INSTALLATION / EMC GUIDE

X20 system - X67 system
Power Panels - Power supplies

Version:  1.30 (June 2019)
Model no.:  MAEMV-ENG

User's manual

Translation of the original manual

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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 different 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)

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Image: 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 (≥16 mm² to the control cabinet, ≥4 mm² 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

<table>
<thead>
<tr>
<th>Inductive DC loads</th>
<th>Inductive AC loads</th>
</tr>
</thead>
<tbody>
<tr>
<td>With diode</td>
<td>With Z-diode</td>
</tr>
<tr>
<td><img src="image1" alt="Diode Circuit" /></td>
<td><img src="image2" alt="Z-diode Circuit" /></td>
</tr>
<tr>
<td>With varistor</td>
<td>With RC element</td>
</tr>
<tr>
<td><img src="image3" alt="Varistor Circuit" /></td>
<td><img src="image4" alt="RC Element Circuit" /></td>
</tr>
</tbody>
</table>

Table 1: Application-specific measures

**Important!**

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.
Figure 2: Each module consists of 3 subcomponents – terminal block, electronics module and bus module.
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 38
- 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 (≥16 mm²).

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.

3.3.1 Horizontal installation

\[
b = n \cdot 12.5 + 0.2
\]

\(^1\) \(n \ldots \text{Number of modules}\)

Figure 3: 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

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.

Important!

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: X20 system - Vertical installation

Figure 5: X20AC0RF1 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 CPUs with exchangeable battery, foam tape must be applied to the inner side of the battery cover to help hold 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.

**Important!**

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1x Set X20ACORF1 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)</td>
<td><img src="image1.jpg" alt="Image of accessories" /></td>
</tr>
<tr>
<td>Apply foam tape (L = 15 mm) to the battery cover on the CPUs.</td>
<td><img src="image2.jpg" alt="Image of battery cover" /></td>
</tr>
<tr>
<td>Use X20IF0000 dummy module in empty slots</td>
<td><img src="image3.jpg" alt="Image of dummy module" /></td>
</tr>
</tbody>
</table>

**Table 2: Required accessories**
3.4 Wiring

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

![Figure 8: X20 system - Wiring](image)

**Important!**

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.

<table>
<thead>
<tr>
<th>Model number</th>
<th>Short description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>X20AC0SD1</td>
<td>B&amp;R screwdriver</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: X20AC0SD1 - Order data

3.4.1 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.
3.4.1.1 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

(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.
3.4.1.2 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 10: 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.
3.4.1.2.1 Cable shielding via X20 shielding bracket

<table>
<thead>
<tr>
<th>Attaching the shield with a ground terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>X20AC0SF7.0010 - 66 mm shielding bracket</td>
</tr>
<tr>
<td>Attaching the shield with a ground terminal</td>
</tr>
<tr>
<td>X20AC0SF9.0010 - 88 mm shielding bracket</td>
</tr>
</tbody>
</table>

![Diagram of cable duct and X20 shielding bracket](image)

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).

**Important!**

- 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.

3.4.1.2.2 X20 cable shield plate

As described in chapter "Shield connection" on page 15, 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.
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).
3.4.1.2.3 X20 shielding bracket

Order data

<table>
<thead>
<tr>
<th>Model number</th>
<th>Length</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>X20AC0SF7.0010</td>
<td>66 mm</td>
<td>• I/O modules</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Power supply modules</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Integrated I/O on X20CP13xx systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Onboard interfaces on CPUs</td>
</tr>
<tr>
<td>X20AC0SF9.0010</td>
<td>88 mm</td>
<td>• Interface modules</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bus controller modules</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• CPUs constructed in the form of an interface module</td>
</tr>
</tbody>
</table>

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:
Dimensions

Figure 12: X20AC0SF7.0010 - Dimensions

Figure 13: X20AC0SF9.0010 - Dimensions

Package contents
- 10 pcs. X20 shielding bracket
- Installation template
3.4.1.2.4 X20 shield connection clamp

Order data

<table>
<thead>
<tr>
<th>Model number</th>
<th>Short description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X20AC0SA08.0010</td>
<td>X20 shield connection clamp 3 to 8 mm, 10 pieces</td>
</tr>
<tr>
<td>X20AC0SA14.0010</td>
<td>X20 shield connection clamp 3 to 14 mm, 10 pieces</td>
</tr>
<tr>
<td>X20AC0SA20.0010</td>
<td>X20 shield connection clamp 5 to 20 mm, 10 pieces</td>
</tr>
<tr>
<td>X20AC0SA35.0010</td>
<td>X20 shield connection clamp 20 to 35 mm, 10 pieces</td>
</tr>
</tbody>
</table>

Table 6: X20AC0SA08.0010, X20AC0SA14.0010, X20AC0SA20.0010, X20AC0SA35.0010 - Order data

Dimensions

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

Table 7: 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.

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.
4.2 Installation

X67 modules can be installed in several different ways:

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

**Important!**

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.

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Figure 17: 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.

---

**Important!**

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.

<table>
<thead>
<tr>
<th>Model number</th>
<th>Short description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>X67ACTS35</td>
<td>X67 top-hat rail mounting plate</td>
<td><img src="image" alt="Table 8: X67ACTS35 - Order data" /></td>
</tr>
</tbody>
</table>

Table 8: X67ACTS35 - Order data

Figure 19: 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 20: 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 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 21: X67 system - Shielding and grounding](image)

**Important!**

The shielding at both ends of the cable must be professionally grounded on field-assembled cables!
4.3.3 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

Important!

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.

<table>
<thead>
<tr>
<th>Model number</th>
<th>Short description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>X67ACTQMX</td>
<td>X67 torque wrench set, for X67 M8 and M12 connectors, for hex-head connectors</td>
<td>![Image]</td>
</tr>
</tbody>
</table>

Table 9: X67ACTQMX - Order data
5 X2X Link settings

To improve the EMC radiation of the X2X bus, 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 22: Retaining clips

Figure 23: Mounting with retaining clips
Important!
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 - Rear view
Important!
Spacing for air circulation must be taken from the user's manual corresponding to the product family.

Figure 25: Power Panel T30 - Spacing for air circulation - Side view
Mounting orientation (e.g. T30)

Important!

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

Figure 26: Power Panel T30 - Mounting orientations
6.3 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 (≥4 mm²) over the intended spade terminal (Faston 6.3 mm).
Figure 29: Power Panel - Ground connection

Figure 30: Power Panel - Grounding
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 PS3400 (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).
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.

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

<table>
<thead>
<tr>
<th>Model number</th>
<th>Short description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0PB0200.1</td>
<td>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</td>
<td></td>
</tr>
</tbody>
</table>

Table 10: 0PB0200.1 - Order data
7.4 Installation and wiring

When installing power supplies intended for top-hat rail installation, the points under 3.3 "Installation" on page 9 must be observed. Information about wiring the various power supplies can be found in the information sheet and in the 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 model 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.
### General requirements

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ambient temperature during operation</strong></td>
<td>X20 standard modules, X20 coated modules, X20 coated safety modules</td>
</tr>
<tr>
<td></td>
<td>-25 to 60°C Vertical mounting orientation</td>
</tr>
<tr>
<td></td>
<td>X20 safety modules</td>
</tr>
<tr>
<td></td>
<td>0 to 60°C Horizontal mounting orientation</td>
</tr>
<tr>
<td></td>
<td>X67 modules</td>
</tr>
<tr>
<td></td>
<td>-25 to 60°C Any mounting orientation</td>
</tr>
<tr>
<td>Power Panel 65</td>
<td>0 to 50°C Vertical and horizontal mounting orientation</td>
</tr>
<tr>
<td>Power Panel T30</td>
<td>-20 to 60°C Vertical and horizontal mounting orientation</td>
</tr>
<tr>
<td>Power supplies</td>
<td>-25 to 70°C Horizontal mounting orientation (&gt;55°C derating)</td>
</tr>
<tr>
<td><strong>Relative humidity during operation</strong></td>
<td>X20 standard modules, X20 safety modules, Power supplies</td>
</tr>
<tr>
<td></td>
<td>Up to 95% non-condensing</td>
</tr>
<tr>
<td>X20 coated modules, X20 coated safety modules, X67 modules</td>
<td>Up to 100% Condensing possible</td>
</tr>
<tr>
<td>Power Panels</td>
<td>Up to 90% non-condensing</td>
</tr>
<tr>
<td><strong>Operating elevation</strong></td>
<td>All products</td>
</tr>
<tr>
<td></td>
<td>0 to 2000 m Installation at elevations above sea level</td>
</tr>
<tr>
<td></td>
<td>&gt;2000 m See data sheet.</td>
</tr>
<tr>
<td><strong>Resistance to vibration during operation</strong></td>
<td>All X20 modules</td>
</tr>
<tr>
<td></td>
<td>1 g Requirement in accordance with EN 61131-2</td>
</tr>
<tr>
<td>X67 modules</td>
<td>2 to 4 g Requirement in accordance with EN 60721-3-5 / Class 5M3</td>
</tr>
<tr>
<td>Power supplies</td>
<td>2.3 g Requirement in accordance with EN 61131-2 and DNV-GL / Class C</td>
</tr>
<tr>
<td><strong>Shock resistance during operation</strong></td>
<td>All X20 modules, Power Panels, power supplies</td>
</tr>
<tr>
<td></td>
<td>15 g Requirement in accordance with EN 61131-2</td>
</tr>
<tr>
<td>X67 modules</td>
<td>30 g Requirement in accordance with EN 60721-3-5 / Class 5M3 (Type I)</td>
</tr>
<tr>
<td><strong>Overvoltage category</strong></td>
<td>All X20 and X67 modules, Power Panels</td>
</tr>
<tr>
<td><strong>(EN 60664-1)</strong></td>
<td>II Requirement in accordance with EN 61131-2</td>
</tr>
<tr>
<td>Power supplies</td>
<td>III Requirement in accordance with EN 60204</td>
</tr>
<tr>
<td><strong>Pollution degree</strong></td>
<td>All products</td>
</tr>
<tr>
<td><strong>(EN 60664-1)</strong></td>
<td>2 Requirement in accordance with EN 61131-2</td>
</tr>
<tr>
<td><strong>Protection rating (IP code)</strong></td>
<td>All X20 modules, Power supplies</td>
</tr>
<tr>
<td><strong>(EN 60529)</strong></td>
<td>IP20 Control cabinet installation required</td>
</tr>
<tr>
<td>X67 modules</td>
<td>IP67 No installation required</td>
</tr>
<tr>
<td>Power Panels</td>
<td>IP20 First number IP2x Protection against ingress of solid foreign bodies ≥12.5 mm diameter</td>
</tr>
<tr>
<td></td>
<td>Second number IPx0 No protection against ingress of water with damaging consequences.</td>
</tr>
<tr>
<td></td>
<td>IP65 First number IP6x Dust-proof</td>
</tr>
<tr>
<td></td>
<td>Second number IPx5 Protection against water jets</td>
</tr>
<tr>
<td></td>
<td>IP67 First number IP6x Dust-proof</td>
</tr>
<tr>
<td></td>
<td>Second number IPx7 Protection against temporary submersion</td>
</tr>
</tbody>
</table>

Table 11: 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

<table>
<thead>
<tr>
<th>Protection rating</th>
<th>First number/IPx</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP20 protection</td>
<td>IP2x/IPx0</td>
<td>Protection against ingress of solid foreign bodies ≥12.5 mm diameter No protection against ingress of water with damaging consequences.</td>
</tr>
<tr>
<td>IP65 protection</td>
<td>IP6x/IPx5</td>
<td>Dust-proof Protection against water jets</td>
</tr>
<tr>
<td>IP67 protection</td>
<td>IP6x/IPx7</td>
<td>Dust-proof Protection against temporary submersion</td>
</tr>
</tbody>
</table>
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 can be found on the information sheet, on the B&R website at www.br-automation.com, in the technical data and data sheets / user’s manuals.

**ATEX**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device group</td>
<td>II</td>
</tr>
<tr>
<td>Device category</td>
<td>3</td>
</tr>
<tr>
<td>Area of use</td>
<td>G</td>
</tr>
<tr>
<td>Ignition protection types</td>
<td>nA</td>
</tr>
<tr>
<td>Equipment protection level</td>
<td>Gc</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>All areas except mining</td>
</tr>
<tr>
<td>Explosive gases, normal degree of safety</td>
</tr>
<tr>
<td>Gas, zone 2</td>
</tr>
<tr>
<td>Non-sparking</td>
</tr>
<tr>
<td>Use in areas where there is risk of gas explosions but no risk of ignition during normal operation</td>
</tr>
</tbody>
</table>

**Table 12: ATEX - Standards, criteria**

**Explosion protection**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 60079-0</td>
<td>Electronic equipment for explosive atmospheres - General requirements</td>
</tr>
<tr>
<td>EN 60079-15</td>
<td>Representative standard for explosive gas atmospheres (X20/X67 for zone 2)</td>
</tr>
</tbody>
</table>

**Table 13: ATEX - Explosion protection**

**Hazardous locations**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class</td>
<td>I</td>
</tr>
<tr>
<td>Division</td>
<td>2</td>
</tr>
<tr>
<td>Groups</td>
<td>ABCD</td>
</tr>
<tr>
<td>Temperature class</td>
<td>T5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Areas where there may be sufficient amounts of combustible gases or fumes in the air to result in an explosive or flammable mixture.</td>
</tr>
<tr>
<td>Areas where there are normally no explosive gases, but which could be subject to explosive gases under abnormal conditions.</td>
</tr>
<tr>
<td>Gas groups (A: Acetylene, B: Hydrogen, C: Ethylene, D: Propane)</td>
</tr>
<tr>
<td>Maximum permissible surface temperature 100°C.</td>
</tr>
</tbody>
</table>

**Table 14: HazLoc - Standards, criteria**

**Explosion protection**

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

**Table 15: HazLoc - Explosion protection**

**8.4 Condensation, corrosive gas - X20c coated modules**

<table>
<thead>
<tr>
<th>Corrosive gas</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td></td>
</tr>
<tr>
<td>EN 60068-2-60</td>
<td>Environmental testing - part 2: Tests, Test Ke: Flowing mixed gas corrosion test, effectiveness in stopping condensation</td>
</tr>
<tr>
<td>BMW GS 95011-4</td>
<td>Electronic component in car, condensation test and climate test</td>
</tr>
</tbody>
</table>

**Table 16: Condensation, corrosive gas - X20c coated modules**
8.5 Maritime / DNV GL

8.5.1 Standards, criteria

- The X20 modules are tested and certified for different environment classes in the areas temperature, moisture, vibration and electromagnetic compatibility. The respective environment classes and operational conditions can be looked up in the technical data or the corresponding certificate, which is available for download from the website www.br-automation.com.

- The safe compass distance measurement in accordance with EN 60945 has been performed for a wide variety of X20 modules. This measurement is undertaken to determine the safety distance between X20 modules and a compass on the ship's bridge. These safety distances can be found in certificate no. 879 from the German Federal Maritime and Hydrographic Agency in the following section of the B&R website: Section: Downloads / Certificates / Maritime / Compass safe distance / X20

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).

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

Table 17: Maritime / DNV GL - Standards, criteria

Important!
The chapter "Installation with increased vibration requirements (4 g)" on page 11 and the respective product data sheet must be observed to fulfill the increased vibration requirements.

8.6 Underwriters Laboratories (UL)

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

Table 18: UL (listing, recognition)

8.7 KC, EAC, RCM

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

Table 19: KC, EAC, RCM