### DC-UPS Control Unit
- Requires Only One 12V Battery for a 24V Output
- Stable Output Voltage in Buffer Mode
- Superior Battery Management for Longest Battery Life
- Comprehensive Diagnostic and Monitoring Functions
- Replace Battery Signal Included
- Electronically Overload and Short Circuit Protected
- 50% Power Reserves
- Selectable Buffer Time Limiter
- 3 Year Warranty

### Short-Form Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>nom. 24Vdc</td>
</tr>
<tr>
<td>Output current</td>
<td>min. 15A</td>
</tr>
<tr>
<td>Output voltage</td>
<td>typ. 0.23V</td>
</tr>
<tr>
<td>Allowed batteries</td>
<td>3.9Ah to 40Ah</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-25 to +70°C</td>
</tr>
<tr>
<td>Derating</td>
<td>0.43A/°C</td>
</tr>
<tr>
<td>Dimensions</td>
<td>49x124x117mm</td>
</tr>
<tr>
<td>Buffer time (at 10A)</td>
<td>typ. 6'45&quot;</td>
</tr>
<tr>
<td></td>
<td>typ. 55’</td>
</tr>
</tbody>
</table>

Typical setup of a DC-UPS system with the UB10.241:

- AC Power Supply
- UB10.241 DC-UPS
- Battery module 24V
- Load

### Order Numbers

<table>
<thead>
<tr>
<th>DC-UPS</th>
<th>Accessory</th>
</tr>
</thead>
<tbody>
<tr>
<td>UB10.241</td>
<td>UZK12.072</td>
</tr>
<tr>
<td></td>
<td>UZO12.072</td>
</tr>
<tr>
<td></td>
<td>UZX12.261</td>
</tr>
<tr>
<td></td>
<td>UZO12.26</td>
</tr>
<tr>
<td></td>
<td>ZM1.WALL</td>
</tr>
<tr>
<td></td>
<td>ZM10.WALL</td>
</tr>
</tbody>
</table>

**Standard controller**

- Battery module 12V 7Ah
- Mounting kit w/o battery
- Battery module 12V 26Ah
- Mounting kit w/o battery
- Panel/Wall mount bracket
- Panel/Wall mount bracket

### Main Approvals

- UL 508
- UL 60950-1
- UL 60079-11
- UL C2
- Class I Div 2
- Marine

For details and the complete approval list, see chapter 19.

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All parameters are specified at an input voltage of 24V, 10A output load, 25°C ambient and after a 5 minutes run-in time unless otherwise noted. It is assumed that the input power source can deliver a sufficient output current.
All parameters are specified at an input voltage of 24V, 10A output load, 25°C ambient and after a 5 minutes run-in time unless otherwise noted. It is assumed that the input power source can deliver a sufficient output current.

**TERMINOLOGY AND ABBREVIATIONS**

**DC-UPS**
Uninterruptible power supply with DC-Input.

**Normal mode**
Describes a condition where the battery is charged, the input voltage is in range and the output is loaded within the allowed limits.

**Buffer mode**
Describes a condition where the input voltage is below the transfer threshold level, the unit is running on battery (buffering) and the output is loaded within the allowed limits.

**Charging mode**
Describes a condition where the battery is being charged, the input voltage is in range and the output is loaded within the allowed limits.

**Inhibit mode**
Describes a condition where buffering is disabled on purpose by using the inhibit input of the DC-UPS. (e.g. for service actions, or to save battery capacity)

**Buffer time**
Same as the term “hold-up time”.

**t.b.d.**
To be defined, value or description will follow later.

**DISCLAIMER**

The information presented in this document is believed to be accurate and reliable and may change without notice. Some parts of this unit are patent by PULS (US patent No 091662,063, Des. 424,529, ...).

No part of this document may be reproduced or utilized in any form without permission in writing from the publisher.
1. INTENDED USE

This device is designed for installation in an enclosure and is intended for commercial use, such as in industrial control, process control, monitoring and measurement equipment or the like.

Do not use this device in equipment where malfunction may cause severe personal injury or threaten human life.

2. INSTALLATION INSTRUCTIONS

**WARNING** Risk of electrical shock, fire, personal injury or death.
- Turn power off before working on the device and protect against inadvertent re-powering.
- Do not open, modify or repair the device.
- Use caution to prevent any foreign objects from entering into the housing.
- Do not use in wet locations or in areas where moisture or condensation can be expected.
- Do not touch during power-on, and immediately after power-off. Hot surface may cause burns.

Obey the following installation instructions:

This device may only be installed and put into operation by qualified personnel.

This device does not contain serviceable parts. The tripping of an internal fuse is caused by an internal defect.

If damage or malfunction should occur during installation or operation, immediately turn power off and send unit to the factory for inspection.

Turn power off and disconnect the battery fuse before working on the device.

Install the device in an enclosure providing protection against electrical, mechanical and fire hazards.

Install the device onto a DIN rail according to EN 60715 with the input terminals on the top of the unit.

The input can be powered from a regulated power supply or a similar DC source. The voltage between the input and ground must not exceed 60Vdc continuously. The ripple voltage in the low frequency range between 50Hz and 10kHz must be negligible when used in marine applications.

The input must be powered from a PELV or SELV source or an “Isolated Secondary Circuit” in order to maintain a SELV or PELV output.

Use an appropriately sized 24V power supply, which can deliver the additional internal current consumption, required to charge the battery.

Use only VRLA lead acid batteries with a capacity between 3.9Ah and 40Ah.

Check for correct input and battery polarity. The device will not operate when the voltage is reversed.

Make sure that the wiring is correct by following all local and national codes. Use appropriate copper cables that are designed for a minimum operating temperature of 60°C for ambient temperatures up to +45°C, 75°C for ambient temperatures up to +60°C and 90°C for ambient temperatures up to +70°C. Ensure that all strands of a stranded wire enter the terminal connection.

Do not use wires smaller than 2.5mm² (or AWG 12) and not longer than 2x1.5m between the battery and the DC-UPS controller. Longer or smaller gauge wires can change performance of the system. Use a 30A fuse (ATOF® 287 030 from Little fuse or an UL listed fuse with the same characteristics) in the battery circuit. The battery fuse protects the wires between the battery and the DC-UPS and shall be located close to the battery.

The device is designed for pollution degree 2 areas in controlled environments. No condensation or frost is allowed.

The device is designed as “Class of Protection III” equipment according to IEC 61140.

The enclosure of the device provides a degree of protection of IP20.

A disconnecting means shall be provided for the input and the battery input of the device.

The device is designed for convection cooling and does not require an external fan. Do not obstruct airflow and do not cover ventilation grid!
Keep the following minimum installation clearances: 40mm on top, 20mm on the bottom, 5mm left and right side. Increase the 5mm to 15mm in case the adjacent device is a heat source. When the device is permanently loaded with less than 50%, the 5mm can be reduced to zero.

The device is designed for altitudes up to 6000m (19685ft).

The maximum surrounding air temperature is +70°C (+158°F). The operational temperature is the same as the ambient or surrounding air temperature and is defined 2cm below the device.

The device is designed to operate in areas between 5% and 95% relative humidity.

**Installation Instructions for Hazardous Location Areas**

The device is suitable for use in Class I Division 2 Groups A, B, C, D locations and for use in Group II Category 3 (Zone 2) environments.

Hazardous Location Classification: ATEX: EPS 15 ATEX 1 025 X, II 3G EX ec nC IIC T3 Gc

**WARNING**

EXPLOSION HAZARDS!

Substitution of components may impair suitability for this environment.

Do not disconnect the device or change unit settings unless power has been switched off or the area is known to be non-hazardous.

A suitable enclosure must be provided for the end-product which has a minimum protection of IP54 and fulfills the requirements of the EN 60079-0.

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All parameters are specified at an input voltage of 24V, 10A output load, 25°C ambient and after a 5 minutes run-in time unless otherwise noted. It is assumed that the input power source can deliver a sufficient output current.
3. INPUT

<table>
<thead>
<tr>
<th>Input voltage</th>
<th>nom.</th>
<th>DC 24V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage ranges</td>
<td>nom.</td>
<td>22.5 - 30Vdc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 - 35Vdc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35Vdc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 - 22.5Vdc</td>
</tr>
</tbody>
</table>

Allowed input voltage ripple max. 1.5Vpp Bandwidth <400Hz
1Vpp Bandwidth 400Hz to 1kHz

Allowed voltage between input and earth (ground) max. 60Vdc or 42.4Vac

Turn-on voltage typ. 22.8Vdc The output does not switch on if the input voltage does not exceed this level.
max. 23Vdc

Input current **)
typ. 120mA Internal current consumption
typ. 1.1A Current consumption for battery charging in constant current mode at 24V input See Fig. 6-2 ***)

External capacitors on the input No limitation

*) The DC-UPS shows “Check Wiring” with the red LED and buffering is not possible

**) The total input current is the sum of the output current, the current which is required to charge the battery during the charging process and the current which is needed to supply the DC-UPS itself. See also Fig. 3-2. This calculation does not apply in overload situations where the DC-UPS limits the output current, therefore see Fig. 3-3.

***) Please note: This is the input current and not the current which flows into the battery during charging. The battery current can be found in chapter 6.

Electronic output current limitation
The DC-UPS is equipped with an electronic output current limitation. This current limitation works in a switching mode which reduces the power losses and heat generation to a minimum. As a result, the output voltage drops since there is not enough current to support the load. A positive effect of the current limitation in switching mode is that the input current goes down despite an increase in the output current resulting in less stress for the supplying source.

Fig. 3-1 Input voltage range
Fig. 3-2 Input current, definitions
Fig. 3-3 Input current and output voltage vs. output current, typ. (battery fully charged)
### 4. Output in Normal Mode

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage in normal mode</td>
<td>nom. DC 24V The output voltage follows the input voltage reduced by the input to output voltage drop.</td>
</tr>
<tr>
<td>Voltage drop between input and output</td>
<td>max. 0.3V At 10A output current, see Fig. 4-1 for typical values</td>
</tr>
<tr>
<td></td>
<td>max. 0.45V At 15A output current, see Fig. 4-1 for typical values</td>
</tr>
<tr>
<td>Ripple and noise voltage</td>
<td>max. 20mVpp 20Hz to 20MHz, 50Ohm*)</td>
</tr>
<tr>
<td>Output current</td>
<td>nom. 15A Continuously allowed</td>
</tr>
<tr>
<td>Output power</td>
<td>nom. 360W Continuously allowed</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>min. 17.9A Load impedance 100mOhm, see Fig. 4-2 for typical values</td>
</tr>
<tr>
<td></td>
<td>max. 21A Load impedance 100mOhm, see Fig. 4-2 for typical values</td>
</tr>
<tr>
<td>Capacitive and inductive loads</td>
<td>No limitation</td>
</tr>
</tbody>
</table>

*) This figure shows the ripple and noise voltage which is generated by the DC-UPS. The ripple and noise voltage might be higher if the supplying source has a higher ripple and noise voltage.

---

**Input to output voltage drop, typ.**

![Input to output voltage drop, typ.](image1)

**Output voltage vs. output current in normal mode at 24V input, typ.**

![Output voltage vs. output current in normal mode at 24V input, typ.](image2)

---

All parameters are specified at an input voltage of 24V, 10A output load, 25°C ambient and after a 5 minutes run-in time unless otherwise noted. It is assumed that the input power source can deliver a sufficient output current.
5. OUTPUT IN BUFFER MODE

If the input voltage falls below a certain value (transfer threshold level), the DC-UPS starts buffering without any interruption or voltage dips. Buffering is possible even if the battery is not fully charged.

<table>
<thead>
<tr>
<th>Output voltage in buffer mode</th>
<th>nom. DC 24V</th>
<th>Output voltage is stabilized and independent from battery voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22.45V ±1%, at no load,</td>
<td>22.25V ±1%, at 10A output current</td>
</tr>
</tbody>
</table>

Transfer threshold for buffering typ. 80mV higher than the output voltage in buffer mode

Ripple and noise voltage max. 20mVpp 20Hz to 20MHz, 500Ohm

Output current

| nom. 10A | Continuously allowed |
| 15A | < 5s with full output voltage*) |

Short-circuit current

| min. 17.9A | Load impedance 100mOhm**) |
| max. 21A | Load impedance 100mOhm**) |

*) If the output current is in the range between 10A and 15A for longer than 5s, a hardware-controlled reduction of the maximal output current to 10A occurs. If the 10A are not enough to maintain the 24V, buffering stops after another 5s. The buffering is possible again as soon as the input voltage recovers.

**) If the nominal output voltage cannot be maintained in buffer mode, the DC-UPS switches off after 5s to save battery capacity.

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Fig. 5-1 Buffering transition, definitions

Fig. 5-2 Transfer behavior, typ.

Fig. 5-3 Available output current in buffer mode

Fig. 5-4 Output voltage vs. output current in buffer mode, typ.
6. Battery Input

The DC-UPS requires one 12V VRLA battery to buffer the 24V output.

<table>
<thead>
<tr>
<th>Battery voltage</th>
<th>nom.</th>
<th>DC 12V</th>
<th>Use one maintenance-free 12V VRLA lead acid battery or one battery module which is listed in the chapter accessories.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery voltage range</td>
<td>max.</td>
<td>9.0 – 15.0V</td>
<td>Continuously allowed, except deep discharge protection</td>
</tr>
<tr>
<td></td>
<td>min.</td>
<td>7.4V</td>
<td>Absolute maximum voltage with no damage to the unit</td>
</tr>
<tr>
<td>Allowed battery sizes</td>
<td>min.</td>
<td>3.9Ah</td>
<td>Above this voltage level battery charging is possible</td>
</tr>
<tr>
<td></td>
<td>max.</td>
<td>40Ah</td>
<td></td>
</tr>
<tr>
<td>Internal battery resistance</td>
<td>max.</td>
<td>100mOhm</td>
<td>See individual battery datasheets for this value</td>
</tr>
<tr>
<td>Battery charging method</td>
<td>nom.</td>
<td>CC-CV</td>
<td>Constant current, constant voltage mode</td>
</tr>
<tr>
<td>Battery charging current (CC-mode)</td>
<td>max.</td>
<td>1.5A</td>
<td>Independent from battery size,</td>
</tr>
<tr>
<td></td>
<td>typ.</td>
<td>1.7A</td>
<td>Corresponding 24V input current see Fig. 6-2</td>
</tr>
<tr>
<td>End-of-charge-voltage (CV-mode)</td>
<td>typ.</td>
<td>13.4–13.9V</td>
<td>Adjustable, see chapter 12</td>
</tr>
<tr>
<td>Battery charging time</td>
<td>typ.</td>
<td>5h(^\ast)</td>
<td>For a 7Ah battery</td>
</tr>
<tr>
<td></td>
<td>typ.</td>
<td>17h(^\ast)</td>
<td>For a 26Ah battery</td>
</tr>
<tr>
<td>Battery discharging current **()</td>
<td>typ.</td>
<td>21A</td>
<td>Buffer mode, 10A output current, 11.5V on the battery terminal of the DC-UPS, see Fig. 6-1 for other parameters</td>
</tr>
<tr>
<td></td>
<td>typ.</td>
<td>0.3A</td>
<td>Buffer mode, 0A output current</td>
</tr>
<tr>
<td></td>
<td>max.</td>
<td>50µA</td>
<td>At no input, buffering had switched off, all LEDs are off</td>
</tr>
<tr>
<td></td>
<td>typ.</td>
<td>270mA</td>
<td>At no input, buffering had switched off, yellow LED shows “buffer time expired” (max. 15 minutes)</td>
</tr>
<tr>
<td>Deep discharge protection ***()</td>
<td>typ.</td>
<td>10.5V</td>
<td>At 0A output current</td>
</tr>
<tr>
<td></td>
<td>typ.</td>
<td>9.0V</td>
<td>At 10A output current</td>
</tr>
</tbody>
</table>

\(\ast\) The charging time depends on the duration and load current of the last buffer event. The numbers in the table represent a fully discharged battery. A typical figure for a buffer current of 10A is 3h 20Min. for a 7Ah battery.

\(\ast\ast\) The current between the battery and the DC-UPS is more than twice the output current. This is caused by boosting the 12V battery voltage to a 24V level. This high current requires large wire gauges and short cable length for the longest possible buffer time. The higher the resistance of the connection between the battery and the DC-UPS, the lower the voltage on the battery terminals which increases the discharging current. See also chapter 22 for more installation instructions.

\(\ast\ast\ast\) To ensure longest battery lifetime, the DC-UPS has a battery deep discharge protection feature included. The DC-UPS stops buffering when the voltage on the battery terminals of the DC-UPS falls below a certain value. The yellow LED will show “buffer time expired” for a period of 15 minutes after the unit stopped buffering.
7. **Buffer Time**

The buffer time depends on the capacity and performance of the battery as well as the load current. The diagram below shows the typical buffer times of the standard battery modules.

| Buffer time with battery module UZK12.072 | min. | 19'12“ | At 5A output current *)
|                                           | min. | 5’42“  | At 10A output current *)
|                                           | typ. | 21'30“ | At 5A output current, see Fig. 7-1**)
|                                           | typ. | 6'45“  | At 10A output current, see Fig. 7-1**)

| Buffer time with battery module UZK12.261 | min. | 99'30“ | At 5A output current *)
|                                           | min. | 39’    | At 10A output current *)
|                                           | typ. | 130’   | At 5A output current, see Fig. 7-1**)
|                                           | typ. | 55’    | At 10A output current, see Fig. 7-1**)

*) Minimum value includes 20% aging of the battery and a cable length of 1.5m with a cross section of 2.5mm² between the battery and the DC-UPS and requires a fully charged (min. 24h) battery.

**) Typical value includes 10% aging of the battery and a cable length of 0.3m with a cross section of 2.5mm² between the battery and the DC-UPS and requires a fully charged (min. 24h) battery.

---

### Fig. 7-1 Buffer time vs. output current with the battery modules UZK12.072 and UZK12.261

The battery capacity is usually specified in amp-hours (Ah) for a 20h discharging event. The battery discharge is non-linear (due to the battery chemistry). The higher the discharging current, the lower the appropriated battery capacity. The magnitude of the reduction depends on the discharging current as well as on the type of battery. High current battery types can have up to 50% longer buffer times compared to regular batteries when batteries will be discharged in less than 1 hour.

High discharging currents do not necessarily mean high power losses as the appropriated battery capacity is reduced with such currents. When the battery begins to recharge after a discharging event, the process is completed much faster since only the energy which was taken out of the battery needs to be “refilled”.

For this reason, the buffer time cannot be calculated using the Ah capacity value. The equation “I x t” = capacity in Ah generally leads to incorrect results when the discharging current is higher than C20 (discharging current for 20h). The battery datasheet needs to be studied and a determination of the expected buffer time can be made according to the following example:

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Example how to determine the expected buffer time for other battery types and battery sizes:

Step 1  Check the datasheet of the battery which is planned to be used and look for the discharging curve. Sometimes, the individual discharging curves are marked with relative C-factors instead of current values. This can easily be converted. The C-factor needs to be multiplied with the nominal battery capacity to get the current value. E.g.: 0.6C on a 17Ah battery means 10.2A.

![Typical discharging curve of a typical 17Ah battery, curve taken from a manufacturer's datasheet](image)

Step 2  Determine the required battery current. Use Fig. 6-1 “Battery discharging current vs. output current” to get the battery current. Fig. 6-1 requires the average voltage on the battery terminals. Since there is a voltage drop between the battery terminals and the battery input of the DC-UPS, it is recommended to use the curve A or B for output currents > 3A or when long battery cables are used. For all other situations, use curve C.

Step 3  Use the determined current from Step 2 to find the appropriate curve in Fig. 7-2. The buffer time (Discharging Time) can be found where this curve meets the dotted line. This is the point where the DC-UPS stops buffering due to the under-voltage lockout.

Step 4  Depending on Fig. 7-2, the buffer time needs to be reduced to take aging effects or guaranteed values into account.

Example:
The buffer current is 7.5A and a battery according Fig. 7-2 is used. The cable between the battery and the DC-UPS is 1m and has a cross section of 2.5mm². How much is the maximum achievable buffer time.

Answer:
- According to Fig. 6-1, the battery current is 18A. Curve A is used since the battery current is > 3A and the length of the cable is one meter.
- According to Fig. 7-2, a buffer time (Discharging Time) of 30 Minutes can be determined. It is recommended to reduce this figure to approximately 24 minutes for a guaranteed value and to cover aging effects.
8. EFFICIENCY AND POWER LOSSES

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>typ. 97.8%</th>
<th>Normal mode, 10A output current, battery fully charged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power losses</td>
<td>typ. 2.9W</td>
<td>Normal mode, 0A output current, battery fully charged</td>
</tr>
<tr>
<td></td>
<td>typ. 5.5W</td>
<td>Normal mode, 10A output current, battery fully charged</td>
</tr>
<tr>
<td></td>
<td>typ. 5.0W</td>
<td>During battery charging, 0A output current</td>
</tr>
<tr>
<td></td>
<td>typ. 2.1W</td>
<td>During battery charging, to be added to power losses in normal mode, Fig. 8-2</td>
</tr>
<tr>
<td></td>
<td>typ. 18.5W</td>
<td>Buffer mode, 10A output current</td>
</tr>
</tbody>
</table>

![Efficiency at 24V, typ.](image1)

![Losses at 24V, typ.](image2)

![Losses, typ.](image3)

Efficiency vs. output current in normal mode

Power losses versus output current in normal mode

Power losses in buffer mode, typ.
9. Functional Diagram

Fig. 9-1   Functional diagram

*) Return current protection; This feature utilizes a MOSFET instead of a diode in order to minimize the voltage drop and power losses.
10. CHECK WIRING AND BATTERY QUALITY TESTS

The DC-UPS is equipped with an automatic “Check Wiring” and “Battery Quality” test.

“Check Wiring” test:
Under normal circumstances, an incorrect or bad connection from the battery to the DC-UPS or a missing (or blown) battery fuse would not be recognized by the UPS when operating in normal mode. Only when back up is required would the unit not be able to buffer. Therefore, a “check wiring” test is included in the DC-UPS. This connection is tested every 10 seconds by loading the battery and analysing the response from the battery. If the resistance is too high, or the battery voltage is not in range, the unit displays “Check Wiring” with the red LED. At the same time the green “Ready” LED will turn off.

“State of Health” (SoH) test:
The battery has a limited service life and needs to be replaced in a fixed interval which is defined by the specified service life (acc. to the Eurobat guideline), based on the surrounding temperature and the number of charging/discharging cycles. If the battery is used longer than the specified service life, the battery capacity will degrade. Details can be found in chapter 24.1. The battery SoH test can not determine a gradual loss in capacity. However, it can detect a battery failure within the specified service life of the battery. Therefore, a SoH is included in the DC-UPS.

The battery quality test consists of different types of tests:
- During charging:
  If the battery does not reach the ready status (see chapter 12) within 30h, it is considered to be defective. The reason could be a broken cell inside the battery.
- During operation:
  Once the battery is fully charged, a voltage drops test and a load test is performed alternately every 8 hours. Three of the tests must consecutively produce negative results to indicate a battery problem.

A battery problem is indicated with the yellow LED (replace battery pattern) and the relay contact “Replace Battery”. Please note that it can take up to 50 hours (with the largest size of battery) until a battery problem is reported. This should avoid nuisance error messages as any urgent battery problems will be reported by the “Check Wiring” test and create a warning signal. The battery tests require up to 50h uninterrupted operation. Any interruptions in the normal operation of the DC-UPS may result in the “Replace Battery” test cycle to start over.

When “Replace battery” is indicated, it is recommended to replace battery as soon as possible.
11. RELAY CONTACTS AND INHIBIT INPUT

The DC-UPS is equipped with relay contacts and signal inputs for remote monitoring and controlling of the unit.

Relay contacts:

Ready: Contact is closed when battery is charged more than 85%, no wiring failure are recognized, input voltage is enough and inhibit signal is not active.
Buffering: Contact is closed when unit is buffering.
Replace Battery: Contact is closed when the unit is powered from the input and the battery quality test (SOH test) reports a negative result.

Relay contact ratings
- max. 60Vdc 0.3A, 30Vdc 1A, 30Vac 0.5A resistive load
- min. 1mA at 5Vdc min.

Isolation voltage
- max. 500Vac, signal port to power port

Signal input:

Inhibit: The inhibit input disables buffering. In normal mode, a static signal is required. In buffer mode, a pulse with a minimum length of 250ms is required to stop buffering. The inhibit is stored and can be reset by cycling the input voltage. See also chapter 24.1 for application hints.

Signal voltage
- max. 35Vdc

Signal current
- max. 6mA, current limited

Inhibit threshold
- min. 6Vdc, buffering is disabled above this threshold level
- max. 10Vdc

Isolation
- nom. 500Vac, signal port to power port

Restriction apply when using the signal and relay contacts in a Haz-Loc environment:

The Buffering, Ready and Replace Battery contact is intended to be used for a separately investigated nonincendive field wiring and/or field wiring apparatus. The DC-UPS may be located in a Class I, Division 2 (Group A, B, C or D) hazardous (classified) location. Associated apparatus must be installed in accordance with its manufacturer’s control drawing and Article 504 of the National Electrical Code (ANSI/NFPA 70) for installation in the United States, or chapter 18 of the Canadian Electrical Code for Installations in Canada.

Selected associated apparatus must be third part listed as providing nonincendive field circuits for the application, and have Voc not exceeding Vmax, Isc not exceeding Imax.

Non associated non incendive field wiring apparatures shall not be connected in parallel unless this is permitted by the associated non incendive field wiring apparatures approval.
Selected barriers must have entity parameters such that:
\[ \text{Voc} \leq \text{Vmax}, \text{ISC} \leq \text{Imax}, \]
\[ \text{Ca} \geq \text{Ci} + \text{C-cable}, \text{La} \geq \text{Li} + \text{L-cable} \]

For C-cable and L-cable, if the capacitance per foot or the inductance per foot is not known, then the following values shall be used:
- \( \text{C-cable} = 60\text{pF/foot} \)
- \( \text{L-cable} = 0.2\mu\text{H/foot} \)

Contact current: \( \text{I max} = 50\text{mA} \)
Contact voltage: \( \text{V max.} = 35\text{V (DC or AC)} \)
Max. associated circuit capacitance \( \text{Ci} = 0 \)
Max. associ*) Minimum value includes 20% aging of the battery and a cable length of 1.5m with a cross section of 2.5mm2 between the battery and the DC-UPS and requires a fully charged (min. 24h) battery.

**) Typical value includes 10% aging of the battery and a cable length of 0.3m with a cross section of 2.5mm2 between the battery and the DC-UPS and requires a fully charged (min. 24h) battery.
No polarity requirement

---

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All parameters are specified at an input voltage of 24V, 10A output load, 25°C ambient and after a 5 minutes run-in time unless otherwise noted. It is assumed that the input power source can deliver a sufficient output current.
12. FRONT SIDE USER ELEMENTS

A  Power Port
Quick-connect spring-clamp terminals, connection for input voltage, output voltage and battery

B  Signal Port
Plug connector with screw terminals, inserted from the bottom. Connections for the Ready, Buffering, Replace Battery relay contacts and for the Inhibit input. See details in chapter 11.

C  Green Status LED
Ready: Battery is charged > 85%, no wiring failure is recognized, input voltage is enough and inhibit signal is not active.
Charging: Battery is charging, and the battery capacity is below 85%.
Buffering: Unit is in buffer mode.
Flashing pattern of the green status LED:

D  Yellow Diagnosis LED
Overload: Output has switched off due to long overload in buffer mode or due to high temperatures.
Replace battery: Indicates a battery which failed the battery quality test (SoH test). Battery should be replaced soon.
Buffer-time expired: Output has switched off due to settings of Buffer-timer Limiter. This signal will be displayed for 15 minutes.
Inhibit active: Indicates that buffering is disabled due to an active inhibit signal.
Flashing pattern of the yellow diagnosis LED:
E  Red Check Wiring LED
   This LED indicates a failure in the installation (e.g. too low input voltage), wiring, battery or battery fuse.

F  Buffer-time Limiter:
   User accessible dial which limits the maximum buffer time in a buffer event to save battery energy. When the battery begins to recharge after a discharging event, the process is completed much faster since only the energy which was taken out of the battery needs to be "refilled". The following times can be selected: 10 seconds, 30 seconds, 1 minute, 3 minutes, 10 minutes or infinity (until battery is flat) which allows buffering until the deep discharge protection stops buffering.

G  End-of-charge-voltage Selector:
   The end-of-charge-voltage shall be set manually according to the expected temperature in which the battery is located. The dial on the front of the unit allows a continuously adjustment between +10 and +40°C. 10°C will set the end-of-charge-voltage to 13.9V, 25°C→13.65V and 40°C→13.4V. If in doubt about the expected temperature, set the unit to 40°C.
13. TERMINALS AND WIRING

<table>
<thead>
<tr>
<th>Power terminals</th>
<th>Signal terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>Bi-stable, quick-connect spring-clamp terminals. IP20 Finger-touch-proof. Suitable for field- and factory installation. Shipped in open position.</td>
</tr>
<tr>
<td><strong>Solid wire</strong></td>
<td>0.5-6mm²</td>
</tr>
<tr>
<td><strong>Stranded wire</strong></td>
<td>0.5-4mm²</td>
</tr>
<tr>
<td><strong>AWG</strong></td>
<td>20-10AWG</td>
</tr>
<tr>
<td><strong>Ferrules</strong></td>
<td>Allowed, but not required</td>
</tr>
<tr>
<td><strong>Pull-out force</strong></td>
<td>10AWG:80N, 12AWG:60N, 14AWG:50N, 16AWG:40N according to UL486E</td>
</tr>
<tr>
<td><strong>Tightening torque</strong></td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Wire stripping length</strong></td>
<td>10mm / 0.4inch</td>
</tr>
</tbody>
</table>

**Fig. 13-1 Spring-clamp terminals, connecting a wire**

1. Insert the wire
2. Close the lever
To disconnect wire: reverse the procedure

**Instructions:**
- Use appropriate copper cables, that are designed for an operating temperature of 60°C
- Follow national installation codes and regulations!
- Ensure that all strands of a stranded wire enter the terminal connection!
- Up to two stranded wires with the same cross section are permitted in one connection point

14. RELIABILITY

<table>
<thead>
<tr>
<th>Lifetime expectancy</th>
<th>min. 137 400h</th>
<th>At 10A output current, 40°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min. &gt; 15 years</td>
<td>At 5A output current, 40°C</td>
</tr>
<tr>
<td></td>
<td>min. &gt; 15 years</td>
<td>At 10A output current, 25°C</td>
</tr>
</tbody>
</table>

**MTBF SN 29500, IEC 61709**
- 886 000h | At 10A output current, 40°C
- 1 482 000h | At 10A output current, 25°C

**MTBF MIL HDBK 217F**
- 397 900 | At 10A output current, 40°C, ground benign GB40
- 545 000 | At 10A output current, 25°C, ground benign GB25

The **Lifetime expectancy** shown in the table indicates the operating hours (service life) and is determined by the lifetime expectancy of the built-in electrolytic capacitors. Lifetime expectancy is specified in operational hours. Lifetime expectancy is calculated according to the capacitor's manufacturer specification. The prediction model allows a calculation of up to 15 years from date of shipment.

**MTBF** stands for **Mean Time Between Failure**, which is calculated according to statistical device failures and indicates reliability of a device. It is the statistical representation of the likelihood of a unit to fail and does not necessarily represent the life of a product.
15. EMC

The unit is suitable for applications in industrial environment as well as in residential, commercial and light industry environment without any restrictions. CE mark is in conformance with EMC guideline 89/336/EEC and 93/68/EEC and the low-voltage directive (LVD) 73/23/EEC, 93/68/EEC.

A detailed EMC Report is available on request.

<table>
<thead>
<tr>
<th>EMC Immunity</th>
<th>EN 61000-6-1, EN 61000-6-2</th>
<th>Generic standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrostatic discharge</td>
<td>EN 61000-4-2</td>
<td>Contact discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Air discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Criterion A*)</td>
</tr>
<tr>
<td>Electromagnetic RF field</td>
<td>EN 61000-4-3</td>
<td>80MHz-1GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10V/m</td>
</tr>
<tr>
<td>Fast transients (Burst)</td>
<td>EN 61000-4-4</td>
<td>Out- and input lines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Signal lines***)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Criterion A</td>
</tr>
<tr>
<td>Surge voltage</td>
<td>EN 61000-4-5</td>
<td>Output + → -</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Input + → -</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ / - → housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Criterion A</td>
</tr>
<tr>
<td>Conducted disturbance</td>
<td>EN 61000-4-6</td>
<td>0,15-80MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Criterion A</td>
</tr>
</tbody>
</table>

*) DIN rail earthed  
**) Tested with coupling clamp

<table>
<thead>
<tr>
<th>EMC Emission</th>
<th>EN 61000-6-3, EN 61000-6-4</th>
<th>Generic standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conducted emission</td>
<td>EN 55032</td>
<td>Input lines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class B*)</td>
</tr>
<tr>
<td></td>
<td>EN 55032</td>
<td>Output lines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class B*)</td>
</tr>
<tr>
<td>Radiated emission</td>
<td>EN 55011, EN 55032</td>
<td>Class B</td>
</tr>
</tbody>
</table>

This device complies with FCC Part 15 rules.

Operation is subjected to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

*) Informative measurement with voltage probe

Switching frequencies

The DC-UPS has three converters with three different switching frequencies included.

<table>
<thead>
<tr>
<th>Switching frequencies</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching frequency of boost converter</td>
<td>100kHz</td>
<td>Constant frequency</td>
</tr>
<tr>
<td>Switching frequency of electronic output current limitation</td>
<td>78kHz</td>
<td>Constant frequency</td>
</tr>
<tr>
<td>Switching frequency of battery charger</td>
<td>19.5kHz</td>
<td>Constant frequency</td>
</tr>
</tbody>
</table>
16. ENVIRONMENT

Operational temperature  
-25°C to +70°C (-13° to +158°F)  
For the DC-UPS control unit.  
Keep battery in a cooler environment!

Derating  
0.43A/°C  
+60°C to +70°C (+140°F to +158°F),  
normal mode see Fig. 16-1  
+60°C to +70°C (+140°F to +158°F),  
buffer mode see Fig. 16-2

Storage temperature  
-40 to +85°C (-40° to +185°F)  
Storage and transportation, except battery

Humidity  
5 to 95% r.H.  
IEC 60068-2-30  
Do not energize while condensation is present

Vibration sinusoidal  
2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g  
IEC 60068-2-6

Shock  
30g 6ms, 20g 11ms  
IEC 60068-2-27

Altitude  
0 to 6000m  
Approvals apply only up to 2000m

Over-voltage category  
II  
EN 50178  
II  
EN 50178 above 2000m altitude

Degree of pollution  
2  
EN 50178, not conductive

Fig. 16-1  Output current vs. ambient temperature

Allowable Output Current in Normal Mode

| Ambient Temperature | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 60 | 62 | 64 | 66 | 68 | 70 | 72 |
|---------------------|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Current (A)          | 0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 |

The ambient temperature is defined 2cm below the unit.

Fig. 16-2  Output current vs. ambient temperature

Allowable Output Current in Buffer Mode

| Ambient Temperature | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 60 | 62 | 64 | 66 | 68 | 70 | 72 |
|---------------------|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Current (A)          | 0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 |

17. PROTECTION FEATURES

Output protection  
Electronically protected against overload, no-load and short-circuits

Output over-voltage protection in buffer mode  
typ. 32Vdc  
max. 35Vdc  
In case of an internal defect, a redundant circuitry limits the maximum output voltage. The output automatically shuts-down and makes restart attempts.

Degree of protection  
IP20  
EN/IEC 60529

Penetration protection  
> 3.5mm  
E.g. screws, small parts

Reverse battery polarity protection  
yes  
Max. -35Vdc;

Wrong battery voltage protection  
yes  
Max. +35Vdc (e.g. 24V battery instead of 12V battery)

Battery deep discharge protection  
yes  
The limit is battery current dependent

Over temperature protection  
yes  
Output shutdown with automatic restart

Input over-voltage protection  
yes  
Max. 35Vdc, no harm or defect of the unit

Internal input fuse  
25A, blade type  
No user accessible part, no service part

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### 18. Safety Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>SELV</th>
<th>IEC/EN 60950-1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output voltage</strong></td>
<td>SELV</td>
<td>IEC/EN 60950-1</td>
</tr>
<tr>
<td>Max. allowed voltage between any input,</td>
<td>PELV</td>
<td>EN 60204-1, EN 50178, IEC 60364-4-41</td>
</tr>
<tr>
<td>output or signal pin and ground:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60Vdc or 42.4Vac</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Class of protection</strong></td>
<td>III</td>
<td>PE (Protective Earth) connection is not</td>
</tr>
<tr>
<td></td>
<td></td>
<td>required</td>
</tr>
<tr>
<td><strong>Isolation resistance</strong></td>
<td>&gt; 5MOhm</td>
<td>Power port to housing, 500Vdc</td>
</tr>
<tr>
<td><strong>Dielectric strength</strong></td>
<td>500Vac</td>
<td>Power port to signal port</td>
</tr>
<tr>
<td></td>
<td>500Vac</td>
<td>Power port / signal port to housing</td>
</tr>
<tr>
<td><strong>Touch current (leakage current)</strong></td>
<td>The leakage</td>
<td>The leakage current which is produced by</td>
</tr>
<tr>
<td></td>
<td>current</td>
<td>the DC-UPS itself depends on the input</td>
</tr>
<tr>
<td></td>
<td>which is</td>
<td>voltage ripple and need to be investigated</td>
</tr>
<tr>
<td></td>
<td>produced by</td>
<td>in the final application.</td>
</tr>
<tr>
<td></td>
<td>the DC-UPS</td>
<td>For a smooth DC input voltage, the produced</td>
</tr>
<tr>
<td></td>
<td>itself</td>
<td>leakage current is less than 100µA.</td>
</tr>
<tr>
<td></td>
<td>depends on</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the input</td>
<td></td>
</tr>
<tr>
<td></td>
<td>voltage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ripple</td>
<td></td>
</tr>
<tr>
<td></td>
<td>need to</td>
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<tr>
<td></td>
<td>be identified</td>
<td></td>
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<tr>
<td></td>
<td>in the final</td>
<td></td>
</tr>
<tr>
<td></td>
<td>application.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All parameters are specified at an input voltage of 24V, 10A output load, 25°C ambient and after a 5 minutes run-in time unless otherwise noted. It is assumed that the input power source can deliver a sufficient output current.
## 19. Approved, Fulfilled or Tested Standards

### UL 508
- **UL Certificate**
- Listed equipment for category NMTR - Industrial Control Equipment
- Applicable for US and Canada
- E-File: E198865

### IEC 60950-1
- **CB Report**
- CB Scheme Certificate
- General safety requirements for Information Technology Equipment (ITE)

### UL 60950-1
- **UL Certificate**
- Recognized component for category QGQQ - Information Technology Equipment (ITE)
- Applicable for US and Canada
- E-File: E137006

### ATEX
- **Agency Certificate** (Bureau Veritas)
- EN 60079-0 Explosive atmospheres - General requirements
- EN 60079-7, EN 60079-15 Equipment protection by type of protection "e" and "n" Certificate: EPS 15 ATEX 1 025 X
- Temperature Code: T3
- Type of Protection: ec nC

### IECEx
- **IECEx Certificate**
- IEC 60079-0 Explosive atmospheres - General requirements
- IEC 60079-7, IEC 60079-15 Equipment protection by type of protection "e" and "n" Certificate: IECEx EPS 15.0049 X
- Temperature Code: T3
- Type of Protection: ec nC

### Class I Div 2
- **CSA Certificate**
- Power Supplies for Hazardous Location
- Applicable for Canada and US
- CSA Class: 5318-01 (Canada), 5318-81 (USA)
- Temperature Code: T3
- Groups: A, B, C and D

### Class I Div. 2
- **UL Certificate**
- Recognized component for category QQPX - Power Supplies for Use in Hazardous Locations
- Applicable for US and Canada
- E-File: E246846
- Temperature Code: T3
- Groups: A, B, C and D

### Marine (DNV)
- **DNV Certificate**
- DNV Type approved product
- Certificate: TAA00001ST
- Temperature: Class D
- Humidity: Class B
- Vibration: Class C
- EMC: Class A
- Enclosure: Class A

### Marine (ABS)
- **ABS Design Assessment Certificate**
- ABS (American Bureau of Shipment) assessed product
- Certificate: 17-HG1599236-PDA
IEC 60068-2-60

Manufacturer’s Declaration (Online Document)
Environmental Tests, Flowing Mixed Gas Corrosion Test
Test Ke - Method 4
H2S: 10ppb
NO2: 200ppb
Cl2: 10ppb
SO2: 200ppb
Test Duration: 3 weeks, which simulates a service life of 10 years

ISA-71.04 G3

Manufacturer’s Declaration (Online Document)
Airborne Contaminants Corrosion Test
Severity Level: G3 Harsh
H2S: 100ppb
NOx: 1250ppb
Cl2: 20ppb
SO2: 300ppb
Test Duration: 3 weeks, which simulates a service life of 10 years.

VDMA 24364

Paint Wetting Impairment Substances Test (or LABS-Test)
Tested for Zone 2 and test class C1 according to VDMA 24364-C1-L/W for solvents and water-based paints

20. REGULATORY PRODUCT COMPLIANCE

EU Declaration of Conformity
The CE mark indicates conformance with the
- EMC directive
- Low-voltage directive
- RoHS directive

REACH Directive
Manufacturer’s Statement
EU-Directive regarding the Registration, Evaluation, Authorization and Restriction of Chemicals

WEEE Directive
Manufacturer’s Statement
EU-Regulation on Waste Electrical and Electronic Equipment
Registered in Germany as business to business (B2B) products.

KC Korean Certificate
KC Registration
Korean registration of Broadcasting and Communication Equipment

EAC TR Registration
EAC Certificate
EAC EurAsian Conformity - Registration Russia, Kazakhstan and Belarus
8504408200, 8504409000
21. **Physical Dimensions and Weight**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>49mm / 1.93’’</td>
</tr>
<tr>
<td>Height</td>
<td>124mm / 4.88’’ Plus, height of signal connector plug</td>
</tr>
<tr>
<td>Depth</td>
<td>117mm / 4.61’’ Plus, depth of DIN rail</td>
</tr>
<tr>
<td>Weight</td>
<td>530g / 1.17lb</td>
</tr>
<tr>
<td>DIN rail</td>
<td>Use 35mm DIN rails according to EN 60715 or EN 50022 with a height of 7.5 or 15mm. The DIN rail depth must be added to the depth (117mm) to calculate the total required installation depth.</td>
</tr>
</tbody>
</table>

Electronic files with mechanical data can be downloaded at www.pulspower.com

---

**Fig. 21-1 Side view**

**Fig. 21-2 Front view**

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All parameters are specified at an input voltage of 24V, 10A output load, 25°C ambient and after a 5 minutes run-in time unless otherwise noted. It is assumed that the input power source can deliver a sufficient output current.
22. **Installation Notes**

**Mounting:**
The power terminal shall be located on top of the unit. An appropriate electrical and fire end-product enclosure should be considered in the end use application.

**Cooling:** Convection cooled; no forced air cooling required. Do not obstruct air flow!

**Installation clearances:** 40mm on top, 20mm on the bottom, 5mm on the left and right side are recommended when loaded permanently with full power. In case the adjacent device is a heat source, 15mm clearance are recommended.

**Risk of electrical shock, fire, personal injury or death!**

Turn power off and disconnect battery fuse before working on the DC-UPS. Protect against inadvertent re-powering. Make sure the wiring is correct by following all local and national codes. Do not open, modify or repair the unit. Use caution to prevent any foreign objects from entering the housing. Do not use in wet locations or in areas where moisture or condensation can be expected.

**Service parts:**
The unit does not contain any service parts. The tripping of an internal fuse is caused by an internal fault. If damage or malfunctioning should occur during operation, immediately turn power off and send unit to the factory for inspection!

**Wiring and installation instructions:**

1. Connect the power supply to the input terminals of the DC-UPS.
2. Connect the battery to the battery terminals of the DC-UPS. It is recommended to install the battery outside the cabinet or in a place where the battery will not be heated up by adjacent equipment. Do not install the battery in airtight housings or cabinets. The battery should be installed according to EN50272-2, which includes enough ventilation. Batteries store energy and need to be protected against energy hazards. Use a 30A battery fuse type ATO® 257 030 (Little fuse) or similar in the battery path. The battery fuse protects the wires between the battery and the DC-UPS. It also allows the disconnection of the battery from the DC-UPS which is recommended when working on the battery or DC-UPS. Disconnect battery fuse before connecting the battery. Please note: Too small or too long wires between the DC-UPS and the battery can shorten the buffer time or can result in a malfunction of the DC-UPS. Do not use wires smaller than 2.5mm² (or 12AWG) and not longer than 2x1.5m (cord length 1.5m). Avoid voltage drops on this connection.
3. Connect the buffered load to the output terminals of the DC-UPS. The output is decoupled from the input allowing load circuits to be easily split into buffered and non-buffered sections. Noncritical loads can be connected directly to the power supply and will not be buffered. The energy of the battery can then be used in the circuits which requires buffering.
4. Install the fuse when the wiring is finished.

---

![Typical wiring diagram](image-url)
23. ACCESSORIES

23.1. BATTERY MODULES

Two pre-assembled battery modules with a single 12V battery are available for different buffer times. As an option, the mounting brackets are also available without batteries. This option offers more flexibility in selecting an appropriate battery or can save shipping and logistic costs. See individual datasheets for detailed information.

<table>
<thead>
<tr>
<th>Battery Modules</th>
<th>UZK12.072</th>
<th>UZK12.261</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery type</td>
<td>Standard version</td>
<td>High current version</td>
</tr>
<tr>
<td></td>
<td>12V, 7Ah</td>
<td>12V, 26Ah</td>
</tr>
<tr>
<td>Service life</td>
<td>3 to 5 years</td>
<td>10 to 12 years</td>
</tr>
<tr>
<td>Dimensions</td>
<td>155x124x112mm</td>
<td>214x179x158mm</td>
</tr>
<tr>
<td>Weight</td>
<td>3.2kg</td>
<td>9.9kg</td>
</tr>
<tr>
<td>DIN rail mountable</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Order number</td>
<td>UZK12.072</td>
<td>UZK12.261</td>
</tr>
<tr>
<td></td>
<td>UZ012.072</td>
<td>UZ012.26</td>
</tr>
<tr>
<td></td>
<td>UZB12.071</td>
<td>UZB12.261</td>
</tr>
</tbody>
</table>

23.2. ZM1.WALL - WALL MOUNTING BRACKET

This bracket is used to mount specific Dimension units onto a flat surface without utilizing a DIN rail. The two aluminum brackets and the black plastic slider of the unit have to be removed, so that the two steel brackets can be mounted.

*) PSU for illustration purpose only.
23.3. **ZM10.WALL - WALL MOUNTING BRACKET**

This bracket is used to mount the devices on a wall/panel without utilizing the DIN rail. The bracket can be mounted without detaching the DIN rail brackets from the power supply. Product for illustration purpose only.

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**Fig. 23-5** Isometric view

**Fig. 23-6** Isometric view

**Fig. 23-7** Isometric view

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**Fig. 23-8** Wall/panel mounting, side view

**Fig. 23-9** Hole pattern for wall mounting

**Fig. 23-10** Wall/panel mounting, side view
24. APPLICATION NOTES

24.1. BATTERY REPLACEMENT INTERVALS

Batteries have a limited lifetime. They degrade slowly beginning from the production and need to be replaced periodically. The design life figures can be found in the individual datasheets of the batteries and usually is specified according to the Eurobat guideline or according to the manufacturer’s specifications.

The design life is the estimated life based on laboratory condition and is quoted at 20°C using the manufacturer’s recommended float voltage condition. According to the Eurobat guideline, design lives have been structured into the following different groups:

3 - 5 years: This group of batteries is very popular in standby applications and in small emergency equipment. This represents a 4 years design life with a production tolerance of ±1 year.
6 - 9 years: This group of batteries is usually used when an improved life is required. This represents a 7.5 years design life with a production tolerance of ±1.5 years.
10 - 12 years: This group of batteries is used when in applications where longest life and highest safety level are required. This represents a 11 years design life with a production tolerance of ±1 year.

A battery failure within the specified design life of the battery usually results in a complete loss of the battery function (broken cell, defect connection, …) and will be detected and reported by the periodical battery tests which are included in the UB10.241 DC-UPS control unit.

If the operational parameters differ from those which are specified for the design life, an earlier change of the battery might be necessary. The “real life” is called service life and is defined as the point at which the cell’s actual capacity has reached 80% of its nominal capacity. At the end of the service life the capacity degrades much faster, so that a further use of the battery is not recommended.

Temperature effect:
The temperature has the most impact in the service life. The hotter the temperature, the earlier the wear-out phase of the battery begins. The wear-out results in a degradation of battery capacity. See Fig. 24-1 for details.

Effect of discharging cycles
The number as well as the depth of discharging cycles is limited. A replacement of the battery might be necessary earlier than the calculated service life if the battery exceeds the numbers and values of Fig. 24-2.

Other effects which shortens the service life:
- Overcharging and deep discharging shortens the service life and should be avoided. Thanks to the single battery concept of the UB10.241, the end-of-charge-voltage can be set very precisely to the required value a thereby avoiding unnecessary aging effects.
- Charge retention is important to get the longest battery life. Stored batteries which are not fully charged age faster then charged batteries. Batteries which are not in use should be recharged at least once a year.
- Excessive float charge ripple across the battery has an effect of reducing life and performance. The UB10.241 does not produce such a ripple voltage. This effect can be ignored when the battery is charged with the UB10.241.

Guidelines for a long battery service life:
- Place the battery in a cool location: E.g. near the bottom of the control cabinet.
- Do not place the battery near heat generating devices.
- Do not store discharged batteries.
- Do not discharge the battery more than necessary. Set buffer time limiter to the required buffer time.
- When choosing the battery capacity, always try to get the next higher capacity than required. The depth of discharge reduces the service life of the battery and limits the number of cycles. See Fig. 24-2.

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All parameters are specified at an input voltage of 24V, 10A output load, 25°C ambient and after a 5 minutes run-in time unless otherwise noted. It is assumed that the input power source can deliver a sufficient output current.
Example for calculating the service life and the required replacement cycle:

Parameters for the example:
- A 7Ah battery with a design life of 3-5 years is used (e.g. Yuasa battery from the battery module UZK12.072)
- The average ambient temperature is 30°C
- One buffer event consumes approx. 25% of the achievable buffer time.
- One buffer event per day

Calculation:
Ambient temperature influence:
According to Fig. 24-1 curve A, a 2 years service life can be expected for an ambient temperature of 30°C.
Number of discharging cycles: 2 years * 365 cycles = 730 cycles in 2 years.
According to Fig. 24-2, curve C has to be used (only 25% of battery capacity is required). 730 cycles have only a negligible influence in a battery degradation and can be ignored.

Result:
The battery shall be replaced after 2 years.
Please note that the battery degrading begins from the production date (check date code on the battery) which may shorten the replacement intervals.

24.2. PARALLEL AND SERIAL USE

Do not use the DC-UPS in parallel to increase the output power. However, two units of the DC-UPS can be paralleled for 1+1 redundancy to gain a higher system reliability.

Do not use batteries in parallel, since the battery quality test might create an error message.

Do not connect two or more units in series for higher output voltages.

Do not connect two or more units in a row to get longer hold-up times.
24.3. Using the Inhibit Input

The inhibit input disables buffering. In normal mode, a static signal is required. In buffer mode, a pulse with a minimum length of 250ms is required to stop buffering. The inhibit is stored and can be reset by cycling the input voltage.

For service purposes, the inhibit input can also be used to connect a service switch. Therefore, the inhibit signal can be supplied from the output of the DC-UPS.

![Wiring example for inhibit input](image)

24.4. Troubleshooting

The LEDs on the front of the unit and relay contacts indicate about the actual or elapsed status of the DC-UPS. Please see also chapter 12.

The following guidelines provide instructions for fixing the most common failures and problems. Always start with the most likely and easiest-to-check condition. Some of the suggestions may require special safety precautions. See notes in chapter 22 first.

- **“Check wiring” LED is on**
  - Check correct wiring between the battery and the DC-UPS
  - Check battery fuse. Is the battery fuse inserted or blown?
  - Check battery voltage (must be typically between 7.4V and 15.1V)
  - Check input voltage (must be typically between 22.8V and 30V)
  - Check battery polarity

- **DC-UPS did not buffer**
  - Inhibit input was set
  - Battery did not have enough time to be charged and is still below the deep discharge protection limit.

- **DC-UPS stopped buffering**
  - Buffer time limiter stopped buffering → set buffer time limiter to a higher value
  - Deep discharge protection stopped buffering → use a larger battery, or allow enough time for charging the battery
  - Output was overloaded or short circuit → reduce load

- **Output has shut down**
  - Cycle the input power to reset the DC-UPS
  - Let DC-UPS cool down, over temperature protection might have triggered.

- **DC-UPS constantly switches between normal mode and buffer mode**
  - The supplying source on the input is too small and can not deliver enough current → Use a larger power supply or reduce the output load