

ME3000-V

**2M LINEAR AMPLIFIER
GU78B
LED BARGRAPH VERSION**



Mechanics & Electronics Inc. Hungary

Draskovits Gábor HA1YA Szombathely, Kárpáti K. u. 43. H-9700

e-mail: ha1ya@isiscom.hu web: www.ha1ya.hu

CONTENT

1.0	General overview	2
2.0	Specifications.....	4
3.0	Technical description	5
3./a	Front Panel	6
3./b	Rear Panel.....	8
4.0	Installation	9
5.0	Troubleshooting.....	10
6.0	AC wiring	13
7.0	Drawings	14

ATTENTION!

**Please read this manual carefully before operating the equipment!
The Linear Amplifier is easy to use, and damages can be avoided by following the instructions stated below. Incorrect use may cause the loss of warranty.**

1.0 GENERAL OVERVIEW

The Linear Amplifier is produced by M+E Mechanics & Electronics Inc. During the design of the ME series, the main point was to construct Linear Amplifiers for HF, VHF, and UHF amateur bands with similar mechanical measures and appearance, using ceramic valves easily available on the market.

The ME500-3000 series utilises the advantages of the ceramic valve, and considering the power output and price, is a worthy competitor of similar equipment on the market.

The Amplifiers are protected by modern circuits,- specially designed and used only by our company,- providing a very high level of protection. With their low input power and high efficiency they fulfil the requirement of an improved amateur station.

To use the Amplifier with satisfaction and utilising all it's advantages , please read the following general instructions carefully:

- 1.1 Do not use higher driving power(35w) as given in the instruction manual. During SSB transmission the 'MIC GAIN' control of the TCVR is not fit for the TCVR is regularly activating the protection of the Linear.
In case of lately designed equipment the output power of the TCVR is control of the radio.
- 1.2 The SWR protection of the Linear is inactive during STBY mode.
Max VSWR must be <1:2 in QRO mode, than the protection will active.
- 1.3 The required external HV power supply input is 230V 50/60 Hz or 400V 50/60 Hz between two phase according to the EU standard. Verify that the rating of the line fuses located in the rear panel of power supply 20A is suitable for the AC line voltage you will be using. The fuse should be jump off type. The rating should be 25 Ampere by 230V AC, 20 Ampere by 400 V AC.
- 1.4 The Amplifier is constructed with a forced air cooling. Free air movement has to be provided and considered during positioning.
Do not operate the Amplifier in excessively warm locations or near heating vents or radiators. Be sure air can circulate freely around and through the Amplifier cabinet, and can provide an unobstructed air inlet for the internal cooling fan. Do not place any books, magazines, manuals, or equipment that will impede the free flow of air near the sides and the hot air exhaust holes located on the top of the cabinet. The internal fan allows an air flow of approximately 200m³/hours. The exhaust air becomes quite warm at high power levels. Do not position any heat-sensitive objects in the exhaust airflow path.

1.5 The PA is constructed with the following protection circuits and useful features:

- Heat up time checking circuit 180sec.
- Protection circuits (Ia, Ig1, Ig2, temperature, SWR>2, ext.)
- Cooling fan(250m³/h)
- Function and status indicator LEDs (6 pcs)
- 4 LED bargraph front-page (RFOUT, RFL, Ig1/Ig2, Ia/Ua)
- 5KVA transformer
- Built-in 3-way PIC controlled sequencer./PRE,TVR,PA/
- Built in I/O coax relays 7/16" connectors.
- External ME3000-S HV supply,230V or 400V AC depending from order.

2.0 SPECIFICATIONS

ME3000-V

Frequency coverage	144-146MHz	
Operating modes	ALL mode	
Output Power	3000 W pep	CW/SSB
	1.8KW FSK 1min. cycle	continuous
Driving Power	0-35Wmax, 25W typ.	
Input VSWR	max 1:1.5	
In/Out impedance	50 Ohm	
Valve(s)	GU78B	
T/R System	opto 5V/1mA	OPEN COLL. OK
Harmonic supression	>50dB	at 2000W RF out
Intermodulation	>35dB	at 2000W RF out
Protection	Ia > 2A	
	Ig1 > 25mA	
	Ig2 > 40mA	
	Temp > 80C°	
	VSWR > 2	
Dimension	19X14X14 coll	
Weight	25kg	

3.0 TECHNICAL DESCRIPTION

1. GENERAL

RF deck of this amplifier is built in aluminium compartment which must be electrically tight to avoid RF radiation. RF radiation will decrease output power and can cause self oscillation of the transmitter chain as well as a health risk. We can build "box" version the line ME2000-ME3000..

2. INPUT CIRCUIT

Tube is driven in grid 1 with grounded cathode. Grid 1 is loaded with 100 ohm RF power resistor in order to decrease gain and increase stability factor. Loading resistor is connected on the "way" between grid 1 and resonance tuning capacitor of the matching circuit due to this parasitic inductance of the tube plus tube socket. The input circuit is working between 144-146 MHz without external tuning. The input SWR is better than 1:1.5 in this segment. The input vswr factory set on 144.200MHz to the minimum (<1:1.1)

3. OUTPUT CIRCUIT

Output resonator is based on W6PO design. Tuning for resonance should be done by changing length of two resonators rather than increasing C5 tuning capacitor. The output capacitor value is about 3-4 pF. Tune is very easy to maximum output we set it the best efficiency on peak output.

4. COOLING

Cold air inlet is located in to input compartment. We can deliver the PA with external fan 230V/250m3. Air flows through over the cathode box and across the tube body and anode cooling fins. Hot air outlet is located above the tube anode cooling fins. The protection circuit will work over 80 degree air temperature.

5. TUNING THE AMPLIFIER

Tuning the input resonance circuit should be done using VSWR meter connected between driver and input. Output coupling capacitor should be set as on the schematic to about 4pF.

Output you can indicate across the built in power meter. The output is 4.4KW pep in right end of the output bargraph.

Before any high voltage will applied to the tube, tube should be run on heater for several hours especially if the tube wasn't use for long time. From this point of time, cooling must be operational.

Having heater voltage connected to the tube without adequate cooling will damage the tube.

Anode voltage should be applied /from your external high voltage supply ME 3000-S/ and idle conditions of the amplifier checked. Push the PTT and you can see about 200mA on Ip bargraph. When you have more than this value, you can adjust this value with P1 poti on Ug1 stabilizer.(over bottom cover slots..)

3/a FRONT PANEL

1. ON LED

The LED indicator glows when the Linear is switched on with main switch on ME3000-S HV supply. Doesn't lit on case the 12V and 24V DC – supply for the protection circuits and antenna switch - is missing.

2. OVR LED

The blinking red LED indicates the active stage of the protection circuit. The protection might be active due to overdrive, I_{g1} , I_{g2} , I_p higher as specified, $SWR > 2$, output air temperature higher than 80 degree C. (no fault led indication)

If the protection is active, the TCVR power by-pass the PA. To reset the protection release the STBY switch, than push it again. The reason of the trouble has to be cleared first.

When output air temperature is higher of 80 C, only the OVR LED blinking because doesn't separate LED display for the high temperature. You can reset „warm air” problem, when the temperature is going back down 75 C.

3. AIR LED

The indicator glows during the transmitting periods.

4. OPR LED

Glows when the PA is ready for transmission. During heating up period, when the LED doesn't lit, the driving is blocked. The stby time is about 180 sec.

5. WAIT LED

Blinking during the heating up period, indicating that the heating is in progress. Required time is abt. 180 sec, when the light goes out and the OPR led lit up.

6. QRO LED

Indicates the high power mode of the PA. Can be activated by the switch OPR/STBY. On case STBY mode the TCVR power goes directly to the aerial.

7. HV PUSHBUTTON

When you push this red button you can see the anode voltage on I_p /HV bargraph. Multiplay the scale with x2. (full scale is 6kV).

8. I_{g2} PUSHBUTTON

Normally you can see on the I_{g1} / I_{g2} bargraph the current of the grid1(I_{g1}). When you push this button you can check the actual I_{g2} current on this scale.

9. OPR/STBY SWITCH

The PA can be driven only if this switch is ON. If the switch is in STBY position the PA don't receive high voltage, it is on „bypass” position.

In case the overload protection is active, release the the stby switch and push it again to reset the protection circuit.

10. RF FORWARD POWER BARGRAPH

Indicate RF output power in KW.

11. REFLECTED POWER BARGRAPH

Indicate the reflected power in Watts.

12. I_{g1}/I_{g2} BARGRAPH

Indicate grid 1 current, when you push the G2 pushbutton indicate the G2 current in mA.

13. I_p/U_a BARGRAPH

Indicate the I_a current when you push the HV pushbutton indicate the U_a voltage in KV.(scale 2x)

14. TUNE KNOB

Used for tuning the PA. Tune it for max. output power.

15. FAULT LEDs

You can check one or more LED-s blinking on case overload. You can check what cause of the problem. There is not LED display for overheating, on this case only the OVR LED is blinking.

3/b REAR PANEL

1. Remote connector 7 pin
Connecting with short cable to ME3000-S power supply.(gray cable,7 pin)
2. FAN 1
Cooling fan of the RF tube (230V/AC)
3. PTTin (red RCA)
SEND relay contact input (paddle,computer ptt out,etc). The relays are closed by earth connection. Low voltage, low current entry of the sequencer. Fit for open collector control as well.(it saved with 6.8V bipolar suppressor)
5. INP
Input connection for the driver TCVR. 50 Ohm.("N")
6. OUT
Aerial connection 50 Ohm (" 7/16"connector).
7. GND
Ground connection.
8. SCART connector (If you want, you can order)
Connect possibilities to external units, preamplifier, etc....You can use free relay contacts of Ug1 stabilizer unit relay for external units.(TXG,RXG, PTTin,GND etc) Normally N.C,
9. Sequencer output RCA's
Near of the red PTTin RCA you find 3 other RCA's:
 - 1st is the TCVR ptt out (give ptt signal to your radio 100msec later when you put the PTT red input to GND. (radio go to TX)
 - 2nd PA on TX gnd output(parallel with PA i/o relays)
 - 3rd PReamplifier relay ground switch parallel with Pttin in time . +60V/30A MOSFET open drain outputs!!!

4.0 INSTALLATION

- 4.1 Connect your TCVR to the Linear using a short, 50 Ohm coaxial cable.**
- 4.2 Connect paddle, computer PTT out on case DIGI MODES to the PTTin RCA socket(red) on the rear panel. The send out of the radio is not the best solution because on this case your radio will send and give out power immediately, but usable.
Connect your PREamp relay output to the PRE output of sequencer.**
- 4.3 Connect your aerial to the OUT socket of the Linear. VSWR must be better than 1:2.**
- 4.4 Using a flexible cable at least 6mm², connect your PA to a suitable grounding point and to the grounding point of the transceiver, and to ME3000-S HV power supply.**
- 4.4 Connect the power cord to the mains and switch on the equipment (ME3000-S).**
- 4.5 Connect the remote and HV cable.**
- 4.6 SWITCH ON the supply. The ON LED glows and the WAIT LED start blinking for a period of abt. 180 sec, during the heating period. Set the OPR/STBY switch to STBY position before switch on the supply.
The readiness of the Linear is indicated by the OPR LED. The control unit will switch the high voltage to linear only, when the OPR LED lits, and you switch the STBY/QRO to QRO position. The vacuum relay can switch the HV only on case if you connected the HV cable to linear!**
- 4.6 Switch the OPR/STBY switch to OPR. Check the Ua voltage, push the red HV knob the led bargraph will sign about 1.8KV(3.6kv) Give small cw driving power to reach 300-400 mA indication on the IP bargraph. Set Tune knob and tune the Linear to reach maximum output power on RF out bargraph. Increase the driving power until maximum anode current(1-1.3A max), than carry out fine tuning using the Tune knob again. In case a 50 Ohm aerial, the power meter will indicate the output power exactly. NEVER use more input power than 35W! On reflected power bargraph you can check the reflected power of your antenna. Check the Ig1/Ig2 currents, if everything is right you can start the work. After the some minuts, when the PA will reach the working temperature tune for the peak output again with TUNE knob if necessary.**

REMEMBER THIS AMPLIFIER DOES NOT REQUIRE MUCH DRIVE POWER. SO START WITH LOW DRIVE POWER, AND THEN TUNE TO RESONANCE AS OUTLINED ABOVE. OTHERWISE, ARCING MAY OCCUR INSIDE YOUR AMPLIFIER.

NEVER RUN YOUR AMPLIFIER FOR ANY SUSTAINED PERIOD WITH A G2 CURRENT READING GREATER THAN SPECIFIED. IF YOU DO, POSSIBLE DAMAGE AND FAILURE OF THE TUBE(S) WILL RESULT, AND THEY WILL NOT BE COVERED BY WARRANTY!

NEVER USE MORE DRIVING POWER AS 35 WATTS!

5.0 TROUBLESHOOTING

Malfunctions are mostly due to improper handling, overload or similar reason.

5.1 Do not use higher input power as stated in the specification. The grid protector circuit will usually safe the power valves, but OVERLOAD alarm will appear regularly. This may happening often in SSB mode, especially in case of old transceivers, when the output power in SSB mode is not adjustable. The 'MIC GAIN' knob is not fit for power reduction!

5.2 INPUT SWR

The input SWR of the Linear is $< 1:1.5$.

A well adjusted TCVR will tolerate these values without any trouble.

5.3 OUTPUT SWR

The protection of the Linear will block the transmission in case the SWR of the aerial exceed 1:2 use good quality connectors , cables etc

5.4 FAILURES

- The PA not turn on, nothing happens when the main switch is ON.
 - External AC wiring, fuse or circuit breaker may be open.
 - Amplifier power cable not in place.
 - Fuse F1, F2,F3, F4 open or missing - check fuses .
 - 1 or more phase is missing.

- The PA turns on but no HV is indicated on bargraph.
 - The HV cable is not on his connector any phase missing,
 - You connected the HV cable?
 - You switched the STBY/QRO switch to QRO position?
 - Check visually 3 green status led on the UCU-04 control unit:
 - If 3 leds lits you have Ua,UG1, and UG2 voltage in the PA.
 - Check the serial 10ohm/10W resistors, check the panel fuses(1.6A and 500Ma)
 - Check the UG1 or UG2 stabilizer units if any UG1 or UG2 leds doesn't lits.

- **No idle current when you push the PTT (about 150-200 mA on bargraph).**
 - **Ua, Ug2 or Ug1 voltage is missing (You can check it visually: 3 green led lit inside of PA box on control unit if you have this voltages.) Check fuses on Ug2 and Ug1 board, check both stabilizer board. (Bottom side of PA)**
- **The idle current is too low or too high.**
 - **Check the Ig1 and Ig2 voltage on his PCB boards. (-Ug1 approx. 73-75V, Ug2 must be 310V) You can set the idle current on poti of Ug1 stabilizer panel (You can set it with screwdriver over slots of bottom cover of the PA)**
- **You can indicate Ip current on Ip bargraph when you drive the PA, but is not any output power.**
 - **Check the output coaxial relay contacts.**

5.5 LIMITED WARRANTY

The M+E *Mechanics & Electronics* will warrant that the equipment will perform substantially in accordance with the written materials for a period of 12 month from the date of receipt and will be free from defects in material and workmanship under normal use. This Limited Warranty is void if failure of the equipment has resulted from accident or misapplication, any kind of modification done, overvoltage, shipping, and in case the damage of the power valve(s.)

Warranty repairs done only on the base of the M+E *Mechanics & Electronics*. Return cost will be covered by the PA owner.

5.6 ALWAYS THINK - SAFETY

THIS LINEAR AMPLIFIER DESCRIBED IN THIS MANUAL CONTAINS VOLTAGE HAZARDOUS TO HUMAN LIFE AND SAFETY WHICH IS CAPABLE OF INFLECTING PERSONAL INJURY. NEVER OPERATE THE AMPLIFIER WITH THE TOP COVER REMOVED AND THE TOP COVER SAFETY SWITCH DEFEATED. BEFORE REMOVING THE TOP COVER MAKE SURE THE AC LINE POWER CORD HAS BEEN DISCONNECTED FROM THE AC POWER SOURCE. ALLOW A MINIMUM OF 5 MINUTES TO ELAPSE BEFORE REMOVING THE TOP COVER AFTER POWER HAS BEEN REMOVED. THIS IS NECESSARY TO ALLOW THE PLATE VOLTAGE FILTER CAPACITORS TO BLEED DOWN TO A SAFE LEVEL.

Before operating this unit ensure that the protection conductor (green/yellow wire) is connected to the ground (earth) protective conductor of the power outlet. Do not defeat the protective features of the third protective conductor in the power cord by using a two conductor extension cord or a three-prong/two-prong adapter.

Before operating this unit:

1. Ensure that the instrument is configured to operate on the voltage available at the power source. (See Installation Section)
2. Ensure that the proper fuses are in place in the amplifier's AC line fuse holders located on the rear panel.
3. Ensure that all other devices connected to or in proximity to this amplifier are properly grounded or connected to the protective third-wire earth ground.

If at any time the amplifier shows visible damage, has sustained stress, emits a foul smell, fails to operate satisfactorily, it should not be used until its performance has been checked by qualified service personnel.

Connect a good earth or water pipe ground to the ground post on the rear of the Amplifier. Use the heaviest and shortest connection possible. Before you use a water pipe ground, inspect the connections around your water meter and make sure that no plastic or rubber hose connections are used. These connections interrupt the continuity to the water supply line. Install a jumper around any insulating water connectors you may find. Use heavy copper wire and pipe clamps.

It is best to ground all equipment to one point at the operating position and then ground this point as described above.

5.7 SAFETY INTERLOCK SWITCH

While the Amplifier's top cover is in place, the interlock switch closes to allow AC line voltage to reach the power transformer. When the top cover is removed, the interlock switch opens and disconnects the line voltage. This does not discharge the bank of power supply filter capacitors. Be sure to allow the filter capacitors to discharge before you touch anything inside the Amplifier. You can select the High Voltage function of the Multimeter to check the high voltage potential.

6.0 AC WIRING

ME3000-S HV supply connect to 400V/3 phase line:

400V/3 phase con.	Power cord
R	black
S	gray
T	brown
„0”	blue
GND	green/yellow

The PA is works from 400V AC beetwen 2 phase. Fan, and the G1/G2 transformer from 230V AC single phase.