ALPHA 6

OPERATING MANUAL

PRELIMINARY DRAFT

ALPHA/POWER

by CrossLink, Inc. RF

Power for Communications and Industry

6185 Arapahoe Road,

Boulder, Colorado 80303-1401

*(303) 473-9232 * FAX (303) 473-9660*

ALPHA POWER PRODUCTS

ALPHA 6
Operating Manual

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6185 Arapahoe Road • Boulder, CO 80303
Phone 303.473.9232 • Fax 303.473.9660

Read this entire manual and all other publications pertaining to the work to be performed before you install, operate, or maintain this equipment. Practice all product safety instructions and precautions. CrossLink, Inc. provides information on its products and associated hazards, but it assumes no responsibility for the after-sale operation of the equipment or the safety practices of the Owner or User. See Warranty and Notices Appendix.

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1

Introduction

IMPORTANT
Critical precaution during installation of your Alpha 6:
While the cover is removed to install the power transformer, make sure that the tube is properly installed as described below. Failure to do this may cause severe damage or destruction of the tube. Such damage is not covered under warranty.

General Description of the ALPHA 6 Amplifier

The ALPHA 6 is a self-contained 6m VHF Linear power amplifier capable of continuous operation at 1500 watts peak power output on SSB, keyed CW, SSTV, RTTY, digital modes or FM, with no time limit. If periods of "continuous-key-down" carrier operation will exceed 5 minutes, or if the amplifier is to be operated from 50 Hz mains, the optional auxiliary cooling fan available from CrossLink must be installed to avoid possible damage not covered by the warranty.

All shipped, units delivered within the USA and its territories are manually tunable to cover the entire 6m amateur band from 50-54 MHz.

Specifications, ALPHA 6

Frequency Coverage: Amateur band 50-54 MHz.

Power Output: 1500 watts peak all modes, including SSB, CW and continuous or modulated carrier. Carrier operation (e.g., A0, RTTY or FM) for more than 5 minutes at or near maximum rated power requires use of the auxiliary cooling fan accessory.

Drive Power: 50 to 60 watts nominal for rated output.

Power Gain: Nominally 14 dB, a power increase of 25 times.
Input Impedance: 50 ohms nominal, unbalanced; VSWR <2:1.This manual provides all information necessary to install and operate the ALPHA 6. Schematic diagrams are available on request, at no charge to owners.

Output Impedance:	50 ohms unbalanced.
Maximum Load VSWR:	2:1 at full rated power output.
VSWR Trip:	Automatic standby when reflected power >250 watts.
Intermodulation Distortion:	30 dB below rated output.
Harmonic Output:	<-60 dBc.
Tubes:	One Svetlana 4CX1600B ceramic-metal tetrode.
Cooling:	Full-cabinet, ducted forced air using cushion-mounted centrifugal blower.
Automatic Level Control (ALC):	Negative from 0, adjustable.
Primary Power:	190-250 or 90-130 VAC nominal, 50-60 Hz, fused at 20 amperes.
Power Transformer:	3+ kVA with strip-wound Hipersil core.
Protective Functions:	Grid and screen current limiting; trip to standby (automatic reset) for excessive VSWR or average plate current, RF arc, severe mistuning; AC off trip for HV fault; primary and step-start fuses; cover AC interlock and HV crowbar switches; AC inrush-current limiting (Step-start).
Status Indicators:	STANDBY, WAIT (initial turn-on time delay), OPERATE and FAULT LEDs.
Metering:	Dedicated, full-time LED bargraphs display forward and reflected rf power; grid current LEDs; LED bargraph selectable among plate voltage, plate current, and tune-up functions.
Size:	7.5" H x 17" W x 16.5" D (19x43x39cm) excluding controls, feet, and connectors.
Weight:	66lb. (30kg) net, 75lb (34kg) ship; two cartons.

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

Owner Assistance

Assistance is available from CrossLink Alpha Technical Support at 303.473.9232 x.141, by fax at 303.473.9660, or by email at alpha-service@crosslinkinc.com.

Equipment Shipped

The Alpha 6 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 6 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 6.

The ALPHA 6 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 6

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 A-C 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 the tube is solidly seated in its socket with the red silicone rubber chimney firmly seated against the chassis.

4. Connect the green conductor in the Alpha 6 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 check 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 6 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 6. 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 Alpha 6 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 which 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 objects 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 feedline 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 375 Watt amplifier and achieved the same radiated signal by buying good quality feedline components! Use the lowest loss 50 Ohm coaxial cable you can get your hands on. Use new, clean connectors installed per the manufacturers recommendations. 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 feedline to antenna is waterproof. Provide for disconnection of the feedline when not in use.

Air Flow

It is critical that the 6 air flow 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. CrossLink 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 6 into your amateur radio station, do not hesitate to call CrossLink Alpha Technical Support.

Section

2

PREPARING THE ALPHA 6 FOR OPERATION

Transformer Installation (See Figures 2-4)

Remove the amplifier top cover to install the transformer. Only one possible transformer orientation allows mating all its connectors without straining leads. Lift the transformer high enough to clear the right side chassis lip and move it sideways into the chassis. **USE CAUTION--PROCEED SLOWLY to avoid damaging wires or components.** From underneath, insert the supplied bolts with washers through the clearance holes in the chassis and into the nuts in the transformer base. CAUTION! Mate transformer connectors carefully and gently to insure that all connector pins engage correctly and fully.

Inspection of Tube & Chimney

While the top cover is removed, make sure tube is firmly seated in its socket, rubber exhaust chimney is fully and correctly installed, and anode connector is tightly clamped to tube. The silicone rubber chimney installed on the 4CX1600B tube is an absolutely essential part of the cooling system. Make sure the chimney is straight and fully installed so that the bottom of the chimney is firmly against the tube deck and completely covers the airflow openings in the deck. Tube cooling air must exit only through the tube anode fins; it must not be allowed to escape outside them. Failure to ensure proper cooling airflow may result in tube damage or destruction which is not covered under warranty.

AC Primary Connections & Amplifier Grounding

Primary voltage taps are selected at the terminal strip numbered "1" to "7" and located on the mains board mounted on the chassis center divider, left of the transformer. Terminal number 1 is closest to the rear panel of the amplifier. Connect the two wires labeled "A" and "B" for the line voltage to be used, as shown in the following table. The two short jumper wires supplied are not used on 190-250V, but must be connected as shown for operation on 90-130V mains.

PRIMARY	**"A" Terminal**	**"B" Terminal**	**Blower***	**Jumpers**
230-250V	4 **	2**	4 & 2**	Not used
210-230V	4	3	4 & 3	for 190 - 250V
190-210V	5	3	4 & 3	operation
110-130V	4	6	4 & 7	1 - 2, 6 - 7
90-110V	5 6	4 & 7	1 - 3	6 - 7

** The blower wires are the 2 black wires marked "4" and "x", (4 to terminal4, X to 2, 3, or 7 per table). Optional external muffin fan has 2 black wires, one is connected with blower wire 4 and the other to the same terminal as blower wire X (2,3,or 7 per table)*

*** Factory settings.*

NOTE: If you intend to operate the amplifier on any of the 90 - 130V settings, the two lower fuses on the rear panel (2 amp) will have to be changed to 5 amp to allow for the increased in-rush current.
NOTE: Do not operate amplifier without all cover screws installed. Do not operate amplifier without a good RF ground connection on the rear panel ground terminal.

Power Cord Connections — WARNING!

To avoid the hazard of a potentially fatal electric shock and/or severe damage to the ALPHA 6 and other equipment, always use an AC plug which is appropriate for the primary mains voltage, current rating and configuration. NEVER use 120V-type plugs and power receptacles for 190-250V circuits.

ALWAYS use grounding type AC connectors which conform to local codes and ensure that the green wire in the Alpha 6 power cable is wired only to the AC mains safety ground (or to neutral, as may be necessary with a 240V circuit configured 120V-N-120V without a separate ground, commonly found in the US).

The green conductor in the power cord is wired to the ALPHA 6 chassis. It MUST be connected only to the power source safety ground or neutral. The black and white power cord wires connect to the two "hot" wires of the AC source; either wire may be connected to either side of the line. For best results use a dedicated 200-240V branch circuit of #10 AWG copper wire or equivalent, rated at 20A, to feed the amplifier.

Important information concerning operation from 90-130V mains

Electrical power equipment will draw twice as much primary current from 120V mains as from 240V mains. Therefore, operating the ALPHA 6 on a typical 120V/20A household circuit without exceeding the 20A circuit rating will limit maximum peak power output to about 600-1000 watts. Maximum possible RF output power for any particular primary AC voltage and current capacity may be estimated as:

Po max = (Vline x Iline) / 2.3.

For example, if the Alpha 6 operates from a circuit which is capable of delivering 115V AC at a maximum current of 20A, (with no other loads connected to the circuit), maximum peak RF output possible without tripping the 20A breaker (or fuse) is approximately:

Po max = (115V x 20A) / 2.3 = 2300/2.3 = 1000 watts.

If the same circuit also supplies a transceiver drawing peak line current of 5A and a lamp drawing 1A, only 20-5-1 = 14A is available for the amplifier and maximum possible output is about:

Po max = (115V x 14A) /2.3 = 1610/2.3 = 700W.

RF Grounding

A ground stud with wing nut is provided on the rear of the chassis. Connection should be made from this stud to a good RF earth ground, such as a copper water pipe or driven rod, via heavy copper braid or strap. CAUTION: When using any high power amplifier, failure to connect ALL station equipment to a good common ground may allow RF feedback to leak into the transceiver and cause severe signal distortion.

Replacing the Amplifier Cover

Use only the 6-32 screws supplied with the amplifier and do not tighten any of the screws until all are started.

Blower

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.

Figures 2 – 4 ALPHA 6 Transformer Installation to be added here.

Section

3

Amplifier/Station Interconnections

(See fig. 5)

Coaxial Cable Types & Connectors

Connect the transceiver RF output to the ALPHA 6 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 6 RF OUTPUT to antenna should be RG-8A/U, RG-213/U, or equivalent high quality type with a type N male plug on the amplifier end. RG8X cable is not recommended.

T/R Control Cable

The Alpha 6 has a full break-in vacuum relay QSK system requiring only the normal interconnection when used with a modern QSK transceiver. The Alpha 6 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 normally open in receive and closed in transmit. Shielded wire should be used for the T/R control cable. The Alpha 6 end must be fitted with a common phono (RCA-type) plug and the other end with a connector suitable for the transceiver. The T/R relay contact must close before application of RF drive. The Alpha 6 protection circuitry prevents "hot-switching" with RF drive applied. Modern transceivers have the proper time delay between keyup and the start of the transmitted signal to allow the Alpha 6 to follow the CW keying. If a T/R timing problem is suspected, connect the CW keyer to the RELAY jack on the Alpha 6, and connect a cable from KEY OUT on the amplifier to the keying input of the transmitter.

ALC

The use of external ALC is not normally needed or recommended when the ALPHA 6 is used with modern transceivers. However, the Alpha 6 does generate a negative-going ALC control voltage that can be fed back to most transceivers if required, to minimize the possibility of overdriving the amplifier. This external ALC voltage is available at the amplifier's rear panel ALC jack via a common phono connector. Alpha 6 grid current exceeding about 1mA will initiate ALC and light the green GRID LED. About 5-10mA yields full ALC output-nominally -10 Vdc - and the red GRID LED lights. If the exciter requires a lower ALC voltage, the Alpha 6 ALC potentiometer may be set accordingly. While driving the amplifier, adjust the ALC pot to limit maximum transceiver output as desired. We recommend contacting CrossLink customer service before attempting to use external ALC with the Alpha 6.

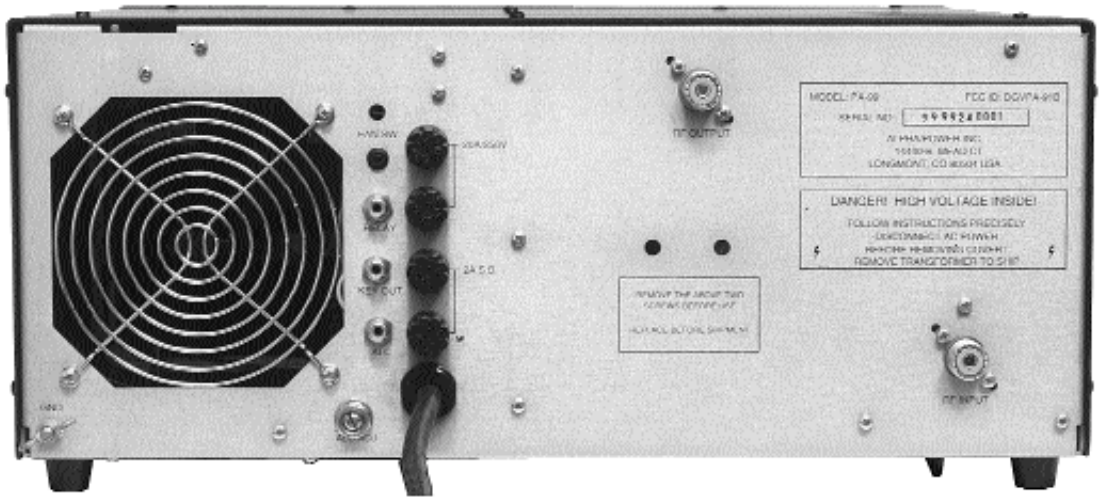

Figure 5: ALPHA 6 Rear Panel

To be labeled

Section

4

Operation

(Refer to Figures.)

4.1 Control Functions

(See front cover photo)

TUNE - Sets output tank circuit to resonance. Higher frequencies tend to tune toward the "0" end of the dial scale, while lower frequencies tend to tune further toward the "100" end.
LOAD - Sets amplifier plate loading and determines the power level at which best efficiency and linearity are achieved. In general, loading is heavier at greater scale settings. Higher frequencies tend to load more toward the "100" end of the dial scale and lower frequencies toward the "0" end.
POWER - Press ON to apply primary AC power to the amplifier or to reset power if the plate overcurrent relay has tripped. Press OFF to remove primary AC power.
OPR/STBY - Operate places the amplifier in-line. With the Alpha 6 off, in StandBy, or in warm-up with the WAIT LED lighted, the amplifier is bypassed and the exciter is connected directly to the antenna.
Metering LEDs & Bargraphs - Separate bargraphs provide instantaneous full-time display of peak values.
RF OUTPUT and REFLECTED POWER: Red and green "GRID" LEDs indicate, respectively, that normal peak drive has been reached and the onset of overdrive and flattopping.
A switch-selected bargraph monitors three additional functions:
TUNE: Permits a simple and safe tune-up procedure to be performed at low output power. See section 4.2 below.
IP: Plate current, 1.5 amperes full scale (approximately 75 mA per segment).
HV: Plate voltage, 3000 VDC full scale (150 V per segment).

4.2 Tune-up

The objective of tune-up is to adjust the amplifier (and the drive applied to it) to obtain optimum efficiency and linearity at the desired output power. Any linear amplifier must be adjusted for optimum efficiency and linearity at a specific power level. If operation at higher power is then attempted without appropriate readjustment, the result will be flattopping, "splatter," and (usually) excessive amplifier grid current. If operated at a much

lower power level than it has been adjusted for, the amplifier's efficiency decreases considerably.

Grid Current

The ALPHA 6 operates in Class AB1 when delivering maximum output power consistent with excellent linearity. A small amount of grid current flows and the green GRID MIN LED lights as drive approaches the optimum level. The green GRID LED should flicker on some SSB voice peaks, and light under CW/SSTV/RTTY carrier conditions. As overdrive approaches, grid current increases rapidly and the red GRID MAX LED lights. At maximum output and efficiency, the red LED lights dimly; full illumination of the red LED indicates overdrive and must be avoided. If the red LED lights before the desired value of plate current and/or power output is reached, readjust amplifier loading before continuing. On SSB, optimum output consistent with good linearity occurs when the green GRID LED lights on most voice peaks and the red LED flickers dimly only on the highest peaks. Excessive grid current results from overdrive and/or inadequate loading. The solution is to reduce drive, and/or increase amplifier loading. The 6's 4CX800A/GU74b tubes are well protected and these adjustments tend to be less critical than in many other amplifiers.

ALC

The Alpha 6 grid current limiting circuits provide substantial tube protection against possible damage. The ALC voltage generated by the Alpha 6 cannot control the amplifier itself and is not applied internally. If ALC control is required, a connection must be made from the Alpha 6 to the transceiver ALC input. (See Sections 3 and 4.4)

Tune-up Procedure

NOTE: The forward and reflected power LED bargraphs and GRID LEDs are peak-responding.
BEFORE INITIAL TUNE-UP, MAKE SURE A SUITABLE ANTENNA OR 50 OHM DUMMY LOAD IS CONNECTED TO THE ALPHA 6. Leave the amplifier off or in standby and apply exciter power to make a forward vs. reflected power check. If reflected power is less than ten percent of forward power, the VSWR is lower than 2:1 and it is safe to proceed with tuneup.

1. Turning on the amplifier.

· Place the OPR-STBY switch in STBY (standby).
· Rotate the multimeter selector switch to HV.
· Depress POWER/ON.

If any of the following does NOT occur, depress POWER/OFF switch immediately and investigate before proceeding:
· The blower starts (note air exhausting above tubes).
· The multimeter bargraph automatically displays HV; it should indicate approximately 2.8 KV.
· The WAIT LED is lighted

IMPORTANT: EXHAUST AIR MUST BE DETECTABLE FROM THE TOP VENTS: If it is not, TURN OFF the amplifier immediately and verify that the exhaust chimneys are properly positioned over the tubes. When the warm up delay is complete (about 150 seconds), the WAIT LED will extinguish. The ALPHA 6 is now "ready".

2. Tuning Up for Operation at 1,500 Watts RF Output

Preset TUNE, and LOAD controls to the nominal positions given in TABLE I, below.

TABLE I - Preliminary Tuneup Settings

Frequency (MHz)	Tune	Load
50	TBD	TBD
51	TBD	TBD
52	TBD	TBD
53	TBD	TBD
54	TBD	TBD

NOTE: Final TUNE and LOAD settings will vary with the operating frequency, antenna characteristics, and power level.

3. Reduce transceiver carrier output control to ZERO.
4. Press OPR (operate) on OPR-STBY switch. OPR LED should light.
5. Select TUNE function of the multimeter bargragh.

IF AT ANY TIME IN THE FOLLOWING PROCEDURE THE AMPLIFIER FAILS TO RESPOND AS DESCRIBED, REMOVE DRIVE IMMEDIATELY!

6. Switch transceiver to CW and increase its carrier output to approximately 15 watts (6 output approx. 300-500 watts).

NOTE! If more than about 25 W drive is applied while the 6 is substantially mistuned, the 6 will switch to STBY. If the amplifier is returned to receive (key-up) it will automatically reset to OPR in about 4 seconds.

7. Adjust TUNE control to deflect the TUNE LED maximum leftward.
8. Adjust LOAD control to place the illuminated TUNE LED below the "V" mark on the TUNE scale.
9. Repeat steps 6 and 7 above.
10. Increase excitation until 6 output is about 1500 watts.
11. Repeat steps 6 and 7 at least twice.
12. Touch up TUNE for maximum power output.

The ALPHA 6 is now correctly tuned to deliver 1500 watts RF output on SSB, CW, FSK, SSTV and FM. The TUNE LED normally fluctuates during modulation or keying. Illumination of the first red LED on the RF OUTPUT bargraph indicates output has exceeded 1500 watts.

To operate at reduced power in any mode, simply decrease drive (i.e., transceiver power out put).

4.3 Reflected Power Protection

While operating, check the bargraph to ensure that reflected power remains below about 165 watts peak (2:1 VSWR when amplifier output is 1,500 watts). Fluctuating reflected power may indicate a problem in the feedline or antenna. If reflected power exceeds 250 watts the 6 will automatically switch to standby. The FAULT LED will illuminate,

indicating that the 6 protection system has tripped it to STBY. Such faults reset automatically if the transceiver is returned to receive for approximately 4 seconds.

4.4 Automatic Level Control (ALC)

If external ALC is used, amplifier grid current peaks greater than approximately 3mA will initiate ALC. At grid current of 5-10 mA, ALC output is nominally -10V. If the transceiver requires less ALC voltage, adjust the rear panel ALC potentiometer counterclockwise until smooth ALC action results. Increase the exciter RF output until the red GRID LED just illuminates on voice peaks.
A VOM can be used to measure ALC voltage while the pot is adjusted for suitable peak ALC voltage. Many Kenwood and Yaesu transceivers work well with -8 and -10 VDC maximum. Icom transceivers generally require lower peak voltage, typically -2 to -3 VDC.

Figure 6 – Inside Top View

Figure 7 – Front Panel Lowered

Figure 8 - Inside Front Panel

Section

5

OPERATING AND MAINTENANCE NOTES

TUBES

The 4CX1600B tube used in the ALPHA 6 is very rugged and normally operates with a large margin of safety. It should provide outstanding service for many years if not damaged by abuse - especially overdrive or blockage of cooling airflow. Allow at least twelve inches (31 cm) unobstructed clearance around the air intake and exhaust areas. Stacking equipment is not recommended.

Never allow key-down plate current to exceed 1.5 amperes for more than one or two seconds. If you do and a plate current trip occurs, it will automatically reset in about 4 seconds if the amplifier is returned to receive (key-up). Never allow the red GRID LED to stay brightly illuminated for more than a second.

Frequent on-off AC power cycling may shorten tube life. It's better to leave equipment in standby for several hours than to cycle power repeatedly on-off-on-off over the same period.

INTERLOCKS

The ALPHA 6 is equipped with a cover interlock switch intended to remove primary power from the amplifier, and a crowbar to short-circuit the high voltage to chassis whenever the cover is lifted. These interlocks are designed to protect against dangerous electric shock resulting from accidental contact with potentially lethal voltages inside the amplifier.

WARNING! WARNING! WARNING! WARNING! WARNING!

ALWAYS DISCONNECT THE AC LINE CORD FROM THE POWER SOURCE BEFORE REMOVING THE TOP COVER FROM THE 6 FOR ANY REASON!

Cover interlocks are intended only as back-up protection against accidents. Never depend on them! Always disconnect the power cord from the AC mains before removing the cover! Interlock switches should never be disabled for any reason except by a skilled and experienced technician.

FUSES

Never replace any fuse with one of a different type or greater current rating. Blowing of one or both primary line fuses indicates that the maximum safe average power capability of the amplifier has been substantially exceeded or that an equipment failure has occurred. USE ONLY 20 AMP, 250 VOLT RATED FUSES.
Slow-blow fuses F3 and F4, located above the primary line fuses, may prevent damage to the step-start resistors and HV rectifiers in the event of abnormal turn-on conditions or HV faults. If the AC interlock is defeated and primary power is applied while the HV crowbar is closed, the step-start fuses normally will blow.

DAMAGE RESULTING FROM USE OF A FUSE OF INCORRECT SIZE OR TYPE WILL NOT BE COVERED UNDER WARRANTY AND MAY VOID THE WARRANTY.

PLATE OVERCURRENT RELAY

This relay will quickly turn off the amplifier in the event of grossly excessive plate current or fault in the high voltage circuitry. The relay will not prevent tube or other damage due to either short or long term overdrive or improper tuning. It is the operator's responsibility to ensure safe tuning, drive, and general operating conditions. Should the overcurrent relay trip and remove AC power from the amplifier, determine and correct the cause of the trip before turning the 6 on again.

IDLING PLATE CURRENT AND ELECTRONIC BIAS CONTROL (EBS)

Idling plate current of the ALPHA 6 is approximately 350 to 400 mA during transmission. A detector senses RF drive, and reduces plate current to 30-50 mA during pauses in speech and key-up intervals, thus substantially reducing average power supply loading, heat generation, and wasted energy.

ARC & MISTUNING PROTECTION

ALPHA/POWER's exclusive circuit senses the beginning of any RF arc in, for example, a TUNE or LOAD variable capacitor and automatically switches the 6 to standby within a few milliseconds. This system has virtually eliminated RF arc damage in current ALPHA amplifiers. The system similarly detects severe mis-tuning of the 6, and if drive exceeds about 25 watts switches the amplifier to standby. The 25 watt input trip threshold permits safe tuneup at low power levels using the TUNE indicator, without aggravating and unnecessary trip-outs.

PREVENTIVE MAINTENANCE

The amplifier interior, particularly high voltage areas, should be cleaned with a vacuum cleaner and a soft bristle brush frequently enough to prevent visible accumulation of dust. In extremely dusty conditions it may be advisable to secure a thin air filter of the type used for window air conditioners across the air intake on the rear panel. The ALPHA accessory cooling fan also should be installed to insure adequate cooling airflow.

There are no user-accessible lubrication points in the amplifier. Do not apply oil or grease to any of the components. The exterior of the ALPHA 6 may be cleaned with a mild household liquid detergent such as Formula 409 or Fantastik. Do not use chemical solvents, as these may severely damage the front panel or cabinet finish. Never use an abrasive cleaner.

Figure 9 - Rear Panel Connections

Section

6

TROUBLESHOOTING HINTS

A) 6 will not turn on; nothing happens when ON switch is pushed.

1) External AC wiring, fuse or circuit breaker may be open.
2) Amplifier cover not in place; cover safety interlock open.
3) Fuse F1-F4 open or missing; check fuses with an ohmmeter.
4) Step-start resistor R4 or R5 open.

B) Amplifier turns on but no HV is indicated by the multimeter LED bargraph.

1) Multimeter selector switch in wrong position, e.g., Ip.
2) Possible HV circuit fault.
3) HV sampling resistor in power supply damaged.
4) Transformer plugged into power supply incorrectly.

C) Amplifier turns on but no multimeter indications; other LED bargraphs are operative.

1) Low voltage power supply problem.
2) Defect or damage on control board.

D) Amplifier turns on but time delay will not complete; WAIT LED does not turn off.

1) Defect or damage in timing circuitry on control board.

E) Amplifier turns on, time delay completes but amplifier will not transmit.

1) Open T/R control line from transceiver to RELAY jack.

F) Amplifier transmits but red GRID LED often lights.

1) Amplifier overdriven or underloaded; reduce transceiver output and /or increase amplifier loading.
2) Load VSWR (reflected power) exceeds 200W.
3) Exciter output poorly controlled. External ALC may help.

G) Amplifier operates but green GRID LED will not light and plate current is low; transceiver does not seem to be able to drive amplifier to its rated RF

output power level.

1) External ALC control voltage to transceiver excessive (see section 4.4, Automatic Level Control).
2) Input rf load resistor or bias circuitry damaged.
3) Possible damaged or defective tube(s).

H) Receive signals disappear or are severely attenuated when switching from STBY to OPR.

1) RELAY (T/R) control cable from transceiver is shorted.
2) Transceiver locked in transmit

I) Plate current indicated when amplifier is in STBY or receive.

1) 4CX1600B tube heater-to-cathode leakage or short.
2) Tube bias supply or T/R bias switch faulty.

J) Distorted SSB signal; possible severe television interference.

1) Excessive RF drive from transceiver and/or insufficient amplifier loading.
2) Coaxial connector, coax feedline, antenna feedpoint balun, tuner, or antenna trap arcing on voice peaks.
3) RF feedback from antenna into transceiver via the transceiver power cord, microphone or key cable, or other unshielded station patch cables.
4) Poor station RF ground.

K) Low frequency audio hum on transmitted signal.

1) Defective microphone cord (especially, broken ground lead).
2) Dynamic (magnetic) microphone located within about two feet of 6 power transformer. All dynamic microphones pick up some magnetically-coupled hum from the external field of nearby power transformers. In cases where objectionable hum is experienced while using the 6 and popular microphones such as the Heil series, the problem usually can be resolved by keeping the microphone at least 18 to 24 inches from the front of the amplifier and ensuring that transceiver mike gain, speech processing, and internal drive (ALC) levels are not adjusted to exceed 10 dB. In rare cases it may be necessary to use a ceramic or condenser type microphone.

Section

7

DESIGN AND CIRCUIT OVERVIEW

RF Amplifier Section (See Figure 6, 13)

Two 4CX800A/GU74b tubes are employed in a grounded-cathode, grid-driven circuit. Excellent linearity is achieved by operating the tubes as tetrodes with normal control grid (G1), screen grid (G2), and plate (anode) DC voltages. Drive voltage required under these conditions is low enough to permit using an untuned input loaded by non-inductive 50 ohm resistor R1. A simple network (C7, C8, K2, L1 in Figure 13) compensates for tube and wiring reactances on the highest-frequency bands, yielding extremely low input VSWR across the entire HF range.

RF negative feedback provided by un-bypassed cathode resistors R4 and R13 stabilizes amplifier power gain at the desired level of about 14 dB and further enhances linearity. Protection of tubes and other components against damage due to internal tube flash-over is provided by a gas-discharge surge suppressor, GT1, connected from the screen grids to ground, as well as D1 and R3 on the screen/filament board.
The Alpha 6 RF output network is a conventional pi-L except that plate RF choke L4 is switched by a relay to optimize performance across all nine 1.8-29.7 MHz amateur bands. Two-section TUNE and LOAD capacitors C22 and C32 are switched to provide an "electrical vernier" for smooth, easy and accurately-resettable tuneup "by the numbers" on all bands.

Power Supplies (Figures 6, 9, 12)

Transformer T1 supplies all raw AC voltages required. Step-start resistors R4 and R5 in series with the primary of T1 limit inrush current to a safe level and are shorted out by relay K2 shortly after turn-on. NOTE: For heavy-duty use or 50 Hz operation, the optional auxiliary fan must be installed.
The high voltage full-wave bridge rectifier (Figure 9) consists of a molded block HV rectifier assembly. Bridge D1-D4 provides rectified DC for the screen grids, while D5-D8 and associated components make up the regulated bias supply.
Figure 12 shows HV filter capacitor bank C2-C10 and the monitoring points for HV and IP. K1 is

the plate overcurrent relay. MOSFET Q12 and associated components provide regulated screen grid voltage for the tubes and also limit maximum screen current to a safe value. Q12 is mounted on the rear of the 6 front subpanel for heat sinking.

Control Circuits (Figure 7)

Control and monitoring circuits are grouped on the Control Board, which is physically located on the front of the 6 subpanel. Generally, monitoring and protective functions are clustered on page 1 of the schematic; warm-up, status indicators, and keying/switching functions are on page 2.

Front Panel Displays (Figure 8)

The Display Board, located on the rear side of the 6 front panel, incorporates all indicator LEDs and their associated driver chips. The RF forward (output) power bargraph is at top right, reflected power bargraph center right, multimeter bottom right, and the individual indicator LEDs at bottom left.

Output RF Wattmeter Detector Board - See Figure 14.

Multimeter Selector Switch Wiring - See Figure 11.

Switch Matrix Board - See Figure 10.

SAFETY

There are lethal voltages in the Alpha 6 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 6.

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.

ALPHA Products Warranty

CROSSLINK INC. warrants as follows each new amateur radio product of its manufacure, 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. US sale of export models).

2. *Eimac* power tubes are warranted by their manufacturer, CrossLink Inc. will assist owners in securing warranty service if requested.

   Svetlana power tubes are warranted by CrossLink for one year from date of original purchase.

3. Warranty does not apply to repair of damage resulting from improper maintenance or repair, misuse, neglect, abuse, or improper installation, nor to units not operated in accordance with specifications and instructions furnished by CrossLink, nor to units repaired or altered by persons not authorized by CrossLink,, nor 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 CrossLink or the selling dealer for service, the owner shall contact CrossLink or the selling dealer factory service department, providing model and serial number plus details of equipment hookup, accessory equipment used, operating conditions, and abnormalities observed. CrossLink 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 tofactory. Equipment authorized for return shall be shipped to CrossLink fully prepaid and insured via United Parcel Service or air express. USING ONLY FACTORY APPROVED PACKING; REMOVE POWER TRANSFORMER BEFORE SHIPPING ANY UNIT WHICH WAS ORIGINALLY SHIPPED FROM THE FACTORY WITH TRANSFORMER REMOVED. All shipping charges are the responsibility of the owner.

5. In order to receive service under this warranty, the owner must either (a) have returned a completed warranty registration form to CrossLink within 30 days of original purchase OR (b) provide proof of ownership as well as proof of the original date of sale by CrossLink or by an authorized CrossLink dealer.

6. No person is authorized to assume for CrossLink any liability in connection with our products, other than as set forth in this warranty. CrossLink reserves the right to change its products as it deems desirable, without obligating itself to make such changes available for previously manufactured products.

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CrossLink Inc.
303.473.9232 x. 151 Sales & Serivce
303.473.9660 fax
www.crosslinkinc.com
6185 Arapahoe Road, Boulder CO 80303