

BECKHOFF New Automation Technology

Manual | EN

CP72xx

Panel PC



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1 Notes on the documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.

The following instructions and explanations must be followed during installation and commissioning of the components. The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development. For that reason the documentation is not in every case checked for consistency with performance data, standards or other characteristics. In the event that it contains technical or editorial errors, we retain the right to make alterations at any time and without warning. No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams, and descriptions in this documentation. All illustrations shown are only examples. The configurations depicted may deviate from the standard.

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All the components are supplied in particular hardware and software configurations appropriate for the application. Changes to the hardware or software configuration are permitted, provided they are within the specified limits for power consumption and power loss (please refer to the respective data sheet).

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2 For your safety

The signal words and their meanings are explained in the chapter on safety. They contain fundamental safety instructions that are essential for the avoidance of personal injuries and damage to property.

Exclusion of liability

Beckhoff shall not be liable in the event of non-compliance with this documentation and thus the use of the devices outside the documented operating conditions.

2.1 Signal words

The signal words used in the documentation are classified below.

Warning of personal injuries

DANGER

Hazard with high risk of death or serious injury.

WARNING

Hazard with medium risk of death or serious injury.

CAUTION

There is a low-risk hazard that can result in minor injury.

Warning of property and environmental damage

NOTICE

There is a possibility of damage to the environment, equipment or data.

2.2 Intended use

The the Panel PC is intended for use as a control system for automation, visualization and communication in machine and system engineering.

The device has been developed for an IP65 working environment. It offers full protection against contact (dust-tight) and against water jets (nozzle) from any angle.

The specified limits for technical data must be adhered to.

The device can be used within the documented operating conditions.

Improper use

Do not use the device outside the documented operating conditions.

2.3 Fundamental safety instructions

The following safety instructions must be observed when handling the device.

Application conditions

- Do not use the device under extreme environmental conditions.
- Only use the device in hazardous areas if it is explicitly designed for this purpose.
- Do not carry out any work on the device while it is live. Always switch off the supply voltage for the device before mounting it, replacing device components or rectifying malfunctions. This does not apply to the replacement of hard disks in a RAID configuration.
- Never plug or unplug connectors during thunderstorms. There is a risk of electric shock.
- Ensure that the device has a protective and functional earth connection.

Damage to property, loss of data and impairment of functions

- If you change the hardware and software configurations, you must keep within the specified limits of power consumption and power loss (please refer to the respective data sheet).
- Ensure that only trained specialists with a control and automation engineering background, operate the device. Use by unauthorized persons can lead to damage to property and loss of data.
- In the case of a 24 V DC power supply unit, fuse the power supply line according to its cross-section to protect the supply line in the event of a short circuit.
- In case of fire, extinguish the device with powder or nitrogen.

2.4 Operator's obligation to exercise diligence

The operator must ensure that

- the products are used only for their intended purpose (see Chapter 2.2 [Intended use](#) [▶ 6]).
- the products are only operated in sound condition and in working order.
- the products are operated only by suitably qualified and authorized personnel.
- the personnel is instructed regularly about relevant occupational safety and environmental protection aspects, and is familiar with the operating instructions and in particular the safety instructions contained herein.
- the operating instructions are in good condition and complete, and always available for reference at the location where the products are used.

2.5 Notes on information security

The products of Beckhoff Automation GmbH & Co. KG (Beckhoff), insofar as they can be accessed online, are equipped with security functions that support the secure operation of plants, systems, machines and networks. Despite the security functions, the creation, implementation and constant updating of a holistic security concept for the operation are necessary to protect the respective plant, system, machine and networks against cyber threats. The products sold by Beckhoff are only part of the overall security concept. The customer is responsible for preventing unauthorized access by third parties to its equipment, systems, machines and networks. The latter should be connected to the corporate network or the Internet only if appropriate protective measures have been set up.

In addition, the recommendations from Beckhoff regarding appropriate protective measures should be observed. Further information regarding information security and industrial security can be found in our <https://www.beckhoff.com/secguide>.

Beckhoff products and solutions undergo continuous further development. This also applies to security functions. In light of this continuous further development, Beckhoff expressly recommends that the products are kept up to date at all times and that updates are installed for the products once they have been made available. Using outdated or unsupported product versions can increase the risk of cyber threats.

To stay informed about information security for Beckhoff products, subscribe to the RSS feed at <https://www.beckhoff.com/secinfo>.

3 Product overview

The CP72xx Economy Panel PC is designed for installation on the mounting arm and represents a powerful platform for use in machine and system engineering.

Thanks to its processors, you can use the panel PC for the following applications, among others:

- diverse automation and visualization tasks
- wide range of IoT tasks, for example when used as an IoT gateway
- simple HMI applications
- axis control
- short cycle times
- high-volume data handling

The panel PC is available in the following display sizes, with corresponding resolutions:

- 12-inch (800 x 600) 4:3
- 15-inch (1024 x 768) 4:3
- 19-inch (1280 x 1024) 5:4

In its basic configuration, the CP72xx includes the following features:

- 3½-inch motherboard
- Intel® processor
- DDR4-RAM
- 2½-inch hard disk/SSD
- 1 slot for 2½-inch hard disk/SSD
- 24 V DC power supply unit

3.1 Structure

The figure only shows an example device.

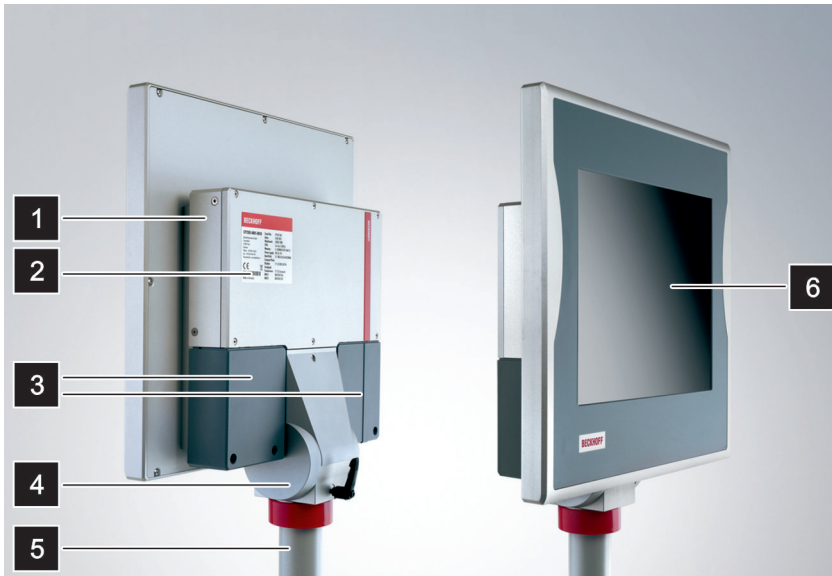


Fig. 1: Structure

Table 1: CP72xx structure

No.	Component	Description
1	Side cover	Access to battery and storage medium
2	Name plate	Information on the equipment of the panel PC
3	Connection compartment	Access to interfaces
4	Mounting arm adapter	Adapter for installation on the mounting arm tube
5	Mounting arm tube	Mounting arm tube for installation from above or below
6	Display and touch screen glass	Operation of the panel PC

3.2 Interface description

In the basic configuration, the panel PC includes the following interfaces:

- Power supply (X101)
- Ethernet RJ45 (X106)

The interfaces are located on the rear side of the panel PC behind two plastic caps. Loosen and remove the four M4 screws and then remove the plastic caps (see Fig. 2).

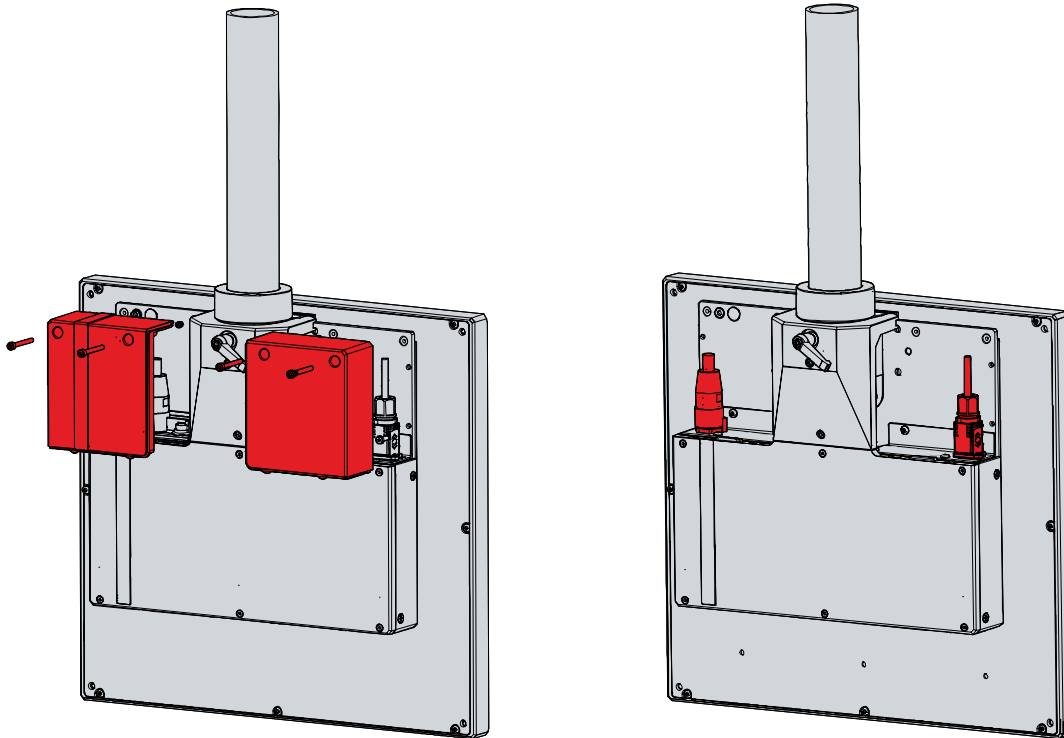


Fig. 2: Access to interfaces

3.2.1 Power supply

The panel PC is supplied with a nominal voltage of 24 V. The power supply and the protective earth of the panel PC are connected via the 12-pin round connector (X101). The cable is routed through the mounting arm adapter. The main supply voltage is applied between pins 5 (0 V) and 6 (24 V). If the panel PC is equipped with an integrated uninterruptible power supply (UPS), an external battery can additionally be connected to PIN 1 and PIN 2. The Beckhoff option C9900-U330 is available for this purpose.

Table 2: Wiring with 8-core cable



Pin	Core	Signal	Description
1	1	- BAT	Negative pole of the battery pack
2	2	+ BAT	Positive pole of the battery pack
3	3	NC	not used
4	yellow/ green		Protective earth
5	4	-	24 V supply voltage, negative pole
6	5	+ 24 V	24 V supply voltage, positive pole
7	6	PC-ON	Input PC-ON
8	7	P-S	Power Status output, minus is the negative pole of the supply voltage
9	-	NC	not used
10	-	NC	not used
11	-	NC	not used
12	-	NC	not used

Table 3: Wiring with 12-core cable

Pin	Core	Signal	Description
1	1, 8	- BAT	Negative pole of the battery pack
2	2, 9	+ BAT	Positive pole of the battery pack
3	3	NC	not used
4	yellow/ green		Protective earth
5	4, 10	-	24 V supply voltage, negative pole
6	5, 11	+ 24 V	24 V supply voltage, positive pole
7	6	PC-ON	Input PC-ON
8	7	P-S	Power Status output, minus is the negative pole of the supply voltage
9	-	NC	not used
10	-	NC	not used
11	-	NC	not used
12	-	NC	not used

3.2.2 Ethernet RJ45

The basic version of the panel PC has an Ethernet RJ45 interface (X106) in the form of a push-pull built-in socket. The 100Base-T, 1000Base-T and 2500Base-T Ethernet standards enable the connection of corresponding network components and data rates of 100/1000/2500 Mbit/s. The required speed is selected automatically. The cable is routed through the mounting arm adapter.

The RJ45 connection technology with twisted-pair cables is used. The maximum length of the cable connection is 100 m.

The controllers is used as follows, based on the device generation:

Table 4: Controller classification based on device generation

Device generation	Controller	Mbit/s
CP72xx--0060	Intel® i210	100/1000
CP72xx--0070	Intel® i210	100/1000
CP72xx--0080	Intel® i225	100/1000/2500

The Ethernet port is suitable for cycle times <= 1 ms and for distributed clock applications with EtherCAT.

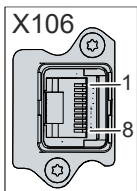


Fig. 3: Ethernet interface pin numbering

Table 5: Ethernet interface pin assignment

Pin	Signal	Description
1	T2 +	Pair 2
2	T2 -	
3	T3 +	Pair 3
4	T1 +	Pair 1
5	T1 -	
6	T3 -	Pair 3
7	T4 +	Pair 4
8	T4 -	

3.3 Optional interfaces

Various interface options are available to expand your panel PC with additional interfaces beyond the basic configuration. The following table provides information about the available interfaces depending on the device generation:

Table 6: CP72xx interface options

Ordering option	Description	Device generation
C9900-E185	IP65 connector in the connection compartment of the CP72xx for the second on-board Ethernet adapter, push-pull Ethernet socket	CP72xx-xxxx-0060 CP72xx-xxxx-0070 CP72xx-xxxx-0080
C9900-E186	IP65 connector M12 socket in the connection compartment of the CP72xx for a serial interface RS232	CP72xx-xxxx-0070 CP72xx-xxxx-0080
C9900-E187	IP65 connector M12 socket in the connection compartment of the CP72xx for a USB 2.0 port	CP72xx-xxxx-0060 CP72xx-xxxx-0070 CP72xx-xxxx-0080
C9900-E190	USB-A socket in the connection compartment of the CP72xx for a USB 2.0 port, with IP65 cover	CP72xx-xxxx-0060 CP72xx-xxxx-0070 CP72xx-xxxx-0080
C9900-E169	2-port USB interface in the back wall of the panel PC, DIN 8-pin with IP65 screw cap , with adapter cable from DIN 8-pin to 2 x USB	CP72xx-xxxx-0060 CP72xx-xxxx-0070 CP72xx-xxxx-0080
C9900-E215	1-port USB interface in the back wall of the panel PC, USB socket with IP65 screw cap	CP72xx-xxxx-0060 CP72xx-xxxx-0070 CP72xx-xxxx-0080
C9900-E283	IP65 connector in the connection compartment of the CP72xx for a USB 3.0 port, push-pull USB 3.0 socket	CP72xx-xxxx-0060 CP72xx-xxxx-0070 CP72xx-xxxx-0080
C9900-E248	IP65 connector M12 socket in the connection compartment of the CP72xx for a serial interface RS422, electrical isolation, overvoltage protection. Configuration as full duplex endpoint: Echo on, Auto send off, Always send on, Auto receive off, Always receive on, Termination on	CP72xx-xxxx-0070 CP72xx-xxxx-0080
C9900-E261	IP65 connector M12 socket in the connection compartment of the CP72xx for a serial interface RS485, electrical isolation, overvoltage protection. Configuration as endpoint without echo: Echo off, Auto send on, Always send off, Auto receive on, Always receive off, Termination on	CP72xx-xxxx-0070 CP72xx-xxxx-0080

3.4 Name plate

The name plate provides information about the panel PC equipment. The name plate shown here serves only as an example.

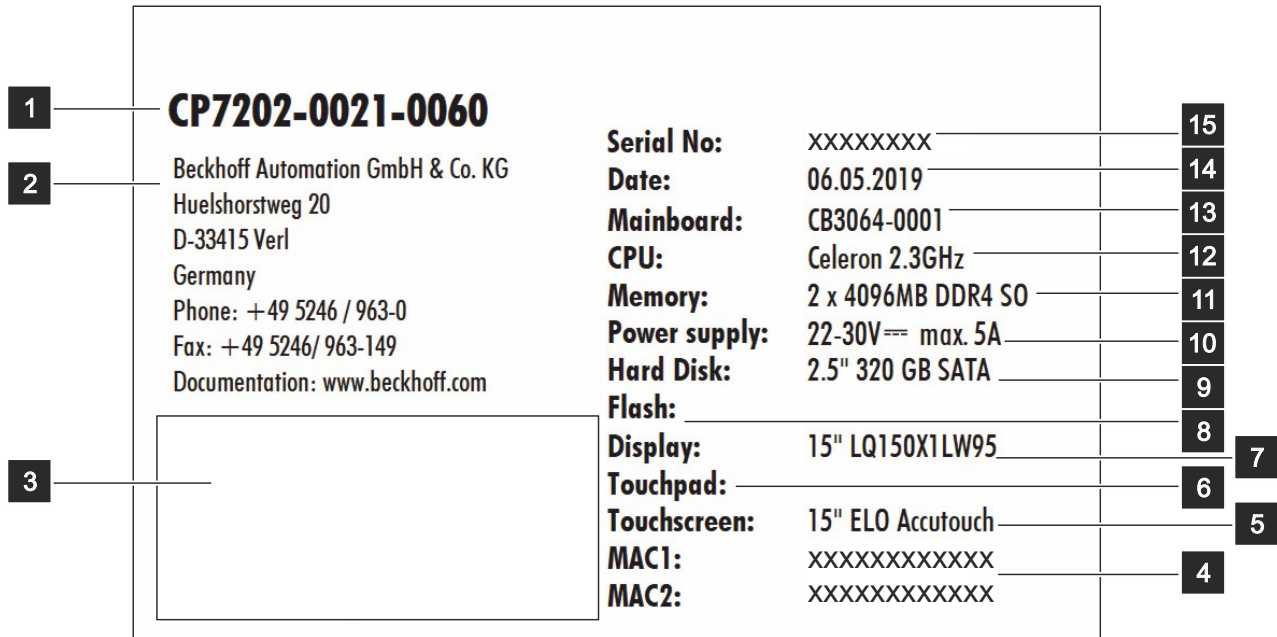
















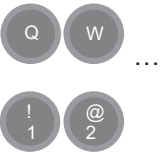
Fig. 4: Name plate


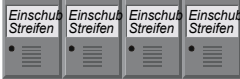
Table 7: Legend CP72xx name plate

No.	Description
1	Model: The last four digits indicate the device generation.
2	Address of the vendor
3	Symbols Note: Here are the symbols applicable to the device such as CE, EAC, UKCA,  . The approvals of your device can be found on the name plate and in chapter 10.2 Approvals [▶ 44].
4	MAC addresses of the Ethernet interfaces
5	Touch screen
6	Touch pad
7	Display
8	SSD or CFast
9	Hard disk
10	Power supply
11	Main memory
12	CPU
13	Mainboard
14	Date of manufacture
15	Serial number (BTN)

3.5 Key functions

Table 8: Key functions CP72xx

Key	Function
	Move the cursor one step in the corresponding direction
	<i>Home</i> = cursor to beginning of the line <i>End</i> = cursor to end of the line
	<i>Pg Up</i> = scroll forward one page <i>Pg Dn</i> = turn back one page
	<i>Tabulator</i> = cursor to next input field <i>Shift + Tab</i> = cursor to previous input field
	<i>Del</i> = delete character to the right of the cursor
	<i>Enter</i> = confirm input
	<i>Backspace</i> = delete character to the left of the cursor
	<i>Shift</i> pressed with letter = upper case instead of lower case letter <i>Shift</i> pressed with number = displayed character instead of number
	<i>Caps Lock</i> = permanent pressing of the <i>Shift</i> key (pressing the <i>Shift</i> key deactivates the function)
	<i>Ctrl, Alt</i> = change the meaning of a key pressed at the same time
	Open the start menu of the operating system in use
	Opening the properties window of a selected object
	<i>Esc</i> = close dialog box, cancel operations
	Set printed character to the cursor position

	<p><i>Function keys</i> = functions of the keys determined by the software</p>
	<p><i>Special keys</i> = special keys with LED that can be controlled by the TwinCAT automation software</p>

3.6 Connection cable

Optionally, ready-made connecting cables for all connections are available in various lengths. You can order them using the following article descriptions:

Table 9: Power supply cable

Connecting cable	Power supply cable with IP65 plug
C9900-K364	Power supply cable IP65 for CP32xx, CP37xx or CP72xx up to 19-inch display, length 2 m, pre-assembled, M23 socket, screw-type, 8-wire, second end open
C9900-K271	Power supply cable IP 65 for CP32xx, CP37xx or CP72xx, length 5 m, pre-assembled, M23 socket, screw-type, 8-wire, second end open
C9900-K272	Power supply cable IP 65 for CP32xx, CP37xx or CP72xx, length 10 m, pre-assembled, M23 socket, screw-type, 8-wire, second end open
C9900-K275	Power supply cable IP 65 for CP32xx, CP37xx or CP72xx, length 5 m, 12-wire: 24 V minus, battery plus and battery minus each 2 x 1 mm ² for low voltage drop, pre-assembled, M23 socket, screw-type, second end open
C9900-K276	Power supply cable IP 65 for CP32xx, CP37xx or CP72xx, length 10 m, 12-wire: 24 V minus, battery plus and battery minus each 2 x 1 mm ² for low voltage drop, pre-assembled, M23 socket, screw-type, second end open
C9900-K277	Power supply cable IP 65 for CP32xx, CP37xx or CP72xx, length 20 m, 12-wire: 24 V minus, battery plus and battery minus each 2 x 1 mm ² for low voltage drop, pre-assembled, M23 socket, screw-type, second end open

Table 10: Network cable

Connecting cable	Network cable with IP65 plug
C9900-K363	Network cable for CP32xx, CP37xx and CP72xx, length 2 m, pre-assembled, push-pull Ethernet connector IP65, second end RJ45, IP20
C9900-K281	Network cable for CP32xx, CP37xx and CP72xx, length 3 m, pre-assembled, push-pull Ethernet connector IP65, second end RJ45, IP20
C9900-K282	Network cable for CP32xx, CP37xx and CP72xx, length 5 m, pre-assembled, push-pull Ethernet connector IP65, second end RJ45, IP20
C9900-K283	Network cable for CP32xx, CP37xx and CP72xx, length 10 m, pre-assembled, push-pull Ethernet connector IP65, second end RJ45, IP20
C9900-K284	Network cable for CP32xx, CP37xx and CP72xx, length 15 m, pre-assembled, push-pull Ethernet connector IP65, second end RJ45, IP20
C9900-K285	Network cable for CP32xx, CP37xx and CP72xx, length 20 m, pre-assembled, push-pull Ethernet connector IP65, second end RJ45, IP20
C9900-K286	Network cable for CP32xx, CP37xx and CP72xx, length 30 m, pre-assembled, push-pull Ethernet connector IP65, second end RJ45, IP20
C9900-K287	Network cable for CP32xx, CP37xx and CP72xx, length 40 m, pre-assembled, push-pull Ethernet connector IP65, second end RJ45, IP20
C9900-K288	Network cable for CP32xx, CP37xx and CP72xx, length 50 m, pre-assembled, push-pull Ethernet connector IP65, second end RJ45, IP20

Table 11: USB cable

Connecting cable	USB cable with IP65 connector
C9900-K291	USB 2.0 cable for CP32xx, CP37xx or CP72xx, length 3 m, pre-assembled, M12 connector IP65, screw-type, 4-pin, second end USB B connector
C9900-K292	USB 2.0 cable for CP32xx, CP37xx or CP72xx, length 5 m, pre-assembled, M12 connector IP65, screw-type, 4-pin, second end USB B connector
C9900-K306	USB 3.0 cable for CP32xx, CP37xx or CP72xx, length 3 m, pre-assembled, push-pull USB 3.0 connector IP65, second end USB B connector IP20

3.7 Accessories

You can order your panel PC with accessories already mounted ex factory. The following Beckhoff options are available:

- C9900-M400: Toolboard for keyboard or tools, mounted on the bottom of a Control Panel or Panel PC CP7xxx, can only be ordered together with the control panel or panel PC.

Figure 5 shows an example of a panel PC with mounted toolboard.

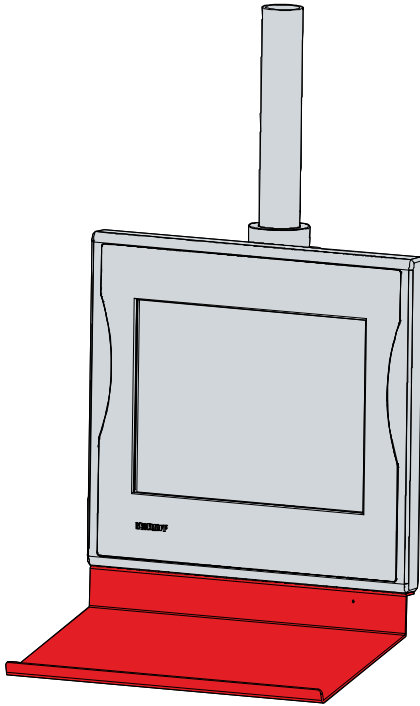


Fig. 5: Toolboard

4 Commissioning

In order to use the panel PC, you must first commission it. The first step is to transport the device to its operating location and unpack it. This is followed by the installation of the device on the mounting arm, the connection of the cables and the power supply and finally the switching on of the panel PC.

Operation of the panel PC

The panel PC is operated via the touch screen.

NOTICE

Damage to the touch screen

Operating the touch screen with unsuitable objects may damage the touch screen.

- Operate the touch screen only with bare fingers or wearing suitable gloves.
- If you use gloves, make sure that no hard particles such as metal shavings, glass splinters or similar adhere to the glove.

If you, as the user, require additional protection for the touch screen against dirt and scratching, for example due to dirty hands, this can be achieved with a Beckhoff protective film. The film provides short-term protection for a few days.

You can either order a Beckhoff protective film individually and fit it yourself retrospectively, or you can order the film for fitting directly ex factory. Please refer to the price list for the available protective films according to the display size of your device.

Proceed as follows to attach the protective film to the touch screen:

1. Ensure that the environment is as dust-free as possible.
 2. Thoroughly clean the surface of the device to be fitted with the film and remove all grease residues.
 3. Detach the film from the backing at the short edge and place it on the surface.
 4. Gradually remove the film from the backing. At the same time, use a doctor blade or other object with a soft rubber or felt edge to apply the film.
 5. Brush away air bubbles towards the edge with a doctor blade or other object with a soft rubber or felt edge.
- ⇒ The film is now fitted.

4.1 Transport and unpacking

The specified storage conditions must be adhered to (see chapter 9 [Technical data \[▶ 42\]](#)).

Despite the robust design of the unit, the components are sensitive to strong vibrations and impacts. During transport the device must therefore be protected from mechanical stress. Appropriate packaging of the panel PC, in particular the original packaging, can improve the vibration resistance during transport.

NOTICE

Hardware damage due to condensation

Unfavorable weather conditions during transport can cause damage to the device.

- Protect the device against moisture (condensation) during transport in cold weather or in case of extreme temperature fluctuations.
- Do not put the device into operation until it has slowly adjusted to the room temperature.
- Should condensation occur, wait for about 12 hours before switching the device on.

Unpacking

Proceed as follows to unpack the device:

1. Check the packaging for transport damage.
2. Remove packaging.
3. Keep the packaging for possible future transport.
4. Check your delivery for completeness by comparing it with your order.
5. Check the contents for visible shipping damage.

In case of discrepancies between the package contents and the order, or in case of transport damage, please inform Beckhoff Service (see Chapter 10.1 [Service and Support \[▶ 43\]](#)).

4.2 Installation

The panel PC is designed for installation on a mounting arm system. Please observe the environmental conditions prescribed for the operation (see Chapter 9 [Technical data](#) [▶ 42]).

NOTICE

Extreme environmental conditions

Extreme environmental conditions can cause damage to the device.

- Avoid extreme environmental conditions.
- Protect the device from moisture and heat.

The panel PC is installed on the mounting arm system using the mounting arm adapter. By default, the panel PC is delivered with the rotatable mounting arm adapter for installation on the mounting arm tube from above. Alternatively, you can order the panel PC with the following mounting arm adapters:

Table 12: Mounting arm adapter ordering options

Position	Order identifier	Version
2	C9900-M161	Rotatable mounting arm adapter on CP72xx Panel PC for Rittal and Rolec mounting arm systems with 48 mm tube from below instead of from above
3	C9900-M162	Rotatable and tiltable mounting arm adapter on CP72xx Panel PC for Rittal and Rolec mounting arm systems with 48 mm tube, from above instead of rotatable mounting arm adapter
4	C9900-M163	Rotatable and tiltable mounting arm adapter on CP72xx Panel PC for Rittal and Rolec mounting arm systems, with 48 mm tube, from below instead of rotatable mounting arm adapter

Figure 6 shows the standard mounting arm adapter (1) and the three available adapter options (2-4). All adapters have a clamping lever to prevent rotation and can be swiveled by $\pm 165^\circ$. The adapters adapt the panel PC with a 48 mm circular tube. The permissible tolerance is -0.1 to $+0.8$ mm.

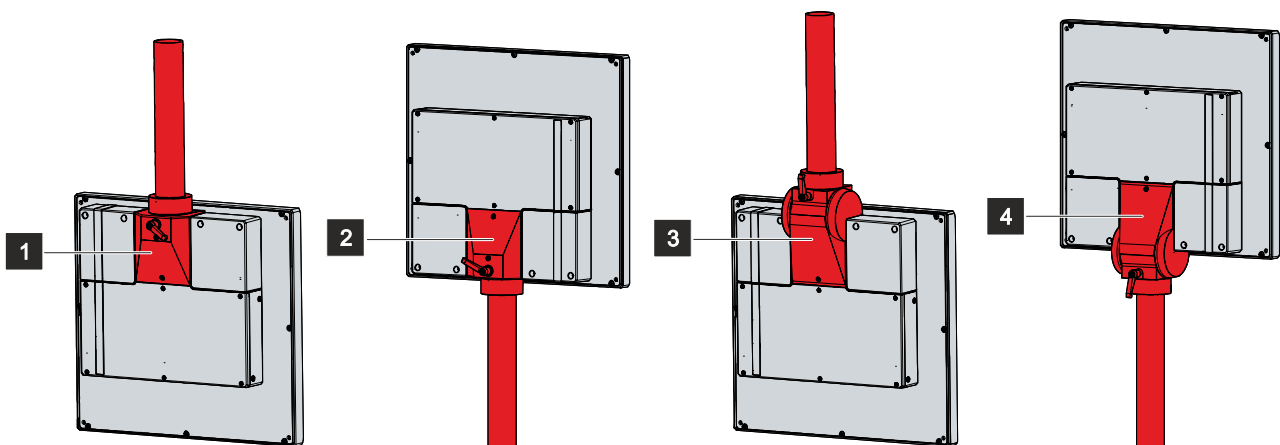


Fig. 6: Mounting arm adapter

Installing the mounting arm tube

Observe the following points when installing the mounting arm tube on the mounting arm adapter:

- For the correct installation height, use the position of the screen for guidance. This should always be optimally visible to the user.
- Do not expose the panel PC to direct sunlight.

Regardless of which of the Beckhoff mounting arm adapters you have chosen, the procedure for installing the mounting arm tube is the same. Depending on whether you have oriented the mounting arm adapter upwards or downwards, the mounting arm tube has to be installed on the adapter in the same direction.

Figure 7 shows an example of the procedure with the standard mounting arm adapter facing upwards.

To install the mounting arm tube on the mounting arm adapter, proceed as follows:

1. Slide the red plastic cover ring upwards (section A).
2. Unscrew the two hexagon socket screws (1) a few turns with a 3 mm Allen key (section B).
3. Insert the mounting arm tube into the mounting arm adapter all the way to the stop (section C).
4. Retighten the two hexagon socket screws with a torque of 3 Nm to additionally secure the mounting arm tube.
5. Push the red plastic cover ring back down (section D).

⇒ You have installed the mounting arm tube on the mounting arm adapter.

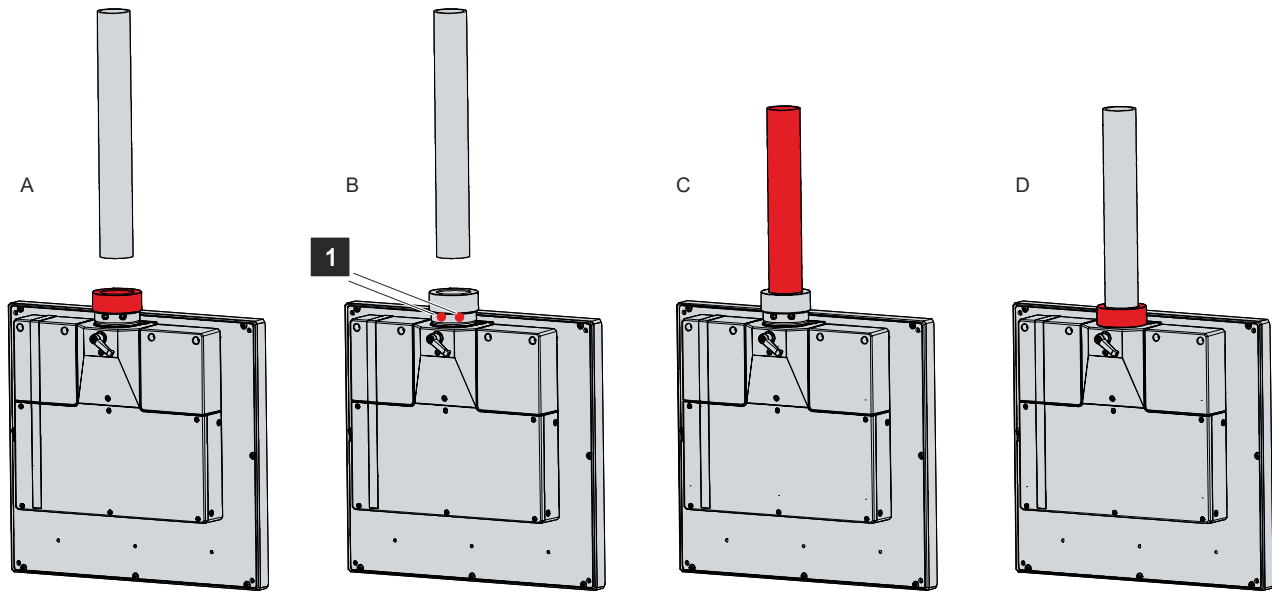


Fig. 7: Installing the mounting arm tube

4.3 Connecting the panel PC

⚠ CAUTION

Risk of electric shock

Dangerous touch voltages can lead to electric shock. To avoid electric shock, observe the following:

- Never connect or disconnect the device cables during a thunderstorm.
- Provide protective earthing for handling the device.

To prepare the industrial PC for operation, it must be connected. The first step is to ground the device. Then you can connect the cables and the power supply.

An external power supply unit is required to supply 24 V DC (-15 %/+20 %) for operation.

The cabling of the industrial PC in the control cabinet must be done in accordance with the standard EN 60204-1:2006 PELV = Protective Extra Low Voltage:

- The PE conductor (protective earth) and the "0 V" conductor of the voltage source must be on the same potential (connected in the control cabinet).
- Standard EN 60204-1:2006, section 6.4.1:b stipulates that one side of the circuit, or a point of the energy source for this circuit must be connected to the protective conductor system.

Devices connected to the industrial PC with their own power supply must have the same potential for the PE and "0 V" conductors as the industrial PC (no potential difference).

4.3.1 Grounding the panel PC

Potential differences are minimized and electrical currents are diverted to the ground through grounding or potential equalization of electronic devices. This is to prevent dangerous touch voltages and electromagnetic interference.

Protective earth

The protective grounding of a device serves to avoid dangerous touch voltages. According to the EN 60204-1 standard (Chapter 8 Potential equalization), protective grounding is required if:

- the device exceeds dimensions of 50 mm x 50 mm,
- the device can be touched or encompassed over a large area,
- contact between the device and active parts is possible,
- an insulation fault may occur.

Establish low-resistance protective earthing of the panel PC via the voltage connection to avoid dangerous touch voltages. There is a pin in the voltage socket for the protective earth (PE).

EMC

NOTICE

Hardware damage due to electromagnetic interference

The use of the panel PC without a functional earth can lead to material damage due to electromagnetic interference.

- Only use the device with functional earth.

Electromagnetic compatibility (EMC) of the panel PC includes on the one hand not affecting other devices and equipment by electromagnetic interference and on the other hand not being disturbed by electrical or electromagnetic effects itself.

To do this, the panel PC must comply with certain protection requirements. The panel PC has EMC interference immunity according to EN 61000-6-2. The EMC interference emission of the device meets the requirements of EN 61000-6-4.

The functional earth is necessary for the EMC of the device. The functional earth is established via the connection of the grounding bolt in the connection section of the panel PC (see Fig. 8). Use wires with a cross-section of at least 4 mm² or a flat conductor for the ground connection, as the circumference of the conductor should be as large as possible.

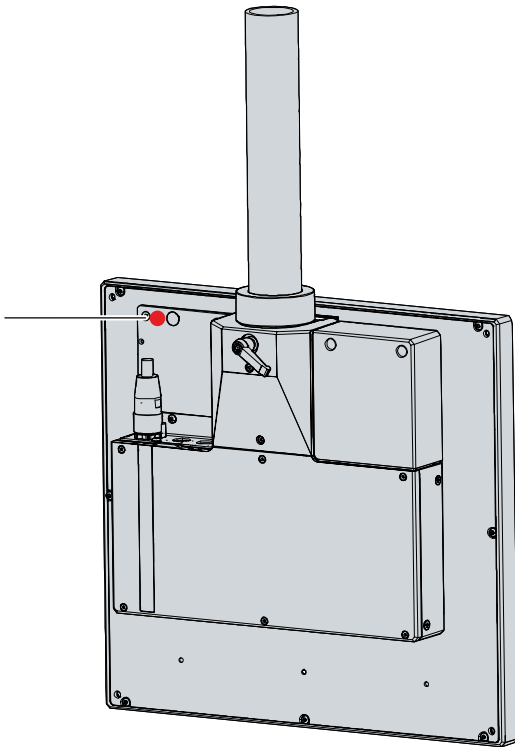


Fig. 8: Grounding bolt for functional earthing

For information on how to access the connection compartment, refer to chapter 3.2 [Interface description](#) [► 11].

4.3.2 Connecting cables and power supply

NOTICE

Incorrect connection procedure

Incorrect procedure when connecting the cables and the power supply can cause hardware damage.

- Follow the documented procedure for connecting the cables and the power supply.
- Always connect all cables first and only then switch on the power supply.
- Please read the documentation for the external devices prior to connecting them.

NOTICE

Connection of incorrect battery packs

Connecting the wrong battery packs can cause damage to the device and the battery packs.

- Only connect the C9900-U330 Beckhoff battery pack to your device.

The connections are located at the rear of the panel PC in the connection compartment. The interface cables are routed through the mounting arm tube. To gain access to the connection compartment, you must first remove the two plastic caps (see chapter 3.2 [Interface description](#) [► 11]).

Connecting cables

Make sure that you first ground the panel PC (see chapter 4.3.1 [Grounding the panel PC](#) [► 24]) and then plug in all data transmission cables.

Connecting the power supply

Cables with a maximum cable cross-section of 1.5 mm² can be used for connecting the power supply. For long supply lines, use 1.5 mm² cables to achieve a low voltage drop on the supply line. There should be at least 22 V at the voltage connector of the panel PC, so that the PC remains switched on during voltage fluctuations.

Proceed as follows to connect the 24 V_{DC} power supply unit:

1. Plug the power supply cable into the power supply socket of the panel PC.
2. Connect the panel PC to your external 24 V power supply.
3. Switch on the 24 V power supply.

External battery pack

If you ordered your device with an integrated UPS, then you can connect an external battery pack and install it on a DIN rail near to the PC. Use only Beckhoff battery packs for this:

- C9900-U330: universal battery pack for PCs and panel PCs in any configuration

PIN 4 and 5 of the battery pack are available for looping through a 24 V power supply. Accordingly, you can connect a three-core sheathed cable with plus and minus of the supply voltage as well as protective earth to the battery pack and then connect to the panel PC with a five-core sheathed cable. The method of connecting different components can be taken from the wiring diagram in fig. 9.

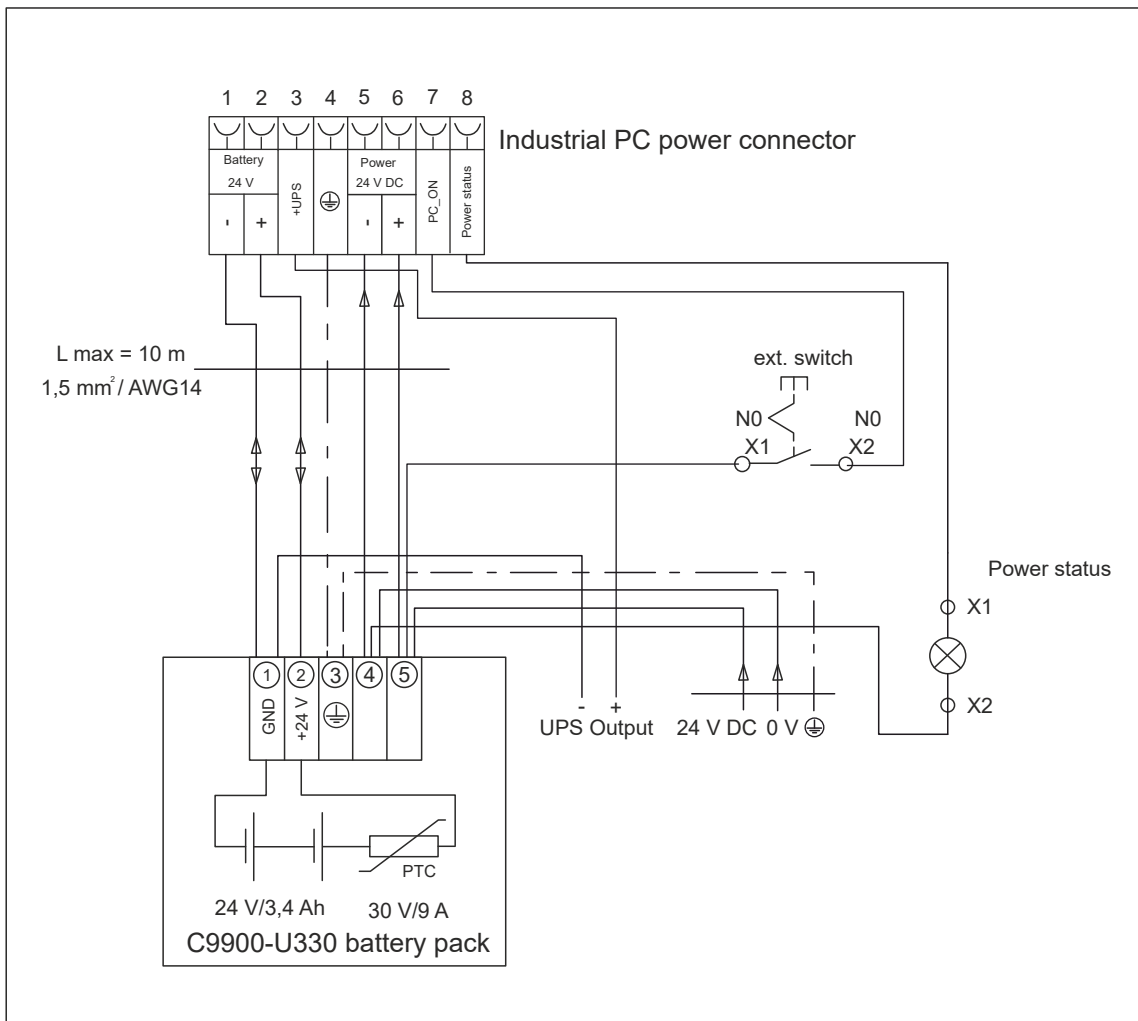


Fig. 9: Wiring diagram

For more information on the battery pack, please refer to the corresponding [manual](#).

4.4 Switching the panel PC on and off

NOTICE

Public networks

Connecting the PC to public networks without additional protective measures can compromise the safety of the device.

- Protect the PC before connecting it to public networks.

NOTICE

Data loss due to switching off the PC while the software is running

Switching off the PC before the running software is terminated and the operating system is shut down can lead to data loss.

- Quit the running software and shut down the operating system before switching off the PC.

NOTICE

Data loss due to switching off the power supply when the UPS battery is empty

Switching off the power supply when the UPS battery is empty can lead to data loss, as the operating system cannot be shut down properly without battery power.

- Ensure that the UPS battery is charged in the event of a power failure.
- For UPS C9900-P209 and C9900-U209, charge the battery exclusively via the switched-on PC. Never connect a charger.

NOTICE

Shortened battery life due to switching off the power supply

If the power supply is simply switched off, the operating system shuts down via the battery. With daily use, this significantly shortens the life of the battery.

- Avoid switching off the power supply before shutting down the operating system.
- Use the PC-ON input (see the following description) to shut down the operating system in a battery-friendly manner.

The industrial PC is started or switched off when the system is switched on or off or when the power supply to the PC is connected or disconnected.

You can use the PC-ON input of the PC to control the startup and shutdown of the operating system. The PC-ON signal is inverted, which is why the operating system boots up at 0 V at the input and shuts down at 24 V. During operation, 0 V must therefore be permanently applied to the input. If you want to shut down the operating system, you must apply 24 V to the PC-ON input. Once the operating system has shut down, the PC power supply unit sets the Power Status output from 24 V to 0 V. This indicates that the shutdown is complete. You can then switch off the power supply. If you remove the 24 V from the PC-ON input before you have switched off the power supply, the operating system restarts. Therefore, 24 V must be applied to the PC-ON input until you have switched off the power supply.

To shut down the operating system properly, you can install an additional ON/OFF switch next to the machine's main switch to turn the machine on and off. The main switch can thus remain switched on in principle and thus ensures that the PC is still supplied with power during the shutdown of the operating system. Via the Power Status output, you can switch, for example, a contactor that switches off the entire system. The load capacity of the Power Status output is limited to max. 0.5 A. No fuse protection is required.

Driver installation

When you switch on the PC for the first time, the optionally pre-installed operating system will be started. For any additional hardware you have connected, you have to install the drivers yourself afterwards. In addition, the Beckhoff Device Manager starts automatically. The Device Manager is a software from Beckhoff that supports you in configuring the PC.

If you have ordered the PC without an operating system, you must install this and the driver software for the additional hardware you have connected and for the devices in the PC yourself. Please follow the instructions in the documentation for the operating system and the additional devices.

UPS software components

The UPS software components with the corresponding drivers must be installed on the PC to operate the power supply unit as a UPS. The software components and drivers are already installed on delivery of the PC with operating system. Otherwise, you have to install the installation package *Beckhoff UPS* yourself.

You can obtain the installation package from Beckhoff Service (service@beckhoff.com), who will provide you with the package. You then use the installation package to install the UPS software components. The UPS software components come with a detailed help function. Call up the help files either directly from the configuration register by clicking the Help button or start the file under *Start > Programs > Beckhoff > UPS software components*.

5 Beckhoff Device Manager

The Beckhoff Device Manager enables detailed system diagnostics with uniform secure access to the existing hardware and software components. System data is recorded, analyzed and evaluated during operation. The data helps to detect deviations at an early stage and prevent PC downtime.

The Beckhoff Device Manager always starts automatically after the industrial PC has been booted. In addition, you have the option of manually starting the previously closed Device Manager at any time.

The industrial PC is delivered with predefined access data as standard:

- User name: Administrator
- Password: 1

You also have the option of using the Beckhoff Device Manager to remotely configure the industrial PC via a web browser. More detailed information is available in the Beckhoff Device Manager [manual](#).

First start Beckhoff Device Manager

When your industrial PC is booted for the first time, the Beckhoff Device Manager also starts automatically for the first time. The Security Wizard opens. This tells you that you should reset the default password set by Beckhoff. Proceed as follows:

1. Click **Next** on the Security Wizard start page.
⇒ This will take you to the **Change Passwords** page:

BECKHOFF Device Manager

Change Passwords

Your Beckhoff IPC is delivered with default user accounts and related default passwords! It is strongly recommended to change the default passwords to prohibit unauthorized access to your Beckhoff IPC. Please note that these passwords are valid for the access to the Beckhoff Device Manager, too.

Change the default password of the user account(s) to prohibit unauthorized access to your Beckhoff IPC.

Local Users	Administrator
Password	<input type="text"/>
New Password	<input type="text"/>
New Password (confirm)	<input type="text"/>

Auto Logon Enabled

<< Back Next >>

Fig. 10: Beckhoff Device Manager - Change passwords

2. Enter the access data of the Device Manager on delivery.
3. Choose a secure new password. Instructions for choosing a secure password are given below.
4. Confirm the changes by clicking on the tick in the red box on the right.
5. Exit the Security Wizard.
⇒ You have reached the Device Manager start page.

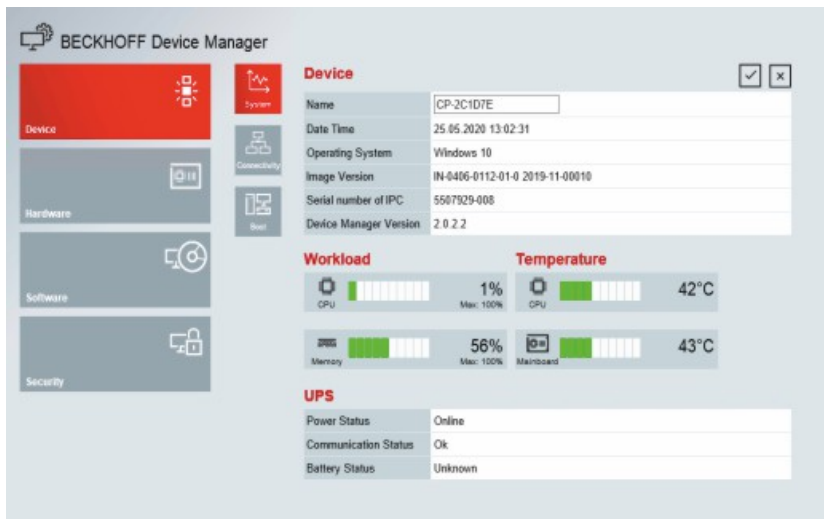


Fig. 11: Beckhoff Device Manager – Start page

Navigate forward in the menu and configure the industrial PC. Note that modifications only become active once they have been confirmed.

Manual start Beckhoff Device Manager

To start the Beckhoff Device Manager manually, proceed as follows:

1. Open a web browser locally on the industrial PC.
2. Enter *localhost/config* in the web browser to start the Beckhoff Device Manager.

The Beckhoff Device Manager starts. The Security Wizard appears.

Secure passwords

Strong passwords are an important prerequisite for a secure system.

Beckhoff supplies the device images with standard user names and standard passwords for the operating system. It is imperative that you change these.

Controllers are shipped without a password in the UEFI/BIOS setup. Beckhoff recommends assigning a password here as well.

Please note the following:

- Passwords should be unique for each user and service.
- Only change passwords after an incident in which passwords have become known without authorization.
- Train the device users in the use of passwords.

A secure password has the following characteristics:

- Password complexity: The password should contain capital and lower-case letters, numbers, punctuation marks and special characters.
- Password length: The password should be at least 10 characters long.

6 Decommissioning

NOTICE

Hardware damage due to power supply

A connected power supply can cause damage to the panel PC during disassembly.

- Disconnect the power supply from the device before starting to disassemble it.

As part of the decommissioning of the panel PC, you must first disconnect the power supply and cables. Afterwards, you can dismount the device from the mounting arm.

If you do not wish to use the panel PC any further, chapter 6.2 [Disassembly and disposal \[► 33\]](#) provides information on the correct disposal of the device.

6.1 Disconnecting the power supply and cables

⚠ CAUTION

Risk of electric shock

Dangerous touch voltages can lead to electric shock. To avoid electric shock, observe the following:

- Never connect or disconnect the device cables during a thunderstorm.
- Provide protective earthing for handling the device.

Before disassembling the panel PC, disconnect the cables and the power supply. Follow the steps below:

1. Shut down the panel PC.
 2. Gain access to the connection compartment of the panel PC (see chapter 3.2 [Interface description \[► 11\]](#)).
 3. Disconnect the panel PC from your external 24 V power supply.
 4. Pull the power supply cable out of the power supply socket.
 5. Make a note of the wiring of all data transmission cables if you want to restore the cabling with another device.
 6. Disconnect all data transmission cables from the panel PC.
 7. Finally, disconnect the ground connection.
- ⇒ You have disconnected the cables and the power supply.

6.2 Disassembly and disposal

In order to be able to dismount the panel PC from the mounting arm, you must first have disconnected the power supply and the cables (see Chapter 6.1 [Disconnecting the power supply and cables](#) [▶ 32]).

Disassembly mounting arm tube

NOTICE

Damage to property due to falling down

If the panel PC is suspended from the ceiling and you remove the mounting arm tube from the mounting arm adapter without securing it, the panel PC will fall down.

- Always secure the panel PC against falling before removing the mounting arm tube from the mounting arm adapter.

To remove the mounting arm tube from the mounting arm adapter, follow the steps below, shown in Figure 12:

1. Slide the red plastic cover ring upwards (section A).
2. Unscrew the two hexagon socket screws (1) a few turns with a 3 mm Allen key (section B).
3. Pull the mounting arm tube out of the mounting arm adapter (section C).
4. Screw in the two hexagon socket screws until they no longer protrude on the outside.
5. Push the red plastic cover ring back down (section D).

⇒ You have removed the mounting arm tube from the mounting arm adapter.

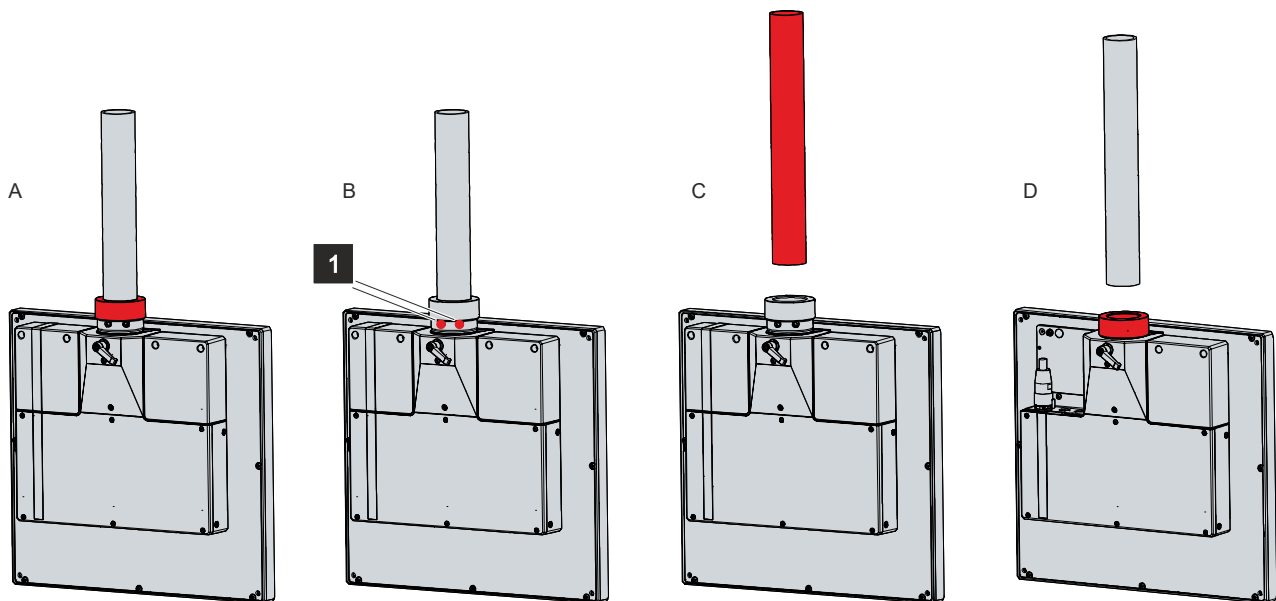


Fig. 12: Disassembly mounting arm tube

Disposal of the panel PC

When disposing of the panel PC, be sure to observe the national electronic waste regulations.

7 Maintenance

⚠ CAUTION

Risk of electric shock

Working on the panel PC when live can lead to electric shock.

- Switch off the power supply before replacing device components. This does not apply to the replacement of hard disks and SSDs in a RAID configuration.

Maintenance measures increase the efficiency of the device by ensuring long-term functionality. Cleaning and maintenance by replacing certain device components contribute to this.

7.1 Cleaning

NOTICE

Unsuitable cleaning agents

The use of unsuitable cleaning agents can damage the device.

- Clean the device only as specified.

NOTICE

Faulty touch screen function

Cleaning the front screen except for the edge of the glass pane may result in touch screen malfunction due to liquid residue.

- Always clean the front screen including the edge of the glass pane to avoid liquid residue.

It is essential to observe the following points when cleaning the PC:

- Keep to the boundary conditions of protection rating IP65.
- Never use compressed air to clean the PC.
- Maintain an ambient temperature range of 0 °C to 45 °C.

Cleaning agents

In order to avoid damage to the front of the panel PC during cleaning, you must use suitable cleaning agents. Examples include:

- benzine
- spirit
- glass cleaner

Avoid the following cleaning agents:

- detergents with scouring or abrasive components
- metal cleaning objects such as razor blades or steel spatulas
- steam jet cleaner or very hot water
- cold water with a heated device
- high water pressure, e.g. high-pressure cleaner

Cleaning the front screen

You can clean the front screen of the panel PC during operation. In order to avoid inadvertent touch entries when doing this, you must first set the device to "Cleaning Mode" with the help of the Beckhoff Control Tool. Also make sure that you not only clean the display area, but also the edge of the glass pane. Impurities in the edge area or liquids that do not run down the glass pane as drops but as a long short-circuit bridge create an electrically conductive connection between the touch screen area and the metal housing of the device. This unintentionally triggers a touch event at the edge of the touch screen, which can lead to incorrect operation.

The Beckhoff Control Tool does not start automatically when the panel PC starts up. Proceed as follows to activate the "Cleaning Mode" of the Beckhoff Control Tool:

1. Go to the Beckhoff Control Tool to start it.
 - ⇒ When the tool is started, a small sun symbol appears in the taskbar.
 2. Right-click the sun symbol.
 3. Select the "Cleaning Mode" (see Fig. 13).
- ⇒ "Cleaning Mode" is activated. You can now clean the front panel.

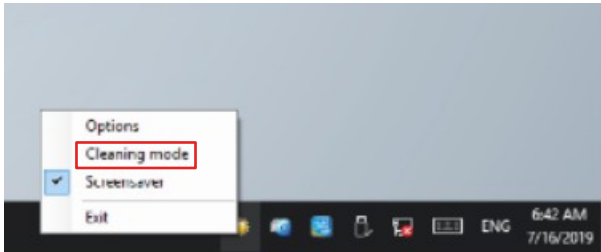


Fig. 13: Select "Cleaning Mode"

You can set the duration for which the panel PC should remain in "Cleaning Mode". The period can be set between 5 and 120 seconds. Right-click the sun symbol again and click "Options". Now select the appropriate period (see Fig. 14).

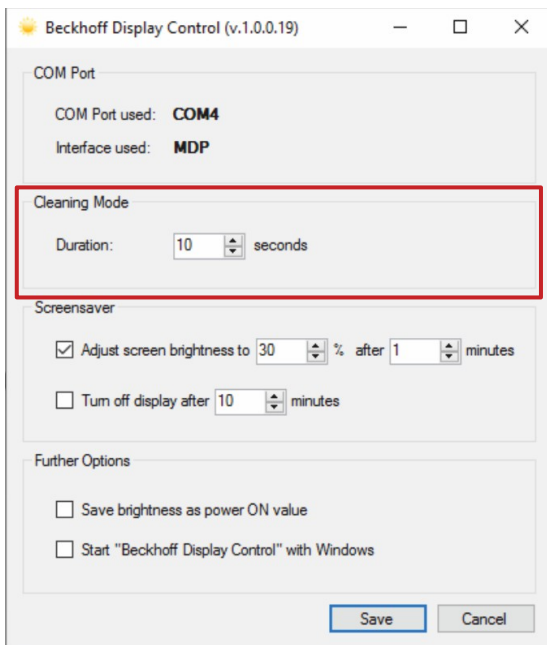


Fig. 14: Configuration "Cleaning Mode"

7.2 Maintenance

NOTICE

Use of incorrect spare parts

The use of spare parts not ordered from Beckhoff Service can lead to unsafe and faulty operation.

- Only use spare parts that you have ordered from Beckhoff Service.

Beckhoff Panel PCs are manufactured from components of the highest quality and robustness. They are selected and tested for best interoperability, long-term availability and reliable function under the specified environmental conditions.

Nevertheless, some components of the panel PC may be subject to a limited service life if they are operated under certain conditions, such as more demanding ambient conditions during operation or during storage, or if they are out of service for long periods of storage.

Beckhoff therefore recommends replacing some of the panel PC components after the time after which predictions of the remaining service life of such components can no longer be reliably calculated.

These are the following components:

- Storage media
- Battery and battery pack

The following table provides recommendations for the regular, precautionary replacement of the PC components:

Table 13: Replacement recommendations for PC components

Component	Recommendation for replacement intervals (years)
UPS battery pack	5 years
2.5-inch hard disk	5 years or after 20,000 operating hours at more than 40 °C or after 30,000 operating hours at less than 40 °C
3.5-inch hard disk	5 years, irrespective of the operating hours
Fan	7 years
Compact Flash, CFast or SSD	10 years
Motherboard battery	5 years

Beckhoff is excluded from liability in the event of possible damage occurring during maintenance work. In order to avoid damage caused by electrostatic discharge when replacing device components, protective measures are recommended. Below are some suggestions.

ESD protection

NOTICE

Electrostatic discharge

The replacement of device components without ESD protection can lead to functional impairment and destruction of the device.

- If possible, apply ESD protection measures during maintenance work.

When working on electronic devices, there is a risk of damage due to ESD (electrostatic discharge), which can impair the function or destroy the device.

Protect the panel PC and create an ESD-protected environment in which existing electrostatic charges are safely discharged to ground and charging is prevented.

An ESD-protected environment can best be created by setting up ESD protection zones. The following measures serve this purpose:

- ESD-compliant floors with sufficient conductivity to the reference potential PE;
- ESD-compatible work surfaces such as tables and shelves;
- Wrist grounding strap, especially for sedentary activities;
- grounded and electrostatically dissipating equipment and operating materials (e.g. tools) within the ESD protection zone.

If it is not possible to create an ESD protection zone, you can still protect the device against ESD damage. For example, the following measures can be used:

- Use conductive mats connected to the ground potential as underlays.
- Dissipate possible charges from your own body by touching grounded metal (e.g. control cabinet door).
- Wear a wrist grounding strap.
- Only remove new electronic components from the ESD packaging (tinted plastic bag) after putting on the wrist grounding strap.

- Do not walk around with electronic components in your hand if they are not in ESD packaging.

Access to battery and storage media

To be able to replace the battery and the storage media, you must first gain access to these device components. You can access the battery and the storage media via the cover at the side. To do this, loosen the two M4 screws and remove the cover (see Fig. 15).

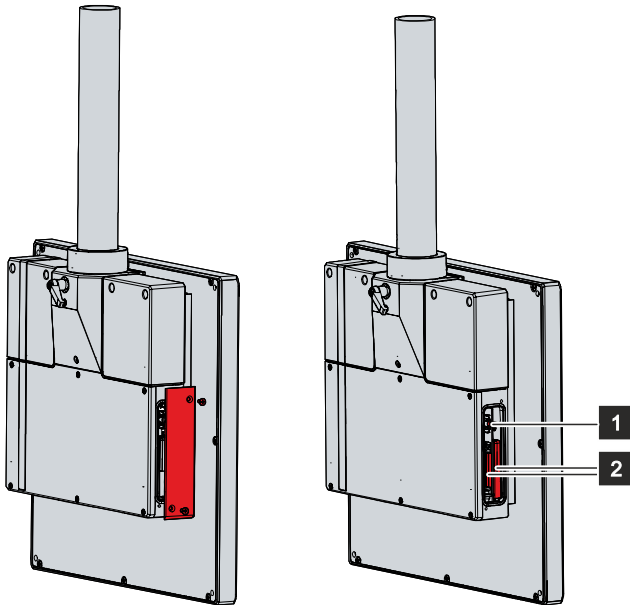


Fig. 15: Access to battery and storage media

You now have access to the battery (1) and the storage media (2).

7.2.1 Replacing the battery

NOTICE

Incorrect battery type

Replace the battery with R/C (BBCV2), order number CR2032, nominal voltage 3 V. Using any other battery may cause fire or explosion.

- Only replace the battery with a replacement battery from Beckhoff Service.
- When replacing the battery, make sure that the polarity is correct.

NOTICE

Battery damage

Incorrect handling of the motherboard battery can damage it.

- Do not recharge the battery.
- Do not throw the battery on the fire.
- Do not open the battery.
- Protect the battery against direct sunlight and moisture.

NOTICE

Failure of the electronics due to mechanical damage

Scratches or damaged components on PCBs can cause the electronics to fail.

- Be very careful when replacing the battery and avoid mechanical damage to the electronics.

The panel PC does not contain a lithium-ion battery. The motherboard battery is a CR2032 lithium-metal cell. It is used to supply power to the clock integrated on the motherboard. If the battery is depleted or missing, the date and time are displayed incorrectly.

Table 14: Technical data of the battery

Battery type	Electrical properties (at 20 °C)		Dimensions		
	Nominal voltage	Nominal capacity	Diameter	Height	Weight
CR2032	3.0 V	225 mAh	20.0 mm	3.20 mm	3.1 g

Chapter 7.2 [Maintenance](#) [▶ 35] shows how to access the battery.

To change the battery, proceed as follows:

1. Pull the battery out of the panel PC with needle-nose pliers.
2. Insert the new battery into the PC by hand. Pay attention to the correct polarity. The positive pole must point to the rear of the PC, the negative pole to the display (see Fig. 16).

⇒ You have successfully replaced the battery.

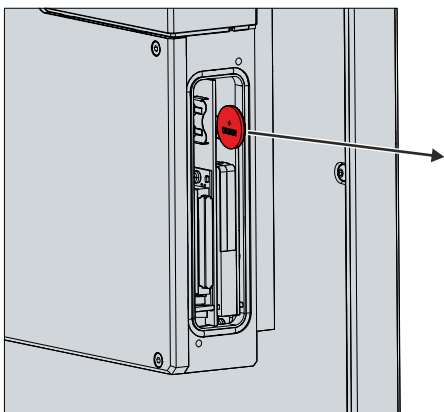


Fig. 16: Replacing the battery

To dispose of the battery, remove it, tape off the poles and put it in the battery disposal.

7.2.2 Replacing the storage media

For new storage media, please contact your Beckhoff Sales only. Hard disks from Beckhoff are optimized for industrial applications. SSDs have a considerably higher lifetime expectancy than commercially available SSDs.

Chapter 7.2 [Maintenance](#) [▶ 35] shows how to access the storage media.

Data transmission before replacement

If you want to exchange a storage medium according to Beckhoff's recommendation, you must copy the data from the old to the new storage medium. You can use the Beckhoff Service Tool (BST) for this purpose. BST is a graphical backup and restore program for PCs with a Windows operating system. You can create an image of your operating system and use it to back up the operating system. Then you can restore the created image to a new data carrier. The BST is available on a bootable BST USB flash drive. This includes Windows and a backup software. Select the size of the BST USB flash drive according to the size of the backup copy of your operating system. You can then keep the flash drive as a backup copy. For this purpose, the BST USB flash drives are designed for particularly long data preservation by means of special flash. For more information on the function of the BST, please refer to the corresponding [manual](#).

If your storage medium is defective and there is no backup, Beckhoff Service can provide you with a fresh Windows image. For this to be possible, the Beckhoff PC must already have been shipped with a valid operating system license. After installing the fresh image, the applications must be reinstalled.

Exchange hard disk and SSD

Regardless of whether you have ordered your panel PC with a 2.5-inch hard disk or a 2.5-inch SSD, you must proceed in the same way when replacing the storage medium. To do this, follow the steps below as shown in Figure 17:

1. Remove the storage medium from the panel PC by pulling on the protruding Beckhoff sticker (section A).
 2. Insert the new storage medium into the panel PC in the same orientation up to the stop (section B).
- ⇒ You have replaced the hard disk or SSD.

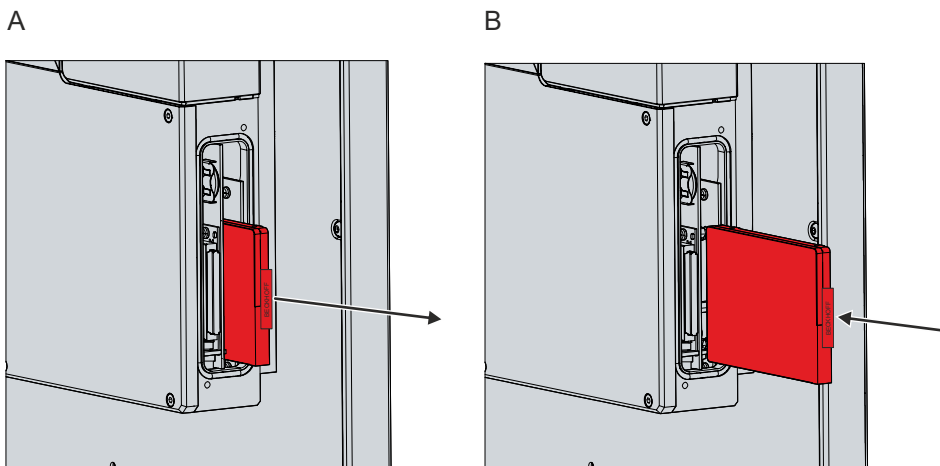


Fig. 17: Exchange hard disk/SSD

Replacing the CFast

To replace the CFast, follow the steps shown below in Fig. 18:

1. Press lightly against the CFast, as if pressing a button (section A).
⇒ When you release the CFast, the push-pull mechanism guides the CFast out of the slot far enough for you to grab it (section B).
2. Pull the CFast out of the PC (section C).

3. Insert the new CFast into the PC in the same orientation until it protrudes just a bit from the PC.
 4. Press the CFast into the PC.
- ⇒ You have replaced the CFast.

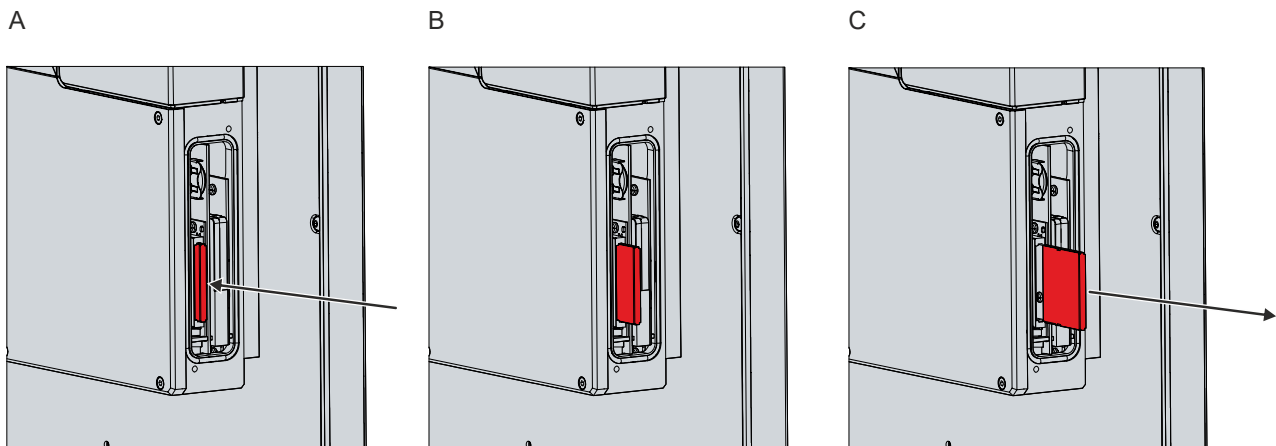


Fig. 18: Replacing the CFast

8 Troubleshooting

Fault	Cause	Measures
No function of the panel PC	No power supply to the panel PC Other cause	Check the power supply cable Call Beckhoff Service
The panel PC does not boot fully	BIOS setup settings are incorrect Other causes	Check BIOS setup settings (load defaults) Call Beckhoff Service
Panel PC boots, software starts, but controller does not work properly	The cause of the error is the software or plant parts outside of the panel PC	Call the machine and software manufacturer
The panel PC only works partially or only temporarily (e.g. dark image or none at all)	Defective backlight in the display Components defective in the panel PC	Call Beckhoff Service Call Beckhoff Service
Malfunction of the touch screen	Poor or missing functional earth of the device Poor or missing ground connection of the user	Establish functional earth User must stand on the floor with normal shoes
USB error during access with TwinCAT via USB	Cycle times in TwinCAT set to 10 ms (default)	Increase the cycle times to between 50 ms and 80 ms

9 Technical data

Table 15: Technical data

Product designation	CP72xx		
Supply voltage	22-30 V _{DC} (24 V _{DC} power supply unit)		
Power consumption	Data sheet for calculating power consumption and power loss in the download finder - Data sheets: http://www.beckhoff.com/downloadfinder		
Protection rating	IP65		
Vibration resistance (sinusoidal vibration)	EN 60068-2-6:	10 ... 58 Hz:	0.035 mm
		58 ... 500 Hz:	0.5 G (~ 5 m/ s ²)
Shock resistance (shock)	EN 60068-2-27:	5 G (~ 50 m/ s ²), duration: 30 ms	
EMC interference immunity	conforms to EN 61000-6-2		
EMC interference emission	conforms to EN 61000-6-4		
Permissible ambient temperature	Operation: 0 °C ... +45 °C		
	Transport / storage: -20 °C ... +65 °C		
Permissible relative air humidity	Maximum 95%, no condensation		
Transport and storage	The same values for air humidity and shock resistance are to be observed during transport and storage as in operation. The vibration resistance during transport can be improved by suitable packaging of the device.		

10 Appendix

In the appendix you will find information for servicing and details of the approvals that your device has.

10.1 Service and support

Beckhoff and its worldwide branch offices offer comprehensive service and support, providing fast and competent assistance with all issues relating to Beckhoff products and system solutions.

Beckhoff Service

The Beckhoff Service Center supports you in all matters of after-sales service:

- on-site service
- repair service
- spare parts service
- hotline service

Hotline: + 49 5246/963-460
email: service@beckhoff.com

If your device requires service, please indicate the serial number, which you can find on the name plate.

Beckhoff Support

Support offers you comprehensive technical assistance, helping you not only with the application of individual Beckhoff products, but also with other, wide-ranging services:

- World-wide support
- Design, programming and commissioning of sophisticated automation systems
- extensive training program for Beckhoff system components

Hotline: + 49 5246/963-157
email: support@beckhoff.com

Headquarters

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Hülshorstweg 20
33415 Verl
Germany

Phone: + 49 5246/963-0
email: info@beckhoff.de

The addresses of the worldwide Beckhoff branches and agencies can be found on our website at <http://www.beckhoff.com/>.

You will also find further documentation for Beckhoff components there.

10.2 Approvals

Your device has at least the following approvals:

- CE
- EAC
- UKCA
- FCC

You will find all other applicable approvals on the name plate of your device.

FCC approvals for the United States of America

FCC: Federal Communications Commission Radio Frequency Interference Statement

This device was tested and complies with the limits for a digital device of class A, according part 15 of the FCC regulations. These limits are designed to provide adequate protection against adverse interference, if the device is used in a commercial environment. This device generates, uses and may emit radio frequency energy and may cause adverse interference with radio communications, if it is not installed and used in accordance with the operating instructions. If this device is used in a residential area it is likely to cause adverse interference, in which case the user must take appropriate countermeasures in order to eliminate the interference at his own expense.

FCC approvals for Canada

FCC: Canadian Notice

This device does not exceed the class A limits for radiation, as specified by the Radio Interference Regulations of the Canadian Department of Communications.

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