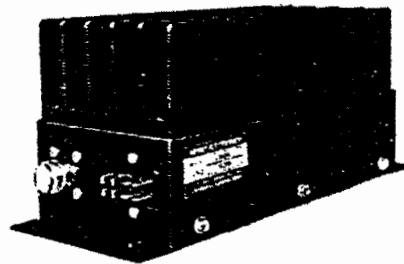


## HENRY/TEMPO SOLID STATE UHF AMPLIFIERS

INCLUDING MODELS:

C70D30	70D30
C70D10	70D10
C70D02	70D02
C40D10	40D10
C40D02	40D02
C10D02	10D02

OPERATING AND MAINTENANCE MANUAL



***Henry Radio***

HENRY RADIO  
2050 So. Bundy Drive  
Los Angeles, CA 90025

## PLEASE NOTE

All rated amplifier outputs are measured with maximum defined drive (3 watts for -02 amplifiers, 15 watts for -10 amplifiers, and 40 watts for -30 amplifiers) and an operating voltage of 13.8 VDC. Additionally, the amplifier should be operated into a 50 ohm load. Keep all coax leads as short as possible, because line loss is definitely significant at 150 and 450 MHz. When the amplifier is operated at less than optimum conditions, the power output will be less than maximum.

## WARRANTY

Henry Radio warrants each new product sold by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit which under normal installation, use, and service discloses such defect, provided the unit, or part, is delivered by the original owner to us intact for our examination, with all transportation charges prepaid to our factory, within ninety days from the date of sale to the original purchaser and provided that such examination discloses in our judgment that it is thus defective. Should a malfunction be suspected, write in detail to our service department for suggestions concerning the operation, repair, or return of your unit if it should prove necessary.

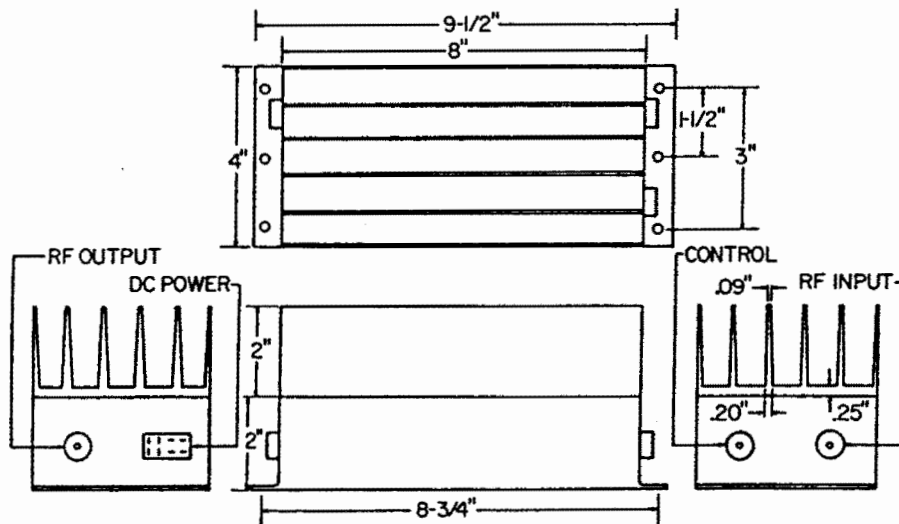
This warranty does not extend to any of our radio products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of the instructions furnished by us, nor extend to units which have been repaired or altered outside of our factory, nor in cases where the serial number thereof has been removed or defaced or changed, nor to units used with accessories not manufactured or recommended by us.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by Henry Radio without charge to the owner. This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our products.

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

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# HENRY/TEMPO SOLID STATE UHF POWER AMPLIFIERS OPERATING AND MAINTENANCE MANUAL

## SECTION 1 TYPE ACCEPTANCE INFORMATION

With the installation of commercial filtering, these amplifiers are type accepted for operation under all applicable parts of the land mobile and fixed base station services. However it is the responsibility of the technician installing and tuning the amplifier to hold the proper class of FCC commercial license and to be familiar with the rules and regulations pertaining to the power output permissible under the class of station license the amplifier is to be used with.

Also, it is extremely important to consult the specifications published by the manufacturer of the exciter. This will insure that the power level which the transceiver will be raised to will not invalidate its type acceptance because of spurious content or frequency stability.

The technician must determine what the maximum power level is in the class of operation he intends to use the amplifier. We suggest that the technician consult the FCC publications regarding the regulations.

For all regulations calling for the measurement of the final input power, consult Sections 4 and 5 of this manual.

To comply with any regulation regarding low power capability, see Section 6, which describes the function of the control jack.

The content of harmonic spurious signals generated by this amplifier is attenuated far in excess of the FCC requirements for the service that the amplifier is type accepted. The attenuation of these spurious signals is guaranteed in the design of the amplifier as well as by the use of a low pass filter on the output of the amplifier section.

## SECTION 2 UNPACKING AND INSTALLATION

The solid state amplifier you have purchased was tested and aligned at the factory for the frequency you requested. Further alignment should not be necessary. The solid state devices in your amplifier are easily damaged if they are incorrectly serviced. The equipment warranty can not cover damages caused by negligent service, therefore we recommend that all service be carried out by a well trained technician.

Remove the amplifier from its shipping box and packing material and examine it for visible damage. If the equipment has been damaged in shipment, save the box and packing material and notify the transportation company immediately. DO NOT put the amplifier into service if it has been damaged.

FOR MAXIMUM OUTPUT POWER, MAXIMIZE  
YOUR OPERATING PARAMETERS

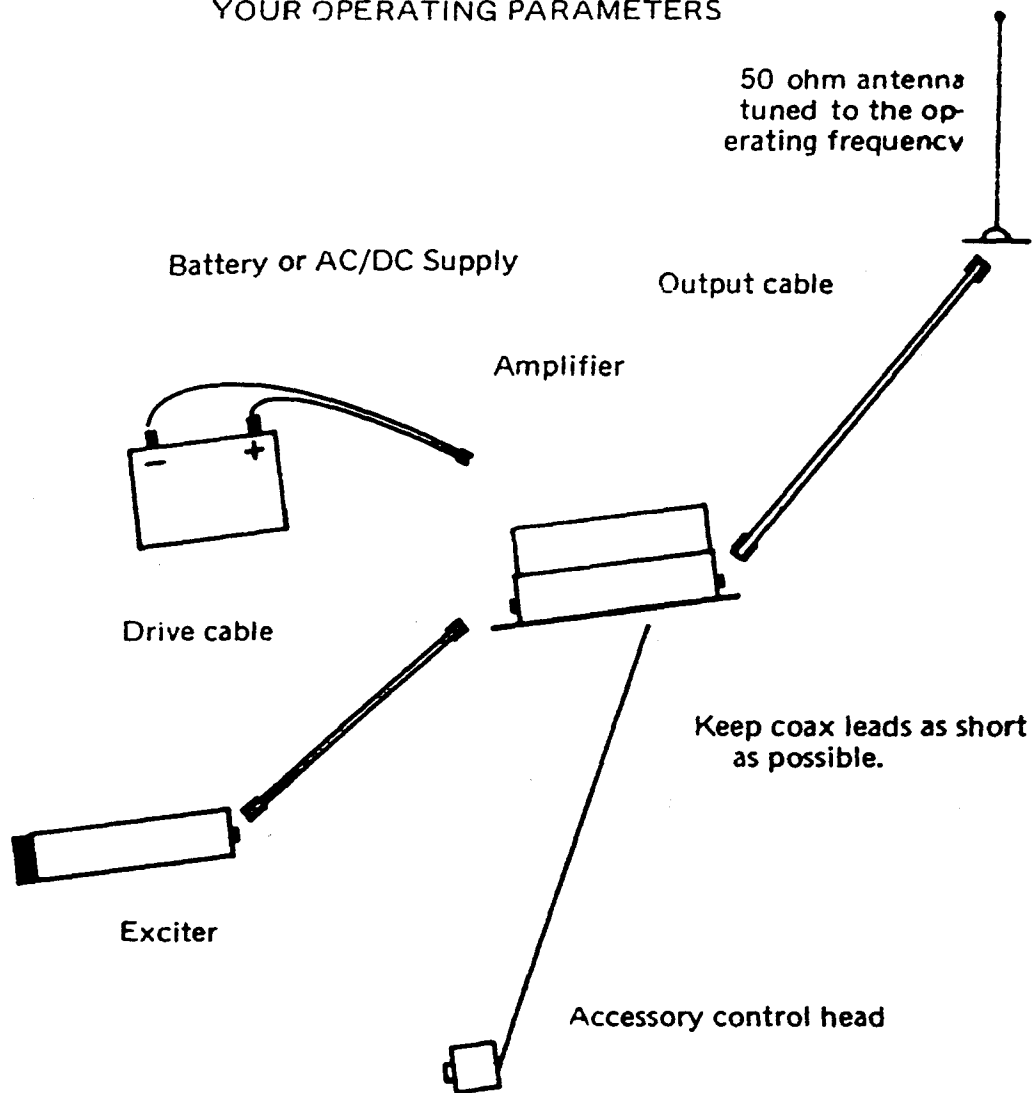


Figure 1. Installation Diagram.

All necessary cables should be provided with the amplifier. Special cables or connectors can be supplied on request. When installing the amplifier, keep in mind that the equipment should be mounted as closely as possible to the 13.8 VDC power source to prevent low output caused by a voltage drop in the DC cable. We recommend installation inside the vehicle for mobile installations. The red\*power lead connects to the battery's positive (+) terminal and the black DC lead connects to the battery's negative (-) terminal. Figure 1 is a diagram of the necessary interconnections.

The DC power cables should be connected directly across the battery to prevent damage to the amplifier caused by starting transients and to prevent damage to the ignition system of the car caused by the high operating current of the amplifier. Screw the amplifier into position at the location desired and plug the DC power cable into the 13.8 VDC connector (8 pin Jones plug) of the amplifier.

Connect the RF OUT coax connector to an appropriate antenna (50 ohms) using coaxial cable. Remember that long coax leads cause significant power losses at VHF and UHF frequencies. Connect the supplied drive cable to the exciter and to the RF IN coax connector of the amplifier.

The installation is complete when all of these connections have been made.

For base station installations, the amplifier must be connected to a 13.8 VDC source (either a storage battery or an AC to DC power converter) capable of supplying the necessary current.

The amplifiers are designed to key into transmit automatically whenever they are driven with more than about .5 watt. The CONTROL jack, described in Section 6, disables the automatic keying circuit for low power operation.

For optimum output power, remember that the voltage at the amplifier, the drive power, the length of the coax leads, and proper antenna tuning are all important operating parameters. Low output is usually caused by not having a proper installation.

\*sometimes white

## SECTION 3 CIRCUIT DESCRIPTION

### 3.1 MODEL 70D02

The circuit diagram of the amplifier is shown in Figure 2. All of the UHF amplifiers are built on a modular, building block technique. The 70D02 consists of a relay board and four amplifier boards.

On the relay board, the RF from the antenna connector goes directly through the relay into the exciter during receive. During transmit the RF from the exciter enters the amplifier through the RF IN connector and creates a DC voltage across diode D1 which is amplified by Q1 to trip relay RY1 causing the signal to enter the amplifier section. Grounding the base circuit of Q1 disables the sensing circuit to turn the amplifier off.

D2 senses the output power of the amplifier and sends a DC current to the tip of the control jack for monitoring of relative RF output.

The 70D02 consists of four amplifier boards. Referring to the schematic diagram, PB3 through PB5 are nearly identical. PB2 uses a lower power transistor.

On each board, the 50 ohm input is matched through the printed circuit inductance along with C1, C2, and C3. The DC return for the base is through L1. The center frequency of the input circuit is factory set by selection of the position of C2 and C3 on the printed circuit inductance.

The collector tuned circuit consists of a printed circuit inductance which is series resonated by C7 and matched to 50 ohms by C6. Capacitors C4 and C5 serve as collector balance capacity. Here, as in the input circuit, the center frequency is set by proper positioning of C6 and C7. The latter components form a band pass filter which serves to attenuate harmonics more than 50 db below the fundamental carrier level.

The amplifier is inherently broadband in its design and will operate  $\pm 10$  MHz from its center frequency with less than 1 db decrease in output.

Power and impedance matching is achieved through transformers T1 and T2, which are made up of two quarter wave 72 ohm lines. This technique is used for both interstage and output coupling on the 70D02.

Printed circuit inductor L2, along with C8, C9, and C10 serve to decouple the collector B+ from the signal circuit.

SK1 is the RF input connector, type BNC. SK2 is the CONTROL jack for remote control and power monitoring. SK3 is the DC power connector. D1 is a polarity protection diode. SK4 is a type N RF output connector.

## 3.2 OTHER MODELS

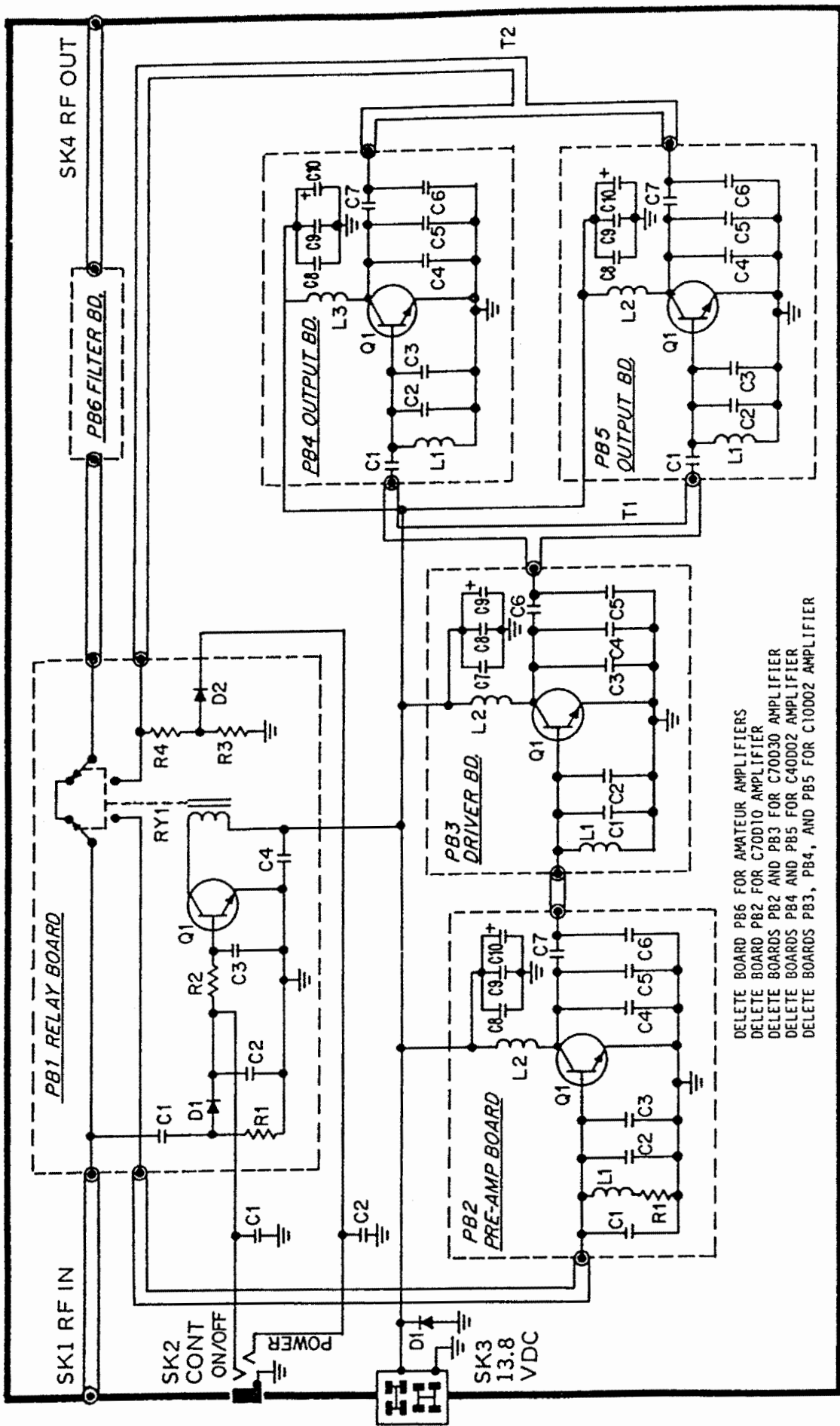
All the other amplifiers are combinations of PB1 through PB5 to match the desired input and output configurations, as described on the schematic.

## 3.3 COMMERCIAL MODELS

The low pass filter located on PB6 is made up of fixed capacitors and a strip-line inductor. The filter is an 8 pole device with input matching. The response of the filter is such that the second harmonic is attenuated an additional 46 db and the third an additional 70 db.

## SECTION 4 TESTING AND ALIGNMENT

The broadband design and fixed tuning preclude any field adjustment of the amplifier. If it becomes necessary to shift the center frequency of the equipment, the amplifier should be returned to the manufacturer. However



DELETE BOARD PB6 FOR AMATEUR AMPLIFIERS  
 DELETE BOARD PB2 FOR C70D10 AMPLIFIER  
 DELETE BOARDS PB2 AND PB3 FOR C70D30 AMPLIFIER  
 DELETE BOARDS PB4 AND PB5 FOR C40D02 AMPLIFIER  
 DELETE BOARDS PB3, PB4, AND PB5 FOR C10D02 AMPLIFIER

Figure 2. C70D02 Schematic.



the broadband design of the amplifier makes it unnecessary to retune unless the frequency of operation is changed by more than about 20 MHz.

#### 4.1 TEST PROCEDURE

Connect the amplifier and its exciter as shown in the block diagram of Figure 3. Figure 4 shows the standard component locations.

Be certain that the DC power supplied to the amplifier is a regulated 13.8 VDC.

Be certain that the RF output of the transceiver does not exceed the rated input of the amplifier (3 watts for the D02 models, 15 watts for the D10 models, and 40 watts for the D30 model).

Connect the thru-line wattmeter between the transceiver and the amplifier, energize both units and verify the input VSWR is less than 2:1.

Connect the wattmeter between the amplifier output and the antenna (or dummy load) key the exciter and verify proper output power.

### SECTION 5 POWER ADJUSTMENT

The wideband design and fixed tuning eliminates all tunable components.

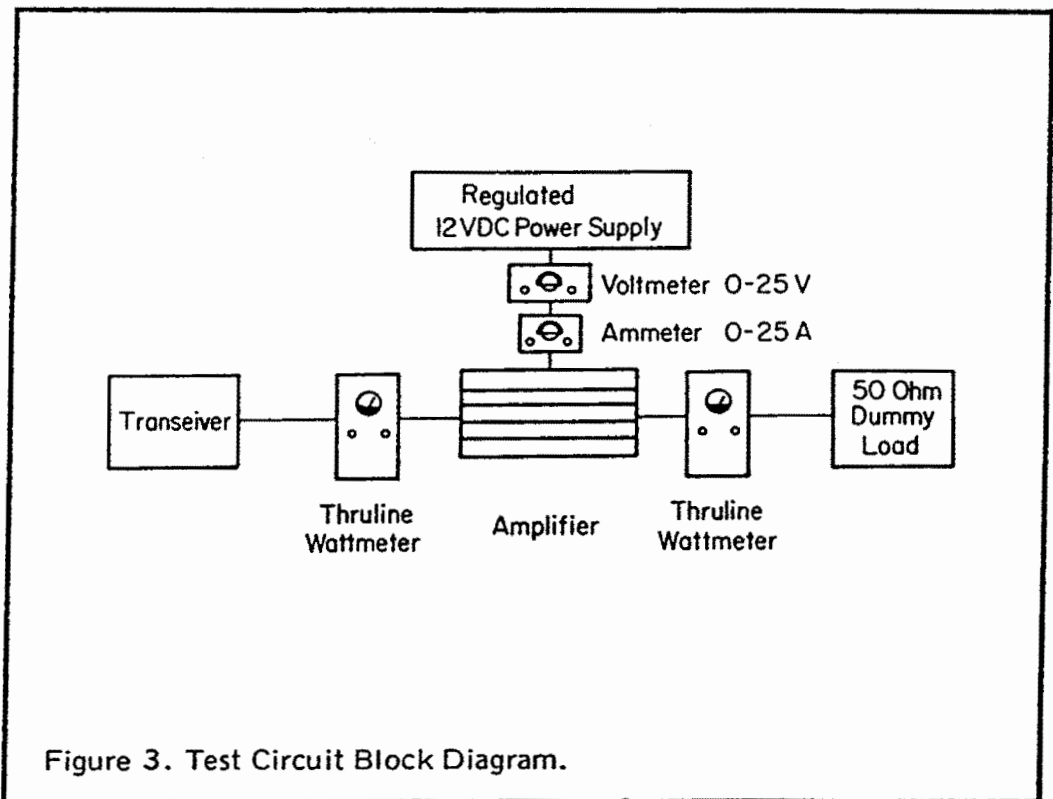
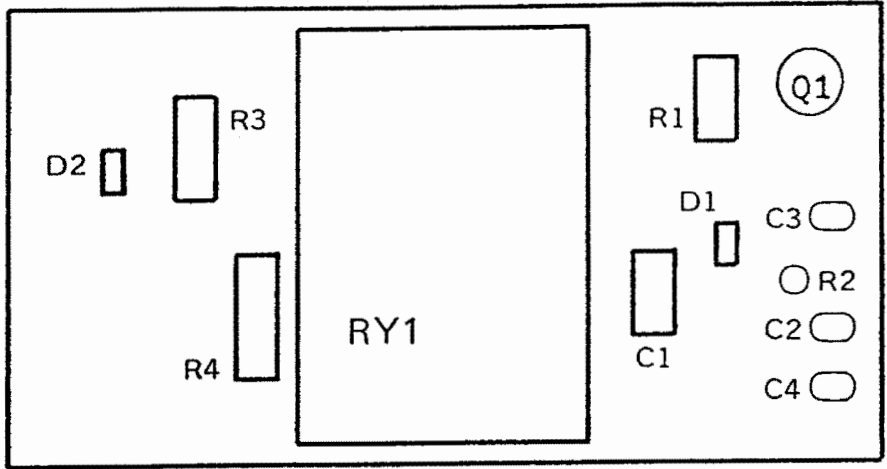
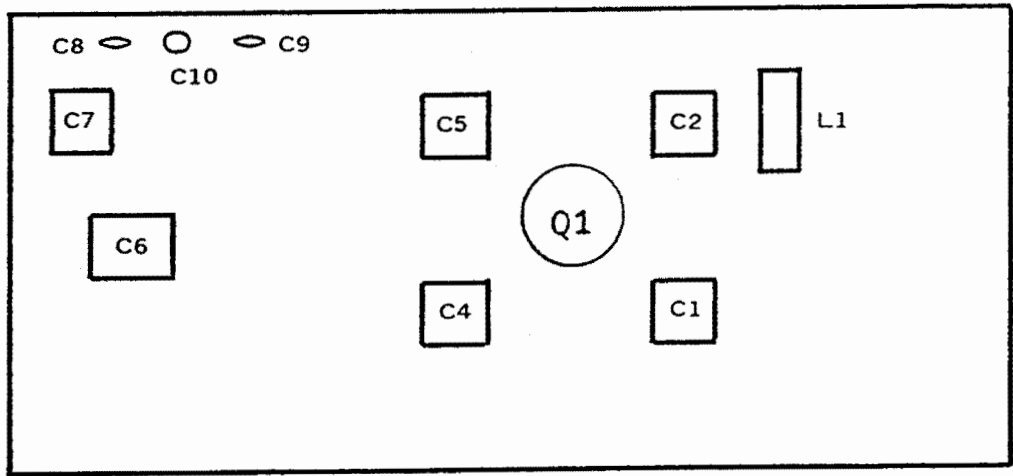


Figure 3. Test Circuit Block Diagram.



PB1 Relay Board



PB2, PB3, PB4, and PB5

Figure 4. Parts Location Diagram.

A 3 to 6 db decrease in power output may be accomplished by decreasing the input drive through the use of a suitable attenuator. This will not degrade the spurious response or cause oscillation in the amplifier.

Input power may be measured directly by breaking the B+ lead to the amplifier's output stage and inserting a 20 amp meter.

## SECTION 6 CONTROL AND MONITOR CONNECTOR

A dual function control jack is provided on each amplifier to allow remote control and power output monitoring of the amplifier.

Grounding the control line (ring), as shown in Figure 5, disables the amplifier, connecting the transceiver directly to the antenna.

To monitor the relative output power, connect a DC voltmeter or milliammeter between ground and the tip of the three circuit control plug.

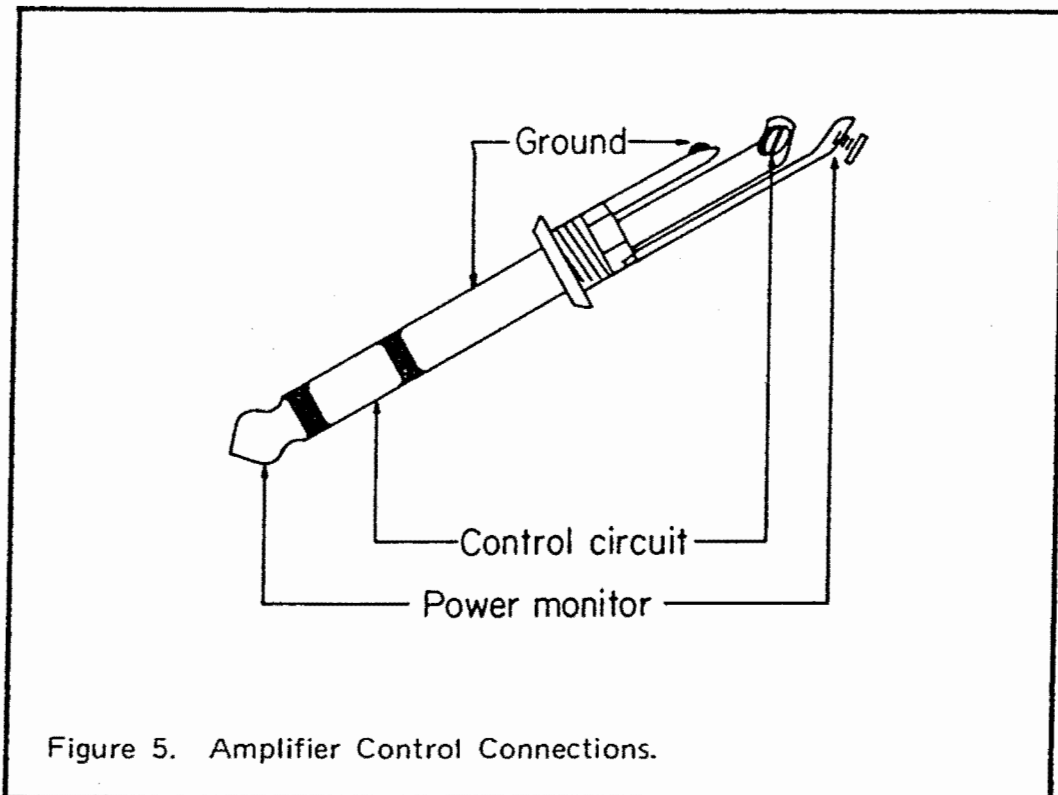


Figure 5. Amplifier Control Connections.

SECTION 7 C70D02 PARTS LIST

Schematic No.	DESCRIPTION	Manufacturer
	Box and Packing Material.	Henry
	CABLE: DC primary cable.	Henry
	CABLE: RF drive cable.	Henry
C1 and C2	CAPACITOR: Ceramic disc, .05 mf, 20 v, $\pm 20\%$ .	CTL* UK20-503
D1	DIODE: Silicon rectifier, 1 amp. 1000 PIV, polarity protection.	GE-509
	MANUAL: UHF Amplifier Operating and Maintenance Manual.	Henry
	METAL WORK:	
	Bottom Plate.	Henry
	Chassis.	Henry
	Heat Sink.	Henry
PB1	PRINTED CIRCUIT ASSEMBLY: Relay board.	Henry
PB2	PRINTED CIRCUIT ASSEMBLY: Pre-amplifier board.	Henry
PB3	PRINTED CIRCUIT ASSEMBLY: Driver board.	Henry
PB4 and PB5	PRINTED CIRCUIT ASSEMBLY: Output board.	Henry
PB6	PRINTED CIRCUIT ASSEMBLY: Filter board.	Henry
SK1	CONNECTOR: RF IN, type UG-290A/U, BNC.	Amph. 031-203
SK2	CONNECTOR: CONTROL, 3 conductor phone jack, 1/4".	Switchcraft S-12B
SK3	CONNECTOR: 13.8 VDC, DC primary connector, 8 pin.	Cinch S308-AB
SK4	CONNECTOR: RF OUT, type UG-58A/U, N connector.	Amph. 82-097
<b>PB1 RELAY BOARD MODULE</b>		
	CIRCUIT BOARD: Glass epoxy relay board.	Henry
C1	CAPACITOR: Ceramic disc, 2.2 pf, 650 v.	CTL* DTZ-2R2
C2 through C4	CAPACITOR: Ceramic disc, .01 mf, 150 v.	CTL* DDM-103
D1 and D2	DIODE: Silicon rectifier, 50 PIV, 1 amp.	1N4148
Q1	TRANSISTOR: RF amplifier, type 2N2222.	2N2222.
R1 through R3	RESISTOR: Carbon, 1 K ohm, 1/2 watt, 10%.	Resistor
R4	RESISTOR: Carbon, 10 K ohm, 1/2 watt, 10%.	Resistor
RY1	RELAY: RF antenna change over.	Guard. 1365-PC-2C

(continued)

(continued)

### PB2 PREAMPLIFIER MODULE

CIRCUIT BOARD: Glass epoxy UHF board.

C1 CAPACITOR: Toothpick mica, 5 pf.  
C2 CAPACITOR: Toothpick mica, 25 pf.  
C3 CAPACITOR: Toothpick mica, 15 pf.  
C4 through C6 CAPACITOR: Toothpick mica, 10 pf.  
C7 CAPACITOR: Toothpick mica, 150 pf.  
C8 CAPACITOR: Ceramic disc, .01 mf, 150 volt.  
C9 CAPACITOR: Ceramic disc, .001 mf, 1000 volt.  
C10 CAPACITOR: Electrolytic tubular, 25 mf, 50 volt.

L1 INDUCTOR: 2 turns of R1 lead.  
L2 INDUCTOR: RF choke, 3.3 uh.

Q1 TRANSISTOR: RF power amplifier, uhf, 10 watts.  
R1 RESISTOR: Carbon, 3.3 ohm, 1/2 watt, 10%.

Henry

Unelco T101-5  
Unelco T101-25  
Unelco T101-15  
Unelco T101-10  
Unelco J101-150  
CTL\*DDM-103  
CTL\* DD-102  
Arco RME/FJ/025

Henry  
Miller 9250-332  
CTC CM10-12

Resistor

### PB3 DRIVER BOARD MODULE

C1 CAPACITOR: Toothpick mica, 25 pf.  
C2 CAPACITOR: Toothpick mica, 15 pf.  
C3 CAPACITOR: Toothpick mica, 35 pf.  
C4 CAPACITOR: Toothpick mica, 25 pf.  
C5 CAPACITOR: Toothpick mica, 10 pf.  
C6 CAPACITOR: Toothpick mica, 150 pf.  
C7 CAPACITOR: Ceramic disc, .01 mf, 150 volt.  
C8 CAPACITOR: Ceramic disc, .001 mf, 1000 volt.  
C9 CAPACITOR: Electrolytic tubular, 25 mf, 50 volt.

L1 INDUCTOR: 1 uh, printed circuit coil.  
L2 INDUCTOR: RF choke, 3.3 uh.

Q1 TRANSISTOR: RF power amplifier, UHF, 40 watts.

Unelco T101-25  
Unelco T101-15  
Unelco T101-35  
Unelco T101-25  
Unelco T101-10  
Unelco J101-150  
CTL\* DDM-103  
CTL\* DD-102  
Arco RME/FJ/025

Henry  
Miller 9250-332  
CTC CM40-12

### PB4 AND PB5 OUTPUT BOARD MODULES

C1 CAPACITOR: Toothpick mica, 25 pf.  
C2 CAPACITOR: Toothpick mica, 25 pf.

Unelco J101-25  
Unelco T101-25

(continued)

(continued)

C3	CAPACITOR: Toothpick mica, 15 pf.	Unelco T101-15
C4 and C5	CAPACITOR: Toothpick mica, 35 pf.	Unelco T101-35
C6	CAPACITOR: Toothpick mica, 10 pf.	Unelco T101-10
C7	CAPACITOR: Toothpick mica, 150 pf.	Unelco J101-150
C8	CAPACITOR: Ceramic disc, .01 mf, 150 volt.	CTL* DDM-103
C9	CAPACITOR: Ceramic disc, .001 mf, 1000 volt.	CTL* DD-102
C10	CAPACITOR: Electrolytic tubular, 25 mf, 50 volt.	Arco RME/FJ/025
L1	INDUCTOR: 1 uh, printed circuit coil.	Henry
L2	INDUCTOR: RF Choke, 3.3 uh.	Miller 9250-332
Q1	TRANSISTOR: RF power amplifier, UHF, 40 watts.	CTC CM40-12
PB6 FILTER BOARD MODULE		
CIRCUIT BOARD: Glass epoxy, UHF filter board.		
C1	CAPACITOR: Toothpick mica, 5 pf.	Henry
C2	CAPACITOR: Toothpick mica, 25 pf.	Unelco T101- 5
C3	CAPACITOR: Toothpick mica, 50 pf.	Unelco T101-25
C4	CAPACITOR: Toothpick mica, 25 pf.	Unelco T101-50
C5	CAPACITOR: Toothpick mica, 5 pf.	Unelco T101-25

The manufacturers and part numbers listed above are typical values.  
In actual production, the parts used may be equivalents of another manufacturer.

\*CTL - Centralab.