INITIAL TESTS

The purpose of this section of the Manual is to make sure your Receiver operates properly and will not be damaged as a result of a wiring error. A transistor or other component, for example, could be destroyed instantly by a short circuit that causes excessive current.

RESISTANCE CHECKS

PRIMARY WIRING TESTS

A wiring error in the primary wiring circuit (line cord, On-Off switch, etc.) of your Receiver could cause you to receive a severe electrical shock. These "Primary Wiring Tests" will assure you that no such wiring errors exist.

( ) Be sure the line cord is not plugged in.

( ) Turn the AF GAIN control to OFF.

If you do not have an ohmmeter, carefully check the line cord, fuse block, switch SW1, and the transformer wiring against that shown in Pictorials 5-3, 5-4, 5-14, and Detail 5-14D or 5-14E. Make sure there are no fine strands of wire, or solder blobs, touching adjacent terminals or the chassis. Then proceed to "Sound Check" on Page 70.

If you have an ohmeter, perform the following resistance measurements.

( ) Turn on your ohmmeter and allow it to warm up, if necessary.

( ) Set your ohmmeter on the R X 10 range.

NOTE: When you are instructed to connect a lead to ground, connect the lead to the chassis.

METER CONNECTIONS		METER READING	POSSIBLE CAUSE OF TROUBLE
RED LEAD	BLACK LEAD		
1. Either flat prong of the line cord plug.	Ground	INFINITE with the AF GAIN control ON or OFF.	A. Switch SW1 wiring. B. Terminal strip CB wiring. C. Fuse block wiring. D. T1.
2. Other flat prong of the line cord plug.	Ground	INFINITE with the AF GAIN control ON or OFF.	A. Switch SW1 wiring. B. Terminal strip CB wiring. C. Fuse block wiring D. T1.
3. Round prong of the line cord plug.	Ground	0 Ω with the AF GAIN control ON or OFF.	A. Green lead of the line cord not properly connected at solder lug CS. See Pictorial 5-14.
4. Either flat prong.	Other flat prong.	1 MΩ or higher (AF GAIN control OFF).	A. Terminal strip CB wiring. B. SW1 wiring.
5. Either flat prong.	Other flat prong.	Approximately 50-70 Ω for 120 VAC, or approximately 200 Ω for 240 VAC wiring. (AF GAIN control ON).	A. Terminal strip CB wiring. B. SW1 wiring. C. Fuse F1. D. Fuse block wiring. E. T1.

This completes the "Primary Wiring Tests." If all tests were satisfactory, proceed to "Other Resistance Checks." If any of the tests were not correct, you must make the corrections necessary to obtain the correct readings before you continue.

OTHER RESISTANCE CHECKS

( ) Turn on your ohmmeter and allow it to warm up, if necessary.

( ) Set your ohmmeter on the RX10 range.

( ) Position the chassis bottom-side-up as shown in Figure 1-1 (in the "Illustration Booklet").

( ) Connect the common ohmmeter test lead to the chassis.

NOTE: The internal wiring of most ohmmeters is such that the positive terminal of the meter battery is connected to the positive test lead and the negative battery terminal is connected to the negative (common) test lead. In some ohmmeters this wiring is reversed and will give erroneous readings in the following measurements. Interchange the ohmmeter leads if the measurements do not check out correctly the first time.

Connect the positive ohmmeter test lead to the chassis connector terminals listed in the following chart and check your resistance readings. If your readings disagree with those given in each step, check the items listed in the "Possible Cause" column.

NOTE: Some of the readings, in the following steps, may take a few seconds to reach the indicated resistance due to the charging of capacitors.

TEST POINT TERMINAL	RESISTANCE IN OHMS	POSSIBLE CAUSE
( ) D18	INFINITY	1. D1-D4.* 2. C2. 3. IC201.
( ) D17	10-20 (approximate)	1. Wiring error on SW1. 2. Solder bridge on AUD/REG circuit board.
( ) D16	10-20 (approximate)	1. Wiring error at chassis connectors D16, D4, C7, B6, or A12. 2. Wiring error on SW3 or SW4. 3. Solder bridge on any circuit board.

VOLTAGE CHECKS

Preset the front panel controls and switches as follows:

AF GAIN ..... Off until it clicks.

RF GAIN ..... Fully clockwise.

BAND switch ..... 80.

MODE switch ..... LSB.

FUNCTION switch ..... Wide.

PRESELECTOR ..... Midrange.

( ) Connect the Receiver power cord to an AC outlet.

NOTE: The following voltage checks require the use of a high-impedance input (1 megohm or more) voltmeter. Voltage measurements are ±20%.

( ) Set your voltmeter to measure at least +20 VDC and connect the common lead to the chassis.

NOTE: If any of the following observations and checks fail, immediately turn the Receiver off and disconnect the line cord. Correct the problem before you proceed. Check the "Possible Causes" that follow each check.

( ) Rotate the AF GAIN control clockwise until it clicks. The dial lamps should light.

POSSIBLE CAUSE CHART

1. Dial lamps do not light.

   A. Wiring error on PL1 or PL2.
   B. Wiring error on R1.
   C. Wiring error on SW3.
   D. Wiring error on SW2.
   E. Wiring error on connector A12.
   F. PL1 and/or PL2.

Connect the positive voltmeter test lead to the chassis connector terminals listed in the following chart and check the voltage readings. If your readings disagree with those given in each step, check the items listed in the "Possible Cause" column.

TEST POINT TERMINAL	VOLTAGE (±20%)	POSSIBLE CAUSE
( ) D18	23	1. F1. 2. Wiring error on terminal strip CB. 3. D1-D4. 4. C2.
( ) D16	13.5	1. IC201.
( ) D4	13.5	1. Wiring error at D16 or D4.
( ) C7	13.5	1. Wiring error at D16 or C7.
( ) A12	13.5	1. Wiring error at C7 or A12.
( ) B6	13.5	1. Wiring error at A12 or B6.

( ) Turn the AF GAIN control to Off.

SOUND CHECK

( ) Connect a 4 or 8-ohm speaker to the SPKR (speaker) jack on the rear panel.

( ) Connect the Receiver power cord to an AC outlet, if not already done.

( ) Rotate the AF GAIN control fully clockwise. You should hear noise from the speaker.

( ) Turn the lamp shields on PL1 and PL2 for proper lighting at the meter and tuning dial.

POSSIBLE CAUSE CHART

1. No sound from speaker.

   A. Speaker connections.
   B. Wiring error on R4.
   C. Wiring error on J3 or J4.
   D. J3 defective.
   E. Wiring error at connector D6.
   F. IC202 or IC203.
   G. Q208 or Y205 (LSB only).
   H. Q209 or Y206 (USB only).

( ) Turn the AF GAIN control to Off.

This completes the "Initial Tests." Proceed to the "Alignment" section.

ALIGNMENT

You can completely align your Receiver without any external equipment. You may be able to improve the sensitivity by using a VTVM and an RF generator, but they are not necessary.

If you do not obtain the proper results during alignment, proceed to the "In Case of Difficulty" section on Page 83.

ALIGNMENT PREPARATION

Refer to Figure 2-1 for the following steps.

( ) Prepare a 12" gray wire.

( ) Solder a PCB connector on each end of the 12" wire.

Set this jumper wire aside. It will be used during "HFO Coil Alignment."

( ) Refer to Figure 2-2 and use a pair of pliers to push the 1" steel blade into the smaller end of the nut starter until 1/8" remains exposed. Use this tool when you are instructed to adjust trimmer capacitors.

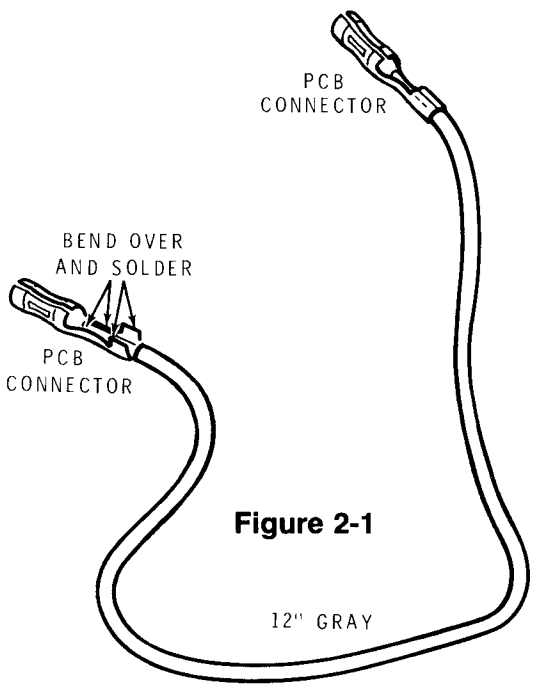


Figure 2-1

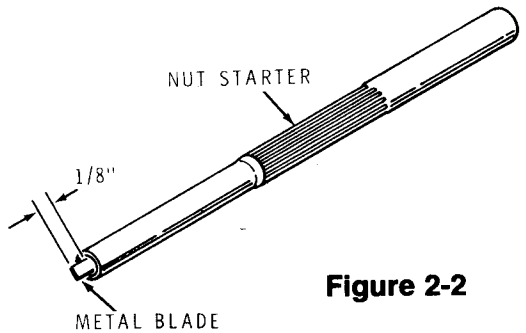


Figure 2-2

Refer to Figure 2-3 (in the "Illustration Booklet") for the following steps.

NOTE: The Figure shows only one extender assembly. You will actually be assembling three of these assemblies when you perform the following steps.

( ) Unfold and straighten the large bare wire as much as possible.

( ) Cut eighteen 4-1/2" lengths of large bare wire.

( ) Solder a female connector on one end of each of the 18 large bare wires.

( ) Cut the ears from the three extender terminal housings and the three remaining chassis connectors.

NOTE: Perform the next four steps three times, once for each extender assembly.

( ) ( ) ( ) Push one of the female terminals on the end of a large bare wire into each of the six holes in an extender terminal housing. Push each terminal until it locks in place.

( ) ( ) ( ) Cut the free ends of the six bare wires, if necessary, until their ends are even.

( ) ( ) ( ) Solder the free ends of the bare wires to the six terminals on a chassis connector.

( ) ( ) ( ) Check the extender assembly. All connections should be soldered. Also, make sure the bare wires do not touch each other.

( ) Set the three extender assemblies aside, they will be used during "Calibrator Adjustment."

( ) Set the front panel controls and switches as follows:

AF GAIN ..... Off.

RF GAIN ..... Fully clockwise.

MODE ..... LSB.

FUNCTION ..... WIDE.

BAND ..... 80.

PRESELECTOR ..... 12 o'clock position.

Refer to Figure 2-4 (in the "Illustration Booklet") for the following steps.

( ) Set control R306, on the VFO circuit board, to the center of its rotation.

( ) Set the tab on control R7 on the rear of the S-meter to the 3 o'clock position as shown on Figure 2-4.

( ) Connect a speaker to the SPKR jack on the rear panel, if not already done.

HFO COIL ADJUSTMENT

NOTE: You will adjust the heterodyne frequency oscillator (HFO) coils in the following steps. Refer to Figure 2-5 for the methods of inserting the alignment tool into the coil and making a "flag" out of tape for the alignment tool so you can count the turns of the tool. Rotate the tool until the voltage peaks on the meter scale. Then rotate the tool as shown in the HFO alignment chart.

( ) Remove the gray wire from PCB pin C, on the VFO circuit board, and connect it to PCB pin D.

( ) Remove the white-black wire from PCB pin A. Leave this wire unhooked.

( ) Connect one end of the 12" jumper wire, that you prepared earlier, to PCB pin A. Connect the other end of the jumper wire to T.P. on the HFO/XTAL calibrator circuit board.

( ) Connect the line cord to an AC outlet.

( ) Turn the Receiver on with the AF GAIN control.

NOTE: Refer to the HFO/XTAL Calibrator Circuit Board Troubleshooting Chart on Page 86 if you experience any problems during the following adjustments.

( ) Adjust each HFO coil as described in the following chart. Before you adjust each coil for the peak meter indication, turn the slug counterclockwise two full turns. Then rotate the slug **clockwise** for maximum meter indication.

NOTE: Rotate control R7, on the rear of the meter, as necessary to keep the S-meter needle on scale.

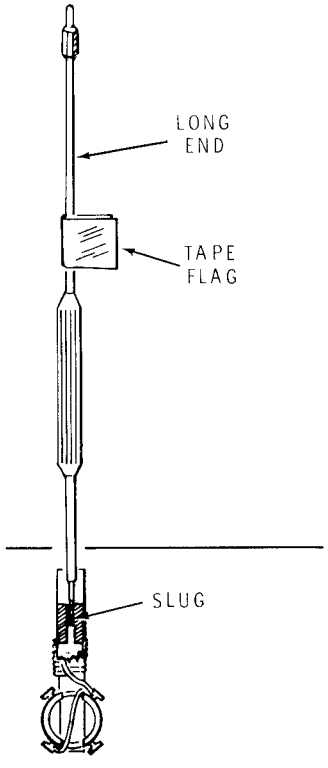


Figure 2-5

BAND SWITCH	COIL NUMBER	ROTATE SLUG FOR PEAK INDICATION. THEN ROTATE SLUG AS DESCRIBED.
80	L406	1/2 turn CW*
40	L405	1/4 turn CW
20	L404	1/4 turn CW
15	L403	1/4 turn CW
10A	L402	1/4 turn CW
10B	L401	1/4 turn CW
		*clockwise

( ) Turn the Receiver off.

( ) Disconnect the line cord from the AC outlet.

( ) Disconnect the jumper wire from PCB pin A on the VFO circuit board and T.P. on the HFO/XTAL calibrator circuit board.

( ) Reconnect the white-black wire to PCB pin A.

( ) Remove the gray wire from PCB pin D and reconnect it to PCB pin C.

VFO ALIGNMENT

NOTE: Refer to the VFO Circuit Board Troubleshooting Chart on Page 86 if you experience any problems during the following adjustments.

( ) Set the front panel controls and switches as follows:

AF GAIN ..... Off.

RF GAIN ..... Fully clockwise.

MODE ..... LSB.

FUNCTION ..... WIDE.

BAND ..... 15.

PRESELECTOR ..... 12 o'clock position.

( ) Refer to the inset drawing on Figure 2-4 and turn the screw in each VFO trimmer down snug. DO NOT FORCE. Then loosen each screw 1/3 turn.

( ) Connect the line cord to an AC outlet.

( ) Turn the MAIN TUNING knob clockwise until the dial stops rotating.

( ) Manually turn the square dial drive plate, located between the VFO assembly and the front panel, clockwise until the STOP mark near 500 aligns with the pointer.

( ) Turn the main tuning knob counterclockwise until the dial reads 200.

( ) Turn the Receiver on.

( ) Rotate R306, on the VFO circuit board, until the S-meter indicates zero (0).

( ) Turn the AF GAIN control knob clockwise until you hear noise from the speaker.

( ) Insert the alignment tool into the slug in coil L301 on the VFO circuit board.

NOTE: When you adjust the coil in the following step, you should be able to find the tone within 2 turns either way from its present setting.

( ) Turn the alignment tool very slowly until you hear a tone.

( ) Turn the BAND switch to 80.

( ) Turn the MAIN TUNING knob counterclockwise until the dial reads 0.

( ) Peak the PRESELECTOR on noise.

( ) Slide the FUNCTION switch to CAL (calibrator).

NOTE: When you perform the following adjustments, always use the strongest calibrator signal, if you find more than one.

( ) If necessary, turn the MAIN TUNING knob one or two dial divisions to either side of zero until you hear the calibrator signal. Note whether the signal occurred higher or lower in frequency than the zero mark on the dial.

( ) Return the dial to 0.

NOTES:

1. Several of the alignment steps call for adjusting your Receiver to obtain a zero-beat. To do this, slowly make the required adjustment in one direction and listen for a decrease in pitch and volume of the tone. If the pitch and volume seem to increase, make the adjustment in the opposite direction. The tone will go lower and lower in frequency and either disappear or become only an intermittent growl. This is zero-beat.

2. Perform **one** of the next two steps. If one trimmer does not provide enough range, adjust both trimmers in the same direction. Refer to the inset drawing for the location on the access holes on the bottom of the chassis.

( ) If the calibrate signal was **lower** in frequency, carefully adjust either VFO trimmer (through the access hole in the chassis bottom) **counterclockwise** until you hear the calibrator signal. Adjust the trimmer for zero beat.

( ) If the calibrate signal was **higher** in frequency, carefully adjust either VFO trimmer (through the access hole in the chassis bottom) **clockwise** until you hear the calibrator signal. Adjust the trimmer for zero beat.

( ) Turn the MAIN TUNING knob until the dial reads 500.

( ) Repeak the PRESELECTOR.

( ) Adjust coil L301 slightly for zero beat.

( ) Return the dial to 0.

( ) Adjust either VFO trimmer for zero beat.

( ) Repeat the preceding five steps as many times as necessary until zero beat occurs at 0 and 500 on the dial. Be sure the **last** adjustment you make is to a VFO trimmer. NOTE: You may have to repeat these adjustments several times.

( ) Turn the Receiver off.

( ) Disconnect the line cord from the AC outlet.

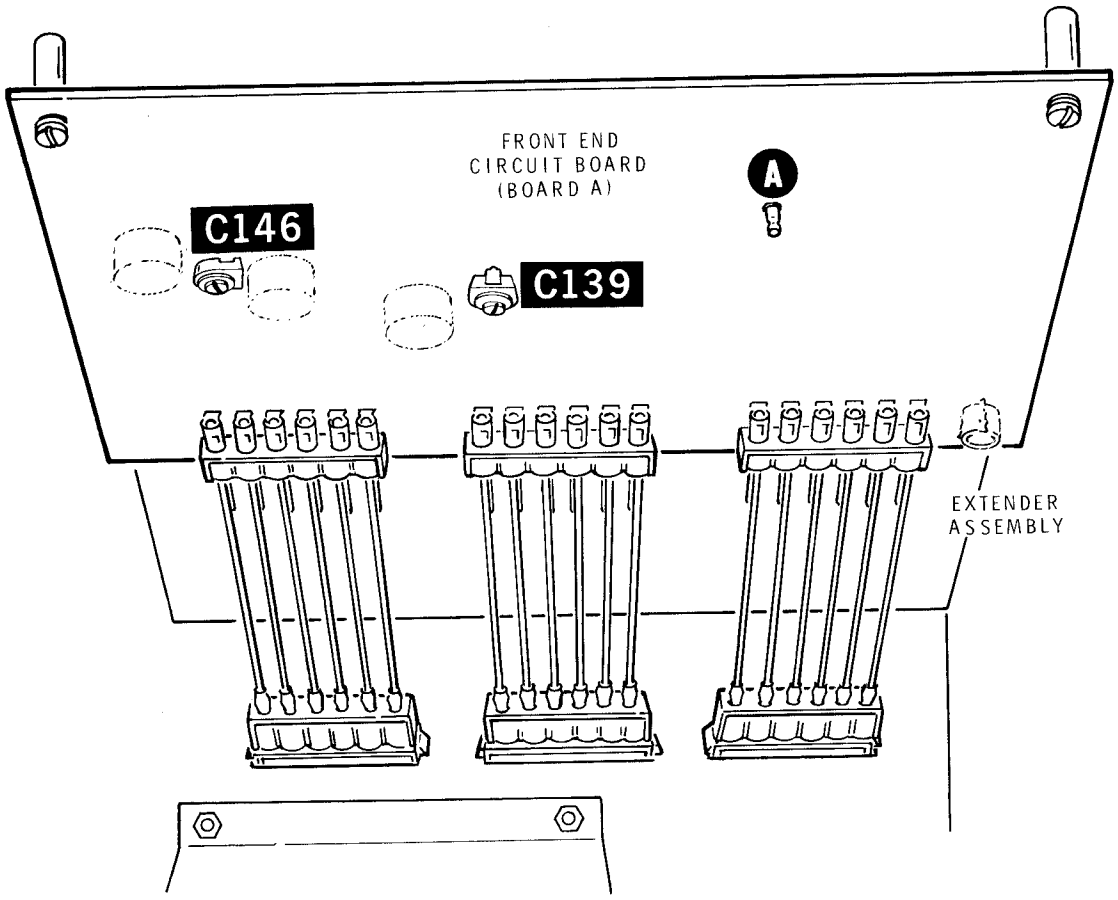


Figure 2-6

FRONT END ALIGNMENT

NOTE: Refer to the Front End Circuit Board Troubleshooting Chart on Page 86 if you experience any problems during the following adjustments.

IF Bandpass Adjustment

NOTE: You may notice some improvement in overall gain if you use an RF generator and an AC voltmeter (in place of the calibrator signal and S meter) in the following steps.

Refer to Figure 2-6 for the following steps.

( ) Unplug the gray wire from PCB pin A on the front end circuit board.

( ) Remove the two screws that hold the front end circuit board (board A) in place. Then remove the circuit board.

( ) Push an extender assembly onto the three chassis connectors where the front end circuit board was plugged in. Then push the circuit board onto the extender assembly.

( ) Set the front panel controls and switches as follows:

AF GAIN ..... Off.

RF GAIN ..... Fully clockwise.

MODE ..... CW.

FUNCTION ..... CAL.

BAND ..... 15.

TUNING DIAL ..... 300.

( ) Connect the line cord to an AC outlet.

( ) Turn the Receiver on.

( ) Turn the MAIN TUNING knob one or two dial divisions each way and locate the strongest nearby calibrator signal, if there is more than one.

( ) Adjust trimmer capacitors C139 and C146 for maximum S-meter indication. These trimmers may have only a little effect.

( ) Adjust control R7 on the rear of the S meter for mid-scale indication. If you cannot obtain a mid-scale indication, set the control for a maximum indication.

( ) Tune to the calibrator signal near 500 and adjust C139 for maximum meter indication.

( ) Tune to the calibrator signal near 0 and adjust C146 for maximum meter indication.

( ) Repeat the previous two adjustments several times for maximum meter indication at each end of the band.

( ) Turn the Receiver off.

( ) Disconnect the line cord from the AC outlet.

( ) Remove the front end circuit board from the Receiver.

( ) Unplug the extender assemblies from the circuit board. Then replace the circuit board in its compartment. Secure the circuit board with two 6-32 × 3/8" screws and two #6 lockwashers.

( ) Refer to Pictorial 5-11 (in the "Illustration Booklet") and push the connector on the end of the gray wire coming from lug 1 of C1 onto PCB pin A on the front end circuit board. Position this wire exactly as shown in the Pictorial.

RF Amplifier Adjustments

( ) Set the front panel controls and switches as follows:

AF GAIN ..... Off.

RF GAIN ..... Fully clockwise.

MODE ..... CW.

FUNCTION ..... CAL.

BAND ..... 80.

( ) Connect the line cord to an AC outlet.

( ) Turn the Receiver on and adjust the AF GAIN control to a comfortable listening level.

NOTE: When you align the front end circuit board, use the following procedure:

1. Turn the BAND switch to the position indicated in the following Alignment Chart.
2. Tune the Receiver to the calibrator signal near 200 on the dial.
3. Adjust the PRESELECTOR for maximum S-meter indication. Use the RF GAIN control to keep the S-meter indicator near mid-scale.
4. Adjust the indicated trimmer on the front end circuit board for maximum S-meter indication. Some of these trimmers may have only a little effect.
5. Repeat 3 and 4 until no further improvement is noticed.

Refer to Figure 2-4 (in the "Illustration Booklet") for the location of the trimmers in the following steps.

BAND SWITCH	APPROXIMATE PRESELECTOR POSITION	ADJUST TRIMMER
( ) 80	12 o'clock	C119 and C155
( ) 40	1 o'clock	C123
( ) 20	10 o'clock	C126
( ) 15	2 o'clock	C128
( ) 10B	2 o'clock	C131

( ) Turn the Receiver off.

S METER ADJUSTMENT

( ) Set the front panel controls and switches as follows:

AF GAIN ..... Off.

RF GAIN ..... Fully Clockwise.

MODE ..... CW.

FUNCTION ..... CAL.

BAND ..... 80.

TUNING DIAL ..... 300.

( ) Turn the Receiver on.

( ) Turn the MAIN TUNING knob and the PRESELECTOR for maximum indication of the S meter.

( ) Adjust control R7 (on the rear of the S meter) for an indication of about 40 on the S meter. NOTE: If you are unable to get a meter reading of "40," adjust control R7 for the highest obtainable reading.

( ) Turn the Receiver off.

( ) Disconnect the line cord from the AC outlet.

CALIBRATOR ADJUSTMENT

NOTE: The calibrator should now be reasonably close to the correct setting. If you desire to have the calibrator set more accurately, perform one of the following adjustments. They are listed in order of preference.

Refer to Figure 2-7 for the following steps.

NOTE: Refer to the HFO/XTAL Calibrator Circuit Board Troubleshooting Chart on Page 86 if you experience any problems with the following adjustment.

( ) Remove the two screws that hold the HFO/XTAL calibrator circuit board in place. Then remove the circuit board.

( ) Push an extender assembly onto the two chassis connectors where the HFO/XTAL circuit board was plugged in. Then push the circuit board onto the extender assembly.

Method #1

( ) Connect an accurate frequency counter through a 500 pF capacitor to the collector of transistor Q404 on the HFO/XTAL calibrator circuit board.

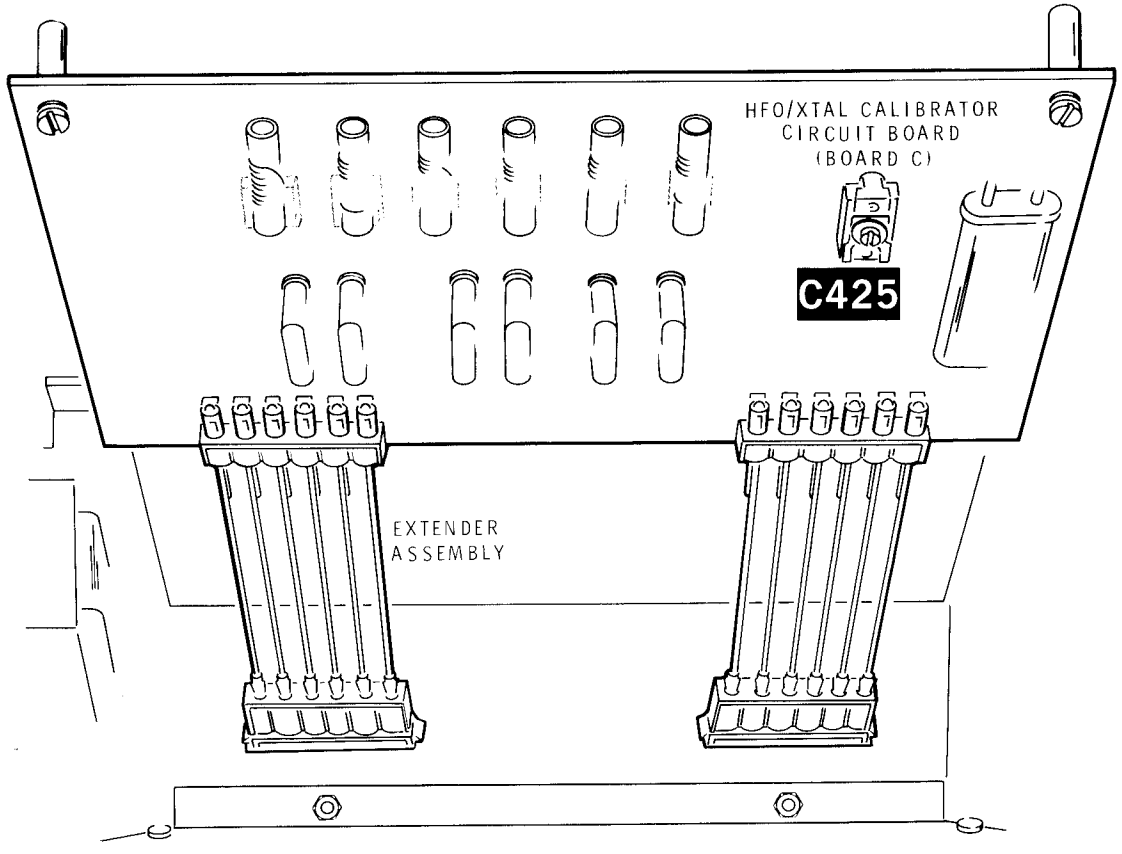


Figure 2-7

( ) Connect the line cord to an AC outlet.

( ) Turn the Receiver on.

( ) Adjust trimmer capacitor C425 until the frequency counter indicates 100 kHz.

( ) Turn the Receiver off and disconnect the frequency counter.

( ) Disconnect the line cord from the AC outlet.

( ) Remove the HFO/XTAL calibrator circuit board from the Receiver.

( ) Unplug the extender assemblies from the circuit board. Then replace the HFO/XTAL calibrator board in its compartment. Secure the circuit board with two 6-32 × 3/8" screws and two #6 lockwashers.

This completes the "Alignment." Proceed to "Cabinet Assembly."

Method #2

( ) Connect an antenna (suitable for the 40-meter band) to the ANT jack on the rear panel.

( ) Turn the BAND switch to 40.

( ) Connect the line cord to an AC outlet.

( ) Turn the Receiver on and tune to station CHU, Canada, on 7335 kHz. Note whether the station is higher or lower than 7335 kHz on your dial.

( ) Turn the main tuning knob until the dial reads 7335 kHz. Then hold the ZERO SET button in and tune to zero beat CHU.

( ) Turn the main tuning knob until the dial reads 7300 kHz.

( ) Adjust trimmer capacitor C425 for zero beat.

( ) Turn the Receiver off.

( ) Disconnect the line cord from the AC outlet.

( ) Remove the HFO/XTAL calibrator circuit board from the Receiver.

( ) Unplug the extender assemblies from the circuit board. Then replace the HFO/XTAL calibrator board in its compartment. Secure the circuit board with two 6-32 × 3/8" screws and two #6 lockwashers.

This completes the "Alignment." Proceed to "Cabinet Assembly."

Method #3

NOTE: This method requires the use of a separate SWL receiver that can receive station WWV, Colorado, on 15,000 kHz or 10,000 kHz.

( ) Tune your SWL receiver to zero beat WWV on either 15,000 kHz or 10,000 kHz.

( ) Connect the antenna input on your SWL receiver to the ANT socket on the rear panel of your HR-1680.

( ) Connect the line cord to an AC outlet.

( ) Turn your HR-1680 on and place the FUNCTION switch in the CAL position.

( ) Adjust trimmer capacitor C425 for zero beat with WWV in your SWL receiver.

( ) Turn both receivers off and disconnect the wire that connects the antenna inputs together.

( ) Disconnect the line cord from the AC outlet.

( ) Remove the HFO/XTAL calibrator circuit board from the Receiver.

( ) Unplug the extender assemblies from the circuit board. Then replace the HFO/XTAL calibrator board in its compartment. Secure the circuit board with two 6-32 x 3/8" screws and two #6 lockwashers.

This completes the "Alignment." Proceed to "Cabinet Assembly."

OPERATION

Refer to Figure 4-1 (in the "Illustration Booklet") for the location of the front panel controls and switches referred to in the following paragraphs.

TUNING DIAL

The tuning dial is calibrated in divisions from 0 to 500. Each division represents 5 kHz. The dial reading (in kHz) is added to the BAND switch setting (in MHz) to determine the frequency to which the Receiver is tuned. For example:

BAND switch	40 (7 MHz)
Dial reading	35 kHz
Frequency	7.035 MHz

ZERO SET

Pushing this button while turning the MAIN TUNING knob locks the dial scale while the VFO frequency is being changed. This permits the tuning dial to be calibrated at 100 kHz intervals.

AF GAIN

Turns the power on and increases the volume of the received signal with clockwise rotation.

RF GAIN

Clockwise rotation increases the Receiver sensitivity. This control is usually positioned fully clockwise. Turn the control counterclockwise to reduce sensitivity when exceptionally strong signals are being received, or to reduce adjacent channel interference.

BAND

Selects the desired amateur band in meters. The Band switch markings on the front panel correspond to the following frequencies in MHz when the tuning dial is set to zero (0):

80	3.5
40	7
20	14
15	21
10A	28
10B	28.5

PRESELECTOR

Tunes the RF amplifier stages. Readjust this control for maximum signal on each BAND as the main tuning is changed.

PHONE

Connect low impedance headphones (or high sensitivity, high impedance headphones) through a phone plug. When you insert a plug in this jack, the loudspeaker is automatically disconnected.

NOTE: If you use low impedance headphones, you may notice a hum at low volume levels. Add a 100 Ω resistor (not supplied) in series with your headphones to reduce this hum.

MODE

Place this switch in the appropriate position for lower sideband, upper sideband, or CW reception. This switch also selects a slow AGC time constant in the sideband positions and a fast AGC time constant in the CW position.

FUNCTION

Place this switch in the desired bandpass position (either narrow or wide). Place the switch in the calibrate position to turn on the 100 kHz crystal calibrator for dial calibration.

TYPICAL OPERATING CHARACTERISTICS

The following conditions are normal and you should not consider them as malfunctions.

1. The S meter may show two peak indications on strong signals. This is due to the audio-derived AGC circuit. One peak is considerably lower than the desired peak. Tune for the greatest peak on the meter.

2. The Receiver may have a different pitch (tone) at high volume levels when the Function switch is in the narrow position. This is due to the narrower bandpass and is normal.

3. When you are calibrating the Receiver dial, there may be several weak calibrator signals. Always use the strongest calibrator signal.

4. If you cannot peak the Preselector on both ends of the 80-meter band, adjust trimmer C155 on the front end circuit board until you are able to.

5. You may notice a hum when you use low impedance headphones. Connect a 100 Ω resistor (not supplied) in series with your headphones to reduce this hum.

6. The heat sink on transistor Q201, on the AUD/REG circuit board, becomes quite hot to the touch. Use caution when you have your hands near this area.

IN CASE OF DIFFICULTY

Begin your search for any trouble that occurs after assembly by carefully following the steps listed below in the "Visual Checks." After you complete the "Visual Checks," refer to the Troubleshooting Charts.

NOTE: Refer to the "Circuit Board X-Ray Views" on Page 94 for the physical location of parts on the circuit boards.

VISUAL CHECKS

1. Recheck the wiring. Trace each lead with a colored pencil on the Pictorial as you check it. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something that you have consistently overlooked.

2. About 90% of the kits that are returned to the Heath Company for repair do not function properly due to poor connections and soldering. Therefore, you can eliminate many troubles by reheating all connections to make sure they are soldered as described in the "Soldering" section of the "Assembly Notes" on Page 14. Be sure there are no solder "bridges" between circuit board foils.

3. Check to be sure all transistors and diodes are in their proper locations. Make sure each lead is connected to the proper point. Make sure each diode band is positioned above the band printed on the circuit board.

4. Check electrolytic capacitors to be sure their positive (+) mark is at the correct position.

5. Check to be sure each IC is properly installed in its socket, and the pins are not bent out or under the IC. Also be sure the IC's are installed in their correct positions.

6. Check the values of the parts. Be sure in each step that you wired the correct part into the circuit, as shown in the Pictorial. It would be easy, for example, to install a 68 kΩ (blue-gray-orange) resistor where a 6800 Ω (blue-gray-red) resistor should be installed.

7. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.

8. A review of the "Circuit Description" may also help you determine where the trouble is.

If you still have not located the trouble after the "Visual Checks" are complete, and a voltmeter is available, check voltage readings against those shown on the Schematic. Read the "Precautions for Troubleshooting" before you make any measurements. NOTE: All voltage readings were taken with a high impedance voltmeter. Voltages may vary as much as ±20%.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of this Manual. Your Warranty is located inside the front cover.

PRECAUTIONS FOR TROUBLESHOOTING

1. Use caution when you test IC and transistor circuits. Although they have almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage or current than other circuit components.

2. Be sure you do not short any terminals to ground when you make voltage measurements. If the probe should slip, for example, and short across terminals or voltage sources, it is very likely to cause damage to one or more IC's, transistors, or diodes.

CHECKING TRANSISTORS AND DIODES

SILICON BIPOLAR TRANSISTORS

To check a transistor accurately, you should use a transistor tester. However, if one is not available, you can use an ohmmeter to determine the general condition of any one of the bipolar transistors in this kit. The ohmmeter you use must have at least 1 volt DC at the probe tips to exceed the threshold of the diode junctions in the transistor you are testing. Most vacuum tube voltmeters meet this requirement.

To check a transistor with an ohmmeter, proceed as follows:

1. Remove the transistor from the circuit.

2. Set the ohmmeter to the R X 100 range.

3. Connect one of the ohmmeter test leads to the base (B) of the transistor. Touch the other meter lead to the emitter (E) and then to the collector (C). Both readings should be the same, but may be either high or low. If one reading is high and the other low, the transistor should be replaced. (Use the Identification Chart on Page 98 to identify the transistor leads).

4. Interchange the test leads and repeat step 3.

NOTE: In the unusual case when the readings are all low, or all high, no matter which ohmmeter lead is connected to the base, the transistor should be replaced.

MOSFETS

Insulated gate type MOSFETs are used at Q101, Q102, and Q103 on the front end circuit board and at Q205 on the AUD/REG circuit board. Usually, any defect in these devices is an internal short circuit between the source and one of the gates. You can check them in the circuit with a high impedance voltmeter (10 megohms or higher). An abnormally low source voltage may indicate an internal short circuit.

DIODES

To check a diode, unsolder one end from the circuit board, pull the lead up and out of the circuit board hole, and proceed as follows:

1. Set the ohmmeter to the R X 1000 range.

2. Connect one of the ohmmeter test leads to the lead at the cathode (banded) end of the diode. Connect the other test lead to the other diode lead. Note the meter reading. Then interchange the meter leads and take another reading. One reading should be high and the other low (at least 10:1). If both readings are either high or low, the diode should be replaced.

TROUBLESHOOTING CHARTS

The following charts list the "Problem" and the "Possible Cause" of a large number of malfunctions. If a particular part or parts are mentioned (transistor Q201, for example, or switch SW2) as a possible cause, check these parts to see if they are wired or installed incorrectly. Also check to see if an improper part was installed at that location. It is also possible, on rare occasions, for a part to be faulty.

GENERAL

PROBLEM	POSSIBLE CAUSE
Dial lamps don't light.	1. Fuses F1 and F201. 2. Switch SW1 defective or wired wrong. 3. Lamps PL1 and PL2 open or shorted. 4. Check wiring of red wires on chassis. 5. See AUD/REG Circuit Board Troubleshooting Chart.
No audio output.	1. Speaker or connections. 2. Wiring error on jack J3, control R4, or switch SW2. 3. Defective shielded cable.
No IF output.	1. Cable wiring error on chassis. 2. See AUD/REG Circuit Board Troubleshooting Chart.
No output from first mixer (Q102).	1. Cable wiring error at terminal C6 or A13, or defective cable. 2. HFO aligned incorrectly. 3. See HFO/XTAL Circuit Board Troubleshooting Chart.
No output from second mixer (Q103).	1. Cable wiring error at terminal B1 or B16, or defective cable. 2. See VFO Circuit Board Troubleshooting Chart.
No RF amplifier output.	1. Wiring error on switch SW4. 2. Wiring error on control R1 or defective control. 3. See Front End Circuit Board Troubleshooting Chart.
AGC does not operate.	1. Wiring error on switch SW3. 2. See AUD/REG Circuit Board Troubleshooting Chart.
BFO does not operate.	1. Wiring error on switch SW3 or at terminals D14 or D15. 2. See AUD/REG Circuit Board Troubleshooting Chart.
Calibrator does not operate.	1. Wiring error on switch SW2 or terminal C3. 2. See HFO/XTAL Calibrator Circuit Board Trouble-shooting Chart.
No sidetone from transmitter.	1. Wiring error on socket BD (J5) or terminal D9.
No muting or continuous muting.	1. Wiring error on socket BF (J2) or terminal D3. 2. See VFO Circuit Board, Front End Circuit Board, and AUD/REG Circuit Board Troubleshooting Charts.
No voltage from 23 VDC power supply.	1. Diodes D1 through D4 installed wrong or defective. 2. Capacitor C2 defective. 3. Wiring error on terminal strip CB or CC. 4. Fuse F1 open. 5. Wiring error on switch SW1 or defective switch. 6. AC source.
Will not operate from a 13.5 volt battery.	1. Wiring error on switch SW1 or connector BH (P1). 2. Fuse F201 open.

FRONT END CIRCUIT BOARD

PROBLEM	POSSIBLE CAUSE
Weak or no output from RF amplifier.	1. Diodes D101 through D118 installed wrong or defective. 2. Coils L106 through L109 installed wrong. 3. Front end alignment. 4. Transistor Q101 installed wrong or defective. 5. Wiring error on control R1 or defective control. 6. Transistor Q104 installed wrong or defective. 7. Capacitor C1 open or shorted.
No output from first mixer (Q102).	1. No HFO signal (see HFO/XTAL Calibrator Circuit Board Troubleshooting Chart). 2. Transistor Q102 installed wrong or defective. 3. Wrong part installed at C138, C139, C141 through C147, and L116 through L118.
No output from second mixer (Q103).	1. Wrong part at L119. 2. Capacitor C153 or C154. 3. Transistor Q103 installed wrong or defective. 4. No VFO signal (see VFO Circuit Board Troubleshooting Chart).

VFO CIRCUIT BOARD

PROBLEM	POSSIBLE CAUSE
No VFO output.	1. Transistors Q301 through Q304 installed wrong or defective. 2. Coil L301 installed wrong. 3. Wrong part at C301 through C307. 4. Wire from hole E to VFO capacitor C3 not connected or shorted to mounting bracket.
S meter does not operate.	1. Wrong part at R305 and R306. 2. Wiring error between meter and VFO circuit board. 3. Meter M1 defective. 4. See AUD/REG Circuit Board Troubleshooting Chart. 5. Diode D5 defective. 6. Controls R306 or R7 incorrectly set or defective.

HFO/XTAL CALIBRATOR CIRCUIT BOARD

PROBLEM	POSSIBLE CAUSE
No HFO signal.	1. Diodes D401 through D406, D408, D409, and D411 through D414 installed wrong or defective. 2. Wrong parts installed at capacitor locations C402, C406, C408, C412, C415, or C418. 3. Wrong parts installed at L401 through L406. 4. Wrong parts installed at Y401 through Y406 or defective crystal. 5. Transistors Q401 and Q402 installed wrong or defective. 6. Wiring error on switch SW4.
Calibrator does not operate.	1. Wiring error on switch SW2. 2. Transistors Q403 and Q404 installed wrong or defective. 3. Crystal Y407 defective. 4. Diode ZD401 installed wrong or defective.

AUD/REG CIRCUIT BOARD

PROBLEM	POSSIBLE CAUSE
No audio output.	1. IC202 and IC203 installed wrong or defective. 2. BFO not operating (see next problem).
BFO does not operate.	1. Transistors Q206, Q208, and Q209 installed wrong or defective. 2. Crystal Y205 or Y206 defective. 3. See General Troubleshooting Chart.
Product detector does not operate.	1. IC204 installed wrong or defective. 2. BFO not operating (see above problem). 3. No IF signal (see next problem).
No IF output.	1. Transistors Q205 and Q207 installed wrong or defective. 2. Wrong part at C235, C237, L201, or L202. 3. Wrong parts or defective at Y201 through Y204, C254, and C256. 4. Incorrect AGC voltage (see problem below). 5. Transistor Q202 defective. 6. Coil TC201 defective.
S meter does not operate.	1. Transistor Q204 installed wrong or defective. 2. Diodes D205 and D206 installed wrong or defective. 3. See VFO Circuit Board Troubleshooting Chart.
Incorrect AGC voltage.	1. Transistor Q203 installed wrong or defective. 2. Diode ZD202 defective. 3. Receiver muted (see muting problem in General Troubleshooting Chart). 4. Diode D207 defective. 5. Transistor Q101 (on front end circuit board) or Q205 defective. 6. See S-meter problem above.
Incorrect or no 13.5-volt supply.	1. IC 201 defective. 2. Capacitor C202 defective. 3. Fuse F201 defective. 4. Wrong part at R201 and R202. 5. See General Troubleshooting Chart.

SPECIFICATIONS

Frequency Coverage (Megahertz)	3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5, 21.0 to 21.5, 28.0 to 28.5, 28.5 to 29.0.
Sensitivity	Less than 0.5 microvolts for 10 dB signal-plus-noise to noise ratio for SSB operation.
IF Selectivity	2.1 kHz minimum at 6 dB down, 7 kHz maximum at 60 dB down.
Overall Audio Response	
Wide	2100 Hz minimum at 6 dB down, 7 kHz maximum at 60 dB down.
Narrow	250 Hz minimum at 6 dB down, 2.5 kHz maximum at 60 dB down (center frequency approximately 750 Hz).
Overall Gain	Less than 1.5 microvolt input for 0.25 watts of audio output.
Audio Output Power	.8 watts into a 4-ohm load continuous (1.2 watts peak power) at less than 10% THD.
AGC Characteristic	
Blocking Level	3 volts.
Dynamic Range	120 dB or greater.
Time Constant	Attack time less than 1 millisecond. Release time switch selectable at 100 milliseconds (CW) or 1 second (SSB).
Intermodulation Distortion	−60 dB
Image Rejection	50 dB or better.
IF Rejection	60 dB or better.
Internally Generated Spurious Signals	Below 1 microvolt equivalent antenna input except at 3.74, 21.2, 28.6, and 28.9 MHz.
Mode of Operation	Selectable upper or lower sideband and CW.

Frequency Stability	Less than 100 Hz per hour drift after 30 minutes warm up. Less than 100 Hz drift for 10% change in line voltage.
Tuning Rate	Approximately 15 kHz per turn.
Dial Accuracy	Within 2 kHz after calibration at nearest 100 kHz marker.
Muting	Shorted external ground at Mute socket.
Sidetone Input Level	10 millivolts or greater (300 mV maximum).
Dial Backlash	50 Hz or less.
IF Frequencies	
First IF	8.395 to 8.895 MHz.
Second IF	3.395 MHz.
Antenna Input Impedance	50 Ω unbalanced.
Temperature Range	−10°C to 50°C.
Meter Calibration	0 to S-9 +60 dB.
Front Panel Controls	AF Gain control/Power on-off. Preselector. RF Gain. VFO tuning. Band switch. Function switch. Mode switch.
Power Requirements	120 or 240 volts AC (50/60 Hz) 27 watts maximum or 11.5 VDC to 15 VDC at 0.75 amperes maximum.
Overall Dimensions (with knobs and feet installed)	12-3/4" wide × 6-3/4" high × 12" deep (32.39 cm × 17.15 cm × 30.48 cm).
Net Weight	9-3/4 lbs (4.42 kg).

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

Refer to the Block Diagram and the Schematic while you read this "Circuit Description." The part numbers on the Schematic are arranged in the following groups to help you locate specific parts on the Schematic, circuit boards, and chassis:

1-99	Parts mounted on the chassis.
100-199	Parts mounted on the front end circuit board.
200-299	Parts mounted on the AUD/REG circuit board.
300-399	Parts mounted on the VFO circuit board.
400-499	Parts mounted on the HFO/XTAL calibrator circuit board.

Incoming signals at the antenna are first amplified by transistor Q101 and then mixed in transistor Q102 with a signal from the HFO/XTAL Calibrator circuit board. The resulting 8.395 to 8.895 MHz first IF signal passes through an 8.5 MHz bandpass filter to transistor Q103. Q103 mixes the first IF signal with the VFO signal which produces a 3.395 MHz second IF signal. The second IF signal passes through a crystal filter to IF amplifier transistor Q205. The amplified IF signal is then changed to audio frequencies by IC204 which is a product detector. The detected audio signal is amplified in IC203C and, depending on the position of the Function switch, is coupled either directly to audio amplifier IC202 or through the active bandpass filter, IC203A and IC203B, to IC202. IC202 amplifies the audio enough to drive a speaker.

The following paragraphs describe the operation of each circuit in more detail.

FRONT END CIRCUIT BOARD

ANTENNA INPUT CIRCUIT

Signals from the antenna first pass through a 3.395 MHz trap, a high frequency trap, and an 8.5 MHz trap before they are coupled to the antenna tuning circuits. The 3.395 MHz trap (TC101) is a series tuned circuit that traps out the 3.395 MHz signal on the antenna input and improves the IF rejection of the Receiver. The high frequency trap (L102 and C103) is a parallel tuned circuit that traps out signals above 30 MHz. The 8.5 MHz trap (L103 through L105 and C105 through C107) is a series and parallel tuned circuit combination which operates in a manner similar to the 3.395 MHz trap.

After the signal passes through the three trap circuits, it is coupled through a tuned circuit to RF amplifier Q101. Each of the four tuned circuits (L106 through L109, C109, C112, and C1) performs two functions. First, the circuit allows only the proper signals to pass through, as determined by the band to which you are tuned, and second, it matches the low impedance antenna circuit to the high impedance input of gate G1 of the RF amplifier. The tuned circuits are selected by the Band switch and switching diodes D101 through D108.

RF AMPLIFIER CIRCUIT

Signals from the antenna input circuit are coupled through C116 to gate G1 of RF amplifier Q101, where they are amplified. Tuned circuits (L111 through L115 and the associated capacitors) provide further signal selectivity. These tuned circuits are selected by the Band switch and switching diodes D114 through D118.

The gain of the RF amplifier is controlled by two methods. AGC voltage, from the AUD/REG circuit board, is applied to gate G2 of Q101 and a voltage from the RF Gain control is applied through R109 to the source (S) of Q101. As the AGC voltage goes down, the RF amplifier gain decreases. As the voltage from the RF Gain control goes up, Q101 becomes cut off. Q104 is used to cut off Q101 during muting when the Receiver is used with a transmitter.

FIRST MIXER CIRCUIT

Signals from the RF amplifier are coupled through C133 to gate G1 of first mixer transistor Q102. At the same time, a signal from the HFO (heterodyne frequency oscillator) circuit board is coupled through C134 to gate G2 of Q102. Q102 mixes these two signals and produces sum and difference frequencies at its drain (D). The bandpass filter (L116 through L118 and the associated capacitors) allows only the 8.395 to 8.895 MHz first IF signal to pass through to the second mixer.

SECOND MIXER CIRCUIT

The first IF signal from the bandpass filter is coupled through C147 to gate G1 of second mixer transistor Q103. At the same time, a signal from the VFO (variable frequency oscillator) circuit board is coupled through C149 to gate G2 of Q103. Q103 mixes these two signals and produces sum and difference frequencies at its drain (D). A tuned circuit (L119, C153, and C154) provides a low impedance for the 3.395 MHz second IF signal which now goes to the AUD/REG circuit board.

AUD/REG CIRCUIT BOARD

CRYSTAL FILTER CIRCUIT

The 3.395 MHz second IF signal, which comes from the front end circuit board, is coupled through C246 to the base (B) of Q207. This transistor matches the impedance of the output of the front end circuit board to the impedance of the crystal filter circuit. The second IF signal from the collector (C) of Q207 is then coupled through C248 to the 2.1 kHz crystal filter (Y201 through Y204, TC201, C254, and C256). Because the crystal filter allows only the 3.395 MHz signal to pass, the sharp selectivity provided by the filter permits excellent rejection of unwanted adjacent signals.

IF AMPLIFIER CIRCUIT

The 3.395 MHz second IF signal, coming from the crystal filter circuit, is coupled through C239 to gate G1 of IF amplifier Q205. Power is supplied to the drain (D) of the transistor through a tuned circuit formed by L201 and C235. AGC voltage is applied to gate G2 of Q205 to limit the gain during strong signal reception.

BFO CIRCUIT

The BFO (beat frequency oscillator) is made up of two crystal controlled oscillators which are selected by the Mode switch. The LSB oscillator (Q208, Y205, and associated components) and the USB/CW oscillator (Q209, Y206, and associated components) are coupled through C243 and C244, respectively, to the base (B) of Q206. Q206 is an emitter follower stage which matches the high impedance output of the crystal oscillators to the low impedance input of the product detector.

PRODUCT DETECTOR

The amplified 3.395 MHz second IF signal is coupled through C231 to the signal input (pin 4) of product detector IC204. A signal from the BFO is coupled through C233 to the carrier input (pin 7) of IC204. IC204 mixes the two input signals and produces sum and difference signals at its output (pin 6). The sum frequency is filtered out by C224 and C225. The difference frequency is an audio signal. R229 sets the gain of the stage.

AUDIO CIRCUIT

The audio signal, coming from the product detector, is coupled through C224 and R218 to the inverting input (pin 13) of operational amplifier IC203C. The amplified audio signal (pin 14) is coupled either through C216 to the function switch or through R213 to the active filter stage. The active filter stage is formed by IC203A and IC203B. These cascaded operational amplifiers are bandpass tuned for a selected bandwidth of audio frequencies. The bandwidth of the active filter circuit is 300 Hz at a center frequency of 750 Hz. This active filter provides sharp selectivity and permits excellent rejection of unwanted adjacent audio signals in the CW mode. The output of the active filter stage is coupled through C215 to the Function switch.

Function switch (SW2) selects either wide bandpass audio signal, coming from IC203C, or the narrow bandpass audio signal, coming from IC203B, and passes it to the AF Gain control (R4). The audio signal, coming from the AF Gain control, and the sidetone input, coming from Sidetone jack J5 (when used), are then fed to the input (pin 7) of the audio power amplifier IC202. The amplified audio signal is then coupled through C205 to the Phone jack (J3) and the SPKR jack (J4). When headphones are connected to the Phone jack, the speaker is automatically disconnected.

S-METER AND AGC CIRCUIT

A sample of the audio signal, coming from the product detector (IC204), is coupled through C218 to operational amplifier IC203D. The amplified audio signal is then coupled through C221 to voltage doubling diodes D205 and D206. D205 and D206 rectify the positive half of the audio signal to produce a pulsating DC voltage.

The DC voltage is affected by a selectable-release time-constant circuit formed by C223 and either R5 or R6 on the Mode switch. The Mode switch selects either R5 or R6 to produce fast and slow AGC action.

The controlled DC voltage causes the source (S) of Q204, a DC voltage detector, to vary in proportion with the amount of voltage on its gate (G). Part of this varying voltage is sent to the S meter to indicate the strength of the received signal. Another part of this varying voltage is DC-coupled through resistor R234 to the base of AGC control transistor Q203. When there is no signal present, Q203 is turned off, allowing zener diode ZD201 to hold the AGC voltage to about 3 volts DC. When a signal is present, the voltage on the source of Q204 goes up, causing Q203 to turn on. The AGC voltage at its collector will drop to .2 volts DC. The AGC voltage controls the gain of IF amplifier Q205 and RF transistor Q101 (on the front end circuit board). This prevents the Receiver from overloading on strong incoming signals.

POWER SUPPLY CIRCUIT

DC voltage from the power supply mounted on the chassis is connected to the input of regulator IC201. IC201 samples and compares the incoming DC voltage with the output voltage and adjusts itself as necessary to maintain a fixed DC voltage level. R201 and R202 control the regulated output voltage.

Fuse F201 is used for protection against short circuits during battery operation.

VFO CIRCUIT BOARD

A field effect transistor (Q301) is used in a Hartley oscillator circuit in the VFO. Part of coil L301, variable capacitor C3 (the main tuning capacitor), and fixed temperature compensating capacitors C301 through C307 are used in the frequency determining circuits. The remaining part of coil L301 is used for feedback to maintain oscillation. Zener diode ZD301 regulates the voltage at the drain of Q301.

The output of oscillator Q301 is coupled through C308 to source-follower transistor Q302, which acts as a buffer and impedance matching device. Transistor Q303 is a fixed-tuned amplifier which is followed by a low-pass filter (L302 through L305 and C314 through C318) to reduce the harmonic output of the VFO.

Transistor Q304 is used to turn off transistor Q303 during transmission, when the Receiver is used with a transmitter.

Control R306 is used to adjust the S meter to zero during no-signal conditions.

HFO/XTAL CALIBRATOR CIRCUIT BOARD

HFO CIRCUIT

This circuit is formed by a straight-forward crystal controlled oscillator. Switching diodes D401 through D406, D408, D409, and D411 through D414 and Band switch SW4 determine which crystal and its associated tuned circuit is connected to oscillator transistor Q401. The HFO signal produced by Q401 is coupled through C409 to the base of HFO amplifier transistor Q402. The amplified HFO signal is then coupled through C416 to the front end circuit board.

A detector circuit consisting of C419, C421, R419, and D415 provides a DC voltage at TP for use during HFO alignment.

CRYSTAL CALIBRATOR CIRCUIT

Transistors Q403 and Q404 form a 100 kHz astable multivibrator that is controlled by crystal Y407. The output of this multivibrator circuit is a square wave that produces harmonics at every 100 kHz on the dial. Resistor R427 and zener diode ZD401 reduce the 12-volt supply voltage to 5 volts for the multivibrator.

This circuit operates when the Function switch is in the Cal position.

OTHER CIRCUITS

MUTING CIRCUIT

The purpose of this circuit is to shut down the Receiver during transmit (when used with a transmitter) so no interfering or strong signals are present.

When Mute jack J2 is shorted during transmit, transisor Q104, on the front end circuit board, and Q202, on the AUD/REG circuit board, are turned on which turn off RF amplifier transistor Q101 and IF amplifier transistor Q205 respectively.

At the same time, Q304 on the VFO circuit board is turned off, which removes the supply voltage to buffer transistor Q303.

During receive, the opposite occurs allowing the receiver circuits to operate normally.

POWER SUPPLY CIRCUIT

AC power is supplied through fuse F1 and switch SW1A to the primary of transformer T1. T1 has dual primary windings to allow operation from either 120 or 240-volt line voltages.

The voltage at the secondary is rectified by a full-wave bridge circuit formed by diodes D1 through D4. The rectified DC voltage is then filtered by capacitor C2 and is then applied to the regulator circuit on the AUD/REG circuit board.

CIRCUIT BOARD X-RAY VIEWS

NOTE: To identify a part shown in one of these views, so you can order a replacement, proceed in either of the following ways:

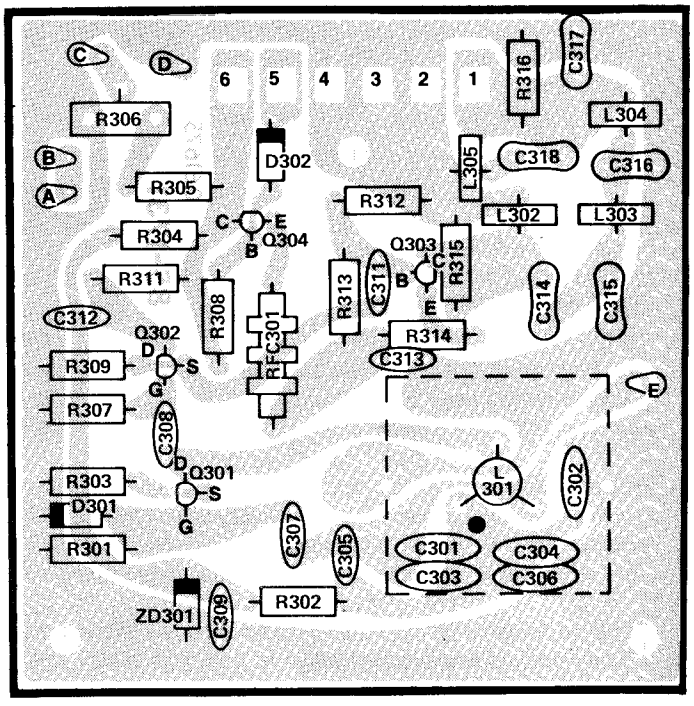
1. A. Refer to the place where the part is installed in the Step-by-Step instructions and note the "description" of the part (for example: 22 kΩ, .05 μF, or MPF105).

   B. Look up this description in the appropriate parts list.

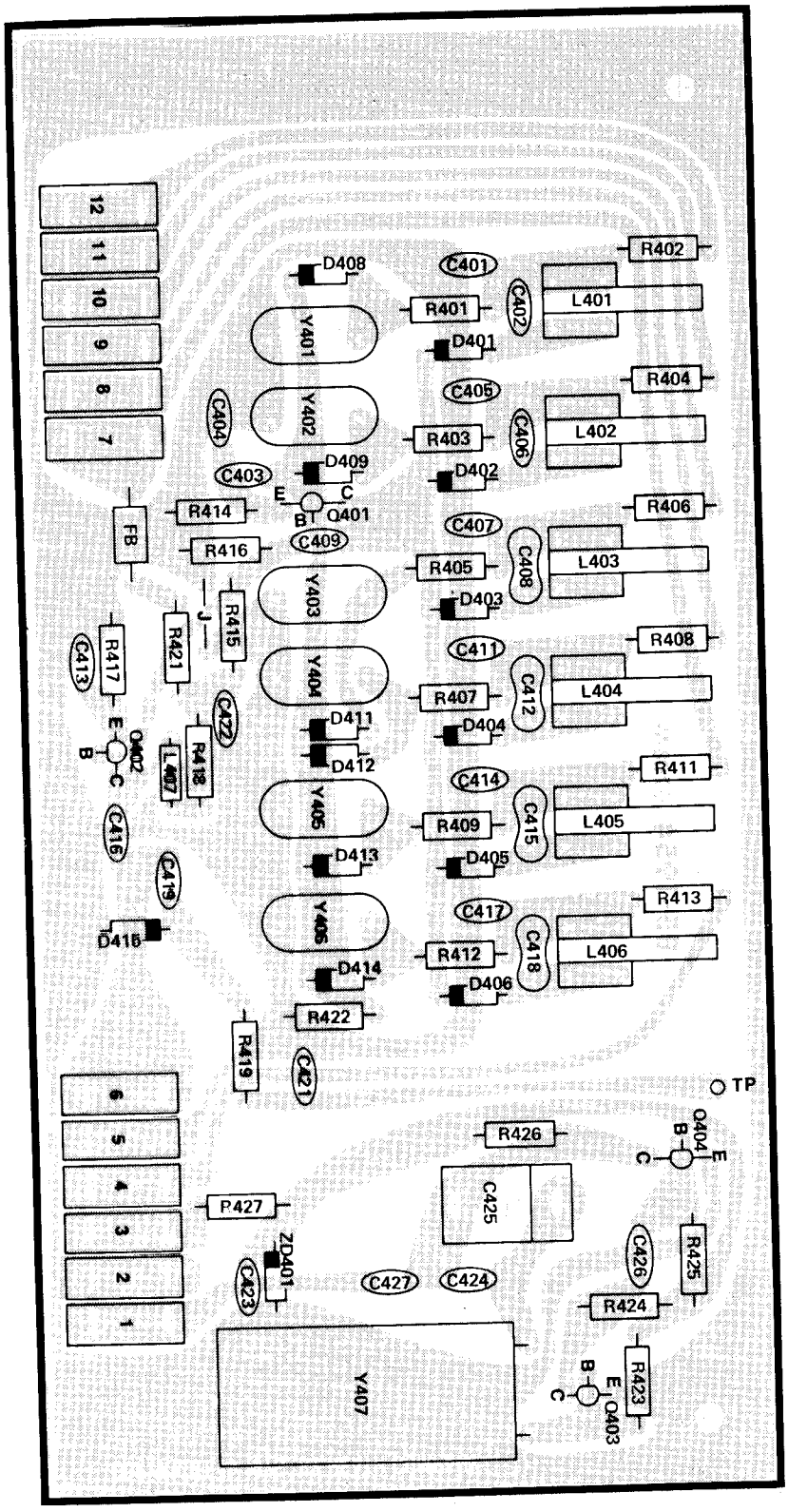
2. A. Note the identification number of the part (R-number, C-number, etc.).

   B. Locate the same identification number (next to the part) on the Schematic. The "description" of the part will also appear near the part.

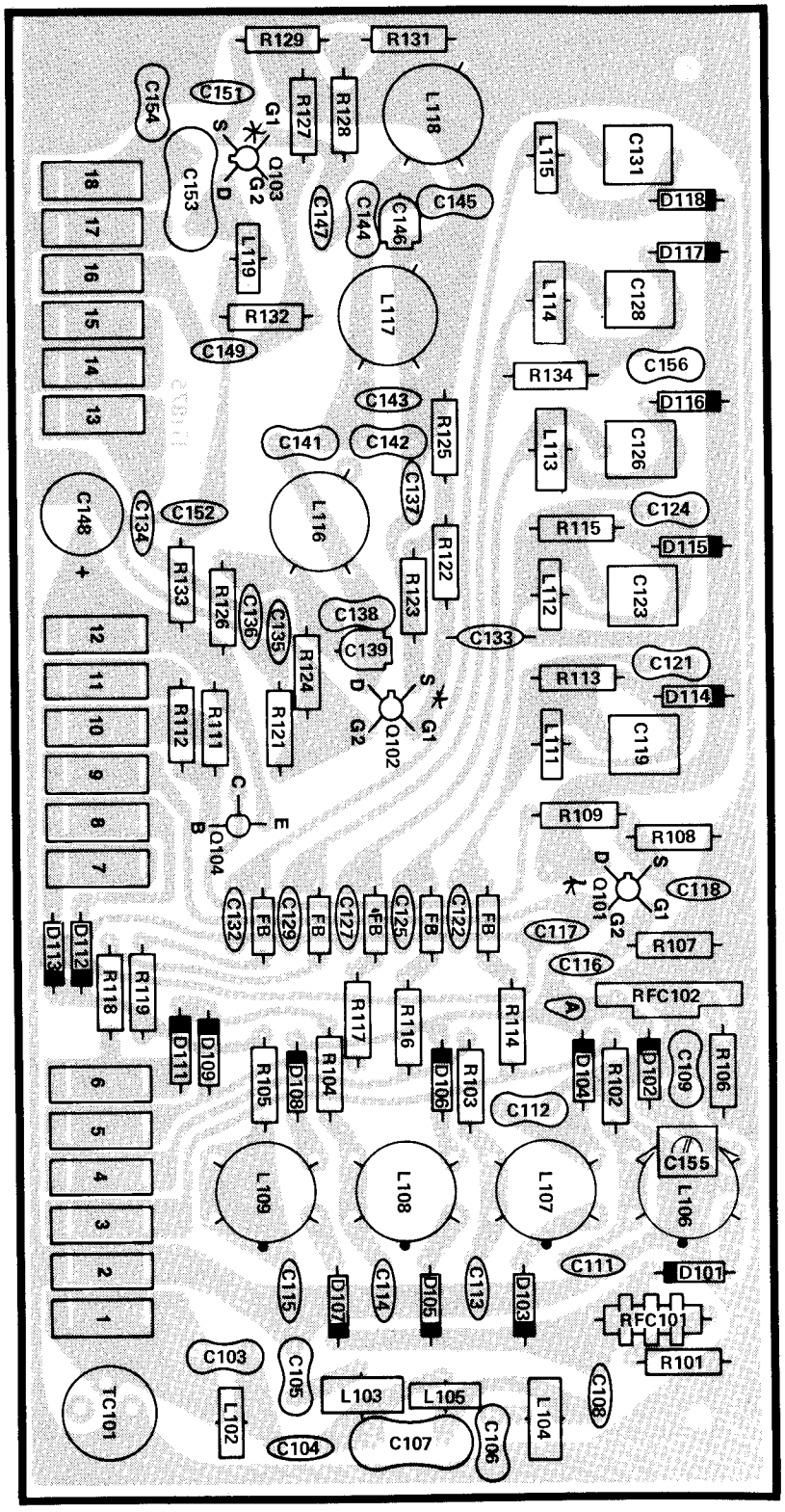
   C. Look up this description in the appropriate parts list.



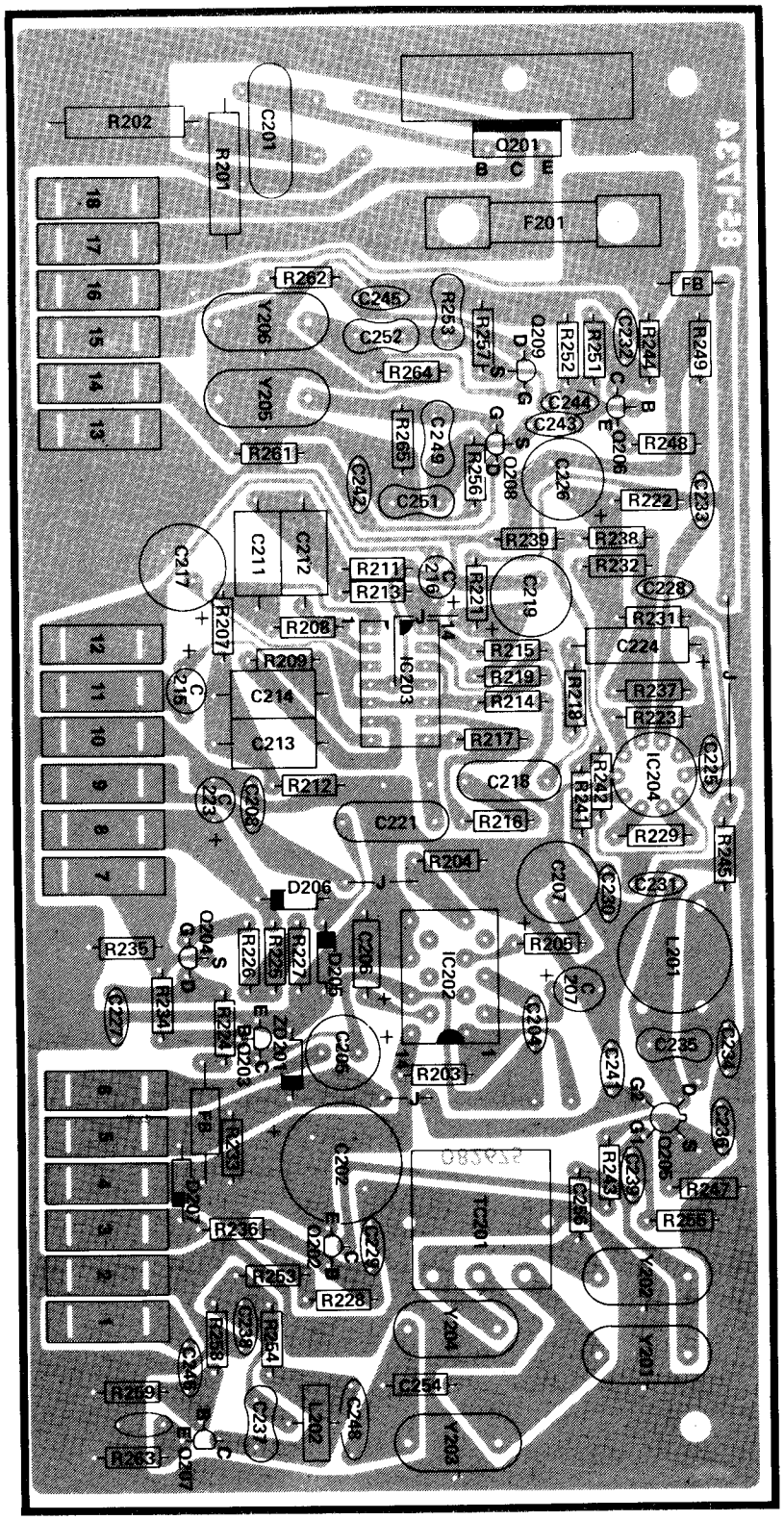
VFO CIRCUIT BOARD
(Shown from component side)



HFO/XTAL CALIBRATOR CIRCUIT BOARD
(Shown from component side)



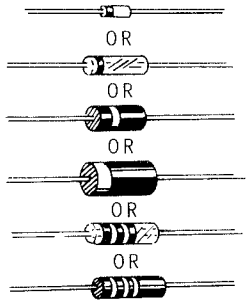
FRONT END CIRCUIT BOARD
(Shown from component side)



AUD/REG CIRCUIT BOARD
(Shown from component side)

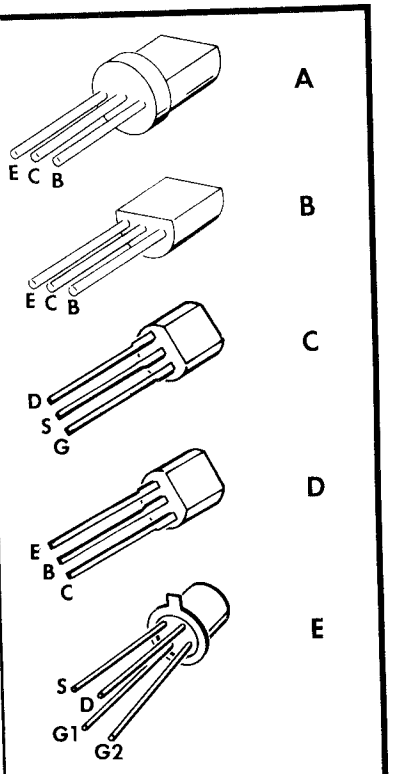
IDENTIFICATION CHARTS

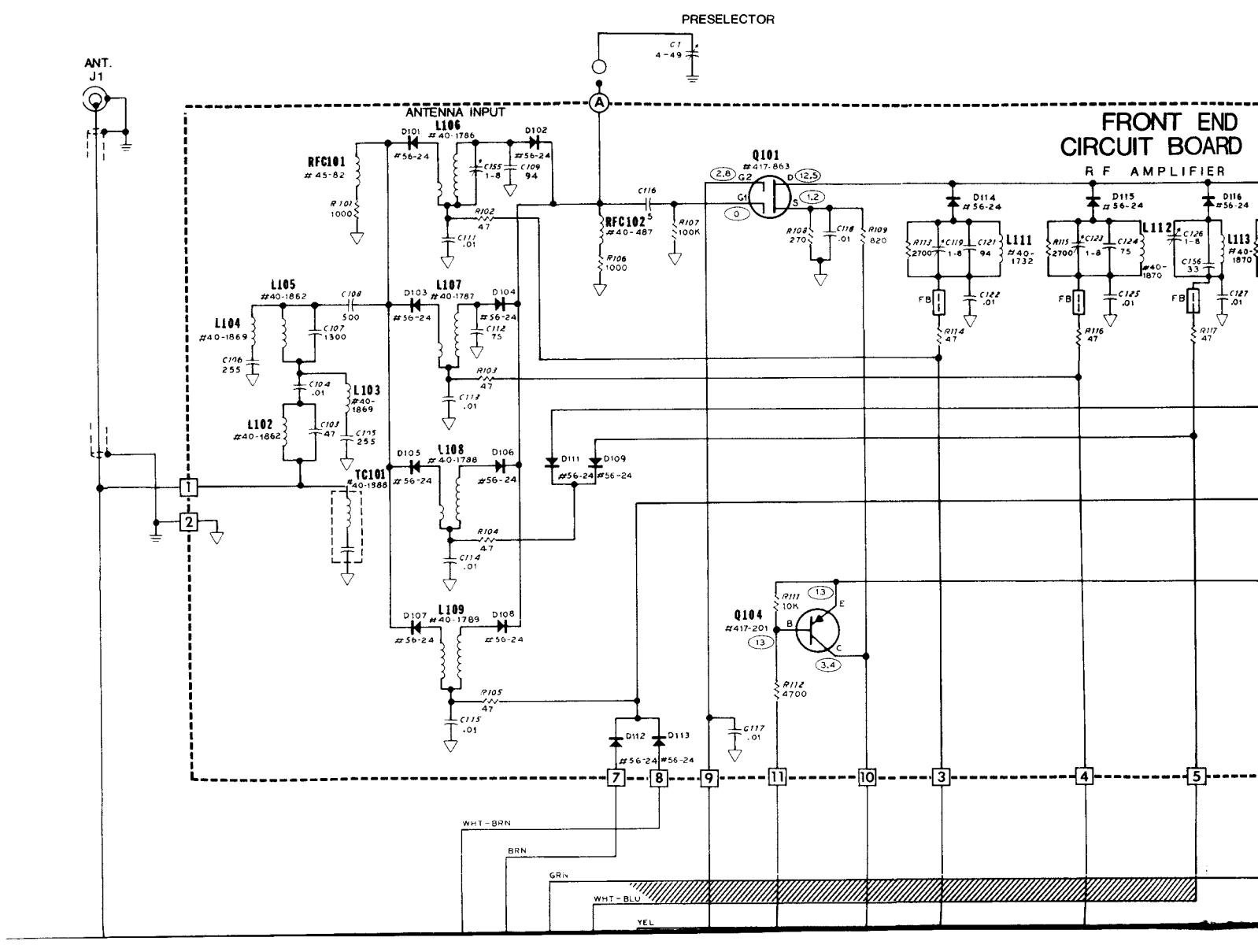
DIODES

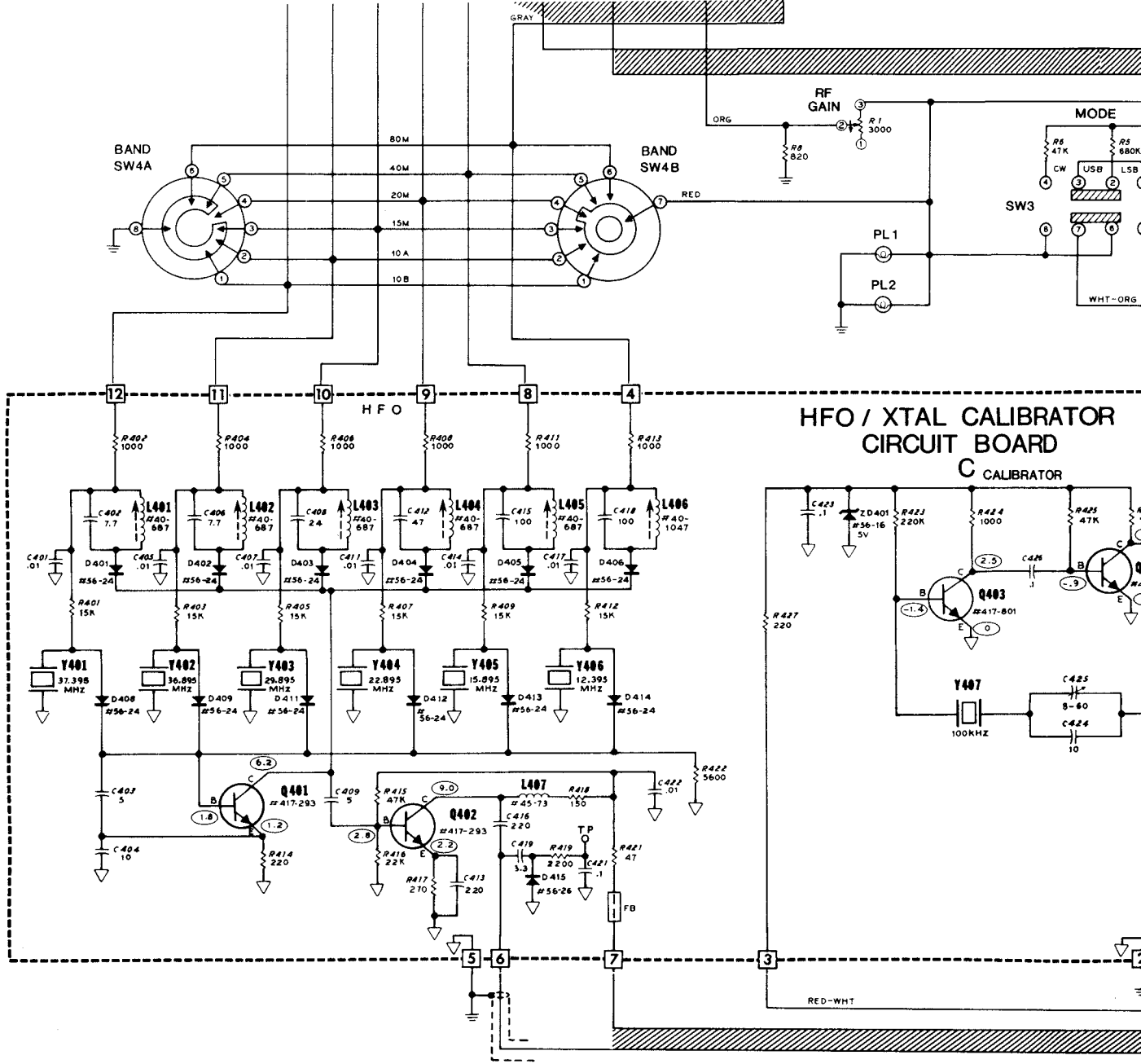
HEATH PART NUMBER	MAY BE REPLACED WITH	CIRCUIT COMPONENT NUMBER	IDENTIFICATION
56-16	1N751	ZD401	NOTE: HEATH PART NUMBERS ARE STAMPED ON MOST DIODES 
56-19	VR-9.1	ZD301	
56-24	1N458	D101, D102, D103, D104, D105 D106, D107, D108, D109, D111 D112, D113, D114, D115, D116 D118, D401, D402, D403, D404 D405, D406, D408, D409, D411 D412, D413, D414	
56-26	1N191	D205, D206, D207, D415	
56-50	DO-7 1N4729	ZD201	
56-89	GD510	D5, D302	
57-65	1N4002	D1, D2, D3, D4,	

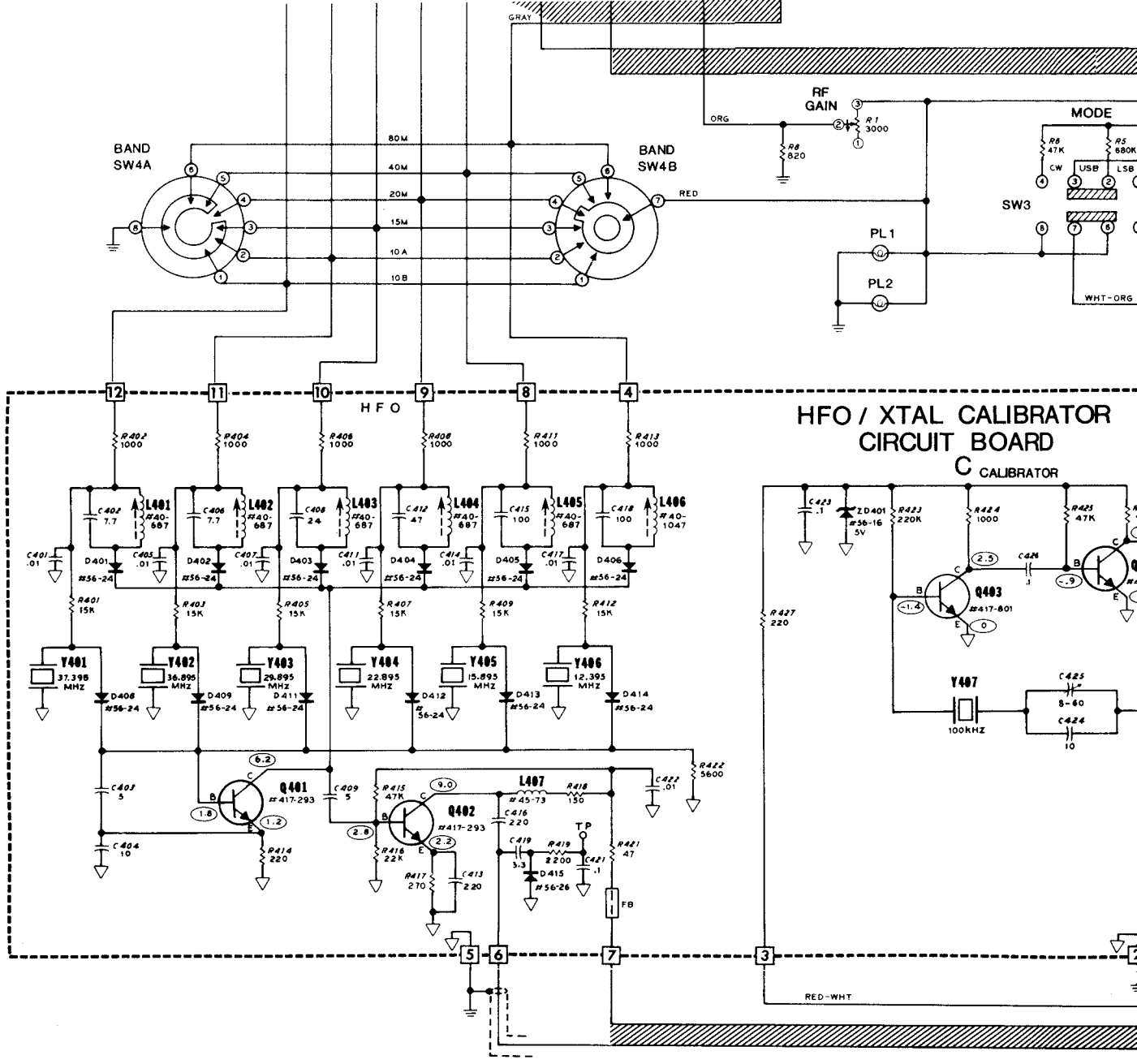
TRANSISTORS

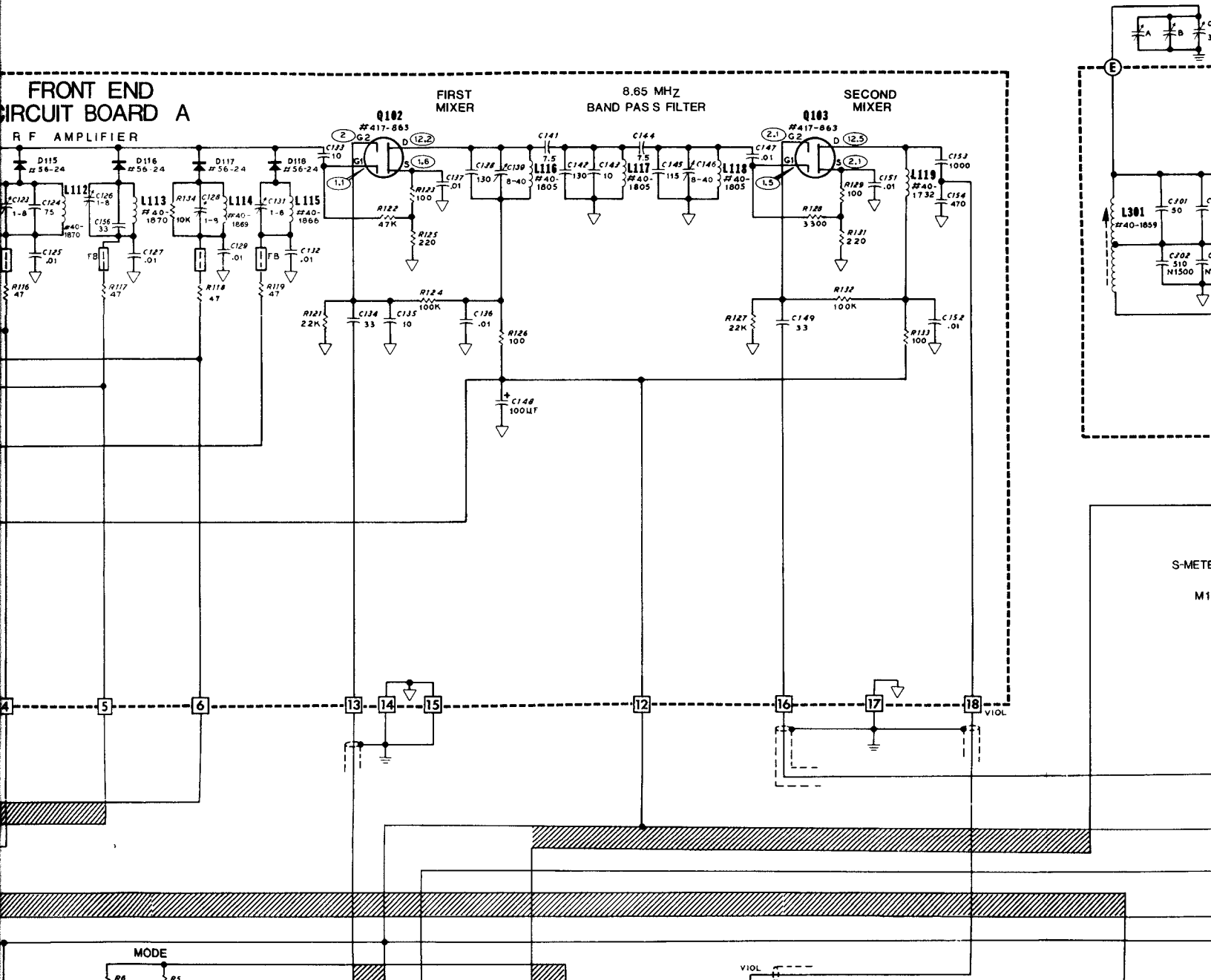
HEATH PART NUMBER	MAY BE REPLACED WITH	CIRCUIT COMPONENT NUMBER	BASING DIAGRAM
417-293	2N5770	Q401, Q402	D
417-169	MPF105	Q208, Q209, Q301, Q302	C
417-201	X29A829	Q104, Q202	A OR B
417-234	2N3638A	Q303	D
417-241	EL131	Q204	C
417-801	MPSA20	Q203, Q206, Q207, Q304, Q403	D
417-863	MFE131	Q101, Q102, Q103, Q205	E

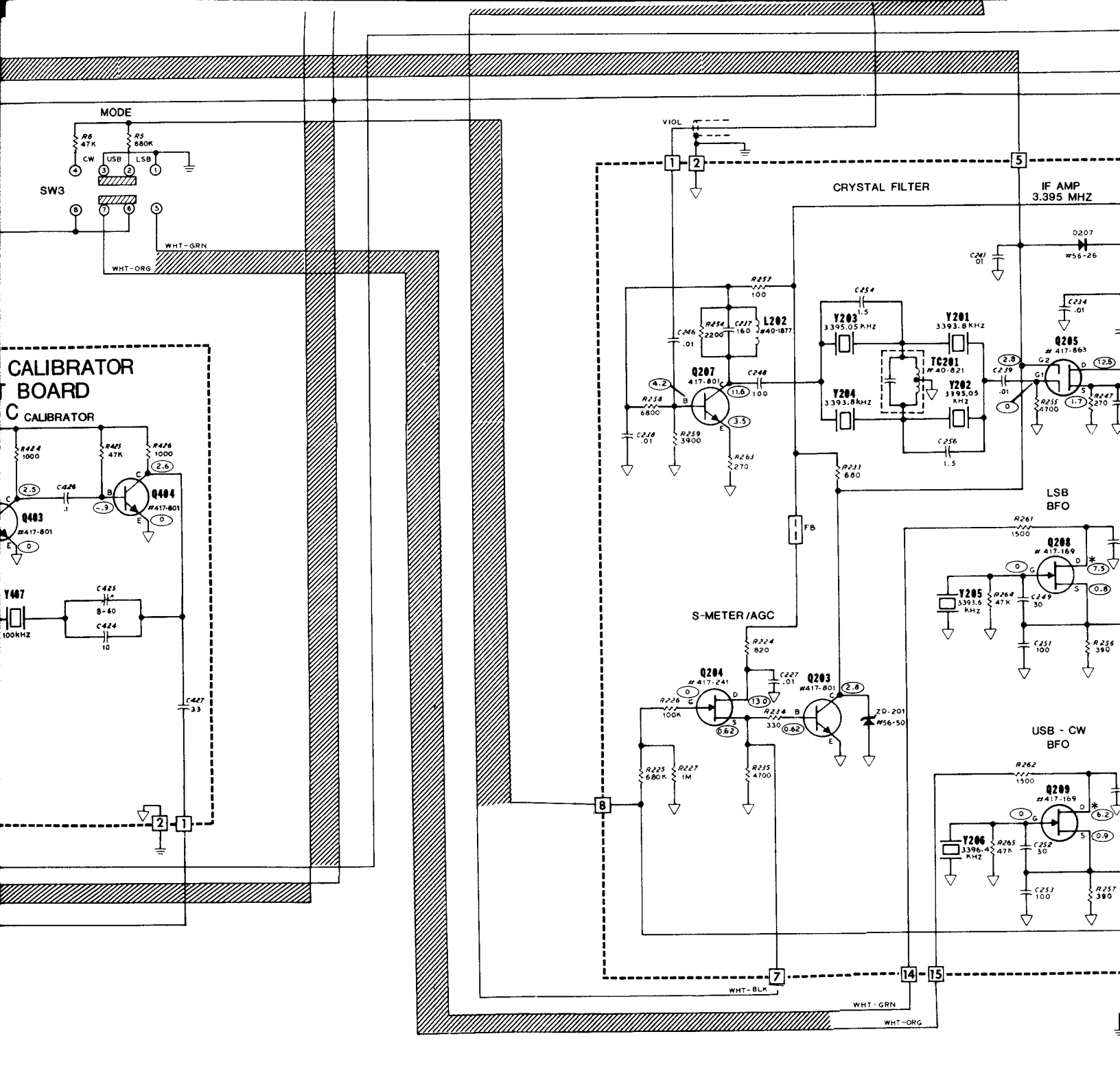



PRESELECTOR
C1
4-49
ANT.
J1
ANTENNA INPUT
FRONT END
CIRCUIT BOARD
R F AMPLIFIER
RFC101
#45-82
R101
1000
D101
#56-24
L106
#40-1786
D102
#56-24
C155
1-8
C109
94
R102
47
C111
.01
RFC102
#40-487
R106
1000
C116
R107
100K
Q101
#417-863
G1
G2
D
S
R108
270
C118
.01
R109
820
D114
#56-24
R113
2700
C119
1-8
C121
94
L111
#40-1732
FB
C122
.01
R114
47
D115
#56-24
R115
2700
C123
1-8
C124
75
L112
#40-1870
FB
C125
.01
R116
47
D116
#56-24
C126
1-8
L113
#40-1870
C156
33
FB
C127
.01
R117
47
L105
#40-1862
C108
500
D103
#56-24
L107
#40-1787
D104
#56-24
C112
75
L104
#40-1869
C107
1300
C106
255
R103
47
C113
.01
C104
.01
L103
#40-1869
L102
#40-1862
C103
47
C105
255
TC101
#40-1588
D105
#56-24
L108
#40-1788
D106
#56-24
D111
#56-24
D109
#56-24
R104
47
C114
.01
D107
#56-24
L109
#40-1789
D108
#56-24
R105
47
C115
.01
Q104
#417-201
R111
10K
R112
4700
D112
#56-24
D113
#56-24
C117
.01
WHT-BRN
BRN
GRN
WHT-BLU
YEL

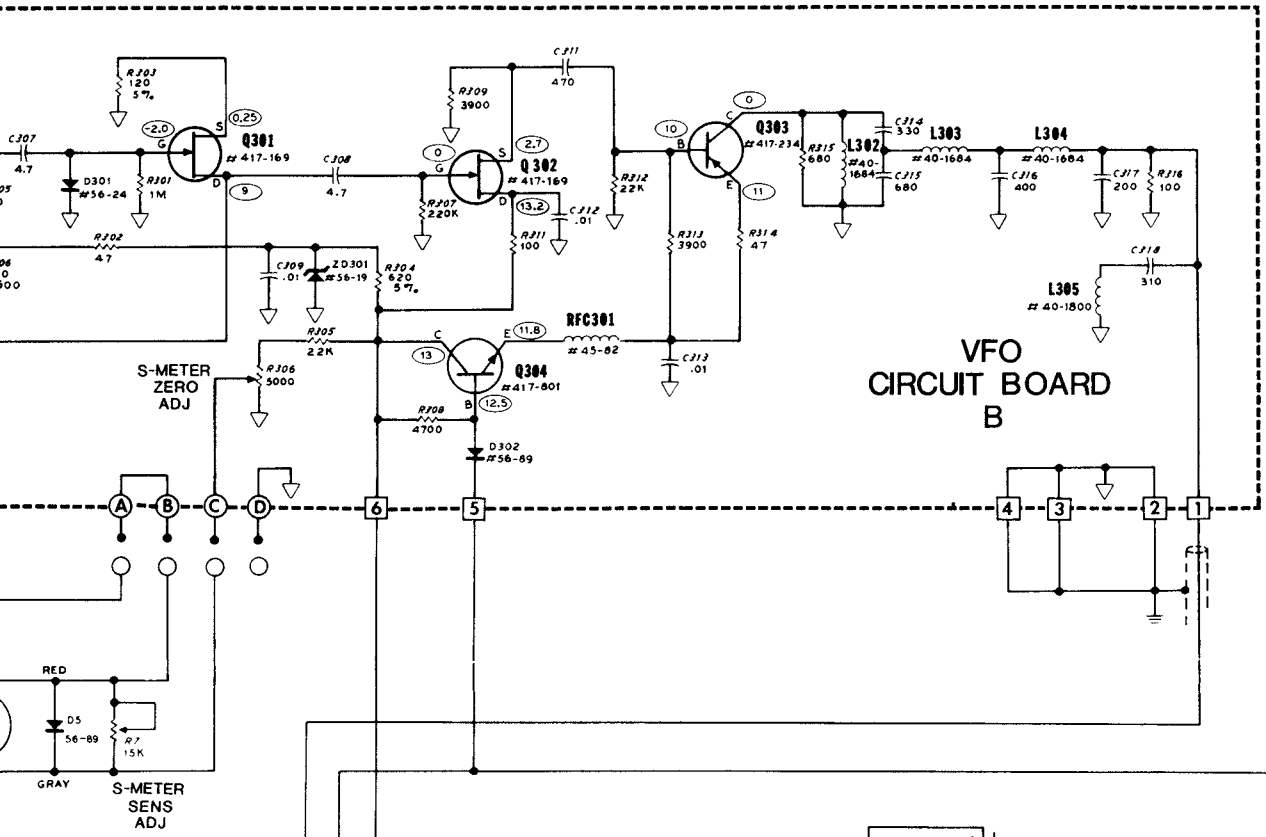

HFO / XTAL CALIBRATOR
CIRCUIT BOARD
C CALIBRATOR
HFO
BAND SW4A
BAND SW4B
80M
40M
20M
15M
10A
10B
RED
GRAY
ORG
RF GAIN
R1 3000
R8 820
MODE
R6 47K
R5 680K
CW
USB
LSB
SW3
PL1
PL2
WHT-ORG
RED-WHT
R402 1000
R404 1000
R406 1000
R408 1000
R411 1000
R413 1000
L401 #40-687
L402 #40-687
L403 #40-687
L404 #40-687
L405 #40-687
L406 #40-1047
C402 7.7
C406 7.7
C408 24
C412 47
C415 100
C418 100
C401 .01
C405 .01
C407 .01
C411 .01
C414 .01
C417 .01
D401 #56-24
D402 #56-24
D403 #56-24
D404 #56-24
D405 #56-24
D406 #56-24
R401 15K
R403 15K
R405 15K
R407 15K
R409 15K
R412 15K
Y401 37.395 MHZ
Y402 36.895 MHZ
Y403 29.895 MHZ
Y404 22.895 MHZ
Y405 15.895 MHZ
Y406 12.395 MHZ
D408 #56-24
D409 #56-24
D411 #56-24
D412 #56-24
D413 #56-24
D414 #56-24
C403 5
C404 10
Q401 #417-293
C409 5
R414 220
R415 47K
Q402 #417-293
R416 22K
R417 270
C413 220
L407 #45-73
R418 150
C416 220
C419 3.3
R419 3200
C421 .1
D415 #56-26
TP
R421 47
FB
C422 .01
R422 5600
C423 .1
ZD401 #56-16 5V
R423 220K
R424 1000
R425 47K
C426 .1
Q403 #417-801
R427 220
Y407 100KHZ
C425 8-60
C424 10
12
11
10
9
8
4
5
6
7
3

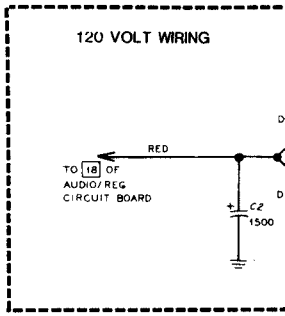

HFO / XTAL CALIBRATOR
CIRCUIT BOARD
C CALIBRATOR
HFO
BAND SW4A
BAND SW4B
80M
40M
20M
15M
10A
10B
RED
GRAY
ORG
RF GAIN
R1 3000
R8 820
MODE
R6 47K
R5 680K
CW
USB
LSB
SW3
PL1
PL2
WHT-ORG
R402 1000
R404 1000
R406 1000
R408 1000
R411 1000
R413 1000
L401 #40-687
L402 #40-687
L403 #40-687
L404 #40-687
L405 #40-687
L406 #40-1047
C402 7.7
C406 7.7
C408 24
C412 47
C415 100
C418 100
C401 .01
C405 .01
C407 .01
C411 .01
C414 .01
C417 .01
D401 #56-24
D402 #56-24
D403 #56-24
D404 #56-24
D405 #56-24
D406 #56-24
R401 15K
R403 15K
R405 15K
R407 15K
R409 15K
R412 15K
Y401 37.398 MHZ
Y402 36.895 MHZ
Y403 29.895 MHZ
Y404 22.895 MHZ
Y405 15.895 MHZ
Y406 12.395 MHZ
D408 #56-24
D409 #56-24
D411 #56-24
D412 #56-24
D413 #56-24
D414 #56-24
C403 5
C404 10
Q401 #417-293
R414 220
C409 5
R415 47K
Q402 #417-293
R416 22K
R417 270
C413 220
L407 #45-73
R418 150
C416 220
C419 3.3
R419 2200
D415 #56-26
C421 .1
R421 47
FB
TP
C422 .01
R422 5600
C423 .1
ZD401 #56-16 5V
R423 220K
R424 1000
R425 47K
C426 .1
Q403 #417-801
R427 220
Y407 100kHZ
C425 8-60
C424 10
RED-WHT
12
11
10
9
8
4
5
6
7
3

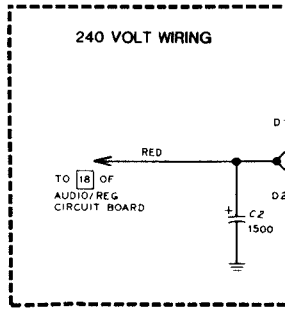

FRONT END
CIRCUIT BOARD A
R F AMPLIFIER
FIRST MIXER
8.65 MHz BAND PASS FILTER
SECOND MIXER
Q102 #417-863
Q103 #417-863
D115 #56-24
D116 #56-24
D117 #56-24
D118 #56-24
L112
L113 #40-1870
L114 #40-1869
L115 #40-1866
L116 #40-1805
L117 #40-1805
L118 #40-1805
L119 #40-1732
L301 #40-1859
C123 1-8
C124 75
C125 .01
C126 1-8
C127 .01
C128 1-9
C129 .01
C131 1-8
C132 .01
C133 10
C134 33
C135 10
C136 .01
C137 .01
C138 130
C139 8-40
C140 7.5
C141 7.5
C142 130
C143 10
C144 7.5
C145 115
C146 8-40
C147 .01
C148 100µF
C149 33
C151 .01
C152 .01
C153 1000
C154 470
C156 33
C301 50
C302 510 N1500
R116 47
R117 47
R118 47
R119 47
R121 22K
R122 47K
R123 100
R124 100K
R125 220
R126 100
R127 22K
R128 3300
R129 100
R131 220
R132 100K
R133 100
FB
MODE
VIOL
S-METE
M1

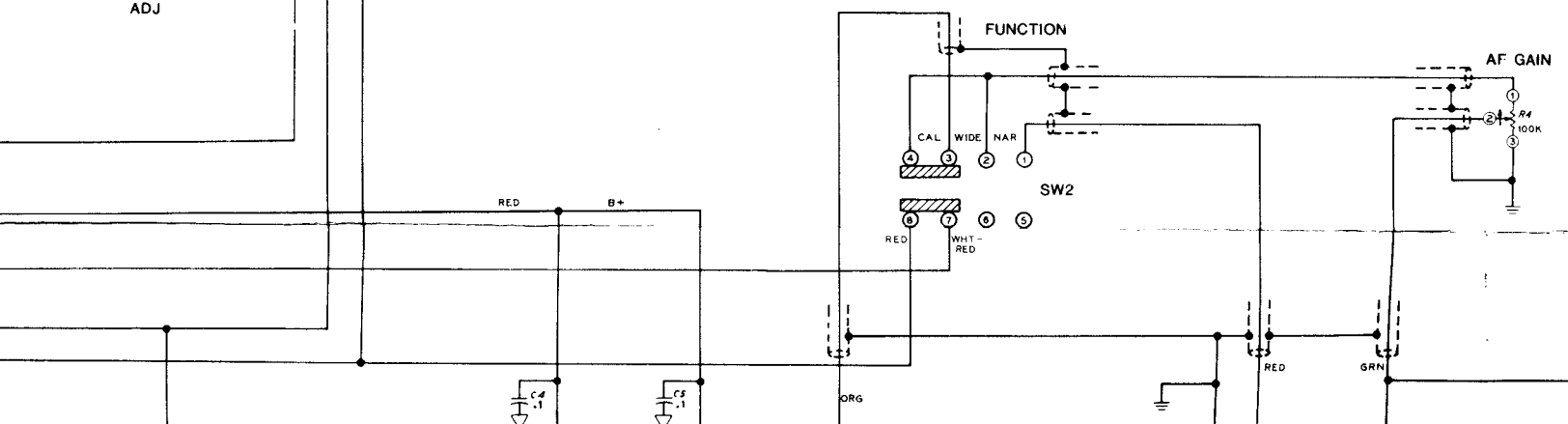

MODE
R6 47K
R5 680K
CW
USB
LSB
SW3
WHT-GRN
WHT-ORG
CALIBRATOR
BOARD
CALIBRATOR
R424 1000
R425 47K
R426 1000
Q403 #417-801
Q404 #417-801
C426
Y407 100KHZ
C425 8-60
C424 10
C427 33
VIOL
CRYSTAL FILTER
IF AMP 3.395 MHZ
L202 #40-1877
Y203 3395.05 KHZ
Y201 3393.8KHZ
Y204 3393.8KHZ
Y202 3395.05 KHZ
TC201 #40-821
Q207 417-801
Q205 # 417-863
D207 #56-26
R253 100
C254 1.5
C246 .01
C237 160
R254 2200
C248 100
R258 6800
R259 3900
R263 270
C238 .01
C256 1.5
R233 680
C241 .01
C234 .01
C239 .01
R255 4700
R247 270
FB
S-METER/AGC
Q204 # 417-241
Q203 #417-801
ZD-201 #56-50
R224 820
C227 .01
R226 100K
R234 330
R225 680K
R227 1M
R235 4700
LSB BFO
Q208 # 417-169
Y205 3393.6 KHZ
R261 1500
R264 47K
C249 30
C251 100
R256 390
USB - CW BFO
Q209 #417-169
Y206 3396.4 KHZ
R262 1500
R265 47K
C252 30
C253 100
R257 390
WHT-BLK
WHT-GRN
WHT-ORG

CAPACITOR

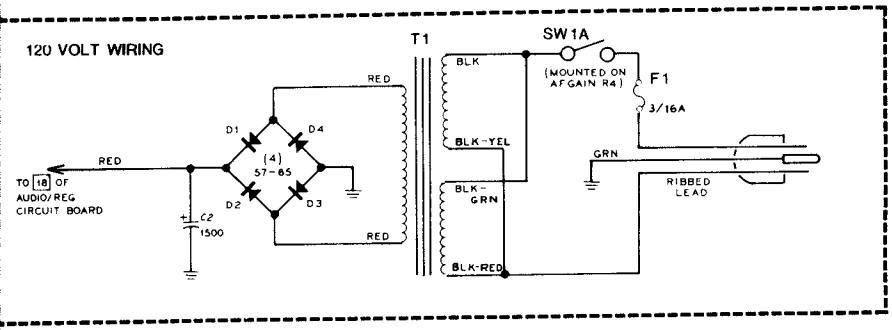

VFO
CIRCUIT BOARD
B
Q301
#417-169
Q302
#417-169
Q303
#417-234
Q304
#417-801
L302
L303
L304
L305
RFC301
D301
D302
ZD301
S-METER
ZERO
ADJ
S-METER
SENS
ADJ
RED
GRAY
A
B
C
D
6
5
4
3
2
1

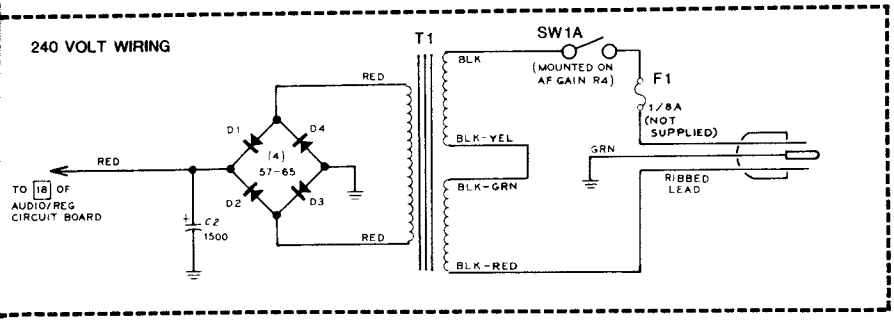

120 VOLT WIRING
RED
TO 18 OF
AUDIO/REG
CIRCUIT BOARD
C2
1500

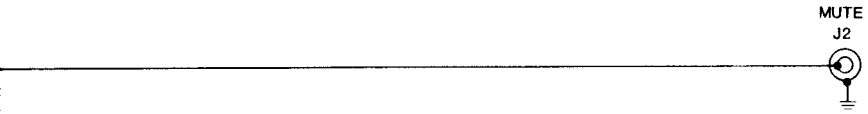

240 VOLT WIRING
RED
TO 18 OF
AUDIO/REG
CIRCUIT BOARD
C2
1500

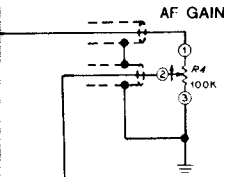

FUNCTION
AF GAIN
CAL
WIDE
NAR
SW2
R4
100K
RED
B+
WHT-
RED
ORG
GRN
C4
.1
C5
.1

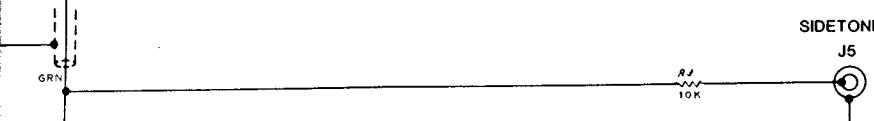
POWER SUPPLY

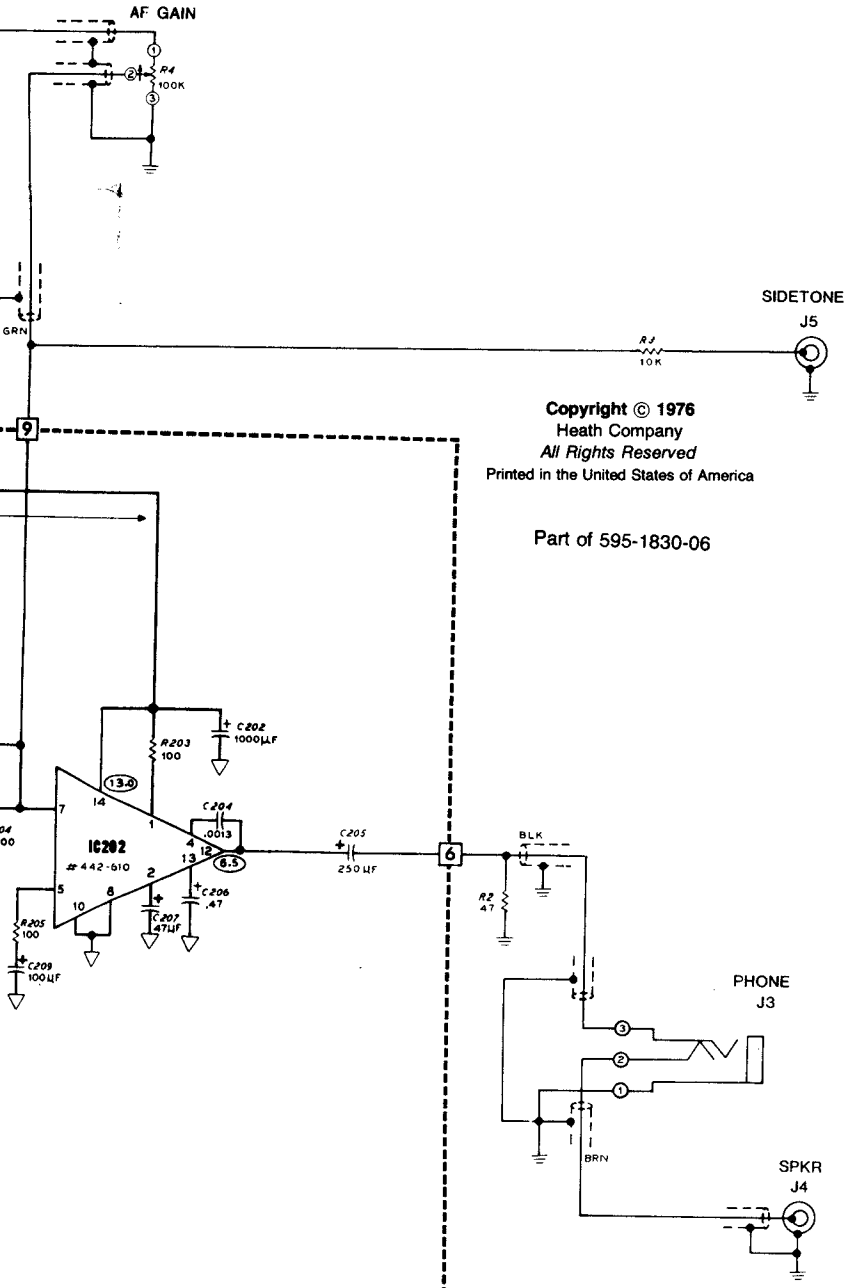












Part of 595-1830-06

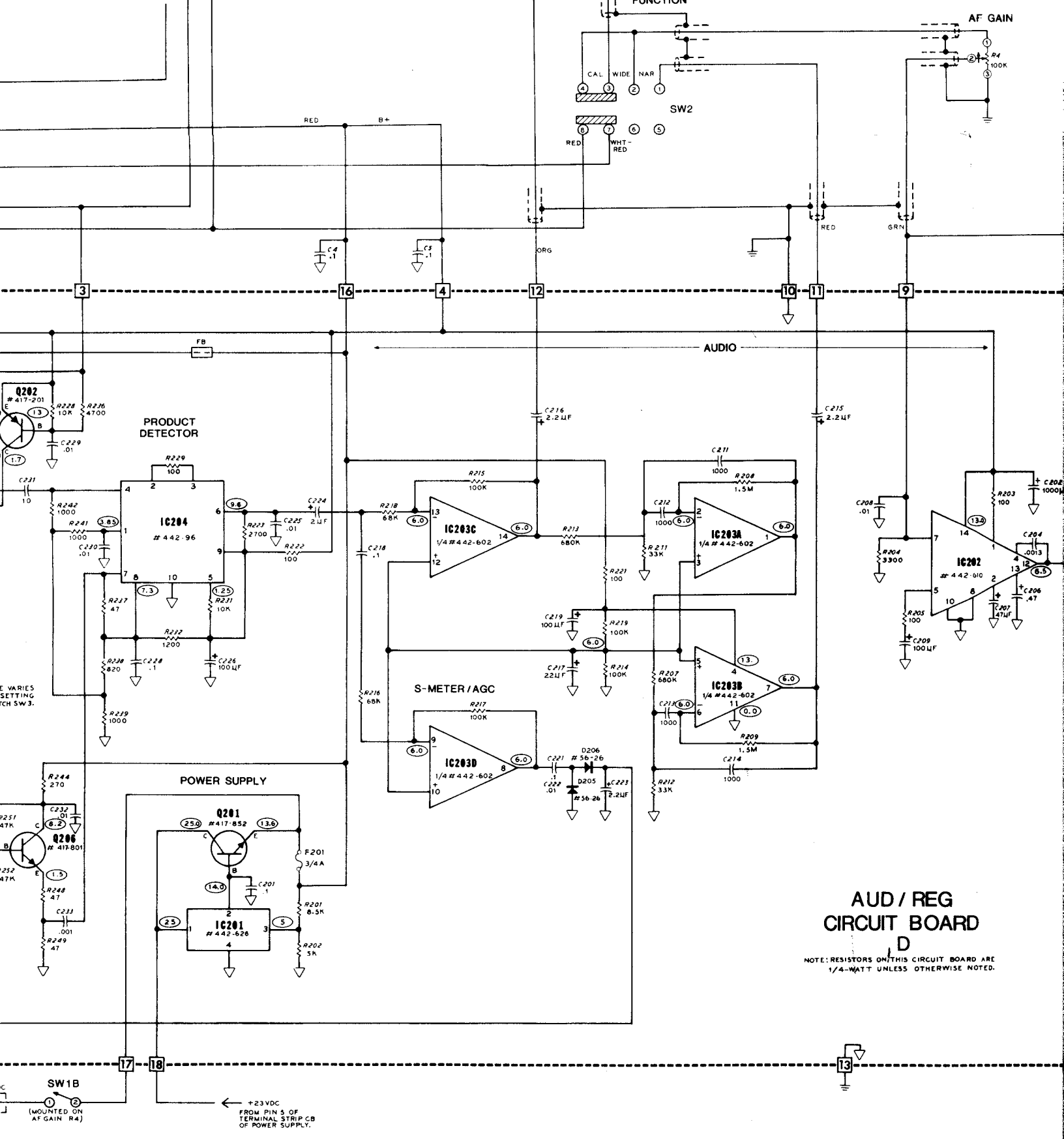
/ REG
BOARD
D
IS CIRCUIT BOARD ARE
SS OTHERWISE NOTED.

SCHEMATIC OF THE HEATHKIT® SSB/CW RECEIVER MODEL HR-1680

NOTES:

1. COMPONENT NUMBERS ARE IN THE FOLLOWING GROUPS:
   1-99 PARTS MOUNTED ON THE CHASSIS.
   100-199 PARTS MOUNTED ON THE FRONT END CIRCUIT BOARD.
   200-299 PARTS MOUNTED ON THE AUD/REG CIRCUIT BOARD.
   300-399 PARTS MOUNTED ON THE VFO CIRCUIT BOARD.
   400-499 PARTS MOUNTED ON THE HFO/XTAL CALIBRATOR CIRCUIT BOARD.
2. ALL RESISTORS ARE 1/2 WATT, 10% TOLERANCE UNLESS OTHERWISE NOTED. RESISTOR VALUES ARE IN OHMS: K=1000, M=1,000,000.
3. CAPACITORS LESS THAN 1 ARE IN µF (MICROFARADS). ALL OTHER CAPACITORS ARE IN pF (PICOFARADS) UNLESS OTHERWISE NOTED.
4. ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION, VIEWED FROM THE SHAFT END OF THE CONTROL.
5. ⬭ THIS SYMBOL INDICATES A POSITIVE DC VOLTAGE MEASURED WITH A HIGH INPUT IMPEDANCE VOLTMETER FROM THE POINT INDICATED TO CHASSIS GROUND. VOLTAGES ARE ±20%.
6. ▽ THIS SYMBOL INDICATES ∴ CIRCUIT BOARD GROUND.
7. ⏚ THIS SYMBOL INDICATES CHASSIS GROUND.
8. □ THIS SYMBOL WITH A NUMBER INDICATES A CIRCUIT BOARD EDGE CONNECTOR.
9. ○ THIS SYMBOL WITH A LETTER INDICATES A PCB PIN.
10. TP= TEST POINT
    FB= FERRITE BEAD
11. SWITCHES ARE SHOWN IN THE FOLLOWING POSITIONS:

    MODE: USB
    FUNCTION: CAL
    BAND: 20


FUNCTION
AF GAIN
R4
100K
CAL
WIDE
NAR
SW2
RED
B+
WHT-
RED
RED
GRN
ORG
C4
.1
C5
.1
3
16
4
12
10
11
9
FB
AUDIO
Q202
#417-201
R228
10K
R236
4700
C229
.01
PRODUCT
DETECTOR
R229
100
C231
10
R242
1000
R241
1000
IC204
#442-96
C230
.01
R223
2700
C225
.01
C224
2.2µF
R222
100
R237
47
R232
1200
R231
10K
R238
820
C228
.1
C226
100µF
R239
1000
E VARIES
SETTING
TCH SW3.
C216
2.2µF
C215
2.2µF
R215
100K
R218
68K
IC203C
1/4 #442-602
R213
680K
C218
.1
R221
100
C211
1000
R208
1.5M
C212
1000
IC203A
1/4 #442-602
R211
33K
C219
100µF
R219
100K
C217
22µF
R214
100K
S-METER/AGC
R216
68K
R217
100K
IC203D
1/4 #442-602
C221
.1
C222
.01
D206
#56-26
D205
#56-26
C223
2.2µF
R207
680K
C213
1000
IC203B
1/4 #442-602
R209
1.5M
C214
1000
R212
33K
R203
100
C208
1000µF
C208
.01
R204
3300
IC202
#442-610
C204
.0013
C206
.47
C207
.47µF
R205
100
C209
100µF
POWER SUPPLY
R244
270
C232
.01
Q206
#417-801
R248
47
C233
.001
R249
47
Q201
#417-852
F201
3/4A
C201
.1
IC201
#442-626
R201
8.5K
R202
5K
AUD/REG
CIRCUIT BOARD
D
NOTE: RESISTORS ON THIS CIRCUIT BOARD ARE
1/4-WATT UNLESS OTHERWISE NOTED.
17
18
13
SW1B
(MOUNTED ON
AF GAIN R4)
+23VDC
FROM PIN 5 OF
TERMINAL STRIP CB
OF POWER SUPPLY.

K4XL's  BAMA

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