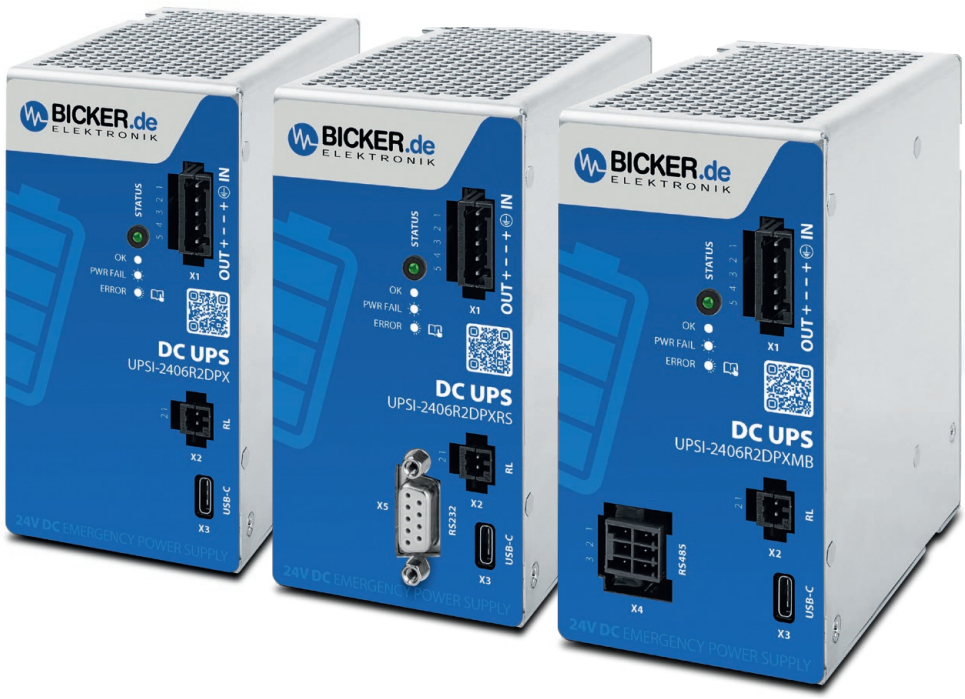
English

# User Manual | UPSI-2406R2DPx




## UPS SYSTEM
## DIN-RAIL

**Bicker Elektronik GmbH**
Ludwig-Auer-Straße 23 | 86609 Donauwörth · Germany

## 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 |
|---|---|
| 12.04.2024<br>Revision 0-1 | Initial version |
| 18.08 .2026<br>Revision 1-0 | Release version |

## Declaration of nomination

**UPSI - 2406 R2 - DPx**

- *Basic name for USV*
- *24V, 6A*
- *Revision 2*
- *DP1 – Lithium-Ion*
- *DP2 – Supercaps*
- *DP3 – LiFePO4*

| NAME | TYPE OF BATTERY | USB | RS-232 | RS-485 |
|---|---|---|---|---|
| UPSI-2406R2DP1 | Lithium-Ion | X | | |
| UPSI-2406R2DP1RS | Lithium-Ion | X | X | |
| UPSI-2406R2DP1MB | Lithium-Ion | X | | X |
| UPSI-2406R2DP2 | Supercaps | X | | |
| UPSI-2406R2DP2RS | Supercaps | X | X | |
| UPSI-2406R2DP2MB | Supercaps | X | | X |
| UPSI-2406R2DP3 | LiFePO4 | X | | |
| UPSI-2406R2DP3RS | LiFePO4 | X | X | |
| UPSI-2406R2DP3MB | LiFePO4 | X | | X |

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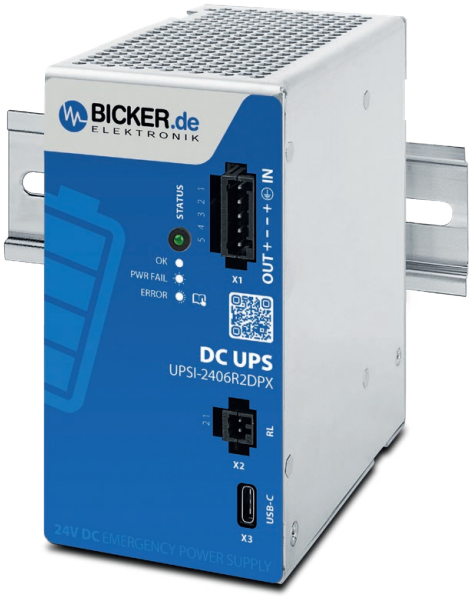
**F Name / Address / Support E-Mail / Phone number of the manufacturer ... 44**

## A Brief specification

# UPSI-2406R2DP1

24 V DC / 4 A

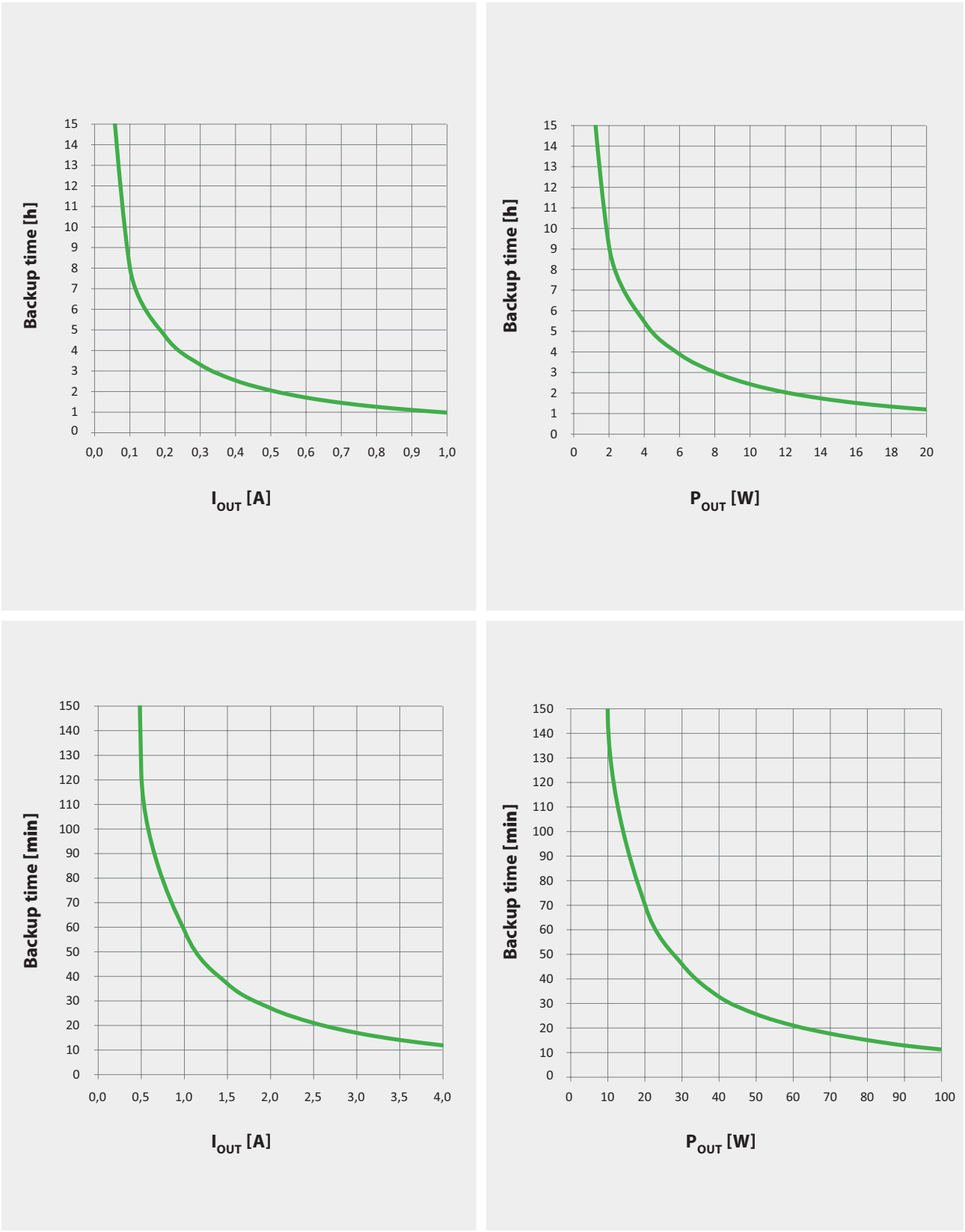
- **24 V DC UPS (DIN-Rail version)**
- **Integrated Li-Ion battery**
- **Up to 500 cycles**
- **Capacity: 37 Wh**
- **Intelligent input current detection**
- **Regulated output voltage in battery mode**
- **Minimum load detection**
- **Power-fail timer function**
- **Relay dry contact on power fail**
- **Reboot function**
- **Fuel gauge**
- **Shutdown via external signal**




*The picture is exemplary for all models of the DP1 series*

| Technical Data | |
|---|---|
| Input voltage | 24 V DC (23…30 V) |
| Input current | 4.8 A max. |
| Output voltage | Normal mode: $V_{IN}$ – 0.5 V DC max. (depending on load)<br>Battery mode: 23.5 V DC |
| Output current | 4 A nominal |
| Capacitive load | 3000 µF (in normal mode, at start, 0 A load) |
| Charging method | CC / CV / CP |
| Protection | Input: Reverse polarity protection<br>Output: Overcurrent protection, Short circuit protection |
| Interface | USB, HID-UPS, *RS-232 (optional), RS-485 (optional)* |
| Battery technology | Li-Ion 2.5 Ah / 37 Wh |
| Ambient temperature | Operating 0…+50 °C<br>Storage / Transport -20…+50 °C |
| Operating altitude | ≤4000 m |
| Max. permitted humidity | ≤95 % (at +25 °C, no dew) |
| Dimensions W / H / D | 63 x 120.5x 105 mm<br>(without front connectors and DIN-Rail mounting bracket) |
| Weight | 0.52 kg |

## Backup time* UPSI-2406R2DP1 – Battery type: Lithium-Ion

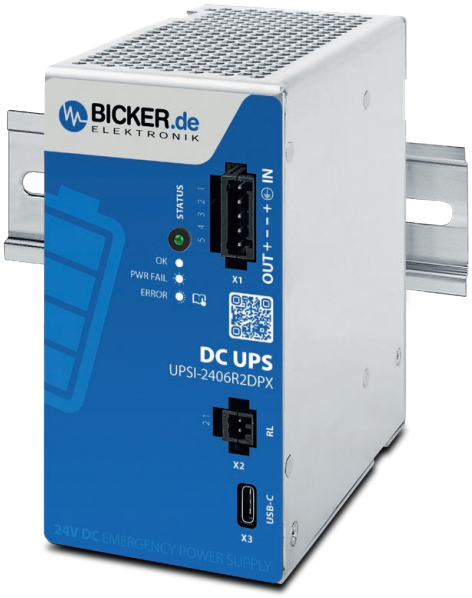



**Backup time depends on battery capacitance, load and temperature. At very high or low temperatures a reduction of backup time occurs. Unless otherwise specified, the values apply to measurements at +25 °C*

# UPSI-2406R2DP2

24 V DC / 6 A

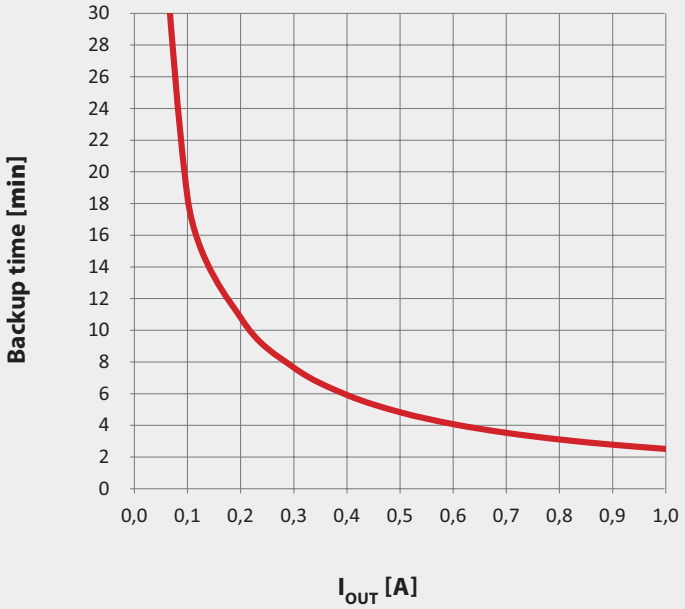
- **24 V DC UPS (DIN-Rail version)**
- **Integrated Supercaps**
- **Up to 500 000 cycles**
- **Capacity: 5.73 kJ**
- **Intelligent input current detection**
- **Regulated output voltage in battery mode**
- **Minimum load detection**
- **Power-fail timer function**
- **Relay dry contact on power fail**
- **Reboot function**
- **Fuel gauge**
- **Shutdown via external signal**

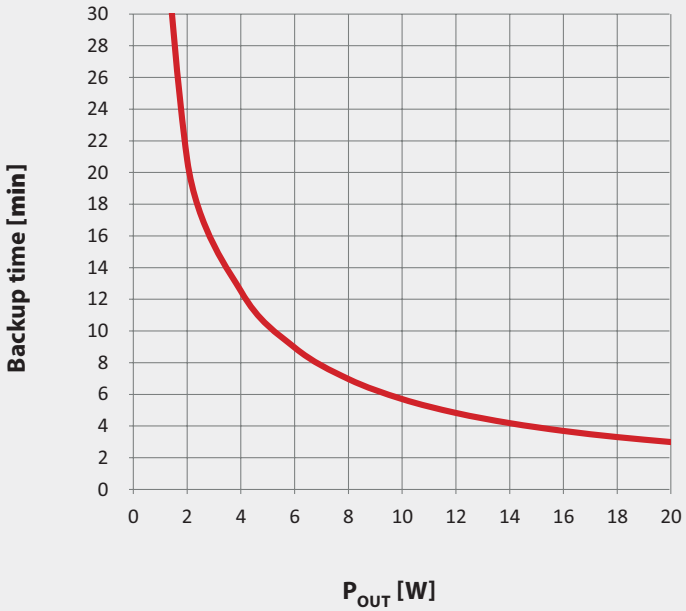



*The picture is exemplary for all models of the DP1 series*

| Technical Data | |
|---|---|
| Input voltage | 24 V DC (23…30 V) |
| Input current | 6.2 A max. |
| Output voltage | Normal mode: $V_{IN}$ – 0.5 V DC max. (depending on load)<br>Battery mode: 23.5 V DC |
| Output current | 6 A nominal |
| Capacitive load | 3000 µF (in normal mode, at start, 0 A load) |
| Charging method | CC / CV / CP |
| Protection | Input: Reverse polarity protection<br>Output: Overcurrent protection, Short circuit protection |
| Interface | USB, HID-UPS, *RS-232 (optional), RS-485 (optional)* |
| Battery technology | EDLC 5.73 kJ (3.88 kJ useful) / 1.59 Wh (1.08 Wh useful) |
| Ambient temperature | Operating: -20…+65 °C<br>Storage / Transport: -30…+65 °C |
| Operating altitude | ≤4000 m |
| Max. permitted humidity | ≤95 % (at +25 °C, no dew) |
| Dimensions W / H / D | 63 x 120.5x 105 mm<br>(without front connectors and DIN-Rail mounting bracket) |
| Weight | 0.6 kg |

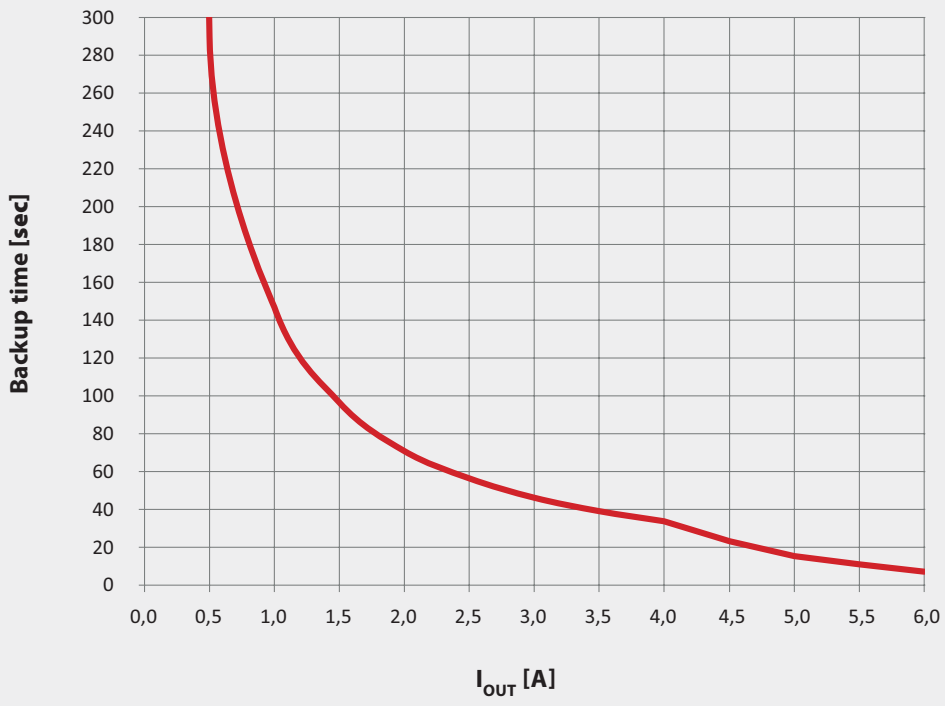
## Backup time* (1/2) UPSI-2406R2DP2 – Battery type: EDLC (Supercaps)

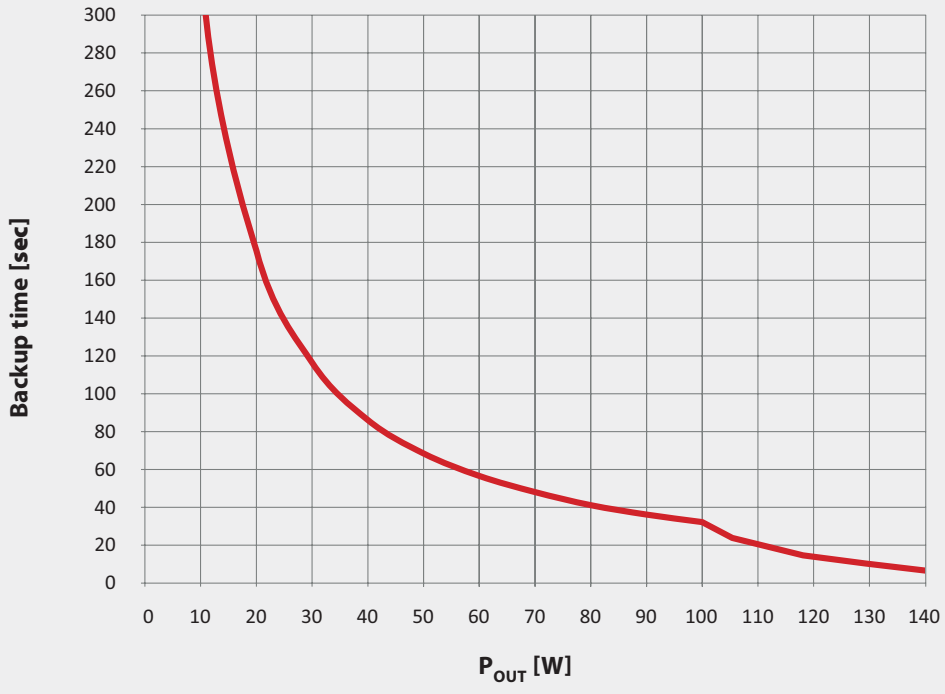



**Backup time depends on battery capacitance, load and temperature. At very high or low temperatures a reduction of backup time occurs. Unless otherwise specified, the values apply to measurements at +25 °C*

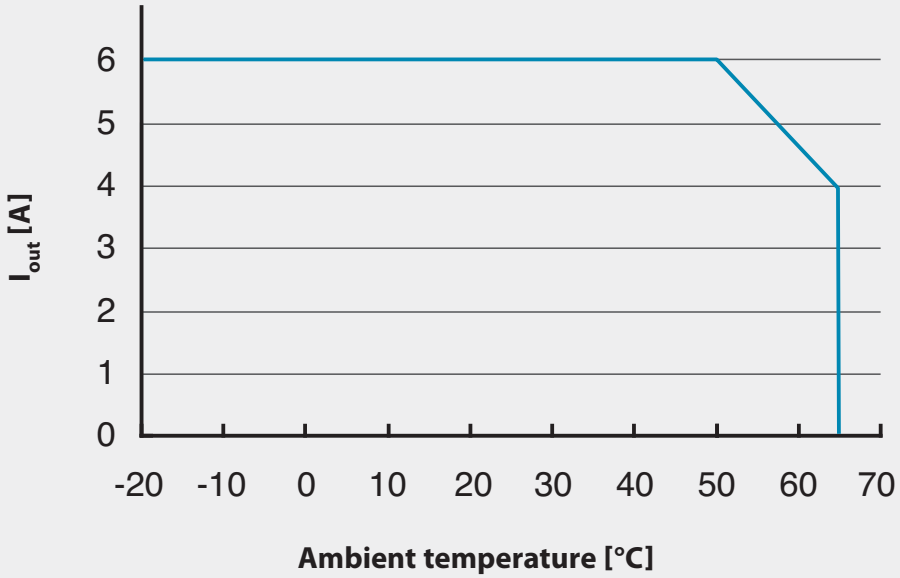
## Backup time* (2/2) UPSI-2406R2DP2 – Battery type: EDLC (Supercaps)




**Backup time depends on battery capacitance, load and temperature. At very high or low temperatures a reduction of backup time occurs. Unless otherwise specified, the values apply to measurements at +25 °C*

**Derating UPSI-2406R2DP2**

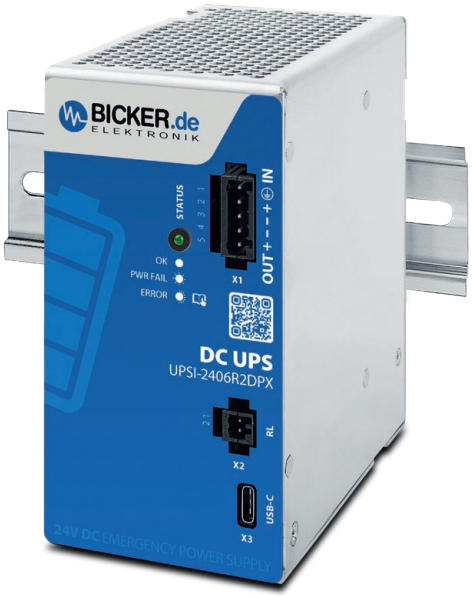



*-20…0 °C: At sub-zero temperatures, the charging time increases according to the physical properties of the cells (increased internal resistance).*

# UPSI-2406R2DP3

24 V DC / 6 A

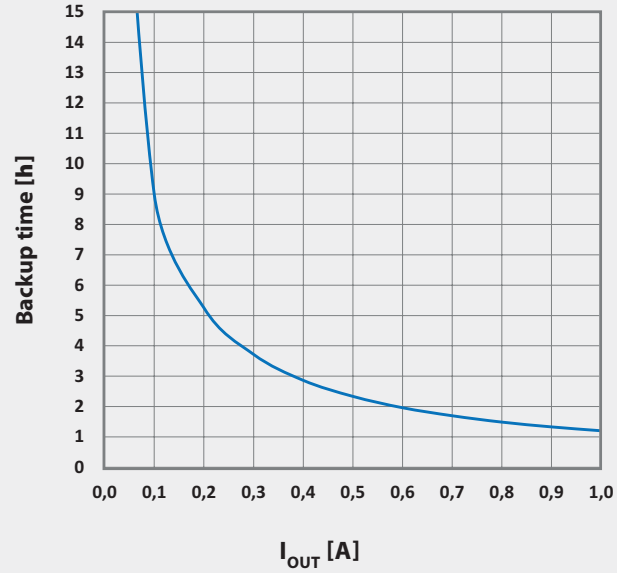
- **24 V DC UPS (DIN-Rail version)**
- **Integrated LiFePO4 battery**
- **Up to 6 000 cycles**
- **Capacity: 33 Wh**
- **Intelligent input current detection**
- **Regulated output voltage in battery mode**
- **Minimum load detection**
- **Power-fail timer function**
- **Relay dry contact on power fail**
- **Reboot function**
- **Fuel gauge**
- **Shutdown via external signal**

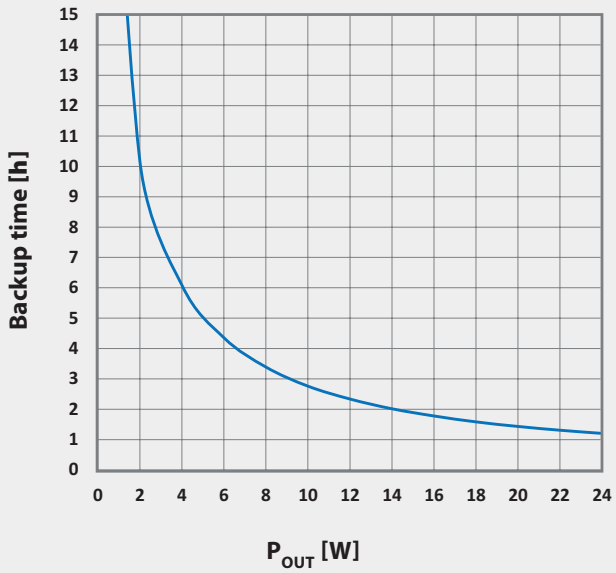


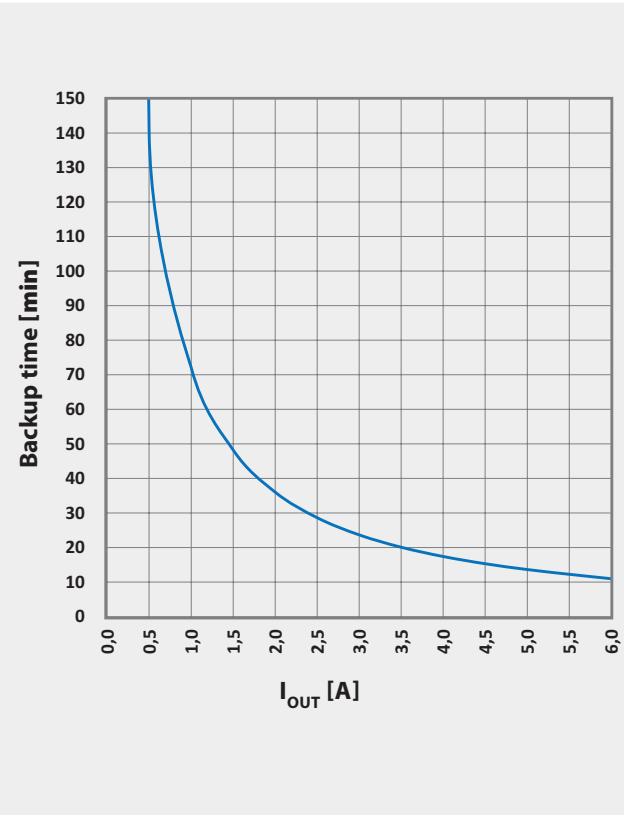

*The picture is exemplary for all models of the DP1 series*

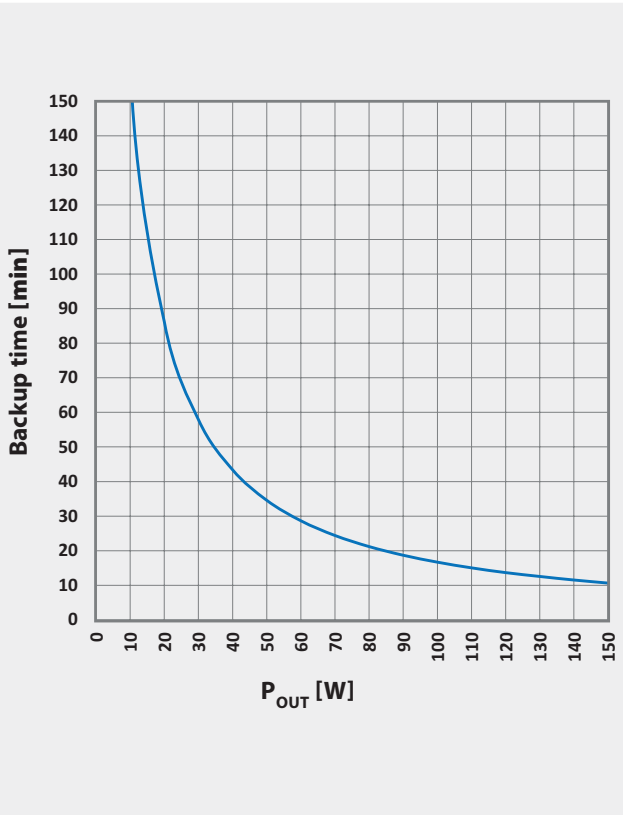
| Technical Data | |
|---|---|
| Input voltage | 24 V DC (23…30 V) |
| Input current | 6.2 A max. |
| Output voltage | Normal mode: $V_{IN}$ – 0.5 V DC max. (depending on load)<br>Battery mode: 23.5 V DC |
| Output current | 6 A nominal |
| Capacitive load | 3000 µF (in normal mode, at start, 0 A load) |
| Charging method | CC / CV / CP |
| Protection | Input: Reverse polarity protection<br>Output: Overcurrent protection, Short circuit protection |
| Interface | USB, HID-UPS, *RS-232 (optional), RS-485 (optional)* |
| Battery technology | LiFePO4 2.5 Ah / 33 Wh |
| Ambient temperature | Operating: -20…+50 °C<br>Storage / Transport: -30…+55 °C, recommended state of charge 80 % |
| Temperature derating | See derating curve on next after next |
| Operating altitude | ≤4000 m |
| Max. permitted humidity | ≤95 % (at +25 °C, no dew) |
| Dimensions W / H / D | 63 x 120.5x 105 mm<br>(without front connectors and DIN-Rail mounting bracket) |
| Weight | 0.68 kg |

## Backup time* UPSI-2406R2DP3 – Battery type: LiFePO4



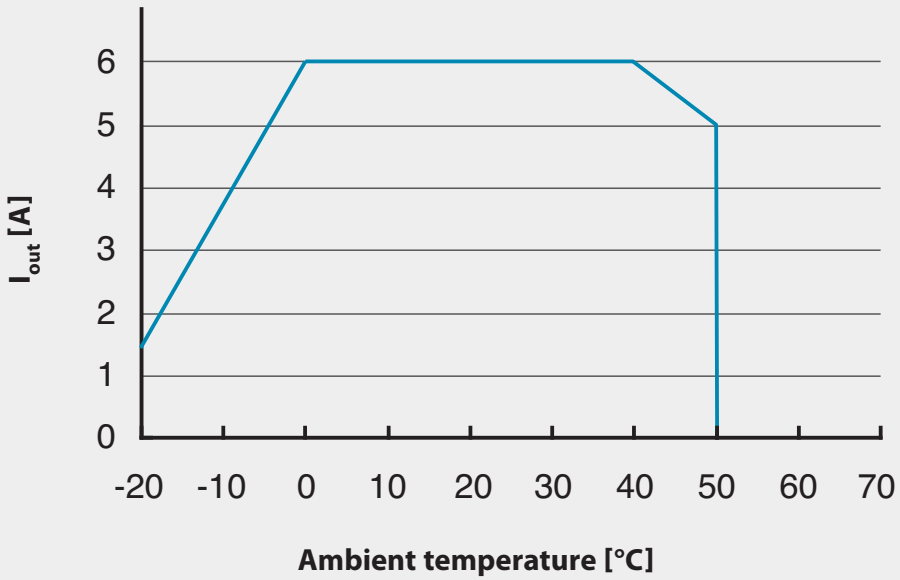




**Backup time depends on battery capacitance, load and temperature. At very high or low temperatures a reduction of backup time occurs. Unless otherwise specified, the values apply to measurements at +25 °C*

**Derating UPSI-2406R2DP3**




*-20…0 °C: At sub-zero temperatures, the charging time increases according to the physical properties of the cells (increased internal resistance).*

# 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-2406R2DP2, UPSI-2406R2DP2 and UPSI-2406R2DP3 (hereinafter also called UPS) are DC/DC UPS systems with numerous digital features and high performance. Die UPS combines the UPSI-2406 with an integrated energy storage: The UPSI-2406R2DP1 uses an energy storage with Lithium-ion technology, the UPSI-2406R2DP2 uses an energy storage with supercap (also EDLCs) technology and the UPSI-2406R2DP3 uses an energy storage with LiFePO4 technology. 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 integrated 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 fla-shing (1 Hz flashing). When the UPSI-2406R2DP3 (with LiFePO4 battery) and the UPSI-2406R2DP1 (with lithium-ion battery) are used and they are 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.

## B3 Software

Two different software solutions are available for the UPS Gen$^2$ devices, which should be selected depending on the operating mode or desired functions.

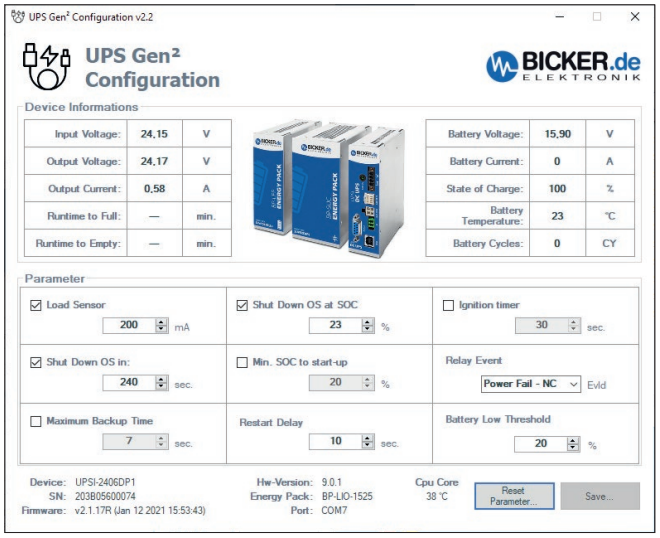
The models have the native UPS device group “HID Power Class” integrated via USB. Most operating systems recognize the UPS via Plug & Play as HID UPS or HID battery without additional drivers and can be operated with the operating system’s own energy settings, which means self-sufficient operation without additional software. In this scenario, only the UPS Gen$^2$ Configuration Software is required to configure the internal UPS parameters.

If more functions are required, such as running a script before shutdown, the “UPScom - UPS Management Software“ is the right choice. Unlike the “UPS Gen$^2$ Configuration Software“, this is permanently installed and started on the system.

### UPS Gen$^2$ Configuration Software

The UPS Gen$^2$ Configuration Software is used for setting parameters and programming new firmware for all UPSI Gen$^2$ devices under Microsoft® Windows. The software tool also shows the operating status of the UPS and its energy storage and can be connected to the device via USB.

The UPS Gen$^2$ software tool provides additional setting options in HID power mode, such as time-bound shutdown and other important functions.



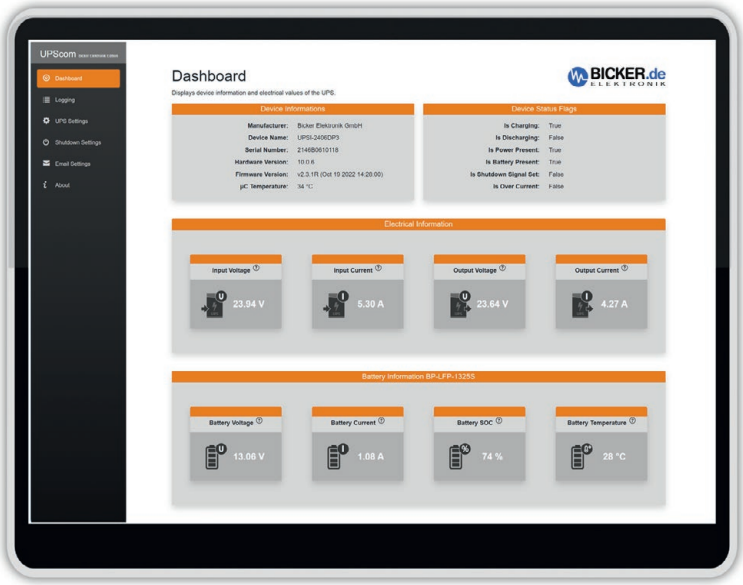

**DOWNLOAD**
**UPS Gen$^2$ Configuration Software**

**DOWNLOAD**
**User Manual**

## UPScom - UPS Management Software

During a power fail, the “UPScom” software enables controlled shutdown and switch off of connected equipment to prevent data loss or corruption. The responsive WEB UI is called up in a web browser to set and preprogram all parameters of the DC UPS system as well as for real-time monitoring with a display of the charge status.

Adjustable parameters include load sensor (mA), shutdown delay, maximum backup time, minimum load capacity before system start, email notifications and running scripts or programs before the system shuts down.




**DOWNLOAD**
**UPScom for Windows® – All CPU**

**DOWNLOAD**
**UPScom for Linux – All CPU**

**DOWNLOAD**
**Installation Manual Windows®**

**DOWNLOAD**
**Installation Manual Linux**

## 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.
13. Keep the device away from children.



### 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**<br>Unless otherwise stated, all specifications apply to +25 °C ambient temperature, 24 V DC input voltage and nominal output current ($I_N$). | | | |
|---|---|---|---|
| | **UPSI-2406R2DP1** | **UPSI-2406R2DP2** | **UPSI-2406R2DP3** |
| Input voltage | 24 VDC | | |
| Input voltage range | 23 VDC…30 VDC | | |
| Electric strength max. | 35 VDC | | |
| Fixed connect threshold<br>Undervoltage<br>Voltage drop Input/Output | <br>22.5 VDC<br>0.5 VDC max. (depending on load) | | |
| Current consumption<br>$I_N$ ($U_N$, $I_{OUT} = I_N$, $I_{CHARGE} = 0$)<br>$I_{MAX}$ ($U_N$, $I_{OUT} = I_N$, $I_{CHARGE}$ = 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) | **UPSI-2406R2DP1**<br>4.1 A<br>4.8 A<br>4.1…6.1 A<br><100 mA<br>1.8 A | **UPSI-2406R2DP2**<br>6.1 A<br>6.2A<br>n.a.<br><100 mA<br>1.8 A | **UPSI-2406R2DP3**<br>6.1 A<br>6.2A<br>6.1…8.1 A<br><100 mA<br>1.8 A |
| Power consumption<br>$P_N$ ($U_N$, $I_{OUT} = I_N$, $I_{CHARGE} = 0$)<br>$P_{MAX}$ ($U_N$, $I_{OUT} = I_N$, $I_{CHARGE}$ = 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>98.5 W<br>115 W<br>98.5…146.5 W<br>43 W | <br>146.5 W<br>150 W<br>n.a.<br>43 W | <br>146.5 W<br>150 W<br>146.5…194.5 W<br>43 W |
| Internal input fuse | Yes (10 A) | | |
| Switch-on time | <5 sec | | |

**Max. 58 sec., depending on output power (see for that „F12 Dynamic Powerboost“)*

## OUTPUT DATA – NORMAL MODE

Unless otherwise stated, all specifications apply to +25 °C ambient temperature, 24 V DC input voltage and nominal output current ($I_N$).

| | UPSI-2406R2DP1 | UPSI-2406R2DP2 | UPSI-2406R2DP3 |
|---|---|---|---|
| Output voltage | 24 VDC | | |
| Output voltage range | $U_{OUT} = U_{IN}$ – 0.5 VDC max. (depending on load) | | |
| Capacitive load | 3000 µF (at start, 0 A load) | | |
| **Output current**<br>$I_N$<br>$I_{DYN.BOOST}$*<br>$I_{SFB}$ | **UPSI-2406R2DP1**<br>4 A<br>4.1…6 A<br>30 A (5 ms) | **UPSI-2406R2DP2**<br>6 A<br>n.a.<br>30 A (5 ms) | **UPSI-2406R2DP3**<br>6 A<br>6.1…8 A<br>30 A (5 ms) |
| **Output power**<br>$P_N$ ($U_N$, $I_{OUT} = I_N$, $I_{CHARGE} = 0$)<br>$P_{DYN.BOOST}$ ($U_N$, $I_{OUT} = I_{DYN.BOOST}$, $I_{CHARGE} = 0$)* | <br>96 W<br>96…144 W | <br>144 W<br>n.a. | <br>144 W<br>144…192 W |
| Overcurrent shutdown | 4.1…6 A for max. 58 sec*;<br>6…10.8 A for max. 100 ms;<br>>10.8 A for max. 5 ms | 6.1…10.8 A for max. 100ms;<br>>10.8 A for max. 5 ms | 6.1…8 A for max. 58 sec*;<br>8…10.8 A for max. 100ms;<br>>10.8 A for max. 5 ms |
| Short-circuit proof | Yes | | |
| No-load proof | Yes | | |

## OUTPUT DATA – BATTERY MODE

Unless otherwise stated, all specifications apply to 25 °C ambient temperature and nominal output current ($I_N$).

| | UPSI-2406R2DP1 | UPSI-2406R2DP2 | UPSI-2406R2DP3 |
|---|---|---|---|
| Output voltage | 23.5 VDC | | |
| **Output current**<br>$I_N$<br>$I_{DYN.BOOST}$*<br>$I_{SFB}$ | **UPSI-2406R2DP1**<br>4 A<br>4.1…6 A<br>30 A (5 ms) | **UPSI-2406R2DP2**<br>6 A<br>n.a.<br>30 A (5 ms) | **UPSI-2406R2DP3**<br>6 A<br>6.1…8 A<br>30 A (5 ms) |
| **Output power**<br>$P_N$ ($U_N$, $I_{OUT} = I_N$, $I_{CHARGE} = 0$)<br>$P_{DYN.BOOST}$ ($U_N$, $I_{OUT} = I_{DYN.BOOST}$, $I_{CHARGE} = 0$)* | <br>94 W<br>94…141 W | <br>141 W<br>n.a. | <br>141 W<br>141…188 W |
| Overcurrent shutdown | 4.1…6 A for max. 58 sec*;<br>6…10.8 A for max. 100 ms;<br>>10.8 A for max. 5 ms | 6.1…10.8 A for max. 100ms;<br>>10.8 A for max. 5 ms | 6.1…8 A for max. 58 sec*;<br>8…10.8 A for max. 100ms;<br>>10.8 A for max. 5 ms |
| Short-circuit proof | Yes | | |
| No-load proof | Yes | | |
| Switching time normal mode ≫ battery mode | <600 µs | | |

**Max. 58 sec., depending on output power (see for that „F12 Dynamic Powerboost")*

| ENERGY STORAGE UPSI-2406R2DP1 | |
|---|---|
| Charging method | CC / CV / CP |
| Nominal voltage $U_N$ | 14.8 V |
| End-of-charge voltage | 15.9 V |
| Battery charge current | 1 C max. |
| Undervoltage protection | As soon as first cell reaches 2.7 V |
| Battery technology | Lithium-Ion |
| Nominal capacity | 2.5 Ah / 37 Wh |
| Charging time ($I_{CHARGE}$ = max) | App. 55 min |
| Buffer time (at $I_{OUT}$ = 4 A) | App. 12 min |

| ENERGY STORAGE UPSI-2406R2DP2 | |
|---|---|
| Charging method | CC / CV / CP |
| Nominal voltage $U_N$ | 8.4 V |
| End-of-charge voltage | 8.4 V |
| Battery charge current | 16 A max. |
| Undervoltage protection | 5 V |
| Battery technology | EDLC (Supercap) |
| Nominal capacity | 5.73 kJ (3.88 kJ useful) / 1.59 Wh (1.08 Wh useful) |
| Charging time ($I_{CHARGE}$ = max) | App. 4 min 30 sec |
| Buffer time (at $I_{OUT}$ = 4 A) | App. 30…35 sec |
| Buffer time (at $I_{OUT}$ = 6 A) | App. 8 sec |

| ENERGY STORAGE UPSI-2406R2DP3 | |
|---|---|
| Charging method | CC / CV / CP |
| Nominal voltage $U_N$ | 13.2 V |
| End-of-charge voltage | 13.8 V |
| Battery charge current | ≤2 C max. |
| Undervoltage protection | As soon as the first cell reaches 2.5 V |
| Battery technology | LiFePO4 |
| Nominal capacity | 2.5 Ah / 33 Wh |
| Charging time ($I_{CHARGE}$ = max) | App. 60 min |
| Buffer time (at $I_{OUT}$ = 6 A) | App. 11 min |

| CONNECTION DATA INPUT / OUTPUT | |
|---|---|
| Connection method | Lockable plug connector (spring clamp) |
| Conductor cross-section solid | 0.08 $mm^2$…1.5 $mm^2$ (28…14 AWG) |
| Conductor cross-section flexible | 0.08 $mm^2$…1.5 $mm^2$ (28…14 AWG) |
| Conductor cross-section with ferrule | 0.25 $mm^2$…1.5 $mm^2$ |
| Stripping length | 6 mm … 7 mm |
| **CONNECTION DATA – RELAY** | |
| Connection labeling | RL |
| Switch contact (potential free) | Relay |
| Status (configurable) | Power Fail Alarm |
| Max. 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) |
| Connection method | Lockable plug connector (spring clamp) |
| Conductor cross-section solid | 0.08 $mm^2$…0.5 $mm^2$ (28…20 AWG) |
| Conductor cross-section flexible | 0.08 $mm^2$…0.5 $mm^2$ (28…20 AWG) |
| Conductor cross-section with ferrule | 0.25 $mm^2$…0.34 $mm^2$ |
| Stripping length | 5 mm…6 mm |
| Switching time | 1500 ms max. |
| Electrical isolation | Yes |
| **DATA INTERFACE – USB** | |
| Interface designation | USB |
| Numbers of interfaces | 1 |
| Connection method | USB type C (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 – RS-232 | |
|---|---|
| Interface designation | RS-232 |
| Numbers of interfaces | 1 |
| Connection method | DSUB 9-Pin (female) |
| Locking | Yes (screwable) |
| Transmission physics | RS-232 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 |

| DATA INTERFACE – RS-485 | |
|---|---|
| Interface designation | RS-485 |
| Numbers of interfaces | 1 |
| Connection method | Lockable plug connector |
| Locking | Yes (lockable) |
| Transmission physics | Modbus RTU |
| Topology | Daisy-Chain |
| Symbol rate (baud rate) | 38400 |
| Conductor cross-section solid | 0.08 $mm^2$…1.5 $mm^2$ (28…16 AWG) |
| Conductor cross-section flexible | 0.08 $mm^2$…1.5 $mm^2$ (28…16 AWG) |
| Conductor cross-section with ferrule | 0.25 $mm^2$…1 $mm^2$ |
| Stripping length | 6 mm…7 mm |
| Transmission length | <100 m |
| Access time | <1 s |
| Voltage level | -3.3 V DC…+3.3 V DC |
| Electrical isolation | No |

| GENERAL DATA | |
|---|---|
| Flammability class according to UL 94 (housing / terminal blocks) | V0 |
| Weight | DP1: 0.52 kg, DP2: 0.6 kg, DP3: 0.68 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 | 63 mm / 120.5 mm / 105 mm (without front connectors and DIN-Rail mounting bracket) |

| ENVIRONMENTAL CONDITIONS | |
|---|---|
| Ambient temperature (operation) | DP1: 0…+50 °C / DP2: -20… +65 °C / DP3: -20… +50 °C |
| Ambient temperature (storage / transport) | DP1: -20…+50 °C / DP2: -30…+65 °C / DP3: -30…+55 °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 (UPSI-2406R2DP1, UPSI-2406R2DP2 and UPSI-2406R2DP3) | |
|---|---|
| Certified according to | UL61010-1<br>UL61010-2-201<br>CSA C22.2 61010-1-12<br>CSA C22.2 61010-2-201 |
| CB Scheme | IEC 61010-1<br>IEC 61010-2-201 |

| EMISSION ACCORDING TO EN 55016-2-3 (DOMESTIC) | |
|---|---|
| **Basic standard CE** | **Fulfilled requirements according to EN 55016-2-3 (CE) (Domestic)** |
| Conducted emission from the power port<br>EN 55016-2-3<br>Frequency range<br>Comment | <br><br>150 kHz–30 MHz<br>Conform |
| Electric field radiated emission<br>EN 55016-2-3<br>Frequency range<br>Comment | <br><br>30 MHz–1 GHz<br>Conform |

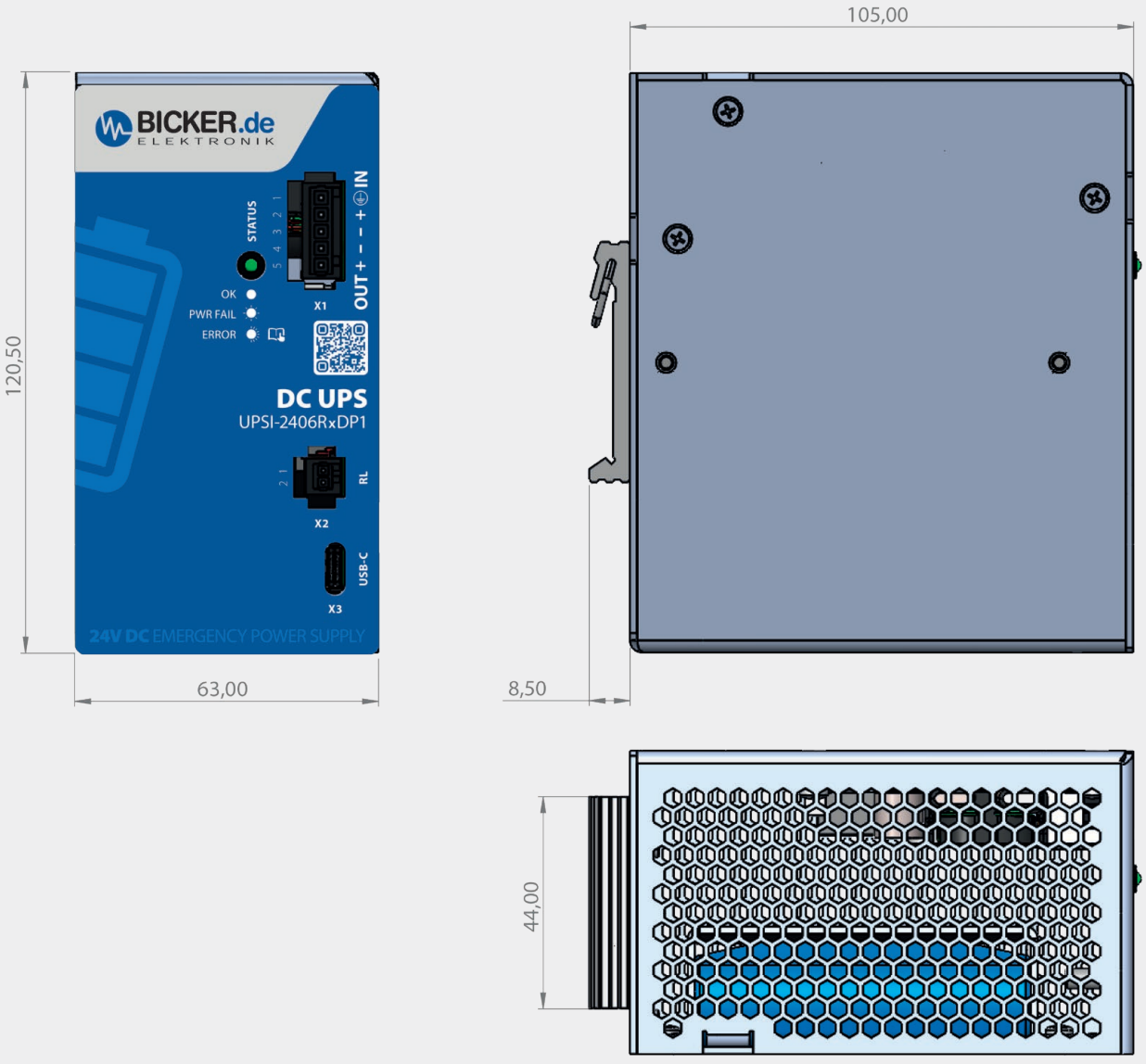
| INTERFERENCE IMMUNITY ACCORDING TO EN 61000 (INDUSTRY) | |
|---|---|
| **Basic standard CE** | **Fulfilled requirements according to EN 61000 (CE) (Interference immunity of industrial environment)** |
| Electrostatic discharge<br>EN 61000-4-2 | |
| Contact discharge | 4 kV |
| Air discharge | 8 kV |
| 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 | ±0.5 kV |
| Test voltage L–PE, N–PE | ±1 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 |

| 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 Zeichnungen

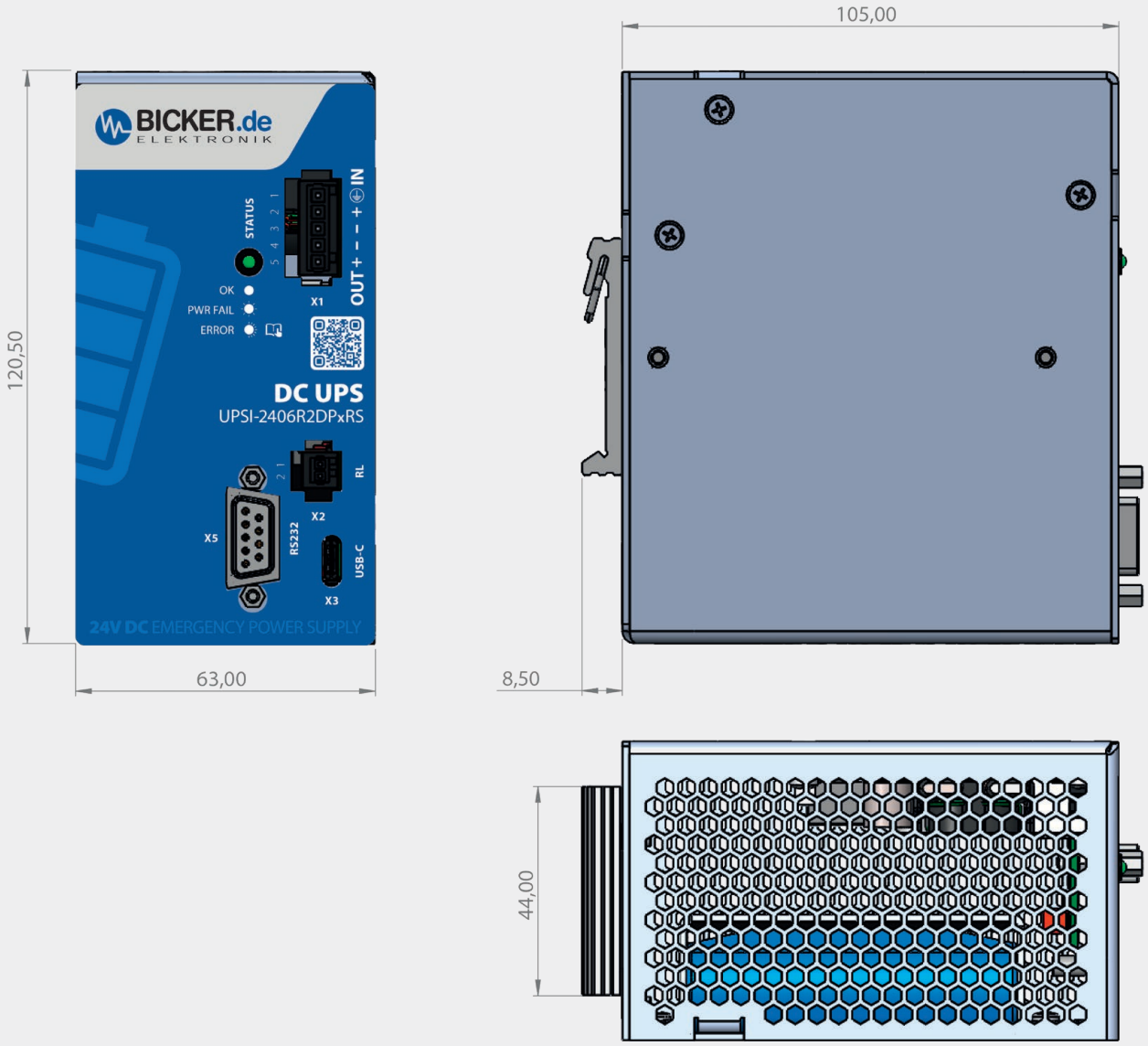
## D2.1 UPSI-2406R2DP1 / UPSI-2406R2DP2 / UPSI-2406R2DP3

*Sofern nicht anders angegeben,*
*Toleranz nach:*
*DIN ISO 2768 T1 - m*
*DIN ISO 2768 T2 - K*



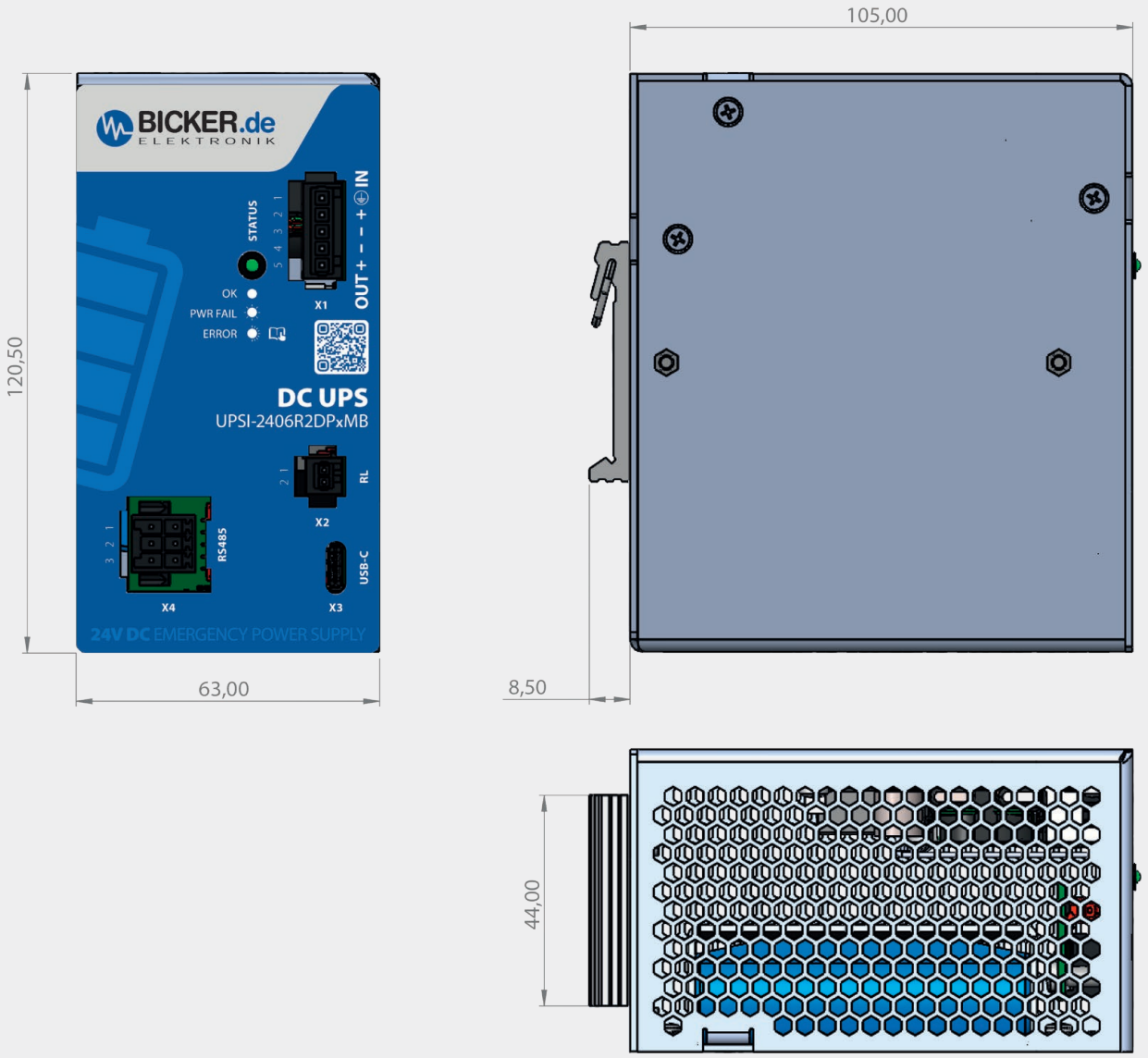
## D2.2 UPSI-2406R2DP1RS / UPSI-2406R2DP2RS / UPSI-2406R2DP3RS (mit zusätzlicher RS-232-Schnittstelle)

*Sofern nicht anders angegeben,*
*Toleranz nach:*
*DIN ISO 2768 T1 - m*
*DIN ISO 2768 T2 - K*



## D2.3 UPSI-2406R2DP1MB / UPSI-2406R2DP2MB / UPSI-2406R2DP3MB (mit zusätzlicher RS-485-Schnittstelle)

*Sofern nicht anders angegeben,*
*Toleranz nach:*
*DIN ISO 2768 T1 - m*
*DIN ISO 2768 T2 - K*



# E General Data

## E1 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!

## E2 Convection and installation position

For these DIN rail versions, 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 the respective highest 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

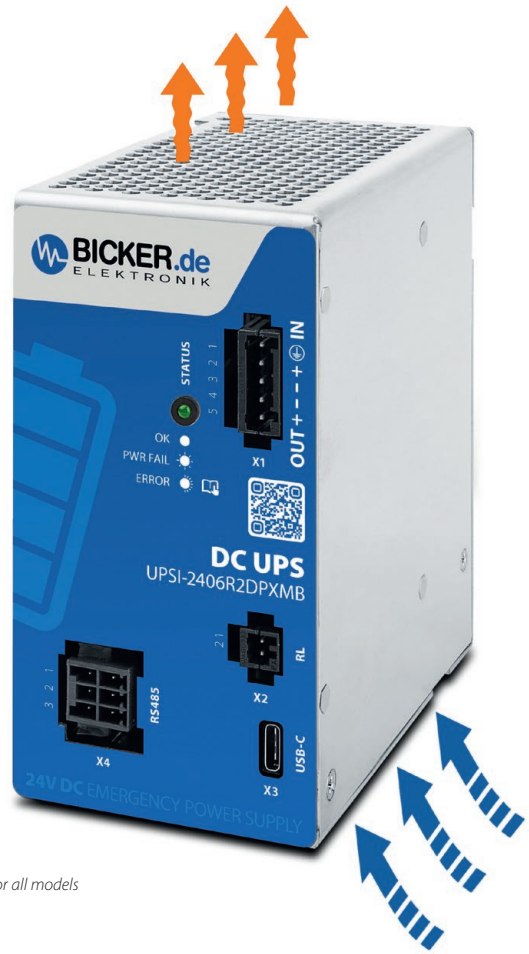
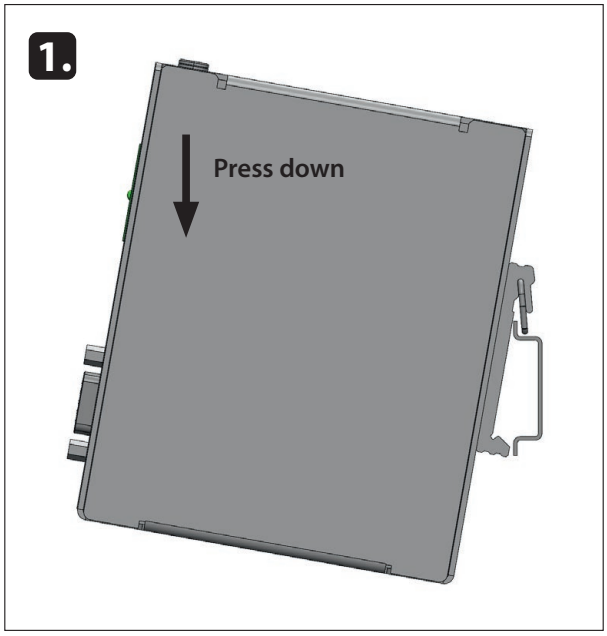
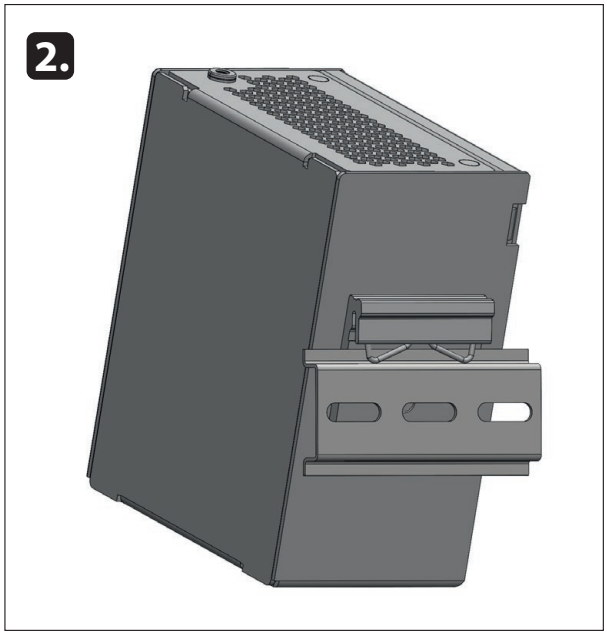



*Image similar.*
*This model is an example for all models*

The devices comply with the IP protection class 20.

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

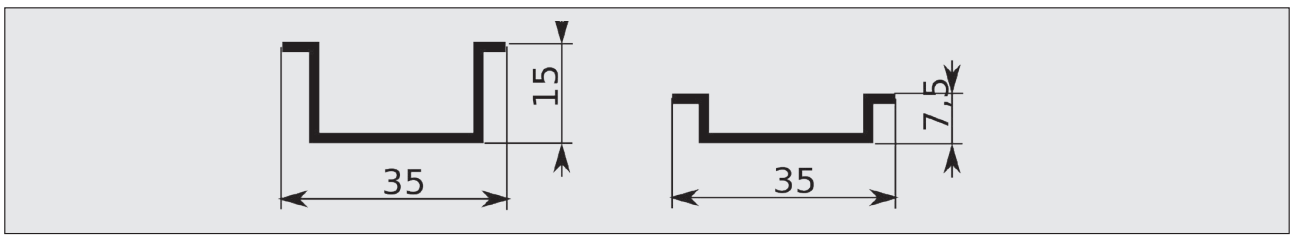






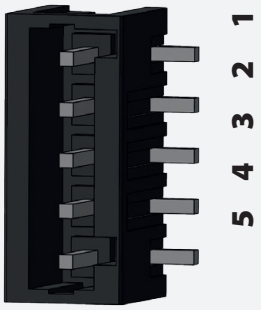


## E3 Description of connectors

For a list of the part numbers of the plugs and mating plugs, see the following chapter F7.

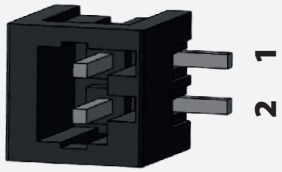
### INPUT, OUTPUT, FUNCTIONAL EARTH (IN, OUT, FE)




| PIN | FUNCTION |
|---|---|
| 1 | FE (functional earth) |
| 2 | Vin + |
| 3 | Vin – |
| 4 | Vout – |
| 5 | Vout + |

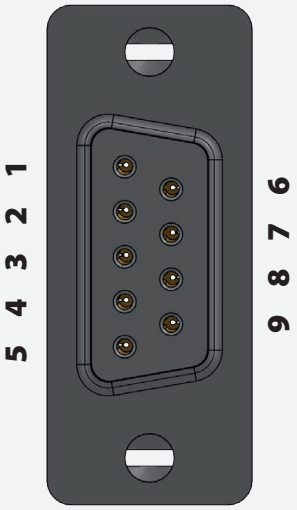
### RELAY CONNECTION (RL)

The function of the relay connection is configurable via software (see chapter B3). 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 |

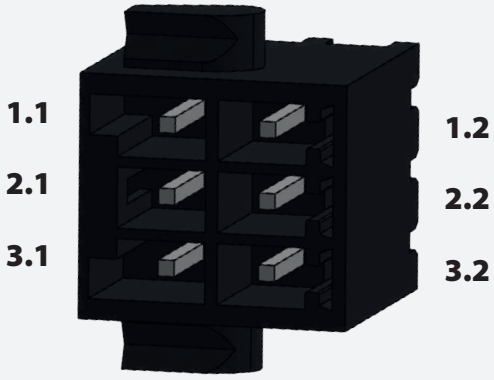
### RS-232




| PIN | FUNCTION |
|---|---|
| 1 | NC |
| 2 | TXD |
| 3 | RXD |
| 4 | DSR |
| 5 | GND |
| 6 | DTR |
| 7 | NC |
| 8 | NC |
| 9 | NC |

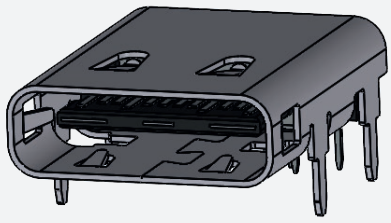
## RS-485

For an optimal transmission result, it is recommended to use a shielded cable with a twisted pair of wires and to connect the shield to FE. If the other communication participants do not have a galvanically isolated RS-485 interface, it is urgently recommended to connect the signal GND of all interfaces. If this is not observed, irreversible damage to the module or customer application can occur due to potential shifts.




| PIN | FUNCTION |
|---|---|
| 1.1 | D+ |
| 1.2 | D+ |
| 2.1 | D – |
| 2.2 | D– |
| 3.1 | GND |
| 3.2 | GND |

## USB-C PIN ASSIGNMENT STANDARDIZED



| PIN | FUNCTION |
|---|---|
| A1 | GND |
| A2 | SSTXp1 |
| A3 | SSTXn1 |
| A4 | VBUS |
| A5 | CC1 |
| A6 | Dp1 |
| A7 | Dn1 |
| A8 | SBU1 |
| A9 | VBUS |
| A10 | SSRXn2 |
| A11 | SSRXp2 |
| A12 | GND |

| PIN | FUNCTION |
|---|---|
| B12 | GND |
| B11 | SSRXp1 |
| B10 | SSRXn1 |
| B9 | VBUS |
| B8 | SBU2 |
| B7 | Dn2 |
| B6 | Dp2 |
| B5 | CC2 |
| B4 | VBUS |
| B3 | SSTXn2 |
| B2 | SSTXp2 |
| B1 | GND |

## E4 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 UPS device with complete functionality, **no** constant current function should be used and the upstream power supply should be able to provide at least the following values:

- UPSI-2406R2DP1 and DP2: 24 V / 5 A (120 W)
- with Powerboost function: 24 V / 6.25 A (150 W)

- UPSI-2406R2DP2: 24 V / 6.25 A (150 W)

- UPSI-2406R2DP3: 24 V / 6.25 A (150 W)
- with Powerboost function: 24 V / 8.25 A (200 W)

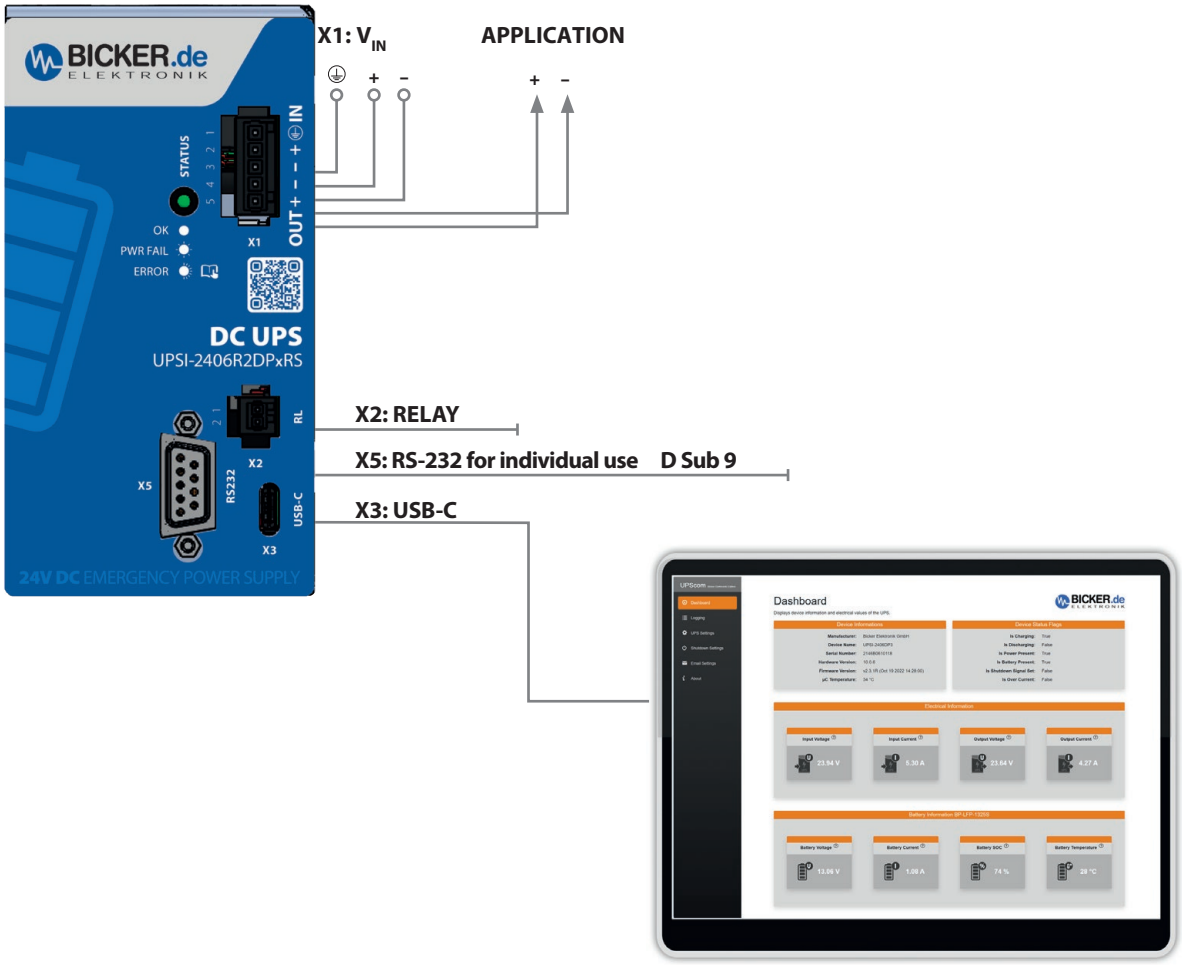
If less load than the maximum load is required at the output, the voltage supply can be dimensioned according to the tables below (column 3).

| UPSI-2406R2DP1 | | |
|---|---|---|
| $I_{LOAD}$ [A] | $I_{CHARGE}$ [A] | $I_{IN-MIN}$ [A] |
| 0 | 1.8 | 2 |
| 1 | 1.5 | 2.5 |
| 2 | 1.3 | 3.5 |
| 3 | 1 | 4 |
| 4 | 0.8 | 5 |

| UPSI-2406R2DP2 | | |
|---|---|---|
| $I_{LOAD}$ [A] | $I_{CHARGE}$ [A] | $I_{IN-MIN}$ [A] |
| 0 | 1.5 | 1.5 |
| 1 | 1.3 | 2.5 |
| 2 | 1.2 | 3.5 |
| 3 | 1 | 4 |
| 4 | 0.8 | 5 |
| 5 | 0.5 | 5.5 |
| 6 | 0.2 | 6.25 |

| UPSI-2406R2DP3 | | |
|---|---|---|
| $I_{LOAD}$ [A] | $I_{CHARGE}$ [A] | $I_{IN-MIN}$ [A] |
| 0 | 1.8 | 2 |
| 1 | 1.5 | 2.5 |
| 2 | 1.3 | 3.5 |
| 3 | 1 | 4 |
| 4 | 0.8 | 5 |
| 5 | 0.5 | 5.5 |
| 6 | 0.2 | 6.25 |

## E5 Connecting diagram – USB + RS-232




**CONNECTING ORDER**

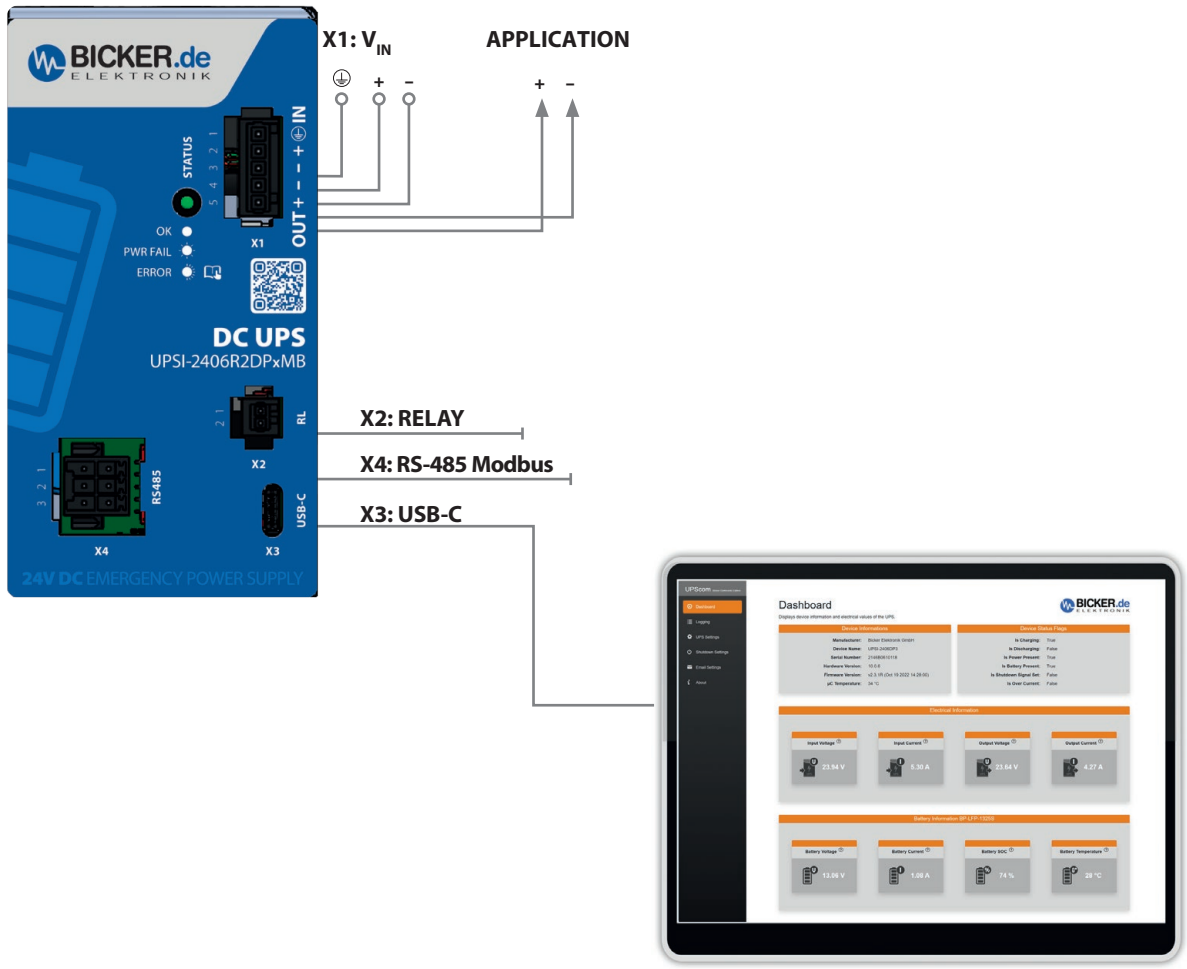
1. FUNCTIONAL EARTH (FE)
2. APPLICATION ($V_{OUT}$)
3. DC SOURCE ($V_{IN}$)
4. RELAY / USB / RS-232

**Dismantling order reverse to connection!**

**$V_{IN}$/$V_{OUT}$ – ATTENTION!**

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

## Connecting diagram – USB + RS-485




### CONNECTING ORDER

1. FUNCTIONAL EARTH (FE)
2. APPLICATION ($V_{OUT}$)
3. DC SOURCE ($V_{IN}$)
4. RELAY / USB / RS-485

**Dismantling order reverse to connection!**

### $V_{IN}/V_{OUT}$ – ATTENTION!

1. Note polarity!
2. AWG16 wire should be used (1.5 $mm^2$)

## E6 Initial operation

The correct installation of the UPS has to be ensured. The connecting order in chapter F5 must be observed.

**The start is accomplished by connecting the upstream power supply:** When an input voltage higher than 23 V is connected to the input terminals, the energy storage gets queried and transmits its data. The UPS sets the corresponding end-of-charge voltage and releases the pack via the system present signal. After that, the charging of the energy storage starts.

The applied voltage at the input of the UPS is passed through to the output, reduced by a current-dependent voltage drop ($V_{OUT} = V_{IN}$ - 0.5 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.

## E7 Overview connector / Counterpart with description / Scope of delivery

| CONNECTOR | PART NO. | COUNTERPART NO. |
|---|---|---|
| $V_{IN}$ / $V_{OUT}$ / FE<br>*(input / output / functional earth)* | Wago 734-165/105-604 | Wago 734-105/037-004<br>(black, with locking) |
| | | Wago 734-105/037-000<br>(lightgrey, with locking) |
| | | Wago 734-105/000-004<br>(black, without locking) |
| | | Wago 734-105<br>(lightgrey, without locking) |
| | | Degson 8EDGKG-3.5-05P-10020001289<br>(lightgrey, with locking) |
| | | Degson 8EDGKG-3.5-05P-10020001015<br>(lightgrey, without locking) |
| | | Amtek 5TM350N-W02E05WLB-01<br>(lightgrey, with locking) |
| RL<br>*(Relay connector)* | Wago 733-362/105-604 | Wago 733-102/037-004<br>(black, with locking) |
| | | Wago 733-102/037-000<br>(lightgrey, with locking) |
| | | Wago 733-102/000-004<br>(black, without locking) |
| | | Wago 733-102<br>(lightgrey, without locking) |
| | | Degson 8EDGK-2.5-02P-10020000997<br>(lightgrey, without locking) |
| | | Amtek 5TM250N-W02F02GLB-01<br>(lightgrey, with locking) |
| RS-232 | Würth 61800929321 | D-Sub 9 Male |
| RS-485 | Wago 713-1403/116-000 | 713-1103/037-000 |
| USB-C | Würth 632723300011 | USB Type C connector |

| SCOPE OF DELIVERY | |
|---|---|
| **QUANTITY** | **DESCRIPTION** |
| 1x device | UPSI-2406R2DP1 or UPSI-2406R2DP2 or UPSI-2406R2DP3 - DC UPS |
| 1x | $V_{IN}$ / $V_{OUT}$ / FE connector counterpart |
| 1x | Relay connector counterpart |
| 1x | RS-485 connector counterpart (Modbus) – applies for MB versions |

## E8 Charging time (Mains operation UPS)

Charging times depend on energy storage, input voltage and the load current. The approximate remaining charging time of the energy storage device can be read using the UPS Gen$^2$ or UPScom software described in chapter B3.

## E9 Reverse polarity / Overcurrent / Short circuit

Reverse polarity:
The device has active reverse polarity protection at the input if the input terminal is connected with reverse polarity while the device is still switched off (e.g. during commissioning). If the device operates in battery mode and the input terminals are connected with reverse polarity, no reverse polarity protection is given.

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". See for that chapter F12 „Dynamic Powerboost". 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.

## E10 Backup time in battery mode

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

## E11 Behaviour in case of exceeding maximum backup time (battery operation)

If the specified backup times are exceeded, the UPS output ($V_{OUT}$) is switched off. The backup time remaining in battery operation of the UPS can be read out via the UPS Gen$^2$ or UPScom software described in chapter B3. In particular, the energy storage devices UPSI-2406R2DP3 (LiFePO4) and UPSI-2406R2DP1 (Li-Ion) have additional deep discharge protection at cell level. In exceptional cases, the UPS output can be disconnected prematurely based on the discharge voltage of the corresponding energy storage device.

## E12 Dynamic Powerboost (DP1 and DP3 versions only)

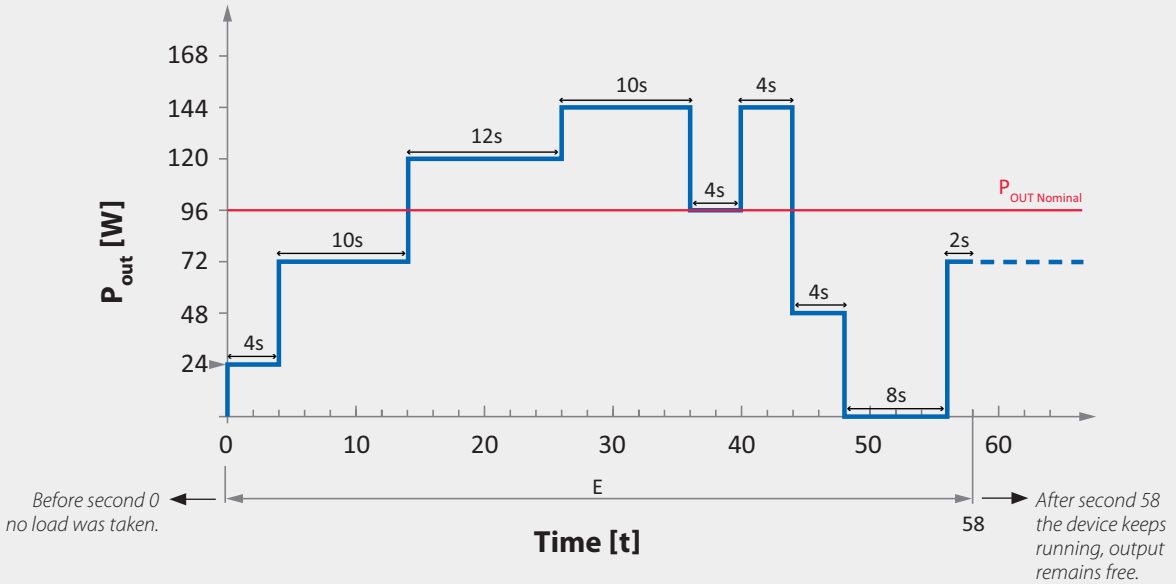
With the dynamic power boost function, the UPSI-2406R2DP1 and UPSI-2406R2DP3 offer the possibility to temporarily draw a higher output power (overload) from the UPS. As soon as an overload is detected when the threshold value is exceeded, this is possible in a dynamic overload range of up to 58 seconds, before the output is disconnected.

During operation, the device constantly measures the output energy drawn over the last 58 seconds (1 reading / second). This measured output energy is compared with the maximum possible output energy (DP1: max. 5.57 kJ, DP3: max. 8.35 kJ). If the value is smaller, the device continues to run and the output remains unlocked. If the value is larger, the output is disconnected. The output energy will continue to be recorded and the output will not be released again until the value falls below the maximum value. Due to the system, no power boost is possible with the UPSI-2406R2DP2.

| | UPSI-2406R2DP1 | UPSI-2406R2DP3 |
|---|---|---|
| Nominal output power ($I_{OUT\ Nominal}$ x $U_{OUT}$) | 96 W | 144 W |
| Threshold for detecting an overload | >96 W | >144 W |
| Range for dynamic overload | 96…144 W | 144…192 W |
| Maximum output energy ($P_{OUT\ Nominal}$ x t) | ~ 5.57 kJ (5568 Ws) (96 W x 58 sec) | ~ 8.35 kJ (8352 Ws) (144 W x 58 sec) |

***Note:*** *The output power is determined by output current and output voltage. A current-dependent voltage drop can reduce the output voltage, which is why the output power varies in some cases.*

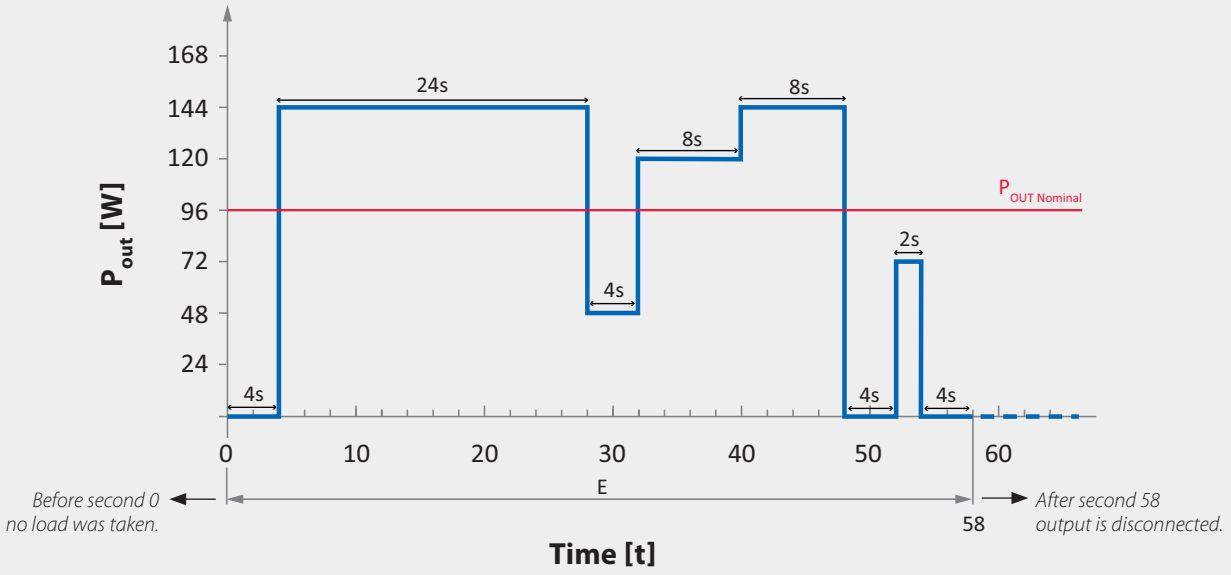
### Example 1 (UPSI-2406R2DP1)




*E = 24 W · 4 sec + 72 W · 10 sec + 120 W · 12 sec + 144 W · 10 sec + 96 W · 4 sec + 144 W · 4 sec + 48 W · 4 sec + 0 W · 8 sec + 72 W · 2 sec = 4992 Ws ≈ 4.99 kJ*

***→ UPS output keeps unlocked after second 58 because the output energy does not exceed 5.57 kJ.***

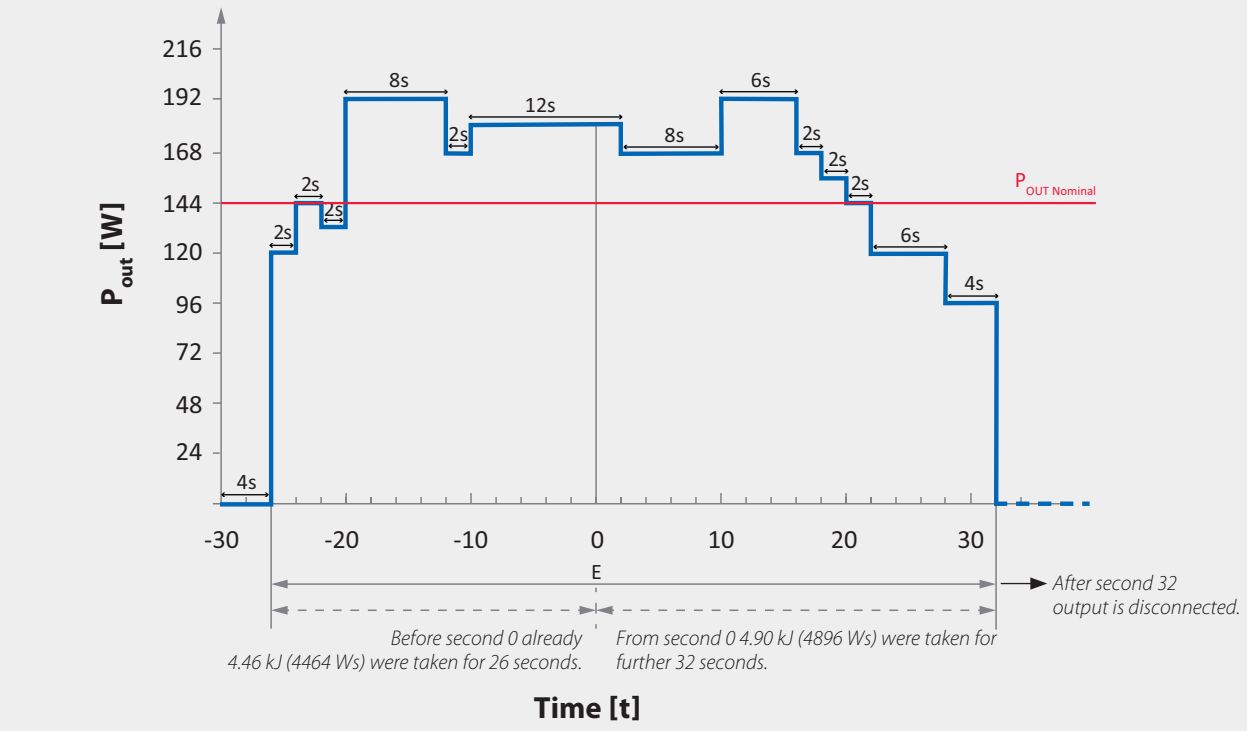
## Example 2 (UPSI-2406R2DP1)




*E = 0 W · 4 sec + 144 W · 24 sec + 48 W · 4 sec + 120 W · 8 sec + 144 W · 8 sec + 0 W · 4 sec + 24 W · 2 sec + 0 W · 4 sec + 72 W · 2 sec = 5808 Ws ≈ 5.81 kJ*

***→ UPS output is disconnected after 58 seconds because the output energy exceeds 5.57 kJ.***

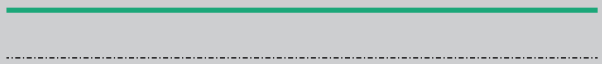
## Example 3 (UPSI-2406R2DP3)

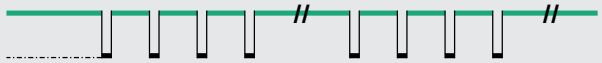


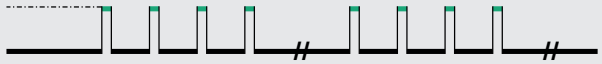

*E = 120 W · 2 sec + 144 W · 2 sec + 132 W · 2 sec + 192 W · 8 sec + 168 W · 2 sec + 180 W · 12 sec + 168 W · 8 sec + 192 W · 6 sec + 168 W · 2 sec + 156W · 2 sec + 144 W · 2 sec + 120 W · 6 sec + 96 w · 4sec = 9360 Ws ≈ 9.36 kJ*

***→ UPS output is already disconnected after 32 seconds because the output energy (of the last 58 seconds) exceeds 8.35 kJ.***

## E13 Status LED

| 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. |

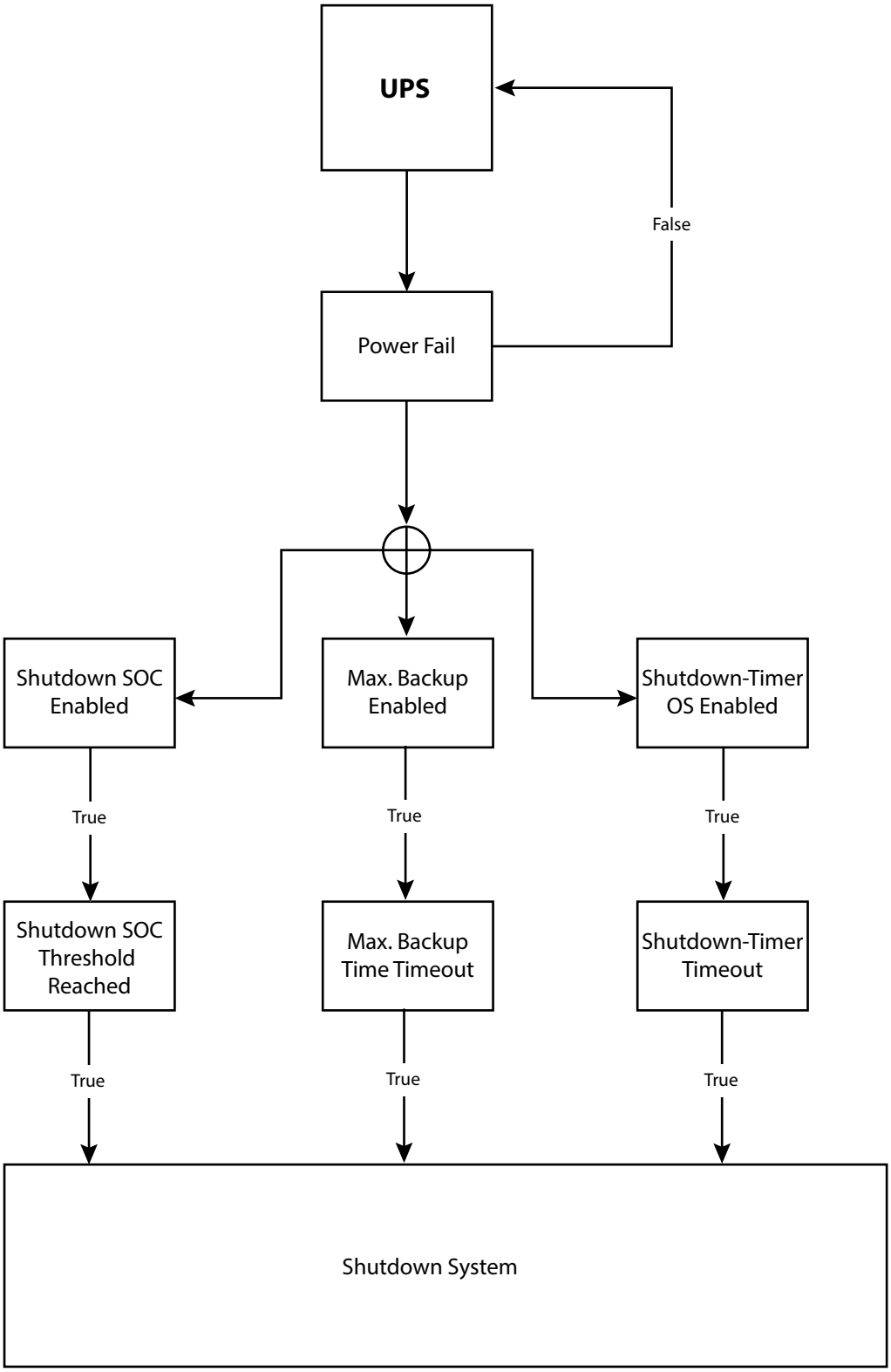
| INTERNAL STATES | | |
|---|---|---|
|  | 1 x flash (LED is off briefly), pause 2 s | **Status: Battery start***<br>>> Manual start from the battery by pressing the BS button. |
|  | 2 x flash (LED is off briefly), pause 2 s | **Status: Capacity not reached**<br>>> Capacity is required. Output is only 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, output is deactivated<br>>> Short circuit at output, output is deactivated<br>>> Internal failure, UPS is deactivated. |

** Not available for these versions*

## E14 Shutdown diagram



## E15 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 device should not be placed near sources of heat and should be placed within good air-circulation. When using the UPSI-2406R2DP3 (LiFePO4 battery) and the UPSI-2406R2DP1 (Li-ion battery), a larger capacity than actually required should always be used. The less deep the packs are discharged, the longer the service life lasts.

## E16 Maintenance

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

## E17 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.



## E18 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.

## E19 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 23 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 or input 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.

## E20 Transport information

**Transport regulations for devices with energy storage**
Devices containing LiFePO4 batteries and supercapacitors are subject to special transport restrictions in accordance with applicable dangerous goods regulations.

**Road Transport**
The following UN classifications apply to road transport:
- **LiFePO4 batteries:** UN3480/UN3481 (depending on installation / packaging condition)
- **Supercapacitors:** UN3499 with special provision 361

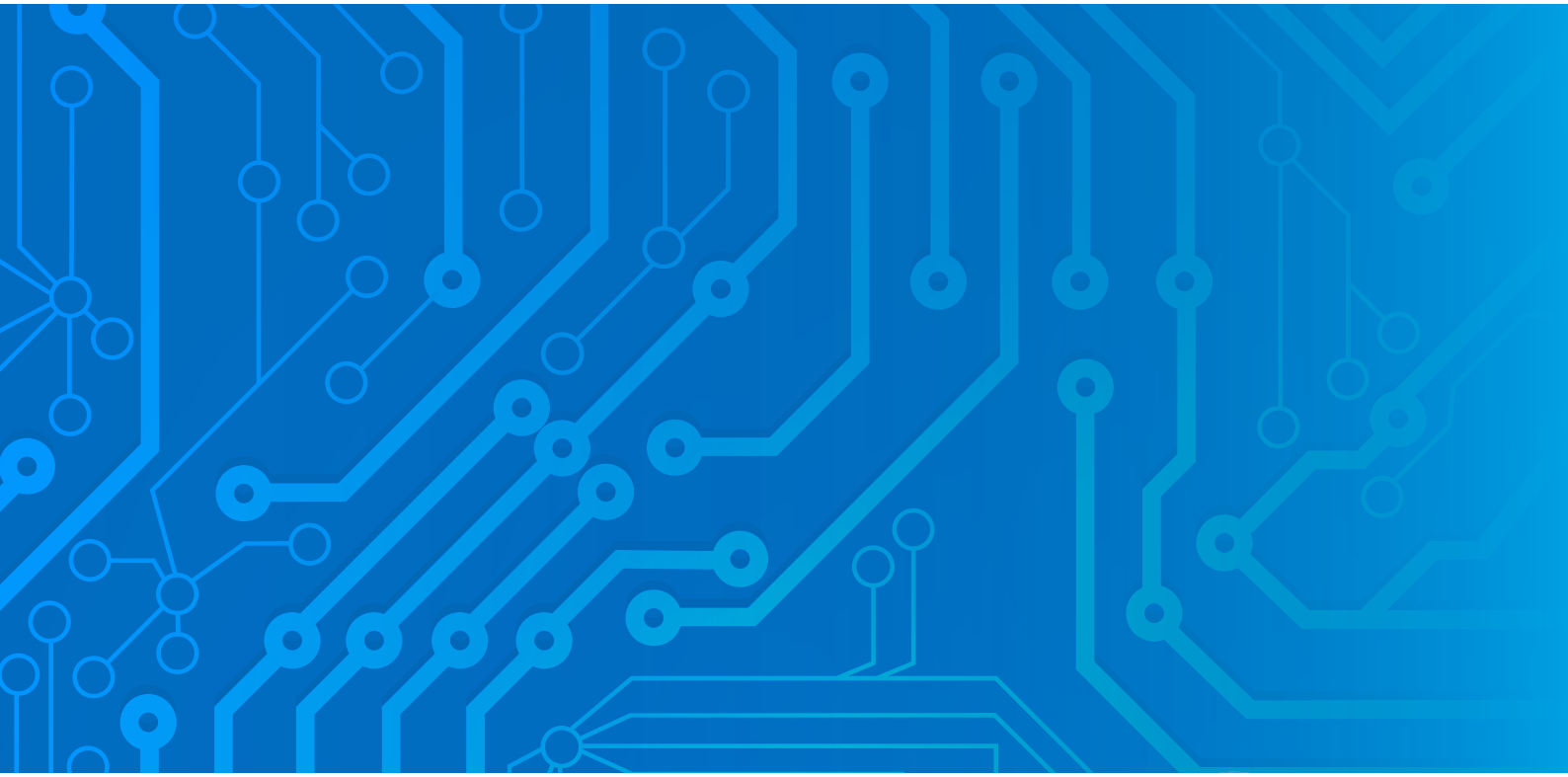
*Further information on dangerous goods regulations for road transport can be found at:*
*www.bmv.de - Dangerous Goods by Road*

**Sea and Air Freight**
For transport by sea and air, please contact the relevant authorities for information on the relecant regulations:
- **Sea freight:** www.bmv.de - Dangerous Goods Maritime Shipping
- **Air freight:** IATA Dangerous Goods Regulations

**Note:** Compliance with current regulations must be checked before each transport and the relevant documentation have to be provided.

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

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