CE

TECHNICAL MANUAL

"XS" Battery charger

MANUAL FOR USE BY AUTHORISED TECHNICIANS AND SERVICE PERSONNEL

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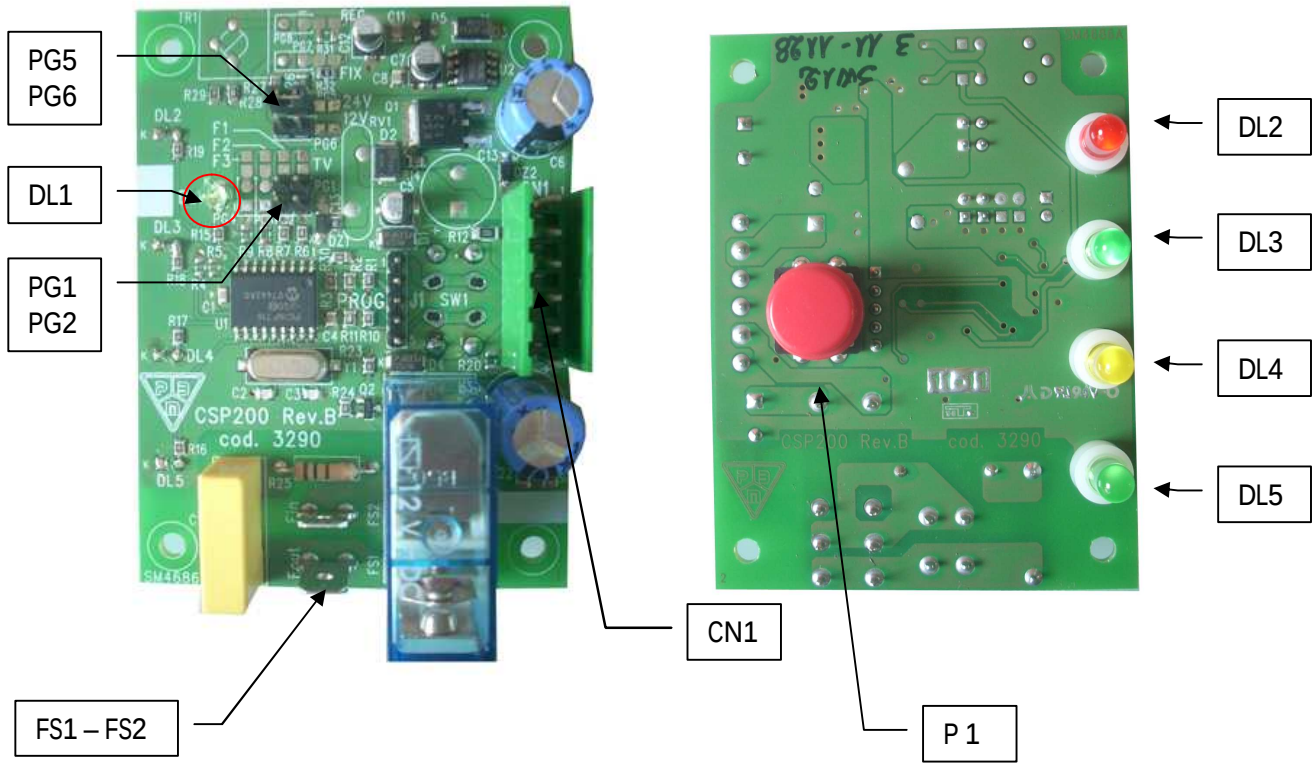
CHAPTER 1: INTRODUCTION

- The new PBM200 card is used for low-power single-phase battery chargers in the versions for 12V and 24V batteries.
- The card is also fitted with 4 LEDs used to signal the various charging phases and/or any anomalous situations.

CHAPTER 2: DESCRIPTION OF CARD PBM200



P1	STOP/START button	
DL1	LED signalling "Gas development threshold" (Green)	
DL2	LED signalling “Anomaly” (Red)	
DL3	LED signalling “Charge completed” (Green)	
DL4	LED signalling “Final charge in progress” (Yellow)	
DL5	LED signalling "Battery connected” or “Battery charging” (Green)	
PG1 PG2	JUMPER to select the charging parameters.	
PG5 PG6	JUMPER to select the rated voltage for 12/24V batteries.	
CN1	AMP MODU-1 Connector (6 poles)	
	CN1.1	- battery
	CN1.2	+ battery
	CN1.3	Vac
	CN1.4	
	CN1.5	transformer thermal cut-out
	CN1.6	transformer thermal cut-out
FS2	F in	Mains input
FS1	F out	Transformer relay contact output

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CHAPTER 3: COMMISSIONING AND START-UP

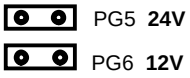
- The PBM200 board is a battery-powered device, so the board will start up even by just connecting the battery. By connecting the mains power supply only, the board does not start up.
- Connect the power supply cable to a230Vca mains outlet.
- Connect the battery to the charger through the appropriate cables, paying attention to the polarity.
- Make sure the 4 LEDs light up sequentially for a short period of time which confirms that the device is connected to the electrical supply and that the LEDs are working properly (diagnostics autotest)
- If the battery is properly connected the Autostart function is launched, charging starts automatically 5 seconds after the battery has been connected (indicated by the alternate flashing of the DL5 and DL4 LEDs).
- By disconnecting the mains supply, charging stops and the board maintains its indications, because it is on battery power and reports that there is "no mains power supply" DL5 LED is flashing).
- Charging is fully suspended when the battery is disconnected; when the battery is reconnected, charging resumes from the initial stage.
- WARNING ! : Do not disconnect the battery during charging to prevent electric shocks.
- Before disconnecting the battery when charging is in progress, stop the charging process by pressing the ON/OFF button.
- By entering PG1 the Quick Test, which accelerates all times related to the charging cycle, is enabled. It is used to verify the exact sequence of the phases that characterise the charging curve (see Chapter 5 and Chapter 7). This situation is signalled with a faster flashing of the LEDs.

NOTE !!

AVAILABLE FUNCTIONS (ENABLING AND/OR DISABLING OF THE JUMPERS) MUST BE CONDUCTED WHEN THE BATTERY AND THE MAINS POWER SUPPLY AND DISCONNECTED FOR THEM TO BE ACCEPTED BY THE MICROPROCESSOR.
THE ONLY EXCEPTION IS THE INSERTION OF THE QUICK TEST JUMPER.

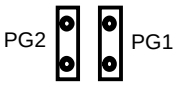
CHAPTER 4: SETTING THE RATED VOLTAGE OF THE BATTERY AND CALIBRATING THE THRESHOLD VOLTAGE

The rated voltage of the battery is set using the PG5 and PG6 jumpers located on the top of the electronic board.
When selecting the jumper corresponding to the rated voltage of the battery the threshold voltage will adjust automatically(Please refer to the following chapter to set the various threshold voltages).
The table below shows the battery types that can be chosen using the jumpers and the related standard pre-set threshold voltages.



PG5	PG6	Rated voltage (2.0V/el)	Threshold voltage (2.4V/el)
-	X	12,0	14,4
X	-	24,0	28,8

CHAPTER 5: SETTING THE CHARGING PARAMETERS (PG1 PG2 JUMPERS)



PG1	PG2	Description	Std
1	-	Quick test inserted	
0	-	Quick test not inserted	*
-	0	Lead Batteries	*
-	1	Gel Batteries	

Where:
- '1' indicates that the corresponding JUMPER is PRESENT,
- '0' indicates that the corresponding JUMPER is NOT PRESENT,
The configuration used to set the board by the manufacturer during commissioning (Std) Is indicated with *.

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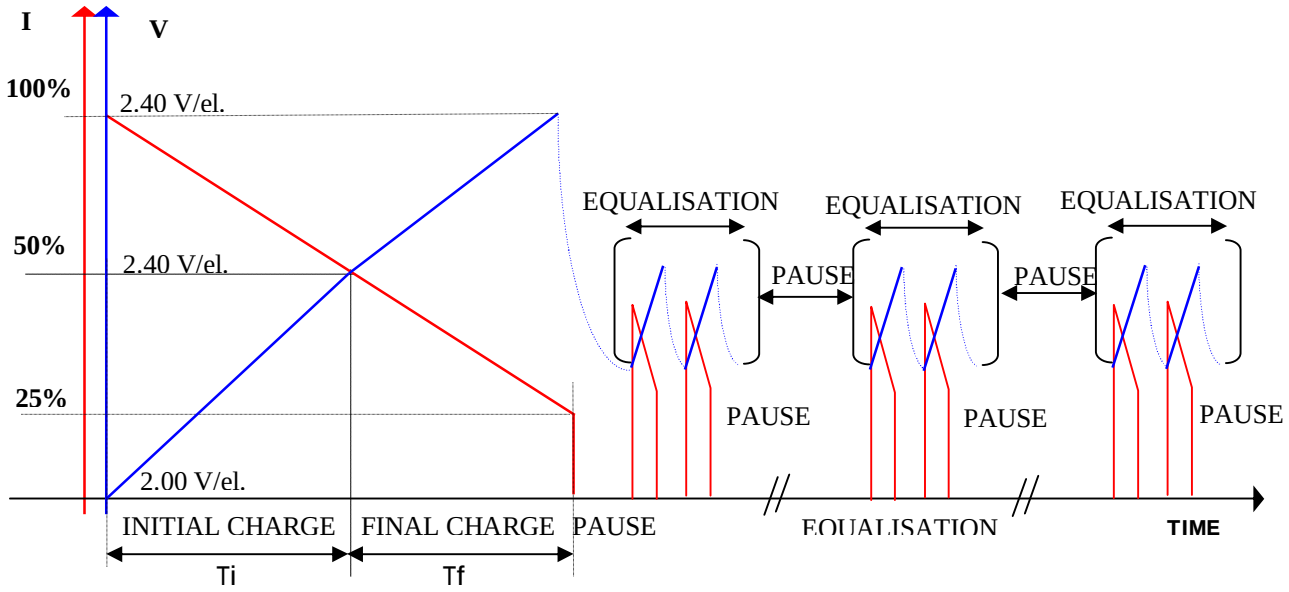
CHAPTER 6: DESCRIPTION OF THE Wa TYPE CHARGING CURVE

Figure 5.1



This charging curve is structured as follows :

- Initial charge with the increasing current with intervention of the final charge at the pre-set threshold via the battery selection jumpers.
  If the battery does not reach the threshold voltage within a Ti time equal to 9 hours after the charging cycle began, the anomaly of the safety timer intervenes.
- Final charge controlled in a Tf time (standard: 3 hours).

EQUALISING CHARGE

The equalising charge is a function which is usually inserted as default setting.

- It develops after a T.Pause time (equal to 60 min) From the normal charge and lasts for an overall time equal to Teq (equal to 45h)
- This equalisation consists of a Np (equal to 3) number of packets of Neq (April 2 5) impulses each, each featuring an Activation time T.On (equal to 12min) and a de-activation time T.Off (equal to 48min).
- These packets are separated by a pause Tp (equal to 15h).
- These impulses follow one another during the Active Cycle (lasting45h) followed by the Stop Cycle (equal to 120h)
- This type of equalisation has no time limits and stops only when the battery is disconnected. This system is useful also in summertime is and weekends, allowing the battery to keep its charge without the risk of overcharging, heating and/or water consumption.

Summary table

Board model	Sfw version	T.Pause (min)	T.On (min)	T.Off (min)	Vb On (V/cell)	Vb Off (V/cell)	Np	Neq	Active cycle (hours)	Stop cycle (hours)
PBM200	V1.5	60	12	48	2.05	2.80	3	5	45h	120h (5 gg.)

- The equalisation charge is indicated by the continuous flashing of the two DL3 and DL5 green LEDs and the functions of the other LEDs remain unchanged (see table 9.1).
- The end of the full charging cycle (nominal charge + equalisation charge) is indicated by the fixed light of the DL3 and DL53 green LEDs.

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CHAPTER 7: LIST OF LED INDICATIONS

The table below shows the indications provided using the LED battery.

Indication	DL5 LED (green)	DL4 LED (yellow)	DL3 LED (green)	DL2 LED (red)
Autotest	All the LEDs switch on in sequence for 3 times			
Autostart execution	OFF	OFF	BLV	BLV
Initial charge	BLK	OFF	OFF	OFF
Final charge	BLK	ON	OFF	OFF
Charging completed or equalisation pause	ON	*	ON	OFF
Equalising charge	BLK	*	ON	OFF
Safety timer alarm	ON	OFF	OFF	ON
No mains power supply or Thermal cut-out alarm	ON	OFF	OFF	BLK
Battery disconnected	OFF	OFF	OFF	BLV

OFF = the LED is off
ON = the LED is permanently on
BLK = the LED flashes slowly (Blink , T = 1 second)
BLV = the LED flashes quickly (Blink , T = 0.5 seconds)
* = the LED can be in any status

CHAPTER 8: LIST OF THE ALARMS

A1 Safety timer alarm

- On the PBM200 board there is a safety timer which controls the first charging phase.
- If during the initial charging phase, the battery does not reach the voltage threshold set in the Ti time interval (9 hours), the Timer stops the time during permanently and this is signalled by the DL2 red LED which switches on.
- Check the state of the battery charger and of the battery.

A2 No mains power supply a/or thermal cut-out alarm

- The transformer has a thermal protection fitted into the primary winding, which opens the circuit if the transformer exceeds the temperature of 150°C ;
- Check the mains voltage, check that the battery charger and battery match, taking into account the Wa tables (16A x 100Ah).
- The alarm is indicated by the DL5 green LED (fixed) and DL2 red LED (flashing) which are both turned on.

CHAPTER 9: INSTALLATION, SAFETY, MAINTENANCE AND TROUBLESHOOTING

This chapter aims to provide the main information necessary to the Support Services to conduct the installation of the battery charger correctly, effective troubleshooting of the most common fault and correct maintenance of the machine over time.

9.1 INSTALLATION

The general information to install the battery charger has already been extensively illustrated in the user manual that comes with each battery charger. The main elements are summed below.

- Always make sure that the power available to the user and the mains voltage are adequate and match the ones required for the battery charger to operate correctly.
- The battery charger is fitted with sockets to adjust the voltage in order to compensate for any differences between the voltage available to the user and the rated voltage.

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- The battery charger is set for a rated voltage of 230Vac.
- It is essential to check the mains voltage: Higher or lower voltages compared to the rated value result in significant differences in the current released by the battery charger, which leads to malfunctioning of the machine and loss of battery performance.
- The transformer has adjustment sockets for 220V and 240V.

9.2 SAFETY WARNINGS

1) Make sure that the battery charger is positioned on a surface that ensures it is stable and that it is protected against any collisions with forklifts or other vehicles. The cabinet is provided with slots for wall mounting using expansion inserts (not supplied).
2) The battery charger must be positioned in the area free of materials that prevent proper natural ventilation necessary to dissipate the heat generated.
3) Check that there are rather no explosive, flammable and/or dangerous materials in the proximity of the machine.
4) Make sure the charger is placed in a location protected from rain, water splashes, steam and fog; we do not recommend outdoor installation* under canopies and/or temporary shelters.
   * except for special versions with IPX3 or higher protection .
5) Also check the conditions of the user's electrical sockets, fuses and/or switches and extension cords; avoid using extension cords for the power supply cable of the battery charger !!
6) Check whether the electrical plug of the battery charger is compatible with its voltage and current and that it is connected to an adequate electrical outlet !! (Check the absorption and voltage on the label).
7) Check the integrity of the connections between the battery and battery charger, which may lead to dangerous overheating, if damaged and/or worn.
8) All the checks, calibration and maintenance operations that require the opening of the battery charger must be conducted by qualified and in any case trained and authorised personnel.

9.3 TROUBLESHOOTING

The indications below are general considerations as there may be various types of faults and/or malfunctioning and these cannot all be extensively described.
As for the battery charger, please consider that:

NOTE decreasing current battery charger are also subject to *apparent malfunctioning* due to external factors, such as electrical systems and/or batteries in bad conditions, so all checks should also consider this possibility.

9.3.1 MINIMUM INSTRUMENTS REQUIRED

- Portable multifunction digital tester
- Direct current amperometric pliers

9.3.2 FIRST CHECKS TO CONDUCT

- Check the general state of the battery charger and of the battery.
- Check that the power supply cable of the battery charger is connected properly to the electricity outlet and that the mains switch is closed.
- Check there is electricity inside the battery charger.
- Check the battery charger is connected correctly to the battery and the state of the connectors.

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9.3.3 TROUBLESHOOTING

TYPE OF FAULT	PROBABLE CAUSES	SOLUTIONS AND/OR CHECKS TO CONDUCT
THE BATTERY AND THE MAINS HAVE BEEN CONNECTED THAT THE BOARD DOES NOT SIGNAL A AND THE BATTERYCHARGER DOES NOT START UP	- Blown fuses - Faulty connections and/or contacts - Faulty board	1) Check the d.c. output fuse (battery side). 2) Check the battery's cables and make sure there are no false contacts on the plugs and/or overheating along the cable or cable terminals. 3) Use the digital tester to make sure there is battery voltage between the CN1.1 and CN1.2 contacts of the board (see the specific electrical diagram) 4) Check, and if necessary replace, the PBM200 control board.
THE BATTERY AND THE MAINS ARE CONNECTED, THE RELAY CLOSES BUT THE BATTERY CHARGER DOES NOT GENERATE CURRENT	- No mains - Blown fuses - Faulty connections and/or contacts - Faulty rectifying bridge	1) Check the relay is operating correctly by verifying that there is mains voltage on the terminal board of the transformer (TR). 2) Check the battery's cables and make sure there are no false contacts on the plugs and/or overheating along the cable or cable terminals. 3) Check the efficiency of the rectifying bridge (RD).
THE BATTERY CHARGER GENERATES LOW POWER	- Faulty connections and/or contacts - Faulty rectifying bridge - Low Mains Voltage - Incorrect cabling of the Main Transformer	1) The battery is ready charged or not fully charged. 2) Make sure the socket of the voltage control on the transformer is positioned correctly with respect to the voltage available. 3) Check the integrity of the cables making sure there are no burnt wires or oxidised cable terminals in the power circuit up to the battery cables 4) Check the efficiency of the rectifying bridge (RD).
THE BATTERY CHARGER GENERATES TOO MUCH POWER	- Very high voltage - Incorrect adjustments - Battery with very low charge - Incorrect cabling of the Main Transformer	1) Check that the power of the battery charger is adequate for the battery to be charged. 2) Check that the battery is not subject to extended periods of time when it is not charged and/or intense charging cycles compared to its capacity. 3) Check the mains voltage 4) Make sure the socket of the voltage control on the transformer is positioned correctly with respect to the voltage available.

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TYPE OF FAULT	PROBABLE CAUSES	SOLUTIONS AND/OR CHECKS TO CONDUCT
THE BATTERY CHARGER INDICATES THE INTERVENTION OF THE THERMAL CUT-OUT	- Very high mains voltage. - The battery charger is not suited to the capacity of the battery - Battery with very low charge - Incorrect cabling of the Main Transformer	1) Check that the mains voltage matches the rated voltage 2) Make sure the capacity of the battery does not exceed the capacity of the battery charger. Usually the rated capacity should not exceed the product 7*Inom. 3) Check that the battery is not subject to extended periods of time when it is not charged and/or intense charging cycles compared to its capacity. 4) Make sure the socket of the Transformer is connected properly to the power supply Voltage
THE MAINS FUSE BLOWS OR THE MAINS SWITCH ON THE ELECTRICAL PANEL INTERVENES.	- Low amount of power available. - Components in short circuit.	1) Check that the user's electrical power (kW) is adequate to the one required by the battery charger. 2) Check the main transformer (TR), making sure there are no windings in short-circuit and/or burnt windings. 3) Make sure the rectifying bridge (RD) is not in short-circuit. 4) Check that the battery charger does not generate too much current (see previous indications). 5) If the mains switch on the electrical panel intervenes after just a few minutes, check the type of switch installed as a battery charger represents a particularly heavy load from an electrical point of view. 6) We recommend using automatic and/or differential switches to protect the battery charger with intervention features adequate to this type of load (K / D curve).
THE SAFETY TIMER INTERVENES AFTER 9 HOURS	- Very low mains voltage. - Inefficient battery - Faulty board - Faulty diode bridge	1) Make sure the mains voltage value and the voltage adjustment socket on the transformer is positioned correctly with respect to the voltage available. 2) Check that each element of the battery is operating efficiently, making sure there are no elements in short-circuit or voltage lows. 3) Check that the calibration voltage of the board matches the reference one (2.4 V/el.) ; replace the PBM200 board. 4) Make sure the rectifying bridge (RD) is not in short-circuit or open.

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(RD) Checking the rectifying bridge

The rectifying bridge is made up of Schotcky button diodes on aluminium laminates that act as heatsinks.
To create different current flows the bridge is designed with a variable number of diodes placed in parallel on the same plate.

- With an eye check, make sure there are no burnt diodes or unsoldered leading wires.
- If when the battery charger is started up, there are any vibrations, And it does not generate power due to intervention of the mains switch for of the mains fuses, the bridge is in short-circuit and must be replaced.
- An “open bridge” fault can be checked by operating the battery charger without connecting the battery, forcing power supply from the transformer by disconnecting the wires from the FS1/FS2 fast-on on the board and short-circuit them.
- If in these conditions there is no no-load voltage of the transformer on the battery cables the rectifying bridge is at least partly “open” and must be replaced.

RATED BATTERY VOLTAGE	NO-LOAD VOLTAGE OUTPUT (DC)
12V	13 ÷ 15V
24V	27 ÷ 29V

9.3.4 MAINTENANCE AND CLEANING

All the maintenance and cleaning operations must be conducted by qualified and in any case trained and authorised personnel.

- The battery charger is a static electrical appliance and since it has no moving mechanical parts it does not require any particular maintenance.
- However, it is best to inspect, check and clean it at least once a year if the battery charger is operated in relatively "clean" environments.
- For “heavy-duty” environments with great exposure to dance and/humidity, there is the need for more frequent checks. It is best to apply a " label" on each battery charger to note the dates and/or maintenance intervals.

The main operations to conduct are:

- Take the battery charger(s) outdoors and remove the closing panels.
- Use a dust mask and protective devices and remove the dust accumulated inside with compressed air.
- Remove slime or other deposits with non-corrosive detergents.

Once completed the cleaning, check the following:

- The general state of the components and their integrity.
- Replace any oxidised cables and/or cable terminals.
- Use the designated sprays to clean electrical contacts on the connectors.
- Make sure screws and bolts are securely tightened; replace any "rusty" elements.
- As for the electronic boards, just conduct some " dry" cleaning all use designated sprays only.
- Check the state of both control and power connectors; for power connectors on the battery check their "wear" and if necessary replace them.
- Check the state of the electrical sockets.
- Once all these operations have been conducted, closed panels and coverings and placed a battery charger back into place.

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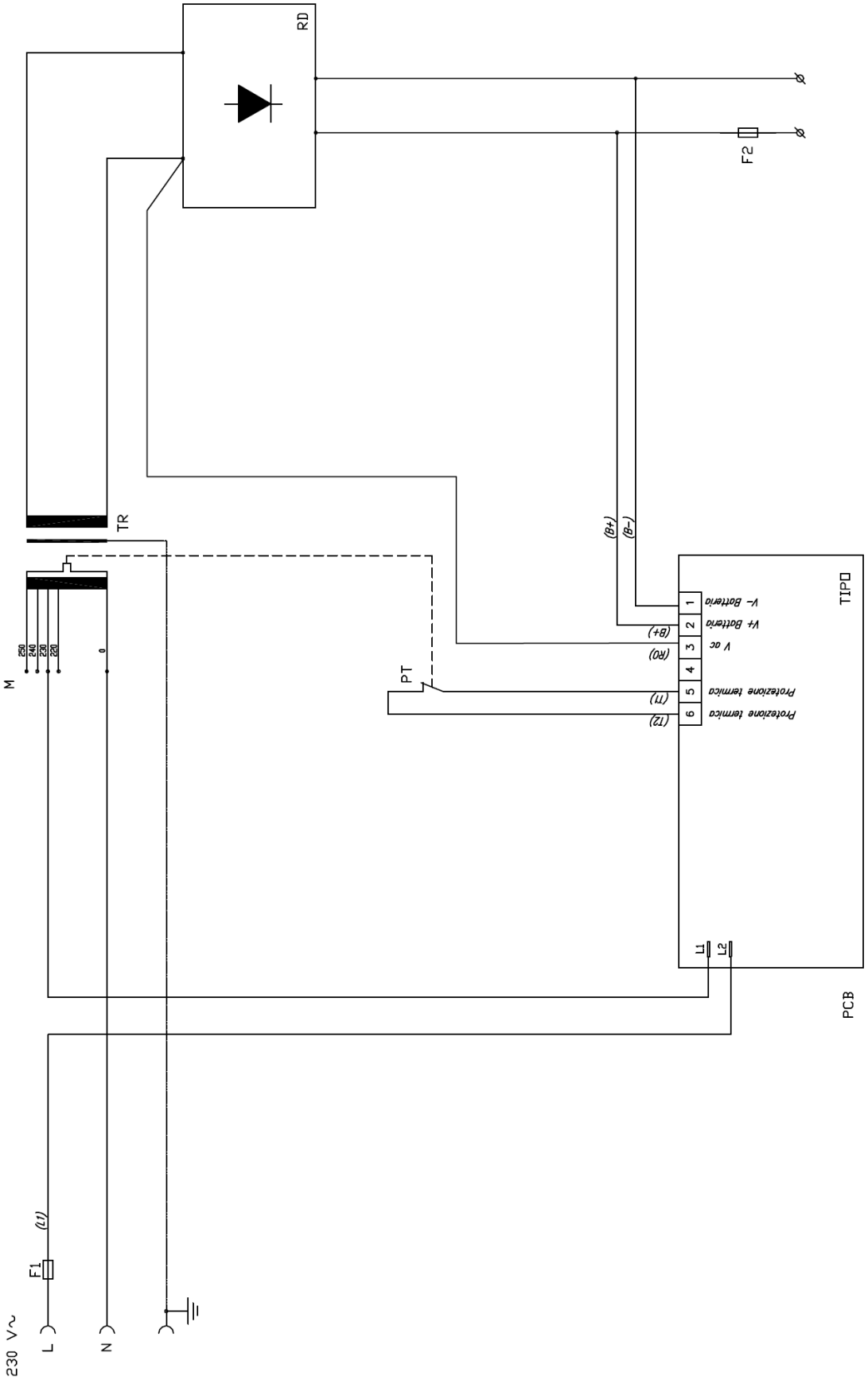
CHAPTER 10 : ELECTRICAL DIAGRAM VA01



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