MAINTENANCE SERVICE MANUAL FT-901DM

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INDEX

SECTION 4 – REPAIR PARTS

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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Public Relations Manager
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Tokyo, Japan

Printed in Japan.

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 μV for S/N 10 dB
AM	1 μV for S/N 10 dB
FM	0.3 μV 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

12BY7A	1
6146B	2

SEMICONDUCTOR COMPLEMENT

Germanium transistors:

T20A6	2

Silicon transistors:

2SA564A	2
2SA639	1
2SA733	4
2SC372Y	3
2SC373	10
2SC535A	1
2SC735Y	3
2SC7850	5
2SC945	3
2SC1000GR	5
2SC1815GR	2
2SC1815Y	49
2N4427	1
MPSA13	1

FET:

2SK19GR	15
2SK19BL	8
2SK34E	1
3SK40M	14
3SK59Y	1
3SK59GR	1
JF1033B	5

IC:

8043	1
μPC78L05	2
μPC78L08	5
μPC14305	2
μPC14308	2
μPC14312	1
F4024CP	1
F40192	2
LM308	1
MC1416P	1
MC3403P	1
MC4044P (μPC1008C)	2
MC14011B	3
MC14042B	5
MM74C90	1
MSL980Y7	1
MSL980Y4	1
MSM561	3
MSM5501	1
MSM5562	1
MSM5564	1
SN75450B	1
SN76514N	1
SN74LS00N	2
SN74L04N	3
SN74LS90N	1
SN74LS123N	1
SN74LS192N	5
TA7060P	1
TA7061AP	2
TA7063P	2
TA7089M	1
TA7205AP	1
TA7310P	1
TC5032P	1

Germanium diodes:

IN60	17
1S188FM	6
1S1007 (GB) (1N270)	22

Silicon diodes:

1S1555	89
10D1	7
10D10	8
VO6B	2

Varactor diodes:

1S2209	2
1S2236	1
FC63	1
MV104	10

Silicon varistor diodes:

MV13	1

Zener diodes:

WZ050	2
WZ090	4
WZ110	2

Light-emitting diodes:

GD4-203SRD	11

Light-emitting display:

HP5082-7740	6

Specifications subject to change without notice.

RECOMMENDED ACCESSORIES

FV-901DM

FTV-901R

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 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.

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.

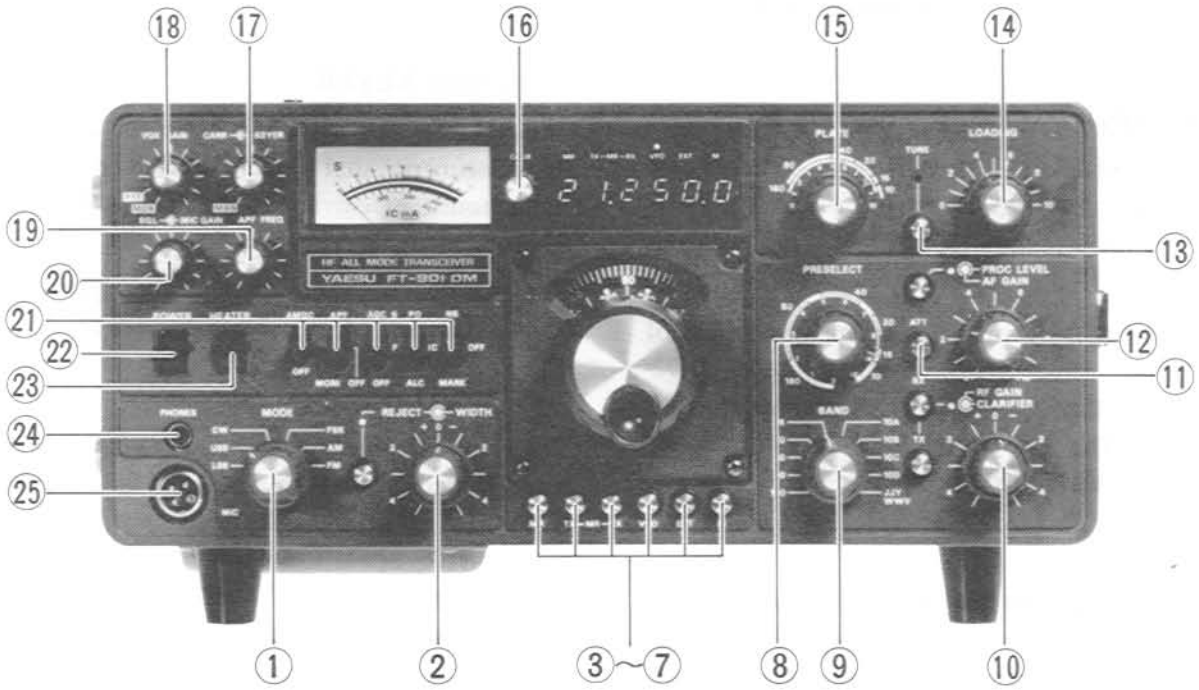
FC-901

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 transfered 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 transceive frequency by pushing the MR button.

(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 to ON again, the memory circuits will have to be reset.

(23) HEATER

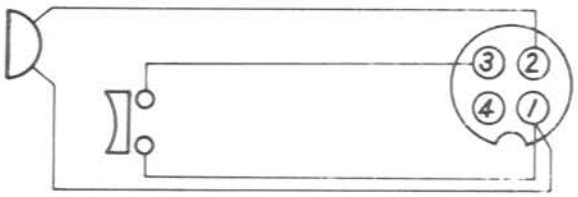
With the HEATER switch in the down position, the transmitter tube heaters are turned off. This reduces battery drain to 1.1 amp and thus permits long periods of listening without excessive battery drain. Placing this switch in the up position provides supply voltage to the tube heaters, and after 30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

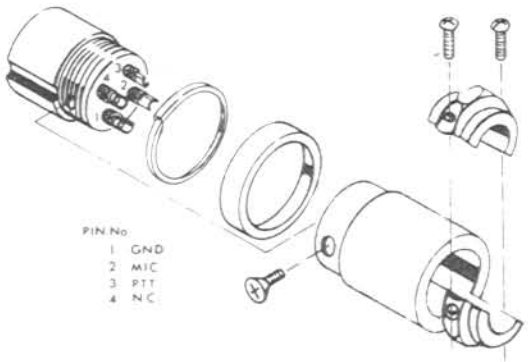
(24) PHONES

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

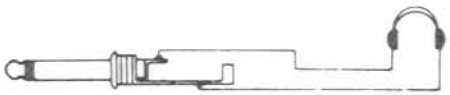
(25) MIC

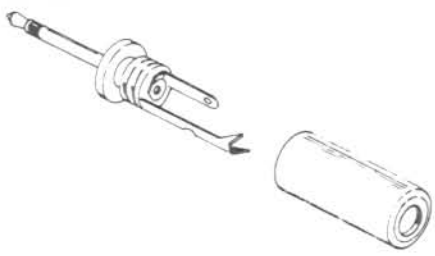
This four-conductor jack accommodates the microphone plug for microphone input as well as for PTT actuation.





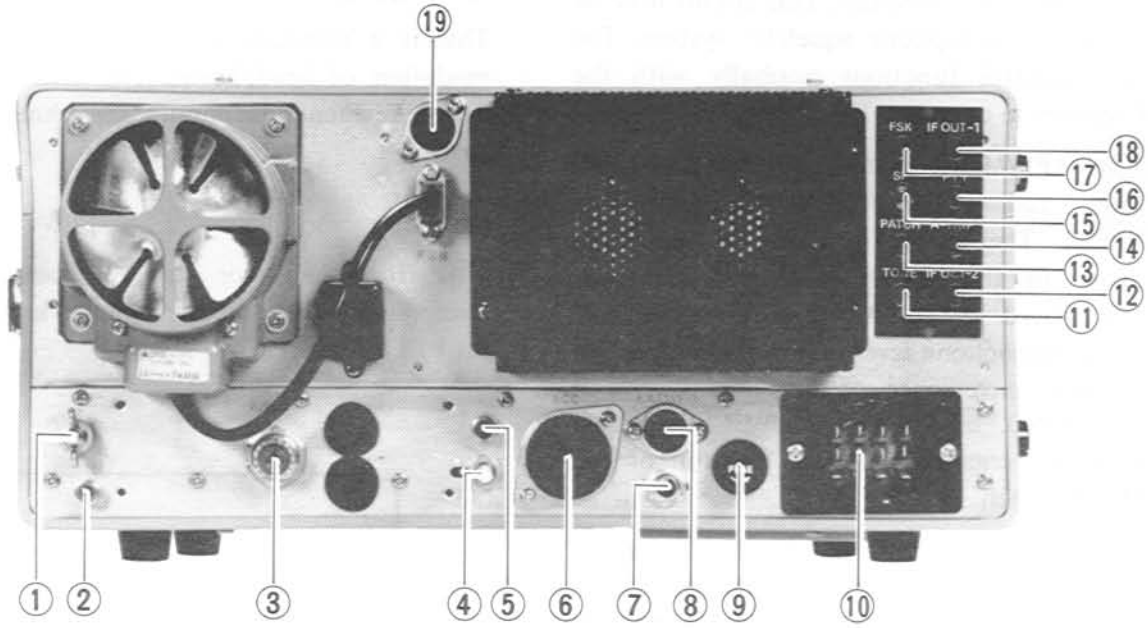
Mic plug





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

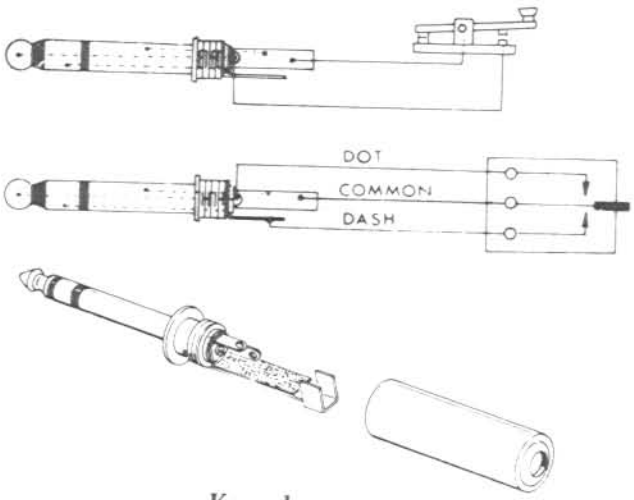
Input from the FSK terminal may be made through this jack. The FT-901DM is set up for 170 Hz shift.

(18) IF OUT 1

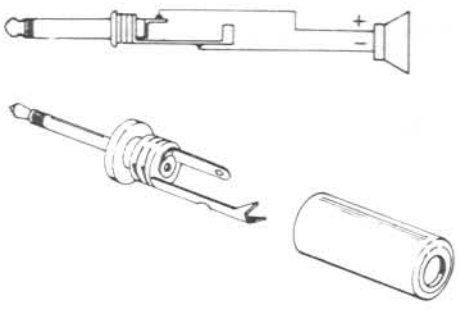
Narrow bandwidth 8.9 MHz IF output is available for use with an IF monitorscope, etc.

(19) REMOTE

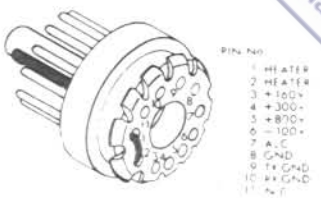
Provides switched 13.5 VDC for relay control for external low-pass filter units, etc. As the bandswitch is rotated, 13.5 VDC will appear at various pins on the REMOTE jack. Use a VOM to determine the proper pin for the band in use.



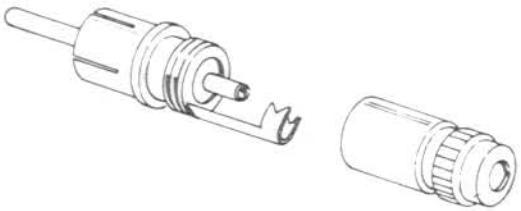
Key plug



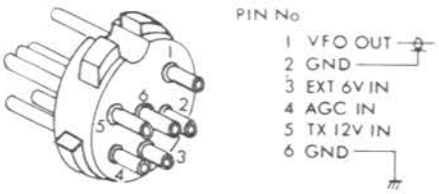
External speaker



ACC plug

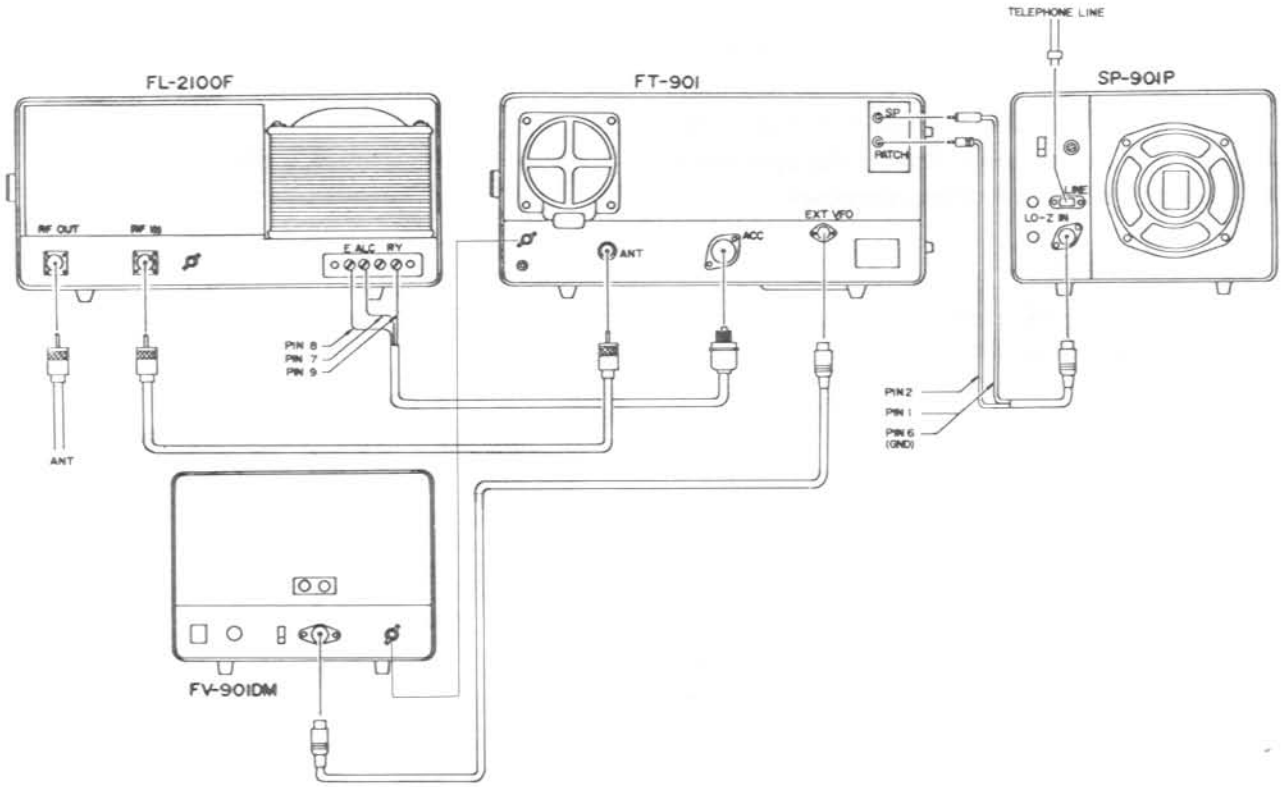


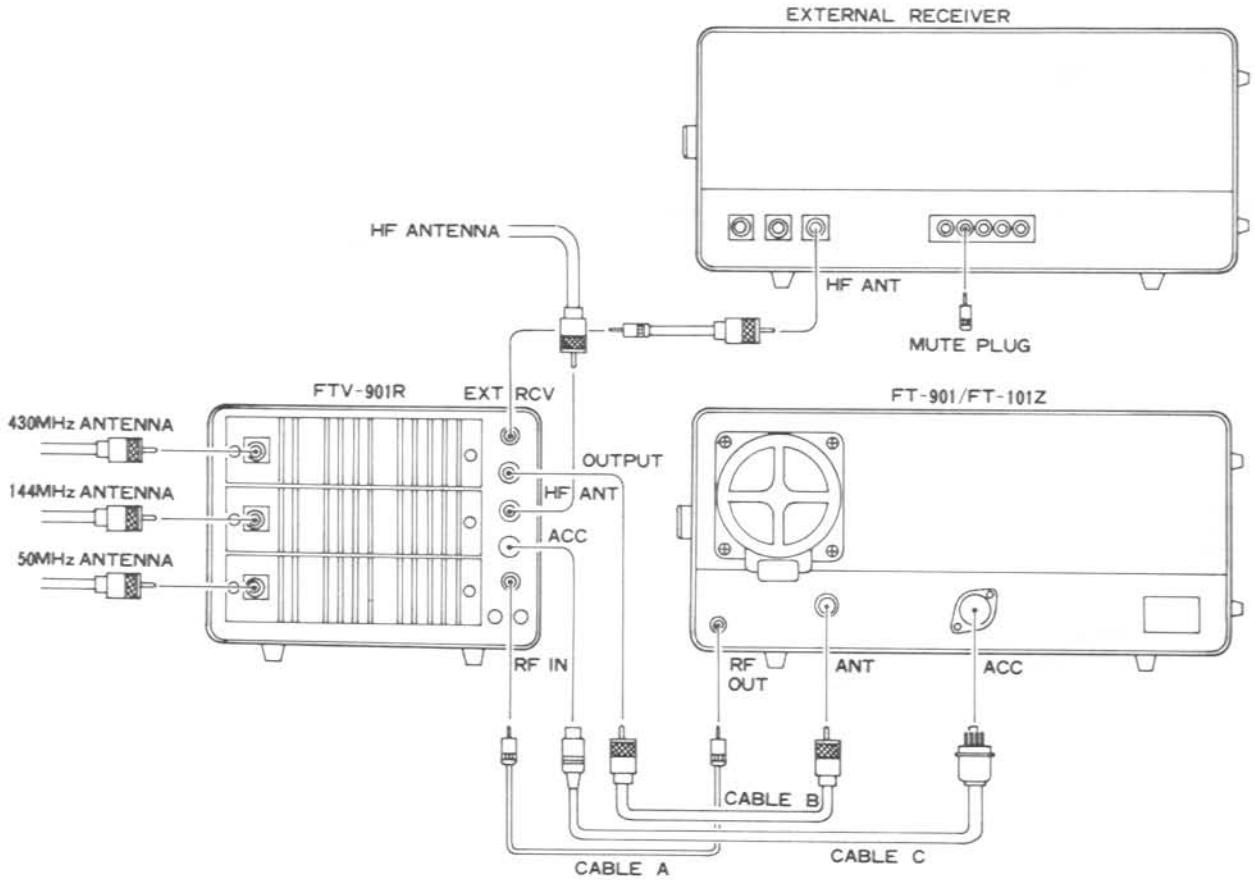
Pin plug

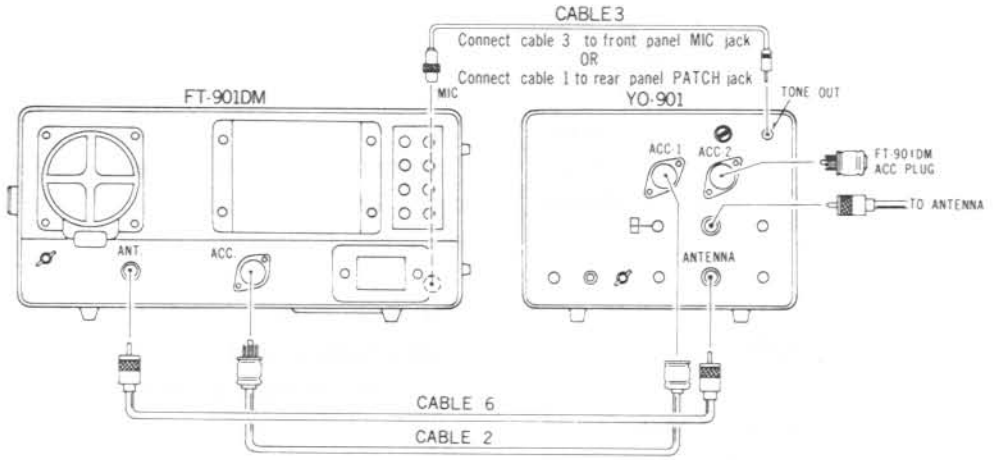


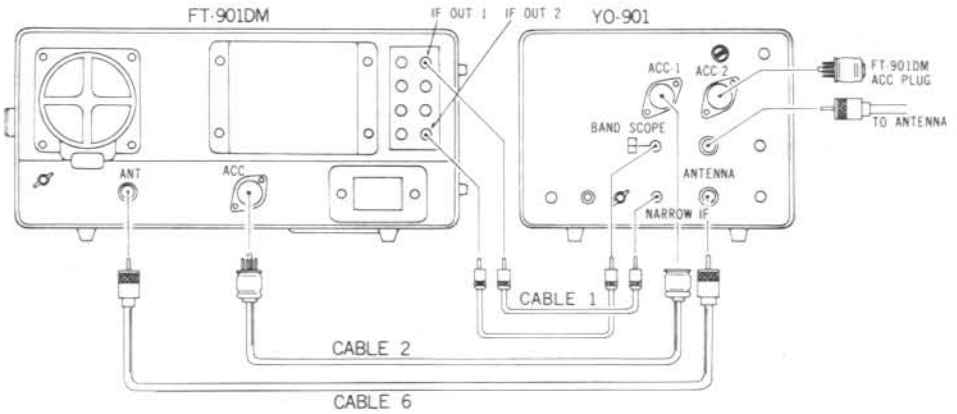
VFO plug

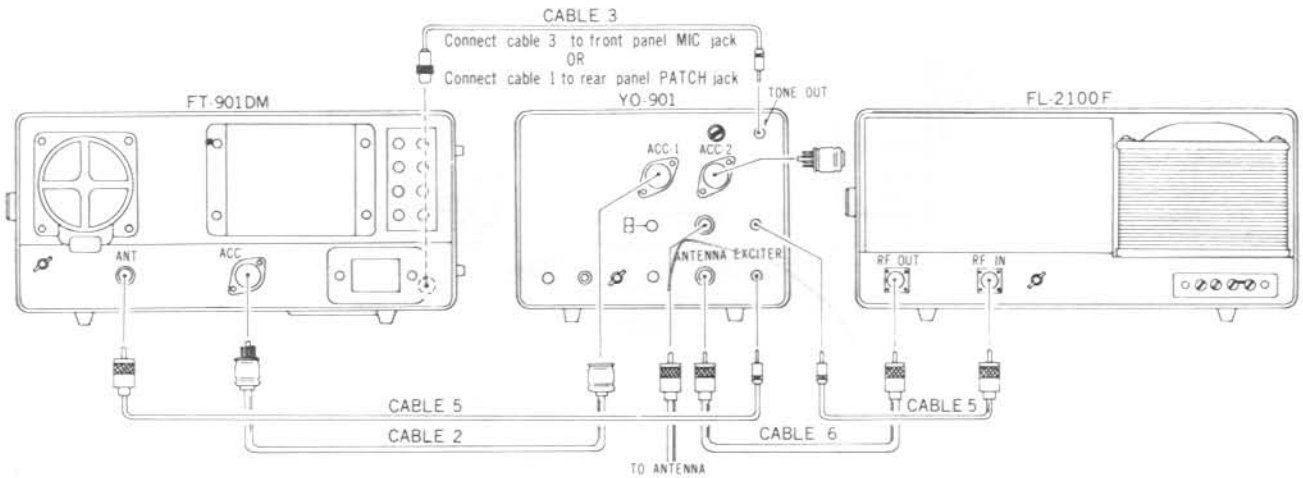
INTERCONNECTIONS











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 flexiblity 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

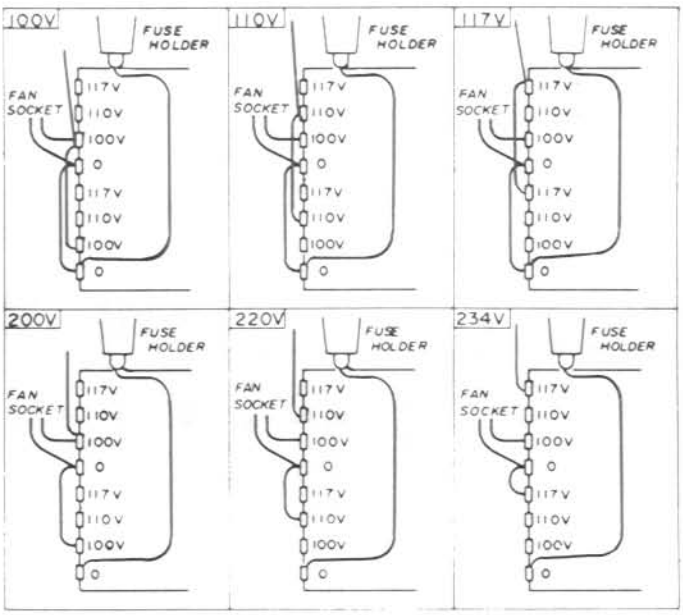
PERMANENT DAMAGE WILL RESULT IF IMPROPER AC SUPPLY VOLTAGE IS APPLIED TO THE TRANSCEIVER.

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

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:

POWER. . . . . .OFF
HEATER. . . . .OFF
VFO . . . . . .Switch depressed
VOX GAIN . . .PTT position
RF GAIN . . . .Fully clockwise
AF GAIN . . . .Adjust subsequently for comfortable level
BAND . . . . . .Desired band
MODE. . . . . .Desired 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

improvement in signal-to-noise ratio. The selectivity of the APF circuit may be varied by adjusting VR_{501} 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:

POWER . . . . . .OFF
HEATER. . . . . .OFF
CARR . . . . . .Fully counter-clockwise position
MIC GAIN. . . . .Fully counter-clockwise position
AMGC . . . . . .OFF
METER switch . .IC
SELECT . . . . . .VFO (Depressed)
BAND . . . . . .Desired band segment
MODE. . . . . .USB or LSB
PLATE . . . . . .Desired band segment
PRESELECT. . . .Desired band segment
LOADING. . . . .To position shown in table
PROC . . . . . .OFF (Not depressed)
TUNE . . . . . .OFF (Not depressed)
CLAR TX . . . . .OFF (Not depressed)
VOX GAIN . . . .PTT 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 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.

(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 PRESELECT 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.

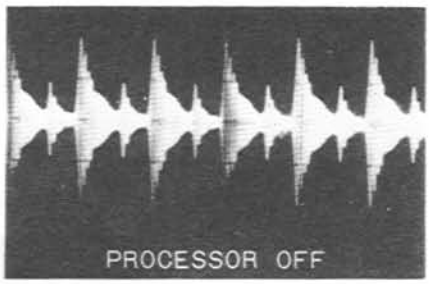
If desired, the AMGC circuit may be activated. This circuit acts as a "microphone squelch;" that is, it initiates a threshold for microphone input which must be exceeded before output from the microphone amplifier will occur. This feature permits minor noises such as a TV in the operating room to be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

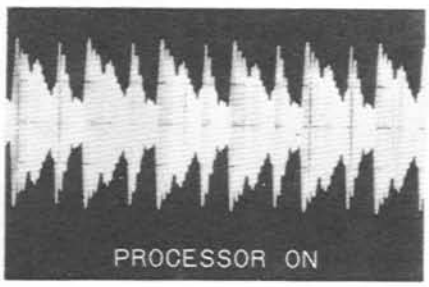
RF SPEECH PROCESSOR ADJUSTMENT (All models)

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

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 S_{601}, which is located on the VOX unit.

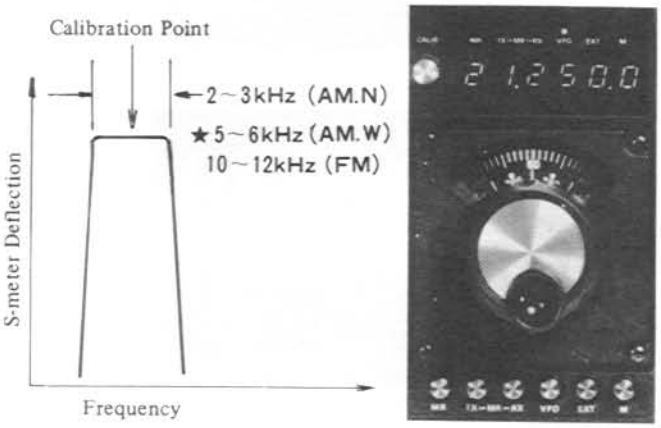
(2) As the main tuning knob is turned, a beat note will be heard every 25 kHz or 100 kHz, depending on the position of S_{601}. Tune the dial and secure a zero beat (lowest pitch frequency) with the marker signal nearest the desired operating frequency.

(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.

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 READOUT 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:

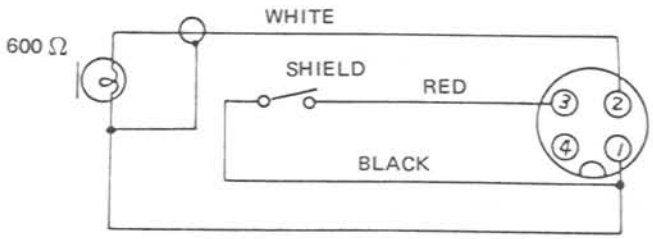
(1) You are operating on a net on 3970 kHz and must QSY down 10 kHz to handle a piece of traffic. With the VFO button depressed and the main dial on 3970 kHz, press M; 3970 is now memorized. Move the main dial down to 3960 kHz to handle the message. When finished, press MR for instant return to 3970 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.

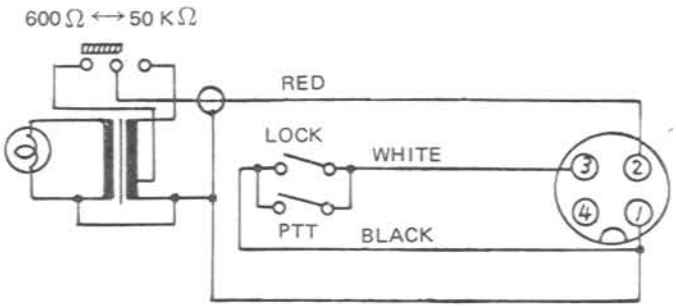
(3) You find DX1DX on 21270 kHz, working stations by order of call area. By pressing the M button, 21270 kHz may be stored in memory and the operator may periodically check to see if his call area is being acknowledged by pressing MR or RX MR.

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.

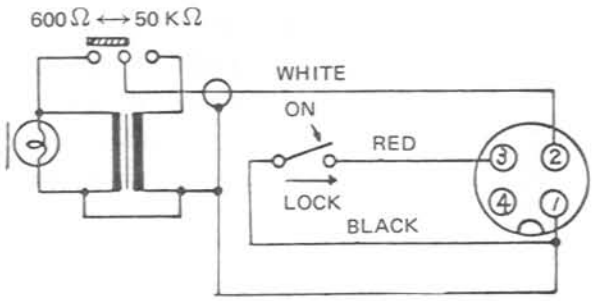
MICROPHONE CONNECTIONS



YE-7A Original Microphone



YD-844A



YD-148

PART DESIGNATIONS ON CIRCUIT BOARDS

PLUG-IN MODULES

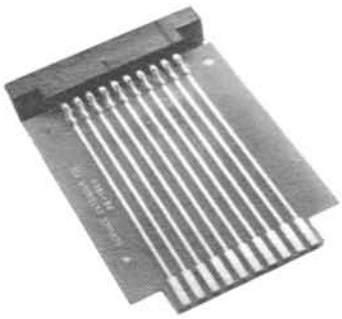
The FT-901DM utilizes computer-type plug-in modules, for ease of servicing. Extender boards of 10 pins (single and double face), 18 pins (single and double face), and 22 pins (single face) can be had from your Yaesu dealer to provide access to test points.

All parts used in the FT-901 transceivers have a part number (e.g. Q_{506}) assigned to them.

Part numbers 01-99 (e.g. R_{12}) 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.

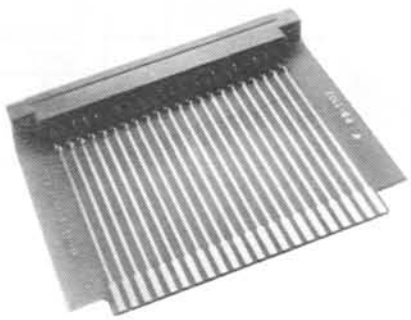
Thus, Q_{301} is transistor number 01, located on circuit board #3, which is the FILTER unit. Refer to the chart below for a tabulation of the code numbers assigned to the various circuit boards used in the FT-901 trnsceivers.

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

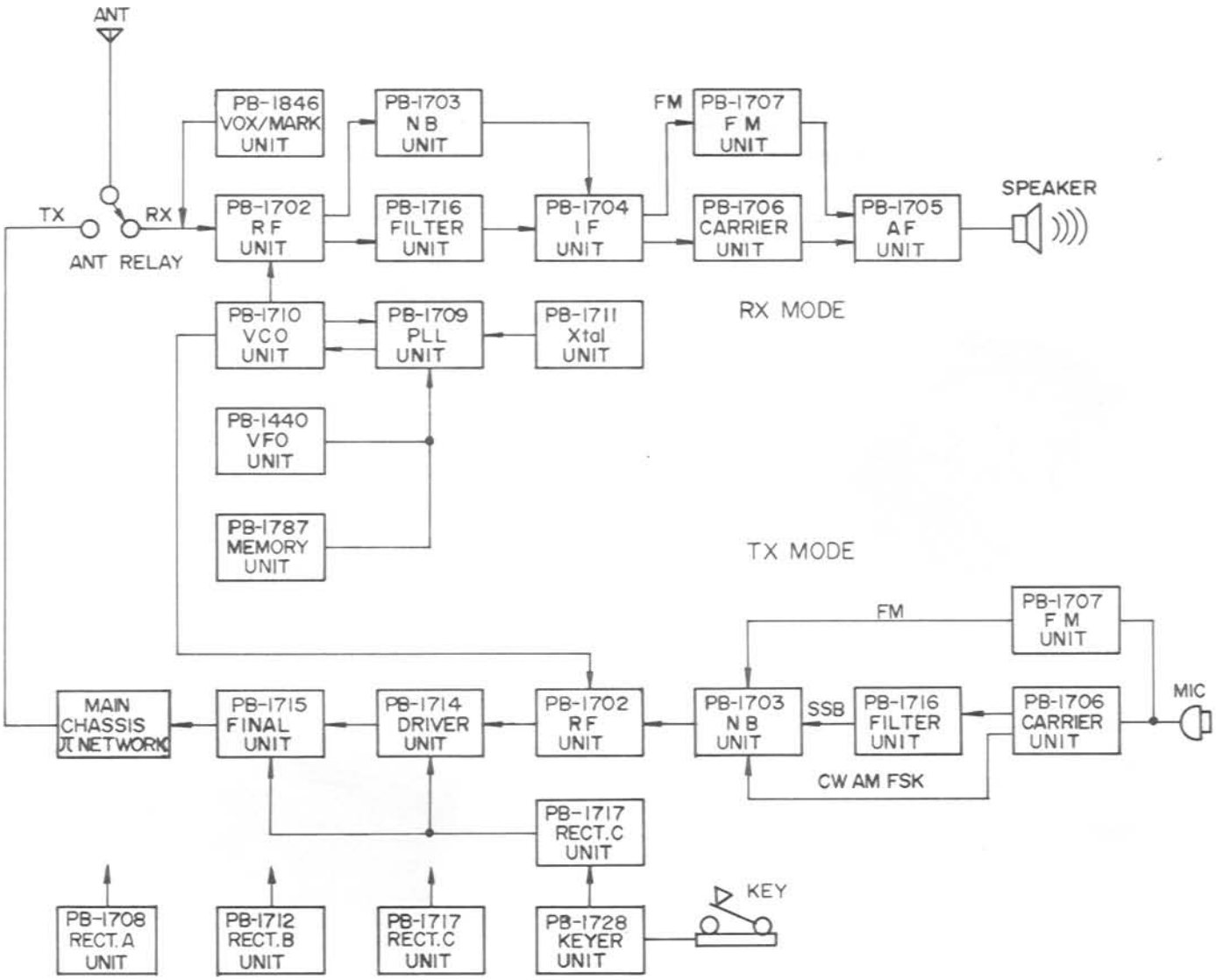
EXTENDER BOARDS

SIGNAL TRACING IN THE FT-901

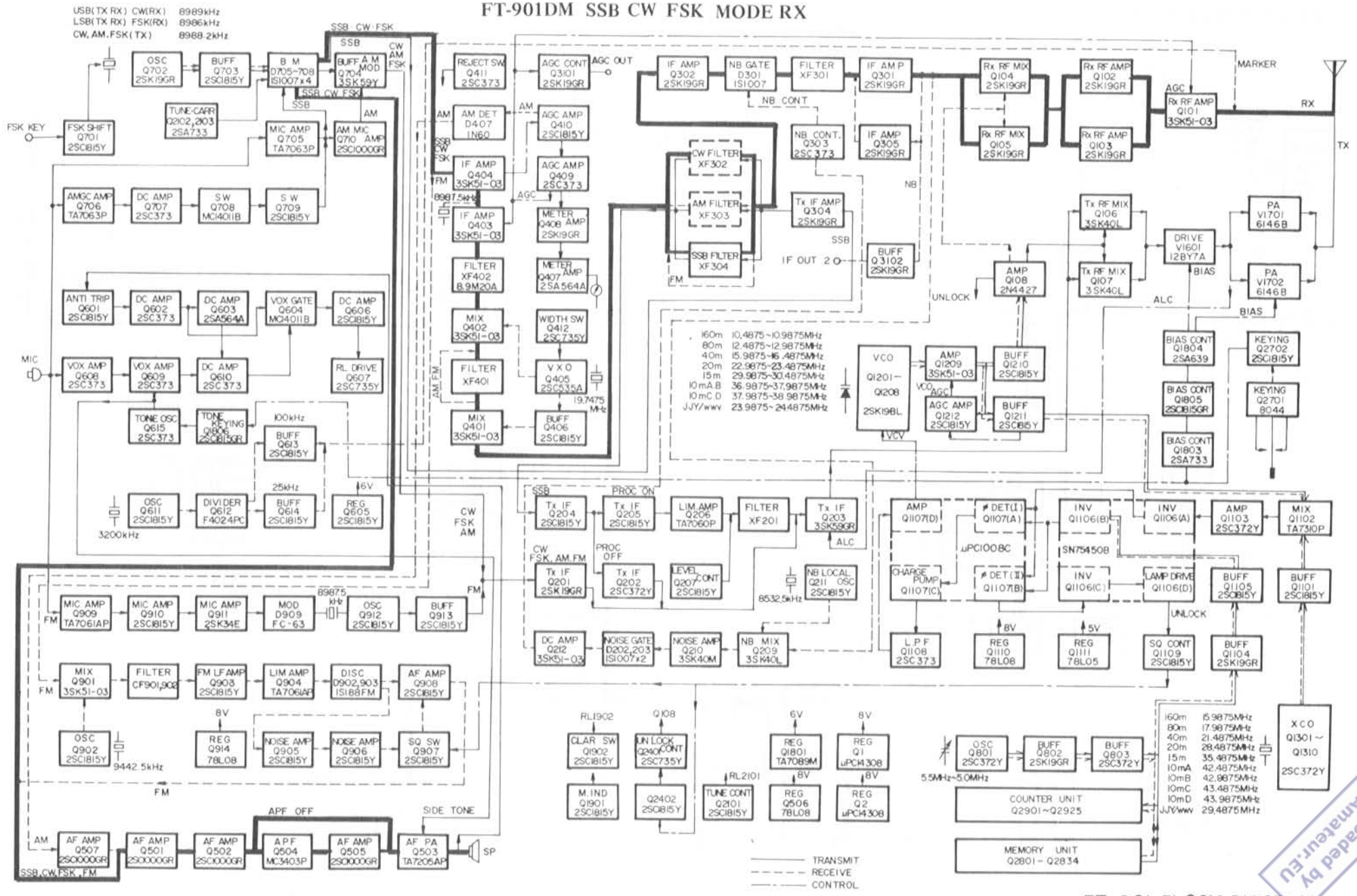
Because the signal path may change considerably when the mode is changed, we have included augmented block diagrams on page 2-3 through 2-9, in order to assist you in understanding the function of the FT-901.

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

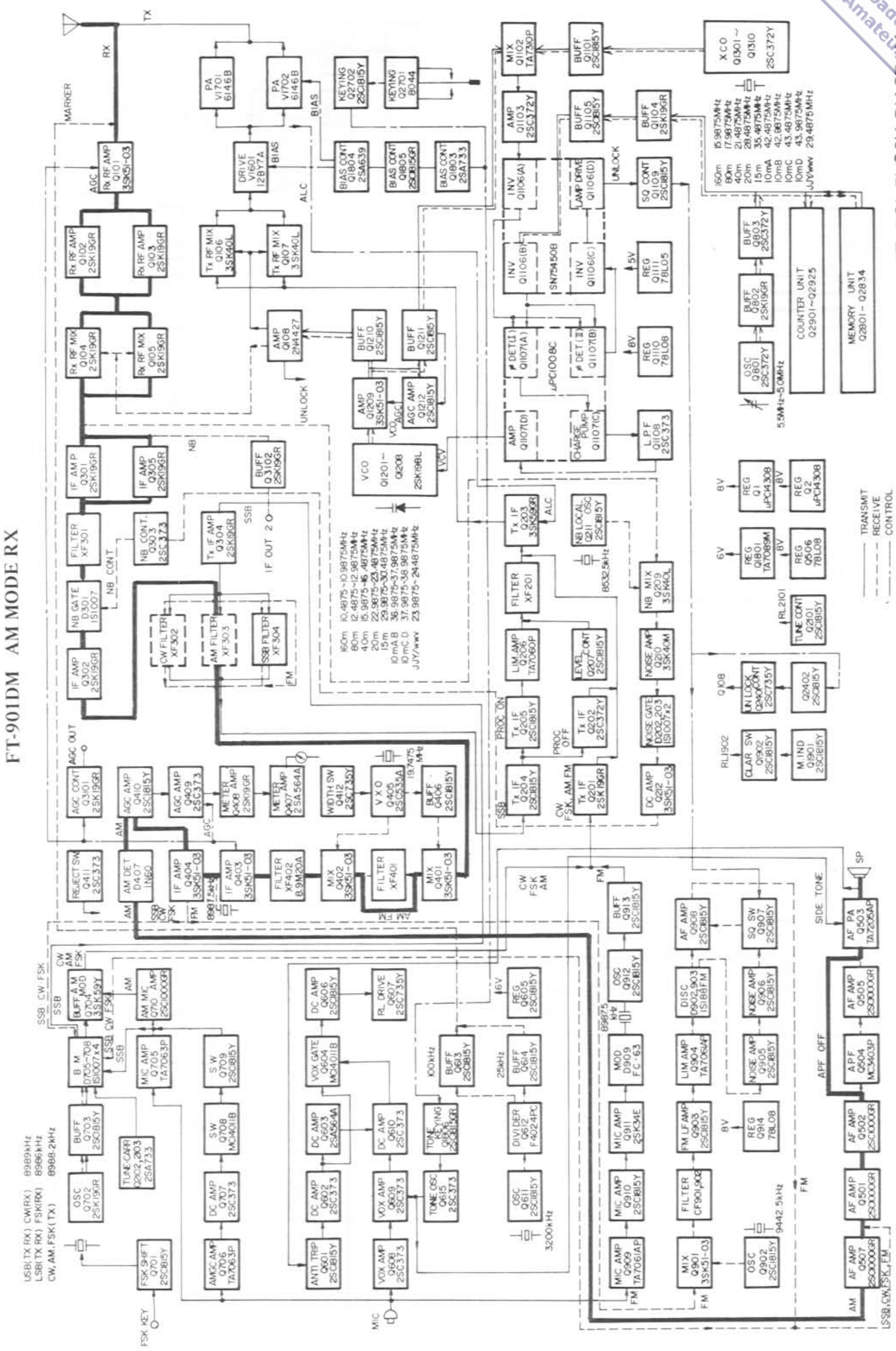
It should be noted that the internal calibrator (Marker) is an extremely useful signal for preliminary fault localization. In a properly functioning FT-901, the S-meter should read approximately S9 + 10 dB, when the preselector is peaked on 14.000 MHz SSB. Minor variations from this number are not unusual, 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.



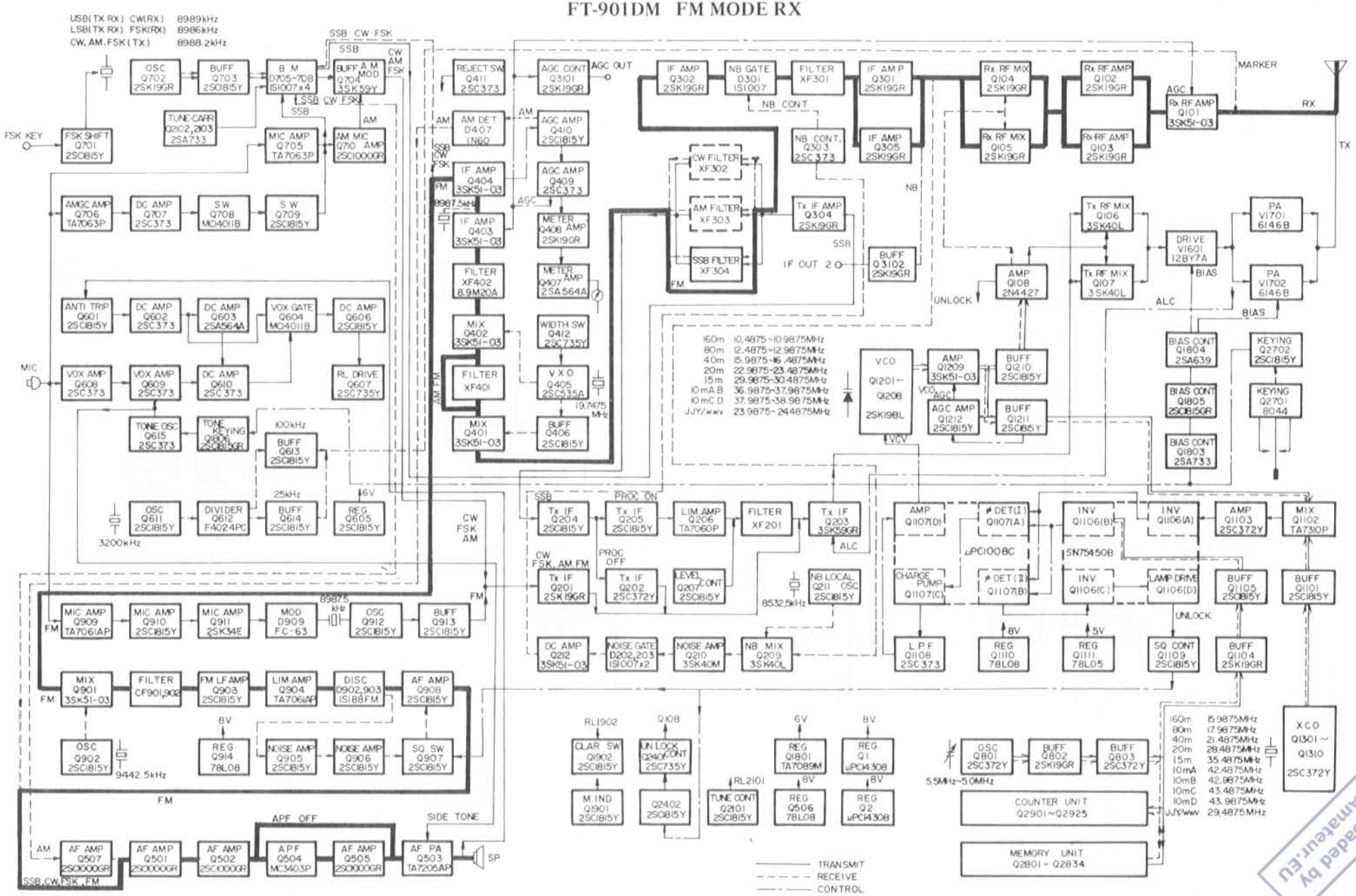
FT-901DM SSB CW FSK MODE RX



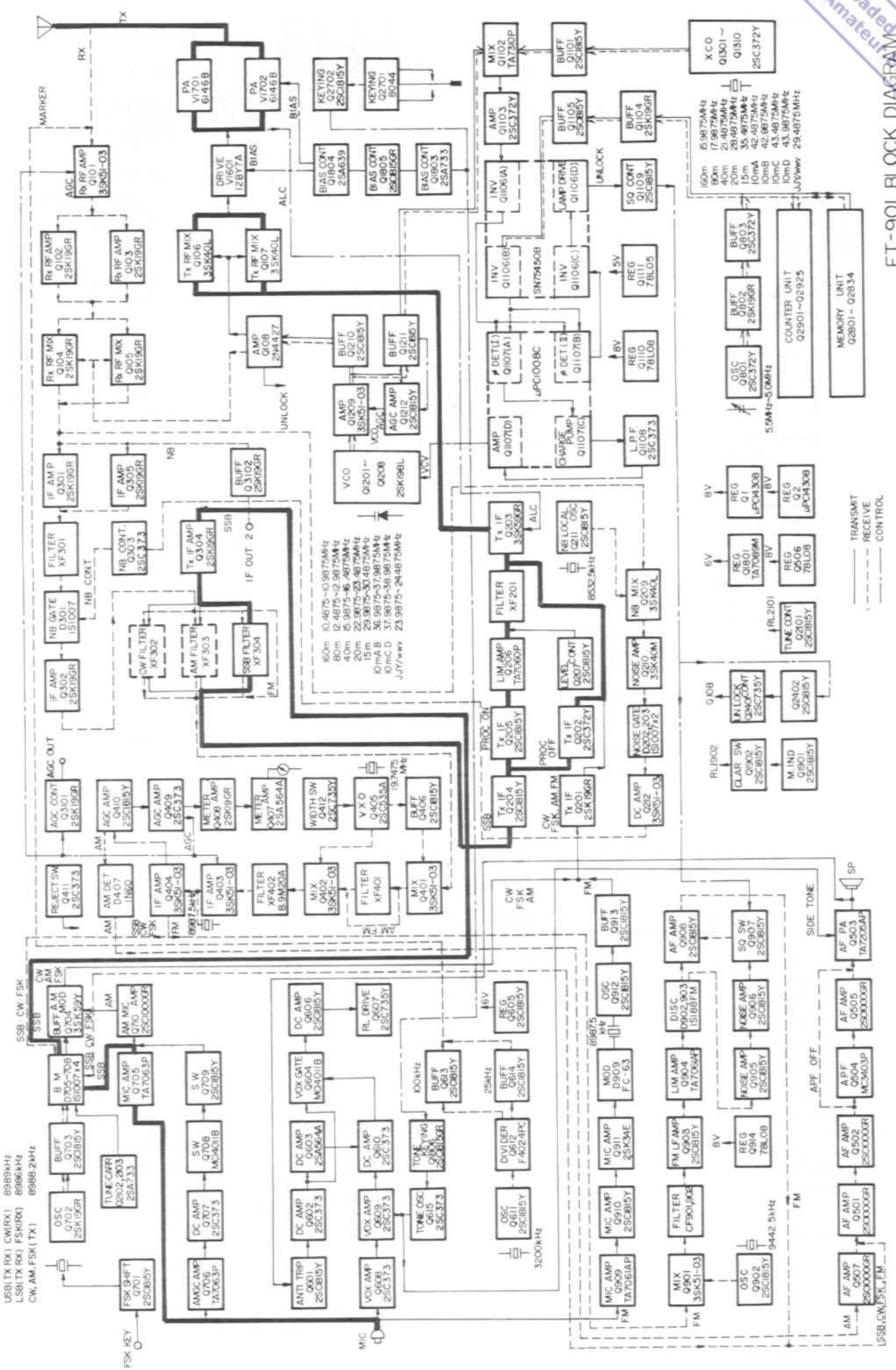
F.T-901 BLOCK DIAGRAM



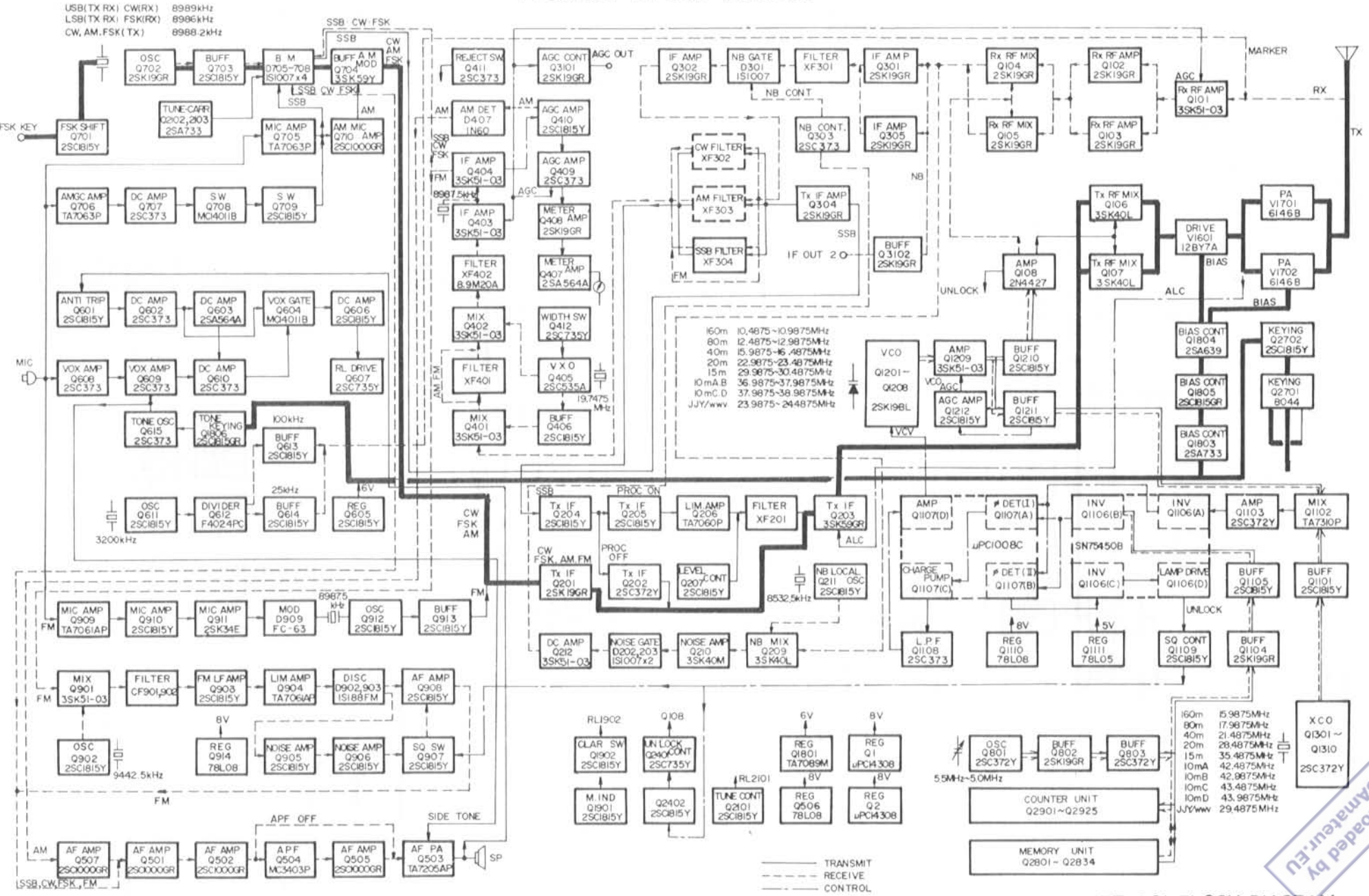
FT-901DM FM MODE RX



FT-901 BLOCK DIAGRAM

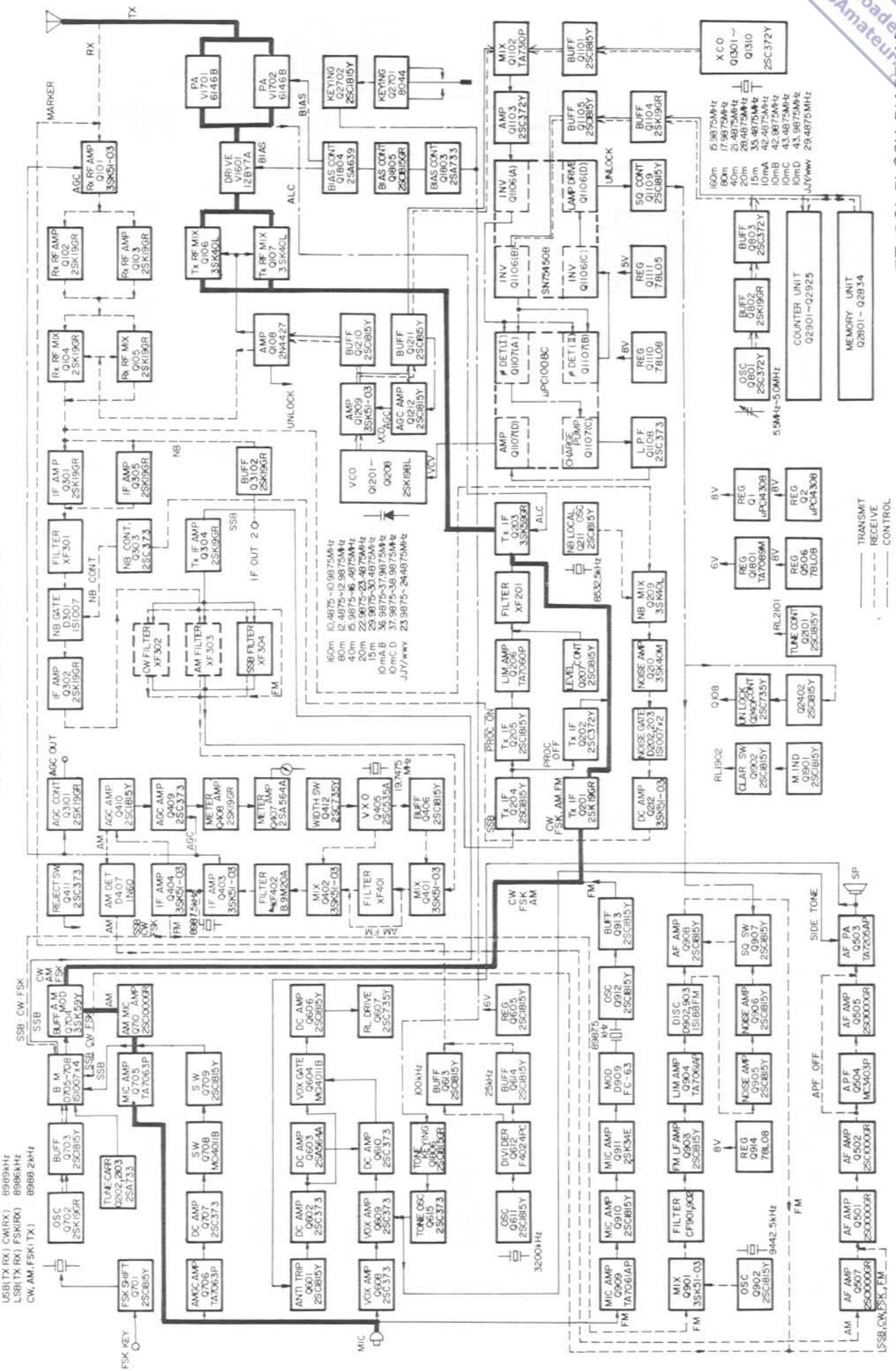


FT-901DM CW FSK MODE TX

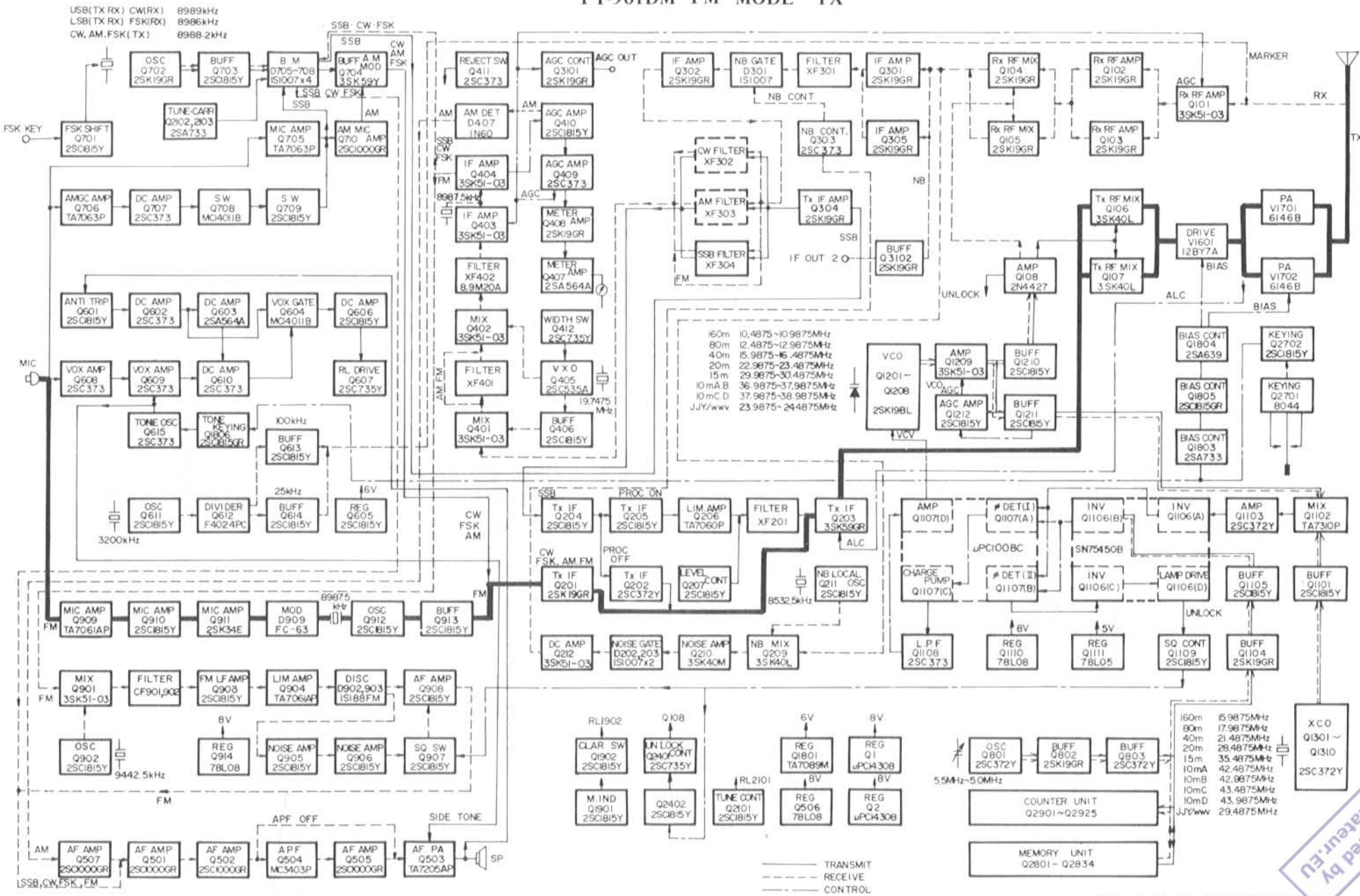


FT-901 BLOCK DIAGRAM

FT-901 DM AM MODE TX

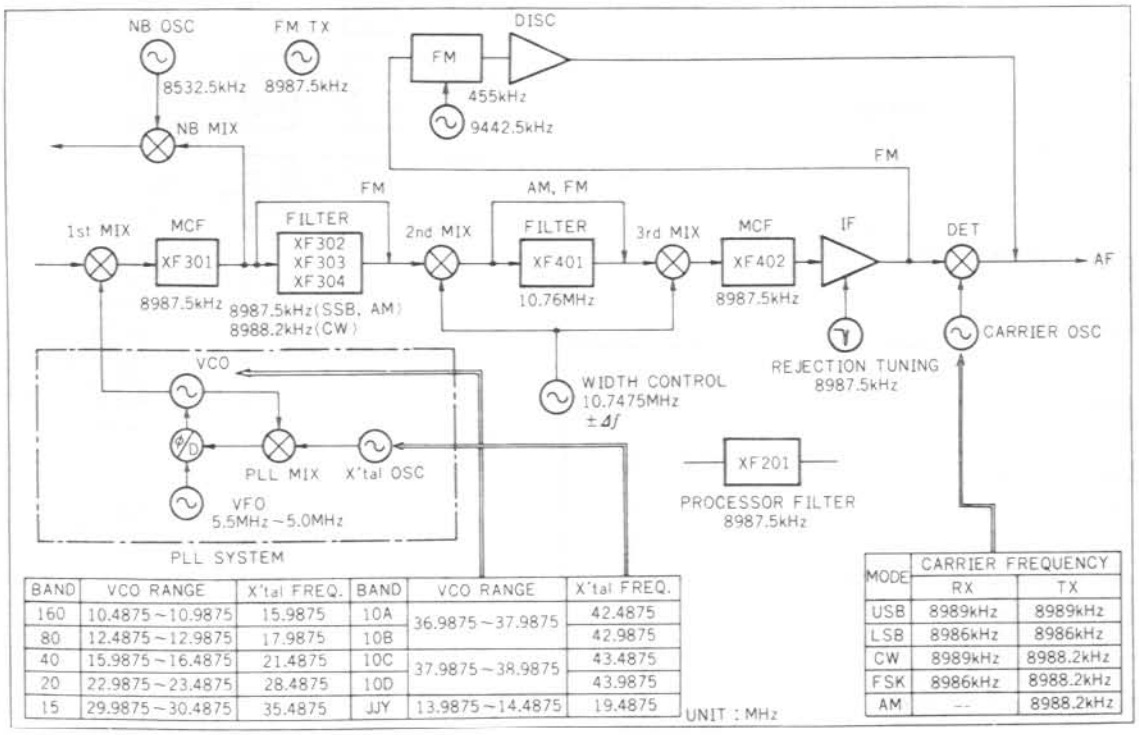


FT-901 BLOCK DIAGRAM



FT-901 BLOCK DIAGRAM

FREQUENCY RELATIONS



BAND	VCO RANGE	X'tal FREQ.	BAND	VCO RANGE	X'tal FREQ.
160	10.4875~10.9875	15.9875	10A	36.9875~37.9875	42.4875
80	12.4875~12.9875	17.9875	10B		42.9875
40	15.9875~16.4875	21.4875	10C	37.9875~38.9875	43.4875
20	22.9875~23.4875	28.4875	10D		43.9875
15	29.9875~30.4875	35.4875	JJY	13.9875~14.4875	19.4875

UNIT : MHz

MODE	CARRIER FREQUENCY	
	RX	TX
USB	8989kHz	8989kHz
LSB	8986kHz	8986kHz
CW	8989kHz	8988.2kHz
FSK	8986kHz	8988.2kHz
AM	--	8988.2kHz

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.

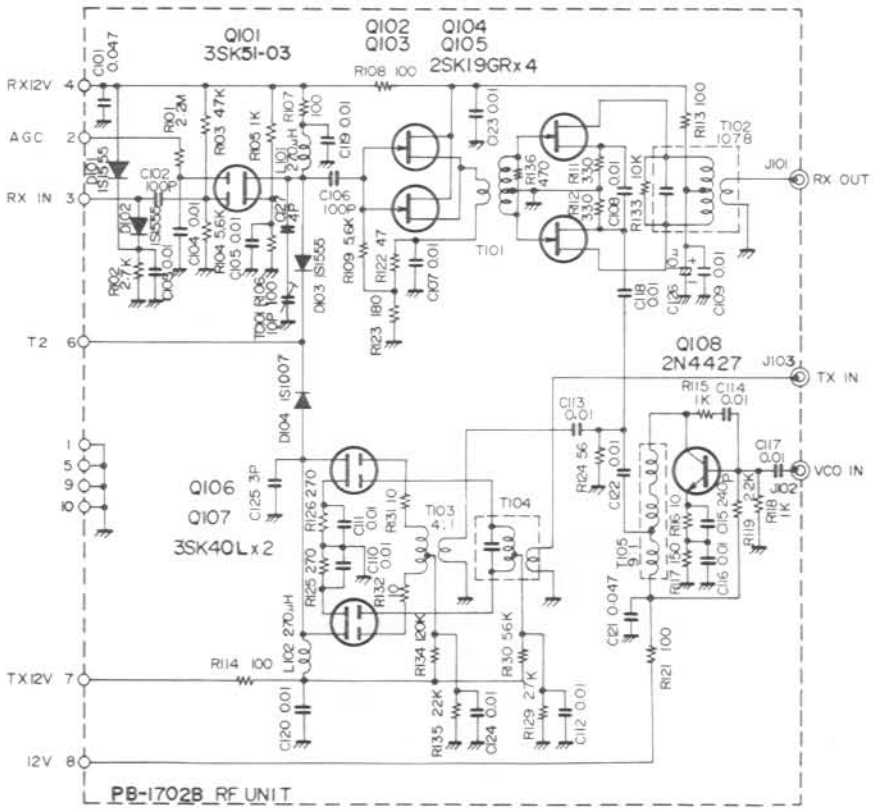
RECEIVER

The RF input signal from the antenna is fed to pin 3 of the RF UNIT (PB-1702) via antenna relay RL_2, line fuse FH_1, attenuator switch S_{2103}, input transformer T_1, and 9 MHz trap coil T_{2402}.

RF UNIT (PB-1423)

The incoming signal is amplified by the RF amplifier Q_{101} (**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 Q_{102} and Q_{103} (both **2SK19GR**) to the balanced mixer consisting of Q_{104} and Q_{105} (both **2SK19GR**), where the input signal is heterodyned with a local signal delivered from buffer amplifier Q_{108} (**2N4427**), producing an IF signal of 8.9875 MHz at J_{101}.

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.



FILTER UNIT (PB-1716C)

The IF signal received at pin 2 of the FILTER UNIT **(PB-1716)** is amplified by parallel-connected Q_{301} and Q_{305} (both **2SK19GR**), and fed through a monolithic filter XF_{301} **(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, Q_{302} **(2SK19GR)**.

The noise blanker diode D_{301} **(1S1007)** is placed between T_{302} and T_{303}, and it functions as an ON/OFF switch which is controlled by the noise blanker driver Q_{303} **(2SC1815Y)**. The output from the source of Q_{302} is passed through the SSB filter XF_{304} (or the optional AM or CW filters). Selection of the filter to be used is performed by one of the diode switches D_{303} - D_{308} **(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 D_{310} **(1S1555)** to pin 5 of the IF UNIT.

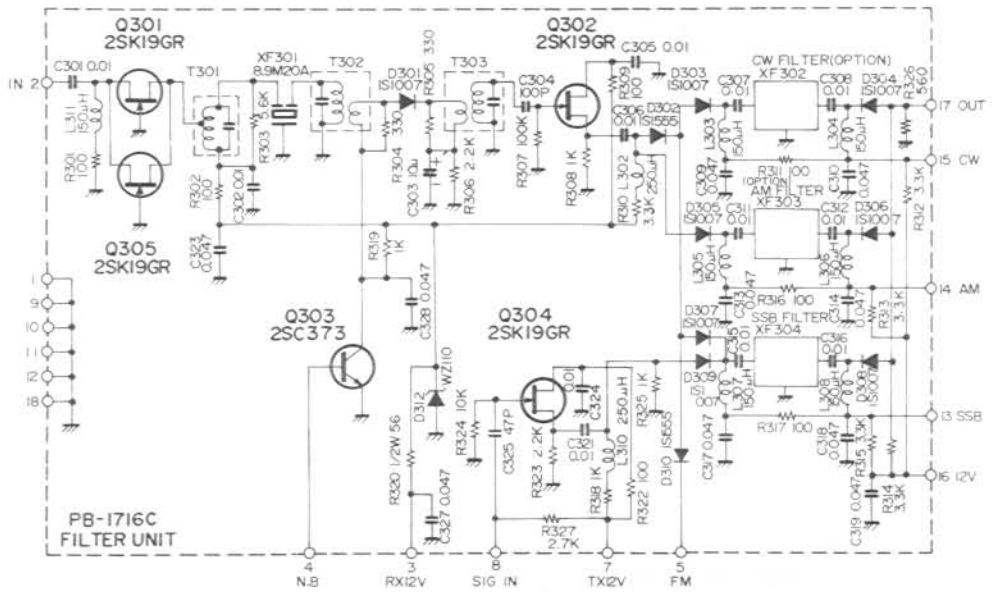
IF UNIT (PB-1704)

The IF signal from pin 14 is fed to the gate of the IF first mixer, Q_{401} **(3SK51)**, where the IF signal is heterodyned with a 19.7475 MHz ± Δf local signal delivered from crystal oscillator Q_{405} **(2SC535A)** and buffer amplifier Q_{406} **(2SC1815Y)**. resulting in a signal of 10.76 MHz ±Δf.

The new 10.76 MHz ± Δf signal is fed through filter XF_{401} to the IF second mixer, Q_{402} **(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 XF_{401}. The combination of filters XF_{304} and XF_{401} provides continuously variable width of the IF passband.

The frequency of crystal oscillator Q_{405} is varied by varactor diode D_{401} **(1S2209)**.

On the AM and FM modes, the IF signal is passed through diode switches D_{402} and D_{403} **(1S1007)**, and does not pass through filter XF_{401}.



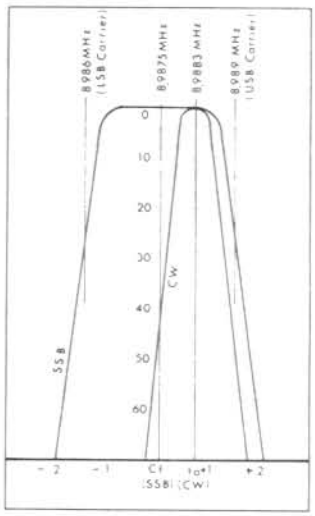
The output from the IF second mixer is fed through a monolithic filter XF_{402} to the two-stage IF amplifier consisting of Q_{403} and Q_{404} (both **3SK40M**). The output from Q_{403} is coupled to the rejection tuning circuit which eliminates interference within the IF passband. This rejection function is accomplished by varying the resonant frequency of a crystal with varactor diode D_{406} (**1S2209**) on the SSB, CW, and FSK modes.

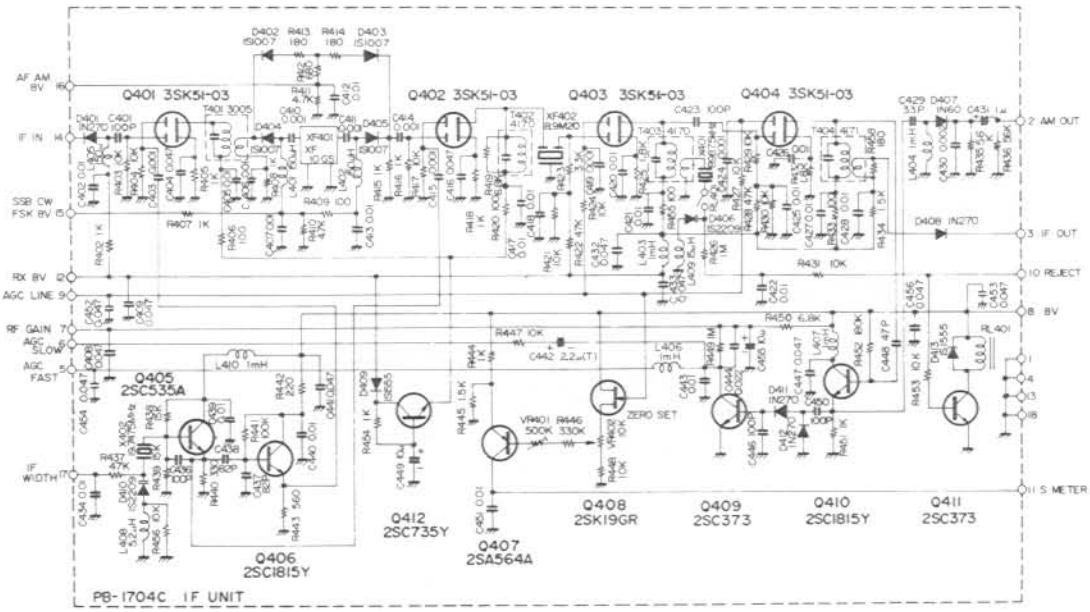
The amplified IF signal is fed to the CARRIER UNIT. In the AM mode, the signal is fed through a buffer amplifier Q_{410} (**2SC1815Y**) to the AM detector D_{407} (**1N60**). The signal is then fed to the AF UNIT.

A portion of the output from Q_{410} is rectified by D_{411} and D_{412} (**1N60**) to produce AGC voltage. The AGC voltage is amplified by DC amplifier Q_{409} (**2SC373**) and fed to the gate of RF amplfier Q_{101} and to IF amplifiers Q_{403} and Q_{404} to control the gain of these stages for AGC purposes. The time constant of the AGC voltage decay is selectable (**FAST/SLOW**) by switch S_{2003}. The AGC voltage is further amplified by Q_{408} (**2SK19GR**) and Q_{407} (**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.

Q_{411} (**2SC373**) works as a relay driver for the IF rejection tuning circuit. Delay transistor Q_{412} (**2SC735Y**) supplies the voltage to the drain of Q_{401} and Q_{402} when the transceiver returns to the receive mode after transmission.



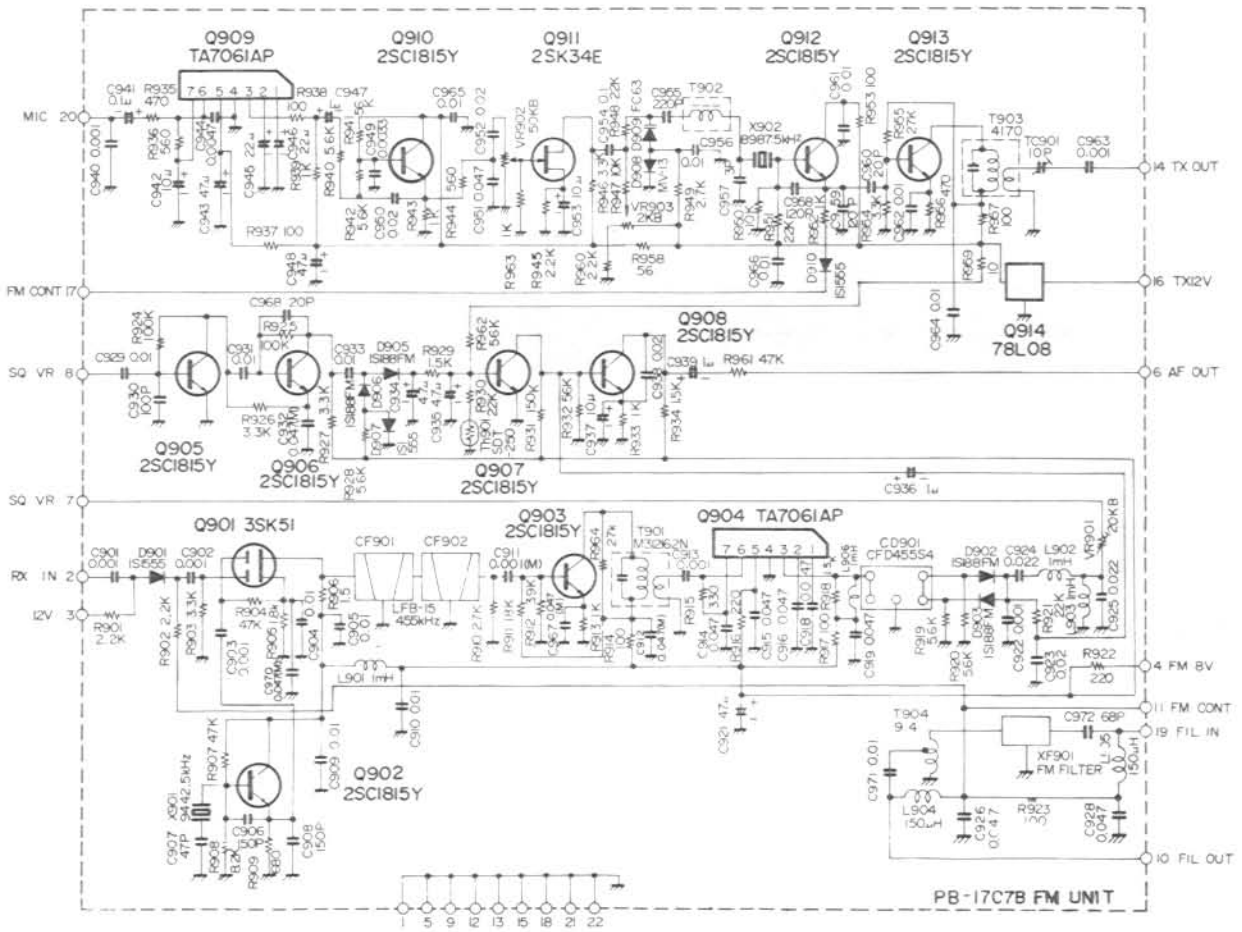


FM UNIT (PB-1707)

In the FM mode, the IF signal from the IF UNIT is fed to the gate of Q_{901} (**3SK40M**), where it is heterodyned with the 9442.5 kHz signal delivered from the FM oscillator Q_{902} (**2SC1815Y**), thus producing a 455 kHz IF signal. The 455 kHz IF signal passes through a two-stage ceramic filter consisting of CF_{901} and CF_{902} (**LFB-15**), and is amplified by an amplifier limiter consisting of Q_{903} (**2SC1815Y**) and Q_{904} (**TA7061AP**).

A ceramic discriminator consisting of CD_{901} (**CFD455S4**) and D_{902} and D_{903} (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 Q_{908} (**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 Q_{905} and Q_{906} (both **2SC1815Y**) and detected by D_{905} and D_{906} (both **1S188FM**) to produce a DC voltage. This voltage is applied to turn "on" Q_{907} (**2SC1815Y**). With Q_{907} "on," the base of Q_{908} 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 Q_{907} is turned "off," permitting normal action of Q_{908}. The squelch control VR_{901} sets the squelch threshold level.

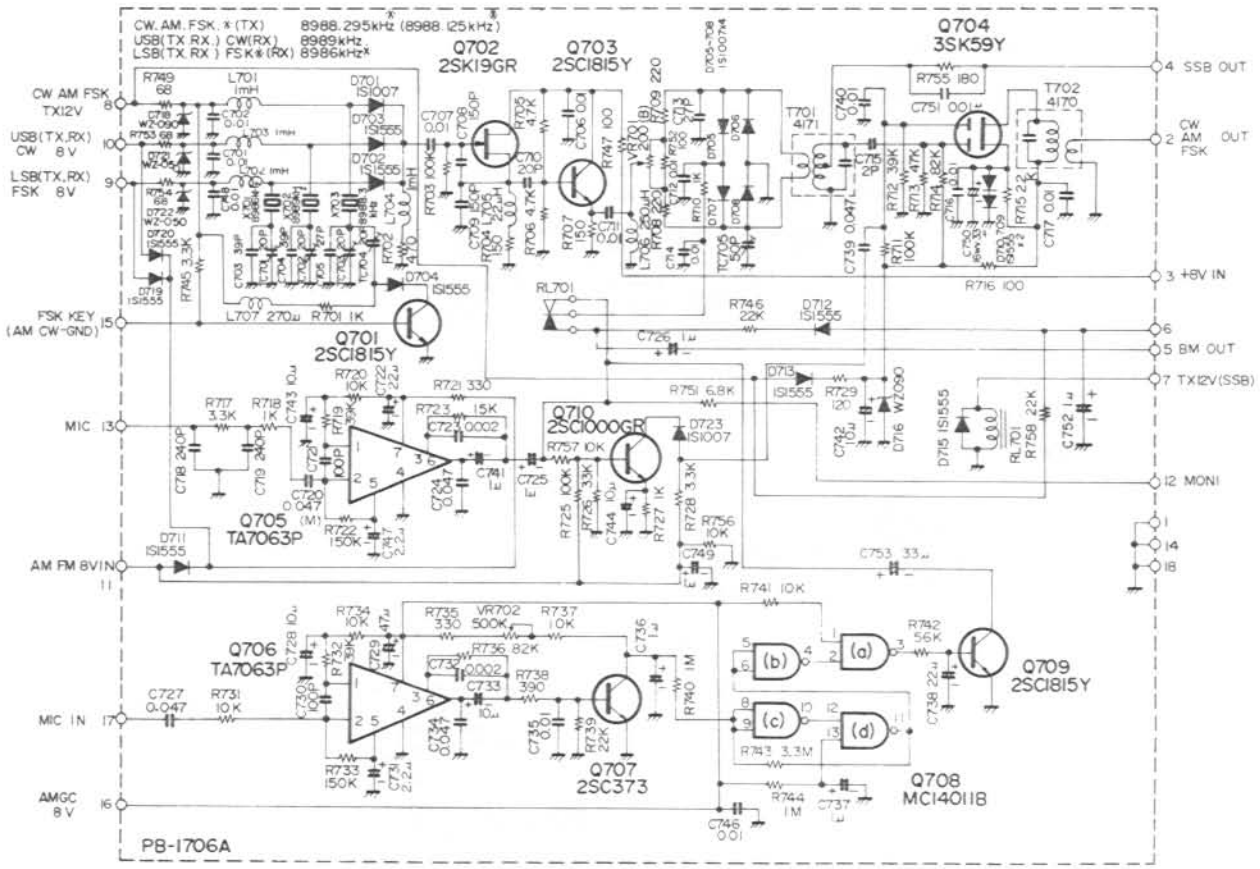


CARRIER UNIT (PB-1706)

The carrier oscillator Q_{702} (**2SK19GR**) is followed by a buffer amplifier Q_{703} (**2SC1815Y**). It oscillates at one of the following frequencies, depending on the mode of operation: 8989 kHz with X_{702}; 8986 kHz with X_{701}; or 8988.295 kHz with X_{703}. The crystal selection is made by diode switches D_{701} - D_{703} (**1S1555**).

Diode D_{701} conducts to activate X_{703}, which is used for the CW, FSK, AM, and TUNE transmit signal. Diode D_{702} conducts to activate X_{701} for LSB and FSK reception. Diode D_{703} conducts to activate X_{702} for USB and CW reception.

The carrier signal is fed to the ring demodulator consisting of D_{705} - D_{708} (all **1S1007**), which demodulates the IF signal into audio using the carrier signal applied from Q_{703}. The audio is then fed through relay contacts to the AF UNIT.

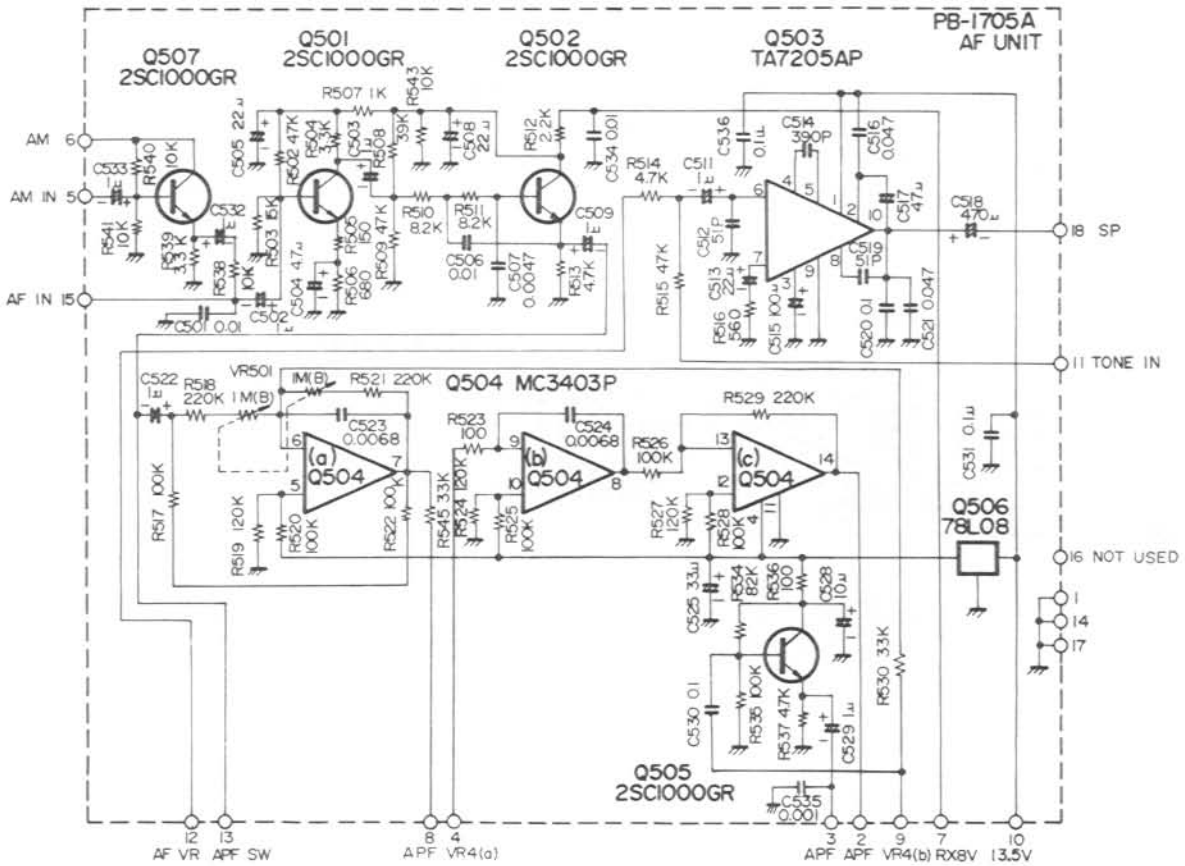


AF UNIT (PB-1705)

The audio signal from the AM detector is amplified by Q_{507} **(2SC1000GR)** and fed to the first audio amplifier Q_{501} **(2SC1000GR)**. On SSB, CW, FM, and FSK, the audio signal is directly fed to Q_{501} from pin 15. The audio signal is amplified through Q_{501} and Q_{502} (both **2SC1000GR**) and is then fed through the APF switch and audio volume control VR_5a to the audio output amplifier Q_{503} **(TA7205AP)**, which delivers 3 watts of audio output to the speaker.

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

Operational amplifier Q_{504} **(MC3403)** and AF amplifier Q_{505} **(2SC1000GR)** are placed into the audio circuit by the APF switch on the front panel. The frequency of this selective amplifier is varied with the front panel APF control VR_4a/b between 400 Hz and 900 Hz, providing single-signal, noise-free CW reception. VR_{501} provides adjustment of the selectivity of the APF circuit.



NB UNIT (PB-1703)

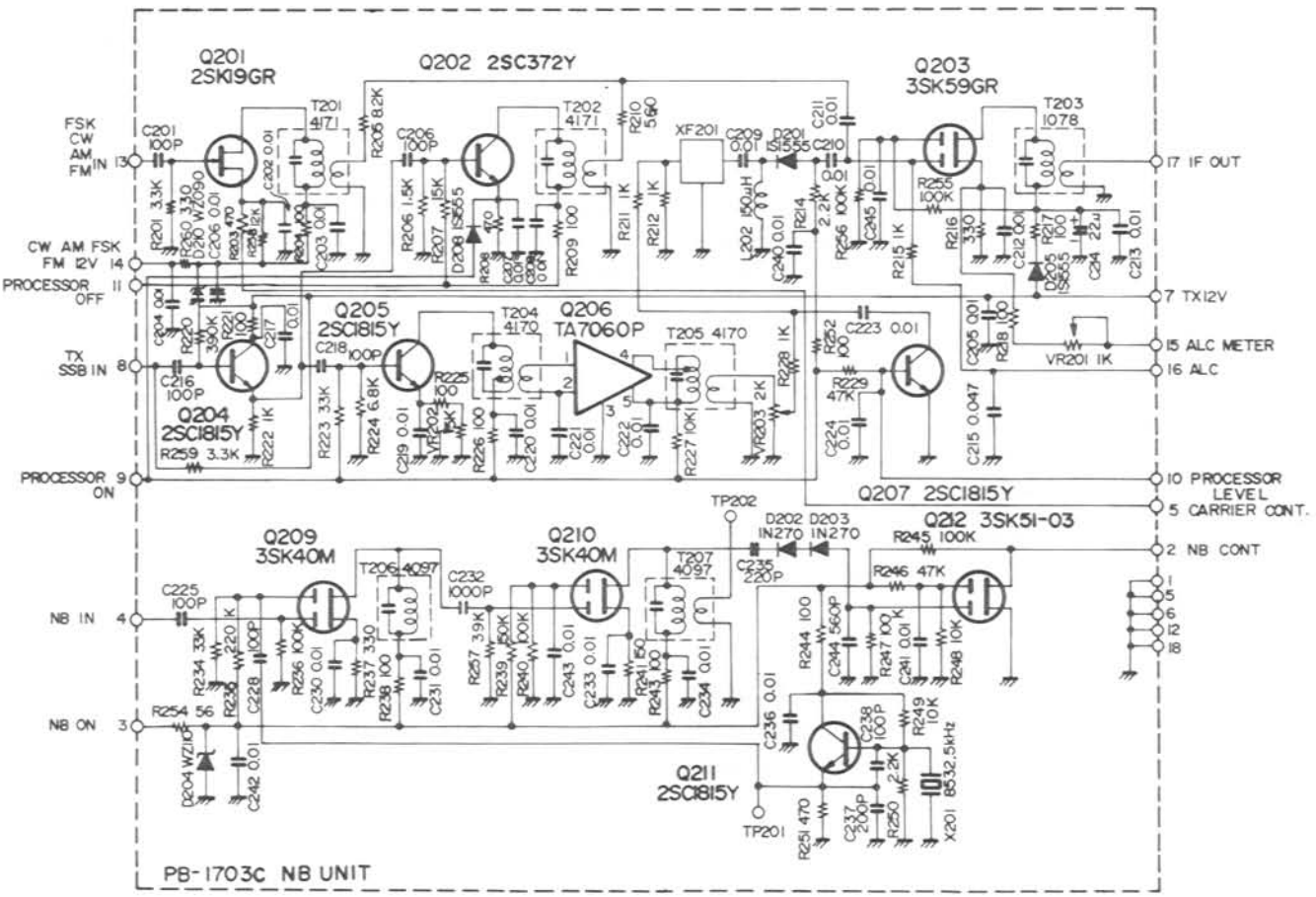
A portion of the 8987.5 kHz IF signal is fed to pin 4 of the noise blanker unit and appears at noise blanker mixer Q_{209} **(3SK40M)**, where the 8532.5 kHz signal generated by Q_{211} **(2SC1815Y)** is mixed with the incoming signal to produce a 455 kHz signal. The 455 kHz signal is then amplified by Q_{210} **(3SK40M)**.

When a carrier or a noise-free modulated signal is received, the 455 kHz signal (with its corresponding strength) is rectified by D_{202} and D_{203} (both **1N60**) to charge C_{235}. There is no discharge loop for C_{235}; therefore, signals which exceed the charged voltage established by the reference voltage on C_{235} will not pass through D_{202} and D_{203}. Accordingly, there will be no voltage drop across R_{247}, and Q_{212} **(3SK40M)** will conduct as the gate voltage approaches zero potential. When Q_{212} conducts, the drain voltage at pin 2 of the printed board will drop.

The drain of Q_{212} is directly connected to the base of Q_{303} **(2SC1815Y)** in the FILTER UNIT. As the drain voltage of Q_{212} drops, the base voltage of Q_{303} drops, turning off Q_{303}. The collector voltage will then increase, producing a forward bias to D_{301} **(1S1007)**. As D_{301} conducts, the signals will pass normally through the circuit.

When pulse-type noise is received which exceeds the charged reference voltage established by C_{235}, D_{202} and D_{203} will permit negative-going pulses to turn Q_{212} off. The drain voltage will rapidly increase as it turns off.

As the drain voltage increases, Q_{303} will turn on and the collector voltage will decrease. Accordingly, D_{301} 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 J_2 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 Q_{705} **(TA-7063P)** and fed through relay RL_{701} to the ring modulator, consisting of D_{705} – D_{708} (all **1S1007**), where the signal modulates a carrier signal delivered from Q_{703} **(2SC1815Y)**. The double sideband signal is fed through T_{701} 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 Q_{304} **(2SK 19GR)** and is passed through sideband filter XF_{304} by diode switches D_{309} **(1S1555)** and D_{307} - D_{308} (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 Q_{204} **(2SC1815Y)** to the bases of Q_{202} and Q_{205} (both **2SC1815Y**). When the RF processor switch is "OFF," the SSB signal is amplified by Q_{202} and fed to Q_{203} **(3SK59GR)**. When the processor switch is "ON," the SSB signal is amplified by Q_{205} **(2SC1815Y)** and is further amplified by the limiter Q_{206} **(TA7060P)**, where the signals that exceed the preset clipping level are sliced out. VR_{203} is used to equalize the level of the clipped and unclipped signals.

This highly clipped SSB signal is passed through a selective filter XF_{201} to remove RF harmonics that result from signal clipping. The filtered output signal is amplified by Q_{203} 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 Q_{205} (2SC 1815Y), thus changing the input signal level to the filter.

The CW, FSK, AM, and FM signals pass through Q_{201} **(2SK19GR)** and are fed to Q_{203}.

The ALC (Automatic Level Control) voltage detected at the grid circuit of the PA tube is fed to the first gate of Q_{203} to reduce the gain of the amplifier, thus preventing overloading and distortion.

RF UNIT (PB-1702)

The SSB signal from J_{102} of the printed board is fed to the balanced mixer consisting of Q_{106} and Q_{107} (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 D_{104} **(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 V_{1601} **(12BY7A)** where it is amplified to a level sufficient to drive the final amplifier tubes V_{1701} and V_{1702} **(6146B)**. A portion of the RF signal is coupled through C_{16} 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 TC_1 to the cold end of the T_3/L_9 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 Q_{702} **(2SK19GR)** on the CARR UNIT generates a crystal controlled carrier signal of 8988.2 kHz. The carrier is fed through buffer amplifier Q_{703} **(2SC1815Y)** to the ring modulator. Q_{702} also oscillates for TUNE operation.

DC voltage is applied through diode switch D_{912} **(1S1555)** and RL_{701}, to unbalance the ring modulator for CW, AM, and FSK operation; the resulting carrier signal is fed to T_{701}.

The output from T_{701} is amplified by Q_{704} **(3SK59Y)** and fed to Q_{201} **(2SC1815Y)** on the NB UNIT. The signal is then further amplified by Q_{203} **(3SK59GR)**, and is fed to the transmitter mixer.

Keying of the transmitter is accomplished by changing the bias voltage to V_{1601}, V_{1701}, and V_{1702}. The tubes are cut off on "key up" by application of −35V for V_{1601} and −110V for V_{1701} and V_{1702}. These cutoff voltage are reduced to −0.1V and −60V, respectively, during "key down" conditions.

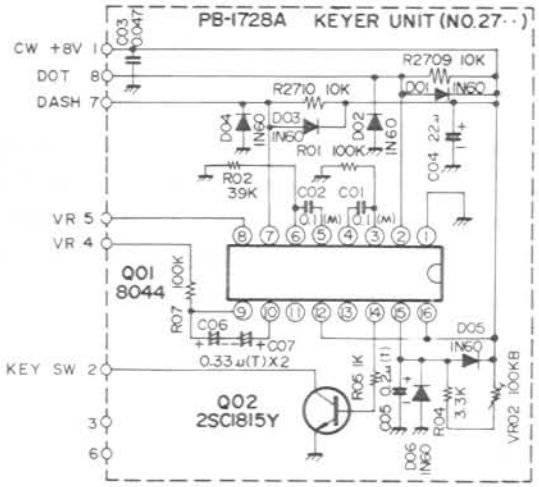
The key is connected to pin 13 of the REC C unit **(PB1717)**. Under "key down" conditions, the base of Q_{1803} **(2SA733)** is grounded, causing Q_{1805} **(2SC1815GR)** and Q_{1804} **(2SA639)** to conduct. The voltage at pin 16 of PB-1717 reaches zero when Q_{1804} conducts. Since pin 16 of PB-1717 is connected to pin 2 of the RECT A UNIT **(PB-1708)**, the bias voltage of V_{1601}, V_{1701}, and V_{1702} places these tubes in the normal operating condition.

On other modes, 12 volts is applied to pin 15, causing Q_{1804} to conduct, thus placing the operating bias on the tubes.

KEYER UNIT (PB-1728)

The built-in electronic keyer utilizes Q_{2701} (Curtis **8044 IC**). The output of Q_{2701} is high during "key down" conditions; this output is connected to the base of Q_{2702} **(2SC1815Y)**, the collector current of which is connected to the base of Q_{1803}, causing Q_{1803} to conduct during "key down" conditions.

Keyer speed is controlled by VR_2 b on the front panel. VR_{2701} provides adjustment of the dot-space symmetry, while VR_{2702} adjusts the keying weight. VR_{2702} normally is set to minimum, providing a 1:1 dot: space weight.



AM

The microphone signal is amplified by Q_{705} **(TA7063P)** and Q_{710} **(2SC1000GR)** and fed to Q_{704} **(3SK59Y)**, where it modulates the 8988.2 kHz carrier signal. The output from T_{702} is fed to the NB UNIT in the same manner as described in the CW section previously.

FSK

The carrier oscillator Q_{702} **(2SK19GR)** generates a crystal controlled carrier frequency of 8988.2 kHz. When keying is applied to the FSK jack J_{15}, the base voltage of Q_{701} **(2SC1815Y)** becomes zero, causing Q_{701} to cut off. In the "space" condition, Q_{701} conducts, placing TC_{704} 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-

tor). The microphone signal is fed to pin 17 of the CARRIER UNIT, amplified by Q_{706} **(TA 7063P)**, and fed to Q_{707} **(2SC373)**. When a sufficient level of speech input is applied to the microphone, Q_{707} conducts, causing the output of NAND gate Q_{708} **(MC14011B)** to be "low." This condition cuts off AMGC controller Q_{709} **(2SC1815Y)**. The collector circuit of Q_{709} is connected with the output circuit of the microphone amplifier Q_{705}.

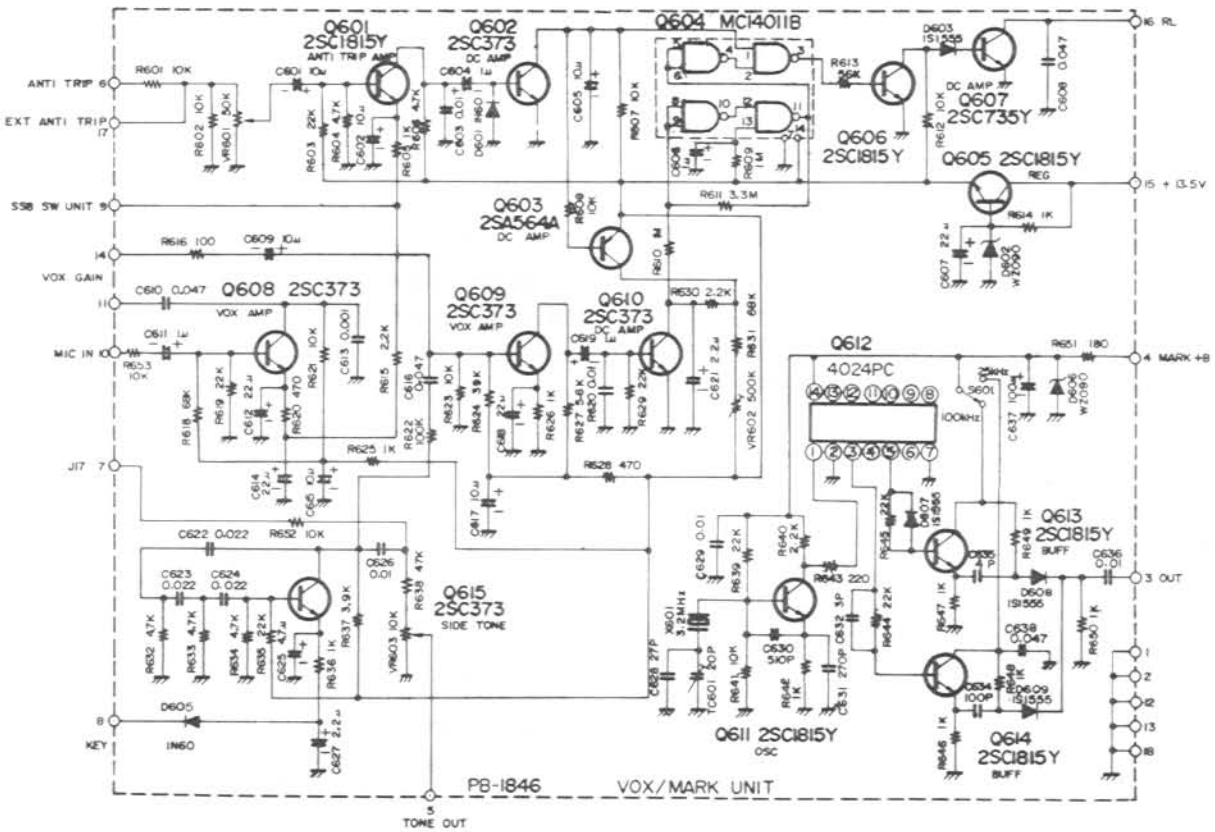
When the microphone input signal becomes significantly lower than the normal speech level (background noise only), Q_{707} turns OFF, causing the output of Q_{708} to be "high." This condition causes Q_{709} to conduct, grounding the output circuit of Q_{705}.

The gate holding time can be adjusted by means of VR_{702}, 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 Q_{608} and Q_{609} **(2SC373)** and fed to the base of Q_{610} **(2SC373)**. When the signal is applied, Q_{610} conducts, causing C_{621} to discharge. The DC voltage of C_{621} is then fed to the gate circuit of Q_{604} **(MC14011B)**. When pins 1 and 2 of Q_{604} are high, the output of the VOX gate of Q_{604} becomes low, causing Q_{606} **(2SC1815Y)** to cut off, thus turning relay driver Q_{607} **(2SC735)** ON to actuate the VOX relay RL_1.

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 VR_{601} to amplifier Q_{601} **(2SC1815Y)** and is then rectified by D_{601} **(1N60)**. The rectified DC voltage turns Q_{602} **(2SC373)** ON, placing its collector at a low level, thus preventing the gate circuit from activating the relay driver Q_{607}. The collector of Q_{602} is connected through R_{608} to the base of Q_{603} **(2SA564A)** which shorts the supply voltage for C_{621}; thus, C_{621} 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} (2SC 1815Y) regulates the supply voltage to the VOX circuit.

FM UNIT (PB-1707)

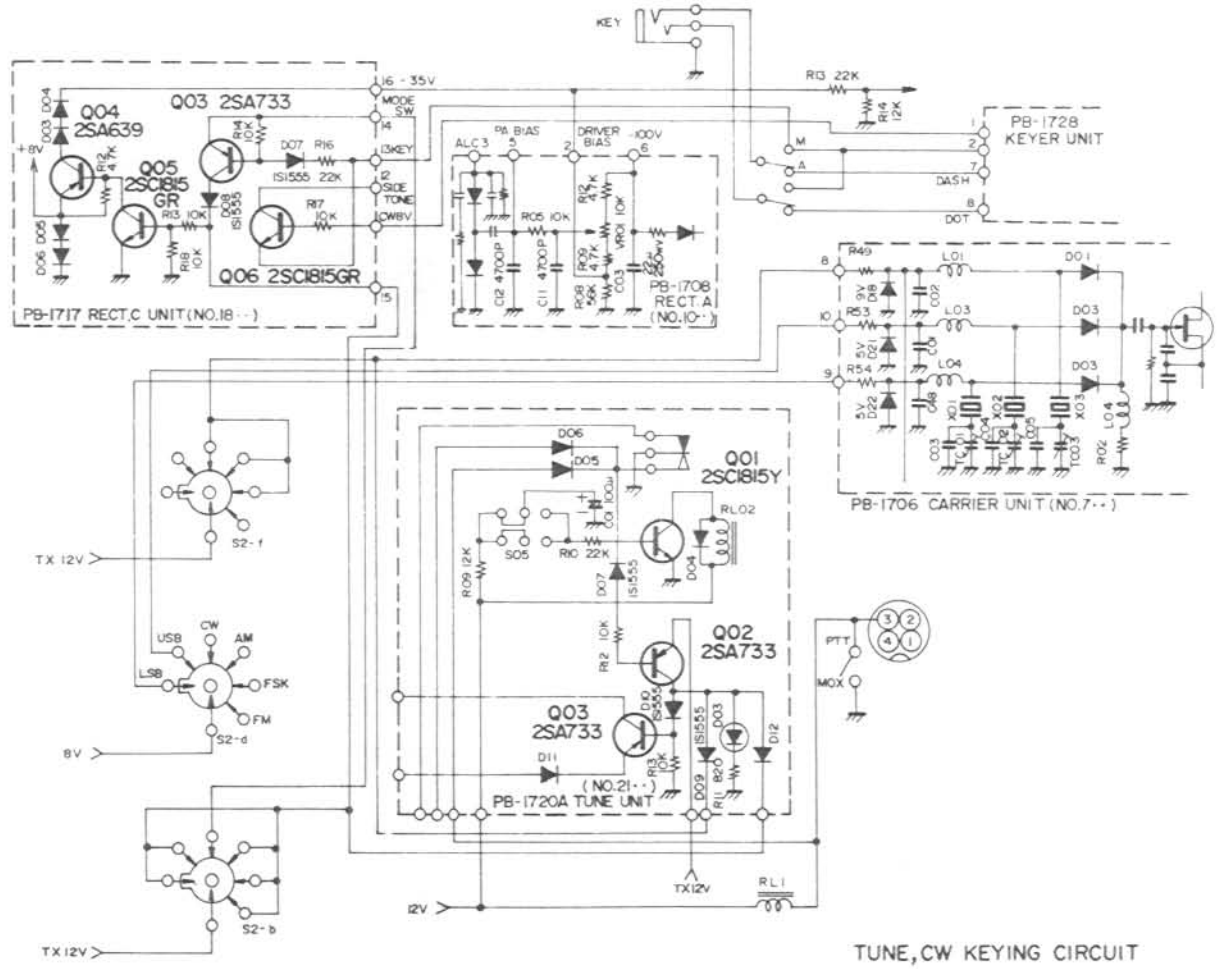
The speech signal from pin 20 of PB-1707 is fed to amplifier limiter Q_{909} (TA7061AP), which clips both positive and negative peaks when they exceed the level set for maximum deviation of the transmitter frequency. Q_{910} (2SC1815Y) acts as an active low pass filter to eliminate harmonics caused by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



TUNE, CW KEYING CIRCUIT

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.

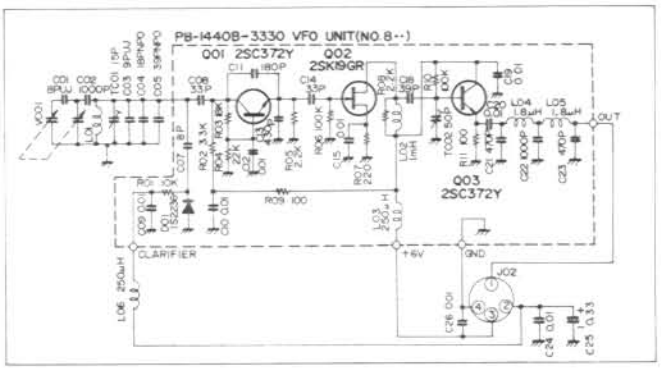
XTAL UNIT (PB-1711)

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)

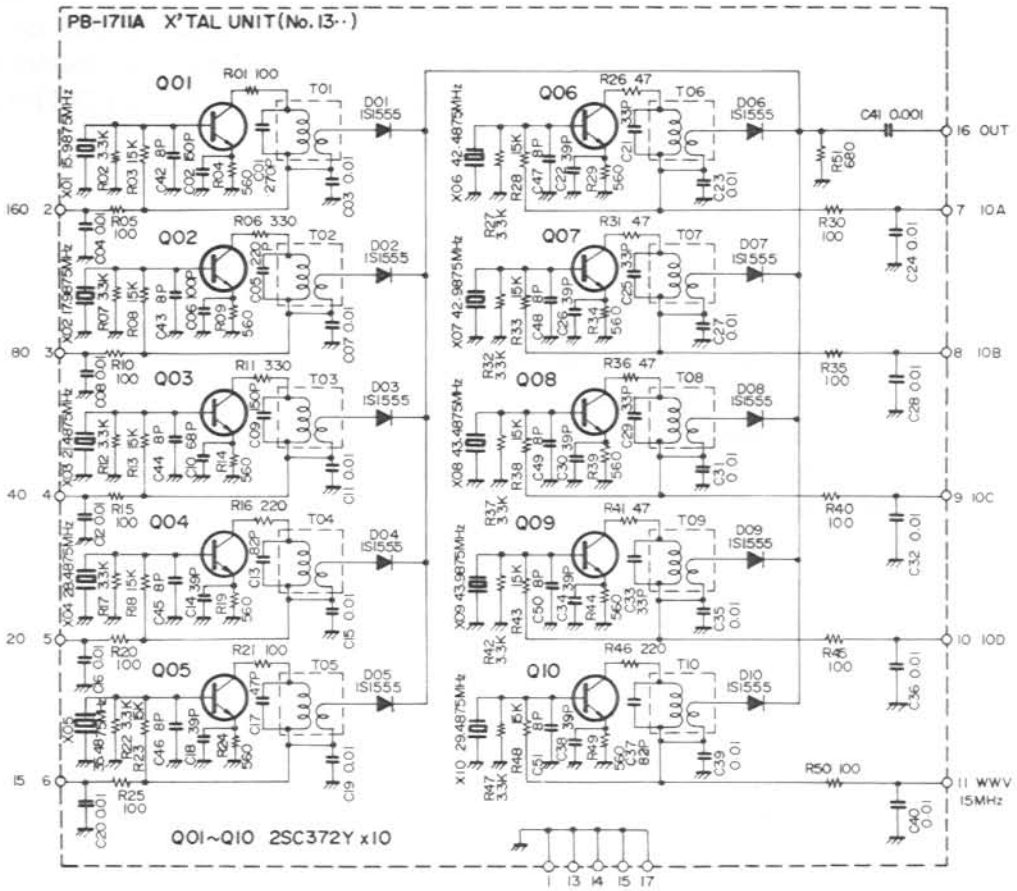
The VCO (Voltage Controlled Oscillator) generates a heterodyne signal which is 8.9875 kHz higher than the operating frequency. The frequency is locked by the voltage detected by the PLL UNIT.

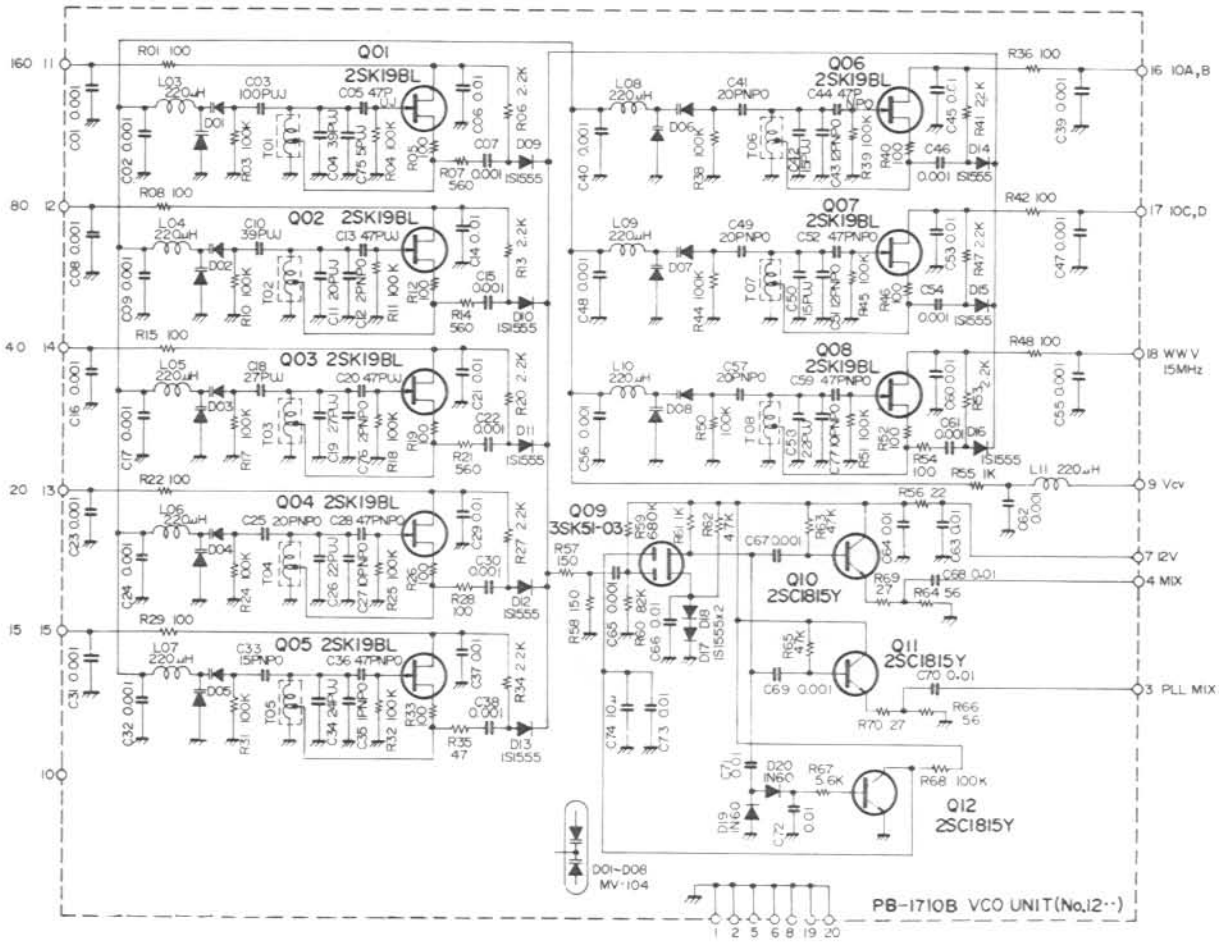
Q_{1201} - Q_{1208} (all 2SK19BL) oscillate at the frequency given in Table 1. The frequency is locked by varactor diodes D_{1201} - D_{1208} (all MV104), which are controlled by the VCV voltage supplied from the PLL UNIT. The oscillator output signal is amplified by Q_{1209} (3SK40M) and fed to the 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	37.9875~38.9875
10mD	43.9875	
JJY/WWV	29.4875	23.9875~24.4875

Table 1





A portion of the Q_{1209} output is rectified by D_{1219} and D_{1220} (both **1N60**); this rectified DC voltage is amplified by DC amplifier Q_{1212} **(2SC 1815Y)** to generate AGC voltage which controls the gain of Q_{1209}, thus obtaining unity signal output when the band is changed.

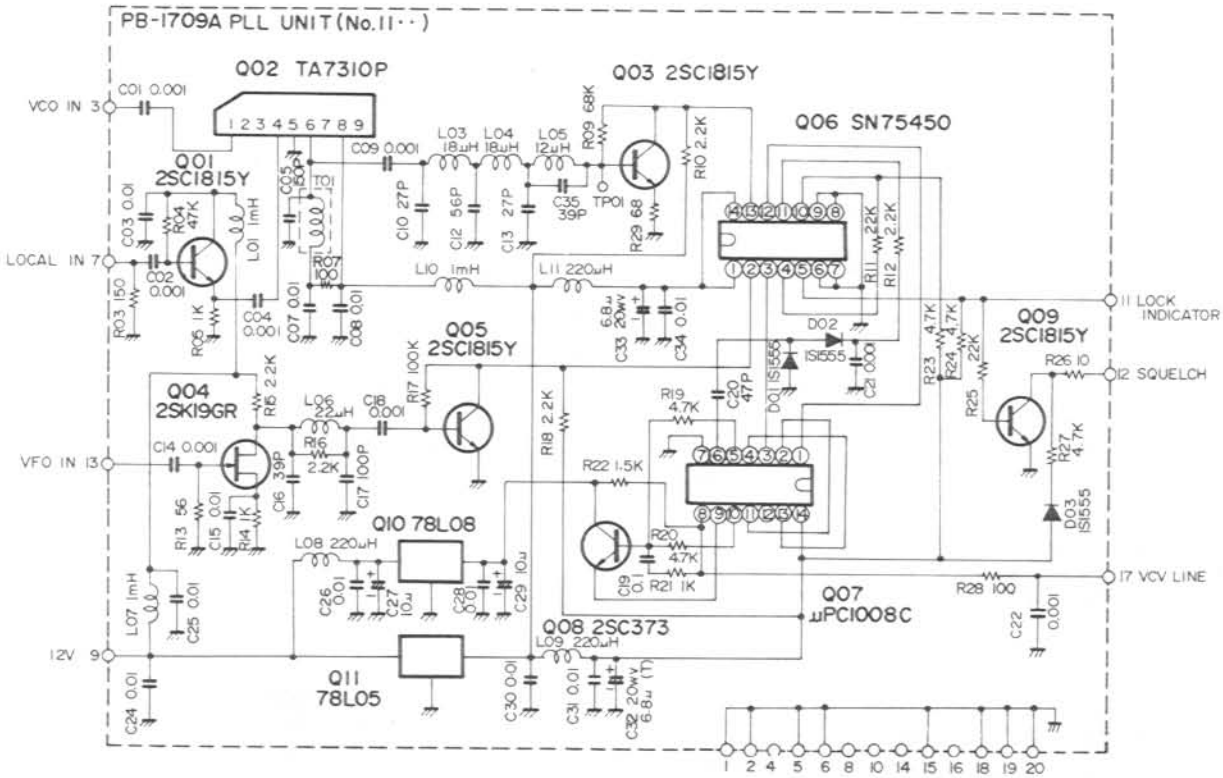
PLL UNIT (PB-1709)

The sample signal from the VCO UNIT is fed to the PLL mixer Q_{1102} **(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 Q_{1101} **(2SC 1815Y)**. The 5.0 - 5.5 MHz signal is fed through amplifier Q_{1103} **(2SC1815Y)** to Q_{1106} **(SN 75450B)**, where the signal waveform is shaped prior to being supplied to a phase detector Q_{1107} **(MC4044P)**; here the phase of the signal is compared with the phase of the signal delivered through wave shaper Q_{1106}, buffer Q_{1105} **(2SC 1815Y)**, and amplifier Q_{1104} **(2SK19GR)** from the VFO UNIT.

Q_{1107} compares the phase of the two signals and converts the phase difference into the VCV voltage which controls the VCO frequency. Q_{1108} **(2SC 373)** acts as an active low pass filter to remove ripples from the VCV voltage.

When the VCO is unlocked, Q_{1109} **(2SC1815Y)** delivers the signal to prevent receive or transmit action of the transceiver.

Q_{1110} **(78L08)** and Q_{1111} **(78L05)** are voltage regulators.



COUNTER UNIT (PB-1729)

DISPLAY UNIT (PB-1730)

The 5.0 - 5.5 MHz VFO signal is amplified by Q_{2901} **(3SK40M)** and fed through source follower Q_{2902} **(2SK19GR)** to a balanced mixer Q_{2903} **(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 Q_{2907} **(2SC945)** generates an 18.0 MHz signal for the 160, 80, 10B, and 10D bands, and Q_{2906} **(2SC945)** generates an 18.5 MHz signal for the 40, 20, 15, 10A, 10C, and WWV/JJY (15 MHz) bands.

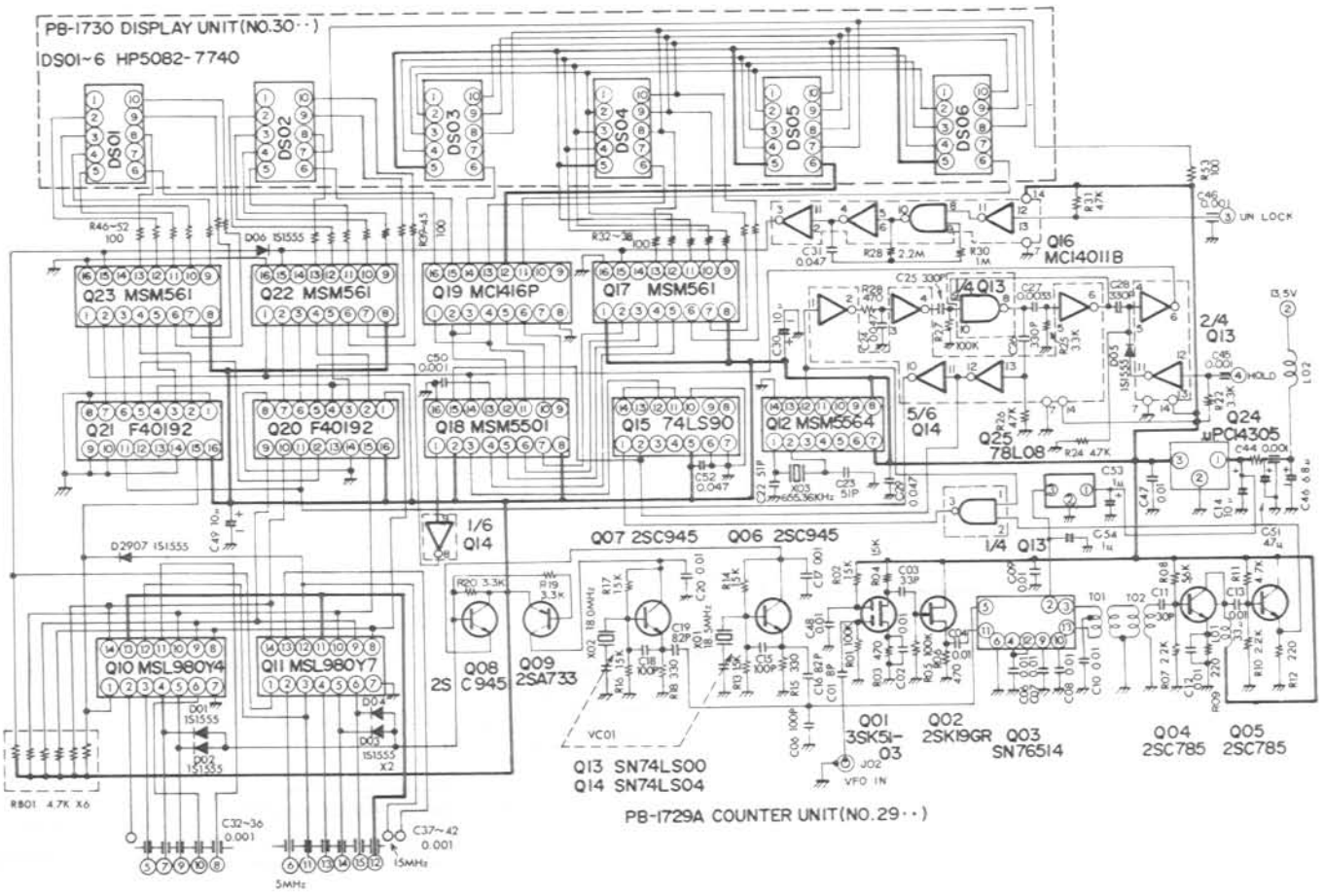
The oscillators are controlled by Q_{2908} **(2SC945)** and Q_{2909} **(2SA733)** in accordance with the band in use. The output from the balanced mixer is fed through amplifiers Q_{2904} and Q_{2905} (both **2SC785**) to the counter gate Q_{2913} **(SN74LS00N)**.

The MHz display is programmed by the diode matrix Q_{2910} **(MSL980Y7)** and Q_{2911} **(MSL 980Y4)**. The output from Q_{2910} and Q_{2911} is fed to the up/down counter Q_{2921} and Q_{2920} (both **F40192**); the output from the up/down counter is fed to drivers Q_{2923} and Q_{2922} (both **MSM561**) and then to the display LED's DS_{3001} and DS_{3002} **(HP5082 - 7740)**.

The crystal oscillator/divider Q_{2912} **(MM5564)** generates a 655.36 kHz clock signal and produces 5 Hz gate pulses which are fed to the counter gate Q_{2913}.

The pulses which pass through the gate are fed to the decade counter Q_{2915} **(SN74LS90N)**, which counts 10 Hz digits. The 10th pulse at pin 12 of Q_{2915} is fed to Q_{2918} **(MM5501)**, which counts 100 Hz, 1 kHz, 10 kHz, and 100 kHz digits. The BCD output signal from Q_{2918} is fed through driver Q_{2917} **(MSM561)** to the display LED's DS_{3003} - DS_{3006} **(HP-5082 - 7740)**.

Q_{2919} **(MC1416P)** works as a series of switches operated by a timing signal delivered by Q_{2918} to select the output of Q_{2917} which drives the display LED's in a sequence of 100 Hz, 1 kHz, 10 kHz, and 100 kHz.



When the unlock signal is received from the PLL UNIT, Q_{2916} **(MC14011B)** generates a blanking signal which is fed to the LED drivers Q_{2917}, Q_{2922}, and Q_{2923}.

To calibrate the display, the heterodyne crystal frequency can be shifted by VC_{2901} from the front panel.

Voltage regulator Q_{2924} **(uPC14305)** stabilizes the supply voltage.

MEMORY UNIT (PB-1787)

The VFO signal delivered to pin 4 of PB-1787 is amplified by Q_{2809} **(3SK40M)** and Q_{2810} **(2SC 785)**, and fed to counter gate Q_{2813} **(SN74 LS00N)**. A clock signal generator Q_{2811} **(MSM 5562)** 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 Q_{2815} **(TC5032P)**, which counts the VFO frequency. The BCD output from Q_{2815} is fed through Q_{2822} - Q_{2826} (all **MC14042B**) to up/down counter Q_{2827} - Q_{2831} **(SN74LS192N)**, which presets the VFO frequency.

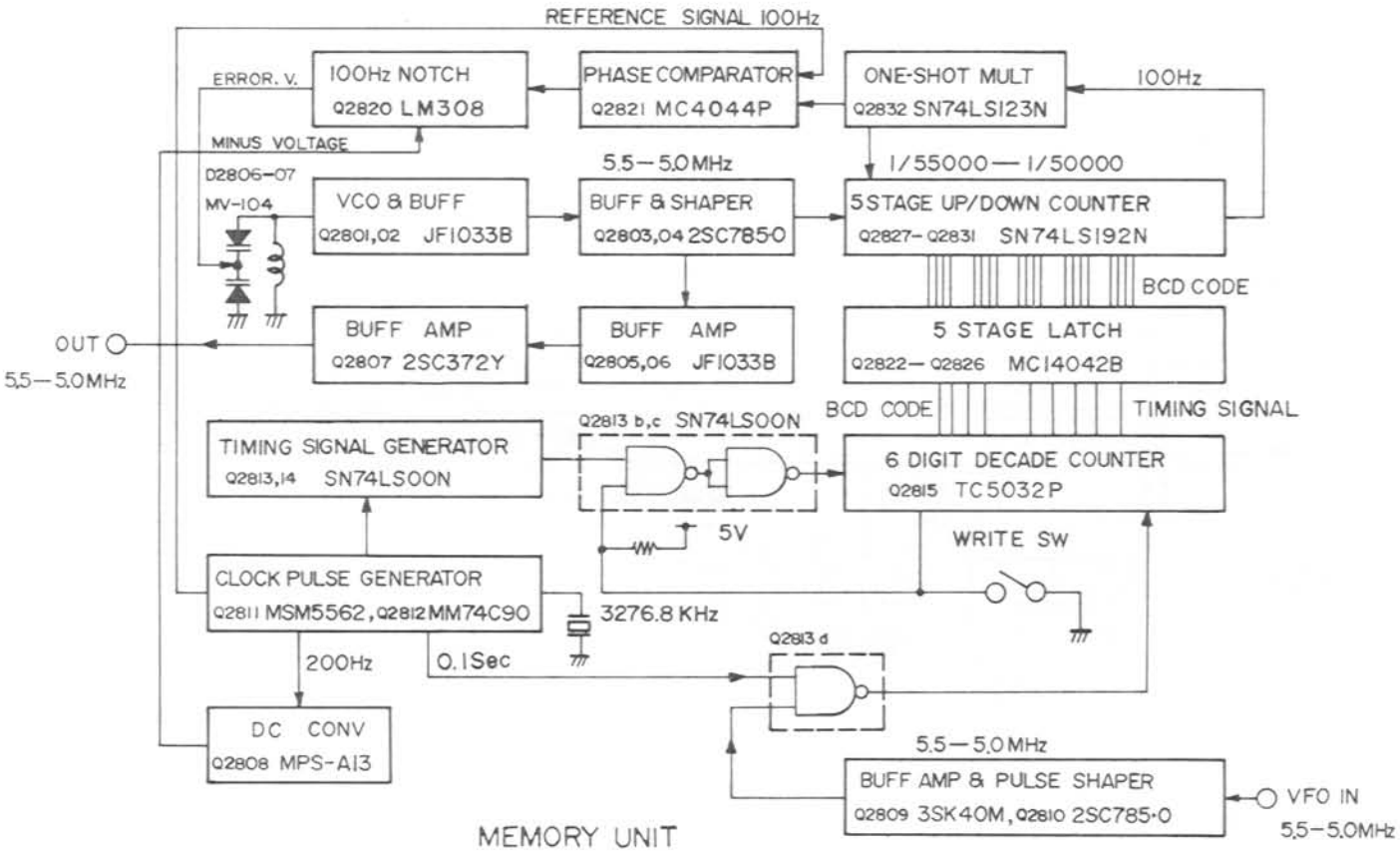
The 5.0 - 5.5 MHz signal generated by Q_{2801} **(JF1033B)** is fed through buffer/amplifier Q_{2802} **(JF1033)** and Q_{2803} **(2SC785)** to pulse shaper Q_{2804} **(2SC785)**.

The switching pulse generated by Q_{2804} is also fed to Q_{2827}, where the signal is divided to 1/5000 to 1/55000 in accordance with the program preset by Q_{2827} - Q_{2831}. The output from Q_{2831} (approximately 100 Hz) is fed through a one-shot multivibrator Q_{2832} **(SN74LS123N)** to the phase comparator Q_{2821} **(MC4044P)** where the phase of the 100 Hz signal is compared with the phase of the 100 Hz signal which is delivered from Q_{2811}.

The DC output from Q_{2821} passes through a low pass filter, operational amplifier Q_{2820} **(LM308)**, to remove the 100 Hz ripple. This DC voltage is applied to varactor diodes D_{2806} - D_{2807} **(MV-104)**, thus locking the VCO frequency.

When the M (memory) switch is pushed, the counter output from Q_{2815} is latched and the VCO frequency is locked.

When the MR (memory recall) switch is pushed, the output from VCO buffer Q_{2802} **(JF-1033B)**



MEMORY UNIT

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 (**μPC14312**) (+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.

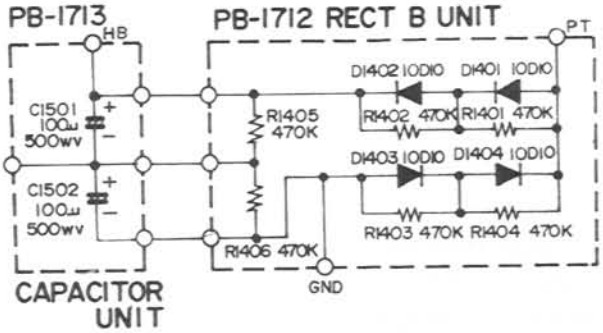
(2) High voltage supply

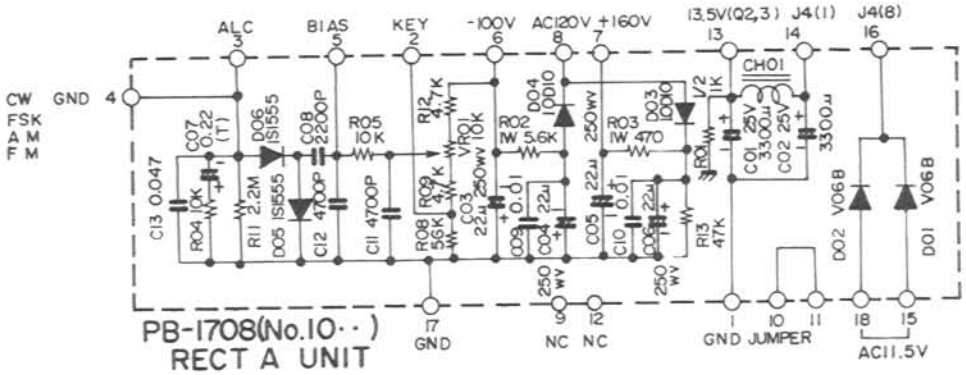
The power amplifier plate voltage of +800 Volts DC is supplied from the bridge-controlled doubler RECTIFIER UNIT B consisting of D_{1401} - D_{1414} (**10D10**) and C_{1501} and C_{1502} in PB-1712.

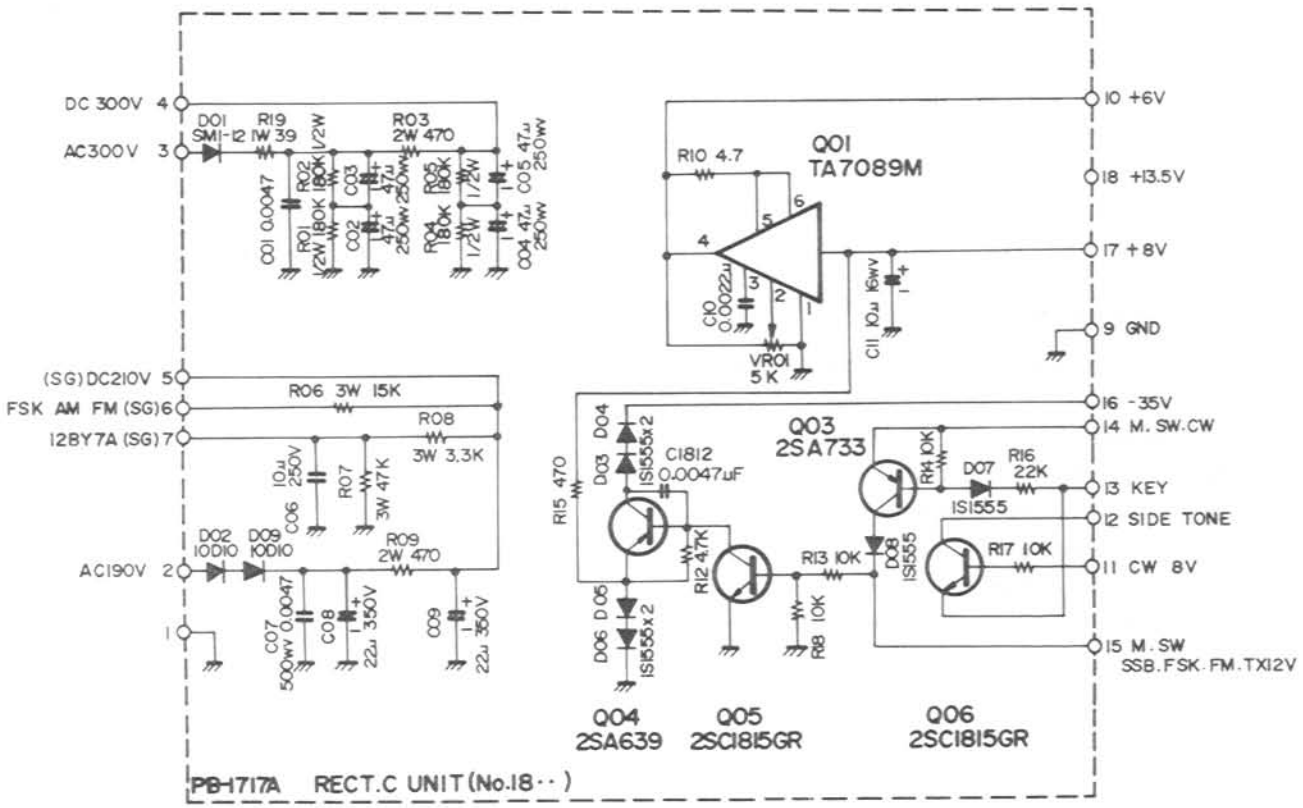
AC 190 Volts is rectified by D_{1802} (**10D10**) in RECTIFIER UNIT C to obtain 210 Volts for the screen grid supply of the power amplifier tubes. The screen grid voltage is reduced to 180 Volts for the FM, AM, and FSK modes.

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.

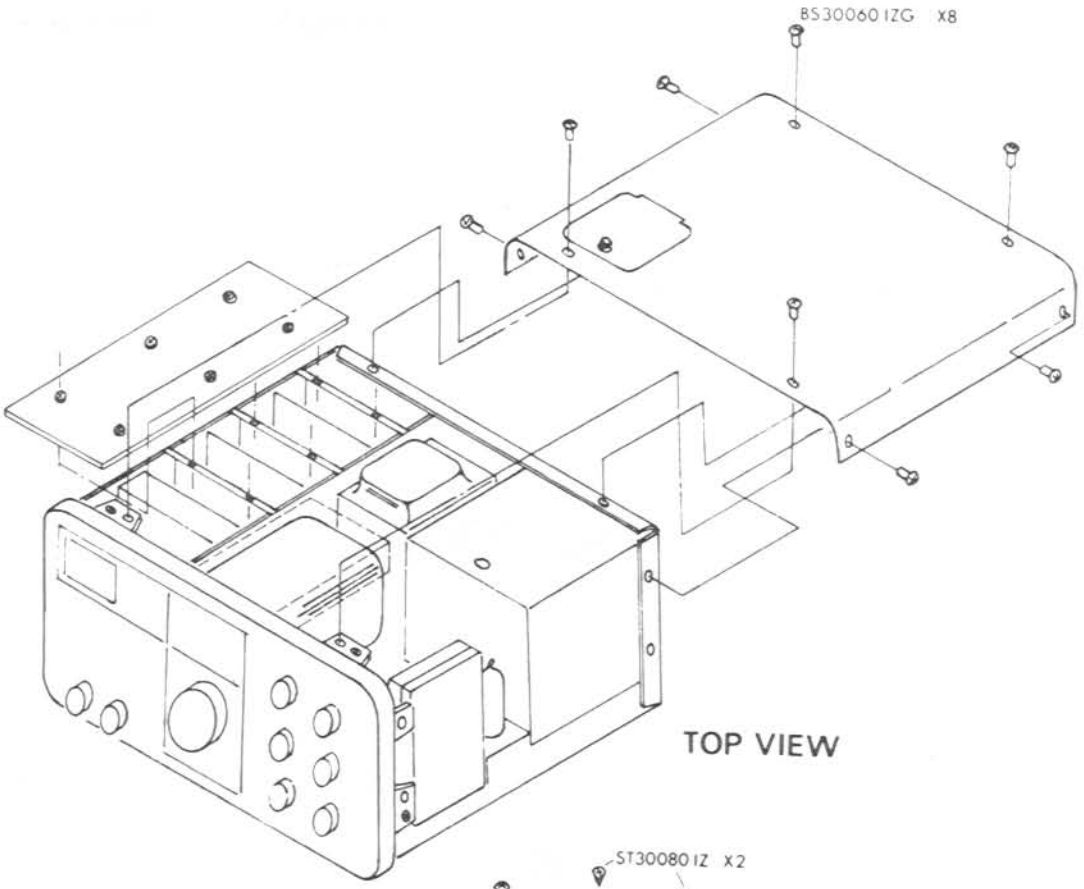
120 Volt AC from the transformer secondary winding is rectified by D_{1004} (**10D10**) in the RECTIFIER A UNIT (**PB-1708**) to obtain −140 Volts for the grid bias voltage for the driver and final amplifier tubes.



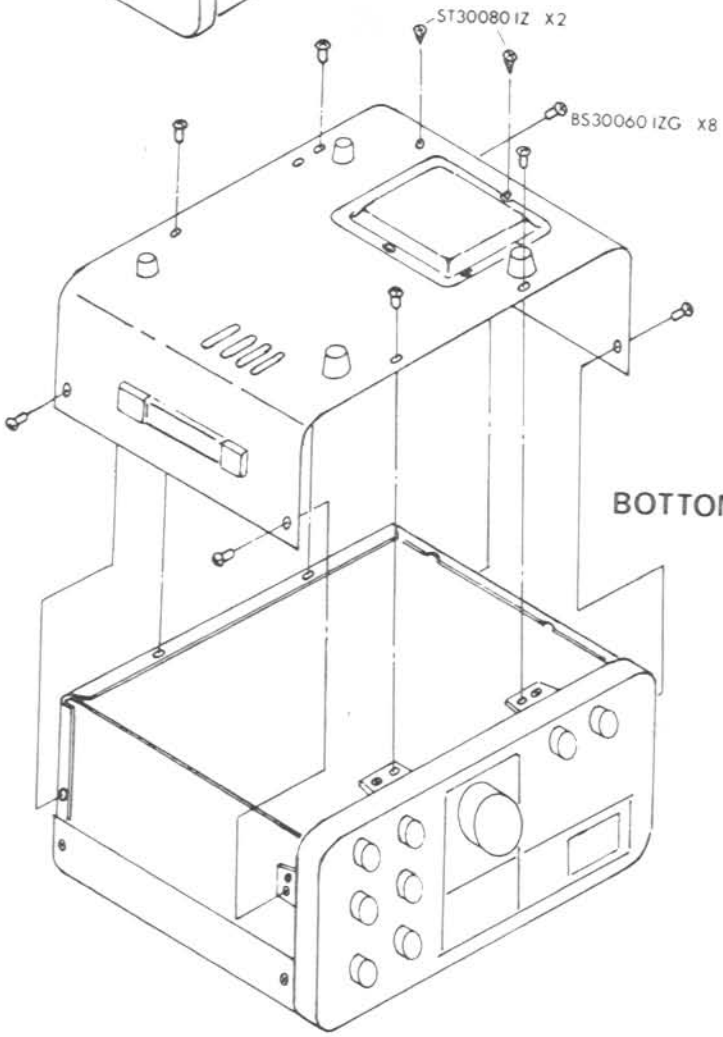




OUTER COVER REMOVAL



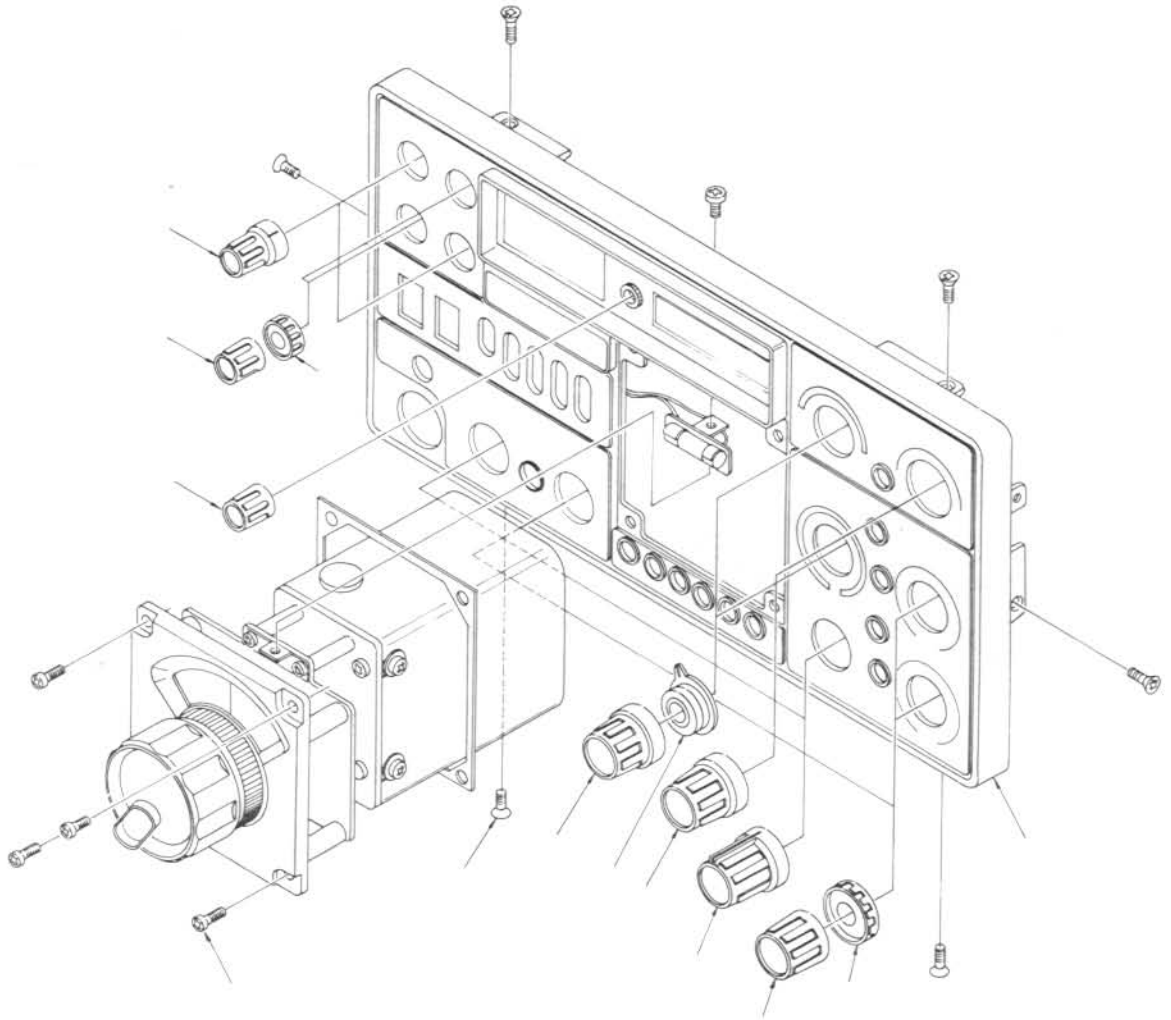
TOP VIEW



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.

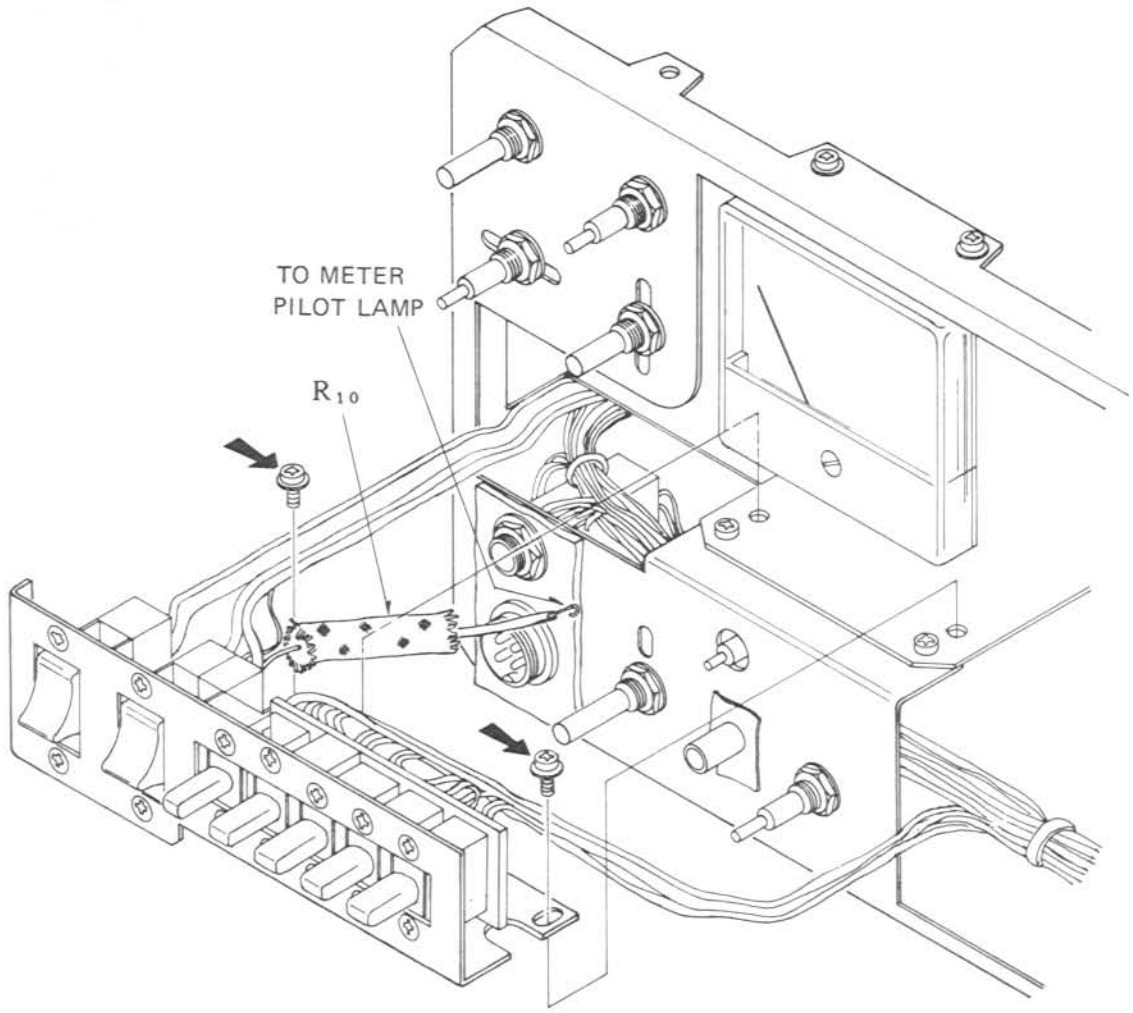
(3) Disconnect the cable connected to the VFO compartment.

(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.

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.

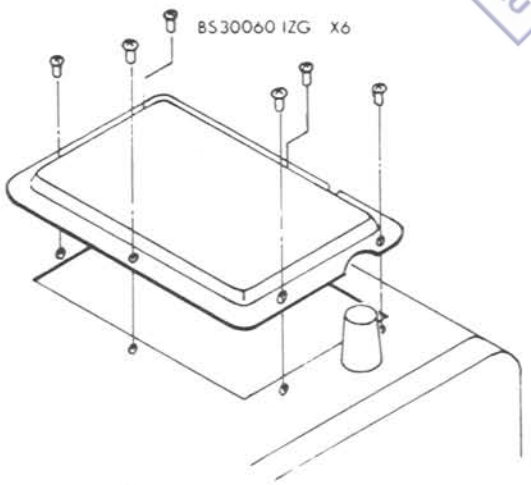


Figure 1

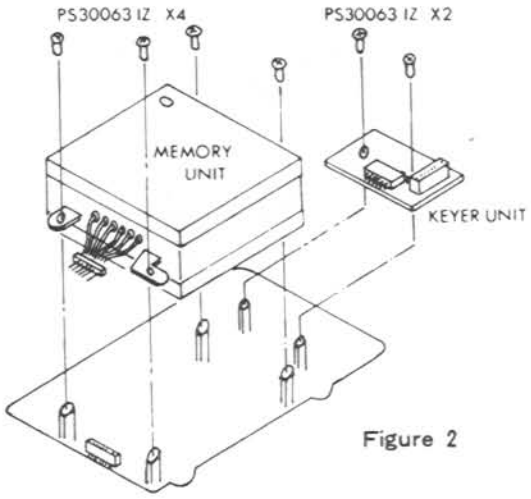
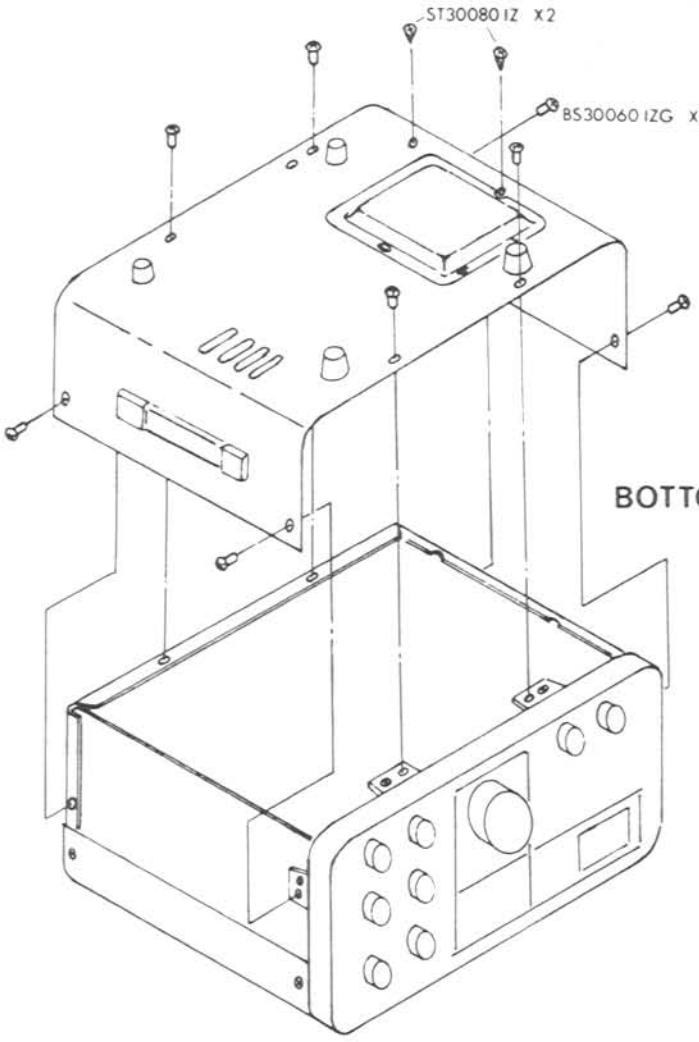


Figure 2



BOTTOM VIEW

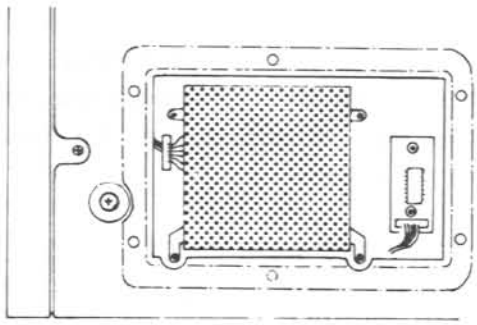


Figure 3

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.

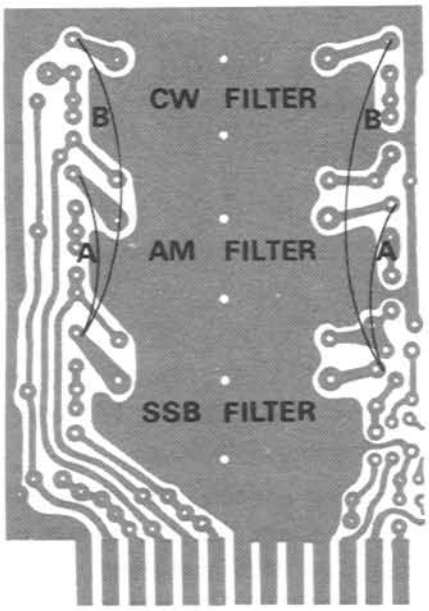


Figure 1

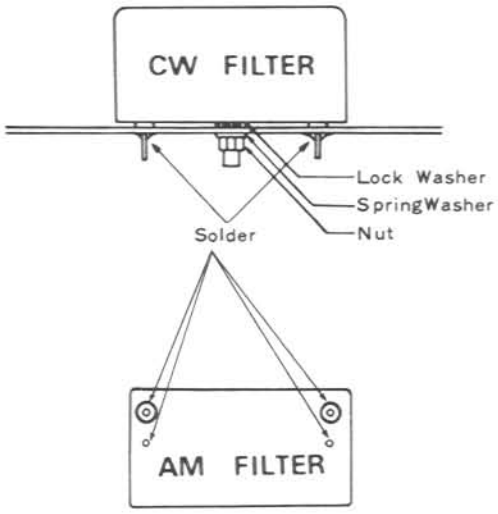
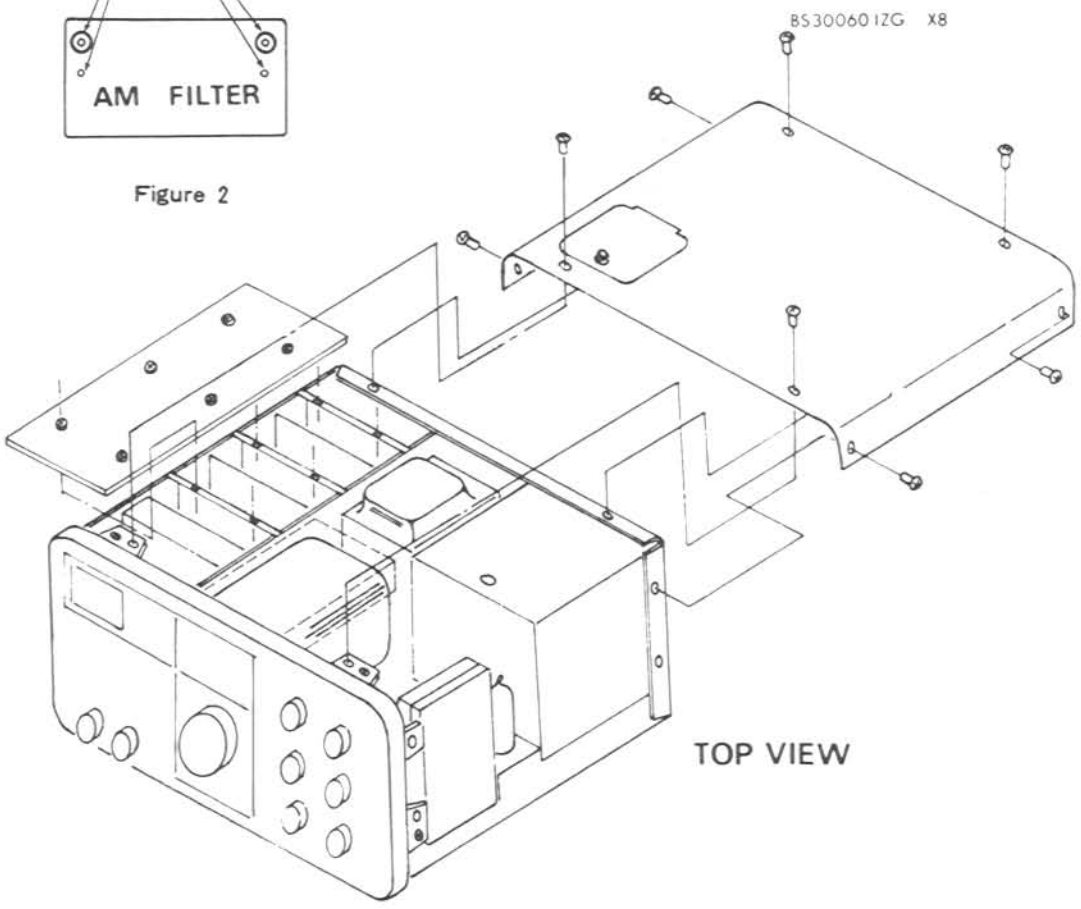


Figure 2



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.

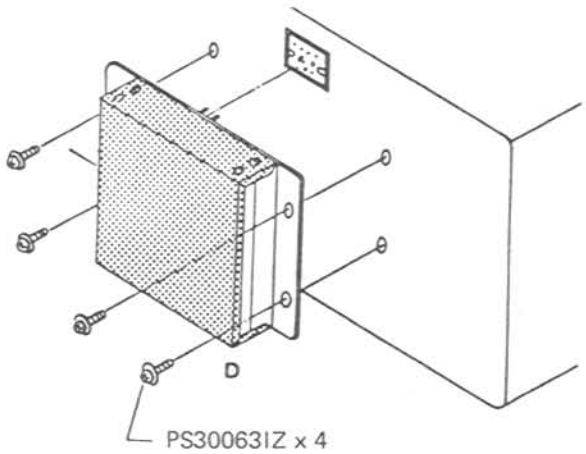
(1) Install the DC-DC converter module as shown in the drawing. Use the four screws supplied with the kit. Do not force the plug into the socket, as the connection should be smooth.

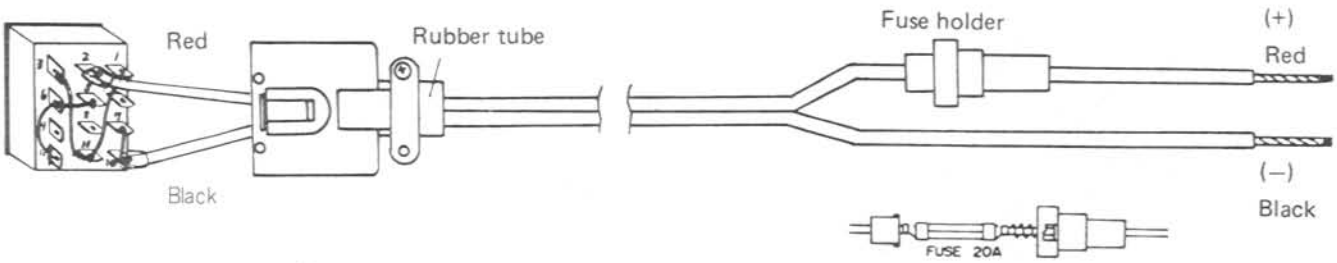
(2) Check the DC cable fuse socket, located in the positive (red) lead, to be certain that a 20 amp fuse is installed.

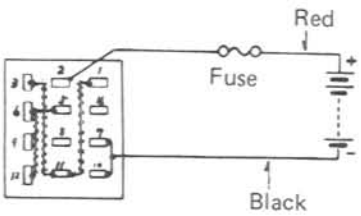
(3) When making connections to the battery, be absolutely certain that the proper polarity is observed. The RED lead should be connected to the POSITIVE (+) battery terminal, and the BLACK lead should be connected to the NEGATIVE (–) terminal. OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY REVERSED POLARITY 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 ihgher 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.

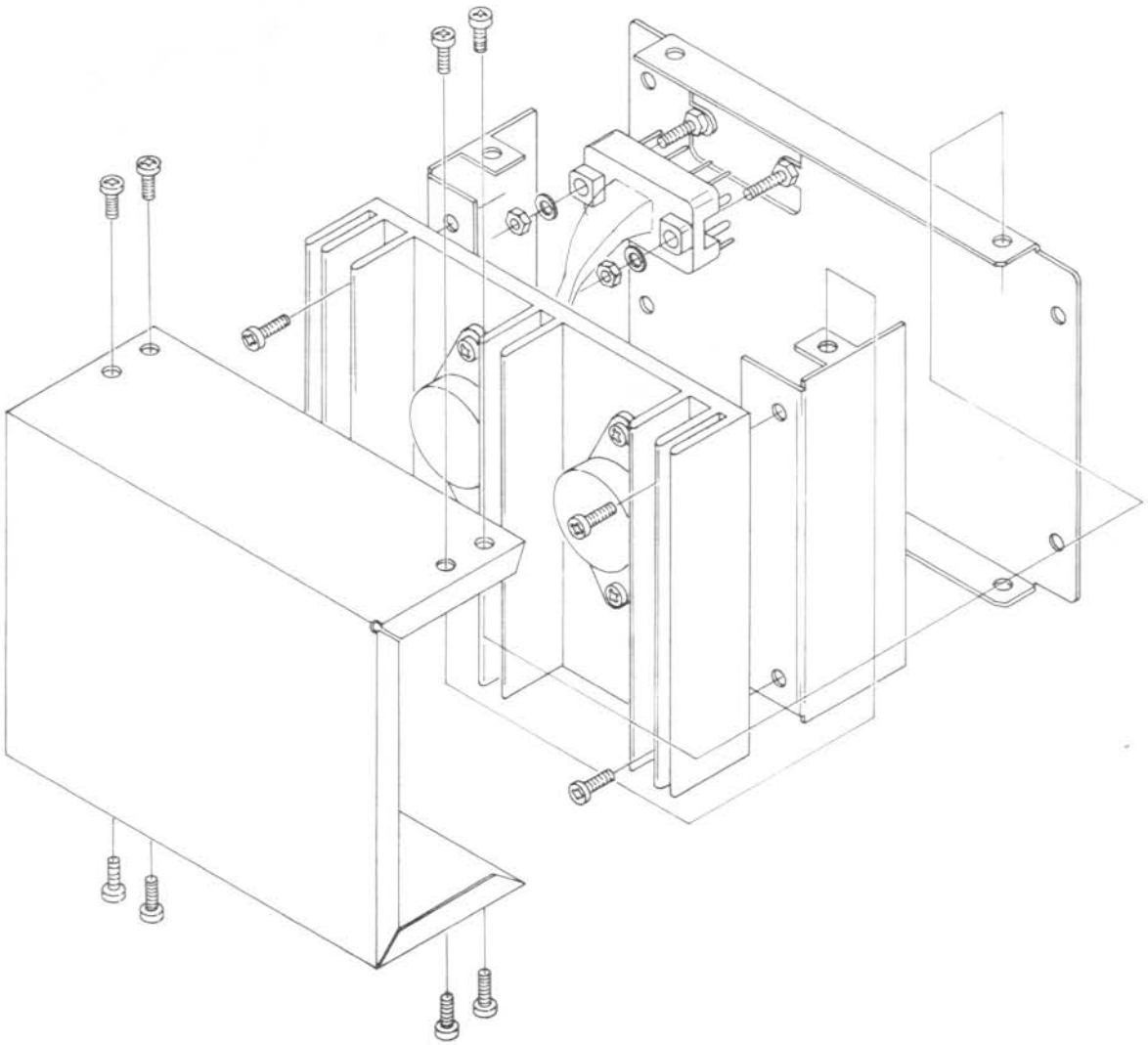
(5) Connect the DC cable to the transceiver. Power connections are made automatically when the DC cable is connected to the POWER jack.

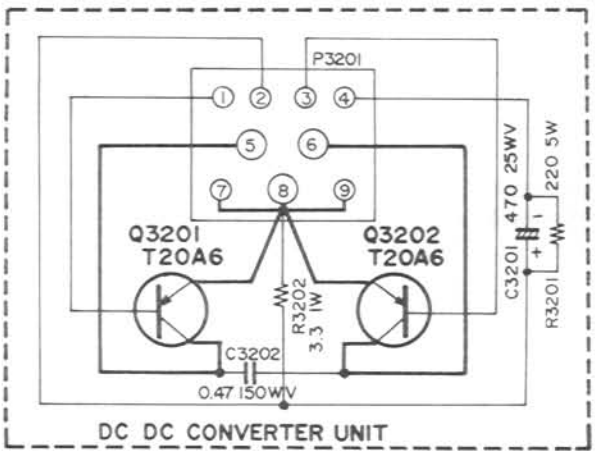


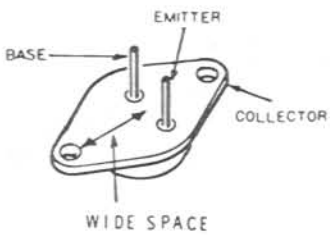




DC-DC CONVERTER (EXPLODED VIEW)







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.

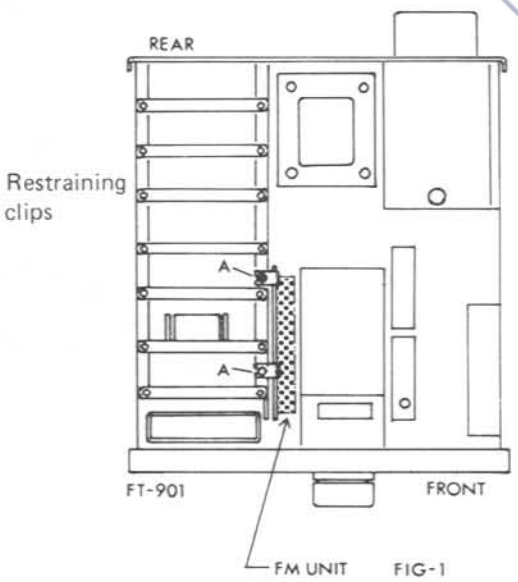


FIG-1

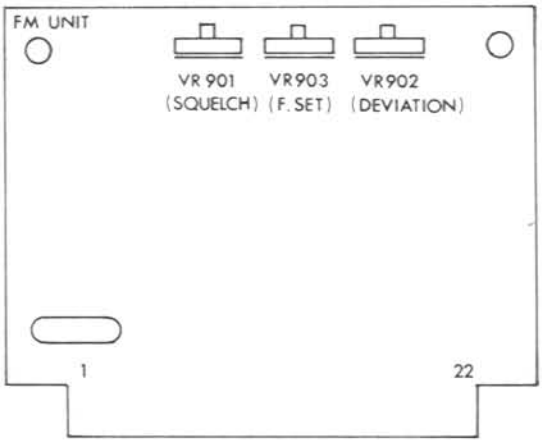


FIG-2
Alignment potentiometers

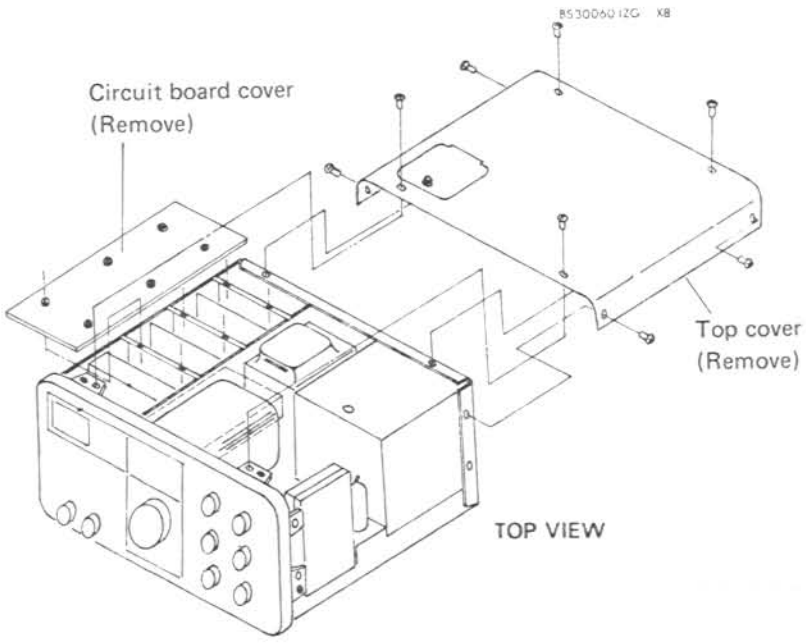


FIG-3

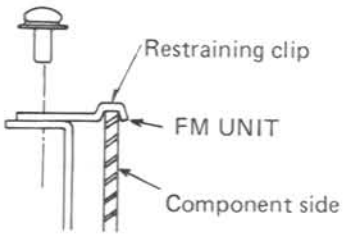


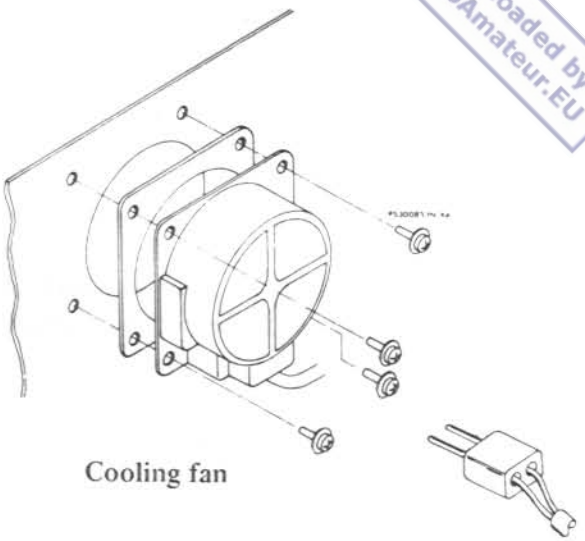
FIG-4

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.



Cooling fan

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.

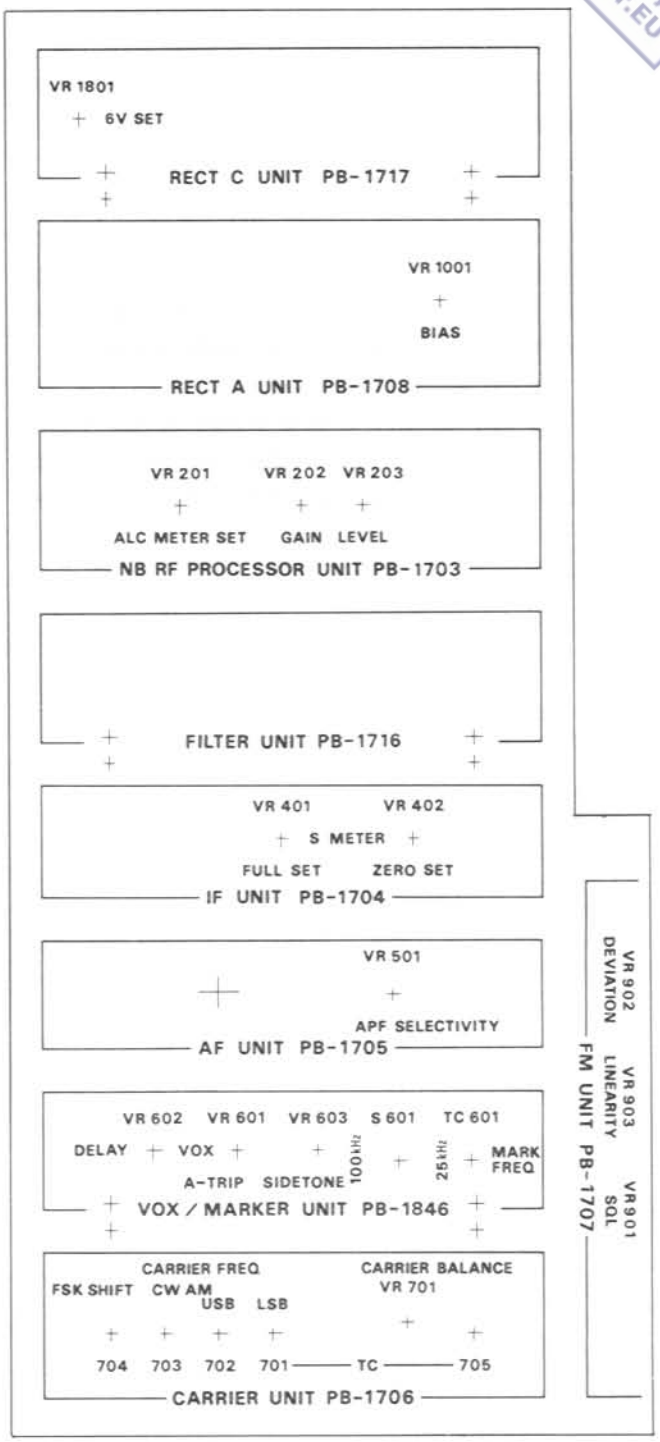
1. Use only a 12 to 30 watt chisel-tip soldering iron. Yes, some "repairmen" have been known to use small blowtorches on cards.

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.



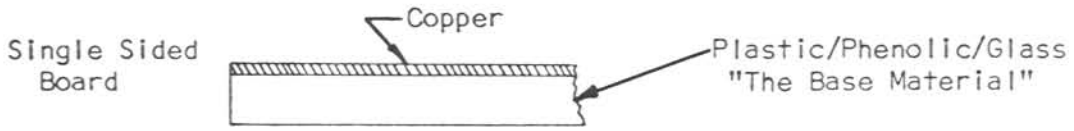
IMPORTANT

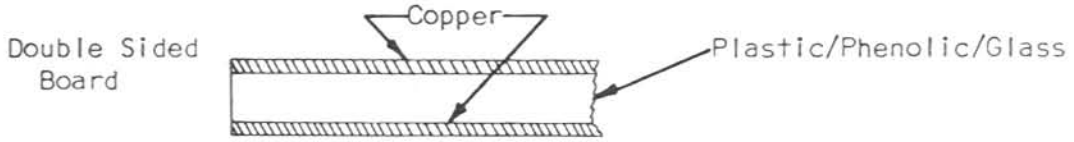
The circuit boards used in the FT-901 are not keyed, and it is possible to install a board backwards, or to install it in the wrong socket.

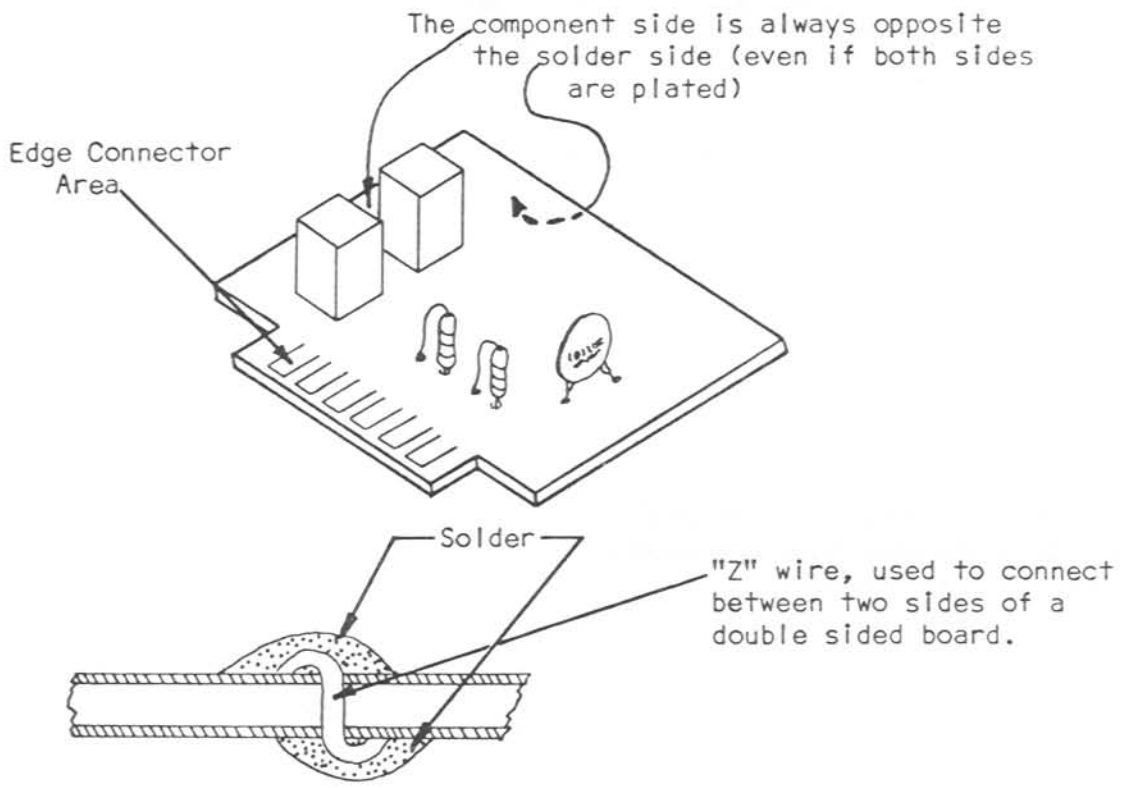
If you have several boards out of the chassis at any one time, be certain to install the boards correctly into their sockets. Use the reference plate which is installed above the circuit board rack.

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.

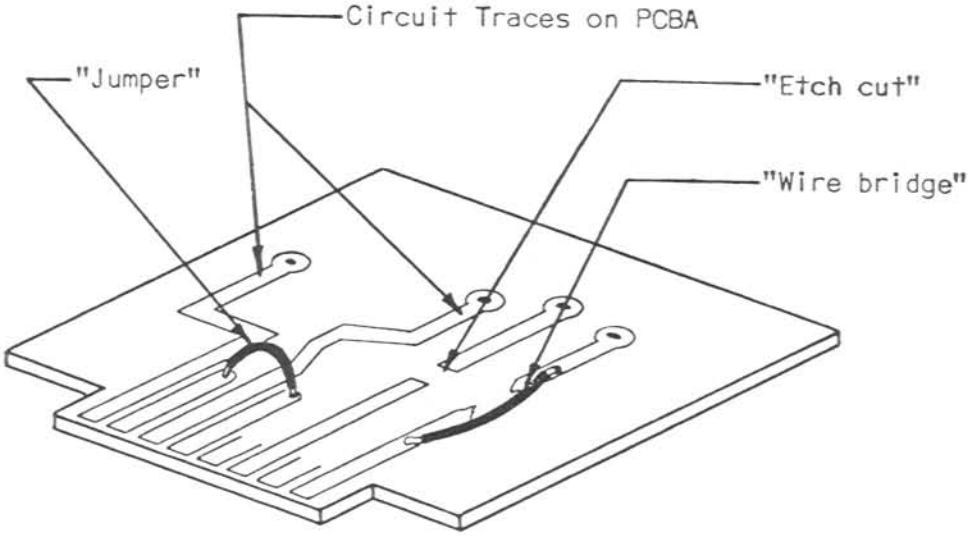


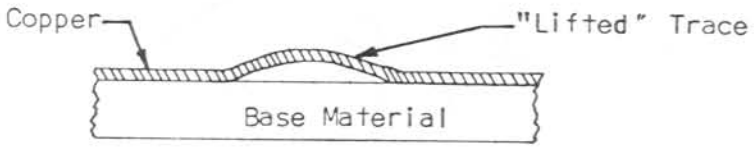




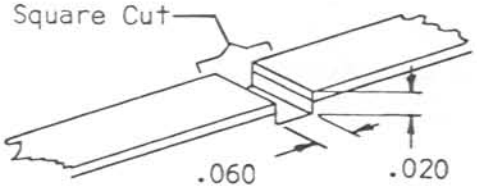
Sometimes, after the design and drafting of a board are completed, a board is produced with an error in it. Though non-technical managers sometimes suffer a stroke at hearing of this situation, it is not unheard of in engineering circles. Thus, should you encounter etch cuts and jumpers on a board, be 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 enginner, 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 J_{802}. Re-route the lead so that the connection is from pin 4 of J_{802} to the center hole under C_{822}.

(3) Change the screw adjacent to C_{822} to a NYLON screw.

(4) Ad a new 0.01 disc ceramic capacitor between pins 3 and 4 of J_{802}.

(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. .

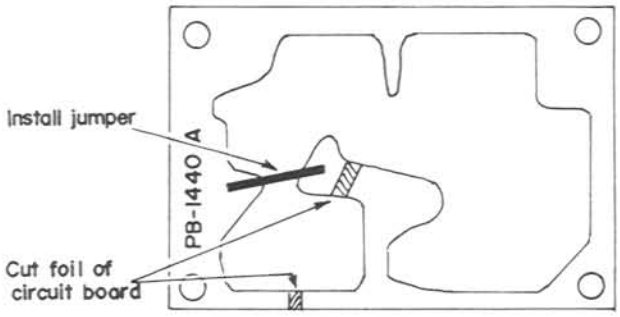


Figure 1

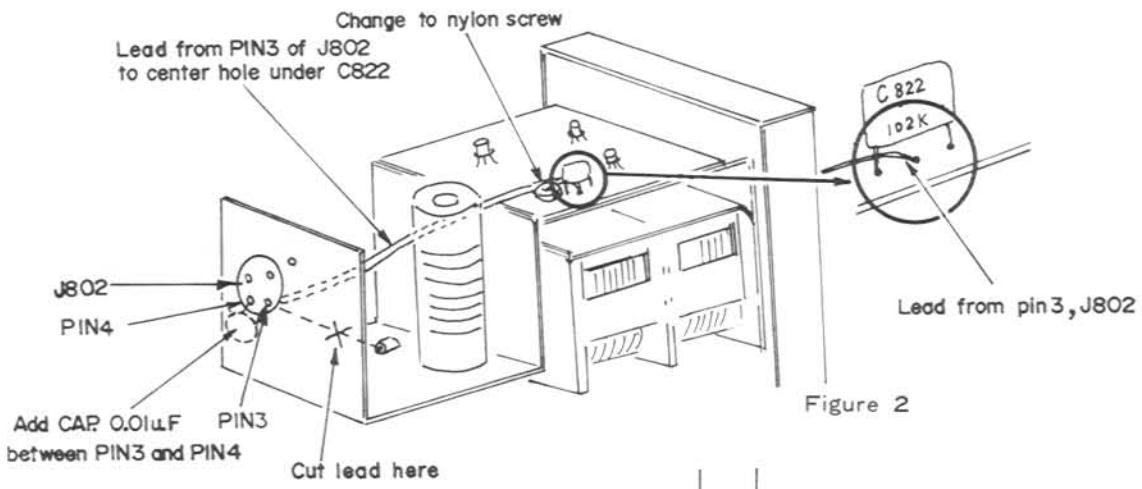


Figure 2

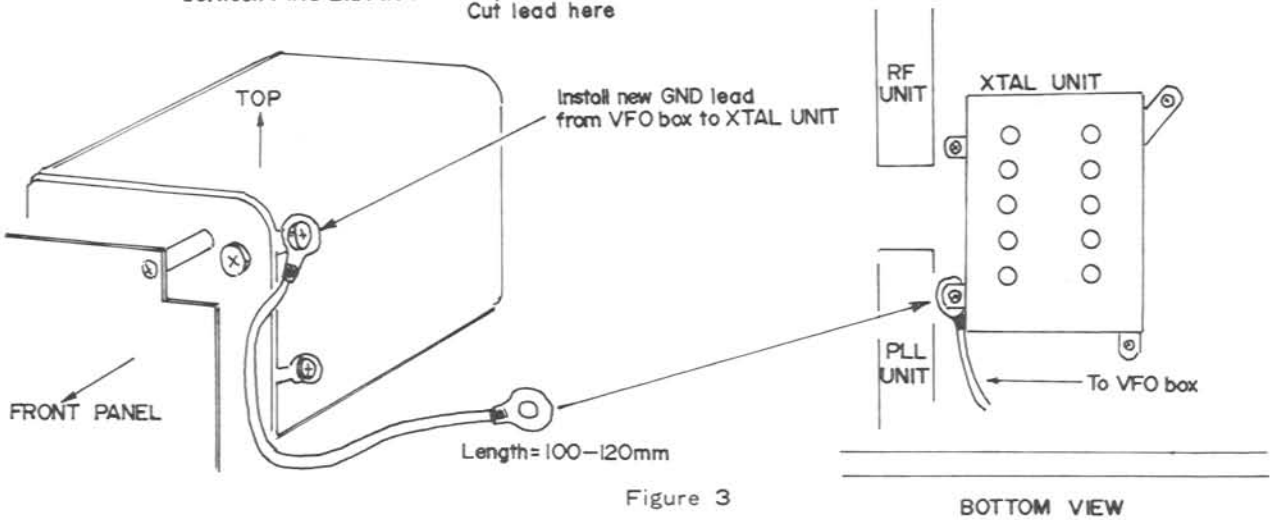


Figure 3

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.

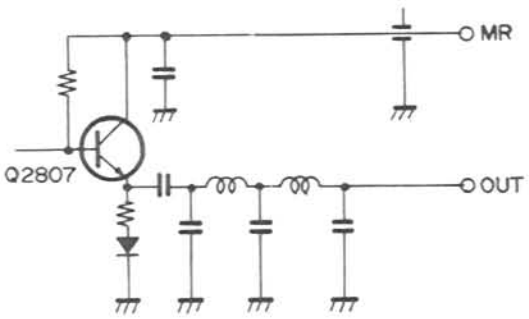
Modification Procedure:

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

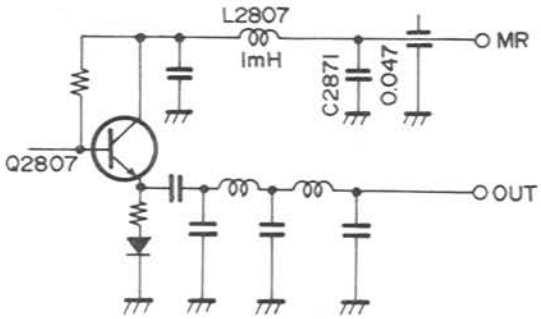
(2) Remove the white/orange wire connected to the MR terminal, and connect it to the ungrounded lug of the new terminal. Connect a 1 mH mini-inductor in the collector lead of Q_{2807}. This new inductor is labeled L_{2807} in future productions.

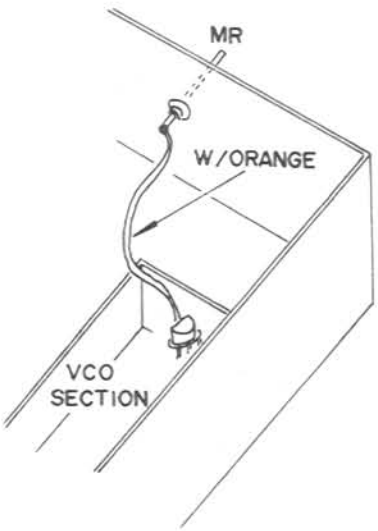
(3) Install a new 0.047 μF disc ceramic capactitor between the MR terminal and ground, as shown in the drawing. Modification is now complete.

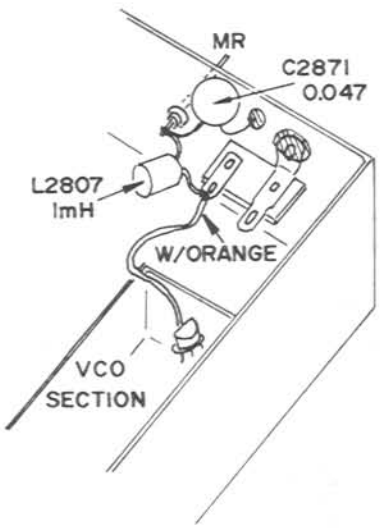
BEFORE



AFTER MODIFICATION







New terminal strip

COUNTER UNIT CAPACITOR REVERSAL

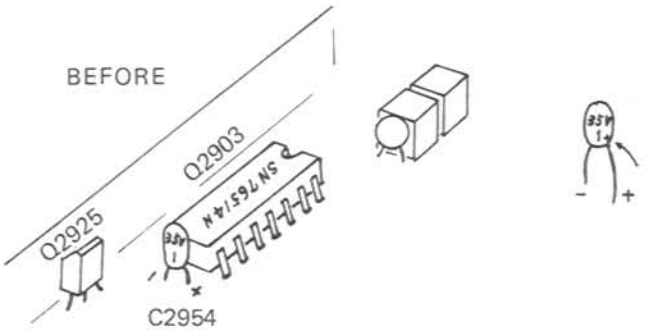
In FT-901DM units bearing serial numbers 8F030001 through 8H059999, the markings on PB-1729 showed the polarity of C_{2954} incorrectly. As a result, the capacitor was installed correctly according to the marking, but **incorrectly** according to the intended purpose.

Modification Procedure:

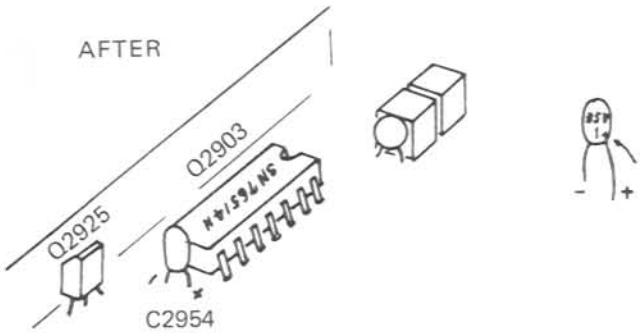
(1) Remove the COUNTER UNIT, PB-1729, from the transceiver. Locate C_{2954}, and observe the polarity. On sets bearing the above serial numbers, if the capacitor is installed with **reversed polarity** according to the circuit board making, your unit is already modified. If it is the **same** as the circuit board marking, remove and discard the capacitor. A correctly installed capacitor has its markings facing in the direction of Q_{2903}.

(2) Install a new C_{2954} (1 μF, 35 WV, tantalum) as shown in the drawing below. Its markings should face Q_{2903}.

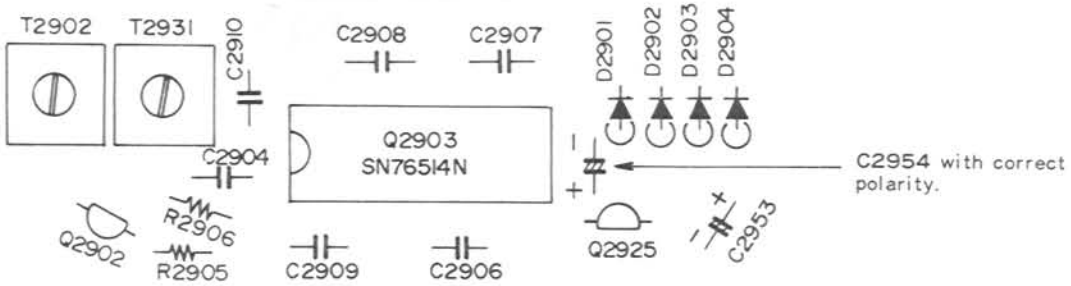
(3) Replace the COUNTER UNIT. Modification is now complete.



Capacitor installed per PB marking (incorrect).
Remove and reverse C_{2954}.



Markings should face Q_{2903}.
Capacitor reversed according to PB marking.



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.

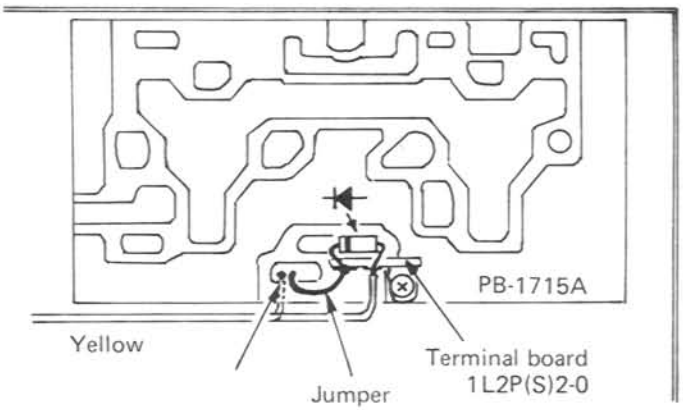


Figure 1

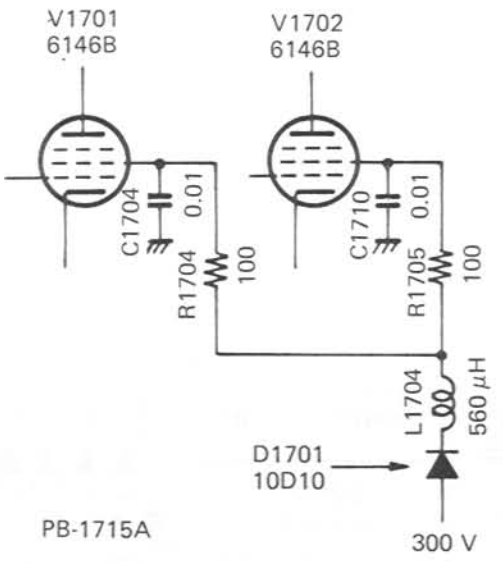
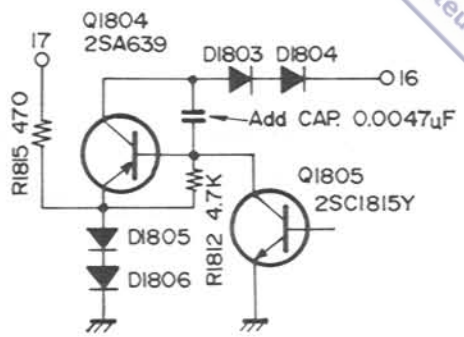


Figure 2

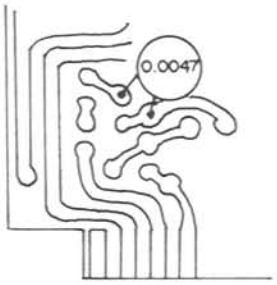
KEY CLICK MODIFICATION

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:

(1) Connect a 500 WV 0.0047 μF disc ceramic capacitor between the collector and base of Q_{1804}, as shown in the drawing.

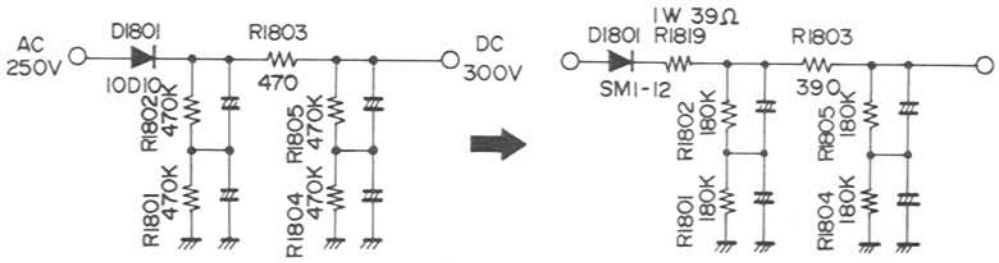


This modification was adopted in production runs beginning with serial numbers 080001.

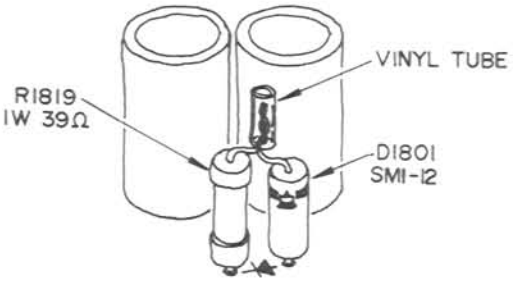
RECTIFIER C UNIT MODIFICATION

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:

1) Change R_{1801}, R_{1802}, R_{1804}, and R_{1805} to 180 K ohms, ½ watt.
2) Change R_{1803} to 390 ohms, 2 watts.
3) Add a new R_{1819} (39 ohms, 1 watt) in series with D_{1801}, as shown.
4) 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 D1801. 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.



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.

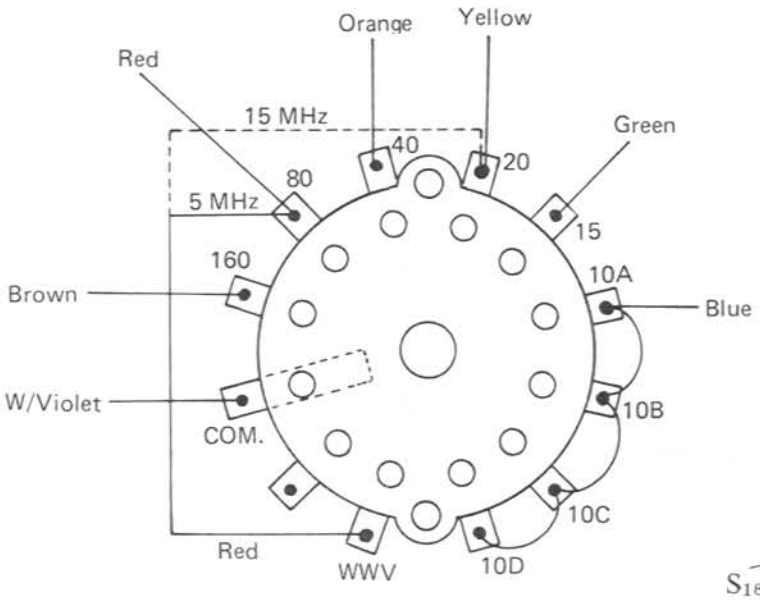
Modification Procedure:

(1) Locate bandswitch segments (e) and (g). Refer to the drawing for reference.

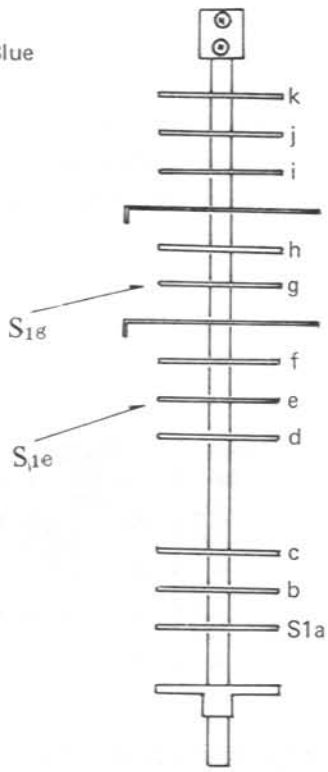
(2) For WWV 5 MHz reception, the red jumper wires on these wafers must be connected between the WWV terminal and the 80 meter terminal.

(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.



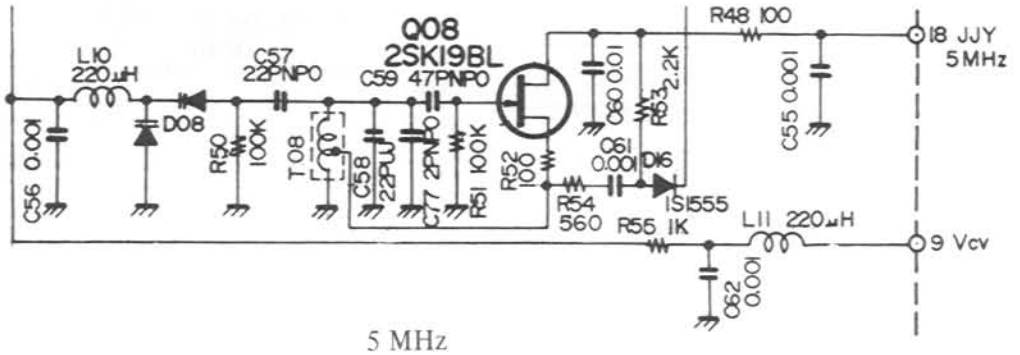
CHASSIS BOTTOM SIDE



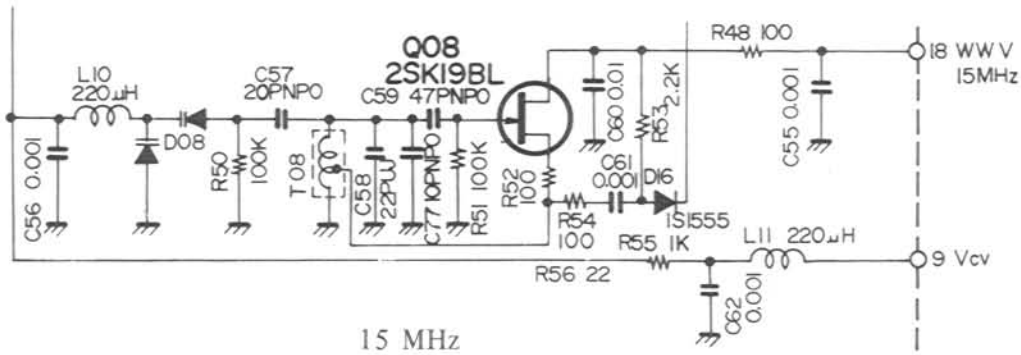
Band switch segment location

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

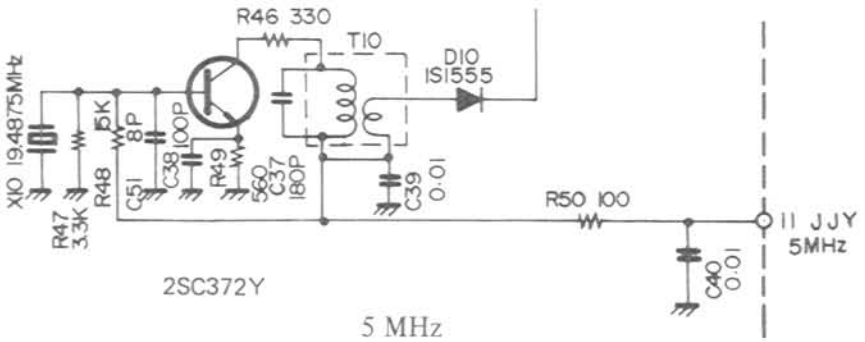


5 MHz

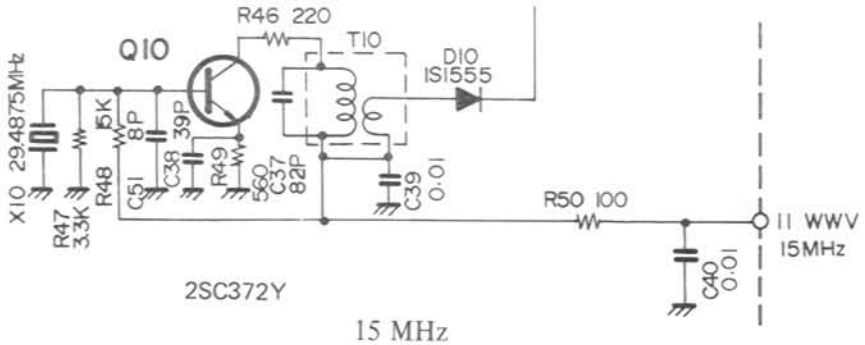


15 MHz

X'TAL UNIT



5 MHz



15 MHz

	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.

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.

x Do not replace with this type.

Example:

PART	3SK40M	3SK40L (R/B)	3SK51-03	Change for
Q_{106}	○	△	x	R_{126}: 390→270

This means: when replacing Q_{106}, it may be replaced with type 3SK40M with no further changes; a 3SK40L(R/B) may be used by changing R_{126} from 390 ohms to 270 ohms; type 3SK51-03 should not be used.

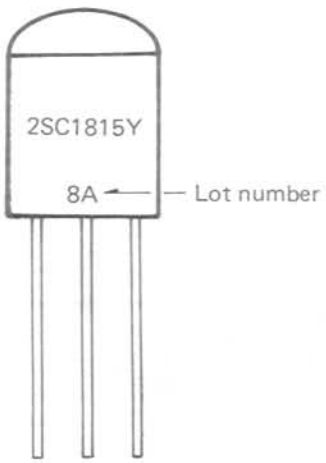
PART	3SK40M	3SK40L (R/B)	3SK51-03	
Q_{101}	○		△	R_{103} 39K → 47K
Q_{106}	○	△	x	R_{126} 390 → 270
Q_{107}	○	△	x	R_{125} 390 → 270
Q_{209}	○	○		
Q_{210}	○	○		
Q_{212}	○		○	(3SK41M OK)
Q_{401}	○		△	R_{405} 560 → 1K
Q_{402}	○		△	R_{418} 560 → 1K
Q_{403}	○		△	R_{425} 560 → 1.8K
Q_{404}	○		△	R_{432} 560 →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

RF PROCESSOR/XTAL UNIT TRANSISTOR MODIFICATION

On the NB UNIT, transistor Q_{202} 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.

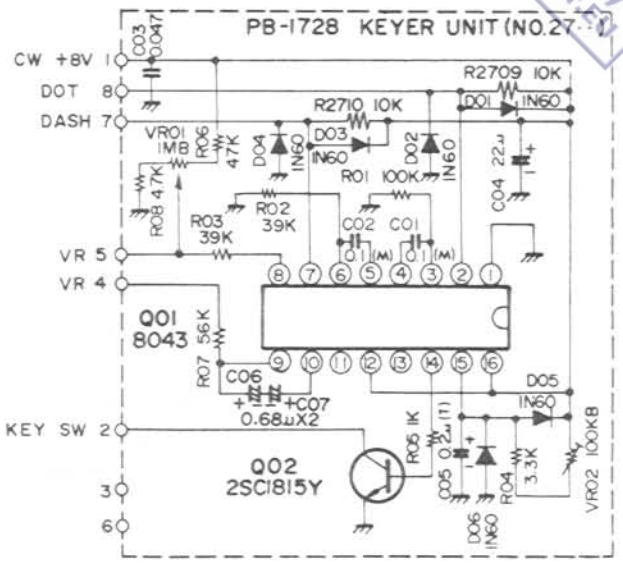
The same consideration applies to transistors Q_{1301}–Q_{1310} on the XTAL UNIT.

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



KEYER UNIT MODIFICATIONS

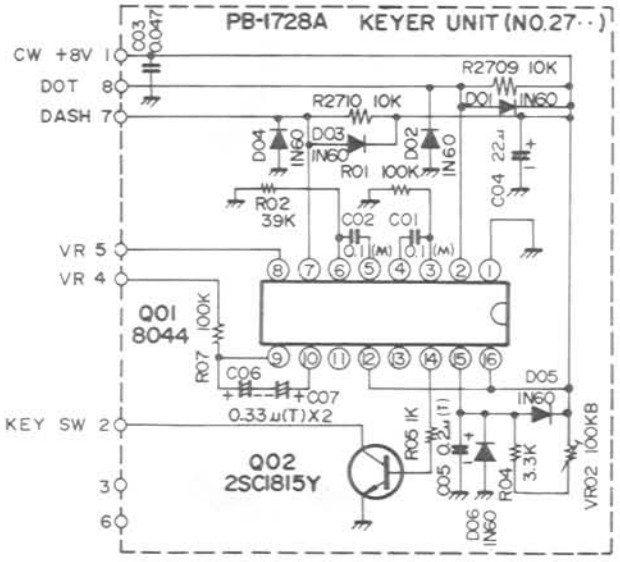
Several minor changes were made during the production of FT-901DM units using the Curtis 8043 IC. The diagram below represents the final version of the KEYER UNIT, and if you should have to perform service on this board, we recommend that the circuit be modified as shown here.



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.

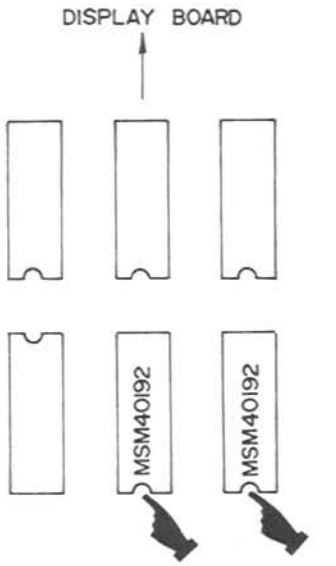


COUNTER UNIT IC INSTALLATION NOTE

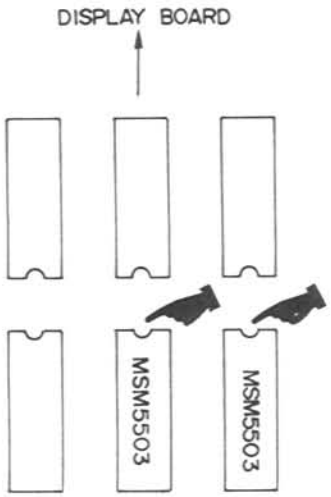
In some FT-901 transceivers, Q_{2920} and Q_{2921} were changed from type MSM40192 to type MSM5503. The units are identical in operation, but the MSM5503 pin layout is the reverse of that of the MSM40192.

For this reason, if you have to replace Q_{2920} or Q_{2921}, 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.

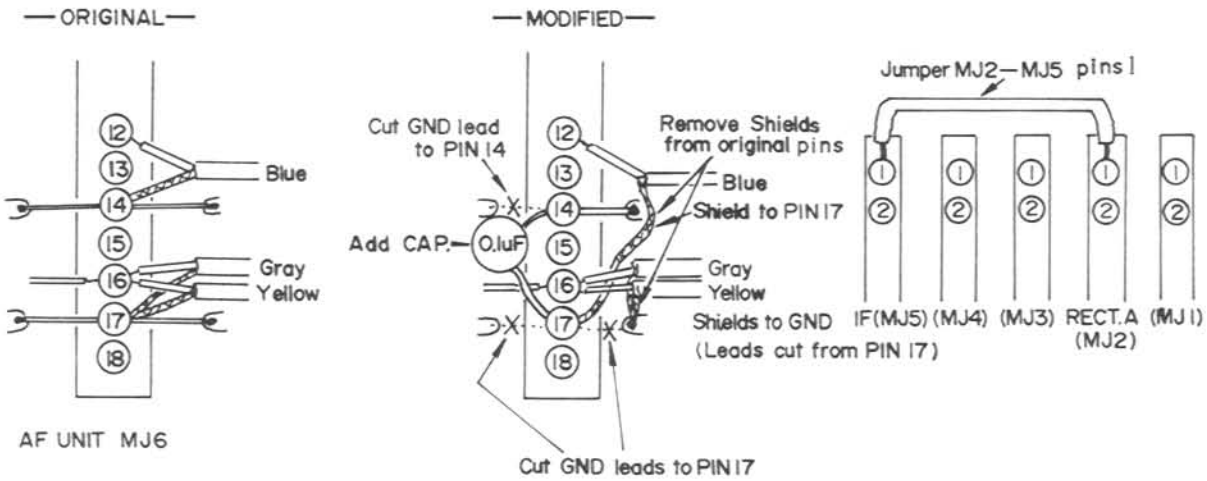


For models using MSM5503. Install reversed from PCB marking.

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 MJ_6 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. And the 0.1 μF 25 WV capacitor between pins 14 and 17, as shown. A ceramic capacitor is OK in this application.
6. Connect a jumper between MJ_2, pin 1, and MJ_5, pin 1. This completes the modification.



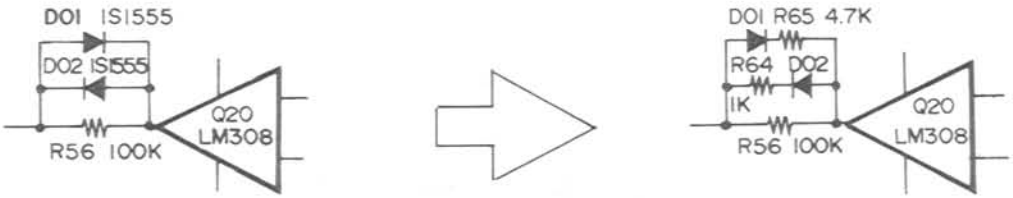
MEMORY LOCK MODIFICATION

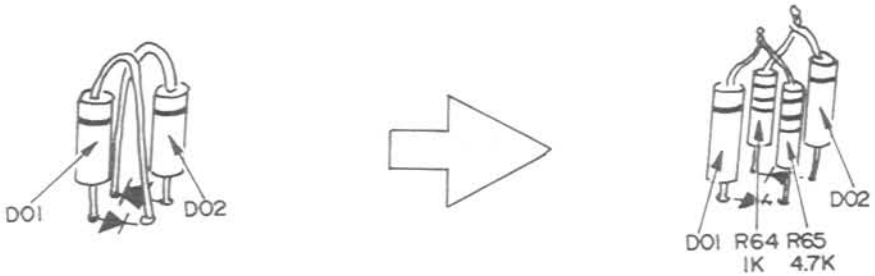
In some FT-901 transceivers, it was not possible to obtain a memory lock through the entire range of the VFO, especially toward the high end. The following modification will allow a lock to be obtained, in these isolated situations.

Refer to the drawing below, and install a 4.7 K ohm resistor in series with D_{2801}. Install a 1 K ohm resistor in series with D_{2802}. 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

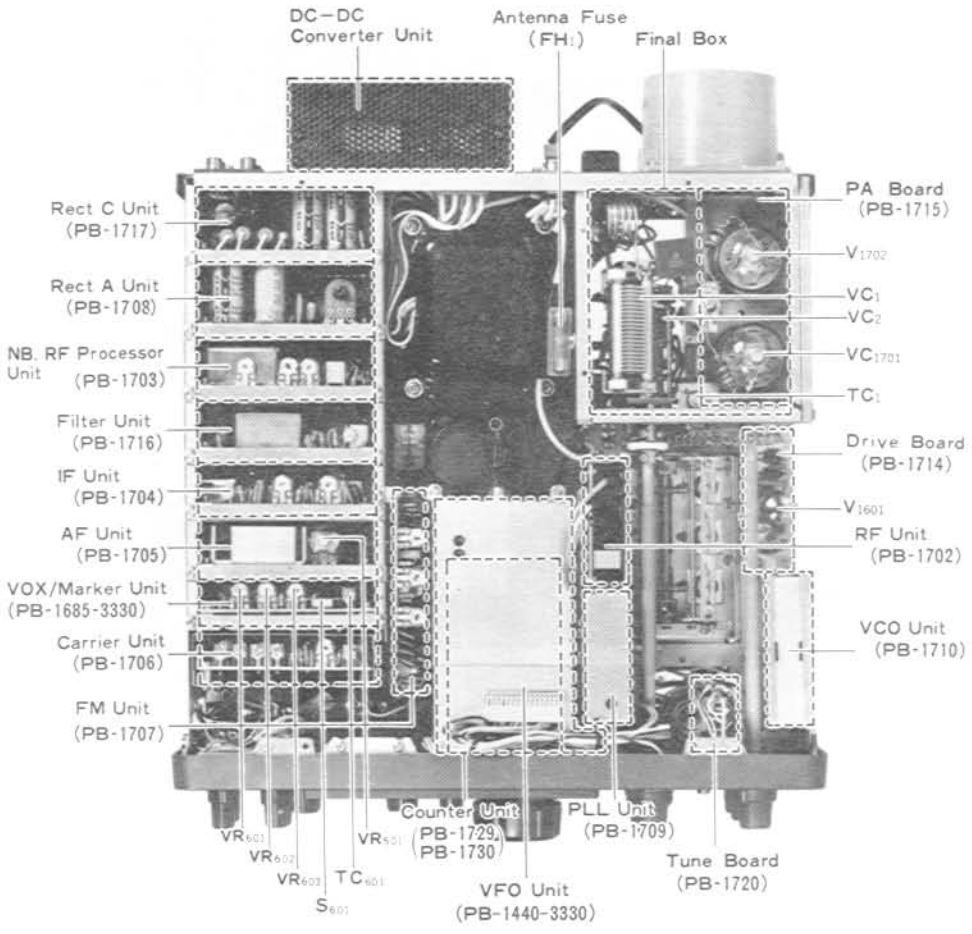
DANGEROUS VOLTAGES ARE PRESENT WITHIN THIS TRANSCEIVER. USE EXTREME CAUTION WHEN WORKING ON THE TRANSCEIVER WITH THE COVERS REMOVED. DISCHARGE ALL CAPACITORS BY SHORTING THEM TO GROUND WITH AN INSULATED SCREWDRIVER AFTER POWER HAS BEEN REMOVED, AND OBSERVE OTHER NORMAL SAFETY PRECAUTIONS.

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.



Top View

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.

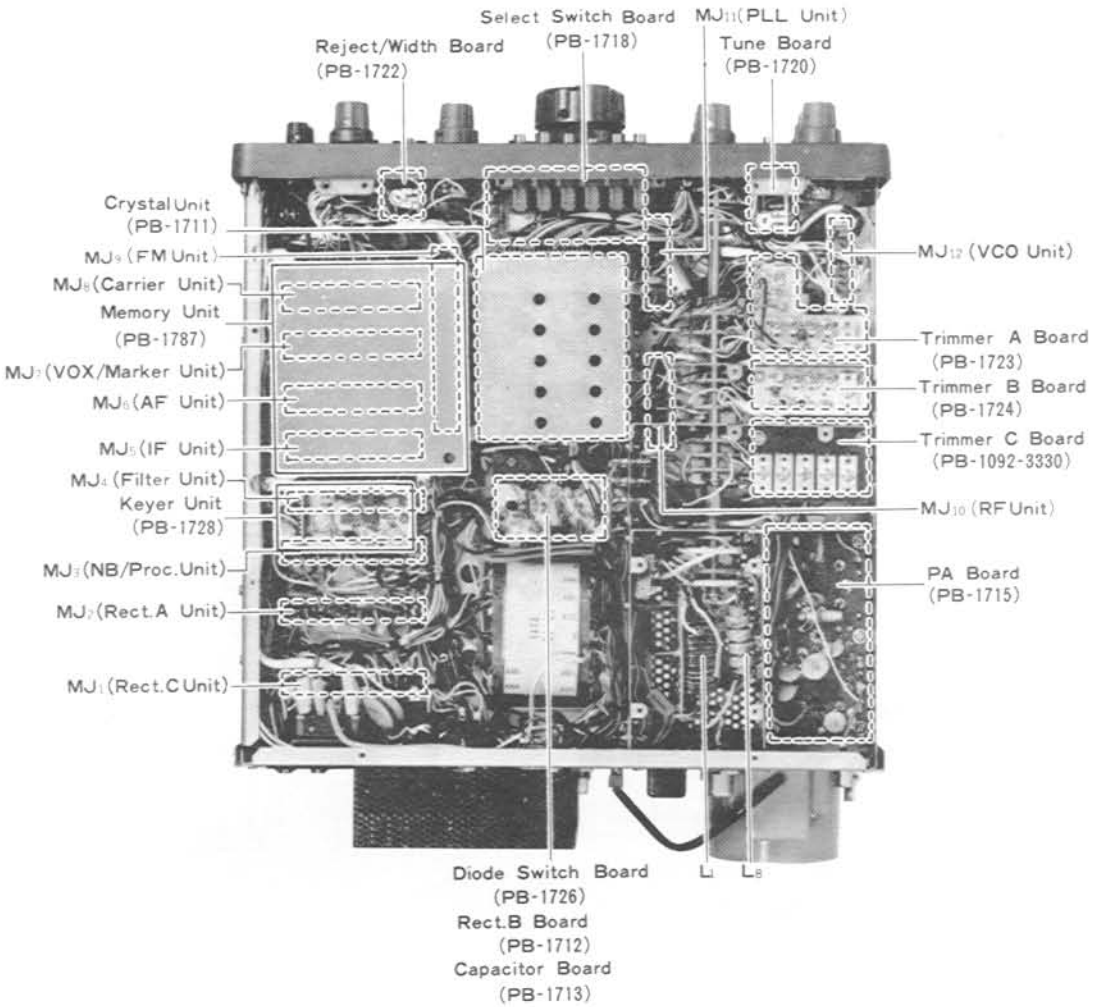
(5) A general coverage receiver covering the frequency range from 3 to 30 MHz with a 100 kHz calibrator.

(6) A frequency counter, Yaesu Model YC-500 or equivalent, with resolution to .01 kHz and frequency coverage to 30 MHz.

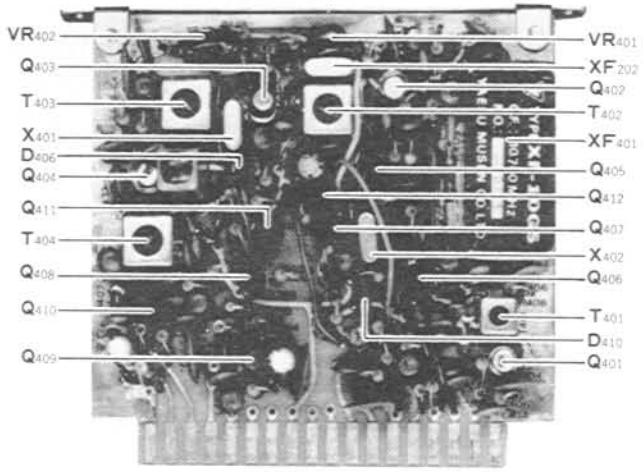
1. S-METER SENSITIVITY ADJUSTMENT

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 VR_{402} 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 VR_{401}. VR_{401} and VR_{402} are located on PB-1704.

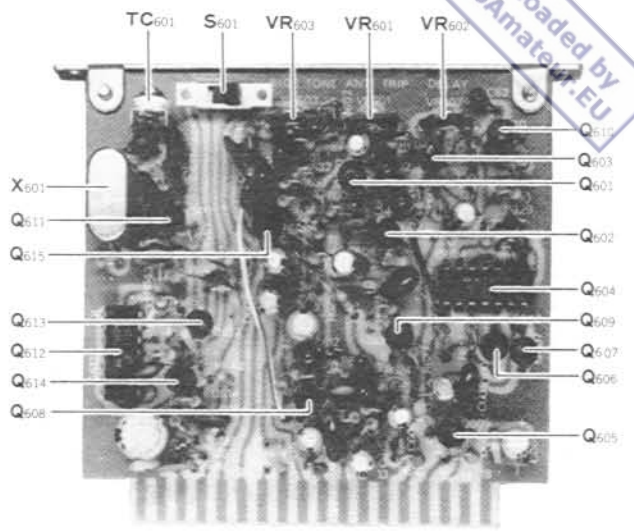
When the transceiver is tuned to 14200 kHz, the 100 kHz calibrator signal will indicate approximately S9 + 10 dB when MARK switch is activated.



Bottom View



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 VR_{601} 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, VR_{601} may be advanced too far.

Adjust the DELAY control VR_{602} for the desired release delay. Clockwise rotation of VR_{602} will increase the delay time. For CW semi-break-in operation, VR_{602} 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 counter-clockwise (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 may be made by adjustment of potentiometer VR_{603}, located on PB-1685, while the transceiver is being keyed.

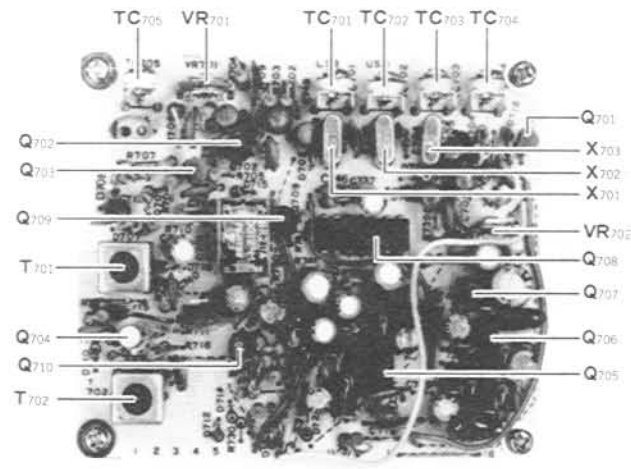
4. CARRIER BALANCE

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 VR_{701} and TC_{705} 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 VR_{701} and TC_{705} 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)

5. AMGC (Automatic Mic Gain Control)

The hold time of the AMGC system is adjusted by VR_{702} on PB-1706; clockwise rotation of VR_{702} 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 TC_{701} 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 TC_{703} for a reading of 8988.295 kHz on the frequency counter.

Transmit on the FSK mode. Set TC_{704} 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 VR_{201} on PB-1703 will be required. Adjust VR_{201} for a reading of 350 (full scale) and return the VOX GAIN control to PTT.

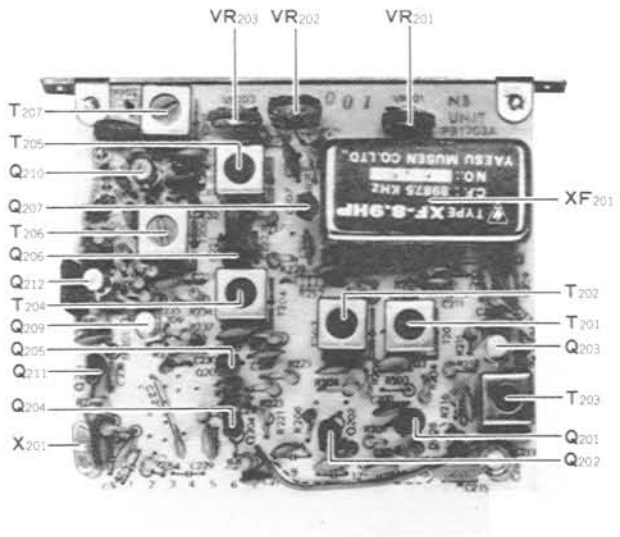
8. RF SPEECH PROCESSOR ADJUSTMENT

Tune up the transceiver on USB at 14.2 MHz. Set VR_{202} 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 VR_{203} so as to obtain the same power output when the RF Processor switch is in the ON and OFF positions.

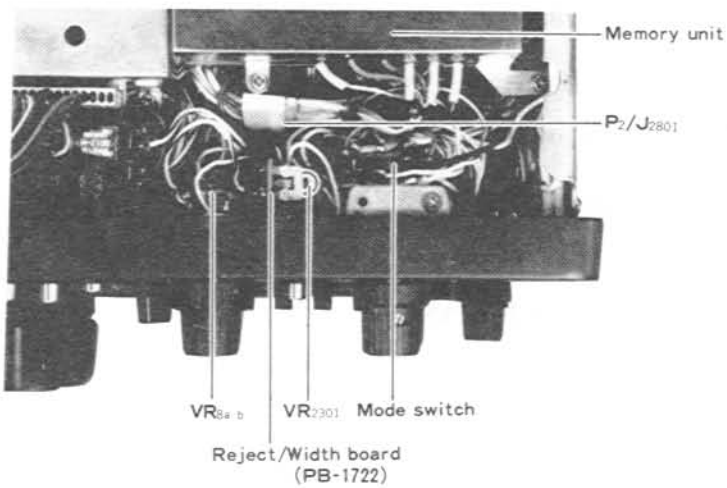
9. IF PASSBAND TUNING ADJUSTMENT

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 VR_{2301} located adjacent to the MODE switch below the chassis until the noise is of the same pitch when switching between USB and LSB.

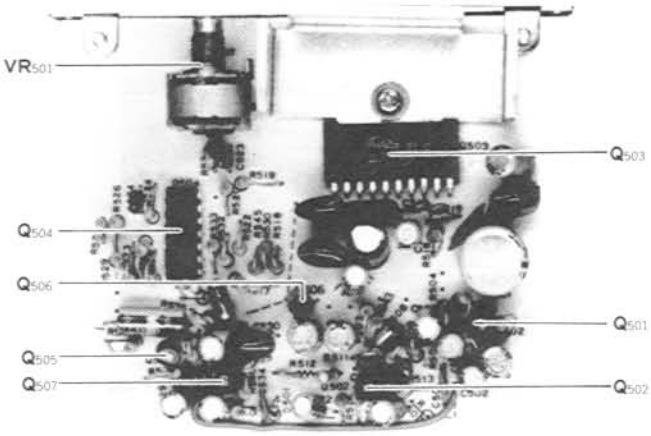


NB/PROC unit (PB-1703)



10. APF SELECTIVITY

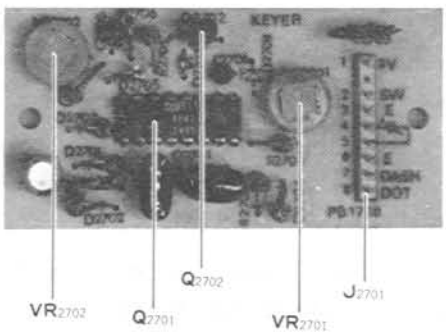
The selectivity of the APF (Audio Peak Filter) can be adjusted by varying VR_{501}, located on PB-1705. Clockwise rotation of VR_{501} will yield sharper selectivity of the filter.



AF unit (PB-1705)

11. KEYER ADJUSTMENT

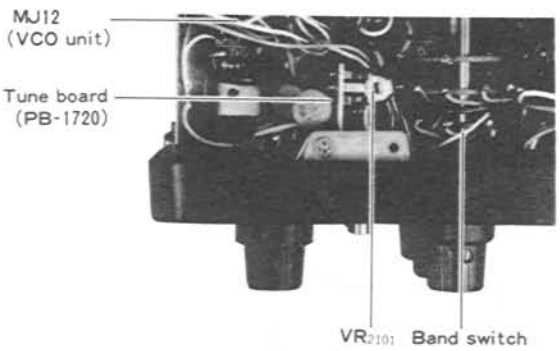
VR_{2702} controls the dot-to-space ratio for the built-in electronic keyer; this is normally set to 1:1 at the factory. VR_{2701} adjusts the symmetry between dots and dashes. Once VR_{2701} is set, this setting is correct for all keying speeds. Adjustment of VR_{2702} will make both dots and dashes change uniformly with respect to the space. Both of these controls are located on PB-1728.



Keyer unit (PB-1728)

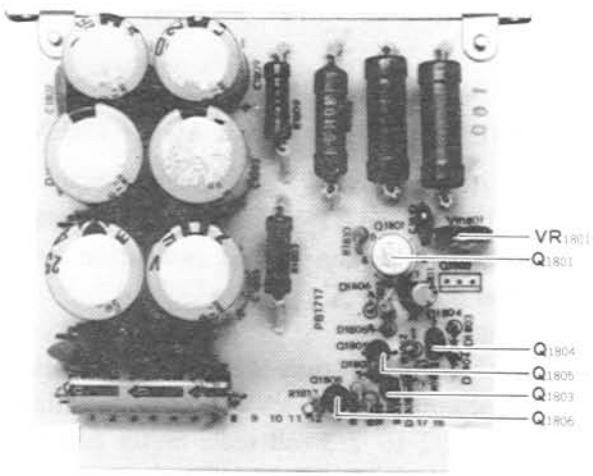
12. CLARIFIER ADJUSTMENT

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 VR_{2101}, which is located inside the cabinet near the CLARIFIER control potentiometer.



13. VOLTAGE REGULATOR ADJUSTMENT

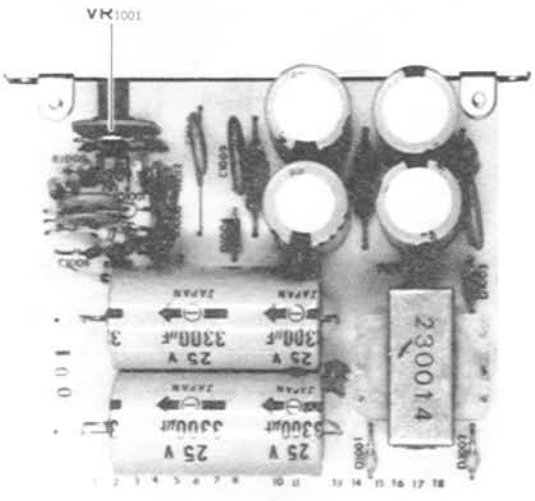
Connect a VTVM DC probe between pin 10 of MJ_1 (PB-1717) and ground. Adjust 6V SET potentiometer VR_{1801} for exactly 6 Volts as indicated on the VTVM.



Rectifier C unit (PB-1717)

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 VR_{1001} 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 VR_{1001} for the correct value.



Rectifier A unit (PB-1708)

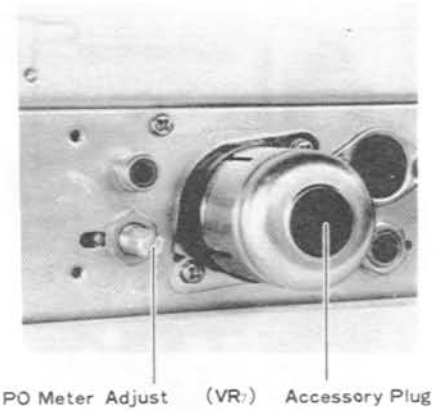
15. POWER OUTPUT METER ADJUSTMENT

VR_7, 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, VR_7 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.

VR_7 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 VR_7 while using an unknown load or antenna of possibly high VSWR.



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 TC_{01}, 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).

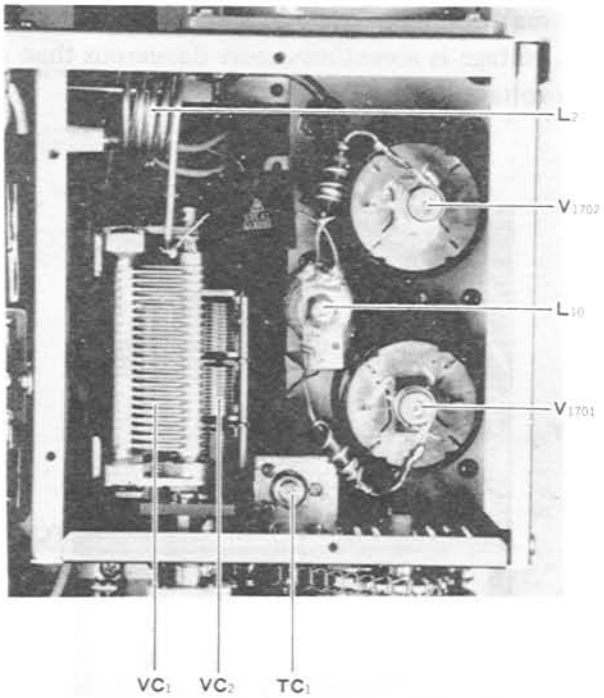
(4) Tune up the transceiver at 29 MHz, using either the 10B or 10C band, and adjust the carrier level so that it is 150 mA. in the TUNE condition.

(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.

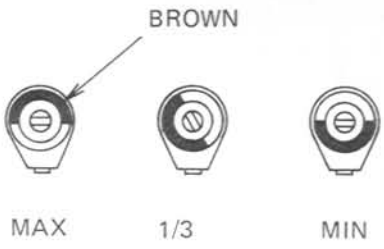
(6) Determine which side of the dip rises abruptly. Set the PLATE control slightly to this side of the dip, keep the meter reading below 100 mA.

(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 TC_{2506} 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 seonds), and carefully adjust T_2 and T_3 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 T_1 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 TC_{2506} maximum IC indication on the meter (FSK mode, still).

(7) Set the MARKER switch ON, and tune to the calibrator signal. Peak TC_{2406} 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 TC_{2605}

and TC_{2505} for maximum PO indication on the meter. On receive, tune in the MARKER signal, and adjust TC_{2405} 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 TC_{2604} for maximum PO indication on the meter. On receive, tune in the MARKER signal, and adjust TC_{2404} 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 L_9 and T_{2501} for maximum PO indication on the meter. On receive, tune in the MARKER signal, and adjust T_{2401} 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 TC_{2602} and TC_{2502} for maximum PO indication on the meter. On receive, tune in the MARKER signal, and adjust TC_{2402} for maximum S-meter deflection.

(15) Because of possible interaction of adjustments, please repeat steps (13) and (14).

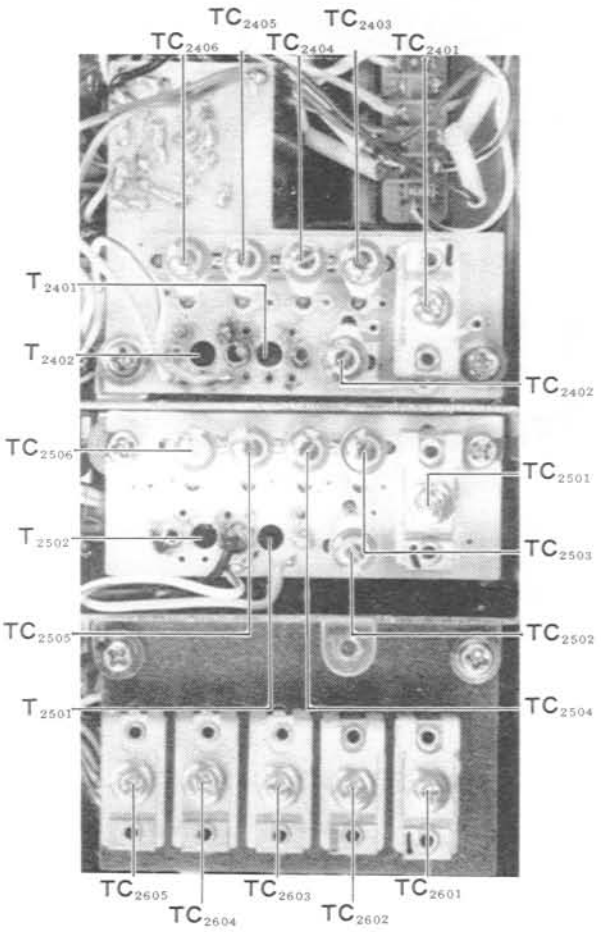
(16) Set the BAND switch to 40, tune the main dial for a reading of 7.200 MHz, and set the PRESELECT control to 6.5 on its scale. Dip the PLATE control for a minimum IC reading while tuning. Set the VOX GAIN control to MOX, and adjust TC_{2603} and TC_{2503} for maximum PO indication on the meter. On receive, tune in the MARKER signal, and adjust TC_{2403} 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	* Defective power switch * Defective AC line cord * Cold solder joint to AC cord * Loose contact at power jack
	(b) Fuse blows	* 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	* 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	* 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	* Defective DC cord
	(f) OK on AC, fuse blows on DC with heater switch on	* 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	* Defective T20A6 transistor * Cold solder joint in DC-DC converter

(2) No reception	(a) S-meter OK, but no audio output from speaker	* 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	* Defective D_{407} (PB-1704) * Defective Q_{507} (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	* Defective RF GAIN control * Defective Q_{407}, Q_{408}
	(d) Speaker appears OK, no S-meter deflection	* Defective RL_1, Q_{407}, VR_2 * Defective 19.7475 MHz xtal * Defective Q_{405}, Q_{406} (PB-1704) * Defective Q_{303} (PB-1716) * Defective Q_{212} (PB-1703) * Defective Q_{101} –Q_{105} (PB-1702) * Defective Q_{301}, Q_{302}, Q_{305} (PB-1716) * Defective Q_{401} –Q_{404}, Q_{409}, Q_{419} (PB-1704)
	(e) MARKER ON, only slight S-meter deflection on the marker signal	* Low VCO output (see section on COMMON CIRCUITS) * Defective T_1, T_{2402}, or C_{2406} * Check tuning or T_{102}, T_{301} –T_{303}, T_{401} –T_{404} * Tracking error in RF coils * Defective XF_{302} –XF_{304} or XF_{401}
	(f) Normal S-meter deflection against marker signal (S9 +10 dB nominal)	* Defective RH-1 (lamp fuse) * Defective RL_2 * Defective S_{2103}

(3) Partial reception	(a) Poor reception on one or more bands (some bands OK)	* Low VCO output or VCO unlocked (see section on COMMON CIRCUITS) * Defective band switch * Defective TC_{2401} (160m)–TC_{2406} (10m), C_{2401} (160m)–C_{2406} (10m)
(4) Self-oscillation on receive	(a) Oscillation with HEATER switch on	* Defective 6146B, R_{1005}, R_{1703}, L_{1701} * Defective L_{1701}, C_{04} * Defective R_{13}, R_{14}, R_{1601}, R_{1602}, C_{84}, C_{1101} * Defective Q_{1804}, Q_{1805} (PB-1717)
	(b) Oscillation with HEATER switch either on or off	* TX 12V line shorted to RX 12V line. Check at each board, TX/RX switching diodes and switches
(5) Marker inoperative	(a) RX OK, no marker signal heard	* Defective NB/MARK switch Check voltage at pin 4 of PB-1846 and PB-1685. Should be 12 volts nominally * Defective X_{601} * Defective Q_{612} * Defective D_{606}
	(b) 25 kHz marker inoperative	* Defective S_{601}
(6) REJECT inoperative	(a) No notch action	* Defective RL_{401} * Defective X_{401} * Defective D_{406} * Defective Q_{411} * Defective REJECT switch
(7) APF inoperative	(a) Low or no output, serious distortion	* Defective Q_{504}, Q_{505}, Q_{506}

TRANSMITTER

Problem	Condition	Probable Cause(s)
(1) No power output	(a) IC OK, but no power output	* 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	* Cold solder joint between band switch and tank coil * Defective band switch
	(c) No IC indication	* 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	* 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	* Defective X_{701}
	(b) No power output on USB only	* Defective X_{702}
	(c) No power output on both USB/LSB	* 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	* Defective X_{703}, Q_{704}, Q_{201}
	(e) Keyer OK, but no CW keying	* Defective mode switch, Q_{1803}, and associated circuit * Defective D_{605} if carrier hangs up.

	(f) No modulation on AM	* Defective Q_{710}
	(g) No output on FM	* Defective X_{902}, Q_{912}, Q_{913}
	(h) No modulation on FM	* Defective T_{902}, D_{908}, D_{914}
	(i) No FSK shift	* Defective Q_{701}, defective or misaligned TC_{703}, TC_{704} * FSK jack grounded
(3) Abnormal meter operation	(a) Cannot set ALC meter to full scale	* Defective C_{1008} * Defective Q_{203}, VR_{201} * Defective meter switch or RL_1
	(b) ALC meter does not function	* Defective 12BY7A * ALC line shorted to ground * Defective D_{1005}, D_{1006} * Driver, IF stages require realignment
	(c) Power output OK, no IC meter indication	* Defective R_{06} or meter switch * Defective RL_1
	(d) Power output OK, PO meter does not function	* Improper setting of VR_7 * Defective C_{11}, C_{19}, C_{24}, C_{41}, L_{11}, D_{11}, VR_7, or mode switch
(4) No changeover from RX to TX	(a) TX OK in MOX position	* Failure in MIC or PTT line * Loose MIC jack or plug connection
	(b) No TX in MOX position	* Defective VR_1 * Defective RL_1, D_5
	(c) VOX inoperative	* If CW semi-break-in is OK, then Q_{608} defective * If no CW semi-break-in, check Q_{601} – Q_{607}, Q_{609}, Q_{610}
(5) No return to RX from TX		* PTT line grounded * Defective Q_{607} * Defective Q_{602} –Q_{604}, Q_{606} * Defective keyer unit (CW)

(6) Fuse blows on transmit	(a) OK on RX	* TX 12V or TX 8V line grounded * Insufficient bias voltage on 6146B * Defective D_5 or D_7
(7) TX self-oscillation	(a) OK on receive	* Neutralization of final tubes required * Defective C_{16}, C_{30}, C_{87}, C_{1605} * 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	* Processor switch defective * Defective XF_{201} * Defective Q_{205}, Q_{206}, Q_{207}
(9) Monitor trouble	(a) Inoperative	* Defective APF/MONI switch or loose contact * Defective R515
(10) Keyer trouble	(a) Keyer not functioning	* Defective Q_{2701}, Q_{2702}
	(b) Key-down all the time or string of dots, etc.	* Key line shorted to ground * Latch-up of 8043 IC. Replace IC and replace leaky C_{2706} (use 0.33 μf mylar or 2 back-to-back tantalum of 0.68 μf each).
	(c) Side tone normal, but carrier hangs on for 2–3 seconds.	* Defective D_{605}

COMMON CIRCUITS

Problem	Condition	Probable Cause(s)
(1) Counter circuit	(a) Digital display does not work	* Defective Q_{2924} * 5V line in Counter Unit grounded * Defective display LED * Defective Q_{2917}, Q_{2919}, Q_{2922}, Q_{2923} * Defective R_{2932} – R_{2952}
	(b) Four digits to the right read "000.0"	* VFO input not connected or is grounded * Defective Q_{2901} – Q_{2905}, Q_{2913}, Q_{2915}, Q_{2918}, Q_{2925} * Defective 18.0 or 18.5 MHz crystal in counter * Defective 655.36 kHz crystal * Defective Q_{2912}
	(c) Display unstable, all digits working OK	* PLL unlock. Refer to section on PLL trouble. * Defective 655.36 MHz crystal * Low VFO input (80–120 mV OK)
	(d) MHz display incorrect	* Check wiring between P_{10}/J_{2902} and band switch * Defective Q_{2910}, Q_{2911}, D_{2901} – D_{2904}, D_{2920} – D_{2923}
	(e) Display flickers	* Defective Q_{2916}. * PLL or VCO problems. Refer to appropriate sections of this guide
(2) PLL, VCO circuits	(a) Display flickers	* T_{1201} – T_{1208} require alignment * Loose connection on band switch * VCO not oscillating
	(b) No VCO output, all bands	* Defective Q_{1209} – Q_{1212} * VCO output cable grounded or cut
	(c) No input signal– local, VCO, VFO– to PLL unit	* 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

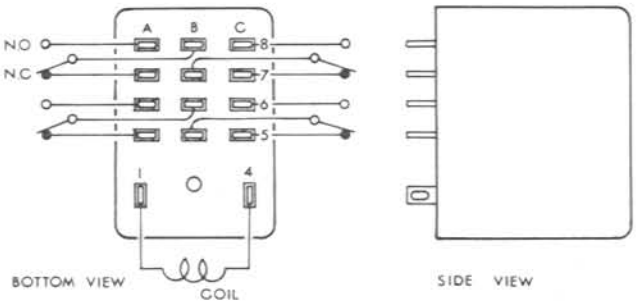
		select relay; check wiring to pin 3 of P7 for short to ground; check Q_{1804} * If no VFO signal, but VFO LED lights up, check PB-1726 and VFO unit
(3) Indicators	(a) APF LED does not work	* Defective D_8, R_{2001}, or APF switch
	(b) REJECT LED does not work	* Defective D_{2301}, R_{2301}, S_{2301}
	(c) CLARIFIER LED does not work	* Defective S_{2104}, S_{2105}, R_{2104}, D_{2101}
	(d) PROCESSOR LED does not work	* Defective R_{2108}, D_{2101}, S_{2102}
	(e) TUNE LED does not work	* If TUNE relay does not operate, check RL_{2101}, R_{2110}, C_{2101}, D_{2164}, S_{2161} * If TUNE relay is working, check Q_{2102}, R_{2111}, R_{2112}, D_{2103}, D_{2107}
	(f) MR LED does not work	* Defective LED or S_{1901} – S_{1905}
	(g) TX MR LED does not work	* Defective LED or RL_{1901}, S_{1902}
	(h) RX MR LED does not work	* Defective LED, RL_{1901}, S_{1903}
	(i) VFO LED does not work	* Defective LED, S_{2103} – S_{2104}, RL_{1901}
	(j) EXT LED does not work	* Defective LED, S_{1905}
	(k) M LED does not work	* Defective LED, R_{2203}, or memory unit.

(4) Clarifier	(a) Frequency jumps with clarifier on	* Defective VR_{06}, R_6, R_{2103}, S_{2105}, S_{2105}, RL_{2102}
	(b) OFF and "0" condition do not coincide in frequency	* Defective VR_{2101}, R_{2101}, R_{2102}, RL_{2101}
	(c) Frequency jumps with clarifier off, OK with clarifier on	* Defective VR_{2101}, R_{2101}, R_{2102}, S_{2105}
	(d) Frequency jumps regardless of clarifier position	* Unstable 6V REG supply, check Q_{1801} and VR_{1801} * Check VFO unit * Check VCO unit

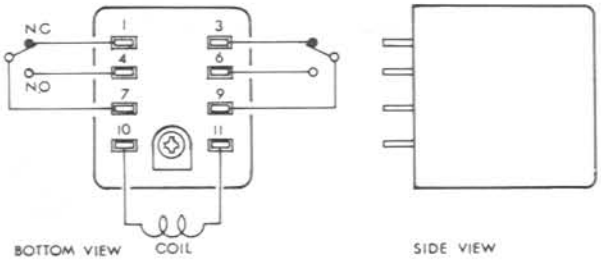
RELAY CONNECTION INFORMATION

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.

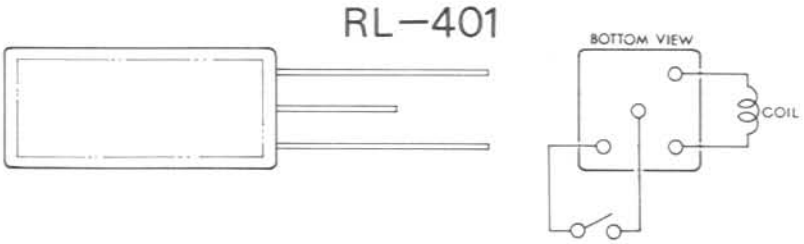
RL–1



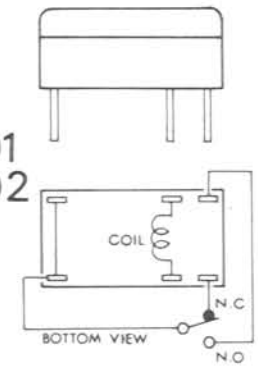
RL–2



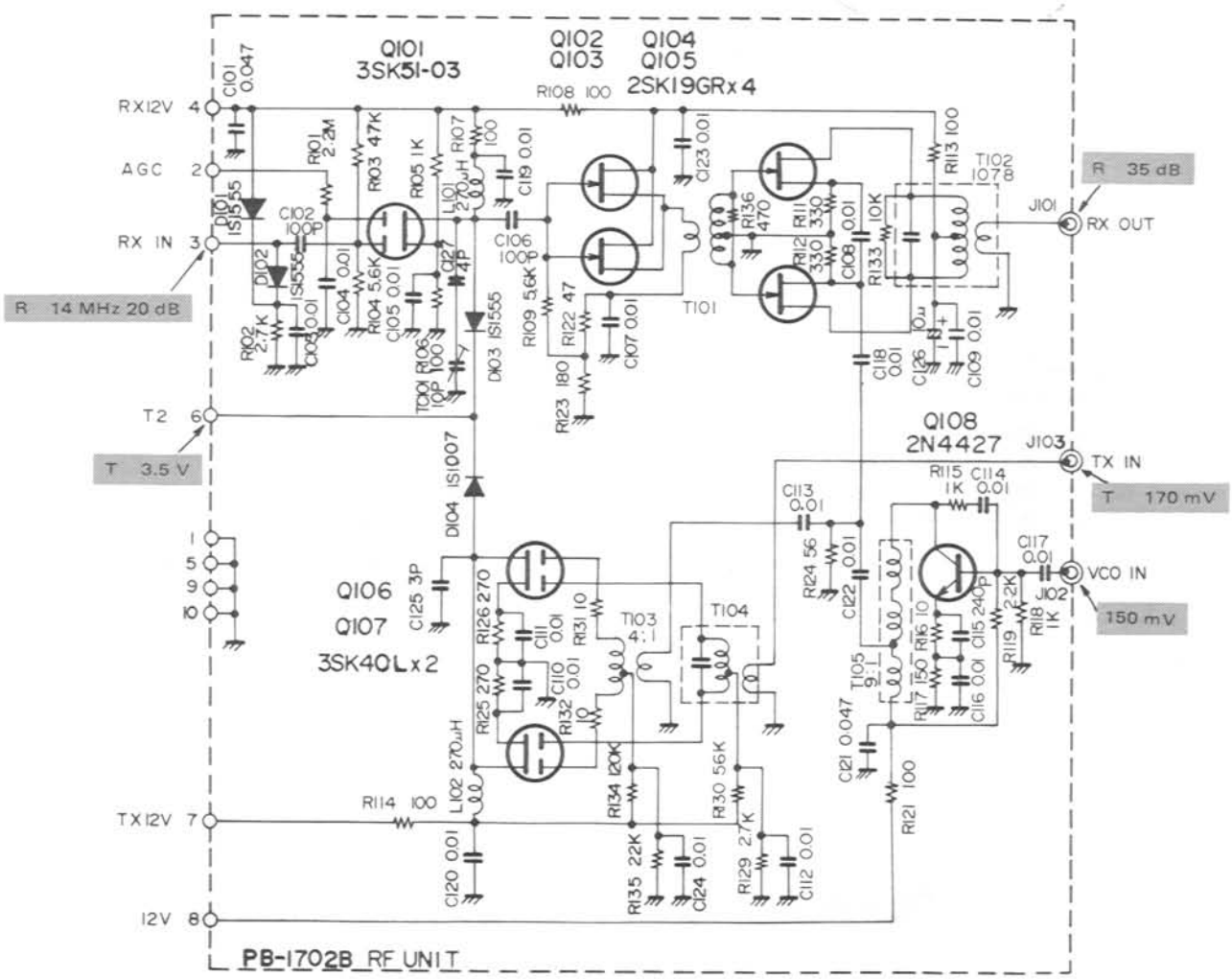
RL–401



RL–701
2101
2102



RF UNIT (PB-1702B)



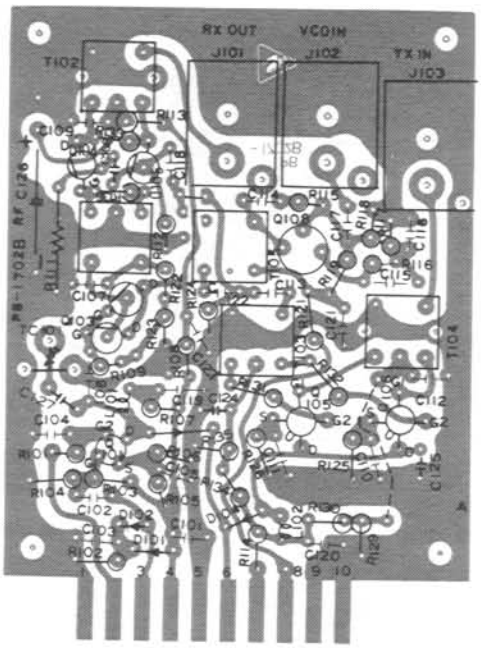
SIGNAL LEVEL

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

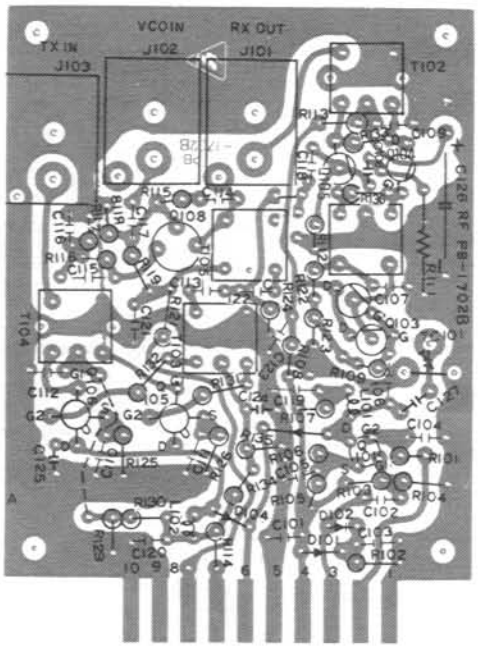
DC VOLTAGES (V)

	E(S)		C(D)		B(G_1)		(G_2)	
	R	T	R	T	R	T	R	T
Q_{101}	1.5	0	10.6	0	1.3	0	2.5	2.5
Q_{102}	2.0	0	10.2	0	1.6	0	—	—
Q_{103}	2.0	0	10.2	0	1.6	0	—	—
Q_{104}	1.4	0	9.5	0	0	0	—	—
Q_{105}	1.4	0	9.5	0	0	0		
Q_{106}	0	0.9	0	10.3	0	0.5	0	1.6
Q_{107}	0	0.9	0	10.3	0	0.5	0	1.6
Q_{108}	2	2	8.7	8.7	2.7	2.7	—	—

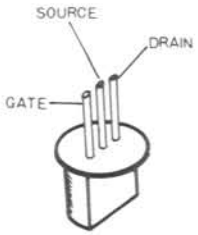
RF UNIT PARTS LAYOUT



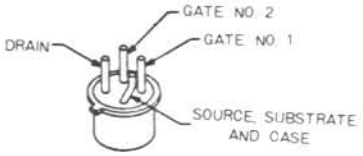
Viewed from component side



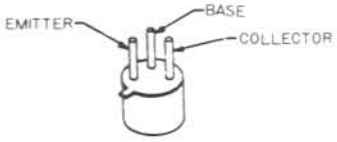
Viewed from solder side



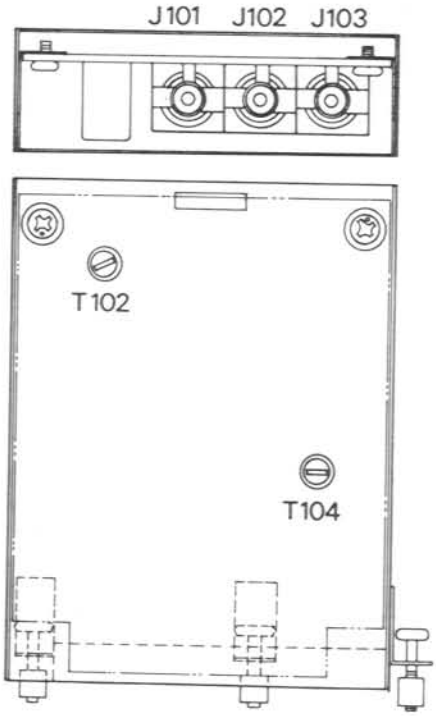
2SK19Y
2SK19GR



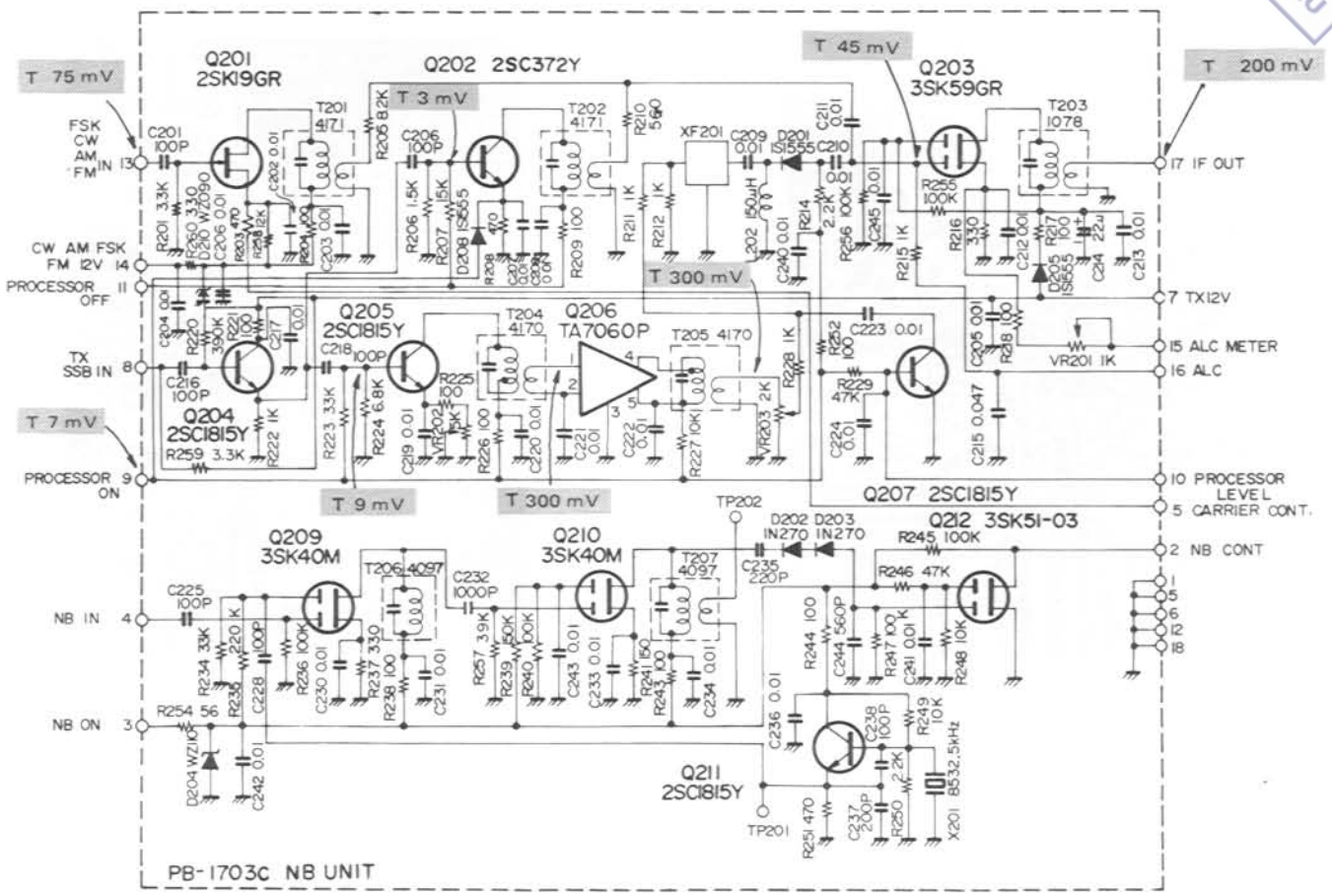
3SK40L
3SK40M
3SK51-03



2N4427



NB/PROC UNIT (PB-1703C)

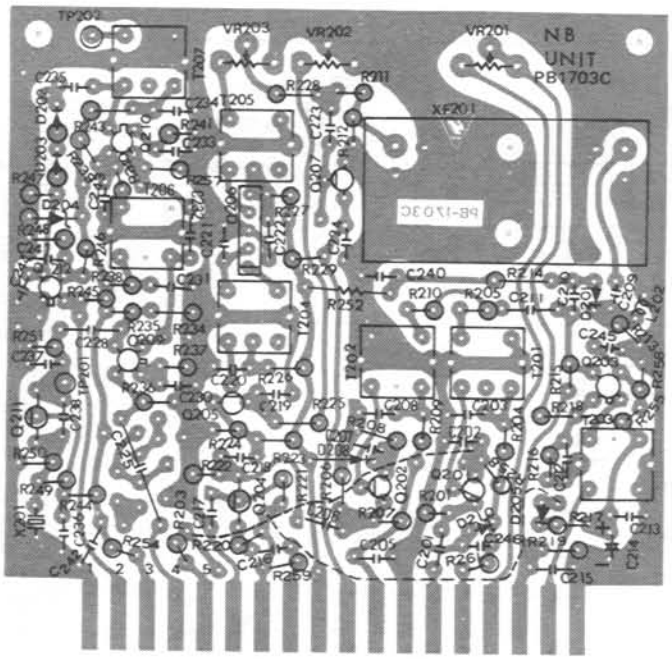


DC VOLTAGES (V)

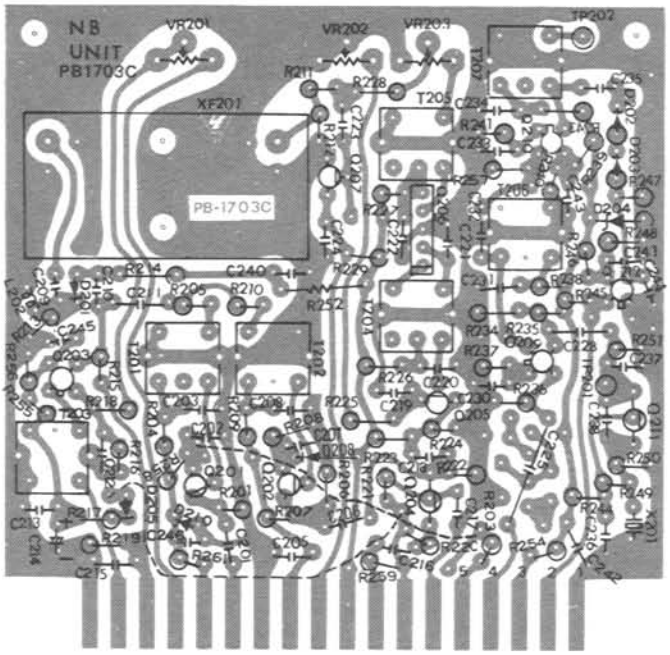
	E(S)		C(D)		B(G_1)		(G_2)		
	R	T	R	T	R	T	R	T	
Q_{201}	0	4	0	8.9	0	0.7	—	—	CW, AM, FSK, FM
Q_{202}	0	0.3	0	10.9	0	1.0	—	—	SSB , PROC OFF
Q_{203}	0	0.6	0	11	0	2.5	0	5.5	
Q_{204}	0	3.2	0	11.9	0	3.9	—	—	SSB
Q_{205}	0	1.1	0	10.3	0	1.8	—	—	SSB , PROC ON
Q_{207}	0	0	0	0	0	0.5	—	—	SSB , PROC ON
Q_{209}	0.5	0.5	10.5	10.5	0	0	1.4	1.4	NB ON
Q_{210}	0.5	0.5	10.3	10.3	0	0	4.1	4.1	NB ON
Q_{211}	3.5	3.5	9.7	9.7	1.8	1.8	—	—	NB ON
Q_{212}	0	0	0	0	0	0	0	0	

		1	2	3	4	5	
Q_{206}	R	0	0	0	0	0	SSB, PROC ON
	T	1.4	1.4	0	2.3	2.3	

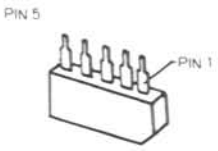
NB/PROC UNIT PARTS LAYOUT



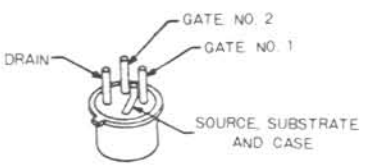
Viewed from component side



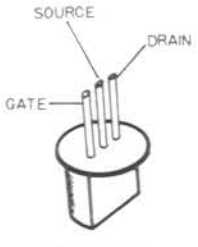
Viewed from solder side



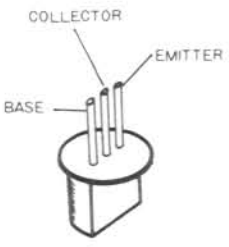
TA7060P



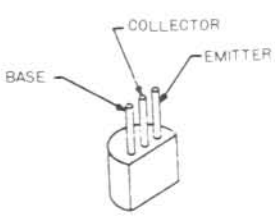
3SK40M
3SK59GR
3SK51-03



2SK19GR

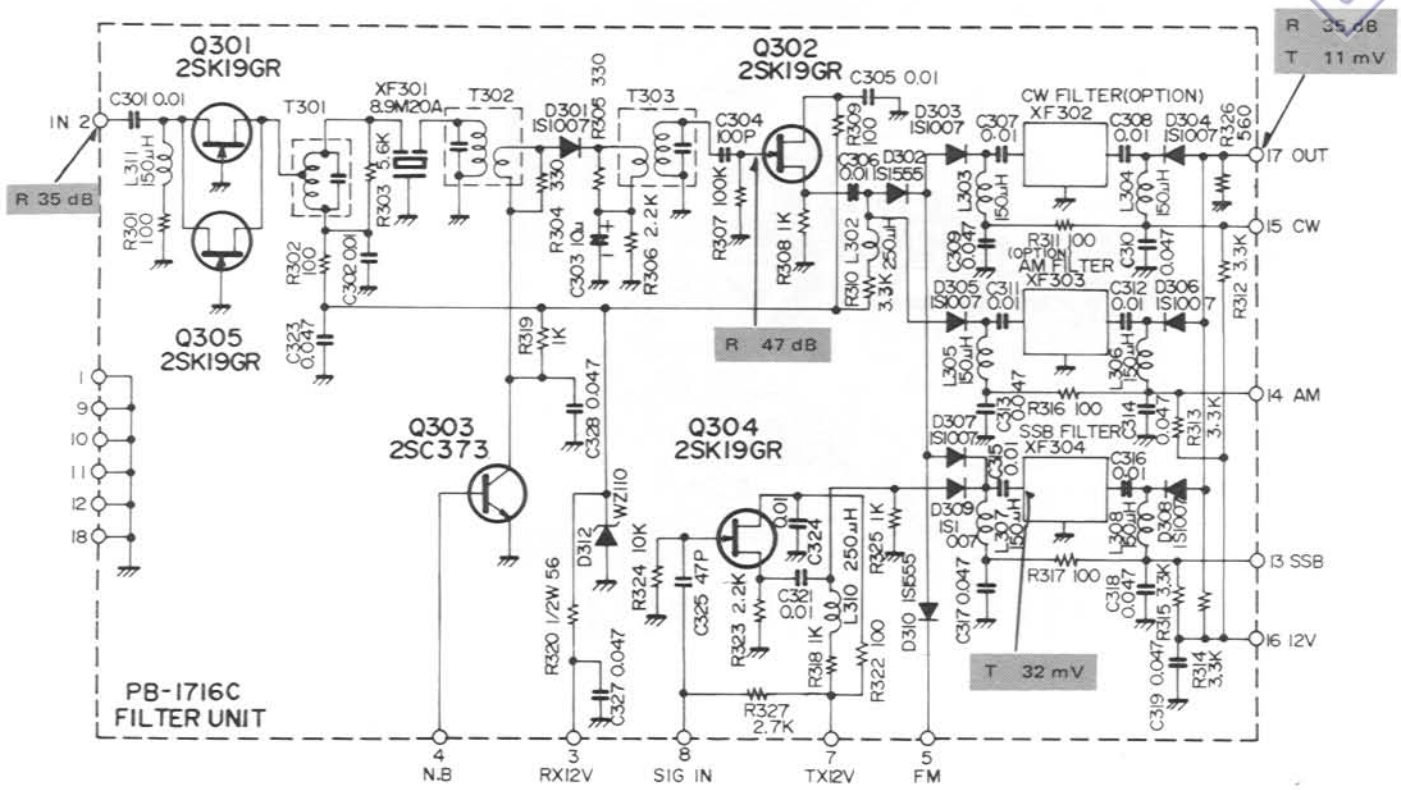


2SC372Y



2SC1815Y

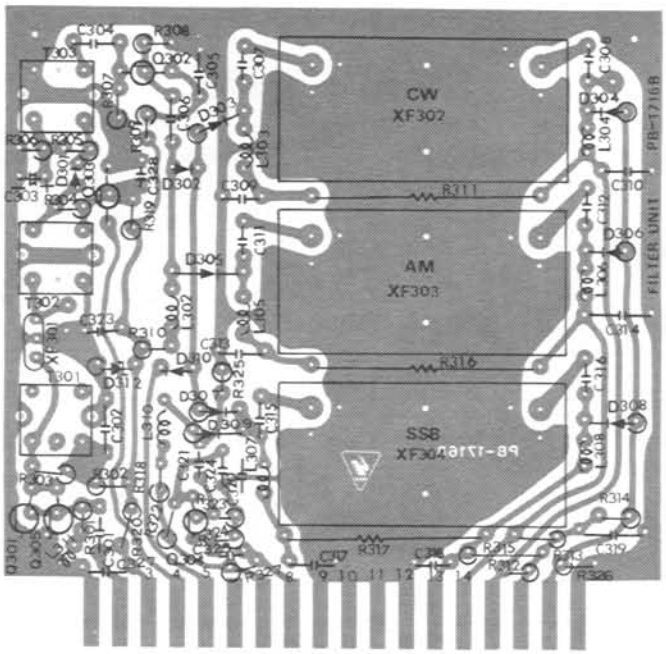
FILTER UNIT (PB-1716C)



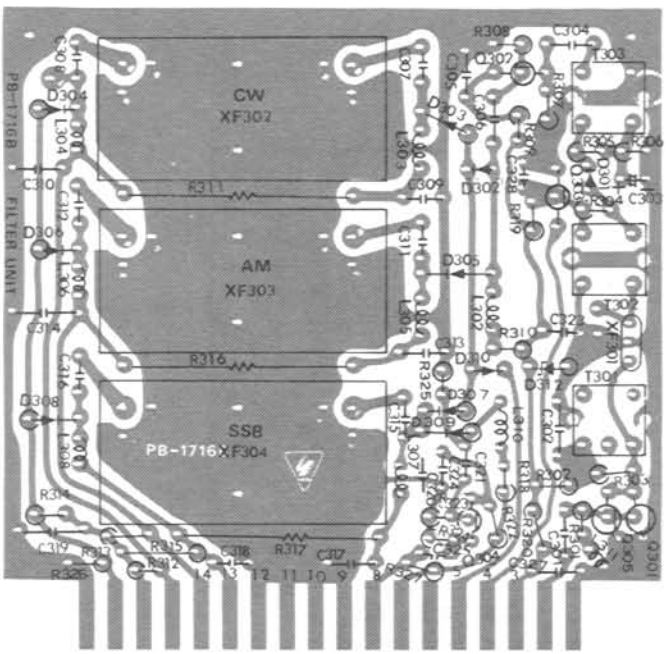
DC VOLTAGES (V)

	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

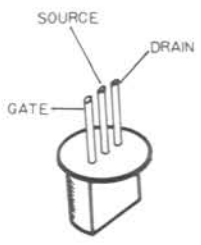
FILTER UNIT PARTS LAYOUT



Viewed from component side



Viewed from solder side



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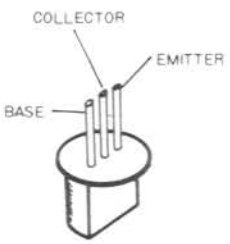
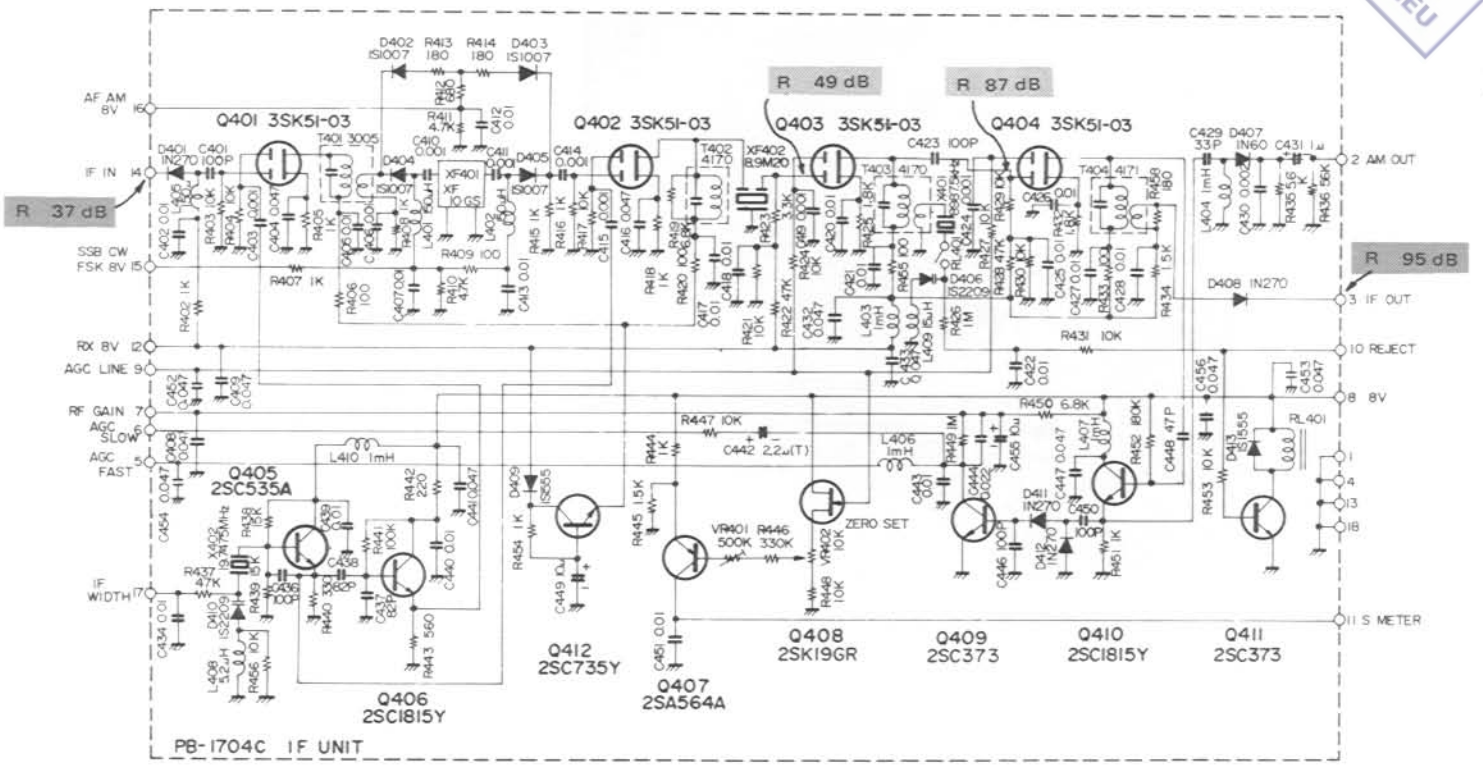


2SC373

IF UNIT (PB-1704C)

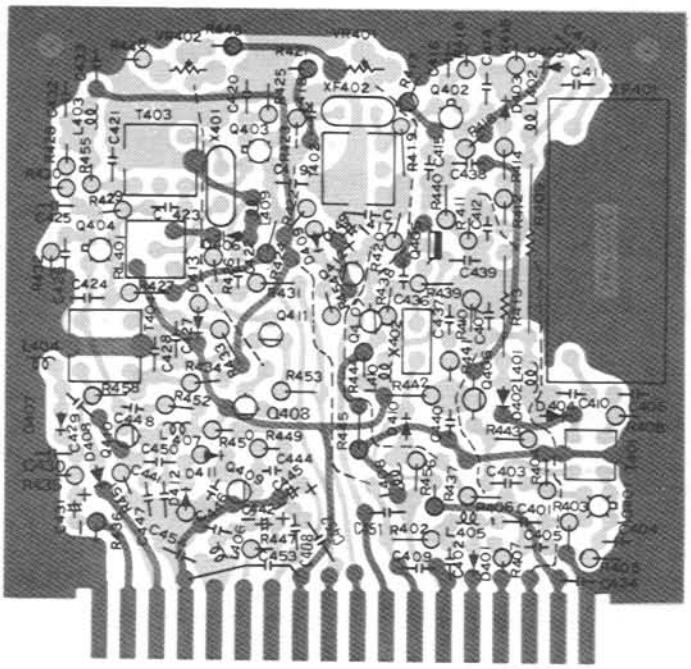


DC VOLTAGES (V)

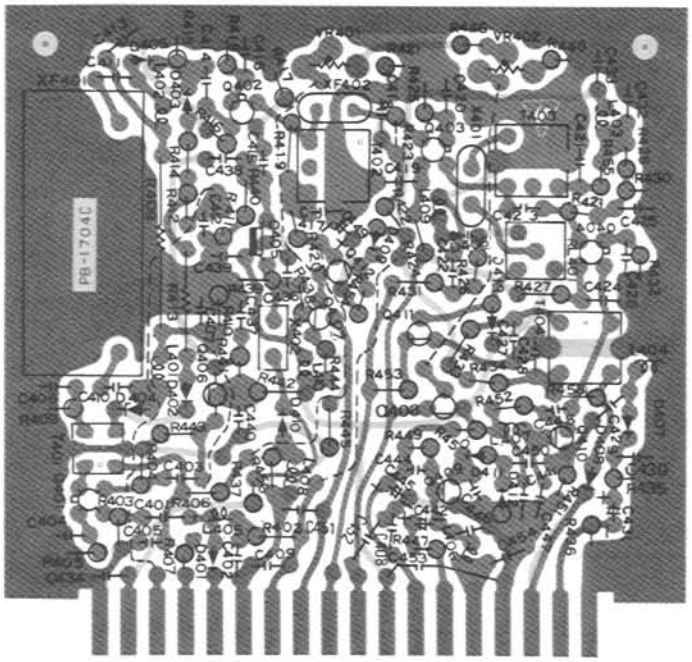
	E(S)		C(D)		B(G1)		(G2)		
	R	T	R	T	R	T	R	T	
Q401	0.5	0	6.8	0	0	0	0	0	
Q402	0.5	0	6.8	0	0	0	0	0	
Q403	2.0	0	8.0	0	1.7	0	2.9	2.9	
Q404	2.0	0	8.0	0	1.4	0	2.9	2.9	
Q405	2.4	2.4	8.0	8.0	2.4	2.4	—	—	
Q406	3.2	3.2	7.0	7.0	3.8	3.8	—	—	
Q407	5.0	5.0	0	3.9	4.3	4.3	—	—	
Q403	5.2	5.2	8.2	8.2	3.0	3.0	—	—	
Q409	0	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	—	—	REJECT ON
Q412	6.8	0	7.5	0.3	7.5	0.3	—	—	

* REJECT OFF 8.0 V

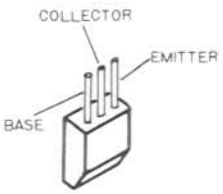
IF UNIT PARTS LAYOUT



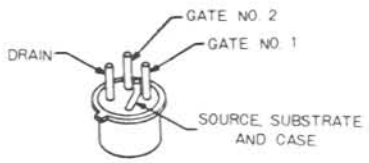
Viewed from component side



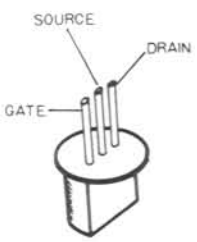
Viewed from solder side



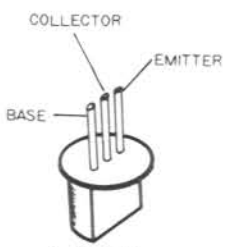
2SC535A



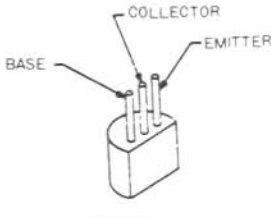
3SK40M
3SK51-03



2SK19GR

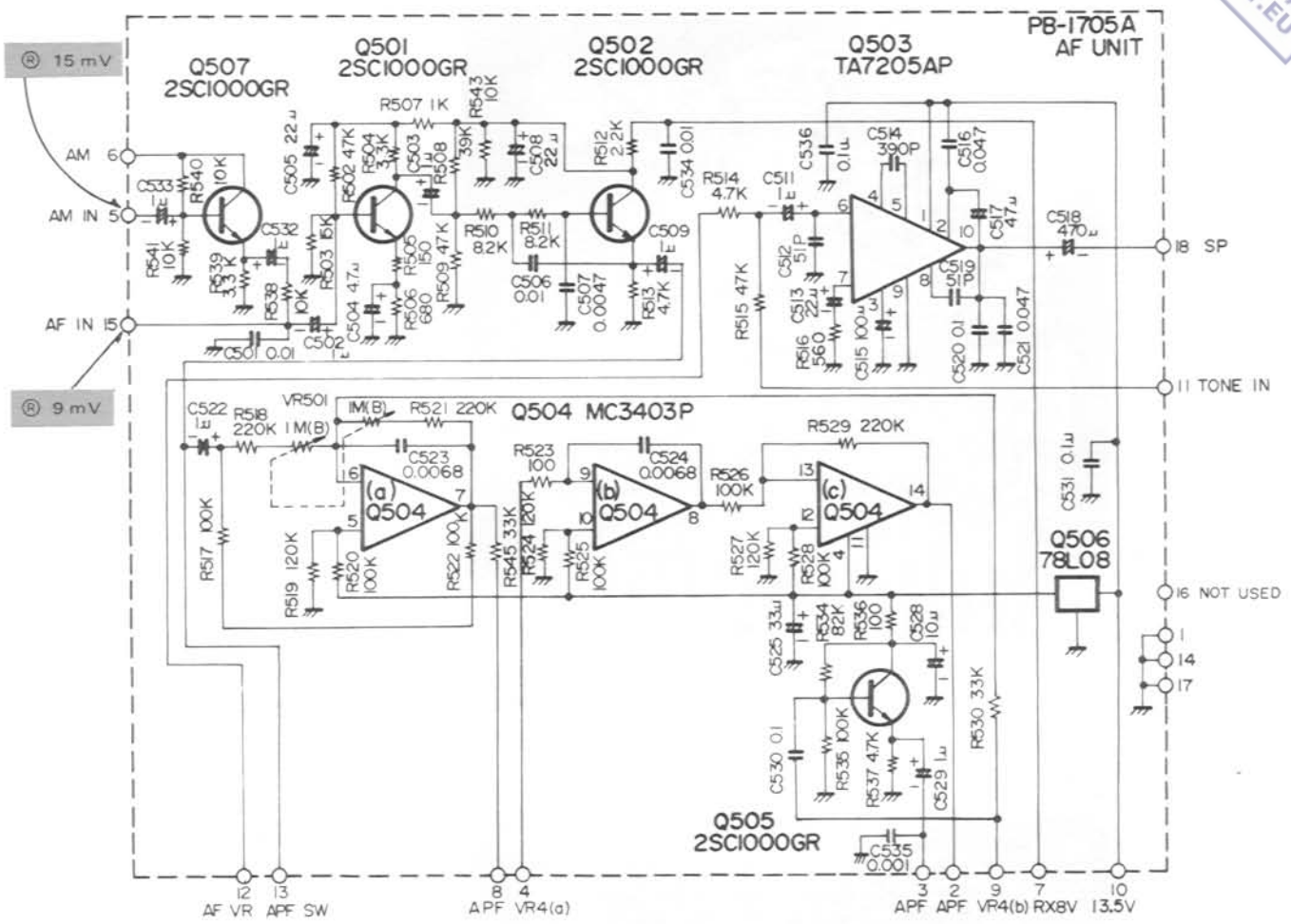


2SC373
2SC735Y



2SA564A
2SC1815Y

AF UNIT (PB-1705A)



DC VOLTAGES (V)

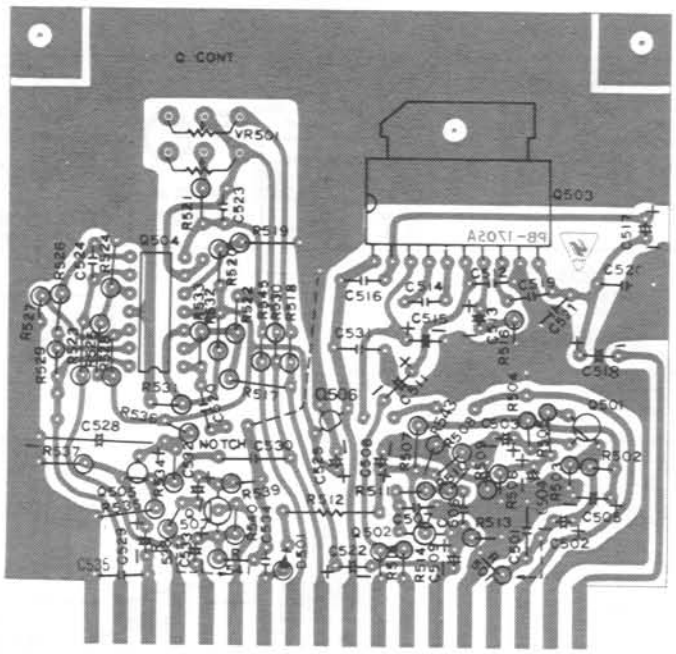
	E		C		B		
	R	T	R	T	R	T	
Q501	0.7	0	2.8	0	1.4	0	
Q502	3.0	0	6.9	0	3.6	0	
Q505	3.6	3.6	8.0	8.0	4.3	4.3	
Q507	3.3	3.3	7.9	7.9	3.9	3.9	AM

DC VOLTAGES (V)

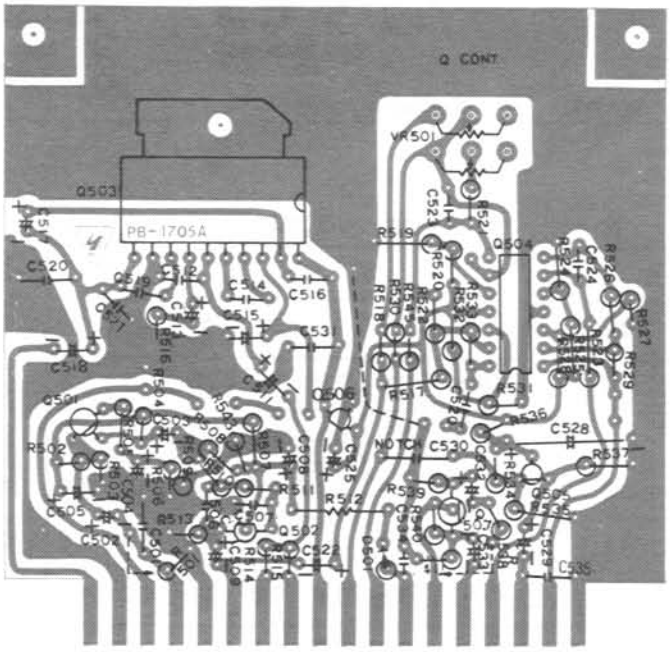
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Q503	R	14.9	13.8	4.2	8.6	1.5	3.6	3.6	1.2	0	7.3	—	—	—	—
	T	14.9	13.8	4.2	8.6	1.5	3.6	3.6	1.2	0	7.3	—	—	—	—
Q504	R	6.9	4.4	0.3	8.2	4.4	4.5	4.5	4.4	4.5	4.4	0	4.4	4.4	4.4
	T	6.9	4.4	0.3	8.2	4.4	4.5	4.5	4.4	4.5	4.4	0	4.4	4.4	4.4

	IN	OUT
Q506	15	8.0

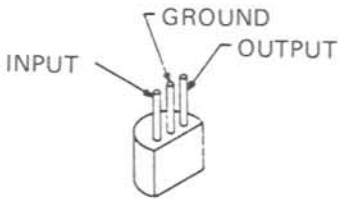
AF UNIT PARTS LAYOUT



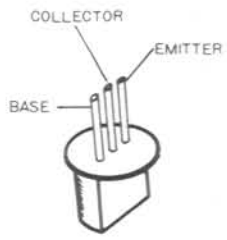
Viewed from component side



Viewed from solder side



78L08



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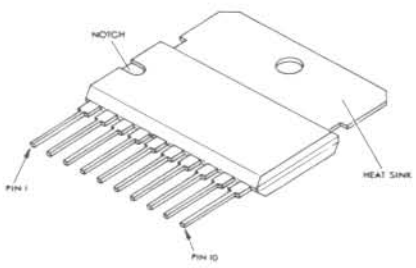
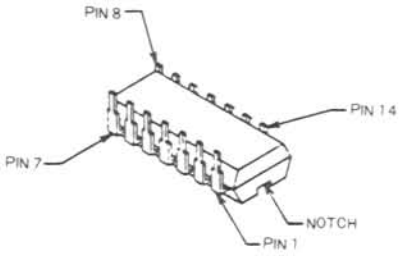


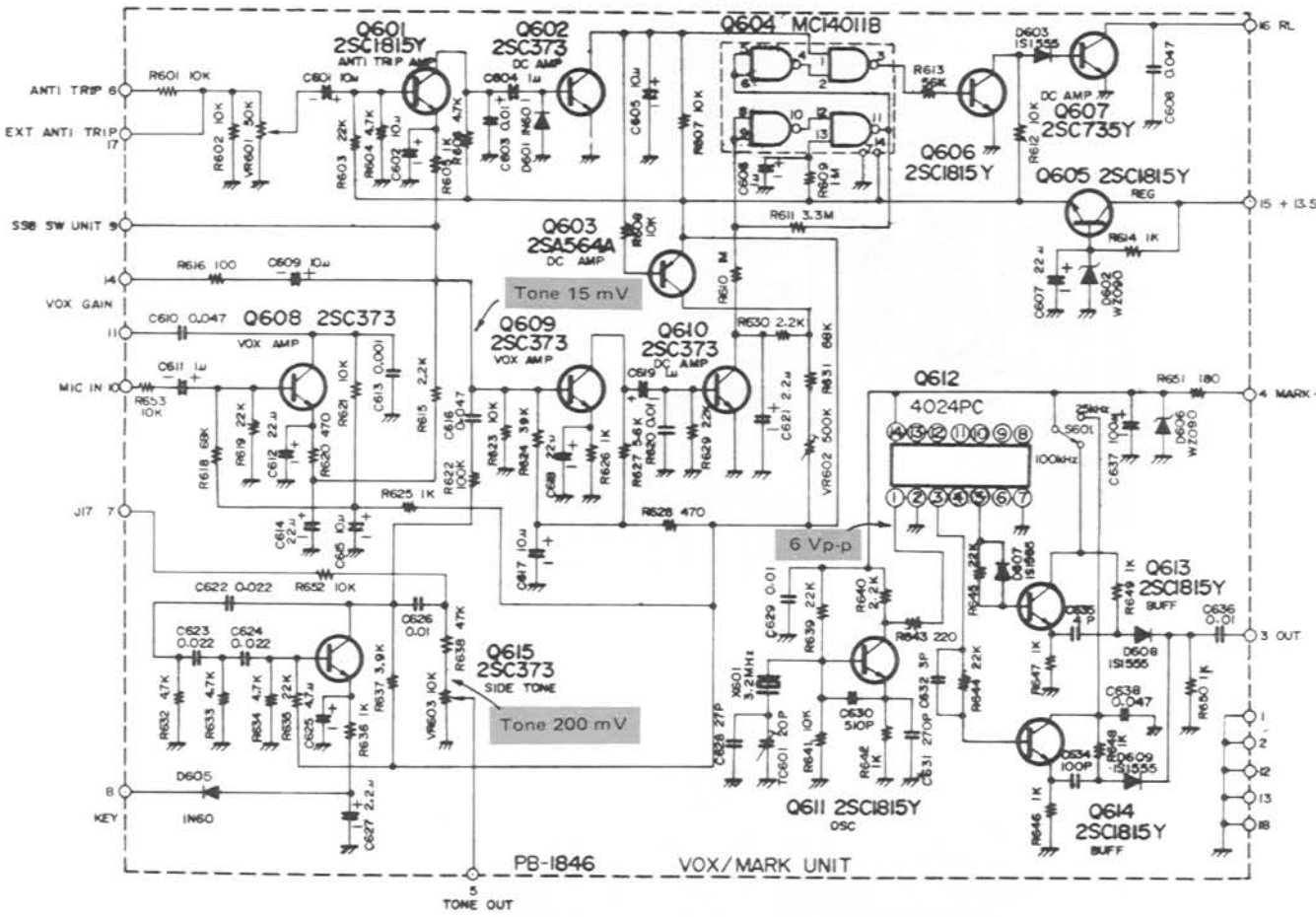
TA7205AP



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

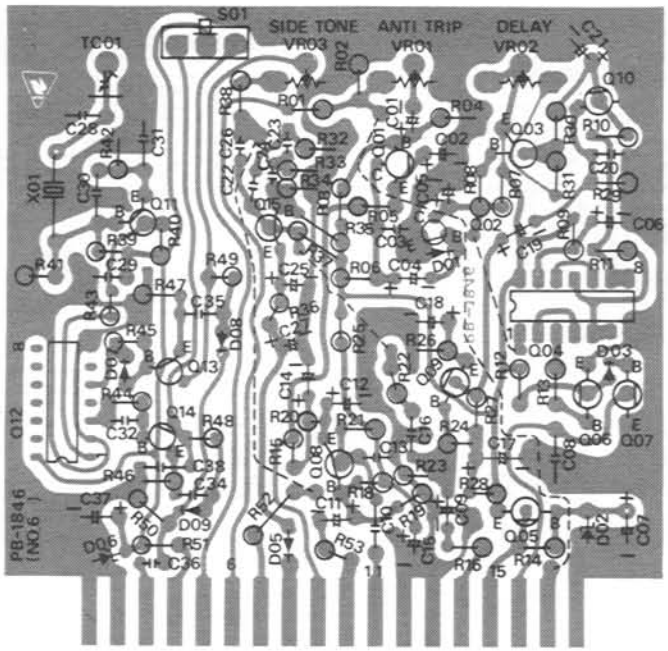
DC VOLTAGES (V)

	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	MARK ON
Q613	3.7	3.7	9.0	9.0	2.9	2.9	25 kHz ON
Q614	3.6	3.6	9.0	9.0	4.0	4.0	100 kHz ON
Q615	0.9	0.9	8.3	8.3	1.5	1.5	

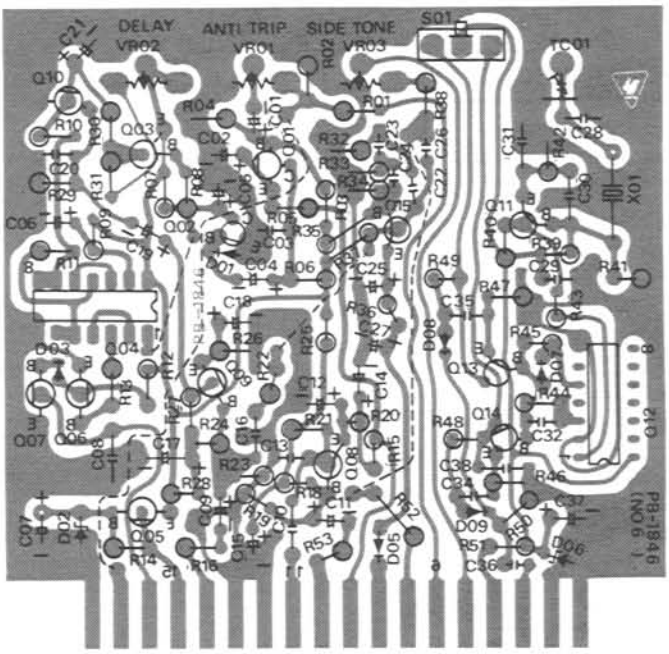
DC VOLTAGES (V)

		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

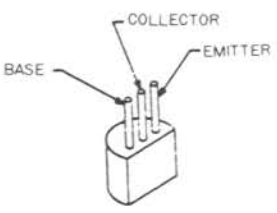
VOX/MARKER UNIT PARTS LAYOUT



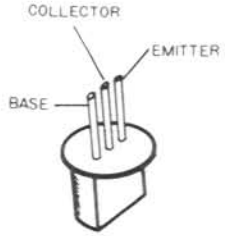
Viewed from component side



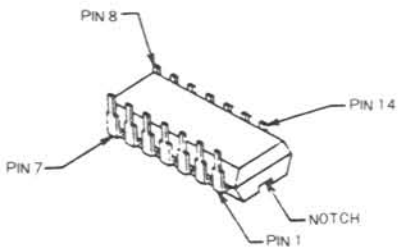
Viewed from solder side



2SA564A
2SC1815Y

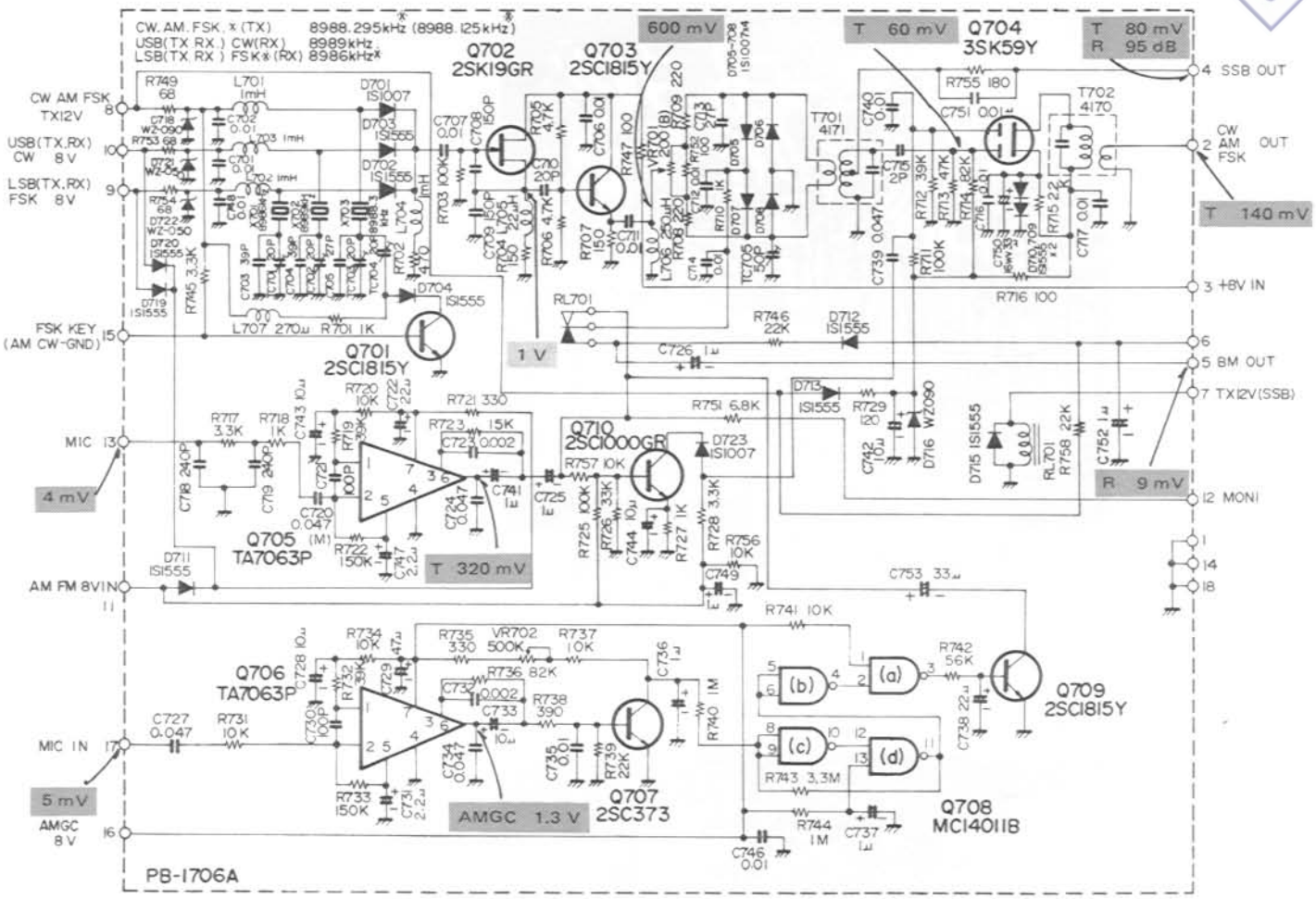


2SC373
2SC735Y



MC14011B
MC4024PC

CARRIER UNIT (PB-1706A)

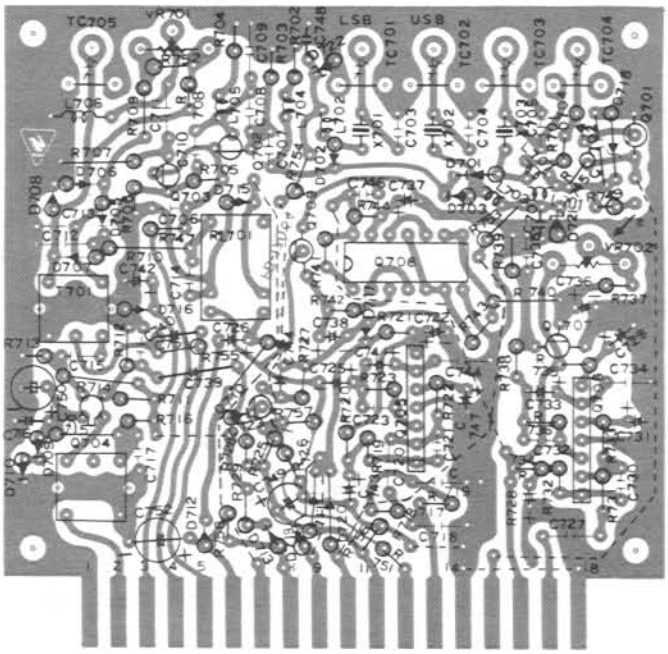


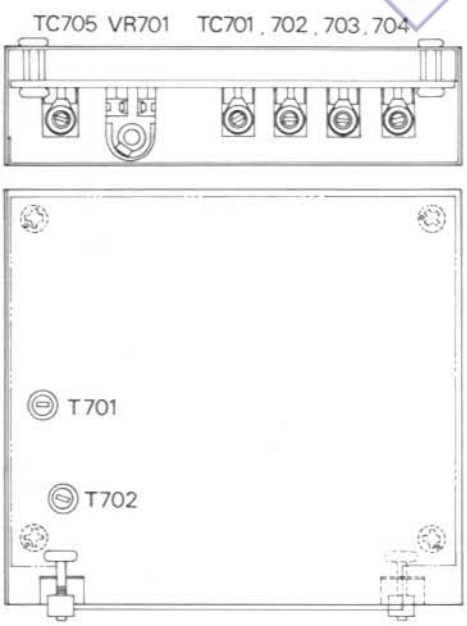
DC VOLTAGES (V)

		E(S)		C(D)		B(G_1)		(G_2)		
		R	T	R	T	R	T	R	T	
Q_{701}		0	0.2	0	14.3	0	0.6	—	—	
Q_{702}		0.7	0.7	6.2	6.2	0	0	—	—	
Q_{708}		2.2	2.2	6.2	6.2	2.9	2.9	—	—	
Q_{704}		0	1.4	0	7.4	0	3.2	0	2.5	
Q_{707}		0	0	0.4	0.4	0	0	—	—	AMGC OFF
		0	0	8.0	8.0	0	0	—	—	" ON
Q_{709}		0	0	0	0	0	0	—	—	" OFF
		0	0	0	0	0.6	0.6	—	—	" ON
Q_{710}		1.3	1.3	3.7	3.7	1.9	1.9	—	—	AM
			1	2	3	4	5	6	7	
Q_{705}	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	
Q_{706}	R		0.4	0	0	0	0	0	0.4	
	T		0.4	0	0	0	0	0	0.4	AMGC OFF
	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 ON

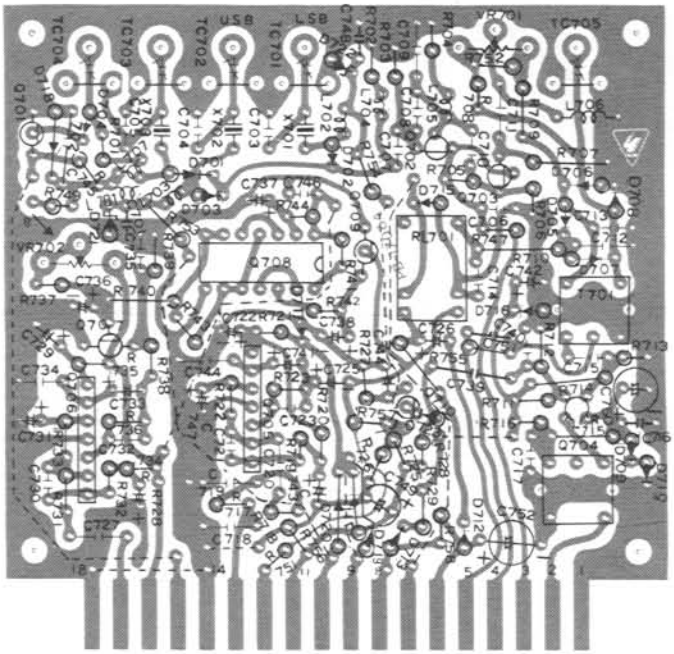
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Q_{708}	R	0.4	0	0.3	0	0.3	0.3	0	0.3	0.3	0	0.3	0	0.4	0	
	T	0.4	0	0.3	0	0.3	0.3	0	0.3	0.3	0	0.3	0	0.4	0	AMGC OFF
	R	8.2	0	8.2	0	8.2	8.2	0	7.5	7.5	0	8.2	0	7.4	8.2	
	T	8.2	0	8.2	0	8.2	8.2	0	7.5	7.5	0	8.2	0	7.4	8.2	AMGC ON

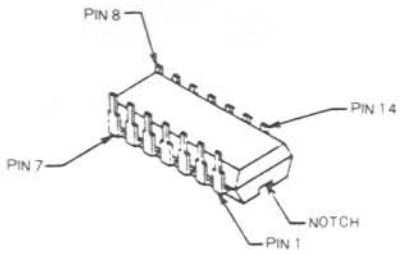
CARRIER UNIT PARTS LAYOUT



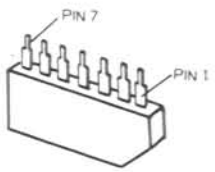


Viewed from component side



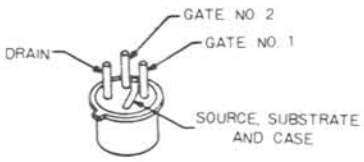


MC14011B

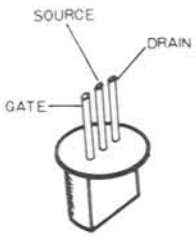


TA7063P

Viewed from solder side



3SK59Y



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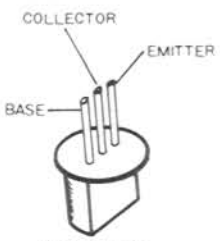
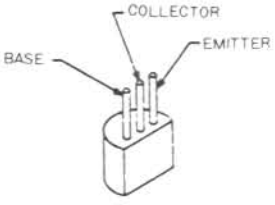


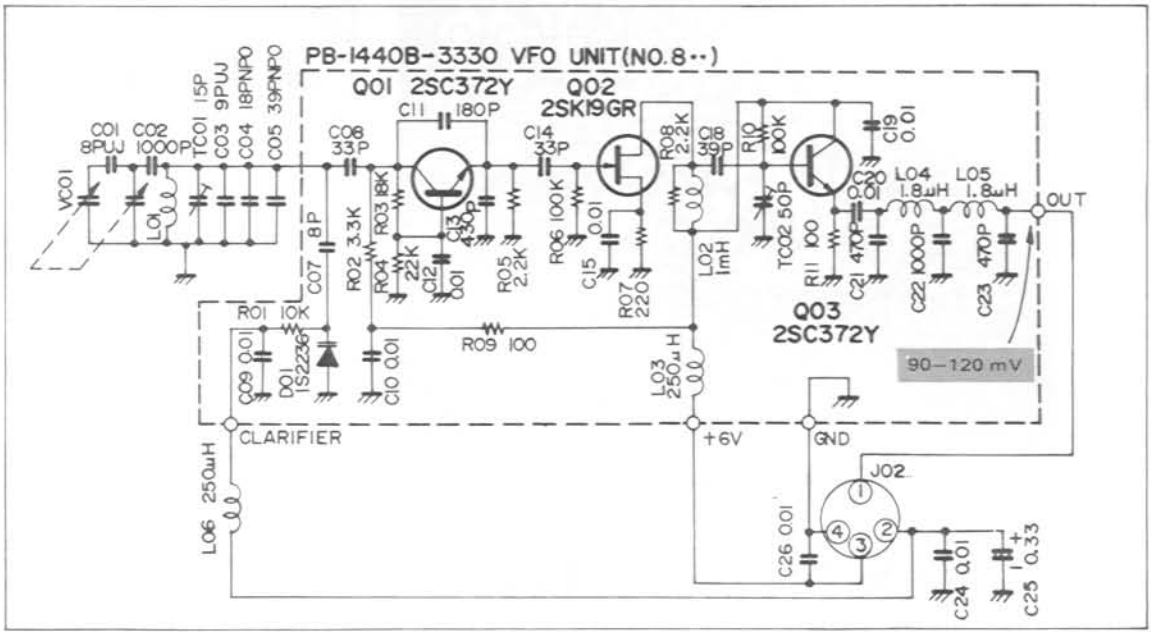
2SC372Y
2SC373
2SC1000GR

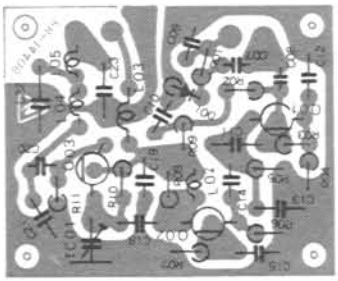


2SC1815Y

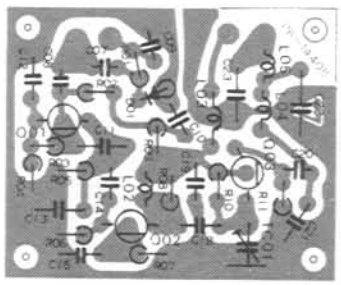
VFO ASSEMBLY

VFO BOARD (PB-1440B-3330)

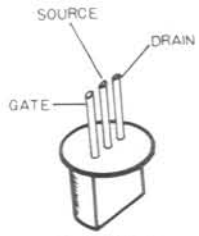




Viewed from component side



Viewed from solder side



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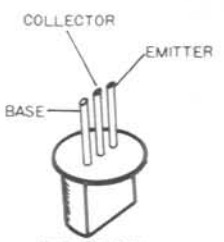
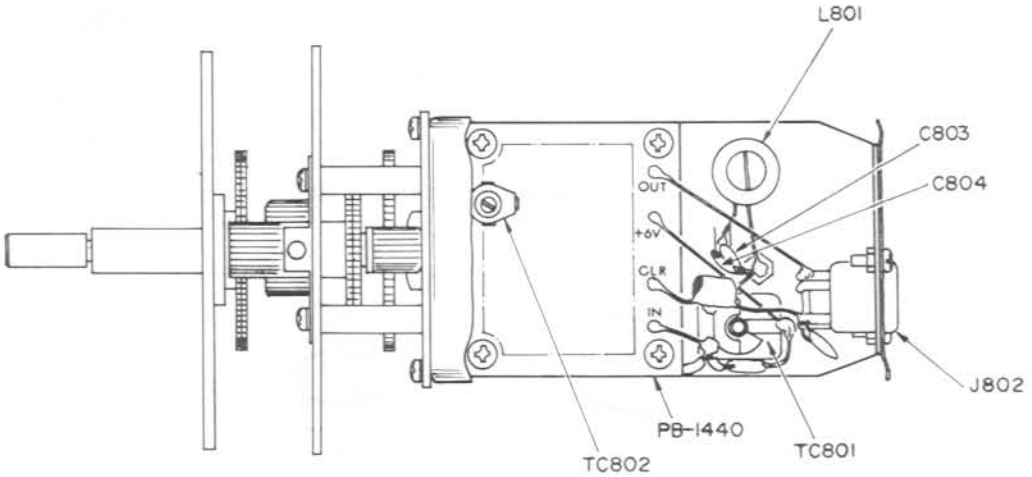


2SC372Y

DC VOLTAGES (V)

	E(S)		C(D)		B(G)	
	DC	RF	DC	RF	DC	RF
Q801	1.3	(120 mV)	3.8	(1.4 V)	2.0	–
Q802	0.7	–	6.2	(400 mV)	0	(100 mV)
Q803	0.8	(200 mV)	6.3	–	1.6	(200 mV)



VFO UNIT EXPLODED VIEW

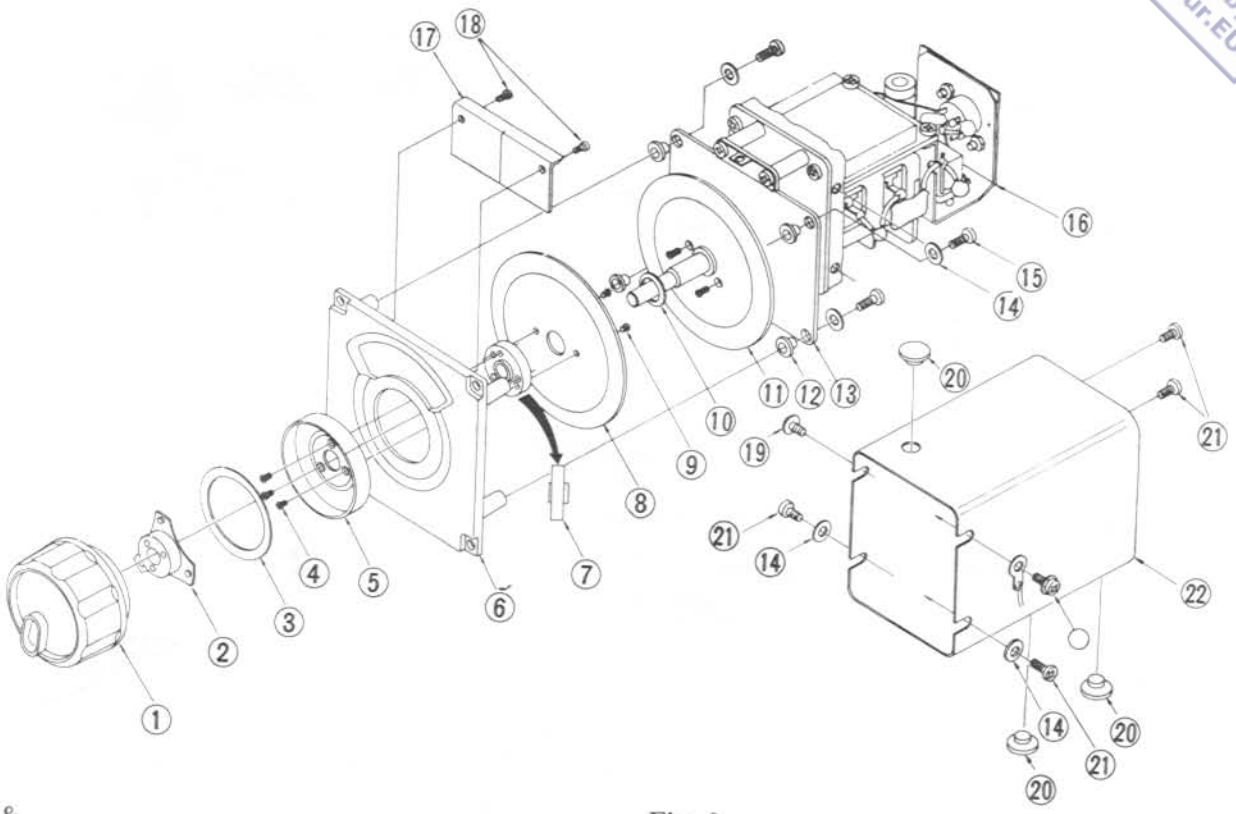
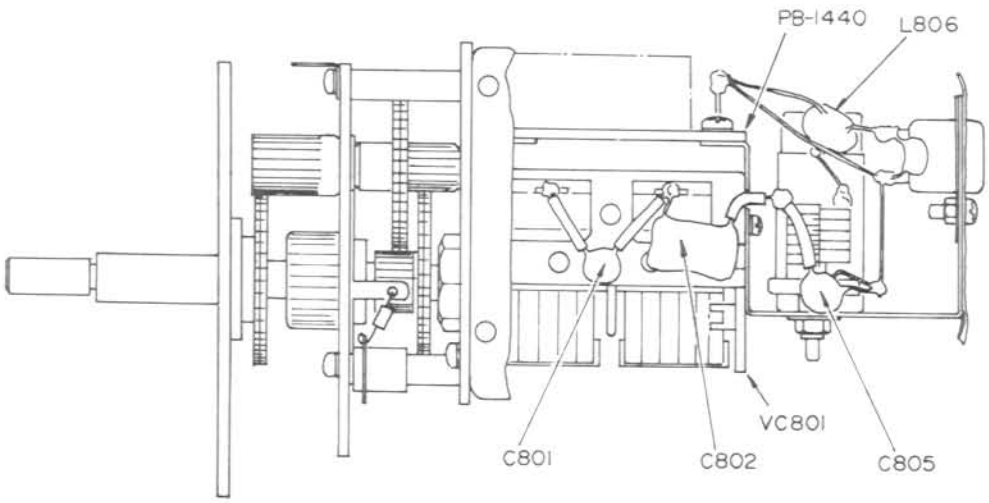
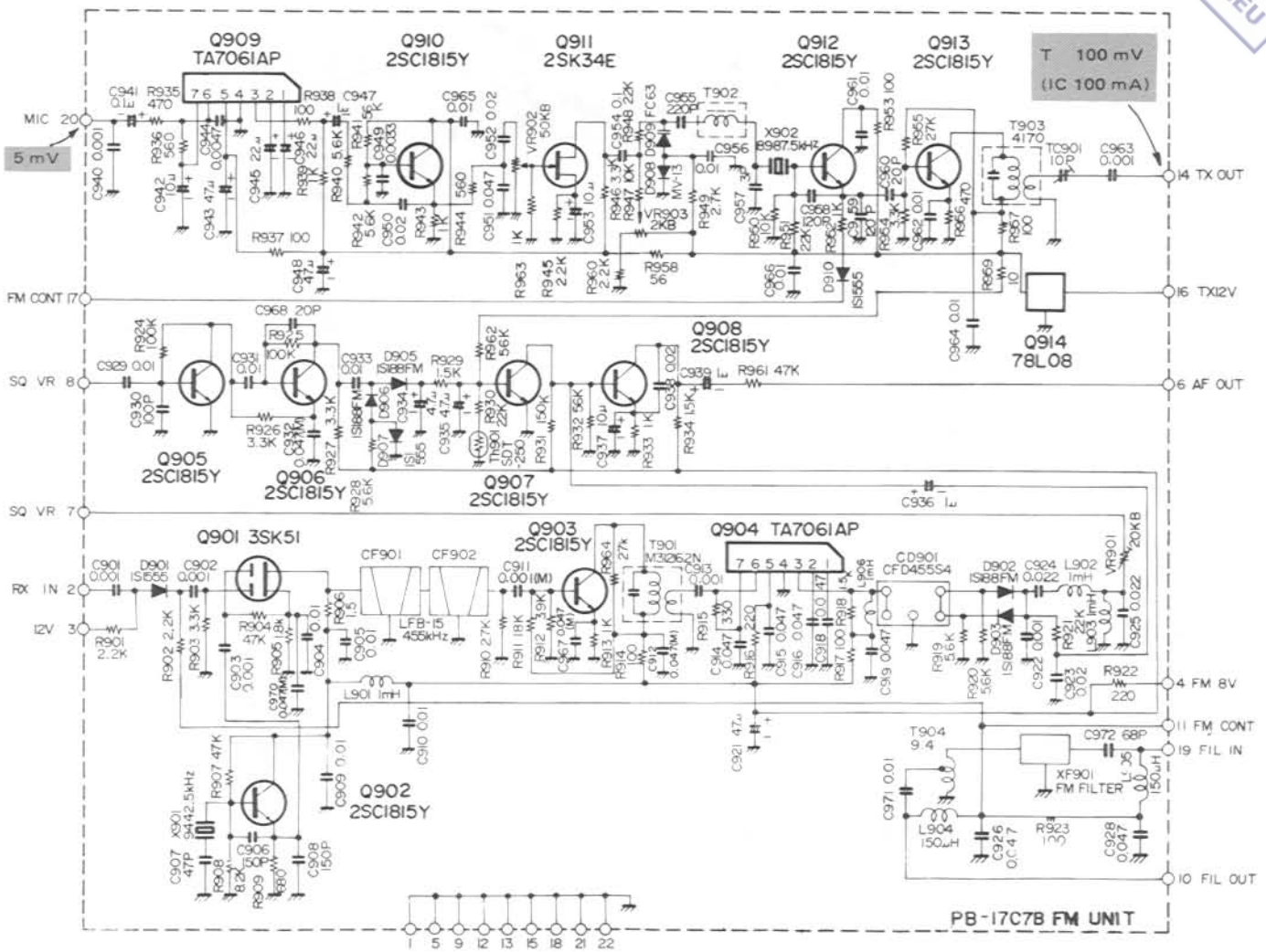


Fig. & Index No.	Q'ty	Name & Description
1-1	1	Knob : Tuning Set Screw: M4 x 6, mm, Steel
1-2	1	
1-3	1	Washer:
1-4	3	Screw: Flat Head, M2 x 4, mm, Steel
1-5	1	Calibration Ring
1-6	1	Escutcheon
1-7	1	Holder: Aluminum
1-8	1	Sub Dial
1-9	2	Screw: Flat Head, M2 x 4, mm, Steel
1-10	1	Washer: Flat, Steel
1-11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



FM UNIT (PB-1707B)



DC VOLTAGES (V)

	E(S)		C(D)		B(G1)		(G2)	
	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		

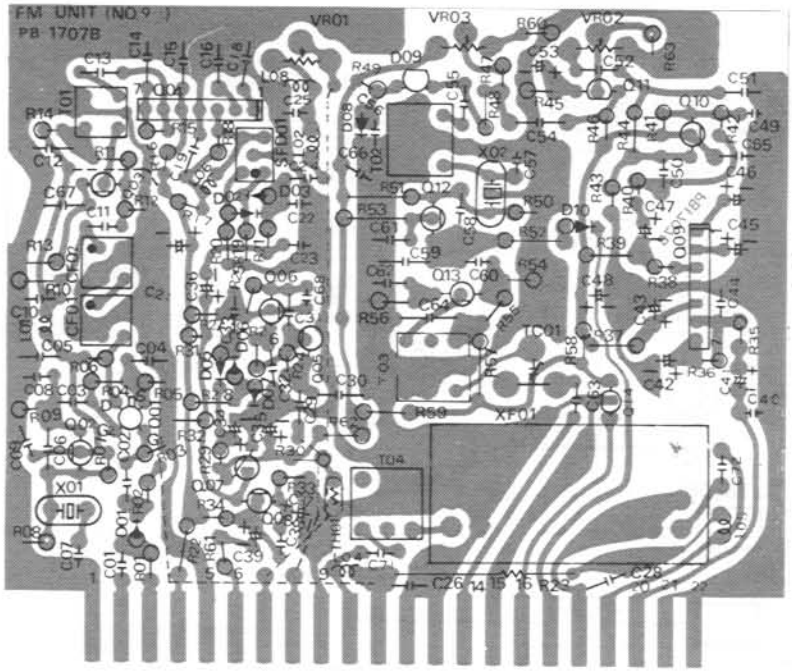
SQ: OFF
SQ: OFF

DC VOLTAGES (V)

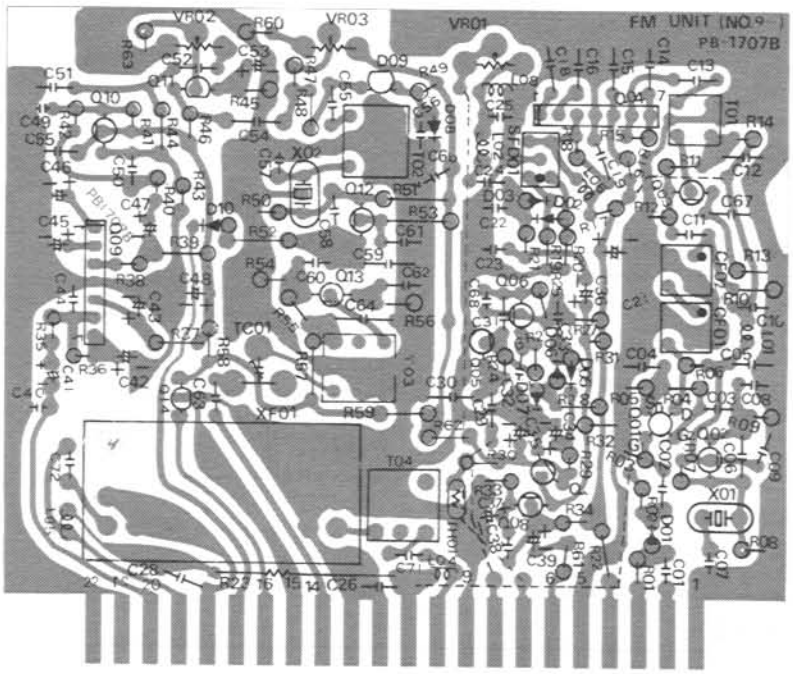
		1	2	3	4	5	6	7
Q904	R	1.6	1.6	5.6	0	4.5	1.6	1.6
	T	1.6	1.6	5.6	0	4.5	1.6	1.6
Q909	R	0	0	0	0	0	0	0
	T	1.8	1.9	4.4	0	6.4	1.9	1.9

		IN	OUT
Q914	R	0	0
	T	12.0	8.0

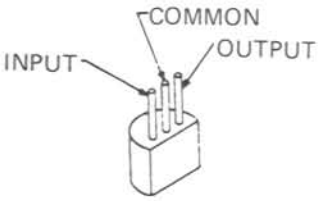
FM UNIT PARTS LAYOUT



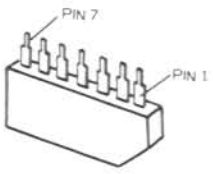
Viewed from component side



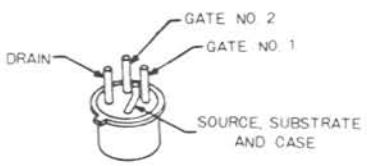
Viewed from solder side



78L08



TA7061P



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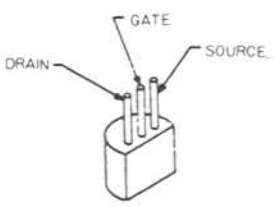
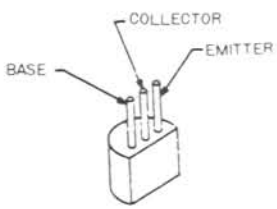
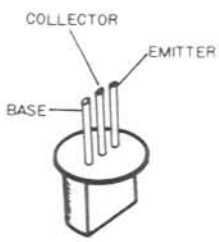
3SK51-03



2SK34E

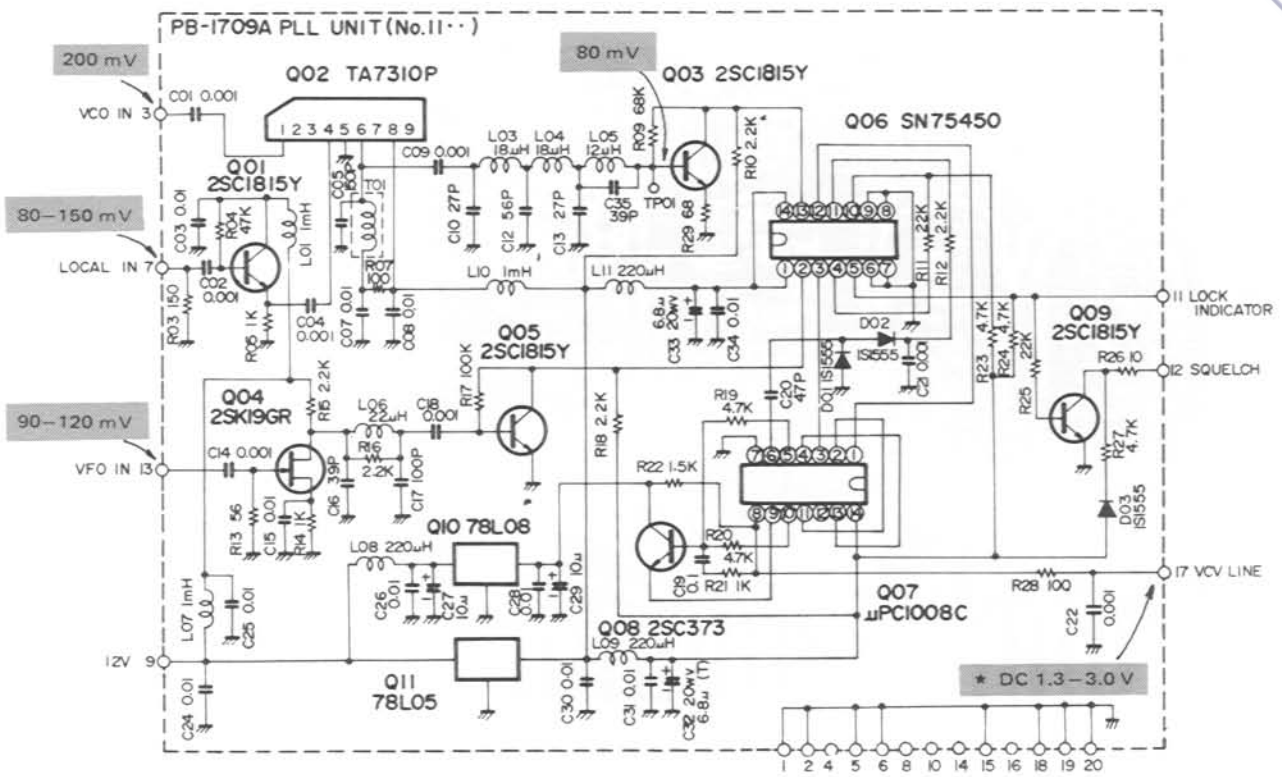


2SC1815Y



2SC372Y

PLL UNIT (PB-1709A)



DC VOLTAGES (V)

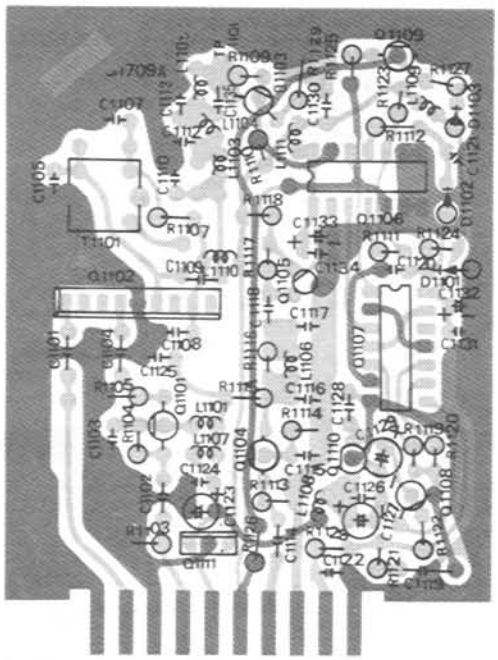
	E(S)		C(D)		B(G)	
	R	T	R	T	R	T
Q1101	8.4	8.4	11.1	11.1	9.0	9.0
Q1103	0.1	0.1	1.5	1.5	0.8	0.8
Q1104	2.0	2.0	6.7	6.7	0	0
Q1105	0	0	1.7	1.7	0.6	0.6
Q1108	1.3	1.3	8.0	8.0	1.8	1.8
Q1109	0	0	0	0	0.6	0.6

	IN	OUT
Q1110	11.2	8.0
Q1111	11.3	5.0

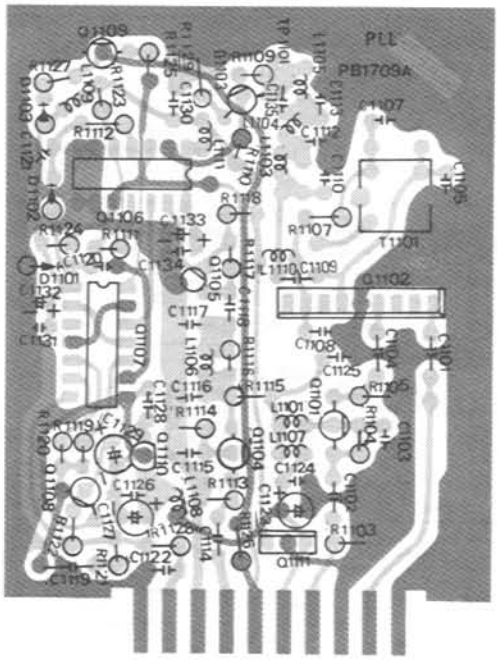
DC VOLTAGES (V)

		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

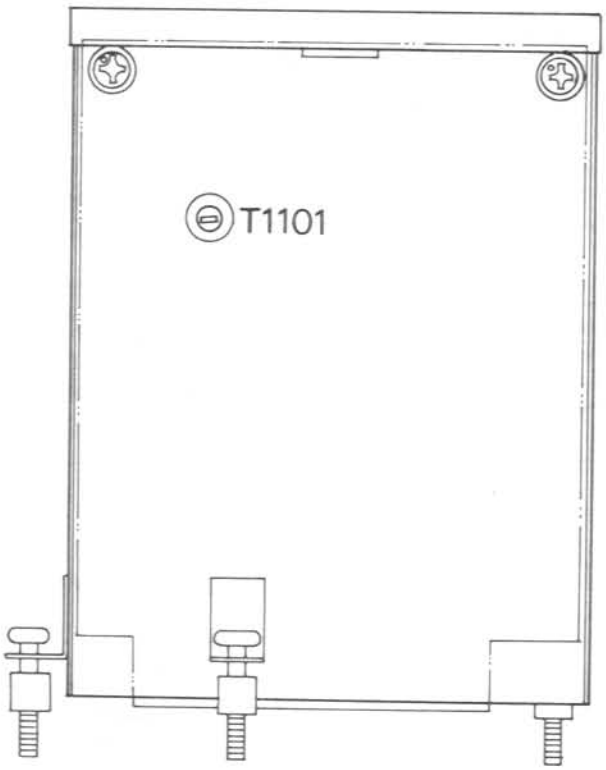
PLL UNIT PARTS LAYOUT

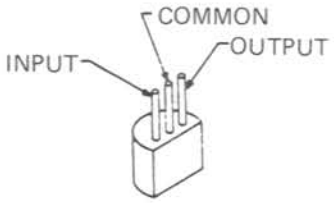


Viewed from component side

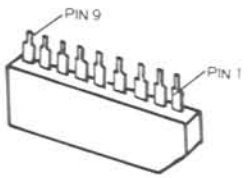


Viewed from solder side

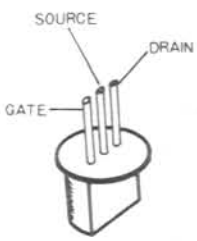




78L05
78L08



TA7310P



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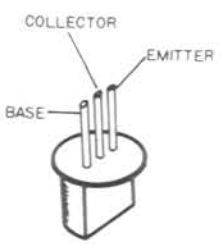

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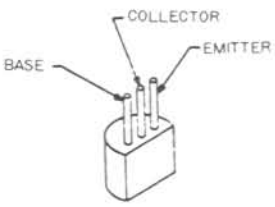

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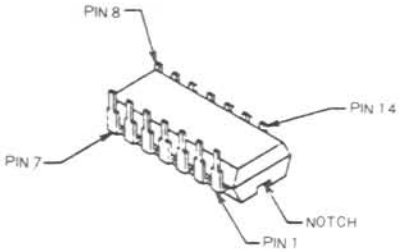
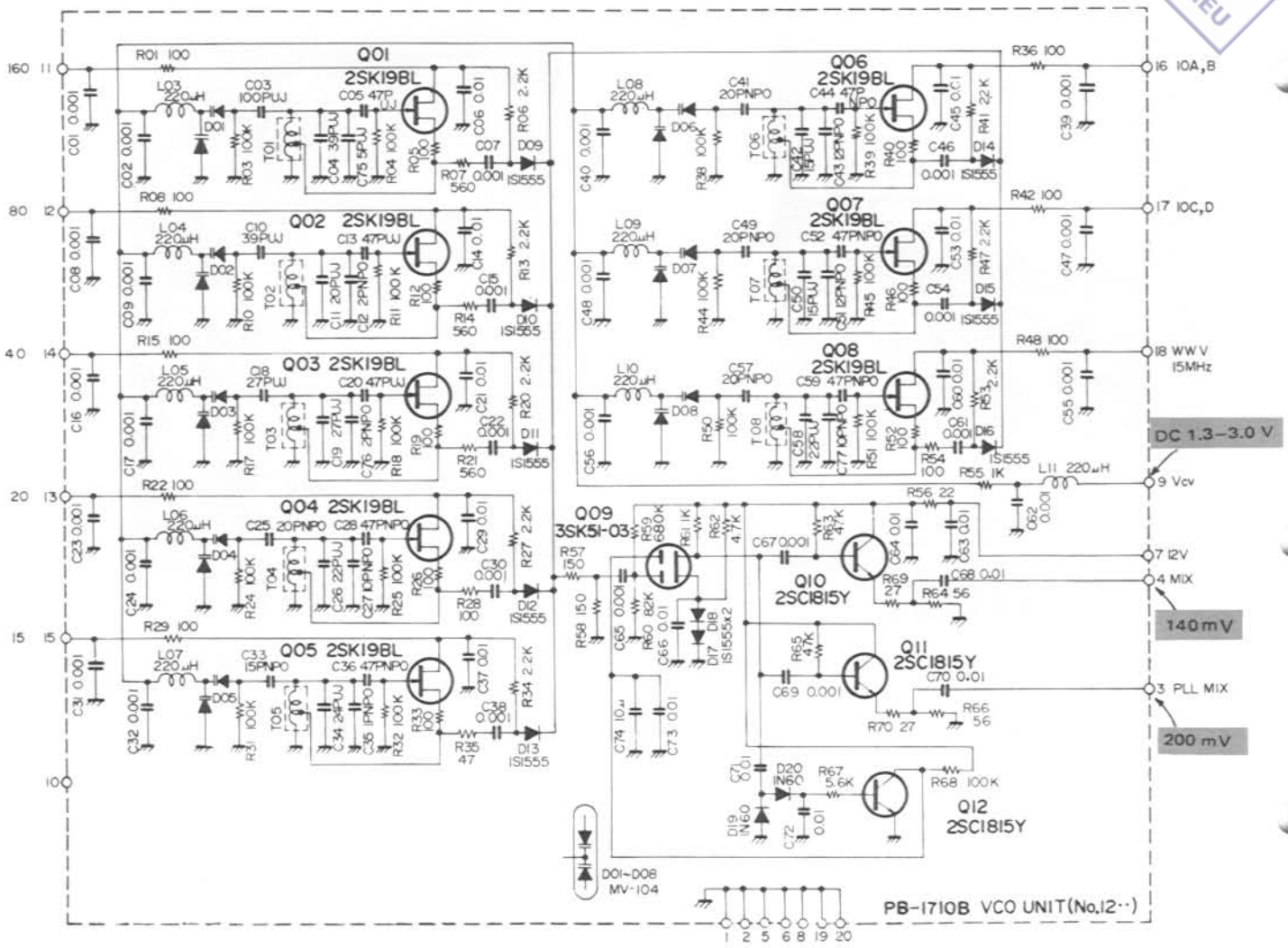


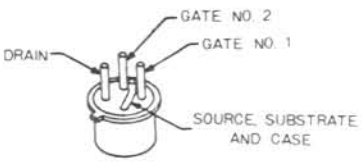
SN75450B
MC4044P
μPC1008C

VCO UNIT (PB-1710B)

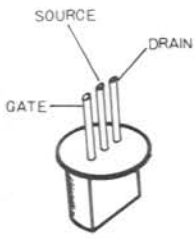


DC VOLTAGES (V)

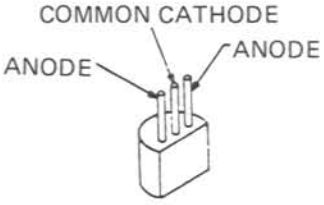
	E(S)		C(D)		B(G_1)		(G_2)	
	R	T	R	T	R	T	R	T
Q_{1201}	0.7	0.7	7.1	7.1	0	0	—	—
Q_{1202}	0.9	0.9	6.9	6.9	0	0	—	—
Q_{1203}	0.9	0.9	7.0	7.0	0	0	—	—
Q_{1204}	0.9	0.9	7.0	7.0	0	0	—	—
Q_{1205}	0.9	0.9	7.0	7.0	0	0	—	—
Q_{1206}	0.9	0.9	6.4	6.4	0	0	—	—
Q_{1207}	0.8	0.8	6.4	6.4	0	0	—	—
Q_{1208}	0.7	0.7	7.2	7.2	0	0	—	—
Q_{1209}	1.3	1.3	3.5	3.5	0.8	0.8	1.5	1.5
Q_{1210}	1.3	1.3	7.3	7.3	2.0	2.0	—	—
Q_{1211}	1.7	1.7	7.3	7.3	2.4	2.4	—	—
Q_{1212}	0	0	1.5	1.5	0.6	0.6	—	—



3SK40M
3SK51-03

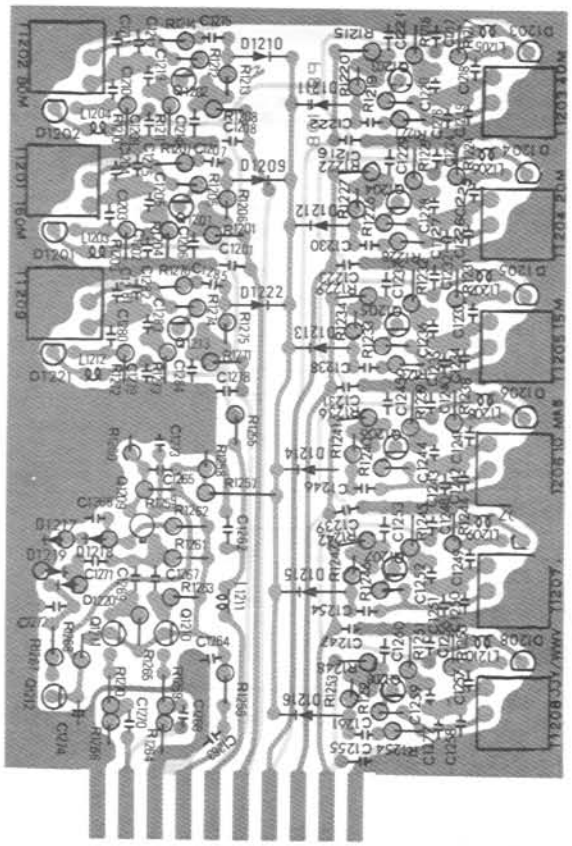


2SK19BL

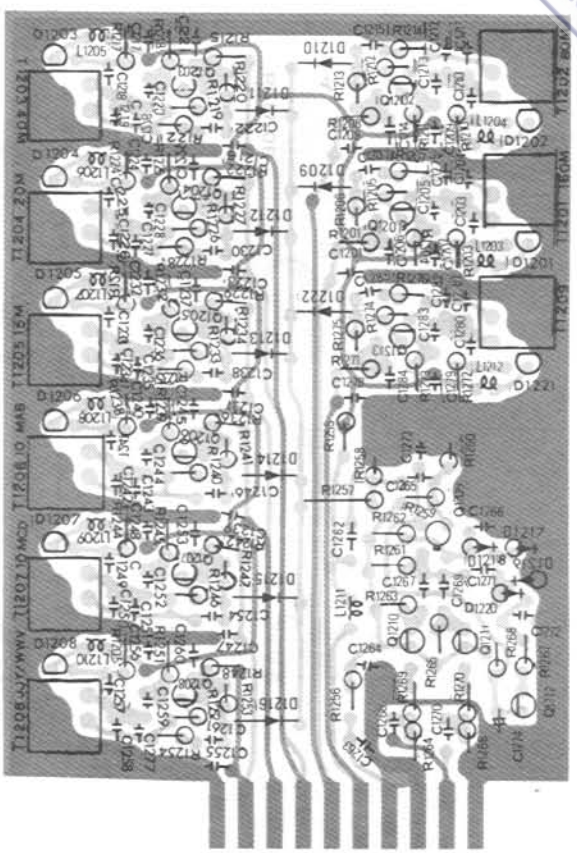


MV104

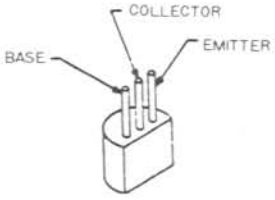
VCO UNIT PARTS LAYOUT



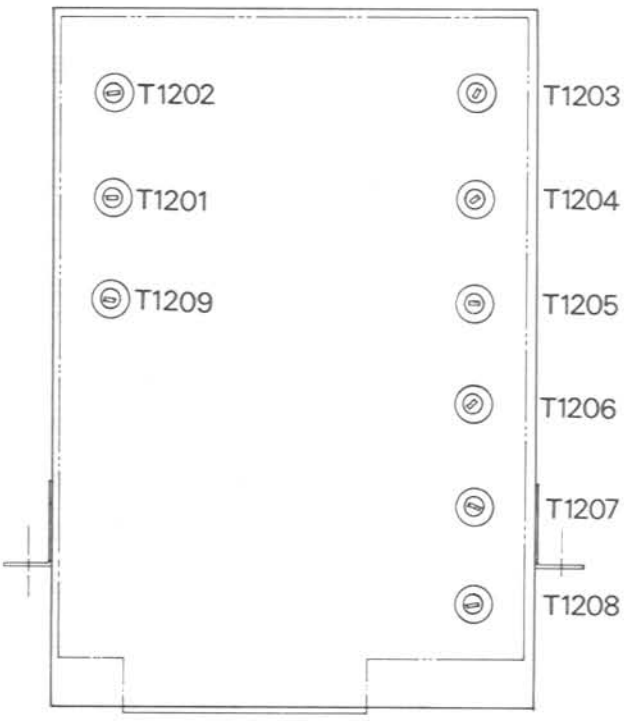
Viewed from component side



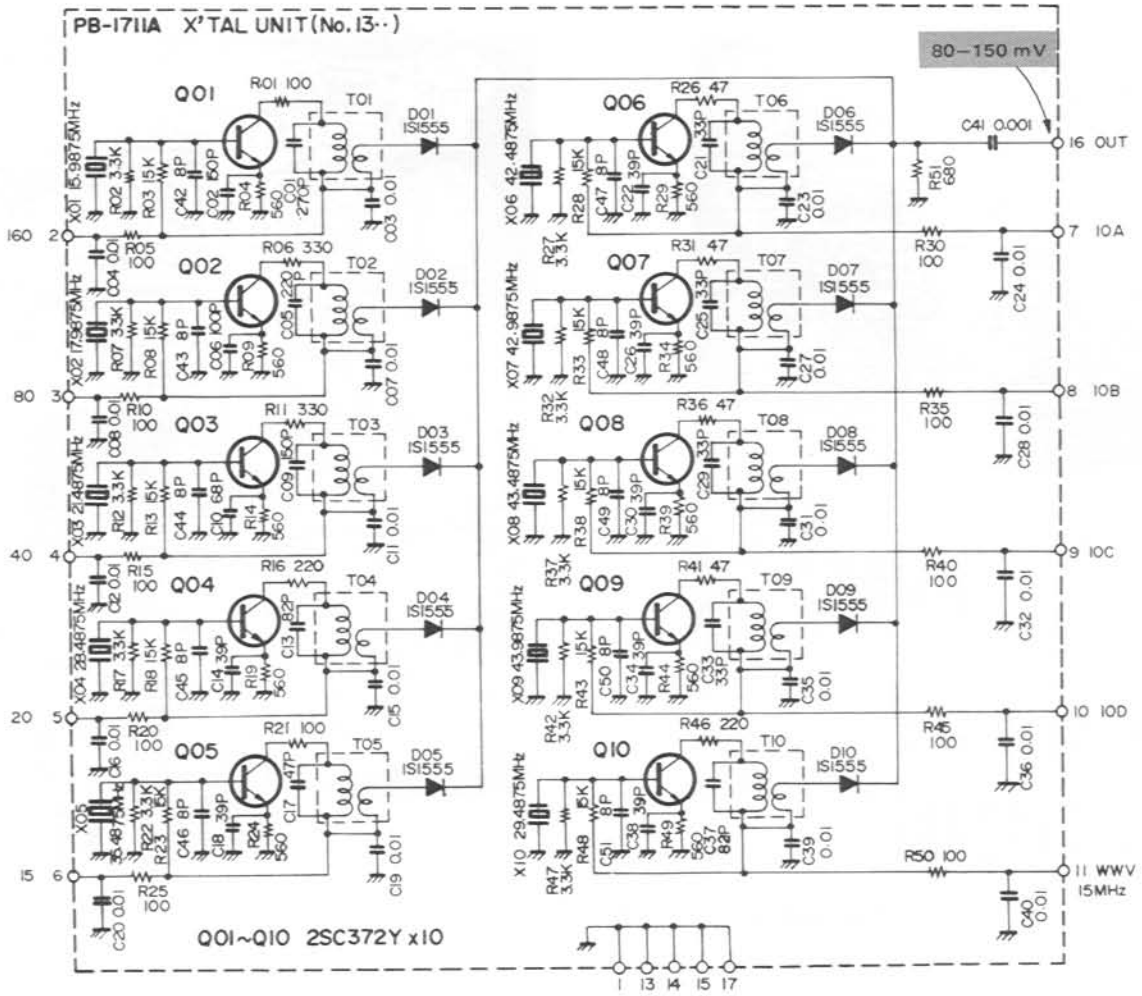
Viewed from solder side



2SC1815Y



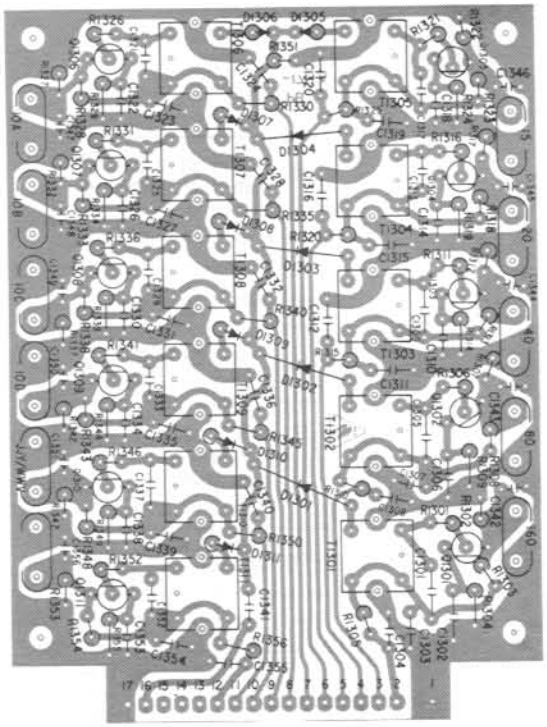
XTAL UNIT (PB-1711A)



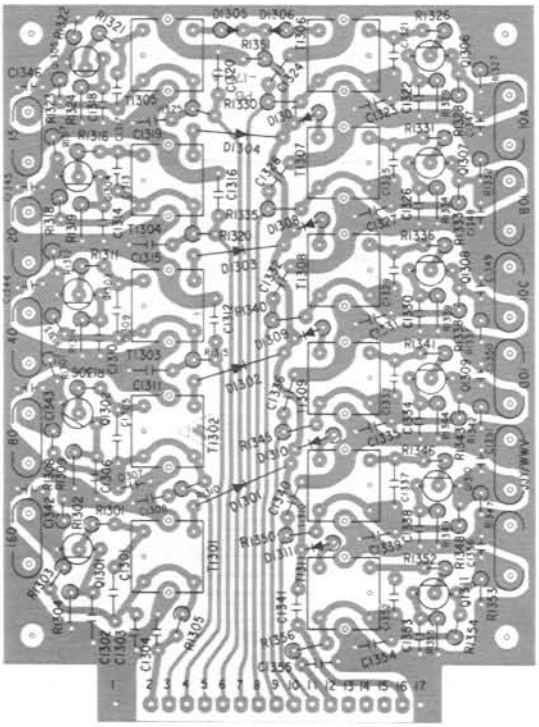
DC VOLTAGES (V)

	E		C		B	
	R	T	R	T	R	T
Q_{1301}	0.7	0.7	6.9	6.9	1.3	1.3
Q_{1302}	0.6	0.6	6.7	6.7	1.2	1.2
Q_{1303}	0.7	0.7	6.7	6.7	1.2	1.2
Q_{1304}	0.7	0.7	6.8	6.8	1.3	1.3
Q_{1305}	0.7	0.7	6.9	6.9	1.3	1.3
Q_{1306}	0.7	0.7	7.0	7.0	1.3	1.3
Q_{1307}	0.7	0.7	7.0	7.0	1.3	1.3
Q_{1308}	0.7	0.7	7.0	7.0	1.3	1.3
Q_{1309}	0.7	0.7	7.0	7.0	1.3	1.3
Q_{1310}	0.7	0.7	6.8	6.8	1.3	1.3

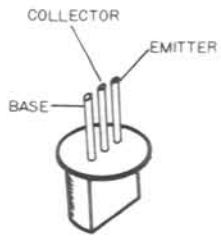
XTAL UNIT PARTS LAYOUT



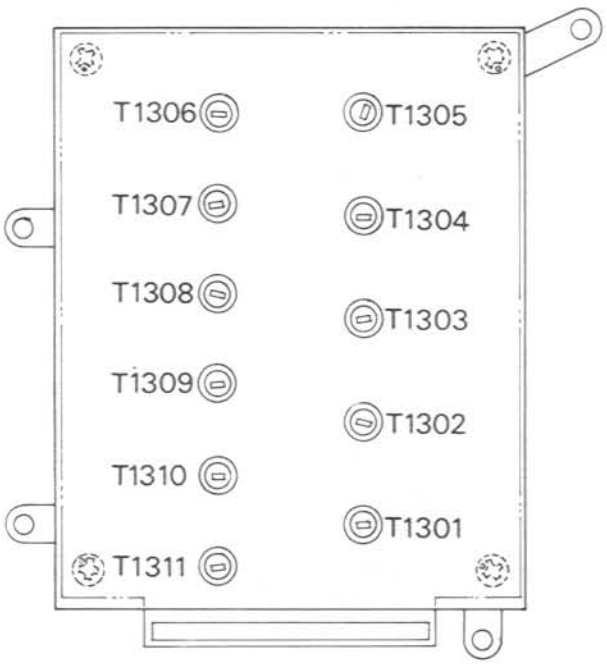
Viewed from component side



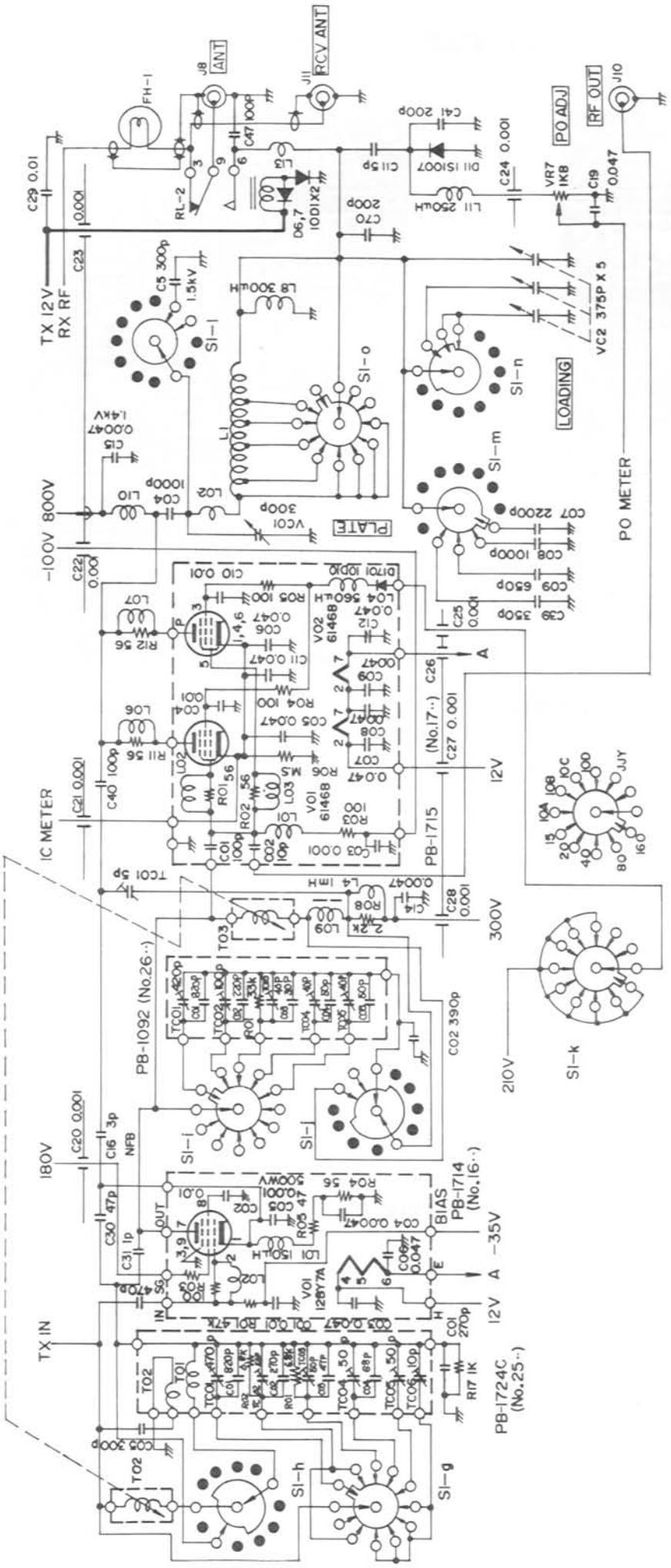
Viewed from solder side



2SC372Y



DRIVER/FINAL AMPLIFIER STAGES



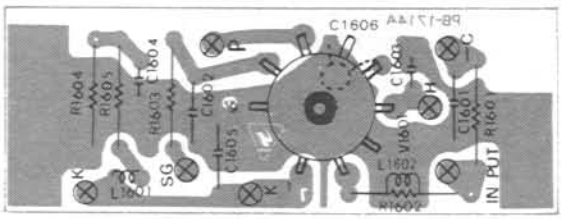
VOLTAGES AT SOCKET (V)

		1	2	3	4	5	6	7	8
V_{1701} 6146B	R	0	AC 6.5	264	0	-130	0	0	973
	T	0.1	AC 6.5	245	0.1	-65	0.1	0	922
V_{1702} 6146B	R	0	AC 13	264	0	-130	0	AC 6.5	973
	T	0.1	AC 13	245	0.1	-65	0.1	AC 6.5	922

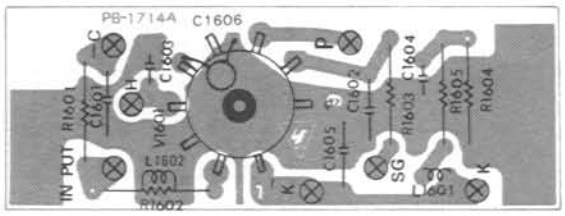
VOLTAGES AT SOCKET (V)

		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)

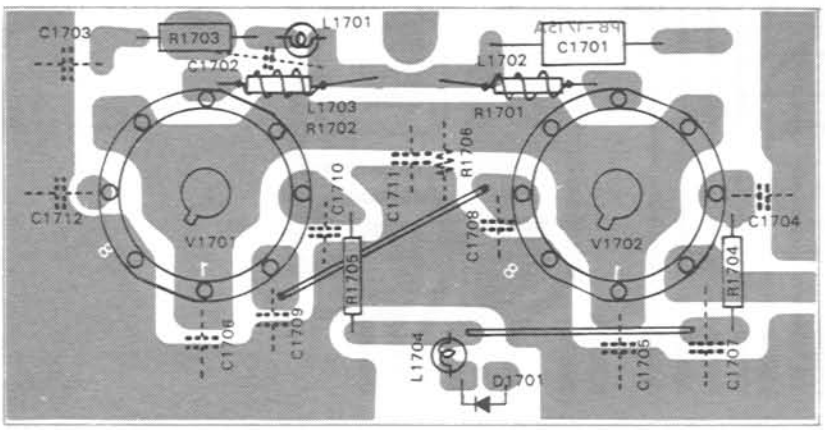


Viewed from component side

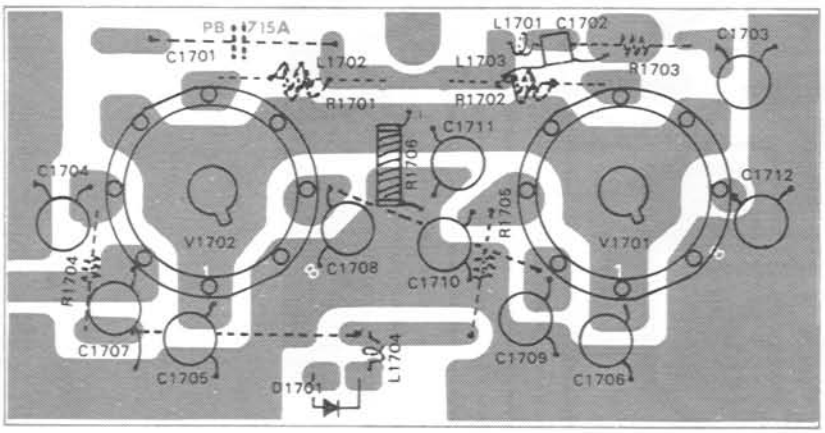


Viewed from solder side

FINAL BOARD (PB-1715A)

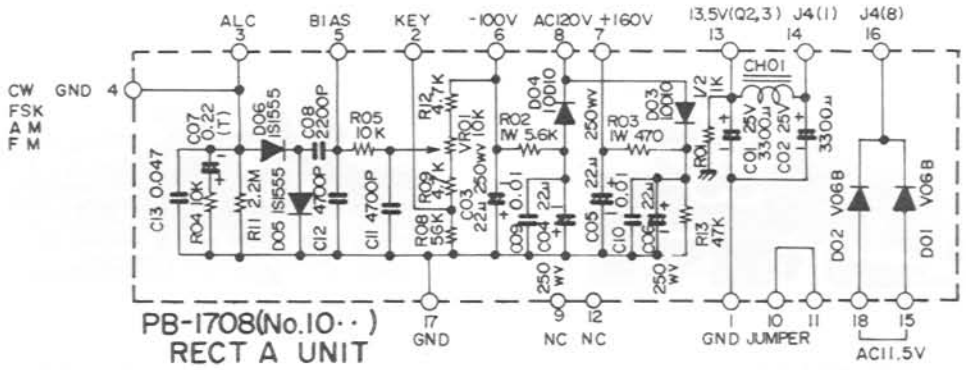


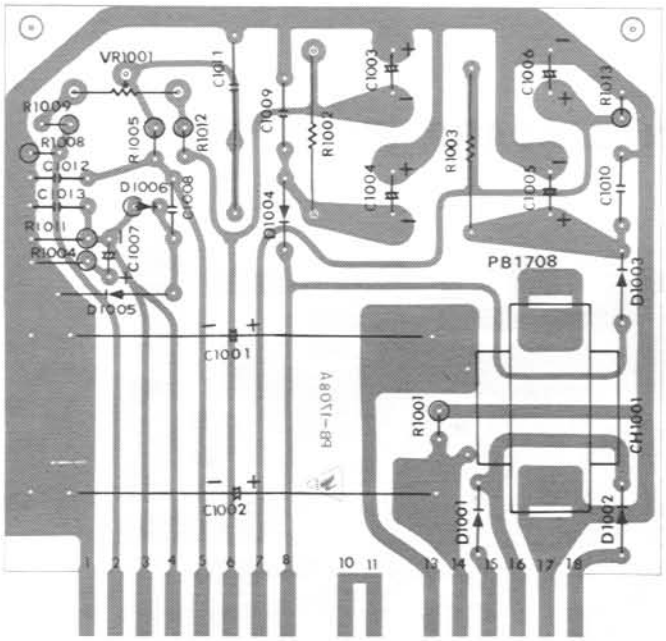
Viewed from component side

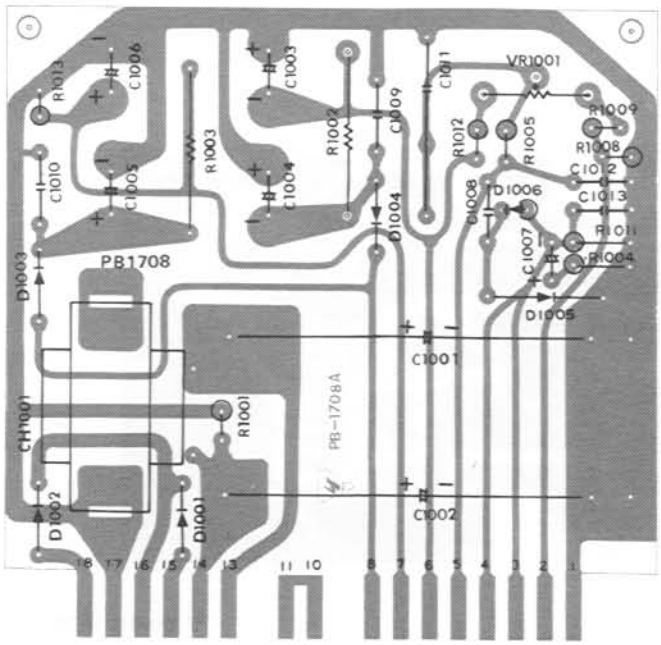


Viewed from solder side

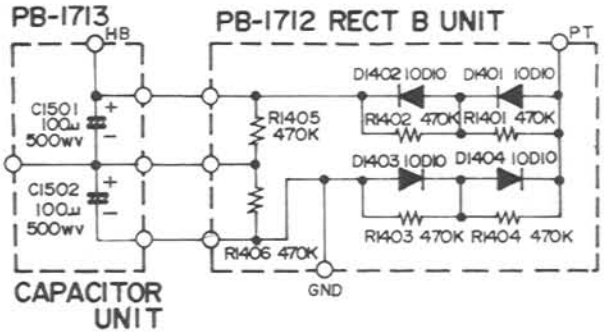
RECT A UNIT (PB-1708A)

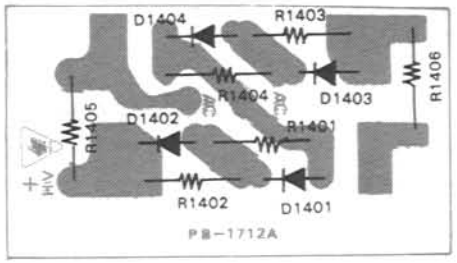




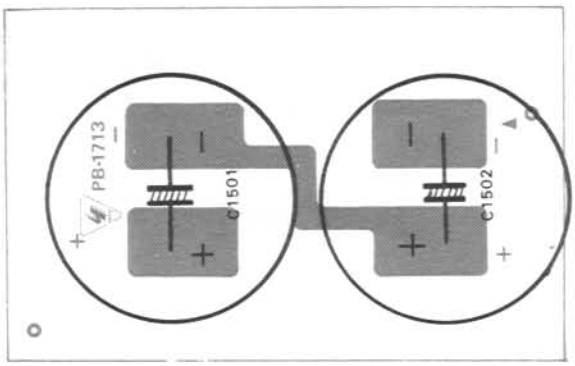


RECT B BOARD/CAPACITOR BOARD

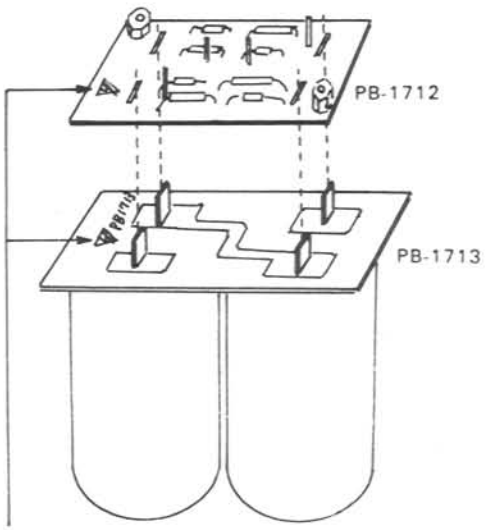




Viewed from component side

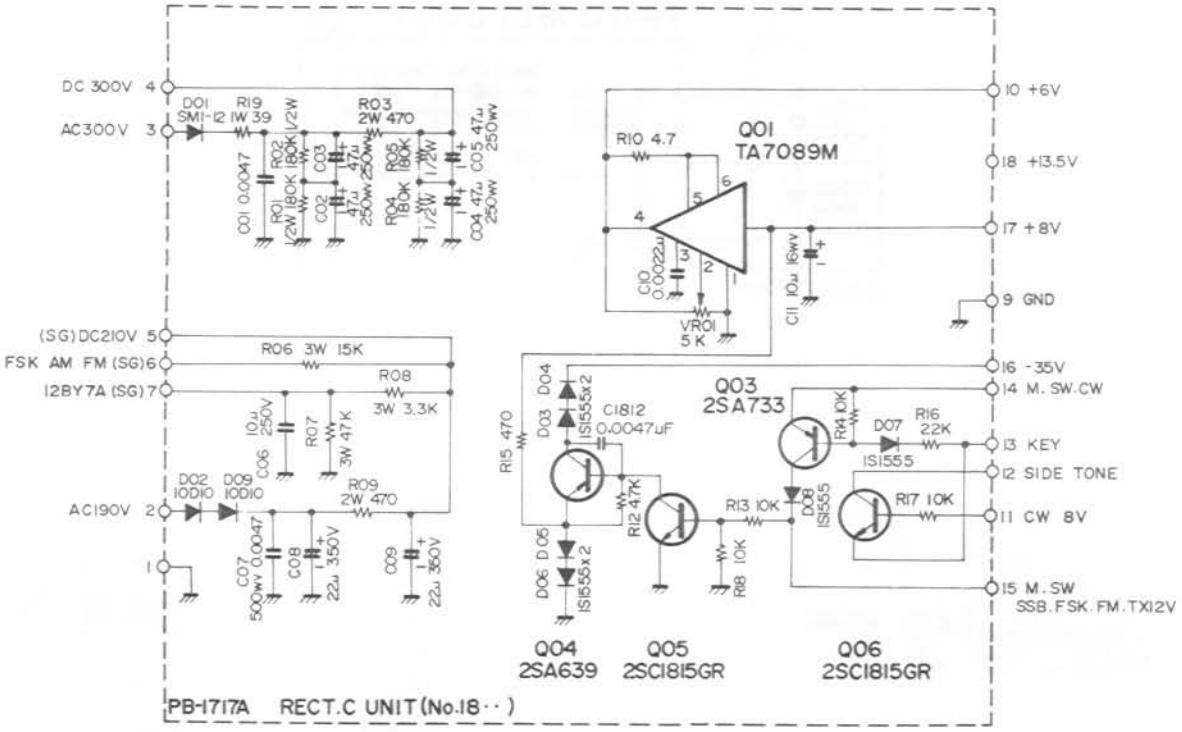


Viewed from solder side



Please align with YAESU emblems together.

RECT C UNIT (PB-1717A)

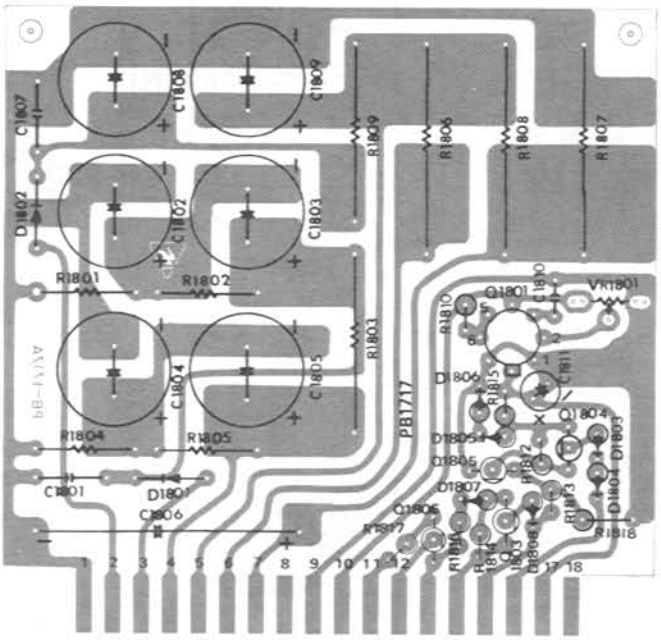


DC VOLTAGES (V)

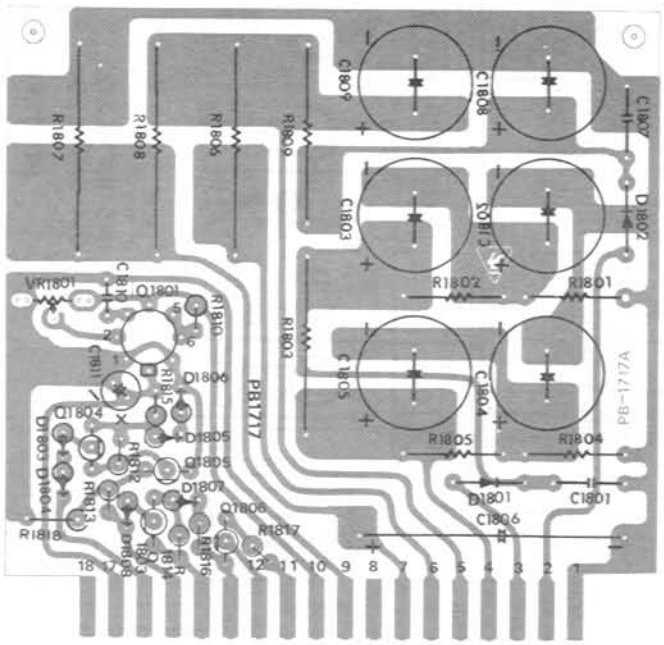
	E		C		B		
	R	T	R	T	R	T	
Q1803	0	0.1	−0.1	0	0	0.1	
Q1804	1.5	0.8	−88.8	0.6	1.5	0	SSB
Q1805	0	0	1.5	0	0	0.7	
Q1806	7.6	11.6	7.8	7.8	8.2	8.2	CW
	0	0	0	0	0.7	0.7	KEY DOWN

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

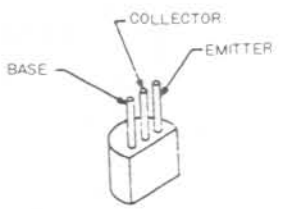
RECT C UNIT PARTS LAYOUT



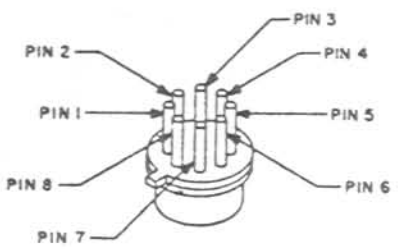
Viewed from component side



Viewed from solder side

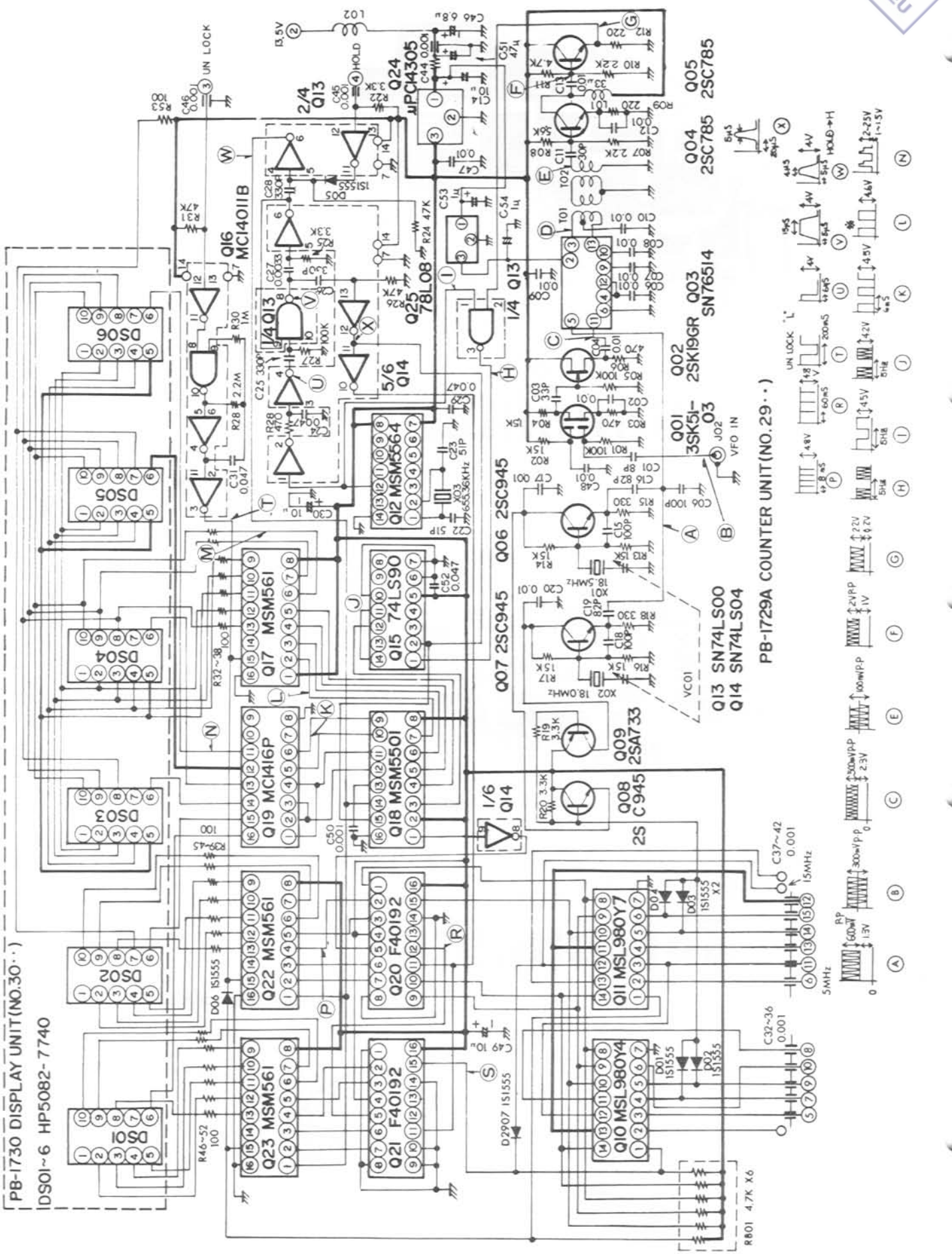


2SA639
2SC1815GR
2SA733

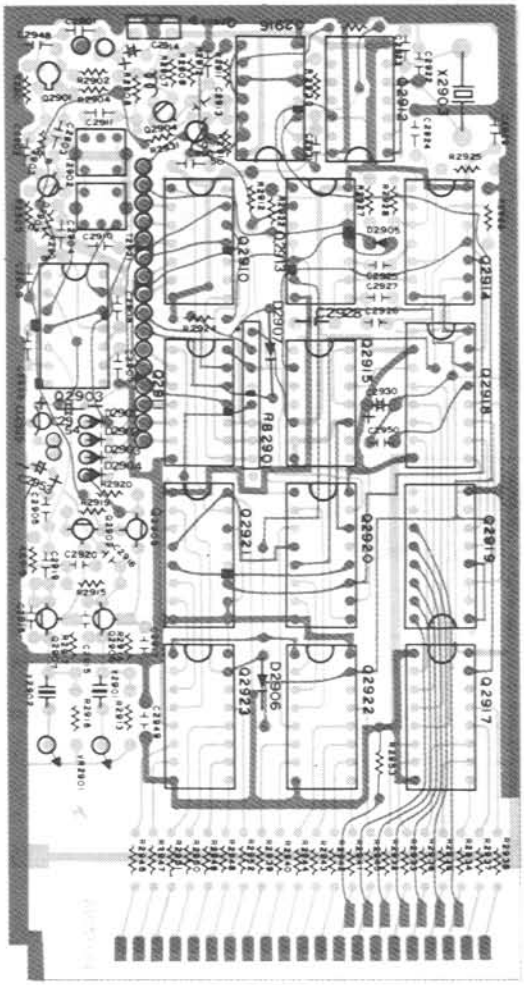


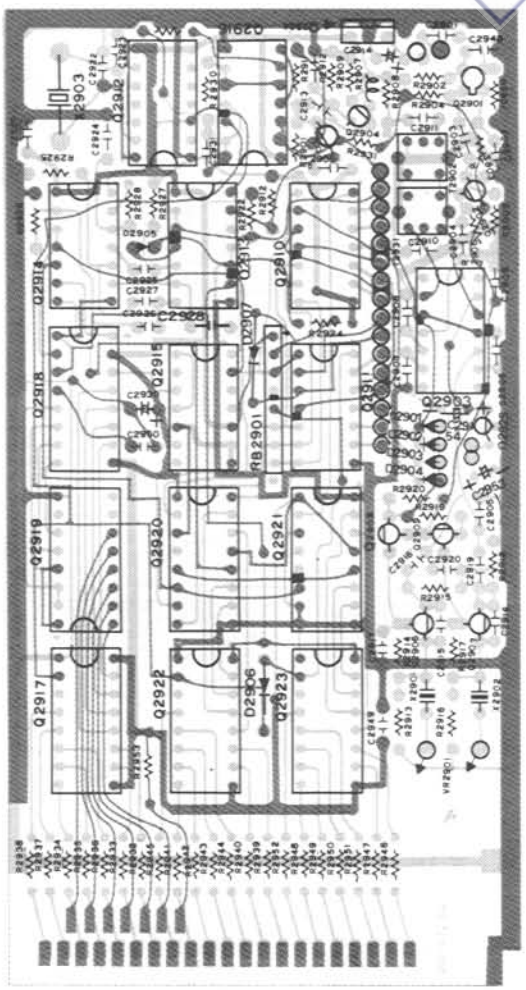
TA7089M

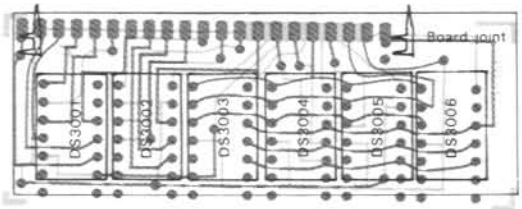
COUNTER (PB-1729A)/DISPLAY (PB-1730) UNIT

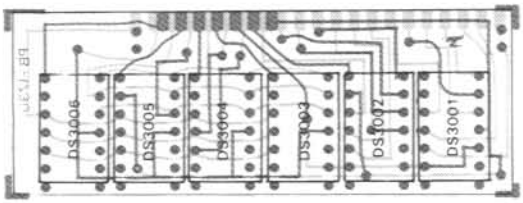


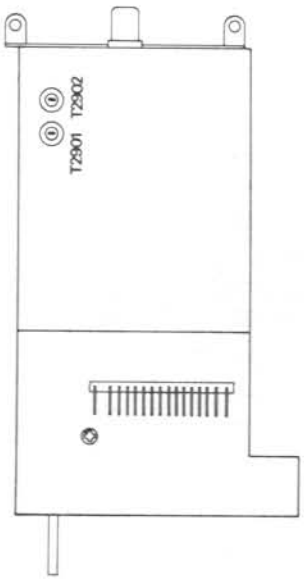
COUNTER/DISPLAY UNIT PARTS LAYOUT

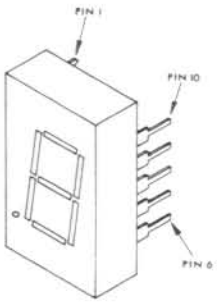








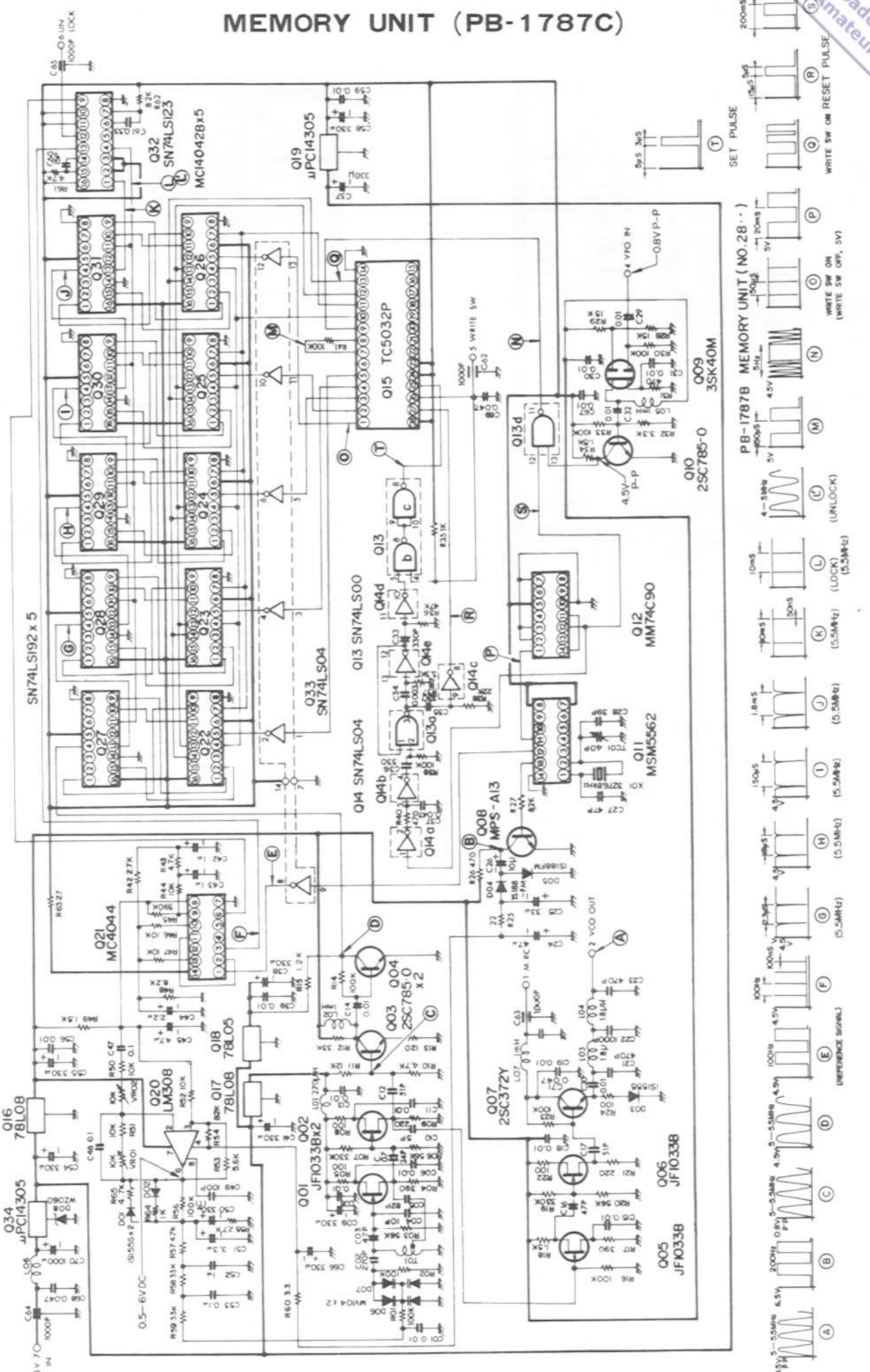




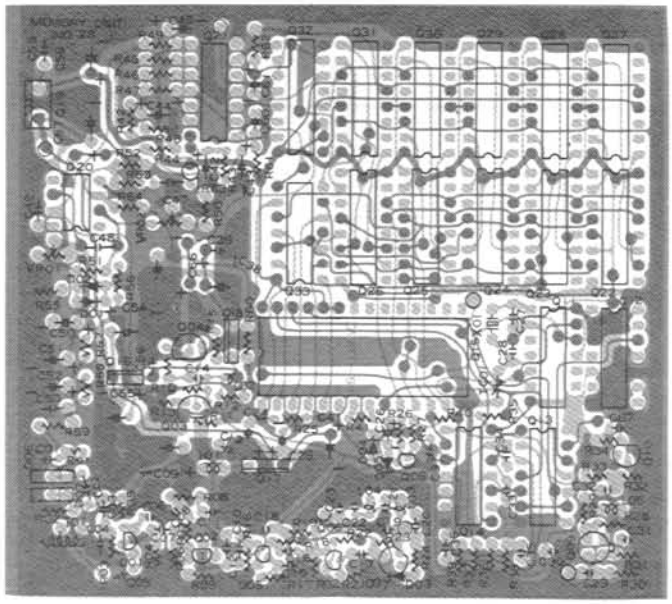
HP5082-7740

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

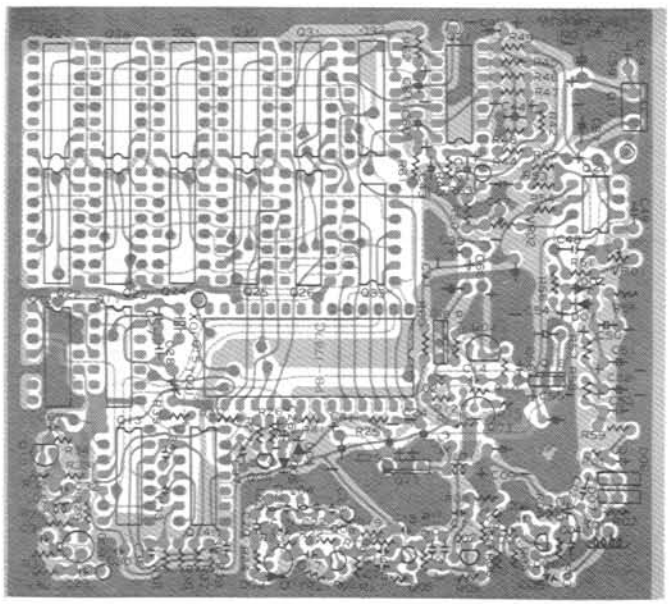
MEMORY UNIT (PB-1787C)



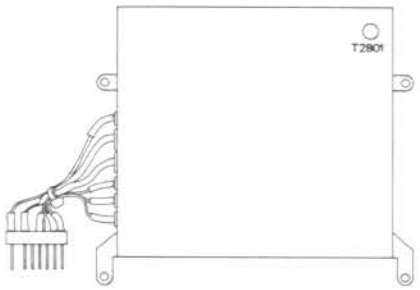
MEMORY UNIT PARTS LAYOUT

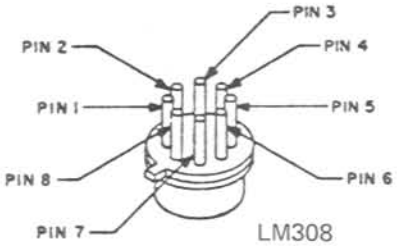


Viewed from component side

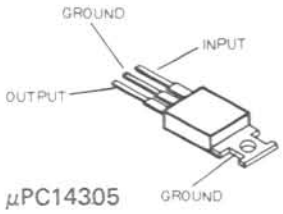


Viewed from component side

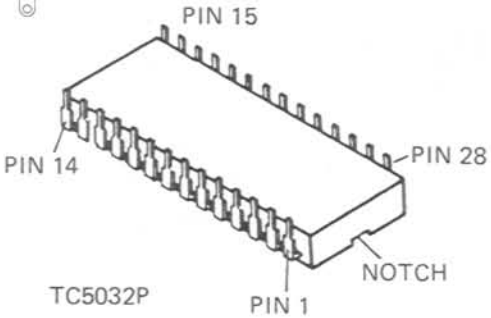




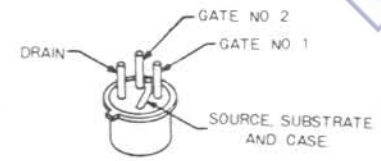
LM308



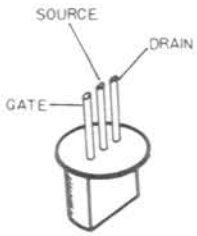
μPC14305



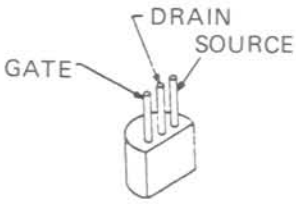
TC5032P



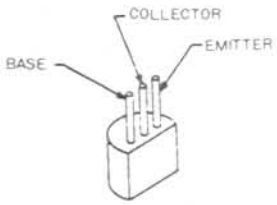
3SK40M
3SK51-03



2SK19GR



JF1033B



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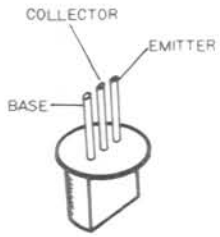
2SA733



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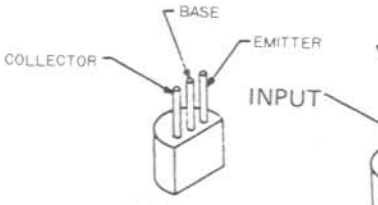
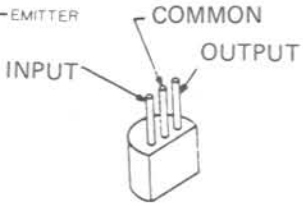
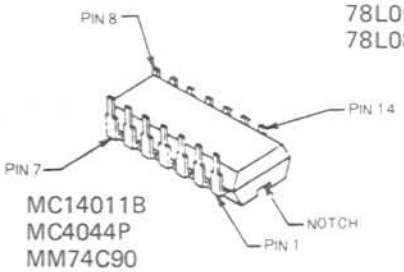


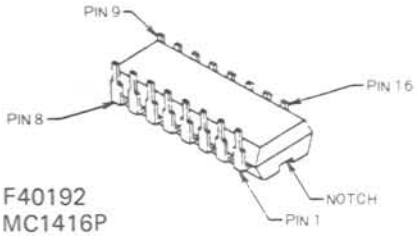
MPSA13



78L05
78L08

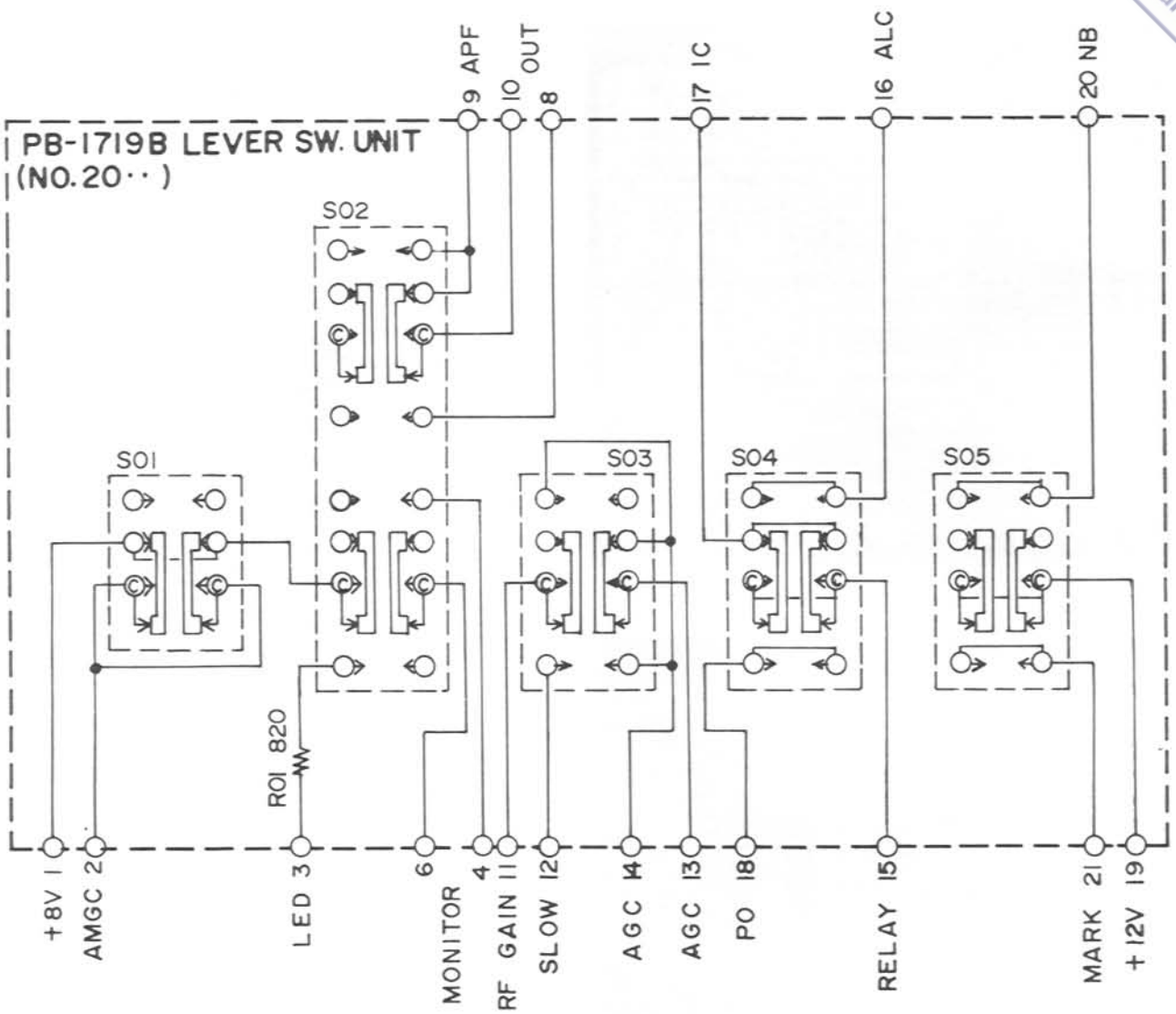


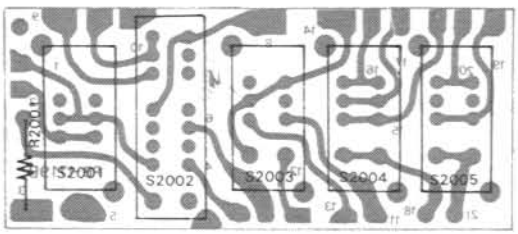
MC14011B
MC4044P
MM74C90
MSM5562
MSM5564
SN74LS00N
SN74LS04N
SN74LS90N
SN76514N
MSL980Y4
MSL980Y7



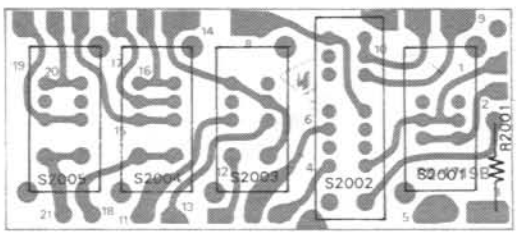
F40192
MC1416P
MC14042B
MSM561
MSM5501
SN74LS123N
SN74LS192N

LEVER SWITCH BOARD (PB-1719B)



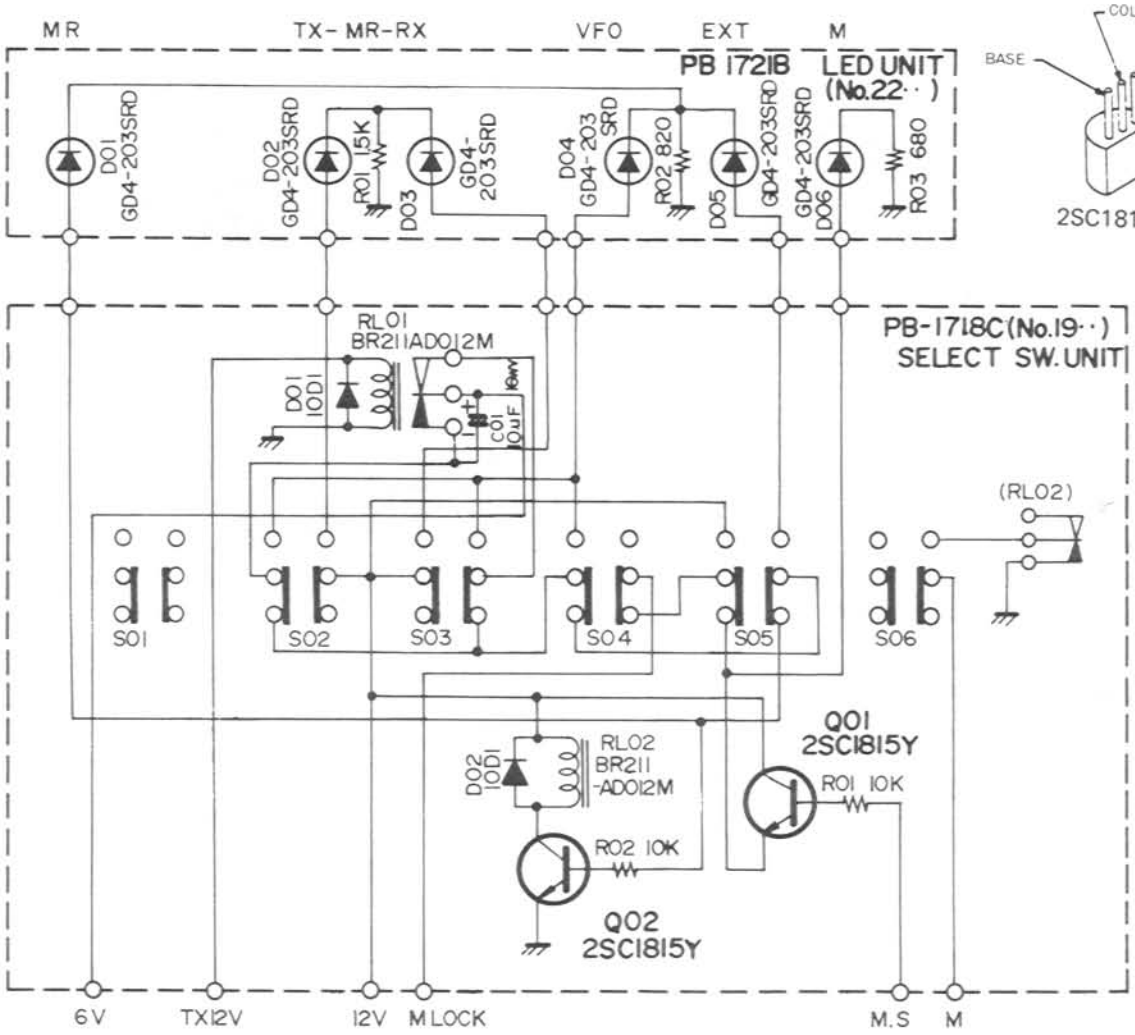


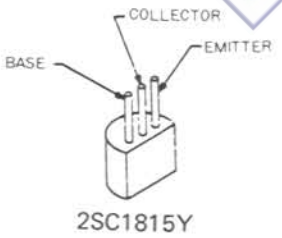
Viewed from component side



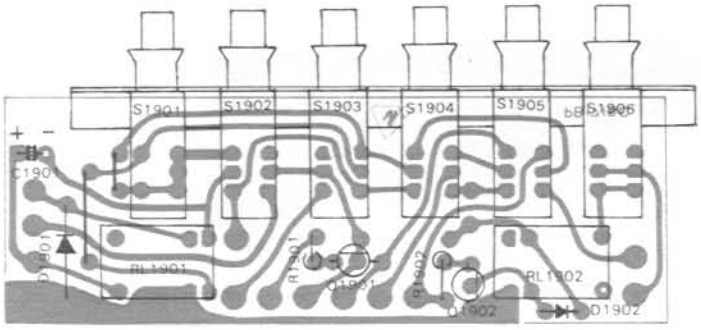
Viewed from solder side

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

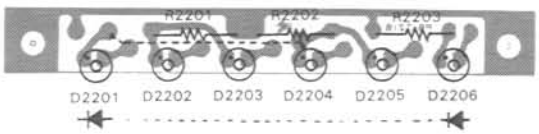




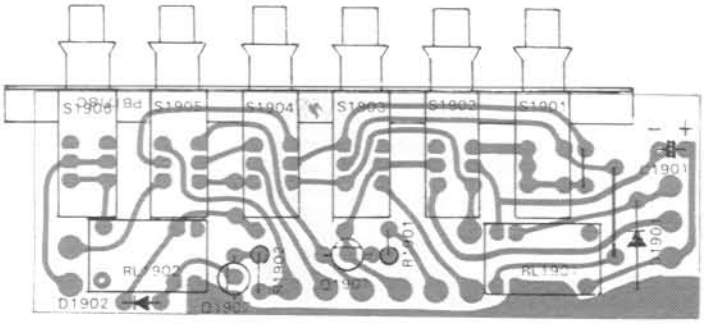
	E	C	B	
Q1901	3.2	12	3.9	M ON
	0	12	0	M OFF
Q1902	0	0.2	0.8	MR ON
	0	12	0	MR OFF



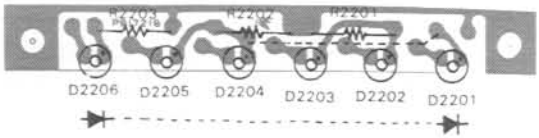
Viewed from component side



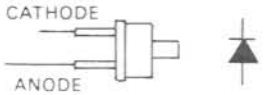
Viewed from component side



Viewed from solder side

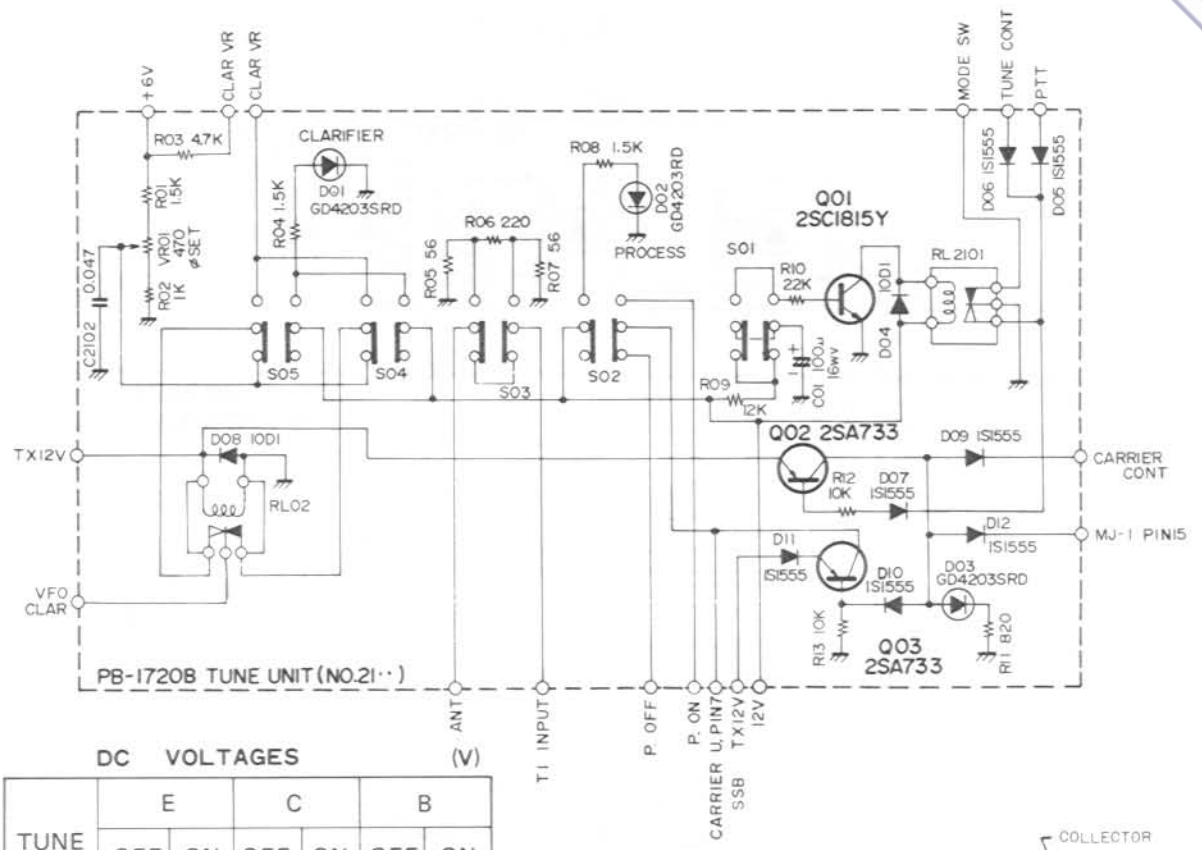


Viewed from solder side



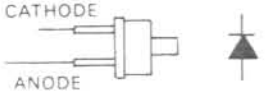
LED Connection

TUNE SWITCH BOARD (PB-1720B)

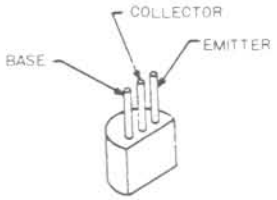


DC VOLTAGES (V)

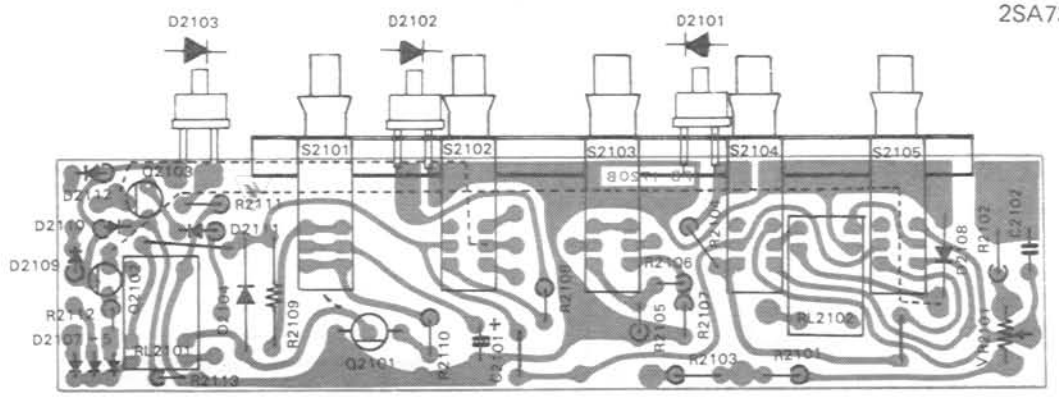
TUNE SW	E		C		B	
	OFF	ON	OFF	ON	OFF	ON
Q2101	0	0	12.0	0.4	0	0.7
Q2102	0	12.0	0	11.7	0.1	11.2
Q2103	0	11.6	0	0	0	11.1



LED Connection

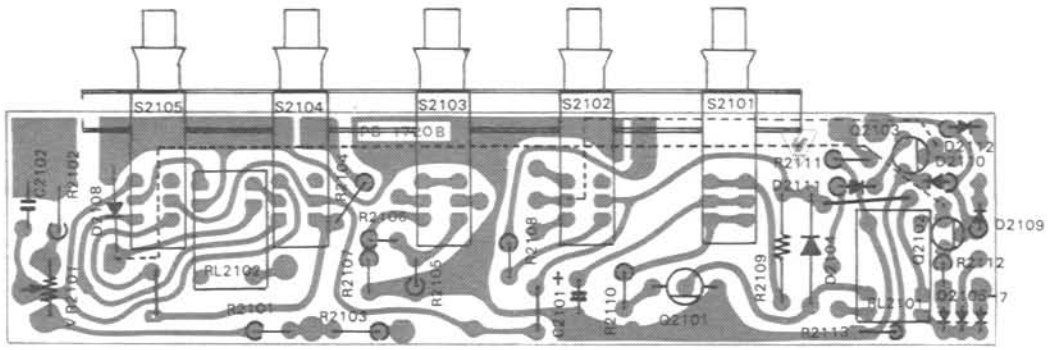


2SC1815Y
2SA733



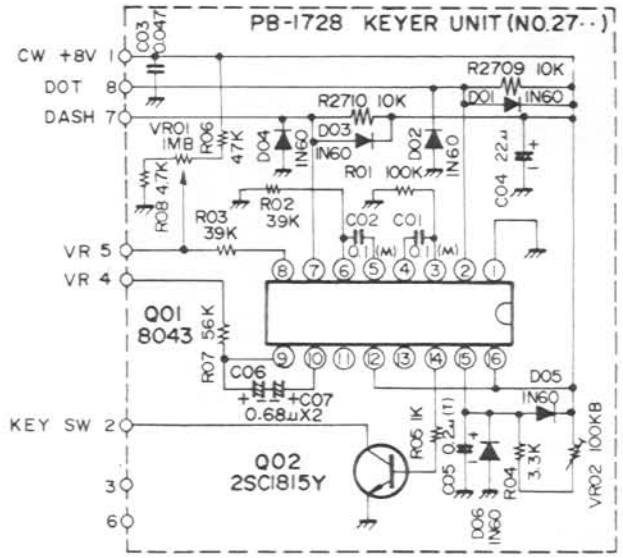
D2103 D2102 D2101

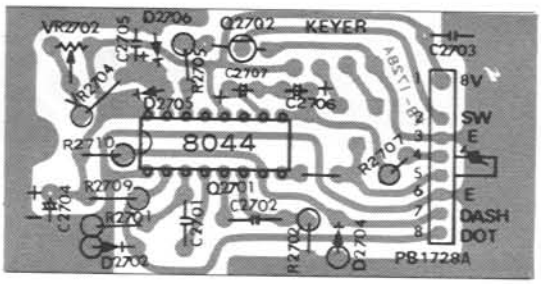
Viewed from component side



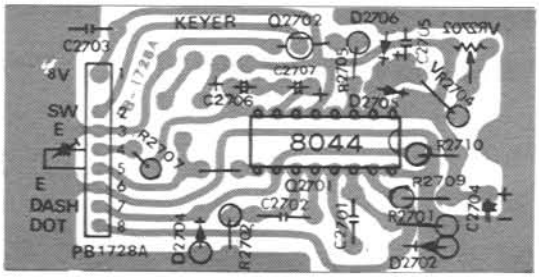
Viewed from solder side

KEYER UNIT (PB-1728A)





Viewed from component side



Viewed from solder side

DC VOLTAGES (V)

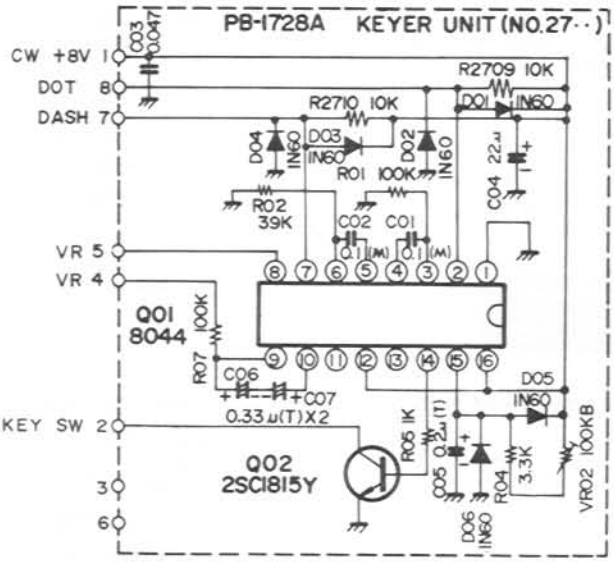
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Q_{2701}	R	0	8.2	0	0	0	0	8.2	0	1.7	8.2	8.2	8.2	0	0	8.2	8.2
	T	0	0	8.1	8.2	8.2	8.1	0	4–5	4–5	4–5	1–5	8.2	4–8	3–5	2–5	8.2

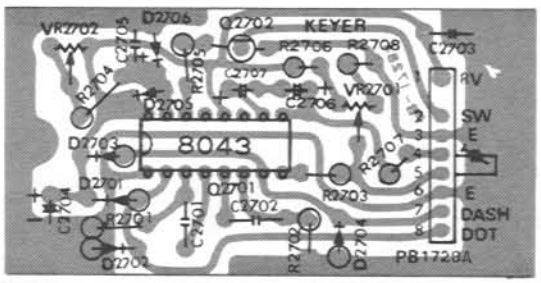
MODE CW
KEYER ON

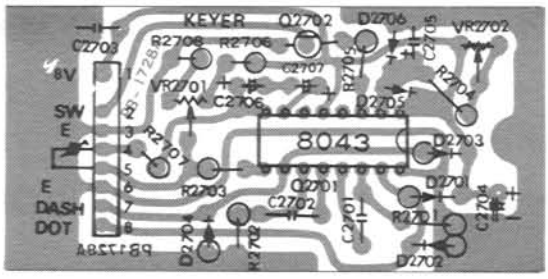
DC VOLTAGES (V)

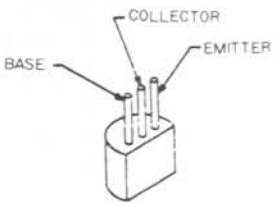
	E		C		B	
	R	T	R	T	R	T
Q_{2702}	0	0	7.7	–	0	0.4–0.9

MODE CW
KEYER ON

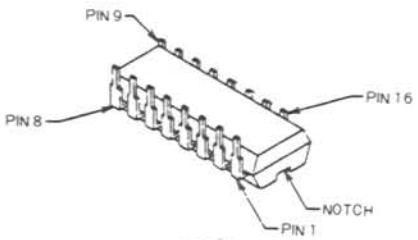






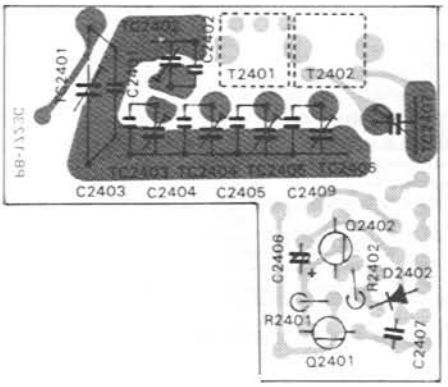


2SC1815Y

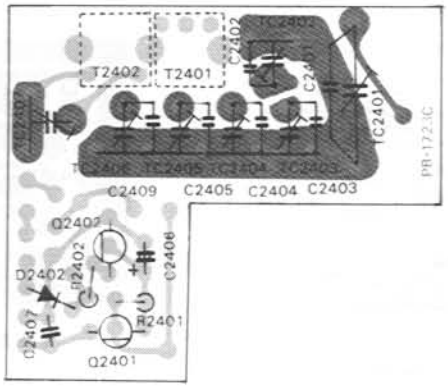


8043
8044

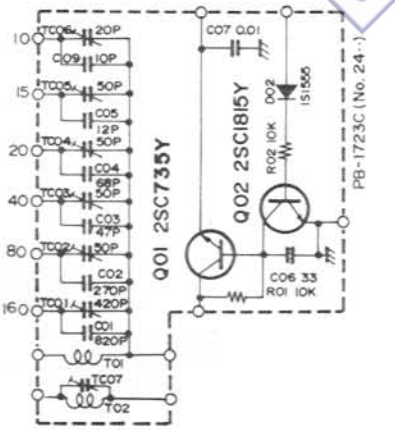
TRIMMER A BOARD (PB-1723C)



Viewed from trimmer side

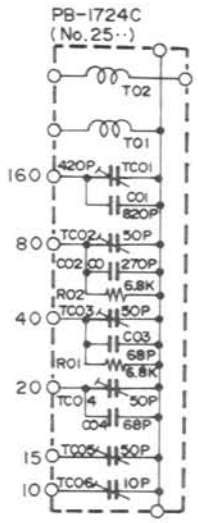


Viewed from component side

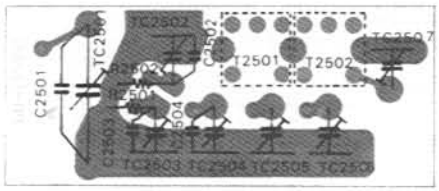


DC VOLTAGES (V)

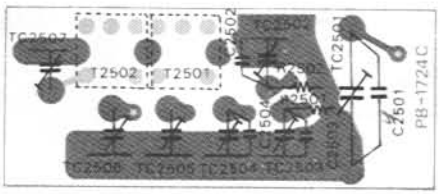
	LOCK			UNLOCK		
	E	C	B	E	C	B
Q2401	10.2	12	10.9	0	12	0
Q2402	0	10.9	0.2	0	0	0.7



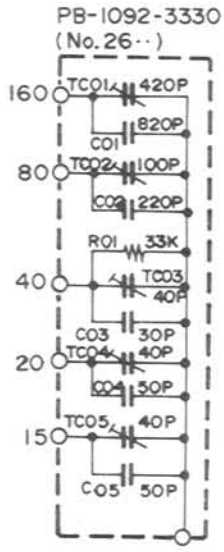
TRIMMER B BOARD (PB-1724C)



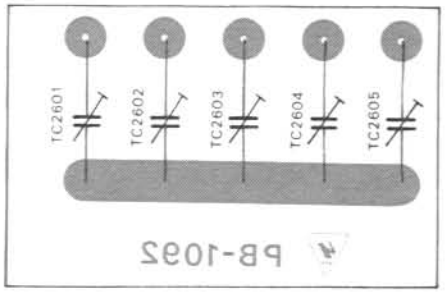
Viewed from trimmer side



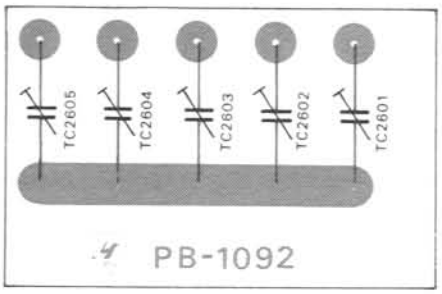
Viewed from component side



TRIMMER C BOARD (PB-1092-3330)

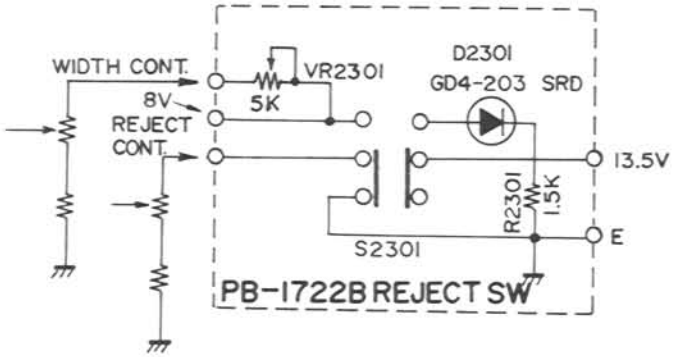


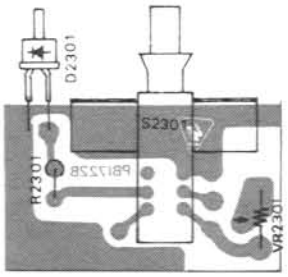
Viewed from trimmer side

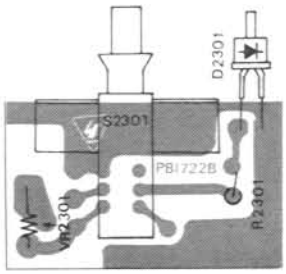


Viewed from component side

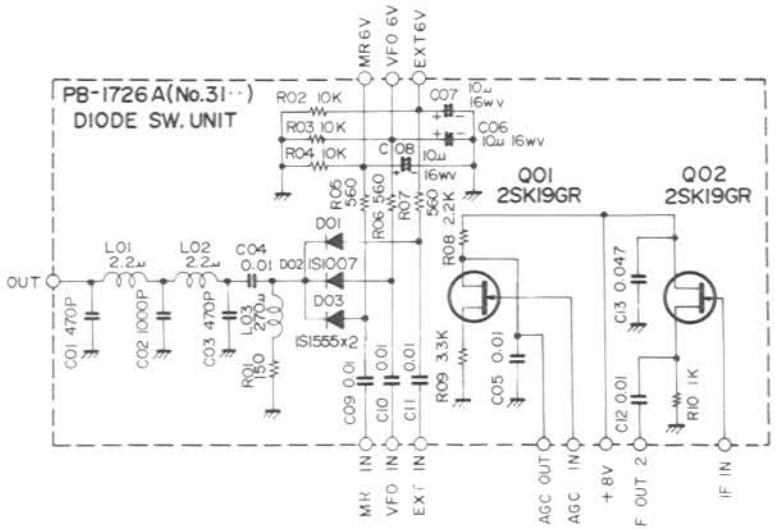
REJECT SWITCH BOARD

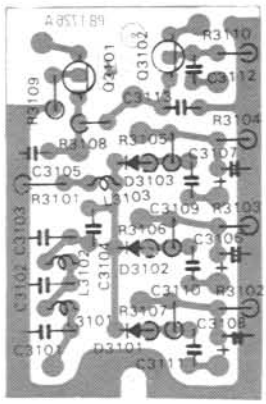






DIODE SWITCH BOARD (PB-1726A)

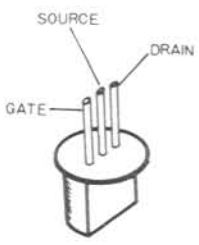




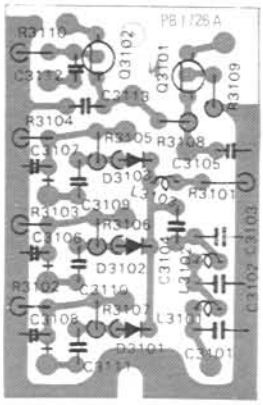
Viewed from component side

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



2SK19GR



Viewed from solder side

PARTS LIST

MAIN CHASSIS

Symbol No.	Parts No.	Description
		IC
Q1, 2	25000116	μPC 14308
Q3	25000068	μPC 14312
		DIODE
D10, 16, 18, 19	21010070	Germanium 1S1007
D1~3, 9, 11~15, 17	21015550	Silicon 1S1555
D5~7	21090011	" 10D1
		RESISTOR
R5	41143821	Carbon film 1/4W TJ 820Ω
	40143102	" " " VJ 1 kΩ
R6	41143332	" " " TJ 3.3kΩ
R19	41143472	" " " " 4.7kΩ
R2	40143273	" " " VJ 27kΩ
R1	41143104	" " " TJ 100kΩ
R4, 16	42124100	" composition 1/2W GK 10Ω
R11, 12 (L6, 7)	42124560	" " 1W " 56Ω
R34	42104222	" " " 2.2kΩ
R3, 18, 30	42124101	" " 1/2W GK 100Ω
R22	42124221	" " " " 220Ω
R20	42124561	" " " " 560Ω
R7, 9, 17	42124102	" " " " 1kΩ
R8, 36	42124222	" " " " 2.2kΩ
	42124272	" " " " 2.7kΩ
R33	42124103	" " " " 10kΩ
R14	42124123	" " " " 12kΩ
R13, 29	42124223	" " " " 22kΩ
R26	43204220	Metallic film 2W 22Ω
R10	43304240	" " 3W 24Ω
		POTENTIOMETER
VR1	49800085	VM11A5M 1112' 10kΩA
VR2	49800086	DM11A5M 1222 10kΩB/500kΩC
VR3, 6	49800087	DM10A 5kΩB/5kΩB
VR4	49800088	GM70A 50kΩB/50kΩB
VR5	49800089	DM70A 5kΩB/5kΩA
VR7	49800091	VM10A 1kΩB
VR8	49800092	DM10E 5kΩB/5kΩB
		CAPACITOR
C69	31820200	Ceramic disc 50WV 20PF CH
C30	31820470	" " " 47PF "
C5	31249301	" " 1.5KV 300PF
C16	31249030	" " 3KV 3PF
C0103	30320104	" " 25WV 0.1μF
C29,59,60,89,90, 0104, 0105,0107	30820103	" " 50WV 0.01μF
C17,18,19,37, 38,46,48~50	30820473	" " " 0.047μF
52~56, 58, 62~68, 71~73,75,81, 82,88, 91,96, 98, 99, 0101, 0102	30820473	Ceramic disc 50WV 0.047μF
C35, 36	30830472	Ceramic disc 500WV 0.0047μF
C77,79,80,83,0106	30830103	" " " 0.01μF
C40, 47	30840101	" " 1 KWV 100PF
C14, 15	30240472	" " 1.4KV 0.0047μF
C12, 13, 44, 78, 92	30240103	" " " 0.01μF
C41	33821201	Dipped mica 50WV 200PF
C31	33824020	" " 500WV 1PF
C11	33834050	" " 500WV 5PF
C87	33834100	" " " 10PF
C1, 42	33834271	" " " 270PF
C39	33834351	" " " 350PF
C3	33834471	" " " 470PF
C9	33834651	" " " 650PF
C8	33834102	" " " 1000PF
C2	33844391	" " 1KWV 390PF
C7	33844222	" " " 2200PF
C70	33147101	Moulded mica " 100PF
C70	33147201	" " " 200PF
C4	33197102	" " 6KV 1000PF
C84	36835473	Mylar 250WV 0.047μF
C20~28, 51	32830102	Feed thru 500WV 0.001μF
	34220105	Electrolytic 16WV 1μF
C61	34220106	" " 10μF
C57	34220336	" " 33μF
	35220107	" " 100μF
C34, 43	34220227	" " 220μF
	34320477	" 25WV 470μF
		VARIABLE CAPACITOR
VC1	39000058	RT-18-300VC
VC2	39000061	C134E125
		TRIMMER CAPACITOR
TC1	39000072	120C 10x2 1.5KV 5PF
TC2	39000016	B-2PY 100PF
		INDUCTOR
L1	55003214	#220304B
L2	55003215	#220305A
L4	53020001	Microindicator FL-5H 1mH
L11, 12, 14	53010003	" 250μH
	53040001	250μH #220100
L8	54000040	300μH #220064
L6, 7 (R11, R12)	55003216	#220308
L9	55000490	#220009
L10	54000050	500μH #220065
L13		#220349
		TRANSFORMER
T1	55000450	#220073
T2	55000460	#220011

T3	55000500	#220074
		METER
M1 (with R1706,PL3,4)	75000350	500μA #250007
		SPEAKER
SP1	75000018	SA-77K-Y 4Ω 3W
		POWER TRANSFORMER
PT1	52000051	#230013A
		RELAY
RL1	70000013	AE 3244
RL2	70000002	MX2P 12V
		RELAY SOCKET
RS1	69000006	AE3840
RS2	69000003	PX08
		SWITCH
S1	61000450	RS-14-14-11
S2	61000460	GS-4-8-6A
S3	64000007	WD9216
S4	64000006	WD92231
		PLUG
P1 (with Wire)	68080007	5047-08 #240032A
P2 (with Wire)	68070028	5047-07 #240052B
P3 (with Wire)	68170001	5047-17 #240034A
P8 (with Wire)	68160002	5047-16 #240035D
P4, 5, 6	67020007	SQ4052
P10	67020014	SQ4152
P7	67040002	SI5908 4P
P9	67020009	SI7502 2P
		CONNECTOR
J1	68030001	SG-7701
J2	68040003	FM-144-S
J3	68030002	SG-7814
J10, 11	68020001	CN-7017
J12~18	80040622	Jack Ass'y Board
J19	68020012	SG-8050
J4	67120009	QS-A-DB12ML
J5	67060006	D6-701B00
J6	68070027	D7-701B00
J8	68000011	M-BR-06B (D)
J20	67090003	AC9-PF
J7	68020010	SI-7501-I

J9	68110001	SA602B00
		MULTI JACK
MJ1~8	68180003	121S-18B-105A
MJ9	68220003	121S-22B-105A
MJ10	68100009	121S-10B-105A
MJ11, 12	68200002	220D-20B-205A
		COOLING FAN
FAN1	75000004	2SB10A
		FUSE
F1	73000004	5A (100~117V)
	73000003	3A (200~234V)
		FUSE HOLDER
FH1, 3	69030007	F3265
FH2	69030001	SN1001 #2
		PILOT LAMP
PL1	14000027	BF 311-04071A 14V 0.12A
PL2	14000028	BF 311-03011A 8V 0.15A
PL3, 4 (M1)	—	Meter lamp 8V 0.055A
PB-1390	60413900	LED B BOARD
D8	21090140	LED GD4-203-SRD

RF UNIT

Symbol No.	Parts No.	Description
	017022AZ	RF unit with Components
PB-1702B	60417022	P.C. Board
		FET & TRANSISTOR
Q102~105	22800195	FET 2SK19GR
Q106, 107	23800402	MOS FET 3SK40L
Q101	23800513	MOS FET 3SK51-03
Q108	22390006	Transistor 2N4427
		DIODE
D104	21010070	Germanium 1S1007
D101~103	21015550	Silicon 1S1555
		RESISTOR
R116, 131, 132	40143100	Carbon film 1/4W VJ 10Ω

R122	40143470	Carbon film 1/4W VJ 47Ω			
R124	40143560	" " " " 56Ω			
R106, 107, 108, 113, 114, 121	40143101	" " " " 100Ω			
R117	40143151	" " " " 150Ω			
R123	40143181	" " " " 180Ω			
R125, 126	40143271	" " " " 270Ω			
R112	40143331	" " " " 330Ω	**NB UNIT**		
R111	41143331	" " " TJ 330Ω	Symbol No.	Parts No.	Description
R136	40143471	" " " VJ 470Ω		019940AZ	NB unit with components
R105,115,118	40143102	" " " " 1kΩ	PB-1994	60419940	P.C. Board
R119	40143222	" " " " 2.2kΩ			
R102, 129	40143272	" " " " 2.7kΩ			
R104, 109	40143562	" " " " 5.6kΩ			
R133	40143103	" " " " 10kΩ			**IC, FET & TRANSISTOR**
R135	40143223	" " " " 22kΩ	Q 206	25000105	IC TA7060P
R103	40143473	" " " " 47kΩ	Q 201,	22800195	FET 2SK19GR
R130	40143563	" " " " 56kΩ	Q 209, 210, 212	23800401	FET 3SK40M
R134	40143124	" " " " 120kΩ	Q212	23800513	FET 3SK51-03
R101	42144225	" composition 1/4W GK 2.2MΩ	Q 203	23800595	FET 3SK59GR
			Q202	22303724	Transistor 2SC372Y
			Q 204,205,207, 211	22318154	2SC1815Y
					DIODE
		CAPACITOR	D202, 203	2109 07	Germanium 1N270
C102, 106	31829101	Ceramic disc 50WV 100PF SL	D201, 205, 208	21015550	Silicon 1S1555
C103, 104, 109,112,119, 120,123,124	30821103	" " " 0.01μF YY	D210	21090034	Zener WZ090
			D204	21090036	Zener WZ110
C105, 107, 108,110,111, 113,114,116 ~118, 122	30820103	" " " 0.01μF			
					CRYSTAL
			X201	71800088	HC-18/U 8532.5kHz #210043
C101, 121	30820473	" " " 0.047μF			
C125	33821030	Dipped mica " 3PF			
C127	33821040	" " " 4PF			
C115	33820241	" " " 240PF			**CRYSTAL FILTER**
C126	34220106	Electrolytic 16WV TT 10μF	XF201	71000028	XF-8.9HP #210089
					RESISTOR
			R254	40143560	Carbon film 1/4W VJ 56Ω
		TRIMMER CAPACITOR	R204, 209, 217,218,221, 225,226,238, 243,244	40143101	" " " " 100Ω
TC101	39000006	ECV1ZW 10x40 10PF			
			R252	41143101	" " " TJ 100Ω
			R241	40143151	" " " VJ 150Ω
		INDUCTOR	R216, 237, 260	40143331	" " " " 330Ω
L101, 102	53020027	Micro inductor FL-5H 270μH	R203, 208, 251	40143471	" " " " 470Ω
			R210	40143561	" " " " 560Ω
			R211, 212, 215, 222, 228	40143102	" " " " 1kΩ
		TRANSFORMER	R206	40143152	" " " " 1.5kΩ
T101, 103	55003174	#220209	R214, 250	40143222	" " " " 2.2kΩ
T102, 104	55003175	#220221	R201, 259	40143332	" " " " 3.3kΩ
T105	55003176	#220210	R224	40143682	" " " " 6.8kΩ
			R205	40143822	" " " " 8.2kΩ
			R227, 248, 249	40143103	" " " " 10kΩ
			R258	40143123	" " " " 12kΩ
		JACK	R207	40143153	" " " " 15kΩ
J101,102,103	68020021	SQ-3081	R223, 234	40143333	" " " " 33kΩ
			R257	40143393	" " " " 39kΩ
			R229, 246	40143473	" " " " 47kΩ

R236, 240, 245, 247, 255, 256	40143104	Carbon film 1/4W VJ 100kΩ
R239	40143154	" " " " 150kΩ
R235	40143224	" " " " 220kΩ
R220	40143394	" " " " 390kΩ
		POTENTIOMETER
VR201	49912102	V10K-8-1-2 1kΩB
VR203	49912202	" 2kΩB
VR202	49912502	" 5kΩB
		CAPACITOR
C201, 206, 216, 218, 225, 228, 238	31829101	Ceramic disc 50WV 100PF SL
C237	31829201	" " " 200PF SL
C235	31829221	" " " 220PF SL
C244	31829561	" " " 560PF SL
C202, 203, 205, 208~213, 217, 219~224, 230, 231, 233, 234, 236, 240 ~243, 245, 246	30820103	" " " 0.01μF
C215	30820473	" " " 0.047μF
C232	33824102	Dipped mica 50WV 0.001μF
C214	34220226	Electrolytic 16WV TW 22μF
		INDUCTOR
L202	53020013	Micro inductor 150μH
		TRANSFORMER
T206, 207	54140970	R12-4097 #220101
T201, 202, 204, 205	54141700	R12-4170 #220140
T203	55003177	R12-1078 #220221
	91100008	Wrapping Terminal C

FILTER UNIT

Symbol No.	Parts No.	Description
	019950AZ	Filter unit with components
PB-1995	60419950	P.C. Board
		FET & TRANSISTOR
Q301, 302, 304, 305	22800195	FET 2SK19GR
Q303	22303730	Transistor 2SC373

		DIODE
D301, 303~309	21010070	Germanium 1S1007
D302, 310, D312	21015550	Silicon 1S1555
	21090036	Zener WZ110
		CRYSTAL FILTER
XF301	71200017	8.9M-20A #210047
XF304	71000023	XF-8.9HS #210086
XF303	71000029	XF-8.9GA #210087 (OPTION)
XF302	71000021	XF-8.9HC #210088 (OPTION)
		RESISTOR
R323	40143220	Carbon film 1/4W VJ 22Ω
R301, 302, 309,	40143101	" " " " 100Ω
R311, 316, 317	41143101	" " " TJ 100Ω
R304, 305	40143331	" " " VJ 330Ω
R322, 326,	40143561	" " " " 560Ω
R308, 318, 319, 325	40143102	" " " " 1kΩ
R306	40143222	" " " " 2.2kΩ
R327	40143272	" " " " 2.7kΩ
R310, 312~315	40143332	" " " " 3.3kΩ
R303	40143562	" " " " 5.6kΩ
R324	40143103	" " " " 10kΩ
R307	40143104	" " " " 100kΩ
R320	42124560	" composition 1/2W GK 56Ω
		CAPACITOR
C304	31829101	Ceramic Disc 50WV 100PF SL
C302, 305, 324	30821103	" " " 0.01μF YY
C301, 306, 307, 308, 311, 312, 315, 316, 321	30820103	" " " 0.01μF
C309, 310, 313, 314, 317, 318, 319, 323, 327, 328	30820473	" " " 0.047μF
C325	31820-101	" " " 100pF NPO
C303	34220106	Electrolytic 16WV TW 10μF
		INDUCTOR
L312		Micro inductor FL5H 33μH
L303~308, 311	53020013	Micro inductor FL5H 150μH
L302, 310	53010003	" " " 250μH
		TRANSFORMER
T301~303	54141710	R12-4171 #220141

IF UNIT

Symbol No.	Part No.	Description
	017043AZ	IF unit with components
PB-1704C	60417043	P.C. Board
		FET & TRANSISTOR
Q408	22800195	FET 2SK19GR
Q401~404	23800513	" 3SK51-03
Q407	22105641	Transistor 2SA564A
Q409, 411	22303730	" 2SC373
Q405	22305351	" 2SC535A
Q412	22307354	" 2SC735Y
Q406, 410	22318154	" 2SC1815Y
		DIODE
D407	21090115	Germanium 1N60
D401, 408, 411, 412	21090107	" 1N270
D402~405	21010070	" 1S1007
D409, 413	21015550	Silicon 1S1555
D406, 410	21022090	Varactor 1S2209
		CRYSTAL
X402	71800111	HC-18/U 19.7475MHz #210043-2
X401	71800091	" 8987.5MHz #210043-1
		CRYSTAL FILTER
XF402	71200017	8.9M20A #210047
XF401	71000024	XF-10GS #210090
		RESISTOR
R406, 409, 420, 433, 455	40143101	Carbon film 1/4W VJ 100Ω
R413, 414, 458	40143181	" " " " 180Ω
R442	40143221	" " " " 220Ω
R440	40143331	" " " " 330Ω
R443	40143561	" " " " 560Ω
R412	40143681	" " " " 680Ω
R402, 405, 407, 408, 415, 416, 418, 444, 451, 454	40143102	" " " " 1kΩ
R434, 445	40143152	" " " " 1.5kΩ
R425, 432	40143182	" " " " 1.8kΩ
R423	40143332	" " " " 3.3kΩ
R410, 411	40143472	" " " " 4.7kΩ
R435	40143562	" " " " 5.6kΩ
R419, 450	40143682	" " " " 6.8kΩ
R403, 404, 417, 421, 424, 427, 429~431, 447, 448, 453, 456	40143103	" " " " 10kΩ
R438, 439	40143153	Carbon film 1/4W VJ 15kΩ
R422, 428, 437	40143473	" " " " 47kΩ
R436	40143563	" " " " 56kΩ
R441	40143104	" " " " 100kΩ
R452	40143184	" " " " 180kΩ
R446	40143334	" " " " 330kΩ
R426, 449	40143105	" " " " 1MΩ
	42144105	" composition 1/4W GK 1MΩ
		POTENTIOMETER
VR402	49912103	V10K-8-1-2 10kΩB
VR401	49912504	" 500kΩB
		CAPACITOR
C401, 423, 446, 450	31829101	Ceramic disc 50WV 100PF SL
C437, 438	31827820	" " " 82PF UJ
C436	31827101	" " " 100PF UJ
C429	31820330	" " " 33PF NPO
C448	31820470	" " " 47PF NPO
C402, 405~407, 412, 413, 417, 418, 421, 425, 427, 428	30820103	" " " 0.01μF YY
C403, 410, 411, 414, 415, 419, 424	30820102	" " " 0.001μF
C430	30820222	" " " 0.002μF
C420, 422, 426, 434, 439, 440, 443, 451	30820103	" " " 0.01μF
C404, 408, 409, 416, 432, 433, 441, 447, 452~454, 456	30820473	" " " 0.047μF
C444	36825223	Mylar 50WV 0.022μF
C442	36226225	Tantalum 16WV 2.2μF
C431	34220105	Electrolytic 16WV TW 1μF
C445, 449	34220106	" " " 10μF
		INDUCTOR
L409	53020020	Micro inductor FL5H 15μH
L401, 402, 405	53020013	" " " 150μH
L403, 404, 406, 407, 410	53020001	" " " 1mH
L408	55003178	VXO coil 5.2μH #220145
		TRANSFORMER
T401	55003185	3005 #220187
T402, 403	54141700	R12-4170 #220140
T404	54141710	R12-4171 #220141
		RELAY
RL401	70000032	UFM-10208 8V

AF UNIT

Symbol No.	Parts No.	Description
	017051AZ	AF unit with components
PB-1705A	60417051	P.C. Board
		IC & TRANSISTOR
Q503	25000133	IC TA7205AP
Q504	25000125	IC MC3403P
Q506	25000128	IC 78L08
Q501, 502, 505, 507	22310005	Transistor 2SC1000GR
		RESISTOR
R523, 536	40143101	Carbon film 1/4W VJ 100Ω
R505	40143151	" " " " 150Ω
R516	40143561	" " " " 560Ω
R506	40143681	" " " " 680Ω
R507	40143102	" " " " 1kΩ
R512	40143222	" " " " 2.2kΩ
R504, 539	40143332	" " " " 3.3kΩ
R513, 514, 537	40143472	" " " " 4.7kΩ
R510, 511	40143822	" " " " 8.2kΩ
R538, 540, 541, 543	40143103	" " " " 10kΩ
R503	40143153	" " " " 15kΩ
R530, 545	40143333	" " " " 33kΩ
R508	40143393	" " " " 39kΩ
R502, 509, 515	40413473	" " " " 47kΩ
R534	40143823	" " " " 82kΩ
R517, 520, 522, 525, 526, 528, 535	40143104	" " " " 100kΩ
R519, 524, 527,	40143124	" " " " 120kΩ
R518, 521, 529	40143224	" " " " 220kΩ
		POTENTIOMETER
VR501	49800078	GM-70R 1MΩBx2
		CAPACITOR
C535	32820102	Ceramic disc 50WV 0.001μF
C501, 534	30820103	" " " 0.01μF
C521	30820473	" " " 0.047μF
C512, 519	31829510	" " " 51PF SL
C514	33824391	Dipped mica " 390PF SL
	36825102	Mylar 50WV 0.001μF
C507	36825472	" " 0.0047μF
C523, 524	36825682	" " 0.0068μF
C506	36825103	" " 0.01μF
C516,	36825473	" " 0.047μF
C520, 530, 531, 536	36825104	" " 0.1μF
C502, 503, 509, 511, 522, 529,	34220105	Electrolytic 16WV TW 1μF
C532, 533	34220105	Electrolytic 16WV TW 1μF
C504	34220475	" " " 4.7μF
C528	35220106	" " " 10μF
C505, 508, 513	35220226	" " " 22μF
C525	34120336	" 10WV " 33μF
C517	34120476	" " " 47μF
C515	34120107	" " " 100μF
C518	34120477	" " " 470μF
		HEAT SINK
	80042802	(TA-7205)

VOX/MARKER UNIT

Symbol No.	Parts No.	Description
	018460AZ	VOX/Marker unit with components
PB-1846	40618460	P.C. Board (=PB-1685-3330)
		IC & TRANSISTOR
Q604	25000114	IC MC14011B
Q612	25000177	IC 4024PC
Q603	22105641	IC 2SA564A
Q602, 608~610, 615	22303730	Transistor 2SC373
Q607	22307354	Transistor 2SC735Y
Q601, 605, 606, 611, 613, 614	22318154	Transistor 2SC1815Y
		DIODE
D601, 605	21090115	Germanium 1N60
D603, 607~609	21015550	Silicon 1S1555
D602, 606	21090034	Zener WZ090
		CRYSTAL
X601	71600032	HC-6W 3200kHz #210026
		RESISTOR
R616	40143101	Carbon film 1/4W VJ 100Ω
R643	40143221	" " " " 220Ω
R620, 628	40143471	" " " " 470Ω
R605, 614, 625, 626, 636, 642, 646~650	40143102	" " " " 1kΩ
R615, 630, 640	40143222	" " " " 2.2kΩ
R637	40143392	" " " " 3.9kΩ
R604, 606, 632~634	40143472	" " " " 4.7kΩ
R627	40143562	" " " " 5.6kΩ
R601, 602, 607, 608, 612, 621,	40143103	" " " " 10kΩ

R623, 641, 652, 653	40143103	Carbon film 1/4W VJ	10kΩ
R603, 619, 629, 635, 639, 644, 645	40143223	" " " "	22kΩ
R624	40143393	" " " "	39kΩ
R 638	40143473	" " " "	47kΩ
R613	40143563	" " " "	56kΩ
R618, 631	40143683	" " " "	68kΩ
R622	40143104	" " " "	100kΩ
R609, 610	40143105	" " " "	1MΩ
R651	42124181	" composition 1/2W GK	180Ω
R611	42144335	" " 1/4W "	3.3MΩ
		POTENTIOMETER	
VR603	49912103	V10K-8-1-2	10kΩB
VR601	49912503	"	50kΩB
VR602	49912504	"	500kΩB
		CAPACITOR	
C632	31829030	Ceramic disc 50WV	3PF SL
C635	31829040	" " "	4PF SL
C634	31829101	" " "	100PF SL
C628	31820270	" " "	27PF CH
C631	31820271	" " "	270PF CH
C630	31820511	" " "	510PF CH
C613	30820102	" " "	0.001μF
C603, 620, 626, 629, 636	30820103	" " "	0.01μF
C638	30820473	" " "	0.047μF
C622~624	36825223	Mylar "	0.022μF
C608, 610, 616	36825473	" "	0.047μF
C606	36226105	Tantalum 16WV	1μF
C621	36226225	" "	2.2μF
C602, 605	36226106	" "	10μF
C612, 618	36226226	" "	22μF
C604, 611, 619	34220105	Electrolytic 16WV TW	1μF
C627	34220225	" " "	2.2μF
C625	34220475	" " "	4.7μF
C601, 609, 615, 617	34220106	" " "	10μF
C607, 614	34220226	" " "	22μF
C637	34220107	" " "	100μF
		TRIMMER CAPACITOR	
TC601	39000007	ECV-1ZW 20x40	20PF
		SWITCH	
S601	63000008	SS-12-L06	

CARRIER UNIT

Symbol No.	Parts No.	Description	
	017061AZ	Carrier unit with components	
PB-1706A	60417061	P.C. Board	
		IC, FET & TRANSISTOR	
Q705, 706	25000134	IC	TA7063P
Q708	25000114	IC	MC14011B
Q702	22800195	FET	2SK19GR
Q704	23800594	FET	3SK59Y
Q707	22303730	Transistor	2SC373
Q710	22310005	Transistor	2SC1000GR
Q701, 703, 709	22318154	Transistor	2SC1815Y
		DIODE	
D701, 705~708, 723	21010070	Germanium	1S1007
D702~704, 709 ~713, 715, 719, 720, 724	21015550	Silicon	1S1555
D716, 718	21090034	Zener	WZ090
D721, 722	21090111	Zener	WZ050
		CRYSTAL	
X701	71800085	HC-18/U 8986kHz	#210042-1
X703	71800087	" 8988.3kHz	#210042-3
X702	71800086	" 8989kHz	#210042-2
		RESISTOR	
R749 ,753, 754	40143680	Carbon film 1/4W VJ	68Ω
	41143680	" " " TJ	68Ω
R716, 747,752	40143101	" " " VJ	100Ω
	41143101	" " " TJ	100Ω
R729	40143121	" " " VJ	120Ω
R704, 707	40143151	" " " "	150Ω
R755	40143181	" " " "	180Ω
R708, 709	40143221	" " " "	220Ω
R721, 735	40143331	" " " "	330Ω
R710, 738	40143391	" " " "	390Ω
R702	40143471	" " " "	470Ω
	40143681	" " " "	680Ω
R701, 718, 727	40143102	" " " "	1kΩ
R715	40143222	" " " "	2.2kΩ
R717, 728, 745	40143332	" " " "	3.3kΩ
R705, 706	40143472	" " " "	4.7kΩ
R751	40143682	" " " "	6.8kΩ
R720, 731, 734, 737, 741, 756, 757	40143103	" " " "	10kΩ
R723	40143153	" " " "	15kΩ
R739, 746, 758	40143223	" " " "	22kΩ
R726	40143333	" " " "	33kΩ
R712, 719, 732	40143393	" " " "	39kΩ
R713	40143473	" " " "	47kΩ
R742	40143563	" " " "	56kΩ
R714, 736	40143823	" " " "	82kΩ

R703, 711, 725	40143104	Carbon film 1/4W VJ 100kΩ			
R722, 733	40143154	" " " " 150kΩ			
R740, 744	40143105	" " " " 1MΩ			**RELAY**
R743	42144335	" composition 1/4W GK 3.3MΩ	RL701	70000031	FBR-211AD012M 12V
		POTENTIOMETER	**VFO UNIT**		
VR701	49910201	EVL SOAA 00B22 200ΩB	Symbol No.	Parts No.	Description
VR702	49910504	EVL SOAA 00B55 500kΩB			VFO assembly 3330
				014402BZ	PCB with components
			PB-1440B-3330	60414402	P.C. Board
		CAPACITOR			
C715	31829020	Ceramic disc 50WV 2PF SL			
C721, 730	31829101	" " " 100PF SL			**FET & TRANSISTOR**
C718, 719	31829241	" " " 240PF SL	Q802	22800195	FET 2SK19GR
C705	31820270	" " " 27PF CH	Q801, 803	22303724	Transistor 2SC372Y
C713	31820270	" " " 27PF CH*			
C703, 704	31820390	" " " 39PF CH			
C708, 709	31820151	" " " 150PF CH			
C701, 702, 706, 707, 711, 712, 714, 716, 717, 735, 740, 746, 748, 751	30820103	" " " 0.01μF			**DIODE**
			D801	21022360	Varactor 1S2236
C739	30820473	" " " 0.047μF			**RESISTOR**
C710	33824200	Dipped mica " 20PF	R809, 811	40143101	Carbon film 1/4W VJ 100Ω
C723, 732	36825202	Mylar " 0.002μF	R807	40143221	" " " " 220Ω
C720, 724, 727, 734	36825473	" " 0.047μF	R805, 808	40143222	" " " " 2.2kΩ
			R802	40143332	" " " " 3.3kΩ
C725, 726, 736, 737, 741, 749, 752	34220105	Electrolytic 16WV TW 1μF	R801	40143103	" " " " 10kΩ
			R803	40143183	" " " " 18kΩ
			R804	40143223	" " " " 22kΩ
C731, 747	34220225	" " " 2.2μF	R806, 810	40143104	" " " " 100kΩ
C728, 733, 742 ~744	34220106	" " " 10μF			
C722, 738	34220226	" " " 22μF			
C750, 753	34220336	" " " 33μF			
C729	34220476	" " " 47μF			
					CAPACITOR
			C807	31820080	Ceramic disc 50WV 8PF CH
			C801	31827080	" " " 8PF UJ
			C803	31827090	" " " 9PF UJ
			C804	31820180	" " " 18PF CH
		TRIMMER CAPACITOR	C808, 814	31820330	" " " 33PF CH
TC701~704	39000007	ECV-1ZW 20x40 20PF	C805, 818	31820390	" " " 39PF CH
TC705	39000009	ECV-1ZW 50x40 50PF	C809, 810, 812, 815, 819, 820, 824, 826	30820103	" " " 0.01μF
			C811	33824181	Dipped mica " 180PF
		INDUCTOR	C813	33824431	" " " 430PF
L705	53020007	Micro inductor FL-5H 22μH	C821, 823	33824471	" " " 470PF
L706	53010003	" " 250μH	C802, 822	33824102	" " " 1000PF
L707	53020027	" " 270μH	C825	36226334	Tantalum 10WV 0.33μF
L701~704	53020001	" " FL-5H 1mH			
					VARIABLE CAPACITOR
		TRANSFORMER	VC801	39000027	C521
T701	54141710	R12-4171 #220141			
T702	54141700	R12-4170 #220140			

		TRIMMER CAPACITOR	
TC801	39000070	TSN-100D 15	15PF
TC802	39000005	ECV-1ZW 50×32	50PF
		INDUCTOR	
L801	55003184		#220268
L804, 805	53020014	Micro inductor FL-4H	1.8μH
L803, 806	53010003	" "	250μH
L802	53030001	" "	S4 102K 1mH
		RECEPTACLE	
J802	68040001	SI-6303-1	
		TERMINAL	
	90000000	Lighthouse type	
	91100008	Wrapping terminal C	

FM UNIT

Symbol No.	Parts No.	Description	
	017072AZ	FM unit with components	
PB-1707B	60417072	P.C. Board	
		IC, FET & TRANSISTOR	
Q904, 909	25000099	IC	TA7061AP
Q914	25000128	IC	78L08 ±10%
Q911	22800345	FET	2SK34E
Q901	23800513	FET	3SK51-03
Q902, 903, 905, 906, 907, 908, 910, 912, 913	22318154	Transistor	2SC1815Y
		DIODE	
D902, 903, 905, 906	21001880	Germanium	1S188FM
D901, 907, 910	21015550	Silicon	1S1555
D908	29090007	Varistor	MV-13
D909	21090137	Varactor	FC-63
		CRYSTAL	
X902	71800091	HC-18/U 8987.5kHz	
X901	71800092	HC-18/U 9442.5kHz	
		CERAMIC FILTER	
CF901, 902	71200016	LFB-15	

		CERAMIC DISCRIMINATOR	
CFD901	70900001	SFD-455-S4	
		RESISTOR	
R959	41143100	Carbon film 1/4W TJ	10Ω
R958	40143560	" " " VJ	56Ω
R914, 917, 937, 938, 953, 957	40143101	" " " "	100Ω
R923	41143101	" " " TJ	100Ω
R916, 922	40143221	" " " VJ	220Ω
R915	40143331	" " " "	330Ω
R935, 956	40143471	" " " "	470Ω
R936, 944	40143561	" " " "	560Ω
R909	40143681	" " " "	680Ω
R913, 933, 939, 943, 952, 963	40143102	" " " "	1kΩ
R906, 918, 929, 934	40143152	" " " "	1.5kΩ
R905	40143182	" " " "	1.8kΩ
R901, 902, 945, 960	40143222	" " " "	2.2kΩ
R910, 949	40143272	" " " "	2.7kΩ
R903, 926, 927, 946, 954	40143332	" " " "	3.3kΩ
R912	40143392	" " " "	3.9kΩ
R919, 920, 928, 940, 942	40143562	" " " "	5.6kΩ
R908	40143822	" " " "	8.2kΩ
R947, 950	40143103	" " " "	10kΩ
R911	40143183	" " " "	18kΩ
R921, 930, 948, 951	40143223	" " " "	22kΩ
R955, 964	40143273	" " " "	27kΩ
R904, 907, 961	40143473	" " " "	47kΩ
R932, 941, 962	40143563	" " " "	56kΩ
R924, 925	40143104	" " " "	100kΩ
R931	40143154	" " " "	150kΩ
		THERMISTOR	
TH901	29090001	SDT-250	
		POTENTIOMETER	
VR903	49912202	V10-K8-1-2	2KB
VR901	49912203	"	20kΩB
VR902	49912503	"	50kΩB
		CAPACITOR	
C901, 902, 903, 913, 963	30820102	Ceramic disc 50WV	0.001μF
C904, 905, 909, 910, 956, 961, 962, 964, 966 971	30820103	" " "	0.01μF
C926, 928,	30820473	" " "	0.047μF
C968	31829200	" " "	20PF CH
C972	31829680	" " "	68PFCH
C957	33824030	Dipped mica "	3PF

C960	33824200	Dipped mica 50WV	20PF
C907	33824470	" " "	47PF
C927	33824500	" " "	50PF
C930	33824101	" " "	100PF
C958, 959	33824121	" " "	120PF
C906, 908	33824151	" " "	150PF
C955	33824221	" " "	220PF
C911, 922, 940	36825102	Mylar "	0.001μF
C949	36825332	" "	0.0033μF
C944	36825472	" "	0.0047μF
C929, 931, 933, 965	36825103	" "	0.01μF
C923, 924, 925, 938, 950, 952	36825223	" "	0.02μF
C912, 914, 915, 916, 918, 919, 932, 951, 967, 970	36825473	" "	0.047μF
C954	36825104	" "	0.1μF
C941	36526104	Tantalum 35WV	0.1μF
C936, 939, 947	34220105	Electrolytic 16WV TW	1μF
C934, 935	34220475	" "	4.7μF
C937, 942, 953	34220106	" "	10μF
C945, 946	34220226	" "	22μF
C921, 943, 948	34220476	" "	47μF

TRIMMER CAPACITOR

TC901	39000006	ECV-1ZW 10x40	10PF

INDUCTOR

L904, 905	53020013	Micro inductor	150μH
L901, 902, 903, 906	53020001	" " FL-5H	1mH

TRANSFORMER

T901	55003084		#220188
T902	55003028		#221024
T903	54141700	R12-4170	#220140
T904	55003176		#220210

RECT. A UNIT

Symbol No.	Parts No.	Description
	017080AZ	Rect. A unit with components
PB-1708	60417080	P.C. Board

DIODE

D1001, 1002	21090022	Silicon	V06B
D1003, 1004	21090019	"	10D10
D1005, 1006	21015550	"	1S1555

RESISTOR

R1009, 1012	40143472	Carbon film 1/4W VJ	47kΩ
R1004, 1005	40143103	" " "	10kΩ
R1001	42124102	" composition 1/2W GK	1kΩ
	42124473	" " " "	47kΩ
R1008	40143563	" film 1/4W VJ	56kΩ
R1011	42144225	" composition 1/4W GK	2.2MΩ
R1003	43104471	Metallic film 1W	470Ω
R1002	43104562	" " "	5.6kΩ
R1013	43204473	" " 2W	47kΩ

POTENTIOMETER

VR1001	49910103	V18K-3-2	10kΩB

CAPACITOR

C1011, 1012	30830472	Ceramic disc 500WV	0.0047μF
C1009, 1010	30830103	" "	0.01μF
C1013	30820473	" 50WV	0.047μF
C1008	30834222	Dipped mica 500WV	2200PF
C1007	36526224	Tantalum 35WV	0.22μF
C1003~1006	35330226	Electrolytic 250WV TW	22μF
C1001, 1002	34329901	" 25WV TT	3300μF

AF CHOKE

CH1001	55000011	#230014

PLL UNIT

Symbol No.	Parts No.	Description
	017091AZ	PLL unit with components
PB-1709A	60417091	P.C. Board

IC, FET & TRANSISTOR

Q1102	25000129	IC	TA7310P
Q1106	25000130	IC	SN75450B
Q1107	25000135	IC	MC4044P (μPC1008C)
Q1111	25000132	IC	78L05±5%
Q1110	25000128	IC	78L08±10%
Q1104	22800195	FET	2SK19GR
Q1108	22303730	Transistor	2SC373
Q1101, 1103, 1105, 1109	22318154	Transistor	2SC1815Y

DIODE

D1101~1103	21015550	Silicon	1S1555

		RESISTOR	
R1126	40143100	Carbon film 1/4W VJ	10Ω
R1113	40143560	" " " "	56Ω
R1129	40143680	" " " "	68Ω
R1107, 1128	40143101	" " " "	100Ω
R1103	40143151	" " " "	150Ω
R1105, 1114, 1121	40143102	" " " "	1kΩ
R1122	40143152	" " " "	1.5kΩ
R1110, 1112, 1115, 1116, 1118	40143222	" " " "	2.2kΩ
R1119, 1120, 1123, 1124, 1127	40143472	" " " "	4.7kΩ
R1111, 1125	40143223	" " " "	22kΩ
R1104	40143473	" " " "	47kΩ
R1109	40143683	" " " "	68kΩ
R1117	40143104	" " " "	100kΩ
		CAPACITOR	
C1110, 1113	31829270	Ceramic disc 50WV	27PF SL
C1116, 1135	31829390	" " "	39PF SL
C1120	31829470	" " "	47PF SL
C1112	31829560	" " "	56PF SL
C1117	31829101	" " "	100PF SL
C1105	31829151	" " "	150PF SL
C1101, 1102, 1104, 1109, 1114, 1118, 1121, 1122	30820102	" " "	0.001μF
C1103, 1107, 1108, 1115, 1124~1126, 1128, 1130, 1131, 1134	30820103	" " "	0.01μF
C1119	36825104	Mylar "	0.1μF
C1132, 1133	36326685	Noise limiter 20WV	6.8μF
C1127, 1129	34220106	Electrolytic 16WV TW	10μF
		INDUCTOR	
L1105		Micro inductor FL4H J	12μH
L1103, 1104	53020028	" " FL5H	18μH
L1106	53020019	" " "	22μH
L1108, 1109, 1111	53020021	" " "	220μH
L1101, 1107, 1110	53020001	" " "	1mH
		TRANSFORMER	
T1101	54141840	R12-4184	#220169
TP1101	91100008	Wrapping terminal C	

VCO UNIT

Symbol No.	Parts No.	Description
	017102AZ	VCO unit with components
PB-1710B	60417102	P.C. Board
		FET & TRANSISTOR
Q1201~1208	22800196	FET 2SK19BL
Q1209	23800513	FET 3SK51-03
Q1210~1212	22318154	Transistor 2SC1815Y
		DIODE
D1219, 1220	21090115	Germanium 1N60
D1209~1218	21015550	Silicon 1S1555
D1201~1208	21090138	Varactor MV104
		RESISTOR
R1256	40143220	Carbon film 1/4W VJ 22Ω
R1269, 1270	40143270	" " " " 27Ω
R1235	40143470	" " " " 47Ω
R1264, 1266	40143560	" " " " 56Ω
R1201, 1205, 1208, 1212, 1215, 1219, 1222, 1226, 1228, 1229, 1233, 1236, 1240, 1242, 1246, 1248, 1252, 1254★ 1271▲	40143101	" " " " 100Ω
R1257, 1258	40143151	" " " " 150Ω
R1207, 1214, 1221, 1254▲	40143561	" " " " 560Ω
R1255, 1261	40143102	" " " " 1kΩ
R1206, 1213, 1220, 1227, 1234, 1241, 1247, 1253	40143222	" " " " 2.2kΩ
R1262	40143472	" " " " 4.7kΩ
R1267	40143562	" " " " 5.6kΩ
R1263, 1265	40143473	" " " " 47kΩ
R1260	40143823	" " " " 82kΩ
R1203, 1204, 1210, 1211, 1217~1218, 1224, 1225, 1231, 1232, 1238, 1239, 1244, 1245, 1250, 1251, 1268, 1272▲	40143104	" " " " 100kΩ
R1259	40143684	" " " " 680kΩ
▲ 5MHz WWV ★ 15MHz WWV		

					TRANSISTOR
			Q1301~1310	22303724	Transistor 2SC3722Y
		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
		INDUCTOR	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

		CAPACITOR	
C1342~1351	31820080	Ceramic disc 50WV	8PF CH
C1321, 1325, 1329, 1333	31820330	〃 〃 〃	33PF CH
C1314, 1318, 1322, 1326, 1330, 1334 1338*	31820390	〃 〃 〃	39PF CH
C1317	31820470	〃 〃 〃	47PF CH
C1310	31820680	〃 〃 〃	68PF CH
C1313, 1337*	31820820	〃 〃 〃	82PF CH
C1306, 1338▲	31820101	〃 〃 〃	100PF CH
C1302, 1309	31820151	〃 〃 〃	150PF CH
C1337▲	31820181	〃 〃 〃	180PF CH
C1305	31820221	〃 〃 〃	220PF CH
C1301	31820271	〃 〃 〃	270PF CH
C1341	30820102	〃 〃 〃	0.001μF
C1303, 1304, 1307, 1308, 1311, 1312, 1315, 1316, 1319, 1320, 1323, 1324, 1327, 1328, 1331, 1332, 1335, 1336, 1339, 1340	30820103	〃 〃 〃	0.01μF
		TRANSFORMER	
T1301~1310	55003217		#220017
		MINI CONNECTOR	
J1301	68170001	5048-17A	

RECT. B BOARD

Symbol No.	Parts No.	Description
	017121AZ	Rect. B board with components
PB-1712A	60417121	P.C. Board
		DIODE
D1401~1404	21090019	Silicon 10D10
		RESISTOR
R1401~1406	42124474	Carbon composition 1/2W GK 470kΩ
	91100008	Wrapping terminal C

CAPACITOR BOARD

Symbol No.	Parts No.	Description
	017130AZ	Capacitor board with components
PB-1713	60417130	P.C. Board
		CAPACITOR
C1501, 1502	34839902	Electrolytic 500WV 100μF (CE-62L)

DRIVER BOARD

Symbol No.	Parts No.	Description
	017140AZ	Driver board with components (without vacuum tube)
PB-1714A	60417141	P.C. Board
		VACUUM TUBE
V1601	10000020	12BY7A
		VACUUM TUBE SOCKET
VS1601	68090006	SB-9403
		RESISTOR
R1605	42124470	Carbon composition 1/2W GK 47Ω
R1602(L1602),1604	42124560	〃 〃 〃 〃 56Ω
R1603	42124101	〃 〃 〃 〃 100Ω
R1601	42124473	〃 〃 〃 〃 47kΩ
		CAPACITOR
C1601, 1602	30820103	Ceramic disc 500WV 0.01μF
C1603, 1604, 1606	30820473	〃 〃 50WV 0.047μF
C1605	33834102	Dipped mica 500WV 1000PF
		INDUCTOR
L1601	53020013	Micro inductor FL5H 150μH
L1602(R1602)	55003219	#220029
	91100008	Wrapping terminal

FINAL BOARD

Symbol No.	Parts No.	Description
	017152AZ	Final board with components
PB-1715B	60417152	P.C. Board
		VACUUM TUBE
V1701, 1702	10000026	6146B
		DIODE
D1701	21090019	Silicon 10D10
		VACUUM TUBE SOCKET
VS1701, 1702	68080006	SB-3606
		RESISTOR
R1701, 1702 (L1702, 1703)	42124560	Carbon composition 1/2W GK 56Ω
R1703, 1704, 1705	42124101	" " " " 100Ω
R1706	—	Meter shunt
R1707	43304153	Metallic film 3W 15kΩ
		CAPACITOR
C1704, 1710	30830103	Ceramic disc 500WV 0.01μF
C1705~1709, 1711, 1712	30820473	" 50WV 0.047μF
C1703	30830102	" 500WV 1000PF
C1701	33147101	Moulded mica 1kWV 100PF
C1702	33831050	Dipped mica 500WV 5PF
		INDUCTOR
L1701	53020013	Micro inductor 150μH
L1704	53020015	Micro inductor 560μH
L1702, 1703 (R1701, 1702)	53003220	RF choke #220307
	91100008	Wrapping terminal C

RECT. C UNIT

Symbol No.	Parts No.	Description
	017171AZ	Rect. C unit with components
PB-1717A	60417171	P.C. Board

		IC. TRANSISTOR
Q1801	25000074	IC TA7089M
Q1804	22106390	Transistor 2SA639
Q1803	22107330	Transistor 2SA733
Q1805, 1806	22318155	Transistor 2SC1815GR
		DIODE
D1801, 1802	21090019	Silicon 10D10
D1803~1808	21015550	Silicon 1S1555
		RESISTOR
R1810	40143479	Carbon film 1/4W VJ 4.7Ω
R1815	40143471	" " " " 470Ω
R1812	40143472	" " " " 4.7kΩ
R1813, 1814 1817, 1818	40143103	" " " " 10kΩ
R1816	40143223	" " " " 22kΩ
R1801, 1802, 1804, 1805	42124474	Carbon composition 1/2W GK 470kΩ
R1803, 1809	43204471	Metallic film 2W 470Ω
R1808	43304332	" " 3W 3.3kΩ
R1806	43304153	" " " 15kΩ
R1807	43304473	" " " 47kΩ
		POTENTIOMETER
VR1801	49915502	V10K-8-1-2 5kΩB
		CAPACITOR
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

SELECT SWITCH BOARD

Symbol No.	Parts No.	Description
	017183AZ	Select switch board with components
PB-1718C	60417183	P.C. Board
		TRANSISTOR
Q1901, 1902	22318154	Transistor 2SC1815Y
		DIODE
D1901, 1902	21090011	Silicon 10D1

		RESISTOR			**DIODE**
R1901, 1902	40143103	Carbon film 1/4W VJ 10kΩ	D2101~2103	20900140	LED GD4-203SRD
			D2104, 2108	21090011	Silicon 10D1
			D2105~2107, 2109~2112	21015550	Silicon 1S1555
		CAPACITOR			
C1901	34220106	Electrolytic 16WV TW 10μF			**RESISTOR**
			R2105, 2107	40143560	Carbon film 1/4W VJ 56Ω
			R2106	40143221	" " " " 220Ω
			R2111	40143821	" " " " 820Ω
			R2102	40143102	" " " " 1kΩ
		RELAY	R2101, 2104, 2108	40143152	" " " " 1.5kΩ
RL1901, 1902	70000031	FBR211AD012M 12V	R2103	40143472	" " " " 4.7kΩ
			R2112, 2113	40143103	" " " " 10kΩ
			R2109	40143123	" " " " 12kΩ
			R2110	40143223	" " " " 22kΩ
		SWITCH			
S1901~1906	65000039	6B0002CC2060			
	91100008	Wrapping terminal C			
					POTENTIOMETER
			VR2101	49912471	V10K-8-1-2 470ΩB

LEVER SWITCH BOARD

Symbol No.	Parts No.	Description
	017191AZ	Lever switch board with components
PB-1719B	60417191	P.C. Board
		RESISTOR
R2001	41143821	Carbon film 1/4W TJ 820Ω
		SWITCH
S2001	64000103	SLE 62251
S2002	64000102	SLE 64301
S2003, 2004, 2005	64000101	SLE 62301

TUNE SWITCH BOARD

Symbol No.	Parts No.	Description
	017202AZ	Tune switch board with components
PB-1720B	60417202	P.C. Board
		TRANSISTOR
Q2102, 2103	22107330	Transistor 2SA733
Q2101	22318154	Transistor 2SC1815Y

		CAPACITOR
C2102	30820473	Ceramic disc 50WV 0.047μF
C2101	34220107	Electrolytic 16WV TW 100μF
		RELAY
RL2101, 2102	70000031	FBR211AD012M 12V
		SWITCH
S2101~2105	65000035	5B0001FC2060
	91100008	Wrapping terminal C

LED A BOARD

Symbol No.	Parts No.	Description
	017212AZ	LED A board with components
PB-1721B	60417212	P.C. Board
		DIODE
D2201~2206	20900140	LED GD4-203SRD

		RESISTOR	
R2203	41143271	Carbon film 1/4W TJ	270Ω
R2202	41143821	" " " "	820Ω
R2201	41143152	" " " "	1.5kΩ

REJECT SWITCH BOARD

Symbol No.	Parts No.	Description
	017222AZ	Reject switch board with components
PB-1722B	60417222	P.C. Board
		DIODE
D2301	20900140	LED GD4-203SRD
		RESISTOR
R2301	40143152	Carbon film 1/4W VJ 1.5kΩ
		POTENTIOMETER
VR2301	49915502	V10K-8-1-2 5kΩB
		SWITCH
S2301	65000034	1B0001AC2060

TRIMMER A BOARD

Symbol No.	Parts No.	Description
	017233AZ	Trimmer board A with components
PB-1723C	60417233	P.C. Board
		TRANSISTOR
Q2401	22307354	Transistor 2SC735Y
Q2402	22318154	Transistor 2SC1815Y
		DIODE
D2402	21015550	Silicon 1S1555
		RESISTOR
R2401, 2402	40143103	Carbon film 1/4W VJ 10kΩ

		CAPACITOR
C2407	30820103	Ceramic disc 50WV 0.01μF
C2409	33824100	Dipped mica " 10PF
C2405	33824120	" " " 12PF
C2403, 2404	33824680	" " " 68PF
C2402	33824271	" " " 270PF
C2401	33824821	" " " 820PF
C2406	34220336	Electrolytic 16WV TW 33μF
		TRIMMER CAPACITOR
TC2401	39000018	B7P 420PF
TC2407	39000001	ECV-1ZW 10x32 10PF
TC2406	39000002	ECV-1ZW 20x32 20PF
TC2402~2405	39000005	ECV-1ZW 50x32 50PF
		TRANSFORMER
T2401	55003292	#220303A
T2402	55003222	#220261

TRIMMER B BOARD

Symbol No.	Parts No.	Description
	017243AZ	Trimmer B board with components
PB-1724C	60417243	P.C. Board
		RESISTOR
R2501, 2502	40143682	Carbon film 1/4W VJ 6.8kΩ
		CAPACITOR
C2503	33824330	Dipped mica 50WV 33PF
C2504	33824680	" " " 68PF
C2502	33824271	" " " 270PF
C2501	33824821	" " " 820PF
		TRIMMER CAPACITOR
TC2501	39000018	B7P 420PF
TC2506, 2507	39000002	ECV-1ZW 10x32 10PF
TC2502~2505	39000005	ECV-1ZW 50x32 50PF
		TRANSFORMER
T2501	55003292	#220303A
T2502	55003222	#220261

TRIMMER C BOARD

Symbol No.	Parts No.	Description
	010920BZ	Trimmer C board with components
PB-1092-3330	60610920	P.C. Board
		RESISTOR
R2601	42124333	Carbon composition 1/2W TJ 33kΩ
		CAPACITOR
C2605	33834100	Dipped mica 500WV 10PF
C2603	33834300	" " " 30PF
C2604	33834500	" " " 50PF
C2602	33834221	" " " 220PF
C2601	33834821	" " " 820PF
		TRIMMER CAPACITOR
TC2603~2605	39000017	B-1P1 40PF
TC2602	39000016	B-2PY 100PF
TC2601	39000018	B-7P 420PF

KEYER UNIT

Symbol No.	Parts No.	Description
	017281AZ	Keyer unit with components
PB-1728A	60417281	P.C. Board
		IC & TRANSISTOR
Q2701	25000203	IC 8044
Q2702	22318154	Transistor 2SC1815Y
		DIODE
D2701~2706	21090115	Germanium 1N60
		RESISTOR
R2705	40143102	Carbon film 1/4W VJ 1kΩ
R2704	40143332	" " " " 3.3kΩ
R	40143472	" " " " 4.7kΩ
R2709, 2710	40143103	" " " " 10kΩ
R2703	40143393	" " " " 39kΩ
R2706	40143473	" " " " 47kΩ
R	40143563	" " " " 56kΩ
R2701,2702,2707	40143104	" " " " 100kΩ
VR2702	49905104	**POTENTIOMETER** SR19R 100kΩB
	49905105	SR19R 1MΩB
		CAPACITOR
C2703	30820473	Ceramic disc 50WV 0.047μF
C2701, 2702	36825104	Mylar 50WV 0.1μF
C2705	36526204	Tantalum 35WV 0.2μF
C2706, 2707	36526334	" " 0.33μF
C2704	34220226	Electrolytic 16WV 22μF
		MINI CONNECTOR
J2701	67080006	5048-8A

MEMORY UNIT

Symbol No.	Parts No.	Description
	017872AZ	Memory board with components
PB-1787B	60417872	P.C. Board
		IC, FET & TRANSISTOR
Q2820	25000149	IC LM308
Q2821	25000135	IC MC4044P (μPC1008C)
Q2822~2826	25000090	IC MC14042B
Q2812	25000147	IC MM74C90
Q2811	25000146	IC MSM5562
Q2818	25000172	IC NJM78L05
Q2816, 2817	25000175	IC NJM78L08
Q2813	25000140	IC SN74LS00N
Q2814, 2833	25000141	IC SN74LS04N
Q2832	25000151	IC SN74LS123N
Q2827~2831	25000150	IC SN74LS192N
Q2815	25000148	IC TC5032P
Q2819, 2834	25000109	IC μPC14305
Q2801, 2802, 2805, 2806	22890017	FET JF1033B
Q2809	23800401	FET 3SK40M
Q2807	22303724	Transistor 2SC372Y
Q2803, 2804, 2810	22307853	Transistor 2SC785O
Q2808	22390001	Transistor MPS A13
		DIODE
D2804, 2805	21001880	Germanium 1S188FM
D2801~2803	21015550	Silicon 1S1555
D2806, 2807	21090141	Varactor MV104
D2808	21090145	Zener WZ060

		CRYSTAL	
X2801	71800092	HC-18/U	3276.8kHz
		RESISTOR	
R2863	40143279	Carbon film RD 1/4F	2.7Ω
R2860	40143339	" " " "	3.3Ω
R2825	40143220	" " " "	22Ω
R2805, 2808, 2822, 2824	40143101	" " " "	100Ω
R2813	40143121	" " " "	120Ω
R2809, 2821	40143221	" " " "	220Ω
R2804, 2817	40143391	" " " "	390Ω
R2826, 2831, 2840	40143471	" " " "	470Ω
R2835	40143102	" " " "	1kΩ
R2815	40143122	" " " "	1.2kΩ
R2818, 2834, 2849	40143152	" " " "	1.5kΩ
R2842, 2855	40143272	" " " "	2.7kΩ
R2832, 2837	40143332	" " " "	3.3kΩ
R2810, 2843, 2857, 2861	40143472	" " " "	4.7kΩ
R2853	40143562	" " " "	5.6kΩ
R2827, 2848	40143822	" " " "	8.2kΩ
R2844, 2846, 2847, 2850~2852	40143103	" " " "	10kΩ
R2811	40143123	" " " "	12kΩ
R2828, 2829	40143153	" " " "	15kΩ
R2838	40143223	" " " "	22kΩ
R2812, 2858, 2859	40143333	" " " "	33kΩ
R2836	40143473	" " " "	47kΩ
R2803, 2806, 2820	40143563	" " " "	56kΩ
R2854, 2862	40143823	" " " "	82kΩ
R2801, 2802, 2814, 2816, 2823, 2830, 2833, 2839, 2841, 2856	40143104	" " " "	100kΩ
R2807, 2819	40143334	" " " "	330kΩ
R2845	40143394	" " " "	390kΩ
R2864	41143102	" " " 1/4P	1kΩ
R2865	41143472	" " " 1/4P	4.7kΩ
		POTENTIOMETER	
VR2801, 2802	49800093	PN822H103H	10kΩB
		CAPACITOR	
C2849	31829101	Ceramic disc 50WV	100PF SL
C2807	31820240	" " "	24PF CH
C2828	31820390	" " "	39PF CH
C2827	31820470	" " "	47PF CH
C2805	31820820	" " "	82PF CH
C2804	31827100	" " "	10PF UJ
C2803	31827470	" " "	47PF UJ
C2802	31827271	Ceramic disc 50WV	270PF UJ
C2821, 2823	38820471	" " "	470PF (2222-660-02-471)
C2822	38820102	" " "	0.001μF (RD200YZ1-2P)
C2801, 2806, 2808, 2811, 2813~2815, 1818~2820, 2829~2832, 2839, 2856, 2859, 2867	38820103	" " "	0.01μF (RD204YM103P)
C2868,2869,2871	30820473	" " "	0.047μF
C2810	33821050	Dipped mica "	5PF
C2860	33824150	" " "	15PF
C2816	33824470	" " "	47PF
C2812, 2817	33824510	" " "	51PF
	33824820	" " "	82PF
C2834	36825332	Mylar "	0.0033μF
C2837	36825473	" "	0.047μF
C2847, 2848, 2853	36825104	" "	0.1μF
C2861	36526334	Tantalum 35WV	0.33μF
C2842, 2843, 2852	36526105	" "	1μF
C2844	36526255	" "	2.2μF
C2851	36526335	" "	3.3μF
C2850	36916337	" 6.3WV	330μF
C2862~2865	32821102	Feed thru 50WV	0.001μF
C2833, 2835, 2836	36824331	Styrol "	330PF
C2825	34120336	Electrolytic 10WV "	33μF
C2824	34120476	" 10WV TW	47μF
C2845	34220475	" 16WV TW	4.7μF
C2826	34220106	" " "	10μF
C2809, 2838, 2841, 2854, 2855, 2857, 2858, 2866	34220337	" " " (CE04 RVC 16WV 330μF)	330μF
C2870	34220108	" " "	1000μF
		TRIMMER CAPACITOR	
TC2801	39000073	ECV-1ZW 40x53	40PF
		INDUCTOR	
L2802,2805,2807	53020001	Micro inductor FL-5H	1mH
L2803, 2804	53020014	" " FL-4H	1.8μH
L2801	53020027	" " FL-5H	270μH
L2806	55003069	" " 35μH	#220012
		TRANSFORMER	
T2801	55003223		#220332A

COUNTER UNIT

Symbol No.	Parts No.	Description
	017291AZ	Counter/Display unit assembly
PB-1729A	60417291	P.C. Board
		IC, FET & TRANSISTOR
Q2920, 2921	25000144	IC F40192
Q2919	25000143	IC MC1416P
Q2916	25000114	IC MC14011B
Q2911	25000138	IC MSL980-Y7
Q2910	25000139	IC MSL980-Y4
Q2917, 2922, 2923	25000085	IC MSM561
Q2918	25000084	IC MSM5501
Q2912	25000080	IC MSM5564
Q2925	25000175	IC NJM78L08
Q2913	25000140	IC SN74LS00N
Q2914	25000141	IC SN74LS04N
Q2915	25000072	IC SN74LS90N
Q2903	25000104	IC SN76514N
Q2924	25000109	IC μPC14305
Q2902	22890017	FET JF1033B
Q2901	23800401	FET 3SK40M
Q2909	22107330	Transistor 2SA733
Q2904, 2905	22307853	Transistor 2SC785O
Q2906~2908	22309450	Transistor 2SC945
		DIODE
D2901~2907	21015550	Silicon 1S1555
		CRYSTAL
X2901	71800105	HC-18/U 18.5MHz #210045-2
X2902	71800106	HC-18/U 18.0MHz #210045-1
X2903	71400001	HC-14/W 655.36kHz #210025
		RESISTOR
R2954	42124100	Carbon composition 1/2W 10Ω
R2932~2953	40143101	Carbon film RD 1/4F 100Ω
R2909, 2912	40143221	" " " " 220Ω
R2915, 2918	40143331	" " " " 330Ω
R2903, 2906, 2928	40143471	" " " " 470Ω
R2904	40143152	" " " " 1.5kΩ
R2907, 2910	40143222	" " " " 2.2kΩ
R2919, 2920, 2922, 2925	40143332	" " " " 3.3kΩ
R2911	40143472	" " " " 4.7kΩ
R2908	40143562	" " " " 5.6kΩ
R2902, 2913, 2914, 2916, 2917	40143153	" " " " 15kΩ
R2924, 2926,	40143473	" " " " 47kΩ
R2931	40143473	Carbon film RD 1/4F 47kΩ
R2901, 2905, 2927	40143104	" " " " 100kΩ
R2929	40143105	" " " " 1MΩ
R2930	40143225	" " " " 2.2MΩ
		BLOCK RESISTOR
RB2901	47000004	RK1/16B8R 4.7kΩ × 8
		CAPACITOR
C2901	31829080	Ceramic disc 50WV 8PF SL
C2903, 2911	31829330	" " " 33PF SL
C2916, 2919	31827820	" " " 82PF UJ
C2922, 2923	31820510	" " " 51PF CH
C2905, 2915, 2918	31820101	" " " 100PF CH
C2902, 2904, 2906~2910, 2912, 2913, 2917, 2920, 2947, 2948	30820103	" " " 0.01μF
C2929, 2931 2952	30820473	" " " 0.047μF
C2926	33824331	Dipped mica " 330PF
C2927	36825332	Mylar " 0.0033μF
C2950	36825102	" " 0.001μF
C2924	36825473	" " 0.047μF
C2914, 2930, 2949	36226106	Tantalum 16WV 10μF
C2932~2945	32821102	Feed thru 50WV 0.001μF
C2925, 2928	36324331	Styrol 25WV 330PF
C2946	36326685	Noise limiter 20WV 6.8μF
C2951	34220477	Electrolytic 16WV 470μF
C2953, 2954	36526105	Tantalum 35WV 1μF
		RECEPTACLE
J2901	67160002	Pin connector 5049-16A 16P
J2902	68020001	CN 7017
		VARIABLE CAPACITOR
VC2901	39000072	TSN-120SX 10PF×2
		TRANSFORMER
T2901, 2902	52000064	8X377004 13MHz #220306
		INDUCTOR
L2901	55020025	Micro inductor FL-5H 33μH
L2902	55003370	Noise filter coil SFT840D

DISPLAY BOARD

Symbol No.	Parts No.	Description
PB-1730	60417300	P.C. Board
		DISPLAY LED
DS3001~3006	21090135	HP5082-7740
		SOCKET
QS3001~3006	68140005	314-AG-37D
	67200003	Board joint 163740

DIODE SWITCH BOARD

Symbol No.	Parts No.	Description
	017261AZ	Diode switch board with components
PB-1726A	60417261	P.C. Board
		FET
Q3101, 3102	22800195	2SK19GR
		DIODE
D3102	21010070	Germanium 1S1007
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
		CAPACITOR
C3104, 3105, 3109~3112	30820103	Ceramic disc 50WV 0.01μF
C3113	30820473	" " " 0.047μF
C3101, 3103	33824471	Dipped mica 50WV 470PF
C3102	33824102	" " " 1000PF
C3106, 3107, 3108	34220106	Electrolytic 16WV TW 10μF

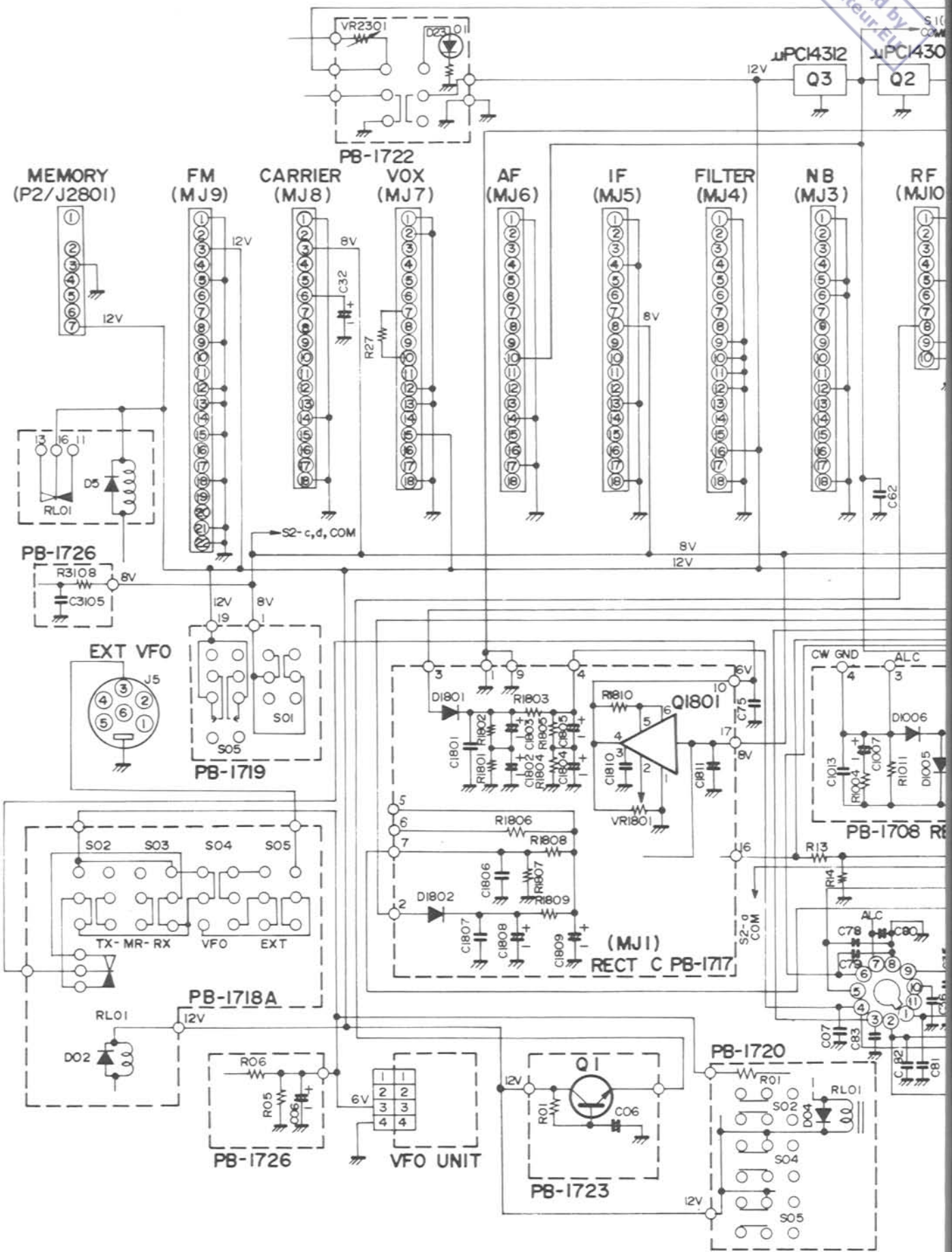
		INDUCTOR
L3101, 3102		Micro inductor FL-4H 220μH
L3103	53020027	Micro inductor FL-5H 270μH
	91100008	Wrapping terminal C

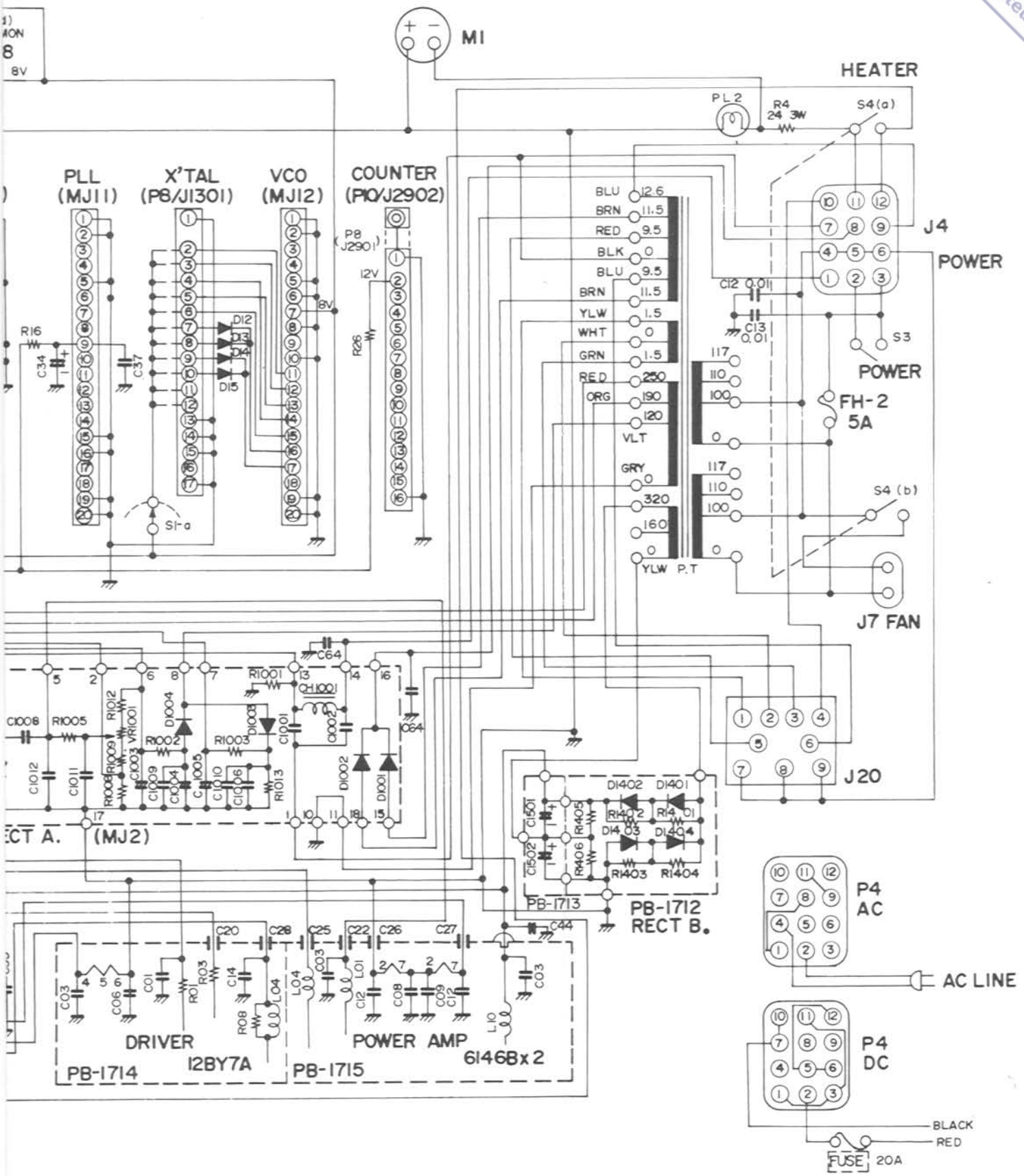
DC-DC CONVERTER UNIT

Symbol No.	Parts No.	Description
		TRANSISTOR
Q3201, 3202	22290020	T20A6 with insulator
		RESISTOR
R3202	43104332	Wire wound 1W 3.3Ω
R3201	43504221	Metallic film 5W 220Ω
		CAPACITOR
C3202	38235473	Metallized paper 150WV 0.047μF
C3201	34320227	Electrolytic 25WV 220μF
		CONNECTOR
P3201	68090038	AC9M

ACCESSORIES

Symbol No.	Parts No.	Description
	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
	9003684	3 wire, 2 prong EU plug
	67120009	Power plug QS-A-P12FL
	T9003720	DC Power cord #240037
	67120009	Power plug QS-A-P12FL
	69000002	Fuse holder SN1102
	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)





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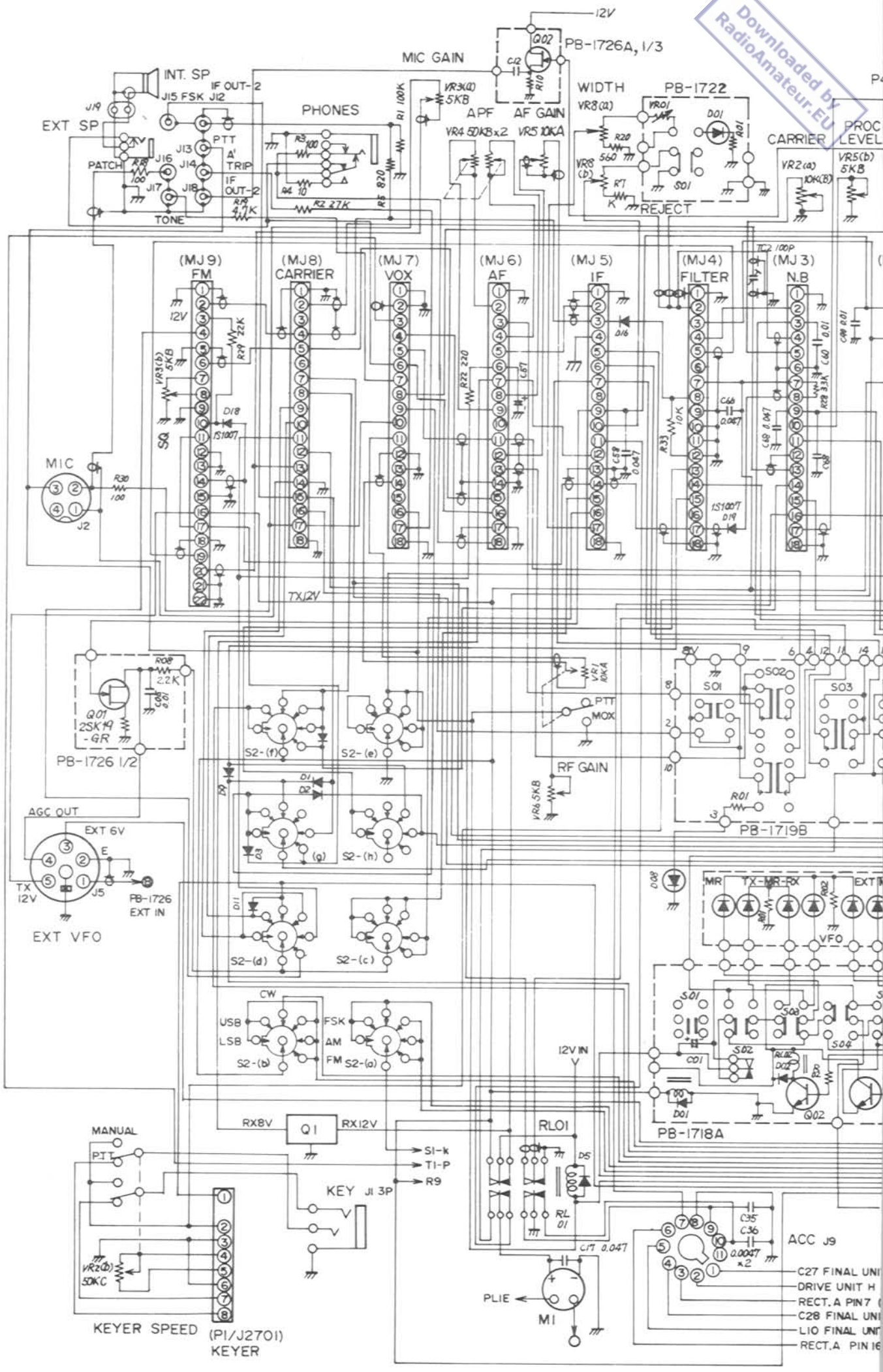
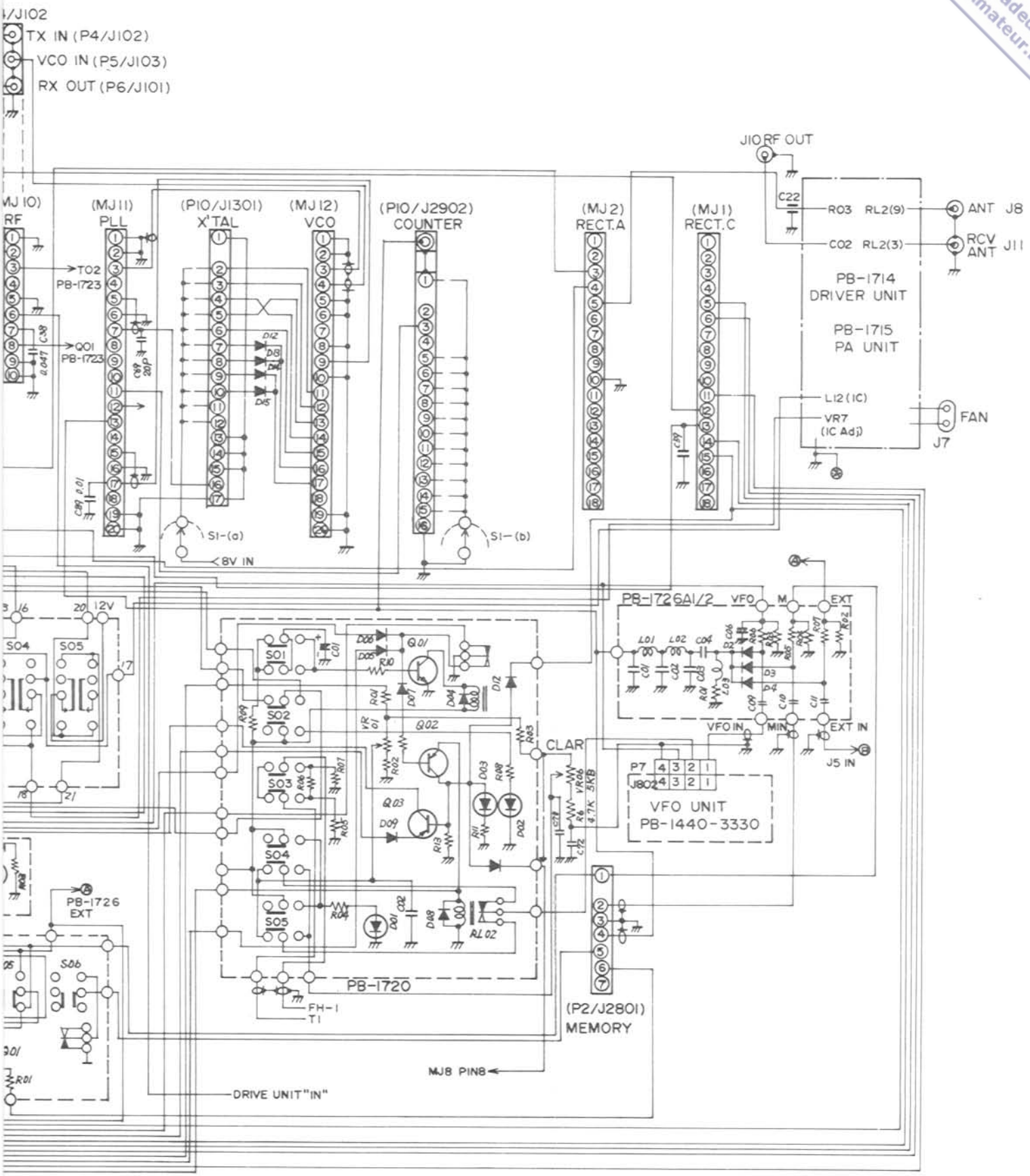
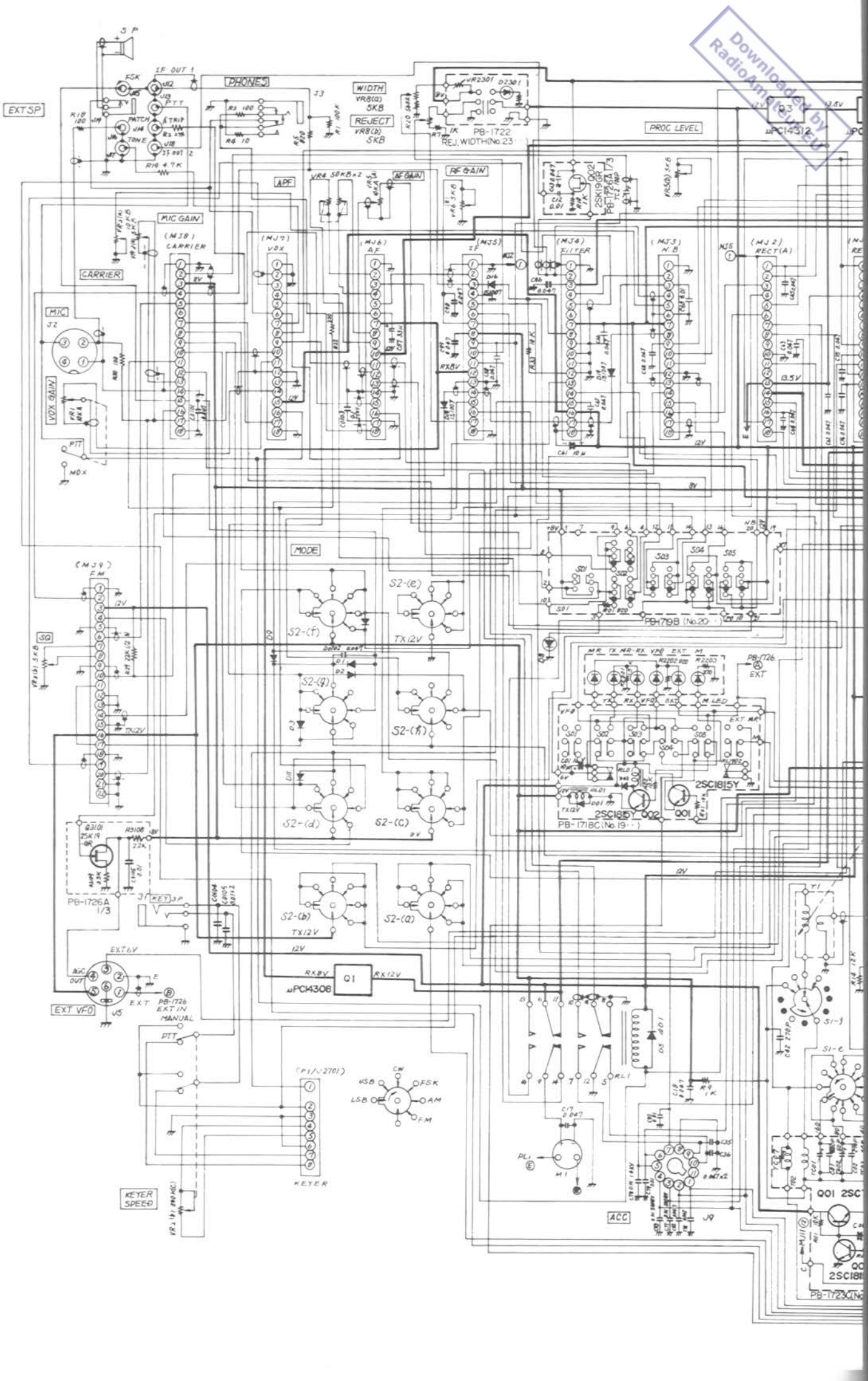
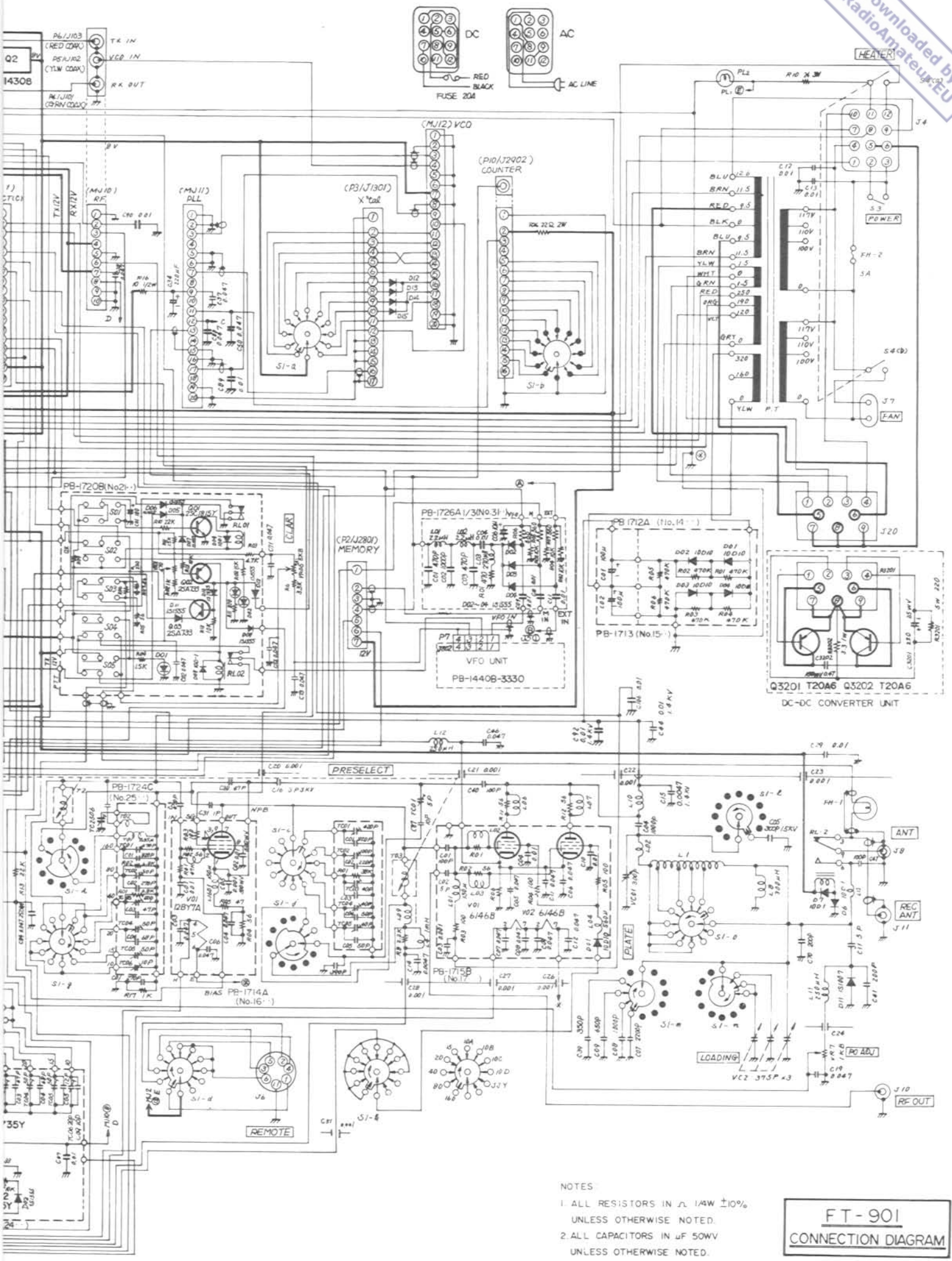
POWER DISTRIBUTION



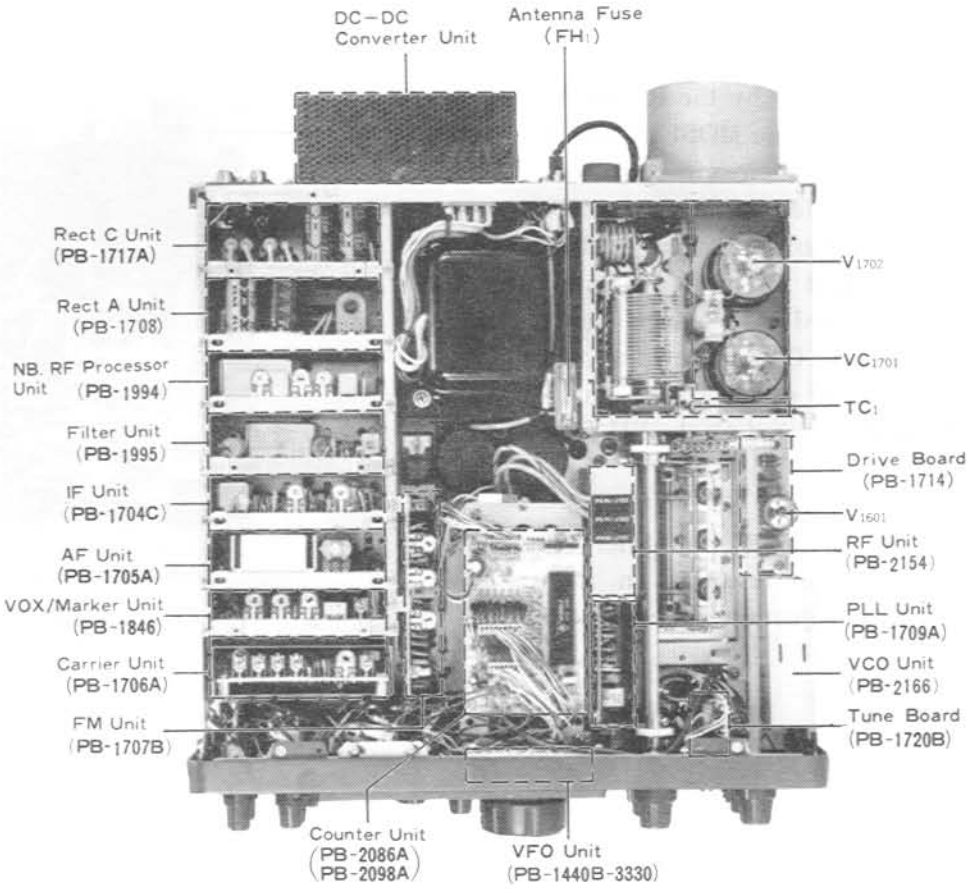


FT-901 MAIN CHASSIS
SIGNAL AND CONTROL WIRING

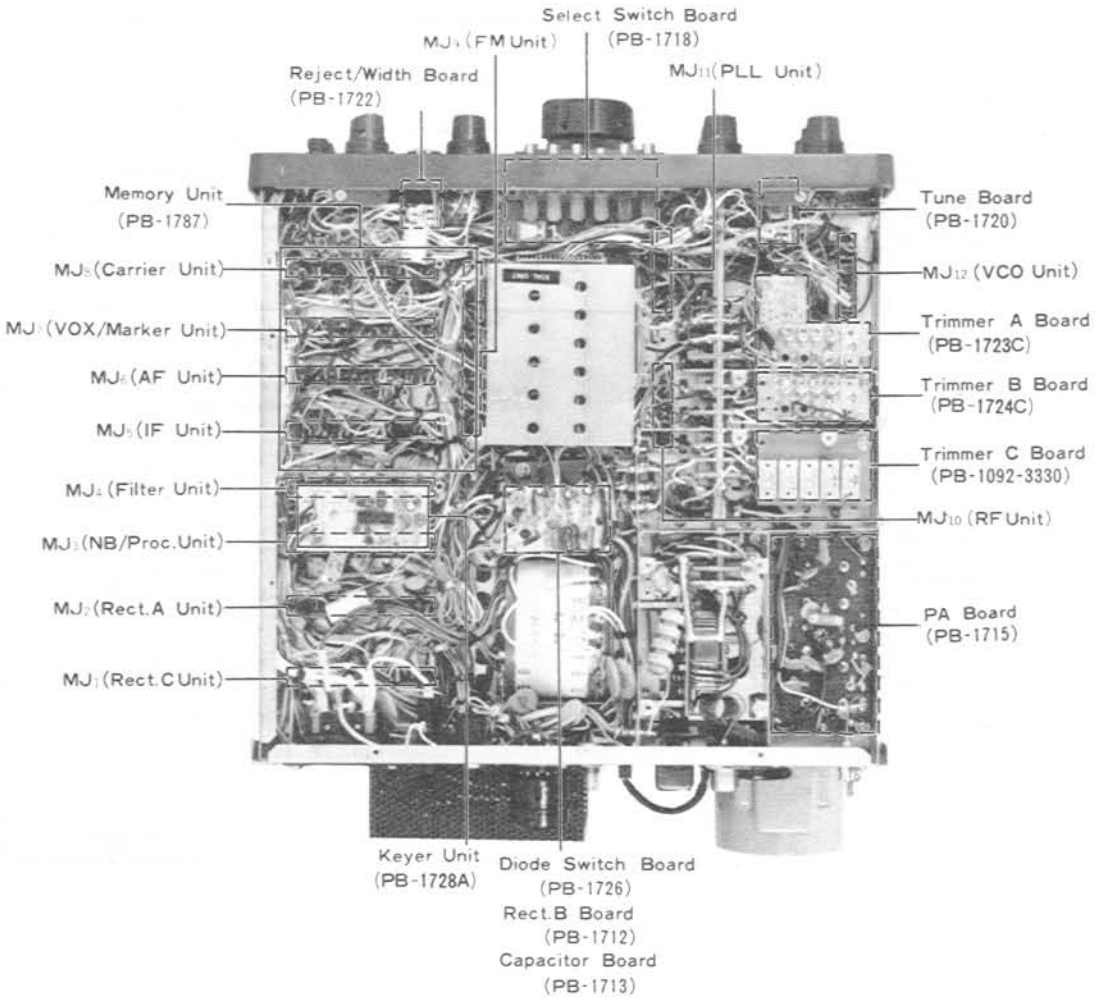

EXT SP
SP
PHONES
WIDTH
VR8(a) 5KB
REJECT
VR8(b) 5KB
PB-1722
REJ. WIDTH(No.23··)
PROC LEVEL
AF GAIN
APF
MIC GAIN
CARRIER
MIC
VOX GAIN
PTT
MOX
MODE
S2-(e)
S2-(f)
S2-(g)
S2-(h)
S2-(d)
S2-(c)
S2-(b)
S2-(a)
PB-1726A 1/3
PB-1718C(No.19··)
PB-1726 EXT
2SC1815Y
2SC1815Y
Q1
μPC14308
EXT 6V
EXT VFO
EXT
MANUAL
KEYER
KEYER SPEED
ACC
(MJ1) CARRIER
(MJ2) RECT(A)
(MJ3) N.B.
(MJ4) FILTER
(MJ5) IF
(MJ6) AF
(MJ7) VOX
(MJ8) FM
(MJ9) FM
PB-1723(No.
Downloaded by RadioAmateur.eu



SECTION 5 — CIRCUIT UPDATE (FT-902DM)



Top View

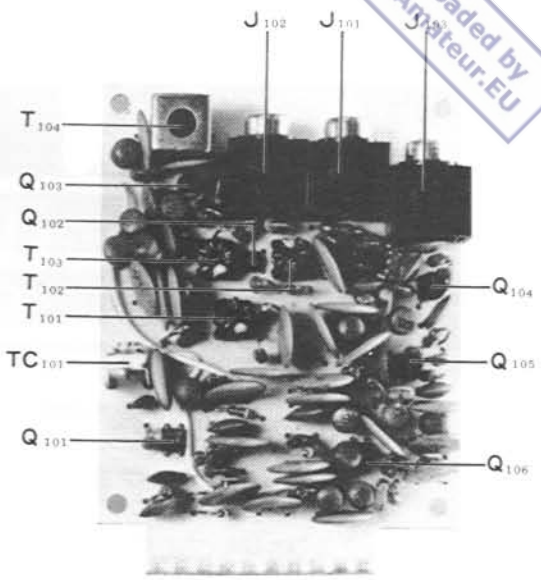


Bottom View

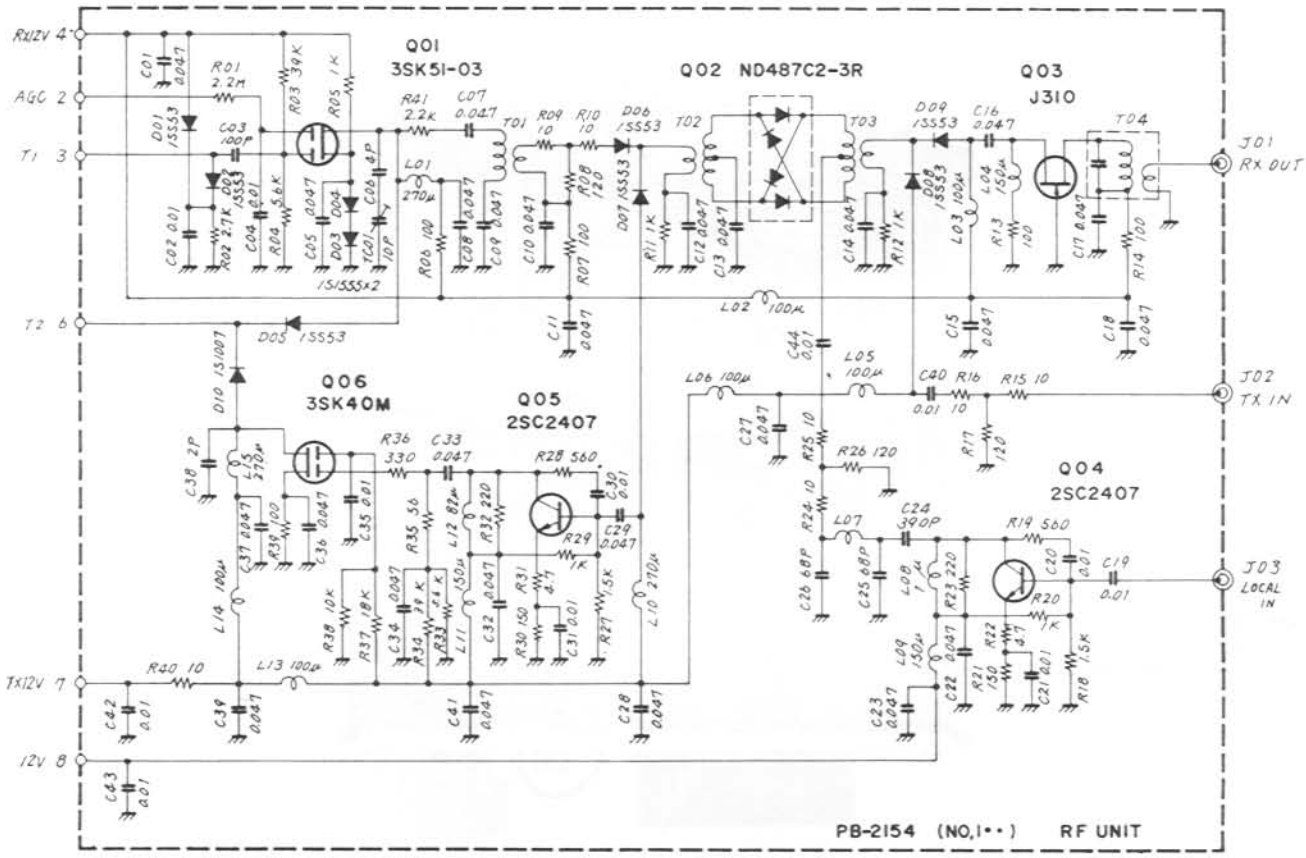
RF UNIT (PB-2154)

The incoming signal is amplified by the RF amplifier Q_{101} (3SK51-03), a dual gate MOSFET which has superior rejection against cross modulation. The amplified signal is then fed to the first mixer Q_{102} (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 Q_{103} (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.



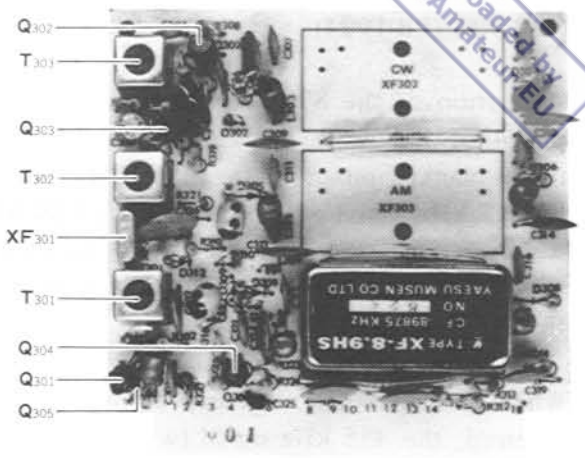
RF unit (PB-2154)



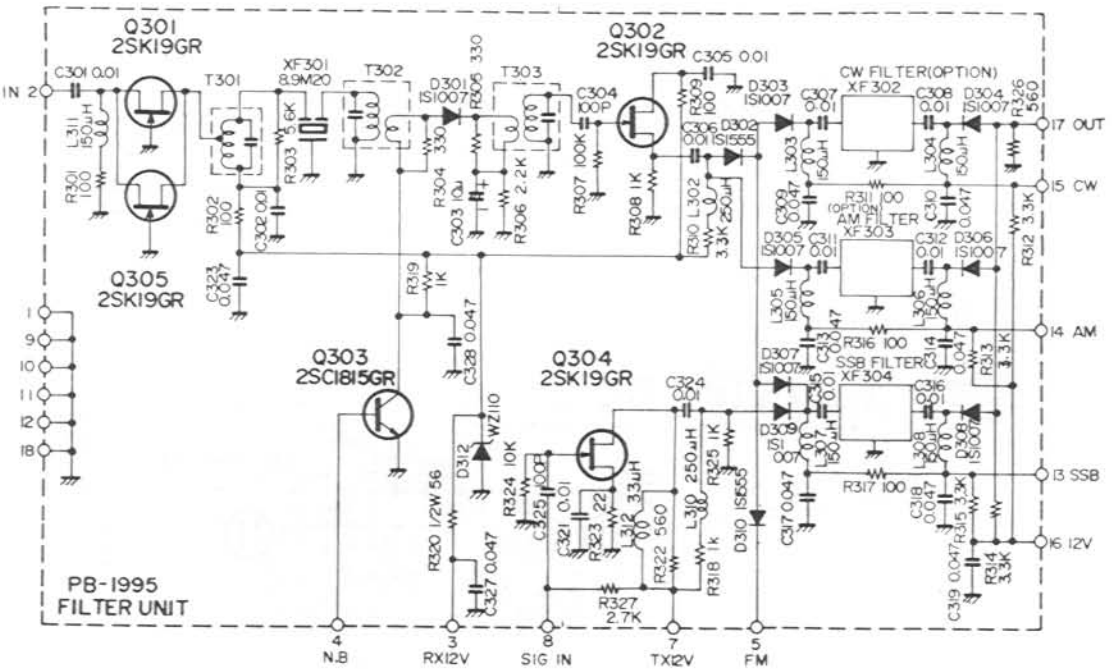
FILTER UNIT (PB-1995)

The IF signal received at pin 2 of the FILTER UNIT (**PB-1995**) is amplified by parallel-connected Q_{301} and Q_{305} (both **2SK19GR**), and fed through a monolithic filter XF_{301} (**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, Q_{302} (**2SK19GR**).

The noise blanker diode D_{301} (**1S1007**) is placed between T_{302} and T_{303}, and it functions as an ON/OFF switch which is controlled by the noise blanker driver Q_{303} (**2SC1815GR**). The output from the source of Q_{302} is passed through the SSB filter XF_{304} (or the optional AM or CW filters). Selection of the filter to be used is performed by one of the diode switches D_{303} - D_{308} (**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 D_{310} (**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 Q_{209} **(3SK40M)**, where the 8532.5 kHz signal generated by Q_{211} **(2SC1815Y)** is mixed with the incoming signal to produce a 455 kHz signal. The 455 kHz signal is then amplified by Q_{210} **(3SK40M)**.

When a carrier or a noise-free modulated signal is received, the 455 kHz signal (with its corresponding strength) is rectified by D_{202} and D_{203} (both **1N270**) to charge C_{235}. There is no discharge loop for C_{235}; therefore, signals which exceed the charged voltage established by the reference voltage on C_{235} will not pass through D_{202} and D_{203}. Accordingly, there will be no voltage drop across R_{247}, and Q_{212} **(3SK51-03)** will conduct as the gate voltage approaches zero potential. When Q_{212} conducts, the drain voltage at pin 2 of the printed board will drop.

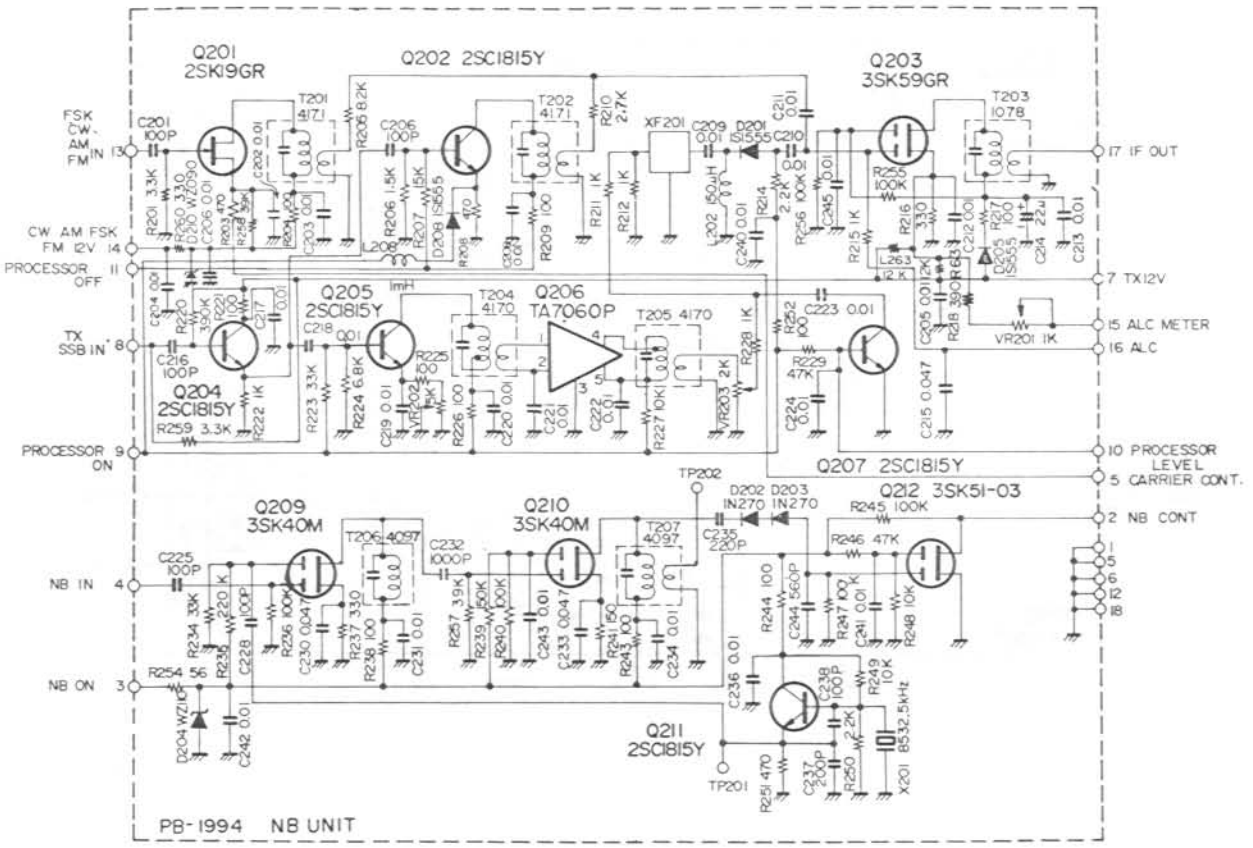
The drain of Q_{212} is directly connected to the base of Q_{303} **(2SC1815GR)** in the FILTER UNIT. As the drain voltage of Q_{212} drops, the base voltage of Q_{303} drops, turning off Q_{303}. The collector voltage will then increase, producing a forward bias to D_{301} **(1S1007)**. As D_{301} conducts, the signals will pass normally through the circuit.

When pulse-type noise is received which exceeds the charged reference voltage established by C_{235}, D_{202} and D_{203} will permit negative-going pulses to turn Q_{212} off. The drain voltage will rapidly increase as it turns off.

As the drain voltage increases, Q_{303} will turn on and the collector voltage will decrease. Accordingly, D_{301} 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, Q_{401} **(3SK51-03)**, where the IF signal is heterodyned with a 19.7475 MHz ± Δf local signal delivered from crystal oscillator Q_{405} **(2SC535A)** and buffer amplifier Q_{406} **(2SC1815Y)**, resulting in a signal of 10.76 MHz ±Δf.



The new 10.76 MHz ± Δf signal is fed through filter XF_{401} to the IF first mixer Q_{401} (**3SK51-03**), 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 XF_{401}. The combination of filters XF_{304} and XF_{401} provides continuously variable width of the IF passband.

The frequency of crystal oscillator Q_{405} is varied by varactor diode D_{410} (**1S2209**).

On the AM and FM modes, the IF signal is passed through diode switches D_{402} and D_{403} (**1S1007**), and does not pass through filter XF_{401}.

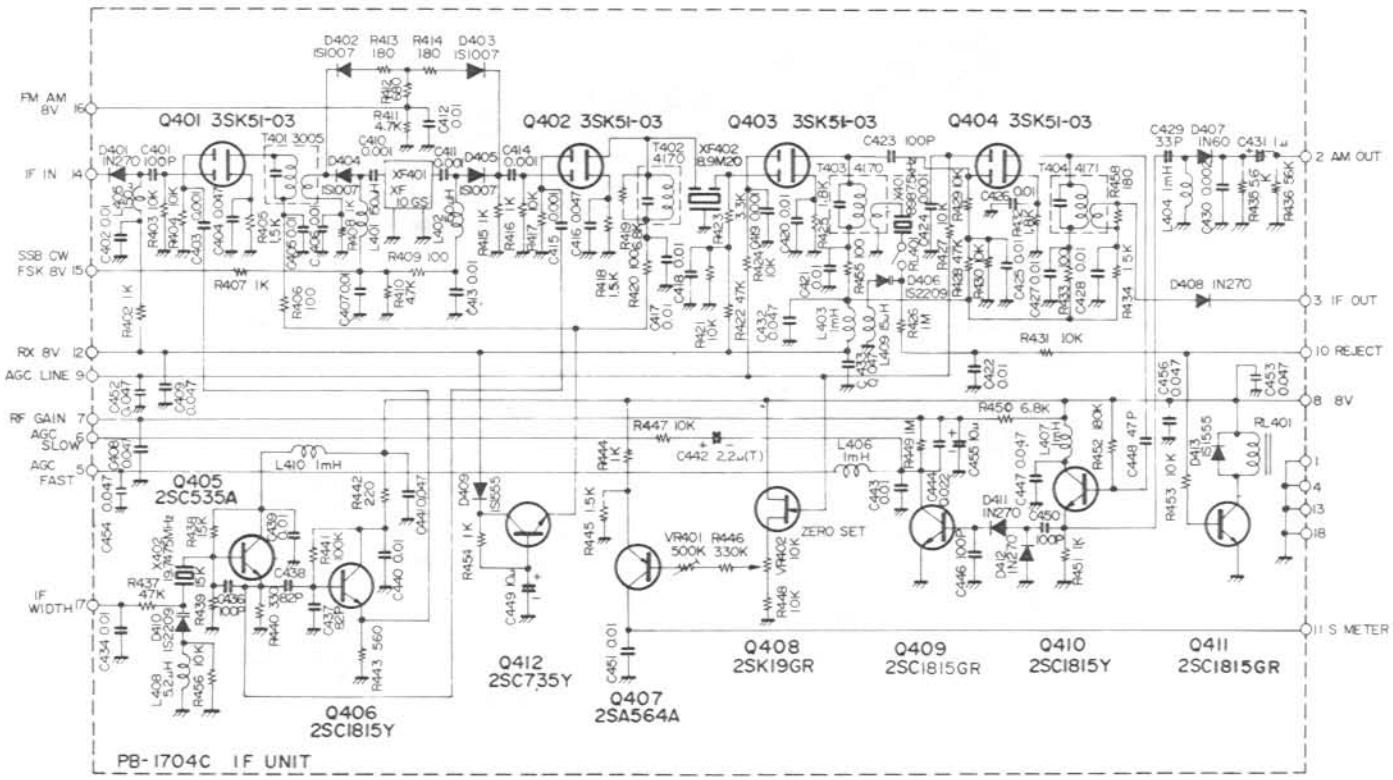
The output from the IF second mixer is fed through a monolithic filter XF_{402} to the two-stage IF amplifier consisting of Q_{403} and Q_{404} (both **3SK51-03**).The output from Q_{403} is coupled to the rejection tuning circuit which eliminates interference within the IF passband. This rejection function is accomplished by varying the resonant frequency of a crystal with varactor diode D_{406} (**1S2209**) on the SSB, CW, and FSK modes.

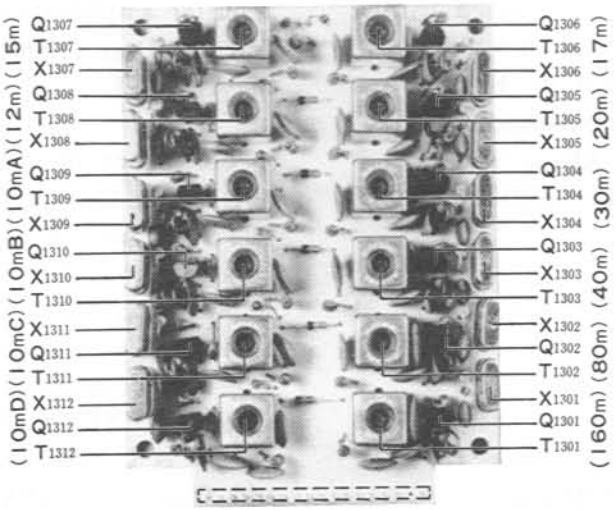
The amplified IF signal is fed to the CARRIER UNIT. In the AM mode, the signal is fed through a buffer amplifier Q_{410} (**2SC1815Y**) to the AM detector D_{407} (**1N60**). The signal is then fed to the AF UNIT.

A portion of the output from Q_{410} is rectified by D_{411} and D_{412} (**1N270**) to produce AGC voltage. The AGC voltage is amplified by DC amplifier Q_{409} (**2SC1815GR**) and fed to the gate of RF amplfier Q_{101} and to IF amplifiers Q_{403} and Q_{404} to control the gain of these stages for AGC purposes. The time constant of the AGC voltage decay is selectable (**FAST/SLOW**) by switch S_{2003}. The AGC voltage is further amplified by Q_{408} (**2SK19GR**) and Q_{407} (**2SA564A**) for signal strength indication on the front panel S-meter.

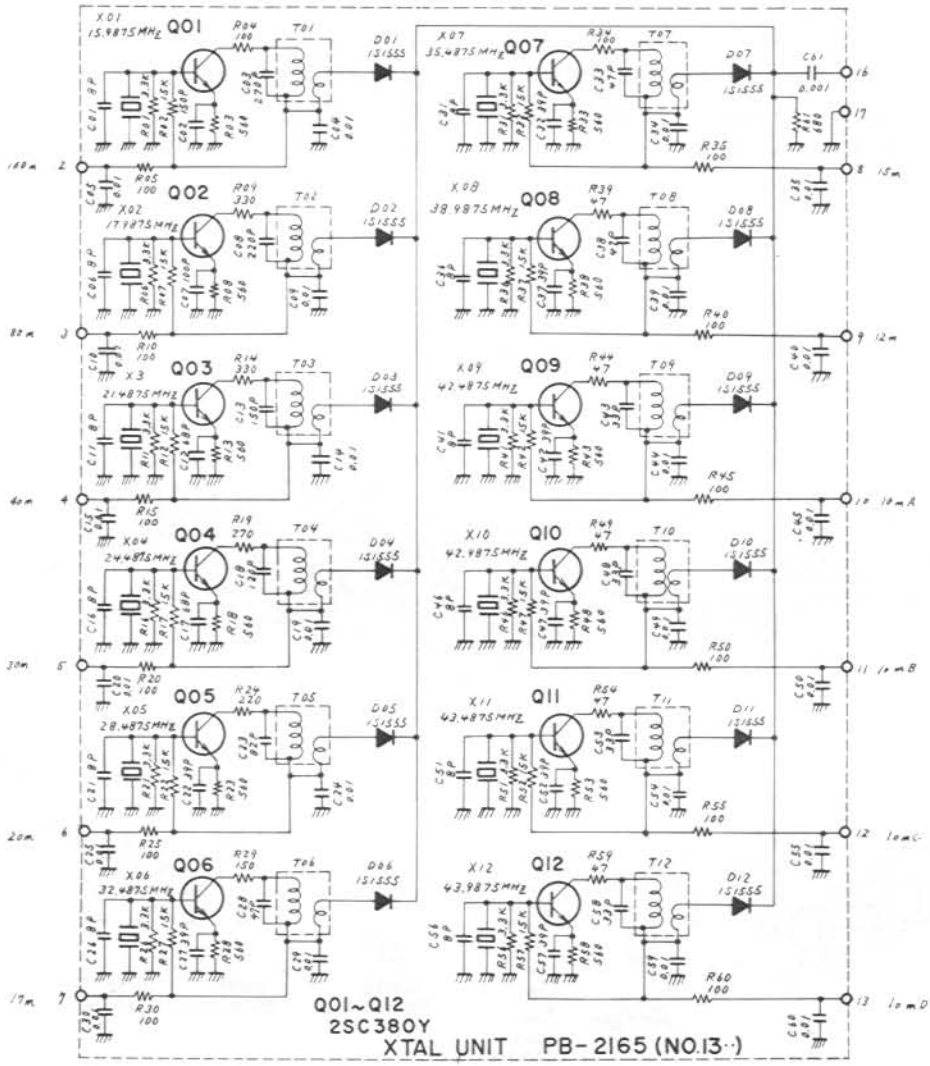
The RF GAIN control on the front panel varies the AGC voltage level, providing manual control of the gain of the RF and IF stages.

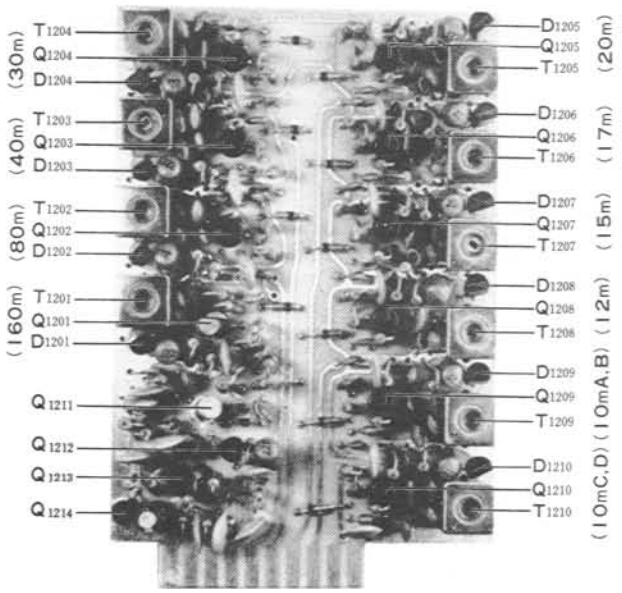
Q_{411}(**2SC1815GR**) works as a relay driver for the IF rejection tuning circuit. Delay transistor Q_{412} (**2SC735Y**) supplies the voltage to the drain of Q_{401} and Q_{402} when the transceiver returns to the receive mode after transmission.



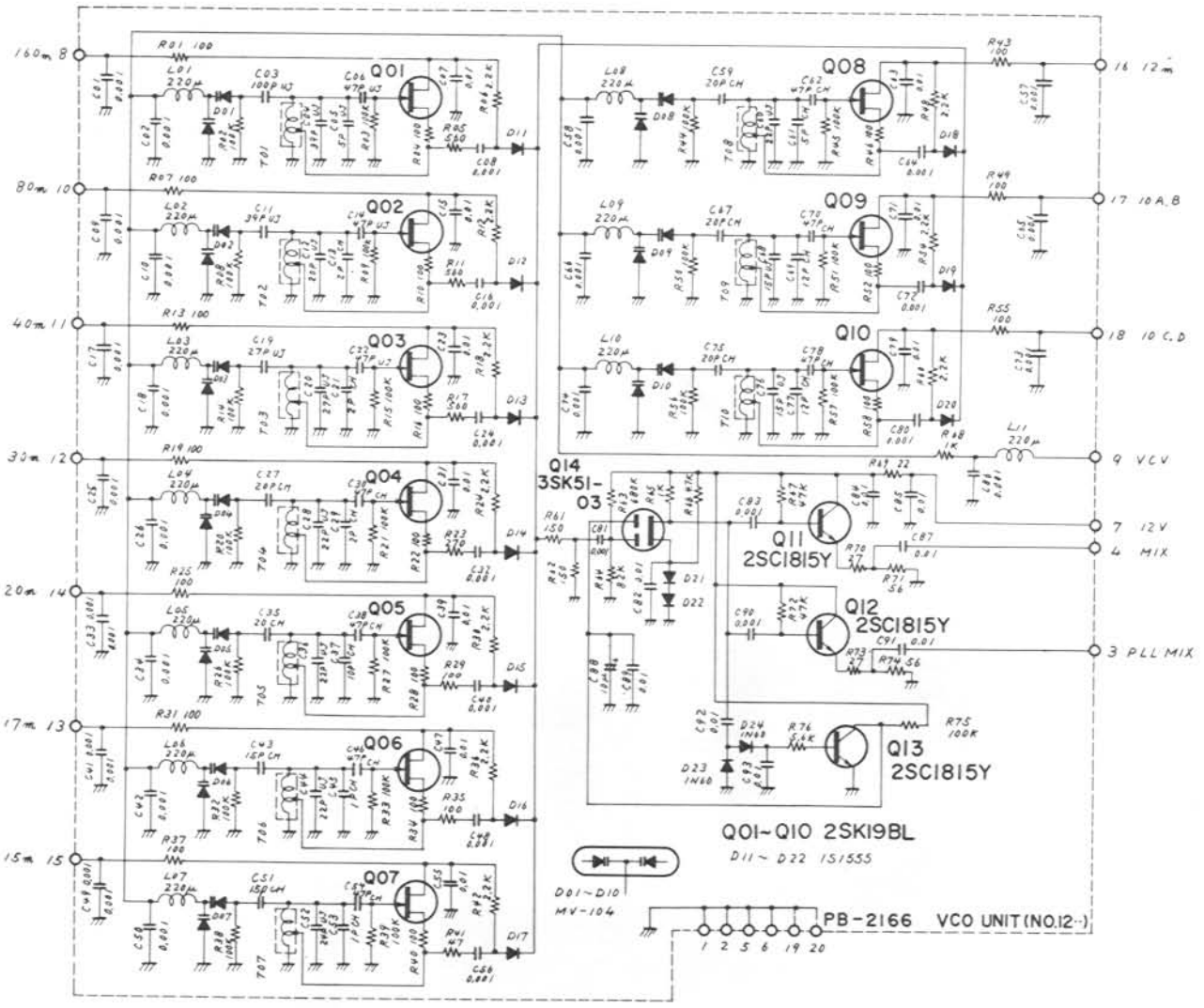


Crystal unit (PB-2165)





VCO unit (PB-2166)



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

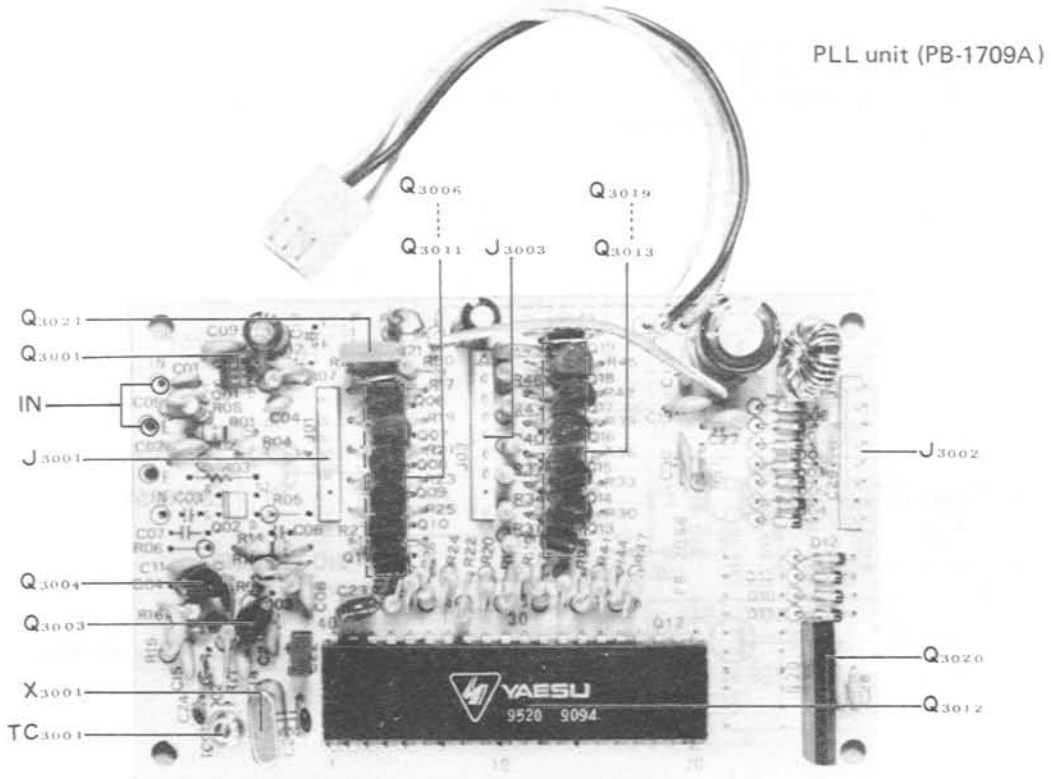
The local oscillator signal is applied to Large-Scale Integrated Circuit (LSI) chip for display on the front panel digital display.

The premix signal as shown in Table 2 from the LOCAL Unit, is amplified by Q_{3001} **(3SK73)**. The amplified signal is further amplified by Q_{3003} **(2SC 1674)** and delivered to the **LSI** counter chip, Q_{3012} **(MSM95 20RS)**. of the output from Q_{3003} is amplified by Q_{3004} **(2SC1815Y)** and fed to gate 2 of Q_{3001} controlling the gain of those amplifiers.

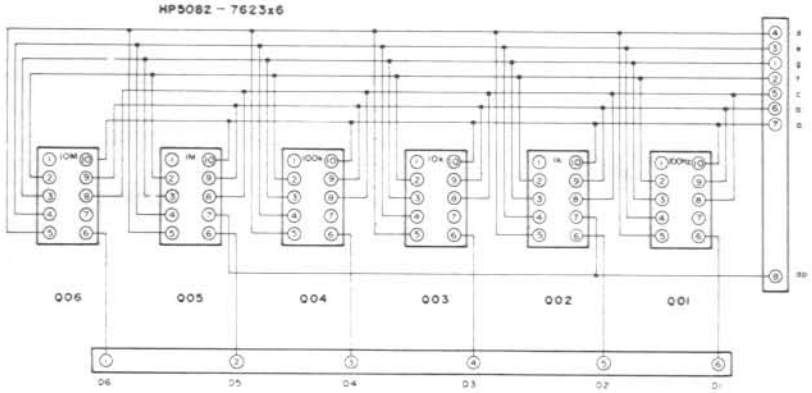
The output from the LSI is fed to the display. The output from pins 24 through 30 is delivered to segment drivers Q_{3013}–Q_{3019} **(2SA952L)** and digit drivers Q_{3006}–Q_{3011} **(2SA952L)** through a dynamic drive configuration. Display is performed by D_{2901}–D_{2906} **(HP5082-7623)**, seven-segment 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

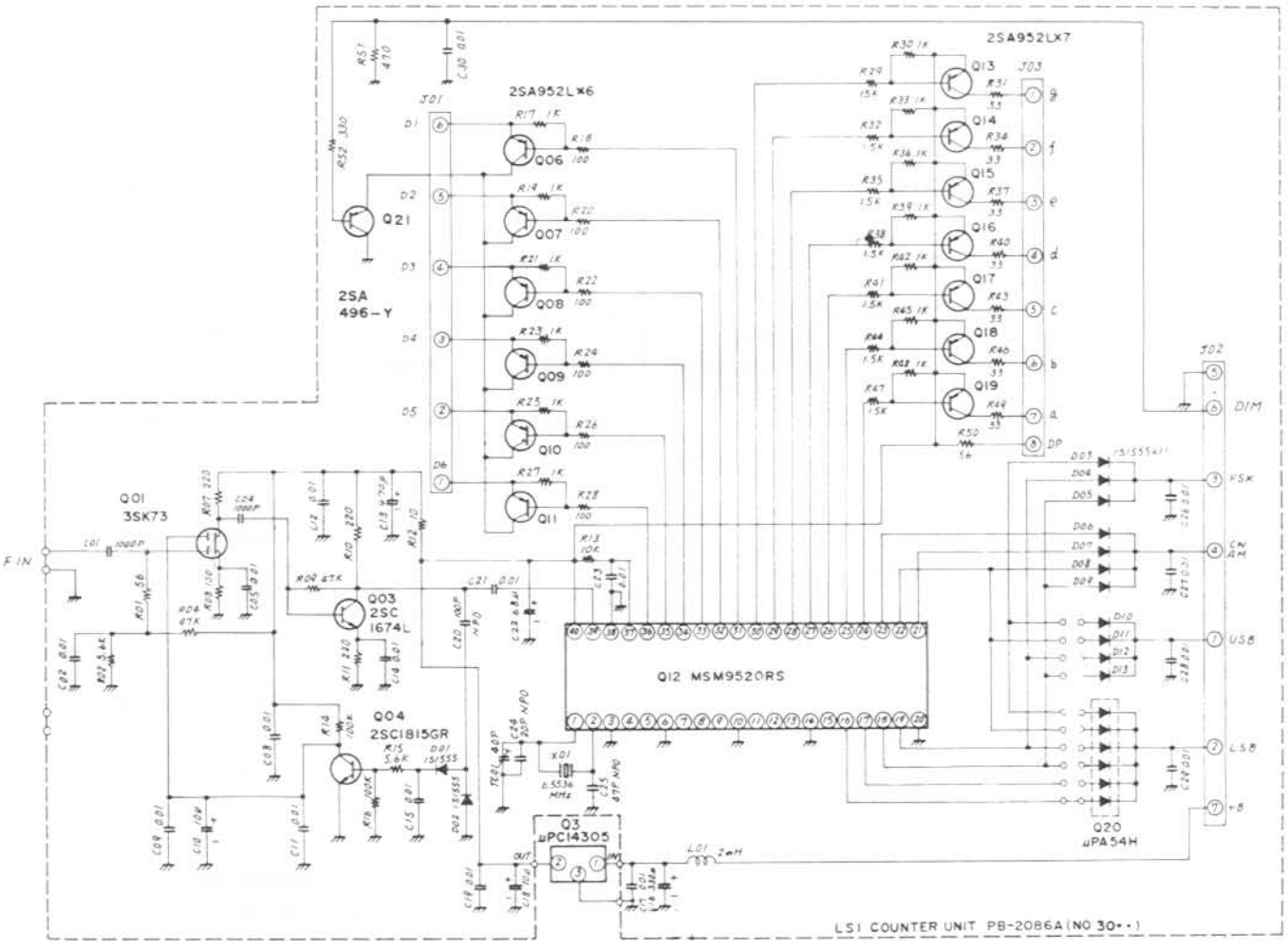
Table 2



Counter unit (PB-2086A)



DISPLAY UNIT PB-2098 (NO.29)



PARTS LIST

MAIN CHASSIS

Symbol No.	Part No.	Description
		IC
Q1,2	G1090070	μPC14308
Q3	G1090114	μPC14312
		TRANSISTOR
Q5	G3107150C	2SA715C
		DIODE
D10,16,18,19,31	G2090118	Germanium 1SS97
D1~3,9,11~15,17,27~30	G2015550	Silicon 1S1555
D5~7,20,26	G2090001	〃 10D1
	J01245562	Carbon film ¼W TJ 5.6kΩ
		RESISTOR
R5	J01245821	Carbon film ¼W TJ 820Ω
	J00245102	〃 〃 〃 VJ 1kΩ
R6	J01245332	〃 〃 〃 TJ 3.3kΩ
R19,43	J01245472	〃 〃 〃 〃 4.7kΩ
R2	J00245273	〃 〃 〃 VJ 27kΩ
R1	J01245104	〃 〃 〃 TJ 100kΩ
R4,16	J10276100	〃 composition ½W GK 10Ω
R39	J30356150	Cement 3W 〃 15Ω
R37	J01245681	Carbon film ¼W TJ 680Ω
R3,18,30	J10276101	〃 Composition ½W 〃 100Ω
R22	J10276221	〃 〃 〃 〃 220Ω
R7,9,17	J10276102	〃 〃 〃 〃 1kΩ
R20	J10276152	〃 〃 〃 〃 1.5kΩ
R8	J10276222	〃 〃 〃 〃 2.2kΩ
R25	J10276272	〃 〃 〃 〃 2.7kΩ
R33	J10276103	〃 〃 〃 〃 10kΩ
R14	J10276123	〃 〃 〃 〃 12kΩ
R13,29	J10276223	〃 〃 〃 〃 22kΩ
R44	J01245471	Carbon film ¼W TJ 470Ω
R40	J10276279	〃 〃 ½W 〃 2.7Ω
R36	J20306222	Metallic film 1W 2.2kΩ
R35	J20356332	〃 〃 3W 3.3kΩ
R41,42	J01245562	Carbon film ¼W TJ 5.6kΩ
R38	J01245182	〃 〃 〃 〃 1.8kΩ
		POTENTIOMETER
VR1	J60800021	VM11AA41A5M1112 10kΩA
VR2	J62800035	DM11A743A5M1222 10kΩB/500kΩC
VR3	J62800020	DM10A039A 5kΩB/5kΩB
VR4	J61800007	GM70A619A 50kΩB×2
VR5	J62800034	DM70A039A 5kΩB/5kΩA
VR7	J60800064	VM10A654C 1kΩB
VR8	J62800026	DM10E553A 5kΩB/5kΩB
VR9	J60800039	VM10AB08A 5kΩB
VR6	J62800047	DM10A042A 5kΩB/5kΩB
		CAPACITOR
C30	K02175470	Ceramic disc 50WV 47pF (DD106CH470J50V02)
C5	K00329001	Ceramic disc 1.5KV 300pF (MD40JSL301K1.5KV)
C16	K00359003	Ceramic disc 3KV 3pF (CC45SL3F030KY)
C4	K12359001	Ceramic disc 3KV 1000pF (CK45E3F102KY)
C103	K14179003	Ceramic disc 25WV 0.1μF (DB209YZ104Z5L0)
C29,59,60,89,90,104,105~107,109	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)
C17,18,19,37,38,46,48~50,52,~56,58,75 59,62~68,71~73,81,82,88,91,96,98,99,101,102,112,93	K13170473	Ceramic disc 50WV 0.047μF (DB207YF473Z5L5)
C110	K02175121	Ceramic disc 50WV 120pF
C35,36	K12279004	Ceramic disc 500WV 0.0047μF (ECKD2H472PE)
C77,79,80,83,106	K12279002	Ceramic disc 500WV 0.01μF (ECKD2H103PE)
C40	K00309002	Ceramic disc 1KWV 100pF (CC45SL3A101KY)
C14,15	K12329002	Ceramic disc 1.4KV 0.0047μF (ECKDAL472PE)
C12,13,44,78,92	K12329001	Ceramic disc 1.4KV 0.01μF (ECKDAL103PE)
C41	K30176201	Dipped mica 50WV 200pF (Z17D201K05)
C31	K30273010	Dipped mica 500WV 1pF (LCQ11010D5)
C11	K30273050	Dipped mica 500WV 5pF (LCQ11050D5)
C87	K30276100	Dipped mica 500WV 10pF (LCQ11100D5)
C1,42	K30276271	Dipped mica 500WV 270pF (LCQ1721K5)
C39	K30275361	Dipped mica 500WV 360pF (LCQ17361J5)
C3	K30276471	Dipped mica 500WV 470pF (LCQ17471K5)
C9	K30276511	Dipped mica 500WV 510pF (LCQ18651K5)
C8	K30279048	Dipped mica 500WV 750pF DM19D102K5)
C2	K30306391	Dipped mica 1KWV 390pF (DM15D391K10)
C7	K30306222	Dipped mica 1KWV 2200pF (DM19D222K10)
C47,70	K31306800	Moulded mica 1KWV 80pF (CML1-800K10)
C84	K50247473	Mylar 250WV 0.047μF (250F2U473M)
C20~28,51	K21270002	Feed thru 500WV 0.001μF (ECKL2H-102PE)
C61	K40120106	Electrolytic 16WV 10μF (16RL10)
C57	K40120336	Electrolytic 16WV 33μF (16RL33)
C34,43	K41120227	Electrolytic 16WV 220μF (16TL220)
C111	K31306201	Dipped mica 1KV 200pF
C108	K41140227	Electrolytic 25WV 220μF
		VARIABLE CAPACITOR
VC1	K90000035	RT-18B-300
VC2	K90000016	C134E125
		TRIMMER CAPACITOR
TC1	K91000007	120C 10×2 1.5KV 5pF

PARTS LIST

		INDUCTOR	
L1	L0020304C		
L2	L0020305A		
L4	L1190017	FL-5H 102K	1mH
L11,12,14	L1190001	EL0710-251K	250μH
L8	L1020064		300μH
L6,7(R11,R12)	L0020308		
L9	L0020009		
L10	L1020690		500μH
L13	L0020705		
		TRANSFORMER	
T1	L0020073		
T2,T3	L0020074		
		METER	
M1(With PL3,4)	M0090007A	500μA	
		SPEAKER	
SP1	M4090031	SA-77K-Y 4Ω 3W	
		POWER TRANSFORMER	
PT1	L3030013A		
		RELAY	
RL1	M1090006	AE3244	
RL2	M1090002	MX2P 12V	
		RELAY SOCKET	
RLS1	M1490004	AE3840	
RLS2	M1490001	PX08	
		SWITCH	
S1	N0050055A	RS-9-9-12	
S2	N0050054	GS-4-8-6B	
S3	N7090004	WD9216	
S4	N7090005	WD9223	
S5	N0190090	CS-3,5,12	
		PLUG	
P1(with Wire)	T9200320C	5047-08	
P2(with Wire)	T9200520E	5047-07	
P3(with Wire)	T9200340C	5047-17	
P8(with Wire)	T9203640	5047-07	
P4,5,6	P0090045	SQ4052	
P10	P0090009	SQ4152	
P7	P0090002	SI5908 4P	
P9	P0090005	SI7502 2P	

		CONNECTOR
J1	P1090001	SG-7701
J2	P0090009	FM-144-S
J3	P1090004	SG-7814
J10,11	P1090025	CN-7017
J12~18	R7040620A	Jack Ass'y Board
J19	P1090005	SG-8050
J4	P0090046	QS-A-DB12ML
J5	P1090033	D6-701B00
J6	P1090034	D7-701B00
J8	P1090028	M-BR-06B(D)
J20	P1090045	AC9-PF
J7	P1090014	S1-7501-1
J9	P1090040	SA602B00
		MULTI JACK
MJ1~8	P4090003	121S-18B-105A
MJ9	P4090004	121S-22B-105A
MJ10	P4090001	121S-10B-105A
MJ11,12	P4090007	220D-20B-205A
		COOLING FAN
FAN1	M2090001	2SB10A
		FUSE
F1	Q0000005	5A(100~117V)
	Q0000004	3A(200~234V)
		FUSE HOLDER
FH1	P2000003	F3265
FH2	P2000001	SN1001 #2
		PILOT LAMP
PL1	Q1000039	BF311-04071A 14V0.12A
PL2,3	Q1000040	BQ-044-22839A 8V 100mA
PL4(M1)	—	Meter lamp 8V0.055A
PB-1390	F0001390	LED B BOARD
D8	G2090060	LED GD4-203-SRD

RF UNIT

Symbol No.	Part No.	Description
	C0021540	RF unit with components
PB-2154A	F0002154A	P.C.Board
		FET
Q101	G4800510C	3SK51-03
Q106	G4800400M	3SK40M
Q103	G3090019	J310
Q102	G2090135	ND487C2-3R

PARTS LIST

		TRANSISTOR	
Q104,105	G3324070	2SC2407	
		DIODE	
D101,102,105~109	G2090027	Si 1SS53	
D103,104	G2015550	Si 1S1555	
D110	G2090093	Ge(GB) 1N270	
		RESISTOR	
R122,131	J00245479	Carbon film ¼WVJ 4.7Ω	
R109,110,115,116,124 140	J00245100	〃 〃 〃 10Ω	
R135	J00245223	〃 〃 〃 22kΩ	
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)	
C138	K02179003	Ceramic disc 50WV 2pF (DD104CK020C50V02)	
C106	K02172040	Ceramic disc 50WV 4pF (DD104CH040C50V02)	
C125,126	K00175680	Ceramic disc 50WV 68pF (DD104SL680J50V02)	
C103	K00175101	Ceramic disc 50WV 100pF (DD105SL101J50V02)	
C102,104,116,130,119 ~121,131,135,140 144,145	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)	
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	

		INDUCTOR
L107	L0020491	0.32μH
L108	L1190005	FL-4H 1R0M 1μH
L112	L1190033	FL-5H 820K 82μH
L102,103,105,106,113 114	L1190016	FL-5H 101K 100μH
L104,109,111	L1190020	FL-5H 151K 150μH
L101,110,115	L1190038	FL-5H 271K 270μH
		TRANSFORMER
T101~103	L0020788A	
T104	L0020221A	
		JACK
J101~103	P1090018	SQ-3081

NB UNIT

Symbol No.	Part No.	Description
	C0019940	NB unit with components
PB-1994	F0001994	P.C. Board
		IC, FET & TRANSISTOR
Q206	G1090063	IC TA7060P
Q201	G3801680D	FET 2SK168D
Q209,210	G4800400M	FET 3SK40M
Q212	G4800510C	FET 3SK51-03
Q203	G4800590G	FET 3SK59GR
Q202,204,205,207,211	G3318150Y	Transistor 2SC1815Y
		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 ¼W VJ 56Ω
R204,209,221,225 226,238,243,244	J00245101	〃 〃 〃 〃 100Ω

PARTS LIST

R252	J01245101	Carbon film ¼W TJ	100Ω
R241	J00245151	〃 〃 〃 VJ	150Ω
R216,237,260	J00245331	〃 〃 〃 〃	330Ω
R203,208,251	J00245471	〃 〃 〃 〃	470Ω
R211,212,215,217,222,228	J00245102	〃 〃 〃 〃	1kΩ
R206	J00245152	〃 〃 〃 〃	1.5kΩ
R214,250	J00245222	〃 〃 〃 〃	2.2kΩ
R210	J00245272	〃 〃 〃 〃	2.7kΩ
R201,259	J00245332	〃 〃 〃 〃	3.3kΩ
R224	J00245682	〃 〃 〃 〃	6.8kΩ
R205	J00245822	〃 〃 〃 〃	8.2kΩ
R227,248,249	J00245103	〃 〃 〃 〃	10kΩ
R263	J01245123	〃 〃 〃 TJ	12kΩ
R207	J00245153	〃 〃 〃 VJ	15kΩ
R223,234	J00245333	〃 〃 〃 〃	33kΩ
R257,258	J00245393	〃 〃 〃 〃	39kΩ
R229,246	J00245473	〃 〃 〃 〃	47kΩ
R236,240,245,247,255,256,257	J00245104	〃 〃 〃 〃	100kΩ
R239	J00245154	〃 〃 〃 〃	150kΩ
R235	J00245224	〃 〃 〃 〃	220kΩ
R220	J00245394	〃 〃 〃 〃	390kΩ
R262	J01245225	〃 〃 〃 TJ	2.2MΩ
		POTENTIOMETER	
VR201,203	J50710202	V10KB-1-2	2kΩB
VR202	J50711502	TR11R100	5kΩB
		CAPACITOR	
C201,206,216,238,225,228	K00175101	Ceramic disc 50WV (DD105SL101J50V02)	100pF
C237	K00179019	Ceramic disc 50WV (DD106SL201J50V02)	200pF
C235	K00175221	Ceramic disc 50WV (DD107SL221J50V02)	220pF
C232	K13170102	Ceramic disc 50WV (DB200YF102Z5L2)	0.001μF
C202,203,205,208~213,217,219~224,218,231,246,234,236,240~243,245	K13170103	Ceramic disc 50WV (DB201YF103Z5L5)	0.01μF
C215	K13170473	Ceramic disc 50WV (DB207YF473Z5L5)	0.047μF
C244	K30176561	Dipped mica 50WV (LCQ18-561K05)	560pF
C214	K40120226	Electrolytic 16WV (16RL22)	22μF
C230,233	K50177473	Mylar 50WV (50F2U473M)	0.047μF
		INDUCTOR	
L202	L1190020	FL-5H 151K	150μH
L203	L1190017	FL-5H 102K	1mH

		TRANSFORMER
T206,207	L0020101	R12-4097
T201,202,204,205	L0020140	R12-4170
T203	L0020221A	R12-1078
	Q5000011	Wrapping Terminal C

FILTER UNIT

Symbol No.	Part No.	Description
	C0019950	Filter unit with components
PB-1995	F0001995	P.C. Board
		FET & TRANSISTOR
Q301,302,304,305	G3090035	FET 2SK19TM-GR
Q303	G3318150G	Transistor 2SC1815GR
		DIODE
D301,303~309	G2090093	Germanium 1N270
D302,310	G2015550	Silicon 1S1555
D312	G2090012	Zener WZ110
D315~321	G2090118	Germanium 1SS97
		CRYSTAL FILTER
XF301	H1100470	8.9M-20
XF304	H1100860	XF-8.9HS
XF303	H1100870	XF-8.9GA (OPTION)
XF302	H1100880	XF-8.9HC (OPTION)
		RESISTOR
R323	J00245220	Carbon film ¼W VJ 22Ω
R301,302,309	J00245101	〃 〃 〃 〃 100Ω
R311,316,317	J01245101	〃 〃 〃 TJ 100Ω
R304,305	J00245331	〃 〃 〃 VJ 330Ω
R322,326	J00245561	〃 〃 〃 〃 560Ω
R308,318,319,325	J00245102	〃 〃 〃 〃 1kΩ
R306	J00245222	〃 〃 〃 〃 2.2kΩ
R327	J00245272	〃 〃 〃 〃 2.7kΩ
R310,312~315	J00245332	〃 〃 〃 〃 3.3kΩ
R303	J00245562	〃 〃 〃 〃 5.6kΩ
R324	J00245103	〃 〃 〃 〃 10kΩ
R307	J00245104	〃 〃 〃 〃 100kΩ
R320	J10276560	〃 composition ½W GK 56Ω
		CAPACITOR
C304	K00175101	Ceramic disc 50WV 100pF (DD105SL101J50V02)
C325	K02175101	Ceramic disc 50WV 100pF (DD107CH101J50V02)
C302,305,324	K10177103	Ceramic disc 50WV 0.01μF (DB205YB103M5L5)

PARTS LIST

C301,306,307,308, 311,312,315,316 321	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)	
C309,310,313,314, 317,318,319,323, 327,328	K13170473	Ceramic disc 50WV 0.047μF (DB207YF473Z5L5)	
C303	K40120106	Electrolytic 16WV 10μF (16RL10)	
		INDUCTOR	
L312	L1190025	FL-5H 330K 33μH	
L303~308,311	L1190020	FL-5H 151K 150μH	
L302,310	L1190001	EL0710 251K 250μH	
		TRANSFORMER	
T301~303	L0020141	R12-4171	

IF UNIT

Symbol No.	Part No.	Description
	C0017040	IF unit with components
PB-1704C	F0001704C	P. C. Board
		FET & TRANSISTOR
Q408	G3090035	FET 2SK19TM-GR
Q401~404	G4800510C	〃 3SK51-03
Q407	G3105641	Transistor 2SA564A
Q409,411	G3318150G	〃 2SC1815GR
Q405	G3305350A	〃 2SC535A
Q412	G3319590Y	〃 2SC1959Y
Q406,410	G3318150Y	〃 2SC1815Y
		DIODE
D407	G2090029	Germanium 1N60
D401,408,411,412	G2090093	〃 (GB)1N270
D402~405,414~417	G2090118	〃 1SS97
D409,413	G2015550	Silicon 1S1555
D406,410	G2022090	Varactor 1S2209
		CRYSTAL
X402	H0100433	HC-18/U 19.7475MHz
X401	H0100432	〃 8.9875MHz
		CRYSTAL FILTER
XF402	H1100470	8.9M20A
XF401	H1100900	XF-10GS

		RESISTOR
R406,420,433,455	J00245101	Carbon film ¼W VJ 100Ω
R409	J01245101	〃 〃 〃 TJ 100Ω
R413	J01245181	〃 〃 〃 〃 180Ω
R414	J00245181	〃 〃 〃 VJ 180Ω
R442	J00245221	〃 〃 〃 〃 220Ω
R440	J00245331	〃 〃 〃 〃 330Ω
R443	J00245561	〃 〃 〃 〃 560Ω
R412	J00245681	〃 〃 〃 〃 680Ω
R402,407,408,415,418 416,444,451,454	J00245102	〃 〃 〃 〃 1kΩ
R405,434,445,418	J00245152	〃 〃 〃 〃 1.5kΩ
R425,432	J00245182	〃 〃 〃 〃 1.8kΩ
R423	J00245332	〃 〃 〃 〃 3.3kΩ
R410,411	J00245472	〃 〃 〃 〃 4.7kΩ
R435	J00245562	〃 〃 〃 〃 5.6kΩ
R419,450	J00245682	〃 〃 〃 〃 6.8kΩ
R403,404,417,421, 424,427,429~431, 447,448,453,456	J00245103	〃 〃 〃 〃 10kΩ
R438,439	J00245153	〃 〃 〃 〃 15kΩ
R422,428,437	J00245473	〃 〃 〃 〃 47kΩ
R436	J00245563	〃 〃 〃 〃 56kΩ
R441	J00245104	〃 〃 〃 〃 100kΩ
R452	J00245184	〃 〃 〃 〃 180kΩ
R446	J00245334	〃 〃 〃 〃 330kΩ
R426,449	J00245105	〃 〃 〃 〃 1MΩ
		POTENTIOMETER
VR402	J50710103	V10K-8-1-2 10kΩB
VR401	J50710504	〃 500kΩB
VR403	J50705501	EVN-A1A-A00B52 500ΩB
		CAPACITOR
C401,423,446,450	K00175101	Ceramic disc 50WV 100pF (DD105SL101J50V02)
C448	K02175470	Ceramic disc 50WV 47pF (DD106CH470J50V02)
C429	K02179013	Ceramic disc 50WV 33pF (DD105CH330J50V02)
C436	K06175101	Ceramic disc 50WV 100pF (DD106UJ101J50V02)
C437,438	K06175820	Ceramic disc 50WV 82pF (ECC-D1H820JU2)
C402,405~407,412, 413,417,418,421, 425,427,428	K10177103	Ceramic disc 50WV 0.01μF (DB205YB103M5L5)
C403,410,411,414, 415,419,424	K13170102	Ceramic disc 50WV 0.001μF (DB200YF102Z5L2)
C430	K13170222	Ceramic disc 50WV 0.0022μF (DB201YF222Z5L5)
C420,422,426,434, 439,440,443,451	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)
C404,408,409,416, 432,433,441,447, 456,452~454	K13170473	Ceramic disc 50WV 0.047μF (DB207YF473Z5L5)
C444	K50177223	Mylar 〃 0.022μF (50F2U223M)
C442	K70127225	Tantalum 16WV 2.2μF (CS15E1C2R2M)

PARTS LIST

C431	K40170105	Electrolytic (50RL1)	16WV 1μF
C445,449	K40120106	Electrolytic (16RL10)	16WV 10μF
		INDUCTOR	
L409	L1190019	FL-5H 150K	15μH
L401,402,405	L1190020	FL-5H 151K	150μH
L403,404,406,407, 410	L1190017	FL-5H 102K	1mH
L408	L0020145	VXO coil	5.2μH
		TRANSFORMER	
T401	L0020187		
T402,403	L0020140	R12-4170	
T404	L0020141	R12-4171	
		RELAY	
RL401	M1190018	UFM-10208	8V

AF UNIT

Symbol No.	Part No.	Description
	C0017050	AF unit with components
PB-1705A	F0001705A	P. C. Board
		IC & TRANSISTOR
Q503	G1090110	IC TA7205AP
Q504	G1090077	〃 MC3403P
Q506	G1090123	〃 78L08
Q501,502,505,507	G330732G	Transistor 2SC732TM-GR
		RESISTOR
R523,536	J00245101	Carbon film ¼W VJ 100Ω
R516	J00245561	〃 〃 〃 〃 560Ω
R506	J00245681	〃 〃 〃 〃 680Ω
R507	J00245102	〃 〃 〃 〃 1kΩ
R512	J00245222	〃 〃 〃 〃 2.2kΩ
R504,539	J00245332	〃 〃 〃 〃 3.3kΩ
R513,514,537,538	J00245472	〃 〃 〃 〃 4.7kΩ
R510,511	J00245822	〃 〃 〃 〃 8.2kΩ
R543	J00245103	〃 〃 〃 〃 10kΩ
R503	J00245153	〃 〃 〃 〃 15kΩ
R530,545	J00245333	〃 〃 〃 〃 33kΩ
R508	J00245393	〃 〃 〃 〃 39kΩ
R502,509,515	J00245473	〃 〃 〃 〃 47kΩ
R534,540	J00245823	〃 〃 〃 〃 82kΩ
R517,520,522,525, 526,528,535,541	J00245104	〃 〃 〃 〃 100kΩ
R519,524,527	J00245124	〃 〃 〃 〃 120kΩ
R518,521,529	J00245224	〃 〃 〃 〃 220kΩ
R505	J00254151	Carbon film ¾W VJ 150Ω
		POTENTIOMETER
VR501	J61800006	GM-70R 1MΩB×2
		CAPACITOR
C512,519	K02179016	Ceramic disc (DD106CH510J50V02) 50WV 51pF
C535	K13170102	Ceramic disc (DB200YF102Z5L2) 50WV 0.001μF
C501,534	K13170103	Ceramic disc (DB201YF103Z5L5) 50WV 0.01μF
C521	K13170473	Ceramic disc (DB207YF473Z5L5) 50WV 0.047μF
C514	K30176391	Dipped mica (Z18D391K05) 50WV 390pF
C507	K50177472	Mylar (50F2U472M) 50WV 0.0047μF
C523,524	K50177682	Mylar (50F2U682M) 50WV 0.0068μF
C506	K50177103	Mylar (50F2U103M) 50WV 0.01μF
C516	K50177473	Mylar (50F2U473M) 50WV 0.047μF
C520,530,531,536	K50177104	Mylar (50F2U104M) 50WV 0.1μF
C502,503,509,511, 522,529,532,533	K40170105	Electrolytic (50RL1) 50WV 1μF
C504	K40140475	Electrolytic (25RL4R7) 25WV 4.7μF
C528	K41120106	Electrolytic (16TL10) 16WV 10μF
C513	K40100226	Electrolytic (10RL22) 10WV 22μF
C505,508	K40120226	Electrolytic (16RL22) 16WV 22μF
C525	K40100336	Electrolytic (10RL33) 10WV 33μF
C517	K40100476	Electrolytic (10RL47) 10WV 47μF
C515	K40100107	Electrolytic (10RL100) 10WV 100μF
C518	K40100477	Electrolytic (10RL470) 10WV 470μF
		HEAT SINK
	R0042800A	(TA-7205)

VOX/MARKER UNIT

Symbol No.	Part No.	Description
	C0018460	VOX/Marker unit with components
PB-1846B	F0001846B	P. C. Board

PARTS LIST

		IC & TRANSISTOR	
Q604	G1090068	IC	MC14011B
Q612	G1090064	IC	4024PC
Q603	G3105641R	Transistor	2SA564A
Q602,608~610,615	G3318150G	Transistor	2SC1815GR
Q607	G3319590Y	Transistor	2SC1959Y
Q601,605,606,611	G3318150Y	Transistor	2SC1815Y
Q613,614	G3303800Y	〃	2SC380TM-Y
		DIODE	
D601	G2090029	Germanium	1N60
D603,607~609	G2015550	Silicon	1S1555
D602,606	G2090010	Zener	WZ090
D605	G2090093	Ge(GB)	1N270
		CRYSTAL	
X601	H0100260	HC-6W 3200kHz	
		RESISTOR	
R616	J00245101	Carbon film ¼W VJ	100Ω
R643	J00245221	〃 〃 〃 〃	220Ω
R620,628	J00245471	〃 〃 〃 〃	470Ω
R605,614,625,626, 636,642,646~650	J00245102	〃 〃 〃 〃	1kΩ
R615,630,640,	J00245222	〃 〃 〃 〃	2.2kΩ
R637	J00245392	〃 〃 〃 〃	3.9kΩ
R604,606,632~634	J00245472	〃 〃 〃 〃	4.7kΩ
R627	J00245562	〃 〃 〃 〃	5.6kΩ
R601,602,607,608, 612,621	J00245103	〃 〃 〃 〃	10kΩ
R623,641,652,653	J00245103	〃 〃 〃 〃	10kΩ
R603,619,629,635, 639,644,645	J00245223	〃 〃 〃 〃	22kΩ
R624	J00245393	〃 〃 〃 〃	39kΩ
R638	J00245473	〃 〃 〃 〃	47kΩ
R613	J00245563	〃 〃 〃 〃	56kΩ
R618,631	J00245683	〃 〃 〃 〃	68kΩ
R622	J00245104	〃 〃 〃 〃	100kΩ
R609,610	J00245105	〃 〃 〃 〃	1MΩ
R651	J10276181	〃 composition ½W GK	180Ω
R611	J10246335	〃 〃 ¼W 〃	3.3MΩ
		POTENTIOMETER	
VR603	J50710103	V10K-8-1-2	10kΩB
VR601	J50710503	〃	50kΩB
VR602	J50710504	〃	500kΩB
		CAPACITOR	
C632	K00172030	Ceramic disc 50WV	3pF
		(DD104SL030C50V02)	
C635	K00172040	Ceramic disc 50WV	4pF
		(DD104SL040C50V02)	
C628	K02179011	Ceramic disc 50WV	27pF
		(DD104CH270J50V02)	
C640	K00173100	Ceramic disc 50WV SL	10pF
C634	K00175101	Ceramic disc 50WV	100pF
		(DD105SL101J50V02)	
C613	K13170102	Ceramic disc 50WV	0.001μF
		(DB200YF102Z5L2)	
C603,620,626,629, 636	K13170103	Ceramic disc 50WV	0.01μF
		(DB201YF103Z5L5)	
C638	K13170473	Ceramic disc 50WV	0.047μF
		(DB207YF473Z5L5)	
C631	K30176271	Dipped mica 50WV	270pF
		(Z17D271K05)	
C630	K30176511	Dipped mica 50WV	510pF
		(Z18D511K05)	
C622~624	K50177223	Mylar 50WV	0.022μF
		(50F2U223M)	
C608,610,616	K50177473	Mylar 50WV	0.047μF
		(50F2U473M)	
C606	K70147105	Tantalum 25WV	1μF
		(CS15E1E010M)	
C621	K70127225	Tantalum 16WV	2.2μF
		(CS15E1C2R2M)	
C602,605	K70127106	Tantalum 16WV	10μF
		(CS15E1C100M)	
C612,618	K70127226	Tantalum 16WV	22μF
		(CS15E1C220M)	
C604,611,619	K40170105	Electrolytic 50WV	1μF
		(50RL1)	
C627	K40170225	Electrolytic 50WV	2.2μF
		(50RL2R2)	
C625	K40140475	Electrolytic 25WV	4.7μF
		(25RL4R7)	
C601,609,615,617	K40120106	Electrolytic 16WV	10μF
		(16RL10)	
C607,614	K40120106	Electrolytic 16WV	22μF
		(16RL22)	
C637	K40120107	Electrolytic 16WV	100μF
		(16RL100)	
		TRIMMER CAPACITOR	
TC601	K91000020	ECV-1ZW 20×40	20pF
		SWITCH	
S601	N6090012	27S120	
		INDUCTOR	
L601	L1190005	FL4H 1ROM	1μH

CARRIER UNIT

Symbol No.	Part No.	Description	
	C0017060	Carrier unit with components	
PB-1706A	F0001706A	P. C. Board	
		IC, FET & TRANSISTOR	
Q705,706	G1090086	IC	TA7063P
Q708	G1090068	IC	MC14011B
Q702	G3090035	FET	2SK19TM-GR
Q704	G4800590Y	FET	3SK59Y
Q707	G3318150G	Transistor	2SC1815GR
Q710	G3303720G	Transistor	2SC732TM-GR
Q701,703,709	G331815Y	Transistor	2SC1815Y

PARTS LIST

		DIODE
D705~708	G2090118	Germanium (GB) 1SS97
D702~704,709,~713, 715,719,720,724	G2015550	Silicon 1S1555
D716,718	G2090010	Zener WZ090
D721,722	G2090025	Zener WZ050
D701,723	G2090093	Germanium 1N270
		CRYSTAL
X701	H0100421	HC-18/U 8986kHz
X703	H0100422A	〃 8988.3kHz
X702	H0100423	〃 8989kHz
		RESISTOR
R749,753,754	J00245680	Carbon film ¾W VJ 68Ω
R747,752	J00245101	〃 〃 〃 VJ 100Ω
R729	J00245121	〃 〃 〃 VJ 120Ω
R704,707	J00245151	〃 〃 〃 〃 150Ω
R755	J00245181	〃 〃 〃 〃 180Ω
R708,709	J00245221	〃 〃 〃 〃 220Ω
R721,735	J00245331	〃 〃 〃 〃 330Ω
R710,738	J00245391	〃 〃 〃 〃 390Ω
R702	J00245471	〃 〃 〃 〃 470Ω
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
R723	J00245153	〃 〃 〃 〃 15kΩ
R739,746,758	J00245223	〃 〃 〃 〃 22kΩ
R726	J00245333	〃 〃 〃 〃 33kΩ
R712,719,732	J00245393	〃 〃 〃 〃 39kΩ
R713,745	J00245473	〃 〃 〃 〃 47kΩ
R742	J00245563	〃 〃 〃 〃 56kΩ
R714,736	J00245823	〃 〃 〃 〃 82kΩ
R703,711,725	J00245104	〃 〃 〃 〃 100kΩ
R722,733	J00245154	〃 〃 〃 〃 150kΩ
R740,744	J00245105	〃 〃 〃 〃 1MΩ
R743	J10246335	〃 composition 〃 GK 3.3MΩ
		POTENTIOMETER
VR701	J50702201	EVL SOAA 00B22 200ΩB
VR702	J50702504	EVL SOAA 00B55 500kΩB
		CAPACITOR
C715	K00172020	Ceramic disc 50WV 2pF (DD104SL020C50V02)
C710	K02179008	Ceramic disc 50WV 20pF (DD104CH200J50V02)
C705,713	K02179011	Ceramic disc 50WV 27pF (DD104CH270J50V02)
C704	K02179012	Ceramic disc 50WV 30pF (DD105CH300J50V02)
C703	K02175390	Ceramic disc 50WV 39pF (DD105-275CH390J50V02)
C721,730	K00172101	Ceramic disc 50WV 100pF (DD105SL101J50V02)
C718,719	K00179020	Ceramic disc 50WV 240pF (DD107SL241J50V02)
C701,702,706,707, 711,712,714,716, 717,735,740,746, 748,751	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)
C739	K13170473	Ceramic disc 50WV 0.047μF (DB207YF473Z5L5)
C708,709	K30176151	Dipped mica 50WV 150pF (Z17D151K05)
C723,732	K50177222	Mylar 50WV 0.0022μF (50F2U222M)
C720,724,727,734	K50177473	Mylar 50WV 0.047μF (50F2U473M)
C725,726,736,737, 741,749,752	K40170105	Electrolytic 50WV 1μF (50RL1)
C731,747	K40170225	Electrolytic 50WV 2.2μF (50RL2R2)
C728,733,754,742~744	K40120106	Electrolytic 16WV 10μF (16RL10)
C722,738	K40120226	Electrolytic 16WV 22μF (16RL22)
C750,753	K40120336	Electrolytic 16WV 33μF (16RL33)
C729	K40120476	Electrolytic 16WV 47μF (16RL47)
		TRIMMER CAPACITOR
TC701~704	K91000020	ECV-1ZW 20×40 20pF
TC705	K91000023	ECV-1ZW 50×40 50pF
		INDUCTOR
L705	L1190023	FL-5H 220K 22μH
L706	L1190001	EL-0710 251K 250μH
L707	L1190038	FL-5H 271K 270μH
L701~704	L1190017	FL-5H 102K 1mH
		TRANSFORMER
T701	L0020141	R12-4171
T702	L0020140	R12-4170
		RELAY
RL701	M1190002	FBR-211AD012M 12V

PARTS LIST

VFO UNIT

Symbol No.	Part No.	Description
	C0014403	VFO assembly 3330
		VFO chassis
		VFO board
★★★★★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)
C805	K02175330	Ceramic disc 50WV CH 33pF (DD105CH330J50V02)
C824,826	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)
C802	K30209001	Dipped mica 50WV 1000pF (DM19D102K1)
C825	K70167334	Tantalum 35WV 0.33μF (CS15E1VR33M)
		VARIABLE CAPACITOR
VC801	K90000024	C521R-112
		TRIMMER CAPACITOR
TC801	K90000001	TSN-100D15 15pF
		INDUCTOR
L801	L0020268A	
L806	L1190001	EL0710-251K 250μH
		JACK
J802	P1090012	SI-6303-1
J801	P1090022	STR-01
	Q5000005	Lighthouse type terminal
★★★★★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
		RESISTOR
R809,811	J00245101	Carbon film 1/4W 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
		CAPACITOR
C807	K30173080	Dipped mica 50WV 8pF (LCQ11080D05)
C814	K30176330	Dipped mica 50WV 33pF (Z11C330K05)
C809,810,812,815, 819,820	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)
C811	K30176181	Dipped mica 50WV 180pF (Z17D181K05)
C813	K30176431	Dipped mica 50WV 430pF (Z18D431K05)
C808,818	K30176390	Dipped mica 50WV 39pF (Z11C390K05)
C822	K30209001	Dipped mica 50WV 1000pF (DM19D102K1)
C821,823	K00175471	Ceramic 50WV SL 470pF (DD109SL471J50V02)
		TRIMMER CAPACITOR
TC802	K91000016	ECV-1ZW 50×32 50pF
		INDUCTOR
L804,805	L1190007	FL-4H 1R8M 1.8μH
L803	L1190001	EL0710-251K 250μH
L802	L1190040	S4 102K 1mH

PARTS LIST

FM UNIT

Symbol No.	Part No.	Description
	C0017070	FM unit with components
PB-1707B	F0001707B	P.C. Board
		IC, FET & TRANSISTOR
Q904,909	G1090059	IC TA7061AP
Q914	G1090123	IC 78L08
Q911	G3800340E	FET 2SK34E
Q901	G4800510C	FET 3SK51-03
Q902,903,905,906, 907,908,910,912, 913	G3318150Y	Transistor 2SC1815Y
		DIODE
D902,903,905,906	G2001880F	Germanium 1S188FM
D901,907,910	G2015550	Silicon 1S1555
D908	G9090006	Varistor MV-13
D909	G2090040	Varactor FC-63
		CRYSTAL
X902	H0100440A	HC-18/U 8988.3kHz
X901	H0102275	HC-18/U 9442.5kHz
		CRYSTAL FILTER(OPTION)
XF901	H1102020	XF-8.9GF
		CERAMIC FILTER
CF901,902	H3900030	LFB-15
		CERAMIC DISCRIMIMNATOR
CFD901	H7900060	SFD-455-S4
		RESISTOR
R959	J00245100	Carbon film ¼W VJ 10Ω
R958	J00245560	〃 〃 〃 〃 56Ω
R914,916,917,937, 938,953,957	J00245101	〃 〃 〃 〃 100Ω
R923	J01245101	〃 〃 〃 TJ 100Ω
R922	J00245221	〃 〃 〃 VJ 220Ω
R915	J00245331	〃 〃 〃 〃 330Ω
R956	J00245471	〃 〃 〃 〃 470Ω
R936,944,952	J00245561	〃 〃 〃 〃 560Ω
R909	J00245681	〃 〃 〃 〃 680Ω
R913,933,939,943 963	J00245102	〃 〃 〃 〃 1kΩ
R906,918,929,934	J00245152	〃 〃 〃 〃 1.5kΩ
R905	J00245182	〃 〃 〃 〃 1.8kΩ
R901,902,945,960	J00245222	〃 〃 〃 〃 2.2kΩ
R910,935	J00245272	〃 〃 〃 〃 2.7kΩ
R903,926,927,946, 954	J00245332	〃 〃 〃 〃 3.3kΩ
R912	J00245392	〃 〃 〃 〃 3.9kΩ
R919,920,928,940, 942	J00245562	〃 〃 〃 〃 5.6kΩ
R908	J00245822	〃 〃 〃 〃 8.2kΩ
R947,950	J00245103	Carbon film ¼W VJ 10kΩ
R911	J00245183	〃 〃 〃 〃 18kΩ
R921,930,948,951 965,	J00245223	〃 〃 〃 〃 22kΩ
R955,964	J00245273	〃 〃 〃 〃 27kΩ
R904,907,949,961	J00245473	〃 〃 〃 〃 47kΩ
R932,941,962	J00245563	〃 〃 〃 〃 56kΩ
R924,925	J00245104	〃 〃 〃 〃 100kΩ
R931	J00245154	〃 〃 〃 〃 150kΩ
R927	J01245332	〃 〃 〃 TJ 3.3kΩ
R966	J01245152	〃 〃 〃 〃 1.5kΩ
		THERMISTOR
TH901	G9090001	SDT-250
		POTENTIOMETER
VR903	J50710202	V10-K8-1-2 2KB
VR901	J50710203	〃 20kΩB
VR902	J50710503	〃 50kΩB
		CAPACITOR
C968	K02179008	Ceramic disc 50WV 20pF (DD104CH200J50V02)
C901,902,903,913, 963	K13170102	Ceramic disc 50WV 0.001μF (DB200YF102Z5L2)
C904,905,909,910, 956,961,962,964, 966,971	K13170103	Ceramic disc 50WV 0.01μF (DB201YF473Z5L5)
C926,928,973	K13170473	Ceramic disc 50WV 0.047μF (DB207YF473Z5L5)
C960	K30176200	Dipped mica 50WV 20pF (Z11C200K05)
C907	K30176470	Dipped mica 50WV 47pF (Z11C470K05)
C930	K30176101	Dipped mica 50WV 100pF (Z12D101K05)
C958,959	K30176121	Dipped mica 50WV 120pF (Z17D121K05)
C906,908	K30176151	Dipped mica 50WV 150pF (Z17D151K05)
C955	K30176221	Dipped mica 50WV 220pF (Z17D221K05)
C911,922,940	K50177102	Mylar 50WV 0.001μF (50F2U102M)
C949	K50177332	Mylar 50WV 0.0033μF (50F2U332M)
C944	K50177472	Mylar 50WV 0.0047μF (50F2U472M)
C929,931,933,965		Mylar 50WV 0.01μF (50F2U103M)
C923,924,925,938, 950,952	K50177223	Mylar 50WV 0.022μF (50F2U223M)
C941	K50177333	Mylar 50WV 0.033μF
		(50F2U333M)
C912,914,915,916, 918,919,932,951 967,970	K50177473	Mylar 50WV 0.047μF (50F2U473M)
C954	K50177104	Mylar 50WV 0.1μF (50F2U104M)

PARTS LIST

C936,939,947	K40170105	Electrolytic (50RL1)	50W	1μF
C934,935	K40140475	Electrolytic (25RL4R7)	25WV	4.7μF
C937,942,953	K40120106	Electrolytic (16RL10)	16WV	10μF
C945,946	K40120226	Electrolytic (16RL22)	16WV	22μF
C921,943,948	K40120476	Electrolytic (16RL47)	16WV	47μF
C972	K13170680	Celamic disc	50WV	68pF
		TRIMMER CAPACITOR		
TC901	K91000019	ECV-1ZW 10×40		10pF
		INDUCTOR		
L904,905	L1190020	FL-5H 151K		150μH
L901,902,903,906	L1190017	FL-5H 102K		1mH
		TRANSFORMER		
T901	L0190002			
T902	L0020319			
T903	L0020140	R12-4170		
T904	L0020210			

RECT.A UNIT

Symbol No.	Part No.	Description
	C0017080	Rect. A unit with components
PB-1708	F0001708	P. C. Board
		DIODE
D1001,1002	G2090003	Silicon V06B
D1003,1004	G2090002	〃 10D10
D1005,1006	G2015550	〃 1S1555
		RESISTOR
R1009,1012	J00245472	Carbon film ¼W VJ 4.7kΩ
R1004,1005	J00245103	〃 〃 〃 〃 10kΩ
R1001	J10276102	〃 composition ½W GK 1kΩ
	J10276473	〃 〃 〃 〃 47kΩ
R1008	J00245563	Carbon film ¼W VJ 56kΩ
R1011	J00245225	〃 〃 〃 〃 2.2MΩ
R1003	J20306471	Metallic film 1W 470Ω
R1002	J20306562	〃 〃 〃 5.6kΩ
R1013	J20336473	〃 〃 2W 47kΩ
		POTENTIOMETER
VR1001	J50708103	V18K-3-2 10kΩB

		CAPACITOR		
C1011,1012	K12279004	Ceramic disc (ECKD2H472PE)	50WV	0.0047μF
C1009,1010	K12279002	Ceramic disc (ECKD2H103PE)	50WV	0.01μF
C1013	K13170473	Ceramic disc (DB207YF473Z5L5)	50WV	0.047μF
C1008	K30279059	Dipped mica (DM19D222K5)	50WV	2200pF
C1003~1006	K40240226	Electrolytic (250RH22)	250WV	22μF
C1001,1002	K41140338	Electrolytic (25TL3300)	25WV	3300μF
C1007	K70167224	Tantalum (CS15E1VR22M)	35WV	0.22μF
		AF CHOKE		
CH1001	L2030064			

PLL UNIT

Symbol No.	Part No.	Description
	C0017090	PLL unit with components
PB-1709A	F0001709A	P. C. Board
		IC, FET & TRANSISTOR
Q1102	G1090081	IC TA7310P
Q1106	G1090082	IC SN75450B
Q1107	G1090111	IC MC4044P (μPC1008C)
Q1111	G1090120	IC 78L05
Q1110	G1090123	IC 78L08
Q1104	G3090035	FET 2SK19TM-GR
Q1108	G3318150G	Transistor 2SC1815GR
Q1101,1103,1105,1109	G3318150Y	Transistor 2SC1815Y
		DIODE
D1101~1103	G2015550	Silicon 1S1555
		RESISTOR
R1126	J00245100	Carbon film ¼W VJ 10Ω
R1113	J00245560	〃 〃 〃 〃 56Ω
R1129	J00245680	〃 〃 〃 〃 68Ω
R1107,1128	J00245101	〃 〃 〃 〃 100Ω
R1103	J00245151	〃 〃 〃 〃 150Ω
R1105,1114,1121	J00245102	〃 〃 〃 〃 1kΩ
R1122	J00245152	〃 〃 〃 〃 1.5kΩ
R1110,1112,1115,1116 1118	J00245222	〃 〃 〃 〃 2.2kΩ
R1119,1120,1123,1124 1127	J00245472	〃 〃 〃 〃 4.7kΩ
R1111,1125	J00245223	〃 〃 〃 〃 22kΩ
R1104	J00245473	〃 〃 〃 〃 47kΩ
R1109	J00245683	〃 〃 〃 〃 68kΩ

PARTS LIST

R1117	J00245104	Carbon film ¼W VJ 100kΩ	
		CAPACITOR	
C1110,1113	K00175270	Ceramic disc 50WV 27pF (DD104SL270J50V02)	
C1135	K00175330	Ceramic disc 50WV 33pF (DD104SL330J50V02)	
C1116	K00175390	Ceramic disc 50WV 39pF (DD104SL390J50V02)	
C1120	K00175470	Ceramic disc 50WV 47pF (DD104SL470J50V02)	
C1112	K00175560	Ceramic disc 50WV 56pF (DD104SL560J50V02)	
C1117	K00175101	Ceramic disc 50WV 100pF (DD105SL101J50V02)	
C1105	K00175151	Ceramic disc 50WV 150pF (DD14SL151J50V02)	
C1101,1102,1104,1109 1114,1118,1121	K13170102	Ceramic disc 50WV 0.001μF (DB200YF102Z5L2)	
C1103,1107,1108,1115 1124~1126,1128, 1130,1131,1134,	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)	
C1119	K50177104	Mylar 50WV 0.1μF (50F2U104M)	
C1132,1133	K71137685	Noiselimiter 20WV 6.8μF (CC99E1D6R8M)	
C1127,1129	K40120106	Electrolytic 16WV 10μF (16RL10)	
		INDUCTOR	
L1105	L1190015	FL-4H 120J 12μH	
L1103,1104	L1190021	FL-5H 180K 18μH	
L1106	L1190023	FL-5H 220K 22μH	
L1108,1109,1111	L1190024	FL-5H 221K 220μH	
L1101,1107,1110	L1190017	FL-5H 102K 1mH	
		TRANSFORMER	
T1101	L0020169	R12-4184	
TP1101	Q5000011	Wrapping terminal C	

VCO UNIT

Symbol No.	Part No.	Description
	C0021660	VCO unit with components
PB-2166A	F0002166A	P. C. Board
		FET
Q1214	G4800510C	3SK51-03
Q1201~1210	G3090036	2SK19TM-BL

		TRANSISTOR
Q1211~1213	G3318150Y	2SC1815Y
		DIODE
D1201~1210	G2090043	MV104
D1211~1222	G2015550	1S1555
D1223,1224	G2090029	1N60
		RESISTOR
R1269	J00245220	Carbon film ¼W VJ 22Ω
R1270,1273	J00245270	〃 〃 〃 〃 27Ω
R1241	J00245470	〃 〃 〃 〃 47Ω
R1271,1274	J00245560	〃 〃 〃 〃 56Ω
R1201,1204,1207,1210 1213,1216,1219,1222 1225,1228,1229,1231 1234,1235,1237,1240 1243,1246,1249,1252 1255,1258	J00245101	〃 〃 〃 〃 100Ω
R1261,1262	J00245151	〃 〃 〃 〃 150Ω
R1223	J00245271	〃 〃 〃 〃 270Ω
R1205,1211,1217	J00245561	〃 〃 〃 〃 560Ω
R1265,1268	J00245102	〃 〃 〃 〃 1kΩ
R1206,1212,1218,1224 1230,1236,1242,1248 1254,1260	J00245222	〃 〃 〃 〃 2.2kΩ
R1266	J00245472	〃 〃 〃 〃 4.7kΩ
R1276	J00245562	〃 〃 〃 〃 5.6kΩ
R1267,1272	J00245473	〃 〃 〃 〃 47kΩ
R1264	J00245823	〃 〃 〃 〃 82kΩ
R1202,1203,1208,1209 1214,1215,1220,1221 1226,1227,1232,1233 1238,1239,1244,1245 1250,1251,1256,1257 1275	J00245104	〃 〃 〃 〃 100kΩ
R1263	J00245684	〃 〃 〃 〃 680kΩ
R1277	J01245560	〃 〃 〃 TJ 56Ω
		CAPACITOR
C1245,1253	K02179001	Ceramic disc 50WV 1pF (DD104CK010C50V02)
C1213,1221,1229	K02179003	Ceramic disc 50WV 2pF (DD104CK020C50V02)
C1261	K02172050	Ceramic disc 50WV 5pF (DD104CH050C50V02)
C1237	K02173100	Ceramic disc 50WV 10pF (DD104CH100D50V02)
C1269,1277	K02175120	Ceramic disc 50WV 12pF (DD104CH120J50V02)
C1243,1251	K02175150	Ceramic disc 50WV 15pF (DD104CH150J50V02)
C1227,1235,1259,1267 1275	K02179008	Ceramic disc 50WV 20pF (DD104CH200J50V02)
C1230,1238,1246,1254 1262,1270,1278	K02175470	Ceramic disc 50WV 47pF (DD106CH470J50V02)
C1250	K06172050	Ceramic disc 50WV 5pF (ECC-D1H050CU)
C1268,1276	K06175150	Ceramic disc 50WV 15pF (ECC-D1H150JU)

PARTS LIST

C1212	K06179004	Ceramic disc 50WV 20pF (DD104UJ 200J50V02)
C1228,1236,1244,1260	K06175220	Ceramic disc 50WV 22pF (ECC-D1H220JU)
C1252	K06179005	Ceramic disc 50WV 24pF (DD104UJ240J50V02)
C1219,1220	K06175270	Ceramic disc 50WV 27pF (ECC-D1H270JU)
C1204,1211	K06175390	Ceramic disc 50WV 39pF (DD104UJ390J50V02)
C1206,1214,1222	K06175470	Ceramic disc 50WV 47pF (ECC-D1H470JU2)
C1201,1202,1208~1210,1216~1218,1224~1226,1232~1234,1240~1242,1248~1250,1256~1258,1264~1266,1272~1274,1280,1281,1283,1286,1290	K13170102	Ceramic disc 50WV 0.001μF (DB200YF102Z5L2)
C1207,1215,1223,1231 1239,1247,1255,1263 1271,1279,1282,1284 1285,1287,1289,1291 1292,1293,	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)
C1288	K40129004	Ceramic disc 16WV 10μF (16RE10)
C1294	K70127106	Tantalum 16WV 10μF
C1203	K06175101	Ceramic disc 50WV 100pF
		TRANSFORMER
T1201,1202	L0020294	
T1203,1204	L0020297	
T1205,1206	L0020295	
T1207~1210	L0020296	
		INDUTOR
L1201~1211	L1190024	FL5H 221K 220μH

XTAL UNIT

Symbol No.	Part No.	Description
	C0021650	XTAL unit with components
PB-2165	F0002165	P. C. Board

		TRANSISTOR
Q1301~1312	G3303800Y	2SC380Y
		DIODE
D1301~1312	G2015550	1S1555
		CRYSTAL
X1301	H0100411	15.9875MHz
X1302	H0100412	17.9875MHz
X1303	H0100413	21.4875MHz
X1304	H0102321	24.4875MHz
X1305	H0100414	28.4875MHz
X1306	H0102322	32.4875MHz
X1307	H0100415	35.4875MHz
X1308	H0102323	38.9875MHz
X1309	H0100416	42.4875MHz
X1310	H0100417	42.9875MHz
X1311	H0100418	43.4875MHz
X1312	H0100419	43.9875MHz
		RESISTOR
R1339,1344,1349,1354 1359	J00245470	Carbon film ¼W VJ 47Ω
R1304,1305,1310,1315 1320,1325,1330,1334 1335,1340,1345,1350 1355,1360	J00245101	〃 〃 〃 〃 100Ω
R1329	J00245151	〃 〃 〃 〃 150Ω
R1324	J00245221	〃 〃 〃 〃 220Ω
R1319	J00245271	〃 〃 〃 〃 270Ω
R1309,1314	J00245331	〃 〃 〃 〃 330Ω
R1303,1308,1313,1318 1323,1328,1333,1338 1343,1348,1353,1358	J00245561	〃 〃 〃 〃 560Ω
R1361	J00245681	〃 〃 〃 〃 680Ω
R1301,1306,1311,1316 1321,1326,1331,1336 1341,1346,1351,1356	J00245332	〃 〃 〃 〃 3.3kΩ
R1302,1307,1312,1317 1322,1327,1332,1337 1342,1347,1352,1357	J00245153	〃 〃 〃 〃 15kΩ
		CAPACITOR
C1301,1306,1311,1316 1321,1326,1331,1336 1341,1346,1351,1356	K02173080	Ceramic disc 50WV 8pF (DD104CH080D50V02)
C1343,1348,1353,1358	K02179013	Ceramic disc 50WV 33pF (DD105CH330J50V02)
C1322,1327,1332,1337 1342,1347,1352,1357	K02175390	Ceramic disc 50WV 39pF (DD105-257CH390J50V02)
C1328,1333,1338	K02175470	Ceramic disc 50WV 47pF (DD106CH470J50V02)
C1312,1317	K02175680	Ceramic disc 50WV 68pF (DD107CH680J50V02)
C1323	K02175820	Ceramic disc 50WV 82pF DD107CH820J50V02)
C1307	K02175101	Ceramic disc 50WV 100pF (DD107CH101J50V02)
C1318	K02175121	Ceramic disc 50WV 120pF (DD109CH121J50V02)
C1302,1313	K02175151	Ceramic disc 50WV 150pF (DD109CH151J50V02)
C1361	K13170102	Ceramic disc 50WV 0.001μF (DB200YF102Z5L5)
C1304,1305,1309,1310 1314,1315,1319,1320 1324,1325,1329,1330 1334,1335,1339,1340 1354,1355,1359,1360 1344,1345,1349,1350	K03170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)

C1308	K30176221	Dipped mica 50WV 220pF (Z17D221K05)
C1303	K30176271	Dipped mica 50WV 270pF (Z17D271K05)
		TRANSFORMER
T1301~1312	L0020017	
		CONNECTOR
J1301	P0090056	5048-17A
		CRYSTAL SOCKET
XS1301~1312	P3090002	S2-101P-00

RECT.B BOARD

Symbol No.	Part No.	Description
	C0017120	Rect.B board with components
PB-1712A	F0001712A	P.C. Board
		DIODE
D1401~1404	G2090002	Silicon 10D10
		RESISTOR
R1401~1406	J10276474	Carbon composition ½W GK 470kΩ
	Q5000011	Wrapping terminal C

CAPACITOR BOARD

Symbol No.	Part No.	Description
	C0017130	Capacitor board with components
PB-1713	F0001713	P.C. Board
		CAPACITOR
C1501,1502	K43270002	Electrolytic 500WV 100μF (CE-62L500L100)

DRIVER BOARD

Symbol No.	Part No.	Description
	C0017141	Driver board with components (without vacuum tube)
PB-1714A	F0001714A	P.C. Board
		VACUUM TUBE
V1601	G6090002	12BY7A
		VACUUM TUBE SOCKET
VS1601	P3090022	SB-9403
		RESISTOR
R1605	J10276470	Carbon composition ½W GK47Ω
R1062(L1602),1604	J10276560	〃 〃 〃 〃 56Ω
R1603	J10276101	〃 〃 〃 〃 100Ω
R1601	J10276473	〃 〃 〃 〃 47kΩ
		CAPACITOR
C1601,1602	K12279002	Ceramic disc 500WV 0.01μF (ECKD2H103PE)
C1603,1604,1606	K13170473	Ceramic disc 50WV 0.047μF (DB207YF473Z5L5)
C1605	K30279051	Dipped mica 500WV 1000pF (DM19D102K5)
		INDUCTOR
L1601	L1190020	FL-5H 151K 150μH
L1602(R1602)	L1020307	
	Q5000011	Wrapping terminal

FINAL BOARD

Symbol No.	Part No.	Description
	C0017152	Final board with components (without vacuum tube)
PB-1715B	F0001715B	P.C. Board
		VACUUM TUBE
V1701,1702	G6090001	6146B
		DIODE
D1701	G2090002	Silicon 10D10
		VACUUM TUBE SOCKET
VS1701,1702	P3090024	SB-3606

PARTS LIST

		RESISTOR	
R1701,1702	J10276560	Carbon composition	
(L1702,1703)		½W GK 56Ω	
R1703,1704,1705	J10276101	〃 〃 〃 〃 100Ω	
R1706	J32009007	Meter shunt 0.847Ω±3%	
R1707	J20356153	Metallic film 3W 15kΩ	
		CAPACITOR	
C1703	K12279001	Ceramic disc 500WV 0.001μF (ECKD2H102PE)	
C1704,1710	K12279002	Ceramic disc 500WV 0.01μF (ECKD2H103PE)	
C1705~1709,1711, 1712	K13170473	Ceramic disc 50WV 0.047μF (DB207YF473Z5L5)	
C1702	K30273050	Dipped mica 500WV 5pF (LCQ11050D5)	
C1701	K31306101	Moulded mica 1kWV 100pF (CML1-101K10)	
		INDUCTOR	
L1701	L1190020	FL-5H 151K 150μH	
L1704	L1190039	FL-5H 561K 560μH	
L1702,1703 (R1701,1702)	L1020307		
	Q5000011	Wrapping terminal C	

RECT.C UNIT

Symbol No.	Part No.	Description
	C0017170	Rect. C unit with components
PB-1717A	F0001717A	P. C. Board
		IC. TRANSISTOR
Q1801	G1090036	IC TA7089M
Q1804	G3106390	Transistor 2SA639
Q1803	G3107330	〃 2SA733
Q1805,1806	G3318150G	〃 2SC1815GR
		DIODE
D1802,1809	G2090002	Silicon 10D10
D1803~1808	G2015550	〃 1S1555
D1801	G2090081	SM1-12
		RESISTOR
R1810	J00245479	Carbon film ¼W VJ 4.7Ω
R1815	J00245471	〃 〃 〃 〃 470Ω
R1812	J00245472	〃 〃 〃 〃 4.7kΩ
R1813,1814,1817,1818	J00245103	〃 〃 〃 〃 10kΩ
R1816,1820	J00245223	Carbon film ¼W VJ 22kΩ
R1801,1802,1804,1805	J10276184	Carbon composition ½W GK 180kΩ
R1819	J20306390	Metallic film 1W GK 39Ω
R1803	J20336391	〃 〃 2W 390Ω
R1809	J20336471	〃 〃 2W 470Ω
R1808	J20356332	〃 〃 3W 3.3kΩ
R1806	J20356153	〃 〃 〃 15kΩ
R1807	J20356473	〃 〃 〃 47kΩ
		POTENTIOMETER
VR1801	J50711502	V10K-8-1-2 5kΩB
		CAPACITOR
C1801,1807,1812	K12279004	Ceramic disc 500WV 0.0047μF (ECKD2H472PE)
C1810	K50177223	Mylar 50WV 0.022μF (50F2U223M)
C1811	K40120106	Electrolytic 16WV 10μF (16RL10)
C1806	K41240106	Electrolytic 250WV 10μF (250TL10)
C1808,1809	K40260226	Electrolytic 350WV 22μF (350RH22)
C1802~1805	K40240476	Electrolytic 250WV 47μF (250RH47)

SELECT SWITCH BOARD

Symbol No.	Part No.	Description
	C0017180	Select switch board with components
PB-1718C	F0001718C	P. C. Board
		TRANSISTOR
Q1901,1902	G3318150Y	Transistor 2SC1815Y
		DIODE
D1901,1902	G2090001	Silicon 10D1
		RESISTOR
R1901,1902	J00245103	Carbon film ¼W VJ 10kΩ
		CAPACITOR
C1901	K40120106	Electrolytic 16WV TW 10μF (16RL10)

PARTS LIST

		RELAY
RL1901,1902	M1190002	FBR211AD012M 12V
		SWITCH
S1901~1906	N4090014	6B0002CC2060
	Q5000011	Wrapping terminal C

LEVER SWITCH BOARD

Symbol No.	Part No.	Description
	C0017190	Lever switch board with components
PB-1719B	F0001719B	P. C. Board
		RESISTOR
R2001	J01245821	Carbon film ¼W TJ 820Ω
		SWITCH
S2001	N3090004	SLE62251
S2002	N3090006	SLE64301
S2003,2004,2005	N3090002	SLE62301

TUNE SWITCH BOARD

Symbol No.	Part No.	Description
	C0017200	Tune switch board with components
PB-1720B	F0001720B	P. C. Board
		TRANSISTOR
Q2102,2103	G3107330	Transistor 2SA733
Q2101	G3318150Y	〃 2SC1815Y
		DIODE
D2101~2103	G2090060	LED GD4-203SRD
D2104,2108	G2090001	Silicon 10D1
D2105~2107,2109~2112	G2015550	〃 1S1555
		RESISTOR
R2105,2107	J00245560	Carbon film ¼W VJ 56Ω
R2106	J00245221	〃 〃 〃 〃 220Ω
R2111	J00245821	〃 〃 〃 〃 820Ω
R2102	J00245102	〃 〃 〃 〃 1kΩ
R2101,2104,2108	J00245152	〃 〃 〃 〃 1.5kΩ
R2103	J00245472	〃 〃 〃 〃 4.7kΩ
R2112,2113	J00245103	Carbon film ¼W VJ 10kΩ
R2109	J01245123	〃 〃 〃 TJ 12kΩ
R2110	J00245223	〃 〃 〃 VJ 22kΩ
		POTENTIOMETER
VR2101	J50710471	V10K-8-1-2 470ΩB
		CAPACITOR
C2102	K13170473	Ceramic disc 50WV 0.047μF (DB207YF473Z5L5)
C2101	K40120107	Electrolytic 16WV 100μF (16RL100)
		RELAY
RL2101,2102	M1190002	FBR211AD012M 12V
		SWITCH
S2101~2105	N4090007	5B0001FC2060
	Q5000011	Wrapping terminal C

LED A BOARD

Symbol No.	Part No.	Description
	C0017210	LED A board with components
PB-1721B	F0001721B	P. C. Board
		DIODE
D2201~2206	G2090060	LED GD4-203SRD
		RESISTOR
R2203	J01245271	Carbon film ¼W TJ 270Ω
R2202	J01245821	〃 〃 〃 〃 820Ω
R2201	J01245152	〃 〃 〃 〃 1.5kΩ

REJECT SWITCH BOARD

Symbol No.	Part No.	Description
	C0017220	Reject switch board with components
PB-1722B	F0001722B	P. C. Board
		DIODE
D2301	G2090060	LED GD4-203SRD

		RESISTOR
R2301	J00245152	Carbon film ¼W VJ 1.5kΩ
		POTENTIOMETER
VR2301	J50710502	V10K-8-1-2 5kΩB
		SWITCH
S2301	N4090008	1B0001AC2060

TRIMMER.A BOARD

Symbol No.	Part No.	Description
	C0021900	Trimmer board A with components
PB-2190	F0002190	P.C. Board
		TRANSISTOR
Q2401	G3319590Y	Transistor 2SC1959Y
Q2402	G3318150Y	〃 2SC1815Y
		DIODE
D2402	G2015550	Silicon 1S1555
		RESISTOR
R2401,2402	J00245103	Carbon film ¼W VJ 10kΩ
		CAPACITOR
C2407	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)
C2409	K30176100	Dipped mica 50WV 10pF (Z11C100K05)
C2405,2412	K30176120	Dipped mica 50WV 12pF (Z11C120K05)
C2403,2404,2411	K30176680	Dipped mica 50WV 68pF (Z11D680K05)
C2402	K30176271	Dipped mica 50WV 270pF (Z17D271K05)
C2401	K30176821	Dipped mica 50WV 820pF (LCQ18821K05)
C2406	K40120336	Electrolytic 16WV 33μF (16RL33)
C2410	K30209001	Dipped mica 50WV 1000pF
		TRIMMER CAPACITOR
TC2401	K91000078	BW6P-1 430pF
TC2406	K9000030	ECV-1ZW 20×53 20pF
TC2402~2405	K91000016	ECV-1ZW 50×32 50pF
TC2408,2409,2410	K91000030	ECV-1ZW 40×53 40pF
		TRANSFORMER
T2401	L0020303A	
T2402	L0020545	

TRIMMER.B BOARD

Symbol No.	Part No.	Description
	C0021910	Trimmer B board with components
PB-2191	F00021910	P.C. Board
		RESISTOR
		CAPACITOR
C2503,2508,2509	K30176330	Dipped mica 50WV 33pF (Z11C330K05)
C2504,2506	K30176680	Dipped mica 50WV 68pF (Z11D680K05)
C2502	K30176271	Dipped mica 50WV 270pF (Z17D271K05)
C2501	K30176821	Dipped mica 50WV 820pF (LCQ18821K05)
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
		TRANSFORMER
T2501	L0020303A	

TRIMMER.C BOARD

Symbol No.	Part No.	Description
	C0010922	Trimmer C board with components
PB-1092-3330	F2001092	P.C. Board
		RESISTOR
R2601	J10276333	Carbon composition ½W 33kΩ

PARTS LIST

		CAPACITOR	
C2605	K30276100	Dipped mica 500WV	10pF
		(LCQ11100D5)	
C2603	K30276300	Dipped mica 500WV	30pF
		(LCQ12300K5)	
C2604	K30276510	Dipped mica 500WV	50pF
		(LCQ12510K5)	
C2602	K30276221	Dipped mica 500WV	220pF
		(LCQ17221K5)	
C2601	K30276821	Dipped mica 500WV	820pF
		(LCQ18821K5)	
C2607	K30276330	Dipped mica 500WV	33pF
C2606	K30276101	〃 〃 〃	100pF
		TRIMMER CAPACITOR	
TC2603~2605	K91000031	B-1P1	40pF
TC2602	K91000032	B-2PY	100pF
TC2601	K91000078	BW6P-1	420pF

KEYER UNIT

Symbol No.	Part No.	Description
	C0017280	Keyer unit with components
PB-1728A	F0001728A	P. C. Board
		IC & TRANSISTOR
Q2701	G1090233	IC 8044
Q2702	G3318150Y	Transistor 2SC1815Y
		DIODE
D2701~2706	G2090029	Germanium 1N60
		RESISTOR
R2705	J00245102	Carbon film ¼W VJ 1kΩ
R2704	J00245332	〃 〃 〃 〃 3.3kΩ
	J00245472	〃 〃 〃 〃 4.7kΩ
R2709,2710	J00245103	〃 〃 〃 〃 10kΩ
R2701,2702,2707	J00245104	〃 〃 〃 〃 100kΩ
		POTENTIOMETER
VR2702	J51723104	SR19R 100kΩB
		CAPACITOR
C2703	K13170473	Ceramic disc 50WV 0.047μF
		(DB207YF473Z5L5)
C2701,2702	K50177104	Mylar 50WV 0.1μF
		(50F2U104M)
C2705	K70167224	Tantalum 35WV 0.22μF
		(CS15E1VR22M)
C2706,2707	K70167334	〃 〃 0.33μF
		(CS15E1VR33M)
C2704	K40120226	Electrolytic 16WV 22μF
		(16RL22)
		MINI CONNECTOR
J2701	P0090037	5048-8A

MEMORY UNIT

Symbol No.	Part No.	Description
	C0017870	Memory board with components
PB-1787E	F0001787E	P. C. Board
		IC, FET & TRANSISTOR
Q2820	G1090099	IC LM308
Q2821	G1090087	IC MC4044P (μPC1008C)
Q2822~2826	G1090051	IC MC14042B
Q2812	G1090097	IC MM74C90
Q2811	G1090096	IC MSM5562
Q2818	G1090120	IC NJM78L05
Q2816,2817	G1090123	IC NJM78L08
Q2813	G1090092	IC SN74LS00N
Q2814,2833	G1090093	IC SN74LS04N
Q2832	G1090100	IC SN74LS123N
Q2827~2831	G1090019	IC SN74LS192N
Q2815	G1090098	IC TC5032P
Q2819,2834	G1090065	IC μPC14305
Q2801,2802,2805,2806	G3090020	FET JF1033B
Q2809	G4800510C	FET 3SK51-03
Q2807	G3318150Y	Transistor 2SC1815Y
Q2803,2804,2810	G3307850O	Transistor 2SC785O
Q2808	G3090005	Transistor MPS A13
		DIODE
D2804,2805	G2001880F	Germanium 1S188FM
D2801~2803	G2015550	Silicon 1S1555
D2806,2807	G2090043	Varactor MV104
D2808	G2090047	Zener WZ060
		CRYSTAL
X2801	H0100570	HC-18/U 3276.8kHz
		RESISTOR
R2863	J00245279	Carbon film ¼W VJ 2.7Ω
R2860	J00245339	〃 〃 〃 〃 3.3Ω
R2825	J00245220	〃 〃 〃 〃 22Ω
R2805,2808,2822,2824	J00245101	〃 〃 〃 〃 100Ω

PARTS LIST

R2813	J00245121	Carbon film	¼W	VJ	120Ω
R2809,2821	J00245221	〃	〃	〃	220Ω
R2804,2817	J00245391	〃	〃	〃	390Ω
R2826,2831,2840	J00245471	〃	〃	〃	470Ω
R2835	J00245102	〃	〃	〃	1kΩ
R2815	J00245122	〃	〃	〃	1.2kΩ
R2818,2834,2849	J00245152	〃	〃	〃	1.5kΩ
R2842,2855	J00245272	〃	〃	〃	2.7kΩ
R2832,2837	J00245332	〃	〃	〃	3.3kΩ
R2810,2843,2857,2861	J00245472	〃	〃	〃	4.7kΩ
R2853	J00245562	〃	〃	〃	5.6kΩ
R2827,2848	J00245822	〃	〃	〃	8.2kΩ
R2844,2846,2847,2850 ~2852	J00245103	〃	〃	〃	10kΩ
R2811	J00245123	〃	〃	〃	12kΩ
R2828,2829	J00245153	〃	〃	〃	15kΩ
R2838	J00245223	〃	〃	〃	22kΩ
R2812,2858,2859	J00245333	〃	〃	〃	33kΩ
R2836	J00245473	〃	〃	〃	47kΩ
R2803,2806,2820	J00245563	〃	〃	〃	56kΩ
R2854,2862	J00245823	〃	〃	〃	82kΩ
R2801,2802,2814,2816 2823,2830,2833,2839 2841,2856	J00245104	〃	〃	〃	100kΩ
R2807,2819	J00245334	〃	〃	〃	330kΩ
R2845	J00245394	〃	〃	〃	390kΩ
R2864	J01245102	〃	〃	TJ	1kΩ
R2865	J01245472	〃	〃	〃	4.7kΩ

POTENTIOMETER

VR2801,2802	J51724103	PN822H103H	10kΩB

CAPACITOR

C2804	K06173100	Ceramic disc (ECC-D1H100DU)	50WV	10pF
C2807	K02179010	Ceramic disc (DD104CH240J50V02)	50WV	24pF
C2828	K02175390	Ceramic disc (DD105-257CH390J50V02)	50WV	39pF
C2827	K02175470	Ceramic disc (DD106CH470J50V02)	50WV	47pF
C2803	K06175470	Ceramic disc (ECC-D1H470JU2)	50WV	47pF
C2805	K02175820	Ceramic disc	50WV	82pF
C2849	K00175101	Ceramic disc (DD105SL101J50V02)	50WV	100pF
C2802	K06175271	Ceramic disc (ECC-D1H271JU2)	50WV	270pF
C2821,2823	K10179011	Ceramic disc (2222-660-02471)	50WV	470pF
C2822	K14179001	Ceramic disc (RD200YZ102P50V)	50WV	0.001μF
C2801,2806,2808,2811 2813~2815,2818~ 2820,2829~2832, 2839,2856,2859,2867	K14179002	Ceramic disc (RD204YM103Z50V)	50WV	0.01μF
C2868,2869,2871	K13170473	Ceramic disc (DB207YF473Z5L5)	50WV	0.047μF
C2810	K30173050	Dipped mica (LCQ11050D05)	50WV	5pF
C2860	K30176150	Dipped mica (Z11C150K05)	50WV	15pF
C2816	K30176470	Dipped mica (Z11C470K05)	50WV	47pF
C2812,2817	K30176510	Dipped mica (Z11D510K05)	50WV	51pF
C2834	K50177332	Mylar (50F2U332M)	50WV	0.0033μF
C2837	K50177473	Mylar (50F2U473M)	50WV	0.047μF
C2847,2848,2853	K50177104	Mylar (50F2U104M)	50WV	0.1μF
C2861	K70167334	Tantalum (CS15E1VR33M)	35WV	0.33μF
C2842,2843,2852	K70147105	Tantalum (CS15E1E010M)	25WV	1μF
C2844	K70167225	Tantalum (CS15E1V2R2M)	35WV	2.2μF
C2851	K70127335	Tantalum (CS15E1C3R3M)	16WV	3.3μF
C2850	K40089006	Electrolytic (6.3RE330)	6.3WV	330μF
C2845	K40140475	Electrolytic (25RL4R7)	25WV	4.7μF
C2826	K40120106	Electrolytic (16RL10)	16WV	10μF
C2825	K40120336	Electrolytic (16RL33)	16WV	33μF
C2824	K40100476	Electrolytic (10RL47)	10WV	47μF
C2809,2838,2841,2854 2855,2857,2858,2866	K40129001	Electrolytic (16RL330)	16WV	330μF
C2870	K41120108	Electrolytic (16TL1000)	16WV	1000μF
C2862~2865	K31170002	Feed thru (ECKY1H-102WE)	50WV	0.001μF
C2833,2835,2836	K51176331	Styrol (50SU331K)	50WV	330pF

TRIMMER CAPACITOR

TC2801	K91000030	ECV-1ZW 40×53	40pF

INDUCTOR

L2802,2805,2807	L1190017	FL-5H 102K	1mH
L2803,2804	L1190007	FL-4H 1R8M	1.8μH
L2801	L1190038	FL-5H 271K	270μH
L2806	L1020012		35μH

TRANSFORMER

T2801	L0020332A	

PARTS LIST

COUNTER UNIT

Symbol No.	Part No.	Description
	C0020863	3330 Counter unit Assembly
PB-2086A	C9020863	Main P.C.Board
PB-2098A	C9020983	Display P.C.Board
★★★★★ COUNTER MAIN BOARD ★★★★★		
	C9020863	Main board with components
PB-2086A	F0002086A	Counter main Board
		IC
Q3012	G1090249	MSM9520RS
Q3005	G1090065	μPC14305
Q3020	G1090079	μPA54H
		FET
Q3001	G3800730	3SK73
		TRANSISTOR
Q3003	G331674L	2SC1674L
Q3004	G3318150G	2SC1815GR
Q3006～3011,3013～3019	G3109520L	2SA952L
Q3021	G3104960Y	2SA496Y
		DIODE
D3001～3013	G2015550	1S1555
		CRYSTAL
X3001	H0102272	6.5536MHz
		RESISTOR
R3012	J00245100	Carbon film ¼W VJ 10Ω
R3031,3034,3037,3040 3043,3046,3049	J00245330	〃 〃 〃 〃 33Ω
R3050	J00245560	〃 〃 〃 〃 56Ω
R3001	J01245560	〃 〃 〃 TJ 56Ω
R3008,3018,3020,3022 3024,3026,3028	J00245101	〃 〃 〃 VJ 100Ω
R3007,3010,3011	J00245221	〃 〃 〃 〃 220Ω
R3052	J00245331	〃 〃 〃 〃 330Ω
R3051	J00245471	〃 〃 〃 〃 470Ω
R3017,3019,3021,3023 3025,3027	J01245102	〃 〃 〃 TJ 1kΩ
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
R3016	J00245104	Carbon film ¼W VJ 100kΩ
R3014	J01245104	〃 〃 〃 TJ 100kΩ
		CAPACITOR
C3024	K02179008	Ceramic disc 50WV 20pF (DD104CH200J50V02)
C3025	K02175820	Ceramic disc 50WV 82pF (DD107CH820J50V02)
C3020	K02175101	Ceramic disc 50WV 100pF (DD107CH101J50V02)
C3001,3004	K13170102	Ceramic disc 50WV 0.001μF (DB200YF102Z5L2)
C3002,3005,3008,3009 3011,3012,3014,3015 3017,3019,3026～3030,3021	K13170103	Ceramic disc 50WV 0.01μF (DB201YF103Z5L5)
C3010,3013,3018	K40120106	Electrolytic 16WV 10μF (16RL10)
C3016	K40129001	Electrolytic 16WV 330μF (16RE330)
C3023	K50177103	Mylar 50WV 0.01μF (50F2U103M)
C3022	K71137685	Noiselimiter 20WV 6.8μF (CC99E1D6R8M)
		TRIMMER CAPACITOR
TC3001	K91000030	ECV1ZW 40×53 40pF
		INDUCTOR
L3001	L2030068	
		CONNECTOR
J3001	P0090051	5048-06A
J3002	P0090054	5048-07A
J3003	P0090037	5048-08A
P3003	T9201380A	3021-03
★★★★★ DISPLAY BOARD ★★★★★		
PB-2098A	F0002098A	P.C.Board
	C9020983	P.C.B with components
		DISPLAY LED
D2901～2906	G2090069	5082-7623
		CONNECTOR
P2902	T9202440B	5047-08

PARTS LIST

P2901	T9202430B	5047-06

DIODE SWITCH BOARD

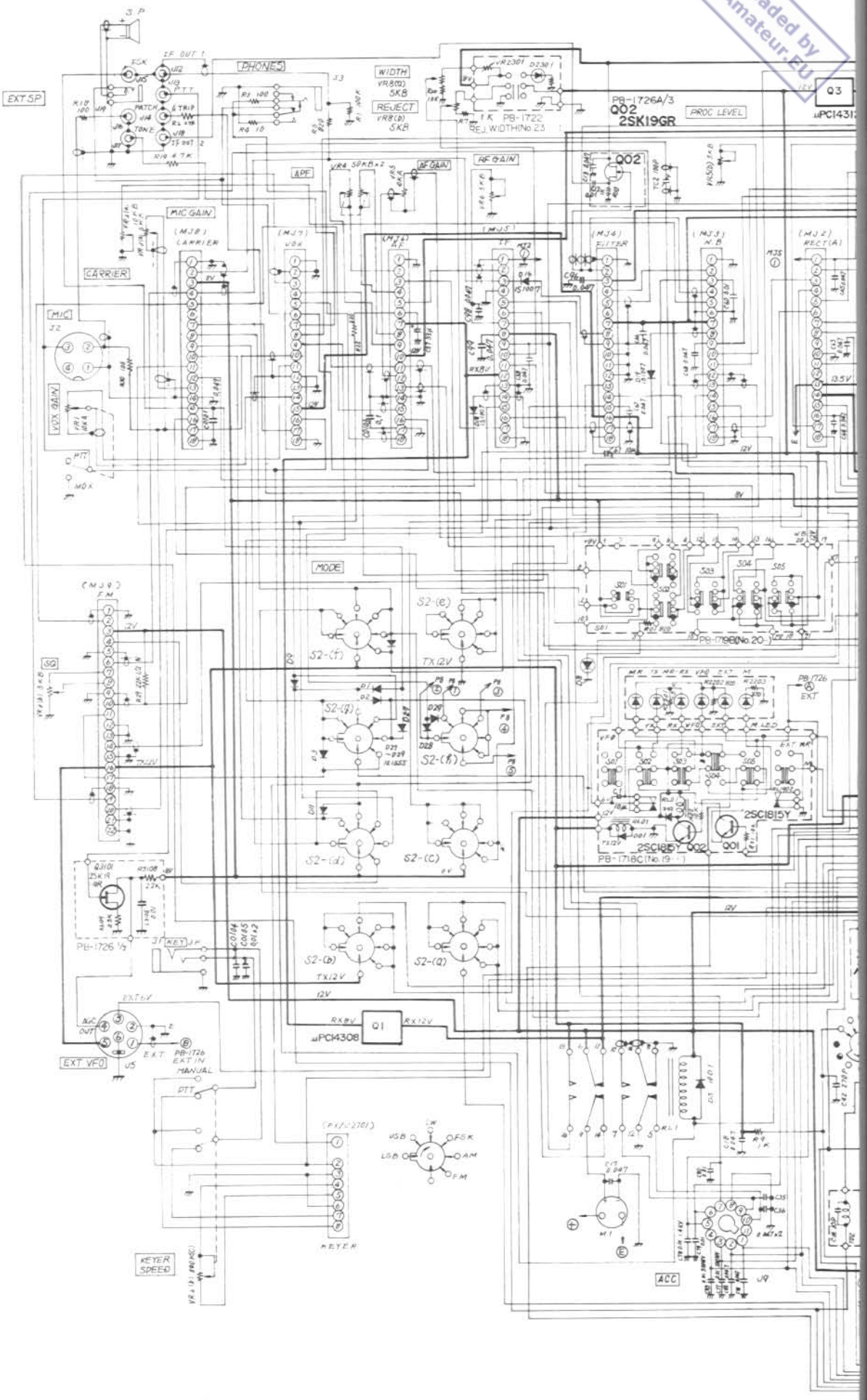
Symbol No.	Part No.	Description
	C0017260	Diode switch board with components
PB-1726A	F0001726A	P. C. Board
		FET
Q3101,3102	G3090035	2SK19TM-GR
		DIODE
D3102	G2090093	Germanium 1N270
D3101,3103	G2015550	Silicon 1S1555
		RESISTOR
R3101	J00245151	Carbon film ¼W VJ 150Ω
R3105~3107	J00245561	〃 〃 〃 〃 560Ω
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

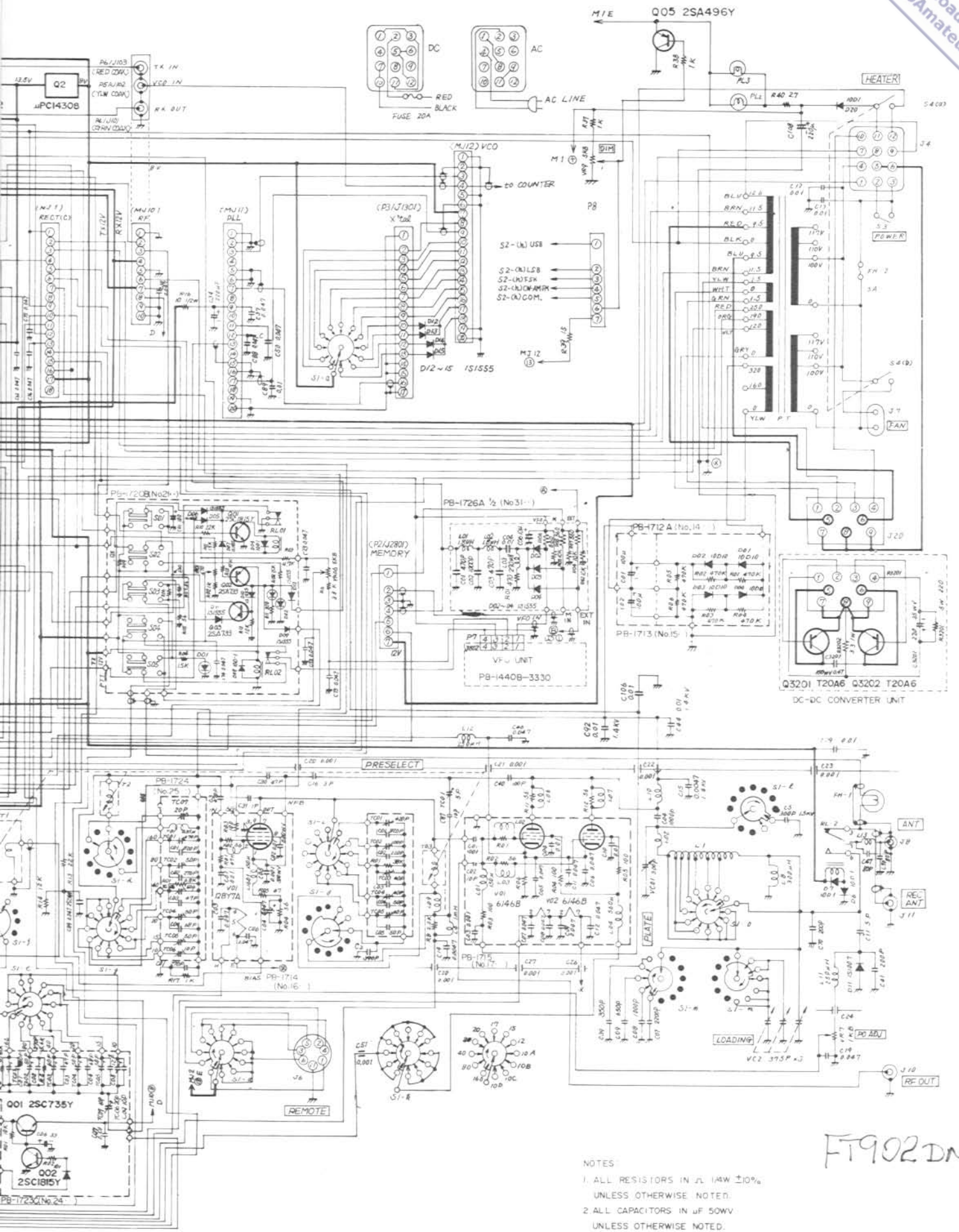
DC-DC CONVERTER UNIT

Symbol No.	Part No.	Description
		TRASISTOR
Q3201,3202	G3090002	T20A6 with insulator
		RESISTOR
R3202	J31306339	Wire wound 1W 3.3Ω
R3201	J20376221	Metallic film 5W 220Ω
		CAPACITOR
C3202	K52247474	Metallized paper 250WV 0.47μF
C3201	K41140227	Electrolytic 25WV 220μF (25TL220)
		CONNECTOR
P3201	P0090066	AC9M

ACCESSORIES

Symbol No.	Part No.	Description
	M3090004	Microphone YE7A with Microphone hanger screws.
	P1090020	Microphone plug FM-144P
		AC Power cord
	T9003680	2 wire, 2 prong plug
	T9003682	3 wire, 3 prong UL plug
	T9003683	3 wire, 3 prong Australia plug
	T9003684	3 wire, 2 porong EU plug
	P1090092	power plug QS-A-P12FL
	T9003720	DC Power cord
	P1090092	power plug QS-A-P12FL
	Q0000009	DC Fuse 20A
	P0090008	Key plug SH3603
	P0090007	Phone plug SH3001
	P0090034	External speaker plug P2240
	P0090019	Antenna plug SO259
	P0090035	ACC plug PA-602B04
	P0090018	RCA pin plug CN7017
	Q0000005	AC Fuse 5A(100V~117V)
	Q0000004	3A(200V~234V)





FT902DM

NOTES:
1. ALL RESISTORS IN Ω 1/4W ±10% UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS IN μF 50WV UNLESS OTHERWISE NOTED.