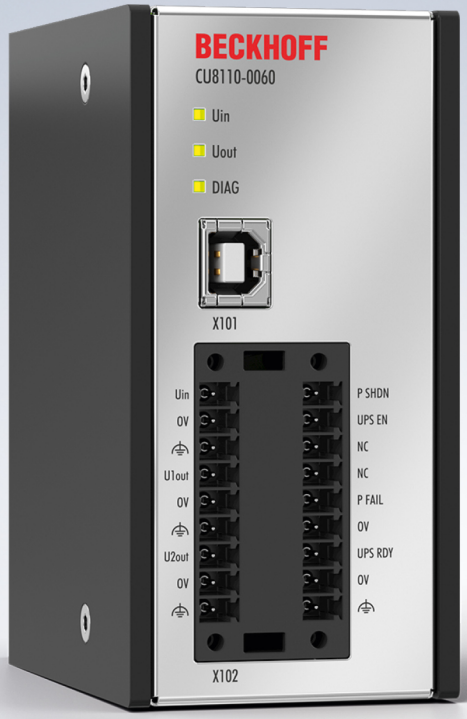
BECKHOFF New Automation Technology

Manual | EN

CU8110-0060

Uninterruptible Power Supply (Capacitive)



2026-09-30 | Version: 1.5

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1 Notes on the documentation

This description is intended exclusively for trained specialists in control and automation technology who are familiar with the applicable national standards.
The documentation and the following notes and explanations must be complied with when installing and commissioning the components.
The trained specialists must always use the current valid documentation.

The trained specialists must ensure that the application and use of the products described is in line with all safety requirements, including all relevant laws, regulations, guidelines, and standards.

Disclaimer

The documentation has been compiled with care. The products described are, however, constantly under development.
We reserve the right to revise and change the documentation at any time and without notice.
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1.1 Representation and structure of warnings

The following warnings are used in the documentation. Read and follow the warnings.

Warnings relating to personal injury:

⚠ 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.

Warnings relating to damage to property or the environment:

NOTICE
There is a potential hazard to the environment and equipment.

Notes showing further information or tips:

This notice provides important information that will be of assistance in dealing with the product or software. There is no immediate danger to product, people or environment.

1.2 Documentation issue status

Version	Changes
1.0	First version.
1.1	Chapter "Safety instructions" adapted.
1.2	UL certification and UL-related content added.
1.3	Chapter "TwinCAT interface" adapted
1.4	UPS-OCT added
1.5	Chapter “Permissible installation positions” added

2 Safety

Read the chapter on safety and follow the instructions in order to protect from personal injury and damage to equipment.

Limitation of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Unauthorized modifications and changes to the hardware or software configuration, which go beyond the documented options, are prohibited and nullify the liability of Beckhoff Automation GmbH & Co. KG.

In addition, the following actions are excluded from the liability of Beckhoff Automation GmbH & Co. KG:

- Failure to comply with this documentation.
- Improper use.
- Assignment of untrained personnel.
- Use of unauthorized replacement parts.
- Use of the devices in a damaged condition.

2.1 Intended use

The CU8110-0060 UPS is intended for mounting on a DIN rail in an industrial control cabinet or terminal box. Alternatively, the UPS can be equipped with a mounting plate and mounted on the rear panel of the control cabinet. The UPS supports in particular Industrial PCs, Embedded PCs, Panels and Panel PCs in case of voltages fluctuations or failures and this way ensures a safe shutdown of the system.

The UPS has been developed for a working environment that satisfies protection class IP20. This involves finger protection and protection against solid foreign objects up to 12.5 mm, but not protection against water. Operation of the devices in wet and dusty environments is not permitted. The specified limits for electrical and technical data must be adhered to.

The CU8110-0060 UPS is maintenance-free. The energy module (EDLC) does not need to be replaced even after several decades.

Improper use

The UPS is not suitable for operation in the following areas:

- Potentially explosive atmospheres.
- In areas with an aggressive environment that is enriched, for example, with aggressive gases or chemicals.
- Living areas. In living areas, the relevant standards and guidelines for interference emissions must be adhered to, and the devices must be installed in housings or control boxes with suitable attenuation of shielding.

2.2 Staff qualification

All operations involving Beckhoff software and hardware may only be carried out by qualified personnel with knowledge of control and automation engineering. The qualified personnel must have knowledge of the administration of the Industrial PC and the associated network.

All interventions must be carried out with knowledge of control programming, and the qualified personnel must be familiar with the current standards and guidelines for the automation environment.

2.3 Safety instructions

Follow the safety instructions to prevent injuries and damage to equipment or property.

Installation

- Never work on live equipment. Always switch off the power supply for the device before installation, troubleshooting, or maintenance. Protect the device against unintentional switching on.
- Prevent polarity reversal of the data and supply cables, as this may cause damage to the equipment.
- Observe the relevant accident prevention regulations for your machine (e.g. the BGV A 3, electrical systems and equipment).
- Observe the temperature limit values for operation. If the UPS is operated outside these temperature limits, it may overheat and electrolyte may leak out.
- The site for the UPS must be adequately ventilated. In the event of a fault, the UPS can release flammable gases that could cause an explosion.
- If you come into contact with electrolyte, rinse the affected body part with water immediately.

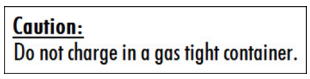
Firefighting

Extinguish the battery pack with dry powder, halon, or CO_2.

- Do not extinguish with water.
- Disconnect the power supply.
- During firefighting, wear self-contained protective respiratory equipment and protective clothing.
- Air the room after you have extinguished the UPS.

Safety labels on the UPS

The following safety labels are attached to the name plate of the UPS:



3 Transport and storage

NOTICE

Short circuit due to moisture

Moisture can form during transport in cold weather or in the event of large temperature fluctuations. Leave the device to adjust to room temperature slowly. If condensation has occurred, wait at least 12 hours before switching on the device.

Transport

Despite the robust design of the unit, the components are sensitive to strong vibrations and impacts. Therefore, during transport please protect your device from:

- mechanical stress and
- use the original packaging.

Table 1: Dimensions and weight

	CU8110-0060
Dimensions (W x H x D)	50 mm x 100 mm x 90 mm
Weight	approx. 425 g

Storage

Observe the following storage conditions, in order to maintain the service life of the UPS:

- Store the UPS at room temperature or below.
- Do not store the UPS in a dusty environment, at high humidity or in location with strong vibrations.

4 Product overview

The CU8110-0060 is a capacitive uninterruptible power supply (UPS) based on double-layer capacitors (EDLC) with a maximum energy of 0.3 Wh and a maximum power output of max. 55 W.

In the event of a fault or the failure in the 24 V DC input voltage, the UPS takes over the supply of power to the connected devices with a controlled and buffered 24 V DC output voltage. All Beckhoff components or components from third parties, especially industrial PCs, embedded PCs, panels and panel PCs, can be equipped with the CU81xx UPS series. The UPS has a total of two 24 V outputs. In addition to the industrial PC, a panel or terminal segment can be supplied with uninterrupted power on the second output.

OCT (One Cable Technology), USB 2.0, and digital signals are available for communication between the UPS and the industrial PC. A special feature of OCT is that the connecting lines (+24 V, 0 V) between the industrial PC and UPS are used not only to supply power to the industrial PC, but also for bidirectional, modulated data transmission.

4.1 Structure

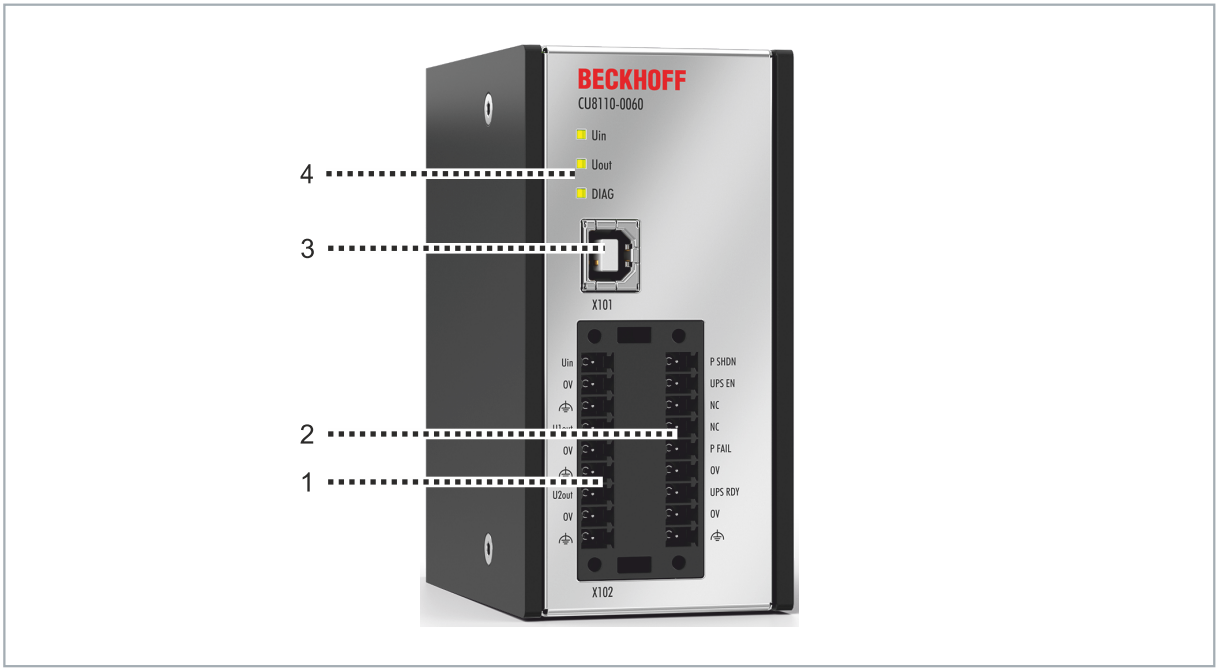


Fig. 1: Structure of a CU8110-0060 UPS.

Table 2: Key for the structure.

No.	Component	Description
1	Power supply (X102) [▶ 15].	Interface for power supply to the UPS (Uin) and the devices being supported (U1out and U2out). The wiring is done via a 9-pin push-in connector.
2	Control inputs and control outputs (X102) [▶ 15].	Interface for digital control inputs (UPS EN, P SHDN) and digital status outputs (UPS RDY, P FAIL).
3	USB 2.0 interface (X101) [▶ 16].	Communication interface between UPS and industrial PC for devices without UPS-OCT. Status queries, device status, or shutdown are possible.
4	Diagnostic LED [▶ 50]	Indicate the state of the input voltage, output voltage, and errors.

4.2 Name plate

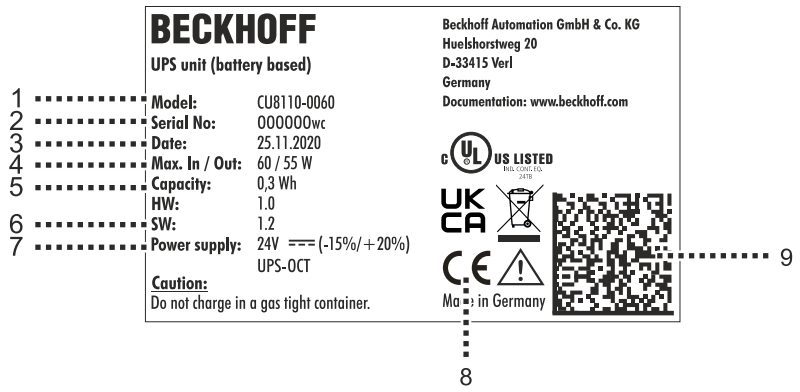


Fig. 2: Name plate example.

Table 3: Information on the name plate.

No.	Description
1	Model designation of the UPS.
2	Serial number for the unambiguous identification of the product.
3	Date of manufacture.
4	Maximum power consumption and power output of the UPS.
5	UPS capacity.
6	Hardware and software version.
7	Power supply 24 V DC.
8	Approvals and markings.
9	Machine-readable information in the form of a Data Matrix Code (DMC, code scheme ECC200) that you can use for better identification and management.

4.3 Block diagram

The block diagram for the CU81xx UPS is described in this chapter. The input voltage Uin typically comes from a single-phase (230 V) or three-phase (400 V) AC power supply, the secondary side of which provides the 24 V DC operating voltage for the UPS. The charging electronics takes the energy for charging the energy carrier, i.e. the batteries or capacitors, from this input voltage. The charging electronics ensures that all parameters of the energy carrier (e.g. maximum charge or discharge currents, temperatures, minimum energy) remain within the permitted limits.

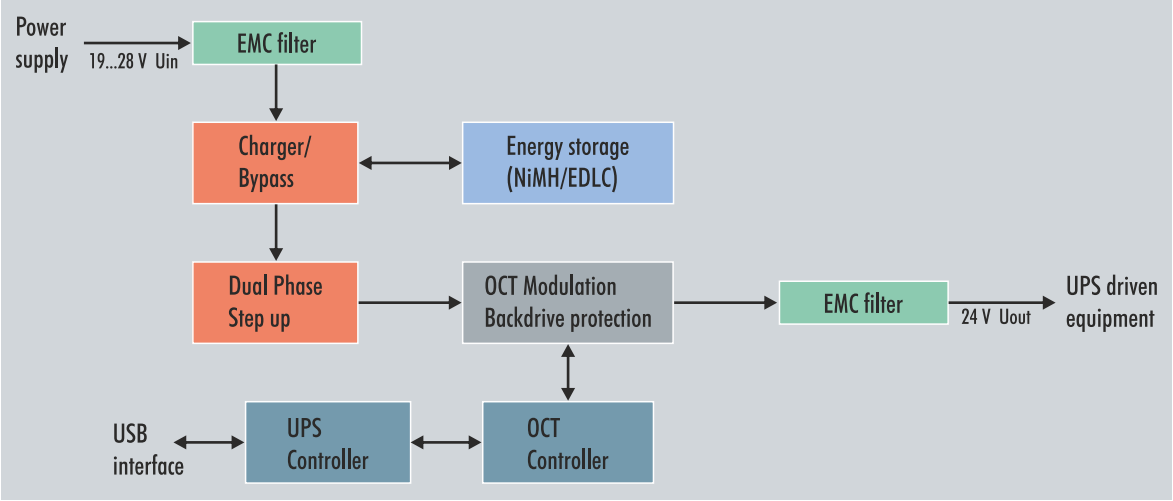


Fig. 3: CU81x0-x00x block diagram.

If the input voltage is at least 24 V - 15 % (20.2 V), the UPS, which is connected between the AC power supply and the load to be supported, always supplies at least 24 V at the output due to a step-up converter. If the input voltage drops below this value, operation is switched to UPS mode and the output is supplied by the energy storage device (UPS mode). The UPS then continues to supply exactly 24 V. In the case of an input voltage from 24 V to 24 V + 20 % (28.8 V), this is present directly at the output due to the bypass circuit. If the input voltage exceeds the threshold of 28.8 V, a transition to UPS mode takes place in order to protect the end devices. At the same time, an overvoltage warning is output. Therefore, less than 24 V and more than 28.8 V can never be present at the UPS output.

The complete control of the UPS is handled by the central UPS controller, which orchestrates the interaction of all other microcontrollers (UPS-OCT communication, charge controller).

4.4 Holding times

Table 4: Capacity and switch-off times at different discharge currents.

Discharge current [A]	Time to switch-off [s]	Usable energy [Wh]
0.25	155	0.26
0.5	86	0.29
0.75	57	0.29
1	45	0.30
1.25	35	0.29
1.5	30	0.30
1.75	24	0.28
2	22	0.29
2.25	19	0.29
2.5	17	0.28

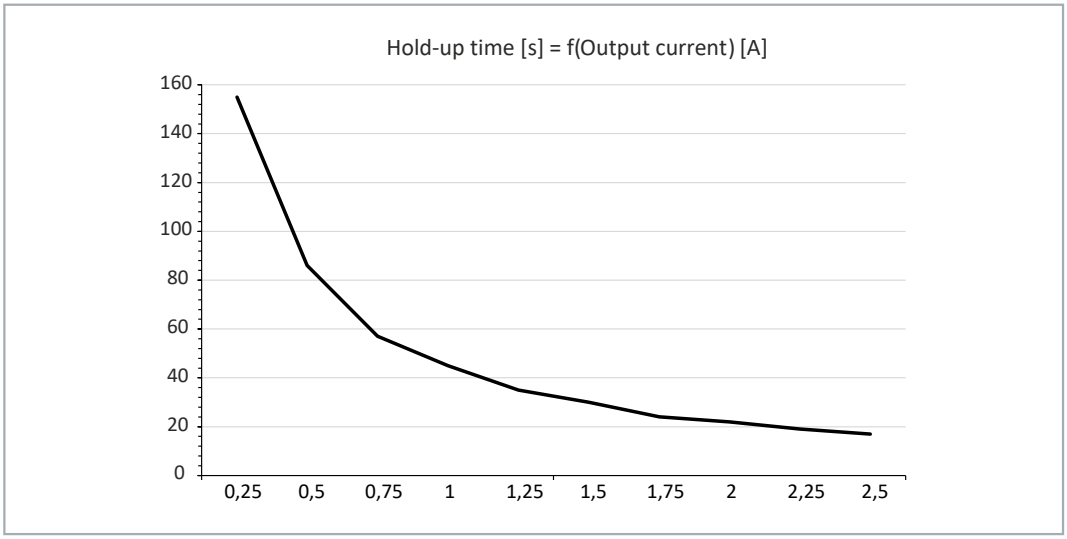


Fig. 4: Hold time without temperature and ageing effects.

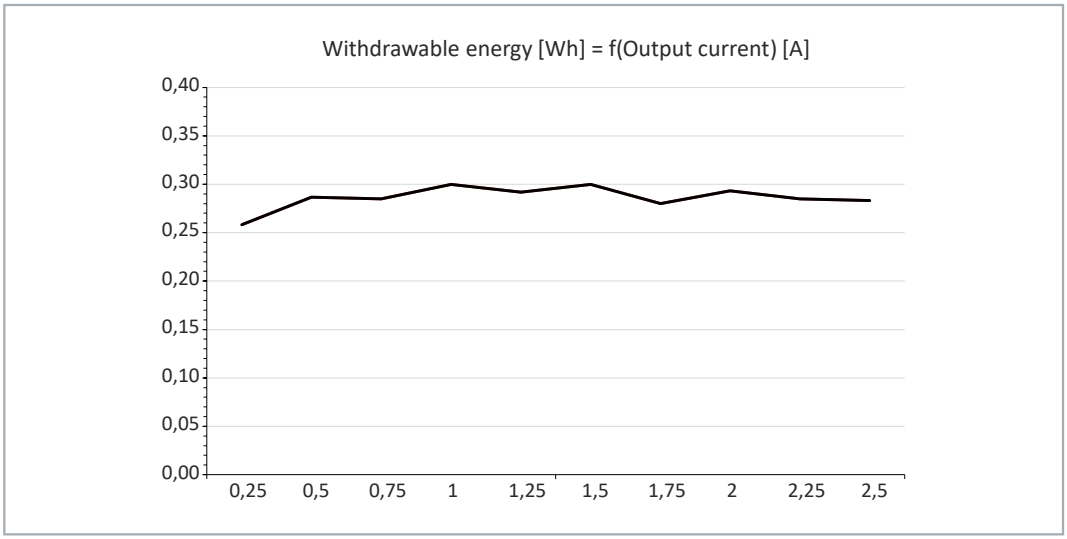


Fig. 5: Usable energy without temperature and ageing effects.

5 Interfaces

5.1 Power supply (X102)

Two 9-pin connectors with push-in connection are used to wire the CU81x0 UPS. Copper cables with a cross-section of 0.5 mm² to 1.5 mm² or AWG20 to AWG16 are required for the 9-pin connectors. A maximum of 1 mm² or AWG 17 is permissible with ferrules.

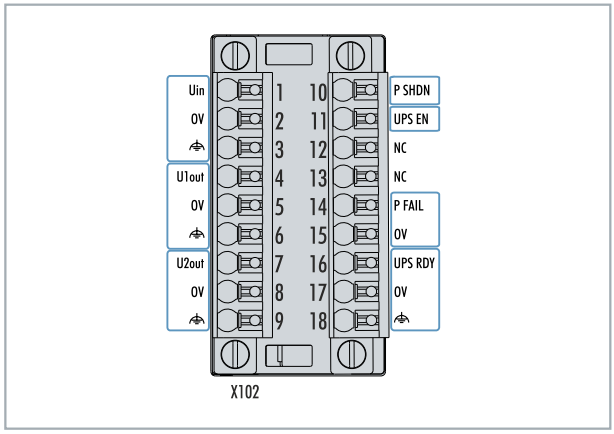


Fig. 6: Power supply X102.

The CU81x0 UPS can be used in areas where special UL requirements must be met. Applications without special UL requirements are not affected by UL regulations.

UL requirements:

- An external overcurrent protection of 20 A is required for the UPS input (Uin).
- The temperature resistance of the copper cables must be at least 70 °C.

Table 5: Power supply X102, connection on left side.

No.	Pin	Description
1	Uin,	+24 V DC input, power supply for UPS.
2	0 V	
3	Functional Earth	
4	U1out	+24 V DC UPS output with UPS-OCT support, interface for the device being supported.
5	0 V	
6	Functional Earth	
7	U2out	+24 V DC UPS output, interface for a second device being supported e.g. control panel (display).
8	0 V	
9	Functional Earth	

The interfaces U1out and U2out together must not exceed the maximum output current of the UPS.

Table 6: Power supply X102, right-hand connection.

No.	Pin	Description
10	P SHDN	+24 V DC input. A rising edge from 0 V to 24 V at this input triggers an immediate shutdown of the operating system. If 24 V is applied to P_SHDN at startup, the PC will not be started until a falling edge from 24 V to 0 V is detected.
11	UPS EN	+24 V DC input. A falling edge from 24 V to 0 V signals the UPS to switch off the outputs U1out and U2out immediately. This input can be connected with the PC_STATUS output on a Beckhoff Industrial PC or any PLC output.
12	NC	Reserved.
13	NC	Reserved.

No.	Pin	Description
14	P FAIL	+24 V DC output for power-fail-signal. This output is switched to 24 V if the power supply fails or if P SHDN is activated. This output can be connected with the PC_ON input on a Beckhoff Industrial PC or any PLC input.
15	0 V	
16	UPS RDY	+24 V DC output. This output is switched to 24 V when the UPS charge is above a set threshold (e.g. 80 %).
17	0 V	
18	Functional Earth	

5.2 USB 2.0 interface (X101)

The USB interface is a communication interface between the UPS and industrial PC. Die USB interface can be used especially by devices without UPS-OCT. These include, for example, older Beckhoff Industrial PCs but also components supplied by third-party providers.

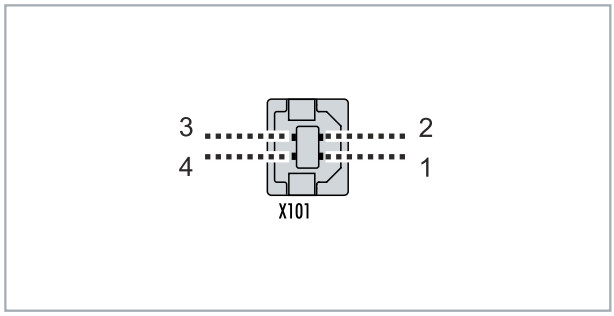


Fig. 7: USB 2.0 interface X101.

The USB interface is of type B and corresponds to the USB 2.0 specification.

Table 7: USB interface (X101), PIN assignment.

Pin	Connection	Typical assignment
1	VBUS	Red
2	D-	White
3	D+	Green
4	GND	Black
Shell	Shield	Drain Wire

6 Commissioning

6.1 Assembly

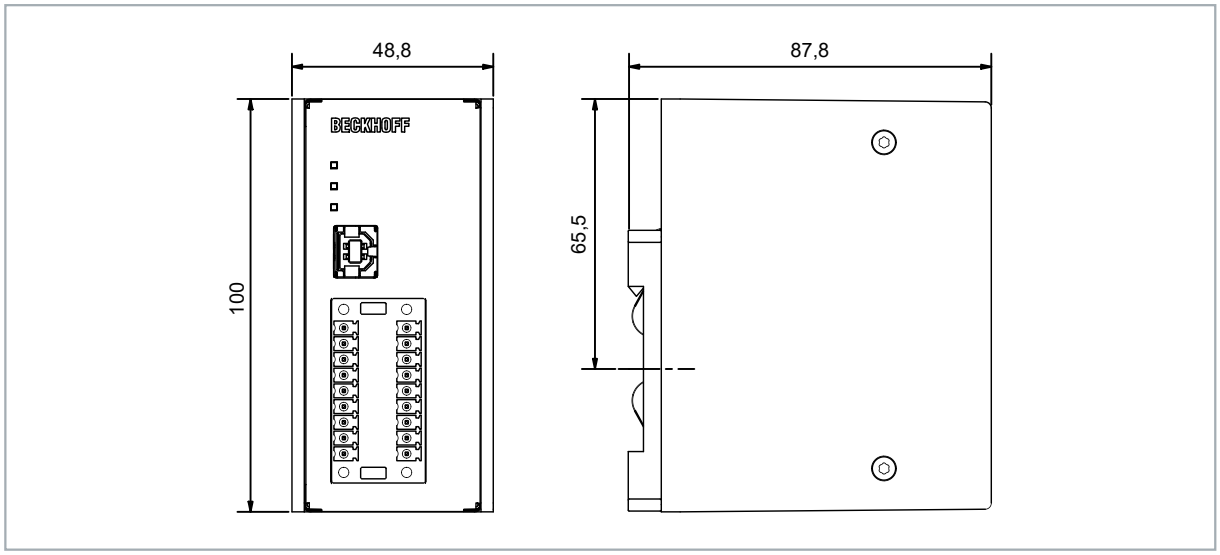


Fig. 8: CU8110-0060 dimensions.

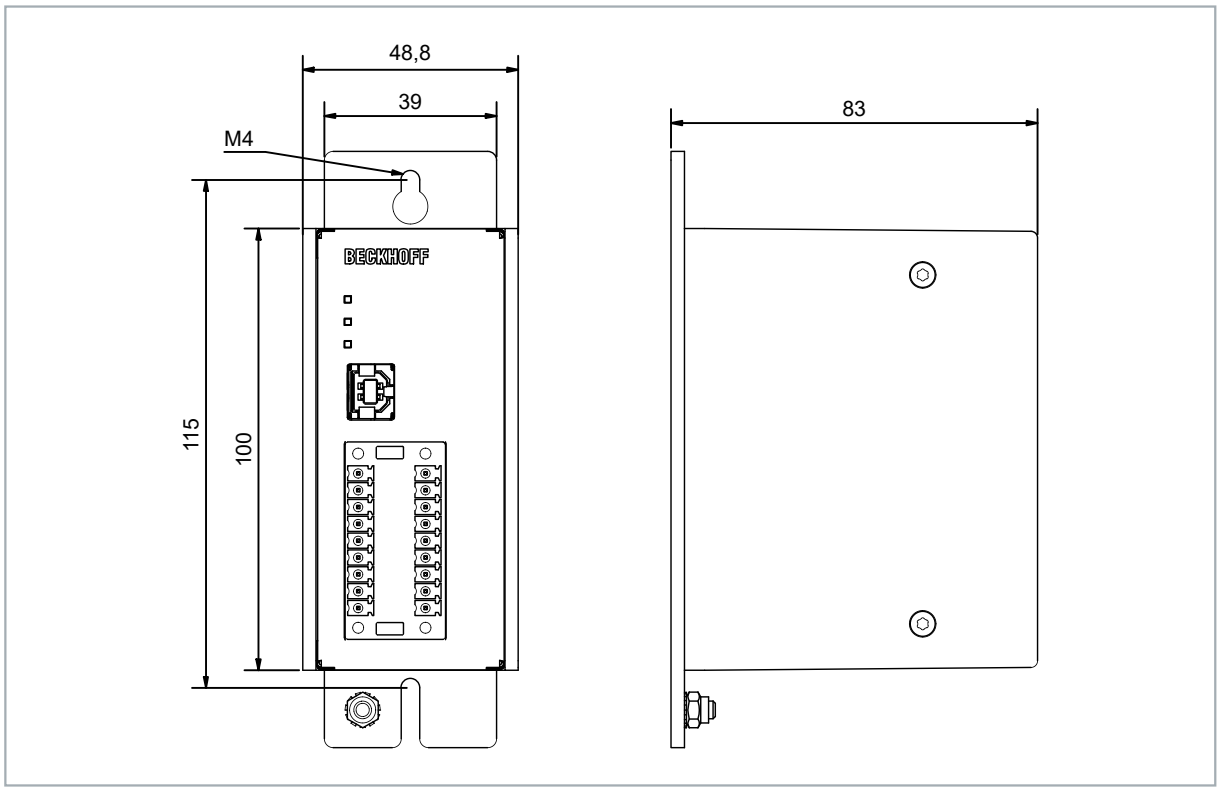


Fig. 9: CU8110-0060 with mounting plate (optional), dimensions.

6.1.1 Permissible installation positions

Mount the CU81x0-0xx0 UPS horizontally on a DIN rail in the control cabinet to ensure optimum heat dissipation. The ventilation openings are located on the top and bottom of the housing. This creates an optimum airflow that passes vertically through the CU81x0-0xx0 UPS.

Observe the following requirements for the control cabinet:

- Maintain the minimum clearances of 30 mm above and below the CU81x0-0xx0 UPS.
- Operate the CU81x0-0xx0 UPS only within the specified ambient temperature range. To determine the ambient temperature correctly, measure the temperature 30 mm below the CU81x0-0xx0 UPS.
- Other electrical devices affect heat generation in the control cabinet. Select an appropriately sized control cabinet for the application, or ensure that excess heat is dissipated from the control cabinet.

6.1.2 Fastening to the DIN rail

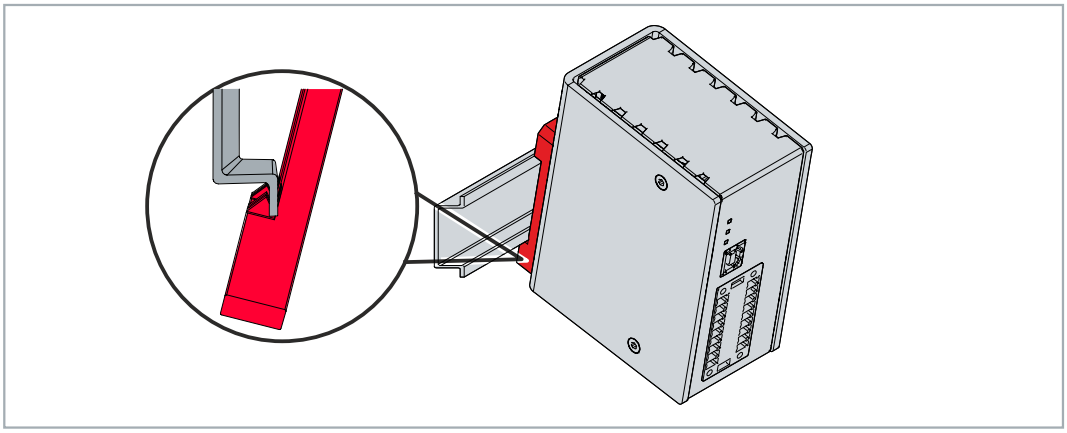
For optimal dissipation of heat, mount the UPS horizontally in the control cabinet on a DIN rail. The housing is designed so that the UPS can be held against the DIN rail and snapped onto it.

Requirements:

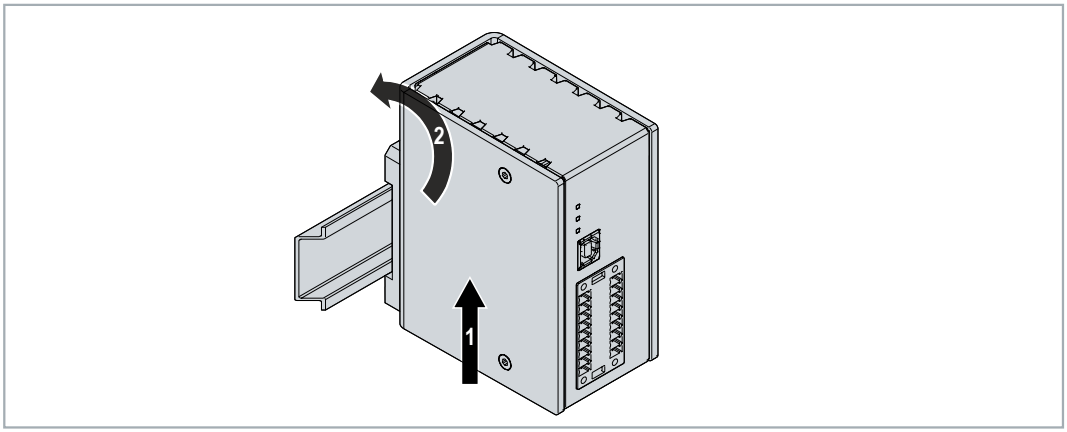
- DIN rail of the type TS35x15 2.3 according to EN 60715.

Fasten the UPS to the DIN rail as follows:

1. First, place the UPS against the lower edge of the DIN rail.



2. Tilt the upper part of the UPS towards the DIN rail.
3. Lightly press the UPS against the DIN rail and upwards.



⇨ As soon as you press the UPS upwards, the lower springs of the DIN rail adapters give way. In this manner, the UPS can be attached on the upper edge of the DIN rail.

4. Attach the UPS to the upper edge of the DIN rail.

⇨ You have successfully mounted the UPS. Check again that the mounting is correct and that the UPS is engaged on the DIN rail.

6.1.3 Installing the mounting plate (optional)

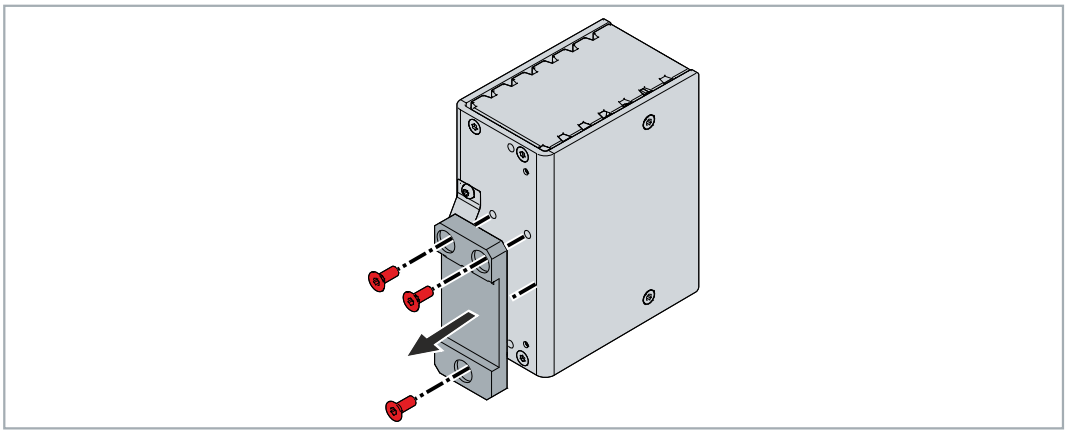
In this chapter, we show you how to install a mounting plate on the UPS. With the mounting plate, the UPS can subsequently be fastened to the rear panel of a control cabinet. To do this, the two DIN rail adapters and the grounding springs on the rear side of the UPS have to be dismounted. The mounting plate is not included in the scope of delivery (see: Accessories [▶ 56]).

Requirements:

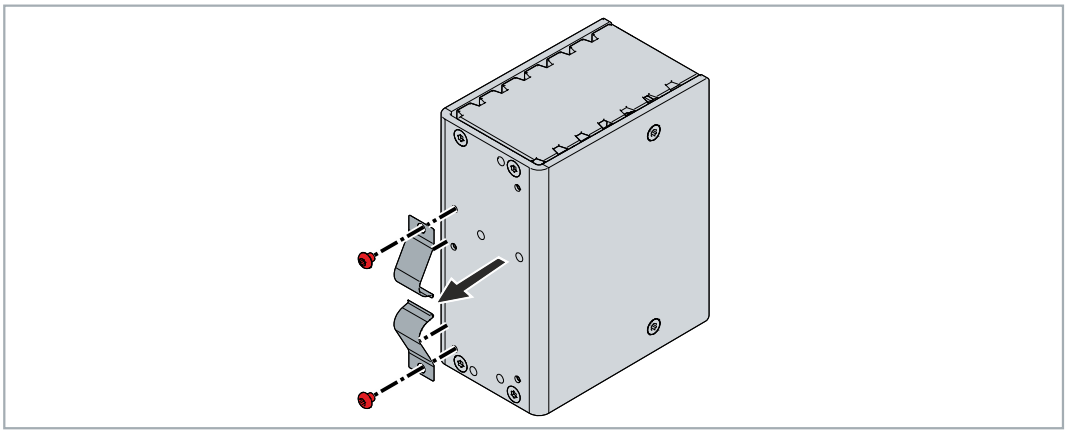
- C9900-M675 mounting plate made of black anodized aluminum.
- Screwdrivers.

Install the mounting plate as follows:

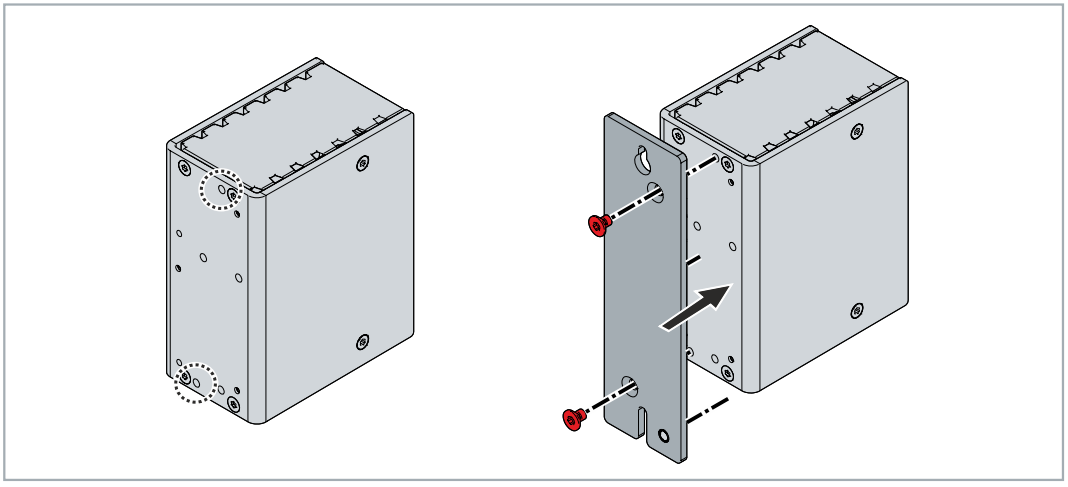
1. Loosen the six M4 screws and remove the DIN rail adapter.



2. Loosen the M3 screws and remove the grounding springs from the UPS.



3. Fasten the mounting plate to the rear panel of the UPS with four M4 screws.



6.2 Power supply

The UPS is equipped with one input (Uin) for power supply and two outputs (U1out and U2out) for supplying connected devices.

- The UPS itself is supplied and charged with 24 V DC voltage (-15 % / +20 %) via Uin.
- A load, such as an industrial PC, is supplied via the primary output U1out. This output is UPS OCT-capable.
- A second load, such as a panel, can be connected via the secondary output U2out. This output is not UPS OCT-capable.

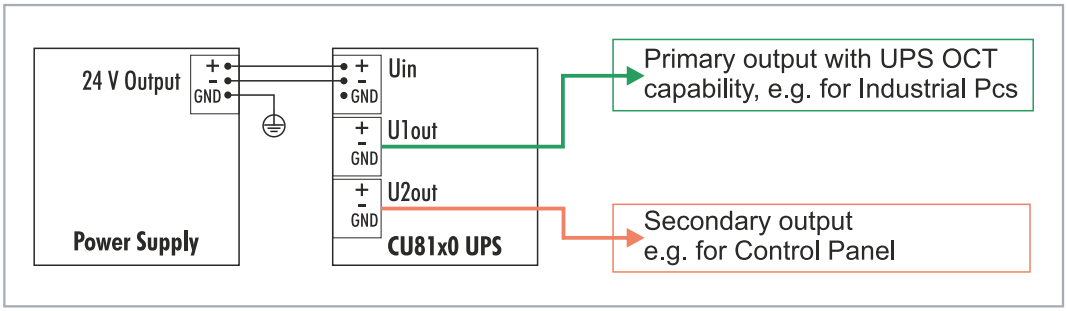


Fig. 10: Schematic wiring of a CU8110-0060 UPS.

Wiring is carried out via two 9-pin connectors with push-in connection on the X102 interface. The 9-pin connectors are included in the scope of delivery.

Table 8: Required cable cross-sections and strip lengths.

Property	Value (metric)	Value (AWG)
Cable cross-section	0.5 ... 1.5 mm², max. 1 mm² with ferrule	AWG 20 ... AWG 16, max. AWG 17 with ferrule
Strip length	8 ... 9 mm	0.33 inch

6.2.1 Supply of the UPS (Uin)

An external power supply unit is required to supply the UPS with a 24 V DC voltage (-15 % / +20 %). Connect the external power supply to the UPS Uin input. Connect the loads to the outputs U1out and U2out.

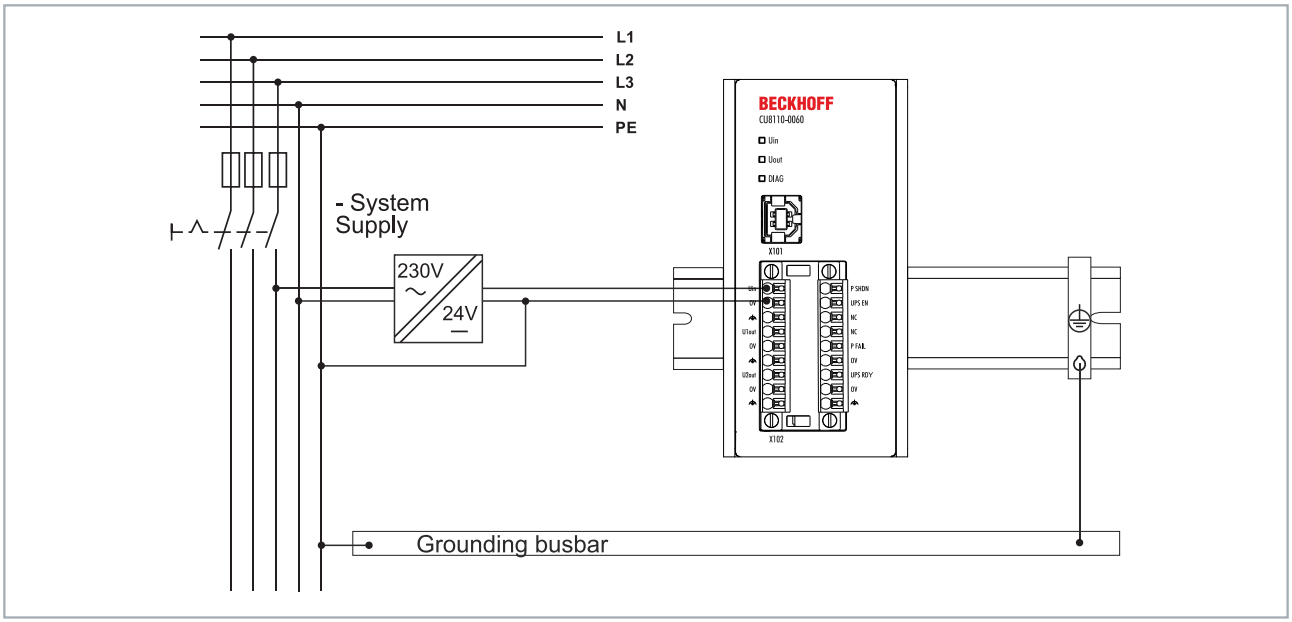


Fig. 11: Connection example for power supply of the UPS via Uin input.

Standard-compliant wiring (PELV/UL)

Wire the UPS in the control cabinet in accordance with the standard EN 60204-1:2006 PELV = Protective Extra Low Voltage:

- The "PE" and "0 V" conductors of the voltage source for a UPS must be at 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 one point of the energy source for this circuit must be connected to the protective conductor system.

The CU81x0 UPS can be used in areas where special UL requirements must be met. Applications without special UL requirements are not affected by UL regulations.

UL requirements:

- An external overcurrent protection of 20 A is required for the UPS input (Uin).
- The temperature resistance of the copper cables must be at least 70 °C.

Selection and dimensioning of the external power supply

The external power supply must be dimensioned so that it can cover both the maximum power consumption of the connected devices and the additional power consumption for charging the UPS. Beckhoff power supplies: https://www.beckhoff.com/power-supplies

Table 9: Technical data, electrical currents and internal fuses.

Technical data	CU8110-0060
Power consumption during charging (without load)	max. 2.2 A
Output current	max. 2.5 A
Fuse (internal, input)	electronic 10 A
Fuse (internal, output)	electronic 3 A

For example, if a CX9020 with a power consumption of 5 W (= 0.21 A) is connected, the calculation looks as follows: 0.21 A + 2.2 A = 2.41 A. In this calculation example, at least a 2.41 A power supply is required for the CX9020. A power supply with 4 A is recommended.

Grounding

In case of mounting on a DIN rail, the UPS is grounded by grounding springs on its rear side. Ground the DIN rail in the control cabinet accordingly. A UPS with a mounting plate (optional) is grounded via the grounding screw.

6.2.2 Supply of the loads (U1out, U2out)

Connect the devices to be supported to the outputs U1out and U2out. If the external 24 V DC input voltage is lost, the UPS takes over the supply of the devices connected to it thanks to its regulated and buffered 24 V DC output voltage. Use the two 9-pin connectors with push-in connection to wire the CU8110-0060 UPS. The devices connected to the U1out and U2out outputs must not exceed the maximum permissible output current of the UPS of max. 2.5 A.

Output U1out

The **U1out** output is primarily intended for connecting an industrial PC. If the industrial PC supports UPS-OCT, output U1out is used to supply the industrial PC and also for bidirectional communication between the UPS and IPC. Observe the following specifications when wiring:

- The shielding must be connected on both sides (ground ⏚). In the case of an industrial PC, the connection to the grounding screw is made using an O-ring. The shield must not be connected to GND of the supply connector.
- No cable interruptions (e.g. no passive terminals, no distributors).
- No parallel loads (e.g. no bridges between Us and Up on the embedded PC, no second industrial PC).

Output U2out

The **U2out** output is used to supply a second load, e.g. a panel or other 24 V devices.

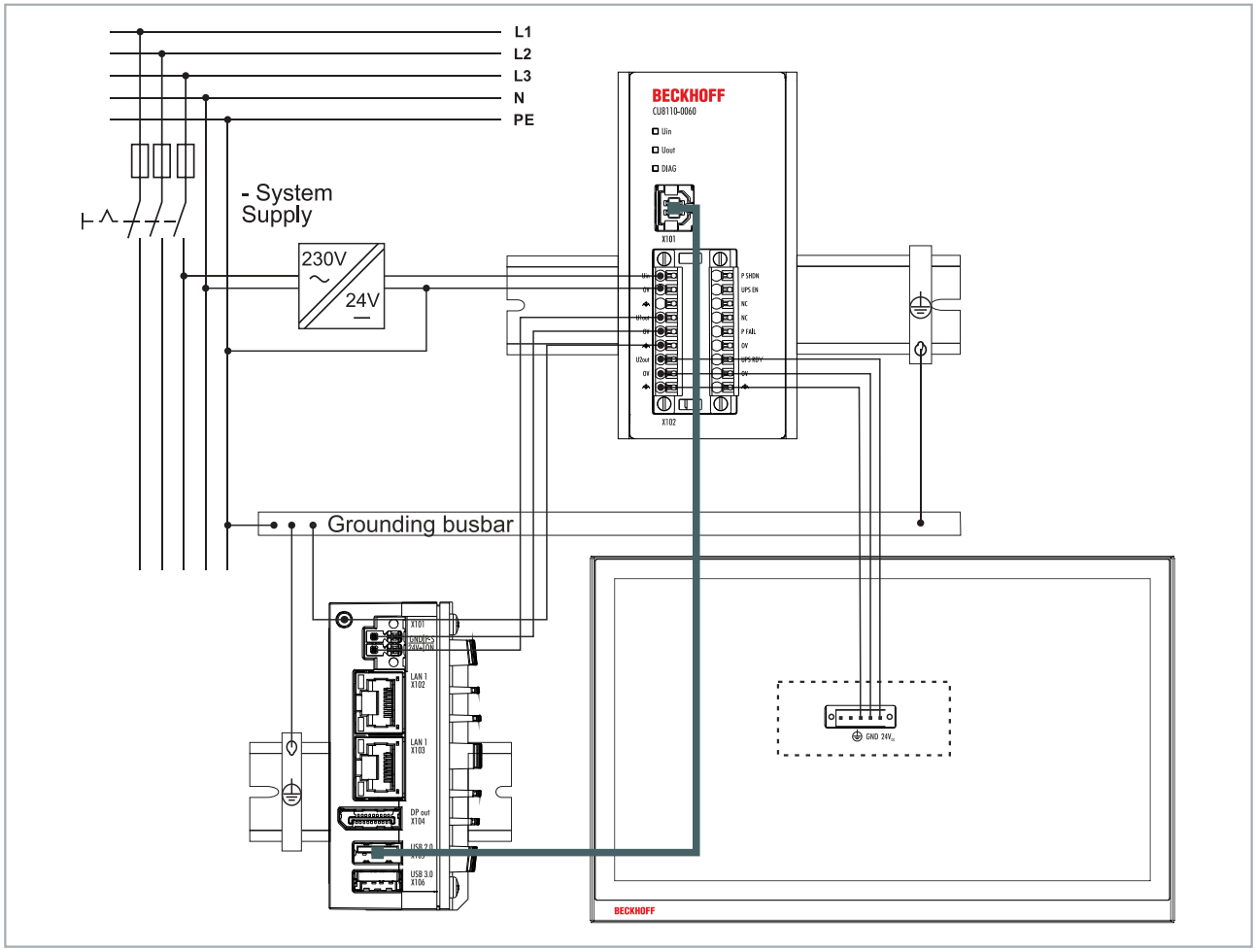


Fig. 12: Connection example with a control panel at U2out output.

6.3 Communication and connection options

NOTICE

Malfunctions due to mixed operation

Simultaneous operation of several communication types (e.g. USB and UPS-OCT) is not permitted and can lead to unpredictable malfunctions.

- Only use one communication and connection option for your application.

It is crucial to choose the right type of communication for integrating the UPS into an automation system. Depending on the type of connection, status information can be queried, the device status monitored or control commands transmitted, including controlled shutdown.

The UPS supports various connection types with the industrial PC:

- Protocol-based communication via UPS-OCT (One Cable Technology)
- Protocol-based communication via USB
- Digital signals for the integration of end devices without protocol support

Parameterization and diagnostics for the UPS-OCT or USB communication types are carried out via the UPS configuration software from Beckhoff, which is available pre-installed in the Windows, TwinCAT/BSD® and Linux® operating systems.

Selecting the communication type

The appropriate communication type depends on the technical requirements, installation conditions, and supported interfaces of the industrial PC. Only one of the three communication options can be used.

Table 10: Selection guide for communication and connection options.

Connection type	Advantages	Restrictions	Cable	Typical application
UPS-OCT	• A cable for power supply and communication • Automatic shutdown of the UPS after shutting down the industrial PC • Conservation of battery capacity	• Industrial PC and UPS must be UPS OCT-capable	• max. 10 m • C9900-K90x power cables required as accessories	• Recommended if simple installation with a single-cable solution is required • USB interfaces not available or occupied
USB	• Simple connection via standard USB • Conservation of battery capacity through switch-off timer • cost-effective wiring	• Less direct control than with UPS-OCT • Limited cable length	• max. 5 m • C9900-K5xx USB cables available as accessories	• Suitable if UPS-OCT is not available but protocol-based communication is required
Digital I/O	• Simple status monitoring and control without a protocol • Cost-effective implementation	• No advanced diagnostic functions • Additional wiring with I/O hardware and PLC programming required	• Depending on the signal type used	• Useful for simple applications without software integration • Or when using the UPS with third-party hardware
Standalone mode	• Operation possible without communication or additional wiring • Simplest form of commissioning	• If the input voltage (Uin) fails, U1out and U2out are shutdown after 4 minutes	• No limitation through communication	• Suitable for test setups or simple systems without diagnostic/control requirements

6.3.1 Connection via UPS-OCT

A special feature of the Beckhoff CU8110-0060 UPS is UPS-OCT (One Cable Technology) as a communication technology between UPS and industrial PC. The two connecting cables (+24 V, 0 V) between the industrial PC and the UPS are used simultaneously for the power supply of the industrial PC and for bidirectional, modulated data transmission. This means that supply and communication are realized via a single cable.

Table 11: System requirements for UPS-OCT.

UPS module	Hardware version
CU8110-0060	1.0

Only the U1out interface of the UPS supports UPS-OCT communication. If you want to use UPS-OCT technology, the industrial PC used must also be UPS OCT-capable.

Special features of UPS-OCT wiring

For UPS-OCT, a special shielded power cable of type C9900-K90x is required. Cable lengths of up to **10 m** are supported. The cable shield must be properly connected on both sides:

Special features of the industrial PC:

- Connect the cable shield on the UPS side to ground (⏚)
- Connect the cable shield on the industrial PC side to the grounding screw using an O-ring
- ***Notice*** The shield must not be connected to GND of the power supply connector
- Cable interruptions (e.g. through passive terminals or distributors) are not permitted
- Parallel loads must not be connected, no second industrial PC or embedded PC as an additional load)

NOTICE

Communication errors and malfunctions

Simultaneous use of UPS-OCT and the PC-ON input on the industrial PC can lead to unpredictable malfunctioning of the UPS and the connected PC.

- In UPS-OCT mode, the PC-ON input on the voltage socket of the industrial PC must not be used.

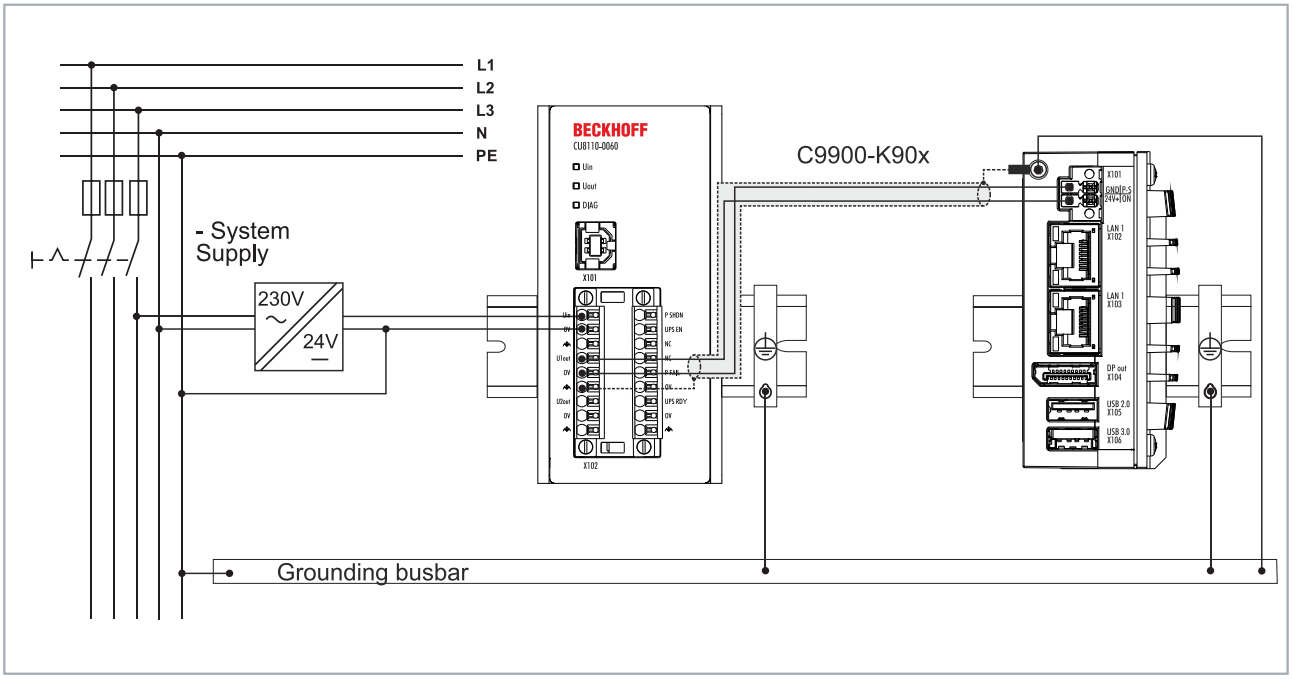


Fig. 13: Connection example via UPS-OCT with a CU8110-0060 UPS and a C6015 Industrial PC.

Special features embedded PC (CX series):

- Connect the cable shield on the UPS side to ground (⏚)
- Connect the cable shield on the embedded PC side to the designated spring-loaded terminal (⏚)
- Cable interruptions (e.g. through passive terminals or distributors) are not permitted
- Parallel loads must not be connected (e.g. no bridges between Us and Up on the embedded PC side, no second industrial PC or embedded PC as an additional load)

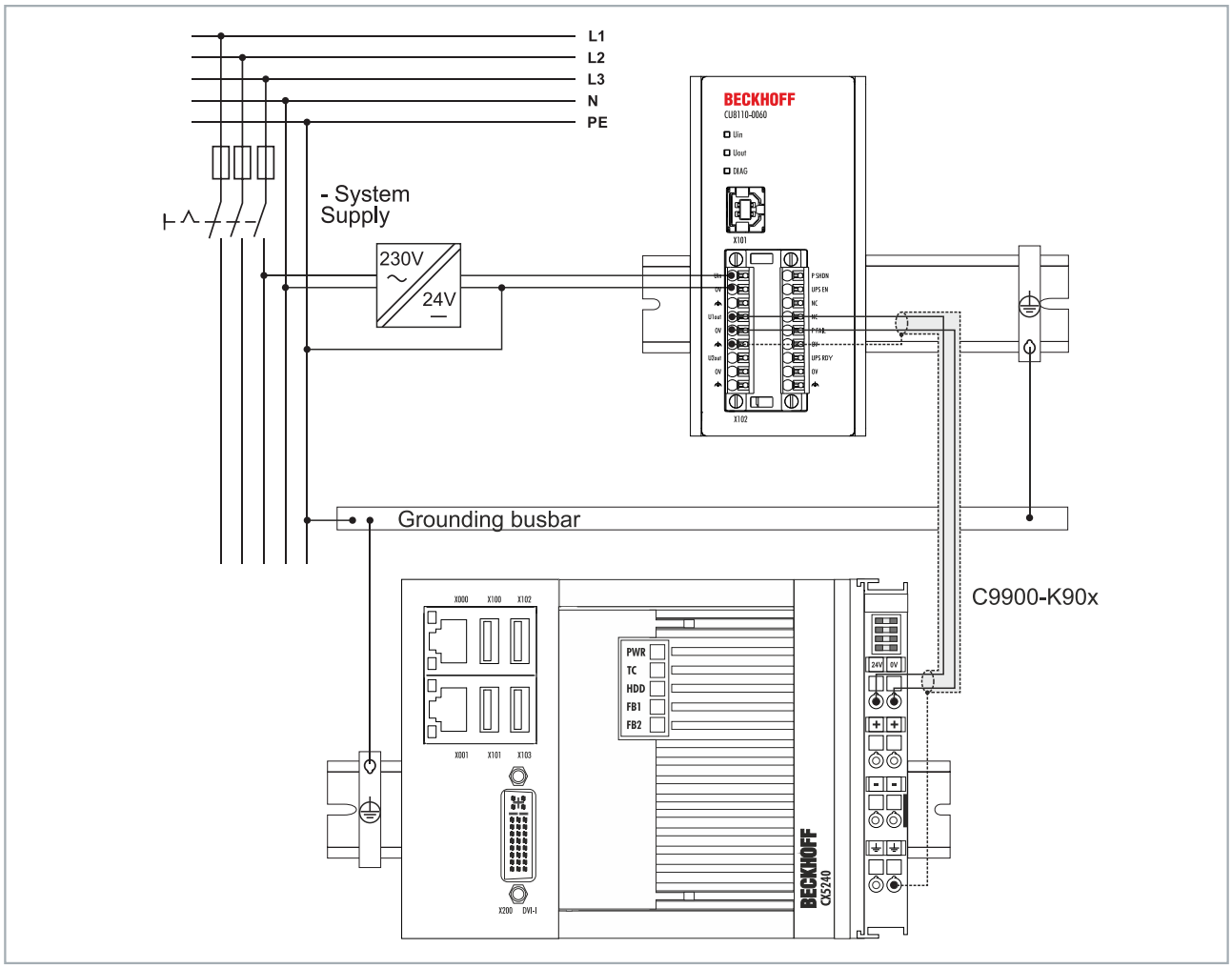


Fig. 14: Connection example via UPS-OCT with a CU8110-0060 UPS and a CX5240 Embedded PC.

Status display

An active UPS-OCT connection is both displayed in the Beckhoff UPS software and signaled via a green status LED on the CX and IPC side.

6.3.2 Connection via USB

For devices without UPS-OCT support, communication is provided by the USB interface. Status data can likewise be retrieved for diagnostic purposes or the UPS configured when communicating via USB.

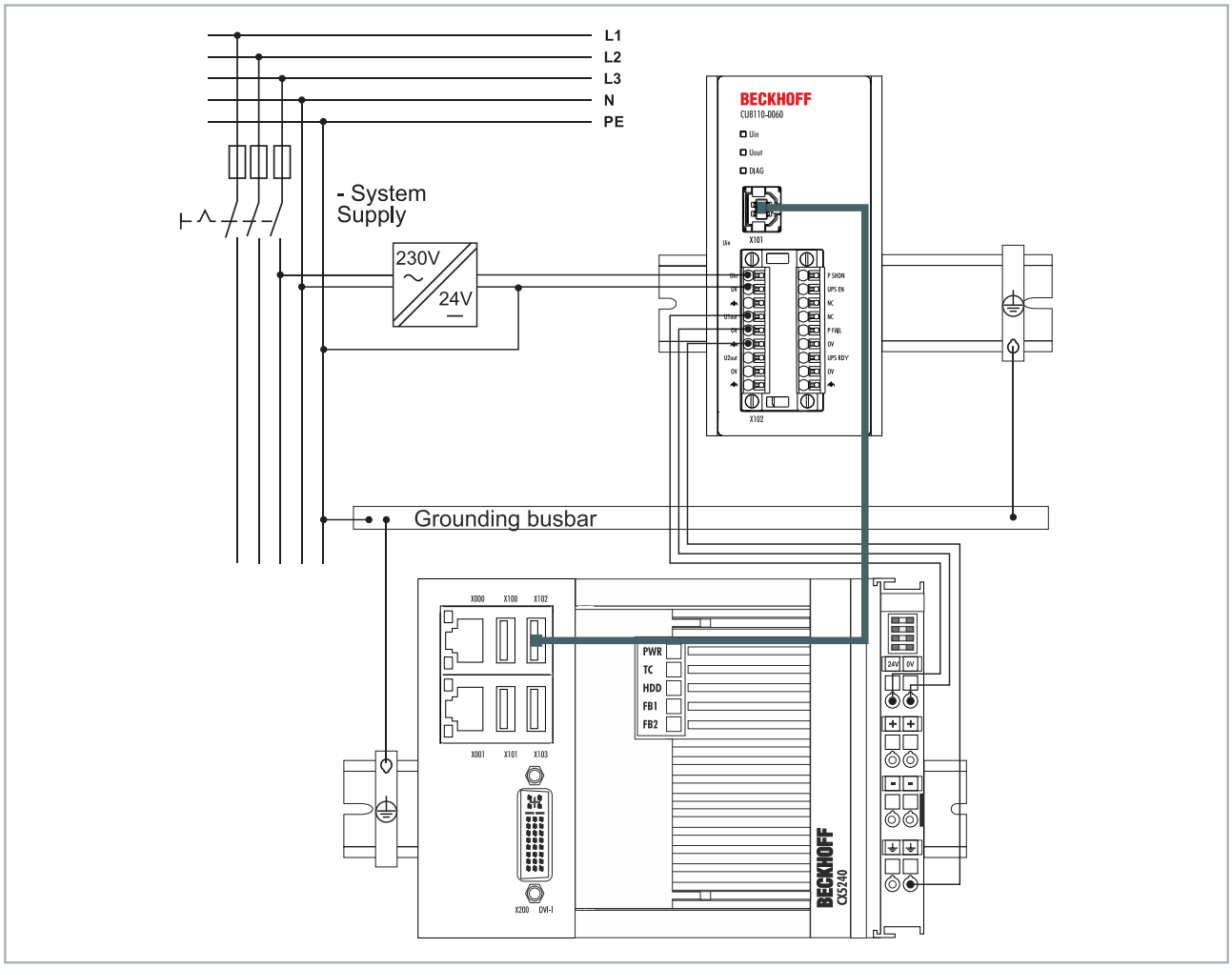


Fig. 15: Connection example via USB with a CU8110-0060 UPS and a CX5240 Embedded PC.

The USB interface conforms to the USB 2.0 standard. The cable length is limited to 5 m. Suitable USB cables of type C9900-K53x are available as accessories.

6.3.3 Connection via digital inputs and outputs

For devices without a USB connection, a digital output signal (P FAIL) of the UPS can be monitored. In the event of a power failure, a power fail signal is sent by the UPS. This signal can be wired to a digital input and monitored in the PLC.

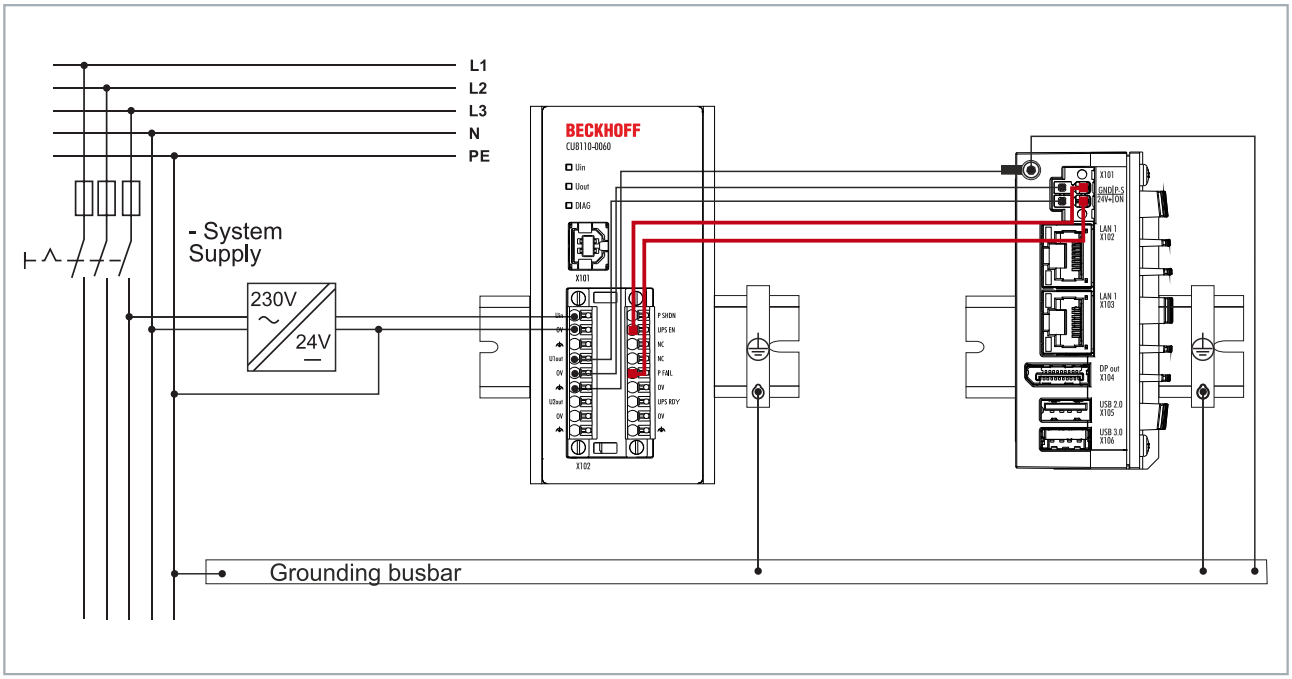


Fig. 16: Connection example via digital I/O with a C6015 Industrial PC.

P FAIL

In the case of Beckhoff Industrial PCs, the P-FAIL output of the UPS can be connected to the PC_ON input of an industrial PC. In the event of a power failure, the P-FAIL output is set to 24 V. 24 V are thus applied to the PC_ON input of the industrial PC and the industrial PC is shut down properly.

UPS EN

The Power Status output of an industrial PC can be connected to the UPS-EN input of the UPS to switch off the U1out and U2out outputs of the UPS in the event of a desired PC shutdown. After the industrial PC is shut down, the Power Status output is switched from 24 V to 0 V. This falling edge signals the UPS to immediately switch off the U1out and U2out outputs.

Similarly, any PLC output can be connected to a UPS-EN input, controlled from the PLC, and used for non-Beckhoff PCs or controllers to switch off the UPS.

7 Start-up and switch-off behavior

Start-up behavior

The system start of the capacitive CU8110-0060 UPS takes place as soon as the input voltage (Uin) is applied and the internal energy storage is fully charged. The system start can be delayed by several seconds to minutes, depending on the current charge state of the UPS.

Switch-off behavior

The switch-off behavior of the UPS can be divided into three scenarios and depends on the selected operation mode and the wiring of the UPS:

- **Direct supply via outputs (U1out and U2out) without communication interfaces**
  The loads are only connected to the U1out and U2out outputs, without USB or UPS-OCT communication. As soon as the external 24 V DC input voltage (Uin) is removed, the UPS switches off its U1out and U2out outputs after a holding time of 4 minutes.
- **Operation mode with digital I/O connection to the industrial PC**
  The UPS is connected to the industrial PC via digital inputs and outputs.
  - The P-FAIL output of the UPS is connected to the PC_ON input of the industrial PC.
  - In the event of a power failure, the P-FAIL output is set to 24 V, which applies 24 V to the PC_ON input and initiates a proper shutdown of the industrial PC.
  - After the industrial PC has been successfully shut down, the power status output on the industrial PC is switched from 24 V to 0 V, which also results in 0 V at the UPS-EN input of the UPS.
  - The falling edge from 24 V to 0 V at the UPS EN input signals the UPS to immediately switch off the U1out and U2out outputs.
- **Operation mode with USB or UPS-OCT communication**
  The industrial PC is connected to the UPS via the USB or UPS-OCT interface. Control is via the UPS configuration software.
  - UPS-OCT: The UPS switches off automatically as soon as the industrial PC is shut down.
  - USB: A shutdown timer can be configured in the UPS configuration software. The UPS switches off as soon as the timer expires.

A complete discharge of the energy storage system can lead to a longer restart time.

8 Configuration

8.1 Install UPS software

Handling older UPS software

Older UPS software versions may cause errors during installation. First, uninstall the existing UPS software.

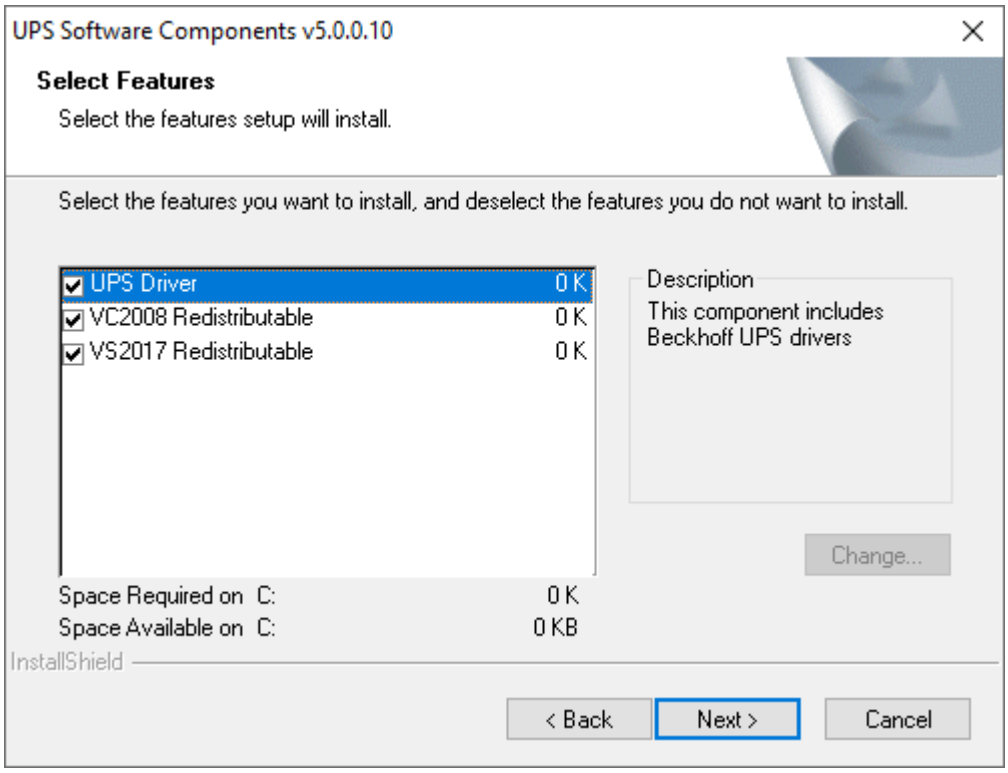
This chapter shows you how to install the Beckhoff UPS software on an Industrial PC or a non Beckhoff PC. If an older version of the UPS software is already installed, uninstall it first, since it may not be possible to update all files.

Requirements:

- Windows 7 or Windows 10 (32 and 64 Bit).
- Installation file available at: https://download.beckhoff.com/download/software/embPC-Control/Tools/CU81x0

Proceed as follows:

1. Close all running applications.
2. Start the file **Beckhoff_UPSvx.x.x.x.exe** to install the UPS software.
3. Select the desired language.
4. Install the UPS driver and confirm with **Next**.



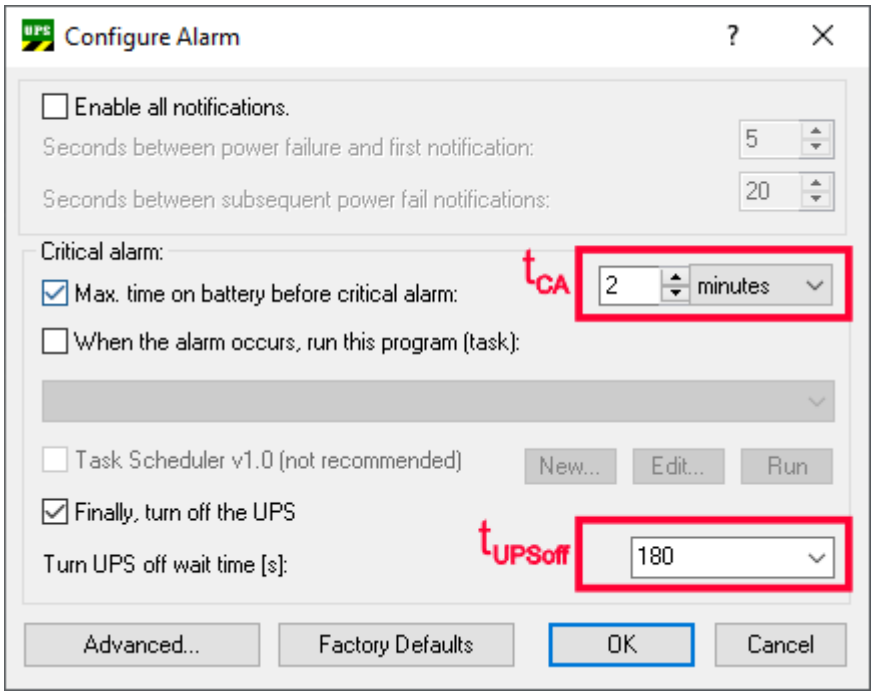
⇨ Restart the industrial PC after installation to complete the process.

8.2 System behavior

The settings under Alarm configuration influence the system behavior of the Beckhoff Miniport driver and affect how long the UPS supports the devices connected to it, when notifications or the critical alarm are issued.

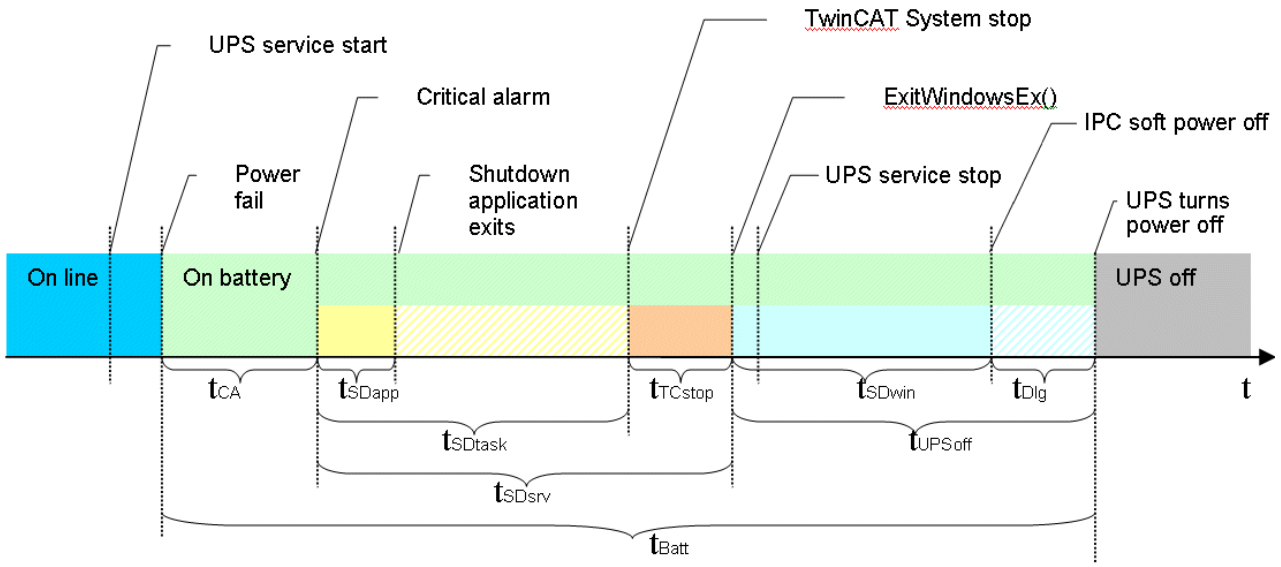
Short power failure: $t_{Batt} < t_{CA}$

Long power failure: $t_{Batt} >= t_{CA}$

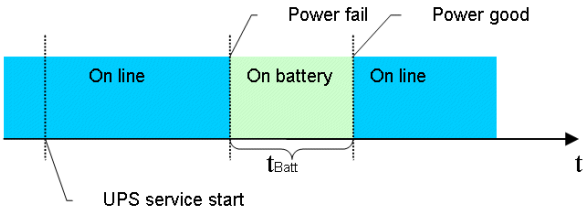


Long power failure during operation (tBatt >=tCA)

The UPS service has been started and is active. During a long power failure, the UPS service irrevocably starts shutting down the system.

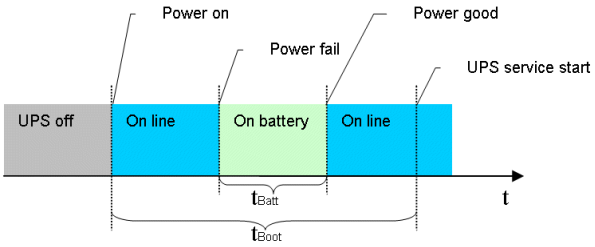


Short power failures during operation (tBatt <tCA)



The UPS service has been started and is active. Short power failures are bridged by the UPS. A shutdown through the UPS service is not initiated.

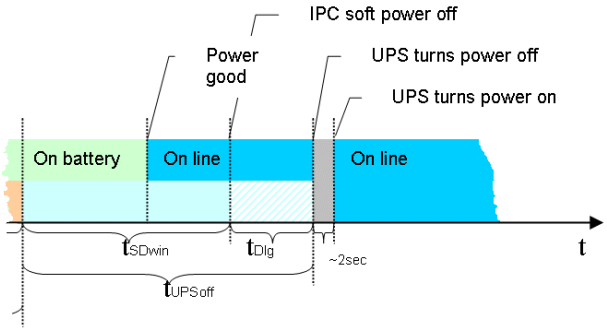
Power failure during the boot process



The UPS service is not yet active at this time. The UPS automatically switches to battery operation, thus bridging the power failure. The PC is booted up in battery mode. During a prolonged power failure, the UPS service takes over control after the start and starts shutting down the system.

Restoration of supply and repeated power failures during UPS shutdown

The following diagram shows a case in which the UPS service initiates a shutdown and the supply is restored during the shutdown.



Once the UPS service has initiated the shutdown this process cannot be stopped and must be completed. Repeated power failures during the shutdown are bridged by the UPS. In order to enable the IPC to restart the external power supply is interrupted briefly (a few seconds).

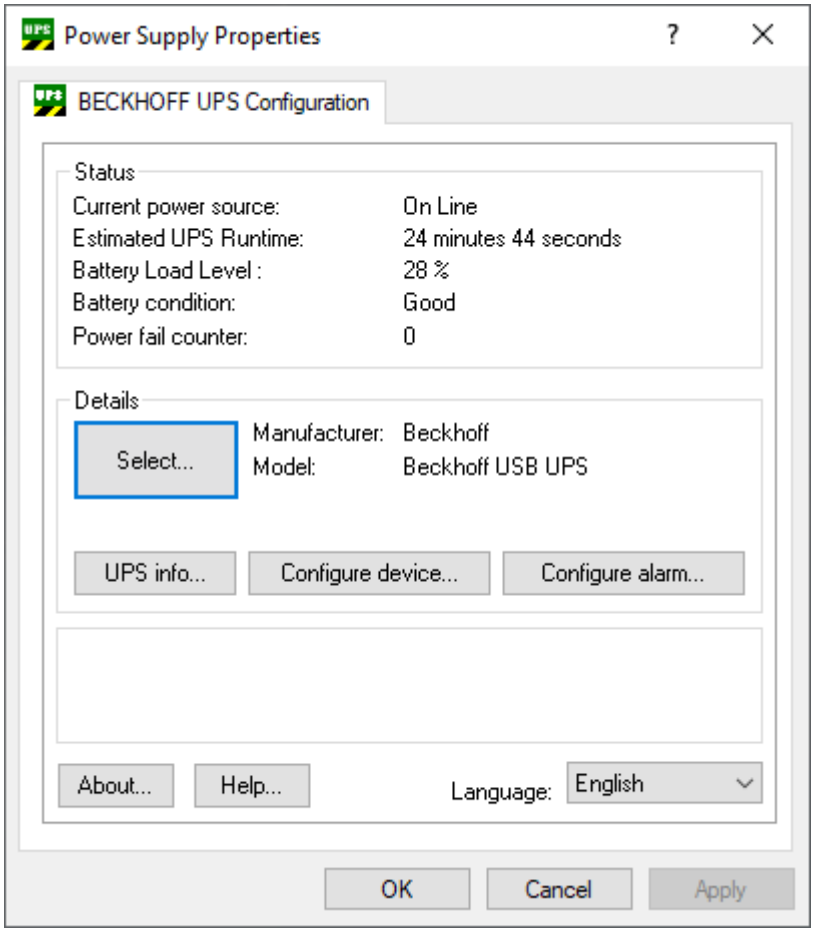
Value	Description	Properties
tBatt	Time during which the system is operated via the battery.	Variable, depending on the duration of the power failure. If tBatt >=tCA the UPS service irrevocably starts shutting down the system.
tCA	Maximum time on battery voltage before critical alarm. Once this time has elapsed the UPS service irrevocably starts shutting down the system.	Configurable in minutes (or in seconds starting from Windows 7 and higher) via the Beckhoff UPS configuration dialog. If tCA = 0 the UPS service immediately starts shutting down the system.
tSDtask	A time window provided by the UPS service for a shutdown application (shutdown task).	Not configurable, fixed and limited to a maximum of 30 seconds.

Value	Description	Properties
		• NT4: tSDtask = 0 if no shutdown application was configured and tSDtask =tSDapp if a shutdown application was configured. • All other operating systems:tSDtask always requires 30 seconds.
tSDapp	Time actually required by the shutdown application (shutdown task).	Variable, depends on the features of the application. Limited to a maximum of 30 seconds. After 30 seconds the shutdown continues irrevocably. tSDapp should always be < maximum oftSDtask.
tTCstop	This time is required for stopping the TwinCAT system. During this time the UPS service stops all TwinCAT servers.	Variable, depends on the number of configured TwinCAT servers. Limited to a maximum of 45 seconds. Shutdown continues irrevocably after 45 seconds. tTCstop = 0 if no TwinCAT is installed or was already stopped previously.
tUPSoff	Delay time for switching off the UPS. The actual shutdown of the operating system starts once the UPS service has completed all internal shutdown tasks. Once this time has started the operating system takes over control and continues with the shutdown (window applications and services including the UPS services are closed and the system is shut down completely). Once this time has elapsed the UPS irrevocably switches off the outputs and the IPC in order to save battery capacity.	Configurable via the Beckhoff UPS configuration dialog. The available values are hardware-specific. tUPSoff should always be >tSDwin.
tSDsrv	Time required by the UPS service for shutting down internal tasks.	tSDsrv =tSDtask +tTCstop
tSDwin	Time required by the operating system for a shutdown.	Variable, depends on the number of running applications that have to be closed.
tDlg	For systems without soft power-off functionality (e.g. NT4): • Time during which the dialog: "It is now safe to turn off your computer" is displayed. For systems with soft power-off functionality (e.g. XP): • With Beckhoff P24Vxxxx UPS: tDlg = 0, the UPS switches off the outputs and the IPC immediately. • With APC-UPS: Time during the IPC continues to be supplied with UPS voltage (standby mode).	Variable, depends on the operating system used, the number of running applications, the motherboard and the UPS hardware: tDlg = tUPSoff -tSDwin tDlg should always be > 0. This value can only be influenced throughtUPSoff. For systems without soft power-off functionality the dialog should be visible at least for a short time before the UPS switches off the IPC. For systems with APC-UPS and soft power-off functionality the IPC should switch off first, followed by the UPS.
tBoot	Time required by the operating system during the boot process until the UPS service is started.	Variable, depends on the number of applications and services that have to be started.

8.3 UPS configuration dialogs

Start the configuration dialog under **Start > Programs > UPS configuration**.

This dialog can be used for example to perform device-specific settings or a firmware update. In addition, the time can be set for how long the UPS should support the devices connected to it and the delay time for switching off the UPS. Only a user with administrator rights can set the settings of the UPS.



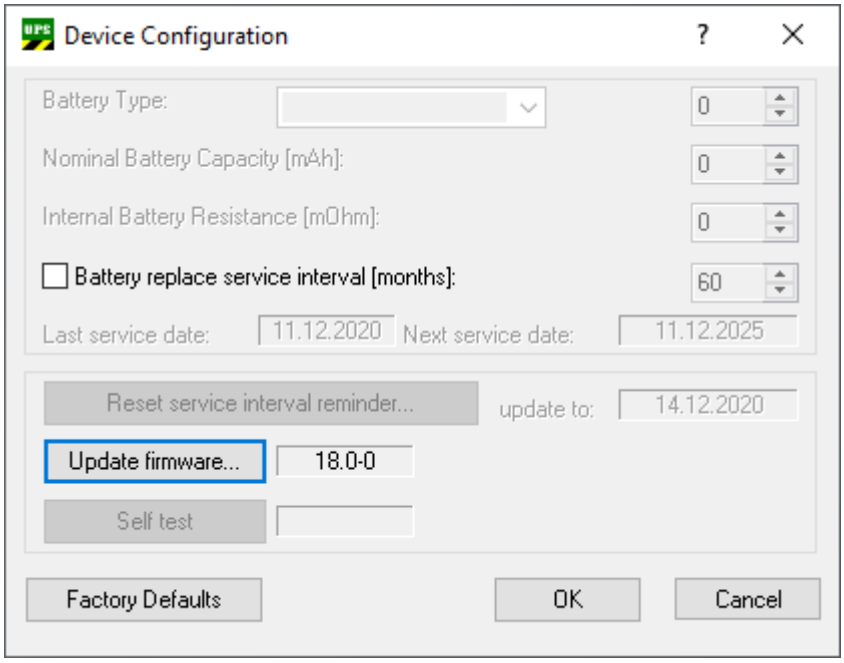
Status: Shows major information about the current power source and battery load information.

Power fail counter: From UPS software version >= 3.0.0.6. The counter is reset at UPS service start and counts the detected power fails.

Details: Shows current configured UPS model and manufacturer name. Manufacturer name "(None)" means UPS service not configured and deactivated.

8.3.1 Device configuration dialog

Dialog with device-specific settings.



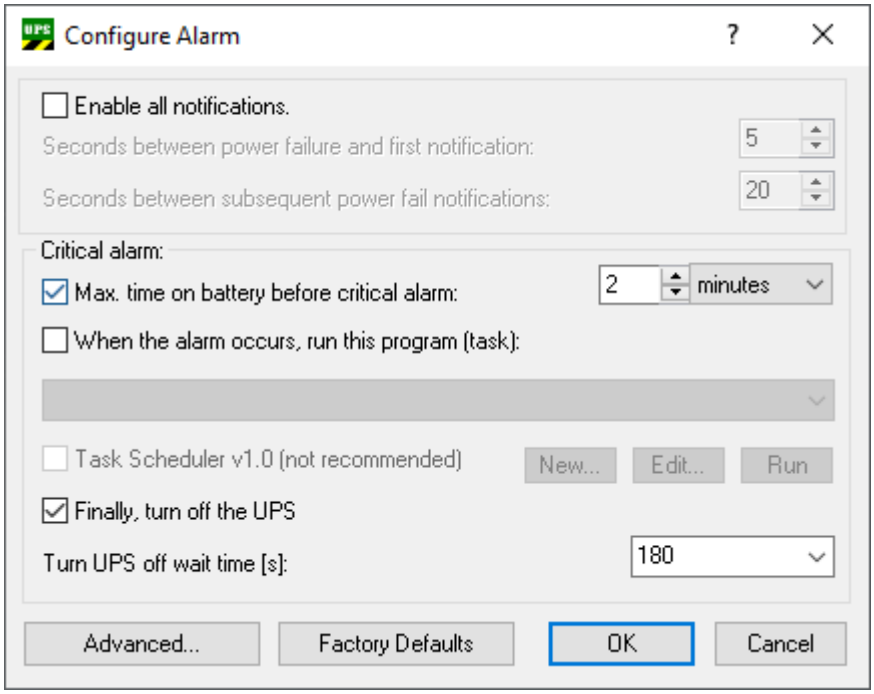
Setting or function	Value range	Default value	Description
Battery Type (combo box)	C9900-U330, C9900-U332, User-Defined	C9900-U330	Configures the used Beckhoff battery pack type.
Battery Type (edit field)	0..99	1	Available only if "User-Defined" battery type is selected. The setting is necessary, for instance, to be able to calculate the remaining charge available under battery operation.
Nominal Battery Capacity	0..99900 [mAh]	3400	Available only if "User-Defined" battery type is selected.The setting is necessary, for instance, to be able to calculate the remaining charge available under battery operation.
Internal Battery Resistance	0..999 [mOhm]	120	Available only if "User-Defined" battery type is selected.The setting is necessary, for instance, to be able to calculate the remaining charge available under battery operation.
Battery replace service interval	0..480 [months]	60 (5 years) and checkbox not enabled	The user is able to enter/configure the battery replace service interval (number of months) before first warning is logged to Windows eventlog. Use the checkbox to activate or deactivate the functionality. The functionality is only available if the battery change date and system time (in the task bar) is also set/configured. The UPS service compares the configured battery change date to the configured service interval at service start. If battery replace date + service interval >= current system date => Windows Eventlog warning message will be logged. The warning message do not reflects the real battery condition and can be used as reminder to check the real battery condition or battery age.

Setting or function	Value range	Default value	Description
Last service date: 01.01.11*	-	-	Shows the actual set battery replace/service date (last service on 1 January 2011).
Next service date: 01.01.16*	-	-	Shows the estimated next battery replace/service date (next service on 1 January 2016).
Reset service interval remainder...	-	-	Updates the record of the most recent battery change and resets the service interval remainder messages. The date is stored in the UPS's EEPROM, and can be examined in the UPS information dialog.
update to: 25.05.12*	-	-	Shows the suggested service interval update date shown in the "Reset service interval" command dialog (25 May 2012).
Update firmware...	-	-	Starts a firmware update.
Self test	-	-	Executes a self-test and displays the result: • "OK" - Test successful, the battery is OK; • "BT" - Failed because the battery capacity was insufficient, or because a battery is not even present; • "NG" - Failed as a result of overload; • "NA" - Test function does not exist;
Factory Defaults	-	-	Restores the factory (default) settings. The default battery type setting is: C9900-U330. Please check your real battery type configuration.
OK	-	-	Saves all settings and closes the dialog. Don't forgett to apply the changes at the Beckhoff UPS Configuration dialog too.
Cancel	-	-	Discards all editable changes.

*) Example value.

8.3.2 Alarm configuration dialog

Shows the dialog with the settings for the system behavior in case of power failure.



Setting or function	Value range	Default value	Description
Enable all notifications	Disabled or enabled	Disabled (checkbox not selected)	This option can be used to instruct the operating system to send messages to the user in case of Power failure. This option is not available under NT4.
Seconds between the power failure and first notification	0..120 [s]	5	The delay after which the first "power fail" message will be sent.
Seconds between subsequent power fail notifications	0..300 [s]	20	The time that elapses before additional messages are sent to the user.
Critical alarm	-	-	The alarm is triggered once the battery voltage has fallen to a certain level or once battery operation has exceeded a certain time limit.
Max. time on battery before critical alarm	0..720 [min]	2	If you have selected this option, then the UPS service will issue a critical alarm after the set time, and will shut down the PC. The critical alarm may, however, be issued earlier if the battery capacity is exhausted. If the value is set to 0, the PC will be shut down immediately in the event of a power failure, and the OS shutdown can no longer be stopped.
Unit for max. time on battery before critical alarm	Seconds, Minutes	Minutes	Seconds are available only under Windows Vista, W7, WES7, W10 (32 and 64 bit).
When the alarm occurs, run this program (task)	Disabled or Enabled	Disabled (checkbox not selected)	This option allows an application to be executed after an alarm has occurred, but before the actual shutdown (shutdown task). If selected then all found task scheduler tasks are listed in the combo box below. The user have to select one of the tasks. The default task (if existing) with the name: "UPS System Shutdown Program" is selected automatically it the task is configured for the first time.

Setting or function	Value range	Default value	Description
Combobox (task list)	Available task scheduler tasks	"UPS System Shutdown Program"	You cannot specify a command file that causes a dialog box to appear, because dialog boxes that require user input can impede a graceful system shutdown. The command file must finish running in 30 seconds. A run time that is greater than 30 seconds threatens the capability of Windows to complete a graceful system shutdown. Windows Task Scheduler executes the shutdown task in context of configured user account. The user account under which the schedule service runs may require specific file access permissions, user permissions and drive mappings. If the configured user name and password parameters match the currently logged-in user, the task will run interactively (visible in the foreground). For the system account the user name can be written as "NT AUTHORITY\SYSTEM", a password is not required. The system account has full access to the local machine but has no permissions on any other machines (or mapped drives) across the Network. Further information can be found in the Windows Task Scheduler documentation.
New...	-	"UPS System Shutdown Program"	Creates new task scheduler task with default name: "UPS System Shutdown Program". This command is only available under XP operating system. The command is only available if the default task is not allready in the task list. Please use the task scheduler dialog in the MMC (Microsoft Management Console) to create new shutdown tasks on Windows Vista or 7 systems.
Edit...	-	"UPS System Shutdown Program"	Displays options that you can configure for a selected task scheduler task that will run before a system shutdown action occurs. This command is only available under XP operating system. Please use the task scheduler dialog in the MMC (Microsoft Management Console) to edit the task configuration on Windows Vista or 7 systems.
Run...	-	"UPS System Shutdown Program"	Starts the selected task scheduler task for test purposes. This command is only available under XP operating system. Please use the task scheduler dialog in the MMC (Microsoft Management Console) to test and run the task on Windows Vista or 7 systems.
Task Scheduler v1.0 (not recommended)	Disabled or enabled	Disabled (checkbox not selected)	Enables forced usage of XP task scheduler v1.0 interface on Windows Vista or 7 operating system. The Task Scheduler v1.0 interface on Windows Vista or 7 offers only limited functionality.
Finally, turn off the UPS	Disabled or enabled	Enabled (checkbox is selected)	If you have selected this option, the UPS will switch the outputs off after the PC has been shut down, in order to save the battery charge (Standard: Selected).
Turn UPS off wait time [s]	Depends on hardware (see table below)	180	The PC must have properly shut down within this time. An internal timer in the UPS measures the time from when the OS began to shut down. Once this time has elapsed, the UPS switches off its outputs in order to save battery charge. Make sure that you have not selected too short a time for this.

Setting or function	Value range	Default value	Description
			The available delay times differ from one device to another. The times are read out from the device, and are placed in the ComboBox. The UPS service must be configured and started up with the appropriate UPS model to make this possible.
Advanced...	-	-	Dialog with advanced shutdown or end session settings for systems without Soft-Power-Off feature (S5) (e.g. NT4). For additional info see: Advanced settings dialog. This option is not available on systems supporting Soft-Power-Off feature (deactivated).
Factory Defaults	-	-	Restores default settings.
OK	-	-	Saves all settings and closes the dialog. Don't forgett to apply the changes at the Beckhoff UPS Configuration dialog too.
Cancel	-	-	Discards all editable changes and closes the dialog.

Delay times for switching off the UPS in seconds:

- Beckhoff USB UPS: 20, 30, 45, 60, 120, 180, 300, 600

8.4 Configuring the UPS

This step shows how to configure the UPS in the Beckhoff UPS software. Two of the most important settings that affect the behavior of the UPS in the event of a power failure are:

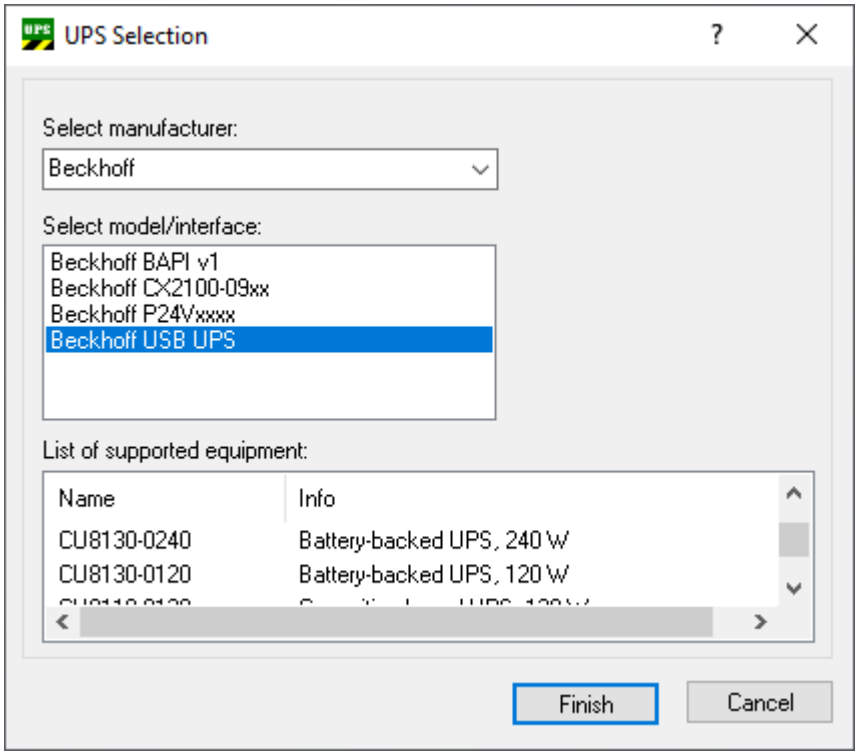
- Max. time on battery before critical alarm
- and Turn UPS off wait time.

In the software, set the time after which the critical alarm should be triggered and the Industrial PC should be shut down in the event of a power failure.

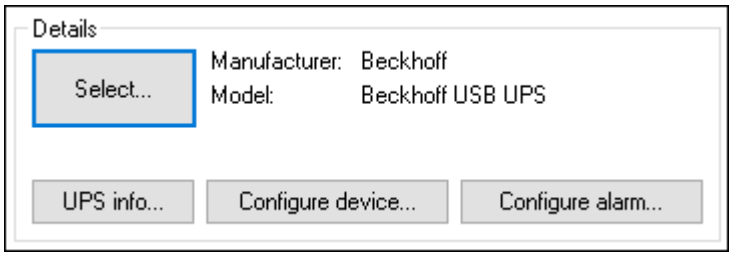
In the next step, define the time after which the ups should switch off its supply outputs. Note that the industrial PC must be shut down properly within this period. Make sure that you do not set a value that is too low and that the set time covers the entire shutdown process.

Proceed as follows:

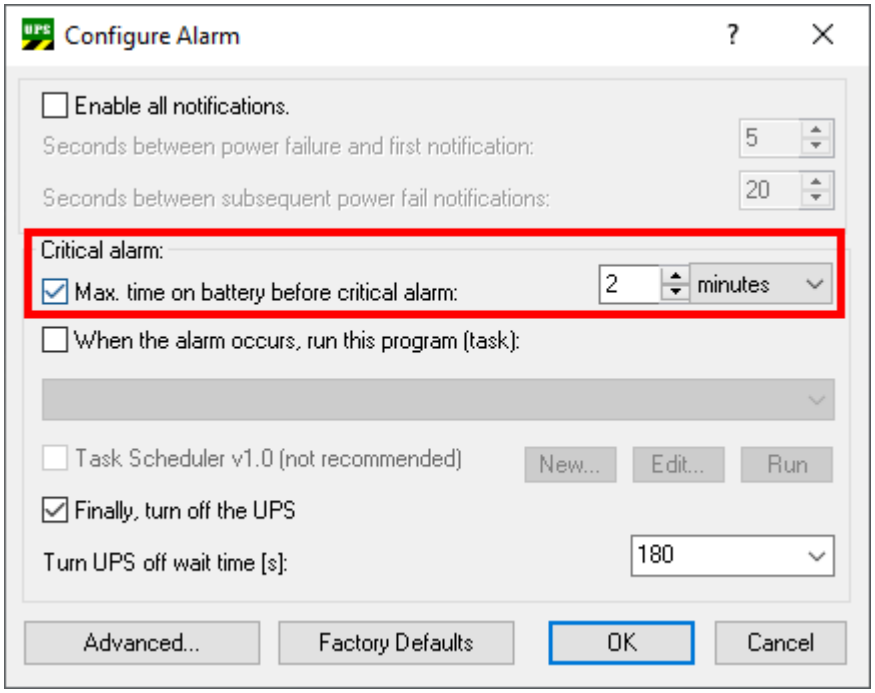
1. Start the UPS software and click **Select**.
2. Select **Beckhoff USB UPS** to configure the communication to the Industrial PC via USB.



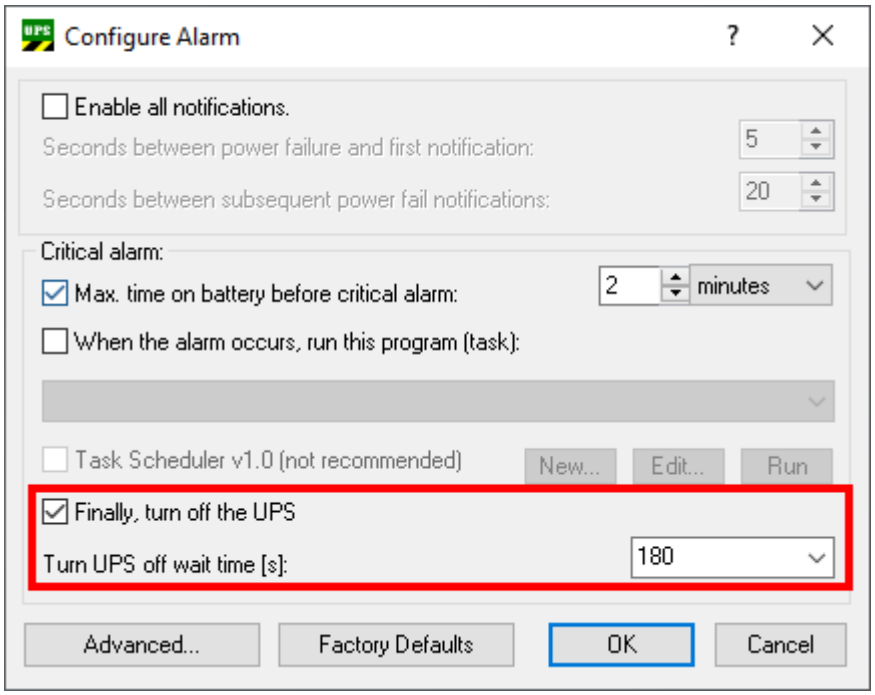
3. Click **Finish** and in the main menu click **Apply** to start the UPS service.
4. The UPS service is running if the manufacturer and the communication type are displayed in the main menu.



5. Click on the Configure alarm button and define under **Max. time on battery before critical alarm**, after which the critical alarm should be triggered in the event of a power failure. The critical alarm is not triggered if the power supply returns within the set time.



6. Under **Turn UPS off wait time**, determine the time after which the UPS should switch off its outputs. Define a time period in which the industrial PC has sufficient time to shut down properly. Always plan for a sufficient headroom.



The outputs of the UPS are irrevocably switched off after the delay time has elapsed, even if the power supply returns.

⇨ In this example, in the event of a power failure, the critical alarm is triggered after two minutes and thereafter the Industrial PC is shutting down. As soon as the critical alarm is triggered, the set countdown of 180 seconds is started. The shutdown of the Industrial PC must be successfully completed within this time (180 seconds), since the outputs of the UPS are switched off directly after the 180 seconds have elapsed.

8.5 TwinCAT interface

8.5.1 FB_GetUPSStatus

Requirements:

- Beckhoff UPS software components have been installed:
  - Windows 7, Windows Embedded Standard 7 and higher: Configuration dialog under "*Start->Programs->Beckhoff->UPS Software Components*".
  - NT4, Win2K, WinXP, WinXP embedded: Additional tab under "*Control Panel->Power Options->Beckhoff UPS Configuration*" or "*Control Panel->Power Options->UPS*".
  - Beckhoff CE devices with 24 V UPS support are delivered with a special Beckhoff Battery Driver for Windows CE. The driver is included in the standard CE image for these devices.
- The UPS has been activated and configured. You can find more information about UPS configuration in the corresponding advanced UPS software and device documentation.
  - Windows 7, Windows Embedded Standard 7 and higher: Configuration dialog under "*Start->Programs->Beckhoff->UPS Software Components*".
  - NT4, Win2K, WinXP, WinXP embedded: Configuration dialog under "*Control Panel->Power Options->Beckhoff UPS Configuration*".
  - Windows CE: The UPS function is disabled by default and must be enabled via a RegFile. Newer images have a configuration dialog under *"Start->Control Panel->BECKHOFF UPS Configuration"*.

The FB_GetUPSStatus function block reads the status of the UPS hardware from the PLC. The function block is level triggered, which means that the status information of the UPS is only cyclically read while the *bEnable* input is set. To keep the system load low, the status information is read every ~4.5 s. When the *bValid* output is set, the most recently read data is valid. The most recent read cycle was, in other words, executed without error. If an error occurs, the read cycle is repeated, and the error signal is automatically reset as soon as the cause of the error (e.g. no communication with the UPS) has been corrected.

Inputs

```
VAR_INPUT
    sNetId   : T_AmsNetId;
    nPort    : T_AmsPort;(* 0 = Windows UPS service / Windows Battery Driver *)
    bEnable  : BOOL;
END_VAR
```

Name	Type	Description
sNetId	T_AmsNetID	A string with the network address of the TwinCAT computer whose UPS status is to be read can be specified here. For the local computer an empty string may be specified.
nPort	T_AmsPort	The ADS port number. Set this value to zero. Other port numbers are reserved for future applications.
bEnable	BOOL	The UPS status is read cyclically if this input is set.

Outputs

```
VAR_OUTPUT
    bValid     :BOOL;
    bError     :BOOL;
    nErrId     :UDINT;
    stStatus   :ST_UPSStatus;
END_VAR
```

Name	Type	Description
bValid	BOOL	If this output is set, the data in the ST_UPSStatus structure are valid (no error occurred during the last reading cycle).
bError	BOOL	This output is set if an error occurred when executing the function.
nErrId	UDINT	Returns the ADS error number or the command-specific error code (table) if the *bError* output is set.

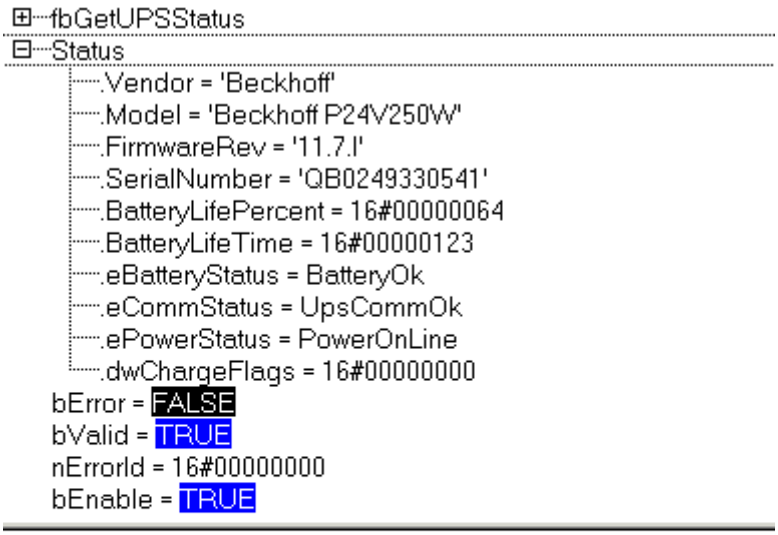
Error codes	Error description
0x0000	No error
0x8001	UPS configuration error. It is possible that the UPS is not configured correctly or that no UPS is configured at all.
0x8002	Communication error. Communication with the UPS was interrupted.
0x8003	Error during the reading of the status data.

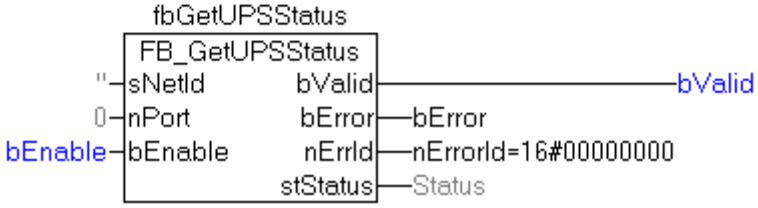
Name	Type	Description
stStatus	ST_UPSStatus [▶ 44]	Structure with the status information of the UPS.

Not all UPS devices can provide all status information. Some devices, for example, cannot supply the *BatteryLifeTime* or *BatteryReplace* status.

Example:

Online data with status information of a UPS:





Requirements

Development environment	Target platform	UPS hardware	PLC libraries to be integrated (category group)
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	• Beckhoff CU81x0-0xx0 • Beckhoff BAPI v1;	Tc2_IoFunctions (IO)

Development environment	Target platform	UPS hardware	PLC libraries to be integrated (category group)
		• Beckhoff P24Vxxxx; • Beckhoff CP903x card (PCI/ISA); • Beckhoff CX2100-09x4 models (e.g. CX2100-0904 or CX2100-0914 + "Smart Battery" CX2900-0192); • The APC devices that come supplied with Beckhoff Industrial PC support the Smart protocol and can be configured with the Windows UPS service.	

8.5.2 ST_UPSStatus

```
TYPE ST_UPSStatus
STRUCT
    Vendor             : STRING; (* UPS vendor name  *)
    Model              : STRING; (* UPS model name *)
    FirmwareRev        : STRING; (* UPS firmware revision *)
    SerialNumber       : STRING; (* UPS serial number *)
    BatteryLifePercent : DWORD; (* The percent of battery capacity remaining in the UPS (0..100%) *)
    BatteryLifeTime    : DWORD; (* Remaining UPS run time, in minutes *)
    eBatteryStatus     : E_BatteryStatus; (* UPS battery state *)
    eCommStatus        : E_UpsCommStatus; (* Status of the communication path to the UPS *)
    ePowerStatus       : E_UpsPowerStatus; (* Status of utility-supplied power into the UPS *)
    nPowerFailCnt      : DWORD; (* Power Fail counter. Increments every time the UPS service detects
 power fail *)
    dwChargeFlags      : DWORD; (* Battery charge status flags. This member can be one or more of th
e following values.
    Bits0..7 := General battery status flags (if all bits are set to 0 => unknown status)
        Bit0 := High (bit set => high battery charge)
        Bit1 := Low (bit set => low battery charge)
        Bit2 := Critical (bit set  => battery is near empty)
        Bit3 := Charging (bit set  => battery is charging)
        Bits4..6 := reserved (all bits are 0)
        Bit7 := No Battery (bit set => battery not found or not connected, bit not set => battery is
 existing or unknown state)
   Bits8..15 := Special status information (if all bits are set to 0 => state ok or unknown state)
        Bit8 := UPS Fan Error (bit set => fan hardware reports an error, bit not set => fan is ok)
        Bit9 := Over Temperature (bit set => over temperature detected, bit not set => temperature i
s ok)
        Bit10 := Service Interval Notify (bit set => service interval time expired, bit not set =>se
rvice interval time not expired )
        Bit11 := Under Temperature (bit set => under temperature detected , bit not set => temperatu
re is ok )
        Bit12 := Fuse Not Ok (bit set => fuse broken or missed, bit not set => fuse ok)
        Bit13 := Alarm1 (reserved for later use, bit is 0)
        Bit14 := Alarm2 (reserved for later use, bit is 0)
        Bit15 := Alarm3 (reserved for later use, bit is 0)
    Bits16..31 := (reserved for later use, all bits are 0)
 *)
END_STRUCT
END_TYPE
```

Not all UPS models can supply every item of status information.

X: The status information is available with this model.

*) Available only if the model “Smart Signaling to any APC UPS & TwinCAT” has been configured.

Status information	CU81x0-0xx0	Beckhoff BAPI v1	Beckhoff P24Vxxxx UPS	Beckhoff 24V UPS on the CP903x card	CX2100-09x4	APC Back-UPS Pro 280	APC Smart-UPS 420	Description
Vendor	X	X	X	X	X	X	X	Vendor name.

Status information	CU81x0-0xx0	Beckhoff BAPI v1	Beckhoff P24Vxxxx UPS	Beckhoff 24V UPS on the CP903x card	CX2100-09x4	APC Back-UPS Pro 280	APC Smart-UPS 420	Description
Model	X	X	X	X	X	X	X	Model string. Empty string if no UPS has been configured.
Firmware Rev	X	X	X	X	X	X	X	UPS firmware version information. Empty string if the UPS does not support this parameter.
SerialNumber	X	X	X	None	X	X	X	Serial number of the UPS. Empty string if the UPS does not support this parameter.
BatteryLifePercent	X	X	X	None	X	X	X	Remaining battery life in percent. The value is always zero if the UPS cannot supply this parameter.
BatteryLifeTime	X	X	X	None	X	X	X	Remaining battery life in minutes. The value is always zero if the UPS cannot supply this parameter.
eBatteryStatus	**BatteryUnknownStatus** when no battery is present (applicable only for the model with battery). **BatteryOk**	**BatteryOk**	**BatteryUnknownStatus** if no battery exists; from UPS software version >= 2.0.0.6 and UPS firmware >= 25.1.I **BatteryOk**	**BatteryUnknownStatus** if no battery exists. **BatteryOk**	**BatteryUnknownStatus** when no battery is present (applicable only for the model with "Smart Battery" and not with capacitors) **BatteryOk**	X	X	Battery status (type: E_BatteryStatus).
eCommStatus	X	X	X	X	X	X	X	Status of the communication with the UPS (type: E_UpsCommStatus).
ePowerStatus	X	X	X	X	X	X	X	Status of external power supply (type: E_UpsPowerStatus).
nPowerFailCnt	X	X	X	X	X	*X	*X	Power-fail counter. The counter is incremented if a voltage failure is detected by the UPS service.
dwChargeFlags	**No Battery** (bit 7 set). No communication to the battery	**No Battery** (bit 7 set) from UPS firmware >=33.12-0 if no battery isconnected.	**No Battery** (bit 7 set) from UPS software version >= 2.0.0.6 and firmware >=	**High** (bit 0 set) if battery is fully charged.	**No Battery** (bit 7 set). No communication to the battery (applicable only for the model	None	None	Battery charge status flags and special status information.

Status information	CU81x0-0xx0	Beckhoff BAPI v1	Beckhoff P24Vxxxx UPS	Beckhoff 24V UPS on the CP903x card	CX2100-09x4	APC Back-UPS Pro 280	APC Smart-UPS 420	Description
	(applicable only for the model with battery). **Service Interval Notify** (bit 10 set). The configured battery service interval has expired.	**Service Interval Notify** (bit 10 set). The configured battery change interval service has expired	25.1.I. The existence of the battery is checked every minute. **UPS Fan Error** (bit 8 set) from UPS software version >= 2.0.0.7 and firmware >= 40.1.I. The UPS fan status is checked each minute. **Requires a newer (second) hardware revision!** **Service Interval Notify** (bit 10 set). The configured battery change interval service has expired. Implemented in the UPS software version >= 3.0.0.8;	**Charging** (bit 3 set) **No Battery** (bit 7 set) if no battery was found.	with "Smart Battery" and not with capacitors). **Over Temperature** (bit 9 set) was detected and the charging of the battery was interrupted. **Requires a newer (second) hardware revision.** Implemented in the UPS software version >= 3.0.0.18. **Service Interval Notify** (bit 10 set). The configured battery service interval has expired. **Under Temperature** (bit 11 set) was detected and the charging of the battery was interrupted. **Requires a newer (second) hardware revision.** Implemented in the UPS software version >= 3.0.0.18. **Fuse Not Ok** (bit 12 set). The "Smart Battery" fuse is defective or not available. **Requires a newer (second) hardware revision.** Implemented in the UPS software version >= 3.0.0.18.			

Requirements

Development environment	Target platform	UPS hardware	PLC libraries to be integrated (category group)
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	• Beckhoff CU81x0-0xx0 • Beckhoff BAPI v1; • Beckhoff P24Vxxxx; • Beckhoff CP903x card (PCI/ISA); • Beckhoff CX2100-09x4 models (e.g. CX2100-0904 or CX2100-0914 + "Smart Battery" CX2900-0192); • The APC devices that come supplied with Beckhoff Industrial PC support the Smart protocol and can be configured with the Windows UPS service.	Tc2_IoFunctions (IO)

8.5.3 E_BatteryStatus

Battery status.

```
TYPE E_BatteryStatus :
(
    BatteryUnknownStatus,
    BatteryOk,
    BatteryReplace
);
END_TYPE
```

Name	Value	Meaning
BatteryUnknownStatus	0	The battery status is unknown.
BatteryOk	1	The battery status is OK.
BatteryReplace	2	The battery should be replaced.

Requirements

Development environment	Target platform	UPS hardware	PLC libraries to be integrated (category group)
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	• Beckhoff CU81x0-0xx0 • Beckhoff BAPI v1; • Beckhoff P24Vxxxx; • Beckhoff CP903x card (PCI/ISA); • Beckhoff CX2100-09x4 models (e.g. CX2100-0904 or CX2100-0914 + "Smart Battery" CX2900-0192); • The APC devices that come supplied with Beckhoff Industrial PC support the Smart protocol and can be configured with the Windows UPS service.	Tc2_IoFunctions (IO)

8.5.4 E_UpsCommStatus

Status of communication with the UPS hardware.

```
TYPE E_UpsCommStatus :
(
    UpsCommUnknownStatus,
    UpsCommOk,
    UpsCommFailed
);
END_TYPE
```

Name	Value	Meaning
UpsCommUnknownStatus	0	The communication status is unknown.
UpsCommOk	1	Communication has been established with the UPS.
UpsCommFailed	2	Communication with the UPS was interrupted.

Requirements

Development environment	Target platform	UPS hardware	PLC libraries to be integrated (category group)
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	• Beckhoff CU81x0-0xx0 • Beckhoff BAPI v1; • Beckhoff P24Vxxxx;	Tc2_IoFunctions (IO)

Development environment	Target platform	UPS hardware	PLC libraries to be integrated (category group)
		• Beckhoff CP903x card (PCI/ISA); • Beckhoff CX2100-09x4 models (e.g. CX2100-0904 or CX2100-0914 + "Smart Battery" CX2900-0192); • The APC devices that come supplied with Beckhoff Industrial PC support the Smart protocol and can be configured with the Windows UPS service.	

8.5.5 E_UpsPowerStatus

Status of the power supply.

```
TYPE E_UpsPowerStatus :
(
    PowerUnknownStatus,
    PowerOnLine,
    PowerOnBattery
);
END_TYPE
```

Name	Value	Meaning
PowerUnknownStatus	0	The status of the power supply is unknown
PowerOnLine	1	Mains power supply.
PowerOnBattery	2	Battery power supply.

Requirements

Development environment	Target platform	UPS hardware	PLC libraries to be integrated (category group)
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	• Beckhoff CU81x0-0xx0 • Beckhoff BAPI v1; • Beckhoff P24Vxxxx; • Beckhoff CP903x card (PCI/ISA); • Beckhoff CX2100-09x4 models (e.g. CX2100-0904 or CX2100-0914 + "Smart Battery" CX2900-0192); • The APC devices that come supplied with Beckhoff Industrial PC support the Smart protocol and can be configured with the Windows UPS service.	Tc2_IoFunctions (IO)

9 Error handling and diagnostics

Table 12: Diagnostics LED, Uin.

LED	Color	Description
Uin	Green	Input voltage Uin is present and is within the defined limits between 24.4 V and 28.8 V.
	Red	Input voltage Uin is below 20.4 V. UPS is switched in the UPS mode (undervoltage protection).
	Yellow	Input voltage Uin is over 28.8 V. UPS is switched in the UPS mode (overvoltage protection).

Table 13: Diagnostics LED, Uout.

LED	Color	Description
Uout	Green	Output voltage Uout present.
	Red	Output voltage Uout switched off.
	Yellow	Output voltage Uout is above 28.8 V.

Table 14: Diagnostics LED, DIAG.

LED	Color	Description
DIAG	Off	No input voltage Uin present. UPS is not initialized.
	White	No battery module or capacitor board found.
	White, Red or White, Green flashing	White: timer for shutdown is active. Red: in case of discharge. Green: intentional shutdown.
	Red	No input voltage Uin present. UPS is not being charged.
	Green, flashing	UPS is being charged.
	Green, Yellow	UPS is below or above the allowed ambient temperature.
	Green	Input voltage Uin present. UPS is ready for operation and charged.
	Red, flashing	No input voltage Uin. UPS mode started and UPS is being discharged.

10 Care and maintenance

Cleaning

⚠ CAUTION

Risk of electric shock

Live devices or parts can cause electric shocks. Disconnect the UPS from the power supply before cleaning.

Clean only the housing of the UPS. Use a soft, moist cleaning cloth for this. Make sure that the ventilation slots of the device are always free and do not clog up.

The following cleaning agents and materials are unsuitable and may cause damage:

- corrosive cleaning agents
- solvents
- scouring agents
- hard objects

11 Decommissioning

11.1 Dismantling the UPS

NOTICE

Electrical voltage

If the power supply is switched on during dismounting, this can lead to damage to the UPS. Switch off the power supply during dismounting.

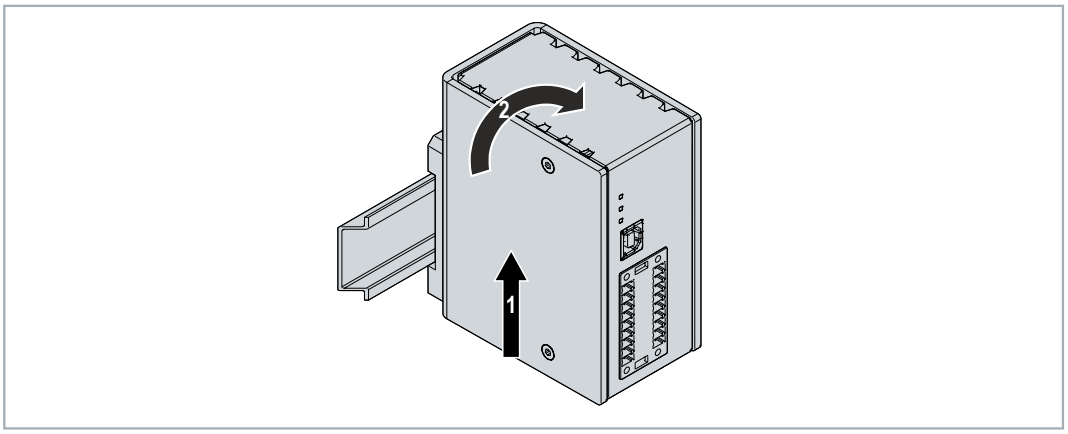
This chapter shows how to disassemble the UPS and thus remove it from the DIN rail. Shut down the industrial PC connected to the UPS so that the UPS is switched off.

Requirements:

- Switch off the power supply.

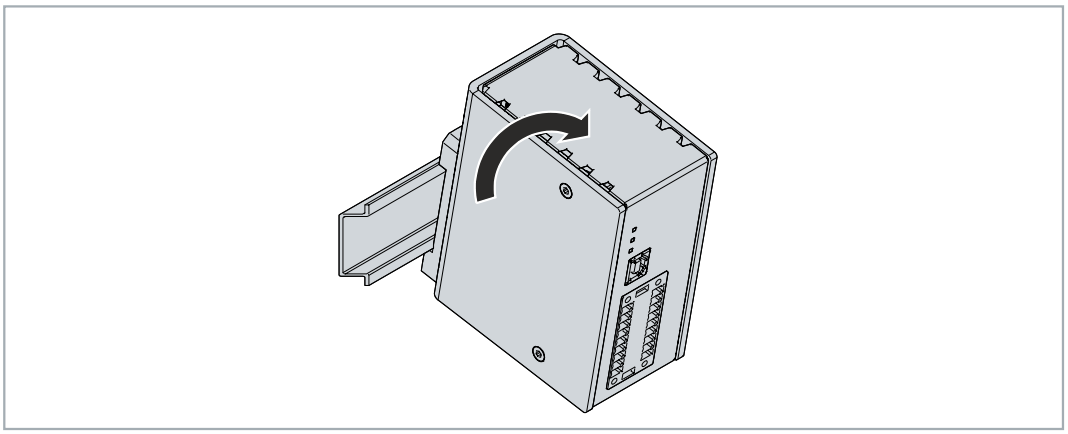
Dismantle the UPS as follows:

1. Push the UPS upwards.



   ⇨ As soon as you push the UPS upwards, the lower springs of the DIN rail adapters give way. This allows the UPS to be released from the top edge of the DIN rail.

2. Tilt the UPS forwards.



⇨ The UPS can be removed from the DIN rail.

11.2 Disposal

Beckhoff Automation products are marketed exclusively to corporate customers. According to the directive 2012/19/EU "WEEE", we take old devices and accessories back for professional disposal. The transport costs are covered by the sender.

Send the old devices with the note "For disposal" to:

Beckhoff Automation GmbH & Co. KG
Gebäude „Service“
Stahlstraße 31
D-33415 Verl

12 Technical data

Table 15: Technical data, dimensions and weights.

Technical data	CU8110-0060
Dimensions (W x H x D)	50 mm x 100 mm x 90 mm
Weight	approx. 425 g

Table 16: Technical data, general data.

Technical data	CU8110-0060
Type	capacitive uninterruptible power supply (UPS), 55 W
Storage technology	EDLC (capacitive)
Capacity	0.3 Wh
Interfaces	USB or UPS-OCT via 24 V DC power supply module, USB cable not included in the scope of supply
Connection	2 x 9-pin plug, push-in
Power supply	24 V DC (-15%/+20%)
Power output	max. 55 W
Power consumption	max. 60 W
Output voltage	min. 24 V DC
Diagnostic LED	1 x UIN, 1 x UOUT, 1 x DIAG
Approvals/markings	CE, UL

Table 17: Technical data, electrical currents and internal fuses.

Technical data	CU8110-0060
Power consumption during charging (without load)	max. 2.2 A
Output current	max. 2.5 A
Fuse (internal, input)	electronic 10 A
Fuse (internal, output)	electronic 3 A

Table 18: Technical data, power loss.

Technical data	CU8110-0060
Power loss during charging	max. 4.25 W
Power loss mains operation, UPS loaded	max. 2.2 W
Power loss UPS operation, UPS discharges	max. 5.5 W

Table 19: Technical data, input UPS_EN and P_SHDN.

Technical data	CU8110-0060
Nominal voltage	24 V_{DC} (-15 %/+20 %)
Signal voltage "0"	-3 … 5 V (EN 61131-2, type 1/3)
Signal voltage "1"	11 … 30 V (EN 61131-2, type 1/3)
Input current	3 mA typ.
Input filter	3 ms typ.

Table 20: Technical data, output P_FAIL and UPS_RDY.

Technical data	CU8110-0060
Nominal voltage	24 V_{DC} (-15 %/+20 %)
Load type	ohmic, inductive, lamp load
Max. output current	0.5 A (short-circuit proof)
Short-circuit current	< 1 A typ.
Output stage	push (high-side switch)
Max. breaking energy (ind.)	< 150 mJ
Changeover times	T_{ON}: 50 µs typ., T_{OFF}: 100 µs typ.

Table 21: Technical data, environmental conditions.

Technical data	CU8110-0060
Relative humidity	95 % no condensation
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4
Protection rating	IP20
Ambient temperature during operation	-25…+50 °C

13 Appendix

13.1 Accessories

Table 22: Mounting accessories.

Order number	Description
C9900-M676	Mounting plate made of black anodized aluminum for UPS mounting on the control cabinet wall, suitable for CU8110-0060
C9900-P950	Replacement plug for the power supply of the CU81xx UPS series. Two 9-pin plugs with push-in connection for cables with a cross-section of 0.14 mm² to 1.5 mm² or AWG26 to AWG16.
C9900-K530	USB cable 0.40 m
C9900-K554	USB cable 1.00 m
C9900-K552	USB cable 3.00 m
C9900-K553	USB cable 5.00 m
C9900-K900	Power cables, shielded 0.50 m
C9900-K901	Power cables, shielded 1.00 m
C9900-K902	Power cables, shielded 2.00 m
C9900-K903	Power cables, shielded 5.00 m
C9900-K904	Power cables, shielded 10.00 m

13.2 Support and Service

Beckhoff Support and Service provides assistance with questions regarding Beckhoff products and system solutions, as well as with their planning, commissioning, and operation.

Beckhoff subsidiaries and representative offices

Please contact your Beckhoff subsidiary or your representative office for local support and service for Beckhoff products. You can find the addresses of Beckhoff subsidiaries and representative offices at: www.beckhoff.com/worldwide.

For Beckhoff products and technologies, we offer Training programs, tutorials, and webinars.

Beckhoff Support

Beckhoff Support provides assistance with technical questions regarding the use, planning, programming, and commissioning of Beckhoff products.

☎ Hotline:	+49 5246 963-157
✉ Email:	support@beckhoff.com, Support form
Web page:	www.beckhoff.com/support

Beckhoff Service

Our service specialists are here to assist you with any questions you may have regarding after-sales service processes, such as replacement parts, repairs, etc.

☎ Hotline:	+49 5246 963-460
✉ Email:	service@beckhoff.com, Service form
Web page:	www.beckhoff.com/service

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The Download finder serves as a central source for downloadable documents and files related to Beckhoff products, such as application reports, technical documentation, drawings, and configuration files.

Beckhoff Information System

The Beckhoff Information System is the central online documentation resource for Beckhoff products and contains documentation on products and automation topics, as well as sample code.

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Beckhoff Automation GmbH & Co. KG
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33415 Verl, Germany

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Web page:	www.beckhoff.com

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