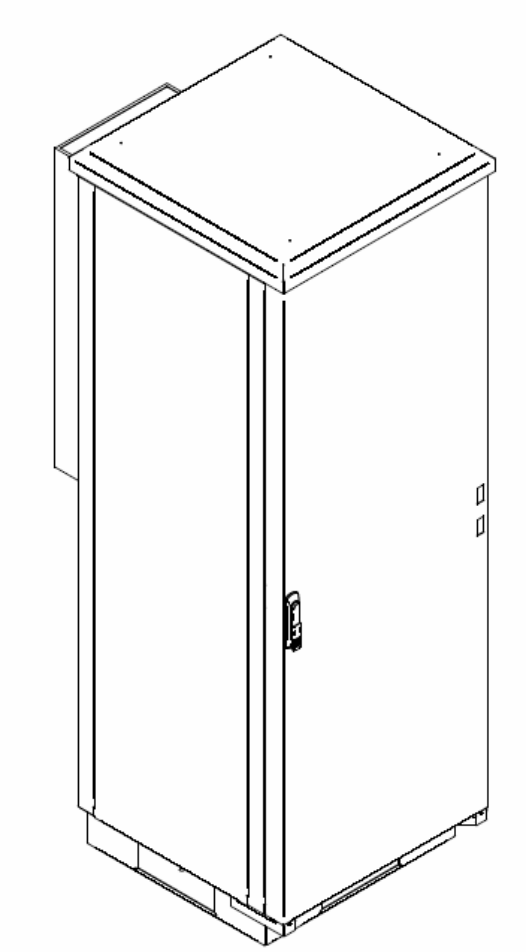
DELTA Energy Systems

ODPS 2000B-48-4 MPS

Outdoor Power Supply System

User manual



02_index_D_Motorola.doc
Issue 29 October 2007

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1 DOCUMENT INFORMATION

1.1 Version control

Document number	Document description	
02_index_D_Motorola.doc	ODPS 2000B-48-4 MPS User Manual	
Previous version	**Description of changes**	
	New document.	
	Controlled by	**Date**
	Andrzej Chaberek	29.10.2007

Approved by	Date

1.2 System

The outdoor power system ODPS 2000B-48-4 MPS is a modular medium power system for power up to 8 kW. The system contains one rectifier shelf for up to 4 FR 48V–2000W–E modules and a distribution unit with configurable elements for AC, DC distribution, LVD and a power system controller. All are installed in outdoor cabinet OM series together with three battery strings and user equipment. The stable construction is based on a double-walled metal (aluminum) design, which provides the robustness for outdoor applications as well as the important protection against sun exposure. It offers an optimum, economical solution for the thermal management with air conditioner unit. A large number of different options provide solutions for global applications in different environments.The modular design allows flexible power system solutions and is the key factor of the success of this power system and it offers a cost effective and reliable solution.

The typical applications for this power system are wireless base stations, core network components, telecommunications and data networks. This compact, high power density power system is the perfect choice for space-critical solutions.

1.3 User Manual

Please read first carefully the safety instructions before installing and commissioning the system. The product description sections contain information and operating instructions for the rectifiers and power system controller. In the installation and commissioning section there are step-by-step instructions for safe and correct installation and commissioning of the system. The maintenance section contains information for maintaining the high performance and reliability of the system. In case of a fault in the system, please refer first to the troubleshooting section of this user manual.

1.4 Contact Information

For additional information or questions please contact your local Delta Energy Systems representative. For the contact information of our locations please check our website at www.deltaenergysystems.com.

DELTA *Energy Systems*

Safety Instructions
Power Supply Systems

20001_03
Issue 2 February 2004

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1 DOCUMENT INFORMATION

1.1 Version control

Document number	**Document description**
20001_03	Safety Instructions for Power Supply Systems
Previous version	**Description of changes**
20001_02	Applicable standards updated. Amendments to the content.

Controlled by	**Date**
	02.02.2004

Markku Havukainen

Approved by	**Date**
	02.02.2004

Petteri Turkki

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2 SAFETY INSTRUCTIONS

Warning! *Please read the following instructions carefully. Ignoring these instructions may result in a loss of life or a health hazard for users working with the equipment and/or in damage to the equipment itself. These safety instructions are an extension of any national laws governing health and safety at work and the applicable EN, DIN, SEV, VDE and IEC standards and any regulations of the statutory authorities. The manufacturer cannot be held responsible for any danger or damage resulting from incorrect operation or usage of the equipment, failure to observe the instructions in the user's documentation and/or failure to observe the safety instructions.*

2.1 General instructions

- Operation of and work on the equipment or parts thereof may only be performed by professional persons (qualified technicians) with appropriate experience who have been specially trained by the manufacturer/distributor (= authorised persons).
- The weight of the components (specified on the front of the unit) requires that physically able-bodied persons be employed for installing / assembling the equipment or parts thereof.
- If work on the equipment or parts thereof is necessary with the equipment under present voltage, another qualified technicians or a supervisor must be present in addition to the electrician performing the work. The supervisor should be capable of providing first aid in case of electrical hazard. Providing the electrician with an emergency switch or disconnection strap, so-called "dead man's switch", is not sufficient protection.
- Work on the equipment may only be carried out using insulated tools and appropriate protective clothing (shoes, gloves, safety spectacles, etc.).
- There is an increased risk of an accident and electrical hazard when working on compact equipment (different components mounted in a single cabinet, e.g. rectifier/inverter modules, DC distribution and battery connection), due to the close proximity of the various different components. Work should therefore be carried out with an extra attention to safety, and appropriate insulating covers over the live electrical parts must be provided for protection against accidental contact.
- If the power supply equipment is not fitted with a disconnecting switch or equivalent device unit, for isolating it from the AC mains or any other hazardous voltage source, the operator of the power supply equipment is responsible for fitting the mains distribution board, battery system or other supplying equipment with appropriate disconnection switch conforming to the relevant regulations.

- The input filters of the rectifier/inverter modules are not protected with input fuses. The operator is responsible for ensuring adequate protection for the equipment and wiring by means of an input fuse, if any rectifier/inverter module is used external to equipment supplied by the manufacturer/distributor and if the manufacturer/distributor is not allowed install fusing or a main distribution board.
- Removing or inserting components from or into the equipment may result in changes to the performance of the equipment. The operator is therefore responsible for the consequences of any change in the hardware configuration that are made without an agreement with the manufacturer or his local representative.
- The operator of the equipment is responsible for ensuring that personnel concerned with the equipment (authorised persons) are provided with safety training when the equipment is installed or when starting their employment and at regular 6-monthly intervals thereafter.
- The operator of the equipment is responsible for ensuring that the rooms in which the equipment and batteries are set up are treated as electrical equipment rooms, which are only accessible to qualified personnel (authorised persons).
- The operator of the equipment is responsible for ensuring that the equipment is installed in suitable rooms, if necessary with air-conditioning. If forced cooling (fan ventilation) is used, there must be adequate airflow in the room, as well as heating/cooling.
- The units or individual parts of the equipment may only be opened by qualified employees (authorised persons) of the equipment operator, who have attended a special repair training course held by the manufacturer or his local representative.
- The operator of the equipment is responsible for ensuring that the rectifier/ inverter / distributor rack is securely locked and not accessible to unauthorised persons.
- Installation and dismantling of the equipment or parts thereof, as well as the laying of the connection cables may only be carried out by persons trained by the manufacturer/distributor (authorised persons).
- The installation instructions and specifications in this user manual are a part of these safety instructions. The order of installation and the specified limit values must be adhered to in order to guarantee that the equipment is correctly installed and operated.

2.2 Special Instructions

- Localised areas of high temperature (> 70 °C) may occur within the rectifier/inverter/distributor rack. Adequate precautions against accidental burns must be taken.
- Fuses should only be gripped using the tools provided for this purpose (Load-break switch handles, etc.)
- Ensure adequate insulation from ground potential (earth) when working on the equipment or changing fuses.

- The DC bussing of the power system (inverter/rectifier/converter) can be grounded either from positive system bus or a negative system bus, and operator is responsible to ensure and secure the correct polarity of the system while installing, operating and/or maintaining the equipment.
- The power system may have dual energy supply by means of primary and secondary energy sources, and operator is responsible to secure the proper precautions by separating or disconnecting the sources for maintenance or service purposes.
- Dangerous voltages may be present on the power connector or plug pins of the rectifiers/inverters for up to 10 seconds after unplugging the rectifier/inverter modules from the mains or switching off the mains voltage. This also applies to other parts of the equipment. Adequate precautions against electrical accident must be taken.
- Some of the potentiometers for adjusting equipment components are mounted under the unit covers and can only be accessed through the ventilation slots of these components. Take care when making adjustments, and use appropriate tools (e.g. an insulated screwdriver for trimming), otherwise sensitive components may be damaged.
- Only suitable measuring devices (e.g. high-impedance multimeter) may be connected to the voltage and current measurement sockets.
- Incorrect operation of the equipment or parts thereof may alter the operating state of the system, trigger false alarms or discharge the batteries connected to the system. Ensure that the settings conform to the specifications, the system configuration and the limit values that you require.
- Make sure that all voltage values are set correctly. Incorrect voltage settings may lead to an increase in the battery voltage and the consequent damage to batteries or even danger of explosion.
- Ensure that the alarm limit values (trigger thresholds) are set correctly. Incorrect settings may trigger false alarms and cause the rectifier/inverter modules to switch off.
- All temporary manipulations of the equipment or parts thereof that are carried out (e.g. for test purposes) must be reset manually. Automatic reset facilities are not provided.

DELTA Energy Systems

System Description
DC Power Supply Systems

31001_02
Issue 13 August 2003

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1 DOCUMENT INFORMATION

1.1 Version control

Document number	**Document description**
31001_02	DC Power Supply System Description
Previous version	**Description of changes**
31001_01	Layout updated.

Controlled by	**Date**
	13.08.2003

Markku Havukainen

Approved by	**Date**
	13.08.2003

Petteri Turkki

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2 SYSTEM DESCRIPTION

The Delta power systems are designed to efficiently supply uninterruptible DC-voltage to modern telecommunications equipment. The systems are constructed using steel profile based cabinets and switched-mode rectifiers of state-of-the-art and development of Delta Energy Systems. The systems are designed to fulfil the high reliability requirements of telecom environment.

The schematic structure of the power systems is presented in Figure 1. The power system comprises switched-mode rectifiers having one or three phase input line connection, terminals for batteries, low voltage disconnections, load terminals with automatic circuit breakers or HRC fuses as well as a control, monitor and alarm unit for automatic operation of the system.

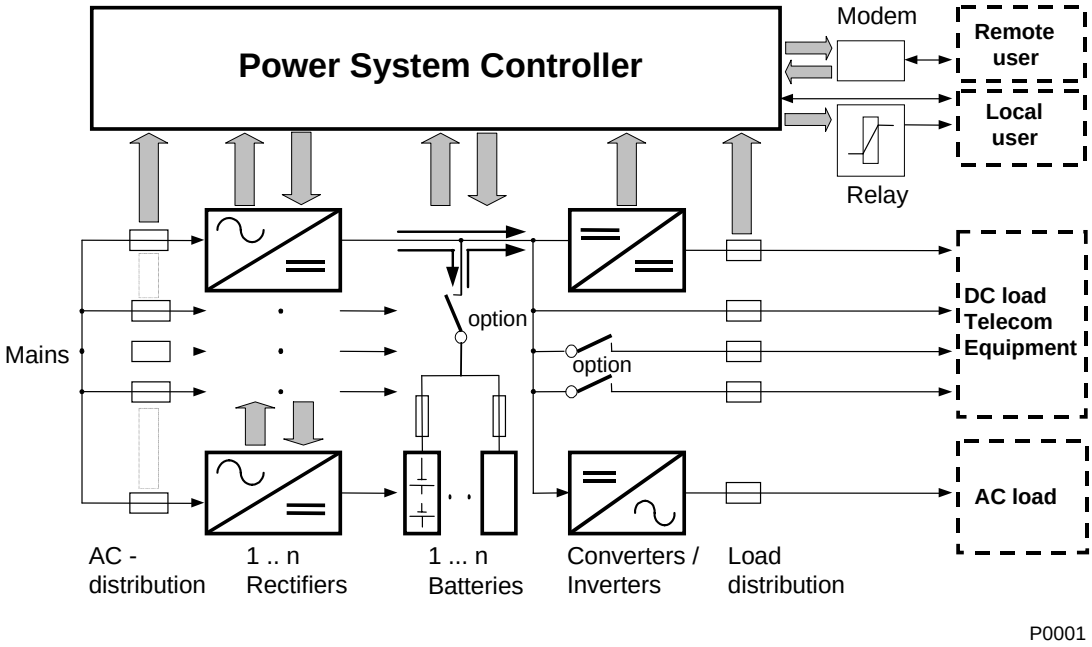

Figure 1. The schematic structure of the Delta power system.

The modularity and extendibility of these power systems makes them ideal for all telecommunications applications, especially for the systems whose initial capacity is far from the final size. The extension can be made in phase with the real need simply by adding new system modules and battery cabinets.

2.1 Operating modes

In normal operation mode the rectifiers deliver the load power taken by the telecom system and simultaneously maintain the batteries at full charge.

During a line power outage or an excessive line-undervoltage, the rectifiers are shut down and the batteries deliver the load power.

If the battery voltage decreases below the preset level, the optional deep discharge prevention circuitry disconnects the battery automatically. As the line power is restored to a proper level, the rectifiers start up automatically and begin to deliver the load power and recharge the batteries at current limiting mode.

The batteries are important components in a telecom power system. The control and monitoring unit is designed to ensure long battery life and effective recharging of the batteries. Automatic boost charge is based on battery current.

The system level control and monitoring functions include local and remote alarms and local controls of the system. The local alarms are shown by alarm LEDs. Remote alarms are issued by means of potential free relay contacts.

The operation of the control and monitoring unit is presented in the product description of the controller.

DELTA *Energy Systems*

Product Description

Rectifier FR 48 V – 2000 W – E

32001_04
Issue 3 February 2004

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1 DOCUMENT INFORMATION

1.1 Version control

Document number	Document description
32001_04	Rectifier FR 48 V - 2000 W – E, Product Description
Previous version	**Description of changes**
32001_03	Front cover updated.

Controlled by	Date
	03.02.2004

Markku Havukainen

Approved by	Date
	03.02.2004

Petteri Turkki

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2 GENERAL

The rectifier FR 48 V - 2000 W - E is a single phase, hot-pluggable and fan-cooled rectifier. The constant output power characteristic supplies the specified power over the full output voltage range. The benefit is an optimized modular system design (fewer modules) and matches the supply requirements for state-of-the-art telecom equipment. This performance as well as the extended temperature range, wide input voltage range, high power density and advanced technology are the key factors of the success of this rectifier and it offers a cost effective and reliable solution.

The typical applications for this rectifier are both in indoor and outdoor environments, which is a perfect solution for wireless base stations, core network components, telecommunications networks and data networks.

The rectifier meets the requirements set by the telecommunications standards.

The rectifier contains two stages of high frequency power converter (Figure 1.):

- The power factor corrector (PFC) has a boost topology with a switching frequency of 90 kHz. It is responsible for the power factor and harmonic content of the input current.
- The DC-DC converter has a phase shifted full bridge topology with a switching frequency of 100 kHz. It is responsible for galvanic isolation and power conversion to the DC output.

The control and interface circuit controls and protects the rectifier during all operation conditions appearing in a power system. The EMC filters guarantee the required standards.

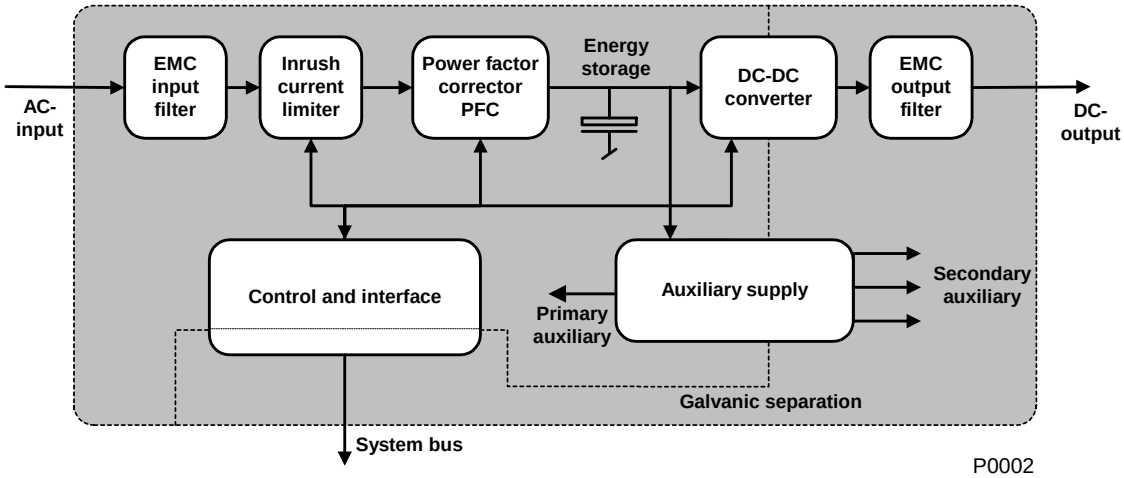


Figure 1. Block Diagram describing the functionality of a rectifier.

2.1 Safety

The rectifier meets the safety standards:

- EN 60 950 (2000-06) - class 1
- UL 60950 rev 3 (Dec1, 2000)
- CAN/CSA-C22.2 No. 60950-00

There are no user serviceable parts except the fan inside the unit. A faulty rectifier module should be replaced as a complete unit. The installation description must be strictly adhered to.

The rectifier contains the following internal protection fuses:

- AC input fuses, F200 / F201, 15A fast, LITTELFUSE INC. P/N 324015
- The protecting AC fuses are connected in L and N.
- DC output fuse, F500, 50A (FK3), PUDENZ (WICKMANN GROUP)
- The protecting DC fuse is connected in – pole.

These fuses are not accessible and should only be replaced in the Delta Energy Systems repair centre.

3 FUNCTIONAL DESCRIPTION

3.1 Input voltage range

If the input voltage exceeds the limits of the input voltage range the rectifier is shut off. The rectifier will restart up automatically as soon as the input voltage returns into the specified input voltage range. At low input voltages, an output power derating is enabled to limit the input current to acceptable values.

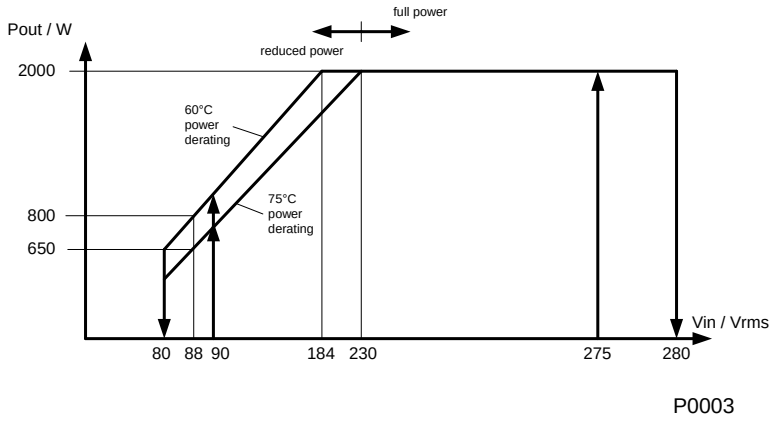


Figure 2. Input voltage range

3.2 Inrush current limitation

When the rectifier is first connected to the mains, the energy storage capacitors are charged via resistors. As soon as a certain voltage limit is reached, these resistors are short-circuited and the rectifier starts up and delivers output power.

3.3 Output characteristic

The rectifier has a constant output power characteristic to meet the demand of optimal use of the power supply to electronic constant power loads. The result is a constant recharging current to the battery after a mains outage, and a better use of rectifier efficiency.

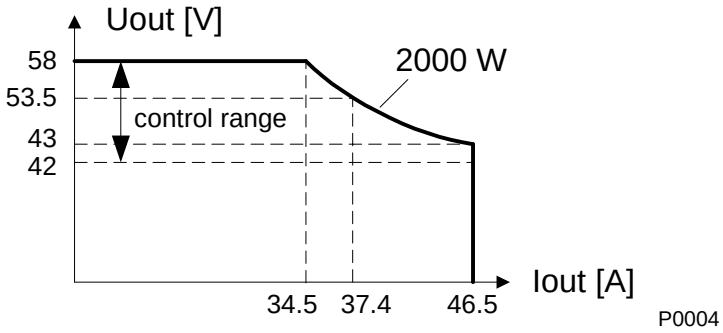


Figure 3. Output characteristic

3.4 Output voltage

The factory setting is defined for flooded battery types: 53.5 V. If a controller with voltage programming function is used, it can remotely adjust the rectifier output voltage to different values via analogue signal interface.

3.5 Output current

The factory setting for the output current limit is 46.5 A_{DC}.

3.6 Cooling

The device is fan cooled.

Note!	*The airflow must not be restricted!*

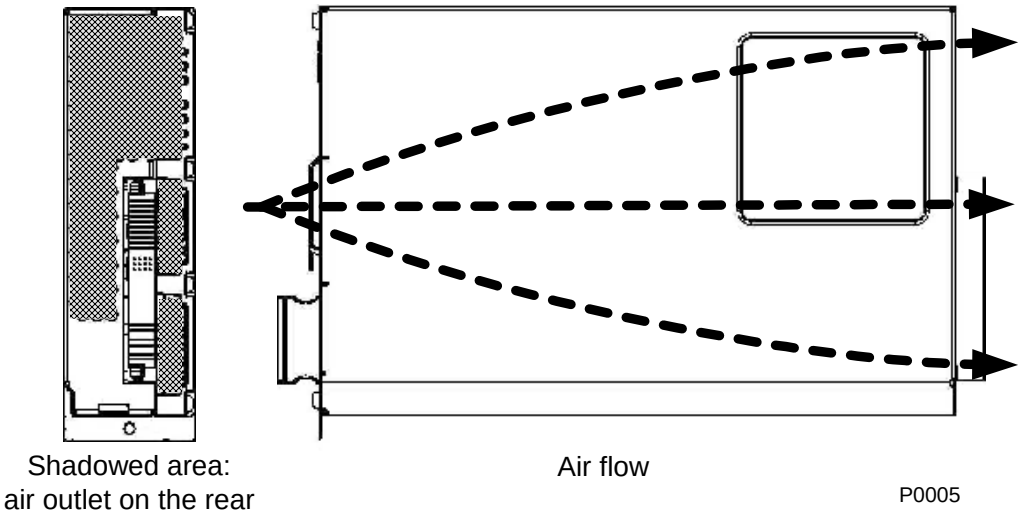


Figure 4. Fan cooling of the rectifier.

3.7 Overvoltage protection OVP

The rectifier is equipped with a selective over voltage protection (OVP), which shuts down the rectifier in case of output voltage exceeding an internally set limit. The protection is combined with a current measuring condition to achieve selectivity between parallel rectifiers; only the «guilty» rectifier will be shut down. The factory setting is 59 V. Reset of OVP shut down can be done by disconnecting the mains supply voltage for a few seconds.

3.8 Thermal management

The rectifier is protected, with two integrated thermal sensors, in case of abnormal environment conditions, interrupted air flow and fan failure (Table 1.).

Sensor	Monitoring	Function
Reference sensor	Combination of heat sink / fresh air temperature	Controls the over-temperature protection (OTP) characteristic.
Protection sensor	Main transformer temperature	Detects interrupted air flow and fan failure.

Table 1. Thermal sensors.

The thermal management (reference sensor) reduces the output current in order to limit internal temperature according the characteristic in Figure 5 below.

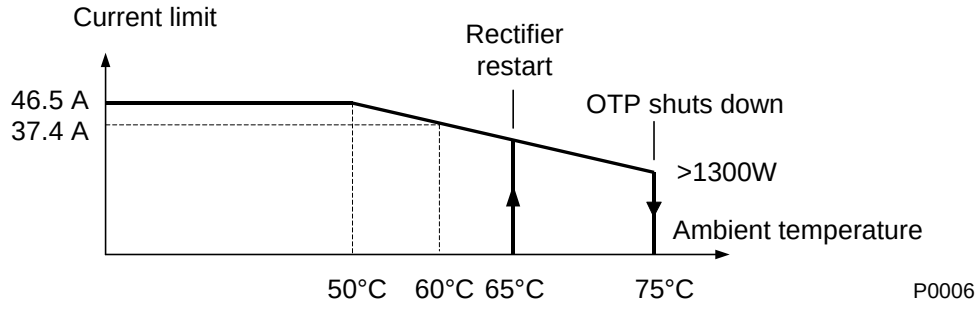


Figure 5. Reducing the output current in order to limit internal temperature.

The thermal management (protection sensor) protects the rectifier against interrupted air flow and fan failure. During these conditions, the rectifier is shut down as soon as the internal temperature reaches a critical value. After several unsuccessful restart attempts the rectifier remains shut down and generates an alarm.

3.9 Load sharing

The rectifier is equipped with an active load sharing function that ensures equal load on parallel rectifiers. The function uses the signal interface bus between rectifiers. This function does not need any other external unit outside rectifiers.

3.10 Rectifier enable

The rectifier is disabled / enabled by external connection:
Disable: Pins D12 – A12 not connected
Enable: Pins D12 – A12 connected

3.11 Precharge

The rectifier module is hot-pluggable. Pushing the rectifier into the cabinet connects leading precharge contacts first to precharge the DC output capacitors. The remaining output power contacts are connected with a delay.

4 FRONT ELEMENTS

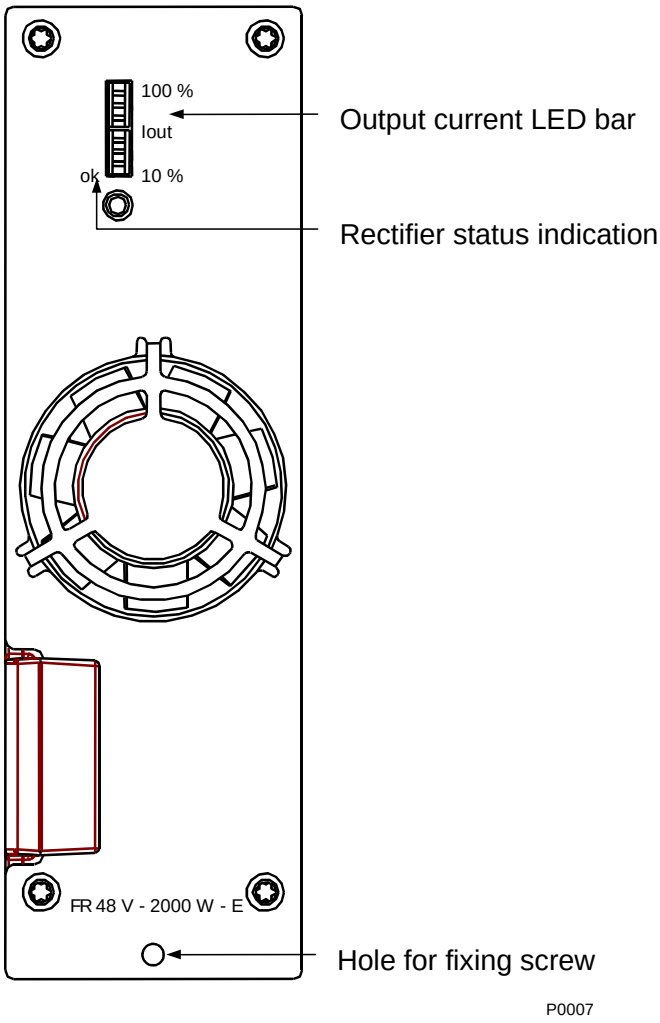


Figure 6. The rectifier from front.

4.1 Rectifier status indications

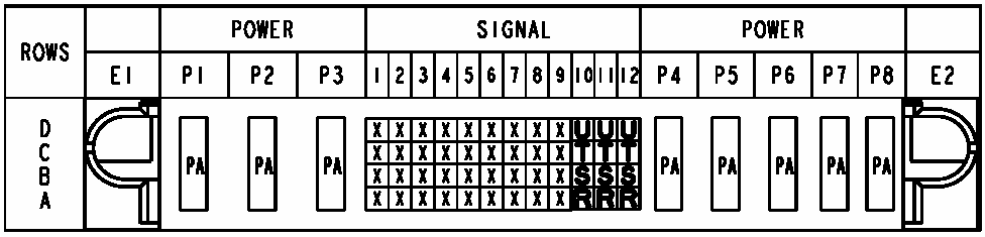
LED «ok» turns off and an alarm is given if:

- Input connection is missing
- Mains voltage is outside the specified range
- OVP / OTP shutdown procedure is activated or a fan failure is detected
  - OVP: The lowest orange LED is short flashing
  - OTP: The middle orange LED is short flashing
  - Fan failure: The top orange LED is short flashing
- Load sharing not working correctly
- The output fuse is blown
- The rectifier is faulty

5 BACK PLANE

5.1 Electrical connections

Combined connector is located on the backside (FCI Power Header R/A 51783-002). The system bus is daisy-chained, with one-to-one connection, from rectifier to rectifier and to the controller (if such is used in the system).



P0008

P1:	PE	AC mains, PE terminal
P2:	L	AC mains, L terminal
P3:	N	AC mains, N terminal
A10:	NC	Reserved for other applications
B10:	VPGM	PSC 1000: output voltage programming
C10:	LS_BUS	Load sharing bus, refer to sec. “3.9 Load sharing”
D10:	GND_SYS	Reference ground for PSC 1000 and load sharing
A11:	NC	
B11:	NC	
C11:	NC	
D11:	RFA	PSC 1000: rectifier failure
A12:	GND_SIG	Reference ground for D12
B12:	NC	Reserved for other applications
C12:	NC	Reserved for other applications
D12:	OFF	Rectifier enable, reference ground A12, refer to sec. “3.10 Rectifier Enable”.
P4:	VOUT-	DC output
P5:	VOUT-	DC output
P6:	OUTP	Precharge for output capacitor, refer to sec. “3.11 Precharge”
P7:	VOUT+	DC output
P8:	VOUT+	DC output

Table 2. Signals on rectifier connector.

Warning! *Operate the device only with connected PE.*

6 MECHANICAL DIMENSIONS

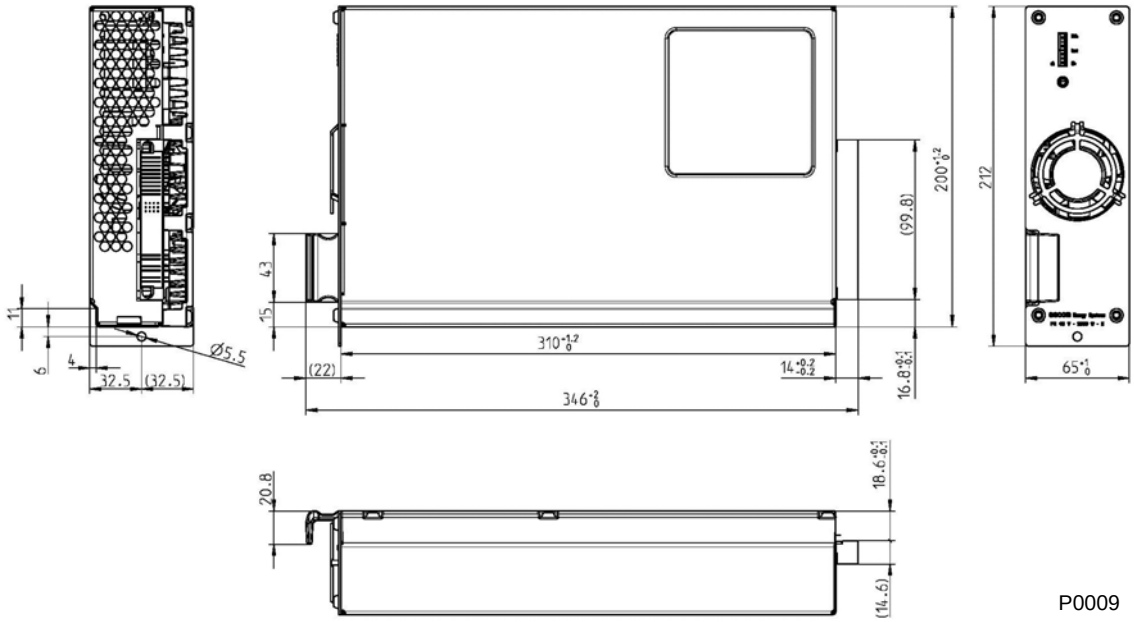


Figure 7. Mechanical design of the rectifier FR 48 V – 2000 W – E.

7 TECHNICAL SPECIFICATIONS

General

Efficiency	≥ 91 %
Losses, max.	200 W
Safety	EN 60 950, class I UL 60 950 CAN / CSA – C22.2
EMI, radiated	EN 55 022, class B
Compliant with	EN 300 386-2
Cooling	Fan cooled
Power density	500 W / l, 8.2 W / in^3

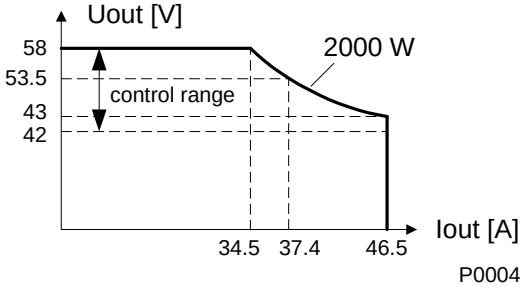
Input

Voltage range	88...276 Vrms
Volt. range, red. power	88...184 Vrms
Inrush current	< 15 Apeak
Current maximum	12 Arms
Line current	Meets IEC 1000-3-2
Harmonic distort. THD	< 5 %
EMI, conducted	EN 55 022, class B
Mains connector	Rear side
Input protection	Internal fuse 2 x 15 A
Input switch	None

Output

Voltage, nominal	53.5 V_{dc}
Voltage adjust range	42...58 V_{dc}
Voltage error, static	± 250 mV_{dc}
Overvoltage protection	59 V ± 1 V
Ripple + spikes	≤ 200 mV_{p-p}
Psophometric noise (weighted)	≤ 1.0 mV_{rms}
EMI, conducted	EN 55 022, class A
Current limit, nominal	46.5 A_{dc}
Limit adjustment range	0...46.5 A_{dc}
Load sharing	< ± 3 A_{dc}
Power limit	2000 W, fixed
Output connector	Rear side
Output protection	Internal fuse 50 A

Output characteristic:



User interface

Output current display	LED bar
Status indication	LED «ok»

Power system controller

PSC 1000	Voltage programming Rectifier fail alarm

Mechanics

Width, overall	65 mm
Depth, overall	346 mm
Height, body	200 mm
Height, front panel	212 mm
Weight	4.4 kg

Environment

Ambient temperature	-25...+ 70 °C
Reduced power	60...+ 70 °C
Relative humidity	95 % max, non cond.

Accessories

Single back plane	P/N: D0100298

Subject to change due to technical progress.

DELTA Energy Systems

Product Description
Controller PSC 1000

34001_03
Issue 17 November 2003

TABLE OF CONTENTS

1 DOCUMENT INFORMATION

1.1 Version control

Document number	Document description
34001_03	Controller PSC 1000, Product Description
Previous version	**Description of changes**
34001_02	Explanation for submenu 8.13 Test factor (Battery test, test factor) added. Explanation for the submenu 1.6 Battery Cap. Amendments to figures P0018 and P0021. Updates to layout.

Controlled by	Date
	17.11.2003

Markku Havukainen

Approved by	Date
	17.11.2003

Mika Pölhö

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2 ABBREVIATIONS AND TERMINOLOGY

UA	Urgent Alarm
NUA	Not Urgent Alarm
MF	Mains Failure
AS	Alarm Stop
RM	Rectifier Module
COBO	Connector board
COBOMO	Connector board for remote access
RFA	Rectifier Fail Alarm
RTC	Real Time Clock, time and date in PSC

2.1 Conventions

menu structure	The menu structure consists of the **main menu,** which contains the **menus**. The menus contain **menu options**. Menus and menu options are numbered. The number 3.3 refers to menu '3.General', menu option '3.Language'.
battery current	battery current positive → current is going into battery (charging).
	battery current negative → current is coming from battery (discharging).
' '	Text and values that appear on display of PSC 1000 are written in single quotes e.g. 'Main Menu'.
" "	Text references within this document are written in double quotes e.g. chapter "Alarms".
→ Configuration	See chapter “7 Configuration/Extended Configuration” for more information.

3 INTRODUCTION

Most of the functions and features are described in chapter "5 PSC 1000 menu structure". The chapter "6 Configuration / Extended Configuration" gives information about how PSC 1000 can be configured before setting in operation.

All the essential parameters can be set by the customer via PSC menu. Most of the menus can be entered by access code only.

Some basic functions of PSC 1000 can be configured via configuration. Depending on Access Rights settings, some of the configuration options may not be accessible by the customer (hardware key needed). The intention of the configuration is, to be able to customize PSC 1000 for the different markets and customers.

3.1 Main functions of PSC 1000

- Display of: system voltage, 2 individual battery voltages, 3 individual system currents and sum of them, 2 individual battery currents and sum of them, calculated entire rectifier current, temperature.
- Alarming of: system voltage deviation, high load current, fuse failure, rectifier failure, mains failure, battery failure, high load power.
- Remote Alarming of: Urgent (Major) Alarm, Not Urgent (Minor) Alarm, Mains Failure Alarm
- Alarm and event protocol
- Temperature compensation of system voltage
- Boost charge after discharge
- Battery test
- Battery equalizing
- External voltage control
- Shunt emulator output of entire load current
- Current alarm and charge state indication
- Battery deep discharge protection
- Alarm stop
- Language switch
- System voltage programming and control
- Customer configurable
- Self test functions
- Separate charging
- Battery charging current limitation
- Remote access (Terminal and MODEM), Report mode

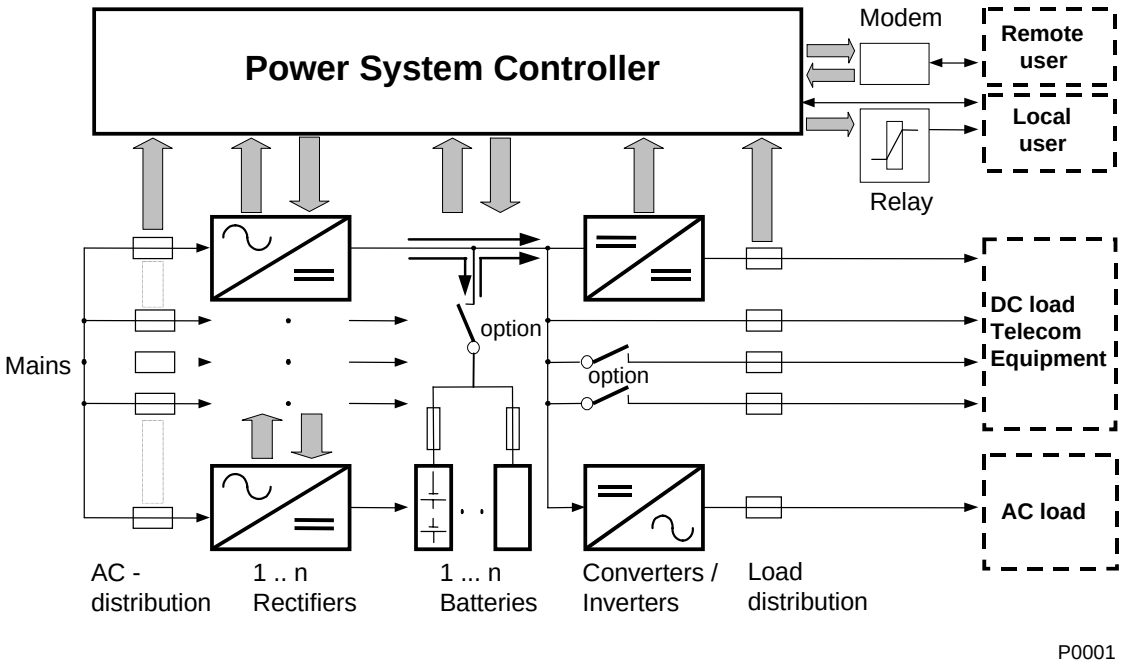


Figure 1. System block diagram.

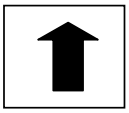
4 OPERATION OF THE PSC 1000

4.1 Operation and the main menu

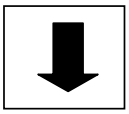
The PSC 1000 is menu-controlled via the keypad and LC display. The controller menu has hierarchical structure. Various sub-menus or functions can be selected for each menu item. The selection is done by using the function keys on the front panel.

Function keys

To exit menu or break input.



Select previous menu item, increment pre-set value.



Select next menu item, decrement pre-set value.

To enter menu, accept value, start function.

Symbols

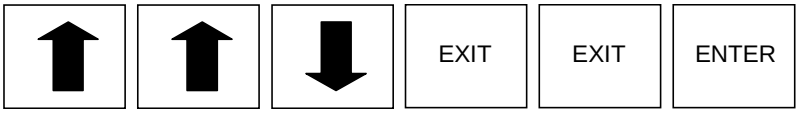
? Function can be started

: ? Parameter can be changed

Menu Code

Menus in which system parameters can be changed are protected against unauthorized access by a code.

The default code is:



4.2 Basic data about the display

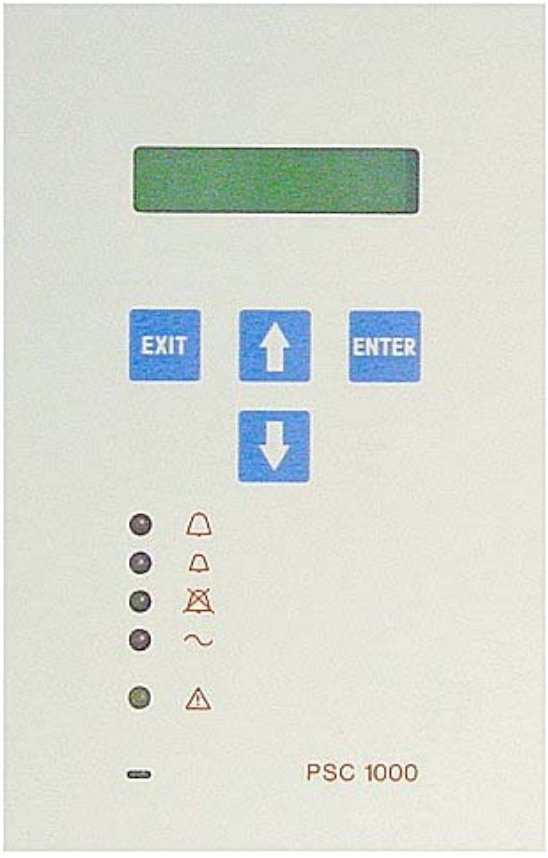
PSC 1000 system display is a liquid crystal display with 2 lines of 16 characters each.

Alarm display

The PSC 1000 front panel includes 4 LEDs for local alarms, 1 for activity indication and 1 for power on/off indication.

- UA – alarm (red LED)
- NUA – alarm (red LED)
- AS – alarm (red LED)
- MF – alarm (red LED)
- Activity indication (boost charge, equalize, battery test or separate charge) (yellow LED).

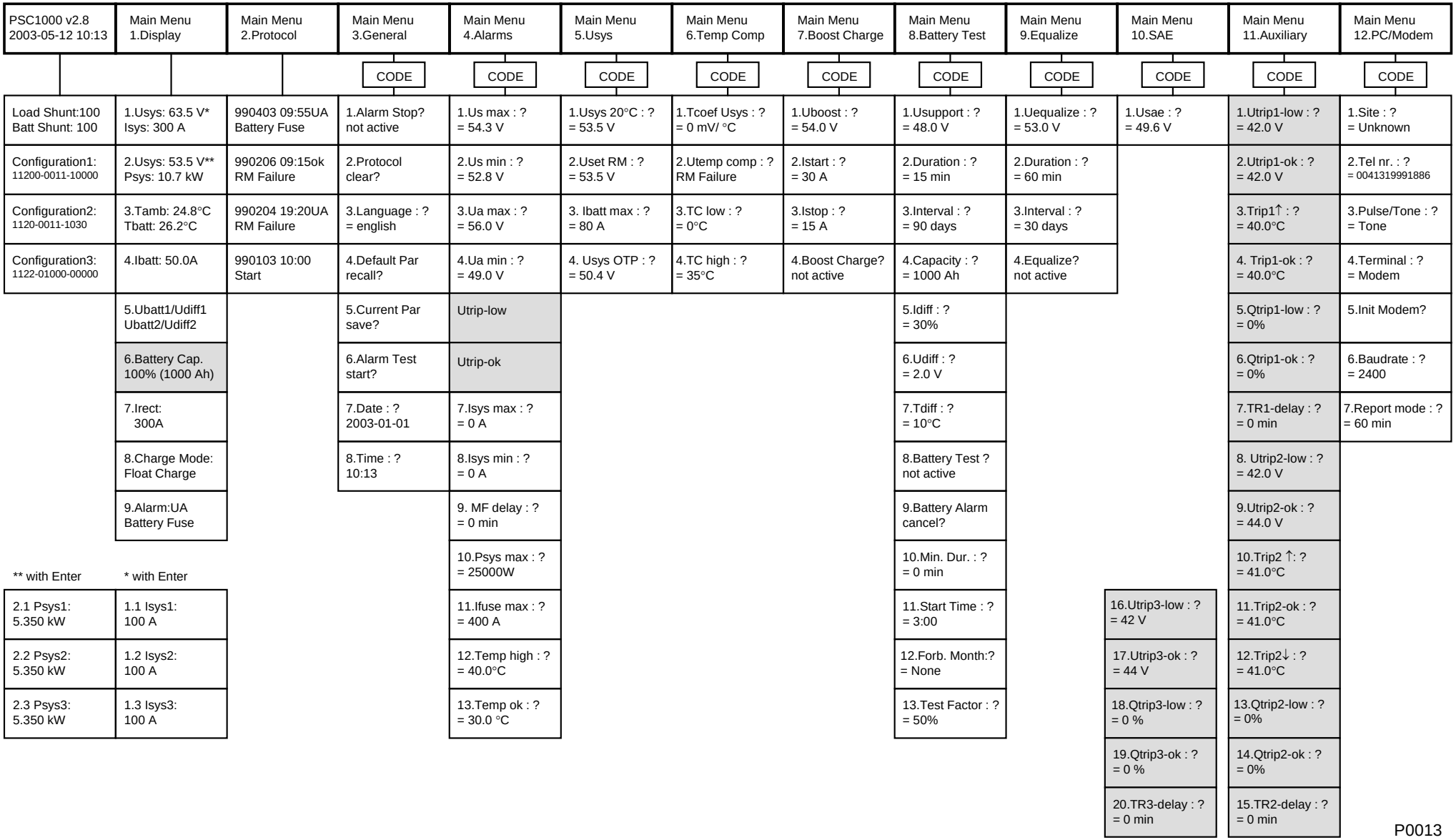
At the bottom of the panel is a green LED indicating that the power is on or off in the PSC.



P0012

Figure 2. PSC 1000 user interface.

5 THE PSC 1000 MENU STRUCTURE



5.1 Main menu structure

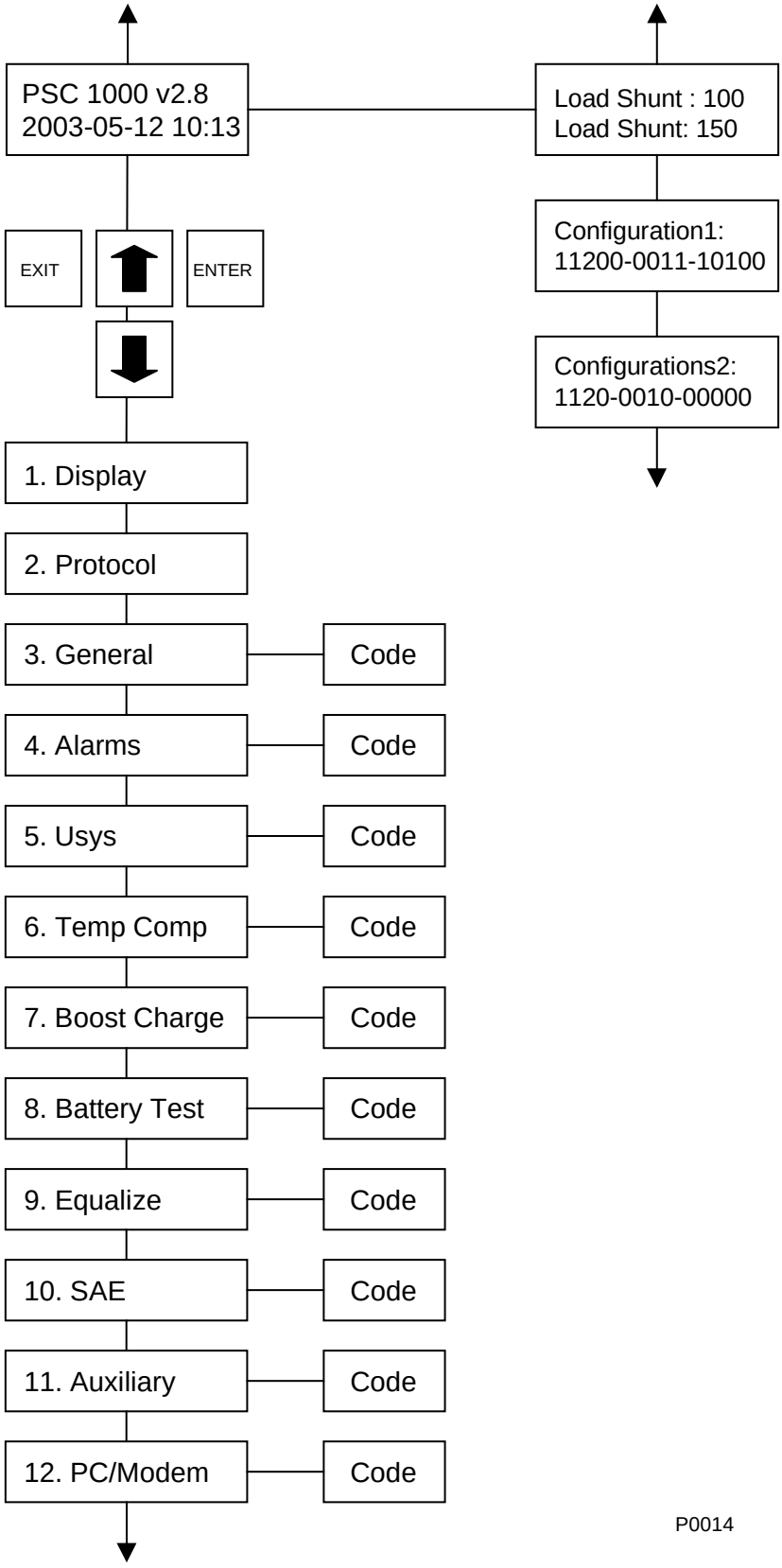
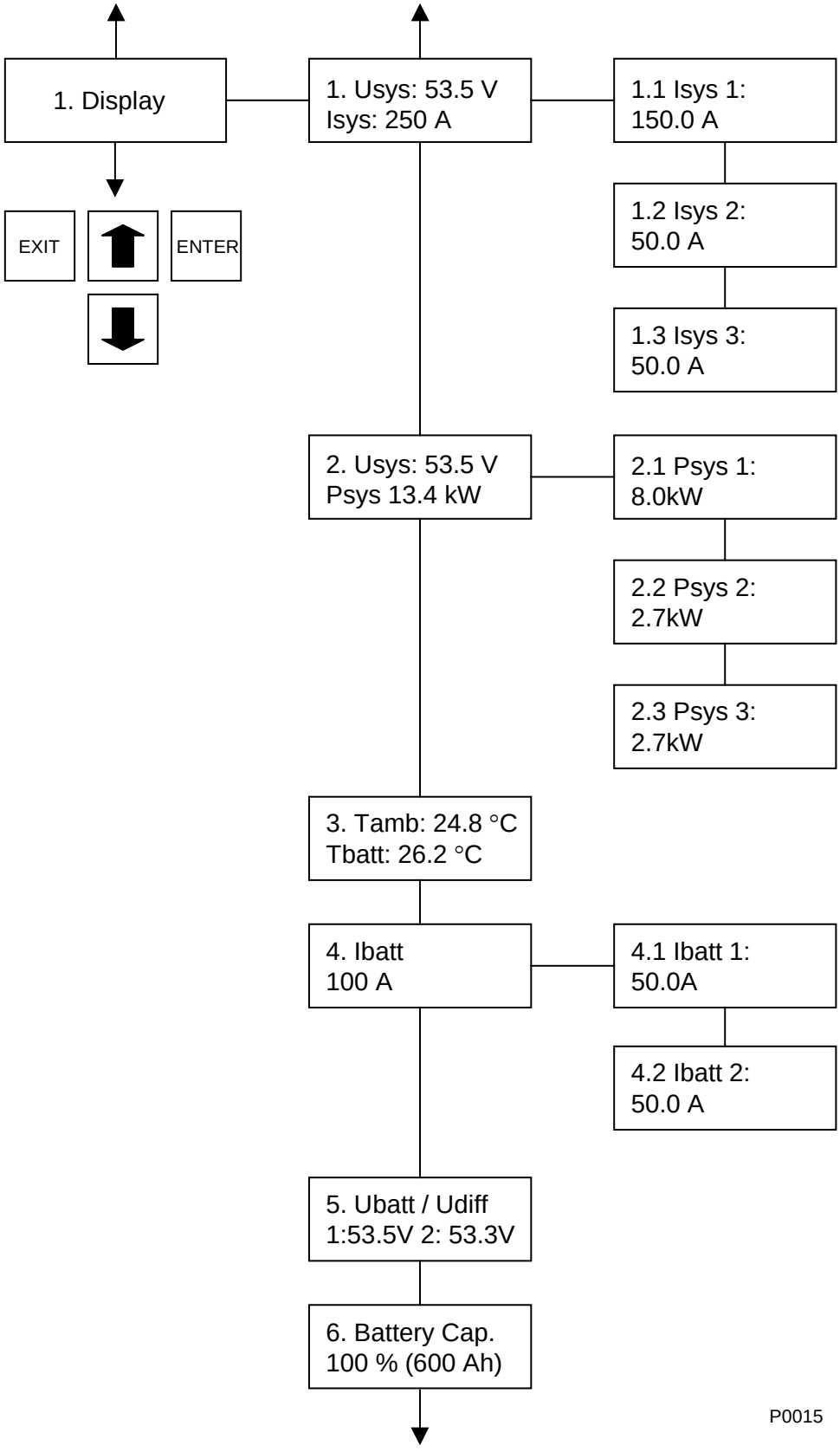


Figure 3. Main menu structure

Press “ENTER” to open the main menu. The main menu consists of the following menus:

Menu name:	**Description:**
1. Display	Displays the current power system information, all measured values and alarms.
2. Protocol	Displays the last 30 system messages.
3. General	Contains general functions for operating the PSC 1000.
4. Alarms	Setting the alarm parameters.
5. Usys	Setting the voltage parameters.
6. Temp Comp	Setting the temperature compensation parameters.
7. Boost charge	Setting the parameters for boost-charging the battery.
8. Battery Test	Setting the parameters for battery test.
9. Equalize	Setting the parameters for periodic battery charging.
10. SAE	Market specific feature. Setting the parameters for using a voltage compensation unit (SAE).
11. Auxiliary	Setting the parameters for disconnecting battery or load due to too low voltage or too high temperature.
12. PC/Modem	Setting the parameters for remote access.
PSC 1000	Program version, time, date, shunt values and configuration codes.

5.2 Display menu



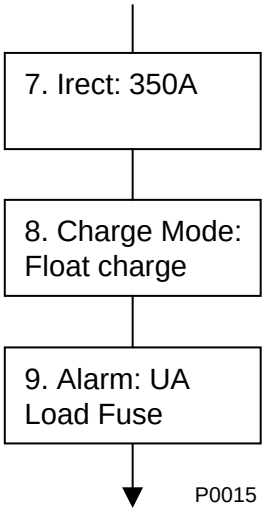


Figure 4. The display menu structure

The display menu contains current power system information such as measured values, alarms etc. 9 analogue system values are measured periodically (every 2 seconds) and displayed in menu option 1.1 through to menu option 1.8:

1.1 Usys and Isys

Usys:	System voltage measured at the load output. If the measurement of the system voltage fails (plausibility test), '***' is displayed.
Isys:	Total load current. Calculated out of 1, 2 or 3 individual load currents (→ Configuration).

1.1.1 Isys 1..3

The currents of up to 3 individual loads can be measured. Press “ENTER” to access this page from point 1.1, if only 1 load group is configured, this menu page does not appear.

1.2 Usys and Psys

Usys:	System voltage measured at the load output. If measurement of system voltage fails (plausibility test), '***' is displayed.
Psys:	Total load power. Calculated out of 1, 2 or 3 individual load currents and system voltage (→ Configuration).

1.2.1 Psys 1..3

The currents of up to 3 individual loads can be measured. Press “ENTER” to access this page from point 2.2, if only 1 load group is configured, this menu page does not appear.

1.3 Temp / Tamb, Tbatt

Temp: Temperature. Displayed only if 'Temp Comp' function is enabled and/or TRIP1 or TRIP2 is temperature controlled (→ Configuration). If 'Temp2' is also configured, the ambient temperature (Temp2) is displayed alternating with the battery temperature (Temp1). If the measurement of a temperature fails (plausibility test), '***' is displayed.

To measure Tamb special hardware is needed (see configuration of RES (TRIP3)).

1.4 Ibatt / Ibatt1, Ibatt2

Ibatt: Total battery current. Calculated out of 1 or 2 individual battery currents. Not displayed if no battery shunt or no battery string is configured (→ Configuration).

Ibatt1: Current of the battery string 1, if configured.

Ibatt2: Current of the battery string 2, if configured.

The value Ibatt is displayed alternating to the values Ibatt1, Ibatt2 if both battery current information are available.

If the battery fuse is blown, no value but '***' is written to display. This is done as - depending on the mounting order of battery fuse and battery shunt - the common mode range of PSC 1000 may be exceeded and an illogical current value would be displayed.

Note!	*The common mode problem may occur at following mounting order: battery - battery shunt - battery fuse – load. No common mode problem would occur with : battery - battery fuse - battery shunt - load.*

The whole page is not displayed if no battery shunt or no battery string is configured (→ Configuration).

1.5 Ubatt1 and Ubatt2/Udiff1 and Udiff2

Voltages at two individual battery strings. The second battery string can be disabled. If so, the second battery voltage is not displayed; according input can be left open.

For inputs that are left open or voltage is smaller than 1 Volt, no value but '----' is written to display.

If middle point measurement is configured (→ Configuration), the display changes in an interval of 2 seconds between 'Ubatt' and 'Udiff'. Udiff is the difference between the first and the second half of the battery string. The whole page is not displayed if no battery string is configured (→ Configuration).

1.6 Battery Cap.

Shows the remaining battery capacity in % format during battery test. The submenu is displayed only during a battery test.

1.7 Irect

The entire current coming from all the rectifiers. The current is not measured but calculated out of the entire load current and the entire battery current. The whole page is not displayed if not configured, or no battery shunt or no battery string is configured (→ Configuration).

1.8 Charge Mode

The currently active charge mode of the battery is displayed. The following charge modes are distinguished: (a = external control enabled (STÖK), b = no external control).

1) Float Charge:
a - System voltage is kept at float charge level (Usys @ 20°C).
b - Temperature compensation is not active or disabled (→ Configuration). System voltage is kept at float charge level (Usys @ 20°C).

2) Temp Comp:
a - System voltage is kept at temp comp level (Utemp comp).
b - Never appears

3) TC Float Charge:
a - Never appears
b - System voltage is kept at temperature compensated float charge level

4) Boost Charge:
a - System voltage is kept at boost charge level (Uboost charge).
b - Boost charge is running.
Additional indication with yellow LED.

5) Battery Test:
a - System voltage is kept at support charge level (Usupport).
b - Battery test is running.
Additional indication with yellow LED.

6) Discharge:
a and b - Battery is being discharged.

7) Equalize:
a - Never appears.
b - Equalize is running.
Additional indication with yellow LED.

8) SepCha / Discha:
a - Never appears.
b - Part of the system is separated to run the separate charge / discharge procedure of the battery. The display changes in an interval of 2 seconds between 'SepCha / Discha' and the currently active charge state of the remaining system. The yellow LED is blinking.

9) SAE-Kennlinie
a - Never appears.
b - SAE-Kennlinie is being requested via digital input. System is kept at SAE-voltage (Usae).

10) Battery charging current limitation

The display changes in an interval of 2 seconds between 'Ibatt limit' and the currently active charge state of the remaining system. The yellow LED is on.

The whole page is not displayed if no battery string is configured (→ Configuration).

1.9 Alarm

Several alarm sources can lead to Urgent or Not Urgent Alarms. This menu option shows a list of the currently active NUA and UA sources. For a list of possible alarms refer to "Protocol". As long as no alarm source is active, '1.8.Alarm' is not displayed. If configured so (→ Configuration), a mains failure (MF) is also displayed on this list.

5.3 Protocol menu

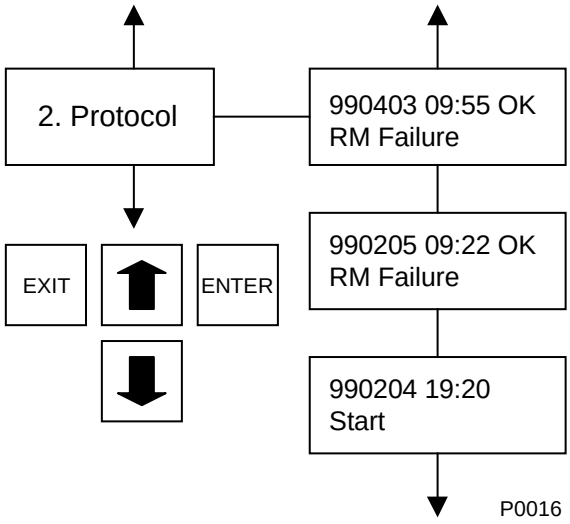


Figure 5. Protocol menu consists a list of events and alarms in the system.

A protocol – a list of system log entries – is maintained and displayed in the menu '2.Protocol'. When an alarm appears or an event occurs in the system, a log entry is made in the protocol with the time of appearance, the alarm source or event and the alarm (NUA, UA, MF). If the alarm status subsequently disappears, a second entry is made in the protocol with the time of disappearance, the alarm source and the key word 'ok '.

The time stamp of each entry shows the date and time when the alarm or event occurred. The real time is based on the PSC system time.

Date is displayed in standard format e.g. 030512 means event occurred the 12. May 2003.

The protocol entries can be cleared manually (only entire protocol) by means of menu option '3.2.Protocol clear?'. However, the 'Start'- entry with the start time remains in the protocol.

The last 30 entries can be stored. They are stored in a volatile RAM and are therefore lost at power down.

The 5 most recent of the last 30 entries are stored in the non-volatile EEPROM. Thus, at a power down and subsequent start up, they are still available and can possibly help to find out what lead to the power down. The time stamps of the 5 messages do only make sense among themselves and do not stand in relation to when the power down occurred. The oldest of the 5 messages always gets the real time stamp.

5.3.1 Alarm sources and alarm types

RM Failure – UA	Rectifier failure according to configured scheme (→ Configuration).
RM Failure – NUA	Rectifier failure according to configured scheme (→ Configuration).
Load Fuse - UA/NUA/No Alarm	One or more load fuses blown. Alarm as configured (→ Configuration).
Battery Fuse - UA/NUA/No Alarm	One or more battery fuses blown. Alarm as configured (→ Configuration).
Usys high/Usys low – UA	System voltage above/below UA level 'Ua max'/'Ua min'. If charge mode is 'Battery Test', UA due to Usys low is suppressed.
Usys high/Usys low – NUA	System voltage above/below NUA level 'Us max'/'Us min'. If charge mode is 'TC Float Charge', NUA levels are temperature compensated. If charge mode is 'Boost Charge', 'Battery Test', 'Temp Comp' or 'Equalize' alarm is suppressed. If mains failure is active, alarm is or is not suppressed, according to chosen configuration (→ Configuration). Alarm is generated only a couple of seconds after level has been passed.
Utrip-low - UA/NUA/no Alarm	System voltage has dropped below 'Utrip-low' level for at least 20 seconds.
Isys high - NUA/UA	System current above 'Isys max'. Alarm as configured (→ Configuration).
Psys high - NUA/UA	System power above 'Psys max'. Alarm as configured (→ Configuration).
Battery Failure - UA/NUA	Battery test recognized battery as faulty. Alarm has to be reset manually. Alarm as configured (→ Configuration).
Battery Failure (U, I, T) - UA/NUA	Battery supervision recognized battery as faulty. Alarm has to be reset manually. Alarm as configured (→ Configuration).
Mains Failure – MF	Mains failure recognized
Mains Failure - UA/NUA	Additional alarm in case of mains failure - if configured so (→ Configuration). Generation of alarm may be delayed (menu option '4.9.MF delay').

Usys Measurement – UA	The measured system voltage is not plausible for at least 25 seconds. Plausible voltage: 10…90 Volt. When a failure in the measurement of the system voltage is recognized, the measured voltage is not considered any more for controlling the system voltage (= feed back loop stopped → open loop control).
Temp Measurement - UA/NUA	The measured battery temperature is not plausible for at least 2 consecutive measurement time slices. Plausible temperature: -20…+90°C. Alarm as configured (→ Configuration). When a failure in the measurement of the battery temperature is recognized, PSC 1000 stops temperature compensation of the system voltage.
Temp 2 Measurement - UA/NUA	The measured ambient temperature is not plausible for at least 25 seconds. Plausible temperature: -20…+90°C. Alarm as configured (→ Configuration). When a failure in the measurement of the ambient temperature is recognized, PSC 1000 stops temperature comparison of the battery supervision.
A/D Failure – UA	Analog/Digital Converter does not work properly. Hardware failure.
Alarm 1 - NUA/UA	Auxiliary alarm input for general purpose.
Alarm 2 - NUA/UA	Auxiliary alarm input for general purpose.
Utrip2-low - UA/NUA/no Alarm	System voltage has dropped below 'Utrip2-low' level for at least 20 seconds.
Utrip3-low - UA/NUA/no Alarm	System voltage has dropped below 'Utrip3-low' level for at least 20 seconds.
Temp TRIP1 - UA/NUA/No Alarm	Temperature has gone above 'Ttrip1-high' level for at least 20 seconds.
Temp TRIP2 - UA/NUA/No Alarm	Depending on configuration, either temperature has gone a) above 'Ttrip2 ↑' OR b) outside temperature band given by 'Ttrip2 ↑' and 'Ttrip ↓', for at least 20 seconds.
System OVP – UA	System over voltage protection procedure switches off the rectifiers (needs additional system hardware). Alarm has to be reset manually.
No Modem – NUA	If MODEM is not available or can not be initialized correctly.

Temp high - UA/NUA/No Alarm	Depending on configuration, either temperature has gone above 'Temp high', for at least 20 seconds.

5.3.2 Events

Boost start	Boost charge started manually or automatically.
Boost stop	Boost charge stopped manually or automatically.
Batt Test start	Battery test started manually or automatically.
Batt Test stop	Battery test stopped manually or automatically.
Batt ok : XX.X V	The battery test is successfully completed. At the end of the test, the voltage had a value of XX.X Volt.
Equalize start	Equalize started manually or automatically.
Equalize stop	Equalize stopped manually or automatically.
SepchDisch start	Separate discharging/charging procedure started.
SepchDisch stop	Separate discharging/charging procedure stopped.
Batt over temp	Temp. compensation configured as 14 = ”User def. + OTP” and upper temperature limit (75°C) reached.
QTRIP1, 2, 3	A specified capacity has been discharged and the Trip relay activated.

5.4 General menu

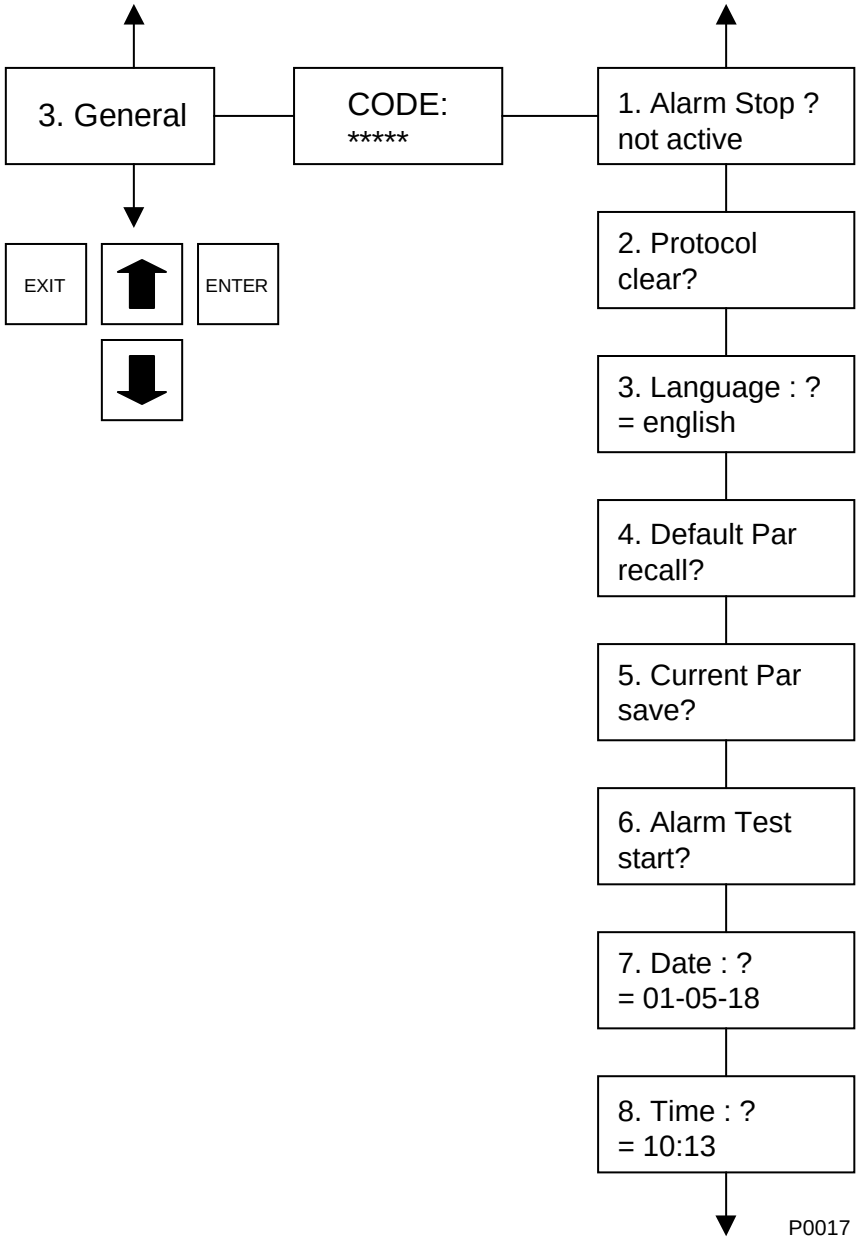


Figure 6. General menu structure.

The general menu contains general functions for operating the PSC 1000 with the following menu options:

3.1.Alarm Stop When activated, some alarms (→ Configuration) are not forwarded via relay outputs to remote alarm panel. However alarms remain indicated on red LEDs on PSC 1000. State of alarm stop (active/not active) is indicated with red Alarm Stop (AS) LED and -if configured so- forwarded via relay output AS.

3.2.Protocol clear Clears all entries in alarm protocol, except 'Start'-entry.

3.3.Language Language selection to choose language of menus.

3.4.Default Par recall

Activates parameters, which are predefined by software.

Note! *If you are not complete sure, do not use the ´3.4 Default Par recall´.*

3.5.Current Par save

Any changes to the parameters must be saved otherwise they will be lost at power down.

3.6.Alarm Test Automatic test (→ Configuration)

Allows a check of the 4 alarms UA, NUA, MF and AS. At start, all alarms (relays as well as LEDs) are activated for 2 seconds, then one after the other is activated for 2 seconds and finally all alarms are activated again for 2 seconds. During an alarm test, all PSC 1000 functions - except alarm indication LEDs and relays - remain active.

Manual test (→ Configuration)

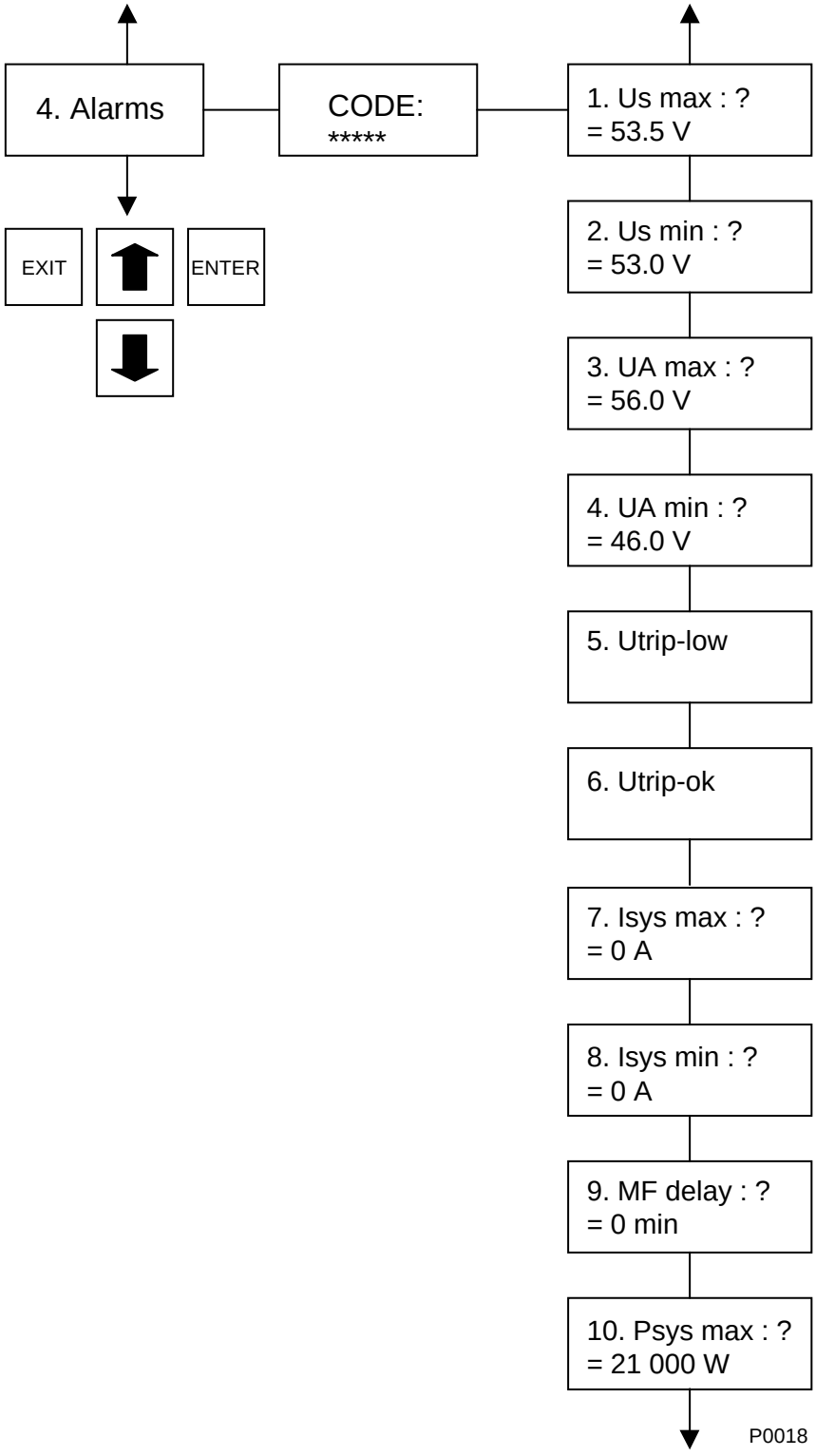
Allows a check of the 4 alarms. The alarms can be activated and deactivated one by one using the arrows 'Up' and 'Down'.

3.7.Date Set the actual date.

The "Real Time Clock" is based on the system (processor) time and it is therefore not very accurate. The RTC is stored every hour in the EEPROM to not loose date and time completely in case of power loss. With every restart the PSC reads the stored RTC and calculates the actual RTC based on the last stored value.

3.8.Time Set the actual time (real time).

5.5 Alarm menu



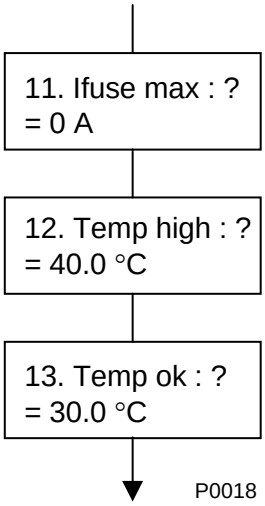


Figure 7. Alarm menu structure.

The alarm menu contains alarm levels and parameters:

4.1.Us max Upper NUA level of system voltage Usys. Level is temperature compensated in charge mode 'TC Float Charge'. NUA is suppressed in charge mode 'Boost Charge', 'Battery Test', 'Temp Comp' and 'Equalize'. If mains failure is active, alarm is or is not suppressed, according to the chosen configuration (→ Configuration). When level is passed, NUA is activated only after a couple of seconds.

4.2.Us min Lower NUA level. Handled as upper NUA level.

4.3.Ua max Upper UA level.

4.4.Ua min Lower UA level. UA is suppressed in charge mode 'Battery Test'.

4.5.Utrip-low Low voltage battery/load disconnect. When system voltage Usys drops below 'Utrip-low' for at least 20 seconds, the low voltage disconnect relay (output TRIP1) is activated and an UA or NUA or no alarm (→ Configuration) is generated. Function and parameter is available only if TRIP1 relay is configured so (→ Configuration).

4.6.Utrip-ok Low voltage battery/load reconnect. Hysteresis of 'Utrip-low'. After a low voltage disconnect, when the system voltage rises above 'Utrip-ok' for at least 20 seconds, low voltage disconnect relay (output TRIP1) is deactivated and according alarm reset.

Function and parameter is available only if TRIP1 relay is configured so (→ Configuration).

4.7.Isys max

Maximal system current. If system current 'Isys' rises above 'Isys max' an NUA or UA (→ Configuration) is generated. If 'Isys max' is set to 0, the function is switched off.

Values can be entered the following way:

0 ... 9.9 A, 0.1A steps
10 ... 99A, 1A steps
100 ... 990A, 10A steps
1'000 ... 9'900A, 100A steps
10'000 ... 150'000A, 1'000A steps

4.8.Isys min

Minimal system current. If system current 'Isys' goes below 'Isys min', NUA or UA due to RM failure will not be generated. This might be useful, since the RM with constant no load limit produces an RFA signal as soon as its output current drops below a certain limit (no load). However, an alarm due to RM failure that was active before 'Isys' dropped, remains active.

Values can be entered the following way:

0 ... 9.9 A, 0.1A steps
10 ... 99A, 1A steps
100 ... 990A, 10A steps
1'000 ... 9'900A, 100A steps
10'000 ... 150'000A, 1'000A steps

4.9.MF delay

Parameter is used for 2 different functions whereof only 1 can be configured at a time.

a) At mains failure, additionally to the MF alarm, a NUA or UA is generated (→ Configuration). This alarm may be delayed.

b) At mains failure, the UA due to low voltage is delayed.

The parameter appears if one of these functions is enabled. Only one function can be active at a time. If both are chosen, option a) is active.

4.10.Psys max

Analog to Isys max. Maximal system power. If system power 'Psys' rises above 'Psys max' a NUA or UA (→ Configuration) is generated. If 'Psys max' is set to 0, the function is switched off.

Values can be entered the following way:

0 ... 99 W, 1W steps
100 ... 990W, 10W steps
1'000 ... 9'900W, 100W steps
10'000 ... 99'000W, 1'000W steps
100 ... 10'000kW, 10kW steps

4.11.Ifuse max

Supervision of fuse current. If load (fuse) current 'Isys' rises above 80% of 'Ifuse max' an NUA is generated. If load (fuse) current 'Isys' rises above of 'Ifuse max' an UA is generated. If 'Ifuse max' is set to 0, the function is switched off.

Values can be entered the following way:

0 ... 9.9 A, 0.1A steps
10 ... 99A, 1A steps
100 ... 990A, 10A steps
1'000 ... 9'900A, 100A steps
10'000 ... 150'000A, 1'000A steps

4.12.Temp high High temperature alarm. When temperature 'Temp' rises above 'Temp high', for at least 20 seconds, the configured alarm (no alarm, NUA or UA) is generated

4.13.Temp-ok High temperature alarm. After activation of high temperature alarm, when temperature 'Temp' drops below 'Temp-ok' for at least 20 seconds, the configured alarm is reset.

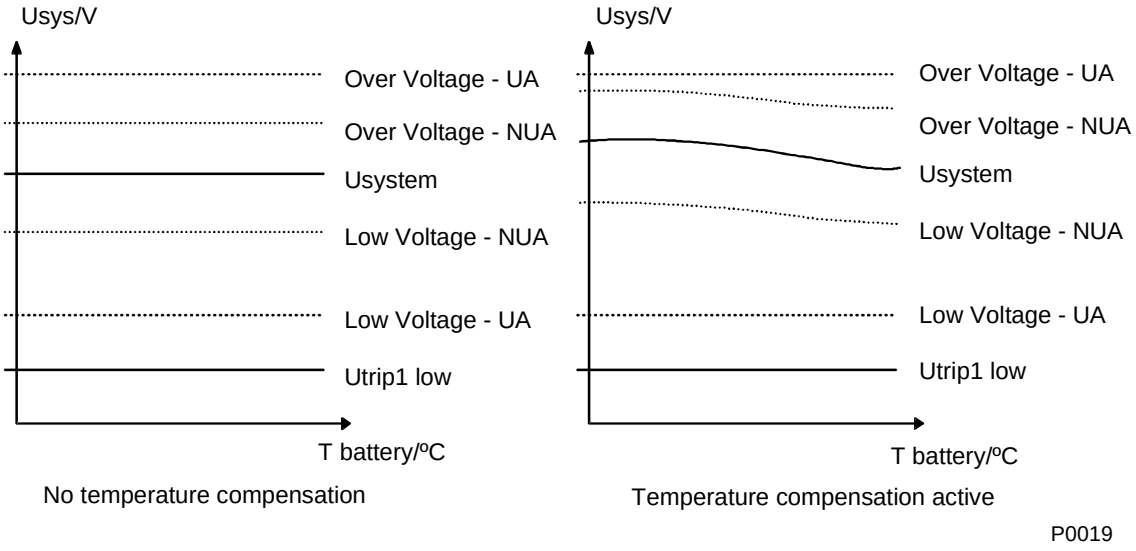


Figure 8. Temperature compensations affect on system voltage and alarms.

5.6 Usys menu

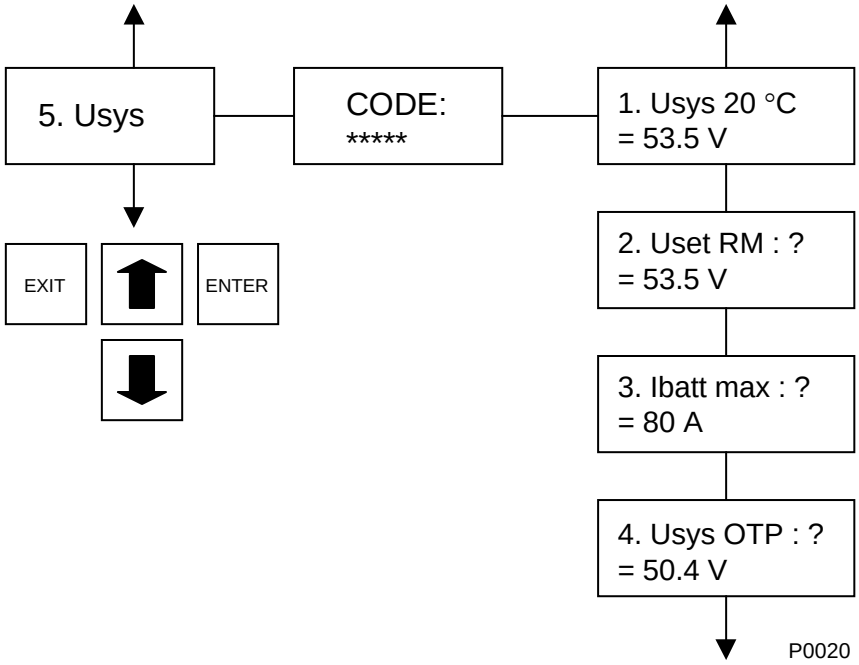


Figure 9. Usys menu structure.

5.1.Usys 20°C Float charge voltage at a battery temperature of 20°C.

5.2.Uset RM Set value of the rectifiers. Rectifiers adopt this value in case of PSC 1000 failure, i.e. when the rectifier is not being controlled. Usually 'Uset RM' and 'Usys 20°C' are the same. This setting is always 53.5V (in 48V system) with rectifier modules, which do not have output voltage setting potentiometer.

Note!	*If this value does not correctly correspond with the value adjusted at the rectifiers, the voltage control algorithm might be in trouble and program an outlandish system voltage!*

5.3.Ibatt max Battery charging current limitation. The total battery current (Ibatt1 + Ibatt2) is limited. It is basically a limitation of the average current, done by controlling the output voltage of the rectifiers. Ibatt max should not be smaller than 10% of the installed rectifier current or 5% of the battery shunt value; otherwise the current limitation could behave unexpectedly.

Values can be entered the following way:

0 ... 9.9 A,	0.1A steps
10 ... 99A,	1A steps
100 ... 990A,	10A steps
1'000 ... 9'900A,	100A steps
10'000 ... 150'000A,	1'000A steps

5.4.Usys OTP Temp compensation configured to 14 = User def. + OTP: if the temperature reaches 75°C then the system voltage is programmed to Usys OTP.

5.7 Temp comp menu

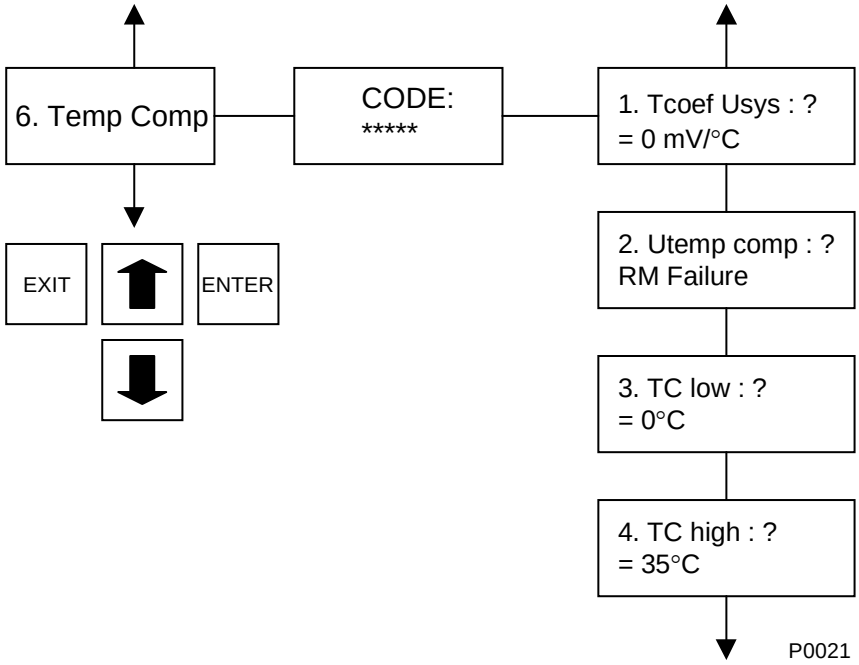


Figure 10. Temp comp menu structure

The temp comp menu only appears when external control (STÖK) or temperature compensation is enabled (→ Configuration).

6.1.Tcoef Usys Temperature compensation coefficient in -mV/°C. It is not related to the single battery cell but to the whole battery. The parameter does not appear when external control is enabled.

Note!	*The temperature compensated system voltage is calculated according to the following formula:* *System voltage = 'Usys 20°C' + ('Tbatt' - 20°C) * 'Tcoeff'*

The compensation is only applied in the range of 0…45 °C, 10…45 °C or user defined (→ Configuration). Beyond these limits, the system voltage stays with the value calculated for the respective limit.

6.2.Utemp comp Temperature compensation level when voltage is controlled externally (STÖK). Parameter only appears when external control is enabled.

6.3.TC low If temperature compensation is 'User defined' (→ Configuration), the compensation is active if temperature is above 'TC low'.

6.4.TC high If temperature compensation is 'User defined' (→ Configuration), the compensation is active if temperature is below 'TC high'.

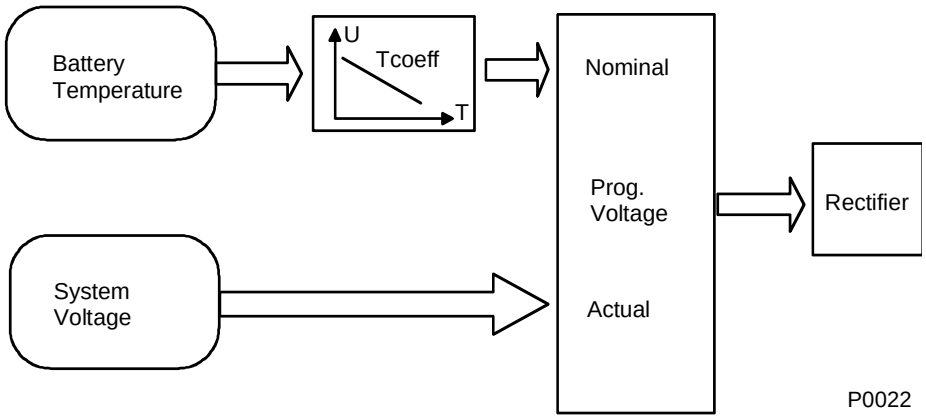


Figure 11. Temperature compensation.

5.8 Boost charge menu

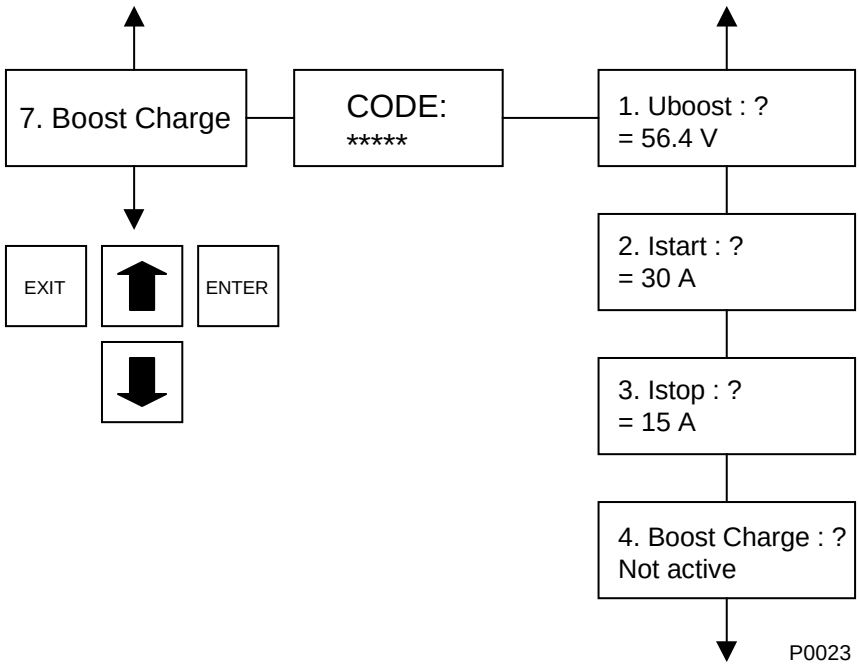


Figure 12. Boost start menu structure.

The boost charge menu only appears when external control (STÖK) or boost charge is enabled (→ Configuration). Boost charge can be temperature compensated or not.

Principle:

After a discharge phase the battery current turns and recharges the battery. Boost charge starts as soon as the recharge current goes above Istart. The wanted system voltage is then lifted to the boost charge voltage so battery will be recharged more quickly. Boost charge stops as recharge current goes below Istop. Boost charge is forced to stop at latest 16 hours after the level 'Usys 20°C' (temperature compensated in case of temperature compensated boost charge) has been crossed even when recharge current doesn't drop below Istop. This could be an indication of a faulty battery (which is however neither indicated nor alarmed).

Start criteria:

- Current to battery is greater than Istart AND
- Battery not is marked faulty AND
- Last boost charge was more than 24 hours ago (only in case that last boost charge was forced to stop due to 16 hours criteria) AND
- Istop > 0 AND
- Neither equalize nor separate charging is active

Stop criteria:

- Current to battery is smaller than Istop OR
- System voltage is above 'Usys @ 20°C' for more than 16 hours (to prevent bad battery from being charged "forever") OR
- Istop = 0 OR
- Separate charging is active

For test and other purposes, boost charge can be started and stopped manually at any time. If configured, boost charge can be stopped/suppressed by means of digital input (STÖK). During boost charge, NUA is suppressed due to low/high system voltage. After boost charge, the NUA suppression stops as soon as the wanted voltage is reached. Wanted voltage means Usys @ 20°C and if configured so, temperature compensated. Boost charge running is indicated with yellow LED.

7.1.Uboost Boost charge voltage. If boost charge is temperature compensated, the wanted system voltage is calculated as described in paragraph "Temp Comp" with parameter '6.1.Tcoef Usys'.

7.2.Istart Battery current at which boost charge starts; is always greater than Istop.

Values can be entered the following way:

0 ... 9.9 A,	0.1A steps
10 ... 99A,	1A steps
100 ... 990A,	10A steps
1'000 ... 9'900A,	100A steps
10'000 ... 150'000A,	1'000A steps

7.3.Istop Battery current at which boost charge stops; is always smaller than Istart. If Istop is 0, boost charge will not be performed, neither automatically nor manually.

Values can be entered the following way:

0 …9.9 A,	0.1A steps
10 ... 99A,	1A steps
100 ... 990A,	10A steps
1'000 ... 9'900A,	100A steps
10'000 ... 150'000A,	1'000A steps

7.4.Boost Charge Start or stop boost charge manually.

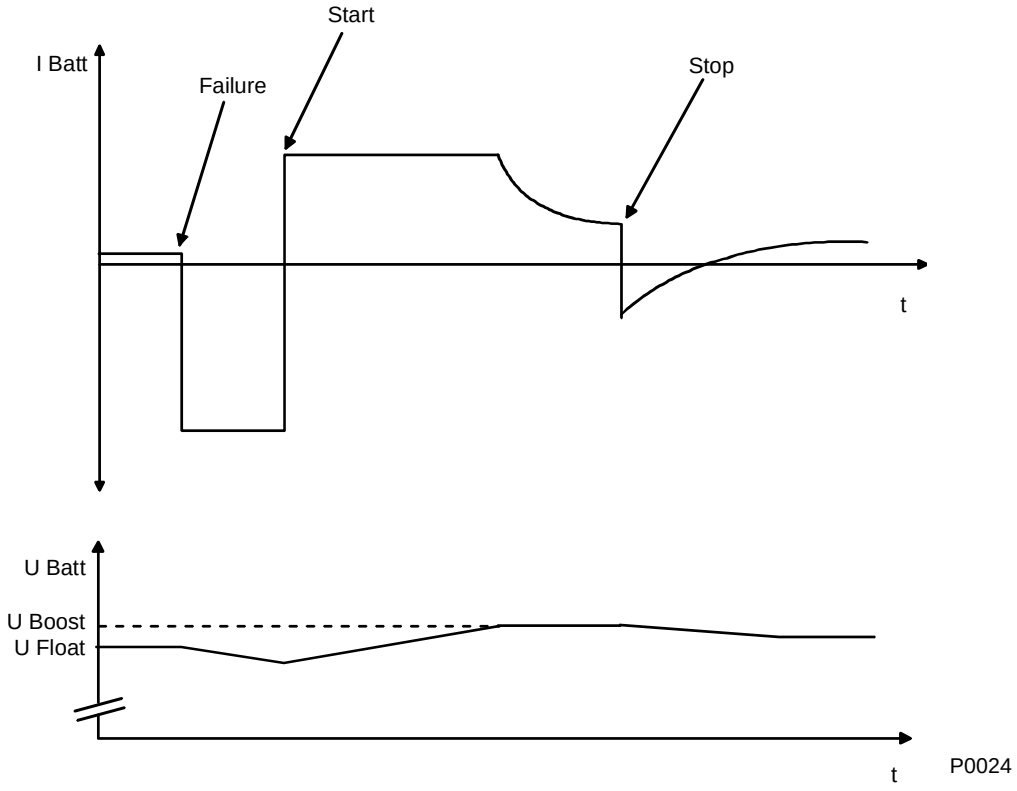
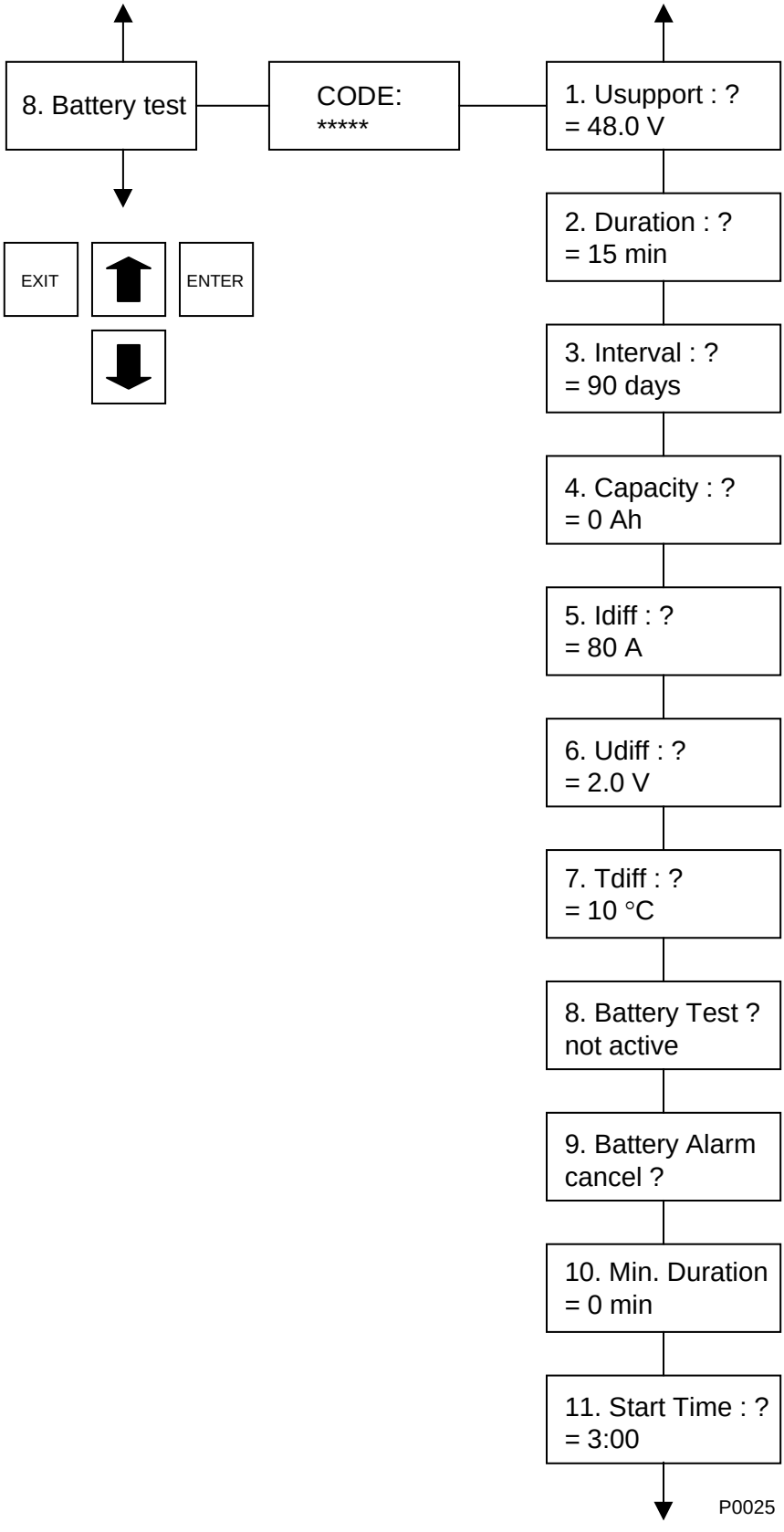


Figure 13. Boost charge

5.9 Battery test menu



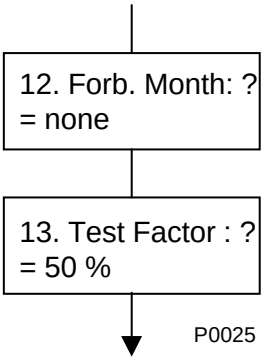


Figure 14. Battery test menu structure.

The battery test menu only appears when external control (STÖK) or battery test is enabled (→ Configuration).

Principle

The battery is supposed to be fully charged when the test starts. For the test, the rectifiers stop delivering current, and full load current is coming from the battery. During the discharge time the rectifiers are kept on the support charge voltage, so in case of a battery failure (string interruption, high impedance) the system voltage doesn't dip below a given value.

The test is complete as soon as the battery has performed for the duration of the test or discharged capacity. At test completion, a protocol entry is made, containing the voltage at the end of the test. Thus, a judgment of the present battery state can be made. The protocol entry with the system voltage is only made at successful test completion.

The test has failed when the system voltage drops down to Usupport level or string current difference exceeds a certain value within test duration.

When the test fails, the battery is marked faulty (Urgent Alarm).

Note!	*The UA mark can only be reset manually (´8.9.Battery Alarm´)!*

Start criteria:

- Test interval expired (→ first battery test not before a time of 'Interval' after power up) AND
- No alarm (NUA, UA, MF) active AND
- System voltage is on the level of wanted voltage = battery full (wanted voltage is Usys @ 20°C and if configured so, temperature compensated) AND
- Last mains failure was at least 7 days ago = battery full (→ first battery test not before 7 days after power up) AND
- Neither the boost charge, equalize nor separate charging is active AND
- Battery test duration and interval > 0 AND
- Time of day (hours) = start time AND
- Not a forbidden month AND
- Capacity > 0 if battery test is “available capa”.

Stop criteria:

- Test duration has expired OR
- Test has recognized faulty battery due to low system voltage
- Test has recognized faulty battery due to difference in string currents
- Battery fuse is blown
- Separate charging is active OR
- Specified amount of capacity has discharged

For test and other purposes battery test can be started and stopped manually at any time. If configured, the battery test can be started/stopped by means of a digital input (STÖK). During battery test, NUA and UA are suppressed due to low/high system voltage. After battery test, suppression of UA stops as soon as system voltage rises above 'Us min' or battery is being discharged. NUA suppression stops as soon as the wanted voltage is reached. Wanted voltage means Usys @ 20°C and if configured so, temperature compensated. Battery test running is indicated with yellow LED.

8.1.Usupport Support charge voltage.

8.2.Duration Battery test duration. If duration is 0, test can not be performed, neither automatically nor manually.

8.3.Interval Battery test interval. If interval is 0, test will never start automatically. Manual start is possible.

8.4.Capacity Nominal battery capacity. Value can be entered as follows.

0..	1'000 Ah	in 10 Ah steps
1'000..	10'000 Ah	in 100 Ah steps
10'000..	120'000 Ah	in 2'000 Ah steps

This value is used to execute a capacity based battery test and to display the actual charge state of the battery (0…100%). In menu 1.6 TRIP1-3 can be configured being activated if a certain percentage of the battery capacity has discharged (Q TRIPx).

8.5.Idiff String current of the two battery strings is compared perpetually. If the string currents differs more than a certain percentage from the theoretical (average) battery string current ('Idiff') for at least 20 seconds, the battery failure alarm (NUA or UA configurable) is generated and remains active until it is manually reset. The protocol entry 'Batt Failure I' is generated.

When battery test is in progress and current difference exceeds the limit the battery test is immediately stopped and battery failure alarm generated.

The following conditions have to be fulfilled before the comparison becomes active:
- Configuration parameter 13.Battery Test = available UmId,
- Configuration parameter 23.Batt = 2 Strings,
- Parameter 8.5.Idiff > 0,
- Battery fuse not blown,

- Separate charging/discharging not running,
- Absolute value of whole battery current (both strings) > 2 strings * 2% of installed battery shunt (in order to: a - avoid measurement problems around 0; b - string currents during float charging possibly quite different).

Example: Ibatt1 = -100A, Ibatt2 = -50A, difference = 25 A = 33% of -75A.

8.6.Udiff

Middle point measurement and comparison is done perpetually. The 2 inputs for Iload2 and Iload3 are used (Therefore Iload2 and 3 can not be measured when middle point comparison is used).

If the voltage of the upper battery block and the voltage of the lower battery block differ more than a certain value ('Udiff') for at least 20 seconds, the battery failure alarm (UA or NUA configurable) is generated and remains active, until it is manually reset. The protocol entry 'Batt Failure U' is generated. The middle point voltage is displayed in menu display, alternating with the battery voltage. In case of separate charging the 'Middle point' is suppressed for the separated battery.

The following conditions have to be fulfilled before the function becomes active:

- Configuration parameter 13.Battery Test = available UmId,
- Configuration parameter 38.Max Loads = 1,
- Parameter 8.6.Udiff > 0.

Example: Voltage Usys- /middle point = 27.8, Voltage middle point/Usys+ = 25.7, difference = 2.1. The middle point is above the expected value of 26.75 volt and the difference is therefore displayed with a preceding '↑'.

Expected signal input: The pins 1 (+) and 2 (-) of LOAD2 and LOAD3 connectors on COBO are used (normally for measuring load current 2 and 3). A signal of 200mV (full range) is interpreted as 49.89V.

8.7.Tdiff

Comparison of battery and ambient temperature is done perpetually. If the 2 temperatures differ more than a certain value ('Tdiff') for at least 2…3 minutes, the battery failure alarm (UA or NUA configurable) is generated and remains active, until it is manually reset. The protocol entry 'Batt Failure T' is generated. The ambient temperature is displayed in menu point 1.3, alternating with the battery temperature.

The temp measurement input is used for both measurements. The input is switched every minute (by means of relay RES in PSC 1000) for a couple of seconds from Tbatt to Tamb probe. Therefore a change in the ambient temperature will only be recognized after a time of 0…60 seconds. Additional hardware is needed to connect the 2 temperature probes to COBO board. The same probe type can be used for both temperatures.

The following conditions have to be fulfilled before the function becomes active:

- Configuration parameter 13.Battery test = available or available UmId,
- Configuration parameter 14.Temp Comp = available,
- Configuration parameter 34.RES = temp switch,
- Parameter 8.7.Tdiff > 0,
- No temp measurement failure active.

8.8.Battery Test Start or stop battery test manually.

8.9.Battery Alarm Reset Battery Alarm. Menu option is only displayed if battery is faulty.

8.10.Min.Duration New battery test menu item "10.Min. Dur.". Minimum value is 0 and maximum is 255, but limited to the actual battery test duration. The value represents the minimum battery test duration in minutes. During that time a battery test is not stopped in case of a voltage drop down below the support voltage. This additional function makes it possible to test a battery with a higher support voltage than usual by suppressing an alarm due to the normal voltage drop of a battery at the beginning of a test. Default value is 0, which is the normal functionality of the battery test.

8.11.Start time Values from 0 to 23 can be entered (according 0:00 to 23:00 o'clock). The programmed battery test is started within this hour time window if all other conditions are fulfilled.

8.12.Forbidden month

At this months a programmed battery test is not executed and delayed. The following values can be entered: none/6, 7 / 7, 8 /6, 7, 8 / 1, 6, 7, 8, 12 corresponding to no forbidden month orJune, July and so on.

8.13.Test Factor Test factor in %. Capacity x Factor = energy to be discharged during test. Nominal battery capacity is defined in the submenu 8.4.

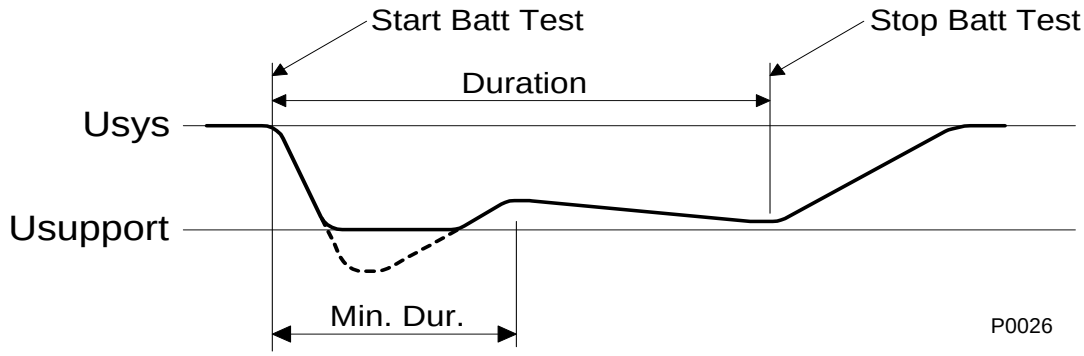


Figure 15. Battery test graph.

5.10 Equalize menu

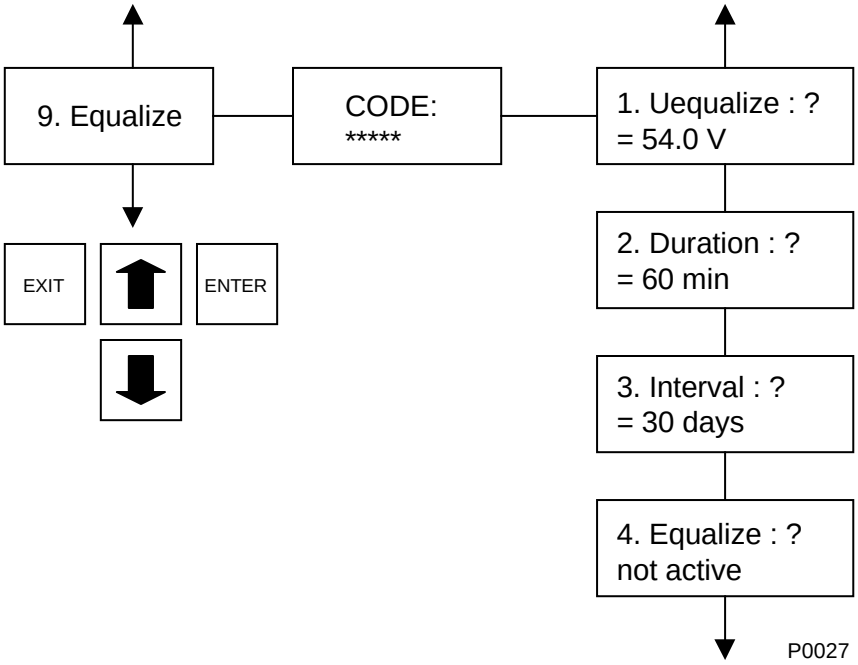


Figure 16. Equalize menu structure.

The equalize menu only appears when external control (STÖK) is not enabled and equalize is enabled (→ Configuration).

Principle

The system voltage is raised periodically e.g. once a month for a certain duration e.g. 1 hour. So battery fluid and battery cells can be equalized.

Start criteria:

- Equalize interval expired (→ first equalize not before a time of 'Interval' after power up) AND
- Last boost charge more than 24 hours ago AND
- Neither battery test nor separate charging active

Stop criteria:

- Equalize duration expired OR
- Battery current negative OR
- Battery test interval and duration > 0 OR
- Separate charging active

For test and other purposes, equalize can be started and stopped manually at any time. During equalize, NUA is suppressed due to low/high system voltage. After equalize, the NUA suppression stops as soon as the wanted voltage is reached. Wanted voltage means Usys @ 20°C and if configured so, temperature compensated. Equalize running is indicated with yellow LED.

9.1.Uequalize Equalize voltage. Equalize can be configured so that the equalizing voltage is temperature compensated. The compensation will then be for the same temperature range as for the normal temperature compensation.

9.2.Duration Equalize duration. If duration is 0, equalize cannot be performed, neither automatically nor manually.

9.3.Interval Equalize interval. If interval is 0, equalize will never start automatically. Manual start is possible.

9.4.Equalize Start or stop equalize manually.

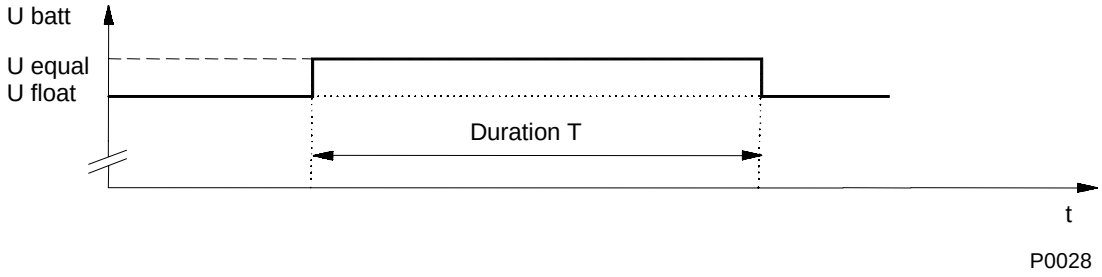


Figure 17. Equalize graph

5.11 SAE menu

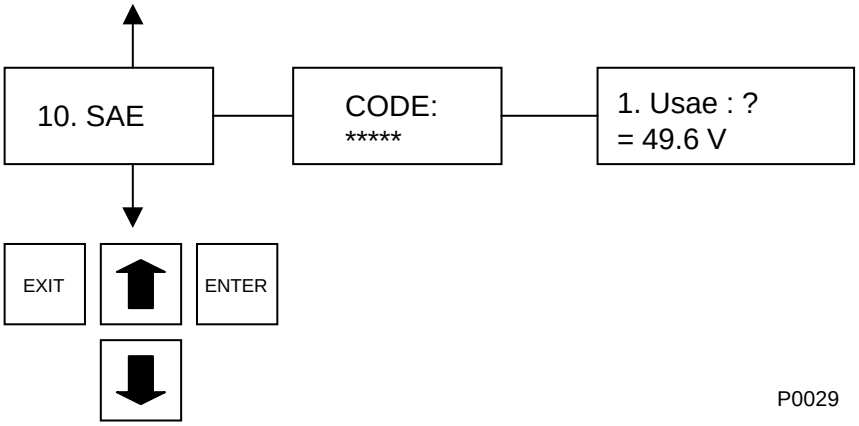
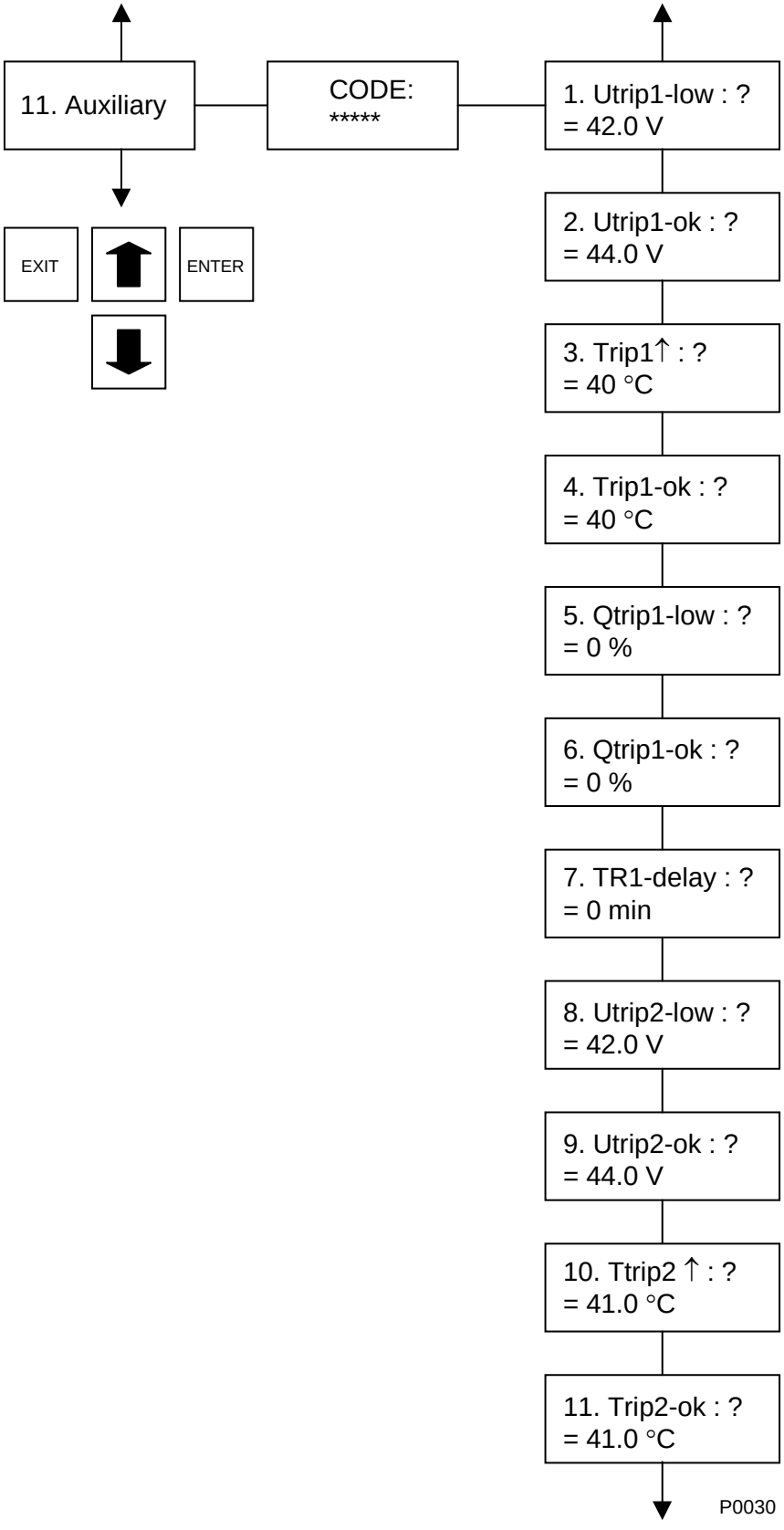


Figure 18. SAE menu structure.

This is a function especially designed for the German market and exclusively used there. Therefore all the specific menu text is implemented in German only and if another language is chosen, the menu text remains in German.

5.12 Auxiliary menu



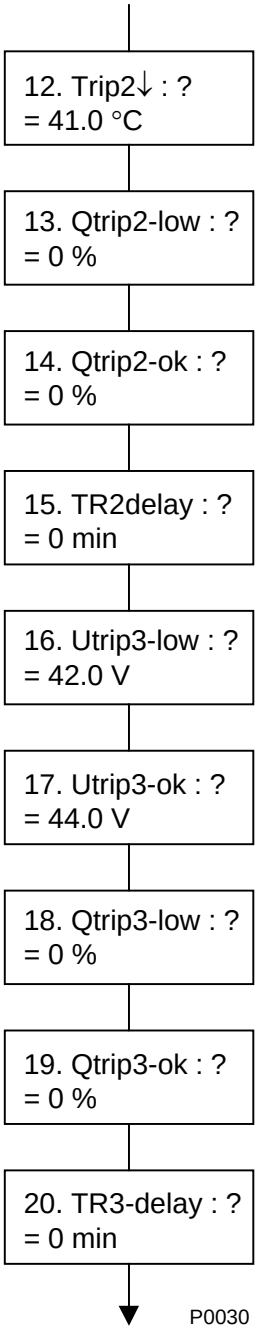


Figure 19. Auxiliary menu structure.

The auxiliary menu only appears if one or several of the TRIP1…3 relays is/are configured to a function different than “not used”.

11.1.Utrip1-low Low voltage battery/load disconnect. When system voltage Usys drops below 'Utrip1-low' for at least 20 seconds, the low voltage disconnect relay 1 (output TRIP1) is activated and an alarm according the configuration is generated.

11.2.Utrip1-ok Low voltage battery/load reconnect. Hysteresis of 'Utrip1-low'. After a low voltage disconnect when system voltage rises above 'Utrip1-ok' for at least 20 seconds, low voltage disconnect relay 1 (output TRIP1) is deactivated and the alarm is reset.

11.3.Ttrip1 ↑ High temperature output 1. When temperature 'Temp' rises above 'Ttrip1 ↑', for at least 20 seconds, the relay 1 (output TRIP1) is activated and no alarm, NUA or UA is generated according to the configuration.

11.4.Ttrip1-ok High temperature output 1. After activation of high temperature output, when temperature 'Temp' drops below 'Ttrip1-ok' for at least 20 seconds, the relay 1 (output TRIP1) is deactivated and alarm is reset.

11.5.Qtrip1-low Low capacity load disconnected. When the battery capacity drops below 'Qtrip1-low', the relay 1 (output TRIP1) is activated and an alarm according to the configuration is generated. If the value is zero, the function is not active.

11.6.Qtrip1-ok Low capacity battery/load reconnected. Hysterisis of 'Qtrip1-low'. After a low capacity disconnect when the battery capacity 'Qtrip1-ok', disconnect relay 1 (output TRIP1) is deactivated and the alarm reset. If the value is zero, then the function is not active.

11.7.Trip1-delay The relay 1 (output TRIP1) is activated with this delay in minutes to a mains failure and an alarm according to the configuration is set. This submenu is visible only if TRIP1 is configured as “V+MF Ctrl”. If the delay is set to zero, the function is not active.

11.8.Utrip2-low Low voltage battery/load disconnect. The system voltage Usys drops below 'Utrip2-low' for at least 20 seconds, the low voltage disconnect relay 2 (output TRIP2) is activated and an alarm according the configuration is generated.

11.9.Utrip2-ok Low voltage battery/load reconnect. Hysteresis of 'Utrip2-low'. After a low voltage disconnect, when system voltage rises above 'Utrip2-ok' for at least 20 seconds, low voltage disconnect relay 2 (output TRIP2) is deactivated and according alarm reset.

11.10.Trip2 ↑ High temperature output 2. When temperature 'Temp' rises above 'Ttrip2 ↑', for at least 20 seconds, the relay 2 (output TRIP2) is activated and no alarm, NUA or UA is generated according to the configuration.

11.11.Ttrip2-ok High temperature output 2. After activation of high temperature output, when temperature 'Temp' drops below 'Ttrip2-ok' for at least 20 seconds, the relay 2 (output TRIP2) is deactivated and alarm is reset.

11.12.Ttrip2 ↓ Temperature output 2. When temperature 'Temp' drops below 'Ttrip2 ↓', for at least 20 seconds, the relay 2 (output TRIP2) is activated and no alarm, NUA or UA according to the configuration is generated. If 'Temp' subsequently rises above 'Ttrip2 ↓' + 2°C for at least 20 seconds, the output and the according alarm are deactivated.

11.13.Qtrip2-low Low capacity load disconnect. When the battery capacity drops below 'Qtrip2-low', the relay 2 (output TRIP2) is activated and an alarm according to the configuration is generated. If the value is zero the function is not active.

11.14.Qtrip2-ok Low capacity battery/load reconnect. Hysteresis of 'Qtrip2-low'. After a low capacity disconnect, when the battery capacity 'Qtrip2-ok', disconnect relay 2 (output TRIP2) is deactivated and the according alarm reset. If the value is zero the function in not active.

11.15.Trip2-delay The relay 2 (output TRIP2) is activated with this delay in minutes to a mains failure and an alarm according to the configuration is set. This submenu is visible only if TRIP2 is configured as “V+MF Ctrl”. If the delay is set to zero the function is not active.

11.16.Utrip3-low Low voltage battery/load disconnect. When the system voltage Usys drops below 'Utrip3-low' for at least 20 seconds, the low voltage disconnect relay 3 (output RES is activated and an UA is generated.

11.17.Utrip3 ok Low voltage battery/load reconnect. Hysteresis of 'Utrip3-low'. After a low voltage disconnect, when system voltage rises above 'Utrip3-ok' for at least 20 seconds, low voltage disconnect relay 3 (output RES) is deactivated an UA reset.

11.18.Qtrip3-low Low capacity load disconnect. When the battery capacity drops below 'Qtrip3-low', the relay 3 (output TRIP3) is activated and an alarm according to the configuration is generated. If the value is zero the function is not active.

11.19.Qtrip3-ok Low capacity battery/load reconnect. Hysteresis of 'Qtrip3-low'. After a low capacity disconnect, when the battery capacity 'Qtrip3-ok' disconnect relay 3 (output TRIP3) is deactivated and the according alarm reset. If the value is zero the function is not active.

11.20.Trip3-delay The relay 3 (output TRIP3) is activated with this delay in minutes to a mains failure and an alarm according to the configuration is set. This submenu is visible only if TRIP3 is configured as “V+MF Ctrl”. If the delay is set to zero the function is not active.

5.13 PC/Modem menu

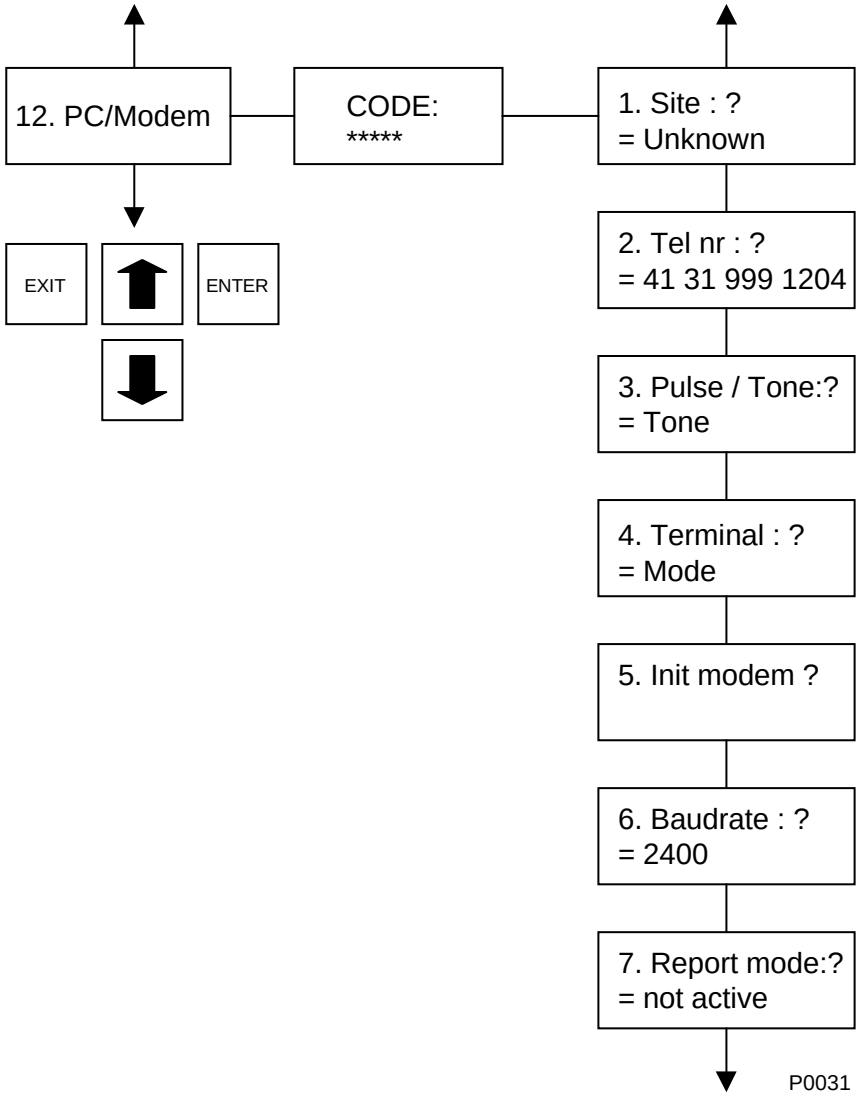


Figure 20. PC/Modem menu structure.

The PC/Modem menu only appears when remote access is configured (→ Configuration).

12.1.Site The site name of each system. The site name is also used in the archive (like an address) therefore:

Note!	*The site name must be unique!*

A site name must contain characters different than blanks. Trailing blanks are cut before transmission. If the terminal type is set to “GSM” then the last four characters of the site name are used to enter the PIN-code of the GSM modem.

12.2.Tel nr If MODEM is used, then this number is used for the ‘Call back’ function to call back to the PSM to open the PSC for control functions. No blanks are allowed!

12.3.Pulse/Tone Pulse or tone (DTMF) dial. Whenever possible chose tone dialing.

12.4.Terminal Set if Terminal (local mode) or MODEM (remote mode) is used.

Note!	*PSC 1000 has only one interface, which is used for both applications. Be very careful with 'Terminals' and not galvanically isolated COBOMO's. Because of the grounding of the PC with respect to the plus bar (ground in the power system) and the power supply of the PSC with respect to the minus bar, a short circuit can happen. PC, PSC and COBOMO can be destroyed.*

If the terminal type is set to "GSM" then additional to the modem initialization string the pin code is sent to the GSM modem. This code is stored as the last four characters in the site name displayed as asterisks (****), in this case only 8 characters are available for the name itself.

12.5.Init modem To initialize the modem with the default initialization string and if set to GSM modem also with the pin code.

12.6.Baudrate Set the baud rate for the communication.

12.7.Report Mode The report mode can be enabled or disabled. In case of a change in the alarm list (UA and NUA alarm), PSC will send an 'alarm telegram' to the PSM. Report mode is working both locally and remotely. With MODEM, PSC is establishing a connection (to the set phone number point 11.2), is sending the telegram and will disconnect after the transmission is successfully done. In case of open line (No Modem on PSM side, wrong telephone number stored in PSC…), busy line or simply no answer, PSC will try again after one minute for 8 times. After 8 not successful calls PSC will wait for one hour, then the procedure starts again.

6 CONFIGURATION / EXTENDED CONFIGURATION

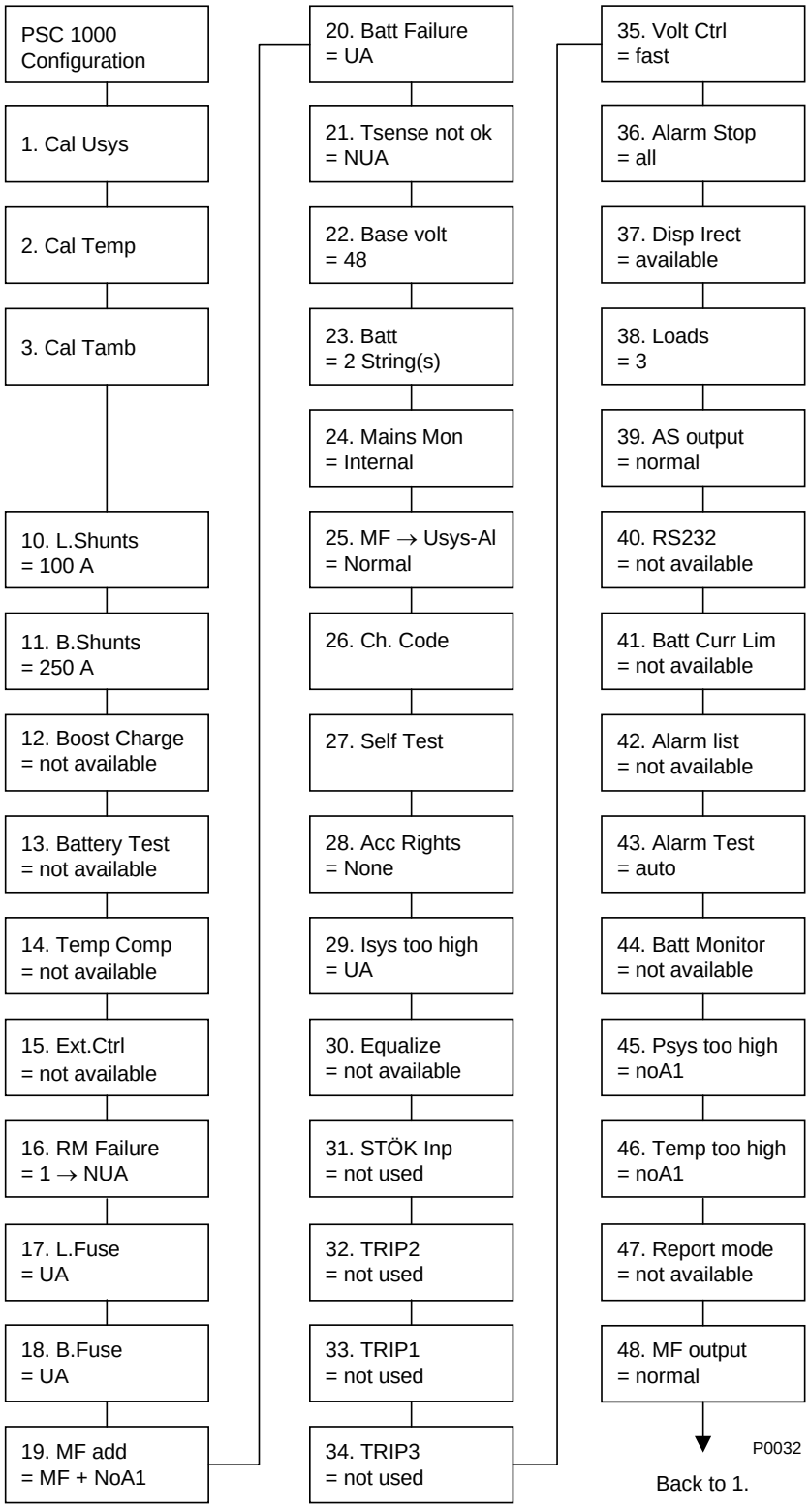


Figure 21. Configuration/Extended Configuration menu structure.

Note!	*Before setting in operation, PSC 1000 has to be configured. Make sure that each value is reasonable.*

With the configuration menu you are able to configure the controller according to your system and your wishes. The parameters you choose are saved permanently.

For access of the configuration press “ENTER” during power up phase when ‘self test’ appears. Give then the code, which is the same as in the menu, and you get into the configuration. For getting into the extended configuration use the same procedure, but depending on access rights you may need to have the hardware key connected **before** start of the procedure. The hardware key is integrated on the test adapter for PSC 1000.

Configuration is available in English and if the display type is graphical in Chinese.

Configuration menu can be exit by either switching off and subsequently on the power, or keeping “BLIND” (= invisible key) pressed and pressing “DOWN” the same time. PSC then starts up normally.

6.1 Configuration

1.Cal Usys

With this function, the system voltage and all other measurements except the battery temperature are calibrated.

To enter the function press “ENTER”; adjust then the value on the display to the voltage you can measure at the system (with an extra voltmeter); then start calibration with “ENTER”; calibration takes about 6 seconds; when done, function can be entered again with “ENTER” and the correct value is now displayed; to exit, press “EXIT”.

- Brk Err1: Calibration not completed. The measured voltage is not stable. Try again.
- Brk Err2: Calibration not completed. A calibration of more than 10% would be necessary. Something in the wiring is probably wrong or the shunt adapter card is broken.

2.Cal Batt Temp

With this function, the measurement of the battery temperature is calibrated.

To enter the function press “ENTER”; adjust then the value on the display to the real temperature at the sensor; then start calibration with “ENTER”; calibration takes about 6 seconds; when done, function can be entered again with “ENTER” and the correct value is now displayed; to exit, press “EXIT”.

- Brk Err1: Calibration not completed. The measured temperature is not stable. Try again.
- Brk Err2: Calibration not completed. A calibration of more than about +/- 20 °C would be necessary. Something in the wiring or the sensor is probably wrong. Calibration is only possible in the range of 0…40°C

3.Cal Amb Temp

With this function, the second temperature measurement is calibrated. The TRIP3 (RES) relay output has to be configured for ‘Temp switch’ and the system hardware equipped for this function. The procedure is the same as for the calibration of the battery temperature measurement.

6.2 Extended configuration

10.Load Shunts

Choose the load shunts you want to use. 60 mV shunts are expected.

Possible shunts: 60mV @

5…	95A	in 5A steps
100…	990A	in 10A steps
1000…	9900A	in 100A steps
10'000…	30'000A	in 1000A steps.

11.Batt Shunts

Choose the load shunts you want to use. 60 mV shunts are expected.

Possible shunts: 60mV @

0…	95A	in 5A steps (0 is shown as no shunt)
100…	990A	in 10A steps
1000…	9900A	in 100A steps
10'000…	30'000A	in 1000A steps.

If 'no shunt' is chosen, following functions will not work:

Display functions: display of battery current (according display page suppressed), display of charge state 'Discharge'.

Other functions: battery current based RM failure (Configuration '16.RM Failure' = Current based), mains monitoring on base of battery / system current and RM failure signal (Configuration '24.Mains Monitor' = Internal), boost charge function, equalize function.

Note! *All these functions cannot be used and **must not** be enabled, otherwise PSC 1000 may behave unexpectedly!*

12.Boost Charge

Disable/enable boost charge function. The parameters are set in the menu.

Option	**Function**
Not available:	Boost charge not available.
Available:	Boost charge available, voltage not temperature compensated.
Temp Comp:	Boost charge available, voltage temperature compensated. Uses the same Tcoefficient as normal Usys. Ordinary Temp Comp must be enabled (if not, boost charge will be uncompensated).

13.Battery Test

Disable/enable battery test function. The parameters are set in the menu.

Option	Function
Not available:	Battery test not available.
Available:	Battery test available (Cap to perform).
UmId:	Battery test available, with middle point measurement, battery string current comparison and temperature comparison. **Attention:** special hardware required!
Available capa:	Battery test available, the test is fulfilled if the percentage of battery capacity chosen in menu 8.4 is discharged.

14.Temp Comp

Disable/enable temperature compensation function. Set the function parameters in the menu:

Option	Function
Not available:	Temperature compensation not available.
Linear 0..45:	Temperature compensation in a band of 0…45°C. If temperature is outside the band, the according band limits are used.
Linear 10..45:	Temperature compensation in a band of 10…45°C. If temperature is outside the band, the according band limits are used.
User defined:	The band of the temperature compensation is defined by the user. Parameter are set in the menu “6.TempComp”.
User def.+OTP	The band of the temperature compensation is defined by the user. Parameters are set in the menu “6.Temp Comp”. If the temperature is higher than 75°C the charge state changes to “Batt over temp”. An according protocol entry together with an urgent alarm is generated and the system voltage is programmed down to the set level (menu 5, sub-menu 4.Usys OTP) until the temperature undergoes 65°C. An ongoing battery test is not interrupted.

15.External Ctrl (STÖK)

Disable/enable external voltage control function. When this function is enabled, boost charge, battery test, temperature compensation and equalize are disabled even when they are marked enabled.

16.RM Failure

Three different schemes can be chosen:

a) Rectifier failure alarming based on number of failed rectifiers (1 → No Al, 1→ NUA, 1 → UA).

- rectifier failed → No alarm, more than 1 failed → UA

- rectifier failed → NUA, more than 1 failed → UA
- 1 or more than 1 rectifier failed → UA

b) Rectifier failure alarming based on battery current (Curr based Al)

If there are failed rectifiers and current is not coming out of battery (battery current positive) → NUA.

If there are failed rectifiers and current is coming out of battery (battery current negative) → UA. (Exact criteria for current coming out of the battery: Ibatt < -(0.5% of batt shunt + 100mA)).

c) Rectifier failure according to DBP (UA – DBP Scheme)

If there are failed rectifiers → UA

If all rectifiers are switched off manually → NUA

Note!	*This scheme is only possible with additional wiring among the rectifiers (B-Bus).*

17.Load Fuse

Choose action in case of one or more blown load fuses. Possible actions: No alarm, NUA, UA.

18.Batt Fuse

Choose action in case of one or more blown battery fuses. Possible actions: No alarm, NUA, UA.

19.MF additional

Choose action in case of mains failure. A MF alarm is always generated. Additional possible actions are: No Alarm, NUA, UA, MF delay. The additional alarm – if chosen – can be generated a certain delay after recognition of mains failure. Choose the delay in menu option ‘4.9.MF delay’.

If MF delay is chosen the relay (remote alarm) will be delayed (‘4.9.MF delay’)

20.Batt Failure

Choose action in case of battery failure. Possible actions: NUA, UA

21.Tsense not ok

Choose action in case of temperature sensor failure. Possible actions: NUA, UA

The temperature sensor is checked by testing whether the measured values can be plausible. Plausible values –20°C…+90°C. Not plausible values need to be measured during at least 25 seconds before alarm is given.

22.Base Voltage

Choose voltage of system in which PSC 1000 is built in. Changing the base voltage causes the parameters in the menu to change too!

If FR 48V-7000W fan cooled rectifier is used, the option ‘48 FR’ has to be chosen due to different voltage programming transfer factor. From a controllers viewpoint the rectifiers with different voltage programming transfer factor cannot be mixed.

23.Battery

Choose 0, 1 or 2 battery strings; choose if the shunt is smart integrated. Smart means the fuse is between the battery and the shunt (Shunt connected directly to minus). The current measurement is no longer suppressed in case of fuse blown or fuse moved for separated charge.

If choosing ‘0 strings’ then following functions will not work or not make sense:

Display functions: battery current and battery voltage, rectifier current, charge state. The according display pages do not appear.

Supervision of battery fuse.

Battery functions: temperature compensation, boost charge, equalizing, battery test, external ctrl (STÖK). The configuration for all these functions is automatically set to ‘not available’ when setting ‘0 strings’.

Note!	*After configuring ‘0 strings’, the disabled functions can be reenabled which should not be done.*

Battery current based RM failure alarming, configuration ‘16.RM Failure = Current based’. Is automatically set to ‘16.RM Failure = 1 -> NUA’ when setting ‘0 strings’.

Mains monitoring on base of battery / system current and RM failure signal, configuration ‘24.Mains Monitor’ = Internal. Is automatically set to ‘24.Mains Monitor = External’ when setting ‘0 strings’.

Note!	*After configuring ‘0 strings’, the changed functions can be rechanged which should not be done.*

Independently of the access rights, ‘0 string’ can be set or changed only by means of the hardware key, as it influences other configuration settings!

24.Mains Monitor

Two different schemes for mains failure recognition can be chosen:

d) With external mains relay
An external mains relay reports mains failure via digital input.

e) With PSC 1000 internally available information
Mains failure, if load current comes entirely from battery (and one or more rectifiers have failed). For reasons of measurement accuracy, the check cannot be done when the load/battery current is too small, so in case of systems with no load, mains failure is not reported.

The battery current has to be smaller (more negative) than 0.1A + 0.5%*BattShuntVal, e.g. < -2.1A for a battery shunt of 400A. In addition the difference between the absolute battery current and the load current has to be smaller than 0.2A + 5%*Iload + 1%*BattShuntVal.

Note!	*With this method, a system with only one rectifier is not able to report a rectifier failure. When the single rectifier does not work (due to mains failure or failure of rectifier), and current is coming entirely out of battery is regarded as mains failure.*

25.MF → Usys-Al

Choose system voltage alarm handling at mains failure.

Option	Function
Normal	UA and NUA are normally generated when low/high voltage.
Suppress	NUA due to low/high voltage is suppressed.
Delay Ua 25	Low voltage UA is suppressed during the first 25 minutes of the mains failure in order to avoid early UA due to possible under swinging of the battery voltage at the beginning of a mains failure.
S.NUA + D.UA 25	Both above mentioned methods in combination.
Delay UA	Like 'Delay UA 25' but time is settable in menu '4.9.MF delay'. Is only usable if '19.MF additional = No Alarm', else UA is not suppressed.
S.NUA + D.UA	Like 'S.NUA + D.UA 25' but time settable. Delay is only usable if '19.MF additional = No Alarm', else UA is not suppressed.

26.Change Code

Set new access code for menu. The code can have a length of 0...8 keys. 0 means no code is required to access the menus.

To set new code, type desired key sequence and terminate input with invisible key (right below “ENTER” key). If typing a sequence of 8 keys, input is terminated after 8th key without invisible key being pressed.

27.Self Test

Do a self-test by means of an external test adapter. Test adapter contains some test and loop back hardware as well as the hardware key.

When the self-test is started, the supply voltage has to be input first. The test takes about 6 seconds. A successful test terminates with the message '...test ok'. If any hardware faults are found, the respective error codes are displayed.

Error codes:

Error code	Error Reason	Deviation
0	RAM failure	
1	EEPROM not accessible	> ± 5%
2	Usys measurement failure, measurement out of range	
3	Tbatt measurement failure. Measurement out of range, measured value not in the range 0...40°C. Attention! The test assumes an ambient temperature of 10...30°C.	
4	Ibatt 1 measurement failure, measurement out of range	> ± 10%
5	Ibatt 2 measurement failure, measurement out of range	> ± 10%
6	Battery fuse 1 measurement failure. Measurement out of range	> ± 10%
7	Battery fuse 2 measurement failure. Measurement out of range	> ± 10%
8	Iload 1 measurement failure. Measurement out of range	> ± 10%
9	Iload 2 measurement failure. Measurement out of range	> ± 10%
10	Iload 3 measurement failure or shunt emulator output failure. Shunt emulator output or measurement out of range	> ± 10%
11	Ubatt 1 measurement failure or voltage programming output failure. Voltage programming output or measurement out of range	> ± 10%
12	Ubatt 2 measurement failure or voltage programming output failure. Voltage programming output or measurement out of range	> ± 10%
13	One of the relays controls wrong digital inputs	
14	Failure of relay K306 (UA) or relay K305 (NUA) or digital input 0 or 1 (rectifier failure inputs).	
15	Failure of relay K304 (MF) digital input 2 (external control input A) or digital input 5 (load fuse).	
16	Failure of relay K303 (AS) or digital input 3 (external control B) or digital input 6 (not used).	
17	Failure of relay K302 (TRIP1), K301 (TRIP2), K300 (TRIP3), digital input 4 (MF input) or digital input 7.	
18	One of the digital inputs is short circuit to 5 Volt.	
19	Uprog out of range: during the self test Uprog has to be >4.5V and < -4.5V related to Usys+. If this is not the case, this error code appears.	

Relay numbering according to the schematics of the new hardware.

28.Access Rights

X = These extended configurations options are accessible without hardware key by entering the code. Give access to certain extended configuration options without hardware key. Several different access rights are implemented:

Option	None	Sverige	Finland	Telekom DBP	All	Portugal Telekom	China	Nokia
10. Load Shunts		X	X		X			X
11. Batt Shunt		X	X		X			X
12. Boost Charge		X			X			X
13. Battery Test		X			X			X
14. Temp Comp		X			X			X
15. External Ctrl		X			X			X
16. RM Failure		X	X		X			X
17. Load Fuse		X	X		X			X
18. Batt Fuse		X	X		X			X
19. MF additional		X	X		X			X
20. Batt Failure		X	X		X			X
21. Tsense not ok		X	X		X			X
22. Base Voltage		X			X			X
23. Battery		X	X	X	X			X
24. Mains Monitor		X			X			X
25. MF→Usys-NUA		X			X			X
26. Change Code		X	X		X	X	X	X
27. Self Test								
28. Acc Rights								
29. Isys too high		X	X		X			X
30. Equalize		X			X			X
31. STÖK		X			X			X
32. TRIP2		X	X		X			X
33. TRIP1		X	X		X			X
34. TRIP3(RES)		X			X			X
35. Volt Ctrl		X			X			X
36. Alarm Stop		X			X			X
37. Display Irect		X			X			X
38. Loads		X	X		X			X
39. AS output		X	X		X			X

Option	None	Sverige	Finland	Telekom DBP	All	Portugal Telekom	China	Nokia
40. RS232		X	X		X			X
41. Batt Cur Lim		X			X			X
42. Alarm list		X			X			X
43. Alarm test		X			X			X
44. Batt Monitor		X			X			X
45. Psys too high		X	X		X			X
46. Temp too high		X			X			X
47. Report mode		X			X			X
48. MF output		X	X		X			X

If the access right "Nokia" is activated, all setup and configuration values are changed to fit to this application.

29.Isys too high

Choose action in case the system current is higher than the maximal system current 'Isys max'. Possible actions: noAl, NUA, UA. Choose maximal system current in menu option '4.7.Isys max'.

If fuse supervision is chosen the 'normal Isys max' function is suppressed. Choose maximal load fuse current in menu option '4.11.Ifuse max'. If the current is above 100% of the current value, an urgent alarm is created. Otherwise if the value is above 80% of the value, a not urgent alarm is created.

30.Equalize

Disable/enable equalize function. The parameters are set in the menu.

Option	Function
Not available:	Equalized not available
Available:	Equalized available, voltage not temperature compensated
Temp Comp:	Equalize available, voltage temperature compensated. Uses the same Tcoefficient as normal Usys. Ordinary Temp Comp must be enabled (if not, equalize will be uncompensated).

31.STÖK inputs

The STÖK inputs can be used for different functions, if 'External Control' is not enabled:

Option	Function
Not used	STÖK inputs not used
SAE Ctrl	Enable SAE function
Pakistan Ctrl	Enable smoke and ambient temperature alarm function
aux NUA/NUA	Auxiliary alarm input for general purpose. STÖK A and B inputs cause NUA
aux NUA/UA	STÖK A causes NUA, STÖK B causes UA

aux UA/UA	STÖK A and STÖK B cause UA
Sep Charge	Separate discharging/charging can be started via STÖK B.
Ext.BattTest	Usupport level (battery test according STÖK) can be started from externally. STÖK input A = 0, B = 1 (0 = Usys- or input open, 1 = Usys)
Suppr.Boost/Equalize	Boost charge and Equalize can be suppressed/stopped from externally. STÖK input A = 1, B = 0 (0 = Usys- or input open, 1 = Usys)
auxNUA/InvNUA	STÖK inputA = Auxiliary alarm 1, NUA B = Inverter alarm, NUA
auxNUA/InvUA	STÖK inputA = Auxiliary alarm 1, NUA B = Inverter alarm, UA
AuxUA/InvNUA	STÖK inputA = Auxiliary alarm 1, UA B = Inverter alarm, NUA
auxUA/InvUA	STÖK inputA = Auxiliary alarm 1, UA B = Inverter alarm, UA

33.TRIP1

Determines control of TRIP1 relay:

Option	**Function**
Not used	TRIP1 relay not used
Low Volt-UA	Controlled by low system voltage. When activated, UA is generated. Parameters in menu points 11.1 and 11.2
Temp Ctrl-noAl	Controlled by temperature, no alarm when activated
Temp Ctrl-NUA	Controlled by temperature, NUA when activated
TempCtrl-UA	Controlled by temperature, UA when activated
Low Volt-NoAl	Controlled by low system voltage. When activated, no alarm is generated. Parameters in menu points 11.1 and 11.2
Low Volt-NUA	Controlled by low system voltage. When activated, NUA is generated. Parameters in menu points 11.1 and 11.2
Usys measure	Controlled by system voltage measurement plausibility test. Activated when Usys is not plausible
V+T ctrl-UA	Controlled by low system voltage and by temperature. When one is activated, UA is generated. Voltage parameters in menu points 11.1 and 11.2, temperature parameters in menu points 11.3 and 11.4
Equalize ind.	Activated when Equalize in progress
Alarm indicat.	TRIP1 relay is activated if MF, NUA or UA is active
V+MF CTRL UA	TRIP1 relay activated if delay after begin of mains failure expired or undervoltage condition fulfilled. UA is activated.
V+MF CTRL NoAl	TRIP1 relay activated if delay after begin of mains failure expired or undervoltage condition fulfilled. No alarm is activated.
V+MF CTRL NUA	TRIP1 relay activated if delay after begin of mains failure expired or undervoltage condition fulfilled. NUA is activated.
Battery Low	visible, but no functionality implemented behind yet
Battery Empty	visible, but no functionality implemented behind yet

Q Ctrl UA	TRIP1 relay activated if specified capacity discharged. UA is activated.
Q Ctrl NoAl	TRIP1 relay activated if specified capacity discharged. No alarm is activated.
Q Ctrl NUA	TRIP1 relay activated if specified capacity discharged. NUA is activated.

34. TRIP3 (RES)

Determines control of TRIP3 (RES) relay:

Option	**Function**
not used	TRIP3 (RES) relay not used
Batt test ind	Activated when Battery Test in progress
Temp switch	Used for Temperature comparison. Needs a special hardware (TEMPO or COBOC)
Low Volt-NoAl	Controlled by low system voltage. When activated, no alarm is generated. Parameters in menu points 11.16 and 11.17
Low Volt-NUA	Controlled by low system voltage. When activated, NUA is generated. Parameters in menu points 11.16 and 11.17
Low Volt-UA	Controlled by low system voltage. When activated, UA is generated. Parameters in menu points 11.16 and 11.17
Fast low volt	Controlled by low system voltage. The unfiltered voltage measurement value is taken to have a response time as fast as possible (about 2 seconds). No alarm is generated. Parameters in menu points 11.16 and 11.17
Alarm indicat.	TRIP3 relay is activated if MF, NUA or UA is active
V+MF CTRL UA	TRIP3 relay activated if delay after begin of mains failure expired or undervoltage condition fulfilled. UA is activated.
V+MF CTRL NoAl	TRIP3 relay activated if delay after begin of mains failure expired or undervoltage condition fulfilled. No alarm is activated.
V+MF CTRL NUA	TRIP3 relay activated if delay after begin of mains failure expired or undervoltage condition fulfilled. NUA is activated.
Battery Low	visible, but no functionality implemented behind yet
Battery Empty	visible, but no functionality implemented behind yet
Q Ctrl UA	TRIP3 relay activated if specified capacity discharged. UA is activated.
Q Ctrl NoAl	TRIP3 relay activated if specified capacity discharged. No alarm is activated.
Q Ctrl NUA	TRIP3 relay activated if specified capacity discharged. NUA is activated.

Note! *First series of PSC 1000 were shipped without TRIP3 (RES) relay being mounted. However, the printed circuit board is prepared and the relay can easily be mounted. The respective connector is mounted on the COBO board.*

35.Volt Ctrl

Disable/enable voltage control output.

Option	Function
Not available	For systems where PSC 1000 is used as monitor only and does not control the system voltage.
fast	Control algorithm 'fast' is applied.
smart	Control algorithm 'smart' is applied.

36.Alarm Stop

Configuration of remote alarm pattern when '3.1.Alarm Stop' function is activated.

Option	Function
All	NUA, UA, MF stopped from being output via relays
Except MF	NUA, UA stopped from being output via relays
All no code	Like 'All' but no code necessary for access in setUp menu
ex.MF no code	Like 'Except MF' but no code necessary for access in setUp menu

37.Display Irect

Enable/disable display of calculated rectifier current.

Has been made configurable because there could there be systems with the load current or a part of it not being measured.

38.Max Loads

Number of loads can be chosen. If only 1 load is chosen, then menu page '1.2.Isys' does not appear. The unused inputs on COBO do not need to be short circuited.

39.AS output

Alarm stop relay AS can be used as configurable output:

Option	Function
normal	Activated when alarm stop is active
Boost indic.	Activated when boost charge in progress
Batt test ind	Activated when batt test in progress
B.fuse blown	Activated when battery fuse blown
L.fuse blown	Activated when load fuse blown
Batt fail	Activated when battery failure
Rect fail	Activated when one or more rectifiers failed
Volt UA	Activated when voltage below UA threshold
Discharging	Activated when battery being discharged
Tamb ctrl	Controlled by ambient temperature (Temp2), activated when temp too high

40.RS 232

Access function. The parameters are set in the menu.

Option	Function
not available	No access through RS232
available	Remote and terminal access through RS232
Param change	Remote and terminal access through RS232, parameter change possible remotely (refer to section 4.12)

41.Batt Curr Lim

Disable/enable battery charging current limitation function. The parameters are set in the menu.

42.Alarm list

Defines which alarms are listed in the alarm list.

Possible combinations: NUA + UA (as up to now) or NUA + UA + MF

43.Alarm test

Disable/enable the alarm test function:

Option	Function
No test	No alarm relay test can be done
Auto	Automatic test of all alarms
Manual	Test one by one of all alarms

44.Batt Monitor

Disable/enable battery monitor function. Can only used with power system manager PSM magic:

Option	Function
Not available:	No storage of battery data
Daily:	Daily average value, stored every day one set
Weekly:	Average value for one week, stored every week one set

45.Psys too high

Choose action in case the system power is higher than maximal system power 'Psys max'. Possible actions: noAl, NUA, UA. Choose maximal system power in menu option '4.10.Psys max'.

46.Temp too high

Choose action in case the temperature is higher than the limit. Possible actions: noAl, NUA, UA. Set the parameter in menu option '4.12.Temp high' and '4.13. Temp ok'.

47.Report Mode

Disable/enable report mode function. If it is enabled it can be activated or deactivated in the menu 12.7

48.MF output

Mains Failure relay MF can be used as configurable output:

Option	Function
Normal	Activated when mains failure is active
Boost indic.	Activated when boost charge in progress
Batt test ind	Activated when battery test in progress
B.fuse blown	Activated when battery fuse blown
L.fuse blown	Activated when load fuse blown
Batt fail	Activated when battery failure
Rect fail	Activated when one or more than one rectifiers failed
Volt UA	Activated when voltage below UA threshold
Discharging	Activated when battery being discharged
Tamb ctrl	Controlled by ambient temperature (Temp2) activated if temperature > 40.0°C, deactivated if temperature < 30.0°C

7 MAINTENANCE MENU

A maintenance menu is located on main menu level under a PSC version display. In the maintenance menu the load and battery shunt values and codes of numbers about the system configuration are displayed in three parts. The meanings of the codes are presented in following tables.

7.1 Configuration 1 code

XXXXX-xxxx-xxxxx

Xxxxx	12.Boost Charge	0 = not available 1 = available 2 = Temp Comp
x**X**xxx	13.Battery Test	0 = not available 1 = available (Cap to perform) 2 = available UmId 3 = available capa
xx**X**xx	14.Temp Comp	0 = not available 1 = 0..45 2 = 10..45 3 = User def. + OTP
xxx**X**x	15.Ext.Control	0 = not available
xxxx**X**	30.Equalize	0 = not available 1 = available 2 = Temp Comp

xxxxx-**XXXX**-xxxxx

Xxxx	22.Base Voltage	0 = 24 Volt 1 = 36 Volt 2 = 48 Volt 3 = 60 Volt 4 = 48 Volt fan cooled rectifier
x**X**xx	23.Battery	0 = No battery 1 = One battery string 2 = Two battery strings 3 = One smart battery string 4 = Two smart battery strings
xx**X**x	24.Mains Monitor	0 = External Mains Failure relay, digital input 1 = Rectifier and Batt current based
xxx**X**	28.Access rights	0 = None 1 = Sverige 2 = Finland 3 = Telekom DBP 4 = All 5 = Portel 6 = China 7 = Nokia

xxxxx-xxxx-**XXXXX**

Xxxxx	31.STÖK Inputs	0 = not used 1 = SAE Ctrl 2 = Pakistan 3 = aux NUA/NUA 4 = aux NUA/UA 5 = aux UA/ UA 6 = Sep Charge 7 = Ext.BattTest 8 = Sup Boost/Equ 9 = aux NUA/InvNUA A = aux NUA/InvUA B = aux UA/InvNUA C = aux UA/InvUA
x**X**xxx	32.TRIP2 relay	0 = not used 1 = Low Volt-UA 2 = Temp Ctrl-NoAl 3 = Temp Ctrl-NUA 4 = Temp Ctrl-UA 5 = Boost charge indication 6 = Battery test indication 7 = System OVP 8 = Low Volt-NoAl 9 = Low Volt-NUA A = Add NUA B = Add UA C = Thigh/low-NoAl D = Thigh/low-NUA E = Thigh/low-UA F = Tamb ctrl - No Alarm G = Alarm indicat H = Load fuse blown I = V+MF Ctrl UA J = V+MF Ctrl NoAl K = V+MF Ctrl NUA L = Battery Low M = Battery Empty N = Q Ctrl UA O = Q Ctrl NoAl P = Q Ctrl NUA
Xx**X**xx	33.TRIP1 relay	0 = not used 1 = Low Volt-UA 2 = Temp Ctrl-NoAl 3 = Temp Ctrl-NUA 4 = Temp Ctrl-UAl 5 = Low Volt-NoAl 6 = Low Volt-NUA 7 = Usys measure 8 = V + T Ctrl – UA 9 = Equalize indication A = Mains failure B = Alarm indicat

		C = V+MF Ctrl UA D = V+MF Ctrl NoAl E = V+MF Ctrl NUA F = Battery Low G = Battery Empty H = Q Ctrl UA I = Q Ctrl NoAl J = Q Ctrl NUA
xxx**X**x	34.TRIP3 (RES) relay	0 = not used 1 = Battery test indication 2 = Temp switch 3 = Low Volt – UA 4 = Low Volt - No Alarm 5 = Low Volt – NUA 6 = Fast low volt 7 = Alarm indicat 8 = V+MF Ctrl UA 9 = V+MF Ctrl NoAl A = V+MF Ctrl NUA B = Battery Low C = Battery Empty D = Load fuse blown E = Q Ctrl UA F = Q Ctrl NoAl G = Q Ctrl NUA
xxxx**X**	35.Usys control	0 = not available 1 = fast 2 = smart

7.2 Configuration 2 code

XXXX-xxxx-xxxx

Xxxx	16.RM Failure	0 = No alarm if one rect failed UA if more than 1 failed 1 = NUA if one rect failed UA if more than 1 failed 2 = UA if one or more rect failed 3 = If one or more rect failed then NUA if current into battery, UA if current out of battery 4 = UA – DBP Scheme
x**X**xx	17.Load Fuse	0 = No alarm 1 = Not urgent alarm 2 = Urgent alarm
xx**X**x	18.Batt Fuse	0 = No alarm 1 = Not urgent alarm 2 = Urgent alarm
xxx**X**	19.MF additional	0 = MF alarm + no alarm 1 = MF alarm + NUA (delayed) 2 = MF alarm + UA (delayed) 3 = MF delayed

xxxx-**XXXX**-xxxx

Xxxx	20.Batt Failure	1 = Not urgent alarm 2 = Urgent alarm
x**X**xx	21.Tsense not ok	1 = Not urgent alarm 2 = Urgent alarm
xx**X**x	25.MF, Alarm-handling due to incorrect Usys	0 = Normal 1 = NUA suppressed 2 = UA delayed 25 3 = NUA suppressed and UA delayed 25 4 = UA delayed (adjustable) 5 = NUA suppr. and UA delayed (adjustable)
xxx**X**	29.Isys too high	0 = No alarm 1 = Not urgent alarm 2 = Urgent alarm 3 = Fuse NUA/UA

xxxx-xxxx-**XXXX**

Xxxx	36.Alarm stop	0 = All 1 = Except MF 2 = All, no code 3 = Except MF, no code
x**X**xx	37.Display Irect	0 = Not available 1 = Available
xx**X**x	38.Max Loads	1 = 1 load displayed and used 2 = 2 load displayed and used 3 = 3 load displayed and used
xxx**X**	39.AS output	0 = Normal 1 = Boost indication 2 = Batt test indication 3 = Battery fuse blown 4 = Load fuse blown 5 = Battery failure 6 = Rectifier failure 7 = Indication of UA due to low voltage 8 = Discharge 9 = Temp Ctrl

7.3 Configuration 3 code

XXXX-xxxxx-x0000

Xxxx	40.RS-232	0 = Not available 1 = Available 2 = Param change
x**X**xx	41.Batt curr limit	0 = Not available 1 = Ibatt total
xx**X**x	42.Alarm list	2 = UA+NUA 3 = UA+NUA+MF
xxx**X**	43.Alarm test	0 = No test 1 = Auto 2 = Manual

xxxx-**XXXXX**-x0000

Xxxxx	44.Batt Monitor	0 = Not available 1 = Daily 2 = Weekly
x**X**xxx	45.Psys too high	0 = No alarm 1 = Not urgent alarm 2 = Urgent alarm
xx**X**xx	46.Temp too high	0 = No alarm 1 = Not urgent alarm 2 = Urgent alarm
xxx**X**x	Battery application	0 = Not available 1 = Smart application
xxxx**X**	47.Report Mode	0 = Not available 1 = Available

xxxx-xxxxx-**X0000**

Xxxxx	39.MF output	0 = Normal 1 = Boost indication 2 = Battery test indication 3 = Battery fuse blown 4 = Load fuse blown 5 = Battery failure 6 = Rectifier failure 7 = Indication of UA due to low voltage 8 = Discharge 9 = Temp Ctrl

8 CONNECTION BOARD (COBOMO)

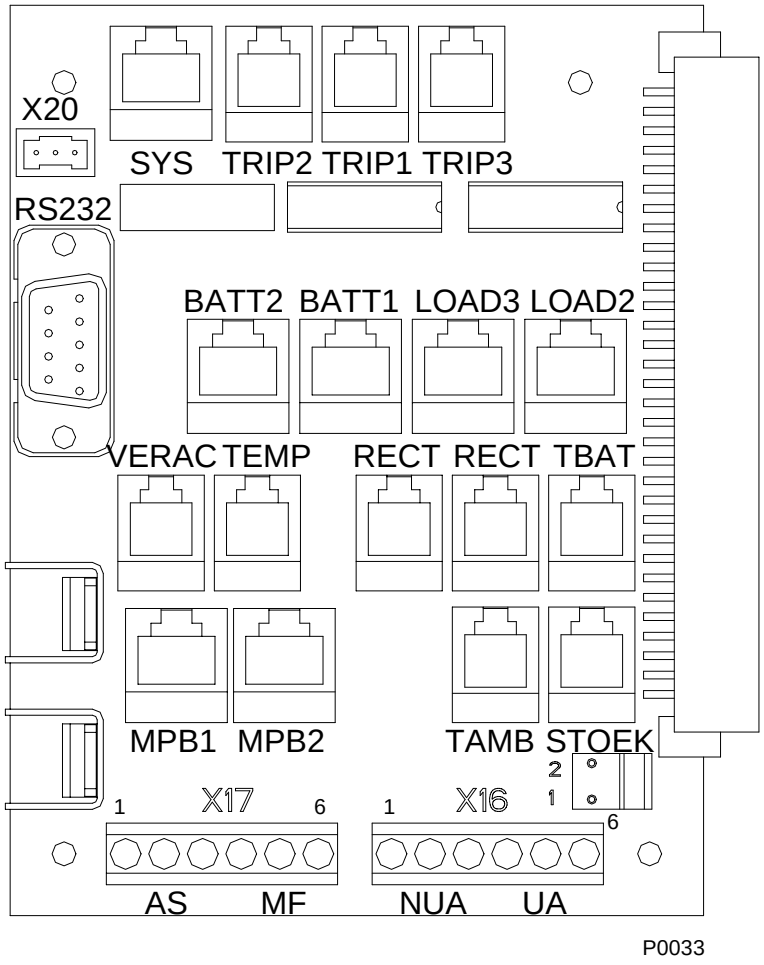


Figure 22. COBOMO-card

8.1 Part layout

SYS	System voltage, Load current1 and load fuse group1 input
TRIP1	Configurable relay output
TRIP2	Configurable relay output
TRIP3(RES)	Configurable relay output
BATT2	Battery voltage2, Battery current2 and Battery fuse2 input
BATT1	Battery voltage1, Battery current1 and Battery fuse1 input
LOAD3	Load current3 and load fuse group3 input
LOAD2	Load current2 and load fuse group2 input
VERAC	External mains monitoring input
TEMP	Temperature sensor input
RECT	Rectifier control bus input

RECT	Rectifier control bus input
STOEK	STÖK-input
RS232	Serial port
X20	Power connector for modem
DFU	Power connector for the controller
AS	Alarms Stopped
MF	Mains Failure
NUA	Not Urgent Alarm
UA	Urgent Alarm

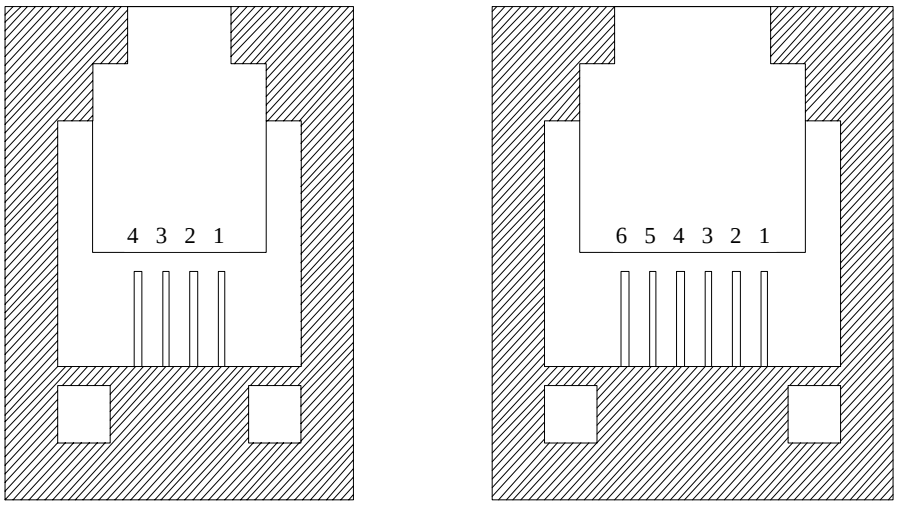


Figure 23. 4-pole and 6-pole connectors.

U_{SYS}:

X1-1 = LOAD_CUR1 +

X1-2 = LOAD_CUR1 –

X1-3 = LOAD_FUSE

X1-4 = U_{SYS} +

X1-5 = SYS_VOL +

X1-6 = SYS_VOL –

LOAD3:

X2-1 = LOAD_CUR3 +

X2-2 = LOAD_CUR3 –

X2-3 = LOAD_FUSE

X2-4 = U_{SYS} +

X2-5 = U_{SYS} +

X2-6 = U_{SYS} +

LOAD2:

X3-1 = LOAD_CUR2 +

X3-2 = LOAD_CUR2 –

X3-3 = LOAD_FUSE

X3-4 = U_{SYS} +

X3-5 = U_{SYS} +

X3-6 = U_{SYS} +

BATT1:

X13-1 = BAT_CUR1 +

X13-2 = BAT_CUR1 –

X13-3 = BAT_FUSE1 +

X13-4 = BAT_FUSE1 -

X13-5 = BAT_VOL1 +

X13-6 = BAT_VOL1 –

BATT2:

X12-1 = BAT_CUR2 +

X12-2 = BAT_CUR2 –

X12-3 = BAT_FUSE2 +

X12-4 = BAT_FUSE2 –

X12-5 = BAT_VOL2 +

X12-6 = BAT_VOL2 –

RECT:

X9-1 = LOADSHARE

X9-2 = U_{SYS} +

X9-3 = U_{PROG}

X9-4 = RECT-FAIL

RECT:

X10-1 = LOADSHARE

X10-2 = U_{SYS} +

X10-3 = U_{PROG}

X10-4 = RECT-FAIL

RES:

X15-1 = RES.1

X15-2 = RES.2

X15-3 = RES.3

X15-4 = U_{SYS} +

TEMP:

X14-1 = U_{SYS} +

X14-2 = TEMP +

X14-3 = TEMP -

X14-4 = U_{SYS} +

VERAC:

X5-1 = MAINS_FUSE

X5-2 = U_{SYS} +

X5-3 = U_{SYS} +

X5-4 = U_{SYS} +

TRIP1:

X7-1 = TRIP 1.1

X7-2 = TRIP 1.2

X7-3 = TRIP 1.3

X7-4 = U_{SYS} +

STÖK:

X11-1 = STÖK -A

X11-2 = STÖK -B

X11-3 = LOAD_CUR +

X11-4 = LOAD_CUR -

TRIP2:

X6-1 = TRIP 2.1

X6-2 = TRIP 2.2

X6-3 = TRIP 2.3

X6-4 = U_{SYS} +

DFU:

X8-1 = U_{SYS} +

X8-2 = U_{SYS} -

X6-3 = TRIP 2.3

X6-4 = U_{SYS} +

8.2 Remote alarm contacts

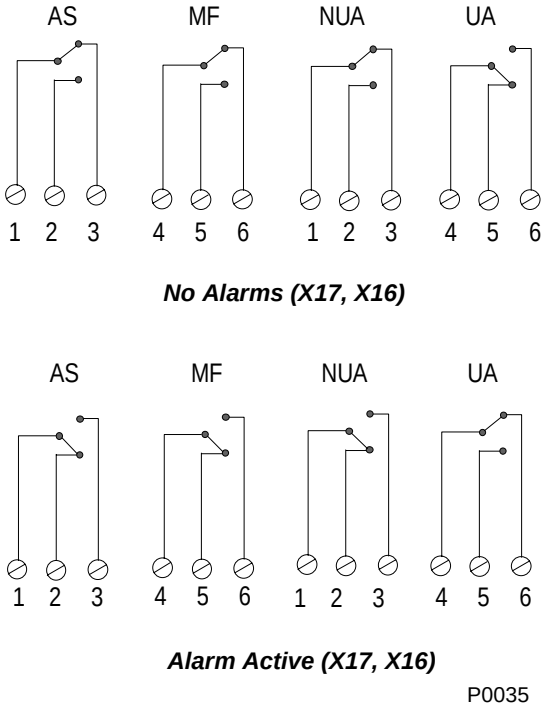


Figure 24. Remote alarm contacts. No Alarm and Alarm Active.

DELTA Energy Systems

ODPS 2000B-48-4 MPS

Outdoor Power Supply System

Installation and Commissioning

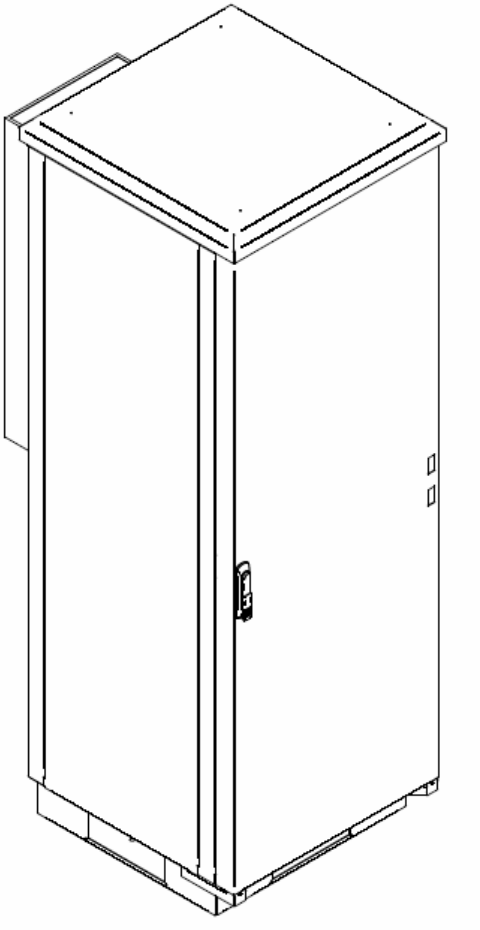


TABLE OF CONTENTS

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1 DOCUMENT INFORMATION

1.1 Version control

Document number	**Document description**	
IC_DPS2000B_48_4- MPS V.0.doc	ODPS 2000B-48-4 MPS Installation and Commissioning	
Previous version	**Description of changes**	
	New document	
	Controlled by	**Date**
	Andrzej Chaberek	29.10.2007

Approved by	**Date**

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2 INSTALLATION

2.1 Before you begin

Step 1. Ensure that you have all the equipment needed to make a proper installation of the system.

Step 2. Also ensure that grounding terminals, DC- and AC-distributions are properly available.

Step 3. Take care that the regulations of IEC 60364 and CENELEC HD384 concerning installation and assembling of telecommunication and electrical equipment have been noticed. The local regulations and special instructions must also be noticed during the work. When choosing the place of the installation, please notice that the cooling air must flow without restrictions through the ventilation holes. The system must have enough space in front of it for operation and service functions. Notice the direction of the cabling and the required space of the other equipment.

2.2 Unpacking the system

Step 1. Check that the received cargo is according to the packing list.

Step 2. Ensure that the rack and the equipment are not damaged during transportation.

Step 3. Check that proper documents are delivered with the system and necessary contact information for technical support is included.

3 SYSTEM CONFIGURATION

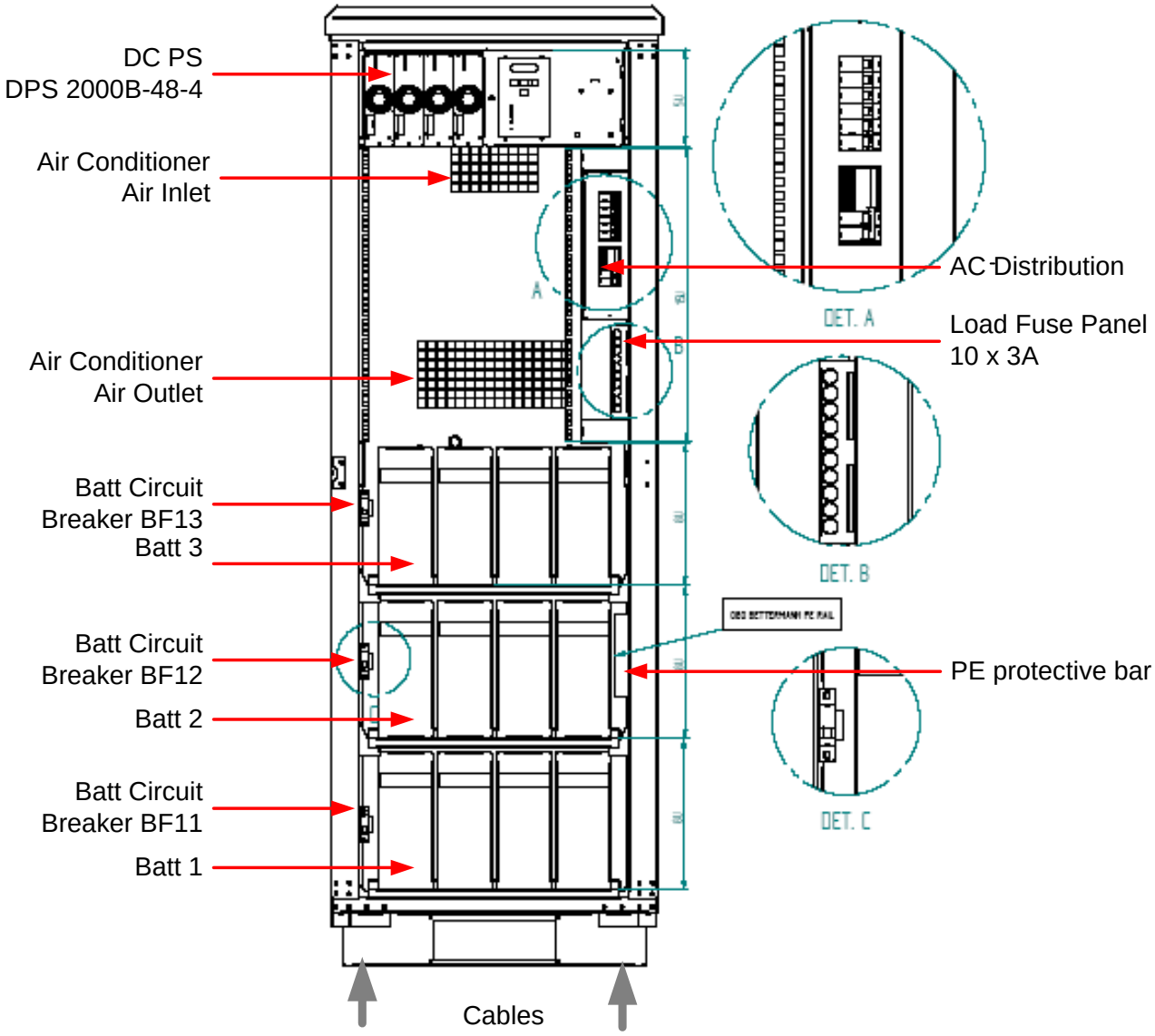


Figure 1. ODPS 2000B-48-4 MPS system configuration.

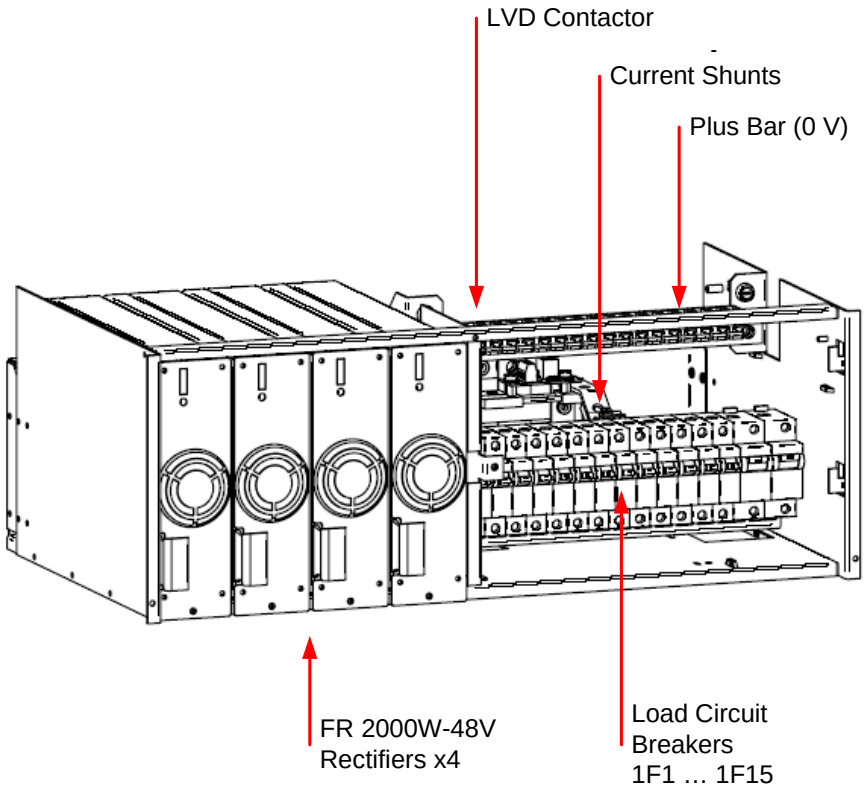


Figure 2. DPS 2000B-48-4 DC Power Supply System.

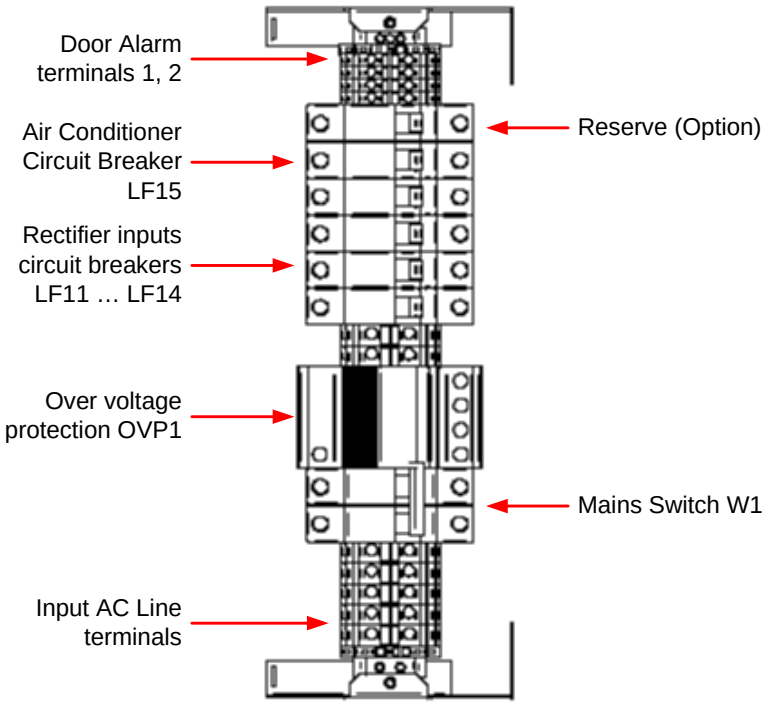


Figure 3. ODPS 2000B-48-4 AC Distribution.

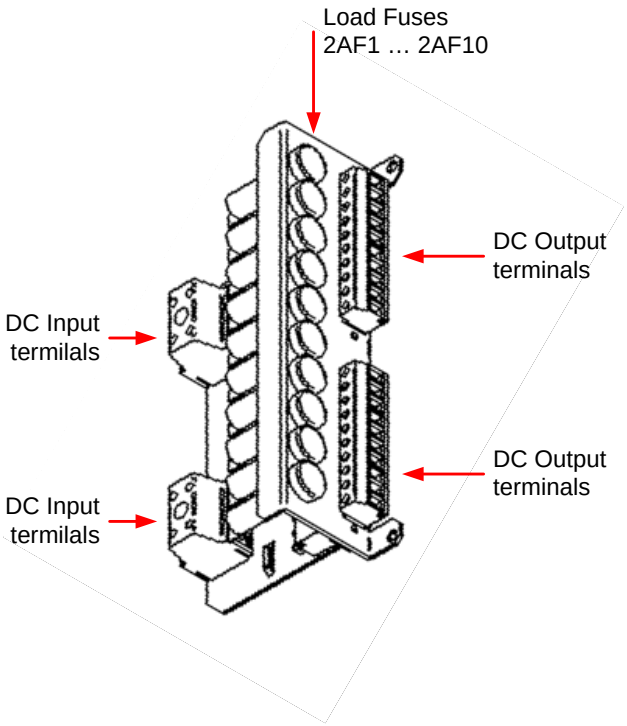


Figure 4. ODPS 2000B-48-4 Load Fuse Panel.

4 INSTALLATION

4.1 System cabinet installation

Step 1 Check if the ground base is well prepared for the installation (horizontal level, dimensioning of the mounting holes or screws, (Fig 4)

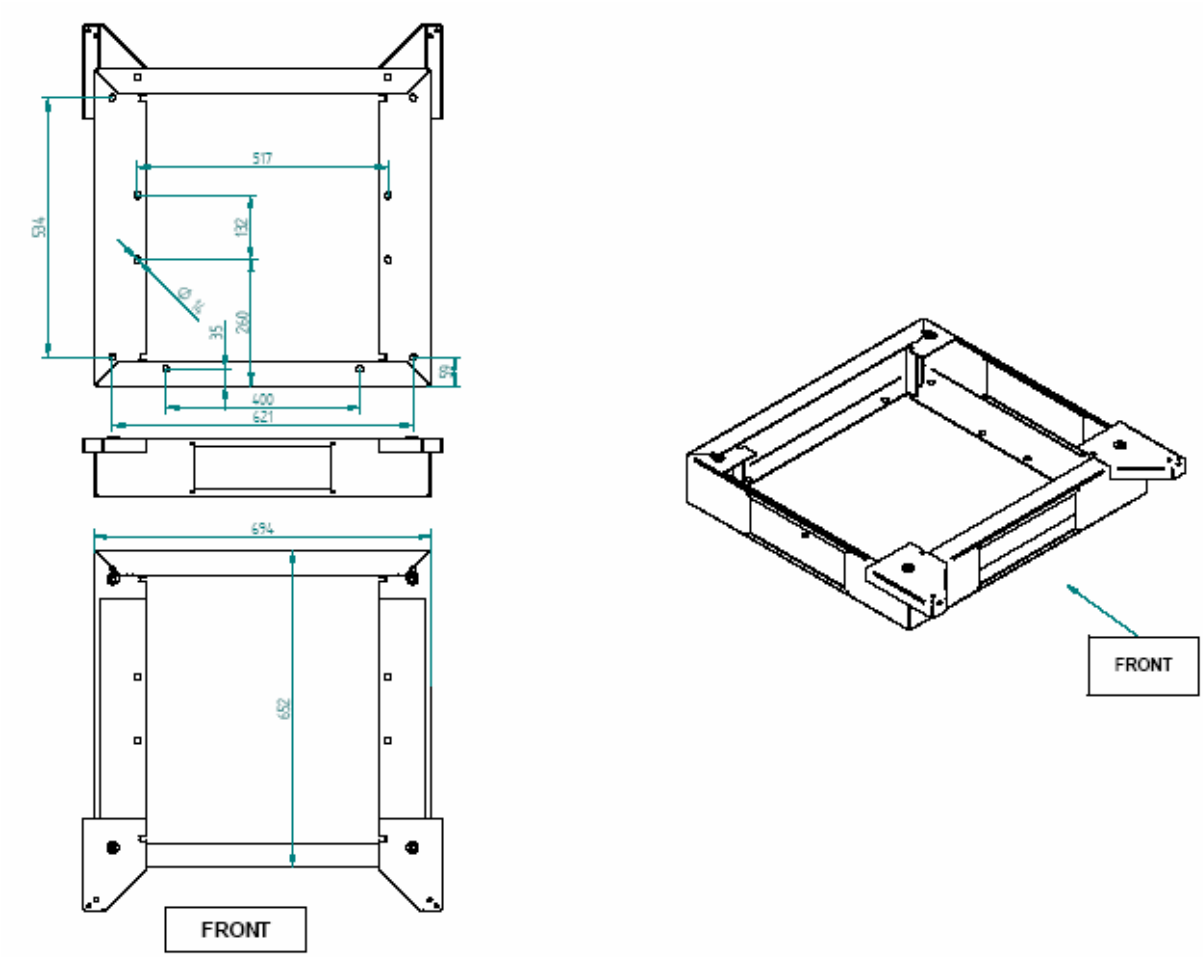


Figure 5. The cabinet plinth.

Step 2 If the cabinet have to be lifted onto the place by the crane follow the next steps, if not go to step 6 and then 8

Step 3 Remove the cabinet roof. In order to unscrew the two bolts located on front top of the cabinet ceiling, then push the roof to the back to release the back fixation and take off the roof from the cabinet finally.

Step 4 Remove 4 blind bolts on the corners of top cover and install eye bolts delivered with the cabinets in these holes.

Step 5 Connect hang lines (length min 1000 mm) to the 4 lifting eye installed on the roof and lift the cabinet onto the position by crane (Fig 6).

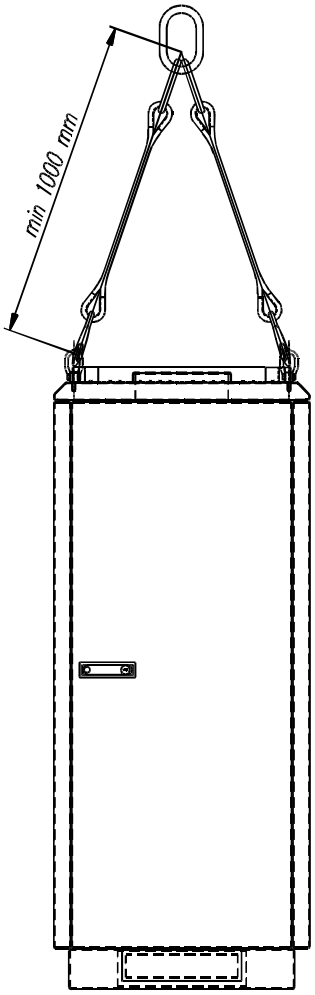


Figure 6. Lifting the cabinet by crane

Step 6 Set the system cabinet standing in its place and straighten it if needed by aluminum or stainless pads.

Step 7 Bolt the cabinet to the ground by 4 screws (M10/50mm) It is necessary to remove the bottom battery shelf and cabinet floor cover to get access to the plinth mounting holes (Fig 5).

Step 8 Install cabinet roof on their position.

4.2 Electrical connections

Note!	*Make sure that all the circuit breakers are in OFF-position.*

The input / output cables could be insert to the cabinet from the bottom, through input sleeve packing on the cabinet plinth

In any case enough length of the cables has to be ensured to make the connections inside the cabinet

4.2.1 Grounding

Step 1 Connect the protective-grounding screw located on the rear side of the cabinet plinth to the main grounding bus bar of the site using proper cable. (35 mm^2).

Note!	*In standard system the common positive bar (L+) is not connected to protecting bar (PE). If such connection is required according local regulation, the internal cable (min 16 mm^2) should be install by service team to connect the positive bar (L+) to the protective-grounding bar PE on right side of the cabinet.*

4.2.2 AC-connection

The AC input terminals are located into AC distribution panel (see Fig. 3)

The system in standard version is prepared to supply via tree phases (L1, L2, L3, N, PE) line in TN-S configuration.

Step 2 Connect AC line cables to the input terminals in AC distribution – PE cable to the PE terminal, phase cables to the phase terminals L1, L2, L3 and the neutral cable to the N terminal (see Fig. 3)

Note!	*The system could be powered also by one phase AC line. In that case the input terminals L1, L2, L3 should be shorted by special bridge or by simple cable connection.*
Note!	*Check the AC-connections from the wiring diagram.*

4.3 Battery connections

Step 1 Install the batteries in their shelves. Connect the internal battery cables so that the total nominal voltage of the each battery string is 48 V. Connect the system's pre-installed battery connection cable marked as "+" to the free plus-pole of the battery string and the cable marked as "-" to the free negative pole. The location of batteries depends on the battery type used. The battery strings are numbered according to the battery fuse it is connected to.

Step 2 Place the battery temperature sensor between the batteries in the battery area. Fasten the sensor cable to the subrack.

4.4 Alarm connections

Step 1 Connect the remote alarm cable to their screw terminal in the COBOMO-card (Fig 7). The alarms are usually connected so, that the alarm circuit is closed and in a case of a fault the circuit opens.

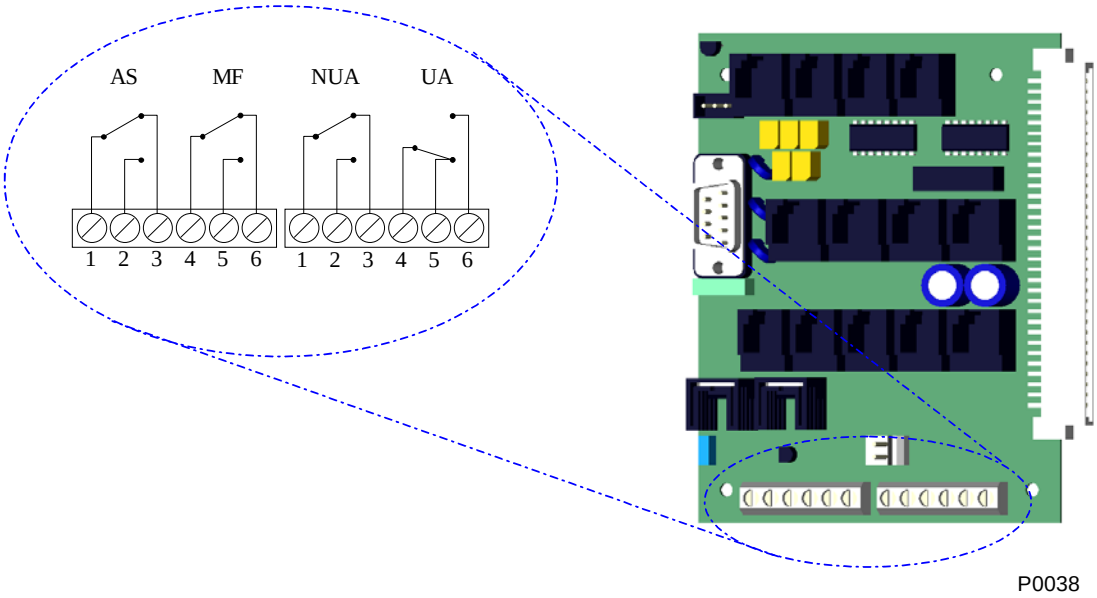


Figure 7. Alarm connections and the connection card (COBOMO).

Note!	***AS-Alarm Stop***	*Left side terminal block pins 1 - 3.*
	MF-Mains failure	*Left side terminal block pins 4 - 6.*
	NUA-Not urgent alarm	*Right side terminal block pins 1 - 3.*
	UA-Urgent alarm	*Right side terminal block pins 4 - 6.*

Step 2 Connect the remote alarm cable to the door alarm screw terminals 1, 2 located in the AC distribution. (Fig.3).

Step 3 Connect the remote alarm cable to the screw terminals 2, L, 3, of the hygrostat located on the right side of the cabinet if it is required.

4.5 DC-load connections

Step 1. Connect the distribution cables to DC power supply system. Plus cables are connected to the positive bus bar (L+) of the system and the negative cables directly to the terminals of the DC-distribution circuit breakers 1F1 ... 1F15.

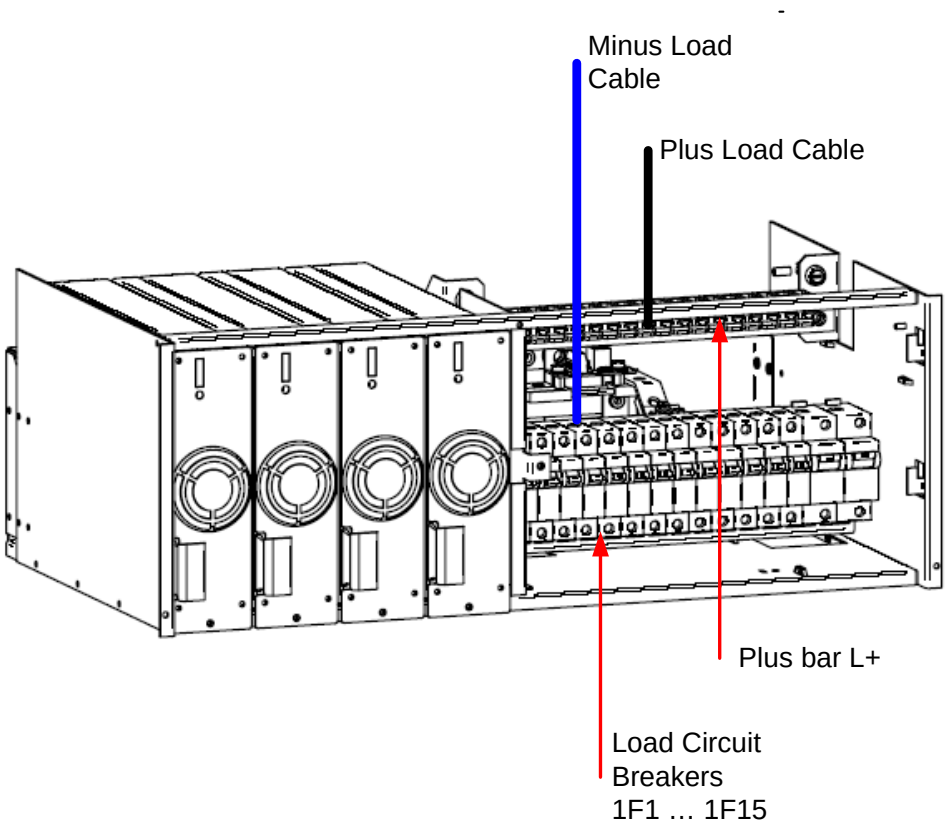


Figure 8. DPS 2000B-48-4 Connection of distribution cables.

Note!	*The maximum cable size for the connectors on the positive busbar is 16 mm^2 for the MCBs 1 A - 32 A. For MCBs 40 A - 120 A maximum cable size is 35mm^2.*

Step 2. Connect the distribution cables to DC fuse panel
Plus and minus cables are connected to screw terminals of DC loads connectors on the fuse panel (Fig. 9).

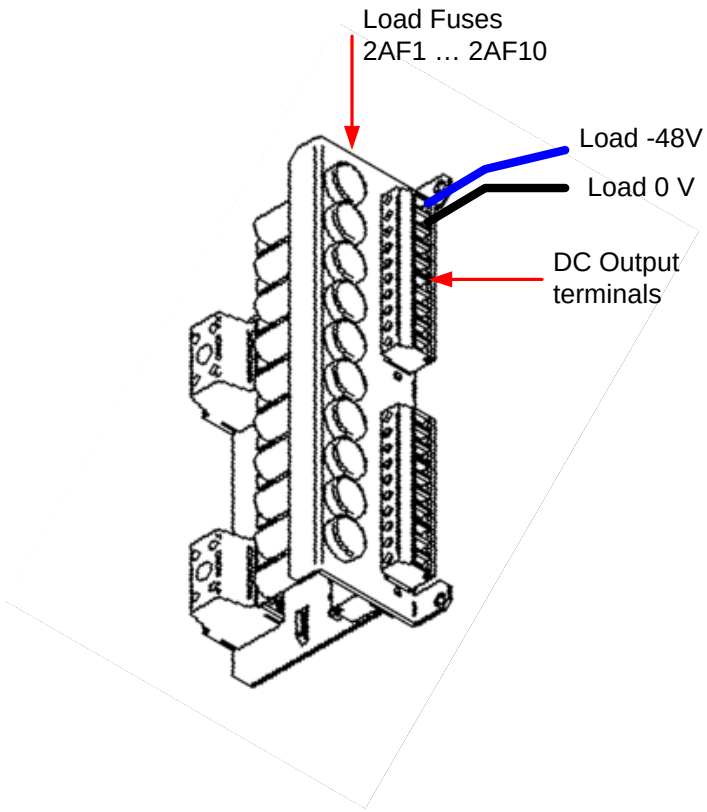


Figure 9. Connection of distribution cables to DC fuse panel.

Note!	*Check that the cabling is according to the wiring diagram and instructions.*

5 COMMISSIONING

5.1 Starting up the system

Remove the screws that are used to fasten the rectifiers to their places. Each rectifier is fastened with one screw. Lift the rectifiers into the cabinet to their shelves starting from the far-left slot and continuing to right, but do not connect any cables or connectors at this stage. Fasten the rectifiers with the screws.

Taking the system into use is presented below step-by-step.

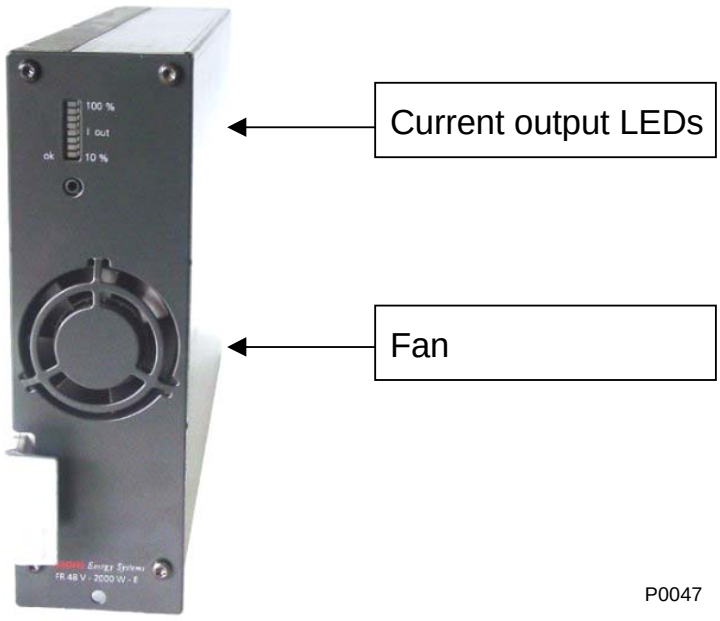


Figure 10. Rectifier FR 48V–2000W–E.

Step 1 Check that the connections are made according to the installation instructions and the wiring diagram.

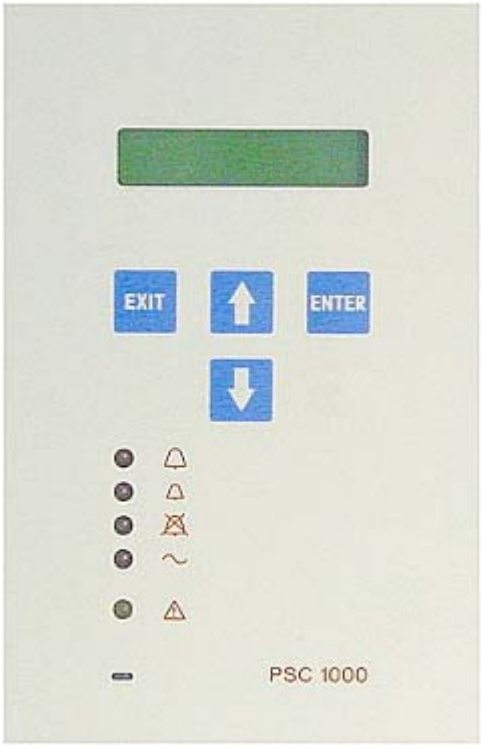
Step 2 Check that the battery circuit breakers BF11 ... BF13 are in “OFF”-position.

Step 3 Start up the system by switching the mains “ON”.

Step 4 Check LEDs “ok”.

5.1.1 Controller calibration

Calibrate the system voltage of the controller according to the following instructions.



P0012

Figure 11. PSC 1000 user interface.

Step 1 Controller of the system is pre-calibrated with rectifiers included by means of accurate meters in factory of Delta Energy Systems. Calibration is not needed unless some changes have been made for hardware of the controller or display of the controller is different than real accurate measurement in maintenance.

Step 2 Switch ON the controller circuit breaker AF1 to switch the controller on.

Step 3 Measure the system voltage between the plus bus bar (L+) and minus on the rectifier DC-output circuit breaker.

Step 4 Read the Usys value on the controller display (Menu 1.1).

Note!	*If the value differs from the measured value more than 0.1 Volts, the controller calibration should be performed. Otherwise continue to the Step 14. The calibration is explained in the following Steps 5-13.*

Step 5 Switch OFF the controller circuit breaker AF1 to switch the controller off.

Step 6 Switch ON the controller circuit breaker AF1 to switch the controller on. Immediately after switching on the AF1 press <ENTER> button on the controller while it is starting up and enter your code. The default factory setting for the code is <↑>, <↑>, <↓>, <EXIT>, <EXIT>, <ENTER>.

Step 7 Select the function “Cal Usys” on the controller display using up <↑> and down <↓> arrow buttons. Press <ENTER> to confirm your selection.

Step 8 Adjust the voltage level with the up and down arrow buttons on the controller to be same as measured.

Step 9 Press <ENTER> on the controller to start calibration. This will take about 6 seconds.

Step 10 Press <ENTER> again. The correct voltage value must now be shown on the controller display.

Step 11 Leave “Calibrate Usys”-function by pressing <EXIT> on the controller.

Step 12 Switch “OFF” the controller circuit breaker AF1

Step 13 Switch “ON” the controller circuit breaker AF1. The controller will perform a self-test.

Step 14 If there are no all battery strings installed in the system, check if the ends of minus battery cables for not installed batteries are insulated to avoid accidental short circuit to the chassis.

Step 15 Check the battery polarity (for installed batteries) by measuring the voltage over the battery circuit breakers BF11 ... BF13. The voltage should be at most a few volts. If voltage is more than that, the battery polarity is not correct and it must be changed by switching the “+” and “-” cables connected to the batteries. If the polarity is O.K. switch “ON” batteries circuit breakers.

Step 16 Check, that the load is connected to the distribution DC-terminals and switch on the DC-distribution circuit breakers, which are used for delivering the load .

Step 17 Check the functioning of the system according to the next two chapters for the rectifier and controller.

5.2 Checking the functioning of the rectifiers

Following procedures are able to accomplish only with a suitable DC-load available.

Step 1 Check that the rectifiers are able to deliver current. The method is to first discharge the batteries for a while and then recharge them. The controller carries out the procedure, which decreases the rectifier voltages below the discharging voltage of the batteries. Therefore in case of a battery failure the system will not crash.

Step 2 Start the discharging by activating the battery test manually from the controller menu “8. Battery Test” and then from its sub-menu “8.8 Battery Test ?”. Press <ENTER> to activate the test.

Step 3 Let the controller discharge the batteries a few minutes.

Step 4 Stop the battery test from the controller and exit from the battery test sub-menu on the controller.

5.3 Checking the control and alarm system

> ***Note!*** *The alarms, system voltage and temperature compensation settings are pre-set according to the used battery. If battery type used is different from the type the pre-set values were adjusted for, then the values must be changed according to the battery type and information of the battery manufacturer.*

5.3.1 Checking the configuration

Values are all pre-set by the factory, and should not be changed without a proper reason (see note above). The pre-set values can be found in the system's test report attached to this user manual. These sub-menus are protected against unauthorized access by a code. The factory setting of the code is <↑>, <↑>, <↓>, <EXIT>, <EXIT>, <ENTER>.

Step 1 The configuration menu is displayed after switching the controller on with the circuit breaker AF1 when the <ENTER> key of the controller is pressed.

Step 2 Restart the controller by switching off the PSC 1000 with AF1 and starting it again without pressing any key.

Step 3 Check the following settings:

Alarm limits: The alarm limits are set in the menu "4.Alarms". The factory setting can be found in test report: part 4 Alarms.

System voltage: The system voltage setting is made in the menu "5.Usys" The factory setting can be found in test report: part 5 Usys.

Temp Comp: The setting of the temperature compensation is made in the menu "6.Temp Comp" The factory settings can be found in test report: part 6 Temp Comp.

Battery Test: The settings for the battery test are made in the menu "8.Battery Test" The factory settings can be found in test report: part 8 Battery Test.

Equalize: The settings for the equalize charge are made in the menu "9.Equalize". The factory settings can be found in test report: part 9 Equalize.

> ***Note!*** *After changes save the settings in a menu "3. General" and sub-menu "3.5 Current Par save?".*

5.3.2 Check the alarms as follows

Step 4 With the alarm test function of the controller the functioning of the alarm relays and LEDs can be checked. The alarm test is on the controller menu “3 General” and its sub-menu “3.6 Alarm test”. When the option is selected, each LED will light up for a few seconds. During the alarm test all the functions of the controller remain active, except the alarm displays and the alarm relay circuits.

5.3.3 Check the fuse monitoring as follows

Step 5 Switch ON all the circuit breakers of the battery BF11 ... BF13 and the DC-distribution MCBs, which have load connected.

Note!	*The following procedure leaves the connected load without power as long as the MCBs are in the OFF-position, so make sure it is allowed to turn off the load as long as this test is going on.*

Step 6 Switch the load and battery breakers OFF and ON one after another, checking that the alarms are indicated as configured. Only the MCBs that are switched on and having the load or batteries connected will produce an alarm when switched off. Load fuse alarm will appear immediately, but battery fuse alarm may take a few minutes until battery voltage decreases enough (>200 mV). The active alarm can be read on the controller display by pressing the up <↑> key once to reach menu 8. The default output alarm class (NUA, UA) can be seen from the test report.

Step 7 Check the rectifier failure alarm by switching OFF the each input rectifier circuit breaker LF11 ... LF14 one at a time, and check the following:

Step 8 Check the battery current in the controller menu 1 (Display):

Battery current (Ibatt) positive ➔Not Urgent Alarm

Battery current (Ibatt) negative (battery is discharging) ➔Urgent Alarm

Load current (Iload) equals Battery current (Ibatt) ➔Mains Failure

The active alarm can be read on the controller display by pushing the up <↑> key once to reach menu 8.

Note!	*During the test there may occur Usys Low and Usys High alarms, which should be omitted at this stage. If there is no load connected to the system, no module alarm will occur. The additional module alarm (RF) does not light up any LEDs on the controller. The alarm can be seen on the menu display, and it is also seen in a remote location. It can be measured in the alarm cable (see alarm connections).*

5.3.4 Testing the mains failure alarm

Step 9 Switch all the rectifiers off manually by using the input rectifier circuit breaker LF11 ... LF14. The LED "~" on the controller front must light up.

Step 10 Switch the rectifiers on again. The LED "~" on the controller front must go out.

Note!	*If there is no load and batteries connected to the system, no mains failure alarm will occur.*
Note!	*After the testing, attach all the covers of the system to their correct places.*

DELTA *Energy Systems*

Troubleshooting
DC Power Supply Systems

60001_02
Issue 13 August 2003

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1 DOCUMENT INFORMATION

1.1 Version control

Document number	**Document description**
60001_02	Troubleshooting for DC Power Supply Systems.
Previous version	**Description of changes**
60001_01	Layout updated.

Controlled by	**Date**
	13.08.2003

Markku Havukainen

Approved by	**Date**
	13.08.2003

Petteri Turkki

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2 TROUBLESHOOTING

When trying to locate a fault in the power system proceed as follows:

Step 1. Check the controller front panel display and alarm LEDs

Step 2. Check the protocol menu in the PSC

Step 3. Check the LEDs on all rectifier front panels

2.1 Power system controller alarms and sources

This section helps to locate power system faults that are displayed in the PSC 1000. Below in section 2.1.2 “Alarms and alarm sources” is a list of possible alarms, errors and messages that appear in the protocol menu, following with information on the possible cause of a fault and its clearance.

2.1.1 Alarm LEDs of the PSC 1000

🔔 Urgent Alarm (UA)

🔔 Non-urgent Alarm (NUA)

~ Mains Failure (MF)

2.1.2 Alarms and alarm sources

RM Failure – UA	Rectifier failure according to configured scheme (→ Configuration).
RM Failure – NUA	Rectifier failure according to configured scheme (→ Configuration).
Load Fuse - UA/NUA/No Alarm	One or more load fuses blown. Alarm as configured (→ Configuration).
Battery Fuse - UA/NUA/No Alarm	One or more battery fuses blown. Alarm as configured (→ Configuration).
Usys high/Usys low – UA	System voltage above/below UA level 'Ua max'/'Ua min'. If charge mode is 'Battery Test', UA due to Usys low is suppressed.
Usys high/Usys low – NUA	System voltage above/below NUA level 'Us max'/'Us min'. If charge mode is 'TC Float Charge', NUA levels are temperature compensated. If charge mode is 'Boost Charge', 'Battery Test', 'Temp Comp' or 'Equalize' alarm is suppressed. If mains failure is active, alarm is or is not suppressed, according to chosen configuration (→ Configuration). Alarm is

	generated only a couple of seconds after level has been passed.
Utrip-low - UA/NUA/no Alarm	System voltage has dropped below 'Utrip-low' level for at least 20 seconds.
Isys high - NUA/UA	System current above 'Isys max'. Alarm as configured (→ Configuration).
Psys high - NUA/UA	System power above 'Psys max'. Alarm as configured (→ Configuration).
Battery Failure - UA/NUA	Battery test recognized battery as faulty. Alarm has to be reset manually. Alarm as configured (→ Configuration).
Battery Failure (U, I, T) - UA/NUA	Battery supervision recognized battery as faulty. Alarm has to be reset manually. Alarm as configured (→ Configuration).
Mains Failure – MF	Mains failure recognized
Mains Failure - UA/NUA	Additional alarm in case of mains failure - if configured so (→ Configuration). Generation of alarm may be delayed (menu option '4.9.MF delay').
Usys Measurement – UA	The measured system voltage is not plausible for at least 25 seconds. Plausible voltage: 10…90 Volt. When a failure in the measurement of the system voltage is recognized, the measured voltage is not considered any more for controlling the system voltage (= feed back loop stopped → open loop control).
Temp Measurement - UA/NUA	The measured battery temperature is not plausible for at least 2 consecutive measurement time slices. Plausible temperature: -20…+90°C. Alarm as configured (→ Configuration). When a failure in the measurement of the battery temperature is recognized, PSC 1000 stops temperature compensation of the system voltage.

Temp 2 Measurement - UA/NUA	The measured ambient temperature is not plausible for at least 25 seconds. Plausible temperature: -20…+90°C. Alarm as configured (→ Configuration). When a failure in the measurement of the ambient temperature is recognized, PSC 1000 stops temperature comparison of the battery supervision.
A/D Failure – UA	Analog/Digital Converter does not work properly. Hardware failure.
Alarm 1 - NUA/UA	Auxiliary alarm input for general purpose.
Alarm 2 - NUA/UA	Auxiliary alarm input for general purpose.
Utrip2-low - UA/NUA/no Alarm	System voltage has dropped below 'Utrip2-low' level for at least 20 seconds.
Utrip3-low - UA/NUA/no Alarm	System voltage has dropped below 'Utrip3-low' level for at least 20 seconds.
Temp TRIP1 - UA/NUA/No Alarm	Temperature has gone above 'Ttrip1-high' level for at least 20 seconds.
Temp TRIP2 - UA/NUA/No Alarm	Depending on configuration, either temperature has gone a) above 'Ttrip2 ↑' OR b) outside temperature band given by 'Ttrip2 ↑' and 'Ttrip ↓', for at least 20 seconds.
System OVP – UA	System over voltage protection procedure switches off the rectifiers (needs additional system hardware). Alarm has to be reset manually.
No Modem – NUA	If MODEM is not available  an not be initialized correctly.
Temp high - UA/NUA/No Alarm	Depending on configuration, either temperature has gone above 'Temp high', for at least 20 seconds.

2.2 Rectifier alarms

The following instructions can be helpful in case of a rectifier alarm, to find out whether a rectifier is faulty or the failure is outside the rectifier module.

2.2.1 Fan cooled rectifiers

Internal failures – except fan replacement – can only be repaired in Delta Energy Systems factory, therefore the faulty rectifier module in the system must be replaced with a new unit.

LED «ok» is off and an alarm is given:

Mains voltage is missing:	Check mains fuse and connector
OVP is activated:	Reset OVP by pulling out the connector for approx. 2 seconds
OTP is activated:	Check air flow at front, clean air filter
Fan failure, air flow blocked:	Check air flow at front, clean air filter, check fan and replace if necessary
Load sharing not working:	Check connector
DC connection open:	Check connector
Rectifier is faulty:	Replace rectifier module

If nothing helps, disconnect the AC connector (FR 48V-1200W) or pull out (FR 48V-2000W-E) the rectifier module for 1 minute to reset the microcontroller. The settings can only be checked or adjusted via separate connector to an external programming box containing the appropriated software.

2.2.2 SMPS rectifiers

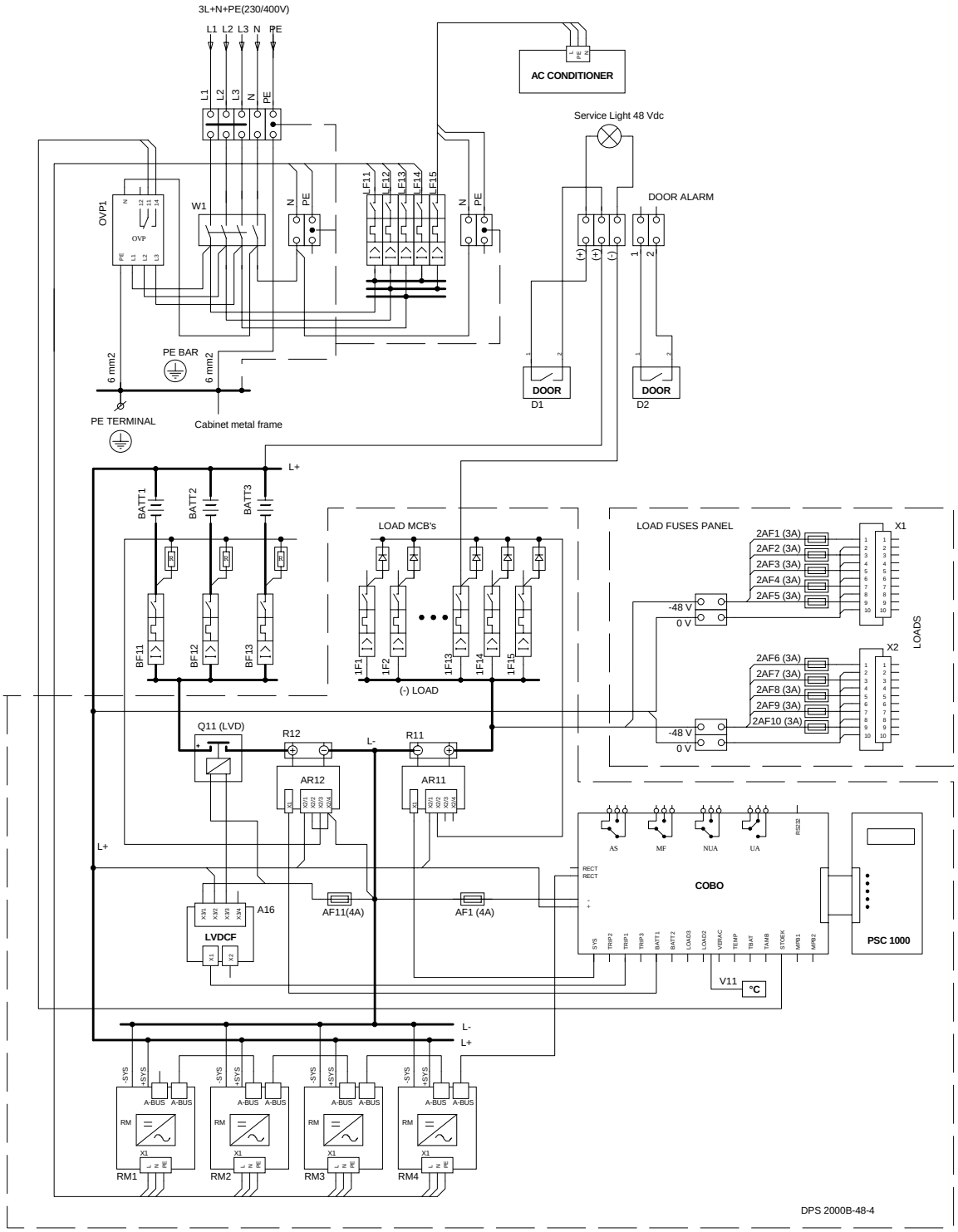
Internal failures can only be repaired in the Delta Energy Systems, therefore the faulty rectifier module in the system must be replaced with a new unit**.**

LED «ok» OFF and alarm signal active:

Mains voltage missing:	Check mains fuse and AC connections
OVP / OTP activated:	Reset OVP (only if conditions for shut down are not existing any more)
Fault inside the rectifier:	Replace rectifier module

LED «ok» is blinking and alarm signal active:

Load sharing not working:	Check U out and bus connection
DC connector open	Check DC connector and cable
Output fuse open	Check output fuse in the rack.



DELTA Energy Systems		Prepared		ODPS 2000B-48-4 (Motorola)
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	Date	30.10.2007 r.		File: 2000503.sch