Power Panel 45

User's Manual

Version:	**1.00 (May 2008)**
Model number:	**MAPP45-ENG**

Power Panel 45 User's Manual V 1.00

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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 However, sometimes a newer version of the user's manual can be downloaded in electronic form (PDF format) from the B&R homepage www.br-automation.com.

1. Manual history

Version	Date	Comment
1.00	May 2008	First edition

Table 1: Manual history

2. Safety guidelines

2.1 Introduction

Programmable logic controllers (PLCs), operating and monitoring devices (industrial PCs, Power Panels, Mobile Panels, etc.), as well as the B&R uninterruptible power supplies have been designed, developed or 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.

When using both programmable logic controllers and 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.) in accordance with applicable national and international regulations must be observed. The same applies for all other devices connected to the system, e. g. drives.

All tasks such as installation, commissioning, and maintenance are only permitted to be carried out by qualified personnel. Qualified personnel are persons familiar with transport, mounting, installation, commissioning and operation of the product and have the respective qualifications (e.g. IEC 60364). National accident prevention guidelines must be followed.

The safety guidelines, connection descriptions (type plate and documentation), and limit values listed in the technical data are to be read carefully before installation and commissioning and must be observed.

2.2 Intended use

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, such as motors, are made secure.

2.3 Protection against electrostatic discharges

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

2.3.1 Packaging

- Electrical components with housing
  … do not require special ESD packaging, but must be handled properly
  (see section"Electrical components with housing").

- Electrical components without housing
  … must be protected by ESD-suitable packaging.

2.3.2 Guidelines for proper ESD handling

Electrical components with housing

- Do not touch the contacts of connectors 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.

2.4 Transport and Storage

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

The devices contain components sensitive to electrostatic charges which can be damaged by inappropriate handling. It is therefore necessary to provide the required safety precautions against electrostatic discharges during installation or removal of the devices (see also section 2.3 "Protection against electrostatic discharges" on page 17).

2.5 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).
- Take the necessary steps to protect against electrostatic discharges (see also section 2.3 "Protection against electrostatic discharges" on page 17).

2.6 Operation

2.6.1 Protection against touching electrical parts

To operate programmable logic controllers, operating and monitoring devices or uninterruptible power supplies, certain components must carry dangerous voltage levels of over 42 VDC. A life-threatening electrical shock could occur if you come into contact with these parts. This could result in death, severe injury or material damage.

Before turning on the programmable logic controller, the operating and monitoring devices and the uninterruptible power supply, ensure that the housing is properly grounded (PE rail). The ground connection must be established when testing the operating and monitoring devices or the uninterruptible power supply, even when operating them for only a short time.

Before turning the device on, make sure that all voltage-carrying parts are securely covered. During operation, all covers must remain closed.

2.6.2 Environmental conditions - dust, humidity, aggressive gases

Use of operating and monitoring devices (e.g. industrial PCs, power panels, mobile panels, etc.) and uninterruptible power supplies in very dusty environments should be avoided. Dust collection on the devices influences their function and, especially in systems with active cooling (fans), sufficient cooling cannot be guaranteed.

The presence of aggressive gases in the environment can also lead to malfunctions. When combined with high temperature and humidity, aggressive gases - e.g. with sulfuric, nitric and chloric components- spur chemical chemical process that can damage electronic components very quickly. Signs of the presence of aggressive gases are blackened copper surfaces and cables on existing installations.

For operation in dusty or humid conditions, correctly installed (cutout installation) operating and monitoring devices like Automation Panel or Power Panel are protected on the front side. The rear side of all devices must be protected from dust and humidity and must be cleaned at suitable intervals.

2.6.3 Programs, viruses and dangerous programs

The system is subject to potential danger each time data is exchanged or software is installed from a data medium (e.g. diskette, CD-ROM, USB flash drive, etc.), a network connection, or the Internet. The user is responsible for assessing these dangers, implementing preventative measures such as virus protection programs, firewalls, etc. and obtaining software from reliable sources.

2.7 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. Definition of terms

Term	Explanation
SG3	System Generation 3 (SG3) - CPUs with Motorola processors. The following CPUs belong to this series: CP260, IF161, IP161, XP152, CP100, CP104, CP152, CP153, CP200, CP210, CP430, CP470, CP474, CP476, CP770, CP774, PP15, PP21, PP35, PP41
SG4	System Generation 4 (SG4) - CPUs with Intel processors. The following CPUs belong to this series: CP1483, CP1484, CP1485-1, CP1486, CP3484, CP3485-1, CP3486, PP45, PP100/200, PP300/400, MP100/200, CP340, CP360, CP380, CP382, CP570, EC20, EC21, AC140, AC141, AR000, AR010, AR102, AR105, APC620, APC700, APC810
SGC	System Generation Compact CPU (SGC) - CPUs with Motorola processors (Embedded µP). The following CPUs belong to this series: CP0201, CP0291, CP0292, XC0201, XC0202, XC0292

Table 3: Definition of terms

4. Abbreviations

Abbreviations appear throughout the User's Manual, for example in data tables or descriptions of pin assignments.

Abbreviation		Description
ND	Not defined	In data tables, this stands for a value that has not been defined. Because a cable manufacturer does not provide certain technical data, for example.
TBD	To be determined	Used in the technical data tables when certain pieces of information are not yet available. The value will be provided later.

Table 4: Abbreviations used in the User's Manual

Chapter 2 • Power Panel 45

1. System characteristics

The PP45 is an especially compact addition to the the proven Power Panel product family. Modular fieldbus interfaces ensure flexible integration in all configurations.

Ethernet and X2X Link are used for the communication system. Additionally, these devices have been equipped with a slot for interface modules. Depending on requirements, the Power Panel can be expanded using a CAN bus, Profibus DP slave, or RS485/RS232, making it perfectly suited for demanding tasks. Custom mylar designs are also available.

- Cost-effective complete solution
- Compact dimensions
- Integrates control, visualization, and I/O interface

1.1 Compact solution

The PP45 is used as a controller and operator panel. Additional peripheral devices can be connected via the integrated X2X interface. Using the optional interface modules, it is also possible to connect other B&R products or even to integrate the PP45 into control systems from other manufacturers. All components are contained within a compact housing with a 5.7" QVGA LCD display.
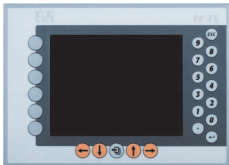
1.2 Simple programming

The full integration of the visualization application into the B&R Automation Studio programming and diagnostics tool goes without saying. The same is true for programming it in all of the IEC languages offered by B&R as well as Automation Basic and ANSI C.

1.3 General technical data

Name	Description
CPU	Intel-compatible 100 MHz CPU
Memory	64 MB DRAM, 32 KB SRAM, nonvolatile, CompactFlash application memory
Interfaces	Ethernet 10/100 X2X Link 2 x USB 2.0
Slots	CompactFlash slot Expansion slot
Miscellaneous	IP65 protection (from front) Temperature range from 0-50°C Fan-free 24 VDC supply voltage
Dimensions	203 mm x 145 mm x 51 mm

1.4 Overview

Model number	4PP045.0571-042	4PP045.0571-062	4PP045.0571-L42
Photo			
Display	LCD m	LCD color	LCD m
Resolution	QVGA	QVGA	QVGA
Diagonal	5.7"	5.7"	5.7"
Touch screen	Analog resistive	Analog resistive	-
Keys	10 touch keys	10 touch keys	24 membrane keys (6 with legend strips)
Slot for interface modules	1	1	1
USB	2 x USB 2.0	2 x USB 2.0	-
Page	24	33	42

2. Topology
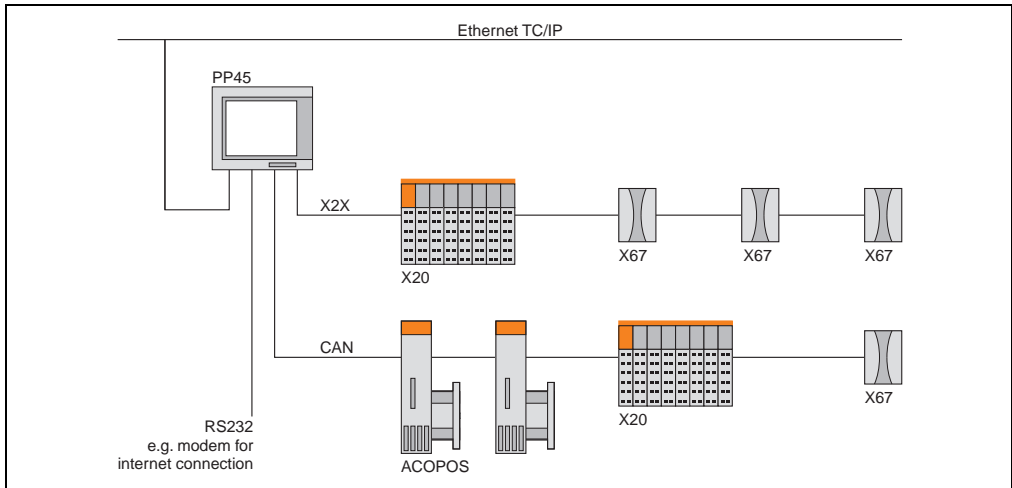
Components and technologies	
Control system	Power Panel 45
Visualization and operation	Power Panel 45
Motion control	ACOPOS: Intelligent servo drives ACOPOSmulti: Modular drive system
Remote I/O systems	X20 System: Slice-based I/O and control system X67 System: Remote I/O with IP67 protection

3. PP45 5.7" LCD m touch screen

3.1 Order data

Model number	Short description	Figure
4PP045.0571-042	Power Panel PP45, touch screen, 5.7" QVGA m LCD, backlighting, 10 touch keys, 64 MB DRAM, 32 KB SRAM, x86 100 MHz Intel compatible, removable application memory (CompactFlash), Ethernet 10/100, X2X Link, 2 x USB, IP 65 protection (front side). Application memory must be ordered separately! Order TB103 and TB704 terminal blocks separately.	
Required accessories		
0TB103.9	Accessory terminal block 3-pin, screw clamp, 3.31 mm², protection against vibration with the screw flange.	
0TB103.91	Accessory terminal block 3-pin, cage clamp, 3.31 mm², protection against vibration with the screw flange.	
0TB704.9	Accessory terminal block, 4-pin, screw clamp, 1.5 mm²	
0TB704.91	Accessory terminal block, 4-pin, cage clamp, 2.5 mm²	
0AC201.9	Lithium batteries, 5 pcs., 3 V / 950 mAh, button cell	
4A0006.00-000	Lithium battery, 3 V / 950 mAh, button cell	
4A0064.00-000	5 DIN A4 legend sheets , 16 fields for a total of 40 devices, CorelDraw template can be downloaded online.	
5CFCRD.0064-03	CompactFlash 64 MB ATA/IDE SiliconSystems	
5CFCRD.0128-03	CompactFlash 128 MB ATA/IDE SiliconSystems	
5CFCRD.0256-03	CompactFlash 256 MB ATA/IDE SiliconSystems	
5CFCRD.0512-03	CompactFlash 512 MB ATA/IDE SiliconSystems	
5CFCRD.1024-03	CompactFlash 1024 MB ATA/IDE SiliconSystems	
5CFCRD.2048-03	CompactFlash 2048 MB ATA/IDE SiliconSystems	
5CFCRD.4096-03	CompactFlash 4096 MB ATA/IDE SiliconSystems	
5CFCRD.8192-03	CompactFlash 8192 MB ATA/IDE SiliconSystems	
Optional accessories		
4PP045.IF10-1	PP45 interface module, 1 RS232 interface	
4PP045.IF23-1	2005 Interface Module, 1 RS485/RS422 interface (RS422: electrically isolated, RS485: electrically isolated and network capable), 1 CAN interface (electrically isolated and network capable).	
4PP045.IF24-1	PP45 interface module, 1 Profibus DP slave interface (electrically isolated and network capable), 1 RS232/RS422/RS485 interface (RS422/RS485: electrically isolated and network-capable)	
4PP045.IF33-1	PP45 interface module, 2 CAN (electrically isolated and network capable).	

Table 5: PP45 LCD m touch screen - Order data

3.2 Technical data

Product ID	PP45 LCD m touch screen
Controller	
Processor	ELAN SC520 100 MHz, Intel compatible
Main memory	64 MB DRAM
SRAM	32 KB, battery-backup
CompactFlash slot	1 slot for Type I CompactFlash card
Insert slot for PP45 interface modules	1
Watchdog	Internal system management controller
Power failure logic	System management controller, 10 ms buffer time
Battery	Lithium, 950 mAh, can be exchanged from the outside
Real-time clock	Battery-buffered
Mode/node switches	2, 16 digits each
Display	
Type	LCD monochrome
Colors	8 shades of gray
Resolution	QVGA, 320 x 240 pixels
Diagonal	5.7"
Brightness	140 cd/m²
Half-brightness time	55,000 h
Front	Multi-layered cover with insertion slots for key labels
Keys	
Touch keys	10 (labeled with legend sheets)
Interfaces	
USB	2 x USB 2.0, type A connection
Ethernet	RJ 45 Twisted Pair (10 BaseT / 100 BaseT)
X2X	X2X Link master
24 VDC supply	
Input voltage	24 VDC ± 25%
General information	
Power consumption	Max. 8 W
Certification	CE, C-UL-US, GOST-R (in development)
Operational conditions	
Operating temperature	0 to +50°C
Relative humidity	10% to 90%, non-condensing
Protection type	IP65 (front side) / IP20 (back side)

Table 6: PP45 LCD m touch screen - Technical data

Product ID	PP45 LCD m touch screen
Storage and transport conditions	
Temperature	-20°C to +70°C
Relative humidity	T ≤ 40°C: 5% to 90%, non-condensing T > 40°C: < 90%, non-condensing
Mechanical characteristics	
Outer dimensions (W x H x D [mm])	203 x 145 x 56.4
Weight	0.5 kg

Table 6: PP45 LCD m touch screen - Technical data

3.3 Additional technical data

Product ID	PP45 LCD m touch screen
Controller	
Battery buffer current	Max. 30 µA
Real-time clock resolution	1 s
Operating system	Automation Runtime
24 VDC supply	
Input voltage (min./nom./max.)	18 VDC / 24 VDC / 30 VDC
Voltage monitoring	An NMI is triggered if the input voltage falls below 15 VDC.
General information	
B&R ID code	$1FB4

Table 7: PP45 LCD m touch screen - Additional technical data

3.4 Diagnostic LEDs

There are four diagnostic LEDs on the back of the PP45:
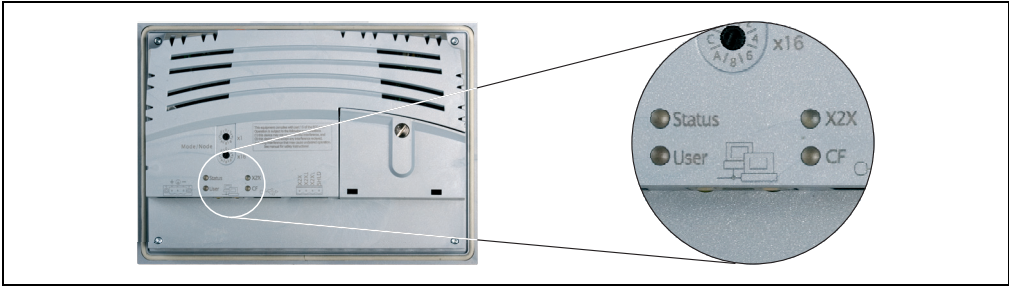
Figure 1: PP45 LCD m touch screen - Diagnostic LEDs

LED	Color	Status	Description
Status	Red	On	Error / Reset
	Green	On	RUN
	Orange	On	Boot, Service or Diagnostics mode
	Green on / Orange blinking		RUN, battery not OK
User	Green	-	This LED can be operated by the user (with the AsHW library). This function is supported by Automation Runtime starting with Version N2.90 / A2.92.
X2X	Orange	On	The module sends data via the X2X Link interface.
CF	Orange	On	Access to the CompactFlash card

Table 8: PP45 LCD m touch screen - Diagnostic LEDs

There are two more LEDs right next to the Ethernet interface:
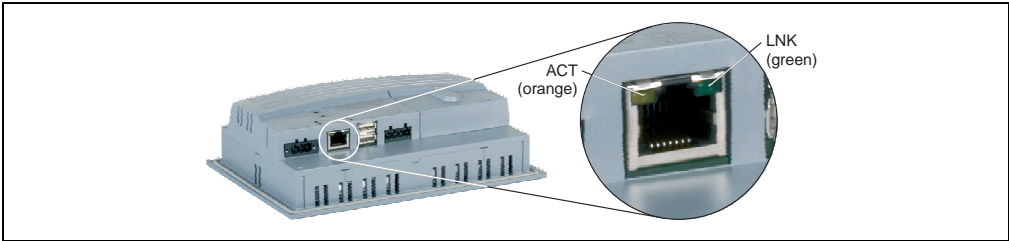
Figure 2: PP45 LCD m touch screen - Ethernet LEDs

LED	Color	Status	Description
ACT	Orange	On	No Ethernet activity on bus
		Blinking	Ethernet activity on bus
LNK	Green	On	A link to the remote station has been established.

Table 9: PP45 LCD m touch screen - Diagnostic LEDs

Chapter 2
Power Panel 45

3.5 Connection elements
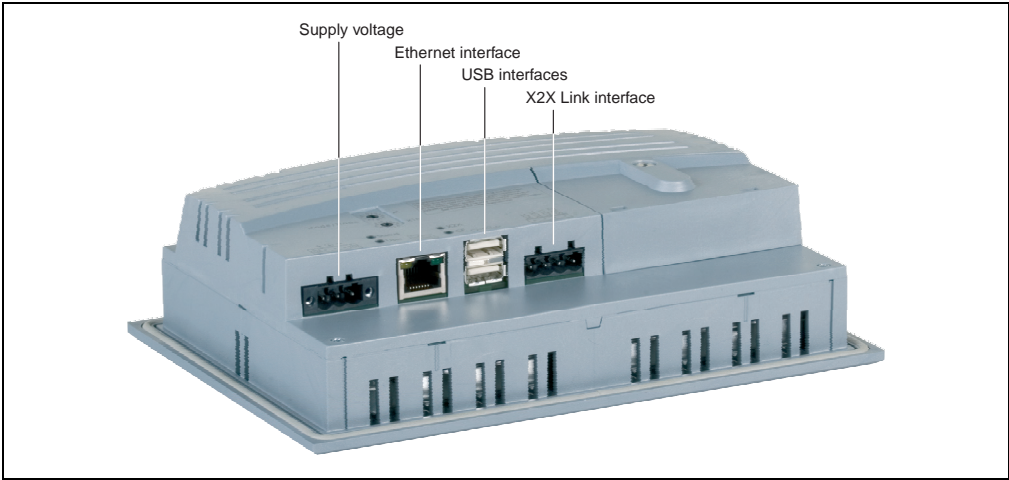
Figure 3: PP45 LCD m touch screen - Connection elements

3.5.1 X2X Link interface
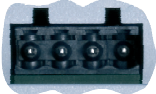
Interface	Pin assignments		
Application interface X2X Link	**Terminal**	**X2X Link**	
	1	X2X	X2X data
	2	X2X⊥	X2X ground
	3	X2X\	X2X data inverted
	4	SHLD	Shield
	Required accessories		
	0TB704.9	Accessory terminal block, 4-pin, screw clamp, 1.5 mm²	
	0TB704.91	Accessory terminal block, 4-pin, cage clamp, 2.5 mm²	
4-pin multipoint connector			

Table 10: PP45 LCD m touch screen - Pin assignments - X2X Link

3.5.2 USB interface

This Power Panel 45 device has a USB 2.0 (Universal Serial Bus) host controller with two USB ports, which are easily accessible for the user.
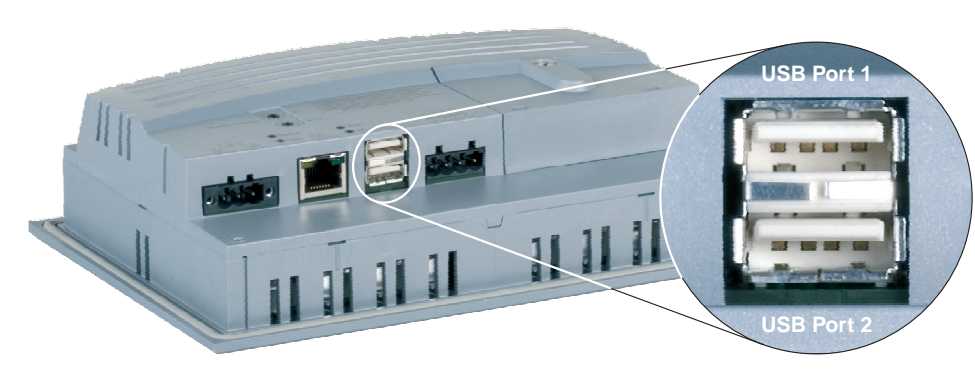
USB interface	
Transfer rate [1]	Low speed (1.5 MBit/s), full speed (12 MBit/s), to high speed (480 Mbit/s)
Power supply	Max. 500 mA per port [2]

Table 11: PP45 LCD m touch screen - USB interface

1) The actual value depends on the operating system or diver being used.

2) For safety, every USB port is equipped with a maintenance free "USB current-limiting circuit breaker" (max. 500 mA)

Warning!

Peripheral USB devices can be connected to the USB interfaces. Due to the vast number of USB devices available on the market, B&R cannot guarantee their performance. B&R does assure the performance of all USB devices that they provide.

Important!

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

3.5.3 Ethernet Interface
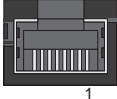
Interface	Pin assignments		
	Terminal		
Ethernet interface	1	RXD	Receive signal
	2	RXD\	Receive signal inverted
	3	TXD	Transmit signal
	4	Termination	Termination
1	5	Termination	Termination
RJ45 twisted pair socket (10BaseT/100BaseT)	6	TXD\	Transmit signal inverted
	7	Termination	Termination
	8	Termination	Termination

Table 12: PP45 LCD m touch screen - Pin assignments - Ethernet interface

3.5.4 Supply voltage

The pin assignments can be found either in the following table or printed on the back of the Power Panel. The Power Panel has reverse polarity protection that prevents the supply voltage from being connected incorrectly, which would damage the device. Overload protection must be provided by an external fuse (5 A, fast-acting).
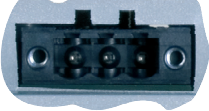
Supply voltage	Pin assignments	
	Terminal	**Assignment**
	$+$	+ 24 VDC
	⏚	Functional grounding
	—	GND
	Required accessories	
	0TB103.9	Accessory terminal block 3-pin, screw clamp, 3.31 mm², protection against vibration with the screw flange.
3-pin multipoint connector	0TB103.91	Accessory terminal block 3-pin, cage clamp, 3.31 mm², protection against vibration with the screw flange.

Table 13: PP45 LCD m touch screen - Pin assignments - Supply voltage

Important!

The pin's connection to the functional ground (e.g. switching cabinet) should be as short as possible. We recommend using the largest possible conductor cross section on the supply plug.

3.6 Operating mode and node number switches
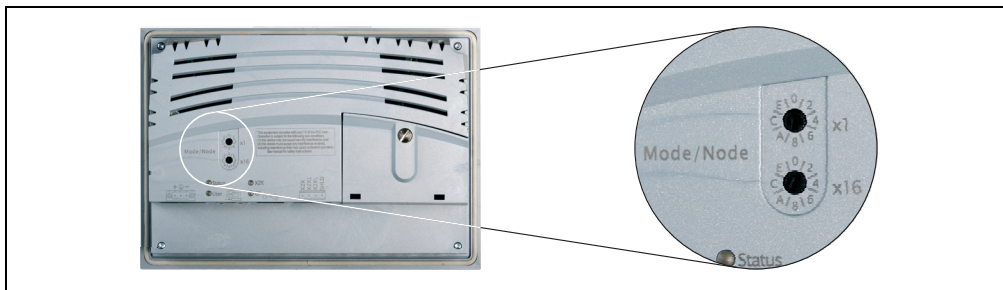
Figure 4: PP45 LCD m touch screen - Operating mode and node number switches

The Power Panel 45 device is equipped with 2 hex switches, which are used as operating mode or node number switches. Switch positions 01 - FE are used to set the INA station number of the Ethernet interface.

Switch position	Description
00	**Boot mode:** The CPU is started in boot mode.
01 - FE	**INA node number** of the Ethernet interface
FF	**Diagnostics mode:** The CPU boots in Diagnostics mode. Program sections in User RAM and User FlashPROM are not initialized. After diagnostics mode, the CPU always boots with a cold restart.

Table 14: PP45 LCD m touch screen - Switch positions of the operating mode and node number switches

3.7 Dimensions
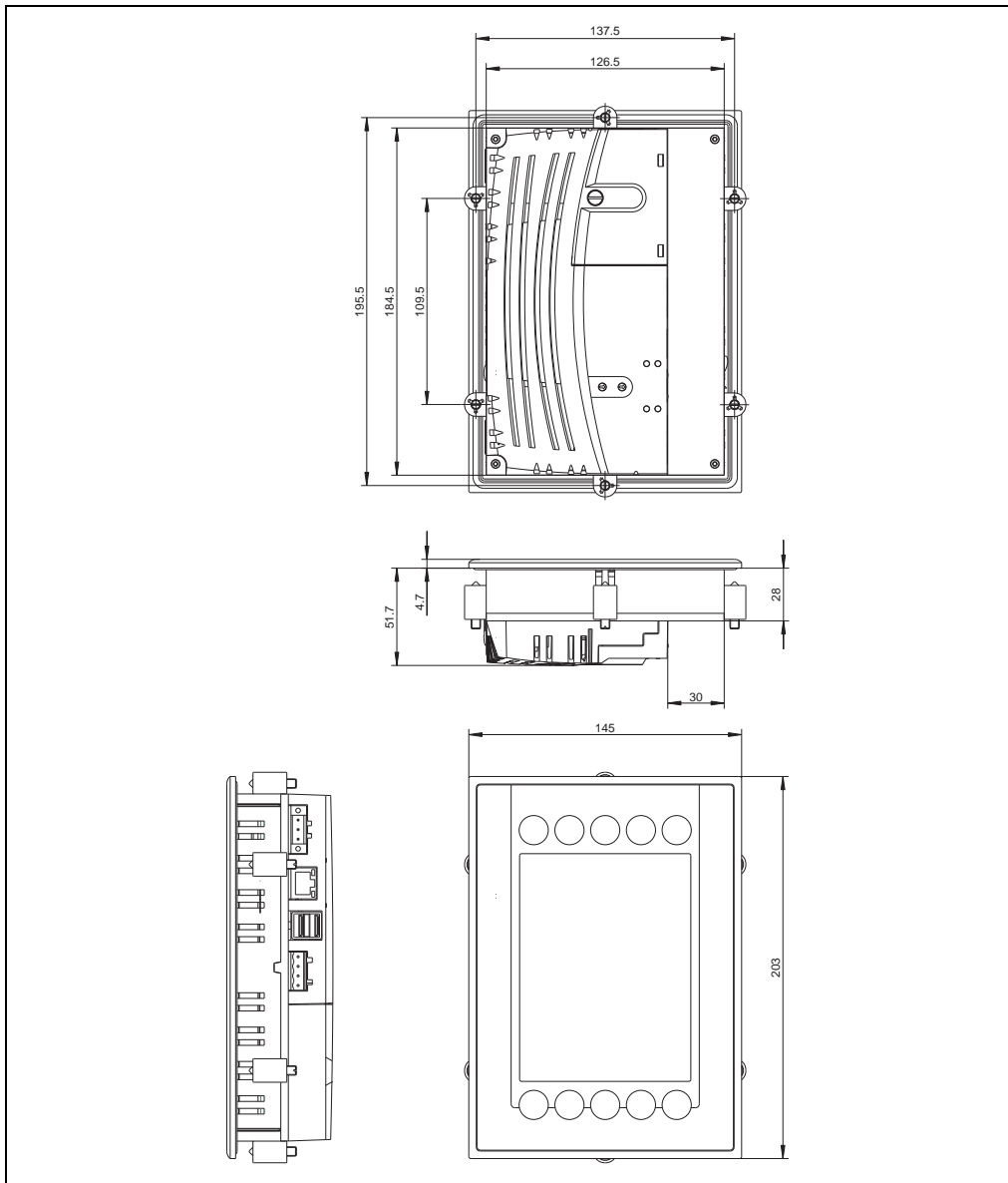
Figure 5: PP45 LCD m touch screen - Dimensions

Installation cutout: 186.1 mm x 128.1 mm

4. PP45 5.7" LCD color touch screen

4.1 Order data

Model number	Short description	Figure
4PP045.0571-062	Power Panel PP45, touch screen, 5.7" QVGA color LCD, backlighting, 10 touch keys, 64 MB DRAM, 32 KB SRAM, x86 100 MHz Intel compatible, removable application memory (CompactFlash), Ethernet 10/100, X2X Link, 2 x USB, IP 65 protection (front side). Application memory must be ordered separately! Order TB103 and TB704 terminal blocks separately.	
Required accessories		
0TB103.9	Accessory terminal block 3-pin, screw clamp, 3.31 mm², protection against vibration with the screw flange.	
0TB103.91	Accessory terminal block 3-pin, cage clamp, 3.31 mm², protection against vibration with the screw flange.	
0TB704.9	Accessory terminal block, 4-pin, screw clamp, 1.5 mm²	
0TB704.91	Accessory terminal block, 4-pin, cage clamp, 2.5 mm²	
0AC201.9	Lithium batteries, 5 pcs., 3 V / 950 mAh, button cell	
4A0006.00-000	Lithium battery, 3 V / 950 mAh, button cell	
4A0064.00-000	5 DIN A4 legend sheets, 16 fields for a total of 40 devices, CorelDraw template can be downloaded online.	
5CFCRD.0064-03	CompactFlash 64 MB ATA/IDE SiliconSystems	
5CFCRD.0128-03	CompactFlash 128 MB ATA/IDE SiliconSystems	
5CFCRD.0256-03	CompactFlash 256 MB ATA/IDE SiliconSystems	
5CFCRD.0512-03	CompactFlash 512 MB ATA/IDE SiliconSystems	
5CFCRD.1024-03	CompactFlash 1024 MB ATA/IDE SiliconSystems	
5CFCRD.2048-03	CompactFlash 2048 MB ATA/IDE SiliconSystems	
5CFCRD.4096-03	CompactFlash 4096 MB ATA/IDE SiliconSystems	
5CFCRD.8192-03	CompactFlash 8192 MB ATA/IDE SiliconSystems	
Optional accessories		
4PP045.IF10-1	PP45 interface module, 1 RS232 interface	
4PP045.IF23-1	2005 Interface Module, 1 RS485/RS422 interface (RS422: electrically isolated, RS485: electrically isolated and network capable), 1 CAN interface (electrically isolated and network capable).	
4PP045.IF24-1	PP45 interface module, 1 Profibus DP slave interface (electrically isolated and network capable), 1 RS232/RS422/RS485 interface (RS422/RS485: electrically isolated and network-capable)	
4PP045.IF33-1	PP45 interface module, 2 CAN (electrically isolated and network capable).	

Table 15: PP45 LCD color touch screen - Order data

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4.2 Technical data

Product ID	PP45 LCD color touch screen
Controller	
Processor	ELAN SC520 100 MHz, Intel compatible
Main memory	64 MB DRAM
SRAM	32 KB, battery-backup
CompactFlash slot	1 slot for Type I CompactFlash card
Insert slot for PP45 interface modules	1
Watchdog	Internal system management controller
Power failure logic	System management controller, 10 ms buffer time
Battery	Lithium, 950 mAh, can be exchanged from the outside
Real-time clock	Battery-buffered
Mode/node switches	2, 16 digits each
Display	
Type	LCD color
Colors	256 colors
Resolution	QVGA, 320 x 240 pixels
Diagonal	5.7"
Brightness	140 cd/m²
Half-brightness time	55,000 h
Front	Multi-layered cover with insertion slots for key labels
Keys	
Touch keys	10 (labeled with legend sheets)
Interfaces	
USB	2 x USB 2.0, type A connection
Ethernet	RJ 45 Twisted Pair (10 BaseT / 100 BaseT)
X2X	X2X Link master
24 VDC supply	
Input voltage	24 VDC ± 25%
General information	
Power consumption	Max. 8 W
Certification	CE, C-UL-US, GOST-R (in development)
Operational conditions	
Operating temperature	0 to +50°C
Relative humidity	10% to 90%, non-condensing
Protection type	IP65 (front side) / IP20 (back side)

Table 16: PP45 LCD color touch screen - Technical data

Product ID	PP45 LCD color touch screen
Storage and transport conditions	
Temperature	-20°C to +70°C
Relative humidity	T ≤ 40°C: 5% to 90%, non-condensing T > 40°C: < 90%, non-condensing
Mechanical characteristics	
Outer dimensions (W x H x D [mm])	203 x 145 x 56.4
Weight	0.5 kg

Table 16: PP45 LCD color touch screen - Technical data

4.3 Additional technical data

Product ID	PP45 LCD color touch screen
Controller	
Battery buffer current	Max. 30 µA
Real-time clock resolution	1 s
Operating system	Automation Runtime
24 VDC supply	
Input voltage (min./nom./max.)	18 VDC / 24 VDC / 30 VDC
Voltage monitoring	An NMI is triggered if the input voltage falls below 15 VDC.
General information	
B&R ID code	$251A

Table 17: PP45 LCD color touch screen - Additional technical data

4.4 Diagnostic LEDs

There are four diagnostic LEDs on the back of the PP45:
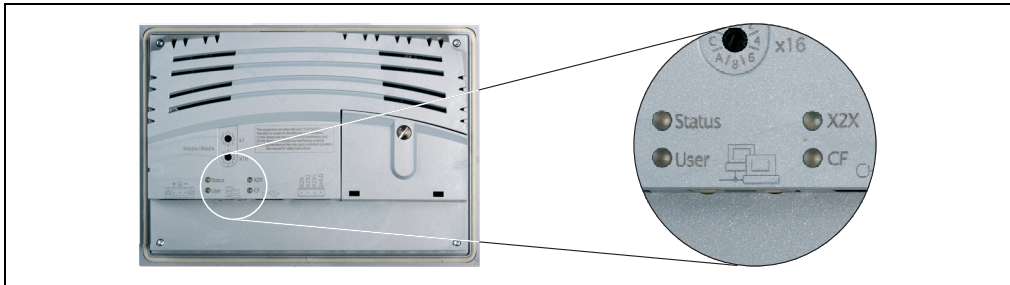
Figure 6: PP45 LCD color touch screen - Diagnostic LEDs

LED	Color	Status	Description
Status	Red	On	Error / Reset
	Green	On	RUN
	Orange	On	Boot, Service or Diagnostics mode
	Green on / Orange blinking		RUN, battery not OK
User	Green	-	This LED can be operated by the user (with the AsHW library). This function is supported by Automation Runtime starting with Version N2.90 / A2.92.
X2X	Orange	On	The module sends data via the X2X Link interface.
CF	Orange	On	Access to the CompactFlash card

Table 18: PP45 LCD color touch screen - Diagnostic LEDs

There are two more LEDs right next to the Ethernet interface:
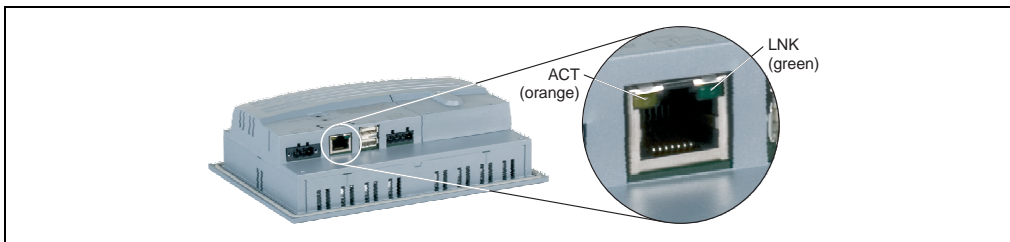
Figure 7: PP45 LCD color touch screen - Ethernet LEDs

LED	Color	Status	Description
ACT	Orange	On	No Ethernet activity on bus
		Blinking	Ethernet activity on bus
LNK	Green	On	A link to the remote station has been established.

Table 19: PP45 LCD color touch screen - Diagnostic LEDs

4.5 Connection elements

Supply voltage
Ethernet interface
USB interfaces
X2X Link interface
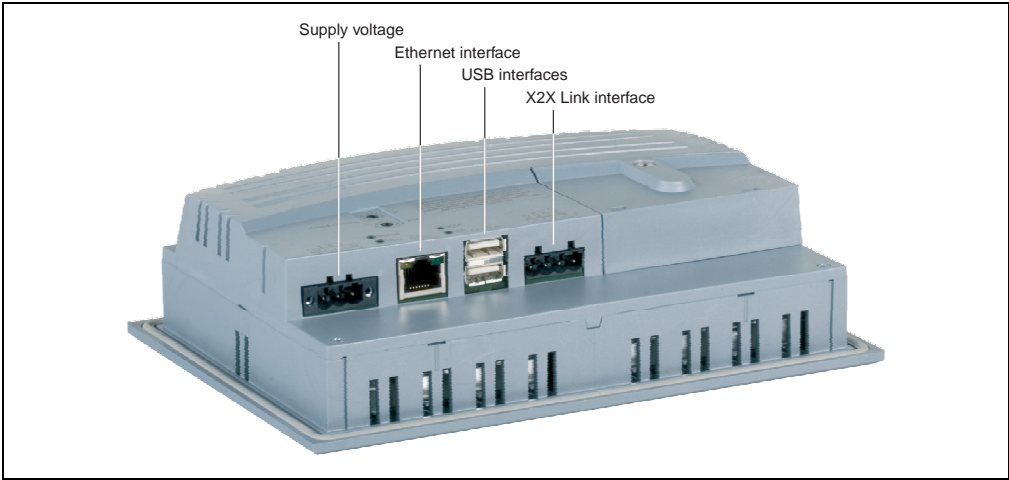
Figure 8: PP45 LCD color touch screen - Connection elements

4.5.1 X2X Link interface
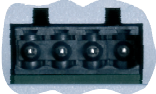
Interface	Pin assignments		
Application interface X2X Link	**Terminal**	**X2X Link**	
	1	X2X	X2X data
	2	X2X⊥	X2X ground
	3	X2X\	X2X data inverted
	4	SHLD	Shield
	Required accessories		
	0TB704.9	Accessory terminal block, 4-pin, screw clamp, 1.5 mm²	
	0TB704.91	Accessory terminal block, 4-pin, cage clamp, 2.5 mm²	
4-pin multipoint connector			

Table 20: PP45 LCD color touch screen - Pin assignments - X2X Link

4.5.2 USB interface

This Power Panel 45 device has a USB 2.0 (Universal Serial Bus) host controller with two USB ports, which are easily accessible for the user.
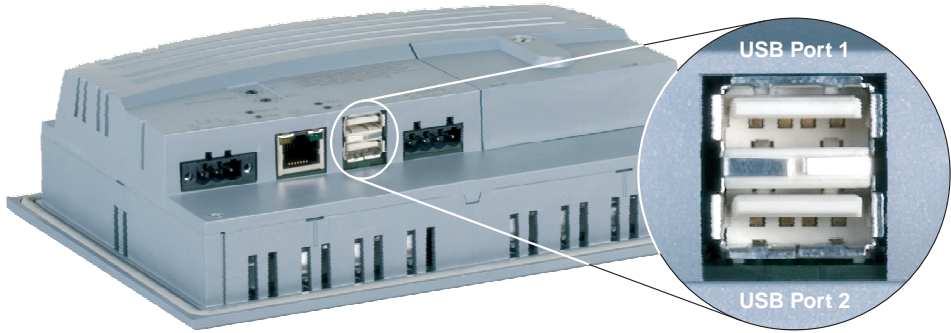
USB interface	
Transfer rate [1]	Low speed (1.5 MBit/s), full speed (12 MBit/s), to high speed (480 Mbit/s)
Power supply	Max. 500 mA per port [2]

Table 21: PP45 LCD color touch screen - USB interface

1) The actual value depends on the operating system or diver being used.
2) For safety, every USB port is equipped with a maintenance free "USB current-limiting circuit breaker" (max. 500 mA)

Warning!

Peripheral USB devices can be connected to the USB interfaces. Due to the vast number of USB devices available on the market, B&R cannot guarantee their performance. B&R does assure the performance of all USB devices that they provide.

Important!

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

4.5.3 Ethernet interface

Interface	Pin assignments		
	Terminal		
Ethernet interface 1 RJ45 twisted pair socket (10BaseT/100BaseT)	1	RXD	Receive signal
	2	RXD\	Receive signal inverted
	3	TXD	Transmit signal
	4	Termination	Termination
	5	Termination	Termination
	6	TXD\	Transmit signal inverted
	7	Termination	Termination
	8	Termination	Termination

Table 22: PP45 LCD color touch screen - Pin assignments - Ethernet interface

4.5.4 Supply voltage

The pin assignments can be found either in the following table or printed on the back of the Power Panel. The Power Panel has reverse polarity protection that prevents the supply voltage from being connected incorrectly, which would damage the device. Overload protection must be provided by an external fuse (5 A, fast-acting).
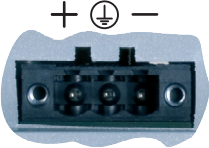
Supply voltage	Pin assignments	
	Terminal	**Assignment**
+ ⊕ − 3-pin multipoint connector	+	+ 24 VDC
	⊕	Functional grounding
	—	GND
	Required accessories	
	0TB103.9	Accessory terminal block 3-pin, screw clamp, 3.31 mm², protection against vibration with the screw flange.
	0TB103.91	Accessory terminal block 3-pin, cage clamp, 3.31 mm², protection against vibration with the screw flange.

Table 23: PP45 LCD color touch screen - Pin assignments - Supply voltage

Important!

The pin's connection to the functional ground (e.g. switching cabinet) should be as short as possible. We recommend using the largest possible conductor cross section on the supply plug.

Chapter 2
Power Panel 45

4.6 Operating mode and node number switches
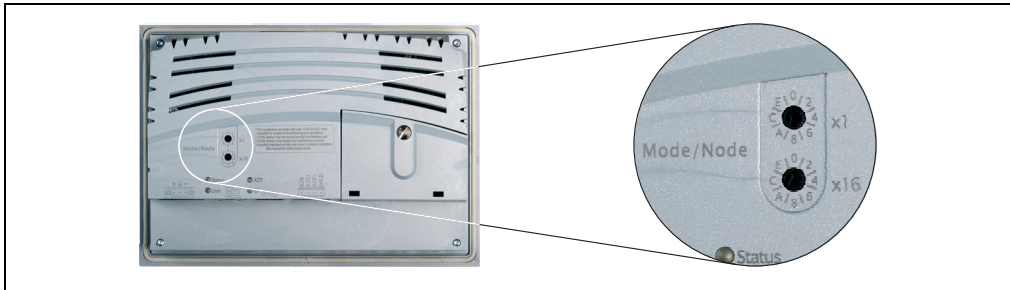
Figure 9: PP45 LCD color touch screen - Operating mode and node number switches

The Power Panel 45 device is equipped with 2 hex switches, which are used as operating mode or node number switches. Switch positions 01 - FE are used to set the INA station number of the Ethernet interface.

Switch position	Description
00	**Boot mode:** The CPU is started in boot mode.
01 - FE	**INA node number** of the Ethernet interface
FF	**Diagnostics mode:** The CPU boots in Diagnostics mode. Program sections in User RAM and User FlashPROM are not initialized. After diagnostics mode, the CPU always boots with a cold restart.

Table 24: PP45 LCD color touch screen - Switch positions of the operating mode and node number switches

4.7 Dimensions
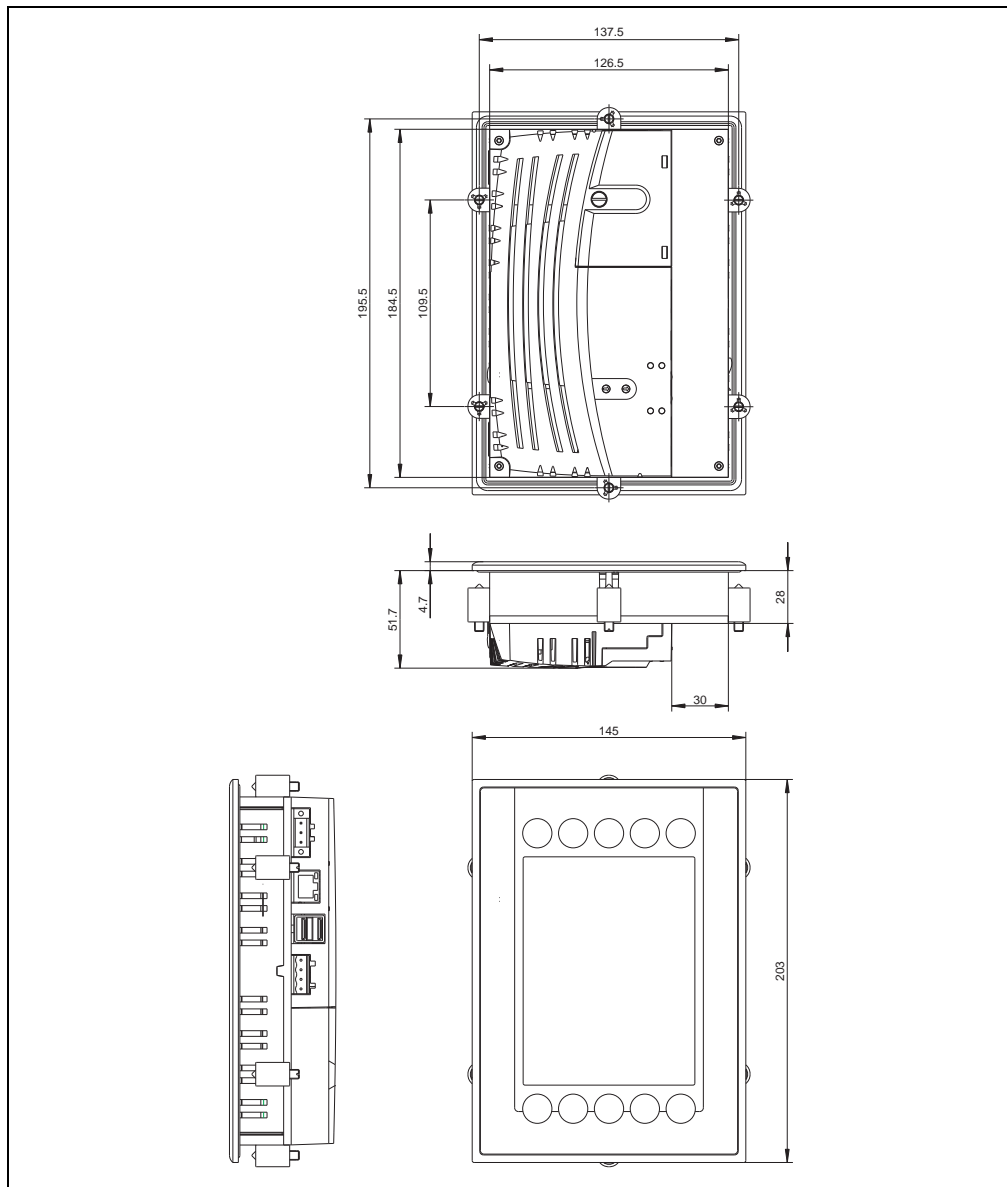
Figure 10: PP45 LCD color touch screen - Dimensions

Installation cutout: 186.1 mm x 128.1 mm

Chapter 2
Power Panel 45

5. PP45 5.7" LCD m

5.1 Order data
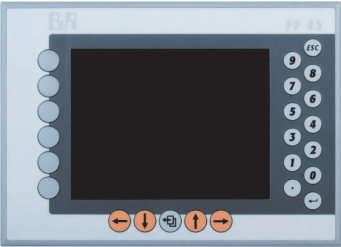
Model number	Short description	Figure
4PP045.0571-L42	Power Panel PP45, 5.7" QVGA m LCD, backlighting, 24 touch keys, 64 MB DRAM, 32 KB SRAM, x86 100 MHz Intel compatible, removable application memory (CompactFlash), Ethernet 10/100, X2X Link, IP 65 protection (front side). Application memory must be ordered separately! Order TB103 and TB704 terminal blocks separately.	
Required accessories		
0TB103.9	Accessory terminal block 3-pin, screw clamp, 3.31 mm², protection against vibration with the screw flange.	
0TB103.91	Accessory terminal block 3-pin, cage clamp, 3.31 mm², protection against vibration with the screw flange.	
0TB704.9	Accessory terminal block, 4-pin, screw clamp, 1.5 mm²	
0TB704.91	Accessory terminal block, 4-pin, cage clamp, 2.5 mm²	
0AC201.9	Lithium batteries, 5 pcs., 3 V / 950 mAh, button cell	
4A0006.00-000	Lithium battery, 3 V / 950 mAh, button cell	
5CFCRD.0064-03	CompactFlash 64 MB ATA/IDE SiliconSystems	
5CFCRD.0128-03	CompactFlash 128 MB ATA/IDE SiliconSystems	
5CFCRD.0256-03	CompactFlash 256 MB ATA/IDE SiliconSystems	
5CFCRD.0512-03	CompactFlash 512 MB ATA/IDE SiliconSystems	
5CFCRD.1024-03	CompactFlash 1024 MB ATA/IDE SiliconSystems	
5CFCRD.2048-03	CompactFlash 2048 MB ATA/IDE SiliconSystems	
5CFCRD.4096-03	CompactFlash 4096 MB ATA/IDE SiliconSystems	
5CFCRD.8192-03	CompactFlash 8192 MB ATA/IDE SiliconSystems	
Optional accessories		
4PP045.IF10-1	PP45 interface module, 1 RS232 interface	
4PP045.IF23-1	2005 Interface Module, 1 RS485/RS422 interface (RS422: electrically isolated, RS485: electrically isolated and network capable), 1 CAN interface (electrically isolated and network capable).	
4PP045.IF24-1	PP45 interface module, 1 Profibus DP slave interface (electrically isolated and network capable), 1 RS232/RS422/RS485 interface (RS422/RS485: electrically isolated and network-capable)	
4PP045.IF33-1	PP45 interface module, 2 CAN (electrically isolated and network capable).	

Table 25: PP45 LCD m - Order data

5.2 Technical data

Product ID	PP45 LCD m
Controller	
Processor	ELAN SC520 100 MHz, Intel compatible
Main memory	64 MB DRAM
SRAM	32 KB, battery-backup
CompactFlash slot	1 slot for Type I CompactFlash card
Insert slot for PP45 interface modules	1
Watchdog	Internal system management controller
Power failure logic	System management controller, 10 ms buffer time
Battery	Lithium, 950 mAh, can be exchanged from the outside
Real-time clock	Battery-buffered
Mode/node switches	2, 16 digits each
Display	
Type	LCD monochrome
Colors	8 shades of gray
Resolution	QVGA, 320 x 240 pixels
Diagonal	5.7"
Brightness	140 cd/m²
Half-brightness time	55,000 h
Front	Multi-layered cover with insertion slots for key labels
Keys	
Design	Mylar keypad with metallic snap-action disks
Front	Multi-layered cover with insertion slots for key legends
Total keys	24 membrane keys
Function keys	6 (labeled with legend sheets)
System keys	18 (number block, cursor block, control keys)
Interfaces	
Ethernet	RJ 45 Twisted Pair (10 BaseT / 100 BaseT)
X2X	X2X Link master
24 VDC supply	
Input voltage	24 VDC ± 25%
General information	
Power consumption	Max. 8 W
Certification	CE, C-UL-US, GOST-R (in development)

Table 26: PP45 LCD m - Technical data

Product ID	PP45 LCD m
Operational conditions	
Operating temperature	0 to +50°C
Relative humidity	10% to 90%, non-condensing
Protection type	IP65 (front side) / IP20 (back side)
Storage and transport conditions	
Temperature	-20°C to +70°C
Relative humidity	T ≤ 40°C: 5% to 90%, non-condensing T > 40°C: < 90%, non-condensing
Mechanical characteristics	
Outer dimensions (W x H x D [mm])	203 x 145 x 56.4
Weight	0.5 kg

Table 26: PP45 LCD m - Technical data

5.3 Additional technical data

Product ID	PP45 LCD m
Controller	
Battery buffer current	Max. 30 µA
Real-time clock resolution	1 s
Operating system	Automation Runtime
24 VDC supply	
Input voltage (min./nom./max.)	18 VDC / 24 VDC / 30 VDC
Voltage monitoring	An NMI is triggered if the input voltage falls below 15 VDC.
General information	
B&R ID code	$2519

Table 27: PP45 LCD m - Additional technical data

5.4 Diagnostic LEDs

There are four diagnostic LEDs on the back of the PP45:
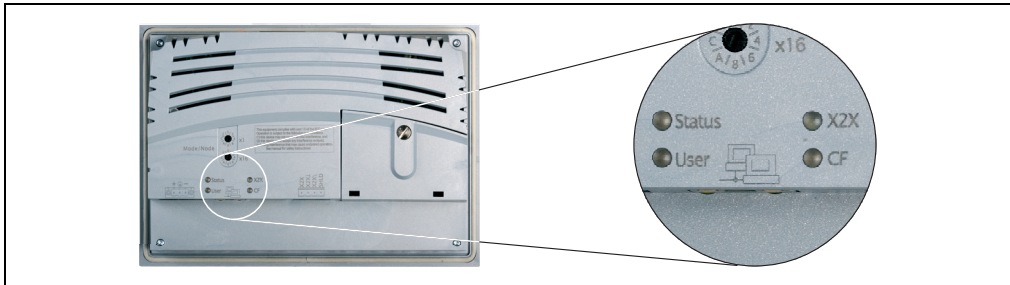
Figure 11: PP45 LCD m - Diagnostic LEDs

LED	Color	Status	Description
Status	Red	On	Error / Reset
	Green	On	RUN
	Orange	On	Boot, Service or Diagnostics mode
	Green on / Orange blinking		RUN, battery not OK
User	Green	-	This LED can be operated by the user (with the AsHW library). This function is supported by Automation Runtime starting with Version N2.90 / A2.92.
X2X	Orange	On	The module sends data via the X2X Link interface.
CF	Orange	On	Access to the CompactFlash card

Table 28: PP45 LCD m - Diagnostic LEDs

There are two more LEDs right next to the Ethernet interface:
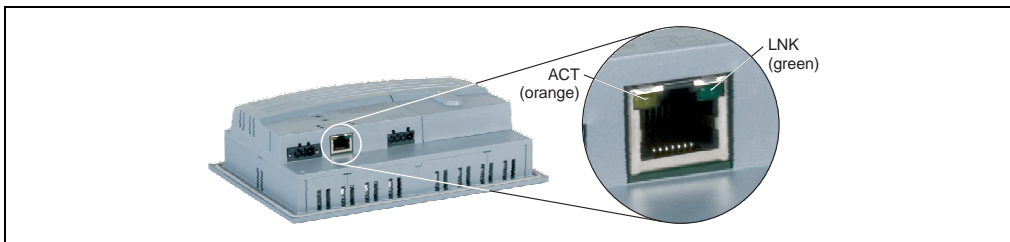
Figure 12: PP45 LCD m - Ethernet LEDs

LED	Color	Status	Description
ACT	Orange	On	No Ethernet activity on bus
		Blinking	Ethernet activity on bus
LNK	Green	On	A link to the remote station has been established.

Table 29: PP45 LCD m - Diagnostic LEDs

5.5 Connection elements
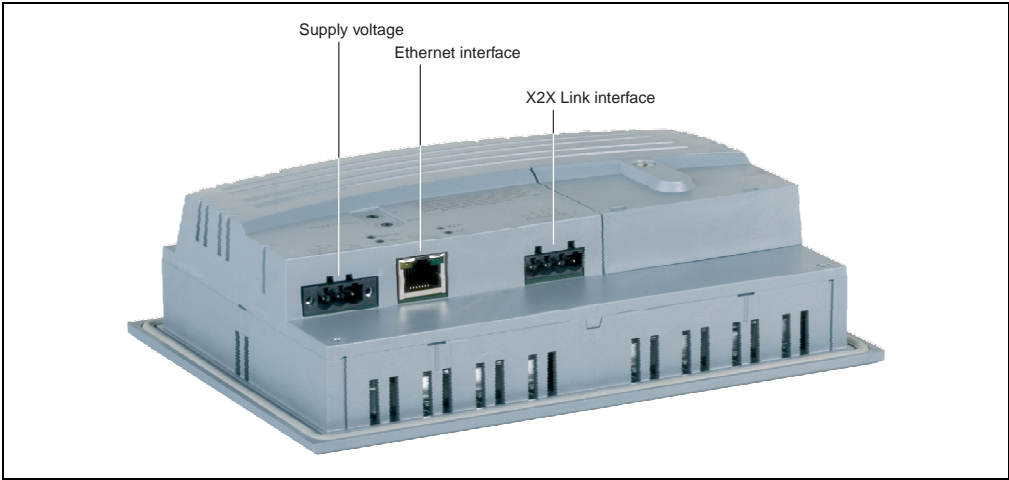
Figure 13: PP45 LCD m - Connection elements

5.5.1 X2X Link interface
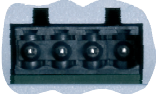
Interface	Pin assignments		
Application interface X2X Link 4-pin multipoint connector	**Terminal**	**X2X Link**	
	1	X2X	X2X data
	2	X2X⊥	X2X ground
	3	X2X\	X2X data inverted
	4	SHLD	Shield
	Required accessories		
	0TB704.9	Accessory terminal block, 4-pin, screw clamp, 1.5 mm²	
	0TB704.91	Accessory terminal block, 4-pin, cage clamp, 2.5 mm²	

Table 30: PP45 LCD m - Pin assignments - X2X Link

5.5.2 Ethernet Interface

Interface	Pin assignments		
	Terminal		
Ethernet interface 1 RJ45 twisted pair socket (10BaseT/100BaseT)	1	RXD	Receive signal
	2	RXD\	Receive signal inverted
	3	TXD	Transmit signal
	4	Termination	Termination
	5	Termination	Termination
	6	TXD\	Transmit signal inverted
	7	Termination	Termination
	8	Termination	Termination

Table 31: PP45 LCD m - Pin assignments - Ethernet interface

5.5.3 Supply voltage

The pin assignments can be found either in the following table or printed on the back of the Power Panel. The Power Panel has reverse polarity protection that prevents the supply voltage from being connected incorrectly, which would damage the device. Overload protection must be provided by an external fuse (5 A, fast-acting).

Supply voltage	Pin assignments	
	Terminal	**Assignment**
3-pin multipoint connector	$+$	+ 24 VDC
	⊕	Functional grounding
	—	GND
	Required accessories	
	0TB103.9	Accessory terminal block 3-pin, screw clamp, 3.31 mm², protection against vibration with the screw flange.
	0TB103.91	Accessory terminal block 3-pin, cage clamp, 3.31 mm², protection against vibration with the screw flange.

Table 32: PP45 LCD m - Pin assignments - Supply voltage

Important!

The pin's connection to the functional ground (e.g. switching cabinet) should be as short as possible. We recommend using the largest possible conductor cross section on the supply plug.

5.6 Operating mode and node number switches
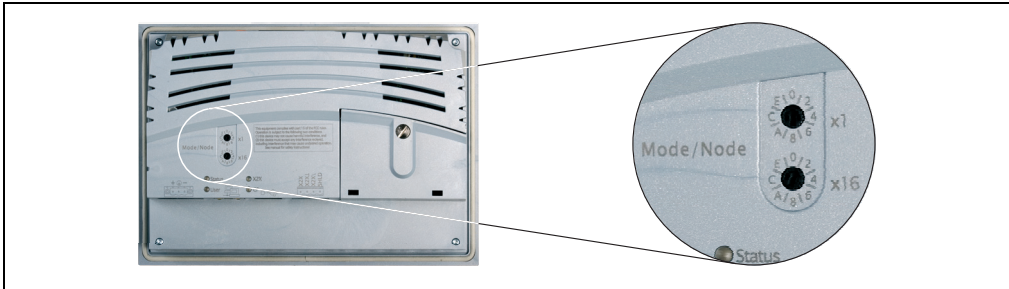
Figure 14: PP45 LCD m - Operating mode and node number switches

The Power Panel 45 device is equipped with 2 hex switches, which are used as operating mode or node number switches. Switch positions 01 - FE are used to set the INA station number of the Ethernet interface.

Switch position	Description
00	**Boot mode:** The CPU is started in boot mode.
01 - FE	**INA node number** of the Ethernet interface
FF	**Diagnostics mode:** The CPU boots in Diagnostics mode. Program sections in User RAM and User FlashPROM are not initialized. After diagnostics mode, the CPU always boots with a cold restart.

Table 33: PP45 LCD m - Switch positions of the operating mode and node number switches

5.7 Dimensions
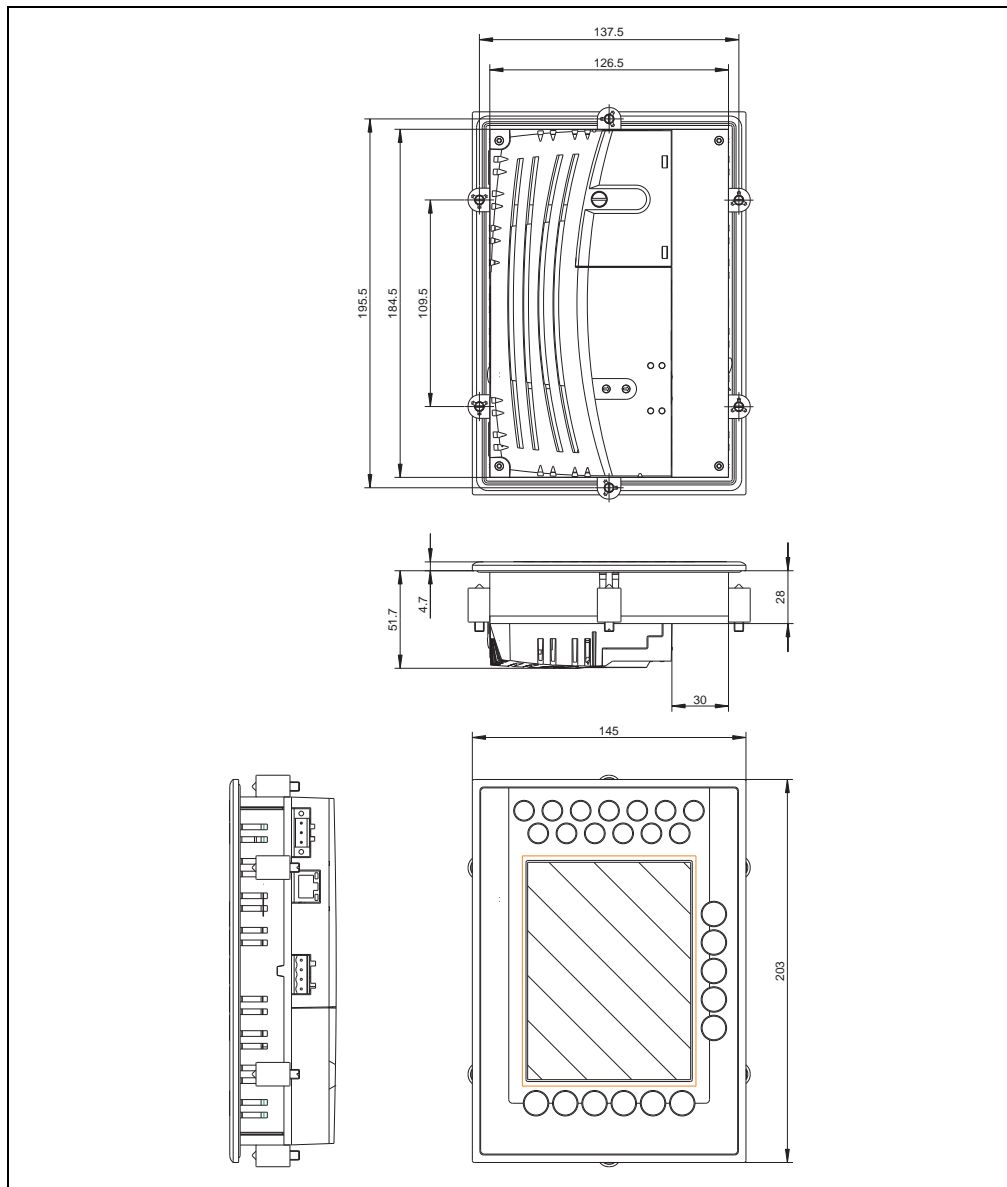
Figure 15: PP45 LCD m - Dimensions

Installation cutout: 186.1 mm x 128.1 mm

Chapter 3 • PP45 interface modules

1. General information

In addition to the integrated interfaces (Ethernet, X2X, USB), Power Panel 45 devices also have a slot for interface modules. Depending on requirements, the Power Panel 45 can be equipped with CAN bus, Profibus DP slave, or RS485/RS232 interfaces, making it perfectly suited for demanding tasks.

2. Overview

Interface module	RS232	RS485/RS422	CAN bus	Profibus DP slave	Page
4PP045.IF10-1	1	-	-	-	52
4PP045.IF23-1	1	1	1	-	55
4PP045.IF24-1	1	1	-	1	60
4PP045.IF33-1	-	-	2	-	65

Table 34: PP45 interface modules - Overview

Chapter 3
PP45 interface modules

3. IF10

3.1 Order data

Model number	Short description	Figure
4PP045.IF10-1	PP45 interface module, 1 RS232 interface	
Optional accessories		
0G0001.00-090	Cable PC <-> PLC/PW, RS232, online cable	

Table 35: 4PP045.IF10-1 - Order data

3.2 Technical data

Product ID	4PP045.IF10-1
Short description	
Communication module	1 x RS232
Interfaces	

Interface IF1
    Type
    Design
    Maximum transfer rate
	RS232
	9-pin DSUB connector
	115.2 kBit/s

General information	
Status indicators	Data transfer
Diagnostics Data transfer	Yes, with status LEDs
Electrical isolation PLC - IF1	No
Certification	CE, C-UL-US, GOST-R
Operational conditions	
Operating temperature	0°C to +50°C
Relative humidity	10 to 90%, non-condensing
Protection type	IP20
Storage and transport conditions	
Temperature	-25°C to +70°C
Relative humidity	10 to 90%, non-condensing
Mechanical characteristics	
Slot	PP45 insert

Table 36: 4PP045.IF10-1 - technical data

3.3 Additional technical data

Product ID	4PP045.IF10-1
IF1 interface, RS232	
Controller	UART type 16C550 compatible
FIFO	16 bytes in send and receive direction
Input filter / protective circuit	Yes
Maximum distance	15 m / 19200 bit/s
Handshake lines	RTS, CTS
Network-capable	No
Data formats 　Data bits 　Parity 　Stop bits	5 to 8 Yes / No / Even / Odd 1 / 2
General information	
B&R ID code	$250B

Table 37: 4PP045.IF10-1 - Additional technical data

3.4 Status LEDs
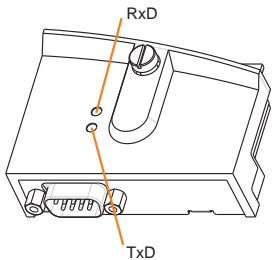
Figure	LED	Color	Status	Description
	RxD	Orange	On	The module is receiving data via the RS232 interface
	TxD	Orange	On	The module is sending data via the RS232 interface

Table 38: 4PP045.IF10-1 - Status LEDs

3.5 RS232 interface
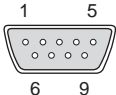
Interface	Pin assignments		
	Pin	**RS232**	
RS232 interface 1 5 6 9 9-pin DSUB connector	1	NC	
	2	RxD	Receive signal
	3	TxD	Transmit signal
	4	NC	
	5	GND	Ground
	6	NC	
	7	RTS	Request To Send
	8	CTS	Clear To Send
	9	NC	

Table 39: 4PP045.IF10-1 - RS232 interface

4. IF23

4.1 Order data

Model number	Short description	Figure
4PP045.IF23-1	2005 Interface Module, 1 RS485/RS422 interface (RS422: electrically isolated, RS485: electrically isolated and network capable), 1 CAN interface (electrically isolated and network capable). Order 0TB710.91 terminal blocks separately.	
Optional accessories		
0AC913.93	Bus adapter, CAN, 2 CAN interfaces, including 30 cm attachment cable (TB704)	
0G0001.00-090	Cable PC <-> PLC/PW, RS232, online cable	
0TB704.9	Accessory terminal block, 4-pin, screw clamp, 1.5 mm²	
0TB704.91	Accessory terminal block, 4-pin, cage clamp, 2.5 mm²	

Table 40: 4PP045.IF23-1 - Order data

4.2 Technical data

Product ID	4PP045.IF23-1
Short description	
Communication module	1x RS232/RS422/RS485, 1x CAN
Interfaces	

Interface IF1
    Type
    Design
    Maximum transfer rate
	RS232
	9-pin DSUB connector (shared with IF2)
	115.2 kBit/s

Interface IF2
    Type
    Design
    Maximum transfer rate
	RS485/RS422
	9-pin DSUB connector (shared with IF1)
	115.2 kBit/s

Interface IF3
    Type
    Design
    Maximum transfer rate
	CAN bus
	4-pin multipoint connector
	1 MBit/s

Table 41: 4PP045.IF23-1 - technical data

Product ID	4PP045.IF23-1
General information	

Status display
  RS232 and CAN bus
  RS485/RS422
	Data transfer per interface
	No display

Diagnostics Data transfer	Yes, with status LEDs

Electrical isolation
  PLC - IF1
  PLC - IF2/IF3
  IF1 - IF2/IF3
  IF2 - IF3
	No
	Yes
	Yes
	Yes

Certification	CE, C-UL-US, GOST-R
Operational conditions	
Operating temperature	0°C to +50°C
Relative humidity	10 to 90%, non-condensing
Protection type	IP20
Storage and transport conditions	
Temperature	-25°C to +70°C
Relative humidity	10 to 90%, non-condensing
Mechanical characteristics	
Slot	PP45 insert

Table 41: 4PP045.IF23-1 - technical data (cont.)

4.3 Additional technical data

Product ID	4PP045.IF23-1
IF1 interface, RS232	
Controller	UART type 16C550 compatible
FIFO	16 bytes in send and receive direction
Input filter / protective circuit	Yes
Maximum distance	15 m / 19200 bit/s
Handshake lines	RTS, CTS
Network-capable	No

Data formats
  Data bits
  Parity
  Stop bits
	5 to 8
	Yes / No / Even / Odd
	1 / 2

Table 42: 4PP045.IF23-1 - Additional technical data

Product ID	4PP045.IF23-1
Interface IF2, RS485/RS422	
Controller	UART type 16C550 compatible
FIFO	16 bytes in send and receive direction
Maximum distance	500 m
Network-capable	Yes
Terminating resistors	Integrated in the module
Interface IF3, CAN bus	
Controller	SJA 1000 controller
Maximum distance	1000 m
Maximum transfer rate Bus length ≤25 m Bus length ≤60 m Bus length ≤200 m Bus length ≤1000 m	1 MBit/s 500 kBit/s 250 kBit/s 50 kBit/s
Network-capable	Yes
Terminating resistors	Integrated in the module, switchable
General information	
B&R ID code	$250D

Table 42: 4PP045.IF23-1 - Additional technical data (cont.)

4.4 Status LEDs
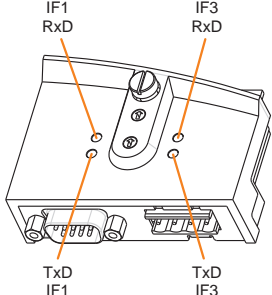
Figure	LED	Color	Status	Description
IF1 RxD / IF3 RxD / TxD IF1 / TxD IF3	RxD	Orange	On	The module is receiving data via the interface
	TxD	Orange	On	The module is sending data via the interface
	IF1 ...RS232 interface IF3 ...CAN bus interface			

Table 43: 4PP045.IF23-1 - Status LEDs

4.5 CAN bus node number
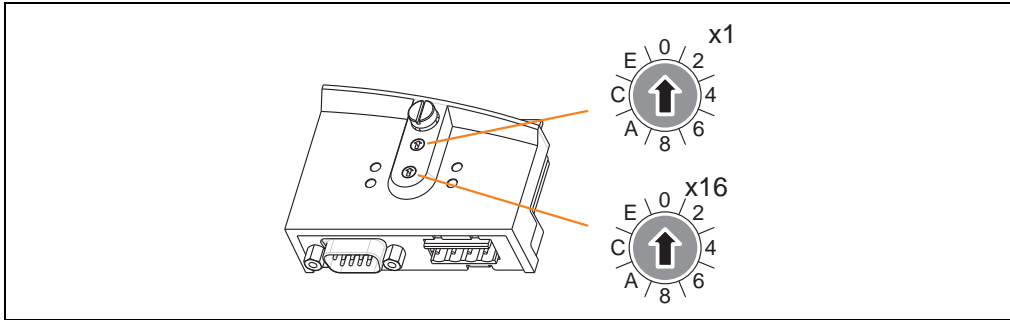
Figure 16: 4PP045.IF23-1 - CAN bus node number switch

Both of these hex switches are used to configure the node number for the CAN bus interface.

4.6 RS232 (IF1) or RS485/RS422 (IF2) interface
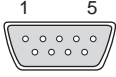
Interface	Pin assignments			
	Pin	RS232	RS485/RS422	
RS232 or RS485/RS422 interface 1 5 6 9 9-pin DSUB connector	1		TxD	Transmit signal
	2	RxD		Receive signal
	3	TxD		Transmit signal
	4		RxD	Receive signal
	5	GND		Ground
	6		RxD\	Receive signal inverted
	7	RTS		Request To Send
	8	CTS		Clear To Send
	9		TxD\	Transmit signal inverted

Table 44: 4PP045.IF23-1 - RS232 (IF1) or RS485/RS422 (IF2) interface

Information:

Interfaces IF1 and IF2 can be used simultaneously when wired appropriately.

4.7 CAN bus interface (IF3)
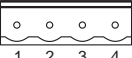
Interface	Pin assignments		
	Pin	CAN bus	
CAN bus interface ○ ○ ○ ○ 1　2　3　4 4-pin multipoint connector	1	CAN_H	CAN high
	2	CAN⊥	CAN ground
	3	CAN_L	CAN low
	4	SHLD	Shield

Table 45: 4PP045.IF23-1 - CAN bus interface (IF3)

4.8 Terminating resistors

There are two switches on the back of the interface module which can be used to switch on a terminating resistor for IF2 (RS485/RS422) and for IF3 (CAN bus).
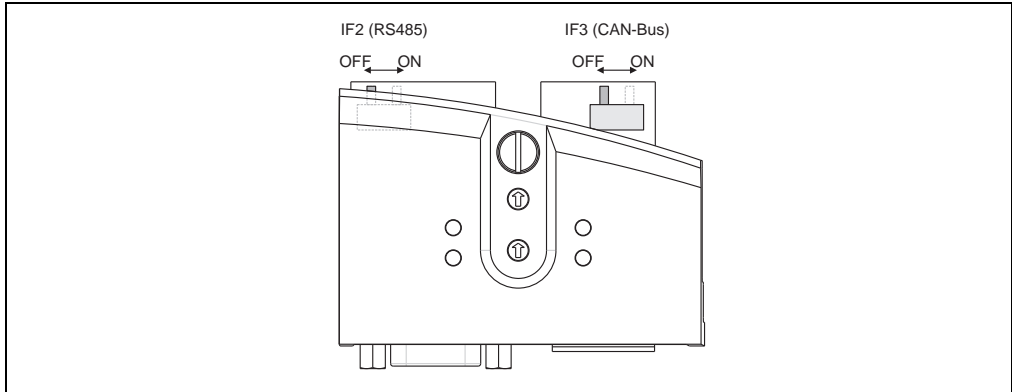
Figure 17: 4PP045.IF23-1 - Terminating resistors for IF2 and IF3

Interface	Switch position	Description
IF2 (RS485/RS422)	ON	Terminating resistor activated (150 Ω)
	OFF	Terminating resistor deactivated
IF3 (CAN bus)	ON	Terminating resistor activated (120 Ω)
	OFF	Terminating resistor deactivated

Table 46: 4PP045.IF23-1 - Terminating resistors for IF2 and IF3

5. IF24

5.1 Order data

Model number	Short description	Figure
4PP045.IF24-1	PP45 interface module, 1 Profibus DP slave interface (electrically isolated and network capable), 1 RS232/RS422/RS485 interface (RS422/RS485: electrically isolated and network-capable)	
Optional accessories		
0G0001.00-090	Cable PC <-> PLC/PW, RS232, online cable	
0G1000.00-090	Bus connector, RS485, for Profibus networks, remote I/O	

Table 47: 4PP045.IF24-1 - Order data

5.2 Technical data

Product ID	4PP045.IF24-1
Short description	
Communication module	1x RS232/RS422/RS485, 1x Profibus DP slave
Interfaces	

Interface IF1
    Type
    Design
    Maximum transfer rate
	RS232
	9-pin DSUB connector (shared with IF2)
	115.2 kBit/s

Interface IF2
    Type
    Design
    Maximum transfer rate
	RS485/RS422
	9-pin DSUB connector (shared with IF1)
	115.2 kBit/s

Interface IF3
    Fieldbus
    Type
    Design
    Maximum transfer rate
	Profibus DP slave
	RS485
	9-pin DSUB socket
	12 MBit/s

General information	
Status indicators	Data transfer per interface
Diagnostics Data transfer	Yes, with status LEDs

Electrical isolation
    PLC - IF1
    PLC - IF2
    PLC - IF3
	No
	Yes
	Yes

Certification	CE, C-UL-US, GOST-R

Table 48: 4PP045.IF24-1 - technical data

Product ID	4PP045.IF24-1
Operational conditions	
Operating temperature	0°C to +50°C
Relative humidity	10 to 90%, non-condensing
Protection type	IP20
Storage and transport conditions	
Temperature	-25°C to +70°C
Relative humidity	10 to 90%, non-condensing
Mechanical characteristics	
Slot	PP45 insert

Table 48: 4PP045.IF24-1 - technical data (cont.)

5.3 Additional technical data

Product ID	4PP045.IF24-1
IF1 interface, RS232	
Controller	UART type 16C550 compatible
FIFO	16 bytes in send and receive direction
Input filter / protective circuit	Yes
Maximum distance	15 m / 19200 bit/s
Handshake lines	RTS, CTS
Network-capable	No

Data formats
    Data bits
    Parity
    Stop bits
	5 to 8
	Yes / No / Even / Odd
	1 / 2

Interface IF2, RS485/RS422	
Controller	UART type 16C550 compatible
FIFO	16 bytes in send and receive direction
Maximum distance	500 m
Network-capable	Yes
Terminating resistors	Integrated in the module, switchable
IF3 interface, profibus DP slave	
Controller	ASIC SPC3
RAM	1.5 KB
Maximum distance	1000 m

Maximum transfer rate
    Bus length <100 m
    Bus length <200 m
    Bus length <400 m
    Bus length <1000 m
	12 MBit/s
	1.5 MBit/s
	500 kBit/s
	187.5 kBit/s

Table 49: 4PP045.IF24-1 - Additional technical data

Chapter 3
PP45 interface modules

Product ID	4PP045.IF24-1
Network-capable	Yes
Terminating resistors	Integrated in the module
General information	
B&R ID code	$250C

Table 49: 4PP045.IF24-1 - Additional technical data (cont.)

5.4 Status LEDs
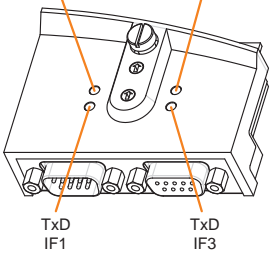
Figure	LED	Color	Status	Description
IF1 RxD · IF3 RxD · TxD IF1 · TxD IF3	RxD	Orange	On	The module is receiving data via the interface
	TxD	Orange	On	The module is sending data via the interface
	IF1 ...RS232 interface IF3 ...Profibus DP slave interface			

Table 50: 4PP045.IF24-1 - Status LEDs

5.5 Profibus DP slave node number

Figure 18: 4PP045.IF24-1 - Profibus DP slave node number switch

The node number for the Profibus DP slave interface is set with the two hex switches.

5.6 RS232 (IF1) or RS485/RS422 (IF2) interface

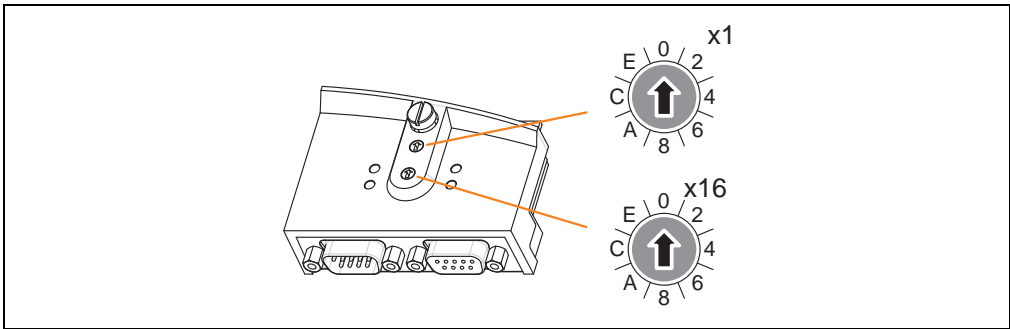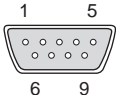| Interface	Pin assignments			
	Pin	RS232	RS485/RS422	
RS232 or RS485/RS422 interface 1　　5 ○ ○ ○ ○ ○ ○ ○ ○ ○ 6　　9 9-pin DSUB connector	1		TxD	Transmit signal
	2	RxD		Receive signal
	3	TxD		Transmit signal
	4		RxD	Receive signal
	5	GND		Ground
	6		RxD\	Receive signal inverted
	7	RTS		Request To Send
	8	CTS		Clear To Send
	9		TxD\	Transmit signal inverted

Table 51: 4PP045.IF24-1 - RS232 (IF1) or RS485/RS422 (IF2) interface

Information:

Interfaces IF1 and IF2 can be used simultaneously when wired appropriately.

5.7 Profibus DP slave interface (IF3)
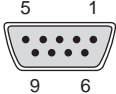
Interface	Pin assignments		
	Pin	Profibus	
Profibus DP slave interface 5　　1 ● ● ● ● ● ● ● ● ● 9　　6 9-pin DSUB socket	1	NC	
	2	NC	
	3	DATA	Data
	4	CTRL	Transmit enable
	5	GND	Profibus GND (electrically isolated)
	6	+5 V / 50 mA	Supply (electrically isolated)
	7	NC	
	8	DATA\	Data inverted
	9	CTRL\	Transmit enable inverted

Table 52: 4PP045.IF24-1 - Profibus DP slave interface

5.8 Terminating resistors

There are two switches on the back of the interface module which can be used to switch on a terminating resistor for IF2 (RS485) and for IF3 (CAN bus).
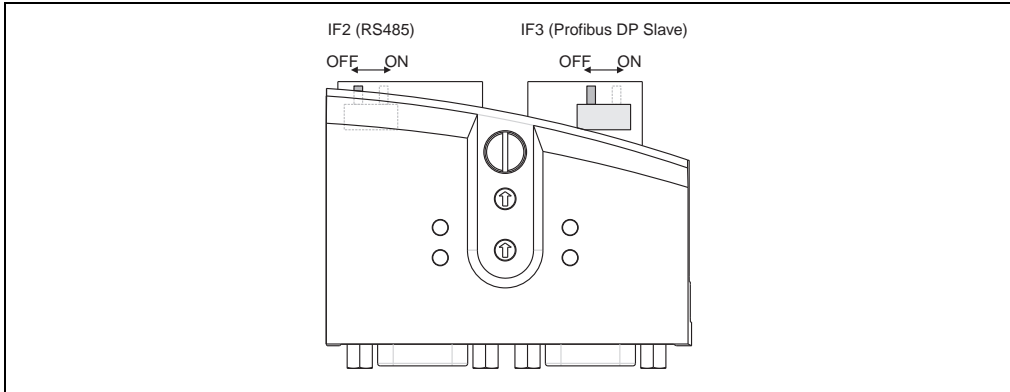
Figure 19: 4PP045.IF24-1 - Terminating resistors for IF2 and IF3

Interface	Switch position	Description
IF2 (RS485)	ON	Terminating resistor activated (150 Ω)
	OFF	Terminating resistor deactivated
IF3 (Profibus DP slave)	ON	Terminating resistor activated (150 Ω)
	OFF	Terminating resistor deactivated

Table 53: 4PP045.IF24-1 - Terminating resistors for IF2 and IF3

6. IF33

The IF33 interface module is used for application-specific expansion of the Power Panel 45. It is equipped with two CAN bus interfaces.

- Dual CAN bus connection
- Integrated terminating resistors

6.1 Order data

Model number	Short description	Figure
4PP045.IF33-1	PP45 interface module, 2 CAN (electrically isolated and network capable). Order 0TB710.91 terminal blocks separately.	
Required accessories		
0TB704.9	Accessory terminal block, 4-pin, screw clamp, 1.5 mm²	
0TB704.91	Accessory terminal block, 4-pin, cage clamp, 2.5 mm²	
Optional accessories		
0AC913.93	Bus adapter, CAN, 2 CAN interfaces, including 30 cm attachment cable (TB704)	

Table 54: 4PP045.IF33-1 - Order data

6.2 Technical data

Product ID	4PP045.IF33-1
Short description	
Communication module	2 x CAN bus
Interfaces	

Interfaces IF1 and IF2
    Type
    Design
    Maximum transfer rate
	CAN bus
	2 x 4-pin multipoint connector
	1000 kBit/s

General information	
Status indicators	Data transfer for IF1 and IF2
Diagnostics Data transfer	Yes, with status LEDs

Electrical isolation
    PLC - IF1/IF2
    IF1 - IF2
	Yes
	Yes

Certification	CE, C-UL-US, GOST-R

Table 55: 4PP045.IF33-1 - technical data

Product ID	4PP045.IF33-1
Operational conditions	
Operating temperature	0°C to +50°C
Relative humidity	10 to 90%, non-condensing
Protection type	IP20
Storage and transport conditions	
Temperature	-25°C to +70°C
Relative humidity	10 to 90%, non-condensing
Mechanical characteristics	
Slot	PP45 insert

Table 55: 4PP045.IF33-1 - technical data (cont.)

6.3 Additional technical data

Product ID	4PP045.IF33-1
Interface IF1/IF2, CAN bus	
Controller	SJA 1000 controller
Maximum distance	1000 m

Maximum transfer rate
    Bus length ≤25 m
    Bus length ≤60 m
    Bus length ≤200 m
    Bus length ≤1000 m
	
	1 MBit/s
	500 kBit/s
	250 kBit/s
	50 kBit/s

Network-capable	Yes
Terminating resistors	Integrated in the module, switchable
General information	
B&R ID code	$269C

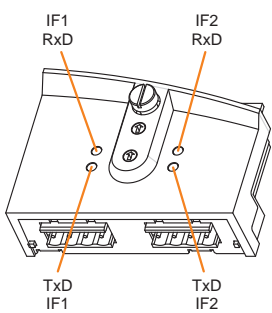Table 56: 4PP045.IF33-1 - Additional technical data

6.4 Status LEDs

Figure	LED	Color	Status	Description
	RxD	Orange	On	The module is receiving data via the interface
	TxD	Orange	On	The module is sending data via the interface
	IF1 ...CAN bus interface 1 IF2 ...CAN bus interface 2			

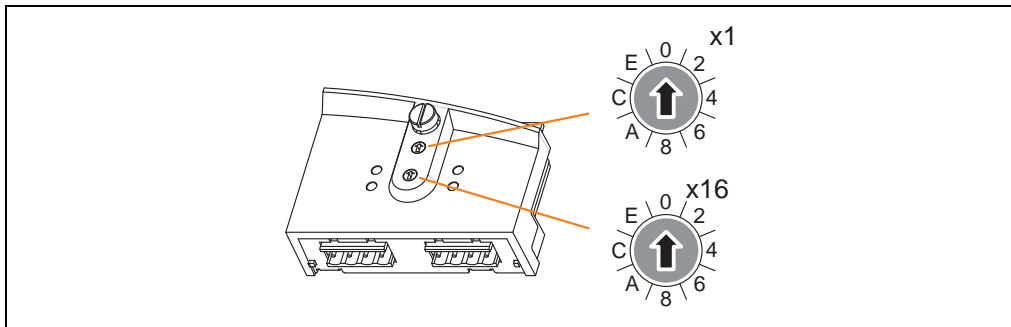Table 57: 4PP045.IF33-1 - Status LEDs

6.5 CAN bus node number

Figure 20: 4PP045.IF33-1 - CAN bus node number switch

The two hex switches are used to configure the node numbers for the CAN bus interfaces. The configured node number applies to both interfaces.
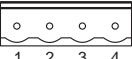
6.6 CAN bus interface (IF1 and IF2)

Interface	Pin assignments		
CAN bus interface 1 2 3 4 4-pin multipoint connector	**Pin**	**CAN bus**	
	• 1	• CAN H	CAN high
	• 2	• CAN⊥	CAN ground
	• 3	• CAN L	CAN low
	• 4	• SHLD	Shield

Table 58: 4PP045.IF33-1 - CAN bus interface (IF1 and IF2)

6.7 Terminating resistors

There are two switches on the back of the interface module which can be used to switch on a terminating resistor for the CAN bus interfaces IF1 and IF2.
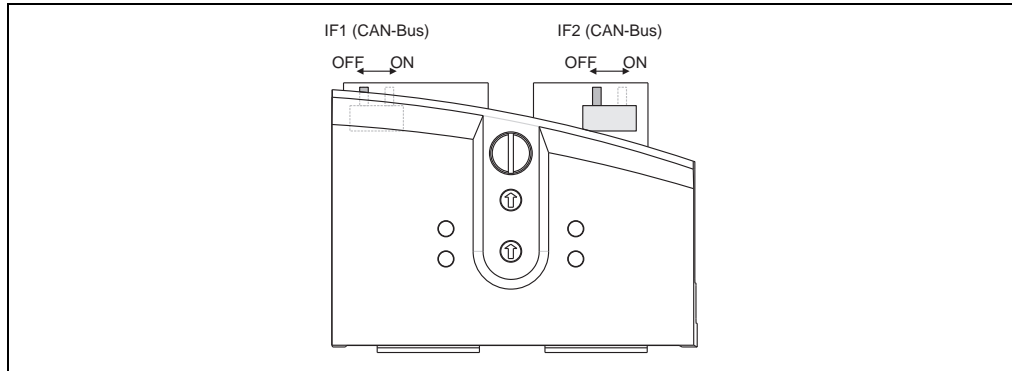

Figure 21: 4PP045.IF33-1 - Terminating resistors for IF1 and IF2

Interface	Switch position	Description
IF1 (CAN bus)	ON	Terminating resistor activated (120 Ω)
	OFF	Terminating resistor deactivated
IF2 (CAN bus)	ON	Terminating resistor activated (120 Ω)
	OFF	Terminating resistor deactivated

Table 59: 4PP045.IF33-1 - Terminating resistors for IF2 and IF3

Chapter 4 • Commissioning

1. Mounting instructions

The Power Panel must be mounted using the retaining clips included in delivery (with a torque of 0.6 Nm). Each Power Panel comes with six retaining clips (two each for top/bottom and one each for left/right).

In order to guarantee proper air circulation, allow a sufficient amount of space above, below, to the side and behind the Power Panel device. The minimum specified free space can be found in the diagram below. The spacing applies for all Power Panel devices.
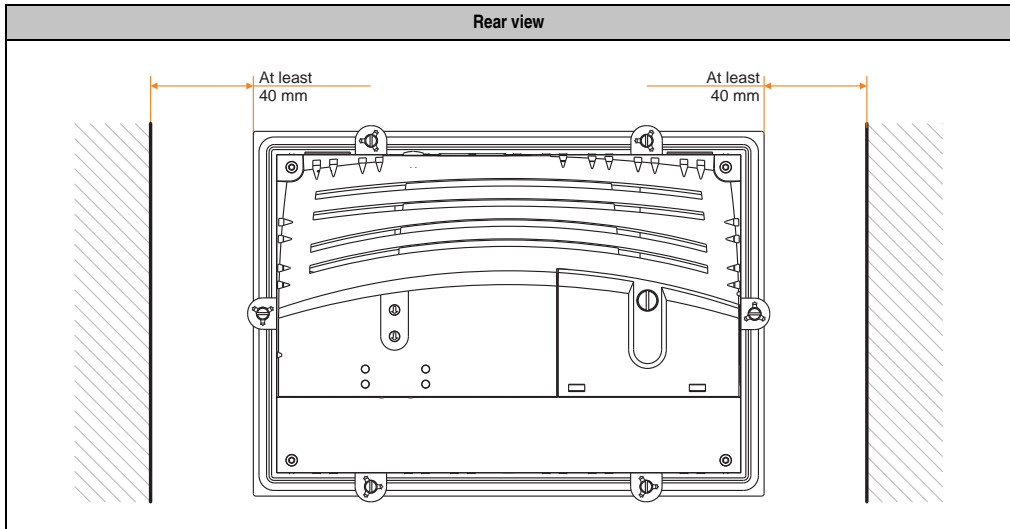

Table 60: Space for air circulation - Rear view
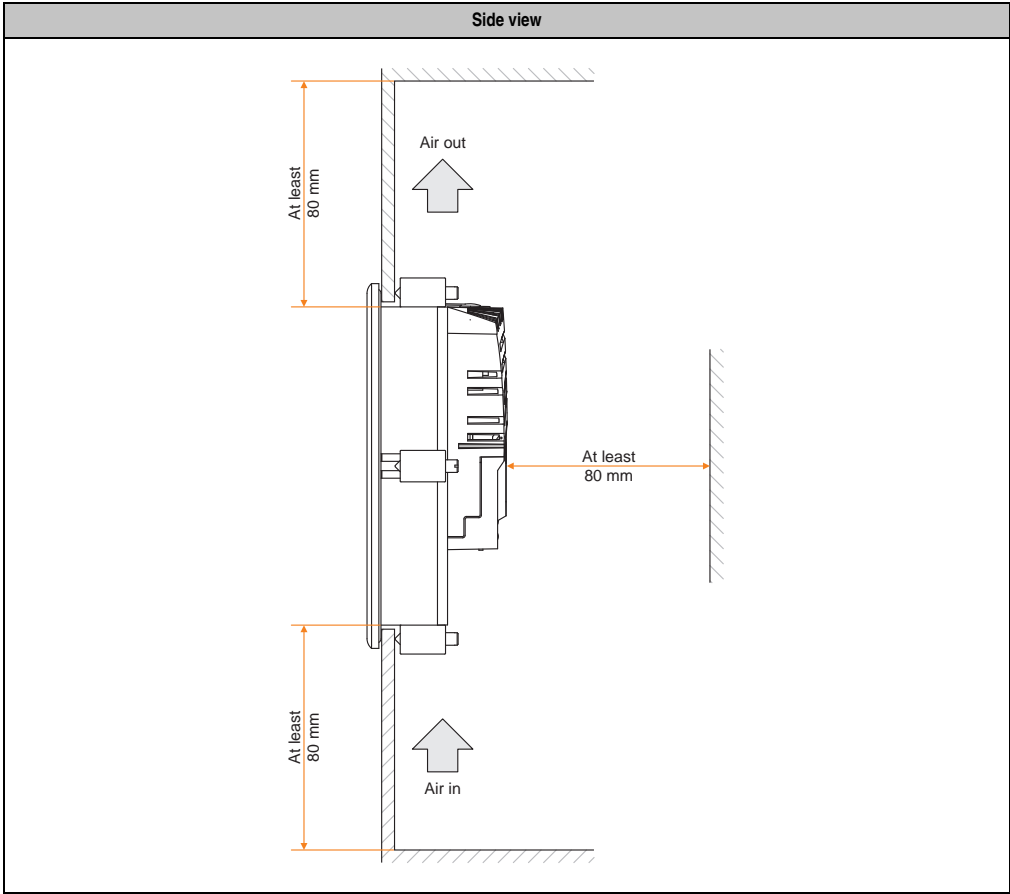
Side view

Table 61: Space for air circulation - Side view

2. Mounting orientation

The following diagram displays the specified mounting orientation for the Power Panel device. The mounting orientations apply for all Power Panel devices.
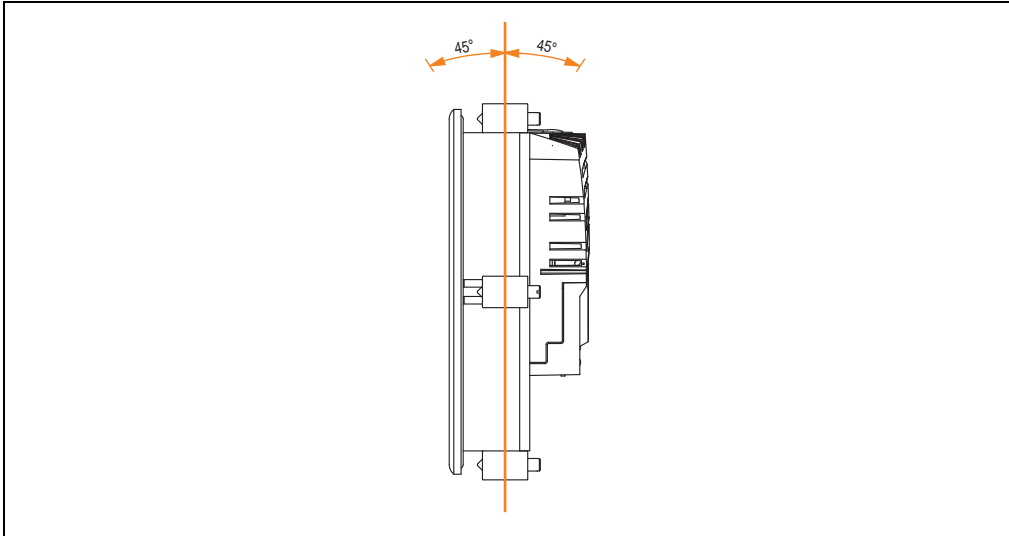

Figure 22: Mounting orientation for the Power Panel

Caution!

The maximum permitted ambient temperature can be found in the technical data for the respective Power Panel device.
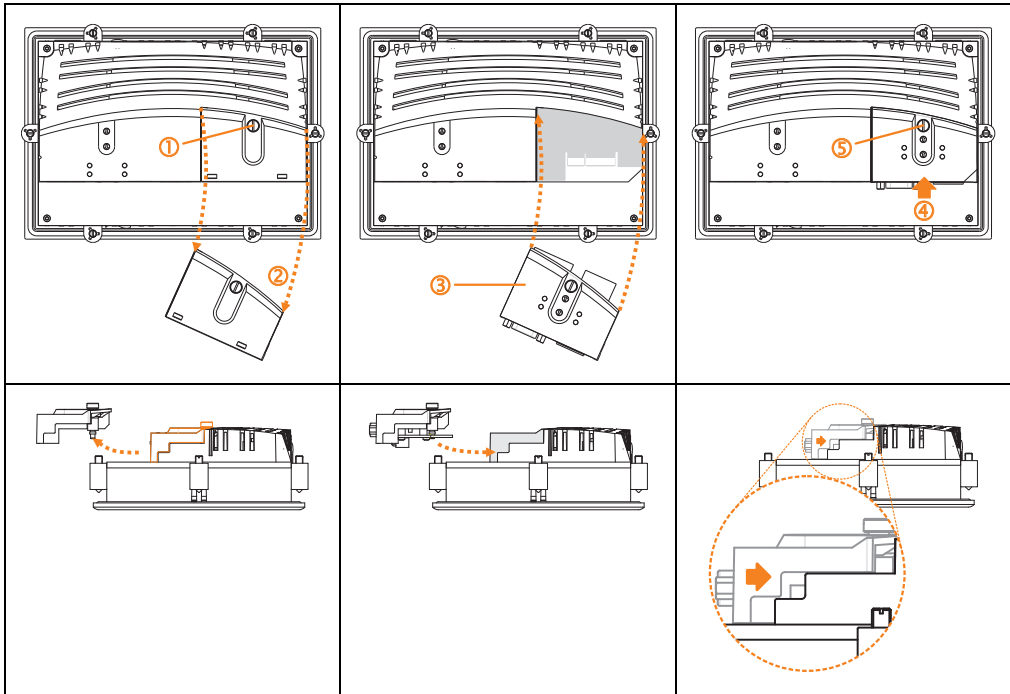
3. Installing the interface modules

Figure 23: Installing the PP45 interface modules in the Power Panel 45

1) Remove screws from cover

2) Remove cover

3) Insert interface module into the PP45

4) Push in gently all the way

5) Fasten the interface module with the screws

4. Touch screen calibration:

B&R touch screen devices are equipped with a touch controller, which supports hardware calibration. This means that the devices are pre-calibrated from stock (pre-calibration). This feature proves advantageous in the case of a replacement part because a new calibration is no longer required when exchanging devices (identical model / type). Nevertheless, we recommend calibrating the device in order to achieve the best results and to better readjust the touch screen to the user's preferences.

Chapter 5 • Standards and certifications

1. Applicable European guidelines

- EMC guidelines 89/336/EWG
- Low-voltage guidelines 73/23/EWG
- Machine guidelines 98/37/EG

2. Overview of standards

The Power Panel 45 devices collectively meet the following standards:

Standard	Description
EN 55011 Class A, B	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, B	Electromagnetic compatibility (EMC), radio disturbance characteristics, information technology equipment (ITE devices), limits and methods of measurement
EN 55024 Class A or B	Electromagnetic compatibility (EMC), immunity characteristics, information technology equipment (ITE devices), limits and methods of measurement
EN 60060-2	High-voltage test techniques - part 2: Measuring systems
EN 60068-2-1	Environmental testing - part 2: Tests; test A: Cold
EN 68068-2-2	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
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 60529	Degrees of protection provided by enclosures (IP code)
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

Table 62: Overview of standards

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Standards and
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Standard	Description
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 61000-6-2	Electromagnetic compatibility (EMC), generic immunity standard - part 2: industrial environment
EN 61000-6-4	Electromagnetic compatibility (EMC), generic emission standard - part 2: industrial environment
EN 61131-2 IEC 61131-2	Product standard, programmable logic controllers - part 2: equipment requirements and tests
NEMA 250 Type 4X	UL protection against sprayed water
UL 508	Industrial control equipment (UL = Underwriters Laboratories)
47 CFR	Federal Communications Commission (FCC), 47 CFR Part 15 Subpart B Class A

Table 62: Overview of standards (cont.)

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, scientific, and medical radio-frequency equipment (ISM devices), class A (industrial areas)
		EN 55022: Information technology equipment (ITE devices), class A (industrial areas)
		EN 61131-2: Programmable logic controllers
		47 CFR Part 15 Subpart B Class A (FCC)
Emissions, Electromagnetic emissions	EN 55011 / EN 55022	EN 61000-6-4: Generic standard (industrial areas)
		EN 55011: Industrial, scientific, and medical radio-frequency equipment (ISM devices), class A (industrial areas)
		EN 55022: Information technology equipment (ITE devices), class A (industrial areas)
		EN 61131-2: Programmable logic controllers
		47 CFR Part 15 Subpart B Class A (FCC)

Table 63: 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 61000-6-4	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
Other connections 500 kHz - 30 MHz	-	-	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	Limits according to 47 CFR Part 15 Subpart B class A	
Power mains connections [1] 150 kHz - 500 kHz	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	
Other connections 150 kHz - 500 kHz	-		
Other connections 500 kHz - 30 MHz	-		

Table 64: Test requirements - Network-related emissions for industrial areas

1) AC network connections only with EN 61131-2

Chapter 5
Standards and certifications

3.2 Emissions, 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		
Test carried out	Limits according to 47 CFR Part 15 Subpart B class A		
30 MHz - 88 MHz measured at a distance of 10 m	< 90 dB (μV/m) quasi-peak value		
88 MHz - 216 MHz measured at a distance of 10 m	< 150 dB (μV/m) quasi-peak value		
216 MHz - 960 MHz measured at a distance of 10 m	< 210 dB (μV/m) quasi-peak value		
>960 MHz measured at a distance of 10 m	< 300 dB (μV/m) quasi-peak value		

Table 65: 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 against 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

Table 66: Overview of limits and testing guidelines for immunity

Chapter 5
Standards and
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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 67: 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 68: 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 69: 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 70: Test requirements - Surge voltages

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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 71: 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 72: 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	
AC power inputs	Voltage dip 70% (30% reduction), 0.5 periods, criteria B	-	
AC power inputs	Voltage dip 40% (60% reduction), 5 periods, 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	-	
AC power inputs	-	20 interruptions, 0.5 periods, criteria A	
DC power inputs	-	20 interruptions for 10 ms < UN - 15%, criteria A	

Table 73: Test requirements - Voltage dips, fluctuations, and short-term interruptions

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 74: Test requirements - Damped vibration

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Standards and
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5. Mechanical conditions

Vibration	Test carried out according to	Limits according to
Vibration operation	EN 60068-2-6	EN 61131-2: Programmable logic controllers
		EN 60721-3-3 class 3M4
Vibration during transport (packaged)	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
		EN 60721-3-2 class 2M3
		B&R
Toppling (packaged)	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
		B&R

Table 75: 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		Limits according to EN 60721-3-3 class 3M4		
Vibration operation: Uninterrupted duty with moveable frequency in all 3 axes (x, y, z), 1 octave per minute	10 sweeps for each axis		10 sweeps for each axis		
	Frequency	Limit value	Frequency	Limit value	
	5 - 9 Hz	Amplitude 3.5 mm	2 - 9 Hz	Amplitude 3 mm	
	9 - 150 Hz	Acceleration 1 g	9 - 200 Hz	Acceleration 1 g	

Table 76: Test requirements - Vibration operation

5.2 Vibration during transport (packaged)

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 77: Test requirements - Vibration during transport (packaged)

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 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 78: Test requirements - Shock 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	Limits according to B&R
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	Acceleration 30 g, Length 11 ms, each 3 shocks, packaged

Table 79: Test requirements - Shock 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	
Toppling and knocking over	Devices: Toppling/knocking over on each edge		Devices: Toppling/knocking over on each edge		Devices: Toppling/knocking over 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 80: Test requirements - Toppling

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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						
	Limits according to B&R							
	Devices packaged							
	Weight	Height						
	<40 kg	1 m						

Table 81: 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
Sprayed water (from front)	NEMA 250 Type 4X	UL 50 - NEMA 250 4X: Degree of protection provided by housing

Table 82: 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 operation. Operation of the device with the max. ambient temperature specified in the data sheet at the max. specified load	3 hours at max. ambient temperature (min. +40°C) duration approx. 5 hours	3 hours at max. ambient temperature (min. +40°C) duration approx. 5 hours	

Table 83: Test requirements - Worst case operation

6.2 Dry heat

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

Table 84: 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	16 hours at -40°C for 1 cycle, then 1 hour acclimatization and function testing, duration approximately 17 hours		

Table 85: 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	3 hours at -40° C and 3 hours at +70°C, 2 cycles, then 2 hours acclimatization and function testing, duration approximately 14 hours		

Table 86: Test requirements - Large temperature fluctuations

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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	3 hours at +5° C and 3 hours at 55°C, 5 cycles, temperature gradient 3°C / min, the unit is occasionally supplied with voltage during testing, duration approximately 30 hours		
Closed devices: These are devices whose data sheet specifies a surrounding housing (enclosure) with the corresponding safety precautions	3 hours at +5°C and 3 hours at +55°C, 5 cycles, temperature gradient 3°C / min, the unit is occasionally supplied with voltage during testing, duration approximately 30 hours		

Table 87: 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	24 hours at +25°C / +55°C and 97% / 83% RH, 2 cycles, then 2 hours acclimatization, function testing and insulation, duration approximately 50 hours		

Table 88: 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)	48 hours at +40°C and 92.5% RH, then insulation test within 3 hours, duration approximately 49 hours		

Table 89: Test requirements - Humid heat, constant (storage)

6.8 Sprayed water (front side)

Test carried out according to UL 50	Limits according to NEMA 250 Type 4X		
Sprayed water (front side)	Spraying using a 25.4 mm (diameter) water jet nozzle Distance: 3 to 3.7 meters (all angles) Water flow: 246 liters/minute Duration: 48 seconds, 5 seconds minimum		

Table 90: Test requirements - Sprayed water (front side)

7. Safety

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

Table 91: Overview of limits and testing guidelines for safety

7.1 Ground resistance

Test carried out according to EN 61131-2	Limits according to EN 60204-1[1]		Limits according to EN 61131-2
Ground resistance: housing (from any metal part to the ground terminal)	Smallest effective cross section of the protective ground conductor for the branch being tested	Maximum measured voltage drop at a test current of 10 A	Test current 30 A for 2 min, < 0.1 Ohm
	1.0 mm²	3.3 V	
	1.5 mm²	2.6 V	
	2.5 mm²	1.9 V	
	4.0 mm²	1.4 V	
	> 6.0 mm²	1.0 V	

Table 92: Test requirements - Ground resistance

1) See EN 60204-1:1997 page 62, table 9.

7.2 Insulation resistance

Test carried out	Limits according to EN 60204-1[1]		
Insulation resistance: main circuits to protective ground conductor	> 1 MΩ at 500 V DC voltage		

Table 93: Test requirements - Insulation resistance

1) See EN 60204-1:1997 page 62, table 9.

7.3 High voltage

Test carried out according to EN 60060-1	Limits according to EN 61131-2[1]				Limits according to UL 508		
High voltage: Primary circuit to secondary circuit and to protective ground circuit (transformers, coils, varistors, capacitors and components used to protect against over-voltage can be removed before the test)	Input voltage	Test voltage			Input voltage	Test voltage	
		1.2/50 µs voltage surge peak	AC, 1 min	DC, 1 min		AC, 1 min	DC, 1 min
	0 - 50 VAC 0 - 60 VDC	850 V	510 V	720 V	≤ 50 V	500 V	707 V
	50 - 100 VAC 60 - 100 VDC	1360 V	740 V	1050 V	> 50 V	1000 V + 2 x U_N	(1000 V + 2 x U_N) x 1.414
	100 - 150 VAC 100 - 150 VDC	2550 V	1400 V	1950 V			
	150 - 300 VAC 150 - 300 VDC	4250 V	2300 V	3250 V			
	300 - 600 VAC 300 - 600 VDC	6800 V	3700 V	5250 V			
	600 - 1000 VAC 600 - 1000 VDC	10200 V	5550 V	7850 V			

Table 94: Test requirements - High voltage

1) See EN 61131-2:2003 page 104, table 59.

7.4 Voltage range

Test carried out according to	Limits according to EN 61131-2			
Supply voltage	Measurement value	Tolerance min/max		
	24 VDC 48 VDC 125 VDC	-15% +20%		
	24 VAC 48 VAC 100 VAC 110 VAC 120 VAC 200 VAC 230 VAC 240 VAC 400 VAC	15% +10%		

Table 95: Test requirements - Voltage range

8. Other tests

Other tests	Test carried out according to	Limits according to
Function test	-	-
Optical test	-	-
Hot spot measurement	-	-
Protection type	-	EN 60529: Degrees of protection provided by enclosures (IP code)
Mounting dimensions	-	B&R

Table 96: Overview of limits and testing guidelines for other tests

8.1 Protection type

Test carried out according to	Limits according to EN 60529	Limits according to EN 60529	
Protection of the operating equipment	IP2. Protection against large solid foreign bodies =12.5 mm diameter	IP.6 Protection against large solid foreign bodies: dust-proof	
Protection of personnel	IP2. Protection against touching dangerous parts with finger	IP.6 Protection against touching dangerous parts with conductor	
Protection against water permeation with damaging consequences	IP.0 Not protected	IP.5 Protected against sprayed water	

Table 97: Test requirements - Protection

Chapter 5
Standards and
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9. 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 c**UL**us	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 CE	All harmonized EN standards for the applicable guidelines are met.

Table 98: International certifications

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1. Overview

Model number	Product ID	Page
0AC201.9	Lithium batteries, 5 pcs., 3 V / 950 mAh, button cell	92
4A0006.00-000	Lithium battery, 3 V / 950 mAh, button cell	
0TB103.9	Accessory terminal block 3-pin, screw clamp, 3.31 mm², protection against vibration with the screw flange.	93
0TB103.91	Accessory terminal block 3-pin, cage clamp, 3.31 mm², protection against vibration with the screw flange.	
0TB704.9	Accessory terminal block, 4-pin, screw clamp, 1.5 mm²	95
0TB704.91	Accessory terminal block, 4-pin, cage clamp, 2.5 mm²	
4A0064.00-000	5 DIN A4 legend sheets, 16 fields for a total of 40 devices, CorelDraw template can be downloaded online.	97
5CFCRD.0064-03	CompactFlash 64 MB ATA/IDE SiliconSystems	98
5CFCRD.0128-03	CompactFlash 128 MB ATA/IDE SiliconSystems	
5CFCRD.0256-03	CompactFlash 256 MB ATA/IDE SiliconSystems	
5CFCRD.0512-03	CompactFlash 512 MB ATA/IDE SiliconSystems	
5CFCRD.1024-03	CompactFlash 1024 MB ATA/IDE SiliconSystems	
5CFCRD.2048-03	CompactFlash 2048 MB ATA/IDE SiliconSystems	
5CFCRD.4096-03	CompactFlash 4096 MB ATA/IDE SiliconSystems	
5CFCRD.8192-03	CompactFlash 8192 MB ATA/IDE SiliconSystems	
5MMUSB.2048-00	**USB flash drive 2 GB SanDisk** USB 2.0 flash drive 2 GB	110
0G0001.00-090	Cable PC <-> PLC/PW, RS232, online cable	
0AC913.93	Bus adapter, CAN, 2 CAN interfaces, including 30 cm attachment cable (TB704)	
0G1000.00-090	Bus connector, RS485, for Profibus networks, remote I/O	

Table 99: Model numbers - Accessories

Chapter 6
Accessories

2. Replacement batteries

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

The battery is subject to wear and must be replaced when the battery power is insufficient ("Bad" status) (see "Changing the battery" on page 116).

2.1 Order data

Model number	Description	Figure
0AC201.9	Lithium batteries, 5 pcs., 3 V / 950 mAh, button cell	
4A0006.00-000	Lithium battery, 3 V / 950 mAh, button cell	

Table 100: Order data - Lithium batteries

2.2 Technical data

Information:

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

The technical data is current as of when this manual was printed. We reserve the right to make changes.

Features	0AC201.9	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	
Environmental characteristics		
Storage temperature	-20°C to +60°C	
Relative humidity	0 to 95%, non-condensing	

Table 101: Technical data - Lithium batteries

2.3 Contents of delivery

Amount	Component
1 or 5	Lithium batteries

Table 102: Contents of delivery for lithium batteries

3. TB103 3-pin supply voltage connector

3.1 General information

This single row 3-pin terminal block is mainly used to connect the supply voltage.

3.2 Order data

Model number	Description	Figure
0TB103.9	Accessory terminal block 3-pin, screw clamp, 3.31 mm², protection against vibration with the screw flange.	
0TB103.91	Accessory terminal block 3-pin, cage clamp, 3.31 mm², protection against vibration with the screw flange.	

Table 103: Order data - TB103 supply plug

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Accessories

3.3 Technical data

> # Information:
>
> **The following characteristics, features and limit values only apply to this accessory and can deviate from those for the entire device. For the entire device where this accessory is installed, refer to the data provided specifically for the entire device.**
>
> **The technical data is current as of when this manual was printed. We reserve the right to make changes.**

Name	0TB103.9	0TB103.91
Number of pins	3	
Type of terminal	Screw clamps	Cage clamps
Distance between contacts	5.08 mm	
Resistance between contacts	$\leq 5\ m\Omega$	
Nominal voltage according to VDE / UL,CSA	250 V / 300 V	
Current load according to VDE / UL,CSA	14.5 A / 10 A per contact	
Terminal size	0.08 mm² - 3.31 mm²	
Cable type	Copper wires only (no aluminum wires!)	

Table 104: Technical data - TB103 supply plug

3.4 Contents of delivery

Amount	Component
1	Supply plug in desired design.

Table 105: Contents of delivery - TB103 supply plug

4. TB704 4-pin X2X Link plug

4.1 General information

This single row 4-pin terminal block is used as a terminal for the X2X Link interface.

4.2 Order data
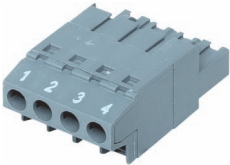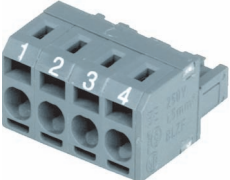
Model number	Description	Figure
0TB704.9	Accessory terminal block, 4-pin, screw clamp, 1.5 mm²	
0TB704.91	Accessory terminal block, 4-pin, cage clamp, 2.5 mm²	

Table 106: Order data - TB704 supply plug

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Accessories

4.3 Technical data

Information:

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

The technical data is current as of when this manual was printed. We reserve the right to make changes.

Name	0TB704.9	0TB704.91
Number of pins	4	4
Type of terminal	Screw clamps	Cage clamps
Distance between contacts	5.08 mm	5.08 mm
Contact resistance	≤5 mΩ	≤5 mΩ
Rated voltage	300 V	300 V
Rated current 2)	10 A / contact	10 A / contact
Connection cross section 　AWG wire 　Solid wire line 　Fine wire line without wire tip sleeves 　Fine wire line with wire tip sleeves 　Wire tip sleeves with plastic covering	 26 - 12 AWG 0.20 - 2.50 mm² 0.20 - 2.50 mm² 0.20 - 1.50 mm² 0.20 - 1.50 mm²	 26 - 12 AWG 0.20 - 2.50 mm² 0.20 - 2.50 mm² 0.20 - 1.50 mm² 0.20 - 1.50 mm²
Cable type	Only copper wires (no aluminum wires!)	Only copper wires (no aluminum wires!)
Comment	Rated values according to UL	Rated values according to UL

Table 107: Technical data - TB704 supply plug

4.4 Contents of delivery

Amount	Component
1	Terminal in desired design.

Table 108: Contents of delivery - TB704 supply plug

5. Legend strip templates

Power Panel devices with keys are delivered with partially pre-labeled key legend strips (F1, F2, etc.). The key legend strip slots are accessible on the back of the Power Panel device.
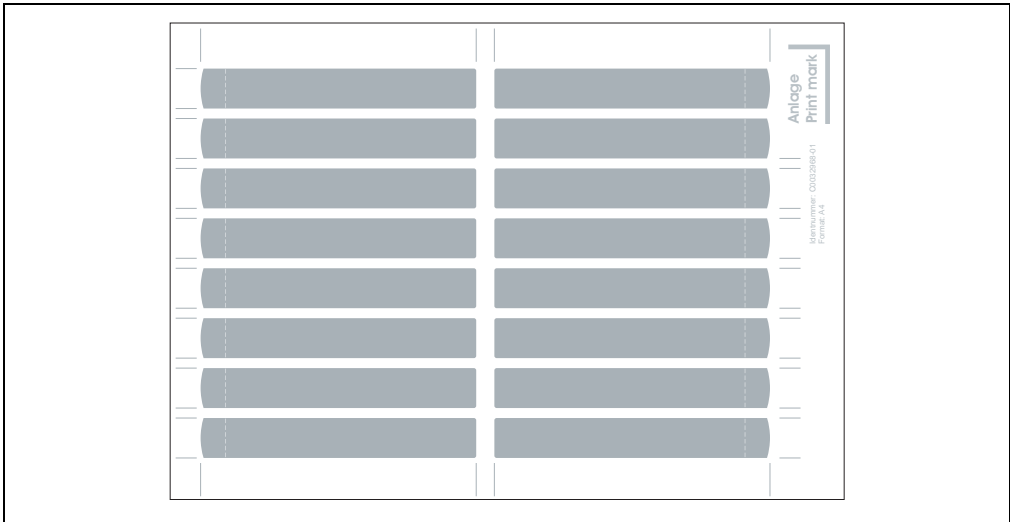
Figure 24: Legend strip templates

Printable legend strips (A4 format) can be ordered from B&R (see table 109 "Order data - Legend strip templates" on page 97). They can be printed using a standard laser printer (b/w or color) in a temperature range from -40°C to +125°C. A print template (available for Corel Draw version 7, 9 and 10) for the respective legend strip template can be downloaded from the B&R homepage **www.br-automation.com**.

5.1 Order data

Model number	Description	Figure
4A0064.00-000	5 DIN A4 legend sheets, 16 fields for a total of 40 devices, CorelDraw template can be downloaded online.	

Table 109: Order data - Legend strip templates

Chapter 6
Accessories

6. CompactFlash cards 5CFCRD.xxxx-03

6.1 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.

6.2 Order data

Model number	Description	Figure
5CFCRD.0064-03	CompactFlash 64 MB ATA/IDE SiliconSystems	
5CFCRD.0128-03	CompactFlash 128 MB ATA/IDE SiliconSystems	
5CFCRD.0256-03	CompactFlash 256 MB ATA/IDE SiliconSystems	
5CFCRD.0512-03	CompactFlash 512 MB ATA/IDE SiliconSystems	
5CFCRD.1024-03	CompactFlash 1024 MB ATA/IDE SiliconSystems	Example: 256 MB CompactFlash cards
5CFCRD.2048-03	CompactFlash 2048 MB ATA/IDE SiliconSystems	
5CFCRD.4096-03	CompactFlash 4096 MB ATA/IDE SiliconSystems	
5CFCRD.8192-03	CompactFlash 8192 MB ATA/IDE SiliconSystems	

Table 110: CompactFlash cards - Order data

6.3 Technical data

Information:

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

The technical data is current as of when this manual was printed. We reserve the right to make changes.

Features	5CFCRD.xxxx-03
MTBF (at 25°C)	> 4,000,000 hours
Maintenance	None
Data reliability	< 1 unrecoverable error in 10^{14} bit read accesses
Write/erase procedures	> 2,000,000 times
Data retention	10 years

Table 111: Technical data - CompactFlash cards 5CFCRD.xxxx-03

Mechanical characteristics	5CFCRD.xxxx-03

Dimensions
    Length
    Width
    Thickness
	36.4 ± 0.15 mm
	42.8 ± 0.10 mm
	3.3 ± 0.10 mm

Weight	11.4 grams
Environmental characteristics	5CFCRD.xxxx-03

Ambient temperature
    Operation
    Storage
    Transport
	0°C to +70°C
	-50°C to +100°C
	-50°C to +100°C

Relative humidity Operation / Storage	8% to 95%, non-condensing

Vibration
    Operation
    Storage / Transport
	Maximum 16.3 g (point to point)
	Maximum 30 g (point to point)

Shock
    Operation
    Storage / Transport
	Maximum 1,000 g
	Maximum 3,000 g

Altitude	Maximum 80,000 feet (24,383 meters)

Table 111: Technical data - CompactFlash cards 5CFCRD.xxxx-03 (cont.)

6.3.1 Temperature humidity diagram - Operation and storage
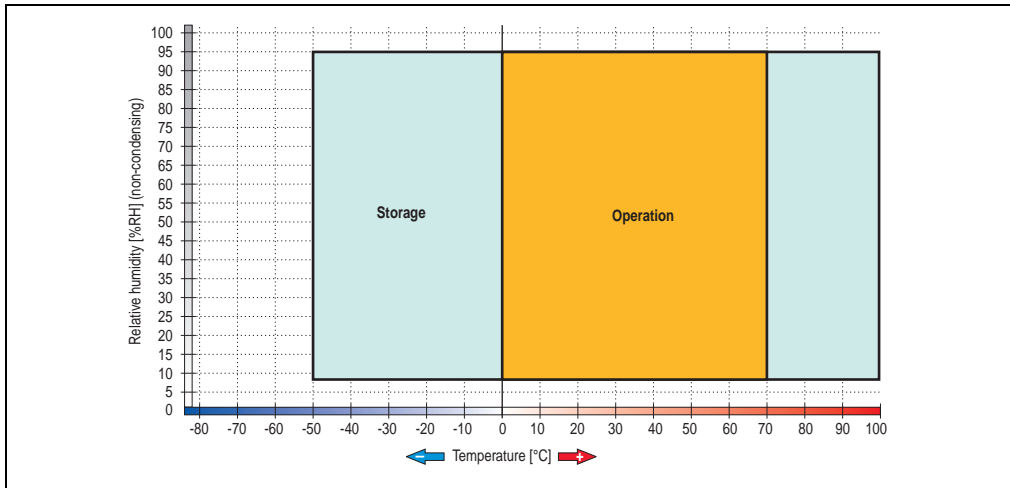
Figure 25: Temperature humidity diagram - CompactFlash cards 5CFCRD.xxxx-03

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Accessories

6.4 Contents of delivery

Amount	Component
1	CompactFlash card in desired size

Table 112: Contents of delivery - CompactFlash cards 5CFCRD.xxxx-03

6.5 Dimensions
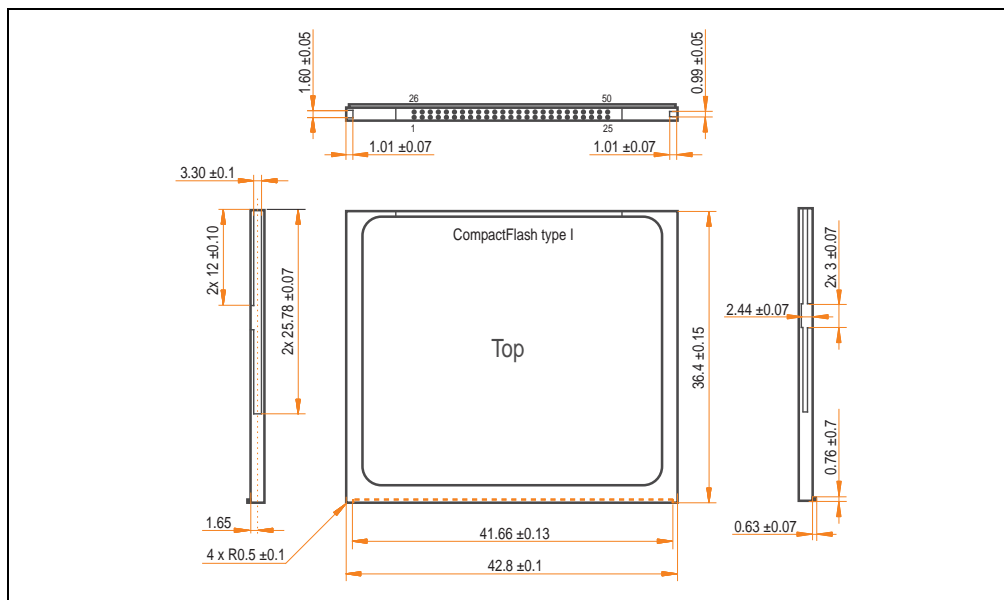
Figure 26: Dimensions - CompactFlash card Type I

6.6 Calculating the lifespan

Silicon Systems provides a 9-page "white paper" for the lifespan calculation for CompactFlash cards (see following pages). This document can also be found on the Silicon Systems homepage (**www.siliconsystems.com**).

Information:

A software tool for calculating the statistical lifespan of the Silicon Systems CompactFlash cards in various settings can be downloaded from the B&R Homepage (www.br-automation.com).
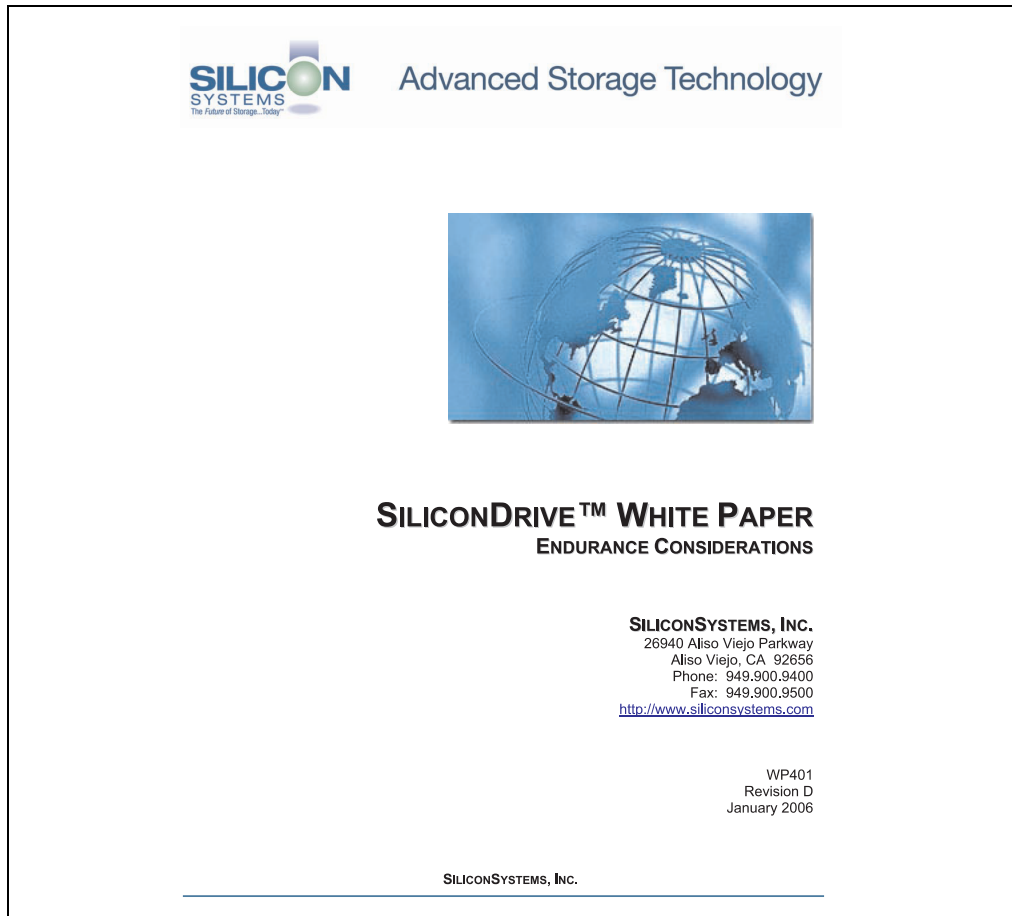
Figure 27: Silicon Systems white paper - page 1 of 9

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INTRODUCTION

SiliconSystems' SiliconDrive™ technology is specifically designed to meet the high performance and high reliability requirements of Enterprise System OEMs in the netcom, military, industrial, interactive kiosk and medical markets. One of the measures of storage reliability in Enterprise System OEM applications is endurance – the number of write/erase cycles that can be performed before the storage product "wears out."

BACKGROUND

It is important to note that endurance is not just a function of the storage media. Rather, it is the combination of the storage media and the controller technology that determines the endurance. For example, magnetic media is an order of magnitude less reliable than NAND flash, yet the controller technology employed by rotating hard drives can compensate for this deficiency to yield reliability results that meet those of solid-state storage.

{NOTE: This is a completely different discussion from the mechanical reliability involving rotating hard drives versus solid-state storage that has no moving parts. This is just an example of how a controller, if it is good enough, can compensate for the deficiencies of the media}.

Write/erase cycle endurance for solid-state storage is specified in many ways by many different vendors. Some specify the endurance at the physical block level, while others specify at the logical block level. Still others specify it at the card or drive level. Since endurance is also related to data retention, endurance can be specified at a higher level if the data retention specification is lower. For these reasons, it is often difficult to make an "apples to apples" comparison of write/erase endurance by solely relying on these numbers in a datasheet.

A better way to judge endurance is to break the specification down into the main components that affect the endurance calculation:

1.   Storage Media
2.   Wear Leveling Algorithm
3.   Error Correction Capabilities

Other factors that affect endurance include the amount of spare sectors available and whether or not the write is done using a file system or direct logical block addressing. While these issues can contribute to the overall endurance calculation, their effects on the resulting number is much lower than the three parameters above. Each of those factors will be examined individually, assuming ten-year data retention.

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                                                                            The Future of Storage…Today™

Figure 28: Silicon Systems white paper - page 2 of 9

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STORAGE MEDIA

The scope of this white paper is confined to non-volatile storage – systems that do not lose their data when the power is turned off. The dominant technology for non-volatile solid-state storage is NAND flash. While NOR flash is also a possible solution, implementation of NOR technology is generally confined to applications like cell phones that require the functionality of DRAM, boot PROM and storage component in a single chip. The economies of scale and component densities of NAND relative to NOR make it the ideal solution for non-volatile, solid-state storage subsystems.

The two dominant NAND technologies available today are SLC (single-level cell, sometimes called binary) and MLC (multi-level cell). SLC technology stores one bit per cell and MLC stores two bits. A comparison of SLC and MLC is shown in figure 1.
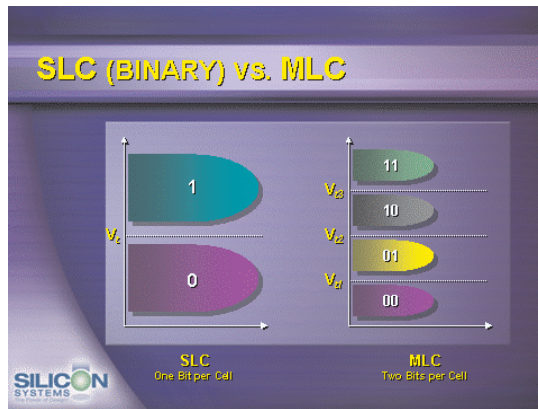
Figure 1

SLC NAND is generally specified at 100,000 write/erase cycles per block with 1-bit ECC (this is explained below). MLC NAND is specified at 10,000 write/erase cycles per block with ECC. The MLC datasheet does not specify a number of bits of ECC required. Therefore, when using the same controller, a storage device using SLC will have an endurance value roughly 10x that of a similar MLC-based product. In order to achieve maximum endurance, capacity and speed, SiliconSystems currently uses SLC NAND in our SiliconDrive technology.

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A more thorough discussion of SLC vs. MLC can be found from the component manufacturers:
Samsung: http://www.samsung.com
Toshiba: http://www.toshiba.com

WEAR LEVELING

Wear leveling is defined as the allowing data writes to be evenly distributed over the entire storage device. More precisely, wear leveling is an algorithm by which the controller in the storage device re-maps logical block addresses to different physical block addresses in the solid-state storage array. The frequency of this re-map, the algorithm to find the "least worn" area to which to write and any data swapping capabilities are generally considered proprietary intellectual property of the controller vendor.

It is important to note that the wear leveling is done in the solid-state memory controller and is independent of the host system. The host system performs its reads and writes to logical block addresses only, so as far as the host is concerned, the data stays in the same place.

To illustrate the effects of wear leveling on overall endurance, assume three different storage devices with the following characteristics:
1.   Flash Card with No Wear Leveling
2.   Flash Card with Dynamic Wear Leveling
3.   SiliconDrive with Static Wear Leveling

In addition, assume that all three storage devices use the same solid-state storage technologies (SLC or MLC – for purposes of this discussion, it doesn't matter). All three devices will have 75% of the capacity as static data, which is defined below:

Static Data: Any data on a solid-state storage device that does not change. Examples include: operating system files, look-up tables and executable files.

Finally, the same type of write is performed to all three systems. The host system is writing a single block of data to the same logical block address over and over again.

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Figure 30: Silicon Systems white paper - page 4 of 9

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No Wear Leveling

Figure 2 shows a normalized distribution of writes to a flash card that does not use wear leveling. In this instance, the data gets written to the same physical block. Once that physical block wears out and all spare blocks are exhausted (see discussion below), the device ceases to operate, even though only a small percentage of the card was used.

In this instance, the endurance of the card is only dependent on the type of flash used and any error correction capabilities in excess of one byte per sector. Early flash cards did not use wear leveling and thus failed in write-intensive applications. For this reason, flash cards with no wear leveling are only useful in consumer electronic applications.

Figure 2

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SILICONSYSTEMS
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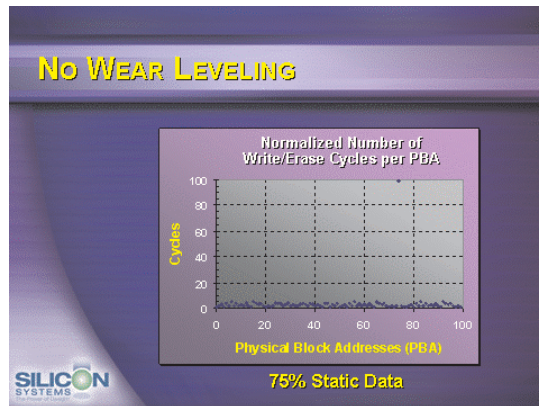
Figure 31: Silicon Systems white paper - page 5 of 9

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Dynamic Wear Leveling

Figure 3 shows a normalized distribution of writes to a flash card that employs dynamic wear leveling. This algorithm only wear levels over "free" or "dynamic" data areas. That is to say, if there is static data as defined above, this area is never involved in the wear leveling process. In the current example, since 75% of the flash card is used for static data, only 25% of the card is available for wear leveling. The endurance of the card is calculated to be 25 times better than for the card with no wear leveling, but only one-fourth that of static wear leveling.

Figure 3

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Figure 32: Silicon Systems white paper - page 6 of 9
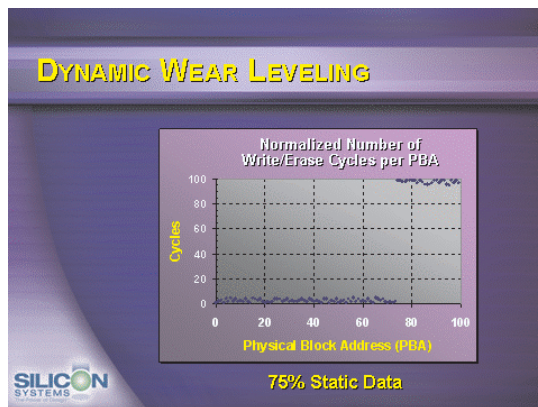
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Static Wear Leveling

Figure 4 shows a normalized distribution of writes to a SiliconDrive that employs static wear leveling. This algorithm evenly distributes the data over the entire SiliconDrive. The algorithm searches for the least-used physical blocks and writes the data to that location. If that location is empty, the write occurs normally. If that location contains static data, the static data is moved to a more heavily-used location prior to the new data being written. The endurance of the SiliconDrive is calculated to be 100 times better than for the card with no wear leveling and four times the endurance of the card that uses dynamic wear leveling.
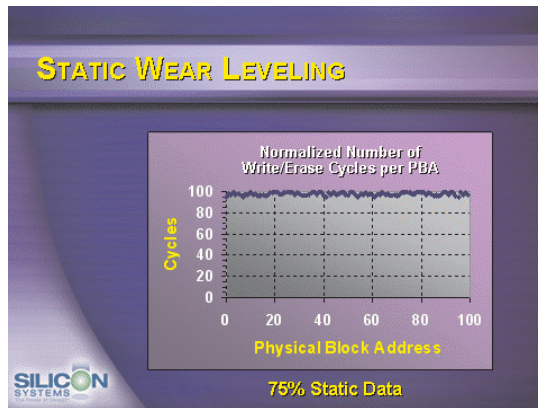
Figure 4

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ERROR CORRECTION

Part of the solid-state memory components specification is related to error correction. For example, SLC NAND components are specified at 100,000 write/erase cycles with one-bit ECC. It goes to reason that the specification increases with a better error correction algorithm. Most flash cards employ error correction algorithms ranging from two-bit to four-bit correction. SiliconSystems' SiliconDrive technology uses six-bit correction.

The term six-bit correction may be slightly confusing. Six-bit correction really defines the capability of correcting up to six $bytes$ in a 512-byte sector. Since a byte is eight bits, this really means the SiliconDrive can correct 48 bits as long as those bits are confined to six bytes in the sector. The same definition holds for two-bit and four-bit correction.

The relationship between the number of bytes per sector the controller can correct does not appear to be directly proportional to the overall endurance, since the bit error rate of the NAND flash is not linear. To state it another way, six-bit error correction is not necessarily three times better than two-bit ECC. In most cases, it is significantly better than that.

SUMMARY OF MEDIA, WEAR LEVELING AND ECC

The matrix below summarizes the effects of the different items discussed above. In the table, a "1" indicates the best possible scenario, and a "10" indicates the least desirable in terms of endurance.

N = No Wear Leveling; D = Dynamic Wear Leveling; S = Static Wear Leveling

ECC	SLC NAND			MLC NAND		
	N	D	S	N	D	S
2-bit	6	5	4	10	9	8
4-bit	5	4	2	9	8	7
6-bit	4	3	1*	8	7	6

= SiliconSystems' SiliconDrive Configuration

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Figure 34: Silicon Systems white paper - page 8 of 9

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ENDURANCE CALCULATIONS

To get an idea of how long a solid-state storage device will last in an application, the following calculations can be used. Note: These calculations are valid only for products that use either dynamic or static wear leveling. Use the solid-state memory component specifications for products that do not use wear leveling.

To calculate the expected life in years a product will last:

$$\text{Years} = \frac{(\alpha - \beta) \times \lambda \times (1 - \varphi)}{(\omega \times \xi) \times k}$$

Where:

α = Capacity in MB (when converting from MB to GB, MB = GB x 1,024)
β = Amount of Static Data in MB (this value should be 0 for static wear leveling)
λ = Endurance Specification
φ = Safety Margin
ω = File Size in MB (when converting from KB to MB, KB = MB x 1,024)
ξ = Number of Writes of file size ω per minute
k = Number of minutes per year = 525,600

To calculate the number of data transactions:

$$\text{Transactions} = \frac{(\alpha - \beta) \times \lambda \times (1 - \varphi)}{\omega}$$

Where:

α = Capacity in MB (when converting from MB to GB, MB = GB x 1,024)
β = Amount of Static Data in MB (this value should be 0 for static wear leveling)
λ = Endurance Specification
φ = Safety Margin Percentage (usually 25%)
ω = File Size in MB (when converting from KB to MB, KB = MB x 1,024)

Figure 35: Silicon Systems white paper - page 9 of 9

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7. 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.

7.1 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"), the USB flash drive becomes an additional drive where data can be read or written. Only USB flash drives from the memory specialists SanDisk are used.

7.2 Order data
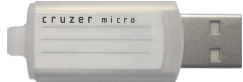
Model number	Description	Figure
5MMUSB.2048-00	USB flash drive 2 GB SanDisk Cruzer Micro	

Table 113: Order data - USB flash drives

7.3 Technical data

> # Information:
>
> **The following characteristics, features and limit values only apply to this accessory and can deviate from the entire device. For the entire device where this accessory is installed, refer to the data provided specifically for the entire device.**
>
> **The technical data is current as of when this manual was printed. We reserve the right to make changes.**

Features	5MMUSB.2048-00
LED	1 LED (green), signals data transfer (send and receive)
Power supply Current requirements	Via the USB port 650 µA sleep mode, 150 mA read/write

Interface
    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)	100000 hours
Data retention	10 years
Maintenance	None
Operating system support	Windows CE 5.0 and Windows XP embedded
Mechanical characteristics	

Dimensions
    Length
    Width
    Thickness
	52.2 mm
	19 mm
	7.9 mm

Table 114: Technical data - USB flash drive 5MMUSB.2048-00

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Features	5MMUSB.2048-00
Environmental characteristics	
Ambient temperature 　Operation 　Storage 　Transport	0°C to +45°C -20°C to +60°C -20°C to +60°C
Relative humidity 　Operation 　Storage 　Transport	10% to 90%, non-condensing 5% to 90%, non-condensing 5% to 90%, non-condensing
Vibration 　Operation 　Storage 　Transport	2 g (10 to 500 Hz), oscillation rate 1/minute 4 g (10 to 500 Hz), oscillation rate 1/minute 4 g (10 to 500 Hz), oscillation rate 1/minute
Shock 　Operation 　Storage 　Transport	40 g and 11 ms duration (all axes) 80 g and 11 ms duration (all axes) 80 g and 11 ms duration (all axes)
Altitude 　Operation 　Storage 　Transport	3048 meters 12192 meters 12192 meters

Table 114: Technical data - USB flash drive 5MMUSB.2048-00 (cont.)

7.3.1 Temperature humidity diagram - Operation and storage
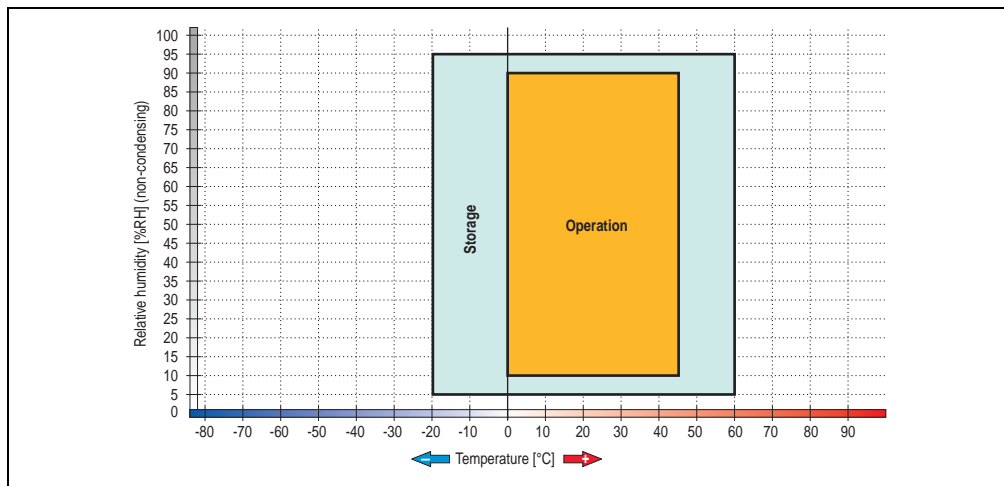
Figure 36: Temperature humidity diagram - USB flash drive - 5MMUSB.2048-00

7.4 Contents of delivery

SanDisk Cruzer Micro
1 USB flash drive in desired size + 2 replacement covers (blue and pink) + 1 strap[1]

Table 115: Contents of delivery - USB flash drive 5MMUSB.2048-00

1) Due to a change in the contents of delivery from the manufacturer, it is possible that the USB flash drive (with white cap) is delivered without the replacement covers or strap.

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Chapter 7 • Maintenance

1. Cleaning

Danger!

Power 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.

A moist towel should be used to clean the Power 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 Power Panel device! Never use aggressive solvents, chemicals, scouring agents, pressurized air or steam jet.

Information:

Displays with touch screens should be cleaned at regular intervals.

2. Changing the battery

2.1 General Information

The battery buffers the internal real-time clock (RTC) and the SRAM data. The buffer duration of the battery is 4 years in devices without SRAM (at 50°C, 8.5 μA of the supplied components and a self discharge of 40%) and at least 3 years in devices with SRAM (at 50°C, 18.5 μA of the supplied components and a self discharge of 40%).

A battery change is only necessary for devices with a lithium battery (see technical data for Power Panel devices).

2.2 Battery check

The battery status (good or bad) is checked every time the Power Panel is turned on, as well as every hour during operation. The check involves applying a load to the battery for a short time (approx. 1 second), followed by an evaluation. The battery status can be read back in a customer application or using 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 116: 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.

Information:

The battery should only be changed by qualified personnel.

2.3 Technical data

See section "Replacement batteries" on page 92.

2.4 Procedure for changing the battery

- Disconnect the power supply to the Power Panel

- Touch the housing or ground connection (not the power supply!) in order to discharge any electrostatic charge from your body.

- Remove the battery cover from the top of the Power Panel device using a screwdriver (1).
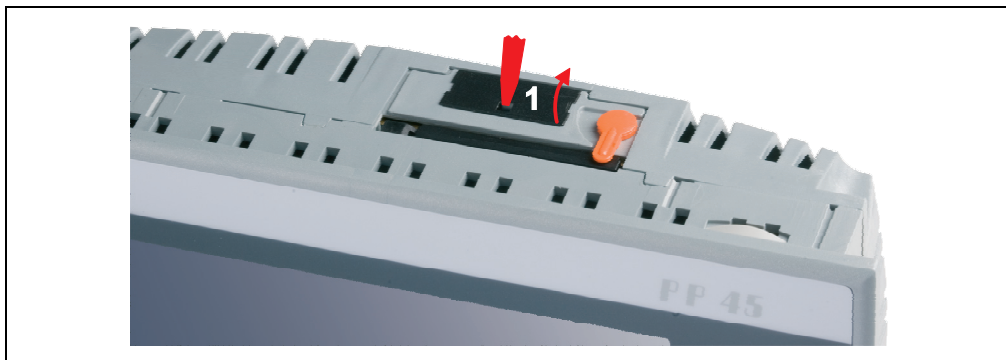
Figure 37: Changing the battery- Remove the battery cover

- Carefully remove the used battery from the holder by pulling the removal strip (2).
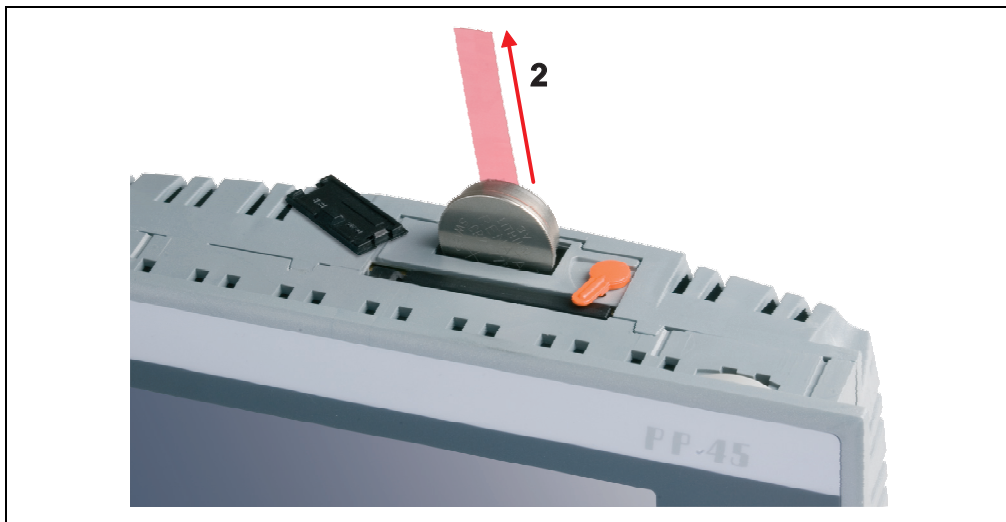
Figure 38: Changing the battery - Remove the battery

- Do not touch the new battery with pliers or uninsulated tweezers to avoid short circuiting. The battery should not be held by its edges.
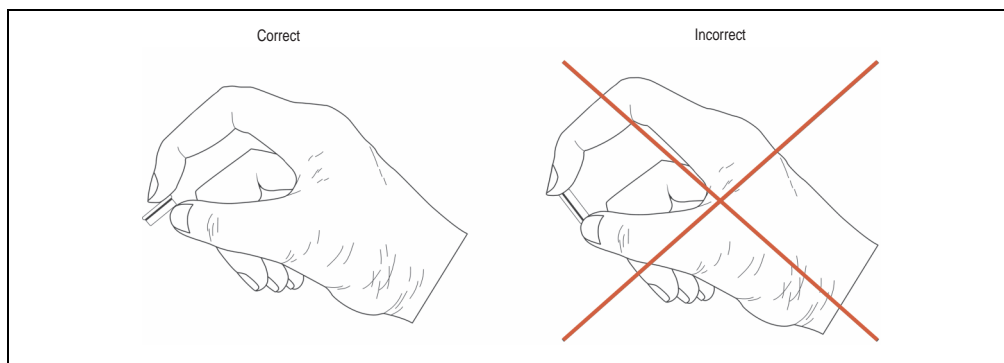
Figure 39: Battery handling

- Insert the new battery with correct polarity. The correct positioning of the removal strip must be taken into consideration.
- Replace the battery cover.
- Reconnect the power supply to the Power Panel.
- Date and time might need to be set again (using B&R Automation Studio).

Warning!

Lithium batteries are considered hazardous waste. Used batteries should be disposed of accordingly.

3. Changing the CompactFlash card

3.1 Removing the CompactFlash card
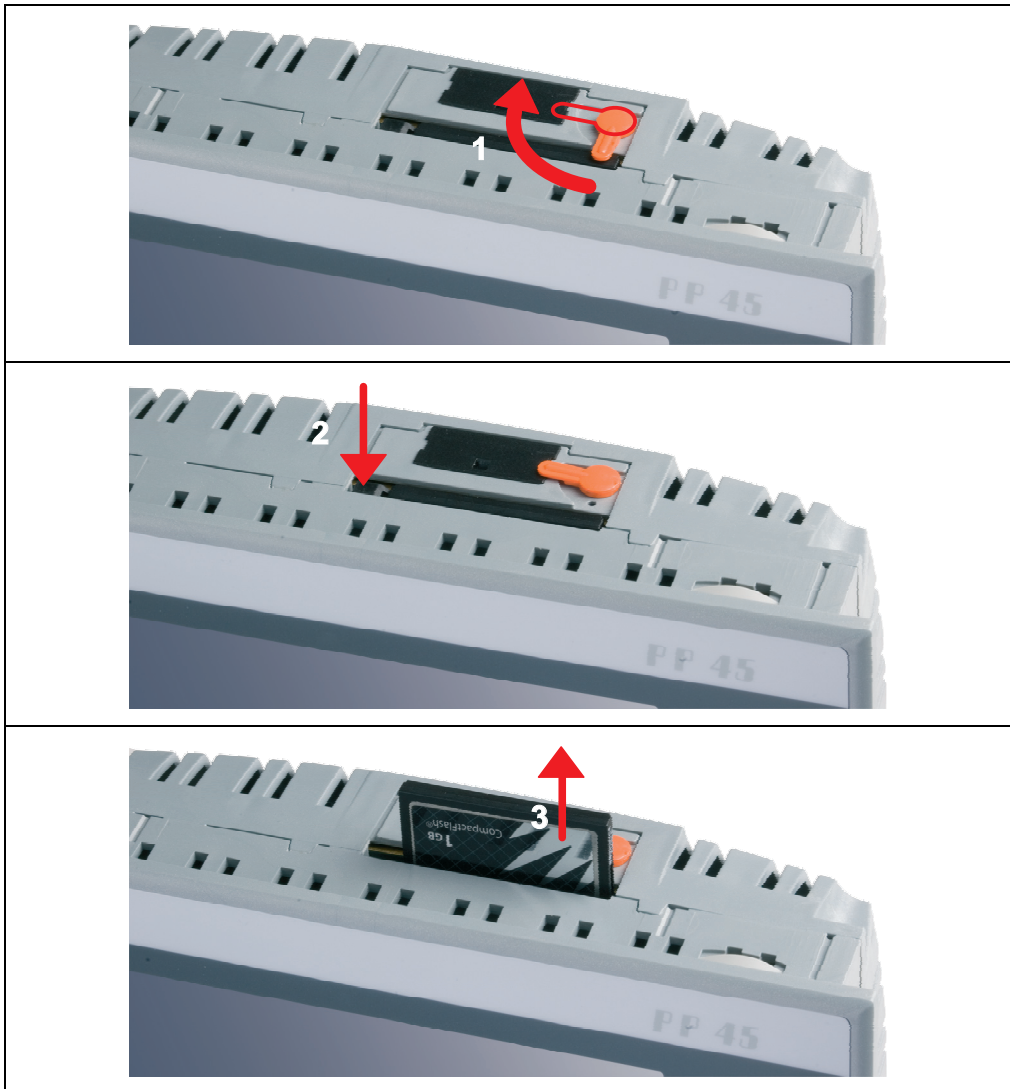
Figure 40: Removing the CompactFlash card

Turn the orange CompactFlash safety latch away from the CompactFlash (1). Then press the CompactFlash ejection lever with a screwdriver (2), until the CompactFlash is ejected. The CompactFlash card can now be removed by hand (3).

3.2 Inserting the CompactFlash card
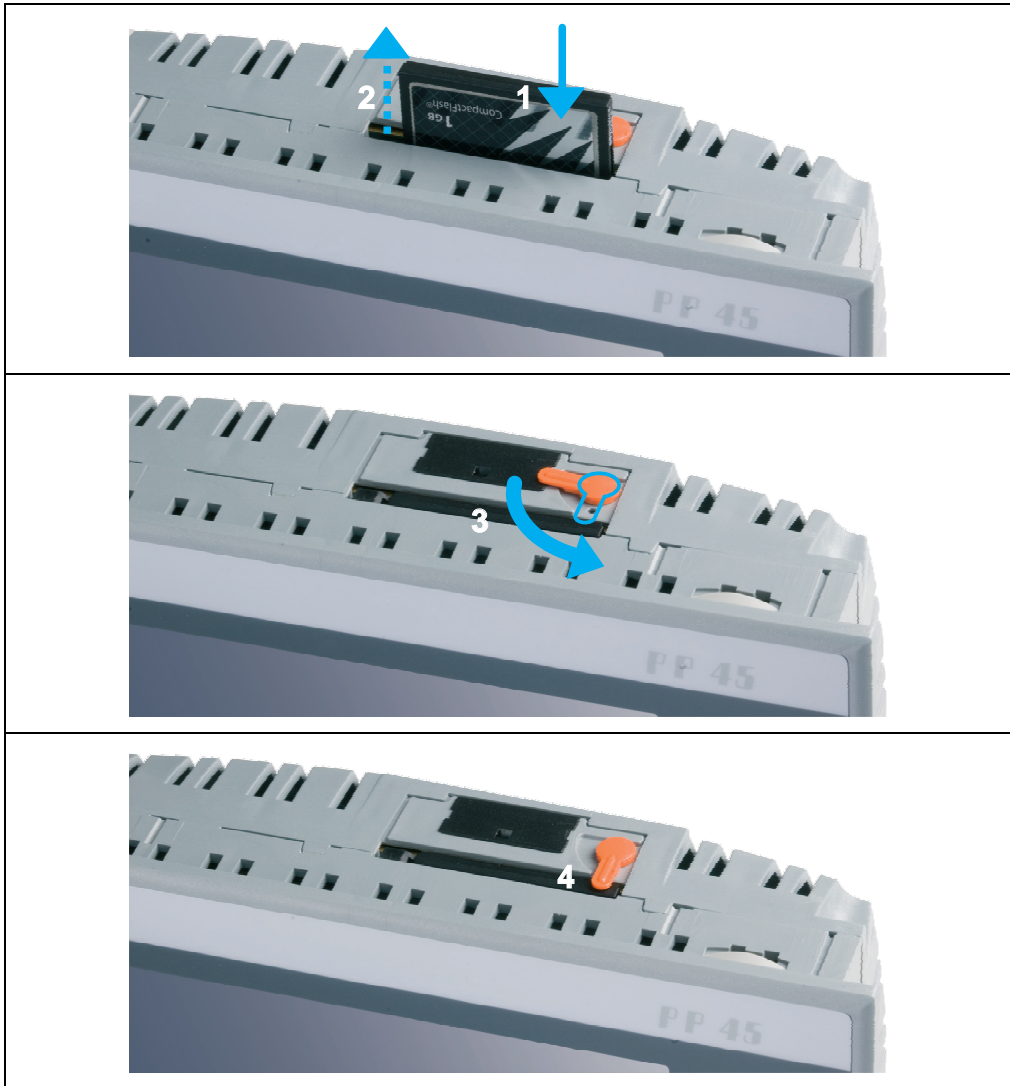
Figure 41: Inserting the CompactFlash card

Insert the CompactFlash by hand, contact side first, into the CompactFlash slot until it is flush with the front of the device (1). This will push the ejection lever out to the same level (2). The CompactFlash is mechanically designed to prevent it from being inserted incorrectly. If inserted incorrectly, the CompactFlash will not go in all the way, and the ejection lever will not come out. Finally, turn down the safety latch over the CompactFlash slot (3) to secure the CompactFlash card (4).

4. Preventing after-image effect in LCD/TFT monitors

Burn-in effect (after images, display memory effect, image retention or also image sticking) occurs in LCD/TFT monitors when a static image is displayed for a long period of time. This static screen content causes the build-up of parasitic capacities within the LCD components that prevent the liquid crystal molecules from returning to their original states. This condition may arise, is not predictable and depends on the following factors:

- Type of image displayed
- Color composition of the image
- Length of image output
- Ambient temperature

4.1 What measures can be taken against this?

There is no total solution, however, measures can be taken to significantly reduce this effect:

- Avoid static pictures or screen content
- Use screen savers (moving) when the display is not in use
- Frequent picture change
- Shut off the display when not in use

Turning off the background lighting (backlight) does not influence the prevention of the after-image effect.

Appendix A • Technical information

1. Mylar

The Mylar 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:

Information:

The following characteristics, features, and limit values only apply to this individual component and can deviate from those 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.

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)
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 Petrol Water Sea water Decon	Ferrous chloride (FeCl3) Dibutyl phthalate Dioctyl phthalate Sodium carbonate

Table 117: Chemical resistance of the Mylar

The Mylar conforms to DIN 42115 section 2 for exposure to glacial acetic acid for less than one hour without visible damage.

2. Perspectives

The perspectives can be seen in the technical data for the individual components.
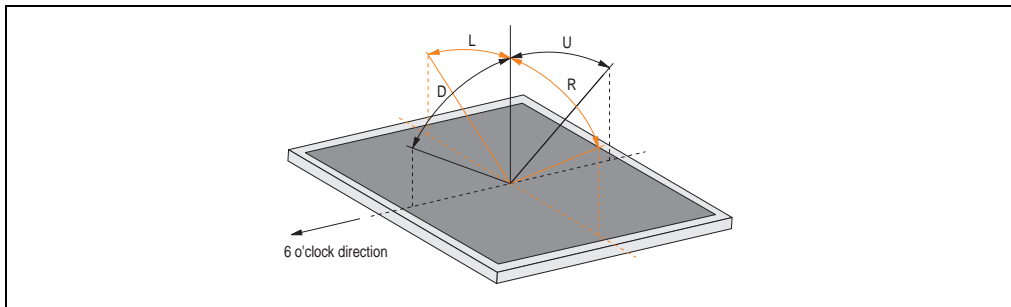
Figure 42: Viewing angles

A

Automation Runtime

A uniform runtime system for all B&R automation components.

B

Bit

Binary digit: Binary position, binary character, binary digit smallest discrete information unit. 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.

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

See *Automation Runtime.*

C

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.

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

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.

CTS

An abbreviation for "**C**lear **T**o **S**end". A signal used when transferring serial data from modem to computer, indicating its readiness to send the data. CTS is a hardware signal which is transferred via line number 5 in compliance with the RS-232-C standard.

Code, coding

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.

D

DCD

An abbreviation for "**D**ata **C**arrier **D**etected". A signal used in serial communication that is sent by the modem to the computer it is connected to, indicating that it is ready for transfer.

DRAM

An abbreviation for "**D**ynamic **R**andom **A**ccess **M**emory". Dynamic RAM consists of an integrated semiconductor circuit that stores information based on the capacitor principle. Capacitors lose their charge in a relatively short time. Therefore, dynamic RAM circuit boards must contain a logic that allows continual recharging of RAM chips. Since the processor cannot access dynamic RAM while it is being recharged, one or more waiting states can occur when reading or writing data. Although it is slower, dynamic RAM is used more often than static RAM since the simple design of the circuits means that it can store four times more data than static RAM.

DSR

An abbreviation for "**D**ata **S**et **R**eady". A signal used in serial data transfer that is sent by the modem to the computer it is connected to, indicating its readiness for processing. DSR is a hardware signal which is sent via line number 6 in compliance with the RS-232-C standard.

DTR

An abbreviation for "**D**ata **T**erminal **R**eady". A signal used in serial data transfer that is sent by the computer to the modem it is connected to, indicating the computer's readiness to accept incoming signals.

E

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].

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.

F

FIFO

An abbreviation for "**F**irst **I**n **F**irst **O**ut". A queuing organization method whereby elements are removed in the same order as they were inserted. The first element inserted is the first one removed. Such an organization method is typical for a list of documents that are waiting to be printed.

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.

G

GB

Gigabyte (1 GB = 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.

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I

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

KB

Kilobyte (1 KB = 1.024 Bytes)

L

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 = 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.

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).

Multitasking

Multitasking is an operating mode in an operating system that allows several computer tasks to be executed virtually simultaneously.

N

Node

Branching point in a network.

P

POH

An abbreviation for "**P**ower **O**n **H**ours". See MTBF.

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 products PP21 and PP41.

Q

QVGA

Abbreviation for **Q**uarter **V**ideo **G**raphics **A**rray. Usually a screen resolution of 320 × 240 pixels.

Glossary

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.

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 V to -30 V, low level: +3 V to +30 V; cable lengths up to 15 m, transfer rates up to 20 kBit/s; for point-to-point connections between 2 stations.

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

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.

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.

SVGA

Abbreviation for »**S**uper **V**ideo **G**raphics **A**rray«; Graphics standard with a resolution of at least 800×600 pixels and at least 256 colors.

T

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.

TFT display

LCD (Liquid Crystal Display) technology where the display consists of a large grid of LCD cells. Each pixel is represented by a cell, whereby electrical fields produced in the cells are supported by thin film transistors (TFT) that result in an active matrix. In its simplest form, there is exactly one thin film transistor per cell. Displays with an active matrix are generally used in laptops and notebooks because they are thin, offer high-quality color displays and can be viewed from all angles.

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.

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, printer, 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.

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