

# DC Power Systems Series ECTe 24/48/110/125V

ES229439 Rev.05  
12.09.13

## OPERATION MANUAL

## History

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## INTRODUCTION

This equipment has been designed to comply with the requirements of European Directives related to the product, i.e.:

- Electromagnetic compatibility directive (EMC) No. 89/336/EEC of 05/03/89 as amended by Directives No. 92/31/EEC of 04/28/92 and No. 93/68/EEC of 22/07/93,
- Electromagnetic compatibility directive (EMC) No. 2004/108/EEC of 15/12/04,
- Low Voltage Directive (LVD) No. 73/23/EEC of 19/02/73 as amended by Directive No. 93/68/EEC of 22/07/93,

Consequently it bears the **CE** mark.

This equipment has been designed for use in an industrial environment.



**Electronic cards are sensitive to ESD (electrostatic discharge). When not installed in equipment, they are supplied in antistatic bags. Before handling a card, the operator must be at the same electrical potential as the equipment on which they are going to work and take all necessary precautions.**

To use the system correctly, the user should first read through this manual and understand its contents. We shall not be held responsible for any damages due to misuse or negligent use of this equipment, alterations or the use of non-original parts without prior authorization from the manufacturer.

### Equipment access areas:

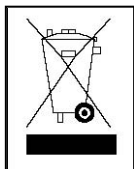
#### - Operator

The operator is a user who, after reading this manual, operates the ECTe equipment with the door closed.

#### - Maintenance staff

Staff who are trained and have the skills to perform maintenance work on hazardous access areas (with the ECTe unit open). These personnel will have read through this manual previously and will be aware of the dangers to which they are exposed. They will take all necessary measures to protect themselves and others.

## WEEE INFORMATION



**Disposal of this product is covered by selective processing of some of its components. For the provision of services, please contact our Customer Service department.**

## 1. GENERAL DESCRIPTION

The ECTe is a rectifier system which provides nominal voltages of 24Vdc, 48Vdc, 110VDC, or 125Vcc to applications while maintaining a bank of sealed NiCd storage batteries (optionally sealed Pb) charged. Should the AC power fail, the batteries will feed the applications.

The system comprises of a wall mounted unit equipped with the following components:

- A rectifier, type PM120-15 (110Vdc-125Vcc), PM48-40 (48Vdc), PM24-50 (24Vdc)
- Control and Monitoring Unit (GCAU) with log of events.
- Front screen and keypad
- Input switch.
- Interface Card which includes: .....
  - Client connections to the equipment (AC network, battery, use ...
  - Protection fuses
  - Precision resistors for measuring currents

Optionally, the following elements can also be provided:

- Analogue Ammeter/Voltmeter
- Relay card for alarm signalling
- LED card for alarm signalling
- Battery low voltage disconnect contactor
- EIA-232/485 communications card

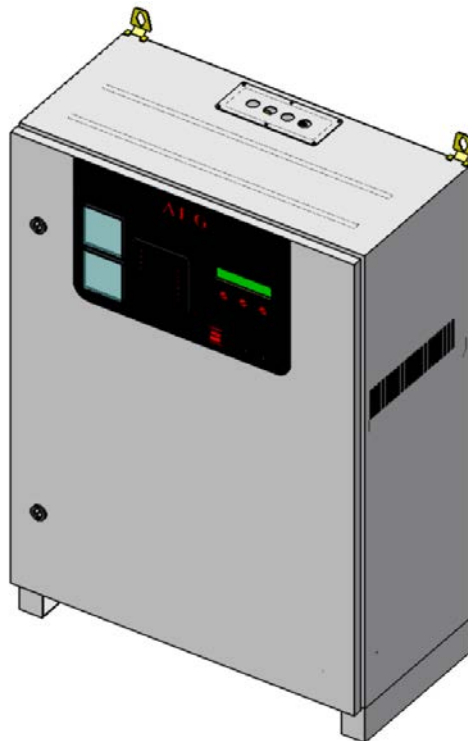


Fig: View of standard ECTe charger

## 2. TECHNICAL CHARACTERISTICS

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### 2.1 - MECHANICAL

The standard variations of the equipment may be mounted inside two types of casing, whose dimensions are the following. The type of casing chosen is based on the voltage and capacity.

#### **24Vdc and 48Vdc standard version**

Height:.....600mm.  
Width:.....500mm.  
Depth: .....300mm.  
Degree of protection:.....IP20  
Colour: .....RAL 7035  
Finish ..... Textured paint finish with powder coating.  
Cable entry:..... Top or bottom

#### **110Vdc and 125Vdc standard version**

Height:.....800mm.  
Width:.....600mm.  
Depth: .....300mm.  
Degree of protection:.....IP20  
Colour: .....RAL 7035  
Finish ..... Textured paint finish with powder coating.  
Cable entry:..... Top and bottom

#### **NOTE:**

At the customer's request, the elements that form the ECTe may be assembled in any other type of cabinet.

## 2.2 - ELECTRICAL

## INPUT

Nominal voltage:.....208Vac - 240Vac.

Number of phases: ..... Single phase

Voltage values:..... 184Vrms to 276Vrms.

Frequency: .....47.5Hz to 63Hz

Max. Current at 230Vac:.....24Vdc

Equipment 6A: 0.9A, Equipment 15A: 2A.

48Vdc:

Equipment 6A: 1.6A, Equipment 15A: 4.1A.

110Vdc:

Equipment 6A: 3.7A, Equipment 15A: 9.2A.

125Vdc:

Equipment 6A: 4.1A, Equipment 15A: 10.2A.

Starting current:..... < Current at full power

Current harmonics:.....Sinusoidal as per EN 61000-3-2.

## OUTPUT

Nominal voltage:.....24Vdc / 48Vdc / 110Vdc /125Vdc.

Maximum output current:..... Available options: **3A, 6A and 15A**

Earth system: ..... Floating or connected to earth.

**BATTERY:**

Equipment with sealed NiCd batteries, available capacity options:

**C= 4Ah**

**C = 7Ah**

**C = 14Ah**

The equipment regulates the voltage so as to provide the battery with constant current charging, equivalent to  $C/30$  A.

Equipment with sealed Pb batteries, available capacity options:

**C=7Ah**

**C=18Ah**

Normally the equipment provides a floating voltage equivalent to 2.27V / Cell, the control unit ensures that the charge current does not exceed C/10 A

## INPUT PROTECTION

- Fuse 10x38 on input phase, on the backplane board card.
- Soft start
- Surge suppression on rectifier module, as per ANSI C62.41.
- Two internal fuses on rectifier module, phase and neutral.
- Automatic shutdown when the power supply is outside input voltage limits. The system will restart automatically when the input power supply returns to nominal values.

## OUTPUT PROTECTION

- Fuse 10x38 on equipment's positive output, on the backplane board.
- DC surge protection with manual restart of the rectifier.
- Output power limit.
- Protection against overcurrents and short circuits
- Automatic power reduction depending on the temperature.
- Thermal overload protection with automatic reset.
- Circuit breaker fuse on the rectifier.

## 2.3 - ENVIRONMENTAL CONDITIONS

### TEMPERATURE

Transport and storage: ..... -25°C to +70°C

Operation: ..... 0°C to +40°C. with reduction of 2.25%/°C  
between 40°C and 55°C.

### HUMIDITY

Operation: ..... 10% to 95% RH w/o condensation.

### ALTITUDE

Operation: ..... 0 to 1000m – 1% reduction per every  
100m above 1000 m up to 3000 m.

### COOLING

The rectifier modules are cooled using forced ventilation.

**STANDARDS**..... Complies with RoHS

**VIBRATION** ..... Only during transportation.



### 3. RECEIVING THE EQUIPMENT

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Receiving the equipment requires the application of correct standards and best practices to ensure the safety of personnel and material.

AEG Power Solutions can provide services to ensure compliance with such.

To do this, contact the **AEG Power Solutions** service department, whose details are shown on the first page of this document.

#### 3.1 - RECEPTION OF THE ECTe CABINET

On receiving the equipment, visually inspect it for damage that may have occurred during transport.

Compare the contents of the package with the delivery slip before discarding the packaging. The rectifier modules may be packaged separately. Keep some packaging for possible returns.

If any damage or partial loss is detected, the customer must promptly file a claim with the carrier and take the necessary steps to protect their rights.

If the equipment is not being installed immediately, store it in a dry ventilated place, protected from rain, water splashes and chemicals, meeting the environmental requirements defined in paragraph 2.3.

#### **ATTENTION:**

**Long storage periods without charge or discharge can cause irreparable damage to the battery.**

**When a battery is stored in a room at a temperature of between 20°C-30°C it will self-discharge at a rate of 3% -6% per month, due to internal chemical reactions. Storage at higher temperatures should be avoided at all cost as it increases the rate of self-discharge. Stored batteries must be recharged every 6 months in order to preserve their capacity and to extend their life.**

#### 3.2 - HANDLING

##### **Safety instructions**

Equipment must be handled by qualified personnel with knowledge of specific hazards and precautions must be taken to ensure the safety of everyone in the vicinity.

During handling of the equipment it is essential to comply with current regulations and use safety equipment such as gloves, shoes and safety glasses, etc., as well as the safety devices required for each operation.

For proper handling, read all the instructions on the packaging. Bear in mind instructions such as weight, up/down, fragile, danger, corrosive liquid, electrical hazard. Failure to comply could result in damage to the contents.

The cabinets must be handled with care and always kept in the upright position. The packages are normally transported on pallets and the cabinets are strapped to the pallet and protected by cardboard or plastic sheeting. If possible a pallet truck should be used to move the cabinets around the premises to their final location.

The packages may be grouped on one pallet. In this case, comply with handling regulations to transport objects using hand trucks or fork lift trucks.

**Handling batteries**

Always keep the batteries in the upright position.

Never lift a battery up by its terminals.

Do not place or drop anything on top of the battery.

## 4. INSTALLATION

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The ECTe system is designed for indoor use.

### 4.1 - INSTALLING THE ECTe

Select an installation site with the following characteristics:

- Ambient temperature between 0°C and +40°C.
- Relative humidity between 10 and 95% without condensation.
- Air free of dust and corrosive fumes.
- Floor level enough to avoid mechanical stresses when fixing it down.
- Floor strong enough to support the weight of the equipment and its batteries.
- Sufficient headroom and side space between the equipment and the ceiling of the installation ( $\geq 50\text{cm}$ ) to allow an air flow and to accommodate cables if necessary.
- Sufficient space in front to allow the modules to be withdrawn.
- Unobstructed air inlets and outlets.

## 5. CONNECTIONS

### SAFETY WARNING



All work done on ECTe equipment must be performed by qualified personnel with knowledge of the specific electrical hazards and the necessary precautions.

The installer shall comply with the requirements of IEC 364 or NF C 15-100.

This equipment generates leakage currents > 3.5 mA.

An earth connection is absolutely essential. Connect the earth wire before connecting the phase and neutral wires.

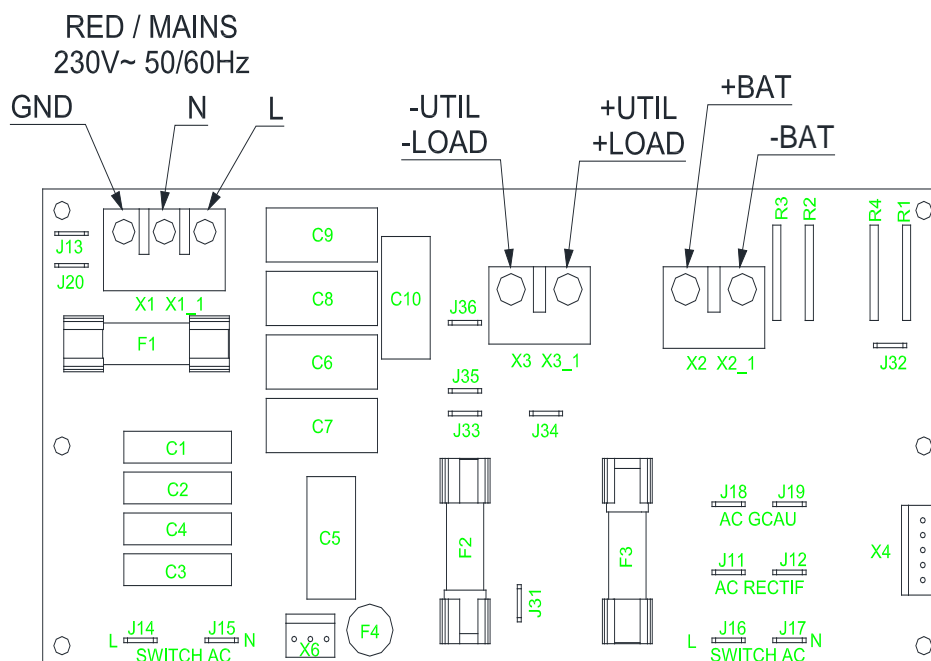
Make electrical connections with all current disconnected and breaking devices in open circuit, i.e.:

- Battery protection device (fuse F3) open.

Make sure that the batteries are installed and that the cells are correctly installed in series, check that the polarity (+BAT/-BAT) matches the markings printed on the backplane board.

AC mains power cables, DC application cables and optionally the alarm relay outputs are introduced through the top or bottom of the equipment. The mains and application cables are connected at terminals X1 and X3 respectively on the backplane board. The alarm relay outputs are connected to the optional relay board A5.1 (refer to chapter 5.5).

Before doing any work inside the equipment, place a protective tray over the GCAU interface card located on the rectifier module, to prevent metal objects falling on it.



View of terminal blocks for AC and DC connections

## 5.1 - EARTH CONNECTION

Always connect the earth to terminal X1 on the equipment's backplane board.

The MIP is delivered without a connection between 0V and earth, which should be made according to the needs of system output. This means that the DC output is supplied as floating.

Refer to the system circuit drawing before making any connections.

## 5.2 - MAINS CONNECTION

Connect the mains power (Phase Neutral Earth) to terminal X1 on the equipment's backplane board.

First make sure that the earth terminal is securely connected.

Size of AC cable.....Minimum: 0.5 mm<sup>2</sup>, Maximum: 16 mm<sup>2</sup>.

## 5.3 - BATTERY CONNECTION

The equipped is supplied with the batteries already installed.

The batteries are protected by fuse F3, located on the backplane board on the positive line for the battery.

It is only necessary to fit the battery fuse F3 in order to connect the batteries to the system.

## 5.4 - OUTPUT CIRCUIT CONNECTION

**Connect the negative pole for use to the route marked as -UTIL on terminal X3 located on the backplane board.**

Now connect the positive pole for use to the route marked as +UTIL on terminal X3 located on the backplane board.

Size of output cable.....Minimum: 0.5 mm<sup>2</sup>, Maximum: 16 mm<sup>2</sup>.

## 5.5 - ALARM OUTPUT CONNECTIONS

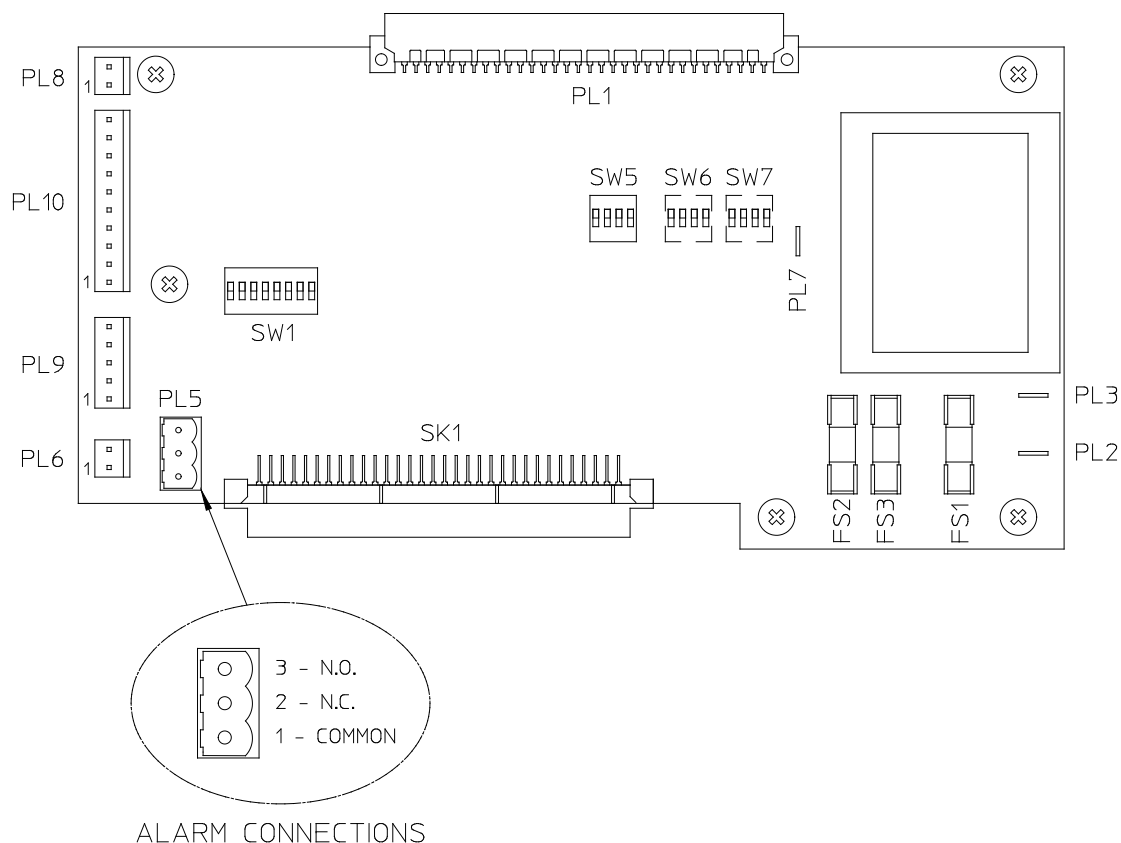
**IMPORTANT:** In order to prevent possible interference phenomena, AEG-PS recommends the use of shielded sheathing for signal cables. The mesh of these cables must be connected to the glands with a serrated nut to ensure perfect contact of the entire section of the mesh with the metal part of the gland nut.

### Common alarm:

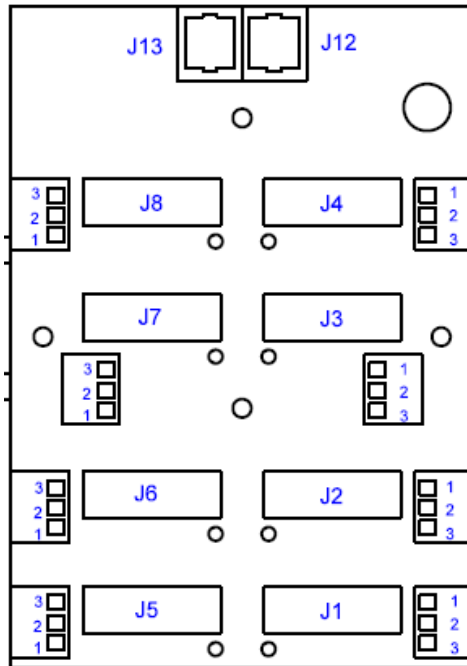
On the back of the board there is a relay connection for the common alarm signal (see layout).

Characteristics: .....Contact 1 Form C

Specifications: .....250Vac at 2A, 24Vdc at 2A & 150Vdc at 0.1A



### Relay card (optional)



The default alarm list provided by each of the relays is the following:

- J1: No mains supply
- J2: Rectifier fault
- J3: +Earth fault
- J4: -Earth fault
- J5: High voltage
- J6: Low voltage
- J7: Battery charge fault
- J8: High temperature

The system provides an optional relay board that communicates digitally with the GCAU monitoring unit via a CAN bus. The card provides 8 programmable potential-free contacts for the alarm output.

Connectors J12 and J13 are used as input/output for the said communication bus, as well as to power the card.

## 6. START UP

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### IMPORTANT NOTE

Any operation on this equipment must be carried out by qualified personnel who have been trained and are aware of specific electrical hazards and precautions.

### 6.1 - PRELIMINARY CHECKS

- Check that all of the equipment's protection elements are open.
- Check that the characteristics for the mains voltage (voltage, frequency) are compatible with the equipment (see the rating label).
- Check that the output and battery connections have been made correctly and are tight.
- Check that the polarities of the battery cells are correctly connected in series.

### 6.2 - SWITCHING ON

- Check that the rectifier module is in place.
- Close any external mains isolator.
- Close the mains breaker **S1** located on the front of the equipment.
- The indicator light for the mains power breaker **S1** will light. The "green "ON" indicator light on the front panel of the rectifier will light up, indicating correct operation. The display and keypad on the door will become active.
- Close the output switch or insert the output fuses.
- Check that the output voltage and current shown on the display are appropriate for the system.
- Close the battery switch or insert the battery fuses.
- Check that the battery charge current is appropriate for the system. Refer to the GCAU user manual for detailed instructions on how to view the battery charge current.

**Note: If the batteries are in a discharged state then the DC voltage will decrease to control the charge current. This may trigger Low DC and/or Low Battery voltage alarms. As the batteries charge the voltage will recover and these alarms will disappear.**



## 7 - PRINCIPLE OF OPERATION

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### 7.1 - FUNCTIONAL DESCRIPTION

The frame is feed by an AC supply and produces a DC output. The rectifier operates when an AC voltage is applied to the ECTe system.

The rectifier converts the alternating current to direct current, collected by the backplane board, which charges the battery and provides power for the applications via terminals X3.

When the rectifier is working properly, the green “ON” light for the rectifier module inside the equipment will light up on the front panel.

The rectifier is connected to and controlled by the GCAU module via the interface and backplane board. The interface card converts the control signal (Vctrl) from the GCAU to a voltage suitable for controlling the rectifier voltage. If the GCAU monitoring unit fails, the rectifier switches to fallback mode (at a set output voltage).

The control signal (Vctrl) ranges from 2 to 8 V. This provides the following output voltages for the rectifier:

24V Rectifier: 16.5 to 33 Volts

48V Rectifier: 33 to 66 Volts

110V & 125V Rectifier: 83 to 166 Volts

During normal operation, the GCAU monitoring unit regulates the DC output voltage of the rectifier module so that the sealed NiCd battery is charged at a constant current value, configurable depending on the selected battery capacity. If Pb batteries are used, the GCAU unit usually provides the set floating voltage, ensuring the battery current is limited to the appropriate value. Refer to point 2.2 for further information.

It also communicates with the display to show the user the system status information. The GCAU is powered from both AC mains and the DC output so it will continue to operate during a mains outage.

An AC power failure causes the rectifier to switch off immediately and the associated “ON” indicators switch off. During the power cut, the batteries supply the load as required.

The GCAU will detect a rectifier fault, including an AC power failure and will display a rectifier failure alarm.

## 7.2 - OPERATION DURING MAINS SUPPLY FAILURE

### **Initial state:**

AC mains supply working.  
Battery charged.

### **When the AC mains supply fails:**

A mains failure (alternating AC voltage outside rectifier margins), causes the rectifier to be inhibited immediately and the LED indicators switch off (both on the rectifier module itself as well as the "mains present" LED indicator located on the front of those units equipped with the "LED card" option).

During the mains failure the power needed by the load circuit is supplied by the batteries as a backup power supply. As the batteries supply power to the load circuit, the voltage will drop in accordance with the battery discharge curve and depending on their state. During the whole process, the battery voltage is monitored by the GCAU monitoring module. As a result of this monitoring, the following events, among others, may be generated:

- "Low Voltage" alarm, which implies the triggering of a Rectifier Fault which is signalled by the corresponding potential free contacts as stated in the alarm table given above.

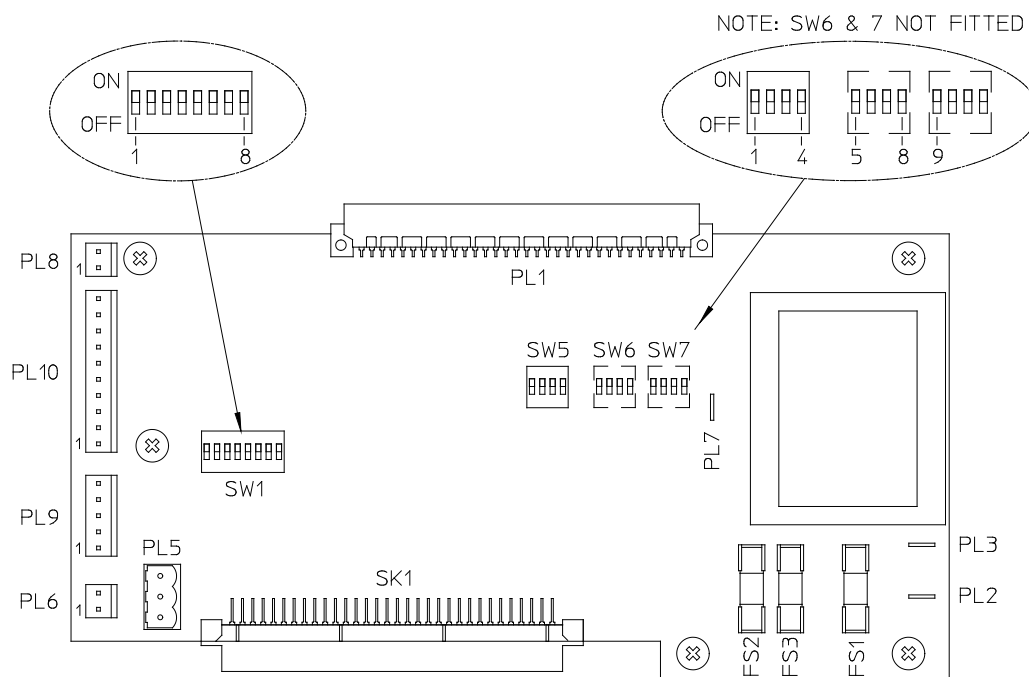
### **When the AC mains supply returns:**

In any of the cases, the output voltage of the rectifier will be controlled within a few seconds so that the battery charging current does not exceed the pre-set current limit.

## 7.3 - RECTIFIER FALLBACK VOLTAGE

If, for any reason, the rectifier voltage control signal (Vctrl) falls outside the range of 2 – 8 volts, circuitry on the interface PCB adjusts the control signal to force the rectifiers to the Fallback Voltage. The Fallback Voltage is set by means of the **SW1** micro-switches on the Interface PCB. Normally this will be set to the factory default suitable for each type of system.

If necessary, the micro-switches allow fine adjustment of the Fallback Voltage. **Appendix B** lists all 256 possible settings for the Fallback Voltage. To use the tables, check the 24V, 48V or 120V columns to find the nearest value to the voltage required. Now read off the switch setting value in the column to the left. For each value of '0' set the corresponding switch to 'ON'. For each value of '1' set the corresponding switch to 'OFF'.



## 7.4 - RECTIFIER MODULE INDIVIDUAL FAIL ALARM SETTING

The micro-switches **SW5** on the Interface PCB can be used to enable or disable the rectifier module fail alarm.

Normally micro-switch 1 will be set to 'ON' and the rest to "OFF" to enable the rectifier fail alarm. If the rectifier module fails or is removed from the system, this will produce a rectifier fail alarm.

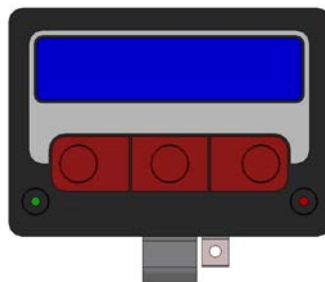
## 7.5 - GCAU CONTROLLER DISPLAY

A comprehensive man-machine interface ensures that all main parameters of the configuration are accessible from the front panel. A 2x16 line LCD display shows the user all of the information. A 3 button keypad is used to interact with the display. Two LEDs (green and red) show the charger status.

The green LED is always on if there is no alarm present.

In the event of an alarm, the red LED lights up and flashes at a frequency of 1 Hz.

If the alarm is acknowledged, the red LED remains permanently on (assuming the alarm is still active). If there are no active alarms after acknowledgement, the red LED switches off and the green one comes on again.



The following section explains the basic menu structure of the system. It provides access to all the functions necessary to use the system.

Menus, prompts and controls available depend on the system configuration.

The keypad assembly has two LEDs:

- Green LED: "System OK" (Indicating correct operation)

Red ● LED: "Fault" (presence of alarm condition)

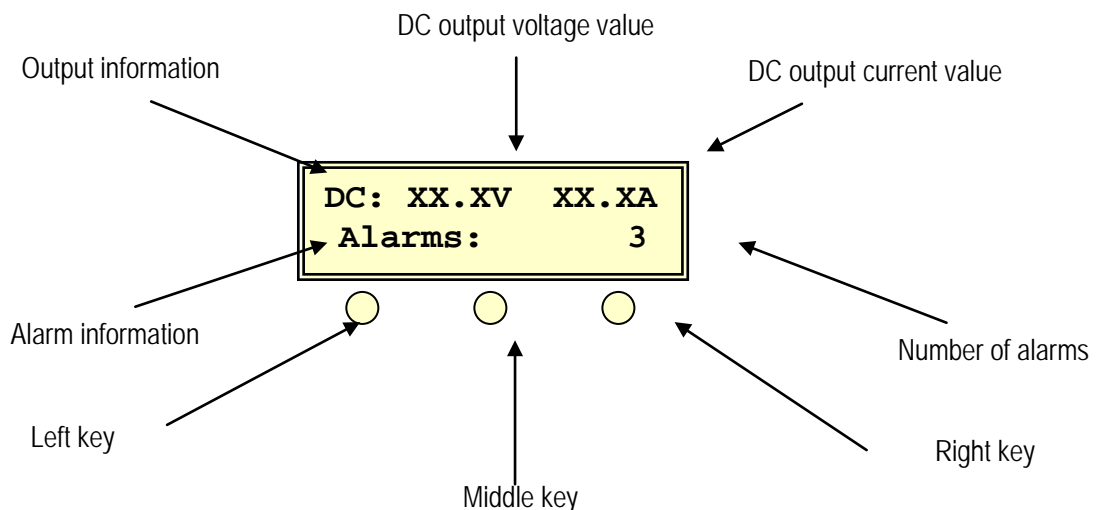
The green LED is always on if there is no alarm present.

In the event that an alarm occurs, the red LED will start to flash.

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

If there are no active alarms after acknowledgement, the red LED switches off and the green LED comes on again.

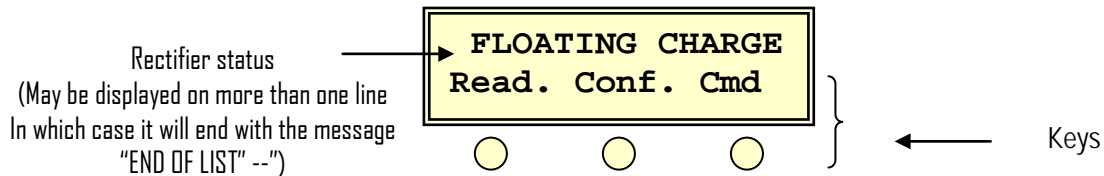
### Start menu



The top line (DC) shows the charger voltage and charge current when there is battery shunt or the total current of the charger (battery + charge) when the battery shunt is not active.

**Press any key to go to the main menu**

### Main menu



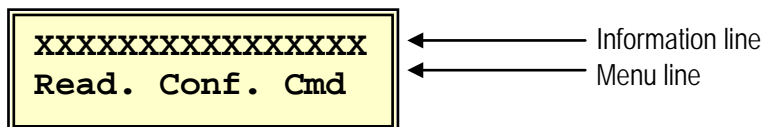
The different states of the rectifier are:

- FLOATING CHARGE
- QUICK CHARGE
- FORMING (= Special Charge)
- RECTIFIC. OFF (See chapter 8.6 "SOLVING BASIC PROBLEMS" for further information)
- TEST BATTERY

### Display layout

Display functions are grouped in a logical way within the menu structure of the display for easy use.

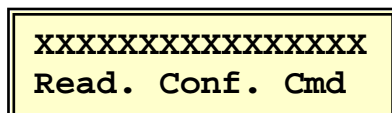
The LCD display has 2 lines of 16 characters. The top line is always used to indicate information whereas the bottom is used to indicate the menu structure.



There are three main groups that contain all of the functions.

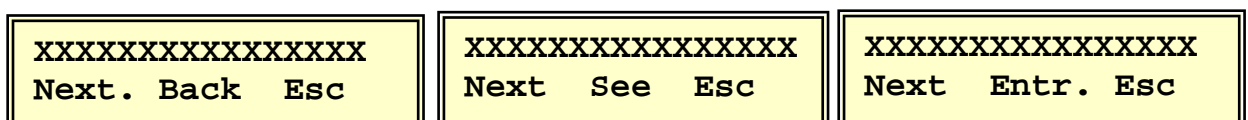
These groups are defined as:

- ☐ **Monitoring** Presentation of analogue measurements and alarms
- ☐ **Configuration** System configuration
- ☐ **Commands** Manually activated functions (Quick Charge, Battery Test, etc.).



The menu display uses five basic functions:

- ☐ **Next** Move one step forward in the menu
- ☐ **Back** Move one step back in the menu
- ☐ **See** Display a selection
- ☐ **Entr** Confirm an input
- ☐ **Esc** Return to start menu

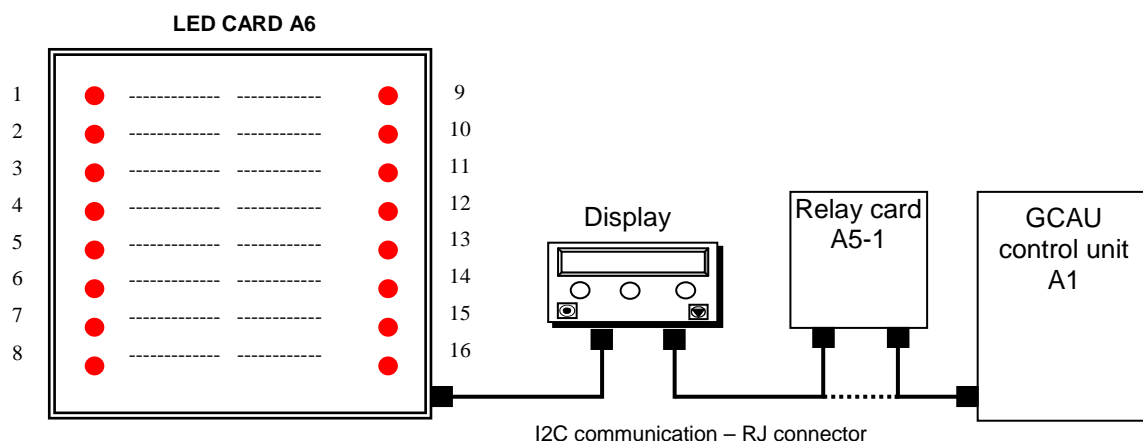


Refer to Appendix A of this document for a schematic of the menus available in the display.

## 7.6 - STATUS AND ALARM SIGNALLING

Apart from the display, the system optionally provides information about alarms and equipment status through potential-free contacts (relay card, see section 5.5) and a series of LEDs located at the front (LED card).

All of these peripherals communicate with the GCAU unit via an I2C communication bus.

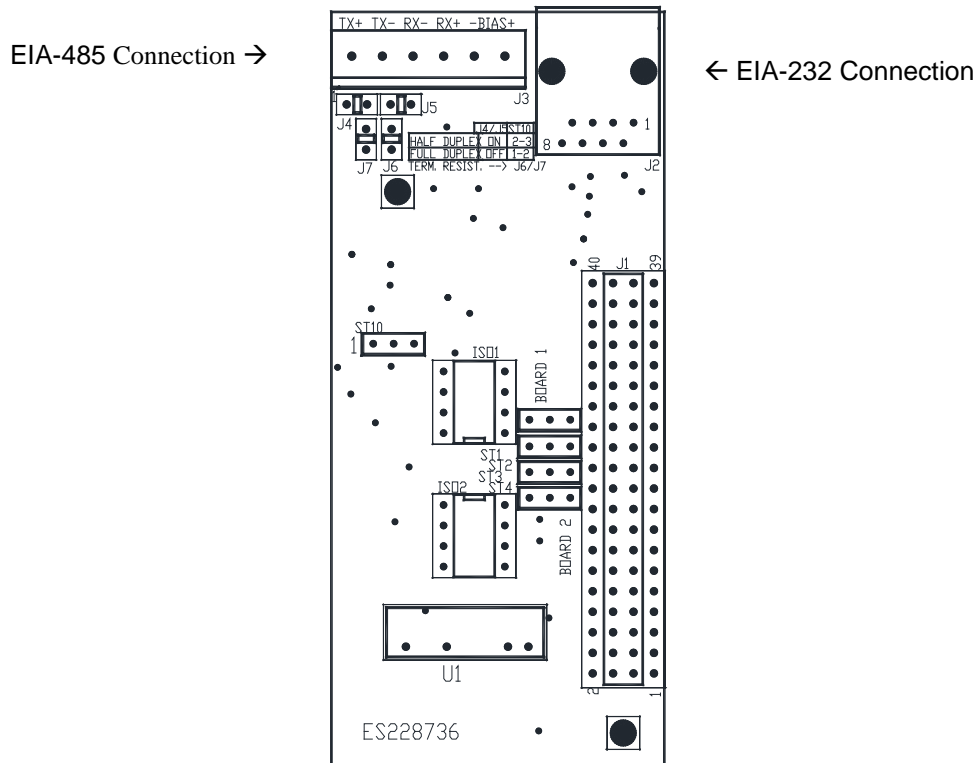


The events assigned by default to equipment fitted with the optional LED card are as follow:

- 01 PRESENCIA DE RED (VERDE)  
MAINS ON (GREEN)
- 02 DEFECTO RECTIFICADOR (ROJO)  
RECTIFIER FAULT (RED)
- 03 TIERRA + (ROJO)  
EARTH + (RED)
- 04 TIERRA - (ROJO)  
EARTH - (RED)
- 05 TENSION ALTA (ROJO)  
HIGH DC VOLTAGE (RED)
- 06 TENSION BAJA (ROJO)  
LOW DC VOLTAGE (RED)
- 07 DEFECTO CARGA BATERIA (ROJO)  
BATTERY CHARGE FAULT (RED)
- 08 TEMPERATURA ALTA BATERIA (ROJO)  
BATTERY HIGH TEMPERATURE (RED)

## 7.7 - COMMUNICATION PORTS (Option)

Optionally, the system provides an EIA-232/485 communications port for monitoring and local system configuration. This option consists of a communication card that plugs directly into the 40 pin connector on the GCAU control unit.



In addition to the AEG Power Solutions proprietary communications protocol, the control unit also includes the Modbus protocol, which means that the ECTe can be integrated into a Modbus network via the EIA-485 connector on the said card.

If the system includes this option, a MODEM or TCP/IP connection can also be included for remote monitoring and configuration.

For more information about the EIA-232/485 communications card refer to the user manual.

## 7.8 - PM SERIES RECTIFIER MODULE

The PM series rectifier modules are high-frequency switching rectifiers. Refer to the corresponding user guide supplied separately with the system.



Fig: View of the ECTe rectifier module



## 8 MAINTENANCE

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**AEG Power Solutions offers a fully comprehensive service through its regional service centres.**



Electronic cards are sensitive to electrostatic discharge (E.S.D).  
When not installed in equipment, they are supplied in antistatic bags.  
Before handling a card, the operator must be at the same electrical potential as the equipment on which they are going to work and take all necessary precautions.

ANY OPERATION MUST BE CARRIED OUT BY QUALIFIED PERSONNEL, AWARE OF THE SPECIFIC ELECTRICAL HAZARDS AND THE NECESSARY PRECAUTIONS.  
ALWAYS USE INSULATED TOOLS.

### 8.1 - PREVENTIVE MAINTENANCE

To keep the power supply system in perfect condition, an annual service inspection is recommended. Visit [www.aegps.es](http://www.aegps.es) for more information about your nearest service centre and further details of services provided by AEG Power Solutions.

#### **Visual inspection:**

Check the general condition of the cabinet and cabling (broken elements, rust, etc.). Check the appearance of the batteries (distorted trays, seepage etc).

#### **Dust:**

Remove any accumulated dust on or around the system and batteries.

#### **Check the integrity of:**

Power conductor terminals for tightness.  
Battery connectors for tightness.  
Load circuit terminals for tightness.  
Alarm terminals for tightness and correct electrical continuity.  
Internal screws/nuts (bars, terminals, etc.) for tightness.

#### **Electrical checks:**

Check the output voltages at the load and battery:  
Check the floating voltage.  
Check the correct operation of the alarms and protective devices.

#### **Recommendations**

Change all of the fans for the system every 5 years.

## 8.2 - BATTERY SERVICING

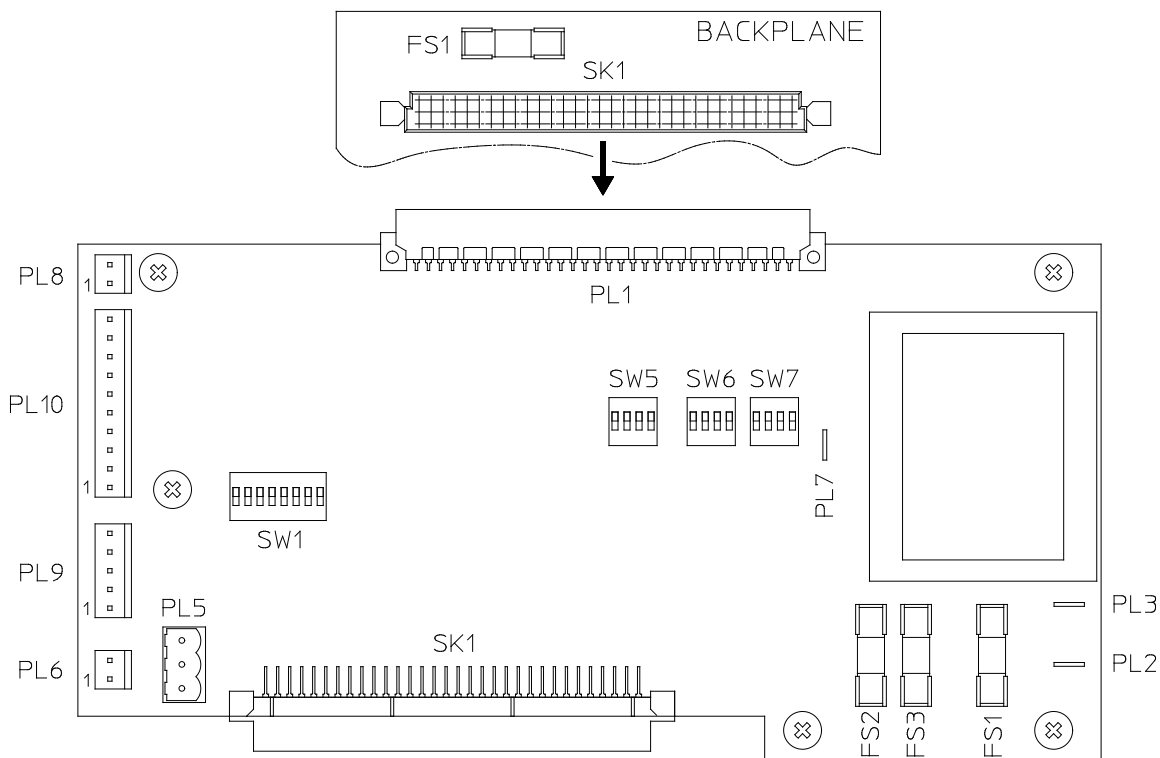
Measure the voltages of each cell to ensure that they are within the margins.  
Check that the batteries are capable of supplying power to the load: reset the floating voltage to a value sufficiently low enough to ensure that the battery discharges so that if the battery fails the rectifiers will still be capable of supplying the load current.

Refer to the battery manufacturer's manual for further battery servicing requirements.

**Used batteries must be collected or disposed of in accordance with European Directive No. 91/157/EEC, 18/03/91. Contact the battery manufacturer at the address indicated in the manual for the batteries.**

**NOTE: NOTE: Before working on the batteries (e.g.: replacing a cell), open the corresponding protection device.**

## 8.3 - PCB FUSES



**Fuse FS1 - 20mm x 5mmØ, 1A (T) - DC supply to GCAU (backplane)**

**Fuse FS1 - 20mm x 5mmØ, 250mA (T)**

**- AC mains supply**

**Fuse FS2 - 20mm x 5mmØ, 630mA (T)**

**- AC supply to GCAU**

**Fuse FS3 - 20mm x 5mmØ, 250mA (T)**

**- DC supply to interface PCB**

## 8.4 - REPAIRS

### Replacing a rectifier module

The rectifier modules are hot pluggable. When no rectifiers are operational, the system will continue to run on batteries. Dangerous voltages may still be present inside the module for several minutes after removing the rectifier. Therefore the module cover must not be removed for at least 5 minutes.

To remove the module from standard systems mounted in casings:

- Remove the screw at the bottom of the lug that fastens the rectifier module to the subrack. The said lug is at the front of the rectifier module, on the left-hand side of the equipment.
- When the screw is removed, it will be possible to rotate the subrack as shown in the diagram below.
- Once the subrack has been rotated sufficiently, remove the rectifier module using the side clips.

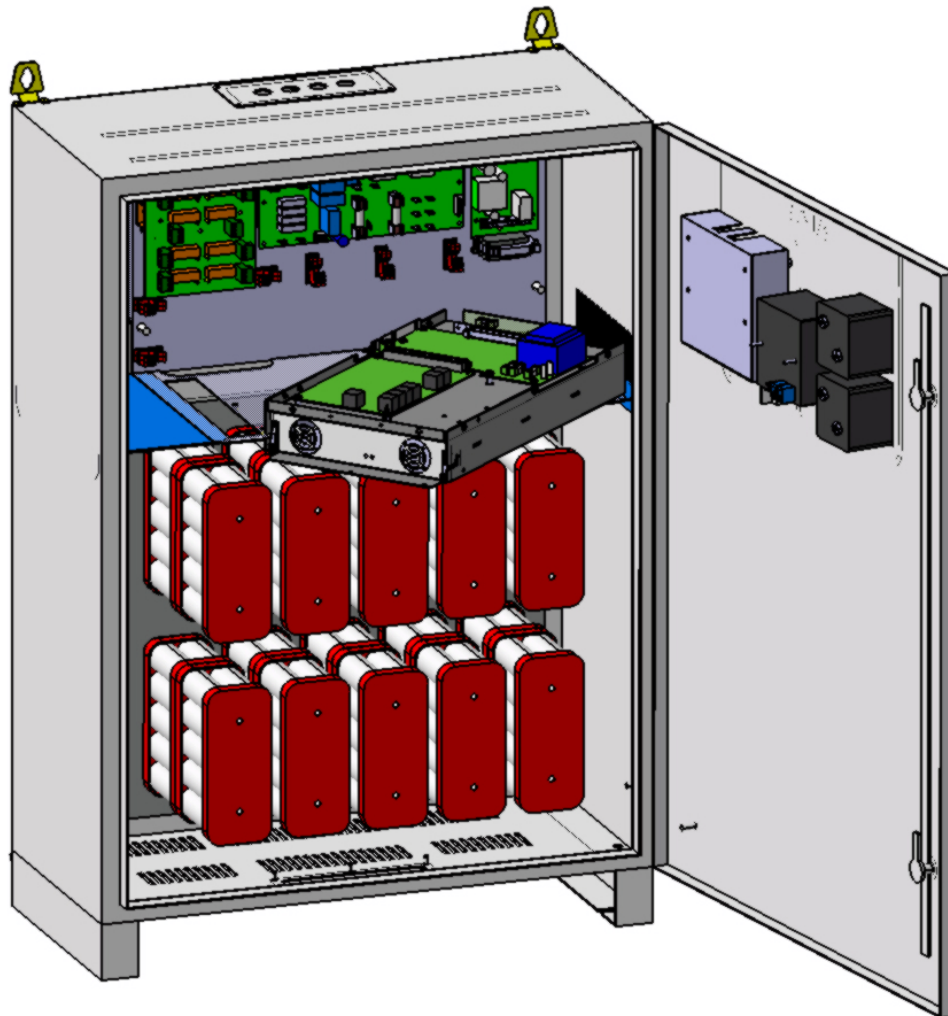


Fig: View of the subrack swivel system to remove the module.

### **Replacing the rectifier module fans**

To prevent possible faults it is advisable to replace the fans every 5 years. Should a fan become faulty, **AEG Power Solutions** recommends that both fans of the rectifier module be replaced.

- Remove the rectifier module. Wait 5 minutes and then remove the cover (secured by 4 screws).
- Replace the fans.
- Refit the cover.
- Plug the module back into its original location.
- Check that there is no alarm produced.

### **Replacing the GCAU module**

The GCAU must only be replaced by qualified personnel. A PC and connection equipment which electrically isolates the PC and the GCAU board are required to connect to the GCAU and upload the correct configuration data after replacement.

#### ***Warning:***

**When a GCAU module is going to be replaced it is essential to disconnect the AC mains supply from the rectifier modules and run the system on batteries. When the new GCAU is installed, the correct configuration data file for the system must be uploaded to the GCAU before restarting the rectifier modules. Otherwise the system could be seriously damaged.**

**Alternatively, if the correct configuration data file has been preloaded into the new GCAU then it can be replaced while the rectifiers are still operating.**

Switch off the rectifier modules by disconnecting the AC mains. Unplug the RJ11 connector from J3 (battery probe) and the RJ11 connector from J5 (communications bus).

#### ***Note:***

**Connectors J3 and J5 are identical, so it is important to ensure that they are not replaced in the wrong sockets. Mark these wires to clearly identify them.**

Remove the cover located on the front top section of the equipment.

Remove the retaining screws from the corners of the board. Compress the lug on plastic spacer at the front right to release the board and gently pull it forward to disconnect the board from the interface PCB.

Replacement is done in the reverse order. If the new GCAU has not been preloaded with the correct configuration file, connect a PC to J7 using the isolation interface and upload the configuration file. Reconnect the AC mains supply to power up the rectifier. Check that the output voltage and current are correct.

### **Replacing the Interface Card (IF)**

The GCAU Interface must only be replaced by qualified personnel.

#### ***Note:***

**The AC mains will have to be isolated while the GCAU interface is being replaced, therefore the system will continue to run on batteries.**

Ensure the AC mains supply is isolated. Remove the GCAU board and disconnect all connectors. Loosen the five retaining screws and pull the interface PCB forward to disconnect it from the backplane.

On the new PCB set the micro- switches SW1 and SW5 to match the board being replaced.

Replacement is done in the reverse order.

### **Replacing an electronic board**

Spare boards must be stored in their original package. They must be handled with caution. Never touch the metal parts or components with the fingers.

A defective board must be stored in its packaging before repair.

### **Replacing a battery protection device**

Before removing the defective protection device, make sure that the equipment is operating on the mains supply. Remove the fuse, fit the new fuse.

### **Checking the output protection devices**

If a circuit breaker trips reset it, or if a fuse blows replace it. If the fault reappears, check the circuits downstream of the protection device.

## 8.5 - SPARE PARTS

### Recommended installation spare parts list:

1. Interface Fuse FS1 – 20mm x 5mmØ, 250mA (T)
2. Interface Fuse FS3 – 20mm x 5mmØ, 250mA (T)
3. Interface Fuse FS2 – 20mm x 5mmØ, 630mA (T)
4. Backplane Fuse FS1 – 20mm x 5mmØ, 1A (T)

### Recommended operating spare parts list:

- |   |                            |
|---|----------------------------|
| 5. GCAU-MIP Controller                        | Ref. 228349                |
| 6. PM Rectifier module (24Vdc, 48Vdc, 120Vdc) | Ref. 226843/226844/ 226845 |
| 7. Rectifier fan                              | Ref. ES228929              |
| 8. Rectifier fan                              | Ref. ES228930              |

It is advisable to purchase one of each type of fan (the 2 fans are not the same) and to replace them as a pair even if only one fan appears to be faulty.

## 8.6 - BASIC TROUBLESHOOTING

Whenever an alarm goes off the green light goes out and the red one lights up. El mensaje de alarma puede verse al apretar cualquier tecla desde la pantalla principal.

If after pressing RESET on the alarm menu it does not disappear (only applicable to preset alarms), refer to the following table for the appropriate corrective action.

### Note:

**With the standard ECTe configuration, for safety reasons the alarms DC V MAX and BATTERY I HIGH inhibit the system. The said alarms are memorised.**

| ALARM or EVENT                         | PROBABLE CAUSES   | CORRECTIVE ACTION   |
|--|---|---|
| No information is shown by the display | - Problem with contrast   | - Do not touch any button for 5 min. This activates the default start menu Press the right-hand button to increase the contrast |
| "AC MAINS V LOW"                       | - Low mains voltage<br><br>- Mains supply fuse open F1 on main backplane board              | - Check mains voltage<br><br>- Check fuse and change if necessary   |
| "CHARGER FAULT"                        | - Low floating voltage (when rectifier is not limiting the current)<br><br>- Fuse FS1 blown | - Check mains voltage and fuse FS1<br><br>- Call Customer Services  |
| "DC V MAX"                             | - The output voltage from the charger is greater than the maximum permitted value           | - Call Customer Services  |

|   |  |  |
|---|--|--|
|   |  |  |
| <p>“DC V MIN”</p> <p>(This may be normal while a heavily discharged battery is recharging, to limit the charge current)</p> | <p>Low output voltage due to:</p> <ul style="list-style-type: none"> <li>- Charger in “Charger OFF” state</li> <li>- Low or absent mains voltage</li> </ul>          | <ul style="list-style-type: none"> <li>- Enter Floating Charge command</li> <li>- Check mains voltage</li> </ul>   |
| <p>“+ EARTH FAULT”</p>  | <ul style="list-style-type: none"> <li>- Low resistance between positive output and frame (earth)</li> </ul>   | <ul style="list-style-type: none"> <li>- Check for possible insulation faults</li> </ul>   |
| <p>“- EARTH FAULT”</p>  | <ul style="list-style-type: none"> <li>- Low resistance between negative output and frame (earth)</li> </ul>   | <ul style="list-style-type: none"> <li>- Check for possible insulation faults</li> </ul>   |
| <p>“FAN FAULT”</p>  | <ul style="list-style-type: none"> <li>- Faulty fan on rectifier module</li> </ul>   | <ul style="list-style-type: none"> <li>- Replace fan for module</li> </ul>   |
| <p>“RECTIF 1 FAULT”</p>   | <ul style="list-style-type: none"> <li>- Rectifier module failure:</li> <li>- Rectifier module not inserted correctly</li> <li>- SW5 switches incorrect</li> </ul>   | <ul style="list-style-type: none"> <li>- Replace faulty module</li> <li>- Make sure that module is inserted correctly</li> <li>- Set SW5 switches correctly</li> </ul> |
| <p>“TEMP PROBE FAULT”</p>   | <ul style="list-style-type: none"> <li>- Temperature sensor disconnected or short-circuited</li> <li>- GCAU unit fault (ADC)</li> </ul>                              | <ul style="list-style-type: none"> <li>- Check sensor connection</li> <li>- Call Customer Services</li> </ul>  |
| <p>“BATT. TEMP. HIGH”</p>   | <ul style="list-style-type: none"> <li>- Ambient temperature in battery area too high</li> <li>- Temperature sensor disconnected or short-circuited</li> </ul>       | <ul style="list-style-type: none"> <li>- Check battery cabinet temperature</li> <li>- Check sensor connection</li> </ul>   |
| <p>“I LIMIT. RECTIF”</p>  | <ul style="list-style-type: none"> <li>- Load current demand is greater than the charger can deliver The rectifier is operating in current limit mode</li> </ul>     | <ul style="list-style-type: none"> <li>- Check that the load does not exceed the rectifier’s nominal value</li> </ul>  |
| <p>“BATTERY I HIGH”</p>   | <ul style="list-style-type: none"> <li>- Battery charge current too high</li> </ul>  | <ul style="list-style-type: none"> <li>- Check wiring from the current measuring shunts</li> <li>- Call Customer Services</li> </ul>                                   |
| <p>“BATT. DISCHARGING”</p>  | <p>The battery is discharging due to:</p> <ul style="list-style-type: none"> <li>- Charger in “Charger OFF” state</li> <li>- Low or absent mains voltage</li> </ul>  | <ul style="list-style-type: none"> <li>- Enter Floating Charge command</li> <li>- Check mains voltage</li> </ul>   |
| <p>“INTERNAL CHECK”</p>   | <ul style="list-style-type: none"> <li>- Communication errors between the micro-controllers or the peripherals (e.g.: Display, external relay card, etc.)</li> </ul> | <ul style="list-style-type: none"> <li>- Check telephone wiring connections joined to the system boards</li> <li>- Call Customer Services</li> </ul>                   |

|   |   |   |
|---|---|---|
| <p>“CHARGER OFF”<br/>May be normal system behaviour</p> | <ul style="list-style-type: none"> <li>- Activation of an alarm with inhibition of the associated system</li> <li>- Manual user inhibition</li> <li>- Delay during system initialization</li> </ul> | <ul style="list-style-type: none"> <li>- Enter Floating Charge command</li> <li>- Call Customer Services</li> </ul> |
|---|---|---|

## 8.7 - CUSTOMER SERVICE

An updated list of technical services available can be found at the **AEG Power Solutions** website:

<http://www.aegps.es/>

### Product services:

Installation & commissioning  
Preventative maintenance  
Spare part kits  
Refurbishments  
service contracts  
24/7 Global service cover  
Training  
Hire & supply

### On-site services:

Battery Replacement  
On-site load bank & capacity tests  
Power Quality Services  
Standby generators and other essential

### E-Service/Remote Monitoring

Battery Monitoring  
Installation & Equipment management  
Design & Build - Turnkey solutions



## AEG Power Solutions Services

To ensure you get the maximum performance from your equipment, AEG Power Solutions are pleased to offer you a wide range of service products.

### Pro Care Preventive Maintenance

A Protect Power Solution maintenance contract is recommended because of the nature of the equipment and the need to keep downtime to a minimum.

Maintenance contracts are the most economical method for servicing or maintaining equipment and this is best performed by the OEM or their authorised service organizations.

Pro Care Contracts guarantee the following benefits:

- a) The equipment is kept in optimum working order to maximize equipment performance and reliability.
- b) Planned Preventative Maintenance requirements are assured.
- c) Continuous communication with **AEG Power Solutions**, allowing us to be constantly aware of your needs at both operational and commercial levels.
- d) Present constantly updated proposals to improve the equipment for better functionality and economy
- e) Provide high quality customer care and support plus a close working relationship with the manufacturer of critical equipment to achieve maximum operational life.

Pro Care helps you to optimize the use of the equipment throughout its useful life. Pro Care gives you various programs and services such as consulting, hardware and software upgrades, repairs and training to maximize your productivity. You can choose the package that best suits your needs.

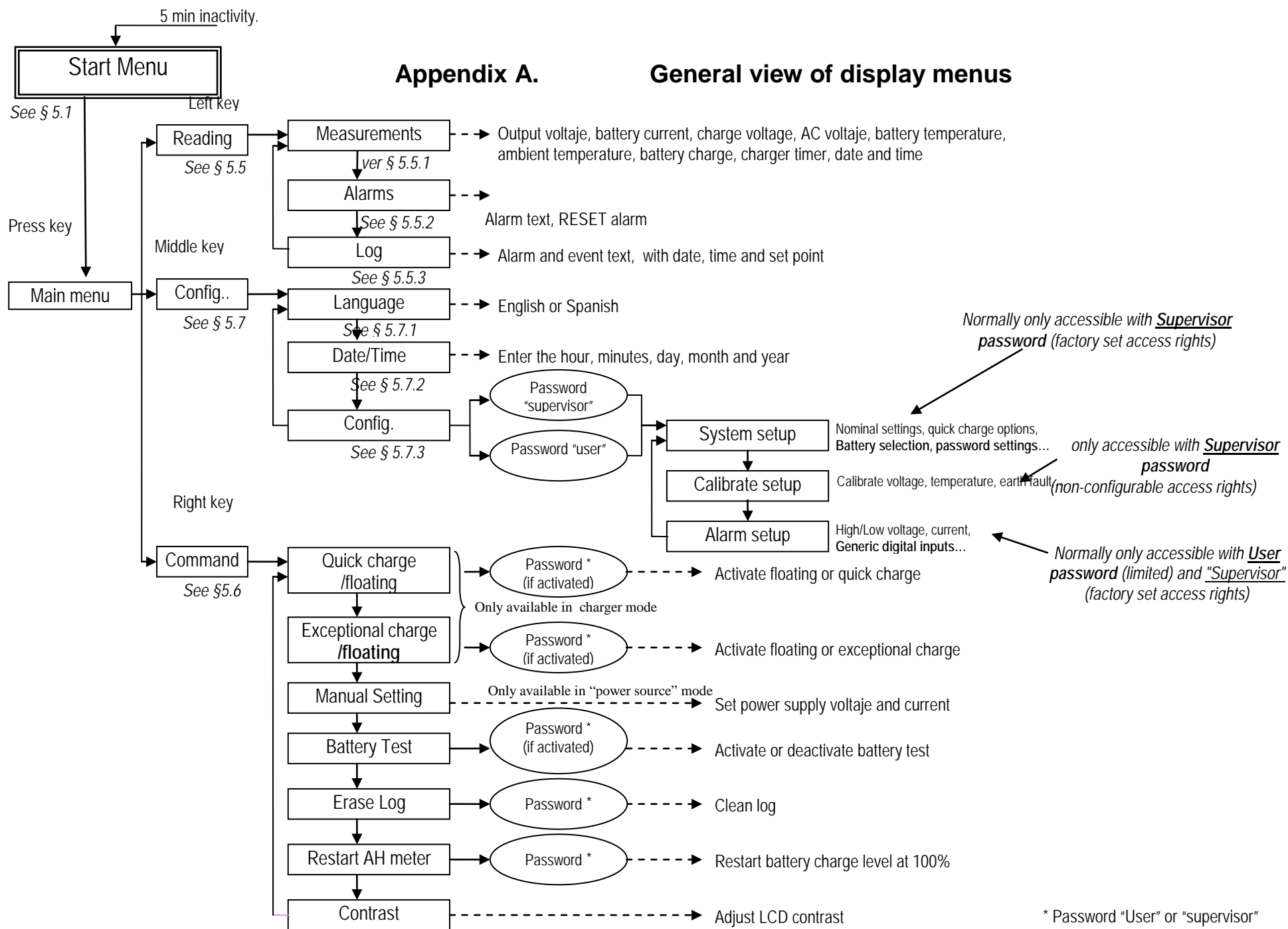
- A) **Pro Care Warranty** upgrades the warranty to include a 24/7 hotline, next working day response and it includes an annual systems health check. This excellent value contract is available for equipment commissioned by **AEG Power Solutions**.
- B) **Pro Care Safe** provides annual maintenance and system safety checks according to our guidelines, performed by duly trained qualified system experts. *Pro Care Safe* reduces the risk of equipment downtime and increases its efficiency. *Pro Care Safe* is our base package for all purchased equipment and includes a 24/7 Hotline and Tele-consulting about system use, combined with an excellent response time and spares support.
- C) **Pro Care Excel** provides all of the benefits of *Pro Care Safe*, along with the added advantage of a labour inclusive contract.
- D) **Pro Care Premium** provides all the benefits of *Pro Care Excel* with the inclusion of replacement parts for maintenance and breakdown visits

## Commissioning

Our engineers will assist you with the commissioning of your power supply products and we can offer complete installation solutions including AC and DC installations.

## Training

**AEG Power Solutions** offers various training courses for our equipment and applications. These courses can be tailored to meet your specific needs.



Note: Depending on the configuration of the equipment in question, certain menus may not be active.

**Appendix B. - Fallback voltages based on micro-switch settings****Appendix B. Fallback voltages based on micro-switch settings**

|    | Switch setting | 24V    | 48V    | 120V    |    | Switch setting | 24V    | 48V    | 120V    |    | Switch setting | 24V    | 48V    | 120V    |     | Switch setting | 24V    | 48V    | 120V    |
|----|----------------|--------|--------|---------|----|----------------|--------|--------|---------|----|----------------|--------|--------|---------|-----|----------------|--------|--------|---------|
| 0  | 00000000       | 21.978 | 43.956 | 109.891 | 30 | 00011110       | 22.941 | 45.882 | 114.704 | 60 | 00111100       | 23.799 | 47.598 | 118.995 | 90  | 01011010       | 24.573 | 49.145 | 122.863 |
| 1  | 00000001       | 22.013 | 44.025 | 110.063 | 31 | 00011111       | 22.971 | 45.943 | 114.857 | 61 | 00111101       | 23.826 | 47.653 | 119.132 | 91  | 01011011       | 24.597 | 49.194 | 122.986 |
| 2  | 00000010       | 22.047 | 44.094 | 110.235 | 32 | 00100000       | 23.004 | 46.007 | 115.018 | 62 | 00111110       | 23.854 | 47.707 | 119.268 | 92  | 01011100       | 24.620 | 49.239 | 123.098 |
| 3  | 00000011       | 22.081 | 44.163 | 110.407 | 33 | 00100001       | 23.034 | 46.068 | 115.170 | 63 | 00111111       | 23.881 | 47.762 | 119.404 | 93  | 01011101       | 24.644 | 49.288 | 123.220 |
| 4  | 00000100       | 22.113 | 44.225 | 110.563 | 34 | 00100010       | 23.064 | 46.129 | 115.322 | 64 | 01000000       | 23.913 | 47.826 | 119.564 | 94  | 01011110       | 24.668 | 49.337 | 123.342 |
| 5  | 00000101       | 22.147 | 44.293 | 110.733 | 35 | 00100011       | 23.095 | 46.189 | 115.473 | 65 | 01000001       | 23.940 | 47.879 | 119.699 | 95  | 01011111       | 24.693 | 49.385 | 123.463 |
| 6  | 00000110       | 22.180 | 44.361 | 110.902 | 36 | 00100100       | 23.122 | 46.244 | 115.610 | 66 | 01000010       | 23.967 | 47.933 | 119.833 | 96  | 01100000       | 24.718 | 49.436 | 123.590 |
| 7  | 00000111       | 22.214 | 44.428 | 111.071 | 37 | 00100101       | 23.152 | 46.304 | 115.760 | 67 | 01000011       | 23.993 | 47.987 | 119.966 | 97  | 01100001       | 24.742 | 49.484 | 123.711 |
| 8  | 00001000       | 22.245 | 44.491 | 111.227 | 38 | 00100110       | 23.182 | 46.364 | 115.909 | 68 | 01000100       | 24.018 | 48.035 | 120.089 | 98  | 01100010       | 24.766 | 49.532 | 123.830 |
| 9  | 00001001       | 22.279 | 44.558 | 111.394 | 39 | 00100111       | 23.212 | 46.423 | 116.058 | 69 | 01000101       | 24.044 | 48.089 | 120.221 | 99  | 01100011       | 24.790 | 49.580 | 123.950 |
| 10 | 00001010       | 22.312 | 44.624 | 111.561 | 40 | 00101000       | 23.239 | 46.478 | 116.195 | 70 | 01000110       | 24.071 | 48.141 | 120.354 | 100 | 01100100       | 24.812 | 49.624 | 124.059 |
| 11 | 00001011       | 22.345 | 44.691 | 111.727 | 41 | 00101001       | 23.269 | 46.537 | 116.343 | 71 | 01000111       | 24.097 | 48.194 | 120.486 | 101 | 01100101       | 24.836 | 49.671 | 124.178 |
| 12 | 00001100       | 22.376 | 44.751 | 111.878 | 42 | 00101010       | 23.298 | 46.596 | 116.490 | 72 | 01001000       | 24.122 | 48.243 | 120.608 | 102 | 01100110       | 24.859 | 49.718 | 124.296 |
| 13 | 00001101       | 22.409 | 44.817 | 112.043 | 43 | 00101011       | 23.327 | 46.654 | 116.636 | 73 | 01001001       | 24.148 | 48.295 | 120.739 | 103 | 01100111       | 24.883 | 49.765 | 124.414 |
| 14 | 00001110       | 22.441 | 44.883 | 112.207 | 44 | 00101100       | 23.354 | 46.708 | 116.770 | 74 | 01001010       | 24.174 | 48.348 | 120.869 | 104 | 01101000       | 24.905 | 49.809 | 124.523 |
| 15 | 00001111       | 22.474 | 44.948 | 112.370 | 45 | 00101101       | 23.383 | 46.766 | 116.915 | 75 | 01001011       | 24.200 | 48.400 | 120.999 | 105 | 01101001       | 24.928 | 49.856 | 124.640 |
| 16 | 00010000       | 22.506 | 45.013 | 112.531 | 46 | 00101110       | 23.412 | 46.824 | 117.059 | 76 | 01001100       | 24.224 | 48.447 | 121.118 | 106 | 01101010       | 24.951 | 49.903 | 124.756 |
| 17 | 00010001       | 22.539 | 45.077 | 112.693 | 47 | 00101111       | 23.441 | 46.881 | 117.204 | 77 | 01001101       | 24.249 | 48.499 | 121.247 | 107 | 01101011       | 24.975 | 49.949 | 124.873 |
| 18 | 00010010       | 22.571 | 45.142 | 112.855 | 48 | 00110000       | 23.469 | 46.938 | 117.346 | 78 | 01001110       | 24.275 | 48.550 | 121.375 | 108 | 01101100       | 24.996 | 49.992 | 124.979 |
| 19 | 00010011       | 22.603 | 45.206 | 113.015 | 49 | 00110001       | 23.498 | 46.996 | 117.489 | 79 | 01001111       | 24.301 | 48.601 | 121.503 | 109 | 01101101       | 25.019 | 50.038 | 125.094 |
| 20 | 00010100       | 22.632 | 45.265 | 113.162 | 50 | 00110010       | 23.526 | 47.053 | 117.632 | 80 | 01010000       | 24.326 | 48.652 | 121.630 | 110 | 01101110       | 25.042 | 50.084 | 125.209 |
| 21 | 00010101       | 22.664 | 45.329 | 113.321 | 51 | 00110011       | 23.555 | 47.109 | 117.774 | 81 | 01010001       | 24.351 | 48.703 | 121.757 | 111 | 01101111       | 25.065 | 50.130 | 125.324 |
| 22 | 00010110       | 22.696 | 45.392 | 113.480 | 52 | 00110100       | 23.581 | 47.161 | 117.903 | 82 | 01010010       | 24.377 | 48.754 | 121.884 | 112 | 01110000       | 25.088 | 50.175 | 125.438 |
| 23 | 00010111       | 22.728 | 45.455 | 113.638 | 53 | 00110101       | 23.609 | 47.218 | 118.044 | 83 | 01010011       | 24.402 | 48.804 | 122.010 | 113 | 01110001       | 25.110 | 50.221 | 125.552 |
| 24 | 00011000       | 22.757 | 45.514 | 113.785 | 54 | 00110110       | 23.637 | 47.274 | 118.185 | 84 | 01010100       | 24.425 | 48.850 | 122.126 | 114 | 01110010       | 25.133 | 50.266 | 125.665 |
| 25 | 00011001       | 22.788 | 45.577 | 113.941 | 55 | 00110111       | 23.665 | 47.330 | 118.324 | 85 | 01010101       | 24.450 | 48.900 | 122.251 | 115 | 01110011       | 25.156 | 50.311 | 125.778 |
| 26 | 00011010       | 22.820 | 45.639 | 114.098 | 56 | 00111000       | 23.691 | 47.382 | 118.454 | 86 | 01010110       | 24.475 | 48.950 | 122.376 | 116 | 01110100       | 25.176 | 50.353 | 125.882 |
| 27 | 00011011       | 22.851 | 45.701 | 114.253 | 57 | 00111001       | 23.719 | 47.437 | 118.593 | 87 | 01010111       | 24.500 | 49.000 | 122.501 | 117 | 01110101       | 25.199 | 50.398 | 125.994 |
| 28 | 00011100       | 22.879 | 45.758 | 114.396 | 58 | 00111010       | 23.746 | 47.492 | 118.731 | 88 | 01011000       | 24.523 | 49.046 | 122.616 | 118 | 01110110       | 25.221 | 50.442 | 126.106 |
| 29 | 00011101       | 22.910 | 45.820 | 114.550 | 59 | 00111011       | 23.774 | 47.548 | 118.869 | 89 | 01011001       | 24.548 | 49.096 | 122.740 | 119 | 01110111       | 25.244 | 50.487 | 126.218 |
|    | Switch setting | 24V    | 48V    | 120V    |    | Switch         | 24V.   | 48V.   | 120V.   |    | Switch         | 24V.   | 48V.   | 120V.   |     | Switch         | 24V.   | 48V.   | 120V.   |

## Appendix B. - Fallback voltages based on micro-switch settings

|     |                |        |        |         |     | setting        |        |        |         |     | setting        |        |        |         |     | setting        |        |        |         |
|-----|----------------|--------|--------|---------|-----|----------------|--------|--------|---------|-----|----------------|--------|--------|---------|-----|----------------|--------|--------|---------|
| 120 | 01111000       | 25.264 | 50.528 | 126.321 | 150 | 10010110       | 25.894 | 51.789 | 129.472 | 180 | 10110100       | 26.464 | 52.927 | 132.318 | 210 | 11010010       | 26.987 | 53.974 | 134.936 |
| 121 | 01111001       | 25.286 | 50.573 | 126.432 | 151 | 10010111       | 25.915 | 51.829 | 129.573 | 181 | 10110101       | 26.482 | 52.964 | 132.410 | 211 | 11010011       | 27.004 | 54.008 | 135.020 |
| 122 | 01111010       | 25.309 | 50.617 | 126.543 | 152 | 10011000       | 25.933 | 51.866 | 129.666 | 182 | 10110110       | 26.500 | 53.001 | 132.501 | 212 | 11010100       | 27.019 | 54.039 | 135.097 |
| 123 | 01111011       | 25.331 | 50.661 | 126.653 | 153 | 10011001       | 25.953 | 51.906 | 129.766 | 183 | 10110111       | 26.519 | 53.037 | 132.593 | 213 | 11010101       | 27.036 | 54.072 | 135.180 |
| 124 | 01111100       | 25.351 | 50.701 | 126.754 | 154 | 10011010       | 25.973 | 51.946 | 129.866 | 184 | 10111000       | 26.535 | 53.071 | 132.677 | 214 | 11010110       | 27.053 | 54.105 | 135.264 |
| 125 | 01111101       | 25.373 | 50.745 | 126.863 | 155 | 10011011       | 25.993 | 51.986 | 129.965 | 185 | 10111001       | 26.554 | 53.107 | 132.768 | 215 | 11010111       | 27.069 | 54.139 | 135.347 |
| 126 | 01111110       | 25.393 | 50.790 | 126.964 | 156 | 10011100       | 26.011 | 52.022 | 130.056 | 186 | 10111010       | 26.572 | 53.143 | 132.858 | 216 | 11011000       | 27.085 | 54.169 | 135.424 |
| 127 | 01111111       | 25.416 | 50.832 | 127.081 | 157 | 10011101       | 26.031 | 52.062 | 130.155 | 187 | 10111011       | 26.590 | 53.179 | 132.948 | 217 | 11011001       | 27.101 | 54.202 | 135.506 |
| 128 | 10000000       | 25.442 | 50.884 | 127.209 | 158 | 10011110       | 26.051 | 52.101 | 130.253 | 188 | 10111100       | 26.606 | 53.212 | 133.031 | 218 | 11011010       | 27.118 | 54.235 | 135.588 |
| 129 | 10000001       | 25.463 | 50.927 | 127.317 | 159 | 10011111       | 26.070 | 52.140 | 130.351 | 189 | 10111101       | 26.624 | 53.248 | 133.120 | 219 | 11011011       | 27.134 | 54.268 | 135.670 |
| 130 | 10000010       | 25.485 | 50.970 | 127.425 | 160 | 10100000       | 26.091 | 52.182 | 130.454 | 190 | 10111110       | 26.642 | 53.284 | 133.210 | 220 | 11011100       | 27.149 | 54.298 | 135.745 |
| 131 | 10000011       | 25.506 | 51.013 | 127.532 | 161 | 10100001       | 26.110 | 52.221 | 130.552 | 191 | 10111111       | 26.660 | 53.319 | 133.299 | 221 | 11011101       | 27.165 | 54.331 | 135.827 |
| 132 | 10000100       | 25.526 | 51.052 | 127.630 | 162 | 10100010       | 26.130 | 52.260 | 130.649 | 192 | 11000000       | 26.681 | 53.361 | 133.404 | 222 | 11011110       | 27.182 | 54.363 | 135.908 |
| 133 | 10000101       | 25.457 | 51.095 | 127.737 | 163 | 10100011       | 26.149 | 52.298 | 130.746 | 193 | 11000001       | 26.698 | 53.397 | 133.492 | 223 | 11011111       | 27.198 | 54.396 | 135.990 |
| 134 | 10000110       | 25.569 | 51.137 | 127.843 | 164 | 10100100       | 26.167 | 52.334 | 130.835 | 194 | 11000010       | 26.716 | 53.432 | 133.580 | 224 | 11100000       | 27.215 | 54.430 | 136.075 |
| 135 | 10000111       | 25.590 | 51.179 | 127.949 | 165 | 10100101       | 26.186 | 52.372 | 130.931 | 195 | 11000011       | 26.734 | 53.467 | 133.668 | 225 | 11100001       | 27.231 | 54.462 | 136.156 |
| 136 | 10001000       | 25.609 | 51.219 | 128.047 | 166 | 10100110       | 26.205 | 52.411 | 131.027 | 196 | 11000100       | 26.750 | 53.499 | 133.749 | 226 | 11100010       | 27.247 | 54.494 | 136.236 |
| 137 | 10001001       | 25.630 | 51.261 | 128.152 | 167 | 10100111       | 26.225 | 52.449 | 131.123 | 197 | 11000101       | 26.767 | 53.534 | 133.836 | 227 | 11100011       | 27.263 | 54.527 | 136.316 |
| 138 | 10001010       | 25.651 | 51.303 | 128.257 | 168 | 10101000       | 26.242 | 52.485 | 131.212 | 198 | 11000110       | 26.785 | 53.569 | 133.923 | 228 | 11100100       | 27.278 | 54.556 | 136.390 |
| 139 | 10001011       | 25.672 | 51.345 | 128.361 | 169 | 10101001       | 26.261 | 52.523 | 131.307 | 199 | 11000111       | 26.802 | 53.604 | 134.010 | 229 | 11100101       | 27.294 | 54.588 | 136.469 |
| 140 | 10001100       | 25.691 | 51.383 | 128.457 | 170 | 10101010       | 26.280 | 52.561 | 131.401 | 200 | 11001000       | 26.818 | 53.636 | 134.091 | 230 | 11100110       | 27.310 | 54.620 | 136.549 |
| 141 | 10001101       | 25.712 | 51.424 | 128.561 | 171 | 10101011       | 26.299 | 52.598 | 131.496 | 201 | 11001001       | 26.835 | 53.671 | 134.177 | 231 | 11100111       | 27.326 | 54.651 | 136.628 |
| 142 | 10001110       | 25.733 | 51.466 | 128.664 | 172 | 10101100       | 26.317 | 52.633 | 131.583 | 202 | 11001010       | 26.853 | 53.705 | 134.263 | 232 | 11101000       | 27.340 | 54.681 | 136.702 |
| 143 | 10001111       | 25.754 | 51.507 | 128.768 | 173 | 10101101       | 26.335 | 52.671 | 131.677 | 203 | 11001011       | 26.870 | 53.740 | 134.349 | 233 | 11101001       | 27.356 | 54.712 | 136.781 |
| 144 | 10010000       | 25.777 | 51.555 | 128.887 | 174 | 10101110       | 26.354 | 52.708 | 131.770 | 204 | 11001100       | 26.886 | 53.771 | 134.428 | 234 | 11101010       | 27.372 | 54.744 | 136.859 |
| 145 | 10010001       | 25.794 | 51.589 | 128.972 | 175 | 10101111       | 26.373 | 52.745 | 131.864 | 205 | 11001101       | 26.903 | 53.805 | 134.513 | 235 | 11101011       | 27.388 | 54.775 | 136.938 |
| 146 | 10010010       | 25.815 | 51.630 | 129.075 | 176 | 10110000       | 26.391 | 52.782 | 131.956 | 206 | 11001110       | 26.920 | 53.839 | 134.599 | 236 | 11101100       | 27.402 | 54.804 | 137.010 |
| 147 | 10010011       | 25.835 | 51.671 | 129.177 | 177 | 10110001       | 26.410 | 52.820 | 132.049 | 207 | 11001111       | 26.937 | 53.873 | 134.683 | 237 | 11101101       | 27.418 | 54.835 | 137.088 |
| 148 | 10010100       | 25.854 | 51.708 | 129.270 | 178 | 10110010       | 26.428 | 52.857 | 132.142 | 208 | 11010000       | 26.954 | 53.907 | 134.768 | 238 | 11101110       | 27.433 | 54.866 | 137.165 |
| 149 | 10010101       | 25.874 | 51.748 | 129.371 | 179 | 10110011       | 26.447 | 52.894 | 132.234 | 209 | 11010001       | 26.970 | 53.941 | 134.852 | 239 | 11101111       | 27.449 | 54.897 | 137.243 |
|     |                |        |        |         |     |                |        |        |         |     |                |        |        |         |     |                |        |        |         |
|     |                |        |        |         |     |                |        |        |         |     |                |        |        |         |     |                |        |        |         |
|     | Switch setting | 24V.   | 48V.   | 120V.   |     | Switch setting | 24V.   | 48V.   | 120V.   |     | Switch setting | 24V.   | 48V.   | 120V.   |     | Switch setting | 24V.   | 48V.   | 120V.   |

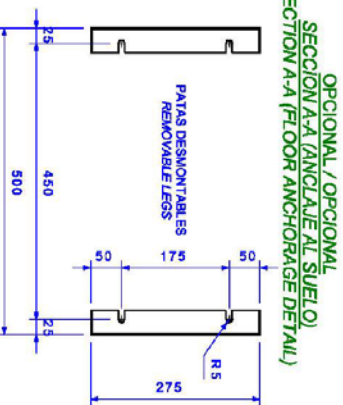
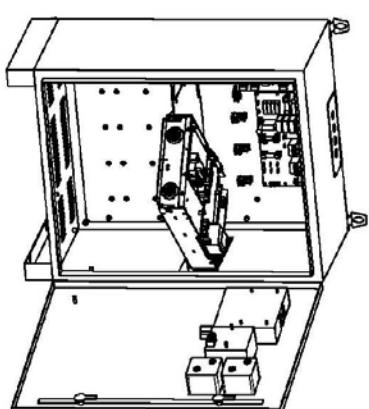
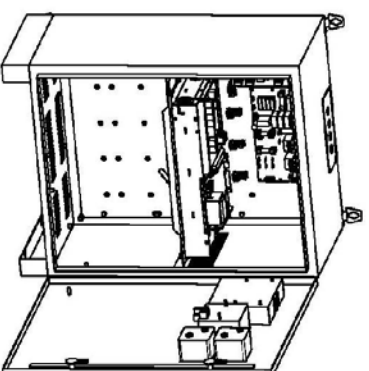
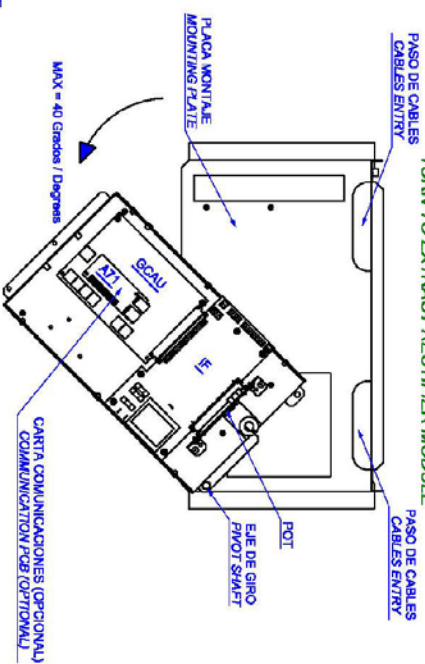
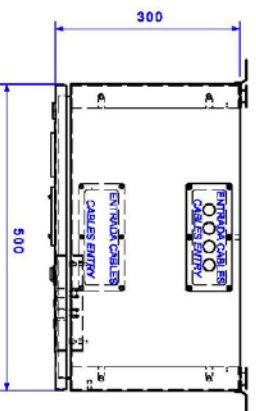
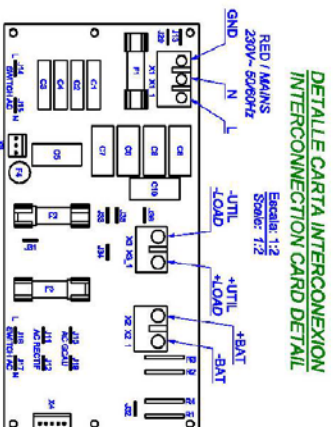
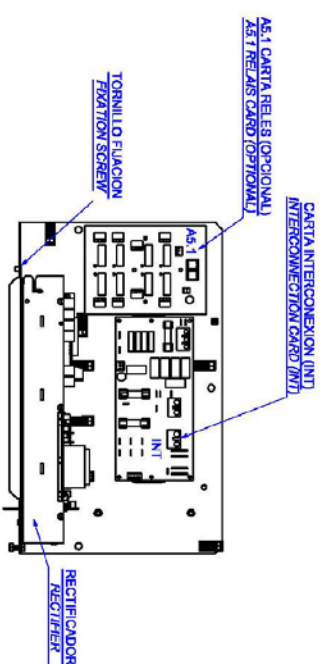
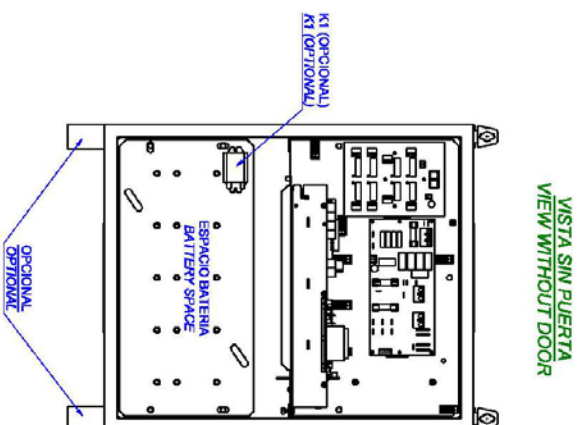
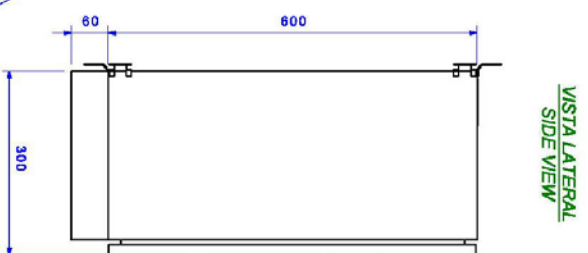
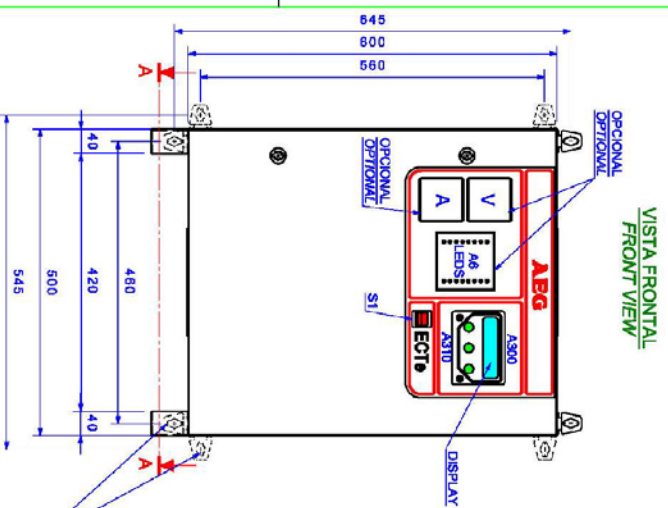
**Appendix B. - Fallback voltages based on micro-switch settings**

|     |          |        |        |         |     |          |        |        |         |     |          |        |        |         |     |          |        |        |         |
|-----|----------|--------|--------|---------|-----|----------|--------|--------|---------|-----|----------|--------|--------|---------|-----|----------|--------|--------|---------|
| 240 | 11110000 | 27.464 | 54.928 | 137.320 | 245 | 11110101 | 27.539 | 55.079 | 137.697 | 250 | 11111010 | 27.614 | 55.228 | 138.070 | 255 | 11111111 | 27.687 | 55.375 | 138.437 |
| 241 | 11110001 | 27.479 | 54.959 | 137.397 | 246 | 11110110 | 27.555 | 55.109 | 137.773 | 251 | 11111011 | 27.629 | 55.258 | 138.145 |     |          |        |        |         |
| 242 | 11110010 | 27.495 | 54.990 | 137.474 | 247 | 11110111 | 27.570 | 55.140 | 137.849 | 252 | 11111100 | 27.643 | 55.286 | 138.214 |     |          |        |        |         |
| 243 | 11110011 | 27.510 | 55.020 | 137.550 | 248 | 11111000 | 27.584 | 55.168 | 137.919 | 253 | 11111101 | 27.658 | 55.315 | 138.288 |     |          |        |        |         |
| 244 | 11110100 | 27.524 | 55.048 | 137.621 | 249 | 11111001 | 27.599 | 55.198 | 137.995 | 254 | 11111110 | 27.673 | 55.345 | 138.363 |     |          |        |        |         |

**Appendix C. Wiring and assembly diagrams.**





[illegible]

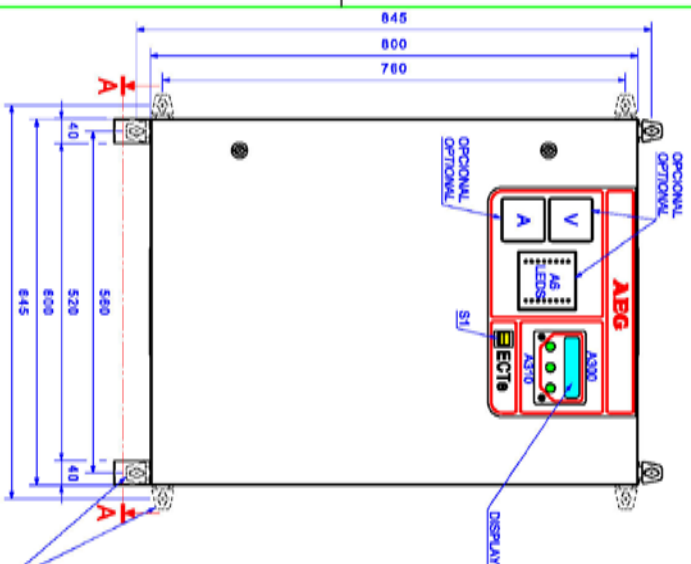
**AEG**  
POWER SOLUTIONS

C/ALBERT EINSTEIN, 31  
PARQUE TECNOLÓGICO DE ALAVIA  
01510 - MIRANO (ALAVA)  
TELÉFONO : +34 845 21 41 10  
FAX : +34 845 21 41 11

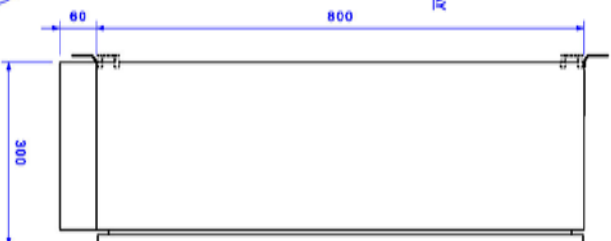
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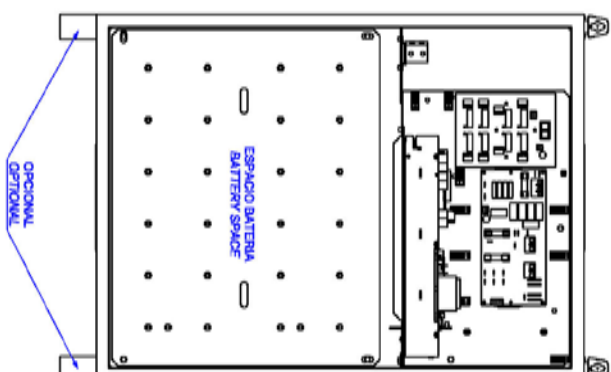
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FRONT VIEW



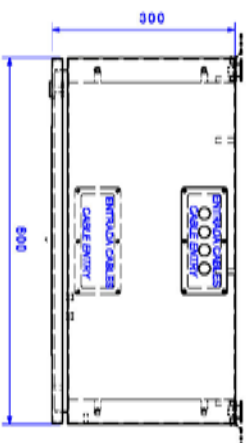
VISTA LATERAL  
SIDE VIEW



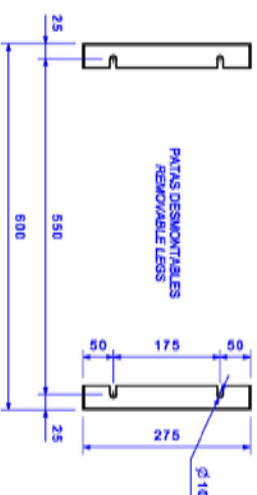
VISTA SIN PUERTA  
VIEW WITHOUT DOOR



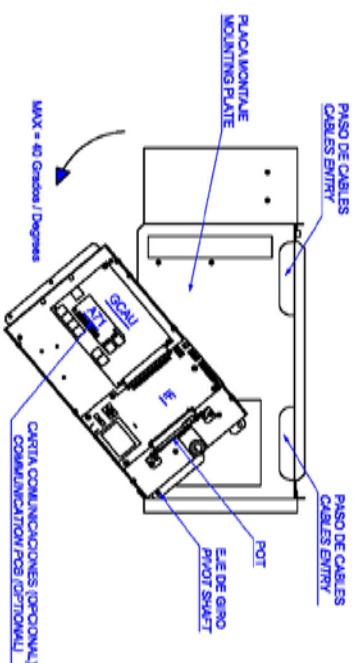
VISTA SUPERIOR  
TOP VIEW



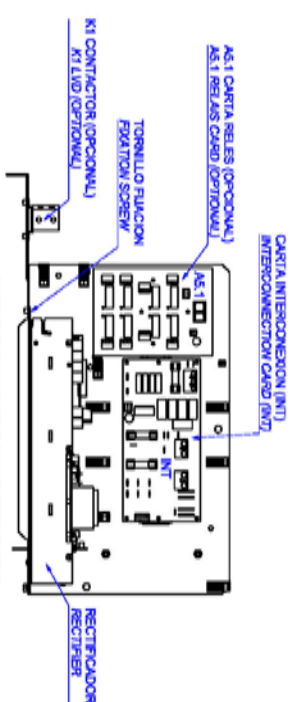
SECCION A-A (ANCLAJE AL SUELO)  
SECTION A-A (FLOOR ANCHORAGE DETAIL)



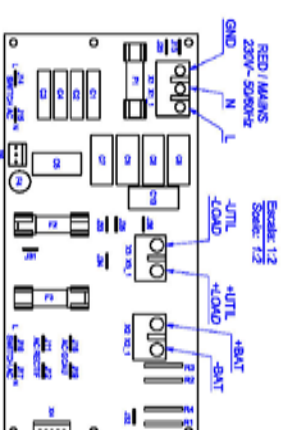
GIRO PARA EXTRAER MÓDULO RECTIFICADOR  
TURN TO EXTRACT RECTIFIER MODULE



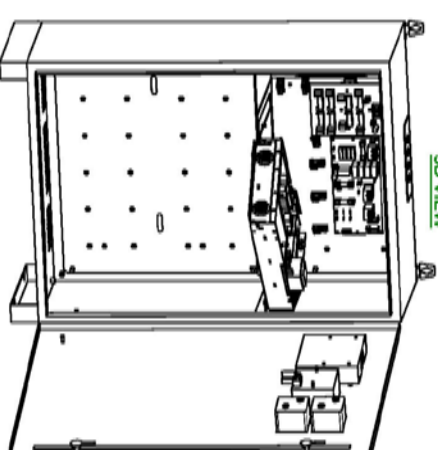
PLACA DE MONTAJE  
MOUNTING PLATE



DETALLE CARTA INTERCONEXION  
INTERCONNECTION CARD DETAIL



VISTAS 3D  
3D VIEW



MONTAJE ETcE COFRE 800x600x300  
ECTe 800x600x300 ENCLOSURE MOUNTING

| DETALLE | DESCRIPCION                         | REVISION | FECHA | REVISION | FECHA |
|---------|-------------------------------------|----------|-------|----------|-------|
| C       | ELIMINAR CONFIGURACION A20          | ALBERTO  | 1.0   | ALBERTO  | 1.0   |
| B       | ASERIR OTRAS COMUNICACIONES         | ALBERTO  | 1.0   | ALBERTO  | 1.0   |
| A       | MODIFICACIONES PARA ESTANDARIZACION | ALBERTO  | 1.0   | ALBERTO  | 1.0   |

**AEG**

PANORAMA TECNICO DE ALUMINIO  
21813 - MARIANO ALUMINIO  
TEL: 044 445 21 41 13  
FAX: 044 445 21 41 11

**A27631**





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## **AEG POWER SOLUTIONS IBERICA, S. L.**

Albert Einstein, 31  
Parque Tecnológico de Álava  
01510 – Miñano (Álava), SPAIN  
Tfno: +34 945 21 41 10  
Fax: +34 945 21 41 11  
[www.aegps.es](http://www.aegps.es)

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POWER SOLUTIONS