EN54-7A40LCD

v.1.1

EN54 27,6V/7A/2x40Ah/LCD
power supply for fire alarm systems

EN**

Edition: 5 from 31.01.2019

Supersedes the edition: 4 from 11.01.2016

LCD Version

TABLE OF CONTENTS

1. PSU features:

- In accordance with standards: EN 54-4, EN12101-10
- 27,6 V DC/ 7 A uninterruptible power supply
- battery housing for two 40 Ah/12 V batteries
- independently protected outputs AUX1 and AUX2
- high efficiency 82%
- low level of voltage ripple
- microprocessor-based automation system
- intelligent PSU overload protection
- measurement of the resistance of the battery circuit
- automatic temperature-compensated charging
- battery test
- two-stage battery charging process
- accelerated battery charging
- monitoring of the continuity of the battery circuit
- monitoring of the battery voltage
- monitoring of the battery fuse
- monitoring of charging and maintenance of the batteries
- deep discharge battery protection (UVP)
- battery overcharge protection
- battery output protection against short-circuit and reverse connection
- monitoring of the load current
- output voltage control
- fuse monitoring of AUX1and AUX2 outputs
- ~230 V mains voltage measurement
- „SERIAL” communication port with implemented MODBUS RTU protocol
- Power Security" is a free application for remote monitoring of power supplies (for PC and Android Phones)
- remote control (options: WiFi, Ethernet, RS485, USB)
- remote battery test (required additional modules)
- cooperation with optional EN54-LB4 or EN54-LB8 fuse modules
- optical indication of PSU overload OVL
- acoustic indication of failure
- adjustable delay for ~230 V power loss indication
- relay output of collective failure ALARM
- input of collective failure EXTi
- controlled relay output EXTo
- technical inputs/outputs with galvanic isolation
- EPS technical output indicating ~230 V power loss
- PSU technical output indicating PSU failure
- APS technical output indicating battery failure
- internal memory of PSU operating status
- optical indication – LCD panel
    - readings of electrical parameters, including: voltage, current, resistance of the circuit, mains supply voltage
    - failure indication
    - configuration of the PSU settings from the control panel
    - two levels of password protected access
    - operation memory of the PSU
    - failure memory
    - real time clock with battery backup
- protections:
    - SCP short-circuit protection
    - OLP overload protection
    - OHP overheat protection
    - OVP overvoltage protection
    - Surge protection
    - Antisabotage protection (Tamper)
- closing the enclosure - lock
- convection cooling
- warranty - 5 years from the production date

2. Package contents.

- Power Supply Unit
- User manual
- Red mounting spacers – 4 pieces
- Red, metal mounting brackets for hanging the power supply – 4 pieces
- M8x16 mounting screws – 4 pieces
- PG9 cable glands – 4 pieces
- PG11 cable glands – 4 pieces
- Battery serial connection cable
- Keys to lock the power supply– 2 pieces
- Cable tie 190x4,8 – 12 pieces

3. Functional requirements of the PSU.

The buffer power supply for fire alarm systems has been designed in accordance with the following standards:
- EN 54-4:2001 and / A2:2007 Fire detection and fire alarm systems.
- EN 12101-10:2007 Smoke and heat control systems.

Functional requirements	Requirements according to standards	PSU EN54-7A40LCD
External Power Supply failure indication	YES	YES
Two independent power supply outputs protected against short-circuit	YES	YES
Temperature-compensated battery charging	YES	YES
Measurement of the resistance of the battery circuit	YES	YES
Low battery indication	YES	YES
Deep discharge battery protection	YES	YES
Protection against short-circuit of the battery terminals	YES	YES
Blown battery fuse indication	YES	YES
Charging circuit failure indication	YES	YES
Low output voltage indication	YES	YES
High output voltage indication	YES	YES
Indication of power supply failure	YES	YES
Overvoltage protection	YES	YES
Short-circuit protection	YES	YES
Overload protection	YES	YES
Output of collective failure ALARM	YES	YES
EPS technical output	YES	YES
APS technical output	YES	YES
PSU technical output	-	YES
Input of an external failure indication EXTi	-	YES
Controlled relay output EXTo	-	YES
Remote battery test	-	YES
~230 V mains supply voltage measurement	-	YES
LCD optical indication	-	YES
Tamper indicating enclosure opening	-	YES

4. Technical description.

4.1. General description.

The buffer power supply has been designed for an uninterrupted supply of fire alarm systems, smoke and heat control systems, fire protection equipment and fire automatics requiring stabilized voltage of 24 V DC (± 15%). The PSU is fitted with two independently protected outputs AUX1 and AUX2, which supply voltage of **27,6 V DC** with a total output current**:**

Continuous operation
Output current Imax a=5 A

Instantaneous operation
Output current Imax b=7 A

In case of power loss, the PSU switches to battery power, providing uninterruptible power supply. The PSU is enclosed in a metal casing (color: RAL 3001 - red) with battery housing for two 40 Ah/12 V batteries. The PSU works with maintenance-free lead acid batteries made with AGM technology or gel technology.

4.2. Block diagram.

The PSU has been manufactured based on a high-efficiency system of DC/DC converter. Applied microprocessor circuit is responsible for the full diagnostics of the PSU parameters and batteries. The figure below shows a flowchart of the power supply, along with selected functional blocks which are essential for the proper functioning of the unit

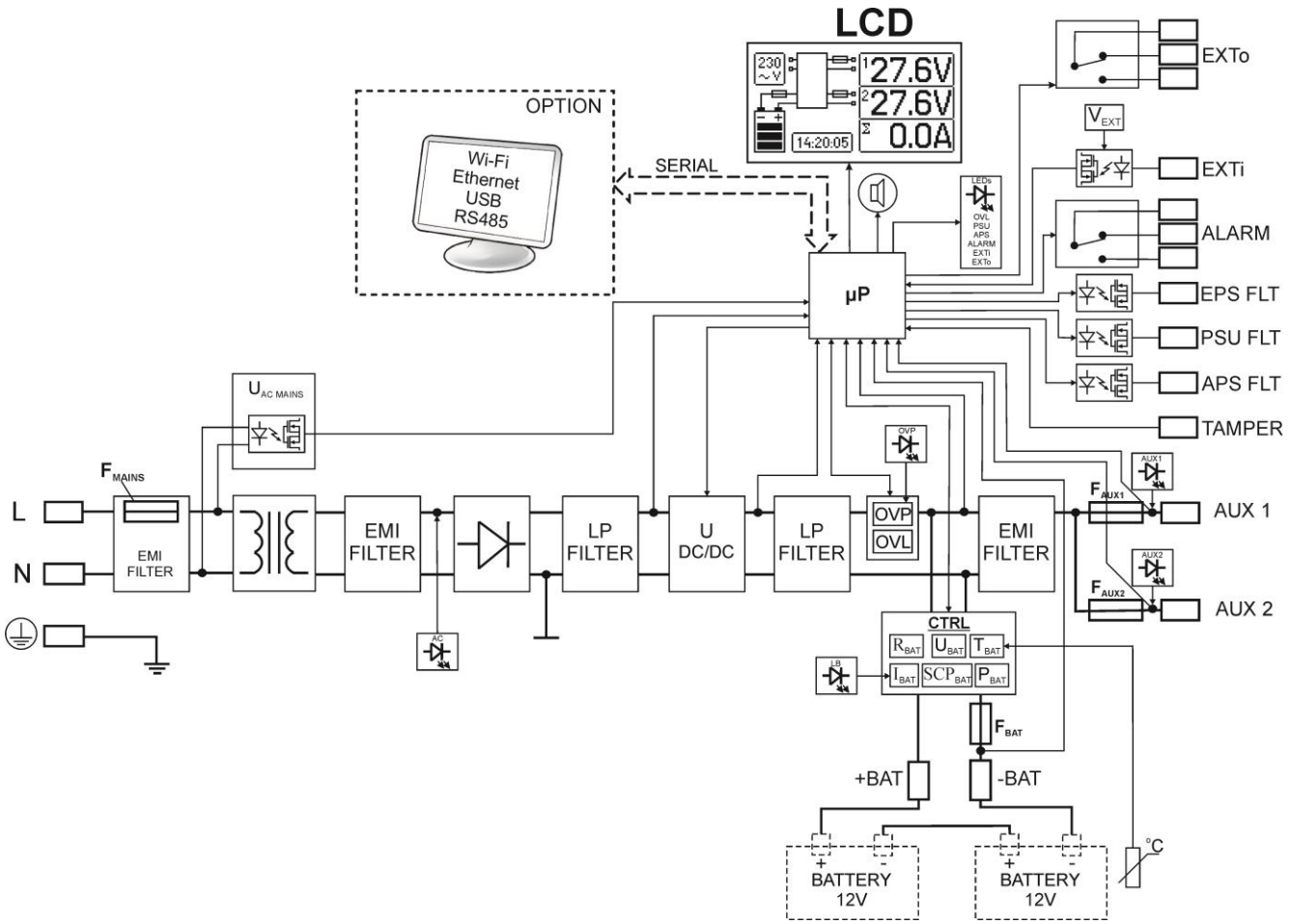


Fig. 1. PSU block diagram.

4.3. Description of components and power supply terminals.

Table 1. Components of the Power supply PCB (Fig. 2).

Component No.	Description
[1]	**PANEL** – optical indication connector
[2]	**BUZZER** – acoustic indication (section 7.2.2)
[3]	**V_{EXT} jumper** – polarization of the EXTi circuit (section 6.6)
[4]	**F_{BAT}** – fuse in the battery circuit, F10 A / 250 V
[5]	**F_{AUX1}** – fuse in the AUX1 output circuit, F8 A / 250 V
[6]	**F_{AUX2}** – fuse in the AUX2 output circuit, F8 A / 250 V
[7]	**SERIAL** – communication port
[8]	**Z2 jumper** – temporary lock of the battery test (section 8.5) – The EXTo relay switch lock from the PowerSecurity application-level (section 7.2.3)
[9]	**OVP** – overvoltage protection optical indication (section 6.9)
[10]	**LEDs** – optical indication: **AC** – AC power **AUX1** – AUX1 output voltage **AUX2** – AUX2 output voltage **OVL** – PSU overload **APS** – battery failure **PSU** – PSU failure **ALARM** – collective failure **EXTi** – EXTi input status **EXTo** – EXTo relay output status **LB** – battery charging
[11]	**Terminals:** **~AC~** – AC power input **EPS FLT** – technical output of AC power failure indication open = AC power failure close = AC power - O.K. **PSU FLT** – technical output of PSU failure indication open = failure close = PSU operation - O.K. **APS FLT** – technical output of battery failure open = battery failure close = battery status - O.K. **ALARM** – technical output of collective failure of the PSU - relay type. **CAUTION!** In Fig.2 the set of contacts shows a potential-free status of the relay, which corresponds to power supply failure. **EXTo** – controlled relay output **EXTi** – input of collective failure **+BAT-** – terminals for connecting the battery **+AUX1-** – AUX1 power output (+AUX1= +U, -AUX=GND) **+AUX2-** – AUX2 power output (+AUX2= +U, -AUX=GND)
[12}	**TAMPER** – antisabotage protection microswitch connector (section 6.7)
[13]	**Connector**– for connecting the EMC filter

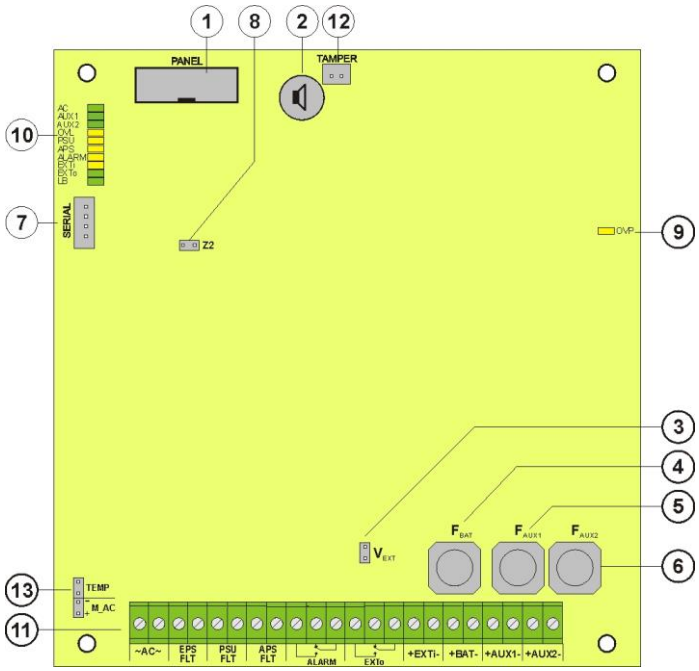


Fig. 2. The view of the PSU's PCB.

Table 2. Components of the PCB of the EMC filter (Fig. 3).

Element No.	Description
1	**F_{MAINS}** fuse in the power supply circuit 230 V, T6,3 A / 250 V
2	**L-N** power supply connector 230 V, ⏚ protective connector
3	**Connector**– for connecting the PSU.

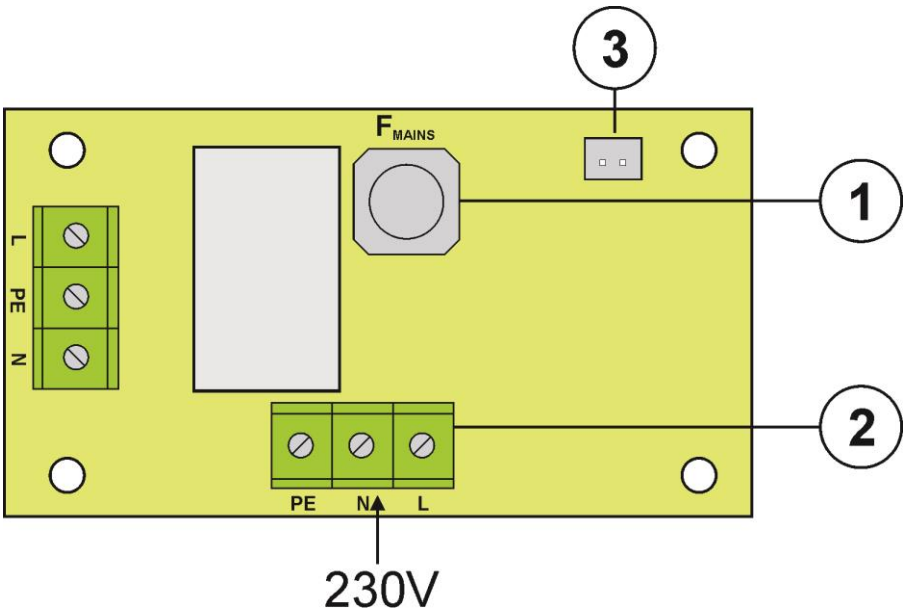


Fig. 3. The view of the EMC filter.

Table 3. Elements of the PSU (see Fig. 4).

Component No.	Description
[1]	Isolation transformer
[2]	Printed Circuit Board (see Table 1, Fig. 2)
[3]	Battery temperature sensor.
[4]	Space to install an additional module: “INTR”, “INTE”, “INTW”,
[5]	Place to install the EN54-LB4 or EN54-LB8 fuse module
[6]	**TAMPER;** microswitch (contacts) of antisabotage protection **(NC)**
[7]	EMC filter module (see Table 2, Fig. 3)
[8]	2x40 Ah batteries
[9]	Embossing for cable gland
[10]	Embossing for cable gland (WiFi antenna or cable communication interface)
[11]	Embossings for concealed wires
[12]	Lock
[13]	Battery connectors; positive: +BAT = red, negative: - BAT = black

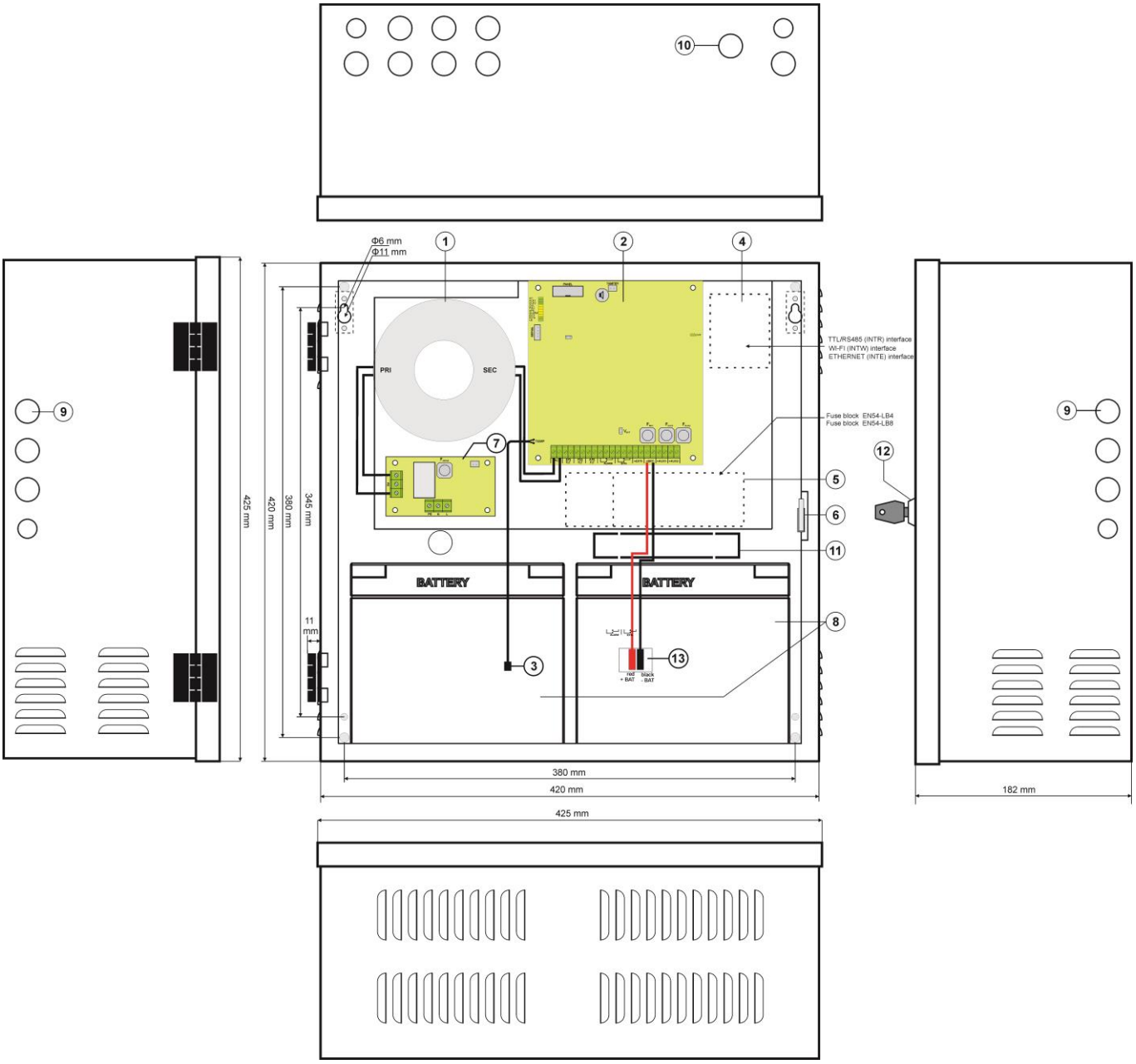


Fig.4. The view of the PSU.

5. Installation.

5.1. Requirements.

The PSU is to be mounted by a qualified installer, holding relevant permits and licenses (applicable and required for a given country) for ~230 V in and low-voltage installations.

As the power supply is designed for a continuous operation and is not equipped with a power-switch, therefore, an appropriate overload protection in the power supply circuit should be provided. Moreover, the user should be informed how to disconnect the power supply unit from the mains supply (usually by assigning an appropriate fuse in the fuse box). The electrical system shall be made in accordance with applicable standards and regulations. The power supply should operate in a vertical position in order to provide free and convectional air flow through ventilating holes of the casing. If necessary, it is possible to permanently disconnect the battery from the power supply systems by removing the F_{BAT} fuse.

As the PSU performs a periodic battery test, measuring the resistance of connections, special attention should be paid to the proper installation of the cables. Installation cables should be firmly connected to the battery side terminals and to the power supply connector.

The side walls of the housing include the embossings, which should be used to carry out installation cables. Use a blunt instrument to make an opening for cable gland from the outside of the housing. Then, carefully mount the cable gland, protecting the PSU from water penetration, in the opening.

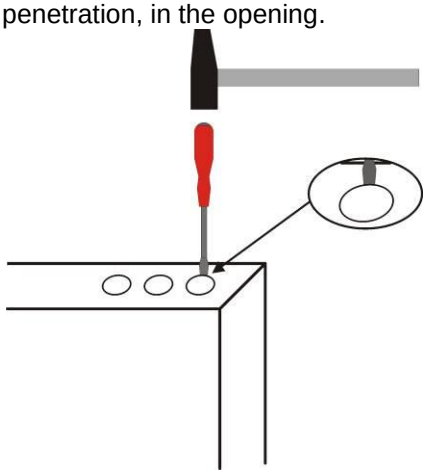


Fig. 5. The method of forming an opening for cable gland.

The PSU is fitted with PG9 and PG11 cable glands. Gland size should be chosen depending on the cross-section of the cable. Single cable gland can be used for only one wire.

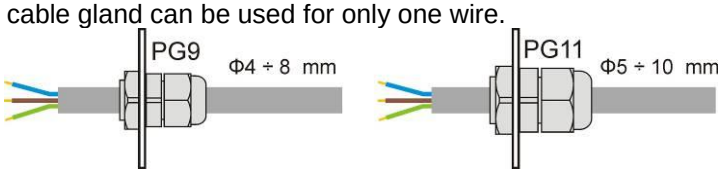


Fig. 6. Recommended types and sections of installation cables PG9 and PG11 for cable glands.

The PSU is protected against access to the configuration menu through two-level passwords. If the default settings should be changed, unlock access by entering the service password – see Table 5 and section 7.1.

5.2. Installation procedure.

CAUTION!

Before installation, cut off the voltage in the 230 V power-supply circuit.

To switch power off, use an external switch, in which the distance between the contacts of all poles in the disconnection state is not less than 3mm

It is required to install an installation switch with a nominal current of min. 3 A in the power supply circuits outside the power supply unit.

1. Mount the PSU in a selected location with use of special metal expansion bolts. Do not use PVC dowels.
2. Connect the power cables (~230 V) to L-N terminals of the PSU. The cable length inside the housing should not exceed 10 cm. Connect the ground wire to the terminal marked with grounding symbol. Use a three-core cable (with a yellow and green protection wire) to make the connection.

The shock protection circuit shall be done with a particular care: the yellow and green wire coat of the power cable should be connected to the terminal marked with the grounding symbol on the PSU enclosure. Operation of the PSU without the properly made and fully operational shock protection circuit is UNACCEPTABLE! It can cause damage to the equipment or an electric shock.

3. Connect the receivers' cables to the AUX1 and AUX2 output terminals on the PSU board.
4. If needed, connect the cables from the devices to the technical inputs and outputs:
   - ALARM; technical output of collective failure of the PSU
   - EPS FLT; technical output of AC power loss indication
   - PSU FLT; technical output of PSU failure.
   - APS FLT; technical output of the battery failure.
   - EXTi; input of collective failure
5. Install the batteries in a designated area of the enclosure (see Fig. 4). Connect the batteries with the PSU paying special attention to the correct polarity. Batteries must be connected in series using the special cable (included).
6. Switch on the ~230 V supply. The corresponding LEDs on the power supply PCB should be ON: green AC and green AUX1 and AUX2. Green LB LED should light up while charging.
7. Check the current consumption of the receivers, taking into account the battery charging current, so as not to exceed the total current efficiency of the PSU (see section 4.1).
8. Once the tests are completed, close the enclosure.

Table 4. Operation parameters.

Environmental class EN 12101-10:2007	2
Operating temperature	-5 ºC...+75 ºC
Storing temperature	-25 ºC...+60 ºC
Relative humidity	20 %...90 %, no condensation
Sinusoidal vibrations during operation: 10 ÷ 50 Hz 50 ÷ 150 Hz	 0,1 G 0,5 G
Surges during operation	0,5 J
Direct insolation	unacceptable
Vibrations and surges during transport	According to the PN-83/T-42106 standard

Table 5. Factory settings of the PSU.

Delay time for EPS technical output indicating AC power loss	10s	See section 7.2.4.
Acoustic indication	ON	See section 7.2.2.
EXTo output	OFF	See section 7.2.3.
Communication address	1	See section 7.2.5.
Transmission	115.2k 8E1	See section 7.2.6.
Backlight	Constant – 50%	See section 7.3.4.
Blinking light indicating failure	ON	See section 7.3.4
Passwords: - user password - service password - keyboard lock	 1111 1234 NO	See section 7.1

6. Functions.

6.1. Control Panel.

The PSU features a panel with buttons and LCD display, enabling reading of all the available electrical parameters. The panel buttons are used to select and confirm the parameters, which should be displayed.

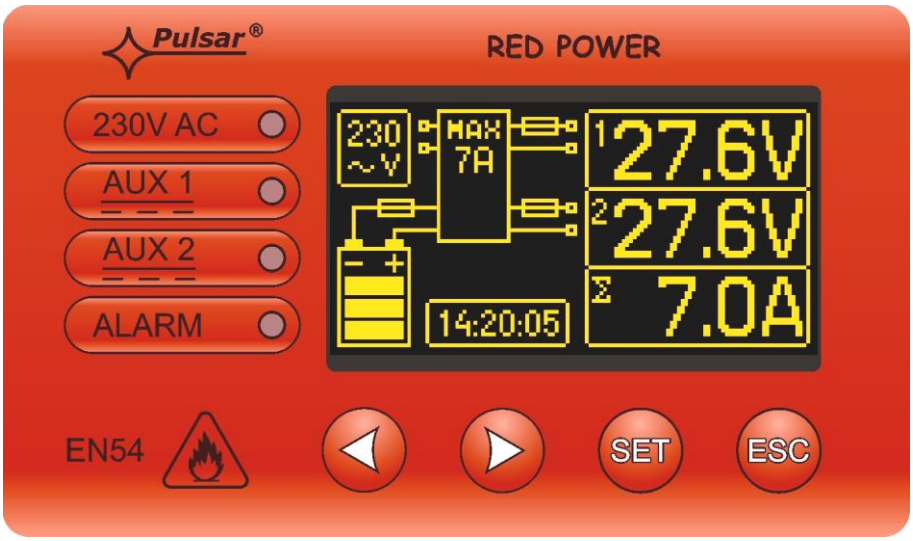
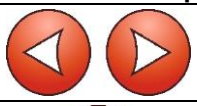


Fig. 7. Control panel.

Table 6. The description of the buttons and LEDs of the LCD panel.

	- moves the pointer on the screen - next screen selection
	- selection approval
	- quit editing without saving - starts preview mode
	- green LED indicating ~230 V power
	- green LED AUX1 indicating power at the AUX 1 output of the PSU
	- green LED AUX2 indicating power at the AUX 2 output of the PSU
	- yellow LED ALARM indicating collective failure

6.2. First run of the PSU – language selection screen.

During the first run of the PSU, language selection screen will be displayed.
Use the „<” or „>” buttons to select the available languages. After selecting the appropriate language, confirm by pressing the "SET" button. The main screen will be displayed.

Fig. 8. Language selection screen.

If the language selection is not done, language selection screen will be displayed on the next startup. If the choice has already been made, language selection can be done as explained in section 7.3.1.

Language selection screen can be displayed by simultaneously pressing the „<” and „>” buttons for a minimum time of 5 seconds.

6.3. Main screen of the LCD.

Main screen of the LCD displays the basic electrical parameters and indicates the current status of the power supply.

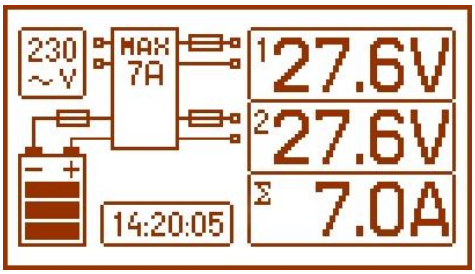


Fig. 9. Main screen of the LCD.

The resolution of voltage and current measurement is 0.1 V and 0.1 A, respectively. The displayed values of voltages and currents should be treated with caution; if a greater accuracy is required, use a multimeter.

Table 7. The description of the main screen symbols.

Screen field	Operating status	Failure status
230 ~V	The indicator displays 230 V mains supply voltage measurement.	Blinking „AC” icon .
1 27.6V 2 27.6V Σ 7.0A	Information about the current voltage at the AUX1 and AUX2 outputs and total power consumption.	The parameter, which value has been exceeded, is blinking.
− +	Information about the current state of battery charge.	Blinking icon.
MAX 7A / MAX 7A !	The value inside the symbol informs about the maximum power supply capacity.	The blinking warning symbol is displayed.
		Fuse icon - blinking
14:20:05	Clock	

6.4. Information displayed on the LCD panel.

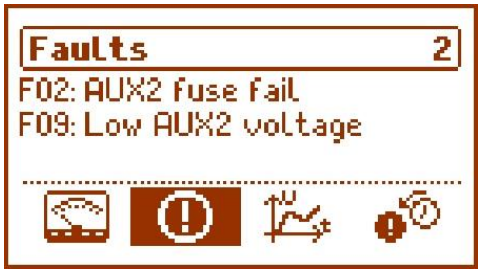
6.4.1. Preview menu.

Pressing the „ESC” button at the bottom of the display starts the preview menu, allowing to choose one of the four available PSU screens.

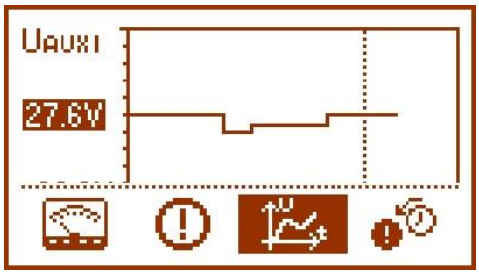
Use the „<” or „>” buttons to choose a proper screen and press the „SET” button to confirm.

- current parameters of the PSU
(see section 6.4.2)

- current failures of the PSU
(see section 6.4.3)



- parameters of the PSU stored in the memory
(see section 6.4.4)



- History of events
(see section 6.4.5)

6.4.2. LCD screen – current parameters .

To set the screen, press the „ESC” button, use the „<” or „>” buttons to choose the icon and press the „SET” button to confirm.

The screen displays electrical parameters and the status of the technical outputs during operation. Illumination of an element informs about an activation and reflects the status of LEDs on the PCB of the PSU (see Table 1, [10]).

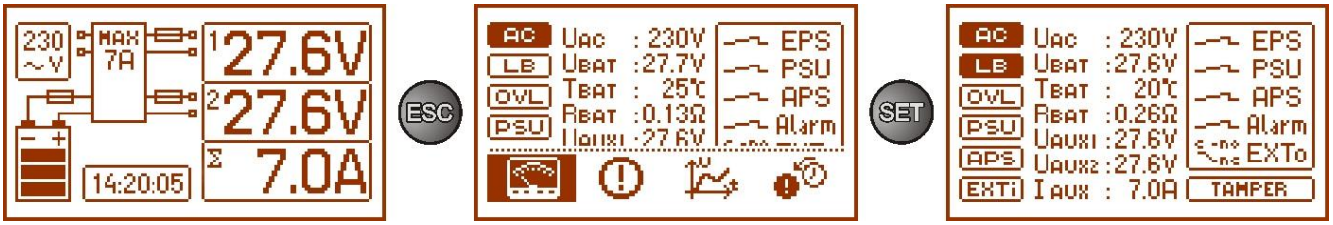


Fig 10. LCD panel – PSU parameters.

Table 8. The description of the screen symbols - current parameters of the PSU.

Screen field	Description	Additional information
AC	- ~230 V power ON (highlighted = ~230 V power on)	See section 7.2.4
LB	- Battery charging indication (highlighted = battery charging)	
OVL	- PSU overload indication (highlighted = PSU overload) - Indication of exceeding the „Imax a” current (flashing = „Imax a” exceeded)	See section: 6.10, 6.11
PSU	- PSU failure indication (highlighted = PSU failure)	See sections: 6.4.6 6.5
APS	- Battery failure indication (highlighted = battery failure)	See sections: 6.4.6 6.5
EXTi	- EXTi input status indication (highlighted = EXTi input activated)	See sections: 6.4.6 6.6
UAC : 230V UBAT :27.6V TBAT : 20℃ RBAT :0.26Ω UAUX1 :27.6V UAUX2 :27.6V IAUX : 7.0A	Current electrical parameters of the PSU: U_{AC} – mains supply voltage (~230 V) U_{BAT} – battery voltage T_{BAT} – battery temperature R_{BAT} – resistance of the battery circuit U_{AUX1} – AUX1output voltage U_{AUX2} – AUX2 output voltage I_{AUX} – total output current	See section: 6.4.4
EPS PSU APS Alarm EXTo	The status of the technical outputs: **EPS -** AC power indication open= AC power failure closed = AC power – O.K. **PSU** – PSU failure indication open= PSU failure closed = PSU working correctly O.K. **APS** – battery failure indication open= battery failure closed = battery O.K. **ALARM** – collective failure indication **CAUTION!** The set of contacts shows a potential-free status of the relay, which corresponds to power supply failure. **EXTo** – relay output status indication	See sections: 6.4.6 6.5
TAMPER	TAMPER input status (highlighted = activated)	See section: 6.7

6.4.3. LCD screen – current failures ⓘ.

In case of abnormal electrical parameters during the operation, the PSU will indicate a failure by displaying a message on the LCD, turning on the red LED ALARM on the panel, activating acoustic indication (if enabled) and changing the status of a dedicated technical output.

Fig. 11. Message indicating blown fuse at the AUX2 output.

At a given time, multiple failures can occur. To check which faults are indicated, choose the current failures of the PSU screen.

To do that, press the „ESC" button, use the „<" or „>" buttons to choose the ⓘ icon and press the „SET" button to confirm.

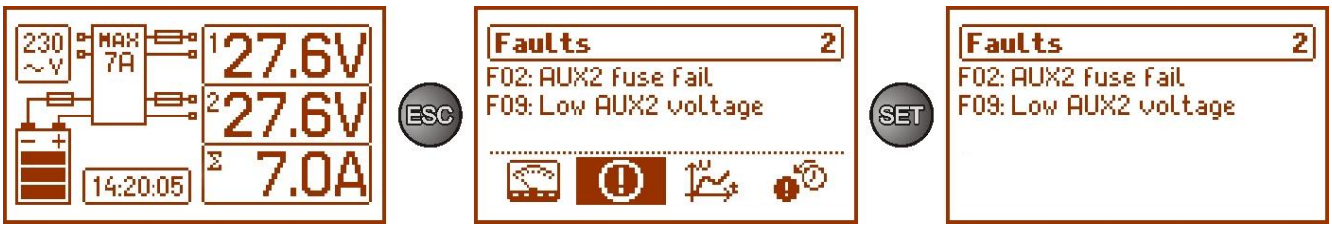


Fig. 12. LCD screen – current failures of the PSU.

The screen displays the codes and descriptions of failures. The display order of failures is arranged by priority of importance. The first failures in the display order are of the highest priority.

If there are more than five failures at the same time, use the „<" or „>" buttons to display the next failure.

6.4.4. LCD screen – history of the parameters .

To set the screen, press the „ESC" button, use the „<" or „>" buttons to choose the icon and press the „SET" button to confirm.

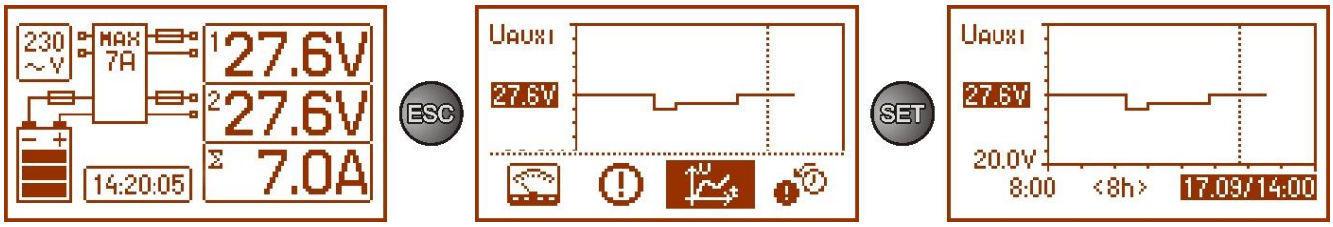


Fig. 13. Screen of the history of PSU's parameters.

During normal operation, the PSU records voltage and current parameters at the output circuits and saves them in the internal non-volatile memory. The saving is repeated in 5 minutes intervals and the internal memory can store up to about 6144 values. The memory works in a circular cycle - when the memory is full, the oldest entries are replaced with the newest ones.

The screen of the parameters history enables reading of the stored parameters and scanning the values on a chart. The screen features a time axis, located horizontally in the bottom part of the chart, and a parameter axis, located vertically in the left. Use the „<" or „>" buttons to move the cursor into various time points and read the value of the measurement.

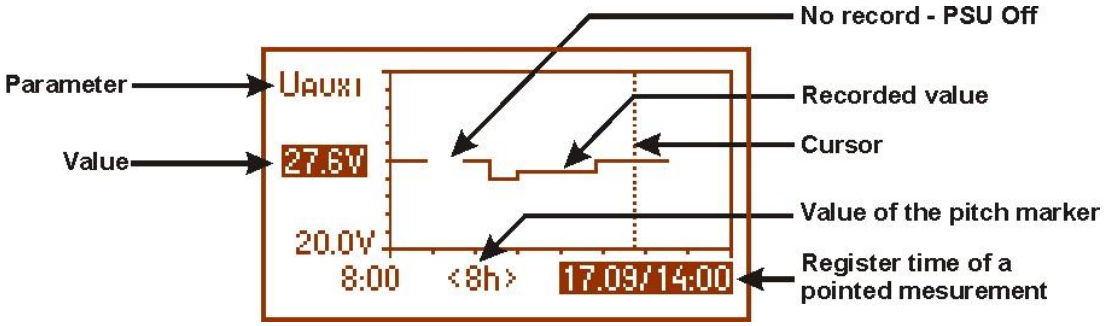


Fig. 14. Screen of the history of PSU's parameters.

In order to change the displayed parameter, highlight its name by pressing the „SET" button and use the „<" or „>" buttons to choose the requested parameter. Pressing the „SET" button again will highlight the time range of the chart, which also can be changed with the „<" or „>" buttons. Pressing the „SET" button again will enable moving the cursor (vertical dotted line on the chart) along the time line with the „<" or „>" buttons. The values of current parameter and the recording time pointed by the cursor will also be highlighted

Among the available positions on the chart, it is possible to view the following values:
- current - the value measured at the end of the measuring cycle
- minimum - the lowest value measured during 5 minutes
- maximum - the highest value measured during 5 minutes

of the following parameters:

- U_{AC} - mains supply voltage (~230 V)
- $U_{AC\ MIN}$ - mains supply voltage - minimum
- $U_{AC\ MAX}$ - mains supply voltage - maximum

- U_{AUX1} - AUX1 output voltage
- $U_{AUX1\ MIN}$ - AUX1 output voltage, minimum
- $U_{AUX1\ MAX}$ - AUX1 output voltage, maximum

- U_{AUX2} - AUX2 output voltage
- $U_{AUX2\ MIN}$ - AUX2 output voltage, minimum
- $U_{AUX2\ MAX}$ - AUX2 output voltage, maximum

- I_{AUX} - output current
- $I_{AUX\ MIN}$ - output current, minimum
- $I_{AUX\ MAX}$ - output current, maximum

- U_{BAT} - battery voltage
- $U_{BAT\ MIN}$ - battery voltage, minimum
- $U_{BAT\ MAX}$ - battery voltage, maximum

- T_{BAT} - battery temperature
- $T_{BAT\ MIN}$ - battery temperature, minimum
- $T_{BAT\ MAX}$ - battery temperature, maximum

- R_{BAT} - resistance in the battery circuit

To optimally read and analyze the values shown in the chart, it is possible to change the time range on the bottom axis of the chart. The following ranges are available:
<8h>
<24h>
<2days>
<week> (weekly)

6.4.5. LCD screen – history of events .

In case of abnormal electrical parameters during the operation, the PSU will indicate a failure by displaying a message on the LCD, periodically turning on and off the LCD backlight, turning on the red LED ALARM on the panel, activating acoustic indication (if enabled) and changing the status of a dedicated technical outputs.

To choose the history of events screen, press the „ESC" button, use the „<" or „>" buttons to choose the icon and press the „SET" button to confirm.

Fig. 15. The history of events screen.

The history of events screen enables overviewing the events recorded by the internal diagnostic system. The internal memory can store up to 2048 events, carrying information about the fault type, time of occurrence and the values of other electrical parameters. In addition, the diagnostic system assigns the failure code for a particular event on the basis of the stored parameters.

In order to preview the history of events, use the „<" or „>" buttons. It can be done in two modes: short mode (date, time, code, fault description) or full mode - with additional information about electrical parameters and status of inputs and outputs. To switch between the modes, press the „SET" button.

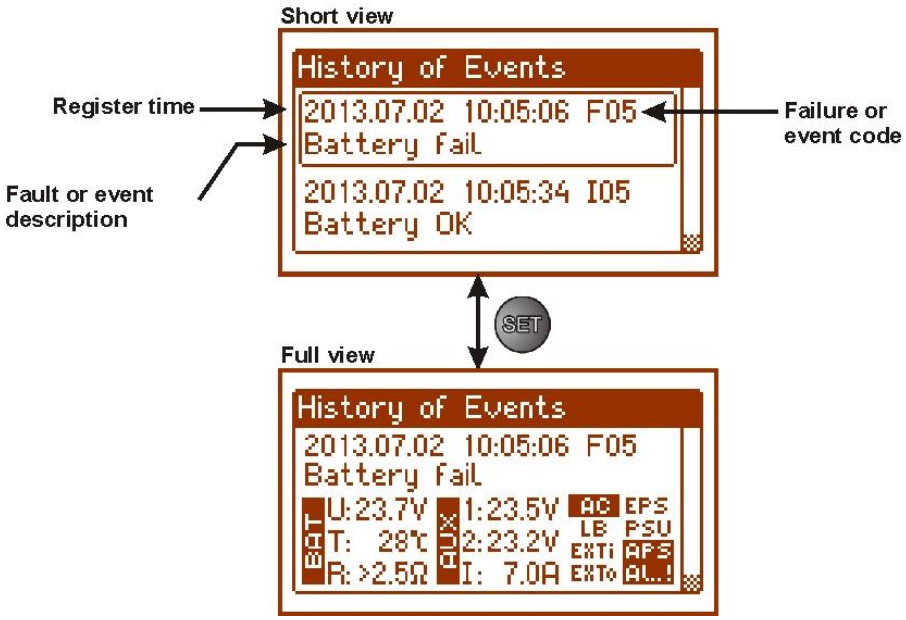


Fig. 16. Description of the history of events screen.

Section 6.4.6 lists all codes that may occur during the operation of the PSU. The individual codes are accompanied by appropriate optical indication on the panel, acoustic indication and activation of a dedicated technical output.

The memory of the new power supply remembers the events that are the result of the efficiency tests carried out at the production stage.

6.4.6. List of failure codes and information messages.

The PSU indicates the operation status with the appropriate code. The codes are divided into two groups, marked with the initial letters "F" or "I".

The codes beginning with the letter "F" indicate a failure. The codes that begin with the letter "I" indicate the correct operation of the PSU or repaired fault, involving, for example, fuse replacement: "I03 - BAT fuse replaced".

Table 9. List of PSU failure codes.

Failure code	Information	Technical output activation	Causes	Additional information
F01	AC power fail!	EPS FLT, ALARM	- No AC mains supply - Blown F_{MAIN} fuse	
F02	AUX1 fuse fail!	PSU FLT, ALARM	- Blown F_{AUX1} fuse	
	AUX2 fuse fail!		- Blown F_{AUX2} fuse	
F03	BAT fuse fail!	APS FLT, ALARM	- Blown F_{BAT} fuse - Short circuit in the battery circuit - Short circuit in the AUX output circuit	
F04	Output overload!	PSU FLT, ALARM	- PSU overload	See section 6.10
F05	Battery undercharged!	APS FLT, ALARM	- Spent batteries - Undercharged batteries	See section 8
F06	High AUX1 voltage!	PSU FLT, ALARM	- Output voltage over 29.2 V	
	High AUX2 voltage!			
F08	Charge circuit fail!	PSU FLT, ALARM	- The output voltage of the PSU set too low, below 26 V - Battery charging circuit failure	
F09	Low AUX1 voltage!	PSU FLT, ALARM	- Output voltage below 26 V	
	Low AUX2 voltage!			
F10	Low battery voltage!	APS FLT, ALARM	- The battery voltage has dropped below 23 V (during battery-assisted operation	
F11	Low battery volt. – off!	APS FLT, ALARM	- the battery voltage has dropped below 20 V (during battery-assisted operation)	See section 8.4
F12	External input EXTi!	ALARM	- Activation of the input of collective failure: EXTi	See section 6.6
F14	Temp. sensor fault!	PSU FLT, ALARM	- Faulty temperature sensor - Temperature sensor disconnected	See section 8.7
F15	High battery temp.!	PSU FLT, ALARM	- Too high ambient temperature of the PSU. - Overloaded batteries. - Faulty batteries.	See section 8.7
F16	No battery!	APS FLT, ALARM	- Disconnected batteries	See section 8.1
F17	Battery fail!	APS FLT, ALARM	- Deeply discharged batteries, voltage below 20 V	See section 8
F18	High batt. circuit resist.!	APS FLT, ALARM	- Spent batteries - Loose cables connecting the batteries	See section 8.6
F19	High AC voltage!	PSU FLT, ALARM	- Mains supply over 254 V AC	
F20	Low AC voltage!	PSU FLT, ALARM	- Mains supply below 195 V AC	
F21	PSU cover opened!	PSU FLT, ALARM		See section 6.7
F50-F54	Internal supply fail!	PSU FLT, ALARM	- service codes	
F60	No communication	PSU FLT, ALARM	- no communication with LCD panel	
F61-F64	Control panel fail	PSU FLT, ALARM	- service codes	
F65	Access unlocked		- passwords unlocked	

Table 10. List of PSU message codes.

Message code	Description
I00	Power supply start-up
I01	AC power back
I02	AUX fuse replaced
	AUX2 fuse replaced
I03	BAT fuse replaced
I04	Battery connected
I05	Battery OK
I06	Battery temperature OK
I07	AC voltage OK
I08	EXTo output ON
I09	EXTo output OFF
I10	Battery test – START
I11	PSU cover closed
I12	Imax_a over limit
I13	Iaux decr. below Imax_a

6.5. Technical outputs.

The PSU is equipped with galvanically isolated indication outputs changing status after a specified event:

- **EPS FLT – output indicating 230 V power loss**.

  The output indicates 230 V power loss. Under normal status, with the 230 V power on, the output is closed. In case of power failure, the PSU will switch the output into the open position after a time lag determined in the „ Delay time for EPS output" menu (see section 7.2.4).

- **APS FLT – output indicating battery failure.**

  The output indicates a failure in the battery circuit. Under normal status (during correct operation) the output is closed. In case of failure, the PSU will switch the output into the open position. Failure can be triggered by the following events:

  - faulty batteries
  - undercharged batteries
  - disconnected batteries
  - high resistance of the battery circuit
  - battery voltage below 23 V during battery-assisted operation
  - blown battery fuse
  - no continuity in the battery circuit

- **PSU FLT – output indicating PSU failure**.

  The output indicates the PSU failure. Under normal status (during correct operation) the output is closed. In case of PSU failure, it will switch into the open position. Failure can be triggered by the following events:

  - $U_{AUX1, AUX2}$ output voltage below 26 V
  - $U_{AUX1, AUX2}$ output voltage over 29,2 V
  - battery charging circuit failure
  - blown F_{AUX1} or F_{AUX2} fuse
  - exceeding the rated current of the PSU
  - activation of overvoltage protection OVP
  - mains supply voltage over 254 V AC
  - mains supply voltage below 195 V AC
  - to high battery temperature (>65 °C)
  - temperature sensor failure, t < -20 °C or t > 80 °C
  - enclosure opening – TAMPER
  - internal damage of the PSU
  - LCD panel damage

The technical outputs have been made with galvanic isolation between the PSU's systems and the attached devices.

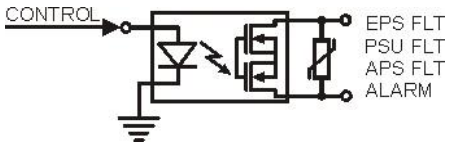


Fig. 17. Electrical diagram of technical outputs.

- **ALARM - technical output of collective failure indication.**
  Output indicating collective failure. In the case of failure at any EPS, APS, or PSU output or at the EXTi input, the collective failure signal ALARM will be generated.

CAUTION! In Fig.2 the set of contacts shows a potential-free status of the relay, which corresponds to power supply collective failure of the PSU).

6.6. Input of collective failure EXTi.

The EXT IN (external input) technical input indicating collective failure is intended for additional, external devices that generate the failure signal. The voltage appearing at the EXT IN input will trigger PSU failure, storing the information about the event in the internal memory and sending the signal about the failure to the ALARM output.

The EXT IN technical input has been made with galvanic isolation between the PSU's systems and the attached devices.

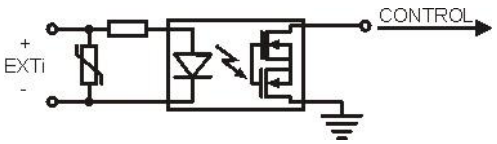


Fig. 18. Electrical diagram of the EXT IN input.

The connection of external devices to the EXT IN input is shown in the electrical diagram below. OC outputs (open collector) or relay outputs can be used as the source of the signal.

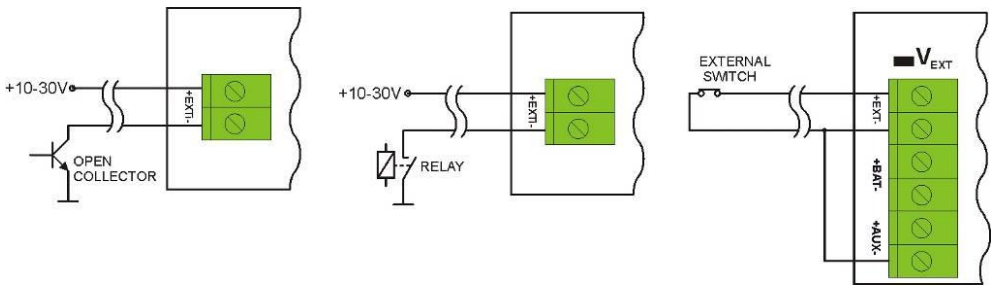


Fig. 19. Examples of connections.

W In the option with external switch, the V_{EXT} jumper, which polarises the EXT IN input circuit and is required in such configuration, must be on.

The EXTi input has been adjusted to work with fuse modules generating a failure signal in case of blown fuse in any of output sections (see section 6.8.). To guarantee a correct cooperation between the fuse module and the EXTi input, the connections shall be made as presented in the diagram below and the V_{EXT} jumper must be on.

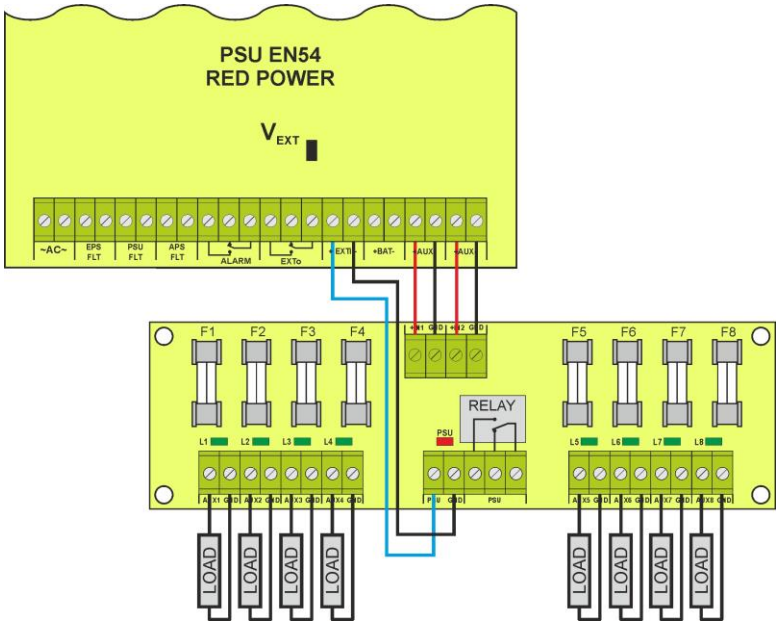


Fig. 20. Example of a connection with the fuse module EN54-LB8.

6.7. Indication of the enclosure opening - TAMPER.

The PSU is fitted with the microswitch tamper indicating enclosure opening.

The tamper cable is not connected to the terminal in the factory settings. In order to activate tamper, remove the jumper from tamper terminal (Fig. 2 [12]) and plug in the tamper cable.

Each opening the enclosure will generate a failure signal at the PSU FLT and ALARM technical outputs and will save the event in the internal memory of the PSU.

6.8. Increasing the number of outputs with optional EN54-LB4 or EN54-LB8 fuse modules.

The PSU has two independently protected outputs for connecting the AUX1 and AUX2 receivers.

If the power supply unit is connected with more receivers, then it is recommended to secure each of them with independent fuse. This solution will protect the power supply system, while the damage to only one receiver (short-circuit on the line) could cause damage to other receivers connected to the same output.

The solution is provided by the optional fuse module EN54-LB4, 4-channel or EN54-LB8, 8-channel, while its mounting location is provided within the housing (see Fig. 4). The figure below shows the connection between the power supply, fuse module and receivers.

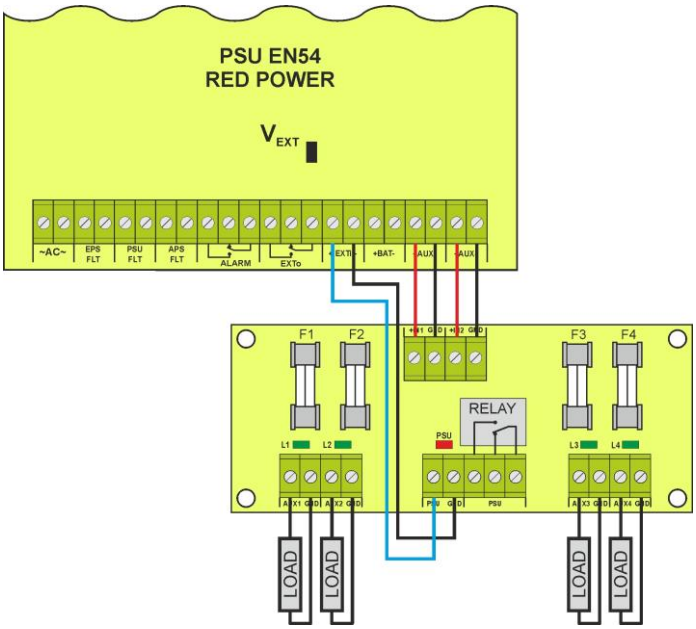


Fig. 21. The connection of fuse module.

When installing the fuse module in the PSU, power supply current consumption, used for the calculation of standby time (see section 8.8), should be taken into account.

Depending on the version, fuse module allows to connect 4 or 8 receivers to the PSU. Output state is indicated by green LEDs.
Blown fuse is indicated as follows:

- corresponding LED turns off: L1 for AUX1 etc.
- red LED on
- PSU technical output on (Hi-Z state)
- switching PSU relay output into voltage free status (contacts as shown in the Fig. 21).

In addition, blown fuse signal is transmitted to the input of collective failure EXTi (ALARM) and saved in the internal memory of PSU.

The PSU's relay output can also be used for remote control, including external optical indication.

6.9. Overvoltage protection of the PSU output OVP.

In case of voltage exceeding 30,5 V±0.5 V at the switching regulator's output, the system cuts off the power at the outputs to protect the battery and the receivers from damage. The outputs will be battery-powered. The activation of the protection system is indicated by the OVP yellow LED on the PCB board, and the PSU FLT and ALARM outputs.

6.10. PSU overload.

The PSU is fitted with the LED OVL (overload) on the PCB, informing about output overload. If the nominal current of the PSU is exceeded, the led turns on and the microprocessor starts a specially implemented procedure. Depending on time and overload level, microprocessor may disconnect the AUX1 and AUX2 outputs and switch into the battery-assisted operation. Restart will occur after 1 minute.
PSU overload is indicated by the PSU FLT and ALARM technical outputs.

6.11. Indication of exceeding the „Imax a" current.

Exceeding the "Imax a" output current during the power supply operation is indicated by the microprocessor using the LED OVL light (overload) on the PCB after 30 seconds. In addition, the main screen of the LCD will display a blinking light:

I_{MAX_A}!

Information about exceeding the „Imax a" current is stored in the history of events. Battery charge current is limited in order to protect the power supply against overload.

6.12. Short-circuit of the PSU output.

In case of short-circuit of the AUX1 or AUX2 output, one of the fuses - F_{AUX1} or F_{AUX2} – becomes permanently blown. The restoration of the voltage at the output requires the replacement of the fuse.

7. PSU settings.

The PSU has a configuration menu, allowing to configure the PSU settings by changing or activating certain parameters. To enter the setting mode, press the "SET" button from the main screen's level.

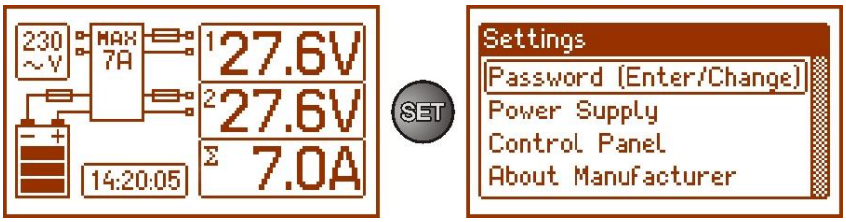


Fig. 22. PSU settings screen.

7.1. Password.

The PSU supports two levels of access to configuration, which limit the possibility of changing the PSU's settings from the LCD panel. Both levels are protected by a separate password.

Service password – full access to the PSU's settings
User's password – locked access to the „PSU" settings menu

Table11. Access ranges.

PASSWORD	Access range	
	„Control panel" settings	PSU settings
SERVICE	•	•
USER	•	-

Preset passwords:
user's password – 1111
service password – 1234

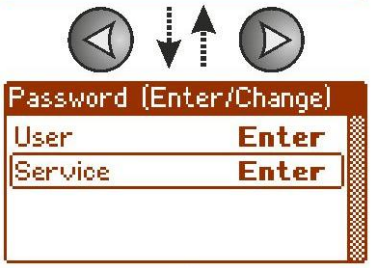
7.1.1. Entering the password.

If the access to the configuration of the power supply has been blocked by the activation of the service or user password, perform the following steps in order to unlock the PSU configuration:

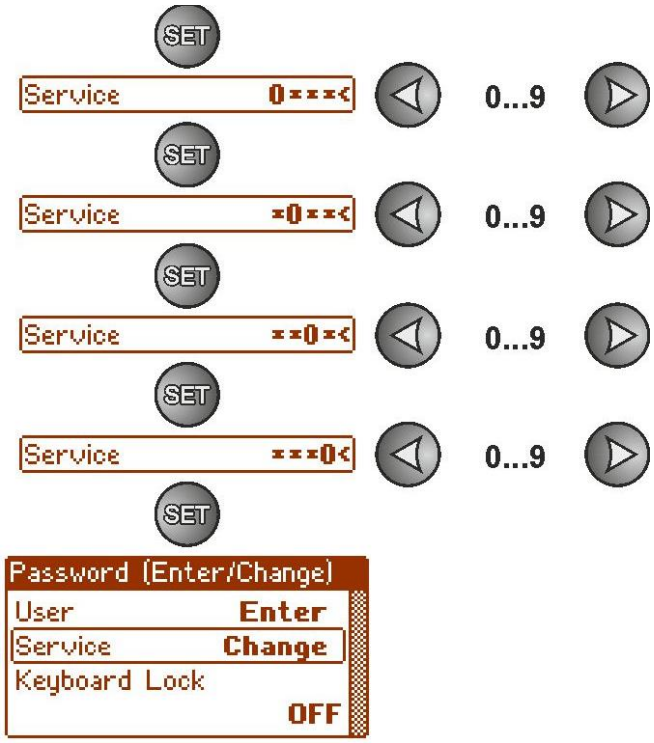
- use the „<" or „>" buttons to display the **Password (enter/change)** menu

- press the „SET" button, another window with available levels of passwords will be displayed

- use the „<" or „>" buttons to choose the right level of password



- confirm by pressing the "SET" button
- use the „<” or „>” buttons to enter the first digit
- confirm by pressing the "SET" button
- use the „<” or „>” buttons to enter the second digit
- confirm by pressing the "SET" button
- use the „<” or „>” buttons to enter the third digit
- confirm by pressing the "SET" button
- use the „<” or „>” buttons to enter the fourth digit
- confirm by pressing the "SET" button



If the entered password is wrong, the following message will be displayed:

Fig. 23. The message after entering a wrong keyboard password.

After entering the correct password, it is possible to access the settings. If no buttons are pressed within 5 minutes, the PSU settings will be locked automatically.

7.1.2. Changing the password.

After entering the correct password, it is possible to change it. To do this, choose a password that will be changed (user’s password or service password) and enter the new one

7.1.3. Disabling the password.

If the password is not required, it can be turned off. The access to the settings will not be locked after 30 seconds of inactivity.
To disable the password, type „0000” as a new password.

User password **„0000”** unlocks the access from the user level.
Service password **„0000”** unlocks the access from the installer level.

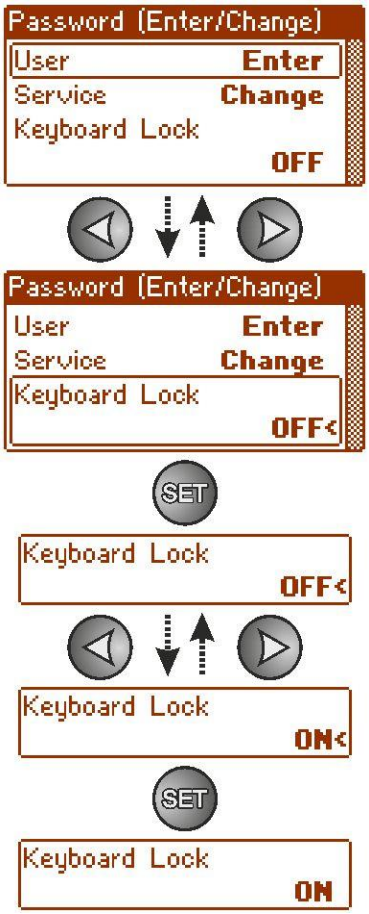
7.1.4. Resetting passwords.

If, for any reason, the passwords have been lost, it is possible to reset the passwords.
To do this:

a) unplug the PSU from the AC network and the batteries for at least 10 seconds
b) put the Z2 jumper on the PCB of the PSU (see Fig. 2 [8])
c) plug in the batteries and the PSU to the AC network
d) remove the Z2 jumper within 5 seconds from switching on the PSU
e) The PSU will display a message: **„Access unlocked”,**
f) confirm by pressing the „SET” button
g) go to the menu **„Settings -> Password”** and change the passwords.

7.1.5. Keyboard lock.

When entering passwords, it is possible to choose whether the buttons on the front panel of the PSU's should be locked. It is enabled by **„Keyboard password”** option.



- use the „<” or „>” buttons to display the **Keyboard lock** menu

- press the „SET” button, the prompt will appear at the end of the line

- use the „<” or „>” buttons to select:
  YES – keyboard lock ON
  NO – keyboard lock OFF

- confirm by pressing the "SET" button

When on, the keyboard will be locked automatically if no buttons are pressed within 5 minutes. After this time, pressing any button on the control panel will display a window with keyboard password request. Enter the password using the „<” or „>” buttons as explained above.

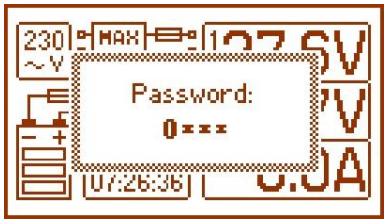


Fig. 24. Keyboard password request.

Entering the correct user’s password unlocks the access to the settings from the user level, while entering the correct service password unlocks the access to the settings from the installer level – full access.

The PSU settings will be locked automatically if no buttons are pressed within 5 minutes.

7.2. PSU.

The “PSU” menu is only available after entering the correct service password.

Selecting the “PSU” in the settings menu will display another menu, allowing full configuration of the PSU; battery test ON/OFF, acoustic indication ON/OFF, EXTo output ON/OFF, setting the delay time for EPS output, setting the communication parameters. After entering the right settings, they are stored in the internal non-volatile memory, which protects the PSU against data loss in case of a failure or power failure.

Fig. 25. „PSU” screen.

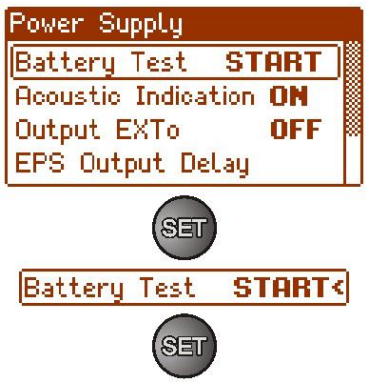
Table 12. The description of the „PSU” screen.

Position	Description	Additional information
Battery test	**START** – battery test activation (see section 5.5)	Section 7.2.1 and 8.5
Acoustic indication	**YES** – acoustic indication ON (see section 4.6) **NO** – acoustic indication OFF	Section 7.2.2
EXTo output	**ON** – output ON (see section 4.9) **OFF** – output OFF	Section 7.2.3
Delay time for EPS output	Setting the delay time for ~230 V power failure indication **- 10s** (factory setting) **- 1min** **- 10min** **- 30min**	Section 7.2.4
Communication address	**1÷ 247** PSU address required during the communication with the computer **1** – factory setting	Section 7.2.5
Transmission	Defines the speed and protocol of communication **9.6k 8N2** **9.6k 8E1** **9.6k 8O1** **:** **115.2k 8N2** **115.2k 8E1** (factory setting) **115.2k 8O1**	Section 7.2.6

7.2.1. Battery test activation.

Battery test menu activates the test of the batteries (see section 8.5) connected to the PSU. If the test is negative, it is indicated by the appropriate message, acoustic indication and activation of the APS FLT and ALARM technical outputs.

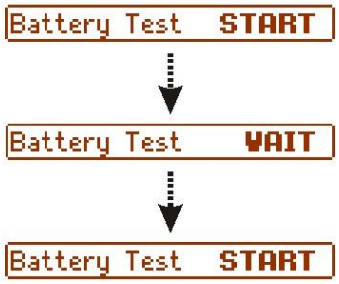
- use the „<” or „>” buttons to display the **Battery test** menu



- press the „SET” button, the prompt will appear at the end of the line

- confirm by pressing the **„SET”** button
(the battery test follows immediately)

- When performing the test, the LCD will display the **"WAIT"** message.



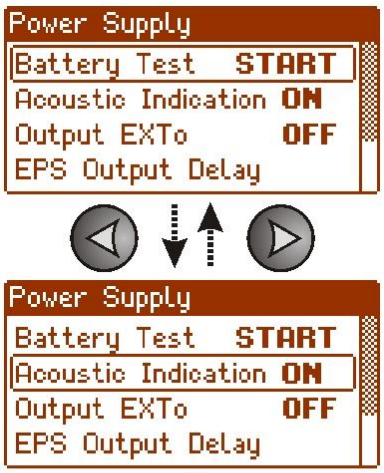
7.2.2. Acoustic indication ON/OFF

Emergency situations that may arise during the operation of the PSU are indicated acoustically. The frequency and number of signals depend on the type of event (see section 6.4.6.).

Table 13. Acoustic indication.

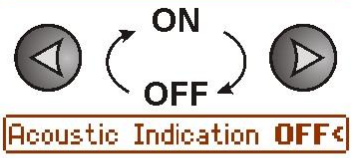
No.	Description	Event
1	1 signal every 10s, battery mode	AC power failure
2	1 signal every 10s, mains operation	Battery failure, undercharged batteries
3	2 signals every 10s, battery mode	Low battery level
4	Fast signals, battery mode	The PSU will be disconnected because of the battery discharge
5	Constant indication	PSU failure [section 6.4.6.]

- use the „<" or „>" buttons to display the **Acoustic indication** menu



- press the „SET" button, the prompt will appear at the end of the line

- use the „<" or „>" buttons to select:
  YES – Acoustic indication ON
  NO – Acoustic indication OFF



- confirm by pressing the „SET" button

7.2.3. EXTo output ON/OFF

Controlled relay output EXTo (external output) does not depend on the operation of the power supply unit and can be switched independently of its work.

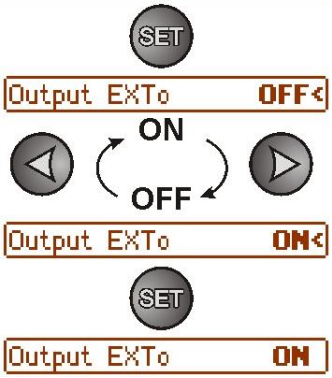
The EXTo output can be used for switching between controlling, resetting and supplying inputs/outputs in low-voltage electrical circuits.

Changes in the EXTo output can be made locally from the panel (section 7.2.3.) or remotely using the PowerSecurity application. In the case of the PowerSecurity application-level control, Z2 jumper must be on.

Information about the changes in the EXTo output is written in the event log of the PSU.

- use the „<” or „>” buttons to display the **EXTo output** menu

- press the „SET” button, the prompt will appear at the end of the line



- use the „<” or „>” buttons to select:
  ON – relay ON
  OFF – relay OFF

- confirm by pressing the „SET” button

7.2.4. Setting the delay time for EPS output indicating ~230 V power loss.

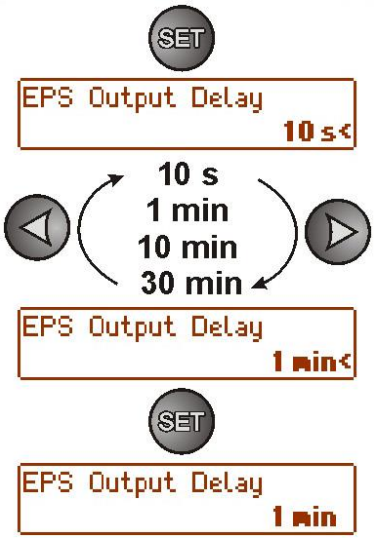
The PSU features adjustable delay for 230 V power loss indication. The delay time can be selected from the four available ranges:

- 10s (factory setting)
- 1min
- 10min
- 30min

230 V power loss is indicated by the activation of the “EPS FLT” and „ALARM” technical output.

- use the „<” or „>” buttons to display the Delay **time for EPS output** menu

- press the „SET” button, the prompt will appear at the end of the line



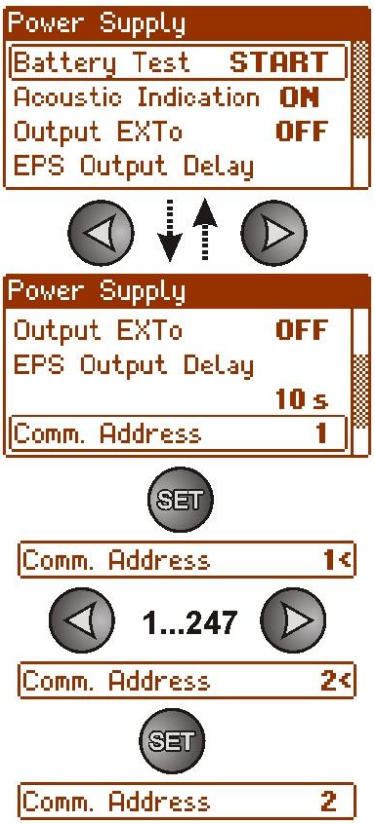
- use the „<” or „>” buttons to set the delay time:
  - **10s**
  - **1min**
  - **10min**
  - **30min**

- confirm by pressing the „SET” button

7.2.5. Setting the communication address ⚠ applies to cooperation with PowerSecurity.

All power supplies are factory-set to address 1.

All the parameters responsible for communication between the PSU and the computer, namely the address, parity and speed should have the same settings for both the PSU and the PowerSecurity program. Communication address allows to identify power supply units in the same communication network.



- use the „<” or „>” buttons to display the **Communication address** menu

- press the „SET” button, the prompt will appear at the end of the line

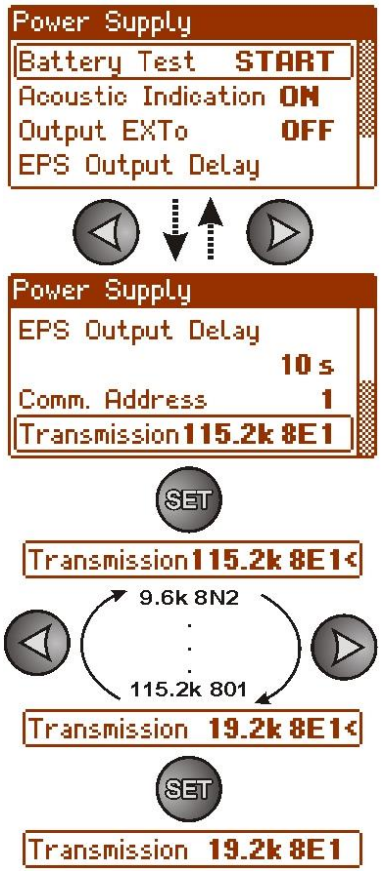
- use the „<” or „>” buttons to set the communication address
  1÷ 247 – PSU address during the communication with the computer

- confirm by pressing the „SET” button

7.2.6. Setting the transmission parameters ⚠ applies to cooperation with PowerSecurity.

All the parameters responsible for communication between the PSU and the computer, namely the address, parity and speed should have the same settings for both the PSU and the PowerSecurity program.

The PSU has preset transmission parameters of 115200 baud 8E1; if these values were changed, they should be restored to original settings.



- use the „<” or „>” buttons to display the **Transmission** menu

- press the „SET” button, the prompt will appear at the end of the line

- use the „<” or „>” buttons to set the transmission speed
  - **9.6k 8N1**
  - :
  - **115.2k 8E1 (factory setting)**
  - :
  - **115.2k 801**

- confirm by pressing the „SET” button

7.3. Control panel.

The menu is only available after entering the correct user's or service password.

The „control panel" menu enables configuration of the settings directly related to the user interface. It is possible to set the display language, date, time, intensity of the backlight and blinking light indicating failure.

Setting the correct date and time is important for keeping chronology of events stored in the internal memory. Setting the backlight mode and contrast guarantees the quality of the displayed messages.

Intensity of the LCD backlight can be set in the range from 0 to100%, in 10% intervals.

The display features a function of constant or temporary backlight mode. In temporary mode, the screen will turn off if no buttons are pressed within 5 min.

Fig. 26. „Control panel" screen.

Table 14. The description of the „Control panel" screen.

Position	Description
Language	Available languages
Date	Current time
Time	Current date
Backlight mode	**5 min** - backlight mode OFF if no buttons are pressed within 5 min **constant** - the backlight will not be turned off **0÷100%** - the intensity of the backlight
Contrast	**0÷ 100% -** the display contrast
Blinking light indicating failure	**YES** –blinking light indicating failure **NO** – constant light indicating failure

7.3.1. Setting the display language

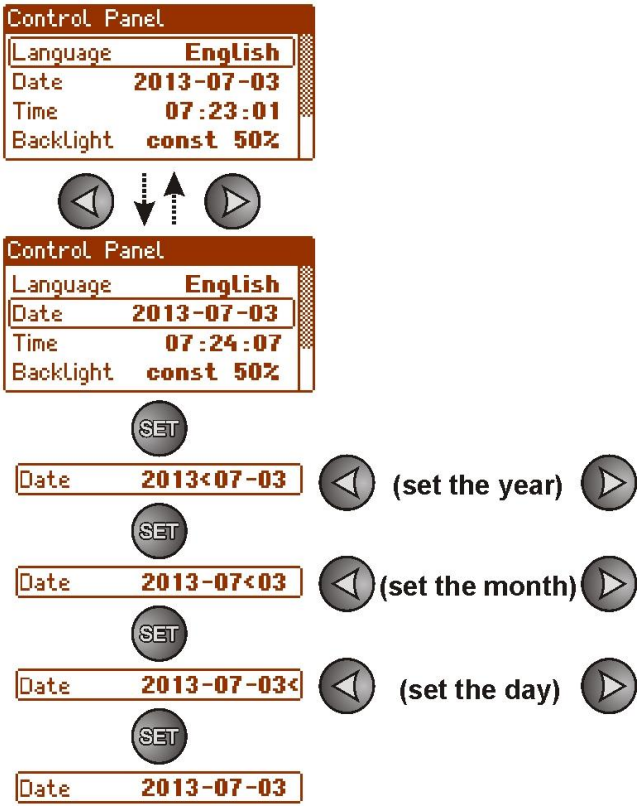
One of the functions of the control panel menu is the possibility to select language. Display language can be set according to personal preference.

- use the „<” or „>” buttons to display the **Language** menu
- press the „SET” button, the prompt will appear at the end of the line
- use the „<” or „>” buttons to choose the display language
- confirm by pressing the „SET” button

To help the user to choose the Display Language, the power supply allows to display the menu of available languages on the main screen. To do this, simultaneously press and hold for at least 5s the"<" and ">" arrow keys on the front panel of the power supply.

7.3.2. Setting the date

The „Date” menu in the „Control panel” menu enables setting the correct date, according to which error messages and operation history will be saved. Built-in real time clock does not take into account leap years and the changes resulting from the switch between summer and winter time. These changes should be taken into account when analyzing events recorded in the history.



- use the „<” or „>” buttons to display the **Date** menu
- press the „SET” button, the prompt will appear next to the year digits
- use the „<” or „>” buttons to set the year
- press the „SET” button, the prompt will appear next to the month position
- use the „<” or „>” buttons to set the current month
- press the „SET” button, the prompt will appear next to the day position
- use the „<” or „>” buttons to set the current day
- confirm by pressing the „SET” button

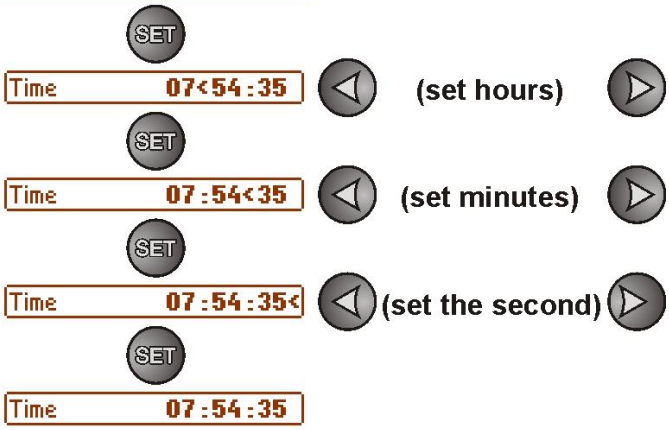
7.3.3. Setting the time

The „Time” menu in the „Control panel” menu enables setting the correct time, according to which error messages and operation history will be saved. Built-in real time clock does not take into account leap year and the changes resulting from the switch between summer and winter time. These changes should be taken into account when analyzing events recorded in the history.

- use the „<” or „>” buttons to display the **Time** menu

- press the „SET” button, the prompt will appear next to the hour digits
- use the „<” or „>” buttons to set the hour
- press the „SET” button, the prompt will appear next to the minute position
- use the „<” or „>” buttons to set the minutes
- press the „SET” button, the prompt will appear next to the seconds' position
- use the „<” or „>” buttons to set the seconds

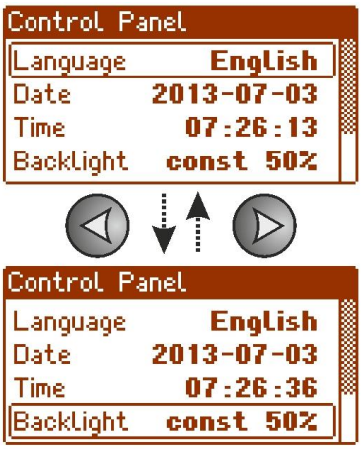
- confirm by pressing the „SET” button



7.3.4. Setting the backlight mode.

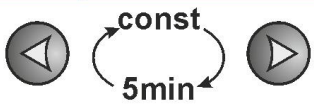
The „Backlight” menu dims the display if no buttons are pressed within 5 min and sets the intensity of the backlight.

- use the „<” or „>” buttons to display the **Backlight mode** menu



- press the „SET” button, the prompt will appear next to the **constant<** option

- use the „<” or „>” buttons to change the setting to **5 min**



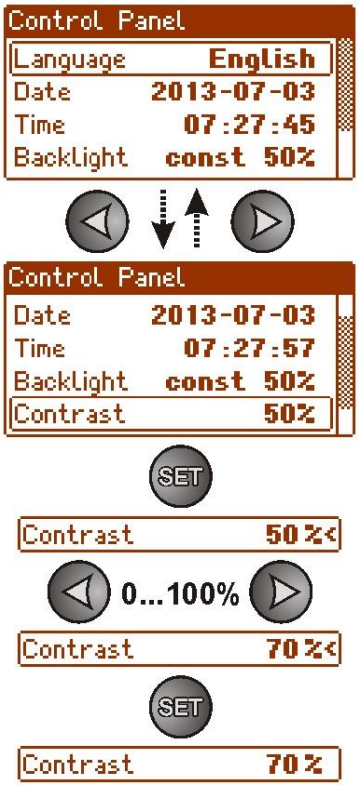
- press the „SET” button, the prompt will appear at the end of the line

- use the „<” or „>” buttons to set the required brightness

- confirm by pressing the „SET” button

7.3.5. Contrast setting

The „Contrast” menu in the „Control panel” enables setting the contrast of the display text.



- use the „<” or „>” buttons to display the **Contrast** menu

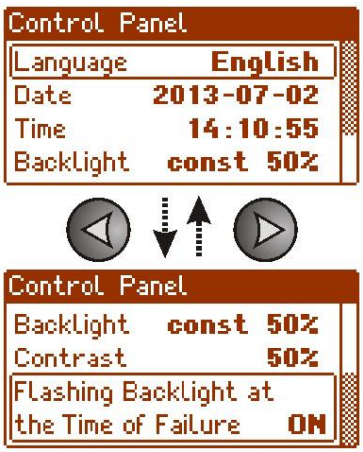
- press the „SET” button, the prompt will appear at the end of the line

- use the „<” or „>” buttons to set the contrast

- confirm by pressing the „SET” button

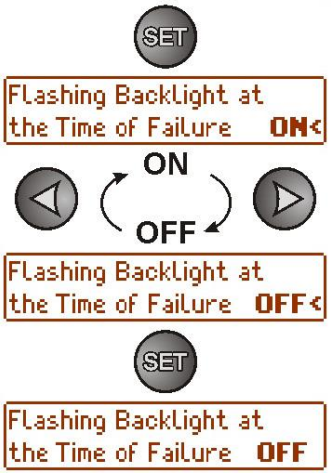
7.3.6. Blinking light indicating failure

The „Blinking light indicating failure” menu enables setting the backlight mode during failure indication. When on, the blinking light will indicate a failure.



- use the „<” or „>” buttons to display the Blinking **light indicating failure** menu

- press the „SET” button, the prompt will appear at the end of the line



- use the „<” or „>” buttons to select
  YES – blinking light indicating failure ON
  NO – blinking light indicating failure OFF

- confirm by pressing the „SET” button

8. Reserve power supply circuit.

The PSU is fitted with intelligent circuits: battery charging circuit with the function of the accelerated charging and battery control, which main task is to monitor the condition of the batteries and the connections in the circuit.
If the controller detects a power failure in the battery circuit, appropriate indication and activation of the APS FLT and ALARM technical outputs takes place.

8.1. Battery detection.

The control unit of the PSU checks the voltage at the battery terminal and, depending on the measured values, determines the appropriate reaction:

U_{BAT} below 4 V - batteries not connected to the PSU circuits
U_{BAT} = 4 to 20 V - faulty batteries
U_{BAT} over 20 V - batteries connected to the PSU circuits

8.2. Protection against short -circuit of the battery terminals.

The PSU is fitted with the circuit protecting against short-circuit of the battery terminals. In case of short circuit, control circuit immediately disconnects the batteries from the rest of the power supply circuit, so the loss of output voltage on power supply outputs is not observed. Automatic reconnection of the batteries to the PSU's circuits is only possible after the removal of the short-circuit and correct connection of the circuits.

8.3. Protection against reverse battery connection.

The PSU is protected against reverse connection of the battery terminals. In case of incorrect connection, the F_{BAT} fuse in the battery circuit becomes damaged. The return to normal operation is possible only after replacing the fuse and correct connection of the batteries.

8.4. Deep discharge battery protection UVP.

The PSU is fitted with the disconnection system and the battery discharge indication. If the voltage at the battery terminals drops below 20 V±0.2 V during battery-assisted operation, acoustic indication will be activated and the batteries will be disconnected within 15s.

The batteries are reconnected to the power supply unit automatically once the ~230 V mains supply is restored.

8.5. Battery test.

The PSU runs dynamic battery test every 5 minutes, temporarily switching the receivers to the battery operation mode. During testing, the control unit of the PSU measures the electrical parameters according to the implemented measuring method.
A negative result occurs when:
- the battery circuit continuity is interrupted,
- resistance in the battery circuit increases above 300 mΩ
- the battery terminal voltage drops below 24 V.

The battery test can be activated manually from the main menu (see section 7.2.1), for example to test the replaced batteries.

The PSU is protected against too frequent performing of the battery test, which could result in undercharging. The protection involves blocking the ability to perform test for 60 seconds from the last activation.

In this case, the LCD will display the "WAIT" message in the PSU Settings -> PSU -> Battery test menu.

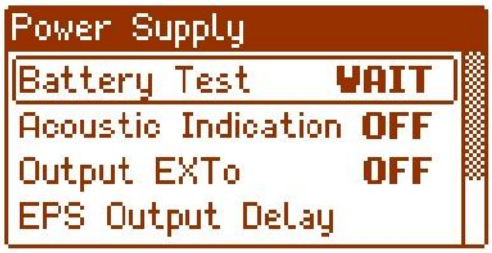


Fig. 27. Temporary lock of the battery test.

This function can be disabled by putting the Z2 jumper on the power supply board (Fig.2 [8]).

The battery test will also be automatically locked when the PSU is in the operating mode, in which the battery test is impossible. Such condition occurs, for example, during battery assisted operation or when the power supply is overloaded.
In this case, the LCD will display the crossed out „START" message in the PSU Settings -> PSU -> Battery test menu.

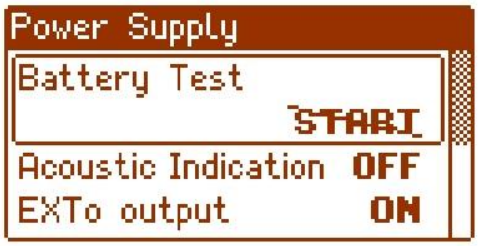


Fig. 28. Battery test – inactive.

8.6. Measurement of the resistance of the battery circuit.

The PSU is checking the resistance in the battery circuit. During the measurement, the PSU driver takes into account the key parameters in the circuit, and once the limit value of 300m ohms is exceeded, a failure is indicated.

A failure may indicate considerable wear or loose cables connecting the batteries.

8.7. Battery temperature measurement.

The PSU has a temperature sensor to monitor the temperature parameters of installed batteries. The sensor is located near the batteries; hence, temperature readings should not be confused with the ambient temperature.

Temperature measurement and compensation of the battery charging voltage can extend the life of the batteries.

8.8. Standby time.

Battery-assisted operating depends on battery capacity, charging level and load current. To maintain an appropriate standby time, current drawn from the PSU in battery mode should be limited.

Required, minimum battery capacity to work with the PSU can be calculated with the following formula:

$$Q_{AKU} = 1.25 \left((Id + Iz) \cdot Td + (Ia + Iz) \cdot Ta + 0.05\, Ic \right)$$

where:

Q_{AKU} – The minimum battery capacity [Ah]
1.25 – the factor related to the decrease in battery capacity due to aging
Id – the current drawn by the load during inspection [A]
Iz – PSU current consumption [A] (Table 15)
Td – required inspection time [h]
Ia – the current drawn by the load during an alarm [A]
Ta – alarm duration [h]
Ic – short-term output current

Rearranging the above equation, the approximate runtime of the system with two 40 Ah batteries can be determined.

The following data can be assumed:

Id = 2,5 A
Iz = 0,065 A
Ia = 5 A
Ta = 0,5h
Ic = 7 A

The approximate runtime of the system with two 40 Ah batteries will amount to 11h 21min.

9. Remote monitoring (options: Wi-Fi, Ethernet, RS485, USB).

The PSU has been adjusted to operate in a system that requires a remote control of the parameters in a monitoring centre. Transmitting data concerning PSU status is possible due to an additional, external communication module responsible for communication in Wi-Fi, Ethernet or RS485 standard. It is possible to connect the PSU and the computer via the USB –TTL interface.

Different connection topologies, presented later in this chapter, are only a part of possible communication schemes. More examples can be found in the manuals dedicated to individual interfaces.

When installing optional features in the power supply unit, power supply current consumption, used for the calculation of standby time, should be taken into account (see section 8.8).

9.1. Communication via the USB-TTL interface.

The easiest way of communication between the PSU and the computer is provided by the USB-TTL "INTU" interface. This interface allows direct connection between the computer and the PSU and is recognizable by the operating system as a virtual COM port.

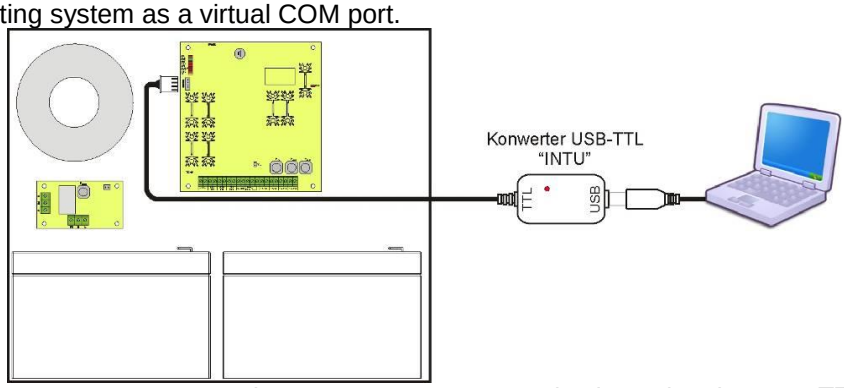


Fig. 29. USB-TTL communication using the USB-TTL „INTU" interface

9.2. ETHERNET network communication.

Communication in the Ethernet network is possible due to the additional interfaces: Ethernet „INTE" and RS485-ETH „INTRE", according to the IEEE802.3 standard.

The Ethernet „INTE" interface features full galvanic isolation and protection against surges. It should be mounted inside the enclosure of the PSU.

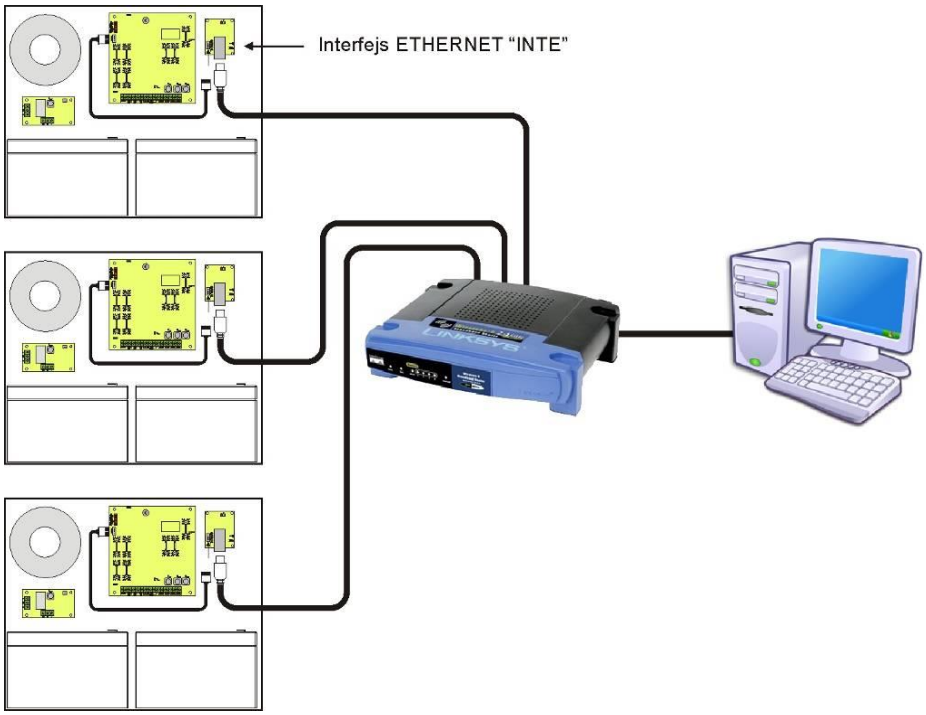


Fig. 30. Ethernet communication using the RS485-Ethernet „INTE" interface.

The RS485-ETHERNET „INTRE” interface is a device used to convert signals between the RS485 bus and the Ethernet network. For proper operation, the unit requires an external power supply in the range of 10÷30 V DC e.g. drawn from a PSU of the EN54 series. The physical connection of the interface takes place under galvanic isolation. The unit is mounted in a hermetic enclosure protecting against adverse environmental conditions.

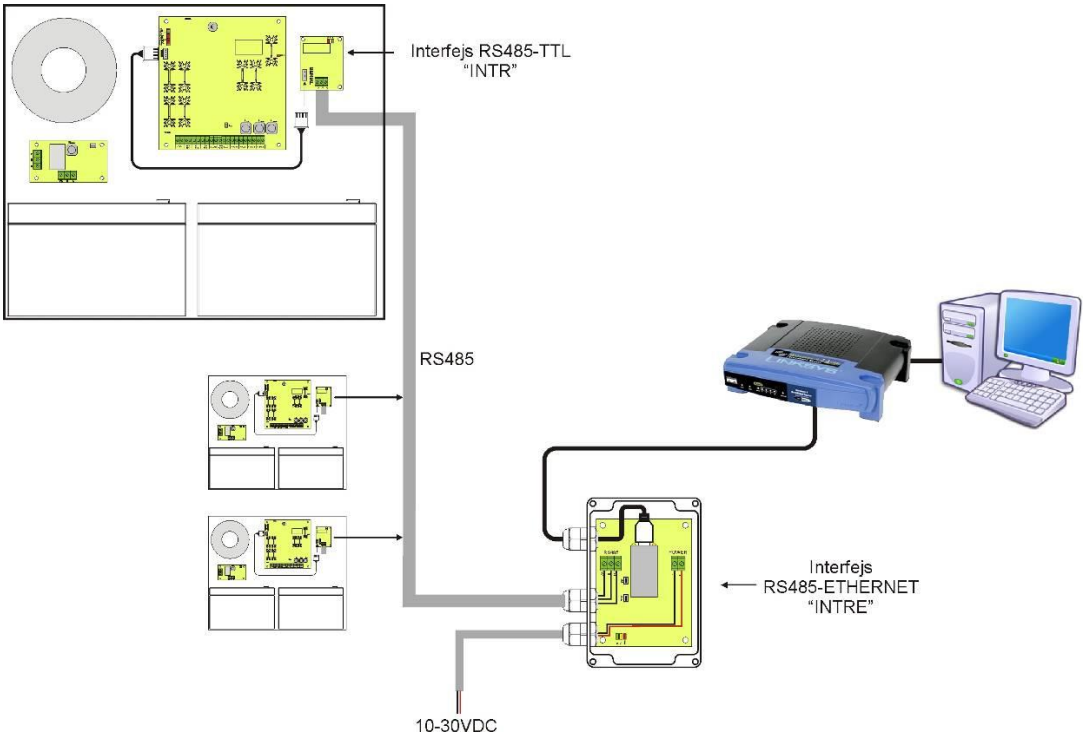


Fig. 31. Ethernet communication using the RS485-Ethernet „INTRE” interface.

9.3. The Wi-Fi wireless communication.

The Wi-Fi wireless communication can be implemented on the basis of additional interfaces: WI-Fi ‘INTW’ and RS485-WiFi, operating within 2,4GHz frequency band, according to the IDEE 802.11 bgn standard.

The WiFi ‘INTW’ interface shall be mounted in a selected location inside the enclosure so that the antenna is exposed to the outside.

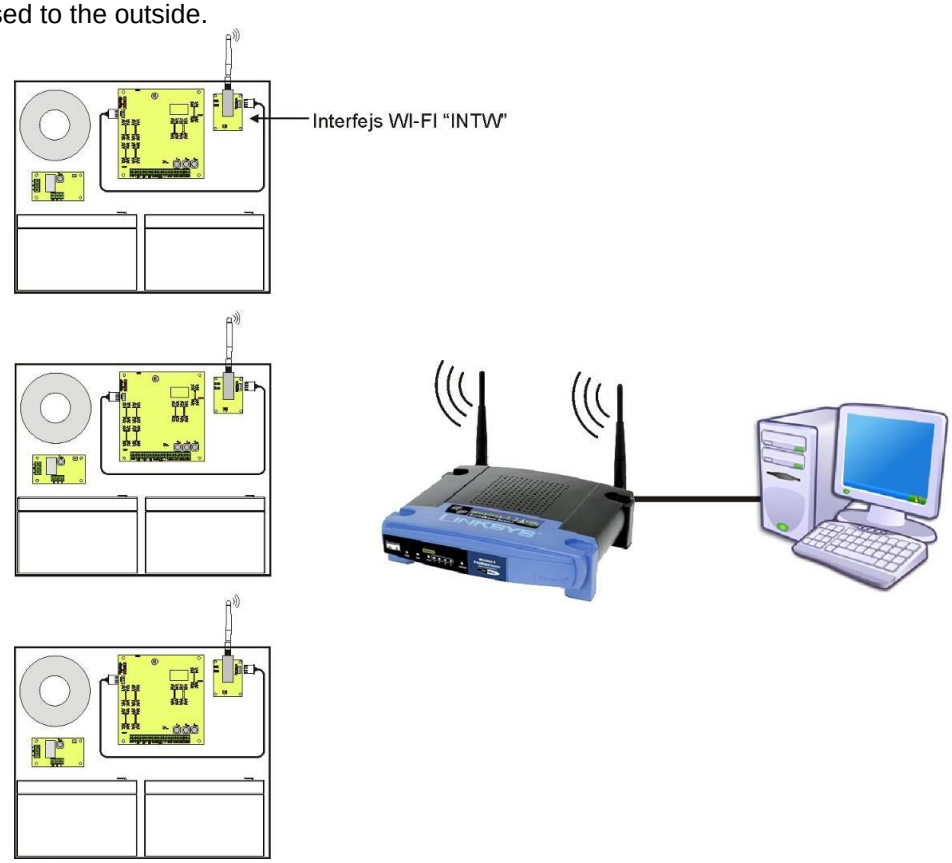


Fig. 32. The Wi-Fi communication using WI-FI „INTW” interface.

The RS485-WiFi „INTRW" interface is a device used to convert signals between the RS485 bus and the WiFi network. For proper operation, the unit requires an external power supply in the range of 10÷30 V DC e.g. drawn from a PSU of the EN54 series. The physical connection of the interface takes place under galvanic isolation. The unit is mounted in a hermetic enclosure protecting against adverse environmental conditions.

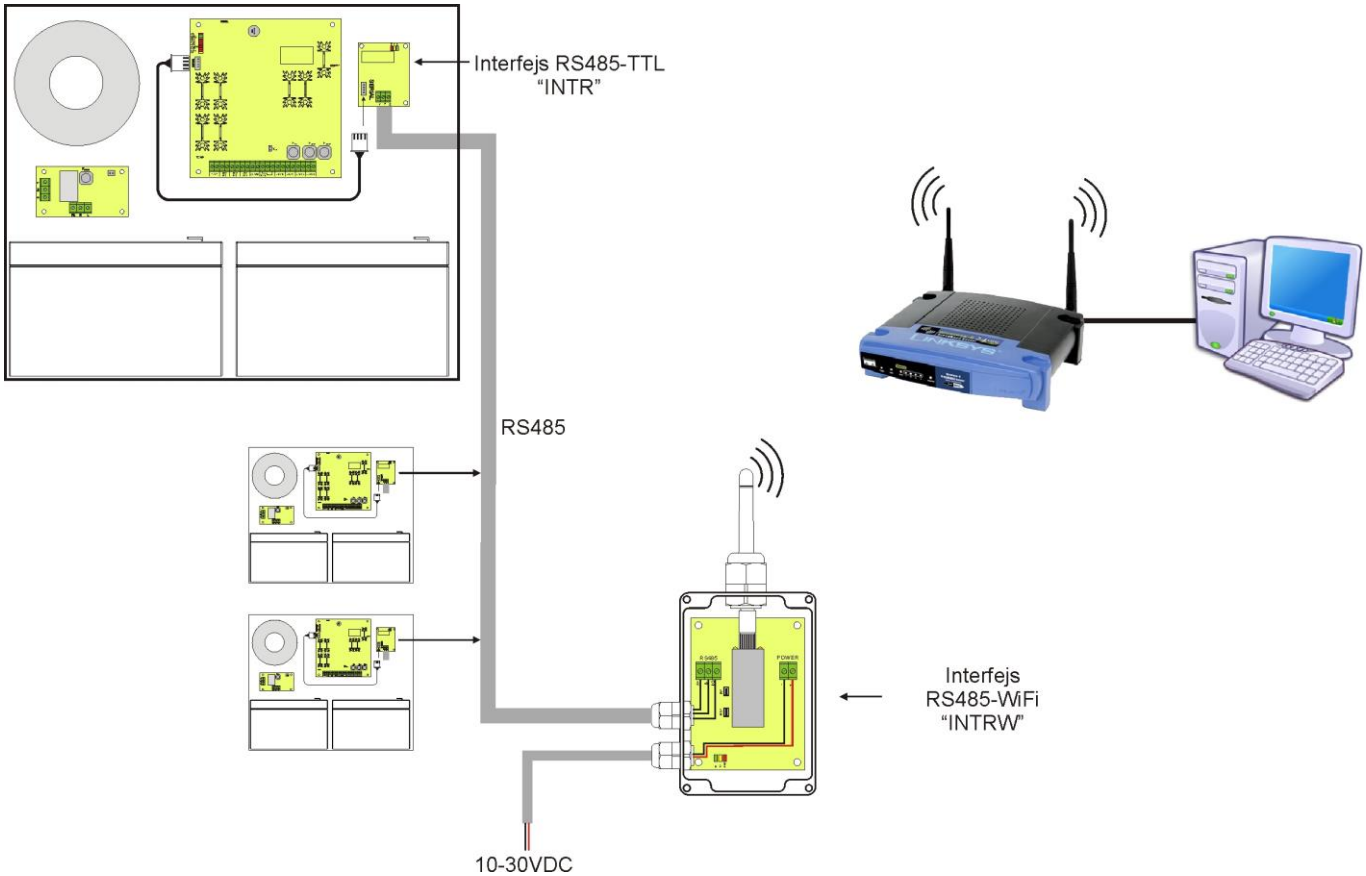


Fig. 33. The The Wi-Fi communication using the RS485-WIFI „INTRW" interface.

9.4. RS485 network communication.

Another type of network communication is the RS485 communication using two-wire transmission path. To achieve this kind of data exchange, the PSU should be equipped with the additional RS485 TTL "INTR" interface, converting data from the PSU into the RS485 standard and the USB-RS485 "INTUR" interface, converting data from the RS485 network to the USB. Offered interfaces are galvanically isolated and protected against surges.

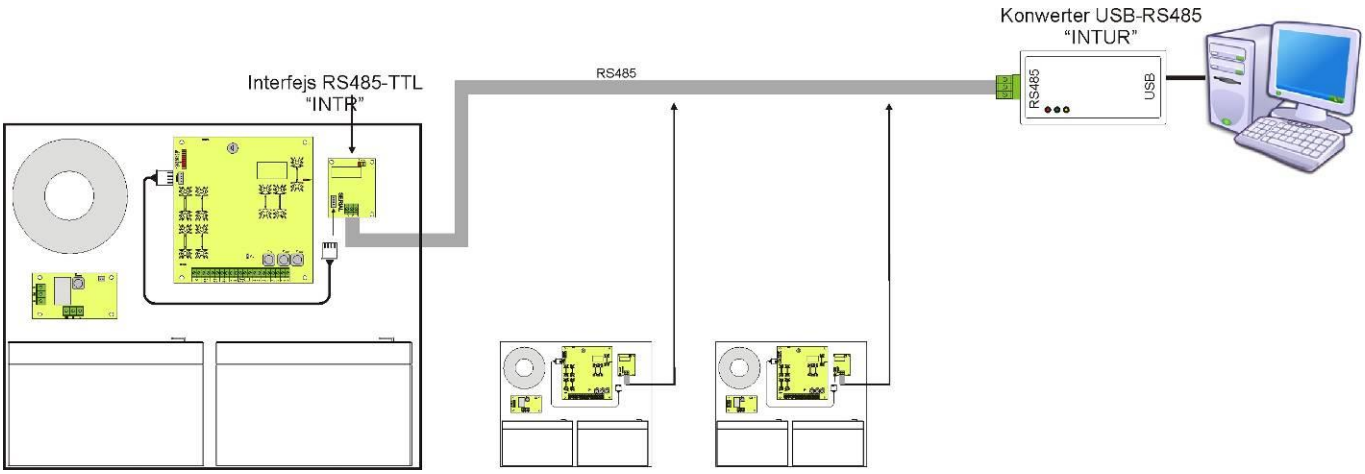


Fig. 34. RS485 communication using the „INTR" and „INTUR" interfaces.

9.5. „PowerSecurity” program.

The ”Power Security” program is available on www.pulsar.pl
Its detailed description can be found in the manual.

PowerSecurity is a program designed to operate with power supplies of the PSBEN, EN54 and EN54C/LCD series.

The graphical interface of the program has been designed so that it is convenient to combine power supplies into groups giving the possibility of monitoring multiple parameters in one window simultaneously.

The program constantly monitors the parameters of all power supplies; in case of failures the backlight changes accordingly in both the manager window and the Windows taskbar. In addition, the program allows you to download the operation history of the power supply, the history of events, and visualization in the form of charts and tables. The downloaded data can be saved.

The program also provides functionality in the form of a remote battery test. The result of the battery test takes the form of a message.

The PowerSecurity software is a free software. Operation requires a PC with the operating system Windows 10 or older.

The application can also be used by people who install and service power supplies. The main panel of the program is shown below.

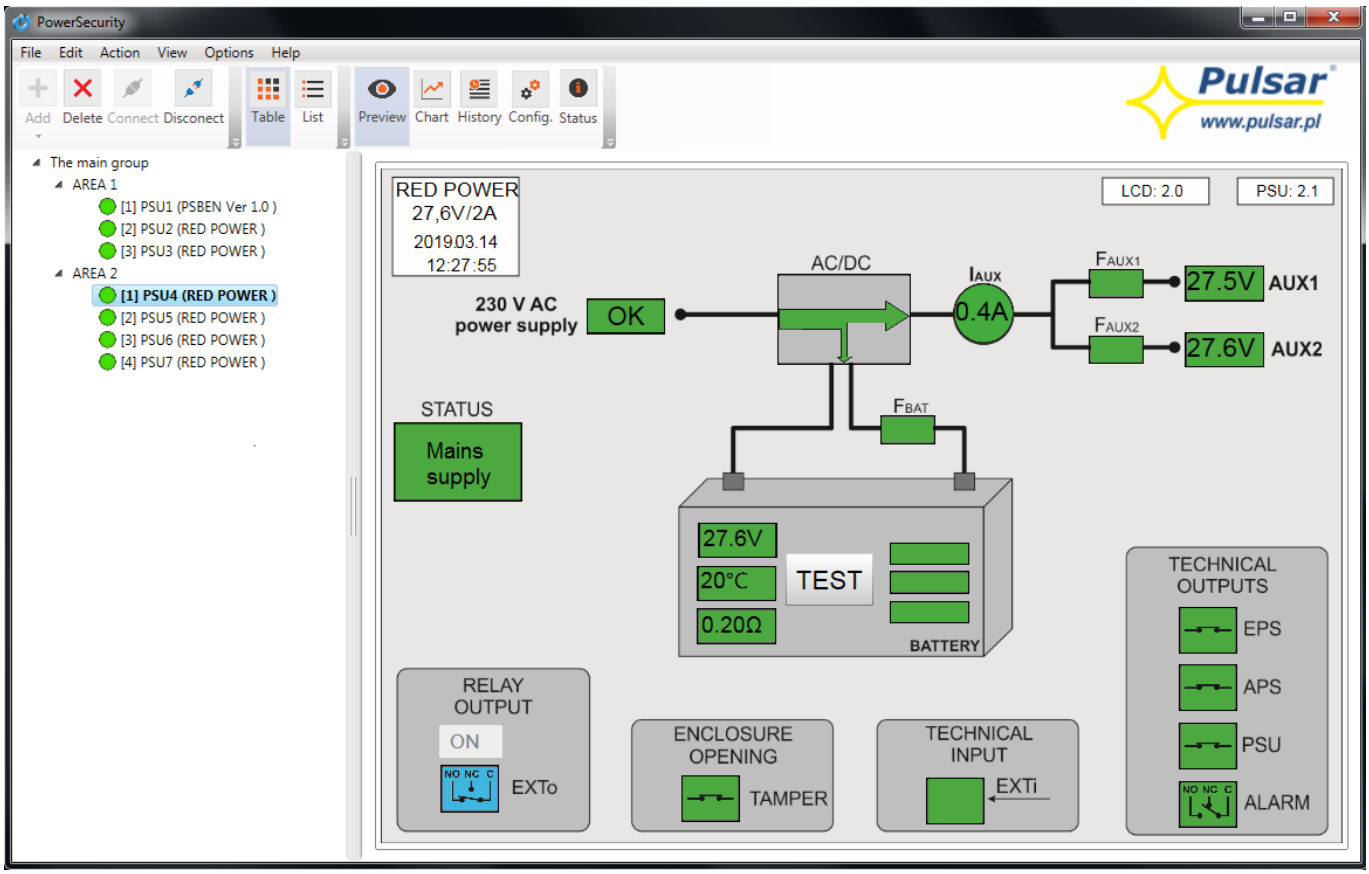


Fig. 35. The main panel of the "Power security" program.

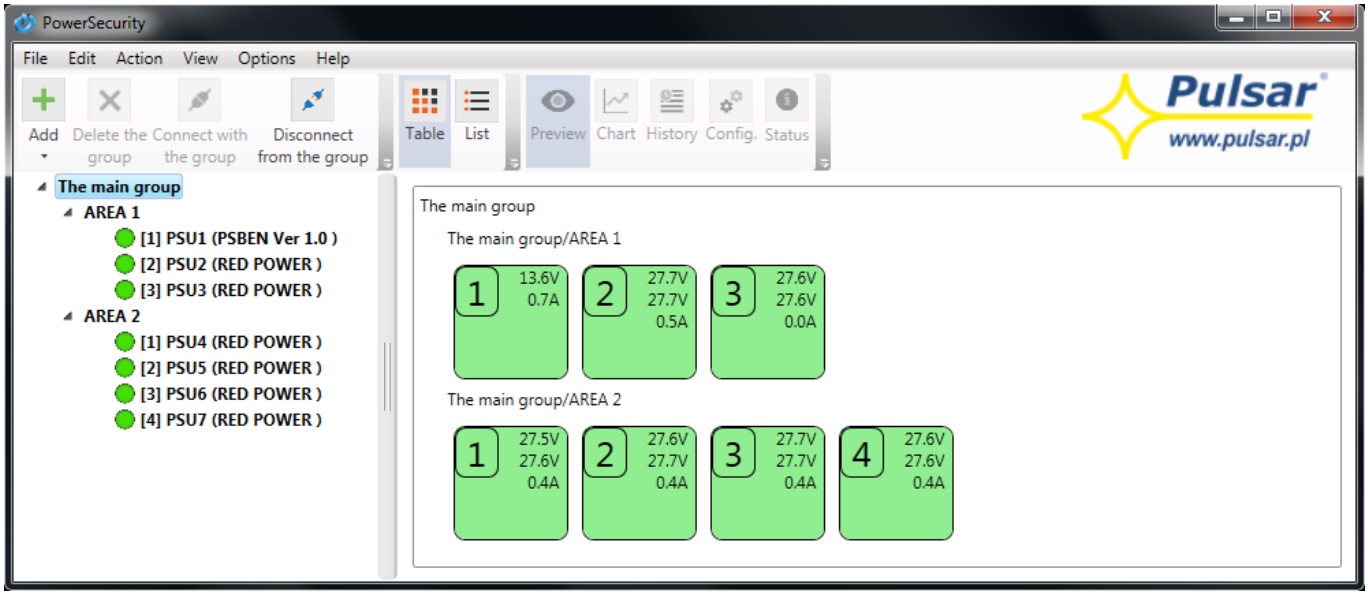


Fig. 36. The main panel of the "Power security" program - the "Synoptic board" tab.

The manager window allows you to combine monitored power supplies into groups / subgroups offering greater control and transparency for more complex systems.

The device window can be switched between two modes: the synoptic board or the list mode. This is especially useful when the PowerSecurity program works with a large number of power supplies.

The application enables both visualization and analysis of read data. Exceeding the permissible parameters is signaled by a change in color of the relevant field to yellow and a flashing indicator light. It is possible to view the current power supply parameters, historical parameters in the chart, electrical parameters, the status of technical outputs, and to read the event log on individual tabs.

10. Technical parameters.

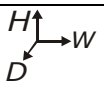
Electrical parameters (Table 15).
Mechanical parameters (Table 16).
Safety of use (Table 17).
Operation parameters (Table 18).
Recommended types and sections of installation cables (Table 19).

Table 15. Electrical parameters.

Functional class EN 12101-10:2007	A
Mains supply	~230 V
Current consumption	1,36 A
Power frequency	50 Hz
PSU's power	193 W
Efficiency	82%
Output voltage at 20 ºC	22,0 V÷ 27,6 V DC – buffer operation 20,0 V÷ 27,6 V DC – battery-assisted operation
Output current	**Continuous operation** **Output current Imax a=5 A** **Instantaneous operation** **Output current Imax b=7 A**
Maximal resistance of the battery circuit	300mΩ
Ripple voltage	100mV p-p max.
Current consumption by the PSU during battery-assisted operation	I = 65mA I = 55mA – LCD panel backlight off Caution ! If the power supply is connected with the communication interface or fuse module, additional current consumption should be considered.
Battery charging current	2 A
Coefficient of temperature compensation of the battery voltage	-40mV/ ºC (-5 ºC ÷ 40 ºC)
Low battery voltage indication	Ubat < 23 V, during battery mode
Overvoltage protection OVP	U>30,5 V±0,5 V - disconnection of the output voltage (AUX+ disconnection), automatic return
Short-circuit protection SCP	F8 A - F_{AUX1}, F_{AUX2} melting fuse (failure requires fuse replacement)
Overload protection OLP	Hardware - Software
Battery circuit protection SCP and reverse polarity connection	F10 A - F_{BAT} melting fuse (failure requires fuse replacement)
Deep discharge battery protection UVP	U<20 V (± 2%) – battery disconnection
TAMPER output indicating enclosure opening	Microswitch TAMPER
Technical outputs: **- EPS FLT; indicating AC power failure**	- type – electronic, max 50mA/30 V DC, galvanic isolation 1500 V_{RMS} - delay time approximately 10s/1m/10m/30m (+/-5 %) – configured from the control panel
- APS FLT; indicating battery failure **- PSU FLT; indicating PSU failure** **- ALARM; indicating collective failure**	- type – electronic, max 50mA/30 V DC, galvanic isolation 1500 V_{RMS}
	- type – relay: 1 A@ 30 V DC/50 V AC **CAUTION!** In Fig.2 the set of contacts shows a potential-free status of the relay, which corresponds to power supply failure.
EXTi technical input	Voltage „ON" – 10÷30 V DC Voltage „OFF" – 0÷2 V DC Level of galvanic isolation 1500 V_{RMS}
EXTo relay output	1 A@ 30 V DC /50 V AC
Optical indication:	- LEDs on the PCB of the power supply unit, - LCD panel • readings of electrical parameters, including: voltage, current, resistance of the circuit, mains supply voltagefailure indication • failure indication • configuration of the PSU settings from the control panel • 2 levels of password protected access

	• operation memory of the PSU – 6144 values • failure memo - 2048 events • real time clock with battery backup
Acoustic indication:	- piezoelectric indicator ~75 dB /0,3 m, switched from the LCD panel
LCD screen battery	3 V lithium battery, CR2032
Fuses: **- F_{MAINS}** **- F_{BAT}** **- F_{AUX1}** **- F_{AUX2}**	 T 6,3 A / 250 V F 10 A / 250 V F 8 A / 250 V F 8 A / 250 V
Additional equipment (not included)	- USB-TTL „INTU” interface; USB-TTL communication - RS485 „INTR” interface; RS485 communication - USB-RS485 „INTUR” interface; USB-RS485 communication - Ethernet „INTE” interface; Ethernet communication - WiFi “INTW” interface; WiFi wireless communication - RS485-Ethernet “INTRE” interface; RS485-Ethernet communication - RS485-WiFi “INTRW” interface; RS485-WiFi wireless communication

Table 16. Mechanical parameters.

Enclosure dimensions	W=420 H=420 D+D_1 =182 + 8 [+/- 2mm] W_1=425 H_1=425 [+/- 2mm]
Mounting	380 x 345 x Φ 6 x4 pieces (WxH)
Recommended battery model	- 2 x EP 42-12 or - 2 x GP12400
Fitting battery	2x40 Ah/12 V (SLA) max. 400 x 180 x 175mm (WxHxD) max 
Net/gross weight	11,8/13,4 kg
Enclosure	Steel plate DC01 1,2mm, color: RAL 3001 (red)
Closing	Key lock
Terminals	Mains supply: Φ0,51÷2 (AWG 24-12) Outputs: Φ0,51÷2 (AWG 24-12) Battery outputs BAT: Φ6 (M6-0-2,5)
Cable glands	PG9 – cable diameter Φ4÷8mm PG11 – cable diameter Φ5÷10mm
Notes	The enclosure does not adjoin the mounting surface so that cables can be led. Convection cooling.

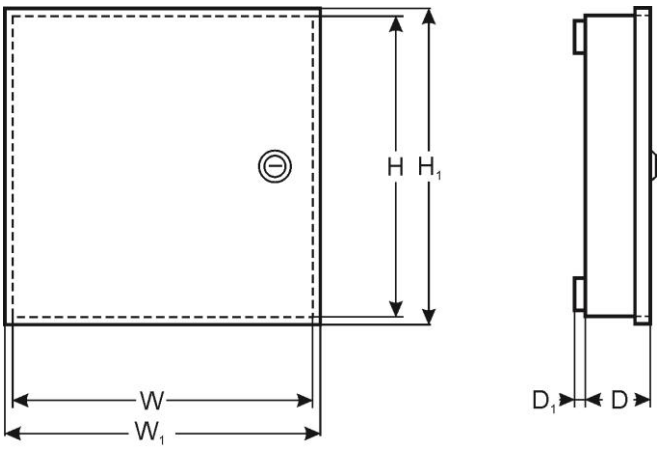


Table 17. Safety of use.

Protection class EN 60950-1:2007	I (first)
Protection grade EN 60529: 2003	IP42
Insulation electrical strength: - between input (network) circuit and the output circuits of the PSU - between input circuit and protection circuit - between output circuit and protection circuit	 3000 V AC min. 1500 V AC min. 500 V AC min.
Insulation resistance: - between input circuit and output or protection circuit	 100 MΩ, 500 V DC

Table 18. Operation parameters.

Environmental class EN 12101-10:2007	2
Operating temperature	-5 ºC...+75 ºC
Storing temperature	-25 ºC...+60 ºC
Relative humidity	20 %...90 %, no condensation
Sinusoidal vibrations during operation: 10 ÷ 50 Hz 50 ÷ 150 Hz	 0,1 G 0,5 G
Surges during operation	0,5 J
Direct insolation	unacceptable
Vibrations and surges during transport	According to the PN-83/T-42106 standard

Table 19. Recommended types and sections of installation cables.

Mains supply ~230 V L-N-PE (see Table 2 [2])	OMY 3 x 0,75 mm^2…1,5 mm^2
AUX1, AUX2 output terminals (see Table 1 [11])	HLGs 2 x 1,5 mm^2…2,5 mm^2
Indication inputs/outputs (see Table 1 [11])	YnTKSY 1 x 2 x 0,8 mm^2
Additional indication lines (with optional interface)	FTP 4x2x0,5 cat. 5e

11. Technical inspections and maintenance.

Technical inspections and maintenance can be performed after disconnecting the power supply from the power network. The PSU does not require any specific maintenance, however, its interior should be cleaned with compressed air if it is used in dusty conditions. In case of fuse replacement, use only compatible replacement parts.

Technical inspections should be carried out not less frequently than once per year. During the inspection, check the batteries and run the battery test.

4 weeks after installation, re-tighten all threaded connections, see Fig. 2 [11] and Fig. 3 [2].

11.1. Battery replacement of the LCD panel.

Estimated operating time of battery type CR2032 is about six years. After this period, the battery will need to be replaced.

Battery replacement of the LCD panel should be done during mains operation or battery-assisted operation in order to avoid resetting the time settings.

CAUTION!
Removed batteries should be stored in a designated collection point. Do not reverse the polarity of the batteries. Use of the wrong type battery could cause an explosion.

WEEE MARK

According to the EU WEE Directive – It is required not to dispose of electric or electronic waste as unsorted municipal waste and to collect such WEEE separately.

CAUTION! The power supply unit is adapted for cooperation with the sealed lead-acid batteries (SLA). After the operation period they must not be thrown but recycled according to the applicable law

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