

ALPHA RADIO PRODUCTS
ALPHA 87A
Operating Manual

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Introduction

The Alpha 87A is a self-contained HF linear amplifier. It provides continuous maximum-legal-power on all amateur HF bands with self-tune capability.

This manual provides all information necessary to install and operate the ALPHA 87A. Schematic diagrams are available on request, at no charge to owners.

Owner Assistance

Assistance is available from Alpha Radio Products at 303.473.9232 x.141, by fax at 303.473.9660, or by email at service@alpharadioproducts.com.

Equipment Shipped

The Alpha 87A ships in two heavy-duty cardboard cartons. One carton holds the power transformer and weighs 43 pounds; the second carton contains the amplifier and weighs 42 pounds.

Safety: Installation and Operation

The Alpha 87A is designed to meet international safety standards and FCC regulations. However, one should always remember that the equipment works with high voltages that are LETHAL!

This operating manual holds information, cautions and warnings that must be followed to ensure safe installation and operation. Read Section 1 before attempting to unpack or operate the amplifier. Failure to perform procedures properly may result in amplifier damage, fire hazard, or electric shock.

Warnings:

- Never open the amplifier case without unplugging the unit from the wall outlet.
- Never stick objects into holes in the case.
- Never touch an antenna during transmission.

CAUTION – READ THE MANUAL CAREFULLY BEFORE INSTALLING YOUR 87A.

The ALPHA 87A is extremely easy to install and operate, but failure to carry out each procedure exactly as described in the manual is likely to lead to amplifier damage, which is not covered under warranty. Damage to other station equipment may also result.

Before Installing Your Alpha 87A

1. Be careful not to twist or warp the chassis when handling the amplifier with its cover removed. Never lift the chassis by a corner, especially when the transformer is in place. Never apply AC power without the transformer properly and fully installed.
2. **When installing or removing the transformer**, move carefully and follow the instructions in this manual exactly. Insure that all connectors are properly mated and fully seated. Don't force them! Tuck the lifting handle out of the way so the interlock can close.
3. Insure that both tubes are solidly seated in their sockets with the red silicone rubber chimneys firmly seated against the chassis.
4. Connect the green conductor in the Alpha 87A power cord only to the power source neutral or ground. *Connecting the green wire to a "hot" line is almost certain to cause immediate damage. Triple checks your wiring before plugging in!*
5. Make sure the primary power tap is connected to the tap closest to your actual AC voltage. See manual section 4.
6. **Solidly bond all station equipment chassis together.** Heavy braid, such as the outer conductor of RG-8/U coaxial cable, is recommended for the purpose. This is important for personal and equipment safety as well as to avoid RF feedback.
7. **Never install cover screws longer than ¼".** Longer screws may penetrate internal boards or wiring and cause severe damage. Make sure each screw hole in the cover is aligned with its corresponding captive nut in the chassis before inserting screws.

Station Engineering Considerations

The 87A is capable of dramatically improving the performance of your amateur station. It is important that you observe good engineering practices to achieve all the benefits of such a station in a safe and reliable manner. This section gives a few hints for important things to look for, but it is recommended that the user also consult a good source of general information such as "The Radio Amateur's Handbook" by the ARRL, especially if this is the first high-power amplifier you have used.

AC power Source If you do not have a 220V ac outlet in your shack, you will need to get a licensed electrical contractor to install one. A minimum of a 20-amp capacity is required. Select a location for the outlet as close as possible to where you expect to operate the 87A. If you are not sure, or contemplate moving the amplifier, it may be cheaper to get a second outlet installed at the same time. Ask your contractor for two or three matching plugs while he is there, as there are several styles of connector available. Ask the contractor to measure the voltage and record it, so you can set the line voltage tap on the 87A appropriately. If he can, ask him to tell you the line voltage with a 10 amp current draw, and use this value for setting the transformer tap.

Antenna Many antennas that are suitable for general use are unsuited for operation with a full 1500 watts of power. At this power level in a 50 ohm circuit, the RMS current is 5.5 amps and the peak RF voltage is 387 volts. With a 2:1 SWR, these values double: 11 amps and 775 volts. The voltage and current at various points in or on your antenna can actually be many times these values. On a simple dipole with sharp wire ends, corona (localized ionization) can easily occur. Corona can (and has!) lead to fire in nearby objects. Traps in beams and verticals can heat up significantly during high power operation. Instances of melting or flashover of traps have occurred in many installations where insufficient thought has been

given to their ratings. If an antenna has been up for a long period of time, it may be worth taking it down for inspection prior to full power operation. If any insulators are cracked or show signs of "tracking", replace them. Doubling-up on insulators is also easy to do, and may save problems. If there is any chance of people or object coming close to the antenna, take steps to move it higher, or place barriers so that this cannot happen. Check the SWR of your antenna. If you have a favorite part of any band you use most often, consider adjusting the antenna for minimum SWR in this part of the band.

Coax and Connectors The importance of a well-constructed feed line system cannot be overstated. After all, the purpose of the amplifier is to provide *(coax and connectors continued)* approximately 2 S units (12+ dB) of improvement in your radiated signal. All too often installations are encountered where cheap/poor/under-rated/old coax and connectors are probably responsible for one S unit of degradation. This means you could have bought a 375watt amplifier and achieved the same radiated signal by buying good quality feed line components! Use the lowest loss 50 ohm coaxial cable you can get your hands on. Use new, clean connectors Clean the connectors after soldering them, and before mating them with the amplifier. Make

sure any excess solder is removed from the connector, likewise any fragments of braid etc. Never use old coax, which may have had moisture penetrate under the jacket. Run the coax in straight lines as much as possible. Support it frequently using non-compressive clips so it does not hang and stretch under its own weight. Avoid sharp bends (most manufacturers will specify a minimum bend radius for their product). Make sure the transition from feed line to antenna is waterproof. Provide for disconnection of the feed line when not in use.

Air Flow It is critical that the 87A airflow is unrestricted in any way. Keep the top of the amplifier clear of any restrictions. If you are mounting the amplifier in a console, make sure that the exhaust air is properly and fully removed from the console. Poorly designed consoles can result in outlet air being drawn back into the amplifier air intake and recirculated, getting hotter and hotter, resulting in degraded amplifier performance or even failure. If you are designing your own console, consider putting in additional fans and/or ducting to deal with waste heat. Try to minimize the possibility of dust or other contamination getting drawn into or falling on the amplifier.

RF Safety The FCC requires users to check their installations for compliance with published values for allowable exposure to RF fields. This information is available in ARRL publications, FCC Printed rules, and on the web. Alpha Radio Products strongly recommends that this be done for any installation, both fixed and at an expedition or contest site.

If you have any questions regarding engineering your 87A into your amateur radio station, do not hesitate to call Alpha Technical Support. Installed per the manufacturers recommendations.

CAUTION – READ THE MANUAL CAREFULLY BEFORE OPERATING YOUR 87A.

The ALPHA 87A is extremely easy to install and operate, but failure to carry out each procedure exactly as described in the manual is likely to lead to amplifier damage which is not covered under warranty. Damage to other station equipment also may result.

Before Operating Your Alpha 87A

1. You must set transceiver power output properly. The Alpha 87A requires about 50 watts drive for full rated output. **Damage caused by overdriving the ALPHA 87A will not be covered under warranty.** Fortunately, most modern transceivers maintain quite consistent output from band to band and mode-to-mode if set up properly. We recommend that you only run the Alpha 87A in high voltage mode, running your amp in low voltage mode with high plate current can damage components.
Setting the transceiver POWER or RF PWR control IS NOT SUFFICIENT. Several popular transceivers can generate RF spikes of 200-300W or more unless the transceiver internal ALC (drive level) is also adjusted carefully according to its manufacturer's instructions. This typically is done with a knob labeled DRIVE (IC-781, FT-1000), PROCESSOR OUT (TS-940, TS-950) or, on SSB when speech processing is not in use, MIC or MIKE.
2. **The ALPHA 87A "faults" into STBY or OFF when unsafe operating conditions occur.** If this happens, record which SEGMENT LEDs are flashing to indicate a BCD fault number, and refer to manual section 8.0.
3. **On any frequency where your antenna VSWR exceeds 1.5:1,** it's important to manually program the ALPHA 87A for a proper match. See manual sections 7.2-7.4. Efficiency, linearity, and output often can be improved even when VSWR is less than 1.5:1. The 87A does not contain an antenna tuner. The SWR will need to be tuned via the antenna or an external tuner connected to the output of the Alpha 87A.
TO SAVE THE DATA TO MEMORY after manually tuning your ALPHA 87A in any given segment, first press ENTER; then, while the ENTER LED is flashing, press the desired SEGMENT button.
4. To operate the ALPHA 87A efficiently and cleanly at power output much different from 1.5kW it must be manually tuned and loaded (i.e. programmed) accordingly or AlphaMax must be turned on. See Section 7.

5. **Induced energy from nearby electrical storms** or other power transients may damage components. Such damage is not covered under warranty. **It is important to use a good lightning arrestor**, and it is good practice to disconnect and ground antenna

feed lines, and to disconnect A-C power, when the equipment is not in use.

6. Never use an automatic antenna tuner into or through the Alpha 87A. This will cause damage to the input wattmeter & input relay.

Overview of Amplifier Capabilities

It is extremely important to thoroughly review the Installation and Operation sections of this manual before attempting to use the ALPHA 87A. Failure to do so could result in serious damage not covered under warranty.

- **Continuous RF Output.** The Alpha 87A is capable of 1.5kW continuous RF output on all commonly used modes and on any authorized amateur frequency from 1.8 to 29.7 MHz. **Band change and tune-up are microprocessor controlled and no special cables or adapters are required.**
- **Compatibility with popular amateur transceiver and excitors.** The Alpha 87A requires approximately 50-55 watts peak RF drive for 1.5kW output. No user programming or adjustments are necessary for maximum-legal-power amateur operation into load VSWRs as high as 1.5:1. However, **the amplifier may easily be user-programmed to optimize operation with VSWRs up to 2:1, on non-amateur frequencies, and at various power levels.**
- **Capable of full CW break-in (QSK) and all digital modes when used with any appropriate transceiver. All front panel functions plus numerous other diagnostic and control functions are accessible via its RS-232 communications port.**
- **Protective functions built in.** The microprocessor-based control system incorporates protective functions that minimize the probability of accidental damage to the amplifier or its power tubes. **In most cases, when one of the protective functions is "tripped," front panel LED indicators display a fault code, which indicates the nature of the problem, (e.g. excessive grid or plate current, load VSWR, etc.)**
- **AlphaMax firmware comes with added features to readjust output network, trim tune-up time, and re-adjust loading to prevent distortion due to overdrive.**
- **AlphaRemote software lets you to control all functions of your Alpha 87A from a compact toolbar on your Windows desktop.**
- **Optional auxiliary cooling fan available. We recommend using the external**



auxiliary fan for extended RTTY or other "locked key" service. This is available separately from Alpha Radio Products.

- Capable of no more than 150 watts into a 50dB load in bypass mode.

ALPHA 87A Specifications

NOTE:

FCC rules do not permit new amateur amplifiers to be operable on 24-30 MHz as delivered within the US and possessions. Owners who send Alpha Technical Support a photocopy of their authorizing amateur license will promptly be provided information on "unlocking" 12 and 10 meter coverage..

Band Change & Tuning: Automatic under microprocessor control; average time required for complete band change and tune-up, <1 second. No special cables or connections required.

Frequency Coverage: All amateur bands 1.8-29.7 MHz* plus most non-amateur frequencies 6.0-19.0 MHz and 20-30 MHz.

Power Output: 1500 watts PEP, keyed CW, or continuous carrier, no time limit. Auxiliary cooling fan (optional) recommended for very high duty cycle continuous operation i.e. contesting & RTTY.

Drive Power: Typically 50 to 55 watts for full rated output.

Input VSWR: $\leq 1.5:1$ within amateur bands; $\leq 2:1$ elsewhere.

Tube Complement: Two Eimac 3CX800A7 triodes in grounded grid.

T/R System: Heavy-duty PIN diode switch capable of feed through and hot switching of 150W exciter power. Switching time approximately 1ms. Enclosed mechanical bypass relay.

ALC: Grid-current-derived, -10V maximum, adjustable gain.

Harmonic Output: Better than 50 dB below rated output.

Intermodulation: Better than 35 dB below rated output.

Fault Protection: Plate current, grid current, load VSWR, T/R sequencing, gain (i.e., severe mistune or RF arc), overdrive, open heater, over temperature, others.

Displays: LED bar graphs for peak P_{out} , P_{ref} & I_g , and switched bar graph for I_p , HV, and Tune indicator.

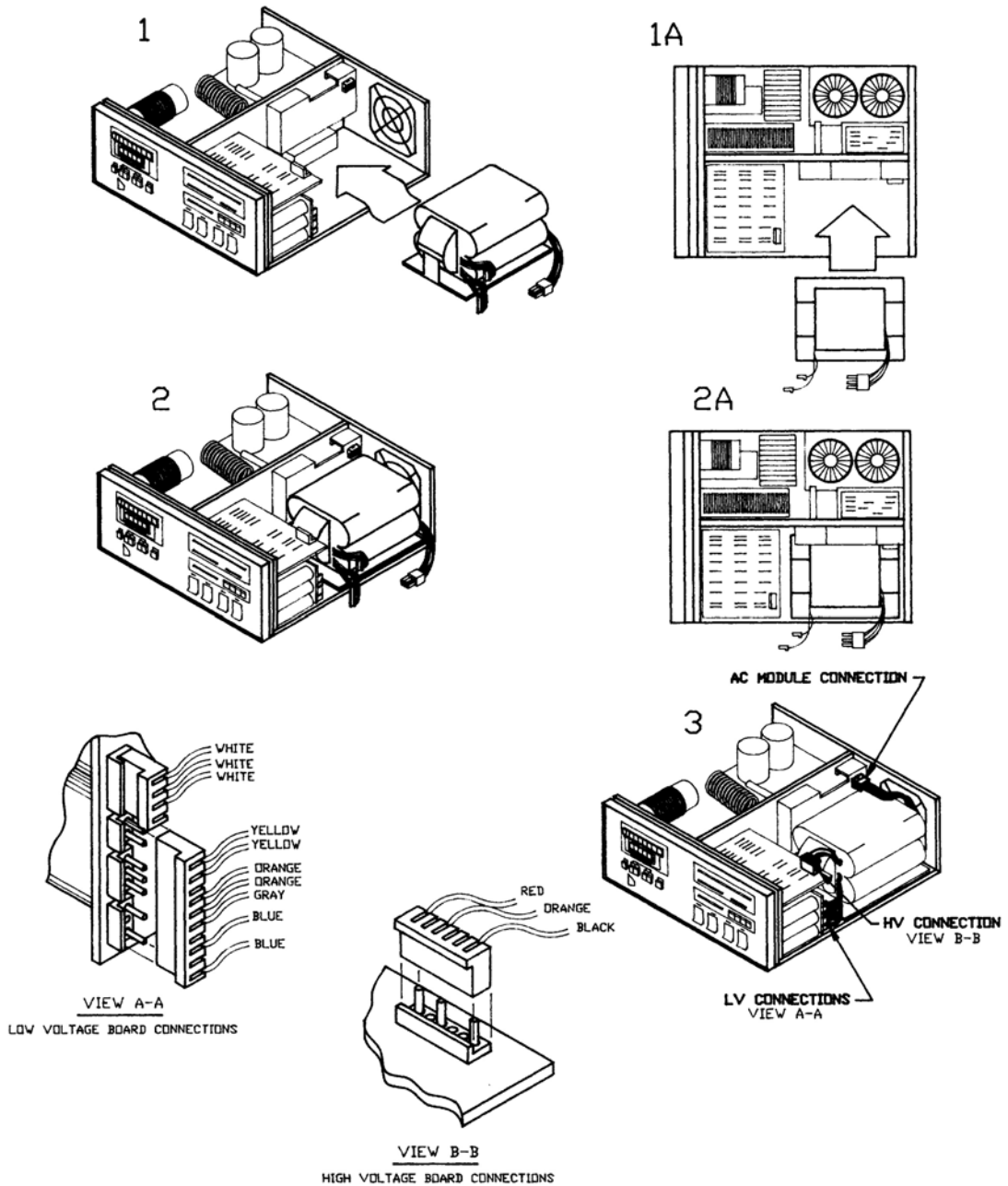
Cooling: Full cabinet ducted air, rear intake/top exhaust. Floating blower mount for quietest operation.

Primary Power: 190-250V (200, 220, 240V nominal taps), 50-60 Hz, single phase; fused 20A.

Size & Weight: 17.3" W x 7"H x 16.5" D (439 x 178 x 419 mm) excluding controls, feet, and connectors. 75 lb. (34kg) net.

Note: Alpha Radio Products reserves the right to change design and/or specifications without prior notice or obligation.

Figures 1-3 Transformer Installation



Unpacking and Preparing for Operation

(Refer to Figures. 1-5, pages 6, 8, 9)

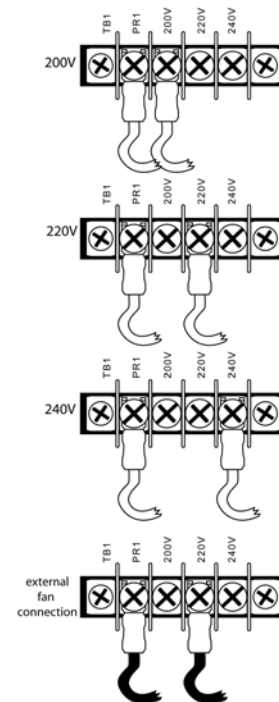
4.1 Carefully unpack amplifier and transformer. Inspect both for physical damage. Save all packing material for future use.

4.2 Remove cover by removing all screws except the two located in the perforated tube exhaust areas. Inspect carefully for shipping damage. Check all connectors for proper seating. If damage is discovered, call Alpha Technical Support immediately.

4.3 Remove blower motor shipping hardware from rear chassis wall. Save the two 10-32 bolts, fiber washers, and rubber shim; reinstall this hardware whenever the chassis is transported. NOTE: For heavy-duty use or 50 Hz operation, the optional auxiliary fan must be installed.

4.4 Connect the proper internal line voltage tap. The ALPHA 87A may be operated from any AC power source of 190-250V, 50-60 Hz, 20-ampere capacity. It is advisable to check the actual voltage at the connector you are going to use for the Alpha 87A. Use an accurate meter such as a DMM set to AC volts. A 4-terminal barrier strip for tap selection is located atop the AC module to the left of the transformer, approximately where the arrow points in fig. 1A. DO NOT MOVE the wire connected to the terminal marked PRI! If necessary, move the other wire to the

tap (200, 220, or 240V) closest to your nominal AC line voltage. (Amplifiers for US distribution destinations normally are shipped connected for 240V input.)



4.5 Install Transformer. Position amplifier flat on a table with the right side of the chassis facing forward. Install the transformer per Figures 1 through 3, using its wire handle. Use care not to damage wiring or

components. You may wish to have a helper steady the chassis during the following two steps. (Bolts must be installed for safe operation!)

Align the transformer captive nuts with corresponding chassis holes. Taking care not to torque or twist the chassis, carefully extend it over the edge of the table just far enough to loosely screw in the two outside transformer-mounting bolts (1/4-20 hex head with flat washers, supplied).

Do not stand the amplifier on edge or move it further over the table edge. Instead, rotate it so as to install the bolts. Now center the transformer as much as possible so that both sides are well clear of metalwork. Move chassis as above while tightening all 4 bolts.

Inspect the connectors on the transformer to be sure there is nothing blocking the connector holes, such as pieces of shipping materials. One of the transformer's connectors plugs into the AC power module near the top/rear of the chassis center partition, on the power supply side. Another connector plugs into the low voltage power supply board, which is immediately in front of the transformer near the chassis floor.

A third (HVAC) connector plugs into the HV board in front of the transformer and up high. (See Fig. 3 and views A-A and B-B). Make certain the connectors are properly mated and seated, but don't force them; they mate and latch easily.

4.6 Insure that both tubes are fully seated in their sockets with their red rubber chimneys firmly contacting the chassis.

4.7 Make sure the HV crowbar works smoothly.

4.8 **Replace the cover and carefully reinstall all screws. Be careful not to force or cross thread the screws.** Never use screws longer than 1/4"! (Screws supplied are 1/4").

Do not attempt to operate the amplifier with the cover removed. This could cause damage to the Alpha 87A or you.

Figure 4 – Inside Top View

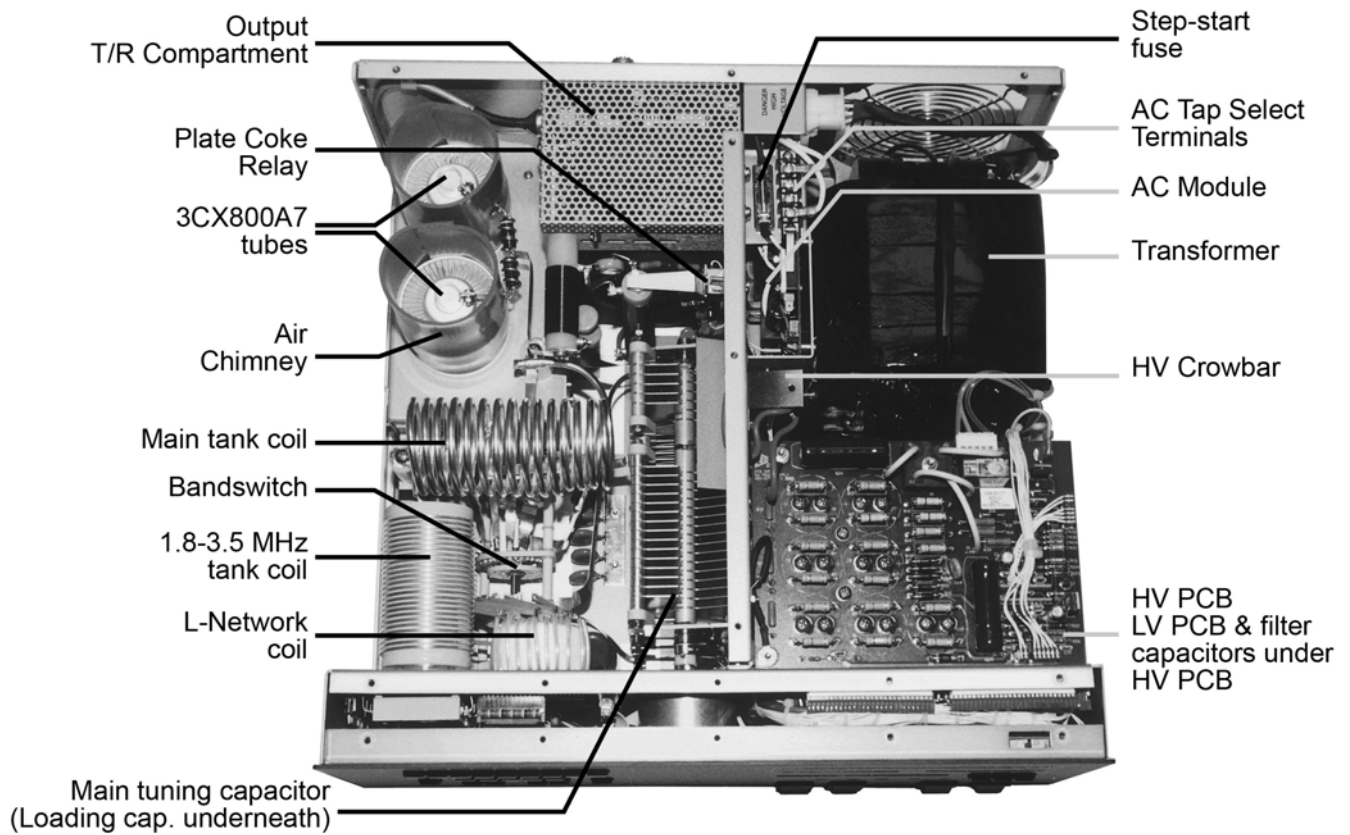


Figure 5 – Front Panel
Lowered

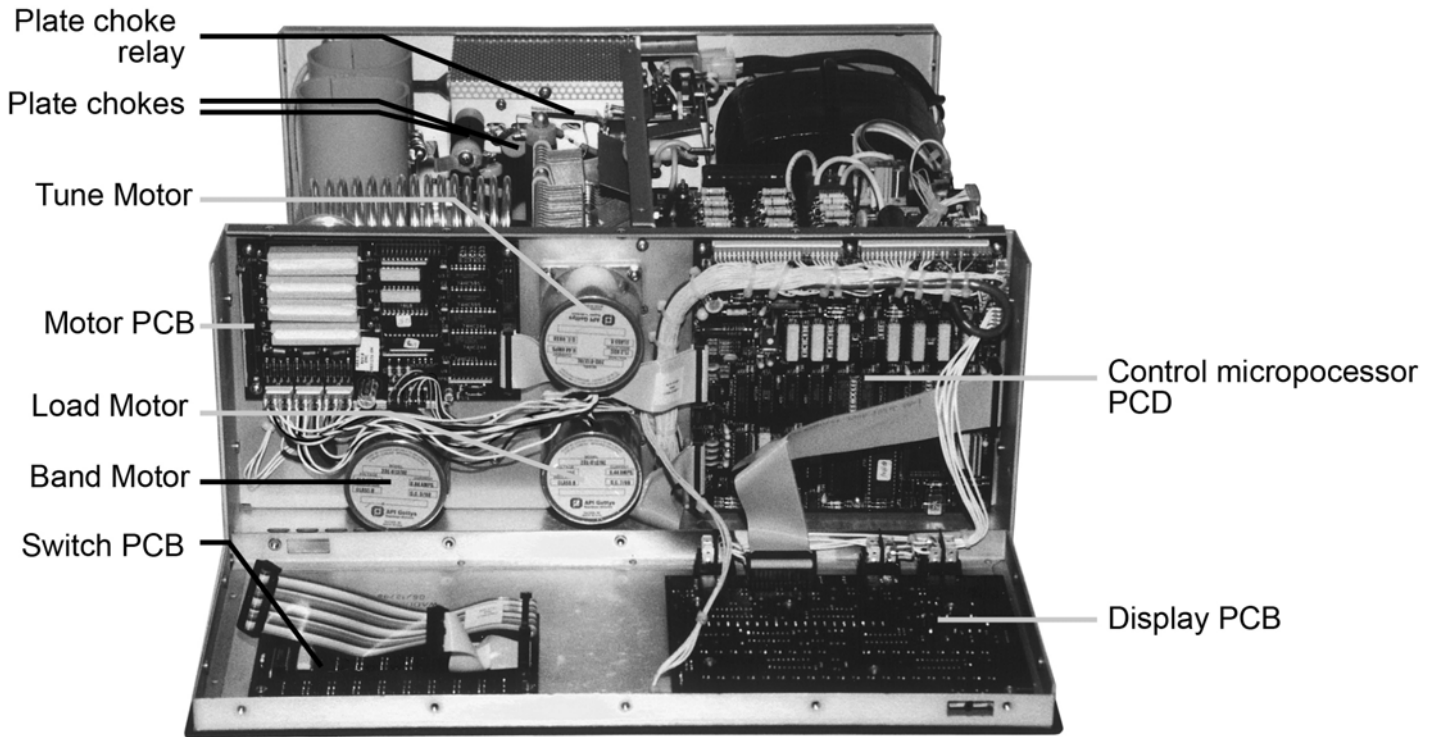


Figure 6 - Inside Front Panel

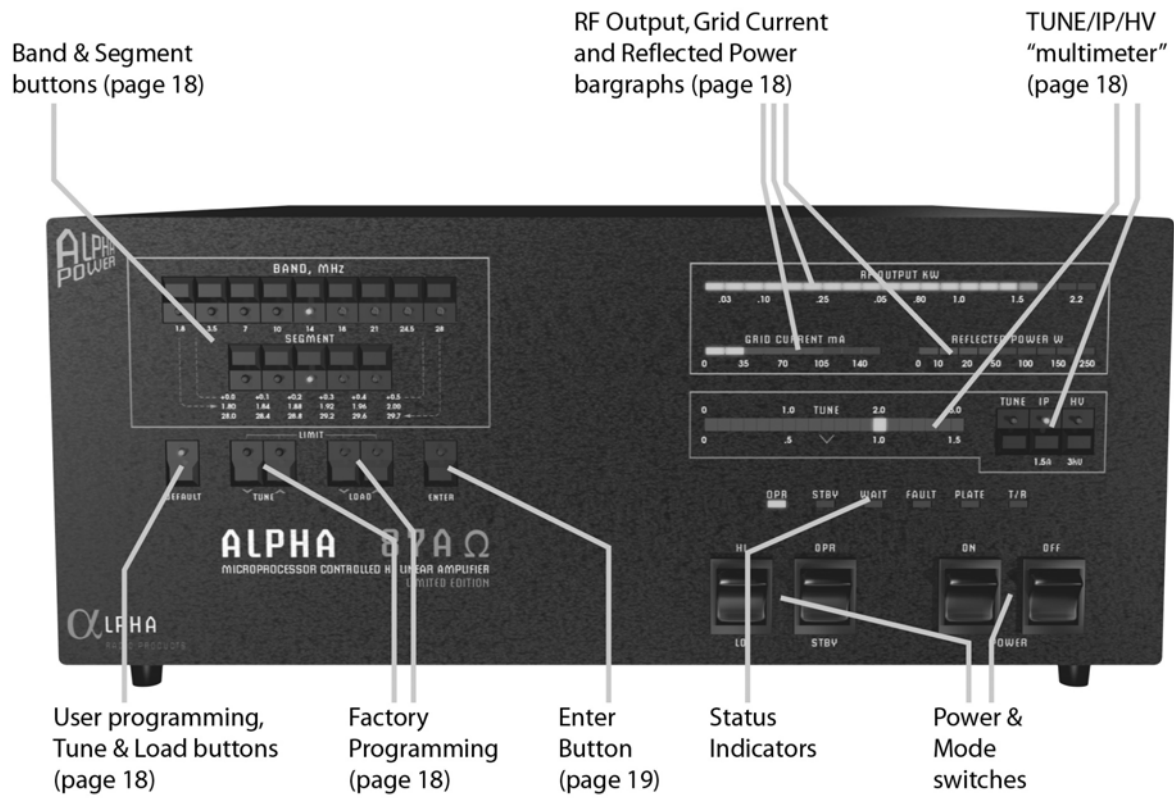
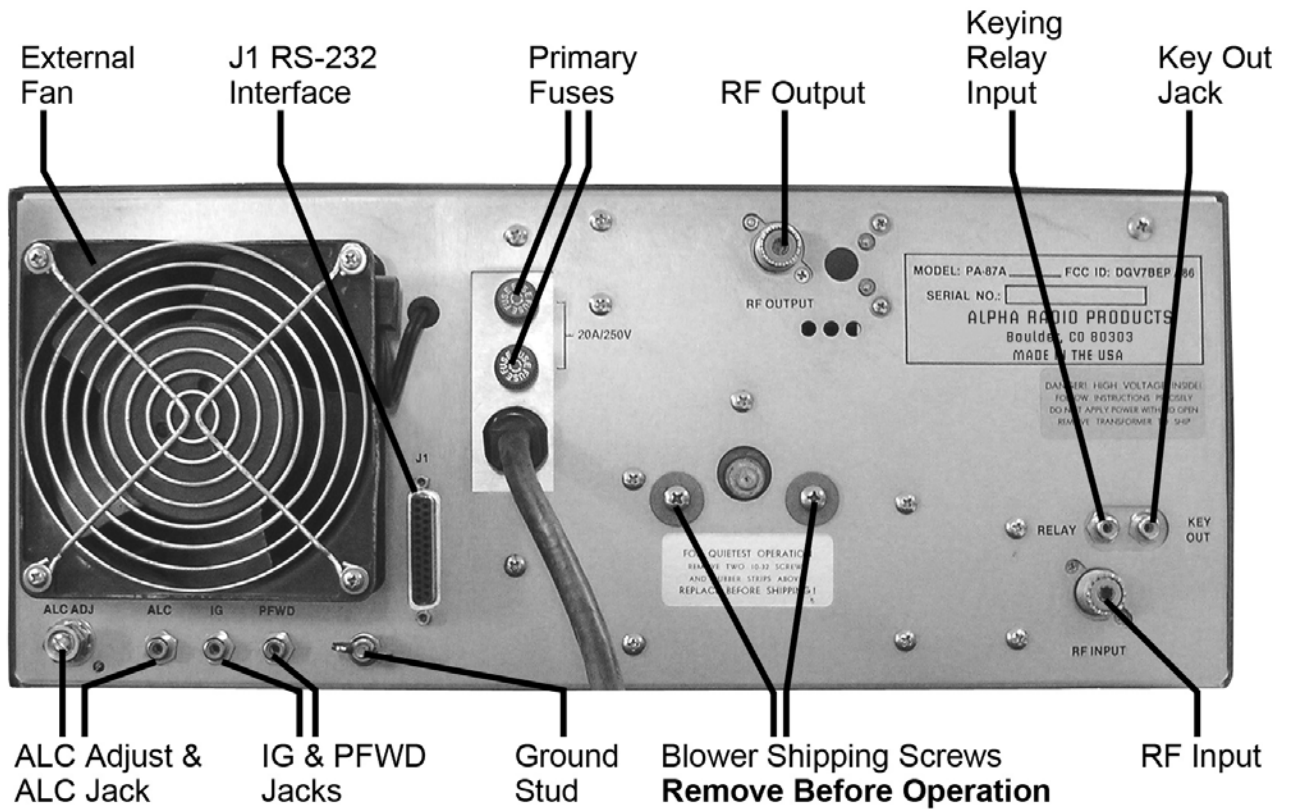


Figure 7 - Rear Panel



Control and Indicator Functions

5.1 RF OUTPUT, GRID CURRENT and REFLECTED POWER bargraphs are peak-reading and generally self-explanatory. Example: 1.5 kW output (forward power into a 50 ohm load) is indicated when all green LED segments to the left of the 1.5 (kW) label are fully lighted and the first red LED segment is barely illuminated. The primary calibration point for RF OUTPUT is at 1.5 kW on 14 MHz. Accuracy of the meter is approximately 10%.

5.2 TUNE/IP/HV "multimeter": The function of this indicator is selected by buttons at its right. It is a moving-dot display. HV (plate voltage) is read on the 0-3 kV top scale and Ip (plate current) on the 0-1.5 A bottom scale.

The TUNE meter function permits fast and safe manual tuning and loading of the amplifier at reduced power (Sec. 7.3)

5.3 BAND and SEGMENT buttons: Each band (tuning range) is represented by a button with indicator LED on the upper left front panel. On each band, five memory channels, or segments, are provided for factory programmed tuning data and five for user (field) programmed data. On the front panel, five SEGMENT buttons with LED indicators correspond to these band segments as detailed below.

BAND or SEGMENT buttons are not used during routine operation because the ALPHA

87A automatically switches bands and tunes up, if necessary, upon application of RF drive.

BAND and SEGMENT buttons may, however, be used before applying drive to avoid the brief amplifier bypass, which occurs during automatic band change with drive applied. When a new BAND is selected manually, the amplifier automatically selects the segment last used on that band unless a different SEGMENT button is pushed. To protect against improper tuning, the ALPHA 87A automatically overrides any improper manual band or segment selection upon application of drive.

The SEGMENT buttons and the row of buttons below them also are used in field programming of the ALPHA 87A as described later.

Each BAND button is labeled with the nominal (MHz) frequency of the principal amateur band covered within its tuning range. Labeling below each SEGMENT button indicates its factory programmed frequency coverage relative to the frequency in MHz shown below the BAND button. As may be deduced, on all bands except 1.8 and 28 MHz segment center frequencies are factory turned at 100 kHz spacing; 1.8 MHz segments are spaced 40 kHz, 28MHz segments 400 kHz.

5.5 Factory Programming: Each segment is factory (default) programmed so that the



ALPHA 87A will deliver 1.5 kW output (into a 50-ohm load of VSWR of $\leq 1.5:1$) efficiently across the frequency range indicated under that SEGMENT button.

Example: Using default (factory) tuning with the "14" (BAND, MHz) button and the number 3 SEGMENT button illuminated, ALPHA 87A tuning is centered at 14.250 MHz for optimum performance from approximately 14.2 to 14.3 MHz. Panel labeling shows the nominal edges of factory segments in the 1.8 and 28 MHz bands. Actual segment coverages overlap somewhat to prevent "hunting".

5.6 User Programming, TUNE & LOAD buttons: The ALPHA 87A may be user-tuned at any five different center frequencies in each band; the five SEGMENT buttons may be assigned to these frequencies in any desired order, as explained in Section 7.2. The TUNE and LOAD buttons are used during user programming.

Each segment is identified in memory by its center frequency and nominal width. During automatic segment selection the amplifier seeks first the nearest user segment centered within 50 kHz of the drive frequency (10M, ± 200 kHz) then such a factory segment. If neither exists it selects the nearest segment.

5.7 DEFAULT button: May be used to override automatically selected user tuneup data for a segment and instead "default" to factory data.

5.8 ENTER button: Used in conjunction with SEGMENT buttons to memorize user-tuning data. (See Section 7.)

5.9 Special rear-panel connections: (See figure 7, opposite)

ALC & ALC Adjust – See sections 7.1 & 10.2.

IG & PFWD – Provide d-c signal outputs proportional to grid current and power output, respectively.

KEY OUT – Provides a pull-down to ground (through 47 ohm resistor) which follows the line connected to the RELAY jack when the amplifier is ON and in OPERATE condition. When the 87A is in STANDBY or OFF, KEY OUT is directly connected to the RELAY jack by a closed relay contact in the amplifier. Useful for special T/R hook-ups when amplifier is used with exciters having poor T/R sequencing. Contact Alpha Power Customer Support for specific advice.

J1-RS-232 communications link; see Section 9. Figure 7 Rear Panel Connections

Installation

(Refer to Fig. 7, page 20)

6.1 Coaxial Cable Types & Connectors

Connect the transceiver RF output to the ALPHA 87A RF INPUT with 50 ohm coaxial cable – RG-58C/U or equivalent. A 6 ft. cable is supplied for this purpose.

Coaxial cable from the Alpha 87A RF OUTPUT to antenna should be RG-8A/U, RG-213/U, or equivalent high quality type with a PL-259 UHF-type plug on the amplifier end. RG8X cable is not recommended.

6.2 T/R Control Cable

The 87A has a full break-in PIN diode QSK system requiring only the normal interconnection when used with a modern QSK transceiver. The Alpha 87A requires a contact closure (short circuit) on transmit from its RELAY jack center pin to chassis. This function is supplied by the transceiver, usually from a dedicated relay that is open in receive and closed in transmit. Shielded wire should be used for the T/R control cable. The Alpha 87A end must be fitted with a common phono (RCA-type) plug and the other end with a connector suitable for the transceiver. See transceiver manual for transceiver connections. The voltage at the relay jack is 5V at 1mA; this is acceptable for most modern transceivers.

The T/R relay contact must close before application of RF drive. 87A protection circuitry prevents “hot-switching” with RF drive applied. Modern transceivers have the proper time delay between key-up and the start of the transmitted signal to allow the Alpha 87A to follow the CW keying. If a T/R timing problem is suspected, connect the CW keyer to the RELAY jack on the 87A, and connect a cable from KEY OUT on the 87A to the keying input of the transmitter.

6.3 Antenna

Connect a nominal 50 ohm antenna of VSWR <2:1 at the frequency to be used to the 87A RF OUTPUT jack.

6.4 Ground Wire

Connect a heavy copper strap or braid from the #10 ground stud & wing nut on the rear panel of the 87A to the chassis of the transceiver and other station equipment, and to the main station RF ground.

6.5 Green Wire

Connect to A-C power consistent with tap selected. **CAUTION: Be sure the 87A green wire connects to A-C ground or neutral.**

ALPHAMAX™

Firmware

AlphaMax is new firmware designed to add new features to the Alpha 87A. All amplifiers shipped after October 1999 have AlphaMax already installed. If you have an amplifier that was shipped from the factory prior to October 1999, the installation of new chips on the 87A controller board is required. The chips to be replaced are in sockets, but if you are not completely comfortable with opening your 87A and installing new chips, then please call Alpha Customer Support for telephone support or for a Return Authorization.

As you transmit, AlphaMax automatically re-adjusts your 87A's output network to deliver maximum power output (within maximum capabilities of the ALPHA 87A) and linearity for the specific antenna and frequency actually in use.

AlphaMax even prevents distortion due to overdrive. If peak RF input to your 87A changes significantly,* AlphaMax detects the onset of non-linearity. It quickly re-adjusts loading and tuning to avert flattopping and splatter - while maximizing power output. No other amplifier, vacuum tube or solid state, can do

AlphaMax Operating Procedures

Function:

The AlphaMax firmware upgrade enables the Alpha 87A to automatically optimize itself for changes in drive level, or antenna impedance. This allows the amplifier to re-tune as the operating frequency is changed and allows the amplifier to re-tune if different antennas are selected. This dynamic adjustment of the tune and load controls helps to provide optimum tuning of the 87A to improve efficiency and reduce the change of distortion.

The classical approach for autotune utilizes a phase detector but AlphaMax uses artificial intelligence to readjust the tune and load controls to optimize the output power while reducing the grid current and plate currents. This approach was chosen to enable the large number of Alpha 87As already in operation to be upgraded without the expensive addition of a phase detector and other associated hardware.

The software emulates the way a human operator would monitor an amplifier and readjust it for optimum performance under varying conditions. The firmware constantly



monitors the various operating parameters and changes the tune and load controls in response to varying levels of drive and load impedance.

AlphaMax autotune algorithms only engage at input power levels of 30 watts or greater, where the improvement in efficiency will provide a significant improvement in amplifier performance.

The optimum settings of the tune and load controls is dependent on both drive level and antenna impedance. SSB is an amplitude-varying modulation and the firmware will make adjustments during operation but may take a few seconds to finalize the best settings for the particular amount of drive. CW autotune typically happens somewhat faster.

OPERATION:

AlphaMax may be engaged remotely from the AlphaRemote software by clicking on AUTO with the left button of the mouse. AlphaMax may also be engaged locally by pressing the ENTER button simultaneously with the LOAD^ button. When AlphaMax is operating, the DEFAULT LED will flash.

AlphaMax will attempt to make up to 80 adjustments of the TUNE and LOAD controls in order to find the optimum settings. Under some conditions AlphaMax will not be able to find an optimized setting within the parameters as defined in the firmware. Under such conditions AlphaMax will stop hunting and the DEFAULT LED will stop flashing. AlphaMax may be restarted by clicking on the AUTO button in AlphaRemote or depressing ENTER and LOAD/UP simultaneously. (Note: Some transceivers appear to have a power drop after a few seconds of operation and this power drop (and subsequent power increase after a few seconds in receive) will tend to make AlphaMax hunt for the proper settings for more than 80 tries and then shut off. This is a problem with the transceiver and the transceiver should be repaired.)

It is advisable to store different default values for a given band and band segment as a better

starting point for the algorithms to find an optimized value in situations where the autotune gives up after 80 iterations.

Autotune operation may be stopped by clicking on AUTO OFF under Alpha/Remote or may be stopped by hitting either TUNE or LOAD UP or DOWN buttons on either the front panel of the 87A or under AlphaRemote.

TIPS:

The AlphaMax algorithm will tune up the 87A into an acceptable range (or window) of values. Manually tuning may result in slightly better settings. For best results and fastest operation manually tune the 87A to the best setting for the preferred antenna and drive level and then store these settings as the DEFAULT values. AlphaMax will then adjust the tuning and loading controls only when the antenna impedance changes or the drive level changes.

AlphaMax will attempt to tune the 87A to the optimum gain point, which results in maximum efficiency and lowest distortion. Under high drive levels this may result in more than 1500 watts output. Output power should be adjusted by setting the input drive level to the appropriate level rather than by mis-tuning the amplifier to reduce power output.

SERIAL PORT OPERATION:

Three new commands control autotune operation:

- AUTOTUNE - queries and returns the autotune status
- AUTOTUNE ON - enables autotune actions
- AUTOTUNE OFF - disables autotune actions

When autotune action is disabled, the LOAD/UP and TUNE/DOWN LEDs provide a indication of what action would be taken if autotune was enabled. For example, when the grid current exceeds the threshold value



associated with the current input power level, the LOAD/UP LED will be turned on to indicate which action would be taken by the autotune algorithm if it was enabled. If the autotune subroutine determines that the gain is too low, the TUNE/DOWN LED will flash to indicate that autotune action would adjust both TUNE and LOAD values in an attempt to increase the gain.

The above serial port commands may be utilized by software other than AlphaRemote. AlphaMax doesn't change normal operation of your ALPHA 87A in any way. You can activate

or de-activate AlphaMax at the touch of a button, but we don't think you'll want to turn it off. And it's easy to install in any 87A; a qualified technician can do it in about 15 minutes.

NOTE: AlphaMax can be used without AlphaRemote (see below). However, AlphaRemote REQUIRES the installation of AlphaMax first. AlphaRemote utilizes new commands that are only available in the AlphaMax ROM upgrade.

ALPHAREMOTETM Software

AlphaRemote is new software to add remote control to your Alpha 87A. It requires the connection of a Windows based computer to your 87A via the serial port.

NOTE: AlphaRemote will work with the Alpha/Power Digital Antenna Selection (DAS) antenna selector installed but requires that the instructions in the DAS manual concerning the serial cable be followed exactly.



SAFETY

There are lethal voltages in the Alpha 87A amplifier. Special precautions must be taken to allow for the safe completion of these modifications.

- 1) Always unplug the amplifier from the 240 vac mains before opening the case and doing any work on your 87A.
- 2) The high voltage crowbar activates when the cover is removed and should eliminate any residual high voltage within the amplifier but it is always prudent to short the high voltage to ground in the area of the tube plates or the plate RF choke with an insulated screw driver as an extra precaution.
- 3) Do not attempt to test the modifications with the cover removed since the built-in interlocks will not allow the amplifier to be energized.
- 4) Do not defeat the interlocks as a means of testing the amplifier with the cover removed. Proper operation of the amplifier requires that the cover be in place for shielding the digital circuitry from the radiated RF signal.

AlphaRemote Operating Procedures

AlphaRemote software allows you to control the Alpha 87A from a computer screen under MS Windows™ with a mouse. The front panel controls of the 87A are represented on the monitor screen and can be actuated with a “left click” of the mouse. The Alpha 87A must be plugged into the AC Mains before the AlphaRemote software is started. But the 87A does not have to be turned ON. The 87A microprocessor runs whenever the 87A is plugged into the AC mains and the AlphaRemote software initializes the amplifier each time it is started. If the amplifier is not properly initialized, the bar graph metering in the AlphaRemote software will not operate. If this situation occurs then the 87A was not AC powered at turn on and the software will need to be restarted once the 87A is plugged into the AC Mains.

The display format of the AlphaRemote software may be controlled by holding down the “left button” of the mouse while the cursor is on the lower left or lower right corner of the current display. By “dragging” the display to an alternate shape the display will change to the format desired—as shown in Figure 2. showing the display formats.

Power ON and OFF, Mode OPERATE and STANDBY, and High Voltage HIGH and LOW can be controlled by left clicking on their appropriate “button”. The current status of the 87A is displayed on the STBY, OK, and READY indicators.

Band and Segment selection is made with pull down menus by left clicking the mouse and selecting the desired band and segment.

AUTO TUNE (AlphaMax firmware) can be engaged by clicking on the AUTO button. If the autotune disengages the text display will notify the operator and the AlphaMax firmware can be restarted by clicking on the AUTO button again or by simultaneously pressing the 87A's ENTER and LOAD^.

TUNE and LOAD settings can be changed manually by clicking on the “up” and “down” arrows.

Manually changing the TUNE and LOAD controls using either the controls on the 87A or the equivalent controls on the Windows screen will result in AlphaMax being turned off. To engage the AlphaMax software again you can either clicking on the AUTO button again or by simultaneously pressing the 87A's ENTER and LOAD^.

The software DEFAULT and ENTER buttons operate in the same fashion as the controls of the same name on the front panel of the 87A.

Status and fault messages are displayed in the window under the control buttons.

The bar graph meter displays differ from the LED displays in that the entire display changes color when a limit is exceeded. This aids in determining when the amplifier is being driven beyond its normal conditions.

Experimentation with the mouse will quickly provide additional information on the operation of the 87A via the AlphaRemote software. Every effort has been made to ensure the operation of the software is intuitive and closely simulates normal operation of the front panel controls.

Installing the AlphaRemote Software

1. Close any programs running under Windows.
2. Insert AlphaRemote CD into CD drive (or disk #1 in floppy drive).
3. Click START on taskbar, then RUN.
4. Click BROWSE and select My Computer, X:\setup.exe, then click OPEN. When X:\setup.exe is showing in RUN window, click OK to start installation of AlphaRemote. Follow the instructions on screen. (Note: X is the drive letter for your CD or floppy drive).
5. To run the AlphaRemote program click START on taskbar, then PROGRAMS, then select the Program Group where software was installed (default is AlphaRemote). Click the AlphaRemote icon once to start program. (NOTE: The Alpha 87A must be connected to the AC power BEFORE starting the software.)
6. Click once on CONTROL, then CONFIGURE, then ADD AMPLIFIER. Select the desired serial port. The default SETTINGS for communications parameters will be correct if a standard 25-pin (87A) to 9-pin (computer) modem cable is used (see paragraph 9 below). Click OK to save the selected parameters.
7. If you have more than one 87A then select another amplifier to configure or click OK to close the CONFIGURE window if you are only setting up one 87A. The AlphaRemote window will open showing status and operating parameters of the selected 87A amplifier(s).
8. The front panel controls of the amplifier are duplicated in the AlphaRemote window. Both Local and Remote control of the 87A are possible when the program is running.
9. A standard 25-pin to 9-pin modem cable will provide the correct connections between the Alpha 87A and computer serial port for 4800 baud data. If a 25-pin to 25-pin cable is used between the 87A and computer, refer to attached sheet (or page 19 of the 87A Operating Manual) for pins that must be disconnected at one end of the cable.
10. If AlphaRemote software is to be used with an 87A which also has a DAS connected, the cable between the DAS and computer must have pins disconnected on the DAS end (see attached sheet). This is necessary whether using a 25-pin to 9-pin cable OR a 25-pin to 25-pin cable between the DAS and computer.

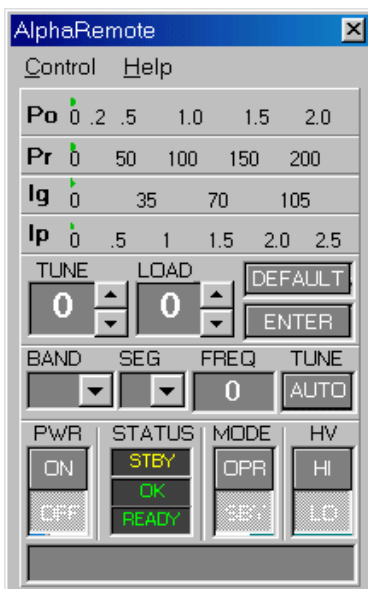
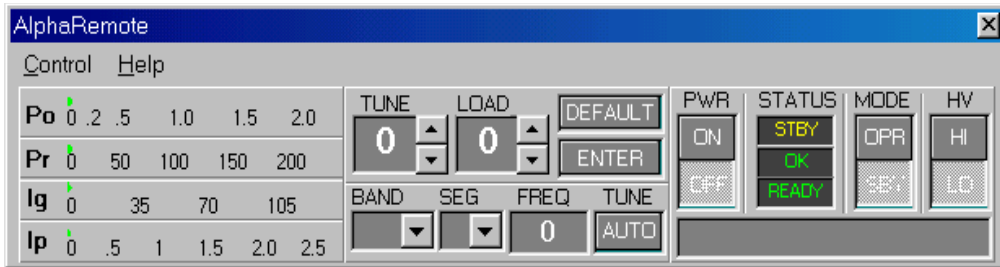
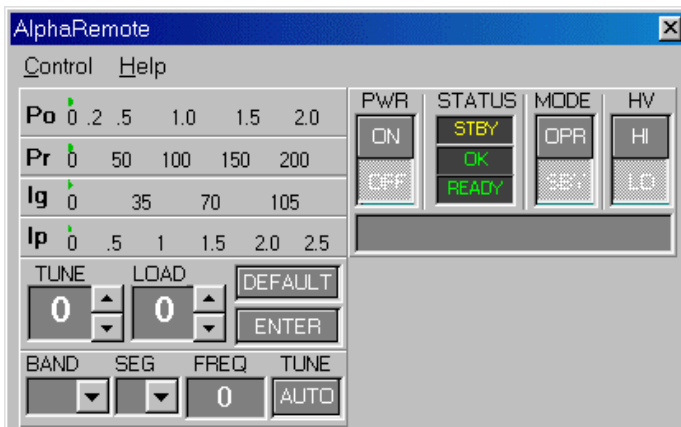


Figure 8. Examples of AlphaRemote screen configurations.

Select the desired configuration by clicking and holding down the left mouse button while the pointer is touching either the lower left or lower right corner of the current display and dragging the display into the desired format.



How to Operate the 87A

Regardless of what frequency the ALPHA 87A was previously on, it is necessary only to apply AC power, wait 3 minutes for tube warm-up, and apply a few watts RF drive*. If driven on a band different from its existing setting the 87A automatically bypasses the transceiver output to the antenna for about one second while it change bands and tunes up. It then switches itself back in-line and the operator can confirm approximately 13-15 dB (20x-30x) power gain.

***NOTE:**

FCC rules do not permit new amateur amplifiers to be operable on 24-30 MHz as delivered within the US and possessions. Owners who send Alpha Customer Support a photocopy of their authorizing amateur license will promptly be provided information on "unlocking" 12 and 10 meter coverage.

Step-by-step Procedure

- a) Press POWER ON button; set mode switches to HI and OPR.
 - b) After the red WAIT (tube warm-up) LED extinguishes, the OPR LED will light. Apply 10-25 watts of excitation on the desired operating frequency.
 - c) Automatic band change and tune-up, when necessary, require only about one second, during which time transceiver output is by-passed directly to the antenna. After the Alpha switches back in line, adjust drive power (in the desired mode) so that peak output as indicated on the RF OUTPUT bargraph is about 1.5 kW. (Once you've become familiar with operation of your ALPHA 87A, it's quite possible that you won't need to re-adjust transceiver output when changing bands.)
- With RF output peaking near 1.5 kW, highest indicated grid current peaks should be 20-50 mA to insure both efficiency and linearity. If peak grid current is higher or lower, drive from the transceiver can be adjusted to correct it. Alternatively, the ALPHA 87A's field (user)

programming capability may be used to accurately match the actual antenna in use while achieving optimum efficiency and linearity at the power level desired. See Section 7.2.

7.1 ALC: Alpha Radio Products does not recommend use of ALC (Automatic Level Control) in most cases. In the rare case where faults or distortion recur because exciter power output cannot be adequately controlled, ALC feedback may be useful. See Sections 10.1 & 10.2.

7.2 User Tuneup Programming: The ALPHA 87A may easily be field-programmed as follows to achieve maximum efficiency and desired loading into the user's actual antennas on any frequency within the capability of the amplifier:

Each of the 5 channel memories represented by the 5 SEGMENT buttons may be user-programmed for any frequency within the tuning range of each band. The frequency labeling of SEGMENT buttons applies only to factory programming and to user segments programmed at the same center frequencies (e.g., 1.860, 14.050, or 28.600 MHz). Therefore it's usually convenient (but not required) to use factory center frequencies when user-programming amateur bands.

Each segment is identified in memory by its center frequency and nominal width. During automatic segment selection the amplifier seeks first the nearest user segment centered within ± 50 kHz of the drive frequency (10m, ± 200 kHz, 160m, ± 20 kHz), then such a factory segment. If neither exists it selects the nearest segment.

The basic approach to user programming is to use the TUNE meter function to pre-adjust tuning and loading at the desired frequency (for amateur use, preferably the center of a factory segment) with the actual load. Then "fine tune" to peak output power, and finally save the resulting tuning data in amplifier memory.

7.3 Pre-Tuning Using the TUNE Meter: The goal (for 1.5 kW peak output) is to adjust LOAD and TUNE alternately until the TUNE LED is positioned at the mid-scale "V" mark.

Heavier loading results when the LED is to the right of mid-scale, while lighter loading occurs when the LED is to the left.

Pre-Tuning Procedure

- a) Select the TUNE meter function and apply about 20 watts drive at the center frequency of the segment to be programmed.
- b) Use the TUNE buttons to move or "dip" the TUNE bargraph as far to the left as possible.
- c) If the TUNE indicator is to the left of the desired position, press the LOAD \blacktriangle (up) button until the indicator moves to the desired position, OR
- d) If the indicator is to the right of the desired position, use the LOAD \blacktriangledown (down) button instead.
- e) Repeat steps 2. and 3. above until the TUNE indicator is correctly positioned for the power level desired.

7.4 Final Touchup & Data Storage:

- a) Increase drive until the RF output is about 1kW. TUNE for maximum RF output.
- b) If the grid current reaches 70mA during operation at or below the desired power, press the LOAD \blacktriangle button once to increase loading and then retune for maximum RF output. Repeat if necessary until peak grid current at desired output is 20-50mA.

IMPORTANT: As the final tuneup step, *always* adjust TUNE for maximum RF output.

- c) To store tuning data in memory, press ENTER. While the ENTER LED is flashing, press the desired SEGMENT button.
- d) Continue as above with remaining bands and segments.

NOTES:

1. User segments may be reprogrammed any number of times by simply repeating the procedures for Pretuning and Final Touchup.
2. If bad user data is entered for any segment, factory data may be substituted by selecting the segment, pressing DEFAULT, ENTER, and then the segment button again.
3. Arrows (up or down) under TUNE buttons indicate increase or decrease tuning capacitance, respectively.
4. Arrows under LOAD buttons indicate (up) greater or (down) lighter loading. Increased loading moves the TUNE LED to the right, decreased loading to the left.
5. A lighted TUNE or LOAD button LED indicates the capacitor has reached its rotational limit. Capacitor rotation is 100 steps limit-to-limit.

Protective Functions and “Faults”

The ALPHA 87A's microprocessor-based control system constantly monitors various signals and conditions within the amplifier. If any signal or condition is detected that could cause damage or improper operation, the amplifier enters a fault condition. There are two types of faults; soft faults and hard faults. Both cause the amplifier to stop operating, hard faults cause the amplifier to turn itself off.

Soft Faults

Soft Faults may be caused by two conditions:

1. Improper operating conditions, usually overdrive (and possibly excessive plate or grid current), high load VSWR, or improper T/R control cable connections or timing.
2. Abnormal amplifier conditions (e.g. low bias) which may result in damage in the OPERATE mode.

When such a condition occurs, the control system automatically switches the amplifier to STANDBY. The FAULT LED lights, and one or more of the five SEGMENT LEDs display a binary fault code (faults numbered 33-37 and 99 are displayed differently, as described in the following Fault Codes Section.) The code displayed indicates the nature of the fault as follows:

Segment buttons----->

LEDs->

Decimal value of LED if flashing:

0	0	0	0	0
16	8	4	2	1



The fault number is determined by adding the values of all lighted LEDs.

Example: (+ = flashing LED, o = dark) + o o + + = fault code number $(16 + 2 + 1) = 19$. A listing of fault codes with a brief explanation of each can be found in the following Fault Codes section.

To reset a soft fault:

1. Return the transceiver to receive
2. Switch the ALPHA 87A to STANDBY
3. Correct the condition that caused the fault, and finally
4. Return the ALPHA 87A to OPERATE

Hard Faults

Failures such as HV shorts (extremely high plate current) or bias or control system failure result in immediate shutdown of amplifier AC power to avoid damage.

To reset a hard fault:

After the cause of the hard (power-off) fault is corrected, simply press the ON button. The fault code will then be displayed on the SEGMENT LEDs for 30 seconds during warm-up, and then clear automatically. **You must not turn off the power before the**

fault clears, or it will log another hard fault the next time the power is turned on.

Six of the SAME hard fault shutdowns over ANY period of time (with no other kind of Hard fault) will then put the 87A in Fault 99 which locks it up. This function was put in the amplifier to prevent any further damage if operation was attempted after a failure had occurred.

If the hard fault persists refer to Chart 2 in Troubleshooting Section.

ALC: In the rare case where faults or distortion recur because exciter output can't be well controlled, refer to Section 10, Troubleshooting Suggestions.

Fault Codes

Note: You must not turn off the power before the fault clears, or it will log another hard fault the next time the power is turned on.

FAULT T C C E E	FRONT PANEL* SEGMENT CODE *(+=flashing LED, o = dark)	FAULT TYPE	CAUSE
1	0 0 0 0 +	Soft	Receive PIN back bias voltage not at minimum required level with key down and no RF drive.
1	0 0 0 0 +	Hard	Same but with R/F drive present.
2	0 0 0 + 0	Hard	Five volt supply voltage too low.
3	0 0 0 ++	Hard	Five volt supply voltage too high.
5	0 0 + 0 +	Hard	Plate voltage abnormally low.
6	0 0 + + 0	Hard	Plate voltage abnormally high.
7	0 0 + + +	Soft	Cathode and/or power PIN diode back bias (-109V) not switching to the required low level with key down.
8	0 + 0 0 0	Soft	Transmit PIN diode back bias below minimum required value key up.
9	0 + 0 0 +	Soft	Transmit PIN diode forward current below minimum required value key down.
11	0 + 0 + +	Soft	Transmit PIN diode forward current exceeds maximum limit key down.
12	0 + + 0 0	Soft	Excessive input reflected power.
13	0 + + 0 +	Soft	Excessive and unsafe drive power.
14	0 + + + 0	Soft	Excessive load reflected power or RF voltage. May be caused by excessive load VSWR at an otherwise acceptable power (e.g. 4:1 at 1.5 kW) or excessive power at otherwise acceptable load VSWR (e.g. 2.5 kW at 1.9:1).

16	+ 0 0 0 0	Soft	Plate current greater than 1.35 amp for more than 4 seconds continuous. Note: The Ip button LED flashes for several seconds before a fault 16 Ip trip occurs.
17	+ 0 0 0 +	Soft	Abnormally low or high amplifier power gain. Usually due to extreme mis-tuning or possibly an RF arc.
18	+ 0 0 + 0	Soft	Filament current less than 2.0 amp. Possible open tube filament.
20	+ 0 + 0 0	Soft	Filament current greater than 3.5 amp. Possible shorted filament.
21	+ 0 + 0 +	Soft	Excessive tube temp. in transmit (key down); abnormal dissipation and/or insufficient airflow.
22	+ 0 + + 0	Hard	Control system fault; D/A feedback) not working.
23	+ 0 + + +	Hard	Control system fault; D/A feedback "1" not working.
24	+ + 0 0 0	Hard	System voltage fault. High voltage, +/-15 volts, or -109 volts below safe operating level.
26	+ + 0 + 0	Soft	RF drive before or without amplifier keyed (possibly mis-sequenced T/R), or attempted automatic band change with excessive RF drive.
29	+ + + 0 +	Soft	Attempt to transmit on invalid frequency, such as above 24 MHz without unlocking 24-30 MHz coverage.
31	+ + + + +	Soft	Excessive grid current; above 100mA continuously for 2 seconds. NOTE: Red LED in Ig bargraph flashes before Ig trip occurs.
33	TUNE▲ & ▼ LEDs flash	Soft	Control system fault; TUNE capacitor not initializing.
34	TUNE▲ & ▼ LEDs flash	Soft	Control system fault; TUNE capacitor not moving or zero sensor position not working.
35	LOAD▲ & ▼ LEDs flash	Soft	Control system fault; LOAD capacitor not initializing.
36	LOAD▲ & ▼ LEDs flash	Soft	Control system fault; LOAD capacitor not moving or zero sensor not working.

37	Bandswitch LEDs scroll>>>>	Hard	Control system fault; bandswitch not moving.
99	Unit refuses to turn on	<p>Results when the same hard fault occurs 6 consecutive times without one successful power-up.</p> <p>Call Alpha Customer Support at Alpha Radio Products for advice if this occurs. This fault protects the amplifier against repetitive abuse and cannot be cleared with user controls. Warranty will not apply to resulting damage if this fault is reset by user without factory authorization.</p>	

RS-232 Serial Communications

The status of the amplifier can be determined via an RS 232 serial communications link. You need to use a modem communications program. For example, Windows 95/98/NT/2000 comes with one called HyperTerminal. It is usually located under ACCESSORIES. HyperTerminal configuration files can be downloaded from www.alpharadioproducts.com, in the tech tips section.

When you click on HYPERTRM.EXE, it will open a window for a new connection. Give it a name, and in the next window select the "Connect Using: Direct to COMx" pulldown menu (in the bottom of the box on my version of Win95); select the Com port you will use. This is the same one that you were using with the AlphaRemote software. If the COM port you select is available it will open another box called "COMx Properties". Going down the list, select Bps-4800, Data bits-8, Parity-NONE, Stop bits-1, Flow control-NONE. Click OK to close the window. Now pull down the FILE menu and click PROPERTIES. Click the SETTING tab and then click ASCII SETUP at the bottom of the window.

Click the box for "Echo typed characters locally" (it could have a check in the box). Click OK to close both windows.

Plug in the amp (power off) and it should be communicating with the computer. Type VER and press the Enter key. The 87A should

respond with the firmware version number. If you see garbage you will need to remove pin 22 of the 25-pin end of the cable (the 87A end). It is used to set the baud rate of the amplifier (see below for a complete explanation of connections).

Once communications are established with the amplifier, type SF and HF to display the Soft

Fault and Hard Fault logs (press Enter key after each command). Save the result of those commands. A list of more commands follows this section.

Communications Link Set-up

Line set-up (default):

Baud rate: 4800
 Parity: None
 Data bits: 8
 Stop bits: 1

Terminal set-up:

Terminal emulation: TTY, ANSI, VT102, etc.¹
 Duplex/Echo: HALF/ON
 XON/XOFF: OFF²
 CTS/RTS: OFF²
 DSR/DTR: OFF

¹ The ALPHA 87A needs no emulation as it provides only ASCII output with no control codes.

Serial control lines

ALPHA 87A		Computer or	Terminal
<u>DB-25F</u>	<u>To >></u>	<u>DB-25 M</u>	<u>DB-9 M</u>
Pin 2	TXD	Pin 2	Pin 3
Pin 3	RXD	Pin 3	Pin 2
Pin 4	RTS	Pin 4	Pin 7
Pin 5	CTS	Pin 5	Pin 8
Pin 7	GRD	Pin 7	Pin 5

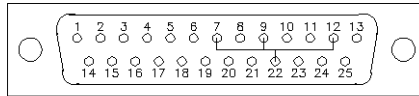
Make no connection from pins 9, 22, 12, 13, or 14 of the DB-25 F connector on the ALPHA 87A to the computer or terminal. These pins are used for baud rate and diagnostic modes of the unit.

Optional baud rate select:

Baud rate	Pin 12	Pin 22	Pin 9
9600	Low	Low	Low
4800	Low	Low	Open
2400	Low	Open	Low
1200	Low	Open	Open
600	Open	Low	Low
Baud rate	Pin 12	Pin 22	Pin 9
300	Open	Low	Open

150	Open	Open	Low
Default 4800	Open	Open	Open

Example: To set baud rate to 9600, tie pins 12,22 and 9 to pin 7 (signal ground).



END VIEW MALE
25pin D—connector

View of Male Connector (pin end).

Remote Commands

OFF or ON mode commands:	
AC	Is AC power on or off?
AC OFF	Turns AC power off.
AC ON	Turns AC power on.
BYE	Turns AC power off. Same as AC OFF.
DATE	Reports date code and serial number
HELP	Displays a list of available commands.
HF	Reports (up to) eight most recent uncorrected hard faults.
HNSHK	What is RS-232 hand-shaking flow control set to?
HNSHK OFF	Sets hand-shaking flow control off.
HNSHK XON	Sets hand-shaking to hardware flow control.
PANEL	Are front panel controls enabled or disabled?
PANEL OFF	Disables the front panel controls.
PANEL ON	Enables the front panel control.
SER	Reports date code and serial number.
SF	Reports (up to) eight most recent soft faults.
STAT	Reports unit status: state warm-up, standby, or operate: HV mode, low or high; 24-30 MHz enabled or disabled, panel enabled or disabled, frequency last entered, band last selected, segment last used, tune and load capacitor positions.
VER	Reports version of firmware installed.

ON mode commands:	
BAND	Reports current band setting: band 1 for 1.8 MHz through band 9 for 28 MHz.
BAND # (1-9)	Sets band switch to any band one through nine.
BAND DOWN	Sets band switch down one band.
BAND UP	Sets band switch up one band.
DEF	Sets tune, load and frequency to default or factory settings.
DM#	Used to diagnose unit with factory assistance.
ENT	Use with SEG command for saving data.
FREQ	What frequency is the unit on or last frequency used?
FREQ # (in kHz)	Sets up unit for this entered frequency.

GRID	Reports current grid current in mA.
ON mode commands:	
LOAD	Reports current load capacitor setting (0-100).
LOAD # (0-100)	Adjusts load capacitor setting (0-100).
LOAD DOWN	Adjusts load capacitor down one step.
LOAD UP	Adjusts load capacitor up one step.
LOCK	Reports 24-30 MHz disabled or enabled.
LOCK # (24-30 MHz unlock code)	With unit in proper configuration, the unit can unlock 24-30 MHz bands with this command.
METER	Reports current reading of the front panel multimeter.
METER HV	Sets multimeter to HV mode & reports value.
METER IP	Sets multimeter to Ip mode & reports value.
METER TUNE	Sets multimeter to TUNE mode & reports value.
MODE	Reports current HV power supply setting, HI or LO.
MODE HIGH	Sets high voltage power supply to high mode.
MODE LOW	Sets high voltage power supply to low mode.
OPER	Reports whether in operate or standby.
OPER OFF	Sets to standby mode.
OPER ON	Sets to operate mode if ready.
PWR	Reports current forward power out in watts.
REFL	Reports current load reflected power in watts.
SEG	Reports current segment setting.
SEG # (1-5)	Sets segment to entered value.
SEG DOWN	Sets segment down one from previous.
SEG UP	Sets segment up one from previous.
TUNE	Reports current tune capacitor setting (0-100).
TUNE # (0-100)	Sets tune capacitor to value entered.
TUNE DOWN	Sets tune capacitor down one step.
TUNE UP	Sets tune capacitor up one step.

Troubleshooting Suggestions

Owner Assistance

Assistance is available from Alpha Radio Products Customer Support at 303.473.9232, by fax at 303.473.9660, or by email at service@alpharadioproducts.com.

Most apparent problems with the ALPHA 87A, especially when first putting one into operation, result directly from failure to observe carefully the procedures given in this manual, especially those repeated as cautions on pages 1 and 2 of the manual and on the handy quick-reference card provided. A few other points learned from experience are given here.

Overdrive related faults (13 & 26)

These nearly always result from failure to set up transceiver power controls properly. Most transceivers have two power-related controls, which operate in an independent fashion.

Setting the transceiver POWER or RF PWR control IS NOT SUFFICIENT. Several popular transceivers can generate RF spikes of 200-300W or more and output may vary widely from band-to-band and mode-to-mode unless the transceiver internal ALC (drive level) also is adjusted carefully according to its manufacturers' instructions! Typically, this is done with a knob labeled DRIVE (IC-781, FT-1000), PROCESSOR OUT (TS-940, TS-950) or, on SSB when speech processing is not in use, MIC or MIKE.

ALC

Automatic Level Control is a system used in transmitters, which is similar in operation to AGC (Automatic Gain Control) in receivers. When the signal at some reference point in an amplifier chain exceeds a preset level, a bias voltage is generated and used to reduce the gain of a preceding, low-level driver stage. The effect is to more or less limit drive and output to the preset level.

Alpha Radio Products, LLC. does not generally recommend use of ALC from amplifier to transceiver because smooth, distortion-free operation requires that characteristics of the ALC bias source be matched to those of the controlled stage. However, transceiver ALC control characteristics are not standardized; each model has its own unique gain and dynamic characteristics. (*Internal* ALC in transceivers works well because the ALC source and

controlled stage are designed together, as a system.)

ALC feedback from ALPHA 87A to transceiver normally isn't necessary because the power output of most modern transceivers can be quite accurately controlled as discussed above, and because the ALPHA 87A's grid current limiting system easily absorbs occasional drive peaks. Extensive tests with TS-850, TS-940, TS-950, IC-761, IC-781, IC-756, IC-746, FT-1000, and FT-1000MP transceivers have revealed no need for ALPHA 87A-to-transceiver ALC feedback to achieve excellent results.

However, the 87A does incorporate an excellent and versatile ALC generator. Therefore, in the rare case where transceiver output cannot be adequately controlled, this can usually be handled by using ALC feedback if the transceiver has an input for negative-going-from-zero ALC. (This type of ALC is standard with most modern transceivers.)

In this case, (refer to Figure 7, p. 18) connect the transceiver ALC input to the ALPHA 87A's phone-type ALC jack with a shielded cable. Turn the ALC adjust pot fully clockwise to start (except set it to mid-rotation when using Icom transceivers.)

The adjustment goal is to use the smallest amount of ALC feedback (the least clockwise rotation of the ALC pot) that will eliminate overdrive faults and distortion. No fixed universal procedure exists, but the following should give good results:

- a. With the ALPHA 87A in STBY, set transceiver peak RF output in CW or SSB as close as possible to the power level (approximately 50W) needed to drive the amplifier to 1.5 kW.
- b. Switch the amplifier to OPERATE and, while driving it as above, turn the ALC pot counterclockwise (CCW) as far as possible without exceeding amplifier grid

current of 50 mA. With some transceivers (e.g. recent ICOMs) this pot setting may be only a fraction of a turn clockwise from the counterclockwise stop; with Kenwoods and some other transceivers it may be half to nearly full clockwise rotation.

- c. Check under both CW carrier and SSB voice conditions for any sign of instability or "motorboating". If either is detected, try turning the ALC pot in small steps while monitoring results. Some experimentation will probably be necessary to find the best adjustment; a monitoring scope such as the Kenwood SM-220 may be useful in evaluating results.

Repeated power-off shutdowns (typically fault 1, 5, 8, or 16)

During the first hundred or so hours of operation, even when in receive or standby a new amplifier may simply shut off. The shutdown may be accompanied by a modest "thump." Usually this is the result of internal tube flashovers, or "hiccups," which are characteristic of many new ceramic-metal tubes. "Thumps" generally occur infrequently and stop entirely after one to perhaps ten occurrences without causing damage or indicating a tube defect.

When such a shutdown occurs, reapply AC power. For possible future reference make a note of the fault code number which is displayed on the SEGMENT LEDs for the first 30 seconds thereafter.

NOTE:

No response (or immediate shutdown) when the POWER ON button is pressed, or the occurrence of such shutdowns more than about ten times, may indicate a more serious problem. In such a case, Alpha Customer Support should be contacted before proceeding.

1. **Footswitch use:** Users have found that some footswitches exhibit contact bounce, which can intermittently cause improper T/R sequencing. Usually this shows up as amplifier drop-out (exciter bypass to the antenna) on occasional CW characters or SSB transmit periods. A capacitor of about .01-.10 μ f across the switch contacts normally cures the problem. Use the smallest value that works.
2. **Repeated high or low voltage hard faults (e.g. faults 1-6):** Is the primary voltage tap correctly set (See section 4.3)? Is an AC line unusually high or low, or regulation bad? Check wiring.
3. **Overtemperature fault 21:** Are air intake (rear panel) and exhaust (above tubes) openings clear of obstructions? A log book lying on top of the amplifier? Intake and exhaust openings should be at least 6 inches clear of any obstructions, and amplifier must be located so that hot exhaust air cannot recirculate into the air intake.
4. **Fault 22:** This is a typical result of incorrect transformer installation, (e.g., a connector not properly mated and seated.)

ALPHA 87A Functional Configuration

The complexity of the ALPHA 87A is such that describing its circuitry in detail here is impractical. However, its basic functional organization is quite easily understood from the following:

Figure 8 (page 37) is a simplified block diagram of the ALPHA 87A, and Figure 9 (page 38) is a simplified schematic showing the principal RF signal paths and primary AC power circuits.

Principal Functional Components

The following block diagram emphasizes the principal functional components as follows:

Heavy rectangular boxes represent individual modules of the amplifier, in most (but not all) cases circuit boards (PCBs).

- a. Signal paths used in both transmit and receive are shown by heavy solid lines.
- b. Signal paths used only in transmit, by heavy dashed lines.
- c. Signal paths used only in receive, by heavy dotted lines.
- d. Internal wiring harnesses are shown as light solid lines. Each is labeled with the
- e. designations of the control, monitoring and power distribution lines, which comprise it.
- f. Principal interfaces to the outside (connectors & controls) are located around the perimeter of the block diagram.

Schematic Description

Transmit signal path: Drive from the transceiver, applied at the TX RF INPUT connector, passes sequentially through the input wattmeter, tube deck T/R section, input T/R PCB, input matching network, (pair of) 3CX800A7 triode tubes, plate tuning network, output pin diode PCB, output T/R PCB, and output wattmeter PCB to the tx rf out/rx rf in jack.

Receive signal path: TX RF out/RX RF in jack, output wattmeter, output T/R PCB, input T/R PCB, input T/R PCB, tube deck T/R section, and input wattmeter to the TX RF input jack (which is, of course, also the RX signal output to the transceiver).

RS-232 communications port: This 25 pin connector and wiring to it is located at the lower left corner of the block diagram.

Schematics Available

One set of current Alpha 87A schematics will be provided at no charge to any owner on request, and assistance with specific questions or problems is always available from Alpha Power Customer Support.

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ALPHA RADIO PRODUCTS WARRANTY

Alpha Radio Products (Alpha Radio Products LLC) WARRANTS EACH NEW AMATEUR RADIO HF AMPLIFIER OF ITS MANUFACTURE, SOLD AND USED IN THE UNITED STATES, ITS POSSESSIONS, AND CANADA:

1. Workmanship and all components except RF power tubes are warranted for FOUR YEARS from date of original purchase if used exclusively in licensed amateur radio service. WARRANTY IS VOIDED BY ILLEGAL SALE OR USE OF EQUIPMENT (e.g. U.S. sale of export models).
2. All power tubes are warranted for one year. Eimac power tubes are warranted by their manufacturer; warranty requests on Eimac power tubes must be submitted to Alpha Radio Products. Svetlana power tubes are warranted by Alpha Radio Products for one year from date of original purchase. Installation and use of power tubes not authorized by Alpha Radio Products will render any and all remaining warranty null and void.
3. Warranty does not apply to repair of damage resulting from neglect, abuse, power surges (generated by lightning strikes or defective public service) or improper installation, nor to units not operated in accordance with specifications and instructions furnished by Alpha Radio Products. The Warranty will be considered null and void if the unit is repaired or altered with parts and/or by persons not authorized by Alpha Radio Products, or in cases where the serial number has been removed, altered, or defaced.
4. If a malfunction is suspected, before attempting repairs or returning equipment to Alpha Radio Products for service, the owner shall contact the Alpha Radio factory service department, providing model and serial number plus details of equipment hookup, accessory equipment used, operating conditions, and abnormalities observed. Alpha Radio Products will furnish a new part in exchange for any covered defective part or, if it is determined that factory service is required, will authorize return to factory. Equipment authorized for return shall be shipped to Alpha Radio Products fully prepaid and insured, USING ONLY FACTORY APPROVED PACKING; REMOVE POWER TRANSFORMER BEFORE SHIPPING ANY UNIT WHICH WAS ORIGINALLY SHIPPED FROM THE FACTORY WITH TRANSFORMER REMOVED! Shipping charges, to and from the factory, and a \$25.00 service fee are the responsibility of the owner.
5. Original purchasers will be informed of any required factory maintenance. Alpha Radio Products will make a best-faith effort to publicize required factory maintenance via Internet and press releases for owners who did not purchase affected units from Alpha Radio Products. Units effected by a required factory maintenance must be returned to the factory for service within One-Year of issuance of required factory maintenance notice. Service, modification and upgrade charges for units effected by required factory maintenance will be assumed by the owner if said unit is not returned the factory within One-Year of a required factory maintenance notice. In the event of required factory maintenance shipping charges to the factory are the responsibility of the owner.
6. In the absence of an Alpha Radio Products sales receipt the term of the four-year warranty will be assessed by the unit's construction date.
7. No person is authorized to assume for Alpha Radio Products any liability in connection with our products, other than as set forth in this warrant. Alpha Radio Products reserves the right to change its products as it deems desirable, without obligating itself to make such changes available for previously manufactured products.

UNDER PROVISIONS OF THE FEDERAL
MAGNUSON-MOSS WARRANTY ACT, THIS
WARRANTY POLICY IS CLASSIFIED AS A LIMITED
WARRANTY.