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USER MANUAL

Emergency power supply units for Voice Alarm Systems

type

ZDSO400-ER1

compliant with standards:
EN-54-4:1997+A1:2002+A2:2:2006, EN-121001-10:2005, ISO 7240-4:2003

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Document No. 0717.00.95-02.0

Warnings

- **Read this User Manual thoroughly before using the device.**
- **Please don't disassemble device which is energized. Touching the internal components results in high risk of electric shock or skin burning.**
- **During repair or exchange of the device please obey basic rules of handling electrical equipment:**
  1. **disconnect mains power and make sure that it couldn't be accidentally switched on;**
  2. **disconnect the batteries and make sure that its terminals couldn't be accidentally short-circuited (such event results in risk of fire or explosion)**
  3. **make sure that the devices nearby are not powered and accidental touching them does not create risk of electric shock.**
- **Protect the device from the possibility of any items or fluids entering in – they can cause a risk of electric shock and device damage.**
- **Do not cover ventilation openings – doing so may result in device damage.**
- **Provide a free space of at least 8 cm at the sides of the device, enabling its proper ventilation.**
- **The device must be supplied from the mains with a protective earthing terminal.**
- **The device may interfere with operation of sensible radio and television equipment located nearby.**

1. Technical description

1.1 Designation

The emergency power supply ZDSO400-ER1 is intended to power voice alarm systems (VAS), providing them power from main and backup power source, namely batteries, for needs of acoustic amplifiers and separately for controllers and other VAS modules.

Emergency power supply allows to connect maxim*u*m 6 amplifiers, controller and 5 routers, operating with one battery bank.

1.2 Design

Metallic cassette of ZDSO400-ER1 with height 1U, designed to mount in typical rack 19".
Weight of power supply is 4,9kg.

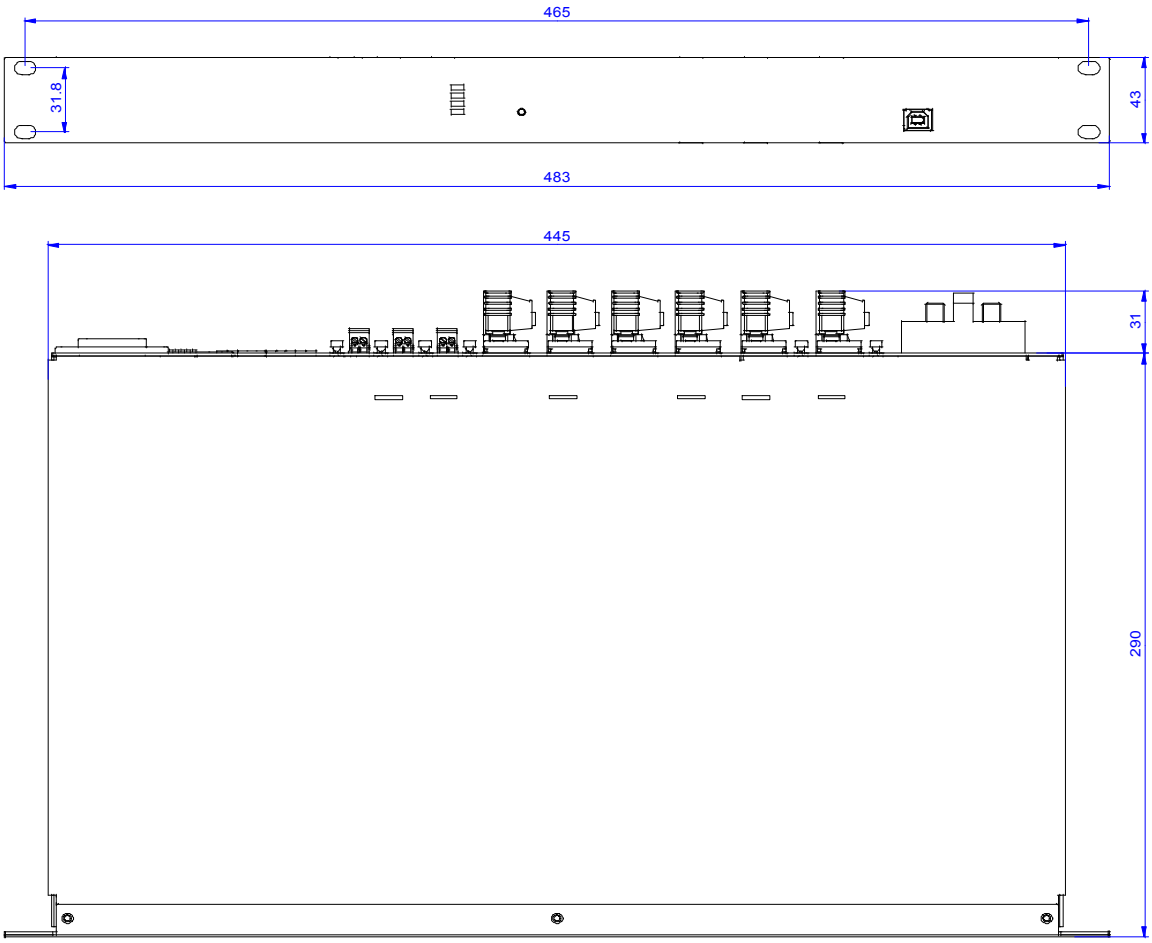


Fig. 1. View and dimensions of ZDSO400-ER1 power supply – model 1

SUPPLIED ACCESSORIES:

1. Temperature sensor, length 1.5m with own plug,
2. Set of 6 plugs for connecting VAS amplifiers by outputs **Out,**
3. Set of 6 plugs for connecting continuous operation devices by output **Aux,**
4. Set of 3 plugs for connecting relay signalling outputs,
5. Plug for connecting external fault input signal, with preassembled jumper.

Fig. 2. View of ZDSO400-ER1 front panel and back panels

On a front panel we see:

- set of 4 indication LEDs,
- push-button **ST** used to:
  a) start from battery (cold start – see par. 4.3)
  b) manual start of battery circuit resistance test (see par. 4.3)

c) erasing errors (see par. 5.5)
- USB socket for communication connection (type **B**).

Marking and meaning of indication LEDs is as follows:

Mains (Green)	**Charging** (Green)
Battery (Yellow)	**Fault** (Yellow)

On the back panel there are following components:
1. Mains socket IEC type C13 (male) to connect mains cable **(230Vac, 50/60Hz)**
2. Two M8 bolt terminals to connect battery 48V (**BAT**)
3. Socket for connecting temperature probe (**Temp sensor**)
4. Input of external fault signal (**Ext fault**)
5. Three outputs of relay signalling (**Mains fault, Bat fault** and **Gen fault**).
6. Six sockets (15A) to connect VAS amplifiers 48V (**Out 1 ÷ Out 6**) – in model 1
7. Four sockets (15A) to connect VAS amplifiers 48V (**Out 3** to **Out 6**) in model 2
8. Two double and two single sockets to connect network controller and other VAS modules (**Aux 1** to **Aux 6**) – in model 1; two single sockets to connect network controller and other VAS modules (**Aux 5 and Aux 6**) – in model 2
9. **Ethernet** communication socket (optional).
10. Tool (DIP switch) to set up battery capacity (charging current limit is calculated from battery capacity) and maximum battery circuit resistance.
11. Fuses of outputs **Out** and **Aux**.
12. LED indicators of blown out fuses.
13. LED indicator of external fault state **Ext fault**.

1.3 Basic electric parameters

Table 1

Mains power voltage	230V +10% -15% 50/60Hz
Power factor	0.94
Efficiency (during battery charging)	84%
Leakage current in guard wire	≤1.5mA
Max. current consumption from mains	2.7A
Battery nominal voltage	48V
Floating voltage @25°C	54.2V
Bulk charging voltage @25°C	55.7V
Temperature compensation index for floating and bulk charging modes	- 80mV/ºC
Maximum capacity of connected battery	200Ah
Number of battery banks	1
Max. charging current	2…8A *1)
Max. resistance of battery circuit	30…100mΩ *2)
Current consumption from battery for own needs	< 55 mA
Current consumption from battery after disconnecting by LVDD (Low Voltage Disconnecting Device)	< 1mA
LVDD battery disconnection threshold	40.8V
Range of output voltage changes	40.0…57.6V *3)
Current capacity of main outputs foreseen for VAS amplifiers (**Out**) - model 1 - model 2	 6 x 15A 4 x 15A
Current capacity of auxiliary outputs foreseen for VAS components operating continuously (**Aux**) - model 1 (**Aux 1**/**2**, **Aux 3**/**4**, **Aux 5**, **Aux 6**) - model 2 (**Aux 1** and **Aux 2**)	 4 x 2A 2 x 2A
Maximum continuous output current on 48V **Aux** outputs Imax. a	0…7A *4)
Max. allowed total current sourced from battery, when main power source is off	100A *5)

**1) Value of maximum charging current depends on battery capacity (see par. 1.4).*

**2) Required value within given range may be set up with 10mΩ accuracy by DIP switch for selection of battery circuit maximum resistance.*

**3) Given range includes voltages between voltage on discharged battery (at the end of battery operation mode) and bulk charging voltage, taking into account temperature compensation.*

**4) Depending on capacity of connected battery. (see par. 1.4).*

**5) At current 100A voltage drop inside power supply between battery connectors and amplifier output connectors amounts 0.4V.*

1.4 Dependence of maximum battery capacity on the current of Aux outputs

Current 16A, available from internal power supply, is used for both – for outputs loaded continuously by VAS components (all outputs **Aux**) and for charging the batteries. As current of output Aux is limiting the battery charging current, so maximum capacity of used battery is limited by this current of outputs Aux in the way shown in below table.

Table 2

Max. current sourced continuously from outputs **Aux** *)	0	1A	2A	3A	4A	5A	6A	7A
Max. capacity of batteries	200Ah	180Ah	160Ah	130Ah	100Ah	80Ah	50Ah	25Ah

**) This current is marked in the table of electric parameters as I max. a*

1.5 Selection aspects of battery capacity

Determining the battery capacity must take into account cumulatively current consumptions during battery operation in following order:

a. during watchdog for 6 or 24 hours
b. during transmission for 20 minutes voice messages with power lower by 10dB than nominal power
c. during fire alarm for 10 minutes with power less by 3 dB than nominal power.

VAS components, mainly amplifiers, are working properly if supply voltage value is over given threshold. Therefore battery circuit must fulfil requirements for voltage and resistance such, that during fire alarm at maximum current wouldn't happen amplifiers switch off.

VAS power system has following parameters when alarm is generated during battery operation:

- Maximum power of installed loudspeakers and current resulting from it during alarm (see par. 4.3)
- Resistance of current flow circuit between battery connectors and amplifier connectors (see par. 3.3.2)

From technical - and at the same point rational point of view - current flow could not cause on this resistance voltage drop higher than 1.2V. This requires selection of battery in such way, that during maximum alarm current flow, after 10 minutes, voltage on battery terminals will not drop below value higher by 1.2V than amplifiers switching off voltage level, or LVDD battery disconnection threshold level.

1.6 Recommended operation conditions

Relative humidity	max 80%
Direct sun exposure	not permissible
Impacts during operation	not permissible
Ambient temperature	
▪ limits of allowed storage temperature	-40…+85°C
▪ operating temperature – class **3K5** by **EN 60721-3-3**	-5…+45°C

2 Principle of operation

2.1 General

Power supply design is based on so called direct buffering operation. Mains power supply (which has also role of a battery charger) is connected in parallel to outputs of ZDSO400-ER1 and external battery. When mains power is present then it is delivering power to outputs and simultaneously charging the battery. In this stage only sourcing current from outputs **Aux** to VAS controller or routers is allowed. After mains failure the load is transferred automatically to battery (battery operation mode). Block diagram of power supply is shown on figure 3.

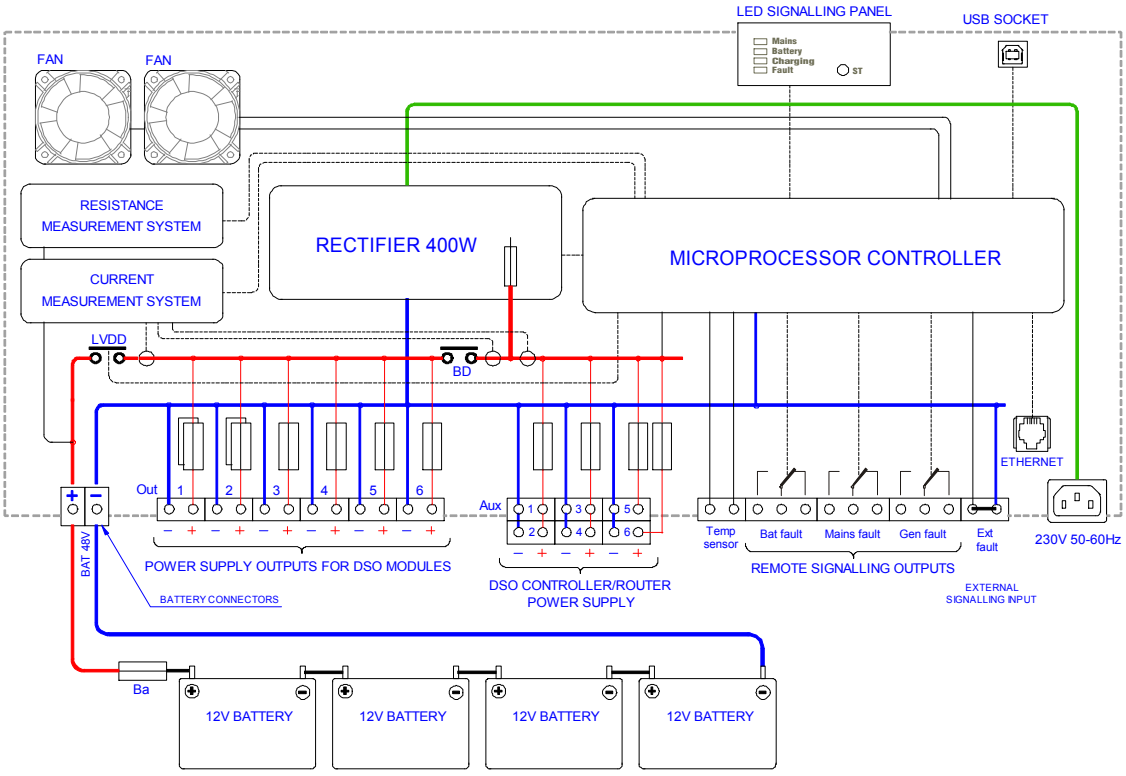


Fig. 3. Block diagram of ZDSO400-ER1 power supply

Power supply is designed to work with VAS systems, in which acoustic power amplifiers have own mains power supply. It causes that there are two circuits with different character of current sourcing:

1. amplifiers of VAS, sourced from outputs **Out**:
   a. when mains is present they are not sourcing current from ZDSO400-ER1;
   b. after mains failure, when there's no fire alarm, they source very low current from power supply's battery for their own needs;
   c. if during mains failure fire alarm occurs, then they source from battery very large current, defined by power necessary to transmit voice messages and alarm signals in particular fire zones.
2. other components of VAS, operating continuously (controllers, routers, calling stations etc.); because they have no own mains power supplies they need backup power source with constant and relatively low power. Outputs **Aux** are doing this service.

ZDSO400-ER1 power supply provides following features besides already described main functions of VAS power (outputs **Out** and **Aux**):

- power from mains by own power supply 400W,
- supervising an external battery, charging and monitoring it's status,
- testing the resistance of battery circuit (readings its value is possible by PC application via USB),
- protection of battery against deep discharge by LVDD,
- monitoring of battery charging current, current on **Aux** outputs and occurrence of load on main outputs **Out** when mains power is present (readings these values is possible by PC application via USB),
- disconnecting the outputs **Aux** by BD when battery terminals or outputs **Out** are shorted and battery is not connected; it secures that voltage on outputs **Aux** is still present despite battery failures previously described.

All functions of power supply are controlled by uP controller, receiving the signals from key points of power supply, that inform about voltage, current, temperature, faulty states, etc. The controller is also setting relays of external signalling, lighting LED indication and ensures communication with external computer by USB link. If power supply is equipped with Ethernet module, there is possibility to control its operation remotely.

2.2 Description of selected functions

2.2.1 "Cold start"

If mains power is missing, then there is possibility to start operation of power supply from battery by using push-button **ST** on the front panel (so called cold start). Please hold the push-button button until indication LEDs are lit, what takes ~5s. Battery voltage has to be over the minimum level ~44V.

NOTE: If power supply has been started from mains power and connected battery has voltage below required level, then pressing push-button **ST** to connect battery will give no result.

2.2.2. Selection of battery operation mode

Power supply can operate with battery in two modes:

- floating mode,
- non-continuous battery charging.

Choosing one of these two modes can be done only by external computer by USB link.
Default factory setting is floating mode operation.

a. **Floating operation mode**

When the mains present, the charger of power supply maintains the external battery bank in its fully charged state. Charger's operation is controlled by the microprocessor controller of power supply, which independently supervises the batteries, maintaining on them the floating mode voltage (depending on ambient temperature, if the external temperature sensor has been connected). If the sensor is absent, the controller maintains voltage corresponding to the ambient temperature of 25°C.

b. **Operation mode with non-continuous battery charging**

If the mode with non-continuous battery charging has been selected, then it is activated with mains supply presence, after charging battery fully, and after floating mode operation lasting for 48 hours (48h is default factory setting, which could be changed by installing technician). After fulfilling above conditions battery will be automatically disconnected from the charger, which will maintain the voltage on power supply outputs at the level 0.2V higher than actual battery voltage. Such state lasts for 18 days (default factory setting, which could be changed by installing technician) or to the moment of battery self-discharging to the preset voltage level. In both cases the refillment charging will start. It means that battery is reconnected to the charger and charged at increased voltage, in the same principle as bulk charging. After recharging the battery and operating in floating mode for 48 hours battery will be again disconnected from the charger for 18 days.

If the mains power fails or if during its presence high peak of current on outputs appears, then the battery is reconnected immediately and momentary voltage drop seen on outputs doesn't exceed 1.5V.

Operation with non-continuous battery charging increases lifecycle of batteries, by limiting time of current flow through battery. It lowers positive electrodes corrosion of the cells and loss of water contained in electrolyte.

3. Installation and connection

3.1. Installation, setting the switches, connecting

The power supply has a form of a cassette offering the IP20 ingress protection, designed for installation in a typical 19" rack cabinet, using the four mounting holes located in the front panel (Fig. 1).

The rack dedicated to the Voice Alarm Systems must have IP30 ingress protection.

To install the power supplies in the rack you need to use guide rails. Guide rails supporting the power supply cassette should be installed in such a way as not to cover the ventilation holes located on the both sides of the cassette. The 8 cm ventilation space is required on both sides of the case.

3.2. Setting the switches of battery capacity and battery circuit resistance

At the rear side of power supply, next to mains socket, there is DIP switch, allowing setting of:

- battery capacity **Cap,** which will operate with ZDSO400-ER1.

Setting the slide of the switch should be done according to calculation of capacity by DSO system calculator and taking into account the time of operation during watchdog and total power of all foreseen loudspeakers to be installed. Then for the calculated capacity right type of battery should be chosen, its

capacity (by rounding up the calculated value) and set the slide to capacity nearing or higher then chosen for installation.

- setting up maximum resistance of battery circuit R_i.

Setting the slide of the switch for maximum resistance of battery circuit on highest level depends on total power of all foreseen loudspeaker to be installed. Value of the current during the fire alarm is closely connected to this power, and it decides about the voltage drop in battery circuit. Right setting is shown in Table 4 par. 4.3

The power supply controller adjusts operation parameters to the settings as they are made.
Power supply is designed to operate with batteries VRLA-AGM.

Near switch, under the mains socket, there is short description of particular position's functions. Look of the switch and settings description is shown on fig. 4.

The minimal value of battery capacity Cap is 25Ah, which could be increased using 3 subsequent slides of the switch 1, 2, and 3. Resulting capacity is a sum of 25Ah and values corresponding to every slide, being in position ON (lifted up). Thus maximum possible capacity value is 200Ah.

The minimal value of resistance Ri is 30mΩ, which by 3 subsequent slides 4,5, and 6 could be increased. Resulting resistance is a sum of 30mΩ and values corresponding to every slide, being in position ON (lifted up). Thus maximum possible resistance value is 100mΩ.

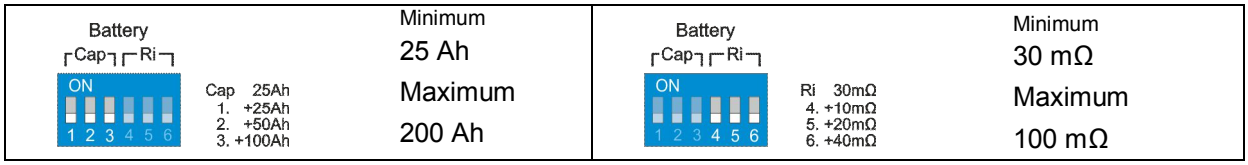


Fig. 4 Look of the DIP switch for selection of capacity and battery circuit resistance with settings description

3.3. Connection

Below table shows the types of connectors used in power supply with their maximum ratings and wire diameters.

Table 3. List of ZDSO400-ER1 connectors

Output	Type of plug used	Model	
		1	2
Mains power **230Vac 50Hz/60Hz**	IEC C13	1 pc.	1 pc.
Outputs **Out** to supply the amplifiers	PC 5/2-STLC-7.62 6mm^2 41A with lock	6 pcs.	4 pcs.
Outputs **Aux** to supply auxiliary modules	MC 1.5/2-ST-3.81 1.5mm^2 8A	6 pcs.	2 pcs.
Temperature sensor input **Temp sensor**	MC 1.5/2-ST-3.81 1.5mm^2 8A	1 pcs.	1 pcs.
Outputs of relay signalling **Bat fault**, **Gen fault** and **Mains fault**	FMC 1.5/3-ST-3.81 1.5mm^2	3 pcs.	3 pcs.
Input of external fault signal **Ext fault**	MC 1.5/2-ST-3.81 1.5mm^2	1 pcs.	1 pcs.
Battery 48V	Two-pole bolt terminal threaded M8 50mm^2 100A	1 pcs.	1 pcs.

3.3.1 Connecting the power supply to the mains

Connecting the power supply to the mains should be implemented by using a 3-wire cable of the 1.5 mm^2 cross-section, equipped with the IEC plug C13 type (to connect at ZDSO side).

NOTES:

1. **The power supply is not equipped with its own mains switch, thus it is necessary to use an external switch e.g. S301 C10A type, to connect it to the mains.**
2. **The required electric installation should be a permanent type and equipped with a surge protection system.**

3.3.2 Connecting the battery and protection of battery circuit

ATTENTION, safety concern:

1. **Because power supply is not equipped with the fuse in the battery circuit, it is required to install such fuse close to positive battery pole. It is allowed to put the fuse in a link between two batteries.**
2. **Reversed connection of battery terminals versus markings on back panel terminals may cause serious damages to both power supply and connected external devices**
3. **Batteries before installation should be pre-charged**

Connection of a battery should be done by cables to terminals on a rear panel marked **BAT 48V**, paying close attention to their polarity.

Connections should have minimum length. The leads connecting battery and power supply should be close together (in parallel). To have the minimum resistance of the leads care should be taken to tight the screws well.

Referring to par 1.5 one need to assume, that maximum drop on these connections should not exceed 0.6V. Assuming this, one need to secure, that their total length does not exceed 2 metres, and cross section of cables should be chosen taking into account the power of installed loudspeakers. Cross sections are shown in table 4 below.

Table 4

Power of loudspeakers [W]	Suggested cross section of cables	Total resistance of cables and battery fuse [mΩ]
≤1500	10mm^2 [1.8mΩ/1m]	≤12 mΩ
1500 < P_L ≤ 3000	16mm2 [1.1mΩ/1m]	≤ 8 mΩ

3.3.3 Connecting the amplifiers of VAS system

The ZDSO400-ER1 power supply is equipped with 6 high power outputs **Out** to connect amplifiers, with 2 models possible:

- **Model 1**
  It has 6 connectors, allowing connection of amplifiers with power 500W each.
- **Model 2**
  It has 4 connectors, allowing connection of amplifiers with power 500W each.

Connections of all amplifiers have to be done by cables with such cross section, that voltage drop on them made by current flow during fire alarm will not exceed 0.2V.

Therefore connections of all amplifiers have to be done by cables with cross section 4mm^2.

If main amplifier has in DSO system its backup amplifier, then is possible to connect both amplifiers to the same output (if there is no free output left). This connection need to be done outside the power supply.

3.3.4 Connecting the other components of VAS system

Components of VAS system, which need continuous power, have to be connected to output **Aux.** They are organized in pairs, protected by common fuses (**Aux 1** with **Aux 2** and **Aux 3** with **Aux 4)**. Two extra outputs **Aux 5** and **Aux 6** are equipped with own independent fuses. **Most important components of VAS system (e.g. controller) should be connected to these independent outputs**!

3.3.5 Connecting the external fault signal

Power supply has one input to connect signaling of external fault, which socket is located on a rear panel. Fitting plug is supplied with accessories. It has factory installed jumper and serves to be put in the input **Ext fault,** when it is not used, because the input is activated by open circuit between its contacts.

3.2.6 Leading out the remote signalling

Outputs of remote relay signalling of ZDSO400-ER1 are 3-pin independent sockets. The power supply unit is supplied with 3-pin plugs. By proper cabling connection the normally connected (NC) or normally open (NO) contacts of the internal relays can be used.

3.3.7 Connecting the temperature sensor

External temperature probe, supplied with accessories, should be connected to right socket (**Temp sensor**). The sensor should be placed **between the walls of two adjacent batteries, in contact with walls!**

4. First Start

4.1. The initial information

The first start of the VAS system including the ZDSO400-ER1 and connected battery should be done by qualified service personnel of the Manufacturer or the properly trained authorized personnel.

The tests during the first start of the system are necessary to ensure safe and reliable operation – both from the mains and battery backup power.

At the first start, you should check the system completeness and all VAS modules for their compliance with the electrical specifications of the object in which the system is to operate. The checking should also include the correctness of connections as well as the connected battery and the signaling circuits.

ATTENTION:

If any of amplifiers, when equipment is already powered on and is connected to the battery, starts sourcing current from output **Out,** as a result of internal fault or disconnection of its individual mains power, then such state can lead to uncontrolled discharging of battery even though power supply is operating properly.

4.2. Start-up sequence

Suggested sequence of switching on devices in the VAS system is like follows:

1. All devices should be switched off (all AMPs and ZDSO400-ER1)
2. Set up battery capacity on a rear panel according to paragraph. 3.2 and table 5 in par. 4.3.
3. Set up battery circuit resistance on a rear panel according to par. 3.2 and table 5 in par. 4.3.
4. Connect 24V battery to the unit, after checking if their polarity is right
5. Put in the fuse insert into a fuse holder
6. Switch on the mains power (230Vac) of all AMPs and ZDSO400-ER1 power supply
7. Test the battery circuit resistance according to par. 4.3
8. Check the operation and signaling with disconnected mains power in accordance with par. 4.4
9. Check the operation and signaling with battery disconnected in accordance with par. 4.5.

4.3. Tests of battery circuit resistance during start up

Limitation of the maximum battery circuit resistance is caused by securing on the outputs of power supply voltage value enough to proper operation of VAS system during fire alarm coming when in battery operation mode.

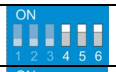
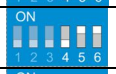
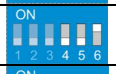
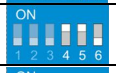
Maximum possible value is 100mΩ, however for loudspeakers power higher than 500W [column 1] the setting of the limit for battery circuit resistance should be lower (see Table 5.)

In practice battery circuit should have lower resistance than the set maximum value, and the margin to the limit has to take into account increase of resistance due to battery aging.

In the Table 5 below [in column4] there are shown resistance values for battery circuits as function of maximum total VAS system power, corresponding to total power of all loudspeaker foreseen for installation [column 1].

For selection of the maximum resistance (its setting out) one need to use Table 5.

Table 5

Loudspeaker power [W]	Expected battery circuit resistance value *1) [mΩ]	Setting of maximum battery circuit resistance Ri [mΩ]		Resistance margin *2) [mΩ]
1	2	3		4
500	≤ 40	80		40
1000	≤ 36	70		34
1500	≤ 28	60		32
2000	≤ 22	50		28
2500 3000	≤ 18 ≤ 18	40 40		22 22

Explanation for the Table 5
*1) Battery circuit resistance value, which was measured by ZDSO400-ER1 power supply. It periodically takes this measurement. It exists possibility to initiate the battery circuit resistance test by pressing and holding ST push-button on a front panel for about 10s. Carrying such test is possible only for pre-charged batteries. Viewing the value of battery circuit resistance is possible by use PC application via USB connector with a software application supplied by manufacturer.
*2) Resistance margin [5] is the difference between the setting of maximum resistance [4] (over this level fault signal is generated) and expected battery circuit resistance value [3]. Resistance margin shown in the table is equal approximately to nominal resistance of batteries with capacity sufficient for system with power presented in column [1].

4.4. Checking the ability of maintaining output voltage after mains power disconnection

Please, disconnect the mains power. The power supply should start operating in the battery mode, supplying voltage to its all outputs for powering the VAS modules. Check the voltage presence and value by a voltmeter.

In this state, the **Mains** LED on the front panel of the ZDSO400-ER1 should go dark and the **Fault** and **Battery** LEDs should be lit.
The both relays of **Mains fault** and **Gen fault** should enter the idle mode (the position of contacts should follow the picture near the connector). The state of the relays can be checked by an ohmmeter.
The connected VAS modules should function normally during the checking.

4.5. Checking the operation when battery is disconnected

When ZDSO400-ER1 is powered from the mains, please break the battery circuit. This event should be detected during nearest test, what can take up to 100s.

Disconnected battery state should be noticed by ZDSO400-ER1 power supply controller, which has to lit **Fault** visual indication and change the state of relays **Bat fault** and **Gen fault** to idle mode (the contacts position following the picture close to the connector).

During the above test, the connected VAS modules should operate normally

5. Operation

5.1. The initial information

Output voltages and signalling thresholds are preset as factory default values. Power supply after installing requires supervision by the service team as some emergency states may occur during the operation of the device.
ATTENTION: In the system with battery backup power source, the power supply should subject periodic checking and tests in line with directions written in instruction manual of this system.

5.2. Operational safety

The power supply unit is a Class I device according to the standard EN 60950-1:2006+A1:2009 (IEC950), designed for connecting to a permanent, one-phase installation using an earthing cable, according to the standard HD 60364-4-41:2007: *Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock*

The metal case of the power supply unit is connected to a guard terminal (PE). The circuits used for connecting the battery, remote signalling and power outputs are separated from the power supply circuits and from the case.

The EMI filters used in the power supply are equipped with the Y2 class capacitors causing the appearance of the leakage current in the guard wire of maximum 1.5 mA.
NOTES:

1. Relay contacts for remote signaling are fully separated (galvanically isolated) from all other circuits (including the output circuits).
2. Input of external fault signal is referred to the potential of negative pole of the battery bank.

5.3. Digital communication

The front panel of the emergency power supply unit is equipped with a **USB** communication socket used routinely for servicing. The PC software allows performing diagnostic works, making possible checking numerous operation parameters of the power supply and modifying its default settings. This output is galvanically insulated from all other circuits of the emergency power supply unit.

Optionally, the emergency power supply may be equipped with an Ethernet interface, enabling operation within a TCP/IP network. Server with ModbusTCP protocol enables device control and supervision.
Detailed information can be obtained from the manufacturer.

5.4. Signalling of the operation state

The emergency power supply is equipped with LED indication and remote signalling. The LED indication is used for bringing attention of the personnel to the operation state of the device and to inform about the reason of a potential malfunction.

Fault indication is maintained as active until fault condition disappears (root cause of fault condition is removed or disappears).

Visual fault indication consists of four LEDs placed on the front panel of power supply. Three of them are indicating current operation mode (**Mains** – green, **Battery** – yellow, **Charging** – green) and fourth is indicating fault (**Fault** – yellow).

The remote signalling includes three sockets marked **Mains fault**, **Bat fault** and **Gen fault**. Each of the sockets has three pins, switchable by relays, electrically separated from all other circuits. During normal operation of the emergency power supply unit, relays are in ON state. It means that indication of Mains Fault (power failure), Battery Fault and General Fault are executed by **switching off** the corresponding relay.

The contacts position in this state (so called zero-voltage state) is shown next to connector of **Mains fault** relay.

List of states of the LED indication and remote signalling is presented in the tables below.

Note:
By a term “rectifier” is understood the power supply equipment with charger functionality

Table 6. LED indication on a front panel.

DESCRIPTION	COLOUR	STATE	EVENT DESCRIPTION
Mains	green	lit	Normal operation state when the mains power present.
		dark	No mains power or rectifier fault.
Battery	yellow	lit	Battery operation (no mains or rectifier fault).
		dark	Normal operation state when the mains present.
Charging	green	blinking	Bulk or refillment charging
		lit	Charging during floating mode
		dark	Charging is finished.
Fault	yellow	lit	Fault occurred within the power supply or external fault.
		blinking	External fault signal active at **Ext fault** input. *).
		dark	Normal operation state at mains power present – no fault signals

*) *If together with the external fault signal active any internal fault occurs, the **Fault** LED will be lit continuously*

Table 7. LED indication on the rear panel.

DESCRIPTION	COLOUR	STATE	EVENT DESCRIPTION
From **Out 1** to **Out 6**	yellow	lit	Particular output fuse blown out.
		dark	Output is powered.
From **Aux 1** to **Aux 6**	yellow	lit	Auxiliary output fuse blown out.
		dark	Output is powered.
Ext fault	yellow	lit	External fault signal terminals open (fault)
		dark	External fault signal terminals shorted (normal operation)

Table 8. Relay remote signalling

DESCRIPTION	STATE	EVENT DESCRIPTION
Mains fault	on	Normal operation state at the mains present.
	off	No mains power or rectifier fault.
Bat fault	on	Correct battery condition.
	off	Battery disconnected, high resistance of battery circuit or battery voltage below a preset level (battery discharged).
Gen fault	on	No fault.
	off	Fault inside the power supply or external fault *)

*) *there are also signalled: blown fuses status on **Out** and **Aux** outputs and external fault incoming on input* **Ext fault**

5.5. Erasing alarms

In the ZDSO400-DR1 power supply push-button ST may be used (by short pressing) to erase two possible internal errors.

- failure of voltage regulation circuit in the charger,
- checksum error in EPROM memory.

Other functions of ST push-button were described in par. 2.2.1 and 4.4

5.6. Maintenance

The device does not require any specific maintenance operations to be performed. Please take care to maintain clean and tidy area around the emergency power supply during normal operation.

6. Servicing

6.1. Fuses

Fuses are accessible for the service team easily and their parameters are specified below in table 9. Fuse holders are located on rear panel.

Table 9.

Protected circuit in the power supply	Fuse type, value and description
Outputs for amplifiers	15A (flat, car style)
Auxiliary outputs 48V	2A (flat, car style)

The VAS system personnel can only exchange the fuses mentioned above. If other fuses used inside the power supply are broken, a repair performed by qualified service personnel is required.

6.2. Diagnosing faults and troubleshooting

Most cases of malfunctions which can occur during device operation are indicated and handled by the microprocessor installed in the device. The ZDSO400-ER1 is equipped with 12 fuses for model 1 and 10 fuses for model 2. They can be replaced by qualified service personnel. These are fuses of output circuits – for powering the amplifiers, VAS controller / routers *or the smoke and heat control system devices.* Damage of output fuses may happen due to short circuit on the output or significant overload. The fuses of outputs mentioned in Table 8 are accessible on the rear panel of the power supply.

Warranty and after-warranty repairs should be performed by service of the manufacturer or by an authorised service partner of the manufacturer.

6.3. List of of indicated errors

Table 10. Power supply faults indication by LED **Fault** on a front panel.

Description
No battery or connected battery voltage is too low.
Output voltage outside the limit set when mains power is present.
Output fuse faulty on **Out** or **Aux** outputs.
External fault (open circuit on the **Ext fault** input) – LED blinking
Faulty rectifier or mains power failure
Missing or faulty temperature sensor
High battery resistance

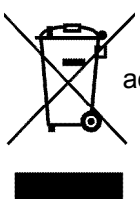
7. Additional information

7.1. Remarks of the manufacturer

The manufacturer reserves the right to introduce design and technology changes to the product, without diminishing its quality.

7.2. Handling the packaging materials and used products

Product packaging is made of non-hazardous materials (wood, paper, cardboard, plastics), which can be recycled. Packages which are no longer needed should be passed on to a waste collection station, after they had been sorted.



The used product is a non-hazardous waste which should not be disposed of in the general waste bin, but it has to be transferred to the local waste collection/recycling station accepting electric and electronic equipment.

Proper handling of used electric equipment contributes to avoiding harmful influences on people and environment resulting from improper warehouse storage and processing of such equipment.