Mobile Panel 100/200

User's Manual

Version: **2.61 (February 2011)**

Model number: **MAMP100.200-ENG**

Translation of the original operating instructions

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Chapter 1 • General information

Information:

B&R does its best to keep the printed versions of its user's manuals as current as possible. However, sometimes a newer version of the user's manual can be downloaded in electronic form (pdf) from the B&R homepage www.br-automation.com.

1. Manual history

Version	Date	Changes
1.0	16.03.2004	First edition, created with BuR HB manual template V33_09_2003
1.1	17.09.2004	- New image for "Automation Runtime summary screen" on page 180 and corresponding description in the table "Automation Runtime summary screen" on page 180. - New image for "Wall mount" on page 107. - Section for wall mount installation of the Mobile Panel using 4MPBRA.0000-00 added (see section "Storing the Mobile Panel device" on page 109). - Replacement touch screen pen added, see section "Touch screen pen" on page 222. - Section "Recommended monitoring devices" on page 116 updated - Note regarding unwanted safety category 4 according to EN 954-1 was added. - Section "Switching cabinet cable (straight thru) 5CAMPC.0020-11" on page 103 (5CAMPC.0020-01) added. - Chapter 5 "Standards and certifications" updated. - Safety-related texts matched to the current BGFE guidelines. - Section "Current load of the enable switch and command device circuit" on page 123 added - Section "Features" on page 34 for Mobile Panel devices updated. - Section "Entire device" on page 37 updated. - Figure "Dimensions - entire device" on page 37 added. - "Appendix A" updated. - Section 5 "CompactFlash cards 5CFCRD.xxxx-02" updated. - Technical data for all operating units was expanded.

Table 1: Manual history

Version	Date	Changes
1.1	17.09.2004	- 2 GB CompactFlash card (5CFCRD.2048-02) added. - Length tolerance values for connection and switching cabinet cables added. - Connection and switching cabinet cable weight values per meter added. - USB memory sticks (5MMUSB.0128-00, 5MMUSB.0256-00, 5MMUSB.0512-00) added. - New "Connection example - Enable switch" on page 121 with new monitoring device. - Connection example for E-stop and key switch added for "Category 3 according to EN 954-1", on page 86. - Connection example for E-stop and key switch added for "Category 2 according to EN 954-1", on page 87. - Connection example for E-stop and key switch added for "Connection example for safety circuits up to category 1 according to EN 954-1", on page 85. - Connection example for E-stop and key switch added for "Category B according to EN 954-1", on page 91. - Connection example for enable switch added for "Category 3, 2, 1 and B according to EN 954-1", on page 94. - 7 meter long Mobile Panel attachment cable (5CAMPH.0070-00) added. - Application example for the Mobile Panel with Automation Runtime expanded (see section "Control and visualization with the Mobile Panel" on page 178 or section "Operation and monitoring with the Mobile Panel" on page 179). - Application example for the Mobile Panel with BIOS expanded (see section "Mobile Panel as a thin client" on page 184). - Model numbers for Windows CE added (see section 5.8 "Software" on page 32). - Shock and vibration values added to the general device data. - Section 4.5 "Serial ActiveSync connection" on page 183 (cable specifications) added. - Windows XP Embedded section added. - SanDisk White Paper added for calculating CompactFlash lifespan. - Mobile Panel labeling sticker added (see "Type plate" on page 48).
1.2	18.10.2004	- New notes for the device components listed in Appendix A. - Section 3.1.7 "Switches, buttons and batteries" moved to chapter 2 "Technical data". - Description for the mode/node switch settings for the Mobile Panel with BIOS updated (see table 17 "BIOS switch settings for the mode / node switch"). - Information for securing the enable switch and command device circuit added (see page 123).
1.3	22.10.2004	- Standard overview changed: EN418 added, PSA guidelines removed. - Existing note for the limited enable function on the controller-side that is time or program step dependent is defined as warning (see section 4.6.3 "Enable switch" on page 26).
1.4	28.10.2004	- Correction of E-stop button properties to pre-emption. - Text changed in "General Information" section for the type plate. - Chapter 3 Start-up / Operation updated (e.g. removal of safety circuits). - Text changed in Chapter 5 Standards and Certifications - section Standards and Definitions for Safety Technology - footnote 1.
1.5	29.10.2004	- Correction of the maximum current load limit for the enable switch circuit from 0.5 to 0.4 A. - Fuse type for protecting the E-stop circuit and enable switch circuit changed from 0.5 to 0.4 A. - Text changes concerning using the PNOZ e2.1p as monitoring device for the enable switch made on page 116.
1.6	01.03.2005	- BG safety certification added (see chapter 5 "Standards and certifications", section 8.1 "Safety certification" on page 208) - Section 4 "Connection and Shielding" on page 124 added
1.7	23.03.2005	- Information regarding reverse polarity protection for supply voltage added.

Table 1: Manual history (Forts.)

Version	Date	Changes
1.80	26.09.2006	- Specification for IP54 protection revised (additional information: protection from dust and sprayed water) - Length value for the 20 meter attachment cable corrected in 27 "Technical data - Mobile Panel cable 5CAMPH.0xxx-10"(previously 15 meters). - Name change for CompactFlash abbreviation. - "Key and LED configurations" on page 126 added. - "HMI Drivers & Utilities DVD 5SWHMI.0000-00" on page 190 added. - Glossary created. - Viewing angle/contrast added for each operating unit. - Accessories revised. - "Mobile Panel with BIOS" on page 135 added. - In figure "Connection and Shielding" on page 124, pin assignments changed. - Safety guidelines revised (ESD problems). - "Protective caps" on page 240 added. - New cable added. - Photos updated. - New model numbers for Windows CE and Windows XPe. - Chapter 3 renamed to "Commissioning". - 2 USB flash drive 5MMUSB.2048-00 from SanDisk added.
1.90	15.01.2007	- Perspective description modified. - "Viewing angles" on page 274 added. - Key switch information modified. - Cable photos changed and manufacturer ID deleted. - Drilling templates changed. - "Connection and Shielding" on page 124 changed. - "Current load of the enable switch and command device circuit" on page 123 changed. - Text changes: Cover changed to cap. - Caps added. - "Connection box 4MPBCBX.0000-00" added on page 104. - "Box cable 5CAMPB.0100-10" added on page 100. - Hot plug button added on page 252. - "Exchanging the box cable" added on page 249. - "Cable gland / screw plug" on page 239. - "Connection example - safety circuits up to category 3 according to EN 954-1" on page 122 and "Connection example - safety circuits up to category 3 according to EN 954-1" on page 124 added. - USB flash drive 5MMUSB.0256-00 and USB flash drive 5MMUSB.1024-00 cancelled
2.00	27.03.2007	- Connection box 4MPCBX.0000-00 and box cable 5CAMPB.0100-10 revised and moved to chapter 6, Accessories. - Hot plug button removed from page 252. - Exchanging the box cable removed. - Cable gland / screw plug removed. - Connection examples revised. - Description of switching cabinet cable revised. - "Strapping plug" on page 110 added.
2.10	18.04.2007	- "Application examples" on page 129 added. - "Features" on page 244 added. - Section "USB flash drive" on page 236 updated. - Installation of the attachment cable protective cap on page 242 and installation of the switching cabined cable cap on page 243 added. - "Application examples" on page 129 added.

Table 1: Manual history (Forts.)

Version	Date	Changes
2.20	10.06.2008	- New model numbers for Windows CE and Windows XPe expanded. - Section "Mobile Panel with Windows CE" on page 181 and section "Mobile Panel with Windows XP Embedded" on page 185 updated. - Section 6 "Touch screen calibration" on page 128 added - Section "Preventing after-image effect in LCD/TFT monitors" updated. - Additional temperature humidity diagram information - Section 9 "Overview of time references - Real-time clock (RTC)" on page 275 added -Real-time clock specifications updated in technical data of individual components (footnote, cross-reference to overview of time references, text). - Section "Replacement CMOS batteries" on page 221 and section "Changing the battery" on page 255 updated. - Heading correction for the cables. - Vibration / shock data revised. - Labels for viewing angle information revised.
2.30	06.02.2009	- Section 4.7 "Environmentally-friendly disposal" on page 26 added - USB flash drive 5MMUSB.0512-00 discontinued. - OEM Microsoft Windows XPe MP100/200 w/CF English 9S0001.21-020 discontinued. - Figure 69 "Hardware numbers - BIOS device keys" on page 127 updated. - Figure 70 "Application example - MP100" on page 129, figure 71 "Application example - MP200" on page 129 and figure 72 "Mobile thin client" on page 130 updated. - Phantom key info added to the technical data. - Safety notice headings changed to the required nomenclature. - Humidity specifications in the technical data on page 38 modified. - Table entries "Technical data" on page 44 changed. - Section "Inserting a CompactFlash card" and section "Removing a CompactFlash card" shifted to chapter 3 "Commissioning" on page 113. - Layout of images revised (orange arrows, text formatting, etc). - Figure 109 "Control and visualization with Mobile Panel" on page 178, figure 110 "Operation and monitoring with the Mobile Panel" on page 179 and figure 114 "Mobile Panel as a thin client" on page 184 updated. - Figure 68 "Display - Keys in the matrix" on page 126 edited. - "Compact Flash" spelling changed to "CompactFlash". - Information in section 6 "B&R Key Editor" on page 188 updated. - "Connection box, small 4MPCBX.0001-00" on page 245 added.

Table 1: Manual history (Forts.)

Version	Date	Changes
2.40	12.08.2009	- Technical data for Silicon Systems CompactFlash cards revised. - Attachment cable 5CAMPH.0018-10 added. - Mobile Panel selection guide on page 35 updated. - Humidity specifications changed in the technical data. - Temperature humidity diagrams added for operating units (individual devices). - Info text ("Information") on the décor foil and filter glass in Appendix A changed. - Information about BG safety certification added (see chapter 5 "Standards and certifications", "Safety certification" on page 208) - Specifications for "Strapping plug" on page 110 revised (weight, dimensions). - Wording for "Windows XP Embedded" and "B&R Embedded OS Installer" standardized throughout document. - Numbering of headings and heading type on page 128 changed (6.2.1 -> 6.3). - Wording for "remote PC" changed to "Remote PC" in German documentation. - Information (General) for Windows XP Embedded on page 185 updated. - Section 2.5 "Creating a bootable CompactFlash card for B&R upgrade files" on page 172 added - The "Touch screen type" table entry was added to the technical data for the devices. - Temperature humidity diagram (5.7" and 8.4" displays) updated in the description of the overall device. - Section "AMT Touch" on page 265 added - Section "Gunze Touch" on page 269 revised and temperature humidity diagram updated. - Figure 159 "Temperature humidity diagram - 3M touch screen" on page 268 added - PILZ, PNOZ PST1 incl. connection example removed from manual. - Graphic labeling of Figure 62 "Connection example - Safety circuits up to EN 13849-1:2008 Category 3" on page 118 changed (MP40/50 -> MP100/200). - Spelling for $\overline{TX}$ and $\overline{RX}$ changed to TX\ and RX\. - Figure 51 on page 101 and figure 54 on page 105 revised.
2.50	09.10.2009	- "Information" section in section "CompactFlash cards 5CFCRD.xxxx-03" on page 223 updated. - Package amount and model number for lithium battery 0AC201.91 changed. - "Transport" in figure 129 "Temperature humidity diagram - USB flash drive - 5MMUSB.xxxx-00" on page 238 updated. - Section "Mobile Panel with Windows CE" on page 181 updated. - Section "Mobile Panel with Windows XP Embedded" on page 185 updated.
2.60	02.12.2009	- Requirements regarding the machine guideline 2006/42/EG, EN ISO 13849-1 added and adjusted. - Section 9 "User tips for increasing the display lifespan" on page 133 added. - Section 9 "Standards and definitions for safety technology" on page 209 updated. - Section 9.3 "Safety category according to EN ISO 13849-1:2008 (safety of machines - safety related parts of control systems, Part 1: General design principles)" on page 210 added. - Section 10 "Information regarding machine guideline 2006/42/EG" on page 216 added. - Note added to the title page (German version) indicating original operating instructions. - Section 2.4 "Creating an MS-DOS boot diskette in Windows XP" on page 170 added. - Section "Preventing after-image effect in LCD/TFT monitors" in Chapter 7 "Maintenance / Servicing" removed.
2.61	01.02.2011	- Section 10 "Pixel errors" on page 134 added.

Table 1: Manual history (Forts.)

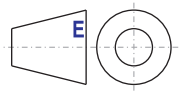
2. Organization of safety notices

The safety notices in this manual are organized as follows:

Safety notice	Description
Danger!	Disregarding the safety regulations and guidelines can be life-threatening.
Caution!	Disregarding the safety regulations and guidelines can result in severe injury or major damage to material.
Warning!	Disregarding the safety regulations and guidelines can result in injury or damage to material.
Information:	Important information for preventing errors.

Table 2: Organization of safety notices

3. Guidelines



All dimension diagrams (e.g. dimension diagrams, etc.) are drawn according to European dimension standards.

4. Safety regulations

Information:

The instructions in this manual regarding the wiring and devices that are used to ensure safety must be followed precisely at all times. Failure to do so may result in dangerous situations in which the safety equipment integrated in the Mobile Panel device is made ineffective.

Danger!

The specific safety guidelines for safety and accident prevention regulations must also be reviewed with respect to the particular operating environment in addition to and independent of this document.

4.1 Intended use

Programmable logic controllers (PLCs), operating and monitoring devices (industrial PCs, Power Panels, Mobile Panels, etc.), and B&R uninterruptible power supplies have been designed, developed, and manufactured for conventional use in industry. They were not designed, developed, and manufactured for any use involving serious risks or hazards that could lead to death, injury, serious physical damage, or loss of any kind without the implementation of exceptionally stringent safety precautions. In particular, such risks and hazards include the use of these devices to monitor nuclear reactions in nuclear power plants, as well as flight control systems, flight safety, the control of mass transit systems, medical life support systems and the control of weapons systems.

4.2 Protection against electrostatic discharges

Electrical components that are vulnerable to electrostatic discharge (ESD) must be handled accordingly.

4.2.1 Packaging

- Electrical components with housing
  … do not require special ESD packaging, but must be handled properly
  (see "Electrical components with housing").
- Electrical components without housing
  … must be protected by ESD-suitable packaging.

4.2.2 Guidelines for proper ESD handling

Electrical components with housing

- Do not touch the connector contacts on connected cables.
- Do not touch the contact tips on the circuit boards.

Electrical components without housing

In addition to "Electrical components with housing", the following also applies:

- Any persons handling electrical components or devices that will be installed in the electrical components must be grounded.
- Components can only be touched on the small sides or on the front plate.
- Components should always be stored in a suitable medium (ESD packaging, conductive foam, etc.).
  Metallic surfaces are not suitable storage surfaces!
- Electrostatic discharges should be avoided on the components (e.g. through charged plastics).
- A minimum distance of 10 cm must be kept from monitors and TV sets.
- Measurement devices and equipment must be grounded.
- Measurement probes on potential-free measurement devices must be discharged on sufficiently grounded surfaces before taking measurements.

Individual components

- ESD protective measures for individual components are thoroughly integrated at B&R (conductive floors, footwear, arm bands, etc.).

The increased ESD protective measures for individual components are not necessary for our customers for handling B&R products.

4.3 Policy and procedures

Electronic devices are generally not failsafe. In the event of a failure on the programmable control system, operating or monitoring device, or uninterruptible power supply, the user is responsible for ensuring that other devices that may be connected, e.g. motors, are in a secure state.

Both when using programmable logic controllers and when using operating and monitoring devices as control systems in conjunction with a soft PLC (e.g. B&R Automation Runtime or comparable products) or a slot PLC (e.g. B&R LS251 or comparable products), the safety precautions applying to industrial control systems (e.g. the provision of safety devices such as

emergency stop circuits, etc.) must be observed in accordance with applicable national and international regulations. The same applies for all other devices connected to the system, such as drives.

All tasks such as installation, commissioning, and maintenance are only permitted to be carried out by qualified personnel. Qualified personnel are persons who are familiar with the transport, mounting, installation, commissioning, and operation of the product and who have the appropriate qualifications (e.g. IEC 60364). National accident prevention guidelines must be followed.
The safety guidelines, connection descriptions (rating plate and documentation) and limit values listed in the technical data must be read carefully and must be observed before installation and commissioning.

4.4 Transport and storage

During transport and storage, devices must be protected from excessive stress (mechanical load, temperature, humidity, aggressive atmospheres, etc.).

4.5 Installation

- Installation must take place according to the documentation, using suitable equipment and tools.
- Devices must be installed without voltage applied and by qualified personnel.
- General safety regulations and nationally applicable accident prevention guidelines must be observed.
- Electrical installation must be carried out according to the relevant guidelines (e.g. line cross section, fuse, protective ground connection).

4.6 Operation

Warning!

- **When operating a system with a Mobile Panel, ensure that operation is only possible using the Mobile Panel and is not possible from any other point in the system.**
- **If the safety equipment (safety door, etc.) is not active, movements may only be carried out using the Mobile Panel at reduced speed and with the enable switch activated.**

Danger!

When using an E-stop circuit according to EN 13849-1:2008, the function of the E-stop circuit must be checked at least monthly.

4.6.1 Supply voltage

Caution!

- **The 24 VDC supply must be separated from the low voltage signals in a secure manner to provide protection from dangerous voltages. This can be done, for example, using a safety transformer or similar equipment.**
- **When dimensioning the supply, the voltage drop on the Mobile Panel attachment cable and switching cabinet cable must be taken into consideration.**
- **The supply circuit must be protected using a 3 A (slow-blow) fuse.**

Warning!

- **The project engineer for a machine or system must take steps to ensure that an interrupted program is started again properly following voltage dips and power failures. No potentially dangerous operating states should be permitted to occur - not even temporarily.**
- **Errors that occur on automation systems can cause personal injury and damage to materials; therefore, additional measures must be taken to ensure safe operation of the entire system even when errors occur.**
- **The functionality of the safety-related equipment (e.g. E-stop and enable switch) must be monitored cyclically.**
- **After heavy loads, e.g. shock to the device or dropping the device, the safety-related equipment must be checked.**

4.6.2 E-stop system

The E-stop safety equipment found on the Mobile Panel meets EN ISO 13850-1:2006 requirements and can be used together with a corresponding monitoring system for safety-relevant control tasks (up to category 4 according to EN 13849-1:2008).

Danger!

- **When unplugged, the Mobile Panel must be kept away from dangerous areas on the machine or system and must be locked up. An E-stop that is not connected must be kept out of sight, because when an emergency occurs the user will press the closest E-stop. If the disconnected E-stop is pressed nothing will happen.**
- **The E-stop must be effective in every operating mode of the machine or system.**
- **Deactivation of the E-stop must never cause an automatic restart.**
- **The E-stop is not a replacement for safety equipment.**
- **If the machine or system was brought to a standstill using the E-stop button, the E-stop button is only to be deactivated and the system being monitored is only to be restarted after the reason for stopping has been corrected and the dangerous situation no longer exists.**

Caution!

Dropping the Mobile Panel can trigger the E-stop button and cause the system being monitored to come to a standstill.

Connection examples for the E-stop button and the key switch for various categories (EN 13849-1:2008) can be found in chapter 3 "Commissioning", section "Connection examples - E-stop and key switch" on page 116.

4.6.3 Enable switch

The enabling equipment consists of the enable button as seen in figure 30 "Handle 4MPHDL.0000-00" on page 75 and is part of the Mobile Panel safety equipment.

Safety category 4 according to EN 13849-1:2008 can be achieved by implementing enabling equipment with 2-circuits and using a corresponding monitoring device.

The enabling functionality is described in EN60204. The 3-step enable switch is state-of-the-art technology. The "Null" and "Panic" positions on the enable switch represent off functions. Only the "Enable" position allows activation. The standards EN60204 and IEC60204-1 are identical, which provides the 3-step enabling switch with international significance.

Warning!

When applicable, the enable function should be limited on the controller according to time or program step.

The electromechanical enable switch and equipment are to be linked with the controller so that the safety-related circuit requirements are met according to DIN EN 775, DIN EN 60204-1, DIN EN 13849-1:2008, DIN EN 1088 and VDI 2854.

Any cables and lines used to set up the system (except for protective ground conductors) that are accessible or open to other conductive parts without opening or removing a cover must either have double or reinforced insulation between the wires and the surface. Otherwise, they must have a metal sheath that can handle the current if a short-circuit occurs between the wire and sheath.

Warning!

- **The enable switch is only suitable as a protective function if the person activating the enable switch can recognize the danger in time and immediately take appropriate action!**
- **Commands for dangerous states must not be initiated by the enable switch alone. A second conscious start command is required here. The only person permitted in the danger area is the person activating the enable switch.**

An enable switch connection example for a monitoring device can be found in Chapter 3 "Commissioning", Section 3.2 "Connection example - Enable switch" on page 121.

4.7 Environmentally-friendly disposal

All B&R programmable controllers, operating and monitoring devices, and uninterruptible power supplies are designed to inflict as little harm on the environment as possible.

4.7.1 Separation of materials

It is necessary to separate different materials so the device can undergo an environmentally-friendly recycling process.

Component	Disposal
Programmable logic controllers Operating and monitoring devices Uninterruptible power supply Cables	Electronics recycling
Cardboard box / paper packaging	Paper / cardboard recycling
Plastic packaging	Plastic recycling

Table 3: Environmentally-friendly separation of materials

Disposal must comply with the respective legal regulations.

5. Model numbers

5.1 Operating unit

Model number	Product ID	Note
4MP181.0843-03	**MP181 TFT C VGA 8.4" FT** Operating unit with 8.4" VGA color LCD with touch screen (resistive); 19 system keys; 64 MB SDRAM; CompactFlash slot (type I); ETH10/100; RS232 (RxD, TxD); USB; E-stop; key switch; IP54 protection (only with handle 4MPHDL.0000-00).	See page 51
4MP251.0571-12	**MP251 LCD C QVGA 5.7" F** Operating unit with 5.7" QVGA color LCD; 14 softkeys and 19 system keys; 64 MB SDRAM; CompactFlash slot (type I); ETH10/100; RS232 (RxD, TxD); CAN; USB; E-stop; key switch; IP54 protection (only with handle 4MPHDL.0000-00).	See page 56
4MP281.0571-12	**MP281 LCD C QVGA 5.7" FT** Operating unit with 5.7" QVGA color LCD with touch screen (resistive); 14 softkeys and 19 system keys; 64 MB SDRAM; CompactFlash slot (type I); ETH10/100; RS232 (RxD, TxD); CAN; USB; E-stop; key switch; IP54 protection (only with handle 4MPHDL.0000-00).	See page 61
4MP281.0843-13	**MP281 TFT C VGA 8.4" FT** Operating unit with 8.4" VGA color LCD with touch screen (resistive); 19 system keys; 64 MB SDRAM; CompactFlash slot (type I); ETH10/100; RS232 (RxD, TxD); CAN; USB; E-stop; key switch; IP54 protection (only with handle 4MPHDL.0000-00).	See page 66
5MP181.0843-07	**MP181 TFT C VGA 8.4" FT** Operating unit with 8.4" VGA color LCD with touch screen (resistive); 19 system keys; 128 MB SDRAM; CompactFlash slot (type I); ETH10/100; RS232 (RxD, TxD); USB; E-stop; key switch; IP54 protection (only with handle 4MPHDL.0000-00).	See page 71

Table 4: Model numbers - Mobile Panel operating units

5.2 Handle

Model number	Product ID	Note
4MPHDL.0000-00	**Mobile Panel handle** Mobile Panel handle with integrated three-step enable switch.	See page 75

Table 5: Model number - Mobile Panel handle

5.3 Attachment cable

Model number	Product ID	Note
5CAMPH.0050-00	**Mobile Panel attachment cable, 5 m**[1)] Mobile Panel attachment cable, 5 meters long; with plug contacts for cabling the Mobile Panel and an industrial connector for the switching cabinet cable.	See page 81
5CAMPH.0070-00	**Mobile Panel attachment cable, 7 m**[1)] Mobile Panel attachment cable, 7 meters long; with plug contacts for cabling the Mobile Panel and an industrial connector for the switching cabinet cable.	See page 81
5CAMPH.0100-00	**Mobile Panel attachment cable, 10 m**[1)] Mobile Panel attachment cable, 10 meters long; with plug contacts for cabling the Mobile Panel and an industrial connector for the switching cabinet cable.	See page 81

Table 6: Model numbers - Mobile Panel attachment cables

Model number	Product ID	Note
5CAMPH.0150-00	**Mobile Panel attachment cable, 15 m**[1)] Mobile Panel attachment cable, 15 meters long; with plug contacts for cabling the Mobile Panel and an industrial connector for the switching cabinet cable.	See page 81
5CAMPH.0200-00	**Mobile Panel attachment cable, 20 m**[1)] Mobile Panel attachment cable, 20 meters long; with plug contacts for cabling the Mobile Panel and an industrial connector for the switching cabinet cable.	See page 81
5CAMPH.0018-10	**Mobile Panel attachment cable, 1.8 m**[1)] Mobile Panel attachment cable, 1.8 meters long; with plug contacts for cabling the Mobile Panel, including a circular plug for the switching cabinet cable.	See page 85
5CAMPH.0050-10	**Mobile Panel attachment cable, 5 m**[1)] Mobile Panel attachment cable, 5 meters long; with plug contacts for cabling the Mobile Panel and a circular plug for the switching cabinet cable.	See page 85
5CAMPH.0100-10	**Mobile Panel attachment cable, 10 m**[1)] Mobile Panel attachment cable, 10 meters long; with plug contacts for cabling the Mobile Panel and a circular plug for the switching cabinet cable.	See page 85
5CAMPH.0150-10	**Mobile Panel attachment cable, 15 m**[1)] Mobile Panel attachment cable, 15 meters long; with plug contacts for cabling the Mobile Panel and a circular plug for the switching cabinet cable.	See page 85
5CAMPH.0200-10	**Mobile Panel attachment cable, 20 m**[1)] Mobile Panel attachment cable, 20 meters long; with plug contacts for cabling the Mobile Panel and a circular plug for the switching cabinet cable.	See page 85

Table 6: Model numbers - Mobile Panel attachment cables (Forts.)

1) Proper operation of the serial interface is only guaranteed up to a total cable length of 15 meters (attachment cable + switching cabinet cable + application-specific cables).

5.4 Switching cabinet cable

Model number	Product ID	Note
5CAMPC.0020-00	**Switching cabinet cable (crossover) 2 m**[1)] Switching cabinet cable, 2 meters long; with wire tip sleeves for connection in the switching cabinet and built-in socket for the Mobile Panel attachment cable.	See page 89
5CAMPC.0020-01	**Switching cabinet cable (straight thru) 2 m**[1)] Switching cabinet cable, 2 meters long; with wire tip sleeves for connection in the switching cabinet and built-in socket for the Mobile Panel attachment cable.	See page 94
5CAMPC.0020-10	**Switching cabinet cable (crossover) 2 m**[1)] Switching cabinet cable, 2 meters long; with wire tip sleeves for connection in the switching cabinet and receptacle for the Mobile Panel attachment cable.	See page 99
5CAMPC.0020-11	**Switching cabinet cable (straight thru) 2 m**[1)] Switching cabinet cable, 2 meters long; with wire tip sleeves for connection in the switching cabinet and receptacle for the Mobile Panel attachment cable.	See page 103

Table 7: Model numbers - Mobile Panel switching cabinet cables

1) Proper operation of the serial interface is only guaranteed up to a total cable length of 15 meters (attachment cable + switching cabinet cable + application-specific cables).

5.5 Wall mount

Model number	Product ID	Note
4MPBRA.0000-00	**Wall mount with cable supports** Wall mount for storing the Mobile Panel; with supports for the Mobile Panel attachment cable.	See page 107

Table 8: Model number - Mobile Panel wall mount

5.6 Strapping plug

Model number	Product ID	Note
4MPBYP.0000-00	**Strapping plug** Mobile Panel lock pull strapping plug for switching cabinet cable 5CAMPC.0020-00, 5CAMPC.0020-01.	See page 110
4MPBYP.0000-10	**Strapping plug** Mobile Panel push pull strapping plug for switching cabinet cable 5CAMPC.0020-10, 5CAMPC.0020-11.	See page 110

Table 9: Model number - Mobile Panel strapping plug

5.7 Accessories

Model number	Product ID	Note
0AC201.91	**Lithium batteries, 4 pcs**. Lithium batteries, 4 pcs., 3 V / 950 mAh, button cell	See page 221
4A0006.00-000	**Lithium battery (1x)** Lithium battery, 1 pc., 3 V / 950 mAh, button cell	See page 221
5AC900.1100-00	**Touch screen pen (5x)** Five replacement touch screen pens	See page 222
5CFCRD.0064-03	**CompactFlash 64 MB SSI** CompactFlash card with 64 MB SLC NAND flash and IDE/ATA interface	See page 223
5CFCRD.0128-03	**CompactFlash 128 MB SSI** CompactFlash card with 128 MB SLC NAND flash and IDE/ATA interface	See page 223
5CFCRD.0256-03	**CompactFlash 256 MB SSI** CompactFlash card with 256 MB SLC NAND flash and IDE/ATA interface	See page 223
5CFCRD.0512-03	**CompactFlash 512 MB SSI** CompactFlash card with 512 MB SLC NAND flash and IDE/ATA interface	See page 223
5CFCRD.1024-03	**CompactFlash 1024 MB SSI** CompactFlash card with 1024 MB SLC NAND flash and IDE/ATA interface	See page 223
5CFCRD.2048-03	**CompactFlash 2048 MB SSI** CompactFlash card with 2048 MB SLC NAND flash and IDE/ATA interface	See page 223
5CFCRD.4096-03	**CompactFlash 4096 MB SSI** CompactFlash card with 4096 MB SLC NAND flash and IDE/ATA interface	See page 223
5CFCRD.8192-03	**CompactFlash 8192 MB SSI** CompactFlash card with 8192 MB SLC NAND flash and IDE/ATA interface	See page 223
5CFCRD.0032-02	**CompactFlash 32 MB SanDisk/A** CompactFlash card with 32 MB flash PROM and IDE/ATA interface.	*Cancelled since 12/2005*

Table 10: Model numbers - Accessories

Model number	Product ID	Note
5CFCRD.0064-02	**CompactFlash 64 MB SanDisk/A** CompactFlash card with 64 MB flash PROM and IDE/ATA interface.	*Cancelled since 12/2005*
5CFCRD.0128-02	**CompactFlash 128 MB SanDisk/A** CompactFlash card with 128 MB flash PROM and IDE/ATA interface	*Cancelled since 12/2005*
5CFCRD.0256-02	**CompactFlash 256 MB SanDisk/A** CompactFlash card with 256 MB flash PROM and IDE/ATA interface	*Cancelled since 12/2005*
5CFCRD.0512-02	**CompactFlash 512 MB SanDisk/A** CompactFlash card with 512 MB flash PROM and IDE/ATA interface	*Cancelled since 12/2005*
5CFCRD.1024-02	**CompactFlash 1024 MB SanDisk/A** CompactFlash card with 1024 MB flash PROM and IDE/ATA interface	*Cancelled since 12/2005*
5CFCRD.2048-02	**CompactFlash 2048 MB SanDisk/A** CompactFlash card with 2048 MB flash PROM and IDE/ATA interface	*Cancelled since 12/2005*
5MMUSB.0256-00	**USB flash drive 256 MB SanDisk** USB 2.0 flash drive 256 MB	*Canceled since 03/2007 - Replaced by 5MMUSB.2048-00*
5MMUSB.0512-00	**USB flash drive 512 MB SanDisk** USB 2.0 flash drive 512 MB	*Canceled since 07/2007 - Replaced by 5MMUSB.2048-00*
5MMUSB.1024-00	**USB flash drive 1 GB SanDisk** USB 2.0 flash drive 1 GB	*Canceled since 03/2007 - Replaced by 5MMUSB.2048-00*
5MMUSB.2048-00	**USB flash drive 2 GB SanDisk** USB 2.0 flash drive 2 GB	See page 236
5CAMPP.0000-00	**Protective cap for add-on socket (attachment cable)** Protection for attachment cable during transport	See page 240
5CAMPP.0000-10	**Protective cap for circular plug (attachment cable)** Protection for attachment cable during transport	See page 240
5CAMPP.0001-10	**Protective cap for receptacle (switching cabinet cable)** Protection for switching cabinet cable during transport	See page 240
4MPCBX.0000-00	**MP connection box PP** Connection box for adapting the connection points for Mobile Panel devices.	See page 244
4MPCBX.0001-00	**MP connection box, small PP** Connection box for adapting the connection points for Mobile Panel devices.	See page 245
5CAMPB.0100-10	**MP box cable, 10m PP** Box cable, 10 meters long; with wire tip sleeves for connection in the switching cabinet; with plug contacts for wiring in the connection box.	See page 246

Table 10: Model numbers - Accessories

5.8 Software

Model number	Product ID	Note
5SWHMI.0000-00	**HMI Drivers & Utilities DVD** Contains drivers, utilities, software upgrades and user's manuals for B&R panel system products (see B&R homepage – Industrial PCs, Visualization and Operation).	See page 190
9S0001.13-010	**OEM Microsoft Windows CE 4.1 German** OEM Microsoft Windows CE 4.1 German license, only supplied together with a Mobile Panel BIOS device.	See page 181
9S0001.13-020	**OEM Microsoft Windows CE 4.1 English** OEM Microsoft Windows CE 4.1 English license, only supplied together with a Mobile Panel BIOS device.	See page 181
9S0001.17-020	**OEM Microsoft Windows CE 4.2 English** OEM Microsoft Windows CE 4.2 English license, only supplied together with a Mobile Panel BIOS device.	See page 181
9S0001.29-020	**OEM Microsoft Windows CE 5.0 English** OEM Microsoft Windows CE 5.0 English license, only supplied together with a Mobile Panel BIOS device.	See page 181
5SWWCE.0519-ENG	**WinCE5.0 Pro MP100 SCX200** Microsoft OEM Windows CE 5.0 Professional, English; for MP181 BIOS; order CompactFlash separately (at least 128 MB).	See page 181
5SWWCE.0619-ENG	**WinCE5.0 ProPlus MP100 SCX200** Microsoft OEM Windows CE 5.0 Professional plus, English; for MP181 BIOS; order CompactFlash separately (at least 128 MB).	See page 181
9S0001.21-020	**OEM Microsoft Windows XPe MP100/200 w/CF English** Only available with a Mobile Panel BIOS device!	*Cancelled since 10/2008* See page 185
9S0001.26-020	**OEM Microsoft Windows XPe MP100/200 w/CF English** Only available with a Mobile Panel BIOS device!	*Cancelled since 10/2009* See page 185
5SWWXP.0419-ENG	**WinXPe FP2007 MP100 SCx200** Microsoft OEM Windows XP Embedded Feature Pack 2007, English; for MP181 BIOS; order CompactFlash separately (at least 512 MB).	See page 185

Table 11: Model numbers - Mobile Panel software

Chapter 2 • Technical data

1. Introduction

The Mobile Panel is a portable operating, display and control device that can be used anywhere machine operation and monitoring require the maximum amount of flexibility. This Mobile Panel advantage is evident in the areas of material handling, robotics, tools, special machines, and more.
The machine operator is always near the machine, allowing him to have a direct influence on the current process.

Depending on the model, Mobile Panel devices can have a 5.7" QVGA color display with or without touch screen or an 8.4" VGA color display with touch screen. In addition, Mobile Panel devices have a foil keypad (numeric and alphanumeric keys). Integrated safety functions consist of a three-step enable switch (2-channel) and an E-stop button (2-channel). They are operated using a foil keypad and a touch screen (with a touch screen pen).

Figure 1: Mobile Panel

Depending on the design, Mobile Panel devices come with the operating system Automation Runtime (AR) or with BIOS.

The AR devices are programmed uniformly into the entire B&R automation system using B&R Automation Studio (Visual Components).

1.1 Features

- 266 MHz processor, MMX compatible
- 5.7" QVGA or 8.4" VGA display [1)]
- CompactFlash card (type I) [2)]
- USB 1.1 connection [2)]
- 24 VDC supply voltage
- Ethernet 10/100 MBit interface
- RS232 interface (RxD, TxD), not modem-capable
- CAN interface[1)]
- 2 operating mode switches (2 x 16 digit)
- Touch screen (analog resistive)
- Filter glass (multiple-coated, non-reflective)[1)]
- Foil keypad
- Fan-free operation
- Automation Runtime or BIOS [1)]
- Real-time clock (battery-buffered)[1)]
- Up to 128 MB SDRAM main memory[1)]
- Integrated E-stop button and key switch
- Touch screen pen (only with touch screen devices)
- IP54 protection against dust and sprayed water (only with handle 4MPHDL.0000-00)
- Left and right handed operation
- Amount handle can be turned in relation to the operating unit: ± 45° from the middle position

1) Depending on the design of the particular Mobile Panel device.

2) Can be accessed from behind the CF/USB cover on the front of the Mobile Panel's operator panel.

1.1.1 Selection Guide

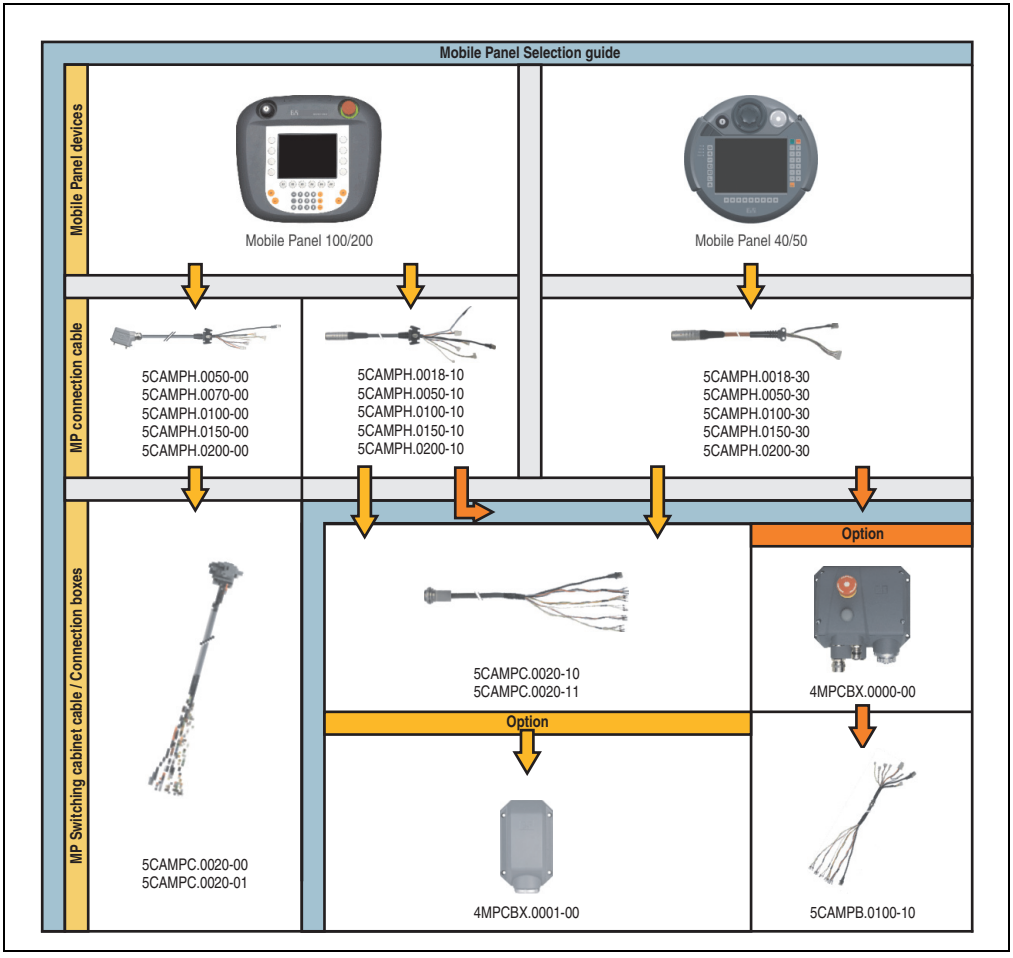


Figure 2: Mobile Panel selection guide

For Mobile Panel 100/200 devices, in addition to the cables with circular plugs (5CAMPH.xxxx-10), there are also cables with square industrial plugs available (5CAMPH.xxxx-00). If these are selected, the only option is a direct connection to the switching cabinet (5CAMPC.0020-00 oder 5CAMPC.0020-01). If the circular connectors are used, there are two variants to choose from:

- Direct cable to switching cabinet (5CAMPC.0020-10 or 5CAMPC.0020-11) with an optional small connection box (4MPCBX.0001-00).
- Alternatively, a large connection box (4MPCBX.0000-00) and the corresponding box cable (5CAMPB.0100-10) can be used.

1.2 Construction

Mobile Panel devices are cable connected, which means they are are connected to the switching cabinet using a cable. For operation, the following components are needed:

- Operating unit
- Handle
- Attachment cable
- Switching cabinet cable

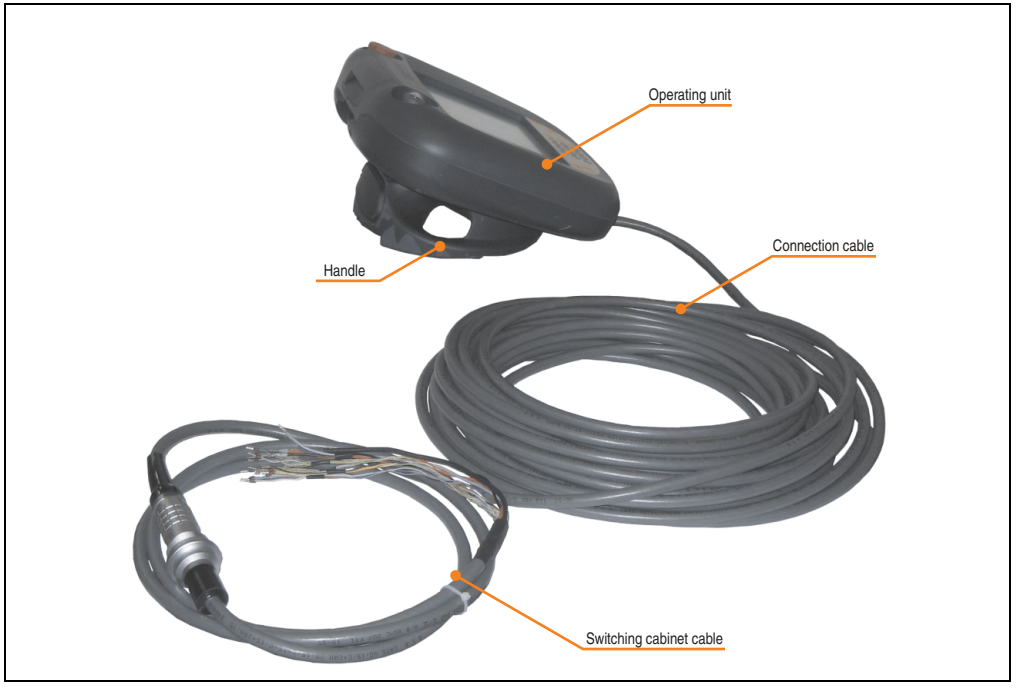


Figure 3: Mobile Panel device construction

An optional wall mount is available for storing the Mobile Panel device and attachment cable during stationary operation of the system (for more see section 3.4 "Wall mount" on page 107).

2. Entire device

2.1 Dimensions

The dimensions of the 5.7" and 8.4" display versions for the Mobile Panel devices are the same.

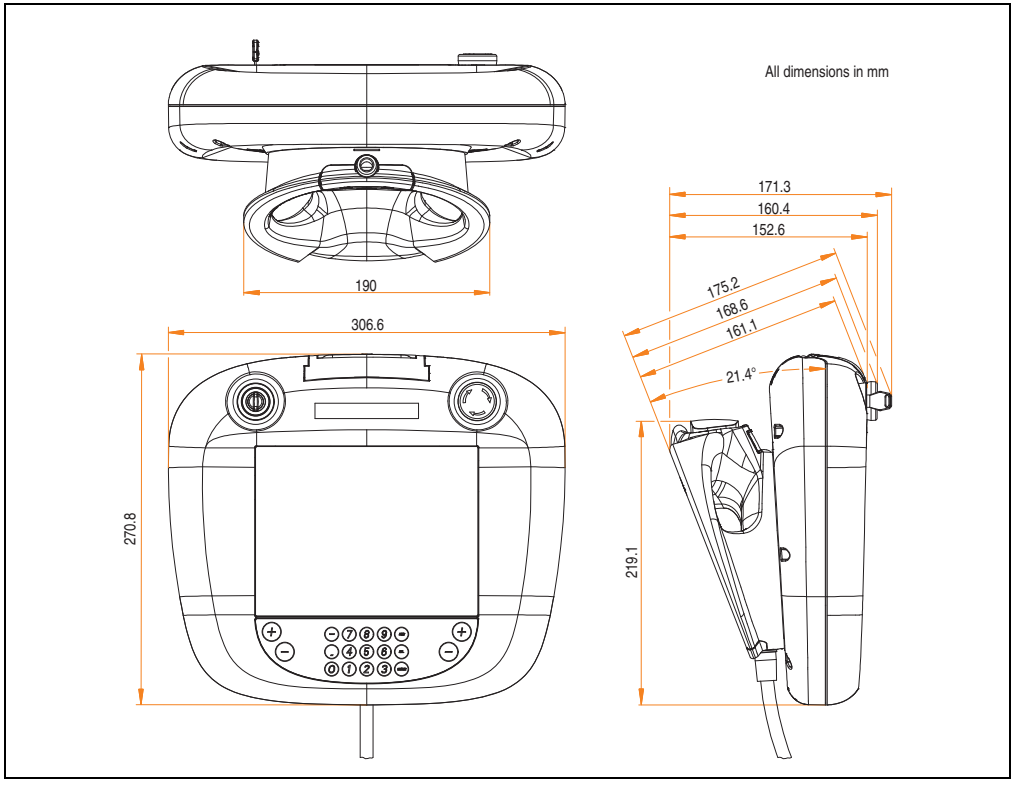


Figure 4: Dimensions - entire device

2.2 Technical data

Features	5.7“ display versions	8.4“ display versions
Power supply Rated voltage Starting current Power consumption Electrical isolation	 24 VDC ±25% (integrated reverse polarity protection) For short time (approx. 1 ms) 20 A Approx. 8 watts typically, 10 watts max. -	
Safety elements / entry devices E-stop button Key switch Enable switch Current load	 2 N.C., located on right side of operating unit 1 N.O., located on left side of operating unit 3-step, 2-channel, located on front of handle See the section "Current load of the enable switch and command device circuit" on page 123. **Pressing more than one key at a time may result in so-called phantom keys, and may trigger unintended actions.**	
Mechanics		
Operating unit Material Paint, color	 Double-walled plastic housing (Cycoloy C2950) Soft-touch coating, similar to RAL7016	
Handle Material Paint, color	 Plastic (pure compact foam) Soft-touch coating, similar to RAL7016	
Outer dimensions in mm (WxHxD) Without handle With handle	 306.6 x 76 x 270.8 306.6 x 152.6 x 270.8	
Weight (without handle, CompactFlash card or attachment cable) (with handle and CompactFlash card, without attachment cable)	 1650 g 2210 g	 1900 g 2460 g
Environment[1)]		
Ambient temperature Operation Bearings Transport	 0 to +45°C -20 to +60°C -20 to +60°C	 0 to +45°C -20 to +70°C -20 to +70°C
Relative humidity	See "Temperature humidity diagram - 5.7" display" on page 39 and "Temperature humidity diagram - 8.4" display" on page 40	
Vibration Operation (continuous) Operation (occasional) Storage Transport	 2 - 9 Hz: 1.75 mm amplitude / 9 - 200 Hz: 0.5 g 2 - 9 Hz: 3.5 mm amplitude / 9 - 200 Hz: 1 g 2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g 2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g	
Shock Operation Storage Transport	 15 g, 11 ms 30 g, 15 ms 30 g, 15 ms	
Height above sea level (operation)	2000 m	
Drop height	1 m on industrial ground	

Table 12: Entire device

Environment[1)]	5.7“ display versions	8.4“ display versions
Flame resistant	UL94V-0	
Protection type	IP54 protection against dust and sprayed water (only with handle 4MPHDL.0000-00)	
Electromagnetic compatibility[2)]		
Requirements for emissions Network-related emissions Electromagnetic emissions	 EN 61000-6-3, EN 55011 class A, EN 55022 class A, EN 61131-2 EN 61000-6-4, EN 55011 class A, EN 55022 class A, EN 61131-2	
Requirements for immunity to disturbances Electrostatic discharge (ESD) High-frequency electromagnetic fields High-speed transient elect. disturbance value Surges Conducted disturbances Magnetic fields with electrical frequencies Voltage dips, fluctuations, and short-term interruptions Damped vibration	 EN 61000-6-2, EN 61131-2, EN 55024 EN 61000-6-2, EN 61131-2, EN 55024 EN 61000-6-2, EN 61131-2, EN 55024 EN 61000-6-2, EN 61131-2, EN 55024 EN 61000-6-2, EN 61131-2, EN 55024 EN 61000-6-2, EN 61131-2, EN 55024 EN 61000-6-2, EN 61131-2, EN 55024 EN 61131-2	

Table 12: Entire device (Forts.)

1) For test requirements and limits for mechanical and climate conditions, see chapter 5 "Standards and certifications" starting on page 193.

2) In preparation. For test requirements and limits for electromagnetic compatibility, see chapter 5 "Standards and certifications" starting on page 193.

2.2.1 Temperature humidity diagram - 5.7" display

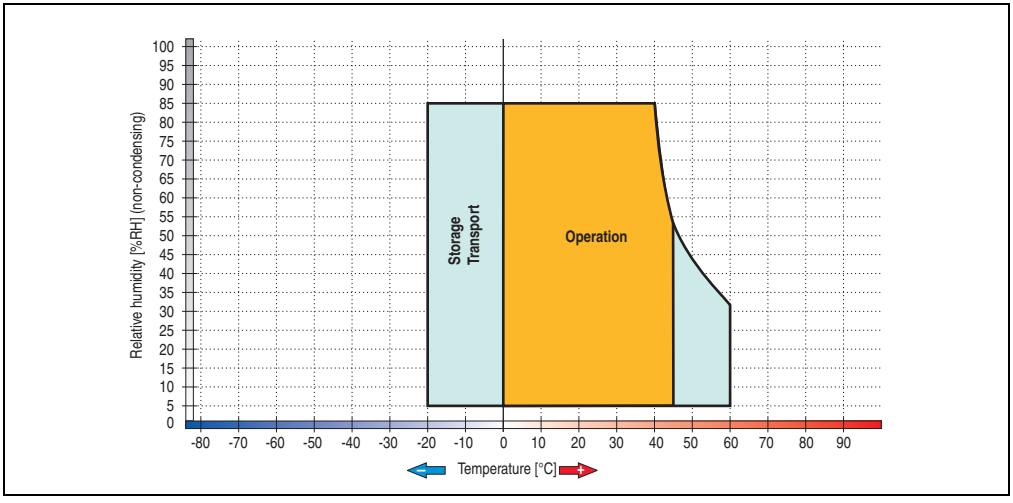


Figure 5: Temperature humidity diagram - 5.7" display

2.2.2 Temperature humidity diagram - 8.4" display

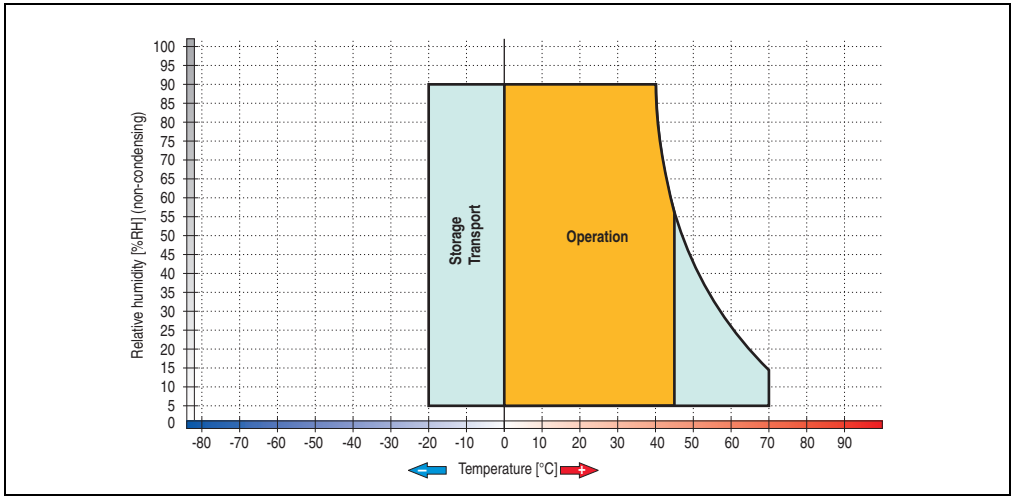


Figure 6: Temperature humidity diagram - 8.4" display

3. Individual components

3.1 Operating unit

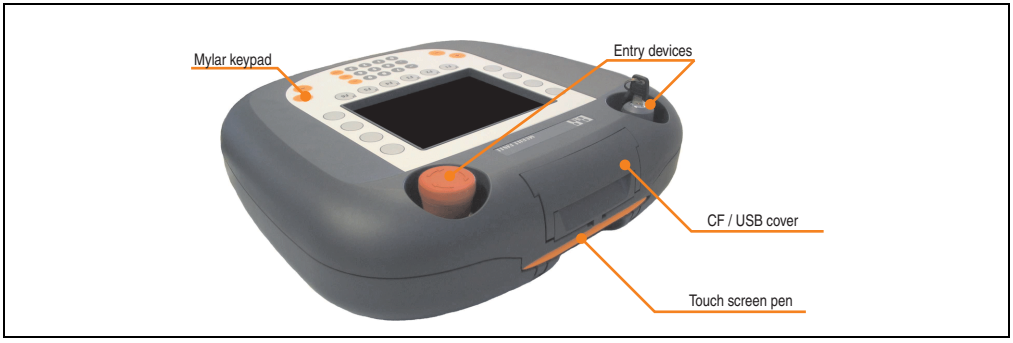


Figure 7: Mobile Panel operating unit

The operating unit contains all the electronics such as the display, the command devices and the foil keypad. For data storage and data exchange, a CompactFlash slot (Type I) and a USB 1.1 interface are available and accessible from the outside (behind the CF / USB cover). For operating touch screen devices, a touch screen pen is integrated on the top center of the Mobile Panel.

The user interface for the operating unit is resistant to alcohol (e.g. ethanol, glycol, isopropanol, glycerine, methanol), diluted acids (e.g. vinegar-based cleaning agent), soap, cleaning agents as used in auto maintenance or industrial facilities (usually short-term exposure during the cleaning process) and normal foodstuffs (e.g. beer, wine, coffee, fruit). For instructions how to clean the device, see chapter 6 "Accessories", section "Cleaning" on page 247.

3.1.1 Dimensions

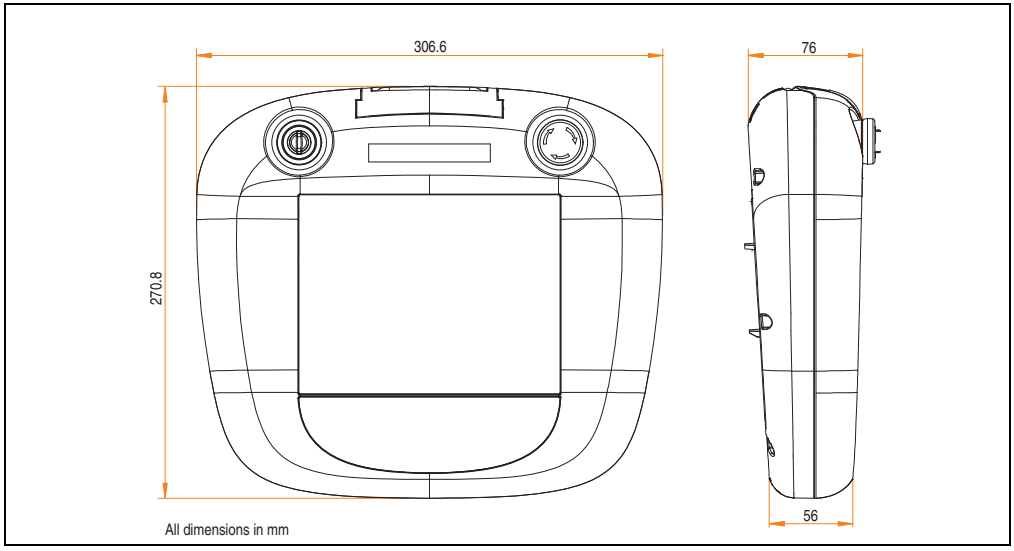


Figure 8: Dimensions - operating unit

3.1.2 Foil keypad

Depending on the design of the Mobile Panel operating unit, it is available with softkeys or system keys, each with or without LEDs.

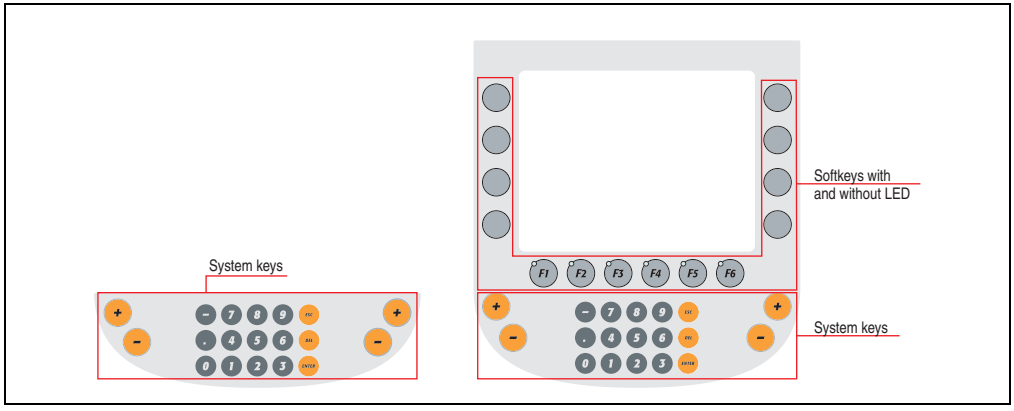


Figure 9: Example of a foil keypad

Softkeys

Softkeys are located along the edges of the display, and each key refers to a function shown on the display beside it (in the form of an icon, for example). Additionally, softkeys have **no legend sheets**.

System keys

Keys such as number block keys, cursor block keys, special keys for Windows functions or letter block keys are referred to as system keys.

3.1.3 Entry devices

All operating units have an E-stop button and a key switch.

E-stop button

- 2 N.C. (2-channel)
- Pre-emptive contacts
- Manipulation-proof in accordance to EN 13850:2006
- Protection against blocking
- Removal by 1/4 turning of the tappet
- Housing protection IP65 according to IEC60529

For more detailed technical data on the E-stop button and its switching element see section "E-stop button" on page 259.

Key switch

Each restart after an emergency stop must be acknowledged by the key switch. This rules out the accidental bypassing of this acknowledgement. In addition, the key switch must be used for acknowledgement each time the Mobile Panel is started. This provides protection against unexpected restarts and protection against restarts after the power fails and is restored, for example.

- Key function, 1 N.O.
- Key can only be removed in 0 position
- IP65 housing according to IEC60529

For more detailed technical data on the key switch and its switching element see section "Key switch" on page 261.

See section "Connection examples - E-stop and key switch" on page 116 for a connection example for the E-stop button and the key switch using a recommended monitoring device.

3.1.4 Touch screen pen

The touch screen pen is held easily accessible on the top of Mobile Panel devices with a touch screen, below the CF / USB cover.

Figure 10: Touch screen pen

Technical data

Touch screen pen	
Material	Plastic (Cycoloy C2950), non-slip
Color	Similar to Pantone 151 CV
Dimensions Length Diameter	 118 mm 7 mm

Table 13: Technical data - touch screen pen

3.1.5 CF / USB cover

Figure 11: CF / USB cover

Behind the CF / USB cover there is a CompactFlash slot (Type I) and a type A USB 1.1 port. The cover can easily be opened without tools and also while wearing gloves.

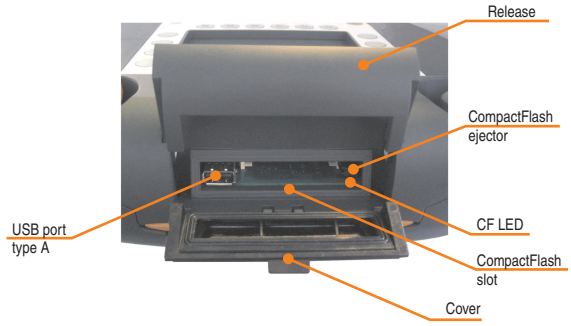


Figure 12: CompactFlash and USB slot

CompactFlash slot

The CompactFlash slot is designed for Type I CompactFlash cards and can be used as application memory and operating system memory (for a description of how to open the CF/ USB cover see section "CompactFlash slot" on page 131).

Warning!

Inserting and removing the CompactFlash card can only take place without power applied!

CF LED

Information:

Mobile Panel devices from Revision ≥ C0 have a CF LED.

LED	Color	Function
CF	Yellow	A lit LED indicates access to a CompactFlash card.

Table 14: CF LED

Type A USB port

A USB flash drive, for example, can be used for data storage or for data or recipe exchange on the type A USB port slot.

Technical data - USB port	
Transfer rate	Low speed (1.5 Mbit/s) to full speed (12 Mbit/s)

Table 15: Technical data - USB port connection

Technical data - USB port	
Power supply	500 mA
Maximum cable length	5 m

Table 15: Technical data - USB port connection

Warning!

Only USB devices tested and approved by B&R may be connected to the USB interface.

Warning!

Because of general PC specifications, this interface should be handled with extreme care with regard to EMC, location of cables, etc.

3.1.6 Rear view of an operating unit

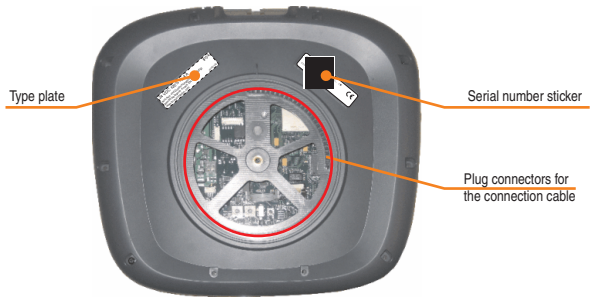


Figure 13: Rear view - operating unit

All the required interfaces and software switches and buttons for connecting the Mobile Panel attachment cable can be found on the back (see also section "Switches, buttons and batteries" on page 49.

If the attachment cable needs to be changed, you can find the connection plan as well as instructions for changing it in section "Exchanging the connection cable" on page 248.

Serial number sticker

General information

Each B&R device is given a unique serial number sticker with a barcode that allows the device to be clearly identified.

Design / dimensions

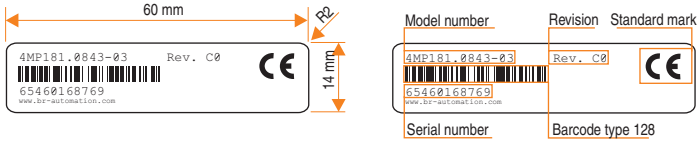


Figure 14: Design / dimensions - Serial number sticker

Type plate

General information

For the enable switch, the Mobile Panel device is additionally equipped with a type plate with the following information.

Design / dimensions

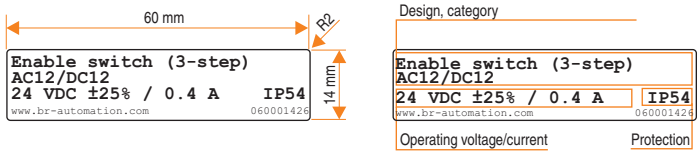


Figure 15: Design/dimensions - Type plate

The type plate is attached to the back of the Mobile Panel operating unit.

This information can also be found on the B&R homepage. Enter the model number or material number of the entire device in the material number search field on the start page **www.br-automation.com**. The search also works if you enter the serial number in the serial number search field. The search provides you with a detailed list of the individual components.

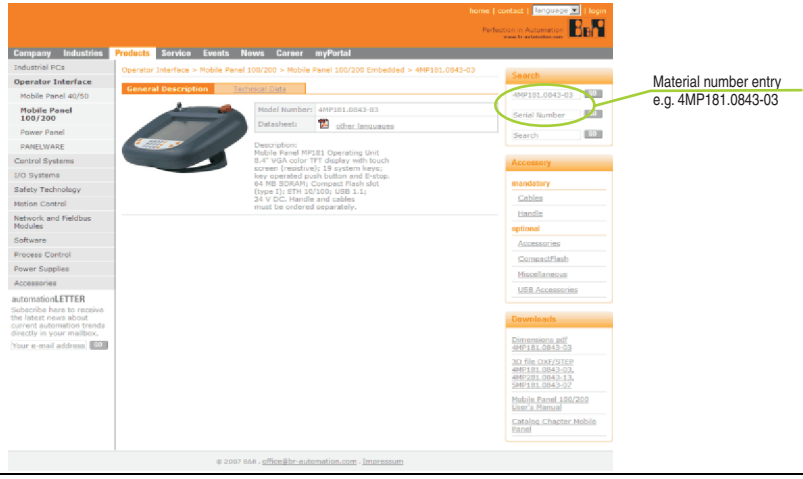


Figure 16: Example - Model number search: 4MP181.0843-03

3.1.7 Switches, buttons and batteries

The following buttons and switches are found on the back of the operating unit for setting parameters and configuring the Mobile Panel motherboard:

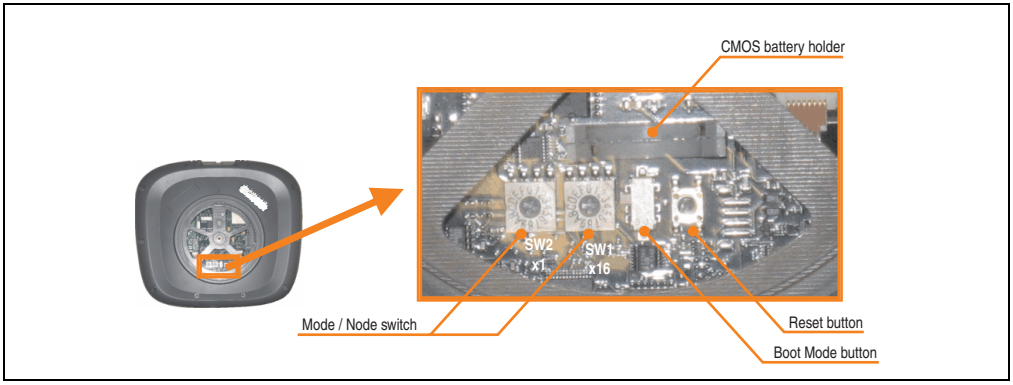


Figure 17: Back of the operating unit - Switches, buttons and batteries

Mode / Node switches

Mobile Panel devices are equipped with 2 hex switches, which are used as operating mode switches for Automation Runtime devices. Switch positions 01 to FD are available for any purpose in an application and can be evaluated by the application program.

Switch position		Function	Description
SW1 (x16)	SW2 (x1)	Operating mode switch	
0	0	Boot	Automation Runtime boot mode for operating system (firmware) upgrade (default: Automation Runtime). In this position, a new or missing operating system can be downloaded.
0 to F	0 to F	Node	Automation Runtime run mode with node 01-FD (CompactFlash Automation Runtime or terminal operation). Freely available for use in an application, e.g. setting the INA2000 node number for the Ethernet interface.
F	E	Dyn. mode	Automation Runtime run mode with node 01-FD (CompactFlash Automation Runtime or terminal operation). Device addresses can be assigned through the software.
F	F	Diagnostics	Automation Runtime diagnostics mode (CompactFlash Automation Runtime or terminal operation).

Table 16: Automation Runtime switch settings for the mode / node switch

For Mobile Panel BIOS devices, the mode/node switches have the following meaning:

Switch position		Function	Description
SW1 (x16)	SW2 (x1)	Operating mode switch	

Table 17: BIOS switch settings for the mode / node switch

Switch position		Function	Description
0	0	Service mode	• When booting Windows CE, the touch screen calibration tool is started (regardless of whether the touch screen is already calibrated). This function is only advantageous if the touch screen can no longer be operated (incorrect calibration, calibration data lost, etc.). • The resolution for the display used is automatically configured. • Contrast and brightness settings for the display are set to default values. • Legacy USB support is always set to "enabled", regardless of the BIOS setting.
x	x	Other switch positions have no significance.	

Table 17: BIOS switch settings for the mode / node switch

CMOS battery holder

Used for inserting a lithium battery. The lithium battery buffers the internal real-time clock (RTC), SRAM data, and individually saved BIOS settings.

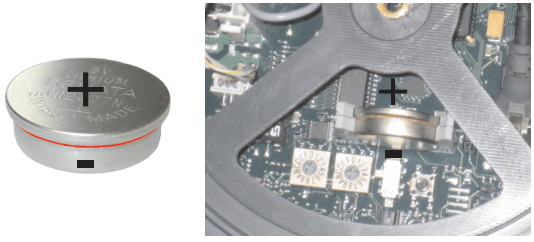


Figure 18: Inserted lithium battery

The battery status (good or bad) can be queried using software. From the point when battery capacity is recognized as insufficient, data buffering is guaranteed for approximately another 500 hours. When changing the battery, data is buffered for approximately another 10 minutes by a gold leaf capacitor. The buffer duration of the battery lasts at least 2 years (at 50°C).

For more on changing the lithium battery, see chapter 7 "Maintenance / Servicing", section "Changing the battery" on page 255.

Boot mode switch

Warning!

This switch is reserved. The switch position must not be changed.

Reset button

This button is used for resetting the Mobile Panel device.

3.1.8 Technical data

Operating unit 4MP181.0843-03

Figure 19: Front view - 4MP181.0843-03

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Features	4MP181.0843-03
Boot loader / Operating system	Automation Runtime
Processor Type MMX compatible L1 cache L2 cache Floating point unit (FPU) Cooling	 Geode SC2200 266 MHz, 32-bit x86 Yes 16 KB - Yes No cooler
Flash	2 MB, onboard, for firmware
Memory Type Quantity Socket	 DRAM 64 MB SO-DIMM 144-pin
Graphics Controller Memory	 Geode SC2200 4 MB shared memory (reserved by main memory)

Table 18: Technical data - 4MP181.0843-03

Features	4MP181.0843-03
SRAM Quantity Battery-buffered	-
Watchdog Controller	-
Power failure logic Controller Buffer time	-
Real-time clock [1)] Battery-buffered Accuracy	 Not battery buffered ±20 ppm[2)] (see "Overview of time references - Real-time clock (RTC)" on page 275)
Battery Type Removable Lifespan Backup capacitor Buffer time	- -
Ethernet Controller Transfer rate Connection Cables	 MacPhyter DP83816 10/100 MBit/s RJ45 twisted pair (10 BaseT / 100 BaseT) S/STP (Category 5, using Mobile Panel cable)
CAN bus Controller Transfer rate Connection	-
CompactFlash Type Amount Connection	Accessible behind the CF / USB cover Type I 1 Primary IDE
Serial interface Type UART Transfer rate Connection	 RS232 (RxD and TxD), not modem-capable 16550-compatible, 16-byte FIFO Max. 115 kBaud Connection using the Mobile Panel cable
USB interface Type Amount Transfer rate Connection	Accessible behind the CF / USB cover USB 1.1 2 1.5 MBit/s (low speed), 12 MBit/s (full speed) Type A
Reset button	Yes (accessible on back above handle)
Mode/Node switch	2 pcs. each 16 digits (accessible on back above handle)
LED [3)]	1 LED CF (yellow) - can be accessed behind the CF / USB cover

Table 18: Technical data - 4MP181.0843-03 (Forts.)

Features	4MP181.0843-03
Display Type Diagonal Colors Resolution Contrast Viewing angle (see page 274) Horizontal Vertical Background lighting Brightness Half-brightness time[4)]	 Color TFT 8.4 in 256 colors VGA, 640 x 480 pixels 250:1 Direction R / direction L =55° Direction U = 55°/ direction D = 40° 120 cd/m² 50,000 hours
Filter glass Degree of transmission Coating	-
Touch screen Touch screen type Technology Controller Degree of transmission	 AMT (Rev. < L0: 3M) Analog, resistive Hampshire, serial, 12-bit 78%
Power supply Rated voltage Starting current Power consumption Electrical isolation	 24 VDC ±25% (integrated reverse polarity protection) For short time (approx. 1 ms) 20 A Approx. 8 watts typically, 10 watts max. -
Keys Function keys Soft keys Cursor keys Number block Other keys Key lifespan	19 keys total - - - 15 without LED 4 without LED > 1,000,000 actuations at 1 ±0.3N to 3 ±0.3 N actuating force **Pressing more than one key at a time may result in so-called phantom keys, and may trigger unintended actions.**
Mechanics	
Operating unit Paint, color	Double-walled plastic housing (Cycoloy C2950) Soft-touch coating, similar to RAL7016
E-stop	Yes (2 normally closed), right position
Key switch	Yes (1 normally open), left position
Touch screen pen Color	Yes Similar to Pantone 151 CV
Outer dimensions (without handle) Width Height Depth	 306.6 mm 76 mm 270.6 mm
Weight (without handle, CompactFlash card or attachment cable)	1900 g

Table 18: Technical data - 4MP181.0843-03 (Forts.)

Mechanics	4MP181.0843-03
Front Design Membrane Light background Orange keys Dark gray keys Gasket	 Gray Polyester Similar to Pantone 427CV Similar to Pantone 151CV Similar to Pantone 431CV Flat gasket around display front
Environment	
Ambient temperature Operation Bearings Transport	 0 to +45°C -20 to +70°C -20 to +70°C
Relative humidity	See "Temperature humidity diagram" on page 55
Vibration Operation (continuous) Operation (occasional) Storage Transport	 2 - 9 Hz: 1.75 mm amplitude / 9 - 200 Hz: 0.5 g 2 - 9 Hz: 3.5 mm amplitude / 9 - 200 Hz: 1 g 2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g 2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g
Shock Operation Storage Transport	 15 g, 11 ms 30 g, 15 ms 30 g, 15 ms
Protection type	IP54 protection against dust and sprayed water (only with handle 4MPHDL.0000-00)
Altitude	2000 m
Drop height	1 m on industrial ground
Flame resistant	UL94V-0

Table 18: Technical data - 4MP181.0843-03 (Forts.)

1) The quartz used with the Mobile Panel has an accuracy of ±20 ppm. That means the deviation is typically 5 seconds per day taking into consideration influences such as temperature and wiring of the quartz.

2) At the maximum specified ambient temperature, the deviation can increase to typically ±60 ppm.

3) Mobile Panel devices Revision C0 or higher have a CompactFlash write/read access LED.

4) At 25°C ambient temperature. Reducing the brightness by 50% can result in an approximate 50% increase of the half-brightness time.

Temperature humidity diagram

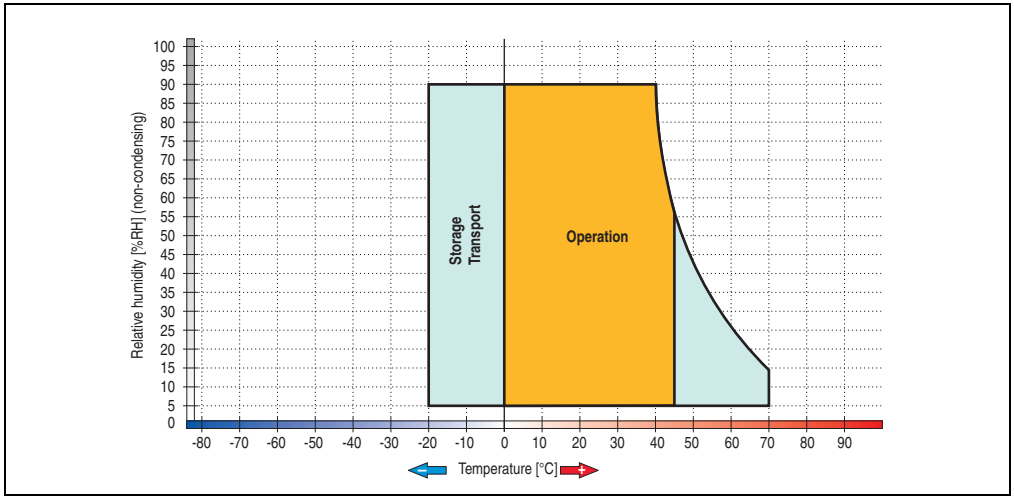


Figure 20: Temperature humidity diagram - 4MP181.0843-03

Operating unit 4MP251.0571-12

Figure 21: Front view - 4PP251.0571-12

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Features	4MP251.0571-12
Boot loader / Operating system	Automation Runtime
Processor Type MMX compatible L1 cache L2 cache Floating point unit (FPU) Cooling	 Geode SC2200 266 MHz, 32-bit x86 Yes 16 KB - Yes No cooler
Flash	2 MB, onboard, for firmware
Memory Type Quantity Socket	 DRAM 64 MB SO-DIMM 144-pin
Graphics Controller Memory	 Geode SC2200 4 MB shared memory (reserved by main memory)
Reset button	Yes (accessible on back above handle)

Table 19: Technical data - 4MP251.0571-12

Features	4MP251.0571-12
SRAM Quantity Battery-buffered	 256 KB Yes
Watchdog Controller	 SMC [1]
Power failure logic Controller Buffer time	-
Real-time clock [2] Battery-buffered Accuracy	 Yes ±20 ppm[3] (see "Overview of time references - Real-time clock (RTC)" on page 275)
Battery Type Removable Lifespan Backup capacitor Buffer time	 Lithium Renata 950 mAh Yes, on back above handle At least 2 years at 50°C Yes 10 minutes
Ethernet Controller Transfer rate Connection Cables	 MacPhyter DP83816 10/100 MBit/s RJ45 twisted pair (10 BaseT / 100 BaseT) S/STP (Category 5, using Mobile Panel cable)
CAN bus Controller Transfer rate Connection	Electrically isolated SJA1000 max. 1 MBits/s Connection via Mobile Panel cable
CompactFlash Type Amount Connection	Accessible behind the CF / USB cover Type I 1 Primary IDE
Serial interface Type UART Transfer rate Connection	 RS232 (RxD and TxD), not modem-capable 16550-compatible, 16-byte FIFO Max. 115 kBaud Connection using the Mobile Panel cable
USB interface Type Amount Transfer rate Connection	Accessible behind the CF / USB cover USB 1.1 2 1.5 MBit/s (low speed), 12 MBit/s (full speed) Type A
Mode/Node switch	2 pcs. each 16 digits (accessible on back above handle)
LED [4]	1 LED CF (yellow) - can be accessed behind the CF / USB cover
Power supply Rated voltage Starting current Power consumption Electrical isolation	 24 VDC ±25% (integrated reverse polarity protection) For short time (approx. 1 ms) 20 A Approx. 8 watts typically, 10 watts max. -

Table 19: Technical data - 4MP251.0571-12 (Forts.)

Features	4MP251.0571-12
Display Type Diagonal Colors Resolution Contrast Viewing angle (see page 274) Horizontal Vertical Background lighting Brightness Half-brightness time[5)]	 Color LCD 5.7 in 256 colors QVGA, 320 x 240 pixels 250:1 Direction R / direction L =55° Direction U = 55°/ direction D = 40° 150 cd/m² 50,000 hours
Touch screen Touch screen type Technology Controller Degree of transmission	-
Filter glass Degree of transmission Coating	 > 98% Multiple double-sided
Keys/LED[6)] Function keys Soft keys Cursor keys Number block Other keys Key lifespan LED brightness	Total of 33 keys / 4 LEDs - 8 without LED 6 with LED (yellow) 15 without LED 4 without LED > 1,000,000 actuations at 1 ±0.3N to 3 ±0.3 N actuating force Typ. 12 mcd (yellow) **Pressing more than one key at a time may result in so-called phantom keys, and may trigger unintended actions.**
Mechanics	
Operating unit Paint, color	Double-walled plastic housing (Cycoloy C2950) Soft-touch coating, similar to RAL7016
E-stop	Yes (2 normally closed), right position
Key switch	Yes (1 normally open), left position
Touch screen pen Color	-
Outer dimensions (without handle) Width Height Depth	 306.6 mm 76 mm 270.6 mm
Weight (without handle, CompactFlash card or attachment cable)	1650 g

Table 19: Technical data - 4MP251.0571-12 (Forts.)

Mechanics	4MP251.0571-12
Front	
Design	Gray
Membrane	Polyester
Light background	Similar to Pantone 427CV
Orange keys	Similar to Pantone 151CV
Dark gray keys	Similar to Pantone 431CV
Gray keys	Similar to Pantone 429CV
Gasket	Flat gasket around display front
Environment	
Ambient temperature	
Operation	0 to +45°C
Bearings	-20 to +60°C
Transport	-20 to +60°C
Relative humidity	See "Temperature humidity diagram" on page 60
Vibration	
Operation (continuous)	2 - 9 Hz: 1.75 mm amplitude / 9 - 200 Hz: 0.5 g
Operation (occasional)	2 - 9 Hz: 3.5 mm amplitude / 9 - 200 Hz: 1 g
Storage	2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g
Transport	2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g
Shock	
Operation	15 g, 11 ms
Storage	30 g, 15 ms
Transport	30 g, 15 ms
Protection type	IP54 protection against dust and sprayed water (only with handle 4MPHDL.0000-00)
Altitude	2000 m
Drop height	1 mm on industrial surfaces
Flame resistant	UL94V-0

Table 19: Technical data - 4MP251.0571-12 (Forts.)

1) **S**ystem **M**anagement **C**ontroller

2) The quartz used with the Mobile Panel has an accuracy of ±20 ppm. That means the deviation is typically 5 seconds per day taking into consideration influences such as temperature and wiring of the quartz.

3) At the maximum specified ambient temperature, the deviation can increase to typically ±60 ppm.

4) Mobile Panel devices Revision C0 or higher have a CompactFlash write/read access LED.

5) At 25°C ambient temperature. Reducing the brightness by 50% can result in an approximate 50% increase of the half-brightness time.

6) The key and LED functions can be freely configured with the B&R Key Editor, which can be found in the download area of the B&R homepage (www.br-automation.com) or on the B&R HMI Driver & Utilities DVD (model number 5SWHMI.0000-00).

Temperature humidity diagram

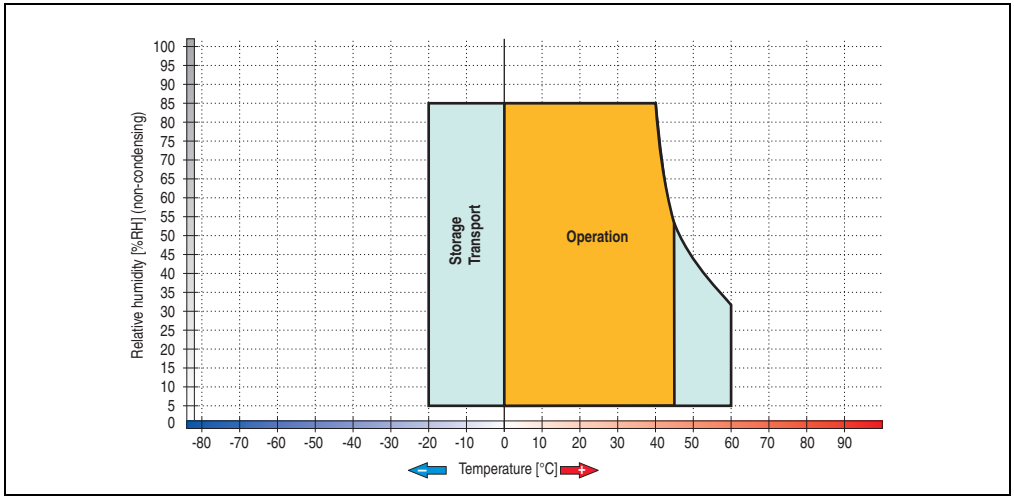


Figure 22: Temperature humidity diagram - 4MP251.0571-12

Operating unit 4MP281.0571-12

Figure 23: Front view - 4MP281.0571-12

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Features	4MP281.0571-12
Boot loader / Operating system	Automation Runtime
Processor Type MMX compatible L1 cache L2 cache Floating point unit (FPU) Cooling	 Geode SC2200 266 MHz, 32-bit x86 Yes 16 KB - Yes No cooler
Flash	2 MB, onboard, for firmware
Memory Type Quantity Socket	 DRAM 64 MB SO-DIMM 144-pin
Graphics Controller Memory	 Geode SC2200 4 MB shared memory (reserved by main memory)
Reset button	Yes (accessible on back above handle)

Table 20: Technical data - 4MP281.0571-12

Features	4MP281.0571-12
SRAM Quantity Battery-buffered	 256 KB Yes
Watchdog Controller	 SMC [1]
Power failure logic Controller Buffer time	-
Real-time clock [2] Battery-buffered Accuracy	 Yes ±20 ppm[3] (see "Overview of time references - Real-time clock (RTC)" on page 275)
Battery Type Removable Lifespan Backup capacitor Buffer time	 Lithium Renata 950 mAh Yes, on back above handle At least 2 years at 50°C Yes 10 minutes
Ethernet Controller Transfer rate Connection Cables	 MacPhyter DP83816 10/100 MBit/s RJ45 twisted pair (10 BaseT / 100 BaseT) S/STP (Category 5, using Mobile Panel cable)
CAN bus Controller Transfer rate Connection	Electrically isolated SJA1000 max. 1 MBits/s Connection via Mobile Panel cable
CompactFlash Type Amount Connection	Accessible behind the CF / USB cover Type I 1 Primary IDE
Serial interface Type UART Transfer rate Connection	 RS232 (RxD and TxD), not modem-capable 16550-compatible, 16-byte FIFO Max. 115 kBaud Connection using the Mobile Panel cable
USB interface Type Amount Transfer rate Connection	Accessible behind the CF / USB cover USB 1.1 2 1.5 MBit/s (low speed), 12 MBit/s (full speed) Type A
Mode/Node switch	2 pcs. each 16 digits (accessible on back above handle)
LED [4]	1 LED CF (yellow) - can be accessed behind the CF / USB cover
Power supply Rated voltage Starting current Power consumption Electrical isolation	 24 VDC ±25% (integrated reverse polarity protection) For short time (approx. 1 ms) 20 A Approx. 8 watts typically, 10 watts max. -

Table 20: Technical data - 4MP281.0571-12 (Forts.)

Features	4MP281.0571-12
Display Type Diagonal Colors Resolution Contrast Viewing angle (see page 274) Horizontal Vertical Background lighting Brightness Half-brightness time[5)]	 Color LCD 5.7 in 256 colors QVGA, 320 x 240 pixels 250:1 Direction R / direction L =55° Direction U = 55°/ direction D = 40° 150 cd/m² 50,000 hours
Touch screen Touch screen type Technology Controller Degree of transmission	 Gunze Analog, resistive Hampshire, serial, 12-bit 78%
Filter glass Degree of transmission Coating	-
Keys/LED[6)] Function keys Soft keys Cursor keys Number block Other keys Key lifespan LED brightness	Total of 33 keys / 4 LEDs - 8 without LED 6 with LED (yellow) 15 without LED 4 without LED > 1,000,000 actuations at 1 ±0.3N to 3 ±0.3 N actuating force Typ. 12 mcd (yellow) **Pressing more than one key at a time may result in so-called phantom keys, and may trigger unintended actions.**
Mechanics	
Operating unit Paint, color	Double-walled plastic housing (Cycoloy C2950) Soft-touch coating, similar to RAL7016
E-stop	Yes (2 normally closed), right position
Key switch	Yes (1 normally open), left position
Touch screen pen Color	Yes Similar to Pantone 151 CV
Outer dimensions (without handle) Width Height Depth	 306.6 mm 76 mm 270.6 mm
Weight (without handle, CompactFlash card or attachment cable)	1650 g

Table 20: Technical data - 4MP281.0571-12 (Forts.)

Mechanics	4MP281.0571-12
Front	
Design	Gray
Membrane	Polyester
Light background	Similar to Pantone 427CV
Orange keys	Similar to Pantone 151CV
Dark gray keys	Similar to Pantone 431CV
Gray keys	Similar to Pantone 429CV
Gasket	Flat gasket around display front
Environment	
Ambient temperature	
Operation	0 to +45°C
Bearings	-20 to +60°C
Transport	-20 to +60°C
Relative humidity	See "Temperature humidity diagram" on page 65
Vibration	
Operation (continuous)	2 - 9 Hz: 1.75 mm amplitude / 9 - 200 Hz: 0.5 g
Operation (occasional)	2 - 9 Hz: 3.5 mm amplitude / 9 - 200 Hz: 1 g
Storage	2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g
Transport	2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g
Shock	
Operation	15 g, 11 ms
Storage	30 g, 15 ms
Transport	30 g, 15 ms
Drop height	1 m on industrial ground
Flame resistant	UL94V-0
Protection type	IP54 protection against dust and sprayed water (only with handle 4MPHDL.0000-00)
Altitude	2000 m

Table 20: Technical data - 4MP281.0571-12 (Forts.)

1) **S**ystem **M**anagement **C**ontroller

2) The quartz used with the Mobile Panel has an accuracy of ±20 ppm. That means the deviation is typically 5 seconds per day taking into consideration influences such as temperature and wiring of the quartz.

3) At the maximum specified ambient temperature, the deviation can increase to typically ±60 ppm.

4) Mobile Panel devices Revision C0 or higher have a CompactFlash write/read access LED.

5) At 25°C ambient temperature. Reducing the brightness by 50% can result in an approximate 50% increase of the half-brightness time.

6) The key and LED functions can be freely configured with the B&R Key Editor, which can be found in the download area of the B&R homepage (www.br-automation.com) or on the B&R HMI Driver & Utilities DVD (model number 5SWHMI.0000-00).

Temperature humidity diagram

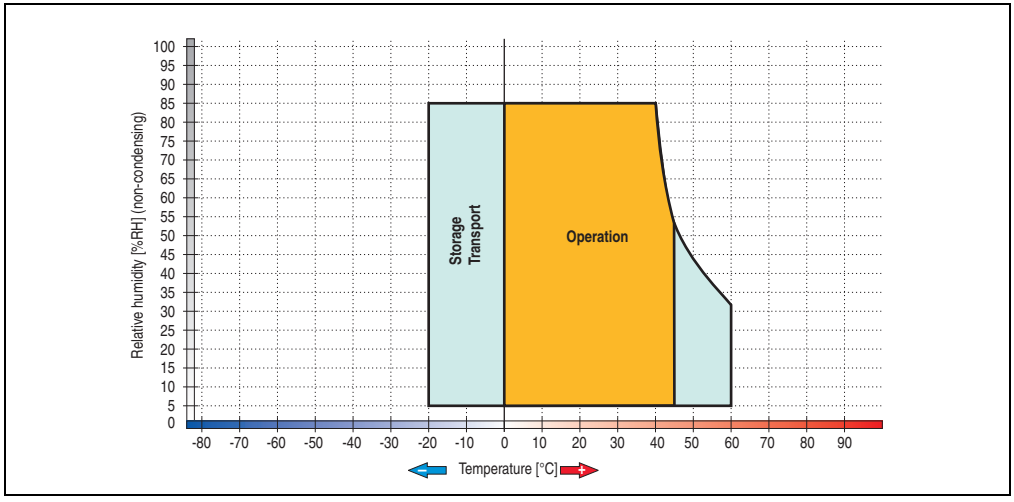


Figure 24: Temperature humidity diagram - 4MP281.0571-12

Operating unit 4MP281.0843-13

Figure 25: Front view - 4MP281.0843-13

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Features	4MP281.0843-13
Boot loader / Operating system	Automation Runtime
Processor Type MMX compatible L1 cache L2 cache Floating point unit (FPU) Cooling	 Geode SC2200 266 MHz, 32-bit x86 Yes 16 KB - Yes No cooler
Flash	2 MB, onboard, for firmware
Memory Type Quantity Socket	 DRAM 64 MB SO-DIMM 144-pin
Graphics Controller Memory	 Geode SC2200 4 MB shared memory (reserved by main memory)
Reset button	Yes (accessible on back above handle)

Table 21: Technical data - 4MP281.0843-13

Features	4MP281.0843-13
SRAM Quantity Battery-buffered	 256 KB Yes
Watchdog Controller	 SMC [1]
Power failure logic Controller Buffer time	-
Real-time clock [2] Battery-buffered Accuracy	 Yes ±20 ppm[3] (see "Overview of time references - Real-time clock (RTC)" on page 275)
Battery Type Removable Lifespan Backup capacitor Buffer time	 Lithium Renata 950 mAh Yes, on back above handle At least 2 years at 50°C Yes 10 minutes
Ethernet Controller Transfer rate Connection Cables	 MacPhyter DP83816 10/100 MBit/s RJ45 twisted pair (10 BaseT / 100 BaseT) S/STP (Category 5, using Mobile Panel cable)
CAN bus Controller Transfer rate Connection	Electrically isolated SJA1000 max. 1 MBits/s Connection via Mobile Panel cable
CompactFlash Type Amount Connection	Accessible behind the CF / USB cover Type I 1 Primary IDE
Serial interface Type UART Transfer rate Connection	 RS232 (RxD and TxD), not modem-capable 16550-compatible, 16-byte FIFO Max. 115 kBaud Connection using the Mobile Panel cable
USB interface Type Amount Transfer rate Connection	Accessible behind the CF / USB cover USB 1.1 2 1.5 MBit/s (low speed), 12 MBit/s (full speed) Type A
Mode/Node switch	2 pcs. each 16 digits (accessible on back above handle)
LED [4]	1 LED CF (yellow) - can be accessed behind the CF / USB cover
Power supply Rated voltage Starting current Power consumption Electrical isolation	 24 VDC ±25% (integrated reverse polarity protection) For short time (approx. 1 ms) 20 A Approx. 8 watts typically, 10 watts max. -

Table 21: Technical data - 4MP281.0843-13 (Forts.)

Features	4MP281.0843-13
Display Type Diagonal Colors Resolution Contrast Viewing angle (see page 274) Horizontal Vertical Background lighting Brightness Half-brightness time[5)]	 Color TFT 8.4 in 256 colors VGA, 640 x 480 pixels 250:1 Direction R / direction L =55° Direction U = 55°/ direction D = 40° 120 cd/m² 50,000 hours
Touch screen Touch screen type Technology Controller Degree of transmission	 AMT (Rev. < L0: 3M) Analog, resistive Hampshire, serial, 12-bit 78%
Filter glass Degree of transmission Coating	-
Keys Function keys Soft keys Cursor keys Number block Other keys Key lifespan	19 keys total - - - 15 without LED 4 without LED > 1,000,000 actuations at 1 ±0.3N to 3 ±0.3 N actuating force **Pressing more than one key at a time may result in so-called phantom keys, and may trigger unintended actions.**
Mechanics	
Operating unit Paint, color	Double-walled plastic housing (Cycoloy C2950) Soft-touch coating, similar to RAL7016
E-stop	Yes (2 normally closed), right position
Key switch	Yes (1 normally open), left position
Touch screen pen Color	Yes Similar to Pantone 151 CV
Outer dimensions (without handle) Width Height Depth	 306.6 mm 76 mm 270.6 mm
Weight (without handle, CompactFlash card or attachment cable)	1900 g
Front Design Membrane Light background Orange keys Dark gray keys Gasket	 Gray Polyester Similar to Pantone 427CV Similar to Pantone 151CV Similar to Pantone 431CV Flat gasket around display front

Table 21: Technical data - 4MP281.0843-13 (Forts.)

Environment	4MP281.0843-13
Ambient temperature Operation Bearings Transport	 0 to +45°C -20 to +70°C -20 to +70°C
Relative humidity	See "Temperature humidity diagram" on page 70
Vibration Operation (continuous) Operation (occasional) Storage Transport	 2 - 9 Hz: 1.75 mm amplitude / 9 - 200 Hz: 0.5 g 2 - 9 Hz: 3.5 mm amplitude / 9 - 200 Hz: 1 g 2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g 2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g
Shock Operation Storage Transport	 15 g, 11 ms 30 g, 15 ms 30 g, 15 ms
Protection type	IP54 protection against dust and sprayed water (only with handle 4MPHDL.0000-00)
Altitude	2000 m
Drop height	1 m on industrial ground
Flame resistant	UL94V-0

Table 21: Technical data - 4MP281.0843-13 (Forts.)

1) **S**ystem **M**anagement **C**ontroller

2) The quartz used with the Mobile Panel has an accuracy of ±20 ppm. That means the deviation is typically 5 seconds per day taking into consideration influences such as temperature and wiring of the quartz.

3) At the maximum specified ambient temperature, the deviation can increase to typically ±60 ppm.

4) Mobile Panel devices Revision C0 or higher have a CompactFlash write/read access LED.

5) At 25°C ambient temperature. Reducing the brightness by 50% can result in an approximate 50% increase of the half-brightness time.

Temperature humidity diagram

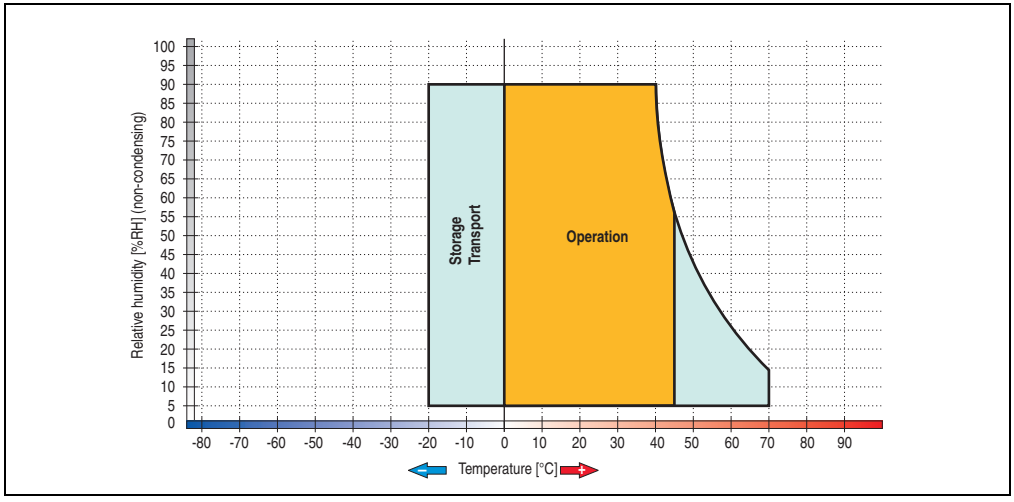


Figure 26: Temperature humidity diagram - 4MP281.0843-13

Operating unit 5MP181.0843-07

Figure 27: Front view - 5MP181.0843-07

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Features	5MP181.0843-07
Boot loader / Operating system	BIOS
Processor Type MMX compatible L1 cache L2 cache Floating point unit (FPU) Cooling	 Geode SC2200 266 MHz, 32-bit x86 Yes 16 KB - Yes No cooler
Flash	2 MB, onboard, for firmware
Memory Type Quantity Socket	 DRAM 128 MB SO-DIMM 144-pin
Graphics Controller Memory	 Geode SC2200 4 MB shared memory (reserved by main memory)
Reset button	Yes (accessible on back above handle)

Table 22: Technical data - 5MP181.0843-07

Features	5MP181.0843-07
SRAM Quantity Battery-buffered	-
Watchdog Controller	-
Power failure logic Controller Buffer time	-
Real-time clock [1)] Battery-buffered Accuracy	 Yes ±20 ppm[2)] (see "Overview of time references - Real-time clock (RTC)" on page 275)
Battery Type Removable Lifespan Backup capacitor Buffer time	 Lithium Renata 950 mAh Yes, on back above handle At least 2 years at 50°C Yes 10 minutes
Ethernet Controller Transfer rate Connection Cables	 MacPhyter DP83816 10/100 MBit/s RJ45 twisted pair (10 BaseT / 100 BaseT) S/STP (Category 5, using Mobile Panel cable)
CAN bus Controller Transfer rate Connection	-
CompactFlash Type Amount Connection	Accessible behind the CF / USB cover Type I 1 Primary IDE
Serial interface Type UART Transfer rate Connection	 RS232 (RxD and TxD), not modem-capable 16550-compatible, 16-byte FIFO Max. 115 kBaud Connection using the Mobile Panel cable
USB interface Type Amount Transfer rate Connection	Accessible behind the CF / USB cover USB 1.1 2 1.5 MBit/s (low speed), 12 MBit/s (full speed) Type A
Mode/Node switch	2 pcs. each 16 digits (accessible on back above handle)
LED [3)]	1 LED CF (yellow) - can be accessed behind the CF / USB cover
Power supply Rated voltage Starting current Power consumption Electrical isolation	 24 VDC ±25% (integrated reverse polarity protection) For short time (approx. 1 ms) 20 A Approx. 8 watts typically, 10 watts max. -

Table 22: Technical data - 5MP181.0843-07 (Forts.)

Features	5MP181.0843-07
Display Type Diagonal Colors Resolution Contrast Viewing angle (see page 274) Horizontal Vertical Background lighting Brightness Half-brightness time[4)]	 Color TFT 8.4 in 262,144 colors VGA, 640 x 480 pixels 250:1 Direction R / direction L =55° Direction U = 55°/ direction D = 40° 120 cd/m² 50,000 hours
Touch screen Touch screen type Technology Controller Degree of transmission	 AMT (Rev. < K0: 3M) Analog, resistive Hampshire, serial, 12-bit 78%
Filter glass Degree of transmission Coating	-
Keys Function keys Soft keys Cursor keys Number block Other keys Key lifespan	19 keys total - - - 15 without LED 4 without LED > 1,000,000 actuations at 1 ±0.3N to 3 ±0.3 N actuating force **Pressing more than one key at a time may result in so-called phantom keys, and may trigger unintended actions.**
Mechanics	
Operating unit Paint, color	Double-walled plastic housing (Cycoloy C2950) Soft-touch coating, similar to RAL7016
E-stop	Yes (2 normally closed), right position
Key switch	Yes (1 normally open), left position
Touch screen pen Color	Yes Similar to Pantone 151 CV
Outer dimensions (without handle) Width Height Depth	 306.6 mm 76 mm 270.6 mm
Weight (without handle, CompactFlash card or attachment cable)	1900 g
Front Design Membrane Light background Orange keys Dark gray keys Gasket	 Gray Polyester Similar to Pantone 427CV Similar to Pantone 151CV Similar to Pantone 431CV Flat gasket around display front

Table 22: Technical data - 5MP181.0843-07 (Forts.)

Environment	5MP181.0843-07
Ambient temperature Operation Bearings Transport	 0 to +45°C -20 to +70°C -20 to +70°C
Relative humidity	See "Temperature humidity diagram" on page 74
Vibration Operation (continuous) Operation (occasional) Storage Transport	 2 - 9 Hz: 1.75 mm amplitude / 9 - 200 Hz: 0.5 g 2 - 9 Hz: 3.5 mm amplitude / 9 - 200 Hz: 1 g 2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g 2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g
Shock Operation Storage Transport	See "Temperature humidity diagram" on page 74 15 g, 11 ms 30 g, 15 ms 30 g, 15 ms
Protection type	IP54 protection against dust and sprayed water (only with handle 4MPHDL.0000-00)
Altitude	2000 m
Drop height	1 m on industrial ground
Flame resistant	UL94V-0

Table 22: Technical data - 5MP181.0843-07 (Forts.)

1) The quartz used with the Mobile Panel has an accuracy of ±20 ppm. That means the deviation is typically 5 seconds per day taking into consideration influences such as temperature and wiring of the quartz.
2) At the maximum specified ambient temperature, the deviation can increase to typically ±60 ppm.
3) Mobile Panel devices Revision C0 or higher have a CompactFlash write/read access LED.
4) At 25°C ambient temperature. Reducing the brightness by 50% can result in an approximate 50% increase of the half-brightness time.

Temperature humidity diagram

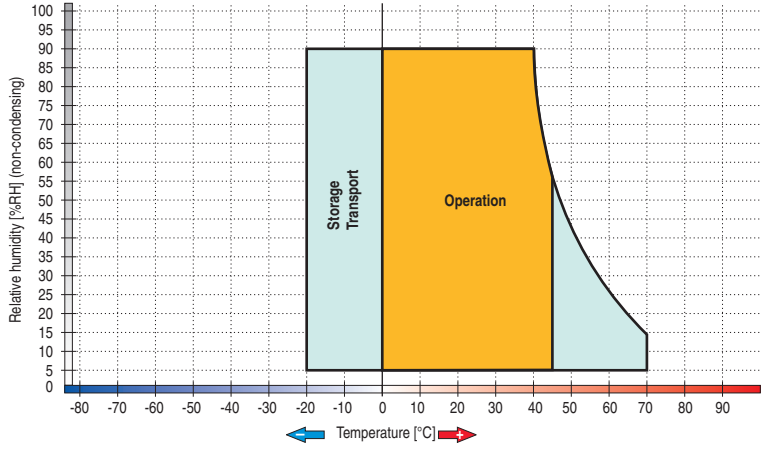


Figure 28: Temperature humidity diagram - 5MP181.0843-07

3.2 Handle

Figure 29: Operating unit, handle and attachment cable

The handle is designed ergonomically for both left and right-handed operators. It is attached to the operating unit using the included threaded screws. The threaded screws can be tightened and loosened with a 4 mm hex key (for more on this, see section "Attaching to operating unit" on page 78).

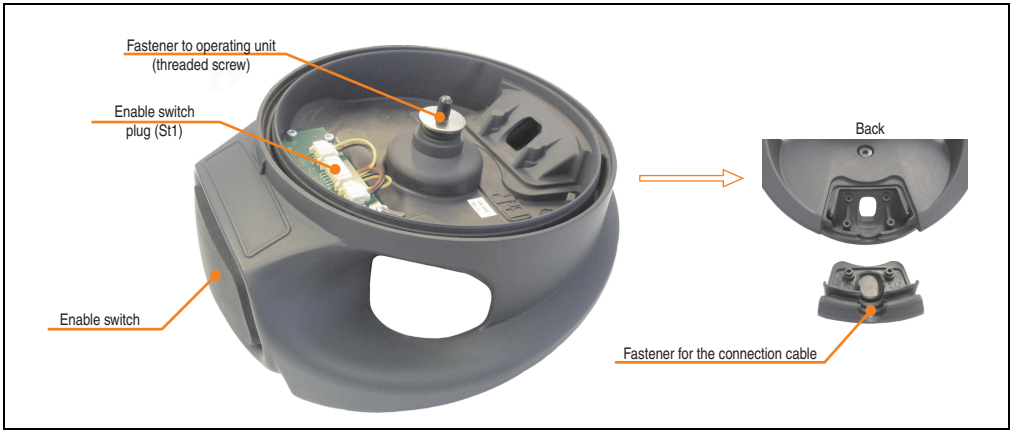


Figure 30: Handle 4MPHDL.0000-00

3.2.1 Dimensions

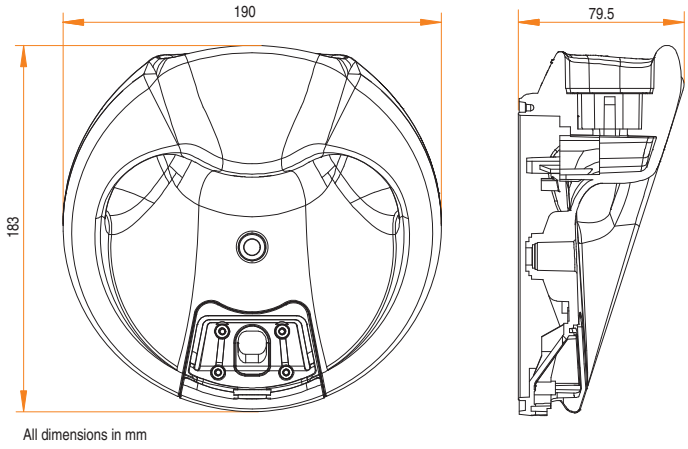


Figure 31: Dimensions - Handle

3.2.2 Technical data

Mechanics	4MPHDL.0000-00
Material Paint, color	Plastic (pure compact foam) Soft-touch coating, similar to RAL7016
Dimensions (WxHxD) Width Height Depth	 190 mm 79.5 mm 183 mm
Weight	540 g
Enable switch	3-step (null, confirm, panic position)

Table 23: Technical data - 4MPHDL.0000-00

3.2.3 Enable switch

The handle has a 3-step, 2-channel enable switch, which is located in the middle of the front side of the handle.

The enable switch is used to implement enabling equipment as a protective function for machines or systems in special operating modes. The enable switch is only one part of this setup.

- 3-step: Null, enable and panic position

For more detailed technical data on the enable switch see section "Enable switch" on page 263.

Functionality

The enable switch has 2 channels, each with 3 switch positions.

Position	Enable switch activation
Null	Not pressed
Enable	Pressed
Panic	Pushed all the way in

Table 24: Switch positions for the enable switch

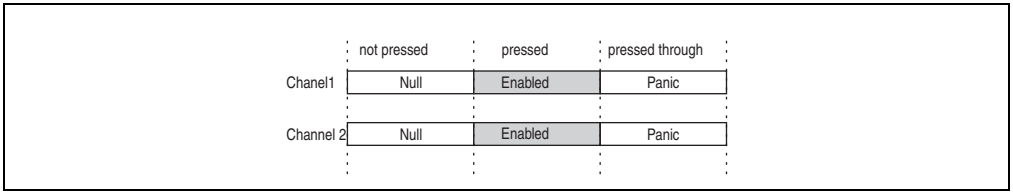


Figure 32: Possible enable switch positions

Both enable switches must always have the same position in order for the monitoring device to consider the switch position OK.

The positions "null" and "panic" must trigger a category 0 or 1 stop command.

Null position

When not pressed, the enable switch returns to the zero position (not enabled).

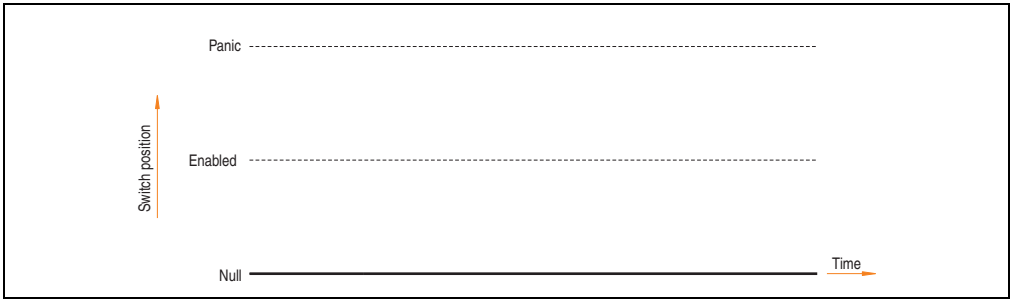


Figure 33: Enable switch - Null position

Enable position

The enable position is the normal operating mode for the enable switch. In this position it is possible, for example, to initiate a movement for an axis by subsequently pressing a direction button.

The enable switch is pressed from the null position to the enable position. After being released, it goes back to the null position again.

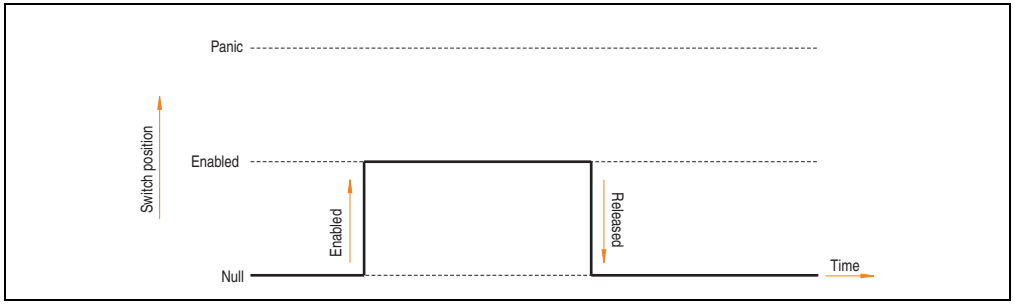


Figure 34: Enable switch - Enable position

Panic position

If the enable switch is pushed all the way in (from enable position to panic position) and released, the enable position is skipped and it goes directly back to the null position.

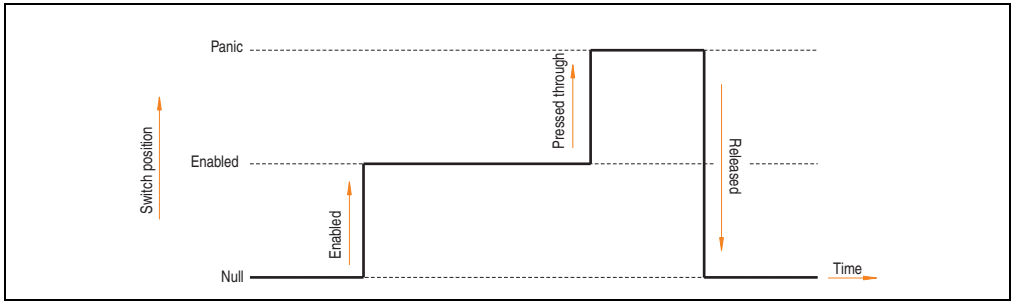


Figure 35: Enable switch - Panic position

See section "Connection example - Enable switch" on page 121 for a connection example for the enable button with a recommended monitoring device.

3.2.4 Attaching to operating unit

The threaded screws can be loosened with a hex key (4 mm). The handle and the operating unit are fastened together using the threaded screw.

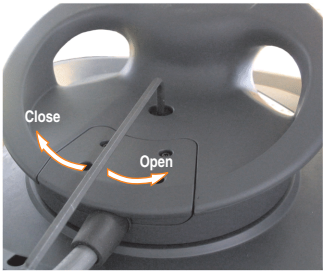


Figure 36: Fastening/removing the handle to/from the operating unit

The handle can also be turned without unfastening it.

3.2.5 Attachment cable fastener

The attachment cable is connected using a stress relief fastener and screwed tight. A size 10 Torx screwdriver is needed for this.

Figure 37: Attachment cable fastener

3.3 Cables

3.3.1 Overview

Model number	Short description	Note
5CAMPH.0050-00	Mobile Panel attachment cable, 5 meters long; with plug contacts for cabling the Mobile Panel, including an industrial plug for the switching cabinet cable.	
5CAMPH.0070-00	Mobile Panel attachment cable, 7 meters long; with plug contacts for cabling the Mobile Panel, including an industrial plug for the switching cabinet cable.	
5CAMPH.0100-00	Mobile Panel attachment cable, 10 meters long; with plug contacts for cabling the Mobile Panel, including an industrial plug for the switching cabinet cable.	
5CAMPH.0150-00	Mobile Panel attachment cable, 15 meters long; with plug contacts for cabling the Mobile Panel, including an industrial plug for the switching cabinet cable.	
5CAMPH.0200-00	Mobile Panel attachment cable, 20 meters long; with plug contacts for cabling the Mobile Panel, including an industrial plug for the switching cabinet cable.	
5CAMPH.0018-10	Mobile Panel attachment cable, 1.8 meters long; with plug contacts for cabling the Mobile Panel, including a circular plug for the switching cabinet cable.	
5CAMPH.0050-10	Mobile Panel attachment cable, 5 meters long; with plug contacts for cabling the Mobile Panel, including a circular plug for the switching cabinet cable.	
5CAMPH.0100-10	Mobile Panel attachment cable, 10 meters long; with plug contacts for cabling the Mobile Panel, including a circular plug for the switching cabinet cable.	
5CAMPH.0150-10	Mobile Panel attachment cable, 15 meters long; with plug contacts for cabling the Mobile Panel, including a circular plug for the switching cabinet cable.	
5CAMPH.0200-10	Mobile Panel attachment cable, 20 meters long; with plug contacts for cabling the Mobile Panel, including a circular plug for the switching cabinet cable.	
5CAMPC.0020-00	Switching cabinet cable (crossover), 2 meters long; with wire tip sleeves for connection in the switching cabinet, including built-in socket for the Mobile Panel attachment cable.	
5CAMPC.0020-01	Switching cabinet cable (straight thru), 2 meters long; with wire tip sleeves for connection in the switching cabinet, including built-in socket for the Mobile Panel attachment cable.	
5CAMPC.0020-10	Switching cabinet cable (crossover), 2 meters long; with wire tip sleeves for connection in the switching cabinet, including receptacle for the Mobile Panel attachment cable.	
5CAMPC.0020-11	Switching cabinet cable (straight thru), 2 meters long; with wire tip sleeves for connection in the switching cabinet, including receptacle for the Mobile Panel attachment cable.	

Table 25: Model number overview - Cables

3.3.2 Attachment cable 5CAMPH.0xxx-00

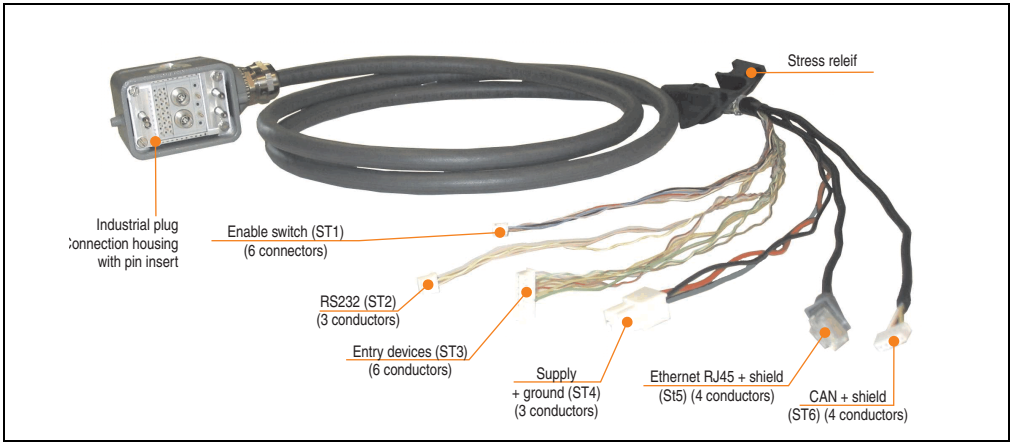


Figure 38: Attachment cable 5CAMPH.0xxx-00

The attachment cable establishes the electrical and mechanical connection between the switching cabinet and Mobile Panel. It includes lines for the network (Ethernet 10/100 Mbit/s), supply 24 VDC, entry devices, enable switch, serial data transfer and CAN.

The surface is protected against water, oil (lubricating and hydraulic oils according to EN 60811 section 2-1) and cooling lubricant.

On the Mobile Panel, the attachment cable is mounted into the handle. On the switching cabinet end, the attachment cable has an industrial plug. The attachment cable is available in different lengths (see table 6 "Model numbers - Mobile Panel attachment cables" on page 28). Information regarding the procedure for exchanging the attachment cable can be found in section 2 "Exchanging the connection cable" on page 248.Technical data.

Figure 39: Attachment cable and handle

Technical data

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Features	5CAMPH.0050-00	5CAMPH.0070-00	5CAMPH.0100-00	5CAMPH.0150-00	5CAMPH.0200-00
Length and tolerance	5 m ±10 cm	7 m ±10 cm	10 m ±10 cm	15 m ±15 cm	20 m ±15 cm
Connector Industrial plug	Connection housing with pin insert				
Cables Total diameter Weight per meter Sheathing material Available lengths Minimum flex radius Supply lines Permissible operating voltage Material Conductor resistance Max. tension stress Color	Hybrid cable, 33 wire 10 mm 153 g Silicon and halogen free, flame retardant PUR outer sheathing See table 6 "Model numbers - Mobile Panel attachment cables" on page 28 60 mm 30 VDC Tinned copper wires ≤ 30 Ω/km 140 N Similar to RAL 7012				
Cable elements Network Enable switch 2 x CAN bus Entry devices Power supply Serial connection (RxD / TxD)	Twisted pair cable for Ethernet (10/100 Mbit/s) (4-wire RJ45 plug) Direct connection between the enable switch and the monitoring device (6-wire) 2 pairs with shielding (4-wire) Direct connection between the entry device and the monitoring device (6-wire) Supply voltage + 24 VDC (2-wire) 3 wires				
Environment					
Operating temperature Non-moving Moving	-20 to +80°C -5 to +60°C				
Standards	Flame retardant according to IEC 60332-1 and VW1 / FT1 according to C-UL Shield damping according to IEC 60096-1, amendment 2 Mechanical characteristics according to DIN VDE 0472 section 603 test type H (100000 cycles) Oil resistant, hydrolysis resistant according to DIN VDE 0282 section 10				

Table 26: Technical data - Mobile Panel cable 5CAMPH.0xxx-00

Cable specifications

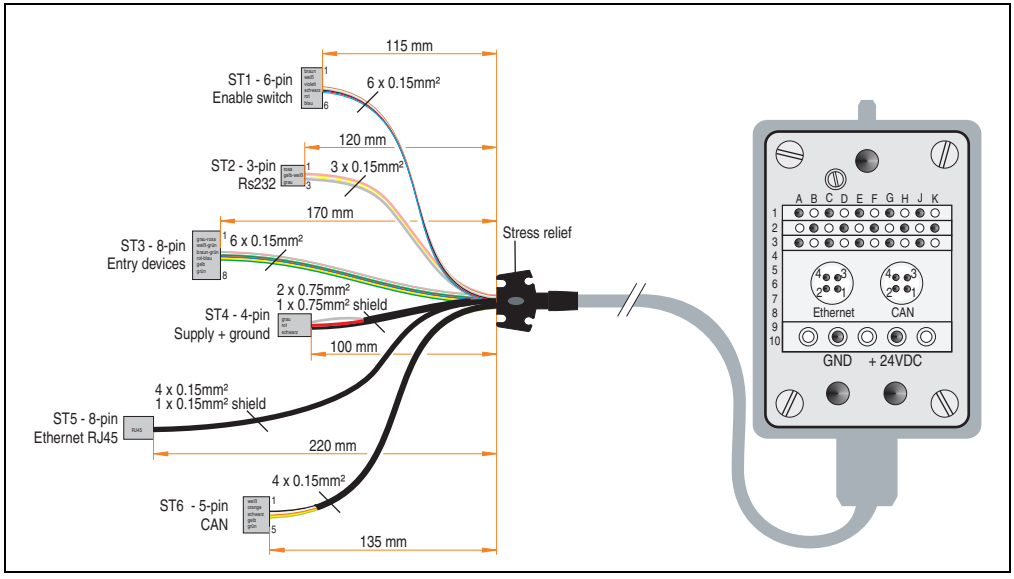


Figure 40: Cable specifications - Attachment cable 5CAMPH.0xxx-00

ST1 enable switch, 6-pin male connector		Wire colors - Attachment cable	Connection housing assignments
C1	Pin 1	Brown	A1
NO1	Pin 2	White	A3
NC1	Pin 3	Purple	B2
C2	Pin 4	Black	C1
NO2	Pin 5	Red	C3
NC2	Pin 6	Blue	D2
ST2 RS232, 3-pin male connector		**Wire colors - Attachment cable**	**Connection housing assignments**
RxD	Pin 1	Pink	J1
GND	Pin 2	White-Yellow	K2
TxD	Pin 3	Gray	J3
ST3 entry device, 8-pin male connector		**Wire colors - Attachment cable**	**Connection housing assignments**
E-stop N.C. contact 1 (11)	Pin 1	Gray-Pink	E1
E-stop N.C. contact 1 (12)	Pin 2	White-Green	E3
E-stop N.C. contact 2 (21)	Pin 3	Brown-Green	G1
E-stop N.C. contact 2 (22)	Pin 4	Red-Blue	G3
Key switch (13)	Pin 5	Yellow	F2
Key switch (14)	Pin 6	Green	H2

n.c.	Pin 7	-	-
n.c.	Pin 8	-	-
ST4 supply		**Wire colors - Attachment cable**	**Connection housing assignments**
+ 24 VDC supply	Pin 1	Red	+ 24 VDC
Shielding	Pin 2	Gray	Plug housing (outer shield)
Ground	Pin 3	Black	GND
n.c.	Pin 4	-	-
ST5 Ethernet RJ45 connector		**Wire colors - Attachment cable**	**Connection housing assignments**
TX	Pin 1	Green	Pin 1
TX\	Pin 2	Yellow	Pin 4
RX	Pin 3	Pink	Pin 2
n.c.	Pin 4	-	-
n.c.	Pin 5	-	-
RX\	Pin 6	Blue	Pin 3
n.c.	Pin 7	-	-
n.c.	Pin 8	-	-
Shielding	-	Shielding	Ethernet shield
ST6 CAN, 5-pin male connector		**Wire colors - Attachment cable**	**Connection housing assignments**
CAN 1 High	Pin 1	White	Pin 1
CAN 1 Low	Pin 2	Orange	Pin 4
Shielding	Pin 3	Black	CAN shield
CAN 2 High	Pin 4	Yellow	Pin 2
CAN 2 Low	Pin 5	Green	Pin 3

3.3.3 Attachment cable 5CAMPH.0xxx-10

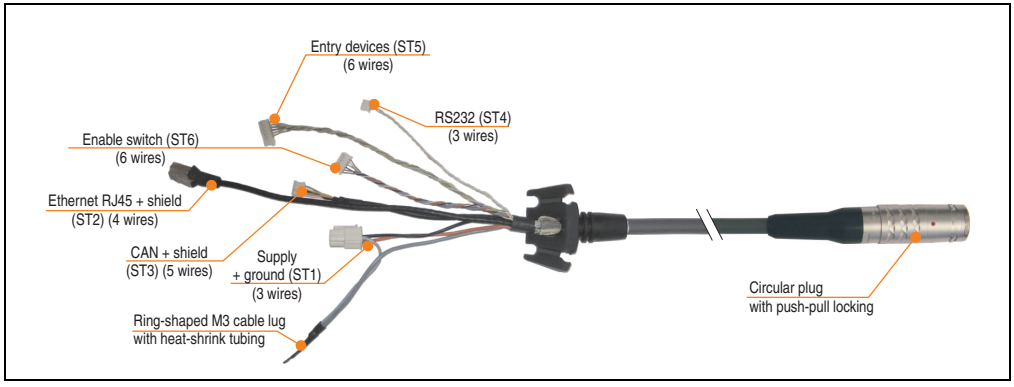


Figure 41: Attachment cable 5CAMPH.0xxx-10

The attachment cable establishes the electrical and mechanical connection between the switching cabinet and Mobile Panel. It includes lines for the network (Ethernet 10/100 Mbit/s), supply 24 VDC, entry devices, enable switch, serial data transfer and CAN.

The surface is protected against water, oil (lubricating and hydraulic oils according to EN 60811 section 2-1) and cooling lubricant.

On the Mobile Panel, the attachment cable is mounted into the handle. On the switching cabinet end, the attachment cable has a circular plug. The attachment cable is available in different lengths (see table 6 "Model numbers - Mobile Panel attachment cables" on page 28). Information regarding the procedure for exchanging the attachment cable can be found in section "Exchanging the connection cable" on page 248.

Figure 42: Attachment cable and handle

Technical data

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Features	5CAMPH.0018-10	5CAMPH.0050-10	5CAMPH.0100-10	5CAMPH.0150-10	5CAMPH.0200-10
Length and tolerance	1.8 m ±5 cm	5 m ±10 cm	10 m ±10 cm	15 m ±15 cm	20 m ±15 cm
Connector Industrial plug	Push-Pull circular plug (ODU circular plug with Push-Pull locking)				
Cables Total diameter Weight per meter Sheathing material Available lengths Minimum flex radius Supply lines Permissible operating voltage Material Conductor resistance Max. tension stress Color	Hybrid cable, 25 wire 10 mm 153 g Silicon and halogen free, flame retardant PUR outer sheathing See table 6 "Model numbers - Mobile Panel attachment cables" on page 28 60 mm 30 VDC Tinned copper wires ≤ 30 Ω/km 140 N Similar to RAL 7012				
Cable elements Network Enable switch 2 x CAN bus Entry devices Power supply Serial connection (RxD / TxD)	 Twisted pair cable for Ethernet (10/100 Mbit/s) (4-wire RJ45 plug) Direct connection between the enable switch and the monitoring device (6-wire) 2 pairs with shielding (4-wire) Direct connection between the entry device and the monitoring device (6-wire) Supply voltage + 24 VDC (2-wire) 3 wires				
Environment					
Operating temperature Non-moving Moving	 -20 to +80°C -5 to +60°C				
Standards	Flame retardant according to IEC 60332-1 and VW1 / FT1 according to C-UL Shield damping according to IEC 60096-1, amendment 2 Mechanical characteristics according to DIN VDE 0472 section 603 test type H (100000 cycles) Oil resistant, hydrolysis resistant according to DIN VDE 0282 section 10				

Table 27: Technical data - Mobile Panel cable 5CAMPH.0xxx-10

Cable specifications

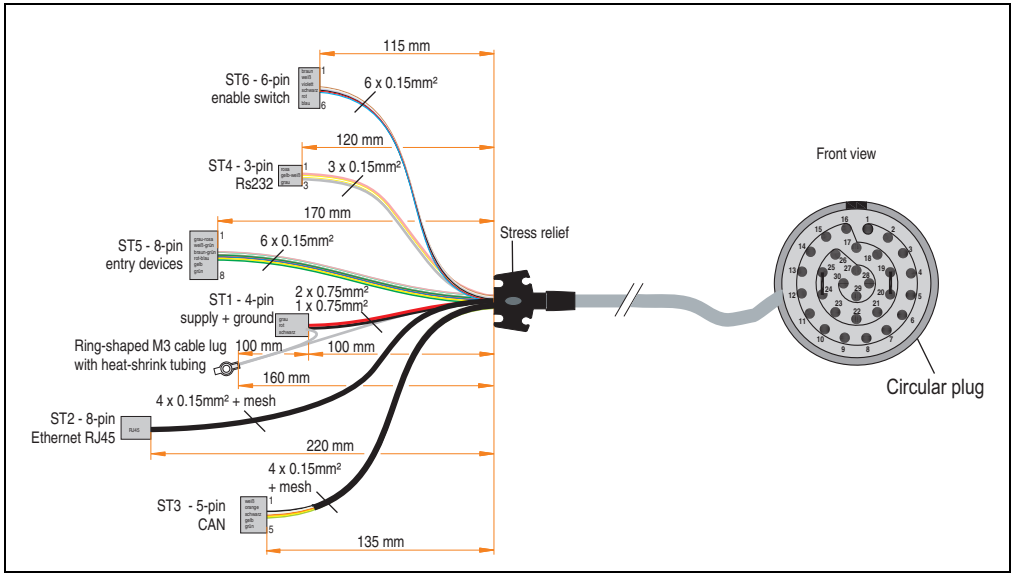


Figure 43: Cable specifications - attachment cable 5CAMPH.0xxx-10

ST6 enable switch, 6-pin male connector		Wire colors - Attachment cable	Connection housing assignments
C1	Pin 1	Brown	Pin 4
NO 1	Pin 2	White	Pin 5
NC 1	Pin 3	Purple	Pin 6
C 2	Pin 4	Black	Pin 9
NO 2	Pin 5	Red	Pin 8
NC 2	Pin 6	Blue	Pin 7
ST4 RS232, 3-pin male connector		**Wire colors - Attachment cable**	**Connection housing assignments**
RxD	Pin 1	Pink	Pin 21
RS232_GND	Pin 2	White-Yellow	Pin 22
TxD	Pin 3	Gray	Pin 23
ST5 entry device, 8-pin male connector		**Wire colors - Attachment cable**	**Connection housing assignments**
E-stop N.C. contact 1 (11)	Pin 1	Gray-Pink	Pin 1
E-stop N.C. contact 1 (12)	Pin 2	White-Green	Pin 15
E-stop N.C. contact 2 (21)	Pin 3	Brown-Green	Pin 2
E-stop N.C. contact 2 (22)	Pin 4	Red-Blue	Pin 16
Button (S13)	Pin 5	Yellow	Pin 18
Button (S14)	Pin 6	Green	Pin 26

n.c.	Pin 7	-	-
n.c.	Pin 8	-	-
ST1 supply + ground		**Wire colors - Attachment cable**	**Connection housing assignments**
+ 24 VDC supply	Pin 1	Red	Pin 3
Shielding	Pin 2	Gray	Pin 17
Ground	Pin 3	Black	Pin 14
n.c.	Pin 4	-	-
ST2 Ethernet RJ45 connector		**Wire colors - Attachment cable**	**Connection housing assignments**
TX	Pin 1	Green	Pin 27
TX\	Pin 2	Yellow	Pin 29
RX	Pin 3	Pink	Pin 28
n.c.	Pin 4	-	-
n.c.	Pin 5	-	-
RX\	Pin 6	Blue	Pin 30
n.c.	Pin 7	-	-
n.c.	Pin 8	-	-
Shielding	-	Shielding	Ethernet shield
ST6 CAN, 5-pin male connector		**Wire colors - Attachment cable**	**Connection housing assignments**
CAN 1 High	Pin 1	White	Pin 10
CAN 1 Low	Pin 2	Orange	Pin 11
Shielding	Pin 3	Black	CAN shield
CAN 2 High	Pin 4	Yellow	Pin 12
CAN 2 Low	Pin 5	Green	Pin 13

3.3.4 Switching cabinet cable (crossover) 5CAMPC.0020-00

The pin assignments for the Ethernet plug (crossover) make it possible to connect directly to a B&R controller like the X20 or to the first Ethernet connection (MDIX) of the B&R Ethernet hub AC808 (model number 0AC808.9).

If a different Ethernet hub is used, it must support the crossover of the RX and TX lines.

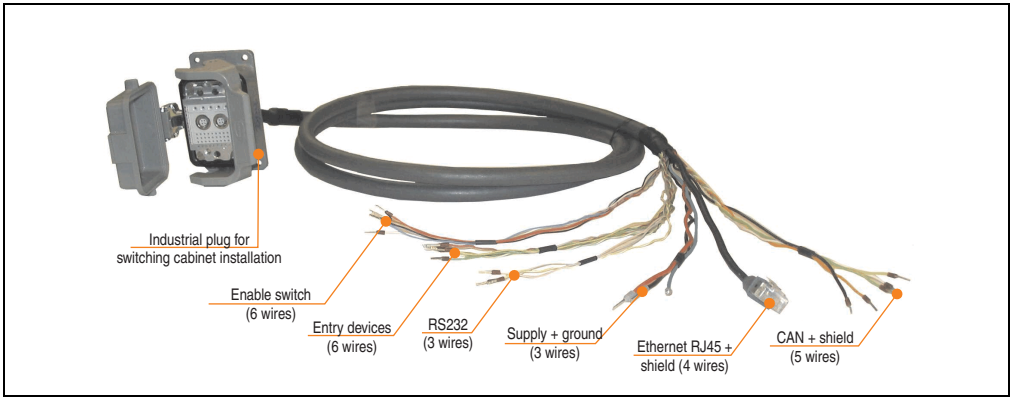


Figure 44: Mobile Panel switching cabinet cable 5CAMPC.0020-00

The switching cabinet cable is required for the wiring inside the switching cabinet.

The surface is protected against water, oil (lubricating and hydraulic oils according to EN 60811 section 2-1) and cooling lubricant.

The connection housing is used to connect the switching cabinet cable to the switching cabinet door (see image 46 "Drilling template - Switching cabinet socket" on page 93). The other end of the switching cabinet cable has a pre-assembled RJ45 Ethernet plug. The rest of the lines have an open end with wire tip sleeves. This makes it easier to wire the cable to safety equipment and the other connections.

Information:

The seal, which is attached to the connection housing with a cable tie, must be placed between the connection housing and the switching cabinet door.

Connections and shielding in the switching cabinet

This topic is addressed in more detail in chapter 3 "Commissioning", section 4 "Connection and Shielding" on page 124.

Technical data

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Features	5CAMPC.0020-00
Length and tolerance	2 m ±5 cm
Connector Industrial socket	 Connection housing with socket insert
Cables Total diameter Weight per meter Sheathing material Available lengths Minimum flex radius Supply lines Permissible operating voltage Material Conductor resistance Max. tension stress Color	Hybrid cable, 25 wire 10 mm 153 g Silicon and halogen free, flame retardant PUR outer sheathing See table 7 "Model numbers - Mobile Panel switching cabinet cables" on page 29 60 mm 30 VDC Tinned copper wires ≤ 30 Ω/km 140 N Similar to RAL 7012
Cable elements Network Enable switch 2 x CAN bus Entry devices Power supply Serial connection (RxD / TxD)	 Twisted pair cable for Ethernet (10/100 Mbit/s) (4-wire) Direct connection between the enable switch and the monitoring device (6-wire) 2 pairs with shielding (5-wire) Direct connection between the entry device and the monitoring device (6-wire) Supply voltage 24 VDC and ground (3-wire) 3 wires
Environment	
Permissible operating temperature Non-moving Moving	 -20 to +80°C -5 to +60°C
Standards	Flame retardant according to IEC 60332-1 and VW1 / FT1 according to C-UL Shield damping according to IEC 60096-1, amendment 2 Mechanical characteristics according to DIN VDE 0472 section 603 test type H (100000 cycles) Oil resistant, hydrolysis resistant according to DIN VDE 0282 section 10

Table 28: Technical data - Switching cabinet cable 5CAMPC.0020-00

Cable specifications

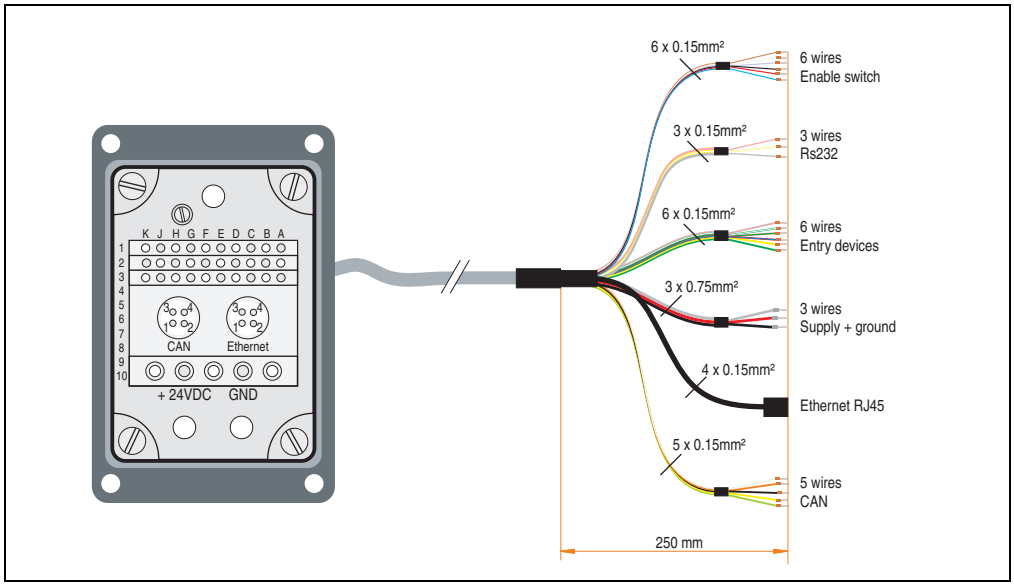


Figure 45: Cable layout - switching cabinet cable 5CAMPC.0020-00

Assignments in connection housing	Wire color - Switching cabinet cable	Enable switch wires
A1	Brown	C1
A3	White	NO1
B2	Purple	NC1
C1	Black	C2
C3	Red	NO2
D2	Blue	NC2
Assignments in connection housing	**Wire color - Switching cabinet cable**	**RS232 wires**
J1	Pink	RxD
J3	Gray	TxD
K2	White-Yellow	GND
Assignments in connection housing	**Wire color - Switching cabinet cable**	**Entry device wires**
E1	Gray-Pink	E-stop N.C. contact 1 (11)
E3	White-Green	E-stop N.C. contact 1 (12)
G1	Brown-Green	E-stop N.C. contact 2 (21)
G3	Red-Blue	E-stop N.C. contact 2 (22)
F2	Yellow	Key switch (13)
H2	Green	Key switch (14)

Assignments in connection housing	Wire color - Switching cabinet cable	Supply wires
GND	Black	Ground
+ 24 VDC	Red	+ 24 VDC supply
Plug housing (outer shield)	Gray	Shielding
Assignments in connection housing	**Wire color - Switching cabinet cable**	**Ethernet RJ45 plug**
Pin 1	Green	Pin 3 (RX)
Pin 2	Pink	Pin 1 (TX)
Pin 3	Blue	Pin 2 (TX\)
Pin 4	Yellow	Pin 6 (RX\)
Ethernet shield	Shielding	
Assignments in connection housing	**Wire color - Switching cabinet cable**	**CAN wires**
Pin 1	White	CAN 1 High
Pin 2	Yellow	CAN 2 High
Pin 3	Green	CAN 2 Low
Pin 4	Orange	CAN 1 Low
CAN shield	Black	Shielding

Information:

When installing the switching cabinet cable, make sure that it is not too loose or pulled too tight in the switching cabinet.

Drilling template - Connection housing

Drilling holes and a cutout must be made according to the following diagram for mounting the connection housing (e.g. to a switching cabinet door).

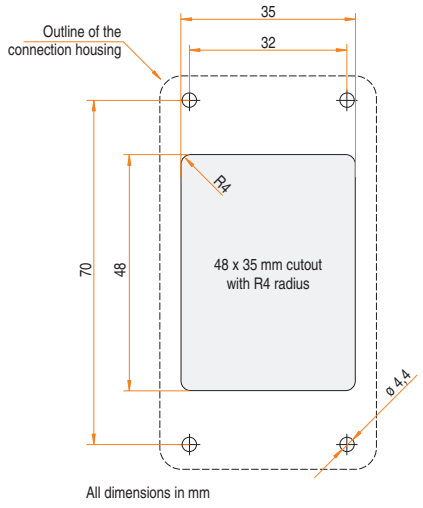


Figure 46: Drilling template - Switching cabinet socket

3.3.5 Switching cabinet cable (straight thru) 5CAMPC.0020-01

The pin assignments for the Ethernet plug (1:1) make it possible to connect directly to a standard Ethernet hub.

If the first Ethernet connection on B&R Ethernet hub AC808 (model number 0AC808.9) is used, make sure that the crossover (MDIX) is not activated.

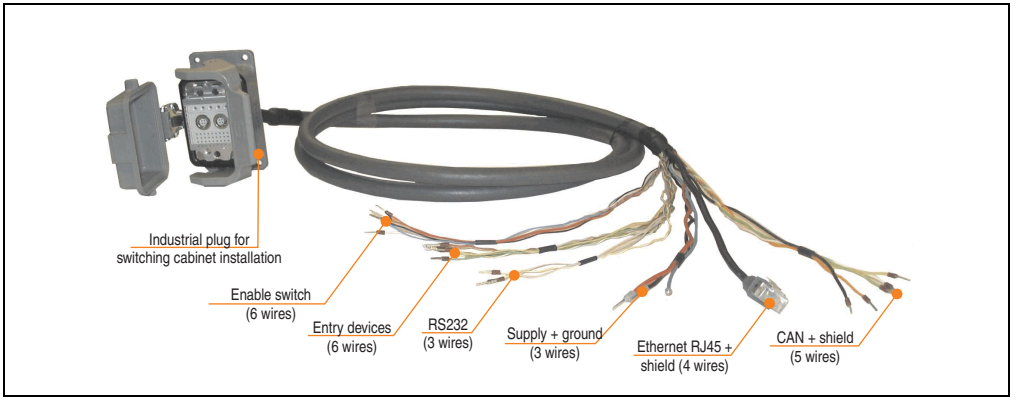


Figure 47: Mobile Panel switching cabinet cable 5CAMPC.0020-01

The switching cabinet cable is required for the wiring inside the switching cabinet.

The surface is protected against water, oil (lubricating and hydraulic oils according to EN 60811 section 2-1) and cooling lubricant.

The connection housing is used to connect the switching cabinet cable to the switching cabinet door (see image 49 "Drilling template - Switching cabinet socket" on page 98). The other end of the switching cabinet cable has a pre-assembled RJ45 Ethernet plug. The rest of the lines have an open end with wire tip sleeves. This makes it easier to wire the cable to safety equipment and the other connections.

Information:

The seal, which is attached to the connection housing with a cable tie, must be placed between the connection housing and the switching cabinet door.

Shielding in the switching cabinet

This topic is addressed in more detail in chapter 3 "Commissioning", section 4 "Connection and Shielding" on page 124.

Technical data

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Features	5CAMPC.0020-01
Length and tolerance	2 m ±5 cm
Connector Industrial socket	 Connection housing with socket insert
Cables Total diameter Weight per meter Sheathing material Available lengths Minimum flex radius Supply lines Permissible operating voltage Material Conductor resistance Max. tension stress Color	Hybrid cable, 25 wire 10 mm 153 g Silicon and halogen free, flame retardant PUR outer sheathing See table 7 "Model numbers - Mobile Panel switching cabinet cables" on page 29 60 mm 30 VDC Tinned copper wires ≤ 30 Ω/km 140 N Similar to RAL 7012
Cable elements Network Enable switch 2 x CAN bus Entry devices Power supply Serial connection (RxD / TxD)	 Twisted pair cable for Ethernet (10/100 Mbit/s) (4-wire) Direct connection between the enable switch and the monitoring device (6-wire) 2 pairs with shielding (5-wire) Direct connection between the entry device and the monitoring device (6-wire) Supply voltage 24 VDC and ground (3-wire) 3 wires
Environment	
Permissible operating temperature Non-moving Moving	 -20 to +80°C -5 to +60°C
Standards	Flame retardant according to IEC 60332-1 and VW1 / FT1 according to C-UL Shield damping according to IEC 60096-1, amendment 2 Mechanical characteristics according to DIN VDE 0472 section 603 test type H (100000 cycles) Oil resistant, hydrolysis resistant according to DIN VDE 0282 section 10

Table 29: Technical data - Switching cabinet cable 5CAMPC.0020-01

Cable specifications

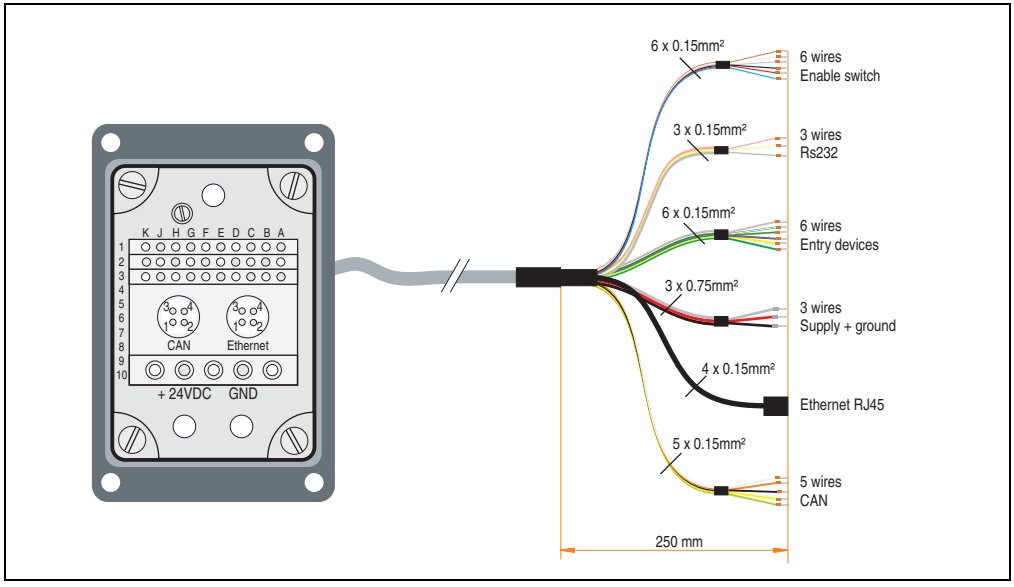


Figure 48: Cable layout - switching cabinet cable 5CAMPC.0020-01

Assignments in connection housing	Wire color - Switching cabinet cable	Enable switch wires
A1	Brown	C1
A3	White	NO1
B2	Purple	NC1
C1	Black	C2
C3	Red	NO2
D2	Blue	NC2
Assignments in connection housing	**Wire color - Switching cabinet cable**	**RS232 wires**
J1	Pink	RxD
J3	Gray	TxD
K2	White-Yellow	GND
Assignments in connection housing	**Wire color - Switching cabinet cable**	**Entry device wires**
E1	Gray-Pink	E-stop N.C. contact 1 (11)
E3	White-Green	E-stop N.C. contact 1 (12)
G1	Brown-Green	E-stop N.C. contact 2 (21)
G3	Red-Blue	E-stop N.C. contact 2 (22)
F2	Yellow	Key switch (13)
H2	Green	Key switch (14)

Assignments in connection housing	Wire color - Switching cabinet cable	Supply wires
GND	Black	Ground
+ 24 VDC	Red	+ 24 VDC supply
Plug housing (outer shield)	Gray	Shielding
Assignments in connection housing	**Wire color - Switching cabinet cable**	**Ethernet RJ45 plug**
Pin 1	Green	Pin 1 (TX)
Pin 2	Pink	Pin 3 (RX)
Pin 3	Blue	Pin 6 (RX\)
Pin 4	Yellow	Pin 2 (TX\)
Ethernet shield	Shielding	
Assignments in connection housing	**Wire color - Switching cabinet cable**	**CAN wires**
Pin 1	White	CAN 1 High
Pin 2	Yellow	CAN 2 High
Pin 3	Green	CAN 2 Low
Pin 4	Orange	CAN 1 Low
CAN shield	Black	Shielding

Information:

When installing the switching cabinet cable, make sure that it is not too loose or pulled too tight in the switching cabinet.

Drilling template - Connection housing

Drilling holes and a cutout must be made according to the following diagram for mounting the connection housing (e.g. to a switching cabinet door).

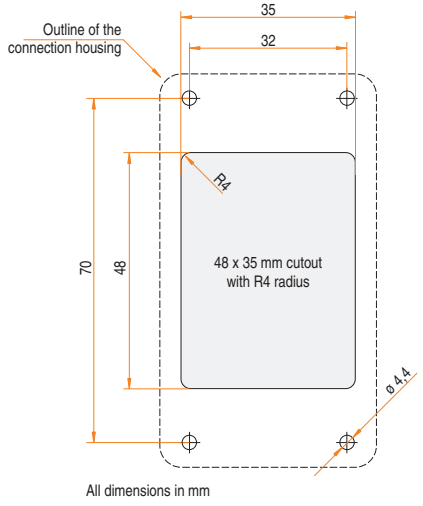


Figure 49: Drilling template - Switching cabinet socket

3.3.6 Switching cabinet cable (crossover) 5CAMPC.0020-10

The pin assignments for the Ethernet plug (crossover) make it possible to connect directly to a B&R controller like the X20 or to the first Ethernet connection (MDIX) of the B&R Ethernet hub AC808 (model number 0AC808.9).

If a different Ethernet hub is used, it must support the crossover of the RX and TX lines.

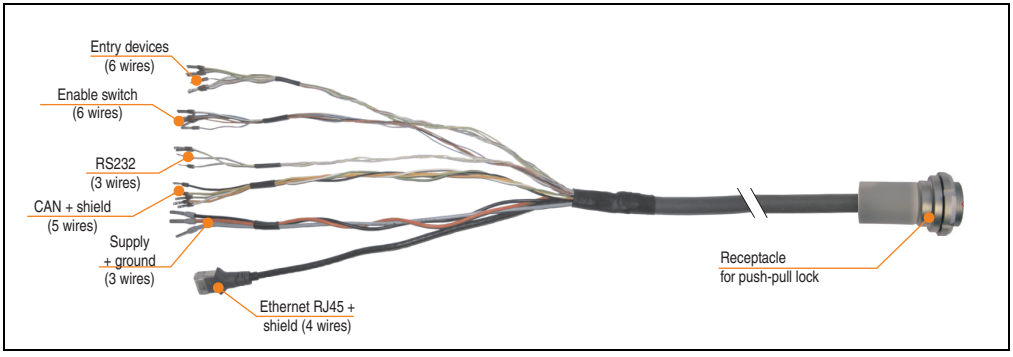


Figure 50: Mobile Panel switching cabinet cable 5CAMPC.0020-10

The switching cabinet cable is required for the wiring inside the switching cabinet.

The surface is protected against water, oil (lubricating and hydraulic oils according to EN 60811 section 2-1) and cooling lubricant.

The connection housing is used to connect the switching cabinet cable to the switching cabinet door (see image 52 "Drilling template - Receptacle" on page 102). The other end of the switching cabinet cable has a pre-assembled RJ45 Ethernet plug. The rest of the lines have an open end with wire tip sleeves. This makes it easier to wire the cable to safety equipment and the other connections.

Connections and shielding in the switching cabinet

This topic is addressed in more detail in chapter 3 "Commissioning", section 4 "Connection and Shielding" on page 124.

Technical data

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Features	5CAMPC.0020-10
Length and tolerance	2 m ±5 cm
Connector Industrial socket	 Receptacle for push-pull locking connection
Cables Total diameter Weight per meter Sheathing material Available lengths Minimum flex radius Supply lines Permissible operating voltage Material Conductor resistance Max. tension stress Color	Hybrid cable, 25 wire 10 mm 153 g Silicon and halogen free, flame retardant PUR outer sheathing See table 7 "Model numbers - Mobile Panel switching cabinet cables" on page 29 60 mm 30 VDC Tinned copper wires ≤ 30 Ω/km 140 N Similar to RAL 7012
Cable elements Network Enable switch 2 x CAN bus Entry devices Power supply Serial connection (RxD / TxD)	 Twisted pair cable for Ethernet (10/100 Mbit/s) (4-wire) Direct connection between the enable switch and the monitoring device (6-wire) 2 pairs with shielding (5-wire) Direct connection between the entry device and the monitoring device (6-wire) Supply voltage 24 VDC and ground (3-wire) 3 wires
Environment	
Permissible operating temperature Non-moving Moving	 -20 to +80°C -5 to +60°C
Standards	Flame retardant according to IEC 60332-1 and VW1 / FT1 according to C-UL Shield damping according to IEC 60096-1, amendment 2 Mechanical characteristics according to DIN VDE 0472 section 603 test type H (100000 cycles) Oil resistant, hydrolysis resistant according to DIN VDE 0282 section 10

Table 30: Technical data - Switching cabinet cable 5CAMPC.0020-10

Cable specifications

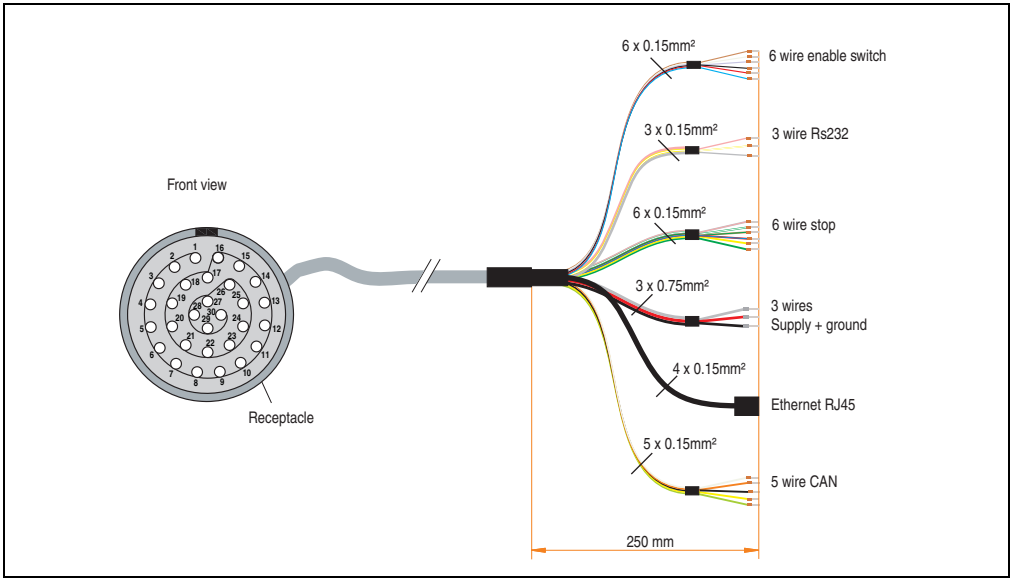


Figure 51: Cable layout - switching cabinet cable 5CAMPC.0020-10

Pin assignments - Receptacle	Wire color - Switching cabinet cable	Enable switch wires
4	Brown	C1
5	White	NO1
6	Purple	NC1
9	Black	C2
8	Red	NO2
7	Blue	NC2
Pin assignments - Receptacle	**Wire color - Switching cabinet cable**	**RS232 wires**
21	Pink	RxD
23	Gray	TxD
22	White-Yellow	GND
Pin assignments - Receptacle	**Wire color - Switching cabinet cable**	**Entry device wires**
1	Gray-Pink	E-stop N.C. contact 1 (11)
15	White-Green	E-stop N.C. contact 1 (12)
2	Brown-Green	E-stop N.C. contact 2 (21)
16	Red-Blue	E-stop N.C. contact 2 (22)
18	Yellow	Button (S13)
26	Green	Button (S14)

Pin assignments - Receptacle	Wire color - Switching cabinet cable	Supply wires
14	Black	Ground
3	Red	+ 24 VDC supply
17	Gray	Shielding
Pin assignments - Receptacle	**Wire color - Switching cabinet cable**	**Ethernet RJ45 plug**
27	Green	Pin 3 (RX)
28	Pink	Pin 1 (TX)
30	Blue	Pin 2 (TX\)
29	Yellow	Pin 6 (RX\)
Ethernet shield	Shielding	Shielding
Pin assignments - Receptacle	**Wire color - Switching cabinet cable**	**CAN wires**
10	White	CAN 1 High
12	Yellow	CAN 2 High
13	Green	CAN 2 Low
11	Orange	CAN 1 Low
CAN shield	Black	Shielding

Information:

When installing the switching cabinet cable, make sure that it is not too loose or pulled too tight in the switching cabinet.

Drilling template - Receptacle

Drilling holes and a cutout must be made according to the following diagram for mounting the receptacle (e.g. to a switching cabinet door).

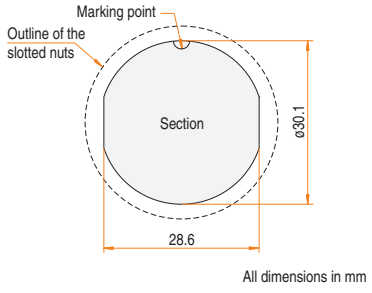


Figure 52: Drilling template - Receptacle

3.3.7 Switching cabinet cable (straight thru) 5CAMPC.0020-11

The pin assignments for the Ethernet plug (1:1) make it possible to connect directly to a standard Ethernet hub.

If the first Ethernet connection on B&R Ethernet hub AC808 (model number 0AC808.9) is used, make sure that the crossover (MDIX) is not activated.

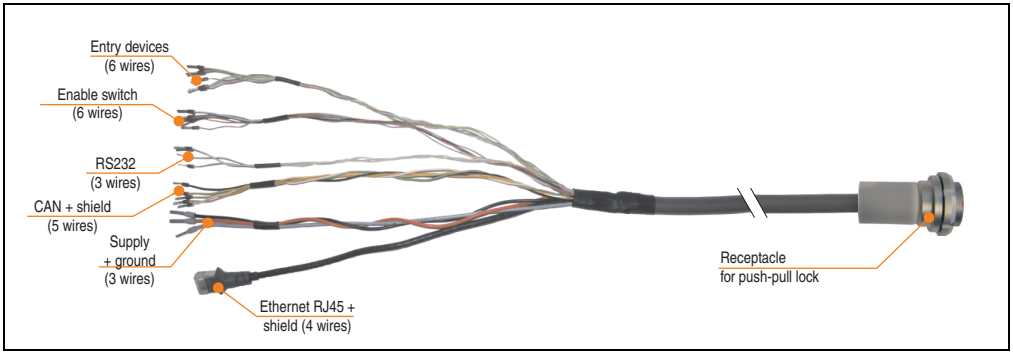


Figure 53: Mobile Panel switching cabinet cable 5CAMPC.0020-11

The switching cabinet cable is required for the wiring inside the switching cabinet.

The surface is protected against water, oil (lubricating and hydraulic oils according to EN 60811 section 2-1) and cooling lubricant.

The connection housing is used to connect the switching cabinet cable to the switching cabinet door (see image 55 "Drilling template - Receptacle" on page 106). The other end of the switching cabinet cable has a pre-assembled RJ45 Ethernet plug. The rest of the lines have an open end with wire tip sleeves. This makes it easier to wire the cable to safety equipment and the other connections.

Shielding in the switching cabinet

This topic is addressed in more detail in chapter 3 "Commissioning", section 4 "Connection and Shielding" on page 124.

Technical data

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Features	5CAMPC.0020-11
Length and tolerance	2 m ±5 cm
Connector Industrial socket	 Receptacle for push-pull locking connection
Cables Total diameter Weight per meter Sheathing material Available lengths Minimum flex radius Supply lines Permissible operating voltage Material Conductor resistance Max. tension stress Color	Hybrid cable, 25 wire 10 mm 153 g Silicon and halogen free, flame retardant PUR outer sheathing See table 7 "Model numbers - Mobile Panel switching cabinet cables" on page 29 60 mm 30 VDC Tinned copper wires ≤ 30 Ω/km 140 N Similar to RAL 7012
Cable elements Network Enable switch 2 x CAN bus Entry devices Power supply Serial connection (RxD / TxD)	 Twisted pair cable for Ethernet (10/100 Mbit/s) (4-wire) Direct connection between the enable switch and the monitoring device (6-wire) 2 pairs with shielding (5-wire) Direct connection between the entry device and the monitoring device (6-wire) Supply voltage 24 VDC and ground (3-wire) 3 wires
Environment	
Permissible operating temperature Non-moving Moving	 -20 to +80°C -5 to +60°C
Standards	Flame retardant according to IEC 60332-1 and VW1 / FT1 according to C-UL Shield damping according to IEC 60096-1, amendment 2 Mechanical characteristics according to DIN VDE 0472 section 603 test type H (100000 cycles) Oil resistant, hydrolysis resistant according to DIN VDE 0282 section 10

Table 31: Technical data - Switching cabinet cable 5CAMPC.0020-11

Cable specifications

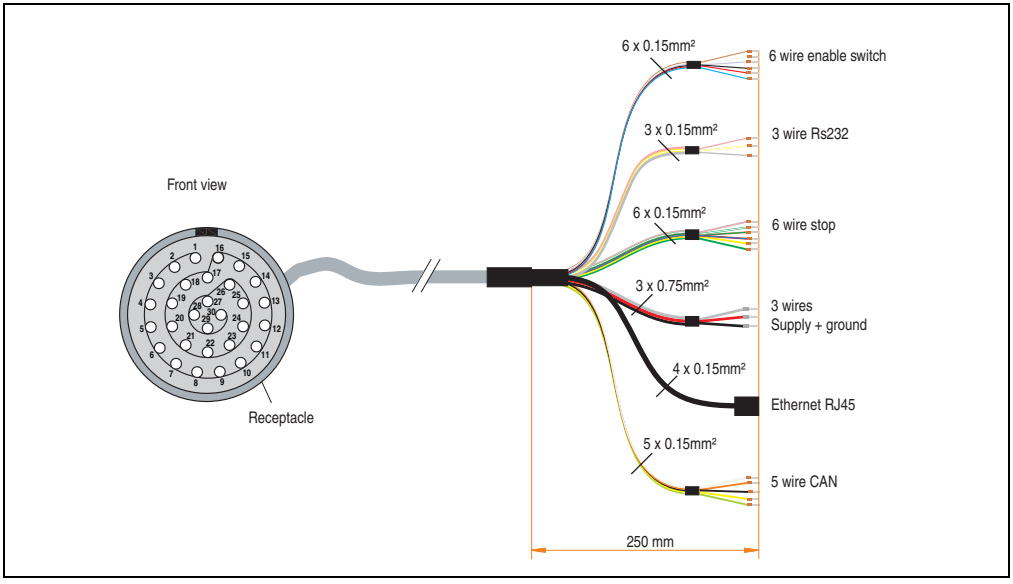


Figure 54: Cable layout - switching cabinet cable 5CAMPC.0020-11

Assignments in connection housing	Wire color - Switching cabinet cable	Enable switch wires
4	Brown	C1
5	White	NO1
6	Purple	NC1
9	Black	C2
8	Red	NO2
7	Blue	NC2
Assignments in connection housing	**Wire color - Switching cabinet cable**	**RS232 wires**
21	Pink	RxD
23	Gray	TxD
22	White-Yellow	GND
Assignments in connection housing	**Wire color - Switching cabinet cable**	**Entry device wires**
1	Gray-Pink	E-stop N.C. contact 1 (11)
15	White-Green	E-stop N.C. contact 1 (12)
2	Brown-Green	E-stop N.C. contact 2 (21)
16	Red-Blue	E-stop N.C. contact 2 (22)
18	Yellow	Button (S13)
26	Green	Button (S14)

Assignments in connection housing	Wire color - Switching cabinet cable	Supply wires
14	Black	Ground
17	Red	+ 24 VDC supply
3	Gray	Shielding
Assignments in connection housing	**Wire color - Switching cabinet cable**	**Ethernet RJ45 plug**
27	Green	Pin 1 (RX)
28	Pink	Pin 3 (TX)
30	Blue	Pin 6 (TX\)
29	Yellow	Pin 2 (RX\)
Ethernet shield	Shielding	Shielding
Assignments in connection housing	**Wire color - Switching cabinet cable**	**CAN wires**
10	White	CAN 1 High
12	Yellow	CAN 2 High
13	Green	CAN 2 Low
11	Orange	CAN 1 Low
CAN shield	Black	Shielding

Information:

When installing the switching cabinet cable, make sure that it is not too loose or pulled too tight in the switching cabinet.

Drilling template - Receptacle

Drilling holes and a cutout must be made according to the following diagram for mounting the receptacle (e.g. to a switching cabinet door).

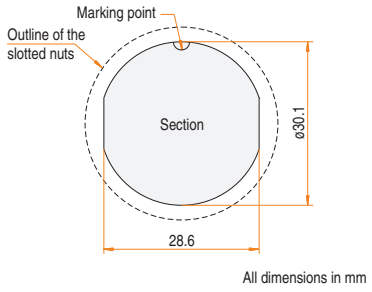


Figure 55: Drilling template - Receptacle

3.4 Wall mount

The wall mount 4MPBRA.0000-00 is used for storing the Mobile Panel (operating unit + handle) together with the Mobile Panel attachment cable and is only intended for upright, hanging installation.

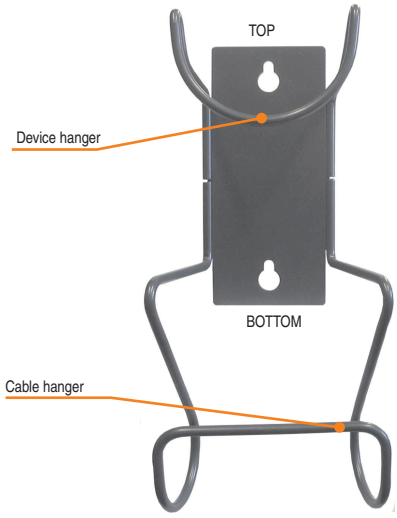


Figure 56: Wall mount 4MPBRA.0000-00

Drilling holes for attaching the wall mount must be made in accordance with the diagram 57 "Dimensions - Wall mount 4MPBRA.0000-00" on page 108.

Caution!

The mounting location for the wall mount should be selected so that the Mobile Panel is not directly subjected to sources of heat or sunlight when placed on it. The wall mount should also be positioned so that operation of the E-stop is not impaired.

Danger!

When the Mobile Panel device is stored on its wall mount and located in a dangerous machine area, the attachment cable and the switching cabinet cable must still be completely connected so that the E-stop button can be activated.

3.4.1 Technical data

Mechanics	4MPBRA.0000-00
Material Paint, color	St37 Powder-coated (semi gloss), similar to RAL 7016
Dimensions Width Height Depth	 140 mm 305 mm 109 mm
Weight	680 g

Table 32: Technical data - 4MPBRA.0000-00

3.4.2 Dimensions

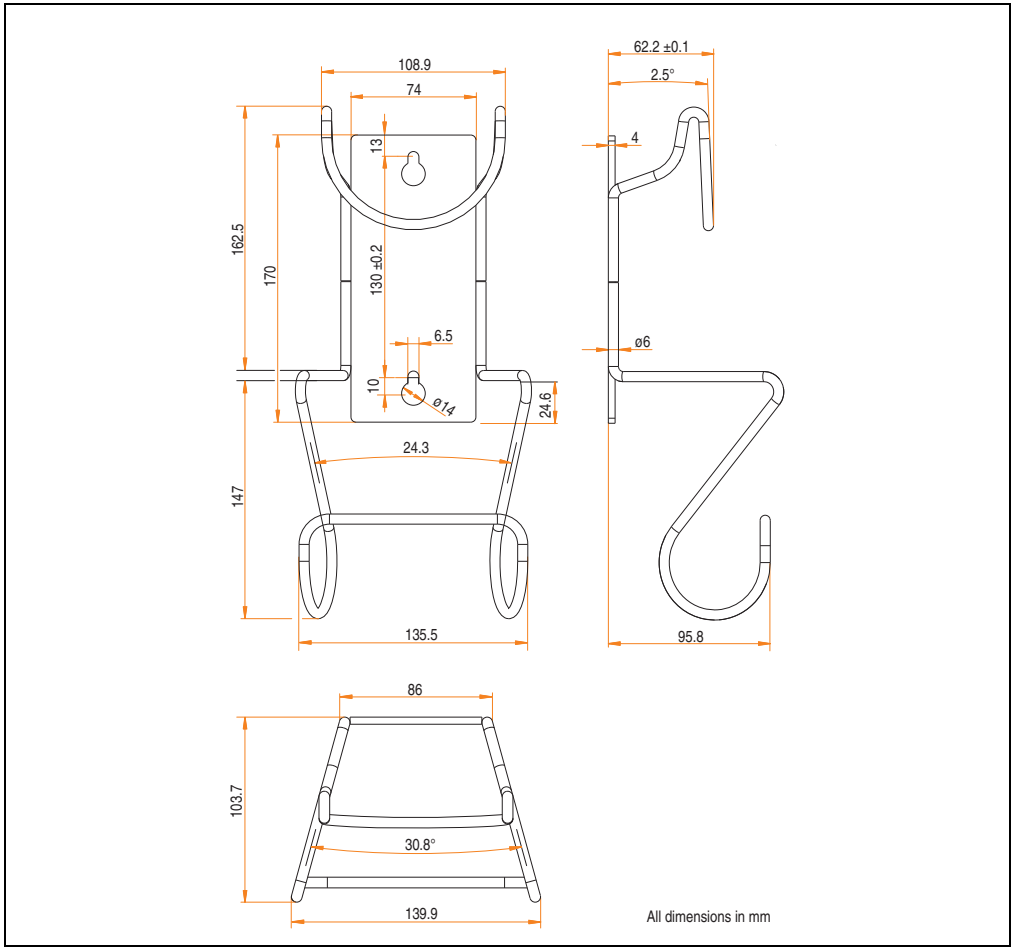


Figure 57: Dimensions - Wall mount 4MPBRA.0000-00

3.4.3 Storing the Mobile Panel device

The following images illustrate the proper way to store a Mobile Panel device on a wall mount.

View from front	Side view

Table 33: Storing a Mobile Panel device on a wall mount

3.5 Strapping plug

The strapping plug is used to bridge the E-stop contact on the switching cabinet when the Mobile Panel is unplugged. This plug is inserted in the connection housing / receptacle for the switching cabinet cable.

3.5.1 Order data

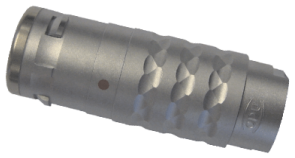
Model number	Description	Figure
4MPBYP.0000-00	**Strapping plug** Mobile Panel lock pull strapping plug for switching cabinet cable 5CAMPC.0020-00, 5CAMPC.0020-01.	
4MPBYP.0000-10	**Strapping plug** Mobile Panel push pull strapping plug for switching cabinet cable 5CAMPC.0020-10, 5CAMPC.0020-11.	

Table 34: Order data - Strapping plug

3.5.2 Technical data

Mechanics	4MPBYP.0000-00	4MPBYP.0000-10
Connector Industrial plug	 Connection housing with pin insert	 Circular plug with push-pull locking
Dimensions Length Width Depth Diameter	 80 mm 43 mm 50 mm -	 74 mm - - 25 mm
Weight	172.3 g	150 g

Table 35: Technical data - Strapping plug

3.5.3 Cable layout - 4MPBYP.0000-00

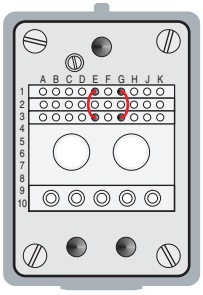


Figure 58: Cable layout - Strapping plug 4MPBYP.0000-00

In the strapping plug, E-stop contacts **E1 - E3** as well as **G1 - G3** are connected with each other.

3.5.4 Cable layout - 4MPBYP.0000-10

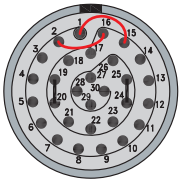


Figure 59: Cable layout - Strapping plug 4MPBYP.0000-10

In the strapping plug, E-stop contacts **Pin 1 - Pin 15** as well as **Pin 2 - Pin 16** are connected with each other.

Information:

When using the strapping plug, the two contacts for the key switch (F2, H2 - 4MPBYP.0000-00 and Pin 5, Pin 6 - 4MPBYP.0000-10) are not connected with each other. They must be wired externally. If the attachment cable of the Mobile Panel device is reconnected with the switching cabinet cable, the key switch could be triggered at two different positions (Mobile Panel + external wiring)!

Chapter 3 • Commissioning

1. Commissioning from a safety perspective

In order to begin operating the Mobile Panel device, the E-stop function must first be acknowledged using the key switch. This causes the E-stop safety relay to begin monitoring the E-stop button. If the E-stop is not pressed, and the enable switch is pressed to the enable position or a safety door on the system is closed, then the main circuit, which must be implemented via external positively driven safeguards, is closed.

When the E-stop button is pressed, it locks in the engaged position. The E-stop monitoring device then shuts down the machine or system. A quarter turn clockwise releases the E-stop button once again to its original position. Releasing the E-stop button must never cause the machine to automatically begin running again. The E-stop action must first be acknowledged with the key switch before the machine or system can be put back into operation. Bypassing the key switch will be detected by the monitoring device.

The machine's safety circuit remains interrupted as long as the 3-step enable switch has not been pressed or the assembly's safety door has not been closed. The enable switch has three steps, and the enable signal is only passed on when it's set in the middle position. In other words, the enable switch must be pressed to the middle position in order for the Mobile Panel to carry out user commands (see also "Functionality" in "Enable switch" on page 76).

1.1 Intended use

The Mobile Panel device may only be used for the applications described in section "Introduction" on page 33.

Information:

The responsibility for the correctness and functionality of the wiring, adherence to prescribed standards, and safety engineering rests solely with the project engineers.

2. Operating the Mobile Panel device

Caution!

- **Make sure that cables are safely out of the way on the floor to prevent any tripping which may result in the Mobile Panel device falling to the ground.**
- **The Mobile Panel attachment cable may not be pinched or come into contact with sharp corners, which would result in damage to the cable or its sheathing.**
- **Operating a Mobile Panel with a damaged connection or switching cabinet cable is not permitted.**
- **When not using the Mobile Panel, it should be safely stowed away on its wall mount. When the Mobile Panel device is stored on its wall mount in a dangerous area around the machine, the attachment cable must still be connected so that the E-stop button can be activated if necessary.**
- **When setting down the Mobile Panel device for a short period of time, do not place it in such a way that its entry devices could be damaged or where it may inadvertently trigger an action. Also, do not place it on unstable surfaces where it may fall. It should never be placed near heat sources or in direct sunlight.**
- **Although the Mobile Panel device has been designed for use in harsh industrial environments, it should still not come into contact with large amounts of dust or humidity, excessive mechanical shocks, or strong magnetic fields.**
- **The touch screen must not be operated with sharp objects such as ballpoint pens, knives, screwdrivers, etc. These objects will permanently damage the touch screen. The ideal object for operating the touch screen is the touch screen pen (see "Touch screen pen" on page 44). The touch screen can also be operated with a finger.**
- **When operating the touch screen, only touch one point at a time. Touching several places at once can cause unintended actions.**
- **Do not place objects on top of the touch screen.**
- **If the Mobile Panel device has sustained a severe shock (e.g. if it has fallen), then the CF / USB cover fitting must be checked directly afterwards. If a CompactFlash card was in the CompactFlash slot at the time of impact, this should also be checked to ensure a proper fit. The safety features on the Mobile Panel must also be inspected (E-stop button, key switch, enable switch).**

Caution!

Pressing several function or system keys at the same time may trigger unintended actions.

Information:

- **Protective coverings on the device, housing screws, housing and cables should all be checked periodically for damage.**
- **For instructions on cleaning the Mobile Panel device, see "Cleaning" on page 247.**

3. Recommended monitoring devices

B&R recommends using PNOZ e1.1p or PNOZ e2.1p safety relays from the Pilz company (www.pilz.com) in order to achieve Safety Category 4 in accordance with EN 13849-1:2008. As a monitoring device for the E-stop button, the PNOZ e1.1p can be used for safety circuits up to Safety Category 4 according to EN 13849-1:2008. It is imperative to use the PNOZ e2.1p as a monitoring device for the enable switch for safety circuits up to Category 4 (EN 13849-1:2008).

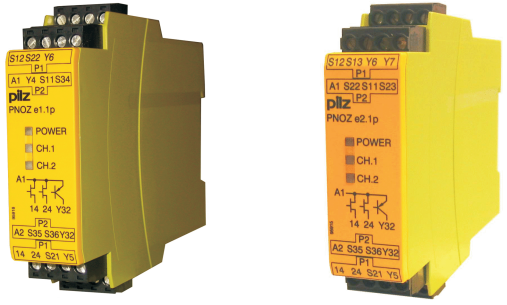


Figure 60: PILZ PNOZ e1.1p (left) and PILZ PNOZ e2.1p (right)

Warning!

If EN 13849-1:2008 Safety Categories 2, 3, and 4 are not necessary, safeguards can be switched directly on the E-stop circuit for Categories B and 1. When doing so, be aware of EN 13849-1:2008 and the max. permitted current load on the E-stop button and the key switch! More information can be found in the section 3.3 "Current load of the enable switch and command device circuit" on page 123.

3.1 Connection examples - E-stop and key switch

Warning!

The highest safety category that can be reached for an entire system is always determined by the lowest safety circuit category being used.

3.1.1 Connection example - Safety circuits up to EN 13849-1:2008 Category 4

This circuit has two channels which monitor starts and detect short circuits. Ground faults, errors in the safety circuit, and errors or faulty connections in the E-stop button are detected.

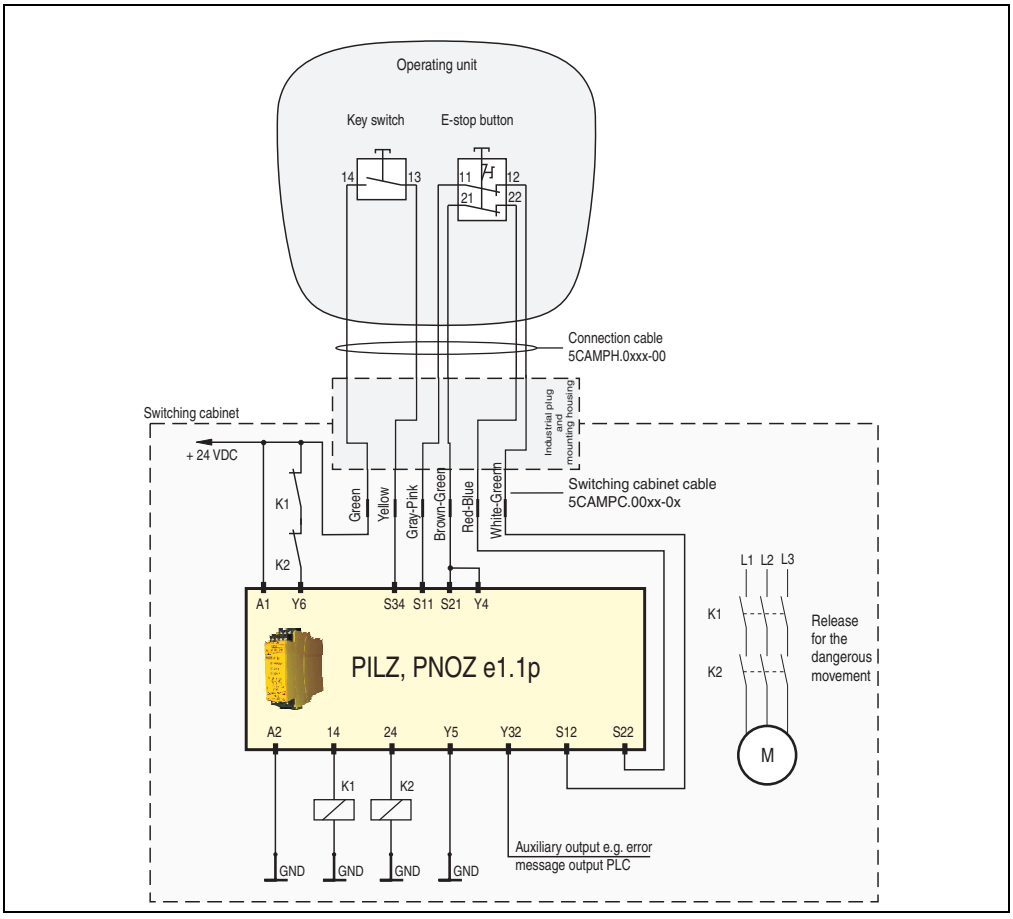


Figure 61: Connection example - Safety circuits up to EN 13849-1:2008 Category 4

Warning!

All K1 and K2 contacts must be positively driven.

Danger!

To guarantee EN 13850-1:2008 and Safety Category 4 accordance with EN 13849-1:2008, the instructions for the monitoring device being used must be followed.

3.1.2 Connection example - Safety circuits up to EN 13849-1:2008 Category 3

This circuit has two channels; the key switch is not wired. To start, an external switch must be connected.

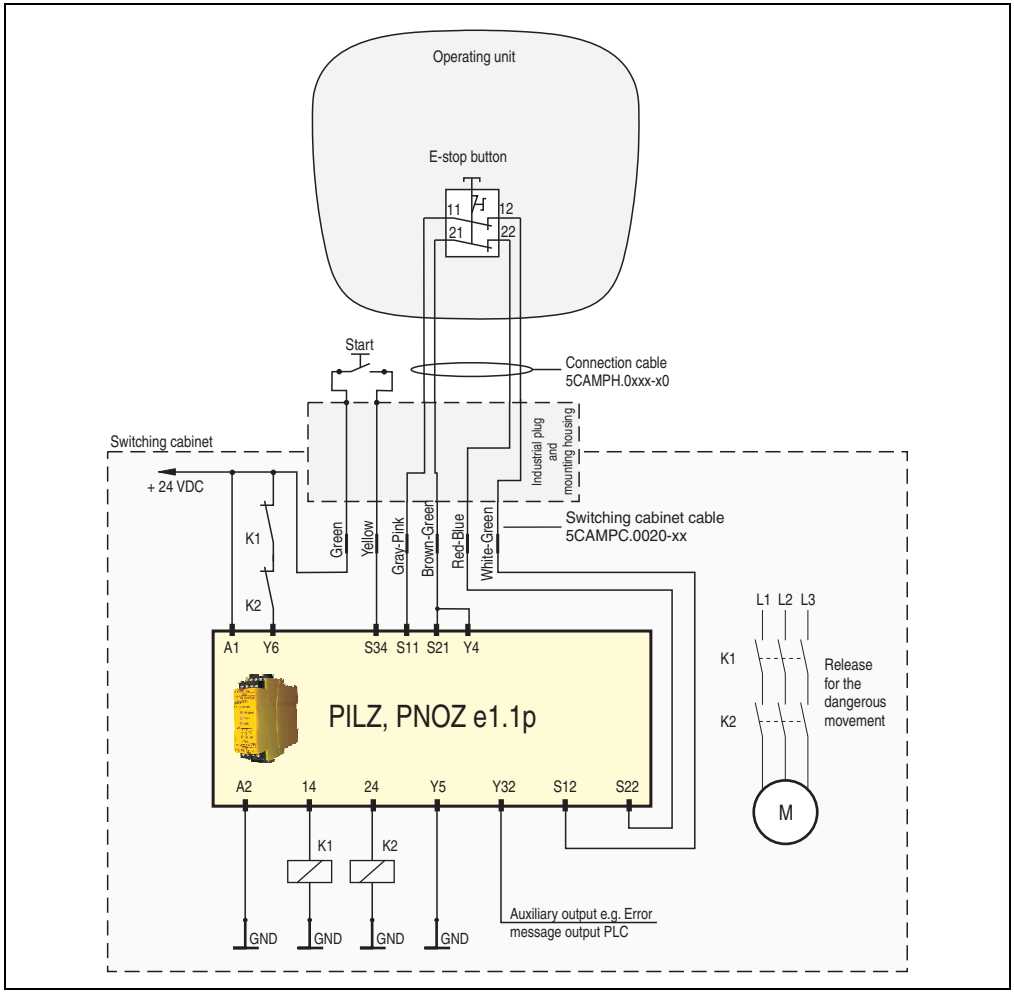


Figure 62: Connection example - Safety circuits up to EN 13849-1:2008 Category 3

3.1.3 Connection example - Safety circuits up to EN 13849-1:2008 Category 1

This switch has one channel. Ground faults are recognized.

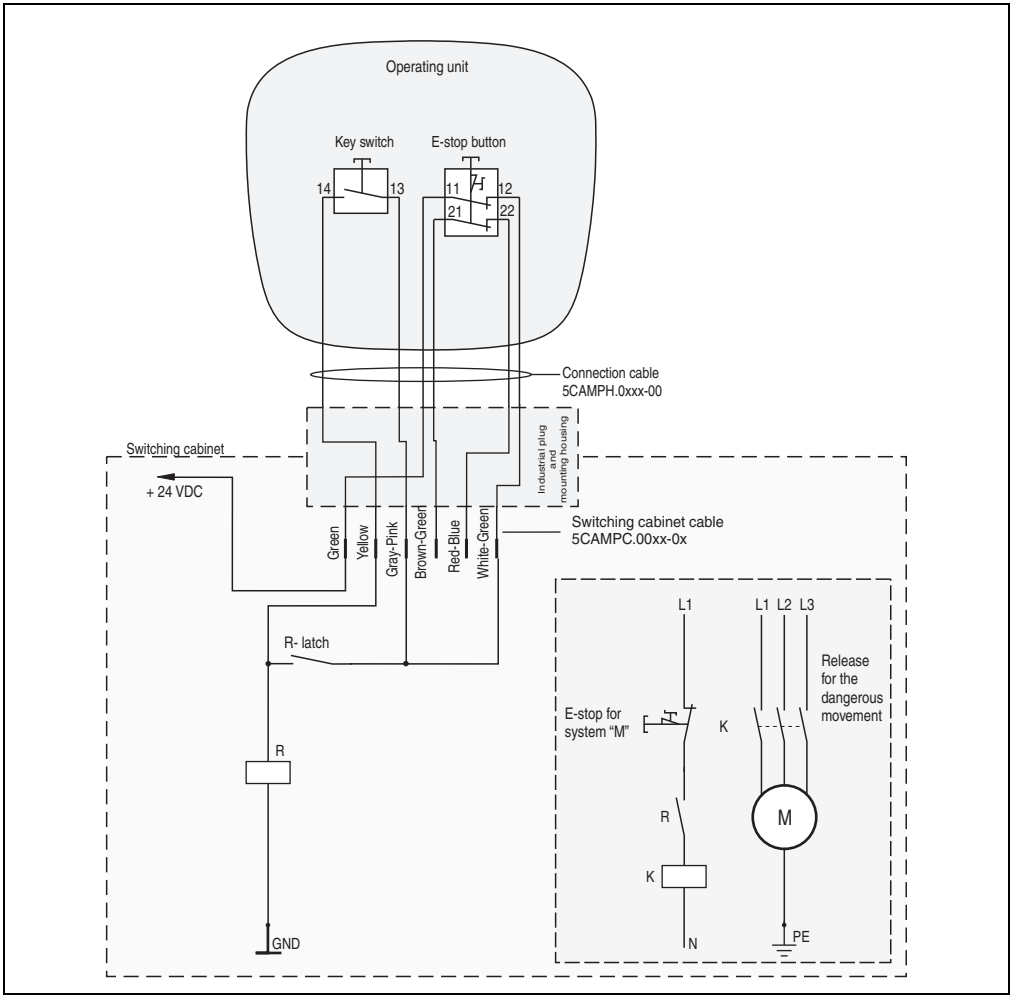


Figure 63: Connection example - Safety circuits up to EN 13849-1:2008 Category 1

Warning!

Pay attention to the max. permitted current load of the E-stop button, the key switch, and the enable switch! More information can be found in the section 3.3 "Current load of the enable switch and command device circuit" on page 123.

The Mobile Panel device should never be operated while the functions which protect the Mobile Panel device are out of order!

3.2 Connection example - Enable switch

Warning!

The highest safety category that can be reached for an entire system is always determined by the lowest safety circuit category being used.

3.2.1 Connection example - Safety circuits up to EN 13849-1:2008 Category 4

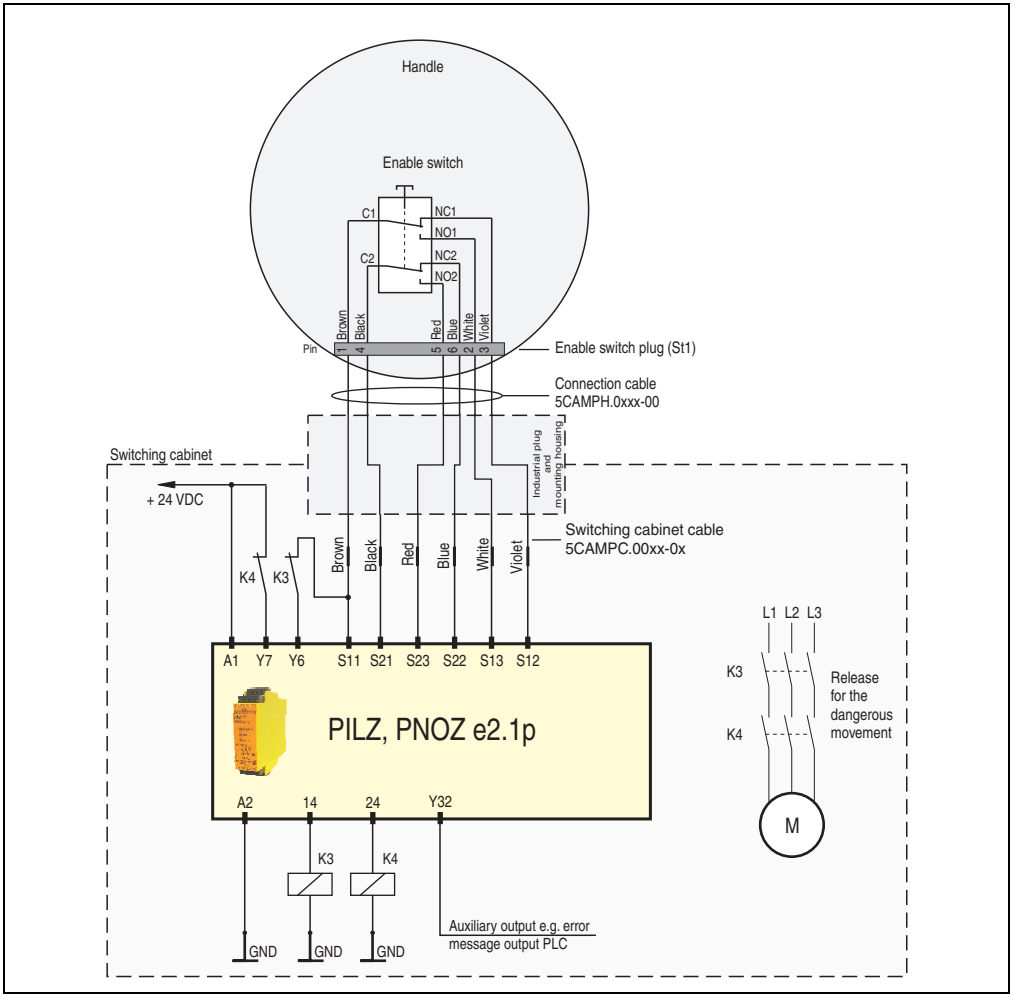


Figure 64: Connection example for using in safety circuits up to Category 4 in accordance with EN 13849-1:2008 with Pilz PNOZ e2.1p safety relay (with short circuit detection and simultaneous operation monitoring)

Warning!

All K3 and K4 contacts must be positively driven.

Danger!

To guarantee EN 13850-1:2008 and Safety Category 4 accordance with EN 13849-1:2008, the instructions for the monitoring device being used must be followed.

3.3 Current load of the enable switch and command device circuit

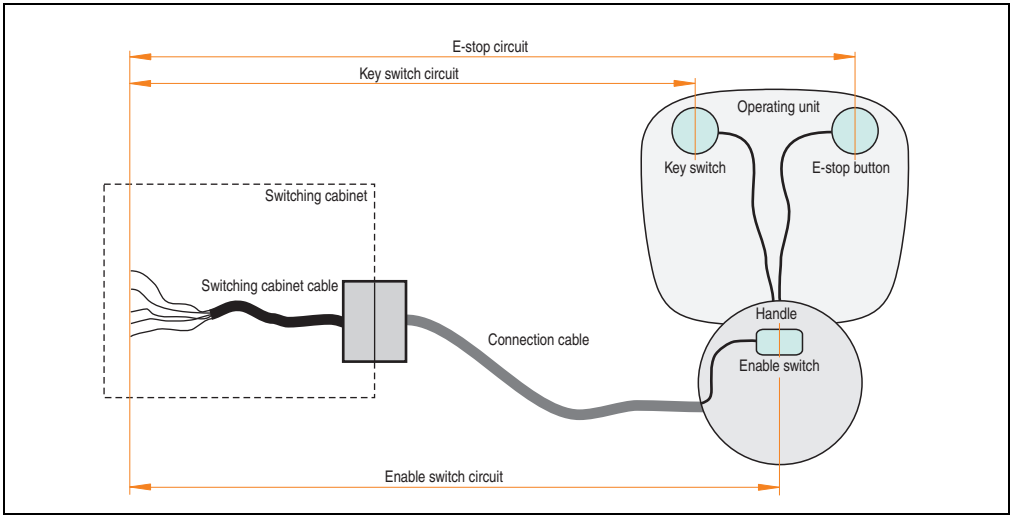


Figure 65: Current load of the enable switch and command device circuit

The limit values in the following table result from the different current loads of the components in the enable switch and command device circuit (circuit boards, cables, buttons, etc.). These values apply beginning from the start of the cable in the switching cabinet (switching cabinet cable) to the respective safety feature or unit (key switch, E-stop button, and enable switch) on the operator panel or handle.

	Max. current load	Max. voltage
E-stop circuit	0.4 A	32 VDC
Key switch circuit	0.1 A	32 VDC
Enable switch circuit (adhere to Category AC12/DC12)	0.4 A	30 VDC

Table 36: Current load of the enable switch and command device circuit

Information:

If you wish to use an additional fuse to protect a circuit, then the following fuse types should be used for the respective circuits:

E-stop circuit: 0.4 A slow-blow glass tube fuse
Key switch circuit: 0.1A slow-blow glass tube fuse
Enable switch circuit: 0.4 A slow-blow glass tube fuse

4. Connection and Shielding

The following figure shows a schematic of a Mobile Panel device.

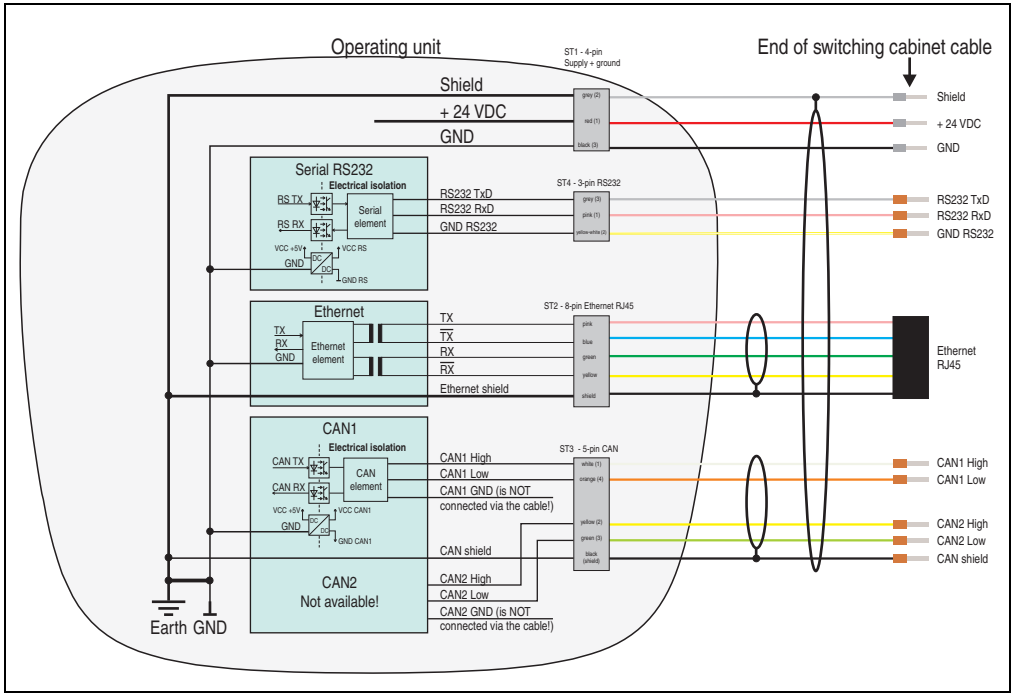


Figure 66: Connection and Shielding

4.1 Power supply

Earth and GND are connected internally in the operating unit! The shield line (gray wire) and GND line (black wire) must be connected to a part of the switching cabinet that is grounded.
The supply voltage is internally protected (self-healing fuse), so that the device cannot be damaged if there is an overload or if the voltage supply is connected incorrectly (reverse polarity protection).

4.2 Serial interface

The RS232 interface is electrically isolated internally.

Warning!

If the RS232 GND line (white-yellow wire) is connected to GND, then electrical isolation no longer exists.

4.3 Ethernet

The Ethernet shield is internally connected to Earth/GND from the operating unit. The plug can in be linked to a shielded socket.

4.4 CAN

Information:

The Mobile Panel can only be connected to a CAN network as the last station.

The CAN1 interface is electrically isolated internally. CAN1 GND is NOT connected to external GND via a cable. The CAN shield line (black wire) corresponds to Earth/GND for the operating unit.

Warning!

If the CAN shield line (black wire) is connected to GND, then electrical isolation no longer exists.

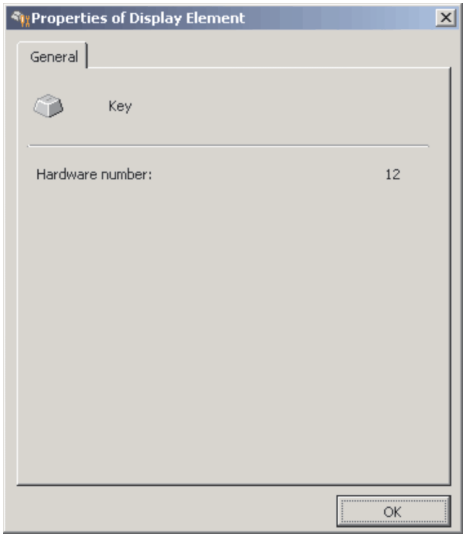
5. Key and LED configurations

Each key or LED can be configured individually and adjusted to suit the application. Various B&R tools are available for this purpose:

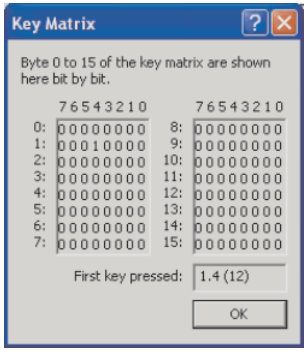
- B&R Key Editor for Windows operating systems
- Visual Components for Automation Runtime

Keys and LEDs from each device are processed by the matrix controller in a bit sequence of 128 bits each.

The positions of the keys and LEDs in the matrix are shown as hardware numbers. The hardware numbers can be read directly on the target system, for example with the B&R Key Editor and the B&R Control Center.



Screenshot from B&R Key Editor



Screenshot from B&R Control Center

Figure 67: Example - Hardware number in the B&R Key Editor or in the B&R Control Center

The following graphics show the positions of the keys and LEDs in the matrix. They are shown as follows.

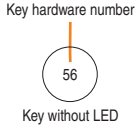


Figure 68: Display - Keys in the matrix

5.1 Hardware numbers - BIOS device

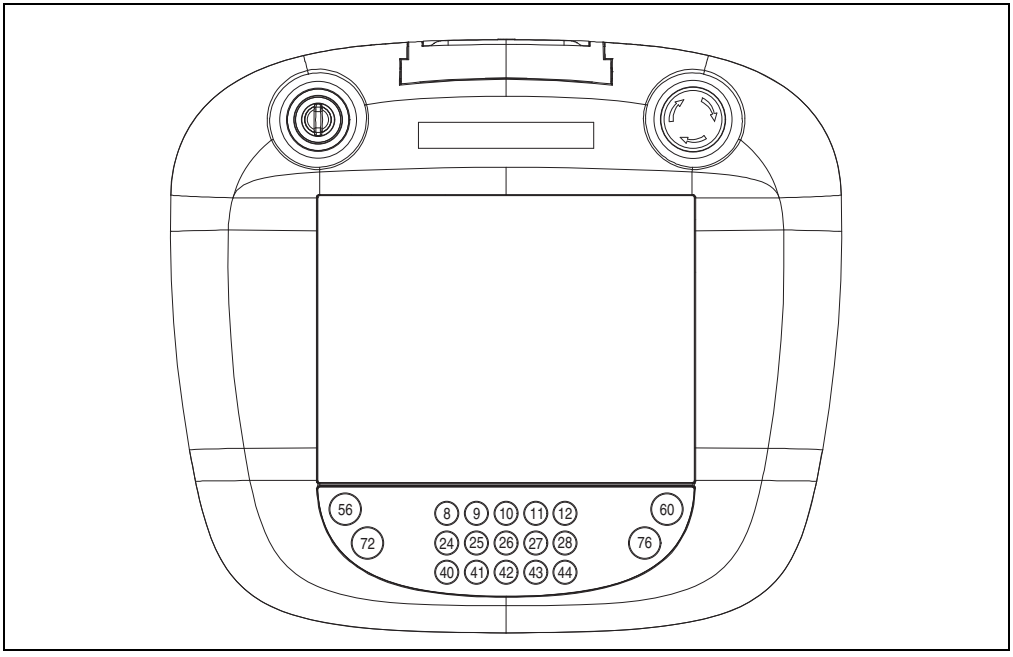


Figure 69: Hardware numbers - BIOS device keys

6. Touch screen calibration

6.1 Windows CE

B&R Windows CE starts the touch calibration sequence during its first boot in the default configuration / delivered state. This guarantees that the touch screen is calibrated correctly.

6.2 Windows XP Embedded

After first starting Windows XP Embedded (First Boot Agent), the touch screen driver must be installed in the device in order to operate the touch screen. The necessary software can be downloaded from the download area on the B&R homepage (**www.br-automation.com**). After installing the software, the touch screen can be calibrated.

6.3 Automation Runtime / Visual Components

The first time the touch screen is used, it must be calibrated at least once in the customer application for the existing device and project. This also applies if the CompactFlash is copied and used again in a similar machine.

7. Application examples

7.1 Connection to a B&R controller (X20)

7.1.1 MP100

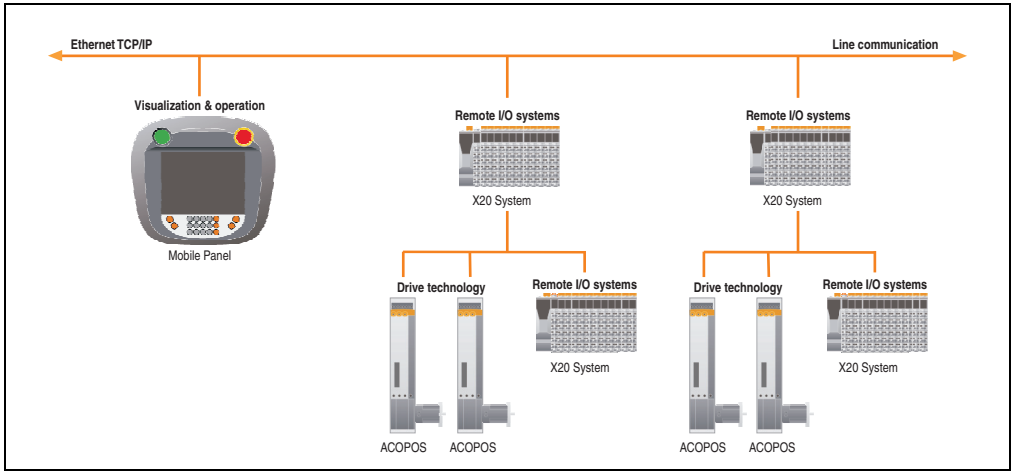


Figure 70: Application example - MP100

7.1.2 MP200

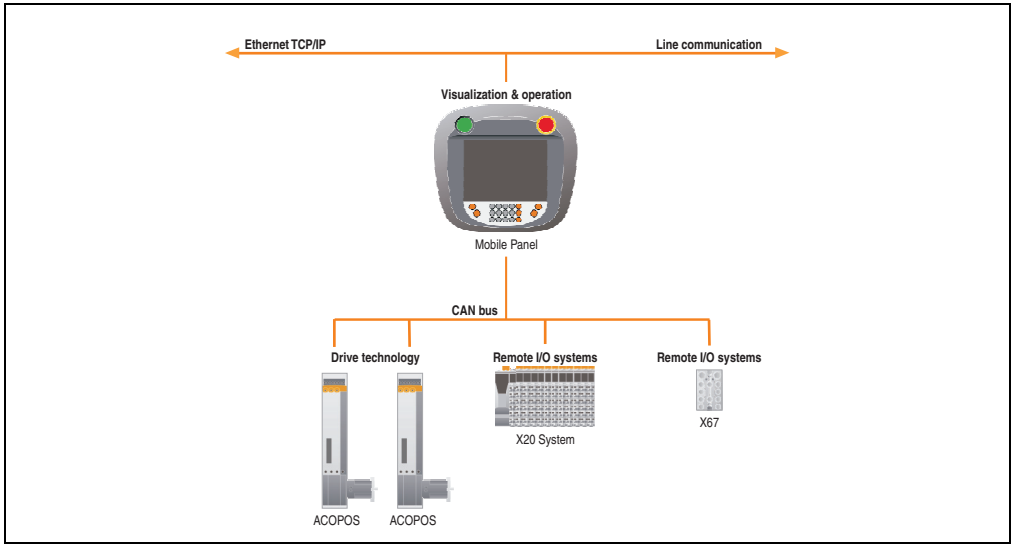


Figure 71: Application example - MP200

7.2 Mobile thin client

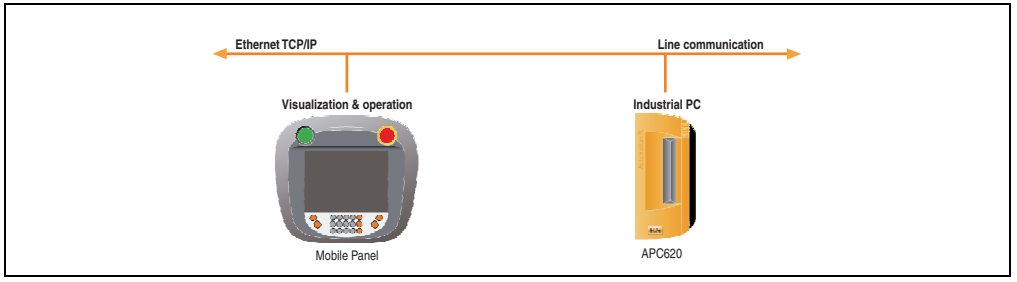


Figure 72: Mobile thin client

8. CompactFlash slot

8.1 Inserting a CompactFlash card

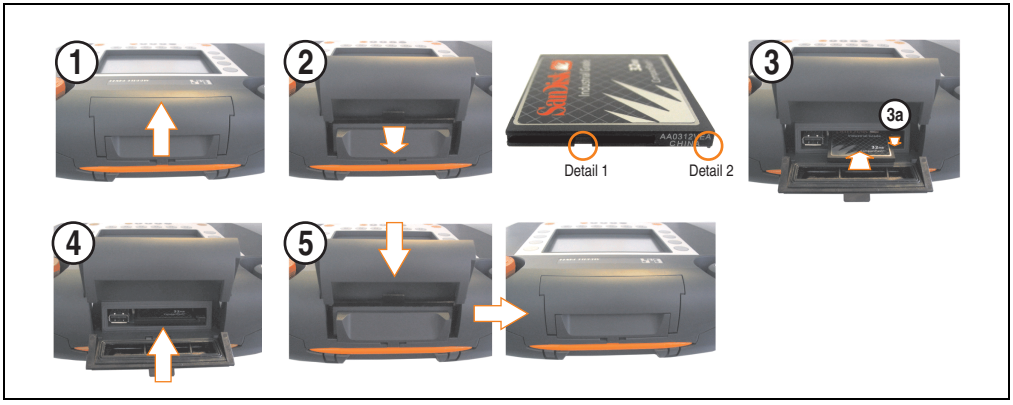


Figure 73: Inserting a CompactFlash card

1) Lift release.

2) Open cover.

3) Ensure that the CompactFlash card is inserted in the correct position in the CompactFlash slot (the ridge (Detail 1) and notch (Detail 2) must be found on the underside of the CompactFlash card and in the direction of the cover). Make sure that the CompactFlash card is pushed into the CompactFlash slot until it is flush with the opened CompactFlash ejection lever (see position 3a).

4) Close cover (as before position 2).

Warning!

Before closing the cover, make sure that the seal is in good condition and that it is sitting correctly!

5) Push release all the way down, as shown. Only then is IP54 protection guaranteed.

8.2 Removing a CompactFlash card

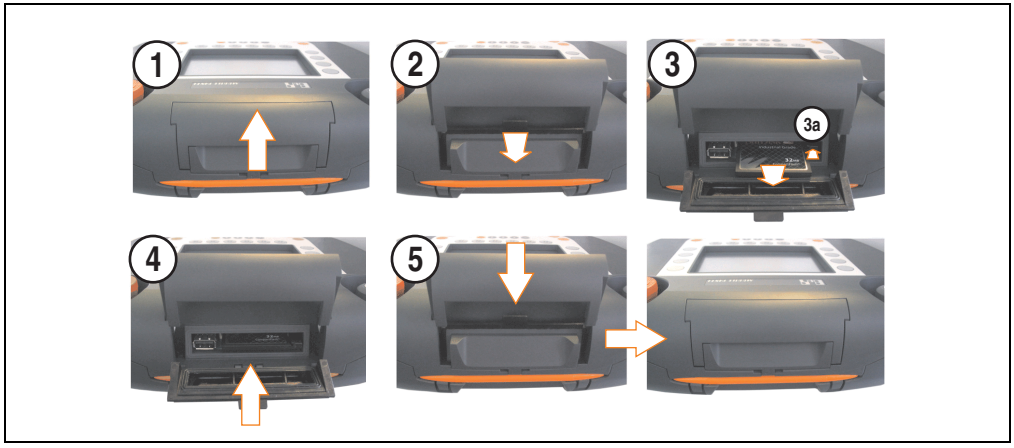


Figure 74: Removing a CompactFlash card

1) Lift release.

2) Open cover.

3) Press the CompactFlash ejection lever (position 3a) and remove the CompactFlash card.

4) Close cover (as before position 2).

Warning!

Before closing the cover, make sure that the seal is in good condition and that it is sitting correctly!

5) Push release all the way down, as shown. Only then is IP54 protection guaranteed.

9. User tips for increasing the display lifespan

9.1 Backlight

The lifespan of the backlight is specified in "Half Brightness Time". An operating time of 50,000 hours would mean that the display brightness would still be 50% after this time.

9.1.1 How can the lifespan of backlights be extended?

- Set the display brightness to the lowest value that is still comfortable for the eyes
- Use dark images
- Reducing the brightness by 50% can result in an approximate 50% increase of the half-brightness time.

9.2 Image sticking

Image sticking is the "burning in" of a static image on a display after being displayed for a prolonged period of time. However, this does not only occur with static images. Image sticking is known in technical literature as the "burn-in effect", "image retention", "memory effect", "memory sticking" or "ghost image".

There are 2 types of this:

- Area type: This is seen with a dark gray image. The effect disappears if the display is switched off for a longer period of time.
- Line type: This can cause lasting damage.

9.2.1 What causes image sticking?

- Static images
- Screensaver not enabled
- Sharp contrast transitions (e.g. black / white)
- High ambient temperatures
- Operation outside of the specifications

9.2.2 How can image sticking be avoided?

- continual change between static and dynamic images
- avoiding excessive brightness contrast between foreground and background display
- use of colors with similar brightness
- use of complementary colors in subsequent images
- use of screensavers

10. Pixel errors

Information:

Displays can contain incorrect pixel because of the manufacturing process. These pixel errors make no demand on reclamation or warranty.

Chapter 4 • Software

1. Mobile Panel with BIOS

Information:

The following diagrams and BIOS menu items including descriptions refer to BIOS Version 1.16. It is therefore possible that these diagrams and BIOS descriptions do not correspond with the installed BIOS version.

1.1 General information

BIOS stands for "Basic Input Output System". It is the most basic standardized communication between the user and the system (hardware). A B&R-modified BIOS from Insyde is used in the Mobile Panel devices.

BIOS setup lets you modify basic system configuration settings. These settings are saved in CMOS RAM.

The CMOS RAM is a nonvolatile, battery-backed memory that retains information when power is not applied to the Mobile Panel.

BIOS is immediately activated when switching on the power supply of the Mobile Panel.

BIOS reads the system configuration information in CMOS RAM, checks the system, and configures it using the power-on self-test (POST).

Information:

After 3 unsuccessful attempts at booting the Mobile Panel device, BIOS overwrites the current CMOS settings with the CMOS backup values. If there is no valid CMOS backup present, then CMOS settings are set to their default values (as with "Load optimized defaults").

When these preliminaries are finished, the BIOS seeks an operating system in the data storage devices available (CompactFlash card, drive, floppy drive). BIOS launches the operating system and hands over control of system operations to it.

Optionally, a BIOS summary screen can be displayed at the end of the POST. This shows the following information:

```
Mobile Panel
BIOS: 1.16                                          Built: 07/04/2006 09:26:04
CPU: SC2200 Rev: D3 @ 266MHz                   PCI: 66MHz    Multiplier: 4x
Memory: 126784k @ 88MHz    CAS: 3  SDRAM Divisor: 3          Shift SDCLK: 1.5
Floppy: Remote   CF Card: None                   COM1: 03F8  XpressROM V3.55GX1
RTC: Present     FPGA: None                      COM2: 02F8  VSA: 0204
USB: Legacy      FPGA1: None                     COM3: 03E8
PM: Disabled                                                 SMC: 0.7
Mode/Node: 00    Device/Comp.ID: 196B 00       TMCLK: 27MHz FactSett: 4

(c) 1999-2002 Copyright National Semiconductor
(c) 2002-2006 Copyright Bernecker + Rainer

No boot device present. Halting.
```

Figure 75: BIOS summary screen - VGA Mobile Panel devices

For info on deactivating this summary screen, see section "Advanced BIOS features" on page 149 for VGA Mobile Panel devices.

To make changes in BIOS setup: while the Mobile Panel device is booting, press the DEL key as soon as the following message appears in the upper margin of the display (during POST):

```
Press DEL for Setup   _
```

Figure 76: Press DEL for setup

If the message disappears before DEL has been pressed[1)] , the Mobile Panel must be rebooted in order to enter BIOS setup.

Warning!

The following general rule applies: Only modify those settings that you completely understand. On no account should settings be changed without a good reason. The BIOS settings have been carefully chosen by B&R to guarantee ideal performance and reliability. Even a seemingly minor change to the settings may cause the system to become unstable.

Information:

The settings recommended by B&R can be loaded with "Load optimized defaults".

The following keys[2)] help you navigate in BIOS setup:

1) A USB keyboard or the REMHOST program is required to enter characters and operate BIOS setup pages.
2) A USB keyboard or the REMHOST program is required to enter characters and operate BIOS setup pages.

Key	Function
Cursor ↑	Moves to the previous item.
Cursor ↓	Go to the next item.
Cursor ←	Moves to the previous item.
Cursor →	Go to the next item.
ESC	Exits the submenu.
Enter or press highlighted character shortcut	Changes to the selected menu.
F1 and ALT+H	Opens up a help window that describes the possible values for the highlighted item. Press ESC to exit the help window. In a help window, the cursor ↑, Cursor ↓, Home, End, Page Up, and Page Down keys can be used to navigate when help texts are longer than the displayable area.
Home	Jumps to the first BIOS menu item or object.
End	Jumps to the last BIOS menu item or object.
ALT+Q and ALT+X	Enters the BIOS main menu.
- (Minus)	Decreases the numerical value or selects the previous parameter value.
+ (Plus)	Increases the numerical value or selects the next parameter value.

Table 37: BIOS-relevant keys

1.2 BIOS settings - VGA Mobile Panel devices

Information:

The following diagrams and BIOS menu items including descriptions refer to BIOS Version 1.16. It is therefore possible that these diagrams and BIOS descriptions do not correspond with the installed BIOS version.

In the following pages, the individual BIOS setup pages for a VGA Mobile Panel device will be described in more detail.

1.2.1 BIOS setup main menu

Immediately after the DEL button is pressed during startup, the main BIOS setup menu appears.

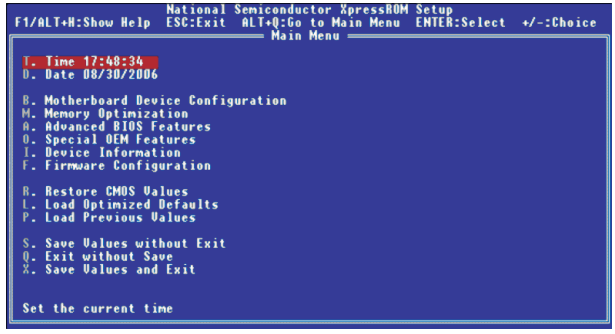


Figure 77: BIOS setup main menu

The individual menu items are explained in detail in the following sections.

Shortcut	BIOS setup menu	Function
T	**Time 05:15:23 AM**	The system time can be configured here.
D	**Date 02/17/2004**	The system date can be configured here.
B	**Motherboard device configuration**	Motherboard resources can be configured here.
M	**Memory optimization**	The settings for memory management can be made here.
A	**Advanced BIOS features**	Advanced BIOS options (boot logo, summary screen, cache areas) can be configured here.
O	**Special OEM features**	Specific B&R settings can be made here.
I	**Device information**	Important parameters (temp., mode/node position, etc.) for the Mobile Panel device.
F	**Firmware configuration**	Onboard firmware for FPGA modules can be configured here.
R	**Restore CMOS values**	Restores the last saved CMOS values from flash memory.
L	**Load optimized defaults**	Load the optimal BIOS settings for best performance.

Table 38: Overview of BIOS main menu functions

Shortcut	BIOS setup menu	Function
P	Load previous values	Reloads values configured when BIOS setup was opened. All changes are lost.
S	Save values without exit	Saves BIOS values without exiting BIOS setup.
Q	Exit without save	Exits BIOS setup without saving any changes.
X	Save values and exit	Saves settings and exits BIOS setup.

Table 38: Overview of BIOS main menu functions (Forts.)

Information:

If using a German keyboard, press the "z" key to enter "y".

1.2.2 Time

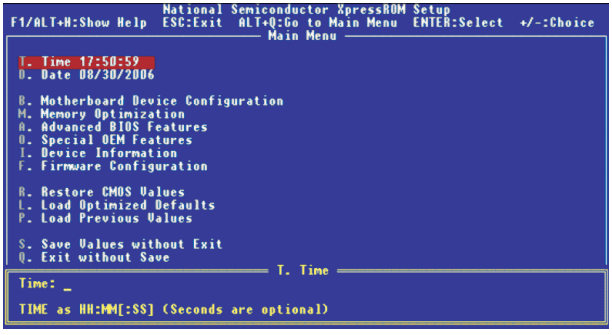


Figure 78: BIOS time menu

The currently configured system time is displayed here. The time is buffered by a battery (CMOS battery) after the Mobile Panel device has been switched off.

By selecting the item "Time" and the confirming by pressing Enter, or using the shortcut "A", you can enter a new system time. The format HH:MM[:SS] must be entered as follows:

Example: Set time to 13:00:00.

The entry can be made in three different ways using the keyboard:

- 13:00:00 - Confirm with Enter
- 01:00:00 PM - Confirm with Enter
- 13: - Confirm with Enter

Information:

If using a German keyboard, press the "Shift+ö" key to enter ":".

1.2.3 Date

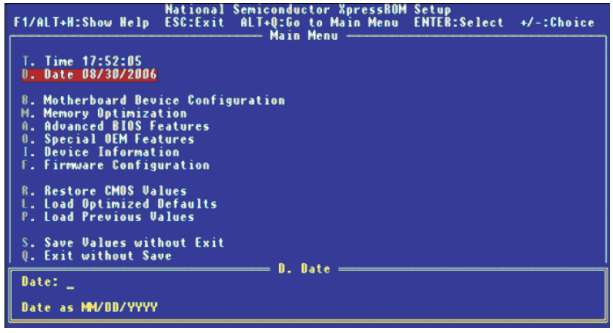


Figure 79: BIOS date menu

The current system date is displayed here. The date is buffered by a battery (CMOS battery) after the Mobile Panel device has been switched off.

By selecting the item "Date" and the confirming by pressing Enter, or using the shortcut "B", you can enter a new system date. The format MM:DD:YYYY must be entered as shown in the following example:

Example: Set date to 2.12.2003.

Entry using keyboard:

- 02/12/2003 - Confirm with Enter

Information:

If using a German keyboard, press the "-" key (next to the Shift key) to enter "/".

1.2.4 Motherboard device configuration

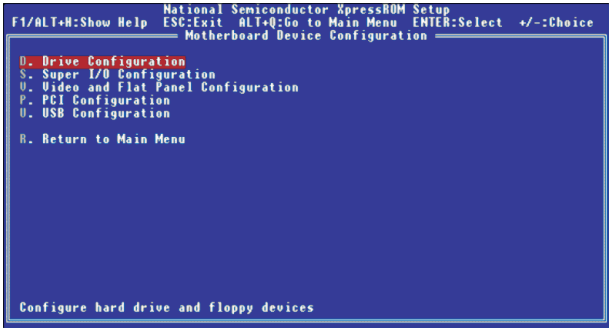


Figure 80: BIOS motherboard device configuration menu

Shortcut	BIOS setup menu	Function
D	**Drive configuration**	Settings for the floppy drive and CompactFlash card.
S	**Super I/O configuration**	Configures the super I/O device.
V	**Video and flat panel configuration**	Displays the video settings and configuration for resolution, brightness, and contrast display parameters.
P	**PCI Configuration**	Configures PCI bus settings.
U	**USB configuration**	Configures USB settings.
R	**Return to main menu**	Exits the current page and returns to the BIOS main menu.

Table 39: BIOS motherboard device configuration menu

Drive configuration

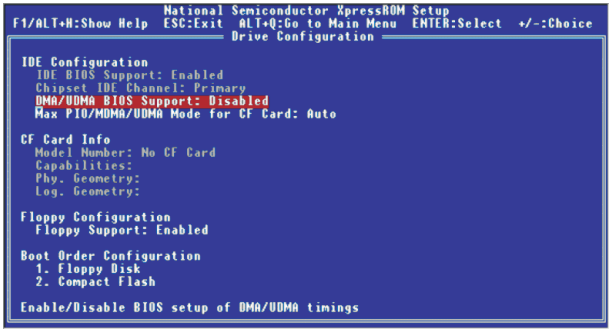


Figure 81: BIOS drive configuration menu

BIOS setting	Meaning	Setting options		Effect
IDE BIOS support	Displays the IDE configuration for the Mobile Panel device.	None		-
Chipset IDE channel	Displays the IDE channel used.	None		-
DMA/UDMA BIOS support	DMA/UDMA BIOS support can be configured here.	Enabled		Enables this function.
		Disabled		Only PIO modes for data transfer to and from CompactFlash cards are used.
Max PIO/MDMA/UDMA mode for CF card	The maximum data transfer mode to and from a CompactFlash card can be configured here. **Information:** **If a mode is configured that is not supported by the CompactFlash card, then the fastest supported mode is configured.**	Auto		Configures the fastest mode supported by the inserted CompactFlash card.
		PIO 0 to PIO 4		Manual configuration option for PIO mode.
		MDMA 0 to MDMA 2		Manual configuration option for MDMA mode.
		UDMA 0 to UDMA 2		Manual configuration option for UDMA mode.
Model number	Displays the CompactFlash model ID.	None		-
Capabilities	Displays the possible data transfer mode speeds to and from an inserted CompactFlash card.	None		-
Phy. geometry	Displays the physical geometry of the inserted CompactFlash card in cylinders, heads and sectors.	None		-
Log. geometry	Displays the logical geometry of the inserted CompactFlash card in cylinders, heads and sectors.	None		-
Floppy configuration	Floppy support (USB) can be enabled here. It is also possible to access a remote floppy drive and e.g. upgrade BIOS using the REMHOST program (see section "REMHOST utility disk" on page 165).	Enabled		Enables USB floppy support.
		Disabled		Disables USB floppy support.
Boot order configuration	Configures the order in which memory media is booted. **Information:** **If two identical devices are selected, a conflict warning is displayed.**	1	Floppy disk [1)]	The device attempts to boot from this drive first.
			CompactFlash	
			NONE	
		2	Floppy disk [1)]	The device attempts to boot from this drive second.
			CompactFlash	
			NONE	

Table 40: BIOS drive configuration menu

1) Only HD diskettes (1.44 MB) are supported by BIOS.

Super I/O configuration

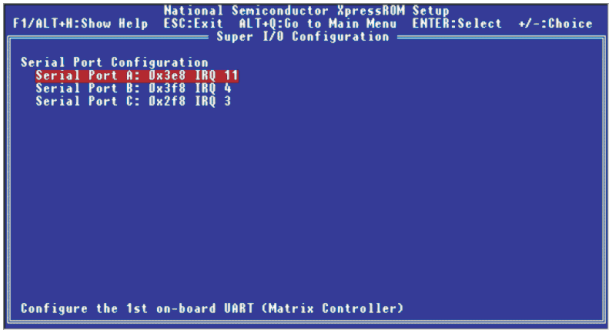


Figure 82: BIOS super I/O configuration menu

BIOS setting	Meaning	Setting options	Effect
Serial port A:	Configures the first UART address range and the corresponding interrupt for the matrix controller. **BIOS default setting: 0x3e8 IRQ 11.** **Information:** **Two ports cannot use the same address range and interrupt.**	Disabled	No assignment.
		0x3e8 IRQ 11	Use this address range and interrupt.
		0x3f8 IRQ 4	
		0x2f8 IRQ 3	
		0x3e8 IRQ 4	
		0x2f8 IRQ 3	
		0x2f8 IRQ 11	
Serial port B:	Configures the second UART address range and the corresponding interrupt for the serial interface. **BIOS default setting: 0x3f8 IRQ 4.** **Information:** **Two ports cannot use the same address range and interrupt.**	Disabled	No assignment.
		0x3f8 IRQ 4	Use this address range and interrupt.
		0x2f8 IRQ 3	
		0x3e8 IRQ 4	
		0x2f8 IRQ 3	
		0x3e8 IRQ 11	
		0x2f8 IRQ 11	
Serial port C:	Configures the third UART address range and the corresponding interrupt for the touch controller. **BIOS default setting: 0x2f8 IRQ 3.** **Information:** **Two ports cannot use the same address range and interrupt.**	Disabled	No assignment.
		0x2f8 IRQ 3	Use this address range and interrupt.
		0x3f8 IRQ 4	
		0x2f8 IRQ 3	
		0x3e8 IRQ 4	
		0x3e8 IRQ 11	
		0x2f8 IRQ 11	

Table 41: BIOS super I/O configuration menu

Video and flat panel configuration

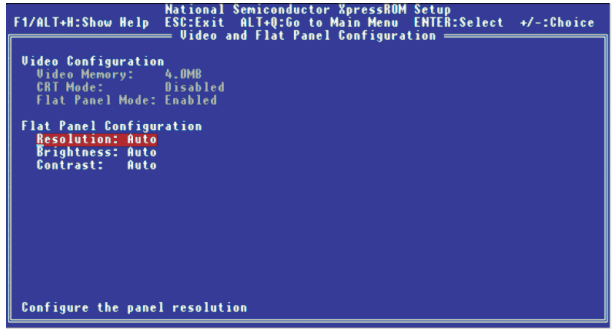


Figure 83: BIOS video configuration menu

BIOS setting	Meaning	Setting options	Effect
Video memory	Displays the current video memory reserved by the main memory.	None	-
CRT mode	Displays on an external screen.	None	-
Flat panel mode	Displays on a Mobile Panel display.	None	-
Resolution	Setting for the maximum resolution for the display. **Information:** **Only the resolution specified for the Mobile Panel device should be configured! Otherwise, the display can be damaged by incorrect timing values.** **If the mode/node switches are set to 0/0, then the resolution is automatically reset every time the Mobile Panel device is restarted.**	Auto	The maximum resolution is read from the factory settings and correctly configured automatically.
		QVGA (320x240) LCD	Optimum setting for a QVGA LCD Mobile Panel.
		QVGA (320x240) TFT	Optimum setting for a QVGA TFT Mobile Panel.
		VGA (640x480)	Optimum setting for a VGA Mobile Panel.
		SVGA (800x600)	Optimum setting for an SVGA Mobile Panel.
		XGA(1024x768)	Optimum setting for an XGA Mobile Panel.
Brightness	Setting for the background lighting of the display. **Information:** **If the mode/node switches are set to 0/0, then brightness settings are automatically set to the default values from the factory settings every time the Mobile Panel device is restarted.**	Auto	The optimal brightness is automatically configured using the factory settings. A brightness value between 100% and 0% is set.
		0% to 100%	Manual setting of the desired brightness within factory settings limits.

Table 42: BIOS video configuration menu

BIOS setting	Meaning	Setting options	Effect
Contrast	Setting for the contrast of the display. **Information:** **Contrast settings can only be configured for passive displays. If the mode/node switches are set to 0/0, then contrast settings are automatically set to the default factory settings every time the Mobile Panel device is restarted.**	Auto	The optimal contrast is automatically configured using the factory settings. A contrast value between 100% and 0% is set.
		0% to 100%	Manual setting of the desired contrast within factory settings limits.

Table 42: BIOS video configuration menu (Forts.)

PCI configuration

Figure 84: BIOS PCI configuration menu

BIOS setting	Meaning	Setting options	Effect
PCI INTA#	Activates the IRQ for the Ethernet controller. **BIOS default setting: IRQ 9.**	Disabled	No IRQ is reserved.
		3, 4, 5, 6, 7, 9, 10, 11, 12, 14 or 15	Assigns these IRQs.
PCI INTB#	Activates IRQ for the USB controller. **BIOS default setting: IRQ 5.** First IRQ for the USB controller.	Disabled	No IRQ is reserved.
		3, 4, 5, 6, 7, 9, 10, 11, 12, 14 or 15	Assigns these IRQs.
PCI INTC#	Activates IRQ for the FPGA. **BIOS default setting: IRQ 10.** Second IRQ for the FPGA.	Disabled	No IRQ is reserved.
		3, 4, 5, 6, 7, 9, 10, 11, 12, 14 or 15	Assigns these IRQs.
PCI INTD#	Activates IRQ for the FPGA. **BIOS default setting: IRQ 7.** First IRQ for the FPGA.	Disabled	No IRQ is reserved.
		3, 4, 5, 6, 7, 9, 10, 11, 12, 14 or 15	Assigns these IRQs.

Table 43: BIOS PCI configuration menu

USB configuration

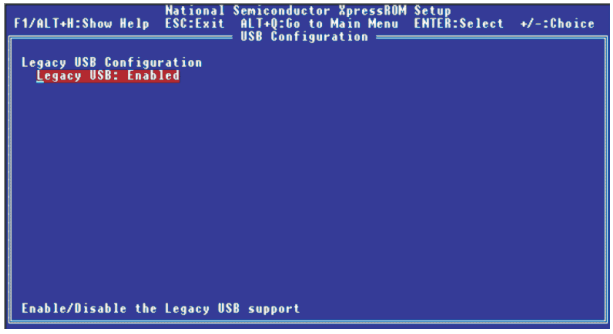


Figure 85: BIOS USB configuration menu

BIOS setting	Meaning	Setting options	Effect
Legacy USB	This function enables USB support in order to make BIOS settings, e.g. using a USB keyboard, even before the operating system with USB support is loaded. **Information:** **If the mode/node switch is set to 0/0, then Legacy USB support is always set to "enabled".**	Enabled	Enables USB Legacy support.
		Disabled	Disables USB Legacy support. **Information:** **After deactivating this support, booting from a USB floppy drive is no longer possible.**

Table 44: BIOS USB configuration menu

1.2.5 Memory optimization

Warning!

The parameters in this screen are for system designers, service personnel, and technically competent users only. Only modify those settings that you completely understand.

Incorrectly setting "Memory optimization" values can cause instability and even cause the entire system not to boot. If the Mobile Panel device can no longer be booted, then the default values can be restored by restarting three times.

Information:

More detailed information about the meaning and effects of the settings can also be found in the corresponding user's manual for the processor.

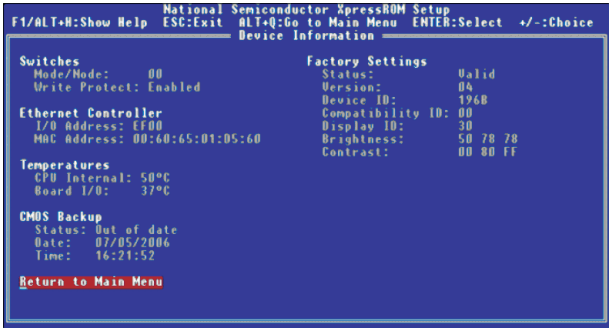


Figure 86: BIOS memory optimization menu

BIOS setting	Meaning	Setting options	Effect
Memory optimization	Defines how memory optimization is handled. With this option, it is recommended that the user upload the current base values being used by the system from the CPU to this BIOS page when setting values manually for the first time.	Conservative	The BIOS automatically uses PC66 timing.
		Optimized	BIOS uses optimized memory settings for the memory chips used. This allows faster timing.
		Aggressive	BIOS uses "aggressive" memory settings based on the SPD and CPU speed. **Warning!** **Aggressive memory settings can cause stability problems for the system.**
		Manual	If "Manual" is selected, then the remaining values can be configured on this BIOS menu page. Values only become active when the user saves them before exiting BIOS and the Mobile Panel is rebooted.
Load current values from CPU	All the specified values are configured on this BIOS setup page with the current configured values.	None	The memory timing values currently used are uploaded by the CPU. It is recommended that when using this option, the user uploads optimal base values (that the system uses) from the CPU to this BIOS page when setting the values manually for the first time.
MD control	Configures MD[63:0] drive strength.	0 to 3	0 = weakest, 3 = strongest
MA/BA control	Configures MA[12:0] and BA[1:0] drive strength.	0 to 3	0 = weakest, 3 = strongest
MEM control	Configures RASA#, CASA#, WEA#, CS[1:0]#, CKEA, DQM[7:0] drive strength.	0 to 3	0 = weakest, 3 = strongest
SDRAM clock ratio	Configures SDRAM timing.	2; 2.5; 3; 3.5; 4; 4.5; 5	Sets DRAM clock timing.
Refresh interval	This parameter defines the number of processor core clocks that are multiplied by 64 between refresh cycles of the DRAM memory.	00 to FF	

Table 45: BIOS memory optimization menu

BIOS setting	Meaning	Setting options	Effect
Refresh stagger	This parameter defines the number of cycles between the RFSH command and each of the four rows.	0 SDRAM clocks to 3 SDRAM clocks	
2 CLK ADDR setup	Enables the two-clock address setup function.	Enabled	Enables this function.
		Disabled	Disables this function.
SMM mapping	Maps the SMM memory area from GX_BASE+400000 to the physical address A0000 to BFFFF in SDRAM.	Enabled	Enables this function.
		Disabled	Disables this function.
X-bus round robin	Configures the priority levels for processor, graphic and display controller requests.	Enabled	Processor, graphic and display controller requests are treated with the same priority level.
		Disabled	Processor requests are given a higher priority level. Display controller requests always have the highest priority.
SDRAM shift SDCLK	This function makes switching possible for SDCLK SDRAM hold time requests.	0.5, 1, 1.5, 2, 2.5, or 3	
		No shift	No switching.
Read data phase	Configures the read data phase. Regulates whether read data is latched to one or two core clocks for the rising edges of the SDCLK.	1 core clock	After one core clock.
		2 core clocks	After two core clocks.
Fast read mask	Prevents the bypassing of FIFO requests via the core.	Enabled	Enables this function.
		Disabled	Disables this function.
CAS latency	Column Address Strobe (CAS) latency describes the time it takes between addressing in a RAM block and preparing the data stored at this address. The higher the subsequent value, the greater the delay.	2, 3, 4, 5, 6, or 7 clk	Sets the desired cycle time.
tRC	Sets the minimum number of SDRAM cycles between RFSH and RFSH/ACT commands.	2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 13; 14; 15 or 16 Clk	Sets the desired cycle time.
tRAS	Sets the minimum number of SDRAM cycles between ACT and PRE commands.	2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 13; 14; 15 or 16 Clk	Sets the desired cycle time.
tRP	Sets the minimum number of SDRAM cycles between PRE and ACT commands.	1; 2; 3; 4; 5; 6 or 7 Clk	Sets the desired cycle time.
tRCD	Configures the delay between the ACT and READ/WRITE command. (tRCD) Sets the minimum number of SDRAM cycles between ACT and READ/WRITE commands.	1; 2; 3; 4; 5; 6 or 7 Clk	Sets the desired cycle time.
tRRD	Configures the time between ACT(0) to ACT(1) command period.	0-7	
tDPL	Sets the minimum number of SDRAM cycles between the time for the last record date until the memory area is reloaded.	1; 2; 3; 4; 5; 6; 7 Clk	Sets the desired cycle time.

Table 45: BIOS memory optimization menu (Forts.)

1.2.6 Advanced BIOS features

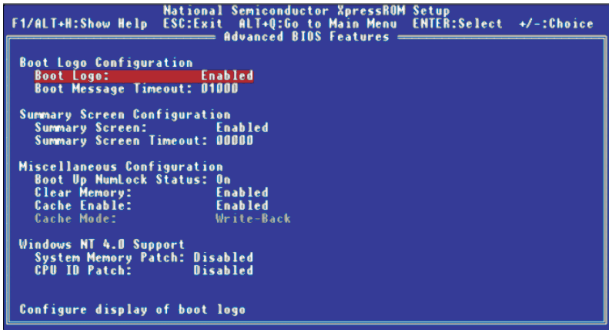


Figure 87: Advanced BIOS features menu

BIOS setting	Meaning	Setting options	Effect
Boot logo	Displays a boot logo while the Mobile Panel is starting.	Disabled	No boot logo displayed during booting.
		Enabled	A B&R boot logo is displayed during booting as long as a bitmap created by a user has not been added.
Boot message timeout	Defines the duration of the "Press DEL for Setup" message on the display and how much time the user has to change to the BIOS configuration. **Can be resumed before the timeout expires by pressing any button.**	0	No waiting.
		1-65535 [milliseconds]	The system waits for the manually set value in milliseconds and then resumes the boot procedure.
Summary screen	Displays information about BIOS, VGA, VSA versions, devices found, etc.	Enabled	Shows the summary screen.
		Disabled	Hides the summary screen.
Summary screen timeout	Defines how long the summary screen is displayed. **Can be resumed before the timeout expires by pressing any button.**	0	No waiting.
		1-65535 [milliseconds]	The manually set value in milliseconds that must pass.
Boot up NumLock status	Defines the status of an existing numeric keypad when the system is booted.	On	Enables the numeric keypad.
		Off	Disables the numeric keypad.
Clear memory	After starting, the BIOS automatically clears the entire main memory. **Information:** **Clearing e.g. 256 MB RAM takes approximately 3 seconds.**	Enabled	The entire main memory is cleared. This makes sense, e.g. when the system to be booted requires initialized main memory when booting.
		Disabled	Disables this function.
Cache enable	The processor has a 16 kB fast L1 cache. The data for fast access is provided in this memory.	Enabled	Recurring commands are processed in the fast L1 cache.
		Disabled	Disables this function.

Table 46: Advanced BIOS features menu

BIOS setting	Meaning	Setting options	Effect
Cache mode	Using cache mode, write accesses are determined on the cache. This option is permanently set to "Write back". The information is only written in the main memory if necessary (main memory and cache do not have the same information content).	None	-
System memory patch	When activated, the buffer address length is not returned as zero from the national specific software interrupt 15h, the system service function E8h and the sub-function 20h (Get system memory map). **This function should be activated only when using the Windows NT 4.0 operating system.**	Enabled	Enables this function.
		Disabled	Disables this function.
CPU ID patch	If Windows NT 4.0 checks the CPU ID and recognizes a Geode CPU, it will not be able to be operated with it. Recognition is implemented starting from Service Pack 6. For this reason, this function must be enabled during installation of Windows NT 4.0 until Service Pack 6 has been installed. **This function should be activated only when using the Windows NT 4.0 operating system.**	Enabled	Enables this function.
		Disabled	Disables this function.

Table 46: Advanced BIOS features menu (Forts.)

1.2.7 Special OEM features

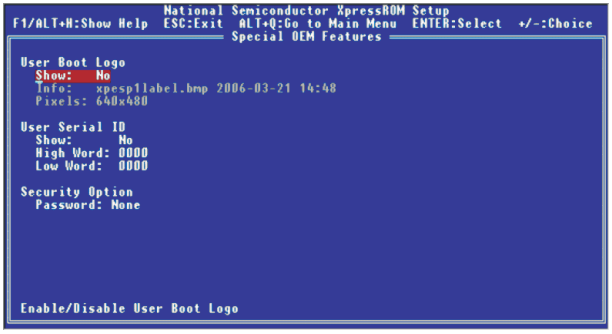


Figure 88: BIOS special OEM features menu

BIOS setting	Meaning	Setting options	Effect
Show (user boot logo)	A boot logo that has been created by a user can be displayed here instead of the B&R boot logo.[1)]	Yes	Display
		No	
Info	Displays the name and the creation date of the user boot logo.	None	-
Pixels	Displays the resolution of the user boot logo.	None	-
User serial ID show	A user serial number can be displayed in the summary screen using this function when the system is started.	Yes	Displays the assigned user serial ID.
		No	Hides the assigned user serial ID.
High word	Input possibilities for the first 4 bytes for the user serial number.	0000-FFFF	The hexadecimal value entered defines the first 4 positions of the user serial ID.
Low word	Input possibilities for the second 4 bytes of the user serial number.	0000-FFFF	The hexadecimal value entered defines the second 4 positions of the user serial ID.
Password	A password can be defined here which must be entered by the user when the BIOS setup is opened.	Max. 8 characters	The password must be confirmed by being entered a second time. The password can be removed again by entering a blank password (just pressing Enter). **Information:** **The password is also saved in the CMOS backup and is impossible to delete.**

Table 47: BIOS special functions menu

1) See section 2.2 "User boot logo upgrade disk" on page 163 regarding guidelines for creating a user boot logo.

1.2.8 Device information

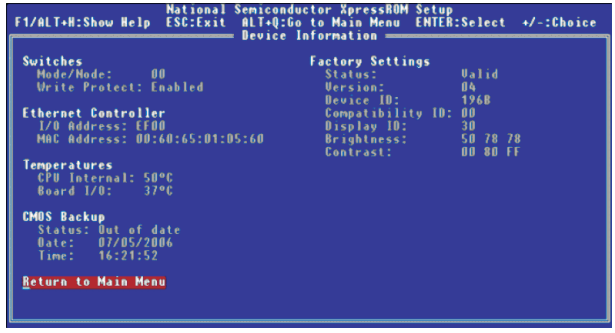


Figure 89: BIOS device information menu

BIOS setting	Meaning	Setting options	Effect
Mode/Node	Displays the current mode/node switch position.	None	-
Write protect	Displays the switch position for the "write protect" switch.	None	-
I/O address	Displays the Ethernet I/O address.	None	-
MAC address	Displays the assigned MAC address.	None	-
CPU intern	Displays the current internal processor temperature.	None	-
Board I/O	Indicates the current board I/O temperature.	None	-
Status	The status for the last automatically saved CMOS backup is displayed here.	None	If the boot procedure is successful, then the CMOS values are automatically saved by BIOS in flash memory. Values are therefore only saved in flash memory if the backup is not equal to the current CMOS, the backup is not available, or the backup checksum is incorrect.
Date	Date of the last automatically saved CMOS backup.	None	
Time	Time of the last automatically created CMOS backup.	None	
Status	Status display for factory settings.	None	-
Version	Version display for factory settings.	None	-
Device ID	Hex value for the device code of the Mobile Panel device.	None	-
Compatibility ID	The compatibility code of the Mobile Panel device is displayed here.	None	-

Table 48: BIOS device information menu

BIOS setting	Meaning	Setting options	Effect
Display ID	Shows the display ID used. Possible display IDs are: 00h - Unknown 10h - Passive displays (STN) 11h - LCD B/W QVGA 12h - LCD COL QVGA 20h - Active displays (TFT) with QVGA 30h - Active displays (TFT) with VGA 40h - Active displays (TFT) with SVGA 50h - Active displays (TFT) with XVGA	None	-
Brightness	The defined brightness values (minimum, default, maximum) for the display used are shown here as hex values.	None	-
Contrast	The defined contrast values (minimum, default, maximum) for the display used are shown here as hex values.	None	-

Table 48: BIOS device information menu (Forts.)

1.2.9 Firmware configuration

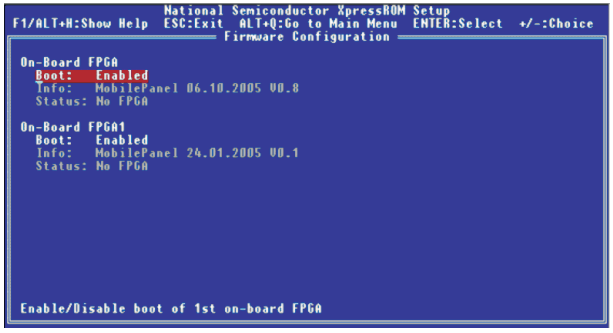


Figure 90: BIOS firmware configuration menu

BIOS setting	Meaning	Setting options	Effect
Onboard FPGA Boot	The onboard FPGA controls the image output for Mobile Panel 200 devices with BIOS.	Enabled	The onboard FPGA is enabled and initialized.
		Disabled	Deactivates the FPGA. If this function is deactivated, then no picture is output on Mobile Panel 200 devices. This function can only be re-enabled using the program "REMHOST" (see section "REMHOST utility disk" on page 165).
Info	Information about the FPGA firmware.	None	-
Status	Status display for the onboard FPGA.	None	-
Onboard FPGA1 Boot	The onboard FPGA controls the image output for Mobile Panel 200 devices with BIOS.	Enabled	The onboard FPGA is enabled and initialized.
		Disabled	Deactivates the FPGA. If this function is deactivated, then no picture is output on Mobile Panel 200 devices. This function can only be re-enabled using the program "REMHOST" (see section "REMHOST utility disk" on page 165).
Info	Information about the FPGA firmware.	None	-
Status	Status display for the onboard FPGA.	None	-

Table 49: BIOS firmware configuration menu

1.2.10 Restore CMOS values

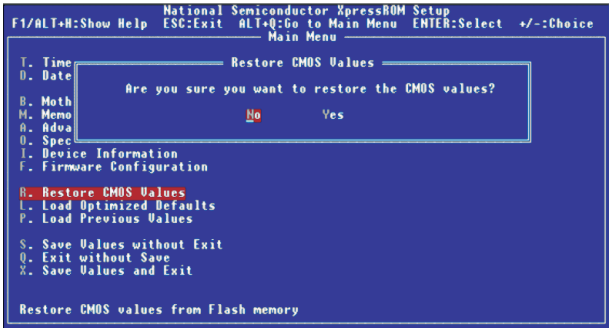


Figure 91: BIOS restore CMOS values menu

Selecting "Yes" under this BIOS menu (R shortcut) restores the last CMOS values stored in flash memory. All configurable CMOS values (besides date and time) are restored again in the BIOS setup.

Information:

If the boot procedure is successful, then the CMOS values are automatically saved by BIOS in flash memory. Values are therefore only saved in flash memory if the backup is not equal to the current CMOS, the backup is not available, or the backup checksum is incorrect.

To protect CMOS data, a CMOS backup was integrated into BIOS. If BIOS setup was ended using "Save Values and Exit" and the Mobile Panel device was correctly restarted, then the CMOS data is burned in the flash memory. If the CMOS checksum is incorrect during startup (battery empty) or the Mobile Panel device cannot be booted correctly on three consecutive attempts, then the salvaged data from flash memory is copied again to CMOS. Setup is back to its original state, except for the time.

Information:

If using a German keyboard, press the "z" key to enter "y".

1.2.11 Load optimized defaults

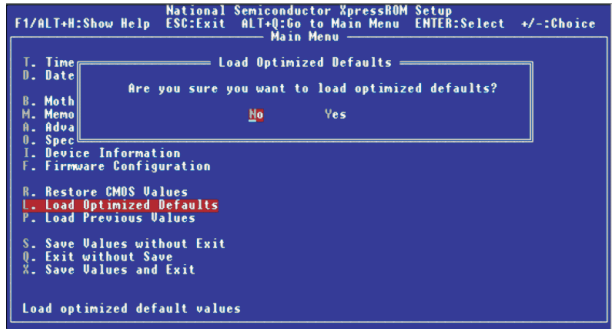


Figure 92: BIOS load optimized defaults menu

By clicking on "Yes", optimal BIOS settings for best performance can be loaded using this BIOS menu item (L shortcut).

Information:

These settings are also recommended by B&R.

Information:

If using a German keyboard, press the "z" key to enter "y".

1.2.12 Load previous values

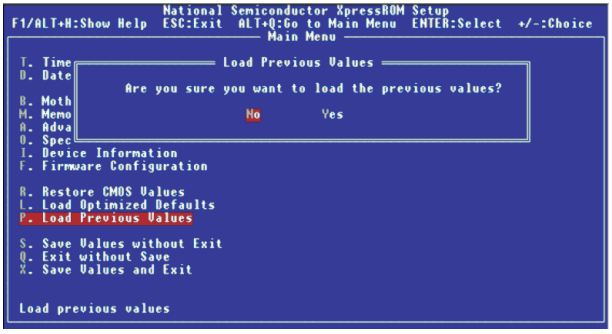


Figure 93: BIOS load previous values menu

Selecting "yes" under this BIOS menu item (P shortcut) reloads the values at the point when BIOS setup was opened. All changes are lost.

Information:

If using a German keyboard, press the "z" key to enter "y".

1.2.13 Save values without exit

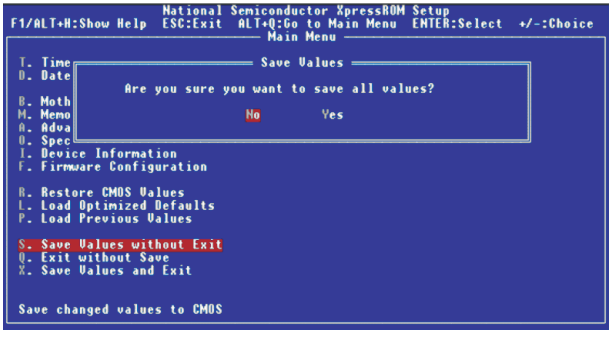


Figure 94: BIOS save values without exit menu

BIOS values are saved using this menu item (S shortcut) by selecting "Yes". The user can then make additional settings or exit BIOS setup.

Information:

If using a German keyboard, press the "z" key to enter "y".

1.2.14 Exit without save

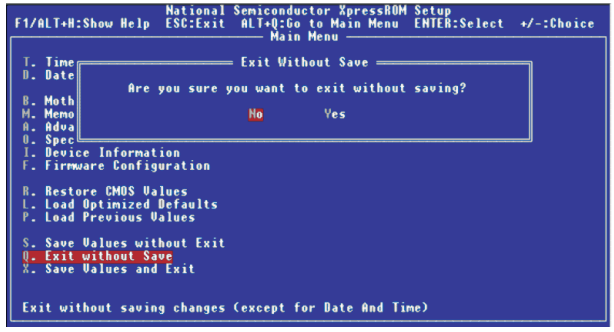


Figure 95: BIOS exit without save menu

BIOS setup can be exited by selecting "Yes" under this menu item (shortcut "Q") without saving any changes that might have been made. The system is then automatically restarted.

Information:

If using a German keyboard, press the "z" key to enter "y".

1.2.15 Save values and exit

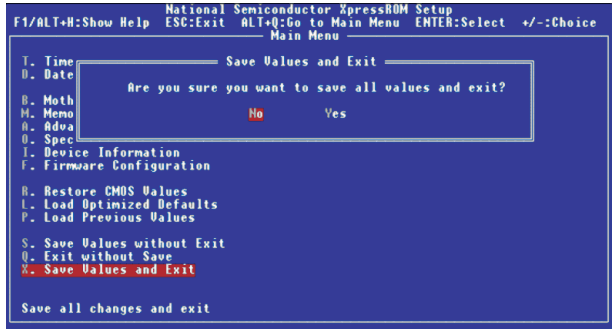


Figure 96: BIOS save values and exit menu

If "Yes" is selected under this menu item (X shortcut), the system saves the settings, automatically exits BIOS setup, and reboots the system.

For more information about the CMOS backup, see the section 2.6 "CMOS backup".

Information:

If using a German keyboard, press the "z" key to enter "y".

2. Upgrade information

Warning!

The BIOS and firmware on Mobile Panel 100/200 systems must be kept up to date. New versions can be downloaded from the B&R homepage (www.br-automation.com).

2.1 BIOS upgrade

An upgrade might be necessary for the following reason:

- To update implemented functions or to add newly implemented functions or components to the BIOS setup (information about changes can be found in the Readme files of the BIOS upgrade).

2.1.1 What information do I need?

Information:

Individually saved BIOS settings are deleted when upgrading the BIOS.

Before you begin the upgrade, it helps to determine the various software versions.

2.1.2 BIOS upgrade

The following steps should be carried out to upgrade or save BIOS:

- First, a blank HD disk must be made bootable (command line "sys a:" or "format a: /s").

Information:

For the upgrade, a boot disk must be created (or a bootable CompactFlash card) with Windows ME, Windows XP or MS-DOS 6.22.

MS-DOS boot disks function with BIOS versions earlier than 1.02 only with REMHOST.

- Copy the contents of the *.zip file to this diskette.
- Insert diskette in the USB floppy disk drive and reboot the Mobile Panel device (possibly from the floppy disk drive of a remote PC using REMHOST, see also section 2.3 "REMHOST utility disk" on page 165). For the settings required when booting the Mobile Panel device from a diskette, see section "Drive configuration" on page 141 for VGA Mobile Panel devices.
- After booting from the diskette, the following start menu opens up:

```
Microsoft Windows Startup Menu
==================================

1. Upgrade complete System (BIOS,FPGA)
2. Upgrade XpressROM BIOS
3. Upgrade FPGA Firmware
4. Save complete System (BIOS, FPGA)
5. Save XpressROM BIOS
6. Save FPGA Firmware
7. Exit

Enter a choice:_
```

Figure 97: BIOS upgrade start menu

Item	Menu item	Description
1	Upgrade complete system (BIOS, FPGA)	All BIOS areas (XpressROM and FPGA firmware) are automatically updated (default after 5 sec).
2	Upgrade XpressROM BIOS only	Only the XpressROM BIOS is automatically updated.
3	Upgrade FPGA firmware only	Only the FPGA firmware is automatically updated.
4	Save complete system	All BIOS areas (XpressROM and FPGA firmware) are automatically protected. **Information:** **It's necessary to have up to 448 KB of free space on the disk.**

Table 50: BIOS upgrade menu description

Item	Menu item	Description
5	Save XpressROM BIOS only	Only the XpressROM BIOS is automatically protected. **Information:** **It's necessary to have approximately 256 KB of free space on the disk.**
6	Save FPGA firmware only	Only the FPGA firmware is automatically protected. **Information:** **It's necessary to have up to 192 KB of free space on the disk.**
7	Exit	Returns to the shell (MS-DOS).

Table 50: BIOS upgrade menu description (Forts.)

Information:

If you do not press a button within 5 seconds, then step 1 "Upgrade complete system" (BIOS, FPGA) is automatically carried out and the Mobile Panel is automatically updated.

If you want to individually upgrade the XpressROM or the FPGA firmware, then these options can be selected in the start menu (2 or 3). It is also possible to protect the existing BIOS or individual components. For this, there must be approximately 448 KB free space on the disk. Otherwise, "Save..." functions might not be able to be executed.

- The system must be rebooted after a successful upgrade.

2.2 User boot logo upgrade disk

A software tool for updating, backing up, or deleting the user boot logo can be downloaded directly from the service portal of the B&R homepage (www.br-automation.com).

2.2.1 Procedure

The following steps should be taken to update, save or delete a user boot:

- First, a blank HD disk must be made bootable (command line "sys a:" or "format a: /s").

Information:

For the upgrade, a boot disk must be created (or a bootable CompactFlash card) with Windows ME, Windows XP or MS-DOS 6.22.

MS-DOS boot disks function with BIOS versions earlier than 1.02 only with REMHOST.

- Copy the contents of the *.zip file to this diskette.
- Create the user boot logo according to section "Guidelines for creating a user boot logo" on page 164 and copy to the disk.
- Insert diskette in the USB floppy disk drive and reboot the Mobile Panel device (possibly from the floppy disk drive of a remote PC using REMHOST, see also section 2.3 "REMHOST utility disk" on page 165). For the settings required when booting the Mobile Panel device from a diskette, see section "Drive configuration" on page 141 for VGA Mobile Panel devices.
- After booting from the diskette, the following start menu opens up:

```
Microsoft Windows Startup Menu
==================================

1. Update User Boot Logo
2. Save User Boot Logo
3. Delete User Boot Logo
4. Exit

Enter a choice:_
```

Figure 98: User boot logo upgrade start menu

Item	Menu item	Description
1	Update user boot logo	The user boot logo is automatically updated with the file USERLOGO.ROM (default after 5 seconds).

Table 51: User boot logo upgrade menu description

Item	Menu item	Description
2	Save user boot logo	The user boot logo is automatically saved in the file USERLOGO.SAV. **Information:** **It's necessary to have up to 192 KB of free space on the disk.**
3	Delete user boot logo	An existing user boot logo is deleted in the flash. **Information:** **The B&R boot logo is then automatically displayed again by BIOS.**
4	Exit	Returns to the shell (MS-DOS).

Table 51: User boot logo upgrade menu description (Forts.)

Information:

If you do not press a button within 5 seconds, then step 1 "Update User Boot Logo" is automatically carried out and the Mobile Panel is automatically updated.

- The system must be rebooted after a successful upgrade.
- In the BIOS CMOS setup, the display of the boot logo must be set from "No" to "Yes" (see section 1.2.7 "Special OEM features" on page 151 for VGA Mobile Panel devices).

Guidelines for creating a user boot logo

To update the user boot logo, a bitmap must be created according to the following guidelines and then copied to the user boot logo upgrade disk:

1) A Windows bitmap with a maximum of 256 colors must be created with the appropriate resolution for the Mobile Panel: 640x480 (VGA). The bitmap is not allowed to be compressed.

2) Since status messages are output on the top of the display when booting the Mobile Panel, there should not be any user boot logo pixels positioned here in the bitmap (approximately 10 rows of pixels), as these would be covered up. These status messages use bitmap palette index 0 as the background color and index 7 as the foreground color (starting from BIOS V1.05; index 63 with older versions).

3) Using the utility USERLOGO.EXE, the bitmap file must then be converted into a ROM file that can be read by BIOS (please refer to the online help for the utility for more instructions about this).

4) The userlogo.rom file created by the utility is only permitted to have a maximum size of 192 KB. If this size is exceeded, a warning appears. The user can e.g. reduce the details in the Windows bitmap in order not to exceed the maximum byte size.

5) After this, the userlogo.rom file should be copied to the disk.

2.3 REMHOST utility disk

The REMHOST (remote host) software tool can be downloaded directly from the service portal on the B&R homepage (www.br-automation.com).

2.3.1 General information

REMHOST is an MS-DOS program (REMHOST.EXE) that can be used by a remote PC to operate a BIOS Mobile Panel device. The Mobile Panel receives keyboard entries from a remote PC using REMHOST. Screen outputs for the Mobile Panel device are redirected to the screen of the remote PC. The Mobile Panel can access the floppy drive (internal or external) of the remote PC or an individual floppy drive (USB) and boot from this as well.

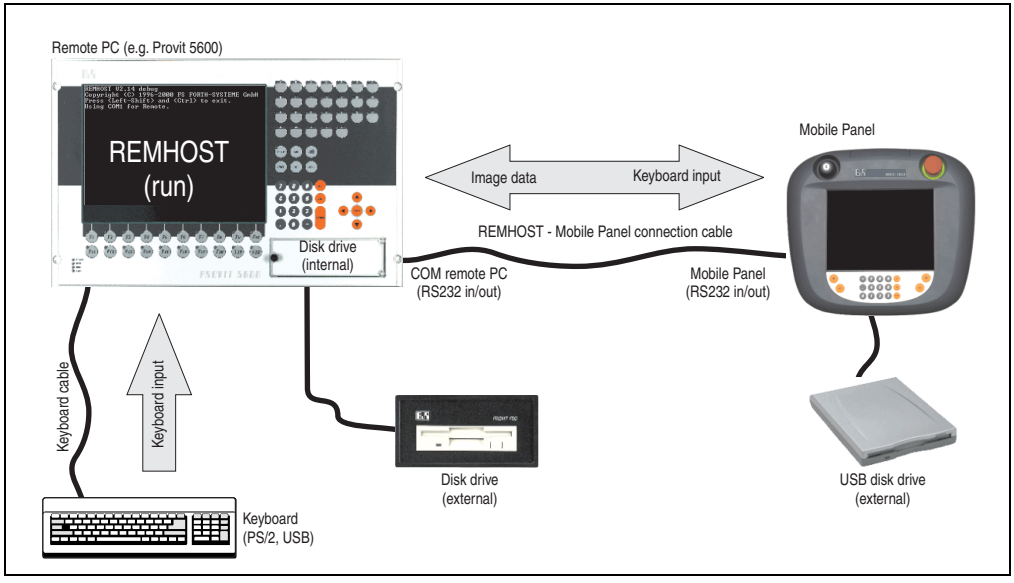


Figure 99: REMHOST communication model

REMHOST can be used if :

- The display for the Mobile Panel device is not functioning.
- Brightness and contrast settings for the Mobile Panel display are adjusted in such a way that outputs can no longer be seen.
- There is no USB floppy present and the BIOS for the Mobile Panel device should be updated.

2.3.2 Requirements

The Mobile Panel must be connected to the remote PC using a serial cable (see figure "Pin assignments - REMHOST / Mobile Panel connection cable" on page 169 for the necessary assignment). The serial cable must be connected to a COM interface on the remote PC and to the COM interface on the Mobile Panel device (see figure 99 "REMHOST communication model"). The mode/node switches on the Mobile Panel device must be set to 00 (service mode) see figure "Mode / Node switches" on page 49.

2.3.3 Important notes

Information:

- **REMHOST only functions when the "diverted" functions for the Mobile Panel device are operated using BIOS calls. This means, for example, that if a program writes directly to the video memory on the Mobile Panel, then these outputs cannot be redirected to the screen of a remote PC. Generally, only programs which work in text mode should be used. Therefore, a MS-DOS start diskette must be used when booting the Mobile Panel using REMHOST. If a Windows start diskette is used, illegible symbols are output on the remote screen and the user's inputs are not correctly displayed.**
- **REMHOST must be run from MS-DOS. In the MS-DOS command prompt in Windows, error-free operation of REMHOST is not guaranteed: e.g. very slow screen outputs (in Windows NT4.0 and 2000), errors with write accesses to the remote floppy, etc.**

Warning!

When upgrading BIOS using REMHOST, note that the Mobile Panel, the remote PC and the serial connection must all remain connected to each other while the upgrade is taking place.

Caution!

The Mobile Panel can no longer be started if the BIOS upgrade is aborted. Therefore, when upgrading BIOS with REMHOST, REMHOST should be started in MS-DOS (not in the MS-DOS command prompt from Windows).

2.3.4 REMHOST configuration

The function of REMHOST is controlled by a REMHOST.INI configuration file. REMHOST.INI is an ASCII text file that can be opened and edited with any text editor (e.g. Notepad).

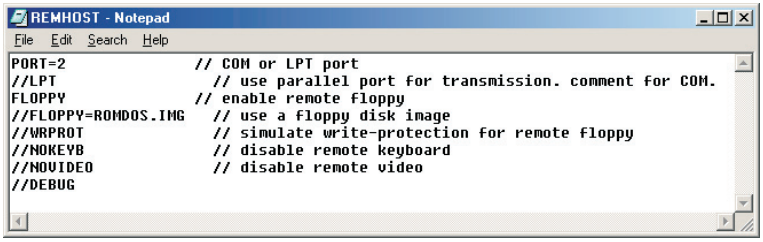


Figure 100: Example of REMHOST.INI

The following table lists all commands supported by REMHOST. If the commands begin with consecutive slash symbols ("//") , then these are evaluated as the beginning of a comment. This can be used to disable individual parameters.

Setting option	Description
PORT=x	Specifies the COM interface on the remote PC that is being used for the serial connection to the Mobile Panel. "x" stands for the COM number, e.g. COM2 is used for PORT=2.
LPT	The parallel interface is used for communication. This option cannot be used with the Mobile Panel.
FLOPPY	The floppy disk drive in the remote PC is used as the floppy disk drive for the Mobile Panel. Therefore, a USB floppy disk drive connected to the Mobile Panel cannot be used.
FLOPPY=ROMDOS.IMG	A floppy image file can be used for the simulation of a floppy disk drive on the hard disk of the remote PC. A floppy image can be created with the program WINIMAGE (a shareware version can be downloaded from www.winimage.com). In this way, several versions of BIOS upgrades can be easily stored on the hard disk of the remote PC.
WRPROT	Write protection for the floppy disk drive can be simulated using this parameter.
NOKEYB	If this parameter is activated, then the keyboard of the remote PC is not used by REMHOST. Input must then take place on the Mobile Panel, e.g. using a USB keyboard.
NOVIDEO	If this parameter is activated, then the screen output is not made on the remote PC. Outputs take place on the display of the Mobile Panel device.
DEBUG	REMHOST outputs debug information.

Table 52: Description of REMHOST.INI configuration options

2.3.5 Program start

The name of the configuration file can be specified when starting the program. If no name is specified, then the REMHOST.INI file is used by default.

```
REMHOST V2.15
Copyright (c) 1996-2000 FS FORTH-SYSTEME GmbH
Copyright (c) 2003      Bernecker + Rainer
Press <Left-Shift> and <Ctrl> to exit.
Using COM1 for Remote.
```

Figure 101: REMHOST program start

After the program is started, REMHOST displays the current version as well as the COM interface of the remote PC that is used for communication with the Mobile Panel.

The connection with the Mobile Panel device is established when it is rebooted and its mode/node switches are set to 00h.

Information:

If the Mobile Panel is already started, then a connection can NOT be established using a subsequent REMHOST start.

2.3.6 Program end

REMHOST can be ended by pressing the left SHIFT key and the CTRL key simultaneously.

Information:

The Mobile Panel must be restarted in order to undo the redirections for keyboard, floppy disk drive and display.

2.3.7 Pin assignments - Connection cable

In order to establish a serial connection between a Mobile Panel CE device and a remote PC (e.g. Provit 5600), an RS232 cable needs to be connected correctly.

The cable can be a maximum of 15 meters, and the pins must be connected as follows:

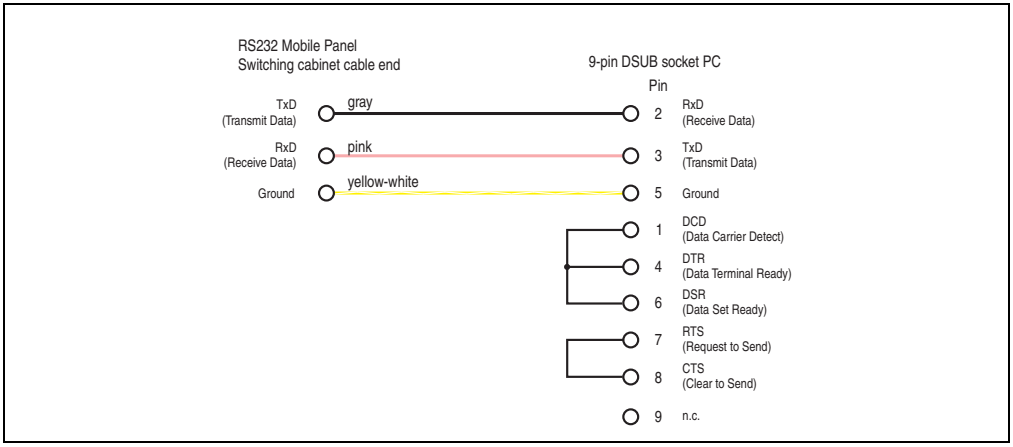


Figure 102: Pin assignments - REMHOST / Mobile Panel connection cable

The three ends of the RS232 Mobile Panel switching cabinet cable (grey, pink, and yellow-white) must be connected to a 9-bin DSUB socket as shown in the above image. Some of the pins of the 9-pin DSUB socket must be connected with each other as well.

2.4 Creating an MS-DOS boot diskette in Windows XP

- Place an empty 1.44 MB HD diskette in the disk drive
- Open Windows Explorer
- Right-click on the 3½" Floppy icon and select "Format...".

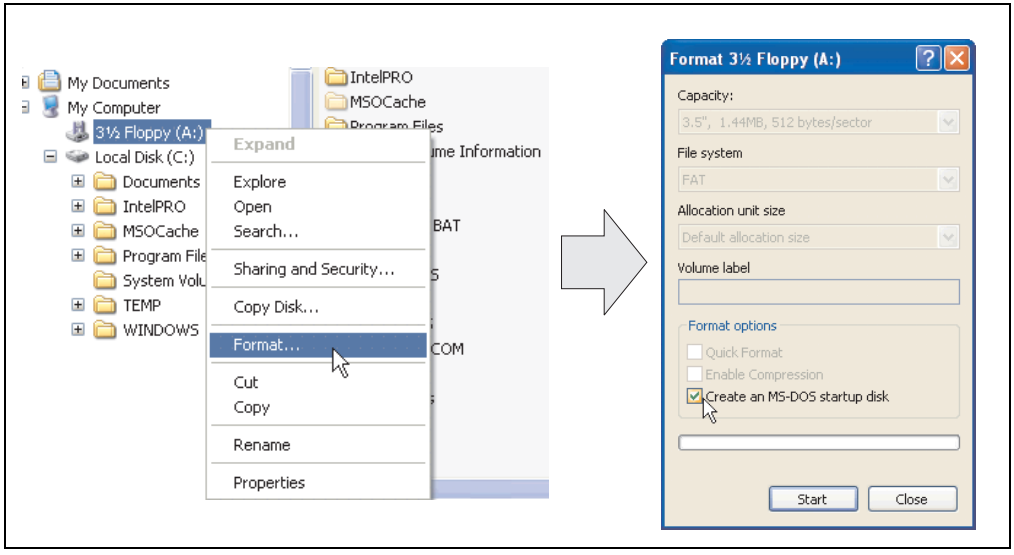


Figure 103: Creating a bootable diskette in Windows XP - step 1

Then select the checkbox **"Create an MS-DOS startup disk"**, press **"Start"** and acknowledge the warning message with "OK".

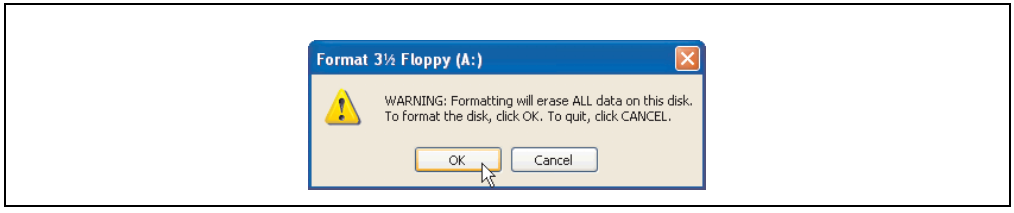


Figure 104: Creating a bootable diskette in Windows XP - step 2

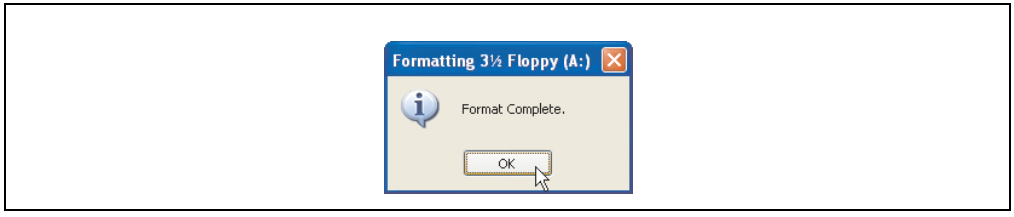


Figure 105: Creating a bootable diskette in Windows XP - step 3

After creating the startup disk, some of the files must be deleted because of the size of the update.

When doing this, all files (hidden, system files, etc.) must be shown on the diskette.

In the Explorer, go to the "Tools" menu, select "Folder Options..." and open the "View" tab - now deactivate the option "Hide protected operating system files (Recommended)" (activated as default) and activate the option "Show hidden files and folders".

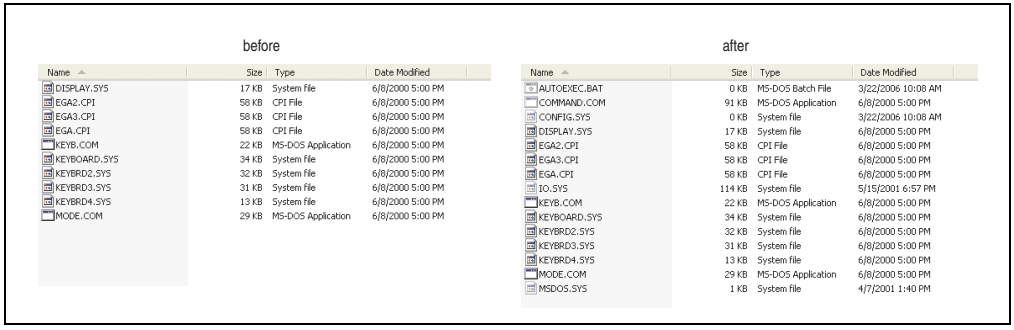


Figure 106: Creating a bootable diskette in Windows XP - step 4

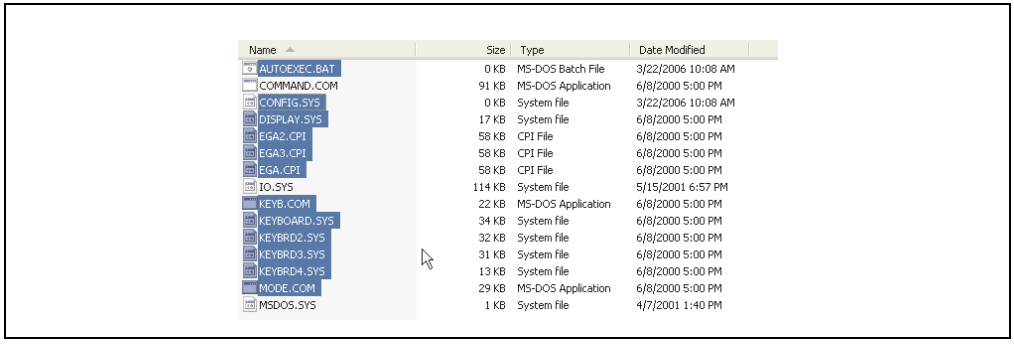


Figure 107: Creating a bootable diskette in Windows XP - step 5

Now all files (marked) except Command.com, IO.sys and MSDOS.sys can be deleted.

2.5 Creating a bootable CompactFlash card for B&R upgrade files

When used in connection with a B&R industrial PC, it is possible to upgrade BIOS from one of the CompactFlash cards available from B&R. To do this, the CompactFlash card must be prepared accordingly. This is done with the B&R Embedded OS Installer, which can be downloaded for free from the B&R homepage (**www.br-automation.com**).

Requirements

The following peripherals are required for creating a bootable CompactFlash card:

- CompactFlash card
- B&R Industrial PC
- B&R Embedded OS Installer (V3.10 or higher)

Procedure

- Insert the CompactFlash card in the CF slot on the industrial PC.
- If the drive list is not refreshed automatically, the list must be updated using the command **Drives > Refresh**.
- Select the desired CompactFlash card from the drive list.
- Change to the **Action** tab and select **Install a B&R Update to a CompactFlash card** as type of action.
- Enter the path to the MS-DOS operating system files. If the files are part of a ZIP archive, then click on the button **By ZIP file...**. If the files are stored in a directory on the hard drive, then click on the button **By folder...**.
- In the **B&R Upgrade** text box, it's also possible to enter the path to the ZIP file for the B&R Upgrade Disk and select the file.
- Click on the **Start action** button in the toolbar.

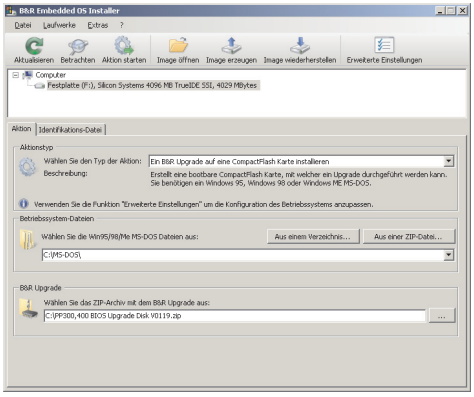


Figure 108: Creating a CompactFlash for B&R upgrade files

Where do I get MS-DOS?

Information concerning creating an MS-DOS boot diskette can be found in section 2.4 "Creating an MS-DOS boot diskette in Windows XP" on page 170. Then the files from the diskette are to be copied to your hard drive.

2.6 CMOS backup

To protect CMOS data, a CMOS backup has been integrated into BIOS. If BIOS setup was ended using "Save Values and Exit“ (see section 1.2.15 "Save values and exit" on page 158 for VGA Mobile Panel devices) and the Mobile Panel device was successfully restarted, then the CMOS data is burned in the flash memory. If the CMOS checksum is incorrect during startup (battery empty) or the Mobile Panel device cannot be booted correctly on three consecutive attempts, then the salvaged data from flash memory is copied again to CMOS. Setup is back to its original state, except for the time.

2.7 Distribution of resources

2.7.1 RAM address assignment

RAM address	Resource
00000000 - 000003FF	Interrupt vectors
00000400 - 000004FF	BIOS data area
00000500 - 0009FBFF	Freely available for the operating system (MS-DOS program area)
0009FC00 - 0009FFFF	Advanced BIOS data area
000A0000 - 000BFFFF	VGA memory
000C0000 - 000C7FFF	VGA BIOS
000C8000 - 000CBFFF	Reserved
000CC000 - 000EFFFF	XpressROM expansion ROMS. Unused areas can be used for HMA.
000F0000 - 000FFFFF	XpressROM BIOS
00100000 - BC_RAM_TOP	Remaining DRAM
40000000	GX_Base Register (determined by BIOS)
40000000 - 40000BFF	L1 scratchpad
40008000 - 400080FF	Internal BUS IF unit registers
40008100 - 400082FF	Graphics pipeline registers
40008300 - 400083FF	Display controller registers
40008400 - 400084FF	Memory controller registers
40009000 - 403FFFFF	PCI Accessible
40010000 - 40010FFF	Video configuration registers
40011000 - 40011FFF	Audio configuration registers
40015000 - 40015FFF	VIP interface registers
40800000 - 40BFFFFF	VGA frame buffer
D0000000 - FBFFFFFF	PCI memory and PCI ROM (are dynamically assigned during POST)
FFE00000 - FFFFFFFF	High BIOS area (flash memory)

Table 53: RAM address assignment

2.7.2 DMA channel assignment

DMA channel	Resource
0	Freely available
1	Freely available
2	Disk drive
3	Freely available
4	Freely available
5	Freely available

Table 54: DMA channel assignment

DMA channel	Resource
6	Freely available
7	Freely available

Table 54: DMA channel assignment (Forts.)

2.7.3 I/O address assignment

I/O address	Resource
0000 - 000F	DMA controller channels 0-3
0020 - 0021	Master programmable interrupt controller
0022 - 0023	CPU configuration registers
0040 - 0043	Programmable interval timer
0060 - 0066	Keyboard controller (emulated by Legacy USB)
0070 - 0071	RTC (real-time clock)
0072 - 0073	Extended RTC (real-time clock)
0080	BIOS POST debug output port
0081 - 0083	DMA channel low page registers
0084	VSA debug output port
0085 - 008F	DMA channel low page registers
0092	Port A control register
00A0 - 00A1	Slave programmable interrupt controller
00C0 - 00CF	DMA controller channels 4-7
00D0 - 00DF	DMA status/control/mode registers channel 0-7
00F0 - 00F1	Co-processor error register
015C - 015D	On-chip SIO configuration
0170 - 0177	Primary IDE
01F0 - 01F7	Primary IDE
0220 - 022F	Audio (not supported)
02F8 - 02FF	COM2
0376 - 0377	Secondary IDE channel
03B0 - 03BB	Video controller
03C0 - 03DF	Video controller
03E8 - 03EF	COM3
03F0 - 03F5	Floppy controller (emulated by Legacy USB)
03F6 - 03F7	Primary IDE
03F8 - 03FF	COM1
0480 - 048F	DMA channel high page registers
04D0 - 04D1	Interrupt edge/level registers
0CF8 - 0CFF	PCI configuration registers

Table 55: I/O address assignment

I/O address	Resource
5000 - 500F	IDE controller configuration registers (F2BAR4)
6000 - 60FF	SMI status
6200 - 623F	X-Bus expansion support registers (F5BAR0)
6400 - 643F	GPIO runtime and configuration registers (F0BAR0)
6600 - 663F	LPC support registers (F0BAR1)
9000 - 903F	CPU configuration registers
AD00 - AFFF	PCI assignment (dynamically assigned during POST)
B000 - BFFF	PCI assignment (dynamically assigned during POST)
C000 - CFFF	PCI assignment (dynamically assigned during POST)
D000 - DFFF	PCI assignment (dynamically assigned during POST)
E000 - EFFF	PCI assignment (dynamically assigned during POST)
F000 - FFFF	Reserved

Table 55: I/O address assignment (Forts.)

2.7.4 Interrupt assignment

Interrupt	Resource
IRQ 0	System timer
IRQ 1	Keyboard (Legacy USB emulation)
IRQ 2	2nd PIC IRQ cascade
IRQ 3	COM2 1)
IRQ 4	COM1 1)
IRQ 5	USB
IRQ 6	Disk drive
IRQ 7	FPGA 1) (1st interrupt)
IRQ 8	RTC (real-time clock)
IRQ 9	Ethernet (MacPhyter) 1)
IRQ 10	FPGA (2nd interrupt)1)
IRQ 11	COM3 1)
IRQ 12	PS/2 mouse (Legacy USB emulation)
IRQ 13	FPU (co-processor)
IRQ 14	Primary IDE (primary hard disk)
IRQ 15	Secondary IDE (secondary hard disk)

Table 56: Interrupt assignment

1) BIOS setup default setting

3. Mobile Panel with Automation Runtime

3.1 General information

B&R Automation Runtime guarantees a uniform runtime environment for Automation Studio programs on all target systems. This ensures uniform programming and operation on all devices.

Automation Runtime™ possesses a multitasking operating system adapted especially for use with control technology. The cycle time for your application can be separated among several task classes. Automation Runtime ensures that all application programs are executed within defined time periods, proving itself to be a configurable, deterministic real-time multitasking system.

An extensive project can be divided into small individual tasks. This way of working increases modularity and makes it much easier to maintain projects.

3.2 Control and visualization with the Mobile Panel

Both the control program and the visualization application run on the Mobile Panel. I/O peripherals and drives are connected via the CAN bus. Communication to higher-level systems is handled by Ethernet.

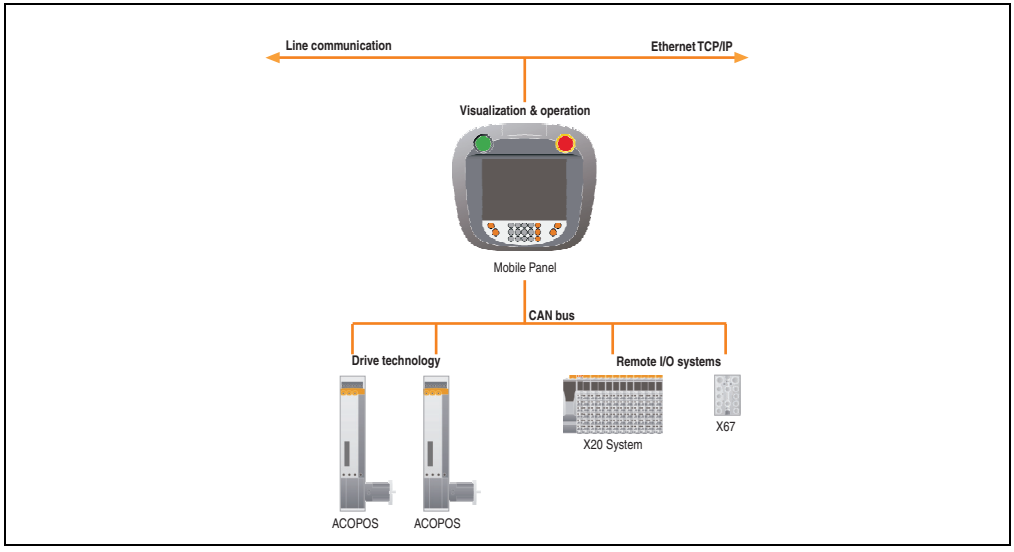


Figure 109: Control and visualization with Mobile Panel

3.3 Operation and monitoring with the Mobile Panel

Control programs are distributed and run over several PLC stations. Fieldbus systems are used to connect I/O systems and drives to the PLCs. Machine operation and visualization take place on a central Mobile Panel, which uses Ethernet to communicate with the controllers.

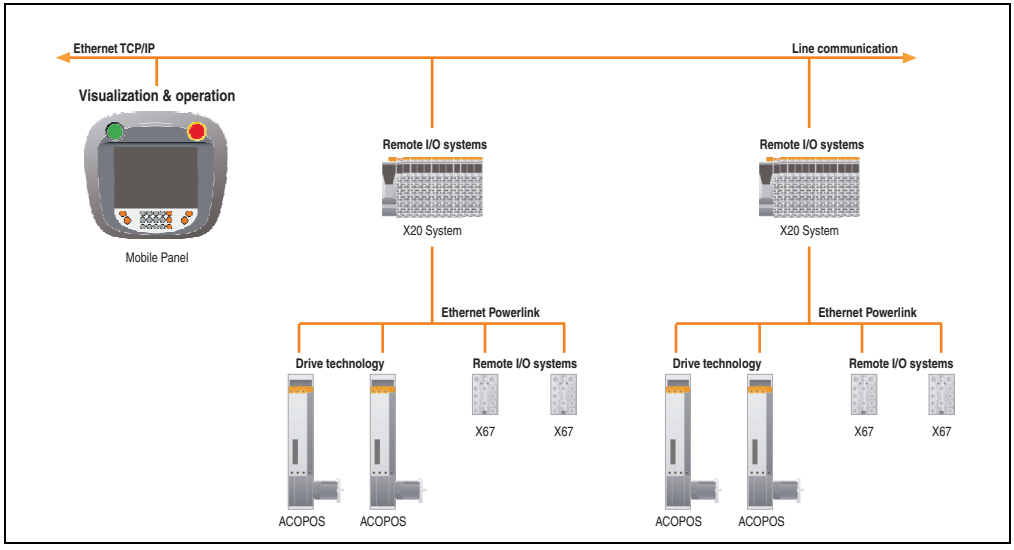


Figure 110: Operation and monitoring with the Mobile Panel

3.4 Summary screen

When the Mobile Panel device is turned on, a summary screen is briefly displayed which shows the parameters most important to an Automation Runtime Mobile Panel device.

Information:

The following image and description refer only to Automation Runtime V2.66. For this reason, this image may not match with Automation Runtime version installed on your device.

```
Bernecker + Rainer Industrie-Elektronik

Facotory Settings
 Version                          03
 DeviceID                         1697
 CompatibilityID                  00
 Brightness (min/typ/max)         D5 EA FF
 Contrast   (min/typ/max)         00 46 FF

Mode/Node            00
MAC Address          00:60:65:00:C6:A7
BootLoader           2.07
HW-Layer             1.2.0
OnBoard AR           V2.66

SMC Version          AD


All values in hex
```

Figure 111: Automation Runtime summary screen

Information	Example value	Meaning
Version	03	Displays the factory settings version. These factory settings determine the device ID, display ID, display-specific initialization sequences, and other important parameters. **Information:** **Factory settings are set by B&R and cannot be changed by the user!**
Device ID	1697	Displays the hexadecimal value of the hardware device number.
Compatibility ID	00	Displays the version of the device within the same B&R device code. This ID is needed for Automation Runtime.
Brightness (min / typ / max)	D5 EA FF	Displays the minimum, typical, and maximum values for the brightness settings of the display as hexadecimal values.
Contrast (min / typ / max)	00 46 FF	Displays the minimum, typical, and maximum values for the contrast settings of the display as hexadecimal values.
Mode/Node	00	Displays the current operating mode switch positions.
MAC address	00:60:65:00:C6:A7	Displays the assigned media access control (MAC) address.
Boot loader	2.07	Displays the version of the boot loader.
HW layer	1.2.0	Displays the version of the hardware layer.
Onboard AR	V2.66	Displays the current onboard Automation Runtime version.
SMC version	AD	Displays the current SMC (system management controller) software version.

Table 57: Automation Runtime summary screen

4. Mobile Panel with Windows CE

Figure 112: Windows CE logo

Model number	Short description	Note
9S0001.13-010	**OEM Microsoft Windows CE 4.1 German** OEM Microsoft Windows CE 4.1 German license, only supplied together with a Mobile Panel BIOS device.	
9S0001.13-020	**OEM Microsoft Windows CE 4.1 English** OEM Microsoft Windows CE 4.1 English license, only supplied together with a Mobile Panel BIOS device.	
9S0001.17-020	**OEM Microsoft Windows CE 4.2 English** OEM Microsoft Windows CE 4.2 English license, only supplied together with a Mobile Panel BIOS device.	
9S0001.29-020	**OEM Microsoft Windows CE 5.0 English** OEM Microsoft Windows CE 5.0 English license, only supplied together with a Mobile Panel BIOS device.	
5SWWCE.0519-ENG	**WinCE5.0 Pro MP100 SCX200** Microsoft OEM Windows CE 5.0 Professional, English; for MP181 BIOS; order CompactFlash separately (at least 128 MB).	
5SWWCE.0619-ENG	**WinCE5.0 ProPlus MP100 SCX200** Microsoft OEM Windows CE 5.0 Professional plus, English; for MP181 BIOS; order CompactFlash separately (at least 128 MB).	

Table 58: Model numbers - Windows CE

4.1 General information

B&R Windows CE is an operating system which is optimally tailored to B&R's devices. It includes only the functions and modules which are required by each device. This makes this operating system extremely robust and stable. A further advantage of B&R Windows CE compared to other operating systems are the low licensing costs.

4.2 Windows CE 5.0 features

Detailed information about Windows CE for B&R devices can be downloaded in the download area on the B&R homepage (www.br-automation.com).

Features	Windows CE 5.0
Supported screen resolutions	QVGA (LCD), QVGA (TFT), VGA (TFT), SVGA (TFT), XGA (TFT)
Color depth	16-bit / 65,536 colors[1)]
Graphics card driver	AMD Geode SC1200/SC2200 graphics card driver with screen rotation without DirectX
Main memory	Automatic detection and use of up to 512 MB RAM
Boot time / Startup time	Approx. 20 seconds
Screen rotation	The desktop can be turned in 90° intervals
Web browser	Internet Explorer 6.0 for Windows CE
.NET	Compact Framework 1.0 with SP3
Image size	Pro: Approx. 26 MB uncompressed ProPlus: Approx. 28 MB uncompressed[2)]
Custom keys	Supported
PVI	Supported
Automation Device Interface	Supported
Remote Desktop Protocol for thin clients	Supported
B&R VNC Viewer	Supported
B&R Task Manager	Supported
B&R Picture Viewer	Supported
Compatible with zenOn	Yes
Serial interfaces for any use	1

Table 59: Windows CE 5.0 features

1) The color depth depends on the display used.
2) Use the function *"Compress Windows CE Image"* in the B&R Embedded OS Installer to reduce the image size.

4.3 Requirements

The device must fulfill the following criteria to be able run the Windows CE operating system.

- At least 128 MB main memory.
- At least one 128 MB CompactFlash card (size should be specified when ordered).

4.4 Installation

Windows CE is usually preinstalled at the B&R plant.

4.4.1 B&R Embedded OS Installer

The B&R Embedded OS Installer allows you to install existing B&R Windows CE images. The four files (NK.BIN, BLDR, LOGOXRES.BMP, and LOGOQVGA.BMP) must be provided from an already functioning B&R Windows CE installation.

The B&R Embedded OS Installer can be downloaded from the download area on the B&R homepage (**www.br-automation.com**). Further information is available in the online help for the B&R Embedded OS Installer.

4.5 Serial ActiveSync connection

In order to establish a serial connection between a Mobile Panel CE device and a desktop PC, an RS232 cable needs to be connected correctly.

Information:

Serial ActiveSync connections are offered on Mobile Panel devices beginning with Revision C0.

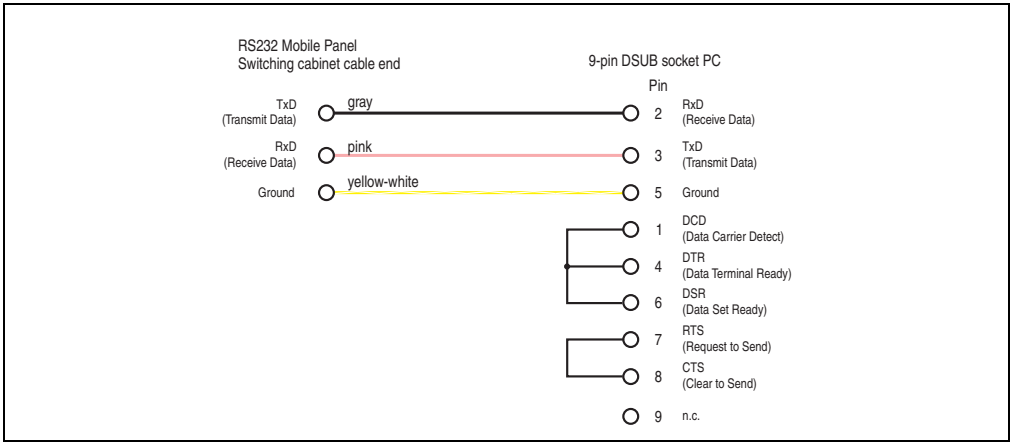


Figure 113: Directions for establishing an ActiveSync connection

The three ends of the RS232 Mobile Panel switching cabinet cable (grey, pink, and yellow-white) must be connected to a 9-bin DSUB socket as shown in the above image. Some of the pins of the 9-pin DSUB socket must be connected with each other as well.

Additional information can also be found in the B&R Windows CE help system.

4.6 Mobile Panel as a thin client

The Mobile Panel with Windows CE is connected as a thin client to an industrial PC with Windows XP Professional/Embedded via Ethernet. The control program runs on the industrial PC, and I/O peripherals and drives are connected to the industrial PC via a fieldbus.

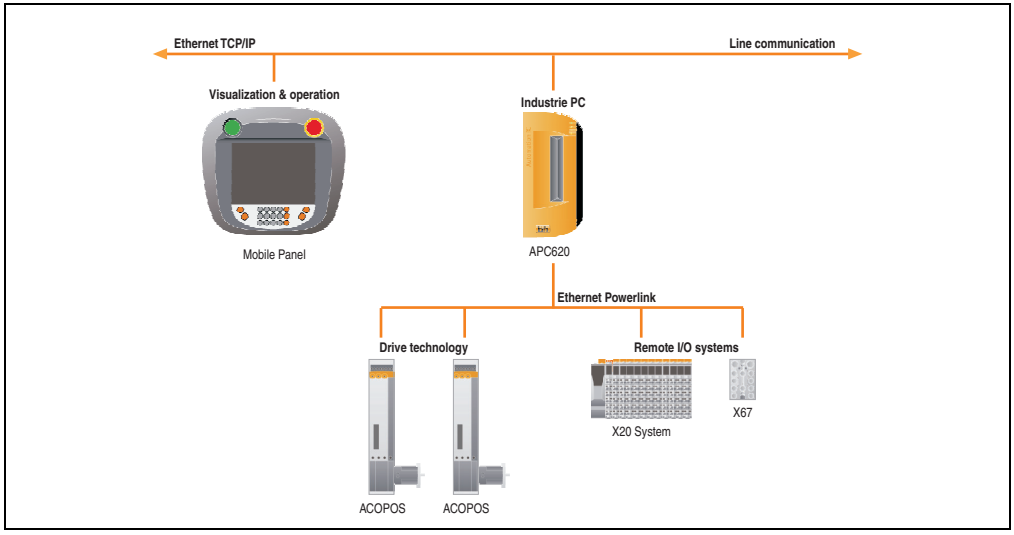


Figure 114: Mobile Panel as a thin client

5. Mobile Panel with Windows XP Embedded

Figure 115: Windows XP Embedded Logo

Model number	Short description	Note
9S0001.21-020	**OEM Microsoft Windows XPe MP100/200 w/CF English** Only available with a Mobile Panel BIOS device!	*Cancelled since 10/2008*
9S0001.26-020	**OEM Microsoft Windows XPe MP100/200 w/CF English** Only available with a Mobile Panel BIOS device!	*Cancelled since 10/2009*
5SWWXP.0419-ENG	**WinXPe FP2007 MP100 SCx200** Microsoft OEM Windows XP Embedded Feature Pack 2007, English; for MP181 BIOS; order CompactFlash separately (at least 512 MB).	

Table 60: Model numbers - Windows XP Embedded

5.1 General information

Windows XP Embedded is the modular version of the desktop operating system Windows XP Professional. Windows XP Embedded is based on the same binary files as Windows XP Professional and is optimally tailored to the hardware being used. In other words, only the functions and modules required by the respective device are included. Windows XP Embedded is also based on the same reliable code as Windows XP Professional. It provides industry with leading reliability, improvements in security and performance, and the latest technology for Web browsing and extensive device support.

The Windows XP Embedded version available from B&R has been developed for Mobile Panel BIOS devices and is only available with a Mobile Panel BIOS device.

5.2 Requirements

The Mobile Panel device must meet the following criteria to run Windows XP Embedded.

- Mobile Panel device with BIOS
- At least 128 MB RAM

5.3 Features

The feature list displays the essential device functions in Windows XP Embedded.

Function	Present
Enhanced write filter (EWF)	✓
File Based Write Filter	✓
Page file	configurable
Administrator account	✓
User account	configurable
Explorer shell	✓
Registry Filter	✓
Internet Explorer 6.0 + SP2	✓
Internet information service (IIS)	-
Terminal service	✓
Windows Firewall	✓
MSN-Explorer	-
Outlook Express	-
Administrative Tools	✓
Remote Desktop	✓
Remote Assistance	-
.NET Framework	-
ASP.NET	-
Codepages/User Locale/Keyboard	✓
Disk Management Service	✓
Windows Installer Service	✓
Class Installer	✓
CoDevice Installer	✓
Media Player	-
DirectX	-
Accessories	✓
Number of fonts	89

Table 61: Device functions in Windows XP Embedded

5.4 Installation

Upon request, Windows XP Embedded can be preinstalled at B&R Austria on a suitable CompactFlash card (min. 512 MB). The system is then automatically configured after it has been switched on for the first time. This procedure takes approximately 30 minutes, and the device will be rebooted a number of times.

Brief instructions for creating your own Windows XP Embedded images or a suitable Target Designer export file can be downloaded from the download area on the B&R homepage (**www.br-automation.com**).

6. B&R Key Editor

On display units, it is often necessary to adjust the function keys and LEDs for the application software being used. With the B&R Key Editor, it is possible to quickly and easily set up the application individually.

Figure 116: B&R Key Editor screenshots (Version 3.00)

Features:

- Configuration of normal keys like on a keyboard (A, B, C, etc.)
- Keyboard shortcuts (CTRL+C, SHIFT+DEL, etc.) on one key
- Special key functions (change brightness, etc.)
- Assign functions to LEDs (HDD access, power, etc.)
- 4 assignments per key possible (using layer function)
- Configuration of panel locking time when multiple Automation Panel 900 devices are connected to Automation PC 620 and Panel PC 700 devices

Supports following systems (V3.00):

- Automation PC 620 (ETX, XTX, Embedded)
- Automation PC 800
- Automation PC 820
- Panel PC 300
- Panel PC 700 (ETX, XTX)
- Panel PC 800
- Power Panel 65
- Power Panel 100.200
- Power Panel 300/400
- Mobile Panel 100, 200
- Mobile Panel 40/50
- IPC2000, IPC2001, IPC2002
- IPC5000, IPC5600
- IPC5000C, IPC5600C

A detailed guide for configuring keys and LEDs can be found in the B&R Key Editor's online help.

The B&R Key Editor can be downloaded for free from the download area on the B&R homepage (**www.br-automation.com**). Additionally, it can also be found on the B&R HMI Drivers & Utilities DVD (model number 5SWHMI.0000-00).

7. HMI Drivers & Utilities DVD 5SWHMI.0000-00

Figure 117: HMI Drivers & Utilities DVD 5SWHMI.0000-00

Model number	Short description	Note
5SWHMI.0000-00	**HMI Drivers & Utilities DVD** Contains drivers, utilities, software upgrades and user's manuals for B&R panel system products (see B&R homepage – Industrial PCs, Visualization and Operation).	

Table 62: Model number - HMI Drivers & Utilities DVD

This DVD contains drivers, utilities, software upgrades and user's manuals for B&R Panel system products (see B&R homepage – Industrial PCs, Visualization and Operation).
Information in detail:

BIOS upgrades for the products

- Automation PC 620
- Panel PC 700
- Automation PC 680
- Provit 2000 product family - IPC2000/2001/2002
- Provit 5000 product family - IPC5000/5600/5000C/5600C
- Power Panel 100 BIOS devices
- Mobile Panel 100 BIOS devices
- Power Panel 100 / Mobile Panel 100 user boot logo
- Power Panel 100 / Mobile Panel 100 REMHOST utility

Drivers for the devices

- Automation Device Interface (ADI)
- Audio
- Chipset
- CD-ROM
- LS120
- Graphics
- Network
- PCI RAID controller
- Touch screen
- Touchpad
- Interface board

Updates

- Firmware upgrades (e.g. MTCX, SMXC)

Utilities/Tools

- Automation Device Interface (ADI)
- Miscellaneous
- MTC utilities
- Key editor
- MTC & Mkey utilities
- Mkey utilities
- UPS configuration software
- ICU ISA configuration
- Intel PCI NIC boot ROM
- Diagnostics
- CompactFlash lifespan calculation for Silicon Systems CompactFlash cards 5CFCRD.xxxx-03

Windows and Embedded operating systems

- Thin client
- Windows CE
- Windows NT Embedded

- Windows XP Embedded

MCAD templates for

- Industrial PCs
- Visualization and operating devices
- Legend strip templates

Documentation for

- B&R Windows CE
- Automation PC 620
- Automation PC 680
- Automation Panel 900
- Panel PC 700
- Power Panel 15/21/35/41
- Power Panel 100/200
- Provit 2000
- Provit 3030
- Provit 4000
- Provit 5000
- Provit Benchmark
- Provit Mkey
- Windows NT Embedded application guide
- Windows XP Embedded application guide
- Uninterruptible power supply

Service tools

- Acrobat Reader 5.0.5 (freeware in German, English, and French)
- Power Archiver 6.0 (freeware in German, English, and French)
- Internet Explorer 5.0 (German and English)
- Internet Explorer 6.0 (German and English)

Chapter 5 • Standards and certifications

1. Applicable European guidelines

- EMC guidelines 89/336/EWG
- Low-voltage guidelines 73/23/EWG
- Machine guideline 98/37/EG - expired (replaced by the machine guideline 2006/42/EG)
- Machine guideline 2006/42/EG (beginning 29.12.2009)

2. Overview of standards

Standard	Description
EN 418	Safety of machines, E-stop equipment, functional aspects, design principles
EN 50081-1	Electromagnetic compatibility (EMC), generic emission standard - part 1: Residential, commercial, and light industrial environments (EN 50081-1 has been replaced by EN 61000-6-3)
EN 50081-2	Electromagnetic compatibility (EMC), generic emission standard - part 2: Industrial environments (EN 50081-2 has been replaced by EN 61000-6-4)
EN 50082-1	Electromagnetic compatibility (EMC), generic immunity standard - part 1: Residential, commercial, and light industrial environments (EN 50082-1 has been replaced by EN 61000-6-1)
EN 50082-2	Electromagnetic compatibility (EMC), generic immunity standard - part 2: Industrial environments (EN 50082-2 has been replaced by EN 61000-6-2)
EN 55011 Class A	Electromagnetic compatibility (EMC), radio disturbance product standard, industrial, scientific, and medical high-frequency devices (ISM devices), limit values and measurement procedure; group 1 (devices that do not create HF during material processing) and group 2 (devices that create HF during material processing)
EN 55022 Class A	Electromagnetic compatibility (EMC), radio disturbance characteristics, information technology equipment (ITE devices), limits and methods of measurement
EN 55024 Class A	Electromagnetic compatibility (EMC), immunity characteristics, information technology equipment (ITE devices), limits and methods of measurement
EN 60068-2-1	Environmental testing - part 2: Tests; test A: Cold
EN 60068-2-2	Environmental testing - part 2: Tests; test B: Dry heat
EN 60068-2-3	Environmental testing - part 2: Tests; test and guidance: Damp heat, constant
EN 60068-2-6	Environmental testing - part 2: Tests; test: Vibration (sinusoidal)
EN 60068-2-14	Environmental testing - part 2: Tests; test N: Change of temperature
EN 60068-2-27	Environmental testing - part 2: Tests; test and guidance: Shock
EN 60068-2-30	Environmental testing - part 2: Tests; test and guidance: Damp heat, cyclic

Table 63: Overview of standards

Standard	Description
EN 60068-2-31	Environmental testing - part 2: Tests; test: Drop and topple, primarily for equipment-type specimens
EN 60068-2-32	Environmental testing - part 2: Tests; test: Free fall
EN 60204-1	Safety of machinery, electrical equipment on machines - part 1: General requirements
EN 60721-1	Classification of environmental conditions - part 1: Environmental parameters and their severities
EN 60721-3-2	Classification of environmental conditions - part 3: Classification of groups of environmental parameters and their severities, section 2: Transport
EN 60721-3-3	Classification of environmental conditions - part 3: Classification of groups of environmental parameters and their severities, section 3: Stationary use at weather-protected locations
EN 61000-4-2	Electromagnetic compatibility (EMC) - part 4-2: Testing and measuring techniques; electrostatic discharge immunity test
EN 61000-4-3	Electromagnetic compatibility (EMC) - part 4-3: Testing and measuring techniques; radiated radio-frequency electromagnetic field immunity test
EN 61000-4-4	Electromagnetic compatibility (EMC) - part 4-4: Testing and measuring techniques; electrical fast transient/burst immunity test
EN 61000-4-5	Electromagnetic compatibility (EMC) - part 4-5: Testing and measuring techniques; surge immunity test
EN 61000-4-6	Electromagnetic compatibility (EMC) - part 4-6: Testing and measuring techniques; immunity to conducted disturbances, induced by radio-frequency fields
EN 61000-4-8	Electromagnetic compatibility (EMC) - part 4-8: Testing and measuring techniques; power frequency magnetic field immunity test
EN 61000-4-11	Electromagnetic compatibility (EMC) - part 4-11: Testing and measuring techniques; voltage dips, short interruptions and voltage variations immunity tests
EN 61000-4-12	Electromagnetic compatibility (EMC) - part 4-12: Testing and measuring techniques; oscillatory waves immunity test
EN 61000-6-1 (EN 50082-1)	Electromagnetic compatibility (EMC), generic immunity standard - part 1: residential, commercial, and light industrial environments (EN 50082-1 has been replaced by EN 61000-6-1)
EN 61000-6-2 (EN 50082-2)	Electromagnetic compatibility (EMC), generic immunity standard - part 2: industrial environments (EN 50082-2 has been replaced by EN 61000-6-2)
EN 61000-6-3 (EN 50081-1)	Electromagnetic compatibility (EMC), generic emission standard - part 1: residential, commercial, and light industrial environments (EN 50081-1 has been replaced by EN 61000-6-3)
EN 61000-6-4 (EN 50081-2)	Electromagnetic compatibility (EMC), generic emission standard - part 2: industrial environments (EN 50081-2 has been replaced by EN 61000-6-4)
EN 61131-2 IEC 61131-2	Product standard, programmable logic controllers - part 2: Equipment requirements and tests
EN 61508-1	Functional safety of electrical/electronic/programmable electronic safety-related systems - part 1: General requirements
EN 61508-2	Functional safety of electrical/electronic/programmable electronic safety-related systems - part 2: Requirements for electrical/electronic/programmable electronic safety-related systems
EN 954-1 (replaced by EN 13849-1:2008)	Safety of machinery – safety-related controller components - Part 1: General design principles
EN 13849-1:2008	Safety of machinery – safety-related controller components - Part 1: General design principles
EN 13850-1:2006	Safety of machines, E-stop equipment, functional aspects, design principles
UL 508	Industrial control equipment (UL = Underwriters Laboratories)

Table 63: Overview of standards (Forts.)

3. Emission requirements

Emissions	Test carried out according to	Limits according to
Network-related emissions	EN 55011 / EN 55022	EN 61000-6-4: Generic standard (industrial areas)
		EN 55011: Industrial product standard, scientific and medical high-frequency devices (ISM devices) class A (industrial area)
		EN 55022: Product standard equipment for Information Technology (ITE devices) class A (industrial area)
		EN 61131-2: Programmable logic controllers
Electromagnetic emissions	EN 55011 / EN 55022	EN 61000-6-4: Generic standard (industrial areas)
		EN 55011: Industrial product standard, scientific and medical high-frequency devices (ISM devices) class A (industrial area)
		EN 55022: Product standard equipment for Information Technology (ITE devices) class A (industrial area)
		EN 61131-2: Programmable logic controllers
		47 CFR Part 15 Subpart B Class A (FCC)

Table 64: Overview of limits and testing guidelines for emissions

3.1 Network-related emissions

Test carried out according to EN 55011 / EN 55022	Limits according to EN 61000-6-3	Limits according to EN 55011 class A	Limits according to EN 55022 class A
Power mains connections 150 kHz - 500 kHz	79 dB (µV) Quasi-peak value 66 dB (µV) Average	79 dB (µV) Quasi-peak value 66 dB (µV) Average	79 dB (µV) Quasi-peak value 66 dB (µV) Average
Power mains connections 500 kHz - 30 MHz	73 dB (µV) Quasi-peak value 60 dB (µV) Average	73 dB (µV) Quasi-peak value 60 dB (µV) Average	73 dB (µV) Quasi-peak value 60 dB (µV) Average
Other connections 150 kHz - 500 kHz	97 - 87 dB (µV) and 53 - 43 dB (µA) Quasi-peak value 84 - 74 dB (µV) and 40 - 30 dB (µA) Average	97 - 87 dB (µV) and 53 - 43 dB (µA) Quasi-peak value 84 - 74 dB (µV) and 40 - 30 dB (µA) Average	97 - 87 dB (µV) and 53 - 43 dB (µA) Quasi-peak value 84 - 74 dB (µV) and 40 - 30 dB (µA) Average
Other connections 500 kHz - 30 MHz	87 dB (µV) and 43 dB (µA) Quasi-peak value 74 dB (µV) and 30 dB (µA) Average	87 dB (µV) and 43 dB (µA) Quasi-peak value 74 dB (µV) and 30 dB (µA) Average	87 dB (µV) and 43 dB (µA) Quasi-peak value 74 dB (µV) and 30 dB (µA) Average
Test carried out according to EN 55011 / EN 55022	**Limits according to EN 61131-2**		
Power mains connections [1)] 150 kHz - 500 kHz	79 dB (µV) Quasi-peak value 66 dB (µV) Average		

Table 65: Test requirements - Network-related emissions for industrial areas

Power mains connections 500 kHz - 30 MHz	73 dB (µV) Quasi-peak value 60 dB (µV) Average		
Other connections 150 kHz - 500 kHz	-		
Other connections 500 kHz - 30 MHz	-		

Table 65: Test requirements - Network-related emissions for industrial areas (Forts.)

1) AC network connections only with EN 61131-2

3.2 Electromagnetic emissions

Test carried out according to EN 55011 / EN 55022	Limits according to EN 61000-6-4	Limits according to EN 55011 class A	Limits according to EN 55022 class A
30 MHz - 230 MHz measured at a distance of 10 m	< 40 dB (µV/m) Quasi-peak value	< 40 dB (µV/m) Quasi-peak value	< 40 dB (µV/m) Quasi-peak value
230 MHz - 1 GHz measured at a distance of 10 m	< 47 dB (µV/m) Quasi-peak value	< 47 dB (µV/m) Quasi-peak value	< 47 dB (µV/m) Quasi-peak value
Test carried out according to EN 55011 / EN 55022	**Limits according to EN 61131-2**		
30 MHz - 230 MHz measured at a distance of 10 m	< 40 dB (µV/m) Quasi-peak value		
230 MHz - 1 GHz measured at a distance of 10 m	< 47 dB (µV/m) Quasi-peak value		

Table 66: : Test requirements - Electromagnetic emissions for industrial areas

4. Requirements for immunity to disturbances

Immunity	Test carried out according to	Limits according to
Electrostatic discharge (ESD)	EN 61000-4-2	EN 61000-6-2: Generic standard (industrial areas)
		EN 61131-2: Programmable logic controllers
		EN 55024: Information technology equipment (ITE devices)
Immunity to high-frequency electromagnetic fields (HF field)	EN 61000-4-3	EN 61000-6-2: Generic standard (industrial areas)
		EN 61131-2: Programmable logic controllers
		EN 55024: Information technology equipment (ITE devices)
Immunity to high-speed transient electrical disturbances (burst)	EN 61000-4-4	EN 61000-6-2: Generic standard (industrial areas)
		EN 61131-2: Programmable logic controllers
		EN 55024: Information technology equipment (ITE devices)
Immunity to surge voltages	EN 61000-4-5	EN 61000-6-2: Generic standard (industrial areas)
		EN 61131-2: Programmable logic controllers
		EN 55024: Information technology equipment (ITE devices)
Immunity to conducted disturbances	EN 61000-4-6	EN 61000-6-2: Generic standard (industrial areas)
		EN 61131-2: Programmable logic controllers
		EN 55024: Information technology equipment (ITE devices)
Immunity against magnetic fields with electrical frequencies	EN 61000-4-8	EN 61000-6-2: Generic standard (industrial areas)
		EN 61131-2: Programmable logic controllers
		EN 55024: Information technology equipment (ITE devices)
Immunity to voltage dips, short-term interruptions and voltage fluctuations	EN 61000-4-11	EN 61000-6-2: Generic standard (industrial areas)
		EN 61131-2: Programmable logic controllers
		EN 55024: Information technology equipment (ITE devices)
Immunity to damped vibration	EN 61000-4-12	EN 61000-6-2: Generic standard (industrial areas)
		EN 61131-2: Programmable logic controllers
		EN 55024: Information technology equipment (ITE devices)

Table 67: Overview of limits and testing guidelines for immunity

Evaluation criteria according to EN 61000-6-2

Criteria A:
The operating equipment must continue to work as intended **during** the test. There should be no interference in the operating behavior and no system failures below a minimum operating quality as defined by the manufacturer.

Criteria B:
The operating equipment must continue to work as intended **after** the test. There should be no interference in the operating behavior and no system failures below a minimum operating quality as defined by the manufacturer.

Criteria C:
A temporary function failure is permitted when the function restores itself, or the function can be restored by activating configuration and control elements.

Criteria D:
Impairment or failure of the function, which can no longer be established (operating equipment destroyed).

4.1 Electrostatic discharge (ESD)

Test carried out according to EN 61000-4-2	Limits according to EN 61000-6-2	Limits according to EN 61131-2	Limits according to EN 55024
Contact discharge to powder-coated and bare metal housing parts	±4 kV, 10 discharges, criteria B	±4 kV, 10 discharges, criteria B	±4 kV, 10 discharges, criteria B
Discharge through the air to plastic housing parts	±8 kV, 10 discharges, criteria B	±8 kV, 10 discharges, criteria B	±8 kV, 10 discharges, criteria B

Table 68: Test requirements - Electrostatic discharge (ESD)

4.2 High-frequency electromagnetic fields (HF field)

Test carried out according to EN 61000-4-3	Limits according to EN 61000-6-2	Limits according to EN 61131-2	Limits according to EN 55024
Housing, completely wired	80 MHz - 1 GHz, 10 V/m, 80% amplitude modulation with 1 kHz, length 3 seconds, criteria A	80 MHz - 1 GHz, 1.4 - 2 GHz, 10 V/m, 80% amplitude modulation with 1 kHz, length 3 seconds, criteria A 800-960 MHz (GSM), 10 V/m, pulse modulation with 50% duty cycle, criteria A	80 MHz - 1 GHz, 1.4 - 2 GHz, 3 V/m, 80% amplitude modulation with 1 kHz, length 3 seconds, criteria A

Table 69: Test requirements - High-frequency electromagnetic fields (HF field)

4.3 High-speed transient electrical disturbances (burst)

Test carried out according to EN 61000-4-4	Limits according to EN 61000-6-2	Limits according to EN 61131-2	Limits according to EN 55024
AC power I/O	±2 kV, criteria B	-	±1 kV, criteria B
AC power inputs	-	±2 kV, criteria B	-
AC power outputs	-	±1 kV, criteria B	-
DC power I/O > 10 m [1)]	±2 kV, criteria B	-	±0.5 kV, criteria B
DC power inputs > 10 m	-	±2 kV, criteria B	-
DC power outputs > 10 m	-	±1 kV, criteria B	-
Functional ground connections, signal lines and I/Os > 3 m	±1 kV, criteria B	±1 kV, criteria B	±0.5 kV, criteria B
Unshielded AC I/O > 3 m	-	±2 kV, criteria B	-
Analog I/O	±1 kV, criteria B	±1 kV, criteria B	-

Table 70: Test requirements - High-speed transient electrical disturbances (burst)

1) For EN 55024 without length limitation.

4.4 Surges

Test carried out according to EN 61000-4-5	Limits according to EN 61000-6-2	Limits according to EN 61131-2	Limits according to EN 55024
AC power I/O, L to L	±1 kV, criteria B	±1 kV, criteria B	±1 kV, criteria B
AC power I/O, L to PE	±2 kV, criteria B	±2 kV, criteria B	±2 kV, criteria B
DC power I/O, L+ to L-, > 10 m	±0.5 kV, criteria B	-	-
DC power I/O, L to PE, > 10 m	±0.5 kV, criteria B	-	±0.5 kV, criteria B
DC power inputs, L+ to L-	-	±0.5 kV, criteria B	-
DC power inputs, L to PE	-	±1 kV, criteria B	-
DC power outputs, L+ to L-	-	±0.5 kV, criteria B	-
DC power outputs, L to PE	-	±0.5 kV, criteria B	-
Signal connections > 30 m	±1 kV, criteria B	±1 kV, criteria B	±1 kV, criteria B
All shielded cables	-	±1 kV, criteria B	-

Table 71: Test requirements - Surge voltages

4.5 Conducted disturbances

Test carried out according to EN 61000-4-6	Limits according to EN 61000-6-2	Limits according to EN 61131-2	Limits according to EN 55024
AC power I/O	150 kHz - 80 MHz, 10 V, 80% amplitude modulation with 1 kHz, length 3 seconds, criteria A	150 kHz - 80 MHz, 3 V, 80% amplitude modulation with 1 kHz, length 3 seconds, criteria A	150 kHz - 80 MHz, 3 V, 80% amplitude modulation with 1 kHz, criteria A
DC power I/O	150 kHz - 80 MHz, 10 V, 80% amplitude modulation with 1 kHz, length 3 seconds, criteria A	150 kHz - 80 MHz, 3 V, 80% amplitude modulation with 1 kHz, length 3 seconds, criteria A	150 kHz - 80 MHz, 3 V, 80% amplitude modulation with 1 kHz, criteria A
Functional ground connections	0.15 - 80 MHz, 10 V, 80% amplitude modulation with 1 kHz, Length 3 seconds, criteria A	150 kHz - 80 MHz, 3 V, 80% amplitude modulation with 1 kHz, length 3 seconds, criteria A	-
Signal connections > 3 m	0.15 - 80 MHz, 10 V, 80% amplitude modulation with 1 kHz, Length 3 seconds, criteria A	150 kHz - 80 MHz, 3 V, 80% amplitude modulation with 1 kHz, length 3 seconds, criteria A	150 kHz - 80 MHz, 3 V, 80% amplitude modulation with 1 kHz, criteria A

Table 72: Test requirements - Conducted disturbances

4.6 Magnetic fields with electrical frequencies

Test carried out according to EN 61000-4-8	Limits according to EN 61000-6-2	Limits according to EN 61131-2	Limits according to EN 55024
Test direction x, test in the field of an induction coil 1 m x 1 m	30 A/m, criteria A	30 A/m, criteria A	50 Hz, 1 A/m, criteria A
Test direction y, test in the field of an induction coil 1 m x 1 m	30 A/m, criteria A	30 A/m, criteria A	50 Hz, 1 A/m, criteria A
Test direction z, test in the field of an induction coil 1 m x 1 m	30 A/m, criteria A	30 A/m, criteria A	50 Hz, 1 A/m, criteria A

Table 73: Test requirements - Magnetic fields with electrical frequencies

4.7 Voltage dips, fluctuations, and short-term interruptions

Test carried out according to EN 61000-4-11	Limits according to EN 61000-6-2	Limits according to EN 61131-2	Limits according to EN 55024
AC power inputs	Voltage dip 70% (30% reduction), 0.5 periods, criteria B	-	Voltage dip < 5% (> 95% reduction), 0.5 half-oscillations, criteria B
AC power inputs	Voltage dip 40% (60% reduction), 5 periods, criteria C	-	Voltage dip 70% (30% reduction), 25 half-oscillations, criteria C
AC power inputs	Voltage dip 40% (60% reduction), 50 periods, criteria C	-	-
AC power inputs	Voltage interruptions < 5% (> 95% reduction), 250 periods, criteria C	-	Voltage interruptions < 5% (> 95% reduction), 250 half-oscillations, criteria C
AC power inputs	-	20 interruptions, 0.5 periods, criteria A	-

Table 74: Test requirements - Voltage dips, fluctuations, and short-term interruptions

Test carried out according to EN 61000-4-11	Limits according to EN 61000-6-2	Limits according to EN 61131-2	Limits according to EN 55024
DC power inputs	-	20 interruptions for 10 ms, < UN - 15%, criterion A	-

Table 74: Test requirements - Voltage dips, fluctuations, and short-term interruptions (Forts.)

4.8 Damped vibration

Test carried out according to EN 61000-4-12	Limits according to EN 61131-2		
Power I/O, L to L	±1 kV, 1 MHz, repeat rate 400/seconds, length 2 seconds, connection lengths 2 m, criteria B		
Power I/O, L to PE	±2.5 kV, 1 MHz, repeat rate 400/seconds, length 2 seconds, connection lengths 2 m, criteria B		

Table 75: Test requirements - Damped vibration

5. Mechanical conditions

Vibration	Test carried out according to	Limits according to
Vibration operation	EN 60068-2-6	EN 61131-2: Programmable logic controllers
Vibration during transport	EN 60068-2-6	EN 60721-3-2 class 2M1
		EN 60721-3-2 class 2M2
		EN 60721-3-2 class 2M3
Shock during operation	EN 60068-2-27	EN 61131-2: Programmable logic controllers
		EN 60721-3-3 class 3M4
Shock during transport (packaged)	EN 60068-2-27	EN 60721-3-2 class 2M1
		EN 60721-3-2 class 2M2
Toppling	EN 60068-2-31	EN 60721-3-2 class 2M1
		EN 60721-3-2 class 2M2
		EN 60721-3-2 class 2M3
Free fall (packaged)	EN 60068-2-32	EN 61131-2: Programmable logic controllers

Table 76: Overview of limits and testing guidelines for vibration

5.1 Vibration operation

Test carried out according to EN 60068-2-6	Limits according to EN 61131-2			
Vibration during operation: Uninterrupted duty with moveable frequency in all 3 axes (x, y, z), 1 octave per minute	10 sweeps for each axis			
	Frequency	**Limit value**		
	5 - 9 Hz	Amplitude 3 mm Periodic		
	9 - 150 Hz	Acceleration 1 g Periodic		

Table 77: Test requirements - Vibration during operation

5.2 Vibration during transport

Test carried out according to EN 60068-2-6	Limits according to EN 60721-3-2 class 2M1		Limits according to EN 60721-3-2 class 2M2		Limits according to EN 60721-3-2 class 2M3	
Vibration during transport: Uninterrupted duty with moveable frequency in all 3 axes (x, y, z)	10 sweeps for each axis, packaged		10 sweeps for each axis, packaged		10 sweeps for each axis, packaged	
	Frequency	**Limit value**	**Frequency**	**Limit value**	**Frequency**	**Limit value**
	2 - 9 Hz	Amplitude 3.5 mm	2 - 9 Hz	Amplitude 3.5 mm	2 - 8 Hz	Amplitude 7.5 mm
	9 - 200 Hz	Acceleration 1 g	9 - 200 Hz	Acceleration 1 g	8 - 200 Hz	Acceleration 2 g
	200 - 500 Hz	Acceleration 1.5 g	200 - 500 Hz	Acceleration 1.5 g	200 - 500 Hz	Acceleration 4 g

Table 78: Test requirements - Vibration during transport

5.3 Shock during operation

Test carried out according to EN 60068-2-27	Limits according to EN 61131-2	Limits according to EN 60721-3-3 class 3M4	
Shock during operation: Pulse (half-sine) stress in all 3 axes (x, y, z)	Acceleration 15 g, Length 11 ms, 18 shocks	Acceleration 15 g, Length 11 ms	

Table 79: Test requirements - Shock during operation

5.4 Shock during transport (packaged)

Test carried out according to EN 60068-2-27	Limits according to EN 60721-3-2 class 2M1	Limits according to EN 60721-3-2 class 2M2	
Pulse (half-sine) stress in all 3 axes (x, y, z)	Acceleration 10 g, Length 11 ms, each 3 shocks, packaged	Acceleration 30 g, Length 6 ms, each 3 shocks, packaged	

Table 80: Test requirements - Shock during transport

5.5 Toppling

Test carried out according to EN 60068-2-31	Limits according to EN 60721-3-2 class 2M1		Limits according to EN 60721-3-2 class 2M2		Limits according to EN 60721-3-2 class 2M3	
Drop and topple	Devices: Drop/topple on each edge		Devices: Drop/topple on each edge		Devices: Drop/topple on each edge	
	Weight	**Required**	**Weight**	**Required**	**Weight**	**Required**
	< 20 kg	Yes	< 20 kg	Yes	< 20 kg	Yes
	20 - 100 kg	-	20 - 100 kg	Yes	20 - 100 kg	Yes
	> 100 kg	-	> 100 kg	-	> 100 kg	Yes

Table 81: Test requirements - Toppling

5.6 Free fall (packaged)

Test carried out according to EN 60068-2-32	Limits according to EN 61131-2		Limits according to EN 60721-3-2 class 2M1		Limits according to EN 60721-3-2 class 2M2		Limits according to EN 60721-3-2 class 2M3	
Free fall	Devices with delivery packaging each with 5 fall tests		Devices packaged		Devices packaged		Devices packaged	
	Weight	**Height**	**Weight**	**Height**	**Weight**	**Height**	**Weight**	**Height**
	< 10 kg	1.0 m	< 20 kg	0.25 m	< 20 kg	1.2 m	< 20 kg	1.5 m
	10 - 40 kg	0.5 m	20 - 100 kg	0.25 m	20 - 100 kg	1.0 m	20 - 100 kg	1.2 m
	> 40 kg	0.25 m	> 100 kg	0.1 m	> 100 kg	0.25 m	> 100 kg	0.5 m
	Devices with product packaging each with 5 fall tests							
	Weight	**Height**						
	< 10 kg	0.3 m						
	10 - 40 kg	0.3 m						
	> 40 kg	0.25 m						

Table 82: Test requirements - Toppling

6. Climate conditions

Temperature / humidity	Test carried out according to	Limits according to
Worst case operation	UL 508	UL 508: Industrial control equipment EN 61131-2: Programmable logic controllers
Dry heat	EN 60068-2-2	EN 61131-2: Programmable logic controllers
Dry cold	EN 60068-2-1	EN 61131-2: Programmable logic controllers
Large temperature fluctuations	EN 60068-2-14	EN 61131-2: Programmable logic controllers
Temperature fluctuations in operation	EN 60068-2-14	EN 61131-2: Programmable logic controllers
Humid heat, cyclic	EN 60068-2-30	EN 61131-2: Programmable logic controllers
Humid heat, constant (storage)	EN 60068-2-3	EN 61131-2: Programmable logic controllers

Table 83: Overview of limits and testing guidelines for temperature and humidity

6.1 Worst case operation

Test carried out according to UL 508	Limits according to UL 508	Limits according to EN 61131-2	
Worst case during operation. Operation of the device with the max. ambient temperature specified in the data sheet at the max. specified load	Max. ambient temperature (min. +40°C) for 3 hours, length 5 hours	Max. ambient temperature (min. +40°C) for 3 hours, length 5 hours	

Table 84: Test requirements - Worst case during operation

6.2 Dry heat

Test carried out according to EN 60068-2-2	Limits according to EN 61131-2		
Dry heat	1 cycle +70°C for 16 hours, then 1 hour acclimatization and testing functions, length 17 hours		

Table 85: Test requirements - Dry heat

6.3 Dry cold

Test carried out according to EN 60068-2-1	Limits according to EN 61131-2		
Dry cold	1 cycle -40°C for 16 hours, then 1 hour acclimatization and testing functions, length 17 hours		

Table 86: Test requirements - Dry cold

6.4 Large temperature fluctuations

Test carried out according to EN 60068-2-14	Limits according to EN 61131-2		
Large temperature fluctuations	2 cycles -25°C / +70°C for each hour, then 2 hours acclimatization and testing of functions, length 14 hours		

Table 87: Test requirements - Large temperature fluctuations

6.5 Temperature fluctuations in operation

Test carried out according to EN 60068-2-14	Limits according to EN 61131-2		
Open devices: These can also have a housing and are installed in switching cabinets	5 cycles +5°C / +55°C for every 3 hours, temperature gradient 3°C / min, during the test, the device is occasionally supplied with voltage, length 30 hours		
Closed devices: These are devices whose data sheet specifies a surrounding housing (enclosure) with the corresponding safety precautions	5 cycles +5°C / +40°C for every 3 hours, temperature gradient 3°C / min, during the test, the device is occasionally supplied with voltage, length 30 hours		

Table 88: Test requirements - Temperature fluctuations in operation

6.6 Humid heat, cyclic

Test carried out according to EN 60068-2-30	Limits according to EN 61131-2		
Alternating climate	2 cycles +25°C / +55°C and 97% / 83% RH for every 24 hours, then 2 hours acclimatization as well as performing function and isolation tests, length 50 hours		

Table 89: Test requirements - Humid heat, cyclic

6.7 Humid heat, constant (storage)

Test carried out according to EN 60068-2-3	Limits according to EN 61131-2		
Humid heat, constant (storage)	+40°C and 92.5% RH for 48 hours, then within 3 hours isolation test, length 49 hours		

Table 90: Test requirements - Humid heat, constant (storage)

7. Further limit values

Safety	Test carried out according to	Limits according to
Ground resistance	EN 61131-2	EN 60204-1: Electrical equipment of machines
		EN 61131-2: Programmable logic controllers
Insulation resistance		EN 60204-1: Electrical equipment of machines
High voltage	EN 60060-1	EN 61131-2: Programmable logic controllers
		UL 508: Industrial control equipment
Residual voltage	EN 61131-2	EN 60204-1: Electrical equipment of machines
		EN 61131-2: Programmable logic controllers
Leakage current		VDE 0701-1: Service, changes and testing of electrical devices
Overload	UL 508	EN 61131-2: Programmable logic controllers
		UL 508: Industrial control equipment
Simulation component defect	UL 508	EN 61131-2: Programmable logic controllers
		UL 508: Industrial control equipment
Voltage range		EN 61131-2: Programmable logic controllers

Table 91: Further limit values

8. International certifications

B&R products and services comply with applicable standards. They are international standards from organizations such as ISO, IEC and CENELEC, as well as national standards from organizations such as UL, CSA, FCC, VDE, ÖVE, etc. We give special consideration to the reliability of our products in an industrial environment.

Certifications	
USA and Canada	All important B&R products are tested and listed by Underwriters Laboratories and checked quarterly by a UL inspector. This mark is valid for the USA and Canada and simplifies certification of your machines and systems in these areas.
Europe	All harmonized EN standards for the applicable guidelines are met.

Table 92: International certifications

8.1 Safety certification

The Mobile Panel 100/200 was certified in accordance with EN 954-1 and is not suited for use in E-stop equipment according to EN 418. The BG safety certificated is limited to the integrated enable switch.

The BG safety certificate expired in June 30, 2009 and was therefore removed from the manual.

Machine guideline 98/37/EG will expire on December 19, 2009 and will be replaced by the new machine guideline 2006/42/EG without transitional period. For information regarding the machine guideline 2006/42/EG, please refer to section 10 "Information regarding machine guideline 2006/42/EG" on page 216.

9. Standards and definitions for safety technology

9.1 Stop functions according to IEC 60204-1:2006 (electrical equipment for machines, Part 1: general requirements)

The following three stop function categories exist:

Category	Description
0	Stop by immediately switching off the power to the machine drive elements (i.e. uncontrolled stop).
1	A controlled stop, the power to the machine drive elements remains on until the stop procedure is completed. The power is switched off after the stop is complete.
2	A controlled stop, the power to the machine drive elements is not switched off.

Table 93: Overview of stop function categories

The necessary stop functions must be determined based on a risk evaluation for the machine. Stop functions in category 0 and category 1 must be able to function regardless of the operating mode. A category 0 stop must have priority. Stop functions must have priority over assigned start functions. Resetting the stop function must never result in a dangerous state.

9.2 Emergency stops according to IEC 60204-1:2006 (electrical equipment for machines, Part 1: general requirements)

The following requirements are valid for emergency stops in addition to the requirements for the stop functions:

- It must have priority over all other functions and operations in all operating modes.
- The power to the machine drive elements which can cause a dangerous state must be switched off as quickly as possible without creating other dangers.
- Resetting is not permitted to cause a restart.
- The stop function must not reduce the effectiveness of the safety equipment or of equipment with safety-related functions.
- The stop function must not interfere with equipment designed to free personnel from dangerous situations.

Emergency stops must be category 0 or category 1 stop functions. The stop function required must be determined based on a risk evaluation for the machine.

For emergency stop functions in stop category 0, only hard wired, electromechanical equipment can be used. Additionally, the function is not permitted to depend on electronic switching logic (hardware or software) or the transfer of commands via a communication network or data connection.[1)]

When using a category 1 stop function for the emergency stop function, it must be guaranteed that the power to the machine drive elements is completely switched off. These elements must be switched off using electromechanical equipment.[1)]

9.3 Safety category according to EN ISO 13849-1:2008 (safety of machines - safety related parts of control systems, Part 1: General design principles)

Safety function (according to EN 13849-1:2006)	Safety integrity level - SIL (according to IEC 61508-1)	Short description	System behavior
B	-	In accordance with the applicable standards, SRP/CS devices and/or their safety equipment and components must be designed, built, selected, assembled and combined so that they can meet the expected operational requirements. Fundamental safety principles must be applied.	**Caution!** **An error can cause the safety function to fail.**
1	1	The requirements of B must be fulfilled. Reliable components and proven safety principles must be used.	**Caution!** **Errors can result in the loss of safety functions, but the probability of their occurrence is less than in Category B.**
2	1	The requirements of B must be fulfilled, and proven safety principles must be used. Safety functions must be tested at appropriate intervals by the machine controller.	**Caution!** **An error between tests can cause the safety function to fail.** **If the safety function fails, it will be recognized during the test.**
3	2	The requirements of B must be fulfilled, and proven safety principles must be used. Safety related parts must be implemented so that: • a single error in each of the parts doesn't result in a loss of safety function, and • when possible within reason, the error is detected.	**Caution!** **The safety function remains active when a single error occurs.** **Some, but not all errors are detected.** **A buildup of errors can cause the safety function to fail.**

Table 94: Safety category overview

1) In accordance to the national foreword for the valid German version of IEC 60204-1/11.98, it is determined that electronic equipment (and especially emergency stop systems) can be used regardless of the stop category, if e.g. it provides the same safety using the standards EN 954-1 and/or IEC 61508 as required by IEC 60204-1.

Safety function (according to EN 13849-1:2006)	Safety integrity level - SIL (according to IEC 61508-1)	Short description	System behavior
4	3	The requirements of B must be fulfilled, and proven safety principles must be used. Safety related parts must be implemented so that: • a single error in each of the parts doesn't result in a loss of safety function, and • the single error must be detected the next time (or before) the safety function is required. If this type of detection is not possible, a buildup of errors must not cause the safety function to fail.	**Information:** **The safety function remains active when a single error occurs.** **Detection of error buildup reduces the probability of losing safety function (high DC).** **Errors are recognized in time to prevent the safety function from failing.**

Table 94: Safety category overview

The following risk graph (according to EN 13849-1:2006, Appendix A) provides a simplified procedure for risk evaluation:

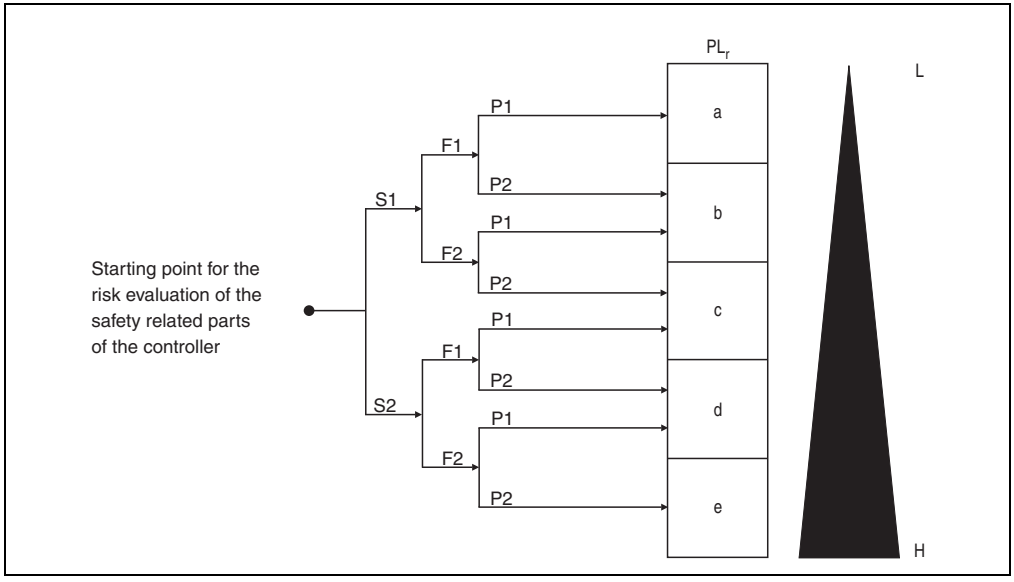


Figure 118: Risk diagram to determine the PL_r for every safety function

Parameter S ... Severity of injury	
S1	Light (usually reversible) injury.
S2	Serious (normally irreversible injury or death).
Parameter F ... Frequency and/or duration of the danger exposure	
F1	Seldom-to-less-often and/or exposure time is short.
F2	Frequent-to-continuous and/or exposure time is long.
Parameter P ... possibility to circumvent the danger or limit the damage	
P1	Possible under some conditions.
P2	Nearly impossible.
Miscellaneous	
L	Low impact on risk reduction.
H	High impact on risk reduction.
PL_r	Required performance level.

Table 95: Legend for risk graph

9.4 Safety category according to EN 954-1/03.97 (safety of machines - safety related parts of control systems, part 1: general design principles) [1)]

The safety related parts of control systems must meet one or more of the requirements for five defined safety categories. The safety categories define the required behavior of safety related controller parts regarding their resistance to errors.

Safety category (according to EN 954-1)	Safety integrity level - SIL (according to IEC 61508-2)	Short description	System behavior
B	-	Safety related parts must be designed and built so that they can meet the expected operational requirements. (No specific safety measures are implemented.)	**Caution!** **An error can cause the safety function to fail.**
1	1	Safety related parts must be designed and built so that only reliable components and safety principles are used. (e.g. prevention of short circuits by using sufficient distances, reducing the probability of errors caused by using oversized components, defining the failure route - bias current fail-safe, etc.)	**Caution!** **An error can cause the safety function to fail.**
2	1	Safety related parts must be designed so that their safety functions are checked in suitable intervals by the machine controller. (e.g. automatic or manual check during start-up)	**Caution!** **An error between checks can cause the safety function to fail. If the safety function fails, it will be recognized during the check.**

Table 96: Safety category overview

1) To prevent confusing EN 954-1 categories with IEC 60204-1 stop categories, the term "safety categories" was used in the text shown above for EN 954-1 categories.

Safety category (according to EN 954-1)	Safety integrity level - SIL (according to IEC 61508-2)	Short description	System behavior
3	2	Safety related parts must be designed so that individual errors do not cause the safety function to fail. Individual errors should - if possible - be recognized the next time (or before) the safety function is required.	**Caution!** **The safety function remains active when an error occurs. Some, but not all errors are recognized. A buildup of errors can cause the safety function to fail.**
4	3	Safety related parts must be designed so that individual errors do not cause the safety function to fail. Individual errors must be recognized the next time (or before) the safety function is required. If this type of recognition is not possible, a buildup of errors is not permitted to cause the safety function to fail.	**Information:** **The safety function remains active when an error occurs. Errors are recognized in time to prevent the safety function from failing.**

Table 96: Safety category overview

These considerations lead to a safety category (B, 1, 2, 3, 4) that specifies how the safety-related parts on a machine must be implemented.

Information:

Connection examples with a suitable monitoring device in chapter 3 "Commissioning", section "Connection examples - E-stop and key switch" on page 116 and section "Connection example - Enable switch" on page 121 show how safety category 4 according to EN 954-1 can be achieved with the Mobile Panel and its safety-related parts. Take note that the entire system concept must be designed accordingly.

The safety category must be selected based on a risk evaluation. This risk evaluation is a part of the total risk evaluation for the machine.

The following risk graph (according to EN 954-1, Appendix B) provides a simplified procedure for risk evaluation:

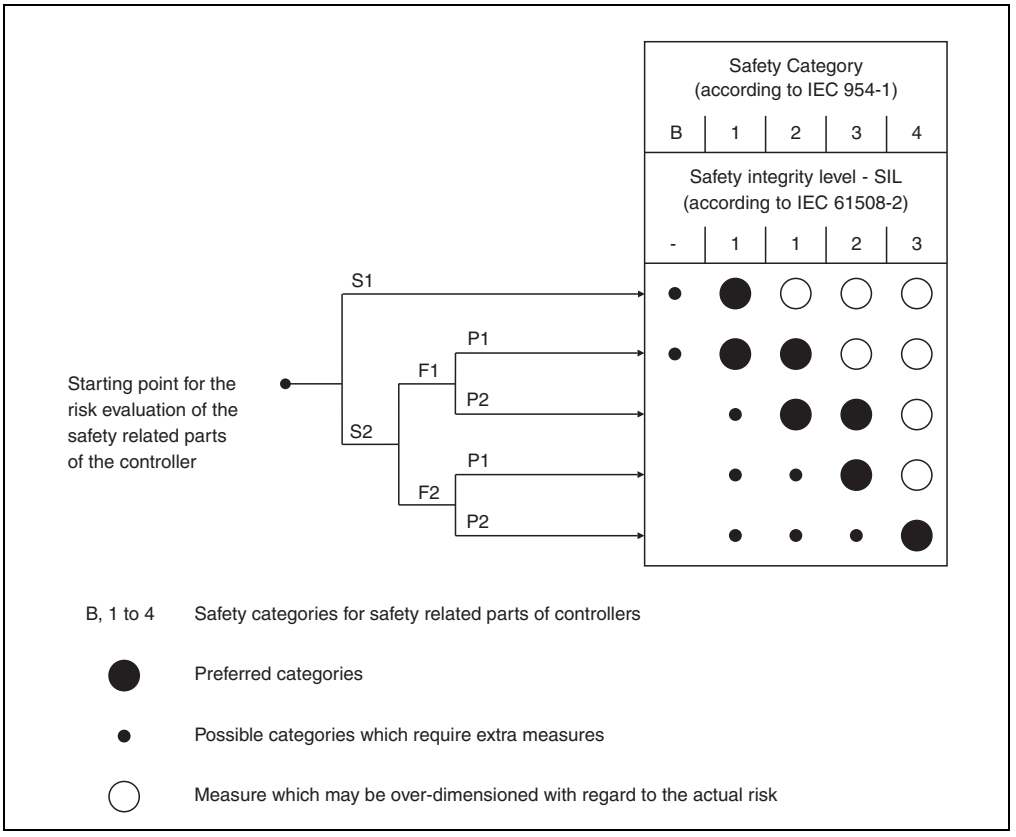


Figure 119: Risk graph according to EN 954-1, Appendix B

Begin at the starting point shown and follow the parameters S, F and P to the safety category to be used.

Parameter S ... Severity of injury	
S1	Light (usually reversible) injury.
S2	Serious (usually irreversible) injury.
Parameter F ... Frequency and/or duration of the danger exposure	
F1	Seldom to slightly more frequent and/or short exposure duration.
F2	Frequent to continuous and/or long exposure duration.
Parameter P ... Possibility to prevent danger	
P1	Possible under some conditions.
P2	Nearly impossible.

Table 97: Parameters S, F and P lead you to the safety category to be used

9.5 Restart inhibit according to EN 1037/04.96 (Safety of machinery - prevention of unexpected start-up)

Keeping a machine in an idle state when people are working in the danger zone is one of the most important requirements for safe operation of machines.

Starting refers to the transition of a machine or its parts from an idle state to moving state. Any start is unexpected if it is caused by:

- A start command sent because of a controller failure or because of external influences on the controller.
- A start command sent because of incorrect operation of a start element or another part of the machine.
- Restoration of power supply after an interruption.
- External/internal influences on parts of the machine.

To prevent unexpected starting of machines or parts of machines, power should be removed and dissipated. If this is not practical (e. g. frequent, short work in danger zone), other measures must be taken:

- Measures to prevent random start commands.
- Measures to prevent that random start commands cause unexpected starting.
- Measures to automatically stop dangerous parts of the machine before a dangerous situation can be caused by unexpected starting.

10. Information regarding machine guideline 2006/42/EG

The machine guideline 2006/42/EG is effective starting December 29, 2009 (without transitional period). This guideline requires that all machines and safety components commissioned after this date must comply with the new machine guideline and harmonized standards.

For B&R handheld operating devices, this means that in addition to the new guideline, the standard EN ISO 13849-1:2008 must also be specified in place of the old EN 954-1. EN ISO 13849-1 requires that the B_{10d} value be provided for the enable switch and red E-stop button safety components. These values are provided in the "Appendix A" Chapter in the sections 1 "E-stop button" on page 259 and 3 "Enable switch" on page 263.

10.1 Quantitative safety specifications for the E-stop button and release control device (enabling equipment)

B&R provides a B_{10d} value. B&R is not able to provide other values (e.g. SIL, PL, Category).

Reason: B&R only supplies the switching element, but no element evaluation. The customer is responsible for connecting the E-stop button and enabling equipment to their application. The manner in which the E-stop button and enabling equipment is implemented in the machine determines the SIL or Category with PL for the customer.

10.2 Relationship between Performance Level and Safety Integrity Level

When evaluating safety functions in accordance with IEC EN 62601, the values in PL can be implemented in SIL according to the EN ISO 13849-1 equivalence table.

Performance Level (PL) acc. to EN ISO 13849-1	Safety Integrity Level (SIL) acc. to IEC 61508-1
a	No equivalence
b	1
c	1
d	2
e	3

Table 98: (EN ISO 13849-1) - Relationship between the Performance Level (PL) and the Safety Integrity Level (SIL)

Performance Level (PL)	Probability of a dangerous failure per hour
a	$\geq 10^{-5}$ to $< 10^{-4}$
b	$\geq 3 \times 10^{-5}$ to $< 10^{-5}$
c	$\geq 10^{-5}$ to $< 3 \times 10^{-5}$
d	$\geq 10^{-7}$ to $< 10^{-5}$
e	$\geq 10^{-8}$ to $< 10^{-7}$

Table 99: (EN ISO 13849-1) - Performance Level (PL)

10.3 Abbreviations

Abbreviation	Term	Explanation
B_{10d}	-	Number of cycles before 10% of the components have experienced hazardous failure (per channel)
$MTTF_d$	Mean Time to Dangerous Failure	Average time before hazardous failure occurs (per channel)
DC	Diagnostic Coverage	Degree to which diagnostic coverage is provided
PL	Performance Level	Ability of safety-related parts to perform a safety function and meet the expected level of risk reduction under foreseeable conditions
PFH	Probability of Failure per Hour	Probability of a failure per hour
SIL	Safety Integrity Level	Level of safety integrity provided

Table 100: Abbreviations

Chapter 6 • Accessories

1. Overview

Model number	Product ID	Note
0AC201.91	**Lithium batteries, 4 pcs**. Lithium batteries, 4 pcs., 3 V / 950 mAh, button cell	
4A0006.00-000	**Lithium battery (1x)** Lithium battery, 1 pc., 3 V / 950 mAh, button cell	
5AC900.1100-00	**Touch screen pen** Five replacement touch screen pens	
5CFCRD.0064-03	**CompactFlash 64 MB SSI** CompactFlash card with 64 MB SLC NAND flash and IDE/ATA interface	
5CFCRD.0128-03	**CompactFlash 128 MB SSI** CompactFlash card with 128 MB SLC NAND flash and IDE/ATA interface	
5CFCRD.0256-03	**CompactFlash 256 MB SSI** CompactFlash card with 256 MB SLC NAND flash and IDE/ATA interface	
5CFCRD.0512-03	**CompactFlash 512 MB SSI** CompactFlash card with 512 MB SLC NAND flash and IDE/ATA interface	
5CFCRD.1024-03	**CompactFlash 1024 MB SSI** CompactFlash card with 1024 MB SLC NAND flash and IDE/ATA interface	
5CFCRD.2048-03	**CompactFlash 2048 MB SSI** CompactFlash card with 2048 MB SLC NAND flash and IDE/ATA interface	
5CFCRD.4096-03	**CompactFlash 4096 MB SSI** CompactFlash card with 4096 MB SLC NAND flash and IDE/ATA interface	
5CFCRD.8192-03	**CompactFlash 8192 MB SSI** CompactFlash card with 8192 MB SLC NAND flash and IDE/ATA interface	
5CFCRD.0032-02	**CompactFlash 32 MB SanDisk/A** CompactFlash card with 32 MB flash PROM and IDE/ATA interface	*Cancelled since 12/2005*
5CFCRD.0064-02	**CompactFlash 64 MB SanDisk/A** CompactFlash card with 64 MB flash PROM and IDE/ATA interface	*Cancelled since 12/2005*
5CFCRD.0128-02	**CompactFlash 128 MB SanDisk/A** CompactFlash card with 128 MB flash PROM and IDE/ATA interface	*Cancelled since 12/2005*
5CFCRD.0256-02	**CompactFlash 256 MB SanDisk/A** CompactFlash card with 256 MB flash PROM and IDE/ATA interface	*Cancelled since 12/2005*
5CFCRD.0512-02	**CompactFlash 512 MB SanDisk/A** CompactFlash card with 512 MB flash PROM and IDE/ATA interface	*Cancelled since 12/2005*
5CFCRD.1024-02	**CompactFlash 1024 MB SanDisk/A** CompactFlash card with 1024 MB flash PROM and IDE/ATA interface	*Cancelled since 12/2005*
5CFCRD.2048-02	**CompactFlash 2048 MB SanDisk/A** CompactFlash card with 2048 MB flash PROM and IDE/ATA interface	*Cancelled since 12/2005*

Table 101: Model numbers - Accessories

Model number	Product ID	Note
5MMUSB.0256-00	**USB flash drive 256 MB SanDisk** USB 2.0 flash drive 256 MB	*Canceled since 03/2007 - Replaced by 5MMUSB.2048-00*
5MMUSB.0512-00	**USB flash drive 512 MB SanDisk** USB 2.0 flash drive 512 MB	*Canceled since 07/2007 - Replaced by 5MMUSB.2048-00*
5MMUSB.1024-00	**USB flash drive 1 GB SanDisk** USB 2.0 flash drive 1 GB	*Canceled since 03/2007 - Replaced by 5MMUSB.2048-00*
5MMUSB.2048-00	**USB flash drive 2 GB SanDisk** USB 2.0 flash drive 2 GB	
5CAMPP.0000-00	**Protective cap for add-on socket (attachment cable)** Protection for attachment cable during transport	
5CAMPP.0000-10	**Protective cap for circular plug (attachment cable)** Protection for attachment cable during transport	
5CAMPP.0001-10	**Protective cap for receptacle (switching cabinet cable)** Protection for switching cabinet cable during transport	
4MPCBX.0000-00	**MP connection box PP** Connection box for adapting the connection points for Mobile Panel devices.	
4MPCBX.0001-00	**MP connection box, small PP** Connection box for adapting the connection points for Mobile Panel devices.	
5CAMPB.0100-10	**MP box cable, 10m PP** Box cable, 10 meters long; with wire tip sleeves for connection in the switching cabinet; with plug contacts for wiring in the connection box.	

Table 101: Model numbers - Accessories

2. Replacement CMOS batteries

The lithium battery is needed for buffering the BIOS CMOS data, the real-time clock, and SRAM data.

The battery is subject to wear and must be replaced when the battery power ("Bad" status) is insufficient.

2.1 Order data

Model number	Description	Figure
0AC201.91	Lithium batteries, 4 pcs., 3 V / 950 mAh button cell	
4A0006.00-000	Lithium battery, 1 pc., 3 V / 950 mAh, button cell	

Table 102: Order data - Lithium batteries

2.2 Technical data

Information:

The following characteristics, features and limit values only apply to this accessory and can deviate those specified for the entire device. For the entire device where this accessory is installed, refer to the data provided specifically for the entire device.

Name	0AC201.91, 4A0006.00-000
Capacity	950 mAh
Voltage	3 V
Self discharge at 23°C	< 1% per year
Storage time	Max. 3 years at 30° C
Storage temperature	-20 to +60°C
Relative humidity	0 to 95% (non-condensing)

Table 103: Technical data - Lithium batteries

3. Touch screen pen

A replacement part is available consisting of 5 touch screen pens for the operation of the Mobile Panel touch screen. See section "Touch screen pen" on page 44 for technical data regarding touch screen pens.

3.1 Order data

Model number	Description	Figure
5AC900.1100-00	**Touch screen pen (5x)**	

Table 104: Order data - Touch screen pen

4. CompactFlash cards 5CFCRD.xxxx-03

4.1 General information

Information:

Silicon Systems CompactFlash cards 5CFCRD.xxxx-03 and CompactFlash cards from a different manufacturer cannot be used in the same system at the same time. Due to differences in technology (older vs. newer technologies), problems can occur during system startup that are caused by the different boot times.

Information:

On Windows CE 5.0 devices, 5CFCRD.xxxx-03 CompactFlash cards up to 1GB are supported.

4.2 - Order data

Model number	Description	Figure
5CFCRD.0064-03	CompactFlash 64 MB SSI	CompactFlash card
5CFCRD.0128-03	CompactFlash 128 MB SSI	
5CFCRD.0256-03	CompactFlash 256 MB SSI	
5CFCRD.0512-03	CompactFlash 512 MB SSI	
5CFCRD.1024-03	CompactFlash 1024 MB SSI	
5CFCRD.2048-03	CompactFlash 2048 MB SSI	
5CFCRD.4096-03	CompactFlash 4096 MB SSI	
5CFCRD.8192-03	CompactFlash 8192 MB SSI	

Table 105: Order data - CompactFlash cards

4.3 Technical data

Caution!

A sudden loss of power can cause data to be lost! In very rare cases, the mass memory may also become damaged.

To prevent damage and loss of data, B&R recommends that you use a UPS device.

Information:

The following characteristics, features and limit values only apply to this accessory and can deviate those specified for the entire device. For the entire device where this accessory is installed, refer to the data provided specifically for the entire device.

Features	5CFCRD. 0064-03	5CFCRD. 0128-03	5CFCRD. 0256-03	5CFCRD. 0512-03	5CFCRD. 1024-03	5CFCRD. 2048-03	5CFCRD. 4096-03	5CFCRD. 8192-03
MTBF (at 25°C)	> 4,000,000 hours							
Maintenance	None							
Data reliability	< 1 unrecoverable error in 10^{14} bit read accesses							
Data retention	10 years							
Lifetime monitoring	Yes							
Supported operating modes	PIO Mode 0-4, Multiword DMA Mode 0-2							
Continuous reading	Typically 8 MB/s							
Continuous writing	Typically 6 MB/s							
Endurance								
Clear/write cycles Typical	> 2,000,000							
SLC flash	Yes							
Wear leveling	Static							
Error Correction Coding (ECC)	Yes							
Support								
Hardware	MP100/200, PP100/200, PP300/400, PPC300, PPC700, PPC800 Provit 2000, Provit 5000, APC620, APC680, APC810, APC820							
Windows XP Professional	-	-	-	-	-	-	Yes	Yes
Windows XP Embedded	-	-	-	Yes	Yes	Yes	Yes	Yes
Windows CE 6.0	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Windows CE 5.0	Yes	Yes	Yes	Yes	Yes	-	-	-

Table 106: Technical data - CompactFlash cards 5CFCRD.xxxx-03

Support	5CFCRD. 0064-03	5CFCRD. 0128-03	5CFCRD. 0256-03	5CFCRD. 0512-03	5CFCRD. 1024-03	5CFCRD. 2048-03	5CFCRD. 4096-03	5CFCRD. 8192-03
PVI Transfer Tool	≥ V2.57 (part of PVI Development Setup ≥ V2.5.3.3005)							
B&R Embedded OS Installer	≥ V2.21							
Mechanical characteristics								
Dimensions Length Width Thickness	36.4 ±0.15 mm 42.8 ±0.10 mm 3.3 ±0.10 mm							
Weight	11.4 g							
Environmental characteristics								
Ambient temperature Operation Bearings Transport	0 to +70°C -50 to +100°C -50 to +100°C							
Relative humidity Operation / Storage / Transport	8 to 95%, non-condensing							
Vibration Operation Storage / Transport	max. 16.3 g (159 m/s^2 0-peak) max. 30 g (294 m/s^2 0-peak)							
Shock Operation Storage / Transport	max. 1000 g (9810 m/s^2 0-peak) max. 3000 g (29430 m/s^2 0-peak)							
Altitude	Maximum 80,000 feet (24,383 meters)							

Table 106: Technical data - CompactFlash cards 5CFCRD.xxxx-03 (Forts.)

4.3.1 Temperature humidity diagram - Operation and storage

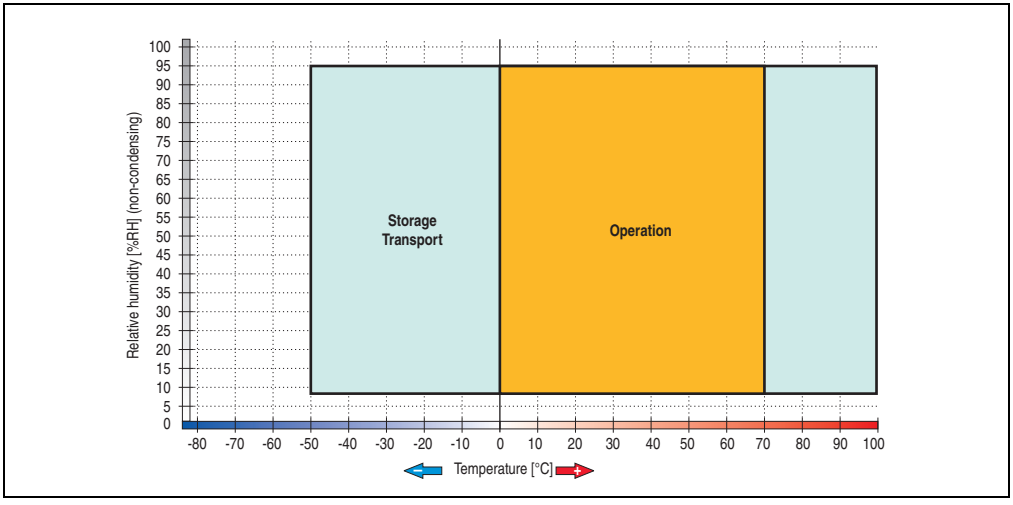


Figure 120: Temperature humidity diagram - CompactFlash cards 5CFCRD.xxxx-03

4.4 Dimensions

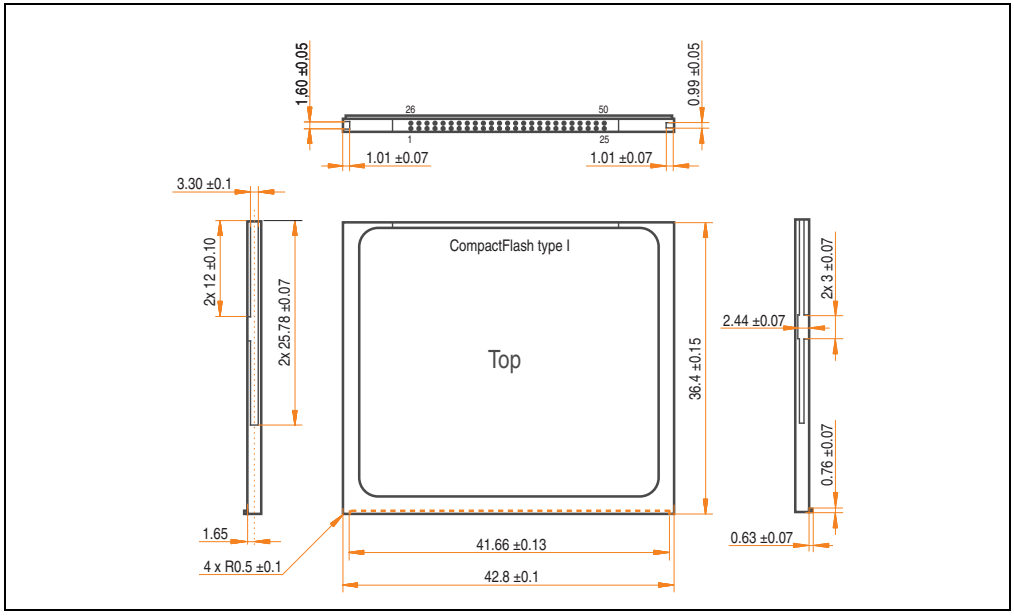


Figure 121: Dimensions - CompactFlash card Type I

5. CompactFlash cards 5CFCRD.xxxx-02

5.1 General information

CompactFlash cards are easy-to-exchange storage media. Due to their robustness against environmental influences (e.g. temperature, shock, vibration, etc.), CompactFlash cards are ideal for use as storage media in industrial environments.

5.2 - Order data

Model number	Description	Figure
5CFCRD.0032-02	CompactFlash 32 MB SanDisk/A	
5CFCRD.0064-02	CompactFlash 64 MB SanDisk/A	
5CFCRD.0128-02	CompactFlash 128 MB SanDisk/A	
5CFCRD.0256-02	CompactFlash 256 MB SanDisk/A	
5CFCRD.0512-02	CompactFlash 512 MB SanDisk/A	
5CFCRD.1024-02	CompactFlash 1024 MB SanDisk/A	
5CFCRD.2048-02	CompactFlash 2048 MB SanDisk/A	

Table 107: Order data - CompactFlash cards

5.3 Technical data

Information:

The following characteristics, features and limit values only apply to this accessory and can deviate those specified for the entire device. For the entire device where this accessory is installed, refer to the data provided specifically for the entire device.

Features	5CFCRD.xxxx-02
MTBF (@ 25°C)	> 3,000,000 hours
Maintenance	None
Data reliability	< 1 unrecoverable error in 10^{14} bit read accesses < 1 faulty correction in 10^{20} bit read accesses
Mechanical characteristics	
Write/erase procedures	> 2,000,000 times

Table 108: Technical data - CompactFlash cards 5CFCRD.xxxx-02

Mechanical characteristics	5CFCRD.xxxx-02
Dimensions Length Width Thickness	 36.4 ±0.15 mm 42.8 ±0.10 mm 3.3 mm ± 0.10 mm
Weight	11.4 g
Environmental characteristics	
Ambient temperature Operation Bearings Transport	 0 to +70°C -25 to +85°C -25 to +85°C
Relative humidity Operation / Storage	 8 to 95%, non-condensing
Vibration Operation / Storage	 Maximum 30 g (point to point)
Shock Operation / Storage	 Maximum 3,000 g
Altitude	24000 meters

Table 108: Technical data - CompactFlash cards 5CFCRD.xxxx-02 (Forts.)

5.4 Contents of delivery

Amount	Component
1	CompactFlash card in desired size

Table 109: Contents of delivery - CompactFlash cards 5CFCRD.xxxx-02

5.5 Dimensions

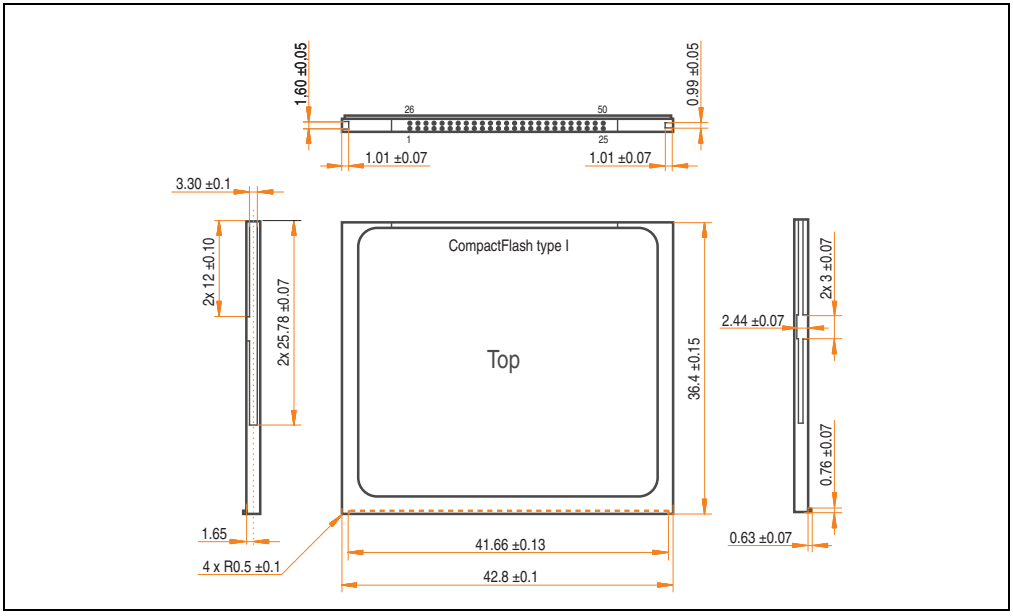


Figure 122: Dimensions - CompactFlash card Type I

5.6 Calculating the lifespan

SanDisk provides a 6-page "white paper" for the lifespan calculation of CompactFlash cards (see following pages). This document can also be found on the SanDisk homepage.

SanDisk

WHITE PAPER

SANDISK FLASH MEMORY CARDS

WEAR LEVELING

October 2003

140 Caspian Court • Sunnyvale, California 94089 • Phone: 408-542-0500 • Fax: 408-542-0503

Figure 123: SanDisk white paper - page 1 of 6

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Lit. No. 80-36-00278 10/03 Printed in U.S.A.

Figure 124: SanDisk white paper - page 2 of 6

OVERVIEW

This purpose of this white paper is to help SanDisk customers understand the benefits of wear leveling and to assist customers in calculating life expectancy of SanDisk cards in specific applications.

Flash memory is susceptible to wear as a result of the repeated program and erase cycles that are inherent in typical data storage applications. Applications in which this is a major concern include hard disk replacement applications where write operations occur frequently. How a storage system manages the wear of the memory is key to understanding the extended reliability of the host that relies on these storage systems.

WEAR LEVELING METHODOLOGY

Current products available in the industrial channel use NAND flash memory. It is important to understand the NAND memory architecture to gain insight into the wear leveling mechanism.

Each memory chip is divided into blocks. A block is an array of memory cells organized as sectors. The number of blocks and sectors vary from product to product. The minimum unit for a write or read operation is a page (or sector). The minimum unit for an erase operation is a block. Physical blocks are logically grouped into zones. For the current technology, a typical zone size is 4 MB. However, this may change from product to product. Wear leveling is done within a zone. The current firmware does not spread the wear across the capacity of the card. Each zone has about 3% additional “spare blocks” beyond what is assigned to meet the logical capacity of the flash card. This group of blocks is commonly referred to as the “Erase Pool”.

With the introduction of SanDisk’s Write-before-Erase architecture, each time a host writes data to the same logical address (CHS or LBA), data is written into a newly assigned, empty physical block from the “Erase Pool”. The intrinsic nature of writing to a new physical location each time a logical address is written to is the basis for wear leveling found in SanDisk cards. This action spreads the writes over the zone, thus greatly extending the overall life of the card. The methodology of using a large number of physical addresses to manage a smaller logical address table allows for rotation of the physical addresses among the entire group of physical blocks within a zone. The resulting wear leveling optimizes the effective life of the media and avoids prematurely reaching the end of life on frequently written to host addresses.

When a card detects that a block has reached the end of its useful life, it removes that block from the blocks that are available for write operations. The result is a reduction of the size of the erase pool. This does not affect the capacity of the card as seen by the host. When the pool of blocks available for write operations has been exhausted due to wear, the card will reach the end of its useful life for write operations.

Figure 125: SanDisk white paper - page 3 of 6

Current SanDisk products do not preempt wear leveling events during normal operation of the card. Applications typically don't require such management beyond the natural wear leveling that occurs during normal host operations. As a result, the effectiveness of wear leveling in current SanDisk products is dependent upon host usage. It is important for customers whose applications do not fall into this typical usage pattern to understand how their applications will affect the lifetime of the card.

LIFE EXPECTANCY SCENARIOS

►best case analysis

In a typical application, large data files are written to the card occupying contiguous sequential logical address space. This results in optimal wear leveling and provides card life exceeding the specification for card endurance. This increased endurance is achieved as follows: The 2,000,000 endurance cycles specification (I-Grade only) is a result of large amounts of test data collected from a very large sample set that accounts for the extreme limits of the test population. With the 3% additional erase pool being used in an ideal fashion, the distribution is narrowed and the card will survive beyond its specified lifetime.

►worst case analysis

In the worst-case application, data will be written as single sectors to random addresses across the card. These single sector writes will exercise the erase pool more rapidly, requiring the system to perform a "garbage collection" operation to free up new blocks for subsequent write operations. At the extreme, each single sector write would cause one block to be programmed and erased. As a typical block size is 16kB or 32 sectors, the amount of wear is increased by a factor of 31 since 32 physical sectors are written and erased for each sector the host writes. Spreading this wear across the erase pool results in an effective 1/30 usable lifetime. This case is an extreme example and is only included to show the range of application dependence. This result is comparable to other vendor's cards based on memory with a 16kB erase block.

►analysis of host dependence

In assessing the life expectancy of a card in a given system several factors need to be understood. These factors include the types of files and their corresponding sizes, frequency of card write operations and file system behavior (including data structures). The types of files must be considered since some files, such as operating systems or executable files, typically remain in fixed locations once they are stored in the card. This limits the number of physical blocks available for circulation into the erase pool. The remaining capacity after these files have been accounted for can then be divided by the typical size of files that will be updated over the lifetime of the card. Related to this calculation is how the file system overwrites existing files. Typical operating system behavior, such as DOS, will allocate new blocks from the file allocation table, or FAT, and so repeated file writes will occupy a new set of addresses on the card. This is very beneficial in spreading wear across the card since it forces the card to cycle the entire physical

Figure 126: SanDisk white paper - page 4 of 6

area being used for such files. Special cases to consider include those where the files being updated are very small. Typically an operating system uses a minimum number of sectors to store a file, referred to as a cluster. Typical cluster sizes range from 8 to 64 sectors in size. The cluster size is important for files that are the same or smaller than the 32-sector block since these may trigger garbage collection operations. If these updates happen in a random fashion (sequential updates would not be affected by cluster size) lifetime may be reduced as a result. Finally, the frequency of such updates is then used to determine how long it will take before the card reaches its statistical limit for endurance. These factors can be combined in an equation that can be used to calculate the minimum time a card will function in that application:

$$lifetime = 2{,}000{,}000 \times \frac{\left(C_{tzone} - C_{fixed}\right) \times \left(1 - k_r \times \frac{32 - N_{cluster}}{32}\right)}{FS_{typ}} \times \frac{1}{f_w}$$

where Czone is the total capacity of the zone, Cfixed is the capacity used by fixed files, Ncluster is the cluster size, FStyp is the average file size and fw is the average frequency at which files are updated. kr is a factor that is 0 for file sizes that are typically over 16kB or for applications that are not random in the order in which such files are updated.

Example 1

In this example 128 KB of data is updated once a day. The zone has 500 KB worth of fixed files. A 4 MB zone size is assumed.

$$lifetime = 2{,}000{,}000 \times \frac{(4000 - 500) \times (1 - 0)}{128} \times \frac{1}{1/day}$$

$$lifetime = 149828\, years$$

Example 2

This example is a data logging operation using a 1GB card where a 4kB file is updated every five seconds. This would result in sequential address being written.

$$lifetime = 2{,}000{,}000 \times \frac{4000}{4} \times \frac{1}{1/5\,\mathrm{sec}}$$

$$lifetime = 317\, years$$

Figure 127: SanDisk white paper - page 5 of 6

Example 3

This example is a data logging operation using the same 1GB card where a new 4kB file is written every five seconds. But in this case the cluster size is 4kB and it is expected that, due to file system fragmentation, the logical addresses will be written randomly.

$$lifetime = 2{,}000{,}000 \times \frac{4 \times \left(1 - 1 \times \frac{32-8}{32}\right)}{.004} \times \frac{1}{1/5\,\text{sec}}$$

$$lifetime = 79.3\,years$$

CONCLUSION

These examples are general in nature but show how the equation can be used as a guideline for calculating card lifetime in different applications. They also demonstrate that SanDisk card architecture exceeds reasonable life expectancy in typical applications. If a particular applications behaves in such a way that this equation cannot be applied, the SanDisk Applications Engineering group can assist in performing card lifetime analysis.

For more information, please visit the SanDisk Web site at: www.sandisk.com

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Figure 128: SanDisk white paper - page 6 of 6

6. USB flash drive

Information:

We reserve the right to supply alternative products due to the vast quantity of flash drives available on the market and their corresponding short product lifecycle. As a result, the following measures may be necessary (e.g. using the SanDisk Cruzer Micro flash drive with 512 MB) to take the following measures in order to boot from these flash drives:

- **The flash drive must be reformatted or in some cases even re-partitioned (set active partition).**
- **The flash drive must be at the top of the BIOS boot order, or alternatively the IDE controllers can also be deactivated in the BIOS. This can be avoided in most cases if a "`fdisk /mbr`" command is also executed on the USB flash drive.**

6.1 General information

USB flash drives are easy-to-exchange storage media. Because of the fast data transfer (USB 2.0), the USB flash drives are ideal for use as a portable memory medium. Without requiring additional drivers ("Hot Plug & Play" - except with Windows 98SE), the USB flash drive can be converted immediately into an additional drive where data can be read or written. Only USB flash drives from the memory specialists SanDisk are used.

6.2 - Order data

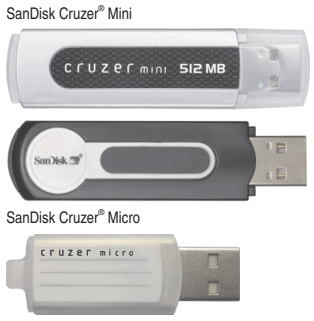
Model number	Description	Figure
5MMUSB.0256-00	USB flash drive 256 MB SanDisk Cruzer Mini	
5MMUSB.0512-00	USB flash drive 512 MB SanDisk Cruzer Mini up to Rev. E0 or Cruzer Micro starting with Rev. E0	
5MMUSB.1024-00	USB flash drive 1 GB SanDisk Cruzer Mini up to Rev. C0 or Cruzer Micro starting with Rev. C0	
5MMUSB.2048-00	USB flash drive 2 GB SanDisk Cruzer Micro	

Table 110: Order data - USB flash drives

6.3 Technical data

Information:

The following characteristics, features and limit values only apply to this accessory and can deviate those specified for the entire device. For the entire device where this accessory is installed, refer to the data provided specifically for the entire device.

Features	5MMUSB.0256-00	5MMUSB.0512-00	5MMUSB.1024-00	5MMUSB.2048-00
LED Cruzer Mini / Cruzer Micro	1 LED (green), signals data transfer (send and receive)			
Power supply Current requirements Cruzer Mini / Cruzer Micro	Via the USB port 650 µA sleep mode, 150 mA read/write			
Interface Cruzer Mini / Cruzer Micro Type Transfer rate Sequential reading Sequential writing Connection	USB specification 2.0 high speed device, mass storage class, USB-IF and WHQL certified USB 1.1 and 2.0 compatible Up to 480 MBit (high speed) Max. 8.7 MB/second Max. 1.7 MB/second To each USB type A interface			
MTBF (at 25°C) Cruzer Mini / Cruzer Micro	100,000 hours			
Data retention Cruzer Mini / Cruzer Micro	10 years			
Maintenance Cruzer Mini / Cruzer Micro	None			
Operating system support Cruzer Mini Cruzer Micro	Windows CE 4.1, CE 4.2, 98SE[1)] , ME, 2000, XP, Mac OS 9.1.x and Mac OS X 10.1.2 Windows CE 4.2, CE 5.0, ME, 2000, XP and Mac OS 9.1.x+, OS X v10.1.2+			
Mechanical characteristics				
Dimensions Height - Cruzer Mini / Cruzer Micro Width - Cruzer Mini / Cruzer Micro Depth - Cruzer Mini / Cruzer Micro	62 mm / 52.2 mm 19 mm / 19 mm 11 mm / 7.9 mm			
Environmental characteristics				
Environmental temperature Cruzer Mini / Cruzer Micro Operation Bearings Transport	0 to +45°C -20 to +60°C -20 to +60°C			
Humidity Cruzer Mini / Cruzer Micro Operation Bearings Transport	10 to 90%, non-condensing 5 to 90%, non-condensing 5 to 90%, non-condensing			

Table 111: Technical data - USB flash drive 5MMUSB.xxxx-00

Features	5MMUSB.0256-00	5MMUSB.0512-00	5MMUSB.1024-00	5MMUSB.2048-00
Vibration Cruzer Mini / Cruzer Micro Operation Bearings Transport	At 10 - 500 Hz: 2 g (19.6 m/s^2 0 peak), oscillation rate 1/minute At 10 - 500 Hz: 4 g (39.2 m/s^2 0 peak), oscillation rate 1/minute At 10 - 500 Hz: 4 g (39.2 m/s^2 0 peak), oscillation rate 1/minute			
Shock Cruzer Mini / Cruzer Micro Operation Bearings Transport	Max. 40 g (392 m/s^2 0-peak) and 11 ms length Max. 80 g (784 m/s^2 0-peak) and 11 ms length Max. 80 g (784 m/s^2 0-peak) and 11 ms length			
Altitude Cruzer Mini / Cruzer Micro Operation Bearings Transport	3048 meters 12192 meters 12192 meters			

Table 111: Technical data - USB flash drive 5MMUSB.xxxx-00 (Forts.)

1) For Win 98SE, a driver can be downloaded from the SanDisk homepage.

6.3.1 Temperature humidity diagram - Operation and storage

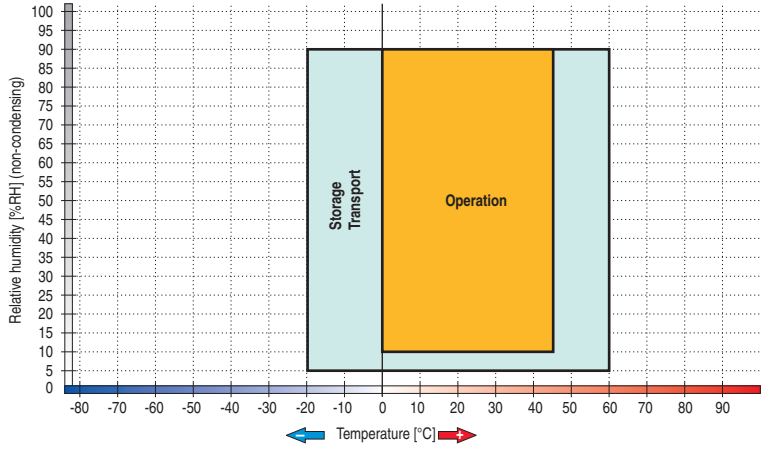


Figure 129: Temperature humidity diagram - USB flash drive - 5MMUSB.xxxx-00

Temperature data is for operation at 500 meters. Derating the max. ambient temperature - typically 1°C per 1000 meters (from 500 meters above sea level).

6.4 Creating a bootable USB flash drive

When used in connection with a B&R industrial PC, it is possible to boot the system from one of the flash drives available from B&R. The flash drive must be specially prepared for this.

6.4.1 Requirements

The following peripherals are required for creating a bootable USB flash drive:

- B&R USB flash drive
- B&R Industrial PC
- USB floppy drive (external)
- USB keyboard
- A start disk created using MS-DOS 6.22 or Windows 98 - 1.44MB HDD (Windows Millennium, NT4.0, 2000, XP start disks cannot be used).
  The tools "`format.com`" and "`fdisk.exe`" must be located on the diskette!

6.4.2 Procedure

- Plug in the flash drive and boot from the start disk.
- Set active partition on the flash drive using "`fdisk`" and follow the further instructions.
- Reboot the system from the start disk.
- Format and simultaneously transfer the system files to the flash drive with the command "`format c: /s`".

7. Protective caps

The protective caps protect all Mobile Panel attachment cables and switching cabinet cables during transport. Each cap is secured to the cable with a strap so it cannot be lost. The protective cap ensures IP65 protection.

Model number	Description	Use
5CAMPP.0000-00	**Protective cap for add-on socket (attachment cable)** Protection for attachment cable and switching cabinet cable	"Attachment cable 5CAMPH.0xxx-00" on page 81 "Switching cabinet cable (crossover) 5CAMPC.0020-00" on page 89 "Switching cabinet cable (straight thru) 5CAMPC.0020-01" on page 94
5CAMPP.0000-10	**Protective cap for circular plug (attachment cable)** Protection for attachment cable during transport	"Attachment cable 5CAMPH.0xxx-10" on page 85
5CAMPP.0001-10	**Protective cap for receptacle (switching cabinet cable)** Protection for switching cabinet cable during transport	"Switching cabinet cable (crossover) 5CAMPC.0020-10" on page 99 "Switching cabinet cable (straight thru) 5CAMPC.0020-11" on page 103

Table 112: Order data - Protective caps

7.1 Attachment cable protective cap 5CAMPH.0xxx-00

Figure 130: Attachment cable protective cap 5CAMPP.0000-00

7.2 Attachment cable protective cap 5CAMPP.0000-10

Figure 131: Attachment cable protective cap 5CAMPP.0000-10

7.2.1 Installation

- Feed the circular plug through the loop.

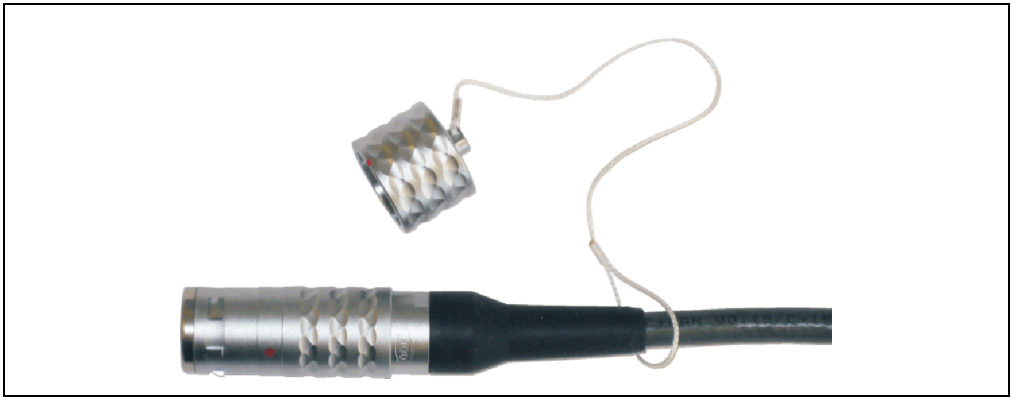


Figure 132: Attaching the protective cap - feed plug through loop

- Pull the loop tight with a pair of pliers and put the cap on the end of the circular plug (the red dot indicates how the cap must go on).

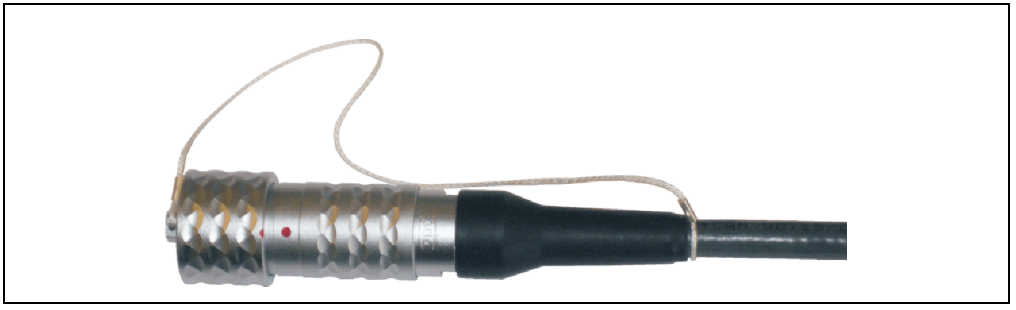


Figure 133: Attaching the protective cap - pull tight

7.3 Switching cabinet cable protective cap 5CAMPP.0001-10

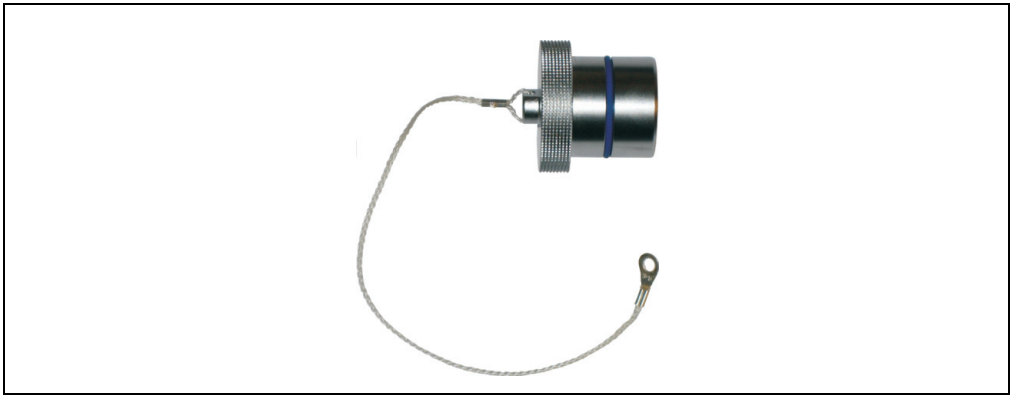


Figure 134: Switching cabinet cable protective cap 5CAMPP.0001-10

7.3.1 Installation

Attaching the switching cabinet cable protective cap (e.g. to the connection box)

- Fasten the protective cap with a size 10 Torx screw.
- Insert the cap into the socket.

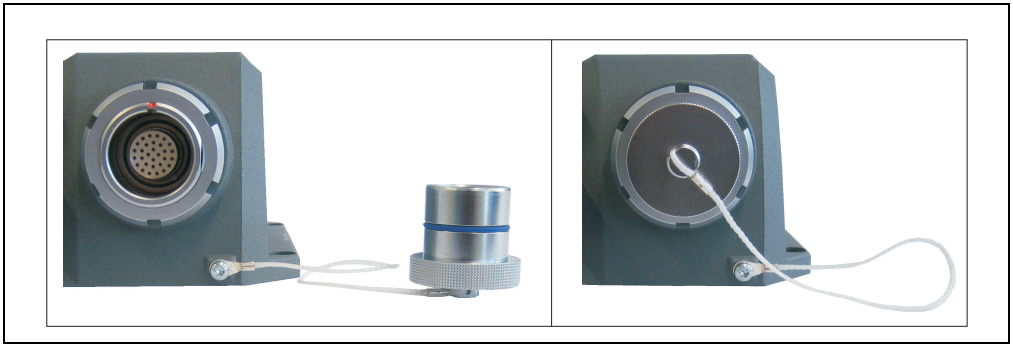


Figure 135: Attaching the switching cabinet cable protective cap

8. Connection box

8.1 MP connection box 4MPCBX.0000-00

Information:

For more detailed information about the connection box, see the Mobile Panel Connection Box User's Manual. This can be downloaded from the B&R homepage (www.br-automation.com).

The connection box 4MPCBX.0000-00 enables a configuration where the Mobile Panel can be operated at various connection points while remaining integrated in the E-stop circuit.

The E-stop circuit remains closed, regardless of whether the Mobile Panel is connected or not. If the Mobile Panel is disconnected during operation, the E-stop circuit in the connection box is automatically closed, and no E-stop is triggered.

Figure 136: Connection box 4MPCBX.0000-00

8.1.1 Features

- Plug and unplug during operation
- Mounting compatible
- Circular plug with push-pull locking
- Integrated E-stop
- Hot-plug button

- IP65 protection
- Safety category 3 PL d according to EN ISO 13849-1:2008

8.2 Connection box, small 4MPCBX.0001-00

Information:

For more detailed information about the connection box, see the Mobile Panel Connection Box User's Manual. This can be downloaded from the B&R homepage (www.br-automation.com).

The connection box 4MPCBX.0001-00 enables simple vertical outlet of the switching cabinet cable, but does not feature an E-stop "Hot Plug" function.

Figure 137: Connection box 4MPCBX.0001-00

8.2.1 Features

- Enables simple vertical connection of the Mobile Panel connection cable to the switching cabinet
- IP65 protection
- Compact dimensions
- Robust

8.3 Box cable 5CAMPB.0100-10

The box cable establishes the electrical connection between the switching cabinet the connection box. It includes lines for the network (Ethernet 10/100 Mbit/s), 24 VDC supply, entry devices / E-stop and key switch or push button, enable switch, serial data transfer and CAN.

For technical data and information on exchanging and installing the box cable, see the Mobile Panel Connection Box User's Manual.

Chapter 7 • Maintenance / Servicing

1. Cleaning

Danger!

Mobile Panel devices may only be cleaned when switched off. This is to prevent unintended functions from being triggered when touching the touch screen or pressing the buttons or entry devices.

A moist towel should be used to clean the Mobile Panel device. When moistening the cloth, use only water with detergent, screen cleaning agent, or alcohol (ethanol). The cleaning agent should be applied to the cloth beforehand, not sprayed directly on the Mobile Panel device! Never use aggressive solvents, chemicals, or scouring agents.

Information:

Displays with touch screens should be cleaned at regular intervals.

2. Exchanging the connection cable

Danger!

The attachment cable may only be exchanged by trained personnel when the Mobile Panel device and the entire system are turned off.

2.1 Procedure

Warning!

Before disassembling, place the Mobile Panel device on a clean flat surface with the display facing down so that the operating elements are not damaged.

1) Remove the handle by loosening the screw with a 4 mm hex key.

Figure 138: Taking out the locking screw

2) Tip up the side of handle to release the connectors of the old attachment cable to the panel.

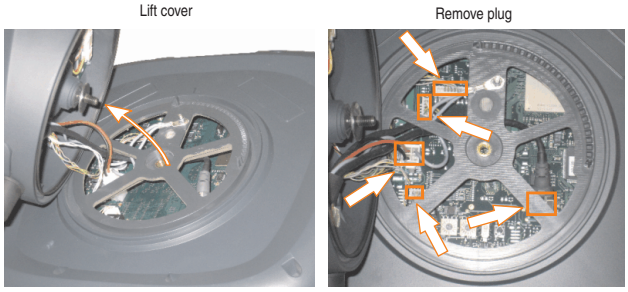


Figure 139: Removing the attachment cable

3) Remove the enable switch connector.

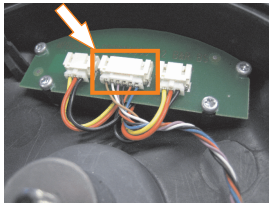


Figure 140: Removing the enable switch connector

4) Separate the attachment cable from the handle. To do so, the four cover screws need to be removed (using a Torx size 10 screwdriver) and the old attachment cable pulled through the cable opening.

Figure 141: Handle clasp screw positions

5) Lead the new attachment cable through the opening carefully, one connector at a time (1). Set the stress relief fastener in place (2). Put on the cover and replace the screws tightly (3).

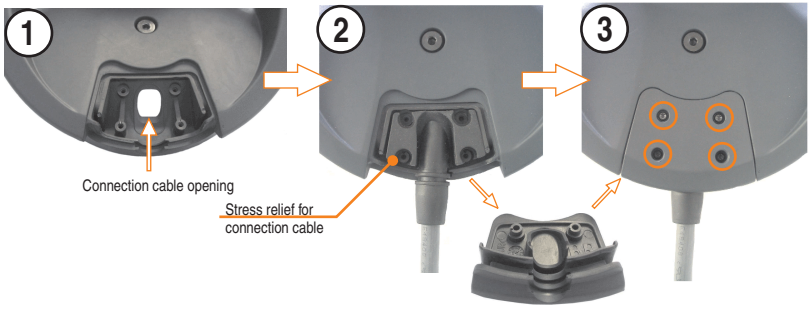


Figure 142: Connecting the attachment cable and handle

6) Connect the enable switch connector to the handle.

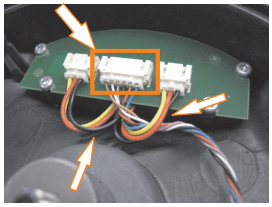


Figure 143: Connecting the enable switch connector (ST1)

Information:

The plug must first be fed through one of the two loops of the enable switch circuit before it is connected to the handle circuit board.

7) Connect the Mobile Panel attachment cable to the panel (ST2, ST3, ST4, ST5, ST6). See figure 41 "Attachment cable 5CAMPH.0xxx-10" on page 85 for connecting the cable. Cables may only be guided through the housing opening identified in the image 144 "Connectors and cable arrangement" (see arrow).

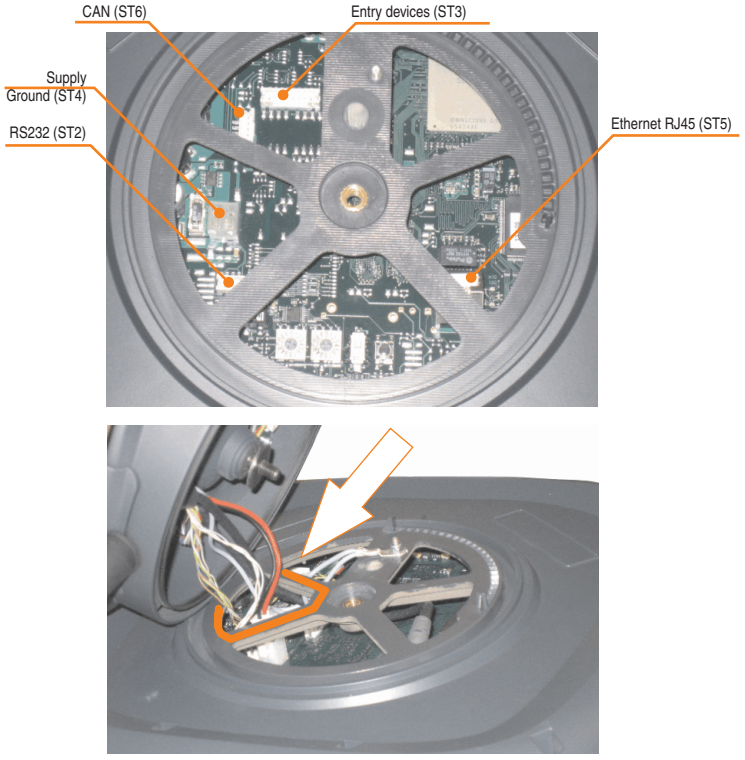


Figure 144: Connectors and cable arrangement

Information:

When connecting the Ethernet RJ45 connector (ST5) and the power supply connector (ST4), make sure that the connector locking mechanisms are engaged.

8) The grounding wire must be fed clockwise up through the next opening and fastened onto the lock washer with a nut. A nut is included with new cables. Before fastening, the heat shrink tubing must be removed from the cable lug.

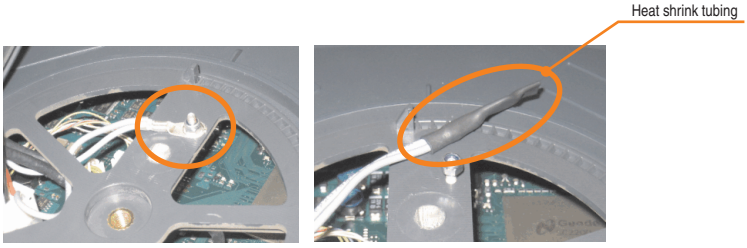


Figure 145: Attaching the ground

9) Put the handle and panel back together again. Note the following when doing so: All cables must be guided through to the left of the cover screws (1) (2). When setting the handle in place, the two markings (3) must line up.

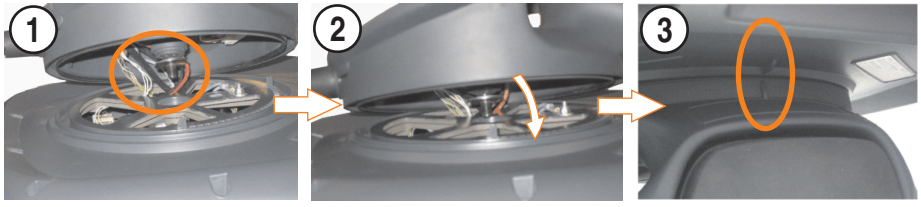


Figure 146: Connecting the handle with the panel

Danger!

Before putting the handle and the panel back together again, all connectors - especially those for the safety equipment (enable switch connector (ST1) and the entry device (ST3)) - must be checked for contact with the attachment cable!

Warning!

Cables must not be pinched when the unit is put back together.

10) Screw in the cover screw.

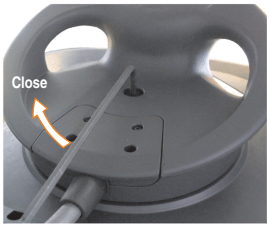


Figure 147: Tightening the cover screw

Danger!

Before commissioning the machine or system, all safety features of the Mobile Panel device must be checked for functionality.

3. Changing the battery

3.1 General Information

The battery guarantees buffering of the internal real-time clock (RTC), SRAM data, and individually saved BIOS settings. The buffer duration of the battery is at least (less with SRAM) 4 (x) years (at 50°C, 8.5 mA current requirements of the supplied components and a self discharge of 40%).

Battery check

The battery status (good or bad) is checked every time the device is turned on, as well as every 24 hours. The check involves applying a load to the battery for a short time (approx. 1 second), followed by an evaluation. The evaluated battery status is displayed in the BIOS Setup pages and in the B&R Control Center (ADI driver), but can also be read in a customer application via the ADI Library.

Battery status	Meaning
OK	Data buffering is guaranteed
Bad	Data buffering is guaranteed for approx. another 500 hours from the point in time that the battery capacity is determined to be BAD (insufficient).

Table 113: Meaning of battery status OK - Bad

From the point when battery capacity is recognized as insufficient, data buffering is guaranteed for approximately another 500 hours. When changing the battery, data is buffered for approximately another 10 minutes by a gold leaf capacitor.

Under normal operating conditions, the battery has a typical lifespan of approximately 2 years.

Danger!

The battery may only be exchanged by trained personnel when the Mobile Panel device and the entire system are turned off.

Technical data

See section 2 "Replacement CMOS batteries" on page 221.

3.2 Procedure

Warning!

Before disassembling, place the Mobile Panel device on a clean flat surface with the display facing down so that the operating elements are not damaged.

1) Remove the handle by loosening the screw with a 4 mm hex key.

Figure 148: Taking out the locking screw

2) Tip up the side of the handle and remove the battery from the fixture (don't use pliers or uninsulated tools --> risk of short circuit). The battery should not be held by its edges. Insulated tweezers may also be used for removing the battery.

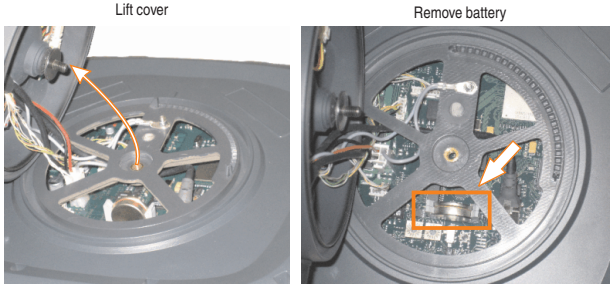


Figure 149: Removing the attachment cable

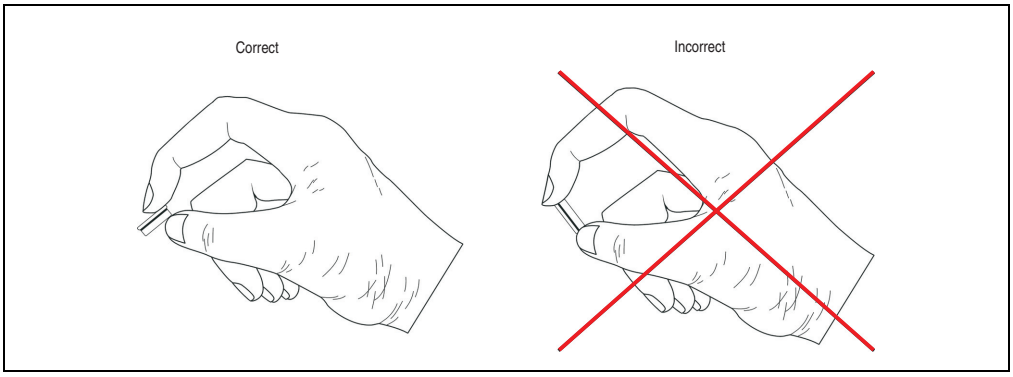


Figure 150: Battery handling

3) After removing the battery, the data is buffered for at least another 10 minutes by a gold leaf capacitor so that data is not lost. Insert the new battery with correct polarity.

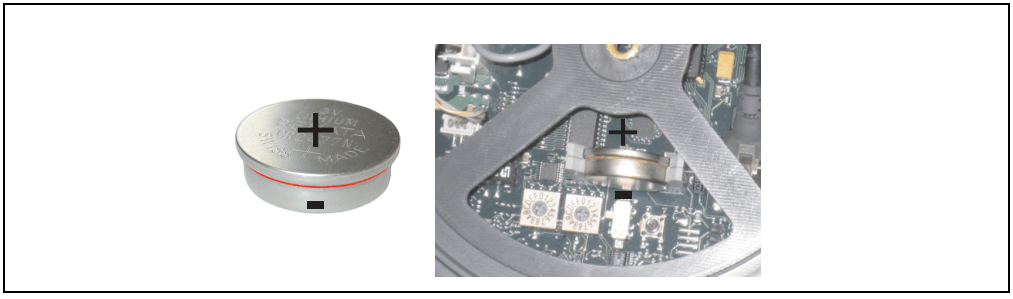


Figure 151: Inserted lithium battery

4) Put the handle and panel back together again. Note the following when doing so: All cables must be guided through to the left of the cover screws (1) (2). When setting the handle in place, the two markings (3) must line up.

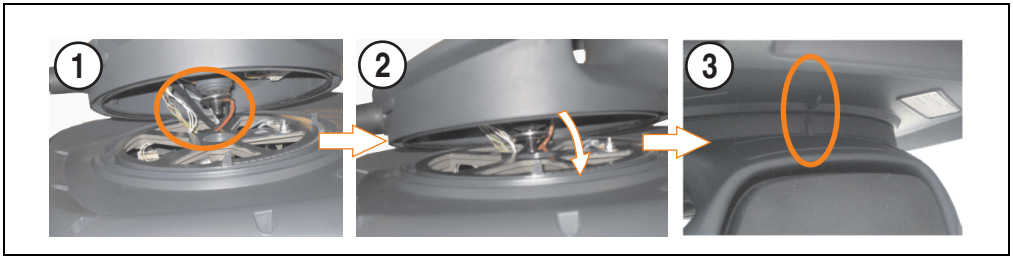


Figure 152: Connecting the handle with the panel

Danger!

Before putting the handle and the panel back together again, all connectors - especially those for the safety equipment (enable switch connector (ST1) and the entry device (ST3)) - must be checked for contact with the attachment cable!

Warning!

Cables must not be pinched when the unit is put back together.

5) Screw in the cover screw.

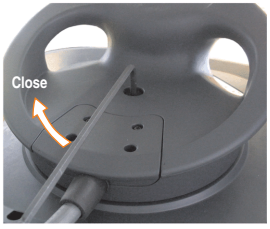


Figure 153: Tightening the cover screw

Danger!

Before commissioning the machine or system, all safety features of the Mobile Panel device must be checked for functionality.

Appendix A

Information:

The following characteristics, features and limit values only apply to the entry device and not to the Mobile Panel device as a whole. For the entire device, refer to chapter 2 "Technical data", section 2 "Entire device" on page 37 and the technical data sections for each of the operating units (see section "Technical data" on page 51).

1. E-stop button

The E-stop unit consists of an E-stop switching element and an E-stop button.

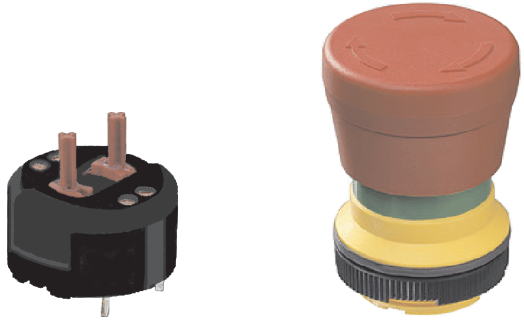


Figure 154: E-stop entry device

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Property	E-stop switching element	E-stop button
Manufacturer Type	RAFI 22FS switching element E-stop, 2 N.C. contacts	RAFI 22FS E-stop, not illuminated
Operating voltage AC/DC	Max. 120 V	-
Operating current AC/DC	Max. 550 mA	-
Contact system	Self-cleaning bridge contact	-
Standards N/C contact Weathering resistance Salt mist Protection (front side) Approbations	 Positive opening contact according to IEC 947-5-1 - - - -	 - According to IEC 68-1-2, 2-2 and 2-30 According to IEC 68-2-11 IP65 IEC 947, 1058; UL 508;CSA 22.2; EU-NSR 73/23; Ulc
B_{10d} total	100,000	
Impact resistance	At least 100 N	
Actuating force	Approx. 5 N per contact element	-
Lifespan	1 million actuations at 10 mA/24 VDC	50,000 actuations
Ambient temperature Operation Bearings Transport	 -25 to +70°C -40 to +80°C -40 to +80°C	

Table 114: Technical data - E-stop switching element and E-stop button

2. Key switch

The key switch unit consists of a key switch switching element and a key switch operating element.

Key switch switching element

Key switch operating element

Figure 155: Key switch entry device

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Property	Key switch switching element	Key switch operating element
Manufacturer Type	RAFI 22FS universal switching element, 1 N.O. contact	RAFI 22FS key switch, round collar
Contact function	Key	
Operating voltage AC/DC	Max. 42 V	-
Operating current AC/DC	Max. 100 mA	-
Contact system	Self-cleaning bridge contact	-
Standards Normally open contact Weathering resistance Salt mist Protection (front side) Approbations	 - - - - -	 - According to IEC 68-1-2, 2-2 and 2-30 According to IEC 68-2-11 IP65 IEC 947, 1058; UL 508;CSA 22.2; EU-NSR 73/23; ULc
Impact resistance	At least 100 N	
Angle of rotation	1 x 40 degrees, clockwise	

Table 115: Technical data - key switch switching element and operating element

Property	Key switch switching element	Key switch operating element
Outlet position for the key	0	
Lifespan	1 million actuations at 10 mA/24 VDC	0.3 million, operations
Ambient temperature Operation Bearings Transport	 -25 to +70°C -40 to +80°C -40 to +80°C	

Table 115: Technical data - key switch switching element and operating element (Forts.)

2.1 Angle of rotation

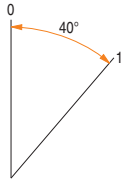


Figure 156: Angle of rotation - key switch

3. Enable switch

The enable switch is part of the enabling equipment and is integrated in the enable switch cover.

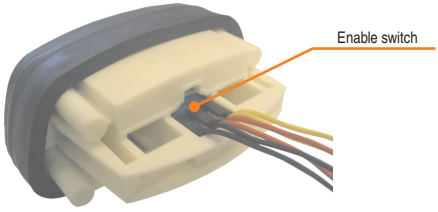


Figure 157: Enable switch

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Characteristics	Enable switch
Manufacturer Type	idec HE5B-M2
Ambient temperature Operation Bearings Transport	 -25 to +60°C -40 to +80°C -40 to +80°C
Relative humidity Operation	 45 to 85%, non-condensing
Altitude	Max. 2000 meters
Operating voltage AC/DC	Max. 125 V
Operating current AC DC	 Max. 0.5 A at 125 V resistive load Max. 0.3 A inductive load Max. 1 A at 30 V resistive load Max. 0.7 A inductive load
Minimum operating requirements	3 V AC/DC, 5 mA
Insulation resistance	100 MOhm
Vibration Operation	 5 to 55 Hz, 0.5 mm amplitude
Shock Operation	 Max. 100 m/s²
Impact resistance	At least 250 N

Table 116: Technical data - Enable switch

Characteristics	Enable switch
Lifespan Mechanical Electrical	 Position [1] 0 -> 1 -> 0: At least 1 million operations Position [1] 0 -> 1 -> 2 -> 0: At least 100,000 operations
Standards	IP65 protection according to IEC60529 IEC60947-5-1 EN60947-5-1 JIS C8201-5-1 UL508 CSA C22.2 No. 14 ISO12100/EN292 IEC60204-1/EN60204-1 ISO11161/prEN11161 ISO10218/EN775 ANSI/RIA R15.06, B11.19
B_{10d} total	100,000

Table 116: Technical data - Enable switch

1) For switch positions, see table 24 "Switch positions for the enable switch" on page 77.

4. Touch screen

4.1 AMT Touch

This touch screen is used in 8.4" Mobile Panel designs (4MP181.0843-03 and 4MP281.0843-13 Rev. L0 and higher, 5MP181.0843-07 Rev. K0 and higher).

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

AMT Touch	Specifications
Manufacturer	AMT
Release pressure	0.10 to 0.80 N
Light permeability	Up to 83%
Temperature Operation Bearings Transport	 -20 to +60°C -40 to +80°C -40 to +80°C
Lifespan	10 million touch operations on the same point
Chemical resistance	-
Activation	Finger, pointer, credit card, glove

Table 117: AMT Touch

4.1.1 Temperature humidity diagram

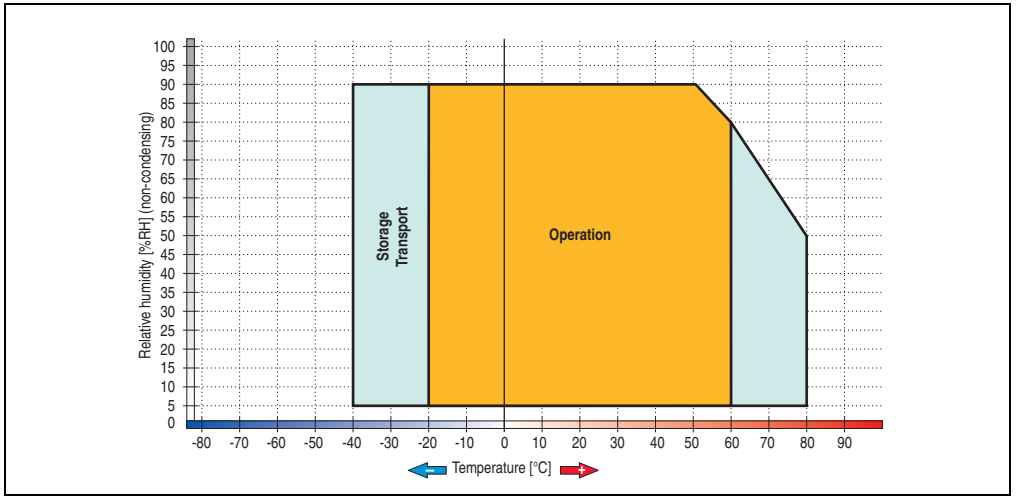


Figure 158: Temperature humidity diagram - AMT touch screen

Temperature data is for operation at 500 meters. Derating the max. ambient temperature - typically 1°C per 1000 meters (from 500 meters above sea level).

4.1.2 Cleaning

The touch screen should be cleaned with a moist lint-free cloth. When moistening the cloth, use only water with detergent, screen cleaning agent, or alcohol (ethanol). The cleaning agent should be applied to the cloth beforehand and not sprayed directly onto the touch screen itself. Never use aggressive solvents, chemicals, or scouring agents.

4.2 3M touch

This touch screen is used in 8.4" Mobile Panel designs (4MP181.0843-03 and 4MP281.0843-13 Rev. < L0 and higher, 5MP181.0843-07 Rev. < K0 and higher).

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

3M touch	Specifications
Manufacturer	3M
Release pressure	10 to 80 g
Light permeability	Up to 85%
Temperature Operation Bearings Transport	 -20 to +50°C -40 to +70°C -40 to +70°C
Lifespan	35 million touch operations on the same point
Chemical resistance 1)	Tea, coffee, ketchup, mustard, vinegar, beer, cola, red wine, cooking oil, whiskey, universal cleaning agents, washing detergent, bleach (5.25%), hydrogen peroxide (3%), Lysol, ethyl, alcohol, isopropyl alcohol, acetone, methyl ethyl ketone (MEK), toluene, concentrated hydrochloric acid, naphtha, mineral oil, motor oil, diesel, gear fluid, brake fluid, antifreeze, hydraulic oil
Activation	Finger, pointer, credit card, glove

Table 118: 3M touch

1) The active area of the touch screen is resistant to these chemicals for a timeframe of one hour at 22°C and 45% humidity.

4.2.1 Temperature humidity diagram

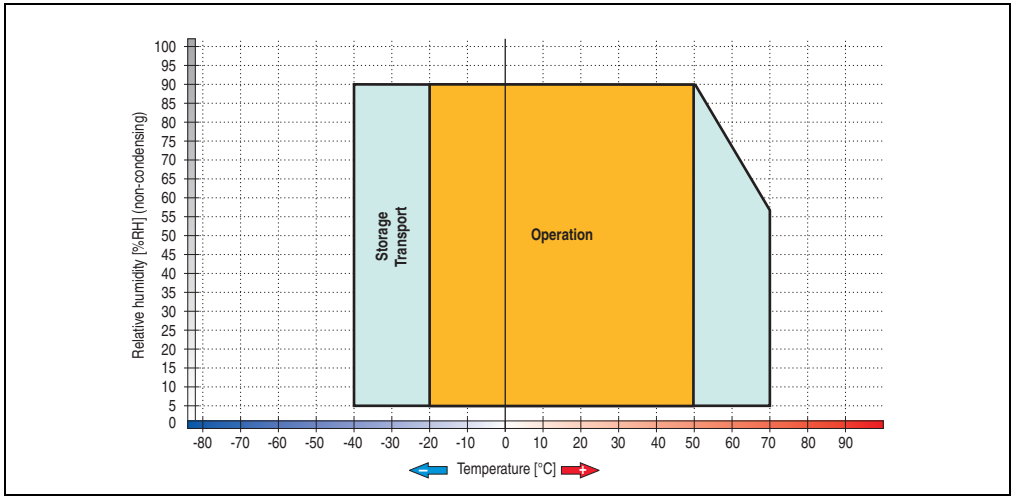


Figure 159: Temperature humidity diagram - 3M touch screen

Temperature data is for operation at 500 meters. Derating the max. ambient temperature - typically 1°C per 1000 meters (from 500 meters above sea level).

4.2.2 Cleaning

The touch screen should be cleaned with a moist lint-free cloth. When moistening the cloth, use only water with detergent, screen cleaning agent, or alcohol (ethanol). The cleaning agent should be applied to the cloth beforehand and not sprayed directly onto the touch screen itself. Never use aggressive solvents, chemicals, or scouring agents.

4.3 Gunze Touch

This touch screen is used in 5.7" Mobile Panel designs.

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

Gunze touch	Specifications
Manufacturer	Gunze
Release pressure	10 to 80 g
Light permeability	Up to 79%
Temperature Operation Bearings Transport	 -10 to +50°C -20 to +70°C -20 to +70°C
Lifespan	1 million touch operations on the same point
Chemical resistance [1)]	Acetone, ammonia-based glass cleaner, normal food and drinks, hexane, methylene chloride, methylethylketone, mineral spirits, turpentine, isopropyl alcohol
Activation	Finger, pencil

Table 119: Gunze touch

1) The active area of the touch screen is resistant to these chemicals for a timeframe of one hour at 21°C.

4.3.1 Temperature humidity diagram

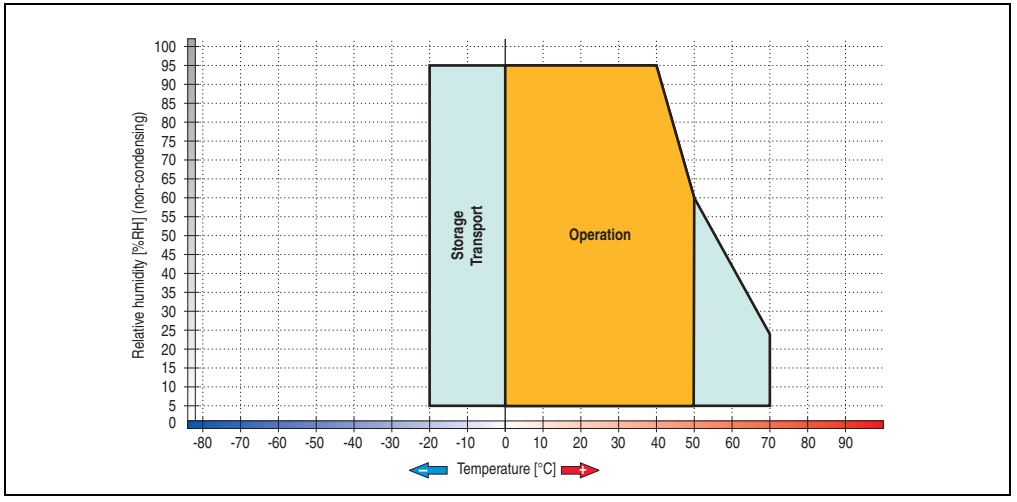


Figure 160: Temperature humidity diagram - Gunze touch screen

Temperature data is for operation at 500 meters. Derating the max. ambient temperature - typically 1°C per 1000 meters (from 500 meters above sea level).

4.3.2 Cleaning

The touch screen should be cleaned with a moist lint-free cloth. When moistening the cloth, use only water with detergent, screen cleaning agent, or alcohol (ethanol). The cleaning agent should be applied to the cloth beforehand and not sprayed directly onto the touch screen itself. Never use aggressive solvents, chemicals, or scouring agents.

5. Décor foil

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device.

The décor foil conforms to DIN 42115 (section 2). This means it is resistant to exposure to the following chemicals for a 24-hour period with no visible signs of damage:

Ethanol Cyclohexanol Diacetone alcohol Glycol Isopropanol Glycerine Methanol Triacetin Dowandol DRM/PM	Formaldehyde 37%-42% Acetaldehyde Aliphatic hydrocarbons Toluene Xylene White spirits	1.1.1.Trichloroethane Ethyl acetate Diethyl ether N-Butyl acetate Amyl acetate Butylcellosolve Ether
Acetone Methyl ethyl ketone Dioxan Cyclohexanone MIBK Isophorone	Formic acid < 50% Acetic acid < 50% Phosphoric acid < 30% Hydrochloric acid < 36% Nitric acid < 10% Trichloracetic acid < 50% Sulphuric acid < 10%	Sodium hypochlorite < 20% Hydrogen peroxide < 25% Potassium carbonate Washing agents Fabric conditioner Ferric chloride Ferrous chloride (FeCl2) Ferrous chloride (FeCl3) Dibutyl phthalate Dioctyl phthalate Sodium carbonate
Ammonia < 40% Caustic soda < 40% Potassium hydroxide Alkali carbonate Bichromate Potassium Acetonitrile Sodium bisulphate	Cutting oil Diesel oil Linseed oil Paraffin oil Blown castor oil Silicon oil Turpentine oil substitute Universal brake fluid Aviation fuel Gasoline Water Sea water Decon	

Table 120: Chemical resistance of the décor foil

The décor foil conforms to DIN 42115 section 2 for exposure to glacial acetic acid for less than one hour without visible damage.

6. Filter glass

If the Mobile Panel is not equipped with a touch screen, then a filter glass with the following properties is used.

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device.

6.1 Mechanical characteristics

Abrasion-resistant according to DIN 52347

Adhesive strength according to DIN 58 196-K2 (section 6)

6.2 Chemical properties

Durability according to DIN 50021 - CASS

7. Housing

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those specified for the entire device. For the entire device in which this individual component is used, refer to the data given specifically for the entire device.

The housing surface (paint) is resistant to the following chemicals:

Ethanol Glycol Isopropanol Glycerine Methanol	Vinigar-based cleaning agent Soaps Cleaning agent (such as for auto maintentance or industrial use)	Beer Wine Coffee Fruit

Table 121: Chemical resistance of the décor foil

8. Viewing angles

The viewing angles can be seen in the technical data for the individual components.

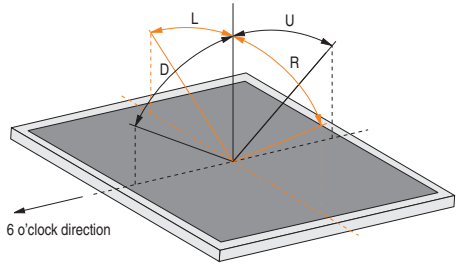


Figure 161: Viewing angles

9. Overview of time references - Real-time clock (RTC)

ppm	Deviation in seconds per day
1	0.0864
10	0.864
20	1.728
30	2.592
40	3.456
50	4.32
60	5.184
70	6.048
80	6.912
90	7.776
100	8.64

Table 122: ppm - Seconds table

10. Glossary

A

APC

Abbreviation for "**A**utomation **PC**".

API

Abbreviation for "**A**pplication **P**rogram **I**nterface" The interface, which allows applications to communicate with other applications or with the operating system.

Automation Runtime

A uniform runtime system for all B&R automation components.

B

Baud rate

Measurement unit for data transfer speed. It indicates the number of states for a transferred signal per second and is measured using the baud unit of measurement. 1 baud = 1 bit/sec or 1 bps.

BIOS

An abbreviation for "**B**asic **I**nput/**O**utput **S**ystem". Core software for computer systems with essential routines for controlling input and output processes on hardware components, for performing tests after system start, and for loading the operating system. Although BIOS is used to configure a system's performance, the user does not usually come into contact with it.

Bit

Binary digit > binary position, binary character, smallest discrete unit of information. A bit can have the value 0 or 1.

Bit rate

The number of bits that can be transferred within a specified time unit. 1 bit/sec = 1 baud.

Bootstrap loader

A program that automatically runs when the computer is switched on or restarted. After some basic hardware tests have been carried out, the bootstrap loader starts a larger loader and hands over control to it, which in turn boots the operating system. The bootstrap loader is typically found in ROM on the computer.

Bus unit

Provit bus units consist of the housing, interface board slots and the power supply for the system units.

Byte

Data format [1 byte = 8 bits] and a unit for characterizing information amounts and memory capacity. The following units are the commonly used units of progression: KB, MB, GB.

B&R Automation Runtime

Windows-based program for creating installation disks to install B&R Automation Runtime™ on the target system.

C

CAN

An abbreviation for "**C**ontroller **A**rea **N**etwork" (serial bus system). Structure according to ISO 11898. Bus medium: twisted pair. Good transfer properties in short distances less than 40 m with a 1 MBit/sec data transfer rate. Maximum number of stations: unlimited in theory, up to 64 with real-time capability in practice, i.e. defined maximum delay times for messages with high priority. High reliability using error detection, error handling, troubleshooting. Hamming distance.

CD-ROM

Abbreviation for "**C**ompact **D**isc **R**ead-**O**nly **M**emory". A removable data medium with a capacity of ~700 MB. CD-ROMs are optically scanned.

CE mark

A CE mark for a product. It consists of the letters "CE" and indicates conformity to all EU guidelines for the labeled product. It indicates that the individual or corporate body who has performed or attached the label assures that the product conforms to all EU guidelines for complete harmonization. It also indicates that all mandatory conformity evaluation procedures have taken place.

CMOS

"CMOS" is a battery powered memory area where fundamental parameters of an IBM (or compatible) personal computer are stored. Information such as the type of hard drive, size of the working memory and the current date and time are required when booting the computer. As the name suggests, the memory is based on CMOS technology standards.

CompactFlash®

CompactFlash memory cards [CF cards] are exchangeable nonvolatile mass memory systems with very small dimensions [43 x 36 x 3.3 mm, approximately half the size of a credit card]. In addition to the flash memory chips, the controller is also present on the cards. CF cards provide complete PC card / ATA functionality and compatibility. A 50-pin CF card can be simply inserted in a passive 68-pin type II adapter card. It conforms to all electrical and mechanical PC card interface specifications. CF cards were launched by SanDisk back in 1994. Currently, memory capacities reach up to 8 GB per unit. Since 1995, CompactFlash Association [CFA] has been looking after standardization and the worldwide distribution of CF technology

Controller

A device component which allows access to other devices on a computer subsystem. A disk controller, for example, allows access to hard disks and disk drives and is responsible both for physical and logic drive access.

CPU

An abbreviation for "**C**entral **P**rocessing **U**nit". Interprets and executes commands. It is also known as a "microprocessor" or "processor" for short. A processor is able to receive, decode and execute commands, as well as transfer information to and from other resources via the computer bus.

D

DVD

An abbreviation for "**D**igital **V**ersatile **D**isc". The next generation of optical data carrier technology. Using this technology it is possible to encode video, audio and computer data on CD. DVDs can store a higher volume of data than conventional CDs. Standard DVDs, which have a single layer, can hold 4.7 GB. Dual-layer DVDs can hold 8.5 GB. Double-sided DVDs can therefore hold up to 17 GB. A special drive is needed for DVDs. Conventional CDs can also be played on DVD drives.

E

EDO-RAM

An abbreviation for "**E**xtended **D**ata **O**ut **R**andom **A**ccess **M**emory". Dynamic RAM that provides data for the CPU while the next memory access is being initialized. This increases speed.

EMC

"**E**lectro**m**agnetic **C**ompatibility". The ability of a device or a system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment [IEV 161-01-07].

Encode, encoding

When processing information, it is often necessary to change the information from one form of representation to another. This conversion process is called encoding, and the rules used to assign one character set to another are referred to as encoding rules. A differentiation is made between ambiguous and unambiguous encoding depending on if one set is a direct reflection of the other. Most codes use unambiguous encoding with one set directly reflecting the other. A differentiation is also made between redundant and non-redundant encoding. With non-redundant encoding, the full range of the available character set is used, i.e. each code is defined. With redundant encoding, the available character set also contains codes that are not used. This differentiation is important during data transfer when detecting and, if necessary, correcting data transfer errors.

EPROM

Erasable **PROM** >(completely with ultraviolet light).

Ethernet

An IEEE 802.3 standard for networks. Ethernet uses bus or star topology and controls the traffic on communication lines using the access procedure CSMA/CD (Carrier Sense Multiple Access with Collision Detection). Network nodes are connected using coaxial cables, fiber optic cables or twisted pair cabling. Data transfer on an Ethernet network takes place in frames of variable lengths that consist of supply and controller information as well as 1500 bytes of data. The Ethernet standard provides base band transfers at 10 megabit and 100 megabit per second.

Ethernet POWERLINK

An enhancement of standard Ethernet. It enables data exchange under strict real-time conditions with cycle times down to 200 µs and jitter under 1 µs. This makes Ethernet power available on all communication levels of automation technology – from control levels to I/O. Ethernet POWERLINK was initiated by the company B&R Industrie-Elektronik and is now managed by the open end user and vendor association, EPSG - Ethernet POWERLINK Standardization Group (**www.ethernet-powerlink.org**).

F

FDD

Abbreviation for "**F**loppy **D**isk **D**rive". Reading device for removable magnetic memory from the early days of PC technology. Due to their sensitivity and moving components, FDDs have been almost completely replaced by CompactFlash memory in modern automation solutions.

Firmware

Programs stored permanently in read-only memory. Firmware is software used to operate computer-controlled devices that generally stays in the device throughout its lifespan or over a long period of time. Such software includes operating systems for CPUs and application programs for industrial PCs as well as programmable logic controllers (e.g. the software in a washing machine controller). This software is written in read-only memory (ROM, PROM, EPROM) and cannot be easily replaced.

Floppy

Also known as a diskette. A round plastic disk with an iron oxide coating that can store a magnetic field. When the floppy disk is inserted in a disk drive, it rotates so that the different areas (or sectors) of the disk's surface are moved under the read/write head. This allows the magnetic orientation of the particle to be modified and recorded. Orientation in one direction represents binary 1, while the reverse orientation represents binary 0.

FPC

An abbreviation for "**F**lat **P**anel **C**ontroller".

FPD

An abbreviation for "**F**lat **P**anel **D**isplay".

FTP

"**F**ile **T**ransfer **P**rotocol". Rules for transferring data over a network from one computer to another computer. This protocol is based on TCP/IP, which has established itself as the standard for transferring data over Ethernet networks. FTP is one of the most used protocols on the Internet. It is defined in RFC 959 in the official regulations for Internet communication.

G

GB

Gigabyte (1 GB = 230 or 1,073,741,824 bytes)

H

Handshake

Method of synchronization for data transfer when data is sent at irregular intervals. The sender signals that data can be sent, and the receiver signals when new data can be received.

HDD

An abbreviation for "**H**ard **D**isk **D**rive". Fixed magnetic mass memory with high capacities, e.g. 120 GB.

I

IDE

An abbreviation for "**I**ntegrated **D**rive **E**lectronics". A drive interface where the controller electronics are integrated in the drive.

Interface

From the hardware point of view, an interface is the connection point between two modules/devices/systems. The units on both sides of the interface are connected by the interface lines so that data, addresses, and control signals can be exchanged. The term interface includes all functional, electrical and constructive conditions [encoding, signal level, pin assignments] that characterize the connection point between the modules, devices, or systems. Depending on the type of data transfer, a differentiation is made between parallel [e.g. Centronics, IEEE 488] and serial interfaces [e.g. V.24, TTY, RS232, RS422, RS485], which are set up for different transfer speeds and transfer distances. From the point of view of software, the term "interface" describes the transfer point between program modules using specified rules for transferring the program data.

ISO

International Organization for Standardization > Worldwide federation of national standardization institutions from over 130 countries. ISO is not an acronym for the name of the organization; it is derived from the Greek word "isos", meaning "equal" (**www.iso.ch**).

K

Keypad modules

Keypad modules are divided into two groups: **standard keypad modules** (can be cascaded to a controller) and **special keypad modules** (must be connected by an electrician according to function, e.g. E-stop).

L

LAD

Ladder Diagram (Graphical programming language according to IEC 1131-3 and DIN EN 61131-3 for creating PLC application programs. LAD).

LCD

An abbreviation for "**L**iquid **C**rystal **D**isplay". A display type, based on liquid crystals that have a polarized molecular structure and are enclosed between two transparent electrodes as a thin layer. If an electrical field is applied to the electrodes, the molecules align themselves with the field and form crystalline arrangements that polarize the light passing through. A polarization filter, which is arranged using lamellar electrodes, blocks the polarized light. In this way, a cell (pixel) containing liquid crystals can be switched on using electrode gates, thus coloring this pixel black. Some LCD displays have an electroluminescent plate behind the LCD screen for lighting. Other types of LCD displays can use color.

LED

An abbreviation for "**L**ight **E**mitting **D**iode". A semiconductor diode which converts electrical energy into light. LEDs work on the principle of electroluminescence. They are highly efficient because they do not produce much heat in spite of the amount of light they emit. For example, "operational status indicators" on floppy disk drives are LEDs.

M

MB

Megabyte (1 MB = 220 or 1,048,576 bytes).

Microprocessor

Highly integrated circuit with the functionality of a CPU, normally housed on a single chip. It comprises a control unit, arithmetic and logic unit, several registers and a link system for connecting memory and peripheral components. The main performance features are the internal

and external data bus and address bus widths, the command set and the clock frequency. Additionally, a choice can be made between CISC and RISC processors. The first commercially available worldwide microprocessor was the Intel 4004. It came on the market in 1971.

MIPS

Million instructions per second > Measurement for the computing speed of computers.

Motherboard

A circuit board that houses the main components of a computer such as the CPU switching circuit, co-processors, RAM, ROM for firmware, interface circuits, and expansion slots for hardware expansions.

MTBF

An abbreviation for "**M**ean **t**ime **b**etween **f**ailure". The average time which passes before a hardware component fails and repair is needed. This time is usually expressed in thousands or ten thousands of hours, sometimes known as power-on hours (POH).

MTC

An abbreviation for "**M**ain**t**enance **C**ontroller". The MTC is an independent processor system that provides additional functions for a B&R industrial PC that are not available with a normal PC. The MTC communicates with the B&R industrial PC via the ISA bus (using a couple register).

MTCX

Abbreviation for "**M**ain**T**enance **C**ontroller E**X**tended".

Multitasking

Multitasking is an operating mode in an operating system that allows several computer tasks to be executed virtually simultaneously.

N

.NET

DOTNET, Microsoft's new development platform that provides a common runtime library and type system for all programming languages. DOTNET is the umbrella term for the following products, strategies and technologies: .NET Framework, a new software platform, Visual Studio .NET, a new development environment that supports several .NET programming languages (e.g. C# or VB.NET, specially created for .NET), .NET My Services, a group of services taking over functions such as authentication, .NET Enterprise Server, which, apart from its name, is independent of the other technologies and includes the products Exchange Server 2000, Application Center 2000, and SQL Server 2000. .NET devices, supported by a slimmed down version of .NET Framework (.NET Compact Framework).

Node

Branching point in a network.

O

OEM

Original **E**quipment **M**anufacturer. A company that integrates third-party and in-house manufactured components into their own product range and then distributes these products under its own name.

OPC

OLE for Process Control > A communication standard for components in the area of automation. The goal of OPC development is to provide an open interface that builds on Windows-based technologies such as OLE, COM and DCOM. It allows problem-free standardized data transfer between controllers, operating and monitoring systems, field devices and office applications from different manufacturers. This development is promoted by the OPC Foundation, which is made up of over 200 companies from around the world, including Microsoft and other leading companies. Lately, OPC is interpreted as a synonym for "openness, productivity, and connectivity", symbolizing the new possibilities that this standard opens up.

OPC server

The missing link between connection modules for the Interbus and the visualization application. It communicates serially with the connection modules via the ISA or PCI bus or Ethernet.

P

Panel

A common term for B&R display units (with or without keys).

Panelware

A generic term given for standard and special keypad modules offered by B&R.

PC card

Registered trademark of PCMCIA for add-on cards conforming to PCMCIA specifications.

PnP

An abbreviation for "**P**lug and **P**lay". Specifications developed by Intel. Using Plug and Play allows a PC to automatically configure itself so that it can communicate with peripheral devices (e.g. monitors, modems, and printers). Users can connect a peripheral device (plug) and it immediately runs (play) without having to manually configure the system. A Plug and Play PC requires a BIOS that supports Plug and Play and a respective expansion card.

POH

An abbreviation for "**P**ower **O**n **H**ours". See MTBF.

POST

An abbreviation for "**P**ower-**O**n **S**elf **T**est". A set of routines that are stored in ROM on the computer and that test different system components, e.g. RAM, disk drive and the keyboard in order to determine that the connection is operating correctly and ready for operation. POST routines notify the user of problems that occur. This is done using several signal tones or by displaying a message that frequently accompanies a diagnosis value on the standard output or standard error devices (generally the monitor). If the POST runs successfully, control is transferred over to the system's bootstrap loader.

Power Panel

Power Panel is part of the B&R product family and is a combination of an operator panel and controller in one device. This covers the PP21 and PP41 products.

POWERLINK

See "Ethernet POWERLINK".

PROFIBUS DP

PROFIBUS for "decentralized peripherals". PROFIBUS DP can be used to allow simple digital and analog I/O modules as well as intelligent signal and data processing units to be installed in the machine room, which among other things can significantly reduce cabling costs. Often used for time-critical factory automation applications.

PV

Process variable. Logical storage location for values and states in a program.

Q

QVGA

Abbreviation for **Q**uarter **V**ideo **G**raphics **A**rray. Usually a screen resolution of 320 × 240 pixels.

R

RAM

An abbreviation for "**R**andom **A**ccess **M**emory". Semiconductor memory which can be read or written to by the microprocessor or other hardware components. Memory locations can be accessed in any order. The various ROM memory types do allow random access, but they cannot be written to. The term RAM refers to a more temporary memory that can be written to as well as read.

Real time

A system is operating in real time or has real-time capability if the input sizes (e.g. signals, data) are received and processed in a defined time period, and the results are made available in real time for a partner system or the system environment. See also "real-time demands" and "real-time system".

ROM

An abbreviation for "**R**ead-**O**nly **M**emory". Semiconductor memory where programs or data were permanently stored during the production process.

RS232

Recommended **S**tandard **N**umber **232**. Oldest and most widespread interface standard, also called a V.24 interface. All signals are referenced to ground making this an unbalanced interface. High level: -3 ... -30 V, low level: +3 ... +30 V. Cable lengths up to 15 m, transfer rates up to 20 KBit/s. For point-to-point connections between 2 participants.

RTS

An abbreviation for "**R**equest **T**o **S**end". A signal used in serial data transfer for requesting send permission. For example, it is sent from a computer to the modem connected to it. The RTS signal is assigned to pin 4 according to the hardware specifications of the RS-232-C standard.

RXD

An abbreviation for "Receive (**RX**) **D**ata". A line for transferring serial data received from one device to another, e.g. from a modem to a computer. For connections complying with the RS-232-C standard, the RXD is connected to pin 3 of the plug.

S

SCADA

Supervision, **C**ontrol **A**nd **D**ata **A**cquisition. SCADA systems are used to control, monitor, and log industrial processes. A high degree of configurability allows customization for various processes.

SDRAM

An abbreviation for "**S**ynchronous **D**ynamic **R**andom **A**ccess **M**emory". A construction of dynamic semiconductor components (DRAM) that can operate with higher clock rates than conventional DRAM switching circuits. This is made possible using block access. For each access, the DRAM determines the next memory addresses to be accessed.

Special keypad modules

The following keypad modules are offered by B&R: Dummy module, emergency stop module, key switch module (made up of 1 key switch and 1 on /off switch) and a start/stop module (made up of 2 buttons and a label field).

SRAM

An abbreviation for "**S**tatic **R**andom **A**ccess **M**emory". A semiconductor memory (RAM) made up of certain logic circuits (flip-flop) that only keeps stored information while powered. In computers, static RAM is generally only used for cache memory.

Standard keypad module

The following keypad modules are offered by B&R: 16 keys with 16 LEDs, 12+4 keys with 4 LEDs, 8 keys with 4 LEDs and a label field and 4 keys with 4 LEDs and 4 label fields.

Switch

Device similar to a hub that takes data packets received in a network and, unlike a hub, passes them only to the respective addressee, not to all network nodes. Unlike a hub, a switch provides targeted communication within a network that only takes place between sender and receiver. Other network nodes are not involved.

System units

Provit system units consist of a mainboard (without processor), slots for RAM modules, VGA controller, serial and parallel interfaces, and connections for the FPD, monitor, PS/2 AT keyboard, PS/2 mouse, USB, Ethernet (for system units with Intel Celeron and Pentium III processors), Panelware keypad modules and external FDD.

T

Task

Program unit that is assigned a specific priority by the real-time operating system. It contains a complete process and can consist of several modules.

TCP/IP

Transmission Control Protocol/Internet Suit of Protocols. Network protocol that has become the generally accepted standard for data exchange in heterogeneous networks. TCP/IP is used both in local networks for communication between various computer and also for LAN to WAN access.

Touch screen

Screen with touch sensors for activating an item with the finger.

TXD

An abbreviation for "Transmit (**TX**) **D**ata". A line for the transfer of serial data sent from one device to another, e.g. from a computer to a modem. For connections complying with the RS-232-C standard, the TXD is connected to pin 2 of the plug.

U

UART

An abbreviation for "**U**niversal **A**synchronous **R**eceiver-**T**ransmitter". A module generally consisting of a single integrated circuit that combines the circuits required for asynchronous serial communication for both sending and receiving. UART represents the most common type of circuit in modems for connecting to a personal computer.

UDMA

An abbreviation for "**U**ltra **D**irect **M**emory **A**ccess". A special IDE data transfer mode that allows high data transfer rates for drives. There have been many variations in recent times.
UDMA33 mode transfers 33 megabytes per second.
UDMA66 mode transfers 66 megabytes per second.
UDMA100 mode transfers 100 megabytes per second.
Both the mainboard and the hard drive must support the specification to implement modifications.

UPS

Abbreviation for "**U**ninterruptible **P**ower **S**upply". See "UPS".

USB

An abbreviation for »**U**niversal **S**erial **B**us« A serial bus with a bandwidth of up to 12 megabits per second (Mbit/s) for connecting a peripheral device to a microcomputer. Up to 127 devices can be connected to the system using a single multipurpose connection, the USB bus (e.g. external CD drives, printers, modems as well as the mouse and keyboard). This is done by connecting the devices in a row. USB allows devices to be changed when the power supply is switched on (hot plugging) and multi-layered data flow.

V

VGA

An abbreviation for "**V**ideo **G**raphics **A**dapter". A video adapter which can handle all EGA (Enhanced Graphics Adapter) video modes and adds several new modes.

Visual Components

Integrated in B&R Automation Studio. Visual Components can be used to configure visualization projects that use text and graphics.

W

Windows CE

Compact 32-bit operating system with multitasking and multithreading that Microsoft developed especially for the OEM market. It can be ported for various processor types and has a high degree of real-time capability. The development environment uses proven, well-established development tools. It is an open and scalable Windows operating system platform for many different devices. Examples of such devices are handheld PCs, digital wireless receivers, intelligent mobile phones, multimedia consoles, etc. In embedded systems, Windows CE is also an excellent choice for automation technology.

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