English

BICKER.de ELEKTRONIK

# User Manual | UPSI-2412D

UPS SYSTEM
DIN-RAIL


**Bicker Elektronik GmbH**
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## Legend of used symbols

| Symbol | Description |
|---|---|
|  | Attention! Important hazard warning. |
|  | Do not dispose of in the domestic waste. |
|  | Warning of electrical voltage. |

## Revision Directory

| Date | Change |
|---|---|
| 09.12.2020<br>Revision 0-1 | Initial version |
| 16.03.2021<br>Revision 1 | Release version |
| 17.10.2021<br>Revision 1-1 | Chapter „Software“ refused, Chapter „Status-LED“ new added |


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ELEKTRONIK
STATUS
+ - - +
OUT IN
RL
BAT PWR
BAT DATA
USB
RS232
TS
BS
UPSI
DC UPS
UPSI DC UPS

## A Brief specification

# UPSI-2412D

24 V DC / 10 A

- **Powerful 24 V DC USV (DIN rail version)**
- **Intelligent input current detection**
- **Regulated output voltage in battery mode**
- **Minimum load detection**
- **Power-fail timer function**
- **Relay dry contact on power fail**
- **Reboot function**
- **Fuel gauge**
- **Battery start function**
- **Shutdown via external signal**


| Technical Data | |
|---|---|
| Input voltage | 24 V DC (22.8…30 V) |
| Input current | 11 A max. |
| Output voltage | Normal mode: $V_{IN}$ – 0.6 V DC max. (depending on load)<br>Battery mode: 23.5 V DC |
| Output current | 10 A / 10.3…12 A for max. 10 s |
| Capacitive load | 10 000 µF (at start / 0 A output load) |
| Charging method | CC / CV / CP |
| Protection | Overcurrent protection at output<br>Short circuit protection at output |
| Interface | USB, RS232, HID UPS |
| Possible battery technology | LiFePO4, Supercaps (EDLC) |
| Ambient temperature | Operating: -20…+70 °C<br>Storage / Transport: -30…+70 °C |
| Operating altitude | ≤4000 m |
| Max. permitted humidity | ≤95 % (at +25 °C, no dew) |
| Dimensions W / H / D | 36 x 147 x 103 mm ±0.5 mm<br>(without front connectors and DIN-Rail mounting bracket) |
| Weight | 0.34 kg |

# B Introduction and description

**Read carefully before initial operation !**

This manual shall help the user to get familiar with the product and its components and features. It shall provide information as accurately and completely as possible.
The manual as well as all documents has to be read and followed strictly before installation. Otherwise in certain situations warranty and guarantee can be cancelled partly or completely. Any liability on the part of Bicker Elektronik is excluded for possible existing errors as well as non-compliance with the instructions for use and installation.

## B1 Description of the product and its functions

The UPSI-2412D (hereinafter also called UPS) is a DC / DC UPS system with numerous digital features and high performance. The UPS can be operated with different energy storage devices (hereinafter also called battery(s)), which are different in technology, capacity and chemistry. Only energy storage devices made by Bicker Elektronik are to be used, due to the charging settings are made according the recognization of the used battery type. The primary use of the UPS is to secure the supply during power failures and / or voltage fluctuations. The application which should be protected is connected to the output of the UPS.

The UPS requires a rated dimensioned power supply of 24 V DC at the input. After the input voltage is applied, the UPS works in normal mode automatically. The input voltage is passed through to the output and the connected energy storage device is charged simultaneously. The charging current depends dynamically on the load current at the UPS output. The green status LED lights up continuously when the UPS is in this state.

In the event of a voltage drop or a voltage fluctuation of the input voltage (below undervoltage limit), the UPS is switched to battery mode (also backup mode). In this state, the application at the UPS output is supplied via the energy storage device. The backup time (also buffer time) depends on the used energy storage, the value of the output current and the software settings of the UPS. An important feature is that the output voltage in battery mode is always regulated to 23.5 V DC and does not decrease as the voltage of the energy storage device drops. If the UPS operates in battery mode, the status LED is slowly flashing (1 Hz flashing). When the UPS is used with LiFePO4 battery and it is discharged completely in battery mode, the recharging has to happen as soon as possible.

When the input voltage returns, the UPS is automatically switched back to normal mode and charging of the energy storage device is continued.

The UPS can also be used for user-initiated shutdowns of the supply voltage or cycles. Application examples are the replacement of larger batteries in vehicles in which the electronics should continue to be supplied, the opening and closing of safety valves after a malfunction or the shutdown of a system.

## B2 Intended use

This device is designed to be installed into a suitable enclosure which protects against electrical, water and fire hazards and can then be used indoors and outdoors. It is primary built for being mounted on a DIN Rail and is intended for professional use in applications such as industrial control, communication and measurement technology. It must not be used in devices or equipment where a malfunction will cause serious injury or endanger human life.

## C Safety instructions

### WARNING!

Disregarding of following issues can result in electric shock, fire, serious injury or death.

1. Care must be taken to ensure proper and professional wiring.
2. The device pack must not be exposed to fire and temperatures outside the specification.
3. The device must not be immersed in water or exposed to splash water.
4. The device must not be operated in a humid environment or in an environment where dew and condensation are to be expected.
5. The device must not be opened, short-circuited, reversed, overheated or otherwise soldered / welded.
6. Changes or attempts to repair the device are to be omitted.
7. Effects of foreign objects on the device must be avoided (e.g. metal parts).
8. Do not put obviously damaged devices into operation (e.g. dents, burn marks, rough contamination).
9. Keep ventilation openings clear.
10. Device must not be dropped.
11. All parts of the device and accessories must not be eaten or swallowed.
12. A current limited source is to be used. The required current values for the UPS are described in this manual.
13. The UPS is supplied with voltage from both the input source and the energy storage. The latter is still energized even after the input source has been disconnected.

### ATTENTION!

1. Improper use and opening of the device will void the warranty.
2. The device may only be used as intended.
3. The national accident prevention and safety regulations must be observed.
4. The assembly of the device and the electrical installation have to be state of the art.
5. The electrical, thermal and mechanical limit values have to be observed.
6. The UPS wiring specifications - as described in this manual - have to be followed.

# D Technical Data

## D1 General Technical Data

| INPUT DATA – UPSI-2412D<br>Unless otherwise stated, all specifications apply to 25 °C ambient temperature, 24 V DC input voltage and nominal output current ($I_N$). | |
|---|---|
| Input voltage | 24 V DC |
| Input voltage range | 22.8 V DC…30 V DC |
| Electric strength max. | 35 V DC |
| **Fixed connect threshold**<br>Undervoltage<br>Voltage drop Input/Output | <br>21.6 V DC<br>0.6 V DC max. (depending on load) |
| **Current consumption**<br>$I_N$ ($U_N$, $I_{OUT} = I_N$, $I_{CHARGE} = 0$)<br>$I_{MAX}$ ($U_N$, $I_{OUT} = I_{STAT.BOOST}$, $I_{CHARGE}$ = max)<br>$I_{DYN}$ ($U_N$, $I_{OUT} = I_{DYN.BOOST}$, $I_{CHARGE} = 0$)<br>$I_{NO-LOAD}$ ($U_N$, $I_{OUT} = 0$, $I_{CHARGE} = 0$)<br>$I_{CHARGE}$ ($U_N$, $I_{OUT} = 0$, $I_{CHARGE}$ = max) | <br>10.1 A<br>11 A<br>12 A<br><100 mA<br>4.5 A |
| **Power consumption**<br>$P_N$ ($U_N$, $I_{OUT} = I_N$, $I_{CHARGE} = 0$)<br>$P_{MAX}$ ($U_N$, $I_{OUT} = I_{STAT.BOOST}$, $I_{CHARGE}$ = max)<br>$P_{DYN}$ ($U_N$, $I_{OUT} = I_{DYN.BOOST}$, $I_{CHARGE} = 0$)<br>$P_{CHARGE}$ ($U_N$, $I_{OUT} = 0$, $I_{CHARGE}$ = max) | <br>242 W<br>264 W<br>288 W<br>108 W |
| Internal input fuse | Yes (12 A) |
| Switch-on time | <5 s |
| Switch-on time battery start (BS) | <5 s |

| **OUTPUT DATA – UPSI-2412D (NORMAL MODE)**<br>Unless otherwise stated, all specifications apply to 25 °C ambient temperature, 24 V DC input voltage and nominal output current ($I_N$). | |
|---|---|
| Output voltage | 24 V DC |
| Output voltage range | $U_{OUT} = U_{IN}$ – 0.6 VDC max. (depending on load) |
| Capacitive load | 10 000 µF (at start / 0 A output load) |
| **Output current**<br>$I_N$<br>$I_{STAT.BOOST}$<br>$I_{DYN.BOOST}$<br>$I_{SFB}$ | <br>10 A<br>10.2 A<br>10.3…12 A for max. 10 s<br>30 A (5 ms) |
| **Output power**<br>$P_N$ ($U_N$, $I_{OUT} = I_N$, $I_{CHARGE} = 0$)<br>$P_{STAT.BOOST}$ ($U_N$, $I_{OUT} = I_{STAT.BOOST}$, $I_{CHARGE} = 0$)<br>$P_{DYN.BOOST}$ ($U_N$, $I_{OUT} = I_{DYN.BOOST}$, $I_{CHARGE} = 0$) | <br>234 W<br>239 W<br>241…280 W for max. 10 s |
| Short-circuit proof | Yes |
| No-load proof | Yes |
| Overcurrent shutdown | 10.3…12 A for max. 10 s; 12.1…16.3 A for max. 100 ms<br>>16.3 A for max. 5 ms |

| **OUTPUT DATA – UPSI-2412D (BATTERY MODE)**<br>Unless otherwise stated, all specifications apply to 25 °C ambient temperature, 24 V DC input voltage and nominal output current ($I_N$). | |
|---|---|
| Output voltage | 23.5 V DC |
| Output voltage range | n.a. |
| **Output current**<br>$I_N$<br>$I_{STAT.BOOST}$<br>$I_{DYN.BOOST}$<br>$I_{SFB}$ | <br>10 A<br>10.2 A<br>10.3…12 A for max. 10 s<br>30 A (5 ms) |
| **Output power**<br>$P_N$ ($U_N$, $I_{OUT} = I_N$, $I_{CHARGE} = 0$)<br>$P_{STAT.BOOST}$ ($U_N$, $I_{OUT} = I_{STAT.BOOST}$, $I_{CHARGE} = 0$)<br>$P_{DYN.BOOST}$ ($U_N$, $I_{OUT} = I_{DYN.BOOST}$, $I_{CHARGE} = 0$) | <br>235 W<br>240 W<br>242…282 W for max. 10 s |
| Short-circuit proof | Yes |
| No-load proof | Yes |
| Overcurrent shutdown | 10.3…12 A for max. 10 s; 12.1…16.3 A for max. 100 ms<br>>16.3 A for max. 5 ms |
| Load current for battery start (BS) | 7 A max. |
| Switching time normal mode > battery mode | <600 µs |

| CONNECTION DATA INPUT / OUTPUT | |
|---|---|
| Connection method | Screwable plug connector |
| Conductor cross-section solid | 0.205 $mm^2$ … 3.31 $mm^2$ (24 … 12 AWG) |
| Conductor cross-section flexible | 0.205 $mm^2$ … 3.31 $mm^2$ (24 … 12 AWG) |
| Conductor cross-section with ferrule | 0.205 $mm^2$ … 3.31 $mm^2$ (24 … 12 AWG) |
| Stripping length | 7 mm … 8 mm |
| Tightening torque | 0.5 Nm … 0.6 Nm |

| BATTERY CHARGE UNIT | |
|---|---|
| Charging method | CC / CV / CP |
| End-of-charge voltage | LiFePO4: 27.6 V / EDLC: 32 V |
| Charging current | max. 4.5 A |
| Battery technology | LiFePO4 / EDLC (Supercaps) |

| RELEASED ENERGY STORAGES | |
|---|---|
| BP-LFP-2725D | LiFePO4 / 25.6 V DC / 2.5 Ah / 64 Wh |
| BP-SUC-30090D | EDLC / 32 V DC / 13.5 kJ (9.0 kJ useful) / 3.75 Wh (2.5 Wh useful) |

| CONNECTION DATA – RELAY | |
|---|---|
| Connection labeling | RL |
| Switch contact (potential free) | Relay |
| Status (configurable) | Power Fail Alarm |
| Switching voltage | 24 V DC / 125 V AC |
| Current carrying capacity | 1 A (DC) / 0.5 A (AC) |
| State - signal assignment | NO (Normally Open) / NC (Normally Closed) – configurable via Software (see UPS Gen$^2$ software manual) |
| Switching time | 1500 ms max. |

| DATA INTERFACE – USB | |
|---|---|
| Interface designation | USB |
| Numbers of interfaces | 1 |
| Connection method | USB type B (female) |
| Locking | No |
| Transmission physics | USB 2.0 |
| Topology | Point-to-point |
| Protocol | VCOM, HID |
| Transmission length | ≤3 m |
| Access time | <1 s |
| Chipset | NXP |
| Electrical isolation | No |

| DATA INTERFACE – RS232 | |
|---|---|
| Interface designation | RS232 |
| Numbers of interfaces | 1 |
| Connection method | DSUB 9-Pin (female) |
| Locking | No |
| Transmission physics | RS232 light (TX / RX) |
| Topology | Point-to-point |
| Symbol rate (baud rate) | 38400 |
| Type of cable | 1:1 |
| Transmission length | ≤10 m |
| Access time | <1 s |
| Voltage level | -6 V DC … +6 V DC |
| Electrical isolation | No |

| GENERAL DATA | |
|---|---|
| Flammability class according to UL 94 (housing / terminal blocks) | V0 |
| Weight | 0.34 kg |
| UPS connection in parallel | No |
| UPS connection in series | No |

| HOUSING | |
|---|---|
| Degree of protection | IP 20 |
| Protection class | III (without PE) |
| Mounting type | DIN-Rail mounting (EN 60715) |
| Housing version | Aluminium |
| Dimension W / H / D | 36 mm / 147 mm / 103 mm ±0.5 mm (without front connectors and DIN-Rail mounting bracket) |

| ENVIRONMENTAL CONDITIONS | |
|---|---|
| Ambient temperature (operation) | -20… +70 °C |
| Ambient temperature (start up without load) | -30 °C |
| Ambient temperature (storage / transport) | -30… +70 °C |
| Max. permitted humidity | ≤95 % (at +25 °C, no dew) |
| Operating altitude | ≤4000 m |
| Climate class | 3k3 (EN 60721) |
| Degree of pollution | 2 |
| **Overvoltage category**<br>EN 61010-1<br>EN 61010-2-201 | <br>I<br>I |
| Indoor / Outdoor use | Yes / Yes (in housing) |

| STANDARDS | |
|---|---|
| Safety extra-low voltage | IEC 61010-1 (SELV)<br>IEC 61010-2-201 |

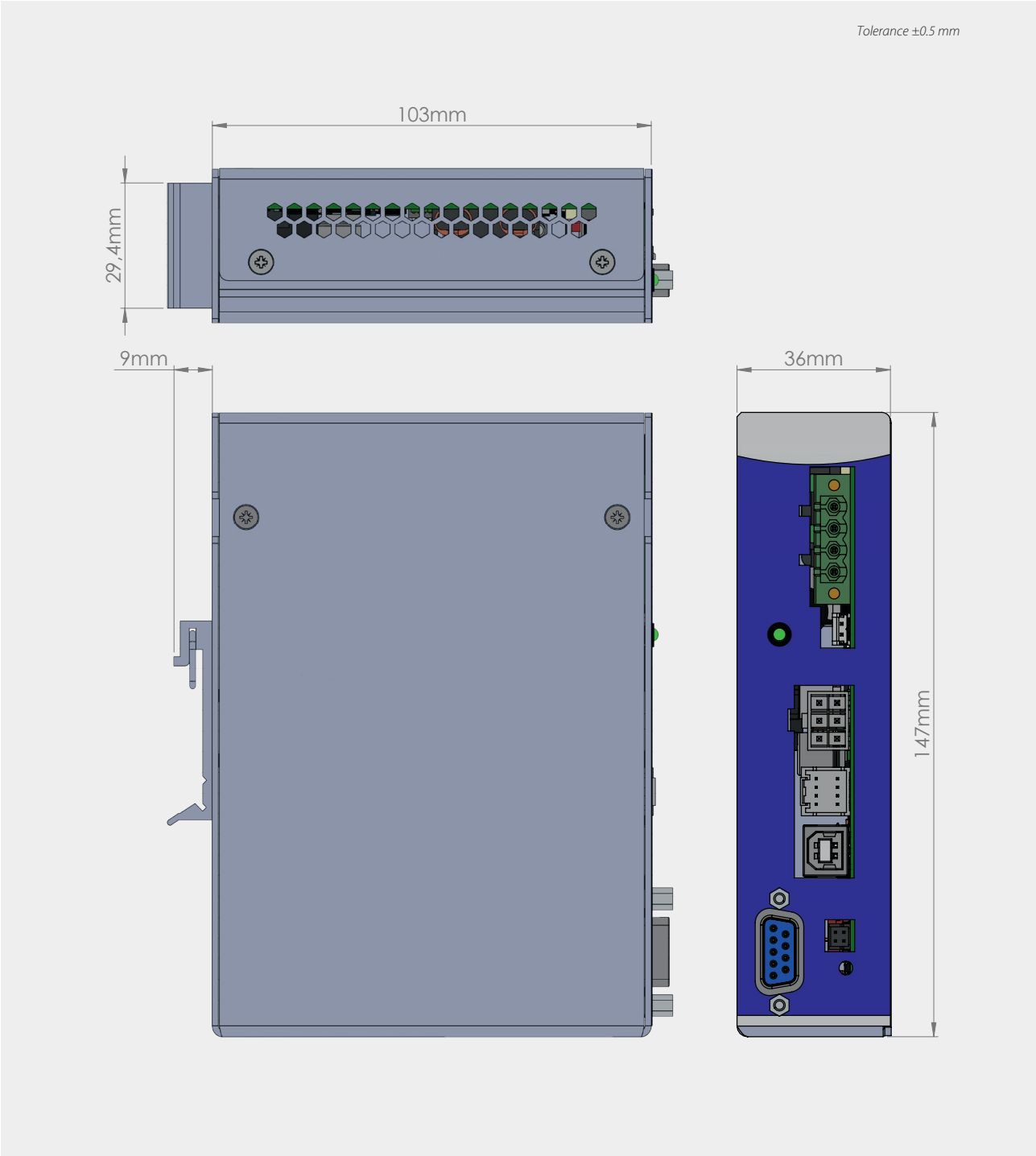
| APPROVALS | |
|---|---|
| UL | n.a. (possible upon consultation) |
| CSA | |
| CB Scheme | |

| INTERFERENCE IMMUNITY ACCORDING TO EN 61000 (INDUSTRY) | |
|---|---|
| **Basic standard CE** | **Fulfilled requirements according to EN 61000 (CE) (Interference immunity of industrial environment)** |
| Electrostatic discharge<br>EN 61000-4-2 | |
| Contact discharge | 4 kV |
| Air discharge | 8 kV |
| Comment | Criterion A |
| Electromagnetic HF field<br>EN 61000-4-3 | |
| Frequency range | 80 MHz … 1 GHz |
| Test field strength | 10 V/m |
| Frequency range | 1.4 GHz … 2 GHz |
| Test field strength | 3 V/m |
| Comment | Criterion A |
| Fast transients (Burst)<br>EN 61000-4-4 | |
| Test voltage | 2 kV |
| Comment | Criterion A |
| Surge voltage load (Surge)<br>EN 61000-4-5 | |
| Test voltage L–N | ±1 kV |
| Test voltage L–PE, N–PE | ±2 kV |
| Comment | Criterion A |
| Induced radio-frequency fields<br>EN 61000-4-6 | |
| Frequency range | 0.15–80 MHz |
| Test level | 10 V; 150 Ω source impedance; AM80 % / 1 kHz (sine) |
| Comment | Criterion A |
| Power frequency magnetic field immunity<br>EN 61000-4-8 | |
| Test level | 30 A/m |
| Comment | Criterion A |

| EMISSION ACCORDING TO EN 61000-6-4 (INDUSTRY) | |
|---|---|
| **Basic standard CE** | **Fulfilled requirements according to EN 61000-6-4 (CE) (Industrial environment)** |
| Conducted emission from the power port EN 61000-6-4<br>Frequency range<br>Comment | <br><br>150 kHz–30 MHz<br>Conform |
| Electric field radiated emission EN 61000-6-4<br>Frequency range<br>Comment | <br><br>30 MHz–1 GHz<br>Conform |

| LEGEND | |
|---|---|
| Criterion A | Normal operating behaviour within the defined limits. |
| Criterion B | Temporary impairment of the operating behaviour, that is corrected by the device itself. |

## D2 Drawing




## E Name / Address / Support E-Mail / Phone number of the manufacturer

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E-Mail: support@bicker.de · Tel.: +49 (0) 906 70595-0

# F General Data

## F1 Assembly and installation advice

**Installation and operation of this device is only allowed to be executed by a qualified electrician!** The application has to be separated from any power during the mounting process. Wires have to be connected safely and must not have contact with sharp edges. Pay attention to correct polarity! Before commissioning, check all the connections for correctness!

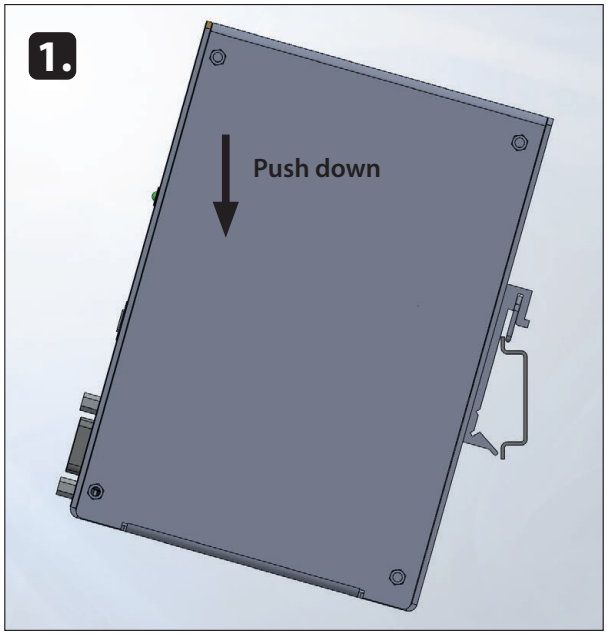
## F2 Convection and installation position

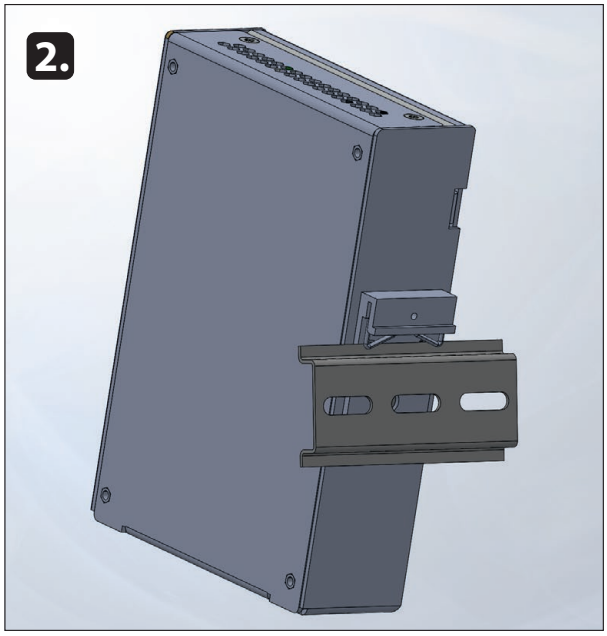
For this DIN rail version, vertical mounting on a horizontal rail (DIN rails according to EN 60715) is recommended in order to achieve the best possible convection of the UPS. Another mounting position is possible, but operation up to +70 °C ambient temperature can not be guaranteed.
Make sure that no ventilation holes are covered by other, neighboring components and devices.

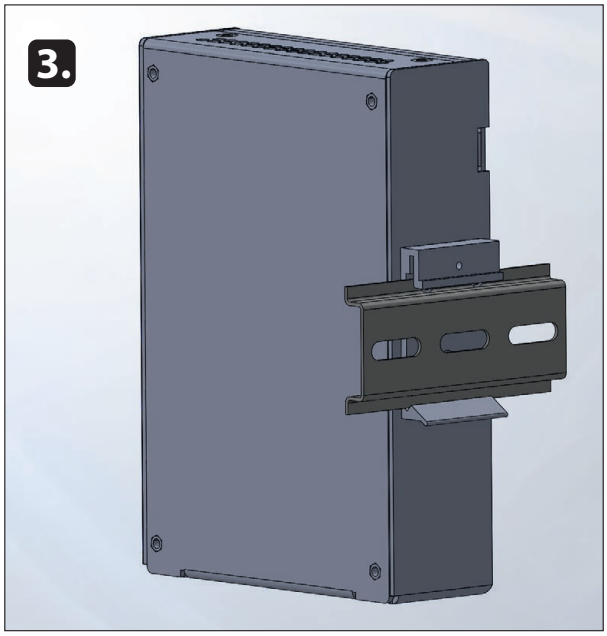
The following distances to neighboring devices are recommended:
Left / right: 20 mm
Top / bottom: 50 mm

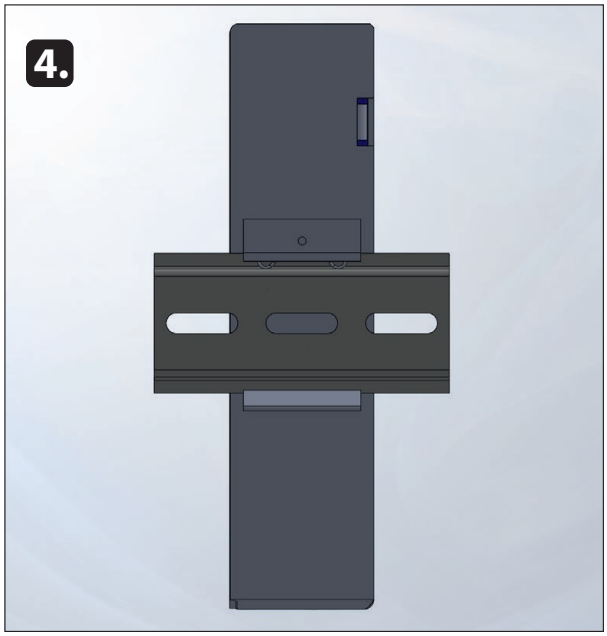

The devices comply with the IP protection class 20.

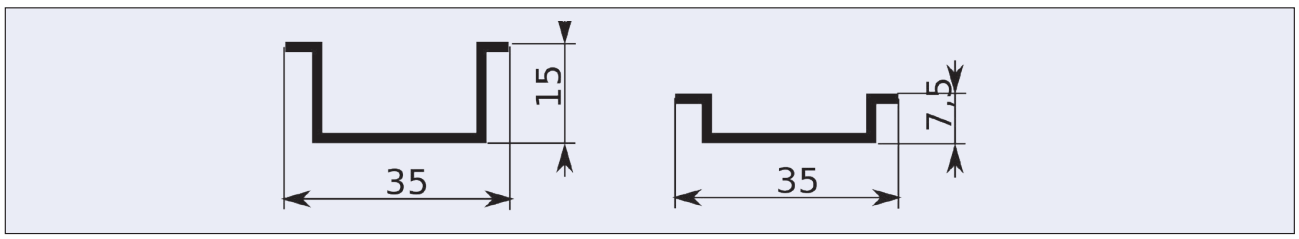
## DIN-Rail mounting and DIN-Rail profile according to EN 60715



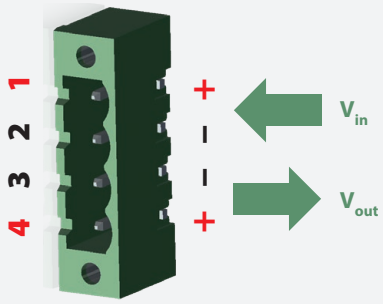



# F3 Description of connectors

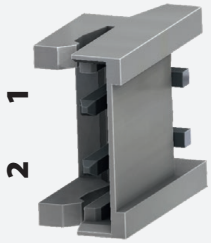
## INPUT & OUTPUT (IN & OUT)




| PIN | FUNCTION |
|---|---|
| 1 | Vin + |
| 2 | Vin – |
| 3 | Vout – |
| 4 | Vout + |

## RELAY CONNECTION (RL)

The function of the relay connection is configurable via software. When closing the relay the resistor value between both contacts is approx. 0 Ω, otherwise they are „open load“.




| PIN | FUNCTION |
|---|---|
| 1 | Relay contact 1 |
| 2 | Relay contact 2 |

## RS-232

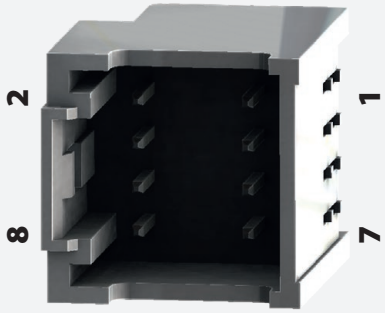
To enable PIN 8, PIN 1 has to be permanently switched to PIN 5 (GND).


| PIN | FUNCTION |
|---|---|
| 1 | PIN 8 ENABLE |
| 2 | TXD |
| 3 | RXD |
| 4 | DSR |
| 5 | GND |
| 6 | DTR |
| 7 | NC |
| 8 | +5 V (4.9 V at 20 mA / 4.6 V at 50 mA) |
| 9 | NC |

## BATTERY POWER (BAT PWR)


| PIN | FUNCTION |
|---|---|
| 1 | Battery – |
| 2 | Battery – |
| 3 | Battery – |
| 4 | Battery + |
| 5 | Battery + |
| 6 | Battery + |

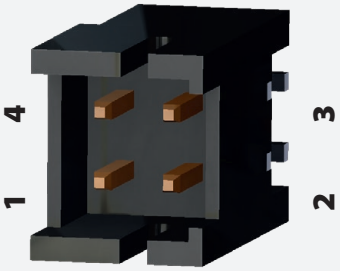
## BATTERY DATA (BAT DATA)




| PIN | FUNCTION |
|---|---|
| 1 | Internal temperature sensor to energy storage, connector 1 |
| 2 | $I^2C$_0-SCL |
| 3 | Internal temperature sensor to energy storage, connector 2 |
| 4 | $I^2C$_0-SDA |
| 5 | NC |
| 6 | SP0 (battery Enable) |
| 7 | +5 V (max. 50 mA) |
| 8 | GND |

| BATTERY TYPE | USED PINS |
|---|---|
| LiFePO4 | 2, 4, 6, 8 |
| Supercap | 1, 2, 3, 4, 6, 7, 8 |

## TEMPERATURE SENSOR (TS)




| PIN | FUNCTION |
|---|---|
| 1+4 | Temperature sensor, external, connector 1 |
| 2+3 | Temperature sensor, external, connector 2 |

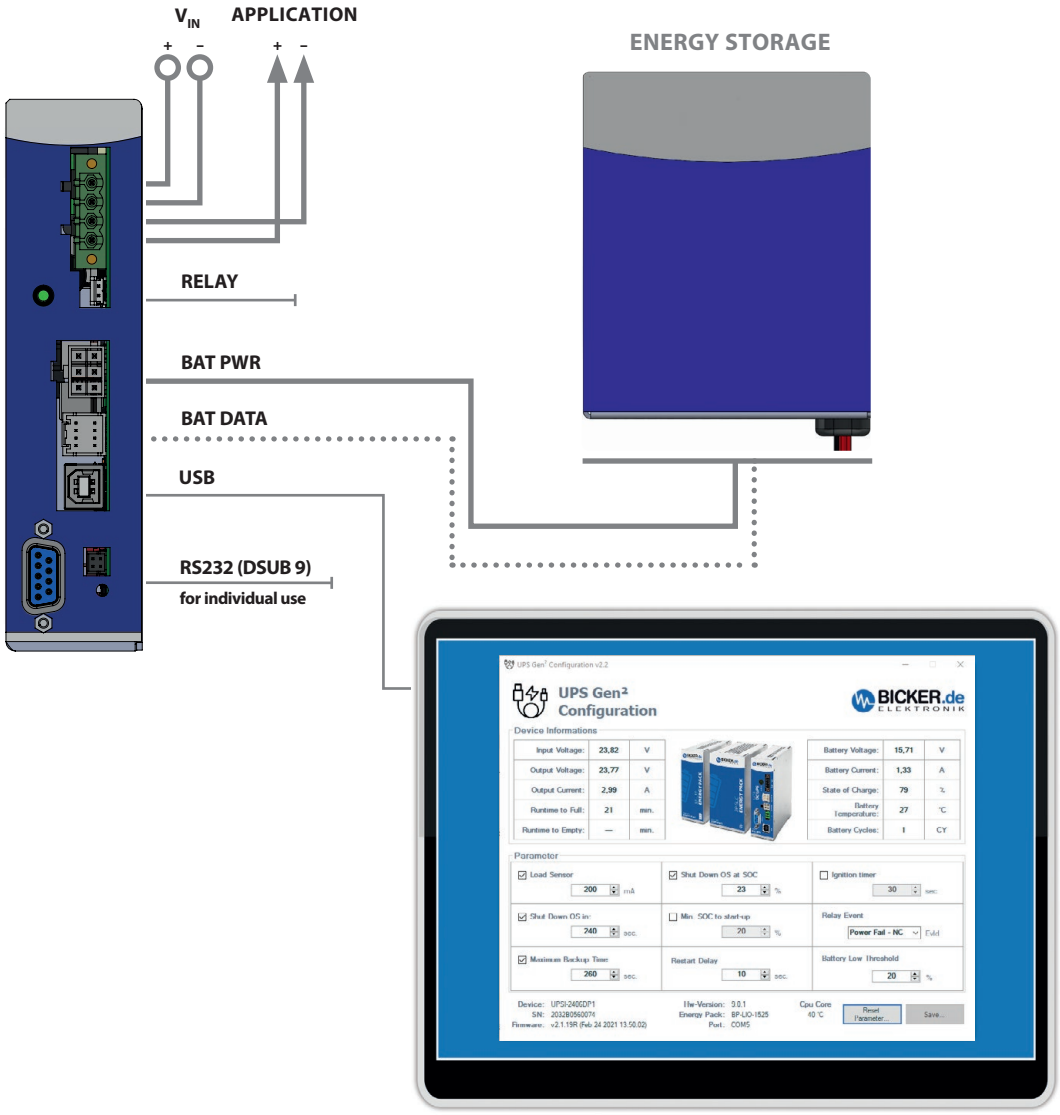
## F4 Dimensioning the upstream power supply

Ensure that the upstream power supply is correctly dimensioned to guarantee the charging process of the batteries and the correct functioning of the application. The input has to be supplied from a SELV or PELV power supply. In order to operate the UPSI-2412D with complete functionality, the upstream power supply has to provide at least 24 V / 20 A and use **no** constant current function.

If less load than the maximum load is required at the output, the voltage supply can be dimensioned according to the table below (column 3).

| UPSI-2412D | | |
|---|---|---|
| $I_{LOAD}$ [A] | $I_{CHARGE}$ [A] | $I_{IN-MIN}$ [A] |
| 0 | 4.5 | 5 |
| 1 | 4 | 5.5 |
| 2 | 3.7 | 6 |
| 3 | 3.4 | 7 |
| 4 | 3 | 7.5 |
| 5 | 2.6 | 8 |
| 6 | 2.3 | 9 |
| 7 | 1.8 | 9.5 |
| 8 | 1.6 | 10 |
| 9 | 1.2 | 11 |
| 10 | 1.0 | 12 |

## F5 Connecting diagram




**CONNECTING ORDER**

1. BAT PWR
2. BAT DATA
3. APPLICATION ($V_{OUT}$)
4. DC SOURCE ($V_{IN}$)
5. RELAY / USB / RS232

**Dismantling order reverse to connection!**

**$V_{IN}$/$V_{OUT}$ – ATTENTION!**

1. Note polarity!
2. AWG16 wire should be used (1.5 mm²)

## F6 Initial operation

The correct installation of UPS and energy storage has to be ensured. The energy storage can be unplugged and exchanged at any time in compliance with the connecting order (see chapter F5 „Connecting diagram“). There are three connections to consider: a data connection to the battery (BAT DATA), a power supply to the battery (BAT PWR) and the input / output to the UPS.

After connecting a charged energy storage, the start can take place in two ways:

1. **By connecting the supply voltage (standard):**
   If a voltage more than 22.8 V is connected to the input terminals, the energy storage is queried and transmits its data. The UPS sets the appropriate end-of-charge voltage and releases the pack via system present. After that, the charging of the energy storage starts.

OR

2. **Starting the battery from the energy storage into battery mode (alternative):**
   By pressing the BS button for more than 2 seconds (max. 5 s). See also chapter F12 „Battery start“.

Only energy storages by Bicker Elektronik may be used. These are appropriately qualified and have the necessary protective functions. In addition, the charging methods are set using internal codes and settings.

The applied voltage at the input of the UPS is passed through to the output, reduced by a current-dependent voltage drop ($V_{OUT} = V_{IN}$ - 0.6 V at maximum current). The device charges the energy storage and monitors the upstream voltage thresholds at the input (UPS function).

It must be ensured that the source supplies enough current to guarantee the charging process (see chapter F4 „Dimensioning the upstream power supply“).

Even after disconnecting the upstream source and also no voltage is measurable at the output, the UPS can be still powered by the energy storage.

## F7 Overview connector / Counterpart with description / Scope of delivery

| CONNECTOR | PART NO. | COUNTERPART NO. |
|---|---|---|
| $V_{IN}/V_{OUT}$ | Würth Elektronik 691317510004 | Würth Elektronik 691340500004 |
| RL | Würth Elektronik 68800211722 | Würth Elektronik 688002113322 |
| USB | Würth Elektronik 61400416121 | USB type B connector |
| RS232 | D-Sub9 Female | D-Sub 9 Male |
| BAT PWR | Würth Elektronik 64900629522 | Würth Elektronik 649006113322 |
| BAT DATA | Würth Elektronik 62400821722 | Würth Elektronik 624008213322 |
| TEMP SENSOR | Hirose DF11-4DP-20S | Hirose DF11-4DS-2C |

| SCOPE OF DELIVERY | |
|---|---|
| **QUANTITY** | **DESCRIPTION** |
| 1x device | UPSI-2412D - DC UPS |
| 1x | $V_{IN}$ / $V_{OUT}$ connector counterpart |
| 1x | Relay cable, 50 cm, AWG 22 |

## F8 Charging time

Charging times depend on energy storage, input voltage and the load current.

## F9 Reverse polarity / Overcurrent / Short circuit

Reverse polarity:
The device has passive reverse polarity protection at the input. In the event of reverse polarity, the input fuse trips irreversibly and the device goes into a safe state.

Overcurrent:
If the load current at the output is too high, the device switches it off. For maximally allowed current values and peak current values refer to chapter D „Technical Data". The status LED indicates the error status by means of a very rapid flashing sequence. A restart attempt occurs every 10 seconds in normal mode. During battery mode there is no restart attempt.

Short circuit:
In the event of a short-circuit at the output of the UPS, the output is immediately disconnected (<5 ms). The status LED indicates the error status by means of a very rapid flashing sequence. A restart attempt occurs every second in normal mode (non-latch). During battery mode there is no restart attempt. The impact of a short-circuit to the device depends on length and diameter (impedance) of the output wiring. In case of a short-circuit directly at the plugs a damage of the device can occur.

## F10 Backup time in battery mode

The nominal backup times can be found within the user manuals or the datasheets of the used energy storages. At extreme low or high temperatures a reduction of the nominal backup times can occur.

## F11 Behaviour in case of exceeding maximum backup time

When the given buffering times are exceeded, the output is separated on the basis of the discharge voltage of the corresponding energy storage (total discharge protection).
With supercapacitors in particular, an additional switch-off threshold can take effect if the discharge current of the energy storage device is too high (>15 A). This can occur at very high load currents at the output of UPSI-2412D. The lower the voltage of the energy storage device decreases, the higher the discharge current so that a constant power is ensured at the output of the UPS.

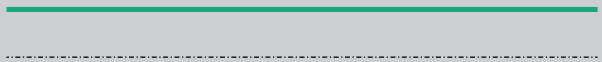
If the allowable output current during battery mode exceeds more than 70%, the converter switches off first, without separating the output immediately. In this case, the voltage at the output of the UPSI-2412D can drop significantly below 23.5 V. This condition should be avoided by shutting down the system in time.

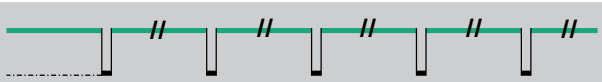
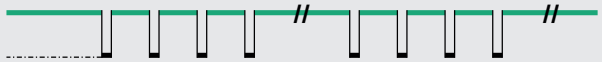
## F12 Battery start

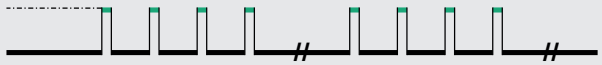
This function enables the application or the device to be started from the battery up to a maximum load current of 7 A without the power supply being available or connected. To do this, the BS button has to be pressed through the hole in the front of the housing with a fine object (thin screwdriver or similar) for more than 2 seconds (max. 5 s). This is usually only useful with a BP-LFP-2725 (D), because with supercapacitors the chemically induced self-discharge does not allow a battery start already after a few minutes.

## F13 Status LED

Valid from firmware version 2.2.6

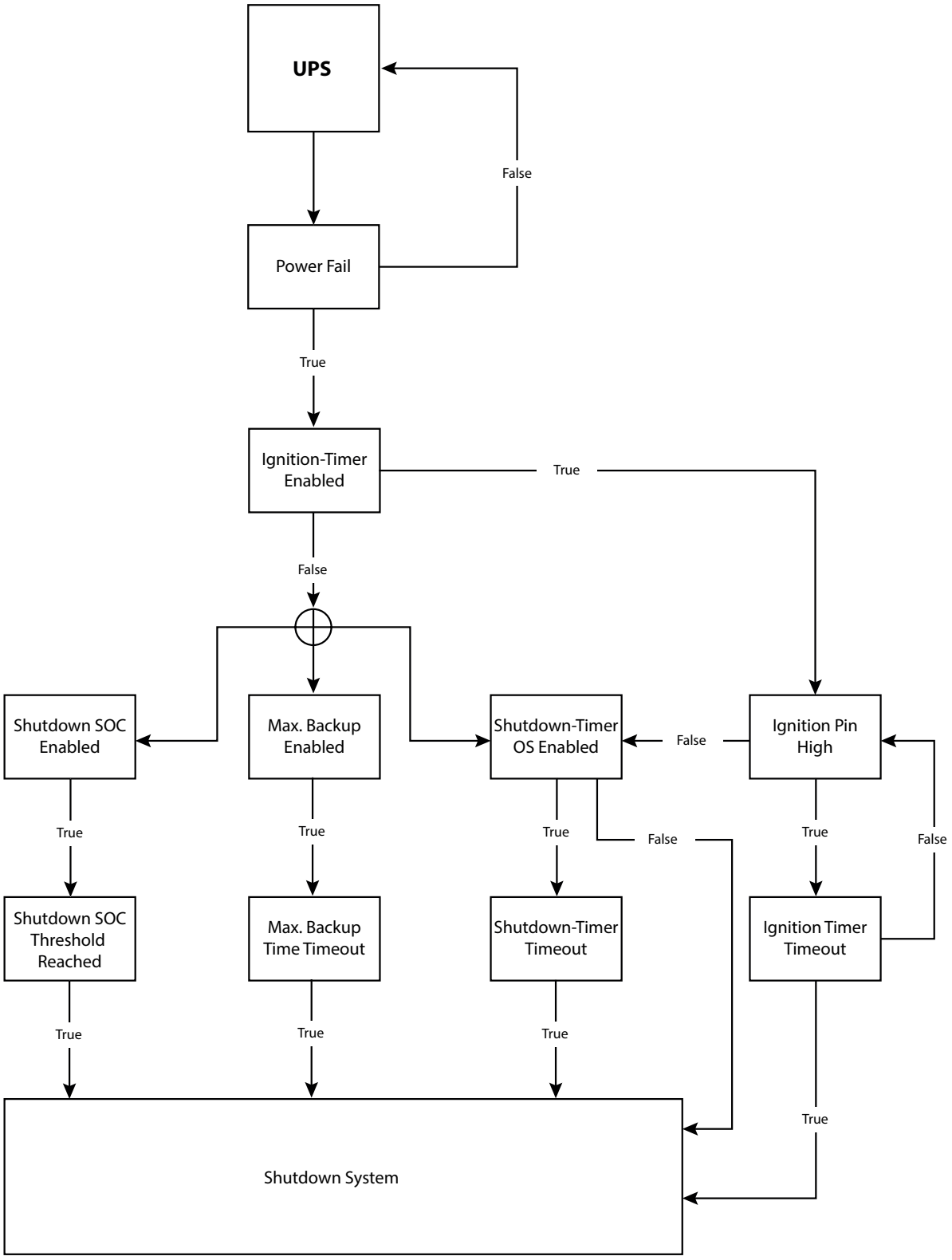
| MAIN STATES | | |
|---|---|---|
|  | Always on | **Status: mains voltage**<br>>> Mains voltage is present. |
|  | 1 Hz flash<br>(1 s on, 1 s off) | **Status: Battery mode**<br>>> Mains voltage is not present. |

| INTERNAL STATES | | |
|---|---|---|
|  | 1 x flash (LED is off briefly), pause 2 s | **Status: Battery start**<br>>> Manual start from the battery by pressing the BS button. |
|  | 2 x flash (LED is off briefly), pause 2 s | **Status: Capacity not reached**<br>>> Capacity is required. Output is only activated when the battery is charged to set SOC. |
|  | 3 x flash (LED is off briefly), pause 2 s | **Status: Shutdown**<br>>> UPS has received a shutdown signal and is waiting until the set load sensor value has fallen below. |
|  | 4 x flash (LED is off briefly), pause 2 s | **Status: Reboot**<br>>> Output is deactivated and time until reboot runs (Reboot phase). |

| BATTERY FAILURES | | |
|---|---|---|
|  | 1 x flash (LED is off a long time), pause 2 s | **Status: No battery detected** |
|  | 2 x flash (LED is off a long time), pause 2 s | **Status: Battery overvoltage**<br>>> Charge voltage at battery is too high, battery is deactivated. |
|  | 3 x flash (LED is off a long time), pause 2 s | **Status: Battery overcurrent**<br>>> Charge current at battery is too high, battery is deactivated. |
|  | 4 x flash (LED is off a long time), pause 2 s | **Status: Battery temperature failure**<br>>> Battery temperature sensor was not detected or battery temperature is too high or low. |

| UPS FAILURES | | |
|---|---|---|
|  | Quick flashing without pause | **Status: UPS failure**<br>>> Output current too low, UPS is deactivated.<br>>> Overcurrent at output (charge current too high), output is deactivated<br>>> Short circuit at output, output is deactivated<br>>> Internal failure, UPS is deactivated. |

## F14 Shutdown diagram



## F15 Recommendations for a long UPS service life

Over time, the capacity of the Supercaps decreases and the ESR (equivalent series resistance) increases. However, EOL is often defined as a reduction in capacity to 70 % and a doubling of the ESR. An important aspect for the aging of the Supercaps is the end-of-charge voltage and the operating temperature.

LiFePO4 batteries also age over time depending on cycles, operating temperature and the level of the end-of-charge voltage. The end-of-charge voltages are optimized so that they are at an optimium between service life and performance.

To extend the lifetime of the system, the UPS and energy storage should not be placed near sources of heat and should be placed within good air-circulation. When using LiFePO4 batteries, a larger capacity than actually required should always be used. The less deep the packs are discharged, the longer the service life lasts.

## F16 Maintenance

The UPS contains no serviceable parts. In case of a malfunction the upstream power source has to be disconnected, the battery and cables have to be removed. Use a dry cloth for cleaning!

## F17 Disposal

Electric and electronic devices must not be disposed with domestic waste! Please consider to each country's own regulation about recycling and disposal of used batteries at the end of their lifetime or resending to any recycling organization.

## F18 Disclaimer

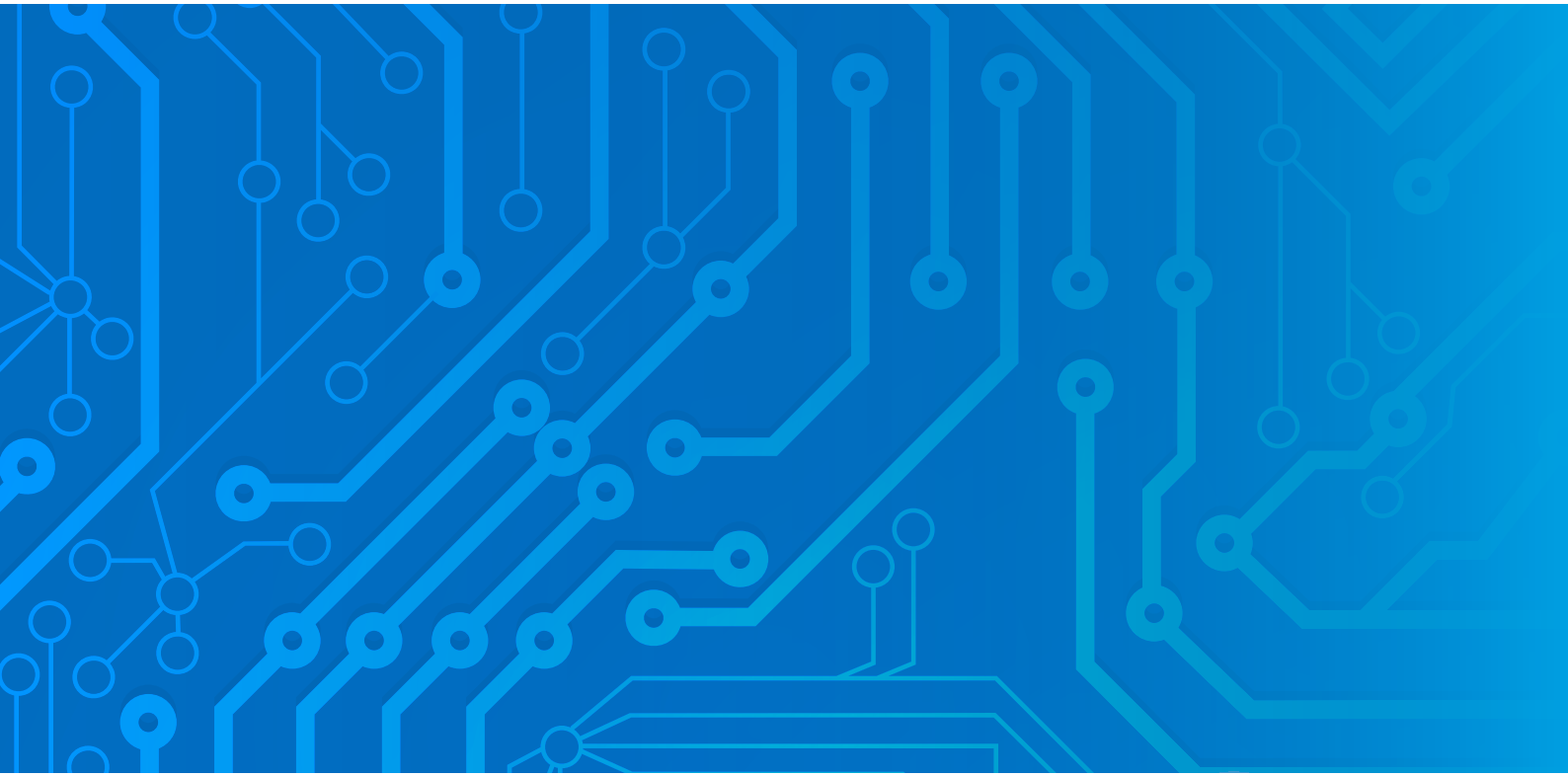
We, the Bicker Elektronik GmbH, have checked the contents of this document for compliance with the hardware and software described. Nevertheless, deviations can not be ruled out, so we assume no liability for the complete agreement. The information in this publication is checked regularly, necessary corrections are included in the updated versions.

Suggestions for improvement as well as tips and criticism are always welcome.

## F19 Preventive measures and rules when operating the UPS system

The voltage drop of the supply line has to be kept in mind! The maximum charge current can cause huge voltage drops if too long supply lines are used. If the voltage drop is too high a shortfall of the threshold values is possible and a not intended Power Fail could be caused. With maximum load the voltage at the input of the device must not undercut 22.8 V.
Even after the upstream supply has been disconnected, the device continues to run for some time after the shortfall of the load sensor (setting of a threshold value for current: currents below this value will be classified as „system off“ (no load)).

A short direct at the output of the device can cause damage or destruction of the UPS. In the event of a fault, electrolytes can escape in liquid and gaseous form.




Status as at: 17.10.2021 – Revision 1-1

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