# Instruction Manual

# OM4000 HF

## SHORTWAVE POWER AMPLIFIER

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# 1. GENERAL INFORMATION

## 1.1. Introduction

The OM Power model OM4000 HF is a manual tuning power amplifier, designed for use on all short wave amateur bands from 1.8 to 29.7 MHz (including WARC bands) and all modes. . It is equipped with a two pieces of ceramic tetrode FU728F.

## 1.2. Specification

### 1.2.1. Parameters

| | |
|---|---|
| Frequency Coverage | Amateur Bands 1.8 – 29.7 MHz including WARC |
| Power Output | 4000W in SSB and CW, 3000W in RTTY, AM and FM |
| Input Power | Usually 60 to 90W for full Output Power |
| Input Impedance | 50 Ohm, VSWR < 1.5 : 1 |
| Power Gain | 17 dB |
| Output Impedance | 50 Ohm unbalanced |
| Maximum Output SWR | 2 : 1 |
| SWR protection | Automatic switching to STBY, when reflected power is 350W or higher |
| Intermodulation distortion | 32dB below nominal output |
| Suppression of harmonics | < -50 dBc |
| Tubes | 2x FU728F Ceramic tetrode |
| Cooler | Centrifugal blower + Axial blower |
| Power supply | 2 x 230V – 50 Hz one or two phases |
| Transformers | 2 pcs of toroidal transformer 3kVA |
| Dimensions | 485 x 200 x 455mm (width x height x depth) |
| Weight | 43 kg |

### 1.2.2. Protection Circuits

There are 11 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.

- VSWR too high
- Input power too high
- Output power too high
- Plate voltage too low
- Anode current too high
- Screen current too high
- Grid current too high
- Mistuning of PA
- Hot switching protection
- Soft start for protecting your fuses
- “switch-on blocking “ at opened amplifier

### *1.2.3. Indicators*

There are couples of LED and bar graph indicators visible on the front panel to inform you about value of some parameters or operation status:

| | |
|---|---|
| Bar graph indicators | Power output - 50 LED<br>Reflected power – 20 LED<br>Current at screen Ig2 – 10 LED<br>Anode voltage, anode current, tuning – 30 LED |
| LED Indicators | Current at control grid (Ig1 – 2 LED)<br>WAIT – preheating of tube (180 sec)<br>STBY – standby<br>OPR – operation condition<br>FAULT – failure, switching off for abt. 2 sec |

## 2. SAFETY INSTRUCTIONS

**WARNING!**
**DANGEROUS HIGH VOLTAGE!**

**The power amplifier is using high voltage up to 3400V DC, which is very dangerous for human life! Read next safety instructions carefully first, before you will start to install and operate power amplifier! NEVER VIOLATE NEXT RULES!**

**WARNING! NEVER ALLOW CHILDREN to play around PA or to touch power amplifier or connected cables in working condition, or to push anything into the case holes!**

**WARNING! The amplifier contains high voltage circuits. Never turn the amplifier on without the upper lid in place. DO NOT ATTEMPT TO SHORT OR BYPASS safety switch under upper lid!**

**WARNING! The OM4000 HF amplifier is neither to be used in a WET or HUMID environment nor to be exposed to RAINFALL!**

**WARNING! 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!**

**WARNING! Before opening the upper lid of the amplifier make sure that power supply has been disconnected AT LEAST 5 minutes, allowing the electrolytic capacitors to discharge fully. Disconnect power cord from the outlet!**

**WARNING! OM4000 HF amplifier can be operated ONLY if both of supply cables are connected! The amplifier reaches optimal parameters in 2 phase's system, if you do not have 2 phases, connect both mains cords into the same phase.**

**WARNING! Make sure that all screws holding the case together are properly in place and tightened before carrying the amplifier with the handles!**

**CAUTION! The amplifier must be installed in such a way that free flow of hot air from the tube is allowed. The amplifier must not be installed in a constrained surrounding (i.e. tight shelves etc.). During long operation the upper lid and the vent grid can reach high temperature!**

**CAUTION! The amplifier must be properly grounded during operation.**

**CAUTION! During operation the amplifier must be installed in such a way that the back of the amplifier remains accessible.**

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

**CAUTION! Read this manual carefully. Fallow 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!**

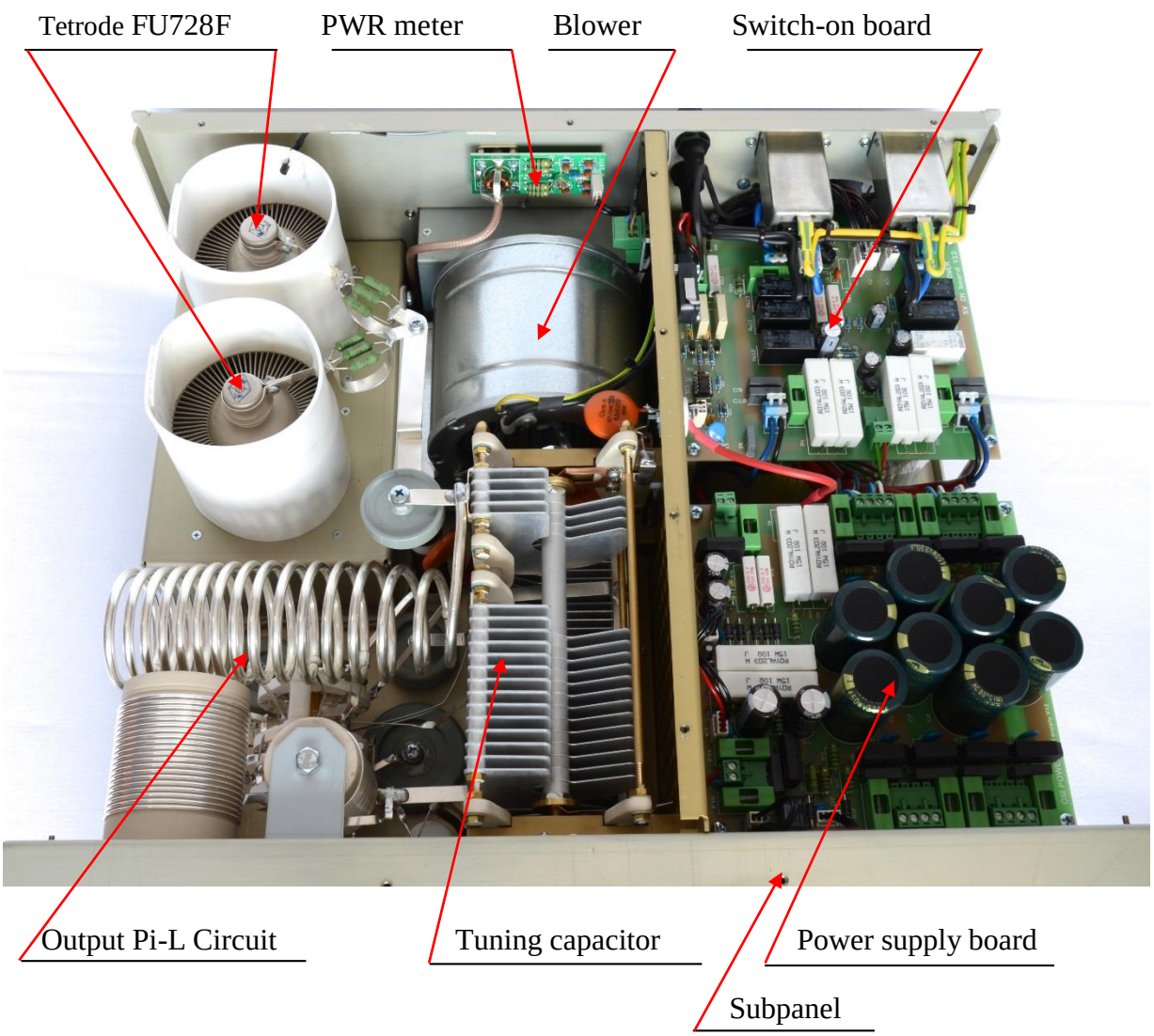
## 3. GENERAL DESCRIPTION

### *3.1. HF part*

This amplifier is using two pieces of ceramic tetrode FU728F in a grounded-cathode circuit (input into control grids). OM4000 HF achieves excellent linearity by the voltage stabilization of the control grid bias and the screen voltage. The power input is given to the control gridS, using a broadband input circuit with an input impedance of 50 Ohms. This adaptable input circuitry ensures a good input SWR (better than 1.5:1) on all amateur bands.

The output of the amplifier is a Pi-L circuit. The ceramic capacitor for TUNE and LOAD are divided. This enables the amplifier to be tuned exactly and makes it possible to easily return to the previously set positions after band changes.

**Top view on the opened OM4000 HF**




### *3.2. Power Supply*

Power supply of the amplifier is comprised of two of 3 kVA toroidal transformers. A soft start is provided using relays and resistors.

The high anode voltage is made by combining 8 x 420 V (total 3360V) @ 2.5A. Each has its own rectifier and filter. In the high voltage circuit, safety resistors are employed to protect the amplifier against overload.

The source for screen grid is regulated by parallel stabilization with BU941 NPN Darlington transistors and delivers a voltage of 350V at 200mA. The -120V for the control grid is regulated with Zener diodes.

### *3.3. Safety Devices*

Control and monitoring circuits ensure control and safety during malfunctions of the PA. These are on the Control board, which is located on the chassis subpanel.

## 4. INSTALLATION

NOTE

Read this chapter carefully prior you will start installation. Before unpacking inspect shipping woody container 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*

**CAUTION**

**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 mm$^2$ at least**.

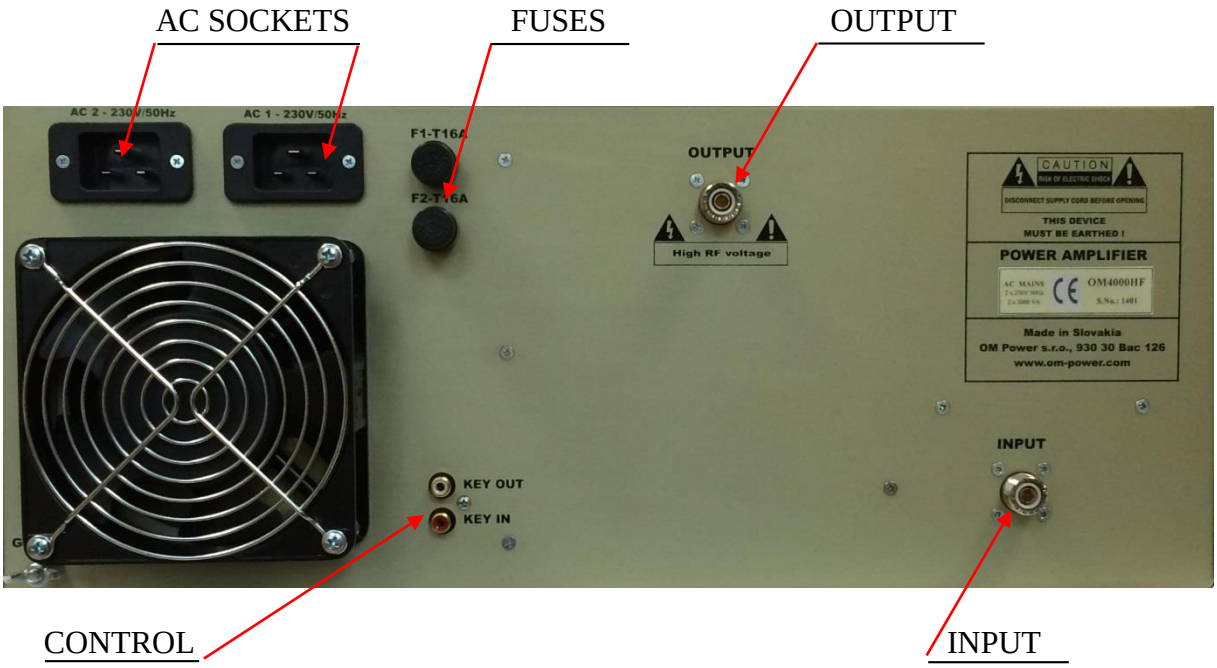
Connect your transceiver to the same grounding system of your shack carefully!

Use minimum length cables and make certain that the connections are both physically and electrically sound. With poor grounding, you may risk damaging 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, RG213 or similar coaxial cable suited for high power is recommended. Both the INPUT and OUTPUT SO-239 sockets with Teflon insulation is used.

**Rear view of the amplifier OM4000 HF**




### *4.3. Control Cable*

Control cable maintains TX / RX switching of the PA (TX GND). The cable is 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.

The relays of the OM4000 HF have to be switched earlier than HF is applied (cold switching).

Modern transceivers they have a time delay between PTT switching and power output.

**CAUTION**

**If you are using and 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 at the transceiver.**

The amplifier is equipped with two 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 30V / 50mA) |

### *4.4. Mains Supply*

**WARNING!**
**The power Amplifier OM4000 HF has to be connected TO THE MAINS WITH BOTH CABLES! The amplifier reaches optimal parameters in the system with 2 phases. Every phase has to be able to deliver 3kVA. If you do not have 2 phases system, connect both mains cords into the same phase. In such a case the amplifier can´t deliver full power output!**

**CAUTION**
**Be sure you got PA with properly terminated mains cables, 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.**

**WARNING!**
**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*

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

The centrifugal blowers provide the necessary cooling of the amplifier, even during long contests. The main blower is activated by switching the PA on and it is turned off when cooling is finished (approx. 1-5 min after switching off the PA depending on the temperature of the tube). The supplemental fan is turned on depending on the temperature of the air exiting from the amplifier. It is switched on at 70°C and switched off at 60°C.

## *5. OPERATION*

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

**CAUTION**
**Before switching PA on, check all connections between PA and TCVR.**

**CAUTION**

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

**CAUTION**

**Never try to change antenna output during a transmission to avoid warranty loss.**

NOTE

When you decide to have a short operating break, place the amplifier in the standby mode rather than switch it off.

### *5.1. Operation Elements*

There is couple of operational elements accessible or visible on the front panel.

**BAND-** Band selector switch (not in the picture).

**TUNE -** Anode capacitor for tuning, tuning of higher frequencies to "0", lower frequencies to „100“.

**LOAD -** Output capacitor tunes antenna load resistance to amplifier. Capacity is low at „100“ and high at "0" on the scale.

**OFF -** You switch off the amplifier by pressing this button.

**ON -** You switch on the amplifier by pressing this button. After 3min of warm-up delay, the amplifier will be ready for operation.

**OPR/STBY** „OPERATE“ sets the amplifier ready for transmit operation. In STBY, if WAIT-LED is on or the amplifier is OFF, the amplifier is in bypass-mode and your transceiver is directly connected to the antenna. Maximum allowed power in bypass mode is 200 Watts!

**RF OUTPUT** Bar graph – shows output power .

**REFLECTED POWER** Bar graph – shows reflected power from the antenna. Maximum level is 350W otherwise amplifier switches to STANDBY mode.

**Ig2** Bar graph – measures the current of the second grid from -80mA to +120mA.

**HV/IP/TUNE** Bar graph – measure the anode voltage, anode currency or tuning of PA.

### *5.2. Tuning of Power Amplifier*

The OM4000 HF amplifier is operated in class AB. Thus it’s possible to obtain a maximum output power at excellent linearity. For this purpose the amplifier has to be tuned carefully.

**WARNING!**
**Before starting tuning you have to check if the right antenna or a 50 Ohms load resistance is connected at the antenna output!**

**CAUTION**
**The operation of a mistuned PA will cause malfunctions, the increase of grid current (the GRID-MAX-LED will light up) and problems with TVI/BCI.**

**CAUTION**
**The grid-current is shown with 2 LED diodes. It’s normal if the green LED is flashing or may be shining a little bit during peak operation. If you overload the amplifier the output power increases the grid current at very small rates and the red GRID-MAX-LED is shining and the safety devices switch the PA to STBY. You must decrease the input power.**

**CAUTION**
**In SSB mode you will have good output power if the green LED lights up a bit. The current of screen grid is measured and shown in a Bar graph Indicator. The amplifier has to be tuned in such a way that the current is between - 80 mA to +80 mA. At currents beyond these values the operating point will be shifted and IM-products will be rapidly increased. If a value of + 100mA is exceeded, the safety devices will switch the amplifier to STBY mode.**

1. Set the multimeter switch to the **HV** position
2. Set the OPR/STBY switch to the **STBY** position
3. Press the **ON** button

The amplifier is prepared for operation with the following automatic steps:

- The toroidal transformers are switched on step by step.
- The cooling blower for the final tube is switched on.
- The multi-meter bar graph measures the high voltage; the normal value is **3.3 kV**
- The WAIT LED lights up

**CAUTION**

**After switching on, please confirm that the blower is operating properly. Air must be flowing from the ventilating aperture above the tube. If there is any concern, or no air flow, press the "OFF"-button immediately !**

Heating the tube takes about **180 seconds**. After this time the WAIT LED goes out and the amplifier is ready for operation.

4. Reduce the power output of your transceiver to the **minimum!**
5. Switch OPR/STBY to **OPR** position (OPR LED lights up)
6. Choose the **TUNE** position of multi-meter
7. Transmit (mode CW) and increase driver power to **10W**

**CAUTION**

**If the input power is higher than 15W and the power amplifier is not correctly tuned, the safety devices will switch to STBY. After switching the amplifier to STBY, the amplifier will automatically reset and switch back to OPR mode after abt. 2 seconds.**

A tuning table is delivered with the power amplifier. Select a band with band switch and choose the setting of "TUNE" and "LOAD" according to the table.

**NOTE**

Delivered tuning table was made for 50 Ohm loading of PA (dummy load). Each amplifier should have different values depending on used frequency and used type of antenna. **Make your own table** valid for your real conditions.

**Tuning Table** shows proper tuning values for **50 Ohm termination**.

| Band | Tune | Load |
|---|---|---|
| 1.8 | 30 | 50 |
| 3.5 | 65 | 55 |
| 7 | 50 | 85 |
| 10 | 60 | 25 |
| 14 | 70 | 40 |
| 18 | 70 | 45 |
| 21 | 30 | 65 |
| 24 | 45 | 60 |
| 28 | 15 | 75 |

8. Set TUNE knob in such a way, that the TUNE-LED lights up maximum left.
9. Set LOAD in such a way, that the TUNE LED on the TUNE scale lights up under the "**V**" sign. If it is possible to obtain the LOAD in 2 positions, set the position that is more to the right.
10. Repeat tuning several times according to 8 and 9, power output should be abt. 600W
11. Increase the input power (to about 50-70 W) until an output power of approximately 4000W will be reached.
12. Repeat steps 8 and 9
13. Set TUNE to maximum output power (RF POWER LED lights up maximum right)

After this procedure the amplifier is tuned correctly and ready to give 4000W output power in all operation modes.

At optimal tuning and full output power a positive max. 80mA current goes through the second grid. On 24 and 28 MHz bands optimal tuning can be achieved when one or two LEDs are lit up to the right from the position "V". If less output is desired you can simply decrease the load of the transceiver.

**CAUTION**

**Should the amplifier demonstrate any malfunctions during tuning or should it not behave in accordance witch the description, interrupt the tuning procedure immediately and check the amplifier! Be sure to have not done any mistakes in choosing bands or TUNE/LOAD values! Be sure that VSWR is not higher than 2:1 and input power is LOW!**

After excluding possible human mistakes you will be able to work for long time with this amplifier!

# 6. MAINTENANCE

## 6.1. *Indication of fault conditions*

OM4000 HF has the following indication LED on the front panel:

| | |
|---|---|
| GRID MIN | - Indication of first gird current |
| GRID MAX | - Max. First grid current exceeded |
| HV | - Measuring of anode voltage by bar graph |
| IP | - Measuring of anode currency by bar graph |
| FAULT | - Fault |
| OPR | - Amplifier in operation mode |
| STBY | - Amplifier in standby mode |
| WAIT | - Heating of tube after switching on the amplifier |

NOTE

Should a fault condition appear during the tuning or operation of the amplifier, the safety circuits of OM4000 HF will react. The amplifier will be turned to STBY mode. After abt. 2 sec the control circuits will switch the amplifier back to OPR.

**CAUTION**

**If the fault will repeat 3 times after each other the control circuits will turn the amplifier to STBY. Bringing the amplifier to OPR is enabled by using the OPR/STBY switch only.**

After reaction of safety circuits, the FAULT LED will be lit up for approx. 5 sec, depending on the nature of the fault.

Flashing LED signalizes:

| | |
|---|---|
| IP | - Anode currency exceeded |
| HV | - Low anode voltage |
| FAULT | - Reflected output exceeded |
| GRID MAX | - Grid currency exceeded |
| | - Screen currency exceeded |
| GRID MAX + HV | - Maximum load power exceeded |
| GRID MAX + IP | - Zero output power during tuning |
| HV + IP | - Tuning fault, incorrect tuning of the Pi-L output circuit |

**In the case when your OM4000 HF amplifier is not working correctly, please contact the manufacturer or your dealer.**

**Manufacturer's contacts:** **OM POWER, s.r.o. 93030 Báč 126, SLOVAKIA**
**Phone : +421 905 321 410**
**e-mail : om-power@om-power.com**

### *6.2. Fuse Replacemeent*

The user is allowed to change mains fuses (6,3 x 32mm), accesible from the rear panel, only. In the case of interrupted fuse (fuses) inside the power amplifier, contact your dealer, please.

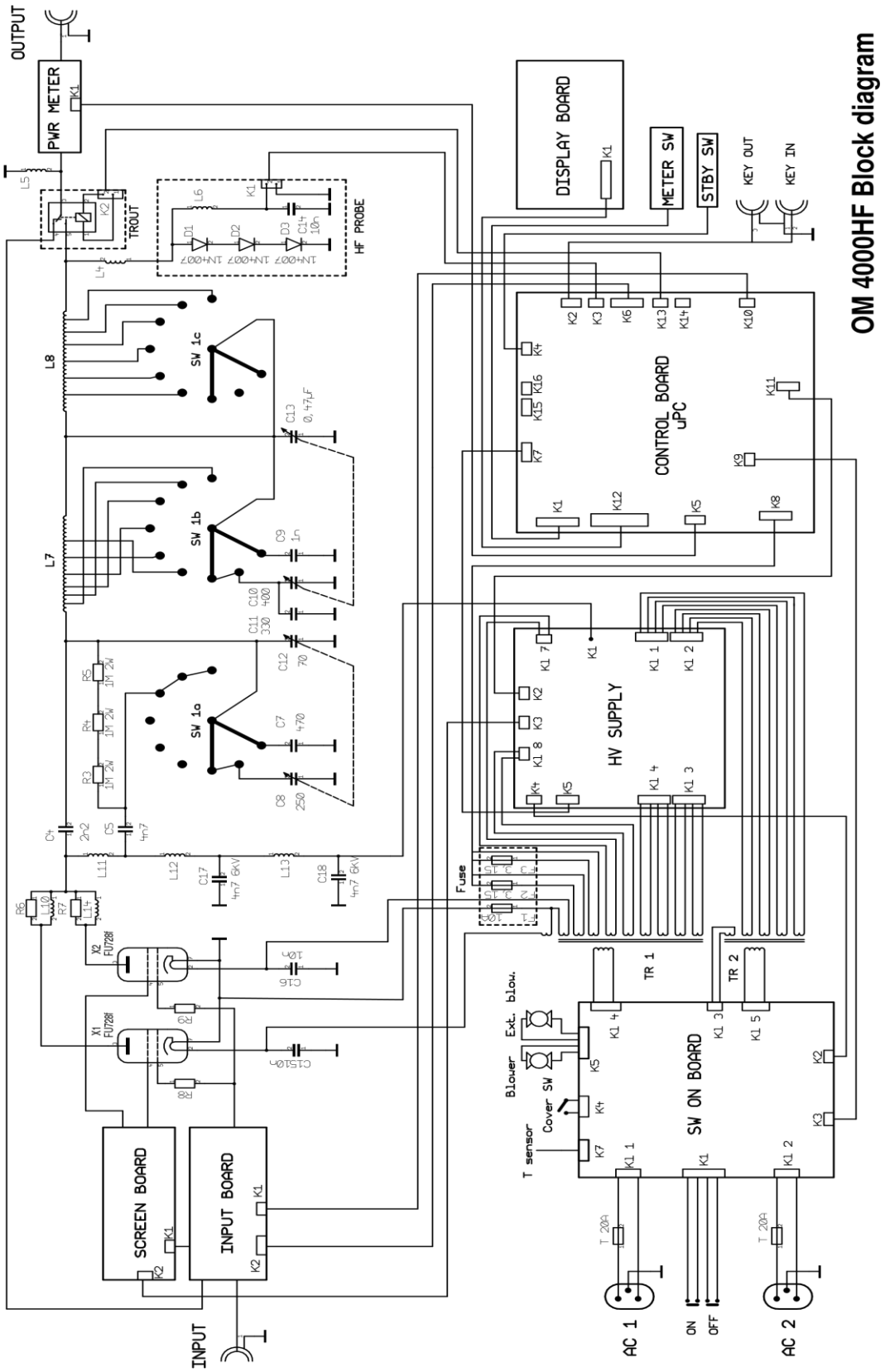
### *6.3. Tube Replacement*

In the case of vacuum tube damaging, contact the manufacturer or your dealer for ordering new one. You will get instructuions how to change tube and how to preset proper parameters, too. **Be very careful, you will do it only on your own risk!**

If you are not comfortable to replace vacuum tube itself, contact your Service Center, please.

### *6.4. Cleaning*

To prevent damage of amplifier surfaces and 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. APPENDIX*

## *7.1. Block Diagram of OM4000 HF Power Amplifier*