HLA 150plus

HF Broadband 1.8—30 Mhz Linear Amplifier

The HLA150 is a 12VDC HF broadband linear amplifier suitable for use in the range from 1.8 to 30 MHz with a maximum output of 150W (Av. power) with a maximum input drive of 10W, it has been designed to be used with transceivers with 10W outputs but can be used equally well with any transceiver capable of producing 1 to 10W output. It uses 2 RF power transistors in a parallel push pull circuit biased in class AB. There are 6 Low Pass Filters with cut-off frequencies of 3,4,5,8,15,22 and 31Mhz that greatly reduce unwanted harmonic output to acceptable levels that may be selected manually or automatically. It features a microprocessor that controls all of the functions of the amplifier and its protection circuits. Protection is provided for excessive input power, excessive load VSWR and excessive heat sink temperature. The amplifier may be used either in a mobile / portable or fixed station installation.

Specifications:

Operation Frequency:	1.8—30 MHz (160m to 10m bands)
Modulation Types:	SSB,CW,AM, FM, data etc (All narrowband modes)
Transistor:	2 x M/A Com MRF455
Power Supply:	13VDC+/- 1V 30A
Input Fuse (Internal):	2x12.5A (5x20mm Fast)
Input RF Power:	1-10W (All modes)
Output RF Power (max):	(150W)
Maximum bypass power (Amplifier off):	100W
Input SWR:	1.1—1.5:1
Output SWR Maximum:	2.5:1

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!!!

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 / ATU (If required), and then the Antenna**
3. **Connect the Amplifier DC power Cables to a suitable 13VDC (± 1V) Power Supply or Auto Battery**
4. **Connect PTT cable if required to the transceivers PTT OUTPUT, (The Amplifier may be used without this connected. PTT is Active Low and only becomes active after the first transmission)**
5. **Set front panel filter selector (2) to Auto**
6. **Make sure that the Amplifier is switched off**
7. **Adjust the Transceivers output RF power to 8W (10W max) if it is capable of more than 10W output**
8. **If the antenna requires tuning this must be done before the Amplifier is switched on!!**
9. **Switch on the Amplifier and start operating**
10. **Check that the antenna VSWR is acceptable with the amplifier in use. Any large increase in VSWR indicates that the Antenna or ATU is not suitable for the power being used. Operation should be halted immediately to avoid damage to the Amplifier / Radio / ATU etc.**

****** The amplifier must not be used whilst the antenna is being tuned by either a manual or Automatic ATU *******

******* Automatic ATU's must be placed in standby after the antenna has been tuned such that they cannot start another tuning cycle whilst the amplifier is in use*******

Front and Rear Panel Description

1. Displays currently selected filter (Auto and manual modes)
2. Manual / Auto filter selector
3. Output power meter
4. Protection warning LED
5. ON LED
6. 3dB Attenuator ‘on’ when attenuator inserted (manual or automatic)
7. TX LED illuminates when amplifier is in transmission
8. Amplifier ON / OFF Switch
9. 3dB Attenuator ON / OFF manual switch
10. SSB Delay switch
11. RF Output SO239 Socket to Antenna (ANT)
12. RF Input SO239 socket to Transceiver (RTX)
13. PTT input (Phono / RCA) (Active Low)
14. DC Power Supply cable (Red Positive / Black Negative)

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 input connector to the output, (Antenna Socket) of the drive Radio. This length of this cable is not critical but should be of good quality and be kept as short as practically possible. The ANT output of the amplifier should then be connected to antenna being used. (Usually there will be a SWR / Power meter immediately after the output on the amplifier followed by an antenna tuner if a non resonant antenna is being used. This order of connection is very important. (if the drive radio has a built in antenna tuner this should be set to OFF / Bypass or Through mode as it can no longer be used to tune the antenna as it is only looking at the input circuit of the amplifier. If a non resonant antenna is being used then an external ATU is required connected on the output of the amplifier before the antenna. Check also that both the ATU and Antenna are suitably rated for the power output levels. (Antenna SWR should not change much from low to high power) (ATU’s usually have a power rating and most often this is the power handling under tuned conditions **NOT** to be confused with the power handling whilst being tuned. All antenna tuning should be completed at low power with the amplifier switched OFF! Not only does this allow for the drive radio, amplifier, ATU to not be damaged but it also causes less QRM on the bands)

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. Immediately after switch on the PTT input socket is disabled, (Additional protection), The first transmission made using the internal RF sense circuit will then activate it. In normal use this does not affect operation and is completely transparent, however trying to trigger the PTT with no RF, immediately after switch on is not possible. (For instance testing the radios PTT O/P)

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 multiway connectors on the rear panel. See the radios operating manual for further details. SSB delay on the front panel should be set to OFF as the PTT output from the radio will control this.

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 12V to 16V DC without damage. The current rating of the power supply must be at least 30A continuous but 45 to 40A 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.

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. for the bands being used . 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 10W. This may be done with the amplifier connected but switched off. 10W is the maximum permissible input power to the amplifier, but approximately 8W input should be sufficient to realise full output, and an input power of 1-10W 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 switch in a 3dB attenuator when the input power reaches approximately 12 to 15W, if the input power is more than about 15-20W the amplifier will disable the input relay and put the amplifier into a protection mode. 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 3dB attenuator can also be selected manually to reduce the output power of the amplifier if the input power is not adjustable say for instance a fixed 10W output. It should not however be used to reduce the input power to the amplifier from a radio that has say 20Watt output. The maximum input to the amplifier should always be adjusted on the radio.

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 10W 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 approximately 10 seconds whilst the amplifier carries out a quick self test procedure. During this time the LED display of the output power and output filter will flash on and off one at a time from top to bottom. When the test is finished the current filter selected will be indicated by the relevant LED and also for the 3dB attenuator if set to ON. SSB delay has no LED associated with it so the switch position must be checked if required on or off.

Filter selection maybe be made manually but for most operation, if changing bands frequently, the filter selection can be left in the AUTO position. Every time the amplifier switches to TX when there is RF present the frequency is calculated and the correct filter latched in circuit. The filter will remain selected until either another frequency (band) is used outside of the filters range or the amplifier is switched off. The default filter in Auto mode after switch on is the 10-12m filter.

Warning: Filter Selection

If using the manual filter selection care must be taken to make sure that the correct filter is selected for the band in use. This is only of concern if the frequency of use is higher than that of the cut off frequency of the selected filter. (For example transmission on 14.275 MHz (20m) with the 80m filter selected. As the cut off frequency of the 80m filter is 4Mhz it will not pass RF at 14.175 MHz and the transistors will see a very high SWR and could be damaged. The amplifier is protected for these conditions but this should obviously be avoided especially at full power.
Selecting the wrong filter but having a transmission frequency lower than the filter cut-off frequency does not cause an error or harm to the amplifier but any harmonics of the transmission frequency will be transmitted if they fall under the cut-off frequency of the filter causing unnecessary QRM on other bands. (e.g. transmission on 1.845 MHz with the 15-17m filter selected would allow also all of the harmonics to be transmitted without attenuation, on 3.69, 5.535, 7,38..... All the way up to the 11th harmonic with the 12th lying outside of the 12-17m filter this is almost the worst example but as can be seen it's quite important.

Warning: ATU / Non resonant Antennas

Non resonant Antennas and ATU's (Antenna Tuning Unit). Before transmission you must make sure that there is a suitable load connected to the antenna output of the amplifier. Transistor amplifiers 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 2.5:1 the amplifier will signal an alarm and enter protection. A power reset should be performed and the amplifier should not be used again until the VSWR has been reduced.

The antenna should be tuned so that the load is as close to 1.1:1 as possible, see above. This should also be carried out with the amplifier switched off and the drive radio at low power, 10W should be sufficient for most tuners to carry out the matching process. If an Automatic ATU is used it should, once it has found a suitable match, be disabled such that it may not carry out another tuning cycle until instructed to do so.

Depending on the type of antenna and ATU being used it may be possible to generate very high and low impedance loads that can look to the amplifier almost like open or short circuits, operating the amplifier at full output whilst trying to tune a non resonant antenna with a tuner either manual or automatic can be catastrophic for the transistors due to the load mismatch. The protection circuit will in most instances cut in at a VSWR of 2.5:1 but if the amplifier is being used at full power whilst tuning the antenna it is possible that the transistors may sustain damage due to the load mismatch. You have been warned!!

Now that the input power has been adjusted correctly, the antenna tuned, (If required), operation can continue. Input power can be adjusted to give the required output power or the amplifier may be run at it's full output.

If using a resonant antenna and having the amplifier set to AUTO (Filter selection), band changes can be as fast as the time it takes to change the band on the drive radio. However changing band on a non resonant antenna always requires the amplifier to be switched off whilst the antenna is retuned to an acceptable VSWR.

MODE:

The HLA300 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 minute or two should be avoided to avoid excessive transistor junction temperature. The exact time for transmission in these modes will depend on numerous factors such as is the amplifier fitted with the cooling fans, How good is the ventilation around the amplifier is there 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 has a thermostat that will block the operation of the amplifier if too high a temperature is reached and automatically returning back operation when the temperature has reduced.

Protection:

Excessive Heat sink temperature:
Three short beeps LED 4 OFF

Excessive Input Power:
Three long beeps LED 4 Flashing

Excessive SWR or LP Filter Error:
Three long beeps LED 4 Flashing

Input drive and power output:

The amplifier should give almost full output with approximately 8W input. This should be the nominal input power. You may find that less power is required on the lower bands and slightly more is required on 10m to obtain full output.

Maximum output power considerations:

All amplifiers have a maximum output and this occurs shortly after gain compression where by Pin no longer produces an 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 150W is nearly 12dB a healthy increase to your signal strength, 2 'S' points, difficult to achieve with an antenna alone for most ham operators, especially if space is limited. Now lets say for example you run the amplifier at a moderate 120W output by slightly reducing the input power, the difference between 150W and 120W is less than 1dB which when you compare this to 6 dB per S point is actually very little and as the amplifier is running not 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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