

LA 251 / V

VHF 150—160 MHz Linear Amplifier



Specifications:

Operation Frequency:	150—160 MHz
Modulation Types:	SSB,CW,AM, FM, data etc (All narrowband modes)
Transistor:	4x Mitsubishi RD70HVF1
Power Supply:	13VDC+/- 1V 40A
Input Fuse (Internal):	3x10A (5x20mm Fast)
Input RF Power:	1-20W (All modes)
Output RF Power:	170W @1dB Gain Compression
Maximum bypass power (Amplifier off):	50W
Input VSWR:	1.1—1.5:1
Output VSWR Maximum:	2.5:1
Protection	Reverse Polarity, High Temperature, Load VSWR and Excessive I/P power

Quick Start Guide:

A more complete guide to the installation is featured later

1. Connect the input RTX connector to transceiver with 50 Ohm patch cable
2. Connect the ANT Output of the Amplifier to SWR Bridge / Wattmeter (If required), and then the Antenna (50 Ohm load Impedance)
3. Connect the Amplifier DC power Cable to a suitable 13VDC ($\pm 1V$) Power Supply or Auto Battery. Pay attention to the correct polarity
4. Connect PTT cable if required to the transceivers PTT OUTPUT, (The Amplifier may be used without this connected, however connection is recommended for SSB operation. PTT is Active Low)
5. Make sure that the amplifier is switched off
6. Adjust the Transceivers RF output power to 10W (15W max) if it is capable of more than 10W output
7. Switch on the Amplifier and start operating
8. Check that the antenna VSWR is acceptable with the amplifier in use. Any large increase in VSWR indicates that the Antenna is not suitable for the power being used. Operation should be halted immediately to avoid damage to the Amplifier / Radio / ATU etc.

WARNING: Before using this product please read carefully all of the information in this manual or at least the quick start guide!!! To avoid damage or incorrect operation this is extremely important!!!

Front / Rear Panel Description



Front Panel

1. LCD Display
2. LCD Backlight control two preset levels
3. AM/FM or SSB operation (Only required if the PTT input is not connected)
4. Amplifier ON/OFF switch
5. ON LED
6. TX LED illuminates when amplifier is in transmission
7. Alarm indicator, flash for warning, solid colour for protection

Rear Panel

1. RTX SO239 RF input connector (Teflon Insulator)
2. DC Input power connector
3. PTT input (Phono / RCA) (Active Low)
4. ANT RF Output SO239 Socket to Antenna (Teflon Insulator)



Installation:

Unpack the amplifier from it's shipping carton and inspect for any signs of damage. The amplifier should be installed (either fixed or mobile installation), in a place that allows good ventilation and provides a suitable base to support it. Failure to allow for reasonable ventilation will cause the amplifier to overheat and shutdown prematurely. A short 50 Ohm patch lead should be used to connect the amplifiers RTX SO239 input connector to the output, (Antenna Socket) of the drive Radio. The length of this cable is not critical but should be of good quality and be kept as short as practically possible and suitable for VHF operation. The ANT output of the amplifier should then be connected to antenna being used. (If an external SWR/Power meter is to be used the amplifier should be connected to the input and then the antenna to the output, however this is not required as the amplifier has a built in power meter and SWR indication). This order of connection is very important. Check also that the Antenna is suitably rated for the power output level. (Antenna SWR should not change much from low to high power). The antenna should be tuned before connecting the power amplifier or with the amplifier switched OFF! However as most VHF antennas require initial tuning after installation this should not be an issue.

The amplifier also has a PTT input located on the rear panel. This may or may not be connected. If left unconnected the amplifier will still function as it contains a RF sense (similar to VOX), circuit that will automatically switch the amplifier to TX when it detects RF on the input. The PTT input is configured as active low which means that shorting it's terminal to ground will trigger the amplifier to enter transmit. (This is the way nearly all modern transceiver PTT outputs are configured either open collector or relay and may be connected directly to the PTT input on the amplifier with a suitable cable. The PTT input socket requires a Phono or RCA type plug and should be made with a screened cable).

If the PTT is connected to the radio it must be connected to the PTT output on the radio. On modern transceivers this is usually embedded in one of the multi-way connectors on the rear panel, and may also be band specific. See the radios operating manual for further details. SSB delay on the front panel should be set to AM/FM for all modes as the PTT output from the radio will control the switching.

In SSB mode if not using the PTT input the front panel switch should be set to SSB. This adds a short delay to the release time of the RTX relays so that pauses in speech do not cause the relays to drop out. The PTT input is however recommended for SSB operation, in which case the switch should be set to AM/FM mode.

The amplifier must be connected to a suitable power supply of the correct voltage output and sufficient current rating. The output should be 13.6 or 13.8V DC but the amplifier may be connected to a supply from 13V to 16V DC without damage. The current rating of the power supply must be at least 40A continuous but 45 to 50A rating is advised. Be aware that the current rating must be greater still if the drive radio is also connected to the same power supply, although this is not generally advised.

The voltage output and current rating are very important for low voltage (12V) RF transistors as voltage sag, (poor load regulation) or insufficient current capability can drastically reduce the output power or cause distortion.

The cross sectional area of the cables used to connect the amplifier to the PSU should not be less than 6mm² or 10 AWG. They should also be kept as short as practicably possible to avoid voltage drop due to ohmic losses. This is less of a problem in a fixed installation where the power supply may be placed close to the amplifier.

For a mobile installation the leads should not exceed a length of 3m and they should be connected directly to the Auto battery. An additional fuse may also be connected inline to provide protection in case of cable short circuit to chassis ground from the amplifier to the battery.

The installation location must also provide a suitable ground system both for RF and the AC line supply. This is very important safety requirement for any radio transmission equipment but as power increases becomes increasingly important. A good RF ground will also help to prevent any returned RF from causing problems with the equipment. Usually erratic operation of equipment when in transmission may be attributed to RF being present or poor RF grounding. Installations where a good RF ground is not possible like operation above the ground floor may require alternative solutions such as artificial earths or the connection of 1/4 wave counterpoises to the operating equipment. Correct RF earthing techniques are however beyond the scope of this manual.

Operation:

Before using the amplifier the user must be familiar with all of the controls and be sure that it has been connected correctly.

Important!!

Before the amplifier is switched on the power output of the drive radio should be adjusted correctly if it is capable of outputting a power greater than 15W. This may be done with the amplifier connected but switched off. 15W is the maximum permissible input power to the amplifier, but approximately 10-12W input should be sufficient to realise full output, and an input power of 2-15W is OK as it is not necessary to run the amplifier at full output if not required.

The amplifier features protection against excessive input power and will begin to signal an error at 15W input by flashing the Alarm LED (front panel) when the input power reaches approximately 20W the amplifier will disable the bias to the transistors open RTX relays, (Bypass) and block operation of the amplifier. The input power should be reduced to an acceptable level and then to restore operation the amplifier must be reset by cycling the on / off switch. The best performance will be obtained if the amplifier is operated at just less than full output which should be achieved with 10 to 12W input.

The protection circuit for excessive input power should not be regarded as a 100% protection for all levels of input power. Up to about 50W the circuit will work very effectively and will save the amplifier from damage, above 50W for example accidental 100W or more applied to the input the protection circuit can not be expected to provide complete protection. In most cases the protection will act sufficiently quickly to protect the transistors from damage but this condition is not guaranteed!!! For this reason when using the amplifier with a 100W capable radio, caution should be used as not to accidentally switch on the amplifier before the power has been reduced to 15W or less.

Switch on the power supply to the amplifier followed by the amplifier on off switch on the front panel. After switch on there is a short delay of a couple of seconds whilst the amplifier carries out a quick self test procedure. The display will then show the following details:



Pin:	displays the input power from the transceiver in Watts
Pfwd:	displays the current output power in Watts
SWR:	displays the current load VSWR seen by the amplifier. (This may show a different value from an externally mounted VSWR meter)
TMP:	Displays the current heatsink temperature

Antenna Considerations:

Most VHF antennas for the 150-160 MHz Amateur 2m band are generally pre-tuned or require some slight adjustment after initial installation but generally do not require tuning afterwards. It is recommended to check that the antenna to be used is sufficiently rated for at least 250 to 300W power handling before connecting this product. It is also recommended to check that the VSWR does not change considerably with increased power as this would indicate that the antenna was not suitable for high power use. Some vertical encapsulated collinear type antennas have quite low power ratings, as do some types of mobile antennas. Feeder quality and length are also more important at VHF frequencies than lower frequencies. Losses particularly increase with increasing frequency. Always use a good quality 50 Ohm feeder and keep the length as short as possible. Not only will this allow more power to reach the antenna but will also increase the signal strength at the receiver.

Antenna preamplifiers should be ideally be mounted at the antenna feed point for maximum effect and care should be taken to ensure that they are capable of handling the transmit power of the amplifier or connected to some type of sequencer to avoid damage.

This amplifier should not be operated into mismatched loads, (high VSWR) An acceptable level

should be less than 1.5:1. Less than 2.0:1 is acceptable but some reduction in power may be seen and the amplifier will work less efficiently and generate more heat. At about 2.0:1 the amplifier will signal an alarm by flashing the Alarm LED (front panel) and when the VSWR reaches about 2.5:1 will enter protection, by removing the bias to the transistors and switching the RTX relays to bypass, operation of the amplifier will be blocked. A message on the display will indicate the current alarm condition. A power reset should be performed and the amplifier should not be used again until the VSWR has been reduced.

MODE:

The LA250 may be used for all of the common narrow band transmission modes such as SSB, CW, AM, FM, SSTV and data modes etc.

Warning: Transmit Time.

Hi Duty cycle modes such as FM, Data modes and AM etc operate the amplifier at full power all of the time unlike modes like SSB and CW that are either intermittent or only reach peak output for very short times, these high duty cycle modes will run the amplifier much harder and generate more heat in the same amount of time. It should be noted that the amplifier although capable of being used with these modes should not be operated continuously. A transmission time of more than a few minutes should be avoided to avoid excessive transistor junction temperature. The transistors are mounted on a copper heat spreader (200x60x3mm) which greatly improves the transfer of heat to the whole heat sink. The exact time for transmission in these modes will depend on numerous factors such as if the amplifier fitted with the cooling fans, how good the ventilation around the amplifier is if there is sufficient space for freely flowing air to circulate, etc. If the ambient temperature is high this will reduce the total time in transmission. Common sense should be exercised if the heat sink is becoming too hot to touch then sufficient time should be allowed to let it cool down before reuse. The amplifier constantly measures the heatsink temperature and if it reaches 56°C it will block the operation of the amplifier automatically. The alarm LED will illuminate (front panel) and the amplifier will emit an audible tone. The display will show the nature of the error as excessive temperature.

Fan Model:

The LA250V model is fitted with two large diameter fans to improve heatsink cooling. These will allow longer transmission times or higher duty cycle operation such as contest type operation and also help to improve cooling if the amplifier is to be used in high ambient temperatures.

The fans partly due to the large diameter are very low noise. They will be constantly active as soon as the amplifier is switched on and rotate at low speed. As the heatsink temperature increases the fans will increase in speed. There are 4 levels. The default low speed, at 38°C the speed will increase to level 2, at 51°C the speed will increase to level 3 and at 55°C the speed will be maximum. At 56°C the amplifier will shutdown from excessive temperature. The fans continue to run until the temperature falls to an acceptable level 50°C at which point the amplifier will automatically reset, and normal use may continue.

Protection:

Excessive Heat sink temperature:

5 short beeps LED (front panel) ON

LCD "Over Temp"

Automatic reset when temperature falls to an acceptable level

Excessive Input Power:

5 short beeps Alarm LED (front panel) ON

LCD "Error Power TRX"

Manual power reset required

Excessive VSWR:

5 short beeps Alarm LED (front panel) ON

LCD "Error SWR >2.5:1"

Manual power reset required

Input drive and power output:

The amplifier should give full output with approximately 10-12W input. Excessive input power should be avoided and the amplifier should always be operated in a responsible manner.

Maximum output power considerations:

All amplifiers have a maximum output and this occurs shortly after gain compression where by Pin no longer produces a proportionate increase in power output . The amplifier should always be operated at a point below its saturated output. Trying to extract every last watt by overdriving the amplifier will not actually help your signal to be stronger, you will in fact cause higher levels of distortion which will make your signal less intelligible at the distant receiver station.

Running the amplifier a little under max output will also allow the amplifier to run cooler and make it more reliable for many years of use.

As an example consider the following situation.

1 'S' point on a receiver is usually approximately calibrated at 6dB so for example the difference between S5 and S7 2 'S' points is 12dB.

The difference between 10W and 230W is about 13.6dB a healthy increase to your signal strength, more than 2 'S' points, with the same antenna. Now lets say for example you run the amplifier at a moderate 180W output by slightly reducing the input power, the difference between 230W and 180W is only 1dB which when you compare this to 6 dB per S point is actually very little and as the amplifier is not running at its absolute maximum will give a cleaner output with less distortion that will actually make a difference at the distant receiver for the better!!

Warranty:

This product is covered by a 24 month warranty commencing from the date of purchase. The original purchase receipt will be required for any claim. This warranty does not cover aesthetic damage or damage to the RF power transistors from incorrect use.

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