Power supply unit for fire systems used DSOS24V-PRA type
Declared performance: Fire safety.
Certificate of constancy of performance: 1438-CPR-1019
Certificate of approval: 5402/2024
Compliant: EN 54-4:1997+ AC:1999 + A1:2002 + A2:2006

CNBOP-PIB 1438 24

USER MANUAL

EN

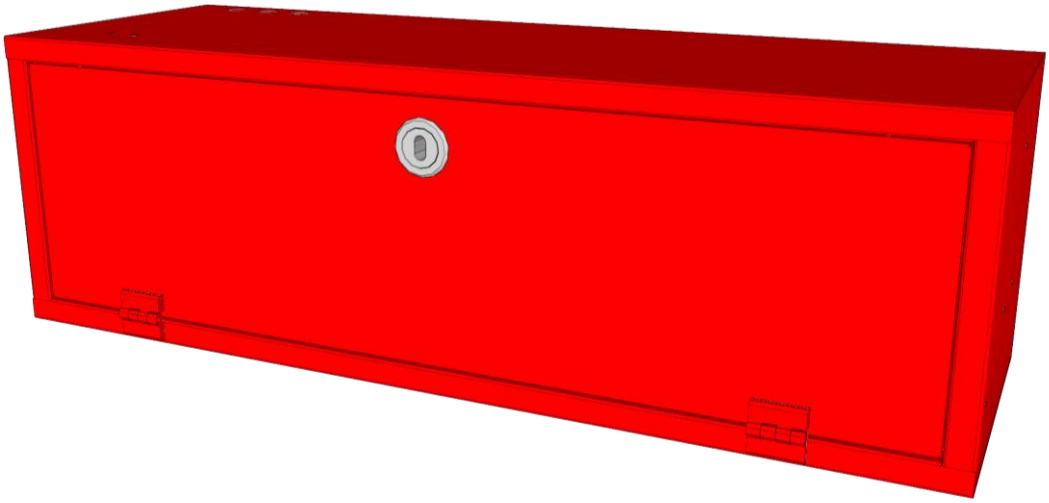
Edition: 1 from 09.07.2023

Supersedes edition: ------

DSOS24V-PRA

v.1.0

FIREFIGHTER'S MICROPHONE POWER SUPPLY FOR VOICE ALARM SYSTEMS 24V PRAESENSA



GENERAL SAFETY RULES

Before installation, read the instruction manual to avoid errors that can damage the device and give you an electric shock.

- 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 3 mm.
- 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.
- The device should be transported without batteries. This has a direct impact on the safety of the user and the device.
- Installing and connecting the power supply must be carried out without batteries.
- When connecting batteries to the power supply, pay particular attention to the correct polarity. If necessary, it is possible to permanently disconnect the battery from the power supply systems by removing the F_{BAT} fuse.
- The power supply is adapted to be connected to a power distribution network with an effectively earthed neutral conductor.
- Ensure a free, convection air flow around the enclosure. Do not cover the ventilation openings.

TABLE OF CONTENTS

1. Features.

- Conformity with EN 54-4:1997+AC:1999+A1:2002+A2:2006, and pt. 12.2 according to Decree of the Ministry of Internal Affairs and Administration of 20.06.2007 (Journal of Laws No. 143, item 1002), as amended on 27.04.2010.
- Power supply for call station of DSO system, e.g. PRA-CSLW, PRA-CSLD and four PRA-CSLW, PRA-CSLD extensions by BOSCH
- 48 V DC uninterruptible power supply
- Recomended batteries 2x 17Ah /12V
- Built in DC/DC converter 24V/48V
- Low ripple voltage
- Microprocessor based automation system
- Measurement of resistance of battery circuit
- Automatic temperature compensation of battery charging
- Battery test
- Two-phase battery charging
- The accelerated battery charging function
- Battery circuit continuity control
- Battery voltage control
- Battery fuse status control
- Battery charging and maintenance control
- Deep discharge battery protection (UVP)
- Battery overcharge protection
- Battery output protection against short circuit and reverse connection
- Output voltage control
- Technical outputs – relay type
- Common failure output ALARM
- EPS technical output indicating 230 V AC power loss
- LED optical indication
- Protections:
  - SCP short circuit protection
  - OLP overload protection
- Convection cooling
- Warranty – 3 years

2. Functional requirements of the PSU.

The buffer power supply for fire alarm systems has been designed in accordance with the following standards:
- EN 54-4:1997+AC:1999+A1:2002+A2:2006 fire detection and fire alarm systems.
- pt. 12.2 according to Decree of the Ministry of Internal Affairs and Administration of 20.06.2007 (Journal of Laws No. 143, item 1002), as amended on 27.04.2010.

Functional requirements	Requirements according to the standards	Power supply unit DSOS24V-PRA
Two independent power sources	YES	YES
EPS network failure indication	YES	YES
Two independent power supply outputs protected against short circuits	YES	YES
Temperature compensation of the battery charging voltage	YES	YES
Measurement of the resistance of the battery circuit	YES	YES
Low battery indication LoB	YES	YES
Recharging battery to 80% of rated capacity within 24 hours	YES	YES
Protection against deep battery discharge	YES	YES
Protection against short-circuit at the battery terminals	YES	YES
Charging circuit failure Indication	YES	YES
Short-circuit protection	YES	YES
Overload protection	YES	YES
Output of common failure ALARM	YES	YES
EPS technical output	YES	YES
Low output voltage indication	-	YES
High output voltage indication	-	YES
Power supply failure indication	-	YES
Surge protections	-	YES
Input of external failure indication EXTi	-	YES

3. Standard configuration.

The table below shows standard configurations in which PSU can operate to ensure the required backup time after 230 V AC power loss.

Table 1. Standard configuration.

Standard configuration	PRA-CSLW	PRA-CSE	PRA-ES8P2S	EKI-2741FHPI	ISFG64	PRA-IM16C8
						
1		x4				
2		x4				
3		x4		x2		
4		x4				
5		x4				
6		x4				

4. Technical description.

4.1. General description.

DSOS24V-PRA is designed for uninterruptible power supply of call stations (firefighter's microphone) used in DSO (Voice Alarm Systems) requiring stabilized voltage of 48 V DC (-5%/+5%).

In case of lack of main power, battery back-up is activated immediately. Power supply unit is placed in metal enclosure (color red RAL 3001) with space for 2x 17Ah/12V batteries. Power supply unit uses maintenance – free, AGM or gel batteries (17Ah/12V).

4.2. Block diagram.

PSU has been manufactured based on a high-efficiency system of AC/DC converter.
Applied microprocessor circuit is responsible for full diagnostics of 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.

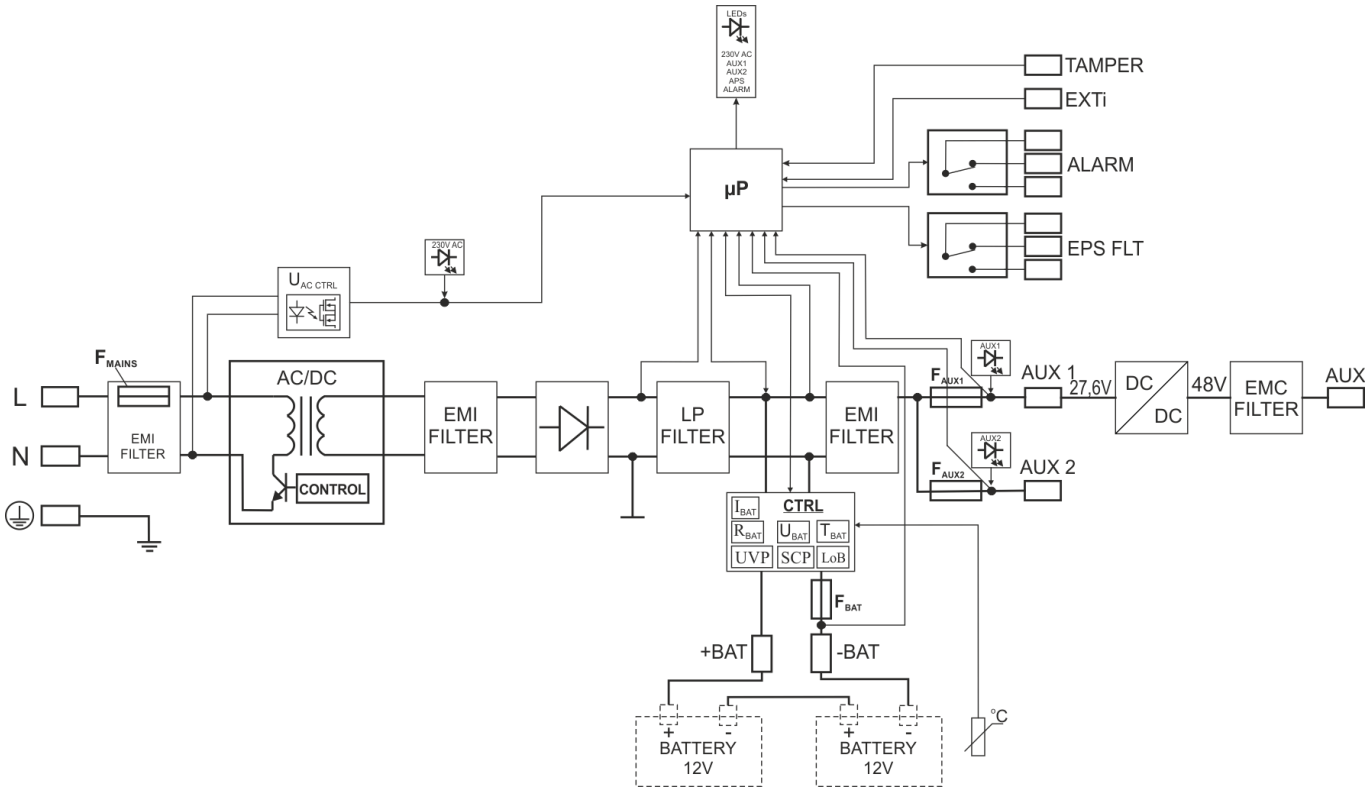


Fig. 1. Block diagram of PSU.

4.3. Description of PSU components and connectors.

Table 2. Description of components and connectors.

Element no.	Description
1	**LEDs** - optical indication: **AC** – AC voltage **DC** – output voltage 24 V DC **FAILURE** – common failure
2	**Microphone hanging point (mounting plate included with PRA-CSLW station)**
3	**Space for PRA-CSLW microphone station**
4	**Space for PRA-CSE extensions, max. 4 pcs.**
5	**Mounting plate**
6 16	**Space for PRA-CSE extensions, max. 4 pcs.**
7	**Space for a fibre optic cable**
8	**PSU module**
9	L-N- 230 V power connector with protective terminal
10	**Power converter 48 V**
11	**Module of EMC filter**
12	**Output connector:** **+AUX-** – 48 V power supply output (- AUX=GND) **PSU** – OC-type technical fault output: OLP/SCP (overcurrent, overload) Close = no indication Open = failure
13	**Battery cables**; positive: +BAT = red, negative: - BAT = black
14	**Recomended batteries** 2x 17Ah/12V
15	**Battery temperature sensor**
17	**Holes for mounting enclosure to the surface**

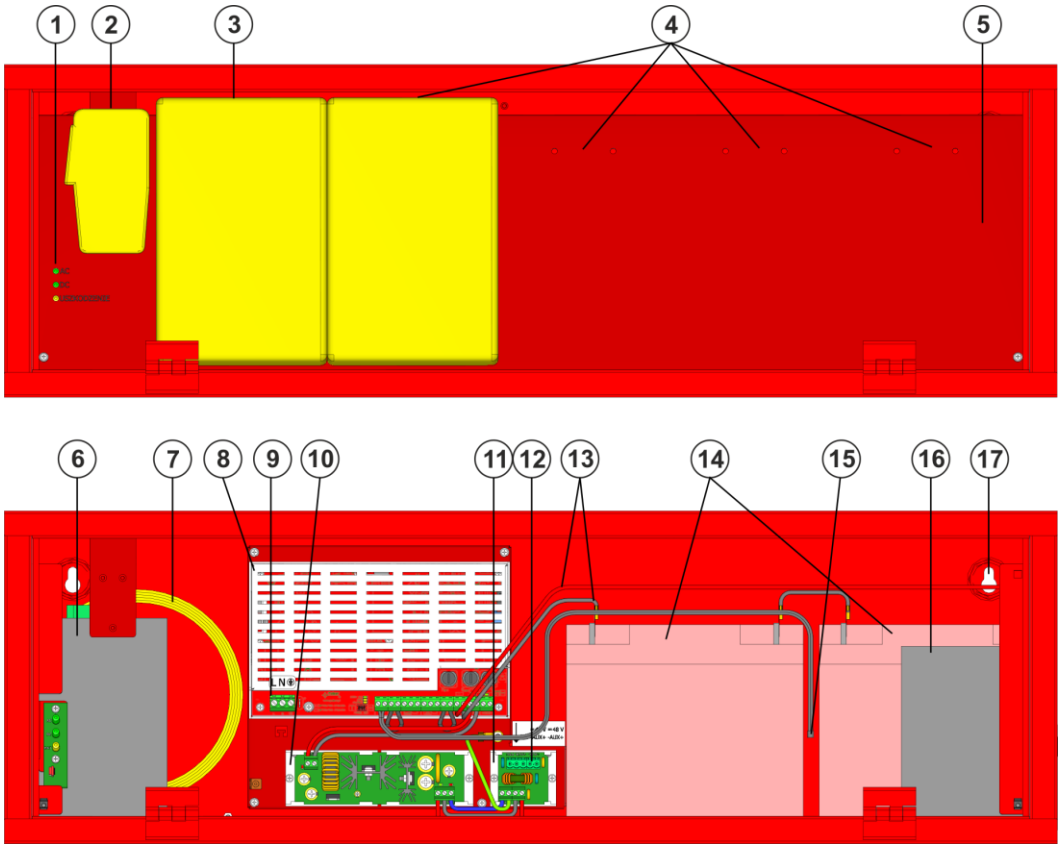


Fig. 2. View of PSU.

5. Installation.

5.1. Requirements.

Buffer power supply is designed to be installed only by qualified installer with necessary permits and authorisations (required in installation country) to connect (interfere) with the 230 V mains supply.

Because the power supply is designed for the continuous operation and is not equipped with ON/OFF switch, the power supply circuit should have the appropriate overload protection. Moreover, the user shall be informed about the method of unplugging (most frequently through separating and assigning an appropriate fuse in the fuse-box).

The electrical system shall follow valid standards and regulations. The PSU shall work in a vertical position that guarantees sufficient convectional air-flow through ventilating holes of the enclosure.

In order to fulfill LVD and EMC requirements, the rules for: power-supply, encasing and screening shall be followed, according to application.

As PSU cyclically runs a periodic battery test, during which resistance in battery circuit is measured, pay attention to proper connection of cables to batter. Connection wires should be firmly screwed to both terminals on battery side and power supply.

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

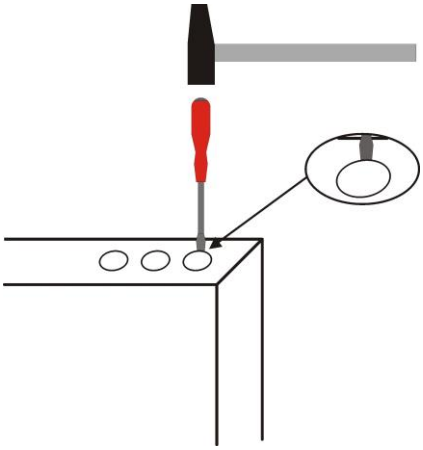


Fig. 5. Method of forming an opening for cable gland.

Power supply is equipped with M20x1.5 glands with a 2-4mm rubber reduction insert. The reduction insert should be used to thin fibre-optic cable. Single cable gland can be used for only one wire.

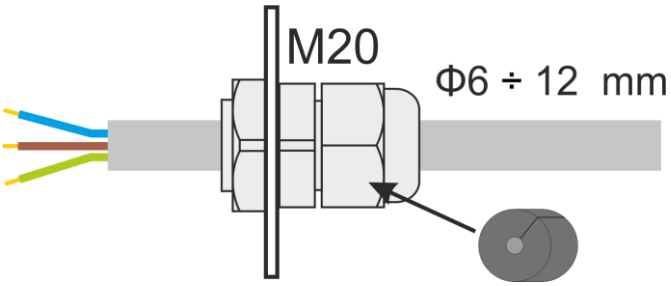


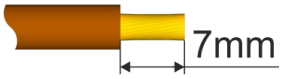
Fig. 6. Recommended types and sections of installation cables.

5.2. Installation procedure.

CAUTION!
Before installation, cut off voltage in 230 V power-supply circuit.
To switch power off, use an external switch, in which distance between contacts of all poles in disconnection state is not less than 3mm.

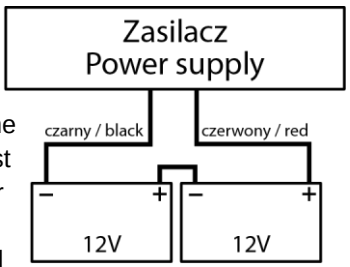
It is required to install in the supply circuits, in addition to power supply, circuit breaker with 6 A nominal current.

1. Open the front door of the PSU and remove the mounting plate by unscrewing the two lower screws at the bottom of the plate.
2. Mount PSU in a selected location with use of special metal expansion bolts. Do not use PVC dowels.
3. Connect power cables ~230 V to L-N clips of PSU. Connect ground wire to clip marked by earth symbol ⏚. Use a three-core cable (with a yellow and green protection wire) to make connection. Wires should be deisolated to a length of 7.2mm.



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

4. Mount the receivers on the appropriate DIN rail.
5. Connect the power supply from the AUX output of the inverter module to the receivers (Ethernet switch, media converter, I/O module) using provided cables.
6. Mount the PRA-CSLW microphone station together with the PRA-CSE extensions to the mounting plate.
7. If needed, connect cables from devices to technical inputs and outputs:
   - ALARM; technical output of common failure of PSU
   - EPS; technical output of AC network absence indication
   - EXTi; input of common failure
8. Install the battery/batteries in a designated area of the enclosure. Connect the batteries with the PSU paying special attention to the correct polarity. Batteries must be connected in series using the special cable (included). Place temperature sensor between batteries.



9. Switch on 230 V AC supply. The appropriate LEDs on the front panel of PSU should light up: green AC and DC.
10. Check current consumption of receivers, taking into account battery charging current, so as not to exceed total current efficiency of PSU.
11. Once tests are completed, close enclosure.

5.3. Procedure for checking power supply.

1. Check indication displayed on front panel of power supply unit:
    a) 230 V AC LED should remain lit to indicate presence of mains supply voltage.
    b) LED DC should remain lit to indicate presence of supply voltage.
    c) Fault LED off.
2. Check output voltage after 230 V AC power failure.
    a) Simulate the absence of 230 V AC mains voltage by disconnecting the relevant switch in the electrical installation.
        i. LED AC should go out
        ii. The DC LED should continue to illuminate indicating the presence of output voltage.
        iii. The Fault LED will begin to flash.
        iv. After approximately 10s the EPS and ALARM technical output will change state to the opposite.
    b) Turn on 230 V mains voltage again. Indication should return to initial status from point 1 after a few seconds.
3. Check whether lack of continuity in batters circuit is properly indicated.
    a) During normal PSU operation (230 V mains voltage on), disconnect battery circuit by disconnecting F_{BAT} fuse.
        i. Within 5 minutes PSU will start signalling a failure in battery.
        ii. The Fault LED will begin to flash.
        iii. APS and ALARM technical output will change state to the opposite.
    b) Turn on the F_{BAT} fuse in battery circuit again.
    c) Power supply should return to normal operation, indicating initial status, within 5 minutes after battery test is completed.

6. Functions.

6.1. Optical indication.

The power supply is equipped with three LEDs on the front panel:

AC	**AC voltage** • on – the PSU is supplied with 230 V AC • off – no 230V AC supply
DC	**Output voltage 48 V DC** • on – 48 V DC voltage in the AUX output of the PSU • off – no 48V DC voltage in the AUX output of the PSU
USZKODZENIE	**Common failure** • blinking - failure • off – normal mode

6.2. Technical outputs.

Power supply is fitted with relay indication outputs changing state upon occurrence of a specific event.

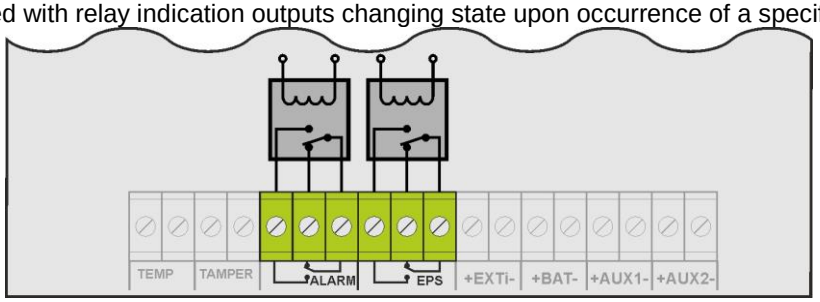


Fig. 8. Electrical diagram of relay outputs.

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

  Output indicates 230 V power loss. Under normal status – with 230 V supply on, output is closed. In case of power failure, PSU will switch output into open position after a time 10s.

Fig. 9. EPS technical output.

CAUTION! The figure set of contacts shows a potential-free status of relay, which corresponds to power supply failur.

- **ALARM - output of common failure indication.**

  Output indicating common failure. In case of 230 V power failure, battery circuit failure, PSU failure, or EXTi input activation, common failure signal ALARM will be generated.

  Failure can be triggered by following events:

  - ~230 V power failure
  - faulty batteries
  - undercharged batteries
  - disconnected batteries
  - high resistance of battery circuit
  - no continuity in battery circuit
  - U_{AUX1}, U_{AUX2} output voltage below 26 V
  - U_{AUX1}, U_{AUX2} output voltage over 29,2 V
  - battery charging circuit failure
  - blown F_{AUX1} or F_{AUX2} fuse
  - PSU overload
  - to high battery temperature (>65°C)
  - temperature sensor failure, t < -20°C or t > 80°C
  - internal damage of PSU

Fig. 10. Technical output ALARM.

CAUTION**!** The figure set of contacts shows a potential-free status of relay, which corresponds to power supply failur.

6.3 Common failure input EXTi.

EXT IN (external input) technical input indicating common failure is intended for additional, external devices that generate failure signal. Disconnection of EXTi terminals will cause a failure of PSU and generate a failure signal at ALARM output.

EXTi technical input is not galvanically isolated from power supply. The "minus" terminal is connected to power supply.

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

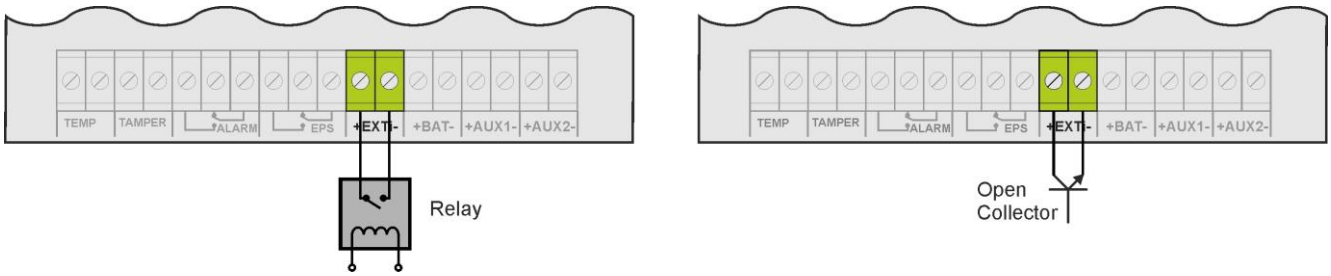


Fig. 11. Connections to EXTi input.

6.4 Overload of the PSU output.

If output overload occurs during PSU operation, PSU will limit battery charging current for 1 minute. If, after this time, overload is removed, normal charging mode will be restored.

6.5 Short-circuit of PSU output.

In case of short-circuit of the AUX output, of the fuse F_{AUX1} becomes permanently blown. Restoration of the voltage at output requires replacement of the fuse.

During a short circuit, the PSU failure is indicated by illuminating the FAILURE LED (LED ALARM on PCB) and giving a common failure signal at the ALARM output.

7. Reserve power supply circuit.

PSU is fitted with intelligent circuits: battery charging circuit with function of accelerated charging and battery control, which main task is to monitor condition of batteries and connections in circuit.

If controller detects a power failure in battery circuit, appropriate indication and change of ALARM technical output.

7.1. Battery detection.

Control unit of PSU checks voltage at battery terminals and, depending on measured values, determines appropriate reaction:

U_{BAT} below 4 V - batteries not connected to PSU circuits

U_{BAT} = 4 to 20 V - faulty batteries

U_{BAT} over 20 V - batteries connected to the PSU circuits

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

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

7.3. Protection against reverse battery connection.

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

7.4. Deep discharge battery protection (UVP).

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

Batteries are reconnected to power supply unit automatically once 230 V mains supply is restored.

7.5. Battery test.

PSU runs battery test every 5 minutes. During testing, control unit of PSU measures electrical parameters according to implemented measuring method.

A negative result occurs when:

- battery circuit continuity is interrupted,
- resistance in battery circuit increases above 300 mΩ
- battery terminal voltage drops below 24 V.

Battery test will also be automatically locked when PSU is in operating mode, in which battery test is impossible. Such condition occurs, for example, during battery assisted operation.

7.6. Measurement of resistance of battery circuit.

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

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

7.7. Battery operating temperature readings.

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

PSU has a temperature sensor to monitor temperature parameters of installed batteries. It is recommended to place temperature sensor between batteries. Attach sensor to battery, e.g. with adhesive tape. Be careful not to damage sensor when moving batteries.

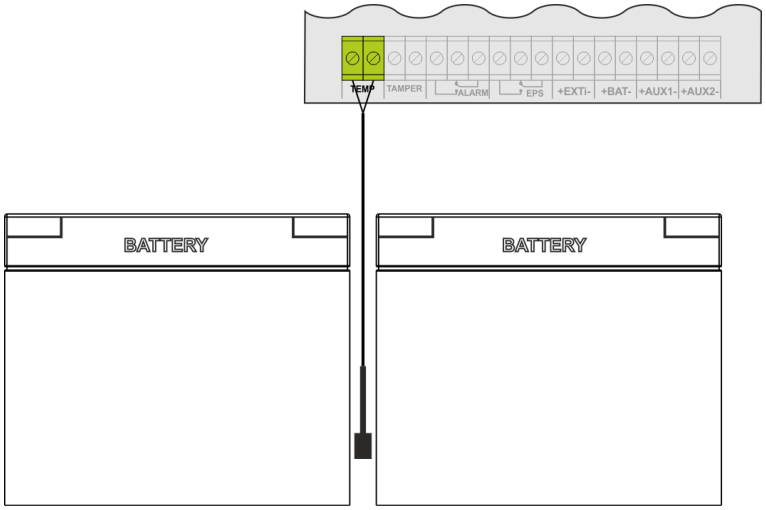


Fig. 12. Mounting of temperature sensor.

Nominal battery operating temperature recommended by many manufacturers is 25°C. Working at elevated temperatures will significantly shorten battery lifetime. Service life is reduced by half for each sustained temperature rise of 8°C above nominal temperature. This means that battery lifespan, when operated at 33°C, can be decreased by 50%!

7.8. Standby time.

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

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

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

where:

Q_{AKU} – minimum battery capacity [Ah]
1.25 – factor taking into account decrease in battery capacity due to ageing
Id – current drawn by the load during inspection [A]
Iz – PSU current consumption (including optional modules) [A]
Td – required inspection time [h]
Ia – current drawn by load during an alarm [A]
Ta – alarm duration [h]
Ic – short-term output current

8. Specifications.

Table 5. Electrical parameters.

Supply voltage	~230 V
Current consumption	0,34 A @230 V AC
Power frequency	50 Hz
Output power PSU	14,4 W
Efficiency	82%
Rated voltage	48 V DC (-5%/+5%)
Output current	300 mA
Maximal resistance of battery circuit	300 mΩ
Ripple voltage	50 mV p-p max.
Current consumption by PSU during battery-assisted operation	80 mA
Battery charging current	0,8 A
Coefficient of temperature compensation of battery voltage	-36 mV/ ºC (-5ºC ÷ 40ºC)
LoB low battery voltage indication	Ubat < 23 V, during battery operation
Over voltage protection (OVP)	U > 32 V ±2 V, automatic recovery
Short-circuit protection SCP	F 4 A - F_{AUX1}, F_{AUX2} fuse (in case of a failure, fuse-element replacement required)
Overload protection OLP	105-150% PSU power, automatically recovered
Battery circuit protection SCP and reverse polarity connection	F 5 A - F_{BAT} fuse (in case of a failure, fuse-element replacement required)
Deep discharge protection UVP	U < 20 V (± 2%) – disconnection of the batteries
Technical outputs: **- EPS FLT; output indicating AC power failure** **- ALARM; indicating common failure**	 - type – relay: 1 A@ 30 V DC /50 V AC - 10s time lag. - type – relay: 1 A@ 30 V DC /50 V AC
Optical indication: **- AC; a diode indicating AC power status** **- DC; a diode indicating power status at the PSU output** **- FAILURE; a diode indicating failure**	 - green, normal status: permanently illuminated, failure: off - green, normal status: permanently illuminated, failure: off - yellow, normal status: failure: off, failure: permanently illuminated
Fuses: - F_{BAT} **- F_{AUX1}** **- F_{AUX2}**	 F 5 A/250 V F 4 A/250 V F 4 A/250 V

Table 6. Mechanical parameters.

Enclosure dimensions	800 x 253 x 270 (WxHxD) [mm] (+/- 2)
Installation	696 x 155 [mm]
Net/gross weight	12,1 / 13,1 [kg]
Enclosure	Steel sheet DC01 1mm, color RAL 3001 (red)
Recomended batteries	2x 17 Ah/ 12 V (SLA)
Terminals	Mains supply: Φ0,51÷2 (AWG 24-12) Outputs: Φ0,51÷2 (AWG 24-12) Battery outputs BAT: Φ6 (M6-0-2,5)
Notes	Convection cooling.

Table 7. Operation safety.

Protection class EN 62368-1	I (first)
Protection grade EN 60529	IP30
Electrical strength of insulation: - between input and output circuits of the PSU - between input circuit and protection circuit - between output circuit and protection circuit	 4000 V DC 2500 V DC 500 V DC
Isolation resistance: - between input circuit and output or protection circuit	 100 MΩ, 500V DC

Table 8. Operating parameters.

Operating temperature	-5ºC...+40ºC
Storage temperature	-25ºC...+60ºC
Relative humidity	20%...90%, without condensation
Sinusoidal vibrations during operation: 10 ÷ 50Hz 50 ÷ 150Hz	 0,1g 0,5g
Impulse waves during operation	0,5J
Direct insolation	unacceptable
Vibrations and impulse waves during transport	According to PN-83/T-42106

9. Maintenance.

Technical inspections and maintenance can be performed after disconnecting power supply from power network. 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 batteries and run battery test.

4 weeks after installation, re-tighten all threaded connections.

WEEE LABEL
Waste electrical and electronic equipment must not be disposed of with normal household waste. According to the European Union WEEE Directive, waste electrical and electronic equipment should be disposed of separately from normal household waste.

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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