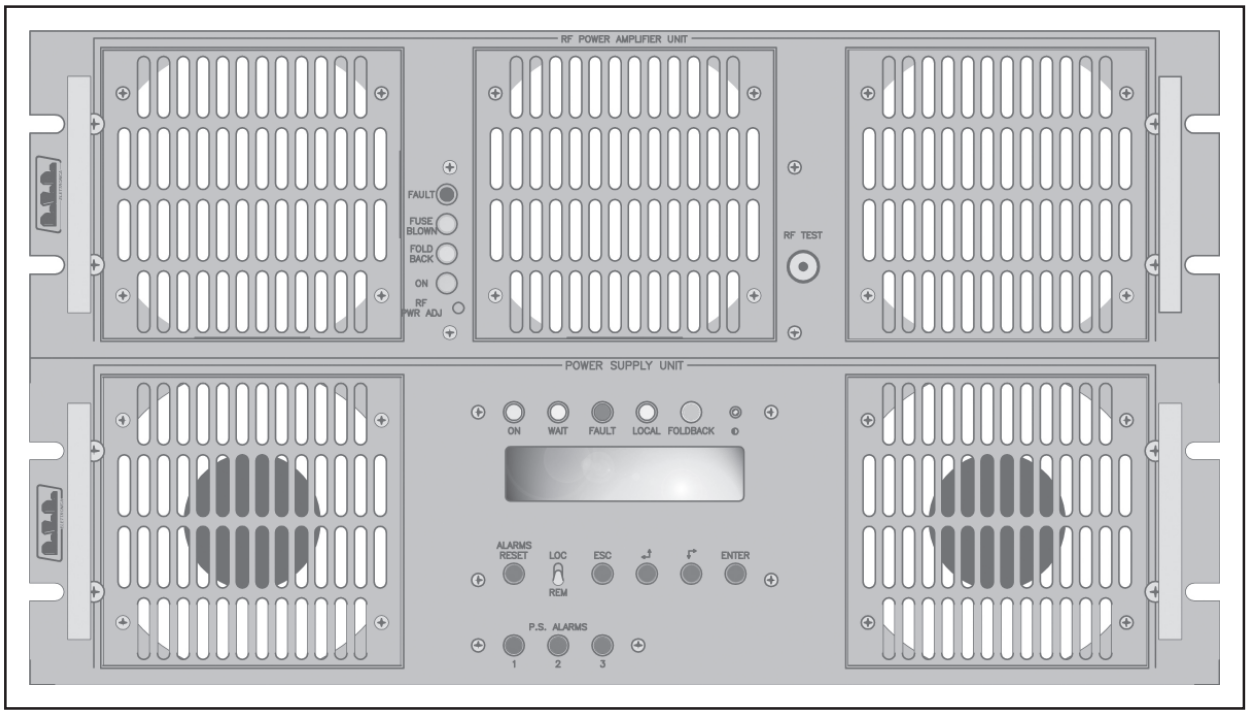
PJ2500M-C /
PJ2000M-C



User Manual

Volume 1

Manufactured by R.V.R. ELETTRONICA **Italy**

File name: CAPITOLI_EN.P65

Version: 1.2

Date: 06/07/2005

Revision History

Date	Version	Reason	Editor
28/01/03	1.0	First Version	D. Canazza
15/07/03	1.1	Description part Upgrade	J. Berti
06/07/03	1.2	Mod. PJ2500M-C Integration	J. Berti

PJ2500M-C / PJ2000M-C - User Manual
Version 1.2

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Notification of intended purpose and limitations of product use
This product is a FM transmitter intended for FM audio broadcasting. It utilises operating frequencies not harmonised in the intended countries of use.
The user must obtain a license before using the product in intended country of use. Ensure respective country licensing requirements are complied with.
Limitations of use can apply in respect of operating freuency, transmitter power and/or channel spacing.

Declaration of Conformity
Hereby, R.V.R. Elettronica SpA, declares that this FM transmitter is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

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1. Preliminary Instructions

This manual is written as a general guide for those having previous knowledge and experience with this kind of equipment, well conscious of the risks connected with the operation of electrical equipment.

It is not intended to contain a complete statement of all safety rules which should be observed by personnel in using this or other electronic equipment.

The installation, use and maintenance of this piece of equipment involve risks both for the personnel performing them and for the device itself, that shall be used only by trained personnel.

R.V.R. Elettronica SpA doesn't assume responsibility for injury or damage resulting from improper procedures or practices by untrained/unqualified personnel in the handling of this unit.

Please observe all local codes and fire protection standards in the operations of this unit.

WARNING: always disconnect power before opening covers or removing any part of this unit.

Please observe all local codes and fire protection standards in the operations of this unit.

WARNING: this device can irradiate radio frequency waves, and if it's not installed following the instructions contained in the manual and local regulations it could generate interferences in radio communications.

This is a "CLASS A" equipment. In a residential place this equipment can cause hash. In this case can be requested to user to take the necessary measures.

R.V.R. Elettronica SpA reserves the right to modify the design and/or the technical specifications of the product and this manual without notice.

2. Warranty

Any product of **R.V.R. Elettronica** is covered by a 24 (twenty-four) month warranty.

For components like tubes for power amplifiers, the original manufacturer's warranty applies.

R.V.R. Elettronica SpA extends to the original end-user purchaser all manufacturers warranties which are transferrable and all claims are to be made directly to R.V.R. per indicated procedures.

Warranty shall not include:

1 Re-shipment of the unit to R.V.R. for repair purposes;

2 Any unauthorized repair/modification;

3 Incidental/consequential damages as a result of any defect;

4 Nominal non-incidental defects;

5 Re-shipment costs or insurance of the unit or replacement units/parts.

Any damage to the goods must be reported to the carrier in writing on the shipment receipt.

Any discrepancy or damage discovered subsequent to delivery, shall be reported to **R.V.R. Elettronica** within **5** (five) days from delivery date.

To claim your rights under this warranty, you shold follow this procedure:

1 Contact the dealer or distributor where you purchased the unit. Describe the problem and, so that a possible easy solution can be detected.

Dealers and Distributors are supplied with all the information about problems that may occur and usually they can repair the unit quicker than what the manufacturer could do. Very often installing errors are discovered by dealers.

2 If your dealer cannot help you, contact **R.V.R. Elettronica** and explain the problem. If it is decided to return the unit to the factory, **R.V.R. Elettronica** will mail you a regular authorization with all the necessary instructions to send back the goods;

3 When you receive the authorization, you can return the unit. Pack it carefully for the shipment, preferably using the original packing and seal the package perfectly. The customer always assumes the risks of loss (i.e., R.V.R. is never responsible for damage or loss), until the package reaches R.V.R. premises. For this reason, we suggest you to insure the goods for the whole value. Shipment must be effected C.I.F. (PREPAID) to the address specified by R.V.R.'s service manager on the authorization

DO NOT RETURN UNITS WITHOUT OUR AUTHORIZATION AS THEY WILL BE REFUSED

4 Be sure to enclose a written technical report where mention all the problems found and a copy of your original invoice establishing the starting date of the warranty.

Replacement and warranty parts may be ordered from the following address. Be sure to include the equipment model and serial number as well as part description and part number.

R.V.R. Elettronica SpA
Via del Fonditore, 2/2c
40138 BOLOGNA
ITALY
Tel. +39 051 6010506

3. First Aid

The personnel employed in the installation, use and maintenance of the device, shall be familiar with theory and practice of first aid.

3.1 Treatment of electrical shocks

3.1.1 If the victim is not responsive

Follow the A-B-C's of basic life support.

- Place victim flat on his backon a hard surface.
- Open airway: lift up neck, push forehead back (**Figure 1**).

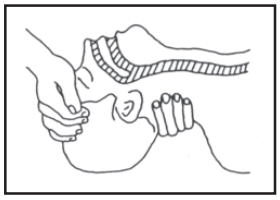


Figure 1

- clear out mouth if necessary and observe for breathing
- if not breathing, begin artificial breathing (**Figura 2**): tilt head, pinch nostrils, make airtight seal, four quick full breaths. Remember mouth to mouth resuscitation must be commenced as soon as possible.

Figura 2

- Check carotid pulse (**Figura 3**); if pulse is absent, begin artificial circulation (**Figura 4**) depressing sternum (**Figura 5**).

Figure 3

Figure 4

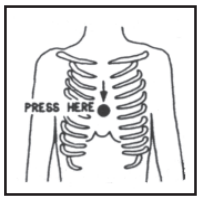


Figure 5

- In case of only one rescuer, 15 compressions alternated to two breaths.
- If there are two rescuers, the rythm shall be of one brath each 5 compressions.
- Do not interrupt the rythm of compressions when the second person is giving breath.
- Call for medical assistance as soon as possible.

3.1.2 If victim is responsive

- Keep them warm.
- Keep them as quiet as possible.
- Loosen their clothing (a reclining position is recommended).
- Call for medical help as soon as possible.

3.2 Treatment of electrical Burns

3.2.1 Extensive burned and broken skin

- Cover area with clean sheet or cloth.
- Do not break blisters, remove tissue, remove adhered particles of clothing, or apply any salve or ointment.
- Treat victim for shock as required.
- Arrange transportation to a hospital as quickly as possible.
- If arms or legs are affected keep them elevated.

If medical help will not be available within an hour and the victim is conscious and not vomiting, give him a weak solution of salt and soda: 1 level teaspoonful of salt and 1/2 level teaspoonful of baking soda to each quart of water (neither hot or cold).

Allow victim to sip slowly about 4 ounces (half a glass) over a period of 15 minutes.

Discontinue fluid if vomiting occurs.

DO NOT give alcohol.

3.2.2 Less severe burns

- Apply cool (not ice cold) compresses using the cleansed available cloth article.
- Do not break blisters, remove tissue, remove adhered particles of clothing, or apply salve or ointment.
- Apply clean dry dressing if necessary.
- Treat victim for shock as required.
- Arrange transportation to a hospital as quickly as possible.
- If arms or legs are affected keep them elevated.

4. General Description

The **PJ2500M-C** is an RF amplifier for frequency modulation sound broadcasting with a max. rated output of 2500 watts, while for the **PJ2000M-C** model the max. rated output is of 2000 watts. They are a fully solid-state apparatus of modern design that use MOSFET as active components in the FM amplifying modules. This chapter briefly describes the machine's main features.

4.1 Make-up

The **PJ2500M-C** and **PJ2000M-C** amplifiers are made up of two interconnected modules pre-arranged for assembly in a 19" rack.

The two modules are as follows:

- Control and power supply module (called **PS**)
- RF amplifier module (called RF)

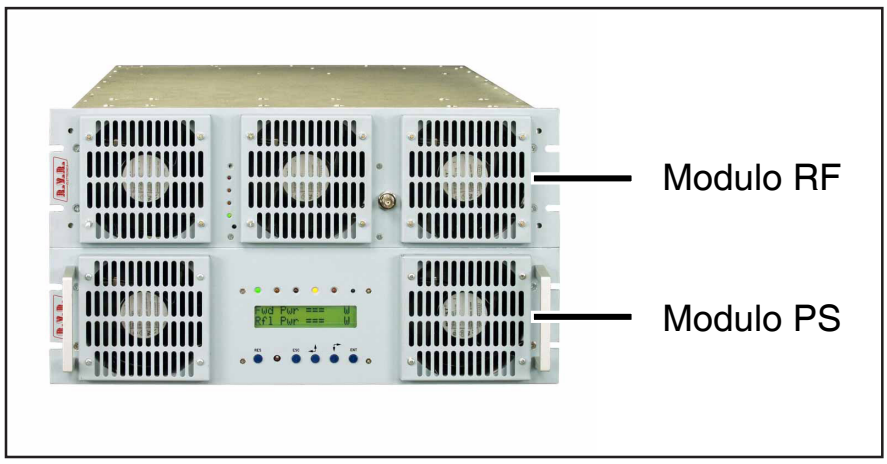


Figure 4-1: PJ2500M-C and PJ2000M-C modules

Subdividing it into two modules not only makes it easier to handle and assemble the amplifier but also permits to perform maintenance to the two parts separately.

The **PJ2500M-C** houses eight identical modules, based on the MOSFET SD2942 device, each supplies 350 watts; the **PJ2000M-C** model houses eight modules, based on the MOSFET BLF278 device, that supply 300 watts each, instead.

The amplifier is controlled by a microprocessor-based system that includes a LCD which carries out the following functions:

- Measuring and displaying amplifier work parameters
- Activating and deactivating power delivery
- Protecting the amplifier as far as potentially harmful situations are concerned

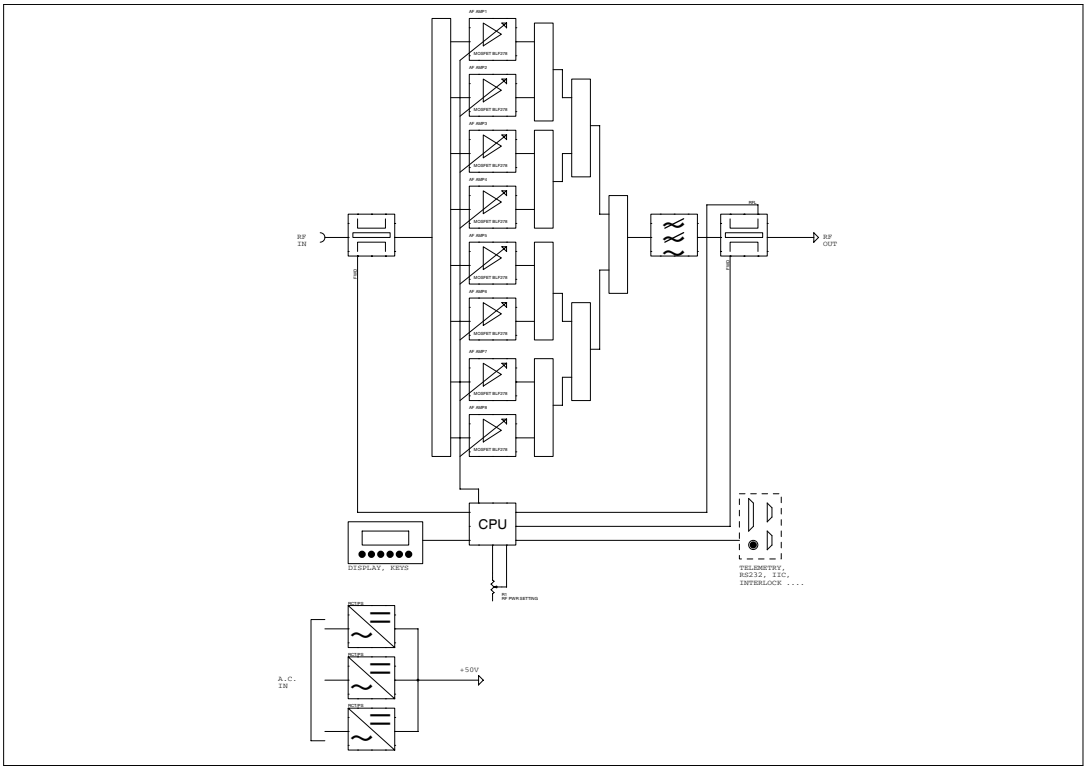
such as excess supplied power, SWR, excessive pilot power or temperature

- Detecting the warning thresholds set by the user (e.g. power delivered below a specific threshold), which are made available to the user via the telemetry connector
- Communicating with external devices

The amplifier's control software is based on a menu system through which the user may navigate using the following four buttons: "Esc", "L-H/Up", "R-H/Down" and "Enter". A fifth button is provided for resetting any triggered alarms.

The PS module of PJ2000M-C houses three rectifier/power supply/switching units that normally work in parallel mode and that provide a fair degree of redundancy to the machine. Even if one of the power supply modules breaks down the amplifier will keep working at reduced power.

A schematic view of the operating theory of amplifier is shown in the figure:



5. Quick installation and operating reference

The scope of this chapter is to summarize the procedures for installing the machine. If any point is not fully comprehensible, such as how to operate the machine the first time, it is advisable to read the entire manual very carefully.

In this description it is assumed that the amplifier is not supplied pre-installed in a rack inside a transmission system. In this case most of the operations outlined herein (for instance the wiring ones) are obviously not necessary.

5.1 Preparation

Unpack the amplifier and firstly check that it has not been damaged in any way during transport. Make sure that all the connectors and controls on the front and back panels are in good order.

Check the default setting of the type of power supply for this machine on the back of the **PS** module, which may be:

- single-phase 230 V, +10% -15%
- three-phase 230 V, +10% -15%
- three-phase 400 V, +10% -15%

Suggestion: Specify the type of power supply at order placement: the machine will be delivered to you configured according to your requirements

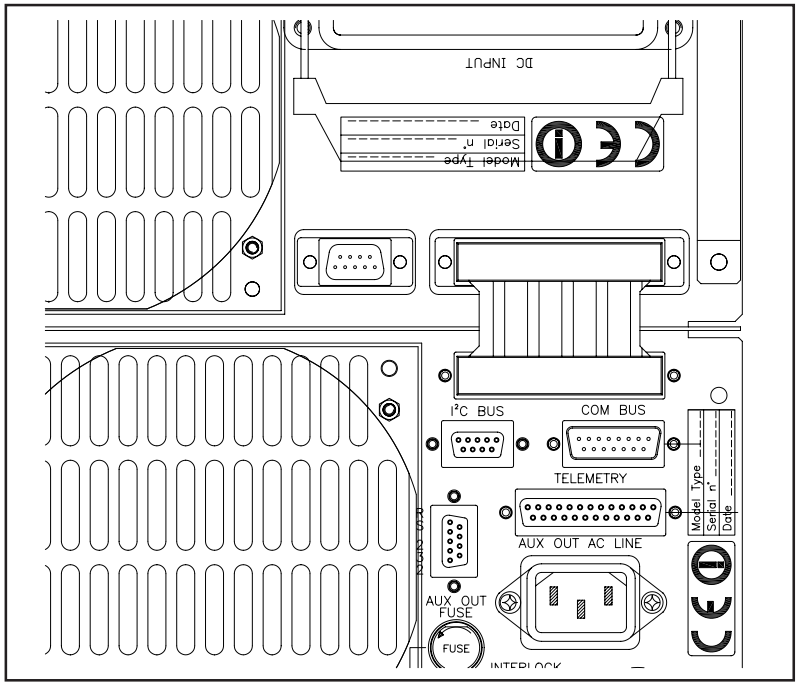
Check, if need be, that the fuses are installed, in good working order and accessible on the back panel of the **PS** module. The required fuse values are as follows:

	@230V single phase	*@230V three phase*	*@400V three phase*
AUX OUT FUSE *(chap. 6.2 - position [9])*	**(1x) F6,3T type 5x20**	**(1x) F6,3T type 5x20**	**(1x) F6,3T type 5x20**
SERVICE FUSE *(chap. 6.2 - position [10])*	**(1x) F6,3T type 5x20**	**(1x) F6,3T type 5x20**	**(1x) F6,3T type 5x20**
MAINS FUSE *(chap. 6.2 - position [1])*	**(3x) F25T type 10x38**	**(3x) F20T type 10x38**	**(3x) F16T type 10x38**

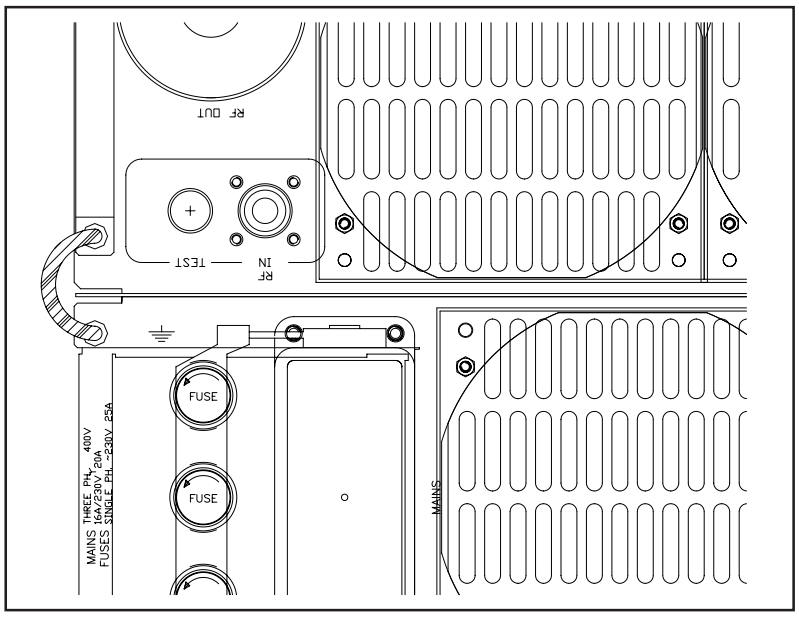
Install the amplifier in a standard rack for 19" modules.
Assemble the modules by inserting them one on top of the other.

Make the connections between the **PS** module and the **RF** module using the cables supplied with the machine:

- Data connection by means of cable with DB37 connectors (PS-RF Interconnection)



- Ground connection between each module chassis



- Power supply connection by means of cable coming out of the **PS** module ending with the ILME CXM 4/2 type of socket (DC Output)

Figure 5-1 *Example of installation in a rack*

Connect the output of a suitable type of FM exciter (e.g. the PTXLCD of R.V.R. Elettronica) to the RF input (**RF** module) using a cable fitted with N type connectors. The exciter should be set to minimum output power and OFF.

Connect the amplifier's INTERLOCK connector (on the back of the **PS** module) to the exciter's Interlock input, if available (it is available in all RVR Elettronica exciters) using a twin wire with BNC connectors.

Note: the amplifier's INTERLOCK connector is an output. The operating logic is as follows: the internal conductor floats when the amplifier works correctly, on the contrary power is delivered and the internal conductor is closed to ground to halt the exciter.

Connect the RF output to the antenna cable or to a dummy load capable of dissipating the power generated by the amplifier.

An ILME model CXF4/2 multipole socket is supplied with the amplifier to power the machine. The socket must be connected to the multipole cable that will be wired to the mains switchboard.

Danger: to avoid any risk of shock make ABSOLUTELY sure that the power supply cable is NOT powered when the multipole socket is connected to the cable itself.

Connect the multipole socket to the power supply cable as described below and refer to figure 5-2:

Three-phase power supply:

- G Gorund
- 1 Neutral
- 2 R Phase
- 3 S Phase
- 4 T Phase
- 11,12 Not connected

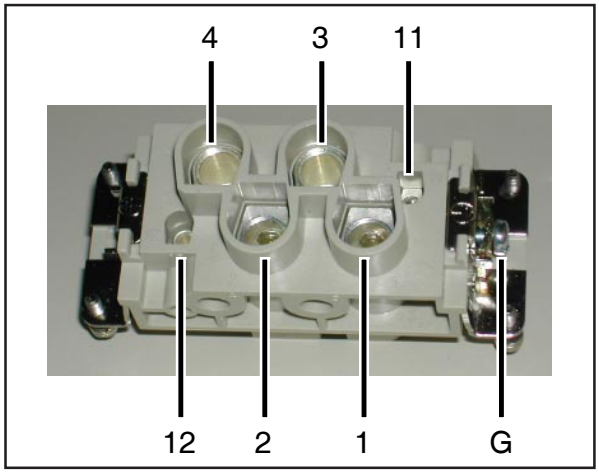


Figura 5-2: *View of the mains multipole socket - terminals side (internal)*

Single-phase power supply:

- G Ground
- 1 Do not connected
- 2 Pahse
- 3 Neutral
- 4 Do not connected
- 11,12 Not connected

Danger: avoid the **risk of damaging the machine** by grounding it correctly. As such, connect the ground conductor of the power supply cable to the specific terminal in the multipole socket and check the efficiency of your own grounding system.

Turn the multi-turn RF PWR ADJ trimmer on the RF module clockwise all the way. As such, the action of the Automatic Gain Control (AGC) is disabled.

5.2 Operation

After having plugged in the power supply socket at the back of the machine, power on the amplifier via the switchboard. The ON LEDs on both modules will turn on and the forced cooling fans will start running. The LCD shows the first introductory screenful and then switches to a screenful that indicates the forward and reflected power values.

Turn on the exciter (at lowest power) and wait until it locks to the work frequency. Once locked, increase power gradually and check the amplifier's display. Increase the exciter's power until the amplifier's output attains the desired value, max. 2500 watts for **PJ2500M-C** model, or 2000 watts for **PJ2000M-C** model (keep in mind

that due to the measurement digitization effect it might not be possible to obtain a reading of exactly 2.5 kW or 2.0 kW, but a lightly higher or lower value which is perfectly normal).

NB **Note:** now the amplifier is adjusted to its rated output, but the **AGC function is not checking the delivered power**. Any changes in the driving power or in the environmental conditions could cause slight output power changes.

In order to operate the AGC, increase the driving power by about 10% as compared to the value required to obtain the amplifier's desired output level (the amplifier's output power will increase but this is not a hazard for the amplifier thanks to its built-in protection system).

Now turn the multi-turn RF PWR ADJ trimmer on the RF module counterclockwise and check on the display that the power delivered by the amplifier decreases until the desired value is attained.

Should you need to use the amplifier at a power level lower than the rated one, proceed as follows:

- If back-off is temporary (for instance to run a test), reduce the output power level of the exciter until power delivered from the amplifier reaches the desired value
- If back-off is permanent (to set the station's power at a level lower than the maximum rated output), first disable the AGC by turning the RF PWR ADJ trimmer clockwise all the way. Then reduce driving power until you attain an amplifier output power value equivalent to the desired level plus approximately 10 %. Finally turn the trimmer counterclockwise until the delivered power decreases to the required level.

Now all of the machine's operating parameters may be checked via the software control system.

As a rule, the machine does not need to be manned to work. If any alarm conditions occur, they will be managed automatically by the protection system or notified to the user by means of LEDs on the panel and messages on the display.

5.3 Software

This chapter describes the ways in which the microprocessor controls the amplifier and how the user may interact with the software.

The figure 5-3 shows the overall software user interface diagram.

NB **Note:** the user may issue commands to the equipment only when in LOCAL mode by means of the selector. Otherwise the user may only read the parameters and not change them.

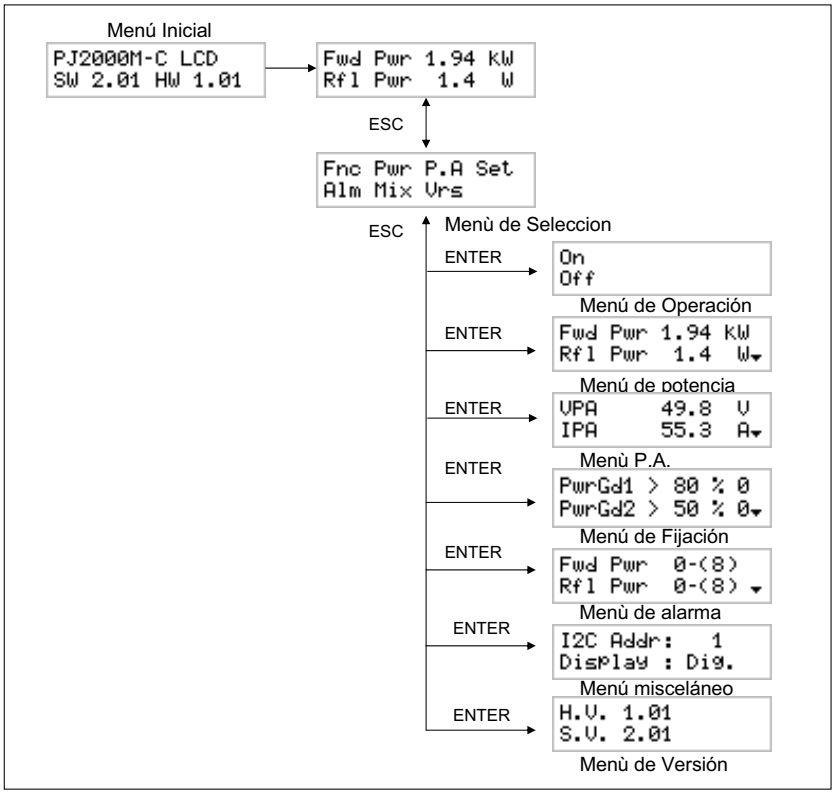


Figure 5-3: *Flow diagram of the software*

When turned on, the LCD shows the introductory screenful with the equipment's software and hardware versions.

```
PJ2500M-C LCD
SW 2.01 HW 1.01
```

A few seconds later the main screenful is displayed indicating the forward and reflected power values:

```
Fwd Pwr 1.94 KW
Rfl Pwr  1.4  W
```

Press the ESC key to view the selection screenful from which to access all the menus:

```
Fnc Pwr P.A Set
Alm Mix Vrs
```

To access one of the submenus select its name (which is underlined by a blinking cursor) using the RIGHT or LEFT keys and then press the ENTER key.

Take note that certain parameters, which are measured and shown to the user, might not be available in a few cases. This occurs when, for physical reasons, the measured vales are not significant for control software internal use.

When the value of a parameter is not available for the aforesaid reason, symbol "==" appears on the display in lieu of the value.

5.3.1 Operating Menu (Fnc)

Turn the power amplifier ON or OFF via this menu.

When the amplifier is turned OFF, the internal conductor of the INTERLOCK connector is set to ground so as to force the connected exciter to a standby condition (this takes place only if the exciter features the interlock option, like those produced by RVR, and if the associated connector is connected to the amplifier).

When the amplifier is turned OFF the software program waits a few seconds for the machine to cool down and then the fans turn OFF.

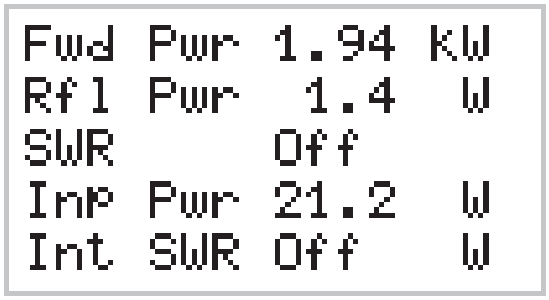
5.3.2 Power Menu (Pwr)

This screenful, made up of several lines that may be scrolled through using the UP and DOWN keys, displays all the measurements associated with the behavior of the amplifier's power section:

- Forward Power (Fwd Pwr)
- Reflected Power (Rfl Pwr)
- SWR (Standing Wave Ratio)
- Input Power (Inp Pwr)
- Internal SWR (Int SWR)

Depending on the machine's configuration a few measurements might be disabled.

The figure below shows the complete aspect of this screenful (only two lines can be seen at a time, use the UP and DOWN keys to scroll through it):

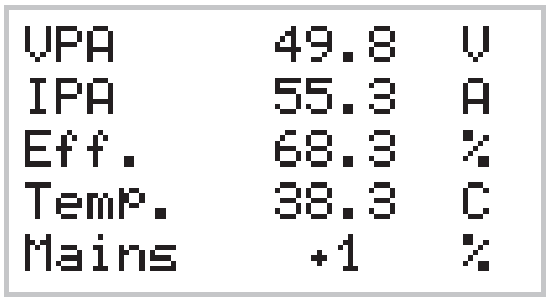


5.3.3 Power Amplifier (P.A.) Menu

This screenful, consisting of several lines that may be scrolled through by using the UP and DOWN keys, displays all the measurements associated with the RF amplifier of the equipment:

- Voltage (VPA)
- Current (IPA)
- Efficiency
- Temperature
- Power supply voltage (Mains - percentage variation as compared to the nominal voltage)

The figure below shows the complete aspect of this screenful (only two lines can be seen at a time, use the UP and DOWN keys to scroll through it):



5.3.4 Warning threshold setting menu

As mentioned in the introduction the amplifier offers three settable warning thresholds. Each one is compared with the level of one of the machine's operating parameters. The results of the comparison are available on the telemetry connector, on the contacts of the optional external telemetry card and may be read on the display as "O" (open, i.e. false result) or "C" (closed, i.e. real result).

Two of the settable threshol (***Power Good***) refer to the emitted power level whereas the reflected power quantity (***Reflected Warning***) is checked for the third one.

The thresholds are expressed in percentage terms of the considered quantity's limit voltage.

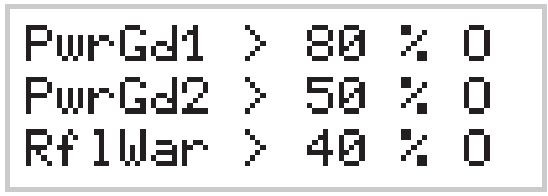
The limit voltages of the quantities monitored by the warning thresholds for are the follows:

- Forward Power 2500 W (mod. **PJ2500M-C**)
- Forward Power 2000 W (mod. **PJ2000M-C**)
- Reflected Power 200 W

Proceed as follows to change the values of the warning thresholds:

- Select the line to be changed (with the UP and DOWN keys)
- Press the ENTER key
- Change the threshold value (UP and DOWN keys)
- Press ENTER to confirm

The figure below shows a configuration example of this menu.



In this example the alarm thresholds are as follows:

- PwrGd1 2000 W (80% x 2500 W x mod. **PJ2500M-C**)
  1600 W (80% x 2000 W x mod. **PJ2000M-C**)
- PwtGd2 1250 W (80% x 2500 W x mod. **PJ2500M-C**)
  1000 W (80% x 2000 W x mod. **PJ2000M-C**)
- RflWar 80 W (40% x 200 W x mod. **PJ2500M-C**)
  80 W (40% x 200 W x mod. **PJ2000M-C**)

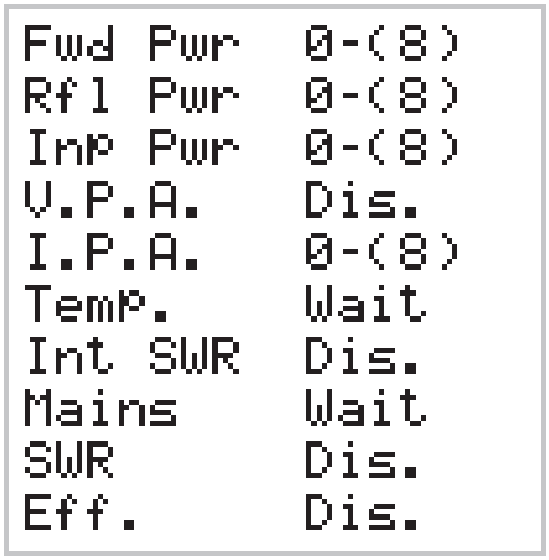
5.3.5 Alarm Menu

This menu provides information about the status of the amplifier's built-in protection system.

It consists of a certain number of lines each of which contains the name of the variable controlled by the protection system and the type of intervention carried out by the system.

Said intervention may be as follows: **X - (Y)**, **Wait**, or **Dis.** (Disabled).

The aspect of this menu is as follows (only two lines can be seen at a time, use the UP and DOWN keys to scroll through it):



The task of this menu is essentially to help the technician in identifying the possible causes of any malfunction.

5.3.6 Miscellaneous Menu

In this menu the user may:

- set the address in the serial bus connection, type I2C
- set the main menu display mode

The network address I2C is very important when the amplifier is connected in an RVR transmission system that envisages the use of this protocol. Do not change it for any reason whatsoever.

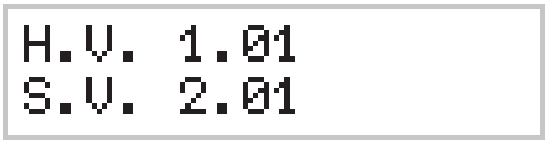
The main menu may be displayed either in **Dig**ital mode (this is the standard mode) or **An**a**l**og mode:

In the analog display mode a small triangle indicates the reflected power level set in the Alarm Threshold Setting Menu (RflWar), whereas the bar at the bottom shows the instant reflected power level.

This type of display might be useful when a device to be tuned is connected to the amplifier's output such as a cavity.

5.3.7 Version Menu

This screenful shows the hardware version (H.V.) and the software version (S.V.) of the equipment.



5.4 Protection System

The protection system implemented inside the amplifier is based on two types of intervention.

The first reaction is called "Foldback" and consists in decreasing the voltage in the power amplifier when the forward or reflected power exceeds the proportional limit voltage value. As such, the amplifier's gain is reduced and the overall result is an action that opposes the increase of the forward or reflected power. The yellow LED on the front panel indicates the tripping of the foldback circuit.

The second type of reaction consists in turning OFF the equipment's amplifying section when a specific variable exceeds a set value.

Depending on the type of event occurred, and after the amplifier has been turned OFF, it will be reactivated after a set length of time or only after the sharing, which caused the locking, has been cleared. In the alarm menu the first type of configuration is indicated by **X - (Y)**, whereas the second one is indicated by **Wait**. The third possibility is that the system does not trigger the protection conforming to a specific parameter: this is indicated by **Dis.** (Disabled).

While the amplifier is OFF temporarily owing to an alarm, the yellow WAIT LED lights up and the reason the protection was triggered is shown on the display.

When the protection system trips due to a "cyclic" type parameter, a counter begins counting up (the X value in the alarm menu). If the counter reaches the max admissible cycle value (Y), the amplifier turns OFF definitely and the red "FAULT" LED lights up on the front panel.

The user may press the ALARMS RESET key to interact with the protection system. The effect differs depending on the machine's status when the key is pressed:

- If the equipment is off, waiting for the cycle time to be reached, or if it is definitively off in FAULT state, press the ALARMS RESET button to immediately turn the amplifier ON and reset the alarm counters.

- If the system is transmitting but alarms were triggered earlier causing certain counters not to be at "0", pressing the key will have no effect unless it is pressed while inside the alarm menu. As such, the system will be sure that the user takes note of the alarms that were triggered before resetting them.

The system resets the alarm counters automatically after thirty minutes of operation, i.e. the user need not do anything, if the amplifier does not trigger any alarms or after the machine the machine has been turned OFF and then back ON.

5.4.1 RF module auxiliary protection

The amplifier's RF module contains a second microcontroller that manages local measurements and carries out auxiliary protection functions of the machine together with the main protection system. This microcontroller card indicates its interventions via the LEDs of the RF module.

A delivered power automatic back-off mechanism is envisaged for excess temperature, SWR or current absorbed by a MOSFET module. The yellow FOLDBACK LED indicates this case.

A FAULT signal is triggered (red LED) when a fault occurs that stops the power amplifier. This situation is signaled to the machine's main microcontroller as well and triggers a lock situation (FAULT).

The LED FUSE BLOWN indicates that one of the fuses that protects the power supply of the MOSFET modules has blown. In this case the machine keeps running as usual (obviously without the contribution of the module) even if it is advisable to single out and clear the cause for the malfunction and replace the fuse as soon as possible to fully restore the machine's working efficiency.

NB **Note:** The RESET key on the PS module also resets the auxiliary protections of the RF module.

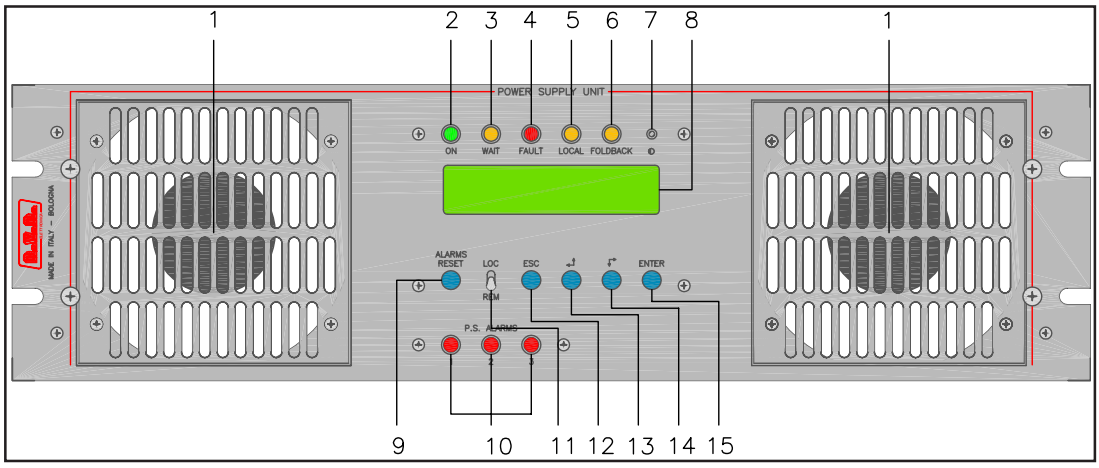
5.4.2 Power Supply Units

Three power supply units, which work in parallel mode, power the machine. Should one of the power supply units malfunction, the machine automatically reduces the delivered power down to a value compatible with the current deliverable from the surviving power supply. This situation is indicated by the "P.S. ALARMS" LEDs on the front panel of the **PS** module.

6. External Description

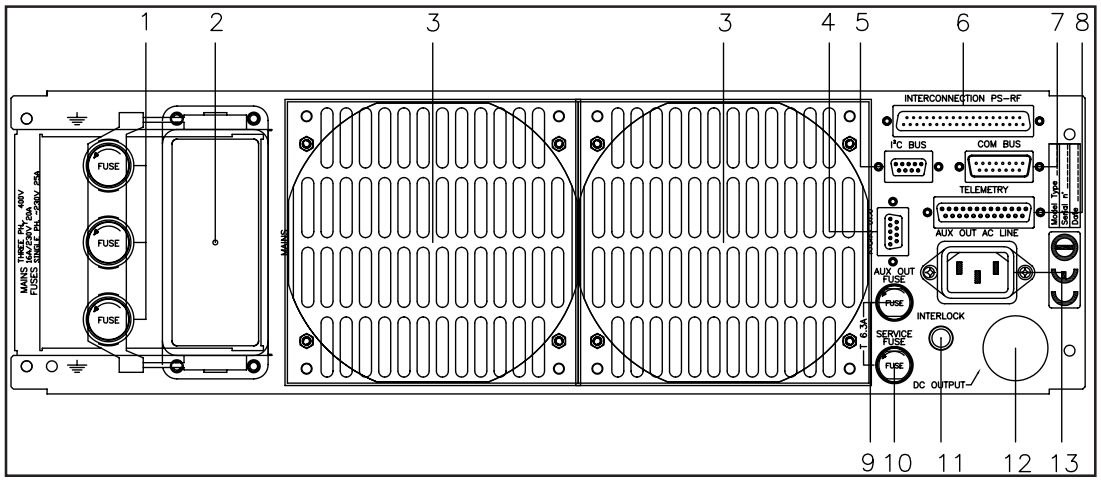
This chapter describes the elements presents on the panels of the **PJ2000M-C** e **PJ2000M-C**.

6.1 PS Module Frontal Panel



[1]	AIR FLOW	Grill for the ventilation flow passage
[2]	ON	Green LED indicating the amplifier is switched on
[3]	WAIT	Yellow LED indicating the amplifier is waiting for a condition that is blocking the power output to be removed
[4]	FAULT	Red LED indicating that a fault that cannot be automatically reverted
[5]	LOCAL	Yellow LED, indicating that the amplifier is in local control mode
[6]	FOLDBACK	Yellow LED, indicating that the foldback function is active (automatic reduction of the distributed power)
[7]	CONTRAST	Trimmer to regulate the contrast of the LCD display
[8]	DISPLAY	LCD display
[9]	ALARM RESET	Button used to manually reset the protection system
[10]	P.S. ALARMS	Yellow LEDs, indicating the presence of a anomaly on one or more power supply boards
[11]	LOC/REM	Switch to select the local or remote control modes
[12]	ESC	Button used to exit from a menu
[13]	LEFT/UP	Button used to navigate in the menu system and to modify the changeable parameters
[14]	RIGHT/DOWN	Button used to navigate in the menu system and to modify the changeable parameters
[15]	ENTER	Button used to accept a parameter's value or to enter into a menu

6.2 PS module Rear Panel

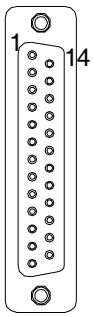


[1]	MAINS FUSE	Protection fuses of the power supplies 1,2 and 3
[2]	MAINS CONNECTOR	Plug for mains power supply
[3]	AIR FLOW	Grill for the ventilation flow passage
[4]	RS232	DB9 connector to link the amplifier with external devices
[5]	I^2C BUS	DB9 connector for I^2C bus networking
[6]	INTERCONNECTION PS-RF	DB37 connector for interfacement with RF part
[7]	COM BUS	DB15 connector for interfacement with other equipment
[8]	TELEMETRY	DB25 telemetry connector
[9]	AUX OUT FUSE	Protection fuse of the auxiliary plug
[10]	SERVICE FUSE	Protection fuse for the service section
[11]	INTERLOCK	BNC connectors to inhibit an external device, as an exciter. In case of fault, the inner connector is shorted to ground
[12]	DC OUTPUT	Plug to supply the RF section
[13]	AUX OUT AC LINE	Auxiliary VDE plug to supply external devices (typically an exciter)

6.3 Connector Description

6.3.1 Telemetry Connector

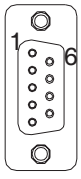
Type: DB25 Female



1	Not Used	
2	RF power amplifier Voltage	3.9V x 50V
3	GND	GND
4	Reflected power	4.3V x 200W
5	Interlock	
6	Set 4	
7	GND	GND
8	“ON” Command	
9	Set 1	
10	WAIT	
11	Alarms reset	
12	OFF	
13	Interlock input	
14	Temperature	3.9V x 100°
15	RF power amplifier current	3.9V x 75A
16	Forward power	4.3V x 2500W (**PJ2500M-C**) 4.3V x 2000W (**PJ2000M-C**)
17	FAULT	
18	Set 3	
19	Input power	3.9V x 50W
20	“OFF” Command	
21	GND	GND
22	Set 2	
23	LOC	
24	+Vcc	
25	ON	

6.3.2 RS 232

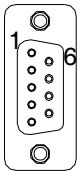
Type: DB9 female



1	NC
2	TX_D
3	RX_D
4	Internally connected with 6
5	GND
6	Internally connected with 4
7	Internally connected with 8
8	Internally connected with 7
9	NC

6.3.3 I²C Connector

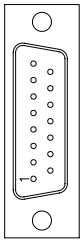
Type: DB9 Female



1	NC	
2	SDA	Serial Data
3	SCL	Serial Clock
4	NC	
5	GND	GND
6	NC	
7	NC	
8	NC	
9	NC	

6.3.4 Com Bus

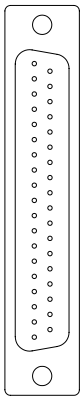
Type: DB15 male



1	GND
2	485+
3	485-
4	GND
5	ON OFF C
6	INP PWR
7	ST BY
8	IRQ
9	GND
10	PWR REG
11	GND
12	NC
13	NC
14	NC
15	NC

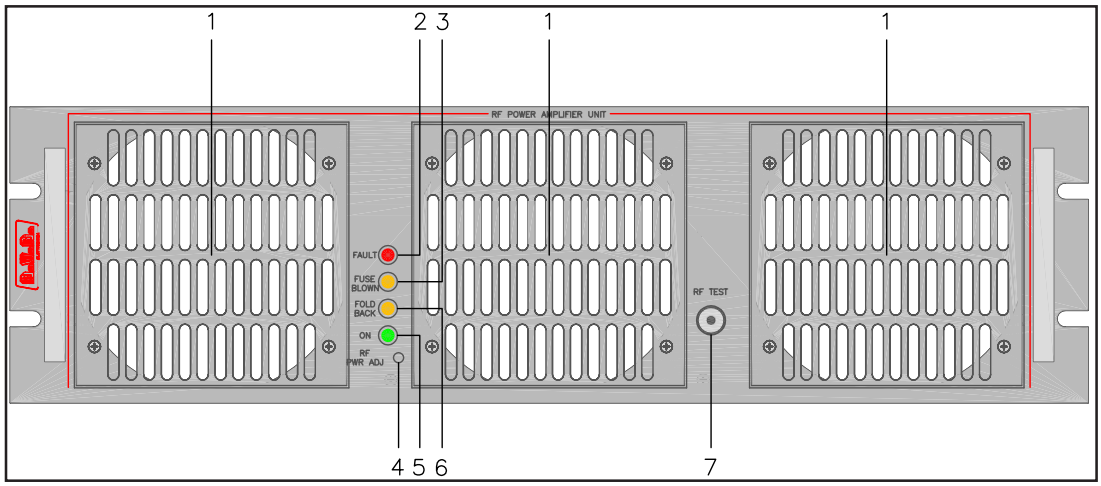
6.3.5 Interconnection PS-RF

Type: DB40 female



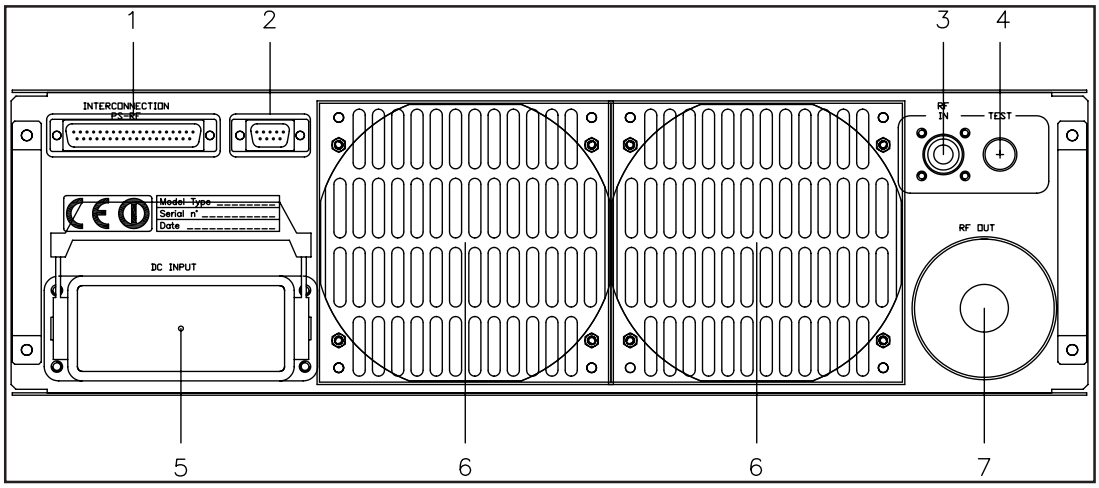
1	Internally connected with 8/12/14/18/23/24/27/28/29
2	I TOT
3	V TOT
4	F PWR
5	R PWR
6	INP PWR
7	TEMP
8	Internally connected with 1/12/14/18/23/24/27/28/29
9	PS OFF
10	PS STATUS
11	PS REG
12	Internally connected with 1/8/14/18/23/24/27/28/29
13	PWR REG
14	Internally connected with 1/8/12/18/23/24/27/28/29
15	ON OFF
16	ST BY
17	IRQ
18	Internally connected with 1/8/12/14/23/24/27/28/29
19	CLIX
20	FAULT
21	RESET AL
22	FUSE PS
23	Internally connected with 1/8/12/14/18/24/27/28/29
24	Internally connected with 1/8/12/14/18/23/27/28/29
25	485+
26	485-
27	Internally connected with 1/8/12/14/18/23/24/28/29
28	Internally connected with 1/8/12/14/18/23/24/27/29
29	Internally connected with 1/8/12/14/18/23/24/27/28
30	NC
31	NC
32	AC3 (Internally connected with 33)
33	AC3 (Internally connected with 32)
34	NC
35	NC
36	AC4 (Internally connected with 37)
37	AC4 (Internally connected with 36)

6.4 RF Module Frontal Panel



[1]	AIR FLOW	Grill for the ventilation flow passage
[2]	FAULT	Red LED that indicates a fault that cannot be automatically reverted
[3]	FUSE BLOWN	Red LED that indicates the presence of one or more broken fuses
[4]	RF PWR ADJ	Power regulation trimmer - A.G.C. control
[5]	ON	Green LED indicating that the amplifier is switched on
[6]	FOLDBACK	Yellow LED indicating that the foldback function is active (automatic reduction of the distributed power)
[7]	RF TEST	BNC connector for RF monitor output. The output level is -60dB referred to the power ouput in 87.5-108 MHz range

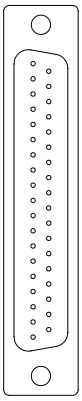
6.5 PS module Rear Panel



[1] INTERCONNECTION PS-RF
DB37 connector for interfacement with PS part
[2] DB9 connector reserved for future uses
[3] RF IN RF input connector (“N” type)
[4] RF IN TEST Connector for the drawn not standardized of the modulator input signal
[5] PLUG Plug for the supply of 50VDC incoming from module PS
[6] AIR FLOW Grill for the ventilation flow passage
[7] RF OUT RF output connector (7/8” EIA flange)

6.5.1 Interconnection PS-RF

Type: DB40 female



1	Internally connected with 8/12/14/18/23/24/27/28/29
2	I TOT
3	V TOT
4	F PWR
5	R PWR
6	INP PWR
7	TEMP
8	Internally connected with 1/12/14/18/23/24/27/28/29
9	PS OFF
10	PS STATUS
11	PS REG
12	Internally connected with 1/8/14/18/23/24/27/28/29
13	PWR REG
14	Internally connected with 1/8/12/18/23/24/27/28/29
15	ON OFF
16	ST BY
17	IRQ
18	Internally connected with 1/8/12/14/23/24/27/28/29
19	CLIX
20	FAULT
21	RESET AL
22	FUSE PS
23	Internally connected with 1/8/12/14/18/24/27/28/29
24	Internally connected with 1/8/12/14/18/23/27/28/29
25	485+
26	485-
27	Internally connected with 1/8/12/14/18/23/24/28/29
28	Internally connected with 1/8/12/14/18/23/24/27/29
29	Internally connected with 1/8/12/14/18/23/24/27/28
30	NC
31	NC
32	AC3 (Internally connected with 33)
33	AC3 (Internally connected with 32)
34	NC
35	NC
36	AC4 (Internally connected with 37)
37	AC4 (Internally connected with 36)

7. Technical specifications

7.1 Physical specifications

PS Cabinet size	132.5 mm (5,22") H x 454.0 mm (17,87") W x 655.5 mm (25,80") D	
RF Cabinet size	132.5 mm (5,22") H x 454.0 mm (17,87") W x 655.5 mm (25,80") D	
Cabinet size	454.0 mm (17,87") x 265.0 mm (10,43") x 507.0 mm (19,98")	
Panel size	483 mm (19,01") x 132.5 mm (5,22")	
Overall Depth	695.00 mm (27,36")	
Weight	PS module	21 Kg
	RF module	34 Kg
	Total	55 Kg
Working temperature	-10 °C ÷ 50 °C	
Humidity	95% Maximum, without condesation	

7.2 Electrical specifications

Generals, PFC model (/PFC)

A.C. power supply	three-phase	400 V, +10% -15%
	three-phase	230 V, +10% -15%
	single-phase	230 V, +10% -15%
Cooling	forced ventilation, automatic switch off delayed in stand-by	
Frequency range	87.5 MHz ÷ 108 MHz	
Output power (@ Y 400V)	2500 W typical (mod. **PJ2500M-C**)	
	2000 W typical (mod. **PJ2000M-C**)	
AC Apparent Power Consumption (@ Y 400V)		
	4520 VA (mod. **PJ2500M-C**)	
	3430 VA (mod. **PJ2000M-C**)	
Active Power Consumption (@ Y 400V)	4430 W (mod. **PJ2500M-C**)	
	3370 W (mod. **PJ2000M-C**)	
RF Fan active Power consumption (@ Y 400V)		
	100 W	
Heat dissipated power	1930 W (mod. **PJ2500M-C**)	
	1370 W (mod. **PJ2000M-C**)	
RF module efficiency	70% (mod. **PJ2500M-C**)	
	60% (mod. **PJ2000M-C**)	
Overall efficiency (@ Y 400V)	56% (mod. **PJ2500M-C**)	
	59% (mod. **PJ2000M-C**)	
Power Factor (@ Y 400V)	0.98	
AC power input connector	ILME CFX 4/2	
Display	LCD Alphanumerical (2 rows x 16 characters)	
Input device	5 pushbuttons	
Driver power for rated output	25 W typical	
Max input power before protection	50W	
Spurious and Harmonics suppression	<75 dB (80 dB typical) Respects all FCC and CCIR requirments	

Generals, Rectifier model (/RCT)

A.C. power supply	three-phase	400 V, +10% -15%
	three-phase	230 V, +10% -15%
	single-phase	230 V, +10% -15%

Cooling	forced ventilation, automatic switch off delayed in stand-by
Frequency range	87.5 MHz ÷ 108 MHz
Output power (@ Y 400V)	2500 W typical (mod. **PJ2500M-C**) 2000 W typical (mod. **PJ2000M-C**)
AC Apparent Power Consumption (@ Y 400V)	5517 VA (mod. **PJ2500M-C**) 5610 VA (mod. **PJ2000M-C**)
Active Power Consumption (@ Y 400V)	4530 W (mod. **PJ2500M-C**) 3690 W (mod. **PJ2000M-C**)
RF Fan active Power consumption (@ Y 400V)	100 W
Heat dissipated power	1690 W (mod. **PJ2000M-C**)
RF module efficiency	70% (mod. **PJ2500M-C**) 60% (mod. **PJ2000M-C**)
Overall efficiency (@ Y 400V)	55% (mod. **PJ2500M-C**) 54% (mod. **PJ2000M-C**)
Power Factor (@ Y 400V)	0.65
AC power input connector	ILME CFX 4/2
Display	LCD Alphanumerical (2 rows x 16 characters)
Input device	5 pushbuttons
Driver power for rated output	25 W typical
Max input power before protection	50W
Spurious and Harmonics suppression	<75 dB (80 dB typical) Respects all FCC and CCIR requirments

Inputs

IN RF	"N" type standard connector
IN RF impedance	50 Ohm

Outputs

Out RF	Connettore standard 7/8" EIA Flange
Out RF impedance	50 Ohm
Monitor RF	Connettore BNC
RF Monitor impedance	50 Ohm
RF Monitor output level	-60 dB referred to RF output

Remote connections

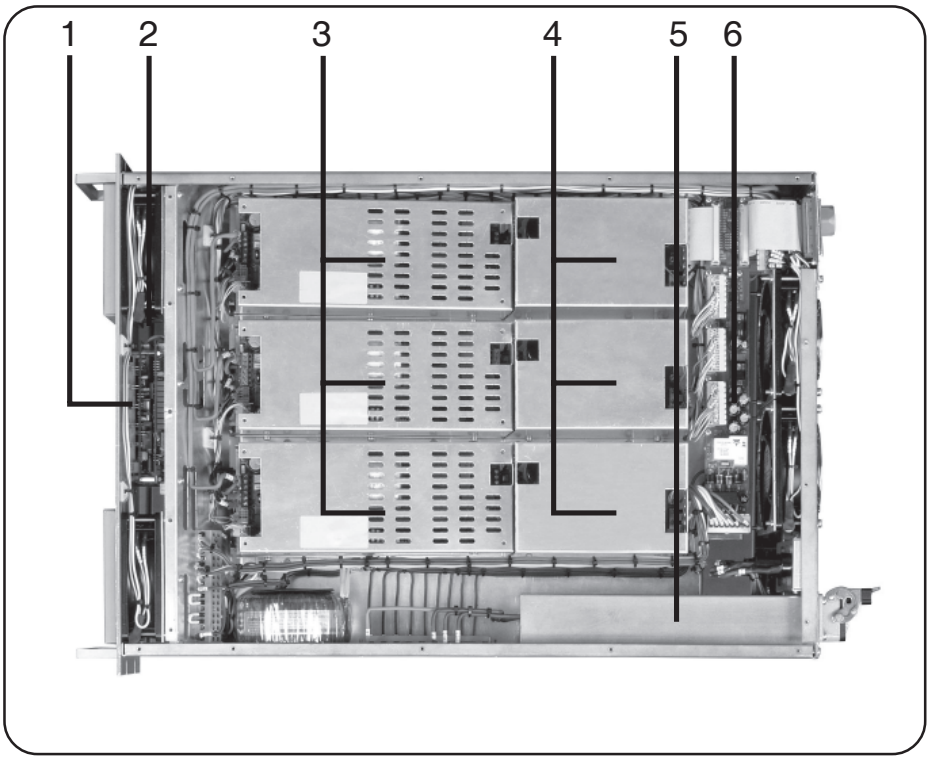
Interlock	BNC female type: when amplifier is in stand-by mode, the inner conductor, usually floating, become grounded
RS232	DB9 female for serial interfacement
COM bus	DB15 connector for interfacement with others equipments
I^2Cbus	DB9 female, I^2C bus communications for optional telemetry
Telemetry	DB25 female, give indications on the state of the device

Options

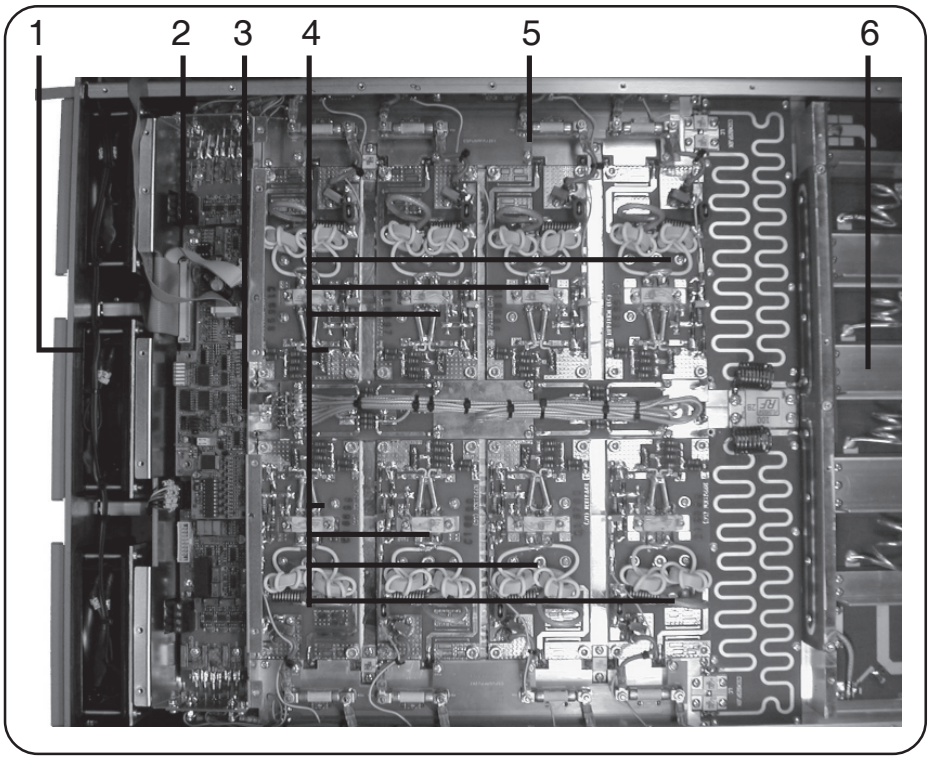
/PFC	Power Factor Correction Model
/RCT	Rectifier Model

8. Operating theory

The figure shows the PS and the RF part of amplifier seen from above. The various cards are described in this chapter:



1) CPU
2) LEDs Card
3) Power Supply Units
4) Rectifiers
5) Surge Diverter
6) PS-RF Interface Card

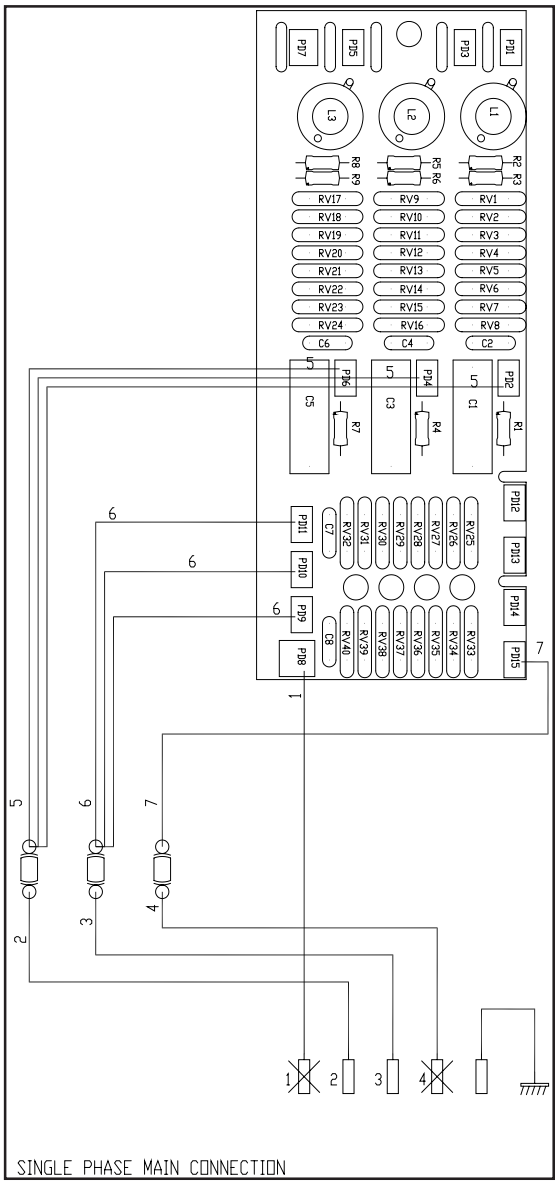


1) LEDs Card
2) Bias Card
3) Control Card
4) Amplifier modules
5) Fuse Card
6) Low-Pass Filter

8.1 Power Supply Change

To use the amplifier with different types of power supply you should connect the mains power supply socket as outlined in chapter 5. Also modify the connections inside the varistors board box as explained below.

In order to access the varistors board box, remove the screws from the side and back of the PS module, which keep it in place, and take out the box.



8.1.1 Single-Phase Wiring

WARNING: the single-phase power supply may be used only with 230 Volts.

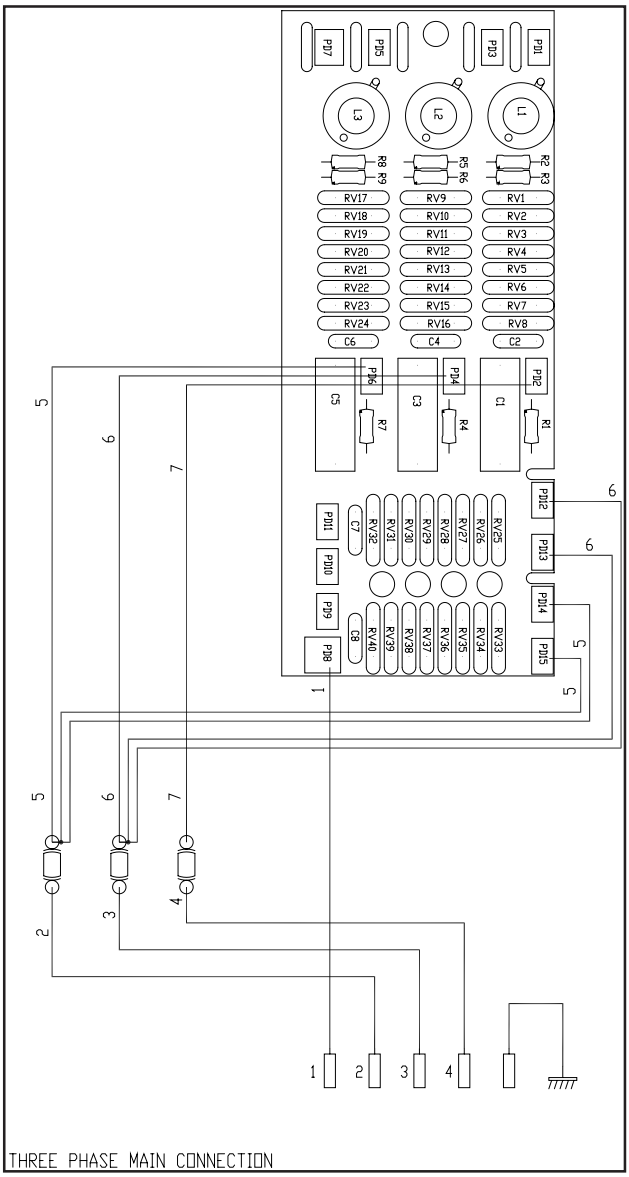
The single-phase wiring must have the following characteristics:

- PIN1 of the main connector is to be connected to PAD8 of the varistors board
- PIN2 of the main connector is connected to the first of the main fuses, from where the connections to Faston connectors PD2, PD4 and PD6, installed in the card, begin.
- PIN3 of the main connector is connected to the second of the main fuses, from where the connections to Faston connectors PD9, PD10 and PD11, installed in the card, begin.
- PIN4 of the main connector is connected to the third of the main fuses, from where the connections to Faston connector PD15, installed in the card, begin.
- PIN5 is directly wired to ground.

WARNING The connector that is connected to the "MAINS CONNECTOR" plug connects only three of the five PINS. Consider PIN1 and PIN4 as Not Connected even if they are wired internally (in the drawing they are shown by the pin marked with an X).

8.1.2 Three-Phase Wiring

The three-phase wiring must have the following characteristics:



- PIN1 of the main connector is to be connected to PAD8 of the scheda scaricatore
- PIN2 of the main connector is connected to the first of the main fuses, from where the connections to Faston connectors PD6, PD14 and PD15, installed in the card, begin.

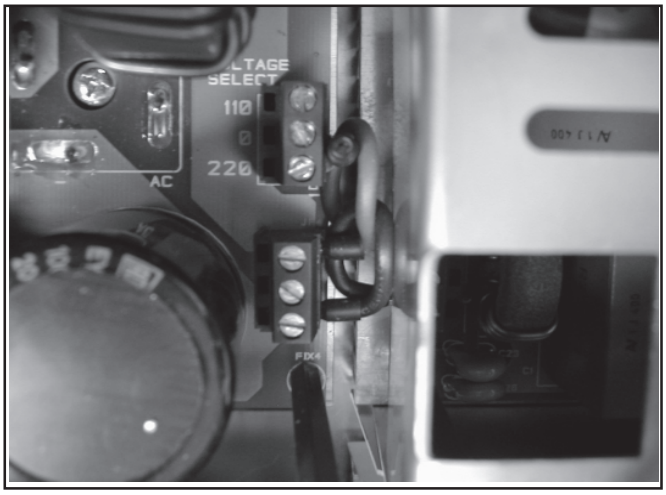
- PIN3 of the main connector is connected to the second of the main fuses, from where the connections to Faston connectors PD4, PD12 and PD13, installed in the card, begin.
- PIN4 of the main connector is connected to the third of the main fuses, from where the connections to Faston connector PD2, installed in the card, begin.
- PIN5 is directly wired to ground.

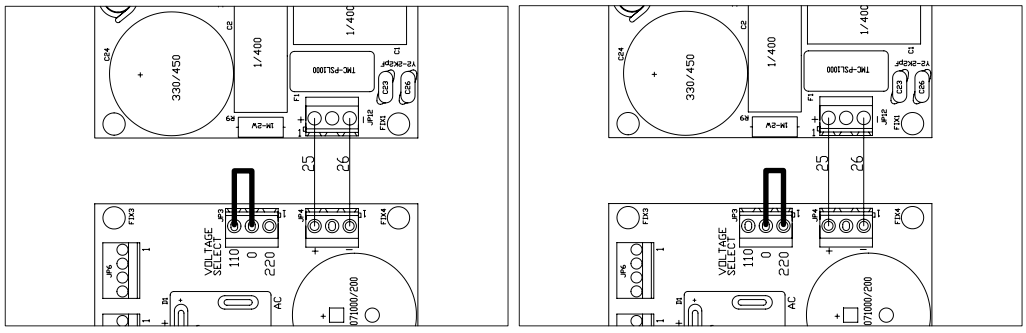
8.1.3 Voltage Change

Warning: the single-phase power supply may be used only with 230 Volts.

Proceed as follows to change voltage inside the machine:

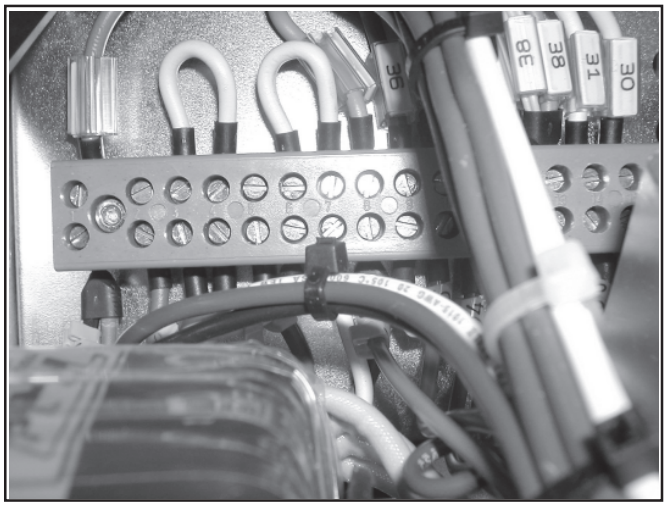
- Make the JP3 connection, on the Rectifier card, between PIN 1 and 2 to select 230 Volts, or between PIN 2 and 3 for 115 Volts.

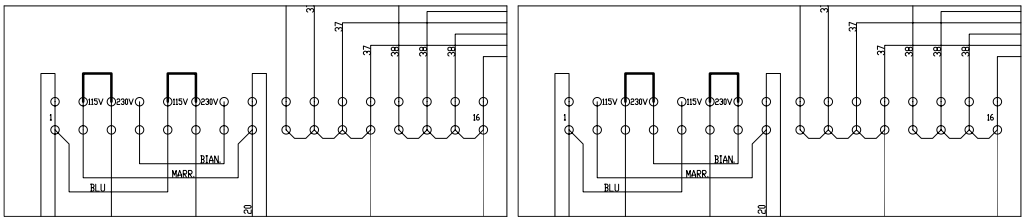




Connection for the selection of 115 or 230 Volts

- In order to select the 230 Volts on the connector inside the PS section near the transformer, make the connection between PIN 3 and 4 and PIN 6 and 7, or between PIN 2 and 3 and PIN 5 and 6 for 115 Volts.





Connection for the selection of 115 or 230 Volts

8.2 PS Part

8.2.1 Surge diverter

This card's main function is to avoid any damage to the internal cards by blocking the contact before current reaches the equipment in case overvoltages occur.

8.2.2 Power Supply

The three power supply modules are located in the middle part of the amplifier. The power supply units are mounted on a cooling fin to cool the amplifier by forced ventilation.

The amplifier houses a transformer the input voltage of which may be selected between 115 and 230 Volts.

The transformer is fitted with three secondary wires: A) 18-0-18 V, B) 0-17 V, C) 0-11.5 V that supply power to the cards inside the equipment.

8.2.3 Rectifier

The task of the rectifier is to rectify and stabilize the shape of the voltage produced by the power supply modules by fixing the voltage value to the value required by the internal circuitry.

This card also applies a resistive load when the amplifier is turned on and excludes said load after a short time to reduce current peaks in the transformer on turning it on (SOFT-START).

8.2.4 PS-RF Interface Card

This interface card is installed at the back of the amplifier for collecting the main signals of the machine and making them available on the connectors. This interface is connected to the three rectifiers, the CPU, the fans, the transformer from which it receives the signals and to which it issues commands.

This interface card is designed to make the PS part communicate with the RF part and making available the dedicated signals at the specific connector for each part.

8.2.5 LEDs Card

Three LEDs are present on this card for indicating the operating status of the three amplifier modules

The lighting up of a LED indicates a malfunction in the associated module.

8.2.6 CPU

This subsystem is made up of three cards: the CPU card, the display card and the analog card.

The CPU subsystem implements all the software functions (measurements, protection, control, data display, communications) outlined in the previous chapters.

This card carries the signals to the DB25 telemetry connector that is on the machine's back panel. The connector is fitted with 7 analog outputs, 8 open-collector digital outputs and 4 digital inputs. It also manages the DB9 signals associated with the RS232 connector, for interfacing with other equipment and for the default programming functions, and the DB9 connector for communications in I2C standard.

8.3 RF Part

8.3.1 RF Power Amplifier

The RF power amplifying section consists in 8 power modules coupled by a Wilkinson splitter and combiner and implemented in strip-line technology.

The 8 RF modules, the splitter and the combiner are housed inside the top part of the equipment.

The whole RF section is mounted on the fin that cools the equipment by means of forced ventilation.

Each RF module supplies 350 watts in **PJ2500M-C** model, or 300 watts in **PJ2000M-C** model, with 4 to 6 pilot power watts and is powered by the switching PSU.

The modules' operating parameters in standby are as follows:

VDC=50V Vgs=3.5V Idq=200mA

The active device used in the amplifier modules is a Mosfet (SD2942 in **PJ2500M-C** model, or BLF278 in **PJ2000M-C** model).

8.3.2 Wilkinson Splitter and Combiner

Both the splitter and the combiner are made in strip-line technology.

The splitter is used for splitting power arriving from the exciter and supplying one eighth to each of the RF modules.

The combiner is then used to combine power output from each module to obtain the amplifier's total power.

The two cards ensure equal phases among the powers generated by the 8 RF modules. One power resistance is used for dissipating the offset power that might be present in case a module breaks down.

The Splitter card is also fitted with the temperature sensor which is monitored by the software.

8.3.3 Bias Card

The task of this card is to check and correct the bias voltage of the Mosfets in the RF amplification section.

This card also supplies the following measurements: current and voltage of each module, total current and average voltage.

8.3.4 Low-Pass Filter

This filter is located at the back of the equipment.

The task of the low-pass filter is to reduce the harmonic emissions of the amplifier to below the levels allowed by standards.

8.3.5 Directional Coupler

The task of these two cards that seem identical is to supply the power measurement. They are installed on the input RF connector on the inside of the machine. One card supplies the amplifier's forward power whereas the other one supplies the reflected power.

8.3.6 Control Card

The control card acts as an auxiliary card for the PROTF card in the PS section should the latter fail to trip due to a malfunction. It implements all the functions associated with measurements, protection, control and communications and is even capable of detecting the individual voltages or currents inside the machine, in addition to the overall ones.

If pre-arranged, this card can carry the signals to the DB9 connector located on the machine's back panel in RS485 standard.

8.3.7 LEDs Card

This card is fitted with 4 warning LEDs that indicate the machine's general operating status.

It also has a trimmer for adjusting power (AGC control). Use a small screwdriver to change the delivered power.

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