

OM2002+

SOLID STATE 145 MHz
POWER AMPLIFIER



User Manual

OM POWER, s. r. o.
930 30 Bač 126
SLOVAKIA

E-mail : om-power@om-power.com
Web : www.om-power.com

Welcome to the solid state high power amplifier owners family! Thank you for purchasing a new model for the 2m amateur band. Parameters, the quality of design and functionality meet the requirements of the market and are the result of our own development.

This product is covered by 3 years of warranty period. We wish you many years trouble-free use of this equipment, lot of fun and successful connections in the world of amateur radio.

The OM POWER Team

Conventions used in this manual



DANGER / WARNING : Information to prevent injury to yourself when completing a task.



CAUTION: Information to prevent damage to the components when completing a task.



NOTE: *Tips and additional information to help you complete a task*

TABLE OF CONTENTS

1. GENERAL INFORMATION	6
1.1. Introduction	6
1.2. Specification	6
1.2.1. Parameters	6
1.2.2. Protection Circuits	8
2. SAFETY INSTRUCTIONS	9
3. GENERAL DESCRIPTION	11
3.1. Front and Rear Panel	11
3.2. HF Part	15
3.3. Power Supply	16
3.4. Safety Devices	18
4. INSTALLATION	19
4.1. Grounding	19
4.2. Coaxial Cable	20

4.3. Control Cable	20
4.4. Main Supply	21
4.5. Cooling	22
5. OPERATION	23
5.1. Operation Elements	24
5.2. Preparing for Use	25
5.3. Setup Menu	26
5.3.1. Language selection	27
5.3.2. Display contrast	27
5.3.3. Display delay	28
5.3.4. Bias switch	28
5.3.5. Preamplifier delay	29
5.3.6. Bias current	30
5.4. Operating Mode	31
6. MAINTENANCE	35
6.1. Fault conditions	35



6.2. Fuses	38
6.3. Cleaning	38
7. BLOCK DIAGRAM	39
8. TIMING	40



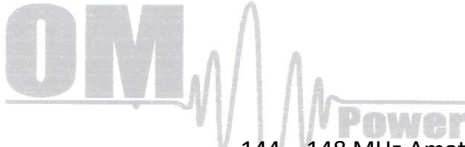
1. General Information

1.1. Introduction

The OM Power model OM2002+ is a single band, solid state amplifier, designed for duty operation on 2 meter's amateur band with all modes and no time limit. It is equipped with a Freescale high rugged N-channel double MOSFETs. This amplifier is characterized by compact design, small size and a low weight.

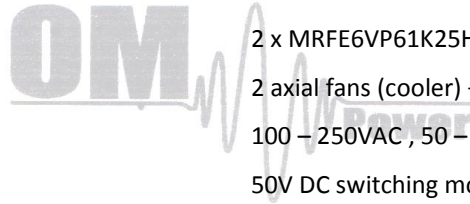
1.2. Specification

1.2.1. Parameters



Frequency Coverage	144 – 148 MHz Amateur Band
Power Output	1800W in CW 1500W in SSB (linearity), RTTY, AM, FM and digi modes, 50% duty cycle
Input Power	10 to 15 W for full output power 1800W
Input Impedance	50 Ohm, VSWR < 1.3 : 1

Power Gain	Typically 20 dB
Output impedance	50 Ohm unbalanced
Maximum output SWR	1,9 : 1 for full output power 1800W
SWR protection:	Automatic switching to STBY , when reflected power is 180W or higher
Intermodulation distortion	- 32 dBc
Suppression of harmonics	< -70 dBc
MOSFET	2 x MRFE6VP61K25HR6
Cooler	2 axial fans (cooler) + 1 axial fan (power supply)
Supplying	100 – 250VAC , 50 – 60 Hz
Power Supplies inside	50V DC switching mode PS 12V DC for logic and protection circuits
Size	318 mm x 144 mm x 362 mm [12.5" x 5.7" x 14.3"] (Width x height x depth)
Weight	11.1 kg (24.4 lb)



1.2.2. Protection Circuits

There is several special protection circuits used in the amplifier. They are activated when one or more of next parameters exceed defined values or some unwanted occasion occurs.

- Output power too high
- Reflected power too high
- Drain current too high
- Differential drain current too high
- Power coupler fault
- VSWR too high
- DC voltage too low or DC voltage error
- Input power too high (hardware protection of input overdrive & software protection)
- Inside temperature too high
- Soft start for power supply protection (PS feature)



2. Safety Instructions



Before you will start to install and operate power amplifier, read carefully next safety instructions!

AVOID CHILDREN to play around PA or to touch power amplifier or connected cables in working condition, or to push anything into the holes!

Never turn the amplifier on without the upper lid in place.

The OM2002+ amplifier is neither to be used in a WET or HUMID environment nor to be exposed to RAINFALL!

Do not turn the amplifier on without having connected the ANTENNA or properly rated DUMMY LOAD! A hazardous HF voltage may build up on the antenna connector after turning the amplifier on with no antenna or dummy load connected!

Before opening the upper lid of the amplifier make sure that power supply has been disconnected. Take out power cord from the outlet!



The amplifier must be installed in such a way that free flow of hot air from inside is allowed. The amplifier must not be installed in a constrained surrounding (i.e. tight shelves etc.)

The amplifier must be properly grounded during operation.

During operation the amplifier must be installed in such a way that the rear panel will stay accessible.

The amplifier is an A category product. In a household it can influence other electric appliances. In such cases the user is to take proper actions to mitigate this disturbance.

Read this manual carefully. Follow all of instructions during installation and operation to avoid damage to the amplifier not covered by manufacturer's warranty! Do not attempt to perform any change of hardware or software!

3. General description

3.1. Front and Rear Panel



Main switch (green) on the right side and OLED display are visible on the front panel. After switch PA ON, the display lights up in couple of seconds and shows the controls and indicators.

RF Output

See Note

RF Input

Grounding Point



Mains Plug

Power Supply

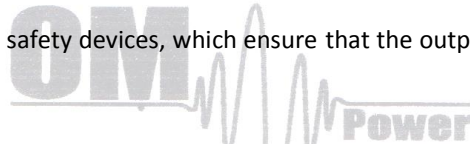
Cooler inside

- LAN** - Local Area Network connection for REMOTE CONTROL of PA
PREAMP - RCA Phono, +12V / 100mA for an external RX preamplifier switching



If you are using an older transceiver or transmitters without time delay, we recommend to connect the PA in such a way that the transmit/receive switch (foot switch for example) is connected with the KEY IN socket of the amplifier. The KEY OUT socket is to be connected with the PTT socket in the transceiver.

The amplifier is equipped with safety devices, which ensure that the output relay is not switched under power mistakenly (hot switching).



- KEY IN** - RCA Phono – Input signal PTT (switching voltage / current 5V / 2 mA)
KEY OUT - RCA Phono – Output signal PTT (maximum switching of 50V / 100mA)



Option. *Two SMA connectors for distribution of transmitter and receiver path with local RX preamplifier connection possibility. Internal circuit ensure cold switching.*

Top view on the power amplifier



Input board with output coax relay together with SWR board is visible on the right upper side.

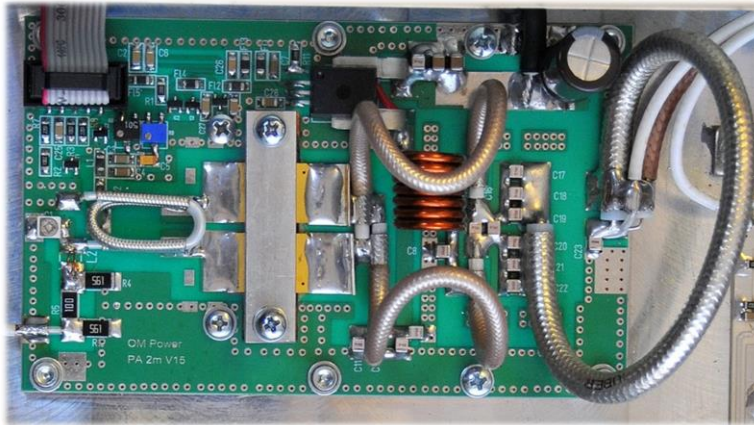
Left side shows the main RF part – two boards with MOSFETs amplifiers, everyone for max. 1 kW of output power.

Down are two axial fans on the left side, together with display board and controller board.

On the right bottom side the PCB of small 12V DC power supply is visible.

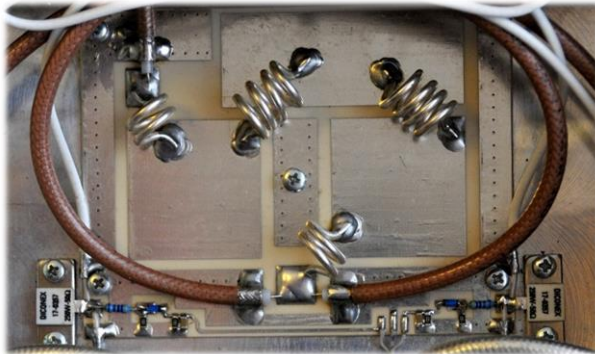
3.2. HF part

OM2002+ power amplifier was designed to achieve the RF performance of the MOSFETs, when applied to the 144 – 148 MHz frequency band. Design was tuned for performance at 1800W CW output, 50VDC. It consists of „no tune“ distributed element matching circuits designed to be as small as possible. For operating it is important that adequate heat sinking was provided in the design.



RF boards are the most important parts of the PA. Detailed view on the one board. Freescale MOSFETs are in use.

The coaxial transformer turns ratio was chosen to meet required impedance level and the length of the coax was tuned to achieve maximum efficiency and maximum power transfer between the device and its load impedance.



Low Pass Filter is installed behind the amplifier to attenuate harmonics. Part of the output coupler is visible, too.

3.3. Power Supply

The amplifier uses two power supplies. A professional switching mode power supply 50V / 60A for power amplifier, and small 12V power supply for logic and protection circuits.



Main power supply contains special soft start circuits, uses its own fan, which is visible from the rear side of the PA. It has its own overloading protection and logic to control fan speed. Power amplifier should be connected to any external source of AC in the range from 100 VAC to 277 VAC, from 45 to 60 Hz. It can be powered by a portable generator, for example.



Small Power Supply for logic and protection circuits. This PS is using for an external preamplifier, too. Current consumption of external preamplifier is limited to 200mA. It is powered from the main power supply.

3.4. Safety Devices

Control and monitoring circuits ensure control and safety during malfunctions of the PA. These are on the Control board and the Protection board. Control board is located behind the front panel. Protection board is visible on the right hand side of PA, close to the input/output relay.



Protection board with Input circuits. Input splitter together with HW protection is visible down on the board. Some of protection circuits are installed on the Control board (behind the front panel), too.

4. Installation



Read this chapter carefully prior starting with installation. Before unpacking inspect shipping carton first, if it is not damaged. Keep all of packing parts for possible future shipment. Check unpacked power amplifier. If you find some damaging, contact your dealer immediately to keep full warranty.

During installation go step by step according to next parts.



4.1. Grounding



The amplifier has to be grounded properly! Connect the screw on the rear panel of the amplifier to your local grounding system with a copper cable; use a cross-section of 4 mm² at least.

Connect your transceiver to the same grounding system of your shack carefully!

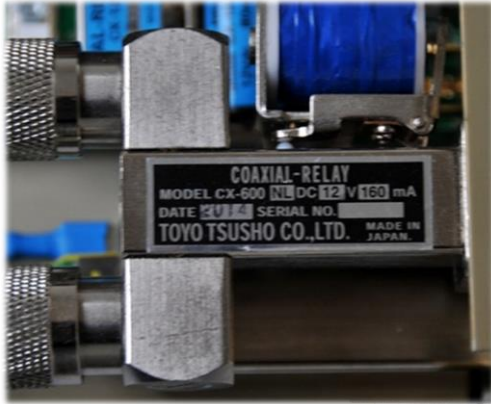
Use minimum length of cables and make sure that the connections are both physically and electrically sound. With poor grounding, you may risk damaging to your equipment, having problems with TVI/BCI or your transmitted signal may be distorted.

4.2. Coaxial Cable

The output of the transceiver is to be connected to the input of the amplifier via RG58 or similar cable. For the connection between the power amplifier and the antenna, Belden 9913 or similar coaxial cable **suited for high power** is recommended. Both the INPUT and OUTPUT N sockets with Teflon insulation are used.

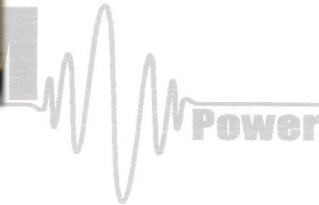
4.3. Control Cable

Control cable maintains TX / RX switching of the PA (TX GND). The cable must be shielded. On the side of the power amplifier a CINCH-socket is used. On the side of your transceiver you have to use a socket suitable for this transceiver. During transmitting the middle pin is connected to the ground.



Amplifier uses one coaxial relay for the output. It has to be switched earlier than HF is applied (cold switching). Modern transceivers they have a time delay between PTT switching and power output.

Sufficiently robust coaxial relay is using for TX/RX switching.



4.4. Main Supply



Be sure you got PA with properly terminated line cable, corresponding with your power system's outlet. If not, contact your dealer. In such a case you should make the necessary changes using a licensed electrician.



Be sure that your power system is correctly wired and properly rated! To use adequately sized and connected grounding system is also very important.

4.5. Cooling



The amplifier must be installed in such a way that free flow of hot air from the amplifier is allowed. Do not obstruct air intake and exhaust areas of the PA.

Installed axial fans provide adequate cooling of the amplifier, even during long time operation. It is automatically activated when PA is switching ON. There are two modes of fan speed selectable. In the normal mode fan speed is gradually rising with increasing temperature. In the contest mode the fan is switched at a constant high speed. **Contest mode should be activated during digi operation, too.** Fan inside the power supply starts to operate depending on the current drawn by the MOSFETs.

When the amplifier reaches inside temperature of 75 deg. Celsius, warning appears and fault LED starts blinking. At 80 degrees transmitting will be automatically blocked, fault LED will light.

5. Operation



Before switching PA on, make sure that amplifier is grounded, antenna or dummy load is connected, and power cord is putted to the outlet.



Do not turn PA on for at least 2 hours after unpacking it and moving in its operating location. Especially when amplifier was moved from a cold place to a warm one, because not visible condensation may develop inside, and this could result in damage of the PA.



Before switching PA on, check connections between PA and TCVR. Never try to change antenna during a transmission to avoid warranty loss.

5.1. Operation Elements

After switch PA ON (green switch on the front panel) main supply will be activated, the touchscreen lights up and shows the controls and indicators. They are very intuitive.



There are 4 yellow touch buttons visible on the screen.

Above the first three buttons (from the left side) their status should be displayed.

Touch of a button will change the operation status. LED above the status line will light.

SETUP touch button is used to set some parameters.



Contest fan speed is selected



PA is in the operation mode



External preamplifier is ON

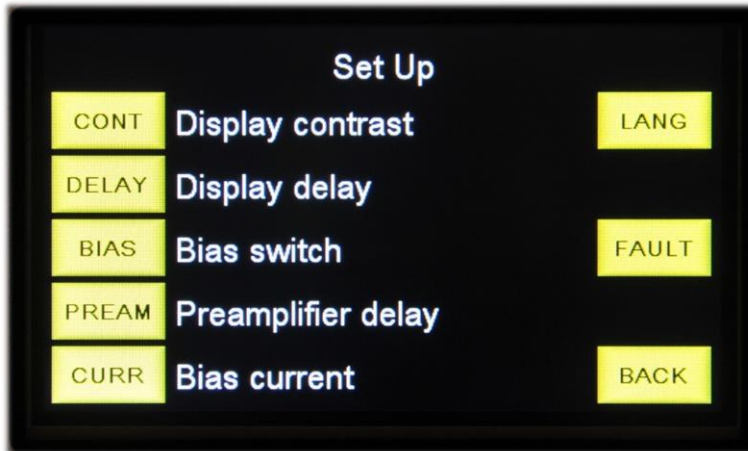


5.2. *Preparing for use*

After turning on the power switch on the front panel power amplifier will automatically go into standby mode. We recommend to start preparation for operation with SETUP menu. Firstly it allows you to set the language, then to set some of the basic parameters. Possible languages: English, German, Slovak, Hungarian and French.

5.3. Setup Menu

In the setup mode you can set the basic parameters of the display and amplifier. In the first step choose language.



Touch **SETUP** on the screen.

Setup menu is displayed.

Touch **LANG**.

5.3.1. Language selection



The language selection screen is displayed. Touch on the corresponding **flag** to select language. Screen will go automatically back to the Setup Menu.

Or, if you do not want to change language, touch **BACK**.

5.3.2. Display contrast



Touch **CONT** from Setup screen. Use **UP/DOWN** to set contrast of the touchscreen. Then touch **SAVE**. Screen will go automatically back to the Setup Menu.

Or, if you do not want to change contrast, touch **BACK**.

5.3.3. *Display delay*



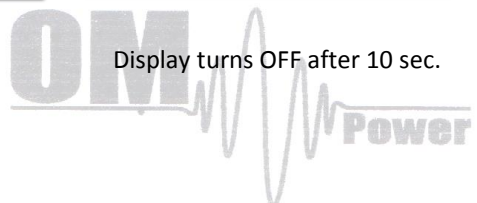
Display will not turns OFF



Display turns OFF after 10 sec.



Display turns OFF after 1 min (max.)



5.3.4. *Bias switch*

Electronic Bias Settings (EBS) is one of significant feature of the power amplifier. It allows to set low MOSFETs drain current (abt. 200mA) after pressing the PTT, until RF signal is no present at the input. At the moment when RF signal comes to the input of the PA, bias will automatically change its value to the higher level (abt. 2.5A), independently on the selected operation mode in the TCVR..... EBS is default activated.

To deactivate EBS you have to set Bias switch to OFF. In such a case bias value immediately after pressing the PTT will be high.



Touch **BIAS** from the Setup screen. Use **ON/OFF** to set bias working condition. Then touch **BACK**. Screen will go automatically back to the Setup Menu.

5.3.5. Preamplifier delay

You can control switching of an external (remote) RX preamplifier from the PA using PREAMP **ON/OFF** touch button. For reliable working condition and safety of preamplifier there is important to set some delay of its switching according to the PTT. Possible range is from 0 to 200ms. Default value is 20 ms.



Touch **PREAM** from Setup screen. Use **UP/DOWN** to set delay value (0-200ms). Then touch **SAVE**. Screen will go automatically back to the Setup Menu.

Or, if you do not want to change delay, touch **BACK**.

5.3.6. Bias current



Touch **CURR** to see both levels of bias current for both MOSFETs. In couple of seconds you will see the values of drain current in the four lines. This parameter will be checked without the possibility to change it. Use **BACK** touch button to release checking. Fluctuation of values is not a mistake. To release the Setup menu touch **BACK** again.

5.4. *Operating mode*



In **STBY** the amplifier is in **bypass-mode** and your transceiver is directly connected to the antenna. Maximum allowed power in **bypass mode** is **100 Watts!** Passing RF power is not measured and displayed if PA is either in **standby mode** or turned **OFF**.

Touch the **OP/STBY** button to activate operating mode. In the **OPERATE** mode you can select fan speed, switching an external RX preamplifier ON or OFF, but it is not possible to go to the Setup menu.



Before you push PTT for the first time, set the RF power in your TCVRr to the minimum (from 3 to 5 watts) !!!

Set **OPERATE** mode, type of operation and press PTT. You can check measured parameters of PA.



Picture shows input power of 0.5 W, output power 206 W. Power gain from input to output of the PA is 26.1 dB.

You can also read other important parameters on the display – MOSFETs voltage, MOSFETs current, reflected power, SWR and temperature. Depending on the reflected power you can consider quality of your antenna (impedance matching).



Picture shows input power of 4.9W, output power 938W. Power Gain from input to output of the PA is 22.8 dB.

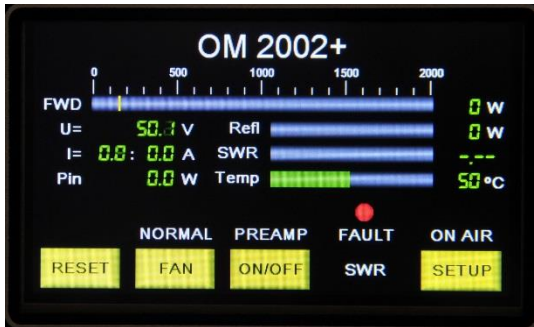
If all looks ok, you can increase RF power from the transceiver **slowly** and check important parameters of the PA. Do not exceed the output power of 1800 watts in CW operation mode and about 1500 watts in SSB, AM, FM and digi operation mode even if more is reachable.



We recommend using the maximum output power of 1500 watts to maintain good linearity of output signal in SSB or AM mode.



Check the temperature of PA during digi modes operation. Decrease the output power, when warning „Temp“ (under the FAULT LED) appears. Output power of about 1500 watts should be ok for 50% of duty cycle.



If something happened with PA loading (for example), protection circuit detects increasing of VSWR (reflected power). If this parameter exceeded the limit value, fault condition appears and PA will be immediately blocked.

Top picture shows such a situation. Fault LED is ON, transmitting is blocking. Under **FAULT** LED exceeded parameter is visible (SWR).



Touch **RESET** to reset fault status and return PA to the operation mode. Press PTT again to be able to transmit.

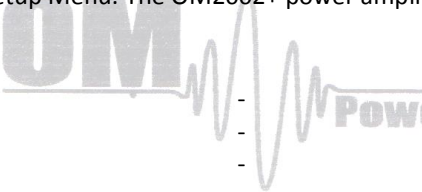
Bottom picture shows the cause of this fault status. VSWR exceeded the limit (1.9:1).

This picture is visible on the display only very short time after fault condition appears.

6. Maintenance

6.1. *Fault conditions*

If a fault condition appears during the operation of the amplifier, the safety circuits of OM2002+ will react, the **FAULT LED** lights. There are several fault or warning messages possible to appear on the display (under the fault LED) in **abbreviated** form, when some of the protection will be activated. To view fault history with full text of the faults, touch **FAULT** from Setup Menu. The OM2002+ power amplifier will respond to these conditions:



1.	High Output Power	-	FWD
2.	High Reflected Power	-	Refl
3.	High Input Power	-	Pin
4.	Different Current Error	-	Diff.
5.	Low Supply Voltage	-	Voltage
6.	PA too Hot	-	Temp
7.	High Supply Current	-	Current
8.	Overdrive Error	-	Overd.
9.	SWR too High	-	SWR
10.	Power coupler fault	-	Coupler

If the output power of the PA exceeds the limit value, „FWD” fault message appears on the display, transmitting will be blocked. **Fault LED** will lights. To be able to transmit again, you have to remove the cause of the error (decrease the input power). Touch **RESET** for going back to the operation mode.

When reflected power of the PA exceeds 180 watts, „Refl” fault message appears on the display, transmitting will be blocked. **Fault LED** will lights. In such a case try to decrease input power first, or improve matching and adapt better the impedance of your antenna. Touch **RESET** for going back to the operation mode.

When the input power of the PA exceeds limit value, „Pin” fault message appears on the display, transmitting will be blocked. Decrease the input power. There are two limit values. First (20% above full driving level) is for software protection. In this case software will block transmitting; PA will stay in OPER mode. Second and very fast protection will be activated, when the input power exceeds 50% above full driving level. In this moment input RF signal will be switched immediately to the dummy load and PA will go to STBY mode. Message „Pin” appears. Decrease the input power under maximum driving level and press **RESET** to resume transmitting possibility.

In the case of the main power supply failure, or when voltage drops below 42 volts, fault message „**Voltage**“ appears, transmitting will be blocked. We recommend to **switch PA** immediately **OFF** in such a case. You have to contact manufacturer or your dealer for assistance.

When the amplifier reaches inside temperature of 75 deg. Celsius, warning message „**Temp**“ appears on the display. **Fault LED** starts blinking. At 80 degrees protection circuit will automatically block transmitting (fault condition). You have to decrease the power or wait couple of minutes to be ready transmitting again. Touch **RESET**.

If current of the PA exceeds the limit value, „**Current**“ fault message appears on the display, transmitting will be blocked. Decrease input power first, touch **RESET** and try to transmit again. If this will not help and current will stay high, contact the manufacturer for assistance.



Never try to change or move any part inside the amplifier. Substitution of parts may void intrinsic safety!

6.2. Fuses

There are no fuses reachable from outside or from inside of the PA. If you turn the power amplifier ON and no LED will be illuminated, display stays dark, check mains first, and then contact your dealer. In such a case main power supply failure occurred, probably. Main power supply is removable from the rear side of the PA. There is no necessary to open upper lid.

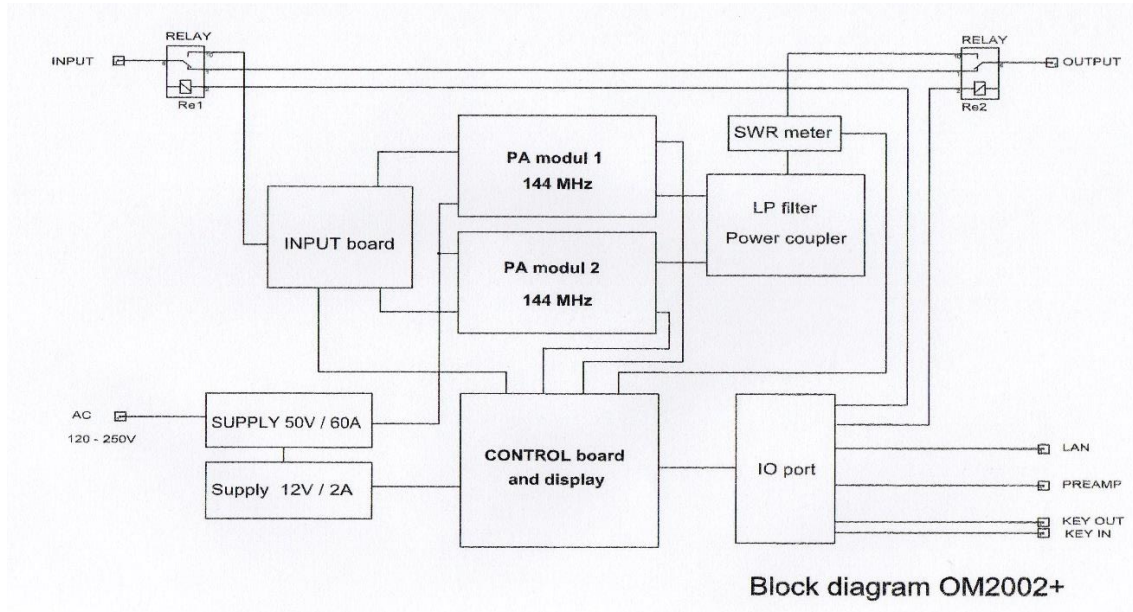


If for some reason you need to open upper lid of the amplifier, make sure that power supply has been disconnected. Take out power cord from the outlet!

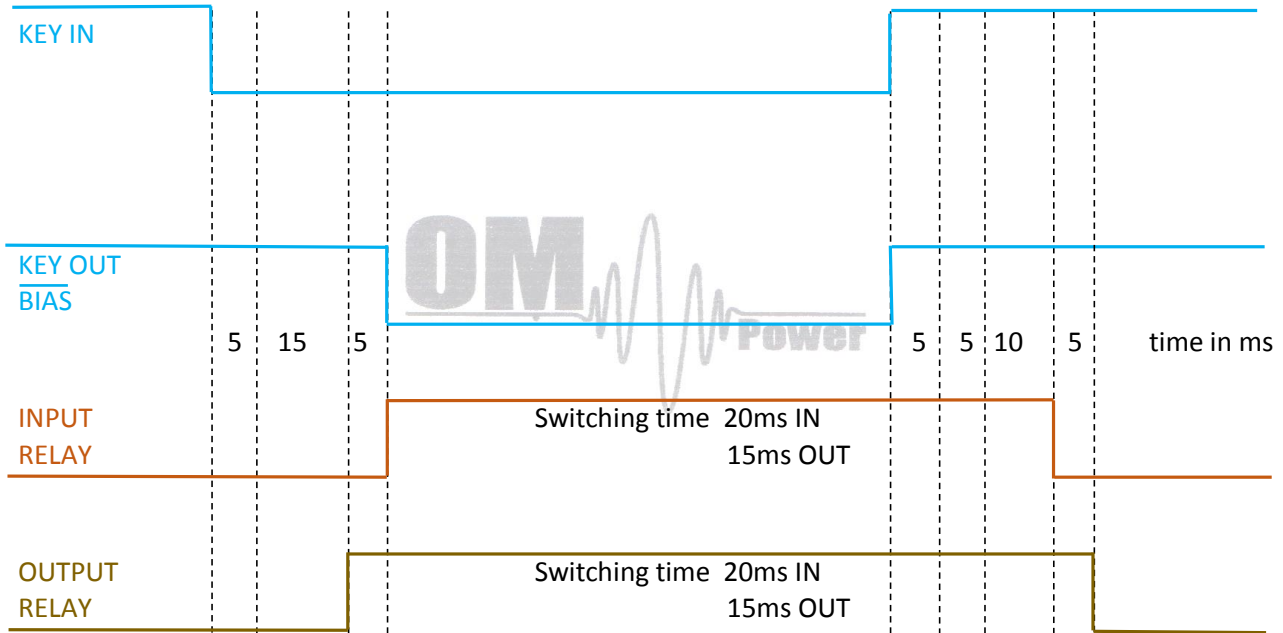
6.3. Cleaning

To prevent damage to the amplifier surfaces and the plastic components do not use aggressive chemicals for cleaning. Do not open the amplifier for cleaning. Outer surface may be safely accomplished by using piece of soft cotton cloth moistured with clean water or window cleaner.

7. Block diagram



8. Timing



In the case if LNA is active (PREAMPLIFIER ON)

