





User Manual | **BP-LFP-2725** **BP-LFP-2725D**



Legend of used symbols

Symbol	Description
	Attention! Important hazard warning. <i>Attention! Avertissement de danger important.</i>
	Do not dispose of in the domestic waste. <i>Ne pas jeter avec les ordures ménagères.</i>
	Warning of electrical voltage. <i>Avertissement de tension électrique.</i>
	Battery intended for recycling. <i>Batterie destinée au recyclage.</i>

Revision Directory

Date	Change
19.11.2020 Revision 0-1	Initial version
05.01.2021 Revision 1	Release version



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A Features

BP-LFP-2725(D)

25.6 VDC / 2.5 Ah

- ✓ 10-year long-life battery for challenging applications
- ✓ High reliability and energy density
- ✓ Safe lithium-iron phosphate technology
- ✓ 100% free of lead and cadmium
- ✓ Extended temperature range -20...+55° C
- ✓ High performance battery management system
- ✓ Extended safety functions, charge algorithm and cell balancing
- ✓ Integrated protection against deep discharge, overcurrent, overvoltage, short circuit and overcharging
- ✓ Compactly shrinked or as DIN-Rail version



B Safety instructions

B1 General information

The safety instructions have to be read completely before the first use and carefully observed!

In addition, the corresponding safety data sheet has to be observed.



Incorrect operation or connection may result in serious injury or death. Due to incorrect operation, leaving the limit values or incorrect connection risk of fire or explosion exists. When working with the battery, care must be taken that no jewelry such as rings or watches are worn, which can cause a short circuit.

B2 Safety instructions and warnings for battery use



The described limit values of the battery module must be observed. A violation of the limit values can cause excessive heating, a defect in the battery module or fire.

As with other batteries, lithium batteries also have the potential to continue being a source of danger even in the supposedly discharged state, as they can deliver a very high short-circuit current.

Too deep discharge leads to lasting damage. Deeply discharged battery modules may no longer be charged or operated. For example, deep discharge can occur during very long storage of a battery module which was completely discharged (to discharge limit) when taken into storage.

The battery must not be disassembled, opened, damaged or crushed.

The battery should not be exposed to heat or fire. Prolonged, direct sunlight is to be avoided.

The battery should be kept out of the reach of children.

The battery must not be short-circuited or connected with the wrong polarity.

The connection cables of the battery must not be modified.

One or more batteries should not be stored dangerously in a box or drawer where they could short-circuit each other or be short-circuited by other conductive materials.

The battery must not be subjected to mechanical shocks.

Only use chargers specifically designed for use with lithium-ion battery systems.

The polarity symbols plus (+) and minus (-) on the cells, batteries and devices must always be observed. The correct use must be ensured.

The battery should be kept clean and dry.

If the battery connections become dirty, clean them with a dry, clean cloth.

The battery must be charged before use. The instructions of the manufacturer or the information in these instructions for correct charging must always be observed.



If a cell leaks, the fluid must not come into contact with the skin or enter the eyes or mouth.

Measures in case of inhalation

Vapors or mists escaping from a damaged cell can cause respiratory irritation. When inhaling the contents of an open cell, remove the source of contamination or remove the affected person to fresh air. Seek medical help.

Measures in case of eye contact

Contact with the contents of an opened cell can cause severe burns or eye irritation. If eye contact occurs with the contents of an opened cell, immediately rinse the contaminated eye(s) with a lukewarm, slightly flowing stream of water for at least 30 minutes. Keep eyelids open. Neutral saline may be used as soon as available. If necessary, further rinse the eyes during transport to the emergency supply station. Take care that contaminated water is not flushed to the naked eye or face. Immediately transfer the affected person to an emergency care center.

Measures in case of skin contact

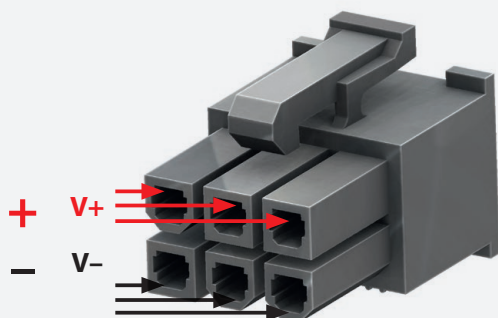
Contact with the contents of an opened cell can cause burns. If skin contact occurs with the contents of an open cell, remove contaminated clothing, shoes and leather parts. Rinse immediately with lukewarm, low-flow water for at least 30 minutes. Seek medical attention if irritation symptoms or pain persist. Thoroughly wash or dispose of clothing, shoes and leather goods before reuse.

Measures if swallowed

Contact with the contents of an opened cell can cause severe chemical burns to the mouth, esophagus and gastrointestinal tract. If you swallow the contents of an open cell, DO NOT deliver anything by mouth if the subject becomes unconscious, unconscious, or has seizures. Rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. In case of spontaneous vomiting, place the affected person in a forward bent position to reduce the risk of suffocation. Rinse mouth again with water. Immediately transfer the affected person to an emergency care center.

C Connections of battery system

POWER SUPPLY



3x Red (Plus): AWG 18

3x Black (Minus): AWG 18

Cable length:

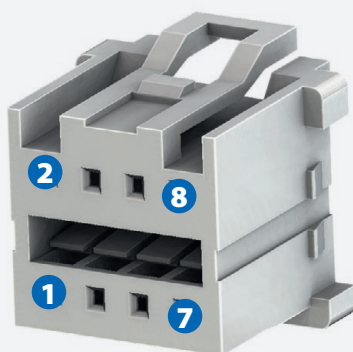
415 mm \pm 10 mm (Pack version)

315 mm \pm 10 mm (DIN-Rail version)

Plug: WST (WELISHENG TERMINAL)

P/N: P6-I42002

DATA CONNECTION (COMMUNICATION)



AWG 22

Cable length:

415 mm \pm 10 mm (Pack version)

315 mm \pm 10 mm (DIN-Rail version)

Plug: Würth Elektronik,

P/N: 624008213322

PIN	FUNCTION
1	N/A
2	SMBC
3	N/A
4	SMBD
5	N/A
6	SYSPRES
7	N/A
8	SGND

D Technical data

BP-LFP-2725(D)	
ELEKTRICAL DATA	
Cell type	A123 ANR26650-M1B
Nominal capacity	2.5 Ah
Nominal voltage	25.6 V
Energy	64 Wh
Voltage range Corepack	19.2 V...29.2 V
Overvoltage shut-off	Once first cell reaches 3.65 V
Overvoltage shut-off Recovery	Once first cell drops below 3.3V
Undervoltage shut-off	Once first cell reaches 2.4 V
Undervoltage shut-off Recovery	As soon as all cells are over 3.1 V
Short-circuit shut-off	~64 A (200 μ s)
Fuse	20 A
Own power consumption in energy-saving mode	100 μ A max.
Maximum installation height	5000 m

CHARGING PARAMETERS	
Recommended charging-end-voltage	27.6 V \pm 0.02 V
Charging mode	CC/CV
Recommended charging current	2.5 A
Maximum charge current	6 A
Shutdown by BMS	>6 A
Operating temperature range	-20...+55°C
Shutdown temperature range	-30°C (Recovery -25°C)...+65°C (Recovery +60°C)

DISCHARGE PARAMETERS	
End-point voltage	~19.2 V
Recommended discharge current	2.5 A
Maximum discharge current	15 A
Shutdown by BMS	>18A \pm 2 A
Operating temperature range	-20°C...+55°C
Shutdown temperature range	-30°C (Recovery -25°C)...+75°C (Recovery +70°C)

MECHANICAL DATA

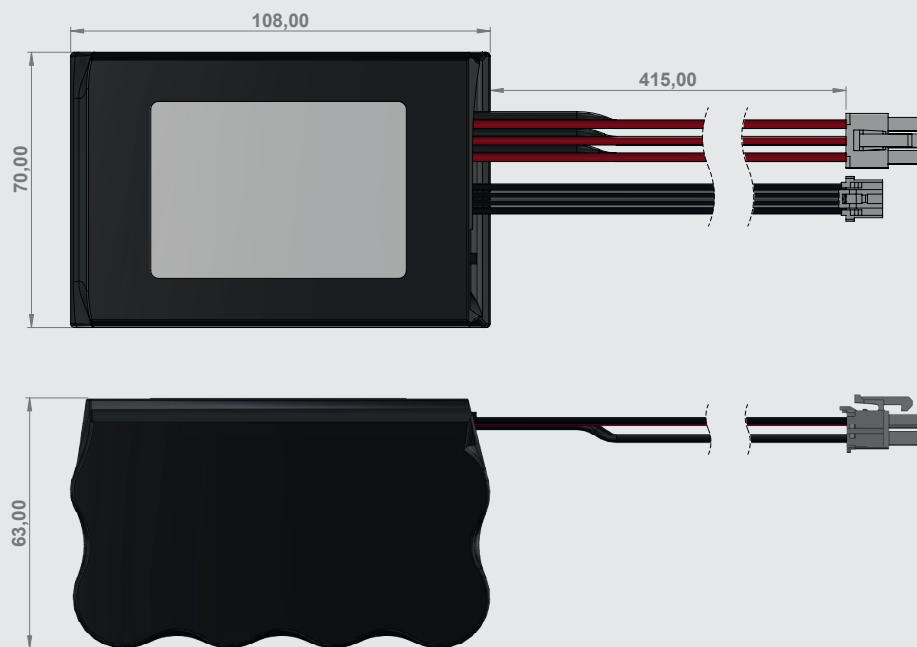
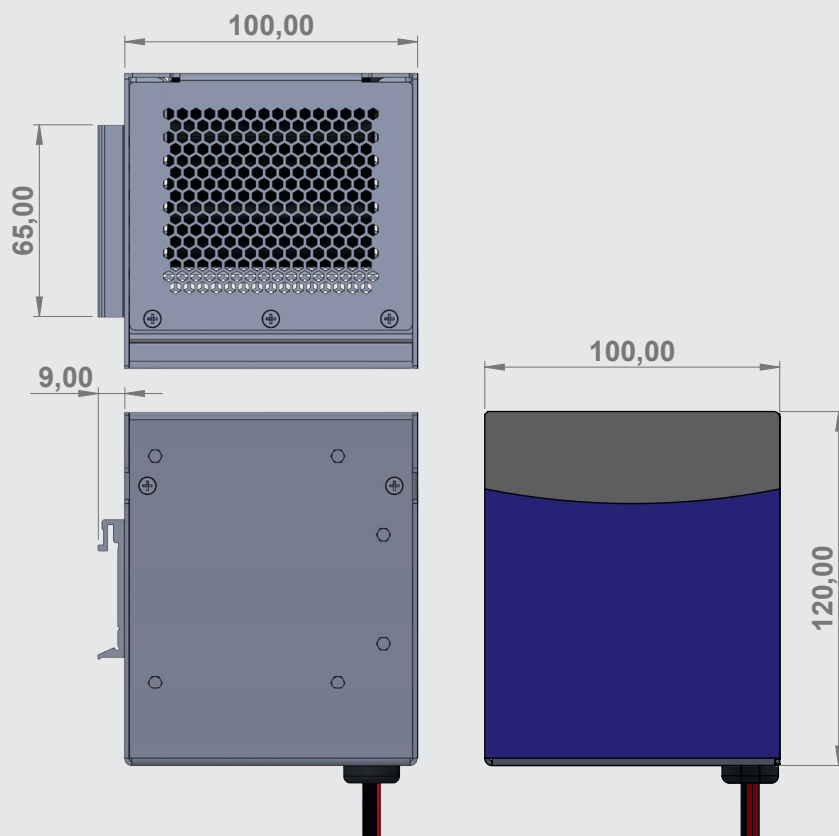
Length	108 mm
Width	70 mm
Height	63 mm
Weight	740 g

STORAGE

Recommended temperature range	25 °C ±5 °C
Maximum temperature range	-25 °C...+55 °C
Recommended charge level	80 %

APPROVALS

UN38.3	
IEC/EN	IEC/EN62133-3

MECHANICAL DIMENSIONS**BP-LFP-2725****BP-LFP-2725D**Tolerance ± 0.5 mm

E Functionality of BMS

If the BMS is in ACTIVE MODE, diverse critical parameters of the battery system (such as voltages, currents, etc.) are monitored cyclically by battery management system for compliance with the limits. In the event of a fault, the battery system disconnects the main current path. Charging and discharging is only possible with an activated battery management system

E1 Protection functions

The BMS has several possibilities for detecting fault conditions. The following is a basic breakdown into short-term, reversible and permanent errors:

If a short-term, reversible fault occurs during operation (e.g. overcurrent, overtemperature), the electronics will switch off briefly and then switch on again when the fault no longer exists, otherwise the battery will remain deactivated.

If a permanent error occurs during operation (e.g. loss of a cell voltage tap, deep discharge), the battery remains permanently deactivated and can only be re-enabled by the manufacturer (after troubleshooting).

	Short circuit and overload detection	Over- and undervoltage detection (cell)
First level of security	Switch off by balancing IC	
Second level of security	15 A fuse	Thermic fuse

Limits for short-term, reversible errors:

Abbreviation	Description	Grenzwerte
CUV	Cell undervoltage detection	2.4 V (Recovery 3.1 V)
COV	Cell overvoltage detection	3.65 V (Recovery 3.3 V)
OCD	Overcurrent detection during discharging	18 A (50 ms)
ASCD	Short-circuit detection during discharging	~64 A (200 µs)
OCC	Overcurrent detection during charging	6 A (160 ms)
OTC	Overtemperature detection of cells during charging	+65°C (Recovery +60°C)
OTD	Overtemperature detection of cells during discharging	+75°C (Recovery +70°C)
UTC	Undertemperature detection of cells during charging	–30°C (Recovery –25°C)
UTD	Undertemperature detection of cells during discharging	–30°C (Recovery –25°C)

E2 Charging behavior

The charging behavior depends on the procedure described in chapter 'Charging process'. For this purpose, a suitable charger should be used.

Abbreviation	Description / Condition	Comments
Charge Term Taper Current	Electricity at end of charge	Limit Current <100mA
CUV_RECOV_CHG	After discharge, the output voltage remains de-activated until a loading process has taken place.	Function is activated

The charging process is finished when the current has dropped below the value of the Charge Term Taper Current.

Charging an empty battery system

If a single cell falls below a voltage of 2.4 V, the discharge MOSFETs are blocked to prevent damage to the cells. As soon as a charger is connected and its output voltage is active, the battery gets charged. The pin "System Present" (F „Additional functions", page 15) of the communication plug must be switched to GND. If all cell voltages exceed 3.1 V, the battery can be discharged again.

Note:

Under extreme conditions e.g. at particularly low or high temperatures, the charging and discharging behavior in conjunction with your application should be checked. The cell characteristic leads to a different voltage behavior of the cells.

E3 Balancing

The BMS balances the cells during charging process. The necessary balancing times are automatically determined by the BMS.

Description	Limits
Limit balancing	≥3.1 V single cell voltage (during charging)
Balancing current	~100 mA (pulsed)

E4 Discharge

The BMS switches off the output voltage when the final discharge voltage is reached. Protective functions of temporary, reversible or permanent faults and short-circuit detection are not affected by this!

After complete discharge, charge the battery system **soon** (within 7 days) to avoid a deep discharge.

E5 Deep discharge

When the battery is not in use, the BMS switches to a power-saving mode with particularly low self-consumption. Thereby the MOSFET main switch and various functions are turned off to protect the cells from deep discharge.

PF shutdown voltage: If a cell voltage is below the limit (1.9 V) the BMS turns into a permanent error state. A charging process is then no longer possible. The core pack is deeply discharged.

E6 SMBus

Various data of used balancer IC are available via SMBus. This is integrated into two-wire SMBus V1.1 standard.

E7 Discharging process

During discharge process, the pack voltage drops from the end-of-charge voltage (100% SoC) to end-of-discharge voltage (0% SoC). Depending on current, the remaining capacity decreases continuously. If the battery management system detects an error, it will be shut down as described in Section 'Functionality of BMS'.

E8 Charging process

Before using the charger for the first time, it is essential to read the operating instructions for the charger used!

General information

The charging process takes place according to the CC-CV procedure. After a charging phase with constant current (CC, Constant Current) up to the end-of-charge voltage, the battery is charged with a constant voltage (CV, Constant Voltage) and sinking current until the end of charge. If the battery management system detects an error, a shutdown occurs as described.

F Additional functions

System Present function

The use of this function is mandatory for the use of the battery. To enable the main current path, pin 6 (SP0) must be bridged to pin 8 (GND) on the communication connector. Otherwise, the BMS permanently blocks the main MOSFET switch.

Status PIN	Behaviour battery
PIN 6 open load	Main current path locked, charging and discharging of the battery is impossible
PIN 6 = PIN 8 = GND	Main current path unlocked, charging and discharging of the battery possible

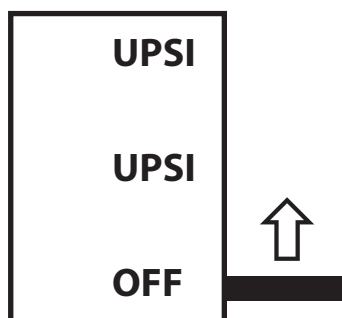
Note:

In case of a failure, the MOSFET main switch is not enabled despite activated System Present function.

G Operation modes

The BP-LFP-2725 has a switch on the cable side of the pack near the cable outlets. This switch has three modes: UPSI, UPSI, OFF. These different switch positions are printed on the label next to the switch:

ON/OFF Switch



G1 Switch position OFF

Please note: The following description applies to the BP-LFP-2725 (pack version), but **not** to the BP-LFP-2725D (DIN rail version, see G2 "Switch position UPSI").

This is the switch position for long-term storage of the battery. The power consumption of the BMS is reduced to an absolute minimum. The main switch of the BMS (Power-MOSFETs) is permanently blocked, which means that the main power plug is de-energized. The battery cannot be charged or discharged in this switch position. IC² communication with the battery is not possible.

Note that the battery should not be stored for a long time in a completely discharged state, as the BMS nevertheless has a very low power consumption and the batteries also show a certain self-discharge.

When the switch is in the OFF position, the storage life is approx. 1 year at 30% SOC.

G2 Switch position UPSI

This is the switch position for operation with the UPS **UPSI-2412** or **UPSI-2412D** from Bicker Elektronik GmbH.

BP-LFP-2725D: BP-LFP-2725D: In the DIN rail version of the battery the switch is delivered in the *UPSI* switch position. It **cannot** be operated without opening the housing.

Both the communication plug and the main power cable must be connected to the UPS system. The UPSI-2412(D) controls the connection and disconnection of the battery via the system present function of the 8-pin communication connector. All necessary information is transferred to the UPSI-2412(D) via the SM bus: current flow, individual cell voltages and state of charge. The protocol is based on the "Smart Battery Data Specification v1.1".

Please note: After a complete backup operation of the UPSI-2412(D) together with the battery, it should be recharged as soon as possible. If the input voltage returns to the UPS, it will automatically start charging the battery.

If the UPS with connected discharged battery is not put in operation again for more than two weeks, the battery may be deeply discharged.

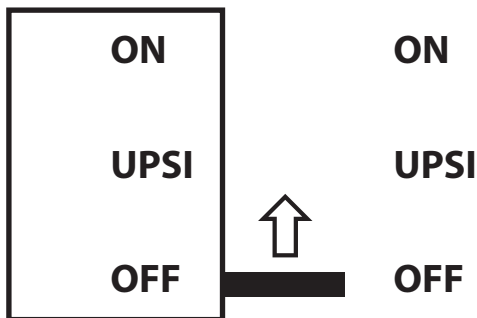
IMPORTANT:

The switch position *UPSI* is available twice on the switch. The switch settings are the same in normal delivery. On request, the *ON* position can be activated by a jumper. The *ON* position allows the user to use the battery without a Bicker UPS in the top switch position. In this position, various energy-saving modes are forcibly inactive because the pack has to be always on standby. As this significantly increases the risk of deep discharge in the event of accidental activation, this function is standardly deactivated.

G3 Switch position ON (ONLY OPTIONAL)

This switch position is used for operation without the Bicker UPS system, in the normal delivery state this is deactivated and is only activated on customer request. The MOSFET main switch is always enabled (the system present function is bridged). It is not necessary to use the communication connector for operation.

The function of the power button changes when activated as follows:



According to an 8S system with lithium iron phosphate batteries, the voltage at the main power plug can vary between 19.2V and 29.2V depending on the state of charge. The battery can be discharged and charged according to the given limit values.

Recommended charging-end-voltage: 27.6V (=3.45V per cell level)

Max. discharge current: 15 A

Max. charge current: 6 A

The maximum capacitive load, the battery can charge, is 1000 μ F. Otherwise the battery detects a short circuit and blocks the main current path.

IMPORTANT:

In switch position ON the battery is always on standby, so the BMS shows permanently the highest idle consumption. The integrated power saving modes of UPSI operation are largely inactive. The battery must not be stored in the ON switch position permanently. If a completely discharged battery is left in the ON position, the battery will be deeply discharged within a few hours! It is recommended to recharge the battery as soon as possible after discharge and to set it to the OFF position when not in use.

H Assembly and installation advice (only for BP-LFP-2725D)

H1 Convection and installation position

Do not cover any ventilation holes by adjacent components. For this 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.

The following distances to neighboring devices are recommended:

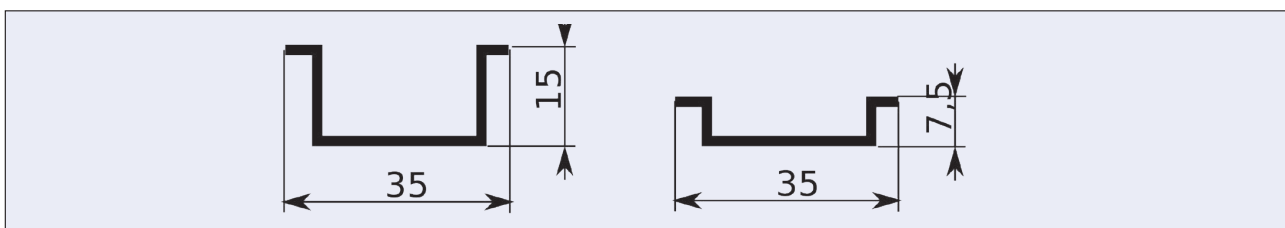
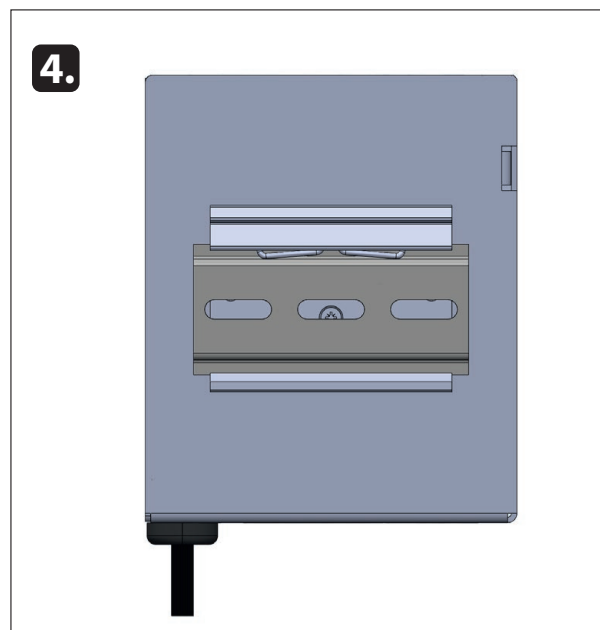
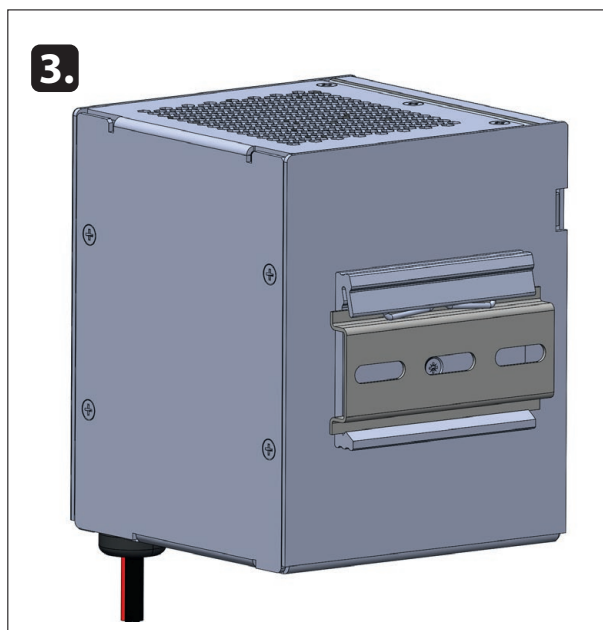
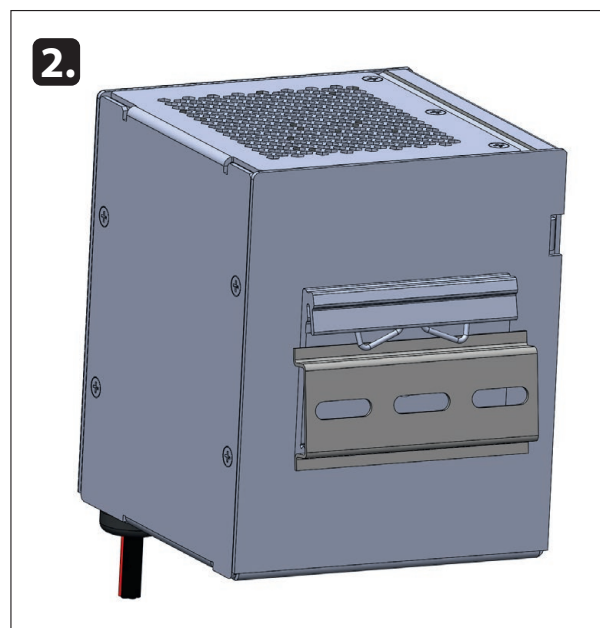
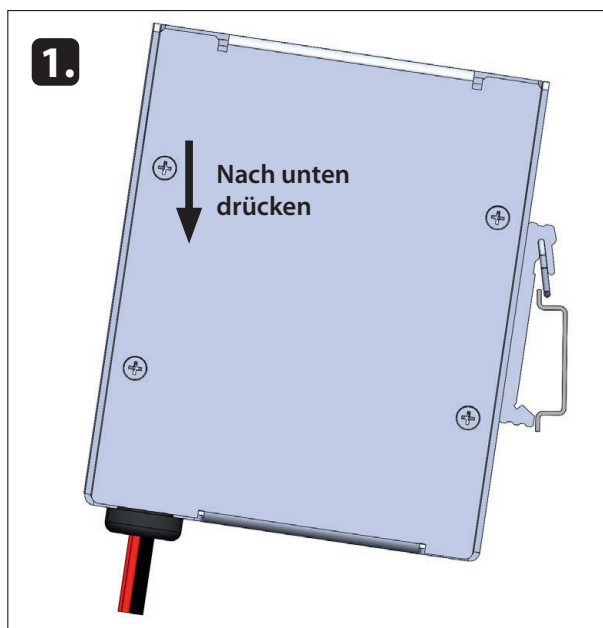
Left / right: 20 mm

Top / bottom: 50 mm



The devices comply with the IP protection class 20.

H2 DIN-Rail mounting and DIN-Rail profile according to EN 60715



I Handling and storage instructions



The battery has to be protected immediately after disconnection from UPSI-2412(D) or the application. No foreign particles (e.g. metal splinters, small nails, chips or other conductive metals) should enter the battery.

The battery should not be exposed to moisture (water, rain water, snow, etc.) during storage.

To avoid deep discharge, the battery should be charged before storing and checked at least every 2 months. If necessary, the battery is to be charged to 80 %.

The battery should be stored in a cool and dry place where it is protected from damage and unauthorized access.

High temperature fluctuations in the storage area should be avoided, for example storage next to heaters. Do not expose battery modules permanently to solar radiation.

To achieve optimum battery life, it should be stored at a temperature of $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and a humidity of 0% to 80%. The state of charge should be more than 30%.

When the battery is completely discharged, the battery must be charged as soon as possible.

J Transport instructions

The commercial transportation of lithium batteries is subject to the dangerous goods law. Transport preparations and transport must only be carried out by appropriately trained persons or the process must be accompanied by appropriate experts or qualified companies.

Transport regulations

Lithium batteries are subject to the following dangerous goods regulations and exceptions - in the respective current version:

- **Class 9**
- **UN 3480: LITHIUM-ION BATTERIES (including lithium-ion polymer batteries)**
- **UN 3481: LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES PACKED WITH EQUIPMENT**
- **Packing group: II**
- **Tunnel category E**

Transport of damaged or defective battery modules

Defective or damaged battery modules are also subject to the stricter transport special provision 376. These reach all the way to packaging in an aluminum box with vermiculite filling or a complete transport ban.

Air transport of waste batteries

Waste batteries and batteries transported for purposes of recycling or disposal are excluded from air freight unless authorized by the competent national authorities of the country of origin and the country of the executing company. (IATA DGR SV A183)

Batteries for disposal and recycling (road/railway/sea)

Lithium batteries may be transported for disposal and recycling in accordance with ADR SV 230 and SV 188, as applicable, or, if they have a gross mass of not more than 500 g, according to ADR SV 636 b.

Transport of used battery modules

When transporting used, intact and undamaged battery modules, the regulations for new batteries can usually be applied. However, for the transport of used - but not damaged - batteries, please also refer to the corresponding special regulations (636) or packing instructions (P903a and P903b / ADR).

Special and packaging regulations

The battery modules have an energy content of less than 100 Wh, therefore simplifying special provisions of the dangerous goods law can be applied:

- **ADR, RID: SV 188;**
- **IMDG: SP 188;**
- **IATA: PI 965, 966, 967, each section II**

For detailed transport instructions please refer to the safety data sheet!

K Disposal instructions

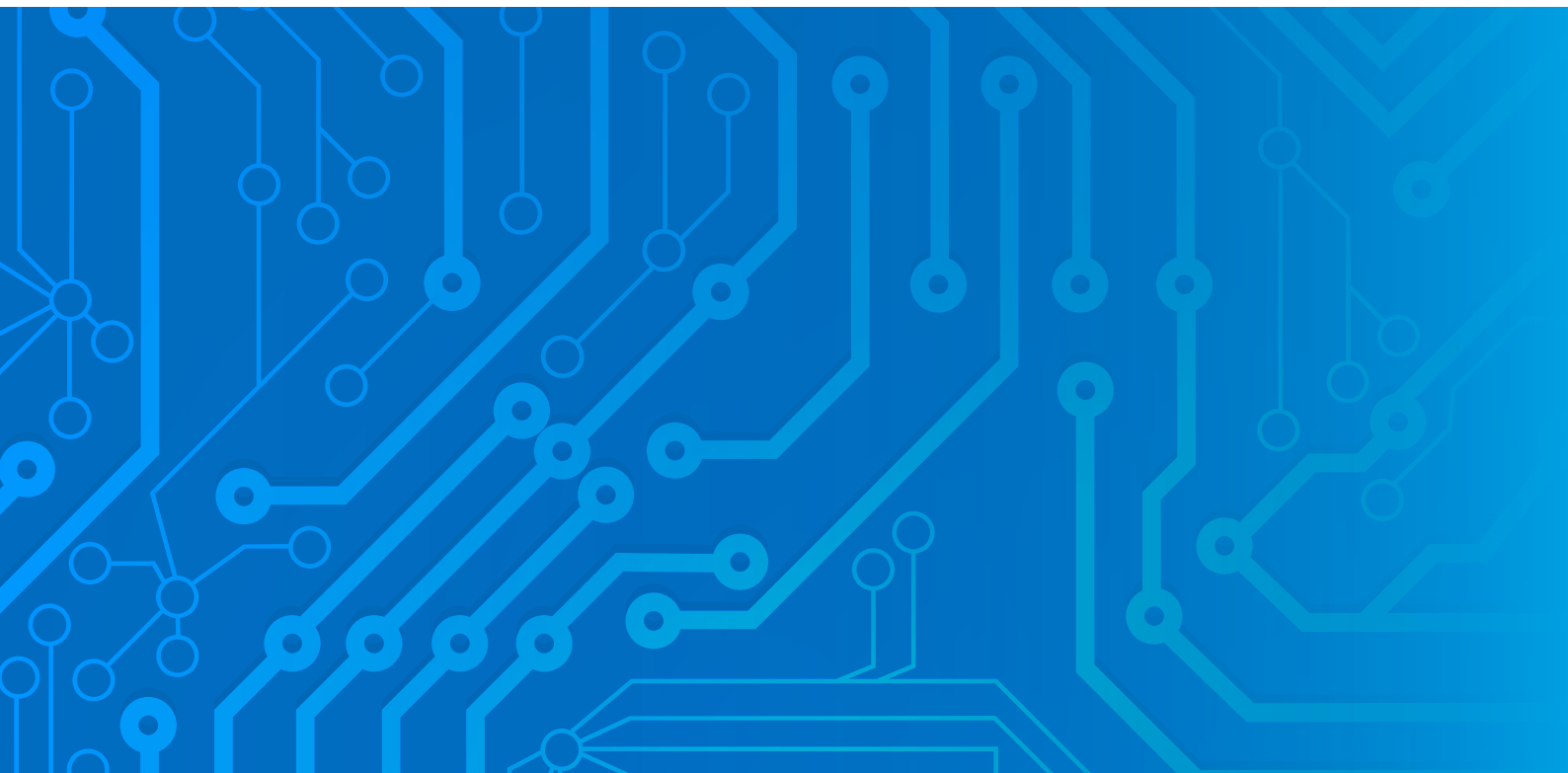


Used battery modules must be returned at the point of sale or in a special disposal system (industry, trade). The return is free. The battery modules must not be disposed of with household waste and must be collected separately from any further waste. The battery modules must not be allowed to enter sewers or bodies of water or be buried in the ground. The used battery modules must also be treated in accordance with section F (page 14) "Handling and storage instructions". They should preferably be given for disposal in a discharged condition and in a plastic bag or in their original packaging.

L Other information



The instructions in this operating manual merely provide assistance for compliance with legal requirements, but do not replace them. The information provided has been compiled to the best of our knowledge and belief.



Note: Subject to errors and technical modifications!
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Status as at: 05.01.2021 - Revision 1



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