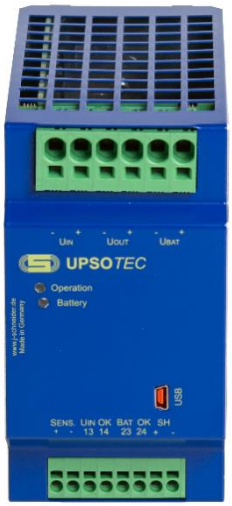
Instruction Manual
UPSO*TEC* 2420



DC-UPS
NBUA1530Gxxxx

Seite

1. General

1.1 General Safety Instructions

	**NOTICE** The operating instructions must be read prior to installation or use of the unit. The instructions must be observed. All warranty claims could be lost in case of non-observance!
	**WARNING** Only specialized electricians are authorized to commission and maintain the unit. In-proper handling with voltage procedures or capacitors can lead to electric shock and severe burns.
	**WARNING** All work on the unit may only be performed in de-energized state! The five safety rules must be observed. Input and output lines must be dimensioned and fused sufficiently! Non-observance can lead to fatal electric shocks.
	**WARNING** In case of short-circuit of energized capacitors, there is a risk of strong heat and the generation of arcs, which may cause severe burns!
	**NOTICE** The valid VDE regulations must be observed, especially DIN VDE 0100 and EN 60204!
	**NOTICE** In case of error we recommend to send the unit back to the manufacturer.
	**NOTICE** The unit must be operate with a corresponding pre-fusing.
	**NOTICE** The energy storage must be operated with a corresponding pre-fusing.

1.2 Short description

Die DC-UPS UPSOTEC includes a charging and monitoring system inside the housing, which charges the externally connected accumulators. The UPS is supplied by an external regulated DC power supply. In case of an interruption of the DC supply, the energy of the accumulators is switched on the output in an unregulated way. The load is supplied from the energy storage via the UPS until the voltage drops below the deep discharge limitation or another defined abortion event occurs. The back-up time depends on the state of charge of the accumulators and on the discharge current.

A more detailed technical description of function is described in chapter 4 Operation

The power supply has the following characteristics:

- Microcontroller based charging and discharging of the accumulators
- Charging of accumulators or ultra-capacitors is possible
- Mains failure message with potential-free contact, LED and USB
- Display of state of charge with signal light
- Vibration secured wiring with spring-type technique
- High efficiency
- Wide temperature range -25 °C up to 50 °C
- Shutdown input for early stop of the buffering
- Battery monitoring (internal resistance, fusing, presence)
- Protected against reverse polarity
- USB interface for monitoring, IPC operation and parameterisation
- Monitoring of operating hours of the energy storage

1.3 Intended Use

The **UPSO***TEC* is designed and developed for the industrial and plant engineering sector. The installation of the **UPSO***TEC* is to be carried out exclusively by qualified electricians.

If the **UPSO***TEC* is operated outside of its intended use, the protection supported by the **UPSO***TEC* cannot be guaranteed.

2 Transportation and Storage

The transportation of the devices may only be effected in original packaging. During transportation and storage the compliance with the environmental conditions must be observed. The device must be protected against humidity and direct sunlight.

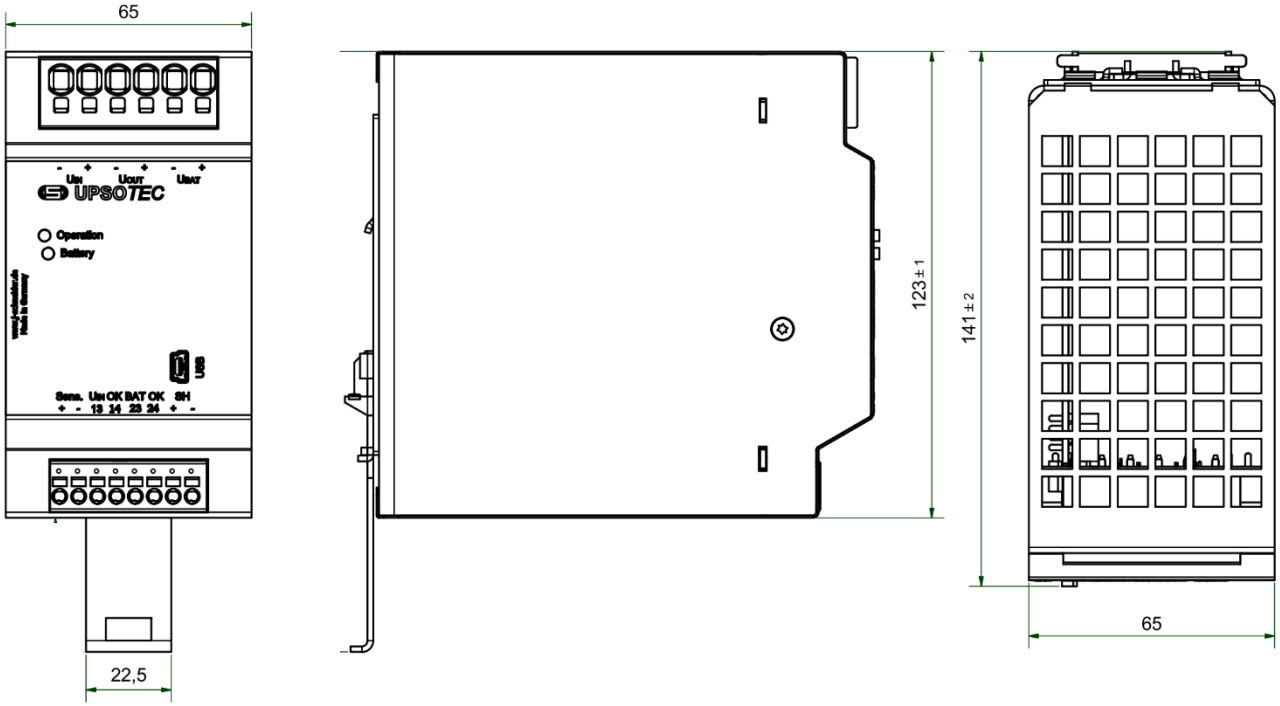
3 Installation and Connection

3.1 Installation

The DC-UPS must be installed in the way, that sufficient air cooling is guaranteed. A minimum distance above and underneath the air in- and outlets to neighbouring devices of at least 40mm must be observed. The specified environmental temperature must not be exceeded. The maximum operation height without load reduction is 2000 m above sea level. The unit is mounted on a DIN rail.

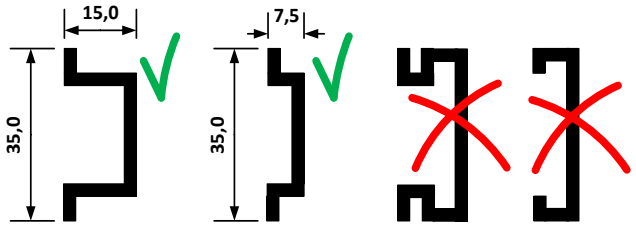
☞	**NOTICE** If drilling chips may fall onto respectively into the unit, it must be covered during installation. **Risk of short-circuit**!.
☞	**NOTICE** The unit is a built-in unit. The operation is only permissible in closed cabinets of housings. The unit is designed for pollution degree 2.
☞	**NOTICE** Please observe the maximum admissible load of your top hat rail corresponding to EN 60715 !

3.2 Dimensions UPSO*TEC* 2420



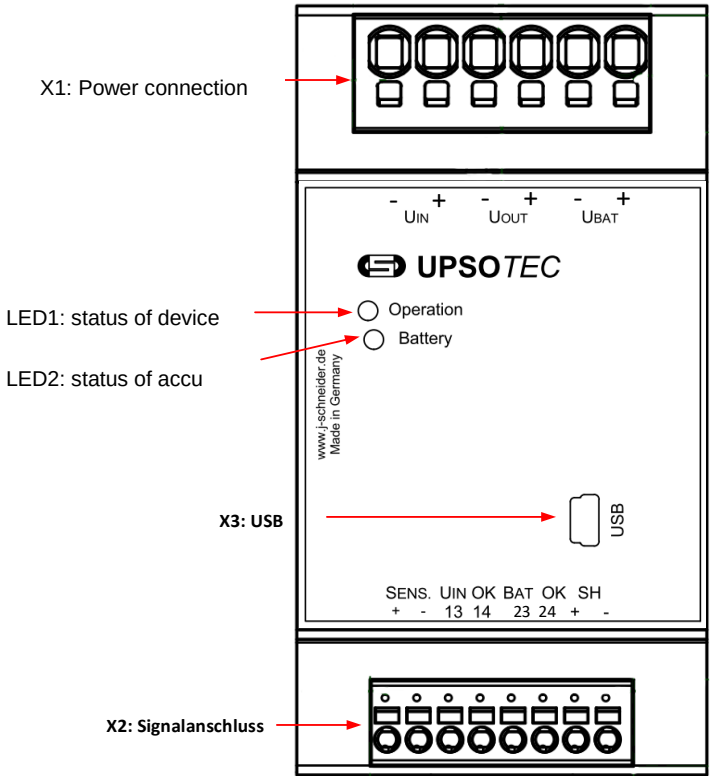
3.3 Dimensions DIN-Rail

DIN hat rail (TS 35) according to EN 50022



3.4 Connection

Prior to connection, the values of the DC supply must be compared with the values of the type plate on accordance. Connection according to the designations of the connection terminals (see circuit diagram and terminal assignment).



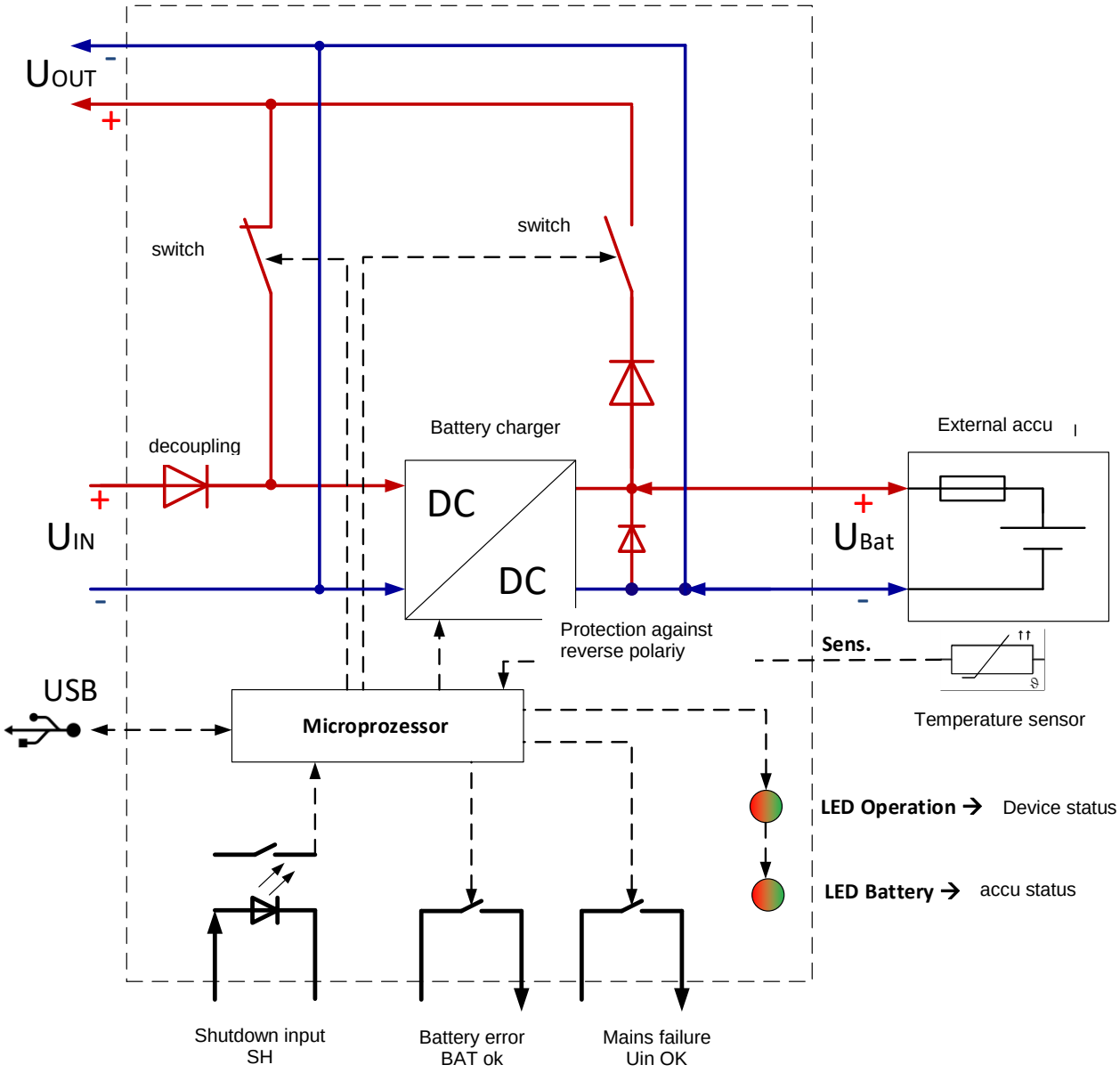
Terminals			Connection	
Designation	**Max. tightening torque/Nm**	**Cable cross section/mm²**		
U_{IN} + / U_{IN} -	Push-in spring connection	2,5 – 10,0	Input voltage	
U_{OUT} + / U_{OUT} -			Consumer	
U_{BAT} + / U_{BAT} -			Battery	
SENS: + / SENS. -	Push-in spring connection	0,2 – 4,0	Temperature sensor	
U_{IN} OK (13 / 14)			Message contact mains	Contact load: Min. 5 V DC / 1 mA Max. 30 V DC / 100 mA
Bat OK (23 / 24)			Message contact Battery OK	
SH + SH -			Shut-Down (Potential-free switch input) switch level 24 V DC (6 … 45 V DC	
USB	Mini-USB-B-socket		USB-interface	

Dimension the cable cross section of the supply and output cables according to EN 62368-1 table G.5; see also table above.

If the system is installed in accordance with EN 62368-1 and supply lines leave the room (building wiring), observe section 6.5.3 of EN 62368-1.

	**WARNING** During connection of the terminals pay attention to the consistency of the nominal voltage and to the polarity. In case of non-observance risk of strong heat and the generation of arcs, which may cause severe burns!
	**WARNING** In case of overload the DC output current is composed of the maximum current of the energy storage as well as of the current of the supplying DC mains. The output circuit must be fused externally to avoid an overload! In case of non-observance risk of strong heat generation, which may cause severe burns!
	**WARNING** Only SELV or PELV voltage sources are permitted for supplying the device. Failure to observe this may result in electric shock with fatal consequences

3.5 Circuit Diagram



4 Operation

The **UPSO***TEC* 2420 is connected between the DC supply and the load. If the input voltage exceeds 22,5 V DC, the unit is ready for operation and displays this status with the illumination of both LEDs and the tightening of the message contact „*UIN OK 13/14*“.
To enable buffer operation, an external energy store must be connected to the DC supply. The device receives the charging energy for the energy storage from the DC supply. The storage can only be charged if the device is ready for operation and the input voltage is higher than 22.5 V DC. The charging time is extended when the supply provides less power as required by the charging current and load current

Operation status:
Standby-Mode : U_{IN} > 22,5 V DC ± 2 %
Charging operation : U_{IN} > 22,5 V DC ± 2 %
Back-up operation : U_{IN} < 22,5 V DC ± 2 %

The device function differentiates between two operation states:

- Mains operation describes the behavior, when the supply mains is present.
- Back-up operation describes the behavior, when the supply mains fails or drops below a minimum voltage value.

4.1 Mains Operation

Mains operation is displayed with the green illumination of the LED *‚Operation‘* and the closed contact *UIN OK 13/14‘* . If an energy storage is connected and faultless, the UPS starts to charge it and the contact ‚*Bat OK 13/14‘* is closed. The charging is realized temperature tracked if a temperature sensor is connected. The state of charge of the energy storage is indicated with the LED ‚Battery‘.

4.1.1 Final Charging Voltage Battery

To achieve maximum charge, a temperature-controlled charge is recommended. For temperature-monitored charging, a corresponding temperature sensor of the type MTIAQ33G3Mxx must be fixed via the battery and connected to the 'Sens.' Connection. Depending on the temperature, the final charging voltage is regulated as follows

Battery temperature	Final Charging Voltage
-25 … -2 °C	28,40 V ± 2 %
-1 … -5 °C	28,15 V ± 2 %
6 … 15 °C	27,85 V ± 2 %
16 … 23 °C	27,55 V ± 2 %
24 … 29 °C	27,26 V ± 2 %
30 … 37 °C	26,97 V ± 2 %
38 … 40 °C	26,70 V ± 2 %

If no temperature sensor is connected, the highest temperature is assumed and the final charging voltage is limited to 26,7 V ± 2 %.

4.1.2 Battery Aging

The UPS records the operating hours of the battery and compares it with the parameterized lifetime.
If the specified life duration is exceeded, the UPS reports it via the 'Battery' LED and via the switch contact, BAT OK 23/24 ', if this is activated. If a new battery is connected, the counter can be reset via the TECControl software. The maximum life duration can be parameterized via the *TEC***Contro**l (see 4.5).
There are two types of operation counters: The first counts the operating hours normally up. The second shortens the operating hours according to the ambient temperature of the battery. This determines the actual aging of the battery related to its operating temperature.

4.1.3 ESR Monitoring

The ESR-Test measures the internal resistance of the accumulator and so enables a diagnosis of its status. The test is carried out at each new start as well as after an adjusted interval. The measurement is influenced by the battery fuse, the battery line and each contact, so that the measured value doesn't only stand for the internal resistance of the accumulator but for the internal resistance of the total accumulator circuit.
In the basic setting the limiting value is adjusted on 500 mΩ, but is should be adapted with the PC Software „TECControl". If the limiting value is exceeded, it is displayed with the LED ‚*Battery'* and the switch contact ‚*BAT OK 23/24'*.

Example of the composition for the total internal resistance:

ESR Battery new (25°C):	20 mΩ
Battery line:	10 mΩ
Battery fusing:	12 mΩ
Contact resistance/connection:	20 mΩ
Total resistance:	**62** mΩ

It is only recommended to read out the actual ESR value with the PC Software „*TEC***Control**" in the monitoring mode and subsequently to adjust the desired limiting value. (see 4.5).

As a possible design factor, a maximum voltage drop, such as 2 V, may be allowed for the determination of the limit value. The information is without guarantee.

Limiting value ≈ max. allowed voltage drop / max. discharge current in back-up operation

4.1.4 Capacitor Modules (UC-Modules)

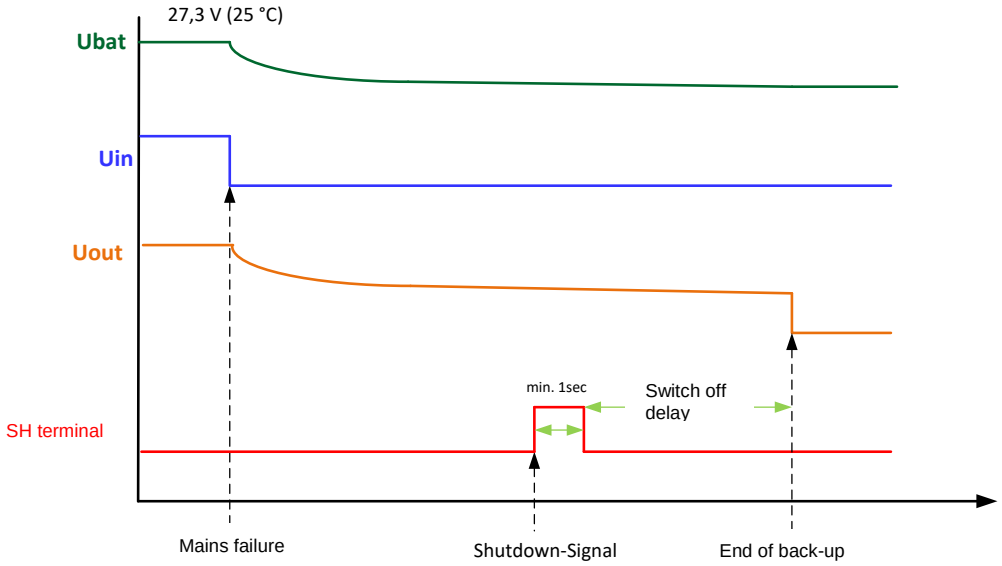
Instead of batteries, it is also possible to use corresponding capacitor modules as energy storage. When connecting capacitor modules, UC mode must be activated via the PC software.
In UC mode, the battery checks and the temperature-controlled charge end voltage are disabled and the capacitors are charged from 0V. The PC software are used to configure additional parameters such as the final charging voltage and the deep discharge voltage

4.2 Back-up Operation

In case of failure of the supply respectively if the minimum input voltage (22,5 V DC ± 2 %) is underrun, the device switches over to back-up operation. The UPS switches the energy storage via an internal switch on the output ‚U_{OUT}'. The LED ‚Operation' illuminates yellow and the contact ‚*UIN OK 13/14*' is released.
The state of charge of the accumulator is displayed with the LED ‚Battery'.

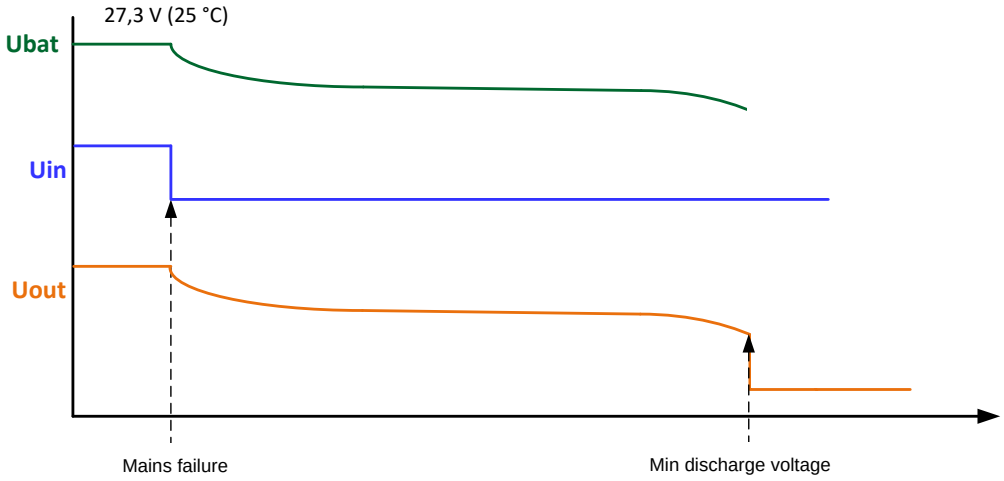
For the back-up operation four operation modes are selectable via the PC software „*TEC***Control**". At delivery the mode "Shutdown terminal" is activated as standard.

4.2.1 Shut-down Terminal (SH-terminal)



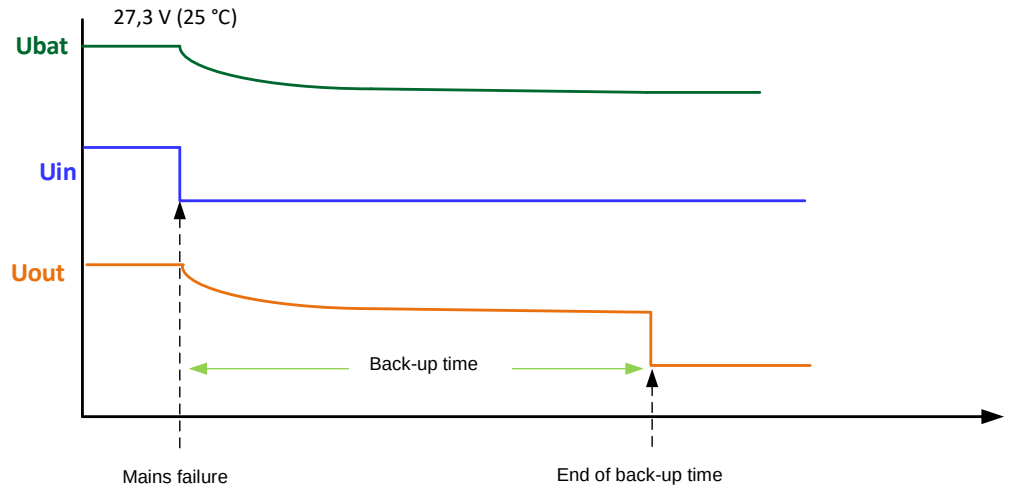
The DC UPS buffers the load until it receives a valid shut-down signal via the SH terminals. After the signal, the load can be buffered for the duration of the adjusted switch off delay. The time of the switch off delay can be adjusted with the PC software „*TEC***Control**" (factory setting 0 sec.).

4.2.2 Umin



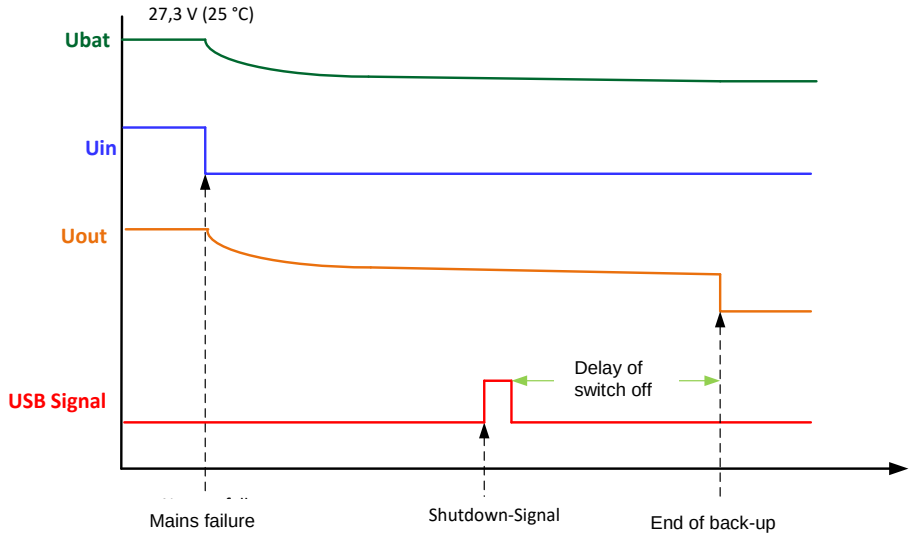
The load is buffered until the adjusted final deep discharge voltage. The threshold can be adjusted with the PC software „*TEC***Control**". (factory setting: 19,8 V ± 2%). This operation is always preferential.

4.2.3 Back-up time



Die DC-USV buffers the load until the end of the adjusted back-up time. The back-up time can be adjusted with the PC software and depends on the capacity of the used energy storage and the load current. (factory setting: 120 sec.).

4.2.4 IPC



The DC UPS buffers the load, until it receives a valid shut-down command from the PC software „*TEC*-**Control**“. After the command, the load is buffered for the duration of the adjusted switch off delay. The switch off delay can be adjusted with the PC software (factory setting: 48sec.)

NOTICE
If the minimum discharge current is reached before another shutdown incident occurs, the back-up is aborted to protect the accumulator against deep discharge.

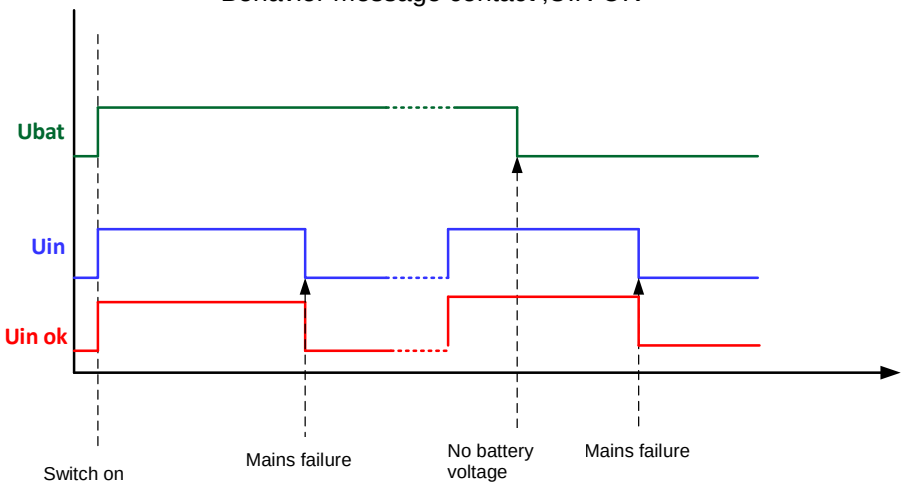
4.3 Status Display

The two RGB LED's ‚Operation' and ‚Battery' visualize the different operation states.
For an external status display, the unit has two message contacts, ‚UIN OK' for the evaluation of the mains entrance and ‚Bat OK' for the battery.

LED ‚Operation'		**Message contact ‚UIN OK'**
Permanently green	Mains OK, device OK, accumulator charged	Contact closed
is blinking green (1 sec. pulse)	Mains OK, device OK, accumulator is charging	Contact closed
Is blinking yellow (500 msec. pulse)	Mains failure	Contact opened
Is blinking red (200 msec. pulse)	UPS has an error, no accumulator present	Contact closed
LED ‚Battery'		**Message contact ‚Bat OK'**
Permanently green	State of charge between 100 and 60 %	Contact closed
Permanently yellow	State of charge between 60 and 30 %	Contact closed
Permanently red	State of charge between 30 and 0 %	Contact closed
Permanently red	State of charge between 30 and 0 %, mains failure	Contact opened
Is blinking red (200 msec. Pulse)	No accumulator present	Contact opened
Is blinking yellow (500 msec. pulse)	Accumulator has an error -> ESR	Contact opened
Is blinking yellow (500 msec. pulse)	Accumulator to warm	Contact opened*
Is blinking yellow (500 msec. pulse)	End of life time of accumulator	Contact opened*

*if this function was activated

Behavior message contact ‚UIN OK'



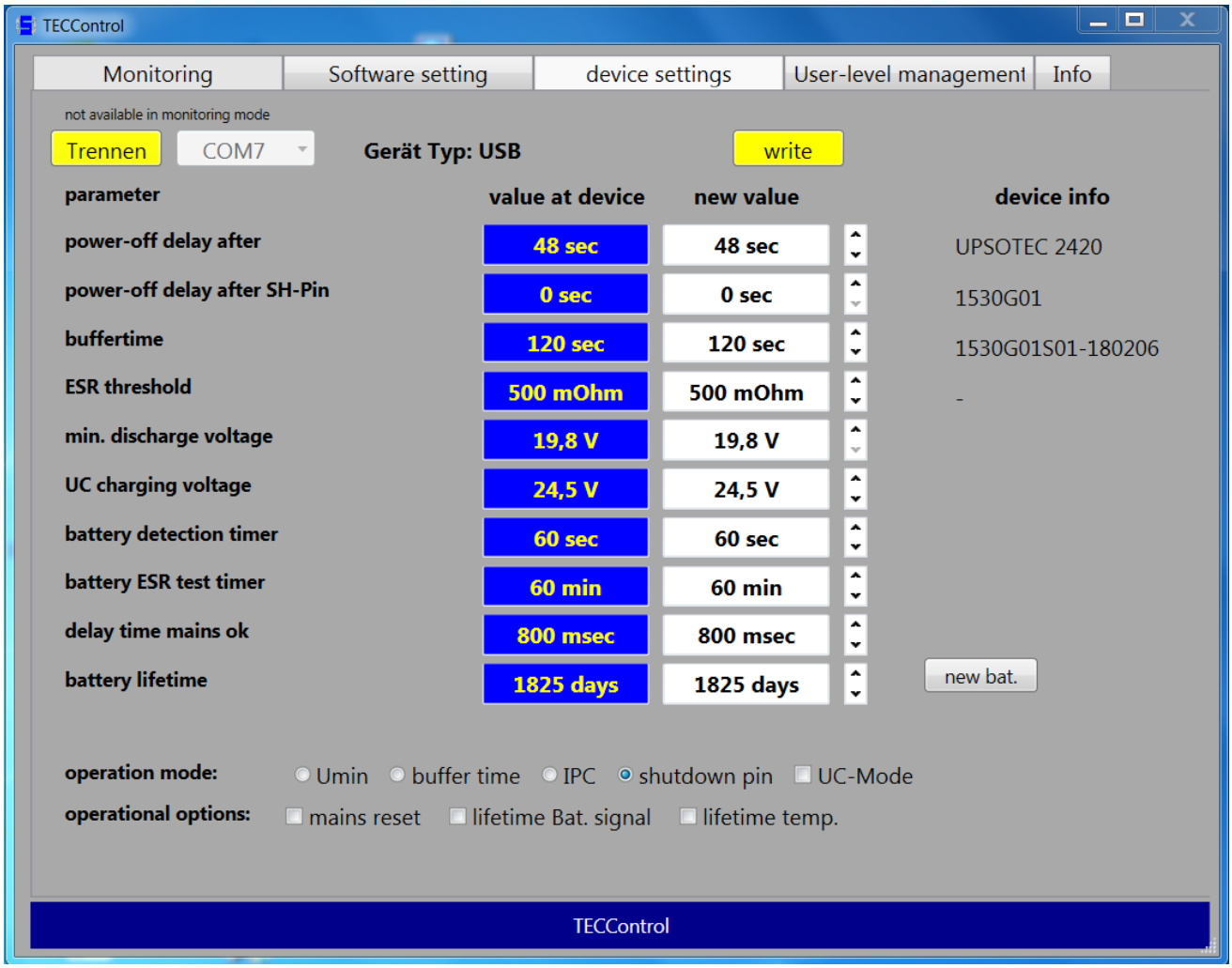
Behavior message contact ‚Bat OK'

4.4 Control Input

The UPSO*TEC* has a control input (Shutdown (SH)), which can terminate the back-up operation early. That the UPS recognizes that the signal as valid, it must be present at least for one second. Short switch pulses are ignored. The input is separated galvanically

4.5 Parameterization

Die DC-UPS is parameterized with the USB interface and the PC Software „*TEC***Control**“. Further information concerning the software can be taken out of the operating instruction of the software.



Die following parameters were already described in chapter back-up operation

- *Switch off delay at USB-SH-Signal*
- *Switch off delay at SH-Pin*
- *Back-up time*
- *min. discharge voltage*
- *operation mode: Umin*
- *operation mode: Back-up time*
- *operation mode: IPC*
- *operation mode: Shutdown terminal*

ESR-limiting value:
The UPS signalizes if the measured ESR value lays above the ajdusted value. (factory setting: 500 mΩ)

UC-charging voltage
The charging voltage in UC-Mode for capacitor modules (factory setting: 24,5 V)

Battery scan timer
The time between two battery scans, of a battery is present (factory setting: 60 sec.)

Batterie ESR Test Timer
The time between two ESR tests (factory setting: 60 min.)

Delay time for mains OK:
The time until the message contact *„Uin ok“* and the LED *„Operation“* signal mains present. If the time interval is to short, it may cause a permanent switch over if the mains is not yet stable.

Battery Lifetime
The maximum number of operating hours until a warning is generated. Here the actual counter value can be reset.

Operation mode: UC-Mode
The UC-mode is used for the operation with capacitor modules as energy storage.
In UC-mode the battery tests are deactivated and the charger can charge the capacitors from 0 V.

Operation mode: IPC
This mode is used fort he operation with an industrial PC. A shut-down command is send via the PC software, which switches off the back-up operation with a defined delay. To enable the IPC to restart, the operation option mains reset should be activated.

Operation options: mains reset
In case of mains reset, the input voltage is separated from the output for 5 sec., if the device is in shutdown und the supply voltage returns before the shutdown is finished. Thereby the IPC can restart automatically..

Operation options: signal Lifetime Bat.
Exceeding the counter of the operation hours of the battery is signaled via message contact and LED..

Operation options: signal Lifetime Bat.
Activation of the accelerated temperature dependent counter of battery operation hours.

5 Maintenance

Inside the housing there are no parts, which should be maintained by the user. The device shall be cleaned regularely depending on the degree of pollution.

5.1 Battery exchange

☞	**NOTICE** The battery exchange may only be realized if the device is switched off.

6 Putting out of operation

Before the separation of the supply voltage and the energy storage, the load must be switched off.
The putting out of operation is realized by the switch off of the supply voltage. The energy storage ‘UBAT‘ remains under voltage until the battery fuse is removed und must be released via the fuse before loosening.

	**WARNING** During operation the disconnection and connection of electrical connections is forbidden! In case of non-observence risk of arcs, which may cause severe burns.
	**WARNING** Hot surface. Touching the housing surface may cause severe burns!

7 Disposal

This symbol indicates, that the device must not be disposed with the normal domestic waste. Please dispose the product professionally as electronic scrap. Herewith materials are separated and recycled according to their qualities and you contribute in environmental protection.

8 Technical Data

U_{IN} nom.	Nominal input voltage	24 V DC -6,3% +20,8% (SELV/PELV)
U_{IN}	Input voltage range	22,5 … 30 V DC ± 2% (SELV/PELV)
	Minimum nominal input voltage for charging operation	22,5 V DC ± 2%
f nom.	Nominal frequency	DC
I_{IN} nom.	Nominal input current	20 A
I_{IN} max.	Max. input current (incl. charging current)	23 A DC
U_{BAT}	Voltage range battery	19,8 … 28,4 V DC ± 2%
U_{BAT} UC	Voltage range UC module	0 … 28,4 V DC ± 2%
I_{BAT} max	Max. charging current in battery mode, (Ubat>19V)	2,5 A
I_{BAT} max UC	Max. . charging current in Ultra Cap Mode	6 A
U_{OUT}	Output voltage range (= U_{IN} or U_{BAT})	19,8 … 30 V DC ± 2%
U_{OUT} nom.	Nominal output voltage in mains operation (= U_{IN})	24 V DC
	Output voltage range in back-up operation, with temperature tracking	19,8 … 28,4 V DC ± 2%
	Output voltage range in back-up operation, without temperature tracking	19,8 … 26,7 V DC ± 2%
I_{OUT} nom.	Nominal output current	20 A DC
	Max. output fusing	20 A (z.B. FK3)
P_V nom.	Power loss (at battery charged)	5,6 W (24 V / 20 A)
η nom.	efficiency (at battery charged)	98,8 %
	Switch in parallel	yes (max. 2)
	Switch in series	no
	Protection class	III
	Overvoltage category	CAT I
	Degree of pollution	II
	Temperature Sensor	MTIAQ33G3Mxx
	Battery type	Lead acid accumulator closed max. 40 Ah
	UC module size	max. 200 F
	Protective system	IP20
ta /	Operation temperatur / storage temperatur	-25 ... +50 °C
	Relative humidity	Max. 95%, no condensation permissible
	Max. mounting height (without load reduction)	2000 m above sea level
	Dimensions (H x W x D)	123 mm x 65 mm x141 mm (±0,5mm)
	Weight	appr. 0,65 kg

9 Norms and Regulations

Test specification	Norm	Class / testing accuracy
Total unit	EN 50178 EN 62368-1 / EN 61010-1/ EN 61010-2-201 UL 508	
Ermitted interference	EN 61000-6-3 (residential area)	B
	EN 55011 (ISM-devices)	B
Noise immunity	EN 61000-6-2 (Industrial area)	
	EN 62040-2 (UPS)	C1
	EN 61000-4-2 (ESD)	
	EN 61000-4-3 (EM - fields)	
	EN 61000-4-4 (Burst)	
	EN 61000-4-5 (Surge)	
	EN 61000-4-6 (Induced HF-fields)	
	EN 61000-4-8 (Magnetic fields)	
Mechanical Test	EN 60068-2-6 (vibrations (sin))	
	EN 60068-2-27 (Shocks)	

10 Error Elimination

Error	Note
No output voltage present after a short-circuit	The UPS must be reset: Switch the device voltage-free for approximately 20s. (separate supply U_{BAT} and U_{IN} from the unit)