

Manual | EN

CU8130-0120

Uninterruptible Power Supply (Battery-backed)



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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.

For installation and commissioning of the components, it is absolutely necessary to comply with the documentation and the following notes and explanations.

The qualified personnel is always obliged to use the currently valid documentation.

The responsible staff must ensure that the application or use of the products described satisfies all safety requirements, 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.

We reserve the right to revise and change the documentation at any time and without notice.

No claims to modify products that have already been supplied may be made on the basis of the data, diagrams, and descriptions in this documentation.

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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 | Modifications |
|---------|---|
| 1.0 | First version. |
| 1.1 | Chapter "Power supply" and "Disposal" revised. |
| 1.2 | Chapter "Power supply" and "Technical data" adapted. |
| 1.3 | Chapter "Technical data" and "Communication" adapted. |
| 1.4 | Chapter "Commissioning" adapted. |
| 1.5 | UPS-OCT availability adjusted. |

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 CU8130-0120 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.

Ensure full functionality and replace the battery module after five years.

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 for protection against injuries and prevention of damage to equipment or property.

Assembly

- 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.
- Avoid 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).
- Note the temperature limit values for operation. If the UPS is operated outside of these temperature limit values, electrolyte can escape, heat up or in the worst case explode.
- The UPS location must be adequately ventilated. In case of a fault, the UPS can release flammable gases that could cause an explosion.
- Do not store the UPS in an airtight container or bag. The battery pack can release gases that could explode if the UPS is kept in an airtight enclosure.
- If you come into contact with electrolyte, rinse the affected body part immediately with water.

Firefighting

Extinguish the battery pack with dry powder, halon or CO₂.

- Do not extinguish with water.
- Disconnect the power supply.
- During firefighting wear self-contained respiratory protective 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:

| |
|--|
| Caution: Do not charge in a gas tight container. |
|--|

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

| | CU8130-0120 |
|------------------------|------------------------|
| Dimensions (W x H x D) | 60 mm x 100 mm x 90 mm |
| Weight | approx. 800 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.
- Store the UPS in a charged state.

If the UPS is stored for longer, it must be recharged at regular intervals. Recharge the UPS after 12 months at the latest. Avoid deep discharge of the UPS.

4 Product overview



UPS-OCT availability

UPS-OCT should be available from Q2 2024 (new hardware required).

The CU8130-0120 is a battery-backed, uninterruptible power supply (UPS) based on NiMH cells with a maximum energy of 15 Wh and a maximum power output of max. 110 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

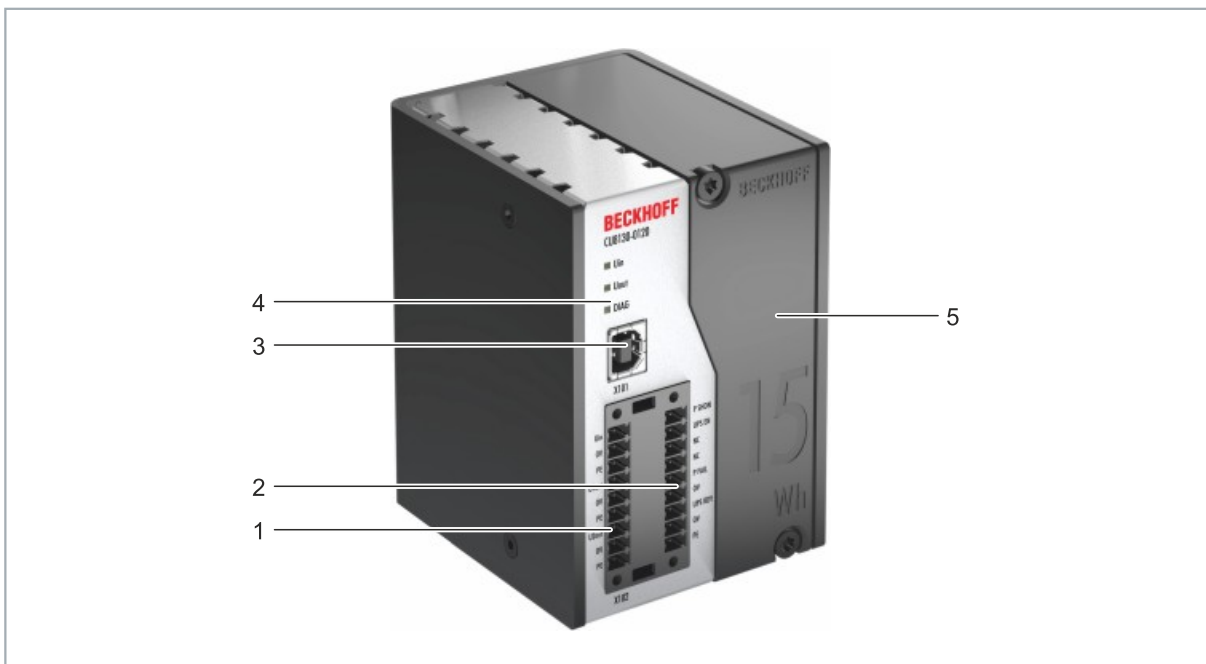


Fig. 1: Structure of a CU8130-0120 UPS.

Table 2: Key for the structure.

| No. | Component | Description |
|-----|--|--|
| 1 | Power supply (X102) [▶ 16] . | Interface for power supply to the UPS (U _{in}) and the devices being supported (U _{1out} and U _{2out}). The wiring is done via a 9-pin push-in connector. |
| 2 | Control inputs and control outputs (X102) [▶ 16] . | Interface for digital control inputs (UPS EN, P SHDN) and digital status outputs (UPS RDY, P FAIL). |
| 3 | USB 2.0 interface (X101) [▶ 15] . | Communication interface between UPS and industrial PC for devices without UPS-OCT. Status queries, device status, or shutdown are possible. |
| 4 | Diagnostic LED [▶ 46] | Indicate the state of the input voltage, output voltage, and errors. |
| 5 | Battery module [▶ 47] . | Exchangeable NiMH battery module. |

4.2 Name plate

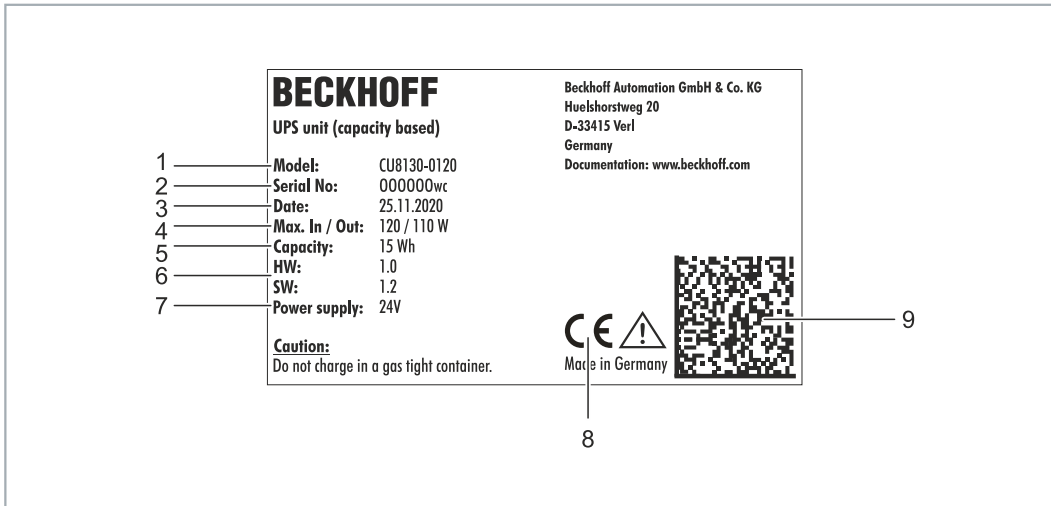


Fig. 2: Name plate example.

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 | CE approval. |
| 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 U_{in} 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.

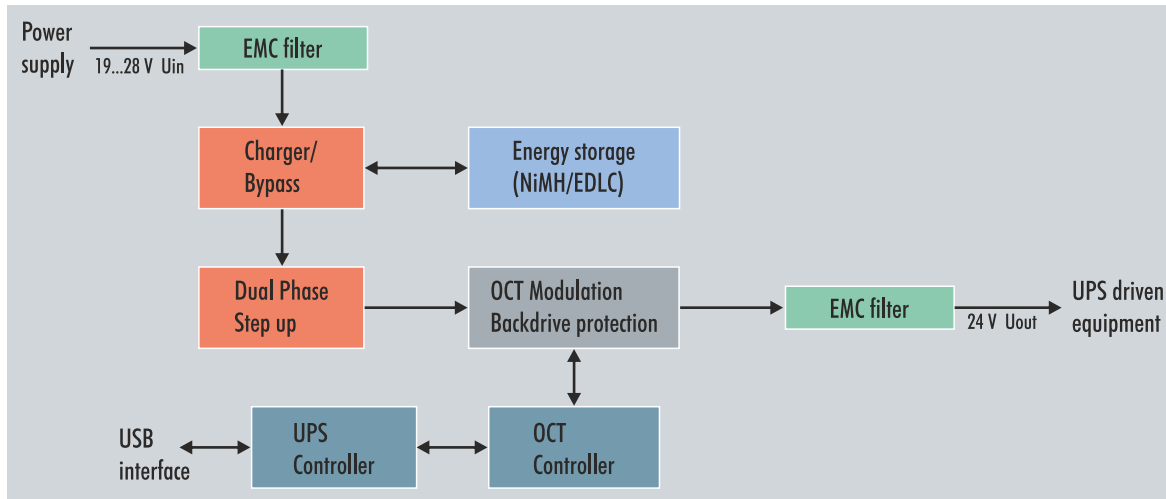


Fig. 3: CU81x0-x00x block diagram.

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] |
|-----------------------|------------------------|--------------------|
| 0.5 | 3750 | 12.50 |
| 1.0 | 1900 | 12.67 |
| 1.5 | 1215 | 12.15 |
| 2.0 | 900 | 12.00 |
| 2.5 | 650 | 10.83 |
| 3.0 | 450 | 9.00 |
| 3.5 | 320 | 7.47 |
| 4.0 | 200 | 4.67 |
| 4.5 | 34 | 1.02 |

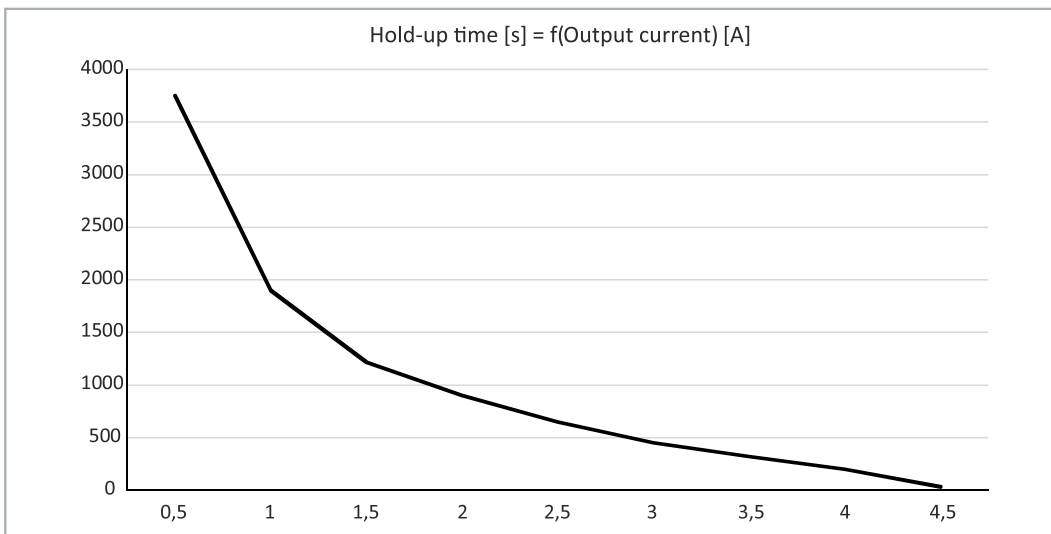


Fig. 4: Hold time without temperature and ageing effects.

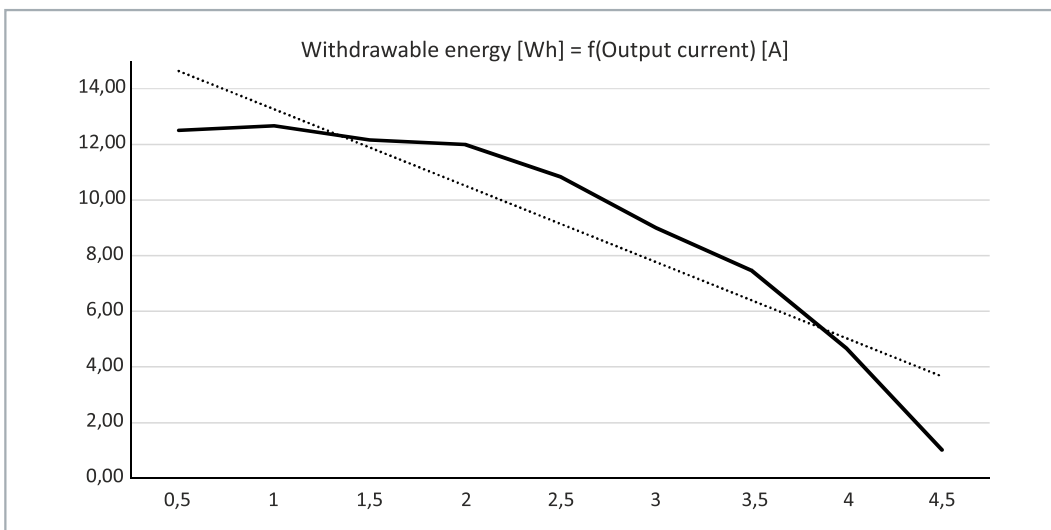


Fig. 5: Usable energy without temperature and ageing effects.

5 Interfaces

5.1 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.

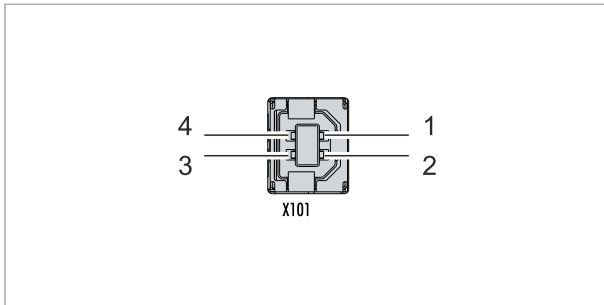


Fig. 6: USB 2.0 interface X101.

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

Table 5: 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 |

5.2 Power supply (X102)

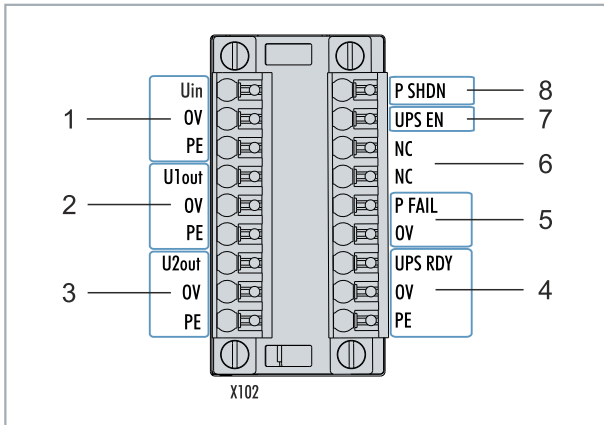


Fig. 7: Power supply X102.

To supply the CU81x0 UPS, two 9-pin connectors with push-in connection are used. For the 9-pin connectors, cables with a cross-section of 0.5 mm² to 1.5 mm² or AWG20 to AWG16 are required. With cable end sleeve max. 1 mm² or AWG 17 are permissible.

Table 6: Power supply X102, connection on left side.

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

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

Table 7: Power supply X102, right-hand connection.

| No. | Pin | Description |
|-----|-----------------------|--|
| 4 | UPS RDY, 0V, PE | +24 V DC output. This output is switched to 24V when the UPS charging is above a set threshold (e.g. 80 %). |
| 5 | P FAIL, 0V | +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. |
| 6 | NC NC | Reserved. |
| 7 | 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. |
| 8 | P SHDN | +24 V DC input. A rising edge from 0V to 24V at this input triggers an immediate shutdown of the operating system. If there is 24 V at P_SHDN on startup, the PC will first be started with a falling edge from 24 V to 0 V. |

6 Commissioning

6.1 Assembly

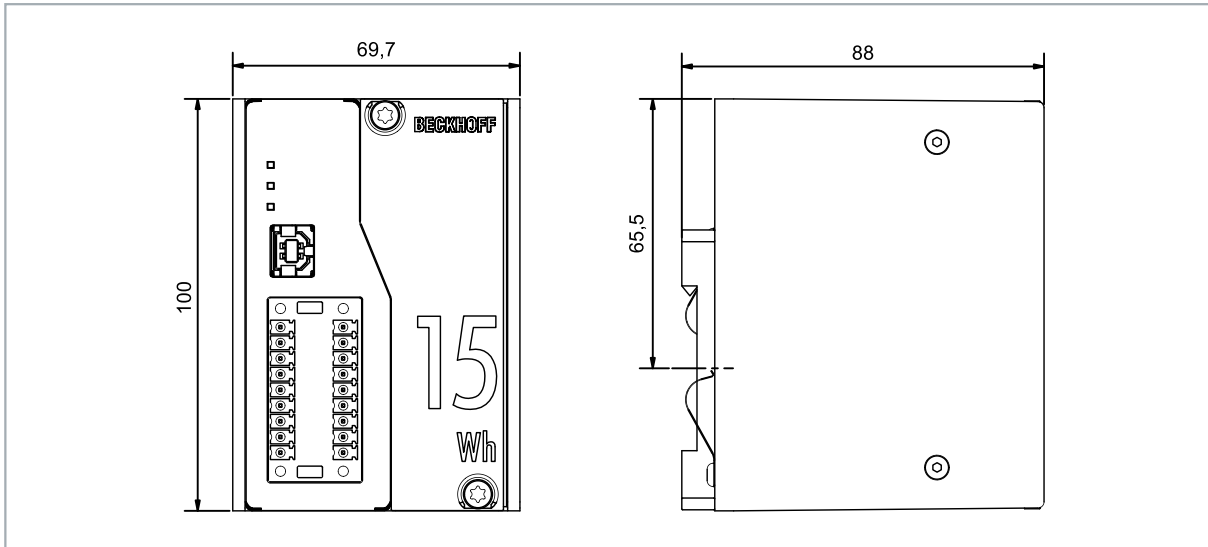


Fig. 8: CU8130-0120 dimensions.

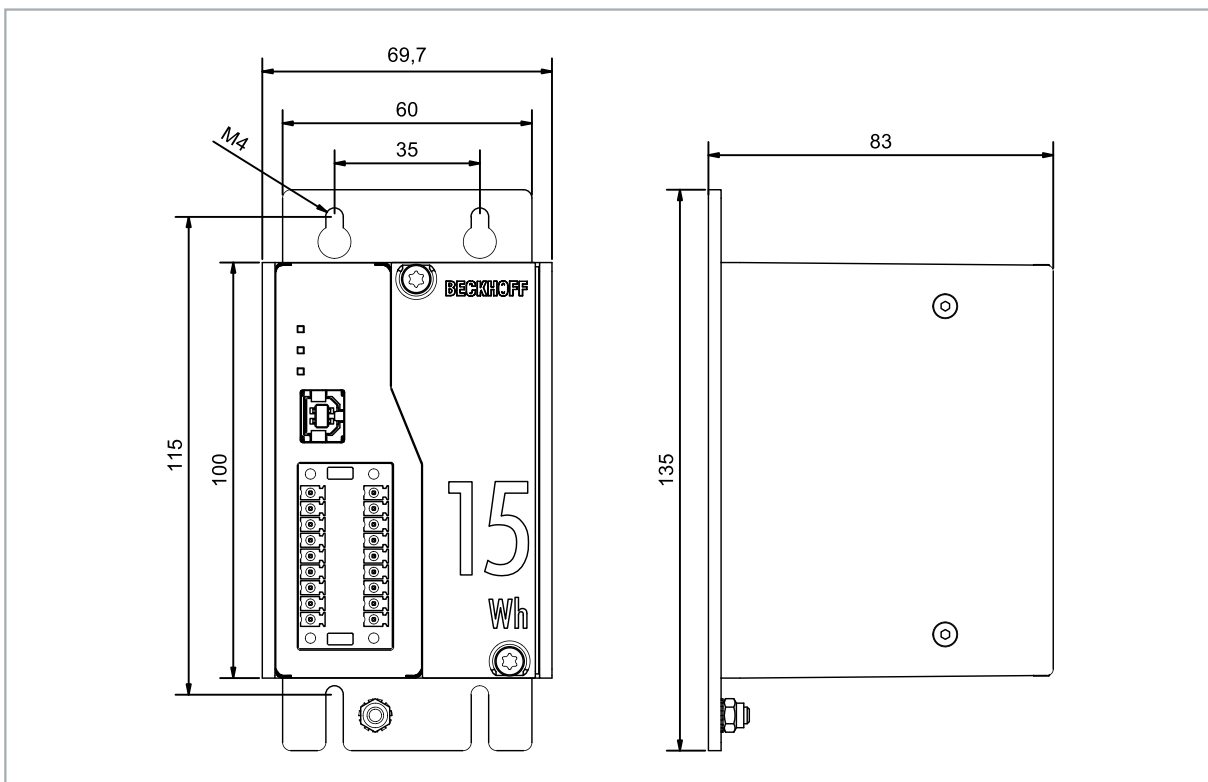


Fig. 9: CU8130-0120 with mounting plate (optional), dimensions.

6.1.1 Fastening to the DIN rail

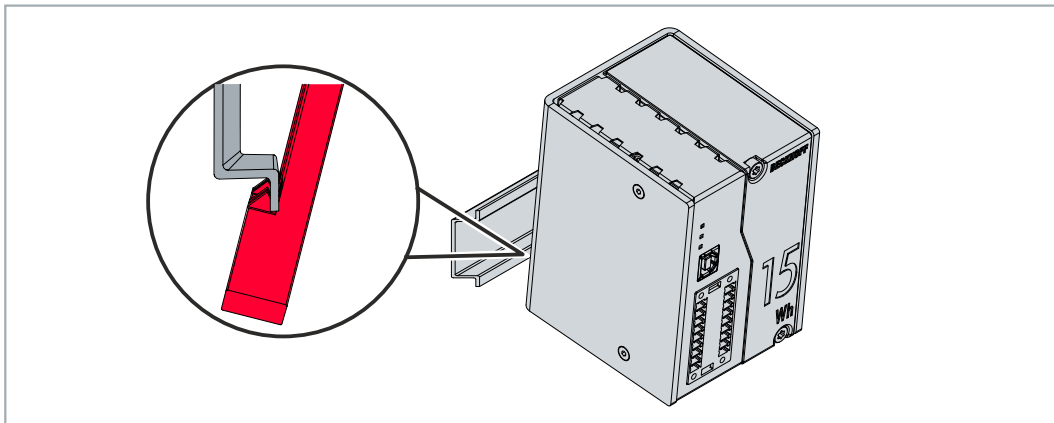
For optimal dissipation of heat, mount the UPS horizontally in the control cabinet on a DIN rail. The housing is designed so that the UPS can be held against the DIN rail and snapped onto it.

Requirements:

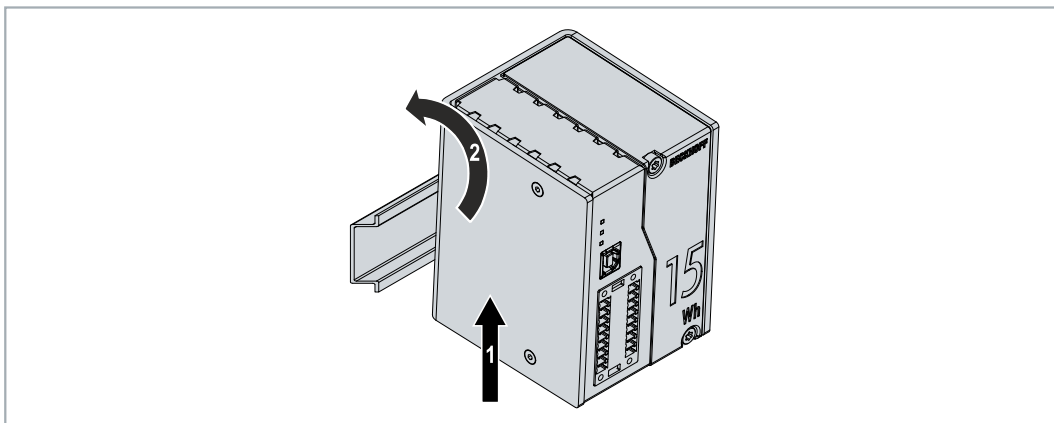
- DIN rail of the type TS35x15 2.3 according to EN 60715.

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.

6.1.2 Installing the mounting plate (optional)

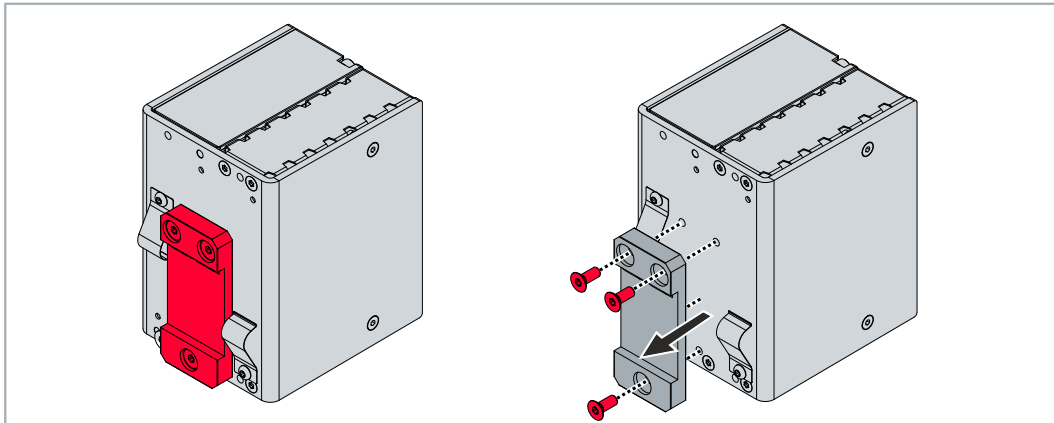
In this chapter, we show you how to install a mounting plate on the UPS. With the mounting plate, the UPS can subsequently be fastened to the rear panel of a control cabinet. To do this, the two DIN rail adapters and the grounding springs on the rear side of the UPS have to be dismantled. The mounting plate is not included in the scope of delivery (see: [Accessories](#) | [► 53](#)).

Requirements:

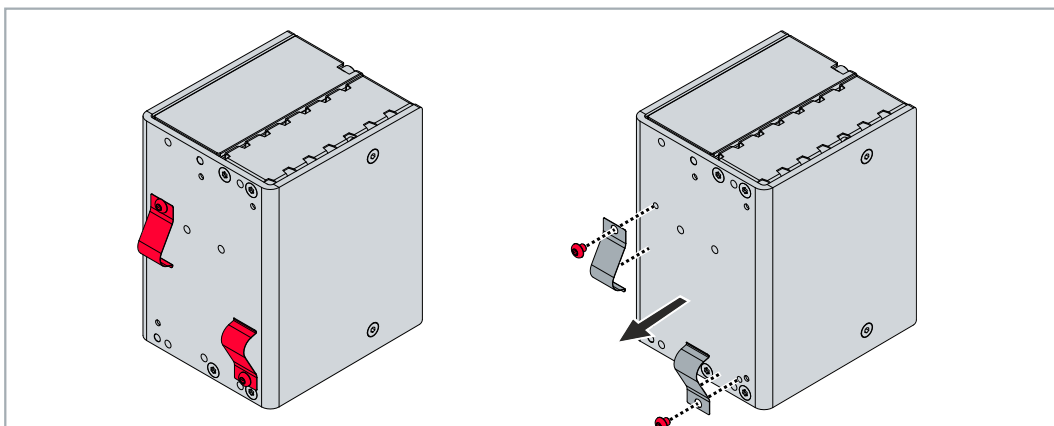
- C9900-M675 mounting plate made of black anodized aluminum.
- Screwdrivers.

Install the mounting plate as follows:

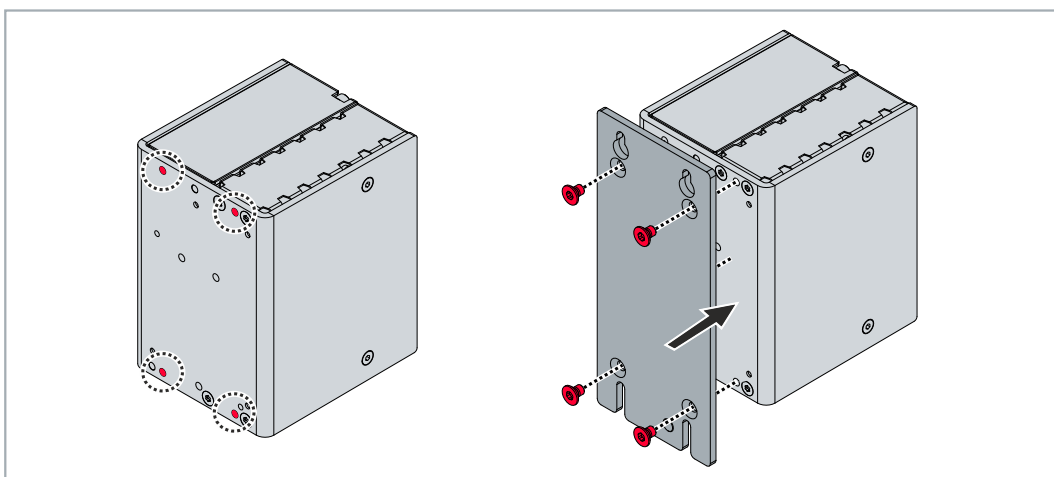
1. Loosen the six M4 screws and remove the DIN rail adapter.



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

An external power supply unit is required for the supply of power to the UPS, which provides a 24 V DC voltage (-15 % / +20 %). Connect the external power supply unit to the U_{in} input of the UPS.

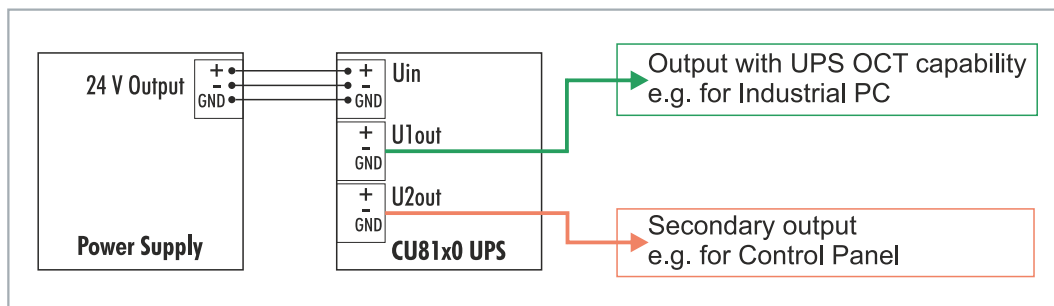


Fig. 10: Schematic wiring of a CU8130-0120 UPS.

The cabling of the UPS in the control cabinet must be done 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 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 earth conductor system.

Selecting the appropriate power supply unit

Dimension the power supply unit according to the maximum power consumption of the connected devices including the current consumption when charging the UPS. For example, if a CX5140 with a power consumption of 23 W (= 0.96 A) is connected, the calculation looks as follows: $0.96 \text{ A} + 0.37 \text{ A} = 1.33 \text{ A}$. In this calculation example, at least a 1.33 A power supply unit is required for the CX5140.

If a C6030 (Intel® Core™ i7-7700 3.6 GHz) with a power consumption of 100 W (= 4.17 A) is connected, at least a 4.54 A power supply unit is required: $4.17 \text{ A} + 0.37 \text{ A} = 4.54 \text{ A}$.

Table 8: Technical data, electrical currents and internal fuses.

| Technical data | CU8130-0120 |
|--|-----------------|
| Current consumption during charging (without load) | max. 0.37 A |
| Output current | max. 4.5 A |
| Fuse (internal, input) | electronic 10 A |
| Fuse (internal, output) | electronic, 5 A |

Connect UPS

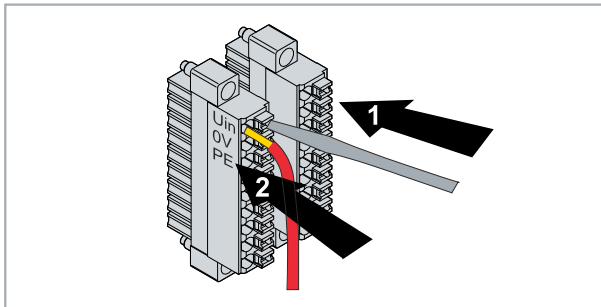
Connect the devices to be supported to the U1out and U2out outputs. If the external 24 V DC input voltage is lost, the UPS takes over the supply of the devices connected to it thanks to its regulated and buffered 24 V DC output voltage. Use the two 9-pin connectors with push-in connection to wire the CU8130-0120 UPS.

Table 9: Required cable cross-sections and strip lengths.

| | | |
|----------------------------|--|--|
| Cable cross-section | 0.5 ... 1.5 mm ² , max. 1 mm ² with ferrule | AWG 20 ... AWG 16, max. AWG 17 with ferrule |
| Strip length | 8 ... 9 mm | 0.33 inch |

Connect the UPS as follows:

1. Open a spring-loaded terminal by lightly pressing the push mechanism with a screwdriver or a mandrel.



2. The wire can now be inserted into the round terminal opening without any force.
 3. The terminal closes automatically when the pressure is relieved.
- ⇒ If the DIAG LED is green, the UPS is being supplied with power. If the DIAG LED is red, the input voltage U_{in} is not present.

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.

6.3 Communication

There are several ways to communicate with the UPS, for example to query the status or to control the device state until shutdown.

The following options are available:

- Protocol-based communication via UPS-OCT (One Cable Technology) or USB.
- Digital signals for communication with non-protocol-capable end devices.
- TwinCAT PLC function blocks for querying the UPS operation.

The configuration and diagnosis of the UPS-OCT or USB communication method is carried out via the Beckhoff UPS software on Windows 7 or Windows 10.

6.3.1 Connection via UPS-OCT

A special feature of the Beckhoff CU8130-0120 UPS is OCT (One Cable Technology) as a communication technology between UPS and Industrial PC. The two connection cables (+24 V, 0 V) between the Industrial PC and the UPS are used to supply power to the Industrial PC and for bidirectional, modulated data transmission.

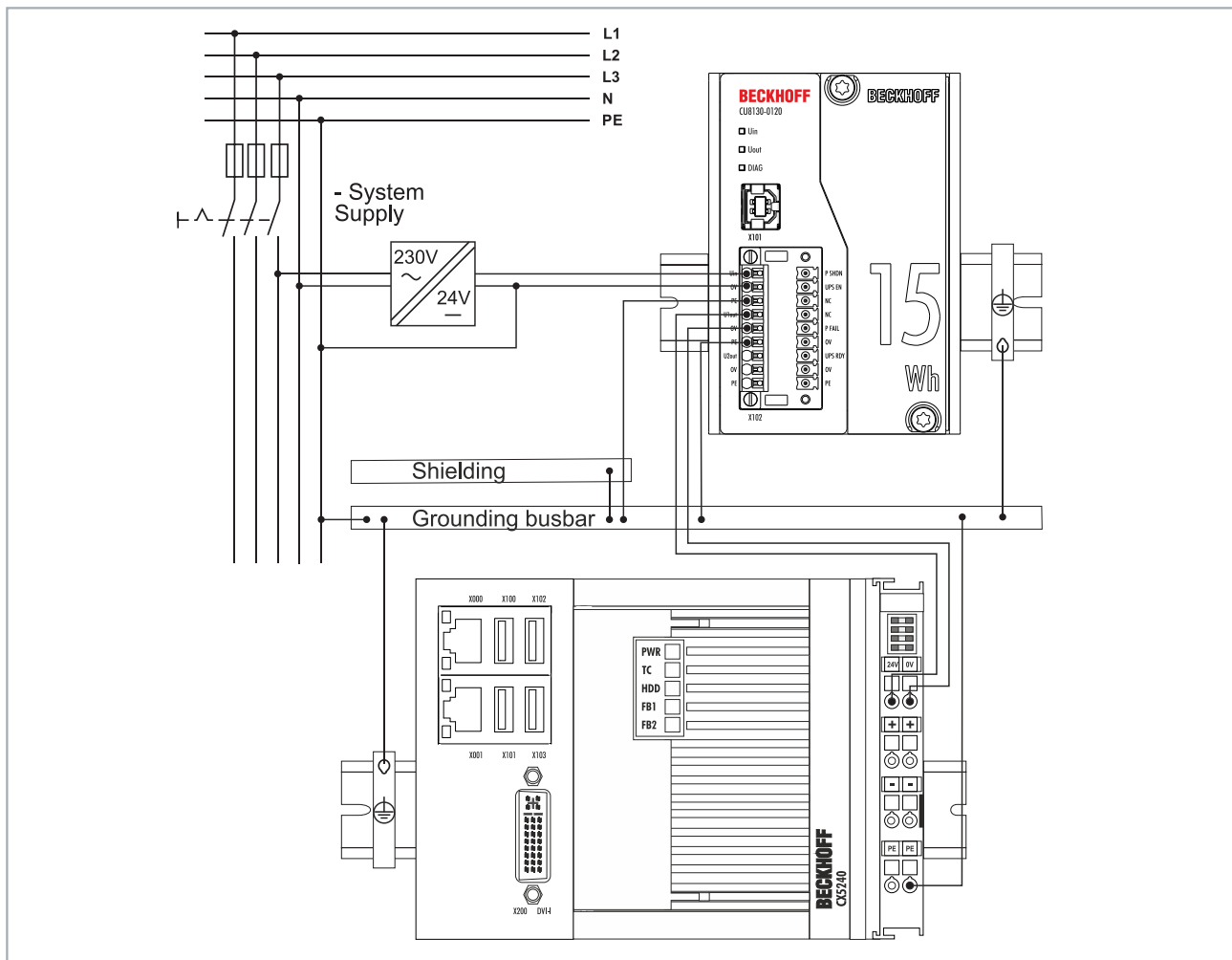


Fig. 11: Example of a connection via UPS-OCT with a CU8130-0120 UPS and a CX5240 Embedded PC.

Only the U1out interface of the UPS supports UPS-OCT communication. If you wish to use the UPS-OCT technology, you must ensure that the Industrial PC supports UPS-OCT. You can use the U1out interface to retrieve status data for diagnostic purposes or to configure the UPS.

6.3.2 Connecting additional devices

If you are supporting an additional device, the interfaces U1out and U2out combined must not exceed the maximum output current of the UPS.

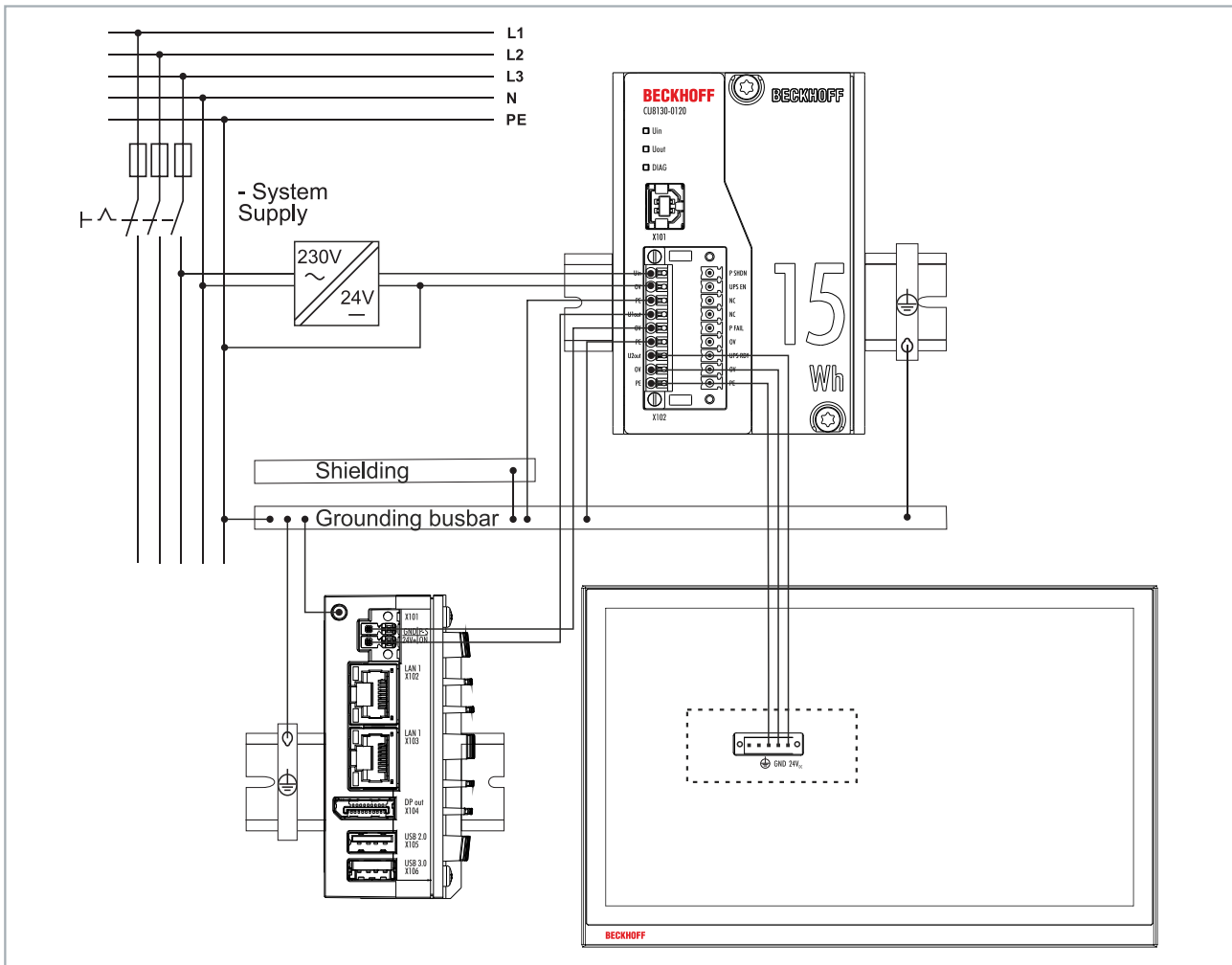


Fig. 12: Connection example when using the second USP output (U2out) for an additional Control Panel.

6.3.3 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.

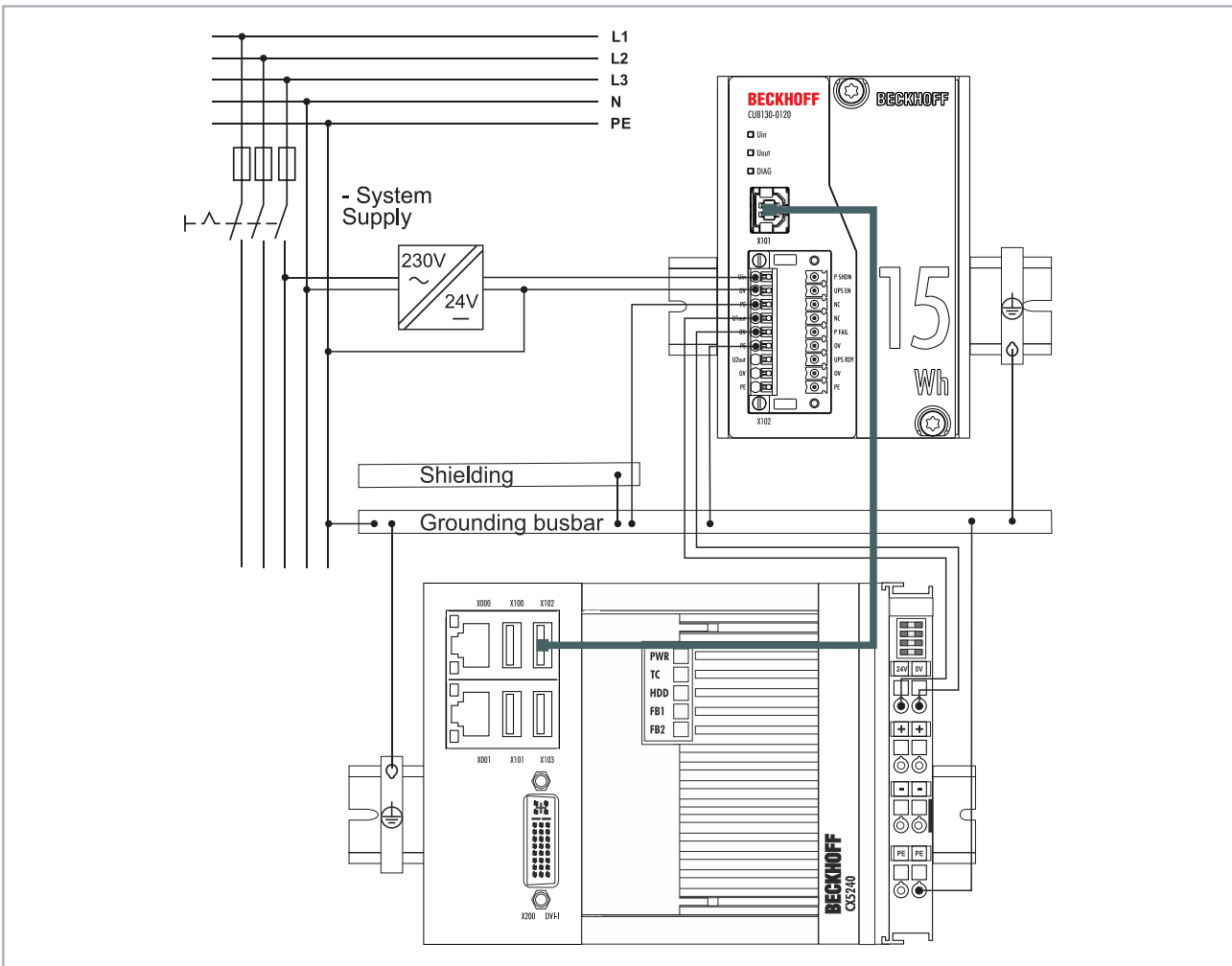


Fig. 13: Example of a connection via USB with a CU8130-0120 UPS and a CX5240 Embedded PC.

The USB interface conforms to the USB 2.0 standard. The cable length is limited to 5 m.

6.3.4 Connection via digital I/O

For devices without USB connection, a digital input signal 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. See figure:

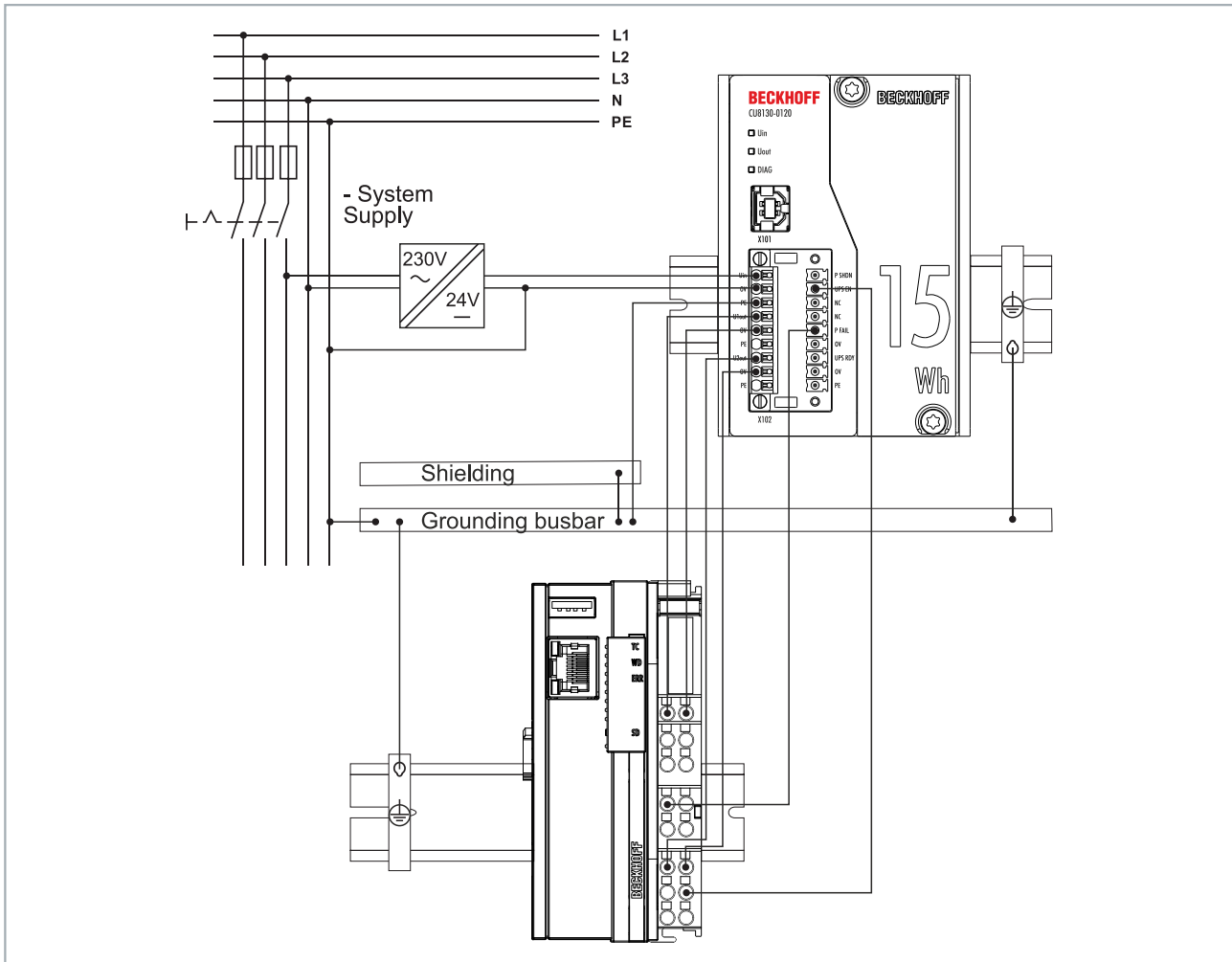


Fig. 14: Connection example via digital I/O with an Embedded PC CX7000 with digital inputs.

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 in order 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 UPS-EN input, controlled from the PLC and used for non-Beckhoff PCs or controllers.

6.4 Charging the UPS

The UPS is charged as soon as a 24 V power supply unit is connected to the Uin input of the UPS and switched on. In standard operation, the load connected to the UPS is immediately supplied by the UPS and the energy carrier of the UPS is continuously charged.

This step shows how you can charge the UPS in order to commission or store the UPS in a charged state. For this you need a 24 V power supply unit and the Beckhoff UPS.

Proceed as follows:

1. Connect a 24-V power supply to the Uin input of the UPS.
2. Switch on the 24 V power supply.
 - ⇒ The UPS is charging. The DIAG LED flashes green.
3. c) Charge the UPS completely.
 - ⇒ The DIAG LED lights up permanently green as soon as the UPS is fully charged.
4. Switch off the 24 V power supply.
 - ⇒ The UPS is switched off after four minutes. The UPS can then be stored or shipped in the charged state.

7 Configuration

7.1 Install UPS software

● Handling older UPS software

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

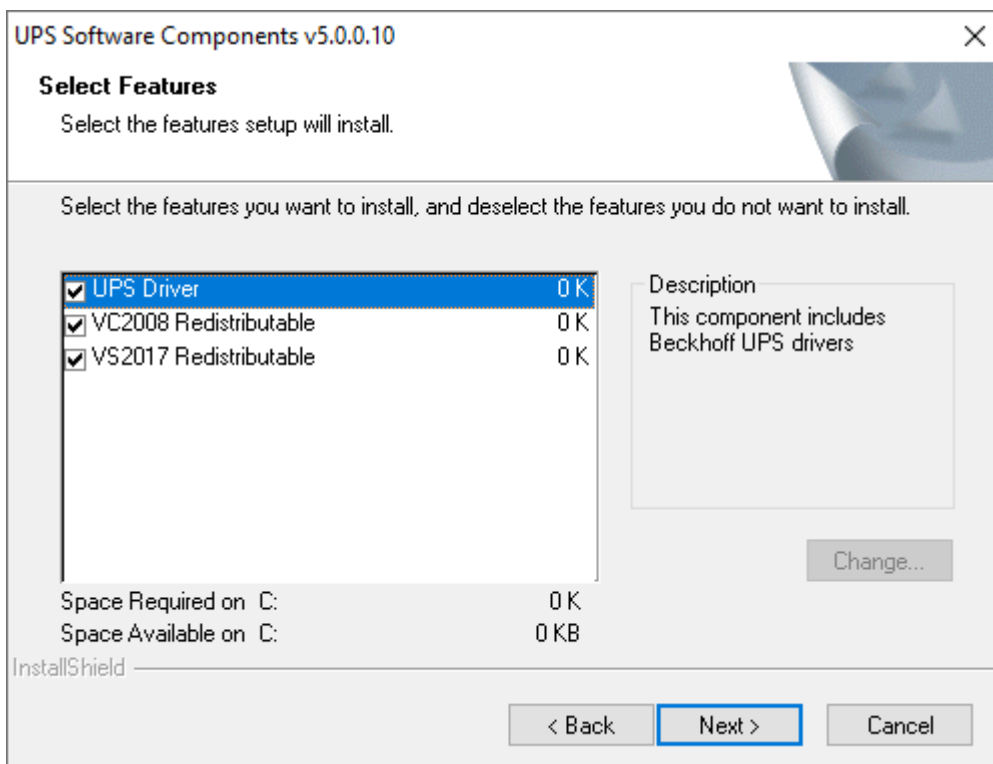
This chapter shows you how to install the Beckhoff UPS software on an Industrial PC or a non Beckhoff PC. If an older version of the UPS software is already installed, uninstall it first, since it may not be possible to update all files.

Requirements:

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

Proceed as follows:

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



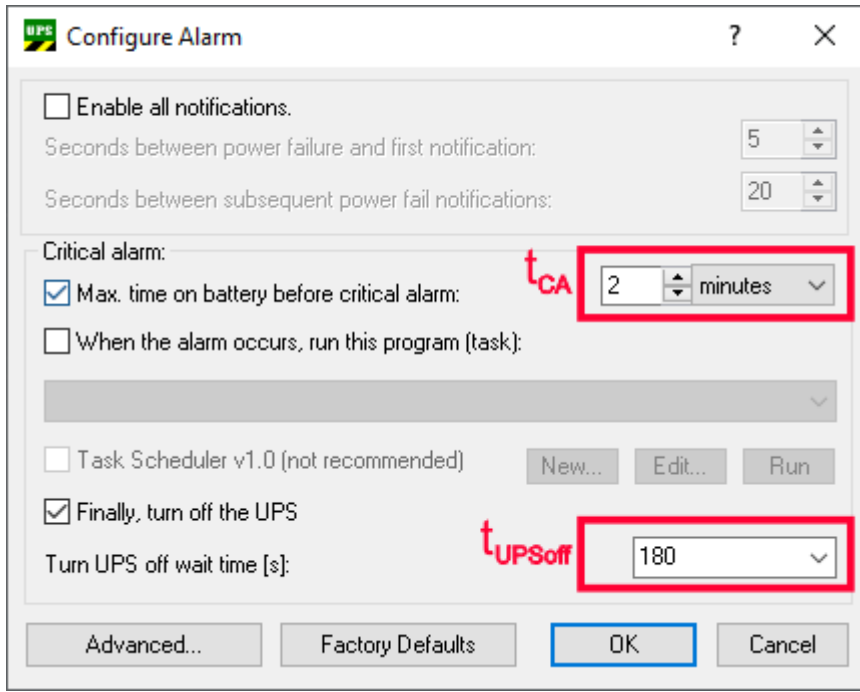
⇒ Restart the industrial PC after installation to complete the process.

7.2 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.

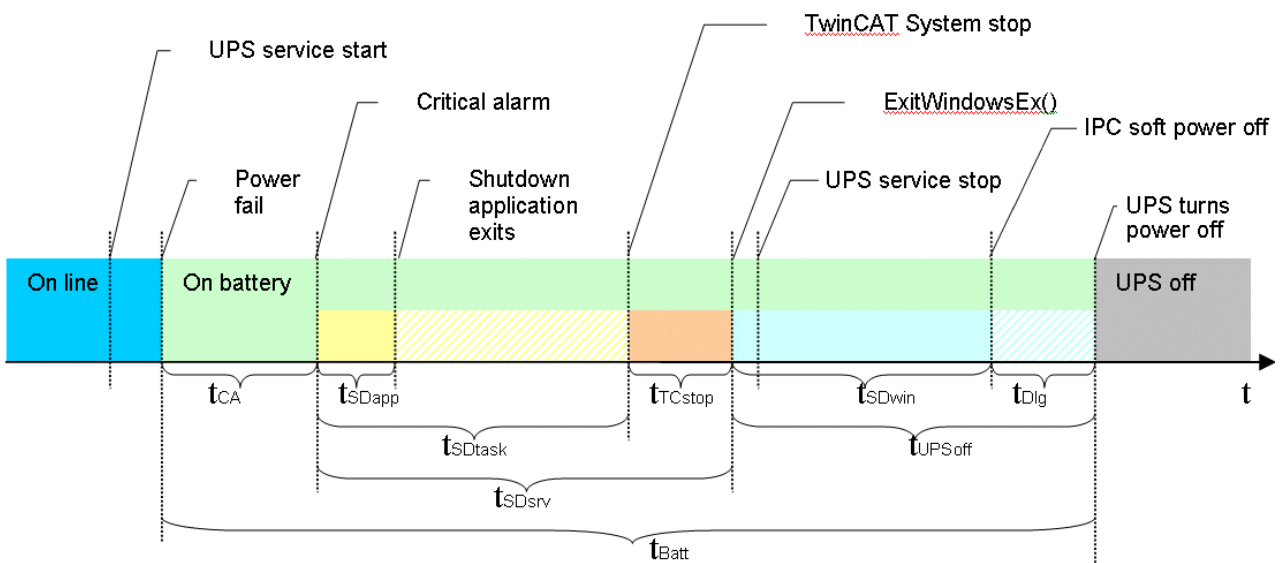
Short power failure: $t_{Batt} < t_{CA}$

Long power failure: $t_{Batt} \geq t_{CA}$

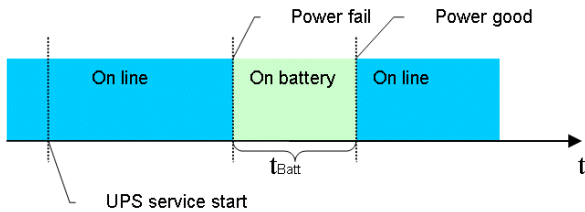


Long power failure during operation ($t_{Batt} \geq t_{CA}$)

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

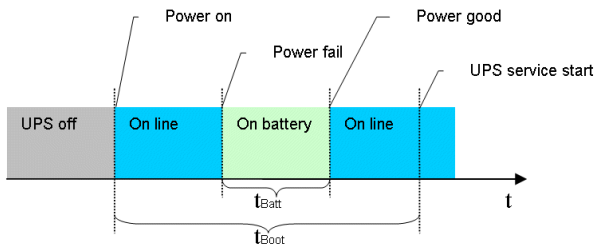


Short power failures during operation ($t_{Batt} < t_{CA}$)



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.

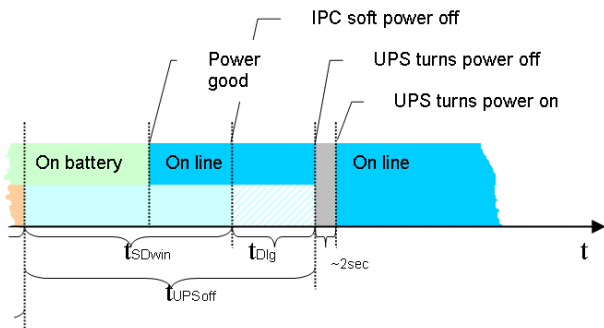
Power failure during the boot process



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).

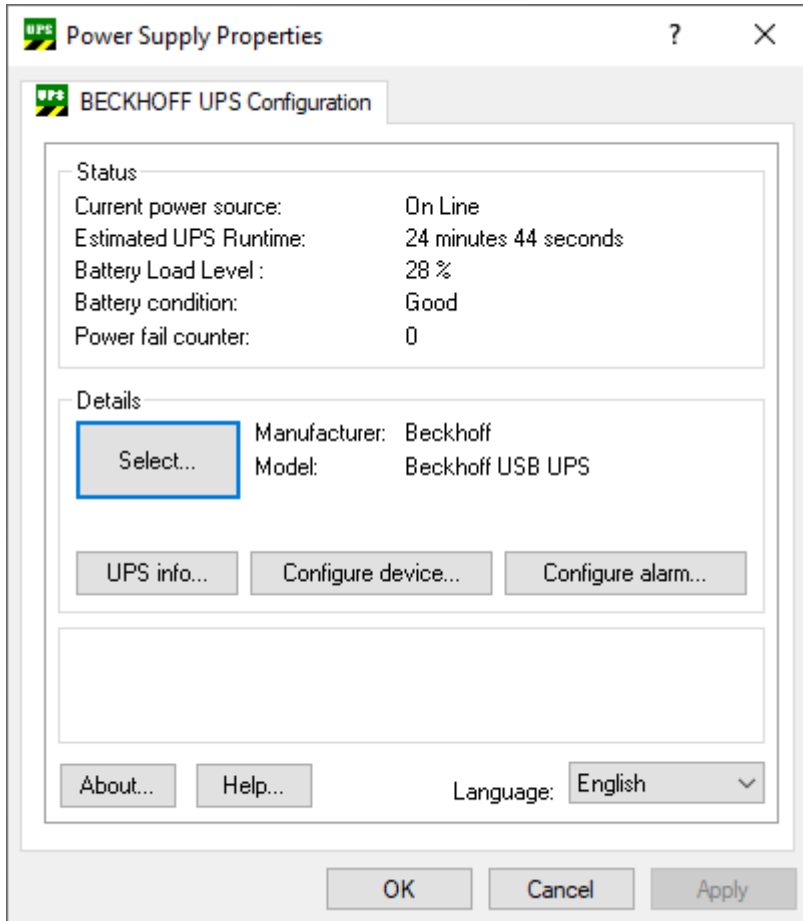
| Value | Description | Properties |
|--------------|--|---|
| t_{Batt} | Time during which the system is operated via the battery. | Variable, depending on the duration of the power failure. If $t_{Batt} \geq t_{CA}$ the UPS service irrevocably starts shutting down the system. |
| t_{CA} | Maximum time 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 $t_{CA} = 0$ the UPS service immediately starts shutting down the system. |
| t_{SDtask} | 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 |
|---------|---|--|
| | | <ul style="list-style-type: none"> 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 | <p>For systems without soft power-off functionality (e.g. NT4):</p> <ul style="list-style-type: none"> Time during which the dialog: "It is now safe to turn off your computer" is displayed. <p>For systems with soft power-off functionality (e.g. XP):</p> <ul style="list-style-type: none"> 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). | <p>Variable, depends on the operating system used, the number of running applications, the motherboard and the UPS hardware: $tDlg = tUPSoff - tSDwin$</p> <p>tDlg should always be > 0. This value can only be influenced through tUPSoff.</p> <p>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.</p> <p>For systems with APC-UPS and soft power-off functionality the IPC should switch off first, followed by the UPS.</p> |
| 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. |

7.3 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.



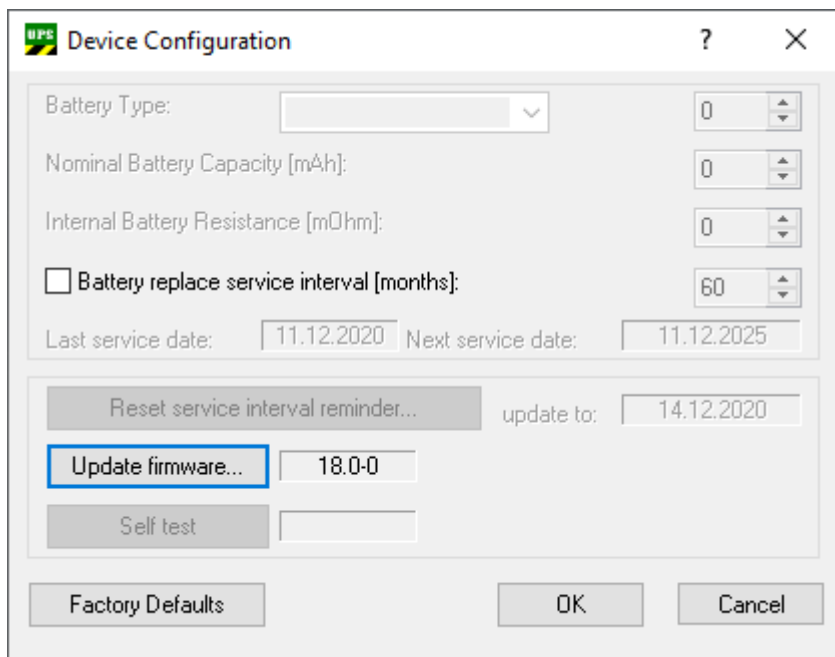
Status: Shows major information about the current power source and battery load information.

Power fail counter: From UPS software version $\geq 3.0.0.6$. 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.

7.3.1 Device configuration dialog

Dialog with device-specific settings.



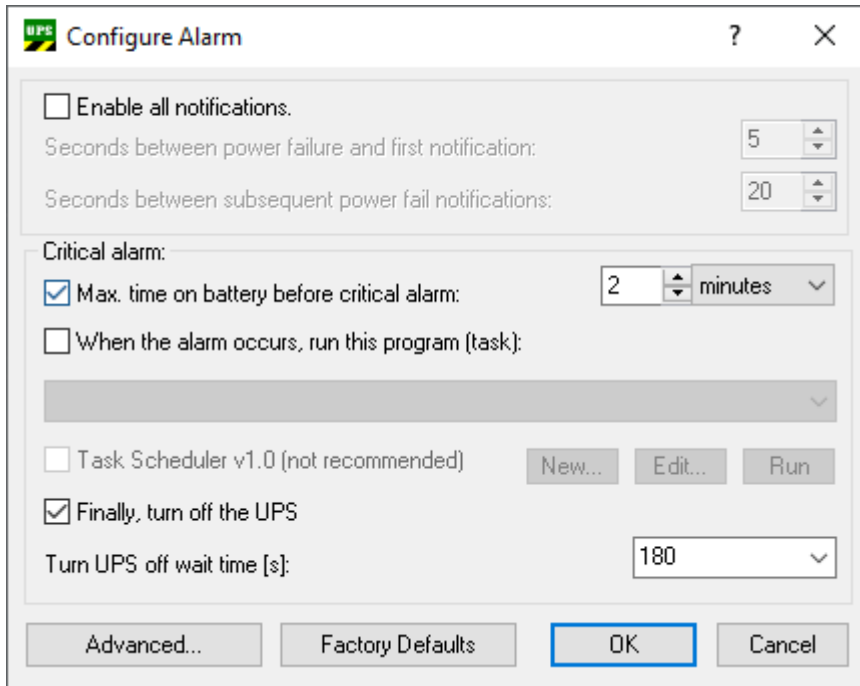
| Setting or function | Value range | Default value | Description |
|----------------------------------|--------------------------------------|---------------------------------------|--|
| Battery Type (combo box) | C9900-U330, C9900-U332, User-Defined | C9900-U330 | Configures the used Beckhoff battery 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 | <p>The user is able to enter/configure the battery replace service interval (number of months) before first warning is logged to Windows eventlog.</p> <p>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.</p> <p>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.</p> <p>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.</p> |

| 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: <ul style="list-style-type: none"> • "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 forget to apply the changes at the Beckhoff UPS Configuration dialog too. |
| Cancel | - | - | Discards all editable changes. |

*) Example value.

7.3.2 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 already 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 forget 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

7.4 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:

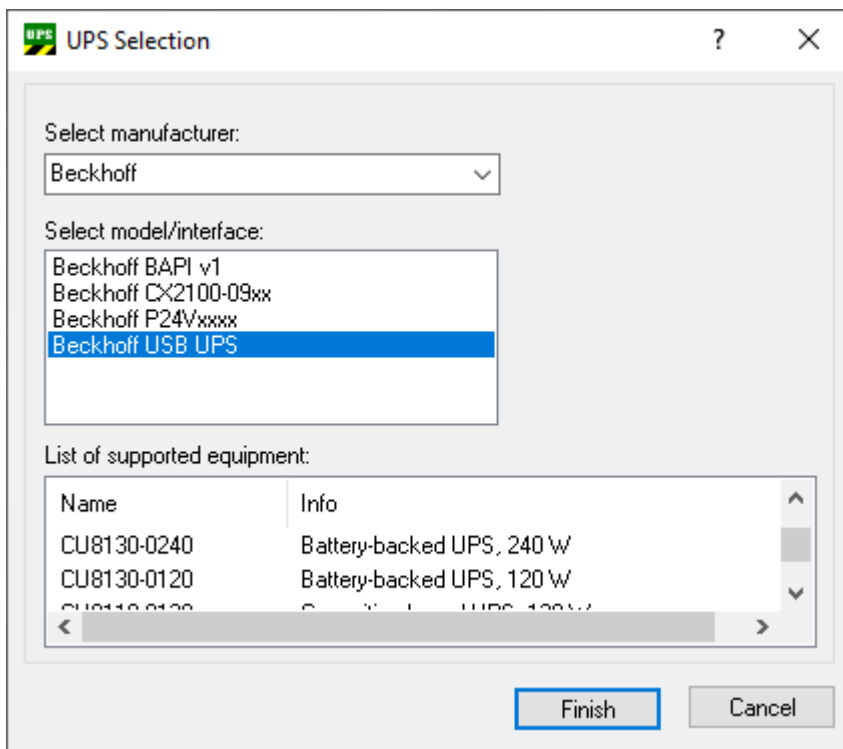
- Max. time on battery before critical alarm
- and Turn UPS off wait time.

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.

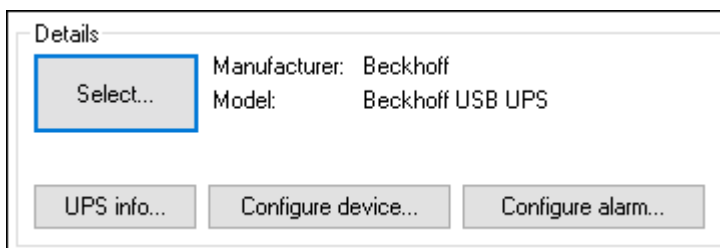
In the next step, define the time after which the ups should switch off its supply outputs. Note that the industrial PC must be shut down properly within this period. Make sure that you do not set a value that is too low and that the set time covers the entire shutdown process.

Proceed as follows:

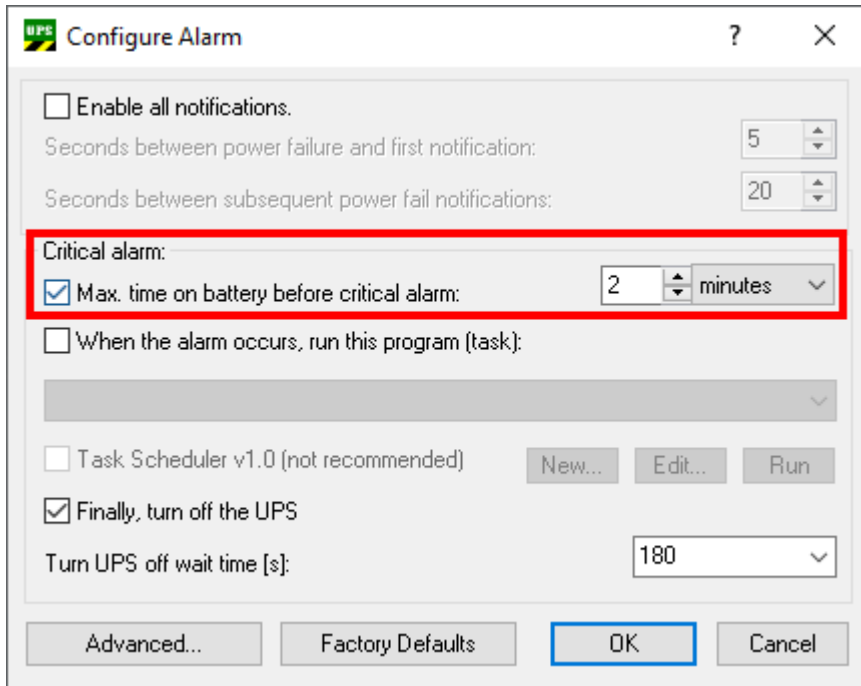
1. Start the UPS software and click **Select**.
2. Select **Beckhoff USB UPS** to configure the communication to the Industrial PC via USB.



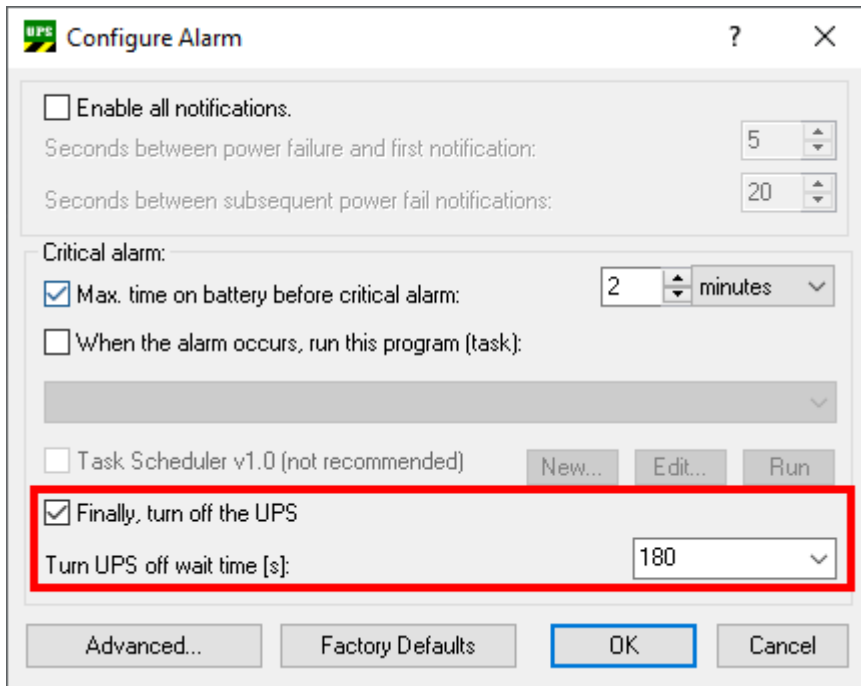
3. Click **Finish** and in the main menu click **Apply** to start the UPS service.
4. The UPS service is running if the manufacturer and the communication type are displayed in the main menu.



- 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.



- 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.

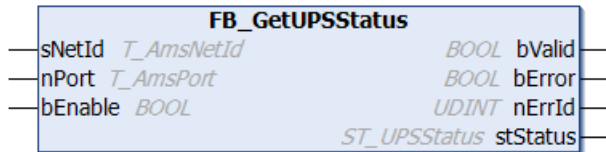


The outputs of the UPS are irrevocably switched off after the delay time has elapsed, even if the power supply returns.

- ⇒ 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.

7.5 TwinCAT interface

7.5.1 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 tabs under "Control Panel->Power Options->Beckhoff UPS Configuration" or "Control Panel->Power Options->UPS".
 - Beckhoff CE devices with 24V UPS support are delivered with a special Beckhoff Battery Driver for Windows CE. In these devices the driver is included in the standard CE image.
- 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: By default the UPS function is disabled and must be enabled via a RegFile. Newer images have a configuration dialog under "Start->Control Panel->BECKHOFF UPS Configuration".

The function block `FB_GetUPSStatus` 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 maintain system loading at a low level, the status information is only read approximately 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.

VAR_INPUT

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

sNetId: A string with the network address of the TwinCAT computer whose UPS status is to be read can be entered here (type: `T_AmsNetID`). If it is to be run on the local computer, an empty string can be entered.

nPort: The ADS port number (type: `T_AmsPort`). Set this value to zero. Other port numbers are reserved for future applications.

bEnable: The UPS status is read cyclically if this input is set.

VAR_OUTPUT

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

bValid: If this output is set, the data in the `ST_UPSStatus` structure are valid (no error occurred during the last reading cycle).

bError: This output is set if an error occurred when executing the function.

nErrId: Supplies the ADS error number or the command-specific error code (table) when 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. |

stStatus: Structure with the status information of the UPS (type: [ST_UPSStatus](#) [▶ 41]).

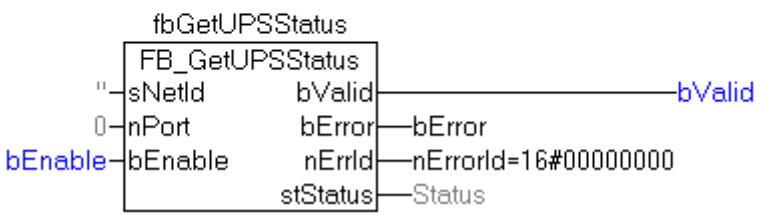
Not every UPS device can supply all the status information. Some devices, for example, cannot supply the *BatteryLifeTime* or *BatteryReplace* status.

Example:

Online data with status information of a UPS:

```

fbGetUPSStatus
├── Status
│   ├── Vendor = 'Beckhoff'
│   ├── Model = 'Beckhoff P24V250W'
│   ├── FirmwareRev = '11.7.1'
│   ├── SerialNumber = 'QB0249330541'
│   ├── BatteryLifePercent = 16#00000064
│   ├── BatteryLifeTime = 16#00000123
│   ├── eBatteryStatus = BatteryOk
│   ├── eCommStatus = UpsCommOk
│   ├── ePowerStatus = PowerOnLine
│   └── dwChargeFlags = 16#00000000
└── bError = FALSE
    ├── bValid = TRUE
    ├── nErrorId = 16#00000000
    └── bEnable = TRUE
    
```



Requirements

| Development environment | Target platform | UPS hardware | PLC libraries to be integrated (category group) |
|-------------------------|--------------------------|--|---|
| TwinCAT v3.1.0 | PC or CX (x86, x64, ARM) | <ul style="list-style-type: none"> Beckhoff BAPI v1; Beckhoff P24Vxxxx; Beckhoff CP903x card (PCI/ISA); | Tc2_IoFunctions (IO) |

| Development environment | Target platform | UPS hardware | PLC libraries to be integrated (category group) |
|-------------------------|-----------------|---|---|
| | | <ul style="list-style-type: none"> 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. | |

7.5.2 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 the 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 is ok)
    Bit10 := Service Interval Notify (bit set => service interval time expired, bit not set => service interval time not expired )
    Bit11 := Under Temperature (bit set => under temperature detected , bit not set => temperature 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 | Beckhoff BAPI v1 | Beckhoff P24Vxxx 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 | Vendor name. |
| Model | X | X | X | X | X | X | Model string. Empty string if no UPS has been configured. |

| Status information | Beckhoff BAPI v1 | Beckhoff P24Vxxx UPS | Beckhoff 24V UPS on the CP903x card | CX2100-09x4 | APC Back-UPS Pro 280 | APC Smart-UPS 420 | Description |
|--------------------|---|--|--|--|----------------------|-------------------|--|
| FirmwareRev | X | X | X | X | X | X | UPS firmware version information. Empty string if the UPS does not support this parameter. |
| SerialNumber | X | X | None | X | X | X | Serial number of the UPS. Empty string if the UPS does not support this parameter. |
| BatteryLifePercent | 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 | None | X | X | X | Remaining battery life in minutes. The value is always zero if the UPS cannot supply this parameter. |
| eBatteryStatus | BatteryOk | BatteryUnknownStatus if no battery exists; from UPS software version >= 2.0.0.6 and UPS firmware >= 25.1.1 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 | Status of the communication with the UPS (type: E_UpsCommStatus). |
| ePowerStatus | X | X | X | X | X | X | Status of external power supply (type: E_UpsPowerStatus). |
| nPowerFailCnt | 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) from UPS firmware >=33.12-0 if no battery is disconnected. Service Interval Notify (bit 10 set). The configured battery change interval service has expired | No Battery (bit 7 set) from UPS software version >= 2.0.0.6 and firmware >= 25.1.1. 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 >= 40.1.1. The UPS fan status is checked each minute. Requires a newer (second) hardware revision! | High (bit 0 set) if battery is fully charged. Charging (bit 3 set) No Battery (bit 7 set) if no battery was found. | No Battery (bit 7 set). No communication to the battery (applicable only for the model 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 | None | None | Battery charge status flags and special status information. |

| Status information | 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 |
|--------------------|------------------|--|-------------------------------------|--|----------------------|-------------------|-------------|
| | | <p>Service Interval Notify (bit 10 set). The configured battery change interval service has expired. Implemented in the UPS software version >= 3.0.0.8;</p> | | <p>battery service interval has expired.</p> <p>Under Temperature (bit 11 set) was detected and the charging of the battery was interrupted.</p> <p>Requires a newer (second) hardware revision. Implemented in the UPS software version >= 3.0.0.18.</p> <p>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.</p> | | | |

Requirements

| Development environment | Target platform | UPS hardware | PLC libraries to be integrated (category group) |
|-------------------------|--------------------------|---|---|
| TwinCAT v3.1.0 | PC or CX (x86, x64, ARM) | <ul style="list-style-type: none"> • 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) |

7.5.3 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) | <ul style="list-style-type: none"> 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) |

7.5.4 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) | <ul style="list-style-type: none"> Beckhoff BAPI v1; | Tc2_IoFunctions (IO) |

| Development environment | Target platform | UPS hardware | PLC libraries to be integrated (category group) |
|-------------------------|-----------------|--|---|
| | | <ul style="list-style-type: none"> • 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. | |

7.5.5 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. |
| Battery power supply. | 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) | <ul style="list-style-type: none"> • 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 Error handling and diagnostics

Table 10: 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 11: 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 12: 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. |
| | Blue, Red | Input voltage Uin present but no battery module. |
| | Blue, Magenta | Battery module does not match the UPS. |
| | 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. |

9 Care and maintenance

9.1 Replacing the battery module

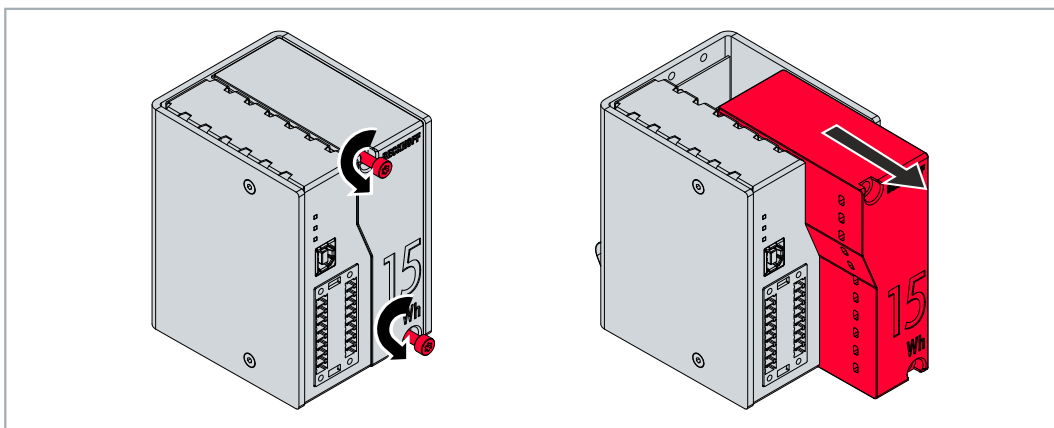
The battery module for the UPS must be replaced every five years. The battery module can be replaced directly in the control cabinet and without removing the DIN rail. A replacement battery module can be ordered from Beckhoff.

Requirements:

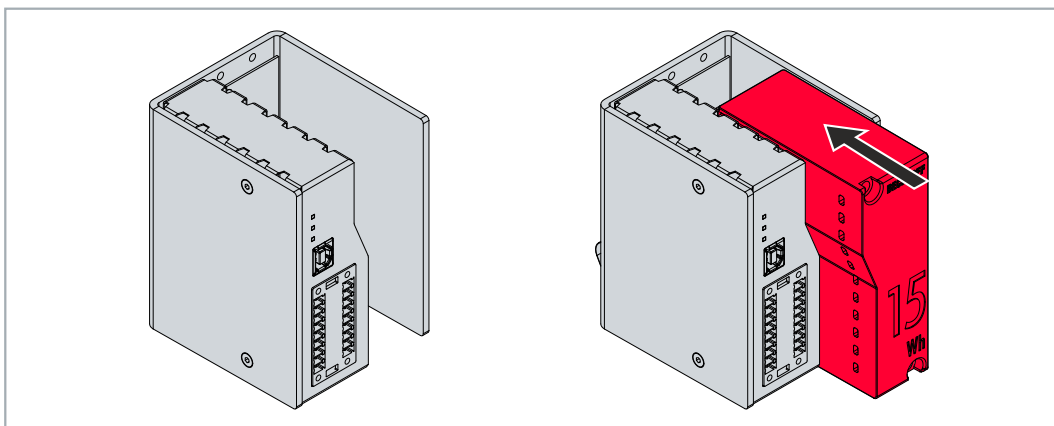
- T20 TORX screwdriver.
- C9900-U015 replacement battery module with 15 Wh.

Replace the battery as follows:

1. Switch off the power supply to the UPS.
2. Unscrew the two T20 screws and pull the battery module out of the UPS.



3. Push the replacement battery module into the UPS until the contacts click into place.



4. Fasten the battery module with two T20 screws and a torque of 0.7 Nm.
⇒ You have installed the battery module correctly if the DIAG LED lights up green at the start.

9.2 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

10 Decommissioning

10.1 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.

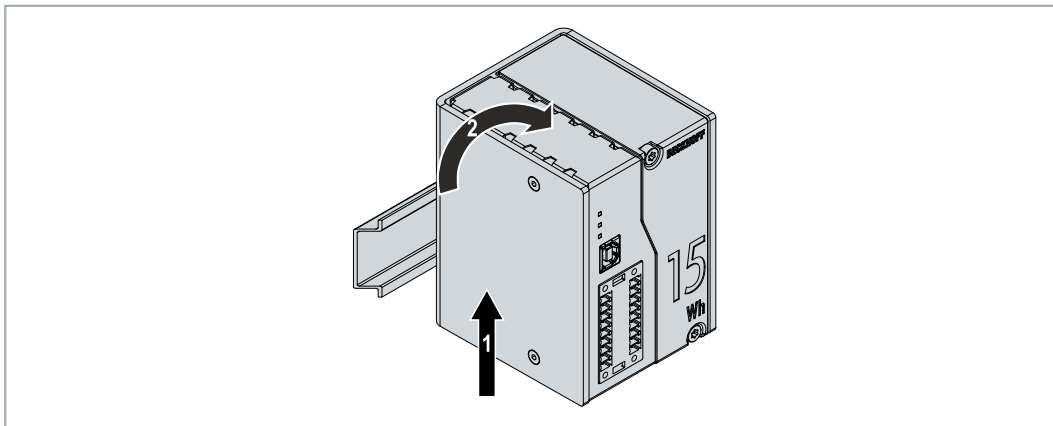
This chapter shows how to disassemble the UPS and thus remove it from the DIN rail. Shut down the industrial PC connected to the UPS so that the UPS is switched off.

Requirements:

- Switch off the power supply.

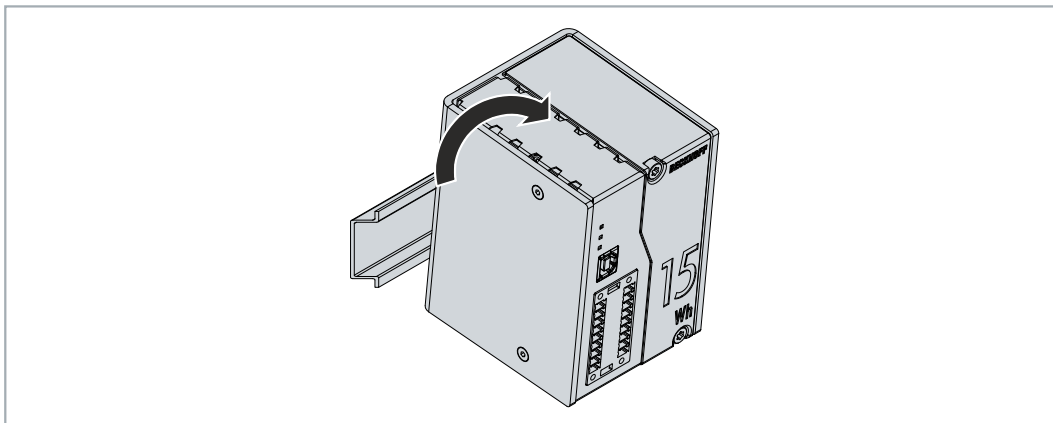
Dismantle the UPS as follows:

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.

10.2 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

Replacement battery modules

CU9900-U015 and CU9900-U030 replacement battery modules for CU8130 UPS modules from Beckhoff Automation GmbH & Co. KG are marketed exclusively to corporate customers. According to the German law on batteries (BattG), we take old batteries back and pass them on to a disposal company. The transport costs are covered by the sender.

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

Beckhoff Automation GmbH & Co. KG
Building "Service"
Stahlstraße 31
D-33415 Verl

The packaging of the replacement battery can be used to return the old battery.

11 Technical data

Table 13: Technical data, dimensions and weights.

| Technical data | CU8130-0120 |
|------------------------|------------------------|
| Dimensions (W x H x D) | 60 mm x 100 mm x 90 mm |
| Weight | approx. 800 g |

Table 14: Technical data, general data.

| Technical data | CU8130-0120 |
|--------------------|---|
| Type | battery-backed uninterruptible power supply (UPS), 110 W |
| Storage technology | NiMh (battery) |
| Capacity | 15 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. 110 W |
| Power consumption | max. 120 W |
| Output voltage | min. 24 V DC |
| Operating system | requires Windows Embedded Standard 7, Windows 7 Professional, Windows 7 Ultimate or Windows 10 IoT Enterprise |
| Diagnostics LED | 1 x UIN, 1 x UOUT, 1 x DIAG |
| Approvals/markings | CE |

Table 15: Technical data, electrical currents and internal fuses.

| Technical data | CU8130-0120 |
|--|-----------------|
| Current consumption during charging (without load) | max. 0.37 A |
| Output current | max. 4.5 A |
| Fuse (internal, input) | electronic 10 A |
| Fuse (internal, output) | electronic, 5 A |

Table 16: Technical data, power loss.

| Technical data | CU8130-0120 |
|--|-------------|
| Power loss during charging | max. 0.73 W |
| Power loss mains operation, UPS loaded | max. 4.4 W |
| Power loss UPS operation, UPS discharges | max. 11 W |

Table 17: Technical data, input UPS_EN and P_SHDN.

| Technical data | CU8130-0120 |
|--------------------|------------------------------------|
| 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 18: Technical data, output P_FAIL and UPS_RDY.

| Technical data | CU8130-0120 |
|-----------------------------|--|
| 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 |
| Switching times | T _{ON} : 50 µs typ., T _{OFF} : 100 µs typ. |

Table 19: Technical data, environmental conditions.

| Technical data | CU8130-0120 | | | | | | | | |
|--------------------------------------|--|----------|--------------|------------|--------------|-----------|--------------|----------|--------------|
| 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 class | IP20 | | | | | | | | |
| Ambient temperature during operation | -10...+50 °C | | | | | | | | |
| Ambient temperature during storage | <table border="0"> <tr> <td>< 1 year</td> <td>-20...+35 °C</td> </tr> <tr> <td>< 6 months</td> <td>-20...+45 °C</td> </tr> <tr> <td>< 1 month</td> <td>-20...+55 °C</td> </tr> <tr> <td>< 1 week</td> <td>-20...+65 °C</td> </tr> </table> | < 1 year | -20...+35 °C | < 6 months | -20...+45 °C | < 1 month | -20...+55 °C | < 1 week | -20...+65 °C |
| < 1 year | -20...+35 °C | | | | | | | | |
| < 6 months | -20...+45 °C | | | | | | | | |
| < 1 month | -20...+55 °C | | | | | | | | |
| < 1 week | -20...+65 °C | | | | | | | | |

12 Appendix

12.1 Accessories

Table 20: Spare battery module.

| Order number | Description |
|--------------|--|
| C9900-U015 | Spare battery module, 15 Wh, suitable for CU8130-0120. |

Table 21: Mounting accessories.

| Order number | Description |
|--------------|---|
| C9900-M675 | Mounting plate made of black anodized aluminum for UPS mounting on the control cabinet wall, suitable for CU8110-0120, CU8130-0120, and CU8130-0240 |
| 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 mm ² to 1.5 mm ² or AWG26 to AWG16. |
| C9900-K552 | USB 2.0 A-B connection cable, 3 m |
| C9900-K553 | USB 2.0 A-B connection cable, 5 m |
| C9900-K554 | USB 2.0 A-B connection cable, 1 m |

12.2 Support and Service

Beckhoff and their partners around the world offer comprehensive support and service, making available fast and competent assistance with all questions related to Beckhoff products and system solutions.

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More Information:

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