OPERATING MANUAL

ALPHA Max™

AND

ALPHA Remote™

NEW Firmware AND SOFTWARE

FOR THE ALPHA 87A

Automatic HF Power Amplifier

ALPHA/POWER
RF Concepts LLC
6185 Arapahoe Avenue
Boulder, CO 80303-1401

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Important Overview—Please Read

This package consists of two products:

AlphaMax is new firmware designed to add new features to the Alpha 87A and requires the installation of new chips on the 87A controller board. 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 the Alpha/Power, Inc. factory for telephone support or for a Return Authorization. Alpha/Power will install and test the new firmware at no charge other than the 2-way shipping charges.

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 1: AlphaMax can be used without AlphaRemote, but AlphaRemote REQUIRES the installation of AlphaMax first. AlphaRemote utilizes new commands that are only available in the AlphaMax ROM upgrade.

NOTE 2: AlphaRemote will work with the Alpha/Power 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.
**ALPHAMAX!**

More new firmware that puts all *ALPHA 87A*‘s ever built even **more** in a class by themselves!

*ALPHAMAX™* auto-adaptive tuning firmware can be installed easily in **any** *ALPHA 87A*.

* Antenna impedance/VSWR vary significantly across the band?

As you transmit, *ALPHAMAX™* automatically re-adjusts your *87A*’s output network to deliver maximum power output* and linearity for the specific antenna and frequency actually in use. *Within maximum capabilities of the *ALPHA 87A*. *

* Contesters &DXers: Use multiple antennas on some (or all) bands?

Within seconds after a band, frequency, or antenna change, *ALPHAMAX™* automatically trims *87A* tune-up, as necessary, to insure that it continues to deliver maximum output, efficiency, and linearity.

* Transceiver power output varies with band or temperature?

*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 that.

*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.

AlphaMax Operating Procedures and Notes
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 ON - enables autotune actions
AUTOTUNE OFF - disables autotune actions
AUTOTUNE - queries and returns the autotune status

The above serial port commands may be utilized by software other than AlphaRemote

AUTOTUNE OFF OPERATION:

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.

Installation of AlphaMax firmware on the ALPHA 87A Control Board

1) Disconnect the ALPHA 87A power cord at the source.

2) Wait at least one minute for the high voltage to bleed down to a safe level.
3) Remove the top cover of the **ALPHA 87A** by removing all screws except the two in the center of the tube vents.

4) Slide the front of the amplifier not more than two inches over the edge of the table (DO NOT LIFT the **ALPHA 87A** with the transformer in place!) Remove the four flat head screws securing the front panel at the sides and the five screws along the bottom. (Lower the bail to elevate the amplifier to facilitate bottom screw removal.)

5) Carefully pull the front panel forward and note the position of the cable connections before gently disconnecting each one. Lower the panel to reveal the socketed 28 pin EPROM (U7) and 20 pin PAL (U9) on the microprocessor control board.

6) **CAUTION!** Before touching the board or any of its components make sure that your body is grounded by touching one hand firmly to the chassis. This will discharge any static buildup and prevent damage to the integrated circuits.

7) Use a VERY small screwdriver to pry VERY gently and alternately on the two ends of EPROM IC (U7) until it lifts free from the socket. Repeat for the PAL IC (U9). See the photo for location of EPROM and PAL.

8) Replace the old EPROM and PAL with the new ones from the AlphaMax upgrade kit. Make sure all IC pins are straight and note that pin 1 of each IC must be in the upper left corner of the socket, notch up. Visually ensure all pins are in the socket and each IC is fully inserted. Pins that miss will typically fold under the IC body. If this happens remove IC, carefully straighten the pin and insert again.

9) Locate JP2, two vertical rows of 5 pins (10 pins total) with a jumper on the top two pins (1&2). Install another jumper (included in AlphaMax kit) on the second pair of pins (3&4).

10) Reverse the disassembly process to close up the **ALPHA 87A**. Be especially careful to make sure that all the front panel cables are plugged in firmly and routed exactly as before. **DO NOT ATTEMPT TO TEST THE MODIFICATION WITH THE COVER REMOVED—THIS IS A SAFETY HAZARD AND MAY RESULT IN IMPROPER OPERATION OF THE MICROPROCESSOR DUE TO RF INTERFERENCE.**

11) Note: If for any reason the **ALPHA 87A** is to be returned to it's original configuration (without AlphaMax capabilities), it is only necessary to change EPROM U7 back to the original IC and remove 2nd jumper added in paragraph #8. The new PAL U9 may be left on the control board.
New firmware for all ALPHA 87As puts every ALPHA 87A even further ahead of every other amateur radio power amplifier!

**ALPHAREMOTE™**… lets you control all functions of your ALPHA 87A from a compact toolbar on your Windows™ desktop.

**ALPHAREMOTE™**… delivers a new level of intuitive remote-control convenience because it’s Windows™ based and compatible with Windows™ 95, 98, and NT.

**ALPHAREMOTE™**… permits control and monitoring of all basic ALPHA 87A functions. Provides fully detailed ALPHA 87A status information. Offers simultaneous, real-time remote metering of major 87A parameters including Ig, Ip, Pout and Prefl.

**ALPHAREMOTE™** also… can be configured as a vertical or horizontal toolbar. Supports multiple ALPHA 87A amplifiers.
**AlphaRemote Operating Procedures and Notes**

AlphaRemote software allows you to control the Alpha 87A from a computer screen under MS Windows (tm) 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.
Installation Instructions for **AlphaRemote** Software

121 Close any programs running under Windows.

132 Insert AlphaRemote disk #1 in floppy drive.

143 Click START on taskbar, then RUN.

154 Click BROWSE and select My Computer, **A:\setup.exe**, then click OPEN. When **A:\setup.exe** is showing in RUN window, click OK to start installation of AlphaRemote. Follow the instructions on screen.

165 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.)

176 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.

187 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).

198 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.

209 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.

2110 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 2. AlphaRemote Configurations.

To change from one display shape to another just “left click” the mouse on a lower corner and drag the panel into the desired shape.
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.*
  Duplex/Echo: HALF/ON
  XON/XOFF: OFF**
  CTS/RTS: OFF**
  DSR/DTR: OFF

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

**The ALPHA 87A will support XON/XOFF (software flow control) or CTS/RTS (hardware flow control) if enabled. The unit is shipped with XON/XOFF and RTS/CTS off.

Serial control lines:

**ALPHA 87A**

<table>
<thead>
<tr>
<th>DB-25 F</th>
<th>to &gt;&gt;</th>
<th>DB-25 M</th>
<th>DB-9 M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 2</td>
<td>TXD</td>
<td>Pin 2</td>
<td>Pin 3</td>
</tr>
<tr>
<td>Pin 3</td>
<td>RXD</td>
<td>Pin 3</td>
<td>Pin 2</td>
</tr>
<tr>
<td>Pin 4</td>
<td>RTS</td>
<td>Pin 4</td>
<td>Pin 7</td>
</tr>
<tr>
<td>Pin 5</td>
<td>CTS</td>
<td>Pin 5</td>
<td>Pin 8</td>
</tr>
<tr>
<td>Pin 7</td>
<td>GND</td>
<td>Pin 7</td>
<td>Pin 5</td>
</tr>
</tbody>
</table>

*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:

<table>
<thead>
<tr>
<th>Baud rate</th>
<th>Pin 12</th>
<th>Pin 22</th>
<th>Pin 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>9600:</td>
<td>low</td>
<td>low</td>
<td>low</td>
</tr>
<tr>
<td>4800:</td>
<td>low</td>
<td>low</td>
<td>open</td>
</tr>
<tr>
<td>2400:</td>
<td>low</td>
<td>open</td>
<td>low</td>
</tr>
<tr>
<td>1200:</td>
<td>low</td>
<td>open</td>
<td>open</td>
</tr>
<tr>
<td>600:</td>
<td>open</td>
<td>low</td>
<td>low</td>
</tr>
<tr>
<td>300:</td>
<td>open</td>
<td>low</td>
<td>open</td>
</tr>
<tr>
<td>150:</td>
<td>open</td>
<td>open</td>
<td>low</td>
</tr>
<tr>
<td>default 4800:</td>
<td>open</td>
<td>open</td>
<td>open</td>
</tr>
</tbody>
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