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MAINTENANCE SERVICE MANUAL FT-901DM



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INDEX

FOREWORD	i
SECTION 1 – GENERAL	
GENERAL DESCRIPTION	1 - 1
SPECIFICATIONS	1 - 2
RECOMMENDED ACCESSORIES	1 - 5
CONTROLS AND SWITCHES	1 - 7
REAR APRON CONNECTIONS	1-10
INTERCONNECTION DIAGRAMS	1-12
INSTALLATION	1-14
OPERATION	1-16
MICROPHONE CONNECTIONS	1-22
SECTION 2 – TECHNICAL NOTES	
PARTS DESIGNATIONS ON CIRCUIT BOARDS	2 - 1
SIGNAL TRACING IN THE FT-901	2 - 2
AUGMENTED BLOCK DIAGRAMS	2 - 3
FREQUENCY RELATIONS/CRYSTAL DATA	2-10
THEORY OF OPERATION	2-11
SECTION 3 – SERVICING	
INTRODUCTION	3 - 1
FRONT PANEL REMOVAL	3 - 2
INSTALLATION OF ACCESSORIES	
KEYER/MEMORY UNITS	3 - 4
AM/CW FILTERS	3 - 5
DC-DC CONVERTER	3 - 6
FM UNIT	3 - 8
COOLING FAN	3 - 8
SOLDERING AND DESOLDERING TECHNIQUE	3-10
CIRCUIT TRACE REPAIR	3-11
MODIFICATIONS	
VFO DRIFT IN PRESENCE OF NEARBY VHF TRANSMITTER	3-13
MEMORY UNIT HUM, MR MODE	3-14
COUNTER UNIT CAPACITOR REVERSAL	3-15
POWER SUPPLY PROTECTION	3-16
KEY CLICK MODIFICATION	3-17
RECTIFIER C UNIT MODIFICATION	3-17
WWV/JJY FREQUENCY CHANGE	3-18
MOSFET CHANGES	3-20
RF PROCESSOR/XTAL UNIT TRANSISTOR CHANGE	3-20

KEYER UNIT MODIFICATIONS	3-21
COUNTER UNIT IC INSTALLATION	3-22
AUDIO HUM CORRECTION	3-23
MEMORY LOCK MODIFICATION	3-24
MAINTENANCE AND ALIGNMENT	3-25
FAULT IDENTIFICATION AND LOCALIZATION	3-33
TROUBLESHOOTING	3-34
RELAY CONNECTION INFORMATION	3-45
CIRCUIT BOARD LAYOUTS AND TEST VOLTAGES	
RF UNIT (PB-1702B)	3-46
NB/PROC UNIT (PB-1703C)	3-48
FILTER UNIT (PB-1716B)	3-50
IF UNIT (PB-1704C)	3-52
AF UNIT (PB-1705A)	3-54
VOX/MARKER UNIT (PB-1846)	3-56
CARRIER UNIT (PB-1706A)	3-58
VFO ASSEMBLY (PB-1440B-3330)	3-60
FM UNIT (PB-1707B)	3-62
PLL UNIT (PB-1709A)	3-64
VCO UNIT (PB-1710B)	3-66
XTAL UNIT (PB-1711A)	3-68
DRIVER/FINAL AMPLIFIER STAGES	3-70
RECTIFIER A/B/C UNITS	3-72
COUNTER/DISPLAY UNITS (PB-1729A/PB-1730)	3-76
MEMORY UNIT (PB-1787)	3-78
LEVER SWITCH UNIT (PB-1719B)	3-80
LED A/SELECT SW. UNITS (PB-1721B/PB-1718C)	3-81
TUNE SW. UNIT (PB-1720B)	3-82
KEYER UNIT (PB-1728A)	3-83
TRIMMER A/B/C UNITS	3-84
REJECT SW./DIODE SW. UNITS	3-85
SECTION 4 – REPAIR PARTS	
PARTS LIST AND ORDERING DATA	4-1
PARTS LIST	4-5

FOREWORD

The purpose of this manual is to provide the reader with the information required to keep his or her FT-901 transceiver in top operating condition. While we have made every effort to provide an in-depth technical analysis of the workings of this equipment, we have attempted to tailor this manual toward the technician or owner, rather than the design engineer. To this end, we have relied heavily on drawings and diagrams.

Use of this manual is entirely at the owner's risk. While we believe that the information presented herein is correct and factual, we assume no responsibility for damage to your equipment when this manual is used as reference.

Moreover, if your test equipment is not equal to the task of performing alignments the right way, we would strongly urge you to refer the unit to a qualified service center.

We truly hope that the test information, parts location data, and modification information presented herein will be sufficient to your needs.

The author wishes to express his gratitude to the engineering and service staffs of Yaesu Musen Co., Ltd. and Yaesu Electronics Corporation, whose skill and insights have contributed significantly to the completion of this manual. Special thanks go to Mr. Y. Morii for his help in assembling the technical materials presented herein.



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A BRIEF HISTORY OF THE FT-901 SERIES

The FT-901 transceiver first appeared in the USA early in 1978 and immediately established a position of pre-eminence among "top-of-the-line" transceivers on the market. The FT-901 series has brought a number of never-before-possible technical features to the amateur community, along with traditional Yaesu quality design and purity of emissions.

The receiver section, in particular, has impressive credentials. A dual-filter variable IF bandwidth control allows continuous variation of the IF passband, from 2.4 kHz down to 300 Hz. Also included is a rejection tuning control, for nulling out of any interfering signal within the remaining IF passband. For CW, and audio peak filter (APF) provides a significant reduction in background noise, in addition to razor-sharp selectivity. The receiver dynamic range – typically well in excess of 85 dB in CW bandwidth – is the best ever achieved in a production-line amateur solid-state receiver.

The transmit side includes RF negative feedback for purity of emissions. A Curtis 8043 IC keyer is built-in on the FT-901DM/DE models, providing high reliability and immunity to RF interference. Another innovation is the 10-second TUNE button, which activates the transmitter for 10 seconds for tuning purposes, then returns the rig to receive, thus saving the final tubes from excessive key-down time.

The most exciting feature of the FT-901 series is the memory system, which provides for storage and recall of any frequency for control on transmit, receive, or transceive. This one feature largely eliminates the need for an external VFO in the traditional sense. That the FV-901DM synthesized scanning external VFO is hardly traditional bears this point out.

With coverage on all modes (SSB, CW, AM, FSK, and FM) on all bands from 160 through 10 meters, the FT-901 series is destined to maintain its position of dominance among top transceivers on the market. With some 2800 components assembled in one box, for a finite price tag, the FT-901 offers more performance per dollar than any other piece or collection of equipment on the market.

ALL MODE HF TRANSCEIVER FT-901DM



GENERAL DESCRIPTION

The FT-901DM is a precision engineered, high-performance HF transceiver of advanced design, providing all band coverage (160 - 10 meters) on all modes of operation: LSB, USB, CW, FSK, AM, and FM. This transceiver operates at an input power of 180 watts SSB/CW and 80 watts on AM, FM, and FSK.

Advanced features include PLL (Phase Locked Loop) frequency derivation, digital plus analog frequency readout with large display LED digits, a built-in Curtis 8043 IC electronic keyer, and memory frequency control circuitry. State-of-the-art receiver performance features include rejection tuning, dual-filter variable IF bandwidth tuning, and, for CW, an audio peak filter (APF) for unsurpassed rejection of unwanted signals. Other built-in features include VOX, semi-break-in CW with sidetone, 25 kHz calibrator, advanced noise blanker, RF speech processor, and a 20 dB RF attenuator for protection against receiver overload.

All circuits, except the transmitter driver and final amplifier stages, are solid state, utilizing modern plug-in printed circuit boards, thus permitting easy maintenance.

The FT-901DM transceiver is entirely self-contained, requiring only an antenna and power source for operation. For base station operation, AC power voltages of 100/110/117/200/220/234 VAC may be chosen, though the unit normally is supplied with 117 volt capability. A DC-DC converter unit provides for mobile or portable operation. Selection of AC or DC power source is automatically made when the proper line cord is inserted.

For mobile operation a separate switch is provided on the front panel to turn off the tube heaters while in the receive mode. With the heaters off, current consumption is only 1.1 amp.

Among the available options on economy models FT901D/SD/DE are the memory unit, the keyer unit, the DC-DC converter, the FM unit, and the cooling fan. Optional equipment on all models are the 600 Hz CW filter and the 6 kHz AM filter.

The entire FT-901DM transceiver weighs approximately 18 kg., and is 342 mm wide, 154 mm high, and 324 mm deep. A diecast front panel and heavy-duty case provide maximum protection against damage from shock and vibration during travel use.

SPECIFICATIONS

GENERAL

Frequency coverage:

160m	1.8 - 2.0 MHz
80m	3.5 - 4.0 MHz
40m	7.0 - 7.5 MHz
20m	14.0 - 14.5 MHz
15m	21.0 - 21.5 MHz
10mA	28.0 - 28.5 MHz
10mB	28.5 - 29.0 MHz
10mC	29.0 - 29.5 MHz
10mD	29.5 - 29.9 MHz
WWV/JJY	15.0 - 15.5 MHz, RX only

Power requirements:

AC	100/110/117/200/220/234 V, 50/60 Hz
DC	13.5 V, negative ground (DC option FT-901D/SD/DE)

Power consumption:

(FT-901DM/D/DE)	
AC 117 V:	70 VA receive (45 VA HEATER OFF) 320 VA transmit (max)
DC 13.5 V:	55 VA receive (45 VA HEATER OFF) 105 VA transmit (max)
(FT-901S)	
AC 117V:	55 watts receive (45 watts HEATER OFF) 105 watts transmit (max)
DC 13.5 V:	3.8 A receive (0.8 A HEATER OFF) 7.5 A transmit (max)

Size:

342 (W) x 154 (H) x 324 (D) mm

Weight:

18 kg

TRANSMITTER

Emission:

LSB, USB (A3j), CW (A1), AM (A3h), FM (F3) (option FT-901SD/DE), FSK (F1)

PA input power:

FT-901DM/D/DE	
SSB/CW:	180 watts DC
AM/FSK/FM:	80 watts DC
FT-901SD	
SSB/CW/FSK/FM:	20 watts DC
AM:	5 watts DC

Carrier suppression:

Better than 40 dB

Unwanted sideband suppression:

Better than 40 dB @ 1000 Hz

Spurious radiation:

Better than 40 dB below rated output

Transmitter frequency response:

300 - 2700 Hz (-6 dB)

Third order distortion products:

Better than 31 dB below rated output

Stability:

Less than 300 Hz drift from a cold start; less than 100 Hz drift over a 30 minute period after warm-up

Negative feedback:

6 dB at 14 MHz

Modulation:

A3J: Balanced modulator
A3h: Amplitude modulation of a low power stage
F3: Variable-reactance frequency modulation, max. deviation ± 5 kHz (F3 feature optional on FT-901SD/DE)

Antenna output impedance:

50 - 75 Ohms, unbalanced

Microphone input impedance:

500 - 600 Ohms

RECEIVER

Sensitivity:

- SSB/CW/FSK 0.25 μ V for S/N 10 dB
- AM 1 μ V for S/N 10 dB
- FM 0.3 μ V for 20 dB quieting

Image rejection:

- 1.8 - 21 MHz - - Better than 60 dB
- 28 MHz - - Better than 50 dB

IF rejection:

Better than 70 dB

Selectivity, WIDTH control at "0"

- SSB: -6 dB/2.4 kHz -60 dB/4.0 kHz
- *CW: -6 dB/0.6 kHz -60 dB/1.2 kHz
- *AM: -6 dB/6.0 kHz -60 dB/12.0 kHz
- **FM: -6 dB/12.0 kHz -60 dB/24.0 kHz
- *AM and CW filters are optional, all models
- **FM UNIT optional on FT-901SD/DE

Passband tuning:

Continuous from 2.4 kHz to 300 Hz

Two-tone dynamic range:

Typically well in excess of 85 dB (20 kHz spacing, 14 MHz, 600 Hz bandwidth)

APF response:

Within 3 dB from 400 - 900 Hz

Audio output:

Better than 3 watts @ 10% THD

Audio output impedance:

4 - 16 Ohms

FT-901D/SD/DE/DM MODEL DIFFERENCES

○ = Built-in feature X = Available option

FEATURE	FT-901D	FT-901SD	FT-901DE	FT-901DM
BAND CRYSTAL 160m	○	○	○	○
BAND CRYSTAL 80m	○	○	○	○
BAND CRYSTAL 40m	○	○	○	○
BAND CRYSTAL 15m	○	○	○	○
BAND CRYSTAL 10mA	○	○	○	○
BAND CRYSTAL 10mB	○	○	○	○
BAND CRYSTAL 10mC	○	○	○	○
BAND CRYSTAL 10mD	○	○	○	○
BAND CRYSTAL WWV/JJY RCV	○	○	○	○
VOX/MARKER UNIT	○	○	○	○
FM UNIT	○	X	X	○
RF SPEECH PROCESSOR	○	○	○	○
AM FILTER	X	X	X	X
CW FILTER	X	X	X	X
KEYER UNIT	X	X	○	○
MEMORY UNIT	X	X	X	○
DC-DC CONVERTER	X	X	X	○
COOLING FAN	○	X	○	○
POWER OUTPUT	100 W	10 W	100 W	100 W

TUBES AND SEMICONDUCTORS

TUBE COMPLEMENT	FET:		MSM5501	1	Varactor diodes:	
	2SK19GR	15	MSM5562	1	1S2209	2
12BY7A	2SK19BL	8	MSM5564	1	1S2236	1
6146B	2SK34E	1	SN75450B	1	FC63	1
	3SK40M	14	SN76514N	1	MV104	10
SEMICONDUCTOR COMPLEMENT	3SK59Y	1	SN74LS00N	2	Silicon varistor diodes:	
	3SK59GR	1	SN74L04N	3	MV13	1
	JF1033B	5	SN74LS90N	1	Zener diodes:	
Germanium transistors:	IC:		SN74LS123N	1	WZ050	2
T20A6	8043	1	SN74LS192N	5	WZ090	4
Silicon transistors:	μ PC78L05	2	TA7060P	1	WZ110	2
2SA564A	μ PC78L08	5	TA7061AP	2	Light-emitting diodes:	
2SA639	μ PC14305	2	TA7063P	2	GD4-203SRD	11
2SA733	μ PC14308	2	TA7089M	1	Light-emitting display:	
2SC372Y	μ PC14312	1	TA7205AP	1	HP5082-7740	6
2SC373	F4024CP	1	TA7310P	1		
2SC535A	F40192	2	TC5032P	1		
2SC735Y	LM308	1	Germanium diodes:			
2SC7850	MC1416P	1	IN60	17		
2SC945	MC3403P	1	1S188FM	6		
2SC1000GR	MC4044P	2	1S1007 (GB)	22		
2SC1815GR	(μ PC1008C)		(1N270)			
2SC1815Y	MC14011B	3	Silicon diodes:			
2N4427	MC14042B	5	1S1555	89		
MPSA13	MM74C90	1	10D1	7		
	MSL980Y7	1	10D10	8		
	MSL980Y4	1	VO6B	2		
	MSM561	3				

Specifications subject to change without notice.

RECOMMENDED ACCESSORIES



FV-901DM

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

The FV-901DM external VFO provides a PLL-synthesized control system for your FT-901DM 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, then it will halt.

PLL synthesis in 100 Hz steps is coupled to 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.

For the CW operator, the use of the FV-901DM, along with the FT-901DM audio peak filter, means that one step of the synthesizer will eliminate a signal from the passband.



FTV-901R

FTV-901R VHF/UHF TRANSVERTER

In another Yaesu "first", the FTV-901R brings three bands in the UHF and VHF regions together in one compact case. The basic FTV-901R comes equipped for 144–148 MHz, and the 6 meter and 70 cm modules can 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-225RD or FT-221R transceivers can also 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 50 and 144 MHz. This means that you can use the FM capability of your FT-901DM to full advantage on these bands.

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YO-901

YO-901 MULTISCOPE

The YO-901 Multiscope provides superb monitoring capability, with instant interface to your FT-901DM station. Both wide and narrow band IF monitoring can be performed, as well as transmitter trapezoidal and two-tone tests. The two-tone generating capability is built in.

A panoramic adapter, known as the Bandscope, is an available option for the YO-901, allowing quick examination of the band for activity.

For a variety of test and measurement purposes, the YO-901 meets your requirements with ease.



SP-901P

SP-901P SPEAKER/HYBRID PHONE PATCH

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



FC-901

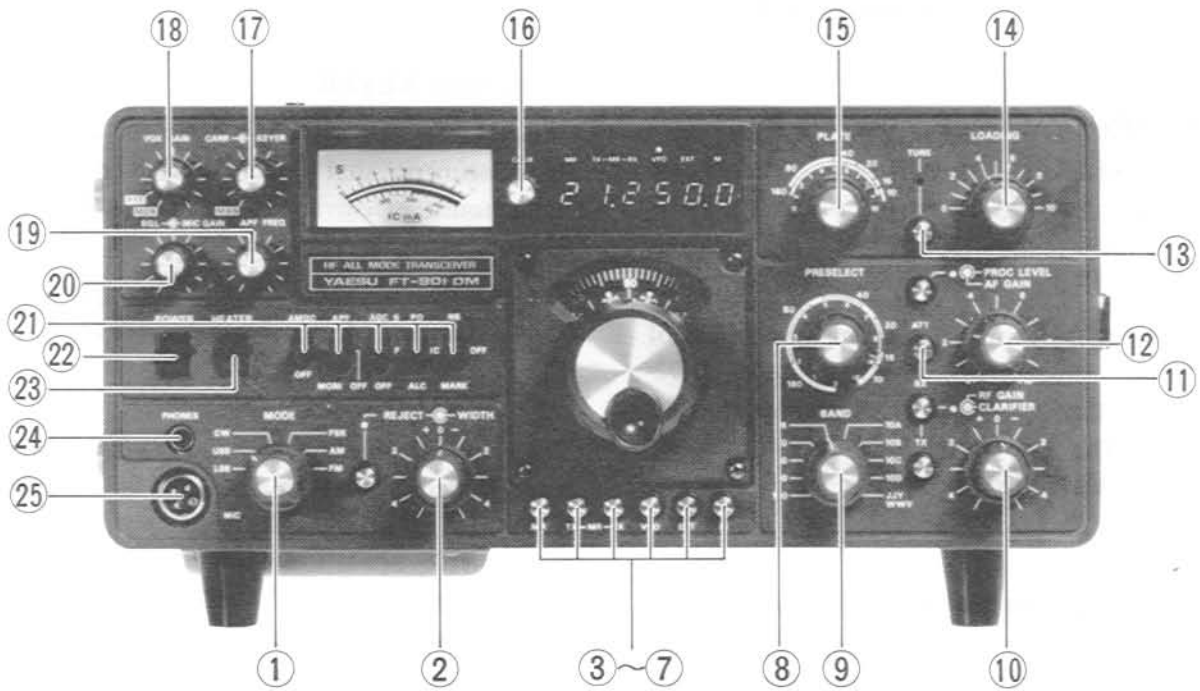
FC-901 ANTENNA COUPLER

Present a 50 ohm load for your FT-901DM transceiver all across the band with the FC-901 antenna coupler. You may select three coax-fed and 1 random wire antenna. Included are an SWR bridge and power output meter. Maximum power handling capability is 500 watts.

CONTROLS AND SWITCHES

This transceiver has been specifically designed for ease of operation and versatility. The operator may, however, be unfamiliar with the operation of the controls, and improper adjustment thereof may result in poor transceiver performance. Thus,

be certain that you understand the function of every control before operating the transceiver. The various front panel controls and switches are described in the following section.



(1) MODE

The MODE switch has six positions for selection of the operating mode desired: LSB, USB, CW, FSK, AM, or FM.

(2) REJECT-WIDTH

The REJECT and WIDTH controls are mounted on concentric shafts. The rejection tuning control (REJECT), when activated by pressing the small silver pushbutton to the left of the REJECT knob, provides a variable IF notch filter action for nulling out a particular interfering signal.

The WIDTH control varies the signal across the passband of one of the two IF 8-pole crystal band-pass filters used in this circuit, thus providing a variable IF bandwidth for rejection of signals above or below the desired signal.

(3) M

The M button is pressed to store a frequency in the memory circuitry. Whatever frequency is being read out on the digital display will be the frequency stored when the M button is pushed.

(4) EXT

When pushed, the EXT button transfers frequency control from the FT-901DM to an external VFO, such as the FV-901 fully synthesized scanning VFO.

(5) VFO

When the VFO button is pushed, frequency control is transferred from EXT or memory control to the FT-901DM internal VFO.

(6) TX-MR-RX

Once a frequency has been stored by the memory (M) button, that frequency may be recalled for control of either the transmit or receive frequency by pushing either the TX or RX MR button, respectively.

(7) MR

Once a frequency has been stored by the memory (M) button, that frequency may be recalled for control of the transceiver frequency by pushing the MR button.

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(8) PRESELECT

This control pretunes the signal circuits for both transmit and receive. The PRESELECT circuit provides continuous permeability tuning throughout the frequency range of the transceiver.

(9) BAND

The BAND switch provides selection of the band desired, 160 through 10 meters plus WWV/JJY (receive only).

(10) RF GAIN/CLARIFIER

The RF GAIN and CLARIFIER controls are mounted on concentric shafts. The RF GAIN control provides manual control of the gain levels of the RF and IF amplifiers on receive.

The CLARIFIER control allows manual offset of ± 2.5 kHz of either the transmit or receive frequency. Selection of transmit or receive clarifier is made by the two silver pushbuttons to the left of the CLARIFIER control.

(11) ATT

The ATT (RF attenuator) button provides insertion of a 20 dB attenuator in the incoming signal path to minimize receiver cross modulation caused by extremely strong local signals.

(12) PROC LEVEL/AF GAIN

The PROC LEVEL and AF GAIN controls are mounted on concentric shafts. The PROC LEVEL control allows manual control of the output level of the RF speech processor. The processor is actuated by pressing the silver pushbutton to the left of the PROC LEVEL control.

The AF GAIN control adjusts the audio output level at the speaker and phone jack. Clockwise rotation increases the audio output.

(13) TUNE

This pushbutton, when depressed, places the transmitter in the "tune" condition for ten seconds for tuning purposes. After ten seconds, the transceiver is returned to the receive mode so as to prevent damage to the final amplifier tubes caused by excessive "key down" time during tune-up.

(14) LOADING

This control tunes the output circuit of the pi network to match the antenna/feedline impedance.

(15) PLATE

This control tunes the plate circuit of the final amplifier.

(16) CALIB

When the MARK switch is activated, the CALIB knob provides manual control for zeroing the calibration of the digital display with the calibrator signal.

(17) CARR/KEYER

The CARR and KEYER controls are mounted on concentric shafts. The CARR control varies the amount of carrier in the CW, AM, FSK, and FM models of operation.

The KEYER control varies the speed of the built-in Curtis 8043 IC electronic keyer.

(18) VOX GAIN

This control selects MOX/PTT/VOX transmitter relay control as well as adjusting the sensitivity of the VOX circuitry. The PTT position provides push-to-talk operation from a microphone PTT switch or a footswitch. The MOX position provides manual transmit. It must be returned to the PTT position for receiver recovery.

(19) APF FREQ

This knob, when actuated by turning on the APF switch, provides manual control for peaking the audio peak frequency (APF) circuit on the desired signal. This control will find its chief usefulness on CW, because its bandwidth is much too narrow for normal SSB reception.

(20) SQL/MIC GAIN

The SQL and MIC GAIN controls are mounted on concentric shafts. The SQL control sets the squelch threshold level for FM reception.

The MIC GAIN control varies the audio level from the microphone amplifier stage. The control has sufficient range to permit the use of any low impedance (500 - 600 Ohm) crystal or dynamic microphone. Clockwise rotation increases the level of output from the microphone amplifier stage.

(21) FUNCTION SWITCHES: AMGC, APF/MONI, AGC, PO/IC/ALC, and NB/MARK

The AMGC switch activates a microphone gain threshold circuit which requires a particular

minimum input level from the microphone to trigger the microphone amplifier. Low-level background noise will not activate the transmitter with the AMGC in operation. This circuit may be considered a "microphone squelch" system. The M GAIN control functions normally with the AMGC system in operation.

When the APF/MONI switch is in the APF position, the audio peak filter (APF) circuitry is activated. The exact frequency of the audio peak is set by the APF FREQ knob. When this switch is placed in the MONI position, monitoring of the microphone level may be accomplished for operator convenience or tape recording both sides of a QSO. In the CW mode, CW sidetone will be heard regardless of the position of the APF/MONI switch.

The AGC switch controls the length of the recovery time for the receiver AGC circuitry. This switch provides slow or fast recovery, and will also turn off the AGC if desired.

The PO/IC/ALC switch will hereafter be referred to as the METER switch. In the PO position, relative transmitter output power can be observed. In the IC position, transmitter final amplifier cathode current may be measured. In the ALC position, transmitter ALC voltage may be read. When the FT-901DM is in the receive mode, the meter functions as an "S" meter.

The NB/MARK switch provides for actuation of either the Noise Blanker (NB) or crystal calibrator (MARK). The marker oscillator can produce calibration signals at intervals of either 25 kHz or 100 kHz by proper positioning of a switch inside the cabinet.

(22) POWER

This is the main on/off switch for the transceiver. In the OFF position, the memory circuits are disabled, so that when the transceiver is turned ON again, the memory circuits will have to be reset.

(23) HEATER

With the HEATER switch in the down position, the transmitter tube heaters are turned off. This reduces battery drain to 1.1 amp and thus permits long periods of listening without excessive battery drain. Placing this switch in the up position provides supply voltage to the tube heaters, and after 30 seconds of warmup the transmitter is

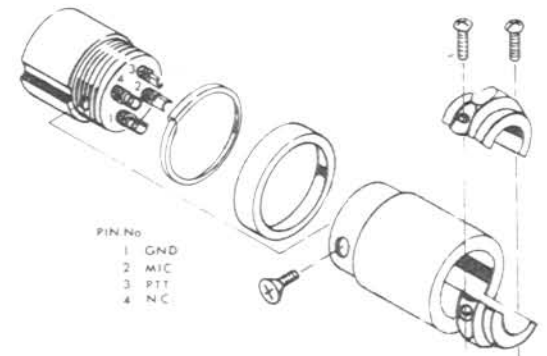
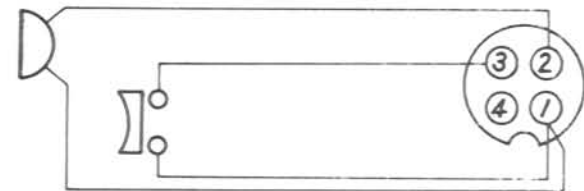
ready for operation. This switch operates in both the AC and DC modes.

(24) PHONES

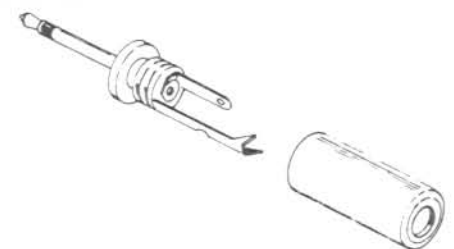
This is a standard 1/4" phone jack for accommodation of headphones. The internal speaker is disabled when headphones are plugged into this jack.

(25) MIC

This four-conductor jack accommodates the microphone plug for microphone input as well as for PTT actuation.

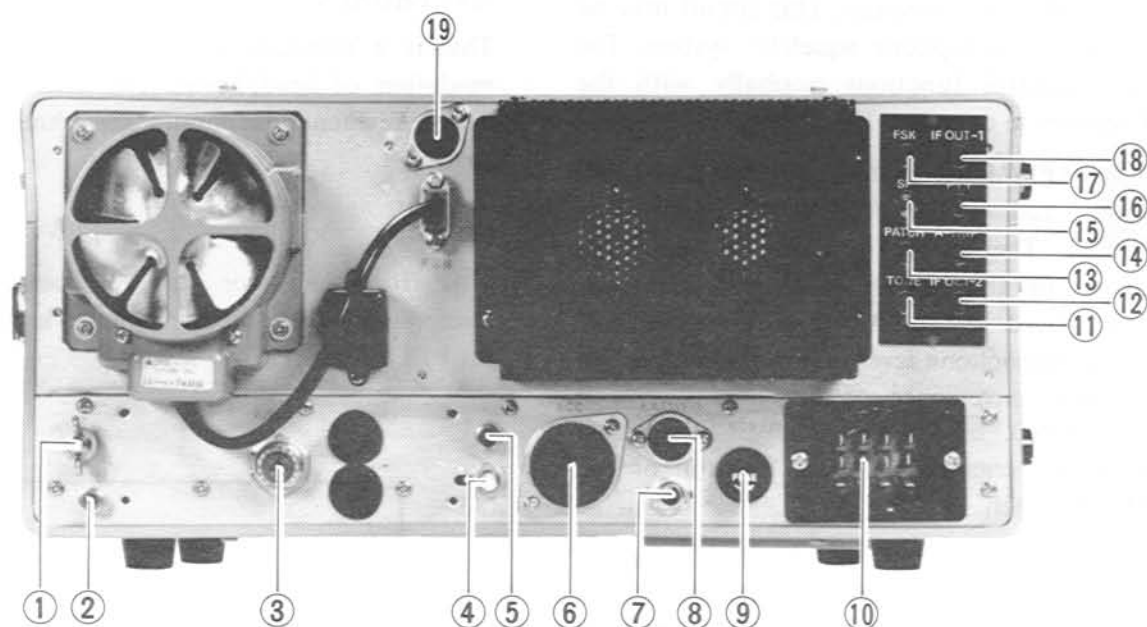


Mic plug



Headphone plug

REAR APRON CONNECTIONS

**(1) GND**

Threaded lug for ground connection.

(2) RF OUT

Signal frequency output from the driver stage may be obtained at this jack for use with optional equipment, such as the FTV-901R VHF/UHF transverter.

(3) ANT

Coaxial connection for antenna.

(4) PO ADJ

Sets PO meter sensitivity.

(5) RCV ANT

A second receiver receives its antenna connection through this jack.

(6) ACC

Accessory socket. Provides access to transceiver operating voltages and relay contacts.

(7) KEY

Three-conductor jack for connection to keyer paddle or external key.

(8) EXT VFO

Connections for external VFO.

(9) FUSE

Fuse holder requires 5 amp fuse for 117 volt or 3 amp fuse for 220 volt operation. For 12 volt DC operation, a 20 amp fuse is installed in the power cable. When replacing fuses, be certain to install a fuse of the proper rating. The warranty does not cover damage caused by improper fuse replacement.

(10) POWER

Power receptacle. Both AC and DC cables are supplied.

(11) TONE

Sidetone output for second receiver (if used).

(12) IF OUT 2

Wide-bandwidth 8.9 MHz IF signal for connection to a spectrum analyzer, etc.

(13) PATCH

Speech input terminal for phone patch connection. Impedance is 500 ohms.

(14) A-TRIP

Anti-trip input from second receiver (if used).

(15) SP

Audio output is provided at this jack for an external speaker. Output impedance is 4 ohms, and

the internal speaker will be disabled when plug is inserted.

(16) PTT

This jack may be used for external actuation of the transmitter. As an example, a footswitch may be connected to this jack to provide remote control of the transmitter relay, leaving the operator's hands free for writing and tuning purposes.

(17) FSK

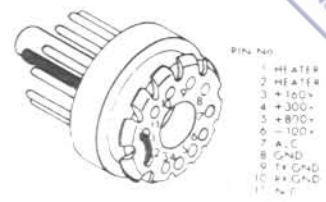
Input from the FSK terminal may be made through this jack. The FT-901DM is set up for 170 Hz shift.

(18) IF OUT 1

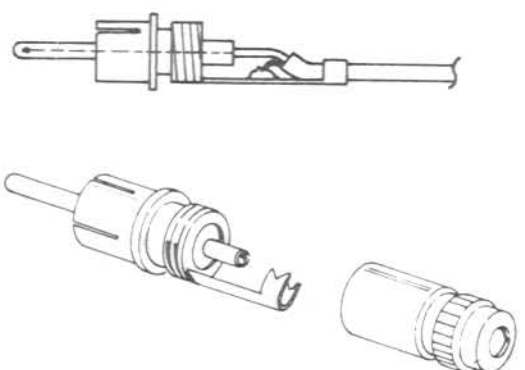
Narrow bandwidth 8.9 MHz IF output is available for use with an IF monitor scope, etc.

(19) REMOTE

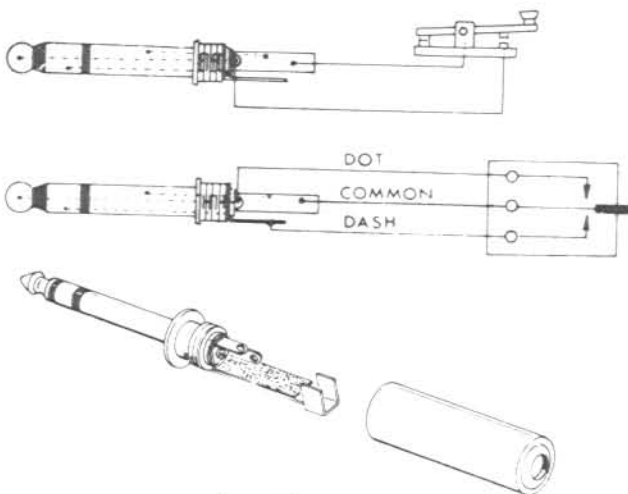
Provides switched 13.5 VDC for relay control for external low-pass filter units, etc. As the band-switch is rotated, 13.5 VDC will appear at various pins on the REMOTE jack. Use a VOM to determine the proper pin for the band in use.



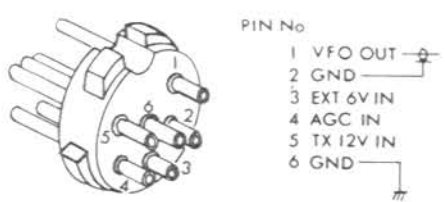
ACC plug



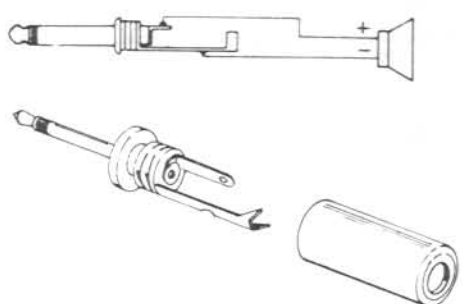
Pin plug



Key plug

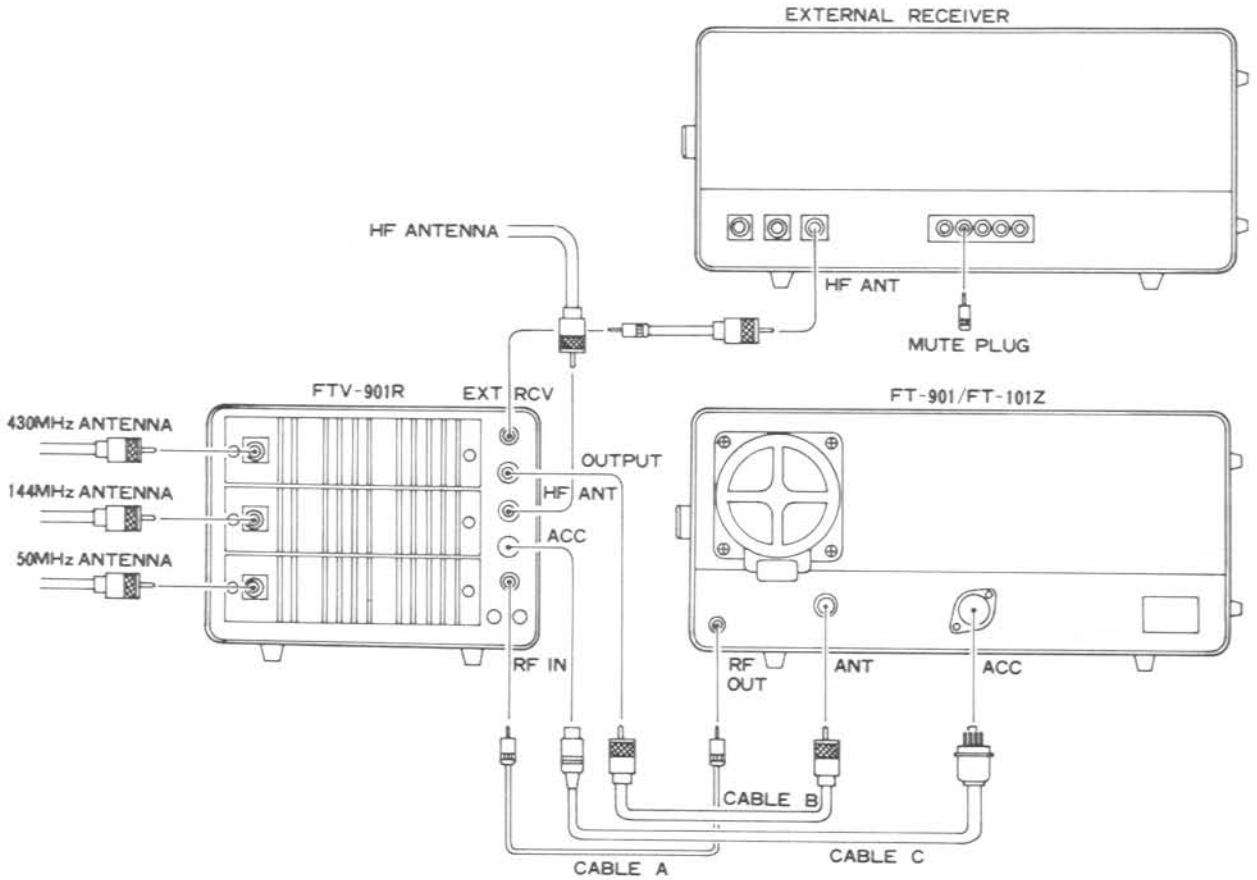
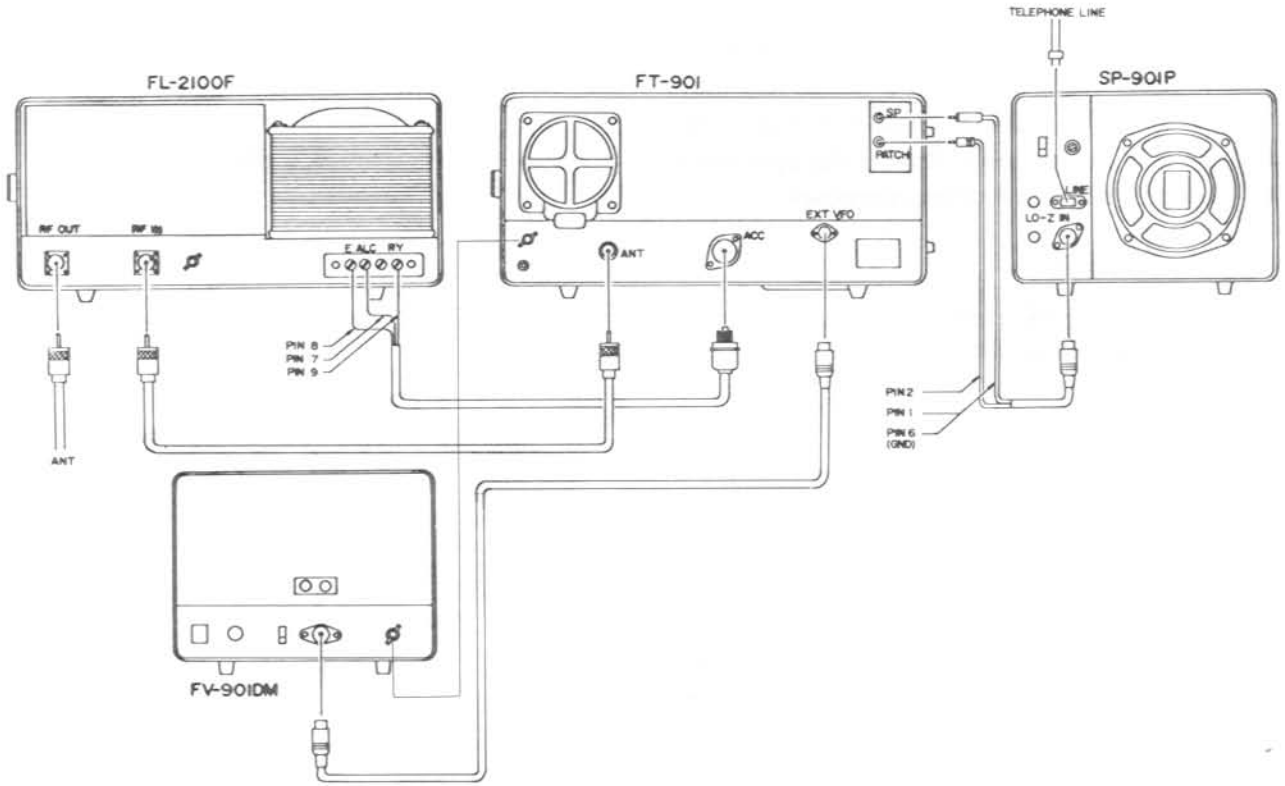


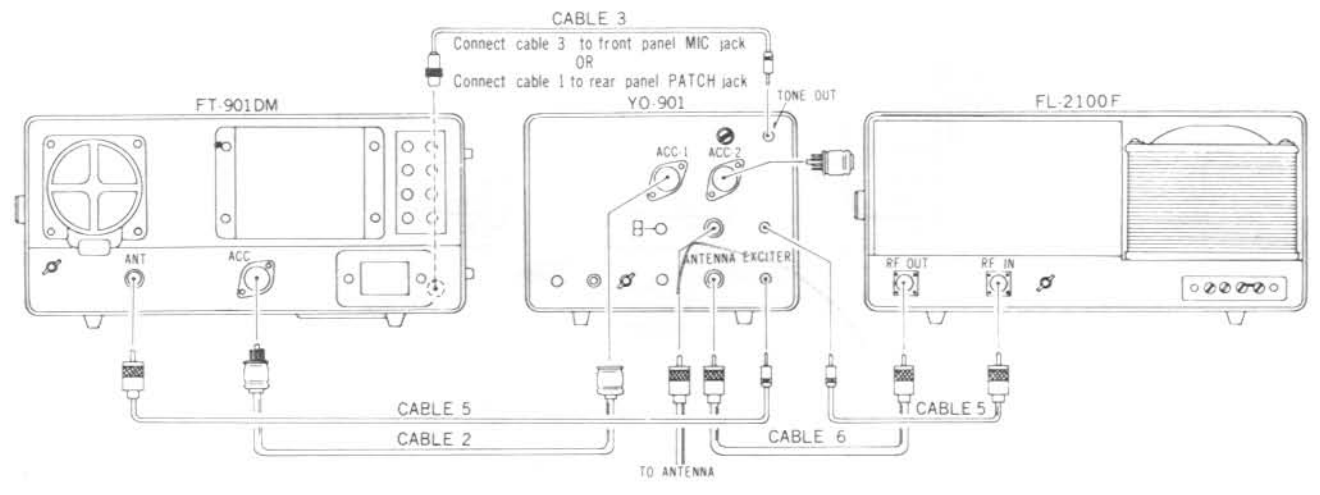
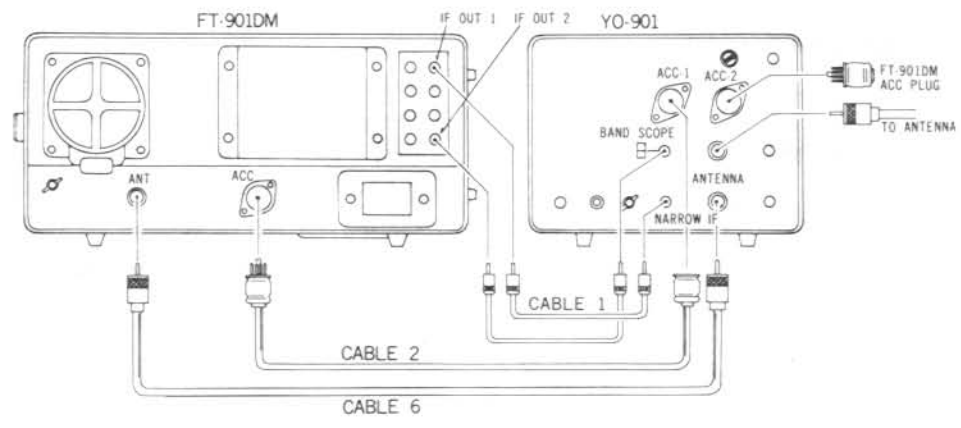
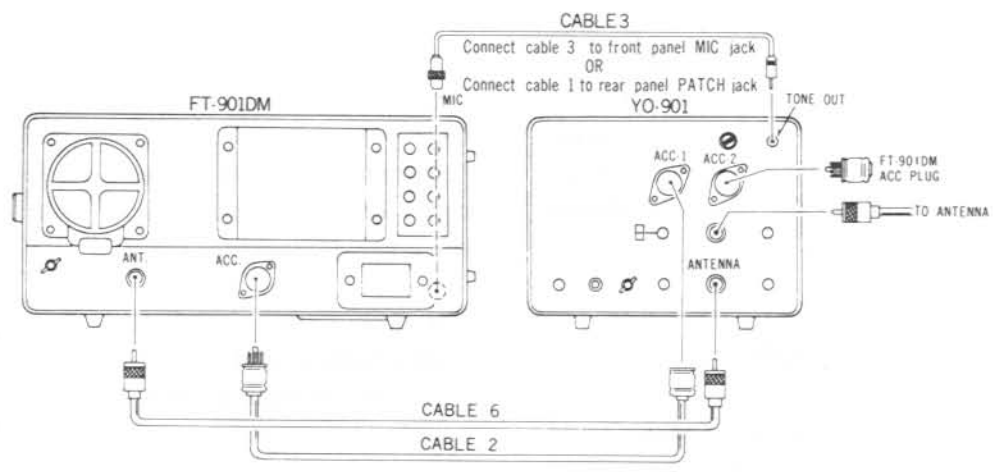
VFO plug



External speaker

INTERCONNECTIONS





INSTALLATION

This transceiver is designed to be a single-unit station for fixed, portable, or mobile operation. Consequently, power supply connections providing for operation from a variety of source voltages are available. This system provides the flexibility required for changing locations or quick moves from fixed to mobile operation.

BASE STATION INSTALLATION

The FT-901DM is designed for use in many areas of the world using supply voltages that may differ from the operator's local supply voltage. For this reason, be sure that the voltage 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 POWER OUTLET.**

CAUTION

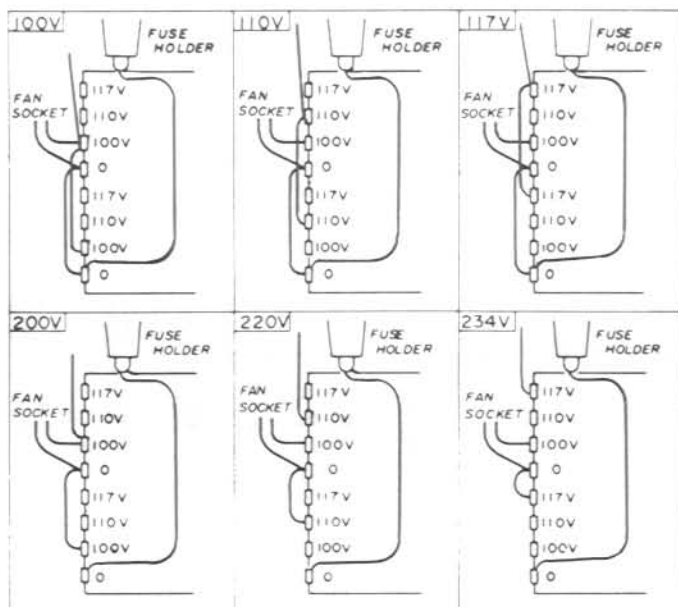
PERMANENT DAMAGE WILL RESULT IF IMPROPER AC SUPPLY VOLTAGE IS APPLIED TO THE TRANSCEIVER.

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

We do not recommend the use of power connectors other than the ones supplied by Yaesu. If a rig brought in for servicing is blowing fuses every time you plug it in, check to make sure that no "improvements" have been made to the power cord through substitution of or modification to the power connector.

For base station installation, the only important consideration that need be made is to ensure adequate circulation around the unit. Do not place books or papers on or around the cabinet, nor should the unit be placed on top of another heat-generating device such as a linear amplifier. Avoid heat ducts and window locations which are exposed to the hot sun, and you will keep your transceiver running at full speed for a long, long time.

Be certain to ground the transceiver through a heavy, braided cable less than 10 feet long. Cold water pipes in newer houses probably are unsatisfactory as grounding posts; it is much better practice to use a system of one or more ground rods, with the ground line securely bonded to the ground system.



MOBILE INSTALLATION

(Note: The DC-DC converter described herein is built-in on the FT-901DM, and is an available option on the FT-901D/SD/DE models)

The FT-901DM will operate satisfactorily from any 13.5 Volt DC negative-ground battery source by connecting the DC power cord to the rear panel receptacle. For under-dash mounting, a special mobile mounting bracket is available from your dealer. In mobile installations the transceiver should be suited away from heater ducts. No special precautions need be observed if adequate ventilation space is available. A minimum of two inches of air space above the cabinet top and on all sides is recommended to allow proper air flow around the cabinet. Never stack other units above or below the transceiver since 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. When making connections to the car battery, be absolutely certain that the RED lead is connected to the positive (+) terminal and the BLACK lead is connected to the negative (-) terminal. Reversed connections could permanently damage the transceiver.

The BLACK lead should, preferably, run directly to the negative terminal of the battery. Using the car frame as a negative connection or connecting the RED lead to a positive point such as the ignition switch places the transceiver in the same current path as noise-creating devices, thus failing to take advantage of the filtering action of the battery. The power cable should be kept away from ignition wires and should be as short as possible to minimize voltage drop and to provide a low impedance path from the transceiver to the battery.

Before connecting the power cable to the transceiver, check the battery voltage with the engine running (battery charging). If the voltage exceeds 15 Volts DC, the regulator should be readjusted so that the highest charging rate does not exceed 15 Volts. The transceiver should always be switched OFF while the car engine is being started to prevent voltage transients from damaging power supply components.

ANTENNA CONSIDERATIONS

The FT-901 transceivers are designed for operation using an antenna system presenting a 50-75 ohm resistive load at the antenna jack. Amateur installations seldom meet this requirement over the entire spread of every band, but the final amplifier pi network is sufficiently forgiving to allow for minor deviations from the target figure. However, significant departures from the 50-75 ohm range will result in seriously degraded transceiver performance.

If an open-wire feedline is used, or if the input impedance of the antenna system presents a very high or very low impedance at the coaxial input, some sort of antenna tuner must be used to provide a 50 - 75 Ohm unbalanced feedpoint for the transceiver.

For mobile operation, most of the commercially-available antennas on the market will provide good 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.

OPERATION

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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 operation.

INITIAL CHECK

Before connecting the transceiver to a power source, carefully examine the unit for any visible damage. Check that all modules are firmly in place and that the controls and switches are operating normally. Make sure that the voltage specification marked on the rear panel matches your supply voltage, and that the line fuse on the rear panel matches the supply voltage; for 117 VAC, use a 5 amp fuse, and for 220 VAC use a 3 amp fuse. For DC operation a fuse holder is installed in the DC cable, and a 20 amp fuse should be installed here.

FREQUENCY SELECTION

Frequency readout for the FT-901DM includes both analog and digital readout. The analog readout dial shows calibrations at the 100 kHz and 10 kHz points, and is marked, as well, in 1 kHz increments for fine tuning. The digital readout displays all digits of the operating frequency, with resolution down to 100 Hz accuracy.

RECEIVE OPERATION

- (1) Preset the controls and switches as indicated:
 - POWEROFF
 - HEATEROFF
 - VFOSwitch depressed
 - VOX GAIN . . .PTT position
 - RF GAINFully clockwise
 - AF GAINAdjust subsequently for comfortable level
 - BANDDesired band
 - MODEDesired mode
 - PRESELECT . .Desired band segment
- (2) Turn the POWER switch to ON. The meter will light up and the operating frequency will be displayed on the dial window. 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 main tuning dial is tuned across the band.
- (3) The RX CLARIFIER may be utilized if the received signal is drifting. Pushing the RX button and rotating the CLARIFIER control will provide a means of offsetting the receiver frequency ± 2.5 kHz without changing the transmitting frequency. 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, providing effective suppression of this type of noise.
- (5) Rejection of adjacent-channel interference may be accomplished by several means. The REJECT control may be utilized to place a steep-skirt 30 dB notch attenuation on any interfering signal within the IF passband. The WIDTH control varies the passband of one of two IF filters (the other is fixed and presents a boundary for narrowing the passband). Varying the WIDTH control varies the IF selectivity from approximately 300 Hz to 2.4 kHz (at 2.4 kHz the WIDTH control is at "0" and the two filters have the same passband). Clockwise rotation from the center ("0") position makes the passband narrow toward the high frequency side, while counter-clockwise rotation narrows the passband on the low-frequency side.
- (6) For CW reception, the APF (Audio Peak Filter) may be activated. This filter has a 100 Hz peak bandwidth with very steep skirts so as to provide single-signal reception for CW, with insertion loss of less than 1 dB when the APF control is tuned exactly to the signal frequency. The APF FREQ control varies the peak frequency from approximately 400 Hz to 900 Hz. The operator will observe that the APF system provides a significant

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improvement in signal-to-noise ratio. The selectivity of the APF circuit may be varied by adjusting VR₅₀₁ under the top cover.

- (7) For extremely strong signals, the ATT (RF attenuator) switch may be pressed to activate a 20 dB attenuation of the incoming signal. This should prevent any chance of overload of the receiver front end.

TRANSMITTER TUNE-UP

The following tune-up procedure must be performed prior to commencing operation on the desired mode: LSB, USB, CW, FSK, AM, or FM. See the paragraphs relating to the specific mode after basic transmitter tune-up is described.

Connect a dummy load or matched antenna to the coaxial fitting on the rear apron. Preset the controls as follows:

- POWEROFF
- HEATEROFF
- CARRFully counter-clockwise position
- MIC GAINFully counter-clockwise position
- AMGCOFF
- METER switch . .IC
- SFLECTVFO (Depressed)
- BAND Desired band segment
- MODEUSB or LSB
- PLATEDesired band segment
- PRESELECTDesired band segment
- LOADINGTo position shown in table
- PROCOFF (Not depressed)
- TUNEOFF (Not depressed)
- CLAR TXOFF (Not depressed)
- VOX GAINPTT position

Turn the POWER and HEATER switches to ON. From a cold start, allow 60 seconds after the HEATER switch is turned on for warm-up of the transmitter tubes. Be certain that the accessory plug is inserted in the accessory socket; without this plug being so connected, there will be no power applied to the tube heaters. Heater voltage is supplied through pins 1 and 2 of the accessory socket.

LOADING POSITIONS

BAND	POSITION
160	5
80	4
40	3.5
20	3
15	2.5
10A	3
10B	3
10C	3
10D	3

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

Set the VOX GAIN control to MOX. The meter will now read final amplifier resting cathode current. This should read .05 (50 mA).* If it is not, adjust the bias control, located under the top cover near the rear of the set. Set the METER switch to ALC and adjust the ALC control under the top cover for full scale deflection of the meter. Return the meter switch to IC and the VOX GAIN control to PTT.

*Note: On the FT-901SD, resting cathode current should be .025 (25 mA).

PRE-TUNING

(IMPORTANT NOTE: Subsequent transmitter tuning utilizes the TUNE button instead of MOX for actuating the transmitter. When pressed, the TUNE button causes the transmitter to be activated for ten seconds, after which time the FT-901DM returns to the receive condition. This is a protective feature that should not be nullified by use of the MOX control.)

- (1) Adjust the PRESELECT control for maximum receiver noise level.
- (2) Depress the TUNE button. Rotate the CARR control until the meter reading rises just above the normal idling current of .05 (50 mA).
- (3) Adjust the PRESELECT control for a maximum meter indication.
Caution: if the meter reading exceeds .1 (100 mA) reduce the setting of the CARR control.

GENERAL

- (4) Rotate the PLATE control for a minimum meter reading ("dip" in final amplifier cathode current).
- (5) Push the TUNE button again to return the transceiver to the receive condition.

FINAL TUNING

Final peak tuning utilizes the relative power output position of the METER switch. At full rated power into a 50 Ohm load, the meter will read approximately 1/2 to 2/3 full scale. If the PO reading is too high (off scale) or too low (1/4 scale or less) and the load impedance is very close to 50 Ohms, the PO ADJ control on the rear apron may be adjusted so as to provide 1/2 to 2/3 scale deflection at full power. Once the PO meter is calibrated, off-scale meter deflections are the result of reflected power due to high SWR, and corrective action may be required in the antenna system.

Final transmitter peaking is described below:

- (1) Set the METER switch to the PO position and rotate the CARR control to the 11 o'clock position.
- (2) Press the TUNE button and rotate the PRE-SELECT control for a maximum meter reading. Press the TUNE button again to return to the receive condition.
- (3) Press the TUNE button and rotate the LOADING control for a maximum meter reading. Press the TUNE button again to return to the receive condition.
- (4) Press the TUNE button and rotate the PLATE control for a maximum meter reading. Press the TUNE button again to return to the receive condition.
- (5) Repeat steps 2 through 4, advancing the CARR control approximately 2 units for each set of adjustments until the CARR control is fully clockwise. The transmitter is now tuned for maximum power output.
- (6) Return the CARR control to the fully counter-clockwise position. Return the METER switch to IC.

With familiarity, some of steps 2 - 4 may be performed within one press of the TUNE button, taking advantage of the 10-second timer. The operator is discouraged, through, from exceeding the 10-second limitation imposed by the timer through use of the MOX position or the microphone PTT switch.

SSB OPERATION

After completion of 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. While speaking in a normal voice into the microphone, advance the MIC GAIN control until the meter kicks down 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 however, is approximately 2 times the indicated value.

To set the sensitivity of the VOX system, begin with the VOX GAIN control in the PTT position. Advance the VOX GAIN and speak in a normal voice. The VOX GAIN control should be advanced until the voice actuates the transmitter (do not press the microphone PTT switch or footswitch, if used, during this adjustment).

Set the antitrip potentiometer under the top cover to the minimum point which prevents the speaker output from tripping the VOX. Do not use more VOX GAIN nor antitrip than necessary. Adjust the delay potentiometer under the top cover for the desired release time.

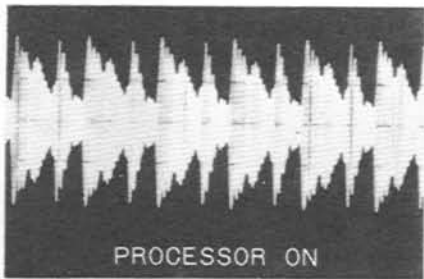
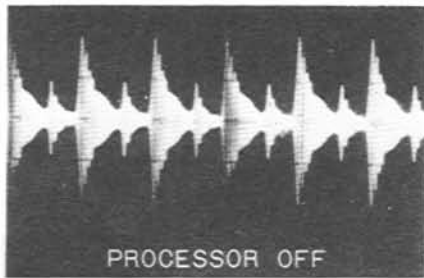
If desired, the AMGC circuit may be activated. This circuit acts as a "microphone squelch;" that is, it initiates a threshold for microphone input which must be exceeded before output from the microphone amplifier will occur. This feature permits minor noises such as a TV in the operating room to be present without going out over the air. Adjustment of the AMGC delay time is made by a control under the top cover.

RF SPEECH PROCESSOR ADJUSTMENT (All models)

The FT-901DM speech processor, when properly adjusted, is designed to 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.

The distortion produced by RF envelope clipping and filtering is less objectionable than that caused by an equivalent amount of audio clipping. RF clipping causes no increase in the peak power output, but it does clip the peaks of the voice waveform so as to increase the average power output.

With the processor switch (located immediately to the left of the PROC LEVEL control) in the OFF position (not depressed), set the METER switch to the ALC position. Speaking at a normal level, set the MIC GAIN control to the level where the meter indication stays in the green portion of the meter scale. Press the processor switch and adjust the PROC LEVEL control to the position where the ALC indication stays in the green portion of the meter scale while speaking in a normal voice. Optimum setting of the MIC GAIN and PROC LEVEL controls may require observation of the transmitted signal using an oscilloscope.



CW OPERATION

Note: The Curtis 8043 IC Keyer Unit is built-in on the FT-901DM/DE, and is an available option on the FT-901D/SD models.

For electronic keyer operation, insert a three conductor plug attached to a keyer paddle into the KEY jack on the rear apron. Keyer speed may then be adjusted by varying the KEYER control on the front panel.

For straight key, bug, or external electronic keyer use, rotate the KEYER control fully counter-clockwise into the click-stop. The desired key line may then be inserted into the KEY jack. Refer to the drawings on page 9 for details of the proper key line plug wiring.

The transmitter may be activated on CW by MOX, PTT, or by VOX (semi-break-in) as desired. The key-up voltage across the key terminals is 7 volts, while the key-down current is 1.5 mA, so most external electronic keyers may be used with the FT-901DM without modification.

The operator may select any power output desired by advancing the CARR control as desired.

NOTE: Insertion of the key plug automatically disconnects the bias supply to the PA tubes. Therefore, bias current will not be indicated when the METER switch is in the IC position.

AM OPERATION

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

After completing basic transmitter tune-up, place the MODE switch in the AM position. Activate the transmitter, and rotate the CARR 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 CARR 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.

For AM reception, an AM filter is available as an option.

FSK OPERATION

After completing basic transmitter tune-up, place the MODE switch in the FSK position. The FSK terminal input may be connected to the FSK jack

GENERAL

on the rear panel. The FT-901DM is set up for 170 Hz shift, and the shift frequency may be adjusted somewhat by means of the trimmer capacitors located under the top cover. The CARR control must be adjusted in the TUNE position for not more than 100 mA. Excessive cathode current may result in damage to the final amplifier tubes.

Audio output from the transceiver may be taken from the SP jack in the rear apron.

FM OPERATION

Note: The FM Unit is built-in on the FT-901D/DM, and is an available accessory on the FT-901SD/DE models.

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

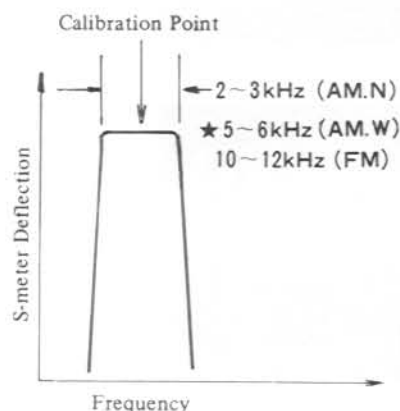
For FM reception, the SQL control on the front panel should be advanced only as far as required to silence background noise. When adjusted just past the silencing threshold, the squelch circuitry will provide noise-free reception with maximum sensitivity to weak FM signals.

DIAL CALIBRATION

The frequency readout of the FT-901DM is designed to indicate the carrier frequency. Consequently, there will be a 3 kHz difference between USB and LSB. When calibrating the dial and digital display, the CLARIFIER switch should always be OFF.

- (1) For SSB calibration, place the NB/MARK switch in the MARK position to activate the internal marker signal generator. The choice of 25 kHz or 100 kHz marker intervals may be made by changing the position of switch S₆₀₁, which is located on the VOX unit.
- (2) As the main tuning knob is turned, a beat note will be heard every 25 kHz or 100 kHz, depending on the position of S₆₀₁. Tune the dial and secure a zero beat (lowest pitch frequency) with the marker signal nearest the desired operating frequency.

- (3) Turn the ribbed calibration ring on the main tuning knob shaft to calibrate the analog scale precisely to the zero or 25 kHz point.
- (4) Adjust the CALIB control for a precisely correct reading in the digital window (for example, 14.225.0).
- (5) For CW calibration, secure a zero beat as above, then adjust the CALIB control until the digital display frequency indication is 700 Hz higher than the zero beat (for example, 14.000.7). Then rotate the main tuning dial to secure the zero or 25 kHz reading on the digital display (14.000.0); rotate the ribbed calibration ring on the main tuning knob shaft to align the analog dial precisely with the calibration mark and the digital display. In the CW mode, to repeat, the transmitter carrier frequency is the frequency being displayed.
- (6) In the AM and FM modes, the zero beat signal is not available. Place the WIDTH control in the "0" position, and tune the dial for maximum S-meter indication on the marker signal to establish the calibration point.



SELECT SWITCHES/MEMORY SYSTEM OPERATION

(Note: The memory unit is built-in on the DM model, optional on the D/SD/DE models)

Frequency control of the FT-901DM is by means of the internal VFO, the memory unit, an external VFO, or various combinations of the three.

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Split-frequency control may be obtained with the memory system or the FV-901 synthesized scanning VFO. The switches involved in frequency control are as follows:

- MR** This button recalls the memorized frequency for control of the transceive frequency.
- TX MR** This button recalls the memorized frequency for control of the transmit frequency.
- RX MR** This button recalls the memorized frequency for control of the receive frequency.
- VFO** Frequency control is by means of the internal VFO as controlled by the main tuning knob.
- EXT** This switch selects the FV-901 synthesized scanning VFO for frequency control as follows: with the EXT and MR buttons pushed, transceive frequency control is by means of the external VFO. With the EXT and TX MR buttons pushed, the external VFO controls the transmit frequency while the internal VFO controls the receive frequency. With the EXT and RX MR buttons pushed, the external VFO controls the receive frequency while the internal VFO controls the transmit frequency.
- M** This button is used to store a frequency in memory. THE FREQUENCY DISPLAYED ON THE DIGITAL READ-OUT WILL BE THE FREQUENCY STORED WHEN THE M BUTTON IS PRESSED. When the M button is pressed, the frequency previously stored in memory will be destroyed. When the power is turned off, the frequency is lost from memory.

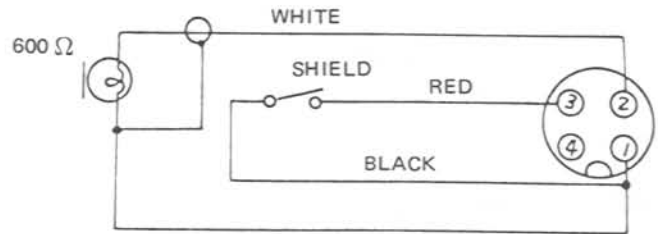
Note: Because of "round-off error" the digital display and memory system may exhibit a 100 Hz difference between the VFO condition and the memory recall condition.

Operation of the memory system is perhaps best described by the use of some examples:

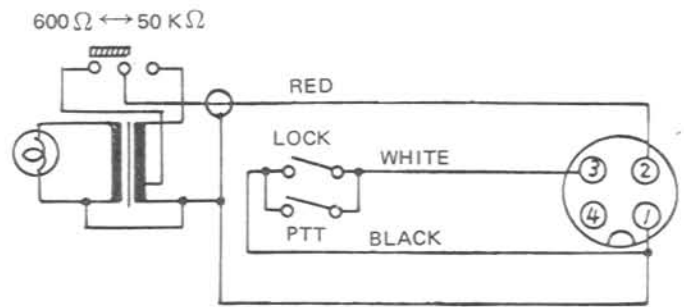
- (1) You are operating on a net on 3970 kHz and must QSY down 10 kHz to handle a piece of traffic. With the VFO button depressed and the main dial on 3970 kHz, press M; 3970 is now memorized. Move the main dial down to 3960 kHz to handle the message. When finished, press MR for instant return to 3970 kHz. The main dial may be left at 3960 kHz if further QSY to that frequency is anticipated. To return to 3960 kHz, simply press VFO.
- (2) You are operating split frequency on 40 meter phone, and you hear DX1DX on 7090 kHz, listening for calls on 7205 kHz. With the VFO button depressed and the main dial on 7090 kHz, press M to store 7090 kHz in memory, and press RX MR to lock the receiver on 7090 kHz. Turn the main tuning dial to 7205 kHz; you will now be transmitting on 7205 kHz and listening on 7090 kHz. To listen to the pile-up on 7205 kHz of stations calling DX1DX, push VFO; you will now be listening and transmitting on 7205 kHz, and another press of RX MR will return you to 7090 kHz for receive. If DX1DX should begin to drift slightly in frequency, push TX MR and M to store 7205 kHz in memory and lock the transmitter on that frequency. Place the main dial on 7090 kHz for precise tracking of the unstable DX1DX signal.
- (3) You find DX1DX on 21270 kHz, working stations by order of call area. By pressing the M button, 21270 kHz may be stored in memory and the operator may periodically check to see if his call area is being acknowledged by pressing MR or RX MR.

Note: After the M button is pushed, the VCO requires 10 seconds to stabilize on the memorized frequency. If one of the MR buttons is pushed during this 10-second period, some "drifting" of the memorized frequency may be observed.

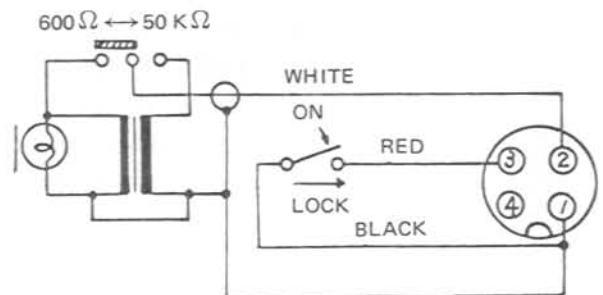
MICROPHONE CONNECTIONS



YE-7A Original Microphone



YD-844A



YD-148

PART DESIGNATIONS ON CIRCUIT BOARDS

PLUG-IN MODULES

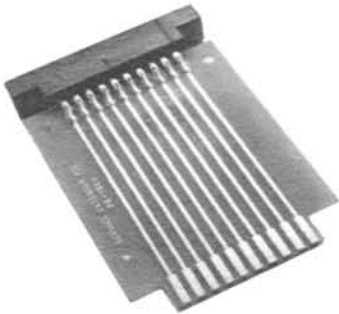
The FT-901DM utilizes computer-type plug-in modules, for ease of servicing. Extender boards of 10 pins (single and double face), 18 pins (single and double face), and 22 pins (single face) can be had from your Yaesu dealer to provide access to test points.

All parts used in the FT-901 transceivers have a part number (e.g. Q₅₀₆) assigned to them.

Part numbers 01-99 (e.g. R₁₂) are located on the main chassis. Other parts located on the printed circuit boards are assigned a three or four digit part number. The last two digits are the part number for that board; the first one or two figures are the code for the printed circuit board.

Thus, Q₃₀₁ is transistor number 01, located on circuit board #3, which is the FILTER unit. Refer to the chart below for a tabulation of the code numbers assigned to the various circuit boards used in the FT-901 transceivers.

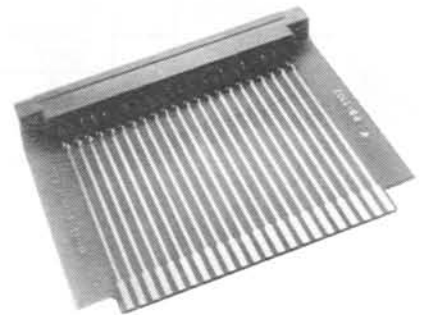
Code #	Unit	Board designation
1	RF	PB-1702
2	NB	PB-1703
3	FILTER	PB-1716
4	IF	PB-1704
5	AF	PB-1705
6	VOX/MARK	PB-1846
7	CARRIER	PB-1706
8	VFO	PB-1440
9	FM	PB-1707
10	RECT A	PB-1708
11	PLL	PB-1709
12	VCO	PB-1710
13	XTAL	PB-1711
14	RECT HIGH B	PB-1708
15	CAPACITOR	PB-1713
16	DRIV	PB-1714
17	FINAL	PB-1715
18	RECT C	PB-1717
19	SELECT SW	PB-1718
20	SW	PB-1719
21	TUNE SW	PB-1720
22	LED A	PB-1721
23	REJ SW	PB-1722
24	TRIMMER A	PB-1723
25	TRIMMER B	PB-1724
26	TRIMMER C	PB-1092
27	KEYER	PB-1728
28	MEMORY	PB-1787
29	COUNTER	PB-1729
30	DISPLAY	PB-1730
31	DIODE SW	PB-1726
32	DC-DC CONVERTER	—



10 Pin



18 Pin



22 Pin

EXTENDER BOARDS

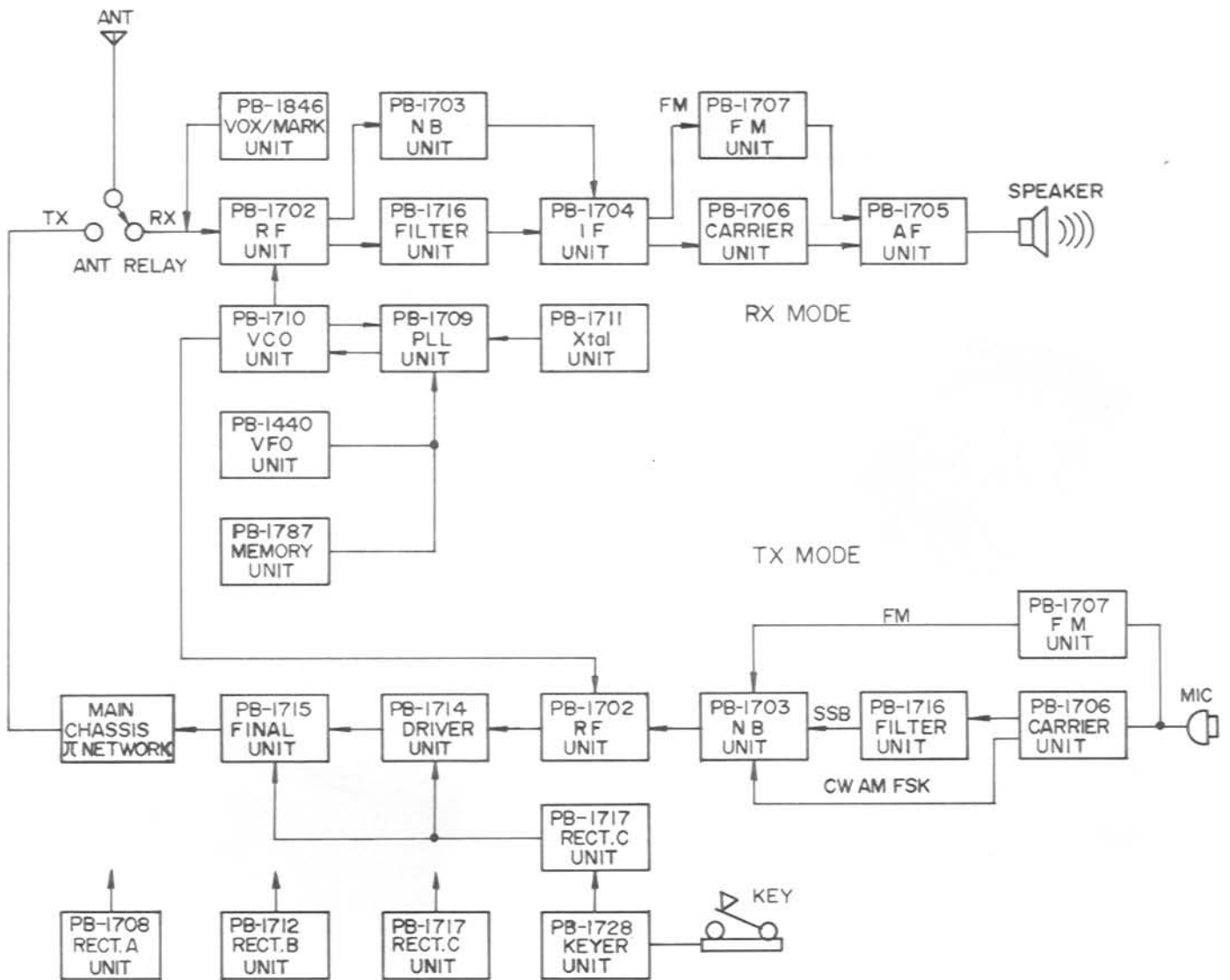
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SIGNAL TRACING IN THE FT-901

Because the signal path may change considerably when the mode is changed, we have included augmented block diagrams on page 2-3 through 2-9, in order to assist you in understanding the function of the FT-901.

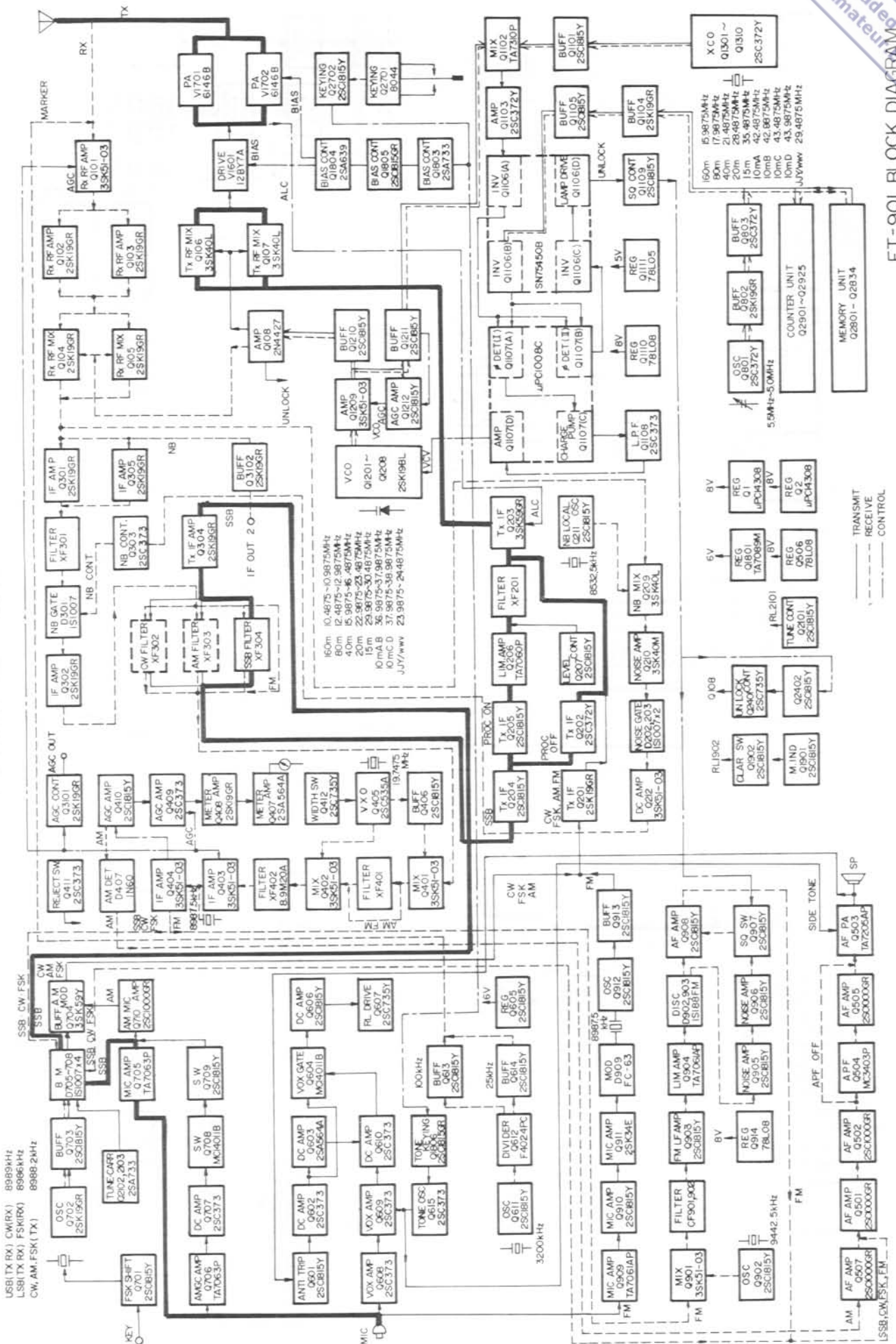
Below you will find a board-to-board block diagram, showing the TX and RX signal paths through the transceiver.

It should be noted that the internal calibrator (Marker) is an extremely useful signal for preliminary fault localization. In a properly functioning FT-901, the S-meter should read approximately S9 + 10 dB, when the preselector is peaked on 14.000 MHz SSB. Minor variations from this number are not unusual, but a blown RF amplifier FET will cause this indication to be practically nil. By using the internal calibrator, an experienced technician can peak practically all circuits on the receiver side, without the use of an external signal generator.



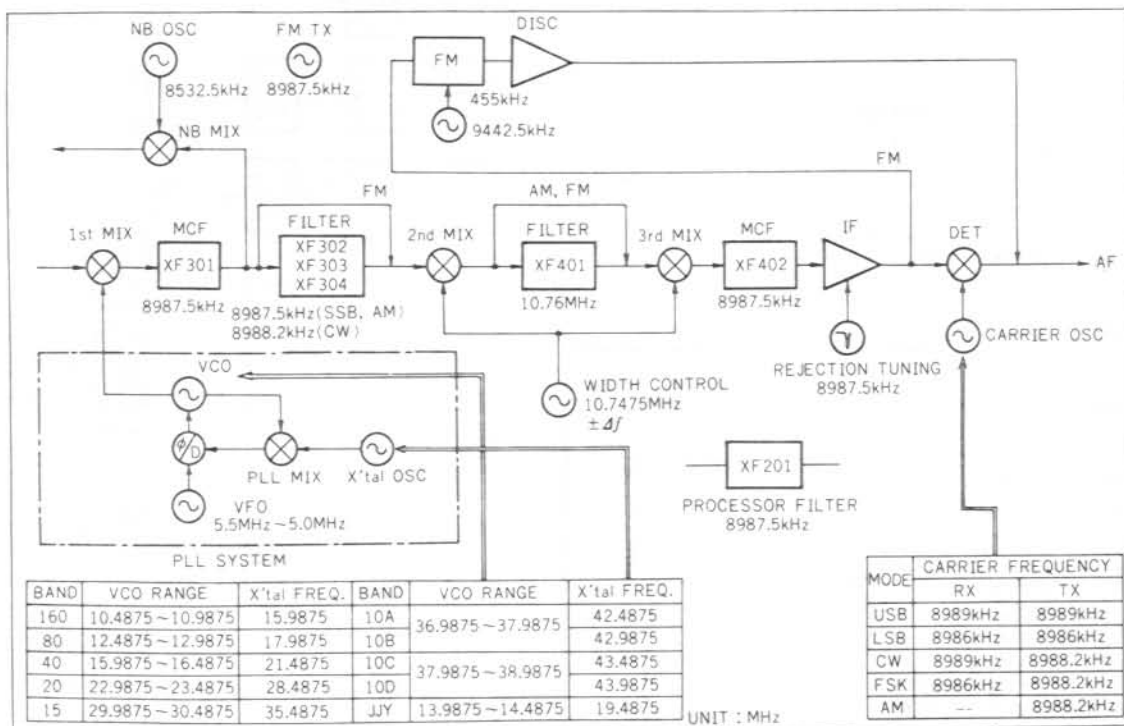
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FT-901DM SSB MODE TX



FT-901 BLOCK DIAGRAM

FREQUENCY RELATIONS



CRYSTAL DATA FT-901DM

UNIT	FUNCTION	HOLDER	FREQUENCY (kHz)	MODE	LOAD C (pF)	EFFECTIVE RESISTANCE	DRIVE LEVEL
CRYSTAL	160m	HC-25/U	15987.5	3rd overtone	30	80 (Ω)	2mW
	80m	" "	17987.5	"	"	60	"
	40m	" "	21487.5	"	"	45	"
	20m	" "	28487.5	"	"	40	"
	15m	" "	35487.5	"	"	40	"
	10m (A)	" "	42487.5	"	"	40	"
	10m (B)	" "	42987.5	"	"	40	"
	10m (C)	" "	43487.5	"	"	40	"
	10m (D)	" "	43987.5	"	"	40	"
	WWV (5MHz)	" "	19487.5	"	"	40	"
" (15MHz)	" "	29487.5	"	"	40	"	
CARRIER	LSB	HC-18/U	8986	Fundamental	35	30	10mW
	USB	" "	8989	"	"	35	"
	CW·FSK·AM	" "	8988.2	"	"	35	"
NB·PROC	Local	" "	8532.5	"	"	35	"
IF	Reject	" "	cf. 8987.5	Resonate	"	35	"
	Width	" "	cf.19747.5	Fundamental	"	15	2mW
FM	Carrier	" "	8987.5	"	"	5	"
	Local	" "	9442.5	"	30	35	"
COUNTER	Local	" "	18000	"	"	15	10mW
	Local	" "	18500	"	"	15	"
	Clock	HC-14/W	655.36	"	23	7K	2mW
VOX/MARK	Marker	HC-6/W	3200	"	"	50	5mW
MEMORY	Clock	HC-18/U	3276.8	"	"	200	3mW

★ Grounded case.
 ACTUAL FREQUENCY: 8534.5 kHz (2kHz up)
 ACTUAL FREQUENCY: 9017.5 kHz (30 kHz up)
 RESONATE FREQUENCY: 8985.5-8989.5 kHz
 XCO FREQUENCY: 19743-19753 kHz
 Decided by circuit

THEORY OF OPERATION

This transceiver utilizes PLL (Phase Locked Loop) circuitry. The receiver is a single-conversion type with a 8.9875 MHz IF. The following circuit description is tailored to the full-feature FT-901DM, and some of the features and circuitry described below are optional on the FT-901D/SD/DE models.

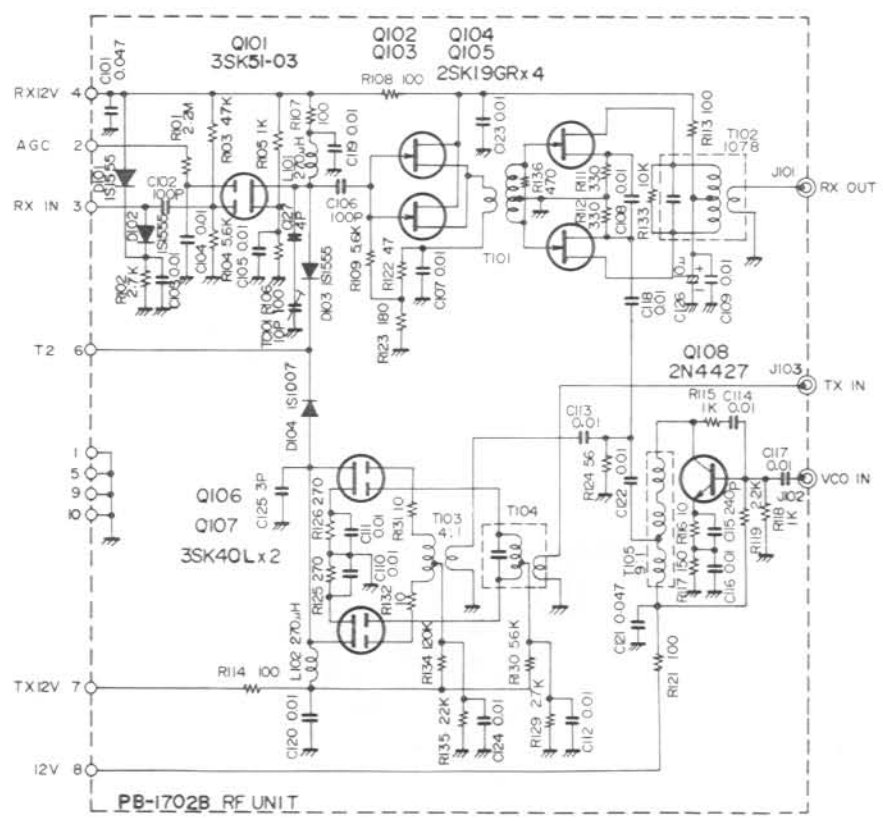
RECEIVER

The RF input signal from the antenna is fed to pin 3 of the RF UNIT (PB-1702) via antenna relay RL₂, line fuse FH₁, attenuator switch S₂₁₀₃, input transformer T₁, and 9 MHz trap coil T₂₄₀₂.

RF UNIT (PB-1423)

The incoming signal is amplified by the RF amplifier Q₁₀₁ (3SK40M), a dual-gate MOSFET which has superior rejection against cross modulation. The amplified signal is then fed through a source follower by parallel-connected Q₁₀₂ and Q₁₀₃ (both 2SK19GR) to the balanced mixer consisting of Q₁₀₄ and Q₁₀₅ (both 2SK19GR), where the input signal is heterodyned with a local signal delivered from buffer amplifier Q₁₀₈ (2N4427), producing an IF signal of 8.9875 MHz at J₁₀₁.

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



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FILTER UNIT (PB-1716C)

The IF signal received at pin 2 of the FILTER UNIT (PB-1716) is amplified by parallel-connected Q₃₀₁ and Q₃₀₅ (both 2SK19GR), and fed through a monolithic filter XF₃₀₁ (8.9M-20A), which has a ±10 kHz bandwidth, providing additional selectivity and enough delay time to match the noise blanker gating pulses. The signal is then fed to the second IF amplifier, Q₃₀₂ (2SK19GR).

The noise blanker diode D₃₀₁ (1S1007) is placed between T₃₀₂ and T₃₀₃, and it functions as an ON/OFF switch which is controlled by the noise blanker driver Q₃₀₃ (2SC1815Y). The output from the source of Q₃₀₂ is passed through the SSB filter XF₃₀₄ (or the optional AM or CW filters). Selection of the filter to be used is performed by one of the diode switches D₃₀₃ - D₃₀₈ (1S1007), depending on the mode of operation. The IF signal is then transferred to the IF UNIT. In the FM mode, the IF signal is coupled directly through D₃₁₀ (1S1555) to pin 5 of the IF UNIT.

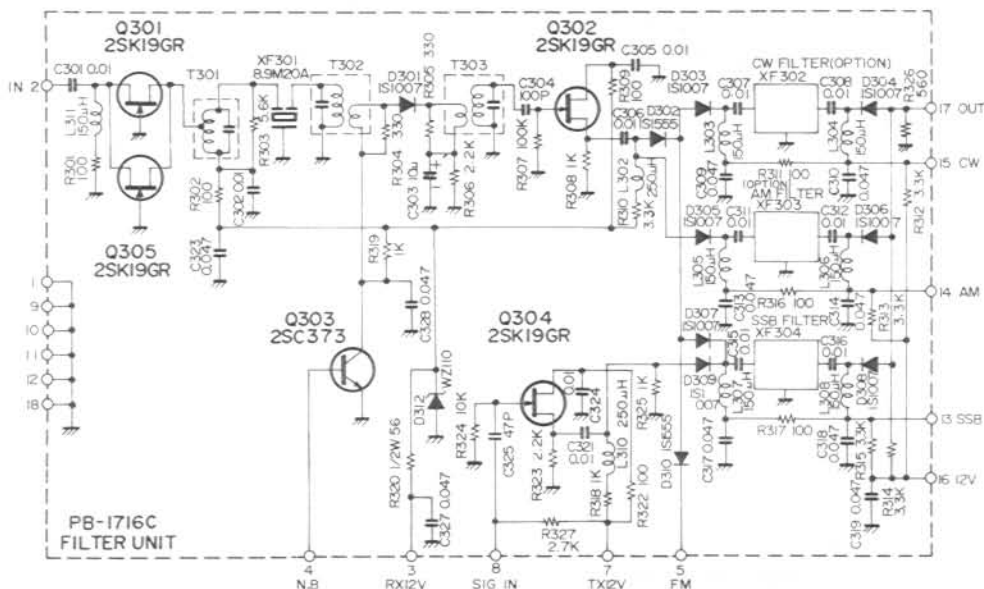
IF UNIT (PB-1704)

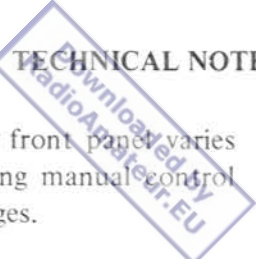
The IF signal from pin 14 is fed to the gate of the IF first mixer, Q₄₀₁ (3SK51), where the IF signal is heterodyned with a 19.7475 MHz ± Δf local signal delivered from crystal oscillator Q₄₀₅ (2SC535A) and buffer amplifier Q₄₀₆ (2SC1815Y), resulting in a signal of 10.76 MHz ± Δf.

The new 10.76 MHz ± Δf signal is fed through filter XF₄₀₁ to the IF second mixer, Q₄₀₂ (3SK51), where the filtered signal is heterodyned with a 19.7475 MHz ± Δf signal, producing an 8.9875 MHz signal, the same as the original IF. This process moves the IF signal across the passband of XF₄₀₁. The combination of filters XF₃₀₄ and XF₄₀₁ provides continuously variable width of the IF passband.

The frequency of crystal oscillator Q₄₀₅ is varied by varactor diode D₄₀₁ (1S2209).

On the AM and FM modes, the IF signal is passed through diode switches D₄₀₂ and D₄₀₃ (1S1007), and does not pass through filter XF₄₀₁.





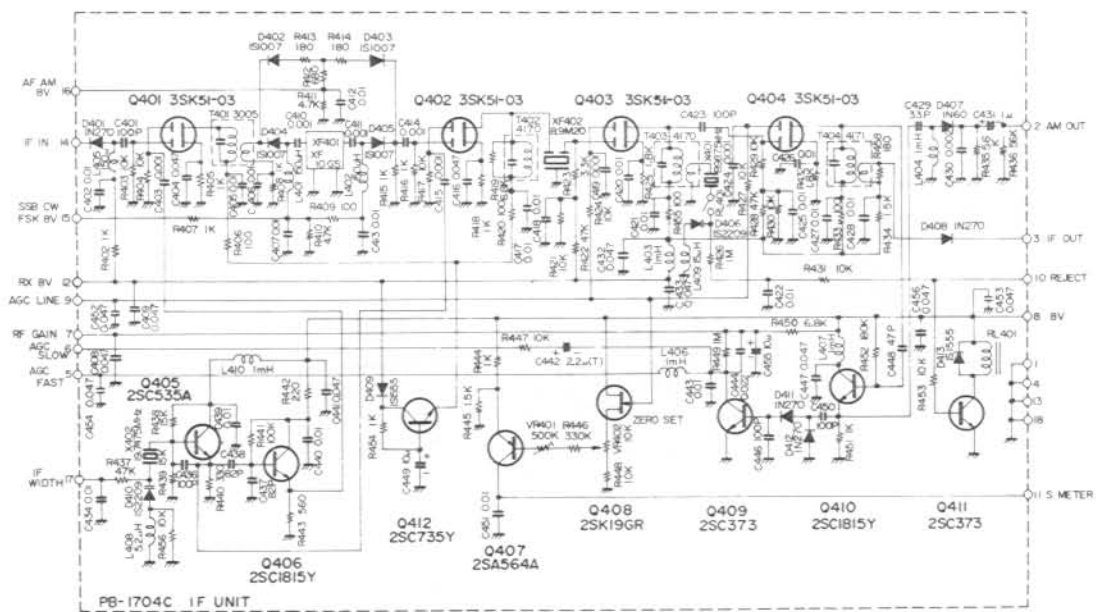
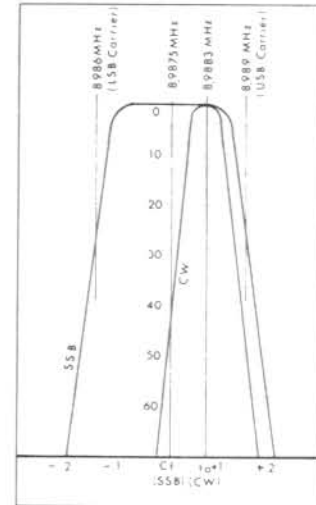
The output from the IF second mixer is fed through a monolithic filter XF₄₀₂ to the two-stage IF amplifier consisting of Q₄₀₃ and Q₄₀₄ (both 3SK40M). The output from Q₄₀₃ is coupled to the rejection tuning circuit which eliminates interference within the IF passband. This rejection function is accomplished by varying the resonant frequency of a crystal with varactor diode D₄₀₆ (1S2209) on the SSB, CW, and FSK modes.

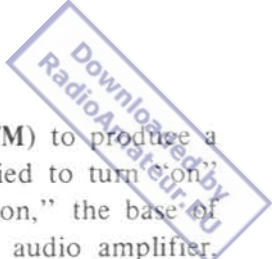
The amplified IF signal is fed to the CARRIER UNIT. In the AM mode, the signal is fed through a buffer amplifier Q₄₁₀ (2SC1815Y) to the AM detector D₄₀₇ (1N60). The signal is then fed to the AF UNIT.

A portion of the output from Q₄₁₀ is rectified by D₄₁₁ and D₄₁₂ (1N60) to produce AGC voltage. The AGC voltage is amplified by DC amplifier Q₄₀₉ (2SC373) and fed to the gate of RF amplifier Q₁₀₁ and to IF amplifiers Q₄₀₃ and Q₄₀₄ to control the gain of these stages for AGC purposes. The time constant of the AGC voltage decay is selectable (FAST/SLOW) by switch S₂₀₀₃. The AGC voltage is further amplified by Q₄₀₈ (2SK19GR) and Q₄₀₇ (2SA564A) for signal strength indication on the front panel S-meter.

The RF GAIN control on the front panel varies the AGC voltage level, providing manual control of the gain of the RF and IF stages.

Q₄₁₁ (2SC373) works as a relay driver for the IF rejection tuning circuit. Delay transistor Q₄₁₂ (2SC735Y) supplies the voltage to the drain of Q₄₀₁ and Q₄₀₂ when the transceiver returns to the receive mode after transmission.





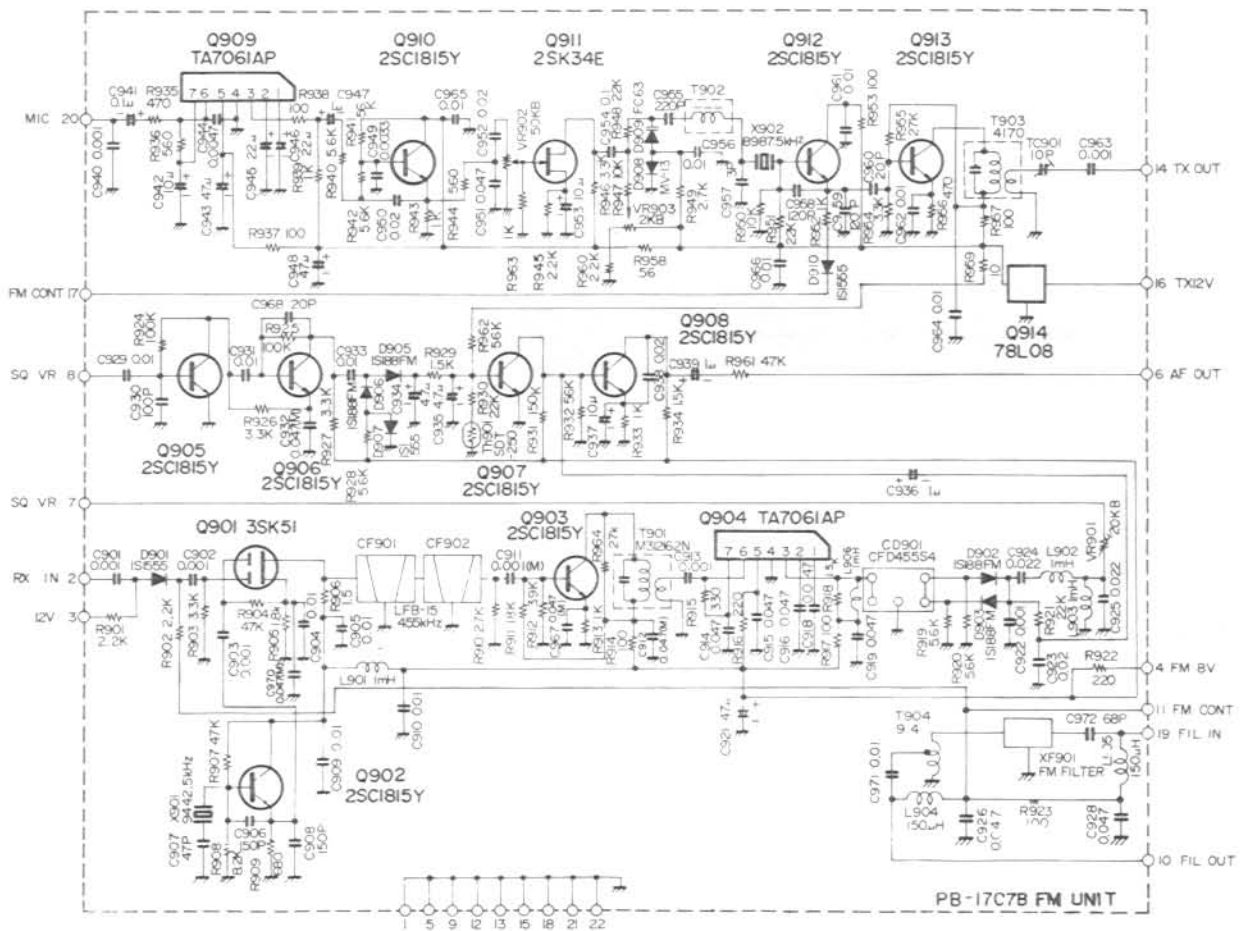
FM UNIT (PB-1707)

In the FM mode, the IF signal from the IF UNIT is fed to the gate of Q₉₀₁ (3SK40M), where it is heterodyned with the 9442.5 kHz signal delivered from the FM oscillator Q₉₀₂ (2SC1815Y), thus producing a 455 kHz IF signal. The 455 kHz IF signal passes through a two-stage ceramic filter consisting of CF₉₀₁ and CF₉₀₂ (LFB-15), and is amplified by an amplifier limiter consisting of Q₉₀₃ (2SC1815Y) and Q₉₀₄ (TA7061AP).

A ceramic discriminator consisting of CD₉₀₁ (CFD455S4) and D₉₀₂ and D₉₀₃ (both 1S188FM) produces an audio output in response to a corresponding frequency shift in the 455 kHz IF signal. The discriminator output is amplified by Q₉₀₈ (2SC1815Y) and fed to the AF UNIT at pin 6.

When no carrier is present in the 455 kHz IF, the noise at the discriminator output is amplified by Q₉₀₅ and Q₉₀₆ (both 2SC1815Y) and detected

by D₉₀₅ and D₉₀₆ (both 1S188FM) to produce a DC voltage. This voltage is applied to turn "on" Q₉₀₇ (2SC1815Y). With Q₉₀₇ "on," the base of Q₉₀₈ is grounded to quiet the audio amplifier. When a carrier is present, the quieting action of the receiver removes noise from the discriminator output and Q₉₀₇ is turned "off," permitting normal action of Q₉₀₈. The squelch control VR₉₀₁ sets the squelch threshold level.

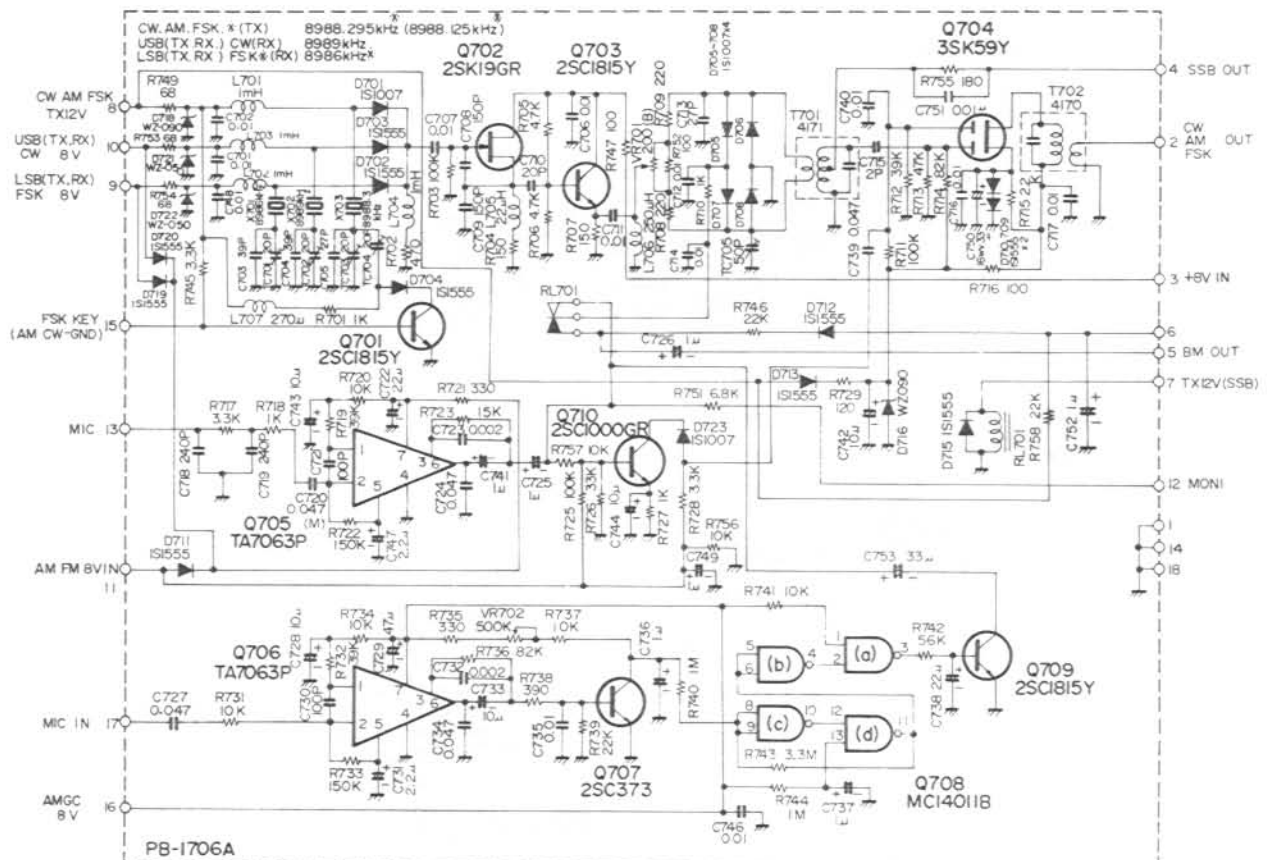


CARRIER UNIT (PB-1706)

The carrier oscillator Q₇₀₂ (2SK19GR) is followed by a buffer amplifier Q₇₀₃ (2SC1815Y). It oscillates at one of the following frequencies, depending on the mode of operation: 8989 kHz with X₇₀₂; 8986 kHz with X₇₀₁; or 8988.295 kHz with X₇₀₃. The crystal selection is made by diode switches D₇₀₁ - D₇₀₃ (1S1555).

Diode D₇₀₁ conducts to activate X₇₀₃, which is used for the CW, FSK, AM, and TUNE transmit signal. Diode D₇₀₂ conducts to activate X₇₀₁ for LSB and FSK reception. Diode D₇₀₃ conducts to activate X₇₀₂ for USB and CW reception.

The carrier signal is fed to the ring demodulator consisting of D₇₀₅ - D₇₀₈ (all 1S1007), which demodulates the IF signal into audio using the carrier signal applied from Q₇₀₃. The audio is then fed through relay contacts to the AF UNIT.



NB UNIT (PB-1703)

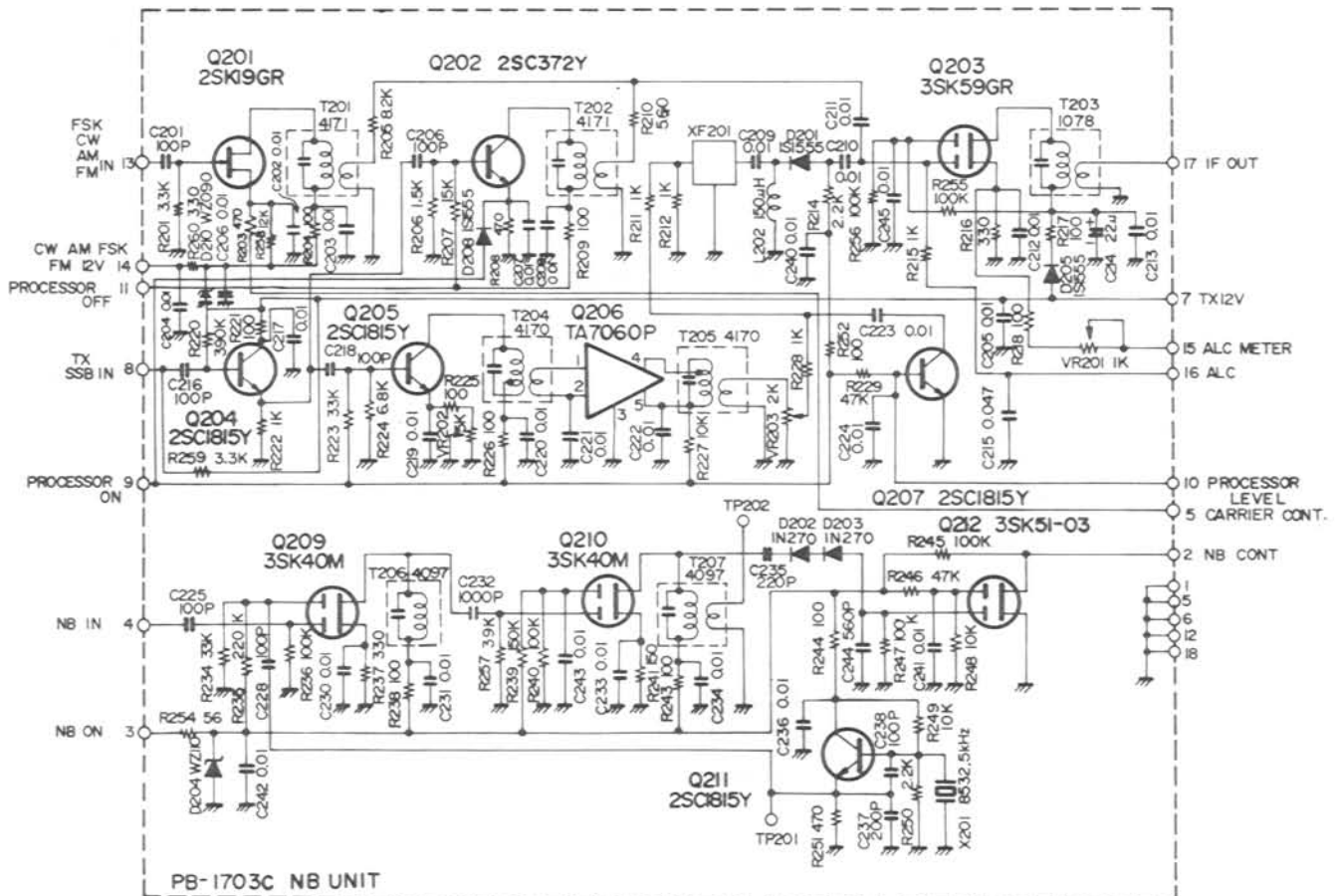
A portion of the 8987.5 kHz IF signal is fed to pin 4 of the noise blanker unit and appears at noise blanker mixer Q₂₀₉ (3SK40M), where the 8532.5 kHz signal generated by Q₂₁₁ (2SC1815Y) is mixed with the incoming signal to produce a 455 kHz signal. The 455 kHz signal is then amplified by Q₂₁₀ (3SK40M).

When a carrier or a noise-free modulated signal is received, the 455 kHz signal (with its corresponding strength) is rectified by D₂₀₂ and D₂₀₃ (both 1N60) to charge C₂₃₅. There is no discharge loop for C₂₃₅; therefore, signals which exceed the charged voltage established by the reference voltage on C₂₃₅ will not pass through D₂₀₂ and D₂₀₃. Accordingly, there will be no voltage drop across R₂₄₇, and Q₂₁₂ (3SK40M) will conduct as the gate voltage approaches zero potential. When Q₂₁₂ conducts, the drain voltage at pin 2 of the printed board will drop.

The drain of Q₂₁₂ is directly connected to the base of Q₃₀₃ (2SC1815Y) in the FILTER UNIT. As the drain voltage of Q₂₁₂ drops, the base voltage of Q₃₀₃ drops, turning off Q₃₀₃. The collector voltage will then increase, producing a forward bias to D₃₀₁ (1S1007). As D₃₀₁ conducts, the signals will pass normally through the circuit.

When pulse-type noise is received which exceeds the charged reference voltage established by C₂₃₅, D₂₀₂ and D₂₀₃ will permit negative-going pulses to turn Q₂₁₂ off. The drain voltage will rapidly increase as it turns off.

As the drain voltage increases, Q₃₀₃ will turn on and the collector voltage will decrease. Accordingly, D₃₀₁ will be biased to block the signal. Thus, when pulse-type noise is received, the signal passage will be blanked off momentarily.





TRANSMIT CIRCUIT

SSB

The output from the MIC jack J₂ is fed through the MIC GAIN control VR_{3a} to pin 13 of the CARRIER UNIT.

CARRIER UNIT (PB-1706)

The microphone signal is amplified by microphone amplifier Q₇₀₅ (TA-7063P) and fed through relay RL₇₀₁ to the ring modulator, consisting of D₇₀₅ - D₇₀₈ (all 1S1007), where the signal modulates a carrier signal delivered from Q₇₀₃ (2SC1815Y). The double sideband signal is fed through T₇₀₁ to the FILTER UNIT.

FILTER UNIT (PB-1716)

The 8987.5 kHz signal fed to pin 8 of the FILTER UNIT is amplified by buffer amplifier Q₃₀₄ (2SK19GR) and is passed through sideband filter XF₃₀₄ by diode switches D₃₀₉ (1S1555) and D₃₀₇ - D₃₀₈ (both 1S1007) where the DSB signal is converted to an SSB signal by removing the unwanted sideband.

NB UNIT (PB-1703)

The SSB signal is fed through a buffer amplifier Q₂₀₄ (2SC1815Y) to the bases of Q₂₀₂ and Q₂₀₅ (both 2SC1815Y). When the RF processor switch is "OFF," the SSB signal is amplified by Q₂₀₂ and fed to Q₂₀₃ (3SK59GR). When the processor switch is "ON," the SSB signal is amplified by Q₂₀₅ (2SC1815Y) and is further amplified by the limiter Q₂₀₆ (TA7060P), where the signals that exceed the preset clipping level are sliced out. VR₂₀₃ is used to equalize the level of the clipped and unclipped signals.

This highly clipped SSB signal is passed through a selective filter XF₂₀₁ to remove RF harmonics that result from signal clipping. The filtered output signal is amplified by Q₂₀₃ and fed to the RF UNIT. The PROC LEVEL control VR_{5b}, located on the front panel, varies the resistance

between the collector and emitter of Q₂₀₃ (2SC1815Y), thus changing the input signal level to the filter.

The CW, FSK, AM, and FM signals pass through Q₂₀₁ (2SK19GR) and are fed to Q₂₀₃.

The ALC (Automatic Level Control) voltage detected at the grid circuit of the PA tube is fed to the first gate of Q₂₀₃ to reduce the gain of the amplifier, thus preventing overloading and distortion.

RF UNIT (PB-1702)

The SSB signal from J₁₀₂ of the printed board is fed to the balanced mixer consisting of Q₁₀₆ and Q₁₀₇ (both 3SK40M), where the SSB signal is heterodyned to the desired RF frequency by mixing with the local signal which is supplied from the VCO UNIT. The mixer output is applied through diode switch D₁₀₄ (1S1555) to the DRIVE UNIT.

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

The output from the RF UNIT is fed to the grid of the transmitter driver V₁₆₀₁ (12BY7A) where it is amplified to a level sufficient to drive the final amplifier tubes V₁₇₀₁ and V₁₇₀₂ (6146B). A portion of the RF signal is coupled through C₁₆ to the cathode of the 12BY7A driver tube so as to improve the linearity of the final amplifier stage (RF negative feedback).

Neutralization of the power amplifier is accomplished by feeding back a small amount of the output through TC₁ to the cold end of the T₃/L₉ combination. The return of the grid circuit is connected to the REC A UNIT (PB1708) to produce ALC voltage to control the gain of the TX IF amplifier, thus preventing distortion caused by overdrive.

CW

In the CW, AM, and FSK modes, carrier oscillator Q₇₀₂ (2SK19GR) on the CARR UNIT generates a crystal controlled carrier signal of 8988.2 kHz. The carrier is fed through buffer amplifier Q₇₀₃ (2SC1815Y) to the ring modulator. Q₇₀₂ also oscillates for TUNE operation.

DC voltage is applied through diode switch D₉₁₂ (1S1555) and RL₇₀₁, to unbalance the ring modulator for CW, AM, and FSK operation; the resulting carrier signal is fed to T₇₀₁.

The output from T₇₀₁ is amplified by Q₇₀₄ (3SK59Y) and fed to Q₂₀₁ (2SC1815Y) on the NB UNIT. The signal is then further amplified by Q₂₀₃ (3SK59GR), and is fed to the transmitter mixer.

Keying of the transmitter is accomplished by changing the bias voltage to V₁₆₀₁, V₁₇₀₁, and V₁₇₀₂. The tubes are cut off on "key up" by application of -35V for V₁₆₀₁ and -110V for V₁₇₀₁ and V₁₇₀₂. These cutoff voltage are reduced to -0.1V and -60V, respectively, during "key down" conditions.

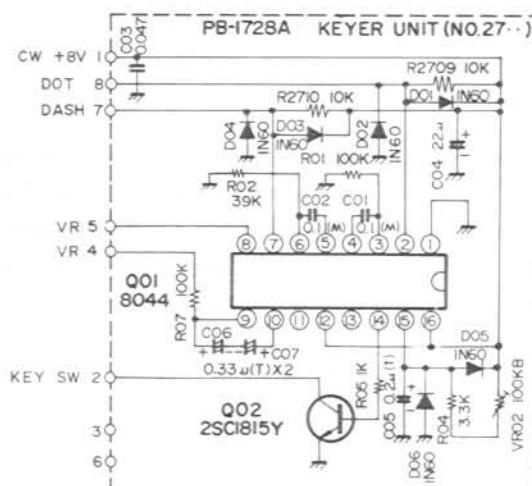
The key is connected to pin 13 of the REC C unit (PB1717). Under "key down" conditions, the base of Q₁₈₀₃ (2SA733) is grounded, causing Q₁₈₀₅ (2SC1815GR) and Q₁₈₀₄ (2SA639) to conduct. The voltage at pin 16 of PB-1717 reaches zero when Q₁₈₀₄ conducts. Since pin 16 of PB-1717 is connected to pin 2 of the RECT A UNIT (PB-1708), the bias voltage of V₁₆₀₁, V₁₇₀₁, and V₁₇₀₂ places these tubes in the normal operating condition.

On other modes, 12 volts is applied to pin 15, causing Q₁₈₀₄ to conduct, thus placing the operating bias on the tubes.

KEYER UNIT (PB-1728)

The built-in electronic keyer utilizes Q₂₇₀₁ (Curtis 8044 IC). The output of Q₂₇₀₁ is high during "key down" conditions; this output is connected to the base of Q₂₇₀₂ (2SC1815Y), the collector current of which is connected to the base of Q₁₈₀₃, causing Q₁₈₀₃ to conduct during "key down" conditions.

Keyer speed is controlled by VR₂₇₀₂ on the front panel. VR₂₇₀₁ provides adjustment of the dot-space symmetry, while VR₂₇₀₂ adjusts the keying weight. VR₂₇₀₂ normally is set to minimum, providing a 1:1 dot: space weight.



AM

The microphone signal is amplified by Q₇₀₅ (TA7063P) and Q₇₁₀ (2SC1000GR) and fed to Q₇₀₄ (3SK59Y), where it modulates the 8988.2 kHz carrier signal. The output from T₇₀₂ is fed to the NB UNIT in the same manner as described in the CW section previously.

FSK

The carrier oscillator Q₇₀₂ (2SK19GR) generates a crystal controlled carrier frequency of 8988.2 kHz. When keying is applied to the FSK jack J₁₅, the base voltage of Q₇₀₁ (2SC1815Y) becomes zero, causing Q₇₀₁ to cut off. In the "space" condition, Q₇₀₁ conducts, placing TC₇₀₄ in the circuit and lowering the carrier frequency to 8988.03 kHz.

AMGC circuit

The AMGC circuit is located in the CARRIER UNIT and is used to reduce the gain of the microphone amplifier when only low-level background noise is present (no speech input from the opera-

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tor). The microphone signal is fed to pin 17 of the CARRIER UNIT, amplified by Q₇₀₆ (TA 7063P), and fed to Q₇₀₇ (2SC373). When a sufficient level of speech input is applied to the microphone, Q₇₀₇ conducts, causing the output of NAND gate Q₇₀₈ (MC14011B) to be "low." This condition cuts off AMGC controller Q₇₀₉ (2SC1815Y). The collector circuit of Q₇₀₉ is connected with the output circuit of the microphone amplifier Q₇₀₅.

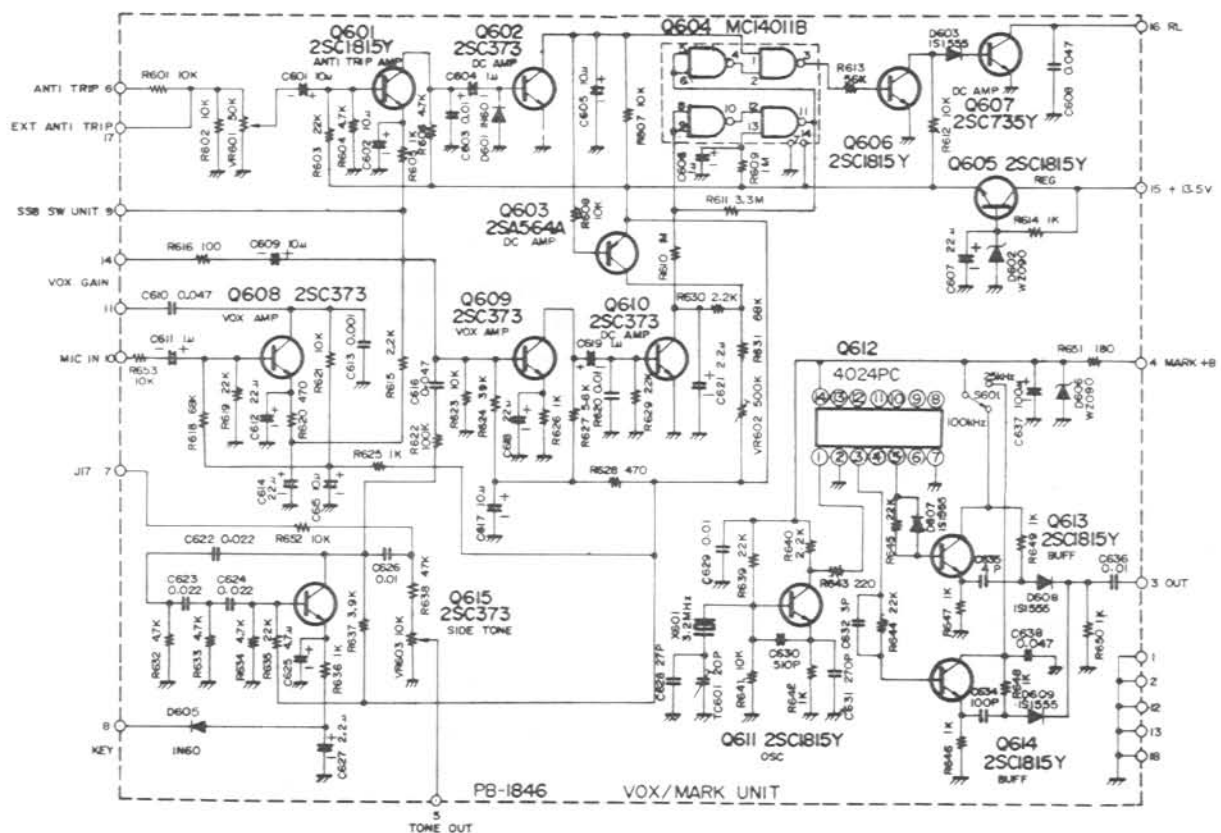
When the microphone input signal becomes significantly lower than the normal speech level (background noise only), Q₇₀₇ turns OFF, causing the output of Q₇₀₈ to be "high." This condition causes Q₇₀₉ to conduct, grounding the output circuit of Q₇₀₅.

The gate holding time can be adjusted by means of VR₇₀₂, to allow for differences in operator preferences.

VOX UNIT PB-1846 (PB-1685-3330)

A portion of the microphone input is delivered to pin 10 of the VOX UNIT. The signal is amplified by Q₆₀₈ and Q₆₀₉ (2SC373) and fed to the base of Q₆₁₀ (2SC373). When the signal is applied, Q₆₁₀ conducts, causing C₆₂₁ to discharge. The DC voltage of C₆₂₁ is then fed to the gate circuit of Q₆₀₄ (MC14011B). When pins 1 and 2 of Q₆₀₄ are high, the output of the VOX gate of Q₆₀₄ becomes low, causing Q₆₀₆ (2SC1815Y) to cut off, thus turning relay driver Q₆₀₇ (2SC735) ON to actuate the VOX relay RL₁.

The antitrip circuit provides a bucking voltage to prevent the speaker output from tripping the transceiver into the transmit condition. The receiver audio output is fed through ANTITRIP control VR₆₀₁ to amplifier Q₆₀₁ (2SC1815Y) and is then rectified by D₆₀₁ (1N60). The rectified DC voltage turns Q₆₀₂ (2SC373) ON, placing its collector at a low level, thus preventing the gate circuit from activating the relay driver Q₆₀₇. The collector of Q₆₀₂ is connected through R₆₀₈ to the base of Q₆₀₃ (2SA564A) which shorts the supply voltage for C₆₂₁; thus, C₆₂₁ is fully charged when the speaker output disappears, turning the gate into the transmit mode immediately with the appearance of microphone input.



The VOX GAIN control VR_1 on the front panel provides adjustment for relay sensitivity, and VR_{601} controls antitrip sensitivity. Relay hold time is determined by delay control VR_{602} .

The tone oscillator Q_{615} (2SC373) operates when the MODE switch is in the CW position. It is a phase shift oscillator operating at approximately 800 Hz. The sidetone level is adjusted by VR_{603} . The sidetone output is also coupled to the VOX circuit for semi-break-in operation.

Located on the VOX UNIT, the crystal marker generator Q_{611} (2SC1815Y) generates a basic 3200 kHz crystal controlled signal which is divided into 100 kHz multiples by frequency divider Q_{612} (4024PC). The voltage regulator Q_{605} (2SC1815Y) regulates the supply voltage to the VOX circuit.

FM UNIT (PB-1707)

The speech signal from pin 20 of PB-1707 is fed to amplifier limiter Q_{909} (TA7061AP), which clips both positive and negative peaks when they exceed the level set for maximum deviation of the transmitter frequency. Q_{910} (2SC1815Y) acts as

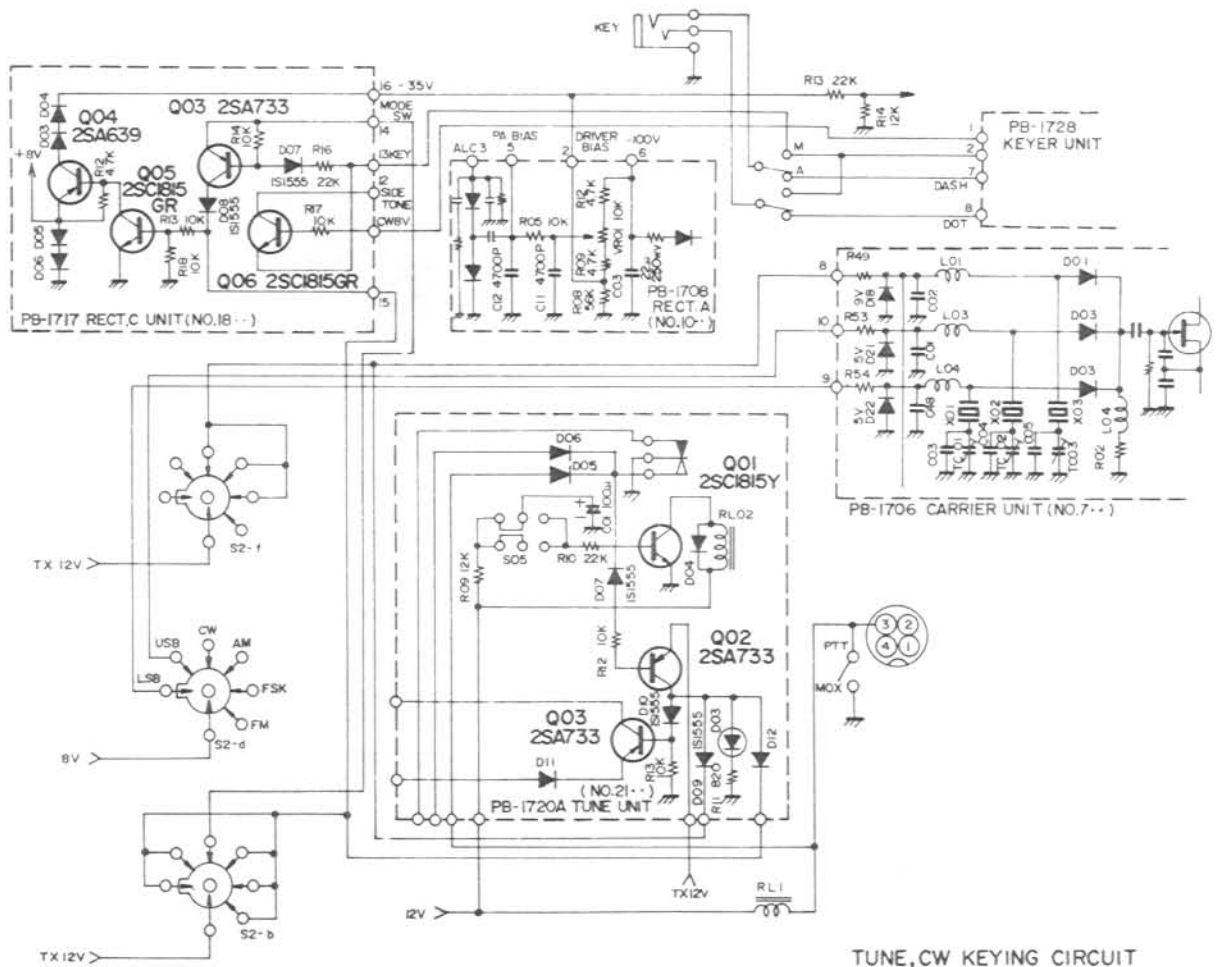
an active low pass filter to eliminate harmonics caused by the clipping. VR_{902} determines the maximum deviation.

The output from Q_{901} is amplified by Q_{911} (2SK34E) and then fed to the modulator D_{909} (FC63). Q_{912} (2SC1815Y) oscillates at a crystal frequency of 8987.5 kHz and is frequency modulated by varactor diode D_{909} . The output from Q_{912} is amplified by Q_{913} (2SC1815Y) and then fed to the NB UNIT.

TUNE UNIT (PB-1720)

When TUNE switch S_{2101} is pushed, the voltage across C_{2101} is applied to the base of Q_{2101} (2SC1815Y), causing Q_{2101} to turn ON; this activates RL_{2102} which grounds the cathodes of D_{2105} and D_{2106} (both 1S1555). As D_{2105} is connected in parallel with the PTT switch, the transceiver is placed in the transmit mode.

Diode D_{2106} grounds the common terminal of the MODE switch S_{2g} and S_{2h} , and the bias voltage of the PA stage is lowered from the cut-off condition to the normal operating level.



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When D_{2107} is grounded, D_{2102} (2SA733) turns ON, and the voltage appearing at the collector of Q_{2102} is fed through D_{2109} (1S1555) to D_{701} on PB-1706 to activate the CW carrier oscillator. In the SSB mode, the SSB carrier oscillator is disabled by reverse voltage.

COMMON CIRCUITS

VFO UNIT (PB-1440A-3330)

A modified Colpitts-type oscillator is used to generate a 5.0 - 5.5 MHz signal, producing a 500 kHz tuning range. The frequency 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) is in series with C_{807} , and the combination of the two is in parallel with TC_{801} . By closing the CLARIFIER switch, the VFO frequency may be varied ± 2.5 kHz with the CLARIFIER control on the front panel.

The oscillator output signal is fed through the amplifier/buffer stage Q_{802} (2SK19GR) and Q_{803} (2SC372Y), and then passes through the low-pass filter to the output terminal.

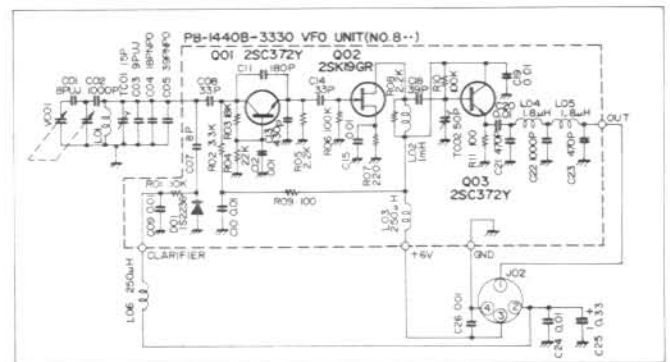
XTAL UNIT (PB-1711)

Crystal oscillator $Q_{1301} - Q_{1310}$ (all 2SC1815Y) produces a heterodyne signal for the PLL (Phase Locked Loop) mixer. The oscillator frequency is selected by the BAND switch, and the output signal is fed through diode switch $D_{1301} - D_{1310}$ (all 1S1555) to the PLL UNIT. The frequency of each crystal is shown in Table 1.

VCO UNIT (PB-1710)

The VCO (Voltage Controlled Oscillator) generates a heterodyne signal which is 8.9875 kHz higher than the operating frequency. The frequency is locked by the voltage detected by the PLL UNIT.

$Q_{1201} - Q_{1208}$ (all 2SK19BL) oscillate at the frequency given in Table 1. The frequency is locked by varactor diodes $D_{1201} - D_{1208}$ (all MV104), which are controlled by the VCV voltage supplied from the PLL UNIT. The oscillator output signal is amplified by Q_{1209} (3SK40M) and fed to the buffer/amplifier consisting of Q_{1210} and Q_{1211} (both 2SC1815Y). The output from Q_{1210} is fed to the transceiver mixer in the RF UNIT; the output from Q_{1211} is fed to the PLL UNIT as a sample signal.

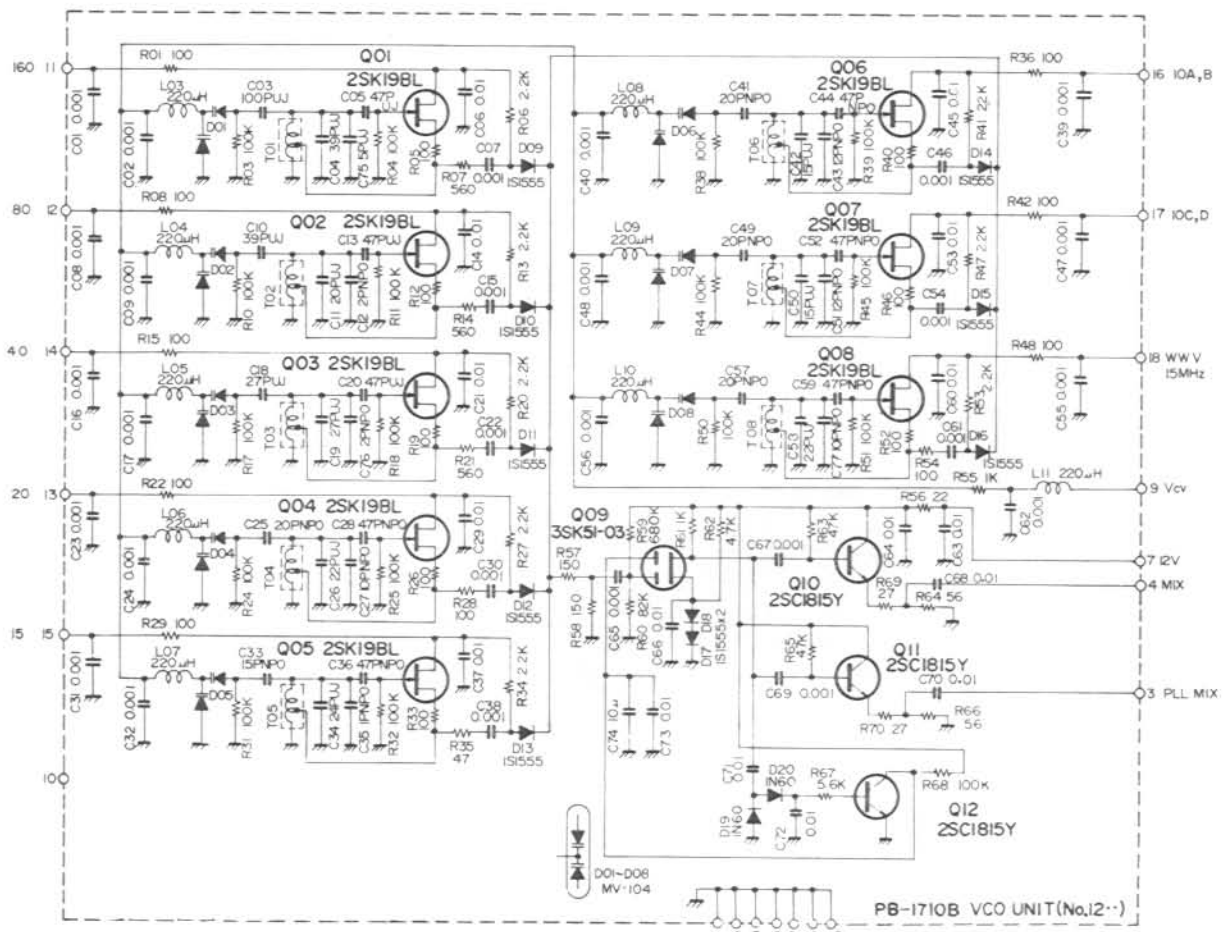
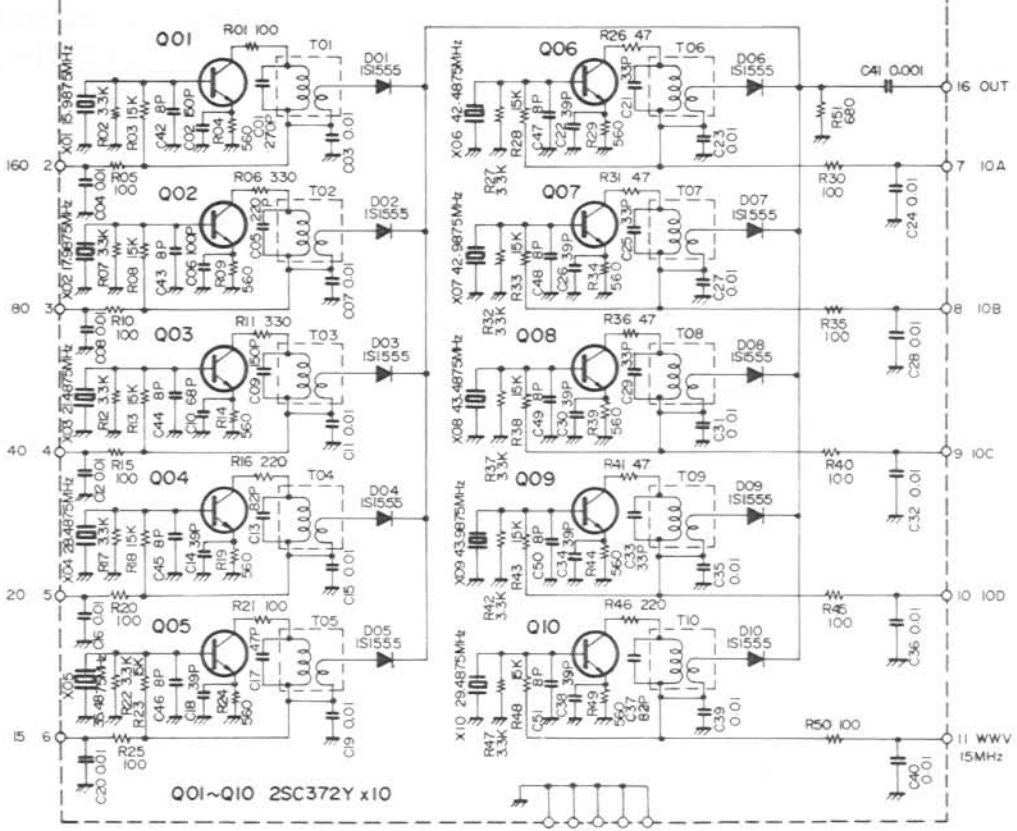


	Crystal Oscillator	V C O
160m	15.9875 (MHz)	10.4875 - 10.9875 (MHz)
80m	17.9875	12.4875 - 12.9875
40m	21.4875	15.9875 - 16.4875
20m	28.4875	22.9875 - 23.4875
15m	35.4875	29.9875 - 30.4875
10mA	42.4875	36.9875 - 37.9875
10mB	42.9875	
10mC	43.4875	
10mD	43.9875	
JJY · WWV	29.4875	23.9875 - 24.4875

Table 1

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PB-171IA X'TAL UNIT(No.13-)



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A portion of the Q₁₂₀₉ output is rectified by D₁₂₁₉ and D₁₂₂₀ (both 1N60); this rectified DC voltage is amplified by DC amplifier Q₁₂₁₂ (2SC1815Y) to generate AGC voltage which controls the gain of Q₁₂₀₉, thus obtaining unity signal output when the band is changed.

prior to being supplied to a phase detector Q₁₁₀₇ (MC4044P); here the phase of the signal is compared with the phase of the signal delivered through wave shaper Q₁₁₀₆, buffer Q₁₁₀₅ (2SC1815Y), and amplifier Q₁₁₀₄ (2SK19GR) from the VFO UNIT.

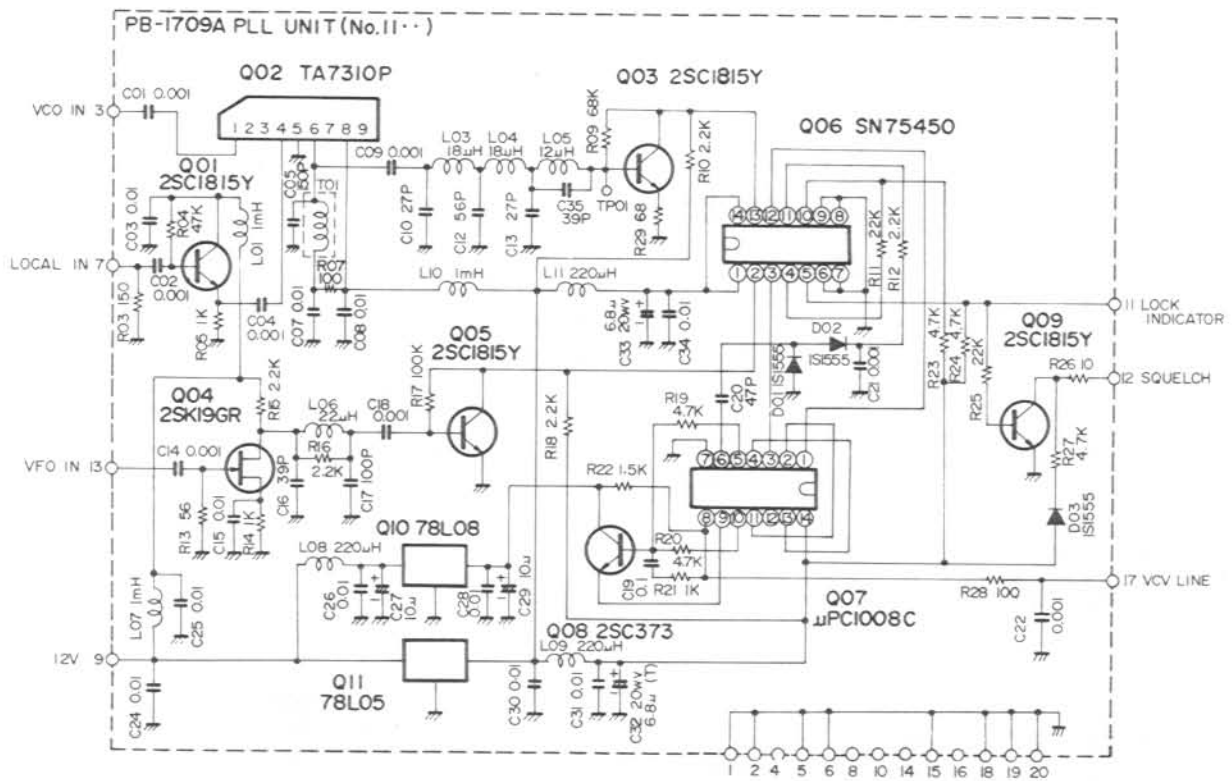
PLL UNIT (PB-1709)

The sample signal from the VCO UNIT is fed to the PLL mixer Q₁₁₀₂ (TA7310P), where the sample signal is mixed with the heterodyne signal (at 5.0 - 5.5 MHz) delivered from the XTAL UNIT through buffer amplifier Q₁₁₀₁ (2SC1815Y). The 5.0 - 5.5 MHz signal is fed through amplifier Q₁₁₀₃ (2SC1815Y) to Q₁₁₀₆ (SN75450B), where the signal waveform is shaped

Q₁₁₀₇ compares the phase of the two signals and converts the phase difference into the VCV voltage which controls the VCO frequency. Q₁₁₀₈ (2SC373) acts as an active low pass filter to remove ripples from the VCV voltage.

When the VCO is unlocked, Q₁₁₀₉ (2SC1815Y) delivers the signal to prevent receive or transmit action of the transceiver.

Q₁₁₁₀ (78L08) and Q₁₁₁₁ (78L05) are voltage regulators.



COUNTER UNIT (PB-1729)

DISPLAY UNIT (PB-1730)

The 5.0 - 5.5 MHz VFO signal is amplified by Q₂₉₀₁ (3SK40M) and fed through source follower Q₂₉₀₂ (2SK19GR) to a balanced mixer Q₂₉₀₃ (SN76514N), where the signal is heterodyned with either an 18.0 MHz or 18.5 MHz signal, producing either a 12.5 - 13.0 MHz or 13.0 - 13.5 MHz signal. The oscillator Q₂₉₀₇ (2SC945) generates an 18.0 MHz signal for the 160, 80, 10B, and 10D bands, and Q₂₉₀₆ (2SC945) generates an 18.5 MHz signal for the 40, 20, 15, 10A, 10C, and WWV/JJY (15 MHz) bands.

The oscillators are controlled by Q₂₉₀₈ (2SC945) and Q₂₉₀₉ (2SA733) in accordance with the band in use. The output from the balanced mixer is fed through amplifiers Q₂₉₀₄ and Q₂₉₀₅ (both 2SC785) to the counter gate Q₂₉₁₃ (SN74LS00N).

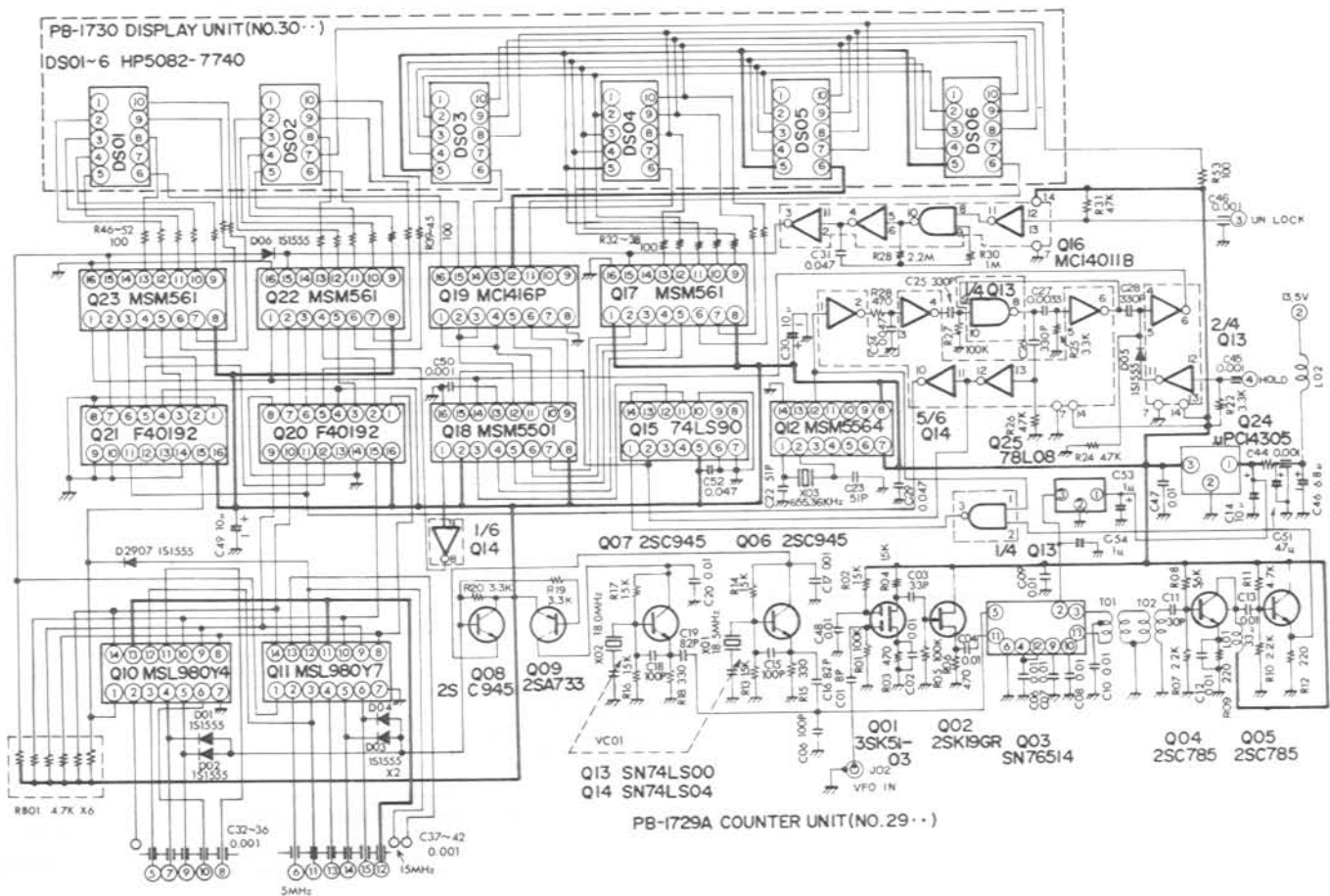
The MHz display is programmed by the diode matrix Q₂₉₁₀ (MSL980Y7) and Q₂₉₁₁ (MSL980Y4). The output from Q₂₉₁₀ and Q₂₉₁₁ is

fed to the up/down counter Q₂₉₂₁ and Q₂₉₂₀ (both F40192); the output from the up/down counter is fed to drivers Q₂₉₂₃ and Q₂₉₂₂ (both MSM561) and then to the display LED's DS₃₀₀₁ and DS₃₀₀₂ (HP5082 - 7740).

The crystal oscillator/divider Q₂₉₁₂ (MM5564) generates a 655.36 kHz clock signal and produces 5 Hz gate pulses which are fed to the counter gate Q₂₉₁₃.

The pulses which pass through the gate are fed to the decade counter Q₂₉₁₅ (SN74LS90N), which counts 10 Hz digits. The 10th pulse at pin 12 of Q₂₉₁₅ is fed to Q₂₉₁₈ (MM5501), which counts 100 Hz, 1 kHz, 10 kHz, and 100 kHz digits. The BCD output signal from Q₂₉₁₈ is fed through driver Q₂₉₁₇ (MSM561) to the display LED's DS₃₀₀₃ - DS₃₀₀₆ (HP-5082 - 7740).

Q₂₉₁₉ (MC1416P) works as a series of switches operated by a timing signal delivered by Q₂₉₁₈ to select the output of Q₂₉₁₇ which drives the display LED's in a sequence of 100 Hz, 1 kHz, 10 kHz, and 100 kHz.



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When the unlock signal is received from the PLL UNIT, Q₂₉₁₆ (MC14011B) generates a blanking signal which is fed to the LED drivers Q₂₉₁₇, Q₂₉₂₂, and Q₂₉₂₃.

To calibrate the display, the heterodyne crystal frequency can be shifted by VC₂₉₀₁ from the front panel.

Voltage regulator Q₂₉₂₄ (uPC14305) stabilizes the supply voltage.

MEMORY UNIT (PB-1787)

The VFO signal delivered to pin 4 of PB-1787 is amplified by Q₂₈₀₉ (3SK40M) and Q₂₈₁₀ (2SC785), and fed to counter gate Q₂₈₁₃ (SN74LS00N). A clock signal generator Q₂₈₁₁ (MSM5562) produces 50 Hz clock pulses from a crystal frequency of 3276.8 kHz. The pulses which passed through the gate are fed to a six digit decade counter Q₂₈₁₅ (TC5032P), which counts the VFO frequency. The BCD output from Q₂₈₁₅ is fed through Q₂₈₂₂ - Q₂₈₂₆ (all MC14042B) to up/down counter Q₂₈₂₇ - Q₂₈₃₁ (SN74LS192N), which presets the VFO frequency.

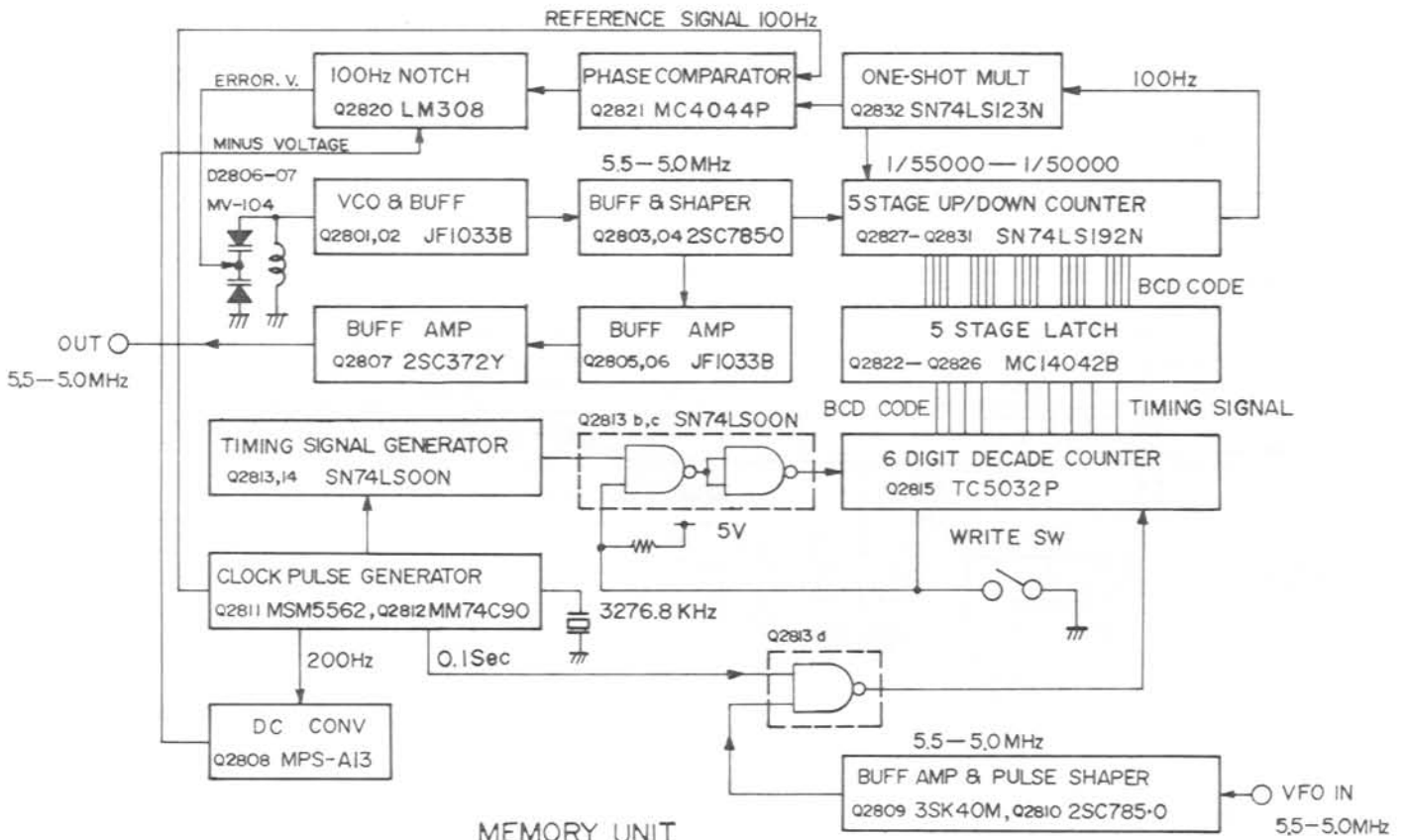
The 5.0 - 5.5 MHz signal generated by Q_{2801,02} (JF1033B) is fed through buffer/amplifier Q_{2803,04} (2SC785) and Q₂₈₀₄ (2SC785).

The switching pulse generated by Q₂₈₀₄ is also fed to Q₂₈₂₇, where the signal is divided to 1/5000 to 1/55000 in accordance with the program preset by Q₂₈₂₇ - Q₂₈₃₁. The output from Q₂₈₃₁ (approximately 100 Hz) is fed through a one-shot multivibrator Q₂₈₃₂ (SN74LS123N) to the phase comparator Q₂₈₂₁ (MC4044P) where the phase of the 100 Hz signal is compared with the phase of the 100 Hz signal which is delivered from Q₂₈₁₁.

The DC output from Q₂₈₂₁ passes through a low pass filter, operational amplifier Q₂₈₂₀ (LM308), to remove the 100 Hz ripple. This DC voltage is applied to varactor diodes D₂₈₀₆ - D₂₈₀₇ (MV-104), thus locking the VCO frequency.

When the M (memory) switch is pushed, the counter output from Q₂₈₁₅ is latched and the VCO frequency is locked.

When the MR (memory recall) switch is pushed, the output from VCO buffer Q₂₈₀₂ (JF-1033B)



is amplified by Q_{2805} and Q_{2806} (both **JF-1033B**) and Q_{2807} (**2SC372Y**), and fed through a diode switch to the PLL UNIT (replacing the VFO signal).

Q_{2813} (**SN74LS00N**) and Q_{2814} (**SN74LS04N**) generate timing pulses to set or reset the counter.

The 200 Hz signal delivered from Q_{2811} is amplified by Q_{2808} (**MPSA13**) and rectified by D_{2804} and D_{2805} (both **1S188FM**) to produce a minus voltage to be used for operational amplifier Q_{2820} .

POWER SUPPLY

The power supply is designed to operate from either 100/110/117/200/220/234 Volts AC 50/60 Hz (all models) or 13.5 Volts DC with the DC-DC converter unit (built-in on the FT-901DM, optional on other models). Insertion of the appropriate power plug into the rear panel receptacle makes the necessary connections for operation from either AC or DC power sources.

When the transceiver is operated from a 13.5 Volt DC power source, transistors Q_{3201} and Q_{3202} (both **T20A6**) function as a low frequency oscillator to provide 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. With the HEATER switch in the OFF position, 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.

(1) Low voltage supply

AC 11.5 Volt power delivered from the secondary winding of the transformer is rectified by D_{1001} and D_{1002} (**V06B**) in the RECTIFIER A UNIT (**PB-1708**) to provide the transistor supply voltage. The rectified DC voltage is supplied through pin 8 and pin 1 of the AC plug to pin 1 of the power receptacle which is connected to the DC power supply line. In the DC mode, the DC voltage from the power cord is directly supplied to pin 1 of the power receptacle. The DC voltage is filtered through CH_{1001} , C_{1001} , and C_{1002} , and fed to the voltage stabilizer Q_2 (**uPC14308**) (8V) and Q_3 (**uPC14312**) (+12V); 13.5 Volt power is also

supplied to the counter unit and accessory socket on the rear panel.

The stabilized 8 Volt supply from Q_2 is used for the VCO, XTAL and IF UNITS, and the stabilized 12 Volt supply is used for the FM, VOX, and AF UNITS, and other circuits as well. The 12 Volt supply is further stabilized by Q_1 (**uPC14308**) to be supplied to the AF and IF UNITS. A further portion of the 8 Volt supply from Q_2 is stabilized at 6 Volts by Q_{1801} (**TA7089M**) to be supplied to the VFO UNIT.

Independent voltage stabilizers are located in the MEMORY, COUNTER, AF, FM, and PLL UNITS.

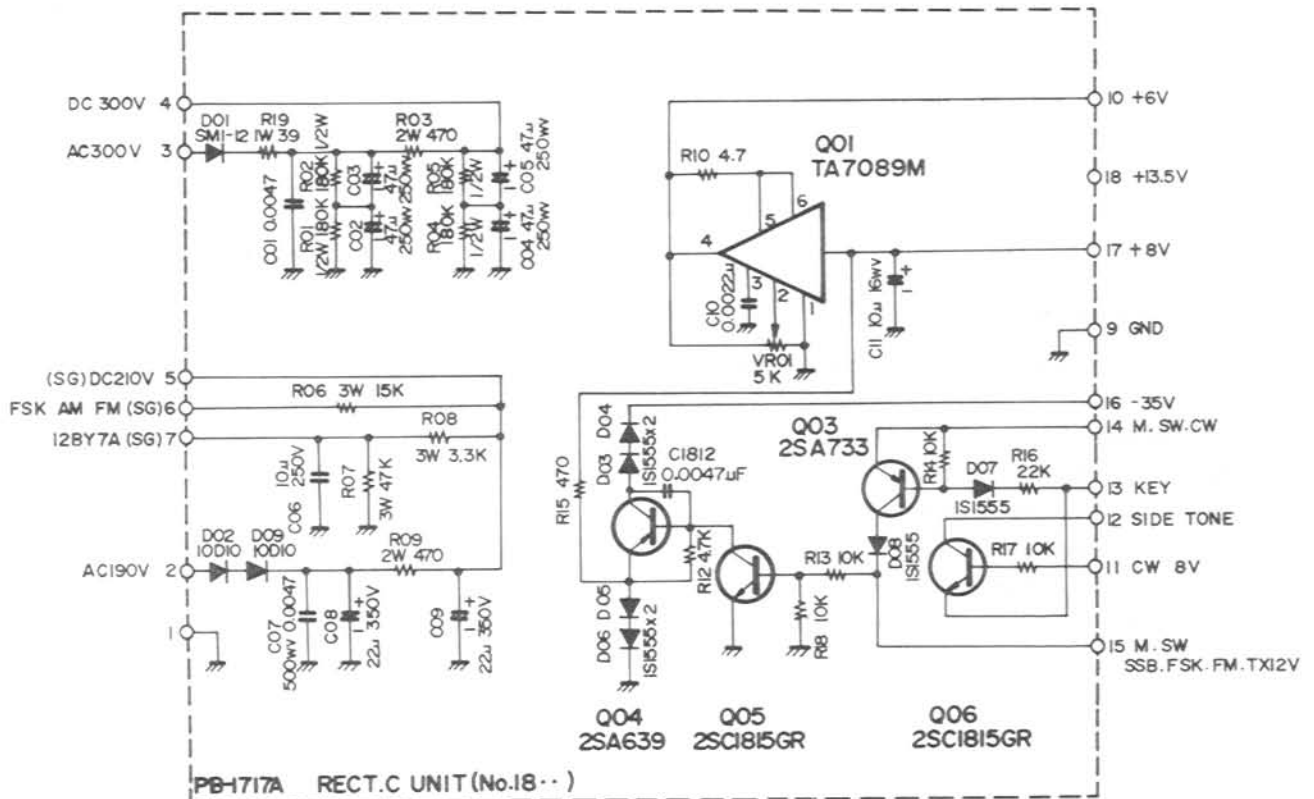
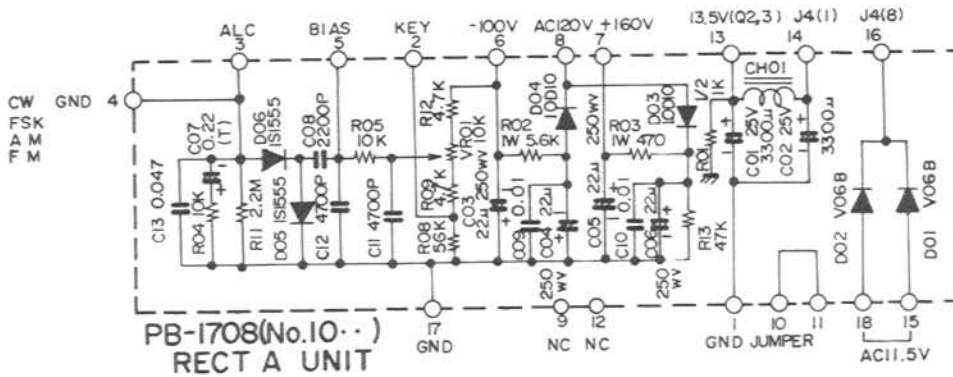
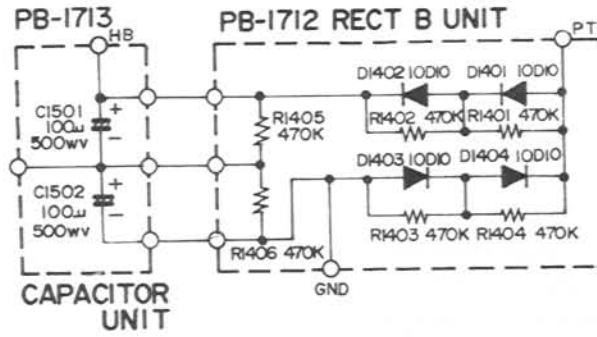
(2) High voltage supply

The power amplifier plate voltage of +800 Volts DC is supplied from the bridge-controlled doubler RECTIFIER UNIT B consisting of D_{1401} - D_{1414} (**10D10**) and C_{1501} and C_{1502} in PB-1712.

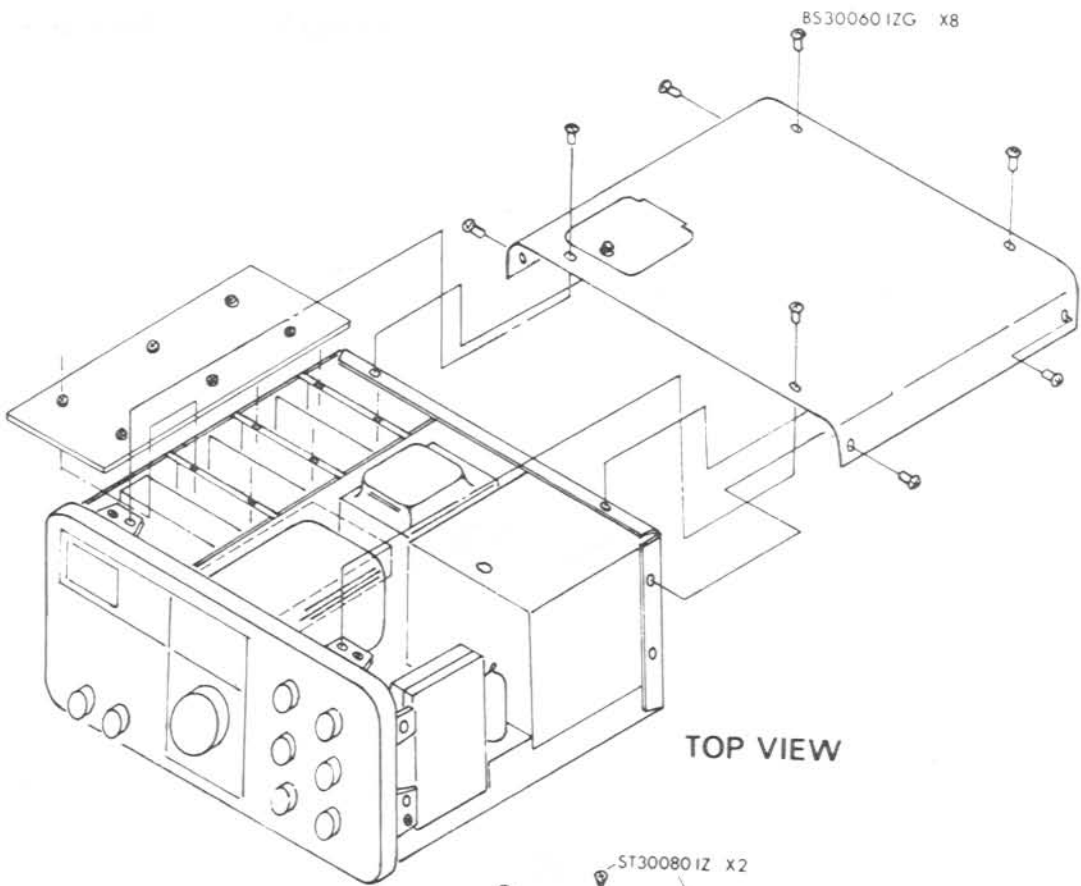
AC 190 Volts is rectified by D_{1802} (**10D10**) in RECTIFIER UNIT C to obtain 210 Volts for the screen grid supply of the power amplifier tubes. The screen grid voltage is reduced to 180 Volts for the FM, AM, and FSK modes.

The plate supply for the driver tube is obtained by rectifying 250 Volt AC by D_{1801} (**10D10**). The DC voltage obtained from the RECTIFIER C UNIT is dropped to 160 Volts by a resistor for the driver screen grid.

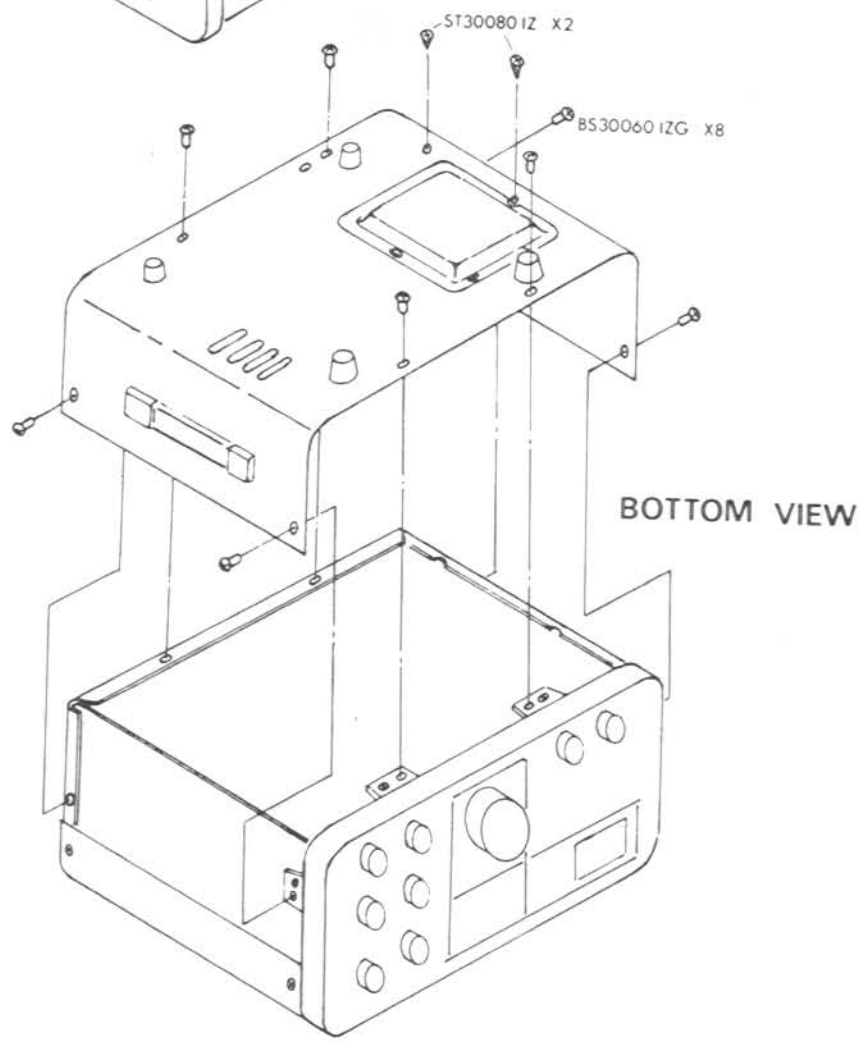
120 Volt AC from the transformer secondary winding is rectified by D_{1004} (**10D10**) in the RECTIFIER A UNIT (**PB-1708**) to obtain -140 Volts for the grid bias voltage for the driver and final amplifier tubes.



OUTER COVER REMOVAL



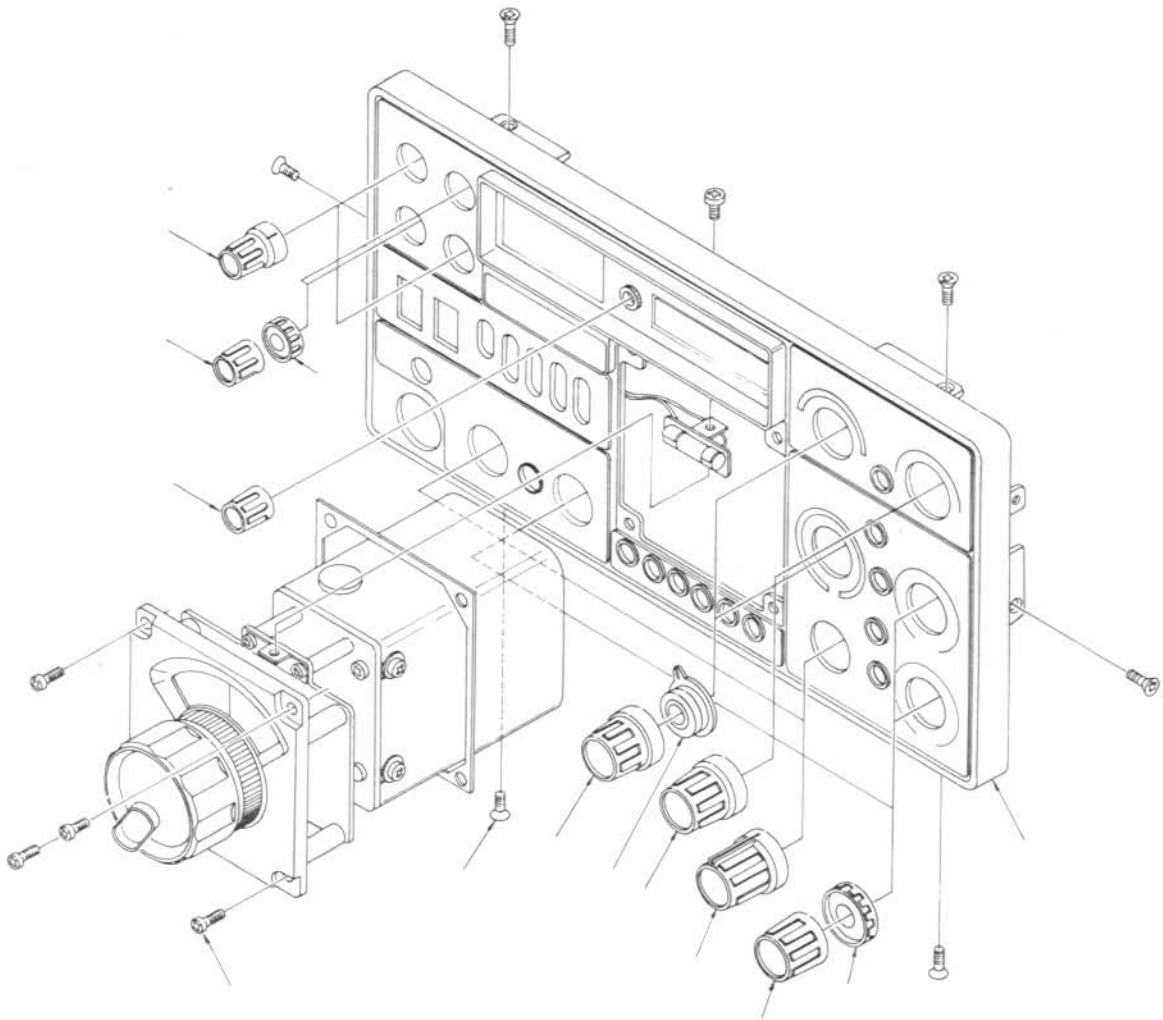
TOP VIEW



BOTTOM VIEW

FRONT PANEL REMOVAL

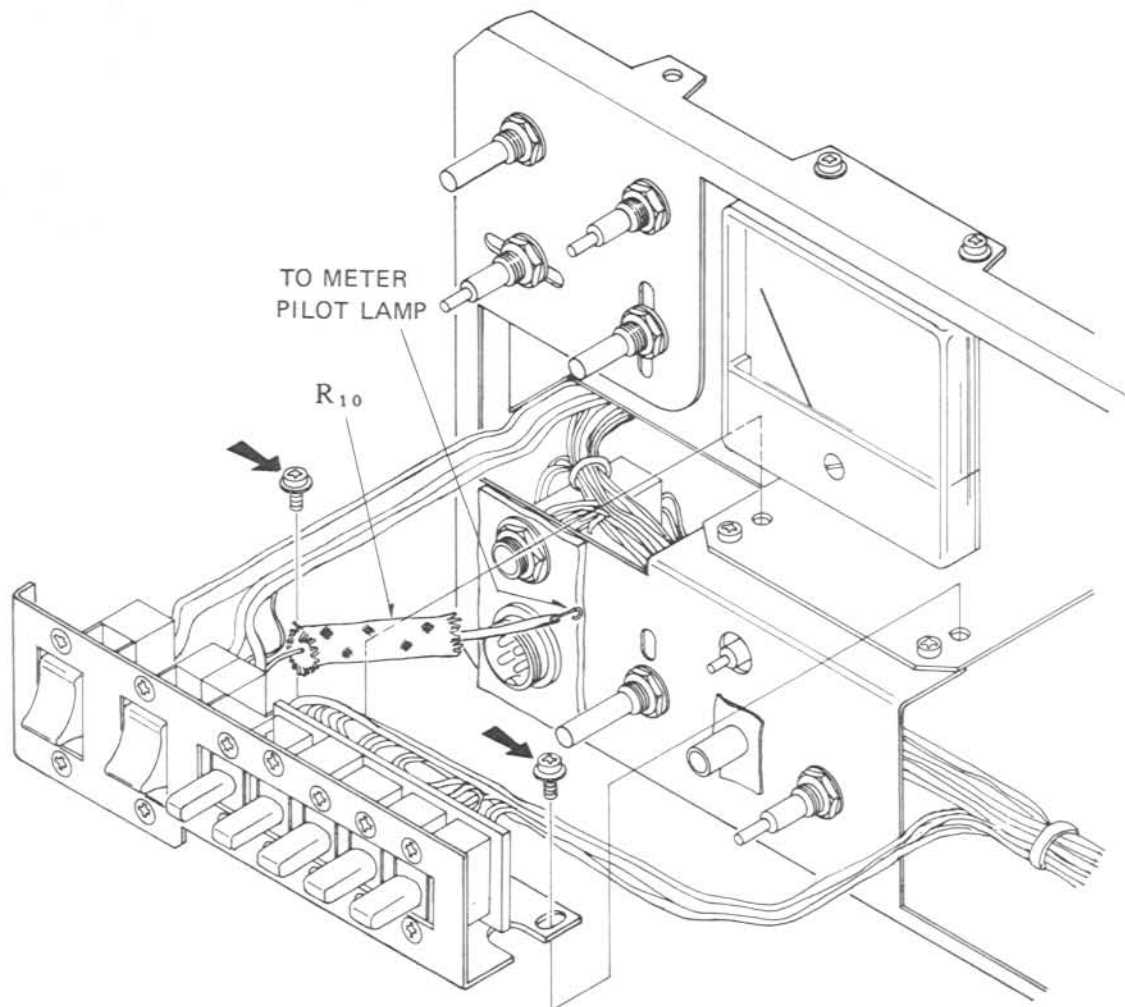
(MAIN DIAL ASSEMBLY See Page 3-61.)



DISASSEMBLY PROCEDURE

- (1) Remove the knobs from all front panel controls, except the main tuning dial. If you must service the VFO unit, remove the main tuning dial, as well.
- (2) With the top cover of the transceiver removed, lift out the COUNTER UNIT, by removing its mounting screws. The purpose of this is to provide access to the connection cable for the VFO.
- (3) Disconnect the cable connected to the VFO compartment.
- (4) Now remove the four mounting screws from the front of the VFO compartment, and gently ease the compartment a short distance out of the front panel.
- (5) Remove the ground cable connected to the VFO compartment. The VFO can now be removed completely.
- (6) Remove the screws holding the front panel assembly to the chassis. The front panel may now be removed completely.

FRONT PANEL SWITCH ASSEMBLY



REMOVAL OF FUNCTION SWITCH STRIP

After you have removed the front panel, locate the yellow wire connected to the meter. This is the line that contains R_{10} . Disconnect this line from the meter, and be sure to note its position for re-assembly purposes.

Now remove the two mounting screws which hold the switch strip to the chassis. These are the screws with the washers attached.

With the two screws removed, carefully ease the switch strip away from the chassis. It will still be restrained by the cable harnesses, but service work can now be performed more easily.

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KEYER/MEMORY UNIT INSTALLATION

Remove the small cover from the bottom of the transceiver as shown in Fig. 1.

Install the MEMORY UNIT using the mounting screws supplied. Connect the 6-pin connector to the socket on the main chassis as shown.

Mount the KEYER UNIT as shown in Fig. 2, and connect the cable to the KEYER UNIT as shown in the drawing.

The completed installation may be viewed in Fig. 3.

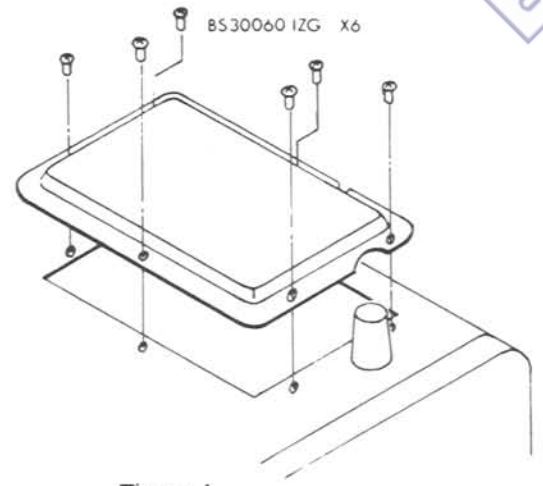
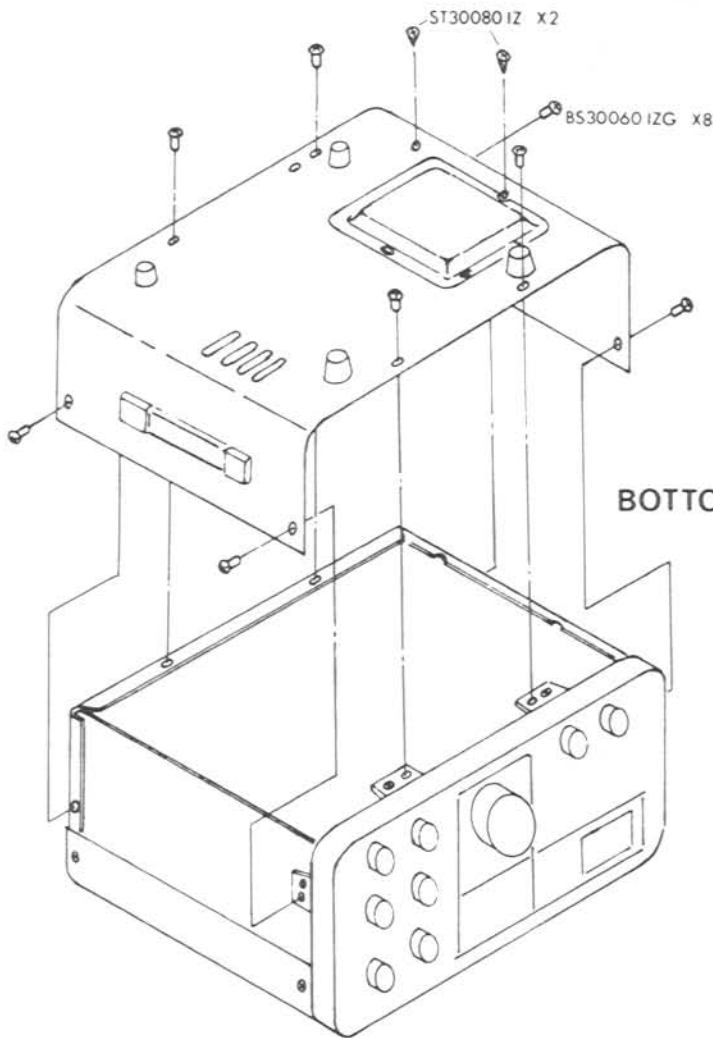


Figure 1



BOTTOM VIEW

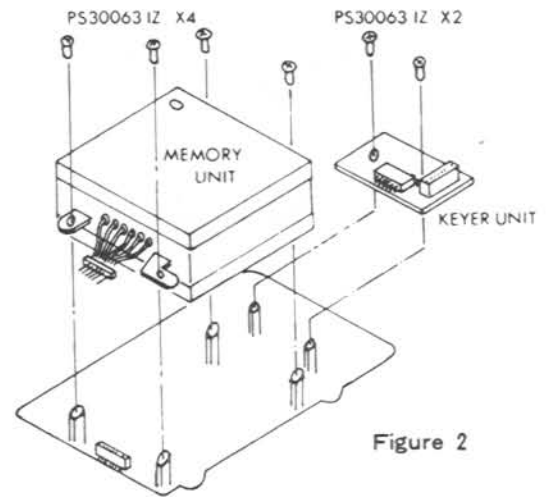


Figure 2

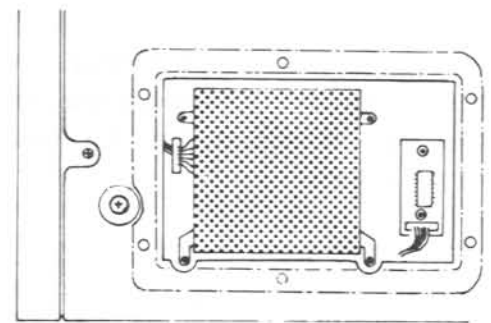


Figure 3

AM/CW FILTER INSTALLATION

Remove the top cover. Locate and remove PB-1716 (FILTER UNIT). Referring to Fig. 1, locate jumpers A and B on the printed board. If the AM filter is to be installed, the jumper marked A must be installed, and for CW filter installation the jumper marked B must be removed.

Referring to Figs. 1 and 2, install the desired filter in the appropriate holes. Make the fastening nuts snug (CW filter only), and solder the pins of the filter to the printed board.

Re-install PB-1716 in the chassis socket, and replace the cover of the transceiver.

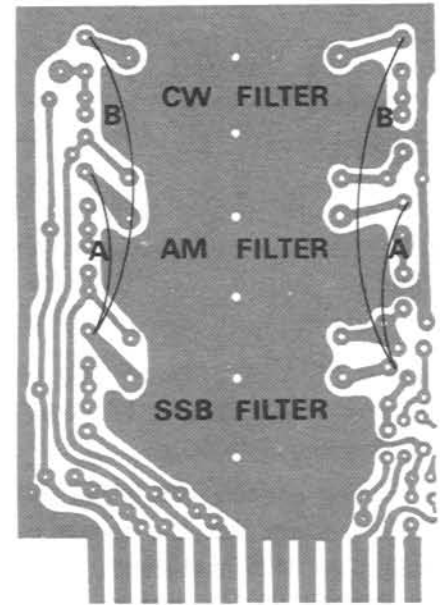


Figure 1

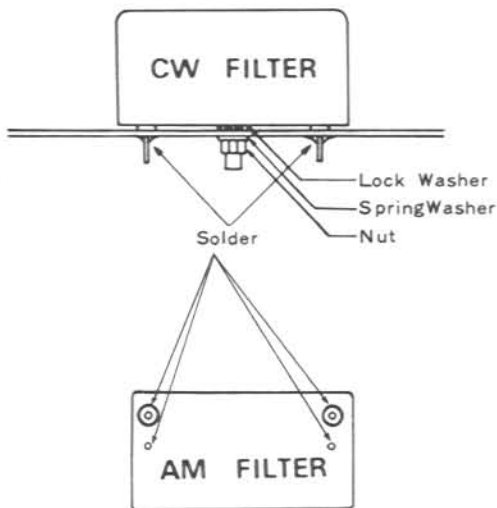
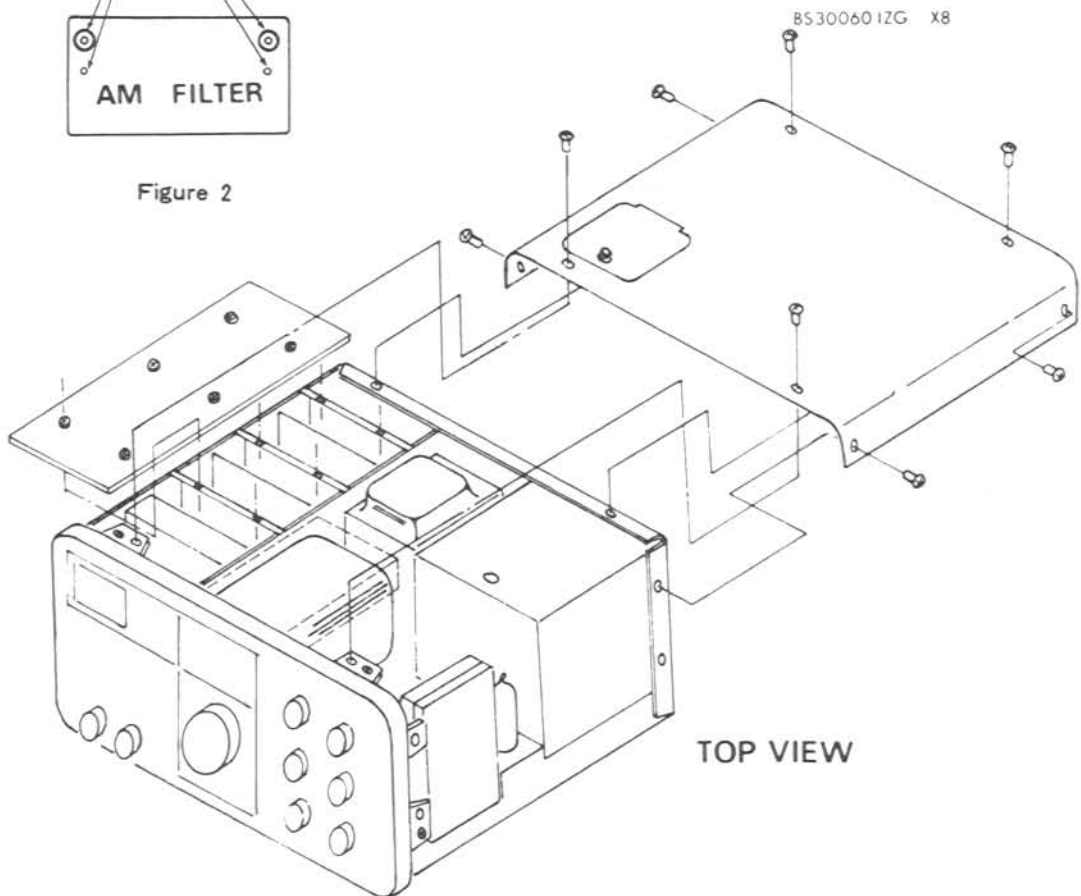


Figure 2

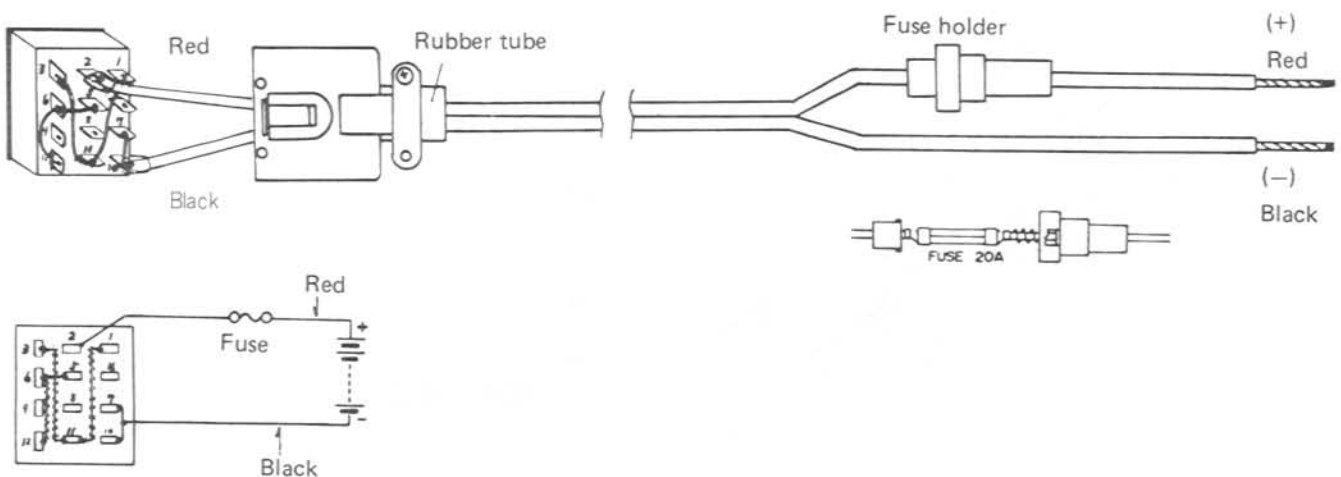
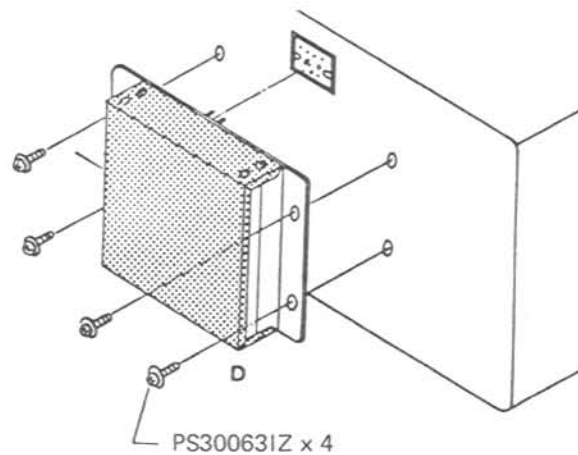


TOP VIEW

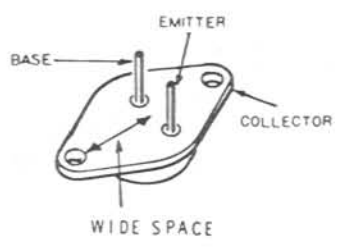
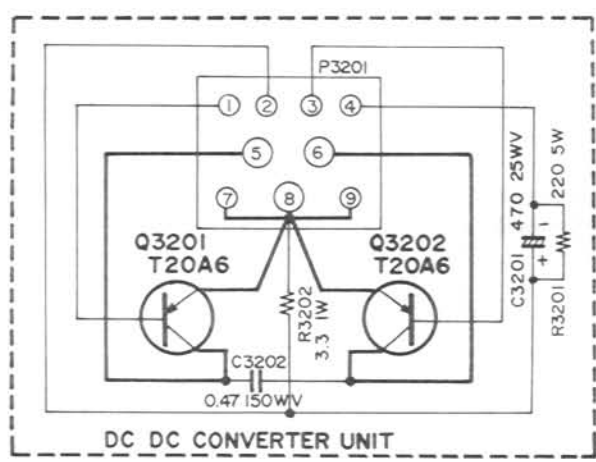
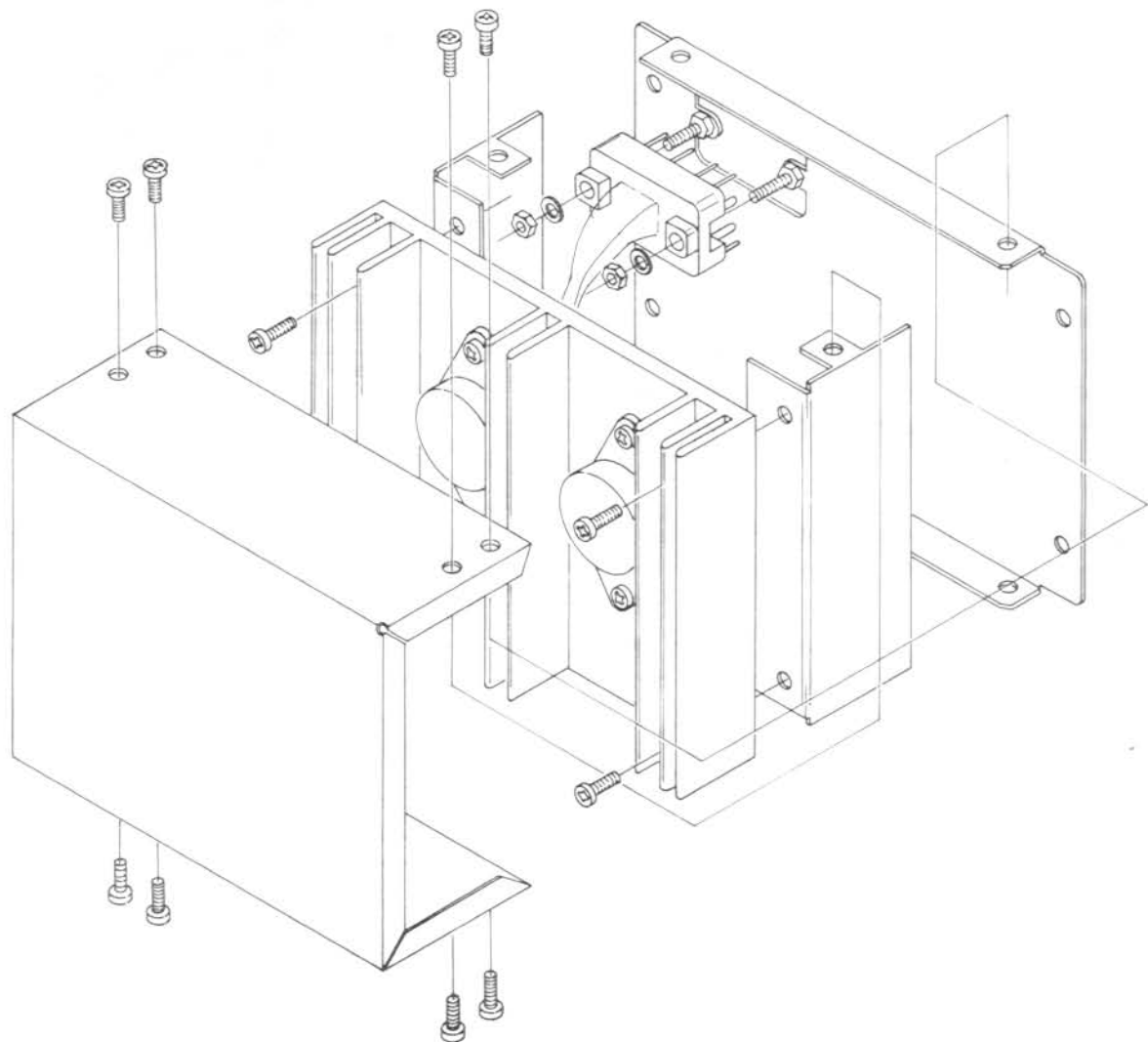
DC-DC CONVERTER INSTALLATION FOR
FT-901D/DE/SD

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.
- (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.



DC-DC CONVERTER (EXPLODED VIEW)



SERVICING

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FM UNIT INSTALLATION FOR FT-901DE/SD

The FM Unit operation for the FT-901DE and SD models can be installed in a matter of minutes.

Remove the top cover of the transceiver, and remove the black cover of the circuit board rack (left-hand side of the transceiver).

Install the FM Unit in the 22-pin connector. The component side of the circuit board should be on the side facing the VFO enclosure. Use the two circuit board restraining clips to secure the board in place, securing the clips to the main circuit board rack with the two screws included with the kit.

The positions of the alignment potentiometers of interest can be found by referring to Fig. 2.

Replace the circuit board cover, and replace the top cover of the transceiver. Installation is now complete.

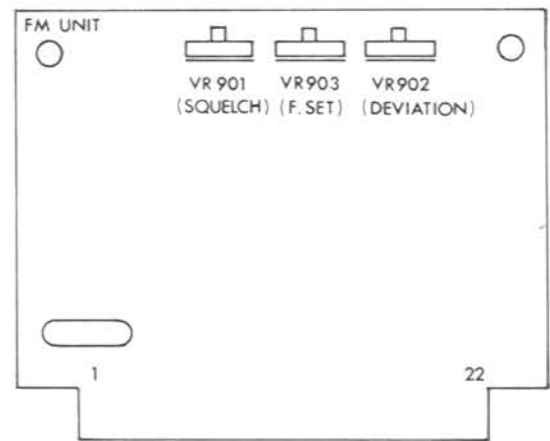
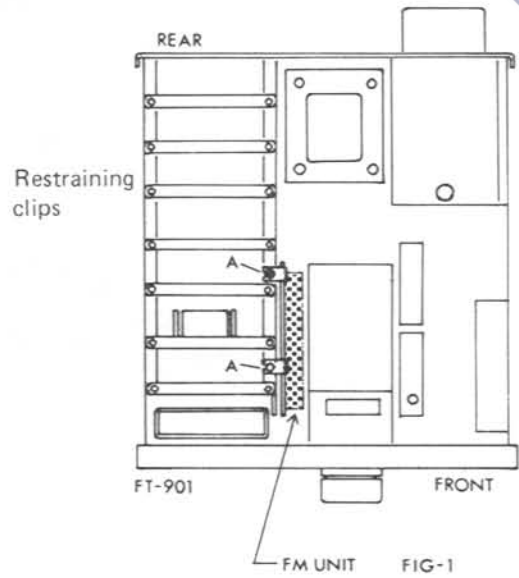


FIG-2
Alignment potentiometers

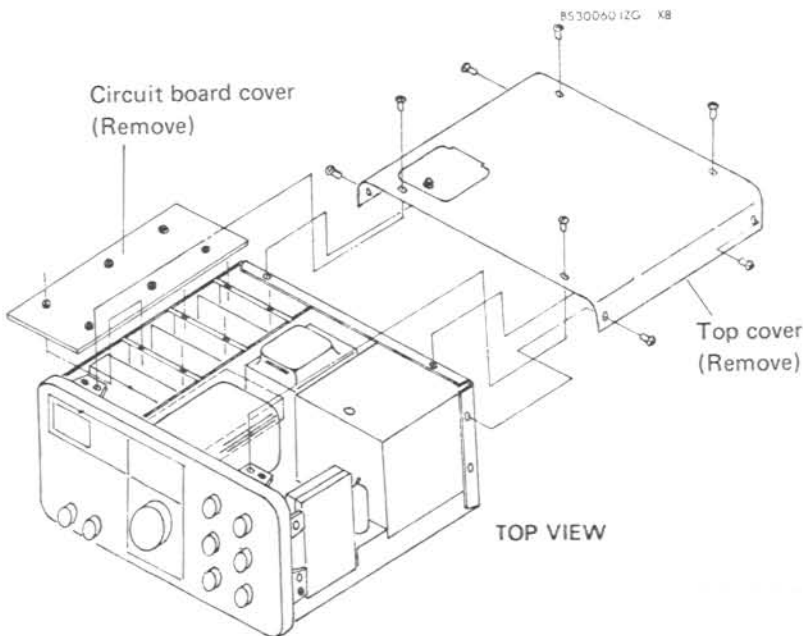


FIG-3

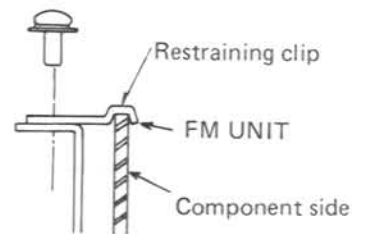


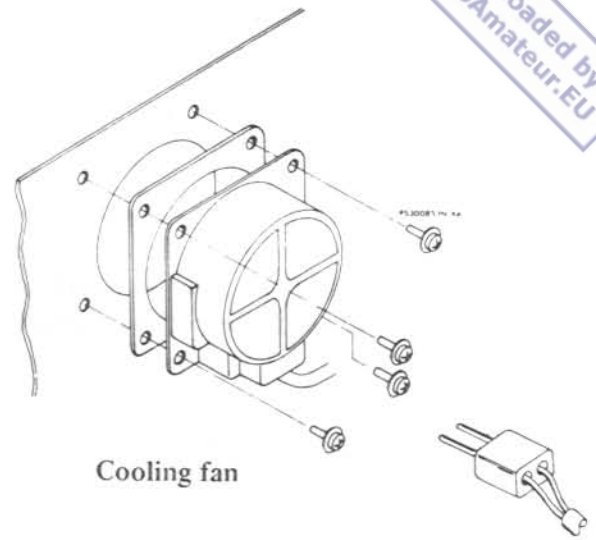
FIG-4

COOLING FAN INSTALLATION (OPTION for FT-901SD)

The FT-901SD 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-901SD 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.



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**SOLDERING AND DESOLDERING TECHNIQUE
ON PRINTED CIRCUIT BOARDS**

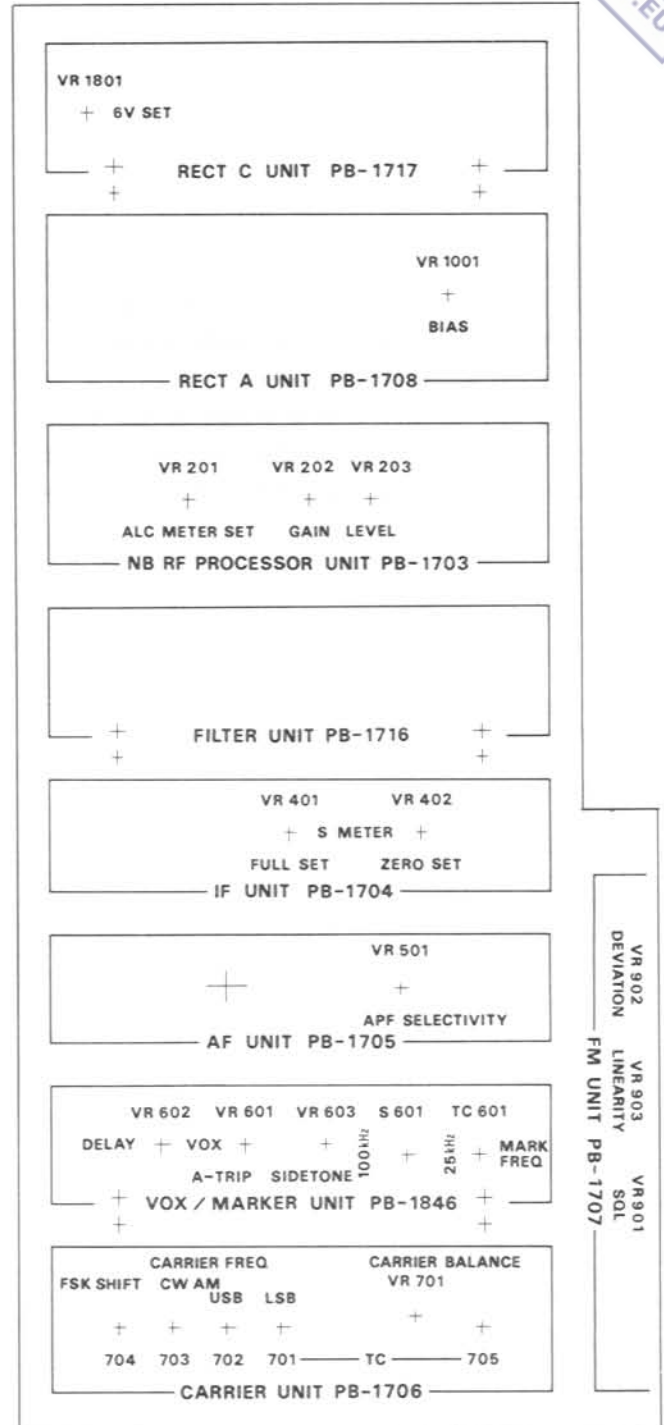
The FT-901 circuit boards are tough, but mishandling during soldering can cause circuit traces to "lift." While this does no permanent damage to the board, much servicing trouble can result, because of the tendency for this lifted trace to break. A few simple precautions will keep your circuit boards 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.

IMPORTANT

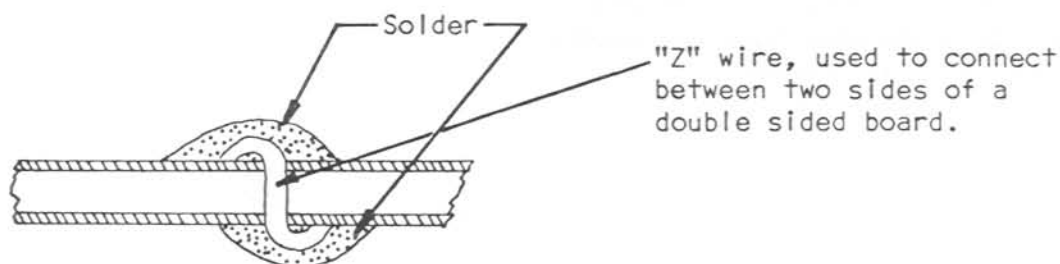
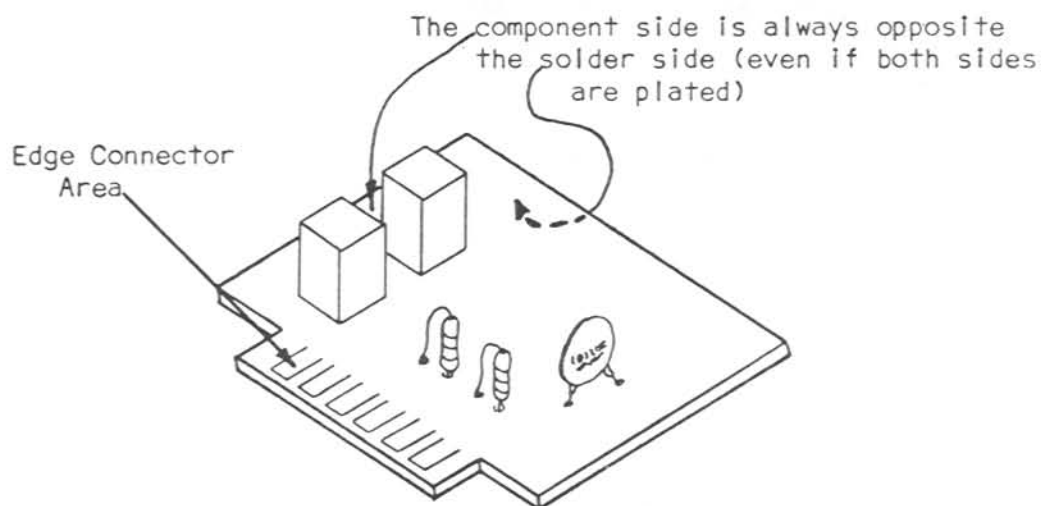
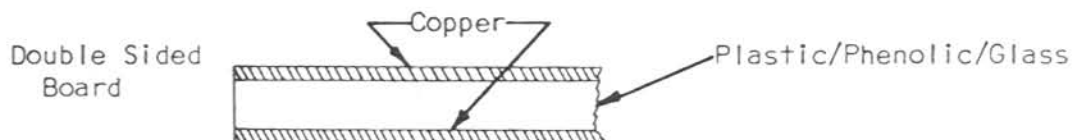
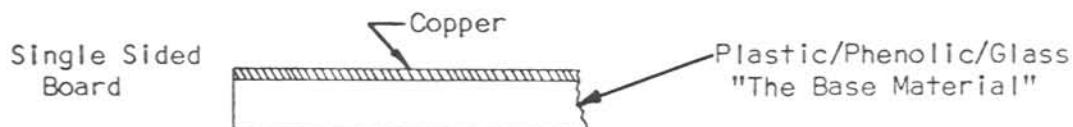
The circuit boards used in the FT-901 are not keyed, and it is possible to install a board backwards, or to install it in the wrong socket.

If you have several boards out of the chassis at any one time, be certain to install the boards correctly into their sockets. Use the reference plate which is installed above the circuit board rack.



CIRCUIT TRACE REPAIR

Most of the printed circuit boards used in the FT-901 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.

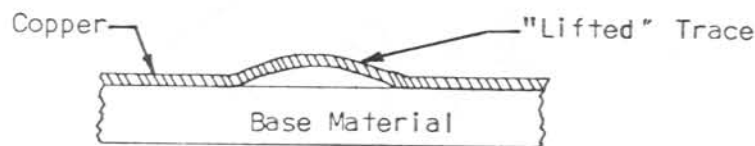
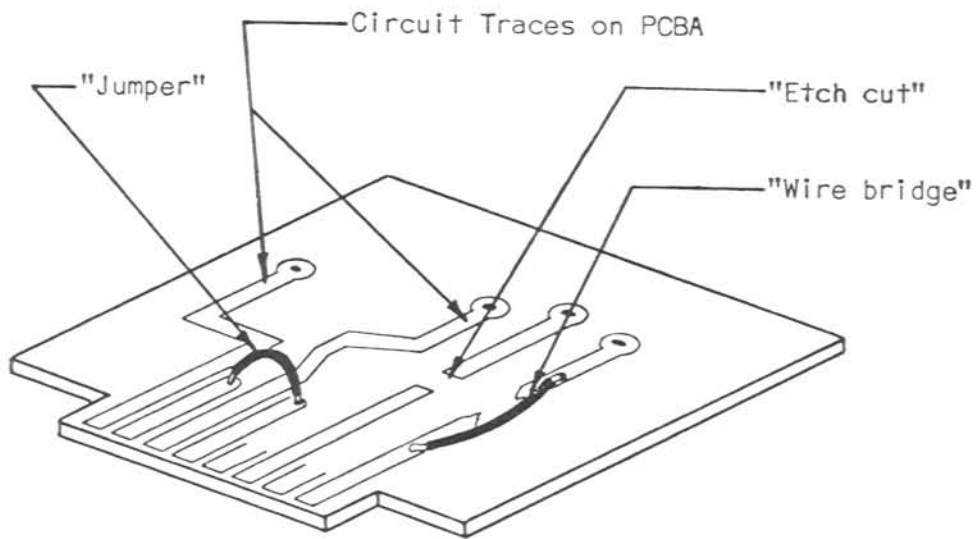


SERVICING

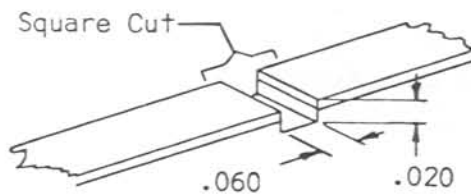
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Sometimes, after the design and drafting of a board are completed, a board is produced with an error in it. Though non-technical managers sometimes suffer a stroke at hearing of this situation, it is not unheard of in engineering circles. Thus, should 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

VFO DRIFT IN PRESENCE OF VHF TRANSMITTER

Some transceivers from the first and second production lots display a VFO drift problem in the presence of a nearby 2 meter transmitter. The problem is caused by a ground loop, and the modification below will eliminate the difficulty.

Modification Procedure:

- (1) Refer to Fig. 1 , and cut the foil on the VFO UNIT, PB-1440A, at the two points shown. Install the jumper wire shown in the drawing.

- (2) Refer to Fig. 2 , and remove the ground lead from pin 4 of J₈₀₂. Re-route the lead so that the connection is from pin 4 of J₈₀₂ to the center hole under C₈₂₂.
- (3) Change the screw adjacent to C₈₂₂ to a NYLON screw.
- (4) Add a new 0.01 disc ceramic capacitor between pins 3 and 4 of J₈₀₂.
- (5) Install a new ground lead, made from a heavy braided wire of 100-120 mm length. This lead should run from the VFO compartment to the ground lug for the XTAL UNIT, as shown in Fig. .

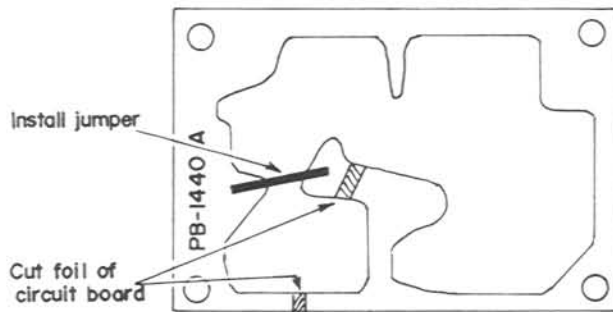


Figure 1

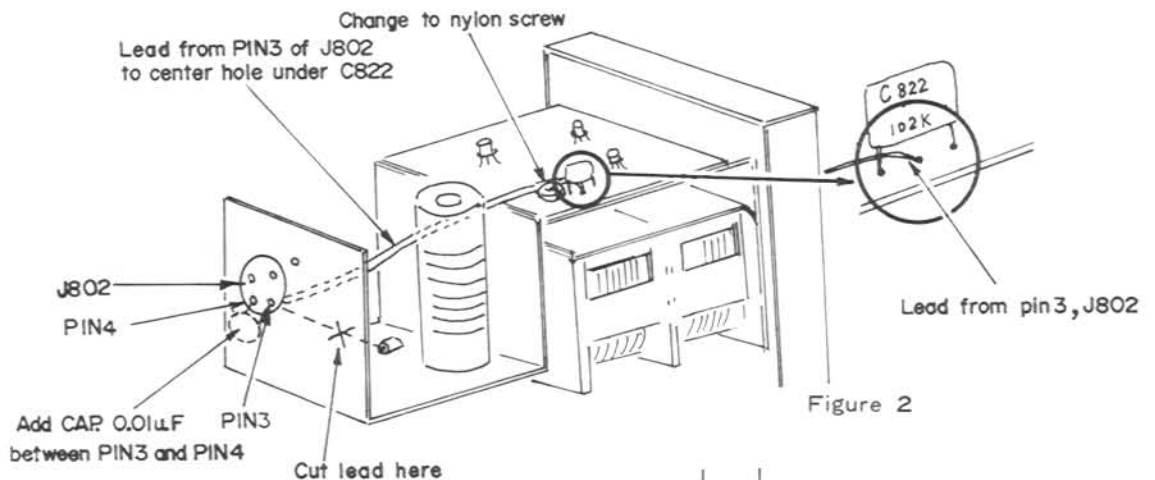


Figure 2

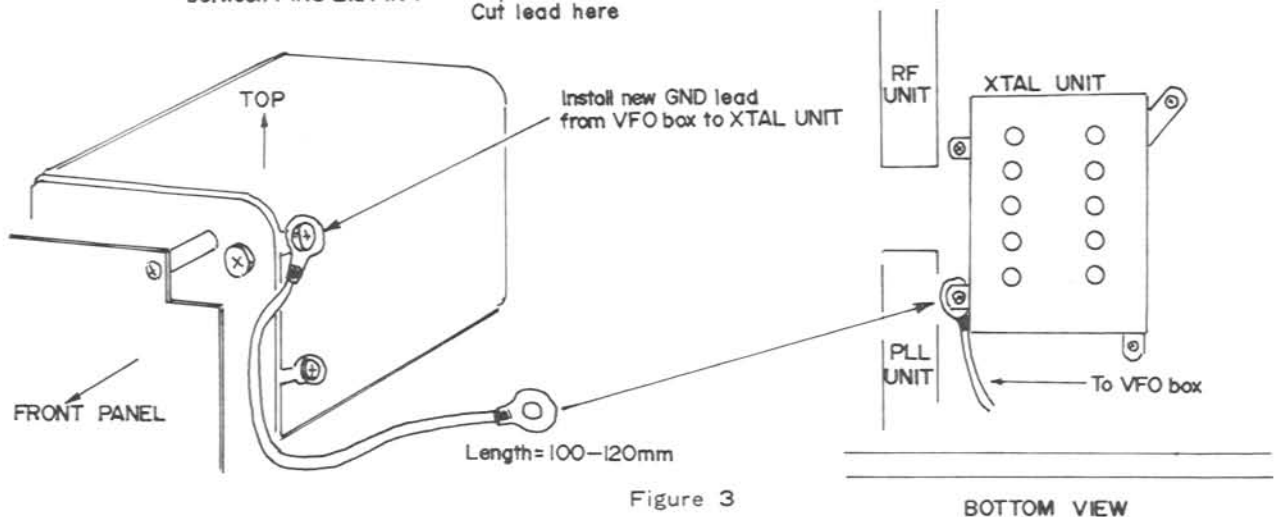


Figure 3

BOTTOM VIEW

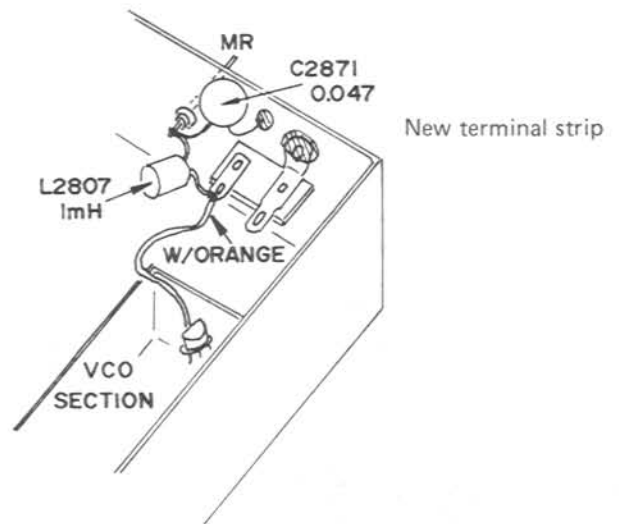
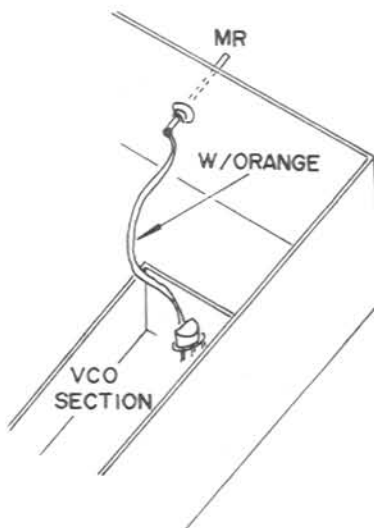
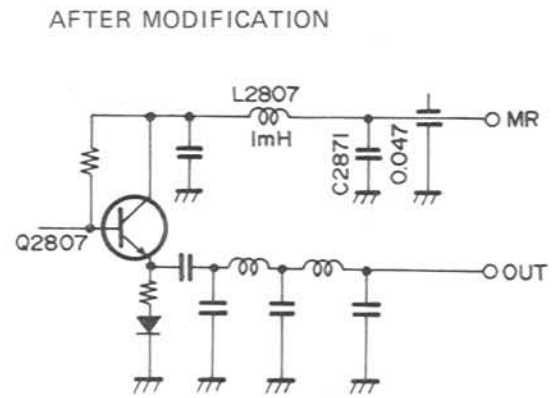
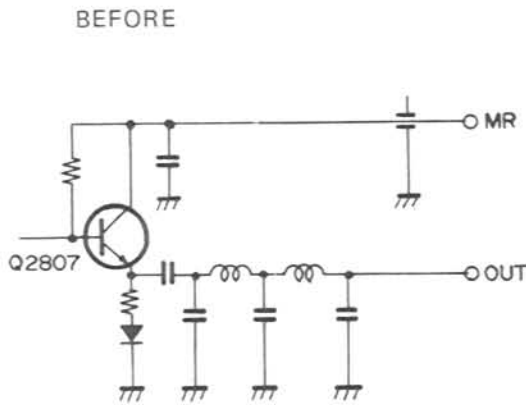
MEMORY UNIT HUM, MR MODE

In some FT-901DM sets, leakage from the memory circuitry could cause a low-level hum to be apparent when going to the MR mode. The following modification should eliminate this problem.

Modification Procedure:

(1) Refer to the drawings below, and install a two-lug terminal strip near the MR terminal on the MEMORY UNIT.

- (2) Remove the white/orange wire connected to the MR terminal, and connect it to the ungrounded lug of the new terminal. Connect a 1 mH mini-inductor in the collector lead of Q₂₈₀₇. This new inductor is labeled L₂₈₀₇ in future productions.
- (3) Install a new 0.047 μ F disc ceramic capacitor between the MR terminal and ground, as shown in the drawing. Modification is now complete.

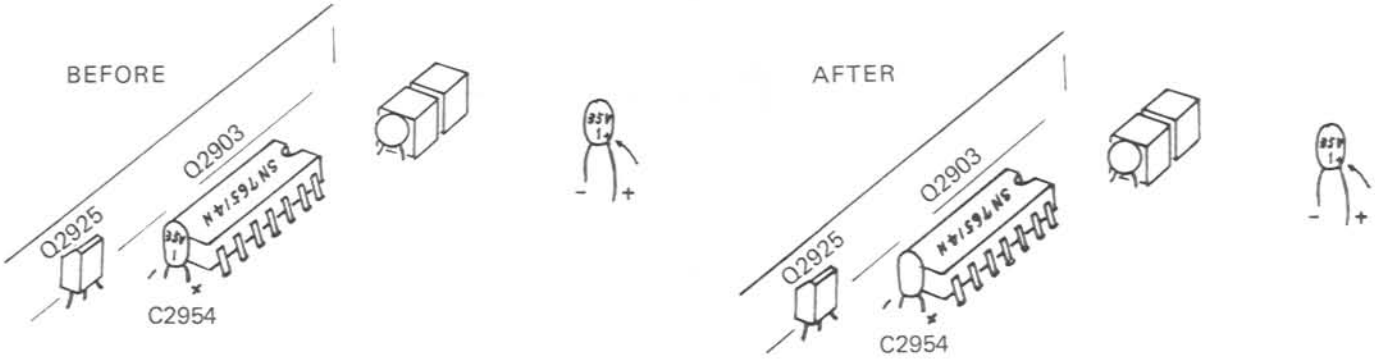


COUNTER UNIT CAPACITOR REVERSAL

In FT-901DM units bearing serial numbers 8F030001 through 8H059999, the markings on PB-1729 showed the polarity of C₂₉₅₄ incorrectly. As a result, the capacitor was installed correctly according to the marking, but **incorrectly** according to the intended purpose.

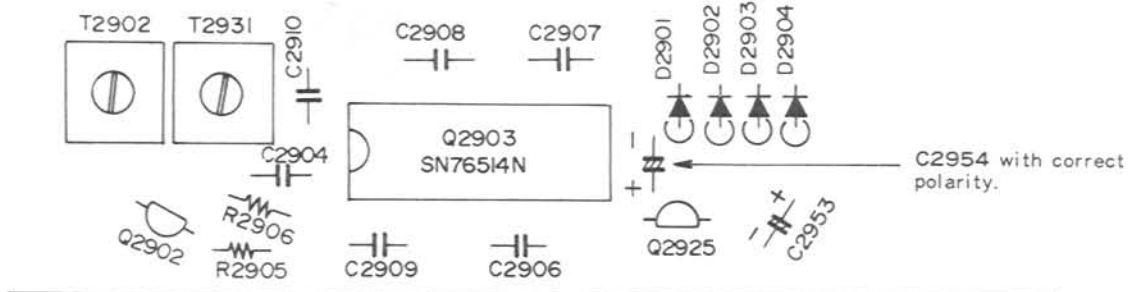
Modification Procedure:

- (1) Remove the COUNTER UNIT, PB-1729, from the transceiver. Locate C₂₉₅₄, and observe the polarity. On sets bearing the above serial numbers, if the capacitor is installed with **reversed polarity** according to the circuit board making, your unit is already modified. If it is the **same** as the circuit board marking, remove and discard the capacitor. A correctly installed capacitor has its markings facing in the direction of Q₂₉₀₃.
- (2) Install a new C₂₉₅₄ (1 μF, 35 WV, tantalum) as shown in the drawing below. Its markings should face Q₂₉₀₃.
- (3) Replace the COUNTER UNIT. Modification is now complete.



Capacitor installed per PB marking (incorrect).
Remove and reverse C₂₉₅₄.

Markings should face Q₂₉₀₃.
Capacitor reversed according to PB marking.



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POWER SUPPLY PROTECTION MODIFICATION

Beginning with production lot No. 6, the following modification was adopted, in order to provide protection for the filter capacitors, screen grid supply, and mode switch. These might be subject to damage in the event of flashover between the electrodes inside the final amplifier tubes.

Modification Procedure:

- (1) Fix a three-terminal soldering post to the chassis, using a self-tapping screw, as illustrated in Fig. 1 .
- (2) Solder a 10D10 diode to the post as shown, being careful to observe proper diode polarity.
- (3) Remove the yellow wire previously connected to the circuit board, as shown in Fig. 1 . Solder it to the anode of the diode, as shown in the drawing.
- (4) Connect a lead from the cathode end of the diode to the circuit board, in the position previously occupied by the yellow wire.
- (5) The modified schematic is shown below.

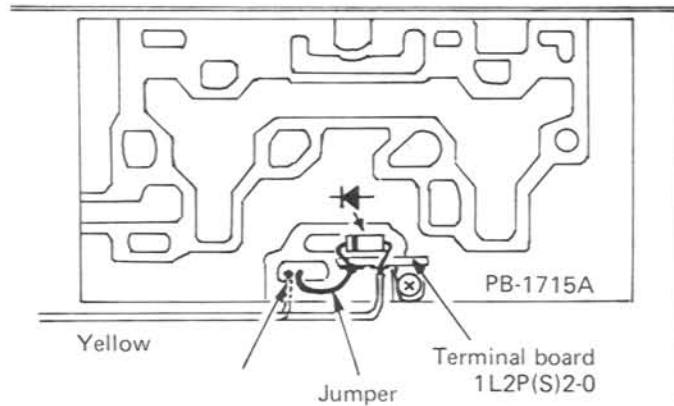


Figure 1

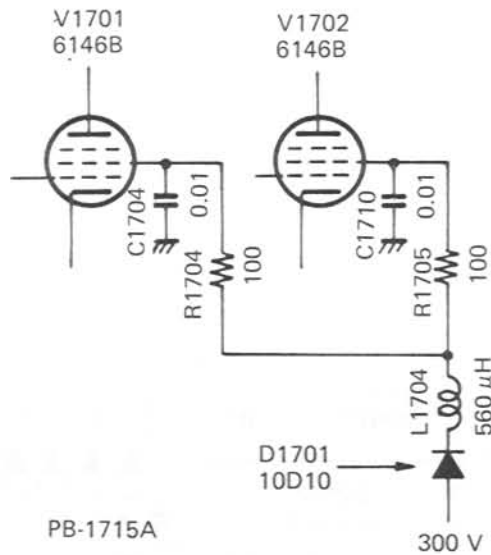


Figure 2

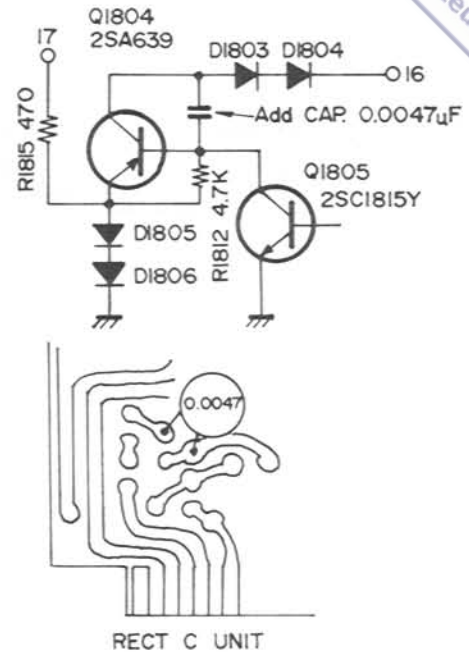
KEY CLICK MODIFICATION

In some FT-901 transceivers, when operating in the CW mode, the keying waveshape could become too "hard" if the drive control (CARR) were advanced too far. The following modification should eliminate this difficulty.

Modification Procedure:

- Connect a 500 WV 0.0047 μ F disc ceramic capacitor between the collector and base of Q_{1804} , as shown in the drawing.

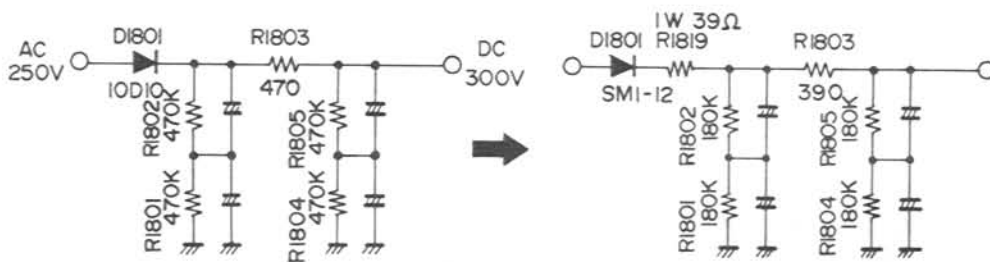
This modification was adopted in production runs beginning with serial numbers 080001.



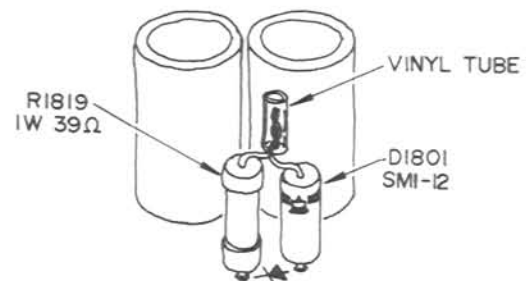
RECTIFIER C UNIT MODIFICATION

The FT-901 series has been modified, starting with the No. 8 production lot, as described below. The change was made in order to provide protection against the loss of R_{1803} caused by unbalance in C_{1802} and C_{1803} . While the problem was highly isolated, the failure of R_{1803} could cause the destruction of the filter capacitors. In order to catch this problem before it causes damage in the field, we recommend the following modification:

- Change R_{1801} , R_{1802} , R_{1804} , and R_{1805} to 180 K ohms, 1/2 watt.
- Change R_{1803} to 390 ohms, 2 watts.
- Add a new R_{1819} (39 ohms, 1 watt) in series with D_{1801} , as shown.
- D_{1801} is being changed in production to type SM1-12, but this change should not be necessary in the field. Modification is now complete.



Note: An easy alternative to the above is to add another 10D10 diode in series with D_{1801} . No further modification is necessary. This was done in the 190 volt line from pin 2, shown on page 2-28, and this should be satisfactory. Modification of the 190 volt line is also recommended.



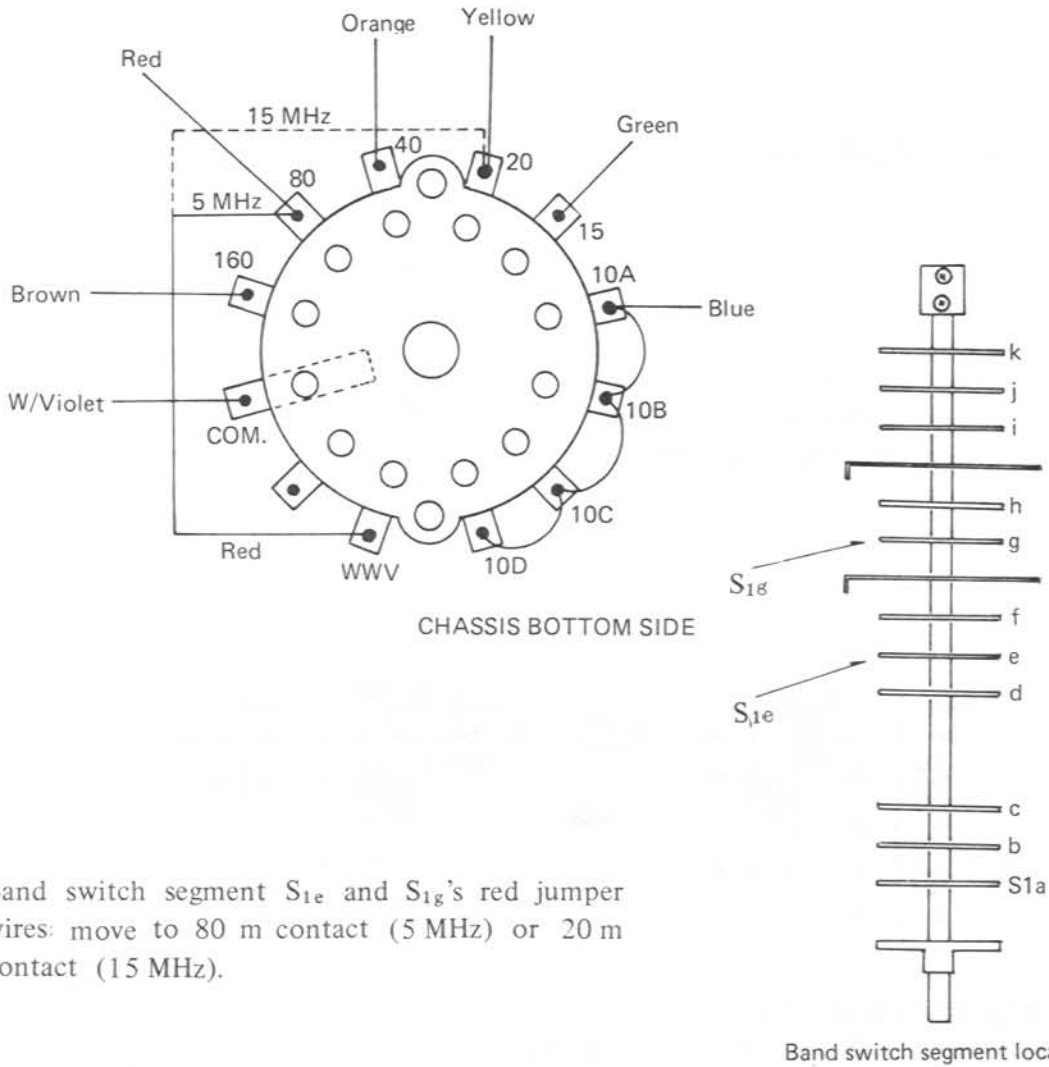
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WWV/JJY MODIFICATIONS

FT-901 transceivers for the first production lot were equipped with 5 MHz WWV coverage. From the second production lot, this was changed to 15 MHz. Units destined from the Japanese domestic market all are equipped for 5 MHz.

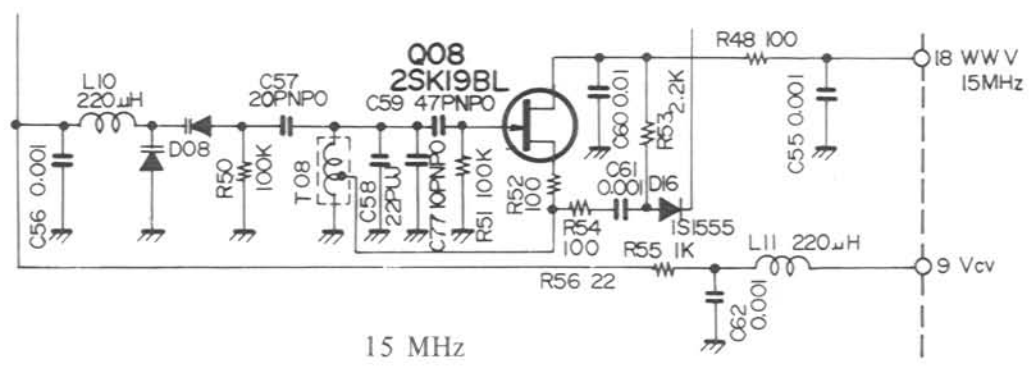
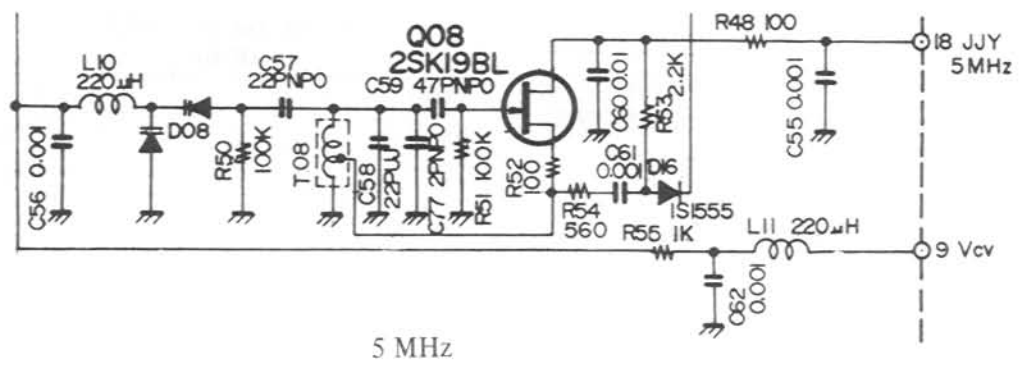
Modification Procedure:

- (1) Locate bandswitch segments (e) and (g). Refer to the drawing for reference.
- (2) For WWV 5 MHz reception, the red jumper wires on these wafers must be connected between the WWV terminal and the 80 meter terminal.
- (3) For WWV 15 MHz reception, the red jumper wires must be connected between the WWV terminal and the 20 meter terminal.
- (4) Make the component changes as shown in Table 1. Peak T_{1310} for a reading of 80-150 mV at the OUT terminal (pin 16) of the XTAL UNIT.

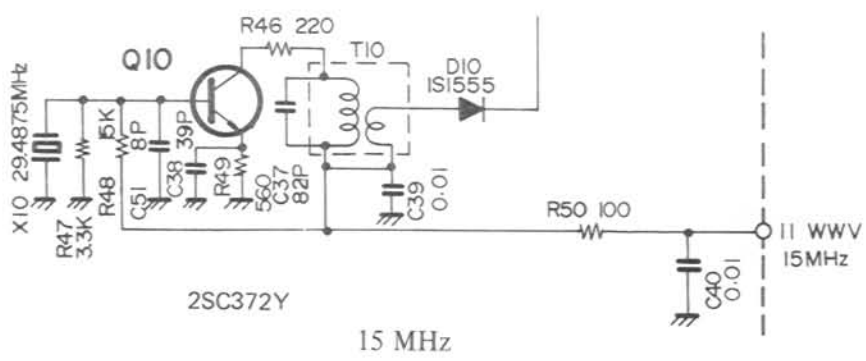
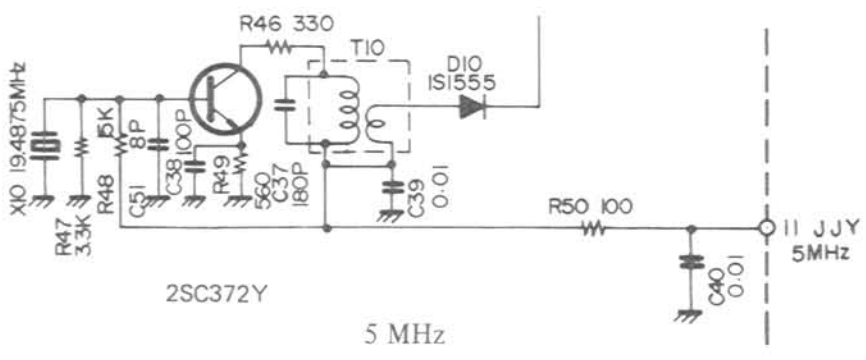


Band switch segment S_{1e} and S_{1g} 's red jumper wires: move to 80 m contact (5 MHz) or 20 m contact (15 MHz).

VCO UNIT



X'TAL UNIT



	5 MHz	15 MHz
R ₁₂₅₄	560 Ω	100 Ω
C ₁₂₅₇	22 pF (NPO)	20 pF (NPO)
C ₁₂₇₇	2 pF (NPO)	10 pF (NPO)
T ₁₂₀₈	# 220293	# 220295
X ₁₃₁₀	HC-18/U 19.4875 MHz	HC-18/U 29.4875 MHz
R ₁₃₄₆	330 Ω	220 Ω
C ₁₃₃₇	180 pF	82 pF
C ₁₃₃₇	100 pF	39 pF

Table 1

See parts location pages 3-67/3-69.

SERVICING

MOSFET CHANGES

Because of a potential parts availability problem, many of the 3SK40M MOSFET components were changed to 3SK51-03 types. There is no reason to make this change in the field, unless the 3SK40M types are not available in your parts inventory.

For replacement MOSFET servicing, please refer to the chart below.

CODE

- Replacement with this type OK without further change.
- △ When changing to this type, make resistor change at right.
- × Do not replace with this type.

Example:

PART	3SK40M	3SK40L (R/B)	3SK51-03	Change for
Q ₁₀₆	○	△	×	R ₁₂₆ : 390→270

This means: when replacing Q₁₀₆, it may be replaced with type 3SK40M with no further changes; a 3SK40L(R/B) may be used by changing R₁₂₆ from 390 ohms to 270 ohms; type 3SK51-03 should not be used.

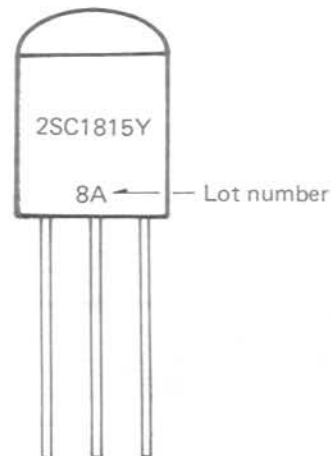
RF PROCESSOR/XTAL UNIT TRANSISTOR MODIFICATION

On the NB UNIT, transistor Q₂₀₂ should bear a lot number . . . 7J, 7K, 7L, or earlier. If the transistor bears a lot number 8A, 8B, 8C, or later, the transistor should be changed from type 2SC1815Y to type 2SC372Y.

The same consideration applies to transistors Q₁₃₀₁–Q₁₃₁₀ on the XTAL UNIT.

The new 2SC1815Y transistors exhibit higher noise than Yaesu specifications will allow, hence the change to the 2SC372Y.

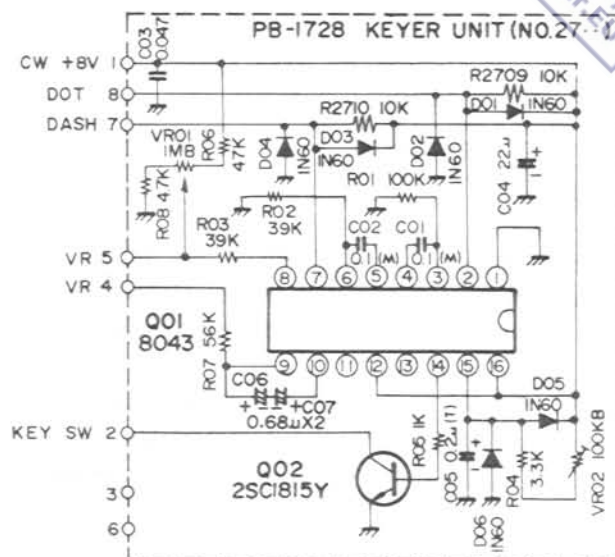
PART	3SK40M	3SK40L (R/B)	3SK51-03		
Q ₁₀₁	○		△	R ₁₀₃	39K → 47K
Q ₁₀₆	○	△	×	R ₁₂₆	390 → 270
Q ₁₀₇	○	△	×	R ₁₂₅	390 → 270
Q ₂₀₉	○	○			
Q ₂₁₀	○	○			
Q ₂₁₂	○		○	(3SK41M OK)	
Q ₄₀₁	○		△	R ₄₀₅	560 → 1K
Q ₄₀₂	○		△	R ₄₁₈	560 → 1K
Q ₄₀₃	○		△	R ₄₂₅	560 → 1.8K
Q ₄₀₄	○		△	R ₄₃₂	560 → 1.8K
Q ₉₀₁	○		△	R ₉₀₅	56 → 1.8K
Q ₁₂₀₉	○		△	R ₁₂₅₉	470K → 680K
Q ₂₈₀₉	○		○		
Q ₂₉₀₁	○		○		



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KEYER UNIT MODIFICATIONS

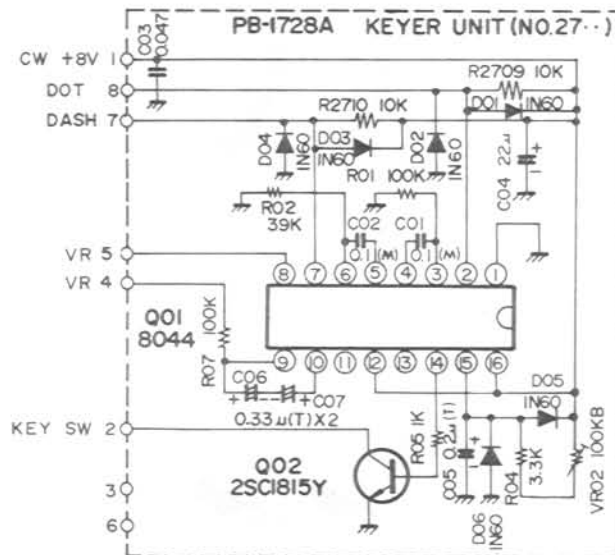
Several minor changes were made during the production of FT-901DM units using the Curtis 8043 IC. The diagram below represents the final version of the KEYER UNIT, and if you should have to perform service on this board, we recommend that the circuit be modified as shown here.



CURTIS 8044 IC CIRCUIT MODIFICATION

Beginning with the No. 8 production lot, the Curtis 8044 IC was used in the KEYER UNIT. The 8044 includes both dot and dash memories, and several changes were made in the circuit board to reflect the use of the new IC. Notable among these was the removal of the symmetry control.

The corrected schematic for the 8044 IC KEYER UNIT is shown below.

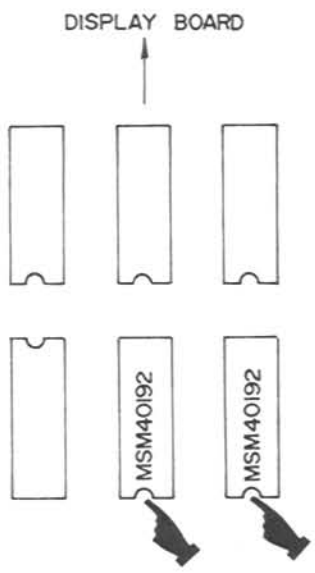


COUNTER UNIT IC INSTALLATION NOTE

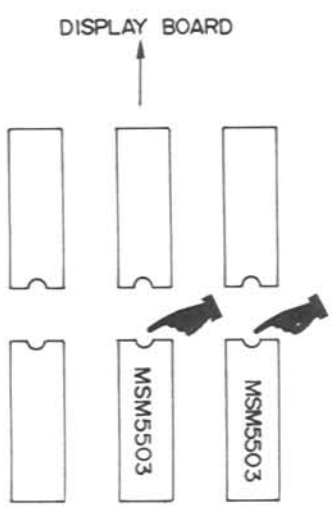
In some FT-901 transceivers, Q₂₉₂₀ and Q₂₉₂₁ were changed from type MSM40192 to type MSM5503. The units are identical in operation, but the MSM5503 pin layout is the reverse of that of the MSM40192.

For this reason, if you have to replace Q₂₉₂₀ or Q₂₉₂₁, be sure to observe the proper alignment of the key marking, as shown in the drawing below.

Note also that the circuit board is marked correctly **only** for installation of the MSM40192 IC. Install MSM5503's with the key mark at the opposite end, as shown below.



For models using MSM40192. Circuit board print is marked correctly.

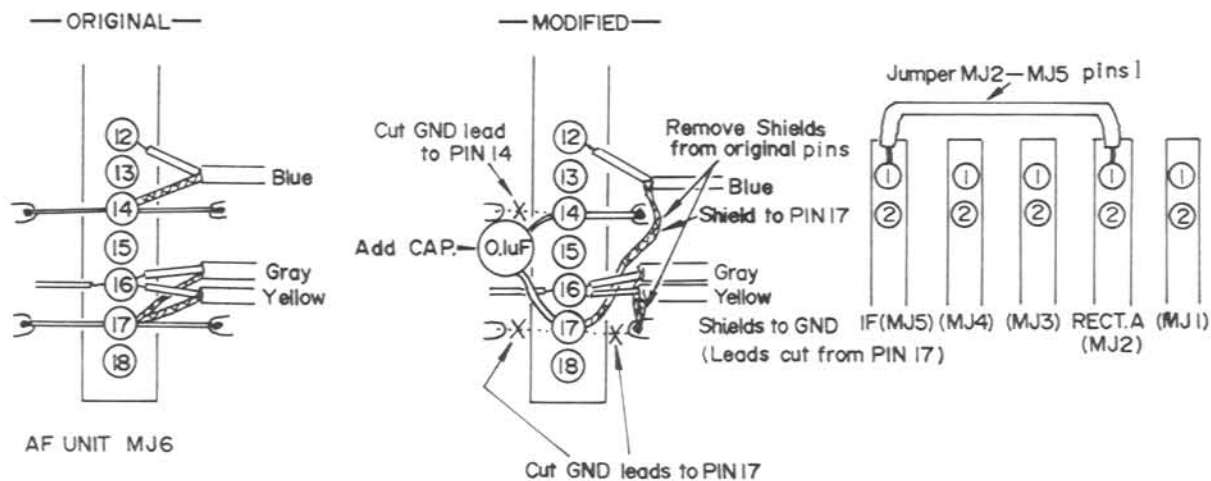


For models using MSM5503. Install reversed from PCB marking.

AUDIO HUM MODIFICATION

In some early models of the FT-901, a slight hum could be heard on receive; this is most easily observed by rotating the AF and RF gain controls to zero. The problem was a ground loop, and this bulletin will detail the simple modification to cure the problem.

1. Refer to the drawing. Locate MJ₆ on the bottom of the chassis.
2. Cut the ground leads from pin 17. Cut the ground lead from the left side of pin 14.
3. Locate the cable whose center conductor is connected to pin 12. Remove the shield of this cable from pin 14, and reconnect it to pin 17.
4. Locate the two cables whose center conductors are connected to pin 16. Their shields should be removed from pin 17, and connected to the ground point previously connected to pin 17 from the right side.
5. Add the 0.1 μ F 25 WV capacitor between pins 14 and 17, as shown. A ceramic capacitor is OK in this application.
6. Connect a jumper between MJ₂, pin 1, and MJ₅, pin 1. This completes the modification.



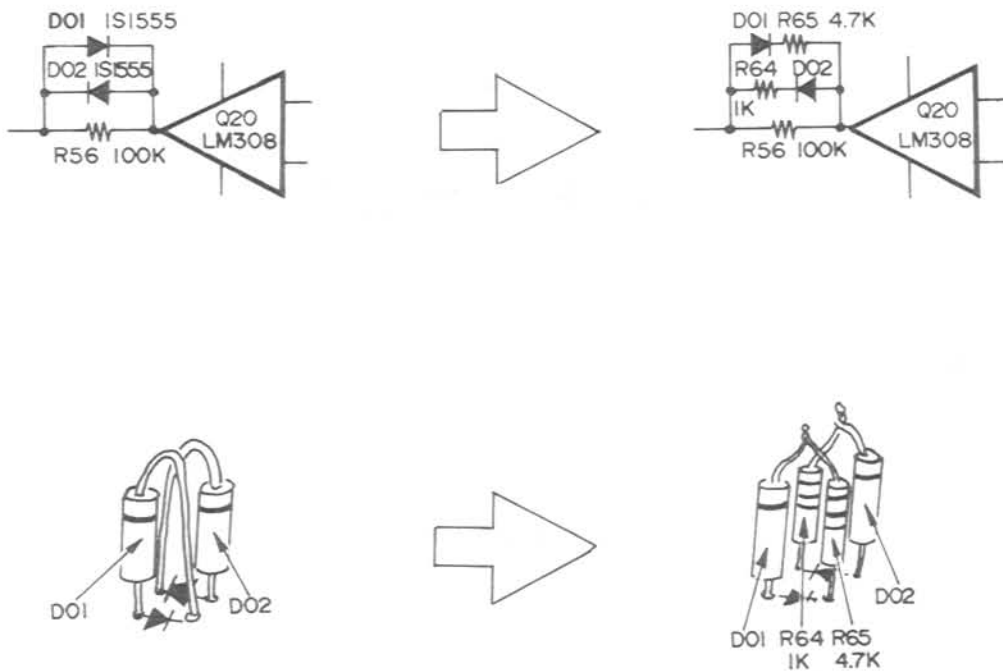
MEMORY LOCK MODIFICATION

In some FT-901 transceivers, it was not possible to obtain a memory lock through the entire range of the VFO, especially toward the high end. The following modification will allow a lock to be obtained, in these isolated situations.

Refer to the drawing below, and install a 4.7 K ohm resistor in series with D₂₈₀₁. Install a 1 K ohm resistor in series with D₂₈₀₂. These resistors should be ¼ watt rating, and should be installed on the cathode side of the diodes.

Use care in reinstalling the components in the circuit board, as the memory unit is extremely densely packed.

This completes the modification.



MAINTENANCE AND ALIGNMENT

WARNING

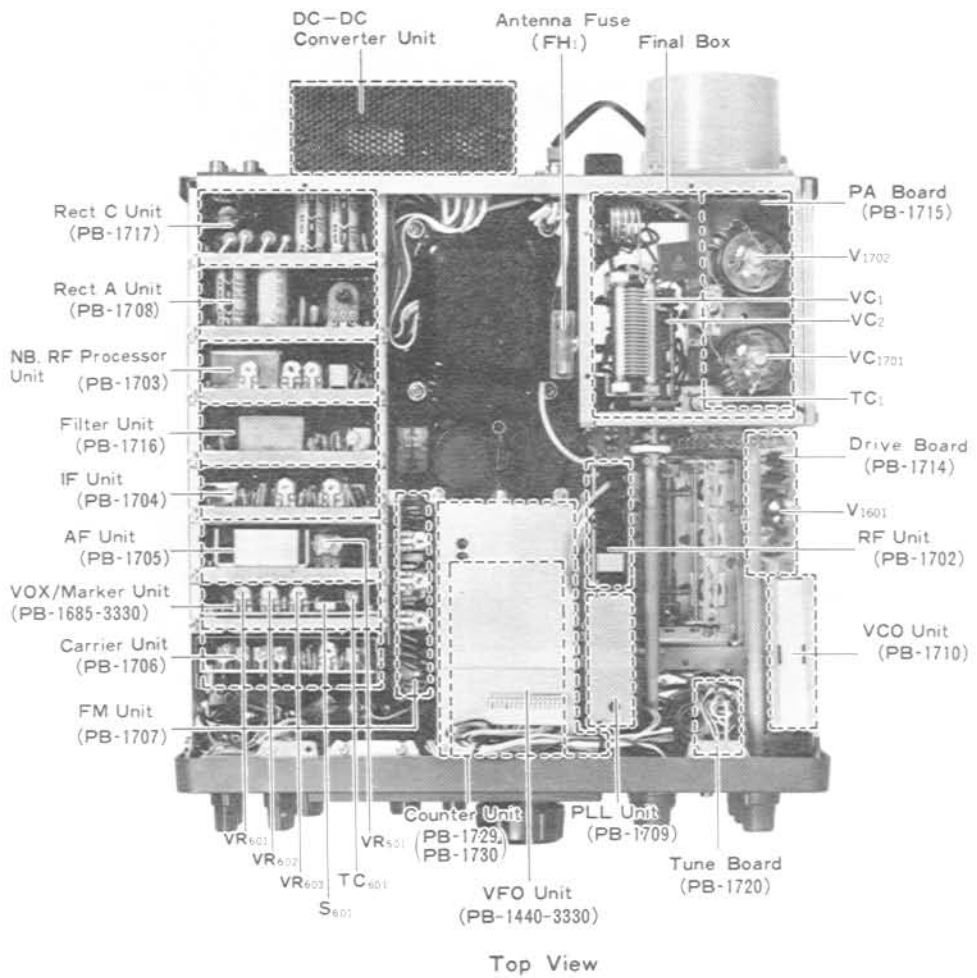
DANGEROUS VOLTAGES ARE PRESENT WITHIN THIS TRANSCEIVER. USE EXTREME CAUTION WHEN WORKING ON THE TRANSCEIVER WITH THE COVERS REMOVED. DISCHARGE ALL CAPACITORS BY SHORTING THEM TO GROUND WITH AN INSULATED SCREWDRIVER AFTER POWER HAS BEEN REMOVED, AND OBSERVE OTHER NORMAL SAFETY PRECAUTIONS.

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 transceiver is operated without the proper load termination.

GENERAL

This transceiver has been carefully aligned and tested at the factory and, with normal usage, should not require other than the usual attention given to electronic equipment. Service or realignment of a major component may require subsequent realignment; 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. Service work should only be performed by experienced personnel using the proper test equipment.



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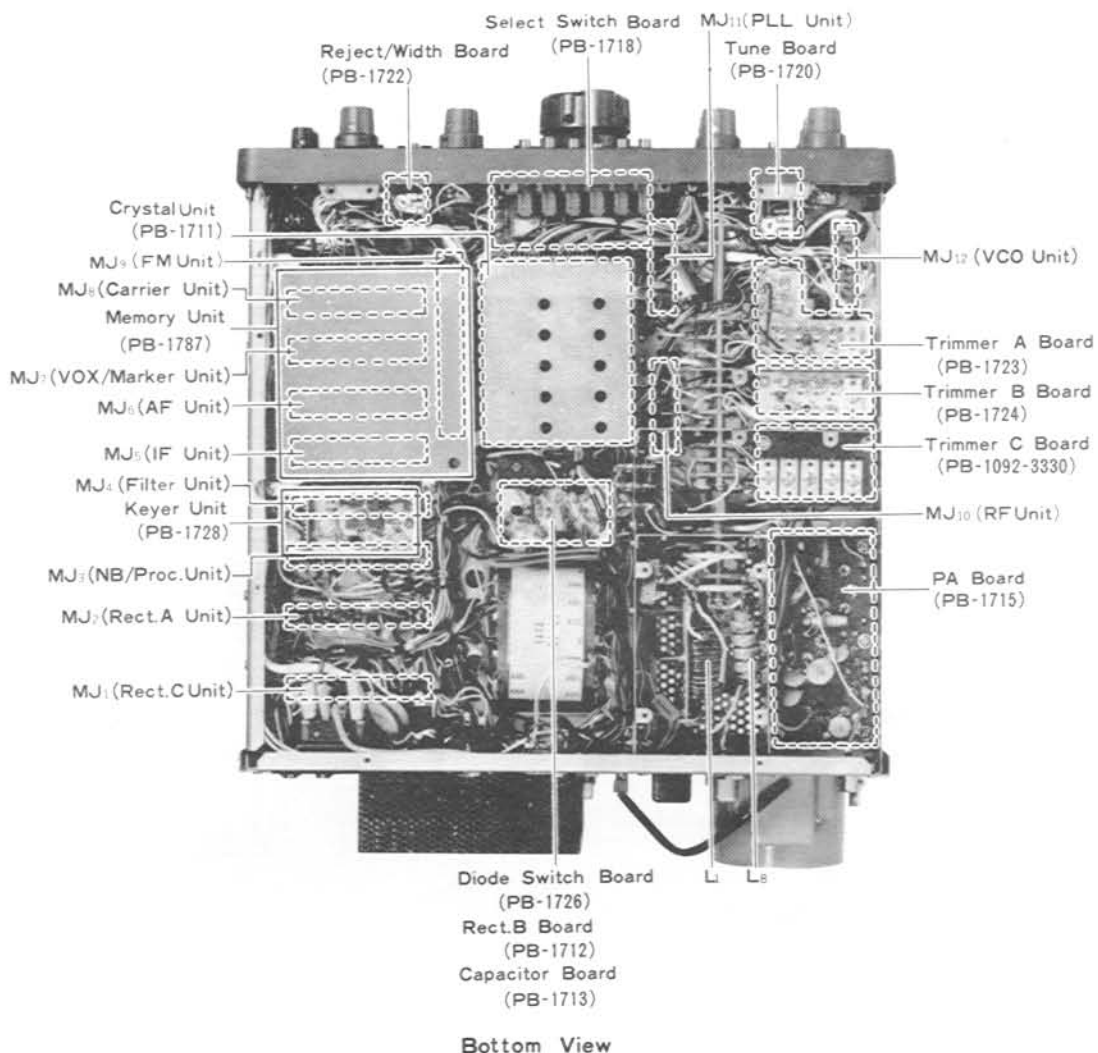
EQUIPMENT REQUIRED

- (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 the frequency range from 3 to 30 MHz with a 100 kHz calibrator.
- (6) A frequency counter, Yaesu Model YC-500 or equivalent, with resolution to .01 kHz and frequency coverage to 30 MHz.

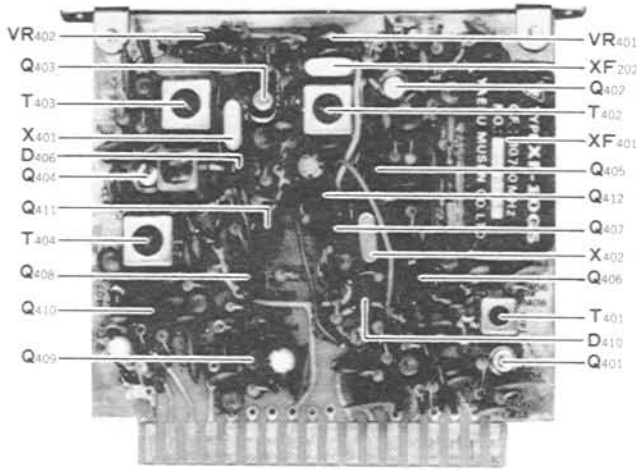
1. S-METER SENSITIVITY ADJUSTMENT

Place the transceiver in the receive mode and connect a signal generator to the antenna terminal of the transceiver. Set the signal generator to 14200 kHz with an output of 6 dB. Tune the transceiver to 14200 kHz for a maximum reading on the S-meter. The S-meter should just start to rise with a 6 dB input. If no deflection is observed, adjust VR₄₀₂ to obtain a slight meter deflection. Apply 100 dB input to the antenna terminal; the S-meter should read S9 + 60 dB. If not, adjust VR₄₀₁. VR₄₀₁ and VR₄₀₂ are located on PB-1704.

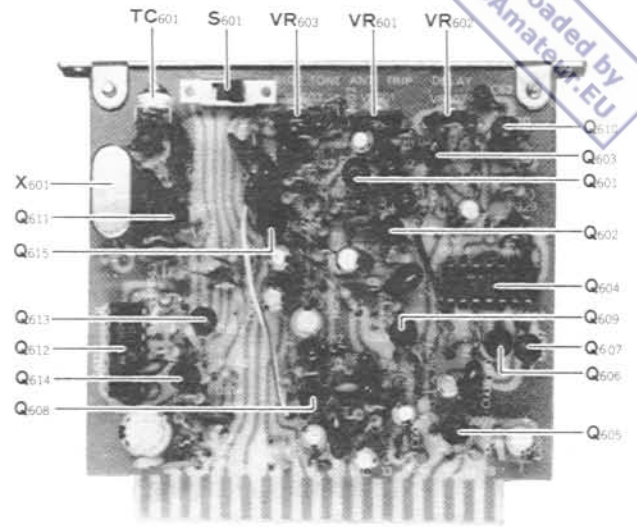
When the transceiver is tuned to 14200 kHz, the 100 kHz calibrator signal will indicate approximately S9 + 10 dB when MARK switch is activated.



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IF unit (PB-1704)



VOX/Marker unit PB-1846 (PB-1685-3330)

2. VOX ADJUSTMENT

Tune in a signal and adjust the AF GAIN control for a normal listening level. With the microphone positioned near the speaker, increase the VOX GAIN control on the front panel until the speaker output causes the VOX relay to switch to the transmit mode. Set the ANTITRIP control VR₆₀₁ on PB-1685 to the point that will just prevent the speaker output from tripping the VOX relay. Speak into the microphone in a normal voice to see if one's voice will activate the VOX relay. If not, VR₆₀₁ may be advanced too far.

Adjust the DELAY control VR₆₀₂ for the desired release delay. Clockwise rotation of VR₆₀₂ will increase the delay time. For CW semi-break-in operation, VR₆₀₂ should likewise be adjusted to suit the operator's preferences. For CW operation with a footswitch for relay actuation, the VOX GAIN control may be rotated fully counterclockwise (but not to the click-stop, which is the MOX position) to disable the VOX system.

3. CW SIDETONE LEVEL

Adjustment of the CW sidetone level may be made by adjustment of potentiometer VR₆₀₃, located on PB-1685, while the transceiver is being keyed.

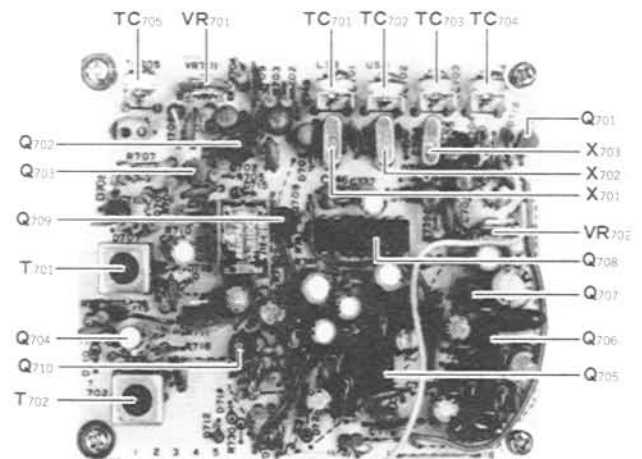
4. CARRIER BALANCE

The transceiver should be allowed to reach normal operating temperature before making carrier balance adjustments.

Tune up the transceiver for SSB operation using a matched antenna or dummy load. Turn the MIC GAIN control fully counterclockwise to remove all audio input from the modulator stage.

With the MODE switch set to either LSB or USB, turn the VOX GAIN control to MOX and adjust the carrier balance controls VR₇₀₁ and TC₇₀₅ on PB-1706 for a minimum meter reading with the METER switch in the PO position.

A more precise balance may be obtained by tuning a receiver which has an S meter to the transmitted frequency. Adjust VR₇₀₁ and TC₇₀₅ for a minimum S meter reading on the remote receiver while switching the MODE switch back and forth between the two SSB positions; this will help ensure good carrier suppression on both LSB and USB.



Carrier unit (PB-1706)

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5. AMGC (Automatic Mic Gain Control)

The hold time of the AMGC system is adjusted by VR₇₀₂ on PB-1706; clockwise rotation of VR₇₀₂ will provide a longer hold time.

6. CARRIER FREQUENCY ADJUSTMENT

Tune up the transmitter on 20 meters in the USB mode, using a dummy load. Apply a 1 kHz audio signal to the microphone input and adjust the audio generator output for 30 watts output from the transmitter as measured by the dummy load wattmeter. Shift the audio generator output frequency to 300 Hz without changing its output level. Adjust TC₇₀₁ until the power output becomes 8 watts. Repeat this procedure for the LSB mode.

NOTE: Recheck the carrier balance after adjusting the carrier frequency.

Connect a frequency counter to pin 17 of the NB UNIT PB-1703. Transmit in the AM mode. Set TC₇₀₃ for a reading of 8988.295 kHz on the frequency counter.

Transmit on the FSK mode. Set TC₇₀₄ a reading of 8988.125 kHz on the frequency counter. Repeat this procedure for AM and then FSK until both frequencies are indicated correctly on the counter. Ground the inner conductor of the FSK jack on the rear panel and confirm that the frequency shifts to 8988.295 kHz.

7. ALC LEVEL ADJUSTMENT

Set the METER switch to ALC, the MODE switch to USB or LSB, the MIC GAIN control counter-clockwise, and the VOX GAIN control to MOX. If the meter reading is not fully deflected to the right, adjustment of the ALC level control VR₂₀₁ on PB-1703 will be required. Adjust VR₂₀₁ for a reading of 350 (full scale) and return the VOX GAIN control to PTT.

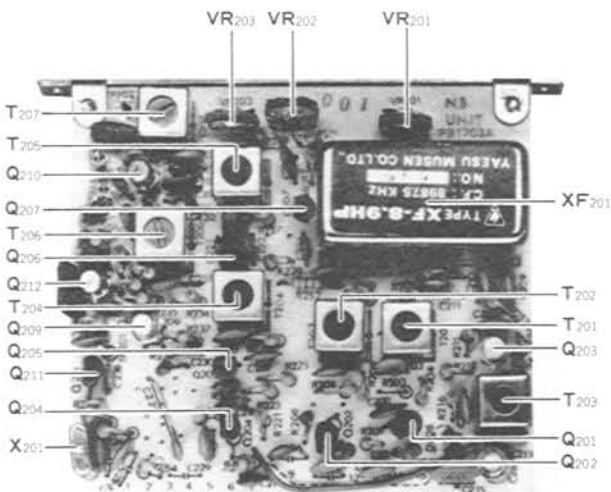
8. RF SPEECH PROCESSOR ADJUSTMENT

Tune up the transceiver on USB at 14.2 MHz. Set VR₂₀₂ and the PROC LEVEL controls to the center of their range. Apply a 1 kHz audio signal to the microphone input and adjust its level to the point where power output levels off after reaching its maximum value; do not advance the input level past the saturation point. Adjust VR₂₀₃ so as to obtain the same power output when the RF Processor switch is in the ON and OFF positions.

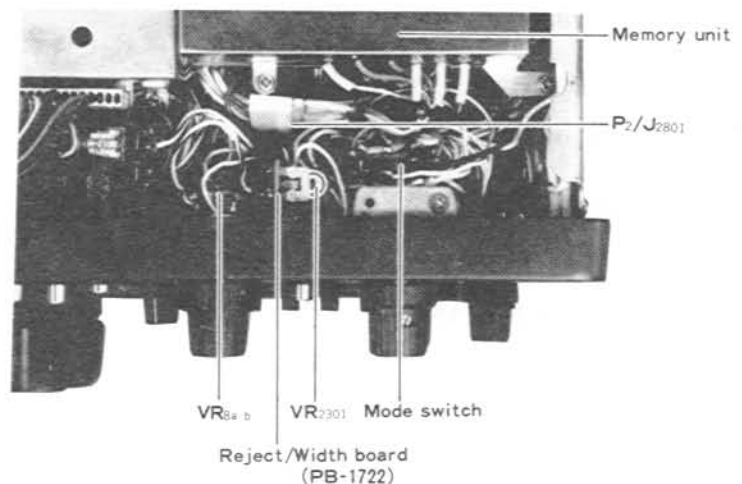
9. IF PASSBAND TUNING ADJUSTMENT

Tune the receiver to 14.2 MHz in the USB mode and set the WIDTH control to the 12 o'clock position. Set the RF GAIN control fully clockwise.

Change the MODE switch from USB to LSB. The receiver background noise at the speaker should not change in pitch. If there is any difference, adjust VR₂₃₀₁ located adjacent to the MODE switch below the chassis until the noise is of the same pitch when switching between USB and LSB.

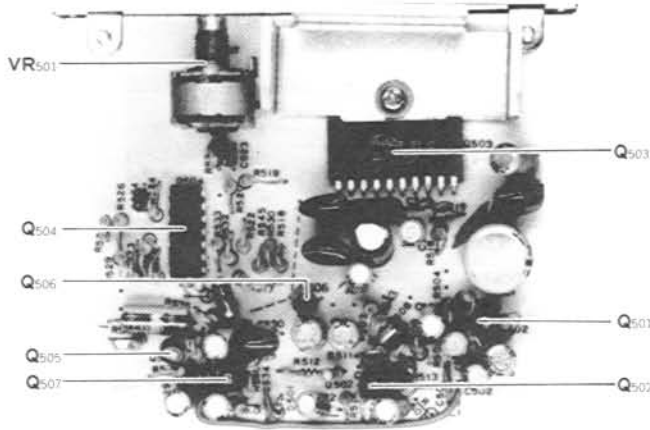


NB/PROC unit (PB-1703)



10. APF SELECTIVITY

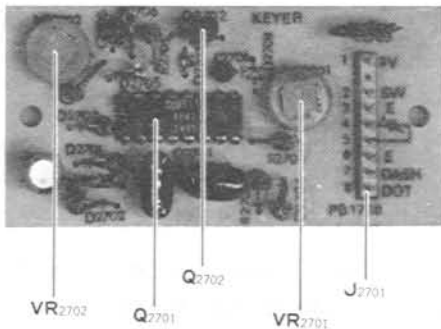
The selectivity of the APF (Audio Peak Filter) can be adjusted by varying VR₅₀₁, located on PB-1705. Clockwise rotation of VR₅₀₁ will yield sharper selectivity of the filter.



AF unit (PB-1705)

11. KEYER ADJUSTMENT

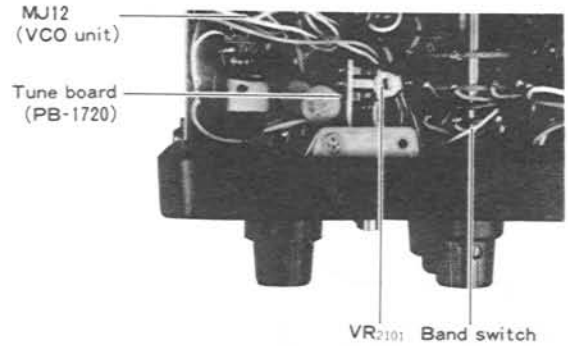
VR₂₇₀₂ controls the dot-to-space ratio for the built-in electronic keyer; this is normally set to 1:1 at the factory. VR₂₇₀₁ adjusts the symmetry between dots and dashes. Once VR₂₇₀₁ is set, this setting is correct for all keying speeds. Adjustment of VR₂₇₀₂ will make both dots and dashes change uniformly with respect to the space. Both of these controls are located on PB-1728.



Keyer unit (PB-1728)

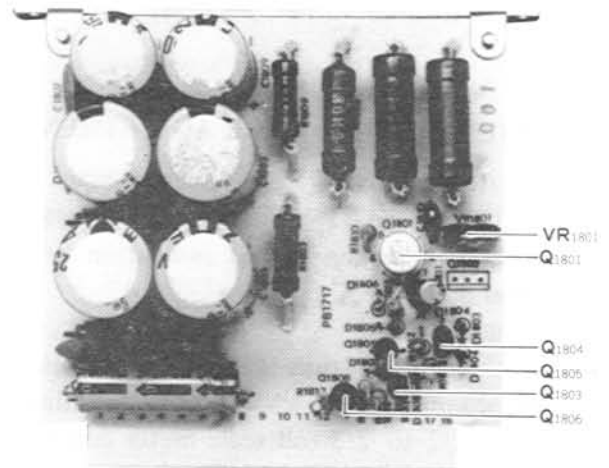
12. CLARIFIER ADJUSTMENT

With the transceiver in the receive mode, push the RX CLARIFIER button and set the CLARIFIER control to 0. Tune in the marker signal on any band and then switch the RX CLARIFIER button OFF. If the frequency changes at all, adjust potentiometer VR₂₁₀₁, which is located inside the cabinet near the CLARIFIER control potentiometer.



13. VOLTAGE REGULATOR ADJUSTMENT

Connect a VTVM DC probe between pin 10 of MJ₁ (PB-1717) and ground. Adjust 6V SET potentiometer VR₁₈₀₁ for exactly 6 Volts as indicated on the VTVM.

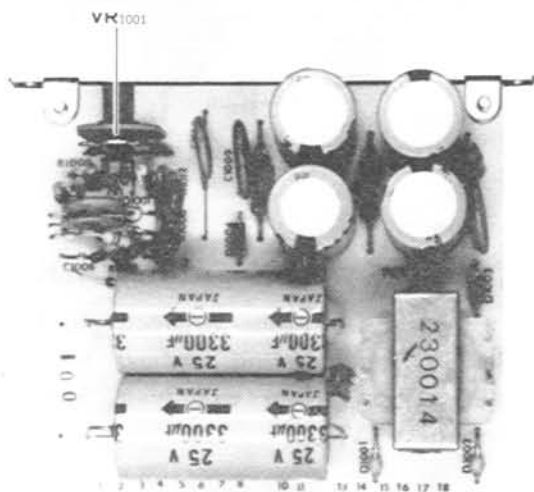


Rectifier C unit (PB-1717)

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14. BIAS ADJUSTMENT

The final amplifier bias must be checked to ensure linearity and normal operating plate dissipation for the final amplifier tubes. Adjust the BIAS control VR₁₀₀₁ on PB-1708 as follows: set the transceiver in the receive mode and allow the tubes to reach normal operating temperature. Set the MODE switch to USB, the METER switch to IC, and the VOX GAIN control to MOX, so as to activate the transmitter. The meter will then indicate cathode current for the PA tubes. The idling cathode current is 50 mA if the bias is correct (25 mA for the SD model). If the idling cathode current is other than 50 mA, adjust the BIAS control VR₁₀₀₁ for the correct value.



Rectifier A unit (PB-1708)

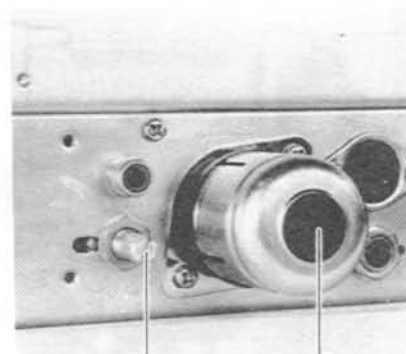
15. POWER OUTPUT METER ADJUSTMENT

VR₇, located on the transceiver rear panel adjacent to the RCV ANT jack, provides adjustment for the relative power output indication on the front panel meter.

With the transceiver tuned at full power into a 50 Ohm dummy load, VR₇ should be adjusted to indicate 1/2 to 2/3 full scale meter deflection, with the METER switch in the PO position.

It should be noted that the PO meter indicates relative power output, and it is not the basis for determining actual power output.

VR₇ has been preset at the factory to read 1/2 to 2/3 full scale into a 50 Ohm dummy load. The operator should not indiscriminately adjust VR₇ while using an unknown load or antenna of possibly high VSWR.



PO Meter Adjust (VR₇) Accessory Plug

16. FINAL AMPLIFIER NEUTRALIZATION

When replacing the final amplifier tubes, it may be necessary to reset the bias to give the correct idling current, and to check neutralization. Using the procedure outlined below will guarantee maximum output and long tube life.

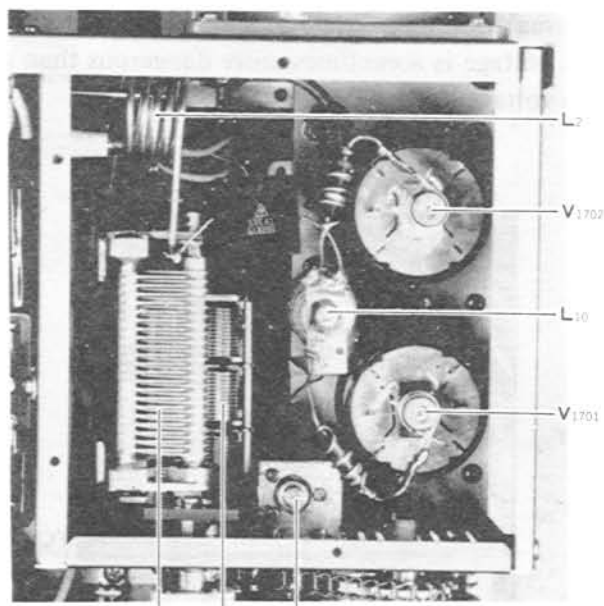
CAUTION

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.

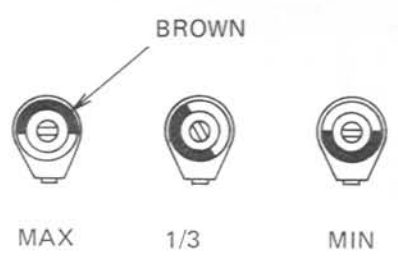
- (1) Connect a dummy load to the antenna receptacle, and set the METER switch to IC.
- (2) Locate TC₀₁, the neutralization variable capacitor shaft, on the inside wall of the final amplifier compartment.
- (3) Check the final amplifier idling current as described in part 7 of this section of the manual (BIAS ADJUSTMENT).
- (4) Tune up the transceiver at 29 MHz, using either the 10B or 10C band, and adjust the carrier level so that it is 150 mA in the TUNE condition.

- (5) Rotate the PLATE tuning control and observe the point of minimum current ("dip") If the dip is not prominent, reduce the LOADING control slightly to get a better dip. As the PLATE control is rotated the meter should rise equally and smoothly on either side of the dip.
- (6) Determine which side of the dip rises abruptly. Set the PLATE control slightly to this side of the dip, keep the meter reading below 100 mA.
- (7) Using a nonmetallic tuning wand, rotate the neutralization capacitor shaft very slightly in the direction which reduces the current on the meter. Repeat steps 6 and 7 until the meter indicates a smooth and equal rise on either side of the dip.

NOTE: The final amplifier compartment cover must be in place to supply the RF shielding required during the neutralization procedure.



Final Amplifier Compartment



ALIGNMENT OF TRANSMITTER MIXER/DRIVER AND RECEIVER FRONT END STAGE

- (1) Connect a dummy load/wattmeter to the rear panel ANT jack.
- (2) Set the RF/AF gain controls fully clockwise, set the MODE switch to FSK, and set TC₂₅₀₆ to the 1/3 capacitance setting, as shown in Fig. 1 .
- (3) Set the BAND switch to 10D, set the main tuning dial for a reading of 30.000 MHz, and set the PRESELECT control to the upper end of the 10 meter band (fully clockwise). Set the LOAD control to 3, and dip the PLATE CONTROL while tuning.
- (4) Set the CARR control to the 12 o'clock position. Set the VOX GAIN control to MOX (for not more than 10 seconds), and carefully adjust T₂ and T₃ for maximum IC reading on the meter. Be sure that the bonding agent has been removed before you adjust the cores.
- (5) While receiving, set the MARKER switch ON, and tune to the calibrator signal. Adjust T₁ for maximum S-meter deflection.
- (6) Now set the BAND switch to 10A, set the VFO for a display frequency of 28.000 MHz, and peak the PRESELECT control for maximum PO while tuning. Dip the PLATE control for minimum IC indication. Now set the VOX GAIN switch to MOX, and adjust TC₂₅₀₆ maximum IC indication on the meter (FSK mode, still).
- (7) Set the MARKER switch ON, and tune to the calibrator signal. Peak TC₂₄₀₆ for maximum S-meter deflection.
- (8) As there may be some interaction of adjustments, please repeat steps (3) through (7).
- (9) Adjust the final amplifier neutralization, as described on page 3-30.
- (10) Again repeat steps (3) through (8).
- (11) Now you are ready to align the other bands. Set the BAND switch to 15, set the main tuning dial for a reading of 21.000 MHz, and set the PRESELECT control at 8.6 on its scale. Dip the PLATE control for minimum IC indication while tuning. Set the VOX GAIN control to MOX, and adjust TC₂₆₀₅

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and TC₂₅₀₅ for maximum PO indication on the meter. On receive, tune in the MARKER signal, and adjust TC₂₄₀₅ for maximum S-meter deflection.

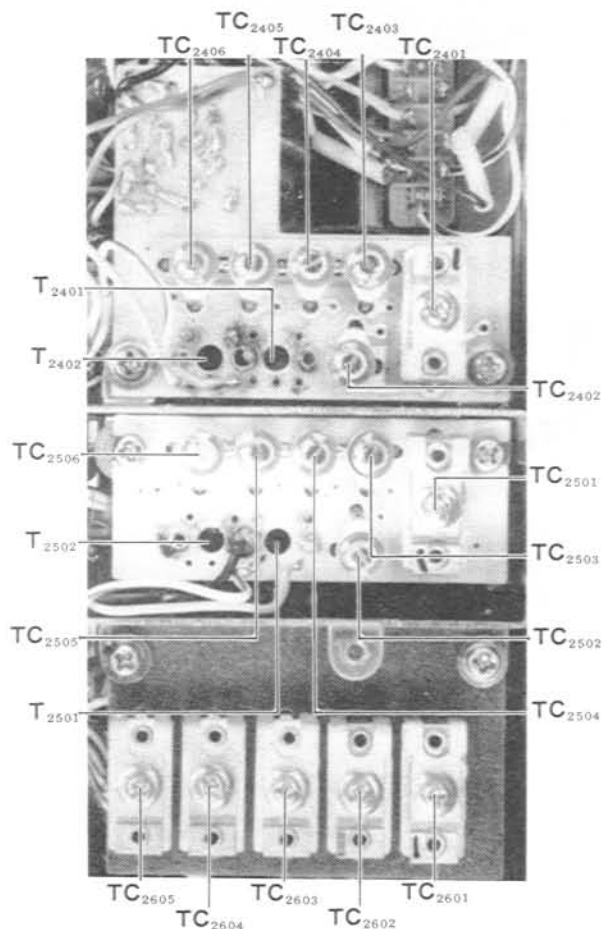
- (12) Set the BAND switch to 20, set the VFO for a frequency of 14.000 MHz, and set the PRESELECT control to 7.2 on its scale. Dip the PLATE control for minimum IC indication while tuning. Set the VOX GAIN control to MOX, and adjust TC₂₆₀₄ for maximum PO indication on the meter. On receive, tune in the MARKER signal, and adjust TC₂₄₀₄ for maximum S-meter deflection.
- (13) Set the BAND switch to 80, tune the main dial for a reading of 4.000 MHz, and set the PRESELECT control to 6 on its scale. Dip the PLATE control for minimum IC indication while tuning. Set the VOX GAIN control to MOX, and adjust L₉ and T₂₅₀₁ for maximum PO indication on the meter. On receive, tune in the MARKER signal, and adjust T₂₄₀₁ for maximum S-meter deflection.
- (14) Set the main tuning dial for a reading of 3.500 MHz, and set the PRESELECT control to 2 on its scale. Dip the PLATE control for minimum IC indication while tuning. Set the VOX GAIN control to MOX, and adjust TC₂₆₀₂ and TC₂₅₀₂ for maximum PO indication on the meter. On receive, tune in the MARKER signal, and adjust TC₂₄₀₂ for maximum S-meter deflection.
- (15) Because of possible interaction of adjustments, please repeat steps (13) and (14).
- (16) Set the BAND switch to 40, tune the main dial for a reading of 7.200 MHz, and set the PRESELECT control to 6.5 on its scale. Dip the PLATE control for a minimum IC reading while tuning. Set the VOX GAIN control to MOX, and adjust TC₂₆₀₃ and TC₂₅₀₃ for maximum PO indication on the meter. On receive, tune in the MARKER signal, and adjust TC₂₄₀₃ for maximum S-meter deflection.

ADVICE ON TROUBLESHOOTING
THE DRIVER/FINAL STAGES

Three tubes are used in the FT-901DM: a 12BY7A and two 6146B's, run in parallel in the final.

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 quickly 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.

If you **should** come into contact with the high voltage, it is best to take a break from servicing. Alert your colleagues to what happened, and 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!**



FAULT IDENTIFICATION AND LOCALIZATION

The process of troubleshooting any electronic equipment 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 transformers smell differently than resistors, etc. If you do find a component that is cooked, remember that another fault may have caused the destruction of the part you have located.

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 is to determine the missing function (no RX on LSB), then the board at fault (CARRIER UNIT), then the bad circuit (LSB oscillator), then the malfunctioning part (X701).

If, after the receiver inspection is completed, all appears 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). Use only a dummy load. **NEVER** troubleshoot using an antenna.

In this manual, we will provide troubleshooting advice which leads you directly to suspect components. As there are some 2,800 parts in the FT-901DM, though, it obviously is impossible for us to trace the path of every possible malfunction in the radio. Therefore, if your tips do not lead to identification of the trouble, the logical elimination process is the way to go.

In all troubleshooting, an “extender board” is essential for quick and easy voltage testing. A major advantage of Yaesu equipment from a service standpoint is that you don’t have to snake a probe into the innards of a rat’s nest of wires to get to a critical test point. With the plug-in circuit boards, you can quickly examine a board and move on to another potential trouble area. But don’t be without extender boards if you do any servicing. They’re cheap, and they cut service time dramatically.



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 a non-inductive sponge.

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 level 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.

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 examples of 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 two above defects.

2. ELECTRICAL DEFECTS

Typical electrical defects encountered are:

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

3. OTHERS

Among the miscellaneous types of failures or difficulties encountered are:

- a) Antenna troubles – be on the alert for antenna problems when the owner of the just-aligned transceiver complains of difficulty “when I switch to the antenna.”
- b) Poor power source – extremely high or low voltage, insufficient capacity, poor regulation, etc.
- c) Murphy's Law – use of a non-Yaesu microphone with different connections, for example. (See page 1-22.)

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

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 $D_{1401} - D_{1404}$ * High voltage line shorted * Short in 6146B electrodes * Defective $D_{1001} - D_{1002}$ in 13.6 VDC line * Defective $D_{1003}, D_{1004}, D_{1801}, D_{1802}$ 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 $R_{1005}, R_{1703}, L_{1701}$ * 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 C_{1701} * Leakage or short at C_{04}
	(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 $D_{1001} - D_{1004}, D_{1801}, D_{1802}$
	(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 TA7205AP or 2SC1000GR on PB-1705 * Defective audio circuit around above transistor/IC * Defective EXT SP jack
	(b) No audio output on some mode:	
	LSB/FSK	* Defective X ₇₀₁
	USB/CW	* Defective X ₇₀₂
	AM	<ul style="list-style-type: none"> * Defective D₄₀₇ (PB-1704) * Defective Q₅₀₇ (PB-1705)
	FM	* Defective Q ₉₀₁ - Q ₉₀₄
	Some mode	* Defective mode switch or cold solder joint on switch
	(c) No audio output, S-meter off scale	<ul style="list-style-type: none"> * Defective RF GAIN control * Defective Q₄₀₇, Q₄₀₈
	(d) Speaker appears OK, no S-meter deflection	<ul style="list-style-type: none"> * Defective RL₁, Q₄₀₇, VR₂ * Defective 19.7475 MHz xtal * Defective Q₄₀₅, Q₄₀₆ (PB-1704) * Defective Q₃₀₃ (PB-1716) * Defective Q₂₁₂ (PB-1703) * Defective Q₁₀₁ - Q₁₀₅ (PB-1702) * Defective Q₃₀₁, Q₃₀₂, Q₃₀₅ (PB-1716) * Defective Q₄₀₁ - Q₄₀₄, Q₄₀₉, Q₄₁₉ (PB-1704)
	(e) MARKER ON, only slight S-meter deflection on the marker signal	<ul style="list-style-type: none"> * Low VCO output (see section on COMMON CIRCUITS) * Defective T₁, T₂₄₀₂, or C₂₄₀₆ * Check tuning or T₁₀₂, T₃₀₁ - T₃₀₃, T₄₀₁ - T₄₀₄ * Tracking error in RF coils * Defective XF₃₀₂ - XF₃₀₄ or XF₄₀₁
	(f) Normal S-meter deflection against marker signal (S9 +10 dB nominal)	<ul style="list-style-type: none"> * Defective RH-1 (lamp fuse) * Defective RL₂ * Defective S₂₁₀₃

SERVICING

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(3) Partial reception	(a) Poor reception on one or more bands (some bands OK)	<ul style="list-style-type: none"> * Low VCO output or VCO unlocked (see section on COMMON CIRCUITS) * Defective band switch * Defective TC₂₄₀₁ (160m)–TC₂₄₀₆ (10m), C₂₄₀₁ (160m)–C₂₄₀₆ (10m)
(4) Self-oscillation on receive	<p>(a) Oscillation with HEATER switch on</p> <p>(b) Oscillation with HEATER switch either on or off</p>	<ul style="list-style-type: none"> * Defective 6146B, R₁₀₀₅, R₁₇₀₃, L₁₇₀₁ * Defective L₁₇₀₁, C₀₄ * Defective R₁₃, R₁₄, R₁₆₀₁, R₁₆₀₂, C₈₄, C₁₁₀₁ * Defective Q₁₈₀₄, Q₁₈₀₅ (PB-1717) * TX 12V line shorted to RX 12V line. Check at each board, TX/RX switching diodes and switches
(5) Marker inoperative	<p>(a) RX OK, no marker signal heard</p> <p>(b) 25 kHz marker inoperative</p>	<ul style="list-style-type: none"> * Defective NB/MARK switch Check voltage at pin 4 of PB-1846 and PB-1685. Should be 12 volts nominally * Defective X₆₀₁ * Defective Q₆₁₂ * Defective D₆₀₆ * Defective S₆₀₁
(6) REJECT inoperative	(a) No notch action	<ul style="list-style-type: none"> * Defective RL₄₀₁ * Defective X₄₀₁ * Defective D₄₀₆ * Defective Q₄₁₁ * Defective REJECT switch
(7) APF inoperative	(a) Low or no output, serious distortion	<ul style="list-style-type: none"> * Defective Q₅₀₄, Q₅₀₅, Q₅₀₆

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_{02}, L_{13}. Shorted VC_{01}, VC_2. Defective C_{70}, C_{47} * Low bands only: Defective $C_{07}-C_{09}, C_{39}$ * Defective RL_2 * Open D_6
	(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, or mode switch
	(d) Idling IC OK, but no drive	<ul style="list-style-type: none"> * Defective 12BY7A * No screen voltage because of defective $R_{1603}, C_{1806}, R_{1807}$, or R_{1808} * Defective Q_{106}, Q_{107}, or Q_{203}
(2) Poor TX performance	(a) No power output on LSB only	<ul style="list-style-type: none"> * Defective X_{701}
	(b) No power output on USB only	<ul style="list-style-type: none"> * Defective X_{702}
	(c) No power output on both USB/LSB	<ul style="list-style-type: none"> * Defective RL_{701}, Q_{705} * No vox operation: defective or grounded MIC or PATCH jack * Defective Q_{708} or C_{709}
	(d) No power output on CW/FSK/AM/TUNE	<ul style="list-style-type: none"> * Defective $X_{703}, Q_{704}, Q_{201}$
	(e) Keyer OK, but no CW keying	<ul style="list-style-type: none"> * Defective mode switch, Q_{1803}, and associated circuit * Defective D_{605} if carrier hangs up.

	<p>(f) No modulation on AM</p> <p>(g) No output on FM</p> <p>(h) No modulation on FM</p> <p>(i) No FSK shift</p>	<p>* Defective Q₇₁₀</p> <p>* Defective X₉₀₂, Q₉₁₂, Q₉₁₃</p> <p>* Defective T₉₀₂, D₉₀₈, D₉₁₄</p> <p>* Defective Q₇₀₁, defective or misaligned TC₇₀₃, TC₇₀₄</p> <p>* FSK jack grounded</p>
(3) Abnormal meter operation	<p>(a) Cannot set ALC meter to full scale</p> <p>(b) ALC meter does not function</p> <p>(c) Power output OK, no IC meter indication</p> <p>(d) Power output OK, PO meter does not function</p>	<p>* Defective C₁₀₀₈</p> <p>* Defective Q₂₀₃, VR₂₀₁</p> <p>* Defective meter switch or RL₁</p> <p>* Defective 12BY7A</p> <p>* ALC line shorted to ground</p> <p>* Defective D₁₀₀₅, D₁₀₀₆</p> <p>* Driver, IF stages require realignment</p> <p>* Defective R₀₆ or meter switch</p> <p>* Defective RL₁</p> <p>* Improper setting of VR₇</p> <p>* Defective C₁₁, C₁₉, C₂₄, C₄₁, L₁₁, D₁₁, VR₇, or mode switch</p>
(4) No changeover from RX to TX	<p>(a) TX OK in MOX position</p> <p>(b) No TX in MOX position</p> <p>(c) VOX inoperative</p>	<p>* Failure in MIC or PTT line</p> <p>* Loose MIC jack or plug connection</p> <p>* Defective VR₁</p> <p>* Defective RL₁, D₅</p> <p>* If CW semi-break-in is OK, then Q₆₀₈ defective</p> <p>* If no CW semi-break-in, check Q₆₀₁ - Q₆₀₇, Q₆₀₉, Q₆₁₀</p>
(5) No return to RX from TX		<p>* PTT line grounded</p> <p>* Defective Q₆₀₇</p> <p>* Defective Q₆₀₂ - Q₆₀₄, Q₆₀₆</p> <p>* Defective keyer unit (CW)</p>

(6) Fuse blows on transmit	(a) OK on RX	<ul style="list-style-type: none"> * TX 12V or TX 8V line grounded * Insufficient bias voltage on 6146B * Defective D₅ or D₇
(7) TX self-oscillation	(a) OK on receive	<ul style="list-style-type: none"> * Neutralization of final tubes required * Defective C₁₆, C₃₀, C₈₇, C₁₆₀₅ * RX 12V line shorted to TX 12V or TX 8V line only on TX
(8) RF processor trouble	(a) Low or no output with processor on	<ul style="list-style-type: none"> * Processor switch defective * Defective XF₂₀₁ * Defective Q₂₀₅, Q₂₀₆, Q₂₀₇
(9) Monitor trouble	(a) Inoperative	<ul style="list-style-type: none"> * Defective APF/MONI switch or loose contact * Defective R515
(10) Keyer trouble	<p>(a) Keyer not functioning</p> <p>(b) Key-down all the time or string of dots, etc.</p> <p>(c) Side tone normal, but carrier hangs on for 2–3 seconds.</p>	<ul style="list-style-type: none"> * Defective Q₂₇₀₁, Q₂₇₀₂ * Key line shorted to ground * Latch-up of 8043 IC. Replace IC and replace leaky C₂₇₀₆ (use 0.33 μf mylar or 2 back-to-back tantalum of 0.68 μf each). * Defective D₆₀₅

Problem	Condition	Probable Cause(s)
(1) Counter circuit	(a) Digital display does not work	<ul style="list-style-type: none"> * Defective Q₂₉₂₄ * 5V line in Counter Unit grounded * Defective display LED * Defective Q₂₉₁₇, Q₂₉₁₉, Q₂₉₂₂, Q₂₉₂₃ * Defective R₂₉₃₂–R₂₉₅₂
	(b) Four digits to the right read "000.0"	<ul style="list-style-type: none"> * VFO input not connected or is grounded * Defective Q₂₉₀₁–Q₂₉₀₅, Q₂₉₁₃, Q₂₉₁₅, Q₂₉₁₈, Q₂₉₂₅ * Defective 18.0 or 18.5 MHz crystal in counter * Defective 655.36 kHz crystal * Defective Q₂₉₁₂
	(c) Display unstable, all digits working OK	<ul style="list-style-type: none"> * PLL unlock. Refer to section on PLL trouble. * Defective 655.36 MHz crystal * Low VFO input (80–120 mV OK)
	(d) MHz display incorrect	<ul style="list-style-type: none"> * Check wiring between P₁₀/J₂₉₀₂ and band switch * Defective Q₂₉₁₀, Q₂₉₁₁, D₂₉₀₁–D₂₉₀₄, D₂₉₂₀–D₂₉₂₃
	(e) Display flickers	<ul style="list-style-type: none"> * Defective Q₂₉₁₆. * PLL or VCO problems. Refer to appropriate sections of this guide
(2) PLL, VCO circuits	(a) Display flickers	<ul style="list-style-type: none"> * T₁₂₀₁–T₁₂₀₈ require alignment * Loose connection on band switch * VCO not oscillating
	(b) No VCO output, all bands	<ul style="list-style-type: none"> * Defective Q₁₂₀₉–Q₁₂₁₂ * VCO output cable grounded or cut
	(c) No input signal—local, VCO, VFO—to PLL unit	<ul style="list-style-type: none"> * If no VCO signal, refer to (b), above * If no local signal, check local crystal and band switch * If no VFO signal and VFO LED is not lighted, check SELECT switch and

		<p>select relay; check wiring to pin 3 of P7 for short to ground; check Q_{1801}.</p> <p>* If no VFO signal, but VFO LED lights up, check PB-1726 and VFO unit</p>
(3) Indicators	<p>(a) APF LED does not work</p> <p>(b) REJECT LED does not work</p> <p>(c) CLARIFIER LED does not work</p> <p>(d) PROCESSOR LED does not work</p> <p>(e) TUNE LED does not work</p> <p>(f) MR LED does not work</p> <p>(g) TX MR LED does not work</p> <p>(h) RX MR LED does not work</p> <p>(i) VFO LED does not work</p> <p>(j) EXT LED does not work</p> <p>(k) M LED does not work</p>	<p>* Defective D_8, R_{2001}, or APF switch</p> <p>* Defective D_{2301}, R_{2301}, S_{2301}</p> <p>* Defective S_{2104}, S_{2105}, R_{2104}, D_{2101}</p> <p>* Defective R_{2108}, D_{2101}, S_{2102}</p> <p>* If TUNE relay does not operate, check RL_{2101}, R_{2110}, C_{2101}, D_{2164}, S_{2161}</p> <p>* If TUNE relay is working, check Q_{2102}, R_{2111}, R_{2112}, D_{2103}, D_{2107}</p> <p>* Defective LED or $S_{1901} - S_{1905}$</p> <p>* Defective LED or RL_{1901}, S_{1902}</p> <p>* Defective LED, RL_{1901}, S_{1903}</p> <p>* Defective LED, $S_{2103} - S_{2104}$, RL_{1901}</p> <p>* Defective LED, S_{1905}</p> <p>* Defective LED, R_{2203}, or memory unit.</p>

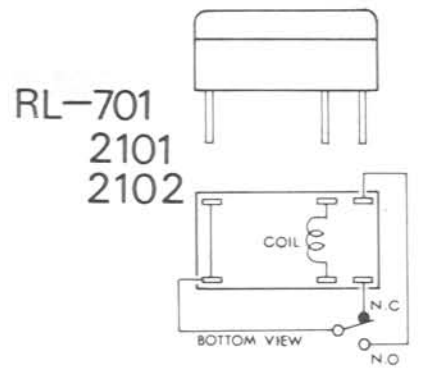
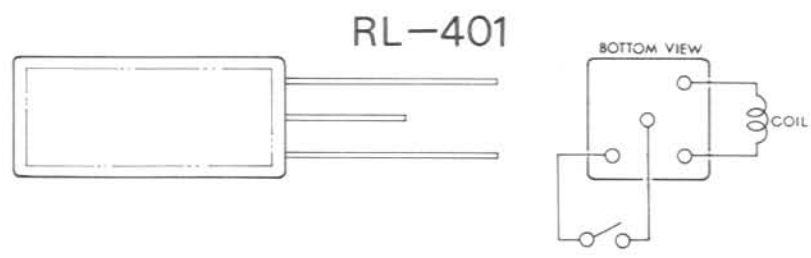
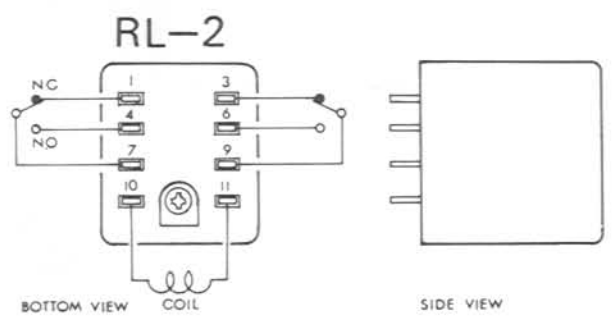
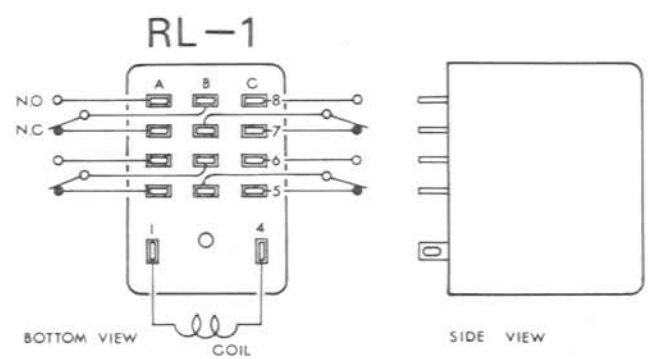
SERVICING

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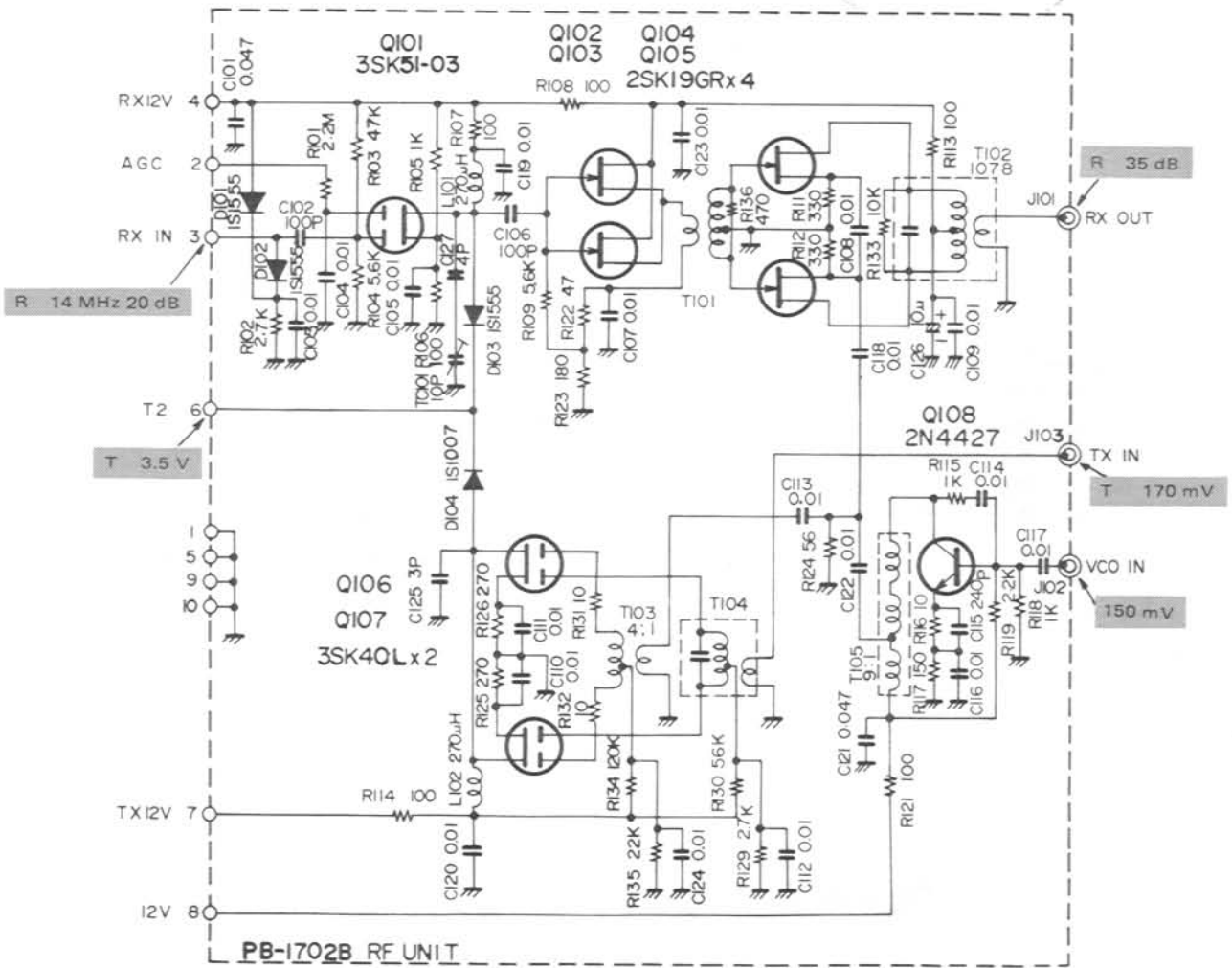
<p>(4) Clarifier</p>	<p>(a) Frequency jumps with clarifier on</p> <p>(b) OFF and "0" condition do not coincide in frequency</p> <p>(c) Frequency jumps with clarifier off, OK with clarifier on</p> <p>(d) Frequency jumps regardless of clarifier position</p>	<p>* Defective VR₀₆, R₆, R₂₁₀₃, S₂₁₀₅, RL₂₁₀₂</p> <p>* Defective VR₂₁₀₁, R₂₁₀₁, R₂₁₀₂, RL₂₁₀₁</p> <p>* Defective VR₂₁₀₁, R₂₁₀₁, R₂₁₀₂, S₂₁₀₅</p> <p>* Unstable 6V REG supply, check Q₁₈₀₁ and VR₁₈₀₁</p> <p>* Check VFO unit</p> <p>* Check VCO unit</p>
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RELAY CONNECTION INFORMATION

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



RF UNIT (PB-1702B)



SIGNAL LEVEL

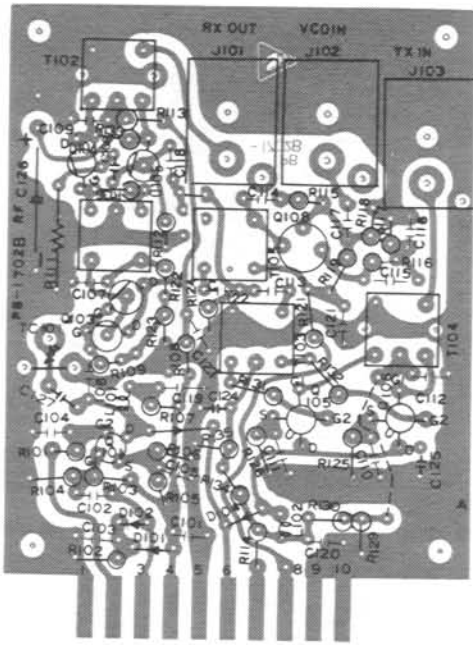
Tx : USB 14.0 MHz 1 kHz 5 mV MIC INPUT
Rx : USB 14.0 MHz S-9 Level
ANT: 18 dB

DC VOLTAGES

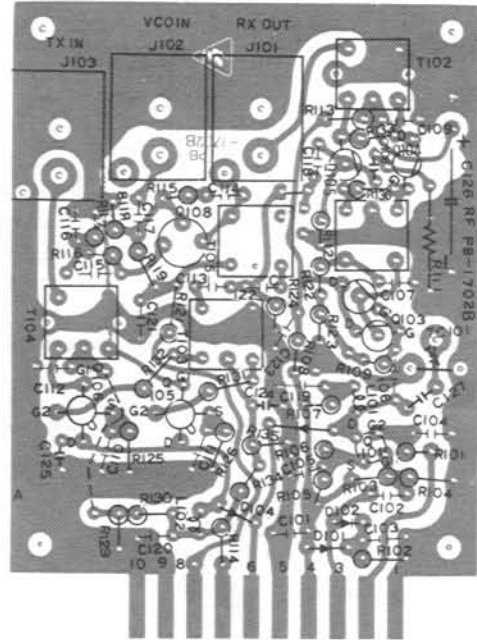
(V)

	E(S)		C(D)		B(G1)		(G2)	
	R	T	R	T	R	T	R	T
Q101	1.5	0	10.6	0	1.3	0	2.5	2.5
Q102	2.0	0	10.2	0	1.6	0	-	-
Q103	2.0	0	10.2	0	1.6	0	-	-
Q104	1.4	0	9.5	0	0	0	-	-
Q105	1.4	0	9.5	0	0	0		
Q106	0	0.9	0	10.3	0	0.5	0	1.6
Q107	0	0.9	0	10.3	0	0.5	0	1.6
Q108	2	2	8.7	8.7	2.7	2.7	-	-

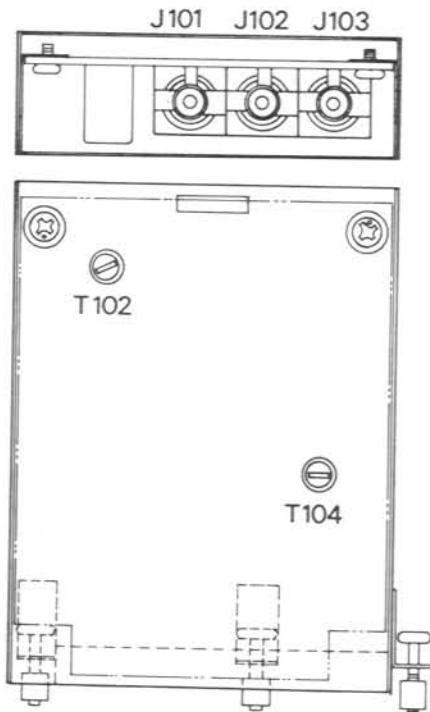
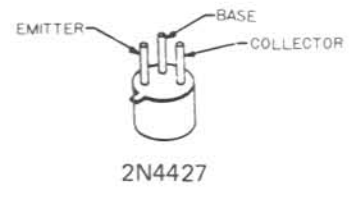
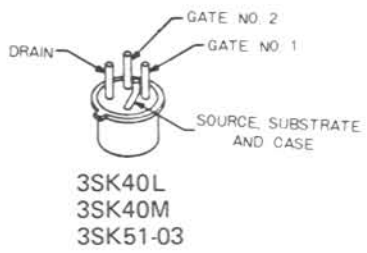
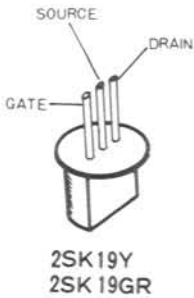
RF UNIT PARTS LAYOUT



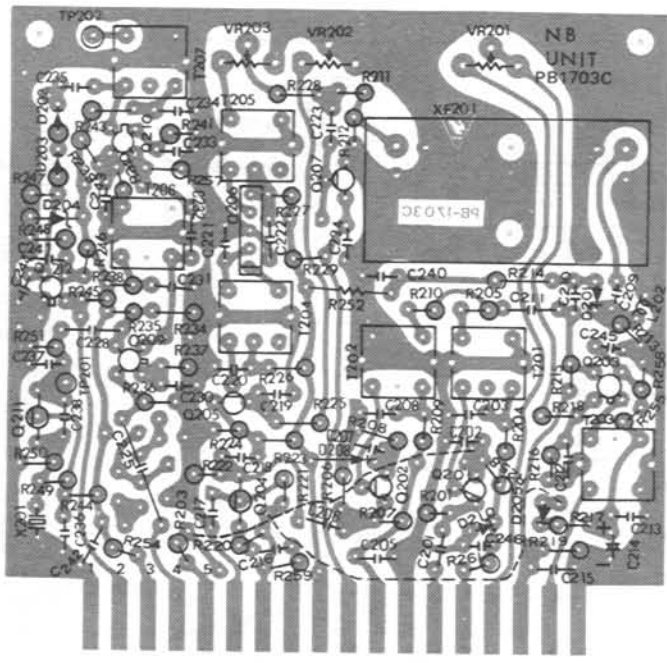
Viewed from component side



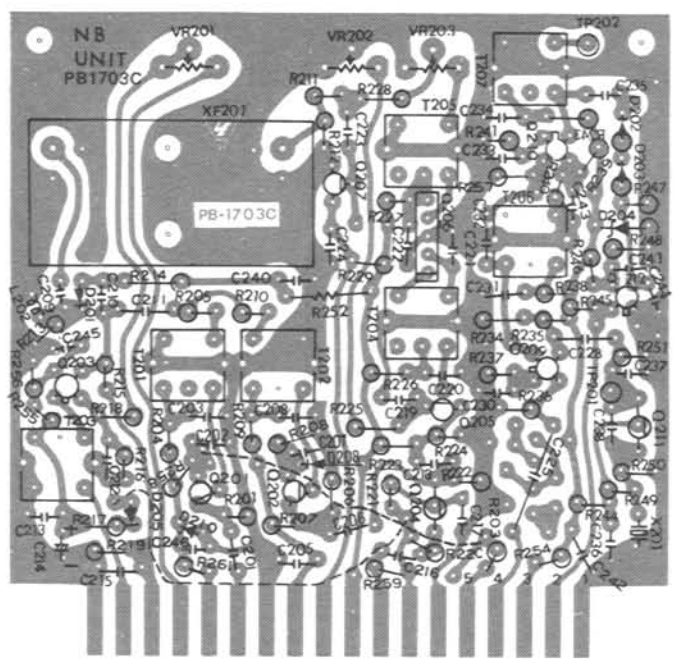
Viewed from solder side



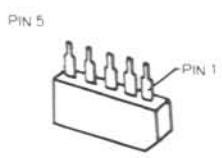
NB/PROC UNIT PARTS LAYOUT



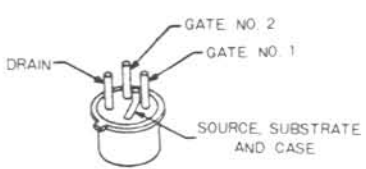
Viewed from component side



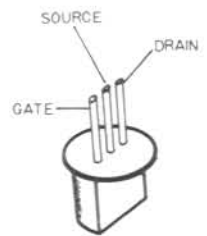
Viewed from solder side



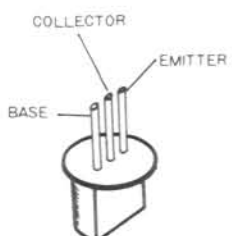
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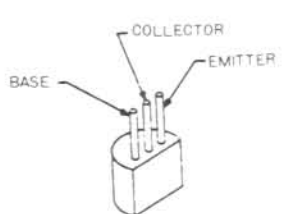
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 3SK59GR
 3SK51-03



2SK19GR

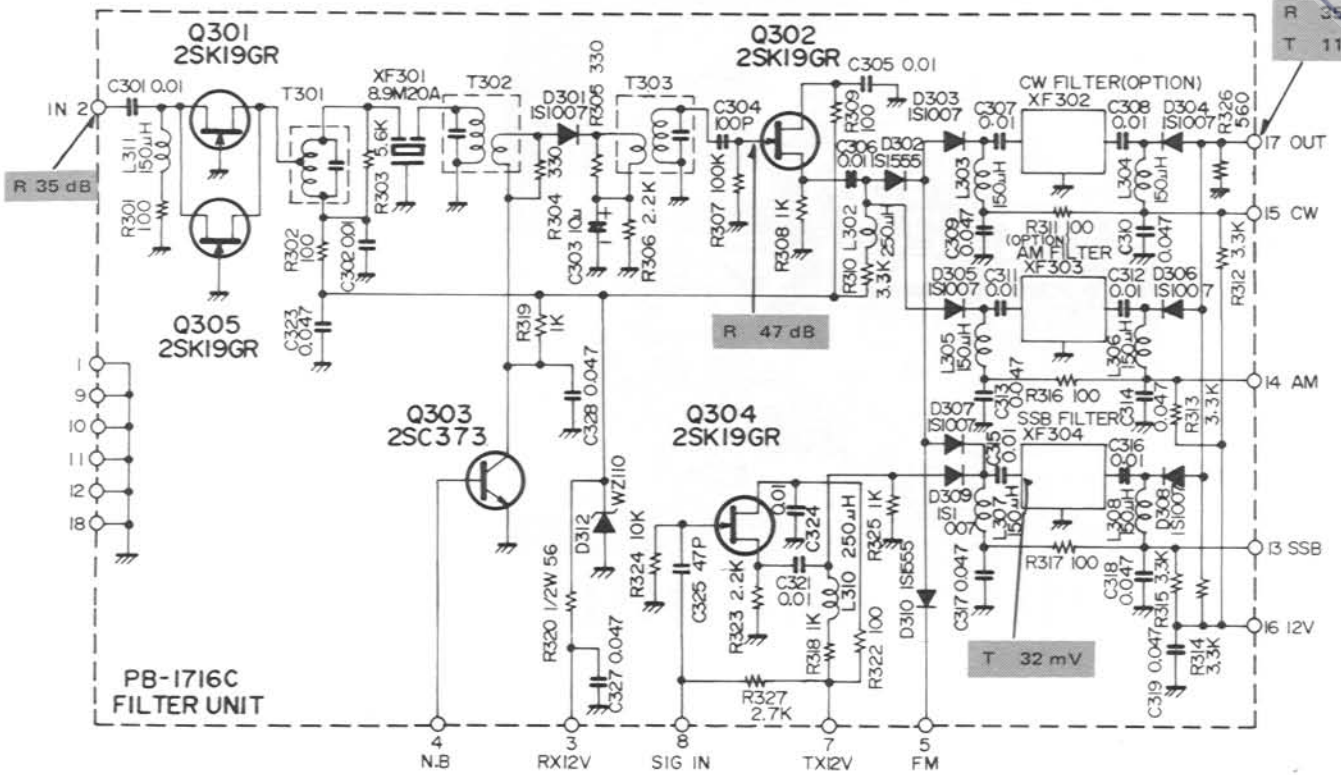


2SC372Y



2SC1815Y

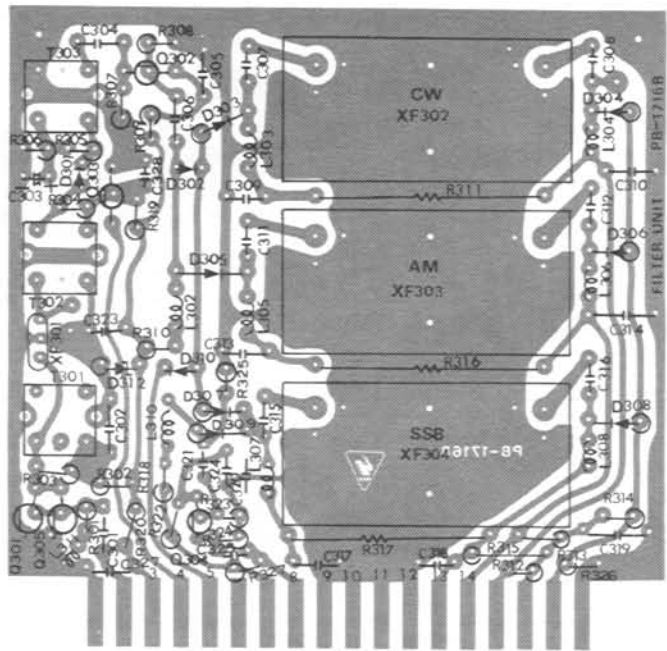
FILTER UNIT (PB-1716C)



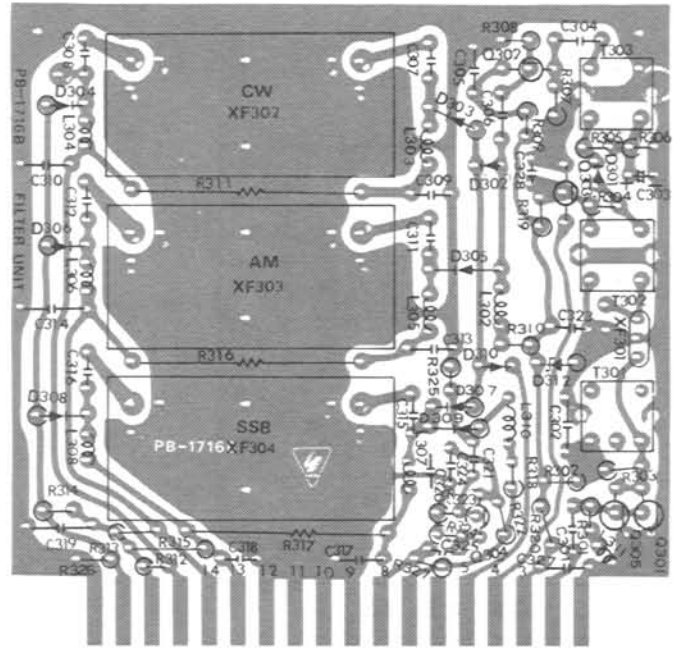
DC VOLTAGES (V)

	E(S)		C(D)		B(G1)	
	R	T	R	T	R	T
Q301	0.8	0	9.8	0	0	0
Q302	1.7	0	10.6	0	0	0
Q303	0	0	7.5	0	0	0
Q304	0	1.8	0	11.9	0	0
Q305	0.8	0	9.8	0	0	0

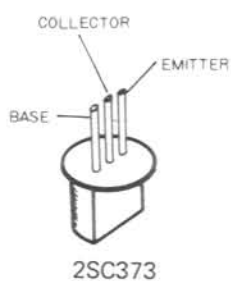
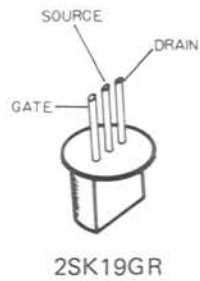
FILTER UNIT PARTS LAYOUT



Viewed from component side

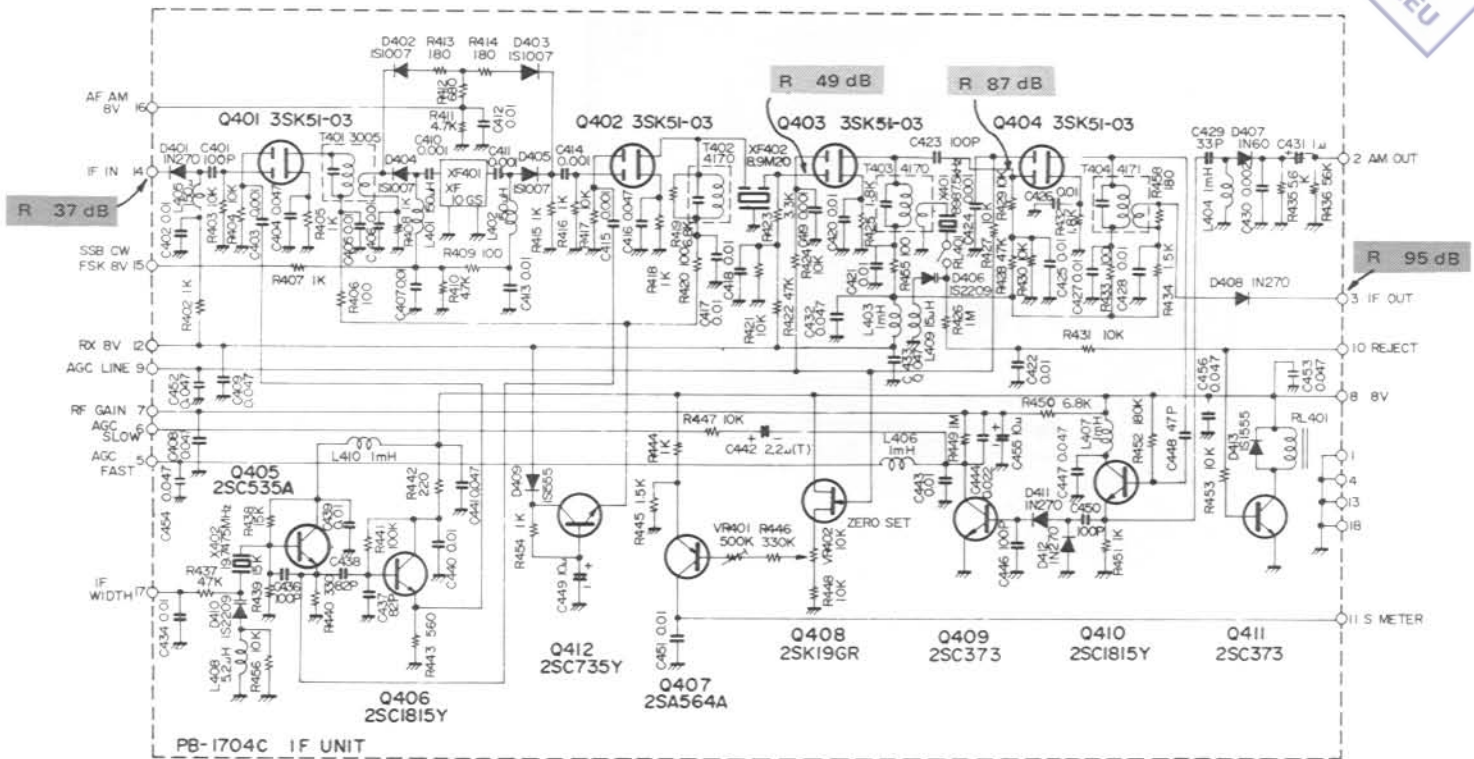


Viewed from solder side



IF UNIT (PB-1704C)

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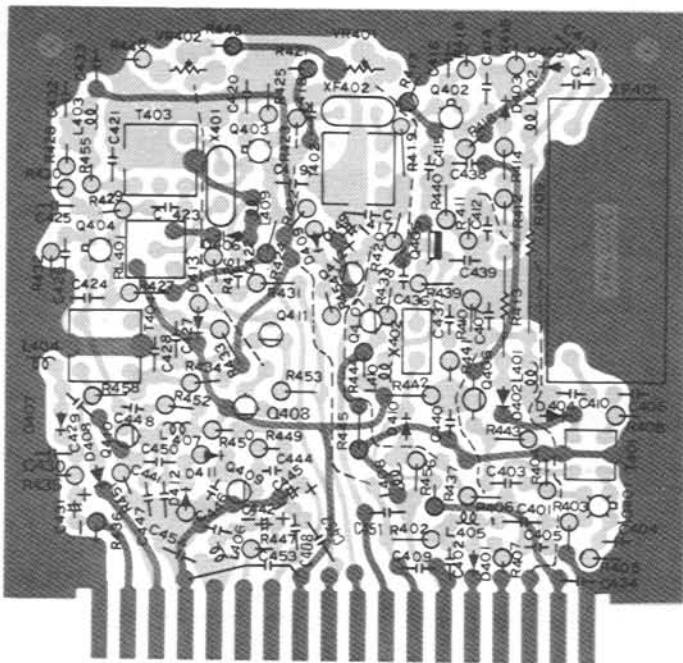
DC VOLTAGES (V)

	E(S)		C(D)		B(G ₁)		(G ₂)	
	R	T	R	T	R	T	R	T
Q401	0.5	0	6.8	0	0	0	0	0
Q402	0.5	0	6.8	0	0	0	0	0
Q403	2.0	0	8.0	0	1.7	0	2.9	2.9
Q404	2.0	0	8.0	0	1.4	0	2.9	2.9
Q405	2.4	2.4	8.0	8.0	2.4	2.4	—	—
Q406	3.2	3.2	7.0	7.0	3.8	3.8	—	—
Q407	5.0	5.0	0	3.9	4.3	4.3	—	—
Q403	5.2	5.2	8.2	8.2	3.0	3.0	—	—
Q409	0	0	3.0	3.0	0	0	—	—
Q410	3.8	3.8	8.0	8.0	4.5	4.5	—	—
Q211	0	0	0.15*	0.15	0.7	0.7	—	—
Q412	6.8	0	7.5	0.3	7.5	0.3	—	—

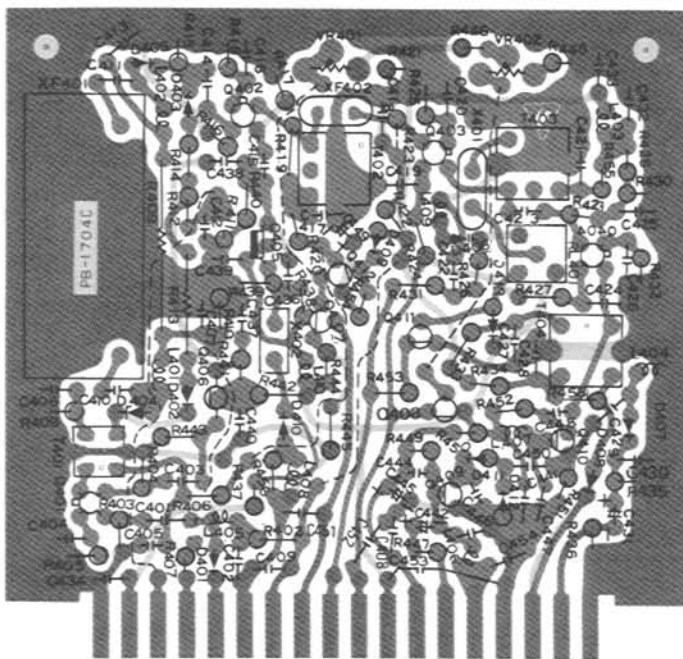
REJECT ON

* REJECT OFF 8.0 V

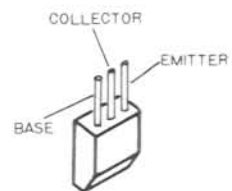
IF UNIT PARTS LAYOUT



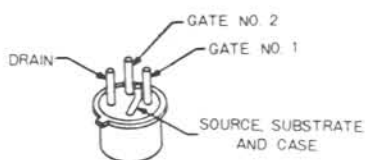
Viewed from component side



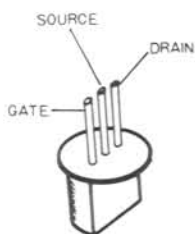
Viewed from solder side



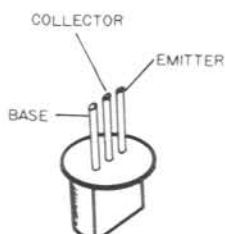
2SC535A



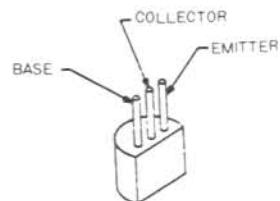
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3SK51-03



2SK19GR



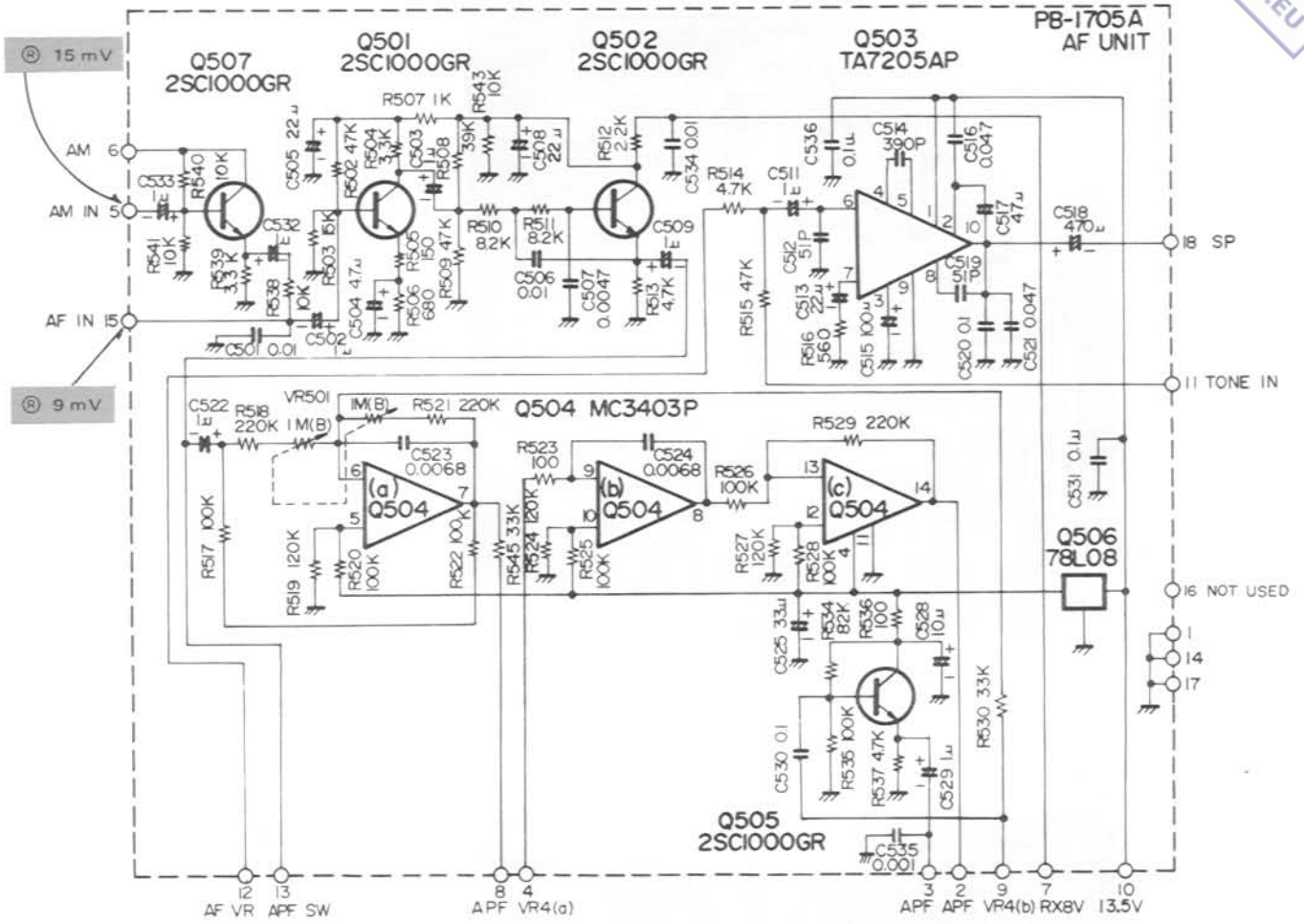
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2SA564A
2SC1815Y

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AF UNIT (PB-1705A)



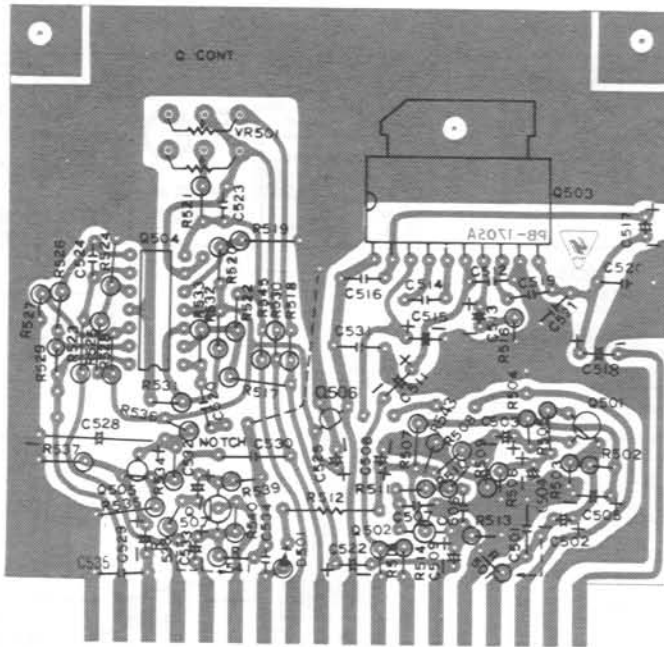
DC VOLTAGES (V)

	E		C		B		AM
	R	T	R	T	R	T	
Q501	0.7	0	2.8	0	1.4	0	
Q502	3.0	0	6.9	0	3.6	0	
Q505	3.6	3.6	8.0	8.0	4.3	4.3	
Q507	3.3	3.3	7.9	7.9	3.9	3.9	

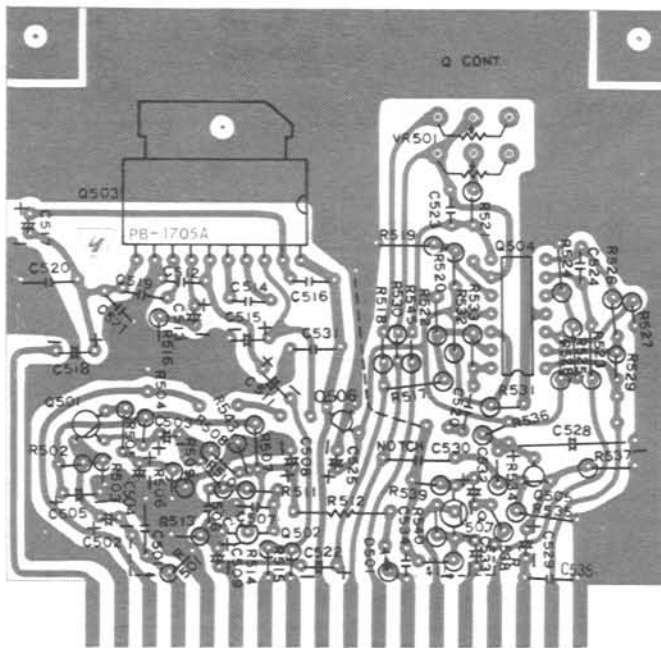
DC VOLTAGES (V)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Q503	R	14.9	13.8	4.2	8.6	1.5	3.6	3.6	1.2	0	7.3	-	-	-	-	
	T	14.9	13.8	4.2	8.6	1.5	3.6	3.6	1.2	0	7.3	-	-	-	-	
Q504	R	6.9	4.4	0.3	8.2	4.4	4.5	4.5	4.4	4.5	4.4	0	4.4	4.4	4.4	
	T	6.9	4.4	0.3	8.2	4.4	4.5	4.5	4.4	4.5	4.4	0	4.4	4.4	4.4	
		IN	OUT													
Q506		15	8.0													

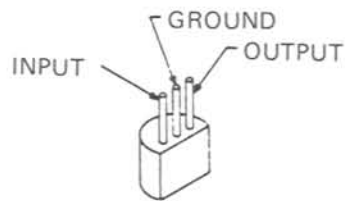
AF UNIT PARTS LAYOUT



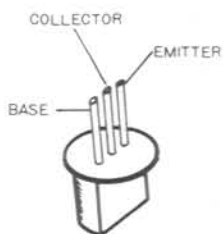
Viewed from component side



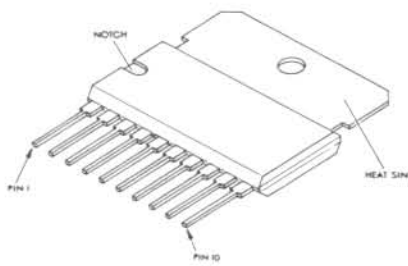
Viewed from solder side



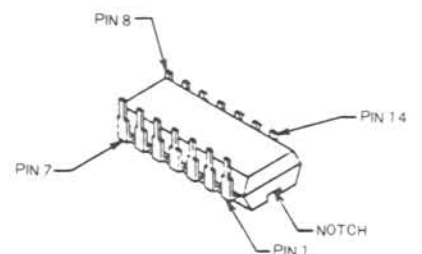
78L08



2SC1000GR



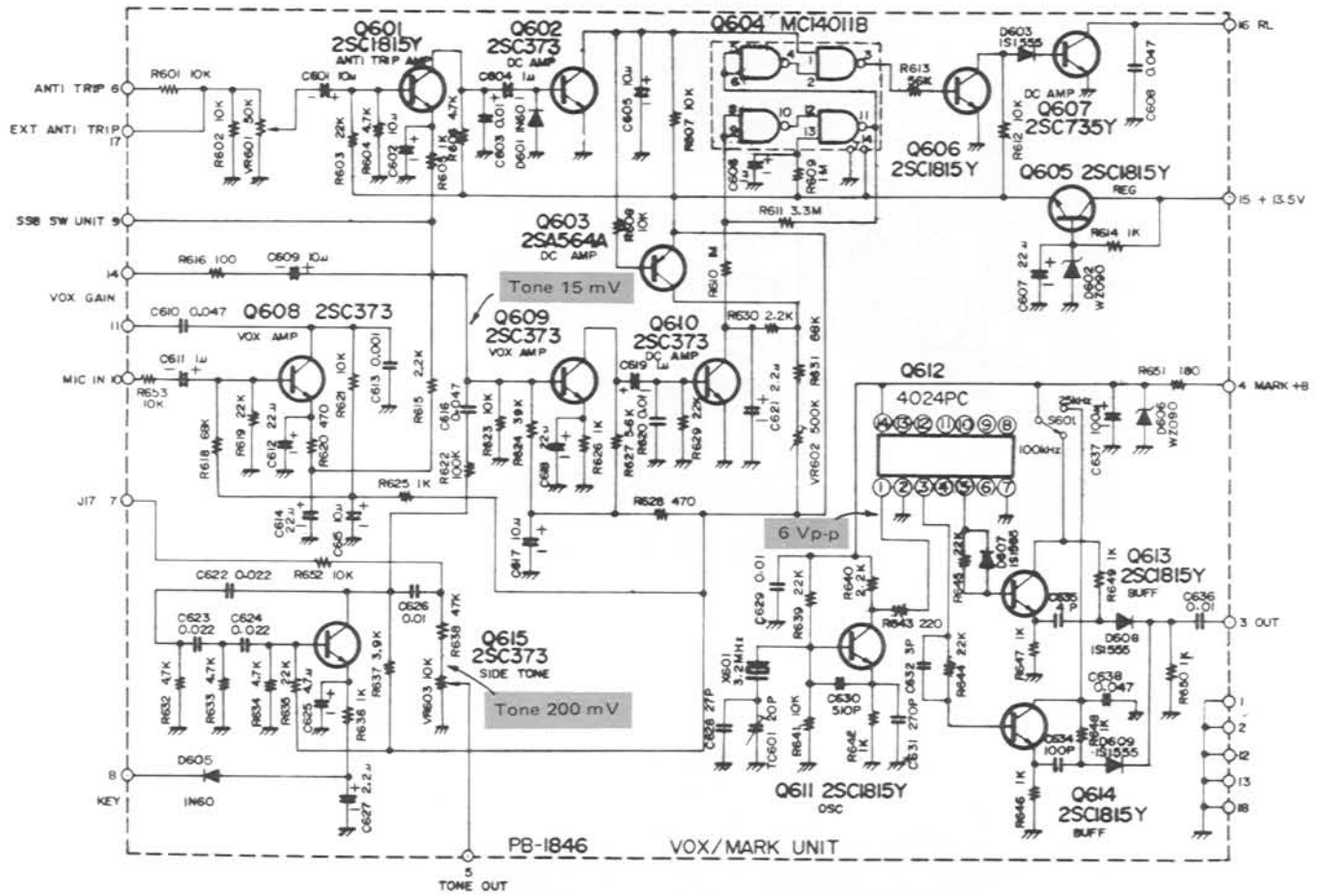
TA7205AP



MC3403P

VOX/MARKER UNIT (PB-1846)

(Early model PB-1685-3330)



DC VOLTAGES (V)

	E		C		B	
	R	T	R	T	R	T
Q601	0.7	0.7	4.6	4.6	1.4	1.4
Q602	0	0	8.3	8.3	0	0
Q603	8.3	8.3	8.2	8.2	8.3	8.3
Q605	8.9	8.9	12.0	12.0	8.3	8.3
Q606	0	0	0.03	0.03	0.7	0.7
Q607	0	0	12.0	0	0.14	0.11
Q608	1.2	1.2	3.4	3.4	1.8	1.8

DC VOLTAGES (V)

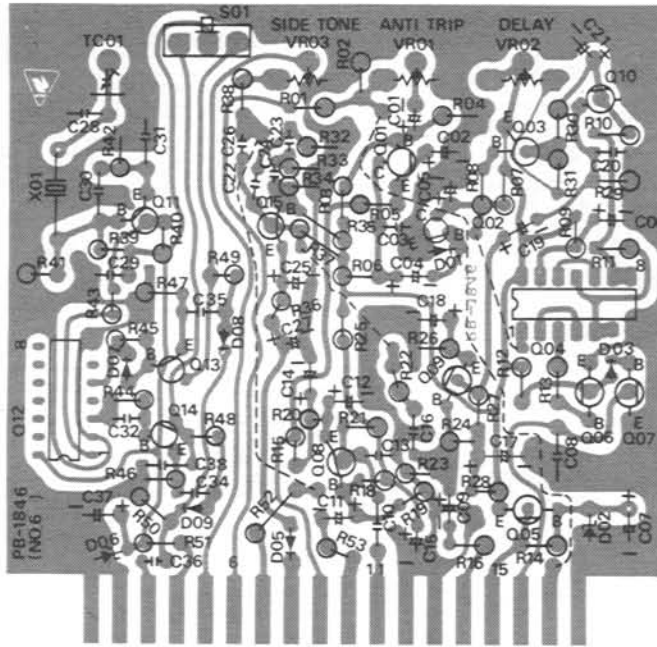
	E		C		B	
	R	T	R	T	R	T
Q609	0.9	0.9	2.6	2.6	1.6	1.6
Q610	0	0	8.2	8.2	0	0
Q611	1.8	1.8	4.5	4.5	2.4	2.4
Q613	3.7	3.7	9.0	9.0	2.9	2.9
Q614	3.6	3.6	9.0	9.0	4.0	4.0
Q615	0.9	0.9	8.3	8.3	1.5	1.5

MARK ON
25 kHz ON
100 kHz ON

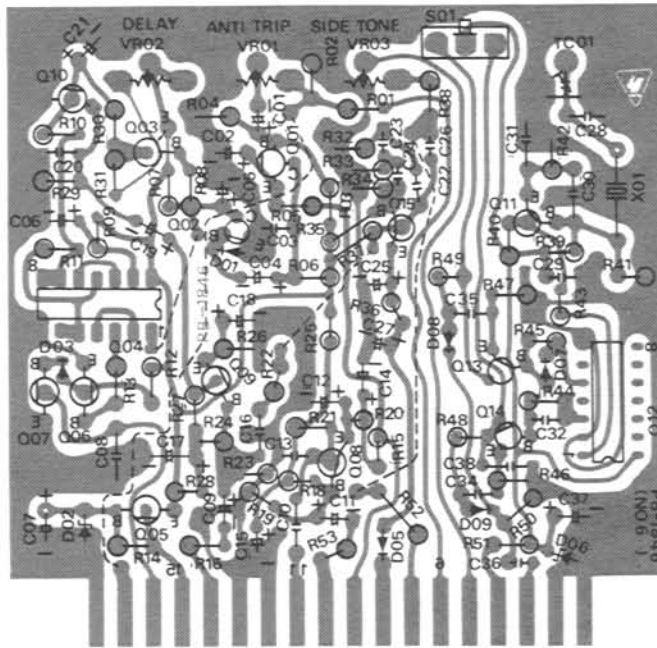
DC VOLTAGES (V)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Q604	R	8.3	0	8.2	0	8.3	8.3	0	7.6	7.6	0	8.3	0	7.4	8.3
	T	8.3	0	8.2	0	8.3	8.3	0	7.6	7.6	0	8.3	0	7.4	8.3
Q612	R	4.5	0	4.5	4.5	4.5	4.5	0	0	4.5	0	4.5	4.4	0	8.9
	T	4.5	0	4.5	4.5	4.5	4.5	0	0	4.5	0	4.5	4.4	0	8.9

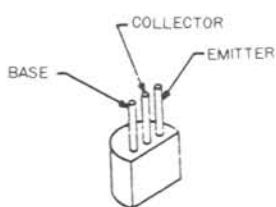
VOX/MARKER UNIT PARTS LAYOUT



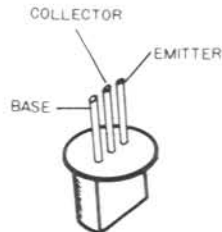
Viewed from component side



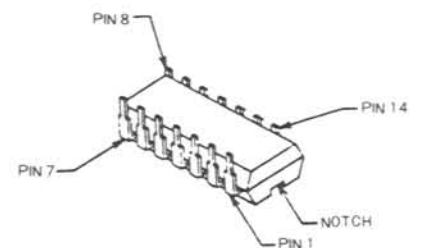
Viewed from solder side



2SA564A
 2SC1815Y



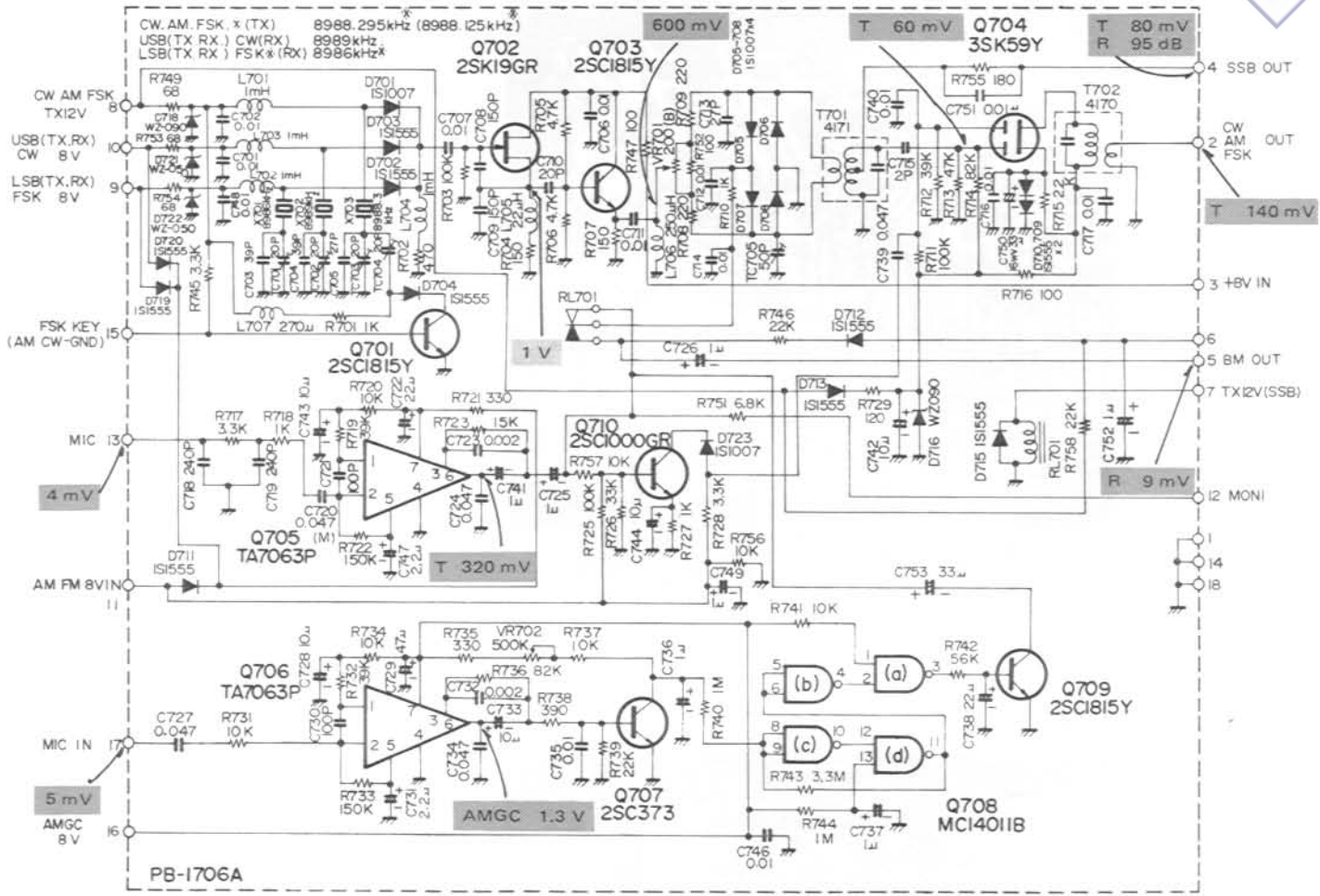
2SC373
 2SC735Y



MC14011B
 MC4024PC

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CARRIER UNIT (PB-1706A)



DC VOLTAGES (V)

	DC VOLTAGES (V)							
	E(S)		C(D)		B(G1)		(G2)	
	R	T	R	T	R	T	R	T
Q701	0	0.2	0	14.3	0	0.6	-	-
Q702	0.7	0.7	6.2	6.2	0	0	-	-
Q708	2.2	2.2	6.2	6.2	2.9	2.9	-	-
Q704	0	1.4	0	7.4	0	3.2	0	2.5
Q707	0	0	0.4	0.4	0	0	-	-
	0	0	8.0	8.0	0	0	-	-
Q709	0	0	0	0	0	0	-	-
	0	0	0	0	0.6	0.6	-	-
Q710	1.3	1.3	3.7	3.7	1.9	1.9	-	-
		1	2	3	4	5	6	7
Q705	R	1.4	0.6	0	0	0.7	4.4	7.0
	T	1.4	0.6	0	0	0.7	4.4	7.0
Q706	R	0.4	0	0	0	0	0	0.4
	T	0.4	0	0	0	0	0	0.4
	R	1.2	0.6	0	0	0.6	5.2	7.7
	T	1.2	0.6	0	0	0.6	5.2	7.7

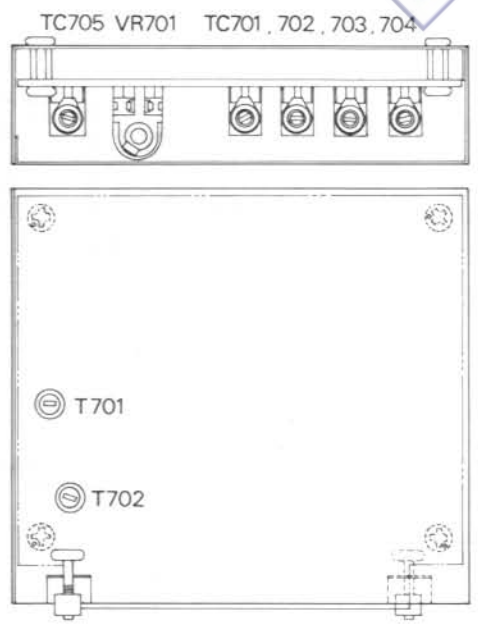
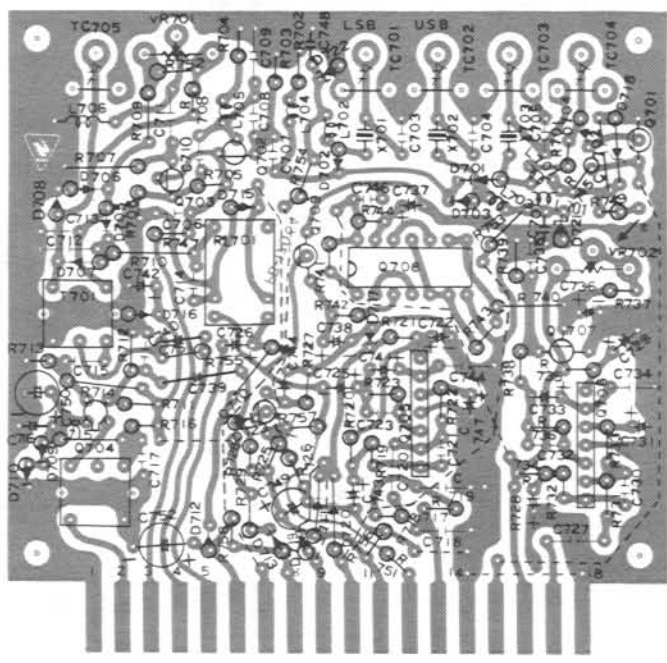
AMGC OFF
" ON
" OFF
" ON
AM

AMGC OFF
AMGC ON

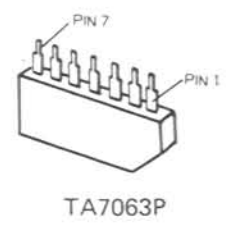
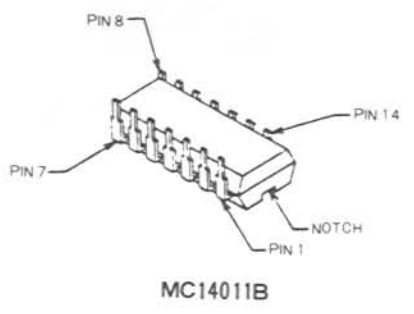
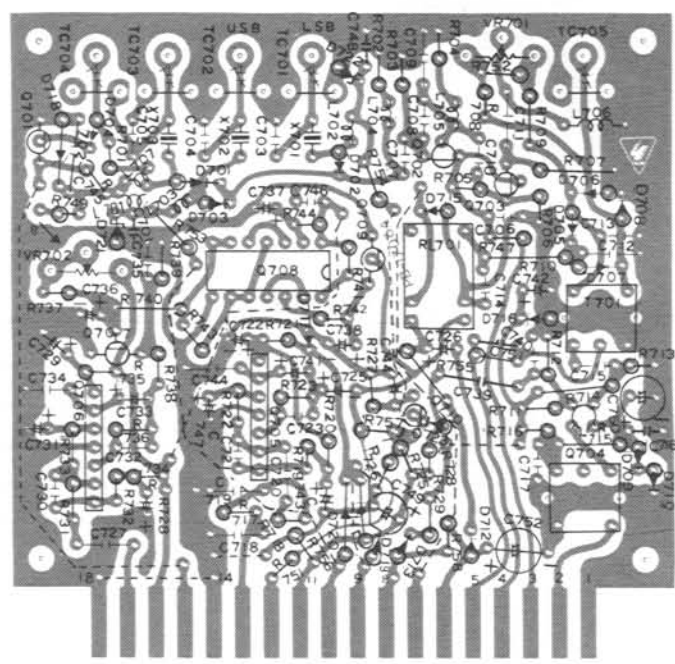
	DC VOLTAGES (V)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Q708	R	0.4	0	0.3	0	0.3	0.3	0	0.3	0.3	0	0.3	0	0.4	0
	T	0.4	0	0.3	0	0.3	0.3	0	0.3	0.3	0	0.3	0	0.4	0
Q708	R	8.2	0	8.2	0	8.2	8.2	0	7.5	7.5	0	8.2	0	7.4	8.2
	T	8.2	0	8.2	0	8.2	8.2	0	7.5	7.5	0	8.2	0	7.4	8.2

AMGC OFF
AMGC ON

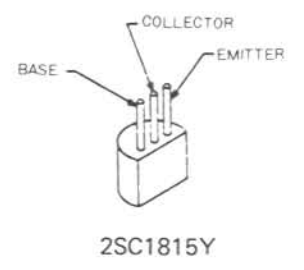
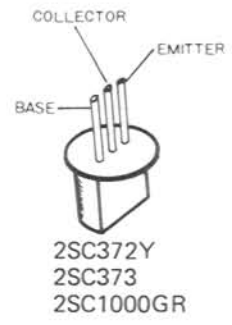
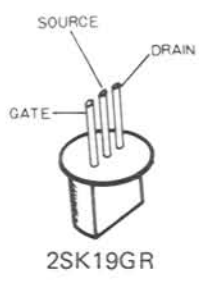
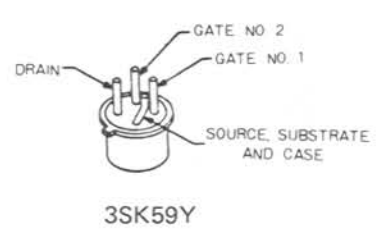
CARRIER UNIT PARTS LAYOUT



Viewed from component side

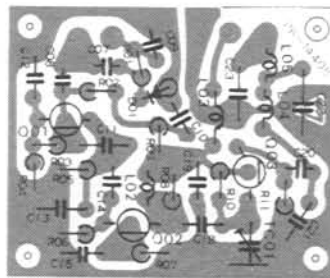
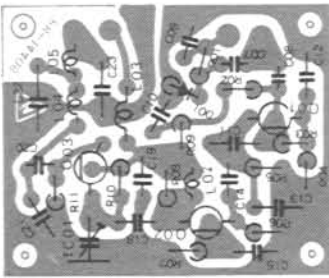
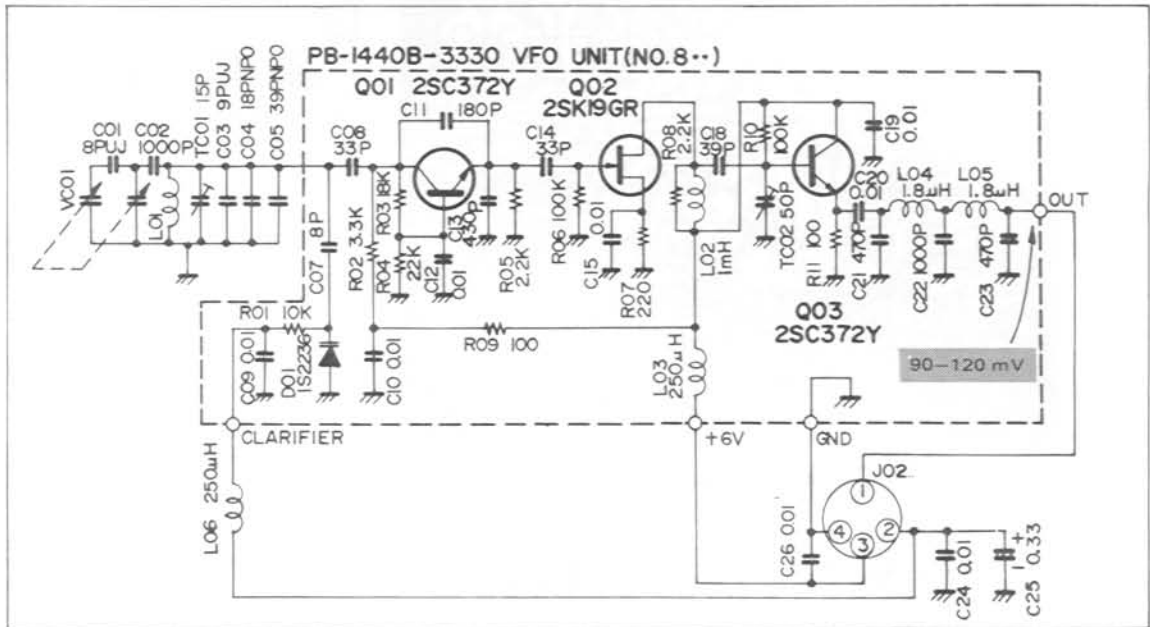


Viewed from solder side



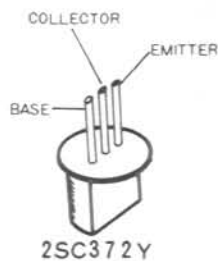
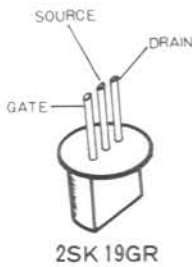
VFO ASSEMBLY

VFO BOARD (PB-1440B-3330)



Viewed from component side

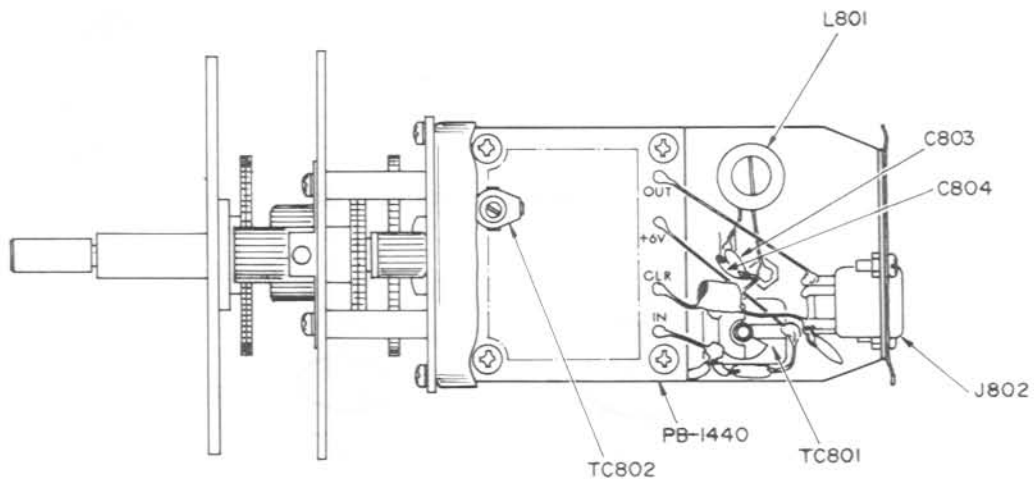
Viewed from solder side



DC VOLTAGES

(V)

	E(S)		C(D)		B(G)	
	DC	RF	DC	RF	DC	RF
Q ₈₀₁	1.3	(120 mV)	3.8	(1.4 V)	2.0	—
Q ₈₀₂	0.7	—	6.2	(400mV)	0	(100 mV)
Q ₈₀₃	0.8	(200 mV)	6.3	—	1.6	(200 mV)



VFO UNIT EXPLODED VIEW

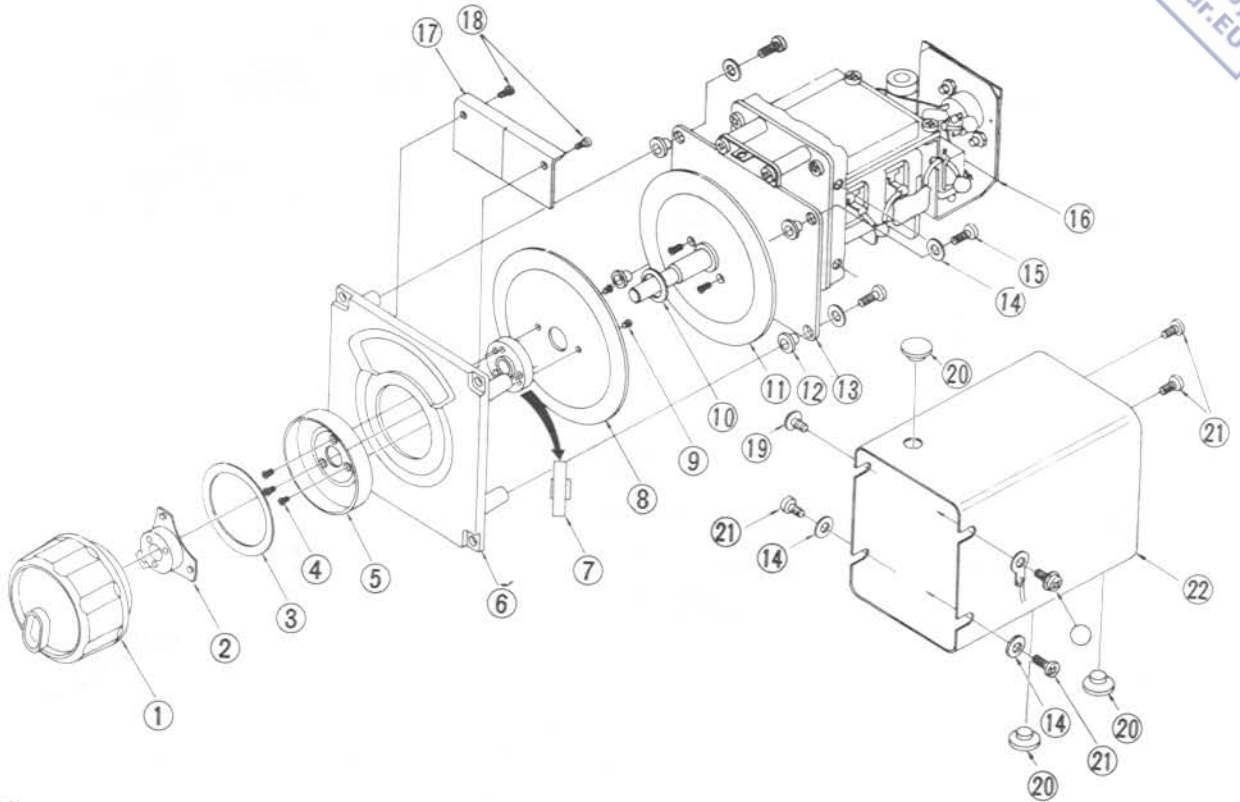
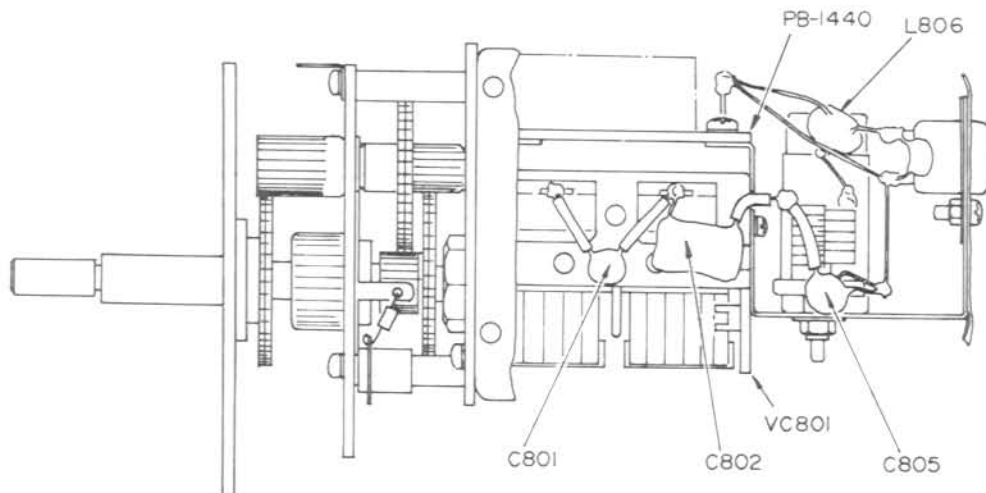
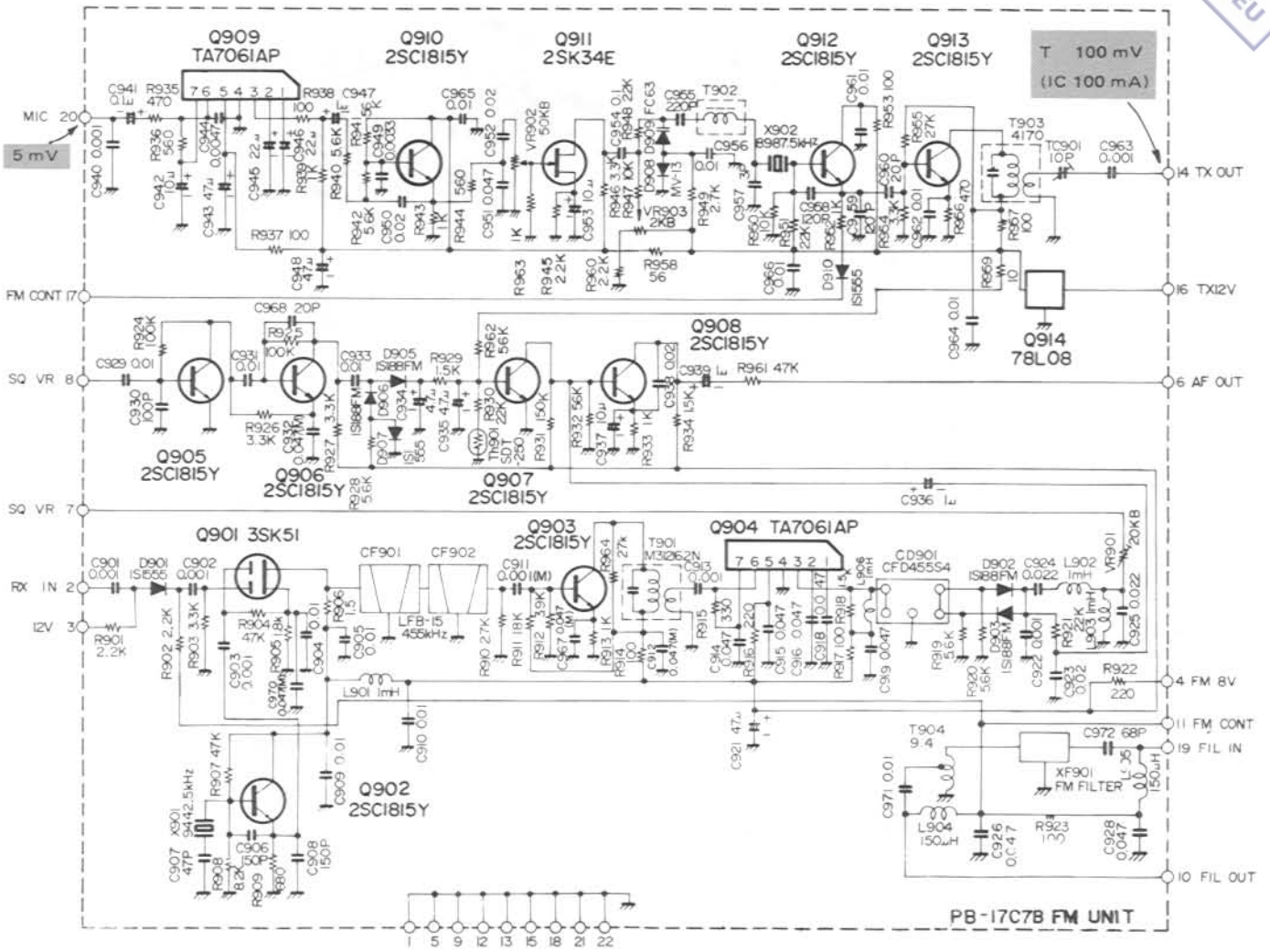


Fig. & Index No.	Q'ty	Name & Description	Fig. & Index No.	Q'ty	Name & Description
1-1	1	Knob : Tuning	1-12	4	Bushing: Sleeve
		Set Screw: M4 x 6, mm, Steel	1-13	1	Gear Assembly
1-2	1		1-14	6	Fiber Washer: Flat
1-3	1	Washer:	1-15	4	Screw: Pan Head with washer, M3 x 6, mm, Steel
1-4	3	Screw: Flat Head, M2 x 4, mm, Steel	1-16	1	Insulator: Sheet
1-5	1	Calibration Ring	1-17	1	Cursol
1-6	1	Escutcheon	1-18	2	Screw: Pan Head, M2 x 4, mm Steel
1-7	1	Holder: Aluminum	1-19	2	Screw: Pan Head with spring washer and flat washer, Steel
1-8	1	Sub Dial	1-20	3	Grommet: Rubber
1-9	2	Screw: Flat Head, M2 x 4, mm, Steel	1-21	4	Screw: Pan Head, M3 x 6, mm, Plastic
1-10	1	Washer: Flat, Steel			
1-11	1	Main Dial			



FM UNIT (PB-1707B)



DC VOLTAGES (V)

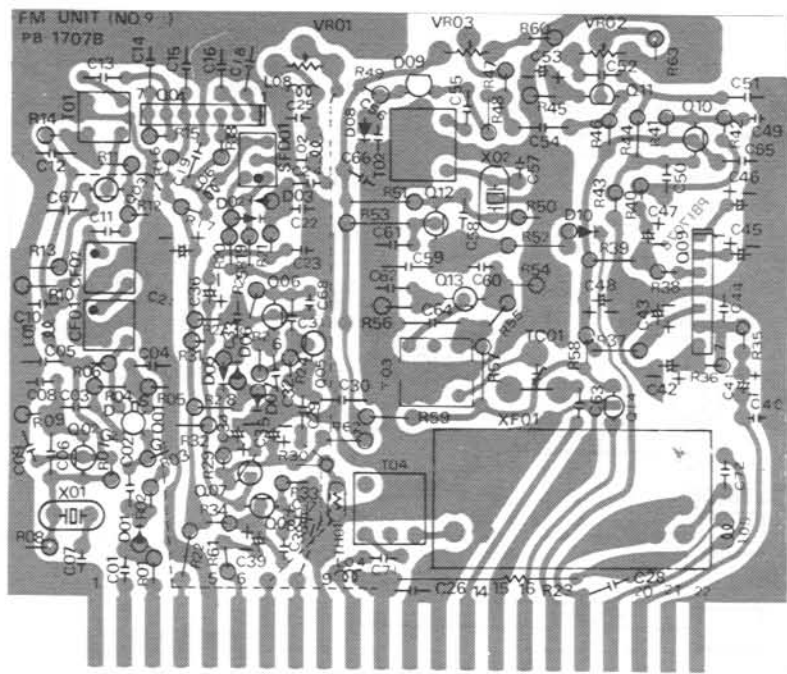
	E(S)		C(D)		B(G ₁)		(G ₂)	
	R	T	R	T	R	T	R	T
Q901	0.6	0.6	5.3	5.3	0	0	0.6	0.6
Q902	0.3	0.3	5.5	5.5	0.8	0.8	-	-
Q903	0.4	0.4	5.7	5.7	1.0	1.0	-	-
Q905	0	0	1.0	1.0	0.6	0.6	-	-
Q906	2.9	2.9	3.9	3.9	3.5	3.5	-	-
Q907	0	0	1.4	0	0.4	0.6	-	-
Q908	0.7	0	4.6	5.8	1.4	0	-	-
Q910	0	4.9	0	7.0	0	5.5	-	-
Q911	0	1.6	0	4.6	0	0	-	-
Q912	0	1.9	0	7.7	0	2.4	-	-
Q913	0	0.2	0	6.3	0	0.8	-	-

DC VOLTAGES (V)

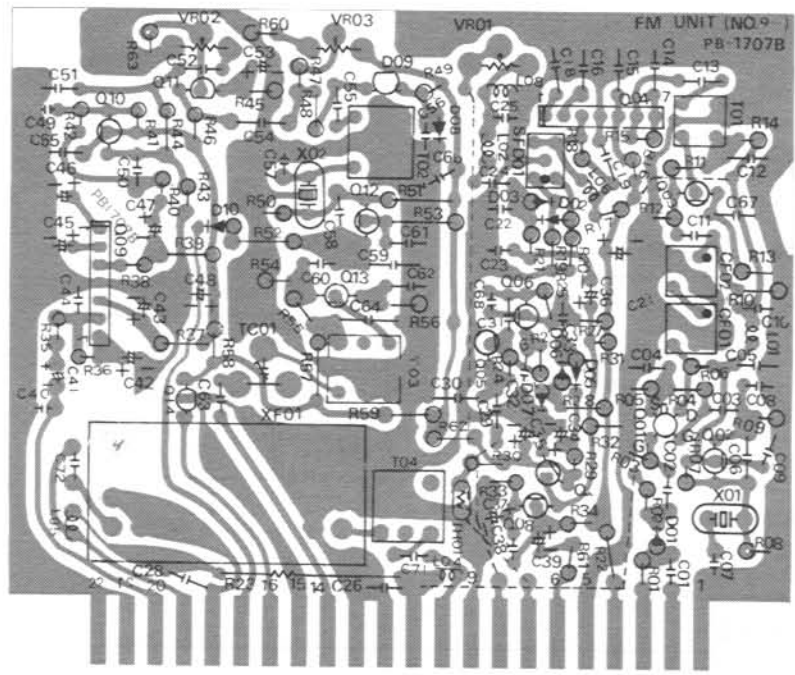
		1	2	3	4	5	6	7
		Q904	R	1.6	1.6	5.6	0	4.5
	T	1.6	1.6	5.6	0	4.5	1.6	1.6
Q909	R	0	0	0	0	0	0	0
	T	1.8	1.9	4.4	0	6.4	1.9	1.9
Q914		IN	OUT					
	R	0	0					
	T	12.0	8.0					

SQ:
OFF
SQ:
OFF

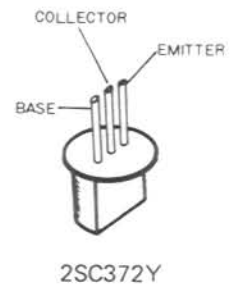
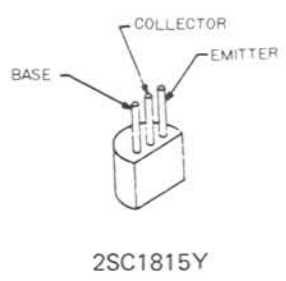
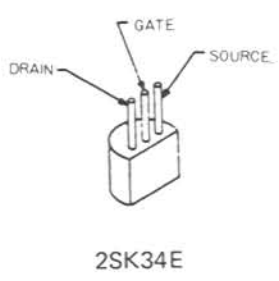
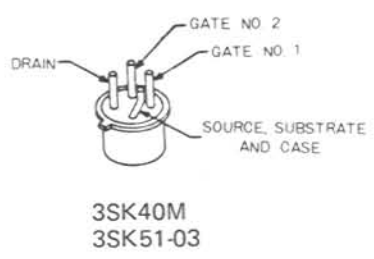
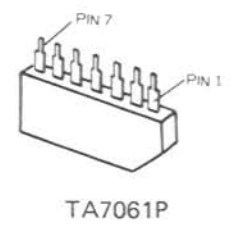
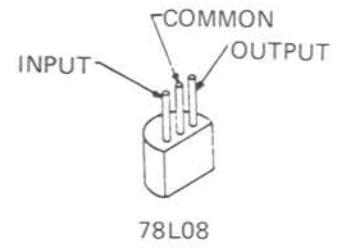
FM UNIT PARTS LAYOUT



Viewed from component side

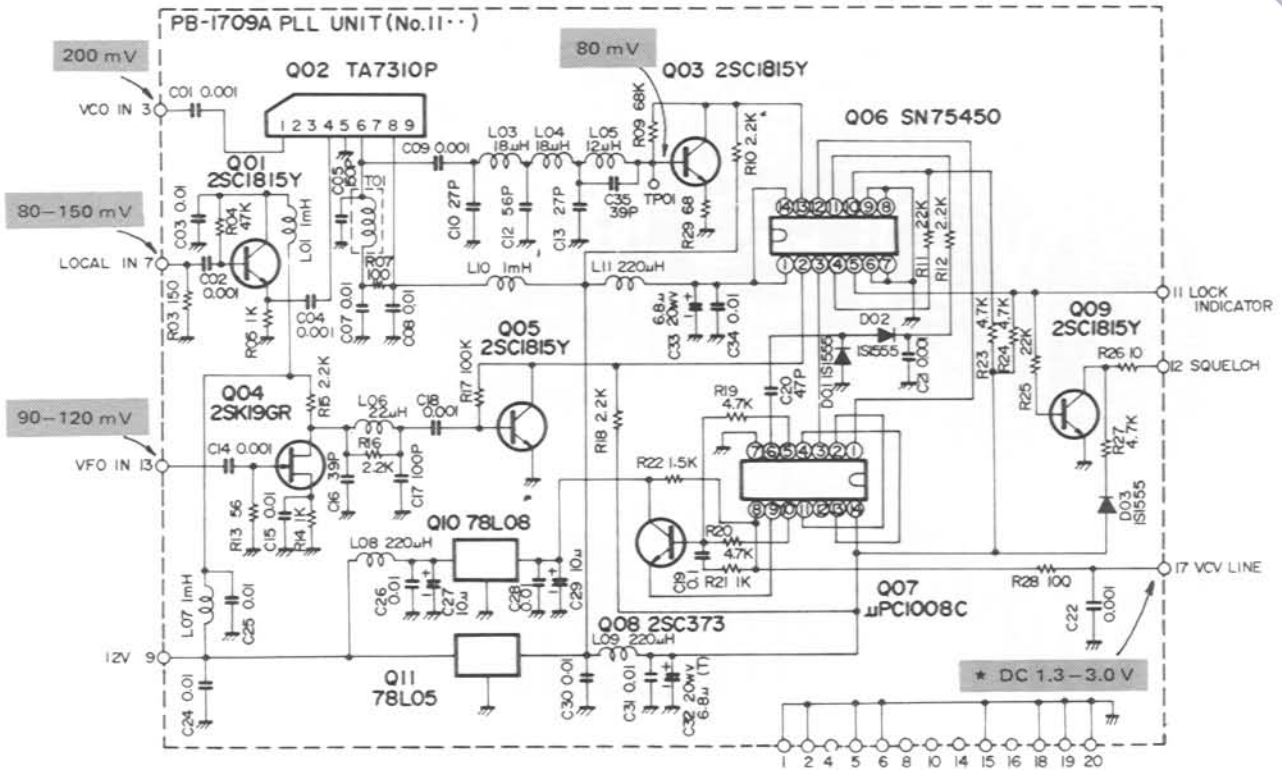


Viewed from solder side



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PLL UNIT (PB-1709A)



DC VOLTAGES (V)

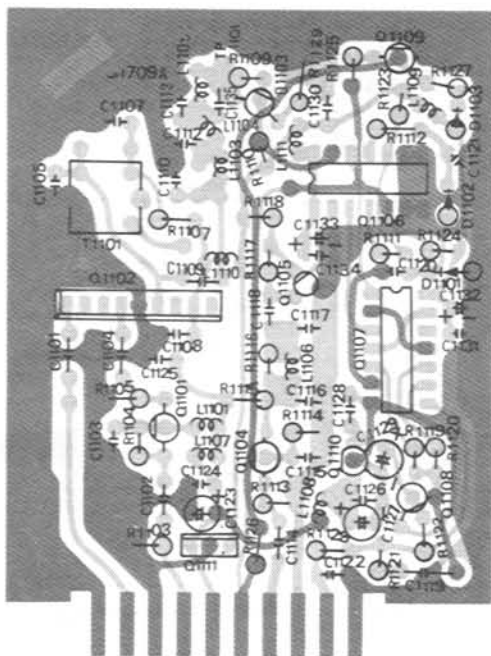
	E(S)		C(D)		B(G)	
	R	T	R	T	R	T
Q1101	8.4	8.4	11.1	11.1	9.0	9.0
Q1103	0.1	0.1	1.5	1.5	0.8	0.8
Q1104	2.0	2.0	6.7	6.7	0	0
Q1105	0	0	1.7	1.7	0.6	0.6
Q1108	1.3	1.3	8.0	8.0	1.8	1.8
Q1109	0	0	0	0	0.6	0.6

	IN	OUT
Q1110	11.2	8.0
Q1111	11.3	5.0

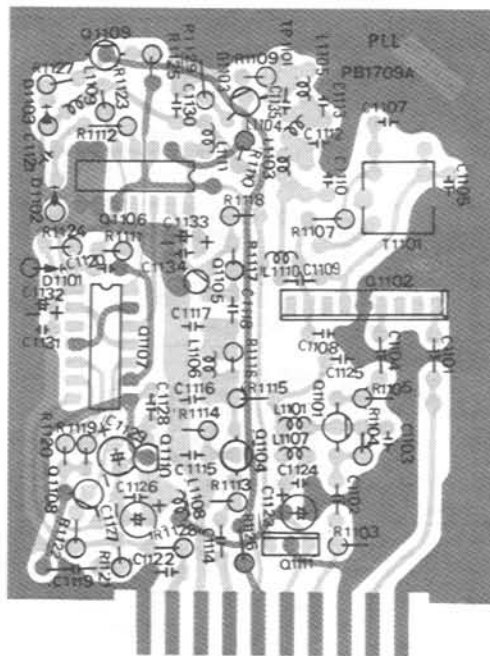
DC VOLTAGES (V)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Q1102	R	2.6	1.9	1.2	2.6	0	4.4	2.0	4.7	1.3	-	-	-	-	-
	T	2.6	1.9	1.2	2.6	0	4.4	2.0	4.7	1.3	-	-	-	-	-
Q1106	R	4.9	1.7	1.2	0	4.2	0	0	0	0	0.07	0.6	1.2	1.5	4.9
	T	4.9	1.7	1.2	0	4.2	0	0	0	0	0.07	0.6	1.2	1.5	4.9
Q1107	R	1.2	3.7	1.2	3.6	1.9	2.5	0	*VCV	1.4	1.8	3.7	3.9	3.6	4.9
	T	1.2	3.7	1.2	3.6	1.9	2.5	0	*VCV	1.4	1.8	3.7	3.9	3.6	4.9

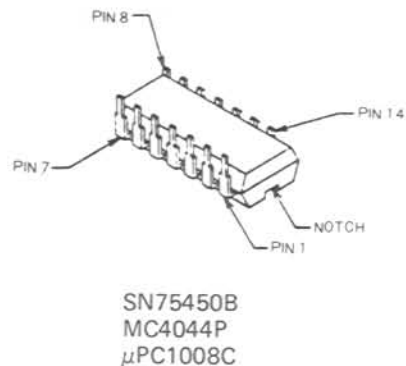
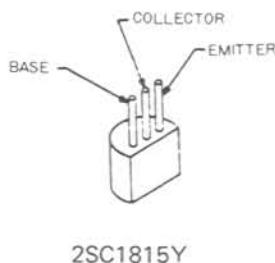
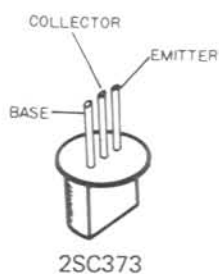
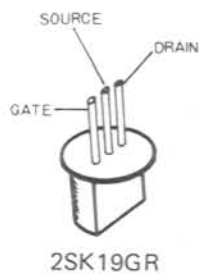
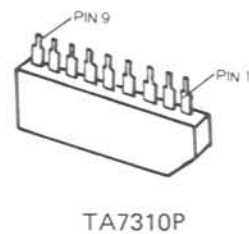
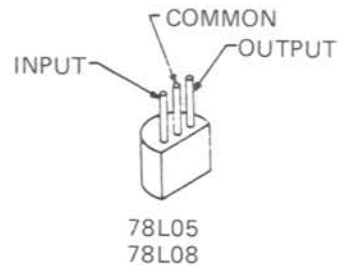
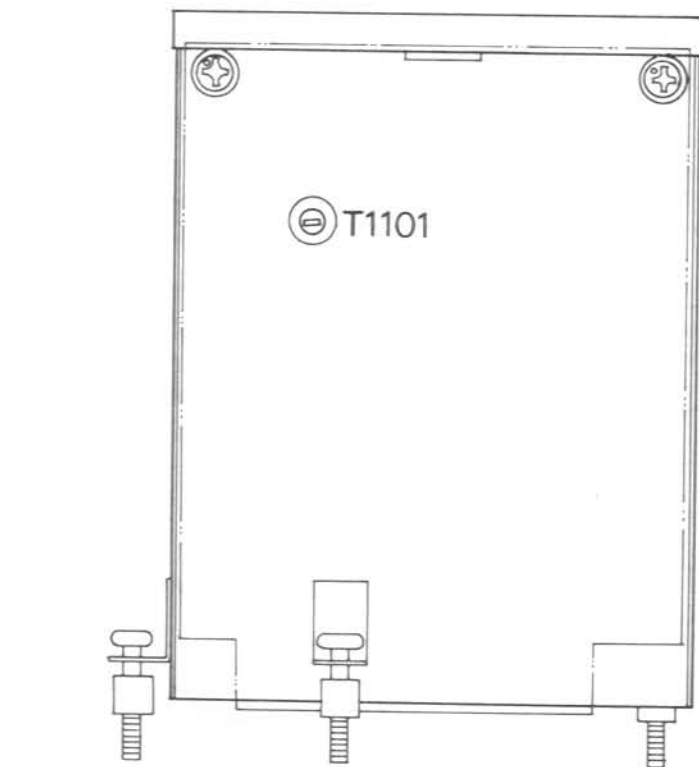
PLL UNIT PARTS LAYOUT



Viewed from component side

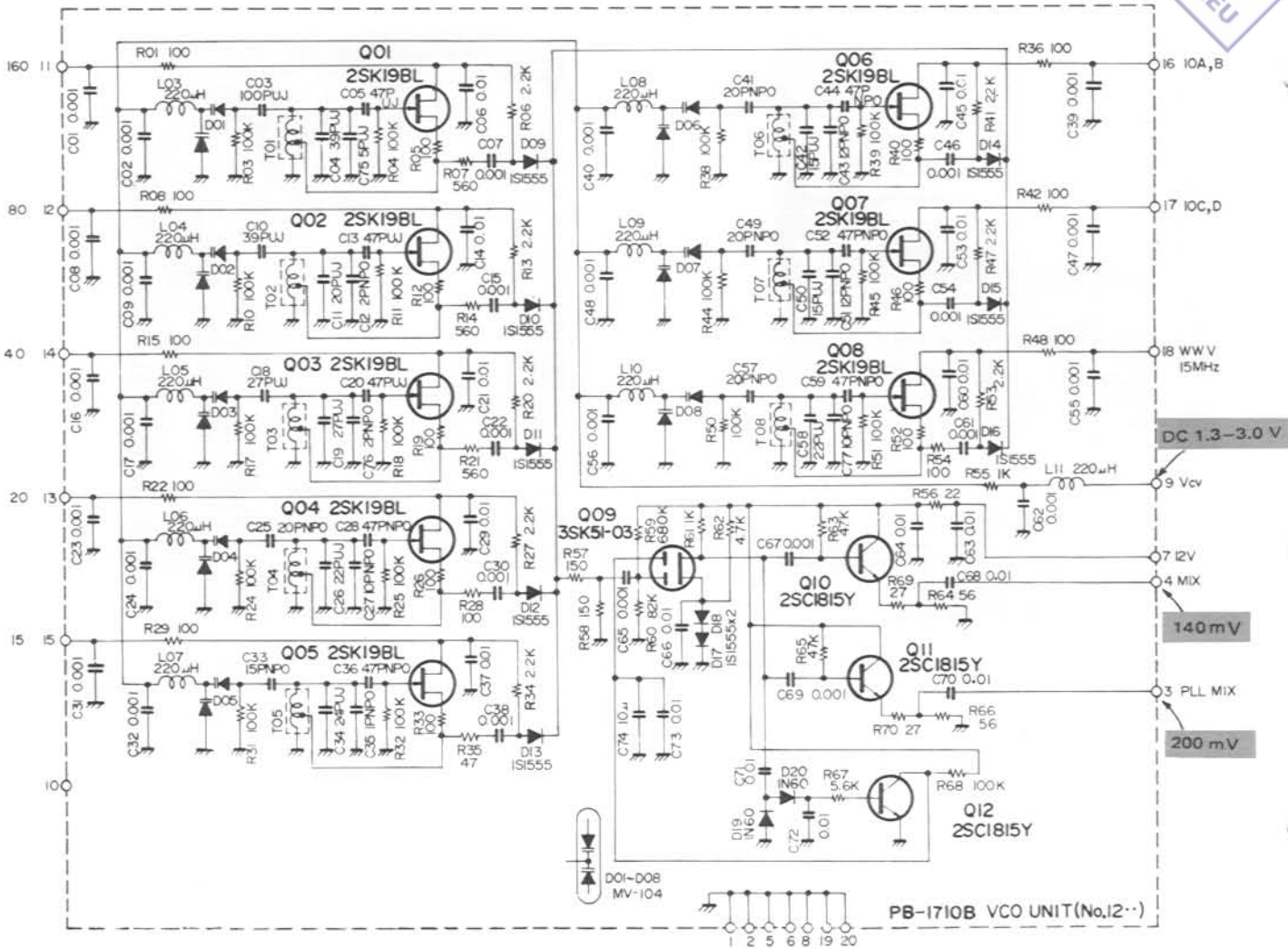


Viewed from solder side



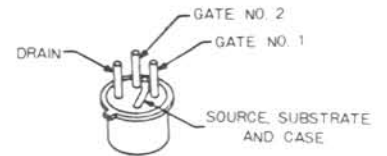
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VCO UNIT (PB-1710B)

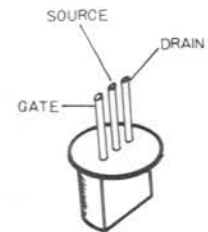


DC VOLTAGES (V)

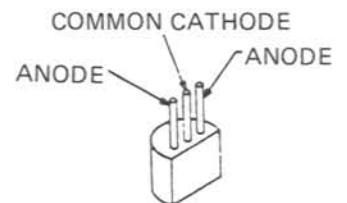
	E(S)		C(D)		B(G1)		(G2)	
	R	T	R	T	R	T	R	T
Q1201	0.7	0.7	7.1	7.1	0	0	-	-
Q1202	0.9	0.9	6.9	6.9	0	0	-	-
Q1203	0.9	0.9	7.0	7.0	0	0	-	-
Q1204	0.9	0.9	7.0	7.0	0	0	-	-
Q1205	0.9	0.9	7.0	7.0	0	0	-	-
Q1206	0.9	0.9	6.4	6.4	0	0	-	-
Q1207	0.8	0.8	6.4	6.4	0	0	-	-
Q1208	0.7	0.7	7.2	7.2	0	0	-	-
Q1209	1.3	1.3	3.5	3.5	0.8	0.8	1.5	1.5
Q1210	1.3	1.3	7.3	7.3	2.0	2.0	-	-
Q1211	1.7	1.7	7.3	7.3	2.4	2.4	-	-
Q1212	0	0	1.5	1.5	0.6	0.6	-	-



3SK40M
3SK51-03

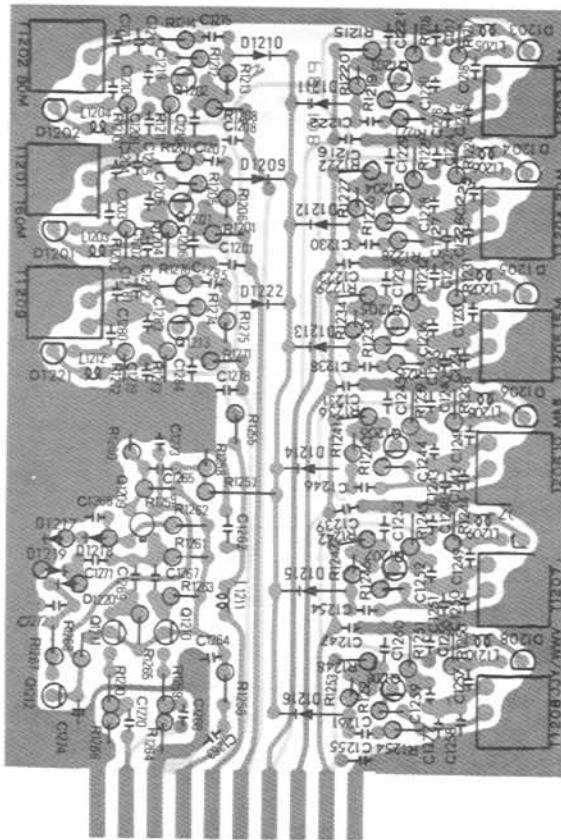


2SK19BL

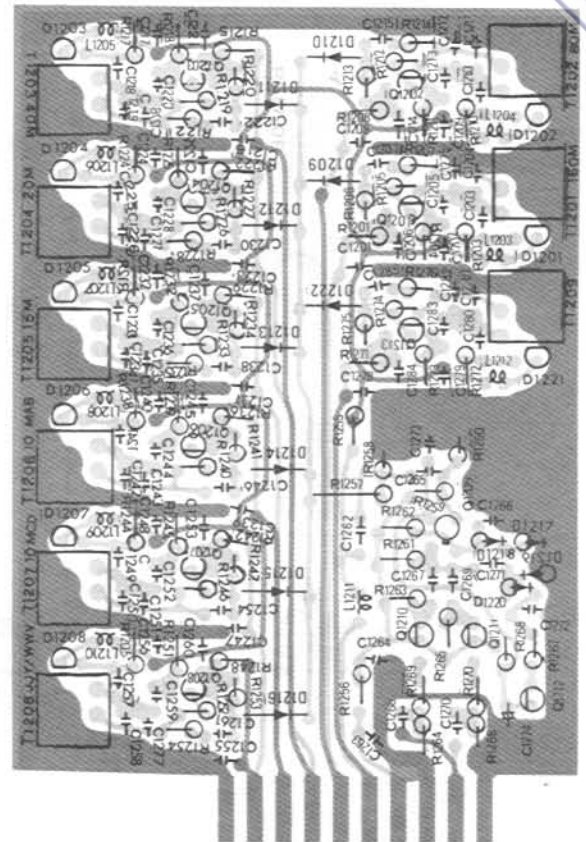


MV104

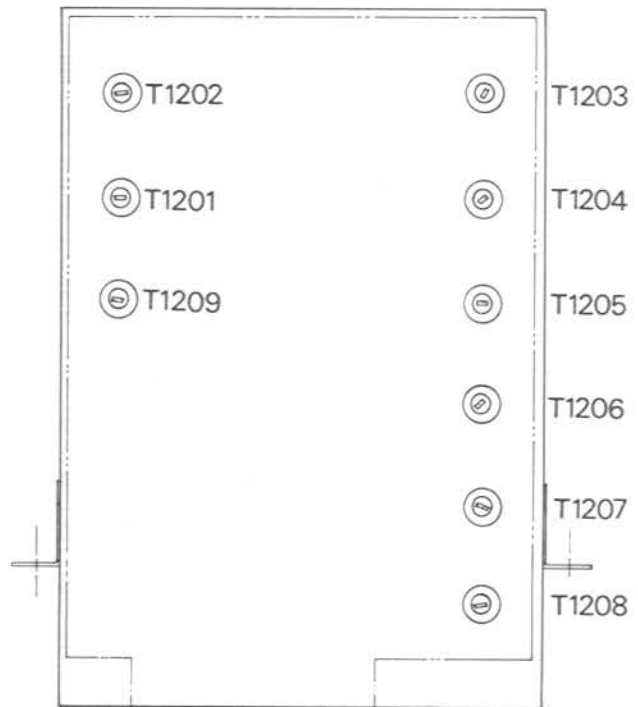
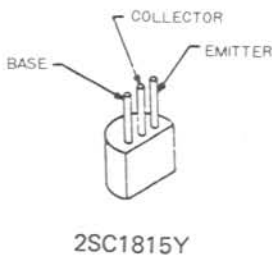
VCO UNIT PARTS LAYOUT



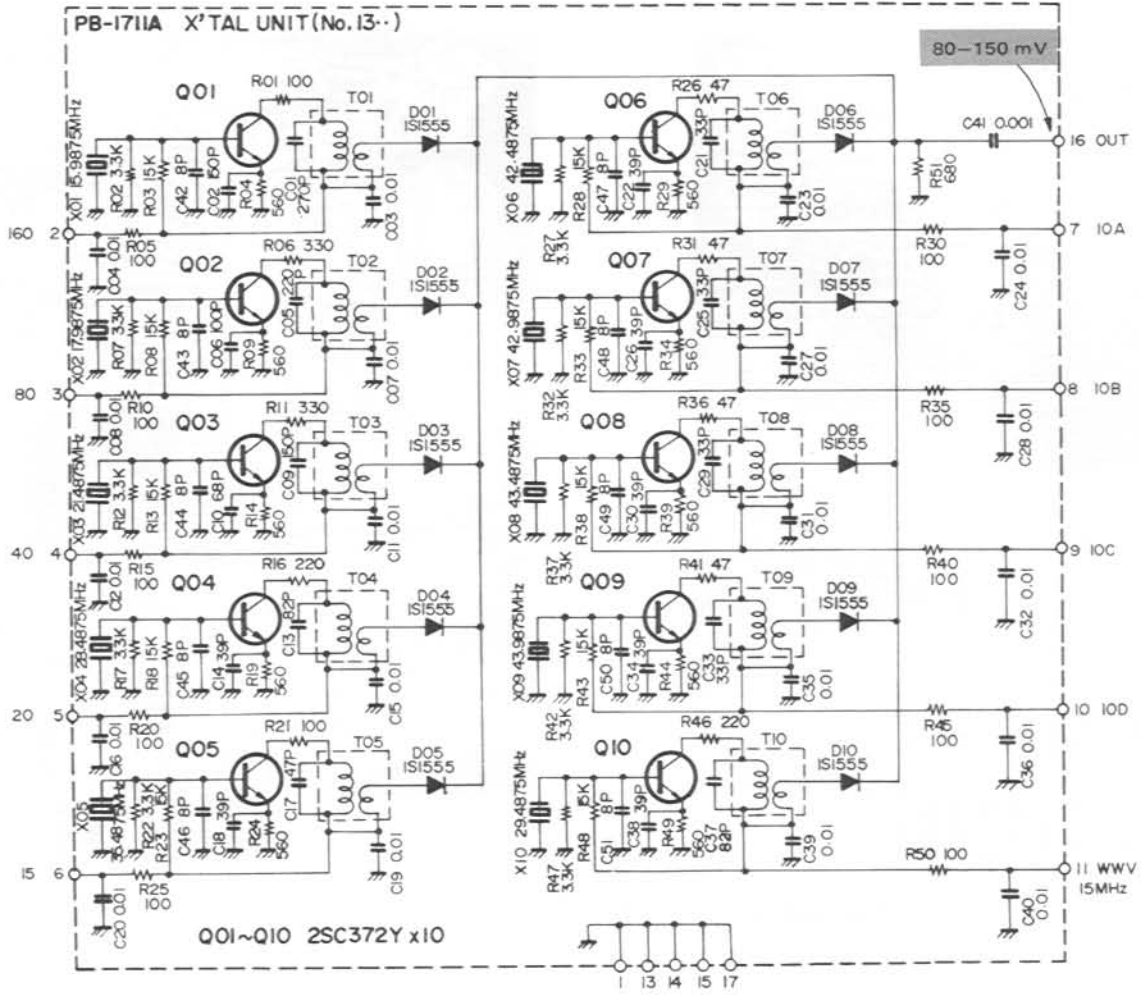
Viewed from component side



Viewed from solder side



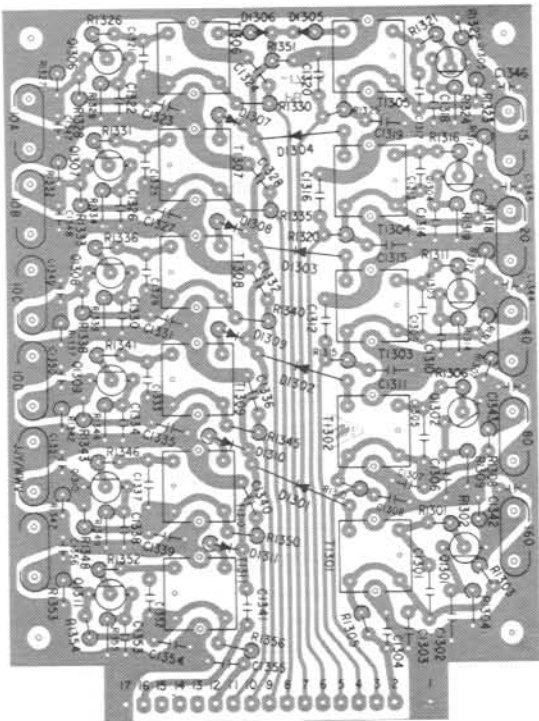
XTAL UNIT (PB-1711A)



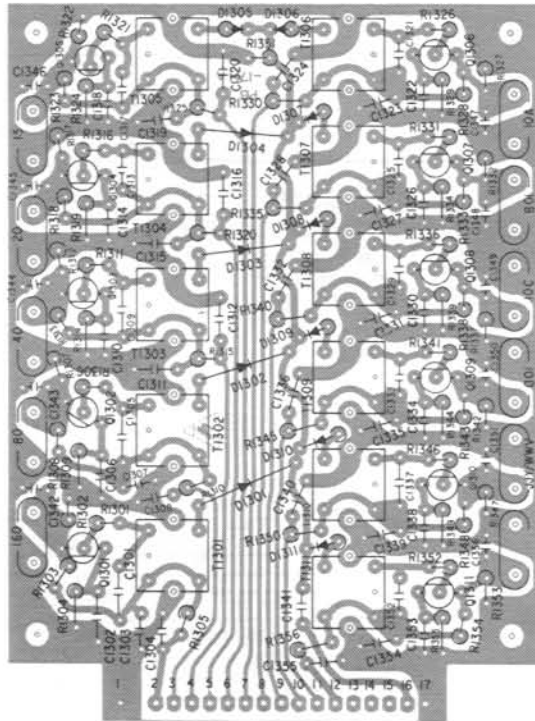
DC VOLTAGES (V)

	E		C		B	
	R	T	R	T	R	T
Q1301	0.7	0.7	6.9	6.9	1.3	1.3
Q1302	0.6	0.6	6.7	6.7	1.2	1.2
Q1303	0.7	0.7	6.7	6.7	1.2	1.2
Q1304	0.7	0.7	6.8	6.8	1.3	1.3
Q1305	0.7	0.7	6.9	6.9	1.3	1.3
Q1306	0.7	0.7	7.0	7.0	1.3	1.3
Q1307	0.7	0.7	7.0	7.0	1.3	1.3
Q1308	0.7	0.7	7.0	7.0	1.3	1.3
Q1309	0.7	0.7	7.0	7.0	1.3	1.3
Q1310	0.7	0.7	6.8	6.8	1.3	1.3

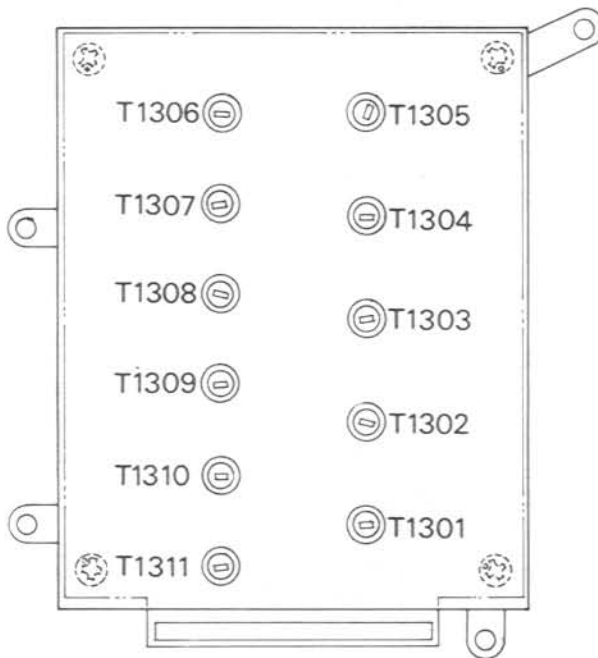
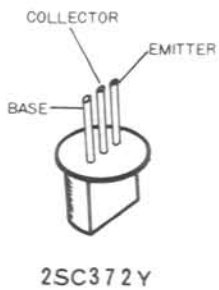
XTAL UNIT PARTS LAYOUT



Viewed from component side

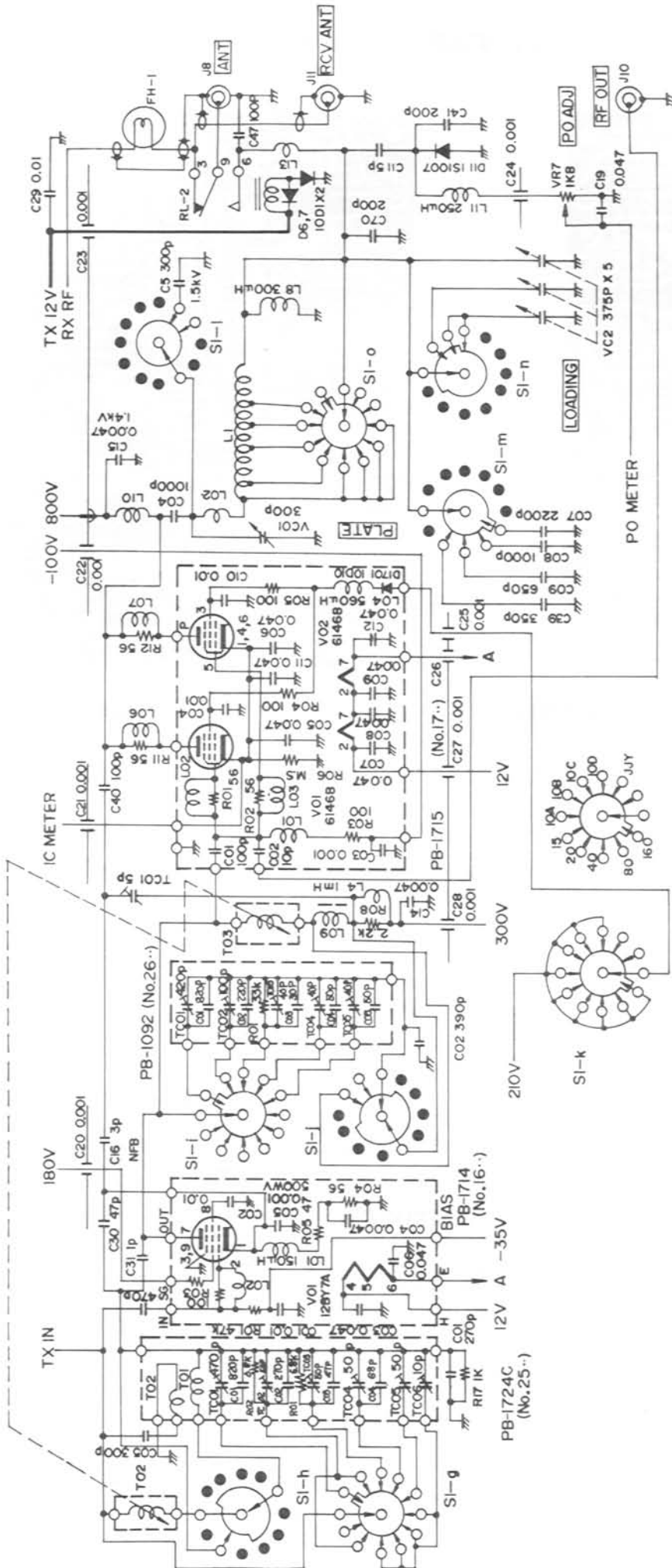


Viewed from solder side



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DRIVER/FINAL AMPLIFIER STAGES



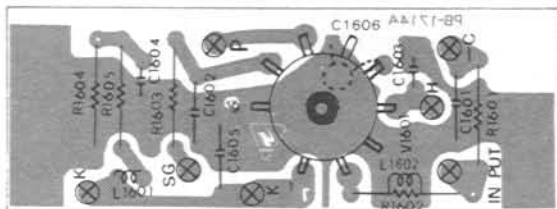
VOLTAGES AT SOCKET (V)

	1	2	3	4	5	6	7	8
V ₁₇₀₁ 6146B	R	0	AC 264	0	-130	0	0	973
	T	0.1	AC 245	0.1	-65	0.1	0	922
V ₁₇₀₂ 6146B	R	0	AC 264	0	-130	0	AC 973	
	T	0.1	AC 245	0.1	-65	0.1	AC 922	

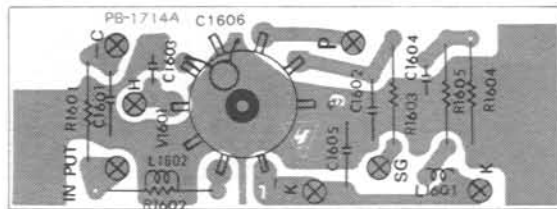
VOLTAGES AT SOCKET (V)

	1	2	3	4	5	6	7	8	9	
V ₁₆₀₁ 12BY7A	R	0	-37	0	AC 13.0	AC 6.5	0	356	245	0
	T	4	0	0	AC 13.0	AC 6.5	0	314	207	0

DRIVER BOARD (PB-1714A)

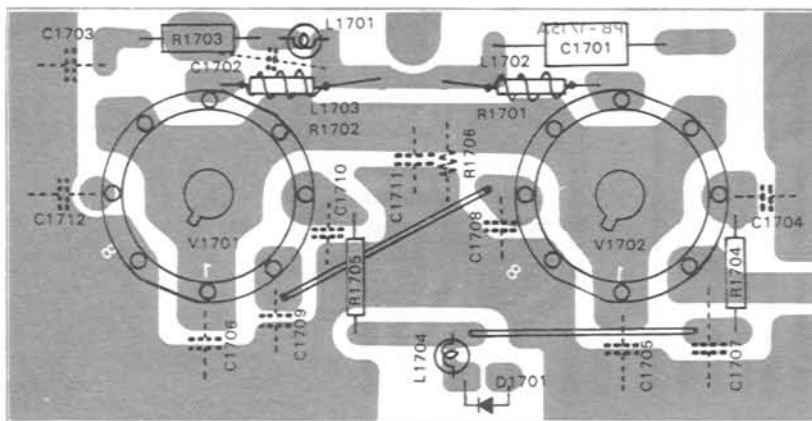


Viewed from component side

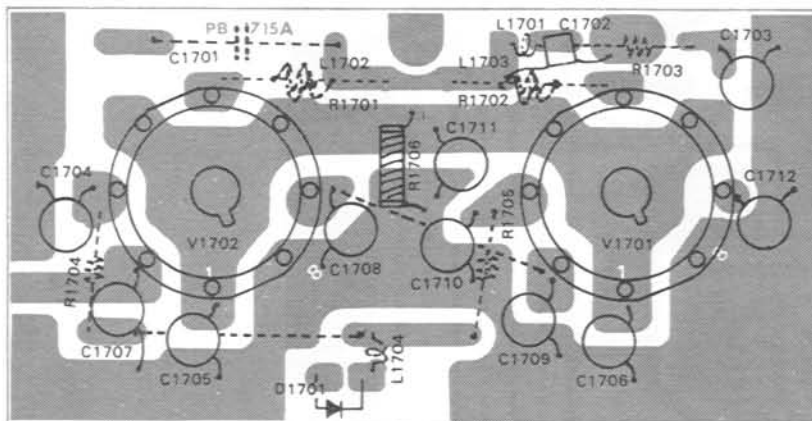


Viewed from solder side

FINAL BOARD (PB-1715A)

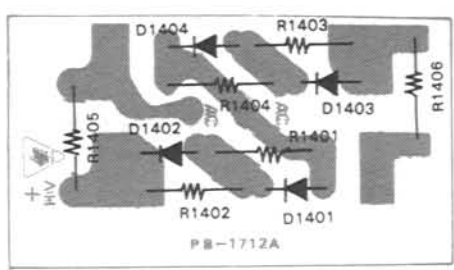
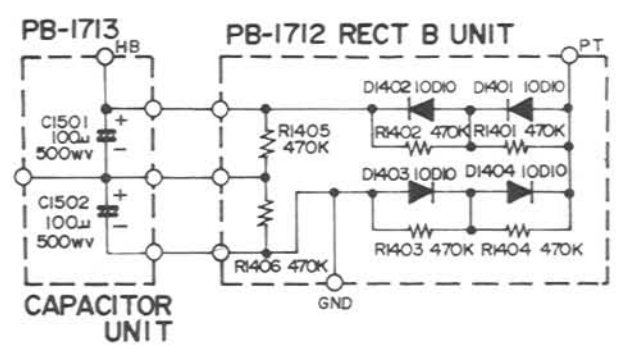


Viewed from component side

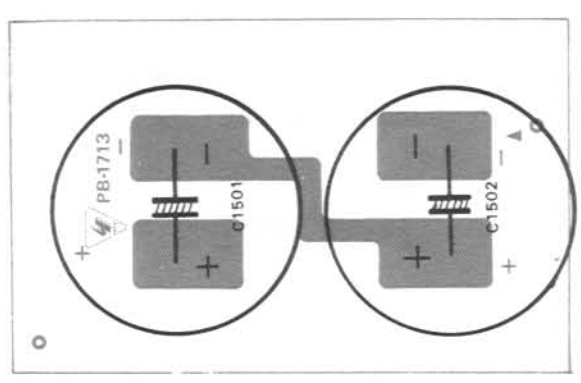


Viewed from solder side

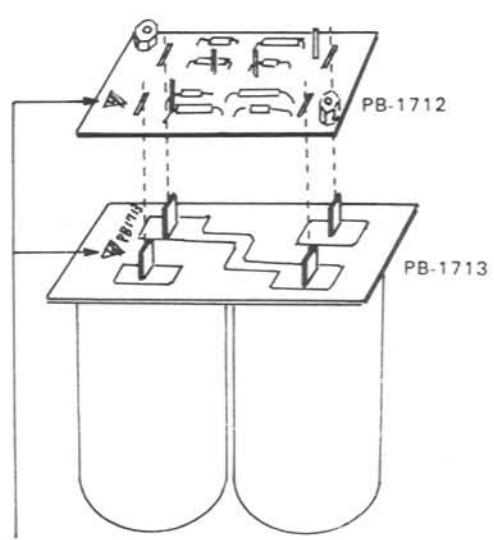
RECT B BOARD/CAPACITOR BOARD



Viewed from component side



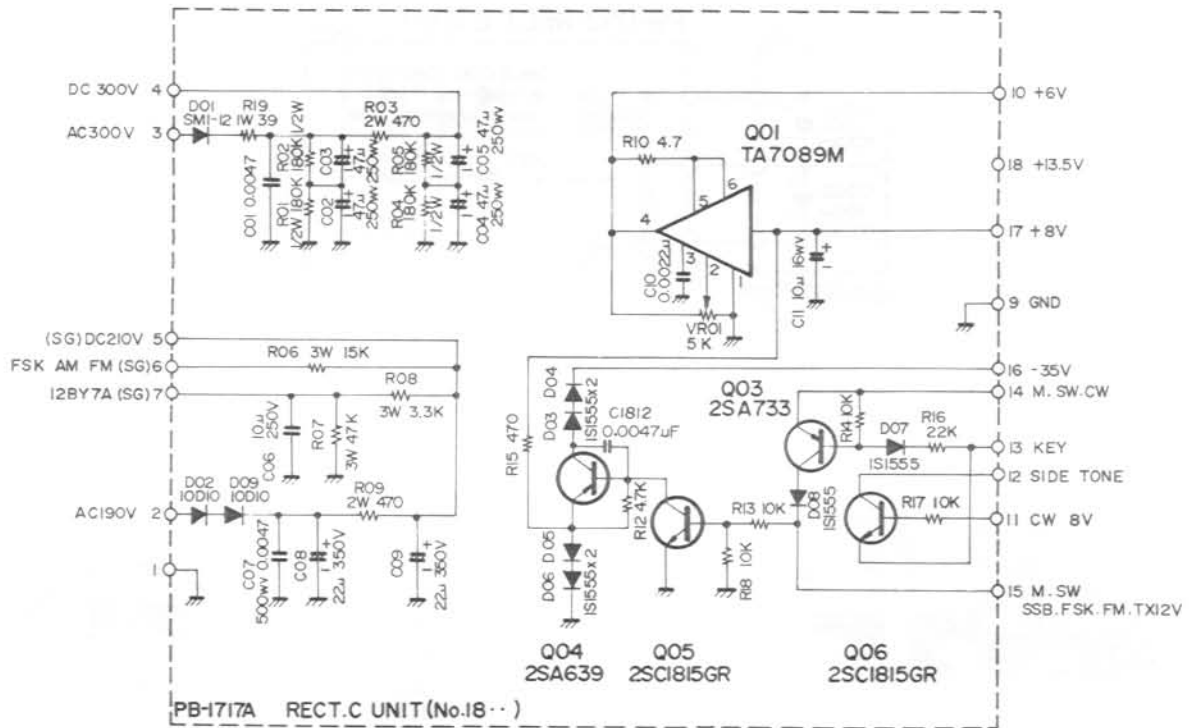
Viewed from solder side



Please align with YAESU  emblems together.

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RECT C UNIT (PB-1717A)

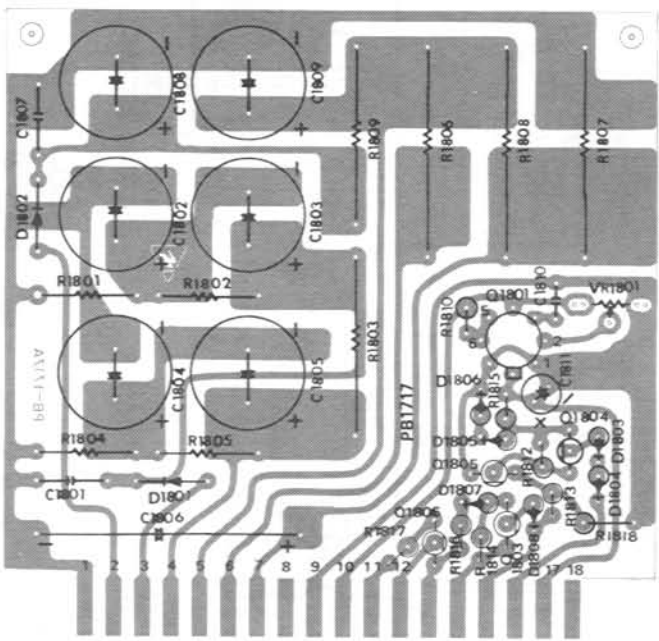


DC VOLTAGES (V)

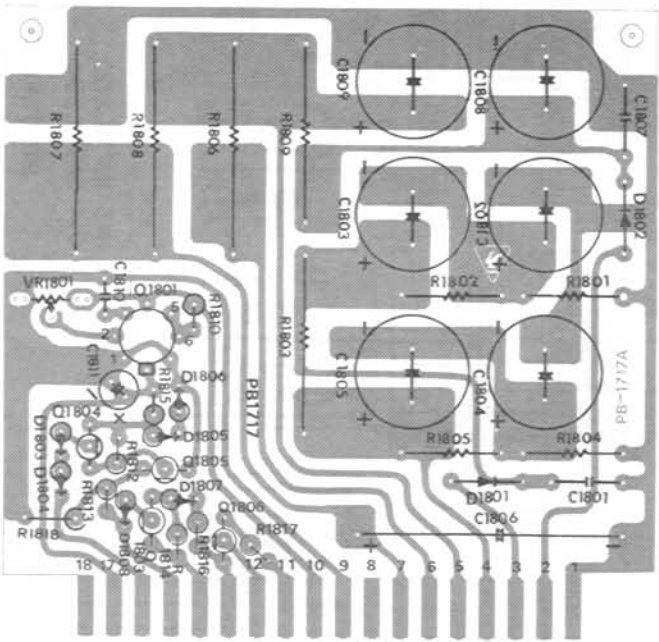
	E		C		B		
	R	T	R	T	R	T	
Q1803	0	0.1	-0.1	0	0	0.1	
Q1804	1.5	0.8	-88.8	0.6	1.5	0	SSB
Q1805	0	0	1.5	0	0	0.7	
Q1806	7.6	11.6	7.8	7.8	8.2	8.2	CW
	0	0	0	0	0.7	0.7	KEY DOWN

		1	2	3	4	5	6	7	8
Q1801	R	E	3.0	7.8	6.0	6.5	6.5	0	8.2

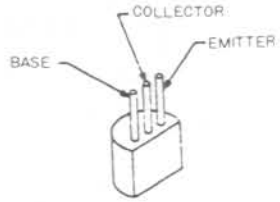
RECT C UNIT PARTS LAYOUT



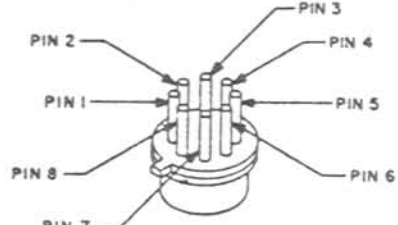
Viewed from component side



Viewed from solder side

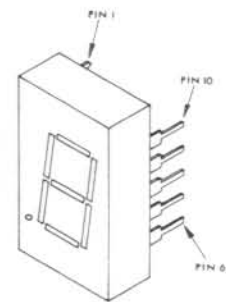
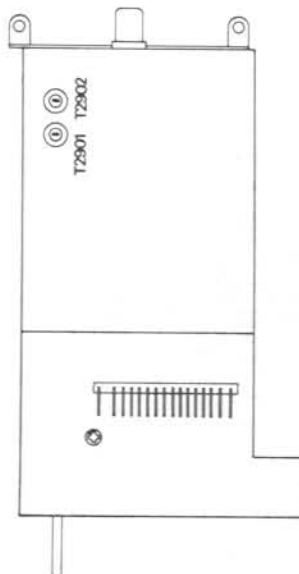
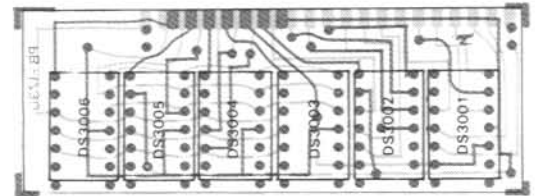
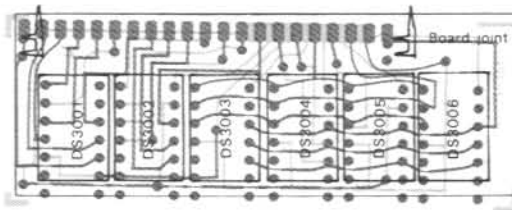
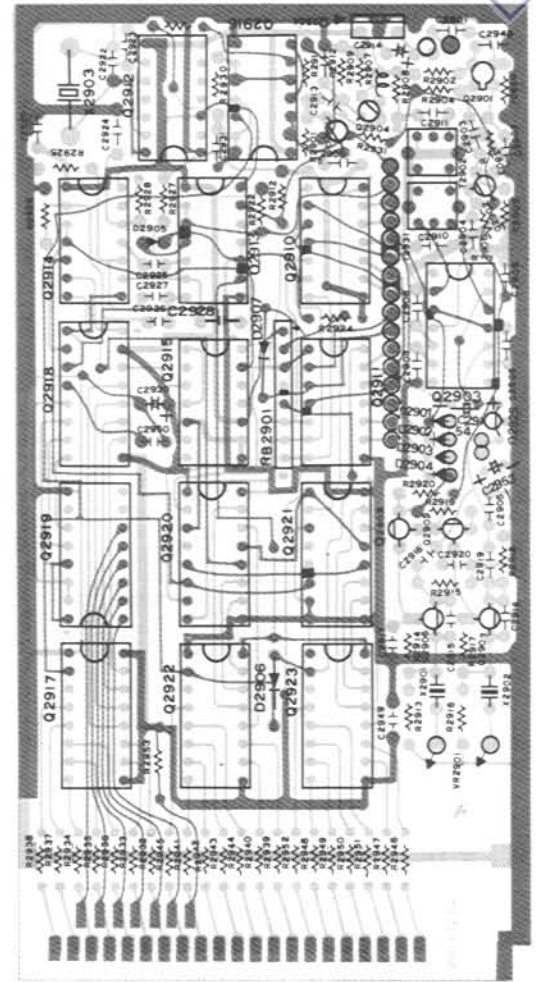
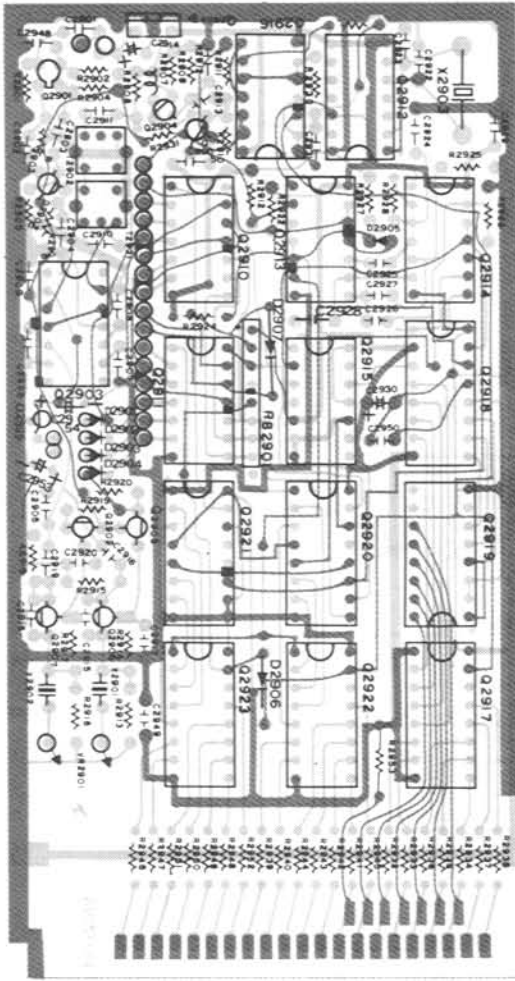


2SA639
 2SC1815GR
 2SA733



TA7089M

COUNTER/DISPLAY UNIT PARTS LAYOUT

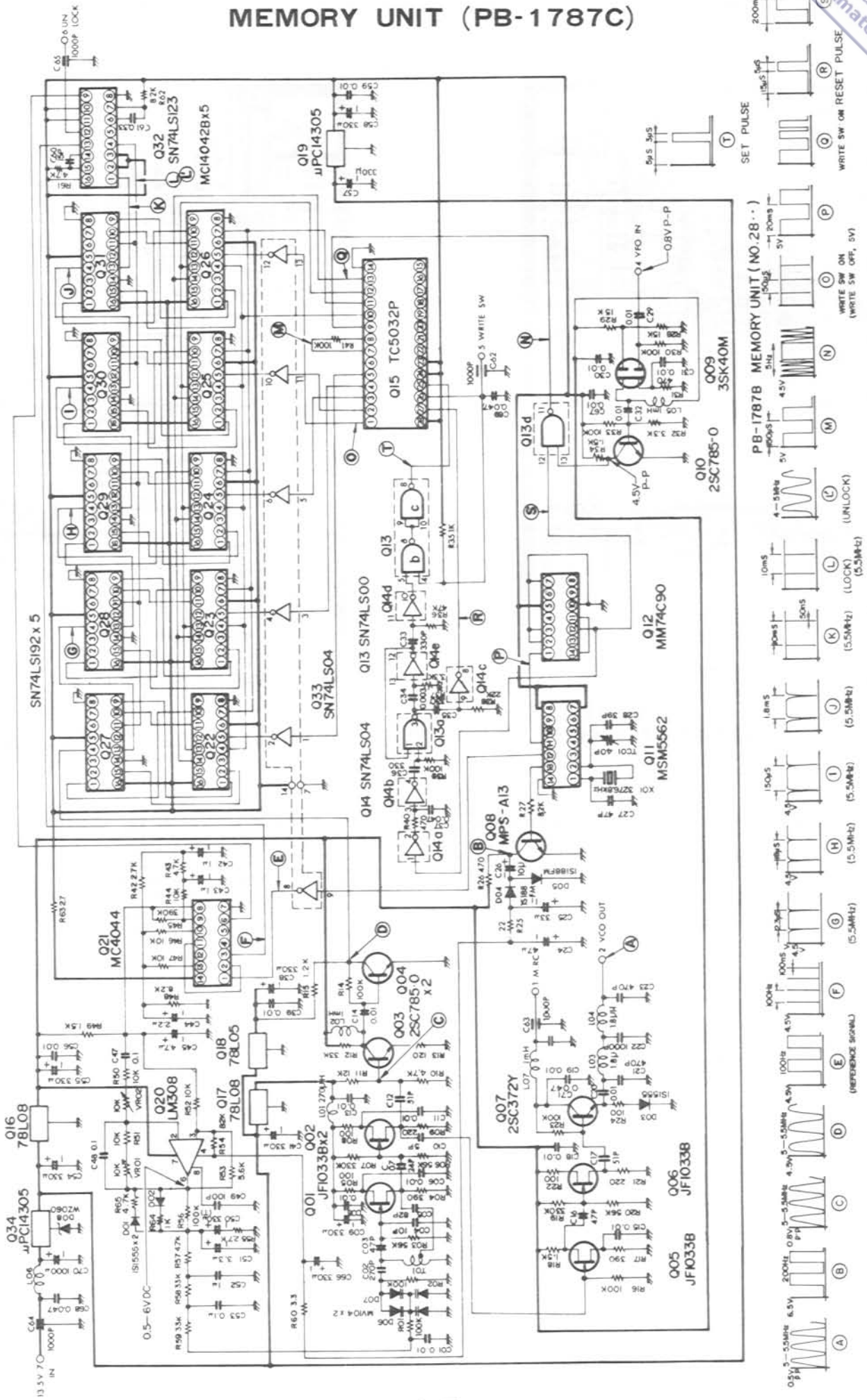


HP5082-7740

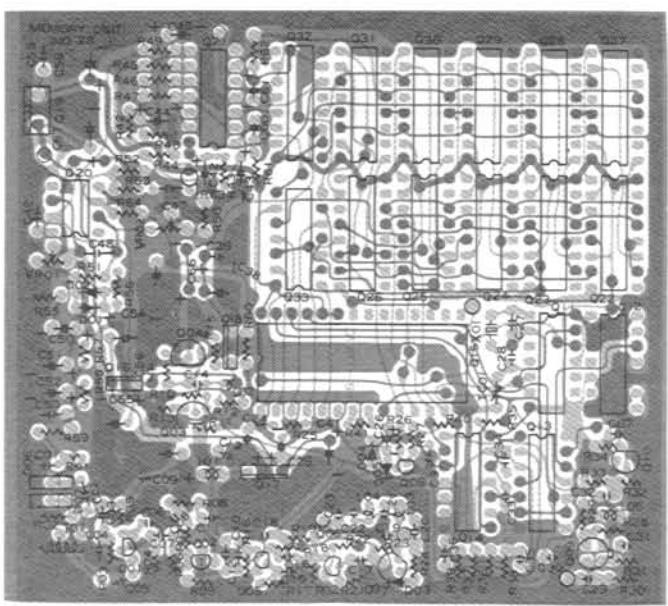
Other semi-conductor connections: see page 3 - 79.

MEMORY UNIT (PB-1787C)

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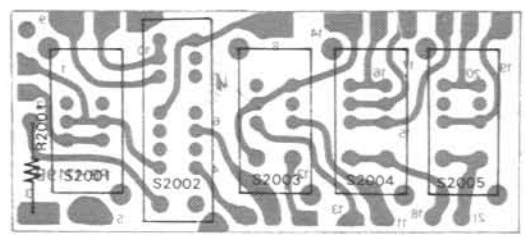
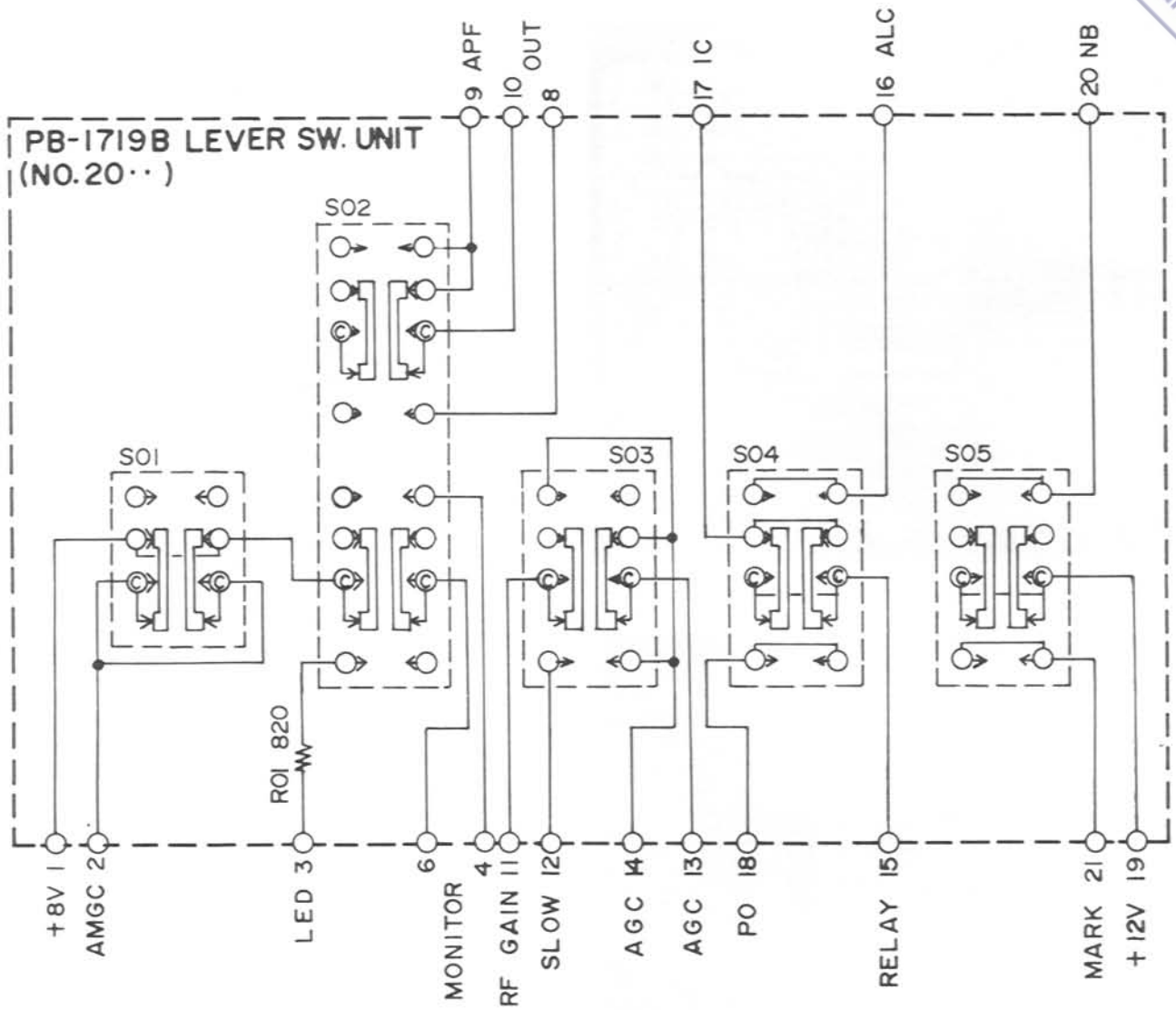


MEMORY UNIT PARTS LAYOUT

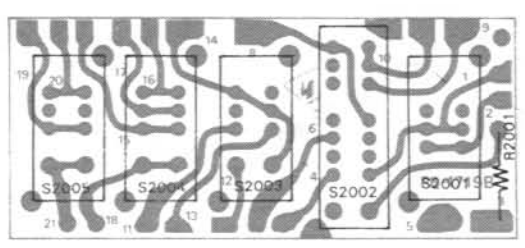


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LEVER SWITCH BOARD (PB-1719B)

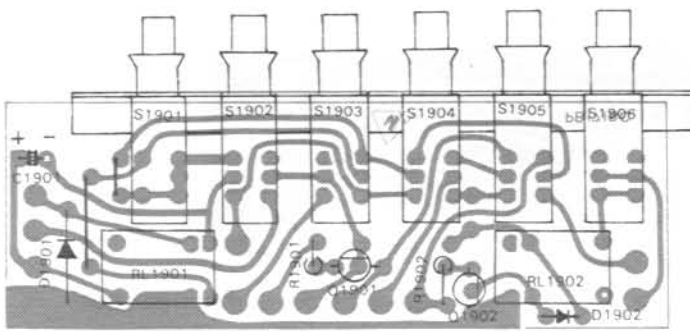
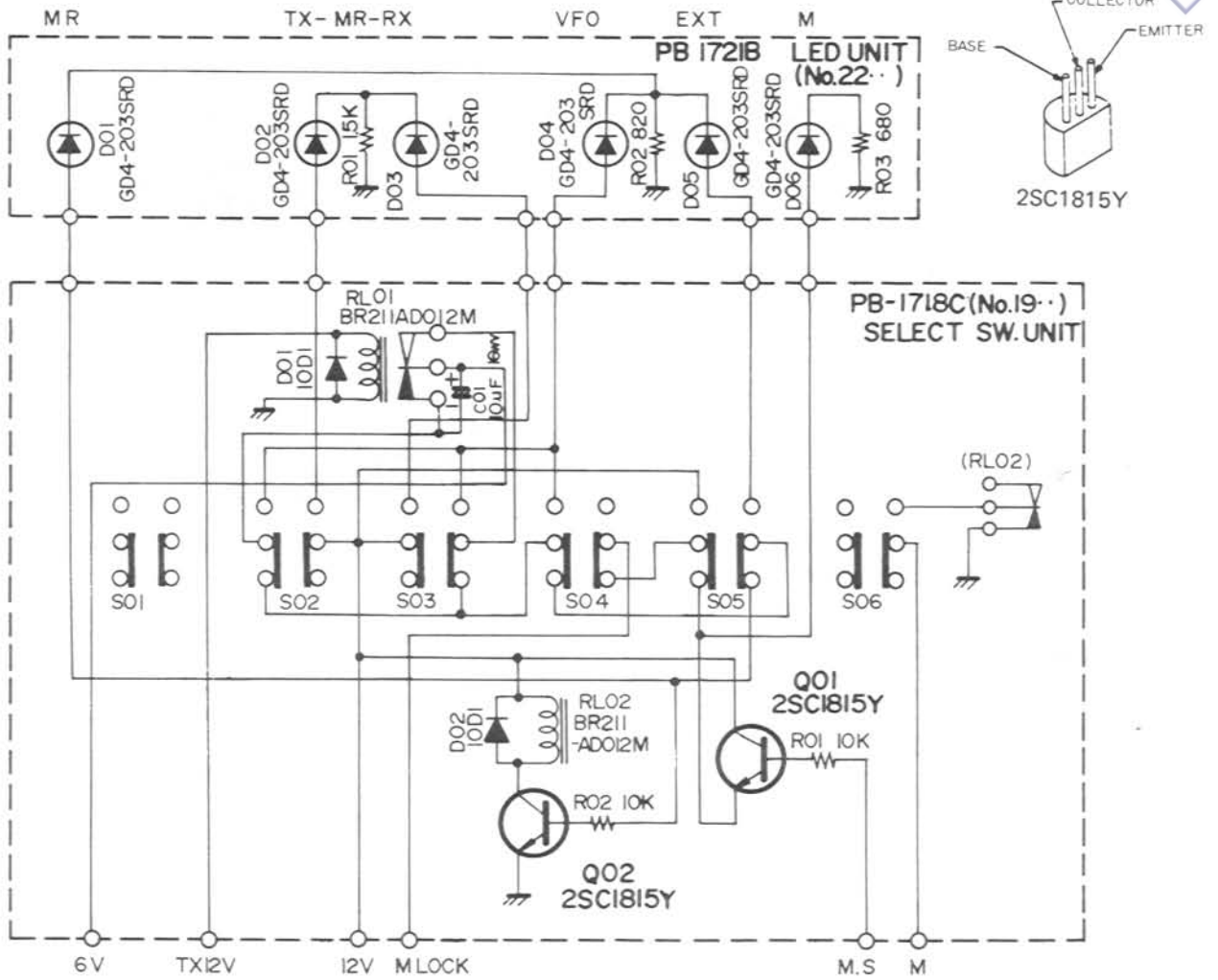


Viewed from component side

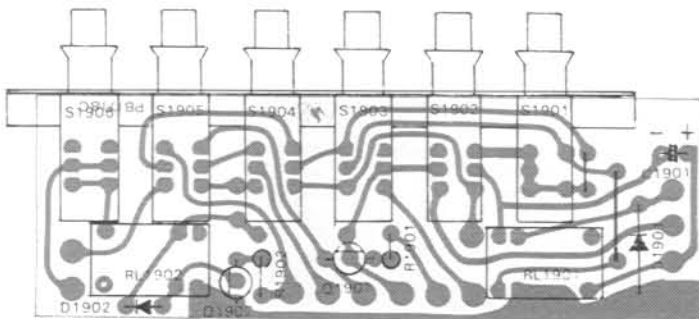


Viewed from solder side

LED A BOARD (PB-1721B) SELECT SWITCH BOARD (PB-1718C)

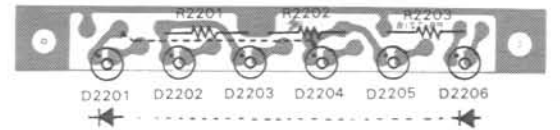


Viewed from component side

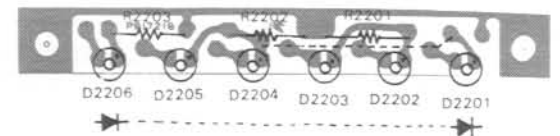


Viewed from solder side

	E	C	B	
Q1901	3.2	12	3.9	M ON
	0	12	0	M OFF
Q1902	0	0.2	0.8	MR ON
	0	12	0	MR OFF



Viewed from component side

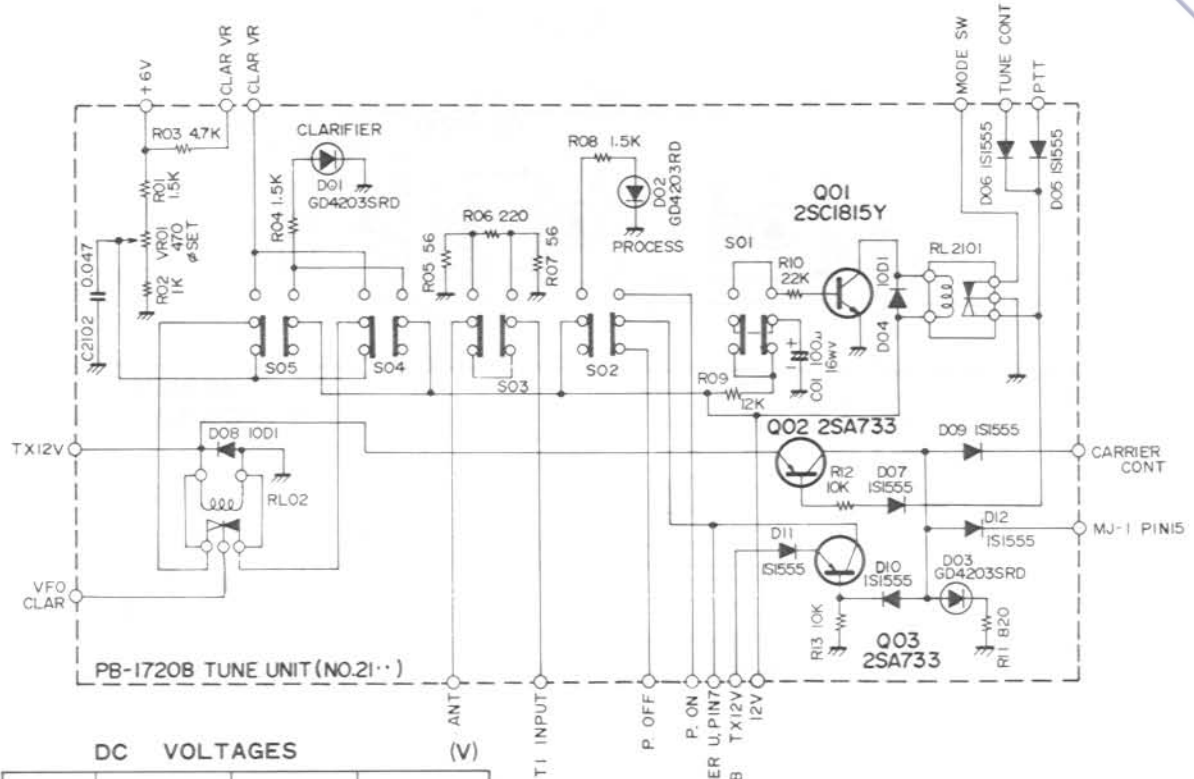


Viewed from solder side



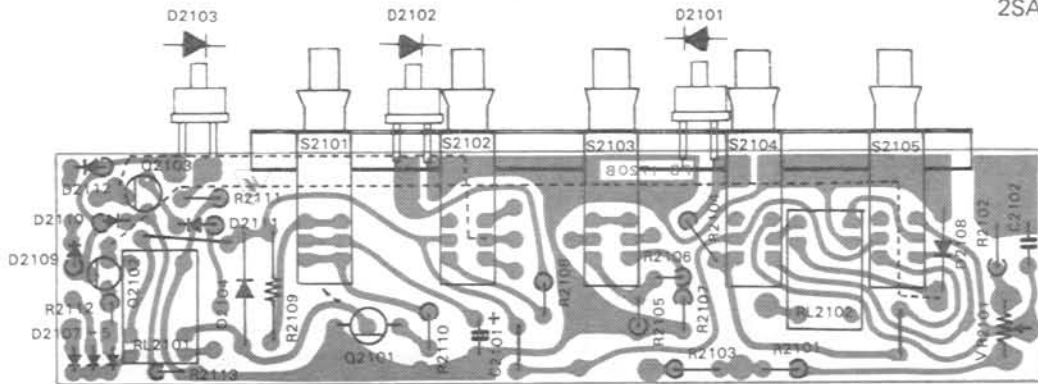
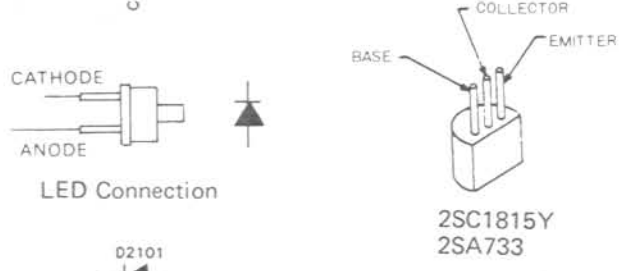
LED Connection

TUNE SWITCH BOARD (PB-1720B)

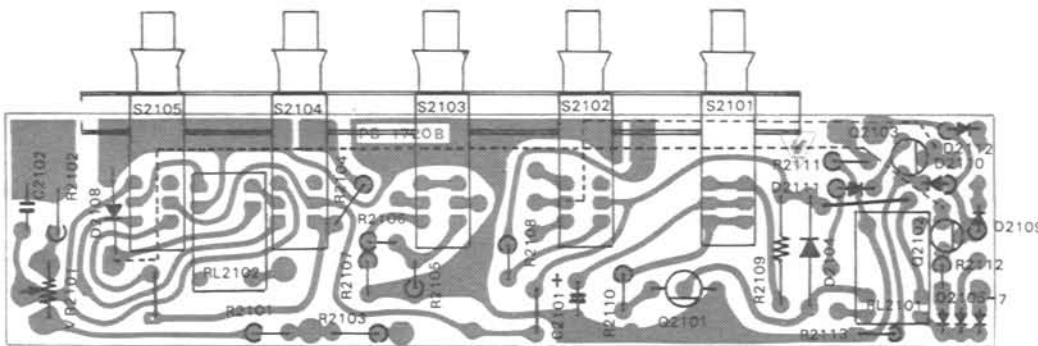


DC VOLTAGES (V)

TUNE SW	E		C		B	
	OFF	ON	OFF	ON	OFF	ON
Q2101	0	0	12.0	0.4	0	0.7
Q2102	0	12.0	0	11.7	0.1	11.2
Q2103	0	11.6	0	0	0	11.1

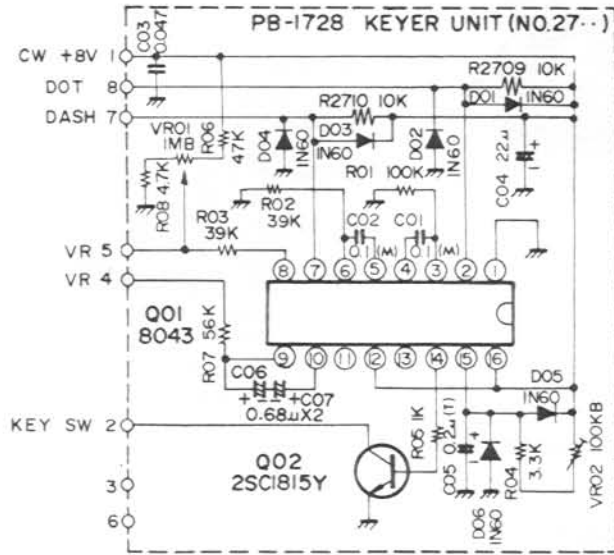


D2103 D2102 D2101 Viewed from component side



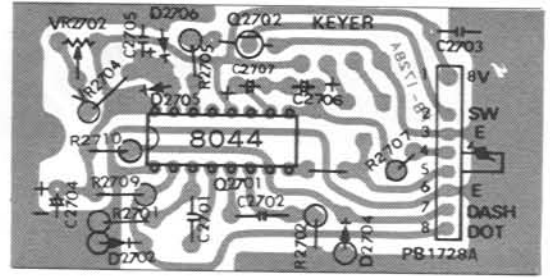
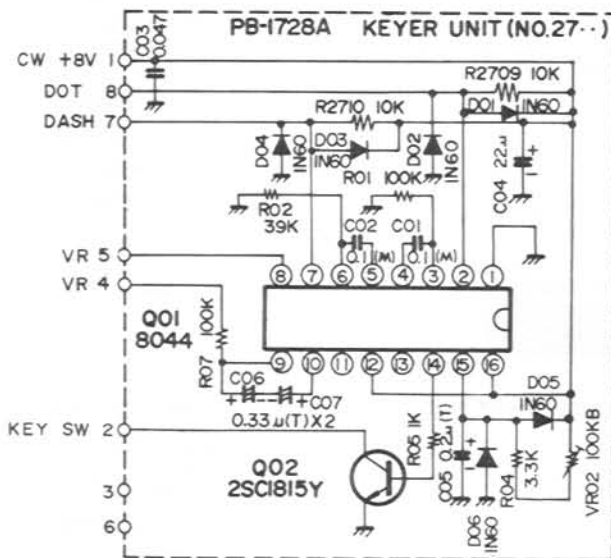
Viewed from solder side

KEYER UNIT (PB-1728A)

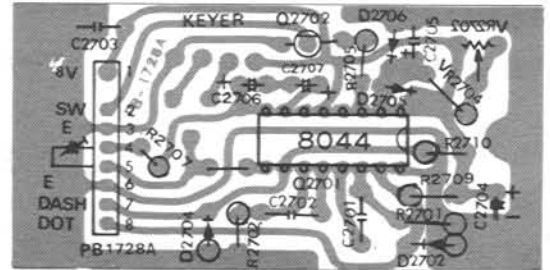


DC VOLTAGES		(V)															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Q2701	R	0	8.2	0	0	0	0	8.2	0	1.7	8.2	8.2	8.2	0	0	8.2	8.2
	T	0	0	8.1	8.2	8.2	8.1	0	4-5	4-5	4-5	1-5	8.2	4-8	3-5	2-5	8.2

MODE CW
KEYER ON



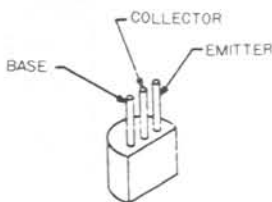
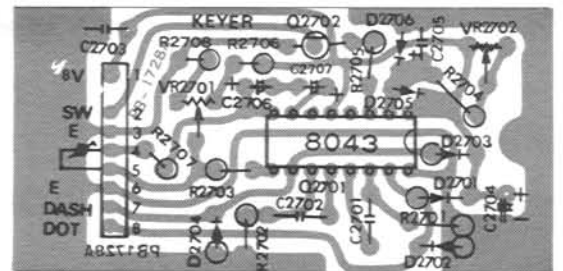
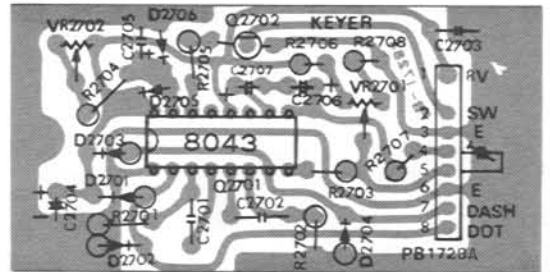
Viewed from component side



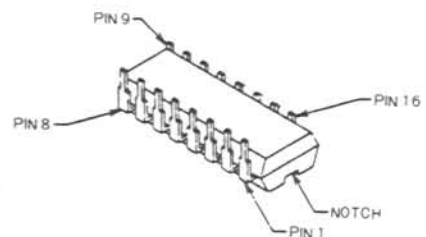
Viewed from solder side

DC VOLTAGES		(V)					
		E	C	B			
		R	T	R	T	R	T
Q2702	R	0	0	7.7	-	0	0.4-0.9
	T	0	0	7.7	-	0	0.4-0.9

MODE CW
KEYER ON



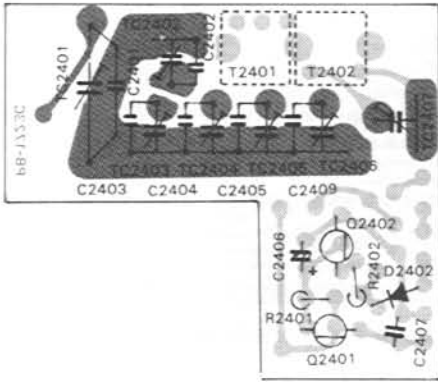
2SC1815Y



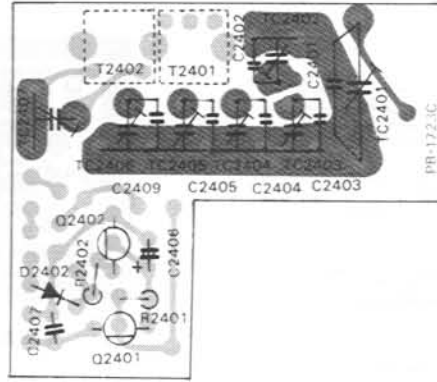
8043
8044

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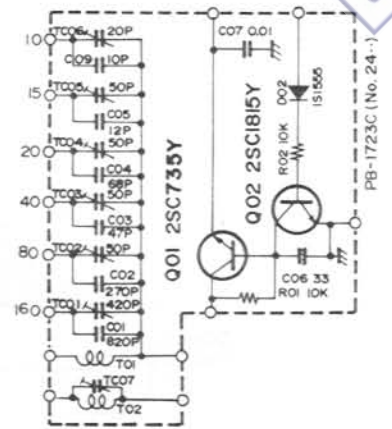
TRIMMER A BOARD (PB-1723C)



Viewed from trimmer side



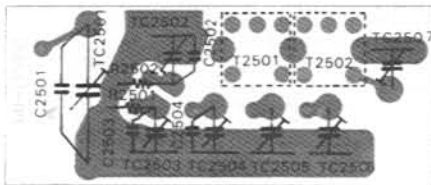
Viewed from component side



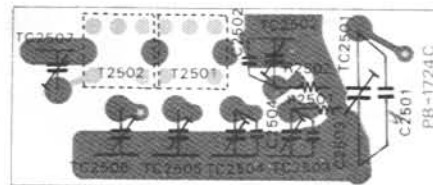
DC VOLTAGES (V)

	LOCK			UNLOCK		
	E	C	B	E	C	B
Q2401	10.2	12	10.9	0	12	0
Q2402	0	10.9	0.2	0	0	0.7

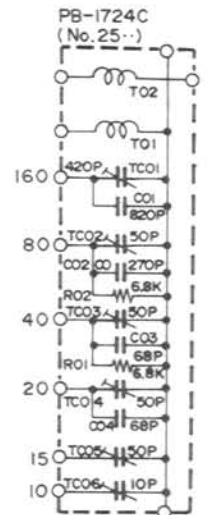
TRIMMER B BOARD (PB-1724C)



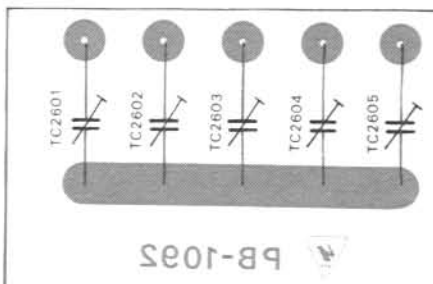
Viewed from trimmer side



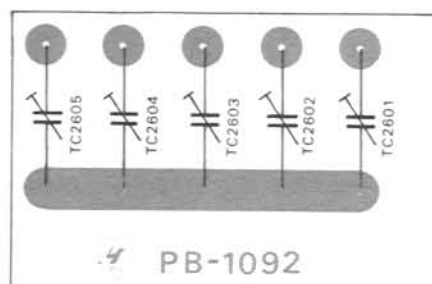
Viewed from component side



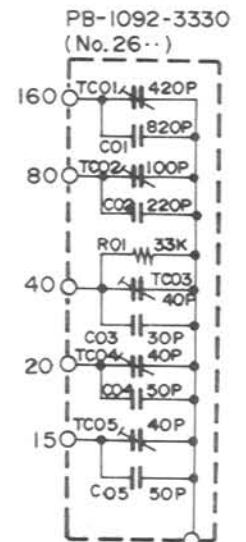
TRIMMER C BOARD (PB-1092-3330)



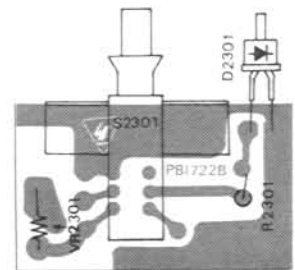
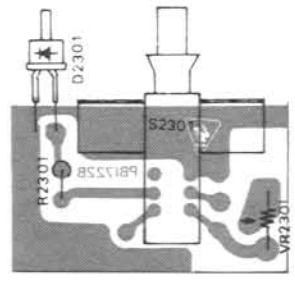
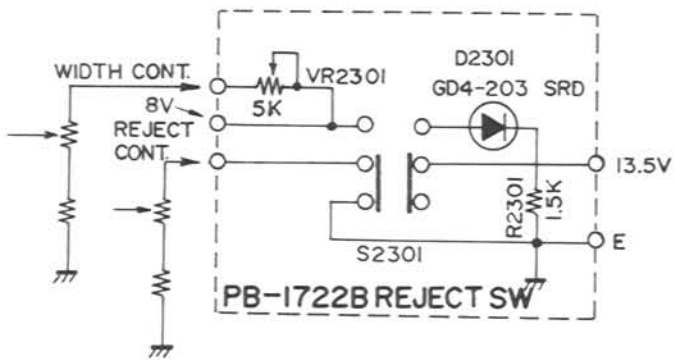
Viewed from trimmer side



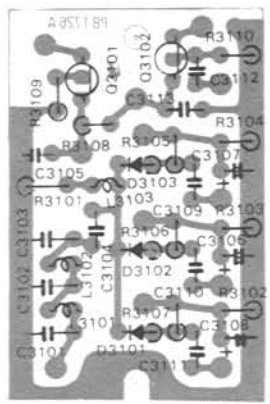
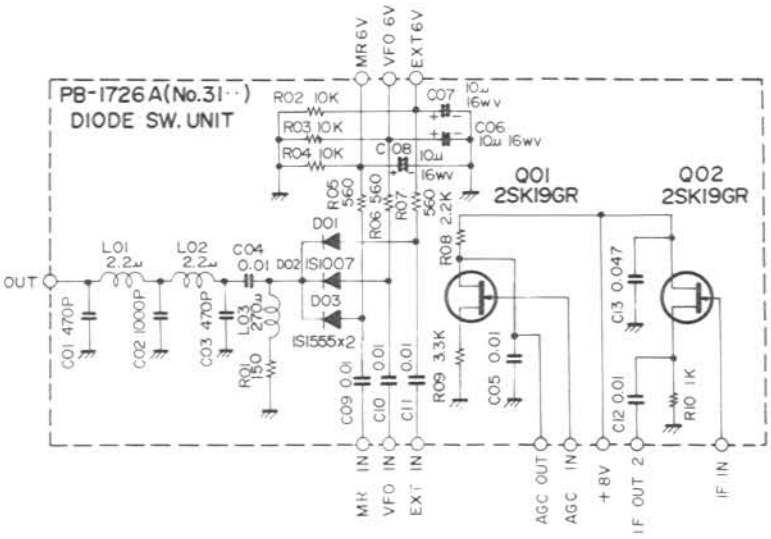
Viewed from component side



REJECT SWITCH BOARD



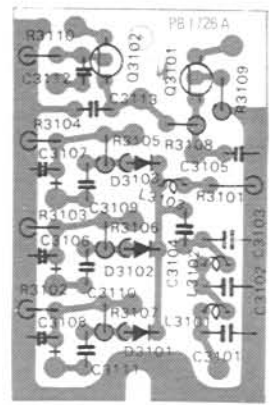
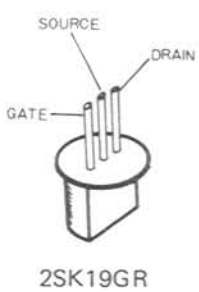
DIODE SWITCH BOARD (PB-1726A)



Viewed from component side

DC VOLTAGES (V)

	S		D		G	
	R	T	R	T	R	T
Q3101	4.6	4.6	5	5	2.9	2.9
Q3102	2.0	2.0	8.2	8.2	0	0



Viewed from solder side

				C532, 533	34220105	Electrolytic 16WV TW	1 μ F
				C504	34220475	" " "	4.7 μ F
AF UNIT				C528	35220106	" " "	10 μ F
Symbol No.	Parts No.	Description		C505, 508, 513	35220226	" " "	22 μ F
	017051AZ	AF unit with components		C525	34120336	" 10WV "	33 μ F
PB-1705A	60417051	P.C. Board		C517	34120476	" " "	47 μ F
				C515	34120107	" " "	100 μ F
				C518	34120477	" " "	470 μ F
IC & TRANSISTOR							
Q503	25000133	IC	TA7205AP				
Q504	25000125	IC	MC3403P				
Q506	25000128	IC	78L08				
Q501, 502, 505, 507	22310005	Transistor	2SC1000GR			HEAT SINK	
					80042802	(TA-7205)	
RESISTOR							
R523, 536	40143101	Carbon film 1/4W VJ	100 Ω				
R505	40143151	" " " "	150 Ω	VOX/MARKER UNIT			
R516	40143561	" " " "	560 Ω	Symbol No.	Parts No.	Description	
R506	40143681	" " " "	680 Ω		018460AZ	VOX/Marker unit with components	
R507	40143102	" " " "	1k Ω	PB-1846	40618460	P.C. Board (=PB-1685-3330)	
R512	40143222	" " " "	2.2k Ω				
R504, 539	40143332	" " " "	3.3k Ω				
R513, 514, 537	40143472	" " " "	4.7k Ω				
R510, 511	40143822	" " " "	8.2k Ω			IC & TRANSISTOR	
R538, 540, 541, 543	40143103	" " " "	10k Ω	Q604	25000114	IC	MC14011B
R503	40143153	" " " "	15k Ω	Q612	25000177	IC	4024PC
R530, 545	40143333	" " " "	33k Ω	Q603	22105641	IC	2SA564A
R508	40143393	" " " "	39k Ω	Q602, 608~610, 615	22303730	Transistor	2SC373
R502, 509, 515	40413473	" " " "	47k Ω	Q607	22307354	Transistor	2SC735Y
R534	40143823	" " " "	82k Ω	Q601, 605, 606, 611, 613, 614	22318154	Transistor	2SC1815Y
R517, 520, 522, 525, 526, 528, 535	40143104	" " " "	100k Ω				
R519, 524, 527,	40143124	" " " "	120k Ω				
						DIODE	
R518, 521, 529	40143224	" " " "	220k Ω	D601, 605	21090115	Germanium	1N60
				D603, 607~609	21015550	Silicon	1S1555
				D602, 606	21090034	Zener	WZ090
POTENTIOMETER							
VR501	49800078	GM-70R	1M Ω Bx2			CRYSTAL	
				X601	71600032	HC-6W 3200kHz	#210026
CAPACITOR							
C535	32820102	Ceramic disc 50WV	0.001 μ F			RESISTOR	
C501, 534	30820103	" " "	0.01 μ F	R616	40143101	Carbon film 1/4W VJ	100 Ω
C521	30820473	" " "	0.047 μ F	R643	40143221	" " " "	220 Ω
C512, 519	31829510	" " "	51PF SL	R620, 628	40143471	" " " "	470 Ω
C514	33824391	Dipped mica	390PF SL	R605, 614, 625, 626, 636, 642, 646~650	40143102	" " " "	1k Ω
	36825102	Mylar 50WV	0.001 μ F				
C507	36825472	" " "	0.0047 μ F				
C523, 524	36825682	" " "	0.0068 μ F	R615, 630, 640	40143222	" " " "	2.2k Ω
C506	36825103	" " "	0.01 μ F	R637	40143392	" " " "	3.9k Ω
C516,	36825473	" " "	0.047 μ F	R604, 606,	40143472	" " " "	4.7k Ω
C520, 530, 531, 536	36825104	" " "	0.1 μ F	632~634			
				R627	40143562	" " " "	5.6k Ω
C502, 503, 509, 511, 522, 529,	34220105	Electrolytic 16WV TW	1 μ F	R601, 602, 607, 608, 612, 621,	40143103	" " " "	10k Ω

		TRIMMER CAPACITOR				CERAMIC DISCRIMINATOR	
TC801	39000070	TSN-100D 15	15PF	CFD901	70900001	SFD-455-S4	
TC802	39000005	ECV-1ZW 50x32	50PF				
RESISTOR							
		INDUCTOR		R959	41143100	Carbon film 1/4W TJ	10Ω
L801	55003184		#220268	R958	40143560	" " " VJ	56Ω
L804, 805	53020014	Micro inductor FL-4H	1.8μH	R914, 917, 937,	40143101	" " " "	100Ω
L803, 806	53010003	" "	250μH	938, 953, 957			
L802	53030001	" " .S4	102K 1mH	R923	41143101	" " " TJ	100Ω
				R916, 922	40143221	" " " VJ	220Ω
				R915	40143331	" " " "	330Ω
				R935, 956	40143471	" " " "	470Ω
				R936, 944	40143561	" " " "	560Ω
J802	68040001	RECEPTACLE		R909	40143681	" " " "	680Ω
		SI-6303-1		R913, 933, 939,	40143102	" " " "	1kΩ
				943, 952, 963			
				R906, 918, 929,	40143152	" " " "	1.5kΩ
				934			
		TERMINAL		R905	40143182	" " " "	1.8kΩ
	90000000	Lighthouse type		R901, 902, 945,	40143222	" " " "	2.2kΩ
	91100008	Wrapping terminal C		960			
				R910, 949	40143272	" " " "	2.7kΩ
				R903, 926, 927,	40143332	" " " "	3.3kΩ
				946, 954			
				R912	40143392	" " " "	3.9kΩ
				R919, 920, 928,	40143562	" " " "	5.6kΩ
				940, 942			
FM UNIT							
Symbol No.	Parts No.	Description					
	017072AZ	FM unit with components		R908	40143822	" " " "	8.2kΩ
PB-1707B	60417072	P.C. Board		R947, 950	40143103	" " " "	10kΩ
				R911	40143183	" " " "	18kΩ
				R921, 930, 948,	40143223	" " " "	22kΩ
				951			
				IC, FET & TRANSISTOR			
Q904, 909	25000099	IC	TA7061AP	R955, 964	40143273	" " " "	27kΩ
Q914	25000128	IC	78L08 ±10%	R904, 907, 961	40143473	" " " "	47kΩ
Q911	22800345	FET	2SK34E	R932, 941, 962	40143563	" " " "	56kΩ
Q901	23800513	FET	3SK51-03	R924, 925	40143104	" " " "	100kΩ
Q902, 903, 905, 906, 907, 908, 910, 912, 913	22318154	Transistor	2SC1815Y	R931	40143154	" " " "	150kΩ
THERMISTOR							
				TH901	29090001	SDT-250	
DIODE							
D902, 903, 905, 906	21001880	Germanium	1S188FM				
D901, 907, 910	21015550	Silicon	1S1555				
D908	29090007	Varistor	MV-13	POTENTIOMETER			
D909	21090137	Varactor	FC-63	VR903	49912202	V10-K8-1-2	2KB
				VR901	49912203	"	20kΩB
				VR902	49912503	"	50kΩB
CRYSTAL							
X902	71800091	HC-18/U	8987.5kHz				
X901	71800092	HC-18/U	9442.5kHz				
				C901, 902, 903, 913, 963	30820102	Ceramic disc 50WV	0.001μF
				C904, 905, 909, 910, 956, 961, 962, 964, 966 971	30820103	" " "	0.01μF
				CERAMIC FILTER			
CF901, 902	71200016	LF-B-15		C926, 928,	30820473	" " "	0.047μF
				C968	31829200	" " "	20PF CH
				C972	31829680	" " "	68PFCH
				C957	33824030	Dipped mica	3PF

		RESISTOR					
R1126	40143100	Carbon film 1/4W VJ	10Ω				
R1113	40143560	" " " "	56Ω				
R1129	40143680	" " " "	68Ω				
R1107, 1128	40143101	" " " "	100Ω	VCO UNIT			
R1103	40143151	" " " "	150Ω	Symbol No.	Parts No.	Description	
R1105, 1114, 1121	40143102	" " " "	1kΩ	PB-1710B	017102AZ	VCO unit with components	
R1122	40143152	" " " "	1.5kΩ		60417102	P.C. Board	
R1110, 1112, 1115, 1116, 1118	40143222	" " " "	2.2kΩ				
FET & TRANSISTOR							
R1119, 1120, 1123, 1124, 1127	40143472	" " " "	4.7kΩ	Q1201~1208	22800196	FET	2SK19BL
				Q1209	23800513	FET	3SK51-03
				Q1210~1212	22318154	Transistor	2SC1815Y
R1111, 1125	40143223	" " " "	22kΩ				
R1104	40143473	" " " "	47kΩ				
R1109	40143683	" " " "	68kΩ				
R1117	40143104	" " " "	100kΩ	DIODE			
				D1219, 1220	21090115	Germanium	1N60
				D1209~1218	21015550	Silicon	1S1555
				D1201~1208	21090138	Varactor	MV104
		CAPACITOR		RESISTOR			
C1110, 1113	31829270	Ceramic disc 50WV	27PF SL	R1256	40143220	Carbon film 1/4W VJ	22Ω
C1116, 1135	31829390	" " "	39PF SL	R1269, 1270	40143270	" " " "	27Ω
C1120	31829470	" " "	47PF SL	R1235	40143470	" " " "	47Ω
C1112	31829560	" " "	56PF SL	R1264, 1266	40143560	" " " "	56Ω
C1117	31829101	" " "	100PF SL	R1201, 1205,	40143101	" " " "	100Ω
C1105	31829151	" " "	150PF SL	1208, 1212,			
C1101, 1102, 1104, 1109, 1114, 1118, 1121, 1122	30820102	" " "	0.001μF	1215, 1219,			
				1222, 1226,			
				1228, 1229,			
				1233, 1236,			
C1103, 1107, 1108, 1115, 1124~1126, 1128, 1130, 1131, 1134	30820103	" " "	0.01μF	1240, 1242,			
				1246, 1248,			
				1252, 1254★			
				1271▲			
C1119	36825104	Mylar "	0.1μF	R1257, 1258	40143151	" " " "	150Ω
C1132, 1133	36326685	Noise limiter 20WV	6.8μF	R1207, 1214,	40143561	" " " "	560Ω
C1127, 1129	34220106	Electrolytic 16WV TW	10μF	1221, 1254▲			
				R1255, 1261	40143102	" " " "	1kΩ
				R1206, 1213,	40143222	" " " "	2.2kΩ
				1220, 1227,			
				1234, 1241,			
				1247, 1253			
				R1262	40143472	" " " "	4.7kΩ
		INDUCTOR		R1267	40143562	" " " "	5.6kΩ
L1105		Micro inductor FL4H J	12μH	R1263, 1265	40143473	" " " "	47kΩ
L1103, 1104	53020028	" " FL5H	18μH	R1260	40143823	" " " "	82kΩ
L1106	53020019	" " "	22μH	R1203, 1204,	40143104	" " " "	100kΩ
L1108, 1109, 1111	53020021	" " "	220μH	1210, 1211,			
				1217~1218,			
L1101, 1107, 1110	53020001	" " "	1mH	1224, 1225,			
				1231, 1232,			
				1238, 1239,			
				1244, 1245,			
				1250, 1251,			
				1268, 1272▲			
		TRANSFORMER		R1259	40143684	" " " "	680kΩ
T1101	54141840	R12-4184	#220169				
TP1101	91100008	Wrapping terminal C		▲ 5MHz WWV			
				★ 15MHz WWV			

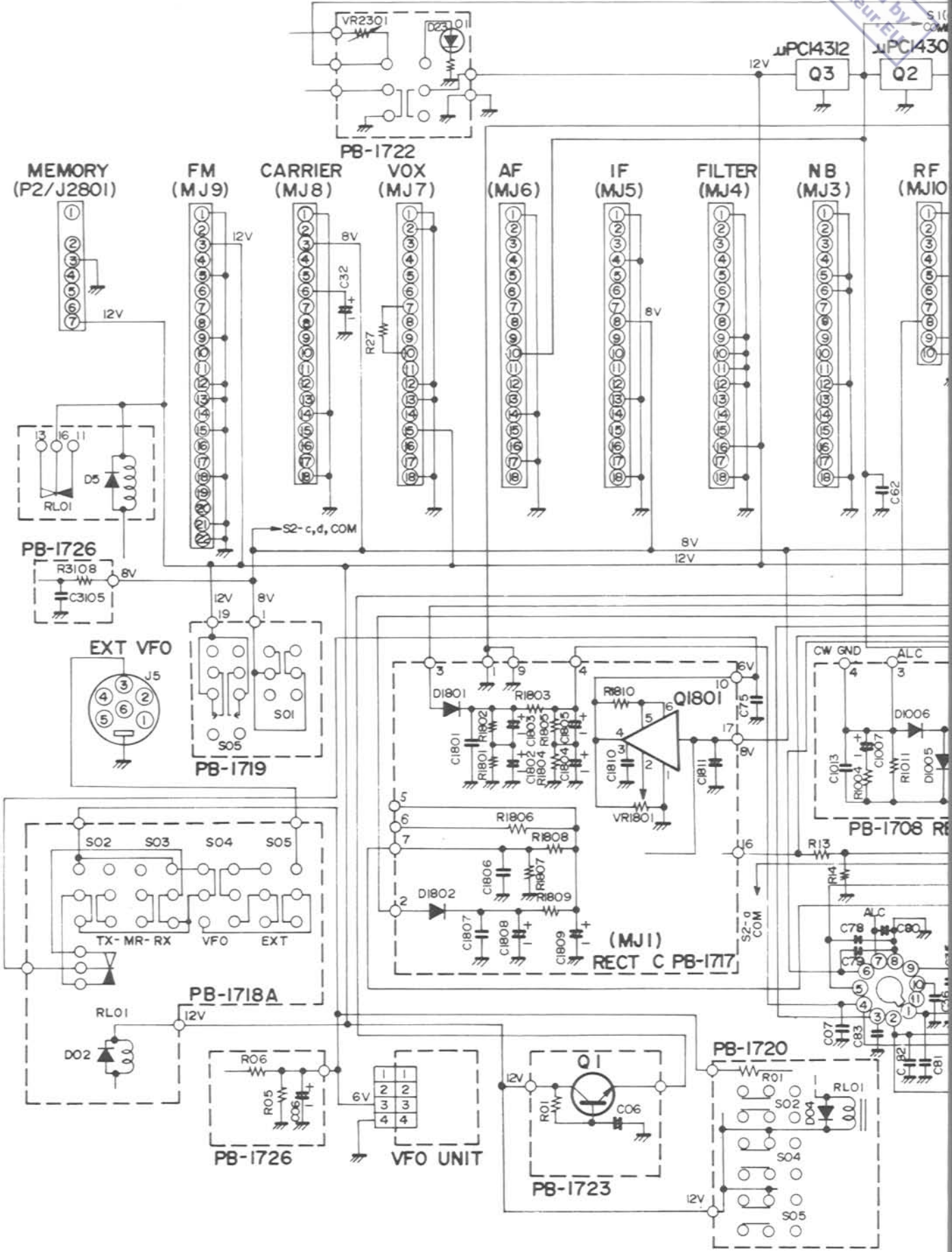
				Q1301~1310	22303724	TRANSISTOR	
						Transistor	2SC372Y
		CAPACITOR					
C1275	31827050	Ceramic disc 50WV	5PF UJ				
C1242, 1250	31827150	" " "	15PF UJ				
C1211,	31827200	" " "	20PF UJ			DIODE	
C1226, 1258	31827220	" " "	22PF UJ		21010070	Germanium	1S1007
C1234	31827240	" " "	24PF UJ	D1301~1310	21015550	Silicon	1S1555
C1218, 1219	31827270	" " "	27PF UJ				
C1204, 1210	31827390	" " "	39PF UJ				
C1205, 1213, 1220, 1259	31827470	" " "	47PF UJ				
C1203	31827101	" " "	100PF UJ			CRYSTAL	
C1235	31820010	" " "	1PF CH	X1301	71500164	(160m) 15.9875MHz	#210041-1
C1212,1276,1277	31820020	" " "	2PF CH	X1302	71500165	(80m) 17.9875MHz	#210041-2
C1227, 1277*	31820100	" " "	10PF CH	X1303	71500166	(40m) 21.4875MHz	#210041-3
C1243, 1251	31820120	" " "	12PF CH	X1304	71500167	(20m) 28.4875MHz	#210041-4
C1233	31820150	" " "	15PF CH	X1305	71500168	(15m) 35.4875MHz	#210041-5
C1225, 1241, 1249, 1257*	31820200	" " "	20PF CH	X1306	71500169	(10A) 42.4875MHz	#210041-6
				X1307	71500170	(10B) 42.9875MHz	#210041-7
C1228, 1236, 1244, 1252	31820470	" " "	47PF CH	X1308	71500171	(10C) 43.4875MHz	#210041-8
				X1309	71500172	(10D) 43.9875MHz	#210041-9
C1201, 1202, 1207~1209, 1215~1217, 1222~1224, 1230~1232, 1238~1240, 1246~1248 1254~1256, 1261, 1262, 1265, 1267, 1269	30820102	" " "	0.001μF	X1310*	71500183	(★15MHz WWV) 29.4875MHz	#210078-11
				X1310▲	71500173	(▲5MHz WWV) 19.4875MHz	#210078-10
						CRYSTAL SOCKET	
				XS1301~1310	69010012	SD0105	1P
						RESISTOR	
C1206, 1214, 1221, 1229, 1237, 1245, 1253, 1260, 1263, 1264, 1266, 1268, 1270~1273	30820103	" " "	0.01μF	R1326, 1331, 1336, 1341	40143470	Carbon film 1/4W VJ	47Ω
				R1301, 1305, 1310, 1315, 1320, 1321, 1325, 1330, 1335, 1340, 1345, 1350	40143101	" " " "	100Ω
C1274	34220106	Electrolytic 16WV TW	10μF	R1316, 1346*	40143221	" " " "	220Ω
				R1306, 1311, 1346▲	40143331	" " " "	330Ω
L1203~1211	53020021	Micro inductor FL5H	220μH	R1304, 1309, 1314, 1319, 1324, 1329, 1334, 1339, 1344, 1349	40143561	" " " "	560Ω
						TRANSFORMER	
T1201, 1202	55003179		#220294				
T1203	55003180		#220297	R1351	40143681	" " " "	680Ω
T1204, 1308*	55003181		#220295	R1302, 1307, 1312, 1317, 1322, 1327, 1332, 1337, 1342, 1347	40143332	" " " "	3.3kΩ
T1205~1207	55003182		#220296				
T1308▲	55003183		#220293				
				R1303, 1308, 1313, 1318, 1323, 1328, 1333, 1338, 1343, 1348	40143153	" " " "	15kΩ
XTAL UNIT							
Symbol No.	Parts No.	Description					
	017111AZ	Xtal unit with components					
PB-1711A	60417111	P.C. Board					

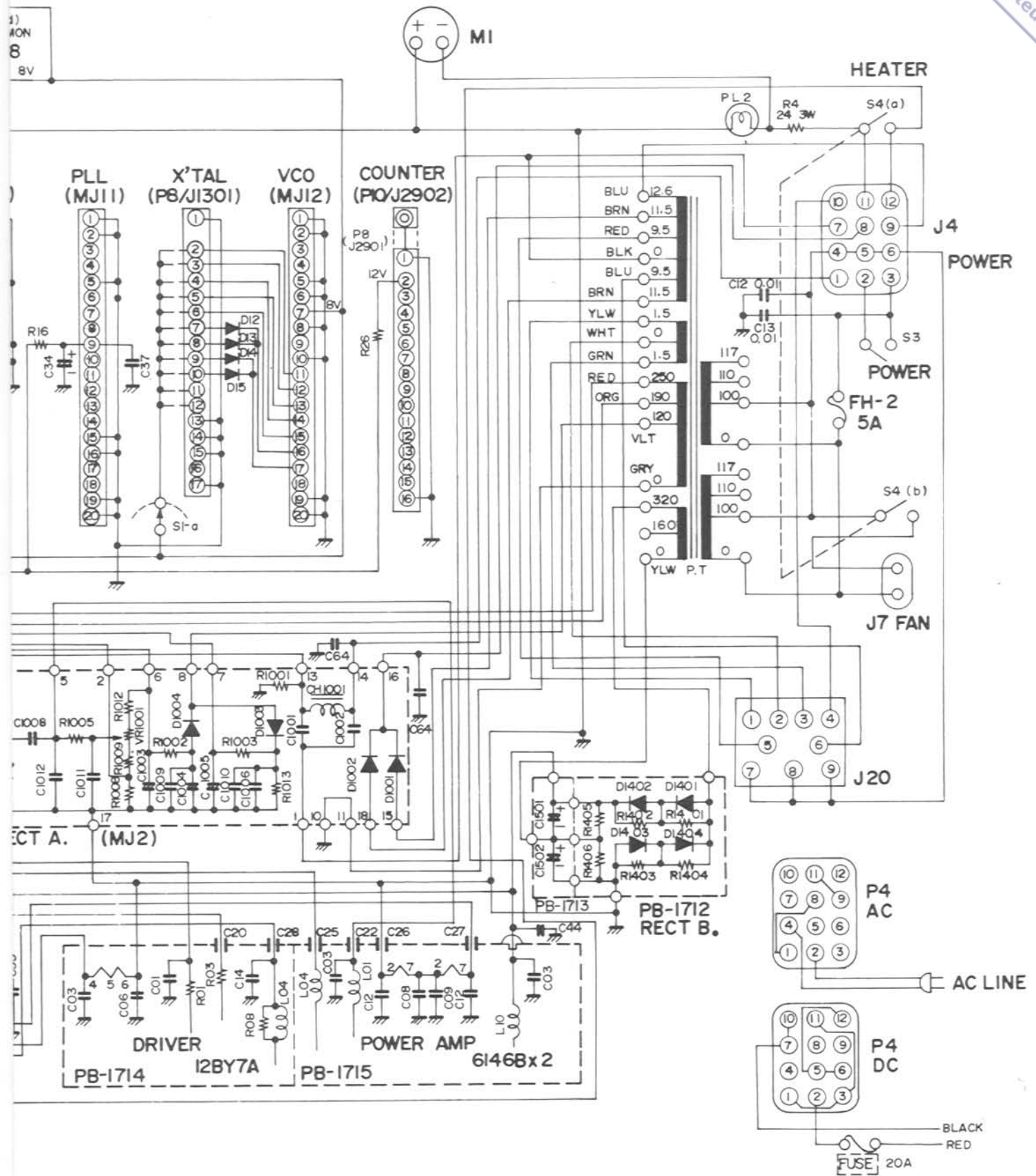
			IC. TRANSISTOR		
			Q1801	25000074	IC TA7089M
			Q1804	22106390	Transistor 2SA639
			Q1803	22107330	Transistor 2SA733
			Q1805, 1806	22318155	Transistor 2SC1815GR
FINAL BOARD					
Symbol No.	Parts No.	Description			
	017152AZ	Final board with components			
PB-1715B	60417152	P.C. Board			
DIODE					
			D1801, 1802	21090019	Silicon 10D10
			D1803~1808	21015550	Silicon 1S1555
VACUUM TUBE					
V1701, 1702	10000026	6146B			
RESISTOR					
D1701	21090019	Silicon	10D10	R1810	40143479 Carbon film 1/4W VJ 4.7Ω
VACUUM TUBE SOCKET					
VS1701, 1702	68080006	SB-3606			
			R1815	40143471	" " " " 470Ω
			R1812	40143472	" " " " 4.7kΩ
			R1813, 1814 1817, 1818	40143103	" " " " 10kΩ
			R1816	40143223	" " " " 22kΩ
RESISTOR					
R1701, 1702 (L1702, 1703)	42124560	Carbon composition 1/2W GK 56Ω		R1801, 1802, 1804, 1805	42124474 Carbon composition 1/2W GK 470kΩ
R1703, 1704, 1705	42124101	" " " " 100Ω		R1803, 1809	43204471 Metallic film 2W 470Ω
R1706	—	Meter shunt		R1808	43304332 " " 3W 3.3kΩ
R1707	43304153	Metallic film 3W 15kΩ		R1806	43304153 " " " 15kΩ
			R1807	43304473	" " " 47kΩ
CAPACITOR					
C1704, 1710	30830103	Ceramic disc 500WV 0.01μF		VR1801	49915502 V10K-8-1-2 5kΩB
C1705~1709, 1711, 1712	30820473	" 50WV 0.047μF			
C1703	30830102	" 500WV 1000PF			
C1701	33147101	Moulded mica 1kV 100PF			
CAPACITOR					
C1702	33831050	Dipped mica 500WV 5PF		C1801, 1807, 1812	30240472 Ceramic disc 500WV 0.0047μF
			C1810	36825223	Mylar 50WV 0.022μF
			C1811	34220106	Electrolytic 16WV TW 10μF
			C1806	35330106	" 250WV TW 10μF
			C1808, 1809	34350226	" 350WV TW 22μF
			C1802~1805	34330476	" 250WV TW 47μF
INDUCTOR					
L1701	53020013	Micro inductor 150μH			
L1704	53020015	Micro inductor 560μH			
L1702, 1703 (R1701, 1702)	53003220	RF choke #220307			
SELECT SWITCH BOARD					
Symbol No.	Parts No.	Description			
	017183AZ	Select switch board with components			
	91100008	Wrapping terminal C			
			PB-1718C	60417183	P.C. Board
TRANSISTOR					
			Q1901, 1902	22318154	Transistor 2SC1815Y
RECT. C UNIT					
Symbol No.	Parts No.	Description			
	017171AZ	Rect. C unit with components			
PB-1717A	60417171	P.C. Board			
DIODE					
			D1901, 1902	21090011	Silicon 10D1

TRIMMER C BOARD				POTENTIOMETER		
Symbol No.	Parts No.	Description	VR2702	49905104	SR19R	100kΩB
PB-1092-3330	60610920	Trimmer C board with components P.C. Board		49905105	SR19R	1MΩB
				CAPACITOR		
RESISTOR				C2703	30820473	Ceramic disc 50WV 0.047μF
R2601	42124333	Carbon composition 1/2W TJ 33kΩ	C2701, 2702	36825104	Mylar 50WV	0.1μF
			C2705	36526204	Tantalum 35WV	0.2μF
			C2706, 2707	36526334	" "	0.33μF
			C2704	34220226	Electrolytic 16WV	22μF
				CAPACITOR		
C2605	33834100	Dipped mica 500WV 10PF				
C2603	33834300	" " " 30PF				
C2604	33834500	" " " 50PF				
C2602	33834221	" " " 220PF	J2701	67080006	MINI CONNECTOR 5048-8A	
C2601	33834821	" " " 820PF				
				MEMORY UNIT		
TRIMMER CAPACITOR				Symbol No.	Parts No.	Description
TC2603~2605	39000017	B-1P1 40PF		017872AZ	Memory board with components	
TC2602	39000016	B-2PY 100PF	PB-1787B	60417872	P.C. Board	
TC2601	39000018	B-7P 420PF				
				IC, FET & TRANSISTOR		
				Q2820	25000149	IC LM308
				Q2821	25000135	IC MC4044P (μPC1008C)
KEYER UNIT				Q2822~2826	25000090	IC MC14042B
Symbol No.	Parts No.	Description	Q2812	25000147	IC MM74C90	
PB-1728A	60417281	Keyer unit with components P.C. Board	Q2811	25000146	IC MSM5562	
			Q2818	25000172	IC NJM78L05	
			Q2816, 2817	25000175	IC NJM78L08	
			Q2813	25000140	IC SN74LS00N	
			Q2814, 2833	25000141	IC SN74LS04N	
Q2701	25000203	IC 8044	Q2832	25000151	IC SN74LS123N	
Q2702	22318154	Transistor 2SC1815Y	Q2827~2831	25000150	IC SN74LS192N	
			Q2815	25000148	IC TC5032P	
			Q2819, 2834	25000109	IC μPC14305	
			Q2801, 2802, 2805, 2806	22890017	FET JF1033B	
DIODE				Q2809	23800401	FET 3SK40M
D2701~2706	21090115	Germanium 1N60	Q2807	22303724	Transistor 2SC372Y	
			Q2803, 2804, 2810	22307853	Transistor 2SC7850	
			Q2808	22390001	Transistor MPS A13	
RESISTOR						
R2705	40143102	Carbon film 1/4W VJ 1kΩ				
R2704	40143332	" " " " 3.3kΩ				
R	40143472	" " " " 4.7kΩ				
R2709, 2710	40143103	" " " " 10kΩ				
R2703	40143393	" " " " 39kΩ	D2804, 2805	21001880	Germanium 1S188FM	
R2706	40143473	" " " " 47kΩ	D2801~2803	21015550	Silicon 1S1555	
R	40143563	" " " " 56kΩ	D2806, 2807	21090141	Varactor MV104	
R2701,2702,2707	40143104	" " " " 100kΩ	D2808	21090145	Zener WZ060	

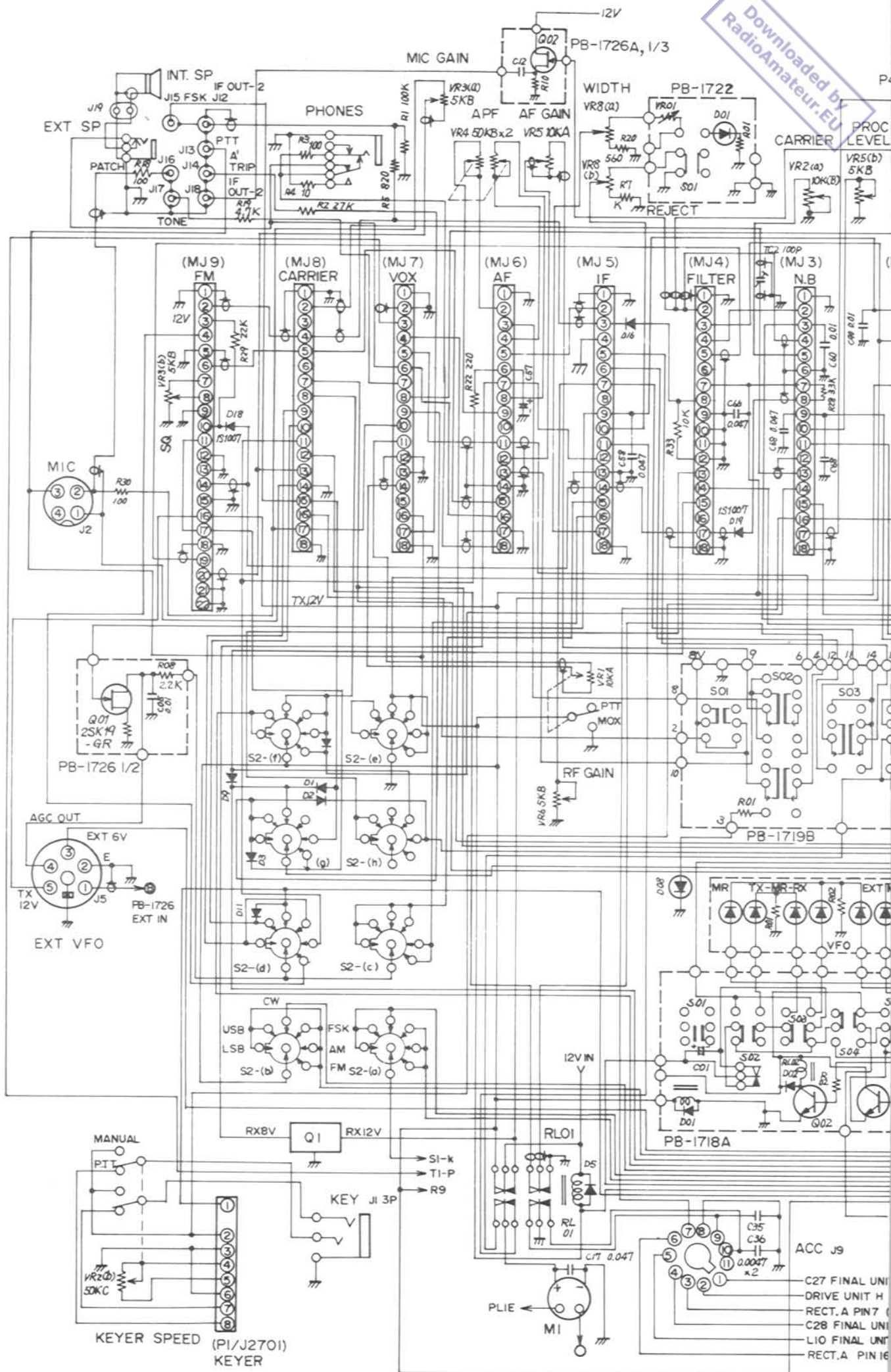
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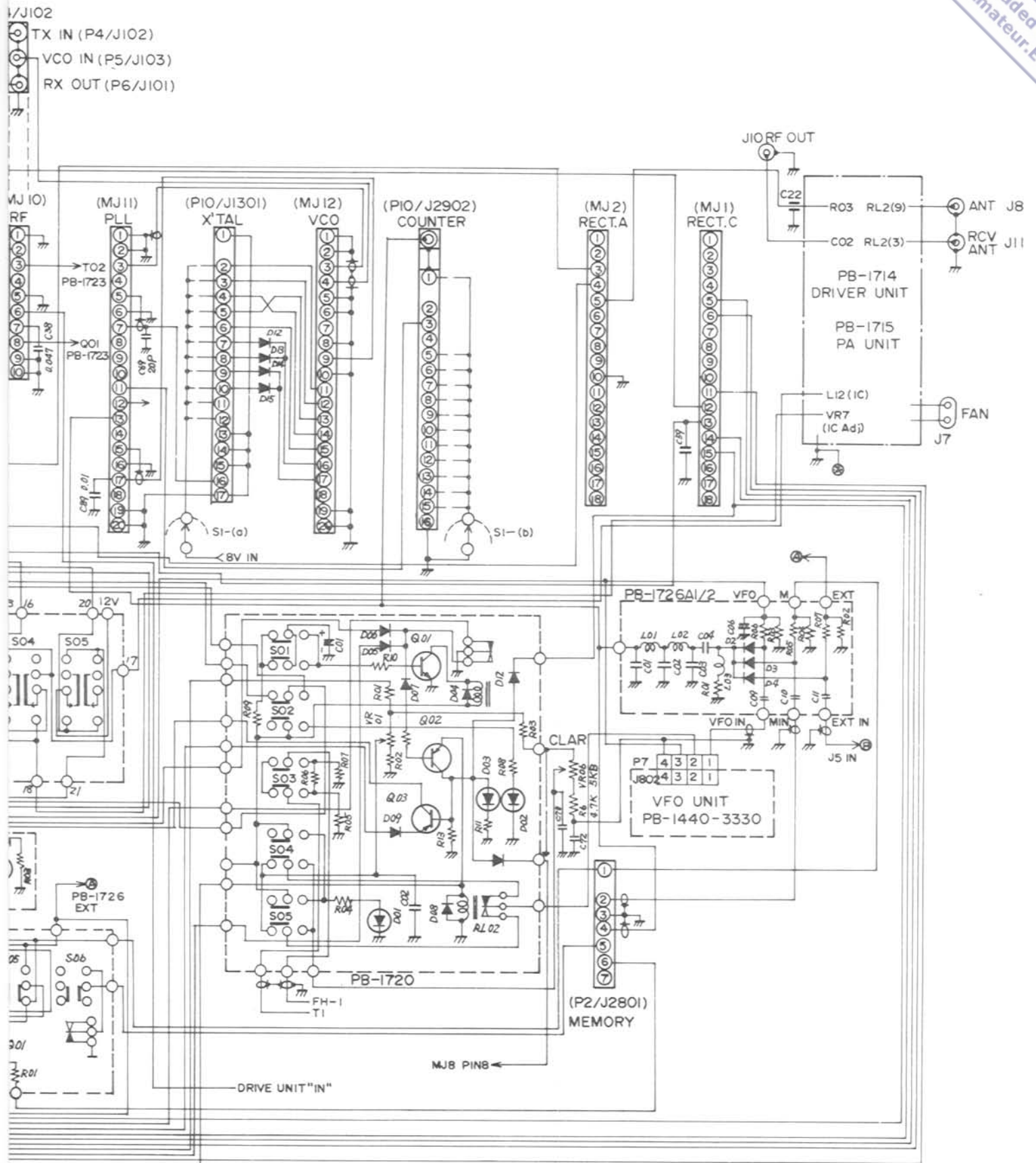
				INDUCTOR	
			L3101, 3102		Micro inductor FL-4H 250H
			L3103	53020027	Micro inductor FL-5H 270H
DISPLAY BOARD					
Symbol No.	Parts No.	Description			
PB-1730	60417300	P.C. Board		91100008	Wrapping terminal C
		DISPLAY LED			
DS3001~3006	21090135	HP5082-7740			
DC-DC CONVERTER UNIT					
		SOCKET		Symbol No.	Parts No.
QS3001~3006	68140005	314-AG-37D			
				TRANSISTOR	
				Q3201, 3202	22290020 T20A6 with insulator
	67200003	Board joint	163740		
RESISTOR					
				R3202	43104332 Wire wound 1W 3.3Ω
				R3201	43504221 Metallic film 5W 220Ω
DIODE SWITCH BOARD					
Symbol No.	Parts No.	Description			
	017261AZ	Diode switch board with components			
PB-1726A	60417261	P.C. Board			
CAPACITOR					
				C3202	38235473 Metallized paper 150WV 0.047μF
				C3201	34320227 Electrolytic 25WV 220μF
FET					
Q3101, 3102	22800195	2SK19GR			
DIODE					
D3102	21010070	Germanium	1S1007	P3201	68090038 AC9M
D3101, 3103	21015550	Silicon	1S1555		
RESISTOR					
R3101	40143151	Carbon film 1/4W VJ	150Ω		
R3105~3107	40143561	" " " "	560Ω		
R3110	40143102	" " " "	1kΩ		
R3108	40143222	" " " "	2.2kΩ		
R3109	40143332	" " " "	3.3kΩ		
R3102~3104	40143103	" " " "	10kΩ		
ACCESSORIES					
				Symbol No.	Parts No.
					77000008
					Microphone YE7A with Microphone hanger screws.
					67040001
					Microphone plug FM-144P
					96000033
					AC Power cord #240036B
					T9003680
					2 wire, 2 prong plug
					T9003681
					3 wire, without plug
					T9003682
					3 wire, 3 prong UL plug
					T9003683
					3 wire, 3 prong Australia plug
					T9003684
					3 wire, 2 prong EU plug
C3104, 3105, 3109~3112	30820103	Ceramic disc 50WV	0.01μF		67120009
					Power plug QS-A-P12FL
C3113	30820473	" " " "	0.047μF		T9003720
					DC Power cord #240037
C3101, 3103	33824471	Dipped mica 50WV	470PF		67120009
					Power plug QS-A-P12FL
C3102	33824102	" " " "	1000PF		69000002
					Fuse holder SN1102
C3106, 3107, 3108	34220106	Electrolytic 16WV TW	10μF		73000007
					Fuse 20A
					67030001
					Key plug SH3603
					67020002
					Phone plug SH3001
					67020003
					External speaker plug P2240
					67020005
					Antenna plug SO259
					67110007
					ACC plug PA-602B 04
					67020001
					RCA pin plug CN7017
					73000004
					Fuse 5A (100V~117V)
					73000003
					3A (200V~234V)





FT-901 MAIN CHASSIS
POWER DISTRIBUTION

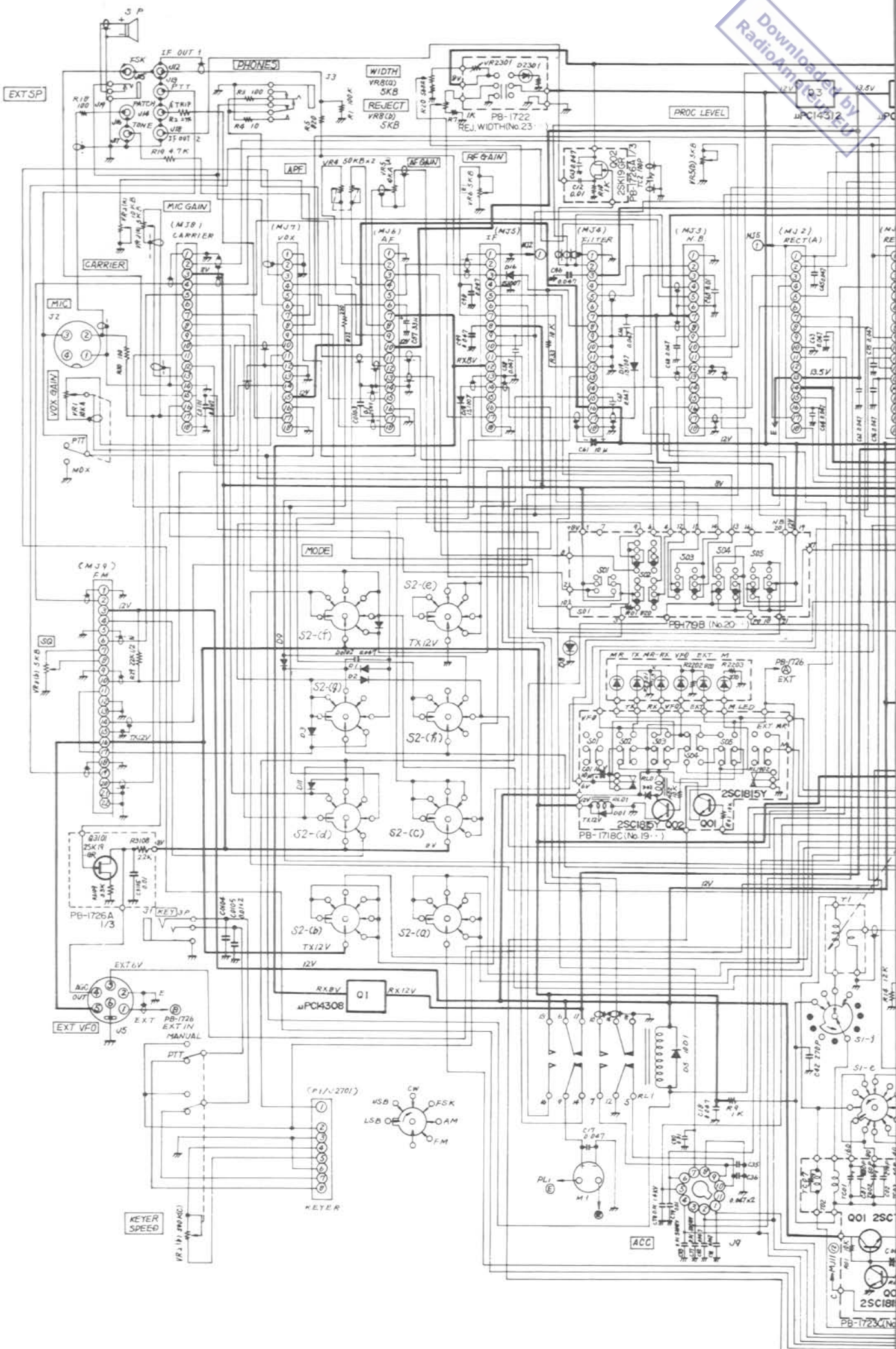


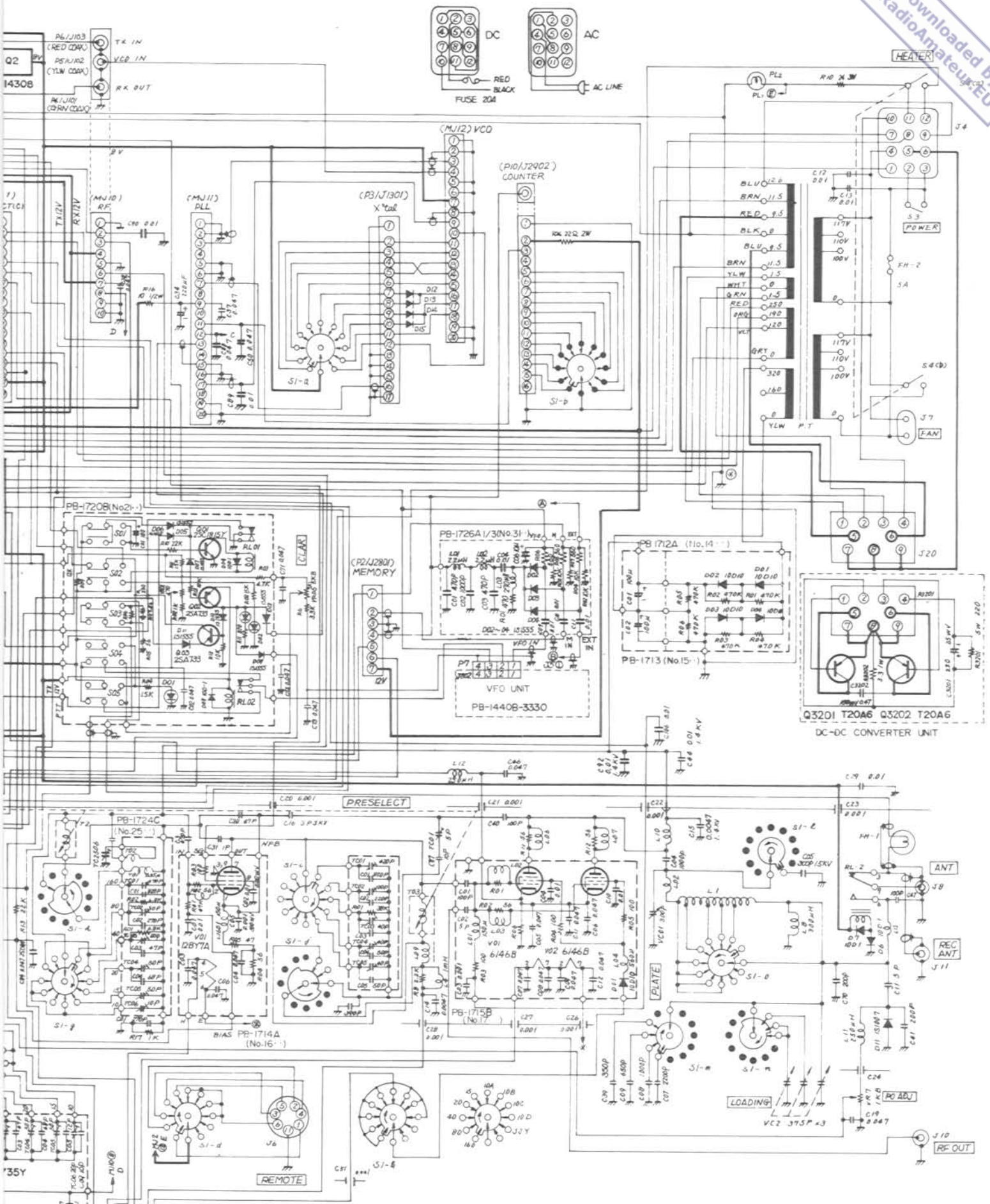


FT-901 MAIN CHASSIS
SIGNAL AND CONTROL WIRING

R04 PB-1723

F H
180V)
T (300V)
(800V)
(-100V)



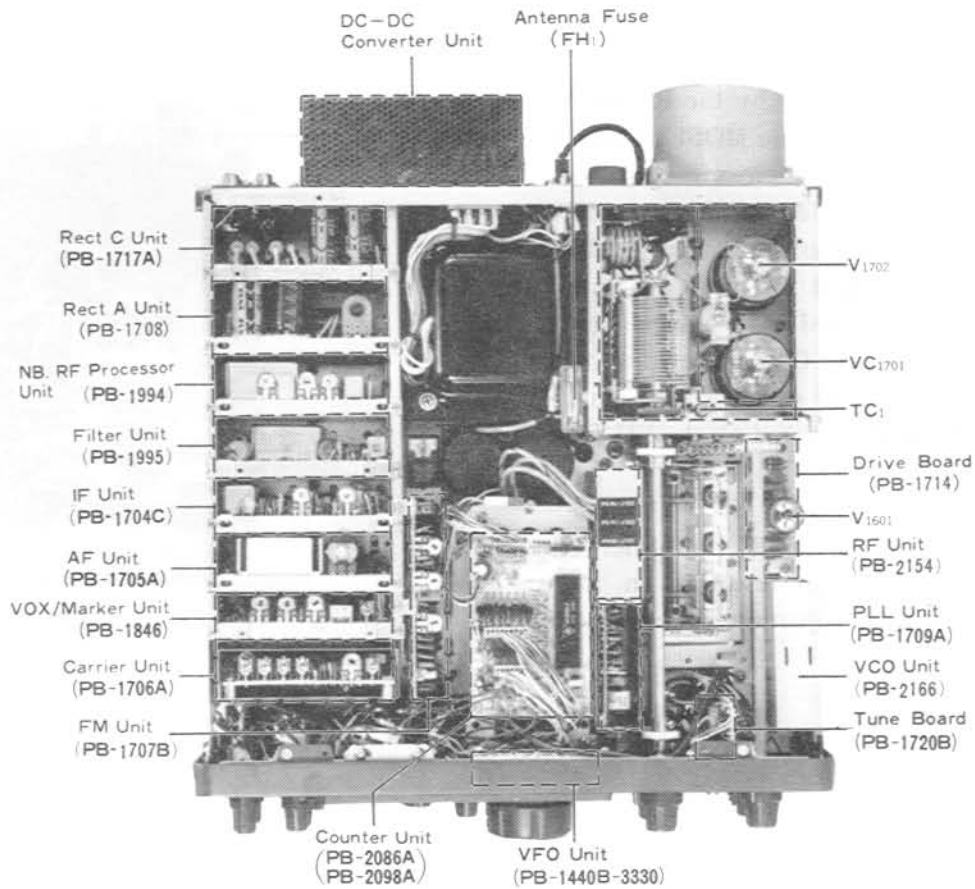


- NOTES
1. ALL RESISTORS IN $\pm 10\%$ UNLESS OTHERWISE NOTED.
 2. ALL CAPACITORS IN μF 50WV UNLESS OTHERWISE NOTED.

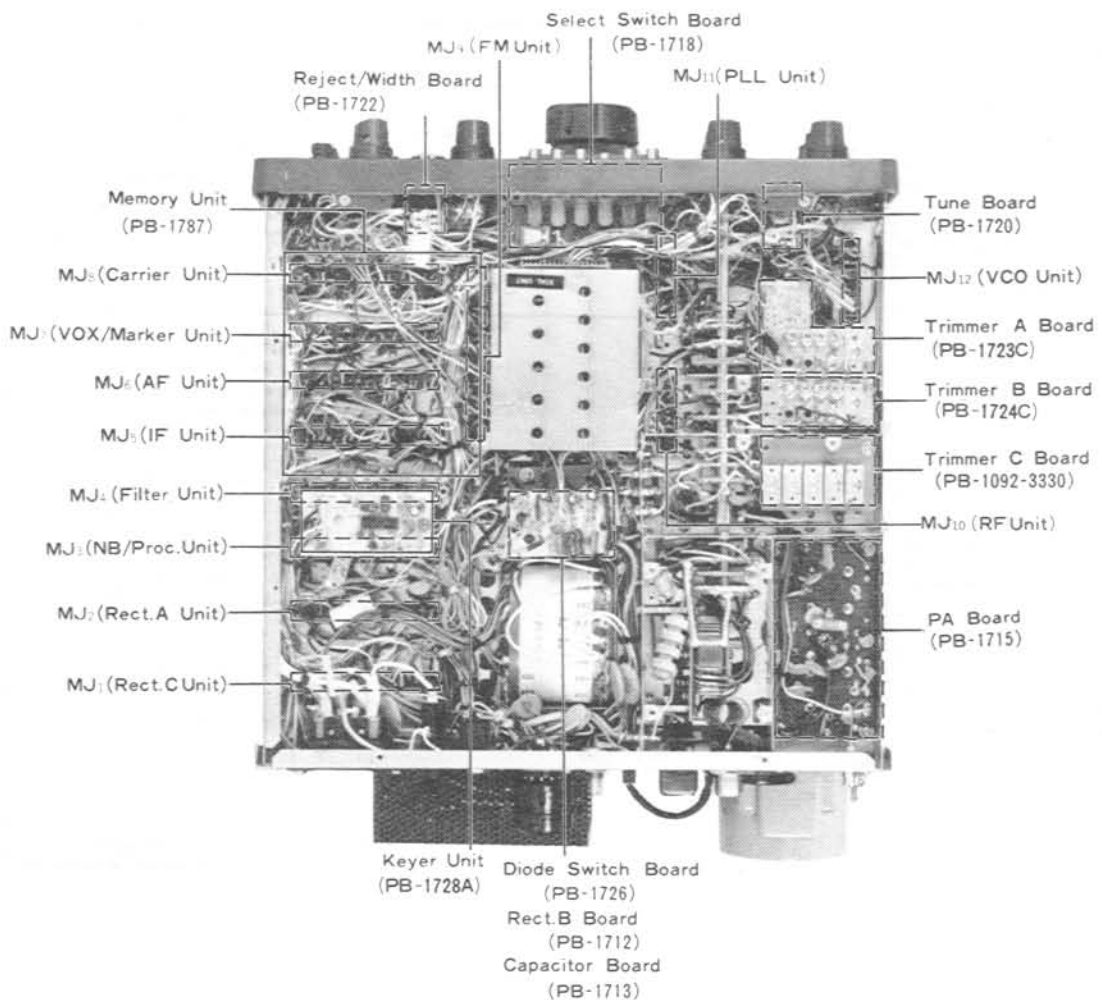
FT-901
CONNECTION DIAGRAM

SECTION 5 — CIRCUIT UPDATE (FT-902DM)

CIRCUIT BOARD LOCATIONS	5 - 1
RF UNIT (PB-2154)	5 - 2
FILTER UNIT (PB-1995)	5 - 3
NB UNIT (PB-1994)	5 - 4
IF UNIT (PB-1704C)	5 - 4
CRYSTAL UNIT (PB-2165)	5 - 6
VCO UNIT (PB-2166)	5 - 7
COUNTER UNIT (PB-2086A-3430/PB-2098)	5 - 8
UPDATED PARTS LIST (COMPLETE)	5-10



Top View

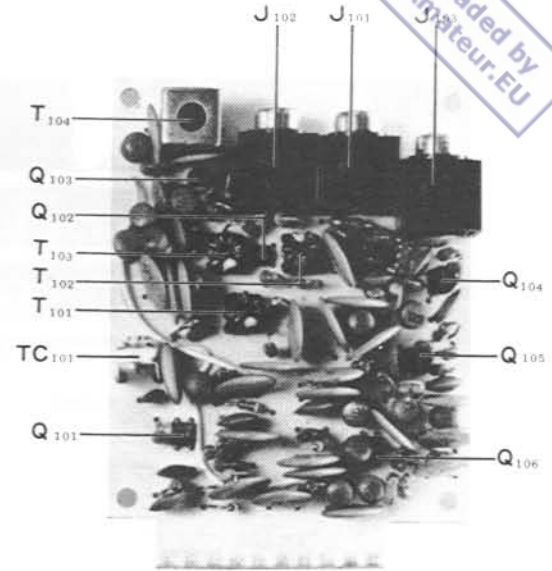


Bottom View

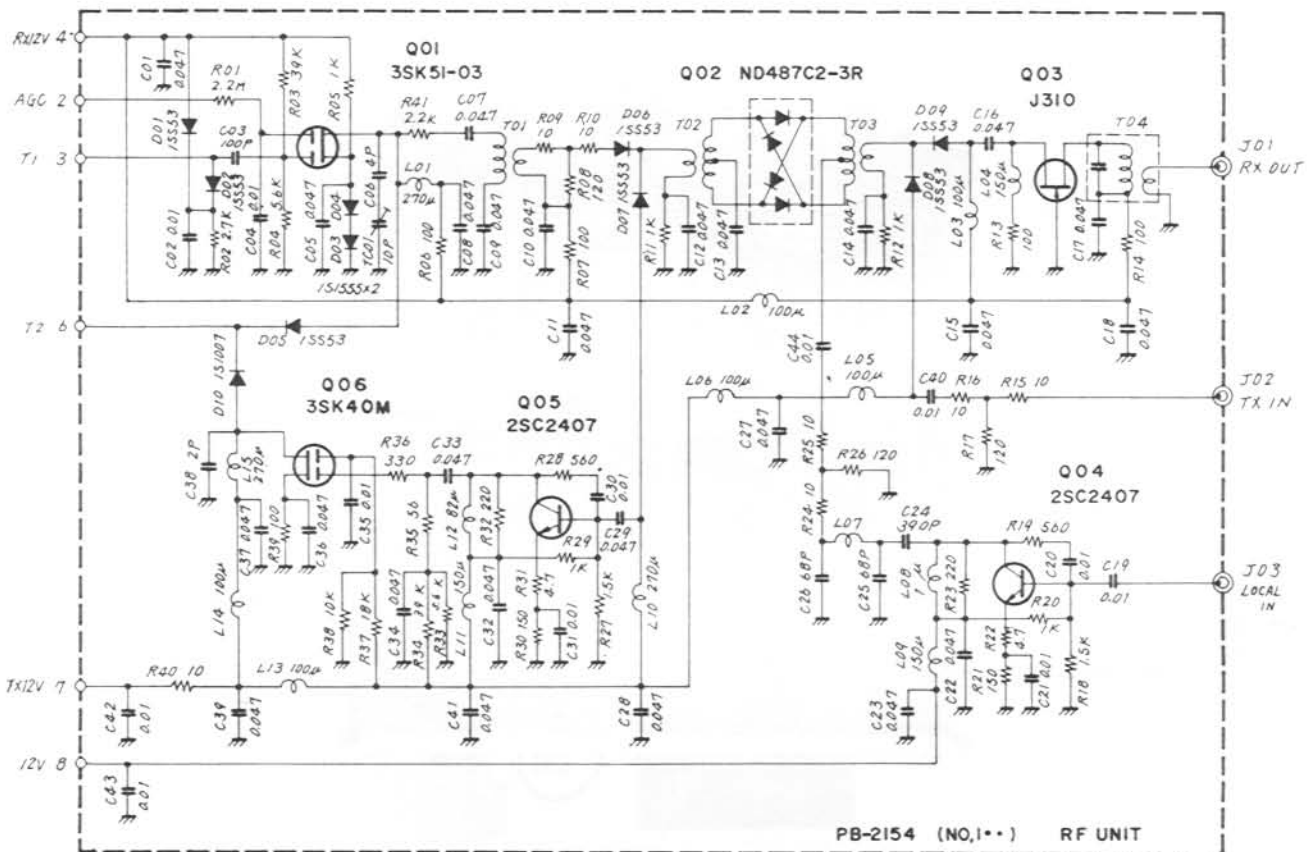
RF UNIT (PB-2154)

The incoming signal is amplified by the RF amplifier Q₁₀₁ (3SK51-03), a dual gate MOSFET which has superior rejection against cross modulation. The amplified signal is then fed to the first mixer Q₁₀₂ (ND487C2-3R), a Schottky-barrier double-balanced mixer, for excellent intercept characteristics. The RF signal is mixed with a local signal delivered from the LOCAL UNIT, resulting in a 8.9875 MHz first IF. The IF signal is then amplified by Q₁₀₃ (J310) and delivered to the FILTER UNIT.

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



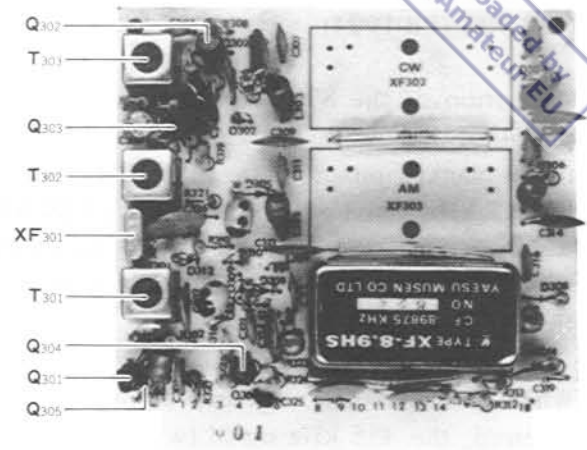
RF unit (PB-2154)



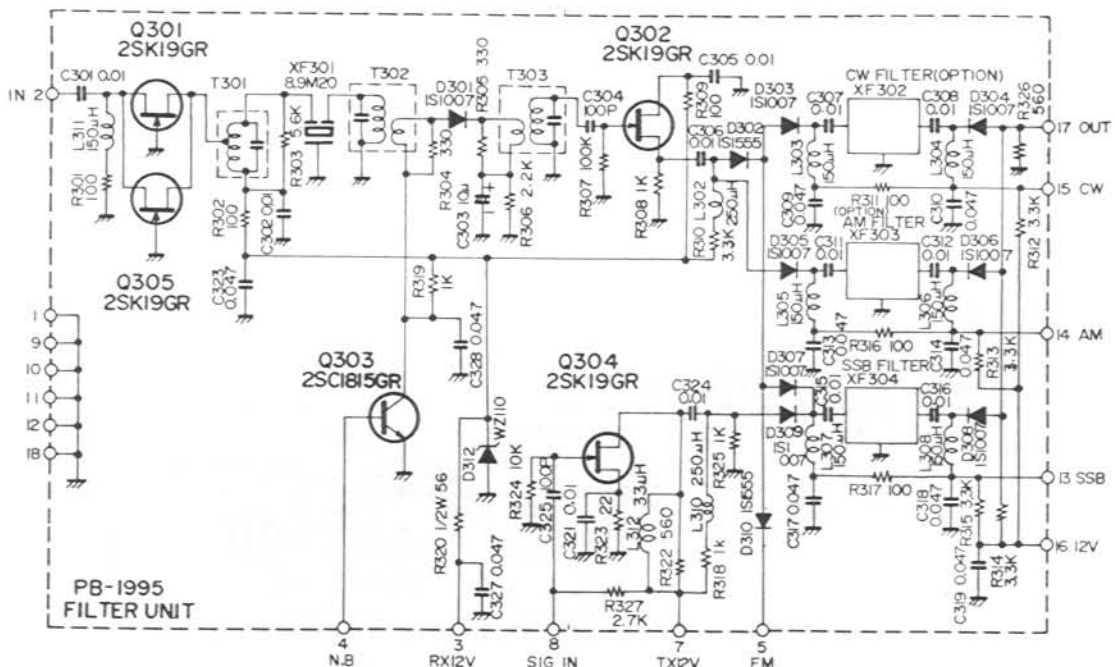
FILTER UNIT (PB-1995)

The IF signal received at pin 2 of the FILTER UNIT (PB-1995) is amplified by parallel-connected Q₃₀₁ and Q₃₀₅ (both 2SK19GR), and fed through a monolithic filter XF₃₀₁ (8.9M-20A), which has a ± 10 kHz bandwidth, providing additional selectivity and enough delay time to match the noise blanker gating pulses. The signal is then fed to the second IF amplifier, Q₃₀₂ (2SK19GR).

The noise blanker diode D₃₀₁ (1S1007) is placed between T₃₀₂ and T₃₀₃, and it functions as an ON/OFF switch which is controlled by the noise blanker driver Q₃₀₃ (2SC1815GR). The output from the source of Q₃₀₂ is passed through the SSB filter XF₃₀₄ (or the optional AM or CW filters). Selection of the filter to be used is performed by one of the diode switches D₃₀₃ - D₃₀₈ (1S1007), depending on the mode of operation. The IF signal is then transferred to the IF UNIT. In the FM mode, the IF signal is coupled directly through D₃₁₀ (1S1555) to pin 5 of the IF UNIT.



Filter unit (PB-1995)



NB UNIT (PB-1994)

A portion of the 8987.5 kHz IF signal is fed to pin 4 of the noise blanker unit and appears at noise blanker mixer Q₂₀₉ (3SK40M), where the 8532.5 kHz signal generated by Q₂₁₁ (2SC1815Y) is mixed with the incoming signal to produce a 455 kHz signal. The 455 kHz signal is then amplified by Q₂₁₀ (3SK40M).

When a carrier or a noise-free modulated signal is received, the 455 kHz signal (with its corresponding strength) is rectified by D₂₀₂ and D₂₀₃ (both 1N270) to charge C₂₃₅. There is no discharge loop for C₂₃₅; therefore, signals which exceed the charged voltage established by the reference voltage on C₂₃₅ will not pass through D₂₀₂ and D₂₀₃. Accordingly, there will be no voltage drop across R₂₄₇, and Q₂₁₂ (3SK51-03) will conduct as the gate voltage approaches zero potential. When Q₂₁₂ conducts, the drain voltage at pin 2 of the printed board will drop.

The drain of Q₂₁₂ is directly connected to the base of Q₃₀₃ (2SC1815GR) in the FILTER UNIT. As the drain voltage of Q₂₁₂ drops, the base voltage of Q₃₀₃ drops, turning off Q₃₀₃. The collector voltage will then increase, producing

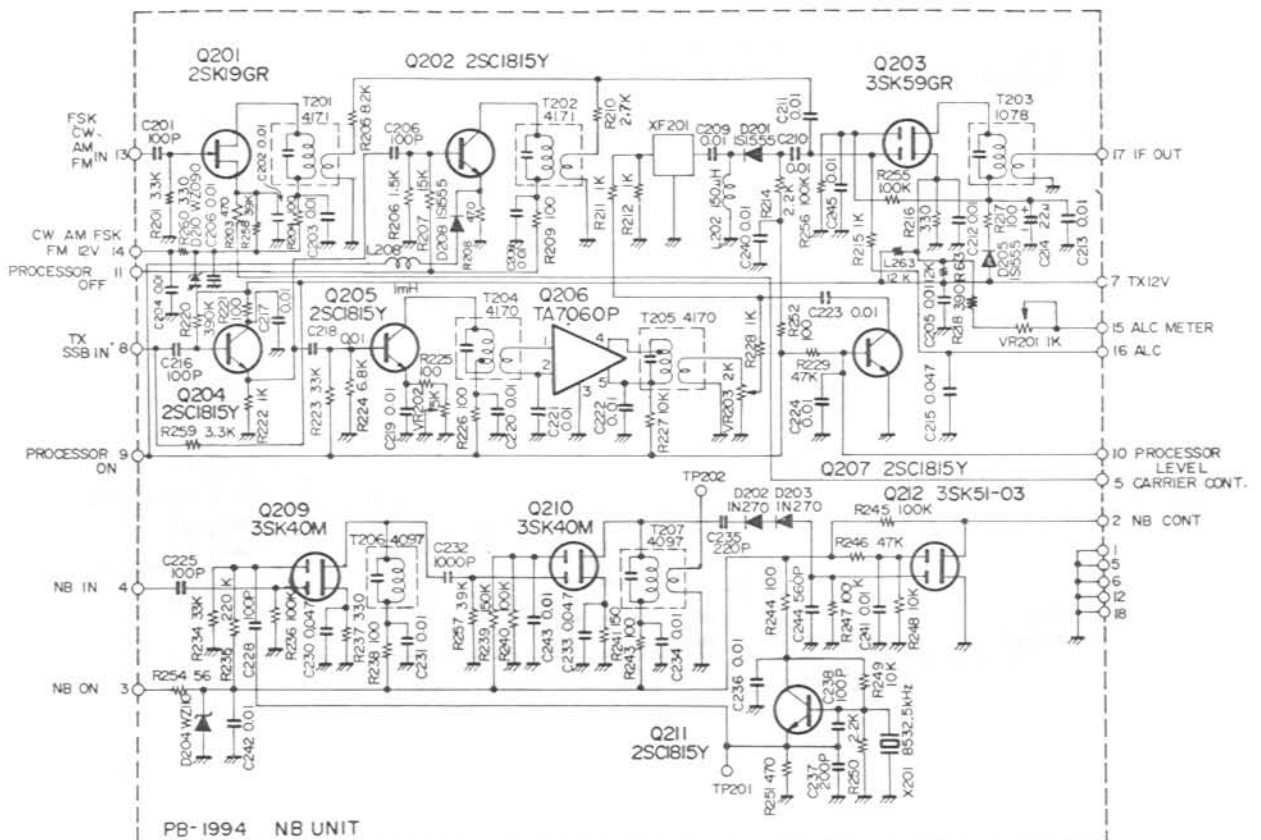
a forward bias to D₃₀₁ (1S1007). As D₃₀₁ conducts, the signals will pass normally through the circuit.

When pulse-type noise is received which exceeds the charged reference voltage established by C₂₃₅, D₂₀₂ and D₂₀₃ will permit negative-going pulses to turn Q₂₁₂ off. The drain voltage will rapidly increase as it turns off.

As the drain voltage increases, Q₃₀₃ will turn on and the collector voltage will decrease. Accordingly, D₃₀₁ will be biased to block the signal. Thus, when pulse-type noise is received, the signal passage will be blanked off momentarily.

IF UNIT (PB-1704C)

The IF signal from pin 14 is fed to the gate of the IF first mixer, Q₄₀₁ (3SK51-03), where the IF signal is heterodyned with a 19.7475 MHz $\pm \Delta f$ local signal delivered from crystal oscillator Q₄₀₅ (2SC535A) and buffer amplifier Q₄₀₆ (2SC1815Y), resulting in a signal of 10.76 MHz $\pm \Delta f$.



The new $10.76 \text{ MHz} \pm \Delta f$ signal is fed through filter XF₄₀₁ to the IF first mixer Q₄₀₁ (3SK51-03), where the filtered signal is heterodyned with a $19.7475 \text{ MHz} \pm \Delta f$ signal, producing an 8.9875 MHz signal, the same as the original IF. This process moves the IF signal across the passband of XF₄₀₁. The combination of filters XF₃₀₄ and XF₄₀₁ provides continuously variable width of the IF passband.

The frequency of crystal oscillator Q₄₀₅ is varied by varactor diode D₄₁₀ (1S2209).

On the AM and FM modes, the IF signal is passed through diode switches D₄₀₂ and D₄₀₃ (1S1007), and does not pass through filter XF₄₀₁.

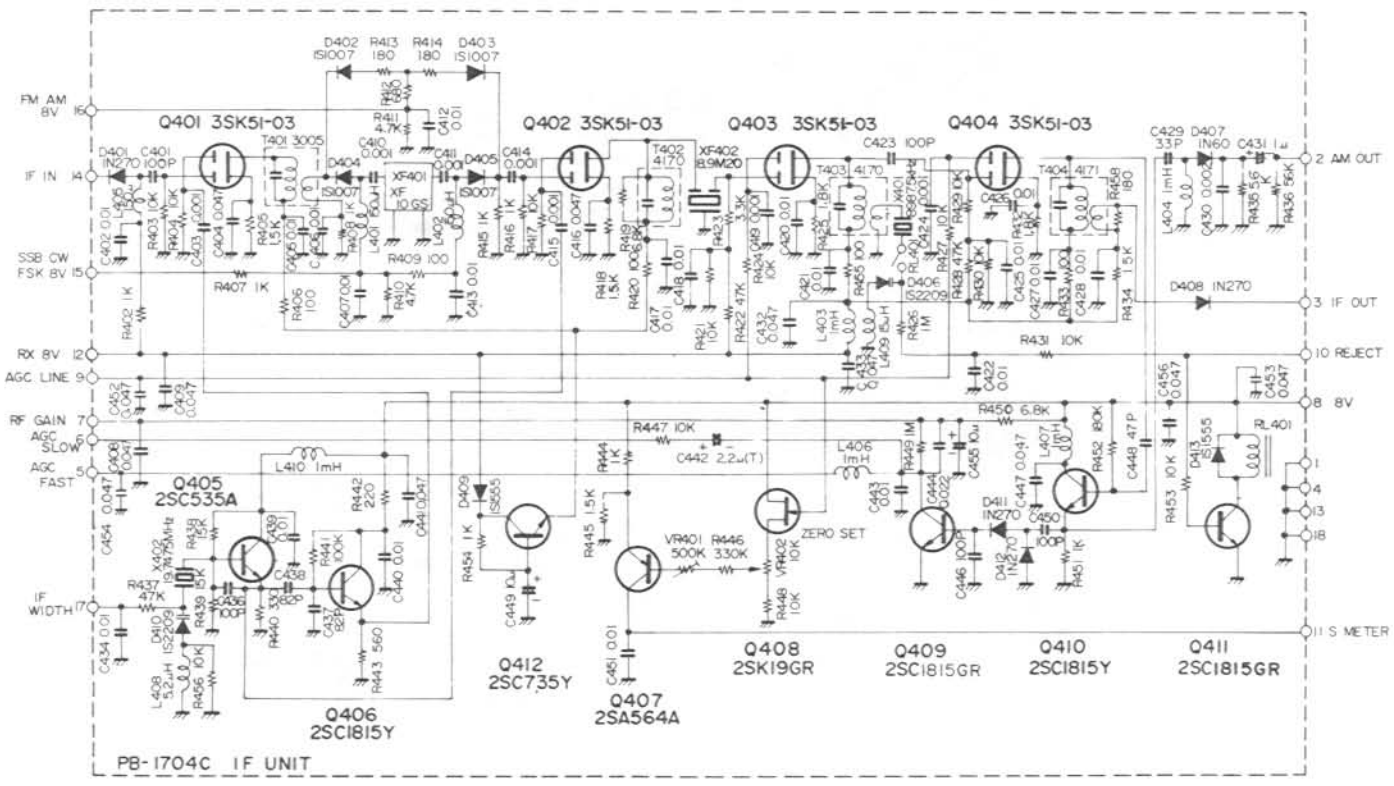
The output from the IF second mixer is fed through a monolithic filter XF₄₀₂ to the two-stage IF amplifier consisting of Q₄₀₃ and Q₄₀₄ (both 3SK51-03). The output from Q₄₀₃ is coupled to the rejection tuning circuit which eliminates interference within the IF passband. This rejection function is accomplished by varying the resonant frequency of a crystal with varactor diode D₄₀₆ (1S2209) on the SSB, CW, and FSK modes.

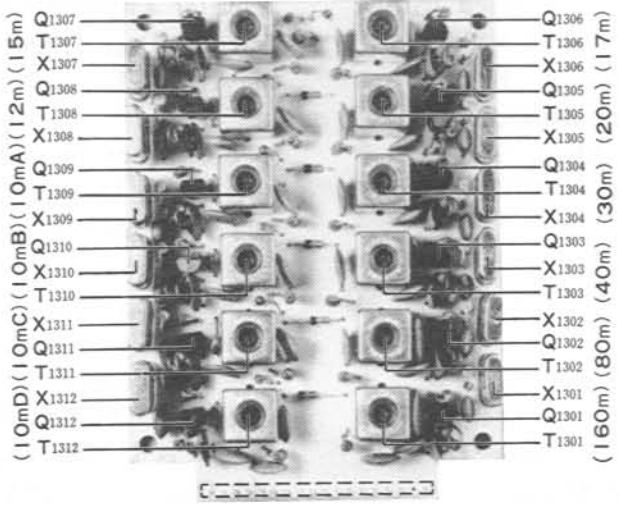
The amplified IF signal is fed to the CARRIER UNIT. In the AM mode, the signal is fed through a buffer amplifier Q₄₁₀ (2SC1815Y) to the AM detector D₄₀₇ (1N60). The signal is then fed to the AF UNIT.

A portion of the output from Q₄₁₀ is rectified by D₄₁₁ and D₄₁₂ (1N270) to produce AGC voltage. The AGC voltage is amplified by DC amplifier Q₄₀₉ (2SC1815GR) and fed to the gate of RF amplifier Q₁₀₁ and to IF amplifiers Q₄₀₃ and Q₄₀₄ to control the gain of these stages for AGC purposes. The time constant of the AGC voltage decay is selectable (FAST/SLOW) by switch S₂₀₀₃. The AGC voltage is further amplified by Q₄₀₈ (2SK19GR) and Q₄₀₇ (2SA564A) for signal strength indication on the front panel S-meter.

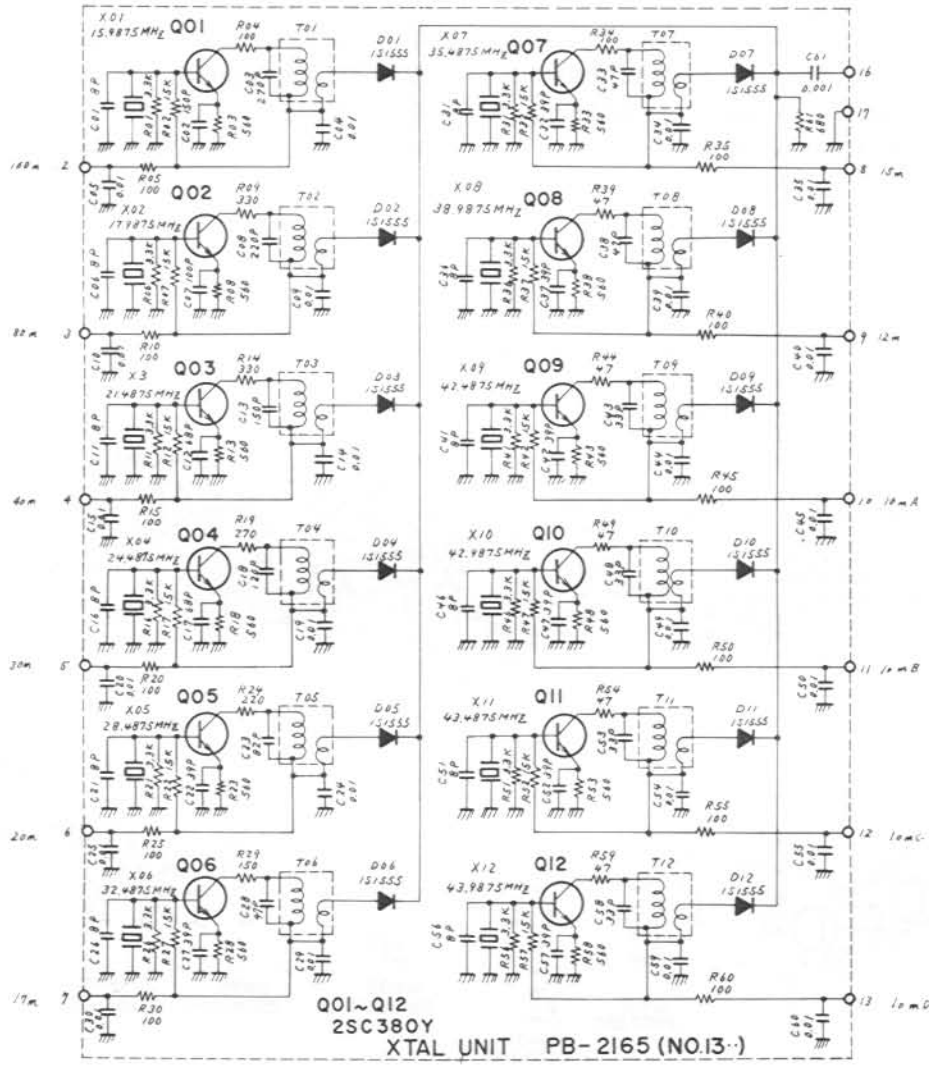
The RF GAIN control on the front panel varies the AGC voltage level, providing manual control of the gain of the RF and IF stages.

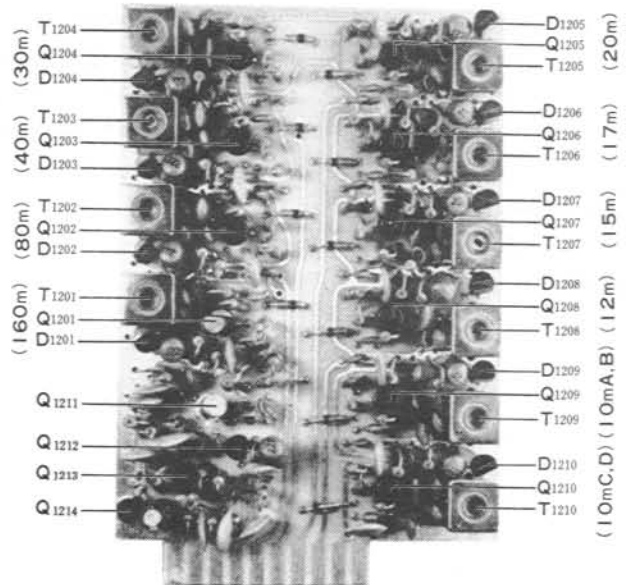
Q₄₁₁ (2SC1815GR) works as a relay driver for the IF rejection tuning circuit. Delay transistor Q₄₁₂ (2SC735Y) supplies the voltage to the drain of Q₄₀₁ and Q₄₀₂ when the transceiver returns to the receive mode after transmission.



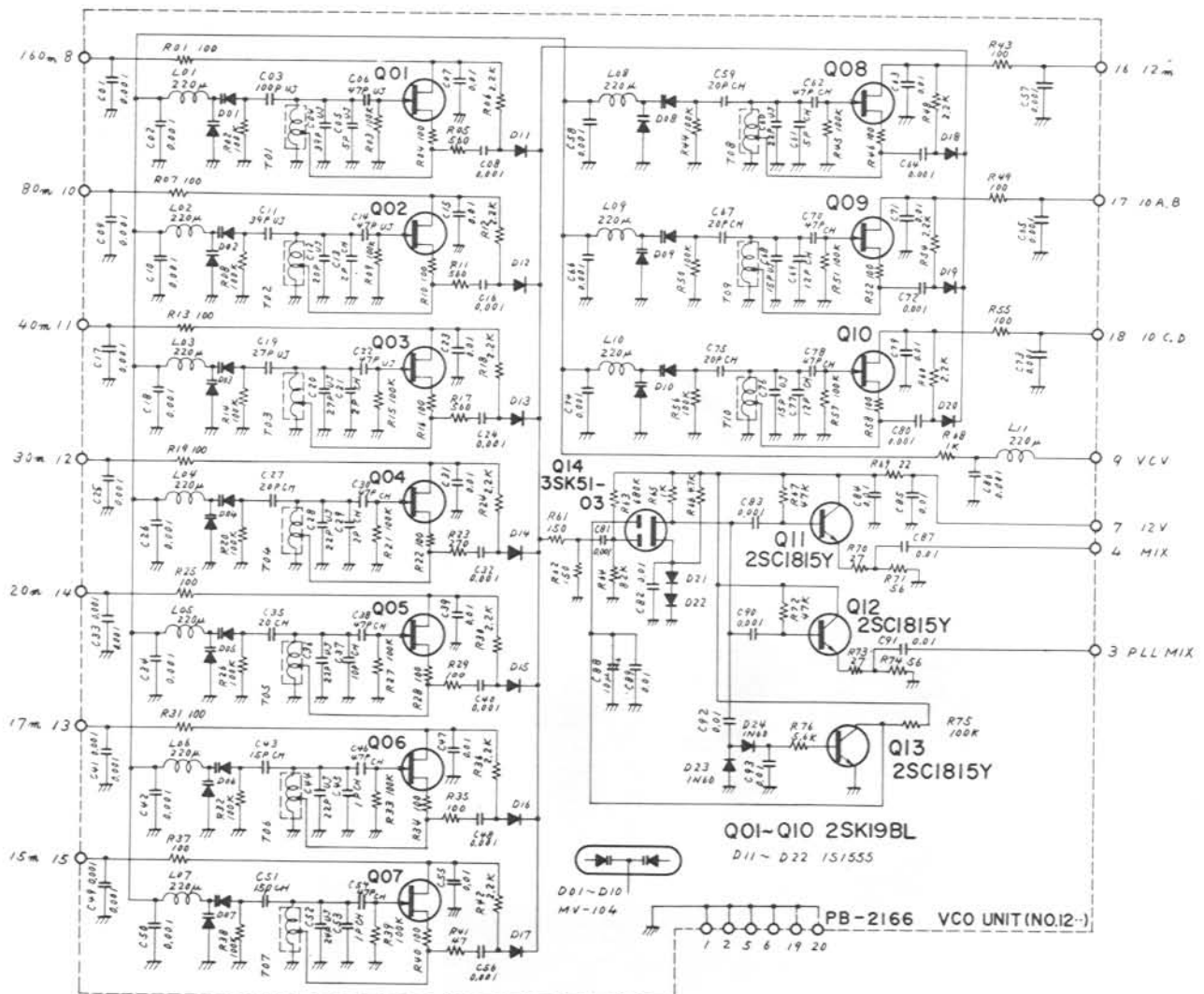


Crystal unit (PB-2165)





VCO unit (PB-2166)



COUNTER UNIT (PB-2086A-3430/PB-2098)

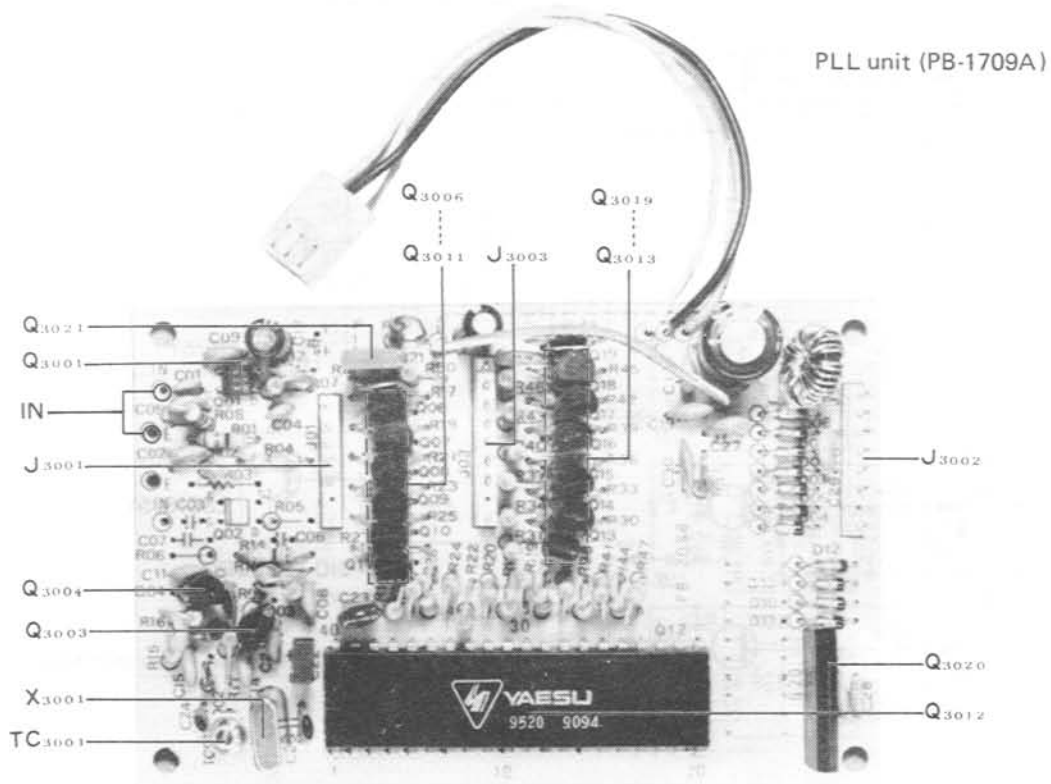
The local oscillator signal is applied to Large-Scale Integrated Circuit (LSI) chip for display on the front panel digital display.

The premix signal as shown in Table 2 from the LOCAL Unit, is amplified by Q₃₀₀₁ (3SK73). The amplified signal is further amplified by Q₃₀₀₃ (2SC1674) and delivered to the LSI counter chip, Q₃₀₁₂ (MSM9520RS). of the output from Q₃₀₀₃ is amplified by Q₃₀₀₄ (2SC1815Y) and fed to gate 2 of Q₃₀₀₁ controlling the gain of those amplifiers.

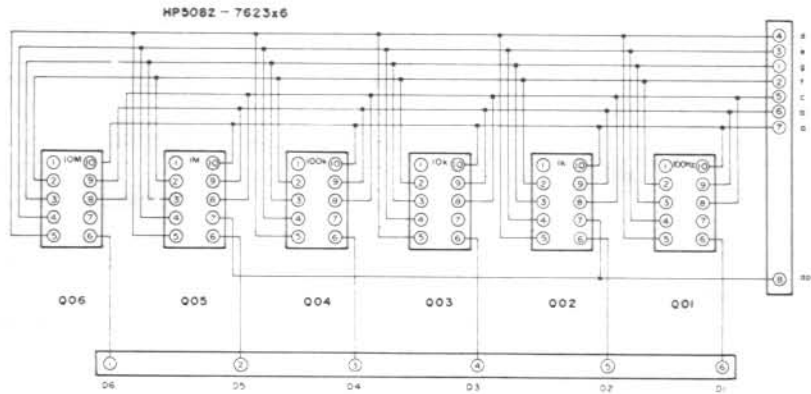
The output from the LSI is fed to the display. The output from pins 24 through 30 is delivered to segment drivers Q₃₀₁₃–Q₃₀₁₉ (2SA952L) and digit drivers Q₃₀₀₆–Q₃₀₁₁ (2SA952L) through a dynamic drive configuration. Display is performed by D₂₉₀₁–D₂₉₀₆ (HP5082-7623), seven-segment light-emitting diodes.

	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)	10.4883–12.9883 (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
30m	18.9875–19.4875	18.986–19.486	18.989–19.489	18.9883–19.4883
20m	22.9875–23.4875	22.986–23.486	22.989–23.489	22.9883–23.4883
17m	26.9875–27.4875	26.986–27.486	26.989–27.489	26.9883–27.4883
15m	29.9875–30.4875	29.986–30.486	29.989–30.489	29.9883–30.4883
12m	33.4875–33.9875	33.486–33.986	33.489–33.989	33.4883–33.9883
10m A	36.9875–37.4875	36.986–37.486	36.989–37.489	36.9883–37.4883
10m B	37.4875–37.9875	37.486–37.986	37.489–37.989	37.4883–37.9883
10m C	37.9875–38.4875	37.986–38.486	37.989–38.489	37.9883–38.4883
10m D	38.4875–38.9875	38.486–38.986	38.489–38.989	38.4883–38.9883

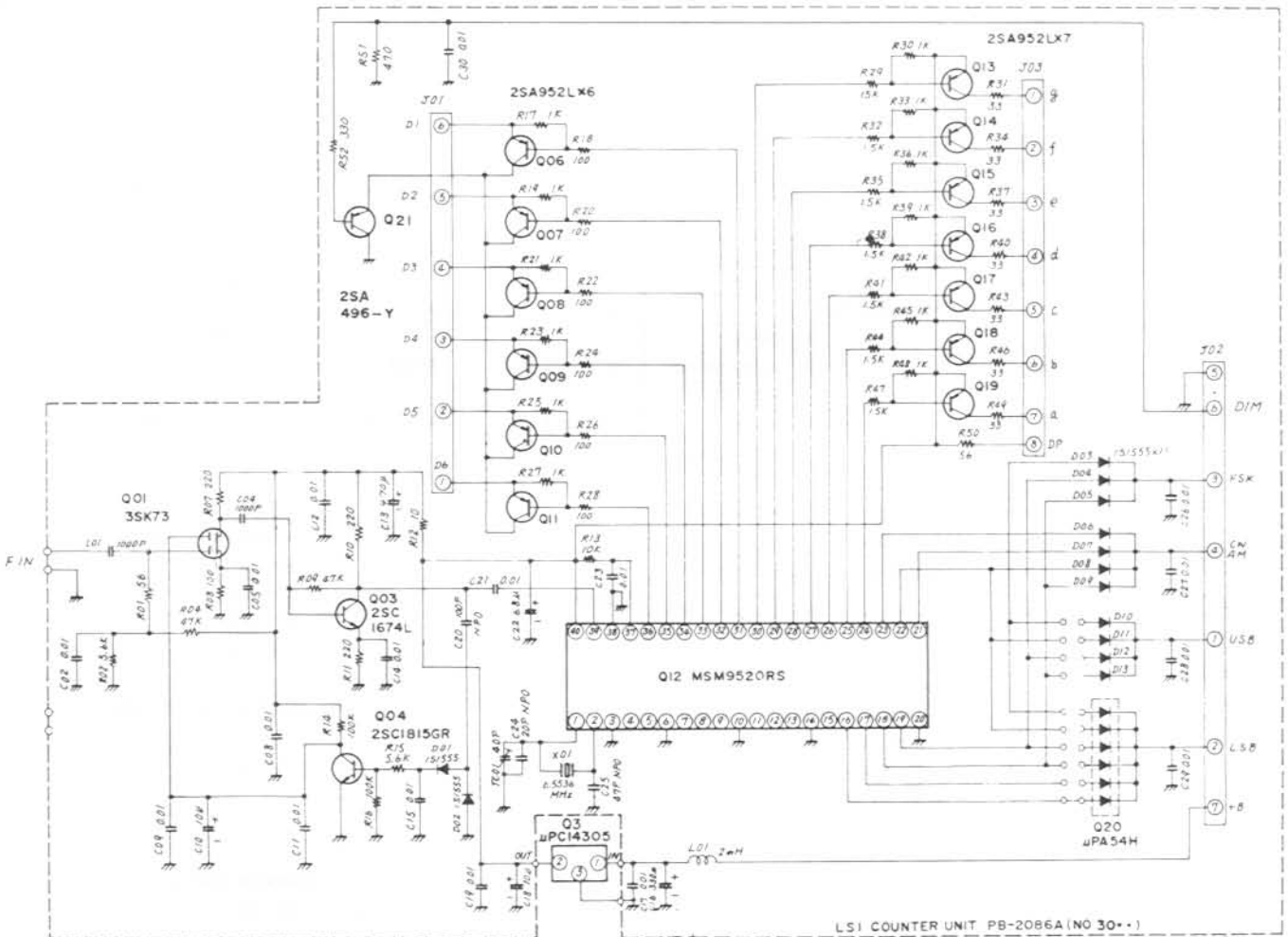
Table 2



Counter unit (PB-2086A)

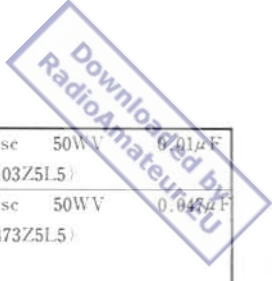


DISPLAY UNIT PB-2098 (NO.29)



LSI COUNTER UNIT PB-2086A (NO.30..)

PARTS LIST



MAIN CHASSIS			C29,59,60,89,90,104, 105~107,109	K13170103	Ceramic disc 50WV (DB201YF103Z5L5)	0.01μF
Symbol No.	Part No.	Description				
		IC	C17,18,19,37,38,46, 48~50,52~56,58,75	K13170473	Ceramic disc 50WV (DB207YF473Z5L5)	0.047μF
Q1,2	G1090070	μPC14308				
Q3	G1090114	μPC14312	59,62~68,71~73,81, 82,88,91,96,98,99, 101,102,112,93			
		TRANSISTOR				
Q5	G3107150C	2SA715C	C110	K02175121	Ceramic disc 50WV	120pF
		DIODE				
D10,16,18,19,31	G2090118	Germanium 1SS97	C35,36	K12279004	Ceramic disc 500WV	0.0047μF
D1~3,9,11~15,17,27 ~30	G2015550	Silicon 1S1555	C77,79,80,83,106	K12279002	Ceramic disc 500WV	0.01μF
D5~7,20,26	G2090001	* 10D1	C40	K00309002	Ceramic disc 1KWV	100pF
	J01245562	Carbon film ¼W TJ 5.6kΩ	C14,15	K12329002	Ceramic disc 1.4KV	0.0047μF
		RESISTOR				
R5	J01245821	Carbon film ¼W TJ 820Ω	C12,13,44,78,92	K12329001	Ceramic disc 1.4KV	0.01μF
	J00245102	* * * VJ 1kΩ				
R6	J01245332	* * * TJ 3.3kΩ	C41	K30176201	Dipped mica 50WV	200pF
R19,43	J01245472	* * * * 4.7kΩ				
R2	J00245273	* * * VJ 27kΩ	C31	K30273010	Dipped mica 500WV	1pF
R1	J01245104	* * * TJ 100kΩ				
R4,16	J10276100	* composition ½W GK10Ω	C11	K30273050	Dipped mica 500WV	5pF
R39	J30356150	Cement 3W * 15Ω				
R37	J01245681	Carbon film ¼W TJ 680Ω	C87	K30276100	Dipped mica 500WV	10pF
R3,18,30	J10276101	* Composition ½W * 100Ω				
R22	J10276221	* * * * 220Ω	C1,42	K30276271	Dipped mica 500WV	270pF
R7,9,17	J10276102	* * * * 1kΩ				
R20	J10276152	* * * * 1.5kΩ	C39	K30275361	Dipped mica 500WV	360pF
R8	J10276222	* * * * 2.2kΩ				
R25	J10276272	* * * * 2.7kΩ	C3	K30276471	Dipped mica 500WV	470pF
R33	J10276103	* * * * 10kΩ				
R14	J10276123	* * * * 12kΩ	C9	K30276511	Dipped mica 500WV	510pF
R13,29	J10276223	* * * * 22kΩ				
R44	J01245471	Carbon film ¼W TJ 470Ω	C8	K30279048	Dipped mica 500WV	750pF
R40	J10276279	* * ½W * 2.7Ω				
R36	J20306222	Metallic film 1W 2.2kΩ	C2	K30306391	Dipped mica 1KWV	390pF
R35	J20356332	* * 3W 3.3kΩ				
R41,42	J01245562	Carbon film ¼W TJ 5.6kΩ	C7	K30306222	Dipped mica 1KWV	2200pF
R38	J01245182	* * * * 1.8kΩ				
		POTENTIOMETER	C47,70	K31306800	Moulded mica 1KWV	80pF
VR1	J60800021	VM11AA41A5M1112 10kΩA				
VR2	J62800035	DM11A743A5M1222 10kΩB/500kΩC	C84	K50247473	Mylar 250WV	0.047μF
VR3	J62800020	DM10A039A 5kΩB/5kΩB				
VR4	J61800007	GM70A619A 50kΩB×2	C20~28,51	K21270002	Feed thru 500WV	0.001μF
VR5	J62800034	DM70A039A 5kΩB/5kΩA				
VR7	J60800064	VM10A654C 1kΩB	C61	K40120106	Electrolytic 16WV	10μF
VR8	J62800026	DM10E553A 5kΩB/5kΩB				
VR9	J60800039	VM10AB08A 5kΩB	C57	K40120336	Electrolytic 16WV	33μF
VR6	J62800047	DM10A042A 5kΩB/5kΩB				
			C34,43	K41120227	Electrolytic 16WV	220μF
			C111	K31306201	Dipped mica 1KV	200pF
			C108	K41140227	Electrolytic 25WV	220μF
		CAPACITOR				
C30	K02175470	Ceramic disc 50WV 47pF (DD106CH470J50V02)			VARIABLE CAPACITOR	
C5	K00329001	Ceramic disc 1.5KV 300pF (MD40JSL301K1,5KV)	VC1	K90000035	RT-18B-300	
C16	K00359003	Ceramic disc 3KV 3pF (CC45SL3F030KY)	VC2	K90000016	C134E125	
C4	K12359001	Ceramic disc 3KV 1000pF (CK45E3F102KY)			TRIMMER CAPACITOR	
C103	K14179003	Ceramic disc 25WV 0.1μF (DB209YZ104Z5L0)	TC1	K91000007	120C 10×2 1.5KV	5pF

PARTS LIST

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		INDUCTOR				CONNECTOR	
L1	L.0020304C			J1	P1090001	SG-7701	
L2	L.0020305A			J2	P0090009	FM-144-S	
L4	L.1190017	FL-5H 102K	1mH	J3	P1090004	SG-7814	
L11,12,14	L.1190001	EL.0710-251K	250μH	J10,11	P1090025	CN-7017	
L8	L.1020064		300μH	J12~18	R7040620A	Jack Ass'y Board	
L6,7(R11,R12)	L.0020308			J19	P1090005	SG-8050	
L9	L.0020009			J4	P0090046	QS-A-DB12ML	
L10	L.1020690		500μH	J5	P1090033	D6-701B00	
L13	L.0020705			J6	P1090034	D7-701B00	
				J8	P1090028	M-BR-06B(D)	
				J20	P1090045	AC9- PF	
		TRANSFORMER		J7	P1090014	SI-7501-1	
T1	L.0020073			J9	P1090040	SA602B00	
T2,T3	L.0020074						
						MULTI JACK	
		METER		MJ1~8	P4090003	121S-18B-105A	
M1(With PL3,4)	M0090007A	500μA		MJ9	P4090004	121S-22B-105A	
				MJ10	P4090001	121S-10B-105A	
				MJ11,12	P4090007	220D-20B-205A	
		SPEAKER					
SP1	M4090031	SA-77K-Y	4Ω 3W			COOLING FAN	
				FAN1	M2090001	2SB10A	
		POWER TRANSFORMER					
PT1	L.3030013A					FUSE	
				F1	Q0000005	5A(100~117V)	
					Q0000004	3A(200~234V)	
		RELAY					
RL1	M1090006	AE3244					
RL2	M1090002	MX2P 12V				FUSE HOLDER	
				FH1	P2000003	F3265	
				FH2	P2000001	SN1001 #2	
		RELAY SOCKET					
RLS1	M1490004	AE3840					
RLS2	M1490001	PX08				PILOT LAMP	
				PL1	Q1000039	BF311-04071A 14V0.12A	
				PL2,3	Q1000040	BQ-044-22839A 8V 100mA	
				PL4(M1)	—	Meter lamp 8V0.055A	
		SWITCH					
S1	N0050055A	RS-9-9-12					
S2	N0050054	GS-4-8-6B		PB-1390	F0001390	LED B BOARD	
S3	N7090004	WD9216		D8	G2090060	LED GD4-203-SRD	
S4	N7090005	WD9223					
S5	N0190090	CS-3,5,12					
		PLUG					
P1(with Wire)	T9200320C	5047-08				RF UNIT	
P2(with Wire)	T9200520E	5047-07		Symbol No.	Part No.	Description	
P3(with Wire)	T9200340C	5047-17			C0021540	RF unit with components	
P8(with Wire)	T9203640	5047-07		PB-2154A	F0002154A	P.C. Board	
P4,5,6	P0090045	SQ4052					
P10	P0090009	SQ4152				FET	
P7	P0090002	SI5908 4P		Q101	G4800510C	3SK51-03	
P9	P0090005	SI7502 2P		Q106	G4800400M	3SK40M	
				Q103	G3090019	J310	
				Q102	G2090135	ND487C2-3R	

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		TRANSISTOR			INDUCTOR		
Q104,105	G3324070	2SC2407	L107	L0020491			
			L108	L1190005	FL-4H 1R0M	0.32μH	
			L112	L1190033	FL-5H 820K	1μH	
			L102,103,105,106,113 114	L1190016	FL-5H 101K	82μH 100μH	
		DIODE	L104,109,111	L1190020	FL-5H 151K	150μH	
D101,102,105~109	G2090027	Si 1SS53	L101,110,115	L1190038	FL-5H 271K	270μH	
D103,104	G2015550	Si 1S1555					
D110	G2090093	Ge(GB) 1N270					
					TRANSFORMER		
			T101~103	L0020788A			
			T104	L0020221A			
		RESISTOR					
R122,131	J00245479	Carbon film 1/4WVJ 4.7Ω					
R109,110,115,116,124 140	J00245100	* * * 10Ω			JACK		
R135	J00245223	* * * 22kΩ	J101~103	P1090018	SQ-3081		
R106,107,113,114,139	J00245101	* * * 100Ω					
R108,117,126	J00245121	* * * 120Ω					
R121,130	J00245151	* * * 150Ω					
R123,132	J00245221	* * * 220Ω					
R136	J00245331	* * * 330Ω					
R119,128	J00245561	* * * 560Ω					
R105,111,112,120,129	J00245102	* * * 1kΩ					
R125	J00245271	* * * 270Ω					
R118,127	J00245152	* * * 1.5kΩ					
R141	J00245222	* * * 2.2kΩ					
R102	J00245272	* * * 2.7kΩ					
R104,133	J00245562	* * * 5.6kΩ					
R138	J00245103	* * * 10kΩ					
R137	J00245183	* * * 18kΩ					
R134	J00245393	* * * 39kΩ					
R101	J00245225	* * * 2.2MΩ					
R103	J00245473	* * * 47kΩ					
		CAPACITOR					
C124	K30176391	Dipped mica 50WV 390pF (Z18D391K05)	Q206	G1090063	IC	TA7060P	
C138	K02179003	Ceramic disc 50WV 2pF (DD104CK020C50V02)	Q201	G3801680D	FET	2SK168D	
C106	K02172040	Ceramic disc 50WV 4pF (DD104CH040C50V02)	Q209,210	G4800400M	FET	3SK40M	
C125,126	K00175680	Ceramic disc 50WV 68pF (DD104SL680J50V02)	Q212	G4800510C	FET	3SK51-03	
C103	K00175101	Ceramic disc 50WV 100pF (DD105SL101J50V02)	Q203	G4800590G	FET	3SK59GR	
C102,104,116,130,119 ~121,131,135,140 144,145	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)	Q202,204,205,207,211	G3318150Y	Transistor	2SC1815Y	
C101,105,107~115, 117,118,122,123, 127~129,132~134, 136,137,142,143, 139	K13170473	Ceramic disc 50WV 0.047μF (DB207YF473Z5L5)					
C141	K40120336	Electrolytic 16WV 33μF (16RL33)					
		TRIMMER CAPACITOR					
TC101	K91000019	ECV-1ZW 10×40 10pF					
					DIODE		
			D202,203	G2090029	Germanium	1N60	
			D201,205,208	G2015550	Silicon	1S1555	
			D210	G2090010	Zener	WZ090	
			D204	G2090012	Zener	WZ110	
					CRYSTAL		
			X201	H0100431A	HC-18/U	8533.3kHz	
					CRYSTAL FILTER		
			XF201	H1100890	XF-8.9HP		
					RESISTOR		
			R254	J00245560	Carbon film 1/4W VJ	56Ω	
			R204,209,221,225 226,238,243,244	J00245101	* * * *	100Ω	

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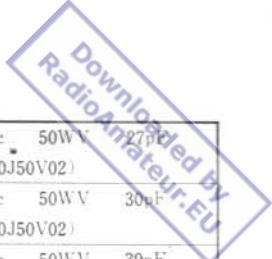
C301,306,307,308, 311,312,315,316 321	K13170103	Ceramic disc 50WV 0.01 μ F (DB201YF103Z5L5)	R406,420,433,455	J00245101	RESISTOR	Carbon film 1/4W VJ 100 Ω
			R409	J01245101	" " " " TJ 100 Ω	
C309,310,313,314, 317,318,319,323, 327,328	K13170473	Ceramic disc 50WV 0.047 μ F (DB207YF473Z5L5)	R413	J01245181	" " " " 180 Ω	
			R414	J00245181	" " " " VJ 180 Ω	
			R442	J00245221	" " " " 220 Ω	
C303	K40120106	Electrolytic 16WV 10 μ F (16RL10)	R440	J00245331	" " " " 330 Ω	
			R443	J00245561	" " " " 560 Ω	
			R412	J00245681	" " " " 680 Ω	
			R402,407,408,415,418 416,444,451,454	J00245102	" " " " 1k Ω	
			INDUCTOR		R405,434,445,418	J00245152
L312	L1190025	FL-5H 330K 33 μ H	R425,432	J00245182	" " " " 1.8k Ω	
L303~308,311	L1190020	FL-5H 151K 150 μ H	R423	J00245332	" " " " 3.3k Ω	
L302,310	L1190001	EL.0710 251K 250 μ H	R410,411	J00245472	" " " " 4.7k Ω	
			R435	J00245562	" " " " 5.6k Ω	
			R419,450	J00245682	" " " " 6.8k Ω	
			R403,404,417,421, 424,427,429~431, 447,448,453,456	J00245103	" " " " 10k Ω	
			TRANSFORMER		R438,439	J00245153
T301~303	L.0020141	R12-4171	R422,428,437	J00245473	" " " " 47k Ω	
			R436	J00245563	" " " " 56k Ω	
			R441	J00245104	" " " " 100k Ω	
			R452	J00245184	" " " " 180k Ω	
			R446	J00245334	" " " " 330k Ω	
			R426,449	J00245105	" " " " 1M Ω	
			IF UNIT			
Symbol No.	Part No.	Description				
	C0017040	IF unit with components				
PB-1704C	F0001704C	P. C. Board				
POTENTIOMETER						
FET & TRANSISTOR			VR402	J50710103	V10K-8-1-2 10k Ω B	
Q408	G3090035	FET 2SK19TM-GR	VR401	J50710504	" 500k Ω B	
Q401~404	G4800510C	" 3SK51-03	VR403	J50705501	EVN-A1A-A00B52 500 Ω B	
Q407	G3105641	Transistor 2SA564A				
Q409,411	G3318150G	" 2SC1815GR				
Q405	G3305350A	" 2SC535A				
CAPACITOR						
Q412	G3319590Y	" 2SC1959Y	C401,423,446,450	K00175101	Ceramic disc 50WV 100pF (DD105SL101J50V02)	
Q406,410	G3318150Y	" 2SC1815Y	C448	K02175470	Ceramic disc 50WV 47pF (DD106CH470J50V02)	
			C429	K02179013	Ceramic disc 50WV 33pF (DD105CH330J50V02)	
DIODE			C436	K06175101	Ceramic disc 50WV 100pF (DD106UJ101J50V02)	
D407	G2090029	Germanium 1N60	C437,438	K06175820	Ceramic disc 50WV -82pF (ECC-D1H820JU2)	
D401,408,411,412	G2090093	" (GB) 1N270	C402,405~407,412, 413,417,418,421, 425,427,428	K10177103	Ceramic disc 50WV 0.01 μ F (DB205YB103M5L5)	
D402~405,414~417	G2090118	" 1SS97	C403,410,411,414, 415,419,424	K13170102	Ceramic disc 50WV 0.001 μ F (DB200YF102Z5L2)	
D409,413	G2015550	Silicon 1S1555	C430	K13170222	Ceramic disc 50WV 0.0022 μ F (DB201YF222Z5L5)	
D406,410	G2022090	Varactor 1S2209	C420,422,426,434, 439,440,443,451	K13170103	Ceramic disc 50WV 0.01 μ F (DB201YF103Z5L5)	
CRYSTAL			C404,408,409,416, 432,433,441,447, 456,452~454	K13170473	Ceramic disc 50WV 0.047 μ F (DB207YF473Z5L5)	
X402	H0100433	HC-18/U 19.7475MHz	C444	K50177223	Mylar " 0.022 μ F (50F2U223M)	
X401	H0100432	" 8.9875MHz	C442	K70127225	Tantalum 16WV 2.2 μ F (CS15E1C2R2M)	
CRYSTAL FILTER						
XF402	H1100470	8.9M20A				
XF401	H1100900	XF-10GS				

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C431	K40170105	Electrolytic (50RL1)	16WV	1 μ F	R505	J00254151	Carbon film	1/4W VJ	150 Ω
C445,449	K40120106	Electrolytic (16RL10)	16WV	10 μ F					
									POTENTIOMETER
					VR501	J61800006	GM-70R		1M Ω ×2
									INDUCTOR
L409	L1190019	FL-5H 150K		15 μ H					CAPACITOR
L401,402,405	L1190020	FL-5H 151K		150 μ H	C512,519	K02179016	Ceramic disc	50WV	51pF (DD106CH510J50V02)
L403,404,406,407, 410	L1190017	FL-5H 102K		1mH	C535	K13170102	Ceramic disc	50WV	0.001 μ F (DB200YF102Z5L2)
L408	L0020145	VXO coil		5.2 μ H	C501,534	K13170103	Ceramic disc	50WV	0.01 μ F (DB201YF103Z5L5)
					C521	K13170473	Ceramic disc	50WV	0.047 μ F (DB207YF473Z5L5)
									TRANSFORMER
T401	L0020187				C514	K30176391	Dipped mica	50WV	390pF (Z18D391K05)
T402,403	L0020140	R12-4170			C507	K50177472	Mylar	50WV	0.0047 μ F (50F2U472M)
T404	L0020141	R12-4171			C523,524	K50177682	Mylar	50WV	0.0068 μ F (50F2U682M)
									RELAY
RL401	M1190018	UFM-10208		8V	C506	K50177103	Mylar	50WV	0.01 μ F (50F2U103M)
					C516	K50177473	Mylar	50WV	0.047 μ F (50F2U473M)
					C520,530,531,536	K50177104	Mylar	50WV	0.1 μ F (50F2U104M)
					C502,503,509,511, 522,529,532,533	K40170105	Electrolytic	50WV	1 μ F (50RL1)
AF UNIT					C504	K40140475	Electrolytic	25WV	4.7 μ F (25RL4R7)
Symbol No.	Part No.	Description							
	C0017050	AF unit with components			C528	K41120106	Electrolytic	16WV	10 μ F (16TL10)
PB-1705A	F0001705A	P. C. Board			C513	K40100226	Electrolytic	10WV	22 μ F (10RL22)
					C505,508	K40120226	Electrolytic	16WV	22 μ F (16RL22)
									IC & TRANSISTOR
Q503	G1090110	IC	TA7205AP		C525	K40100336	Electrolytic	10WV	33 μ F (10RL33)
Q504	G1090077	"	MC3403P		C517	K40100476	Electrolytic	10WV	47 μ F (10RL47)
Q506	G1090123	"	78L08		C515	K40100107	Electrolytic	10WV	100 μ F (10RL100)
Q501,502,505,507	G330732G	Transistor	2SC732TM-GR		C518	K40100477	Electrolytic	10WV	470 μ F (10RL470)
									RESISTOR
R523,536	J00245101	Carbon film	1/4W VJ	100 Ω					
R516	J00245561	" "	" "	560 Ω					
R506	J00245681	" "	" "	680 Ω					
R507	J00245102	" "	" "	1k Ω					HEAT SINK
R512	J00245222	" "	" "	2.2k Ω		R0042800A	(TA-7205)		
R504,539	J00245332	" "	" "	3.3k Ω					
R513,514,537,538	J00245472	" "	" "	4.7k Ω					
R510,511	J00245822	" "	" "	8.2k Ω					
R543	J00245103	" "	" "	10k Ω					
R503	J00245153	" "	" "	15k Ω					
R530,545	J00245333	" "	" "	33k Ω					VOX/MARKER UNIT
R508	J00245393	" "	" "	39k Ω	Symbol No.	Part No.	Description		
R502,509,515	J00245473	" "	" "	47k Ω		C0018460	VOX/Marker unit with components		
R534,540	J00245823	" "	" "	82k Ω	PB-1846B	F0001846B	P. C. Board		
R517,520,522,525, 526,528,535,541	J00245104	" "	" "	100k Ω					
R519,524,527	J00245124	" "	" "	120k Ω					
R518,521,529	J00245224	" "	" "	220k Ω					

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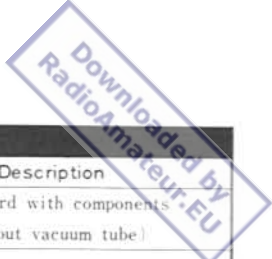
			C705,713	K02179011	Ceramic disc 50WV (DD104CH270J50V02)
			C704	K02179012	Ceramic disc 50WV 30pF (DD105CH300J50V02)
		DIODE			
D705~708	G2090118	Germanium (GB) 1SS97	C703	K02175390	Ceramic disc 50WV 39pF (DD105-275CH390J50V02)
D702~704,709~713, 715,719,720,724	G2015550	Silicon 1S1555	C721,730	K00172101	Ceramic disc 50WV 100pF (DD105SL101J50V02)
D716,718	G2090010	Zener WZ090	C718,719	K00179020	Ceramic disc 50WV 240pF (DD107SL241J50V02)
D721,722	G2090025	Zener WZ050	C701,702,706,707, 711,712,714,716, 717,735,740,746, 748,751	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)
D701,723	G2090093	Germanium 1N270			
		CRYSTAL			
X701	H0100421	HC-18/U 8986kHz	C739	K13170473	Ceramic disc 50WV 0.047μF (DB207YF473Z5L5)
X703	H0100422A	◊ 8988.3kHz			
X702	H0100423	◊ 8989kHz	C708,709	K30176151	Dipped mica 50WV 150pF (Z17D151K05)
		RESISTOR	C723,732	K50177222	Mylar 50WV 0.0022μF (50F2U222M)
R749,753,754	J00245680	Carbon film ¼W VJ 68Ω	C720,724,727,734	K50177473	Mylar 50WV 0.047μF (50F2U473M)
R747,752	J00245101	◊ ◊ ◊ VJ 100Ω	C725,726,736,737, 741,749,752	K40170105	Electrolytic 50WV 1μF (50RL1)
R729	J00245121	◊ ◊ ◊ VJ 120Ω	C731,747	K40170225	Electrolytic 50WV 2.2μF (50RL2R2)
R704,707	J00245151	◊ ◊ ◊ ◊ 150Ω			
R755	J00245181	◊ ◊ ◊ ◊ 180Ω	C728,733,754,742~ 744	K40120106	Electrolytic 16WV 10μF (16RL10)
R708,709	J00245221	◊ ◊ ◊ ◊ 220Ω	C722,738	K40120226	Electrolytic 16WV 22μF (16RL22)
R721,735	J00245331	◊ ◊ ◊ ◊ 330Ω	C750,753	K40120336	Electrolytic 16WV 33μF (16RL33)
R710,738	J00245391	◊ ◊ ◊ ◊ 390Ω			
R702	J00245471	◊ ◊ ◊ ◊ 470Ω	C729	K40120476	Electrolytic 16WV 47μF (16RL47)
R701,718,727	J00245102	◊ ◊ ◊ ◊ 1kΩ			
R715	J00245222	◊ ◊ ◊ ◊ 2.2kΩ			
R717,728,745	J00245332	◊ ◊ ◊ ◊ 3.3kΩ			
R705,706	J00245472	◊ ◊ ◊ ◊ 4.7kΩ			
R751	J00245682	◊ ◊ ◊ ◊ 6.8kΩ			
R720,731,734,737, 741,756,757	J00245103	◊ ◊ ◊ ◊ 10kΩ			TRIMMER CAPACITOR
R723	J00245153	◊ ◊ ◊ ◊ 15kΩ	TC701~704	K91000020	ECV-1ZW 20×40 20pF
R739,746,758	J00245223	◊ ◊ ◊ ◊ 22kΩ	TC705	K91000023	ECV-1ZW 50×40 50pF
R726	J00245333	◊ ◊ ◊ ◊ 33kΩ			
R712,719,732	J00245393	◊ ◊ ◊ ◊ 39kΩ			
R713,745	J00245473	◊ ◊ ◊ ◊ 47kΩ			INDUCTOR
R742	J00245563	◊ ◊ ◊ ◊ 56kΩ	L705	L1190023	FL-5H 220K 22μH
R714,736	J00245823	◊ ◊ ◊ ◊ 82kΩ	L706	L1190001	EI-0710 251K 250μH
R703,711,725	J00245104	◊ ◊ ◊ ◊ 100kΩ	L707	L1190038	FL-5H 271K 270μH
R722,733	J00245154	◊ ◊ ◊ ◊ 150kΩ	L701~704	L1190017	FL-5H 102K 1mH
R740,744	J00245105	◊ ◊ ◊ ◊ 1MΩ			
R743	J10246335	◊ composition ◊ GK 3.3MΩ			
					TRANSFORMER
			T701	L0020141	R12-4171
		POTENTIOMETER	T702	L0020140	R12-4170
VR701	J50702201	EVL SOAA 00B22 200ΩB			
VR702	J50702504	EVL SOAA 00B55 500kΩB			
					RELAY
		CAPACITOR	RL701	M1190002	FBR-211AD012M 12V
C715	K00172020	Ceramic disc 50WV 2pF (DD104SL020C50V02)			
C710	K02179008	Ceramic disc 50WV 20pF (DD104CH200J50V02)			

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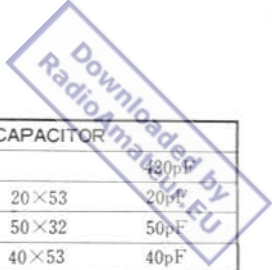
VFO UNIT						
Symbol No.	Part No.	Description				
	C0014403	VFO assembly 3330				
		VFO chassis				
		VFO board	R809,811	J00245101	Carbon film	¼W VJ 100Ω
			R807	J00245221	" "	" " 220Ω
			R805,808	J00245222	" "	" " 2.2kΩ
			R802	J00245332	" "	" " 3.3kΩ
			R801	J00245103	" "	" " 10kΩ
			R803	J00245183	" "	" " 18kΩ
			R804	J00245223	" "	" " 22kΩ
			R806,810	J00245104	" "	" " 100kΩ
*****VFO CHASSIS*****						
		CAPACITOR				
C801	K06173080	Ceramic disc 50WV UJ 8pF (DD104UJ080D50V02)				
C803	K06175120	Ceramic disc 50WV UJ 12pF (DD104UJ120D50V02)				
C804	K02175150	Ceramic disc 50WV CH 15pF (DD104CH150J50V02)	C807	K30173080	Dipped mica 50WV 8pF (LCQ11080D05)	
C805	K02175330	Ceramic disc 50WV CH 33pF (DD105CH330J50V02)	C814	K30176330	Dipped mica 50WV 33pF (Z11C330K05)	
C824,826	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)	C809,810,812,815, 819,820	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)	
C802	K30209001	Dipped mica 50WV 1000pF (DM19D102K1)	C811	K30176181	Dipped mica 50WV 180pF (Z17D181K05)	
C825	K70167334	Tantalum 35WV 0.33μF (CS15E1VR33M)	C813	K30176431	Dipped mica 50WV 430pF (Z18D431K05)	
			C808,818	K30176390	Dipped mica 50WV 39pF (Z11C390K05)	
		VARIABLE CAPACITOR				
VC801	K90000024	C521R-112	C822	K30209001	Dipped mica 50WV 1000pF (DM19D102K1)	
			C821,823	K00175471	Ceramic 50WV SL 470pF (DD109SL471J50V02)	
		TRIMMER CAPACITOR				
TC801	K90000001	TSN-100D15 15pF				
		INDUCTOR				
L801	L0020268A		TC802	K91000016	ECV-1ZW 50×32 50pF	
L806	L1190001	EL0710-251K 250μH				
		JACK				
J802	P1090012	SI-6303-1				
J801	P1090022	STR-01	L804,805	L1190007	FL-4H 1R8M 1.8μH	
	Q5000005	Lighthouse type terminal	L803	L1190001	EL0710-251K 250μH	
			L802	L1190040	S4 102K 1mH	
*****VFO BOARD*****						
PB-1440B	F0001440B	Printed circuit board				
	C9014403	PCB with components				
		FET & TRANSISTOR				
Q802	G3090035	FET 2SK19TM-GR				
Q801,803	G3303800Y	Transistor 2SC380 TM-Y				
		DIODE				
D801	G2022360	Varactor 1S2236				

PARTS LIST



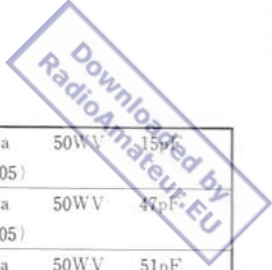
				DRIVER BOARD		
Symbol No.	Part No.	Description				
C1308	K30176221	Dipped mica 50WV 220pF (Z17D221K05)				
C1303	K30176271	Dipped mica 50WV 270pF (Z17D271K05)				
			PB-1714A	F0001714A	P. C. Board	
		TRANSFORMER				
T1301~1312	L0020017				VACUUM TUBE	
			V1601	G6090002	12BY7A	
		CONNECTOR				
J1301	P0090056	5048-17A			VACUUM TUBE SOCKET	
			VS1601	P3090022	SB-9403	
		CRYSTAL SOCKET				
XS1301~1312	P3090002	S2-101P-00			RESISTOR	
			R1605	J10276470	Carbon composition 1/2W GK47Ω	
			R1062(L1602),1604	J10276560	" " " " 56Ω	
			R1603	J10276101	" " " " 100Ω	
			R1601	J10276473	" " " " 47kΩ	
		RECT. B BOARD				
Symbol No.	Part No.	Description				
	C0017120	Rect. B board with components			CAPACITOR	
PB-1712A	F0001712A	P. C. Board	C1601,1602	K12279002	Ceramic disc 500WV 0.01μF (ECKD2H103PE)	
			C1603,1604,1606	K13170473	Ceramic disc 50WV 0.047μF (DB207YF473Z5L5)	
		DIODE	C1605	K30279051	Dipped mica 500WV 1000pF (DM19D102K5)	
D1401~1404	G2090002	Silicon 10D10				
		RESISTOR			INDUCTOR	
R1401~1406	J10276474	Carbon composition 1/2W GK 470kΩ	L1601	L1190020	FL-5H 151K 150μH	
			L1602(R1602)	L1020307		
	Q5000011	Wrapping terminal C				
				Q5000011	Wrapping terminal	
		CAPACITOR BOARD				
Symbol No.	Part No.	Description				
	C0017130	Capacitor board with components			FINAL BOARD	
PB-1713	F0001713	P. C. Board				
				C0017152	Final board with components (without vacuum tube)	
			PB-1715B	F0001715B	P. C. Board	
		CAPACITOR				
C1501,1502	K43270002	Electrolytic 500WV 100μF (CE-62L500L100)			VACUUM TUBE	
			V1701,1702	G6090001	6146B	
					DIODE	
			D1701	G2090002	Silicon 10D10	
					VACUUM TUBE SOCKET	
			VS1701,1702	P3090024	SB-3606	

PARTS LIST



			TRIMMER CAPACITOR		
			TC2401	K91000078	BW6P-1 420pF
			TC2406	K9000030	ECV-1ZW 20×53 20pF
		RESISTOR	TC2402~2405	K91000016	ECV-1ZW 50×32 50pF
R2301	J00245152	Carbon film ¼W VJ 1.5kΩ	TC2408,2409,2410	K91000030	ECV-1ZW 40×53 40pF
		POTENTIOMETER			TRANSFORMER
VR2301	J50710502	V10K-8-1-2 5kΩB	T2401	L0020303A	
			T2402	L0020545	
		SWITCH			
S2301	N4090008	1B0001AC2060			
			TRIMMER B BOARD		
			Symbol No.	Part No.	Description
				C0021910	Trimmer B board with components
			PB-2191	F00021910	P. C. Board
			TRIMMER A BOARD		
			Symbol No.	Part No.	Description
				C0021900	Trimmer board A with components
PB-2190				F0002190	P. C. Board
					RESISTOR
					TRANSISTOR
Q2401	G3319590Y	Transistor 2SC1959Y			CAPACITOR
Q2402	G3318150Y	2SC1815Y	C2503,2508,2509	K30176330	Dipped mica 50WV 33pF (Z11C330K05)
			C2504,2506	K30176680	Dipped mica 50WV 68pF (Z11D680K05)
					DIODE
D2402	G2015550	Silicon 1S1555	C2502	K30176271	Dipped mica 50WV 270pF (Z17D271K05)
			C2501	K30176821	Dipped mica 50WV 820pF (LCQ18821K05)
					RESISTOR
R2401,2402	J00245103	Carbon film ¼W VJ 10kΩ	C2507	K30176101	Dipped mica 50WV 100pF
					TRIMMER CAPACITOR
			TC2501	K91000078	BW6P-1 420pF
			TC2502~2505	K91000016	ECV-1ZW 50×32 50pF
			TC2506,2508	K91000028	ECV-1ZW 10×53 10pF
			TC2509,2510	K91000030	ECV-1ZW 40×53 40pF
C2407	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)			
C2409	K30176100	Dipped mica 50WV 10pF (Z11C100K05)			TRANSFORMER
C2405,2412	K30176120	Dipped mica 50WV 12pF (Z11C120K05)	T2501	L0020303A	
C2403,2404,2411	K30176680	Dipped mica 50WV 68pF (Z11D680K05)			
C2402	K30176271	Dipped mica 50WV 270pF (Z17D271K05)			
C2401	K30176821	Dipped mica 50WV 820pF (LCQ18821K05)			
			TRIMMER C BOARD		
			Symbol No.	Part No.	Description
C2406	K40120336	Electrolytic 16WV 33μF (16RL33)		C0010922	Trimmer C board with components
C2410	K30209001	Dipped mica 50WV 1000pF	PB-1092-3330	F2001092	P. C. Board
					RESISTOR
			R2601	J10276333	Carbon composition ½W 33kΩ

PARTS LIST



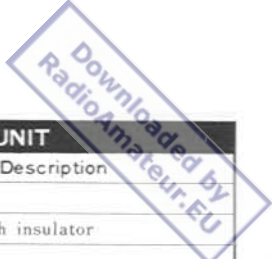
R2813	J00245121	Carbon film	¼ W VJ	120Ω	C2860	K30176150	Dipped mica	50WV	15pF
R2809, 2821	J00245221	" "	" "	220Ω			(Z11C150K05)		
R2804, 2817	J00245391	" "	" "	390Ω	C2816	K30176470	Dipped mica	50WV	47pF
R2826, 2831, 2840	J00245471	" "	" "	470Ω			(Z11C470K05)		
R2835	J00245102	" "	" "	1kΩ	C2812, 2817	K30176510	Dipped mica	50WV	51pF
R2815	J00245122	" "	" "	1.2kΩ			(Z11D510K05)		
R2818, 2834, 2849	J00245152	" "	" "	1.5kΩ	C2834	K50177332	Mylar	50WV	0.0033μF
R2842, 2855	J00245272	" "	" "	2.7kΩ			(50F2U332M)		
R2832, 2837	J00245332	" "	" "	3.3kΩ	C2837	K50177473	Mylar	50WV	0.047μF
R2810, 2843, 2857, 2861	J00245472	" "	" "	4.7kΩ			(50F2U473M)		
R2853	J00245562	" "	" "	5.6kΩ	C2847, 2848, 2853	K50177104	Mylar	50WV	0.1μF
R2827, 2848	J00245822	" "	" "	8.2kΩ			(50F2U104M)		
R2844, 2846, 2847, 2850 -2852	J00245103	" "	" "	10kΩ	C2861	K70167334	Tantalum	35WV	0.33μF
							(CS15E1VR33M)		
R2811	J00245123	" "	" "	12kΩ	C2842, 2843, 2852	K70147105	Tantalum	25WV	1μF
R2828, 2829	J00245153	" "	" "	15kΩ			(CS15E1E010M)		
R2838	J00245223	" "	" "	22kΩ	C2844	K70167225	Tantalum	35WV	2.2μF
R2812, 2858, 2859	J00245333	" "	" "	33kΩ			(CS15E1V2R2M)		
R2836	J00245473	" "	" "	47kΩ	C2851	K70127335	Tantalum	16WV	3.3μF
R2803, 2806, 2820	J00245563	" "	" "	56kΩ			(CS15E1C3R3M)		
R2854, 2862	J00245823	" "	" "	82kΩ	C2850	K40089006	Electrolytic	6.3WV	330μF
R2801, 2802, 2814, 2816 2823, 2830, 2833, 2839 2841, 2856	J00245104	" "	" "	100kΩ			(6.3RE230)		
					C2845	K40140475	Electrolytic	25WV	4.7μF
							(25RL4R7)		
R2807, 2819	J00245334	" "	" "	330kΩ	C2826	K40120106	Electrolytic	16WV	10μF
R2845	J00245394	" "	" "	390kΩ			(16RL10)		
R2864	J01245102	" "	TJ	1kΩ	C2825	K40120336	Electrolytic	16WV	33μF
R2865	J01245472	" "	" "	4.7kΩ			(16RL33)		
					C2824	K40100476	Electrolytic	10WV	47μF
							(10RL47)		
					C2809, 2838, 2841, 2854 2855, 2857, 2858, 2866	K40129001	Electrolytic	16WV	330μF
							(16RL330)		
		POTENTIOMETER							
VR2801, 2802	J51724103	PN822H103H		10kΩB	C2870	K41120108	Electrolytic	16WV	1000μF
							(16TL1000)		
					C2862 ~ 2865	K31170002	Feed thru	50WV	0.001μF
							(ECKY1H-102WE)		
		CAPACITOR							
C2804	K06173100	Ceramic disc	50WV	10pF	C2833, 2835, 2836	K51176331	Styrol	50WV	330pF
		(ECC-D1H100DU)					(50SU331K)		
C2807	K02179010	Ceramic disc	50WV	24pF					
		(DD104CH240J50V02)							
C2828	K02175390	Ceramic disc	50WV	39pF					
		(DD105-257CH390J50V02)			TC2801	K91000030	ECV-1ZW	40×53	40pF
C2827	K02175470	Ceramic disc	50WV	47pF					
		(DD106CH470J50V02)							
C2803	K06175470	Ceramic disc	50WV	47pF					
		(ECC-D1H470JU2)							
C2805	K02175820	Ceramic disc	50WV	82pF					
C2849	K00175101	Ceramic disc	50WV	100pF	L2802, 2805, 2807	L1190017	FL-5H	102K	1mH
		(DD105SL101J50V02)			L2803, 2804	L1190007	FL-4H	1R8M	1.8μH
C2802	K06175271	Ceramic disc	50WV	270pF	L2801	L1190038	FL-5H	271K	270μH
		(ECC-D1H271JU2)			L2806	L1020012			35μH
C2821, 2823	K10179011	Ceramic disc	50WV	470pF					
		(2222-660-02471)							
C2822	K14179001	Ceramic disc	50WV	0.001μF					
		(RD200YZ102P50V)							
C2801, 2806, 2808, 2811 2813 ~ 2815, 2818 ~ 2820, 2829 ~ 2832, 2839, 2856, 2859, 2867	K14179002	Ceramic disc	50WV	0.01μF					
		(RD204YM103Z50V)							
C2868, 2869, 2871	K13170473	Ceramic disc	50WV	0.047μF					
		(DB207YF473Z5L5)							
C2810	K30173050	Dipped mica	50WV	5pF					
		(LCQ11050D05)							

PARTS LIST

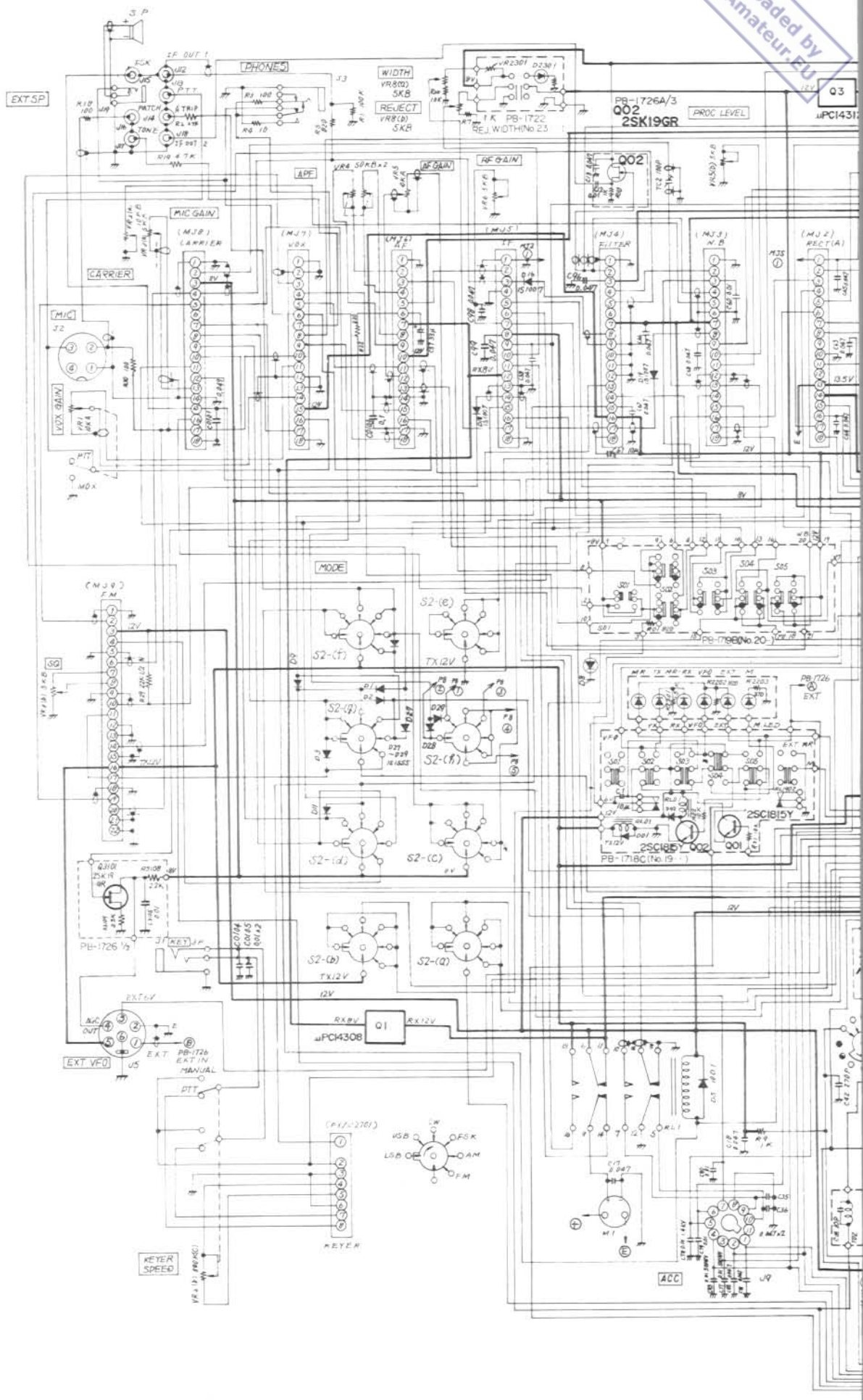
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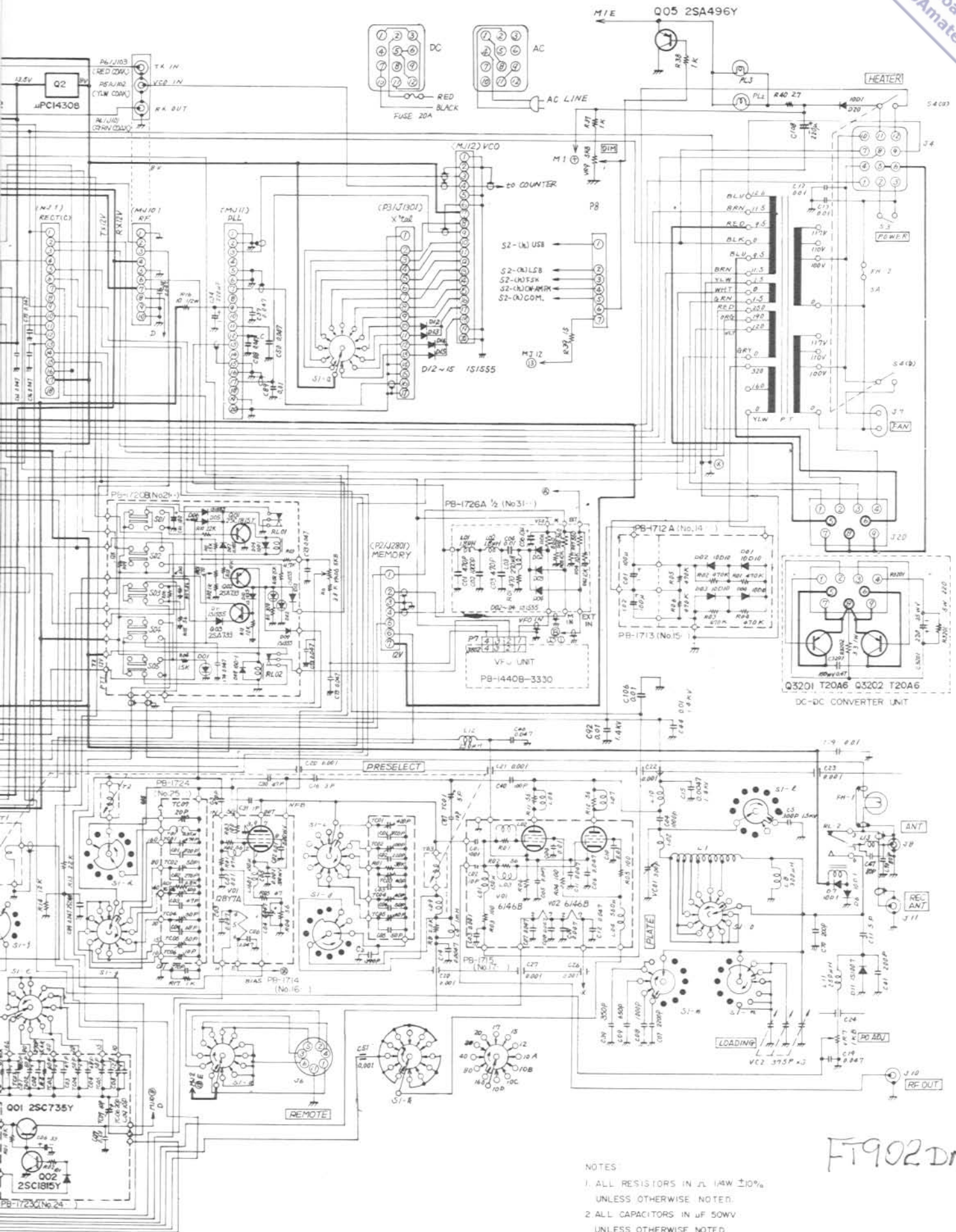
COUNTER UNIT			R3016	J00245104	Carbon film	1/4W	VJ 100Ω
Symbol No.	Part No.	Description	R3014	J01245104	" "	" "	TJ 100Ω
	C0020863	3330 Counter unit Assembly					
PB-2086A	C9020863	Main P. C. Board					
PB-2098A	C9020983	Display P. C. Board					
CAPACITOR							
***** COUNTER MAIN BOARD *****			C3024	K02179008	Ceramic disc	50WV	20pF
	C9020863	Main board with components			(DD104CH200J50V02)		
PB-2086A	F0002086A	Counter main Board	C3025	K02175820	Ceramic disc	50WV	82pF
		IC			(DD107CH820J50V02)		
Q3012	G1090249	MSM9520RS	C3020	K02175101	Ceramic disc	50WV	100pF
Q3005	G1090065	μPC14305			(DD107CH101J50V02)		
Q3020	G1090079	μPA54H	C3001,3004	K13170102	Ceramic disc	50WV	0.001μF
					(DB200YF102Z5L2)		
		FET	C3002,3005,3008,3009	K13170103	Ceramic disc	50WV	0.01μF
			3011,3012,3014,3015		(DB201YF103Z5L5)		
Q3001	G3800730	3SK73	3017,3019,3026-3030,3021				
			C3010,3013,3018	K40120106	Electrolytic	16WV	10μF
					(16RL10)		
		TRANSISTOR	C3016	K40129001	Electrolytic	16WV	330μF
Q3003	G331674L	2SC1674L			(16RE330)		
Q3004	G3318150G	2SC1815GR	C3023	K50177103	Mylar	50WV	0.01μF
Q3006-3011,3013-3019	G3109520L	2SA952L			(50F2U103M)		
Q3021	G3104960Y	2SA496Y	C3022	K71137685	Noiselimiter	20WV	6.8μF
					(CC99E1D6R8M)		
		DIODE					
D3001-3013	G2015550	1S1555					
TRIMMER CAPACITOR							
			TC3001	K91000030	ECV1ZW 40×53		40pF
INDUCTOR							
			L3001	L2030068			
		CRYSTAL					
X3001	H0102272	6.5536MHz					
CONNECTOR							
		RESISTOR	J3001	P0090051	5048-06A		
R3012	J00245100	Carbon film 1/4W VJ 10Ω	J3002	P0090054	5048-07A		
R3031,3034,3037,3040,3043,3046,3049	J00245330	" " " " 33Ω	J3003	P0090037	5048-08A		
R3050	J00245560	" " " " 56Ω	P3003	T9201380A	3021-03		
R3001	J01245560	" " " TJ 56Ω					
R3008,3018,3020,3022,3024,3026,3028	J00245101	" " " VJ 100Ω					
R3007,3010,3011	J00245221	" " " " 220Ω					
R3052	J00245331	" " " " 330Ω	***** DISPLAY BOARD *****				
R3051	J00245471	" " " " 470Ω	PB-2098A	F0002098A	P. C. Board		
R3017,3019,3021,3023,3025,3027	J01245102	" " " TJ 1kΩ		C9020983	P. C. B with components		
R3036,3039,3042,3045,3048,3030,3033	J00245102	" " " VJ 1kΩ					
R3029,3032,3035,3038,3041,3044,3047	J00245152	" " " " 1.5kΩ					
R3002,3015	J00245562	" " " " 5.6kΩ					
R3013	J00245103	" " " " 10kΩ					
R3009	J00245473	" " " " 47kΩ					
R3004	J01245473	" " " TJ 47kΩ					
			P2902	T9202440B	5047-08		
CONNECTOR							

PARTS LIST



P2901			T9202430B			5047-06			DC-DC CONVERTER UNIT		
									Symbol No.	Part No.	Description
									TRANSISTOR		
									Q3201,3202	G3090002	T20A6 with insulator
									RESISTOR		
									R3202	J31306339	Wire wound 1 W 3.3Ω
									R3201	J20376221	Metallic film 5 W 220Ω
DIODE SWITCH BOARD											
Symbol No.			Part No.			Description					
			C0017260			Diode switch board with components					
PB-1726A			F0001726A			P. C. Board					
									CAPACITOR		
									C3202	K52247474	Metallized paper 250WV 0.47μF
									C3201	K41140227	Electrolytic 25WV 220μF (25TL220)
									FET		
Q3101,3102			G3090035			2SK19TM-GR					
									CONNECTOR		
									P3201	P0090066	AC9M
									DIODE		
D3102			G2090093			Germanium 1N270					
D3101,3103			G2015550			Silicon 1S1555					
ACCESSORIES											
									Symbol No.	Part No.	Description
									RESISTOR		
R3101			J00245151			Carbon film ¼W VJ 150Ω					
R3105-3107			J00245561			* * * * 560Ω					
R3110			J00245102			* * * * 1kΩ					
R3108			J00245222			* * * * 2.2kΩ					
R3109			J00245332			* * * * 3.3kΩ					
R3102-3104			J00245103			* * * * 10kΩ					
									CAPACITOR		
C3104,3105,3109-3112			K13070103			Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)					
C3113			K13170473			Ceramic disc 50WV 0.047μF (DB207YF473Z5L5)					
C3101,3103			K30176471			Dipped mica 50WV 470pF (Z18D471K05)					
C3102			K30209001			Dipped mica 50WV 1000pF (DM19D102K1)					
C3106,3107,3108			K40120106			Electrolytic 16WV TW 10μF (16RL10)					
									INDUCTOR		
L3101,3102			L1190008			FL-4H-2R8M 2.2μH					
L3103			L1190038			FL-5H 271K 270μH					
									Q5000011		
						Wrapping terminal C					





- NOTES
1. ALL RESISTORS IN Ω 1/4W $\pm 10\%$ UNLESS OTHERWISE NOTED.
 2. ALL CAPACITORS IN μF 50V UNLESS OTHERWISE NOTED.

FT902DM