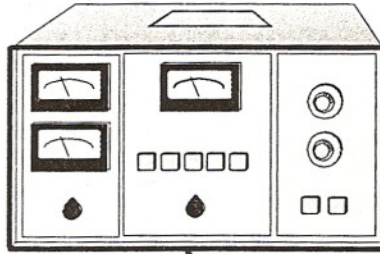


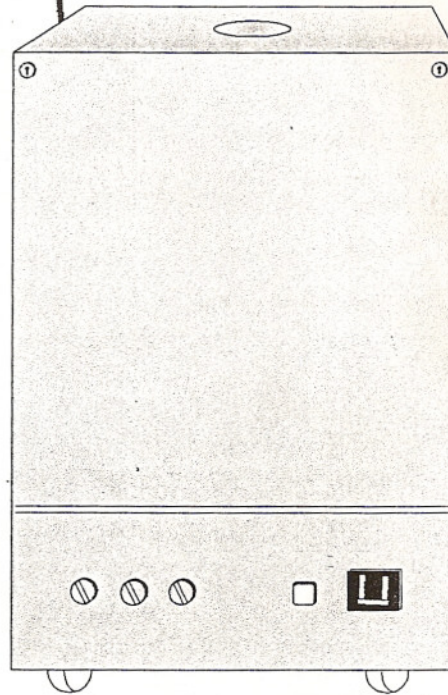
65-445

Desk top controller (no RF components)



4th Edition
October, 1999

Remote amplifier and
power supply console



3K ULTRA and 8K ULTRA Operating and Maintenance Manual

HF LINEAR COMMUNICATION AMPLIFIERS

HENRY RADIO, INC.

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The Importance of Amplifier Tuning

A grounded grid linear amplifier should be tuned so that most of the electrons emitted by the cathode reach the anode circuit. Electrons that fail to reach the anode are lost to grid current. This condition occurs when the amplifier is loaded too lightly - the result of setting the loading capacitor for too much capacitance during tune-up. As grid current rises and fewer electrons reach the anode, distortion increases and output power decreases. Thus, a triode amplifier can be tuned up with fair accuracy by simply applying maximum drive power and quickly adjusting the amplifier's TUNE and LOAD controls for maximum power output. After the amplifier has been tuned for maximum output, a slight increase in linearity can usually be secured by increasing the amplifier loading - that is, by decreasing the loading capacitance - until output power decreases by a few percent. Note, however, that this small improvement in linearity is seldom detectable in practice because the IMD performance of tube amplifiers is usually significantly better than the IMD performance of the bipolar-transistor-output transceivers commonly used nowadays as exciters.

Electrons are negatively charged. Positive charges attract them. The more positive the charge, the stronger the attraction. The 0-V potential of a grounded control grid is more positive than the negative charge of an electron leaving the cathode of a vacuum tube. This causes excessive current to flow in the control-grid circuit unless the tube anode is substantially more positive than the control grid throughout the anode-voltage cycle.

The output of a grounded-grid RF amplifier tube appears at the tube anode as RF AC superimposed on the DC anode supply. As a rule of thumb, successful attraction of most of the cathode's electrons requires that the instantaneous anode voltage not fall below about +200 to +300 V (relative to the grounded grid) during the lowest point of its downward voltage swing (that is, during the anode-current peak). Loading the amplifier too lightly - that is, adjusting the amplifier LOAD control for too much loading capacitance - causes the minimum anode voltage to fall below this level. The result is a dramatic increase in grid current and distortion, and a reduction in peak power output. Loading the amplifier too heavily - insufficient loading capacitance - also causes the output power to decrease because the amplifier output network is not adjusted to the impedance-transformation ratio necessary for maximum power transfer between the amplifier and its load.

Reprinted from March, 1989 QST - Richard L. Measures, AG6K

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LIMITED WARRANTY: Henry Radio warrants each new product to be free from defective material and workmanship. Henry Radio agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit which under normal installation, use, and service discloses such defect. The equipment or part must be delivered by the original owner to us intact for our examination, with all transportation charges prepaid to our factory, within 1 year from the date of sale to the original purchaser. Provided that our evaluation discloses, in our judgement, such a defect, Henry Radio will repair at no charge, or replace at their discretion, such defective part or equipment.

EXCLUSIONS: Henry Radio does not warrant any vacuum tube used in their equipment. These are warranted by the tube manufacturer. Warranty claims must include proof of the date of purchase. The warranty does not extend to damage or failure caused by transportation damage, misuse, neglect, accident, incorrect installation, acts of nature, or to equipment modified or repaired without our prior approval.

This warranty does not include incidental or consequential damages and the Henry Radio warranty disclaims any liability for any such damage. All implied warranties, if any, are limited in duration to the above stated 1 year.

Henry Radio reserves the right to make any improvements to its products which it may deem desirable without obligation to install such improvements in its previously sold products.

Radio Frequency Interference Statement

Manufacturer's Instructions

The operator must observe the following precautions in installing and operating this unit:

1. Operate the equipment in strict accordance with the manufacturer's instructions.
2. Plug the unit into a grounded wall outlet with the AC cord supplied with the unit without modification.
3. Always operate the unit with all factory installed covers in place.
4. Never modify the equipment in any way that would affect its specifications.
5. Always maintain the equipment in a satisfactory state of repair
6. Use a quality shielded RF coax cable on the input and output of the equipment.

User's Responsibility

The user has the ultimate responsibility to correct any problem arising from harmful radio frequency interference from equipment under his control. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one of the following measures. All of these responsibilities and any others not mentioned are exclusively at the expense of the user.

** Change the orientation of the receiving device antenna. ** Change the orientation of the transmitting equipment ** Change the location of the equipment ** Change the equipment power source.

If these attempts are unsuccessful, install one or all of the following devices: *** Line isolation transformer *** Line filters *** Electromagnetic shielding *** Input/Output filters.

If necessary, the operator should consult the dealer, or an experienced radio/television technician for added suggestions. The user may find the following book, prepared by the Federal Communications Commission, to be helpful: "How to Identify and Resolve Radio-TV Interference Problems". The book is available from the U.S. Government Printing Office - Stock Number 004-000-00345-5.

Note: The operator of equipment causing RFI may be required to stop operating his equipment upon finding that the device is causing harmful interference and it is in the public interest to stop operation until the problem is corrected.

Section 1. Henry 3K Ultra and 8K Ultra Specifications

- Type and Function of Equipment: The 3K Ultra and 8K Ultra are remote tuning communications amplifiers capable of transmitting at 1500 or 5000 watts PEP output on most frequencies between 1.8 and 30 MHz. With optional channelizing features, the amplifier can offer 8, 16 or 24 pretuned operating frequencies.
- Type of Emission: SSB, AM, CW FM, RTTY or pulse.
- Output Power: 3K - 1500 watts PEP or DC nominal.
8K - 5000 watts PEP or 2500 watts DC nominal.
- Gain: 15 or more times input power nominal.
- Drive Power: 3K - 100 watts, 8K - up to 200 watts nominal.
- Frequency Range: 1.8 to 24 MHz (1.8 to 30 MHz outside the United States).
- Tube Complement: 3K - 3CX1200D7 ceramic triode.
8K - 3CX3000A7 Ceramic triode.
- Duty Cycle: Continuous duty at rated output.
- Dimensions: Controller - 17.5" W x 10" H x 10.5" D.
Console - 20" W x 32" H x 22" D.
- Weight: Controller - 30 pounds. 3K Console - 250 pounds.
8K Console - 350 pounds.
- Cooling: Forced air cooling built in.
- AC Mains: 3 wire, single phase, 60 H, 230 VAC 30 amp.
Note: Any amplifier can be manufactured for 50 Hz, or 200VAC, or 2 wire 220VAC, or optional 3 phase operation - but you must specify your requirement at the time of order.
- ALC Circuit: An ALC feedback circuit is provided for drive feedback.
- Input/Output Impedance: 50 ohms unbalanced.
- Noise Level: 40 dB down nominal below one tone carrier at 1KW output.
- Metering: Power Meter (Forward or Reflected), Plate Current Meter, Multimeter - Grid Current, HV, Filament VAC.
- Harmonic/Spurious Output: Better than 50 dB down on harmonics. 3rd Order IMD better than 35 dB down.
- Controls: Band Switch, Multimeter Switch, Tune and Load Controls, Forward/Reflected Switch, Circuit Breaker On/Off, Band Switch.
- RF Connectors: BNC Input, N Output.
- Other Connectors: ALC (RCA), Relay Control (RCA).
- Relay Keying: Each amplifier requires a shorting relay contact to ground during transmit, 26 VDC at approximately 300 ma.
- Protection Circuits: HV shorting switch, air flow switch, AC fuses, cathode fuse, circuit breaker.
- Plate Voltage: 3K - 3800-4500VDC nominal.
8K - 5000-5800VDC nominal.
- Power Meter: Built-in Bird dual line section and elements.
- Antenna Relay: Built-in vacuum relay.
- Power Supply: Resonant choke, full bridge rectifier with oil filled filter capacitor.
- Cabinetry: All aluminum cabinetry with double shielded RF chassis.
- Tank Circuit: Pi-L type with silver flashed variable inductors.
- Options: 8, 16, 24 channel memory, 10KW LPF, low current relay box.
- Warranty: 1 year. Made in the U.S.A.

Section 2: 3K/8K Ultra Features

REMOTE AMPLIFIER OPERATION	These models are the only amplifiers available that allow the operating position to be remoted from the amplifier, isolating the noise and heat generated by any high power amplifier.
METERING	Three panel meters monitor tube plate current, tube plate voltage, tube grid current, tube filament voltage, forward power, output power.
ALC CIRCUIT	All models have an adjustable ALC feedback circuit to prevent overdrive from a high powered transceiver.
CONTROLLERS	There are several configurations of desk top controllers available - Manually tuned - 8 preset tuning channels - external 8 channel-controller (up to 24 channels maximum).
FRONT PANEL CONTROLS	BAND switch, LOAD control, TUNE control, METER switch, SSB/CW switch, AC mains fuses, POWER switch.
REAR PANEL CONTROLS	RF input (BNC), RF output (N), ALC feedback jack (RCA), Relay control jack (RCA).
RELAY KEYING	A built-in 26 VDC supply activates the antenna relay when the relay control jack is shorted to ground. An optional low current (less than 10 ua) interface box is available.
POWER SUPPLY OPTIONS	All models are available for single phase 3 wire operation, single phase 2 wire operation, or optionally for any 3 phase configuration.
PROTECTIVE DEVICES	One high voltage shorting switch, primary AC fuses, primary circuit breaker, air flow switch on blower, and cathode fuse.
POWER SUPPLY	Conservatively rated components guarantee superb dynamic regulation in the high voltage supply and reliable, trouble-free performance. An oil filled capacitor is used in the high voltage supply. Diode rectifiers in the supply are rated at 15KV PIV, 3 amps.
STANDBY OPERATION	All models allow "barefoot" operation by leaving the amplifier off, bypassing the transceiver to the antenna.
ANTENNA RELAYS	All models use a Jennings vacuum relay in the output combined with a fast acting open frame relay on the input allowing full break-in keying for CW and RTTY operation.
CABINETS	All aluminum cabinets provide double shielding in the RF section to minimize cabinet leakage and radiation.
HISTORY	Henry amplifiers are backed by a 30 year history of providing the finest RF equipment available to the amateur service.

Section 3: Introduction

The 3K Ultra and 8K Ultra are a family of high quality, console model, single stage linear RF amplifiers designed around rugged and economical ceramic triode power tubes. All models employ the same grounded grid design to insure simplicity of concept and all employ conservatively rated components to insure years of reliable operation. The amplifiers are completely self-contained and use the highest quality RF, DC and AC components available today. All that is necessary for operation is an HF transceiver, a 230 VAC AC mains source (other voltages available) and a 50 ohm antenna system.

The 3K Ultra uses a single 3CX1200D7 tube offering about 11 to 13 dB of power gain (the output power is approximately 20 times the input power). This makes it easy to drive to full output with most popular low power solid state transceivers. It will deliver 1500 watts PEP and 1500 watts continuous wave into a 50 ohm load. FCC regulations require that the units supplied in the United States can not be capable of operating above 25 MHz.

The 8K Ultra uses a single 3CX3000A7 tube offering about 13 dB of power gain which will deliver a minimum of 3500 watts PEP in SSB service and 2500 watts in a CW mode. It is not available for sale to amateur radio operators in the United States.

With proof of a valid amateur service license, Henry Radio will give a United States purchaser information on how to extend the frequency coverage to 30 MHz. All other customers are considered export customers and their units will be supplied with coverage through 30 MHz.

The 3K Ultra and 8K Ultra are for amateur, industrial, scientific, medical, commercial and export users in the 1.8 through 30 MHz frequency range.

All models are designed around the same basic RF chassis which employs a pair of unique rotary tank inductors not found in any other line of production amplifiers. All models can be used for AM, FM, SSB, CW RTTY or pulse operation.

Frequency coverage is instantaneously in any 200 KHz segment between 1.8 and 30 MHz and can be tuned to any frequency between 1.8 and 30 MHz.

The amplifiers are shipped with their tubes installed at the factory. No tube installation is required.

CAUTION: Please read the instruction manual carefully before operating your new equipment. Your amplifier can be **damaged by operating it out of resonance!**

CAUTION: There are **dangerous high voltages** present inside the amplifier when it is plugged in and turned on! Never remove the equipment covers when the amplifier is plugged into its AC source!

CAUTION: Always exercise extreme caution when servicing any amplifier. Henry Radio recommends that any servicing be performed by returning your unit to the factory!

CAUTION: The voltages from the high voltage power supply can be **LETHAL!** Always unplug the amplifier and turn off the circuit breaker before working inside the cabinet of your amplifier.

Section 4: Installation

Section 4.1: UNPACKING

When you first receive your amplifier, you must carefully inspect both of the boxes, the control console and the amplifier for shipping damage. If you see any shipping damage, save the box and packing material, and notify the transportation company immediately. In any case it is a good idea to save the box and packing material because they are expensive to replace, and are useful in protecting the amplifier should you ever decide to ship it or move it to another location.

Remove both parts of the amplifier from their box and crate. All amplifiers are shipped less a power plug on the AC cable. A power plug that mates with the AC socket at the operating location must be properly installed as described in Section 4.3 before the unit can be operated. The amplifier is completely assembled at the factory, and it is shipped with the tube installed.

The following accessories should be included with your amplifier:

- 1 Instruction Manual and warranty card
- 1 N type Coax Connector (RG213 coax type)
- 2 RCA-RCA Cables (Relay and ALC)
- 1 20 foot remote control cable
- 1 RF drive cable (RG58)
- 1 Set spare fuses

Section 4.2: OPERATING LOCATION

The amplifier may be located wherever you wish provided there is a proper AC mains supply and provisions for adequate air flow from the bottom of the amplifier chassis up through the top of the amplifier. Do not restrict the air flow of the amplifier, and never place it too close to a wall that might restrict the airflow into the back of the unit. A location which avoids environmental extremes of temperature, humidity, and dust will keep your amplifier looking and running like new for many years of reliable operation.

SECTION 4.3: CABLING.

All of the following cables must be connected before operation of your amplifier:

POWER CABLE - The amplifier is equipped with a three wire AC power cable that is factory wired to accept 230 VAC, 2 wire, 60 Hz, single phase power unless special instructions were given at the time you ordered your amplifier. A factory modification is required for 3 phase operation, or for 50 Hz operation, or 200 VAC operation, or 2 wire European operation.

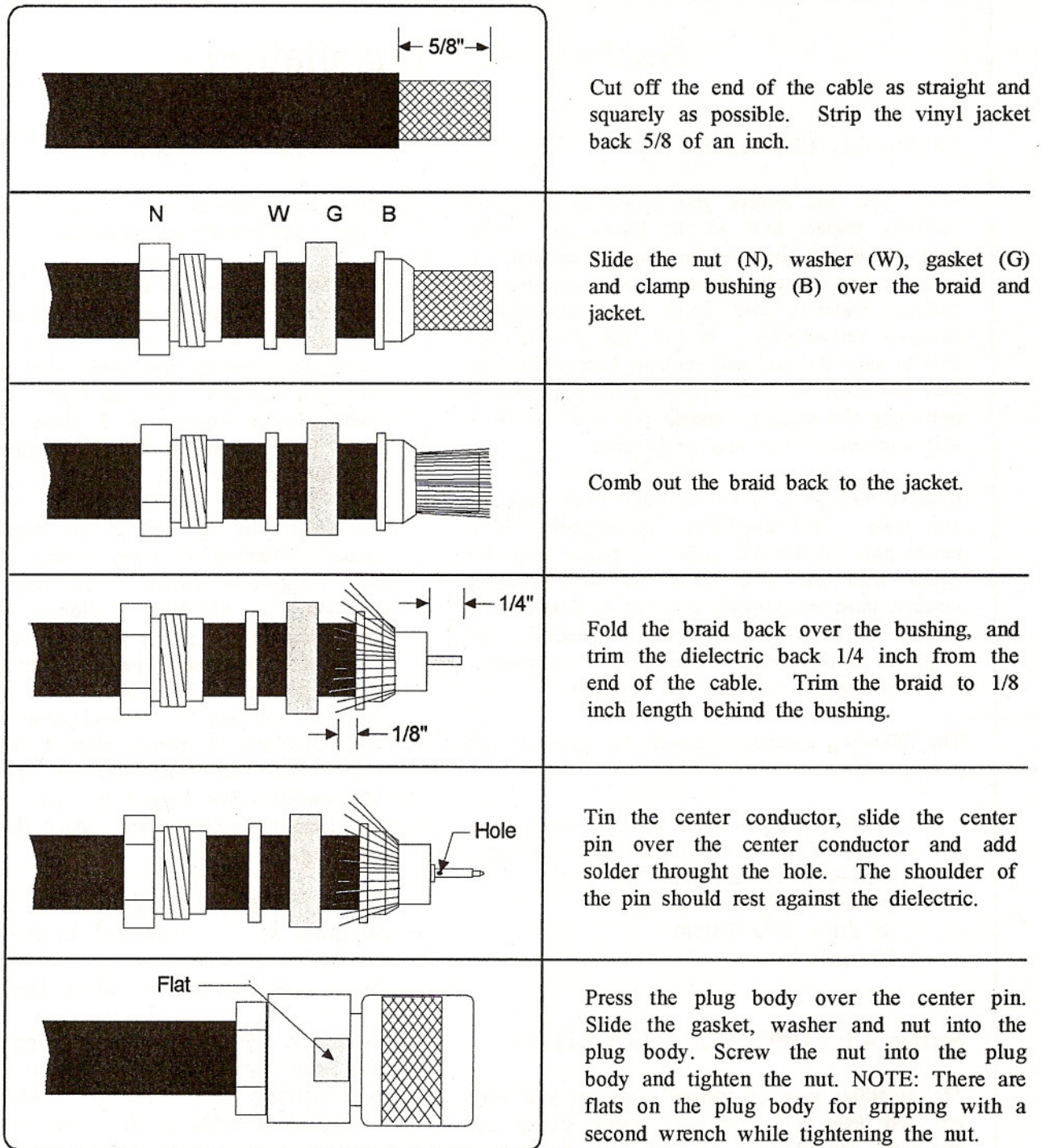
The green wire (ground) is not counted in the standard definition of power wiring, hence the 2 wire designation earlier. (2 wire European operation does not have a ground wire.) The three wires in the power cable are black, white, and green. The green wire is chassis ground and the neutral on all 230 VAC single phase plugs. The black and white wires connect to the hot 230 VAC circuits. A power plug is not provided because there are many different types of 230 VAC outlets. We suggest that you consult with your local electrician about proper installation of your plug.

CAUTION: The amplifier will be damaged if the green wire is connected to the 230 VAC terminal! Always make sure that the green wire is connected to the ground terminal!

ANTENNA COAX - You must select a 50 ohm coax cable for connection of your amplifier to your antenna system. This choice will depend on the desired operating power of the amplifier. At a minimum you should select RG213 type coax. If you are operating an 8K at its full output capability, you may need to look at hard line type coax.

An N type connector is included in the accessory kit. Prepare the cable as shown in Figure 1 below. The N connector mates with the coax jack marked OUTPUT on the rear panel of the floor console (Female N jack).

HENRY 3K/8K ULTRA OPERATING AND MAINTENANCE MANUAL



Cut off the end of the cable as straight and squarely as possible. Strip the vinyl jacket back 5/8 of an inch.

Slide the nut (N), washer (W), gasket (G) and clamp bushing (B) over the braid and jacket.

Comb out the braid back to the jacket.

Fold the braid back over the bushing, and trim the dielectric back 1/4 inch from the end of the cable. Trim the braid to 1/8 inch length behind the bushing.

Tin the center conductor, slide the center pin over the center conductor and add solder through the hole. The shoulder of the pin should rest against the dielectric.

Press the plug body over the center pin. Slide the gasket, washer and nut into the plug body. Screw the nut into the plug body and tighten the nut. NOTE: There are flats on the plug body for gripping with a second wrench while tightening the nut.

Figure 4.1. Connector Installation.

CAUTION: Never operate your amplifier unless it is connected to a matching antenna or a 50 ohm dummy load! Your antenna, coax, or load must be capable of handling the RF output of your amplifier.

You will damage the equipment if you operate the

amplifier into a load with an SWR of greater than 2.0:1, (a reflected power greater than 10% of the forward power). Measure the SWR of your antenna with the built-in RF power meter using only your transceiver's output - before operating the amplifier. With the amplifier on, but the relay control cable not