



CPSDEC

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CRISTEC

L'énergie embarquée

On-Board Energy

Energie an Bord

Energia a bordo

Energia a bordo

**Documentation Gamme C.P.S.
User Manual C.P.S. Range
Bedienungsanleitung C.P.S.-Serie
Manual del usuario Gama C.P.S.
Manuale d'uso Gamma C.P.S.**



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1 Introduction

1.1 INSTALLATION AND OPERATING MANUAL

The present document applies to chargers in the CRISTEC CPS range of battery chargers listed below.

U/I Rating	Power (Watts)	CRISTEC Reference
12V 06A	70	CPS 70-1A
24V 03A		CPS 70-2A
12V 10A	120	CPS 120-1A
24V 05A		CPS 120-2A
12V 16A	190	CPS 190-1A
24V 08A		CPS 190-2A
12V 25A	300	CPS 300-1A
24V 12A		CPS 300-2A
12V 40A	480	CPS 480-1A
24V 20A		CPS 480-2A
12V 60A	720	CPS 720-1A
24V 30A		CPS 720-2A
24V 50A	1200	CPS 1200-2A
24V 60A	1440	CPS 1440-2A

This manual is intended for users, installers and equipment maintenance personnel who must ensure they understand the present document before any intervention on the charger.

1.2 VALIDITY OF THIS DOCUMENT

This document is the property of CRISTEC ; all the information contained in this document applies to the accompanying product. The company reserves the right to modify the specifications without prior notice.

1.3 GUARANTEE

Failure to comply with the rules for installation and operation cancels the manufacturer's guarantee and absolves CRISTEC of all responsibility.

The period of guarantee is 36 months. It applies to parts and labour for any **equipment returned to the factory**.

Only parts acknowledged to have been defective from the outset will be replaced under the guarantee. Equipment which has been misused or damaged by errors in connections, impacts, falls or which is defective from having been worked upon by persons other than those authorised by CRISTEC Industries.

Equipment which has been installed or operated at variance with procedures outlined in the manual provided with each unit.

Under no circumstances, can any indemnity be granted by this warranty.

This warranty does not apply to the following terms :

- ❶ Transportation and packaging charges to and from the factory or authorised service station.
- ❷ Damage sustained in shipment, apparent or concealed.

Claims for such damage must be reported and filed with the carrier by the person receiving the equipment.

1.4 BRIEF PRESENTATION

Chargers in the CPS (charge, programmable, selective) range provide specific charging for 1, 2 or 3 banks of batteries in accordance with the battery manufacturers' specifications.

An internal switch selects the type of battery : Lead/Antimony (**ANT**) or Lead/Calcium (**CAL**).

Entirely automatic with built-in charge distribution, they can remain permanently connected to the batteries in complete safety and do not need to be disconnected when starting the engine.

The timed Boost function, which allows the batteries to be charged more quickly (6 hours ± 30 minutes), may be activated or inhibited by means of an internal switch as the user wishes:

- **"BOOST ON"** position to enable Boost
- **"BOOST OFF"** position to disable Boost

In general, starter batteries are always better charged than auxiliary and utility batteries. In order to increase its life by not overcharging, it is allocated its own specific output .

CPS chargers are protected against polarity reversal and transient short-circuits.

Accepting a wide range of input frequencies and voltages, they work from electricity generating sets and may be connected to international marinas within the specified tolerance range (115/230Vac ± 15%, selected by internal jumper).

Two indicator lamps on the front panel show the state of the charger :

- Green LED → Connection to ac mains
- Yellow LED → Flashing : charging **"BOOST ON"**

Steady : charging **"BOOST OFF"**



CPS chargers are supplied in a metal case with IP22 protection rating. The overhanging cover and hood protect the charger from running water.

The equipment is designed to work in a marine and mobile environment.

All of the CPS range output a filtered and regulated voltage of 12 or 24 V. In the event of battery disconnection, the charger supplies the loads without damage.

Installation and Connections

- When they leave the factory the chargers are configured as follows :
 - Mains supply : 230Vac
 - Battery : Lead/Antimony
 - Charging mode : Boost ON, 3 step charging curve
 - Output voltage setting in Floating :
 - ◆ at 13.8 V \pm 1% off load for 12 V models
 - ◆ at 27.4 V \pm 1% off load for 24 V models
- Cable entry is via cable glands except for 70 and 120 W models for which the battery cables must be attached to terminals.

1.5 REFERENCE STANDARDS APPLIED

The standards applied are :

- **NF EN 60950 + A1 + A2** (October 93) : safety of information processing equipment including electrical office equipment.
- **NF EN 50081-1** (June 92) EMC : Generic standard for emissions
- **NF EN 50082-1** (June 92) EMC : Generic standard for immunity
- **NF EN 55022** (December 1994) : Limits and methods for measuring the characteristics of RF interference produced by information processing equipment.

Enacted at Quimper on : 24 December 2002

For and on behalf of CRISTEC SAS,

2 Characteristics and operation

2.1 TECHNICAL CHARACTERISTICS

2.1.1 Mechanical characteristics

All models have an IP 22 protection rating. The cover and clasp are made of steel and the base is made of aluminium. These parts are protected by several coats of epoxy paint.

Overall dimensions and weights of the various models are specified in the table below :

Model	Length (mm)	Height (mm)	Depth (mm)	Weight (kg)
12V 06A	215	160	85	1,6
24V 03A				
12V 10A	215	160	85	1,7
24V 05A				
12V 16A	270	205	120	2,4
24V 08A				
12V 25A	270	205	120	2,9
24V 12A				
12V 40A	290	235	116	3,6
24V 20A				
12V 60A	356	285	133	4,6
24V 30A				
24V 50A	356	285	133	5
24V 60A	356	285	133	5,1

2.1.2 Input characteristics

Permissible input voltage (Vac) : 115Vac or 230Vac +/- 15% single phase by manual selection.

Permissible input frequency (Hz) : 47 to 63 Hz.
Possibility to power the chargers from a generating set (please refer to page 21).



Model	Typical input current rating at 115Vac	Typical input current rating at 230Vac	Internal input fuse rating and format
12V 06A 24V 03A	2A	1A	3,15A T 5x20
12V 10A 24V 05A	3A	1,5A	3,15A T 5x20
12V 16A 24V 08A	4A	2A	10 A T 6,3x32
12V 25A 24V 12A	6A	3,3A	10 A T 6,3x32
12V 40A 24V 20A	8A	4,5 A	10 A T 6,3x32
12V 60A 24V 30A	11 A	8 A	20 A T 6,3x32
24V 50A	17 A	11 A	20 A T 6,3x32
24V 60A	20 A	13 A	20 A T 6,3x32

2.1.3 Output characteristics

2.1.3.1 Voltage

The output voltages shown in the table below are obtained at **10% of rated power** on outputs BAT 1 and BAT 2. For those models having a BAT D output, the voltage level is reduced by about 0.4 V. These values are set in the factory with an accuracy of $\pm 1\%$ and can be adjusted by turning the potentiometer POT U (use a suitable tool for turning the potentiometer screw).

They depend on the type of battery and mode of operation selected.

Model	Model 12 V	Model 24 V
Lead/Antimony Battery "Floating" Mode "	13,8 V	27,4 V
Lead/Antimony Battery "Boost" Mode	14,5 V	28,8 V
Lead/Calcium Battery "Floating" Mode	14,6 V	29,0 V
Lead/Calcium Battery "Boost" Mode	15,4 V	30,5 V

2.1.3.2 Current

The table below defines the maximum output current at rated output power as well as the type and rating of the carsocket type fuses placed in series with the charger outputs.

Model	Maximum output current	Fuse rating	Output type of fuse
12V 06A	6 A	7,5 A	25707.5 LITTLEFUSE
24V 03A	3 A	5 A	257005 LITTLEFUSE
12V 10A	10 A	15 A	257015 LITTLEFUSE
24V 05A	5 A	7,5 A	25707.5 LITTLEFUSE
12V 16A	16 A	20 A	257020 LITTLEFUSE
24V 08A	8 A	10 A	257010 LITTLEFUSE
12V 25A	25 A	2 x 15 A	257015 LITTLEFUSE
24V 12A	12 A	15 A	257015 LITTLEFUSE
12V 40A	40 A	2 x 20 A	257020 LITTLEFUSE
24V 20A	20 A	20 A	257020 LITTLEFUSE
12V 60A	60 A	3 x 20 A	257020 LITTLEFUSE
24V 30A	30 A	2 x 15 A	257015 LITTLEFUSE
24V 50A	50 A	2 x 25 A	257025 LITTLEFUSE
24V 60A	60 A	3 x 20 A	257020 LITTLEFUSE

2.1.4 Environmental specification

All chargers in the range meet the following characteristics :

- Storage temperature : - 20°C to + 70°C.
- Operating temperature : - 10°C to + 50°C.
- Humidity : < 90% non-condensing



2.1.5 Protection and operating safety

2.1.5.1 Input protection

Models CPS 70, CPS 120, CPS 190 and CPS 300 are fitted with two pole protection by 2 fuses F1 and F2 whose ratings are given in section 2.1.2.

All other models are fitted with single pole protection by a fuse F1 whose rating is given in section 2.1.2.

2.1.5.2 Output protection

Output protection is provided by a fuse placed in series with the "-" terminal of the charger in order to reduce the number of fuses. The rating and type of this fuse are defined in the table in section 2.1.3.2.

2.1.5.3 Additional safety devices

All models are fitted with the following safety devices :

- Protection against input voltage surges by a Varistor (275 Vac).
- Protection against abnormal heating of the power semiconductors.
- Protection against polarity reversal (output fuse blows)
- **Protection against overloads on the output by limiting the power to the rated value for each model.**

It is possible to reduce the power on the 24V 50A and 24V 60A models by means of an external potentiometric switch fixed on the cabinet.

2.1.5.4 Fan Functioning

The following charger models do not have any electromechanical fan; they have a natural ventilation : CPS 70-1A, CPS 70-2A, CPS 120-1A, CPS 120-2A, CPS 190-1A, CPS 190-2A and CPS 300-2A.

All other CPS charger models are equipped with an electromechanical fan. They are driven through a temperature sensor and they are only activated if some specific sensitive devices reach a certain level of temperature.

2.1.6 Options

The options do not form part of the basic battery charger supply. They are available from your reseller. The only extra options that could work with the CPS chargers are the pieces of equipment proposed as an option by CRISTEC.

- **Analogue voltmeter for displaying the charging voltage at the input side of the charge distribution diodes.**

Model	Voltmeter reference
Model 12 V	VL T 0012
Model 24 V	VL T 0024

- **48x48mm analogue ammeter for displaying the total battery charging (SHUNT already fitted into the charger PCB)**

Model	Ammeter reference
12V 06A	AMP 0070/1
24V 03A	AMP 0070/2
12V 10A	AMP 0120/1
24V 05A	AMP 0120/2
12V 16A	AMP 0190/1
24V 08A	AMP 0190/2
12V 25A	AMP 0300/1
24V 12A	AMP 0300/2
12V 40A	AMP 0480/1
24V 20A	AMP 0480/2
12V 60A	AMP 0720/1
24V 30A	AMP 0720/2
24V 50A	AMP 1200/2
24V 60A	AMP 1440/2

- **Battery temperature compensation ***

Probe length	Probe reference
1 m	STEMP/1
3 m	STEMP/3

* : Available as an option on all CPS charger models except CPS 70 et CPS 120.

The temperature sensor has to be connected to the charger after having disconnected the batteries to the charger first. A special plastic terminal is available on the bottom of the charger board. The temperature sensor has to be protected against any cuts and shall not be scratched. Our connection recommendations have to be respected in order to insure the right operating of the charger. The here-above mentioned sensors can only be used on CPS chargers.



The connecting is different depending on models :

➤ **CPS 190 and CPS 300 models :**

There are 3 terminals on these models to connect the temperature sensor. Please refer to the attached drawing. The proper sensor terminals are shown on the drawing as "temperature sensor" (2 off positive terminals and one off negative terminal).

The white cable has to be connected to one of the two positive terminals. The yellow cable will be connected to the remaining positive terminal.

The negative terminal will be linked to the brown cable.

➤ **CPS 480, 720, 1200 and 1440 models :**

There are 2 terminals on these models to connect the temperature sensor.



Please refer to the attached drawing : the proper sensor terminals are shown on the drawing as "temperature sensor" (1 off positive terminals and one off negative terminal).

Cut out and isolate the yellow cable. The white cable has to be connected to the positive terminal. The negative terminal will be linked to the brown cable.

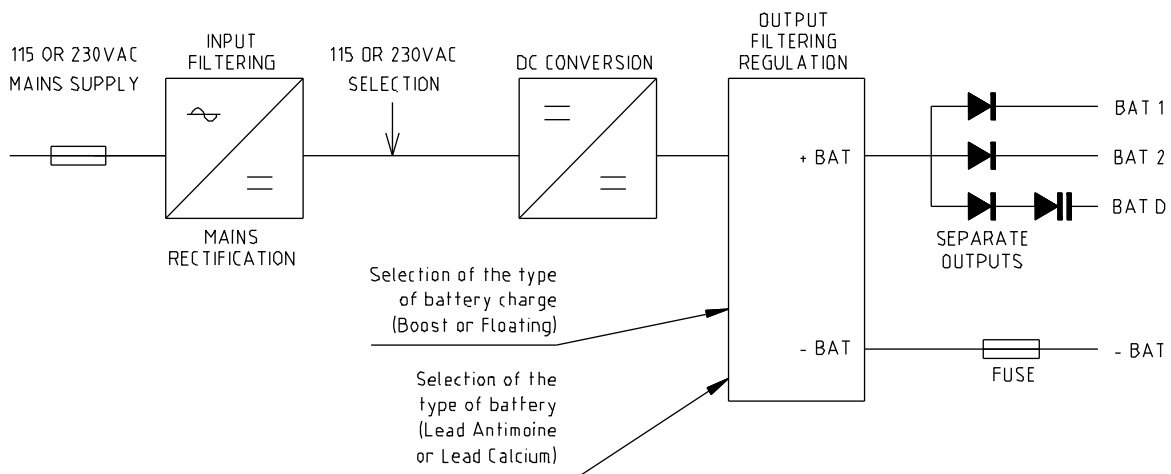
2.2 CHARGER OPERATION

2.2.1 Output voltage

The charger delivers a voltage suitable for recharging 1, 2 or 3 separate batteries.

All models (except for CPS 70 and CPS 120) are fitted with an output suitable for recharging the engine battery (BAT D output). Nevertheless, for chargers CPS 70 and CPS 120, you can use one of the outputs for recharging engine battery.

2.2.2 Block diagram



2.2.3 Principle of operation

The CPS range of battery chargers are designed on the basis of a high frequency switching converter which transforms the ac signal into a regulated, filtered dc voltage suitable for charging accumulator batteries.

2.2.4 Detailed operation

After the initial selection of input mains, type of battery and type of charge, battery charger operation is entirely automatic.



2.2.4.1 Selector operation

- Mains voltage selector

The charger is fitted with an internal voltage selector enabling it to operate on 2 types of Mains supply :

- European mains supply : 230Vac – 50/60Hz
- Other mains supplies (USA, etc. ...) : 115Vac 50/60Hz

- Battery type selector

The charger is fitted with an internal selector enabling it to operate on 2 types of battery just by changing a switch:

- Lead/Antimony battery : "ANT"
- Lead/Calcium battery : "CAL"



● Charge type selector

The charger is fitted with an internal selector enabling it to provide 2 types of charging just by changing a switch :

- Charge in Floating mode : **"BOOST OFF"**
- Charge in Boost mode for 6 hours \pm 30 minutes then automatic switch to Floating mode : **"BOOST ON"**

NB : The Boost voltage off load is about 5% higher than the off load Floating mode voltage.

● Potentiometric switch of power limitation

For 1200W and 1440W models, a potentiometric switch located on the right hand side outside the cabinet enables to limit the charger power. This system allows to avoid the possible disjunction of the AC breakers.

2.2.4.2 Operation of the indicators

These indicators are fitted on the charger front panel and display the unit's mode of functioning.

● "Mains present" indicator

This indicator is extinguished in the following circumstances :

- Absence or degradation of the ac mains supply,
- Input fuse blown,
- Internal malfunction of the battery charger.

● Boost or Floating charge mode indicator

This indicator is extinguished in the following circumstances :

- Output fuse blown,
- Absence of voltage at charger output (for example, ac mains not connected).

This indicator lights steadily when the Floating charge mode : **"BOOST OFF"** has been selected and the charger is functioning correctly.

This indicator flashes if Boost mode operation : **"BOOST ON"** has been selected. This mode of operation lasts for 6 hours \pm 30 minutes before the charger automatically switches to Floating mode operation. At that moment, the indicator changes to a fixed steady light.

2.2.4.3 Special operation

● Special batteries

The factory settings are for standard use of Lead/Antimony and Lead/Calcium batteries.

Refer to a professional installer for special settings to match the battery manufacturer's specifications, taking into account the special features of the installation.

● Electricity generating sets

The CRISTEC battery charger is designed for use from an electricity generating set.

In certain circumstances, generating sets can generate large over-voltage. Before connecting the charger, check that the charger is compatible with the generator: power, voltage, voltage surges, frequency, current, etc...

3 Installation

3.1 INTRODUCTION

This section deals with matters relating to charger installation.

Installation and operating the charger for the first time must be taken by an electrician or professional installer in accordance with the standards in force (in the case of pleasure boats, comply with the international standard ISO 13297).

The installer must take note of this operating manual and must inform users of the matters relating to installation and safety contained in section 5.

3.2 ITEMS SUPPLIED

CRISTEC supply items include the following elements :

- 1 metal case containing the battery charger electronic functions,
- the present documentation (operating manual).

3.3 ADDITIONAL SUPPLIES NECESSARY FOR ELECTRICAL INSTALLATION

These items do not form part of CRISTEC supply.

Reference to additional supply items which are necessary for correct operation of the charger are defined in the following sections :

Any failure to comply with these provisions will result in cancellation of the manufacturer's guarantee.



3.3.1 Cable connecting to the public mains supply or to an electricity generating set

Depending on line lengths, cables connecting to the ac mains supply MUST have a cross-section equal to, or greater than, the values shown in the table below :

Model	Minimum cross-section and types of cable for 115Vac	Minimum cross-section and types of cable for 230Vac
12V 06A	Supplied	Supplied
24V 03A		
12V 10A		
24V 05A		
12V 16A	3 x 1,5 mm ² HO7-VK	3 x 1,5 mm ² HO7-VK
24V 08A		
12V 25A		
24V 12A		
12V 40A	3 x 2,5 mm ² HO7-VK	3 x 1,5 mm ² HO7-VK
24V 20A		
12V 60A	3 x 2,5 mm ² HO7-VK	3 x 1,5 mm ² HO7-VK
24V 30A		
24V 50A	3 x 4 mm ² HO7-VK	3 x 2,5 mm ² HO7-VK
24V 60A	3 x 4 mm ² HO7-VK	3 x 2,5 mm ² HO7-VK

It is ESSENTIAL to use end-fittings with insulated sleeves (in accordance with the installation rules) for connecting the mains input.

The PE conductor (commonly called "earth" green/yellow wire) of the ac source MUST be connected to the charger on the terminal provided for this purpose.

3.3.2 Battery connection cable

Up to 3 meters, cables connecting to the batteries MUST have a cross-section equal to, or greater than, the values shown in the table below :

Model	Cross-section and type of battery connection cables	Type of terminal Cross-section of cable and diameter of the terminal hole
12V 06A	2,5 mm ² HO7-VK	End-fittings with insulated sleeves MUST be fitted (in accordance with standard NF G63-023)
24V 03A	1,5 mm ² HO7-VK	
12V 10A	4 mm ² HO7-VK	
24V 05A	2,5 mm ² HO7-VK	
12V 16A	6 mm ² HO7-VK	6 mm ² - 5 mm
24V 08A	4 mm ² HO7-VK	4 mm ² - 5 mm
12V 25A	10 mm ² HO7-VK	10 mm ² - 5 mm
24V 12A	6 mm ² HO7-VK	4 mm ² - 5 mm
12V 40A	16 mm ² HO7-VK	16 mm ² - 5 mm
24V 20A	10 mm ² HO7-VK	10 mm ² - 5 mm
12V 60A	16 mm ² HO7-VK	16 mm ² - 6 mm
24V 30A	10 mm ² HO7-VK	10 mm ² - 6 mm
24V 50A	16 mm ² HO7-VK	16 mm ² - 6 mm
24V 60A	16 mm ² HO7-VK	16 mm ² - 6 mm

It is ESSENTIAL to use the cable glands on the underside of the case in order to prevent any damage to the cables on the metal edges of the case and to guarantee double insulation between the live conductors and electrical earth.

3.3.3 Voltmeter and Ammeter link cable (only on certain models)

These cables must have a cross-section equal to, or greater than, 0.34mm² and be of type : KZ0506-600V. They must have end-fittings with insulating sleeves in accordance with NF G 63-023.

It is ESSENTIAL to use the cable glands on the underside of the case in order to prevent any damage to the cables on the metal edges of the case and to guarantee double insulation between the charging circuit and electrical earth.

3.3.4 Installation of the earth cable

The cable linking the installation to earth has to be connected to the earth screw situated inside the charger.

The cable used must have a minimum cross-section of 2.5mm², be of the type HO7-VK and be fitted with a suitable terminal.



3.4 SPECIAL RECOMMENDATIONS FOR INSTALLATION

3.4.1 Case position

3.4.1.1 Preventing the charger overheating

The charger is designed to be mounted in a vertical position as indicated in our recommendations ; please refer to the drawings of the appendix.

An area of 150 mm from the sides of the case should be kept clear.

Cooling is provided by forced ventilation on certain models. The installer must make the necessary arrangements to ensure that the temperature of the air at entry (please refer to the drawings in the appendix) is less than 40°C in extreme operating conditions.

Arrangements must also be made to ensure hot air can get away either side of the charger.

3.4.1.2 Preventing running water or spray falling on the charger

The protection factor is IP22 and the charger position must be chosen so as to prevent any moisture or salt entering the charger.

If this were to occur, the equipment would be irreversibly damaged and there would be a potential risk to the user.

You are recommended to position the charger in a dry, well-ventilated location, away from any source of heat.

3.4.1.3 Arrangements for the batteries

Batteries connected to the charger are likely to give off explosive gases during the charging phase.

You are therefore recommended :

- ➔ to ban the use of any equipment generating sparks and flames near to the batteries.
- ➔ to position the batteries in a well-aired and ventilated location.
- ➔ to take note of the battery manufacturer's instructions when installing the batteries.

3.4.1.4 Accidental leakage currents to earth

- ① Accidental leakage current between line and earth
Comply with standard NFC 15-100 in respect of precautions over installation.

Have the connection work done by an electrician or professional installer.

The charger must be connected to a system having a two-pole differential circuit breaker with 30mA sensitivity.

- ② Accidental leakage current between charge circuit and earth

Detection of accidental leakage currents to earth must be provided by a safety device outside the charger (residual differential current device or insulation monitor device).

The installer must ensure that the rating and nature of the protection are appropriate for the risks.

Special precautions are recommended on any installation where there is a danger of electrolytic effects.

Regulations require the presence of a battery cut-out on the output + pole and on the output - pole.

3.4.1.5 Precautions regarding lightning strike

In geographic zones exposed to a high risk of lightning strikes, it may be worthwhile fitting a lightning conductor on the inlet side of the charger in order to prevent the latter being irreversibly damaged.

3.4.1.6 Electromagnetic interference generated by the charger

- Use screened cable for all connections (*). The screening at both the emitter end and receiver end must be connected to earth.
- Make sure the length of the cables and screening connections are kept as short as possible.
- Route the cables as close to earth objects as possible ("flying" cables or cable loops are to be avoided – fasten the cables against earth objects).
- Separate the power supply cables from output cables.
- Separate power cables from monitor signal cables (minimum 200 mm).
- Cables must carry only the charger power supply. Branch or bridging connections in order to supply another equipment are to be banned.

(*) This is advice for installation and not an obligation. The electrician installer will decide whether to use screened cable or not, based on the EMC environment.



3.5 COMMISSIONING

This section lists the operations to be performed in order to commission the charger. It is advisable to comply strictly with these instructions before switching on for the first time.

3.5.1 Selecting the mains supply voltage 115/230Vac

Selection of the input mains supply is made using the selector inside the metal case, marked FN1/FN2.

Precautions to be taken in using this selector are as follows :

- The rating of circuit breakers placed on the supply side of the charger must correspond with the latter's requirement.
- There must be no ac voltage present when the selector is moved.
- Position the voltage selector as a function of the type of alternating mains supply used.

If this selector is incorrectly set irreversible damage to the charger may occur.

3.5.2 Selecting battery type

The drawings available in the appendix indicate the internal selector configuration depending on the type of used batteries.

Precautions to be taken in using this selector are as follows :

- You **MUST** check the compatibility of the selection and the type of battery connected **BEFORE** you switch on.

3.5.3 Selecting charge mode

The drawings available in the appendix indicate the internal selector configuration depending on the required charging mode.

Precautions to be taken in using this selector are as follows :

- You **MUST** check the compatibility of the "**BOOST ON**" mode voltage with the type of battery connected.
- During the winter period, or periods of prolonged charger connection to the batteries, if the charger remains switched on set the switch to "**BOOST OFF**" as a matter of course.
- If using the "**BOOST ON**" function, the starter motor battery **MUST** be connected to BAT D on models having 3 outputs.

- If the charger is supplying 1, 2 or 3 banks of batteries with a low rate of discharge, you are advised to select the "**BOOST OFF**" mode.
- If there is instability on the alternating mains supply to the charger (micro-breaks > 500 ms), the charger will re-initialise the Boost period of 6 hours \pm 30 minutes and, in time, result in battery deterioration. In such circumstances, we recommend that you select the "**BOOST OFF**" mode.

3.5.4 Verifying the charge voltage

Before connecting batteries to the charger, you **MUST** check battery polarity.

Check also the voltage of the batteries using a calibrated voltmeter. A too low voltage on certain types of battery can indicate irreversible damage and an inability to take a recharge.

3.5.5 Connecting up the options

You **MUST** contact your reseller or CRISTEC Sales Department.



4 Maintenance and repair of equipment

4.1 INTRODUCTION

This section deals with arrangements for maintenance and repair of the equipment. Correct operation and the life of the product are conditional on strictly complying with the recommendations below.

4.2 EQUIPMENT MAINTENANCE

- Disconnect the battery charger from the alternating mains supply for all maintenance operations.
- If the charger is placed in a dusty environment, vacuum it periodically to clean it since layers of dust might affect heat dissipation.
- Check the state of charge of the batteries every three months.
- An annual check that nuts and bolts are tight is necessary in order to guarantee correct functioning of the charger (especially in an environment subject to vibration, shock, large changes in temperature, etc ...).
- A complete technical examination by a CRISTEC recommended serviceman is advisable every 5 years. This general technical examination can also be carried out in our factories.

4.3 EQUIPMENT REPAIR

- Disconnect the battery charger from the ac mains supply and from the batteries before carrying out any repairs.
- If a fuse has blown, make sure the replacement complies with the rating and type of fuse recommended in section 2.1.
- For any other repair action, contact a reseller or CRISTEC.

5 Safety

5.1 STANDARDS REFERENCES

- Class I equipment in accordance with standard NF EN 60950.
- Installation requirements are contained in standard NFC 15-100 and the specific standard for "pleasure boats – electrical systems – Installation of ac distribution system", reference ISO 13297.

5.2 PRECAUTIONS RELATING TO PERSONNEL SAFETY

- Installation must be undertaken by an electrician or professional installer.
- The alternating mains supply must be cut off before any intervention on the equipment.

5.3 PRECAUTIONS RELATING TO PROTECTION AGAINST FIRE AND EXPLOSION

- Use the fuses defined in section 3.1.
 - In the vicinity of the batteries :
 - Ventilate the room,
 - Do not smoke,
 - Do not use a naked flame.