



PJ5000U-KLC

(alias BARRACUDA) - USER MANUAL

VOLUME1



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PJ5000U-KLC - User Manual
Version 1.0

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IMPORTANT


The symbol of lightning inside a triangle placed on the product, evidences the operations for which is necessary gave it full attention to avoid risk of electric shocks.




The symbol of exclamation mark inside a triangle placed on the product, informs the user about the presence of instructions inside the manual that accompanies the equipment, important for the efficacy and the maintenance (repairs).


1. Preliminary Instructions

• General Warnings


This equipment should only be operated, installed and maintained by "trained" or "qualified" personnel who are familiar with risks involved in working on electric and electronic circuits. "Trained" means personnel who have technical knowledge of equipment operation and who are responsible for their own safety and that of other unqualified personnel placed under their supervision when working on the equipment. "Qualified" means personnel who are trained in and experienced with equipment operation and who are responsible for their own safety and that of other unqualified personnel placed under their supervision when working on the equipment.

 **WARNING: Residual voltage may be present inside the equipment even when the ON/OFF switch is set to Off. Before servicing the equipment, disconnect the power cord or switch off the main power panel and make sure the safety earth connection is connected. Some service situations may require inspecting the equipment with live circuits. Only trained and qualified personnel may work on the equipment live and shall be assisted by a trained person who shall keep ready to disconnect power supply at need.**


R.V.R. Elettronica S.p.A. shall not be liable for injury to persons or damage to property resulting from improper use or operation by trained/untrained and qualified/unqualified persons.


 **WARNING: The equipment is not water resistant. Any water entering the enclosure might impair proper operation. To prevent the risk of electrical shock or fire, do not expose this equipment to rain, dripping or moisture.**

Please observe local codes and fire prevention rules when installing and operating this equipment.

 **WARNING: This equipment contains exposed live parts involving an electrical shock hazard. Always disconnect power supply before removing any covers or other parts of the equipment.**

Ventilation slits and holes are provided to ensure reliable operation and prevent overheating; do not obstruct or cover these slits. Do not obstruct the ventilation slits under any circumstances. The product must not be incorporated in a rack unless adequate ventilation is provided or the manufacturer's instructions are followed closely.

 **WARNING: This equipment can radiate radiofrequency energy and, if not installed in compliance with manual instructions and applicable regulations, may cause interference with radio communications.**

 **WARNING: This equipment is fitted with earth connections both in the power cord and for the chassis.**

Make sure both are properly connected.

Operation of this equipment in a residential area may cause radio interference, in which case the user may be required to take adequate measures.

The specifications and data contained herein are provided for information only and are subject to changes without prior notice. **R.V.R. Elettronica S.p.A.** disclaims all warranties, express or implied. While R.V.R. Elettronica S.p.A. attempts to provide accurate information, it cannot accept responsibility or liability for any errors or inaccuracies in this manual, including the products and the software described herein. **R.V.R. Elettronica S.p.A.** reserves the right to make changes to equipment design and/or specifications and to this manual at any time without prior notice.

• Notice concerning product intended purpose and use limitations.

This product is a radio transmitter suitable for frequency-modulation audio radio broadcasting. Its operating frequencies are not harmonised in designated user countries. Before operating this equipment, user must obtain a licence to use radio spectrum from the competent authority in the designated user country. Operating frequency, transmitter power and other characteristics of the transmission system are subject to restrictions as specified in the licence.

2. Warranty

La **R.V.R. Elettronica S.p.A.** warrants this product to be free from defects in workmanship and its proper operation subject to the limitations set forth in the supplied Terms and Conditions. Please read the Terms and Conditions carefully, as purchase of the product or acceptance of the order acknowledgement imply acceptance of the Terms and Conditions. For the latest updated terms and conditions, please visit our web site at WWW.RVR.IT. The web site may be modified, removed or updated for any reason whatsoever without prior notice. The warranty will become null and void in the event the product enclosure is opened, the product is physically damaged, is repaired by unauthorised persons or is used for purposes other than its intended use, as well as in the event of improper use, unauthorised changes or neglect. In the event a defect is found, follow this procedure:

- 1 Contact the seller or distributor who sold the equipment; provide a description of the problem or malfunction for the event a quick fix is available.

Sellers and Distributors can provide the necessary information to troubleshoot the most frequently encountered problems. Normally, Sellers and Distributors can offer a faster repair service than the Manufacturer would. Please note that Sellers can pinpoint problems due to wrong installation.

- 2 If your Seller cannot help you, contact **R.V.R. Elettronica S.p.A.** and describe the problem; if our staff deems it appropriate, you will receive an authorisation to return the equipment along with suitable instructions;

- 3 When you have received the authorisation, you may return the unit. Pack the unit carefully before shipment; use the original packaging whenever possible and seal the package perfectly. The customer bears all risks of loss (i.e., R.V.R. shall not be liable for loss or damage) until the package reaches the R.V.R. factory. For this reason, we recommend insuring the goods for their full value. Returns must be sent on a C.I.F. basis (PREPAID) to the address stated on the authorisation as specified

by the R.V.R. Service Manager.



Units returned without a return authorisation may be rejected and sent back to the sender.

- 4 Be sure to include a detailed report mentioning all problems you have found and copy of your original invoice (to show when the warranty period began) with the shipment.

Please send spare and warranty replacement parts orders to the address provided below. Make sure to specify equipment model and serial number, as well as part description and quantity.



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

3. First Aid

All personnel engaged in equipment installation, operation and maintenance must be familiar with first aid procedures and routines.

3.1 Electric shock treatment

3.1.1 If the victim is unconscious

Follow the first aid procedures outlined below.

- Lay the victim down on his/her back on a firm surface.
- the neck and tilt the head backwards to free the airway system (**Figure 1**).

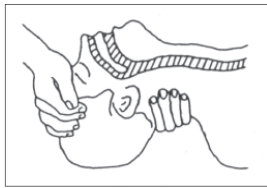


Figure 1

- If needed, open the victim's mouth and check for breathing.
- If there is no breathing, start artificial respiration without delay (**Figure 2**) as follows: tilt the head backwards, pinch the nostrils, seal your mouth around the victim's mouth and give four fast rescue breaths.



Figure 2

- Check for heartbeat (**Figure 3**); if there is no heartbeat, begin chest compressions immediately (**Figure 4**) placing your hands in the centre of the victim's chest (**Figure 5**).

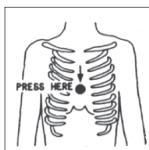
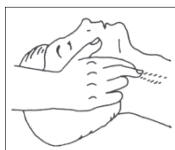


Figure 3

Figure 4

Figure 5

- One rescuer: give 2 quick rescue breaths after each 15 compressions.

- Two rescuers: one rescue breath after each 5 compressions.
- Do not stop chest compressions while giving artificial breathing.
- Call for medical help as soon as possible.

3.1.2 If the victim is conscious

- Cover victim with a blanket.
- Try to reassure the victim.
- Loosen the victim's clothing and have him/her lie down.
- Call for medical help as soon as possible.

3.2 Treatment of electric burns

3.2.1 Large burns and broken skin

- Cover affected area with a clean cloth or linen.
- Do not break any blisters that have formed; remove any clothing or fabric that is stuck to the skin; apply adequate ointment.
- Administer adequate treatment for the type of accident.
- Get the victim to a hospital as quickly as possible.
- Elevate arms and legs if injured.

If medical help is not available within an hour, the victim is conscious and is not retching, administer a solution of table salt and baking soda (one teaspoon of table salt to half teaspoon of baking soda every 250 ml of water).

Have the victim slowly drink half a glass of solution for four times during a period of 15 minutes.

Stop at the first sign of retching.

Do not administer alcoholic beverages.

3.2.2 Minor burns

- Apply cold (not ice cold) strips of gauze or dress wound with clean cloth.
- Do not break any blisters that have formed; remove any clothing or fabric that is stuck to the skin; apply adequate ointment.
- If needed, have the victim change into clean, dry clothing.
- Administer adequate treatment for the type of accident.
- Get the victim to a hospital as quickly as possible.
- Elevate arms and legs if injured.

4. General Description

The package contains:

- 1 **PJ5000U-KLC (alias BARRACUDA)**
- 1 User Manual
- 1 Mains power cable

The following accessories are also available from Your R.V.R. Dealer:

- **Accessories, spare parts and cables**

The **PJ5000U-KLC** is an RF amplifier for frequency modulation sound broadcasting with a max. rated output of 5000W cooled via a non-toxic and non-corrosive liquid, that can withstand temperatures under -30°C . The amplifier is running with a standard load of 50Ohm and operate with less of 70W of piloting power.

The cooling system features a double pump, with switching and automatics diagnostics. Pump reversal is programmable to avoid malfunctions due to long intervals of pump inactivity.

It is 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 **PJ5000U-KLC** amplifier is designed in only 4 units for assembly in a 19" rack. The pumps used for the cooling system are B-CT 61 for powers up to 5kW and the liquid cooling is TEMPER30.

The **PJ5000U-KLC** houses eight identical modules, based on the MOSFET SD2942 (2x), each supplies 800 watts.

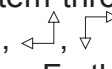
The amplifier is controlled by a microprocessor-based system that includes a LCD which carries out the following functions:

- Setting of the output power
- Activating and deactivating power delivery
- 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
- Pumps and fan of splitter control
- Reporting the false starts of pumps, so to allow the operator to preventively diagnose possible failures in normally function and the construction of tanks in case of liquid reserve indicator.
- Measuring and displaying amplifier work parameters

- Protecting the amplifier as far as potentially harmful situations are concerned such as excess supplied power, SWR, excessive pilot power or temperature
- Communicating with external devices such as programming or telemetry systems via RS232 serial interface or I²C.

The state of equipment is indicated by five LEDs on the front panel: **ON**, **WAIT**, **FAULT**, **LOCAL**, **FOLDBACK**; besides two yellow LEDs indicate possible malfunction of the alimentation.

More informations are provided through additional synoptic panel with LEDs indicating the power status (**POWER SUPPLY**), modules amplifier (**RF AMP**) and the cooling circuit (**COOLANT STATUS**).

The amplifier's control software is based on a menu system through which the user may navigate using the following four buttons: **ESC**, , and **ENTER**. A fifth button is provided for resetting any triggered alarms. Furthermore on the front panel is present the **ALARM RESET** button, the switch for selecting between local and remote function (**LOC - REM**) and the BNC connector for RF drawing on -60dB refers to the output power level.

The **PJ5000U-KLC** 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.

On rear panel are housed network input connectors that allows its use with common power supply voltages, input and output RF connectors, telemetry connector, protection fuse, input and output interlock connectors, I²C connector, RS232 connector for programming, common bus connector for interfacing with other **PJ5000U-KLC** in cascade, the I/O pump connector to control the external pump and the input/output connectors of the coolant.

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

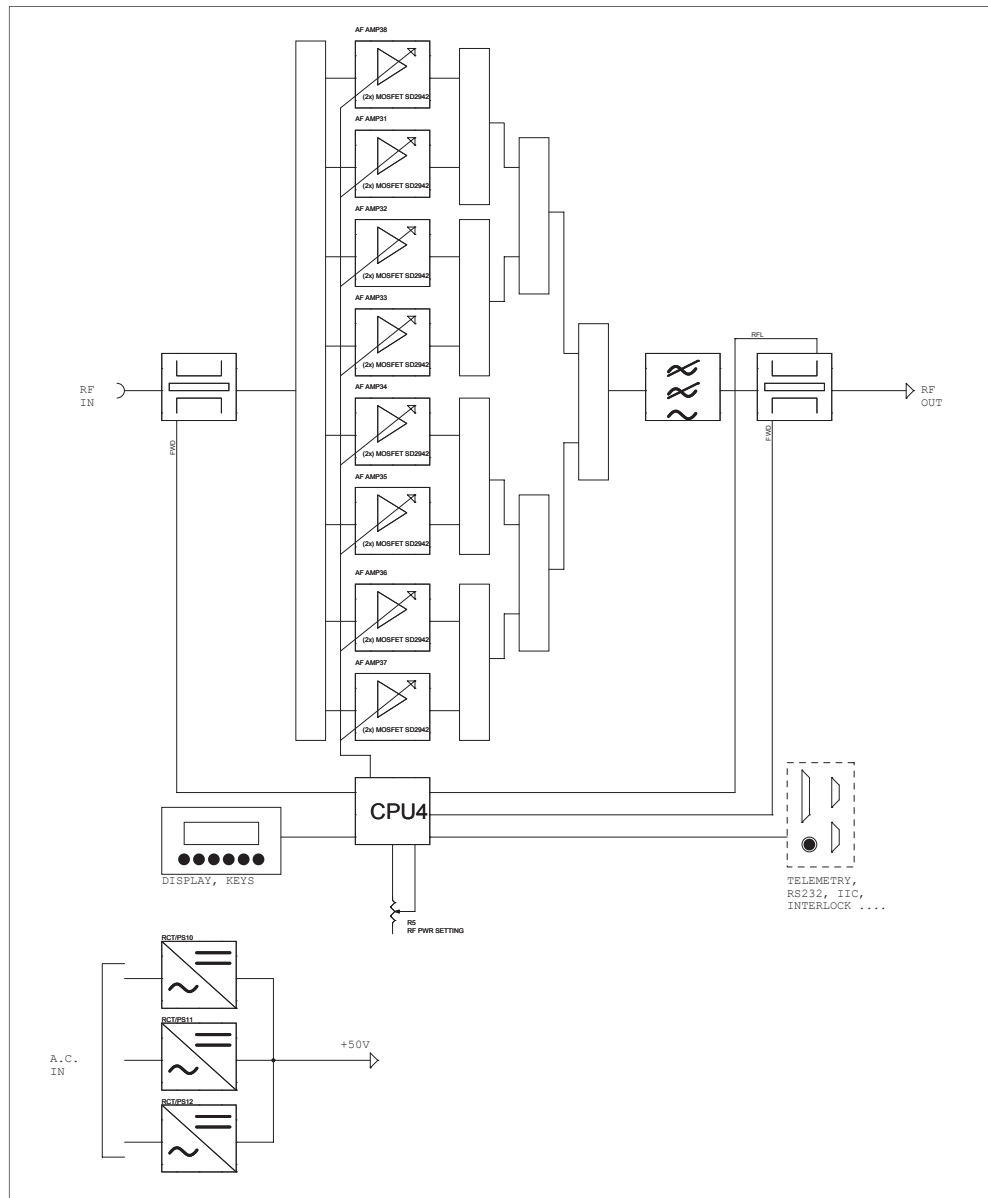


Figure 4-2: theory of operation

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 equipment, which may be:

- single-phase 208 V, +15% -10%
- single-phase 230 V, +10% -15%
- three-phase 208 V, +15% -10%
- three-phase 230 V, +10% -15%
- three-phase (with N) 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:

	@208/230V single phase	@208/230V three phase	@400V three phase
AUX OUT FUSE <i>(chap. 6.2 - position [9])</i>	(1x) F6,3T type 5x20	(1x) F6,3T type 5x20	(1x) F6,3T type 5x20
SERVICE FUSE <i>(chap. 6.2 - position [10])</i>	(1x) F6,3T type 5x20	(1x) F6,3T type 5x20	(1x) F6,3T type 5x20
MAINS FUSE <i>(chap. 6.2 - position [1])</i>	(3x) F32T type 10x38	(3x) F25T type 10x38	(3x) F16T type 10x38

Install the amplifier in a standard rack for 19" modules.

Assemble the amplifier with the pumps through two tubes.

Connect the output of a suitable type of FM exciter (e.g. the PTX100LCD of R.V.R. Elettronica) to the RF input (**RF** module) using a cable fitted with N type connectors (50 Ohm). 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 Ground
- 1 Neutral
- 2 R Phase
- 3 S Phase
- 4 T Phase
- 11,12 Not connected

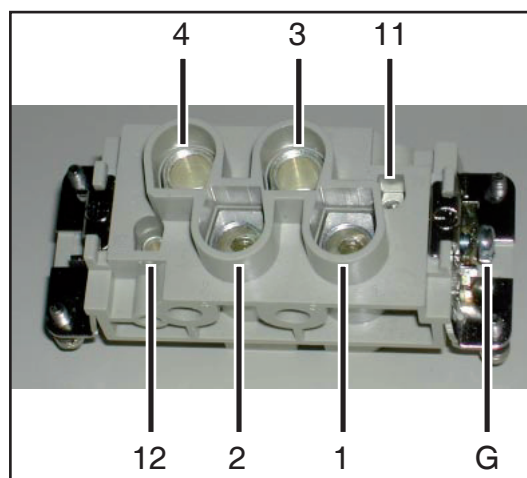


Figure 5-2: View of the mains multipole socket - terminals side (internal)

Single-phase power supply:

- G Ground
- 1 Not connected
- 2 Phase
- 3 Neutral
- 4 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.

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 (keep in mind that due to the measurement digitalization effect it might not be possible to obtain a reading of exactly maximum power, but a lightly higher or lower value which is perfectly normal).

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.



Note: the pump is exchanged automatically every time you switch off and subsequently re-switch on the equipment. In case you never switch off the equipment, the pump is exchanged automatically every 15 days of normal operation. The operation of pumps exchange is necessary for the regular functioning of the same.

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 in the follow shows the overall software user interface diagram.

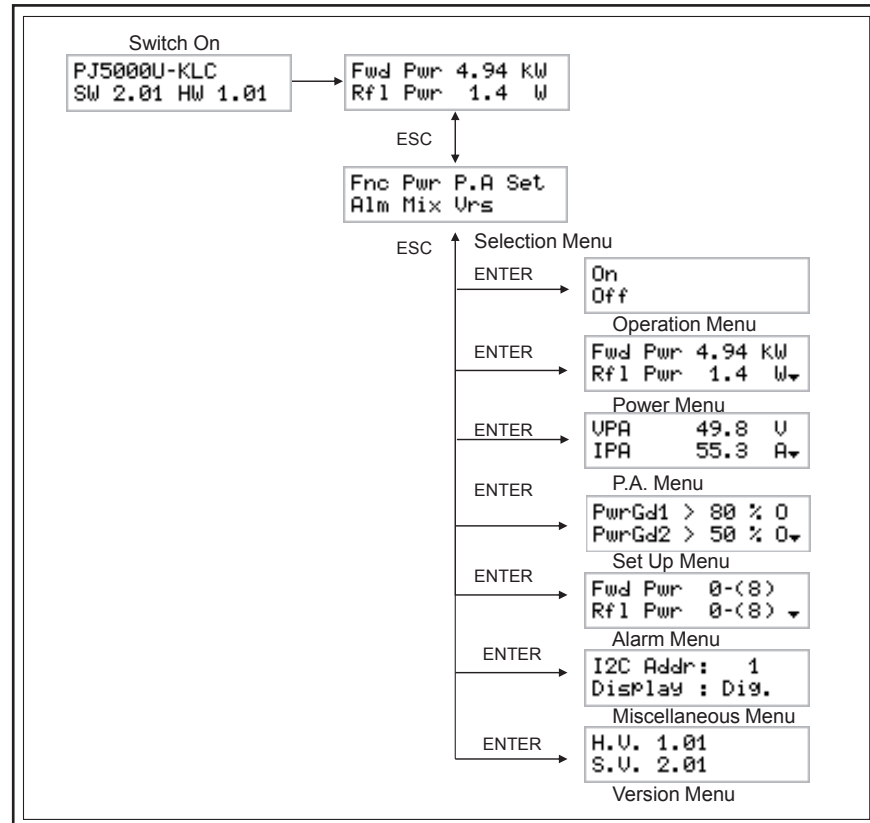


Figure: Flow diagram of the software



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.

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

PJ5000U-KLC
SW 2.01 HW 1.01

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

```
Fwd Pwr 4.94 kW
Rfl Pwr  1.4  W
InP Pwr 21.2  W
SWR      Off
```

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

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

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)

```
On
Off
```

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 stand-by 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 5 minutes for the machine to cool down and then the fans and pumps turn OFF.

5.3.2 Power Menu (Pwr)

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

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

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

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

Fwd Pwr	4.94	kW
Rfl Pwr	1.4	W
Inp Pwr	21.2	W
SWR	Off	

5.3.3 Power Amplifier Menu (P.A.)

This screen, 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)
- Temperature
- Power Supply Voltage (Mains - percentage variation as compared to the nominal voltage)
- Efficiency

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):

VPA	49.8	V
IPA	55.3	A
Temp.	38.3	°C
Mains	+1	%
Eff.	68.3	%

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).

The three settable thresholds (**Power Good**) refer to the emitted power level.

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

- Forward Power 5000 W
- Forward Power 300 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.

Set	Lmt	St
Pwr-Gd1	> 80	% C
Pwr-Gd2	> 50	% 0
Pwr-Gd3	> 50	% 0

In this example the alarm thresholds are as follows:

- PwrGd1 4000 W (80% x 5000 W)
- PwrGd2 2500 W (50% x 5000 W)
- RflWar 150 W (50% x 300 W)

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):

```

Fwd Pwr  0-(8)
Rfl Pwr  0-(8)
InP Pwr  0-(8)
U.P.A.   Dis.
I.P.A.   0-(8)
Mains    Wait
SWR      Dis.
Eff.     Dis.
Inhibit   Off
R.F. Alarm Off
H2O Press. Off
    
```

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
- exchange the operation pump

```

Item:
IIC Addr:  1
Display :  Dig.
Pump:      <2>
    
```

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 **Digital** mode (this is the standard mode) or **Analog** mode:



In the analog display mode a small triangle indicates the reflected power level set in the Alarm Threshold Setting Menu (Rf1War), 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.

The pump is exchanged automatically every time you switch off and subsequently re-switch on the equipment. In case you never switch off the equipment, the pump is exchanged automatically every 10 days of normal operation. The operation of pumps exchange is necessary for the regular functioning of the same.

In case of a fault on pump pressure, and then an interruption of the cooling flow, after 10 seconds is recorded by the machine which starts the operations of exchange pumps.



Note: the delay of 10 seconds is necessary to prevent the record of false positives as a momentary pressure drop due to air bubbles in the cooling system.

The machine will continue to exchange the pumps every two minutes, until the situation that caused the alarm is resolved.

After six minutes the equipment goes in a **WAIT** condition, and will be reported through the red LED on the front, in the meanwhile the machine will continue to exchange pumps every 2 minutes in order to resolve the alarm condition.



Note: Please resolve as soon as possible the condition that brought the equipment to the alarm, this to restore the correct operation. Check the LEDs indicators on the front panel, or check the **ALARM menu**, to see which alarm condition has brought to the halt of the machine.

In the event that only one of two pumps work correctly, and then exchange pumps can not be done, will be reported into display **PUMP FAILED** after 3 minutes of the failed attempt.



Note: Please resolve as soon as possible replacing the faulty pump.

5.3.7 Version Menu

This screenful shows the software version and the hardware version of the equipment.

```

Software Ver.
LCFPA-000101
03.03 25-11-09
Hardware Ver.
03.12
    
```

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.



Note: the RESET button allows you to reset all the auxiliary protection.

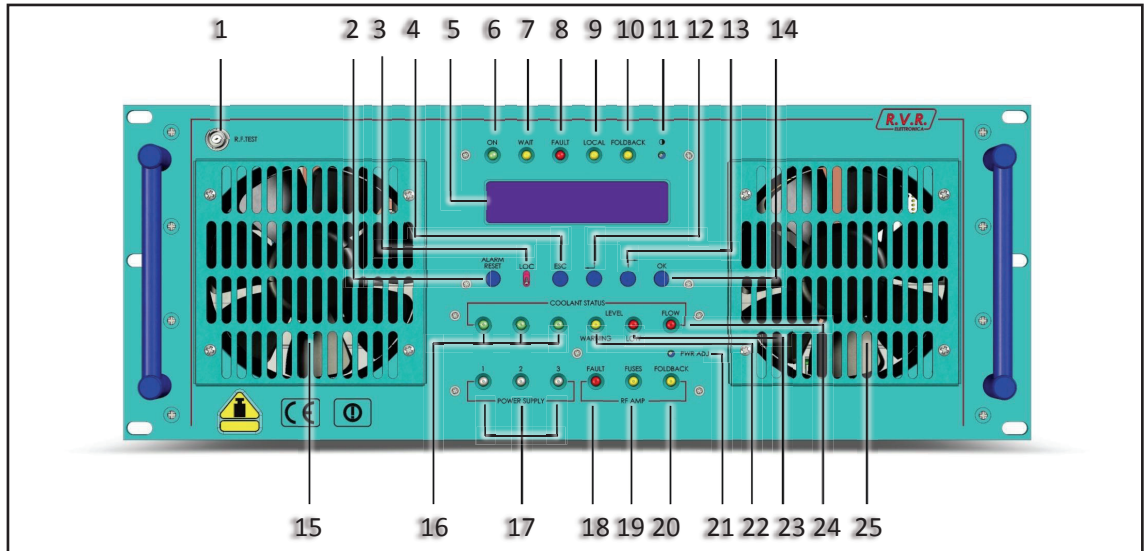
5.4.2 Power Supply Units

Three power supply units, which work in parallel mode, power the machine. Should one of the power supply units malfunction, the machine automatically compensates 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 **PJ5000U-KLC**.

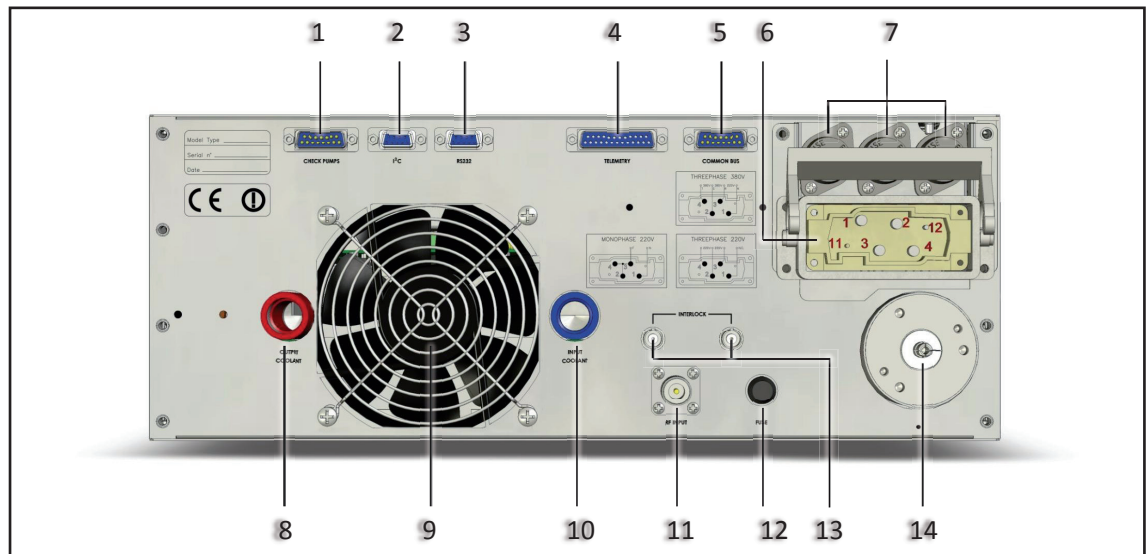
6.1 Frontal Panel



- | | |
|---------------------|---|
| [1] RF TEST | BNC connector for RF monitor output. The output level is -60dB referred to the power output in 87.5 - 108 MHz range |
| [2] ALARM RESET | Button used to manually reset the protection system |
| [3] LOC/REM | Switch to select the local or remote control modes |
| [4] ESC | Button used to exit from a menu |
| [5] DISPLAY | LCD display |
| [6] ON | Green LED indicating the amplifier is switched on |
| [7] WAIT | Yellow LED indicating the amplifier is waiting for a condition that is blocking the power output to be removed |
| [8] FAULT | Red LED indicating that a fault that cannot be automatically reverted |
| [9] LOCAL | Yellow LED, indicating that the amplifier is in local control mode |
| [10] FOLDBACK | Yellow LED, indicating that the foldback function is active (automatic reduction of the distributed power) |
| [11] CONTRAST | Trimmer to regulate the contrast of the LCD display |
| [12] | Button used to navigate in the menu system and to modify the changeable parameters |
| [13] | Button used to navigate in the menu system and to modify the changeable parameters |
| [14] OK | Button used to accept a parameter's value or to enter into a menu |
| [15] AIR FLOW | Grill for the ventilation flow passage |
| [16] COOLANT STATUS | Green LEDs, indicating the correct operation of the two pumps (A and B) and the cooling fan of the splitter (C). |
| [17] P.S. ALARMS | Yellow LEDs, indicating the presence of a anomaly on one or more power supply boards |
| [18] FAULT | Red LED that indicates a fault that cannot be automatically reverted |

[19] FUSES	Yellow LED that indicates the presence of one or more broken fuses
[20] FOLDBACK	Yellow LED indicating that the foldback function is active (automatic reduction of the distributed power)
[21] RF PWR ADJ	Power regulation trimmer - A.G.C. control
[22] WARNING	Yellow LED, indicating the presence of a low level of coolant
[23] LOW	Red LED, indicating the malfunction due to the absence of liquid cooling
[24] FLOW	Red LED, indicating the malfunction due to the absence of pressure of the liquid coolant from the pump. This signal is acquired by the CPU 10 seconds after the successful termination of the flow.
[25] AIR FLOW	Grill for the ventilation flow passage

6.2 Rear Panel

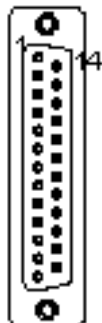


- | | |
|--------------------------|---|
| [1] CHECK PUMPS | DB15 connector for interfacement with other equipment |
| [2] I ² C BUS | DB9 connector for I ² C bus networking |
| [3] RS232 | DB9 connector to interface with external devices or factory programming |
| [4] TELEMETRY | DB25 telemetry connector |
| [5] COM BUS | DB15 connector for interfacement with other equipment |
| [6] MAINS CONNECTOR | Plug for mains power supply |
| [7] MAINS FUSE | Protection fuses of the power supplies 1,2 and 3 |
| [8] OUTPUT COOLANT | Hydraulic connector for the output of liquid cooling (1/2 ") |
| [9] AIR FLOW | Grill for the ventilation flow passage |
| [10] INPUT COOLANT | Hydraulic connector for the input of liquid cooling (1/2 ") |
| [11] RF IN | RF input connector ("N" type) |
| [12] FUSE | Protection fuse for the service section |
| [13] INTERLOCK | BNC connectors to inhibit an external device, as an exciter. In case of fault, the inner connector is shorted to ground |
| [14] RF OUT | RF output connector (7/8" EIA flange) |

6.3 Connector Description

6.3.1 Telemetry Connector

Type: DB25 Female



1	Internal SWR	Disable
2	Tensione dell' amplificatore di potenza RF	3,9V x 50V
3	GND	GND
4	Reflected Power	4.3V x 300W
5	Interlock	
6	Check Pumps	
7	GND	GND
8	"On" Command	
9	Set 1	
10	WAIT	
11	Reset alarm	
12	OFF	
13	Interlock	
14	Temperature	3.9V x 100°C
15	RF power amplifier current	3.9V x 200A
16	Forward Power	4.3V x F.S.
17	FAULT	
18	Set 3	
19	Input power	3.9V x 150W
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



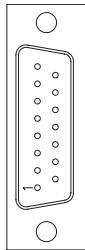
- 1 NC
- 2 SDA
- 3 SCL
- 4 NC
- 5 GND
- 6 NC
- 7 NC
- 8 NC
- 9 NC

Serial Data
Serial Clock

GND

6.3.4 Com Bus

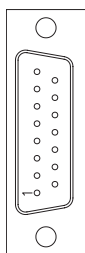
Type: DB15 male



- 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 Check Pumps

Type: DB15 male



- 1 NC
- 2 ON
- 3 GND
- 4 NC
- 5 ON
- 6 GND
- 7 NC
- 8 NC
- 9 GND
- 10 GND
- 11 FAN
- 12 H2OWARN
- 13 H2OMIN
- 14 FLUX
- 15 NC

Pump 1 ON/OFF Command

Pump 2 ON/OFF Command

Radiator fan check

Low level check of coolant

Empty level check of coolant

Flux pression check of coolant

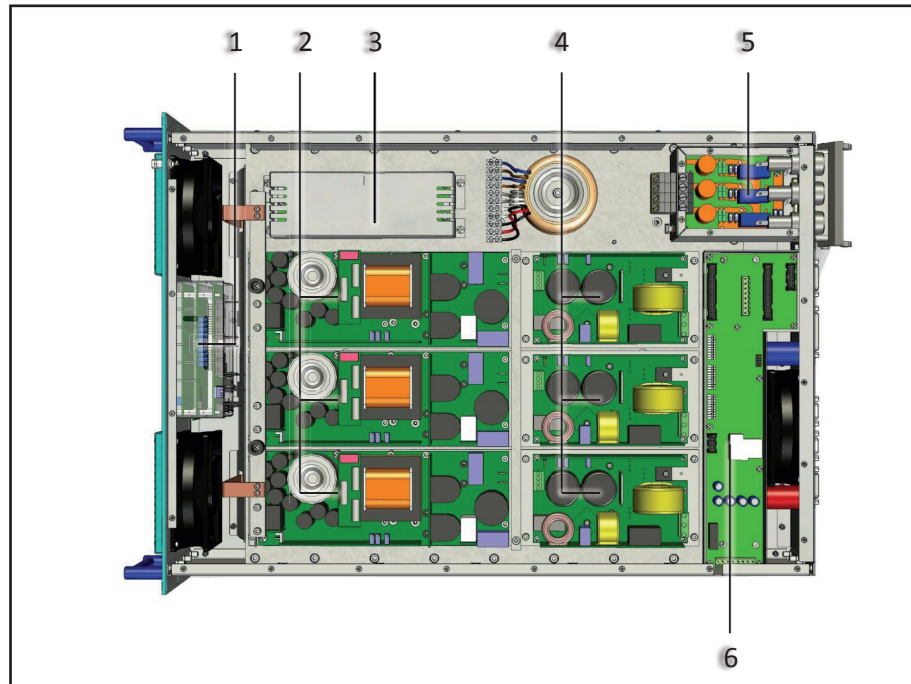
7. Technical Specification

	PJ5000U-KLC
<i>Parameters</i>	
GENERALS	
Rated output power	5000W
Frequency range	FCC -CCIR and other on request
Input power for rated output	70W typical
Input power for rated output LD version	< 5 W
Primary Power	230/400 VAC ±15% , 3-phase +neutral, 50/60Hz or 230 VAC ±10%, 1-phase, 50/60Hz; ILME CFX4/2 connector
AC Power Consumption	8250 VA / 8115W / PF: 0,98
Overall efficiency	> 60 %
Phisical Dimensions (W x H x D)	483 x 176 x 700 mm
Weight	49 kg
Environmental Working Conditions	-10 ÷ +50 °C / 95% relative Humidity non condensing
Cooling	Liquid cooling with external unit
CONNECTORS	
RF Input	N (50 ohm)
RF Output	7/8" EIA flange type, 50 ohm
RF Monitor	BNC (- 60dBr referred to RF output)
Interlock Output	BNC
Interlock Input	BNC
STANDARD COMPLIANCE	
Safety	EN 60215:1989 EN60215/A1:1992-07 EN60215/A2:1994-09
EMC	EN 301 489-1 V1.4.1 (2002-08) EN 301 489-11 V1.2.1 (2002-11)
OPTIONS	
/LD-PJM-C	Low drive power (less than 5W)

8. Operating theory

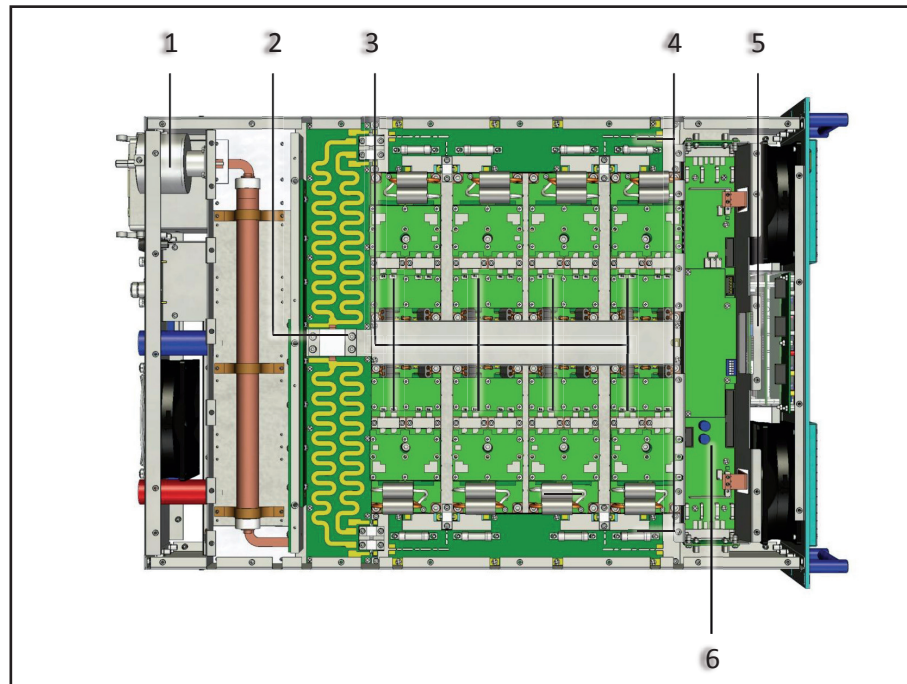
The figure shows the top and the bottom view of amplifier. The various cards are described in this chapter.

- Top View:



- 1) ProtF Board
PROTPJ-HCLCD
& CPU Board
SL154IN2001
- 2) Power Supply
PSL5060
- 3) Low-Drive Power Board
SL154DR2001
- 4) PFC
PFCPSL5060
- 5) Surge Protection Board
SL046SR1002
- 6) PS-RF Interface Board
SLINPSP2K07

- Bottom View:



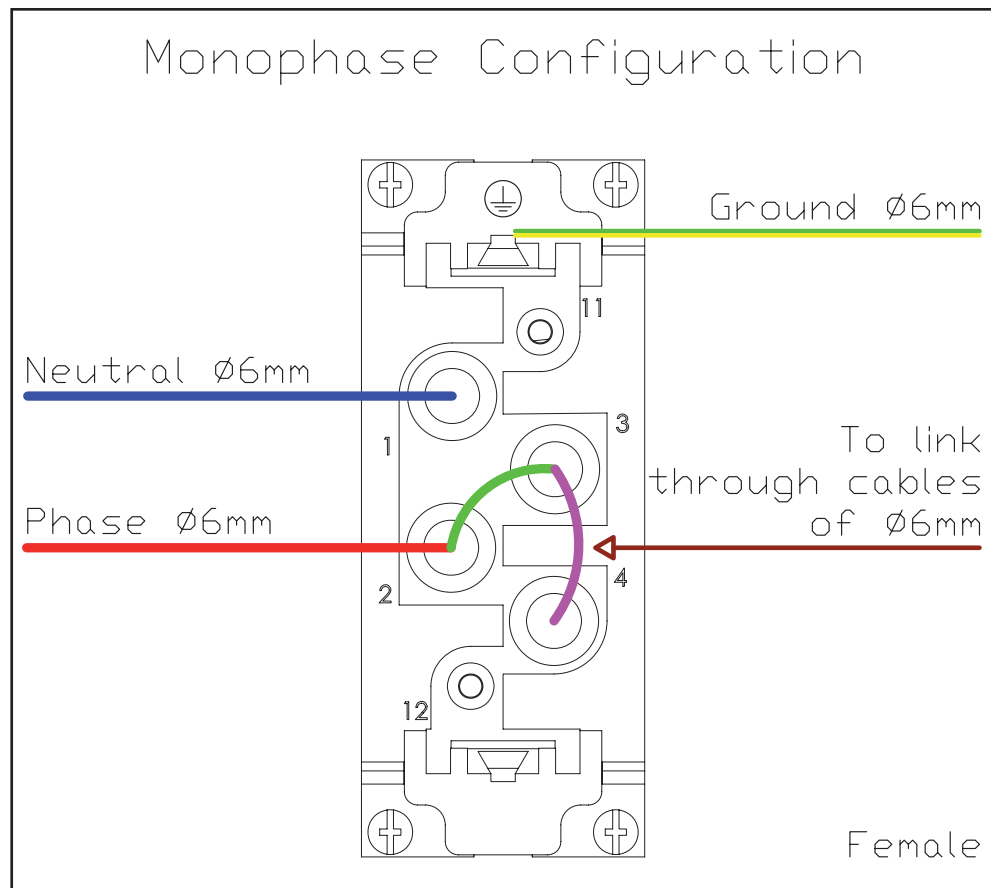
- 1) FWD & RFL Power Meter Board
SL042MT1501
- 2) Splitter Board
SLSPLL5PJ2K
- 3) Amplifier Modules
SL154RF2001
- 4) Fuses Board
SLFUSRFPJ4K1
- 5) LEDs Board
SL154LD1001
- 6) Bias Board
SLMTPRTPJ4K1
& CPU Board
CPUPJ2KMC

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

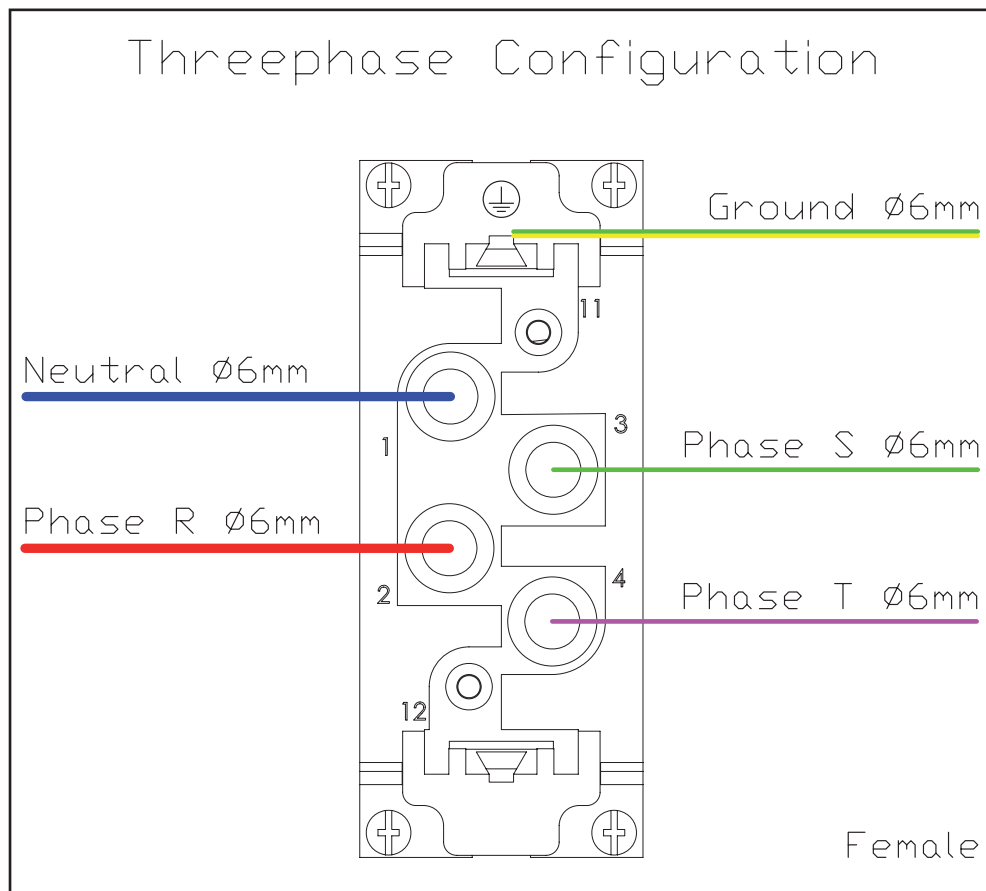


WARNING: the power supply in single-phase can be used only with 208/230V voltage.

For the single-phase, the configuration of the external power supply plug must have the following characteristics:

- PIN1 of the main connector is connected to Neutral wire.
- PIN2 of the main connector is connected to Phase wire and internally connected to PIN3 by Ø 6mm wire.
- PIN3 of the main connector is internally connected to PIN2 and to PIN4 by Ø 6mm wire.
- PIN4 of the main connector is internally connected to PIN3 by Ø 6mm wire.
- PIN5 is directly wired to ground.

8.1.2 Three-Phase Wiring



For the three-phase, the configuration of the external power supply plug must have the following characteristics:

- PIN1 of the main connector is connected to Neutral wire.
- PIN2 of the main connector is connected to Phase R Wire.
- PIN3 of the main connector is connected to Phase S Wire.
- PIN4 of the main connector is connected to Phase T Wire.
- PIN5 is directly wired to ground.

8.2 Card Description

8.2.1 Surge Protection

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 PFC Unit

The PFC unit is a rectifier that modulates the current absorbed so that the wave shape is the most possible sinusoidal, obtaining a factor of power of 99%.

The PFC can work with input supply voltages from 170 V to 250 V. A rectified voltage of 350 V is present on the output.

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 Board

This interface board 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 Board

Three LEDs are present on this board for indicating the operating status of the three power supply 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.

8.2.7 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 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 800 watts with 6 to 9 pilot power watts and is powered by the switching PSU.

The modules' operating parameters in standby are as follows:

VDC=50,5V Vgs=about 2.6-2.7V Idq=200mA (100mA for each MOSFET)

The active device used in the amplifier modules is a Mosfet (2x) SD2942.

8.2.8 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 part 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 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.

8.2.9 Bias Board

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.

8.2.10 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.

8.2.11 Control Board

The control board 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 Board can carry the signals to the DB9 connector located on the machine's back panel in RS485 standard.

8.2.12 LEDs Board

This card is fitted with 12 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.

9. “Low-Drive Power” Option (/LD)

The figure shown the top view of RF section of the equipment with LD option. The board comes described in the continuation of this chapter.

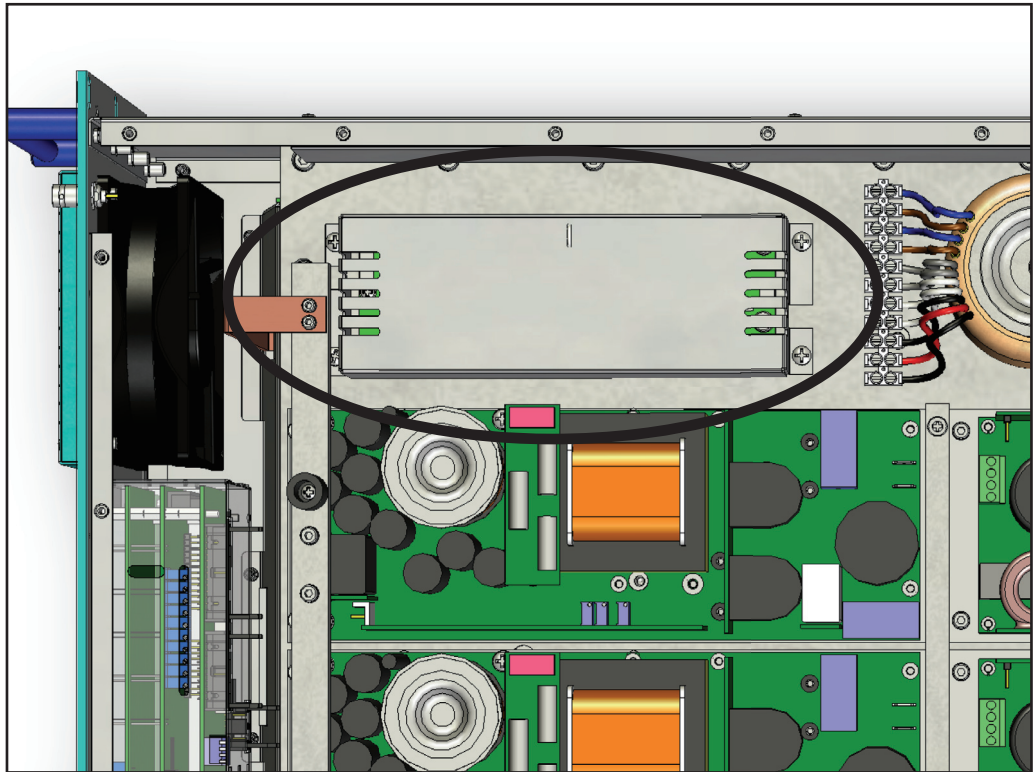


Figure 9-1: “Low-Drive power” Board

9.1 “Low-Drive power” Board

The “Low-Drive power” board contains an RF amplifier with only one stage that, with a power of about 1W, can supply an output power of approximately 30W suitable to pilot the amplifier, with a total gain of approximately 15dB.

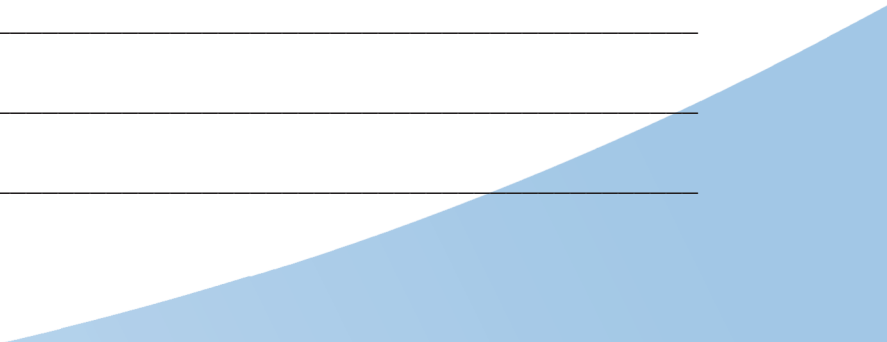
The active device utilized in the amplifier modules is a Mosfet (BLF177) and uses for the feeding the same voltage of $50V_{DC}$ used from the RF amplifiers modules.

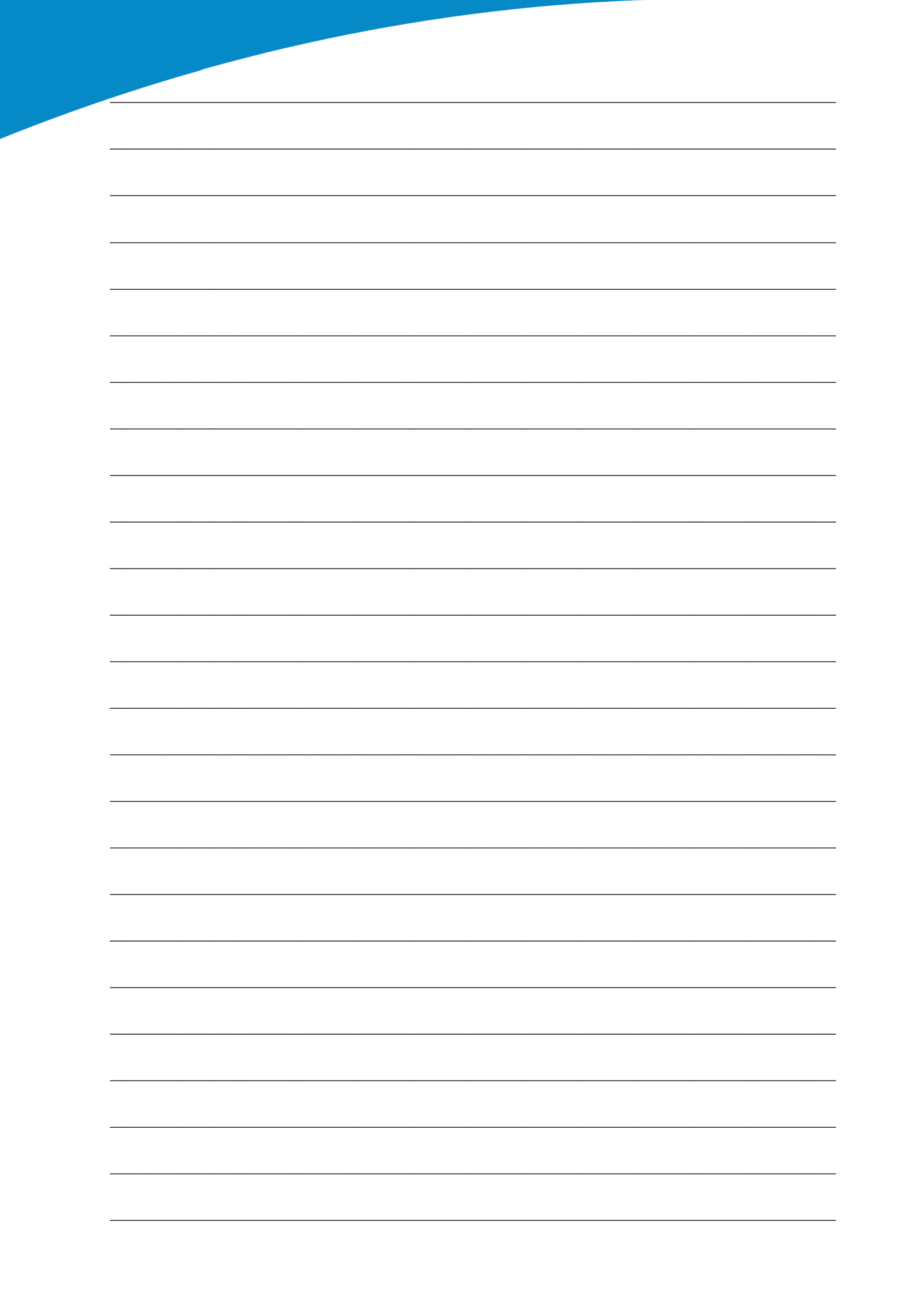
On the output stage of this board is present a directional coupler that measure the reflected and forward power; the latest comes acquired from the control software that represents it legible like input power.

The board is mounted on the fin that supplies to its cooling through forced ventilation.

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A series of 20 horizontal black lines spanning the width of the page, providing a template for writing.



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