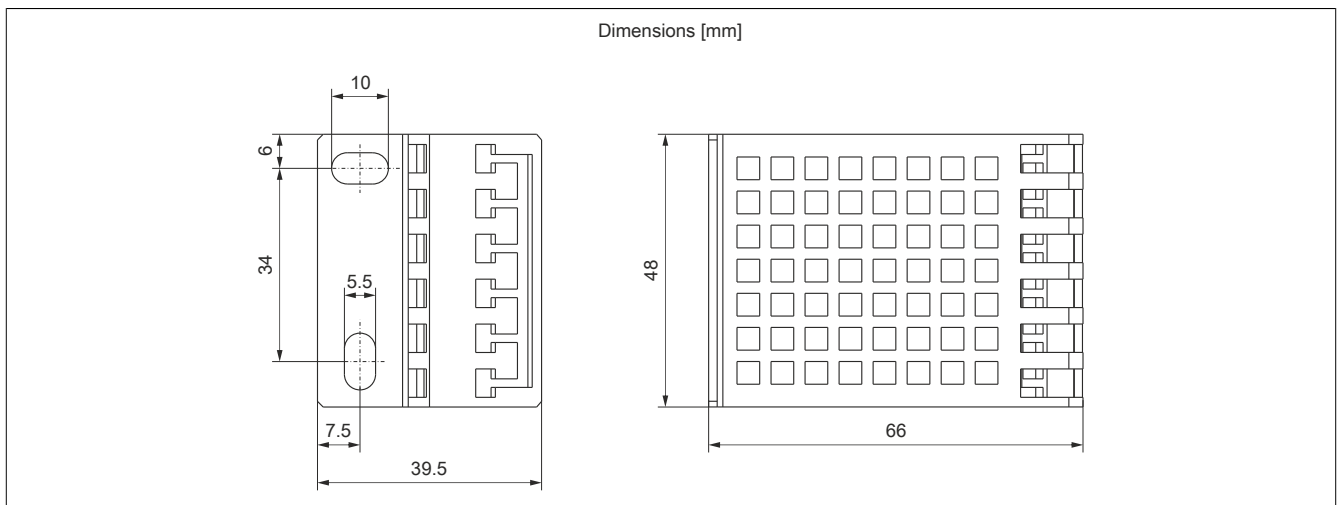


Figure 11: X20AC0SF7.0010 - Dimensions

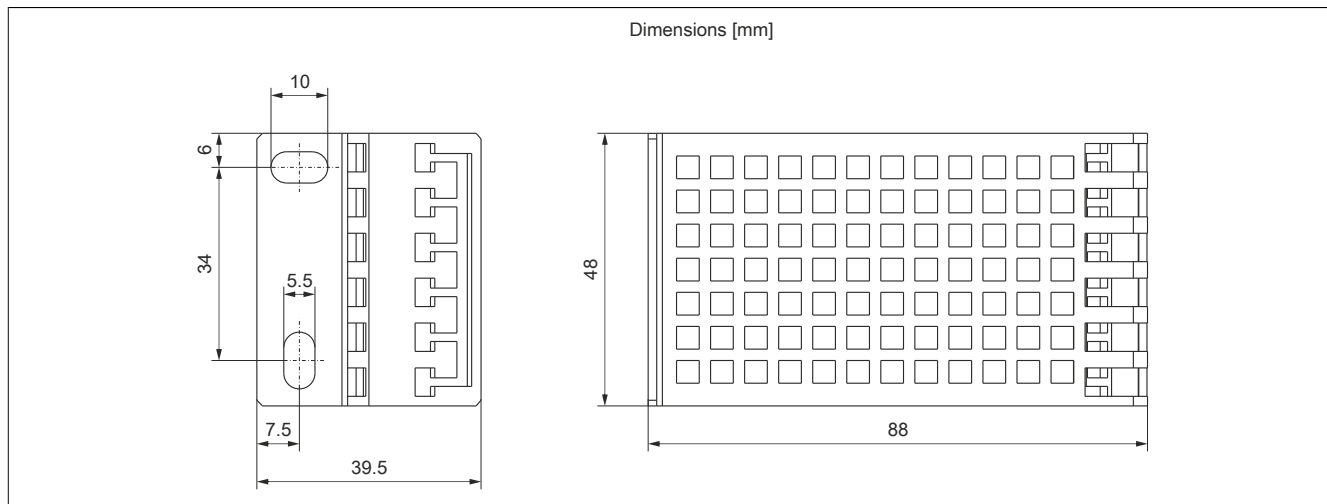


Figure 12: X20AC0SF9.0010 - Dimensions

Package contents

- 10 pcs. X20 shielding bracket
- Installation template

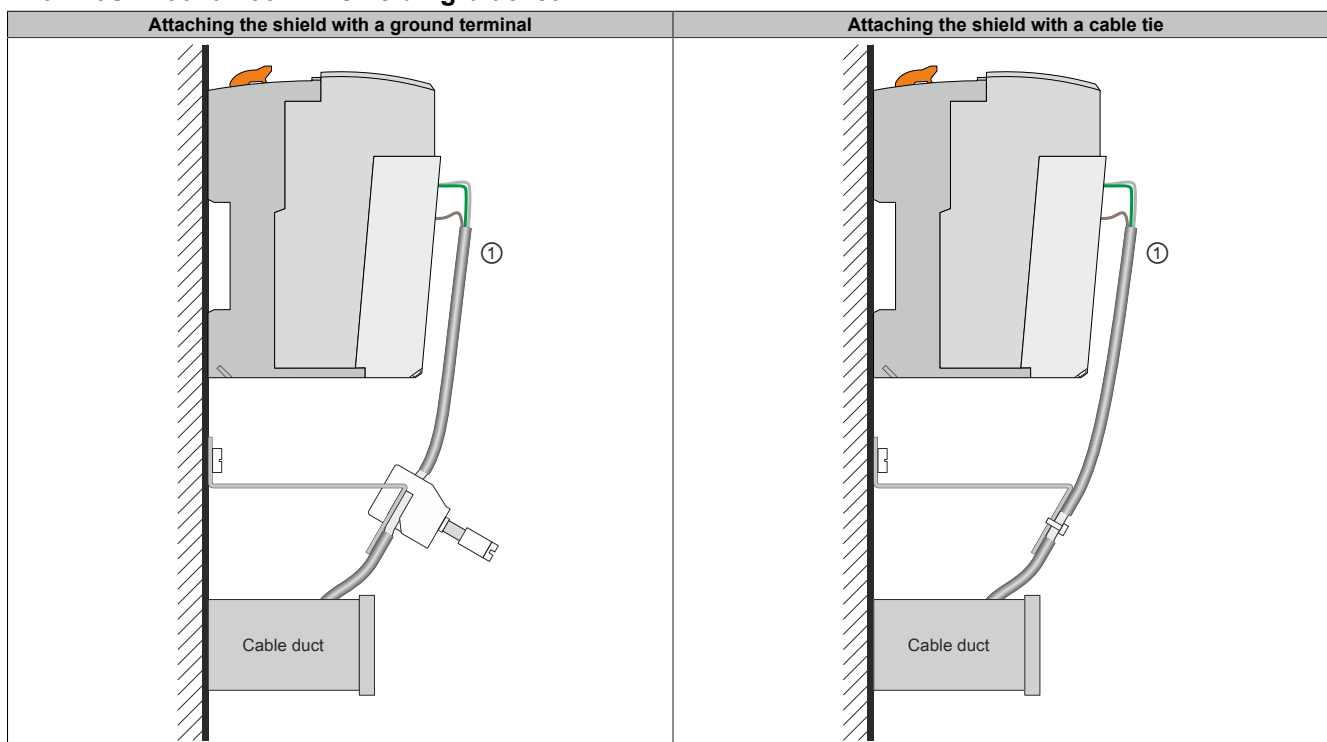
3.6.2.2.3.2 Usage examples**X20AC0SF7.0010 - 66 mm shielding bracket**

Table 6: Cable shielding via X20 shielding bracket

X20AC0SF9.0010 - 88 mm shielding bracket

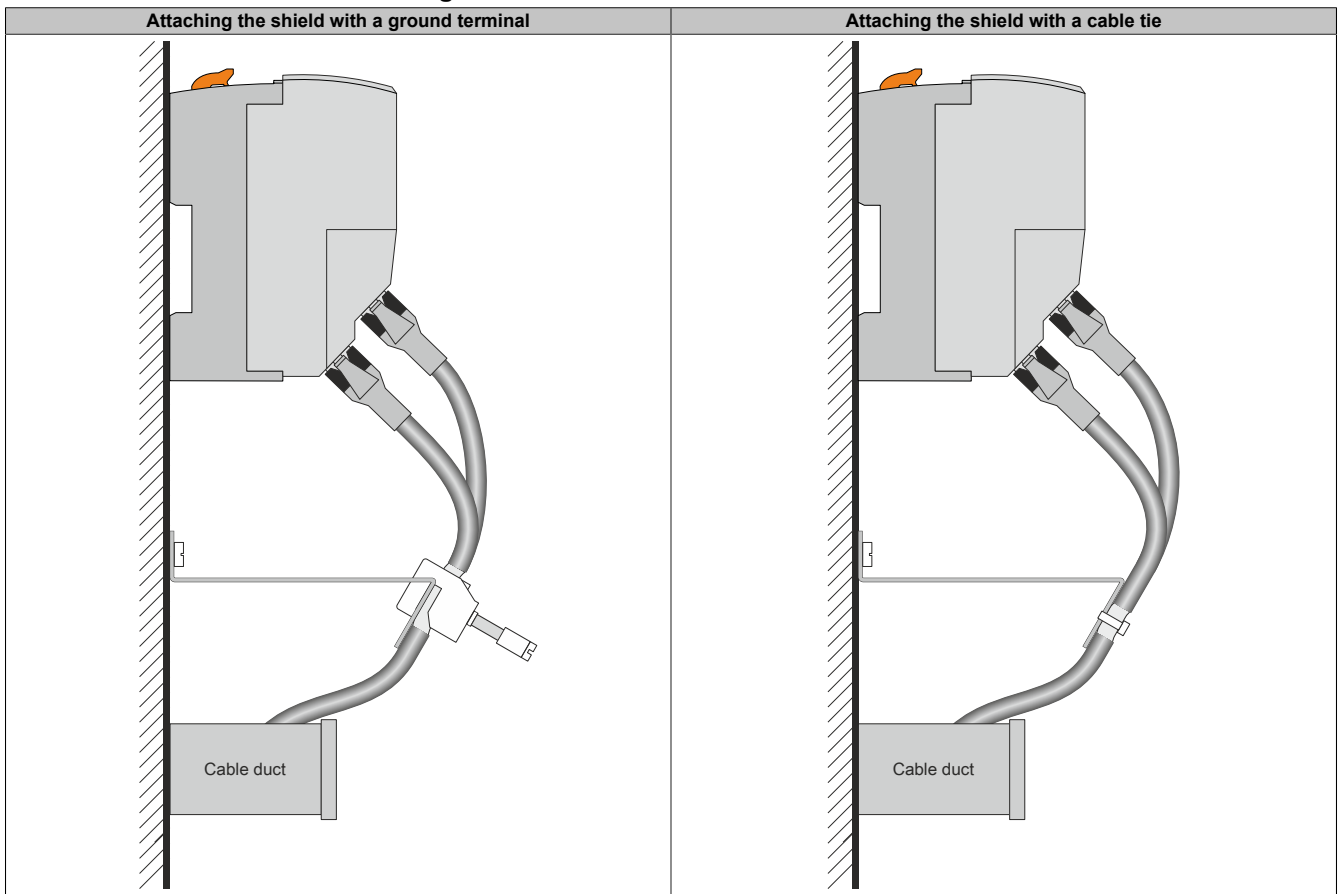


Table 7: Cable shielding via X20 shielding bracket

3.6.2.2.4 X20 shield connection clamp

Order data

Order number	Short description
	Shield connection clamp
X20AC0SA08.0010	X20 shield connection clamp 3 to 8 mm, 10 pieces
X20AC0SA14.0010	X20 shield connection clamp 3 to 14 mm, 10 pieces
X20AC0SA20.0010	X20 shield connection clamp 5 to 20 mm, 10 pieces
X20AC0SA35.0010	X20 shield connection clamp 20 to 35 mm, 10 pieces

Table 8: X20AC0SA08.0010, X20AC0SA14.0010, X20AC0SA20.0010, X20AC0SA35.0010 - Order data

Dimensions

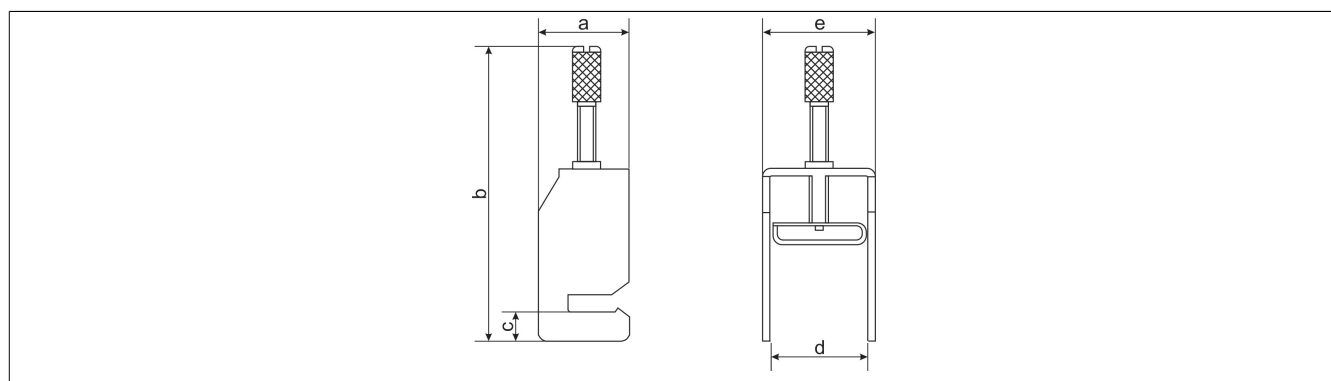


Figure 13: X20 shield connection clamps - Dimensions

Model number	a	b	c	d	e	Max. tightening torque
X20AC0SA08.0010	19.5 mm	Max. 48.7 mm	6.5 mm	9 mm	12 mm	0.6 Nm
X20AC0SA14.0010	19.5 mm	Max. 59.3 mm	6.5 mm	14 mm	17 mm	0.8 Nm
X20AC0SA20.0010	19.5 mm	Max. 75 mm	6.5 mm	21 mm	24 mm	0.8 Nm
X20AC0SA35.0010	20 mm	Max. 106.5 mm	6.5 mm	36 mm	40 mm	1.5 Nm

Table 9: X20 shield connection clamps - Dimensions

4 X67 system

4.1 System characteristics

X67 modules have a plastic housing for use in harsh industrial environments. The devices are fully sealed and are therefore extremely resistant to mechanical stress. Integrated LEDs provide clear status indications on the machine, logically distributed on the individual channels, for the X2X Link status and the entire I/O section.

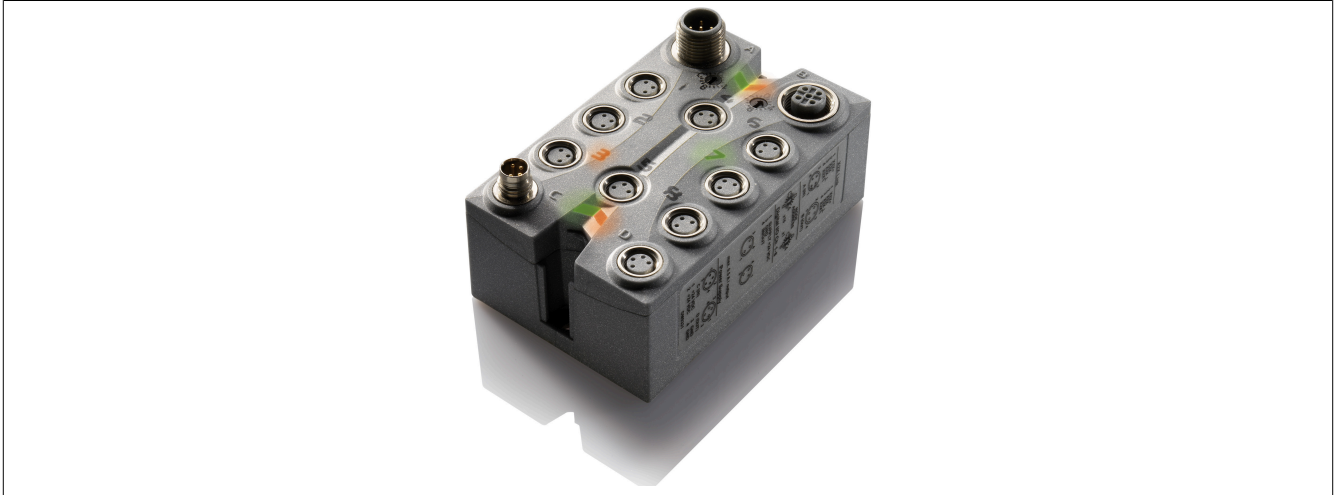


Figure 14: X67 system

All connections are made using standard M8 or M12 connectors. The X2X Link connectors are keyed to prevent mix-ups with the M12 analog connectors.

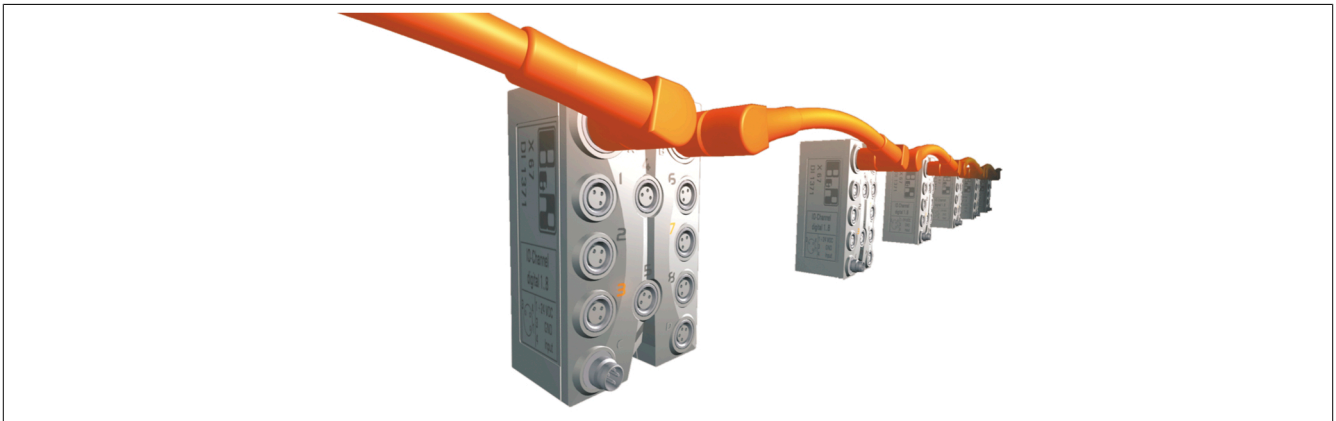


Figure 15: X67 system - X2X Link communication

4.2 Installation

X67 modules can be installed in several different ways:

- Installation on a profile
- Top-hat rail installation
- Direct installation

Notice!

Since electromagnetic disturbances are deflected via the base plate on the back, it is important to ensure that the mounting location has good conductivity!

The mounting location must also be connected with ground potential with good conductivity.

Attaching an X67 module

The thickness of the base plate (1.5 mm) should be taken into consideration when defining the screw length.

The grooved imprint in the base plate ensures that the screws do not become loose, even without an additional retaining ring.

The recommended tightening torque for the M4 screw is 0.6 Nm.

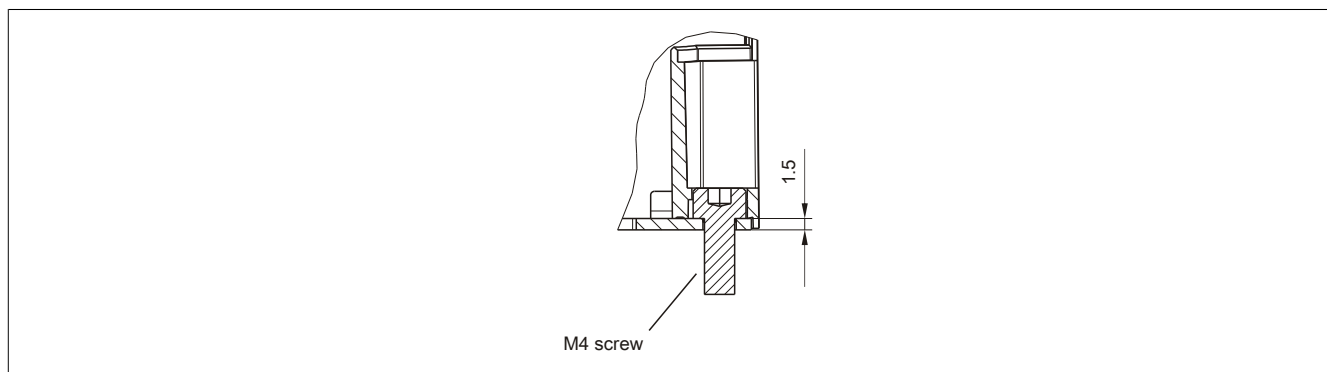


Figure 16: X67 system - Fastening an X67 module

4.2.1 Installation on a profile

Installation here usually takes place with two sliding blocks and M4 screws.



Figure 17: X67 system - Installation on a profile

Notice!

For coated or anodized surfaces, the isolating coated or anodized layer in the area of the base plate for X67 modules must be removed.

4.2.2 Top-hat rail installation

An X67 module can be installed on a top-hat rail using top-hat rail mounting plate X67ACTS35.


Order number	Short description	Figure
X67ACTS35	Mounting plates for DIN rails X67 top-hat rail mounting plate	

Table 10: X67ACTS35 - Order data



Figure 18: X67 system - Top-hat rail installation

4.2.3 Installation on a mounting plate or directly on the machine

X67 modules can also be installed on a mounting plate or directly on the machine.

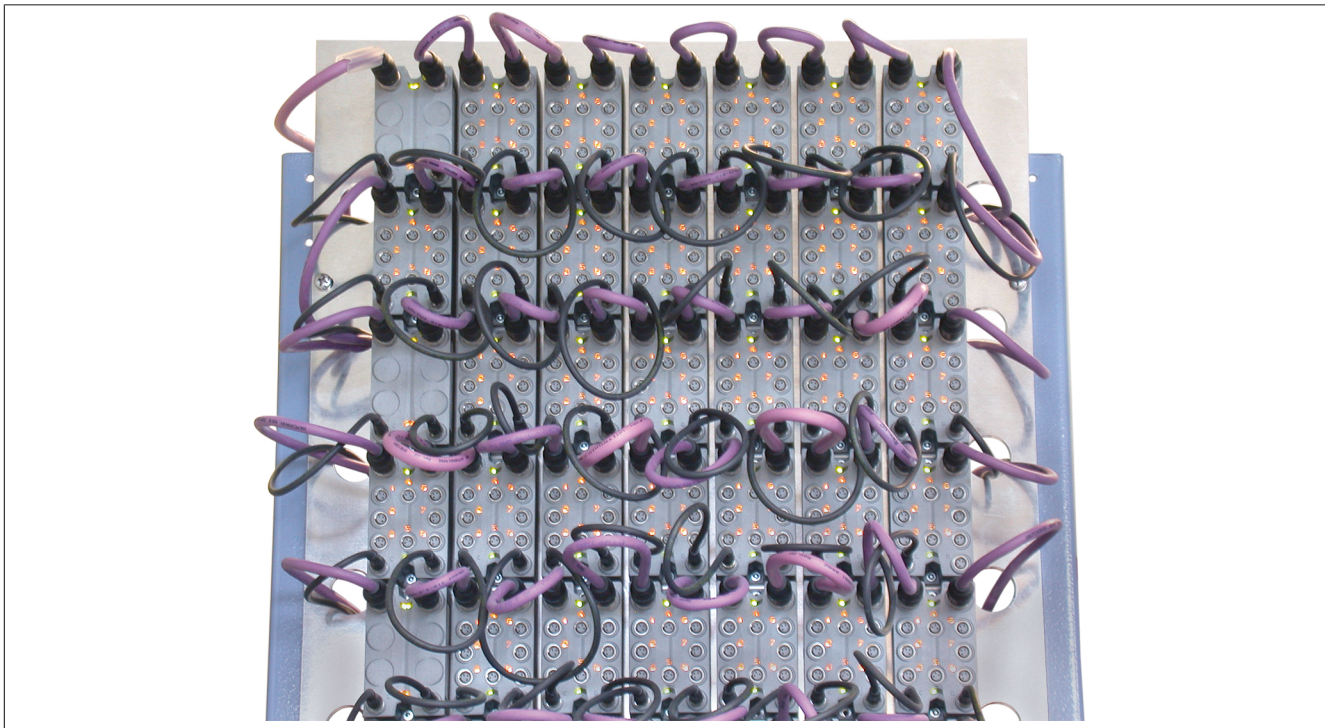


Figure 19: Installation on a mounting plate

4.3 Wiring

4.3.1 Basic information

Due to the high degree of flexibility, a few things must be taken into consideration:

- Maximum number of 253 X67 modules in one X2X line
- Maximum distance between X67 modules
- Distance between the system supply modules
- Station number assignment
- Permissible current consumption
- Corresponding bus termination
- Use of suitable connectors for the X67 system
(for details, see the user's manual)

Possibilities for wiring the X67 system:

- X2X Link power supply with X67 system supply, X67 bus controller or X20 bus transmitter
- Isolated X2X Link and I/O power supply
- Creating potential groups

4.3.2 Lightning and surge protection

Information:

Provide lines at risk of lightning strike with suitable overvoltage protection.

The circuits must be limited to overvoltage category II per IEC 60664-1 or according to other information in the module data sheet.

For the design of your electrical system, see ABB documentation "[Global guide to surge protection](#)".

4.3.2.1 UL/CSA

Electrical installations must comply with the relevant requirements of the National Electrical Code® (ANSI/NFPA-70 (NEC®)) and, where applicable, Canadian Electrical Code (CEC), CE Code, or CSA C22.1. This applies specifically to electrical communication lines that are routed outside of a building and are considered to be at risk of lightning strike (see ANSI/NFPA-70 (NEC®) 2020 Edition - Part III Protection 805.90 Protective Devices).

4.3.3 Shielding and grounding

When using standard cables available from B&R, the cable shield is brought into the X67 module via the connector (complete 360° shielding). Inside the X67 housing, all components including the base plate make contact with the same ground. The final link in the chain is the mounting screw, which connects the base plate and the machine part / mounting plate and completes the seamless ground contact from the cable to the machine part / mounting plate. A contact with good conductivity between the X67 module base plate and the machine part / mounting plate is absolutely required.

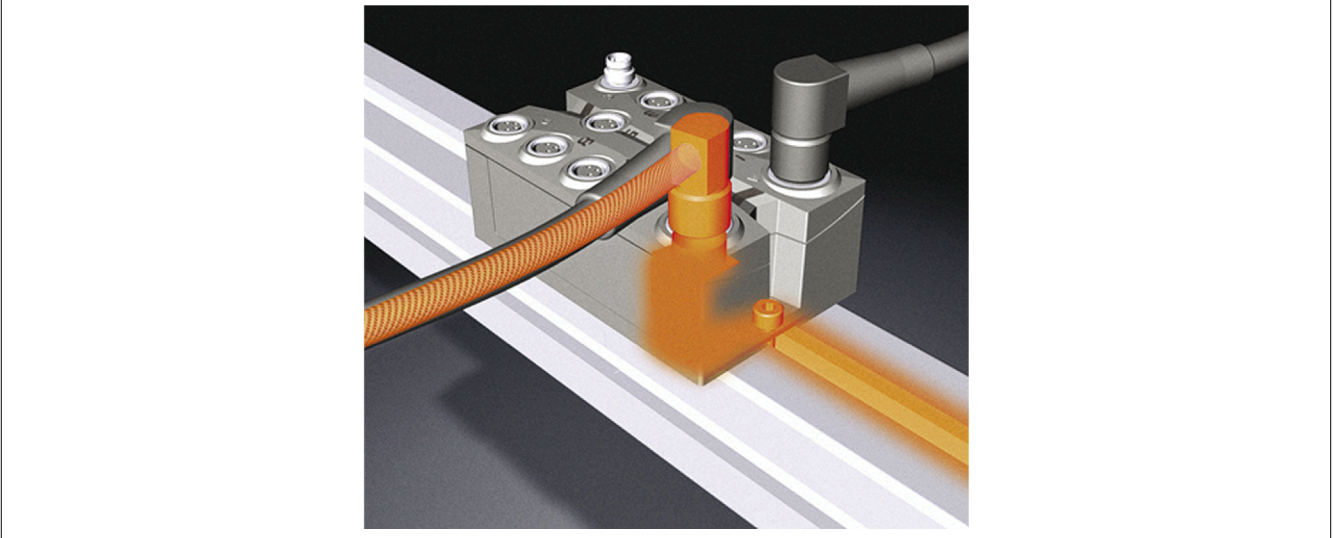


Figure 20: X67 system - Shielding and grounding

Notice!

The shielding at both ends of the cable must be professionally grounded on field-assembled cables!

4.3.4 Accessories

All accessories needed for installation are available from B&R:

Pre-assembled cables

The following pre-assembled cables are available in various lengths and designs:

- POWERLINK cables
- CAN bus / DeviceNet cables
- PROFIBUS DP cables
- X2X Link cables
- Module power supply cables
- M8 sensor cables
- M12 sensor cables
- Multi-function module cables
- Valve terminal cables

Field-assembled connectors

The following connectors are available for field assembly:

- CAN bus / DeviceNet
- PROFIBUS DP / X2X Link
- POWERLINK
- I/O power supply
- Sensors/Actuators
- Special-purpose connectors

Other accessories

- Terminating resistor
- Connectors
- Threaded caps
- Mounting plates for top-hat rails
- Installation tool

Notice!

For the dependable installation of pre-assembled X67 cables, B&R recommends using the torque wrench available as an accessory!

All further information is available in the X67 system user's manual.


Order number	Short description	Figure
X67ACTQMX	Mounting tools X67 torque wrench set, for X67 M8 and M12 connectors, for hex-head connectors	

Table 11: X67ACTQMX - Order data

5 X2X Link settings

To improve the EMC radiation of the X2X Link network, the following settings must be made in Automation Studio:

- 1) Setting the number of stations: By default, the value is set to 64 stations. This value should be set to the number of stations actually present; otherwise, the X2X Link master will search for unavailable stations and amplify the signal.
- 2) Reduce the cable length: Reduce the cable length to the cable length you are actually using.

6 Power Panels

Due to the large number of different Power Panel designs, all notes here are of an exemplary nature only. All details can be found in the respective user's manual.

6.1 System characteristics

Whether operation takes place intuitively via touch screen, hardware function keys or a combination of the two, B&R operator panels provide unbeatable ergonomic comfort. Brilliant displays with a wide viewing angle provide an outstanding overview of all machine and system states. Industry-specific solutions, e.g. for the foodstuffs industry, and even custom adaptations round off this extensive range of products. As with our industrial PCs, these devices are 100% B&R-made, ensuring the long-term availability that machines and systems require.

6.2 Installation

Observe the following points during installation:

- Power Panels must be installed with the retaining clips included in delivery (Tightening torque: 0.4 Nm).
- In order to guarantee sufficient air circulation, allow the specified amount of space around the device. The minimum specification for free space is listed in the user's manual.
- The prescribed mounting orientations are illustrated in the Power Panel user's manual.

Retaining clips for installation

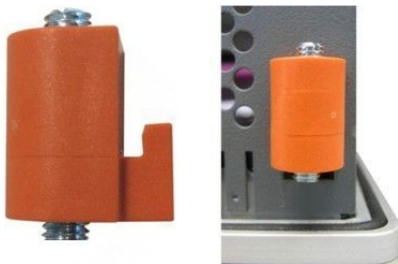


Figure 21: Retaining clips

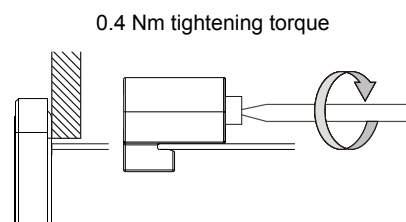


Figure 22: Securing the retaining clips

Spacing for air circulation - Rear view (e.g. T30)

Notice!

Spacing for air circulation must be taken from the user's manual corresponding to the product family.

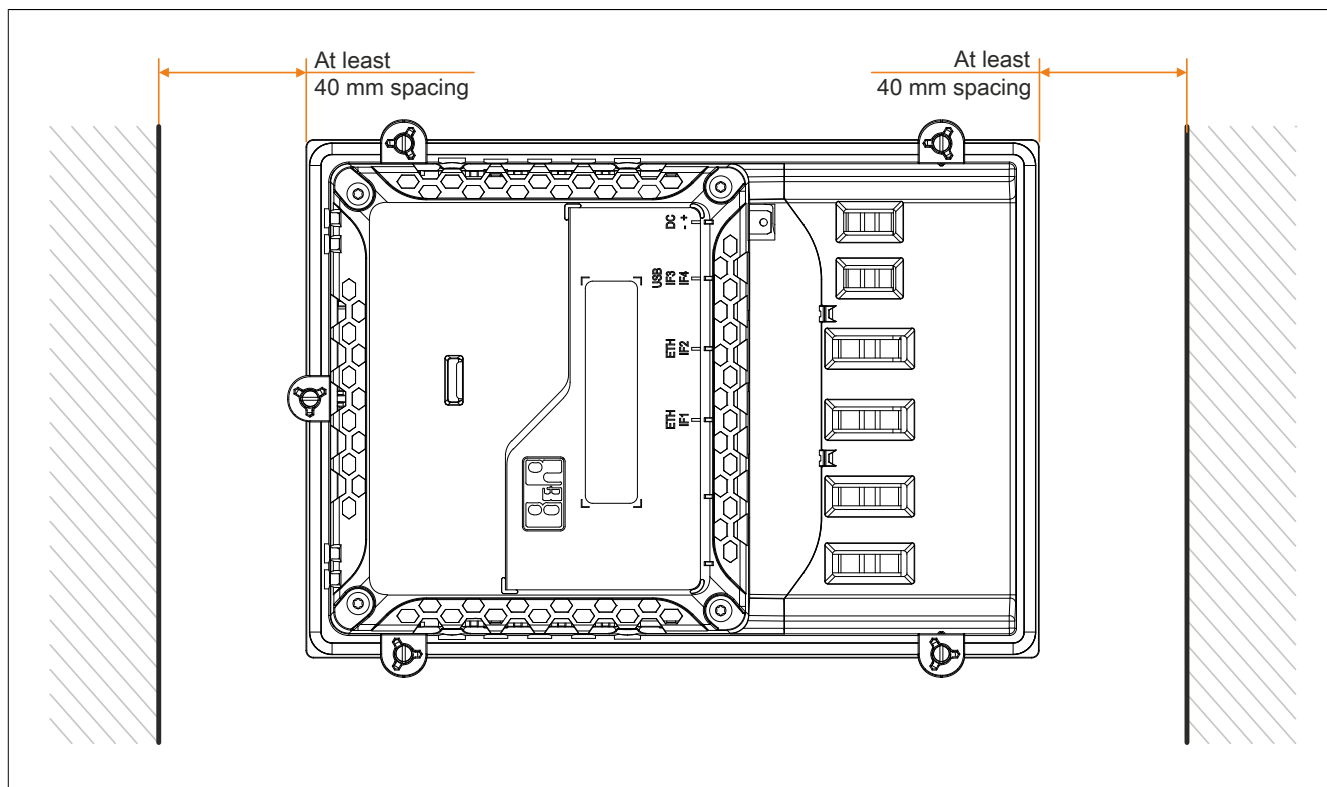


Figure 23: Power Panel T30 - Spacing for air circulation - Rear view

Spacing for air circulation - Side view (e.g. T30)

Notice!

Spacing for air circulation must be taken from the user's manual corresponding to the product family.

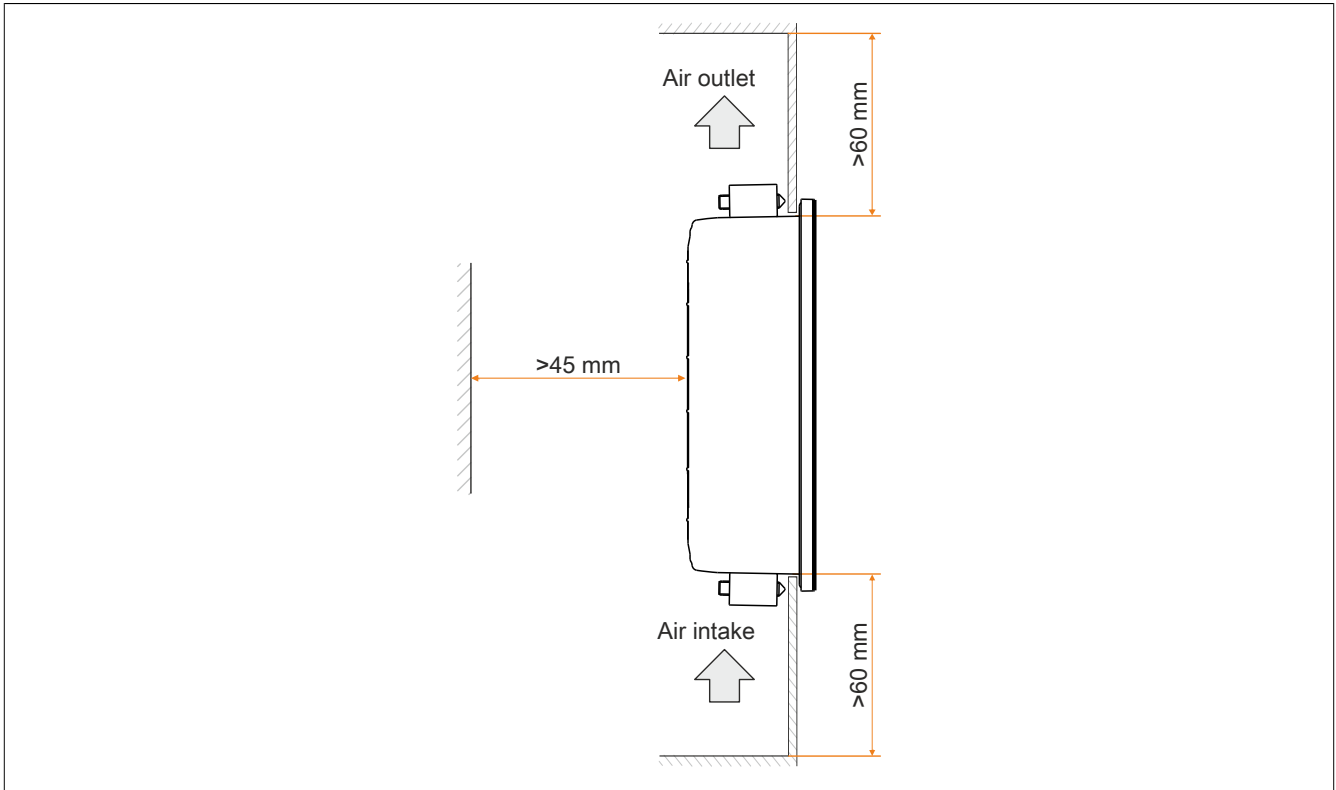


Figure 24: Power Panel T30 - Spacing for air circulation - Side view

Mounting orientation (e.g. T30)

Notice!

Mounting orientations must be taken from the user's manual corresponding to the product family.

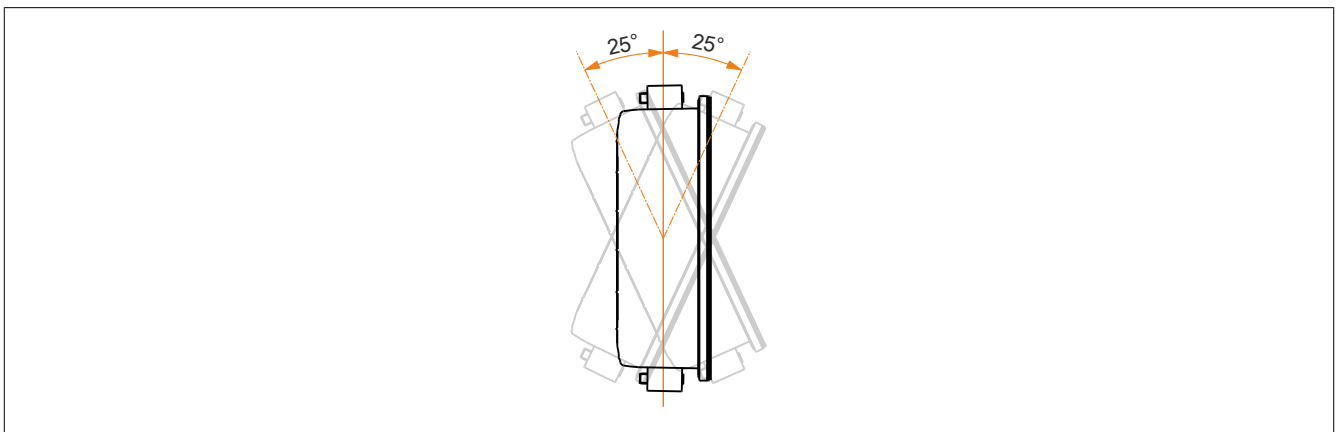


Figure 25: Power Panel T30 - Mounting orientations

6.3 Wiring

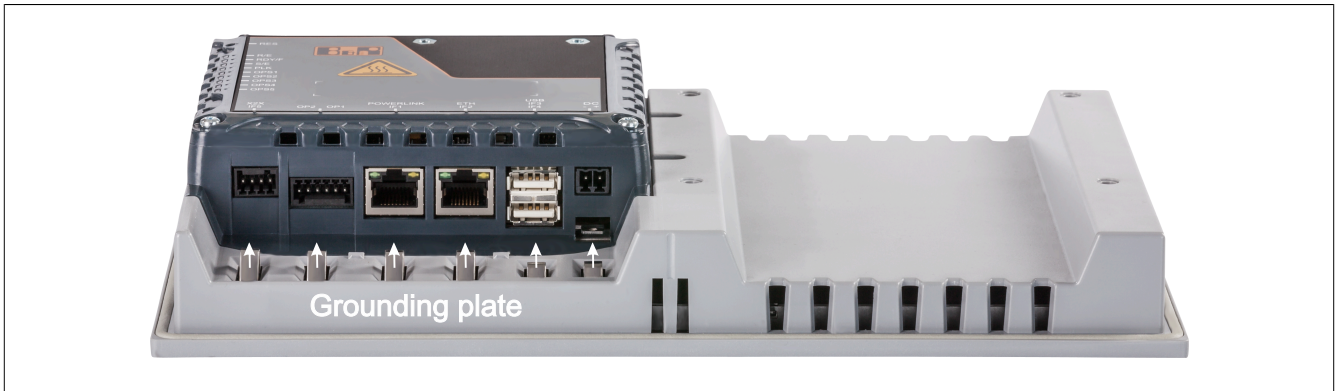


Figure 26: Power Panel - Grounding plate

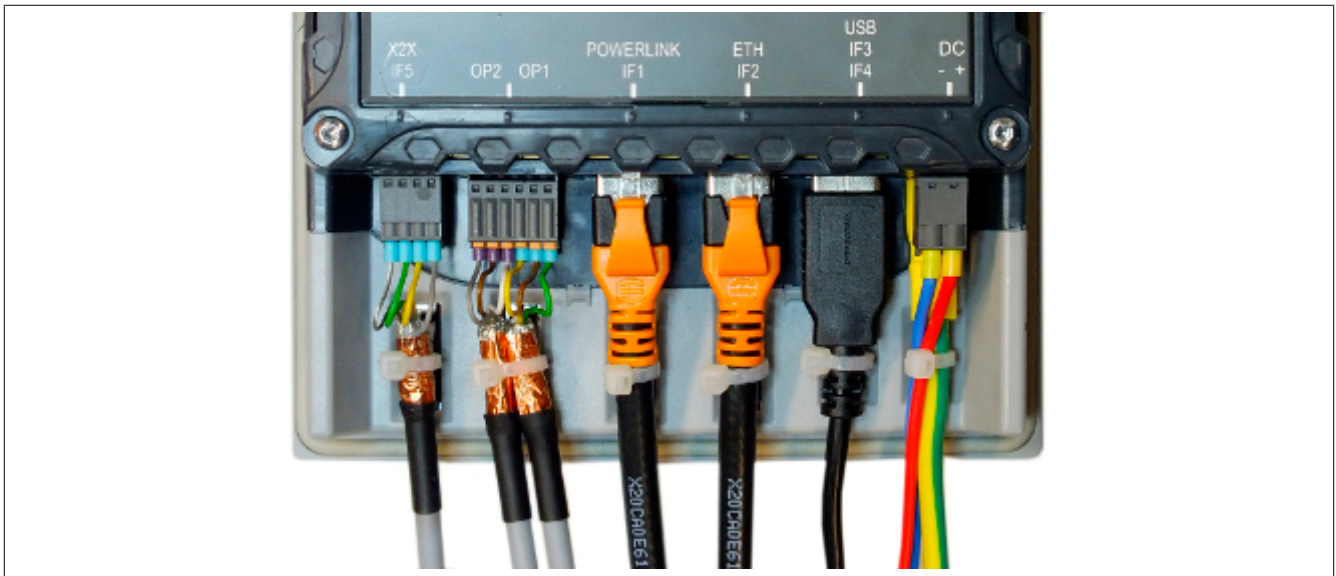


Figure 27: Power Panel - Wiring

Unshielded lines

- All unshielded lines must be relieved of tension by using a cable tie to tie them to the grounding plate.

Shielded lines

- A central ground connection is available to effectively deflect interference. All cable shields must be connected to ground with good conductivity using a cable tie on the grounding plate or some other method.

Grounding

- The connection to ground potential must be as short as possible and sufficiently strong ($\geq 4 \text{ mm}^2$) over the intended spade terminal (Faston 6.3 mm).

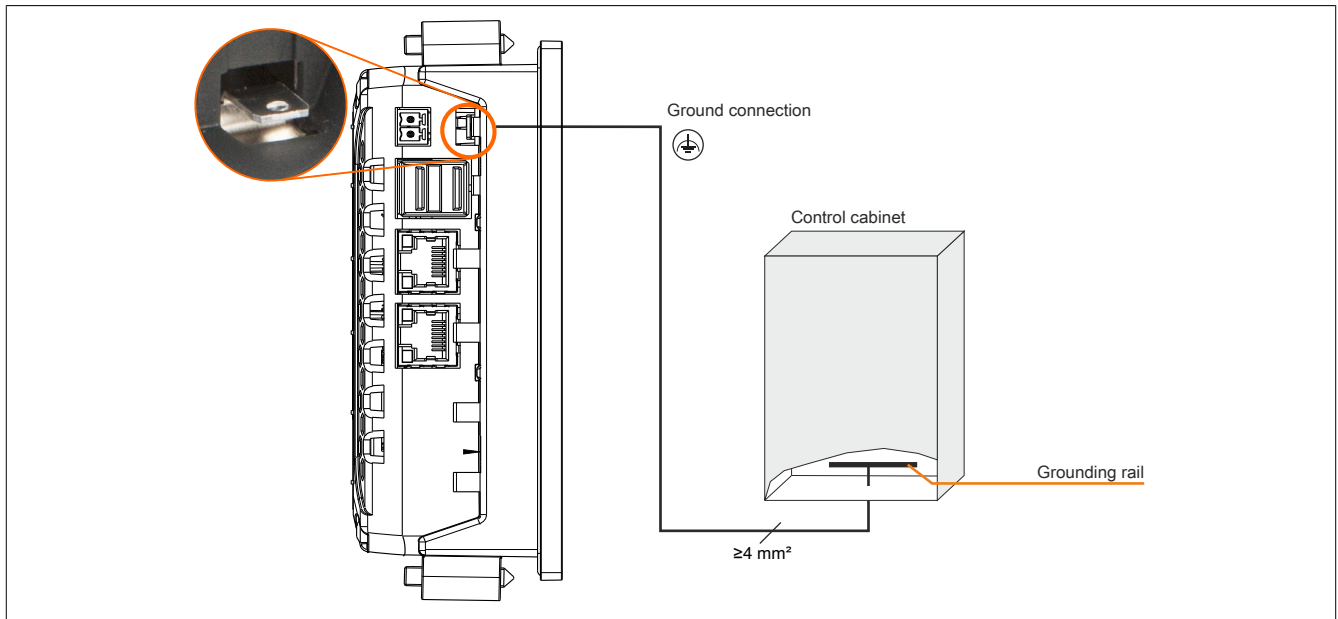


Figure 28: Power Panel - Ground connection

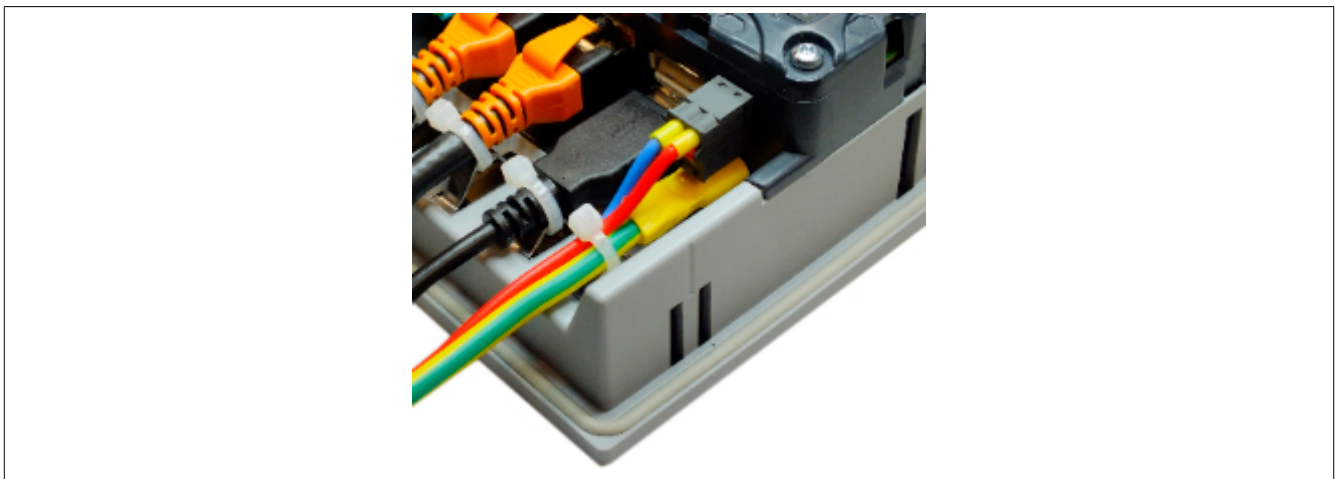


Figure 29: Power Panel - Grounding

6.4 Line filter

6.4.1 5AC804.MFLT-00

6.4.1.1 General information

To meet requirements regarding conducted interference emissions in supply lines for the maritime sector according to the December 2019 edition of ship classification standard DNVGL-CG-0339, it is necessary to use B&R line filter 5AC804.MFLT-00 for T50 and T80 Panel series. For T Panel series a DNVGL Type Approved AC Power Supply with location class EMC B must be used.

The line filter should be installed as close to the end device as possible; the supply line from the end device to the line filter should be kept as short as possible.

6.4.1.2 Order data


Order number	Short description	Figure
5AC804.MFLT-00	Line filter	

Table 12: 5AC804.MFLT-00 - Order data

7 Power supplies

Power supplies available from B&R are recommended to provide power to the products. All available variants are available on the B&R website.

7.1 System characteristics

In order to satisfy demands for complete, comprehensive system solutions, B&R offers a wide range of power supplies for top-hat rail installation. This extensive spectrum ranges from single-phase power supplies that supply 2 A up to three-phase power supplies that supply 40 A. All switching power supplies can manage a wide range of AC and DC input voltages. This input voltage ranges from 100 to 240 VAC or 400 to 500 VAC and from 90 to 350 VDC. In addition to a wide range of input voltages, these devices are also certified for a wide temperature range spanning from -25°C to 70°C. In addition to being no-load proof, all power supplies also provide short circuit and overload protection.

Optimal layout of connection and control elements

Connection terminals and control elements are clearly labeled and arranged on the front of the device. And since the terminals are located at the top or bottom of the front of these devices, they are extremely easy to access. The large size and stability of the terminals also allow the use of a battery-operated screwdriver. Furthermore, the terminals are designed so that the cable does not require heat protection even when using larger devices. These units also come equipped with a third minus terminal for easily implementing secondary grounding, further reducing installation costs.

Safety is key

Electronic current limiting protects electrical installations from overload and short circuits. Overvoltage protection protects connected consumers in the event that the controlled system fails. Overtemperature protection initiates a continuous reduction of output power when the temperature gets too high until it has once again returned to the permissible range (thermal load distribution).

Overload characteristics

To prevent devices from immediately cutting off when a minimal overload occurs, these power supplies operate according to an I-V curve with a variable operating point:

- **Output characteristics:** The I-V curve ensures that highly capacitive loads as well as consumers with DC-to-DC converters in the input circuit are reliably supplied.
- **Overload design:** Output current is limited if a short circuit or overload occurs. Instead of cutting off, the unit delivers a continuous output current. The secondary voltage is also lowered until the secondary short circuit or overload has been corrected. Downstream fuses are triggered. Identical power supplies can be connected in parallel without creating any sort of startup problems.

Electromagnetic compatibility (EMC)

All devices satisfy EN 61000-6-2 (immunity) and EN 61000-6-3 (emissions) standards in the highest respective class. Noise suppression is also provided on the output to prevent even long unshielded lines from emitting noise.

Also provided:

- **Transient overload protection** to protect the device from voltage spikes on the mains.
- **Inrush current limitation** effective for warm devices as well. As a result, even the OPS3400.1 (24 V / 40 A) allows protection using conventional circuit breakers, which are used in the supply line in any case.

In addition to these functions, EMC is also included in the CE certification. These power supplies also satisfy EN 50178, EN 60204-1 and UL508 LISTED requirements in addition to standard international certifications (IEC 60950, EN 60950, UL 60950, CUL CSA-C22.2 No 60950).

Notice!

Primary circuits, from which the connected secondary voltages are derived, must be limited to over-voltage category II and may have a maximum system voltage of 300 V.

All connected circuits must meet the requirements for SELV/PELV circuits (Class III) according to UL/ CSA/IEC 61010-1, 61010-2-201.

7.2 Power supplies

B&R power supplies have either a single-phase or three-phase design. They provide a wide input voltage range as well as a stable output voltage.



Figure 30: Power supply modules

7.2.1 Single-phase power supplies

- 100 to 240 VAC wide-range input
- Can be connected in parallel for increased capacity and redundancy
- High degree of operational safety at full load and high MTBF (>500,000 h) due to long power failure bridging
- International approval package
- Wide temperature range from -25 to 70°C
- Compact design and easy installation on the top-hat rail

7.2.2 Three-phase power supplies

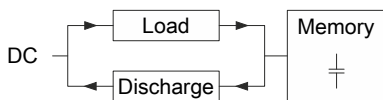
- 400 to 500 VAC wide-range input
- Reliable power supply even if one phase fails temporarily
- High dielectric strength
- Can be connected in parallel for increased capacity and redundancy
- High degree of operational safety at full load and high MTBF (>500,000 h) due to long power failure bridging
- International approval package
- Wide temperature range from -25 to 70°C
- Closed metal housing
- Easy installation on the top-hat rail

7.3 Buffer module

B&R offers buffer modules to bridge temporary power failures and handle longer power failures.

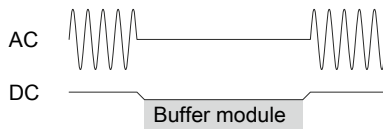
- Buffering for 24 VDC consumers
- Output current up to 20 A
- Can be switched parallel for larger buffer currents and times
- Easy to connect in parallel to the power supply or to the load in the 24 VDC circuit
- Simple and problem-free retrofitting of existing systems
- Industrial-grade since capacitor-based energy storage (no accumulators)
- High MTBF (>500,000 h)
- International approval package
- Wide temperature range from -25 to 70°C

Function principle and application

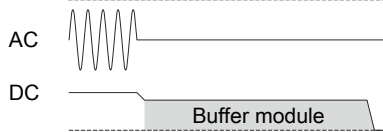


The buffer module is an accessory for regulated 24 VDC power supplies. The energy from the DC circuit is stored in capacitors and then used in the event of a power failure or to handle overloads. Machines and systems can be easily equipped with this buffer module for use worldwide in unstable power circuits. With buffering times less than 4 seconds, this is an ideal alternative to a DC UPS (less expensive, requires less space and maintenance-free). When short-term current peaks occur, it provides the required energy, therefore preventing the otherwise common error of overdimensioning the power supply.

Protection during power supply failures

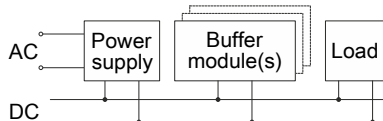


Statistics show that 80% of all power failures occur in 0.2 seconds or less. These power failures are completely bypassed and do not affect the DC voltage, which increases the reliability and availability of the complete system.



After a power failure or shutdown, the buffer module delivers the load current for a specified amount of time and reports the loss of power via signal terminals. Process data can be saved and processes terminated before the DC voltage is switched off. It is then possible to perform a controlled restart.

Easy to operate, expandable and maintenance-free



The buffer module does not require any control lines. It can be connected in parallel at any location in the load current circuit. Five buffer modules can be connected in parallel for redundancy or to extend the buffering time. The double terminals allow easy wiring.

7.3.1 Order data


Order number	Short description	Figure
0PB0200.1	Buffer module 24 VDC buffer module, 0 to 20 A, buffer time 0.2 s at 20 A to 4 s at 1 A, top-hat rail installation	

Table 13: 0PB0200.1 - Order data

7.4 Installation and wiring

When installing power supplies intended for top-hat rail installation, the points under "Installation" on page 12 must be observed. For information about wiring the different power supplies, see the information sheet or respective data sheet (see www.br-automation.com).

8 General requirements

8.1 Introduction

The following describes the typical environmental requirements and characteristics for several B&R products. All specifications listed in this document are standard values; for possible deviations, see the respective technical data, data sheet or product-specific user's manual (see www.br-automation.com).

8.2 CE (EU)

All products have been designed as **industrial devices for zone B** per **product standard EN 61131-2**. If the devices are used in an environment other than that described in this standard or in the respective user's manual, the operating behavior may be impaired or the devices even irreparably damaged. The products correspond to CE (EU) requirements of the European Community for open devices in accordance with the definition provided in the relevant EN 61131-2 product standard.

8.2.1 Housing requirements

All products must be installed in a housing designed with the specific ambient conditions of the site in mind. In order to provide improved immunity to electromagnetic disturbances, installation in a metal housing (control cabinet) is recommended.

8.2.2 Environmental characteristics

The table below contains general environmental characteristics.

The product-specific data sheets contain more detailed information about any reduced ambient conditions (derating). These are available under the order number of the respective product on the B&R website (www.br-automation.com) and can be downloaded from there.

The specifications must be checked and taken into account.

Characteristics		Specification	
Ambient temperature during operation	X20 standard modules, X20 coated modules, X20 coated safety modules	-25 to 60°C	Horizontal mounting orientation
		-25 to 50°C	Vertical mounting orientation
	X20 safety modules	0 to 60°C	Horizontal mounting orientation
		0 to 50°C	Vertical mounting orientation
	X67 modules	-25 to 60°C	Any mounting orientation
	Power Panel 65	0 to 50°C	Vertical and horizontal mounting orientation
	Power Panel T30	-20 to 60°C	Vertical and horizontal mounting orientation
Power supplies	-25 to 70°C	Horizontal mounting orientation (>55°C derating)	
Relative humidity during operation	X20 standard modules, X20 safety modules, Power supplies	Up to 95%	non-condensing
	X20 coated modules, X20coated safety modules, X67 modules	Up to 100%	Condensing possible
	Power Panels	Up to 90%	non-condensing
Operating elevation	All products	0 to 2000 m	Installation at elevations above sea level
		>2000 m	See data sheet.
Resistance to vibration during operation (EN 60068-2-6)	All X20 modules	1 g	Requirement in accordance with EN 61131-2
	X67 modules	2 to 4 g	Requirement in accordance with EN 60721-3-5 / Class 5M3
	Power supplies	2.3 g	Requirement in accordance with EN 61131-2 and DNV-GL / Class C
Shock resistance during operation (EN 60068-2-27)	All X20 modules, Power Panels, power supplies	15 g	Requirement in accordance with EN 61131-2
	X67 modules	30 g	Requirement in accordance with EN 60721-3-5 / Class 5M3 (Type I)
Overvoltage category (EN 60664-1)	All X20 and X67 modules, Power Panels	II	Requirement in accordance with EN 61131-2
	Power supplies	III	Requirement in accordance with EN 60204
Pollution degree (EN 60664-1)	All products	2	Requirement in accordance with EN 61131-2
Protection rating (IP code) (EN 60529)	All X20 modules, Power supplies	IP20	Control cabinet installation required
	X67 modules	IP67	No installation required
	Power Panels	Front: IP65 Back: IP20	Rear-side installation required

Table 14: General requirements - Environmental characteristics

1 g = 10 m/s²

In addition to the general specifications in this table, the technical data of the respective products must be checked and any necessary derating must be taken into account!

Vibration and shock resistance values are valid only under the condition that the connection lines are installed properly and components are mounted correctly.

Definitions in accordance with EN 60664-1

Overvoltage category II: Energy-consuming equipment supplied by the fixed installation

Overvoltage category III: Equipment in fixed installations and for cases where the reliability and the availability of the equipment is subject to special requirements

Pollution degree 2: Only non-conductive pollution occurs. Occasionally, however, temporary conductance may result from condensation.

Protection rating provided by enclosure (IP code) in accordance with EN 60529

IP20 protection	First number IP2x Second number IPx0	Protection against ingress of solid foreign bodies ≥ 12.5 mm diameter No protection against ingress of water with damaging consequences.
IP65 protection	First number IP6x Second number IPx5	Dust-proof Protection against water jets
IP67 protection	First number IP6x Second number IPx7	Dust-proof Protection against temporary submersion

8.3 ATEX / HazLoc

8.3.1 Standards, criteria

X20/X67 modules are permitted for operation in **zone 2** in an temperature range between **0 and 60°C**. Nevertheless, the certification-specific requirements and regulations must always be taken into account as well (possible reduction in upper temperature limit to reduce power, derating, etc.). These are available in the information sheet or in the technical data or data sheets/user's manuals on the B&R website (www.br-automation.com).

ATEX

Characteristics		Description
Device group	II	All areas except mining
Device category	3	Explosive gases, normal degree of safety
Area of use	G	Gas, zone 2
Ignition protection types	nA	Non-sparking
Equipment protection level (EPL)	Gc	Use in areas where there is risk of gas explosions but no risk of ignition during normal operation

Table 15: ATEX - Standards, criteria

Explosion protection		Description
Standard		
EN 60079-0		Electronic equipment for explosive atmospheres - General requirements
EN 60079-15		Representative standard for explosive gas atmospheres (X20/X67 for zone 2)

Table 16: ATEX - Explosion protection

Hazardous locations

Characteristics		Description
Class	I	Areas where there may be sufficient amounts of combustible gases or fumes in the air to result in an explosive or flammable mixture.
Division	2	Areas where there are normally no explosive gases, but which could be subject to explosive gases under abnormal conditions.
Groups	ABCD	Gas groups (A: Acetylene, B: Hydrogen, C: Ethylene, D: Propane)
Temperature class	T5	Maximum permissible surface temperature 100°C.

Table 17: HazLoc - Standards, criteria

Explosion protection		Description
Standard		
CSA Std C22.2 No. 0-M1991		General requirements - Canadian electrical code part II
CSA Std C22.2 No. 142-M1987		Process control equipment
CSA Std C22.2 No. 213-M1987		Non-incendive electrical equipment for use in Class I, Division 2 hazardous locations
UL Std No. 916:2007		Energy management equipment
ANSI/ISA 12.12.01:2007		Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations

Table 18: HazLoc - Explosion protection

8.4 Condensation, corrosive gas - X20c coated modules

Corrosive gas		Description
Standard		
EN 60068-2-60		Environmental testing - part 2: Tests, Test Ke: Flowing mixed gas corrosion test, effectiveness in stopping condensation
BMW GS 95011-4		Electronic component in car, condensation test and climate test

Table 19: Condensation, corrosive gas - X20c coated modules

8.5 Maritime / DNV GL

8.5.1 Standards, criteria

- B&R products are tested and certified for different environmental classes in the areas of temperature, humidity, vibration and electromagnetic compatibility. For the respective environmental classes and related operating conditions, see the technical data or corresponding certificate, which can be downloaded from the website (www.br-automation.com).
- The **compass safe distance measurement per EN 60945** was performed for maritime-certified products. This measurement is used to determine the protective distance to a compass located on the bridge. For the protective distances, see the certificates of the Federal Maritime and Hydrographic Agency on the B&R website in the listed section.

Category: Downloads / Certificates / Maritime / Compass safe distance / X20 or Power Panel T/C.

EN 60945 / application area C:

This standard describes minimum performance characteristics, testing procedures and necessary test results that can be used on all products tested against this standard.

Application area C description:

Application area C only with regard to EMC (electromagnetic compatibility) for all other devices installed on the bridge or deck, devices in direct proximity to receiving antennas and devices that can affect the safety of the ship's navigation and radio transmissions (see IMO resolution A.813).

Maritime Standard	Description
DNVGL-CG-0339 / IACS E10	Det Norske Veritas - Germanischer Lloyd X20 modules for environmental classes B (A) / B / B / B (for all areas incl. bridge and open deck)
EN 60945	Maritime navigation and radiocommunication equipment and systems Section 11.2 Compass safety distance Application area C

Table 20: Maritime / DNV GL - Standards, criteria

Notice!

The chapter "[Installation with increased vibration requirements \(4 g\)](#)" on page 14 and the respective product data sheet must be observed to fulfill the increased vibration requirements.

Notice!

For compliance with the required EMC limits the use of a line filter or a DNV-approved power supply unit suitable for EMC Class B is needed. For additional information, see the respective product data sheet. See also "[Line filter](#)" on page 39.

8.6 Underwriters Laboratories (UL)

UL (listing, recognition) Standard	Description
UL 508	Standard for industrial control equipment
UL 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
UL 61010-2-201	Standard for Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 2-201: Particular Requirements for Control Equipment

Table 21: UL (listing, recognition)

8.7 KC, EAC, RCM

KC, EAC, RCM Standard	Description
KC	Safety and EMC - Korean certification, based on CE (EU) conformity / Unified Korean certification mark
EAC	Eurasian conformity, based on CE (EU) conformity (regulations for Russia, Belarus, Kazakhstan, Armenia and Kyrgyzstan since 2015)
RCM	Conformity certificate from ACMA for Australia and Oceania (previously c-Tick), based on CE (EU) conformity

Table 22: KC, EAC, RCM