

DC Power Systems

PROTECT RCS Series

SPRe - TPRe

Operation Manual

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AEG
Power Solutions

- AEG Power Solutions is a world specialist in DC and AC power conversion.
- The company designs and manufactures rectifiers, inverters and power electronics systems associated with all types of batteries.
- The applications range from Oil & Gas, Petrochemicals, Transport, Power, Manufacturing and Telecommunications Industries through to Military applications.
- AEG Power Solutions makes available to its customers its theoretical and practical training centre at various locations.





This equipment has been designed to meet the requirements of the European Directives applicable to the product concerned, i.e. Directive on Electromagnetic compatibility (EMC) N° 89/336/EEC of 03-05-89 amended by Directives N° 92/31/EEC of 28-04-92 and N° 93/68/EEC of 22-07-93. To comply the units are equipped with the necessary input filters. Together with the compliance to Directive Low Voltage N° 2006/95/CE of 16-01-2007, the systems have the CE mark.

The delivered equipment is conform with these Directives as long as the user does not change these electrical and mechanical characteristics.

This equipment is designed to be used in an industrial environment.

WARNING :

THIS PRODUCT IS FOR RESTRICTED DISTRIBUTION TO INFORMED INSTALLERS OR USERS. INSTALLATION RESTRICTIONS OR ADDITIONAL MEASURES MAY BE NECESSARY TO AVOID DISTURBANCES.

The units equipped with an EMI suppression filter have high leakage currents to the chassis. Always connect the earth connection first before any other connection. Danger to the operator can occur if the units are not firmly connected to earth.

The units contain DC capacitors on the output of the DC line. Allow 5 minutes for the discharge of the capacitor bank when the system is completely powered down.

This equipment has been designed to be connected to class II power supplies with over voltages not exceeding 2500 V peak. All precautions should be taken to stay within these limits.

CONTENTS

1	INTRODUCTION	8
2	INSTALLATION.....	9
2.1	RECEIVING THE EQUIPMENT	9
2.2	HANDLING	9
2.3	INSTALLING AND SECURING THE RECTIFIER CHARGER	9
2.4	INSTALLING THE BATTERY.....	10
2.5	ENVIRONMENTAL REQUIREMENTS (EXCLUDING THE BATTERY).....	10
3	CONNECTIONS (<i>refer to the customer drawing package</i>).....	11
3.1	MAINS INPUT CONNECTION.....	11
3.2	BATTERY CONNECTION	11
3.3	CONNECTING THE OPTIONS.....	12
3.4	CONNECTING THE REMOTE ALARM OUTPUTS.....	12
3.5	CONNECTING THE LOAD.....	12
4	START-UP (<i>refer to the customer drawing package</i>)	13
4.1	PRELIMINARY CHECKS	13
4.2	SWITCHING ON	13
4.3	START-UP PROCEDURE OF SPRE/TPRE PARALLELED SYSTEMS	14
4.4	BATTERY COMMISSIONING CHARGE	14
5	OPERATING INSTRUCTIONS.....	15
5.1	DEFAULT MENU.....	15
5.2	MAIN MENU	15
5.3	HUMAN INTERFACE STRUCTURE	17
5.4	STATUS INDICATION DISPLAY	17
5.5	MONITORING FUNCTION	18
5.5.1	How to Display the Measurements.....	18
5.5.2	How to Display the Alarm List.....	19
5.5.3	How to Read the Alarm and Event Memory List (History List).....	20
5.6	COMMAND FUNCTIONS	21
5.6.1	How to Activate Manual High rate Charge.....	21
5.6.2	How to Activate Manual Commissioning Charge.....	22
5.6.3	How to activate Manual Floating Charge.....	23
5.6.4	Manual Voltage and Current adjustment (OPTION)	24
5.6.5	Battery capacity test Function (OPTION)	25
5.6.6	How to Clear the Event and Alarm History List.....	26
5.6.7	How to reset Ah Meter.....	27
5.6.8	How to Adjust the Display Contrast	28

5.7	CONFIGURATION FUNCTIONS	29
5.7.1	How to Change the Language	29
5.7.2	How to set Date and Time	30
5.7.3	Setup	31
6	FUNCTIONAL DESCRIPTION	34
6.1	OPERATING SEQUENCES	34
6.2	CHARGE MODES	35
6.3	PRINCIPLE OF OPERATION	35
6.4	"GCAU" GENERIC CONTROL AND ALARM UNIT (A1)	36
6.5	DISPLAY CARD (A300) AND KEYBOARD ASSEMBLY (A310)	37
6.6	"TPC" THREE-PHASE CONTROL CARD (A2)	37
7	OPTIONS	38
7.1	ALARM/SIGNALLING/MEASUREMENT OPTIONS	38
7.1.1	LED box (A6)	38
7.1.2	Relay cards (A5)	38
7.1.3	Temperature alarm	38
7.1.4	Supplementary meter functions	38
7.1.5	Analog meters	39
7.1.6	Spare inputs	39
7.1.7	High ripple voltage alarm	39
7.1.8	Audible alarm	39
7.1.9	Electrolyte level alarm	39
7.1.10	Ground fault detection	39
7.1.11	Battery symmetry fault detection circuit (A10)	40
7.2	COMMUNICATION OPTIONS	40
7.2.1	WINSPARC supervision	40
7.2.2	MODBUS communication	41
7.3	CONTROL/COMMAND OPTIONS	41
7.3.1	Manual voltage and/or current adjustments	41
7.4	AC INPUT OPTIONS	41
7.4.1	EMI filter	41
7.4.2	Supplementary protective devices	41
7.4.3	Input contactor	41
7.5	LOAD OPTIONS	42
7.5.1	Supplementary protective devices	42
7.5.2	Additional DC filtering	42
7.5.3	Load switch	42
7.5.4	Blocking diode	42
7.5.5	High-voltage trip	42
7.5.6	Diode stabilizer	42
7.6	BATTERY OPTIONS	43
7.6.1	Battery temperature compensation	43
7.6.2	Battery current limit/display	43
7.6.3	Low-Voltage Disconnect (<i>end-of-discharge contactor</i>)	43
7.6.4	VO battery charging (recombination batteries)	43

7.6.5	C15-100 rectifier monitoring board	44
7.6.6	Supplementary protective devices.....	44
7.6.7	Battery switch	44
7.6.8	Cable drop compensation.....	45
7.6.9	High rate charge interlock (<i>Forced float charge</i>).....	45
7.6.10	Battery capacity test	45
7.7	CABINET OPTIONS	46
7.7.1	IP ratings	46
7.7.2	Eye bolts.....	46
7.7.3	Cabinet heater.....	47
7.7.4	Interior lighting and AC socket outlet.....	47
7.8	SYSTEM OPTIONS	47
7.8.1	Passive Load sharing (<i>"droop" factor</i>)	47
8	MAINTENANCE	48
8.1	RECTIFIER MAINTENANCE.....	48
8.2	FAN MAINTENANCE	48
8.3	BATTERY MAINTENANCE.....	48
9	ELEMENTARY TROUBLESHOOTING.....	49
10	CUSTOMER SERVICE.....	53

1 INTRODUCTION

This manual is designed to familiarize the user with the operating principles, use and maintenance of the PROTECT RCS range of rectifiers fitted in floor mounted cabinets. The Protect RCS range comprises the SPRe and TPR. SPR means Single Phase Rectifier, TPR means Three Phase Rectifier and "e" means "evolution".

To use the system properly, the user should first read this manual carefully.

We will not be responsible for damage due to improper use, neglect, alterations, or use of other than original parts without our written consent.

Equipment access areas:

- Operator: door closed.
- Maintenance personnel: door open.

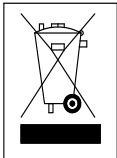
IMPORTANT RECOMMENDATIONS:

ANY OPERATION ON THE EQUIPMENT SHOULD BE CARRIED OUT BY QUALIFIED PERSONNEL, AWARE OF SPECIFIC ELECTRICAL HAZARDS AND PRECAUTIONS TO BE TAKEN.

LETHAL VOLTAGES EXIST PERMANENTLY ACROSS THE BATTERY TERMINALS.

DO NOT MAKE ASSUMPTIONS AS TO THE PRESENCE OR ABSENCE OF A VOLTAGE: CHECK USING A VOLTMETER.

WEEE INFORMATION



The disposal of this product is covered by a selective processing of some components. For this provision of services, please contact our Customer Service.

For general information about operating principles of the charger: please refer first to Chapter 6 "Functional description".

CUSTOMER DRAWINGS:

This manual, covering standard equipment, comes with a customer drawing package specific to your equipment.
These documents will be needed for any on-site action by our Customer Service Department.

2 INSTALLATION

2.1 RECEIVING THE EQUIPMENT

Upon receipt of the equipment, visually inspect the equipment for shipping damage.

Check the contents of the package against the delivery slip before disposing of the package.

If damage or partial loss is found, file a claim with the carrier without delay and take any necessary steps to protect your rights.

If the equipment is not to be installed immediately, store it in a ventilated, dry room, away from rain, splashes of water, and chemicals, complying with the environmental requirements defined in section 2.5.

2.2 HANDLING

The equipment must be handled with care, always in a vertical position. Labels on the outside of the package show the top and bottom.

The SPRe/TPRe rectifiers and the batteries are delivered on pallets for easy handling using a pallet truck.

For cabinets fitted with lifting eye bolts, check that the eye bolts are screwed fully home. Use them at an angle smaller than 45°.

The lifting capacity of the handling equipment used must always be greater than the weight of the cabinets (specified on the packages).

ATTENTION:

Only transport the cabinets in an **upright position!**

Never **tilt** or **cant**, always observe the centre of gravity!

Always keep the battery cells in a vertical position.

Never lift a battery cell by its connections.

Do not put or drop objects on the battery.

2.3 INSTALLING AND SECURING THE RECTIFIER CHARGER

Select an installation site with the following characteristics:

- Ambient temperature and relative humidity as specified in section 2.5.
- Ambient air free from dust and corrosive gases.
- Floor sufficiently flat so that the cabinet will not be distorted when secured to the floor.
- Floor sufficiently strong to carry the weight of the equipment.

Securing the cabinets to the floor is required if the equipment has integral batteries and is recommended otherwise.

For the distances between hole centres and the location and the diameter of the fixing holes, refer to the customer drawings.

Provide:

- Sufficient clearance so that the door can be opened.
- 100 mm minimum clearance at the rear of the cabinet.

Note: In some cases, this clearance can be different (refer to the customer drawings).

Installing palletised cabinets

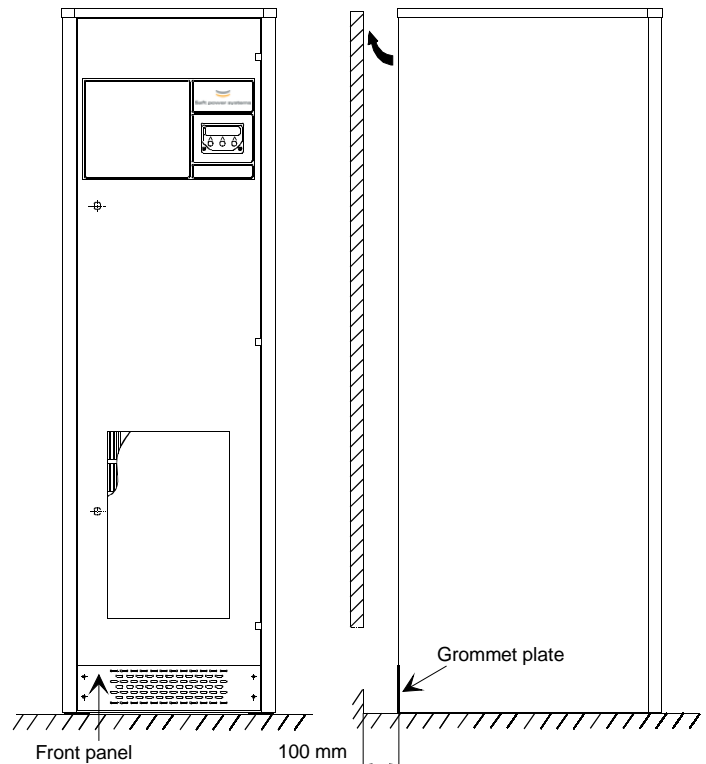
The equipment comes with the front and rear perforated panels (*see figure opposite*) not fitted and stowed inside the cabinet.

Before setting up the cabinet, install the grommet plate (*at the rear*).

The cables enter through the bottom.

Install the front perforated panel after making the connections.

This front panel can be un-perforated.



2.4 INSTALLING THE BATTERY

The ground or floor must be strong enough to carry the weight of the batteries and/or stands or cabinets in which they are mounted.

2.5 ENVIRONMENTAL REQUIREMENTS (EXCLUDING THE BATTERY)

Temperature

Storage : - 25°C to +70°C

Operating : 0°C to +40°C

Above 40°C and up to 55°C, the output current must be de-rated (1.25% per °C).

Relative humidity

Storage : 15% to 90% in the original package.

Operating : 20% to 95 % (non-condensing).

Altitude

≤ 1000 m

Above 1000 m and up to 4000 m, the output current must be de-rated (7% per 1000 m).

3 CONNECTIONS (*refer to the customer drawing package*)

ANY OPERATION ON THE EQUIPMENT SHOULD BE CARRIED OUT BY QUALIFIED PERSONNEL AWARE OF SPECIFIC ELECTRICAL HAZARDS AND PRECAUTIONS TO BE TAKEN.

Always make the connections with power off and the circuit-opening devices in the **"open"** position:

- Mains and load protective devices open.
- Battery protective device or disconnecting switch open.
- Power switch to "OFF" (*option*).

3.1 MAINS INPUT CONNECTION

DANGER, IF THE RECTIFIER IS EQUIPPED WITH AN OPTIONAL INPUT FILTER:
MAINS INPUT: HIGH LEAKAGE CURRENT.
EARTH CONNECTION ESSENTIAL BEFORE CONNECTING SUPPLY.

If no mains input protection is present inside the unit, it must be installed outside the unit in the main switchbox.

Recommended rating: 2 x input current.

- The input current is specified on the front page of the customer drawing package.
- As standard, the inrush current is less than 20 times the input current.

Connect the mains input to the terminal block located in the connection area.

In case of TPRe, the units are not phase rotation sensitive.

Remember to connect the earth bus to the earth.

3.2 BATTERY CONNECTION

IMPORTANT RECOMMENDATIONS

REFER TO THE BATTERY MANUAL.

Refer to the battery manufacturer's instructions for the storage conditions.

Allow no flame or sparks in the battery room. Never smoke in the battery room.
Never disconnect a battery being charged.

To handle the electrolyte, use gloves and safety goggles.

The electrolyte contained in a battery is dangerous to the skin and clothing.

Before doing work on a battery, make sure that there is an accessible supply of water nearby. If electrolyte is splashed, wash immediately with water.

Use tools with insulated handles.

Remove the shipping plugs from "open" Ni-Cd batteries. Always use maintenance accessories (especially electrolyte handling tools) suited to the batteries.

4 START-UP (refer to the customer drawing package)

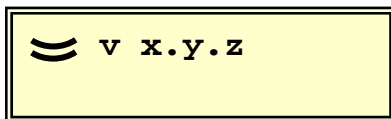
4.1 PRELIMINARY CHECKS

- All circuit-opening devices must be in the "open" position.
- Check that the mains line protective device rating is correct (see section 3.1).
- Check that the mains voltage and frequency are compatible with the equipment (nameplate).
- Check that the mains, battery and load connections are tight.
- Check the polarities and that the battery cells are correctly connected in series.

4.2 SWITCHING ON

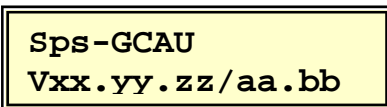
- Leave the positive side of the battery open, either through protective or opening device (e.g. fuse F13: case 1 below) or through the battery cable not connected to the (+) BATT terminal of the rectifier (case 2 below).
- Close the negative side of the battery (-) (fuse, protective device, etc ... if some).
- Close the mains protective devices. Turn on the mains input and the rectifier.

The rectifier starts and the display shows:



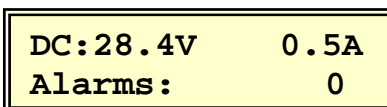
$Vx.y.z$ = software version of the display controller

After a few seconds, the display shows:



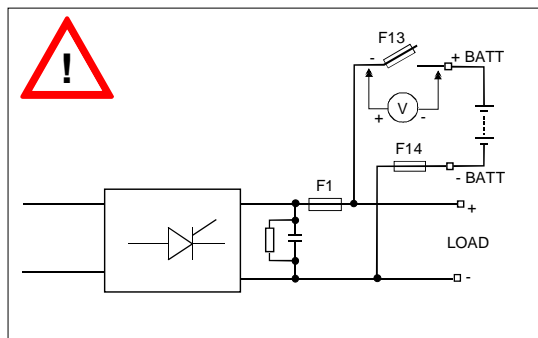
$Vxx.yy.zz$ and $aa.bb$ are the software versions of the two micro controllers (of the GCAU card)

After a few seconds, the display shows the floating voltage and the rectifier current (at no-load).

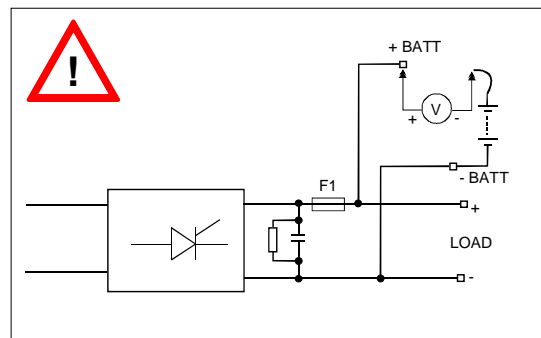


NOTA: The current value is about 0.5 A.

To check that the battery polarities are correct, take a voltage reading using a DC voltmeter as shown below:



- Case 1 -
Configuration with battery fuse F13



- Case 2 -
Configuration without opening device

The voltage reading must not exceed 30% of the nominal voltage (refer to the customer drawings).

- . If the voltage is higher, check the battery cables for correct polarity.
- . If the voltage is correct, close fuse F13 or connect the battery (+) cable to the rectifier terminal. The rectifier will charge the battery. During this operation, arcing may develop across the actuated device.
- Check that the displayed current increases (current to the battery).

DC: 28.4V	3.0A
Alarms: 0	



Dangerous voltages exist across the battery and/or load terminals. Take the necessary safety precautions.



We recommend to change "user" and "supervisor" passwords to prevent bad handlings. See paragraph 5.7.3.

4.3 START-UP PROCEDURE OF SPRe/TPRe PARALLELED SYSTEMS

In the case of SPRe/TPRe units with battery (each one) connected in parallel for redundancy, respect the following instructions :

- Check that the output protective device of each unit is open.
- Start-up the rectifier-battery assembly n°1 according to the previous paragraph 4.2.
- Start-up the rectifier-battery assembly n°2 according to the previous paragraph 4.2.

Then close the output protective device of each unit.

4.4 BATTERY COMMISSIONING CHARGE

For open lead-acid and Nickel-Cadmium batteries, at initial start-up, a commissioning charge can be performed according to the battery manufacturer's instructions (refer to the battery manual enclosed with the equipment).

Open load circuit.

From the command menu, set the rectifier to the commissioning charge (refer to § 5.6.2).

The initial start-up current and time are factory set. Refer to the "System setup" menu (see paragraph 5.7.3.2) to see the adjustment value.

NOTE: If the A3 board (C15-100 rectifier monitoring board) is fitted, set switch S1 to the "ON" position ("High battery voltage protection" detection inhibited) before starting the commissioning charge. At the end of the commissioning charge, remember to set this switch to its original position.

At the end of the commissioning charge:

- from the "Alarm" menu, reset the "HIGH DC VOLTAGE" alarm. This alarm can be triggered when returning from commissioning charge to floating charge.

5 OPERATING INSTRUCTIONS

The following section explains the basic operator menu structure of your system. It allows you to access all necessary functions in order to operate your system.

The menus, indications and controls available depend on the system configuration.

The keyboard assembly has two LEDs indicators:

- green LED: "System OK" (indicates proper operation).
- red LED: "Fault" (a fault is present).

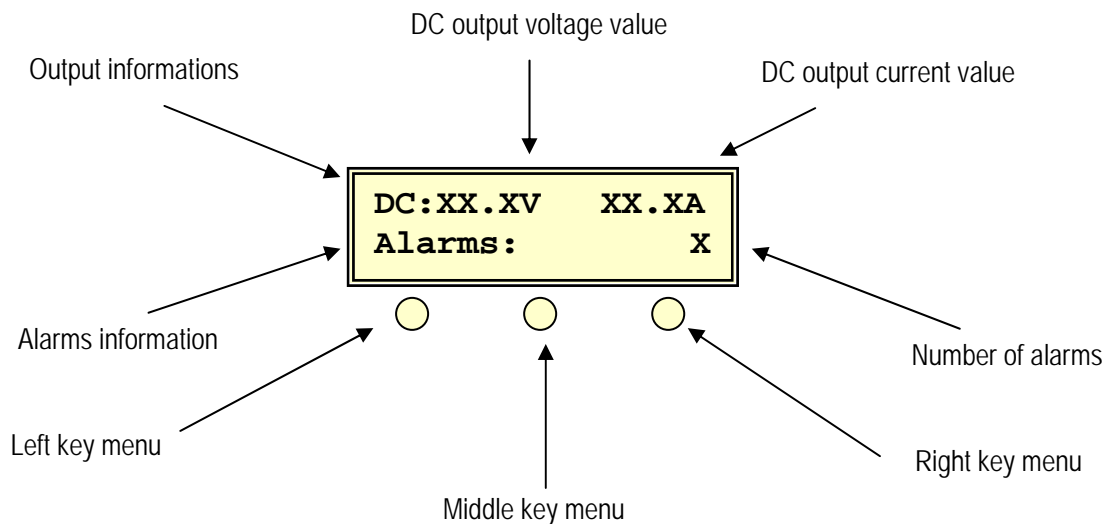
The green LED is always on in case no alarms are present.

In case an alarm is present, the red LED comes on and flashes.

If the alarm is acknowledged, the red LED is on permanently provided the alarm is still active.

If no alarms are active after an acknowledgement, the red LED will be switched off and the green LED comes on again.

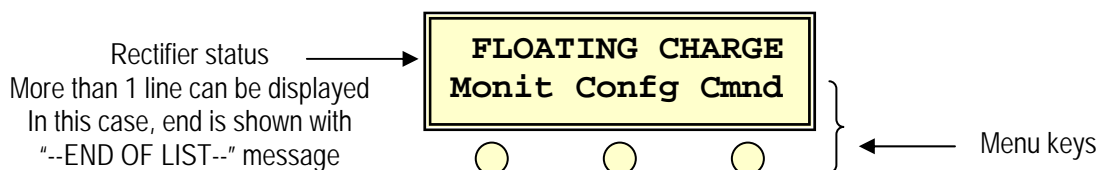
5.1 DEFAULT MENU



The top line ("DC") will display the charger voltage and the load current with battery shunt or the total charger current (battery + load) when the battery shunt is not active.

Hit any key to go to main menu

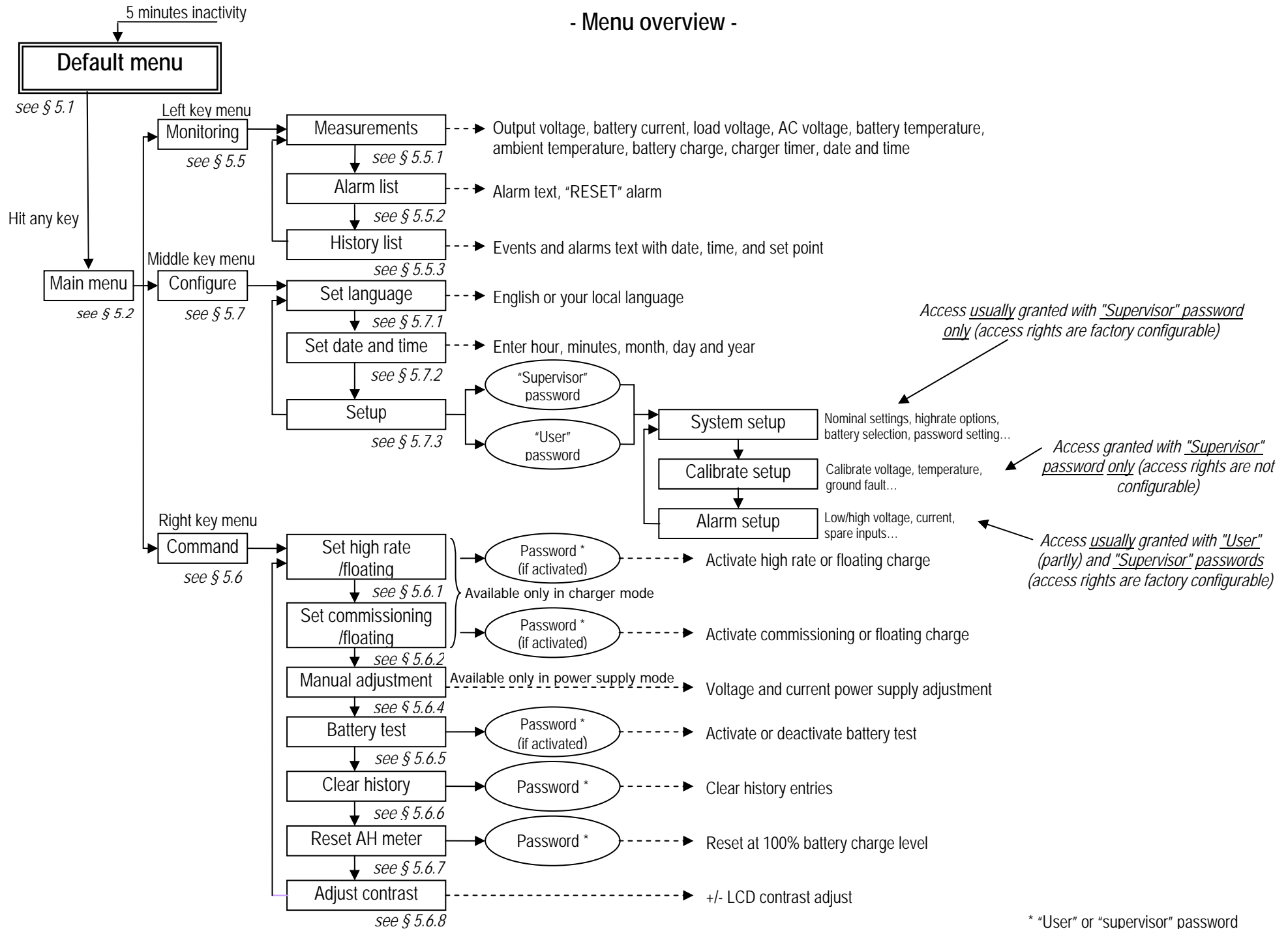
5.2 MAIN MENU



The different rectifier statuses are:

- FLOATING CHARGE
- HIGHRATE CHARGE
- COMMISSIONING
- CHARGER OFF (see Chapter 8 "ELEMENTARY TROUBLESHOOTING" for more explanations)
- BATTERY TEST.

- Menu overview -

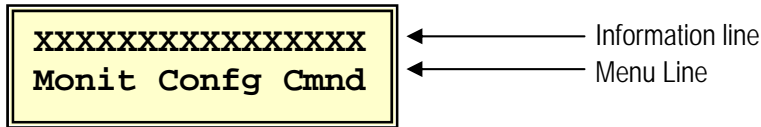


Note: According to your equipment configuration, some menus may be inactivated.

5.3 HUMAN INTERFACE STRUCTURE

The human interface is based on consistency in operation. Consistency means that the functions are grouped logically within the menu structure and will provide ease of use for the operator.

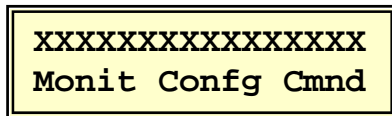
The LCD Display has 2 lines by 16 characters. The top line is always used to indicate information while the bottom line is used for the menu structure indication.



There are three major menu groups under which all functions are located.

These groups are defined as:

- ❑ **Monitoring** Displaying analog measurements and alarms
- ❑ **Configuration** Configuring the system
- ❑ **Commands** Manually activated functions (High rate, Battery test etc.)



The menu indication uses five basic menu functions with the following functions:

- ▶ **Next** One step forward in the menu
- ▶ **Back** One step back in the menu
- ▶ **View** Display an selection
- ▶ **Enter** Acknowledge an entry
- ▶ **Exit** Always return to default menu



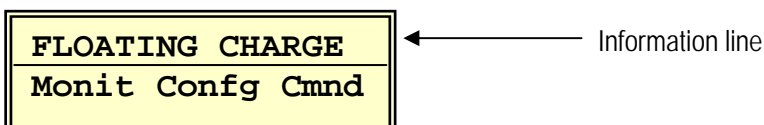
The following sections will clearly explain how you can access the various functions.

5.4 STATUS INDICATION DISPLAY

As explained in the previous chapter the top line of the display will indicate information about the status of the system. If more than one message is active, the messages are displayed in sequence. Each message is displayed for 1 second before the next message is displayed.

The following messages are displayed:

- ▶ Alarm texts of the active alarms
- ▶ Charge status messages
- ▶ Events



The messages are dynamic meaning they are updated continuously. If the alarm texts are Latching you must go into the alarm menu to clear the text from the display. Refer to section 5.5.2 for details.

5.5 MONITORING FUNCTION

5.5.1 How to Display the Measurements

You will find the measurements menus under the Monitoring function. The Monitoring function will display all relative meter indications on the top line of the LCD.

Follow the instructions below.

From the main menu select 'Monit'.

```
FLOATING CHARGE
Monit  Confg  Cmnd
```

Select 'View'.

```
MEASUREMENTS
Next  View  Exit
```

The top line ("Outp") will display the battery voltage and the total charger current (battery + load). Display resolution is 1 decimal for V and A <100 and no decimal for values > 100.

```
Outp:28.4V 23.5A
Next  Back  Exit
```

The 'Next' key can be used to scroll through all available measurements.

In order of appearance the following measurements can be displayed:

- ▶ Load voltage and current*
- ▶ Battery current (charge and discharge)*
- ▶ Battery voltage and total charger current
- ▶ AC input voltage*
- ▶ Battery temperature*
- ▶ Ambient temperature*
- ▶ AH Meter*
- ▶ Remaining charge time* (if in High rate or Commissioning charge)
- ▶ Date and Time

* Menu can be disabled on customer demand.

Note about the ambient temperature in VO battery mode:

The ambient temperature read on the LCD display is particular in case of a VO battery is used. The first value indicates the instantaneous ambient temperature and the second value, in brackets, indicates the integrated ambient temperature. The integrated value is an average temperature calculation on several hours. This function works to absorb fast thermal changes.

5.5.2 How to Display the Alarm List

You will find the Alarm list indication under the Monitoring function. This Alarm List indication will display all active alarms on the top line of the LCD.

Follow the instructions below.

```
FLOATING CHARGE
Monit  Confg  Cmnd
```

From the main menu select 'Monit'.

```
MEASUREMENTS
Next   View   Exit
```

Select 'Next'.

```
Alarm List:   XX
Next  View    Exit
```

The display indication XX shows you how many alarms are in the alarm list. The list shows Active alarms and Non-acknowledged (Reset) alarms based on the alarm configuration. If a "LCD Latch" function is selected for an alarm, it will remain in the alarm list even when the alarm condition has disappeared. In this case, a manual alarm reset has to be given to clear it from the alarm list.

Select 'View'.

```
LOW DC VOLTAGE
Next  Back  Reset
```

The alarm is presented in clear text on the top line. Pressing 'Next' will show you the next alarm in the list and pressing 'Back' will show you the previous alarm in the list.

If an alarm has not been acknowledged the text 'Reset' will flash. If the alarm is acknowledged and the alarm option "LCD latch" was activated (see Alarm Setup for details), the alarm will be removed from the list provided the condition of the alarm has been cleared.

If an alarm is associated with a signalling relay with latching, the display of this alarm is imperatively "latch" set. The acknowledgment of the alarm using the display causes the acknowledgment of the associated relay too.

5.5.3 How to Read the Alarm and Event Memory List (History List)

The GCAU in your system is equipped with an Alarm and Event list. The GCAU card stores the alarm and events, in order of appearance, in a non-volatile memory (permanent storage). Events in this context means indicating if the system has been switched to High rate, Float or Commissioning, Entering the setup mode, Clearing the history etc.

The memory is based on a FIFO mechanism (First In First Out), which means that if the memory is full the oldest event or alarm will be removed from the list.

The alarm and events are time/date stamped using an RTC (Real Time Clock).

Follow the instructions below.

```

FLOATING CHARGE
Monit Config Cmnd
  
```

From the main menu select 'Monit'.

```

MEASUREMENTS
Next View Exit
  
```

Select 'Next' until the top line shows below text.

```

HISTORY LIST :12
Next View Exit
  
```



```

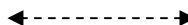
SOFTWARE VERSION
V01.01.32 / 01.60
  
```

The "history list" screen indicates the quantity of Alarm and Event in the list.

Viewing the "history list" will display first the internal software versions of the GCAU card for reference. This message is displayed for two seconds. After two seconds the display will show:

```

'Event or alarm'
Next View Exit
  
```



```

xx/12 : nn_ttt
Next View Exit
  
```

Top line shows event or alarm text.

A non permanent screen will indicate during 1 s the place (xx) of the "alarm and event" in the history list, its internal code (xx) and its internal acronym (ttt).

Select 'View'

```

Data: 24.0
Next Back Exit
  
```

Top line shows set point (alarm level) if valid (analog alarms only)

Pressing 'Next' will show the date and time of the Alarm/Event:

```

Date: 16/12/05
Next Back Exit
  
```



```

Time: 11:28:38
Next Back Exit
  
```

Date format is dd/mm/yy (if temperatures unit is °C) or mm/dd/yy (if temperatures unit is °F).

5.6 COMMAND FUNCTIONS

According to the factory set configuration, your system can have several specific command functions. All these commands are accessible through the Command function 'Cmnd'.

The different command functions are:

- ▶ Manual High rate Charge
- ▶ Manual Commissioning Charge
- ▶ Manual floating Charge
- ▶ Manual Adjustment of Voltage and/or Current
- ▶ Battery Test Function
- ▶ Clear History List
- ▶ Set Display Contrast
- ▶ Reset Ah meter.

5.6.1 How to Activate Manual High rate Charge

The Manual High rate charge is a command function and is located under the Command ('Cmnd') key. To prevent accidental activation, this command can be password protected if required. Follow the instructions below.

```
FLOATING CHARGE
Monit Config Cmnd
```

Starting from the main menu, select 'Cmnd'.

Press 'Next' until the following indication is displayed:

```
SET HIGH RATE
Next Enter Exit
```

```
WRONG PASSWORD
```

Press 'Enter'

```
Password:  1111
↑      →  Enter
```

With the right pointing arrow '→' the digit position can be selected and with the arrow up '↑' an alphanumeric character between 0 and 9 or between A and Z can be set. If all four characters are set, press 'Enter'.

If the password is correct, the display switches to the High rate on/off selection.

Incorrect passwords will cause a jump of two positions back in the menu tree and a message 'WRONG PASSWORD' is displayed.

If no password is activated the High rate selection menu will be shown directly.

```
Start High rate?
Yes      Cancel
```

```
Correct password
```

The high rate charge can be switched on by pressing the "Yes" key.

To stop the high rate charge, the user can manually put the rectifier in floating charge mode via the command menu (see the 5.6.3 paragraph) or wait for the timer times out. In this last case, the rectifier switches automatically in floating charge mode.

The remaining high rate charge time can be read on the LCD display via the measurements menu. See paragraph 5.5.1.

5.6.2 How to Activate Manual Commissioning Charge

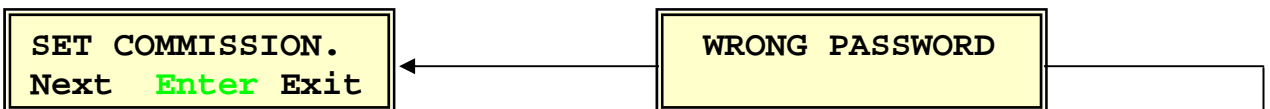
The Manual Commissioning charge is a command function and is located under the Command ('Cmnd') key. To prevent accidental activation, this command can be password protected if required.

Follow the instructions below.

```
FLOATING CHARGE
Monit Config Cmnd
```

Starting from the main menu, select 'Cmnd'.

Press 'Next' until the following indication is displayed:

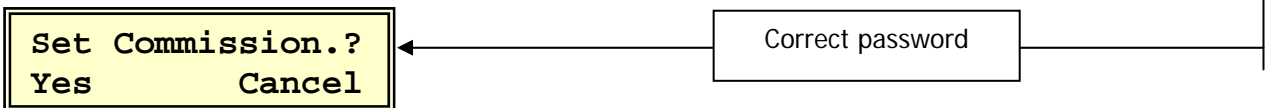


Press 'Enter'.

```
Password: 1111
  ↑      → Enter
```

With the right pointing arrow '→' the digit position can be selected and with the arrow up '↑' an alphanumeric character between 0 and 9 or between A and Z can be set. If all four characters are set, press 'Enter'. If the password is correct the display switches to the Commissioning on/off selection. Incorrect passwords will cause a jump of one position back in the menu tree and a message 'WRONG PASSWORD' is displayed.

If no password is activated the Commissioning selection menu will be shown directly.



With 'Yes', the Commissioning charge can be switched on.

To stop the commissioning charge, the user can manually put the rectifier in floating charge mode via the command menu (see paragraph 5.6.3) or wait for the timer times out. In this last case, the rectifier switches automatically in floating charge mode.

The remaining commissioning charge time can be read on the LCD display via the measurements menu. See paragraph 5.5.1.

5.6.3 How to activate Manual Floating Charge

When you are in high rate or commissioning charge mode, you can manually switch the rectifier in the floating charge mode. Follow the instructions below.

HIGHRATE CHARGE
Monit Config Cmnd

or

COMMISSIONING
Monit Config Cmnd

Starting from the main menu, select 'Cmnd'.

Press 'Next' until the following indication is displayed:

SET FLOATING
Next Enter Exit

Press 'Enter'.

Start Floating?
Yes Cancel

Floating charge can be switched on by hitting the 'Yes' key.

5.6.4 Manual Voltage and Current adjustment (OPTION)

If required, your system can be programmed as a power supply. It allows you to adjust the output voltage and output current over a wide range. Both functions can be activated independently.

When only the output current adjustment is activated, the output voltage is the voltage of the current charge (floating, highrate, commissioning).

Warning:

Do not activate this option when the charger is used for normal battery charging. Consult the nearest agent of your system if you want to use this option. Activating this option without the necessary system knowledge can damage the connected battery.

The rectifier operates as a power supply only. It delivers the adjusted voltage and, if activated, the manually adjusted current. If the manual current adjustment is not activated the current limit is as specified on the nameplate of your system.

The voltage adjustment is configured to operate within a window. The upper and lower limits of this window are configured in the system setup. Refer to the system setup (paragraph 5.7.3) for details.

5.6.4.1 How to Adjust the Voltage and Current (Manual Adjustment)

The procedure below explains how to adjust the voltage and current if the manual Voltage and/or Current option is activated.

FLOATING CHARGE
Monit **Confg** **Cmd**

Current adjustment only activated

or

POWER SUPPLY
Monit **Confg** **Cmd**

Voltage adjustment activated
(current adjustment activated or no).

Starting from the main menu, select 'Cmd'.

MAN.AJUSTMENT
Next **Enter** **Exit**

Press 'Next' until the text 'ADJUSTMENT' is displayed and press 'Enter'.

ADJUSTMENT
Volts **Amps** **Exit**

SET NOT ALLOWED

From this menu, the Voltage or Current adjustment can be selected. If one of these options is not active and the function is selected, a message 'SET. NOT ALLOWED' is displayed for two seconds.

If you need to set the voltage, press 'Volts'. If you need to set the current press 'Amps'.

28.4 <- **28.2V**
↑ ↓ **Back**

75.0 <- **68.2A**
↑ ↓ **Back**

Left: display of setpoint value (change with up or down arrow key).

Right: display of actual value (measurement).

When you press the arrow up '↑', the voltage or current increases. The arrow down '↓' will decrease the voltage and current.

The values are saved in the system memory ensuring the values are permanently stored.

Adjustment Resolution is 1 decimal V or A <100 and no decimal for values >100.

5.6.5 Battery capacity test Function (OPTION)

The Battery Test feature can be used to test the battery performance. The test can be initiated manually or automatically.

Three programmable parameters define the battery test:

- ▶ Discharge Current
- ▶ End Voltage
- ▶ Tolerance percentage.

Warning:

Contact the nearest agent of your equipment for details of the above settings.

Wrong settings can cause mis-interpreted battery performance or loss of DC power.

5.6.5.1 How to Activate the Battery Test

Before activating this test, make sure you are familiar with the Battery Test Operation as further-described in paragraph 7.6.10 BATTERY CAPACITY TEST.

Follow the instructions below.

```
FLOATING CHARGE
Monit Confg Cmnd
```

Starting from the main menu, select 'Cmnd'.

Select 'Next' until the following menu is displayed.

```
BATTERY TEST
Next Enter Exit
```

```
WRONG PASSWORD
```

Press 'Enter'.

```
Password:  1111
  ↑      → Enter
```

If protected by a password enter the password here.

With the right pointing arrow '→' the digit position can be selected and with the arrow up '↑' an alphanumeric character between 0 and 9 or between A and Z can be set. If all four characters are set, press 'Enter'.

If the password is correct, the display switches to the Battery Test on/off selection. If the password is incorrect, a message 'WRONG PASSWORD' is displayed for two seconds and the menu jumps one position back in the menu tree.

```
Battery test
On  Off  Exit
```

```
Correct password
```

Activate or de-activate the Battery Test by selecting 'On' or 'Off'.

The display will show if the battery test is on or off.

5.6.6 How to Clear the Event and Alarm History List

If required, the event and alarm history list of your system can be cleared from the front panel. A password on Supervisor or User level is mandatory to clear the list.

Follow the instructions below.

```
FLOATING CHARGE
Monit Config Cmnd
```

Starting from the main menu, select 'Cmnd'.

Select 'Next' until the following menu is displayed.

```
CLEAR HISTORY
Next Enter Exit
```

```
WRONG PASSWORD
```

Press 'Enter'.

```
Password: 1111
  ↑      → Enter
```

A Supervisor or User level password is required to continue.

With the right pointing arrow '→' the digit position can be selected and with the arrow up '↑' an alphanumeric character between 0 and 9 or between A and Z can be set. If all four characters are set, press 'Enter'.

If the password is correct, the display switches to the Clear History Yes/No selection. If the password is incorrect, a message 'WRONG PASSWORD' is displayed for two seconds and the menu jumps one position back in the menu tree.

```
Clear History ?
Yes No Cancel
```

```
Correct password
```

Clear the History list by pressing the 'Yes' key. Pressing 'No' will cause a jump two menus back.

5.6.7 How to reset Ah Meter

```
FLOATING CHARGE
Monit Config Cmnd
```

Starting from the main menu, select 'Cmnd'.

Select 'Next' until the following menu is displayed.

```
AH METER = 100
Next Enter Exit
```

```
WRONG PASSWORD
```

Press 'Enter'.

```
Password: 1111
  ↑      → Enter
```

A Supervisor or User level password is required to continue.

With the right pointing arrow '→' the digit position can be selected and with the arrow up '↑' an alphanumeric character between 0 and 9 or between A and Z can be set. If all four characters are set, press 'Enter'.

If the password is correct, the display switches to the 'Ah Meter = 100' Yes/No selection. If the password is incorrect a message 'WRONG PASSWORD' is displayed for two seconds and the menu jumps one position back in the menu tree.

```
Ah Meter = 100
Yes No Cancel
```

```
Correct password
```

Reset Ah meter by pressing the 'Yes' key initiates the battery Ah counter to 100% and causes a jump to the default menu. Pressing 'No' or 'Cancel' will cause a jump to 'AH METER = 100' menu. This manipulation must be always done before a manual battery test.

5.6.8 How to Adjust the Display Contrast

The display contrast can be adjusted in two ways:

- ▶ From the default menu directly
- ▶ Using the Command function.

5.6.8.1 Adjusting the Contrast from the Default Menu

When the contrast is too low to read the display, the contrast can be adjusted directly from the default menu. If the leftmost button from the default menu is held, the contrast will be decreased. If the rightmost button from the default menu is held, the contrast will be increased. If you are not sure whether the default menu is displayed, do not touch any button for 5 minutes. This will automatically activate the default menu.

5.6.8.2 Adjusting the Contrast using the Command Function

To adjust the display contrast using the Command function, follow the instructions below:

```
FLOATING CHARGE
Monit Config Cmd
```

Starting from the main menu select 'Cmd'.

Select 'Next' until the following menu is displayed.

```
ADJUST CONTRAST
Next Enter Exit
```

Press 'Enter'.

```
SET CONTRAST
↑      ↓      Enter
```

Use the arrow keys to adjust the contrast.

5.7 CONFIGURATION FUNCTIONS

5.7.1 How to Change the Language

Two languages are available in your GCAU card: the standard language (English) and a second one: the one your specified language when you ordered your equipment.

To change the language, follow the instructions below:

```
FLOATING CHARGE
Monit Config Cmnd
```

Starting from the main menu select 'Config'.

Select 'Next' until the following menu is displayed.

```
SET LANGUAGE
Next Enter Exit
```

Press 'Enter'.

```
Language:English
Next Change Exit
```

Press 'Next' until the desired language is shown.
Pressing the 'Change' key will update the selected language.

5.7.2 How to set Date and Time

```
FLOATING CHARGE
Monit Config Cmnd
```

Starting from the main menu, select 'Config'.

Select 'Next' until the following menu is displayed.

```
SET DATE & TIME
Next Enter Exit
```

Select 'Enter'.

```
Hours:      10
  ↑   ↓   Enter
```

Use the up/down arrows to select your hours. Hit 'Enter' key to go to next menu.

```
Minutes:    12
  ↑   ↓   Enter
```

Use the up/down arrows to select your minutes. Hit 'Enter' key to go to next menu.

```
Month:      4
  ↑   ↓   Enter
```

Use the up/down arrows to select your month. Hit 'Enter' key to go to next menu.

```
Day:        12
  ↑   ↓   Enter
```

Use the up/down arrows to select your day. Hit 'Enter' key to go to next menu.

```
Year:       2006
  ↑   ↓   Enter
```

Use the up/down arrows to select your year. Hit 'Enter' key to come back to the 'SET DATE & TIME' menu.

5.7.3 Setup



The setup menu is accessible with a "user" or "supervisor" password and it allows the modification of your system configuration. The default "user" password is 1111 and the default "supervisor" password is 1211. Any modification of your system configuration is your responsibility. You risk damages on your battery or equipment if the modification is done by a non specialized staff.

According to the factory setting configuration, the access to the "alarms" and "system" setup menus can differ. The following paragraphs describe the menus access usual setup for a standard equipment. When a menu is not accessible to the user, it is not displayed. When there is no menu accessible to the user, the message "SET NOT ALLOWED" is displayed.

5.7.3.1 How to change "user" and "supervisor" password

Enter the Password setting as follows:

```
FLOATING CHARGE
Monit Config Cmnd
```

Starting from the main menu, select 'Config'.

Select 'Next' until the following menu is displayed.

```
SETUP
Next Enter Exit
```

Select 'Enter'.

```
Password:  1111
  ↑      → Enter
```

With arrow keys, select the "supervisor" password 1211 and hit 'Enter' key.

```
SYSTEM SETUP
Next Enter Exit
```

Enter the system setup by hitting 'Enter' key.

```
BATT.SELECTION
Next Enter Exit
```

Select 'Next' until the above menu is displayed.

```
PASSWORD SETTING
Next Change Exit
```

Select 'Change' to enter the password setting menu.

The first menu is to change the "supervisor" password.

```
SUPERVISOR LEVEL
Next Change Exit
```

Select 'Change'.

```
NEW PASSW: 1111
  ↑       → Enter
```

With arrow keys, enter the new "supervisor" password and hit 'Enter' key.

```
VERIFY NEW: 0000
  ↑       → Enter
```

With arrow keys, confirm the new password and hit 'Enter' key.

We can distinguish 2 scenarios:

```
PASSWORD CHANGED
```

or

```
NOT THE SAME
```

In the second case, you must start again.

```
USER LEVEL
Next Change Exit
```

For the user level, apply the same procedure.

5.7.3.2 System setup

With the "supervisor" password, you have access to the following setup:

- ▶ Battery selection: to select battery type, number of cells etc...
- ▶ Nominal settings: to select mains, floating or high rate voltages, limit currents etc...
- ▶ Meter selection: to select °C or °F.
- ▶ High rate options: to allow manual high rate charge, activate the password protection etc...
- ▶ Commissioning options: to allow manual, activate password, select commissioning parameters.
- ▶ Manual adjustment: to switch the rectifier in the power supply mode.
- ▶ VO application: to specify VO battery parameters.
- ▶ Battery test options: to select battery test parameters.
- ▶ LVD function: to select Low Voltage Detection parameters.
- ▶ Diode regulator: to select output diode regulator parameters (option).
- ▶ Regulation compensation: to implement the regulation temperature compensation (option).
- ▶ Communication options: to select serial communication parameters.
- ▶ Charge protections: to set battery charge limits.
- ▶ "User" and "supervisor" passwords setting: to change "user" or "supervisor" passwords.

5.7.3.3 Alarm setup

The alarms setup menus are available with the "user" password and enable to setup the thresholds and the time-delay of the accessible alarms.

The "supervisor" password enables to setup all parameters of the accessible alarms.

Alarms list:

- ▶ High mains voltage alarm parameters.
- ▶ Low mains voltage alarm parameters.
- ▶ Charge fault alarm parameters.
- ▶ High battery voltage alarm parameters.
- ▶ Low battery voltage alarm parameters.
- ▶ High DC voltage alarm parameters.
- ▶ Low DC voltage alarm parameters.
- ▶ Ground fault + alarm parameters.
- ▶ Ground fault – alarm parameters.
- ▶ Spare 1 digital input alarm parameters.
- ▶ Spare 2 digital input alarm parameters.
- ▶ Spare 3 digital input alarm parameters.
- ▶ Spare 4 digital input alarm parameters.
- ▶ Spare 5 digital input alarm parameters.
- ▶ Spare 6 digital input alarm parameters.
- ▶ Spare 7 digital input alarm parameters.
- ▶ Spare 8 digital input alarm parameters.
- ▶ Charger current limit alarm parameters.
- ▶ Battery current limit alarm parameters.
- ▶ High charger current alarm parameters.
- ▶ High battery current alarm parameters.
- ▶ High temperature alarm parameters.
- ▶ Temperature sensor error alarm parameters.
- ▶ Internal communication error alarm parameters.
- ▶ Battery test failed alarm parameters.
- ▶ Battery test abort alarm parameters.
- ▶ High battery temperature alarm parameters.
- ▶ Long charge time alarm parameters.
- ▶ No power supply voltage alarm parameters.
- ▶ Battery operation alarm parameters.

5.7.3.4 Calibrate setup

All these setup menus are available with a "supervisor" password.

- ▶ Battery voltage.
- ▶ Positive battery current.
- ▶ Negative battery current.
- ▶ Charger current.
- ▶ Earth impedance.
- ▶ Load voltage.
- ▶ Mains voltage.
- ▶ Ambient temperature.
- ▶ Battery temperature.

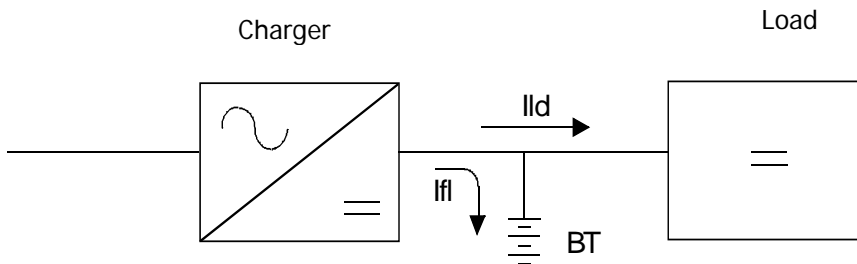
6 FUNCTIONAL DESCRIPTION

The SPRe/TPRe rectifiers are thyristor-controlled rectifiers suitable for charging nickel-cadmium or lead-acid batteries while supplying DC loads. They can also be used as batteryless direct power supplies.

6.1 OPERATING SEQUENCES

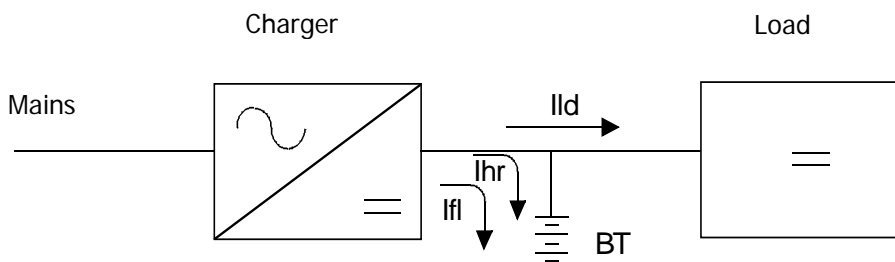
Rectifier with associated battery

Mains power on - battery floating



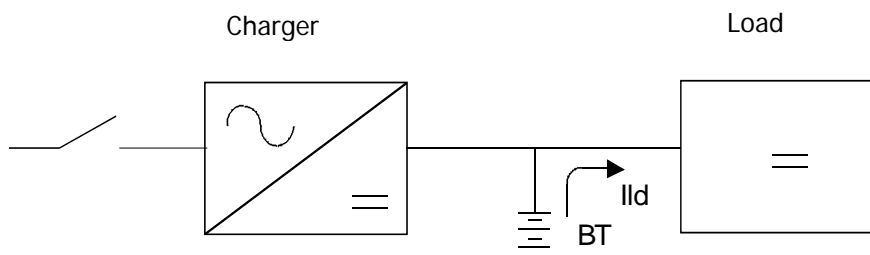
The charger supplies the load (I_{ld}) and delivers a "floating" charge current (I_{fl}) to battery BT.

Mains power on - battery recharging



The charger recharges battery BT at a high rate (I_{hr}) and supplies the load (I_{ld}). The charger automatically switches to "floating" charge (I_{fl}) when the battery is fully charged. Thereafter the battery is kept floating (I_{fl}).

Mains power off



The battery immediately substitutes for the charger in supplying the load (I_{ld}).

6.2 CHARGE MODES

The following battery charge modes are available (depending on the equipment):

Floating charge

Floating charge compensates for the self-discharge of the battery and, in normal operation, maintains the battery in a fully charged condition.

High rate charge (or equalizing charge)

High rate charge restores the battery to full capacity.

Depending on the equipment, it can be activated:

- manually from the keyboard,
- automatically by the system which monitors the state of charge of the battery (mains off or rectifier in current-limiting mode or on Ah drop),
- periodically by the system at fixed intervals (1 month, 6 months, 1 year: factory setting).

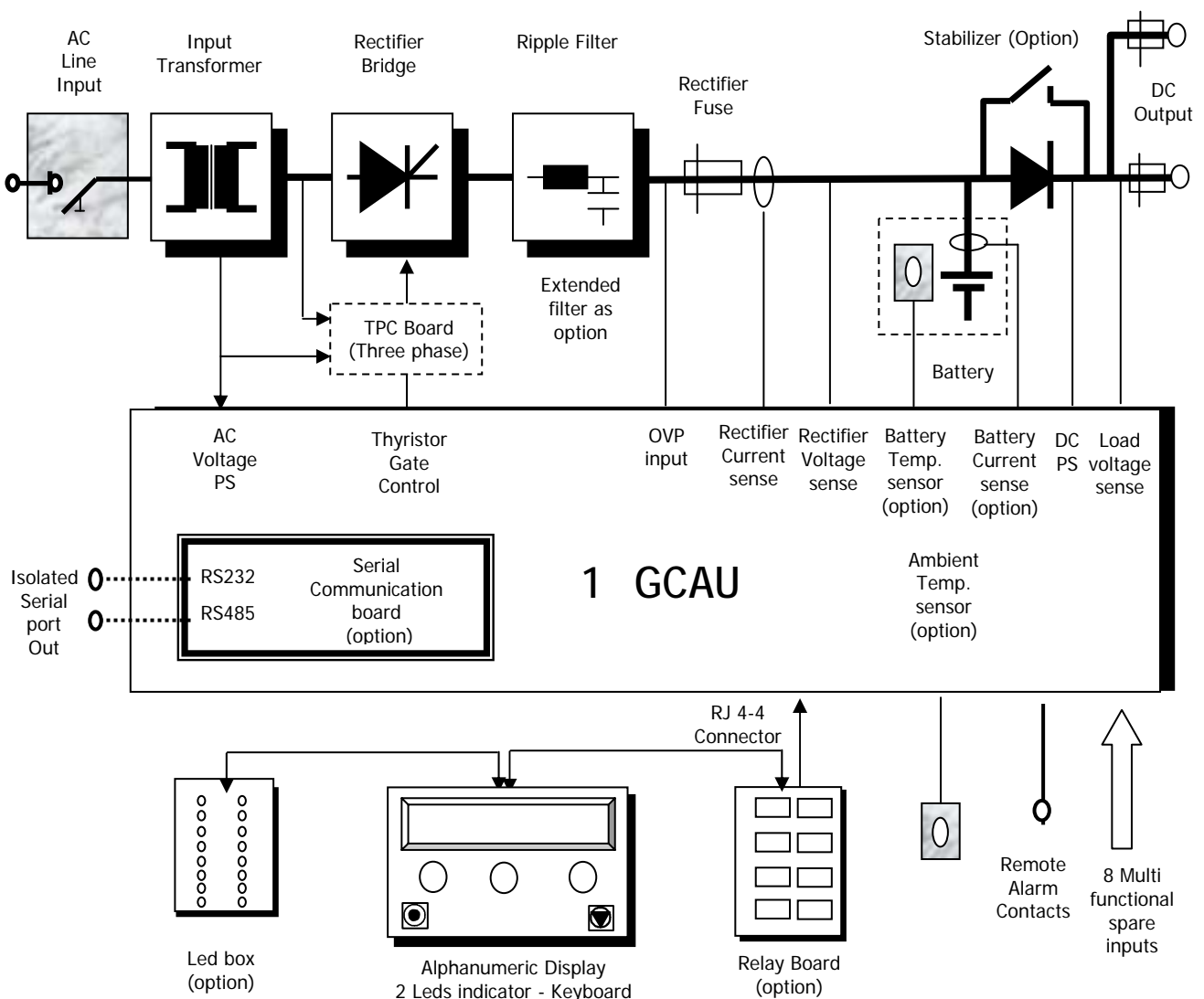
The high rate charge time is factory-set to a value in the range from 0 to 99 hours.

During high rate charge, the remaining charge time can be displayed.

Commissioning charge (or boost charge) (option)

This mode can be used for initial battery charging.

6.3 PRINCIPLE OF OPERATION



- Block diagram -

The mains voltage is applied to the primary winding of the power transformer via the standard mains input switch or other optional circuit-opening devices. The rectifier is then in service, provided no fault has been detected and/or stored by the monitoring systems.

The power converter rectifies the transformer secondary voltage.

The single-phase power converter consists of a mixed diode/thyristor bridge; the three-phase power converter consists of a thyristor bridge.

The rectifier current is smoothed by an inductor and the voltage is filtered by capacitors.

The rectifier current is sensed across a rectifier shunt.

The GCAU control card is supplied either by an auxiliary secondary winding of the transformer or the battery. This card controls the power converter from internal references (which depend on the battery type and the current charge mode) to regulate the rectifier output voltage and/or current. There is a protective fuse inserted in the positive branch of the rectifier.

The battery current is sensed across a battery shunt (*option*).

A temperature sensor senses the battery ambient temperature and compensates the rectifier voltage according to the temperature (*option*).

6.4 "GCAU" GENERIC CONTROL AND ALARM UNIT (A1)

This card has two dedicated microcontrollers, memories for the microcontroller and all necessary analog interface circuits to measure and control. The card is mounted inside the cabinet.

The card consists of two major functional blocks:

- an **analog** block providing the following main functions:
 - . analog signal (current and voltage) matching,
 - . synchronisation (in case of single phase),
 - . power converter thyristor gate drive by electrically isolated pulses (for single-phase only),
 - . electronics power supply ,
 - . analog control signal 0-10V.

- a **digital** block with two micro controllers providing the following main functions:
 - . analog input (voltage, current and temperature) measurement,
 - . digital input/output monitoring,
 - . system operating and monitoring sequences controlled by a program stored in memory,
 - . setpoint (reference) generation for the analog regulators,
 - . full digital control algorithm (separate micro controller),
 - . serial communication for remote monitoring/programming,
 - . serial communication for display unit,
 - . on- board Flash memory and EEPROM.

The protective fuses of the GCAU and TPC cards are integrated into the power transformer (time delayed fuses type 5 x 20 2.5 A – code BYA003540000 - quantity: 2 for SPRe and 3 for TPRe).

6.5 DISPLAY CARD (A300) AND KEYBOARD ASSEMBLY (A310)

The Display card is mounted on the front of the system and is controlled by the GCAU card. It is a plug-in device and is connected through two RJ 4-4 connectors with a 4-wire cable. All data and necessary power supply voltages are transferred over this cable. The display is a 9mm character height two line by sixteen-character alpha numeric LCD with LED backlight.

The Keyboard is connected to the display unit which decodes the three operating buttons and controls the two indicator LEDs.

The menus, indications and controls available depend on the system configuration.

6.6 "TPC" THREE-PHASE CONTROL CARD (A2)

The TPC card is used in case of a three-phase system and is mounted close to the bridge assembly.

The card is controlled via a link cable connected to the GCAU card.

The TPC has all necessary electronics to synchronise to the secondary transformer voltage and to control the thyristors.

The card is phase insensitive meaning it will operate with all possible phase rotations.

7 OPTIONS

The equipment has these options fitted only if they have been specified in the initial order. Refer to the customer drawings.

7.1 ALARM/SIGNALLING/MEASUREMENT OPTIONS

7.1.1 LED box (A6)

The front door of the rectifier can be equipped with 16 electroluminescent diodes and related texts. The LEDs indicate alarm or events as configured in the GCAU card.

7.1.2 Relay cards (A5)

Relay cards A5 provide remote signalling of individual alarms. Each card has eight relays. A maximum of 8 relay cards can be connected to the GCAU card. Note that only one card can be powered from the GCAU. All other relay cards must be powered separately.

7.1.3 Temperature alarm

For natural cooling bridge: a thermo switch is mounted on the rectifier bridge for "high temperature alarm" signalling.

For bridge equipped with fan: another thermo switch (higher temperature threshold than alarm one) is mounted on the bridge for switching off the rectifier when too high temperature is reached.

7.1.4 Supplementary meter functions

As standard, load voltage and current, date and time are displayed in the measurements menu.

Your equipment can have supplementary meter functions:
"AC Meter", "Ibatt meter", "Ah meter", "Ambient Temp" and "Battery Temp".
These options can be activated or deactivated on customer demand.

"AC Meter"

This option allows reading the mains input power supply in the measurements menu.

"Ibatt Meter"

If the system is equipped with the battery shunt option and "Ibatt Meter" is activated, the battery charge and discharge currents can be displayed. The "-" sign preceding the displayed value indicates a discharge condition. In this case, the load current will correspond to the rectifier current minus the battery current.

"Ah Meter"

The ampere-hour meter measures the battery charge and discharge Ahs. This value is displayed as a percentage of the initial battery capacity.

The ampere-hour meter reads 100% in the following cases:

- the counting reaches 100%,
- the system has been operating in the floating mode for at least 100 hours.

NOTE:

During battery recharging, only 80% of Ahs are taken into account (battery average efficiency when recharging).
(Note: Efficiency factor is programmable).

"Ambient Temp" and "Battery Temp"

When these options are activated and temperature sensors are installed, you can read the battery and ambient temperatures on measurements menu. Temperature unit can be set in °C or °F on customer demand.

7.1.5 Analog meters

The digital measurements can be associated with needle analogical measure dials (on the front panel). These dials provide a direct reading of voltage and current.

These options are available for:

- Mains input voltage and current (switchable for three-phase system).
- Battery voltage and current.
- Load voltage and current.

7.1.6 Spare inputs

The GCAU card has 8 multifunctional digital inputs, some can be used for option signalling purpose (e.g.: low electrolyte level, battery symmetry fault detection ...). Depending on the option configuration, some spare inputs remain and they can be used as user alarms centralization. Inputs are not isolated: they are provided to be exclusively connected to the 0 V (negative polarity) typically via a relay or switch contact. A free displayed text can be associated to each input.

7.1.7 High ripple voltage alarm

The DC voltage ripple (AC component) is measured via card A28. If the ripple is greater than a preset level, the card sends a signal to control card A1 via a spare input and the corresponding alarm is displayed.

7.1.8 Audible alarm

To alert the operator to a malfunction, the common alarm, when activated, generates an audible signal. Associated with the audible alarm is a push-button used to reset the buzzer. When the common alarm is reset, the audible alarm is automatically reset.

7.1.9 Electrolyte level alarm

The electrolyte level in the cells can be checked using an external probe.

On the outside of a pilot cell, a capacitive probe is positioned between the minimum and maximum electrolyte level marks on the cell.

If the electrolyte level in the cell drops below the minimum level, the probe sends a signal to control card A1 and the corresponding alarm is displayed.

The probe comes with a bracket and straps for securing it to the battery cell.

7.1.10 Ground fault detection

1 - Case of a single SPRe/TPRe rectifier

The option is integrated into the GCAU card.

The ground fault detection circuit monitors the impedance of the connection between ground and the positive and negative of the DC output.

An alarm is delivered on detection of a leakage current ≈ 10 mA between ground and one of the output polarities.

2 - Case of two SPRe/TPRe rectifiers connected in parallel

In this case, the GCAU integrated option is not applicable. A separate card is installed on the DC output common bus.

This board provides dual insulation fault detection between the positive and negative polarities with reference to ground.

The alarm (Ground + or Ground -) is delivered either:

- directly on free-voltage loops, or
- to the GCAU card using (on each rectifier) : 1 spare input (Ground fault)
or
2 spare inputs (Ground + fault, Ground – fault).

7.1.11 Battery symmetry fault detection circuit (A10)

This card detects the following fault conditions of a connected battery :

- un-symmetrical cell voltages,
- disconnected or shorted cells.

The detection is independent of the charge state of the battery (float charge, high rate charge or commissioning charge).

In order to detect one of the above fault conditions, a battery centre tap input is present.

Cell numbers can be odd or even since the adjustment allows compensation for odd cell numbers.

7.2 COMMUNICATION OPTIONS

7.2.1 WINSPARC supervision

PC computer can be used for local or remote supervision using a communication link:

- RS232 link: if only one charger is to be connected to the PC.
- RS485 4 wires bus: if more than one charger is to be connected to the same communication bus (centralized supervision of chargers). The rectifiers are acting as slaves and the central computer as the master. By giving the different rectifiers different slave numbers, it is possible to command each individual rectifier.

The GCAU card can be equipped with an isolated RS232/RS485 communication card (A71).

The GCAU has an on-board extension connector where the communication card is piggybacked on.

Both RS232 and RS485 are electrically isolated from the charger.

User connections:

RS 232: 2m long wire equipped with subD9 standard connector.

RS 485: interface board (A72) with connector (bus connection and end of line impedances)

The communication protocol is a AEG Power Solutions Maintenance protocol (ASCII based)

A software tool "WinSparc" is supplied as supervision application for PC.

Use of the public telephone line for connections is possible with modem as option.

7.2.2 MODBUS communication

The SPRe/TPRe series of chargers supports the Modbus (Jbus) protocol (RTU or ASCII based), an user SCADA system with MODBUS protocol can be used for supervision.

The connection to the charger(s) can be RS232 (one equipment monitored) or RS485 (more than one charger or equipments on the bus), the same hardware equipment is supplied than WINSPARC supervision.

The complete MODBUS mapping of the various parameters is available.

Communication speed is 2400, 4800, 9600, 19200 or 38400 Baud.

7.3 CONTROL/COMMAND OPTIONS

7.3.1 Manual voltage and/or current adjustments

Option reserved for battery-less systems.

When this option is fitted, the rectifier output voltage and current are set by the operator; the charger operates as an adjustable power supply.

Rectifier output voltage and current adjustment is made through the "Manual adjustment" menu (refer to § 5.6.4). The voltage can be set between an upper limit (max) and a lower limit (min) set in the system set-up (*factory setting*).

The current can be set between 0 and the maximum current of the rectifier.

7.4 AC INPUT OPTIONS

7.4.1 EMI filter

The rectifier is fitted with an input EMI filter. This filter filters out conducted interference in accordance with the EN 55011 standard. To avoid undesirable radiation, the rectifier cabinet must be properly earthed and the doors must be closed.

7.4.2 Supplementary protective devices

Protective devices (fuses and circuit breakers) can be provided for the mains input. For alarm purposes, auxiliary contacts of protective devices are available as additional option.

7.4.3 Input contactor

An input contactor replaces the standard input switch to isolate the AC input from the mains. An ON/OFF switch is available on the front of the rectifier.

7.5 LOAD OPTIONS

7.5.1 Supplementary protective devices

Protective devices (fuses and circuit breakers) can be provided for the load lines.
For alarm purposes, auxiliary contacts of protective devices are available as additional option.

7.5.2 Additional DC filtering

Additional DC filtering (additional capacitor or/and chokes) provides low voltage ripple on DC output without battery. When the battery is connected, the ripple current of the battery is minimized by the additional filter.
1 % filter or 0.1% filter are available.

7.5.3 Load switch

A switch isolates the load from the DC bus.

7.5.4 Blocking diode

A blocking diode is connected to the rectifier output. It is used to isolate a faulty unit, especially when rectifiers are paralleled.

7.5.5 High-voltage trip

The high-voltage trip protects the battery and the load from excessive DC voltages during normal operation. As standard, the rectifier is electronically shut down by inhibiting the thyristor gate drive signals.

If this option is fitted, the trip signal causes the mains input contactor to drop out via the relay card. The trip level is set in the system set-up (*factory setting*).

The alarm is of the latching type, so that the rectifier stays off until the operator has reset the alarm.

7.5.6 Diode stabilizer

A diode stabilizer is used if the DC output voltage is too high for the load.
The GCAU card has a specific function built in which controls the diode stabilizer through the relay card.
The number of diodes depends on the required voltage drop.
For a small load voltage range, the diode stabilizer must be turned on in steps.
The switching in or out of a step is controlled by the contactor energized by the relay card.
The maximum number of diode sections is three.

7.6 BATTERY OPTIONS

7.6.1 Battery temperature compensation

The SPRe and TPRe rectifiers can sense ambient temperature. The sensor is located in a plastic housing and can be mounted to the wall by a screw. The connection from sensor to board is a 4 wire telephone cable. The sensor is used to compensate the floating voltage or the high rate voltage if necessary. The temperature coefficient with reference to the battery ambient temperature can be defined by software in the system set-up (*factory setting*).

Note: The SPRe and TPRe rectifiers can sense both ambient and battery temperature for special applications (as VO battery charging).

7.6.2 Battery current limit/display

Battery branch is equipped with a shunt. Battery current is displayed and battery charging current can be limited to a configured value (*factory setting*).

Note: maximal configurable battery charging current is "battery shunt value / 3.23" (while maximal value of battery discharging current display is up to "battery shunt value").

7.6.3 Low-Voltage Disconnect (*end-of-discharge contactor*)

To protect the battery from over-discharging and the load from too low a DC voltage, the battery is disconnected from the load at a set voltage level. This level is just below that corresponding to the end of the battery reserve time. The battery is disconnected by a contactor in the battery line.

When the mains voltage returns, the rectifier supplies the load, the low voltage alarm is automatically reset, and the battery is reconnected.

7.6.4 VO battery charging (recombination batteries)

This option is reserved to systems equipped with VO (sealed Ni-Cd) batteries, and is used with:

- ▶ C15-100 rectifier monitoring card and input contactor,
- ▶ Battery and ambient temperature sensors,
- ▶ Battery current limit,
- ▶ 1% filter,
- ▶ Relay card.

The batteries are charged at constant voltage at two levels and limited current. Voltage levels are depending on the battery temperature (temperature coefficient is -2,5 mV/°C/cell, factory setting).

The high charge battery is controlled following the difference between the battery temperature and the ambient temperature.

Battery temperature increase (from ambient) and charging time are monitored.

C15-100 independent card monitors permanently battery parameters (voltage, current and temperature). 1% filters insure low ripple voltage and current to the battery and DC output.

7.6.5 C15-100 rectifier monitoring board

Option reserved to systems equipped with VO (sealed Ni-Cd) and sealed lead-acid batteries.

This board trips the rectifier when any of the followings fault are detected :

- high battery voltage (temperature-compensated value)
- high battery charging current
- battery temperature higher than +60°C (this fault is inhibited on mains power return if the rectifier is in the floating mode). The fault can be reset by pressing push-button S2 (only if the fault has disappeared).

The system must be reset by the operator.

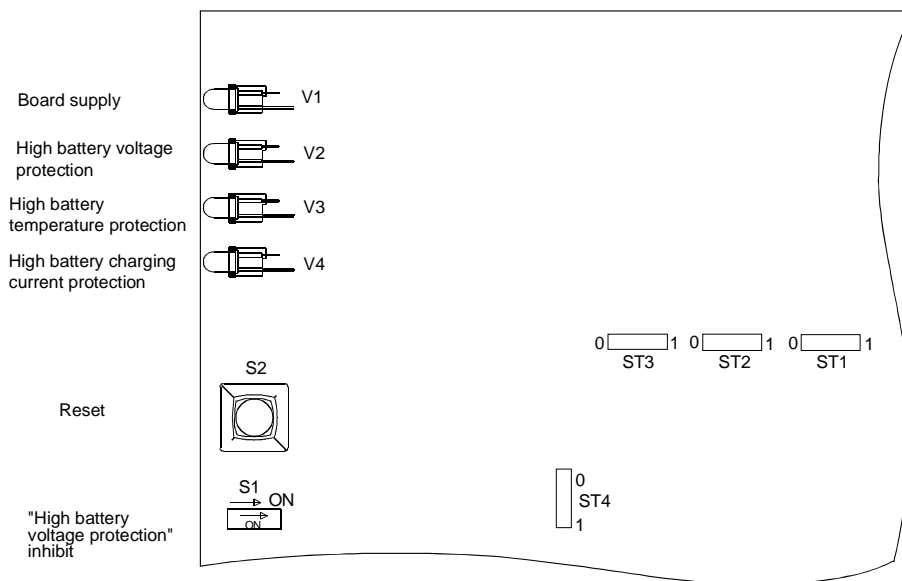
Standard settings

	ST3	ST2	ST1
220 V	0	0	0
110 V	0	0	1
48 V	0	1	1
24 V	1	1	1

ST4	Slope adjustment
0	inhibition
1	compensation : 0,17% /°C

NOTE: During commissioning charge, set S1 on the position ON ("high battery voltage" detection inhibited).

Components location C15-100 board



7.6.6 Supplementary protective devices

Protective devices (fuses and circuit breakers) can be provided for the battery lines.

For alarm purposes, auxiliary contacts of protective devices are available as additional option.

7.6.7 Battery switch

A switch isolates the battery from the DC bus.

7.6.8 Cable drop compensation

The rectifiers can be programmed (cable drop parameter) to compensate for cable drop between your system and the battery without the need of remote sensing.

If battery current limit/display option is present:

The output voltage will be increased as a function of the battery current.

If battery current limit/display option is not present:

The output voltage will be increased as a function of the load current.

This option is mainly used when load cables are connected directly to the battery.

Voltage measurements on the display:

“Outp” (measurement menu): compensated voltage (value from calculation).

“DC” (default menu) and Load (measurement menu): actual voltage

Note: the cable drop parameter is the reverse function of “droop” factor used for passive load sharing.

7.6.9 High rate charge interlock (*Forced float charge*)

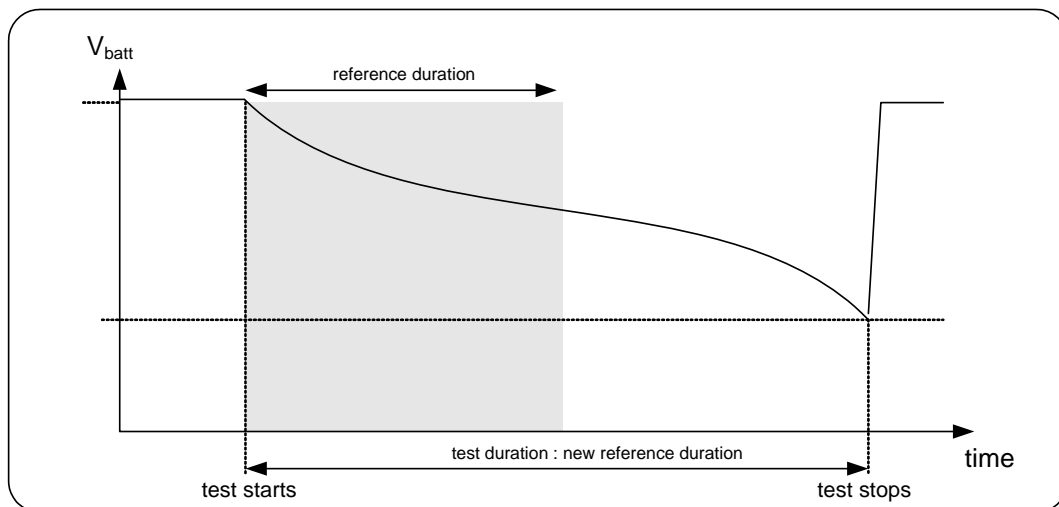
This option is used when high rate charge is not allowed if the load is connected. In this case, an auxiliary contact of the DC load protective device is wired to the spare input configured for forced floating.

7.6.10 Battery capacity test

Battery current display option is necessary for this option.

In order to check the battery performance, a battery test can be activated. The battery test discharges the battery until a predefined voltage. It will discharge the battery with a constant current. To accomplish this, the charger is slowly regulated until the discharge current reaches the desired level. Both charger and battery will deliver current. This ensures you do not lose system performance in case a battery is in a bad condition or has an open cell.

The battery test can only be performed on a 100% charged battery and should discharge the battery at least 60%.



The Battery test can be activated by the operator/serial command or can be initiated periodically.

If initiated periodically but the conditions to start the battery test is not met (see below), the battery test will be postponed 24 hours and a new try is given. After three retries the test will be terminated until the next periodic cycle. During the three retries the periodic counter is stopped and started again after the battery test is initiated.

If the battery test is manually initiated and periodic battery test is active as well, the periodic timer is reset upon selecting manual battery test to prevent sequential battery tests.

The time it takes to reach the End Voltage level is compared to the time of the previous battery test. This previous time is multiplied with a tolerance factor to compensate for battery performance. If the time is shorter than this reference time, an alarm **"BATT.TEST FAILED"** is generated. If the time is longer than the predefined time, or within the defined percentage, a text **"BATT.TEST PASSED"** is generated. This is not an alarm situation but only a message. It will disappear from the screen as soon as another function is selected from the front panel. In both cases this event is written to the history list. If the time is longer than the predefined time, this new time is updated and will be used as the reference for the next battery test.

The first time the battery test is performed the reference time is 0. This ensures that the first battery test logs a time greater than the reference time.

Note:

If required, you can manually set the reference time to 0. Go to the Battery Test Setup in the System Setup and select the discharge current. If you change this setting, the reference time will be set to 0 once you leave the setup.

(If you do not want to change the value, just go up and down with the setting until you have the previous setting. This will have the same effect).

The Battery test is not allowed under the following conditions:

- ▶ AC Failure
- ▶ Standing load < discharge current
- ▶ Battery capacity < 100%
- ▶ Battery current is negative (Discharge)
- ▶ System in High rate or commissioning charge

If you try to activate the battery test manually from the front panel and any of the above conditions is detected, the top line will show the message **"TEST NOT ALLOWED"** for two seconds.

If an AC failure occurs during the battery test, the test will be cancelled and the system will return to normal operation when the mains return.

Under the following conditions the Battery test is aborted:

- ▶ AC Failure
- ▶ Manual Stop (From display, serial port or external digital input).
- ▶ Discharge current is lower than the required current for 5 minutes.

In any of these cases, the battery test will be aborted and an alarm **"BATT.TEST ABORT"** is generated. This alarm can be acknowledged (reset).

7.7 CABINET OPTIONS

7.7.1 IP ratings

Different option IP rating (standard cabinet is IP21) cabinets are available: IP42, IP31, IP54.
A specific option "IP20 open door" ensures IP20 level when cabinet door is opened.

7.7.2 Eye bolts

Eye bolts set for floor mounted cabinet can be supplied, separately or already mounted on the cabinets.

7.7.3 Cabinet heater

The cabinets are fitted with heating resistors supplied via a circuit breaker. The heater circuit must be supplied with 110 VAC to 230 VAC during storage and during periods when the rectifier is not operating.

7.7.4 Interior lighting and AC socket outlet

The cabinet can be fitted with a 230V fluorescent tube turning on automatically when the door is opened. An AC socket outlet is mounted on the terminal block. It delivers a voltage corresponding to the supply voltage.

7.8 SYSTEM OPTIONS

7.8.1 Passive Load sharing (*"droop" factor*)

If two rectifiers are connected in parallel and load sharing is required, the rectifiers can be programmed to perform this function.

The load sharing is passive and is based upon changing the slope (*"droop" factor parameter*) of the rectifier output voltage: droop factor reduces the output voltage if the system current rises.

8 MAINTENANCE

AEG Power Solutions can provide a Global Service capability through regional Service Centres.



Electronic boards are sensitive to E.S.D. (electrostatic discharge).
When not installed in the equipment, they are delivered in antistatic bags.
Before handling a board, the operator must take care to be at the same potential as the equipment to be worked on and take all customary precautions.

8.1 RECTIFIER MAINTENANCE

Remove dust at yearly intervals.

At regular intervals, carry out an inspection including the following:

- 1 - Disconnect the mains input line and the battery.
- 2 - Examine the components and the wiring. Pay special attention to signs of overheating and melted insulation. Check all connections. Check for loose wires.
- 3 - Check that the cooling air flow is not impeded.
- 4 - For rectifiers with air inlet filters (on the door), check the filters for cleanliness.
- 5 - Check the operation of the rectifier and the voltage levels (*see customer drawings*).
- 6 - The GCAU card is equipped with a lithium battery for the Real Time Clock (RTC). This component has a life of about 10 years. Its replacement must be done by specialized personnel.

IMPORTANT

This component, mounted on a support, must be recycled in compliance with the European Directive n° 91/157/EEC of 18.03.91. You can also apply to AEG Power Solutions by shipping back the used card (prepaid shipment).

8.2 FAN MAINTENANCE

Rectifier bridge fan(s):

> 50A rectifiers are fitted with a (or several) fan(s) with a life time of about 5 years.
Thermostat (option) on the heatsink of the power converter starts the fan(s) when the temperature is above 64°C.

Rectifier bridge and cabinet fans:

It is recommended to replace the fans every three years. This operation must be done by specialized personnel.

8.3 BATTERY MAINTENANCE

For the recommended battery maintenance procedures, refer to the battery manufacturer's manual.
At the end of their service life, the batteries must be recycled in compliance with the European Directive n° 91/157/EEC of 18.03.91 and WEEE directive. You can also apply to the battery manufacturer as indicated in the battery manual.

9 ELEMENTARY TROUBLESHOOTING

When an alarm is activated, the green light is out and the red light flashes. The "ALARM" message can be displayed by hitting any key to go to main menu.

Note the descriptions of the alarms present (see Chapter 5 - OPERATING INSTRUCTIONS).

If pressing RESET (in the alarm menu) does not turn off the red light, refer to the following troubleshooting table for the corrective action to be taken.

NOTE:

This elementary troubleshooting guide assumes that the commonest protective options are fitted.

Your equipment may be different and some of alarms can be deactivated. Refer to the customer drawings.

ALARM or EVENT	PROBABLE CAUSE	CORRECTIVE ACTION
The display is white	Contrast problem	Do not touch any button for 5 minutes. This will automatically activate the default menu. Held the rightmost button, the contrast will be increased.
"HIGH MAINS VOLTS"	Mains voltage out of limits. Programmable threshold: default value or customer demand value.	. Check the mains voltage. The voltage must be that specified on the customer drawing package.
"LOW MAINS VOLTS"	. Rectifier off. . Mains fuse(s) opened. Programmable threshold: default value or customer demand value.	. Switch on the rectifier. . Check the fuse(s). Replace if necessary.
"CHARGER FAULT"	. Low floating voltage with the rectifier not in current-limiting mode. . Fuse F1 blown.	. Check the F1 fuse Call the Customer Service Department. . Check the mains voltage and the proper operation of the fans.
"HIGH BATT.VOLTS"	The rectifier output voltage is higher than the maximum allowable value. Programmable threshold: default value or customer demand value.	. Call the Customer Service Department.

ALARM or EVENT	PROBABLE CAUSE	CORRECTIVE ACTION
"LOW BATT.VOLTS"	<p>Battery in discharge resulting from:</p> <ul style="list-style-type: none"> . rectifier off. . mains absence or low mains voltage. . missing phase (TPRe). <p>Programmable threshold: default value or customer demand value.</p>	<ul style="list-style-type: none"> . Switch on the rectifier. . Check the mains.
"HIGH DC VOLTAGE"	<p>The rectifier output voltage is higher than the maximum allowable value.</p> <p>Programmable threshold: default value or customer demand value.</p>	<ul style="list-style-type: none"> . Call the Customer Service Department.
"LOW DC VOLTAGE"	<p>Low load voltage resulting from:</p> <ul style="list-style-type: none"> . rectifier off. . mains absence or low mains voltage. . missing phase (TPRe). <p>Programmable threshold: default value or customer demand value.</p>	<ul style="list-style-type: none"> . Switch on the rectifier. . Check the mains.
"GROUND FAULT +"	<p>Low resistance between positive output and cabinet ground.</p> <p>Programmable threshold: default value or customer demand value.</p>	<ul style="list-style-type: none"> . Check for the insulation fault.
"GROUND FAULT -"	<p>Low resistance between negative output and cabinet ground.</p> <p>Programmable threshold: default value or customer demand value.</p>	<ul style="list-style-type: none"> . Check for the insulation fault.
"HIGH TEMPERATURE"	<p>High temperature on the bridge (up to 90°C). Detection by thermo switch mounted on the heat sink.</p>	<ul style="list-style-type: none"> . Check the fan(s). . Check if no obstacles are blocking the airflow. . Check the ambient temperature. . Check the thermo switch.

ALARM or EVENT	PROBABLE CAUSE	CORRECTIVE ACTION
"TEMP SENSE ERROR"	<ul style="list-style-type: none"> . Short or open circuit temperature sensor. . GCAU card fault (ADC) 	<ul style="list-style-type: none"> . Check the sensor connection. . Call the Customer Service Department.
"HIGH BATT. TEMP."	<p>High battery temperature.</p> <p>Programmable threshold: default value or customer demand value.</p>	<ul style="list-style-type: none"> . Check the battery cabinet temperature.
"CHARGER CURR.LIM"	<p>Charger current limit indicator.</p> <p>It appears when the rectifier cannot supply the necessary power for the load. In this case, the rectifier operates in current-limiting mode.</p>	<ul style="list-style-type: none"> . Check that load isn't higher than your customer drawings specifications
"BATTERY CURR.LIM"	<p>Battery current limit indicator.</p> <p>It appears after battery discharge. When the mains power supply comes back, the battery is in current-limiting mode.</p>	<ul style="list-style-type: none"> . This alarm is a warning. It should not stay more than the usual time charge. . Otherwise, call the Customer Service Department.
"HIGH CHARGR CURR"	<p>High charger current.</p>	<ul style="list-style-type: none"> . Call the customer service department
"HIGH BATT. CURR"	<p>High battery current.</p> <p>Programmable threshold: default value or customer demand value.</p>	<ul style="list-style-type: none"> . If battery current limit option is activated, this alarm should not appear. . Call the customer service department.
"BATT.TEST FAILED"	<p>Appears after a battery test.</p> <ul style="list-style-type: none"> . Battery blackout. . Battery in end of life. 	<ul style="list-style-type: none"> . Call the customer service department
"BATT.TEST ABORT"	<p>Appears during a battery test.</p> <ul style="list-style-type: none"> . Discharge battery current is not sufficient . Battery charge was not initialized before the test. . Battery test appears during high rate or commissioning charge. 	<ul style="list-style-type: none"> . Stop high rate or commissioning charge manually . Initialize battery charge at 100% (in command menus "reset AH meter"). . Restart the battery test manually.

ALARM or EVENT	PROBABLE CAUSE	CORRECTIVE ACTION
"BATT. OPERATION"	Battery in discharge resulting from: <ul style="list-style-type: none"> . rectifier off. . mains absence or low mains voltage. 	<ul style="list-style-type: none"> . Switch on the rectifier. . Check the mains.
"INTERNAL CHECK"	Communication error between the microcontrollers or internal system error (e.g.: DC overvoltage protection, synchro pulse missed, TPC card error ... etc.)	Call the customer service department.
"LONG CHARGE TIME"	High rate charge time too long.	Call the customer service department.
"NO PS VOLTAGE"	No more DC power supply to the board: rectifier output voltage out of order	<ul style="list-style-type: none"> . Check the fuse F1. . Call the customer service department.
"CHARGER OFF" It can be due to a normal system operation.	<ul style="list-style-type: none"> . Alarm activation. . Serial information input. . Manual shutdown. . Initialising delay. 	<ul style="list-style-type: none"> . Put the rectifier in floating charge mode. . Call the customer service department to identify bad system configuration.

10 CUSTOMER SERVICE

AEG Power Solutions Services offer the following Services to Support all Industrial Power Supply Products:

Product Services:

Installation & Commissioning
Preventative Maintenance
Spare Part Kits
Refurbishments
Service Contracts – 24/7 Global Service Cover
Training

Site Services:

Battery Replacement
Load Bank & Site Capacity Tests
Power Quality Services
Standby Generators and other essential equipment
Hire & Supply
E-Service/Remote Monitoring
Battery Monitoring
Facility & Equipment Management
Design & Build - Turnkey Solutions

A list of the AEG Power Solutions Service Centres providing the above services is available on the Web site:

<http://www.aegps.com>