

ME2000-V

**2M LINEAR AMPLIFIER 19" BOX
GS35B**

Mechanics & Electronics Inc. Hungary

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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 ME2000-V series utilises the advantages of the ceramic valve GS35B, 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 its advantages, please read the following general instructions carefully:

- 1.1 Do not use higher driving power 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.
 In case the VSWR > 1:2 in QRO mode, the protection is active.
- 1.3 The required power supply 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 in fuse holders is suitable for the AC line voltage you will be using. The fuse should be the glass cartridge slo-blow type. The rating should be 20 Ampere by 230V AC, 16 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**
- **Protection circuits (Ia, Ig1, temperature, SWR>3)**
- **Cooling fan 230V 60W**
- **Function and status indicator LEDs (6 pcs)**
- **4KVA transformer**
- **OPTO coupled PTT switch**
- **Built in I/O coax relays**

2.0 SPECIFICATIONS

ME2000-V

Frequency coverage	144-146MHz	
Operating modes	ALL mode	
Output Power	2000 W pep	CW/SSB
Driving Power	0-120W MAX	
Input VSWR	max 1:1.5	
In/Out impedance	50 Ohm	
Valve(s)	GS35B	
T/R System	opto 12V/8mA	OPEN COLL. OK
Harmonic supression	>50dB	at 1500W RF out
Intermodulation	>35dB	at 1500W RF out
Protection	la >1.0A lg1 > 360mA VSWR > 3	
Dimension	19X14X14 coll	
Weight	22kg	

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. The PA we can build in 19" "box" version.

2. INPUT CIRCUIT

Tube is driven in cathode over T filter. The input resistance of tube is about 40 Ohm.

The input circuit is working between 144-146 MHz without external tuning. The input SWR is better than 1:1.5 in this segment.

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.

Tuning is very easy to maximum output.

4. COOLING

Cold air inlet is located in the input compartment. We can deliver the PA with internal or external fan.

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 75 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 LED bargraph power meter.

Before any high voltage will be applied to the tube, tube should be run on heater for several hours especially if the tube wasn't used 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.

The 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 100mA on left meter. When you have more than this value, you can adjust for this value with P7 potentiometer on Zener PCB. /On case you use home brew HV supply with lower or larger Ua voltage than 3500V. /Max Ua 3.6KV! /

3/a FRONT PANEL

1. POWER ON

Main switch of the equipment is on the power supply (ME3000-S).

2. ON LED

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

3. OVR LED

The blinking LED indicates the active stage of the protection circuit. The protection might be active due to overdrive, IG1 higher as specified, SWR > 3, or any other case. (See specifications)

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

4. AIR LED

The indicator glows while transmitting and the T/R relay is switched on. Without driving power the Ip bargraph indicates the idle current of the PA.

5. 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 > 120 sec. The vacuum relay in PS switching the HV to PA, when OPR LED is lit.

6. WAIT LED

Blinking during the heating up period, indicating that the heating is in progress. Required time is >120 sec, when the light goes out and the OPR led lit up.

7. QRO LED

Indicates the high power mode of the PA. Can be activated by the STBY/OPR switch. In case the OPR mode is not active, only the TCVR power will on the aerial. (Small PWR STBY mode)

7. HV PUSHBUTTON

When you push this button you can see the anode voltage on Ip/HV bargraph. Multiplay the scale with 2. (full scale is 6kV).

8. TMP PUSHBUTTON

Normally you can see on the Ig1/TMP bargraph the current of the grid1(Ig1). When you push this button you can check the actual outlet air temperature on this scale.

9. OPR/STBY SWITCH

The PA can be driven only if this switch is on OPR, otherwise the TCVR power by passes the PA.(STBY)

In case the overload protection is active, release the STBY switch and push it again to reset the protection circuit. (OPR)

10. RF FORWARD POWER BARGRAPH

Indicate RF output power in KW.

11. REFLECTED POWER BARGRAPH

Indicate the reflected power in Watts.

12. I_{g1} /TMP BARGRAPH

Indicate grid 1 current, when you push the TMP pushbutton indicate the outlet air temperature in °C.

13. I_p /Ua BARGRAPH

Indicate the I_a current, when you push the HV pushbutton indicate the Ua voltage in KV. (Please multiply the scale with x2)

14. TUNE KNOB

Use for tuning the PA. Tune 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 RF overdriving, on this case only the OVR LED is blinking.

3/b REAR PANEL

1. Remote connector
Connecting with short cable to ME3000-S power supply.
2. FAN 1
Cooling fan for the RF tube (230V/AC,60W,200m³/h)
3. PTT
Connection for SEND relay contact of your transceiver. The relays are closed by earth connection. Low voltage, low current opto entry. Fit for open collector control well (24V 10mA).
Use external sequencer unit for long life of coaxial relays!
5. INP
Input connection for the driver TCVR. 50 Ohm.
6. OUT
Aerial connection 50 Ohm ("N" or 7/16"connector).
7. GND
Ground connection.
8. 5PIN tuchel connector (option if you want, you can order)
Connect to external units, preamplifier, etc....You can use free relay contacts of relays for external units.

4.0 INSTALLATION

- 4.1 Connect your TCVR to the Linear using a short, 50 Ohm coaxial cable.**
- 4.2 Connect your TCVR ground giving socket to the PTT RCA connector on the rear panel of the Linear, using a screened cable.**
In case your TCVR has an open collector PA controll output, you can use it without difficulties. The input of the PA PTT is 24V 10mA.
- 4.3 Connect your aerial to the OUT connector 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.**
- 4.5 Connect the power cord to the mains and switch on the equipment (ME3000-S). Check before the exact input voltage of the ME3000-S (230 or 400V AC!). 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.**
The readiness of the Linear is indicated by the OPR LED. If the PA was out of use for a longer period (2-3 month), it would be advisable to keep the PA heated without driving for a few hours. The control unit will switch the high voltage to linear, when the OPR LED lit. 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. Using the tuning mode of the TCVR (CW) or give small driving power to reach 300-400 mA indication on the IP bargraph. With the Tune knob tune the Linear to reach maximum output power on RF out bargraph. Increase the driving power until maximum anode current, 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. On reflected power bargraph you can check the reflected power of your antenna.**
Check the Ig1 current, if everything is right you can start the work. After the some minutes, when the PA will reach the working temperature tune for the peak output again with TUNE knob.

REMEMBER THIS AMPLIFIER DOES NOT REQUIRE TO 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 SCREEN 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!

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 $< 1:1,2$.

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.

5.4 FAILURES

- The PA not turn on, nothing happens ON switch is pushed.
 - External AC wiring, fuse or circuit breaker may be open.
 - Amplifier power cable not in place - cover safety interlock open.
 - Fuse F1, F2, F3, F4 open or missing - check fuses with an ohmmeter. (ME3000-S power supply)
- The PA turns on but no HV is indicated by the multimeter LED bargraph.
 - Possible HV circuit fault.
 - HV sampling resistor or HV fuses in power supply damaged. (ME3000-S power supply)
- No idle current when you push the PTT (about 100 mA on meter).
 - Not Ua voltage. Check the protection resistor in PS or FUSE on HV PCB.
Check the Q1 (BD249C transistor on control board).
The vacuum relay switch the HV to PA after the heating period(OPR ON)
- The base current is too low or too high.
 - Check the control PCB board. Check the Q1 (BD249C transistor and the zener stabilizer circuit PCB, you can set the needed value with poti on zener PCB).Check both transistors on zener PCB.
- You can indicate normal Ia current on meter when drive PA but no output power.
 - Check the output coaxial relay.

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 valves.

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