

RF-103A 1KW LINEAR POWER AMPLIFIER

TECHNICAL SPECIFICATIONS

Frequency Range	2 to 3 MHz
RF Output Power	1000 Watts PEP and Average
Number of Programmed Channels	Up to 10 with manual back-up
Programmed Channel Changing Time	5 seconds nominal
Tube Type	8164/3-1000Z
RF Drive Power Required	65 Watts for full power output
Output Impedance	50 ohms
Tolerable VSWR	1.5 to 1
Intermodulation Distortion	Third order more than 30dB down
Harmonic Output	More than 40dB down
Input Power	115/230 volts \pm 10% 50/60 Hz, 2.8 KW at full power output
Metering	Output Power, Grid Current, Plate Current and Plate Voltage
Operating Temperature	-30 ^o to +50 ^o C
Cooling	Forced air from internal blower
Size	30.1 H x 20.6 W x 21 D inches (760 H x 525 W x 535 D mm)
Unit Weight	246 lb (111 kg)
Shipping Weight	338 lb (153 kg) Approximately, Domestic/Export
Mounting	Floor Mount (standard), Rack, Caster or Shock Mounting (special order)
Shock/Vibration	Suitable for fixed or shipboard applications

RF-103A

OPERATING INSTRUCTIONS

LOCAL MANUAL OPERATION

(Local Operation of the RF-103A with an Exciter that does not have "Channel Control Provisions")

NOTE

For the initial operation make sure the Local/Remote switch S1 (inside front door on Junction/Program Board) is set at Local and that a proper antenna system is connected. The unit must be properly installed and checked out as outlined in section 3 of this manual.

a. Set FILAMENT switch at ON and FREQUENCY MC switch to the band that includes the exciter's operating frequency. Observe that the FILAMENT indicator is lit.

b. If an antenna coupler is being used tune it for minimum VSWR according to the instruction manual supplied with it.

c. Refer to table 1 and check for a previously recorded value for the operating frequency. If a value has been recorded adjust the Tuning Reference Meter with the TUNING switch to the listed value. If no value is listed then set the Tuning Reference Meter to the 50 mark.

d. Set PLATE switch at ON. Observe that the PLATE indicator is lit. Set METER SELECTOR switch at PLATE VOLTS and check that the meter is indicating in the green area. Set METER SELECTOR switch at OUTPUT.

e. Set the exciter for either AM (no modulation) or CW (with reduced drive) for a driver level of 20 to 30 watts. Key the exciter and with the TUNING switch adjust the RF-103 for maximum output power (approximately 370 watts).

NOTE

If the operating frequency is in the lower 50% of the selected band then tune toward the upper end of the Tuning Reference Meter for a peak. If the operating frequency is in the upper 50% of the selected band then tune toward the lower end of the Tuning Reference Meter for a peak.

f. At the exciter adjust the rf drive until the RF-103 indicates 1000 watts in the cw mode or on voice peaks (ssb mode).

g. Unkey the exciter. The system is now ready for normal operation. Record the Tuning Reference Meter indication for future reference.

NOTE

While operating, occasionally check each position of the METER SELECTOR switch to determine if the RF-103 is operating properly.

RF-103A

OPERATING INSTRUCTIONS

LOCAL AUTOMATIC OPERATION

(Local Operation of the RF-103A with an Exciter that has Channel Control Provisions)

NOTE

RF-103 must be installed, checked out, pre-programmed and tuned before automatic operation is possible. Refer to section 3 in this manual.

a. Open the front door and check that the Local/Remote switch on the Junction/Program Board (inside front door) is set at LOCAL. Close the front door.

b. Set FILAMENT switch at ON and FREQUENCY MC switch at CHANNEL.

c. After a one minute warm-up period set PLATE switch ON.

NOTE

All channel information for the RF-103 must be provided for the front panel CHANNEL SELECTOR switch only. No channel information is to be received from the exciter.

d. Select the desired channel with the CHANNEL SELECTOR switch. Observe that the proper channel indicator is illuminated.

e. Energize the exciter. Operation can now be performed by keying the exciter.

NOTE

While operating, occasionally check each position of the METER SELECTOR switch to determine if the RF-103 is operating properly.

NOTE

Replace all burned out CHANNEL lights. A burned out light will cause the coil to de-tune. If no replacement is available, retune the coil.

Frequency vs. Channel Record, for Automatic Operation

FREQUENCY	CHANNEL NO.

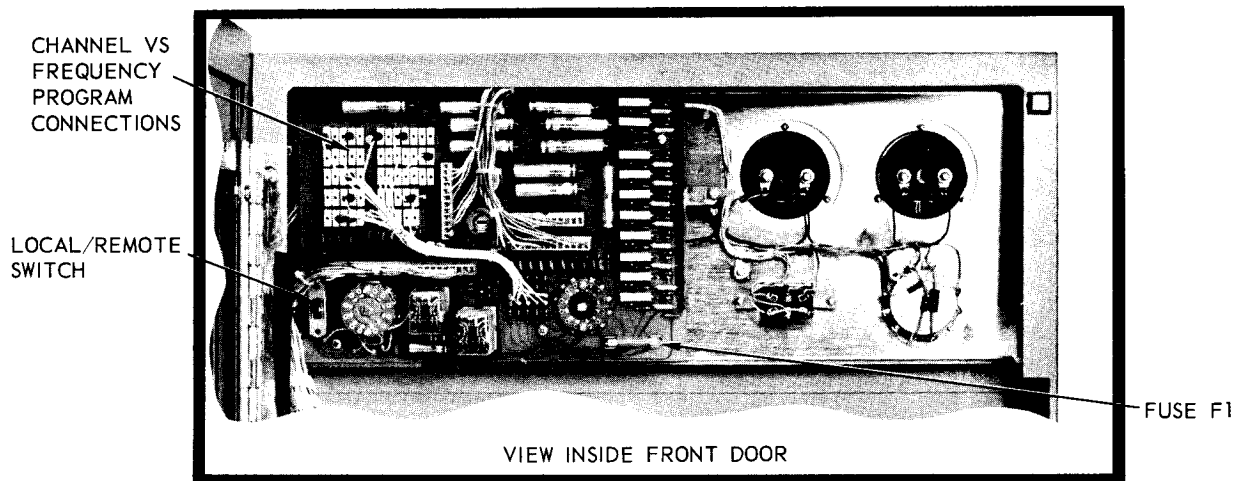
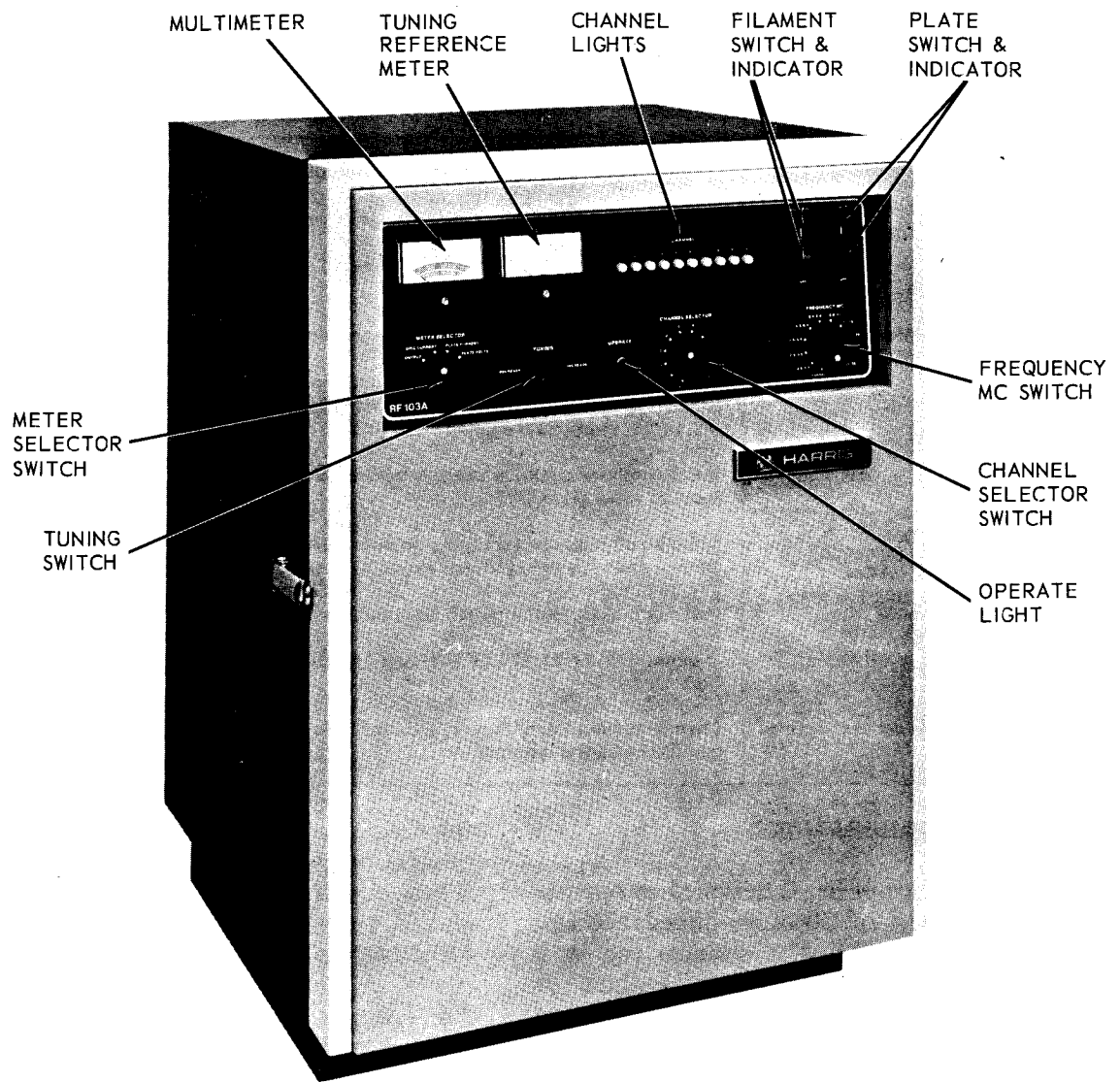


Figure 1.1 RF-103 Operating Controls and Indicators



SECTION 3

INSTALLATION

3.1 GENERAL

This section contains the information necessary for proper installation of the RF-103. Included are detailed instructions on site selection, system connections and for programming and checking out the RF-103 after installation.

3.2 SITE SELECTION

The RF-103 can be installed in any convenient location that is within 100 cable feet (30.4 meters) from the exciter and 200 cable feet (60.8 meters) from the antenna coupler or antenna. At least four inches (0.15 meters) of clearance behind the RF-103 cabinet is required for the exhaust air flow.

3.3 UNPACKING AND INSPECTION

No special procedures are necessary for unpacking. However, care should be exercised to prevent injury to personnel or damage to the unit. After the unit has been removed from the shipping container, inspect for damage. If any damage is found, save the packing material and container to substantiate the claim with the transportation agency.

Check the items received against the shipping list. If any items are missing, notify RF Communications, Sales Department.

3.4 TUBE V1 INSTALLATION

Power amplifier tube V1, the chimney, and the plate cap assembly are packed in separate containers for shipment and must be installed.

Perform the following procedure:

- a. Unpack the tube, chimney, plate cap assembly and plastic bar.
- b. Place the plastic bar over the plate pin of the tube and carefully lower the chimney over the tube.

- c. Lower the tube and chimney through the clamp and into the tube socket. Rotate the tube until the pins align with the socket. Press down to connect the tube pins with the socket.

- d. Seat the chimney in the clamp and tighten the chimney clamp.

- e. Place the plate cap on the plate pin of the tube and press down until the plastic bar is against the tube envelope. Tighten the set screw on the plate cap.

- f. Connect the braided strap of the plate cap assembly to capacitor C29, as shown on the instruction notice supplied on the heat shield (PM-0473A).

CAUTION

Exercise care when connecting the braided strap to C29. Excessive torque can snap the lug from the capacitor.

3.5 CONNECTIONS

Once the RF-103 Power Amplifier is located at the operating site, the unit must be interconnected to the associated equipment that is to be used with it. These connections include the ac primary power, rf power, and control. The control connections consist of the keyline, equipment interlocks, grounds, and channel control wires necessary for operation.

Refer to the exciter and antenna coupler instruction manuals and, if supplied, the system instruction manual and make the necessary inter-unit connections. The following paragraphs, 3.5.1, 3.5.2, 3.5.3, and 3.5.4 outline general information and requirements for proper system connections.

3.5.1 PRIMARY AC POWER CONNECTIONS

Because of the relatively high power requirements, it is suggested that a separate service line be provided from the main service box.

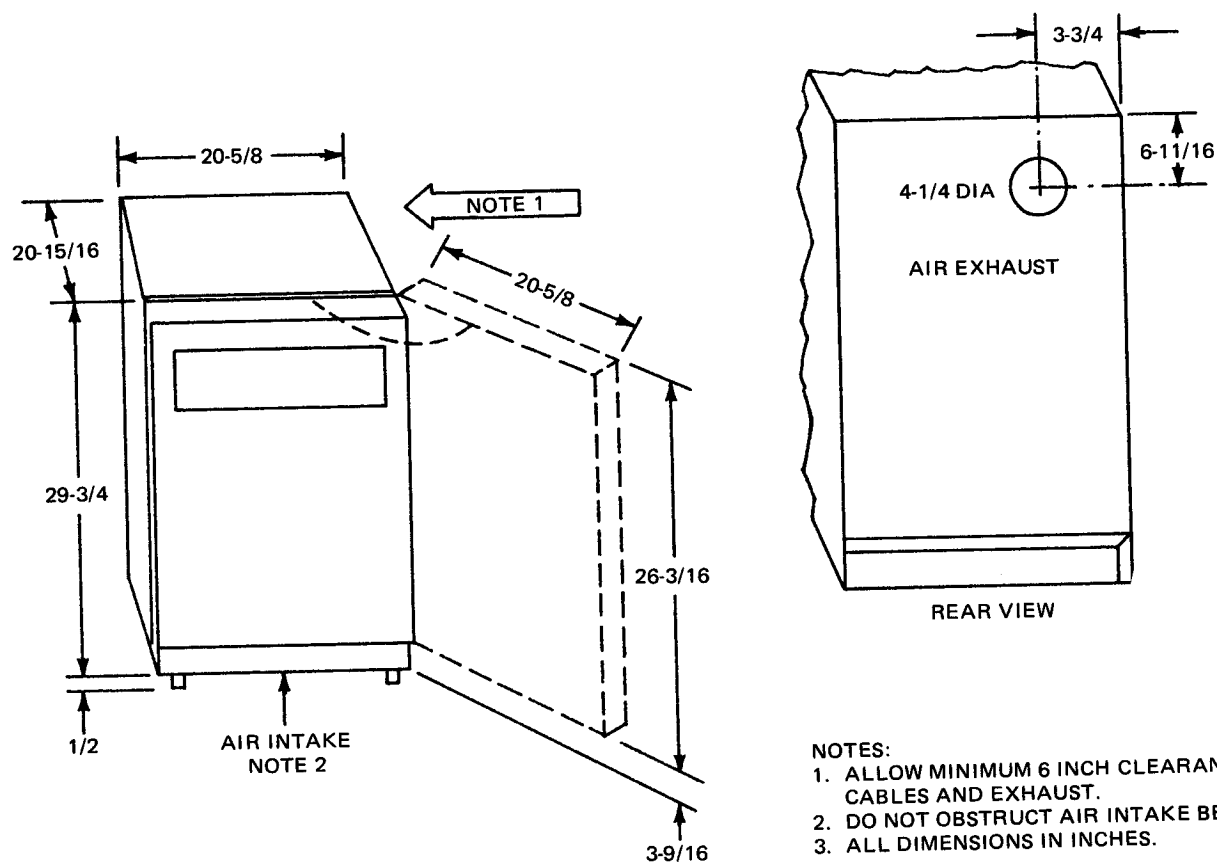


Figure 3.1 RF-103 Outline Dimensions

The line should be free from other services. It is important that the service be capable of supplying 3.2 kVA with good regulation. Regulation is especially important if the exciter is operated from the same line. Ac power is supplied to the power amplifier by means of J25 on the rear panel, see figure 3.2. A power cord is supplied wired with the mating connector for J25. This cord is suitable for either 115V or 230V operation. Connections at the power source should be as follows:

For 105V/130V Operation

Power Cord Color	Function
Black	Ac Line High
White	Ac Line Low
Green	Source Ground

For 210V/260V Operation

Black	Ac Line High
White	Ac Line High
Green	Common

Power Switching may be remotely controlled by the addition of the RF-1206 Remote ON/OFF Kit. This option is normally installed by the factory. Plugs P1 and P2 are normally shipped wired for 110-120 volt operation. For other power line voltages see figure 3.3. Measure the primary power voltage and adjust the wiring of P1 and P2 to the corresponding value. Install the plugs, see figure 3.3.

Connect a ground strap or heavy gauge wire to the ground terminal on the back of the power amplifier. Connect the remaining end to a separate ground, such as a copper cold water pipe or a copper ground rod.

NOTE

Two 15 ampere circuit breakers are provided for protection. Circuit breaker CB1 is used for 210, 230 or 260 volt operation. Both circuit breakers CB1 and CB2 are used for 105, 115 or 130 volt operation.

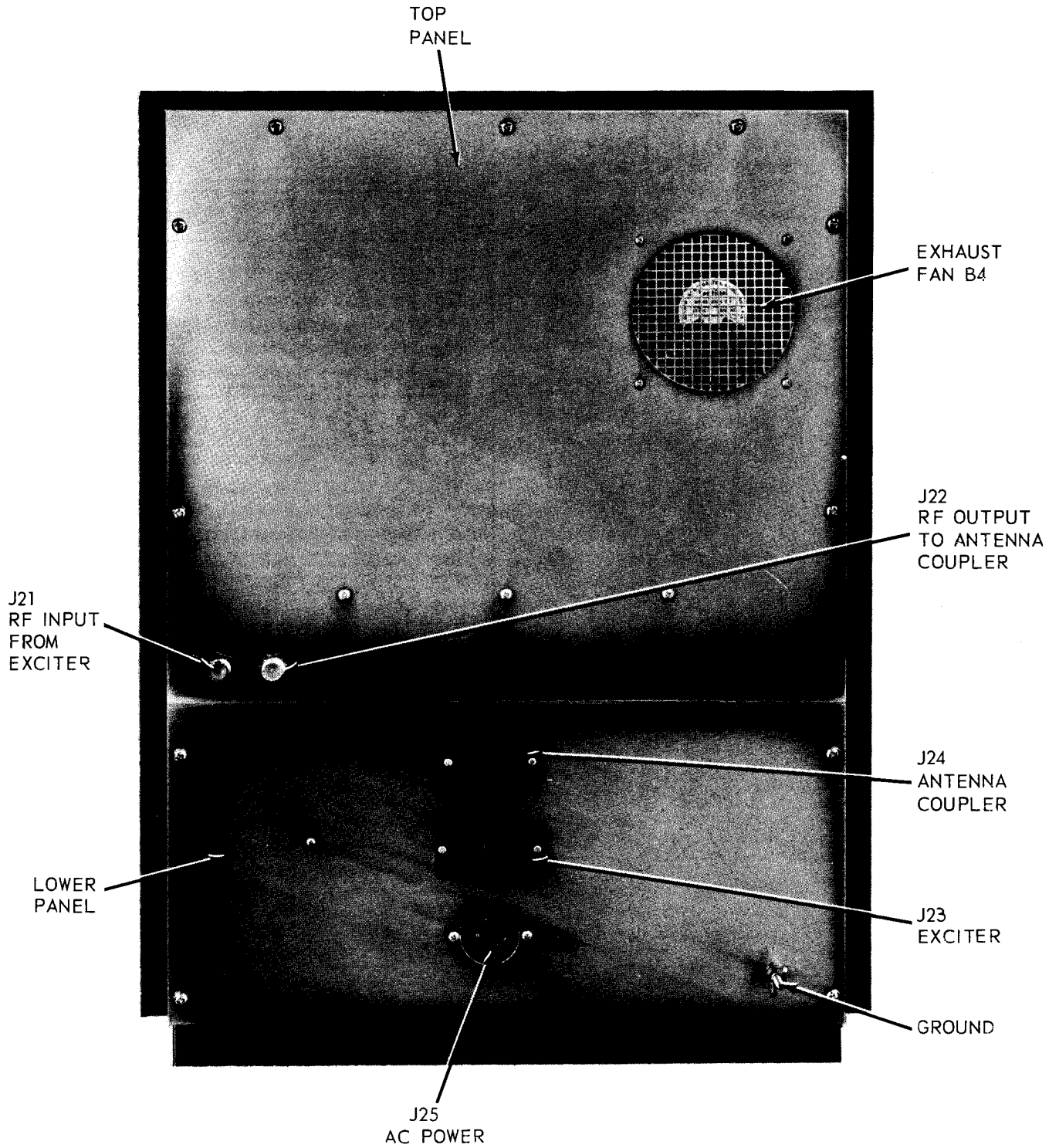


Figure 3.2 Installation Connection Points

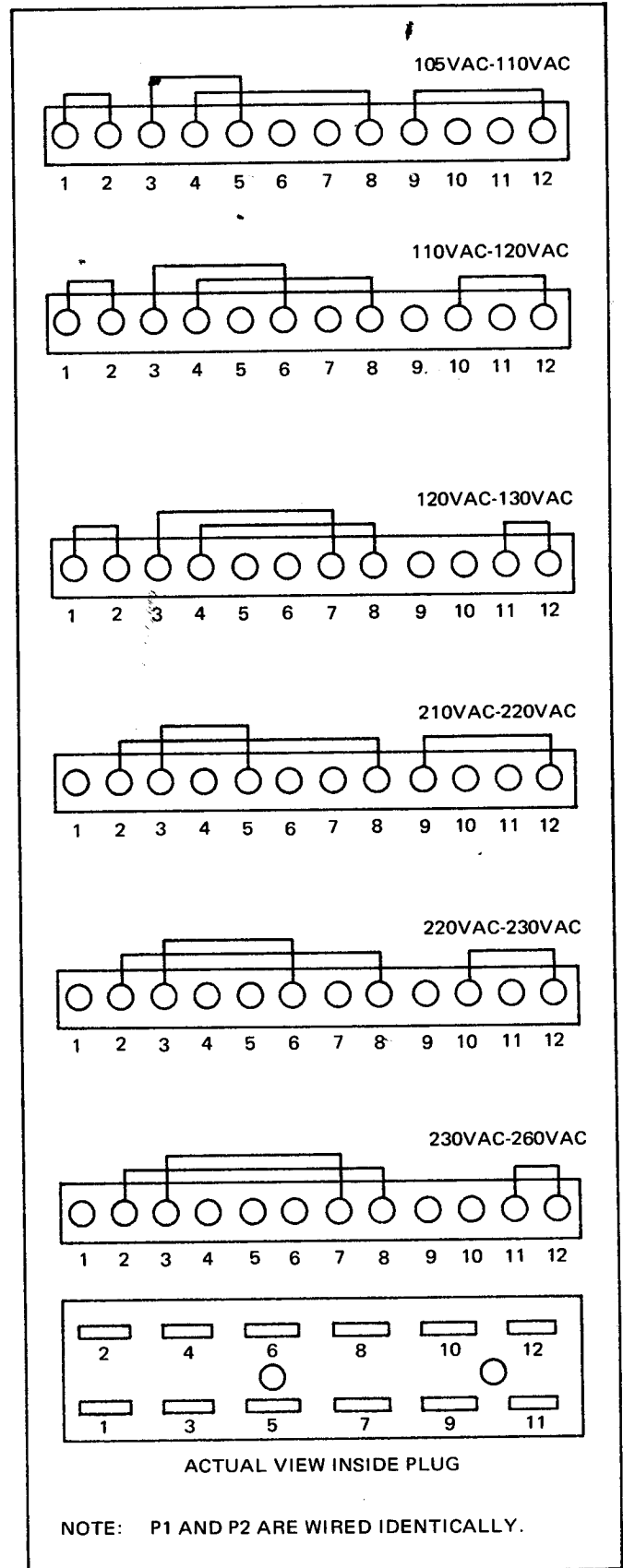
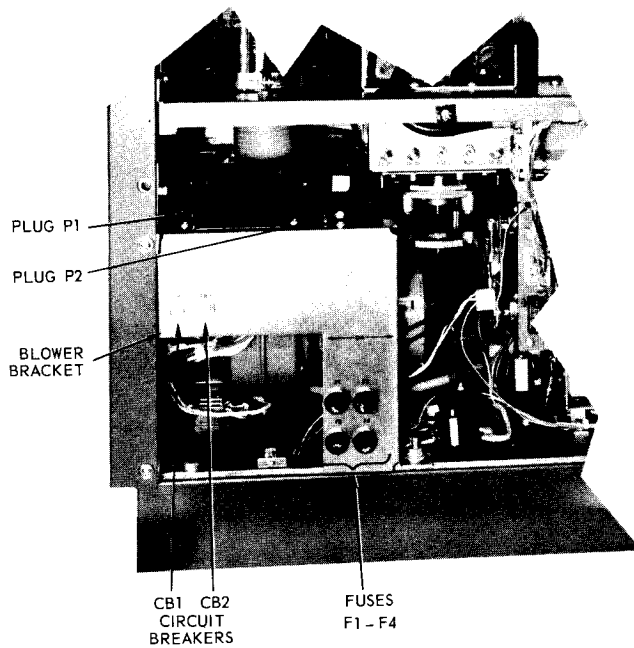
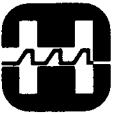
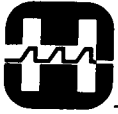


Figure 3.3 Plugs P1 and P2 Installation Location and Wiring Diagram for Various Power Line Voltages



3.5.2 RF CONNECTIONS

The rf cable connections connect the output of the exciter to the power amplifier and the output of the power amplifier to the antenna or antenna coupler. The cables are connected with UHF type connectors to the rear panel.

Type RG-58/U coaxial cable can be used for connecting the exciter if the exciter is located within 30 cable feet (7.1 meters) of the power amplifier. Over 30 feet, type RG-8/U should be used. Extended length of cable reason cable lengths over 100 (30.4 meters) feet are not recommended. The uses of type RG-8/U coaxial cable is recommended for its lower loss factor. Figure 3.2 shows the location of the exciter cable connection, J21, on rear panel.

The RF-103 Power Amplifier can supply full output (1000 watts) with an exciter drive of only 65 watts. However, for installations where the exciter is mounted in close proximity, it is possible to overdrive the power amplifier (most exciters deliver from 100 to 150 watts). To eliminate this problem and to provide a 50 ohm input impedance, an attenuator is

supplied and installed on the front right hand side rail, figure 3.4. The attenuator can be by-passed by connecting the cathode cable directly to the input coaxial relay. The cable attached to the attenuator is stored by connecting it to the unused attenuator connector. If the use of the attenuator is required, the cathode cable is connected to the lower attenuator output lead to the coaxial relay connector normally used by the cathode cable.

The antenna coaxial cable (lengths up to 100 feet (30.4 meters) of RG-8/U can be used) is connected to J22 on rear panel, figure 3.2.

3.5.3 CONTROL CONNECTIONS

Control connections should be made between RF-103 connector J23 and the exciter and, if used, J24 and the antenna coupler. With the exception of the antenna coupler power cables, which requires two #16 AWG wires (included in cable RF P/N W-1795) all other connections should be made with #22 AWG wires. All control cables plug into connectors J23 and J24 on the rear panel of the RF-103. The pin numbers of J23 and J24 are identified as follows and are shown schematically on figure 4.1.

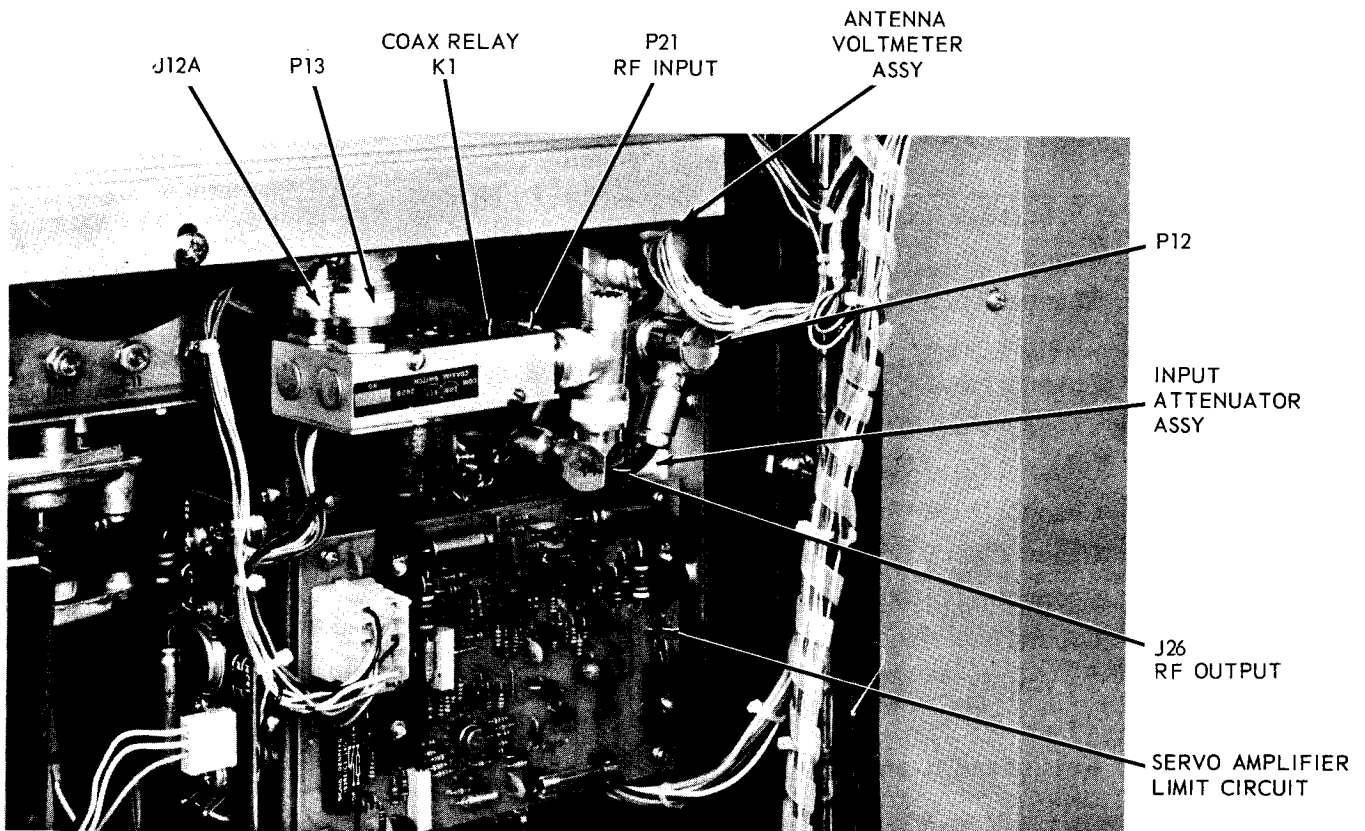
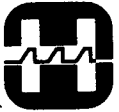


Figure 3.4 Coax Relay K1 Rf Connections



RF-103 J23 Control Input from Exciter	Function
Pin 1	Channel No. 1 Control
Pin 2	Channel No. 2 Control
Pin 3	Channel No. 3 Control
Pin 4	Channel No. 4 Control
Pin 5	Channel No. 5 Control
Pin 6	Channel No. 6 Control
Pin 7	Channel No. 7 Control
Pin 8	Channel No. 8 Control
Pin 9	Channel No. 9 Control
Pin 10	Channel No. 10 Control
Pin 11	Keyline interlock return to exciter
Pin 12	
Pin 13	
Pin 14	} Spares
Pin 15	
Pin 16	
Pin 17	External Operate Light
Pin 18	Ground

RF-103 J24 Control Output to Coupler	Function
Pin 1	Channel No. 1 Control
Pin 2	Channel No. 2 Control
Pin 3	Channel No. 3 Control
Pin 4	Channel No. 4 Control
Pin 5	Channel No. 5 Control
Pin 6	Channel No. 6 Control
Pin 7	Channel No. 7 Control
Pin 8	Channel No. 8 Control
Pin 9	Channel No. 9 Control
Pin 10	Channel No. 10 Control
Pin 11	Ground
Pin 12	24 Vac
Pin 13	24 Vac
Pin 14	Keyline out to antenna coupler
Pin 15	Keyline return from antenna coupler

For exciters with channel control outputs, using +24 Vdc or 24 Vac referenced to ground, channel control can be accomplished automatically after connecting one line from each channel control terminal on the exciter to the corresponding channel control pins (1-10) of J23 on the rear panel of the RF-103.

NOTE

Do not connect the channel lines J24, pins 1-10, on units that are to operate in the Local/Automatic mode. That is with exciters that have channel control information. Refer to Local/Automatic operating Instruction in the front of this manual.

The keyline connections vary depending on equipment used with the amplifier, refer to figure 3.5. The RF-103 has provisions for interlocking the keyline so that, until all motors have ceased turning after a command is given, the amplifier cannot be keyed. In addition, on some exciters the interlock connection will prevent the exciter from being keyed until the power amplifier tuning cycle is completed. The system of interlocking basically consists of extra contacts on the tuning motor relays. The relay contacts open the keyline circuit when activated. The interlock protects against possible damage to switches, tubes and other components should power be applied while switches are open or in the wrong position.

CAUTION

Equipment may be damaged if used without a keyline interlock. If equipment is used without a keyline interlock, utmost care must be taken to insure the system is not keyed until the amplifier and coupler have completed channeling.

If a system is installed without the exciter interlock provision, the OPERATE light on the front panel of the power amplifier can be watched to determine when the exciter can be keyed. If it isn't convenient to observe the OPERATE light, connections are provided to operate a remotely located 24-volt miniature lamp as an operate light.

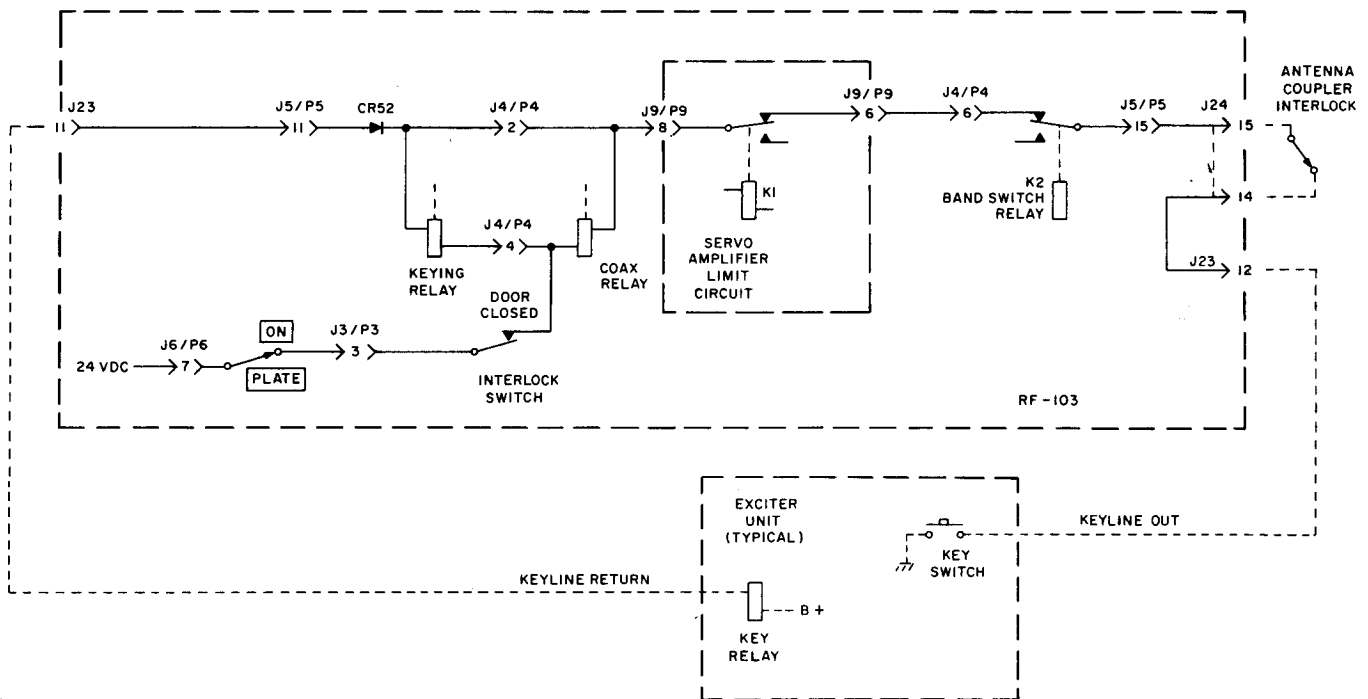
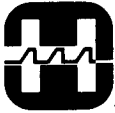


Figure 3.5 RF-103 Simplified Keyline Interlock Diagram with System Connections

3.5.4 GROUND CONNECTIONS

Ground connections between the units should be done with heavy one inch wide copper straps or one inch wide braided wire. Make all leads as short as possible. A ground post is supplied on the RF-103 for this purpose. When the units are separated by a large distance, connect each unit's ground post to a good earth ground connection, a copper rod (six feet or longer) driven into the soil as close as possible to the unit.

3.6 POST INSTALLATION CHECK OUT

NOTE

Perform the following procedures after all units have been installed and connected. Set all power switches at off. Make sure tube V1 has been installed.

a. Set the following RF-103 switches to the position listed:

- FREQUENCY MC switch - 2-2.5 position
- CHANNEL SELECTOR - Neutral (unmarked position)
- FILAMENT switch - OFF
- PLATE switch - OFF

b. Open the door and set the Local/Remote switch on the Program/Junction Board (figure 1.1) at local.

c. Defeat the door interlock switch by pulling out on the switch contact (figure 2.2).

d. Remove the top deck heat shield for access.

e. Energize the RF-103 ac primary power source. Set FILAMENT switch at ON and observe that the FILAMENT and OPERATE indicators are illuminated. The filament V1 should be on, check that both blowers are operating.

f. Rock the TUNING switch and observe that coil L6 rotates in both directions and that the Tuning Reference Meter indicates the change. The meter indication should increase up scale and the coil wiper should move up on the coil windings with the TUNING switch in the INCREASE position.

g. Rotate the FREQUENCY MC switch to each position and observe that the Bands witch indexes properly to each band. Return switch to the 2-2.5 position.



NOTE

Perform the following steps *j* through *g* if the RF-103 is to be used with an exciter that has channel control provisions such as the RF-220. For exciters that do not have channel control information, such as the RF-301 or other synthesized exciters, the same procedures apply as for the RF-220 except use the RF-103 CHANNEL SELECT switch in step *m* to select the channel.

NOTE

If the RF-103 is to be used with both a non channelizing exciter and a non channelizing antenna coupler, then proceed with step *s*.

h. Set PLATE switch at ON. Observe that the PLATE indicator is illuminated. Set Meter Selector switch at PLATE VOLTS. The meter should indicate in the green area. Set Meter Selector switch at PLATE CURRENT.

i. With a jumper wire short pin 15 of J5 (on Program/Junction Board) to the chassis. The meter should indicate in the green area. Disconnect the jumper wire.

j. Set the RF-103 FREQUENCY MC switch at CHANNEL, PLATE switch at OFF, and the CHANNEL SELECTOR switch at a neutral (unmarked) position. Check to see if the Program/Junction Board has been programmed to the exciter's channel frequencies. If not proceed with the following steps:

1. Program each channel that is to be used to the frequency band that contains the channels operating frequency. This is accomplished by connecting the channel pins (E1 through E10) into the frequency band jacks, refer to figure 3.6.
2. If more than five channels are operating within one frequency band, then connect the pin, with the letter "M" on it (at E11), into one of the appropriate frequency band jacks. This provides an additional five connections for that frequency band for a total of ten. It is possible that all ten channels could be programmed to one frequency band.

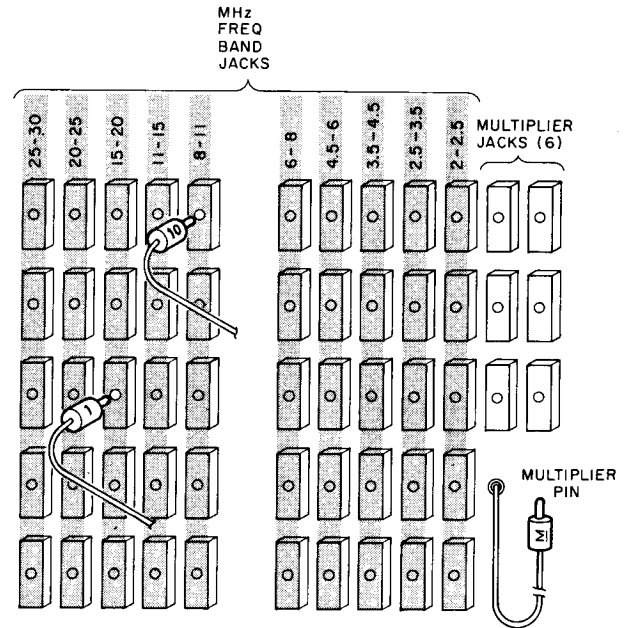
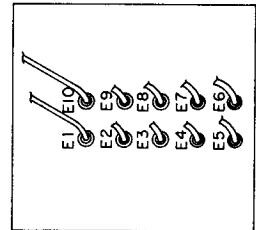


TABLE for CHANNELS	
E1	CHAN - 1
E2	CHAN - 2
E3	CHAN - 3
E4	CHAN - 4
E5	CHAN - 5
E6	CHAN - 6
E7	CHAN - 7
E8	CHAN - 8
E9	CHAN - 9
E10	CHAN - 10



NOTE:
CHANNEL PINS SHOWN ARE FOR
EXAMPLE CHANNEL SETTINGS ONLY.

Figure 3.6 Channel Vs Frequency Band Connections

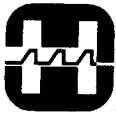
k. Make sure the Local/Remote switch is set at the Local position on the Program/Junction Board.

l. Refer to the antenna coupler instruction manual and tune it by using the exciter drive. (RF-103 PLATE switch at OFF and FILAMENT switch at ON.)

m. Set RF-103 PLATE switch at ON. At the exciter, select the first channel to be aligned. Observe that the RF-103 has channelized and the correct CHANNEL light is illuminated.

n. Set RF-103 METER SELECTOR switch at OUTPUT. Adjust the exciter for reduced output (20-30 watts) by using the AM mode with no modulation or the CW mode with reduced transmit audio gain.

o. Key the exciter and adjust the appropriate channel tune resistor on the Program/Junction Board for a peak indication on the output meter.



<u>Channel No.</u>	<u>Adjust Resistor No.</u>
1	R11
2	R12
3	R13
4	R14
5	R15
6	R16
7	R17
8	R18
9	R19
10	R20

NOTE

Perform the following post installation procedures for units that are to be operated manually, no automatic pre-programmed or pre-tuned channel control.

s. Check that the Local/Remote switch is set at Local. Set CHANNEL SELECTOR switch at a neutral (unmarked) position, FREQUENCY MC switch at desired frequency band, and PLATE switch at ON. Set METER SELECTOR switch at OUTPUT.

p. Increase the exciter drive for an output of 370 watts. Unkey the exciter.

NOTE

Repeat steps m through p for the remaining channels.

q. For exciters with channel control (RF-220) set the Local/Remote switch at Remote. For other types of exciters (RF-301, etc.) leave the switch at Local.

CAUTION

Once the Local/Remote switch has been set at Remote do not try to repeak the tuning by using R11-R20. If R11-R20 are readjusted in this configuration the keyline interlock relay K1 on the Servo Amplifier Board will open the keyline.

r. The post installation procedures are now complete. Refer to either the Local/Automatic or Remote/Automatic operating procedures located at the front of this manual and make a test transmission on each channel.

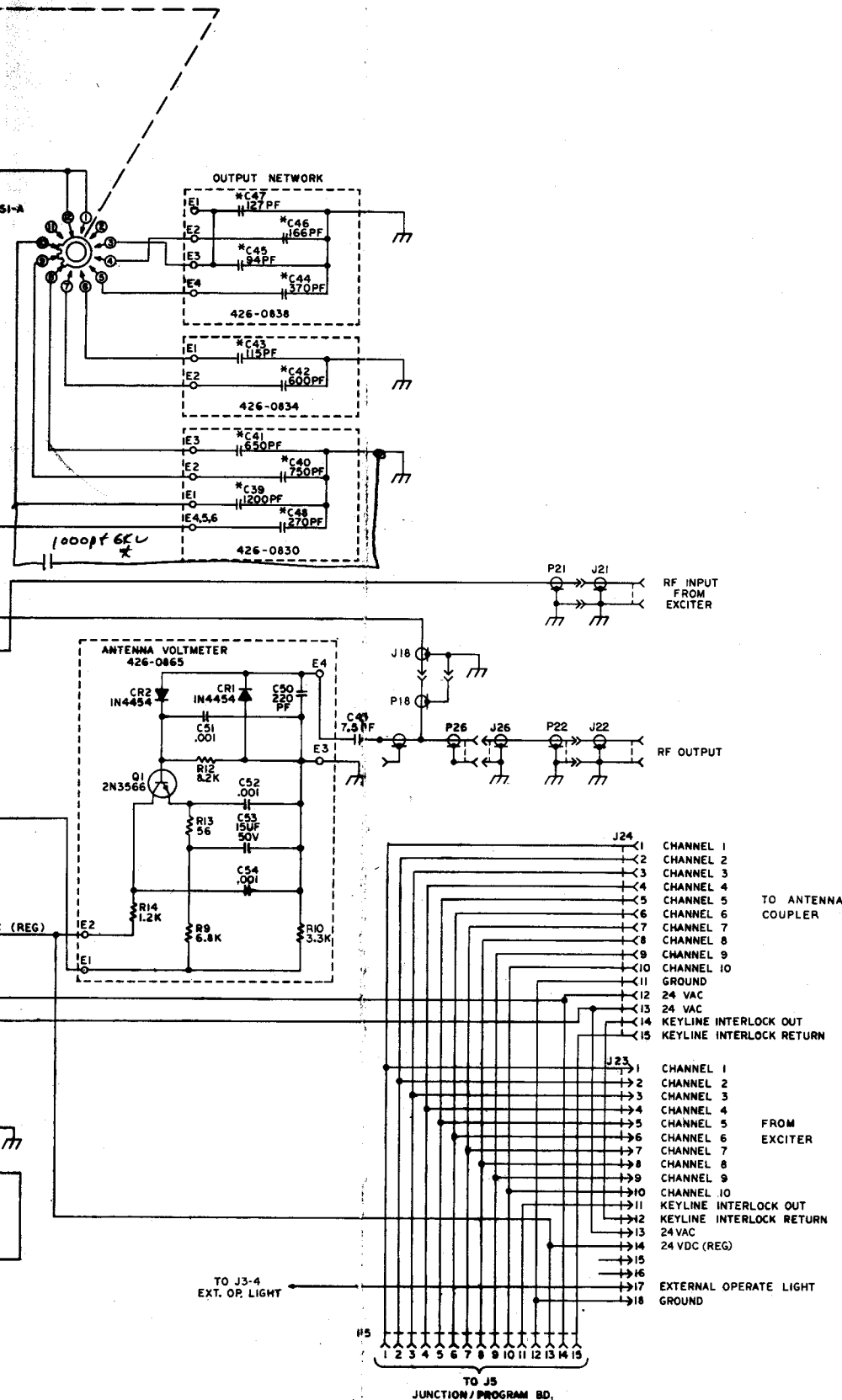
NOTE

Preset the Tuning Reference Meter with the TUNING switch to 50. If the operating frequency is in the lower 50% of the selected band range, then tune toward the upper end of the Tuning Reference Meter for a peak. If the operating frequency is in the upper 50% of the band, then tune toward the lower end of the Tuning Reference Meter for a peak.

t. At the exciter select the operating frequency and adjust for a reduced output level (20-30 watts) by using the AM mode with no modulation or CW with reduced transmit audio gain. Key the exciter and peak the output indication with the TUNING switch.

u. Increase the exciter drive until the RF-103 indicates 370 watts output. Unkey the exciter and record the Tuning Reference Meter indication. Repeat for the other operating frequencies and record the meter value.

v. The post installation procedures are now complete. Refer to the Manual Operating Instructions at the front of this manual.



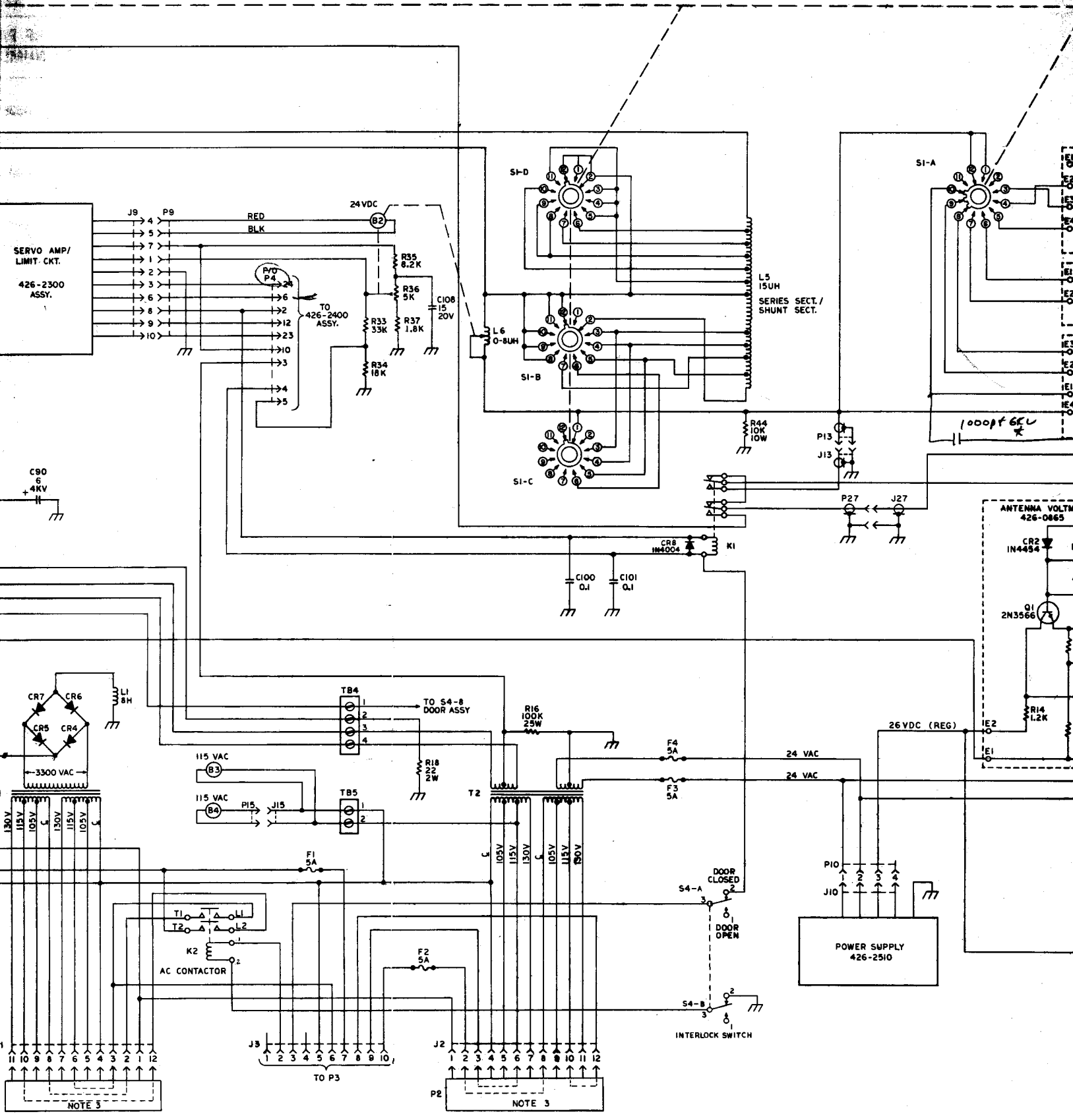
* 160m mods

NOTES

- 1- UNLESS OTHERWISE NOTED, ALL CAPACITOR VALUES IN UFD, ALL RESISTOR VALUES IN OHMS.
- 2- □ DENOTES FRONT PANEL MARKING
- 3- CONNECTIONS SHOWN ARE FOR 220-230 VAC PRIMARY POWER SOURCE. SEE MANUAL FOR OTHER VOLTAGE RANGES.
- 4- ALL 'P' NUMBERS CONNECT TO CORRESPONDING 'J' NUMBERS.
- 5- LAST DESIGNATION USED
 - R44 S4 B4
 - C109 K2 F4
 - V1 CR8 L10
- 6- BANDSWITCH, SI, IS SHOWN IN THE 2-2.5 MHz POSITION.
- 7- ALL SWITCH WAFERS ARE SHOWN FROM THE DRIVEN END.

S426-3100

Figure 4.1 - Main Frame Circuit Diagram and Voltage Chart



SERVO AMP/
LIMIT. CKT.
426-2300
ASSY.

C90
6
+ 4KV

CR7
CR6
CR5
CR4
3300 VAC

130V
115V
105V
130V
115V
105V

T1
T2
AC CONTACTOR
K2

NOTE 3

J9
P9
RED
BLK
1
2
3
4
5
6
7
8
9
10

115 VAC
115 VAC
PI5
J15

F1
5A

J3
1
2
3
4
5
6
7
8
9
10

TO 426-2400
ASSY.
P/O
P4
2
12
23
10
3
4
5

TB4
1
2
3
4
TO S4-8
DOOR ASSY

TB5
1
2

F2
5A

TO P3
1
2
3
4
5
6
7
8
9
10

24 VDC
R35
8.2K
R36
5K
R37
1.8K
R33
33K
R34
18K
C108
15
20V

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

P2
1
2
3
4
5
6
7
8
9
10
11
12

SI-D
SI-B
SI-C

L1
8H

T2
105V
115V
130V
105V
115V
130V

S4-A
DOOR
CLOSED
DOOR
OPEN

NOTE 3

L5
15UH
SERIES SECT./
SHUNT SECT.

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3

L6
0-8UH

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3

CR8
1M4004
K1

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3

C100
0.1
C101
0.1

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3

PI3
Y
J13
P27
J27

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3

26 VDC (REG)

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3

PI0
J10
1
2
3
4

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3

POWER SUPPLY
426-2510

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3

INTERLOCK SWITCH
S4-A
S4-B

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3

DOOR
CLOSED
DOOR
OPEN

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3

1000pf 6KV

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3

ANTENNA VOLTM
426-0865
CR2
1N4454
Q1
2N3566
R14
1.2K
IE2
IE1

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3

NOTE 3

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3

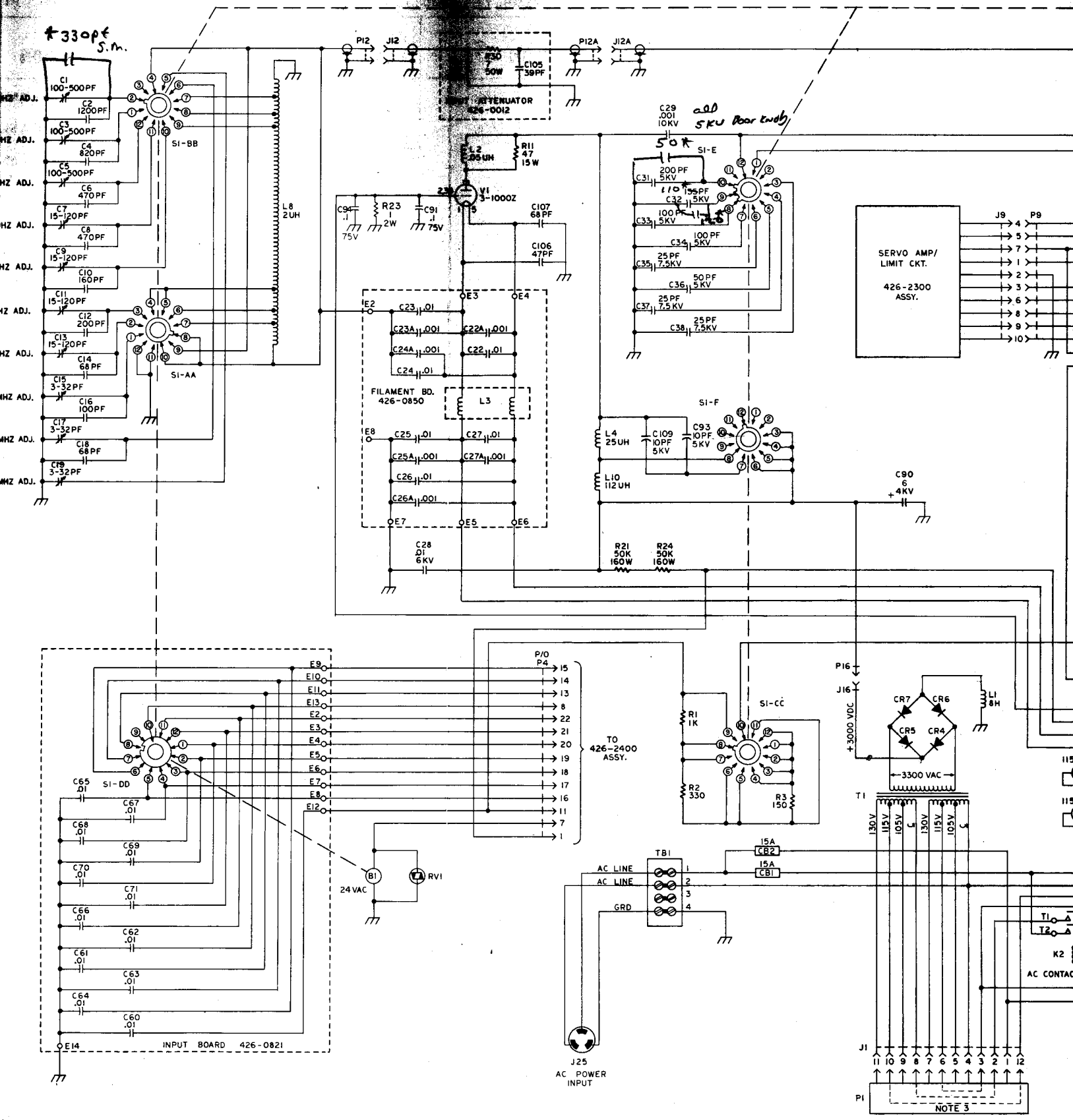
NOTE 3

R16
100K
25W

R18
22K
2W

F4
5A
F5
5A

NOTE 3



NOTE 3

