

MAINTENANCE SERVICE MANUAL FT-101ZD



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HIGH-PERFORMANCE HF TRANSCEIVER

YAESU FT-101ZD



GENERAL DESCRIPTION

The FT-101Z series was introduced early in 1979 as the culmination of a decade of experience with the FT-101 series. Borrowing heavily from the highly regarded FT-901 series, the FT-101Z series brings together a number of "top of the line" features at a "bottom of the line" price.

As with the FT-901, the receiver section of the FT-101Z is particularly impressive. Careful gain distribution has produced wide dynamic range, without compromising sensitivity. Variable IF bandwidth allows continuous adjustment of the width of the IF passband from 300 Hz to 2.4 kHz, and an all-new noise blanker provides significantly improved blanking capability.

The transmit side includes a high-performance RF speech processor, which provides a significant increase in average power without the distortion found in some AF clipping systems used in other makes of equipment. The final tubes utilize RF negative feedback, for improved linearity.

Built into every FT-101ZD transceiver are digital plus analog readout of the operating frequency, VOX, semi-break-in CW with sidetone, a 25 kHz crystal calibrator, selectable AGC, and a 10 dB/

20 dB attenuator in the receive line. For the economy FT-101Z model, the counter and display units are options, which may easily be added at a later date, should you decide to upgrade your station.

Compatibility with the FT-901DM series accessories lets you take advantage of such advanced features as the scanning and memory of the FV-901DM external synthesized VFO; the FTV-901R VHF/UHF transverter; and the YO-901 Multiscope. Read on for details of these accessories and their use with the FT-101Z.

All circuits, except for the driver and final amplifier tubes, are solid state. If the ratings of the solid state devices are not exceeded, they will exhibit practically infinite lifetimes. The FT-101Z series may be operated from AC supplies of 100/110/117/200/220/234 volts, and a DC-DC converter is an available option.

The pages to follow will describe more fully the high-performance features and ease of operation of the FT-101ZD. For today's active amateur, the 101Z series is, indeed, "THE RADIO."

SPECIFICATIONS

Frequency coverage:

160 m	1.8 - 2.0 MHz
80 m	3.5 - 4.0 MHz
40 m	7.0 - 7.5 MHz
▲ 30 m	10.0 - 10.5 MHz
20 m	14.0 - 14.5 MHz
▲ 17 m	18.0 - 18.5 MHz
15 m	21.0 - 21.5 MHz
▲ 12 m	24.5 - 25.0 MHz
10 m	28.0 - 29.9 MHz

(▲ After Prod. #17)

Power requirements:

AC	100/110/117/200/220/234 volts, 50/60 Hz
DC	13.5 volts \pm 10% (DC-DC converter optional)

Power consumption:

AC	85 VA receive (73 VA HEATER OFF) 330 VA transmit
DC	5.5 amps receive (1.1 amps HEATER OFF) 21 amps transmit

Size:

345 (W) x 157 (H) x 326 (D) mm

Weight:

Approx. 15 kg.

TRANSMITTER

Emission type:

LSB, USB, CW, AM, FM

(AM... After Prod. #8, AM or FM...

After Prod. #24)

Power input:

180 watts DC (SSB, CW)
50 watts DC (AM, FM)

Carrier suppression:

Better than 40 dB

Unwanted sideband suppression:

Better than 40 dB (14 MHz, 1 kHz)

Spurious radiation:

Better than 40 dB down

Transmitter frequency response:

300 - 2700 Hz (−6 dB)

Third order distortion products:

Better than 31 dB down

Transmitter frequency stability:

Less than 300 Hz after 10 minute warmup;
less than 100 Hz after 30 minute warmup.

Antenna output impedance:

50 - 75 ohms, unbalanced

Modulation:

- A3J : Balanced modulator
- A3 : Amplitude modulation of a low power stage
- F3 : Variable-reactance frequency modulation, max. deviation \pm 5 kHz.

Microphone input impedance:

500 - 600 ohms (low impedance)

RECEIVER

Sensitivity:

- 0.25 μ V for S/N 10 dB (SSB, CW)
- 0.5 μ V for S/N 10 dB (AM)
- 0.3 μ V for 20 dB noise quieting (FM)

Image rejection:

- Better than 60 dB (160 - 12 m)
- Better than 50 dB (10 m)

IF rejection:

- Better than 70 dB (160, 80, 20 - 10 m)
- Better than 60 dB (40 m, 30 m)

Selectivity:

- SSB 2.4 kHz (−6 dB); 4.0 kHz (−60 dB)
- CW* 0.6 kHz (−6 dB); 1.2 kHz (−60 dB)
- CW** 350 Hz (−6 dB); 1.2 kHz (−60 dB)
- AM*** 3.6 kHz (−6 dB); 6.8 kHz (−60 dB)
- FM*** 12 kHz (−6 dB); 24 kHz (−60 dB)

Bandwidth control:

Continuous from 2.4 kHz to 300 Hz

Audio output impedance:

4 - 16 ohms

Audio output:

3 watts at 10% THD, 4 ohm load

* with optional 600 Hz CW filter

** with optional 350 Hz CW filter

*** with optional unit

Specifications subject to change without notice.

TUBES AND SEMICONDUCTORS

Vacuum Tubes		Field Effect Transistors		Schottky Barrier Diode		FM Unit	
12BY7A	1	2SK19GR	9	ND487C2-3R	1	IC	
6146B	2	2SK19BL	1			μ PC577H	1
		3SK40M	1	Silicon Diodes		Field Effect Transistors	
Transistors		3SK51-03	7	1S1555	80	2SK125	1
T20A6 *	2	3SK73	1	10D1	8	3SK51-03	1
2SA495	1	J310	2	10D10	8	Transistors	
2SA496Y	2			V06B	2	2SA733Q	1
2SA564A	3	Integrated Circuits (IC)		1SS53	6	2SC535B	1
2SA639	1	μ PA54H	1	Varactor Diodes		2SC945Q	13
2SA733	1	μ PC78L05	1	1S2209	1	Diodes	
2SA952L	13	μ PC78L12	1	1S2236	1	1S188FM	4
2S3616	1	μ PC7805H	1	FC63	1	1S1555	1
2SC372Y	25	μ PC14308	1	Zener Diodes		1SS53	8
2SC373	2	μ PC2002H	1	WZ061	1	FC63	1
2SC380TMY	3	MC3403P	1	WZ090	2	MV103	1
2SC535A	1	MC14024B	1	Light Emitting Diodes			
2SC732TMGR	1	MSM9520RS	1	GD4-203SRD	9		
2SC1000GR	2	SN76514N	1	LED Display			
2SC1383	1	SN74LS123N	1	HP5082-7623	6		
2SC1583	2	TA7060P	1				
2SC1674L	1	TA7063P	1				
2SC1815Y	6	Germanium Diodes					
2SC1815GR	1	1N60	11				
2SC2407	2	1S1007(GB)	11				
MPSA13	1						

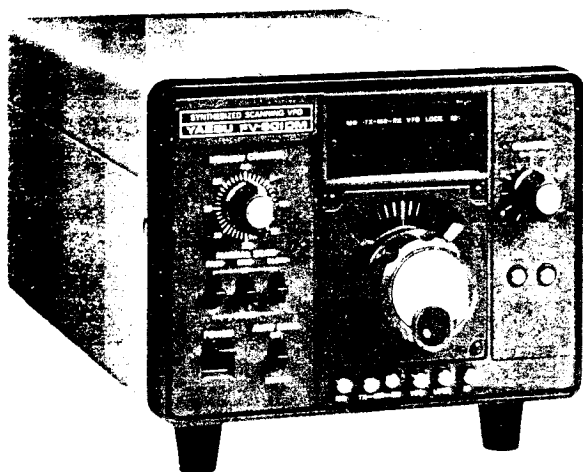
FT-101ZD SERIES MODEL CHART

O = BUILT-IN FEATURE X = AVAILABLE OPTION

FEATURE	FT-101ZD	FT-101Z
ALL BAND CRYSTALS	O	O
COUNTER UNIT	O	X
DC-DC CONVERTER	X	X
CW FILTER	X	X
MICROPHONE	X	X
RF PROCESSOR	O	O
COOLING FAN	X	X
*AM UNIT (After Prod. #8)	X	X
*FM UNIT (After Prod. #24)	X	X

*Either FM or AM Unit can be installed in your FT-101ZD.

RECOMMENDED ACCESSORIES



FV-901DM



FTV-901R

**FV-901DM SYNTHESIZED, SCANNING
REMOTE VFO**

The FV-901DM external VFO provides a synthesized control system for your FT-101ZD station. A three-speed scanner will take you anywhere in the band instantly, and the auto-scan feature will sweep the band until it finds a signal.

The 100 Hz steps of the synthesizer are coupled with a 40-frequency memory bank, allowing wide versatility for contest, DX, or net operation. The TX/RX clarifier allows offset from either dial or memory frequencies, for precise tuning.

Because there is no display provided on the FV-901DM, it is not readily possible to use this unit with the analog FT-101Z, as the operating frequency cannot be determined.

FTV-901 VHF/UHF/OSCAR TRANSVERTER

In another Yaesu "first," the FTV-901R brings together three bands in the VHF and UHF regions, all in one compact case. The basic FTV-901R comes equipped for 144–148 MHz, and the 6 meter and 70 cm modules may be added as options.

The satellite 1–3 bands provide operation on OSCAR Modes A/B/J, on full duplex, when an external receiver is used. Of course, the FT-221R or FT-225RD transceivers may be used for transmission on the OSCAR 145 MHz uplink. In this case, your FTV-901R can be used for instant QSY between 29 MHz, 145 MHz, and 435 MHz.

Repeater split is provided on 6 and 2 meters.



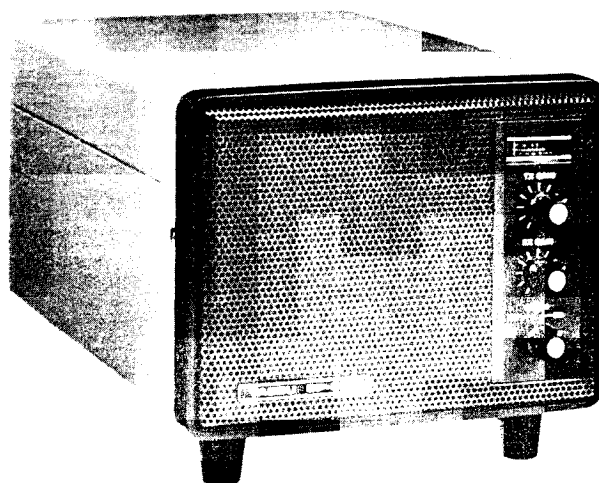
YO-901

YO-901 MULTISCOPE

The YO-901 Multiscope provides superb monitoring capability, with instant interface to your FT-101ZD station. Output signal monitoring, trapezoidal and two-tone tests, and general oscilloscope measurements are made with ease with the YO-901.

A panoramic adapter, known as the Band Scope, is an available option, allowing quick examination of the band for activity.

IF TX and RX monitoring is not possible with the FT-101ZD/YO-901 combination.



SP-901P

SP-901P SPEAKER/HYBRID PHONE PATCH

The SP-901P features a shaped-response loudspeaker, and the hybrid phone patch allows efficient operation during patches. Styling and size match the FT-101Z series.

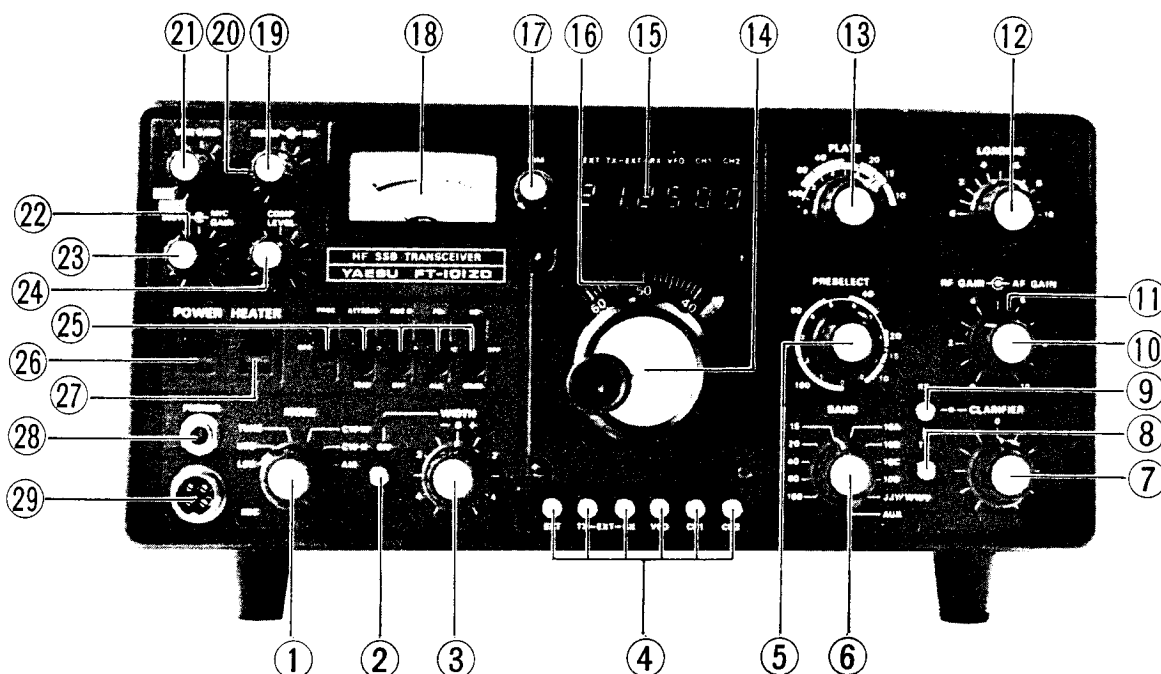


FC-901

FC-901 ANTENNA COUPLER

Present a 50 ohm load to your FT-101ZD transceiver all across the band with the FC-901 antenna coupler. As many as three coax-fed antennas, and one random wire antenna, may be accommodated. SWR and power metering allow quick determination of proper matching conditions.

CONTROLS AND SWITCHES

**(1) MODE**

Selection of LSB, USB, CW-W (SSB filter), CW-N (optional CW filter) and AM is provided.

(2) WIDTH ON

When this button is pressed, the variable bandwidth function is activated.

(3) WIDTH

This control varies the IF bandwidth from 2.4 kHz down to 300 Hz. When the WIDTH switch is OFF, the bandwidth is fixed by the filter selected at the MODE switch.

(4) SELECT switches

When using the optional FV-901DM synthesized, scanning external VFO, these switches determine which component will control the transmit, receive, or transceive frequency.

EXT..... This switch, when pressed, shifts control of the transceive frequency to the external VFO.

TX EXT... This switch, when pressed, shifts control of the transmit frequency to the external VFO.

RX EXT... This switch, when pressed, shifts control of the receive frequency to the external VFO.

VFO..... This switch selects control of the transceive frequency on the FT-101ZD internal VFO.

CH1, CH2. . These switches select optional fixed channels, transceive only.

(5) PRESELECT

The preselector control peaks the RF and IF stages for the frequency in use.

(6) BAND

The bandswitch selects the frequency band in use: 160 - 10 meters, plus WWV/JJY 5 MHz.

(7) CLARIFIER

The clarifier control allows offset of ± 2.5 kHz from the frequency established by the main tuning dial.

(8) (9) CLARIFIER SELECT switches

Press the RX button for offset of the receive frequency.

Press the TX button for offset of the transmit frequency.

Press both buttons for offset of the transceive frequency.

(10) AF GAIN

The AF GAIN control varies the output level of the audio amplifier stages. Clockwise rotation increases the audio output level.

(11) RF GAIN

The RF GAIN control varies the gain of the RF and IF stages. Clockwise rotation increases the gain of these stages.

(12) LOADING

This control tunes the output circuit of the final amplifier pi network to match the feedpoint impedance of the load.

(13) PLATE

This control tunes the plate circuit of the final amplifier.

(14) MAIN TUNING KNOB

Rotation of this knob selects the operating frequency, in conjunction with the setting of the bandswitch. One revolution of the dial produces a frequency change of approximately 17 kHz.

(15) DIGITAL DISPLAY

The digital display reads out the operating frequency, with resolution to 100 Hz. The display unit is built into the FT-101ZD, and is an available option for the FT-101Z.

(16) ANALOG DIAL

The analog dial allows readout of the operating frequency to better than 1 kHz. The combination of the precision dial mechanism and drive unit provides zero backlash at slow tuning rates.

(17) DIM

This control allows dimming of the meter and dial lamps.

(18) METER

The meter displays final amplifier cathode current (IC), relative power output (PO), and ALC feedback voltage.

(19) NB

This control varies the threshold point for the noise blanker, and should be set to the minimum point that provides the desired blanking action.

(20) DELAY

This control sets the delay time for the VOX relay. For voice-actuated SSB, or semi-break-in CW, the operator may select the delay time most suitable for his or her operating habits.

(21) VOX GAIN

The threshold level for the VOX (voice operated relay) system can be varied using this control. In the PTT position, PTT (push to talk) control is provided, for relay control via the microphone PTT switch or footswitch.

(22) DRIVE

This control sets the carrier level for CW/AM and tuning purposes. When the RF processor is ON, this control varies the RF output on SSB, as well.

(23) MIC GAIN

This control sets the output level of the microphone amplifier stage. Clockwise rotation increases the mic gain level.

(24) COMP LEVEL

This control varies the compression level for the built-in RF speech processor. The processor does not function in the AM mode.

(25) FUNCTION switches

PROC This switch activates the RF speech processor.

ATT This switch allows the insertion of 10 or 20 dB attenuators in the incoming signal path.

AGC S/F/OFF . . This switch allows selection of the desired AGC decay time. In the OFF position, the AGC is switched off, and the S-meter will not function.

PO/IC/ALC In the PO position, relative power output is displayed on the meter. In the IC position, final amplifier cathode current is displayed. In the ALC position, ALC voltage is displayed. Regardless of the setting of the meter switch, the meter functions as an S-meter on receive.

NB/MARK In the NB position, the noise blanker is activated. In the MARK position, the internal crystal calibrator is activated.

GENERAL

(26) POWER

This is the main ON/OFF switch for the transceiver.

(27) HEATER

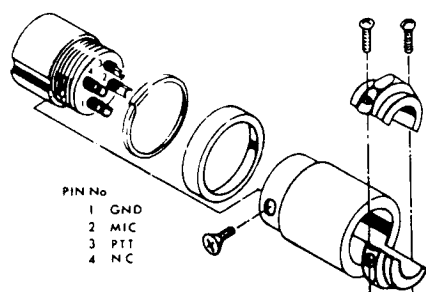
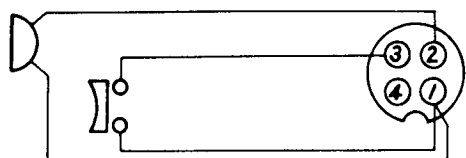
With the HEATER switch on, heater voltage is applied to the driver and final amplifier tubes. This switch may be turned off during periods of RX, when energy conservation is critical.

(28) PHONES

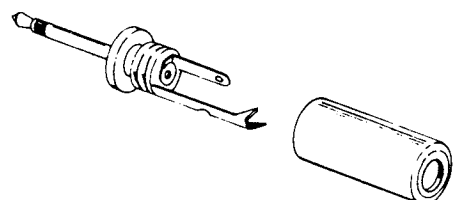
This is a standard 1/4" phone jack for use with headphones.

(29) MIC

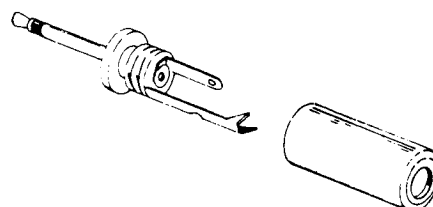
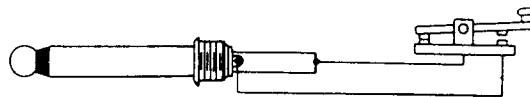
This is a 4 conductor jack for microphone and PTT input.



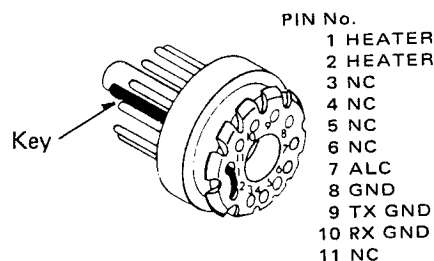
Mic plug



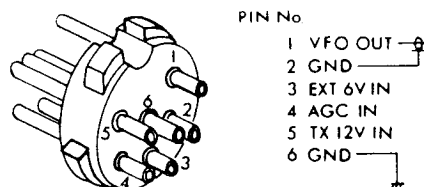
Headphone and external speaker plug



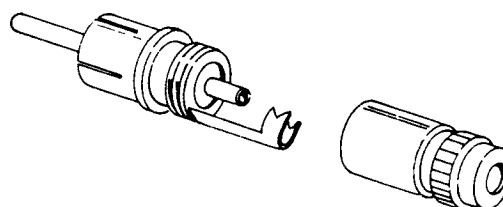
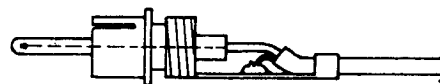
Key plug



ACC plug (After Prod. #24)

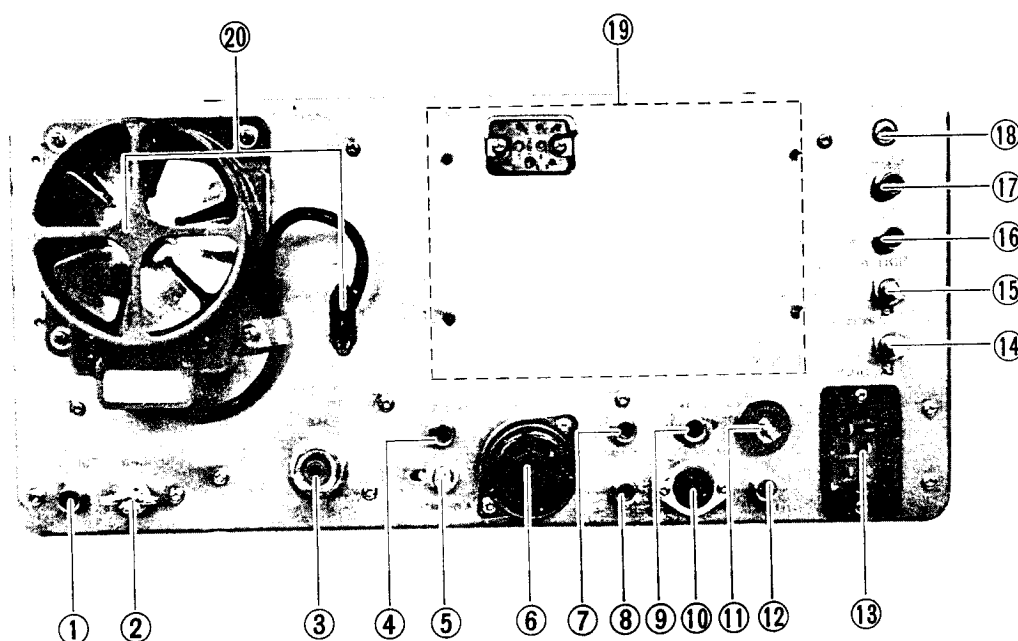


VFO Plug



Pin plug

REAR APRON

**(1) RF OUT**

RF output of 3 volts RMS is available at this jack for use with a transverter. Output is from the driver stage.

(2) GND

For best transceiver performance, as well as protection from electrical shock, a good ground connection should be made at this point, using a heavy, braided wire of the shortest length possible.

(3) ANT

Standard "UHF" connector for the antenna.

(4) RCV ANT

This jack is switched in parallel with the ANT jack on receive, for use with an external receiver.

(5) PO ADJ

This control adjusts the relative power output meter.

(6) ACC

Transceiver operating voltages and relay connections can be accessed through the accessory jack. Please insert the ACC plug at all times, to provide heater voltage for the driver and final amplifier tubes.

(7) TONE OUT

The CW sidetone may be fed to an external receiver through this jack.

(8) A TRIP IN

Anti-trip input from an external receiver may be made via this jack, to prevent the receiver audio output from tripping the FT-101ZD VOX.

(9) KEY

The CW key may be connected at this point. Key-up voltage is 7 volts, and key-down current is 1.5 mA. Be sure your electronic keyer's output switch will handle these levels.

(10) EXT VFO

Connection of an external VFO, such as the FV-901DM, can be made at this jack.

(11) FUSE

This is the fuse holder. For 100 - 117 volts, replace with only a 5 amp use. For 200 - 234 volts, use a 3 amp fuse. Replace fuses only with a fuse of the proper rating.

(12) IF OUT

Wideband IF output is available at this jack for use with a spectrum analyzer, etc.

GENERAL

(13) POWER

Connect the AC power cord at this point, being certain that your AC supply voltage matches the voltage specification for your transceiver. See the transformer primary connection chart. When using the optional DC-DC converter, the DC supply is connected at this point. **DO NOT CONNECT THE AC POWER CORD TO A DC POWER SOURCE. OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY SUCH IMPROPER POWER CONNECTIONS.**

(14) TONE

This control varies the CW sidetone output level.

(15) A TRIP

This control varies the level of the VOX anti-trip circuit.

(16) PTT

External control of the transceiver PTT (push to talk) system may be made at this jack, for use with a footswitch, etc.

(17) PATCH

Microphone or phone patch input may be made at this jack. Impedance is 500 ohms.

(18) EXT SP

This is a miniature phone jack for speaker output. When a plug is inserted into this jack, the transceiver internal speaker will be cut off. Impedance is 4 - 16 ohms.

(19) DC-DC CONVERTER (OPTION)

The optional DC-DC converter allows operation from a 13.5 volt DC power source.

(20) COOLING FAN (OPTION)

The optional cooling fan keeps the tubes at a safe operating temperature, when they are used in a hot environment. The 2 pin fan power jack supplies 100 volts to the fan.

ACCESSORIES

The following accessories are included with your new transceiver:

(1) AC POWER CORD 1

The power cord comes equipped with a 6-prong connector for connection to the AC supply.

(2) ACC PLUG 1

The accessory plug allows access to relay contacts and transceiver operating voltages. The ACC plug must be inserted in the accessory socket for proper operation of the transceiver, whether or not external connections are being made.

(3) PHONO PLUG 2

Use these plugs for interface with station equipment via the FT-101ZD rear panel.

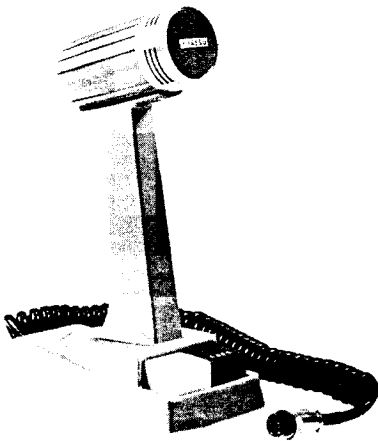
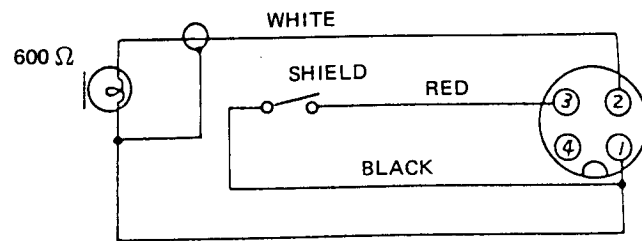
(4) SPARE FUSES 5A (3A) 1 each

When replacing fuses, be absolutely certain to use a fuse of the proper rating. **OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY IMPROPER FUSE REPLACEMENT.** For 100 - 117 volt AC operation, use a 5 amp fuse. For 200 - 234 volt operation, use a 3 amp fuse.

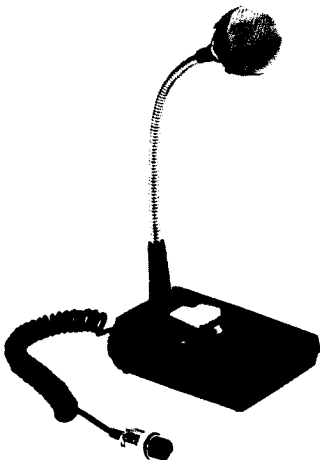
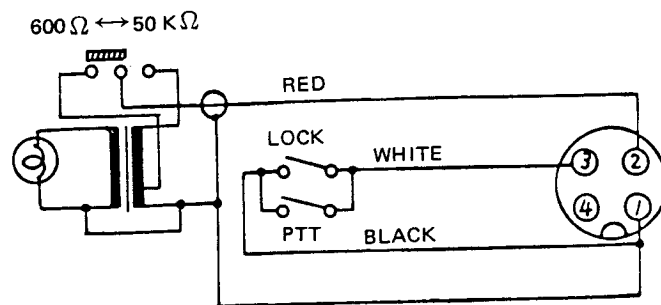
MICROPHONE CONNECTIONS



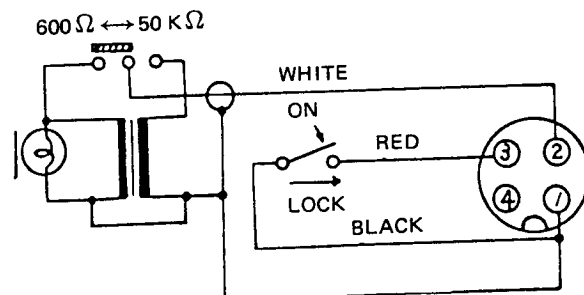
YE-7A



YD-844A



YD-148



INTERCONNECTIONS

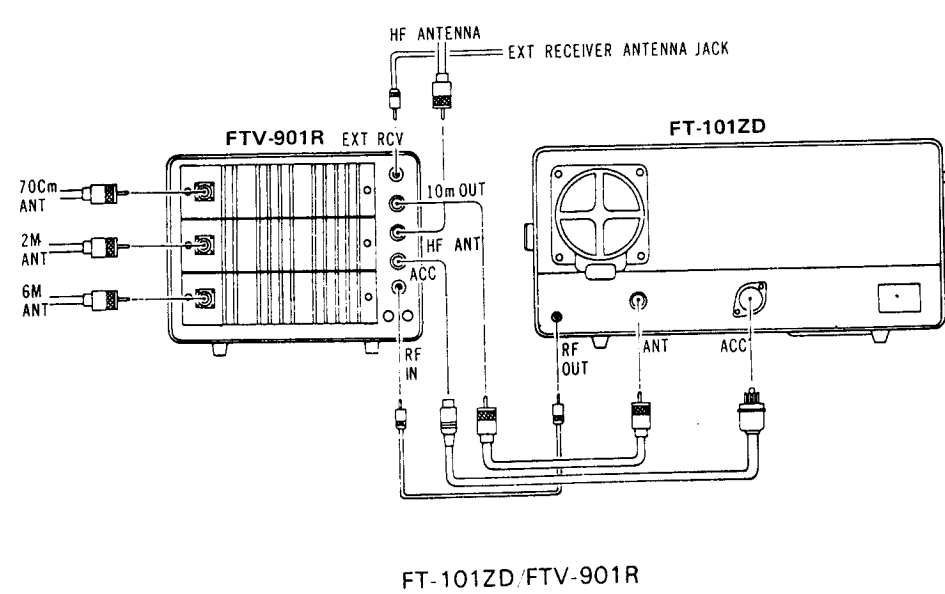
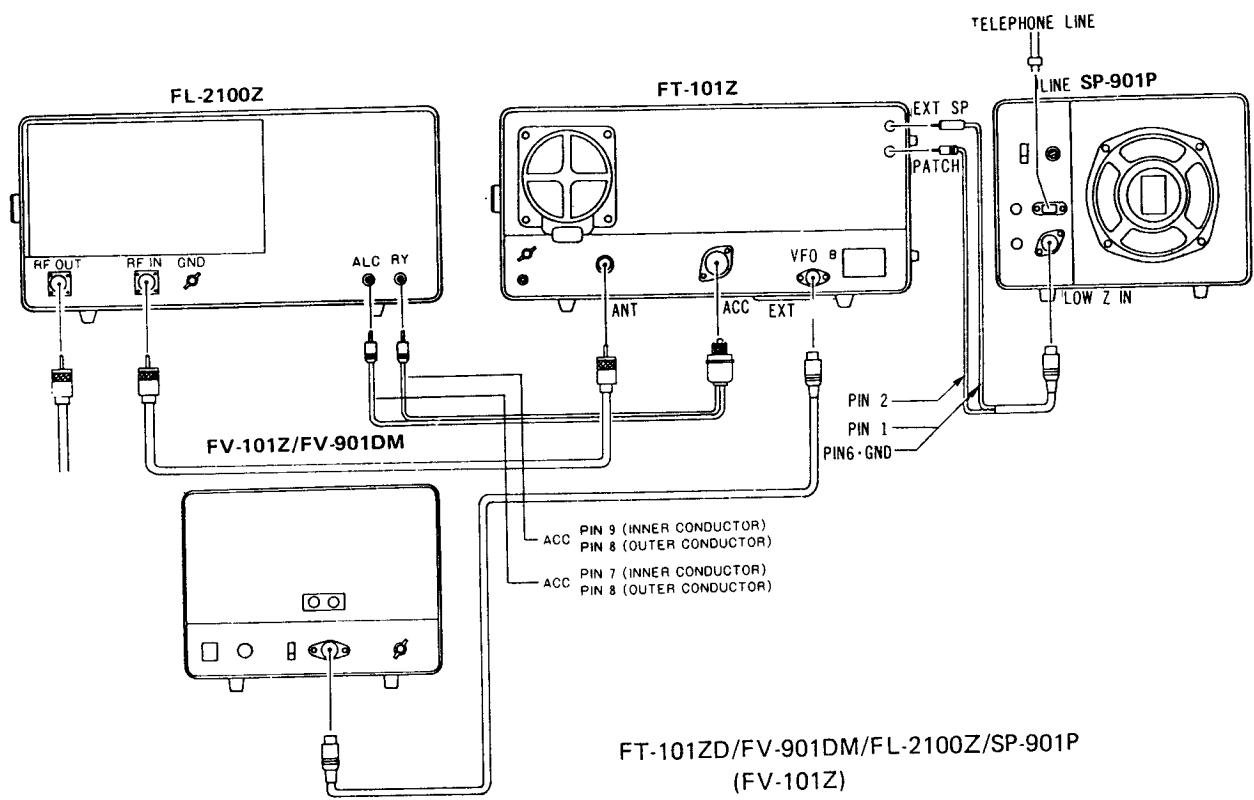
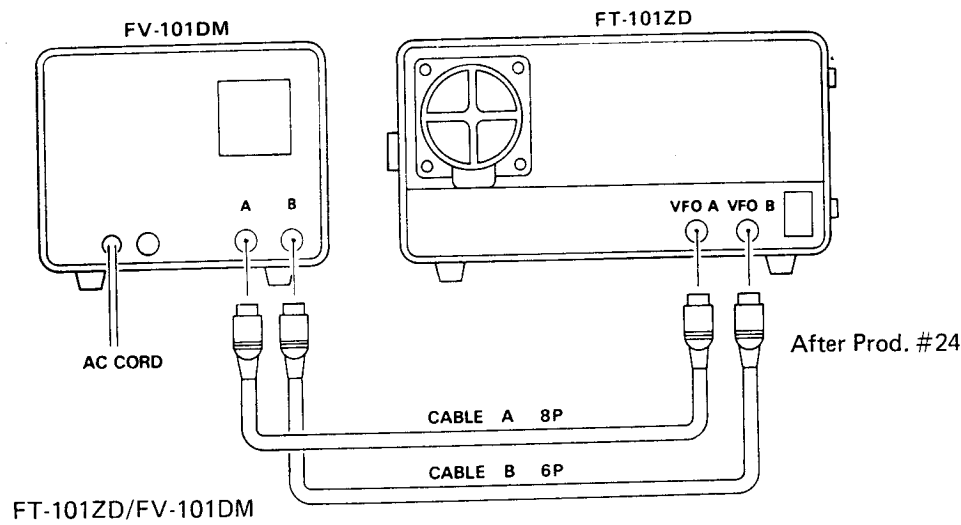


Diagram illustrating the connection of the FT-101Z receiver to the YO-901 antenna system. The FT-101Z receiver (left) has ports for ANT, ACC, and IF OUT. The YO-901 antenna system (right) has ports for ACC1, ACC2, BAND SCOPE, and ANTENNA. The connections are as follows:

- CABLE 1** connects the IF OUT port of the FT-101Z to the ANTENNA port of the YO-901.
- CABLE 2** connects the ACC port of the FT-101Z to the ACC1 port of the YO-901.
- CABLE 6** connects the ANT port of the FT-101Z to the ANTENNA port of the YO-901.
- The **FT-101Z ACC PLUG** is connected to the ACC2 port of the YO-901, which is labeled **TO AN ANTENNA**.

Connect cable 3 to front panel MIC jack
OR
Connect cable 1 to rear panel PATCH jack
YO-901

FT-101Z

YO-901

FL-2100F

ANT

ACC

ACC 1

ACC 2

ANTENNA EXCITER

RF OUT

RF IN

CABLE 5

CABLE 2

CABLE 6

TO ANTENNA

TONE OUT

PIN 8

PIN 7

PIN 9

1-13

INSTALLATION

The FT-101ZD is designed to be a single-unit station for fixed or portable operation from AC power. Power supply connections providing for operation from a variety of source voltages are available. Please read the following sections carefully, so as to ensure proper installation of your new transceiver.

PRELIMINARY INSPECTION

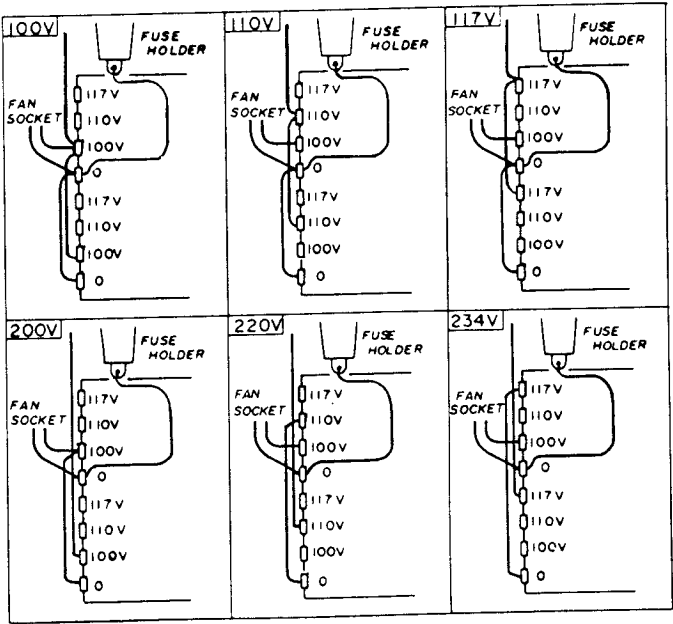
Upon opening the packing carton, immediately give the transceiver a thorough visual inspection. Check to see that all controls and switches are working freely, and inspect the cabinet for any signs of damage. If any damage has been sustained, immediately contact the shipping company, and document the damage completely. Save the packing carton and foam packing material for possible use at a later date.

BASE STATION INSTALLATION

The FT-101ZD is designed for use in many areas of the world, using supply voltages that may differ from your local supply voltage. For this reason, be absolutely certain that the voltage specification marked on the rear of the transceiver agrees with the local AC supply voltage. **THIS INSPECTION MUST BE MADE BEFORE CONNECTING THE AC POWER CORD TO THE REAR APRON OF THE TRANSCEIVER.**

CAUTION

PERMANENT DAMAGE WILL RESULT IF IMPROPER AC SUPPLY VOLTAGE IS APPLIED TO THE TRANSCEIVER. OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY APPLICATION OF IMPROPER SUPPLY VOLTAGE. DO NOT CONNECT THE AC POWER CORD TO A DC POWER SOURCE.



The transceiver should be connected to a good earth ground. The ground lead should be made of a heavy, braided wire, and should be connected to the GND terminal on the rear apron of the transceiver.

MOBILE INSTALLATION

(Note: The DC-DC converter described herein is optional equipment. See your Yaesu dealer.)

When the optional DC-DC converter is installed, the FT-101ZD will operate satisfactorily from a 13.5 volt DC power source capable of providing the required current. The DC power cord is included with the DC-DC converter kit.

For under-dash mobile mounting, a special mobile mounting bracket is an available option for your transceiver. The FT-101ZD should be located away from heater ducts, and a minimum of two inches of air space on all sides is recommended, to allow proper air flow around the cabinet. Never stack other units above or below the FT-101ZD, as the accumulated heat from both units could cause damage.

The transceiver requires an average of 14 amps on transmit, with 20 amps on voice peaks. The DC power cable comes equipped with a 20 amp fuse. Be certain to use only a 20 amp fuse when making replacements.

When making battery connections, be absolutely certain that the RED lead is connected to the POSITIVE battery terminal, and the BLACK lead is connected to the NEGATIVE battery terminal. Reversed connections could cause permanent damage to the transceiver. **OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY IMPROPER SUPPLY CONNECTIONS.**

It is recommended that the power connections be made directly to the battery, instead of to the ignition switch, etc. The battery provides considerable filtering action against ignition noise, and connection to the ignition switch can place the power line in a noisy circuit. Keep the power lead as short as possible, and keep the lead away from ignition cables.

Before connecting the DC power cable to the transceiver, check the battery voltage with the engine running (battery charging). If the voltage exceeds 15 volts DC, the vehicle voltage regulator should be adjusted, so as to limit the highest charging rate to less than 15 volts. As well, do not operate the transceiver if the DC supply voltage is less than 12 volts. The transceiver should always be turned off when the car is started, to prevent voltage transients from damaging the power supply components.

ANTENNA CONSIDERATIONS

The FT-101ZD is designed for use with an antenna system presenting a 50 - 75 ohm resistive load at the antenna jack. While the transmitter output circuitry is designed for uniform response within this impedance range, significant departures from the 50 - 75 ohm specification will result in seriously degraded transceiver performance, and may result in damage to the final amplifier tubes.

If an open-wire feedline is used, or if the input impedance of the antenna system presents a higher or lower impedance than specified, some sort of antenna tuner must be used to provide the proper impedance for the transceiver. See your Yaesu dealer for details of the FC-901 antenna coupler.

For mobile operation, most of the commercially-available antennas will provide satisfactory results, if care is taken to tune the antenna for minimum SWR. The outer conductor of the coaxial cable should be securely grounded to the automobile chassis at the antenna mount. See your Yaesu dealer for details on the RSL series of mobile antennas.

The tuning procedure for this transceiver is not complicated. However, care should be exercised when tuning so that peak performance of the equipment is secured. The following paragraphs describe the procedure for receiver and transmitter tuning.

INITIAL CHECK

Before connecting the transceiver to the power source, be certain that the voltage specification marked on the rear of the transceiver matches your local supply voltage, and also confirm that a fuse of the proper rating is being used.

FREQUENCY SELECTION

Frequency readout on the FT-101ZD is by digital as well as analog displays. The FT-101Z uses analog display only. The analog readout dial provides resolution to 1 kHz, while the FT-101ZD digital display provides resolution to 100 Hz. The digital display may be added to the FT-101Z as an option. See your Yaesu dealer for details.

RECEIVE OPERATION

- (1) Preset the controls and switches as follows:

POWER OFF
 HEATER OFF
 VFO Switch pushed
 VOX GAIN . . PTT position
 RF GAIN Fully clockwise
 AF GAIN . . . Adjust later for comfortable level
 BAND Desired band
 MODE Desired mode
 PRESELECT . Desired band segment
 AGC OFF
 ATT OFF
 MARK/NB . . . OFF

▲ APF/NOTCH . Fully counterclockwise

- (2) Turn the power switch to ON. The meter will light up, and the operating frequency will be displayed on the dial window (FT-101ZD). Adjust the AF GAIN control for a comfortable listening level, and adjust the PRESELECT control for maximum receiver noise or signal level. The PRESELECT control may require repeaking as the transceiver is tuned across the band. ▲ After Prod. #24

- (3) The RX CLARIFIER may be utilized if the received signal is drifting. Push the RX button, and rotate the CLARIFIER control for offset of up to 2.5 kHz. A red LED indicator will light up when the clarifier is in use.
- (4) When pulse-type noise is encountered, the NB (Noise Blanker) switch should be activated. Advance the noise blanker level control (located on the front panel) to the point which provides the desired blanking. Do not advance the level control beyond the point required to eliminate the noise pulses.
- (5) For varying the width of the IF passband, rotate the WIDTH control. In the IF, two 8-pole crystal filters are used. One filter is fixed, and presents a boundary for the bandwidth. The center frequency is then varied across the passband of the second filter, using a mixing scheme that provides no change of pitch in the received signal.

The result is a continuously variable bandwidth, from 2.4 kHz down to approximately 300 Hz. With the WIDTH control in the "0" position, the second IF filter is instantly aligned with the first filter, returning the receiver to a 2.4 kHz bandwidth.

- (6) For extremely strong signals, the ATT (attenuator) switch may be activated, providing 10 dB or 20 dB of attenuation on the incoming signal path, depending on the position of the ATT switch.
- ▲ (7) Under conditions of very heavy QRM, while operating CW, the APF (Audio Peak Filter) may be activated. Push the APF/NOTCH button to APF, and tune the APF/NOTCH control for maximum enhancement of the desired signal. The operator will observe that the background noise will be reduced dramatically, resulting in excellent signal to noise ratio.
- ▲ (8) For elimination of an interfering carrier within the AF passband, set the APF/NOTCH switch to NOTCH. Then rotate the APF/NOTCH control carefully for the best nulling of the offending carrier. The notch is extremely sharp, so tuning is critical, but the excellent notch depth is extremely effective in eliminating interference.

TRANSMITTER TUNING

The following tuning procedure must be performed prior to commencing operation on the desired mode. See the paragraphs relating to the specific mode after basic transmitter tune-up has been accomplished.

Be certain that a dummy load or matched antenna is connected to the antenna receptacle on the rear apron of the transceiver. It is possible to damage the final amplifier components of this equipment if this simple precaution is not followed prior to commencing transmission.

Do not exceed 10 seconds of key-down time while tuning.

As well, be certain that the ACC plug is inserted into the rear apron ACC jack. Without this plug, there will be no power applied to the tube heaters. Heater voltage is applied through pins 1 and 2 of the accessory socket.

- (1) Preset the controls and switches as follows:
 MODE TUNE
 DRIVE Fully counterclockwise
 DELAY Fully counterclockwise
 MIC GAIN Fully counterclockwise
 COMP LEVEL ... Fully counterclockwise
 HEATER ON
 PROC OFF
 PO/IC/ALC IC
 PLATE Set to desired band segment
 LOADING 0
 PRESELECT Peaked on receive for maximum response
 TX CLARIFIER .. OFF (button not pushed)
- (2) Turn the HEATER switch ON, and wait 1 minute for the tube heaters to warm up.
- (3) Set the VOX GAIN switch to the MOX position. Observe the reading on the IC meter: it should read 50 mA with no drive applied. If it is not, adjust the PB-1968 BIAS control for a resting current of 50 mA on the IC meter. Refer to the BIAS Adjustment in Page 41. Be certain that the DRIVE control is fully counterclockwise for this adjustment.
- (4) Set the VOX GAIN switch to MOX. Advance the DRIVE control for a reading of 150 mA.

- (5) Peak the PRESELECT control for a maximum meter reading. If the meter reading exceeds 150 mA, reduce the setting of the DRIVE control.
- (6) Rotate the PLATE control for a minimum reading ("dip") on the IC meter. Return the transceiver to the receive mode by rotating the VOX GAIN switch out of the MOX position.

LOADING POSITIONS

BAND	FREQUENCY	POSITION
160m	1.8MHz	2.5
	2.0MHz	6.0
80m	3.5MHz	3.0
	4.0MHz	6.0
40m	7.0MHz	6.0
	7.5MHz	6.5
▲ 30m	10.0MHz	7.0
	10.5MHz	7.8
20m	14.0MHz	3.0
	14.5MHz	4.0
▲ 17m	18.0MHz	2.0
	18.5MHz	2.0
15m	21.0MHz	2.0
	21.5MHz	2.5
▲ 12m	24.5MHz	3.0
	25.0MHz	3.0
10m A	28.0MHz	2.0
10m B	28.5MHz	2.0
10m C	29.0MHz	2.0
10m D	29.5MHz	2.0

▲ After Prod. #17

NOTE: LOADING positions are nominal. Minor variations from positions shown are to be expected.

FINAL TUNING

Final transmitter tuning uses the relative power output setting of the METER switch. At full rated output, using a 50 ohm load, the PO meter will indicate between 1/2 and 2/3 of full scale deflection. If the PO reading is too high (off scale) or too low (1/4 scale or less), and if the load impedance is very close to 50 ohms, the PO ADJ control on the rear apron may be varied to provide the proper deflection. Once the PO meter is calibrated, off-scale deflections are the result of reflected power (high SWR), and corrective action may be required in the antenna system.

Set the controls as follows for final tuning:

- (1) Set the METER switch to PO. Rotate the DRIVE control to the 9 o'clock position.

GENERAL

- (2) Rotate the VOX GAIN control to the MOX position, and rotate the PRESELECT control for a maximum meter reading.
- (3) Rotate the LOADING control for a maximum meter reading. Rotate the PLATE control for a maximum meter reading.
- (4) Again rotate the LOADING control and PLATE control, each time advancing the DRIVE control approximately 2 steps, until the DRIVE control is fully clockwise. The transmitter is now tuned for maximum power output. Do not exceed the maximum tuning time stipulated previously. Return the VOX GAIN switch to the VOX position (out of the MOX position), return the METER switch to IC, and return the DRIVE control to the fully counterclockwise position.

SSB OPERATION

After completing the above tuning procedure, set the MODE switch to USB or LSB as desired. Set the VOX GAIN control to PTT, and activate the transmitter by pushing the microphone PTT switch or the footswitch, if used. With the METER switch set to the ALC position, speak into the microphone in a normal voice. Advance the MIC GAIN control until the meter kicks up to the midscale of the green-colored portion of the meter scale.

Note: When the METER switch is set to IC, voice modulation peaks will indicate 150 - 200 mA. Actual peak current, though, is approximately 2 times the indicated value.

To set the sensitivity of the VOX (voice-operated T/R switching) system, advance the VOX GAIN control slowly while speaking into the microphone. Advance the VOX GAIN control to the point where the speech signal activates the transmitter.

Set the antitrip potentiometer on the rear apron to the minimum point which prevents the speaker output from tripping the VOX. Do not use more VOX gain nor antitrip than is necessary. Adjust the front panel DELAY control for the desired relay recovery time.

RF SPEECH PROCESSOR ADJUSTMENT

The FT-101ZD RF speech processor, when correctly adjusted, will improve the intelligibility threshold at the receiving end, by increasing the average SSB power output. RF clipping is applied to the IF signal, which is then filtered to remove harmonics and out of band intermodulation products. RF envelope clipping causes much less distortion than that caused by an equivalent amount of AF clipping, and the result is an output signal with more "punch".

Set the PROC switch to OFF, and set the MIC GAIN control as described previously (voice peaks falling within the green zone of the ALC meter scale). Now set the PROC switch to ON, and set the COMP LEVEL control to the 10 o'clock position. Advance the DRIVE control so that the desired power output is obtained, and be sure that the ALC meter indication is within the green zone.

With the RF speech processor activated, the ALC meter indication may not be quite as high as when the processor is off. This is entirely normal, because the average power output is higher with the processor, although the peaks are being clipped.

Setting the COMP LEVEL control up to the 3 o'clock position will provide up to 10 dB of compression. Advancing the control beyond the 10 o'clock point may, however, degrade the voice-to-noise ratio, so caution is recommended.

CW OPERATION

After completing the tuning procedure, insert the key line into the KEY jack on the rear panel.

The operator may select any power output desired by advancing the DRIVE control. Once the maximum power output level has been reached, the DRIVE control should not be advanced further.

The transmitter may be activated by the VOX circuit, or by the PTT or MOX systems. The TONE control on the rear apron of the transceiver sets the CW sidetone level.

The key-up voltage at the key jack is 7 volts, and the key-down current is 1.5 mA.

For receiving, two positions of selectivity are provided. When the optional CW filter is installed, the operator may select between the 600 Hz bandwidth of the CW filter and the 2.4 kHz bandwidth of the SSB filter. The WIDTH control may be used with either position of the MODE switch: CW-W or CW-N.

AM OPERATION (with optional AM unit) (After Prod. #8)

AM operation of the transmitter is accomplished by setting the MODE switch to the AM/FM position and inserting the proper amount of carrier with the DRIVE control.

After completing basic transmitter tune-up, place the MODE switch in the AM/FM position. Activate the transmitter, and rotate the DRIVE control until the meter reads .10 (100 mA) in the IC position of the METER switch. While speaking into the microphone in a normal voice, increase the MIC GAIN control until the meter indicates very slight movement with voice peaks. Care must be exercised that the DRIVE control is not advanced too far. Do not exceed .10 (100 mA) meter indication during AM operation or damage to the transmitter final amplifier tubes may result.

FM OPERATION (with optional FM unit) (After Prod. #24)

After completing the basic transmitter tune-up, set the CARR control for 100 mA carrier level with the MODE switch in the AM/FM position. Speak into the microphone in a normal voice. The MIC GAIN and COMP LEVEL controls have no effect on the FM mode.

For FM reception, the SQL control on the front panel should be advanced only as far as required to silence background noise. When adjusted just past the silencing threshold, the squelch circuitry will provide noise-free reception with maximum sensitivity to weak FM signals.

Note: Either AM unit or FM unit can be installed in your FT-101ZD

SELECT SWITCHES

The SELECT switches allow selection of internal or external VFO frequency control, as well as selection of up to 2 optional crystal-controlled channels.

When the crystal-controlled channels are installed, they may be selected by pressing CH1 or CH2, as desired. See the crystal information elsewhere for full information on crystal requirements.

The external VFO, FV-101Z, FV-101DM and FV-901DM, which provide versatile operations with your FT-101ZD, are available from your Yaesu dealer.

Because there is no calibrated dial for the FV-901DM, it can't be used with the analog FT-101Z.

For transceive frequency control on the external VFO, press EXT. For external VFO control of the transmit frequency, with receive frequency control on the FT-101ZD, press TX EXT. For receive frequency control on the external VFO, and transmit frequency control on the FT-101ZD, press RX EXT. For full transceive control on the FT-101ZD, press VFO.

DIAL CALIBRATION AND FREQUENCY DETERMINATION

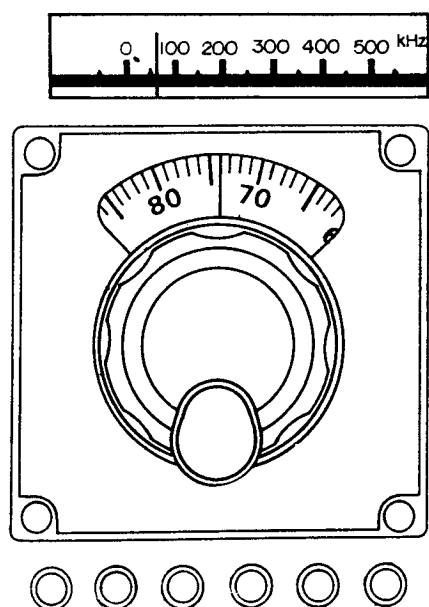
The FT-101ZD mixing scheme accounts for the difference in carrier frequencies between USB and LSB. For this reason, no recalibration is required. Once the calibration is properly aligned (at the factory, or in shop), no further adjustment is required for accurate frequency derivation. The 25 kHz calibrator is included largely for alignment purposes, as it provides a useful reference signal for signal peaking, etc.

Frequency readout on the FT-101ZD digital display is straightforward. The full operating frequency is displayed, with resolution to 100 Hz.

The analog display on the FT-101Z and FT-101ZD transceivers provides easy determination of the operating frequency. The frequency displayed on the analog sub dial (and the main display window, for the FT-101Z) is added to the lower band edge frequency.

GENERAL

For example, if the analog dial indicates 074, as shown in the example, and the BAND switch is on 40 meters (lower band edge: 7000 kHz), the operating frequency will be 7074 kHz. By rotating the BAND switch, this position of the analog display will produce 14074 kHz for 20 meters, 21074 for 15 meters, etc. For 80 and 12 meters, the lower band edges are 3500 kHz and 24500 kHz while for 160 meters the band edge is 1.5 MHz. Therefore, the dial should read 074 to produce 3574 kHz, but 374 for 1874 kHz. Be careful so as not to operate outside the amateur bands.



For operation on 21420 kHz USB, compute the crystal frequency as follows:

$$F_x = 26498.5 - 21420 = 5078.5 \text{ kHz.}$$

Inspection of the values of F_1 in Table 1 will reveal that the 7199 kHz crystal for LSB will work on 14199 kHz, 21199 kHz, etc. Of course, LSB is not normally used on these bands. If the operator switches to USB, the operating frequency will be moved $\frac{1}{2}$ kHz (in this case, to 14196 kHz, 21196 kHz, etc.). If the move is made from LSB to CW, the frequency will move 2.3 kHz down.

BAND \ MODE	U S B	L S B	CW/AM,FM
160m	6998.5	7001.5	6999.2
80m	8998.5	9001.5	8999.2
40m	12498.5	12501.5	12499.2
▲ 30m	15498.5	15501.5	15499.2
20m	19498.5	19501.5	19499.2
▲ 17m	23498.5	23501.5	23499.2
15m	26498.5	26501.5	26499.2
▲ 12m	29998.5	30001.5	29999.2
10m A	33498.5	33501.5	33499.2
10m B	33998.5	34001.5	33999.2
10m C	34498.5	34501.5	34499.2
10m D	34998.5	35001.5	34999.2

Table 1

(▲ After Prod. #17)

FIXED CHANNEL CRYSTAL INFORMATION

Two fixed channels may be used with your FT-101ZD, using optional crystals. Crystals are available from your Yaesu dealer. Crystals must meet the specifications shown in Table 2, and must fall within the operating range 5500 - 5000 kHz. Frequency calculation is made from the formula

$$F_x = F_1 - F_0$$

where F_x is the crystal frequency

F_1 is a constant derived from Table 1

F_0 is the operating frequency.

For example, let us say it is desired to operate on 7199 kHz LSB. Referring to Table 1, we see that for 40 meter LSB, F_1 is 12501.5 kHz. Subtracting F_0 (7199 kHz) from F_1 (12501.5 kHz) yields 5302.5 kHz, the crystal frequency (F_x).

Type	HC-25/U
Load Capacitance	30pF
Series Resistance	25 Ohms or less
Static Capacitance	7pF or less
Drive Level	5mW

Table 2

SECTION 2 – TECHNICAL NOTES

PARTS DESIGNATIONS ON CIRCUIT BOARDS	2-1
AUGMENTED BLOCK DIAGRAMS	2-2
FREQUENCY RELATIONSHIPS/CRYSTAL DATA	2-7
CIRCUIT DESCRIPTION	2-8

PART DESIGNATIONS ON CIRCUIT BOARDS

FT-101Z CIRCUIT BOARDS

The FT-101Z series integrates the “mother board” concept and the “plug-in” type of circuit card. Each circuit board used in the FT-101Z has a code number assigned to it, and each part within the transceiver has a part number assigned to it (e.g. Q₅₀₂).

Parts numbers 01–99 (e.g. R₁₂) are located on the main chassis. Other parts, located on the circuit boards, are assigned a three or four digit part number; the last two digits are the part number for that particular board, while the first one or two digits are the code number for the board.

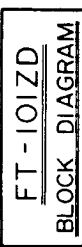
Thus, Q₃₀₁ is transistor number 01, located on circuit board number 3, which is the PREMIX UNIT. Refer to the accompanying chart for a tabulation of the code numbers assigned to the various circuit boards used in the FT-101Z series.

Code #	Unit	Board Designation
1	RF	PB-1960A (PB-2154)
2	NB/FIX	PB-1961B
3	PREMIX	PB-1962A (PB-2152)
4	IF	PB-1963B
5	AF	PB-1964A
6	PREMIX LOCAL	PB-1965 (PB-2153)
7	SELECT SW.	PB-1966C
8	VFO	PB-1440B-3420
9	RECT A	PB-1967
10	RECT B	PB-1968A
11	CAPACITOR	PB-1969A
12	TRIMMER A	PB-1970 (PB-2193B)
13	TRIMMER B	PB-1970 (PB-2192B)
14	TRIMMER C	PB-1092
15	BW CONT (APF)	PB-1972 (PB-2217)
16	DRIVER	PB-1714A
17	FINAL	PB-1715A
18	CLAR CONT	PB-1973A
19	LED	PB-1974A
20	LEVER SW	PB-1975A
21	DISPLAY	PB-1978 (PB-2098A)
22	COUNT/DECODE	PB-1979
23	COUNTER MAIN	PB-1980 (PB-2086A)
24	AM	PB-2040
25	FM	— (PB-2218)
32	DC-DC CONV	—

SIGNAL TRACING IN THE FT-101ZD

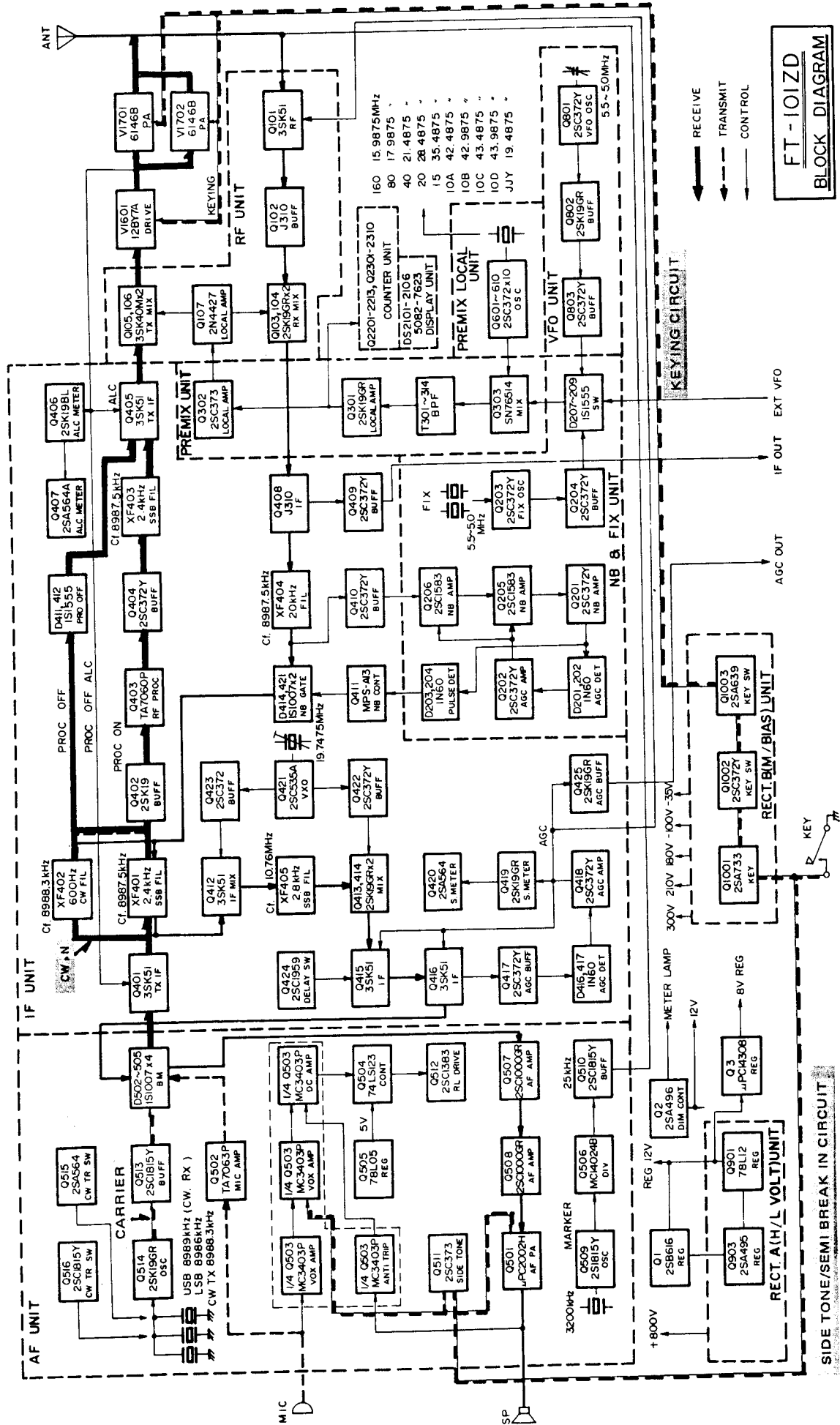
A highly useful signal in the FT-101ZD, one that can be used for most receiver alignment steps, is the internal calibrator. Fed into the receive line right at the antenna terminal, the calibrator signal should read about S9 + 10 dB, with the preselector peaked, at 14.200 MHz, SSB mode. While minor variations from this figure are no cause for alarm, a blown RF amplifier FET will cause this reading to be practically nil.

In the following section, we have presented augmented block diagrams which should help you in tracing the signal paths throughout the FT-101ZD. Armed with a couple of alignment wands and the calibrator signal, receiver peaking can be completed in short order, leaving you free to diagnose problems on the TX side.

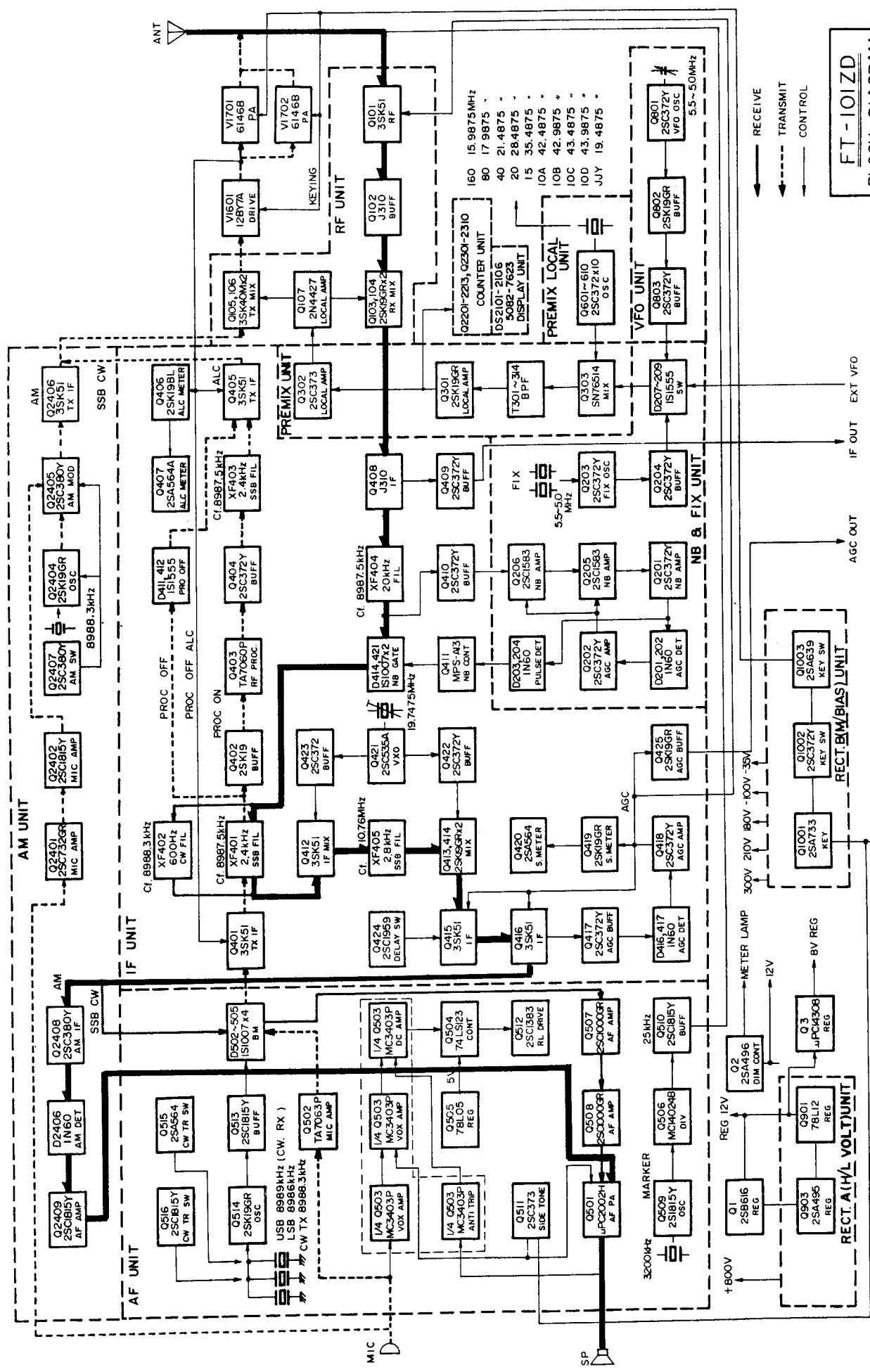




CW MODE TX



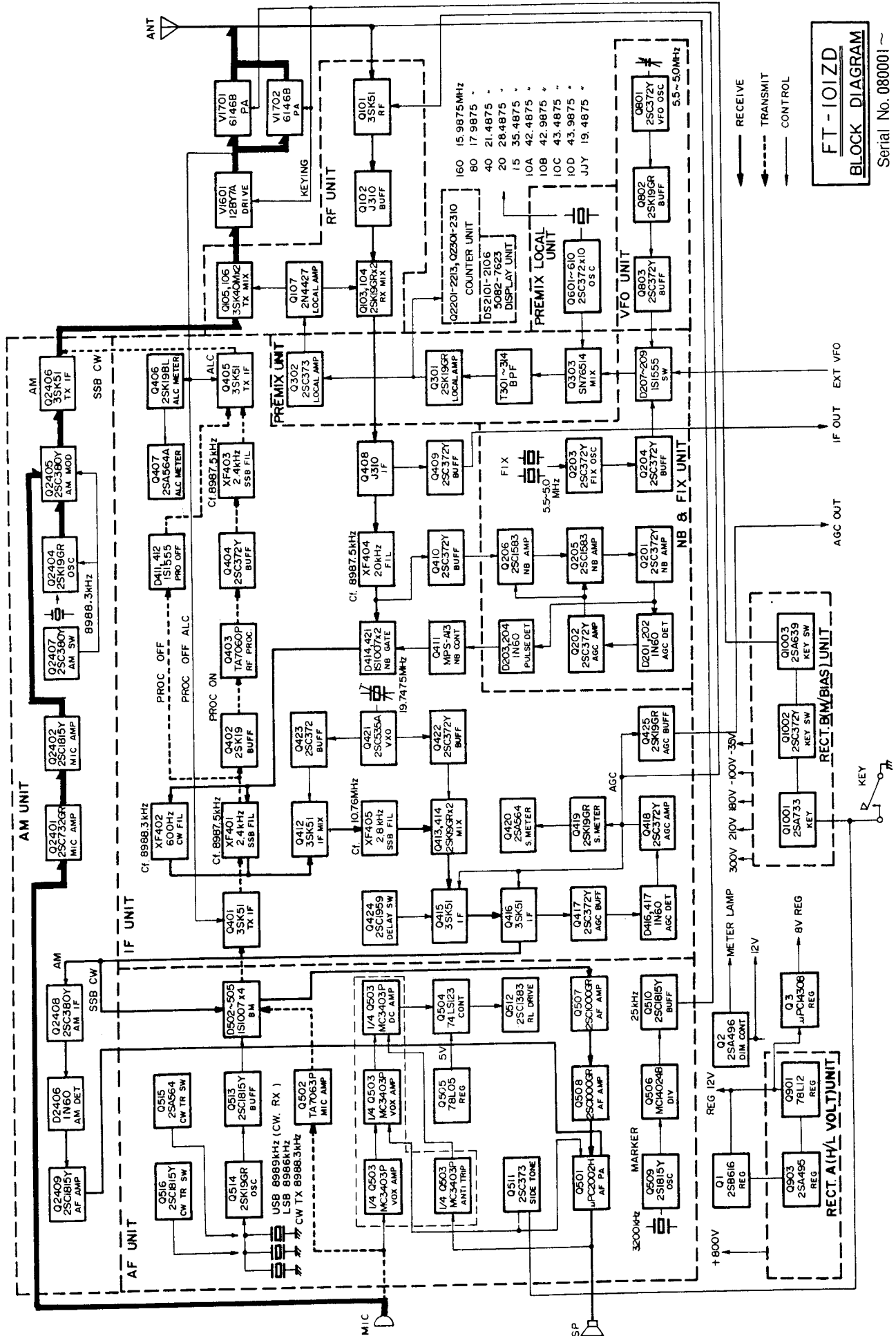
AM MODE RX



FT-101ZD
BLOCK DIAGRAM

Serial No. 080001 ~

AM MODE TX

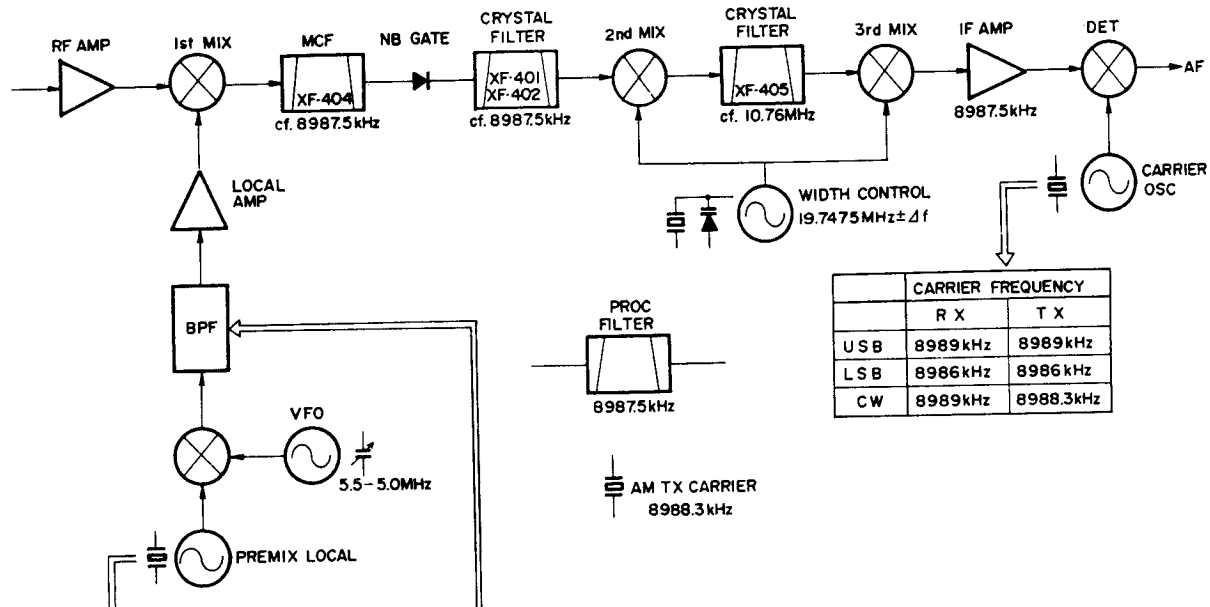


FT-101ZD
BLOCK DIAGRAM

Serial No. 080001 ~

RECEIVE
TRANSMIT
CONTROL

FREQUENCY RELATIONSHIPS



BAND	FREQUENCY
160 m	15.9875 MHz
80	17.9875
40	21.4875
30 [▲]	24.4875
20	28.4875
17 [▲]	32.4875
15	35.4875
12 [▲]	38.9875
10A	42.4875
10B	42.9875
10C	43.4875
10D	43.9875

BAND	RANGE
160 m	10.4875–10.9875 MHz
80	12.4875–12.9875
40	15.9875–16.4875
30 [▲]	18.9875–19.4875
20	22.9875–23.4875
17 [▲]	26.9875–27.9875
15	29.9875–30.4875
12 [▲]	33.4875–33.9875
10	36.9875–38.9875

▲ After Prod. #17)

CRYSTAL DATA FT-101ZD

UNIT	FUNCTION	HOLDER	FREQUENCY (kHz)	MODE	LOAD C (pF)	EFFECTIVE RESISTANCE	DRIVE LEVEL
CRYSTAL	160 m	HC-18/U	15987.5	3rd overtone	30	80 (Ω)	2 mW
	80 m	"	17987.5	"	"	60	"
	40 m	"	21487.5	"	"	45	"
	▲ 30 m	"	24487.5	"	"	45	"
	20 m	"	28487.5	"	"	40	"
	▲ 17 m	"	32487.5	"	"	40	"
	15 m	"	35487.5	"	"	40	"
	▲ 12 m	"	38987.5	"	"	40	"
	10 m(A)	"	42487.5	"	"	40	"
	10 m(B)	"	42987.5	"	"	40	"
	10 m(C)	"	43487.5	"	"	40	"
	10 m(D)	"	43987.5	"	"	40	"
	WWV (5 MHz)	"	19487.5	"	"	40	"
CARRIER	LSB	HC-18/U	8986	Fundamental	35	30	10 mW
	USB	"	8989	"	"	35	"
	CW	"	8988.3	"	"	35	"
	AM	"	8988.3	"	"	35	"
IF	Width	"	★ cf. 19747.5	Fundamental	"	15	2 mW
COUNTER	Local	"	18000	"	"	15	10 mW
	Local	"	18500	"	"	15	"
	Clock	HC-14/W	655.36	"	23	7K	2 mW
VOX/MARK	Marker	HC-6/W	3200	"	"	50	5 mW

★ XCO FREQUENCY : 19743–19753 kHz
Decided by circuit

(▲ After Prod. #17)

CIRCUIT DESCRIPTION

The block diagram and following circuit description will provide you with a better understanding of the design of this transceiver. The circuit description is tailored to the full-feature FT-101ZD, and the reader should note that the counter unit and digital display are optional features for the FT-101Z.

The FT-101ZD consists of a premix-type single conversion system, using a 9 MHz IF for all modes of operation.

RECEIVER

The RF input signal from the antenna is fed through antenna relay RL_2 , lamp fuse FH_2 , attenuator switch S_{2004} (located on the LEVER SW unit, PB-1975), 9 MHz trap L_{2101} and C_{1207} (located on the TRIMMER A UNIT), and input transformer T_1 to pin 3 of the RF UNIT.

RF UNIT (PB-1960) Early model (before Prod. #17)

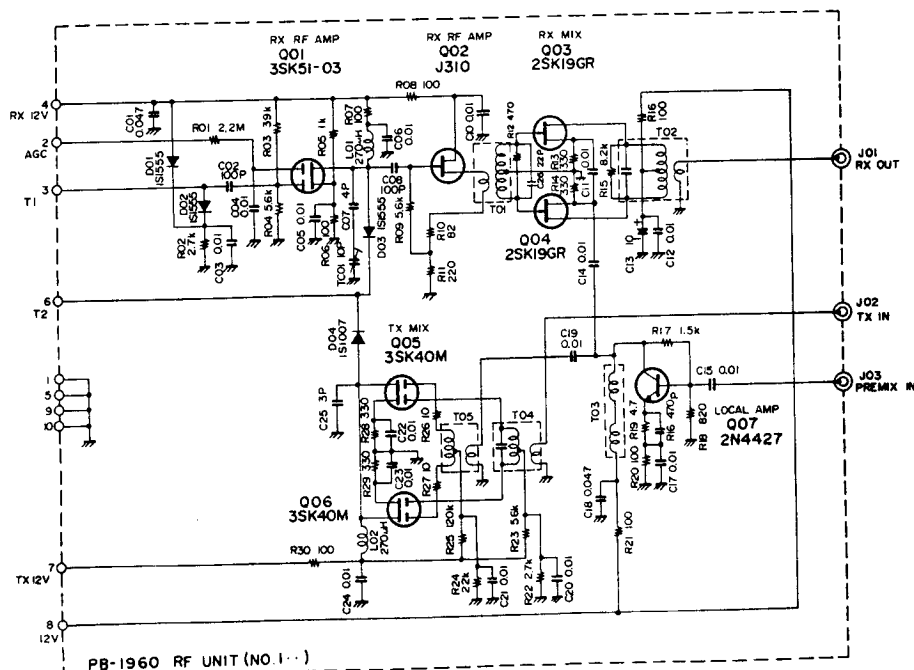
The incoming signal is amplified by the RF amplifier, Q_{101} (3SK51-03), a dual-gate MOSFET used in a grounded source configuration. This transistor has superior immunity from intermodulation distortion. The amplified signal is then fed through a source follower, Q_{102} (J310), to the

balanced mixer consisting of Q_{103} and Q_{104} (2SK19GR), where the input signal is heterodyned with the local oscillator signal. The local signal is delivered from buffer amplifier Q_{107} (2N4427), and the resulting IF signal of 8.9875 MHz is fed through T_{102} to J_{101} .

The input and output of the RF amplifier are permeability-tuned circuits, resulting in high sensitivity and excellent rejection of unwanted out-of-band signals.

IF UNIT (PB-1963)

The IF signal at pin 9 of J_{403} is amplified by Q_{408} (J310) and passed through a monolithic filter, XF_{404} , which has a ± 10 kHz bandwidth. The monolithic filter provides early protection from IMD, while providing a wide-bandwidth point for noise blanking. The IF signal is then fed to noise blanker gate D_{414} , D_{412} (1S1007), which functions as an ON/OFF switch controlled by noise blanker driver Q_{411} (MPSA13).



The IF signal is then passed through the SSB filter XF₄₀₁ (or optional CW filter XF₄₀₂). Selection of the filter to be used is made by diodes D₄₀₅ - D₄₀₈ (1S1007), depending on the mode of operation.

The IF signal is then fed to the IF first mixer, Q₄₁₂ (3SK51-03), where the incoming signal is heterodyned with a 19.7475 MHz $\pm \Delta f$ local signal delivered from crystal oscillator Q₄₂₁ (2SC535A) and buffer amplifier Q₄₂₃ (2SC372Y), resulting in a signal of 10.76 MHz $\pm \Delta f$.

The new 10.76 MHz $\pm \Delta f$ signal is fed through filter XF₄₀₅ to the IF second mixer, Q₄₁₃/Q₄₁₄ (2SK19GR), where the filtered signal is heterodyned with the 19.7475 MHz $\pm \Delta f$ signal delivered from Q₄₂₂ (2SC372Y), resulting in an 8.9875 MHz IF signal, the same as the original IF.

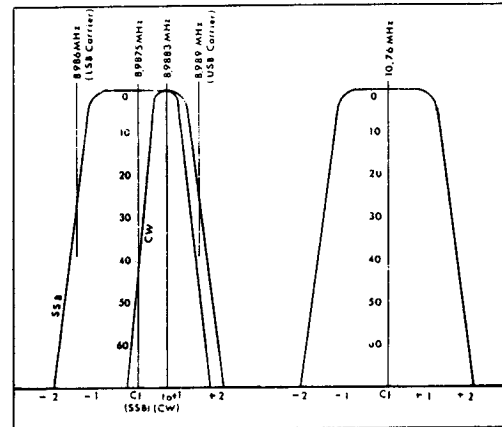
This process varies the IF signal across the passband of the second IF filter. The combination of the two filters, XF₄₀₁ and XF₄₀₅, provides continuously variable width of the IF passband. The frequency of crystal oscillator Q₄₂₁ is varied by varactor diode D₄₁₈ (1S2209).

The output from the IF second mixer is fed to a two-stage IF amplifier, consisting of Q₄₁₅ and Q₄₁₆ (3SK51-03), and delivered through diode switch D₄₀₁ (1S1555) to the AF UNIT.

A portion of the output from Q₄₁₆ is rectified by D₄₁₆ and D₄₁₇ (1N60) to produce AGC voltage. Q₄₁₇ (2SC372Y) provides the necessary buffering between the IF and AGC circuits. The AGC voltage is amplified by Q₄₁₈ (2SC372Y), and applied to gate 2 of the RF and IF amplifiers, to control the gain of these stages. The AGC voltage is also amplified by Q₄₁₉ (2SK19GR) for S-meter indication.

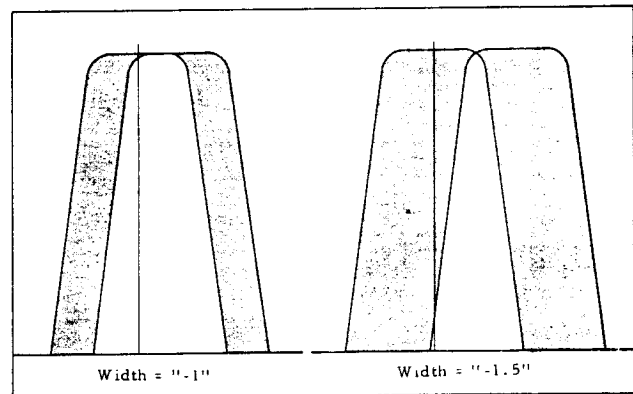
For use with the FV-901DM scanning VFO, or other optional equipment, the AGC voltage is fed through buffer Q₄₂₅ (2SK19GR) and fed to the AGC OUT terminal on the EXT VFO jack, located on the rear panel.

On AM, the output signal from Q₄₁₆ is amplified by Q₂₄₀₈ (2SC380Y) and passed to the AM detector, D₂₄₀₆ (1N60). The resulting audio signal is amplified by Q₂₄₀₉ (2SC1815Y) and delivered to the final audio stage.

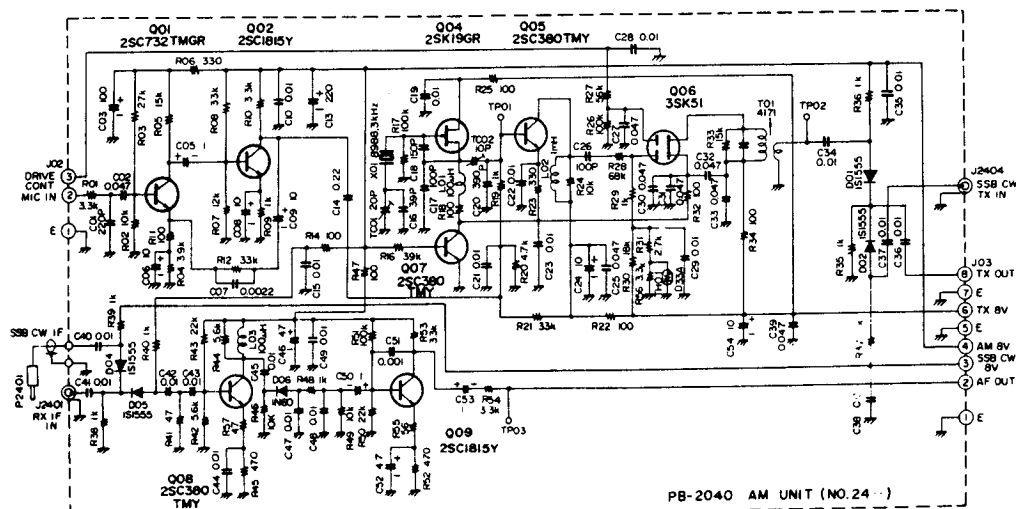


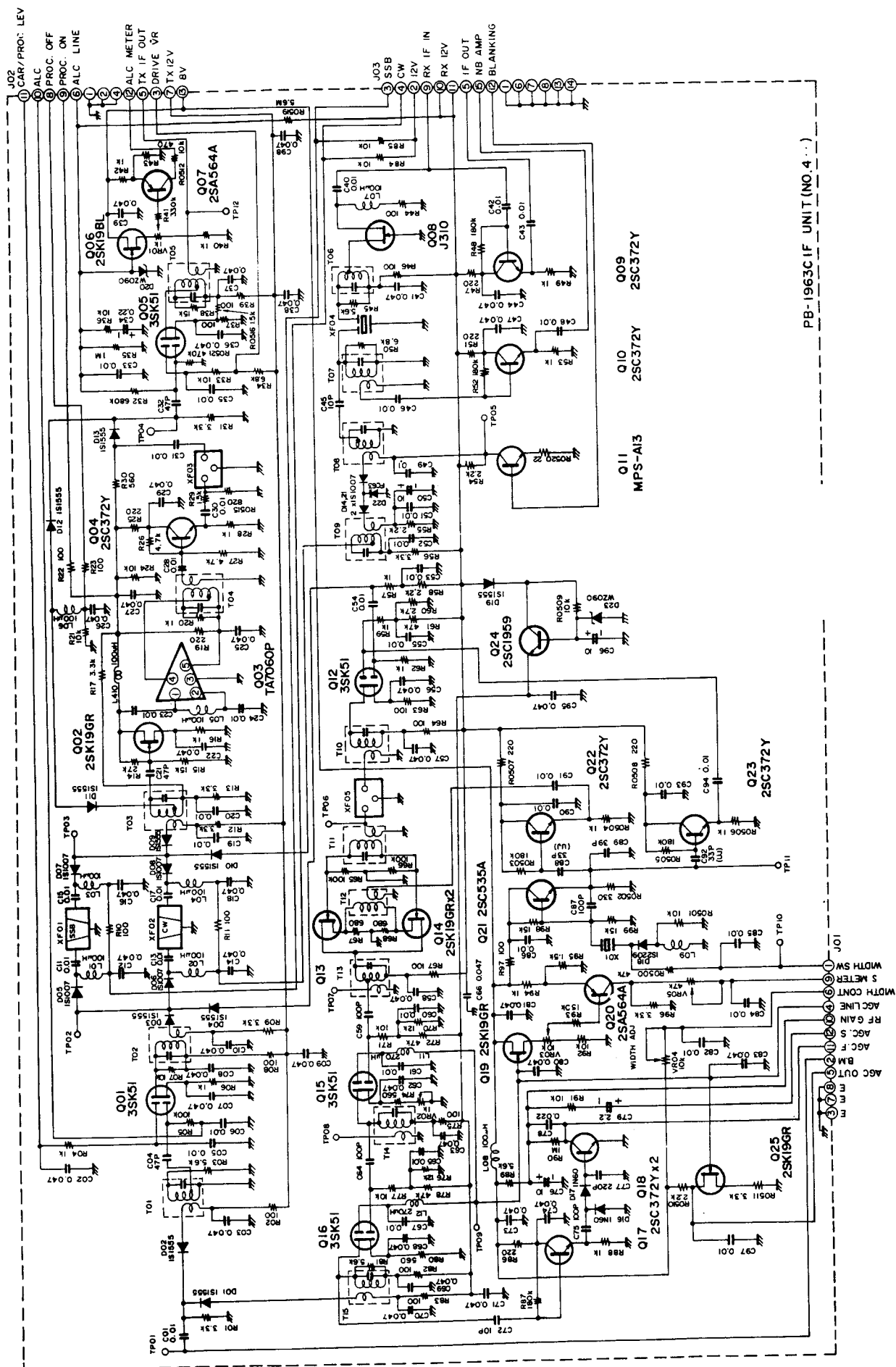
SSB, CW Filters

WIDTH Filter



Width Control Action





NB-FIX UNIT (PB-1961)

A portion of the 8.9 MHz IF signal is fed through buffer Q_{410} (2SC372Y) and amplified by Q_{206} and Q_{205} (2SC1583).

When a carrier of noise-free modulated signal is received, the IF signal is rectified by D_{201} and D_{202} (1N60), producing a DC voltage. This DC voltage is amplified by Q_{202} (2SC372Y), which charges C_{214} , for AGC purposes. The AGC voltage is used to control the gain of Q_{206} and Q_{205} .

When impulse-type noise is received, D_{203} and D_{204} (1N60) rectify the IF signal, producing a DC voltage which controls the NB switch Q_{411} (MPS-A13).

Noise pulses have a very short duration, but high amplitude. Because of the very slow time constant of the C_{214}/R_{212} discharge path, AGC voltage is not induced by these short-duration pulses. Therefore, Q_{206} and Q_{205} operate at full gain, providing maximum voltage to the base of Q_{411} . When a pulse is received, Q_{411} biases D_{414} to block the signal path momentarily. When a desired signal and a noise pulse are received simultaneously, the blanking action is not impaired, because the relative amplitude difference between the desired signal and the noise pulse is still high. The front panel noise blanker level control varies the DC voltage applied to the base of Q_{411} .

AF UNIT (PB-1964)

The IF signal from pin 2 is fed through T_{501} to the ring demodulator, consisting of $D_{502} - D_{505}$ (1S1007), where the IF signal is demodulated into audio, using the carrier signal delivered from Q_{513} (2SC1815Y). The carrier signal is generated by oscillator Q_{514} (2SK19GR), and it oscillates at one of the following frequencies:

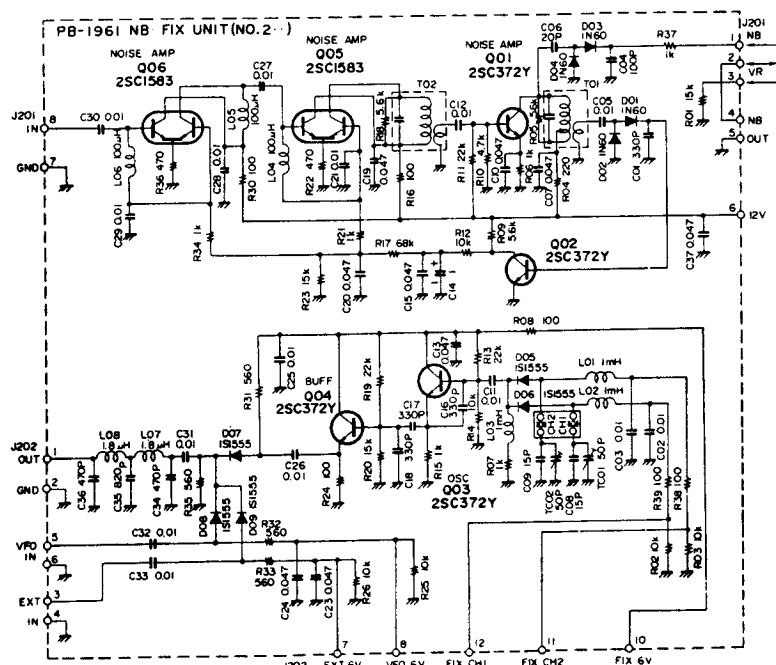
USB, CW-RX	8989 KHz
LSB	8986 KHz
CW-TX	8988.3 KHz

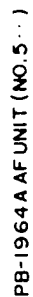
The audio signal is then amplified by audio amplifiers Q_{507} , Q_{508} (2SC1000GR), and Q_{509} (μ PC2002), delivering 3 watts of audio output to the speaker.

The audio spectrum is shaped by an active low-pass filter of $f_0 = 2.7$ kHz, -12 dB/octave.

MARKER GENERATOR

A 25 kHz marker signal is provided, for alignment and testing purposes. Marker generator Q_{509} (2SC1815Y) generates a basic 3200 kHz signal, which is divided into 25 kHz multiples by Q_{506} (MC14024B), a binary counter.





TRANSMIT CIRCUIT

SSB MODE

The output from microphone jack J_2 is fed through the MIC GAIN control VR_{3a} to pin 8 of the AF UNIT.

AF UNIT (PB-1964)

The speech signal from pin 8 is amplified by microphone amplifier Q_{502} (TA7063P) and fed through relay RL_{501} to the ring modulator, $D_{502} - D_{505}$, where the speech signal modulates the carrier signal delivered from Q_{513} . The resulting double sideband signal is fed to the IF UNIT.

IF UNIT (PB-1963)

The 8.9875 MHz double sideband signal is amplified by Q_{401} (3SK51-03) and passed through sideband filter XF_{401} by diode switches D_{403} , D_{409} (1S1555), D_{405} , and D_{407} (1S1007). Here the signal is converted to a single sideband signal by removal of the unwanted sideband.

The signal is then fed to buffer amplifier Q_{402} (2SK19GR). When the RF speech processor is OFF, diode switches D_{411} and D_{412} (1S1555) feed the IF signal to IF amplifier Q_{405} (3SK51-03). When the RF speech processor is ON, the SSB signal is amplified by buffer amplifier Q_{402} (2SK19GR) and further amplified by limiter Q_{403} (TA7060P), where signals that exceed the preset clipping level are sliced out.

This highly clipped SSB signal is amplified by buffer amplifier Q_{404} (2SC372Y) and passed through a selective filter, XF_{403} , which removes RF harmonics that result from signal clipping. The signal is then fed to IF amplifier Q_{405} , and subsequently delivered to the RF UNIT. The front panel COMP LEVEL control, VR_4 , controls the voltage at gate 2 of Q_{401} , thus setting the processor level.

The return of the grid circuit of the final amplifier tubes is fed to Q_{406} (2SK19BL), which produces ALC voltage. This voltage is fed to gate 1 of Q_{405} ,

controlling the gain of this stage. When the RF processor is off, ALC voltage is also fed to gate 1 of $Q_{401} - Q_{407}$ (2SA564) amplifies the ALC voltage for indication on the front panel meter.

RF UNIT (PB-1960) Early model (before Prod. #17)

The IF signal is fed through T_{104} to the transmit mixer, consisting of parallel-connected Q_{105} and Q_{106} (3SK40M), where the IF signal at gate 1 is mixed with the local signal fed to gate 2, producing the RF output signal. The RF signal is then fed through diode switch D_{104} (1S1007) to the DRIVE UNIT.

DRIVE UNIT (PB-1714), PA UNIT (PB-1715)

The RF signal is amplified by driver V_{1601} (12BY7A), and delivered to PA UNIT final amplifier tubes V_{1701} and V_{1702} (6146B). The output from the final tubes is fed to the antenna jack.

A portion of the RF signal is coupled through C_{14} to the cathode of the 12BY7A driver, for the purpose of improving the linearity of the final amplifier. This technique is known as RF negative feedback.

CW MODE

For CW, the 8.9883 MHz carrier is generated by oscillator Q_{514} at the frequency set by X_{504} . The carrier signal is fed through buffer Q_{513} and fed to the ring modulator. The same carrier frequency is used in the tune mode.

DC voltage is applied through diode switch D_{517} (1S1555) and relay RL_{501} , unbalancing the ring modulator for CW operation. The carrier signal is then fed to the IF UNIT. The signal path is identical to that on SSB, up to the DRIVE UNIT.

DRIVE UNIT (PB-1714), PA UNIT (PB-1715)

Keying of the transmitter is accomplished by changing the bias voltage to the driver and final tubes. During "key up," the tubes are cut off by application of -35 volts to V_{1601} and -110 volts to V_{1701} and V_{1702} . These cutoff voltages are

TECHNICAL NOTES

reduced to -0.1 volt and -60 volts, respectively, during "key down" conditions.

The key is connected to the KEY 2 terminal on the RECT B board, PB-1968. When the key is closed, the base of Q_{1001} (2SA733) is grounded, causing Q_{1002} (2SC372Y) to conduct. The base of Q_{1003} (2SA639) is thus set to 0 when the transistor conducts. Under these circumstances, the bias voltage applied to V_{1601} , V_{1701} , and V_{1702} places these tubes in the normal operating condition.

VOX circuit

A portion of the microphone input signal is amplified by three stages of Q_{503} (MC3403P), which drive the VOX control gate, Q_{504} (SN74LS123N). The output from pin 13 of Q_{504} is fed to the base of Q_{512} (2SC1383), switching the VOX relay on and off according to the presence or absence of a speech signal.

A portion of the speaker output is detected by D_{510} and D_{511} (1N60), providing a bucking voltage which is fed to Q_{503} , preventing the speaker output from tripping the VOX.

The VOX delay may be set by adjusting VR_{2b} for the desired delay time.

CW SIDETONE

CW sidetone oscillator Q_{511} (2SC373) oscillates at a frequency of approximately 800 Hz. The output from Q_{511} is amplified by the final audio

amplifier, Q_{501} , for delivery to the speaker. The output from the sidetone oscillator is also fed to VOX amplifier Q_{503} , providing semi-break-in operation for CW.

AM MODE

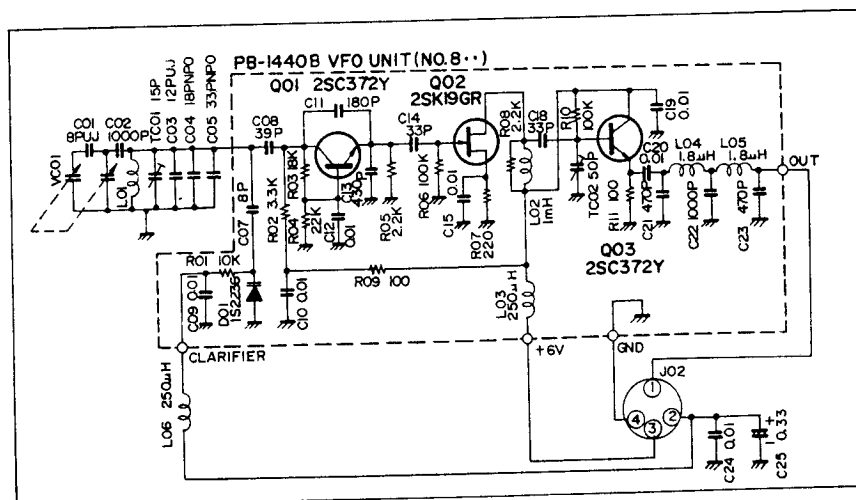
The speech signal from the microphone is amplified by Q_{2401} (2SC732GR) and Q_{2402} (2SC1815Y) and passed to modulator Q_{2405} (2SC380Y), where the speech signal modulates the AM carrier signal at 8988.3 kHz delivered from Q_{2404} (2SK19GR). The modulated signal is amplified by Q_{2406} (3SK51) and delivered to transmit mixer Q_{105}/Q_{106} .

COMMON CIRCUITS

VFO UNIT (PB-1440B-3420)

A modified Colpitts-type oscillator is used to generate a 5.0 - 5.5 MHz VFO signal, thus producing a 500 kHz tuning range. The oscillator signal generated by Q_{801} (2SC372Y) is varied by VC_{801} , which is geared to a precision-built dial tuning mechanism. VC_{801} consists of two sections; the sub-blades compensate for the capacitance variation of the main blades, which may result from extreme temperature change.

Varactor diode D_{801} (1S2236) may be varied by tuning L_{806} , providing ± 2.5 kHz offset from the dial frequency (clarifier).



The VFO signal is amplified by buffer amplifiers Q₈₀₂ (2SK19GR) and Q₈₀₃ (2SC372Y), and passed to the PREMIX UNIT.

NB & FIX UNIT (PB-1961)

Two crystal-controlled channels are provided for operation with this transceiver. The oscillator signal is generated by Q₂₀₃ (2SC372Y) and amplified by Q₂₀₄ (2SC372Y), and delivered to the PREMIX UNIT. Crystals X₂₀₁ and X₂₀₂ oscillate in the 5.0 - 5.5 MHz range.

PREMIX LOCAL UNIT (PB-1711) (before Prod. #17)

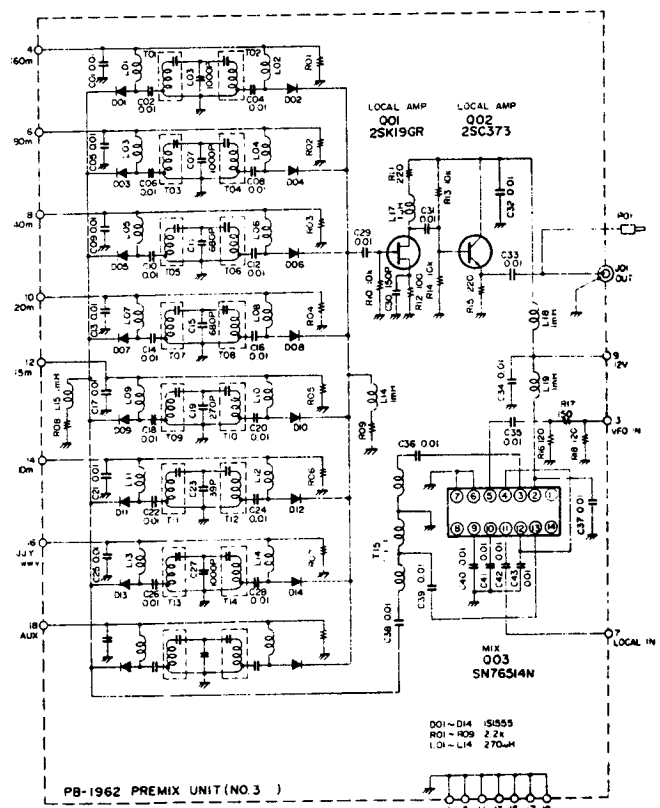
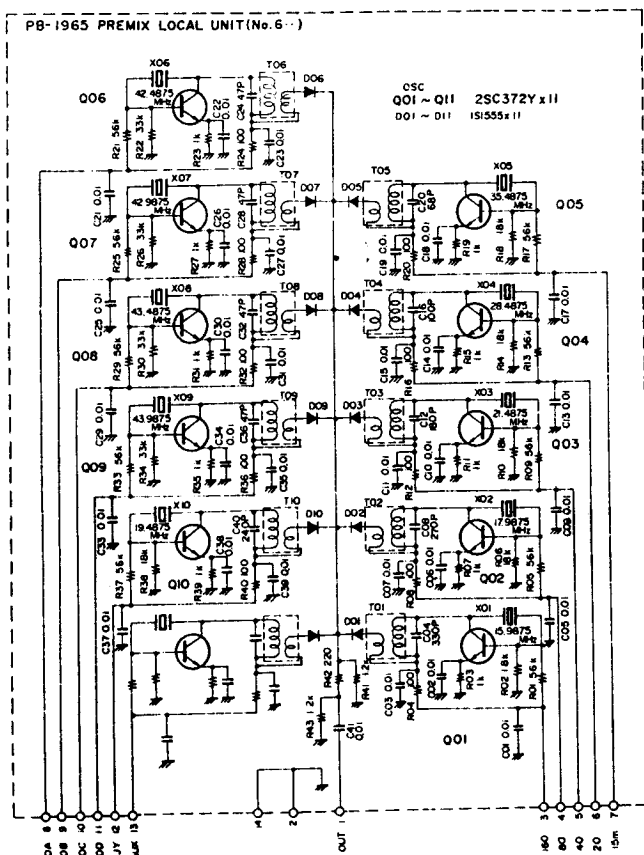
Crystal oscillators Q₆₀₁ - Q₆₁₀ (2SC372Y) generate the premix local signal at the frequencies shown in Table 3. Diode switches D₆₀₁ - D₆₁₀ (1S1555) select the proper local signal for the band in use. The local signal is then delivered to the PREMIX UNIT.

PREMIX UNIT (PB-1962) (before Prod. #17)

The premix signal is produced at Q₃₀₃ (SN76514N), a double-balanced mixer, where the premix local signal from Q₆₀₁ - Q₆₁₀ is mixed with the VFO or crystal controlled 5 MHz signal. The premix output frequencies are shown in Table 3. The premix signal is passed through bandpass filter T₃₀₁ - T₃₁₄, and amplified by Q₃₀₁ (2SK19GR) and Q₃₀₂ (2SC373). The amplified signal is then fed to the RF UNIT, where the signal is further amplified by Q₁₀₇ for delivery to the transmitter and receiver mixers.

		XCO Frequency	PREMIX OUT Frequency
160m	X ₆₀₁	15.9875MHz	10.4875~10.9875MHz
80m	X ₆₀₂	17.9875MHz	12.4875~12.9875MHz
40m	X ₆₀₃	21.4875MHz	15.9875~16.4875MHz
20m	X ₆₀₄	28.4875MHz	22.9875~23.4875MHz
15m	X ₆₀₅	35.4875MHz	29.9875~30.4875MHz
10mA	X ₆₀₆	42.4875MHz	36.9875~37.4875MHz
10mB	X ₆₀₇	42.9875MHz	37.4875~37.9875MHz
10mC	X ₆₀₈	43.4875MHz	37.9875~38.4875MHz
10mD	X ₆₀₉	43.9875MHz	38.4875~38.9875MHz
JJY/ WVW	X ₆₁₀	19.4875MHz	13.9875~14.4875MHz

Table 3



**COUNTER UNIT (PB-1978, PB-1979, PB-1980)
(before Prod. #16)**

The premix local signal from the PREMIX LOCAL circuit is fed to amplifier Q_{2301} (3SK51-03), located on PB-1980. The amplified signal is then fed to waveshaper Q_{2302} (MC10116). Q_{2303} (MPS3640) acts as an interface between Q_{2302} and the TTL circuitry. The signal is then fed to the counter gate, Q_{2304} (SN74S00N).

The clock pulses are generated by Q_{2305} (MSM5564), which produces a 655.36 MHz signal. The signal is divided by a factor of 2^{17} , producing a 5 Hz signal which is fed to the counter gate.

The pulses which pass through the gate are fed to decade counter Q_{2309} (SN74196N), which counts 10 Hz digits. In turn, $Q_{2202} - Q_{2207}$ (SN74LS196N) count 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz, and 10 MHz digits. The BCD output signal from $Q_{2202} - Q_{2207}$ is fed through drivers $Q_{2208} - Q_{2213}$ (MSM561) to the display digits, $DS_{2101} - DS_{2106}$ (HP 5082-7623).

The system of presetting the counter can best be explained by example. For a frequency of 3.500 MHz LSB, the premix local frequency is 12.486 MHz. The LSB preset code is 91.014.0. $12.486 + 91.0140.0 = 103.500$. The "1" digit on the left-hand side is dropped (overflow), and the "0" preceeding the "3" causes a blanking signal to be sent to the 10 MHz digit. The result is a frequency of 3.500 MHz, and this number is displayed.

For USB, the preset number is 91.011.0. For a frequency of 14.000 MHz USB, the manipulation is as follows: $91.011 + 22.989$ (Premix freq.) = 114.000. The first digit is the overflow digit, and the remaining digits are displayed. Note that the second digit from the left is not zero, so no blanking signal is sent to the 10 MHz digit.

For a CW or AM frequency of 21.000 MHz, the premix frequency is 29.9883, and the preset frequency is 91.011.7. The manipulation is: $91.011.7 + 29.9883 = 121.0000$. The first digit is dropped, and the remaining digits are displayed.

The preset frequencies are programmed by Q_{2307} and Q_{2308} (μ PA54H) and diode matrix $D_{2306} - D_{2312}$ (1S1555). Please refer to Table 5 for definition of the premix frequencies for the various bands.

The 5 volt supply is regulated by Q_{2310} (μ PC 14305) for the TTL circuitry. The DIM control controls the emitter/collector voltage at Q_{2201} (2SA496Y), to control the brightness of the digital display and lamps.

	10MHz	1MHz	100kHz	10kHz	1kHz	100Hz
	(Q_{2207})	(Q_{2206})	(Q_{2205})	(Q_{2204})	(Q_{2203})	(Q_{2202})
LSB	9	1	0	1	4	0
USB	9	1	0	1	1	0
CW AM	9	1	0	1	1	7

Preset Number

Table 4

	Nominal Premix Local Frequency	L S B	U S B	CW / AM
160m	10.4875 - 10.9875 (MHz)	10.486 - 10.986 (MHz)	10.489 - 10.989 (MHz)	10.4883 - 10.9883 (MHz)
80m	12.4875 - 12.9875	12.486 - 12.986	12.489 - 12.989	12.4883 - 12.9883
40m	15.9875 - 16.4875	15.986 - 16.486	15.989 - 16.489	15.9883 - 16.4883
20m	22.9875 - 23.4875	22.986 - 23.486	22.989 - 23.489	22.9883 - 23.4883
15m	29.9875 - 30.4875	29.986 - 30.486	29.989 - 30.489	29.9883 - 30.4883
10mA	36.9875 - 37.4875	36.986 - 37.486	36.989 - 37.489	36.9883 - 37.4883
10mB	37.4875 - 37.9875	37.486 - 37.986	37.489 - 37.989	37.4883 - 37.9883
10mC	37.9875 - 38.4875	37.986 - 38.486	37.989 - 38.489	37.9883 - 38.4883
10mD	38.4875 - 38.9875	38.486 - 38.986	38.489 - 38.989	38.4883 - 38.9883

Table 5



POWER SUPPLY

The power supply is designed to operate from 100/110/117/200/220/234 volts AC. A DC-DC converter is an available option, providing operation from 13.5 volts DC. Insertion of the appropriate power plug into the rear panel receptacle makes the necessary connections for AC or DC operation.

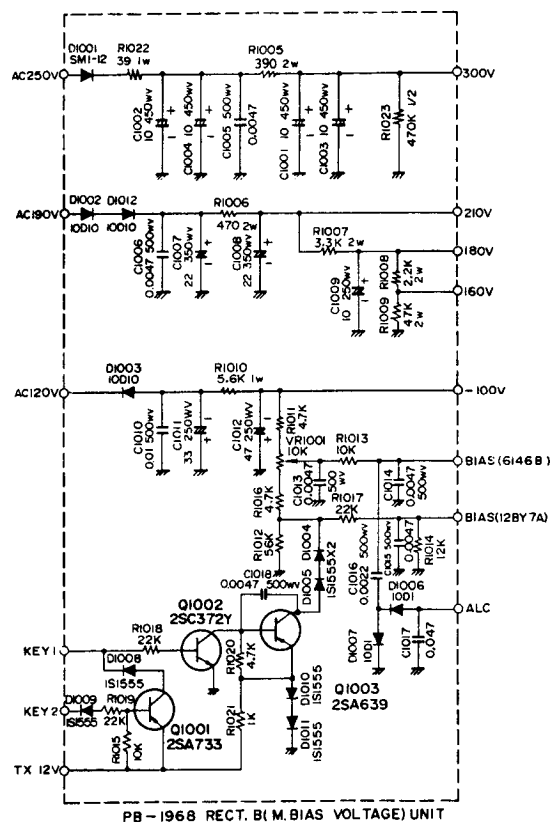
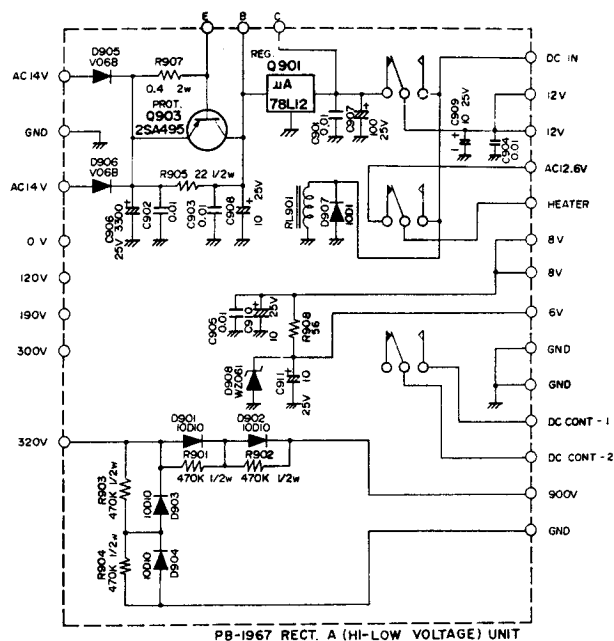
When the transceiver is operated from a DC 13.5 volt power source, using the optional DC-DC converter, transistors Q₃₂₀₁ and Q₃₂₀₂ (T20A6) function as a low frequency oscillator, providing AC voltage at approximately 80 Hz to the power transformer. All of the tube heaters receive their power through the HEATER switch on the front panel. When the HEATER switch is OFF, voltage is still supplied to the receiver section, thus allowing continuous reception with reduced power consumption. The heaters of the two 6146B are connected in series to operate at 12 volts DC.

The 14 volt AC power delivered from the secondary winding of the power transformer is rectified by D₉₀₅ and D₉₀₆ (**V06B**). Voltage regulators Q₁ (**2SB616**), Q₉₀₁ (**78L12**), and Q₉₀₃ (**2SA495**) stabilize the DC supply at 12 volts. The supply voltage is further stabilized at 8 volts by Q₃ (**μPC14308**) for delivery to the counter, AF, and other units. The 6 volt supply for the VFO is provided through zener diode D₉₀₈ (**WZ061**), while the 5 volt supply for the TTL integrated circuits is provided by Q₅₀₅ (**78L05**).

The power amplifier plate voltage of +800 volts is supplied from the bridge-controlled doubler, located on the RECT. A UNIT, and consisting of D₉₀₁ - D₉₀₄ (10D10).

AC 190 volts is rectified by D₁₀₀₂ (10D10), producing 210 volts for the screen grid supply of the power amplifier tubes. The screen grid voltage for the driver tube is obtained by rectifying 250 volts AC at D₁₀₀₁ (10D10), producing 300 volts. This voltage is dropped to 180 volts by a resistor for delivery to the driver tube screen grid.

The 120 volt AC power from the transformer secondary winding is rectified by D₁₀₀₃ (10D10) in order to obtain -140 volts for the driver and final amplifier tube grid bias.



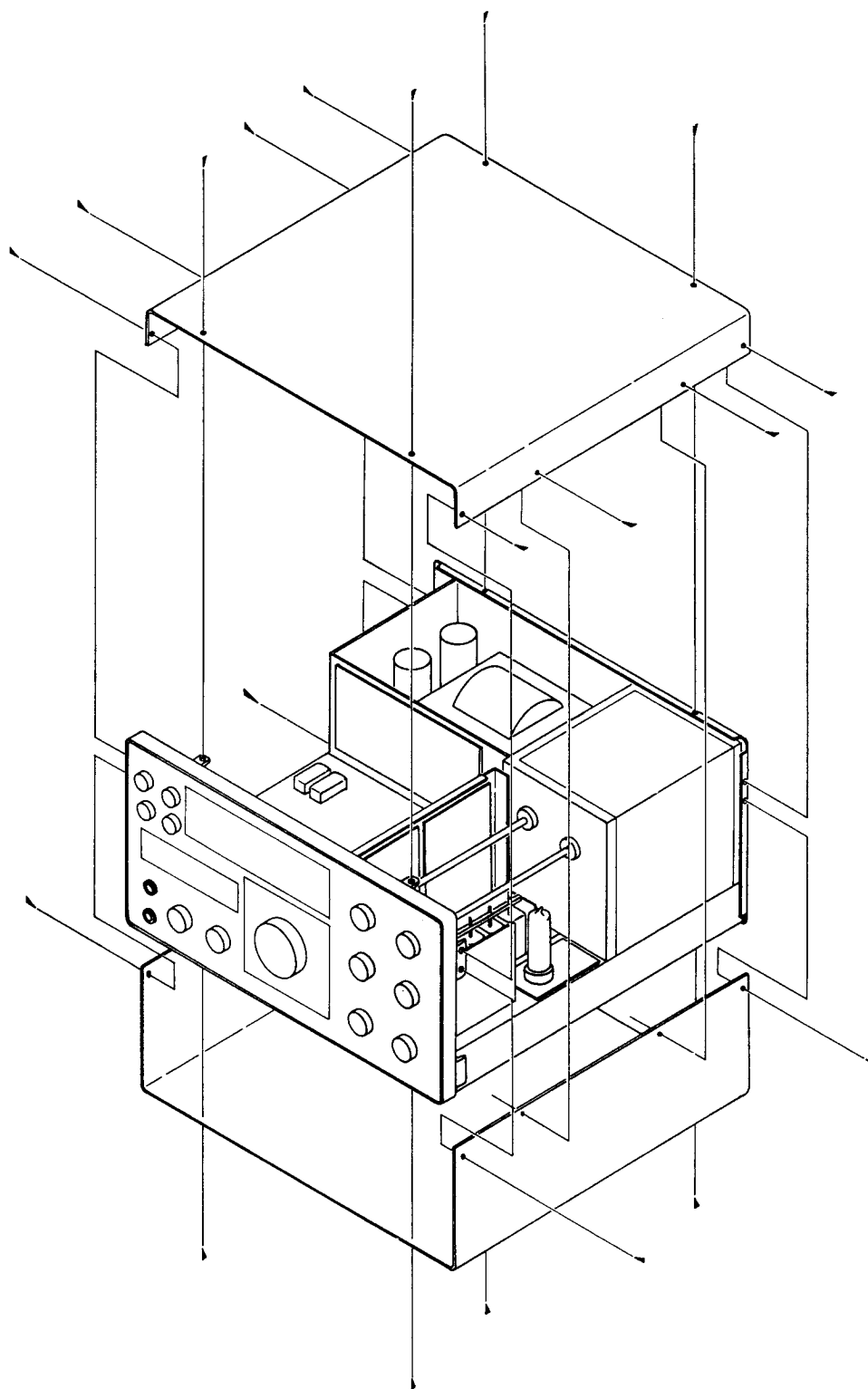
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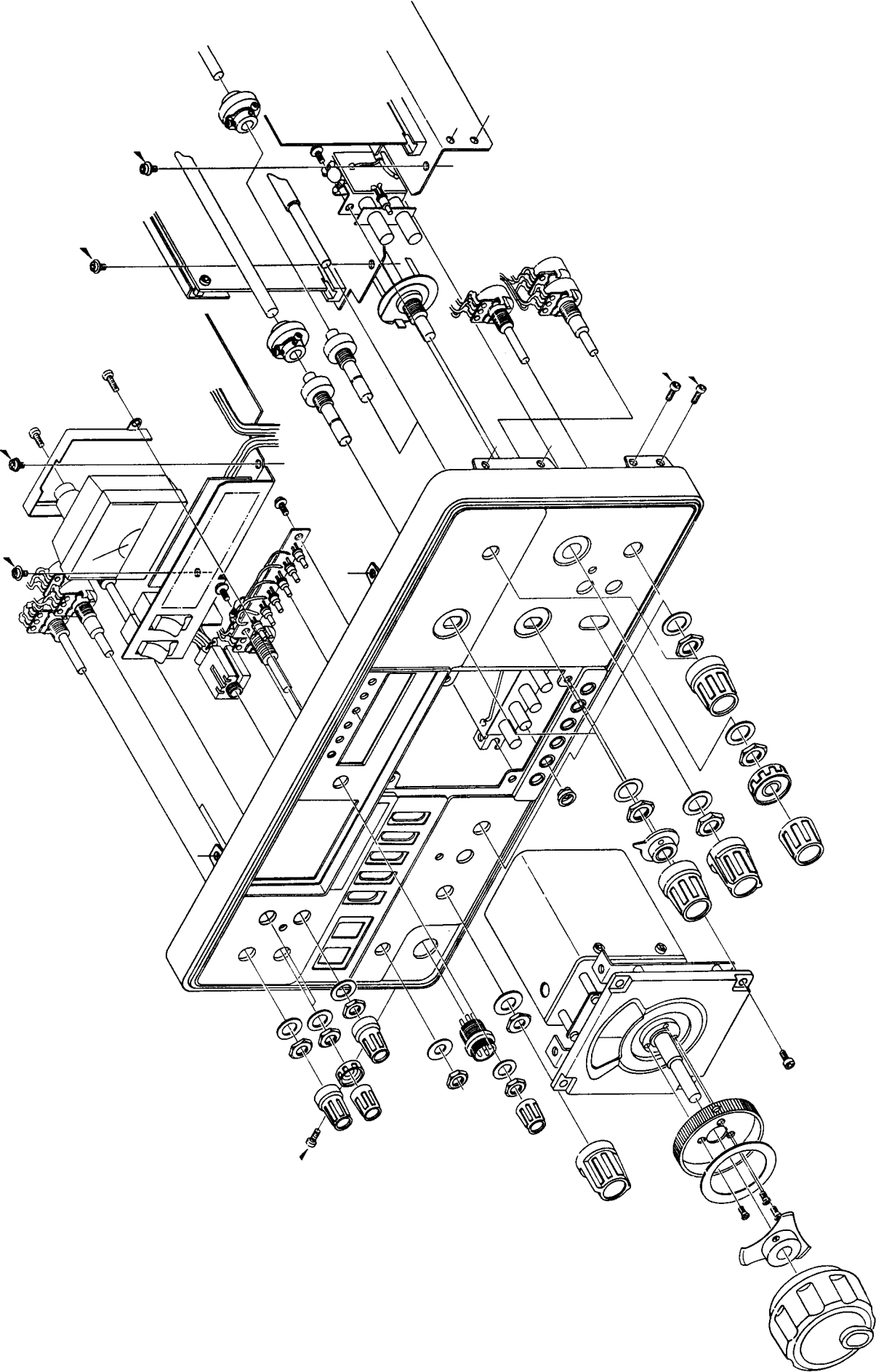
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COUNTER/DISPLAY UNITS (PB-1978/1979/1980)	3-75
DRIVER/FINAL AMPLIFIER STAGES (PB-1714A/1715A)	3-78
AM UNIT (PB-2040)	3-80

OUTER COVER REMOVAL

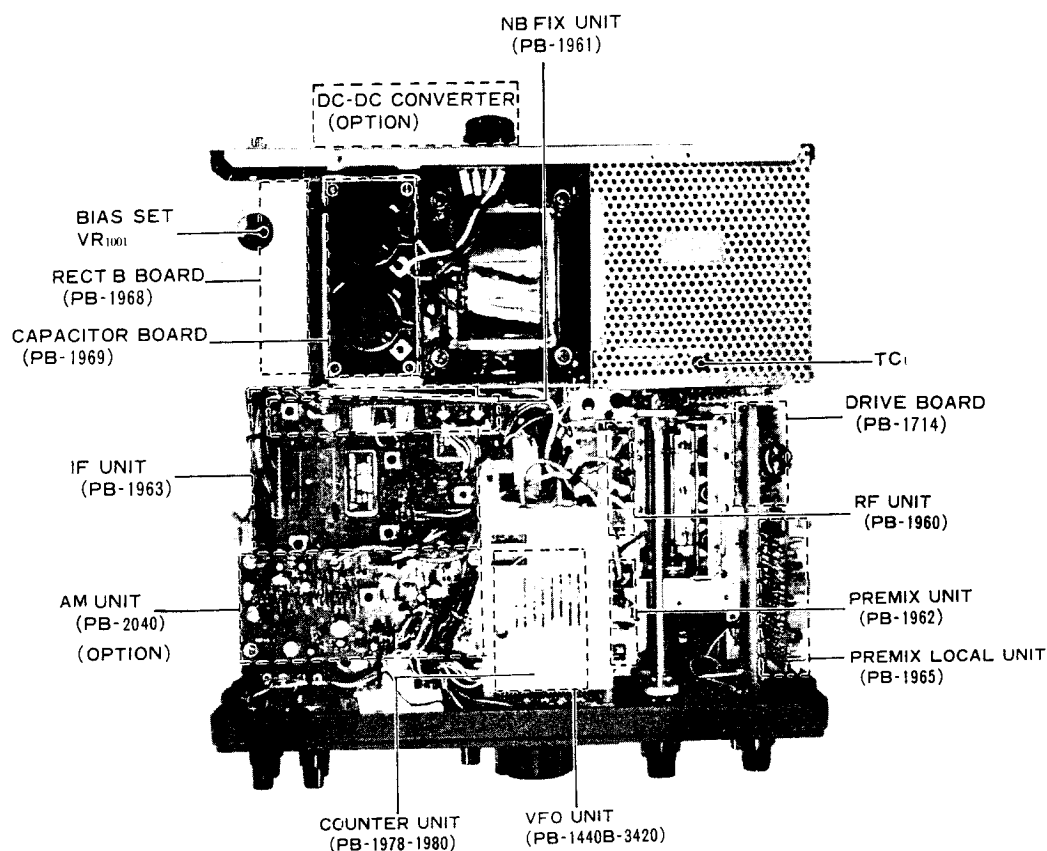


FRONT PANEL REMOVAL

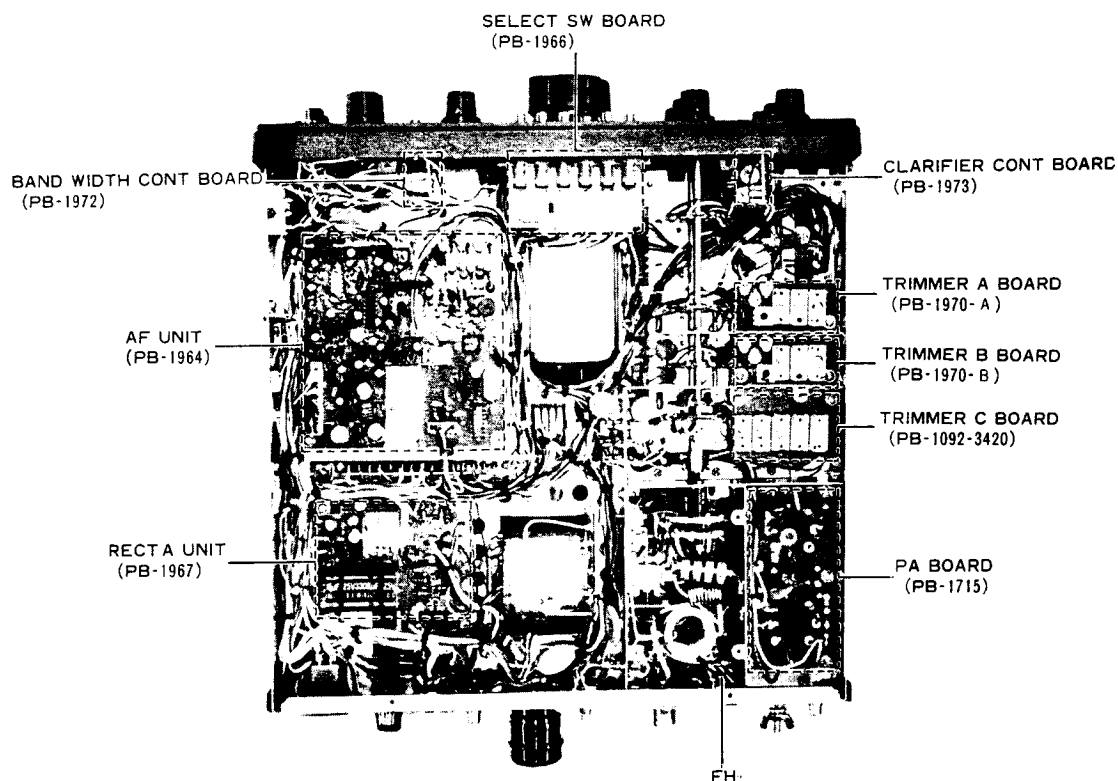


BOARD LAYOUT

Early model (before Prod. #15)

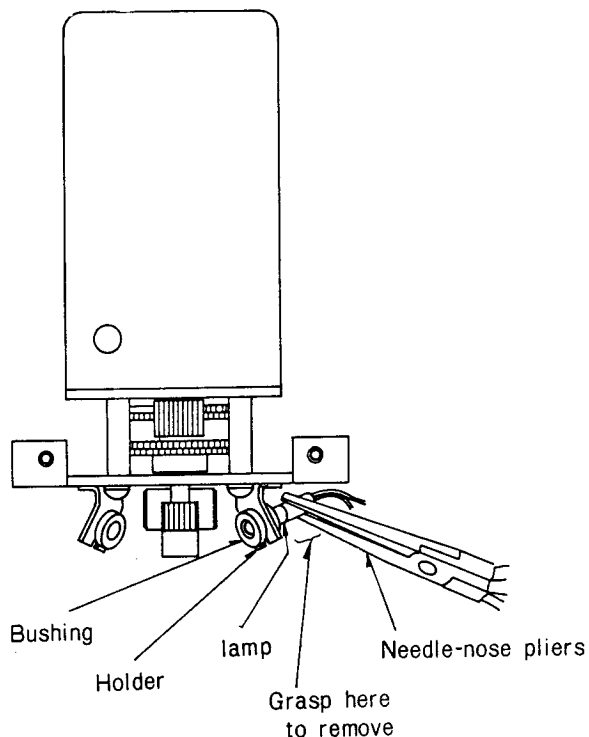


TOP VIEW



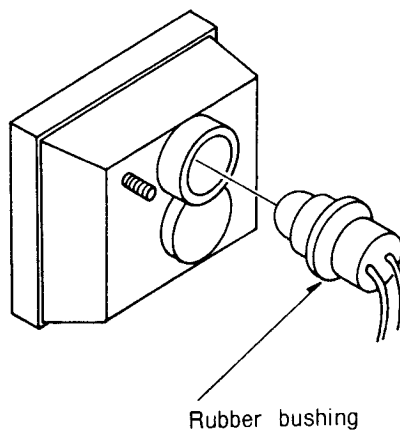
BOTTOM VIEW

PILOT LIGHT REPLACEMENT



The VFO pilot lamps are easily removed, but a little caution is called for. Carefully grasp the rear portion of the shaft with needle nose pliers and ease the lamp out of its mounting holder.

The pilot lamp for the front panel meter may be removed with your fingers.



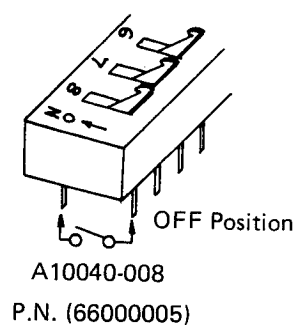
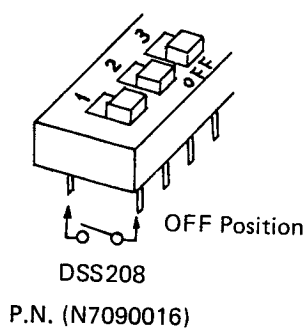
COUNTER PRESET SWITCH REPLACEMENT

Early model (before Prod. #15)

Two types of counter presetting switches are used in the FT-101ZD, and you should take care to install new switches correctly.

The two switches are the DSS208 type (Yaesu part #N7090016) and the A10040-008 type (Yaesu part #66000005). Referring to the drawing, note that when the switch modules are installed so that the numbering is on the same physical side of the switch lever (although reversed in order and upside down), the lever ON/OFF direction will be the same.

Or if you install the switch so that the numbering is in the same direction as the other switch (1-2-3-4-5-6-7-8), the physical direction of the lever action will be reversed.



CW FILTER INSTALLATION(OPTION)

- (1) Remove the top cover of the transceiver case, as shown in Fig. 1.
- (2) Refer to Fig. 2, and locate the NB-FIX circuit board. Remove its mounting screws, because this board is obstructing the removal of the IF unit.
- (3) Remove the 12-pin, 13-pin, and 15-pin plugs from their sockets on the IF unit. Remove the IF unit mounting screws, and remove the IF unit from the transceiver case.
- (4) Install the optional CW filter as shown in the foil side view of the IF unit (Fig. 3). Make the fastening nuts snug, and solder the pins of the filter to the circuit board, and remove the 2 jumper wires shown in Figure 3.
- (5) Re-install the IF unit, being careful to connect the 12-pin, 13-pin, and 15-pin plugs in the correct sockets. Refer to Fig. 3 to be sure. Re-install the NB-FIX unit, and replace the top cover of the transceiver.
- (6) When the optional CW filter is installed, the CW-N position of the mode switch will activate this filter. In the CW-W position, the SSB 2.4 kHz filter will be in use. The WIDTH control is usable in all modes.

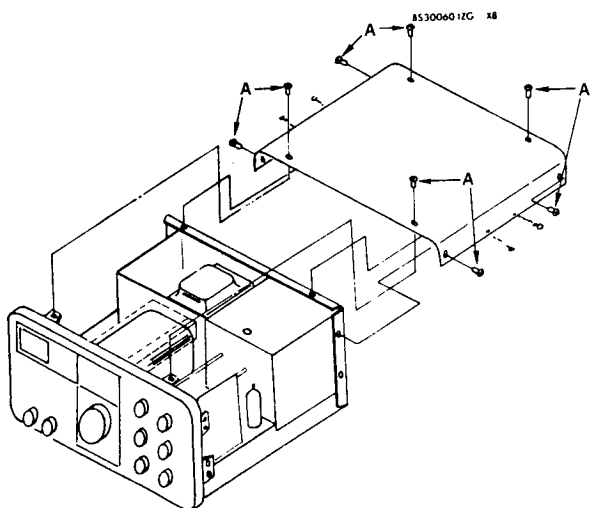


Figure 1

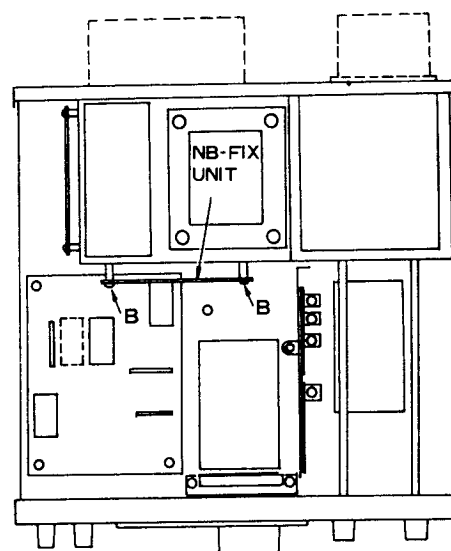


Figure 2

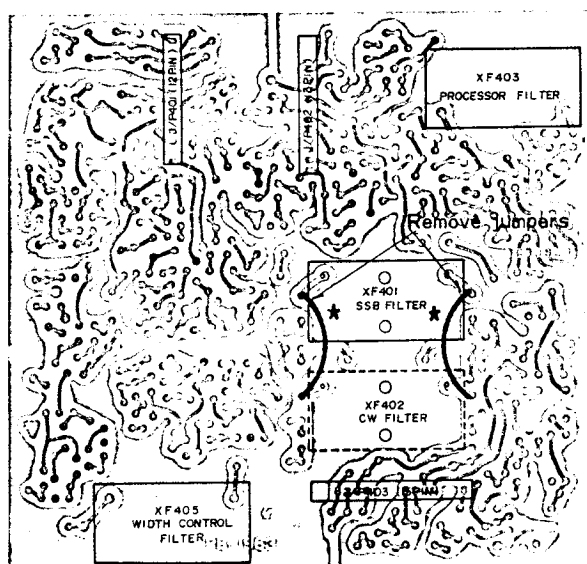


Figure 3

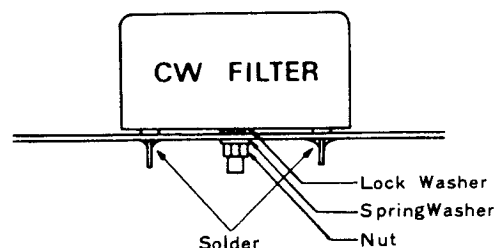


Figure 4

COUNTER UNIT INSTALLATION ON FT-101Z

Early model (before Prod. #15)

This section will deal with the installation of the COUNTER UNIT and digital display, which are optional equipment for the economy FT-101Z model.

PARTS NEEDED

Optical Filter with double-face tape	(1)
Counter Module	(1)
Guide Pins	(2)
Support Tower	(1)
Vinyl Tubes	(2)

socket on the transceiver at point "G" in the drawing. The coaxial cable from the COUNTER UNIT is connected to point "F" in Figure 5.

- (9) Close the transceiver. No alignment of the unit is necessary, unless some change in the preset carrier frequencies is required for a special application. In this case, refer to the section on the COUNTER UNIT in the "ALIGNMENT" chapter of this manual.

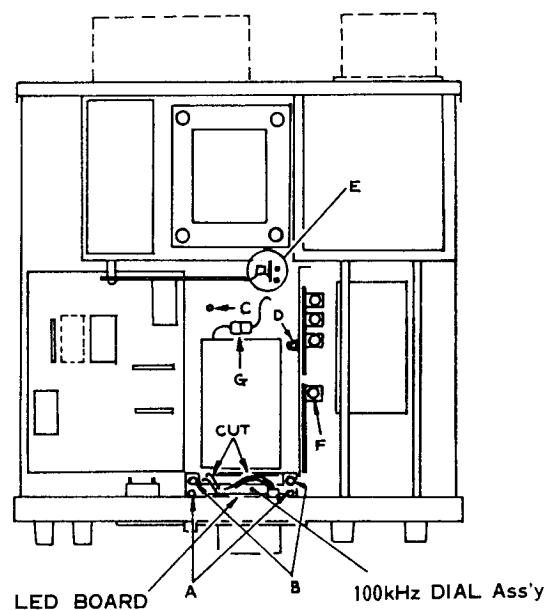
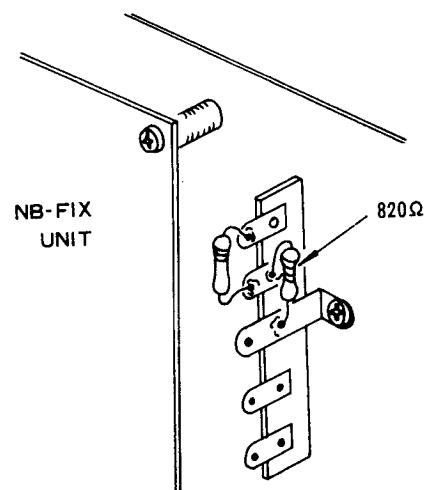


Figure 5.



(Enlarged) Part E

Figure 6.

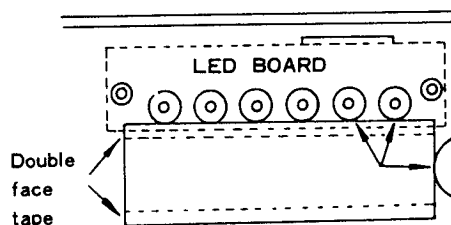


Figure 7.

- (1) Remove the top cover of the transceiver, according to the drawing on page 3-5.
- (2) Remove the screws marked "A" in Figure 5. These screws support the LED board.
- (3) Remove the screws marked "B" in Figure 5, as well as the tension spring, and remove the analog display panel.
- (4) Locate the analog display lamp. Cut the leads to this lamp, insert 1 lead each into the vinyl tube supplied with the counter kit, and position these leads out of the way of the VFO gears, etc.
- (5) Install the orange optical filter on the inside of the front panel of the transceiver, in the position formerly occupied by the analog display panel. Be sure that it is correctly centered. The filter is held in place by the double-face tape included with the filter.
- (6) Install the two guide pins into the holes previously occupied by the "A" screws. When doing this, install the LED board in its previous position. Install the support tower into the hole marked "C" in Figure 5.
- (7) Remove the 820 ohm (Gray-Red-Brown) resistor from the terminal strip marked "E" in Figures 5 and 6.
- (8) Install the COUNTER UNIT. The connection to the guide pins should not be forced. Use the screws previously installed at "A" for securing the counter module at points "C" (support) and "D" in Figure 5. Connect the COUNTER UNIT 9-pin plug into the 9-pin

FT-101Z/ZD AUX BAND INSTALLATION

Early model (before Prod. #16)

The installation of a non-standard frequency band may be accomplished in an hour or two, using the AUX position on the bandswitch. Some alignment is required, but this is not a difficult procedure.

However, please be advised that AUX band installations by someone other than an authorized Yaesu representative will void any warranties in force. As well, Yaesu cannot guarantee that published specifications for operation on the amateur bands will be met during operation on a non-standard band. Of special note are those bands containing, and immediately adjacent to, the IF and VFO frequencies.

The modification process begins with the insertion of the required parts on the PREMIX and PREMIX LOCAL circuit boards, as the AUX band parts were not factory installed. Then the necessary wiring changes are performed, and then the new band is aligned for peak performance on transmit and receive.

PARTS NEEDED

For PREMIX UNIT (PB-1962)

Silicon diodes, type 1S1555, 2 ea. (D₃₁₅/D₃₁₆)

Carbon film resistor, 2.2 K ohms, ¼ watt, 1 ea. (R₃₁₉)

Disc ceramic capacitors, 0.01 µF, 50 WV, 3 ea. (C₃₄₄/C₃₄₅/C₃₄₇)

Disc ceramic capacitor, 50 WV, 1 ea. (C₃₄₆ — see Table 6 on page 3-9.)

Micro inductors, 270 µH, 2 ea. (L₃₂₀/L₃₂₁)

Bandpass coil, see Table 6 on page 3-9 for desired BPF coil among T₃₀₁–T₃₁₄ (for T₃₁₆/T₃₁₇).

For PREMIX LOCAL (XTAL) UNIT (PB-1965)

Transistor, type 2SC372Y, 1 ea. (Q₆₁₁)

Silicon diode, type 1S1555, 1 ea. (D₆₁₁)

Carbon film resistor, 56K ohms, ¼ watt, 1 ea. (R₆₄₄)

Carbon film resistor, 18 K ohms, ¼ watt, 1 ea. (R₆₄₅) (28 MHz: 33 K)

Carbon film resistor, 1 K ohm, ¼ watt, 1 ea. (R₆₄₆).

Carbon film resistor, 100 ohms, ¼ watt, 1 ea. (R₆₄₇)

Disc ceramic capacitors, 0.01 µF, 50 WV, 3 ea. (C₆₄₂/C₆₄₃/C₆₄₄)

Disc ceramic capacitor, 50 WV, 1 ea. (C₆₄₅ — see Table 6)

Local crystal, 1 ea. (X₆₁₁ — see Table 6)

Oscillator transformer, #220017, 1 ea. (T₆₁₁)

MODIFICATION PROCEDURE

- (1) Refer to Figures 8 and 9, and install the above parts on PB-1962 and PB-1965.
- (2) Refer to Figure 10, and locate the bandswitch wafers S1B and S1C. Cut the lead from AUX to COMMON, and re-install the lead so as to run from AUX to the post corresponding to column 6 of Table 6, "BAND." For example, for 2.0–2.5 MHz operation, the lead goes from AUX to 160. Do this on both wafers S1B and S1C.
- (3) Refer to Figure 4, and install the jumper wire shown, between the AUX terminal and the terminal of the "BAND" column in Table 6, on bandswitch wafer S2D. Note that this is a "double" wafer; S2C is the side facing the front of the transceiver, while S2D is the rear face of this wafer.
- (4) Normally, no change in the tank coil tap will be required, as inspection of Table 6 will verify. However, if harmonics or other non-satisfactory transmitter performance characteristics result, use linear interpolation of the values in Table 6, "Tank Coil Tap" column. Note that this will affect the performance in the original amateur band, so beware.

ALIGNMENT AFTER MODIFICATION

- (1) Connect an RF VTVM to pin 1 of MJ₃. Adjust T₆₁₁ for maximum indication on the VTVM (Nom. 300 mV).
- (2) Temporarily remove the plug from output jack J₃₀₁ of the PREMIX Unit, PB-1962. Connect the RF VTVM to J₃₀₁. Set the VFO to 250 (band center), and peak the bandpass filter coils for maximum deflection on the VTVM (nom. 100–150 mV). Now check the response from 000 on the VFO to 500. If the response is not flat within 3 dB across the band, retune the bandpass filter coils for a somewhat staggered response.

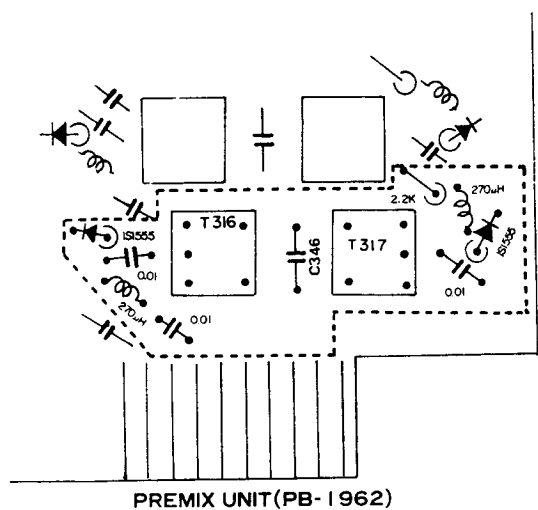


Figure 8.

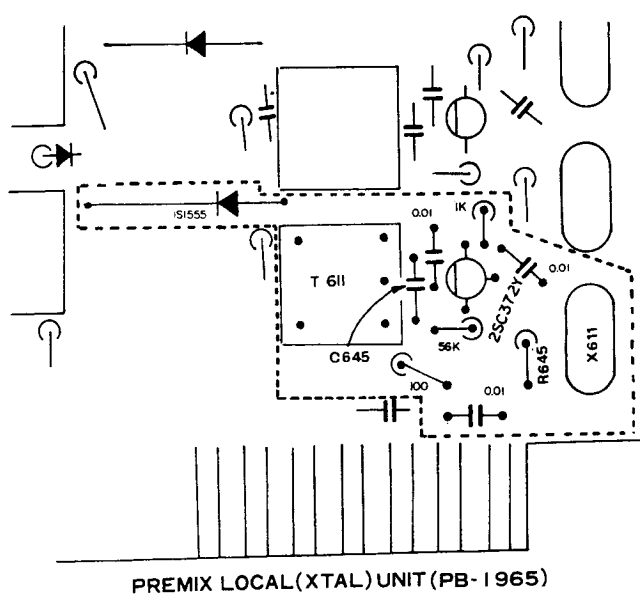
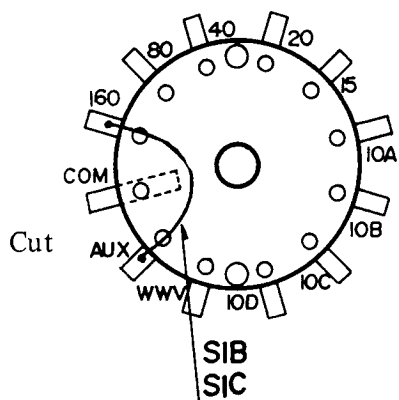


Figure 9



Example for 2.0-2.5 MHz wiring

Figure 10.

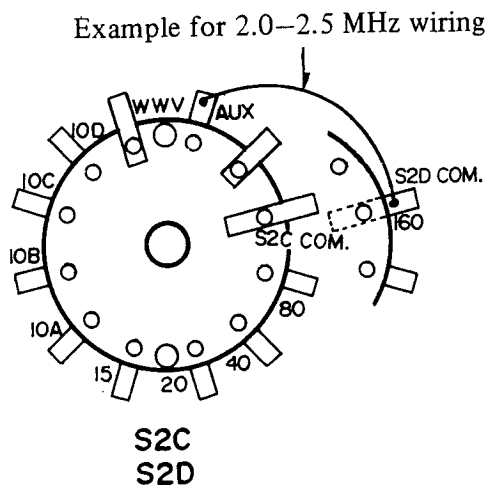


Figure 11.

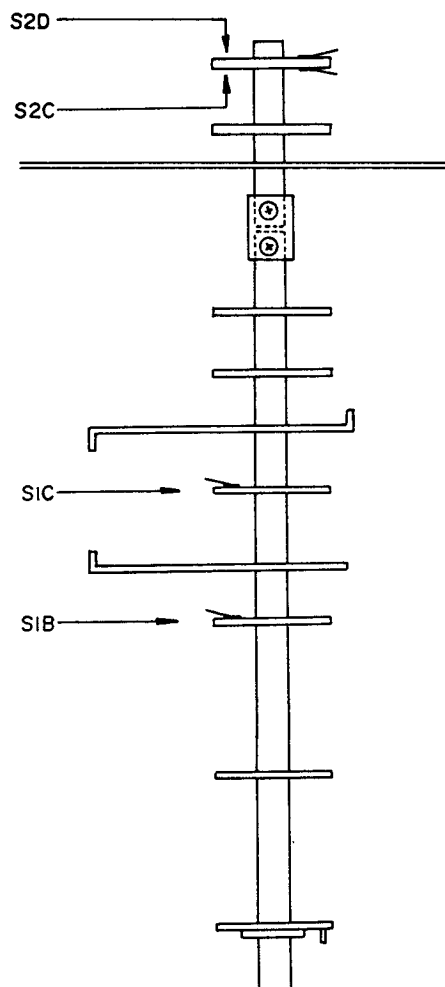


Figure 12.

FT101Z AUX BAND

FREQ(MHz)	XTAL(MHz)	OSC CAP(pF)	BPF COIL NUMBER	PREMIX OUT FREQ(MHz)	BAND	PRESELECT	TANK COIL TAP	LOAD CAP(pF)	PLATE CONTROL	LOAD CONTROL	REMARKS
1.8—2.0	15.9875	330	T301,302	10.4875—10.9875	160	0—2.0	38	3000	3.0	0	
2.0—2.5	16.4875		T303,304	10.9875—11.4875	"	2.0—4.5					
2.5—3.0	16.9875		"	11.4875—11.9875	"	4.5—6.5					
3.0—3.5	17.4875		"	11.9875—12.4875	80	0.5—2.5					
3.5—4.0	17.9875	270	"	12.4875—12.9875	"	2.5—4.0	26	1100	2.8	0	
4.0—4.5	18.4875		"	12.9875—13.4875	"	4.0—5.5					
4.5—5.0	18.9875		T313,314	13.4875—13.9875	40	1.2—2.8					
5.0—5.5	19.4875	240	"	13.9875—14.4875	"	2.8—3.8					*(VFO RANGE)
5.5—6.0	19.9875		"	14.4875—14.9875	"	3.8—4.8					
6.0—6.5	20.4875		T305,306	14.9875—15.4875	"	4.8—5.5					
6.5—7.0	20.9875		"	15.4875—15.9875	"	5.5—6.0					
7.0—7.5	21.4875	180	"	15.9875—16.4875	"	6.0—7.0	16	620	3.9	4.5	
7.5—8.0	21.9875		"	16.4875—16.9875	"	7.0—7.5					
8.0—8.5	22.4875		"	16.9875—17.4875	"	7.5—8.0					*(IF)
8.5—9.0	—	—	—	—	—	—	—	—	—	—	*(IF)
9.0—9.5	—	—	—	—	—	—	—	—	—	—	*(IF)
9.5—10.0	23.9875		T307,308	18.4875—18.9875	20	4.0—4.7					*(IF)
10.0—10.5	24.4875		"	18.9875—19.4875	"	4.7—5.1					*(IF)
10.5—11.0	24.9875		"	19.4875—19.9875	"	5.1—5.5					*(WIDTH IF)
11.0—11.5	25.4875		"	19.9875—20.4875	"	5.5—6.0					
11.5—12.0	25.9875		"	20.4875—20.9875	"	6.0—6.4					
12.0—12.5	26.4875		"	20.9875—21.4875	"	6.4—6.9					
12.5—13.0	26.9875		"	21.4875—21.9875	"	6.9—7.2					
13.0—13.5	27.4875		"	21.9875—22.4875	"	7.2—7.5					
13.5—14.0	27.9875		"	22.4875—22.9875	"	7.5—7.9					
14.0—14.5	28.4875	100	"	22.9875—23.4875	"	7.9—8.1	10	330	6.6	3.3	
14.5—15.0	28.9875		"	23.4875—23.9875	"	8.1—8.3					
15.0—15.5	29.4875		T307,308	23.9875—24.4875	15	5.5—5.8					
15.5—16.0	29.9875		"	24.4875—24.9875	"	5.8—6.0					
16.0—16.5	30.4875		"	24.9875—25.4875	"	6.0—6.3					
16.5—17.0	30.9875		"	25.4875—25.9875	"	6.3—6.7					
17.0—17.5	31.4875		"	25.9875—26.4875	"	6.7—7.0					
17.5—18.0	31.9875		T309,310	26.4875—26.9875	"	7.0—7.2					*(IF HARMONIC)
18.0—18.5	32.4875		"	26.9875—27.4875	"	7.2—7.4					*(")
18.5—19.0	32.9875		"	27.4875—27.9875	"	7.4—7.6					*(")
19.0—19.5	33.4875		"	27.9875—28.4875	"	7.6—7.8					
19.5—20.0	33.9875		"	28.4875—28.9875	"	7.8—8.0					*(WIDTH CARRIER)
20.0—20.5	34.4875		"	28.9875—29.4875	"	8.0—8.3					
20.5—21.0	34.9875		"	29.4875—29.9875	"	8.3—8.5					
21.0—21.5	35.4875	68	"	29.9875—30.4875	"	8.5—8.7	7	—	7.5	2.0	
21.5—22.0	35.9875		"	30.4875—30.9875	"	8.7—9.0					
22.0—22.5	36.4875		"	30.9875—31.4875	10	7.0—7.3					
22.5—23.0	36.9875		"	31.4875—31.9875	"	7.3—7.5					
23.0—23.5	37.4875		"	31.9875—32.4875	"	7.5—7.6					
23.5—24.0	37.9875		T311,312	32.4875—32.9875	"	7.6—7.8					
24.0—24.5	38.4875		"	32.9875—33.4875	"	7.8—8.0					
24.5—25.0	38.9875		"	33.4875—33.9875	"	8.0—8.2					
25.0—25.5	39.4875		"	33.9875—34.4875	"	8.2—8.3					
25.5—26.0	39.9875		"	34.4875—34.9875	"	8.3—8.4					
26.0—26.5	40.4875		"	34.9875—35.4875	"	8.4—8.6					
28.0—28.5	42.4875	47	"	36.9875—37.4875	"	9.0—9.2	5		8.1	1.5	
28.5—29.0	42.9875	47	"	37.4875—37.9875	"	9.2—9.4	5		8.2	1.5	
29.0—29.5	43.4875	47	"	37.9875—38.4875	"	9.4—9.6	5		8.5	1.5	
29.5—30.0	43.9875	47	"	38.4875—38.9875	"	9.6—9.8	5		8.8	1.7	

* QUESTIONABLE PERFORMANCE
(Modifications to be provided
for possible WARC expansion
at 10 and 18 MHz)

Table 6

SERVICING

DC-DC CONVERTER INSTALLATION (OPTION) Early model (before Prod. #23)

The optional DC-DC converter is easy to install in a matter of minutes. Please follow the instructions carefully, in order to make the proper connections.

- (1) Install the DC-DC converter module as shown in the drawing. Use the four screws supplied with the kit. Do not force the plug into the socket, as the connection should be smooth, yet solid.
- (2) Check the DC cable fuse socket, located in the positive (red) lead, to be certain that a 20 amp fuse is installed.
- (3) When making connections to the battery, be absolutely certain that the proper polarity is observed. The RED lead should be connected to the POSITIVE (+) battery terminal, and the BLACK lead should be connected to the NEGATIVE (—) terminal. **OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY REVERSED POLARITY CONNECTIONS.**
- (4) Before connecting the DC power cable to the transceiver, check the automobile voltage regulator level with the engine running (battery charging). The maximum charging rate

should be 15 volts or less. If the voltage is higher than this level, please adjust the voltage regulator for a maximum of 15 volts. This precaution applies, as well, to bench power supplies, which should be adjusted in the same fashion. Also, the transceiver should not be operated from a supply voltage of less than 12 volts.

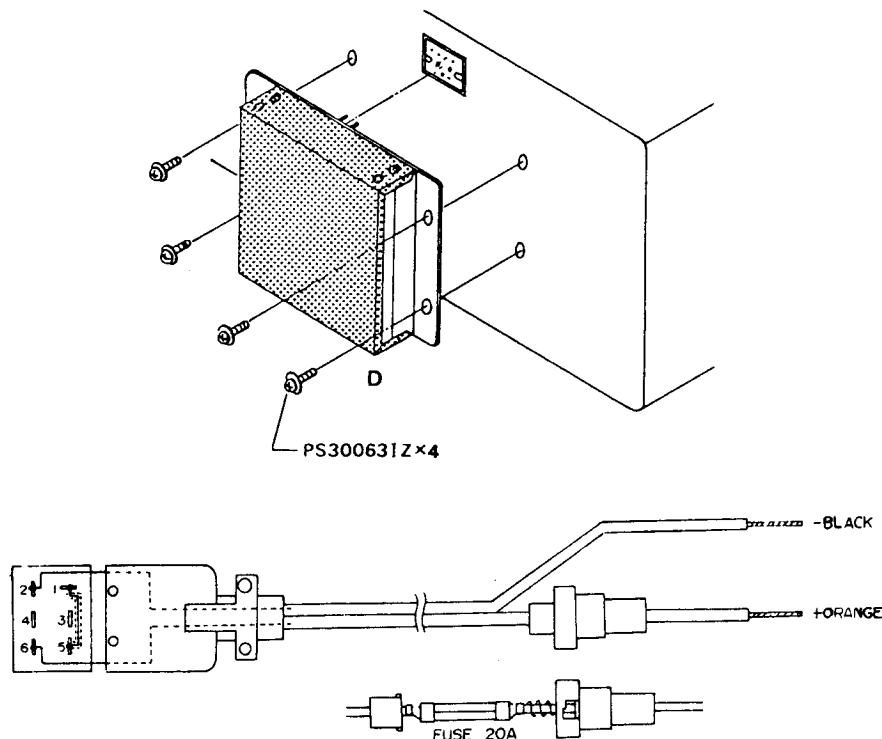
- (5) Connect the DC cable to the transceiver. Power connections are made automatically when the DC cable is connected to the POWER jack.

NOTES ON MOBILE INSTALLATION

Be certain that sufficient room is provided for free air circulation around the transceiver. If the transceiver must be placed on the car seat, set it on a board or other rigid object, in order to provide the necessary air circulation (and to avoid possible heat damage to the upholstery).

A special mobile mounting bracket is available from your YAESU dealer.

The DC supply should be capable of providing 20 amps on voice peaks, 14 amps continuous. The HEATER switch may be turned off during long periods of reception, for energy conservation.

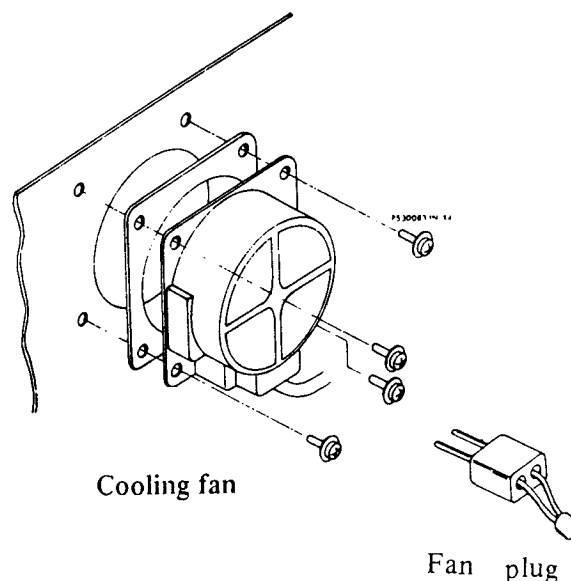


COOLING FAN INSTALLATION (OPTION)

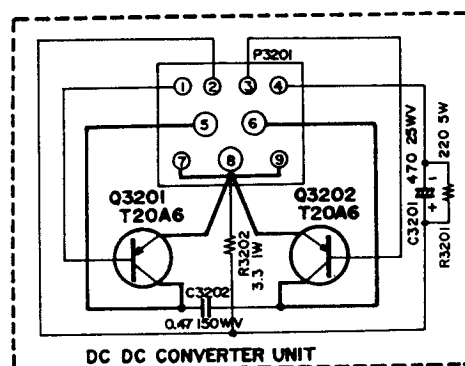
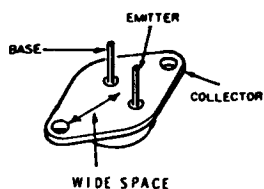
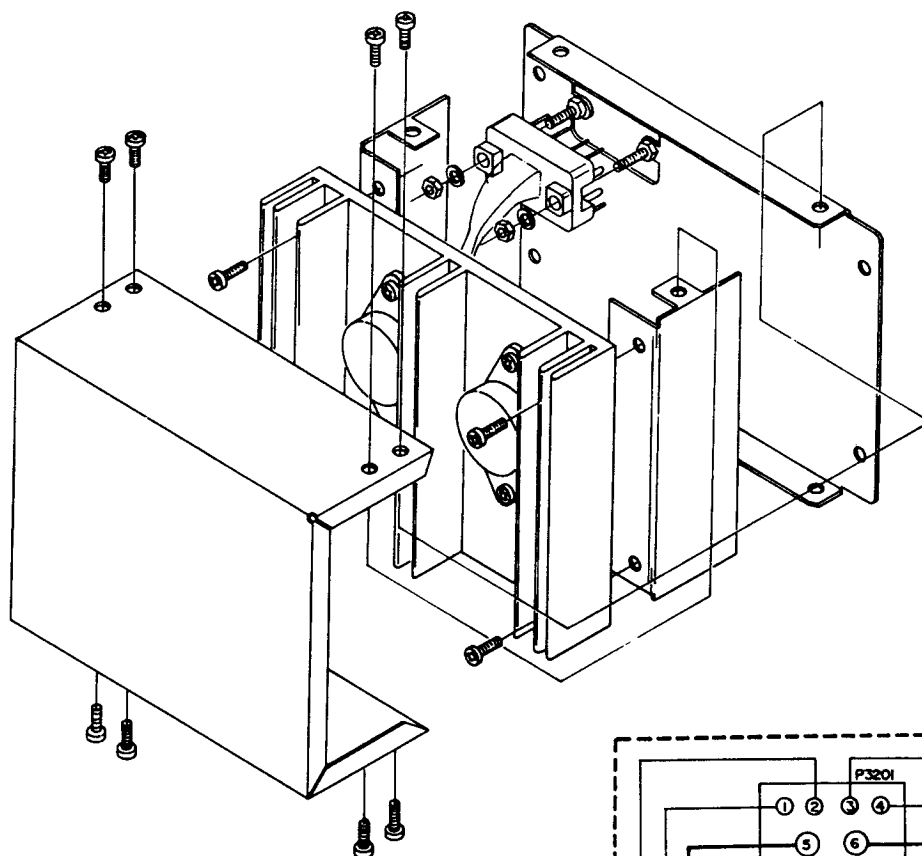
The FT-101ZD cooling fan may be used with other models of Yaesu equipment. Installation is easily accomplished in minutes.

Hold the fan up to the rear panel in its proper location. Determine the proper length of the two-wire power lead to the motor. Solder the leads to the 2-pin plug supplied with the fan. The 4-pin plug is not needed for FT-101ZD installation.

Install the fan onto the rear panel of the transceiver, as shown in the drawing. Insert the power lead from the fan into the fan socket on the rear panel.



DC-DC CONVERTER (EXPLODED VIEW)



SOLDERING AND DESOLDERING TECHNIQUE ON PRINTED CIRCUIT BOARDS

The FT-101Z circuit boards are tough, but mishandling during soldering can cause circuit traces to "lift". While this does not cause permanent damage to the board, much servicing trouble can result, because of the tendency for this lifted trace to break. A few simple precautions will keep your circuit boards in A-1 condition.

1. Use only a 12 to 30 watt chisel-tip soldering iron. Yes, some "repairmen" have been known to use small blowtorches on cards.
2. Use only a soldering iron equipped with a three-wire cord, with the tip grounded. Also acceptable is a soldering iron isolated through a transformer. An old soldering iron or gun may have 117 volts on the tip, and will certainly cause more damage than it repairs!
3. USE ONLY 60/40 ROSIN CORE SOLDER. Acid core solder should be thrown away if you find it in your radio shop!
4. Use a solder sucker and solder tape to ensure a professional repair job.
5. If you do lift a trace, don't worry! Read on to find out how to repair traces like a pro.

NOTES ON USE OF CMOS IC's:

As CMOS devices are extremely sensitive to damage from static electricity, special precautions must be observed.

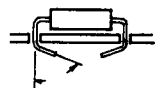
In storage, use only sponge specially designed for CMOS components.

When installing a CMOS IC in a socket, or on a circuit board, be certain that the power is off. In addition, the technician should rest his hand on the chassis as the component is inserted, so as to place his hand at the same potential as the chassis (better to discharge small amounts of static electricity through your fingers than through a \$5 IC!).

When soldering a CMOS IC onto a circuit board, use a low wattage iron, and be sure to ground the tip with a clip lead, if the tip is not grounded through a three-wire power cord.

INSERTION OF PARTS ON CIRCUIT BOARDS

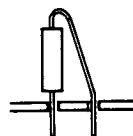
All of the below are acceptable ways of inserting components into circuit board mounting holes.



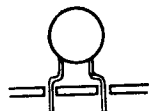
(a) Bend leads slightly



(b) Straight-in mounting



(c) Vertical mounting

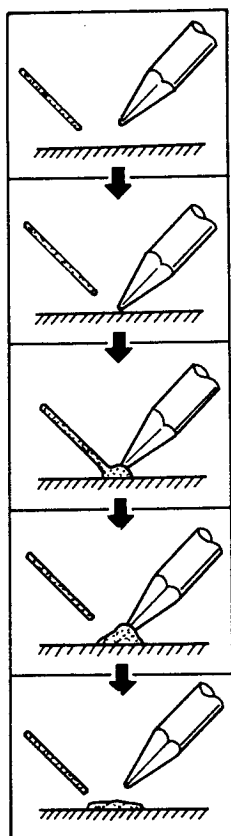


(d) Preformed disc ceramic capacitor



(e) Preformed resistor, diode, etc.

BASIC SOLDERING PRACTICE



(1) Prepare soldering iron and solder.

(2) Apply soldering iron to surface to be soldered.

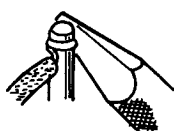
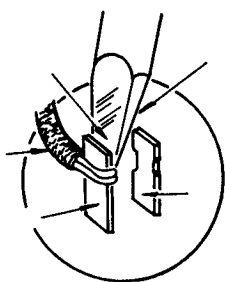
(3) Apply solder to heated surface.

(4) When enough solder is applied, remove solder. Continue to apply heat until solder flows cleanly.

(5) Remove iron from work. Do not apply more heat than necessary for good solder flow.

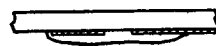
Soldering to terminal posts:

(Be certain to apply heat to both post and wire.)

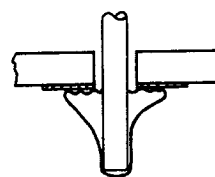


EXAMPLES OF POOR SOLDERING PRACTICE

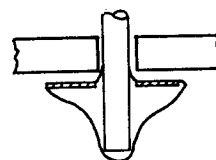
Solder bridge (caused by use of too much solder)



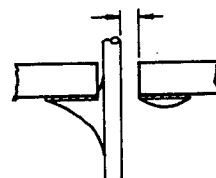
"Cold joint" (caused by insufficient heat to part of work, resulting in poor solder flow)



Lifted trace (caused by too much heat on circuit board foil)

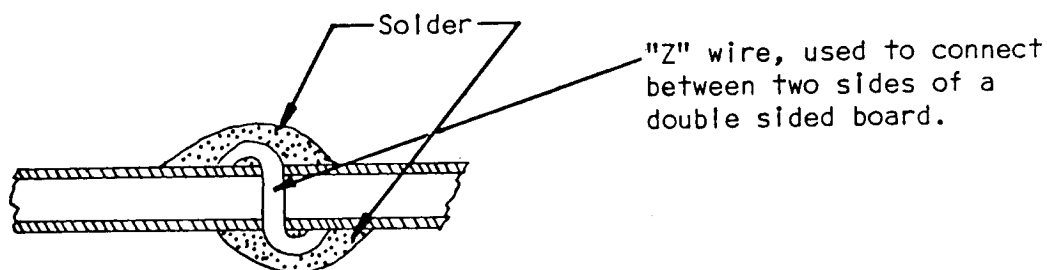
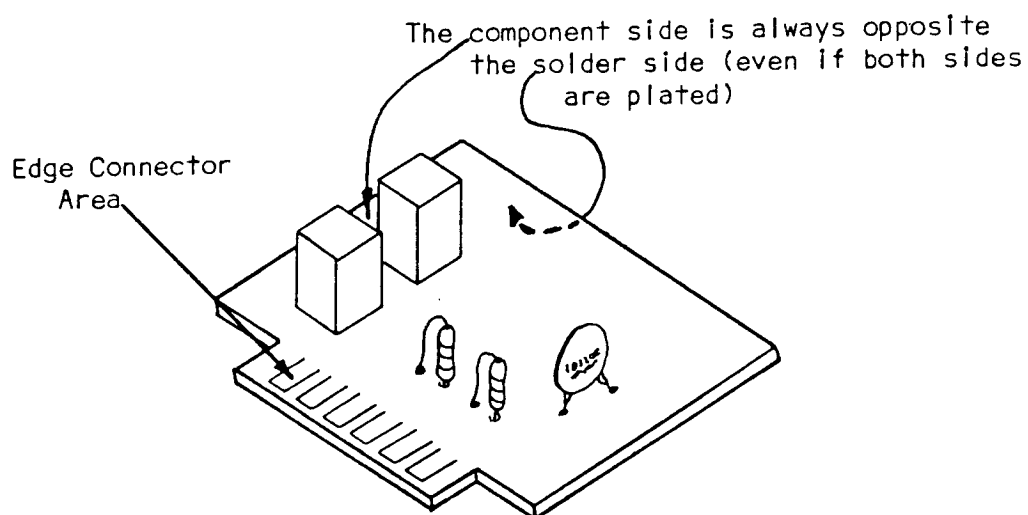
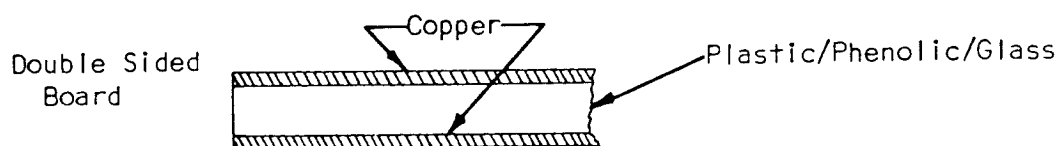
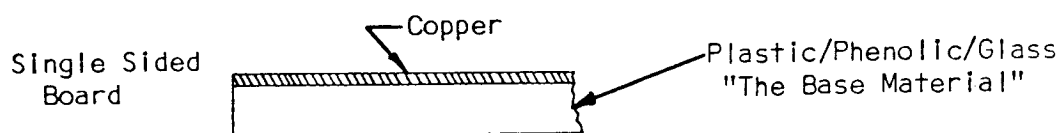


Unstable joint (caused by insufficient heat or solder)



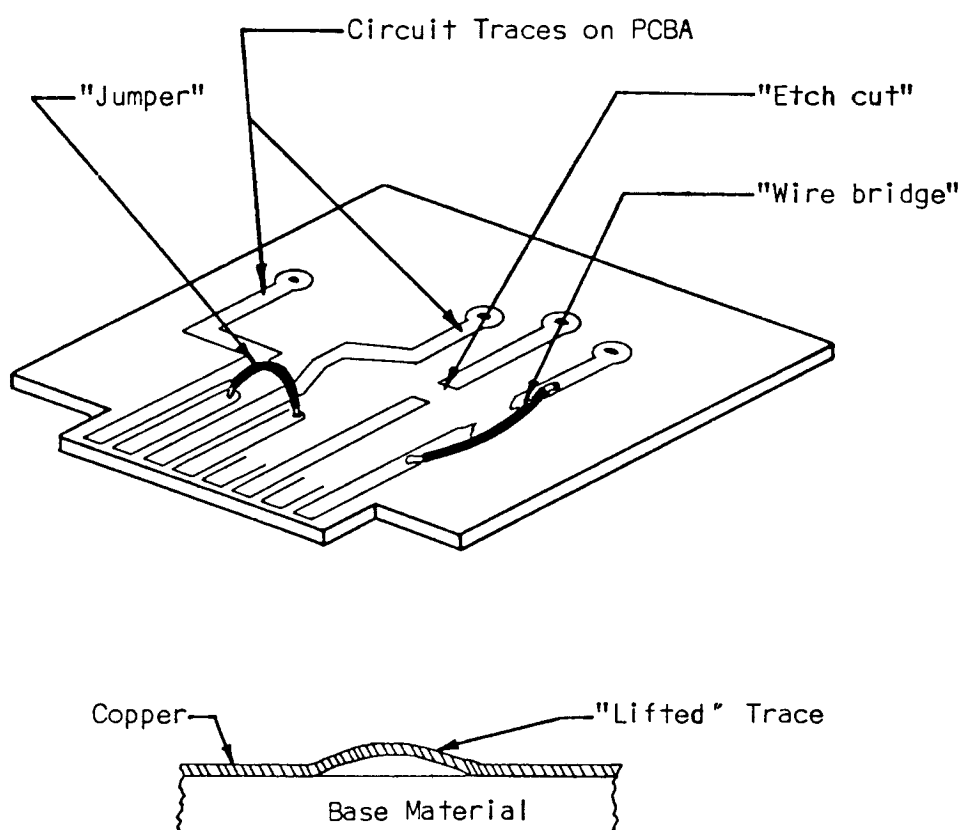
CIRCUIT TRACE REPAIR

Most of the printed circuit boards used in the FT-101Z are single sided boards. However, occasionally a double-sided board is used, in situations where high shielding is required. A comparison of the two types is shown below.

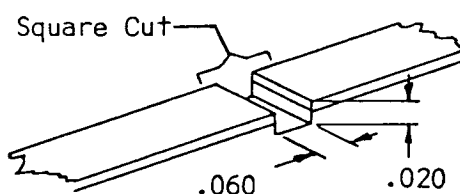


Sometimes, after the design and drafting of a board are completed, a board is produced with an error in it. Though non-technical managers sometimes suffer a stroke at hearing of this situation, it is not unheard of in engineering circles. Thus, should you encounter etch cuts and jumpers on a board, be assured that the modifications were made in the interest of securing optimum performance. Unless you consider your expertise to be superior to that of the design engineer, please leave these mods in place.

However, in service work the occasion does arise when a trace must be cut. Proceed as follows.



If you have previously lifted a trace, make an etch cut on each side of the lifted trace, and install a wire bridge as shown in the drawing.



Coat Cut Area With Eastman 910

MODIFICATIONS

MODIFICATION OF FV-901DM FOR USE WITH FT-101ZD

The tuning dial for the FT-101ZD turns in reversed sense with respect to the FV-901DM synthesized scanning VFO main dial. If it is desired to have both dials rotate in the same direction for a given change in frequency, the modification below will allow this facility. It should be noted that this modification is not required to achieve full functioning of the FV-901DM; however, clockwise rotation of the FV-901DM will correspond with counterclockwise rotation of the FT-101ZD dial.

Modification Procedure:

- (1) Remove the top and bottom covers of the FV-901DM, removing the screws as shown in Figure 13.
- (2) Locate PB-1848 and PB-1849, which can be seen at "A" in Figure 14.
- (3) Referring to Figure 15, locate the white/green wire connected between pin 4 of P₁ and PB-1848; also locate the green wire connected between pin 5 of P₁ and PB-1849. Reverse these wires by unsoldering them from the circuit boards and installing the green wire to PB-1848, the white/green wire to PB-1849. The corrected schematic is shown in Figure 16.
- (4) Locate the CLARIFIER potentiometer inside the front panel of the case. Refer to Figure 17, and locate the yellow and green wires, as well as the 1.5 K ohm resistor. Rewire the connections as shown in Figure 18 for proper CLARIFIER operation. Modification is now complete.

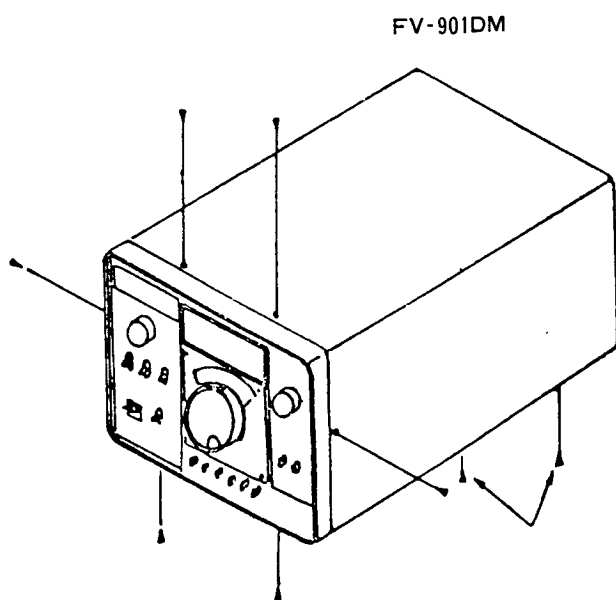


Figure 13.

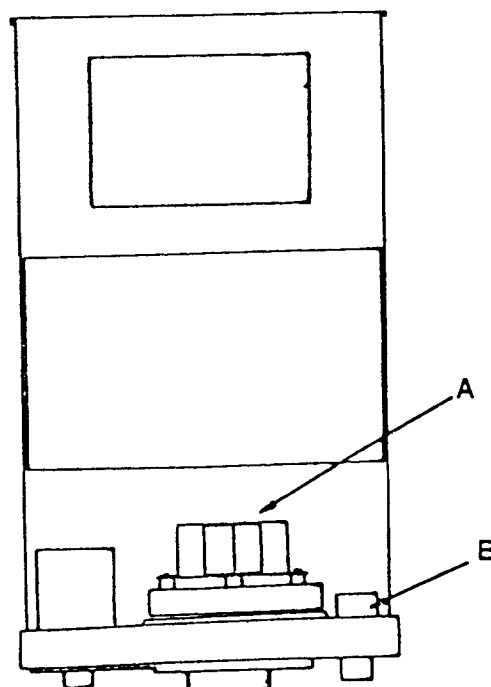


Figure 14

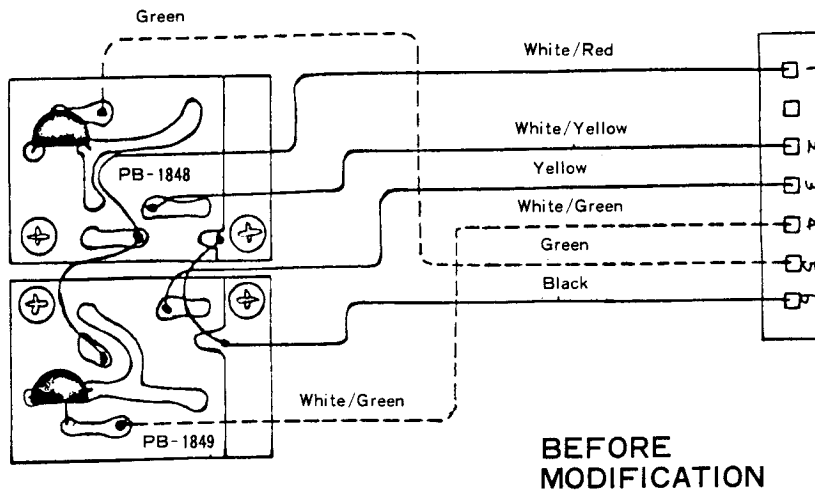


Figure 15.

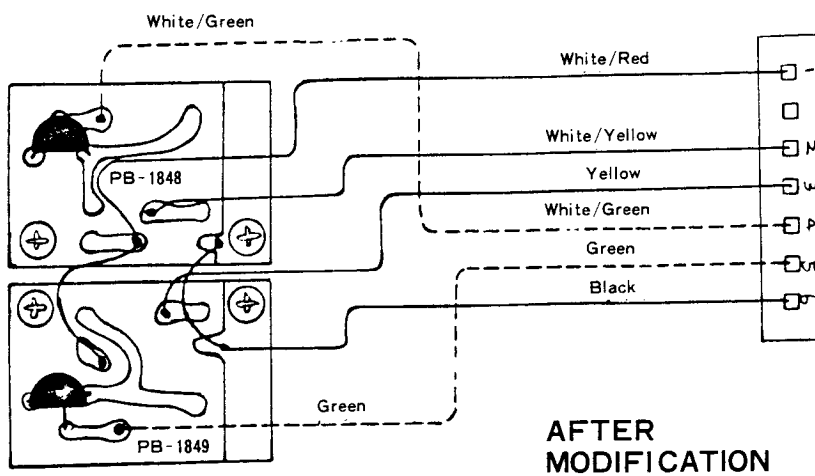


Figure 16.

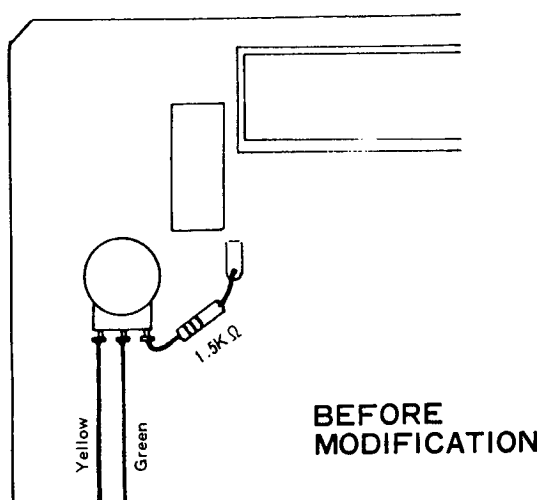


Figure 17.

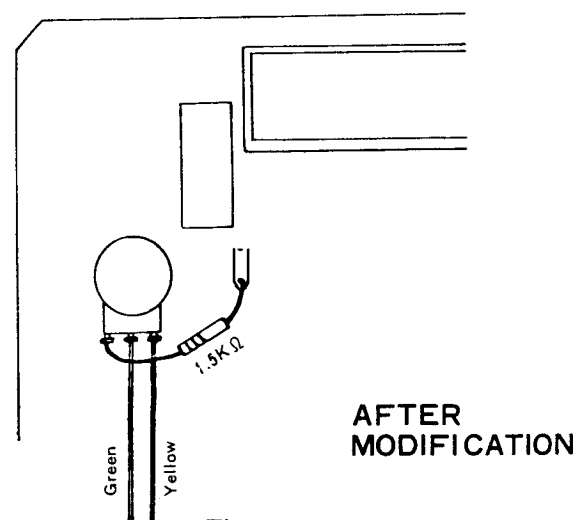


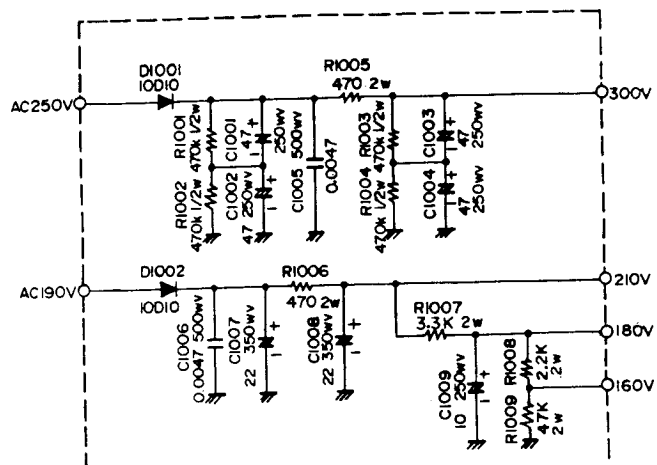
Figure 18.

RECTIFIER B UNIT MODIFICATIONS

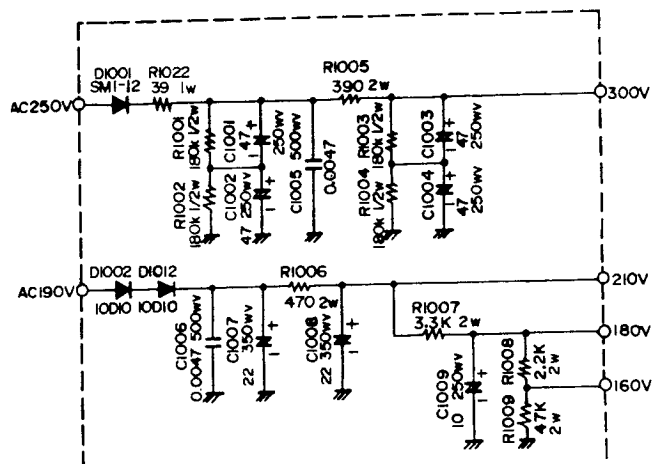
In order to provide additional protection for the power supply circuitry, several changes were adopted in the RECTIFIER B Unit circuit. At A in the schematics is the circuit used for production lots 1 through 4. At B is the circuit modification used for production lots 5 and 6. The modification procedure is described below.

- (1) Add a 270 k ohm, $\frac{1}{2}$ watt resistor in parallel with each of the following: R_{1001} , R_{1002} , R_{1003} , and R_{1004} .
Alternatively, you may change each of the above resistors to a value of 180 k ohms, $\frac{1}{2}$ watt.
- (2) Change R_{1005} to 390 ohms, 2 watts.
- (3) Add a new R_{1022} (39 ohms, 1 watt) in series with D_{1001} , as shown.
- (4) Add a new 10D10 diode in series with D_{1002} .
- (5) D_{1001} is being changed in production to type SM1-12, but field modification is not required.

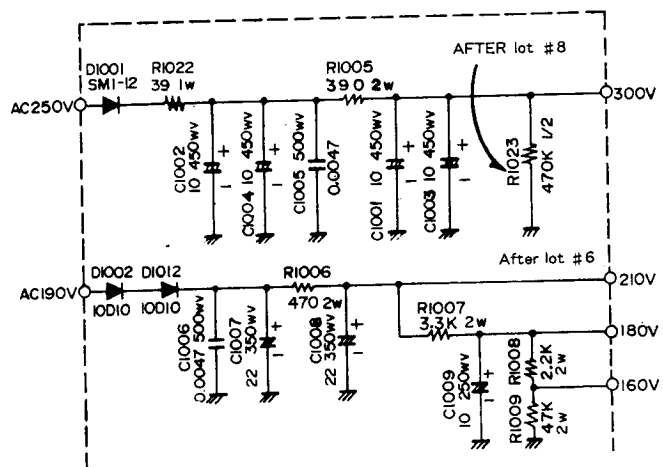
Beginning with production lot 6, the circuit was consolidated. The circuit used after lot 6 is shown at C, with the following exception: R₁₀₂₃ was not installed in lots 6 and 7, and we recommend that it be installed in the field the next time you perform service. The purpose of R₁₀₂₃ is to provide a bleeder path for the filter capacitors.



A: BEFORE MODIFICATION

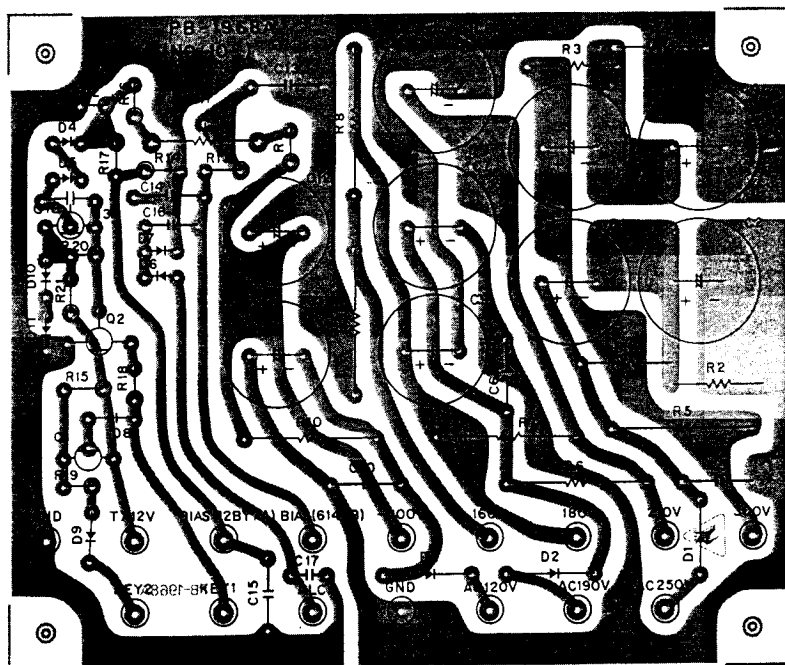


B: AFTER MODIFICATION

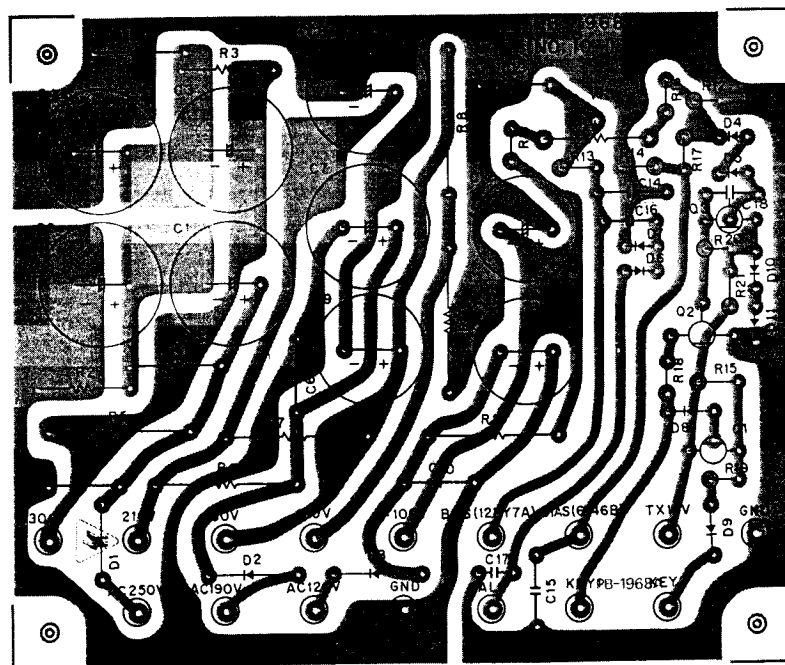
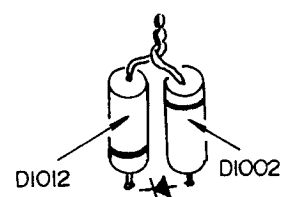
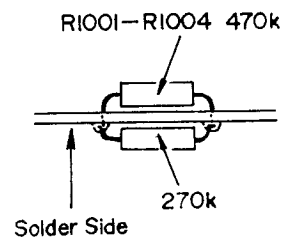


C: AFTER LOT = 6

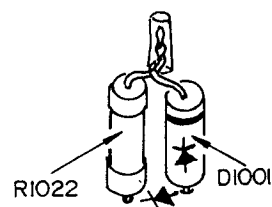
RECT B UNIT PARTS LAYOUT



Viewed from component side

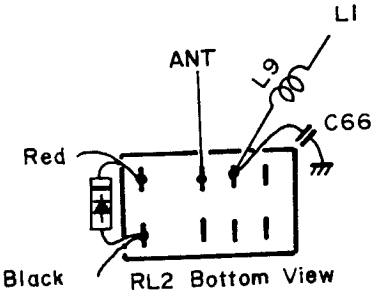
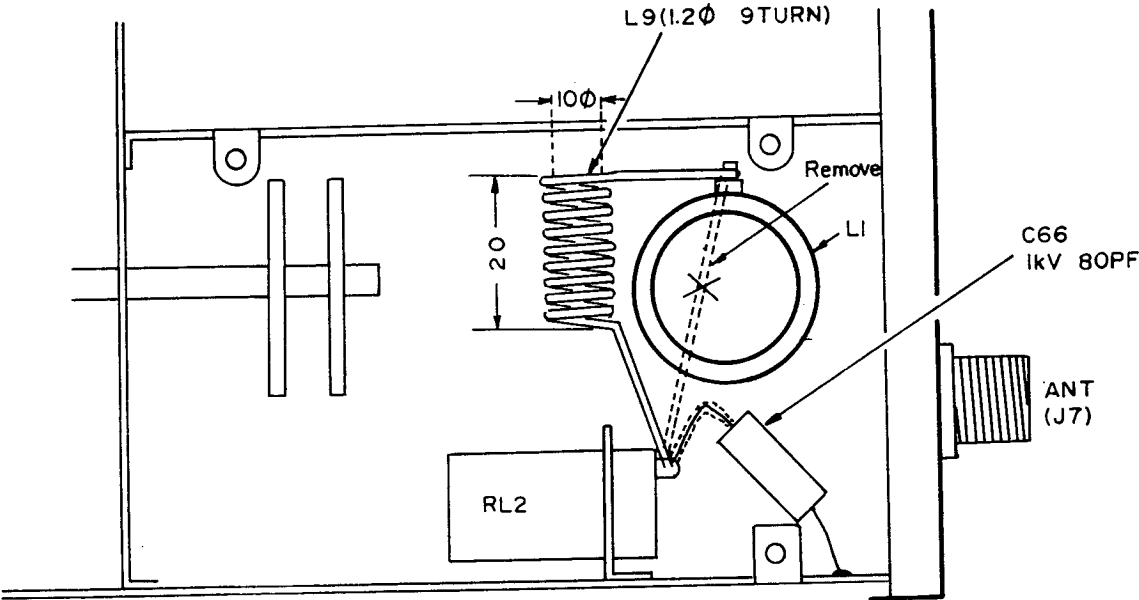


Viewed from solder side



LOW-PASS FILTER ADDITION

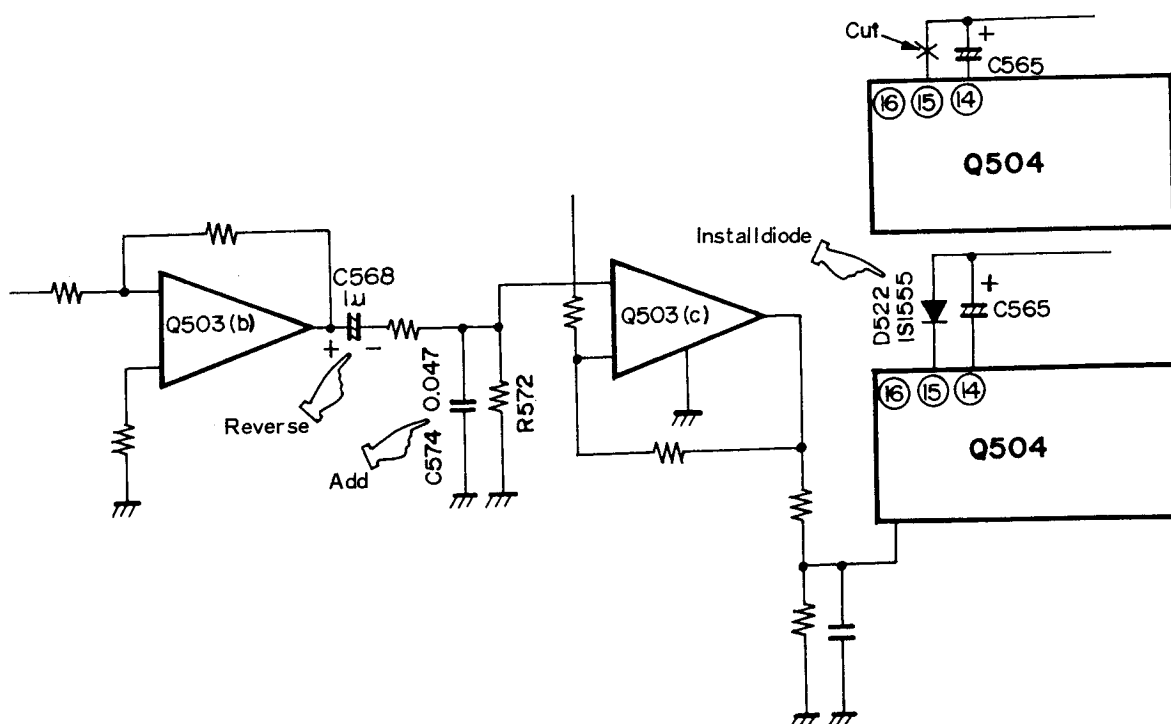
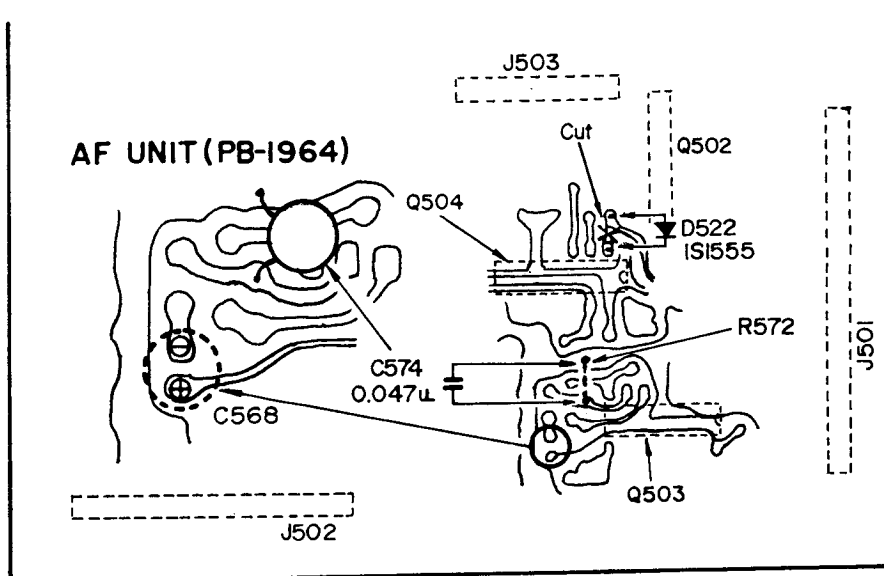
The FT-101Z and FT-101ZD transceivers were modified, beginning with the production lot #04, with the inclusion of the low-pass filter circuit shown below. The parts to be added are L₉ (0.4 μ H) and C₆₆ (mica, 80 pF, 1 kV). The drawing below is an underside view, showing the correct installation.



VOX CIRCUIT MODIFICATION

In order to ensure reliable VOX operation, the following modifications were adopted as of production lot number 7, and may be of help if you have a problem with inconsistent VOX timing.

- (1) Cut the lead to pin 15 of Q₅₀₄. Install a silicon switching diode (1S1555) in its place, as shown in the drawing.
- (2) Add a new disc ceramic capacitor (C₅₇₄), 0.047 μ F, in parallel with R₅₇₂.
- (3) Reverse the polarity of C₅₆₈, as it was installed in reverse order for the intended purpose. The correct installation is shown in the drawing, and a new capacitor is probably called for. See also page 3-25.



COUNTER CIRCUIT MODIFICATIONS

In order to eliminate an occasional low-level counter beat, the following modifications may be of help.

(1) In sets from production lots 1 through 4:

- (a) Solder a three-pin (one grounded) solder lug to the Counter Support Board, as shown in Figure 19.
- (b) Solder new C_{68} ($0.047 \mu\text{F}$) and C_{69} ($0.047 \mu\text{F}$) disc ceramic capacitors, as well as the new C_{70} electrolytic ($10 \mu\text{F}$) to the terminal, per the schematic.

(2) In sets from production lots 1 through 5:

- (a) Install the three bypass capacitors C_{2324} , C_{2325} , and C_{2326} from the CW, USB, and LSB terminals of the COUNTER MAIN BOARD, respectively, to ground. Refer also to the schematic for details (these are shown installed in the schematic on page 2-17).

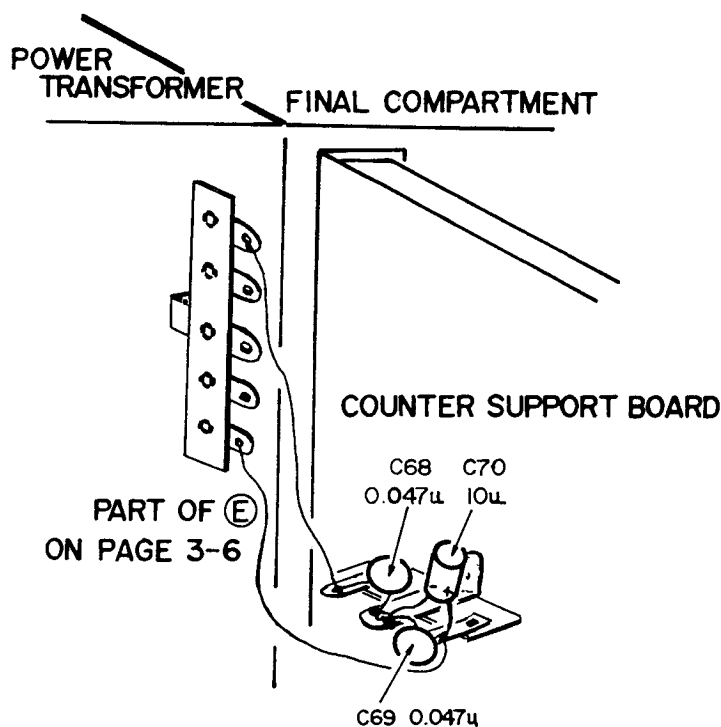
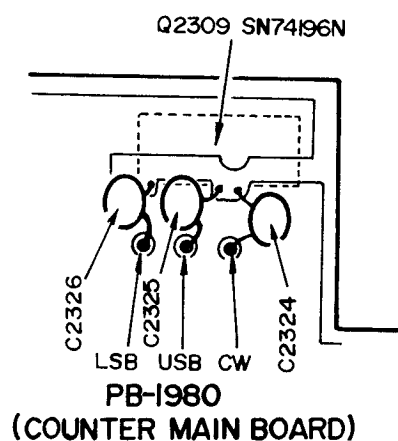


Figure 19.



($C_{2324}/C_{2325}/C_{2326}$ $0.047 \mu\text{f}$)

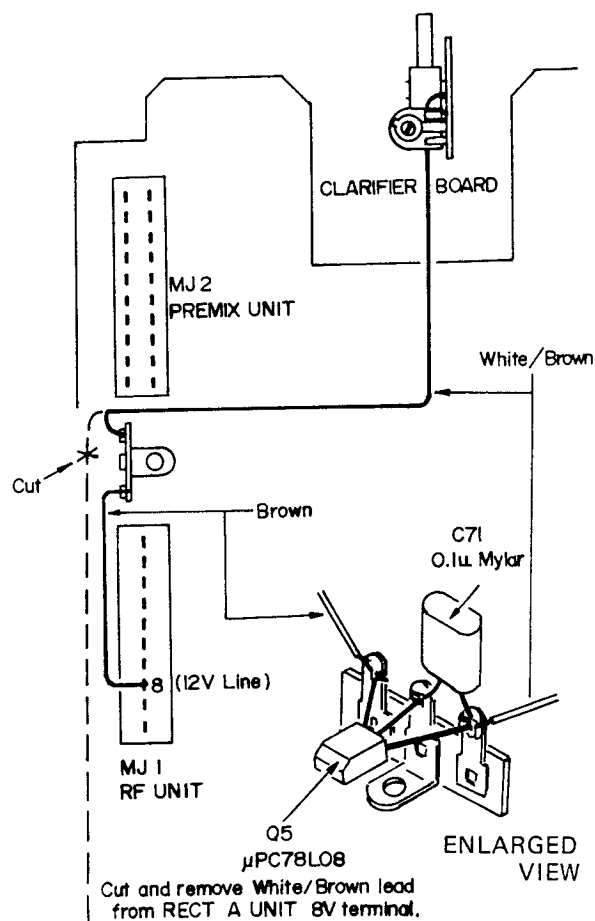
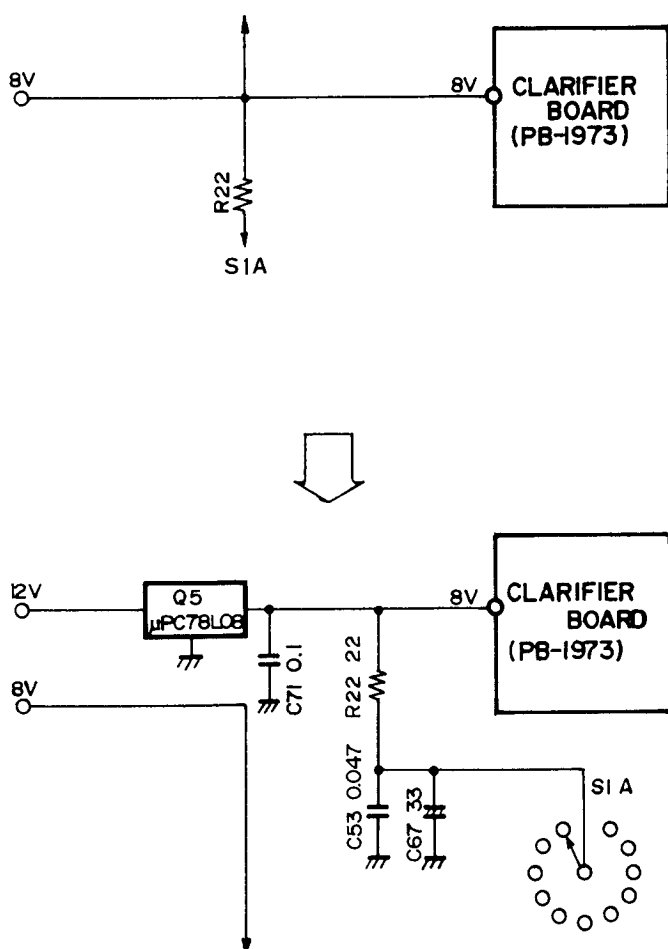
Figure 20

VFO DRIFT IN CONJUNCTION WITH DIMMER CONTROL

Some FT-101ZD transceivers from the first 6 production lots displayed a slight drift of the VFO when the dimmer control was rotated. In order to clear up this problem, the 8 volt line for the clarifier board was separated from the other 8 volt lines, and the following section will describe the correct procedure.

- (1) Locate the white/brown lead between the CLARIFIER board and the 8 V terminal on the RECT A Unit. Cut this lead at the RECT A Unit.

- (2) Install a three-pin (one grounded) terminal strip adjacent to MJ₁, one the bottom side of the chassis, as shown in the drawing. Connect the white/brown wire to one side, and install the μ PC78L08 regulator so that the output side is connected to the white/brown wire. Then install the 0.1 μ F mylar capacitor as shown, and connect the input side of the μ PC78L08 to the (brown) wire shown. The other end of the brown wire connects to pin 8 of MJ₁, the 12 volt line terminal.
- (3) A comparison of the old and new circuits is shown below.

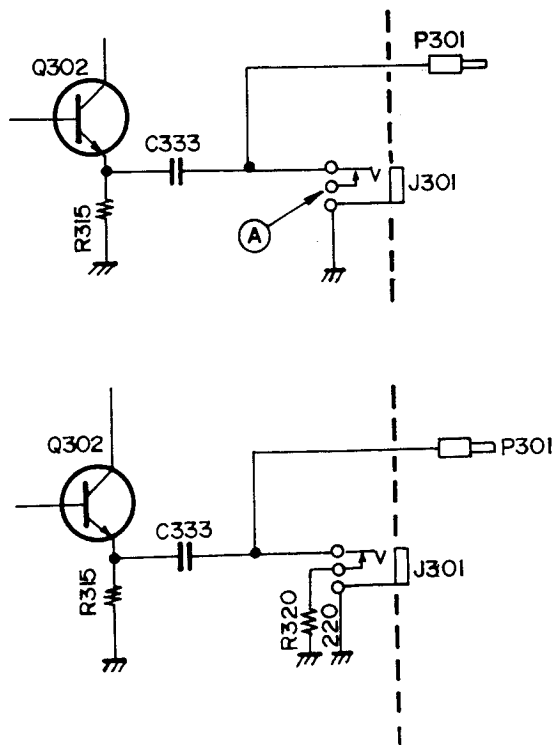
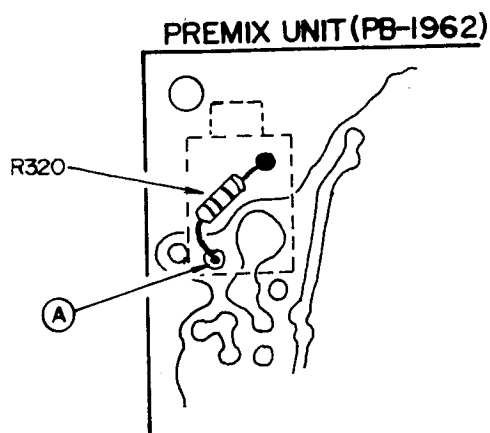


21.2 MHz SPURIOUS SUPPRESSION ON FT-101Z(ANALOG DIAL)

On the analog FT-101Z, a lingering spurious signal could sometimes be heard at 21.2 MHz. With the counter unit installed, the beat is inaudible, and the following modification will eliminate this weak spur in analog versions.

Refer to the drawing below, and install a new 220 ohm $\frac{1}{4}$ watt resistor (R₃₂₀) on the PREMIX Unit as shown.

No further modification is required.



AF UNIT CAPACITOR POLARITY CHECK

In FT-101Z/ZD transceivers bearing serial numbers from the first six production lots, a mistake in the printing on the AF Unit caused several capacitors to be installed in reverse order for their intended purpose, although they were correct according to the printing. In many sets no serious deterioration in performance is noted at all; however, if you get a set for servicing which displays AF oscillation, distortion, or low output, this may be a good place to check. The reversed capacitors should be replaced with new ones installed in the proper position.

The capacitors affected are:

C₅₀₂ (470 μ F)

C₅₀₆ (220 μ F)

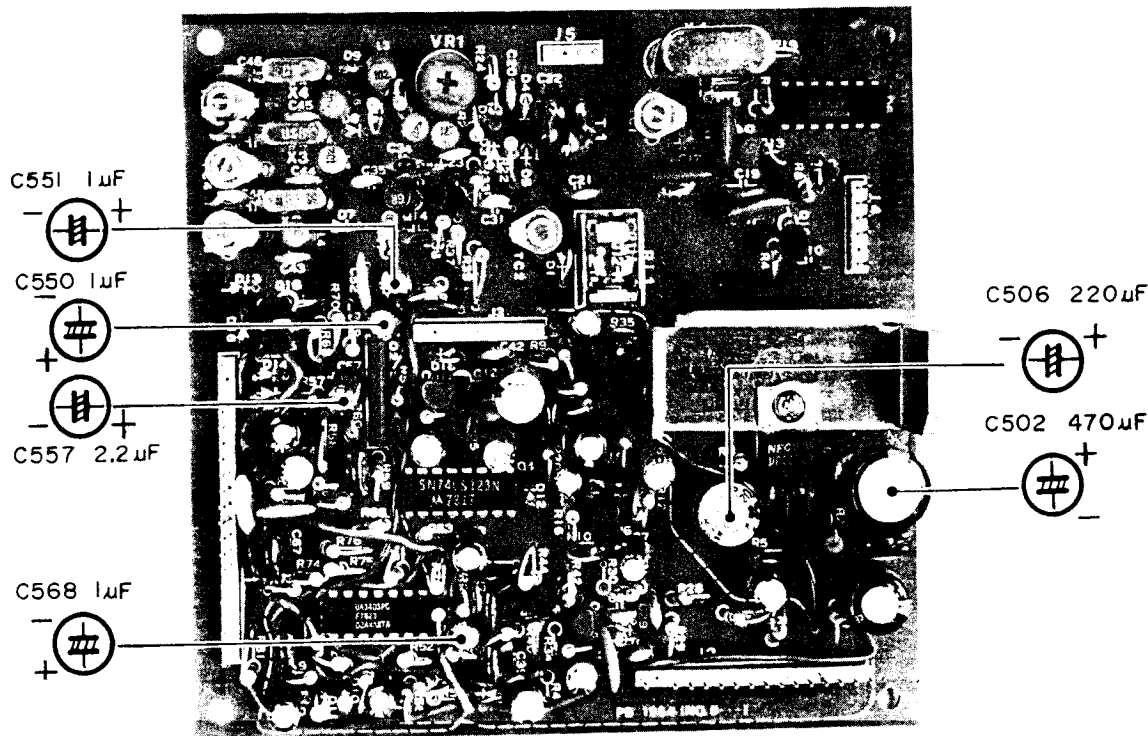
C₅₅₀ (1 μ F)

C₅₅₁ (1 μ F)

C₅₅₇ (2.2 μ F)

C₅₆₈ (1 μ F)

In sets from production lots 7 through 10, the printing is not correct, but the capacitors have been correctly installed. The prints on pages 3-60 and 3-61 are correct, as is the schematic diagram.



MAINTENANCE AND ALIGNMENT

WARNING

DANGEROUS VOLTAGES ARE PRESENT WITHIN THIS TRANSCEIVER. USE EXTREME CAUTION WHEN WORKING ON THE TRANSCEIVER WITH THE COVERS REMOVED. DISCHARGE ALL CAPACITORS BY SHORTING THEM TO GROUND WITH AN INSULATED SCREWDRIVER AFTER POWER HAS BEEN REMOVED. OBSERVE NORMAL SAFETY PRECAUTIONS AT ALL TIMES.

CAUTION

Never operate this transceiver in the transmit mode without a matched antenna or dummy load connected to the antenna receptacle on the rear panel. It is possible to damage the final amplifier tubes and the pi network components if the transmitter is operated without the proper load termination.

GENERAL

This transceiver has been carefully aligned and tested at the factory. With normal use, it should not require other than the usual attention given to electronic equipment. Service or realignment of a major component may require substantial adjustment; under no circumstances, though, should realignment be attempted unless the operation of the transceiver is fully understood, the malfunction has been carefully analyzed, and the fault has definitely been traced to misalignment. Sudden difficulties are almost always caused by component failure rather than misalignment.

Service work should only be performed by experienced personnel, using the proper test equipment.

EQUIPMENT REQUIRED

- (1) RF Signal Generator: Hewlett-Packard Model 606A or equivalent, with one volt output at 50 ohms, and frequency coverage to 30 MHz.

- (2) Vacuum Tube Voltmeter (VTVM): Hewlett-Packard Model 410B or equivalent, with an RF probe good to 40 MHz.
- (3) Dummy Load: Yaesu Model YP-150 or equivalent, with 50 ohm non-reactive load impedance, rated to 150 watts average power.
- (4) AF Signal Generator: Hewlett-Packard Model 200AB or equivalent.
- (5) A general coverage receiver covering 3 to 30 MHz, with a 100 kHz crystal calibrator.
- (6) A frequency counter, Yaesu Model YC-500 or equivalent, with resolution to 0.01 kHz and frequency coverage to 30 MHz.
- (7) An oscilloscope, Hewlett-Packard Model 1740A or equivalent.

AF UNIT ALIGNMENT

VOX Circuit

A. Antitrip level setting

1. Tune in a signal on the FT-101ZD receiver, and adjust the AF GAIN control for a normal listening level. Position the microphone near the speaker, with the MODE switch in the SSB mode. Increase the VOX GAIN control on the front panel until the speaker output causes the VOX relay to switch the transceiver to transmit. Set the ANTITRIP control VR₉, located on the rear apron, to the point that will just prevent the speaker output from tripping the VOX relay.
2. Now place the microphone in the normal operating position, and speak into the microphone to see if your voice will activate the VOX relay. If not, VR₉ may be advanced too far.

B. VOX relay delay setting

1. Adjust the DELAY control VR_{2b}, located on the front panel, for the desired delay time. This may require a different setting for phone and CW operation, owing to differing operating techniques. For CW or phone operation using a footswitch, the VOX GAIN control may be rotated fully counter-clockwise to the PTT position.

CW Sidetone

1. The CW sidetone level may be adjusted by means of VR₁₀, located on the rear apron.

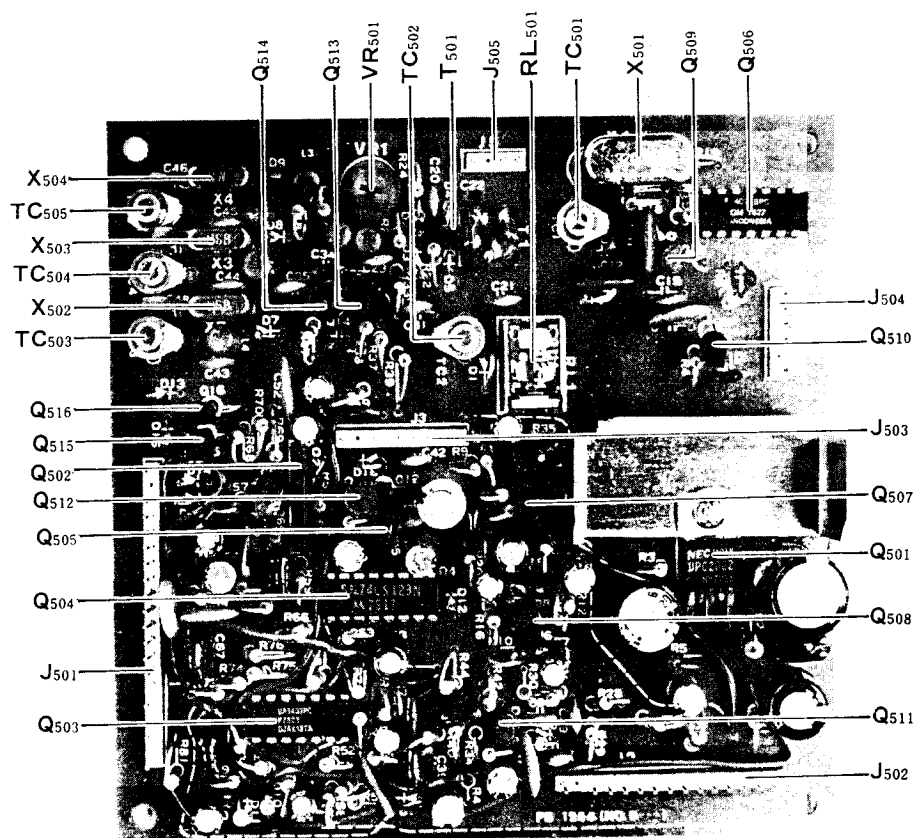
Marker Frequency setting

1. Preset the controls as follows:
BAND JJY/WWV
DIAL 5000.0 kHz
PRESELECT . Peaked for maximum response
MODE TUNE
2. Place the NB/MARK switch in the MARK position. Tune in the WWV or JJY signal, and adjust TC₅₀₁ for an exact zero beat with the carrier of the incoming signal.

Carrier Frequency Adjustment

A. SSB Carrier Point

1. Tune up the transmitter on 20 meters, LSB mode, into a dummy load. Apply a 1 kHz audio signal to the microphone input, and adjust the audio generator output until the transmitter power output is 60 watts, as indicated on the dummy load wattmeter.
2. Shift the audio generator output frequency to 300 Hz, without changing the output level. Adjust TC₅₀₃ for a power output reading of 15 watts on the wattmeter.
3. Shift the MODE switch to USB. Adjust TC₅₀₄ for an identical 15 watt reading on the wattmeter.



AF UNIT (PB-1964)

4. Recheck the LSB adjustment, as well as the carrier balance adjustment, after performing the carrier point alignment. The background noise, when switching between USB and LSB, should not change.

B. Carrier Balance

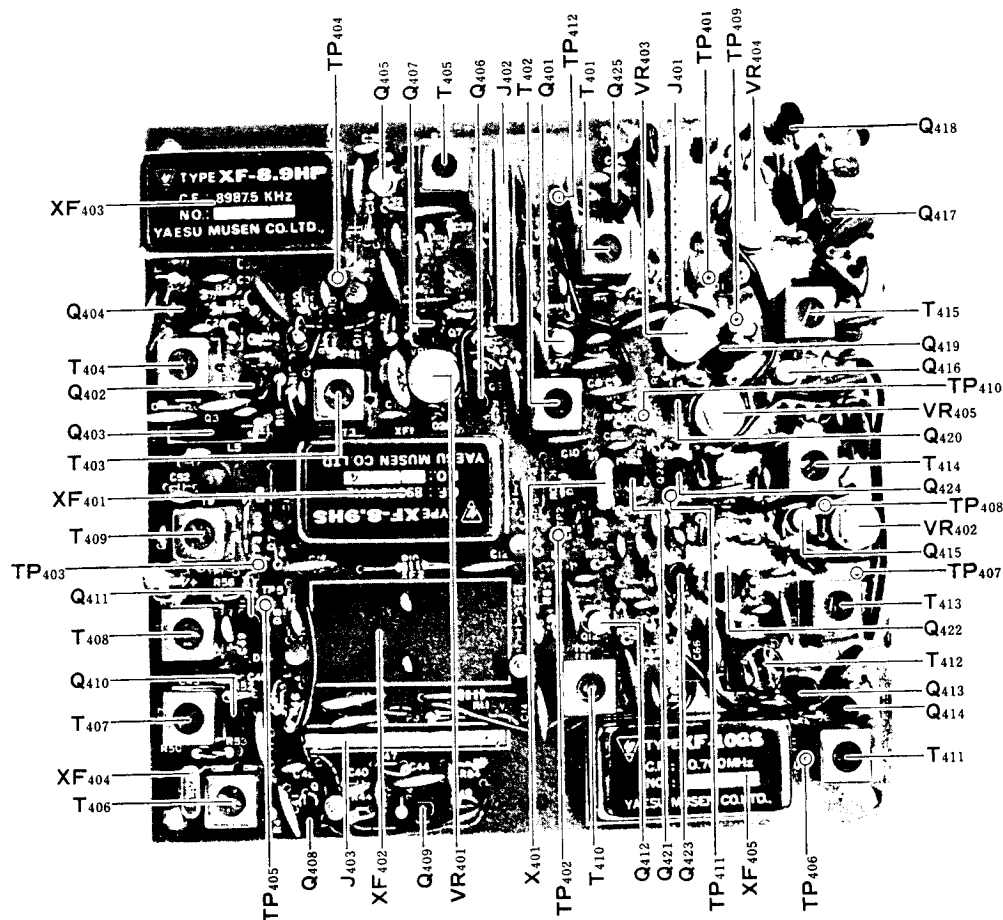
1. Tune up the transceiver on 20 meters, USB mode, into a dummy load. Set the main tuning dial to 14.250 MHz. Connect the RF probe of the VTVM to the antenna jack. Disconnect all microphones, etc., from the microphone jack.
2. Activate the transmitter by placing the VOX GAIN control into the MOX position. Adjust VR₅₀₁ and TC₅₀₂ for a minimum VTVM reading.
3. If a VTVM is unavailable, use an external

monitor receiver, tuned to the transmitter frequency, and adjust VR₅₀₁ and TC₅₀₂ for a minimum S-meter reading on the external receiver.

4. This adjustment should be repeated several times on LSB and USB, in order to ensure complete carrier nulling.

C. CW Carrier Point

1. Connect a frequency counter to TP₄₀₂, located on the IF UNIT. Place the MODE switch in the TUNE position.
2. Adjust TC₅₀₅ for a frequency counter reading of exactly 8988.3 kHz.
3. When using the optional CW filter, a substantial loss on transmit, when in the CW-N position, may indicate the need for adjustment as indicated in steps 1 and 2.



IF UNIT (PB-1963)

IF UNIT ALIGNMENT

S-Meter Sensitivity Adjustment

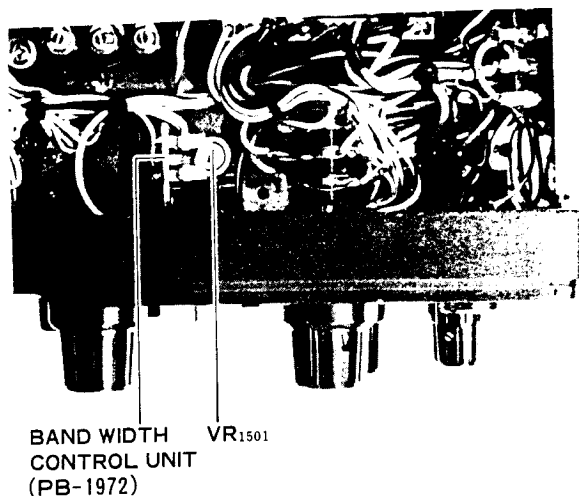
1. Set the BAND switch to 20 meters, the main dial to 14.250 MHz, and set the RF GAIN fully clockwise.
2. Set the signal generator to 14.250 MHz, and set its output to 6 dB. Tune the signal generator signal on the receiver, and peak the preselector for maximum signal strength. The S-meter should just begin to move with the 6 dB input.
3. Adjust VR₄₀₃ for a reading of 0 on the S-meter.
4. Set the generator output to 100 dB, and adjust VR₄₀₅ for a reading of S9 + 60 dB on the S-meter. Confirm that the preselector is peaked.
5. Return the signal generator output to 6 dB, and recheck the adjustment of VR₄₀₃.

Variable IF Bandwidth Alignment

1. Set the controls as follows:
 BAND 20 m
 DIAL 14.200 MHz
 RF GAIN Fully clockwise
 WIDTH switch .. OFF
 MODE USB
 Peak the preselector for maximum response against the marker signal or background noise.
2. Connect the frequency counter to TP₄₁₁. Adjust VR₁₅₀₁ for a reading of exactly 19.7475 MHz.
3. Place the WIDTH switch ON. Make sure that the WIDTH control is exactly in the 12 o'clock position. Adjust VR₄₀₄ for a reading of exactly 19.7475 MHz on the frequency counter.
4. Switch between USB and LSB, and observe the background noise. If there is any difference, adjust VR₁₅₀₁ until the background noise is the same.

ALC Meter Alignment

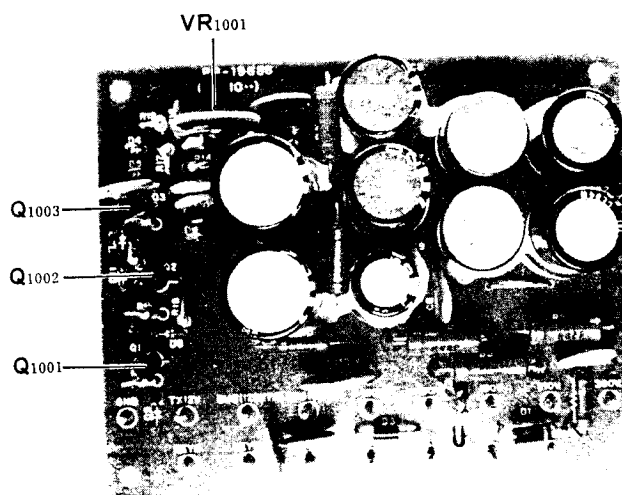
1. On any band, set the MODE switch to USB. Set the meter switch to ALC.
2. With no speech input, activate the transmitter. Adjust VR₄₀₁ for a 0 reading on the ALC meter scale.



RECTIFIER B UNIT

Bias Adjustment

1. Set the MODE switch to USB or LSB, and set the MIC GAIN control fully counterclockwise.
2. Place the METER switch in the IC position, and set the VOX GAIN control to VOX. Adjust the PB-1968 BIAS control, VR₁₀₀₁, for a reading of 50 mA. For 10 watt models, the correct meter reading is 25 mA.



RECT.B UNIT(PB-1968)

VFO UNIT

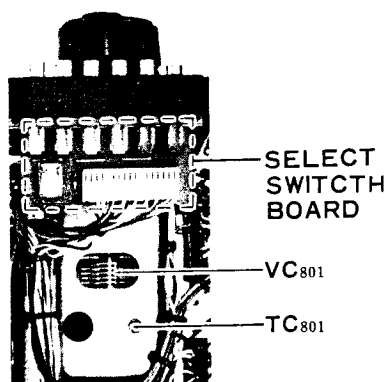
The VFO UNIT is very critical in its adjustment. As well, this is not an area which should ever require alignment. Questions regarding drift, etc., usually can be traced to other areas of the transceiver (instability in the supply voltage, etc.). For this reason, all cases regarding VFO repair should be referred to an experienced service technician.

The following components are of interest from a service standpoint:

TC₈₀₁ is the band set trimmer.

TC₈₀₂ is the VFO level set trimmer.

To confirm proper VFO injection, connect the VTVM to the VFO output. Adjust TC₈₀₂ for a reading of 100 mV.



BAND	CRYSTAL	FREQUENCY	TRANSFORMER
160m	X 601	15.9875MHz	T601
80m	X 602	17.9875	T602
40m	X 603	21.4875	T603
20m	X 604	28.4875	T604
15m	X 605	35.4875	T605
10mA	X 606	42.4875	T606
10mB	X 607	42.9875	T607
10mC	X 608	43.4875	T608
10mD	X 609	43.9875	T609
JJY/WWV	X 610	19.4875	T610

Table 7

NB-FIX UNIT

Fixed Channel Frequency Alignment

When the optional fixed channel crystals are being used, they may be placed exactly on the correct frequency by adjusting TC₂₀₁ (for channel 1) and TC₂₀₂ (for channel 2). Confirmation of the correct

frequency may be made with an external receiver or by loosely coupling a probe from the frequency counter to the transmitter output. A 1-turn loop is usually sufficient to provide indication on the counter.

PREMIX LOCAL UNIT

Premix Local Alignment .

1. Connect the RF probe of the VTVM to pin 1 of MJ₃.
2. Refer to Table 7, and adjust the appropriate transformer for a level of 300 mV for each band and crystal, as shown in the table.

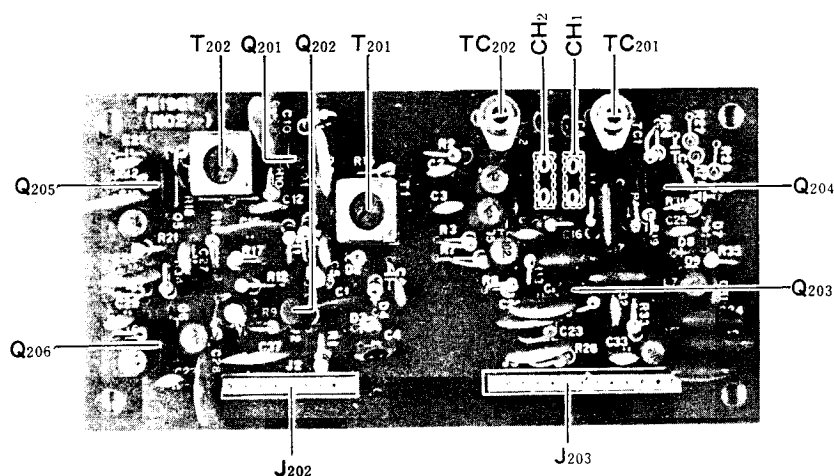
PREMIX UNIT

For this alignment, a wideband (not peak) sweep generator, as well as an oscilloscope, should be used.

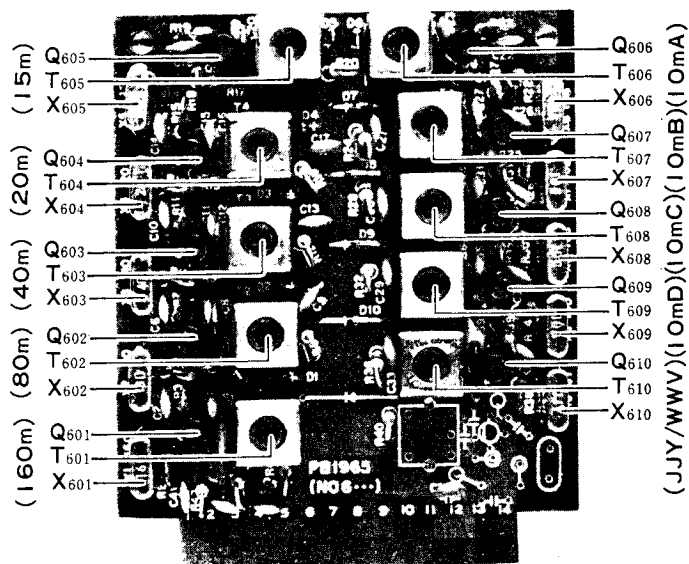
1. Press the EXT select switch. Apply 5.0 - 5.5 MHz sweep output to the VFO output terminal at the rear apron external VFO jack. Connect a high-impedance probe of an oscilloscope to J₃₀₁.
2. Adjust the transformers shown in Table 8 for a flat response across the entire passband. If you have never adjusted a bandpass filter previously, this may take some practice. Perform the adjustments on each band, according to the chart.

BAND	TRANS-FORMER	PASSBAND
160m	T ₃₀₁ , T ₃₀₂	10.4—11.0(MHz)
80m	T ₃₀₃ , T ₃₀₄	12.4—13.0
40m	T ₃₀₅ , T ₃₀₆	15.9—16.5
20m	T ₃₀₇ , T ₃₀₈	22.9—23.5
15m	T ₃₀₉ , T ₃₁₀	29.9—30.5
10mA	T ₃₁₁ , T ₃₁₂	36.9—39.0
JJY/WWV	T ₃₁₃ , T ₃₁₄	13.9—14.5

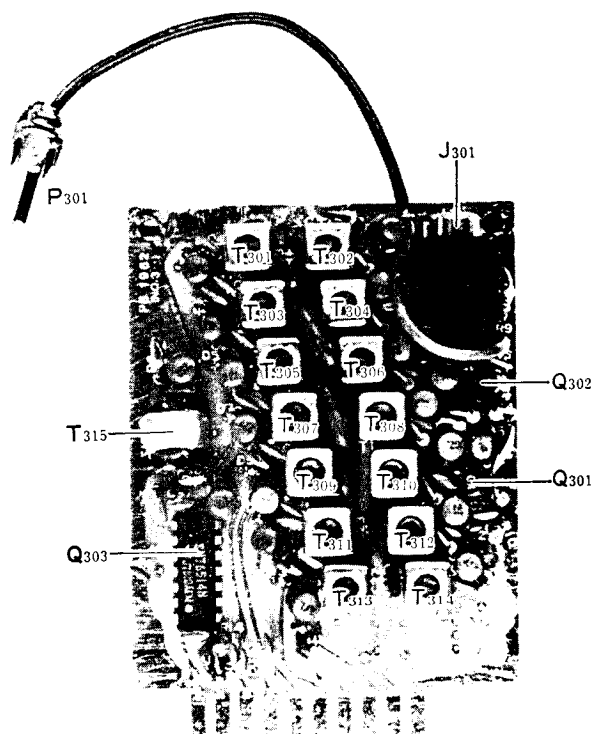
Table 8



NB-FIX UNIT(PB-1961)



PREMIX LOCAL(XTAL)UNIT(PB-1965)



PREMIX UNIT(PB-1962)

AM UNIT (After production lot #8)

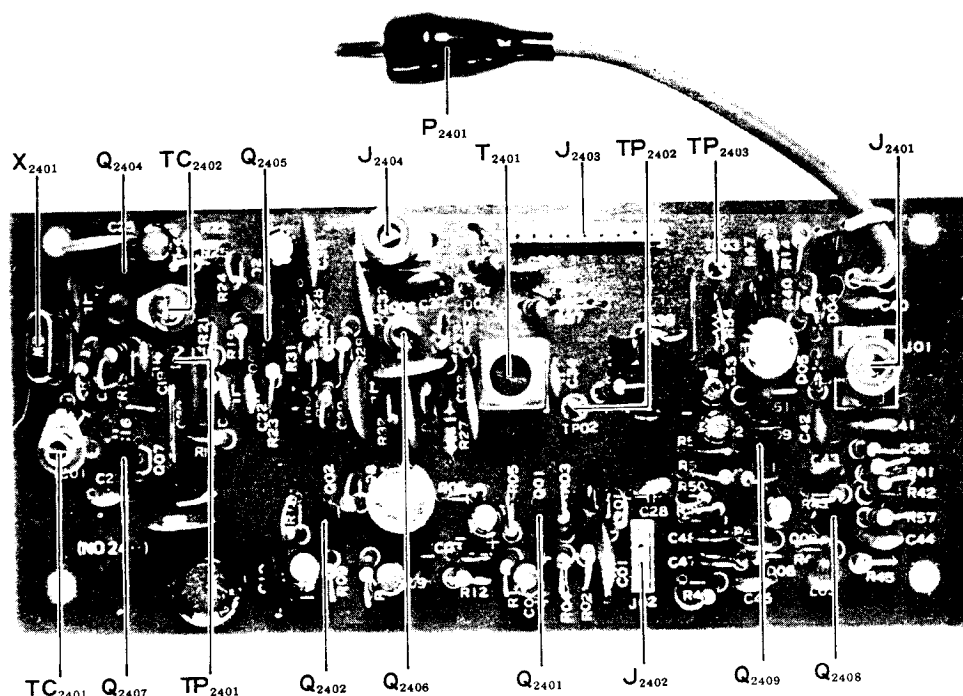
1. Set the BAND switch to 40, the MODE switch to AM, and the DRIVE control to the 3 o'clock position. Tune up the transmitter in the usual fashion. Now adjust the core of T_{2401} for maximum power output into the dummy load/wattmeter.
2. Connect a frequency counter to TP_{2402} . Adjust TC_{2401} for a counter reading of exactly 8988.3 kHz while transmitting.
3. Connect the RF probe of the VTVM to TP_{2401} , and adjust TC_{2402} for a reading of 50 mV while transmitting.

TRANSMIT RF/IF TRANSFORMER ALIGNMENT

- (1) Connect a dummy load to the antenna jack, and connect an audio signal generator to the microphone input. Tune up the transmitter at 14.2 MHz, and adjust the audio generator output for approximately 50 watts output into the dummy load, single-tone, SSB mode.
- (2) Peak T_{104} (RF UNIT) for maximum power output.
- (3) Peak $T_{401} - T_{403}$ and T_{405} (IF UNIT) for maximum power output. Switch the RF processor on, and adjust the COMP LEVEL control for approximately 50 watts output. Peak T_{404} for maximum power output.

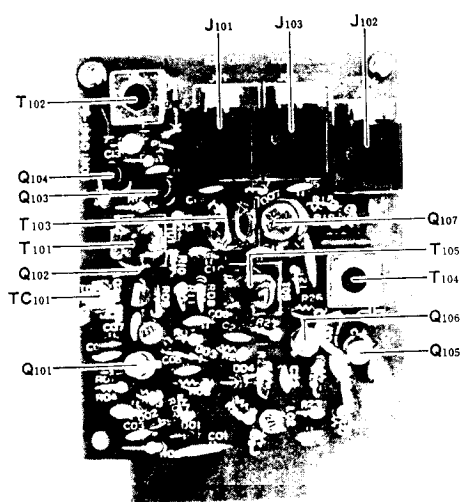
RECEIVER RF/IF/NB TRANSFORMER ALIGNMENT

- (1) Tune in the marker generator signal at 14.2 MHz, with a dummy load connected to the antenna jack. Peak the preselector for maximum S-meter indication.
- (2) Peak T_{102} (RF UNIT) for maximum S-meter indication.



AM UNIT (PB-2040)

- (3) Peak T_{406} - T_{411} and T_{413} - T_{415} for maximum S-meter indication.
- (4) Connect the RF probe of a VTVM to the collector of Q_{202} (NB-FIX UNIT). Reduce the RF GAIN control somewhat, and tune T_{201} and T_{202} for a dip in the VTVM indication. If no dip is observed, reduce the RF GAIN control further.



RF UNIT(PB-1960)

ALIGNMENT OF TRANSMITTER MIXER/ DRIVER AND RECEIVER FRONT END STAGES

CAUTION

Be certain not to exceed the recommended 10 seconds of key down time while performing the alignment of the transmitter mixer and driver stages, as described below. Always dip the PLATE control to establish resonance before proceeding with any adjustments. Off-resonance operation will shorten tube life dramatically.

- (1) Connect a dummy load/wattmeter to the rear panel ANT jack.

- (2) Set the MODE switch to TUNE, the BAND switch to 40, the VFO dial to 000, the PRESELECTOR control to 6 (on the scale of 1-10), and the DRIVE control fully clockwise. Connect a dummy load/wattmeter to the antenna jack, and set the neutralization trimmer TC_1 to the $\frac{1}{2}$ position shown in Figure 2.
- (3) Close the PTT switch, and dip the PLATE control for a minimum IC reading on the transceiver meter (the LOAD control should be set to the nominal setting shown in the "operation" section of this manual). Now adjust TC_{1403} for maximum power output into the wattmeter.
- (4) Set the BAND switch to 10D, the PRESELECTOR control to 10 (on the scale of 1-10), and reduce the setting of the DRIVE CONTROL. Preset TC_{1206} to the $\frac{1}{2}$ position, and TC_{1306} to the $\frac{1}{3}$ position, as shown in Figure 21. Set the LOAD control to the correct position, and close the PTT switch. Dip the PLATE control for minimum IC reading on the transceiver meter. Now advance the DRIVE control to the point where maximum power output is obtained (do not go beyond the maximum PO point). Adjust the cores of T_2 and T_3 for maximum power output. Do not exceed the 10 second key down limitation during this adjustment.
- (5) On receive, set the RF GAIN control fully clockwise, and turn the marker on. Tune in the marker signal at 30.000 MHz, and adjust T_2 and T_3 slightly for maximum deflection on the S-meter. Now recheck the peaking on transmit; several repetitions may be necessary to secure the proper ratio.
- (6) Locate T_1 , and set its core to the same physical level as the cores of T_2 and T_3 were set in step (5).
- (7) Set the BAND switch to 10A, the VFO dial to 000, and tune up the transmitter. Peak the PRESELECTOR control for maximum power output. Now adjust TC_{1306} for maximum power output into the wattmeter. On receive, tune to the marker signal at 28.000 MHz, and adjust TC_{1206} (and TC_{101} on the RF UNIT) for maximum deflection of the S-meter.
- (8) As there may be some interaction of adjustments, please repeat steps (3) through (7), so as to be sure of proper tracking.

SERVICING

- (9) Adjust the final amplifier neutralization, as described on page 3-35
- (10) Again recheck steps (3) through (7).
- (11) Now you are ready to align the other bands. Set the BAND switch to 15, the VFO dial to 000, and the PRESELECTOR control to 8.5 (on the scale of 1-10). Set the LOAD control to the proper position. Close the PTT switch, and dip the PLATE control for minimum IC indication on the transceiver meter. Now adjust TC₁₄₀₅ and TC₁₃₀₅ for maximum power output into the wattmeter. On receive, tune to the marker signal at 21.000 MHz, and peak TC₁₂₀₅ for maximum S-meter deflection on the marker signal.
- (12) Set the BAND switch to 20, the VFO dial to 000, and the PRESELECTOR control to 8 (on the scale of 1-10). Set the LOAD control to the proper position. Close the PTT switch, and dip the PLATE control for minimum IC indication on the transceiver meter. Now adjust TC₁₄₀₄ and TC₁₃₀₄ for maximum power output into the wattmeter. On receive, tune to the marker signal at 14.000 MHz, and adjust TC₁₂₀₄ for maximum S-meter deflection on the marker signal.
- (13) Set the BAND switch to 40, the VFO dial to 000, and the PRESELECTOR control to 6 (on the scale of 1-10). Set the LOAD control to the correct position. Close the PTT switch, and dip the PLATE control for minimum IC

reading on the transceiver meter. Now adjust TC₁₄₀₃ and TC₁₃₀₃ for maximum power output into the wattmeter. On receive, tune to the marker signal at 7.000 MHz, and adjust TC₁₂₀₃ for maximum S-meter deflection on the marker signal.

- (14) To adjust the trap tuning, leave the VFO dial at 000, and the PRESELECTOR at 6. Remove the dummy load/wattmeter from the antenna jack, and connect a signal generator to the antenna jack. Inject a 90 dB signal at 9.9875 MHz. Adjust L₁₂₀₁ and L₁₃₀₁ for minimum S-meter deflection. Remove the signal generator, and reconnect the dummy load/wattmeter.
- (15) Set the BAND switch to 80, the VFO dial to 000, and the PRESELECTOR control to 2.5 (on the scale of 1-10). Set the LOAD control to the correct position. Close the PTT switch, and dip the PLATE control for minimum IC indication on the transceiver meter. Now adjust TC₁₄₀₂ and TC₁₃₀₂ for maximum power output into the wattmeter. On receive, tune to the marker signal at 3.500 MHz, and adjust TC₁₂₀₂ for maximum S-meter deflection on the marker signal.
- (16) Set the BAND switch to 160, the VFO dial to 400 (1.900 MHz), and the PRESELECTOR control to 1.2 (on the scale of 1-10). Set the LOAD control to the correct position. Close the PTT switch, and dip the PLATE control for minimum IC indication on the transceiver meter. Now adjust TC₁₄₀₁ and TC₁₃₀₁ for maximum power output into the dummy load. On receive, tune to the marker signal at 1.900 MHz, and adjust TC₁₂₀₁ for maximum S-meter deflection on the marker signal.

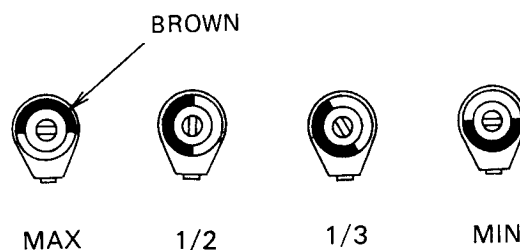
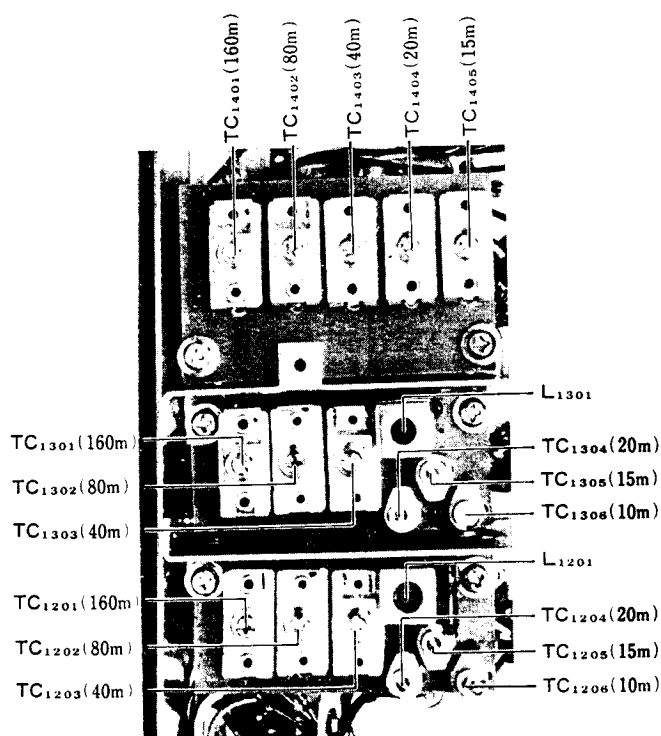


Figure 21

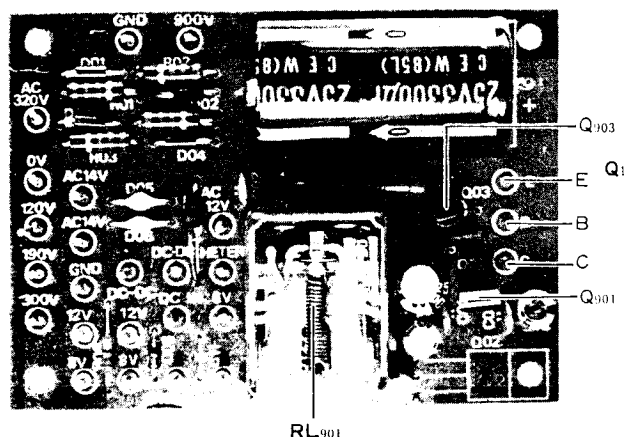
ADVICE ON TROUBLESHOOTING THE DRIVER/FINAL AMPLIFIER STAGES

Three tubes are used in the FT-101ZD: a 12BY7A driver, and two 6146Bs in the final amplifier.

Because not all service personnel are as familiar with tubes as they are with semiconductors, we would begin by cautioning you that tubes are voltage devices. To produce power in useful amounts, they require voltages well in excess of that needed for solid state devices. Take care, lest you develop "serviceman's elbow," a malady well known to old timers. It occurs when your arm jerks back from the +800 volts right into some immovable object. Accompanied by a few colorful phrases, it is not an experience one knowingly encourages, though it is seldom fatal.

The old adage of "keep one hand in your hip pocket" should be heeded whenever working in areas of exposed high voltage. If you should come into contact with the high voltage, it is best to call it quits for the service day. Alert your colleagues to what happened, and do not hesitate for even 5 minutes to seek medical attention should any signs of shock (trauma) develop. Trauma following contact with high voltage is sometimes more dangerous than the high voltage itself. **IT CAN BE FATAL!**

Never work on high voltage circuits while alone. You may need someone to turn off the power in an emergency. **SAFETY FIRST!**



RECT A UNIT(PB-1967)

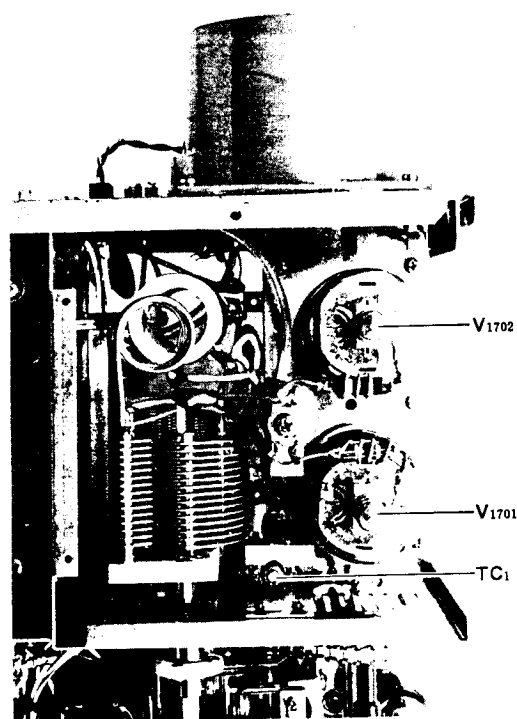
FINAL AMPLIFIER NEUTRALIZATION

Important Note: For this alignment, use a NON-METALLIC tuning wand.

- (1) Set the BAND switch to 10C, set the tuning dial to 29 MHz, and tune into a dummy load for approximately 70% full output power.
- (2) Set the METER switch to IC, and observe the dip in the cathode current. The dip should occur at the same point that maximum power output (measured on the dummy load watt-meter) occurs. If this is not the case, adjust TC₁, located inside the final amplifier cage, for the required coincidence of maximum power output and dip on the IC meter.

CAUTION: HIGH VOLTAGES ARE PRESENT ON THE UNDERSIDE OF THE CHASSIS AND INSIDE THE FINAL AMPLIFIER COMPARTMENT. USE GREAT CARE WHILE MAKING ADJUSTMENTS IN AREAS OF EXPOSED WIRING.

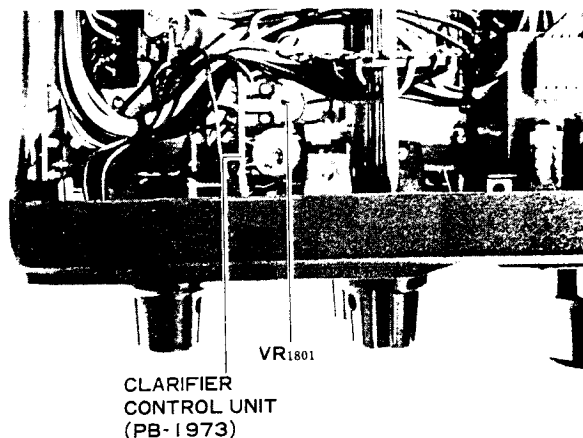
Note: The final amplifier enclosure must be in place to provide the required RF shielding during the neutralization procedure.



Final Amplifier Compartment

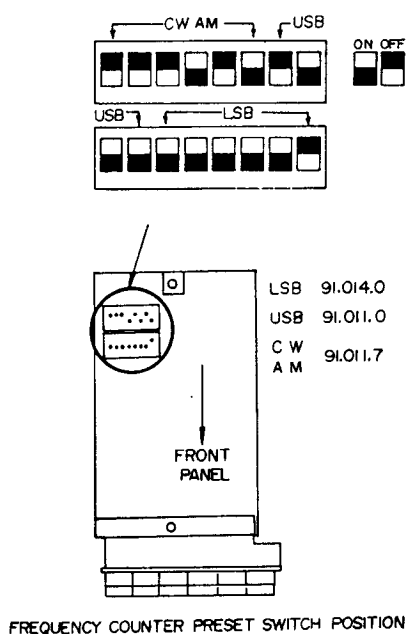
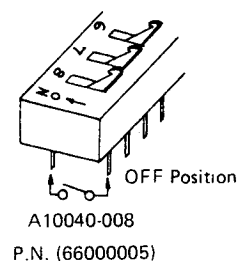
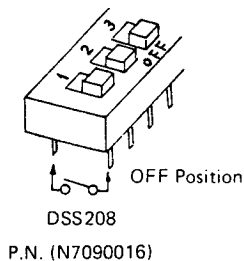
CLARIFIER ALIGNMENT

- (1) Tune in the marker generator signal on any band, and peak the preselector on the marker signal.
- (2) With the CLARIFIER control OFF, make sure that the CLARIFIER knob is exactly at the 12 o'clock position. Note the tone of the marker signal.
- (3) Switch the RX CLARIFIER to ON, and observe the tone of the marker signal. If it is different from when the clarifier was turned off, adjust VR₁₈₀₁ for an identical tone with the CLARIFIER knob exactly on the zero mark.



COUNTER UNIT (Early model ... Prod. #01 - #15)

The carrier points for USB, LSB, and CW are preset as follows: USB = 91.011.0; LSB = 91.014.0; CW or AM = 91.011.7. If, for some reason, it is desired to set these frequencies elsewhere, refer to the "Frequency Counter Preset Switch Position" drawing and chart. Adjustment of ± 200 Hz is possible as shown. The adjustment is carried out on the miniature switch shown in the drawing.



	LSB	USB	CW AM
+200Hz	91.014.2	91.011.2	91.011.9
+100Hz	91.014.1	91.011.1	91.011.8
±0	91.014.0	91.011.0	91.011.7
-100Hz	91.013.9	91.010.9	91.011.6
-200Hz	91.013.8	91.010.8	91.011.5

FAULT LOCALIZATION

The process of troubleshooting is highly individualistic. Fundamentally, though, the process is one of logical elimination.

Begin with a visual inspection of the transceiver, looking for broken, discolored, or charred components. Smell the unit, as burnt transformers smell differently than resistors, etc. If you do find a component that is cooked, remember that another fault may well have caused the destruction of the part you have located.

Set up the unit for test using a dummy load and wattmeter. Never shoot trouble using an antenna.

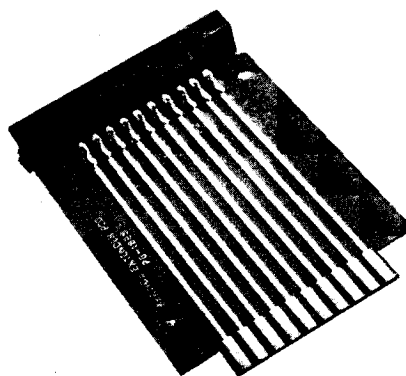
Initially, turn on the receiver, and check out only the RX side. Any malfunctions you detect on the receiver side should be repaired before you check out the transmitter. In doing this, you may well cure the entire problem, as much circuitry is shared on TX and RX.

The logical process of fault identification involves determination of the missing function (no RX on LSB), then the board at fault (AF UNIT), then the band circuit (LSB oscillator), then the malfunctioning part (X_{502}).

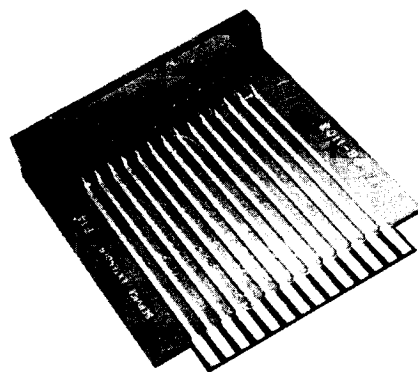
If, after the receiver inspection is completed, all is OK, switch to the transmit side, following the same logical procedure (function-board-circuit-component). Concentrate on those sections unique to the transmit side, as you have already performed a thorough checkout of all receiver and shared circuits (hopefully).

In this section, we will provide troubleshooting advice which leads you directly to suspect components. As the FT-101ZD is a complex electronic instrument, though, it is obviously impossible for us to trace the path of every possible malfunction in the radio. Therefore, if these tips do not lead you to identification of the trouble, the logical elimination process is the way to go.

For troubleshooting, an "extender board" is a valuable tool for quick and easy voltage testing. A double-sided 10-pin extended board will allow tests on the RF and PREMIX boards, and a 14 pin single-face extender will do for the PREMIX LOCAL board. The other boards in the FT-101ZD are not of the plug-in variety, but test points are provided for easy servicing.



10 PIN EXTENDER BOARD



14 PIN EXTENDER BOARD

TROUBLESHOOTING

A FUNDAMENTAL ANALYSIS OF THE TROUBLE

The failure may be caused by one of the following:

- 1) Mechanical defect
- 2) Electrical defect
- 3) Others (Murphy's Law, etc.)

1. MECHANICAL DEFECTS

Typical mechanical defects encountered by the technician are:

- a) Damage from shock during transportation (remember the unit was probably subjected both to sea and truck shipment).
- b) Damage caused by vibration in service.
- c) Damage caused by forcing stubborn knobs or switches. This difficulty is usually preceded by one of the above two defects.

2. ELECTRICAL DEFECTS

Typical electrical defects encountered are:

- a) Part(s) failure(s) caused by aging.
- b) Failures caused by improper application of supply voltage, or by voltage spikes. An improper fuse in use could cause extensive damage to be sustained.
- c) Improper operation (e.g. transistors without load – this usually points to failure elsewhere, in addition to the damaged transistor or IC).
- d) Loose connections at the power connector or elsewhere caused by cold solder joints, etc.

3. OTHERS

Among the miscellaneous types of failures or difficulties encountered are:

- a) Antenna troubles – poor connectors, use of cheap coax not made to withstand weather, and sabotage by neighbors (nail driven through coax, etc.).
- b) "Cockpit error:" including mislabeled coax lines to coax switch, or attempt to use transceiver on frequencies other than those it was designed for.
- c) Murphy's Law: use of a non-Yaesu microphone with different connections, for example (See page 1-11)

TYPICAL PART FAILURES, CAUSES, AND SYMPTOMS

PARTS	CAUSE OF TROUBLE	SYMPTOMS
Semiconductors (IC, FET, TR)	High supply voltage Open circuit Excessive drive High temperature	Short or open circuit Output decreases to 1/2 at 80°C Internal noise Instability
MOS FET MOS IC	Static electricity	Total failure
Crystal Crystal filter	Shock High temperature	Crystal destroyed Frequency drift Filter bandpass change
Resistor	Excessive power Aging High temperature	Component burned Value changed Open circuit
Potentiometer	Excessive power Shock	Component burned Open circuit Noise Unsmooth rotation
Capacitor	Excess voltage High temperature Excess power	Shorted Leakage Open/decreased capacitance
Variable capacitor Trimmer capacitor	Ratings exceeded Dust between plates Shock, forced rotation	Shorted Leakage Unsmooth rotation
Coils	Ratings exceeded Variation	Open or short circuit Leakage or shorted turns Detuned
Switch	Ratings exceeded Aging	Poor contact Unsmooth operation Open circuit
Relay	Ratings exceeded Humidity	Poor contact Noise Coil open

RECEIVE MODE

TROUBLESHOOTING CHART

Problem	Condition	Probable Cause(s)
(1) No AC Power applied	(a) Fuse OK	<ul style="list-style-type: none"> * Defective power switch * Defective AC line cord * Cold solder joint to AC cord * Loose contact at power jack
	(b) Fuse blows	<ul style="list-style-type: none"> * Defective DC-DC Converter (check w/o DC-DC Converter) * Defective D₉₀₁–D₉₀₄ * High voltage line shorted * Short in 6146B electrodes * Defective D₉₀₅, D₉₀₆ in 13.6 VDC line * Defective D₁₀₀₁–D₁₀₀₃ in DC 300 and 210 V line * Short in pilot lamp supply * Improper transformer connections
	(c) Fuse blows after tubes warm up	<ul style="list-style-type: none"> * Defective 6146B * Defective R₁₀₁₃, R₁₇₀₃, L₁₇₀₁ * Cold solder joint to pin 5 of 6146B socket * Defective bypass capacitor in control grid circuit * Check for –130 volts bias on 6146B * Leakage or short at C₁₇₀₁ * Leakage or short at C₁
	(d) Tube heaters do not light up.	<ul style="list-style-type: none"> * Defective heater switch * Cold soldering in heater supply line * Defective tube * ACC plug not installed * Loose connection at tube socket or ACC jack
	(e) No DC operation, OK on AC	<ul style="list-style-type: none"> * Defective DC cord
	(f) OK on AC, fuse blows on DC with heater switch on	<ul style="list-style-type: none"> * Defective T20A6 transistor in DC-DC Converter * Defective D₁₀₀₁–D₁₀₀₃, D₉₀₅, D₉₀₆
	(g) OK on AC, fuse OK, but no DC operation	<ul style="list-style-type: none"> * Defective T20A6 transistor * Cold solder joint in DC-DC converter
(2) No reception	(a) S-meter OK, but no audio output from speaker	<ul style="list-style-type: none"> * Defective speaker * Defective μPC2002H or 2SC1000GR on PB-1964 * Defective audio circuit around above transistor/IC * Defective EXT SP jack

	<p>(b) No audio output on some mode:</p> <p>LSB</p> <p>USB/CW</p> <p>AM</p> <p>Some mode</p> <p>(c) No audio output, S-meter off scale</p> <p>(d) Speaker appears OK, no S-meter deflection</p> <p>(e) MARKER ON, only slight S-meter deflection on the marker signal</p> <p>(f) Normal S-meter deflection against marker signal (S9+10 dB nominal)</p>	<p>* Defective X₅₀₂, D₂₄₀₄</p> <p>* Defective X₅₀₃, D₂₄₀₄</p> <p>* Defective Q₂₄₀₈, Q₂₄₀₉, D₂₄₀₅, D₂₄₀₆</p> <p>* Defective mode switch or cold solder joint on switch</p> <p>* Defective RF GAIN control</p> <p>* Defective Q₄₁₉, Q₄₂₀ (PB-1963)</p> <p>* Defective RL₁, Q₄₁₉, Q₄₂₀, VR₄₀₅</p> <p>* Defective 19.7475 MHz xtal</p> <p>* Defective Q₄₂₁, Q₄₂₂, Q₄₂₃</p> <p>* Defective Q₄₁₁</p> <p>* Defective Q₁₀₁–Q₁₀₄ (PB-1960)</p> <p>* Defective Q₄₀₈</p> <p>* Defective Q₄₁₂–Q₄₁₈</p> <p>* Low PREMIX output (see section on COMMON CIRCUITS)</p> <p>* Defective T₁, L₁₂₀₁, or C₁₂₀₇</p> <p>* Check tuning or T₁₀₂, T₄₀₆–T₄₁₅</p> <p>* Tracking error in RF coils</p> <p>* Defective XF₄₀₁–XF₄₀₂ or XF₄₀₅</p> <p>* Defective FH₂ (lamp fuse)</p> <p>* Defective RL₂ (Antenna Relay)</p> <p>* Defective S₂₀₀₄ (ATT)</p>
(3) Partial reception	(a) Poor reception on one or more bands (some bands OK)	<p>* Low PREMIX output (see section on COMMON CIRCUITS)</p> <p>* Defective band switch</p> <p>* Defective TC₁₂₀₁ (160 m)–TC₁₂₀₆ (10 m), C₁₂₀₁ (160 m)–C₁₂₀₆ (10 m)</p>
(4) Self-oscillation	<p>(a) Oscillation with HEATER switch on</p> <p>(b) Oscillation with HEATER switch either on or off</p>	<p>* Defective 6146B, R₁₀₁₃, R₁₇₀₃, L₁₇₀₁</p> <p>* Defective L₁₇₀₁, C₁</p> <p>* Defective R₁₀₁₄, R₁₀₁₇, R₁₆₀₁, R₁₆₀₂, C₁₀₁₅</p> <p>* Defective Q₁₀₀₂, Q₁₀₀₃ (PB-1968)</p> <p>* TX 12 V line shorted to RX 12 V line. Check at each board, TX/RX switching diodes and switches.</p>

SERVICING

<p>(5) Marker inoperative</p>	<p>(a) RX OK, no marker signal heard</p>	<ul style="list-style-type: none">* Defective NB/MARK switch Check voltage at pin 4 of J₅₀₄ in PB-1964. Should be 8 volts nominally* Defective X₅₀₁* Defective Q₆₀₆, Q₆₀₉ and Q₆₁₀
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TRANSMITTER

Problem	Condition	Probable Cause(s)
(1) No power output	(a) IC OK, but no power output	<ul style="list-style-type: none"> * Defective L_1, L_2, L_9 * Shorted VC_1, VC_2 Defective C_{66} * Low bands only: Defective $C_5 - C_8$ * Defective RL_2
	(b) IC OK, but no output on a particular band	<ul style="list-style-type: none"> * Cold solder joint between band switch and tank coil * Defective band switch
	(c) No IC indication	<ul style="list-style-type: none"> * Defective 6146B * ACC plug not correctly wired or improperly seated * No screen voltage at 6146B because of defective L_{1804}, band switch
	(d) Idling IC OK, but no drive	<ul style="list-style-type: none"> * Defective 12BY7A * No screen voltage because of defective R_{1603}, C_{1009}, $R_{1007} - R_{1009}$ * Defective Q_{105}, Q_{106} or Q_{405}
(2) Poor TX	(a) No power output on LSB only	* Defective X_{502}
	(b) No power output on USB only	* Defective X_{503}
	(c) No power output on both USB/LSB	<ul style="list-style-type: none"> * Defective RL_{501}, Q_{502}, D_{2402} * No vox operation: defective or grounded MIC or PATCH jack * Defective Q_{503}, Q_{504} or Q_{512}
	(d) No power output on CW/TUNE	* Defective X_{504} , Q_{401} , D_{2402}
	(e) No CW keying	<ul style="list-style-type: none"> * Defective mode switch, Q_{1001}, and associated circuit * Defective D_{506} if carrier hangs up
	(f) No modulation on AM	* Defective $Q_{2401} - Q_{2407}$, D_{2401} , X_{2401}
(3) Abnormal meter	(a) Cannot set ALC meter	<ul style="list-style-type: none"> * Defective C_{1016} * Defective Q_{405}, VR_{401} * Defective meter switch or RL_1

	(b) ALC meter does not function (c) Power output OK, no IC meter indication (d) Power output OK, PO meter does not function	* Defective 12BY7A * ALC line shorted to ground * Defective D 1006, D 1007 * Driver, IF stages require realignment. * Defective R 1706 or meter switch * Defective RL ₁ * Improper setting of VR ₈ * Defective C ₁₀ —C ₁₂ , C ₅₀ , L ₇ , D ₁ , VR ₈ , or mode switch
(4) No changeover from RX to TX	(a) TX OK in MOX position (b) No TX in MOX position (c) VOX inoperative	* Failure in MIC or PTT line * Loose MIC jack or plug connection * Defective VR ₁ * Defective RL ₁ , D ₇ * If no CW semi-break-in, check Q ₅₀₃ , Q ₅₀₄ , Q ₅₁₂ .
(5) No return to RX from TX		* PTT line grounded * Defective Q ₅₁₂ * Defective Q ₅₀₃ , Q ₅₀₄
(6) Fuse blows on transmit	(a) OK on RX	* Insufficient bias voltage on 6146B
(7) TX self-oscillation	(a) OK on receive	* Neutralization of final tubes required * Defective C ₁₆ , C ₁₈ , C ₁₅ , C ₁₆₀₅ * RX 12 V line shorted to TX 12 V or TX 8 V line only on TX
(8) RF processor trouble	(a) Low or no output with processor on	* Processor switch defective * Defective XF ₄₀₃ * Defective Q ₄₀₂ —Q ₄₀₄

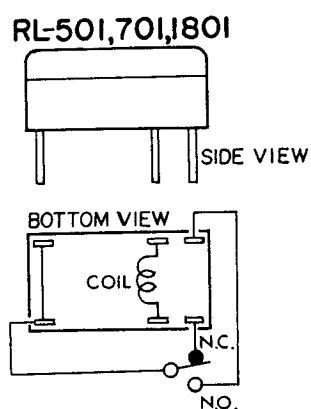
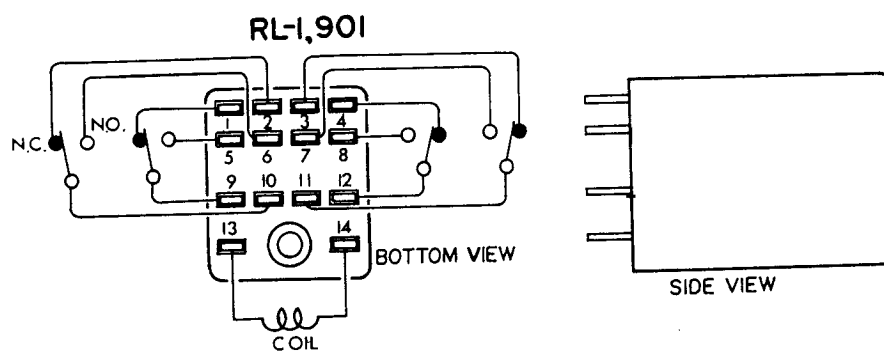
COMMON CIRCUITS

Problem	Condition	Probable Cause(s)
(1) Counter circuit	(a) Digital display does not work	<ul style="list-style-type: none"> * Defective Q₂₃₁₀ * 5 V line in Counter Unit grounded * Defective display LED * Defective Q₂₂₀₈—Q₂₂₁₃ * Defective R₂₂₀₄—R₂₂₄₅
	(b) Six digits to the right read below: LSB "91.014.0" USB "91.011.0" CW "91.011.7"	<ul style="list-style-type: none"> * VFO input not connected or is grounded * Defective Q₂₃₀₁—Q₂₃₀₄, Q₂₃₀₉ * Defective 655.36 kHz crystal * Defective Q₂₃₀₅
	(c) Display unstable, all digits working OK	<ul style="list-style-type: none"> * Defective 655.36 MHz crystal * Low PREMIX input (80–120 mV RMS OK)
(2) PREMIX LOCAL UNIT	(a) No oscillation on all bands	<ul style="list-style-type: none"> * Defective BAND switch S1A * Open R₂₂ * Shorted C₅₃ * Defective Q₃
	(b) No oscillation on particular band	<ul style="list-style-type: none"> * Switching diode for that band defective (check D₆₀₁—D₆₁₀) * Defective output coil for that band (check T₆₀₁—T₆₁₀) * Defective oscillator transistor for that band (check Q₆₀₁—Q₆₁₀) * Defective crystal for that band (check X₆₀₁—X₆₁₀) * Defective resistor or capacitor in oscillator circuit for that band
(3) PREMIX UNIT	(a) Output not correct on all bands (nom. output of 100 mV is OK.)	<ul style="list-style-type: none"> * Defective Q₃₀₁—Q₃₀₃ * Check for 12 V at pin 9 of PREMIX UNIT * Check for local input at pin 7 * Defective R₃₀₈, R₃₀₉, L₃₁₄, L₃₁₅ * Defective Q₃ * Defective R₂₂, C₅₃
	(b) Output not correct on a particular band	<ul style="list-style-type: none"> * Defective BAND switch S1A * Defective diodes D₂—D₅ * Defective bandpass filter output diode for that band (check D₃₀₁—D₃₁₄) * Defective bandpass filter coil for that band (check T₃₀₁—T₃₁₄) * Defective RF choke for that band (check L₃₀₁—L₃₁₄)

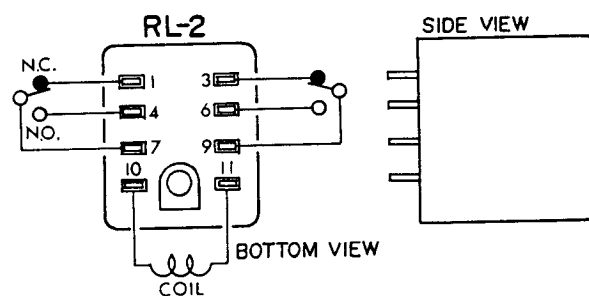
(4) Indicators	<p>(a) WIDTH LED does not work</p> <p>(b) CLARIFIER LED does not work</p> <p>(c) PROCESSOR LED does not work</p> <p>(d) CH₁, CH₂ does not work</p> <p>(e) TX EXT LED does not work</p> <p>(f) RX EXT LED does not work</p> <p>(g) VFO LED does not work</p> <p>(h) EXT LED does not work</p>	<p>* Defective LED D₁₅₀₁ or R₁₅₀₁, S₁₅₀₁</p> <p>* Defective LED D₁₈₀₂ or S₁₈₀₁, S₁₈₀₂, R₁₈₀₄</p> <p>* Defective LED D₉ or R₁₇, S₂₀₀₅</p> <p>* Defective LED D₁₉₀₅, D₁₉₀₆ or S₇₀₁ (e, f), R₁₉₀₂</p> <p>* Defective LED D₁₉₀₂ or RL₇₀₁, S₇₀₁ (a-f), R₁₉₀₂</p> <p>* Defective LED D₁₉₀₃ or RL₇₀₁, S₇₀₁ (a-f), R₁₉₀₂</p> <p>* Defective LED D₁₉₀₄ or S₇₀₁ (a-f), R₁₉₀₁</p> <p>* Defective LED D₁₉₀₁ or S₇₀₁ (a-f), R₁₉₀₁</p>
(5) Clarifier	<p>(a) Frequency jumps with clarifier on</p> <p>(b) OFF and "0" condition do not coincide in frequency</p> <p>(c) Frequency jumps with clarifier off, OK with clarifier on</p> <p>(d) Frequency jumps regardless of clarifier position</p>	<p>* Defective VR₆, R₁₈₀₁, R₁₈₀₂, S₁₈₀₁, S₁₈₀₂, RL₁₈₀₁</p> <p>* Defective VR₁₈₀₁, R₁₈₀₃, R₁₈₀₅, RL₁₈₀₁</p> <p>* Defective VR₁₈₀₁, R₁₈₀₃, R₁₈₀₅, S₁₈₀₁</p> <p>* Unstable 8 V REG supply, check Q₃.</p> <p>* Check VFO unit</p>

RELAY CONNECTION INFORMATION

Should the need for replacement of relays become necessary, or if you are trying to verify proper relay operation, the diagrams below should help you.



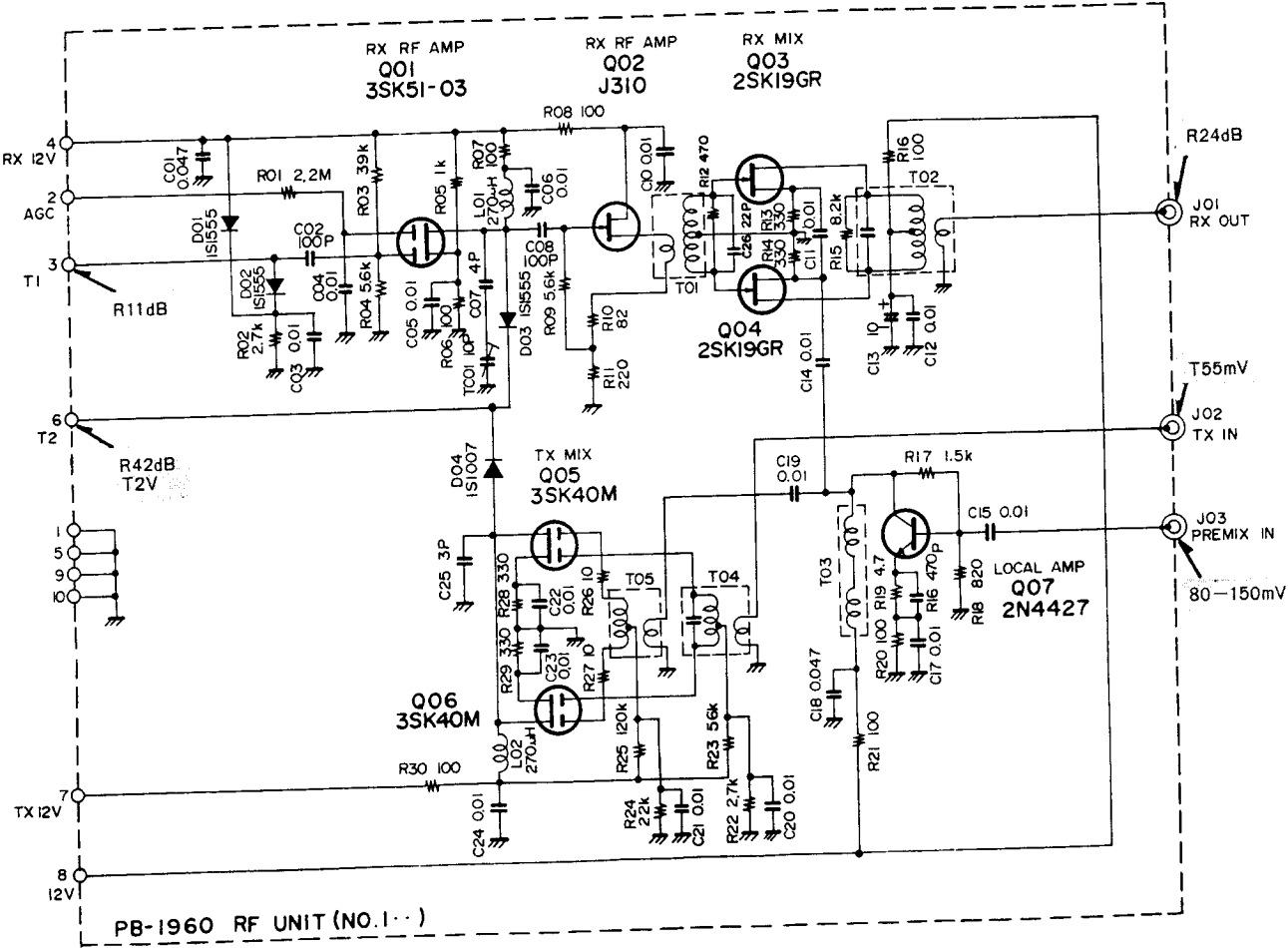
FBR-211AD012M



MX-2P

RF UNIT (PB-1960A)

(Early model) Before Prod. #16

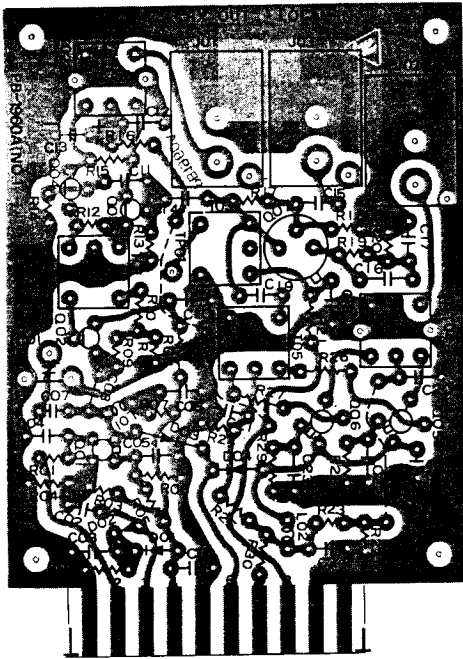


DC VOLTAGES

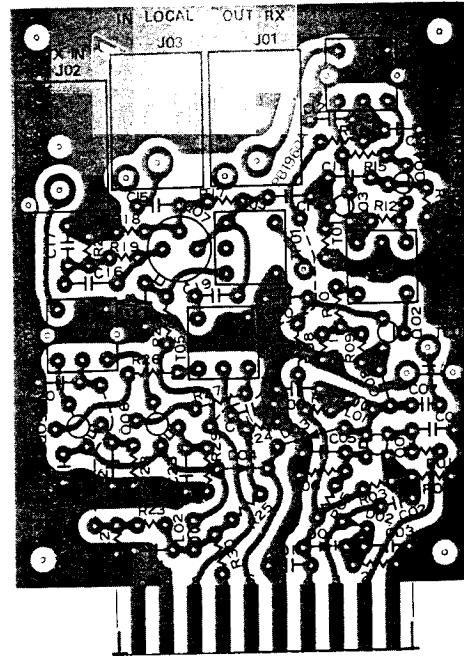
(V)

	E(S)		C(D)		B(G ₁)		(G ₂)	
	R	T	R	T	R	T	R	T
Q ₁₀₁	1.6	0	10.6	0	1.5	0	0.5	0.5
Q ₁₀₂	3.9	0	10.9	0	2.8	0	—	—
Q ₁₀₃	1.0	0	11.6	0	0	0	—	—
Q ₁₀₄	1.0	0	11.6	0	0	0	—	—
Q ₁₀₅	0	0.7	0	10.6	0	0.5	0	1.6
Q ₁₀₆	0	0.7	0	10.6	0	0.5	0	1.6
Q ₁₀₇	2.4	2.4	9.5	9.5	3.1	3.1	—	—

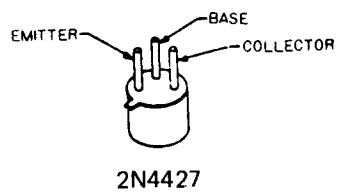
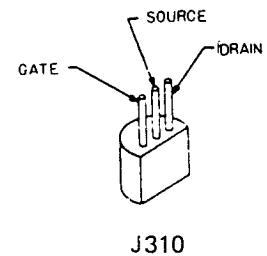
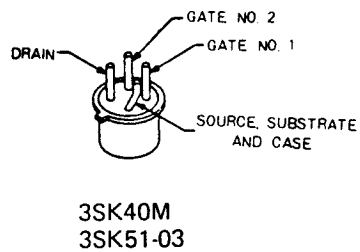
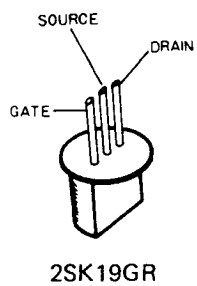
RF UNIT PARTS LAYOUT



Viewed from component side



Viewed from solder side





NB ON (NB OFF 0V)

FIX ON (FIX OFF 0V)

NB ON (NB OFF 0V)

