

HF ALL BAND TRANSCEIVER  
GENERAL COVERAGE RECEIVER

# IC-751A

## SERVICE MANUAL



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## FOREWORD

Thank you very much for selecting ICOM's versatile **IC-751A** HF transceiver, a refined version of the very popular IC-751.

Doubling as both a sophisticated HF multi-mode transceiver and all-purpose general coverage receiver, the **IC-751A** is the result of advanced HF engineering at ICOM and was designed to ensure years of reliable and satisfactory communications for the avid Amateur Radio enthusiast.



## ASSISTANCE

The **IC-751A** was designed to be used all over the world, with some slight modifications made for its use in Australia and France. The Australia and France versions of the **IC-751A** are assigned model #03. This number should be referred to in these countries when assistance or information regarding the **IC-751A** is required. The assigned **IC-751A** model number for all other parts of the world is #02.

Feel free to contact your nearest authorized ICOM Dealer or ICOM Service Center if you require assistance or information regarding the operation or capabilities of your new **IC-751A**. Addresses are provided on the title page of this service manual.

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**SCHEMATIC DIAGRAM**

## SECTION 1 SPECIFICATIONS

### 1 - 1 GENERAL

|                             |   |   |               |
|-----------------------------|---|---|---------------|
| Number of semiconductors    | : | Transistors   | 59            |
|                             |   | (Australia, France:   | 61)           |
|                             |   | FETs  | 23            |
|                             |   | Diodes  | 336           |
|                             |   | ICs (Includes CPU)  | 64            |
| Frequency coverage          | : | Ham Bands   |               |
|                             |   | 1.8MHz ~ 2.0MHz   |               |
|                             |   | 3.45MHz ~ 4.1MHz  |               |
|                             |   | 6.95MHz ~ 7.5MHz  |               |
|                             |   | 9.95MHz ~ 10.5MHz   |               |
|                             |   | 13.95MHz ~ 14.5MHz  |               |
|                             |   | 17.95MHz ~ 18.5MHz  |               |
|                             |   | 20.95MHz ~ 21.5MHz  |               |
|                             |   | 24.45MHz ~ 25.1MHz  |               |
|                             |   | 27.95MHz ~ 30.0MHz  |               |
|                             |   | General Coverage (Receive Only)   |               |
|                             |   | 0.1MHz ~ 30.0MHz  |               |
| Usable temperature range    | : | -10°C ~ +60°C (+14°F ~ +140°F)  |               |
| Frequency control           | : | CPU based 10Hz step digital PLL synthesizer.                              |               |
|                             |   | Independent transmit/receive frequency.                                   |               |
| Frequency readout           | : | 6 digit 100Hz illuminated FIP.  |               |
| Frequency stability         | : | Less than ±200Hz from 1 to 60 minutes after power ON.                     |               |
|                             |   | Less than ±30Hz after 1 hour at 25°C.                                     |               |
|                             |   | Less than ±350Hz in the range of 0°C ~ +50°C.                             |               |
| Power supply requirements   | : | 13.8V DC ±15% (negative ground), current drain 20A maximum at 200W input. |               |
|                             |   | AC power supply is available for AC operation.                            |               |
| Current drain (at 13.8V DC) | : | Transmitting  |               |
|                             |   | At 200 watts input  | Approx. 20.0A |
|                             |   | Receiving   |               |
|                             |   | At maximum audio output   | Approx. 1.8A  |
|                             |   | Squelched   | Approx. 1.5A  |
| Antenna impedance           | : | 50 ohms unbalanced.   |               |
| Weight                      | : | 8.5kg   |               |
| Dimensions                  | : | 306(322)mm(W) x 115(120)mm x 355(385)mm(D)                                |               |
|                             |   | Bracketed values include projections.                                     |               |

### 1 - 2 TRANSMITTER

|                     |   |  |  |
|---------------------|---|--|--|
| RF power            | : | SSB (J3E) : 200 watts PEP input                          |  |
|                     |   | CW (A1A) : 200 watts input                               |  |
|                     |   | FM (F3E) : 200 watts input                               |  |
|                     |   | RTTY (F1A) : 200 watts input                             |  |
|                     |   | AM (A3E) : 50 watts output                               |  |
| Emission modes      | : | SSB (J3E) Upper and Lower sideband                       |  |
|                     |   | CW (A1A)   |  |
|                     |   | FM (F3E)   |  |
|                     |   | RTTY (F1A)   |  |
|                     |   | AM (A3E)   |  |
| Harmonic emissions  | : | More than 40dB below peak power output.                  |  |
| Spurious emissions  | : | More than 60dB below peak power output.                  |  |
|                     |   | (Guaranteed for transmissions within the Amateur bands.) |  |
| Carrier suppression | : | More than 40dB below peak power output.                  |  |
| Unwanted sideband   | : | More than 55dB down with 1000Hz AF input.                |  |
| Microphone          | : | Impedance 600 ohms                                       |  |
|                     |   | Input level 12 millivolts typical                        |  |
|                     |   | Dynamic or electret condenser microphone.                |  |
| ΔTX variable range  | : | ±9.9kHz  |  |

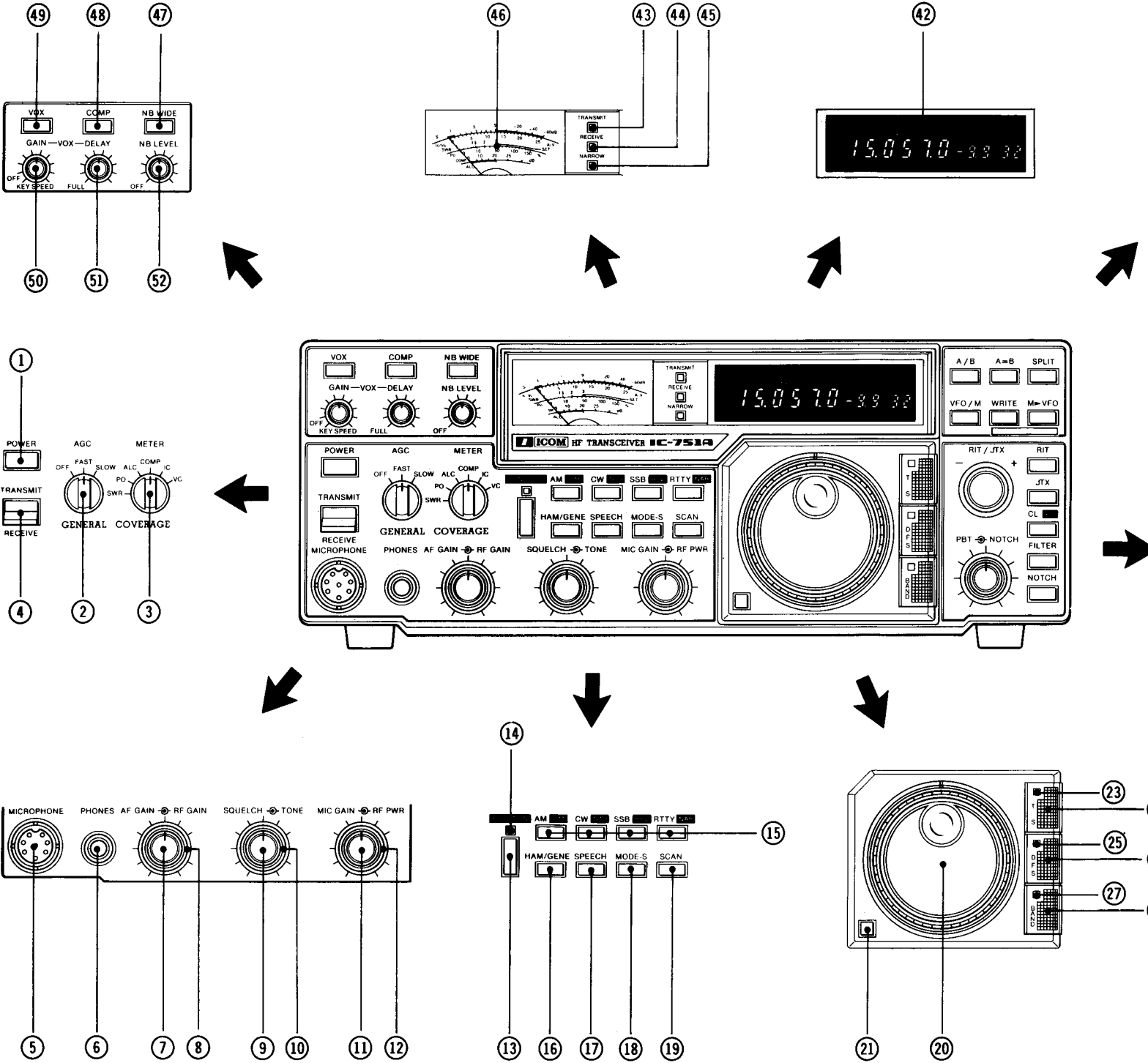
## 1 - 3 RECEIVER

|                                       |  |
|---------------------------------------|--|
| Receive system                        | : SSB, CW, RTTY, AM<br>Quadruple-conversion superheterodyne with continuous bandwidth control.   |
|                                       | FM<br>Triple-conversion superheterodyne.   |
| Receive modes                         | : SSB (J3E) Upper and Lower sideband<br>CW (A1A)<br>FM (F3E)<br>RTTY (F1A)<br>AM (A3E)   |
| Intermediate frequencies              | : 1st: All modes 70.4515MHz<br>2nd: SSB 9.0115MHz<br>CW, RTTY 9.0106MHz<br>FM, AM 9.0100MHz<br>3rd: All modes 455kHz<br>4th: SSB 9.0115MHz<br>CW, RTTY 9.0106MHz<br>AM 9.0100MHz   |
| Sensitivity<br>(PREAMP ON)            | : SSB, CW, RTTY<br>0.1 ~ 0.5MHz Less than 0.5 $\mu$ V for 10dB S/N<br>0.5 ~ 1.6MHz Less than 1 $\mu$ V for 10dB S/N<br>1.6 ~ 30.0MHz Less than 0.15 $\mu$ V for 10dB S/N<br>AM (NARROW FILTER selected)<br>0.1 ~ 0.5MHz Less than 3 $\mu$ V for 10dB S/N<br>0.5 ~ 1.6MHz Less than 6 $\mu$ V for 10dB S/N<br>1.6 ~ 30.0MHz Less than 1 $\mu$ V for 10dB S/N<br>FM<br>28 ~ 30MHz Less than 0.3 $\mu$ V for 12dB SINAD |
| Squelch sensitivity                   | : 1.6 ~ 30MHz Less than 0.3 $\mu$ V  |
| Selectivity                           | : SSB, CW, RTTY (WIDE FILTER selected), AM (NARROW)<br>2.3kHz at -6dB point<br>3.8kHz at -60dB point<br>CW, RTTY 500Hz at -6dB point<br>1.3kHz at -60dB point<br>FM 15kHz at -6dB point<br>30kHz at -50dB point<br>AM (WIDE FILTER selected) 8kHz at -6dB point<br>18kHz at -50dB point  |
| Spurious and image response rejection | : Image rejection More than 80dB<br>IF rejection More than 70dB  |
| Audio output                          | : More than 2.6 watts at 10% distortion with 8 ohm load.   |
| Notch filter attenuation              | : More than 45dB   |
| RIT variable range                    | : $\pm$ 9.9kHz   |

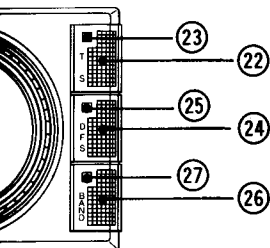
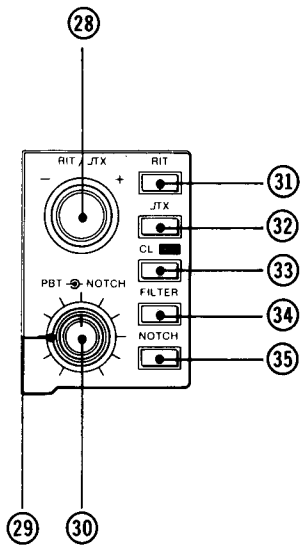
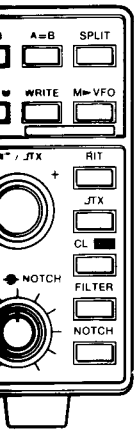
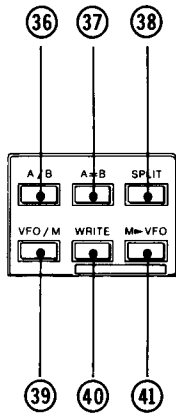
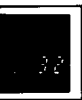
# SECTION 2 OUTSIDE AND INSIDE VIEWS

## 2-1 FRONT PANEL

See SECTION 2-2 for frequency display.



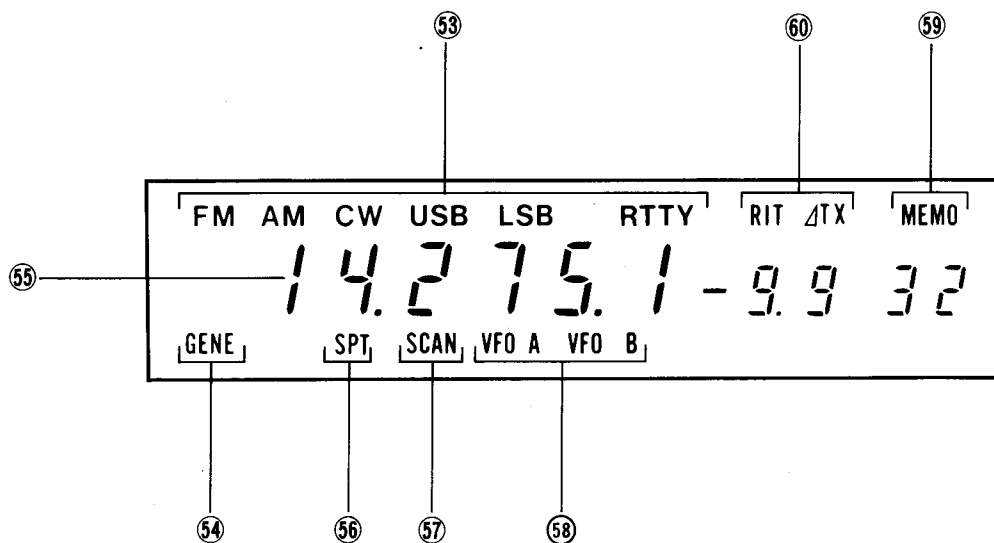
for



- ① POWER SWITCH
- ② AUTOMATIC GAIN CONTROL SWITCH [AGC]
- ③ METER SWITCH
- ④ TRANSMIT/RECEIVE SWITCH
  
- ⑤ MIC CONNECTOR [MICROPHONE]
- ⑥ PHONES JACK
- ⑦ AF GAIN CONTROL
- ⑧ RF GAIN CONTROL
- ⑨ SQUELCH CONTROL
- ⑩ TONE CONTROL
- ⑪ MIC GAIN CONTROL
- ⑫ RF POWER CONTROL [RF PWR]
  
- ⑬ FUNCTION SWITCH
- ⑭ FUNCTION INDICATOR
- ⑮ MODE SWITCHES
- ⑯ HAM BAND/GENERAL COVERAGE SWITCH [HAM/GENE]
- ⑰ SPEECH SWITCH
- ⑱ MODE SCAN SWITCH [MODE-S]
- ⑲ SCAN START/STOP SWITCH [SCAN]
  
- ⑳ TUNING CONTROL
- ㉑ DIAL LOCK SWITCH
- ㉒ TUNING SPEED SWITCH [TS]
- ㉓ TS INDICATOR
- ㉔ DIAL FUNCTION SELECT SWITCH [DFS]
- ㉕ DFS INDICATOR
- ㉖ BAND SELECT SWITCH [BAND]
- ㉗ BAND SELECT INDICATOR
  
- ㉘ INCREMENTAL TUNING CONTROL [RIT/ΔTX]
- ㉙ PASSBAND TUNING CONTROL [PBT]
- ㉚ NOTCH FILTER CONTROL [NOTCH]
- ㉛ RIT SWITCH
- ㉜ ΔTX SWITCH
- ㉝ RIT/ΔTX CLEAR SWITCH [CL]
- ㉞ FILTER SWITCH
- ㉟ NOTCH FILTER SWITCH
  
- ㊱ VFO A/B SWITCH [A/B]
- ㊲ VFO EQUALIZING SWITCH [A=B]
- ㊳ SPLIT SWITCH
- ㊴ VFO MEMORY SWITCH [VFO/M]
- ㊵ MEMORY WRITE SWITCH [WRITE]
- ㊶ FREQUENCY TRANSFER SWITCH [M▶VFO]
  
- ㊷ FREQUENCY DISPLAY
  
- ㊸ TRANSMIT INDICATOR
- ㊹ RECEIVE INDICATOR
- ㊺ NARROW FILTER INDICATOR [NARROW]
- ㊻ MULTIFUNCTION METER
  
- ㊼ NOISE BLANKER TIMING SWITCH [NB WIDE]
- ㊽ SPEECH COMPRESSOR SWITCH [COMP]
- ㊾ VOX SWITCH
- ㊿ VOX GAIN CONTROL
- ① VOX DELAY CONTROL
- ② NOISE BLANKER LEVEL CONTROL [NB LEVEL]

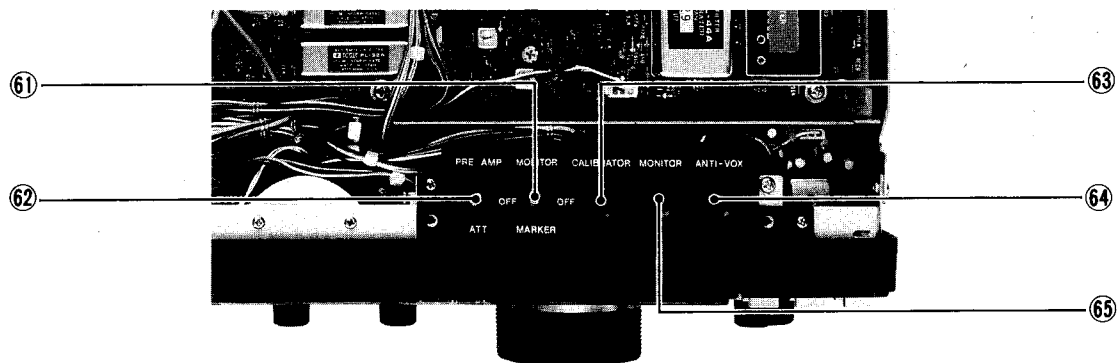


## 2 - 2 DISPLAY



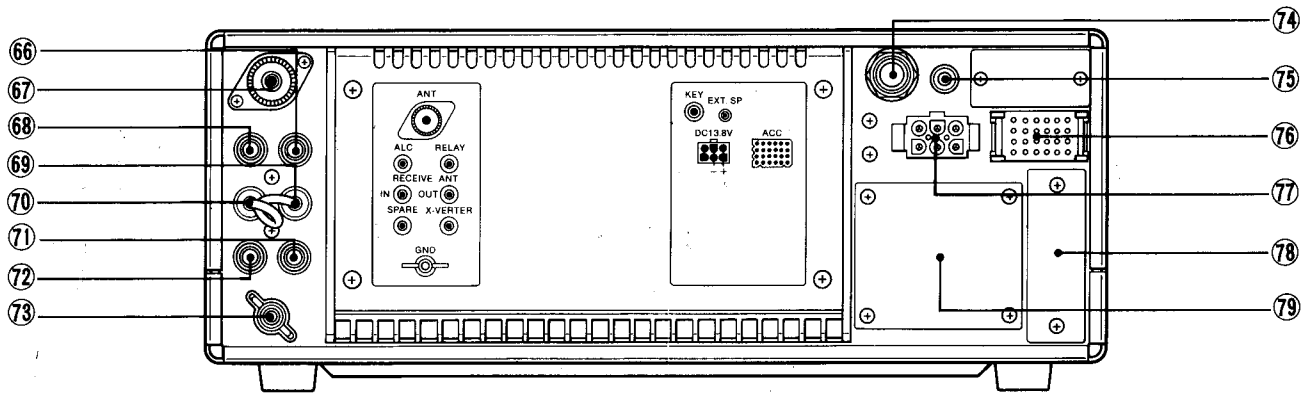
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|-------------------------------|------------------------------|
| ⑤③ MODE INDICATOR             | ⑤⑦ SCAN INDICATOR            |
| ⑤④ GENERAL COVERAGE INDICATOR | ⑤⑧ VFO INDICATOR             |
| ⑤⑤ FREQUENCY READOUT          | ⑤⑨ MEMORY INDICATOR          |
| ⑤⑥ SPLIT INDICATOR            | ⑥① SHIFT FREQUENCY INDICATOR |

## 2 - 3 TOP PANEL



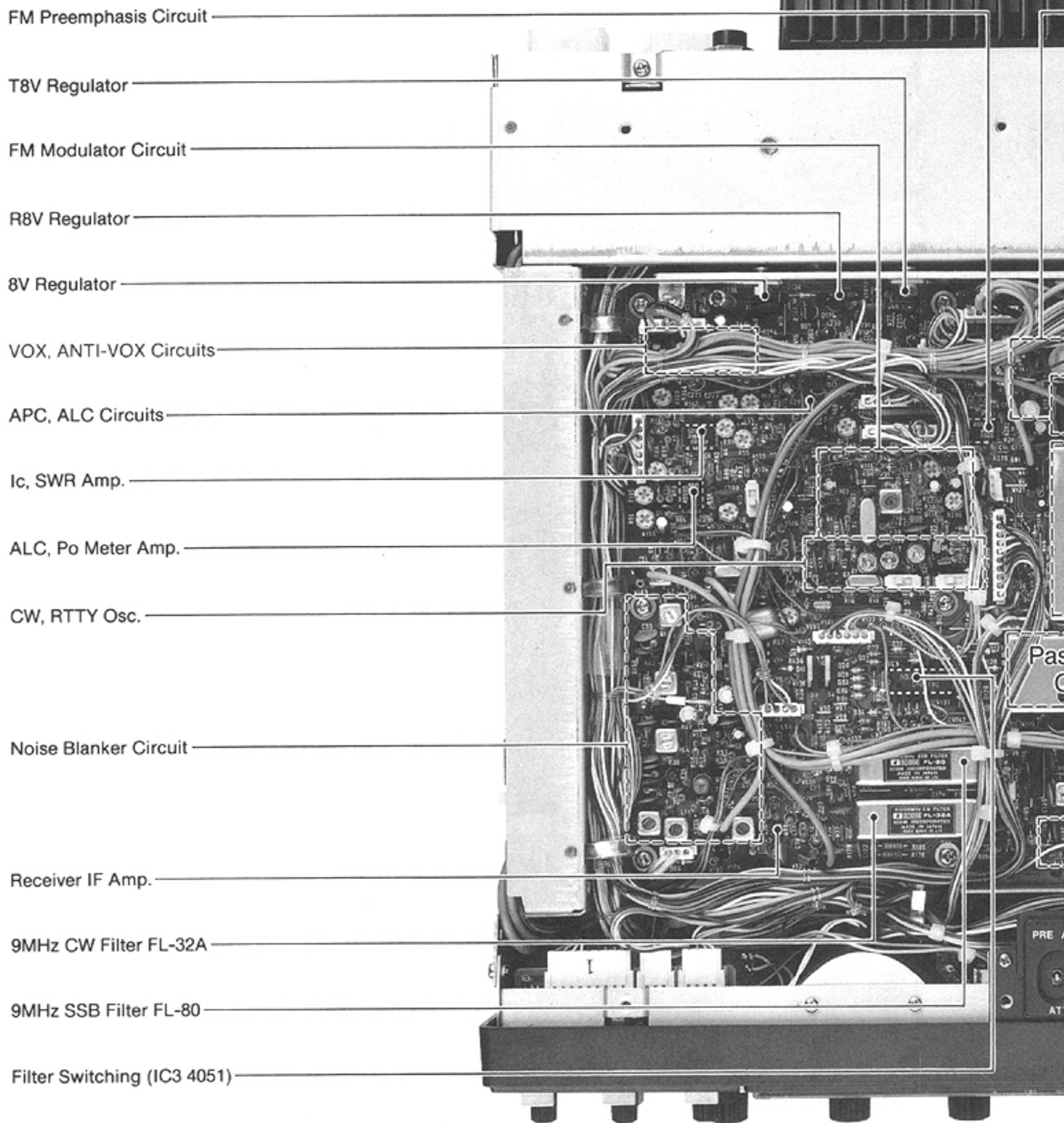
- ⑥① MONITOR/MARKER SWITCH
- ⑥② PREAMP/ATT (ATTENUATOR) SWITCH
- ⑥③ MARKER CALIBRATOR CONTROL
- ⑥④ ANTI-VOX CONTROL
- ⑥⑤ MONITOR LEVEL CONTROL

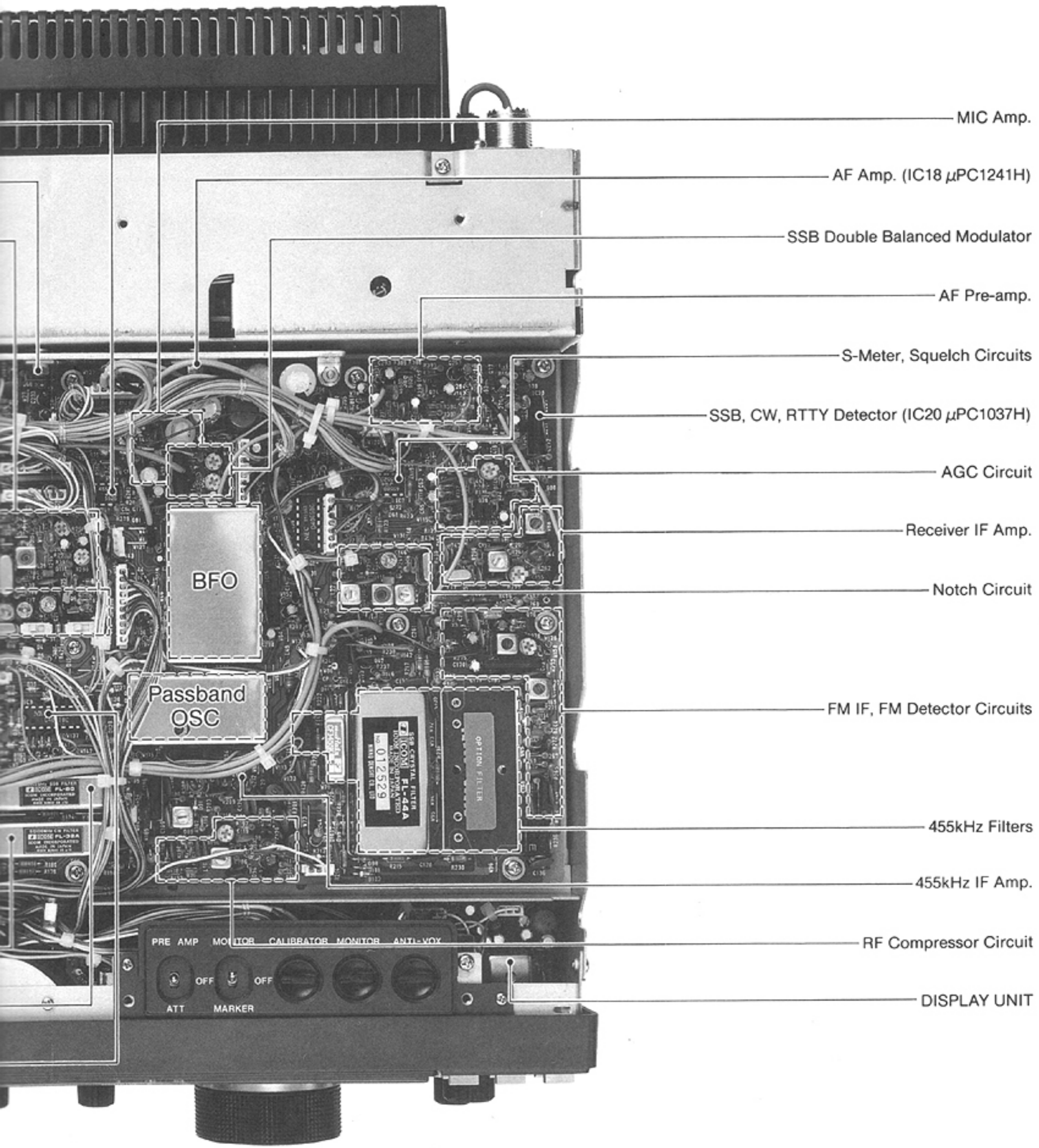
## 2 - 4 REAR PANEL



- ⑥⑥ T/R CONTROL JACK [RELAY]
- ⑥⑦ ANTENNA CONNECTOR
- ⑥⑧ EXTERNAL ALC JACK [ALC]
- ⑥⑨ RECEIVE ANTENNA OUTPUT [RECEIVE ANT OUT]
- ⑦⑦⑦ RECEIVER INPUT [RECEIVE ANT IN]
- ⑦① TRANSVERTER JACK [X-VERTER]
- ⑦② SPARE JACK
- ⑦③ GROUND TERMINAL

- ⑦④ KEY JACK
- ⑦⑤ EXTERNAL SPEAKER JACK
- ⑦⑥ ACCESSORY SOCKET
- ⑦⑦ DC POWER SOCKET [DC 13.8V]
- ⑦⑧ IC-EX309 (OPTIONAL) INTERFACE UNIT CONNECTOR POSITION
- ⑦⑨ IC-PS35 (OPTIONAL) AC POWER SUPPLY SOCKET POSITION





MIC Amp.

AF Amp. (IC18  $\mu$ PC1241H)

SSB Double Balanced Modulator

AF Pre-amp.

S-Meter, Squelch Circuits

SSB, CW, RTTY Detector (IC20  $\mu$ PC1037H)

AGC Circuit

Receiver IF Amp.

Notch Circuit

FM IF, FM Detector Circuits

455kHz Filters

455kHz IF Amp.

RF Compressor Circuit

DISPLAY UNIT

BFO

Passband  
OSC

588 CRYSTAL FILTER  
FL-44A  
012529

OPTIONAL FILTER

PRE AMP MONITOR CALIBRATOR MONITOR ANTI-VOY

OFF OFF  
ATT MARKER

LOGIC UNIT

Data Output for RF BPF

I/O Expander (IC14 M50780SP)

Data Output for TX LPF

Keyer Unit Weight Control (R8)

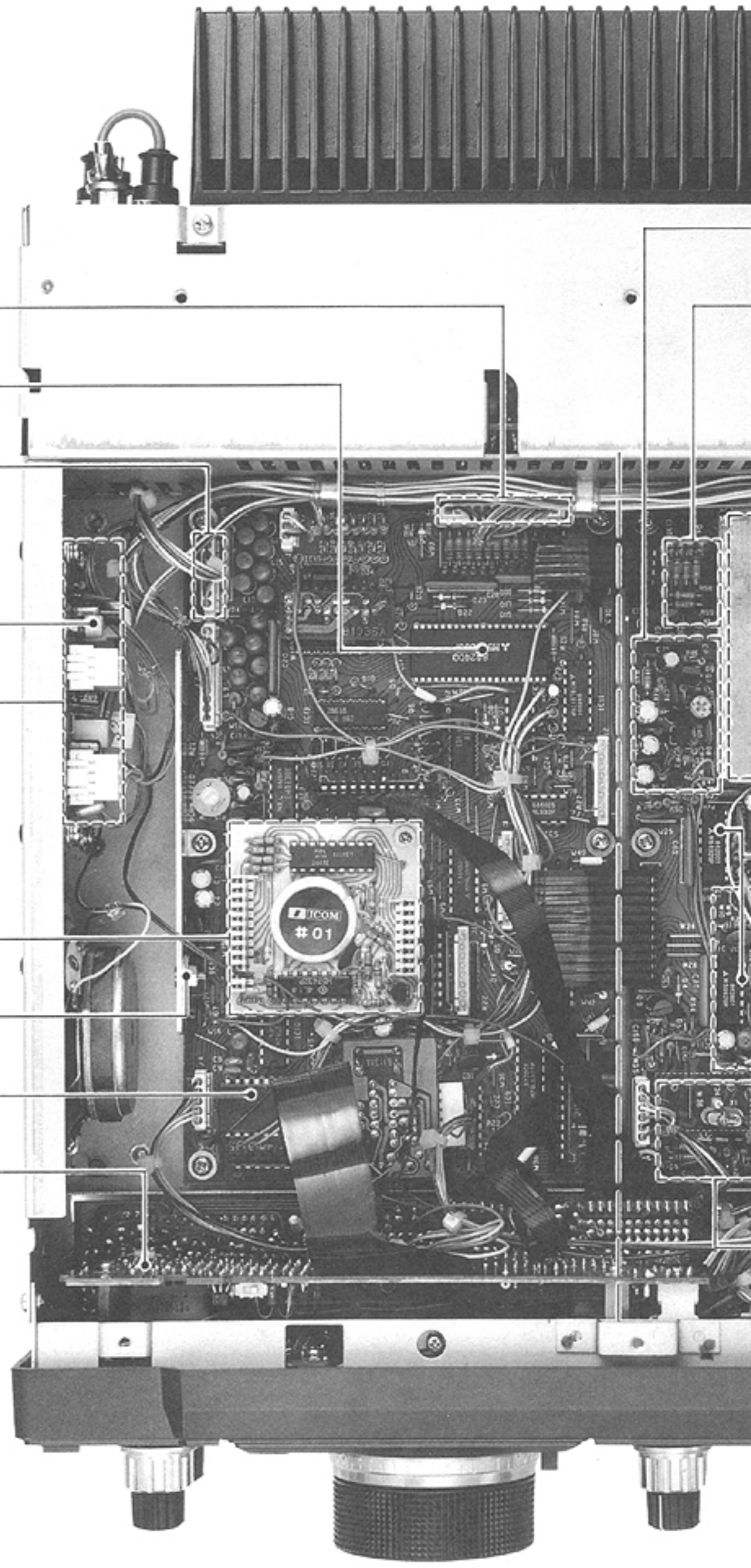
KEYER Unit

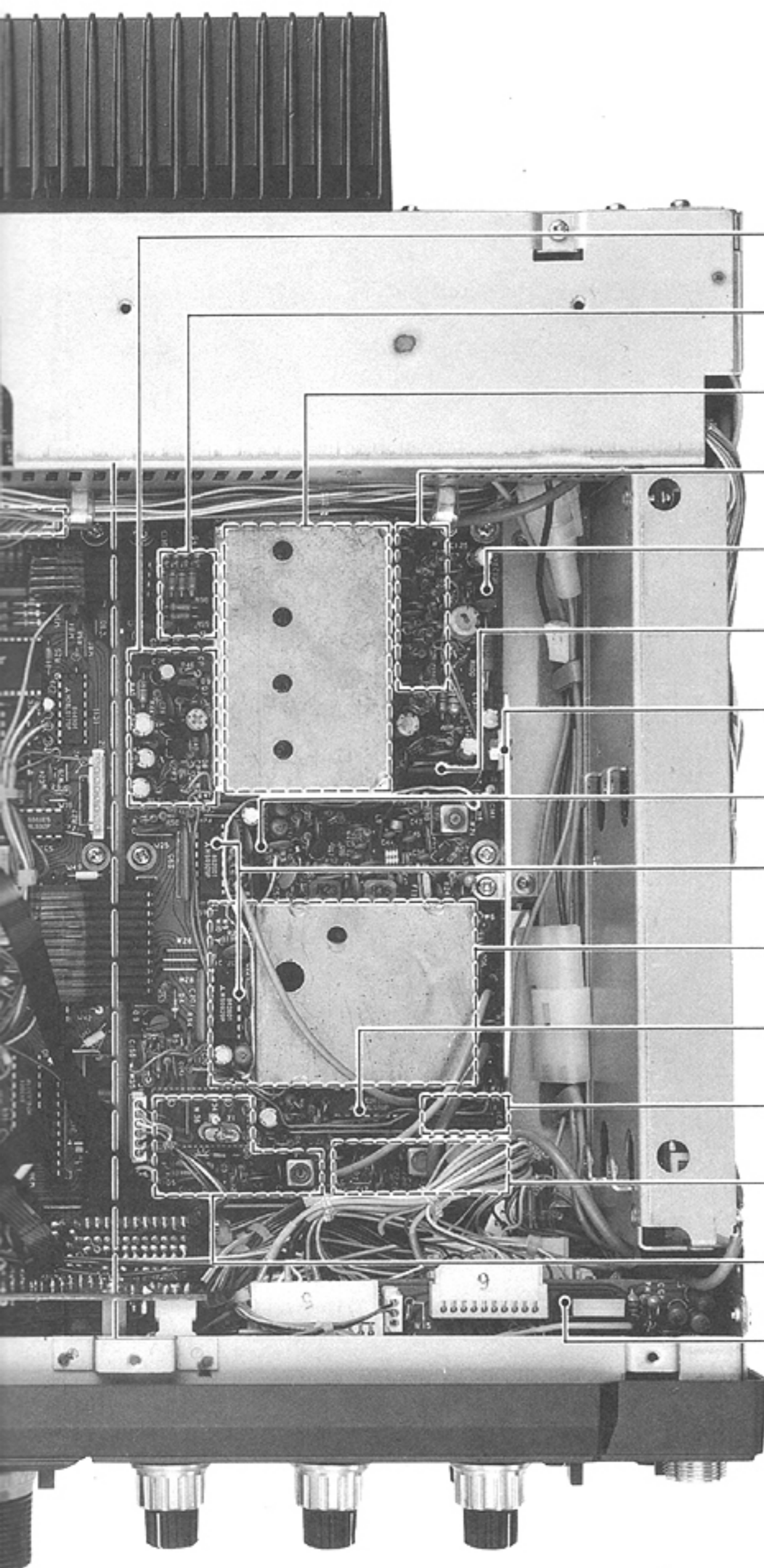
RAM Unit  
(CPU is underneath the RAM Unit)

5V Regulator (IC1  $\mu$ A7805)

Custom LSI (IC2 RP5G01-007)

MATRIX UNIT





**PLL UNIT**

- Loop Filter
- VCO Switching Circuit
- VCO Circuit
- 1st LO Amp.
- 8V Regulator (IC7 TA78L008AP)
- PLL Mixer (IC3  $\mu$ PC1037H)
- 5V Regulator (IC8  $\mu$ A7805)
- Prescaler (IC1, IC202 M54466L)
- PLL IC Chip (IC201 M54929)
- LPL Circuit
- PLL Divider (IC203 SN74LS90N)
- Divider for MARKER (IC6 TC5082P-GL)
- 2nd LO Amp.
- PLL Reference Divider
- AF VR UNIT

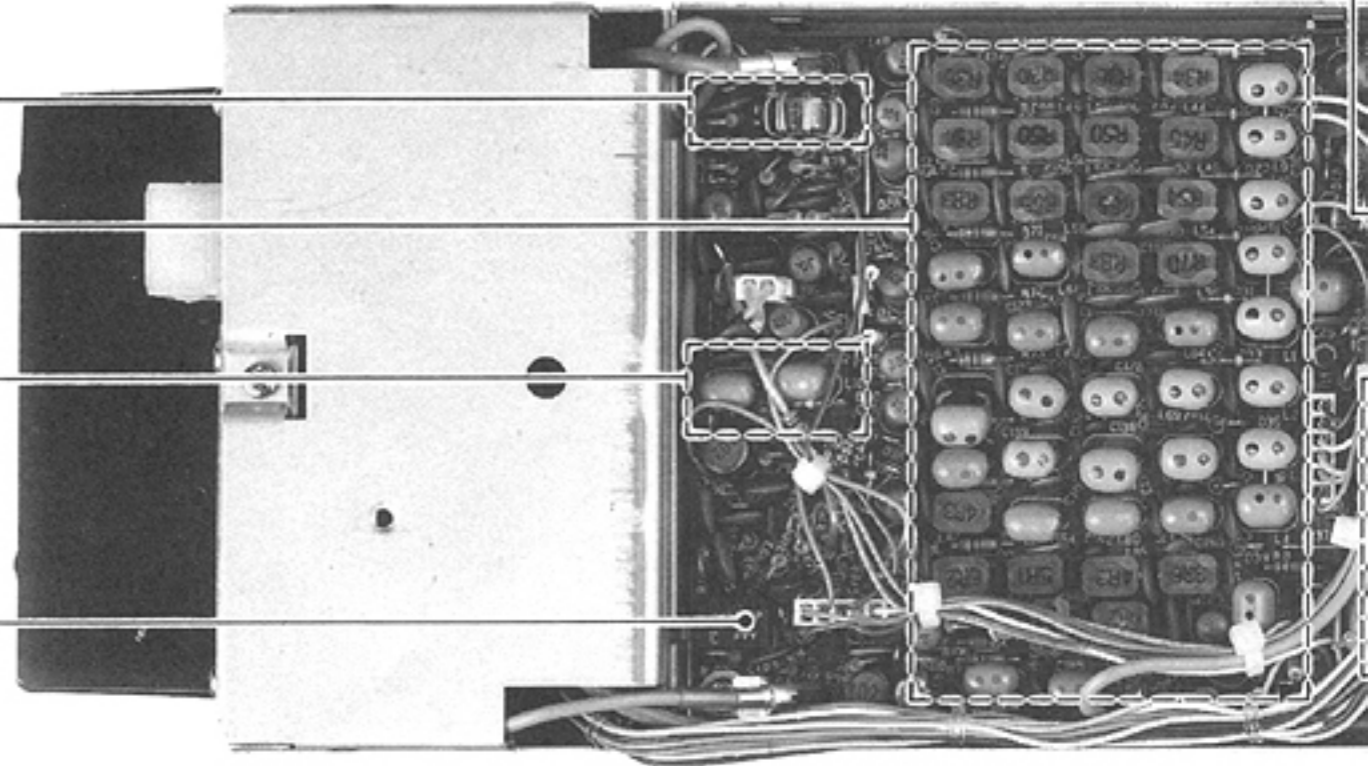
2 - 7 RF UNIT

Transmitter Pre-Amp.

BPF

HPF

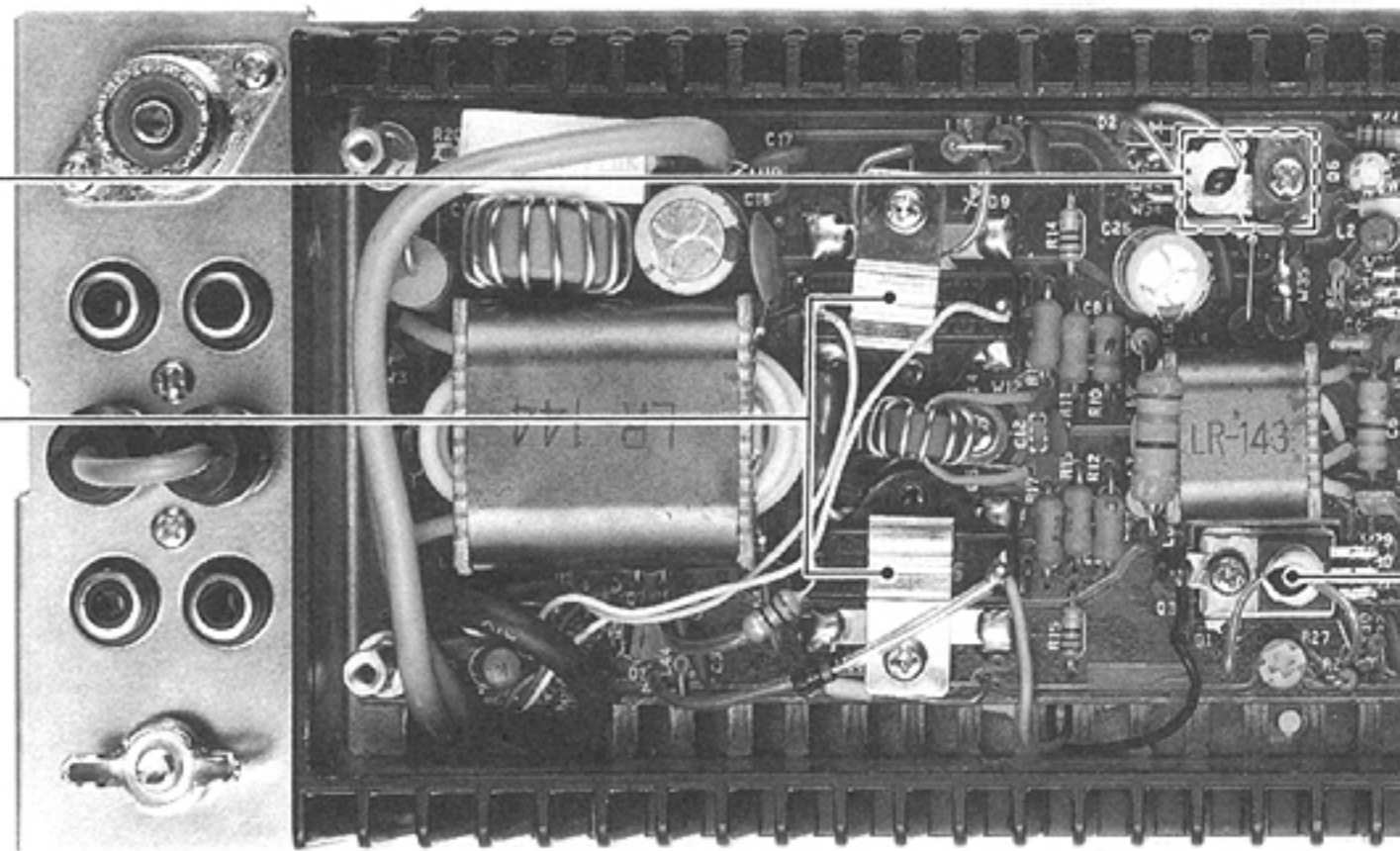
ATT Switching Relay

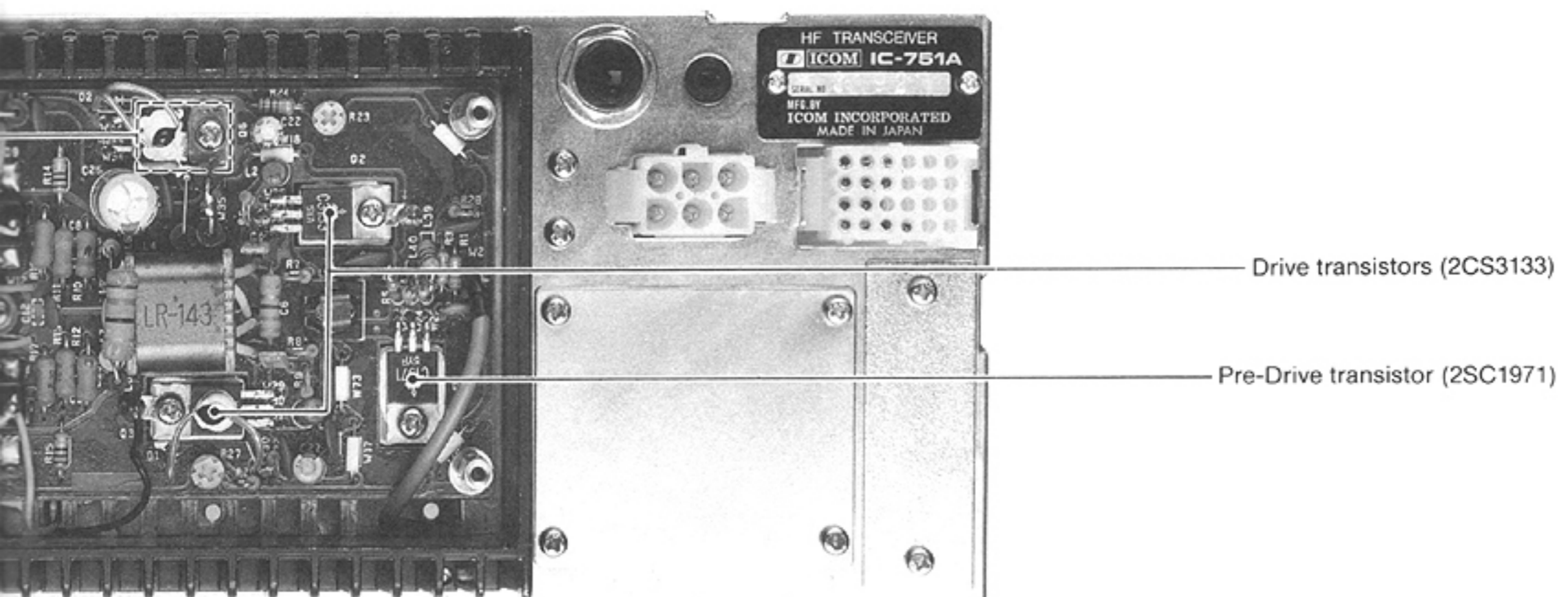
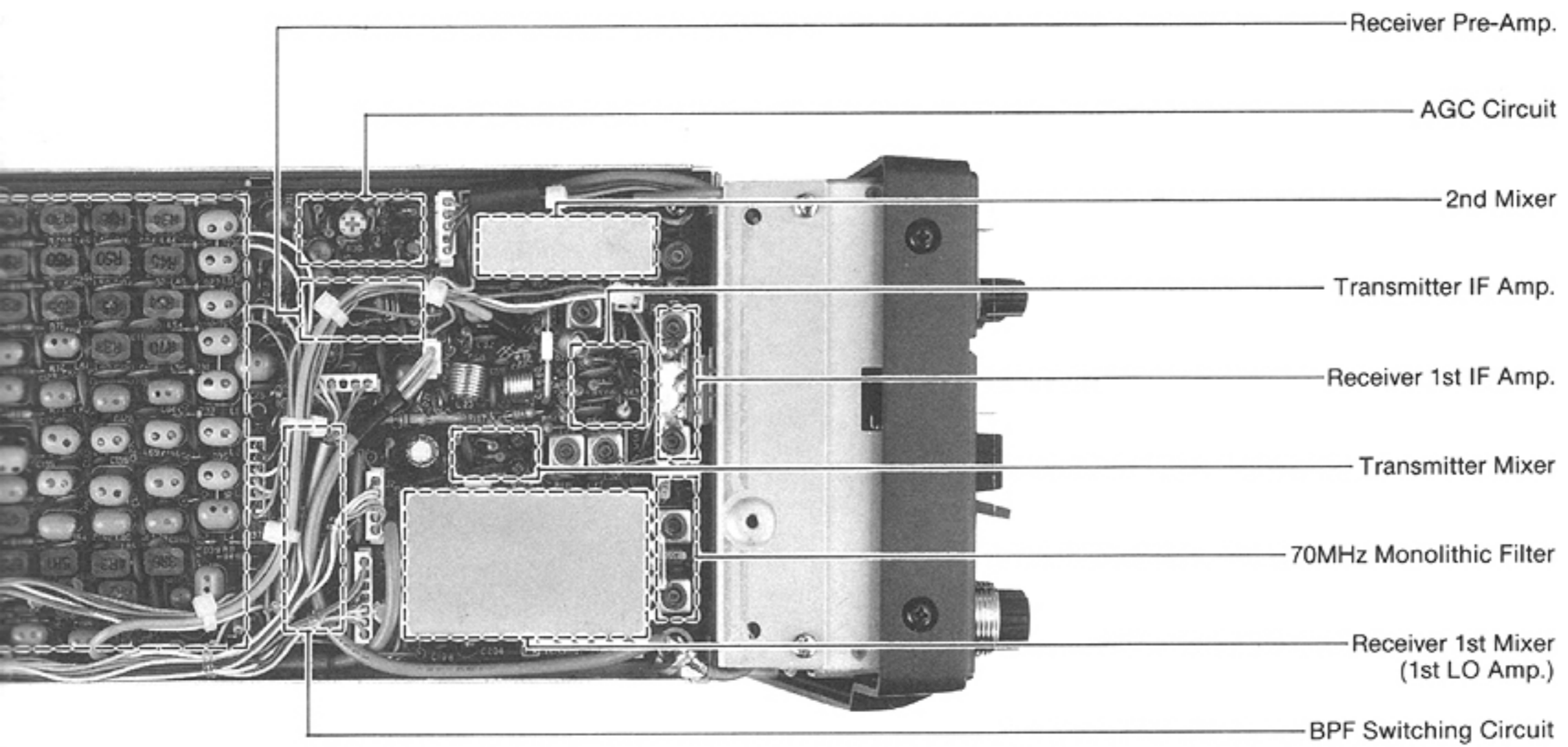


2 - 8 PA UNIT

Idling current control (2SD880)

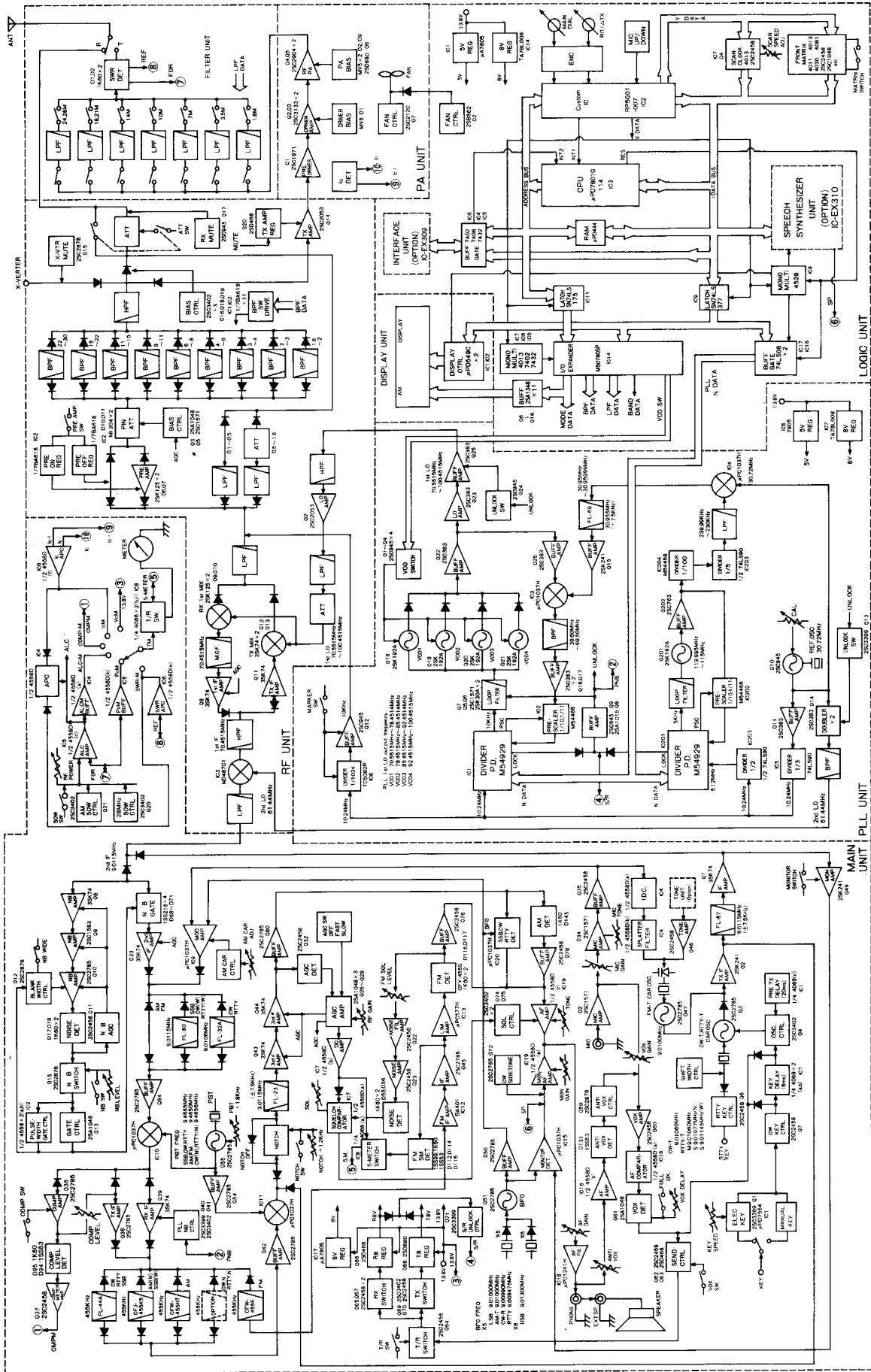
Final transistors (2SC2904) are located under these thermal switches.







# SECTION 3 BLOCK DIAGRAM



## SECTION 4 CIRCUIT DESCRIPTION

### 4 - 1 RECEIVER CIRCUITS

#### 4 - 1 - 1 RF CIRCUITS (RF AND CONNECTOR UNITS)

Receive signals from the antenna connector are fed into J10 on the RF UNIT when D4 and RL1 on the CONNECTOR UNIT are respectively turned OFF and ON. A reed relay is used for RL1 to provide full break-in operation. The T/R switching time of this relay is less than one millisecond, compared to more than 12 milliseconds with a regular relay.

Incoming signals to the RF UNIT pass through an L-type attenuator which consists of R92, R93, and R119. Signals are attenuated at 20dB when the [PREAMP ATT] SWITCH is set in the [ATT] position. Incoming signals are fed into one of three different circuits depending on the receive frequency range.

- (1) 100~500kHz : Signals are fed through a low-pass filter by D44.
- (2) 500~1600kHz : Signals are fed by D42 into a 10dB attenuator and low-pass filter to attenuate strong signals from AM broadcasting stations.
- (3) More than 1600kHz : Signals are fed by D47 into a high-pass filter consisting of L101, L102, and C180 C182. This filter attenuates strong radio signals in the BC band. The signals are then passed into one of nine bandpass filters depending on the frequency of the signal.

Filtered signals are fed into an L-type attenuator which consists of R28 and PIN diodes D10 and D11 which are controlled by AGC bias voltage from Q3, Q4, and Q5. D10 and D11 are linear diodes which are similar to RF variable resistors, depending on current flow when no signal is being received. The voltage of the AGC line from the MAIN UNIT is approximately 4V at this time and the emitter voltage of Q5 is approximately 2.8V. Therefore approximately 15mA flows through D11. This AGC voltage turns OFF Q3 and approximately 0.7V are generated by R32.

The AGC circuit operates when signals are received, lowering Q5. The current flow of D11 is therefore reduced, making resistance higher. Q3 then turns ON and allows the current to flow through D10, lowering resistance. This voltage function in the circuit provides variable attenuation to a maximum of 10dB.

When the [PREAMP ATT] SWITCH is in the [PREAMP] position, signals from the attenuator are fed into a broad-band amplifier which consists of Q6 and Q7. Gain from this amplifier is approximately 10dB. If the [PREAMP ATT] SWITCH is turned OFF or is in the [PREAMP] position, signals bypass this amplifier through D12 and D13.

Signals are fed through one of two filters depending on whether their frequencies are greater or less than 1600kHz. Signals are then passed through a low-pass filter which improves image rejection characteristics and reduces spurious emissions from the ANTENNA CONNECTOR via the local oscillator. Signals are fed into the 1st mixer through T/R Switching Diode D20.

BPF switching voltage is obtained via IC1 and IC2 through the decoding of band signals B1~B11 from the LOGIC UNIT. ON and OFF switching voltages are provided by IC2. R13V is emitted from an OR gate which consists of D5 and D6. Immediate release of this control voltage is provided by D1 and D2 when switching to transmit mode.

#### L-TYPE ATTENUATOR CIRCUIT

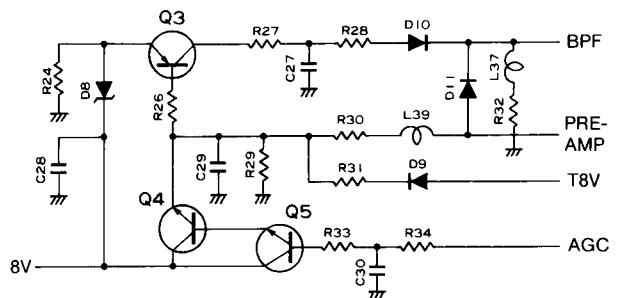


Fig. 1

#### 4 - 1 - 2 IF CIRCUITS

##### 1. RF UNIT

Q9 and Q10 create a double-balanced mixer which uses low-noise FETs (2SK125) and is driven by 13.8V to provide an excellent noise figure. Multi-signal receiving characteristics are determined by the 1st mixer circuit. The double-balanced mixer has a high interception point and reduces spurious characteristics in signals. The IC-751A has a very high dynamic range (100dB in SSB mode and 104~105dB in CW mode) and uses a mixer with a high intercept point figure. The [ATT] SWITCH position is effective for strong receive signals with 20dB attenuation. The [PREAMP] SWITCH position is more effective with weaker signals since PREAMP provides an excellent noise figure and amplification, and increases the receive sensitivity by approximately 6dB.

## TWO SIGNAL RECEIVE CHARACTERISTICS

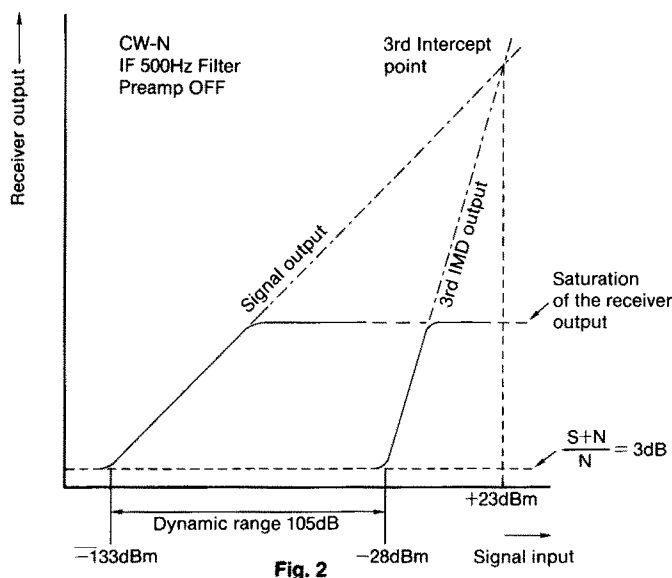


Fig. 2

The 1st mixer circuit is an upconverter which converts receive signals into 70.4515MHz 1st IF signals.

The 1st LO output signal from the PLL UNIT is fed through a high-pass filter, amplified by Q2, filtered by a low-pass filter, and then is applied to the 1st mixer as a local oscillator signal (70.5515~100.4515MHz). R18, L13, and C14 are designed as feedback functions to improve the frequency characteristics of Q2.

The 1st IF signal is filtered by a monolithic crystal filter (F1,  $\pm 7.5\text{kHz}/-3\text{dB}$ ) and then is amplified by a dual-gate FET (Q8), the 2nd gate of which is controlled by the AGC voltage.

Signals are fed through T/R Switching Diode D19 and a high-pass filter to the 2nd IF mixer of Double-Balanced Mixer IC3 where the signals are converted into 9.0115MHz 2nd IF signals. The signals are then filtered in order to have local oscillation components removed by a low-pass filter before being fed to the MAIN UNIT through P3.

2nd LO signals (61.44MHz) from the PLL UNIT are fed to IC3 as local oscillator signals for the 2nd mixer.

## 2. MAIN UNIT

9MHz 2nd IF signals from J4 pass through Q33, a noise-blanker gate and amplifier. After being amplified at Q33, signals are fed through a filter select switch circuit and into a 9MHz IF filter.

Noise blanker gate D68~D71 is a diode balanced-type switch circuit which passes signals through it. Signals are cut by this gate when control voltage from the noise blanker circuit is applied to D72.

Mode switches and the [FILTER] SWITCH on the front panel send signals into the circuit which select a 9MHz IF circuit section consisting of F12 and F18.

Filtered signals amplified at Q84 are fed into the 3rd mixer, IC10. 9.4665MHz ( $\pm$  SHIFT frequency) signals are supplied as local oscillator signals from Q55 to IC10 (pin 7) in order to obtain 455kHz 3rd IF signals. 3rd IF signals are buffer amplified at Q39 and fed into the 455kHz filter section of the

circuit. The 455kHz section consists of F13~F16 and an optional narrow filter (in CW and RTTY modes). 3rd IF signals are selected as in the 9MHz section.

Signals from the 455kHz filter are converted to 9MHz again by IC11, the 4th mixer. When the transceiver is in FM mode, output from F16 (the FM filter) is applied to the FM receive circuit. 9MHz-converted signals pass through the notch circuit and are amplified at Q43 and Q44 before being fed into the detector and APC circuits.

## 4 - 1 - 3 FILTER SECTION (MAIN UNIT)

The IC-751A has two filter sections (9MHz and 455kHz) for passband tuning and high selectivity.

The 9MHz filter section consists of a through circuit in AM and FM modes, F12 in SSB, CW, and RTTY modes, and F18 in CW Narrow and RTTY Narrow modes. 9MHz 3rd IF frequencies are 9.0115MHz in SSB mode, 9.0100MHz in AM and FM modes, and 9.00106MHz in CW and RTTY modes.

The 455kHz filter section consists of F13, F14, F15, and F16. These filters consist of several other filters which are listed below.

- F13 : Contains an SSB High Shape Factor Filter, an SSB Filter, a CW Filter, and an RTTY Filter.
- F14 : Contains an SSB Wide and RTTY Narrow Filter.
- F15 : Contains an AM Filter.
- F16 : Contains an FM Filter and optional CW Narrow and RTTY Narrow Filters.

The above filters are selected by control signals from the filter switching circuit using the switch circuit. Refer to SECTION 4-2-19 FILTER SWITCHING CIRCUIT for more information regarding filters and a combination of filter switches or modes.

## 4 - 1 - 4 NOISE BLANKER CIRCUIT

A portion of 2nd IF signals from the RF UNIT is fed into a noise amplifier circuit consisting of Q8, Q9, and Q10. This circuit has high gain and a wide AGC dynamic range. It amplifies weak signals, giving them higher sensitivity with a wider dynamic range.

Amplified signals from Q10 are detected by D17 and D18, and are then fed into Q11 (the noise AGC) and Q13 and Q15 (noise switches). The bias voltage of Q8, Q9, and Q10 is decreased by Q11 to control the gain of the noise amplifier. This noise AGC has a time constant determined by R46, R47, and C31, and functions as an average-type AGC circuit. The AGC therefore responds to SSB signals such as those without sharp leading edges or those that are constant-amplituded. Rectified voltage of the noise AGC is constant. However, rectified voltage will exceed the threshold level of the determined voltage when noise with a sharp leading edge is received.

Q15 controls the gate control circuit when the rectified voltage exceeds the threshold level. The threshold level is controlled by the NOISE BLANKER [NB] CONTROL on the

front panel which alters the emitter voltage of Q15. Q12, the noise blanker gate, closes when noise is received. Q15 then turns ON with the rectified voltage.

The noise blanker circuit contains a delayed pulse-width circuit which consists of a Miller integrator and a comparator. The output signals from this circuit combine with an output signal from Q13 and the combined signal is used for controlling the noise gate circuit. This allows the noise blanker circuit to blank wide-width pulse noise called woodpecker noise. When the NOISE BLANKER TIMING SWITCH is set at the [WIDE] position, the noise blanker does not function with pulse noise which is less than 1 millisecond of pulse width.

Q12 controls the blanking time and prevents blanking for more than 1 to 2 milliseconds and 10 milliseconds when the [NORMAL] and [WIDE] positions are selected, respectively. This results in a distortion-free audio signal. The limits of blanking time are determined by D16, R56, R57, C39, and C40. Q10 prevents noise blanking times from exceeding the above limits, automatically stopping the function when the limits are reached.

#### 4 - 1 - 5 NOTCH CIRCUIT

A notch circuit is installed in the IC-751A with a 9MHz crystal filter function. This circuit uses a bridge-type notch filter and achieves very sharp attenuation and stability using a crystal unit.

Notch frequency can be altered by a capacitance change of varicap D110 which is installed in series with crystal unit X2. When the notch circuit is not turned ON with the [NOTCH] SWITCH, both the input and output of the notch circuit are grounded by D109.

Monolithic filter FI7 is connected to the next stage of the notch circuit and eliminates spurious signals emitted from mixer IC11.

#### 4 - 1 - 6 DETECTOR CIRCUIT

Signals amplified in the receive IF circuit pass into IC20 for detection of the SSB, CW and RTTY modes, and into D145 for detection of the AM mode through buffer amplifier Q80.

The product detector for the SSB, CW and RTTY modes functions in IC20, a balanced mixer IC chip. BFO signals are applied to IC20 for each mode. In the AM detector, D145 rectifies IF signals and the rectified signals are received at Q79, a high impedance emitter follower circuit which improves the distortion ratio of the rectified signals.

#### 4 - 1 - 7 AGC CIRCUIT

The IC-751A has a fast attack/slow release-type AGC system which maintains the peak voltage of rectified IF signals from the IF amplifier circuit for a brief period of time. The AGC circuit provides a dual gate MOSFET in each IF amplifier circuit. AGC voltage is applied to the PIN attenuator in the RF UNIT, obtaining a dynamic range of 100dB.

#### AGC CIRCUIT SCHEMATIC DIAGRAM

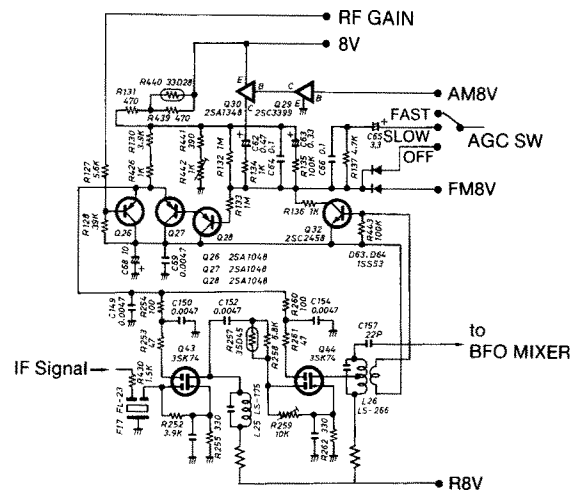


Fig. 3

The time constant of the AGC circuit is selectable, and has three positions, [FAST], [SLOW], and [OFF] for suitable operation.

The received IF amplifier output signals are detected and amplified at Q32. Then, the output of Q32 is connected to a time constant circuit consisting of capacitors and resistors which change the AGC release time. Q27 and Q28 control the AGC voltage. The AGC voltage is set for approximately 4.4V when no signal is received. The voltage will decrease depending on the signal strength of received signals.

When the [AGC] SWITCH is set in the [SLOW] position, R137, C65 and C66 are added to the normal time constant circuit to obtain a longer AGC release time. When the [AGC] SWITCH is set in the OFF position, 8V is applied to the base of Q28 through D64. Therefore, the AGC circuit does not function. The AGC circuit also does not function in FM mode.

#### 4 - 1 - 8 FM IF AMPLIFIER AND DETECTOR CIRCUITS

When FM mode is operating, IF signals are passed through FI6 (a 455kHz filter) and are amplified at IC12 and Q45, and then are limiter amplified at IC13. After being amplified, signals are fed into a detector circuit consisting of D1, D2, and ceramic discriminator X3. Detected signals are deemphasized by an integrated circuit consisting of R405 and C246, and are then applied to the AF preamplifier circuit.

#### 4 - 1 - 9 AF AMPLIFIER CIRCUITS

Audio signals from IC20 or Q76 are amplified at IC19(b) and fed into a tone control circuit consisting of R394 and C258 on the MAIN UNIT and the [TONE] CONTROL on the front panel. After passing through the tone control circuit, audio signals pass through the [AF GAIN] CONTROL on the front panel and are then fed into IC18, the power amplifier. IC18 drives the speaker at more than 3W with 8 ohms of resistance.

Q74 and Q75 comprise a squelch switching circuit which cuts audio output. Output signals from IC19(b) are applied to the rear panel AF OUT pin in the ACCESSORY SOCKET.

#### 4 - 1 - 10 S-METER CIRCUIT

When operating in FM mode, output signals from Q45 (an FM IF signal amplifier) are detected by D114 and D115, and are then applied to the S-METER. D112 is a compression circuit which maintains the S-METER dynamic range at approximately 40dB.

When operating in modes other than FM, AGC voltage is amplified by a differential amplifier which consists of Q26~Q28 and IC7(h). AGC voltage is then supplied to the S-METER. Offset in the differential circuit is adjusted by R132 and sets the S-METER at 0. An AGC reference voltage is adjusted by R442 to obtain excellent meter linearity. When the [AGC] SWITCH is in the OFF position, AGC voltage is fixed and the S-METER will not operate.

#### 4 - 1 - 11 SQUELCH CIRCUIT

##### (a) NOISE SQUELCH (FM MODE)

A portion of the output signals from the FM detector circuit pass through the [SQUELCH] CONTROL on the front panel. They are then applied to the noise amplifier circuit on the MAIN UNIT. The [SQUELCH] CONTROL is a double variable resistor, so it can be used to squelch noise and the S-METER.

The noise amplifier circuit consists of an active filter (Q22) and noise amplifier (Q23). Q22 detects 10~20kHz noise components which are determined by L9 and C55. Noise components amplified at Q23 are detected by D55 and D56, and are then applied to comparator IC7(g).

When operating in FM mode, pin 2 on IC7(g) is at 0V, as determined by Q83, and the S-METER squelch control voltage is grounded by Q25. When no detected voltage is supplied from D56, pin 3 on IC7(g) is at a negative voltage, as determined by R117. The output of IC7(g) is therefore "LOW" and thus the squelch switching circuit (consisting of Q74 and Q75) is turned OFF (squelch opens). Q24 receives the output of IC7(g) through D57, turning ON and OFF the RECEIVE INDICATOR.

When a detected voltage is supplied from D56 (no signal being received), pin 3 on IC7(g) is greater than 0V and the output of IC7(g) is "HIGH". Q74 and Q75 then turn ON, cutting the audio signal.

##### (b) S-METER SQUELCH

When operating in a mode other than FM, IC7(g) receives S-METER voltage at pin 2 and reference voltage from the [SQUELCH] CONTROL at pin 3. When the [SQUELCH] CONTROL is turned CCW to its maximum position, the reference voltage is approximately -0.5V; when turned maximum CW the reference voltage is approximately +2.5V. When the S-METER voltage is lower than the reference voltage, Q74 and Q75 are turned ON, closing the squelch.

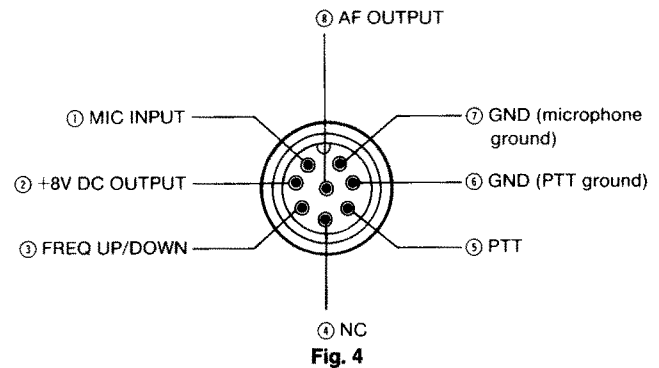
### 4 - 2 TRANSMITTER CIRCUITS

#### 4 - 2 - 1 MIC AMPLIFIER CIRCUIT

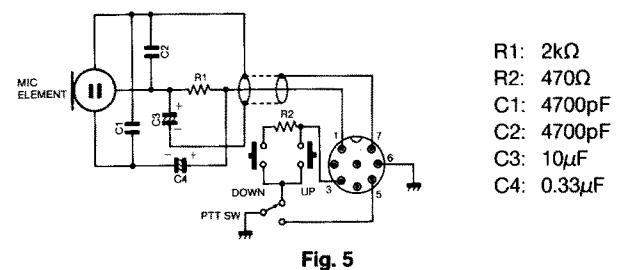
An audio signal from the MIC CONNECTOR is amplified at Q2, the mic preamplifier circuit in the AF VR UNIT, and then passes through the [MIC GAIN] CONTROL. The signal is

then applied to the mic amplifier circuit which consists of Q34 and Q35, and passes through the [TONE] CONTROL which consists of R154, R155, C86, and C87. Frequency characteristics of the audio signal are controlled by R155. The MOD terminal on the ACC CONNECTOR socket is connected to the base of Q35 through R148 and C83.

#### IC-751A MIC CONNECTOR (Front View)



#### HM-36 SCHEMATIC DIAGRAM



#### 4 - 2 - 2 BALANCED MODULATOR CIRCUIT

When operating in SSB or AM mode, an audio signal from the mic amplifier circuit is applied to balanced mixer IC9 where it is mixed with a BFO signal. A double sideband (DSB) signal is then output from IC9. In SSB mode, the bias voltage of IC9 is adjusted by R158 and R161, reducing the carrier signal. In AM mode, R159 and D75 add voltage to pin 5 on IC9, disrupting the balance and generating an AM signal.

#### 4 - 2 - 3 SSB AND AM TRANSMITTER IF CIRCUITS

A DSB or AM signal generated at IC9 is applied to the 9MHz filter as in the receiver circuits. In SSB mode, the DSB signal passes through FI2, creating an SSB signal. In AM mode, an AM signal passes through the circuit. After passing through the filter, a signal is buffer-amplified at Q84 and fed into mixer IC10 for conversion into a 455kHz 2nd IF frequency signal. This 2nd IF frequency signal is applied to Q38 directly when the [COMP] SWITCH is OFF or indirectly through the compressor circuit when the [COMP] SWITCH is ON.

A 455kHz filter, buffer amplifier Q42, and mixer IC11 are commonly used with the receive circuit, so 455kHz 2nd IF frequency signals are re-converted to 9MHz 3rd IF frequency signals and are applied to Q1, the transmitter IF amplifier.

#### 4 - 2 - 4 COMPRESSOR CIRCUIT

The compressor circuit increases the average power needed to limit amplitude when in SSB mode. Since amplitude is limited with an IF frequency signal, signal distortion is slight.

SSB signals from IC10 are amplified at Q36 and are amplitude limited by diode limiters D92 and D93. Parts of the

signals from Q36 are detected at D94 and D95 and are then current amplified by Q37 and applied to the COMP METER. When the [COMP] SWITCH is OFF, output from IC10 is applied directly to Q38 by D90.

#### 4 - 2 - 5 CW, RTTY OSCILLATOR CIRCUITS

In CW or RTTY mode, Q3 and X1 oscillate the transmit carrier signal. In CW mode, oscillation is controlled by the external keys. In RTTY mode, the oscillating frequency is controlled by C17 and C20.

The emitter resistor of Q3 is connected to the collector of Q4 to control oscillation. When Q5 or Q6 is activated, D4 is turned ON by R17, R18 and R19. C15~C20 are then series connected to X1 to oscillate 9.0106MHz (an RTTY marker frequency or a CW oscillator frequency). When both Q5 and Q6 are OFF, D4 is also OFF, thus capacitors C19 and C20 or C17~C20 (which are controlled by S1, the Shift Selection Switch on the MAIN UNIT) are cut from X1 to oscillate either 9.01077MHz (the 170Hz shift frequency) or 9.01145MHz (the 850Hz shift frequency), respectively.

Q5 is an inverter for changing the Mark and Shift polarities in RTTY modes. Polarity is fixed by S2 on the MAIN UNIT, the RTTY Polarity Switch. In CW mode, Q5 receives voltage from D5, so S2 has no relation to the oscillation frequency which is 9.0106MHz.

#### 4 - 2 - 6 CW KEYING CIRCUIT

A keying signal from the [EXT KEY] JACK is applied to Q4 through a delay circuit which consists of IC1, R31, and C23 (delay time is approximately 6ms). Transmit and receive switching time is approximately 20ms, but when using full break-in operation RF signals are delayed for less than 6ms.

#### 4 - 2 - 7 FM OSCILLATOR AND MODULATOR CIRCUITS

An audio signal from the mic amplifier circuit is fed into IC14(a), a limiter amplifier, through C175 and R279, the pre-emphasis circuit. After being amplified at IC14(a), an audio signal is applied to IC14(b), a splatter filter which reduces distortion components. The signal is then applied to the FM modulator circuit.

Output from IC14(b) is applied to the anode of D118 and signals oscillated by Q47 and X4 are frequency modulated. Output from a UT-30 optional tone encoder is amplified at Q46 and is then applied to the anode of D118, the same as an audio signal. ON and OFF switching in the UT-30 is controlled by the FUNCTION LED voltage. when the FUNCTION LED lights up, the UT-30 is activated.

Audio deviation is adjusted by R292 and subaudible tone deviation is adjusted by R290. Output signals from the FM local oscillator circuit are buffer amplified at Q2 and are then applied to Q1, the same as in CW and RTTY modes.

#### 4 - 2 - 8 BFO CIRCUIT

This circuit oscillates local signals for detection of SSB, RTTY, and CW modes via IC20 and for detection of the monitor circuit via IC15. The circuit provides balanced modulation with IC9.

The oscillation frequency should be as follows:

|                   |   |             |
|-------------------|---|-------------|
| USB               | : | 9.01300MHz  |
| LSB, AM (Receive) | : | 9.01000MHz  |
| CW (Receive)      | : | 9.00990MHz  |
| RTTY (Receive)    | : | 9.008475MHz |

The circuit oscillates using X6 in USB mode and X5 with L33, L34 and L35 connected in series in LSB, CW and RTTY modes, respectively. The circuit stops oscillating when the transceiver is operating in AM receiving and CW transmitting as Q52 and Q53 provide no voltage to the circuit.

#### 4 - 2 - 9 TRANSMITTER IF AMPLIFIER CIRCUITS

##### 1. MAIN UNIT

9MHz IF frequencies from the oscillator circuit of each mode pass through monolithic filter FI1 to remove spurious components. The signals are then fed into Q1. Gate 1 of Q1 receives ALC voltage and gate 2 receives control voltage from the power control unit.

##### 2. RF UNIT

IF signals from the MAIN UNIT pass through a low pass filter circuit and are converted into 70.4515MHz signals by IC3, a balanced mixer diode. 9.0115MHz noise components are removed from the output of IC3 by a high pass filter consisting of C64~C66. 61.44MHz noise components are removed by a series resonance circuit consisting of L30 and C67. Signals are then amplified at Q11, a dual gate FET that receives ALC voltage through D22, a T/R switching diode.

Amplified signals from Q11 are fed into Q12 and Q13, the transmit mixer circuit, through a double tuning circuit consisting of L32, L33, and C77. Spurious noise components are then removed from the signal by the 2nd gate of Q12 and Q13 which receive local frequencies with DC bias voltage that eliminates signal spuriousness. Signals are then converted to the desired frequency of 0.1~30MHz.

Converted signals pass through a low pass filter to have local oscillator components eliminated. They are then fed to an attenuator circuit consisting of pin diodes and to a receiver preamplifier bypassing circuit consisting of D12 and D13. In transmit mode, this circuit is provided with bias voltage from D9. Signals then pass through one of nine bandpass filters that are selected by a voltage from the LOGIC UNIT before being fed through a high pass filter.

In receive mode, D47 is ON. In transmit mode, D47 turns OFF since Q16 (ON) and Q18 (OFF) combine to reverse the bias of the diode. Q16 and Q18 are bandpass filter switching transistors that control other diodes such as D26, D28, D30, D32, D34, D36, D38, and D40. Note that current flows through L99 and L100.

In transmit mode, D45 turns ON and signals are wideband-amplified by Q14 and output to the PA UNIT.

When a transverter is used, D46 turns ON and inputs a converted receive signal to the transceiver or outputs a low level transmit signal from the transceiver through the transverter terminal.

## RF UNIT BLOCK DIAGRAM

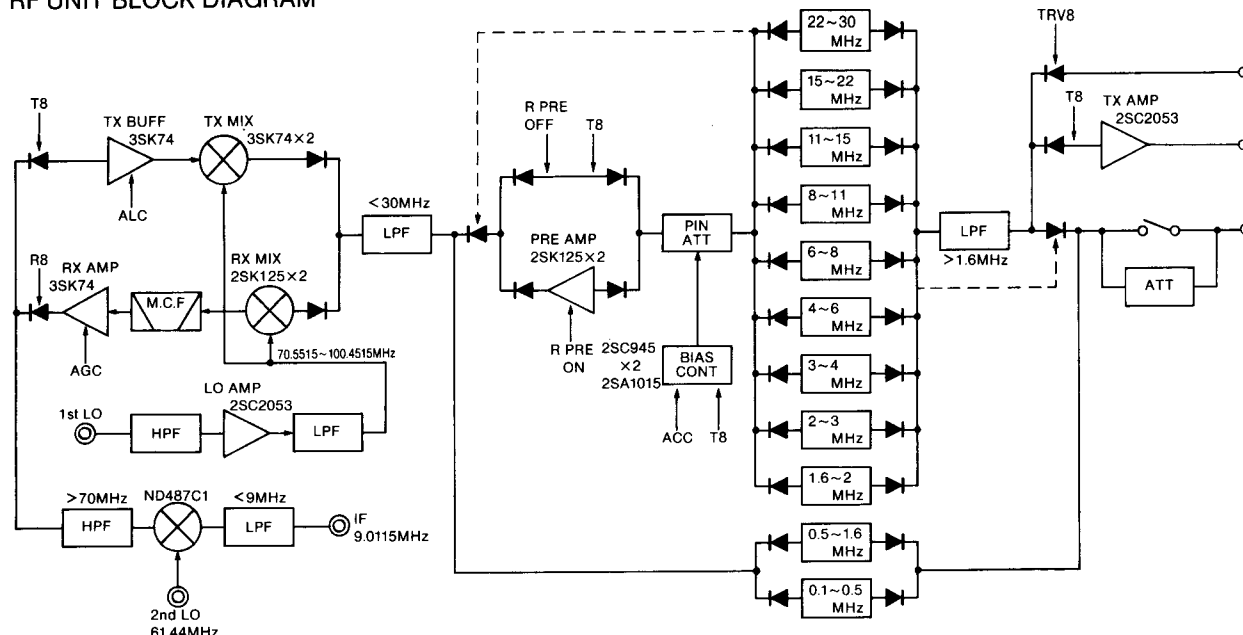


Fig. 6

### 3. PA UNIT

RF signals input from the RF UNIT through P1 are amplified by Q1, a class A amplifier. Output from Q1 is converted to balanced output by L1 and amplified by Q2 and Q3, class AB push-pull amplifiers. Negative feedback circuits inserted between the collector and base of Q2 and Q3 provide wide frequency characteristics. The idling current of Q2 and Q3 is controlled by the junction voltage of D1. The current is set at about 100mA by R27. R30 prevents the adjustment point from deviating due to variations in the characteristics of D1.

Output from Q2 and Q3 is fed into the impedance matching section of L4 and is amplified by Q4 and Q5, class AB push-pull amplifiers which provide 100W output power.

A portion of the output power from Q4 and Q5 is applied to the bases of these transistors through a negative feedback transformer (L9) which provides stability and broadband characteristics in the frequency range 1.8-30MHz. R23 adjusts the idling current to approximately 600mA.

Output from Q4 and Q5 is then fed to L10 for impedance conversion and output to the FILTER UNIT from P2.

### 4. FILTER, CONNECTOR UNITS

RF output from the PA UNIT is fed into J1 on the FILTER UNIT to eliminate harmonic components. Filtered output signals pass through the SWR detecting transformer (L18) to the CONNECTOR UNIT via P2.

The forward wave component detected by L18 is rectified by D1, filtered by C38, divided by R2 and R4, and fed into J7 on the MAIN UNIT. A reflected wave component is also detected by L18 and is rectified by D2, processed by C39, R3, and R5, and is finally sent to the MAIN UNIT.

RF output fed to the CONNECTOR UNIT passes through a diode switch (D4) to the ANTENNA CONNECTOR.

### 4 - 2 - 10 PBT OSCILLATOR CIRCUIT

This oscillator circuit oscillates local frequency signals for mixers IC10 and IC11 which are located at both the input and output terminals of the 455kHz filter. In the receive mode, the local signal frequency is changed by the [PBT] CONTROL and the center frequency of the 455kHz filter is changed likewise. Therefore, passband tuning functions with a 9MHz filter.

In AM and FM modes, the center frequency of the 9MHz filter is 9.0100MHz. In CW and RTTY-Narrow modes, the center frequency is 9.0106MHz. In SSB mode the center frequency is 9.0115MHz. Oscillator frequency variation causes frequency differences between SSB and the other modes.

Oscillator frequency is changed by X7, L36, and varactor diode D126 which is connected to X7 in series. The voltage from the [PBT] CONTROL is between 0 and 8V and the voltage passes to the cathode of D126 through Q58, R332, and R336. -5V are applied to the anode of D126.

The oscillator frequency of this circuit is 9.4665MHz at the center position of the [PBT] CONTROL. The frequency varies up to  $\pm 1.7$ kHz with [PBT] CONTROL rotation. In AM, FM, CW, and RTTY-Narrow modes, R333 and R334 are added to the oscillator circuit by Q56 and Q57. The oscillation frequency for each mode is shifted to 9.4650MHz or 9.4656MHz. In transmit mode the oscillator frequency is fixed by applying a voltage via R337 and D129.

### 4 - 2 - 11 CW SIDETONE CIRCUIT

The CW sidetone circuit consists mainly of Q72 and employs a phase shift oscillator and oscillator frequency of approximately 700Hz. This oscillation is controlled by control voltage from the CW keying circuit through D152. Output signals in this circuit are fed into a monitor preamplifier circuit.

#### 4 - 2 - 12 MONITOR CIRCUIT

The transmitter monitor circuit is not simply a modulation monitor: it also receives signals at the point where ALC is applied, allowing accurate monitoring. After a portion of the transmitting signal is amplified by Q49, it is detected by IC15 and fed into IC19(a), the monitor preamplifier. The monitor circuit is turned ON and OFF by the power source of Q49.

#### 4 - 2 - 13 MONITOR PREAMPLIFIER CIRCUIT

IC19(a) controls the monitor preamplifier circuit and amplifies output from the monitor circuit, CW sidetone circuit, and EX-310, an optional voice synthesizer unit. Output from IC19(a) is applied to IC18, the AF power amplifier, through the [AF GAIN] CONTROL. Monitor gain can be controlled by the [MONITOR] SWITCH on the top panel of the transceiver.

#### 4 - 2 - 14 ALC CIRCUIT

Detected forward voltage from the SWR detector circuit is fed into the negative (−) input of IC5(c). The positive (+) input of IC5(c) receives the reference voltage, so when the forward voltage is higher than the reference voltage, output from IC5(c) is at a negative voltage level. The resulting gain of Q1 on the MAIN UNIT and Q11 on the RF UNIT will be reduced. The reference voltage for IC5(c) is controlled by the [RF POWER] CONTROL to keep peak power continuously between 10 and 100W.

The time constant of the ALC is for fast attack except in AM mode. Slow release occurs in SSB and CW modes and fast release occurs in FM and RTTY modes. The fast release time is fixed by C43 and R70. In FM or RTTY modes, R67 combines with Q18 and Q19 to create slow release times. In AM mode, the time constant is made by Q16 and Q17 to make an average ALC. If an external linear amplifier is used, Q82 controls the ALC line and the input voltage level is 0~−2V.

#### 4 - 2 - 15 APC CIRCUIT

The APC circuit will operate when the antenna impedance is high or when an excessive amount of current flows through the final transistor. Output from IC6(e) (the SWR METER amplifier) or IC6(f) (the IC METER circuit) is applied to the negative (−) input of IC4(b). The positive (+) input receives the reference voltage which is fixed by R75 and R76. The resulting output from IC4(d) controls the output power. The input voltage is adjusted by R95 (SWR) and R99 (Transistor current).

#### 4 - 2 - 16 TRANSMITTER METER CIRCUITS

##### (a) Po METER:

Detected forward voltage from the SWR detector circuit is amplified at IC5(d) and is then applied to the Po METER. D51 and C50 are connected to the output of IC5(d), creating peak conditions on the voltmeter.

##### (b) SWR METER:

Detected reflection voltage from the SWR detector circuit is amplified at IC6(e) and is then applied to the SWR METER.

##### (c) ALC METER:

This meter indicates the ALC level. The ALC circuit begins to function when the RF output power reaches a preset level. The detected ALC voltage is applied to operational amplifier IC4(a) for amplification and the ALC METER indicates the output voltage.

##### (d) Ic METER:

This meter indicates the collector current of the final transistors in the PA UNIT. A very low resistance resistor is connected in the 13.8V line of the PA UNIT in series. This resistor creates voltage when the collector current is flowing. The voltage between both leads of the resistor is applied to a DC differential amplifier IC6(f) for indicating the Ic METER current level.

##### (e) Vc METER:

This meter indicates the power supply voltage. The power supply voltage is divided by resistors on the FRONT UNIT and a portion of the divided voltage creates the Vc indicator. R106 on the MAIN UNIT is for voltage indicator calibrations.

##### (f) COMP METER:

This meter indicates the compression level when the speech compressor is in use.

#### 4 - 2 - 17 VOX AND ANTI-VOX CIRCUITS

A portion of output signals from the mic amplifier in the FRONT UNIT passes through the [VOX] GAIN CONTROL and is applied to the VOX circuit on the MAIN UNIT. Input audio signals are applied to a comparator IC chip, IC16(a), through a variable attenuator for anti-vox control. This attenuator consists of R340, R341, Q59, and amplifier Q60. The comparator outputs 8V normally and Q61 is turned OFF.

When an audio signal is applied to the comparator and the peak of the audio signal is over the threshold level, the comparator output voltage decreases. Therefore, Q61 is turned ON and C227, C228 and C229 are charged so that the SEND line is grounded, creating the transmit mode via Q62 and Q63.

The charged voltage of Q61 is discharged by the [VOX DELAY] CONTROL on the front panel through R355. The transceiver then returns to receive mode. Delay time of the VOX operation is adjusted by the [VOX DELAY] CONTROL.

In CW mode, a voltage from the keying circuit is charged into C227 and C228 and the VOX circuit has the same function as described above. However, the voltage is not charged in C297 since D133 is connected to the collector of Q61. The delay time in CW mode is therefore shorter than in the other modes. Also, C228 is separated from the circuit so that the [VOX DELAY] CONTROL is set for a minimum value and the delay time is negligible when operating with CW full break-in.

The ANTI-VOX circuit prevents the VOX circuit from malfunctioning due to noise from the speaker. A portion of



the speaker output signal is applied to IC16(b) through the [ANTI-VOX] CONTROL on the top panel. Amplified signals from IC16(b) are rectified by D131 and pass into variable attenuator Q59. The [ANTI VOX] CONTROL thus depends on output from the speaker to control the VOX circuit. In CW and RTTY modes, input signals from the VOX circuit are cut by Q59 and the VOX function does not work with microphone input signals.

#### 4 - 2 - 18 METER SWITCHING CIRCUIT

The front panel meter is a multifunction meter so it has the capability of indicating several transceiver meter measurements. Meter functions are changed through use of a CMOS analog switching IC chip (ICS).

The signal output from each detector in transmit mode is applied to the [METER] SWITCH on the front panel. The [METER] SWITCH selects the desired information and the selected signal passes to IC8(c) on the MAIN UNIT.

The signal output from each detector in receive mode has two different signal lines. In FM mode, IC8(a) cuts the signal strength signal for modes other than FM and selects the FMS line for FM signal strength signals.

IC8(a) and IC8(b) are used for receiving. IC8(c) is used for transmitting.

#### 4 - 2 - 19 FILTER SWITCHING CIRCUIT

The filter selector circuit consists of a CMOS four channel multiplexer, IC3. The signals for each mode and for the [FILTER] SWITCH positions (IN or OUT) on the front panel are applied to input terminals A to C on IC3. Output terminals 0 to 7 output a signal which accords with input signal combinations. The output signal is divided into four different lines such as three 9MHz filter lines and a 455kHz filter line.

In FM mode, signals pass through FI6, a 455kHz filter. The switching circuit selects FI6 only, so signals will not pass through any 9MHz filters used for signals in other modes. Refer to the FILTER COMBINATION table in SECTION 11-5 for further information.

The [FILTER] SWITCH on the front panel of the IC-751A selects two receive filter systems for SSB, CW, RTTY or AM modes when it is placed in the IN or OUT positions. The IN/OUT relationship of the [FILTER] SWITCH may be reversed by using the internal FILTER REVERSE SWITCHES, S3 AND S4. Refer to SECTION 11-1 OPTIONAL FILTERS for further details.

### 4 - 3 POWER SUPPLY CIRCUITS

#### 4 - 3 - 1 8V REGULATOR CIRCUIT

This circuit supplies regulated 8V signals both in receiving and transmitting. These 8V signals are generated by a three-terminal voltage regulator IC chip (IC17) on the MAIN UNIT after they pass from the METER SW UNIT as 13.8V signals.

#### TIMING CHART FOR FULL BREAK-IN OPERATION

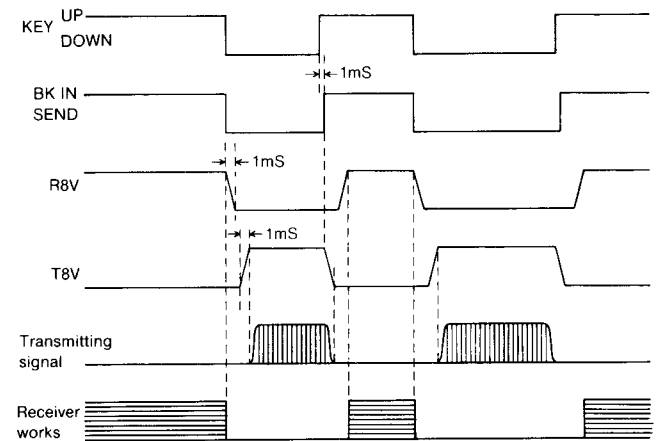


Fig. 7

#### 4 - 3 - 2 RECEIVE 8V (R8V) REGULATOR CIRCUIT

This circuit supplies R8V in receive mode, and consists of Q65, Q66 and Q67. Q65 is used for regulating the voltage. Q65 and Q67 prevent R8V from being supplied in transmit mode.

#### 4 - 3 - 3 TRANSMIT 8V (T8V) REGULATOR CIRCUIT

This circuit supplies T8V in transmit mode, and consists of Q68, Q69 and Q70. Q68 is used for regulating the voltage. Q69 and Q70 prevent T8V from being supplied in receive mode.

#### 4 - 3 - 4 POWER SUPPLY SWITCHING CIRCUIT

Switching of the regulated power supply voltage between receive and transmit mode is performed by an interface circuit consisting of Q64, Q68 and Q69. The interface circuit is connected to the SEND line. When the SEND line voltage is more than 2V as detected by Q64, the R8V regulator circuit functions; when the line voltage is between -0.3 and +0.8V, the T8V regulator circuit functions.

Regulator switching timing chart

#### 4 - 3 - 5 REGULATOR SWITCHING TIMING CIRCUIT

This circuit gives the PLL circuit a faster lockup time when the [RIT] or [ΔTX] SWITCHES are turned ON.

Either R8V or T8V is applied to Q71 through D139 and D140. When both R8V and T8V are 0V at the moment when the receive mode is switched to transmit mode or vice versa, the collector of Q71 is "HIGH" and the level is applied to the MUTE circuit on the PLL UNIT.

### 4 - 4 PLL CIRCUITS

The PLL UNIT in the IC-751A is equipped with a reversed heterodyne 1st mixer and a normal heterodyne 2nd mixer, so PLL output has very accurate oscillation.

The PLL UNIT outputs two oscillator signals for the RF UNIT: a variable first local oscillator output (1st LO output) of 70.55~100.45MHz necessary for the 1st mixer, and a fixed local oscillator output (2nd LO output) of 61.44MHz necessary for the 2nd mixer. A marker signal is also generated in this unit and is sent to the RF UNIT.

All the signals generated in the PLL UNIT are produced from a single oscillator output. Therefore, the frequencies of all signals generated in the PLL UNIT can be calibrated simply by adjusting the reference frequency oscillator.

#### 4 - 4 - 1 REFERENCE FREQUENCY OSCILLATOR AND MARKER CIRCUITS

The frequency of reference frequency oscillator Q10 is the base of all the frequencies of the signals in the PLL UNIT so it requires sufficient stability. Therefore, C3, C6, and C8 are provided for temperature compensation, and a regulator

output voltage of 8V is further obtained from D20, a 5V zener diode.

The frequency of the reference frequency oscillator is 30.72MHz. This frequency is used for the 2nd LO circuit and for reference frequency signals for the main and sub loops, and in-loop LO oscillator.

In order to supply the 2nd LO output, the reference frequency oscillator output is doubled and amplified by Q14. Spurious components are sufficiently reduced by L3, L4 and

PLL SUB-LOOP BLOCK DIAGRAM

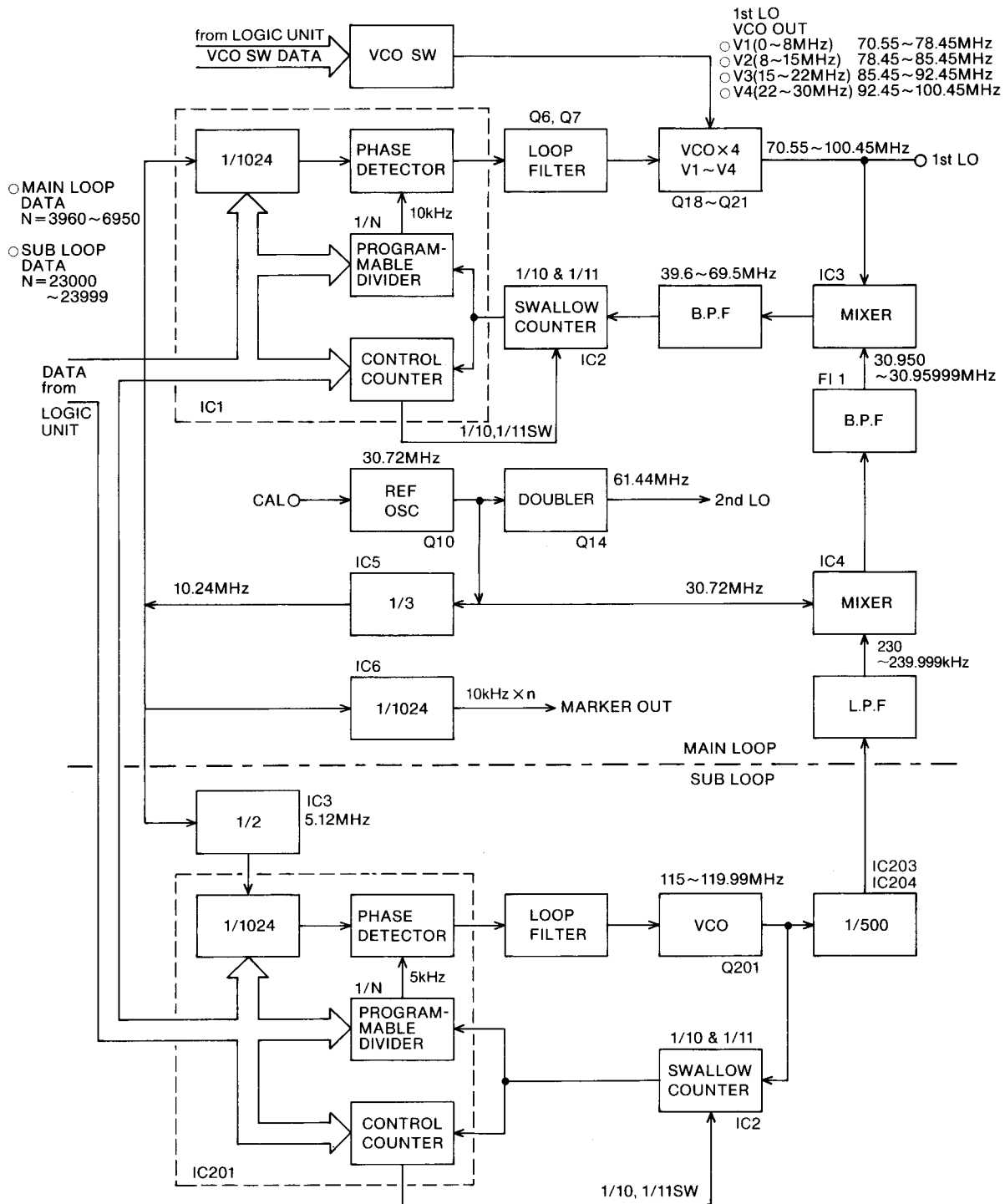


Fig. 8

L5. An output signal of about 3dBm/50Ω is fed to the RF UNIT from J5. A mute signal is applied to this stage when the PLL is unlocked.

In order to obtain a reference signal of 10kHz for the main loop, IC5 divides the reference frequency oscillator signal by three and applies a 10.24MHz signal to IC1. For a sub-loop reference signal of 5kHz, IC203 divides the output signal of IC5 by two and applies a 5.12MHz signal to IC201.

For the marker signal, a 10kHz signal is generated by dividing the IC5 output signal of 10.24MHz by 1024 in IC6. Its harmonics are fed through buffer amplifier Q12 and fed to the RF UNIT through P1. Since the marker signal is derived from reference frequency common to all the frequencies in the PLL UNIT, all the frequencies are adjusted simultaneously when the marker frequency is calibrated

with a standard frequency signal such as JJY or WWV.

#### 4 - 4 - 2 MAIN LOOP CIRCUITS

The main loop forms the PLL loop and supplies the 1st LO output. It consists of a combination of a mixed down and divided system.

The VCO output frequency  $F_v$  is given as:

$$F_v = F_{LO} + N \times F_{ref}$$

Frequency changes are made by changing the  $F_{LO}$  and  $N$ .

The reference frequency ( $F_{ref}$ ) is 10kHz, and the VCO is controlled in 10kHz steps by changing the dividing ratio  $N$  of the programmable divider. A frequency between this step (less than 10 kHz) is obtained by  $F_{LO}$  which controls the VCO output frequency. Note that  $F_{LO}$  can be changed in 10Hz steps over the 9.99kHz range, and in this way the entire 30MHz range of the PLL can be varied in 10Hz steps.

#### MAIN LOOP

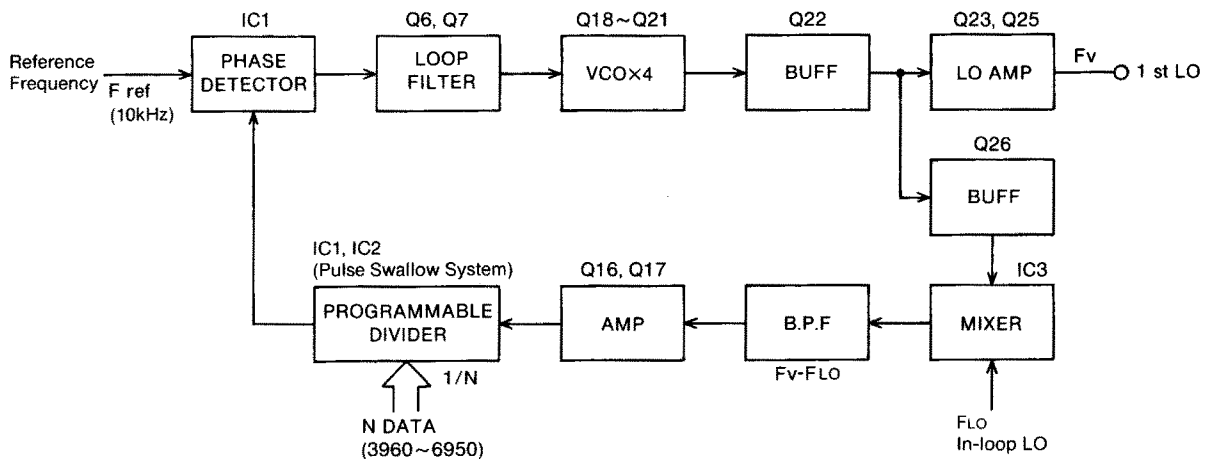


Fig. 9

#### MARKER GENERATOR

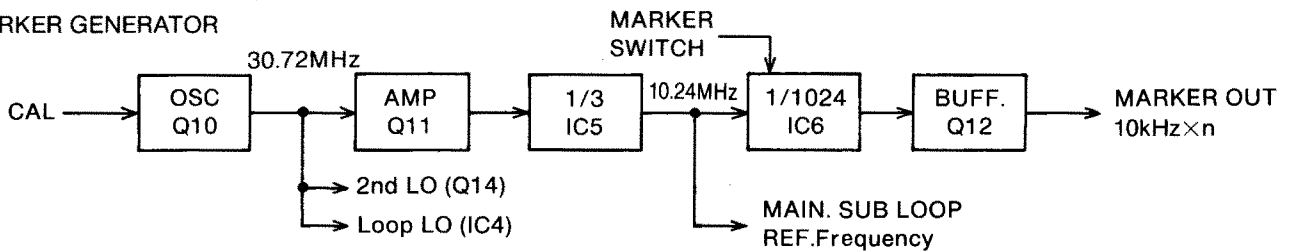


Fig. 10

#### (a) PLL IC

IC1 (M54929P) is a multi-function IC containing a phase comparator, a programmable divider, a reference frequency oscillator circuit, a divider, and a swallow counter controller. By using this IC with IC2 (M54466L, a swallow counter), it performs pulse swallow dividing. This combination forms a

programmable divider which features a large dividing ratio and allows operation even in a higher frequency range. Compared to conventional ICs fewer components are required and the combination allows the PLL to be locked in steps as small as 10Hz.

### (b) VCO

The performance of the VCO is very important for PLL operation. A high carrier-to-noise (C/N) ratio and a stable oscillator output is obtained in the IC-751A by using four separate VCOs, each of which is assigned a quarter of the necessary bandwidth. Dividing the VCOs reduces the burden of one VCO which would otherwise provide frequency changes over the entire bandwidth.

Power supply to the VCOs is doubly regulated as with the reference frequency oscillator. Furthermore, coreless coils are used for the oscillation coils in order to obtain a high Q as well as immunity from external induction.

The location of grounding points on the printed circuit board, allocation of components, and utilization of a solid shielding case additionally give the transceiver a high C/N ratio.

### (c) LOOP SYSTEM

The output of the VCO is separated into two parts after passing through buffer amplifier Q22.

One part is amplified by Q23, and is output to the RF UNIT as a 1st LO output after impedance matching by Q25. The output level is about 0dBm/50Ω.

### IN-LOOP LOCAL OSCILLATOR BLOCK DIAGRAM

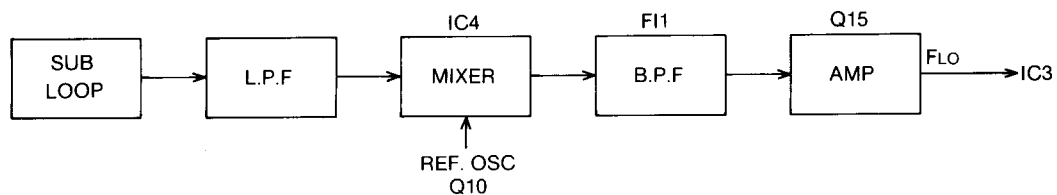


Fig. 11

### (e) LOOP FILTER AND MUTE CIRCUITS

The loop filter of the main loop uses an active filter composed of Q6 and Q7. The loop filter and the VCO are important for the performance of the PLL circuits, and determines lockup time and C/N (Carrier/Noise) ratios.

Lockup time and C/N ratios conflict with each other. That is, as the time constant of the loop filter increases lockup time speed, the C/N ratio will be decreased. In order to solve this problem a variable resistor composed of an FET is inserted into the loop filter in the PLL circuits. Thus, if the frequency changes, the lockup time increases speed, decreasing the time constant of the loop filter, and making the C/N ratio greater by setting the time constant at a higher level than for normal operations.

The circuit changing the time constant Q5 is driven by a mute signal. If the mute signal is generated by the main loop or the sub loop, or if the frequency is changed to more than a certain level at one time, the circuit starts operating.

Mute signals output from IC1 in the main loop or IC201 in the sub loop are processed by Q8 and Q9. They are given appropriate voltages and a time constant, and are fed to Q5, Q13, and Q24. Q13 and Q24 switch the bases of the transistors of the output amplifier for 1st LO and 2nd LO output.

The other part is fed back to the PLL loop through buffer amplifier Q26. A common base amplifier circuit with a high isolation performance is used for the buffer amplifier in order to prevent spurious components from leaking into the 1st LO output. Spurious components arise from various frequency components in the PLL loop. The VCO signal is then mixed with the in-loop LO (F<sub>LO</sub>) by IC3 and mixed down. Output from the mixer passes through a bandpass filter with a bandwidth of 35~75MHz, eliminating spurious components. The output is then amplified by cascade amplifiers Q16 and Q17, and is input to IC2 to form the PLL. D10 and D11 help limit excessive input voltages to IC2.

### (d) IN-LOOP LOCAL OSCILLATOR CIRCUIT

The in-loop local oscillator controls the main loop in 10Hz steps by heterodyning the VCO signal.

Output frequency from the sub-loop is too low to use (230.00~239.99kHz) so the output is mixed with the reference frequency oscillator output via IC4 and converted to an appropriate frequency through heterodyning.

Heterodyned output passes through monolithic filter F11 where spurious components are removed. The output is then amplified by Q15 and fed to IC3.

This switching operation allows the transceiver to transmit or receive on desired frequencies, and completes lockup time operations more quickly.

### 4 - 4 - 3 SUB-LOOP

This loop forms a locked loop using a divider to provide in-loop LO for the main loop.

The reference frequency is 5kHz and the VCO can be locked within the frequency range of 115.00~119.995MHz. The output signal of the 4.995MHz bandwidth with a 5kHz resolution is divided in a 1/500 ratio by IC204 and IC203, providing output ranging from 230.00 to 239.99kHz (i.e., 9.99kHz bandwidth) in 10Hz steps. This output is fed to the main loop.

VCO output is input to IC202 as well as to IC204 and passes through a loop filter composed of IC201 to control the VCO and form a PLL circuit. A pulse swallow counter composed of the combination of IC201 and IC202, as in the main loop, is used in this loop. Therefore the frequency can be changed by changing the dividing ratio. A 10.24MHz reference frequency is divided by 2 in IC203 and then is divided by the built-in divider of IC201 at 5kHz.

## SUB-LOOP BLOCK DIAGRAM

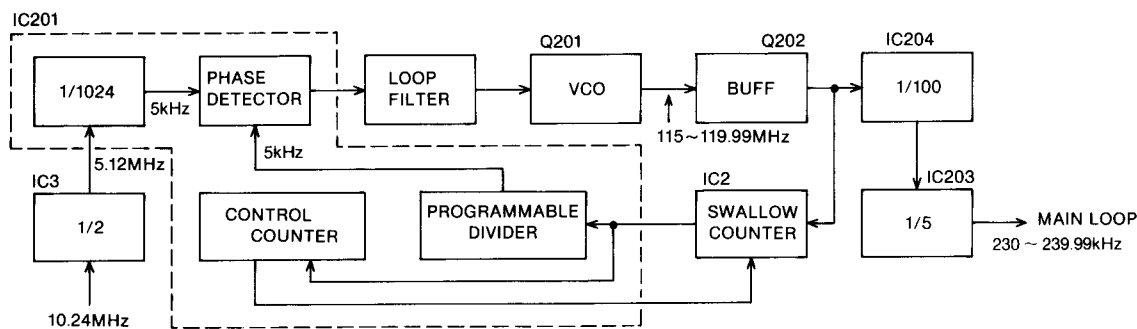


Fig. 12

### 4 - 4 - 4 PLL DATA

Data for setting the dividing ratio N of the programmable divider is sent from the LOGIC UNIT. Control data for switching VCOs is also sent from the LOGIC UNIT. Data to set the dividing ratio (called N-data) is sent dynamically while data for the VCO is sent statically.

Since the dividing ratio of the reference frequency divider of IC1 can be changed, the data (1/1024 constant) is also sent at the same time.

#### (a) HOW TO DERIVE N-DATA

Since there are two locked loops, two kinds of N-data are necessary. Even if the output frequencies from the PLL circuits in all modes are the same, the display frequencies are different depending on the operating mode. For example, if the same frequency is displayed for LSB, AM and FM modes, the frequency will be 600Hz lower in CW and RTTY modes and 3kHz lower in USB mode.

The method for deriving N-data for LSB, AM, and FM modes is shown below.

example : 14.0750MHz

Main Loop

Ignore the digits equal to or lower than 1kHz of the displayed frequency and let the obtained frequency be F1, then:

$$N = F1 \times 100 + 3950$$

where F1 is 14.07 for the case shown above. Thus, we get:

$$N = 14.07 \times 100 + 3950 = 5357$$

Sub-loop

If the frequency shown in the digits is equal to or lower than 1kHz and you let the displayed frequency be F2, then

$$N = F2 \times 100 + 23000$$

where F2 is 5.00 in the case shown above. Thus, we get

$$N = 5.00 \times 100 + 23000 = 23500$$

Note that the digit for 10Hz is not displayed.

To get N for other modes, add 600Hz for CW and RTTY modes and add 3kHz for USB mode to the displayed frequency, then follow the steps shown above.

For the value of N to be derived at in the above way, the dividing ratio of the programmable divider must be 1/N.

## 4 - 5 LOGIC UNIT

The functions in the LOGIC UNIT include the control of frequency, the processing of BPF and LPF signals and mode signals, and data output for the PLL UNIT and DISPLAY UNIT. The LOGIC UNIT is composed of an 8-bit NMOS CPU, a 4-bit 1k word CMOS RAM, a multi-purpose custom IC, and I/O expander ICs.

### 4 - 5 - 1 CPU

Functions are assigned to the pins of the CPU as shown below. The interrupt pins are assigned to the TUNING CONTROL with the highest priority. Pins where no functions are assigned are left unconnected.

Addresses are assigned not only to ROM and RAM, but to all the other peripheral devices.

The CPU's port addressing and its memory maps are shown in Fig. 13 and Fig. 14.

### 4 - 5 - 2 CPU INPUT CONTROL CIRCUIT

A multi-function custom IC (a 40-pin DIL package CMOS IC) is used. (Refer to Fig. 15)

- An external L and C are connected to Pin 18 and Pin 19 to give about a 100kHz clock signal.
- The ATS of Pin 32 is at a HIGH level if the TUNING CONTROL is rotated at a faster speed than can be set by the values of C6 and R7 connected to TC of Pin 21. The HIGH level is used as a strobe signal which switches the dial-pitch(tuning rate) of the matrix input.
- M1 and M2 at Pin 38 and Pin 37 are used to switch the multiplication factors of the input pulses from the TUNING CONTROL. 200 pulses per one rotation are obtained by 50 pulses  $\times$  4 (quadri-speed mode). For RIT/ $\Delta$ TX CONTROL, the multiplication factor is fixed at double to give 50 pulses  $\times$  2 = 100 pulses per one rotation.

### CUSTOM IC PIN CONNECTION

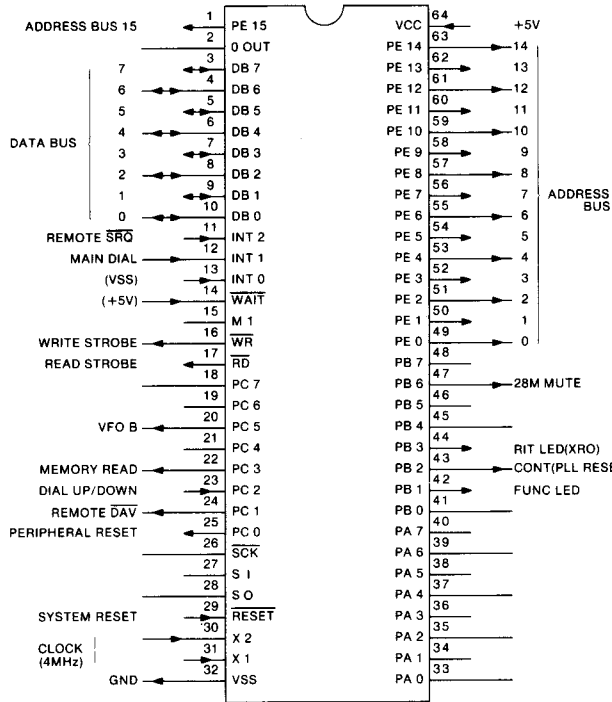


Fig. 13

### CPU MEMORY MAP

|         |                                    |
|---------|------------------------------------|
| 0 0 0 0 | CPU INTERNAL ROM                   |
| 0 F F F | 8bit x 4096W                       |
| 7 F F F | REMOTE CONTROL                     |
| 8 F F 0 |                                    |
| 1       |                                    |
| 2       | Input                              |
| 3       | Matrix                             |
| 4       |                                    |
| 5       |                                    |
| 6       |                                    |
| 7       |                                    |
| 8       |                                    |
| 8 F F 9 |                                    |
| 9 F F D | Display Data Out( $\mu$ PD549c x2) |
| B F F 9 | BPF(High)                          |
| A       | BPF(Mid.)                          |
| B       | BPF(Low)                           |
| C       | MODE(High)                         |
| D       | MODE(Low)                          |
| E       | ALL F                              |
| B F F F | MS. PS                             |
| C F F E | PLL Data Out(M54929 x2)            |
| F 8 0 0 | EXTERNAL RAM                       |
| F B F F | 4bit x 1024W( $\mu$ PD444C)        |
| F F 8 0 | CPU INTERNAL RAM                   |
| F F F F | 8bit x 128W                        |

Fig. 14

### CPU PIN CONNECTION

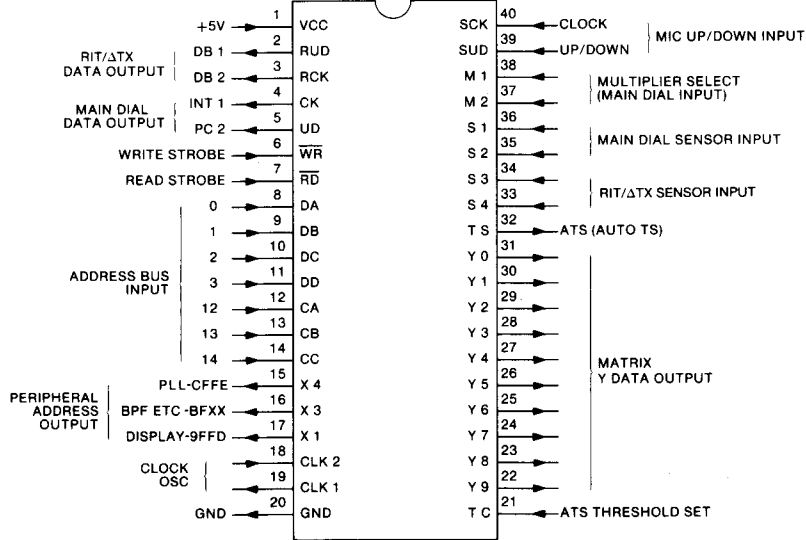


Fig. 15



### 4 - 5 - 5 MATRIX UNIT

The MATRIX UNIT consists of a matrix board, matrix switch board, and mode switch board. It processes the front panel matrix input and transmit and receive data.

#### MATRIX TABLE

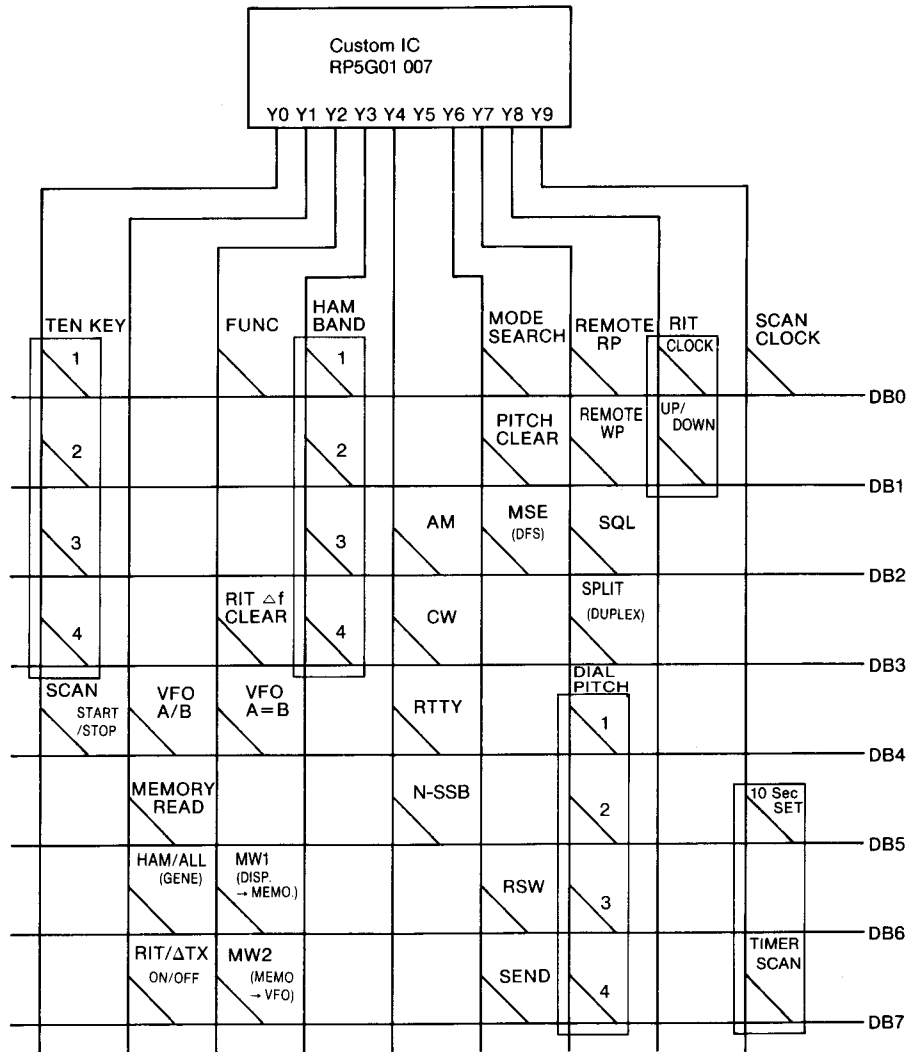


Fig. 18

#### (1) Y0→DB0-DB3 (TEN KEY)

Following is a matrix for frequency settings and band changing through the use of an external RC-10 ten key unit (optional).

| Y0-<br>KEY | D<br>B<br>0 | D<br>B<br>1 | D<br>B<br>2 | D<br>B<br>3 | BAND | HEX<br>CODE |
|------------|-------------|-------------|-------------|-------------|------|-------------|
| 1          | 1           | 0           | 0           | 0           | 1.9  | 1           |
| 2          | 0           | 1           | 0           | 0           | 3.5  | 2           |
| 3          | 1           | 1           | 0           | 0           | 7    | 3           |
| 4          | 0           | 0           | 1           | 0           | 10   | 4           |
| 5          | 1           | 0           | 1           | 0           | 14   | 5           |
| 6          | 0           | 1           | 1           | 0           | 18   | 6           |
| 7          | 1           | 1           | 1           | 0           | 21   | 7           |
| 8          | 0           | 0           | 0           | 1           | 24   | 8           |
| 9          | 1           | 0           | 0           | 1           | 28   | 9           |
| 0          | 0           | 1           | 0           | 1           | —    | A           |
| CE         | 1           | 1           | 0           | 1           | —    | B           |
| ENT        | 0           | 0           | 1           | 1           | —    | C           |

#### (2) Y0→DB4 (SCAN START/STOP)

This matrix starts and stops the scan. It is controlled by the [SCAN] SWITCH and also by the [SQUELCH] CONTROL and the DIAL LOCK SWITCH through IC2(b) and Q3. When the [SCAN] SWITCH is pushed, one pulse signal is input to this matrix to repeatedly start and stop the scan operation.

Three types of scanning operations (MEMORY SCAN, PROGRAMMED SCAN, and SELECTED MODE SCAN) are available. During VFO operation, PROGRAMMED SCAN is automatically selected; during the memory channel operation, MEMORY SCAN is selected. R14 on the LOGIC UNIT adjusts the scanning speed. S10 reactivates the scan if it is interrupted when the squelch is open.

#### (3) Y1→DB4 (VFO A/B)

This matrix selects VFO A or VFO B via the [VFO] SWITCH. When VFO B is selected, pin 20 of the CPU becomes HIGH. Operation mode, frequency, and ham/general selections are stored independently in each mode.



**(4) Y1 – DB5 (MEMORY READ)**

This matrix selects a VFO mode or memory channel mode when it is switched by the [VFO/M] SWITCH. Pin 22 of the CPU is HIGH when the memory channel mode is selected. There are 32 memory channels available for storage of mode, frequency, and ham/general data.

**(5) Y1 – DB6 (HAM/GENERAL)**

This matrix selects the ham band mode or general coverage mode via the [HAM/GENE] SWITCH.

**(6) Y1 – DB7 (RIT ON/OFF)**

This matrix turns ON and OFF the receive circuit via the [RIT/ΔTX] SWITCH. The binary counter IC1(b), IC1(a) outputs receive signals from pins 13 and 1 respectively when the [RIT/ΔTX] SWITCH is turned ON.

Output signals pass through the OR gate of R13 and D15 and are fed to a one-shot circuit consisting of IC4(b), R14, and C5. This circuit outputs a pulse signal to Q8 which turns ON the RIT matrix (Y1–DB7). The XRO output from pin 44 then becomes HIGH and turns on the receive circuit. When no receive input signal is applied, XRO outputs no signal to turn ON the reset circuit (which consists of IC3(c), IC4(c), D14, R3, and C1). Thus the receive circuit is turned OFF by IC1(b), IC1(a).

Digital transistors Q4 and Q5 turn ON and OFF the receive and transmit indicators on the DISPLAY UNIT. When both pin 1 (ΔTX) and pin 13 (RIT) of IC1 are OFF and the RIT setting of the CPU is ON, the matrix reset circuit (consisting of IC3(c), IC3(d), IC5(c), IC3(a) and IC3(b)) drives IC4(b) which switches the CPU RIT matrix ON and OFF, matching the condition of the CPU and the front panel display. The RIT matrix is turned ON and OFF by the multi-vibrator of IC3(a) and IC3(b).

**RIT/ΔTX CIRCUIT**

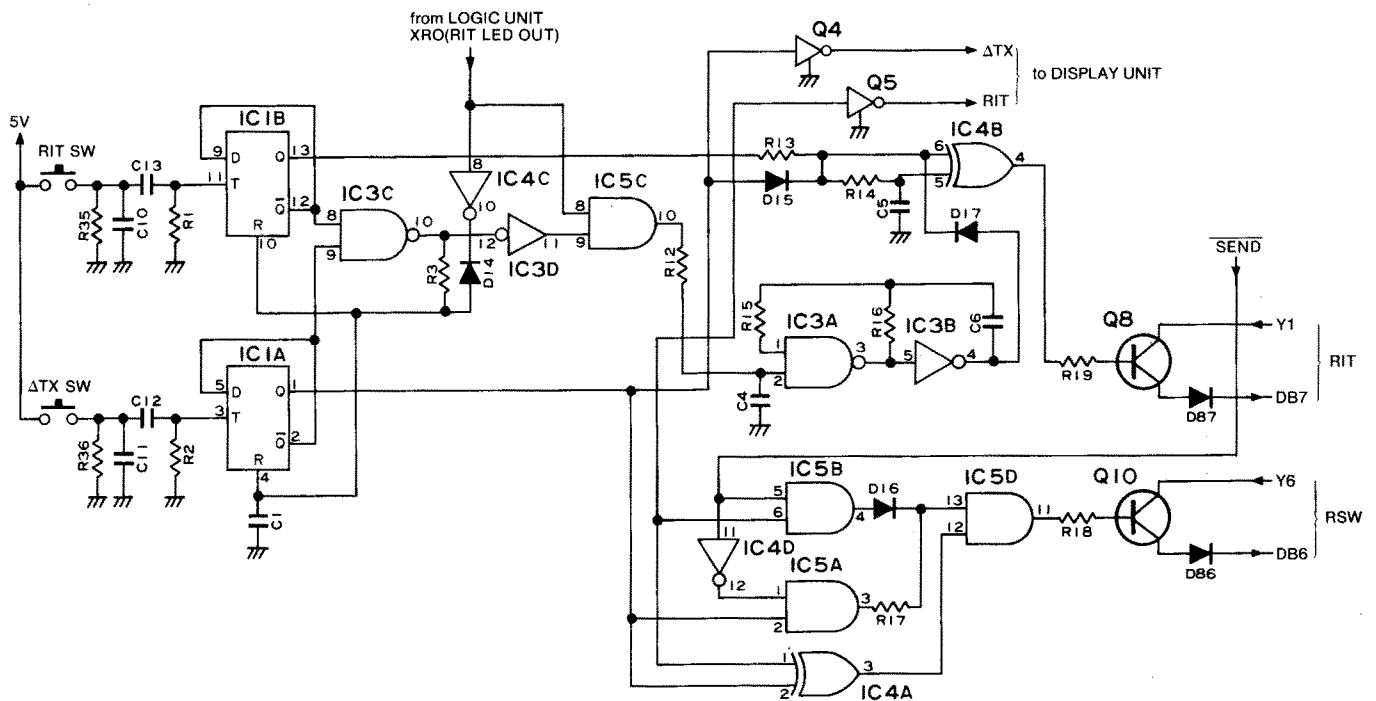


Fig. 19

**(7) Y2 – DB0 (FUNCTION)**

This matrix selects a function by combining switches as shown in the following table.

| COMBINATIONS   | FUNCTION  |
|----------------|---|
| FUNC + A M     | Selects FM mode.  |
| FUNC + C W     | Selects CW-NARROW mode.                                 |
| FUNC + RTTY    | Selects RTTY-NARROW mode.                               |
| FUNC + SSB     | Selects reverse side band. (LSB or USB).                |
| FUNC + A = B   | Selects VFO transfer direction. (A → B or B → A)        |
| FUNC + CLEAR   | Adds RIT/ΔTX Δf to display frequency.                   |
| FUNC + WRITE   | Clears (blanks) the displayed memory channel frequency. |
| FUNC + M ▶ VFO |   |

**(8) Y2 – DB3 (RIT/ΔTX CLEAR)**

This matrix clears the receive/transmit shift frequency. When combined with the [FUNCTION] SWITCH, the shift frequency is added to or subtracted from the displayed frequency.

**(9) Y2 – DB4(VFO A = B)**

This matrix transfers the frequency of VFO A to VFO B. When combined with the [FUNCTION] SWITCH the original VFO is reversed. See table on p. 4-17.

| SWITCH CONDITION | A = B         |
|------------------|---------------|
| VFO A is in use. | VFO A → VFO B |
| VFO B is in use. | VFO B → VFO A |

**(10) Y2 → DB6-DB7**

**(DISPLAY → MEMORY/MEMORY → VFO)**

This matrix is for memory write and the memory data transfer by the [WRITE] and [M▶VFO] SWITCHES. When combined with the [FUNCTION] SWITCH the data in the displayed memory channel is cleared and the channel is blanked.

| SWITCH CONDITION              | PUSH    | FUNCTION  |
|-------------------------------|---------|---|
| VFO A or VFO B is in use      | WRITE   | Transfers the VFO frequency to the selected memory channel.       |
|                               | M ▶ VFO | Transfers the selected memory channel frequency to the VFO.       |
| MEMORY CHANNEL MODE is in use | WRITE   | Transfers the displayed frequency to the selected memory channel. |
|                               | M ▶ VFO | Transfers the displayed frequency to the VFO previously used.     |

**(11) Y3 → DB0-DB3 (HAM BAND)**

This matrix switches the TUNING CONTROL to a band selected by the [BAND] SWITCH. When the [HAM/GENE] SWITCH is at the [GENE] position the frequency is changed in 1MHz increments.

This matrix selects the operation mode when combined with a mode switch or the [FUNCTION] SWITCH. The display frequency is shifted depending on the selected operation mode as shown in the table below.

| BAND (MHz) | INITIALIZED FREQUENCY | DB0 | DB1 | DB2 | DB3 |
|------------|-----------------------|-----|-----|-----|-----|
| 1.9        | 1,900.0               | 1   | 0   | 0   | 0   |
| 3.5        | 3,550.0               | 0   | 1   | 0   | 0   |
| 7          | 7,050.0               | 1   | 1   | 0   | 0   |
| 10         | 10,050.0              | 0   | 0   | 1   | 0   |
| 14         | 14,050.0              | 1   | 0   | 1   | 0   |
| 18         | 18,050.0              | 0   | 1   | 1   | 0   |
| 21         | 21,050.0              | 1   | 1   | 1   | 0   |
| 24         | 24,550.0              | 0   | 0   | 0   | 1   |
| 28         | 28,050.0              | 1   | 0   | 0   | 1   |

**(12) Y4 → DB2 (AM)**

**(13) Y4 → DB3 (CW)**

**(14) Y4 → DB4 (RTTY)**

**(15) Y4 → DB5 (SSB)**

**FREQUENCY DIFFERENCES IN VARIOUS MODES**

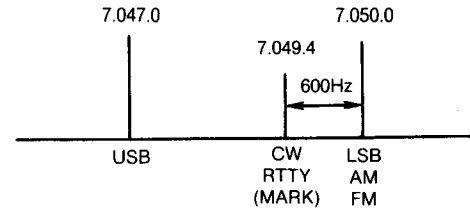


Fig. 20

**(16) Y6 → DB0 (MODE SEARCH)**

This matrix is for the SELECTED MODE SCAN and is activated by the [MODE-S] SWITCH. Only the memory channels with the desired operation mode are selected in this scan.

**(17) Y6 → DB1 (PITCH CLEAR)**

This matrix sets the frequency increment to 1kHz in all modes by the [TS] (Tuning Step) SWITCH. When the [TS] SWITCH is ON, the matrix at Y7→DB4 is also turned ON.

**(18) Y6 → DB2 (DFS)**

This matrix is for dial function selection as set by the [DFS] SWITCH. Refer to the following table.

| DFS SWITCH CONDITION     | OFF   | ON                                      |
|--------------------------|---|---|
| VFO A or VFO B is in use | Changes displayed frequency                           | Changes displayed memory channel number |
| MEMORY CHANNEL MODE      | Selects a memory channel (its frequency is displayed) | Changes displayed frequency             |

**(19) Y6 → DB6 (RSW)**

This matrix resets RIT data or outputs N-data. IC4(a), IC4(b), IC5(a), IC5(b), IC5(d), R17 and D16 are for the RSW input circuit.

| RIT SW | ΔTX SW | T/R | RSW MATRIX | REMARKS  |
|--------|--------|-----|------------|--|
| OFF    | OFF    | RX  | OFF        | <ul style="list-style-type: none"> <li>When RSW MATRIX is OFF, the operating frequency becomes the displayed frequency plus RIT/ΔTX Δf frequency.</li> <li>When RSW MATRIX is ON, the operating frequency is the displayed frequency.</li> </ul> |
|        |        | TX  | OFF        |  |
| ON     | OFF    | RX  | OFF        |  |
|        |        | TX  | ON         |  |
| OFF    | ON     | RX  | ON         |  |
|        |        | TX  | OFF        |  |
| ON     | ON     | RX  | OFF        |  |
|        |        | TX  | OFF        |  |

**(20) Y6 → DB7 (SEND)**

This matrix is for transmit mode recognition for stopping scanning operations.

**(21) Y7 → DB0 (REMOTE RP)**

This matrix is for remote-control read pulses.

**(22) Y7 → DB1(REMOTE WP)**

This matrix is for remote-control write pulses.

**(23) Y7 → DB2 (SQL)**

This matrix inputs one pulse when the squelch is closed, and controls scanning operations.

**(24) Y7 → DB3 (SPLIT/DUPLEX)**

This matrix is for split or duplex operation using the VFO A or VFO B SWITCH and the [SPLIT] SWITCH.

**(25) Y7 → DB4-DB7 (DIAL PITCH 1-4)**

This matrix sets the frequency step tuning rate. The frequency step and the increments per rotation of the TUNING CONTROL in each setting are as follows:

| TS  | VFO   | MEMORY MODE    | BAND WIDTH                |
|-----|---|----------------|---------------------------|
| OFF | 10Hz steps<br>(2kHz/1 rotation)<br>By faster rotation<br>50Hz steps<br>(10kHz/1 rotation) | 8CH/1 rotation | HAM:<br>8 BAND/1 rotation |
| ON  | 1kHz steps<br>(200kHz/1 rotation)<br>100Hz and lower digits<br>will be cleared as "0".    |                | GENE:<br>8MHz/1 rotation  |

| Y7 → DATA |     |     |     | STEPS and BAND |
|-----------|-----|-----|-----|----------------|
| DB4       | DB5 | DB6 | DB7 |                |
| 0         | 0   | 0   | 0   | 10Hz           |
| 0         | 1   | 1   | 1   | 50Hz           |
| 1         | 0   | 0   | 0   | 1kHz           |
| 1         | 0   | 1   | 1   | BAND           |

**(26) Y8 → DB0-DB1 (RIT: CLOCK, UP/DOWN)**

This is a data matrix for RIT which is processed by IC2 on the LOGIC UNIT.

**(27) Y9 → DB0 (SCAN CLOCK)**

This matrix is for the scan control clock formed by the circuit of Q4, IC7(b), and R14 on the LOGIC UNIT.

**(28) Y9 → DB5 and DB7 (10 sec. SET/TIMER SCAN)**

This matrix is for setting a 10-second timer which allows the transceiver to resume scanning after stopping. The matrix Y9→DB7 is ON while the timer scan is operating.

**4 - 6 DISPLAY UNIT**

This unit consists of the display tube and its drivers, and a DC-DC converter section.

**DISPLAY UNIT CIRCUIT**

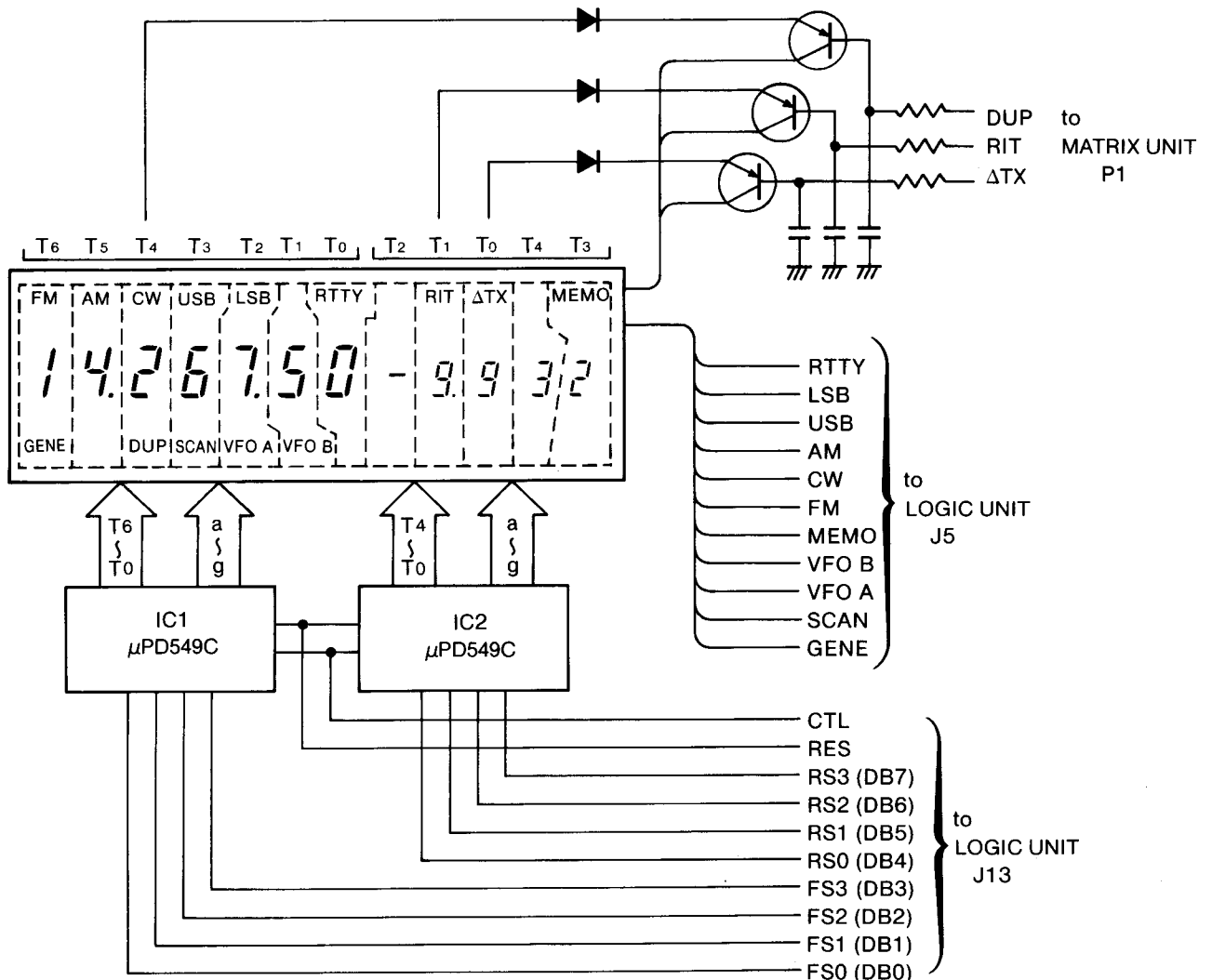


Fig. 21

The display illuminates centralized information of frequency, mode, transmit and receive conditions, memory channel, operating mode (VFO A, VFO B, GENE, DUP, SCAN), etc. The operating conditions of the transceiver can be easily understood because of this centralized display. The display lights up in two colors, red and white, using color filters. LEDs for the transmit and receive indicators and the narrow selection in CW and RTTY modes are also a part of this unit.

**(a) DISPLAY SECTION**

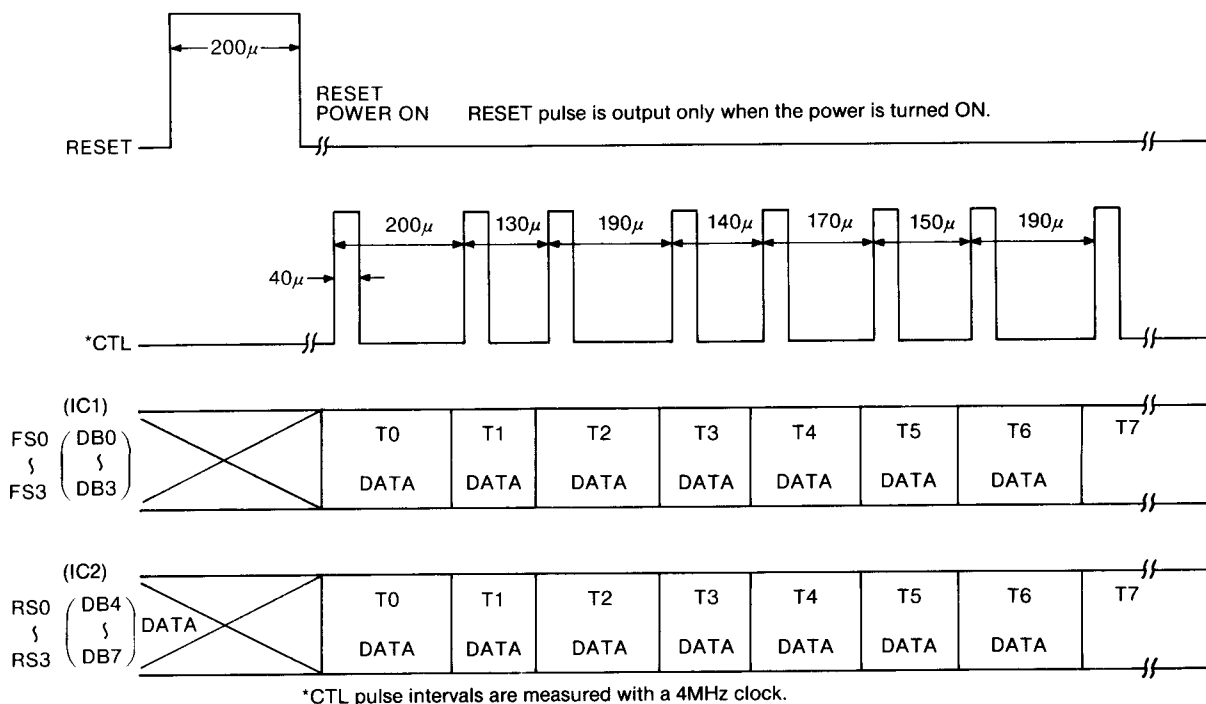
DS1, the luminescent display tube, is driven by drivers IC1 and IC2, and lights dynamically. These ICs contain such functions as input data latch, clock oscillator, timing

counters, and segment decoders. The clock frequency is set by C2 and C6.

Displays for the receive and transmit shift frequencies and memory channels are driven by IC2. Other displays are driven by IC1.

Signals for the display of RTTY through GENE are sent from the LOGIC UNIT to each segment. These are switched by digit signals T0~T6 from IC1 and T3 from IC2. The transmit, receive, "—", and "DUP" INDICATORS are connected to the same digit in the tube, so each indicator is selected by T4, T1, and T0 digit signals and light up dynamically.

**DISPLAY DATA TIMING CHART**



**Fig. 22**

**(b) DC-DC CONVERTER SECTION**

The +5V voltage source is produced from 13.8V, a voltage regulator.

The DC-DC converter is composed of Q4, Q5, and T1, and generates rectangular pulses of about 15kHz. The pulses are applied to T1 to obtain -5V, -35V, 3.5V AC from the corresponding coils.

Except for 3.5V AC which is provided for the filament of the display tube, all the voltages are rectified for DC voltages. As for -5V, the rectified DC-DC converter output is regulated by IC4 and is supplied to IC1, IC2, and the MAIN UNIT.

Q6~Q8 comprise a circuit which keeps the display OFF for about 2 seconds before the initial reset is completed when the power is turned ON. Immediately after the power is turned ON, Q6 through Q8 are OFF and -35V is not output. When data (CTL) is supplied from the LOGIC UNIT as resetting is completed, Q8 is turned ON, and then Q6 and Q7 are turned ON for -35V output for the display.

Q6, Q7, D19, and R41 form a latch circuit, ensuring that once the circuit is turned ON it will keep providing -35V. R42, C21 and C22 are installed to prevent circuit errors.

**4 - 7 OTHER CIRCUITS**

**4 - 7 - 1 ENC 1 AND ENC 2 UNITS**

Pulse signals (SV) from the rotary encoder are fed into transistors QA and QB.

When the T1 SV signal is "LOW", QA and QB are turned OFF and output from QB is "HIGH". When the T2 SV signal is "HIGH" QA and QB are turned ON and output from QB is "LOW".

#### 4 - 7 - 2 RELAY UNIT

The RELAY UNIT is located on the LOGIC UNIT and stops relays on the FILTER UNIT while memory scan is operating. The scan signal appears from pin 29 on IC14 when memory scan is selected. This scan signal turns Q17, Q18 and Q19 OFF. The relays on the FILTER UNIT are controlled by IC15. When Q19 is turned OFF, all the transmit relays are turned OFF and are silent.

#### 4 - 7 - 3 KEYSER UNIT

The KEYSER UNIT employs an electronic keyer circuit and a cooling fan control circuit.

##### (a) DOT, DASH INPUTS AND ELECTRONIC KEYSER OUTPUT

When IC1 receives a dot signal at pin 1, IC1 outputs a DOT and SPACE (ratio is 1:1). If IC1 receives the next dot signal during output of the first DOT and SPACE, IC1 outputs only the first DOT and SPACE.

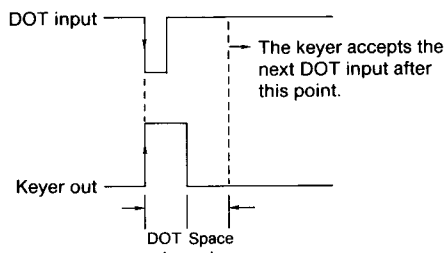


Fig. 23

When IC1 receives a dash signal at pin 2, IC1 outputs a DASH and SPACE (ratio is 1:3). If IC1 receives the next dash signal during output of the first DASH and SPACE, IC1 outputs only the first DASH and SPACE.

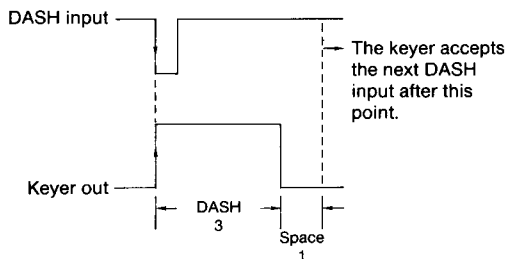


Fig. 24

If IC1 receives a dash signal during a DOT and SPACE output, IC1 outputs a DASH and SPACE after the DOT and DASH output. This is called the DASH MEMORY.

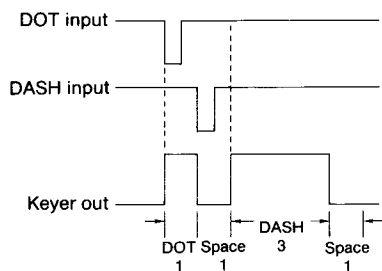


Fig. 25

If IC1 receives a dot signal during a DASH and SPACE output, IC1 outputs a DOT and SPACE after the DASH and SPACE output. This is called the DOT MEMORY.

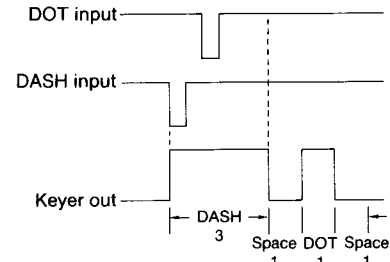


Fig. 26

If IC1 receives the DOT and DASH signal continuously as shown in Fig. 27, IC1 outputs the DOT and DASH alternately. This is called the IAMBIC FUNCTION.

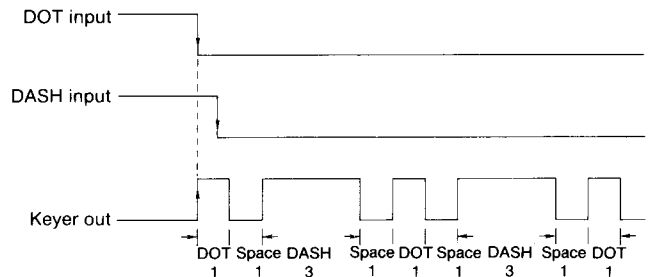


Fig. 27

##### (b) SPD

These terminals determine the speed of the DOT, SPACE and DASH.

##### (c) WEIGHT

These terminals determine the ratio of the DOT, SPACE, AND DASH (DOT: SPACE: DASH).

##### (d) FAN MOTOR CONTROL

Thermal switches S1 and S2 detect the temperature of output from Q4 and Q5 on the PA UNIT and control the cooling fan while decreasing output power.

If the temperature of the transceiver increases in transmit mode, S2 turns ON (at about 50°C) and the cooling fan starts to rotate. The fan continues to rotate even after receive mode is switched to, and will continue until the temperature drops below 50°C. Fan rotation is somewhat slower in receive mode than in transmit mode.

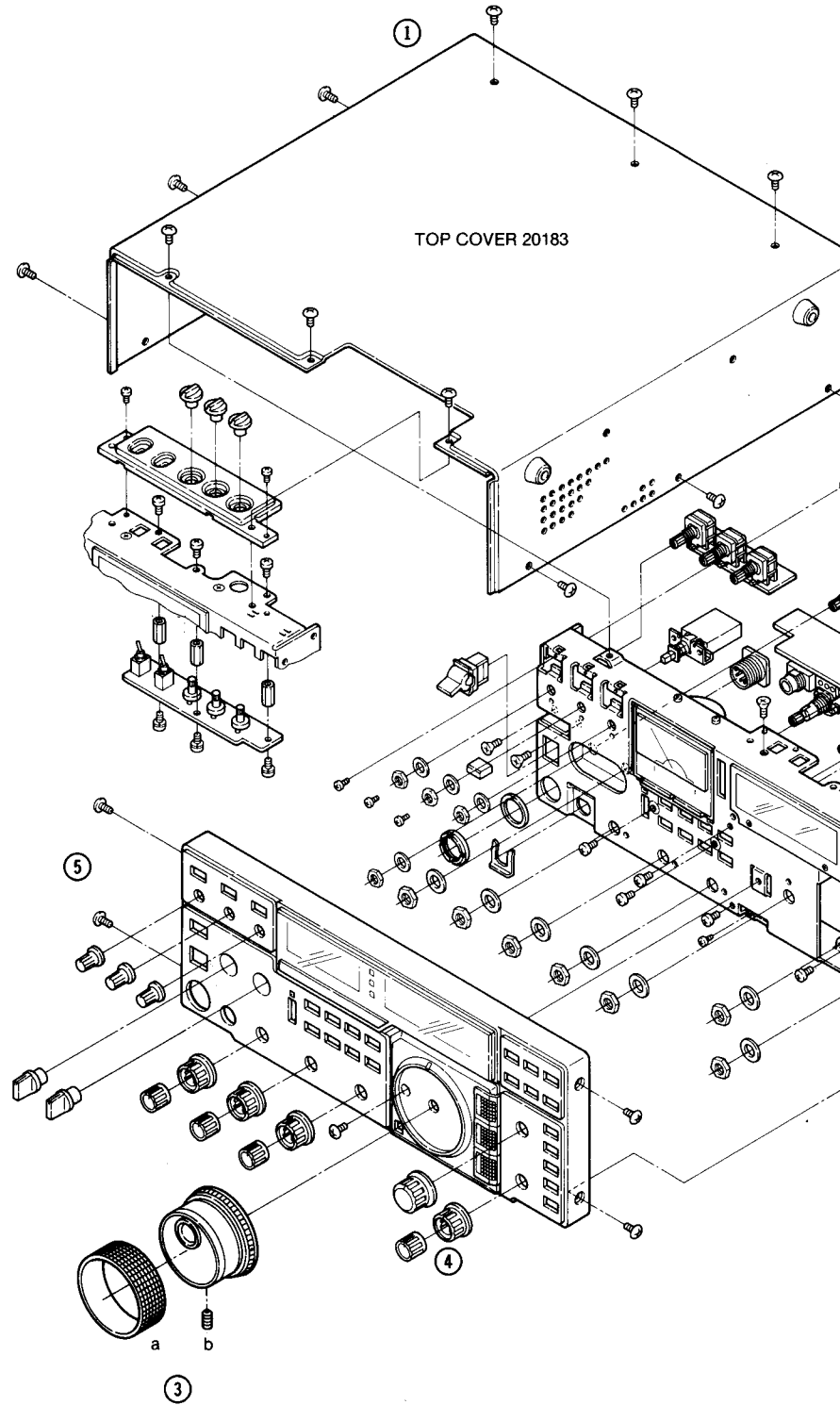
S1 turns ON if the temperature increases to about 90°C or more due to antenna mismatching or other problems. The rotation speed of the fan increases when S1 turns ON.

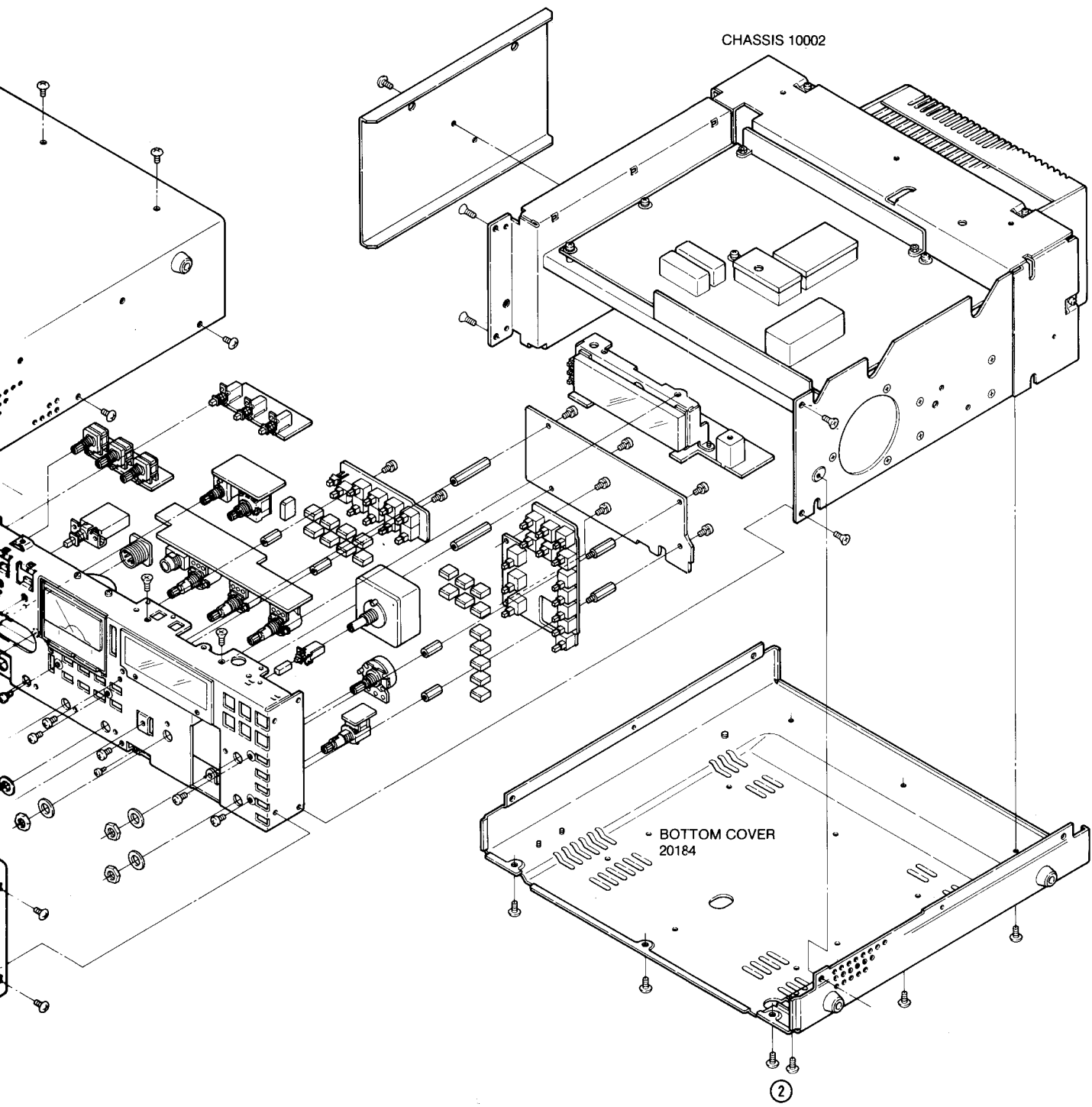
| TEMPERATURE (°C)  |          | ~ 50 | 50 ~ 90   | 90 ~ |
|-------------------|----------|------|-----------|------|
| THERMAL SWITCH    | S1       | OFF  | OFF       | ON   |
|                   | S2       | OFF  | ON        | ON   |
| COOLING FAN SPEED | RECEIVE  | OFF  | SLOW      | MED. |
|                   | TRANSMIT | OFF  | MED. HIGH | HIGH |

## SECTION 5 DISASSEMBLY AND ASSEMBLY DIAGRAMS

### 5 - 1 FRAME DISASSEMBLY

- ① Remove the TOP COVER (12 set screws).
- ② Remove the BOTTOM COVER (6 set screws).
- ③ Remove the rubber grip (a) from the TUNING CONTROL and unscrew (b).
- ④ Remove the FRONT PANEL control knobs by pulling them forward.
- ⑤ Remove the 4 frame-holding screws, and then remove the FRONT PANEL FRAME by pulling it forward.





# 5 - 2 FRONT PANEL (1) DISASSEMBLY

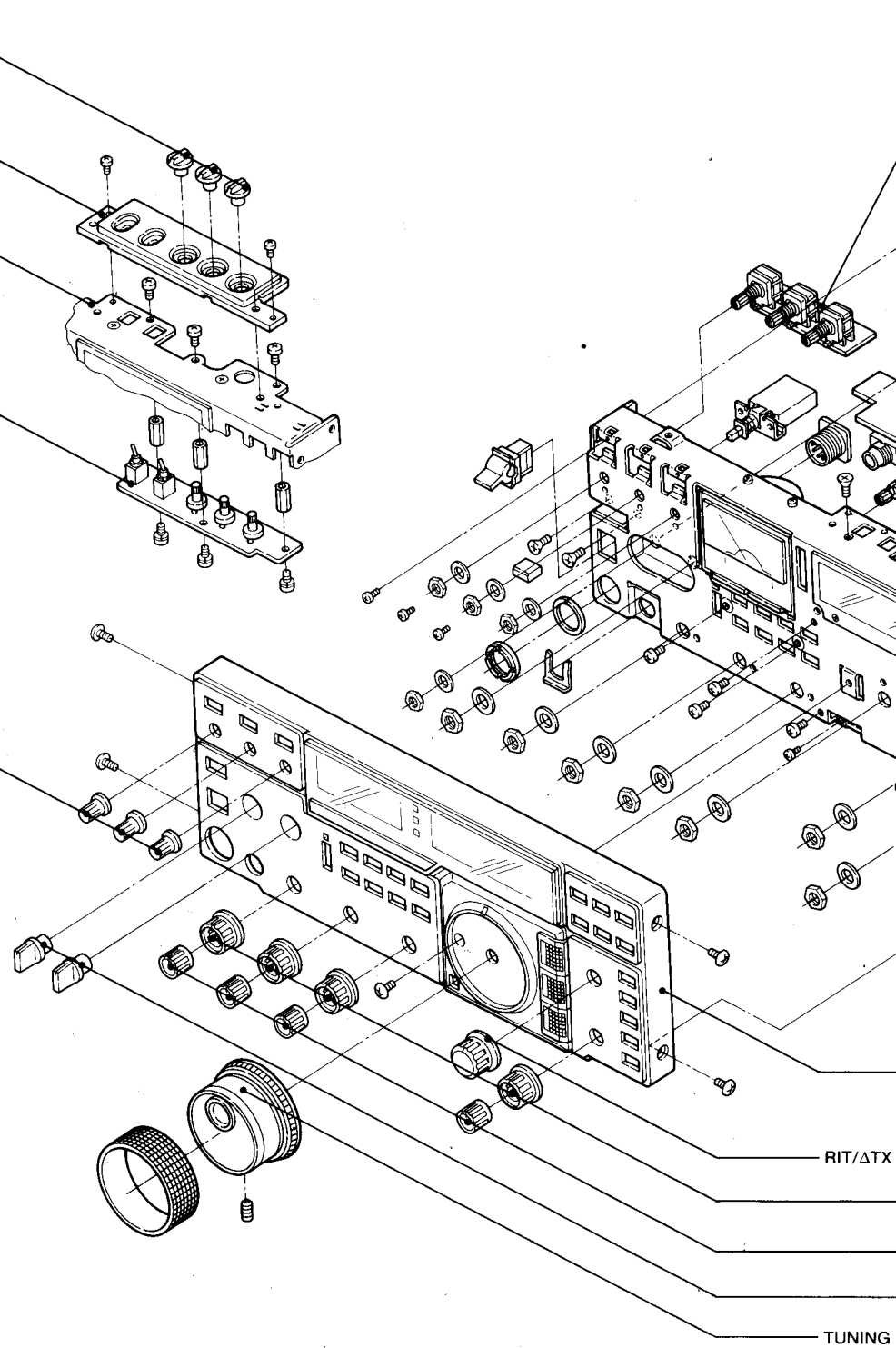
TOP COVER KNOBS N-62 42225

SWITCH PANEL 30304

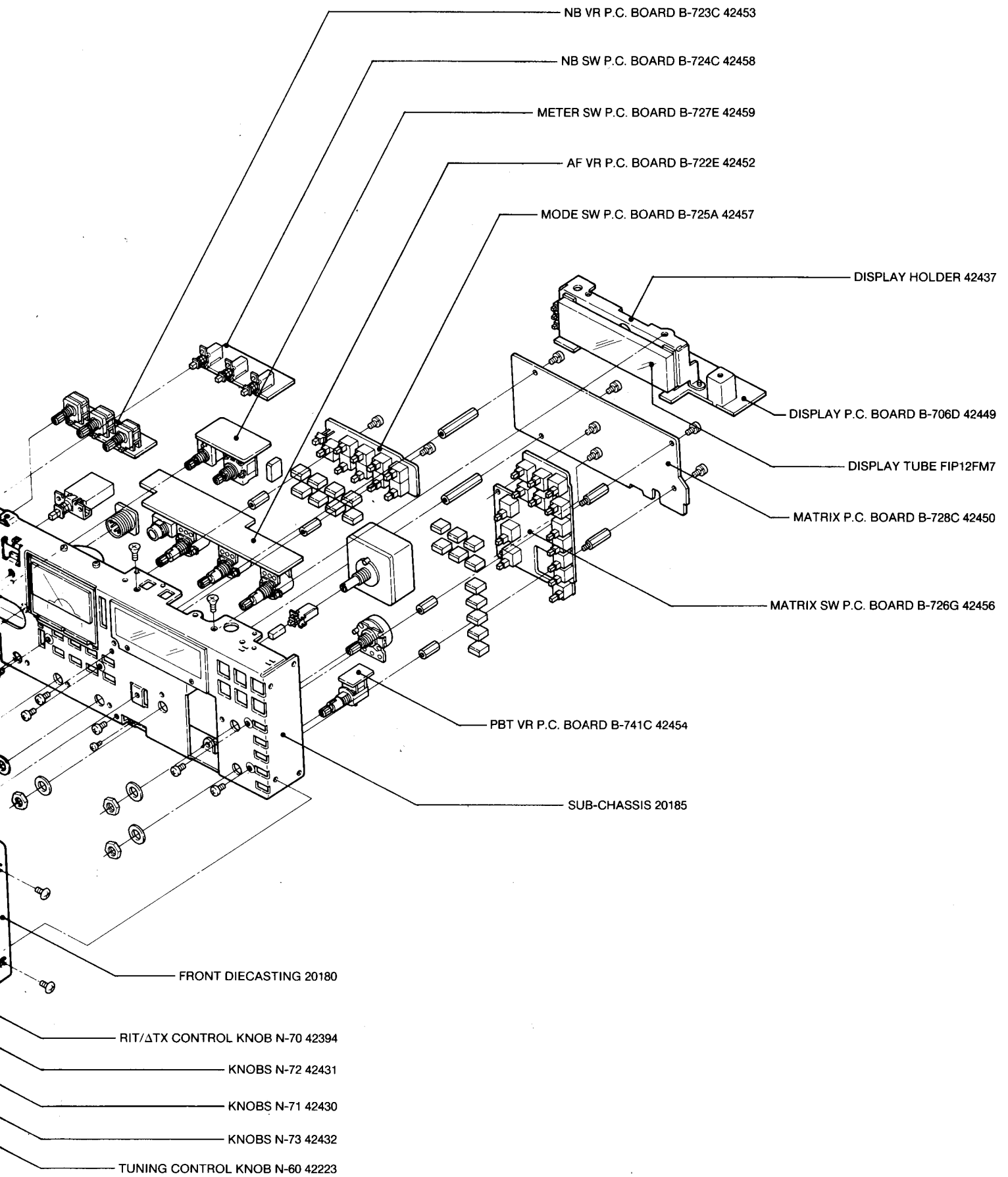
SUB-CHASSIS 20185

MARKER P.C. BOARD B-731E 42450

KNOBS N-74 42433







## 5 - 3 FRONT PANEL (2) DISASSEMBLY

FUNCTION SWITCH SPPH11163A

BUTTONS K-27 (BROWN) 42427

SWITCHES SPPJ31116A

BUTTONS K-27 (SILVER) 42427

BUTTONS K-27 (GRAY) 42427

METER ROTARY SWITCH SRBU16003A

AGC ROTARY SWITCH SRRU13071A

VOX GAIN CONTROL RKBB21004A-10KB-500KC

VOX DELAY CONTROL RKBA11013A-1MB

NB LEVEL CONTROL RKBA11011A-1KB

AF/RF GAIN CONTROL RKDEB0008A-10KBx2

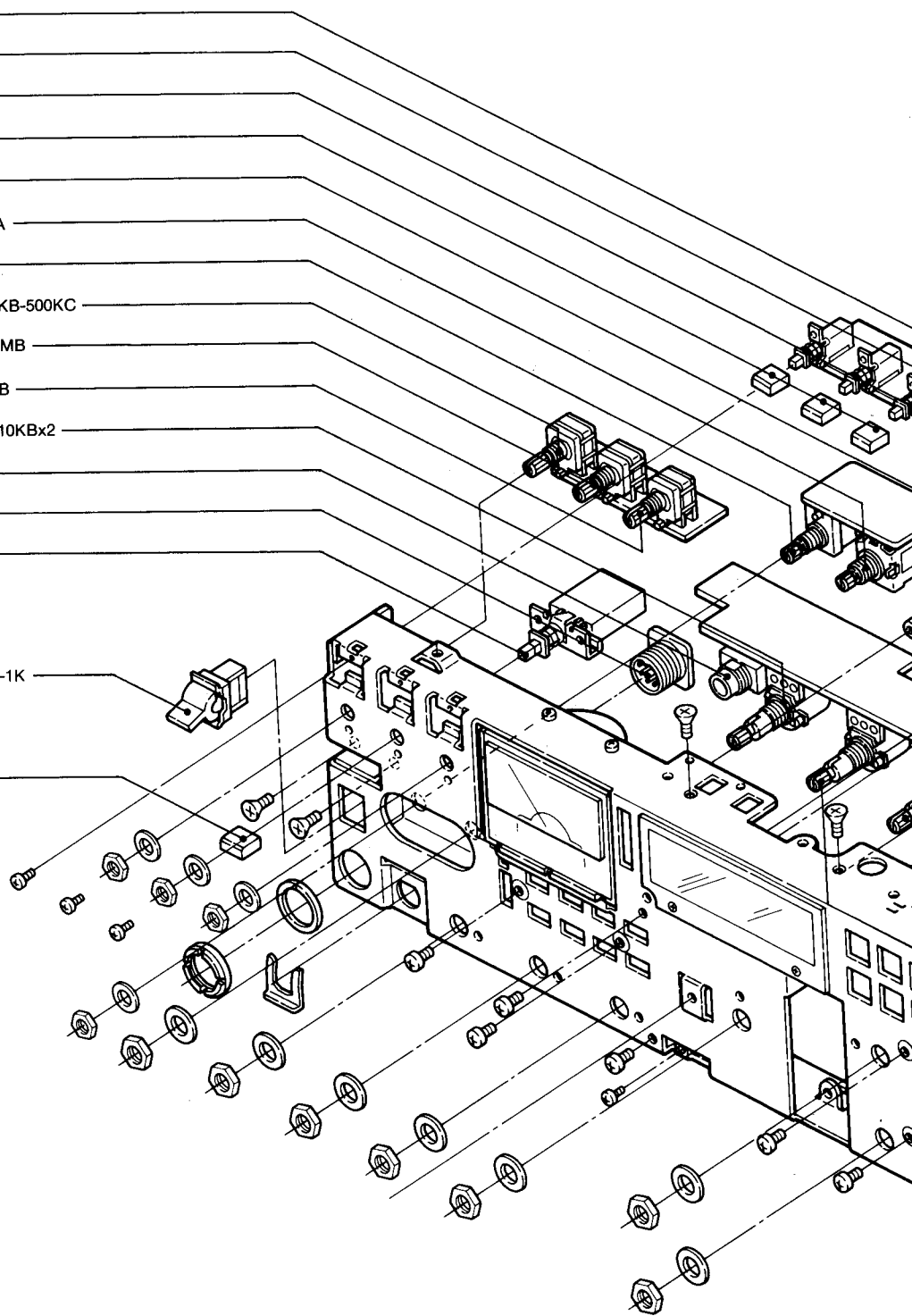
PHONES JACK HLJ4815-01-030

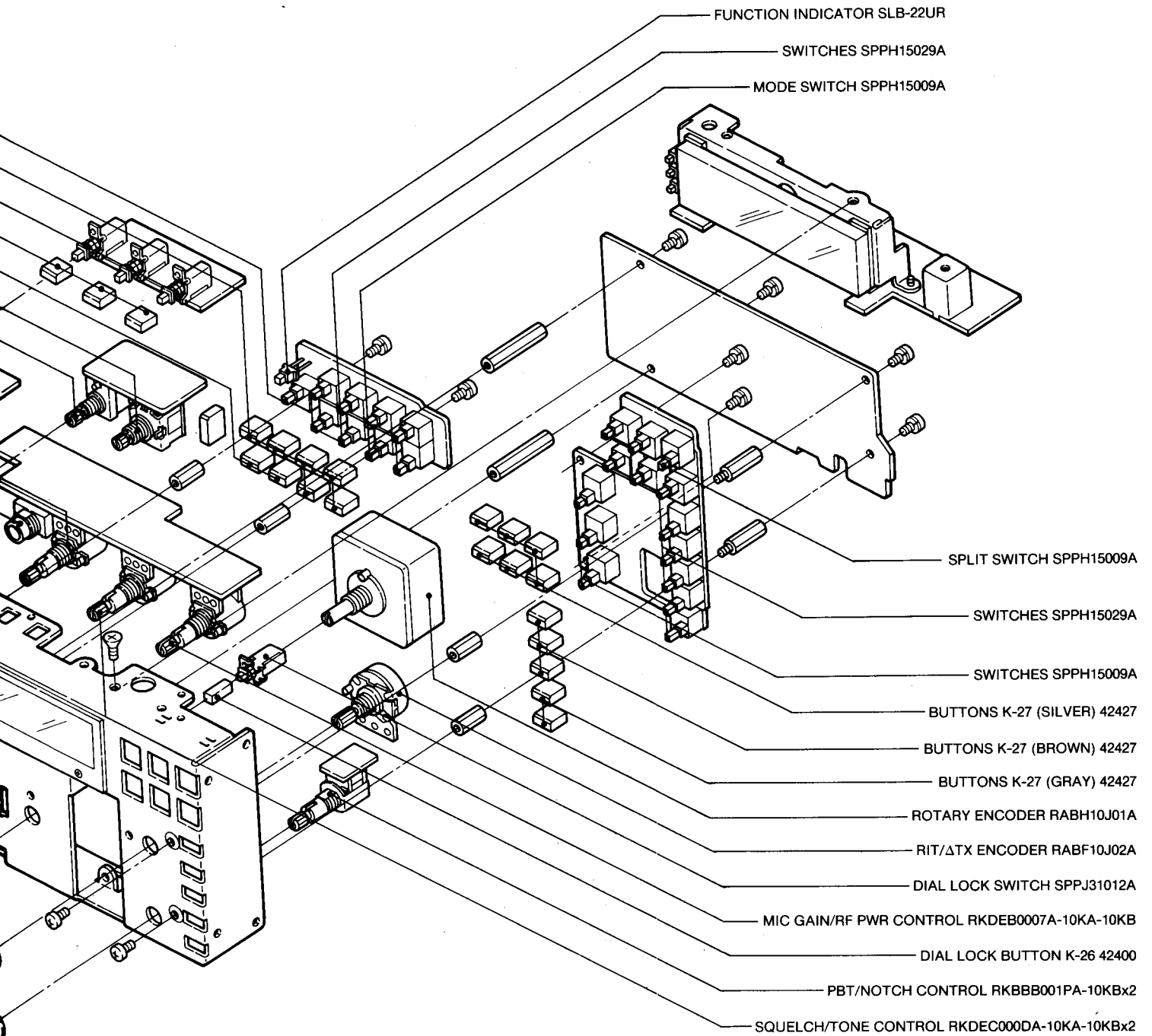
MIC CONNECTOR 8S-S-E

POWER SWITCH TW-0068

TRANSMIT/RECEIVE SWITCH M2012J-1K

POWER BUTTON K-25 42399





5 - 4 FRONT PANEL (3) DISASSEMBLY

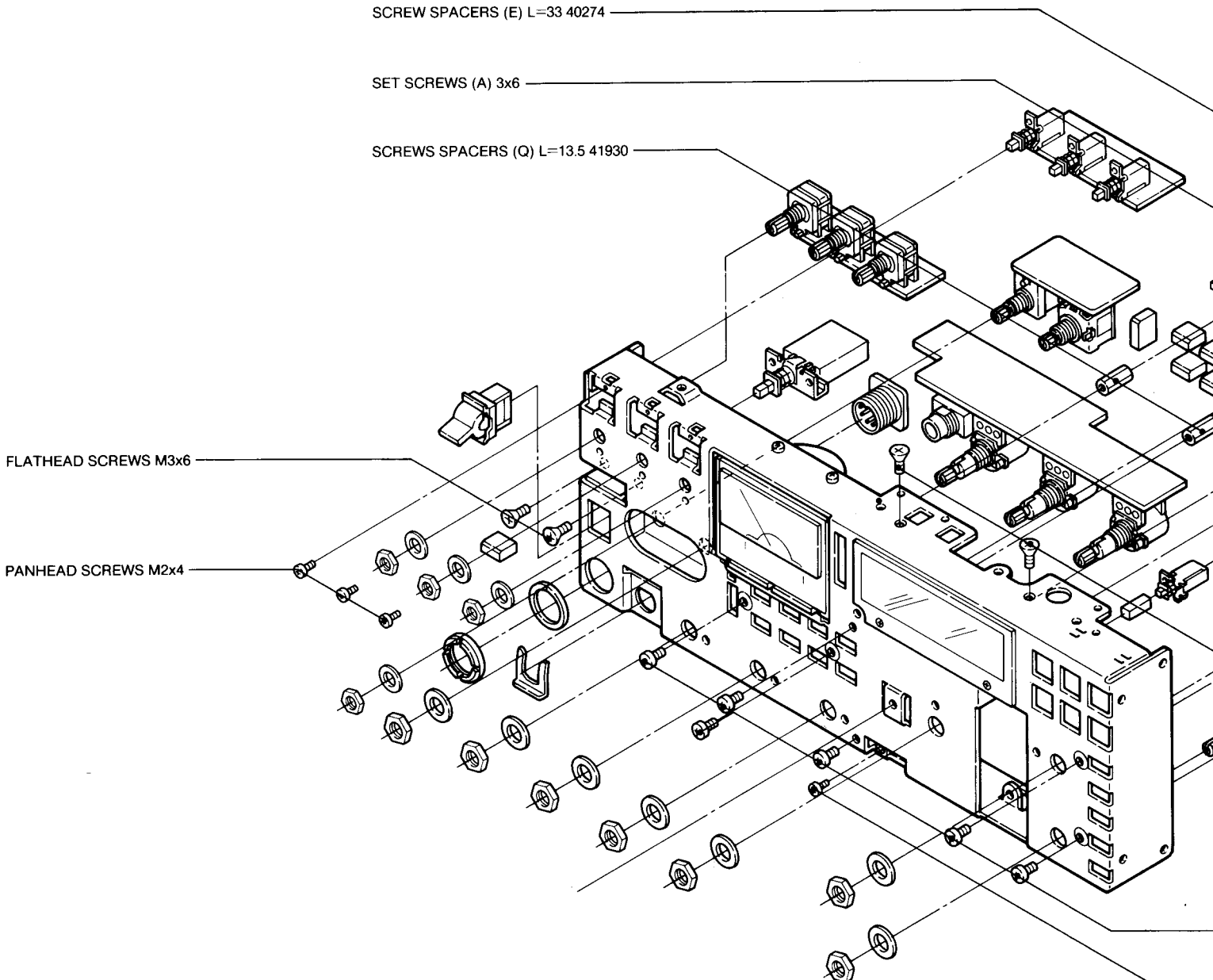
SCREW SPACERS (E) L=33 40274

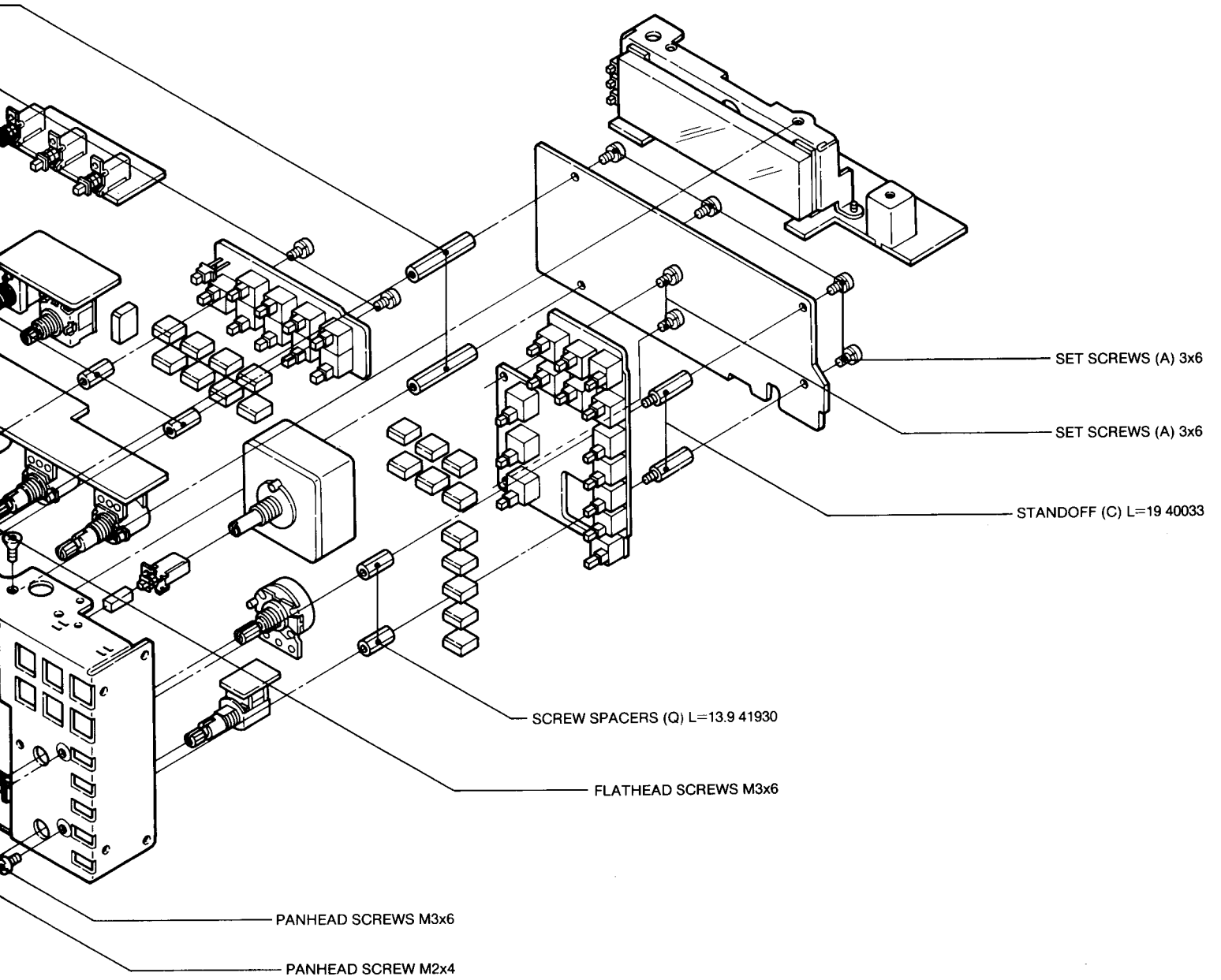
SET SCREWS (A) 3x6

SCREWS SPACERS (Q) L=13.5 41930

FLATHEAD SCREWS M3x6

PANHEAD SCREWS M2x4





# 5 - 5 REAR PANEL DISASSEMBLY

PANHEAD SCREWS (A) M2x2.3 (MOTOR SCREWS)

MOTOR BRACKET 42346

DC MOTOR M6B 12U22

CONNECTOR KC21-0060

PANHEAD SCREW M5x16 Ni

STAR WASHER M5

NUTS M3

GROUND TABS B-5

STAR WASHERS M3

REAR PANEL 30327

ANTENNA CONNECTOR FMMD-RM1

SET SCREWS (A) 3x8

SPRING WASHER M5

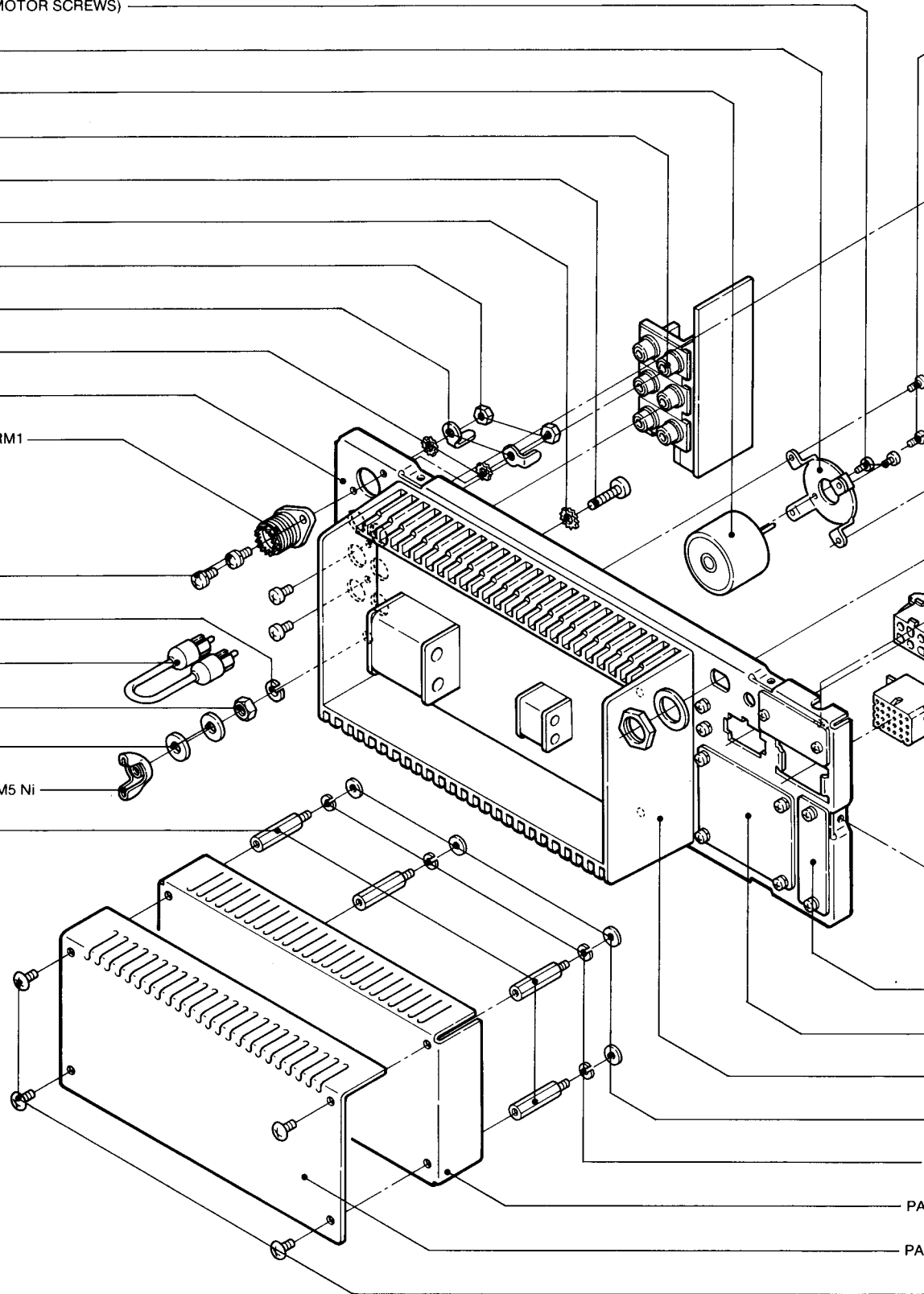
OPC-026

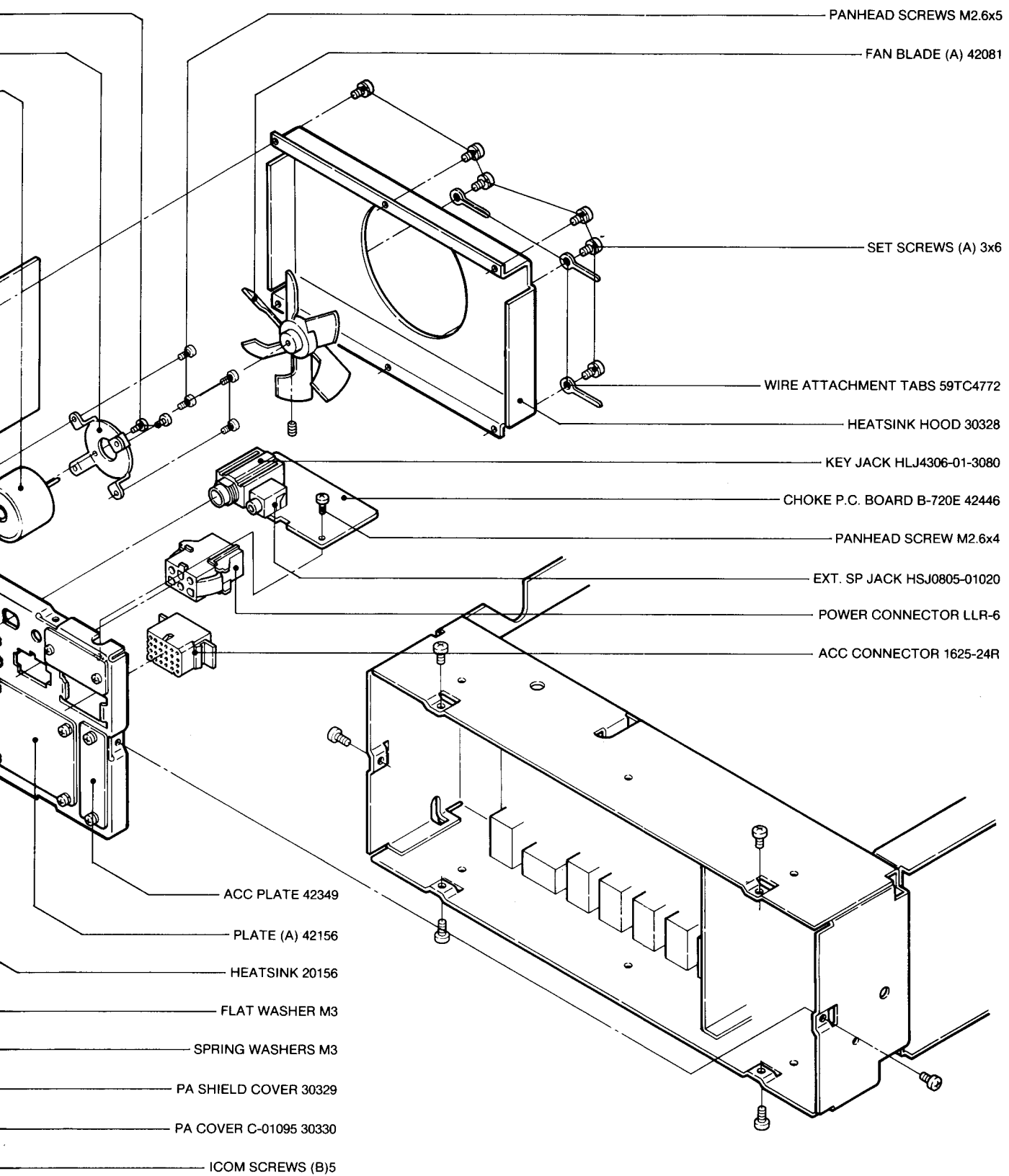
NUT M5 Ni

FLAT WASHERS M5 Ni

GROUND TERMINAL WING NUT M5 Ni

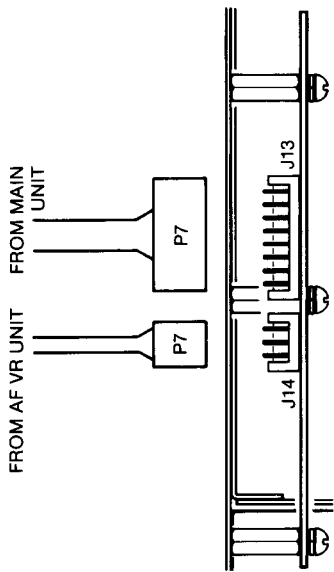
STANDOFF (J) 40033



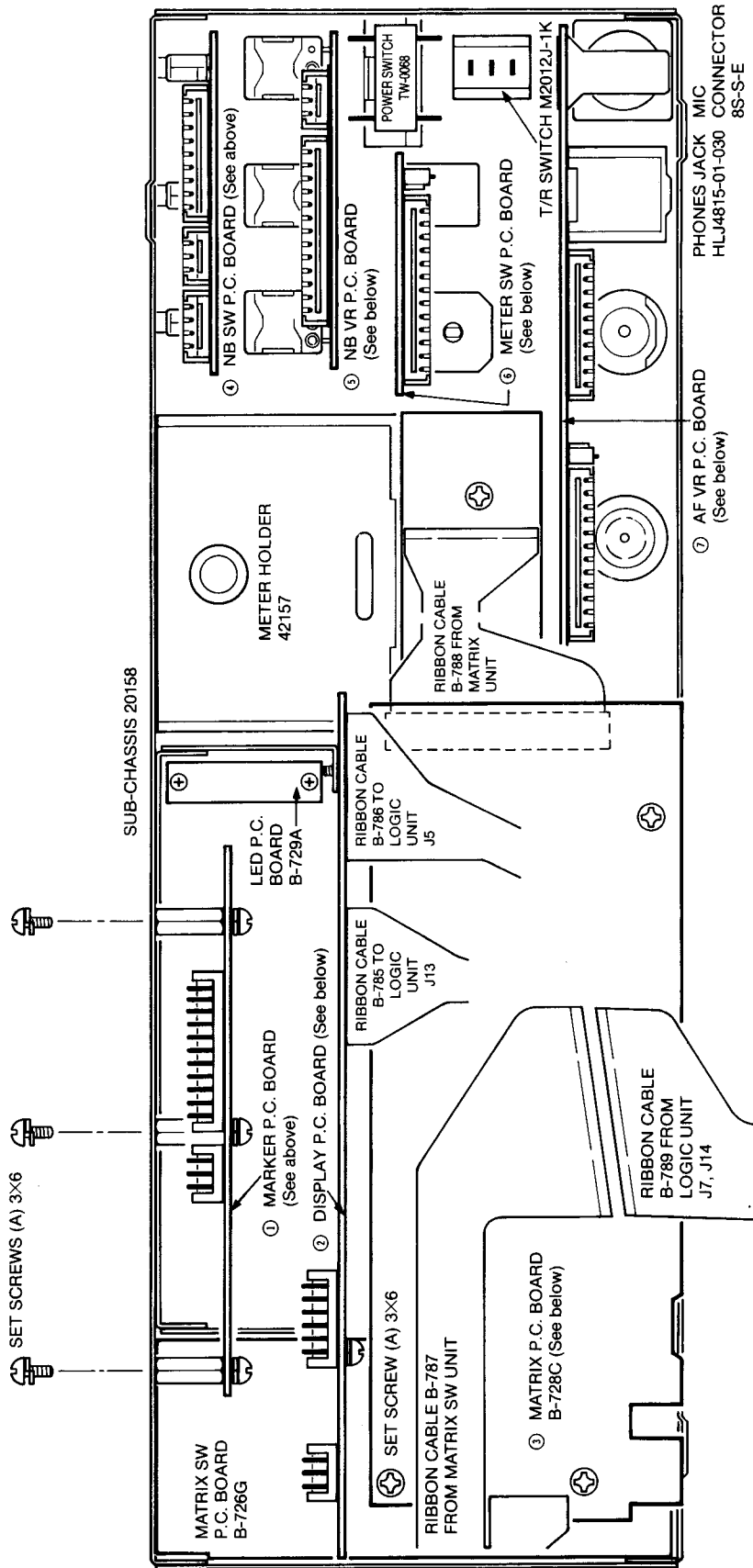
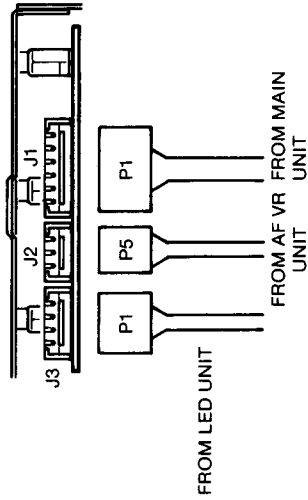


5 - 6 FRONT UNIT CONNECTOR ASSEMBLY

① MARKER P.C. BOARD B-731E



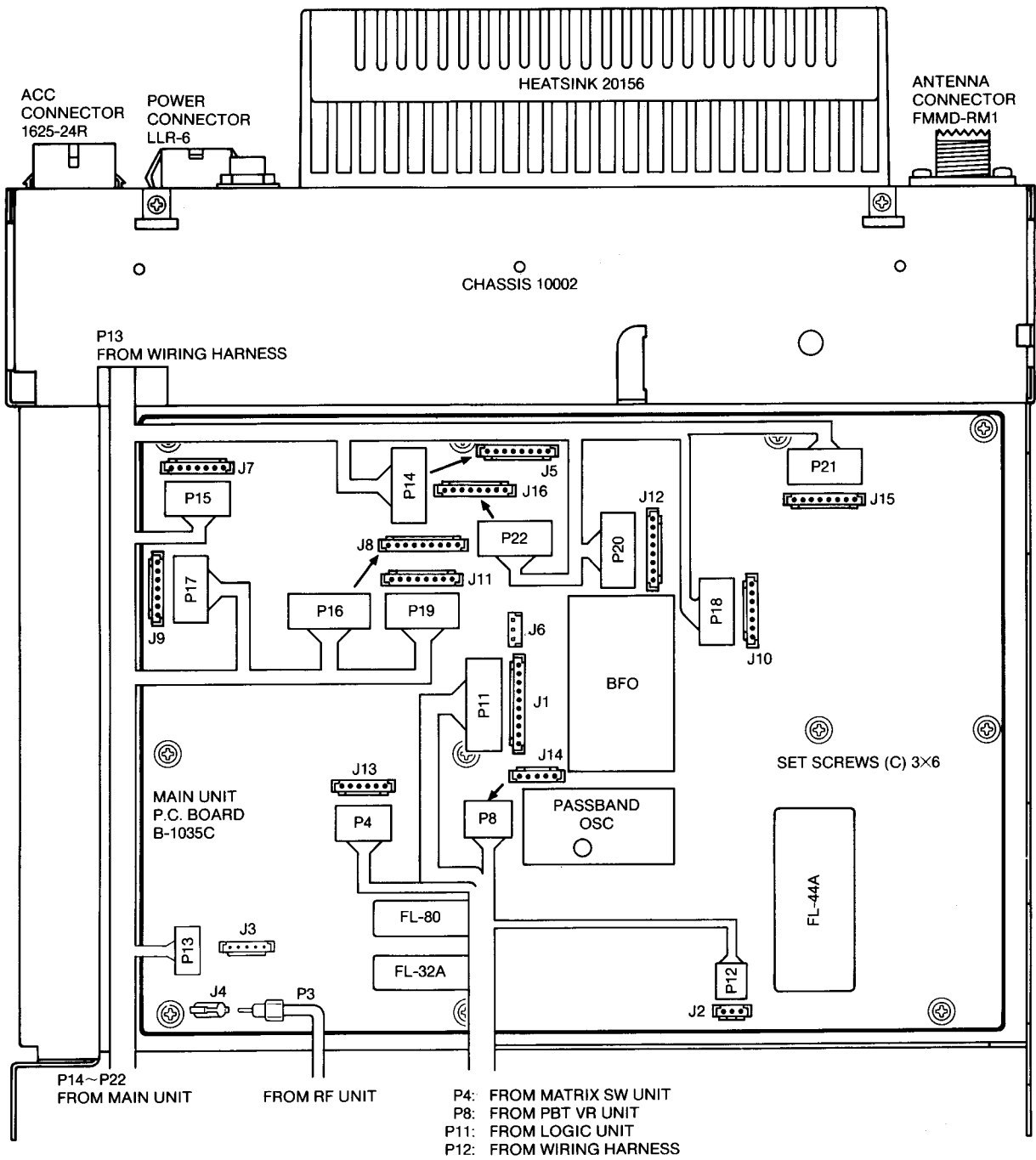
④ NB SW P.C. BOARD B-724C



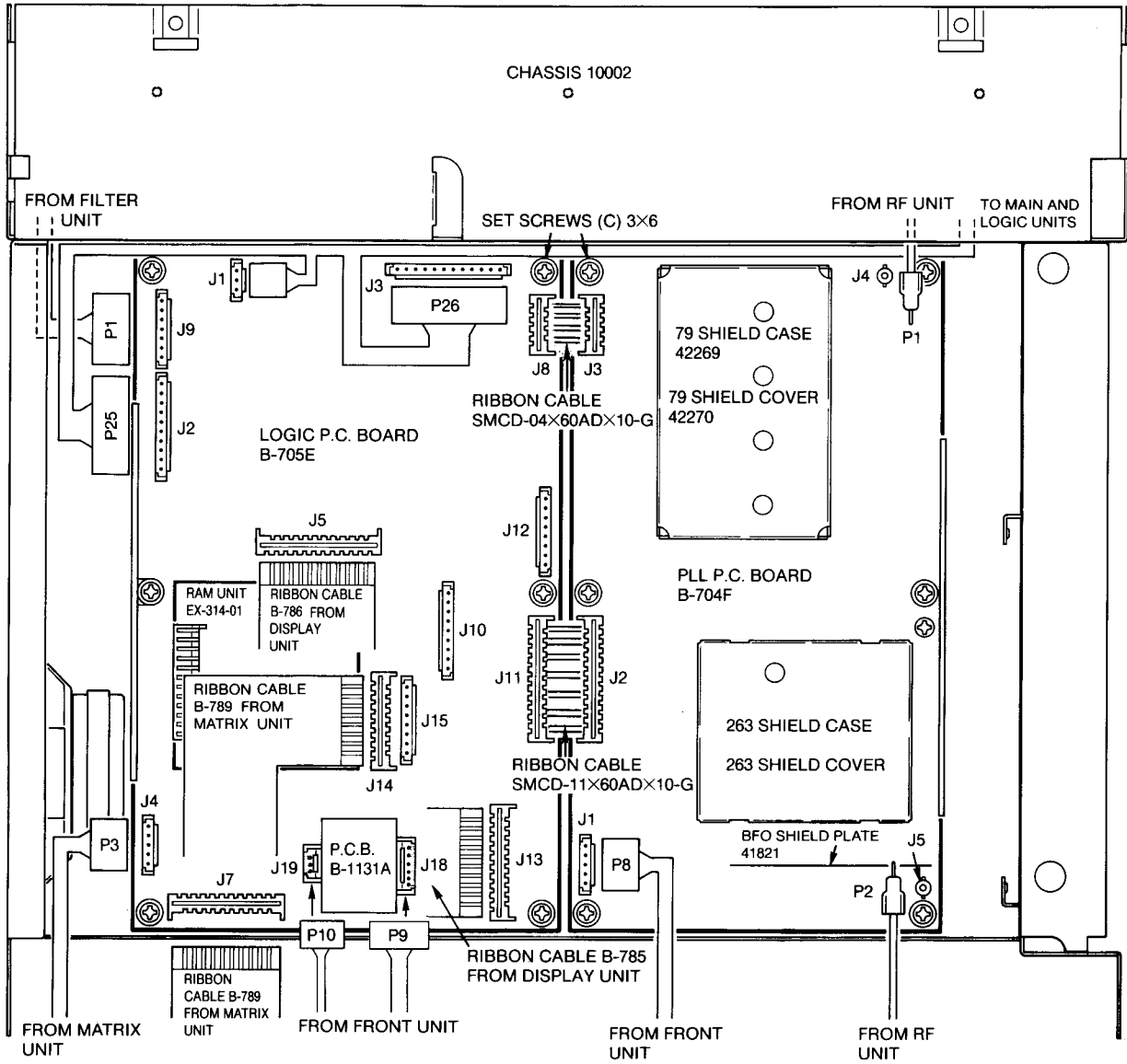




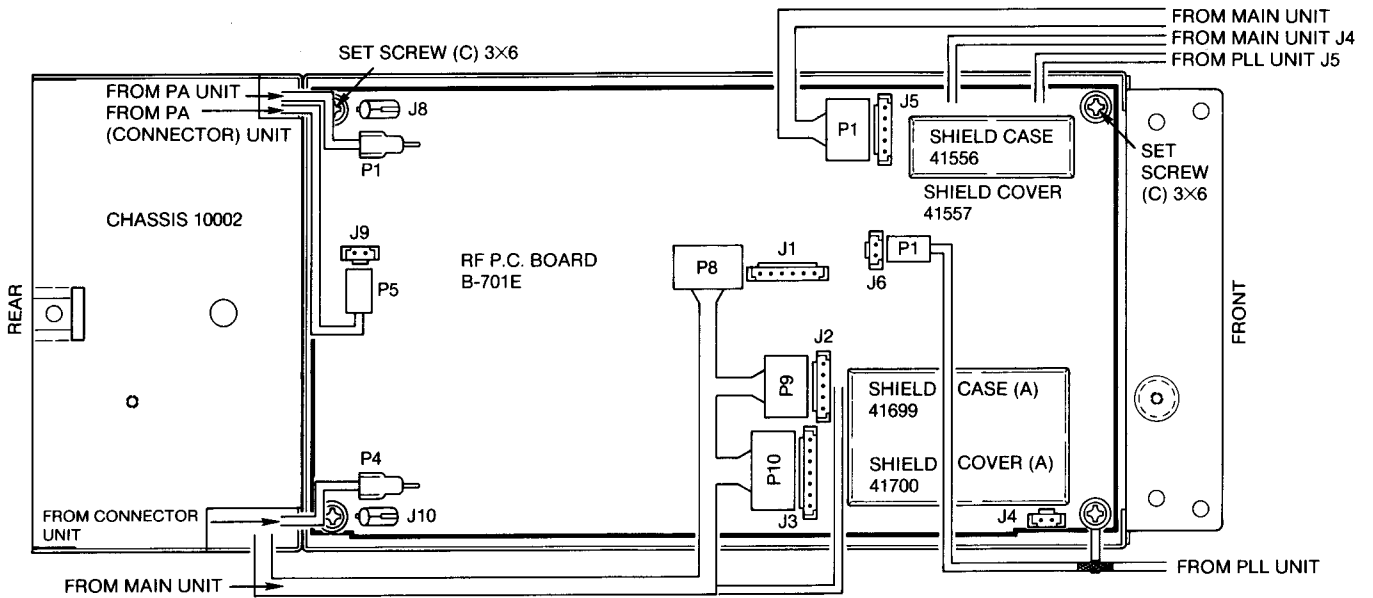
# 5 - 7 MAIN UNIT CONNECTOR ASSEMBLY



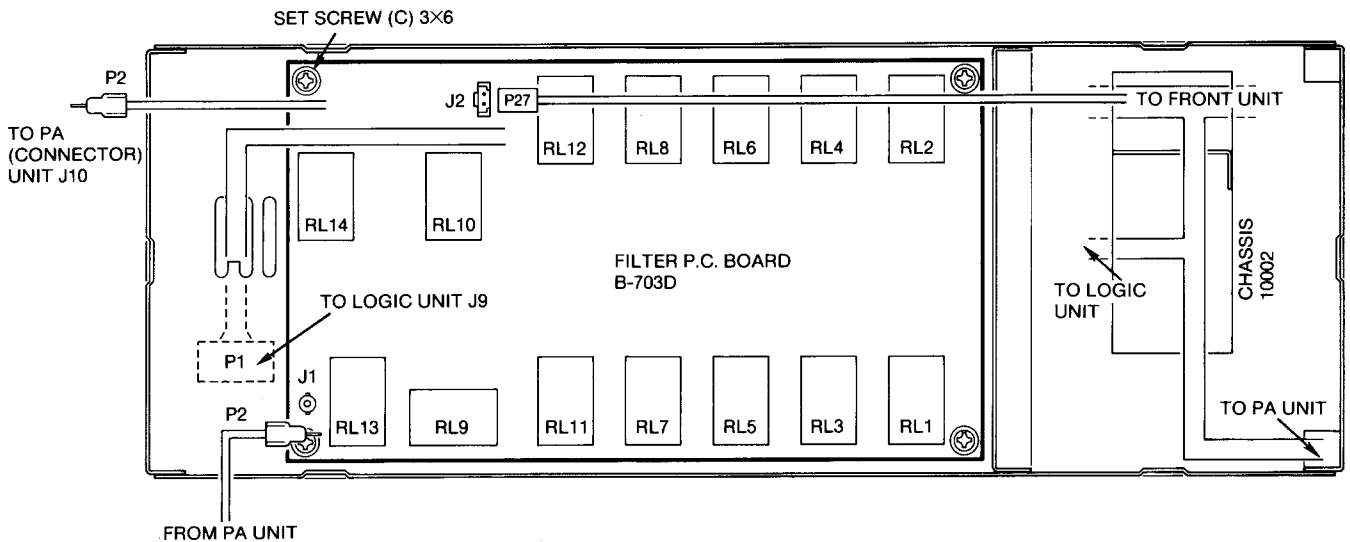
5 - 8 LOGIC AND PLL UNIT CONNECTOR ASSEMBLY



## 5 - 9 RF UNIT CONNECTOR ASSEMBLY



## 5 - 10 FILTER UNIT CONNECTOR ASSEMBLY





## SECTION 6 MAINTENANCE AND ADJUSTMENT

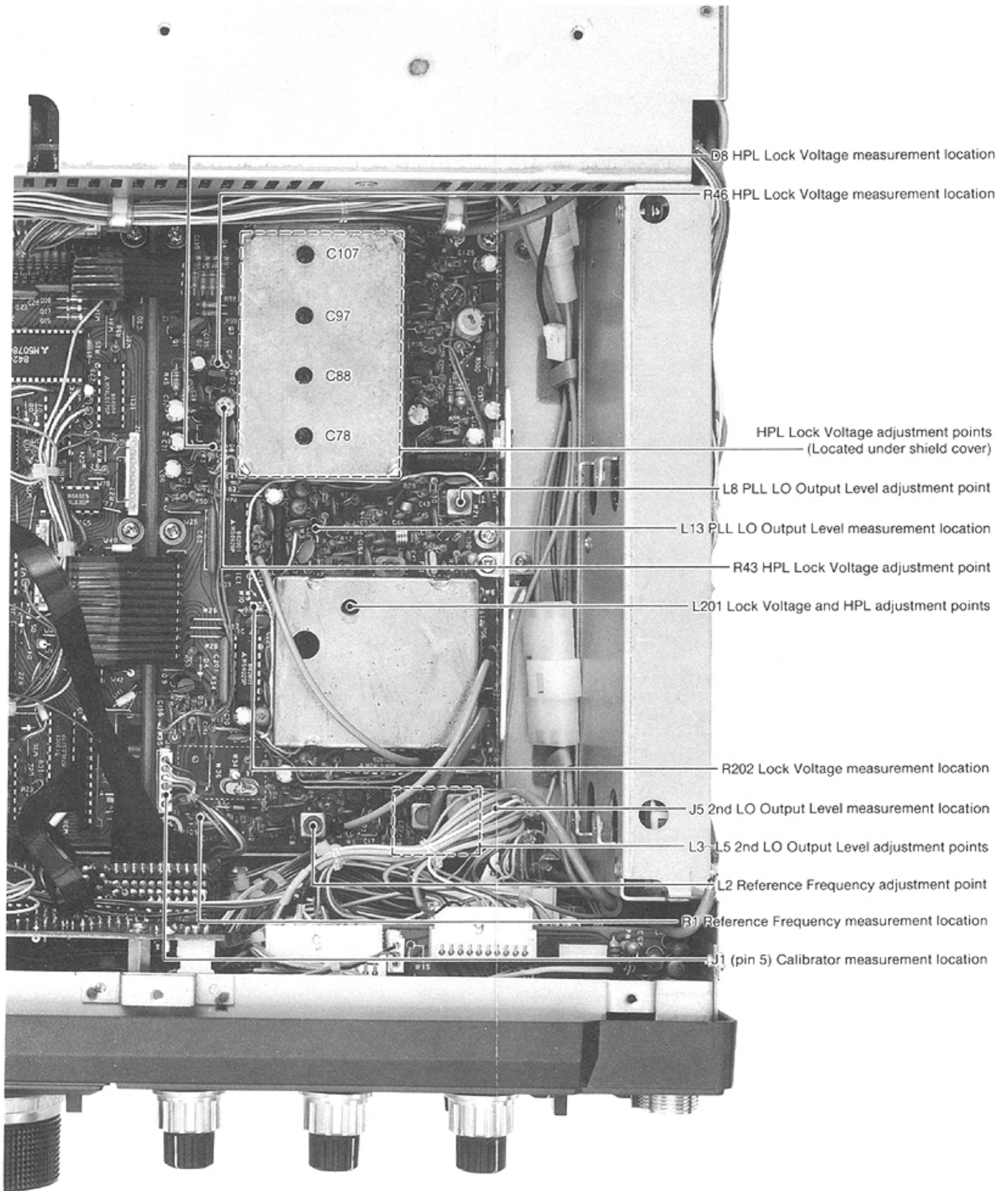
### 6 - 1 PREPARATION BEFORE SERVICING

1. Detach the power cord and turn **OFF** the VOLUME/POWER CONTROL before performing any work on the transceiver.
2. Do not short circuit components while making adjustments.
3. Use an insulated tuning tool for all adjustments.
4. Do not force any of the variable components. Turn them slowly and smoothly.
5. Follow the instructions exactly. If an indicated result is not obtained, repeat the instruction until the correct result is obtained.
6. Check the condition of connectors, solder joints and screws when adjustments are complete. Confirm that components do not touch each other.
7. Confirm defective operation of the transceiver first when checking an out-of-service unit. Verify that external sources do not cause the problem.
8. Use the correct tools and test equipment.
9. Remove the transceiver case as shown in SECTION 5-1.
10. Attach a 13.8V DC external power source to the power supply connector. Be sure to check the polarity.
11. For transmission problems, attach a dummy load to the antenna connector. For reception problems, attach an antenna or signal generator to the antenna connector. **DO NOT transmit** into the signal generator.
12. Recheck for the suspected malfunction with the VOLUME/POWER CONTROL **ON**.
13. Check the defective circuit. Measure the DC voltages of the collector, base and emitter of each transistor.

## 6-2 PLL ADJUSTMENT

| TEST INSTRUMENTS REQUIRED  |  | MEASUREMENT CONNECTION LOCATION |  |   |                  |                    |        |
|--|--|---------------------------------|--|---|------------------|--------------------|--------|
| (1) AC POWER SUPPLY<br>• Output voltage : 13.8V DC<br>• Current capacity : 20A or more<br><br>(2) OSCILLOSCOPE<br>• Frequency range : DC ~ 20MHz<br>• Measuring range : 0.01 ~ 10V<br><br>(3) FREQUENCY COUNTER<br>• Frequency range : 0.1 ~ 90MHz<br>• Frequency accuracy : $\pm 1$ ppm or better<br>• Sensitivity : 100mV or better<br><br>(4) RF VOLTMETER<br>• Frequency range : 0.1 ~ 80MHz<br>• Measuring range : 0.01 ~ 10V |  |                                 |  |   |                  |                    |        |
| ADJUSTMENT   | ADJUSTMENT CONDITIONS                                      | MEASUREMENT                     |  | VALUE                                   | ADJUSTMENT POINT |                    |        |
|  |  | UNIT                            | LOCATION   |   | UNIT             | ADJUST             |        |
| CALIBRATOR   | 1<br>• Frequency display: 8.0000MHz<br>• LSB General mode  | PLL                             | Connect an oscilloscope to J1 pin 5.                                       | 3V                                      | TOP PANEL        | CALIBRATOR CONTROL |        |
| REFERENCE FREQUENCY  | 1<br>• Frequency display: 8.0000MHz<br>• LSB General mode  | PLL                             | Connect a frequency counter to R1 (R2 side).                               | 30.7200MHz                              | PLL              | L2                 |        |
| PLL LO OUTPUT LEVEL  | 1<br>• Frequency display: 8.0000MHz<br>• LSB General mode  | PLL                             | Connect an RF Voltmeter to L13.  | Adjust to maximum output: 400mV~1Vp-p   | PLL              | L8                 |        |
| LOCK VOLTAGE   | 1<br>• Frequency display: 8.0000MHz<br>• LSB General mode  | PLL                             | Connect an oscilloscope to R202.   | 3V                                      | PLL              | L201               |        |
|  | 2<br>• Frequency display: 7.9999MHz                        |                                 |  | 1.5~2V                                  |                  |                    | Verify |
| HPL LOCK VOLTAGE   | 1<br>• Frequency display: 7.9999MHz<br>• LSB General mode  | PLL                             | Connect an oscilloscope to R46.  | 6.5V                                    | PLL              | C78                |        |
|  | 2<br>• Frequency display: 14.9999MHz<br>• LSB General mode |                                 |  |   |                  | C88                |        |
|  | 3<br>• Frequency display: 21.9999MHz                       |                                 |  |   |                  | C97                |        |
|  | 4<br>• Frequency display: 29.9999MHz                       |                                 |  |   |                  | C107               |        |
|  | 5<br>• Frequency display: 8.0000MHz                        |                                 |  |   |                  | L201               |        |
|  | 6<br>• Frequency display: 15.0000MHz                       |                                 |  |   |                  |                    |        |
|  | 7<br>• Frequency display: 22.0000MHz                       |                                 |  |   |                  |                    |        |
|  | 8<br>• Frequency display: 7.9999MHz<br>• LSB General mode  |                                 |  | R43                                     |                  |                    |        |
| 2nd LO OUTPUT LEVEL  | 1<br>• Frequency display: 8.0000MHz<br>• LSB General mode  | PLL                             | Terminate J5 to ground with a 50Ω resistor. Connect an RF Voltmeter to J5. | Adjust to maximum output: 250~400mV rms | PLL              | L3~L5              |        |
| <b>NOTE:</b> After completing the adjustment, return J5 to its original condition.   |  |                                 |  |   |                  |                    |        |

# PLL UNIT



D8 HPL Lock Voltage measurement location

R46 HPL Lock Voltage measurement location

C107

C97

C88

C78

HPL Lock Voltage adjustment points  
(Located under shield cover)

L8 PLL LO Output Level adjustment point

L13 PLL LO Output Level measurement location

R43 HPL Lock Voltage adjustment point

L201 Lock Voltage and HPL adjustment points

R202 Lock Voltage measurement location

J5 2nd LO Output Level measurement location

L3-L5 2nd LO Output Level adjustment points

L2 Reference Frequency adjustment point

R1 Reference Frequency measurement location

J1 (pin 5) Calibrator measurement location

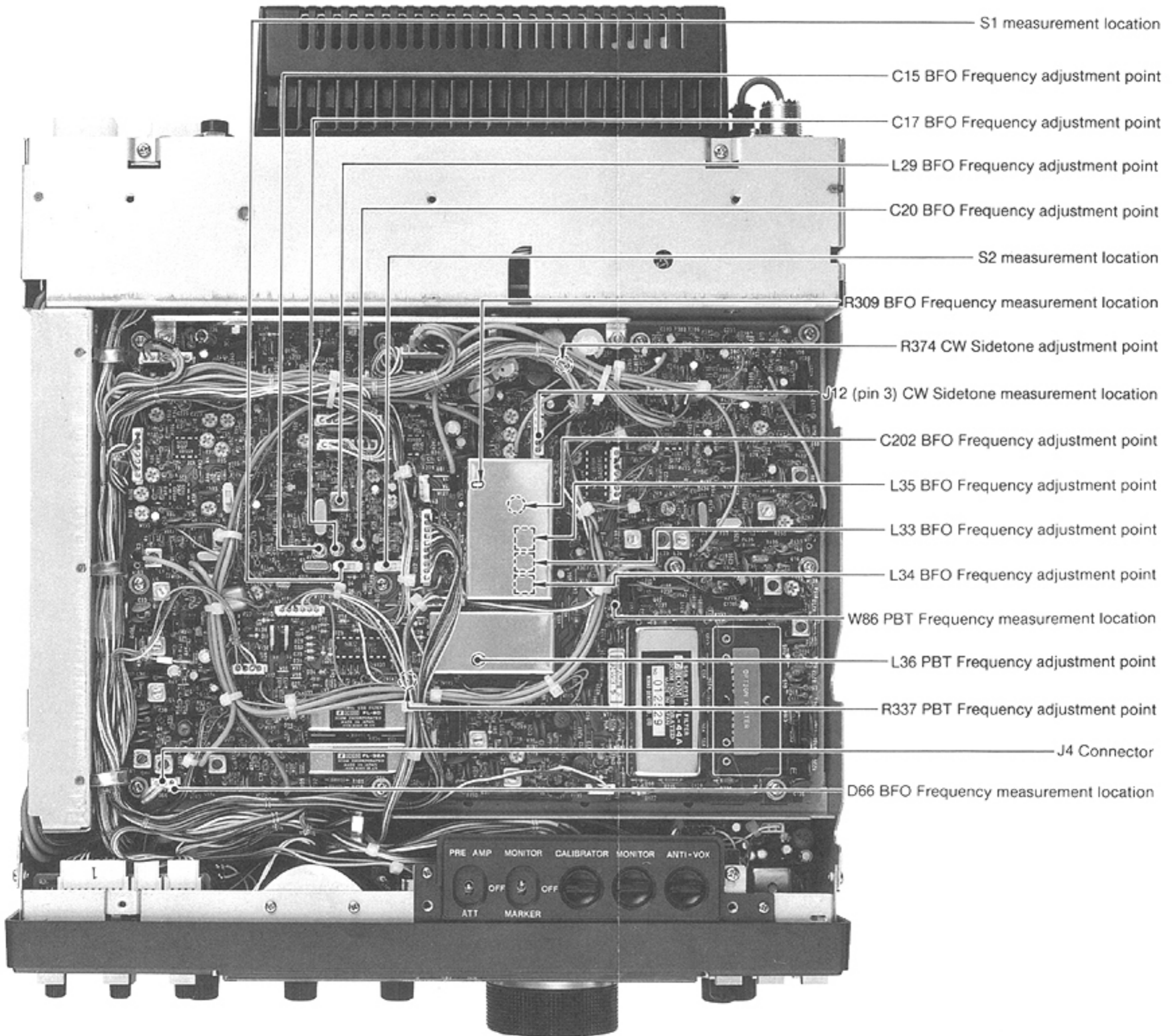


## 6 - 3 FREQUENCY ADJUSTMENT

| TEST INSTRUMENTS REQUIRED   | MEASUREMENT CONNECTION LOCATION |
|---|---------------------------------|
| (1) AC POWER SUPPLY <ul style="list-style-type: none"> <li>• Output voltage : 13.8V DC</li> <li>• Current capacity : 20A or more</li> </ul>   |                                 |
| (2) FREQUENCY COUNTER <ul style="list-style-type: none"> <li>• Frequency range : 0.1 ~ 90MHz</li> <li>• Frequency accuracy : ±1ppm or better</li> <li>• Sensitivity : 100mV or better</li> </ul>                      |                                 |
| (3) RF POWER METER (TERMINATED TYPE) <ul style="list-style-type: none"> <li>• Measuring range : 20 ~ 200W</li> <li>• Frequency range : 1.8 ~ 30MHz</li> <li>• Impedance : 50Ω</li> <li>• SWR : 1.1 or less</li> </ul> |                                 |

| ADJUSTMENT  | ADJUSTMENT CONDITIONS                                       | MEASUREMENT |  |   | ADJUSTMENT POINT |            |     |
|---|---|-------------|--|---|------------------|------------|-----|
|   |   | UNIT        | LOCATION   | VALUE   | UNIT             | ADJUST     |     |
| BFO FREQUENCY   | 1   | MAIN        | Connect a frequency counter to R309 (X6 side).                         | 9.01300MHz  | MAIN             | C202       |     |
|   | 2   |             |  | 9.01000MHz  |                  | L34        |     |
|   | 3   |             |  | 9.00990MHz  |                  | L33        |     |
|   | 4   |             |  | 9.008475MHz   |                  | L35        |     |
|   | 5   |             |  | No output   |                  | Verify     |     |
|   | 6   |             |  | 9.01000MHz  |                  | Verify     |     |
|   | 7   |             |  | 9.01000MHz  |                  | L29        |     |
|   | 8   |             |  | Connect a frequency counter to D66.   |                  | 9.01060MHz | C20 |
|   | 9   |             |  |   |                  | 9.01077MHz | C17 |
|   | 10  |             |  |   |                  | 9.01145MHz | C15 |
|   | <b>NOTE: Repeat adjustments 6 through 10 several times.</b> |             |  |   |                  |            |     |
| 11  | S1: Left (Normal side)<br>S2: Left/Right                    | MAIN        | Connect a frequency counter to D66.                                    | Switch S2 alternately between the right and left sides, confirming that the frequency is 9.01060MHz |                  | Verify     |     |
| <b>NOTE: Return J4 to its original condition after completing Adjustment 8.</b> |   |             |  |   |                  |            |     |
| PBT FREQUENCY   | 1   | MAIN        | Connect a frequency counter to W86.                                    | 9.46650MHz  | MAIN             | L36        |     |
|   | 2   |             |  | 9.46800MHz or higher  |                  | Verify     |     |
|   | 3   |             |  | 9.46500MHz or lower   |                  |            |     |
|   | 4   |             |  | 9.46650MHz  |                  | R337       |     |
| CW SIDETONE   | 1   | MAIN        | Connect a frequency counter to pin 3 on J12.                           | 700Hz   | MAIN             | R374       |     |
| DC-DC CONVERTER FREQUENCY   | 1   | DISPLAY     | Connect a frequency counter to the cathode of D21. (Location on p.7-3) | approx. 20kHz   |                  | Verify     |     |

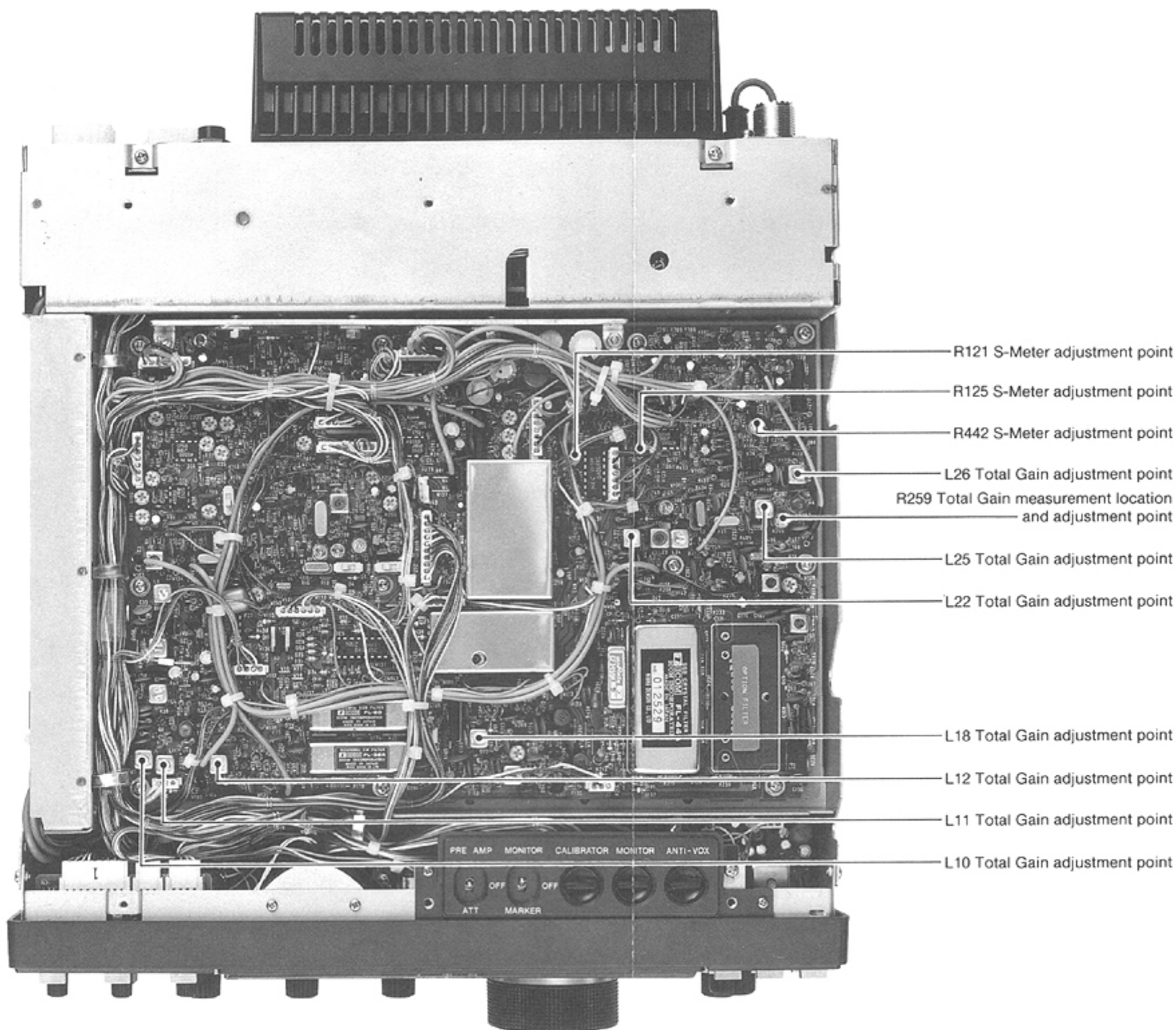
# MAIN UNIT



## 6 - 4 RECEIVER ADJUSTMENT

| TEST INSTRUMENTS REQUIRED  |                       | MEASUREMENT CONNECTION LOCATION |  |                           |                  |                                   |  |                    |                 |
|--|-----------------------|---------------------------------|--|---------------------------|------------------|-----------------------------------|--|--------------------|-----------------|
| (1) AC POWER SUPPLY<br>• Output voltage : 13.8V DC<br>• Current capacity : 20A or more<br><br>(2) STANDARD SIGNAL GENERATOR (SSG)<br>• Frequency range : 0.1 ~ 40MHz<br>• Output level : -127 ~ -17dBm (0.1 $\mu$ V~32mV)<br><br>(3) AC MILLI-VOLTMETER<br>• Measuring range : 10mV ~ 3V<br><br>(4) EXTERNAL SPEAKER<br>• Impedance : 8 $\Omega$<br><br>(5) OSCILLOSCOPE<br>• Frequency range : DC ~ 20MHz<br>• Measuring range : 0.01 ~ 10V |                       |                                 |  |                           |                  |                                   |  |                    |                 |
| ADJUSTMENT   | ADJUSTMENT CONDITIONS | MEASUREMENT                     |  | VALUE                     | ADJUSTMENT POINT |                                   |  |                    |                 |
|  |                       | UNIT                            | LOCATION   |                           | UNIT             | ADJUST                            |  |                    |                 |
| TOTAL GAIN   | 1                     | REAR PANEL                      | Connect an AC milli-voltmeter to the EXT. SP JACK. | Adjust to MAX. AF output. | MAIN             | L10, L11, L12, L18, L22, L25, L26 |  |                    |                 |
|  | 2                     |                                 |  |                           |                  |                                   | Adjust the AF GAIN CONTROL until 2.5V is output.                             | FRONT PANEL        | AF GAIN CONTROL |
|  | 3                     |                                 |  |                           |                  |                                   | Adjust R259 to a point where the noise level is 30dB (about 80mV) from 2.5V. | MAIN               | R259            |
| S-METER  | 1                     | FRONT PANEL                     | Multifunction meter (S scale)                      | S0 (S scale)              | MAIN             | R125                              |  |                    |                 |
|  | 2                     |                                 |  |                           |                  |                                   | Multifunction meter (S scale)  | S9 (S scale)       | R442            |
|  | 3                     |                                 |  |                           |                  |                                   | Multifunction meter (S scale)  | S9 +60dB (S scale) | R121            |

# MAIN UNIT



R121 S-Meter adjustment point

R125 S-Meter adjustment point

R442 S-Meter adjustment point

L26 Total Gain adjustment point

R259 Total Gain measurement location  
and adjustment point

L25 Total Gain adjustment point

L22 Total Gain adjustment point

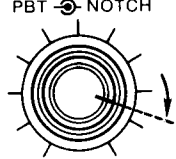
L18 Total Gain adjustment point

L12 Total Gain adjustment point

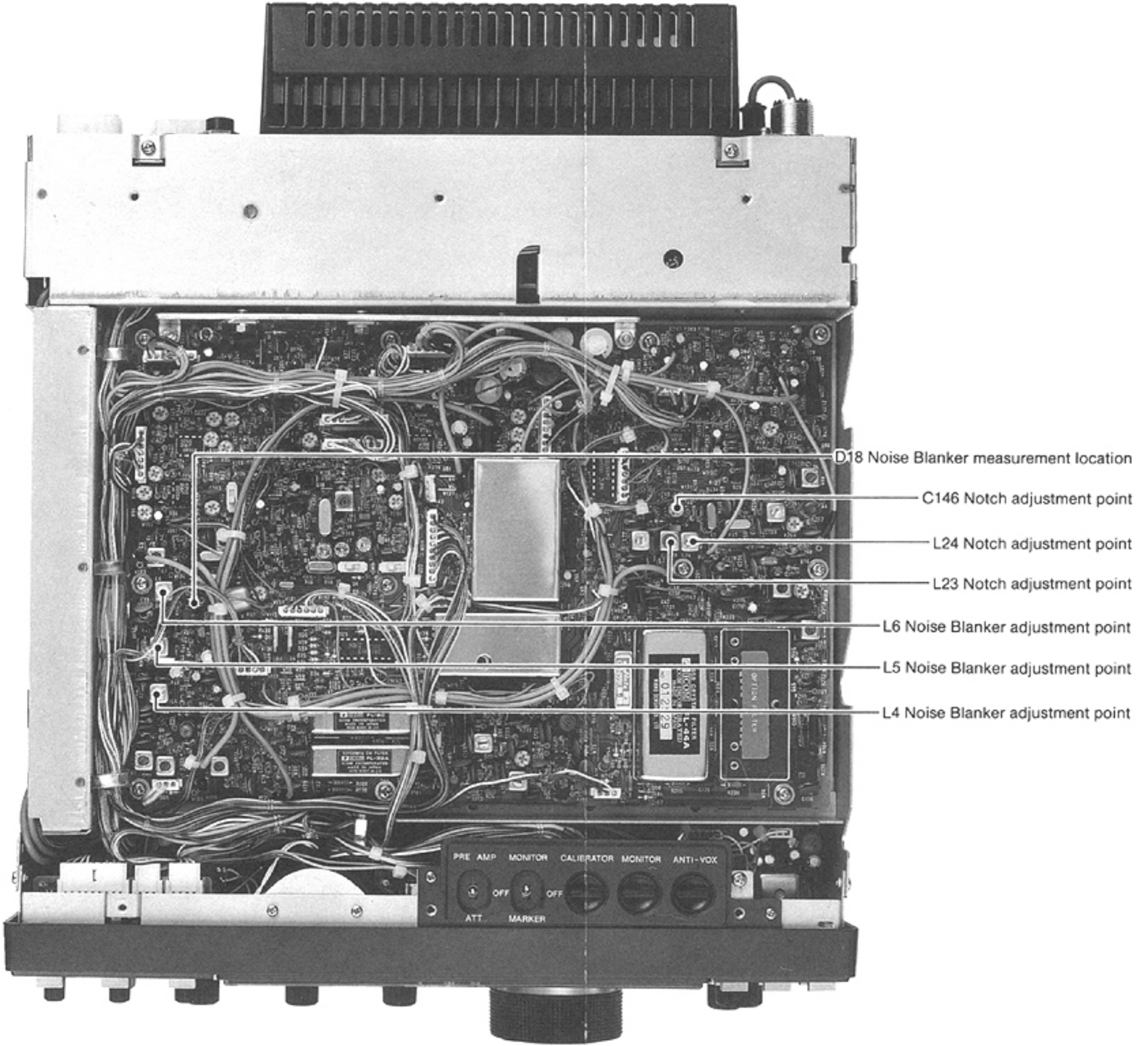
L11 Total Gain adjustment point

L10 Total Gain adjustment point

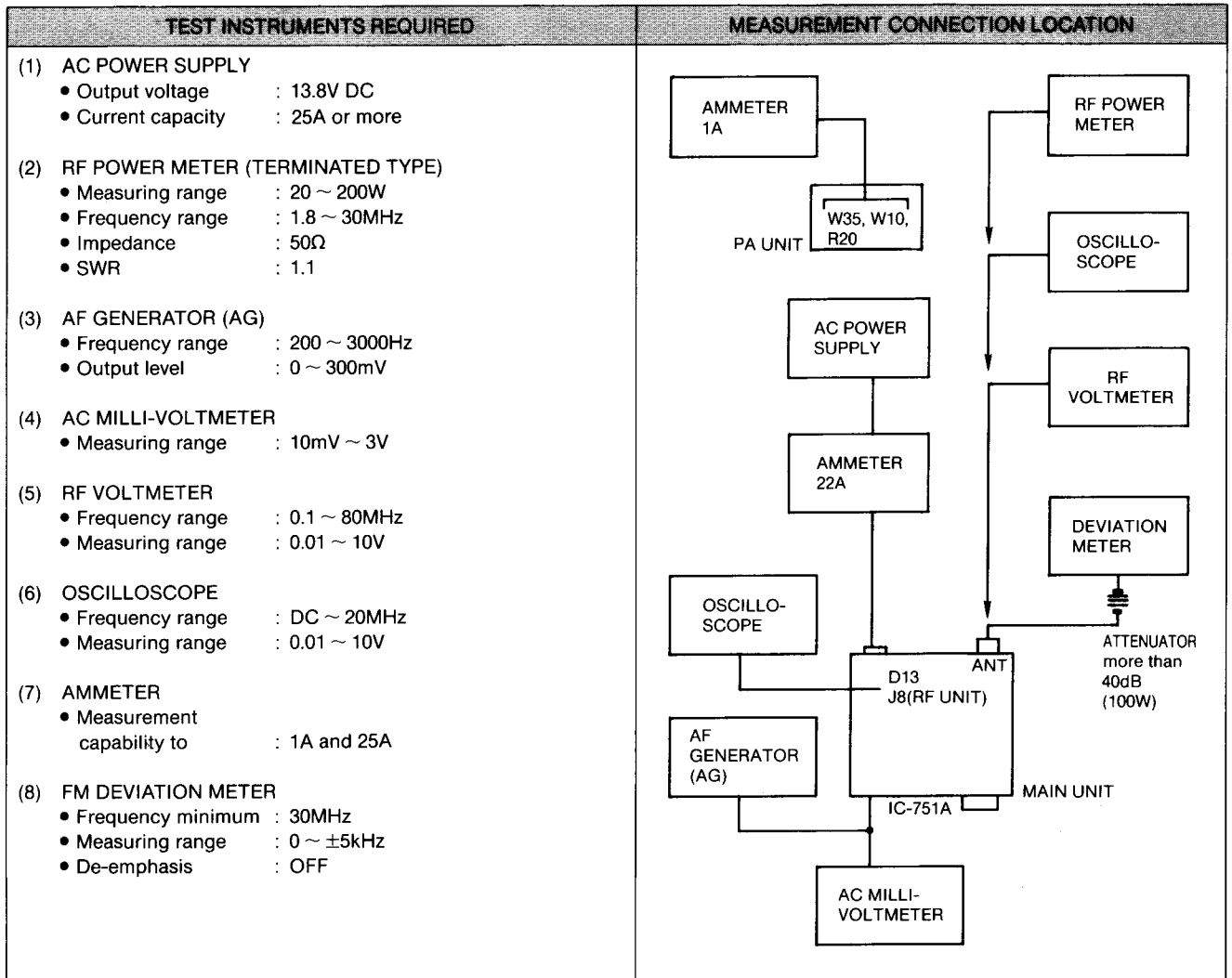
# RECEIVER ADJUSTMENT

| ADJUSTMENT    | ADJUSTMENT CONDITIONS  | MEASUREMENT  |   | VALUE   | ADJUSTMENT POINT  |                 |     |
|---------------|--|--|---|---|-------------------|-----------------|-----|
|               |  | UNIT   | LOCATION  |   | UNIT              | ADJUST          |     |
| S-METER       | 4 <ul style="list-style-type: none"> <li>Apply a -33dBm (5mV) RF signal to the ANTENNA CONNECTOR.</li> <li>PRE AMP SWITCH: ON</li> <li>ATT SWITCH: ON</li> </ul>   | FRONT PANEL  |   | Record the reading.   |                   |                 |     |
|               |  |  |   | A position 10dB up on the S-Meter   |                   | Verify          |     |
|               |  |  |   | A position 20dB down on the S-Meter   |                   |                 |     |
| NOISE BLANKER | 1 <ul style="list-style-type: none"> <li>Frequency display: 14MHz</li> <li>USB mode</li> <li>PRE AMP SWITCH: OFF</li> <li>NB WIDE SWITCH: ON</li> <li>NB LEVEL CONTROL: MAX. CW</li> <li>Apply pulse-type noise to the ANTENNA CONNECTOR.</li> </ul>   | MAIN   | Connect an oscilloscope to D18.                   | Adjust to MAX. wave-form on the oscilloscope.   | MAIN              | L4~L6           |     |
|               | <b>NOTE:</b> The noise blanker will not function for wide noises (pulse width approx. 5m secs.) when the NB WIDE SWITCH is turned OFF. The noise blanker will function when receiving narrow noises (pulse width approx. 0.4 ~ 0.5m secs.) regardless of the position of the NB WIDE SWITCH. |  |   |   |                   |                 |     |
| NOTCH         | 1 <ul style="list-style-type: none"> <li>Frequency display: 14.1485MHz</li> <li>MARKER SWITCH: ON</li> <li>NOTCH SWITCH: ON</li> <li>NOTCH CONTROL: MAX. CW and CCW.</li> </ul>  | FRONT PANEL  |   | S-Meter remains at the same level when the NOTCH CONTROL is turned fully CW or CCW.   | MAIN              | L24             |     |
|               | 2 <ul style="list-style-type: none"> <li>NOTCH SWITCH: OFF</li> <li>NOTCH SWITCH: ON</li> </ul>  | REAR PANEL   | Connect an AC millivoltmeter to the EXT. SP JACK. | 2.5V  | FRONT PANEL       | AF GAIN CONTROL |     |
|               |  |  |   | Less than 150mV   | FRONT PANEL       | NOTCH CONTROL   |     |
|               | <b>NOTE:</b> Repeat steps 2 and 3 (below) two or three times.  |  |   |   |                   |                 |     |
|               | 3  | <ul style="list-style-type: none"> <li>Frequency display: 14.1472MHz</li> <li>NOTCH SWITCH: ON</li> <li>NOTCH CONTROL: MAX. CCW</li> </ul> | REAR PANEL  | Connect an AC millivoltmeter to the EXT. SP JACK.                                     | MIN. audio output | MAIN            | L23 |
| 4             | <ul style="list-style-type: none"> <li>Frequency display: 14.1498MHz</li> </ul>  |  | Connect an AC millivoltmeter to the EXT. SP JACK. | MIN. level  | FRONT PANEL       | NOTCH CONTROL   |     |
|               |  |  |   | <b>NOTE:</b> Verify the NOTCH CONTROL position as shown below.<br>PBT → NOTCH         |                   |                 |     |
|               |  |  |   |  |                   |                 |     |

# MAIN UNIT

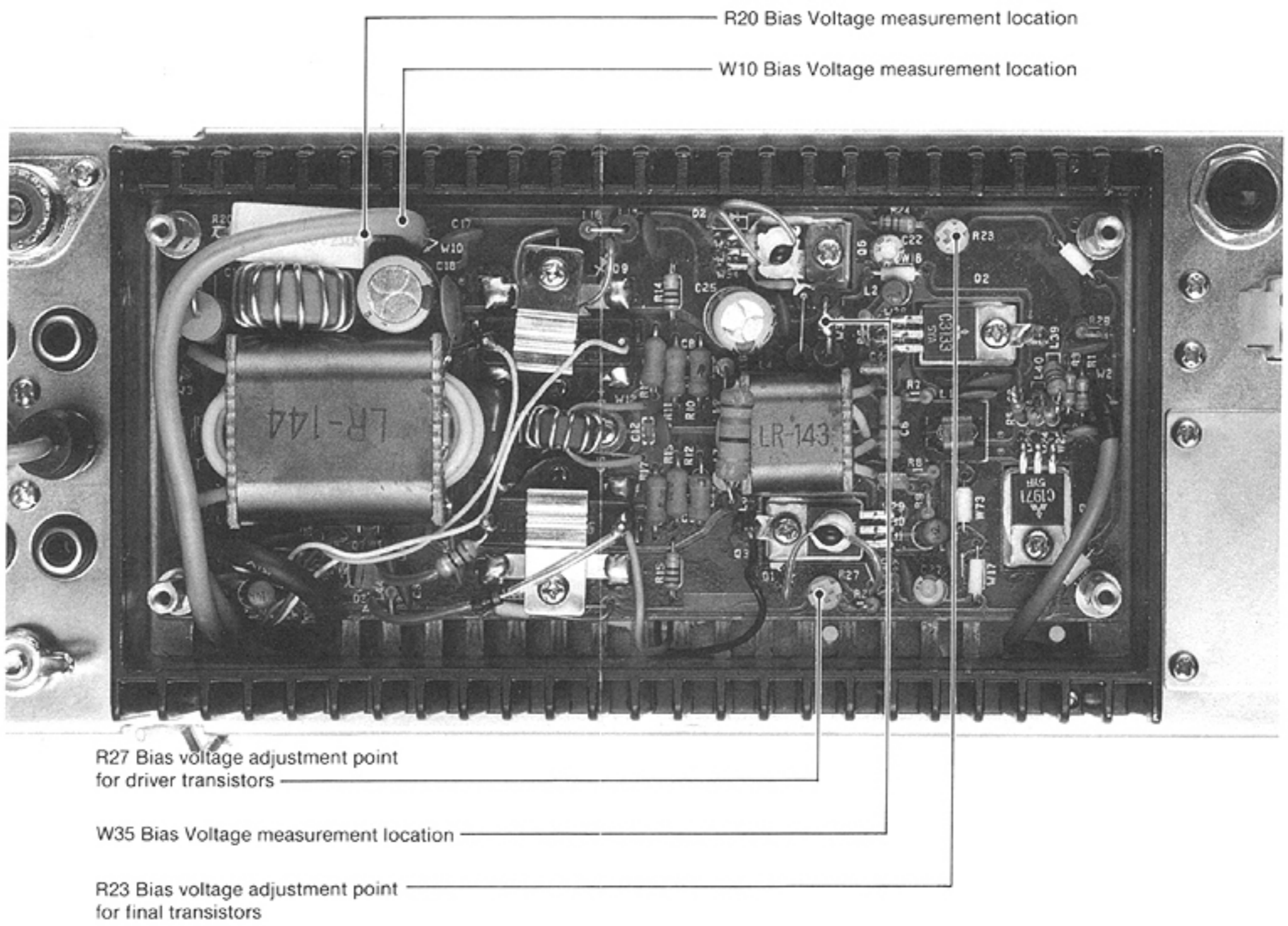


## 6 - 5 TRANSMITTER ADJUSTMENT



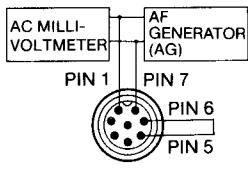
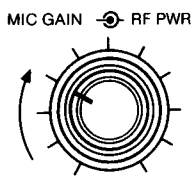
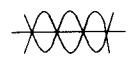
| ADJUSTMENT                               | ADJUSTMENT CONDITIONS   | MEASUREMENT |   | VALUE | ADJUSTMENT POINT |        |
|--|---|-------------|---|-------|------------------|--------|
|  |   | UNIT        | LOCATION  |       | UNIT             | ADJUST |
| BIAS VOLTAGE<br>① For driver transistors | <ul style="list-style-type: none"> <li>• Frequency display: 14MHz</li> <li>• SSB mode</li> <li>• MIC GAIN CONTROL: Turn fully CCW</li> <li>• After confirming there is no MIC input, set the transceiver in transmit mode.</li> </ul> <p><b>NOTE:</b> Resolder after making adjustments in steps 1 and 2.</p> | PA          | Desolder the center of W35.<br><br>Connect an ammeter at W35.<br> | 100mA | PA               | R27    |
| ② For final transistors                  |   |             | Desolder R20 and connect an ammeter between W10 and R20.<br>      | 600mA |                  | R23    |

PA UNIT

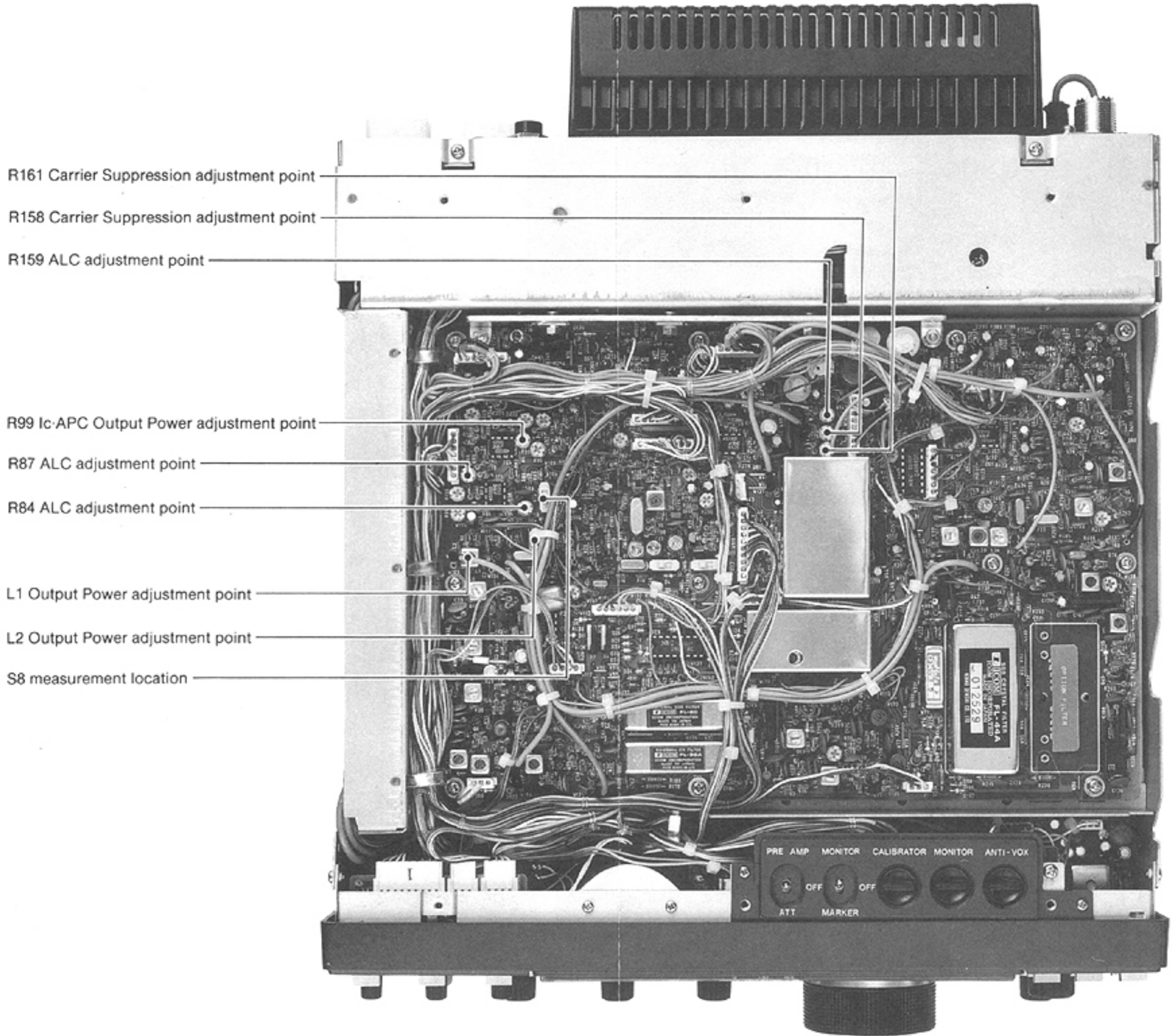




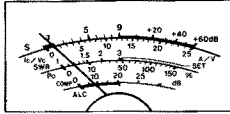
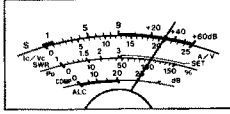
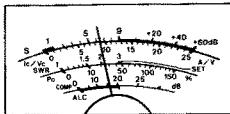
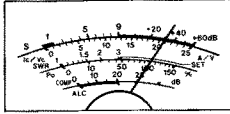
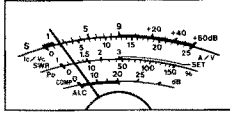
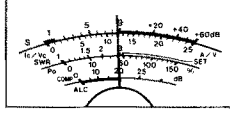
# TRANSMITTER ADJUSTMENT

| ADJUSTMENT   | ADJUSTMENT CONDITIONS   | MEASUREMENT |  | VALUE   | ADJUSTMENT POINT |                  |        |
|--|---|-------------|--|---|------------------|------------------|--------|
|  |   | UNIT        | LOCATION   |   | UNIT             | ADJUST           |        |
| OUTPUT POWER   | 1 <ul style="list-style-type: none"> <li>• Frequency display: 14MHz</li> <li>• USB mode</li> <li>• COMP SWITCH: OFF</li> <li>• Apply a 1.5kHz/3mV signal from the AG, then adjust the MIC GAIN CONTROL to output 30W of power.</li> </ul> | REAR PANEL  | Connect an RF power meter to the ANTENNA CONNECTOR.<br><br>PIN 1: AG input<br>PIN 7: GND<br>PIN 5: Jumper<br>PIN 6: Jumper | Adjust to obtain MAX. output power.   | MAIN             | L1               |        |
|  | 2 <ul style="list-style-type: none"> <li>• FM mode</li> <li>• MIC GAIN CONTROL: MAX. CCW</li> </ul>   |             |  | 50W   | FRONT PANEL      | RF POWER CONTROL |        |
|  | <ul style="list-style-type: none"> <li>• MIC GAIN CONTROL: MAX. CW</li> </ul> Note: The RF POWER CONTROL should remain in the same position as in step 2 above.   |             |  | MAX. output   | MAIN             | L2               |        |
| Ic • APC   | 1 <ul style="list-style-type: none"> <li>• Frequency display: 14MHz</li> <li>• RTTY mode</li> <li>• RF POWER CONTROL: MAX. CW</li> <li>• Transmit mode</li> </ul>   | REAR PANEL  | Connect an ammeter to the power cable.   | 22A   | MAIN             | R99              |        |
| ALC  | 1 <ul style="list-style-type: none"> <li>• Frequency display: 14MHz</li> <li>• RTTY mode</li> <li>• RF POWER CONTROL: MAX. CW</li> </ul>  | REAR PANEL  | Connect an RF power meter to the ANTENNA CONNECTOR.  | 100W  | MAIN             | R87              |        |
|  | 2 <ul style="list-style-type: none"> <li>• RF POWER CONTROL: MAX. CCW</li> </ul>  |             |  | 3~10W   |                  |                  | Verify |
|  | <b>NOTE: Check that the RF output power on each band is 90 ~ 100W and that the current drain is less than 20A.</b>  |             |  |   |                  |                  |        |
|  | 3 <ul style="list-style-type: none"> <li>• RF POWER CONTROL: MAX. CW</li> <li>• S8 on MAIN UNIT: Switch to rear panel side.</li> <li>• Transmit mode</li> </ul>   | REAR PANEL  | Connect an RF power meter to the ANTENNA CONNECTOR.  | 50W   | MAIN             | R84              |        |
|  | 4 <ul style="list-style-type: none"> <li>• RF POWER CONTROL: MAX. CW</li> <li>• AM mode</li> <li>• MIC GAIN CONTROL: (set as shown)</li> </ul>         |             |  | Connect an oscilloscope to the ANTENNA CONNECTOR.<br>100% modulation<br><br>or<br>50W RF output power |                  | R159             |        |
| 5 <ul style="list-style-type: none"> <li>• MIC GAIN CONTROL: MAX. CCW</li> </ul> | Connect an RF power meter to the ANTENNA CONNECTOR.<br>40~60W   |             |  | Verify  |                  |                  |        |
| CARRIER SUPPRESSION  | 1 <ul style="list-style-type: none"> <li>• Frequency display: 14MHz</li> <li>• USB and LSB modes</li> <li>• COMP SWITCH: OFF</li> <li>• MIC GAIN CONTROL: MAX. CCW</li> <li>• Transmit mode</li> </ul>                                    | REAR PANEL  | Connect an RF voltmeter or spectrum analyzer to the ANTENNA CONNECTOR.   | Alternately change the operating mode between USB and LSB, and adjust R158 and R161 for MIN. output of less than -50dB.   | MAIN             | R158<br>R161     |        |
|  | 2 <ul style="list-style-type: none"> <li>• COMP SWITCH: ON</li> </ul>   |             |  | Less than -50dB   |                  | Verify           |        |

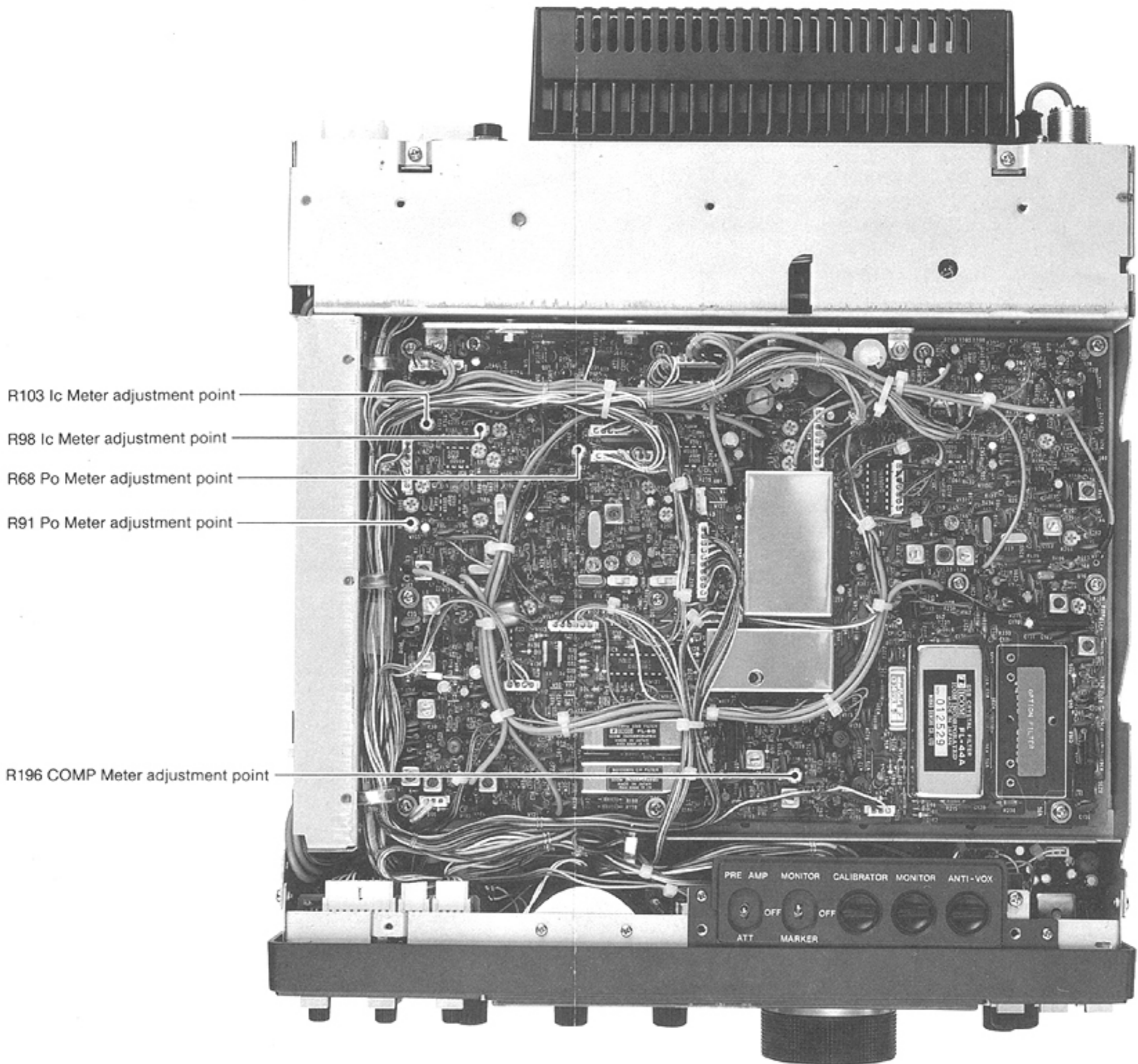
# MAIN UNIT



# TRANSMITTER ADJUSTMENT

| ADJUSTMENT          | ADJUSTMENT CONDITIONS | MEASUREMENT  |   | VALUE   | ADJUSTMENT POINT   |  |                  |
|---------------------|-----------------------|--|---|---|--|--|------------------|
|                     |                       | UNIT   | LOCATION  |   | UNIT   | ADJUST   |                  |
| METER<br>④ Ic METER | 1                     | <ul style="list-style-type: none"> <li>Frequency display: 14MHz</li> <li>RTTY mode</li> <li>RF POWER CONTROL: MAX. CW</li> <li>METER SWITCH: Ic</li> <li>Transmit mode</li> </ul>                    | REAR PANEL  | Connect an ammeter to the power cable.  | Adjust to total current minus 3A.  | MAIN   | R98              |
|                     | 2                     |  | <ul style="list-style-type: none"> <li>HAM/GENE SWITCH: GENE</li> </ul>   |   |  <p>Multifunction meter (Ic scale)</p> | 1A (Ic scale)  |                  |
| ⑥ COMP METER        | 3                     | <ul style="list-style-type: none"> <li>USB mode</li> <li>COMP SWITCH: ON</li> <li>METER SWITCH: COMP</li> <li>Input 2 audio signals into the MIC CONNECTOR:<br/>1.9kHz 3mV<br/>1.3kHz 3mV</li> </ul> | FRONT PANEL   |  <p>Multifunction meter (COMP scale)</p>  | 25dB (COMP scale)  | FRONT PANEL  | MIC GAIN CONTROL |
|                     |                       |  |   |   | <ul style="list-style-type: none"> <li>METER SWITCH: ALC</li> </ul>  |  <p>Multifunction meter (Ic scale)</p> | 9A (Ic scale)    |
|                     | 4                     | <ul style="list-style-type: none"> <li>COMP SWITCH: OFF</li> <li>METER SWITCH: COMP</li> <li>Input an audio signal into the MIC CONNECTOR:<br/>1.5kHz 3mV</li> </ul>                                 | REAR PANEL  | Connect an RF meter to the ANTENNA CONNECTOR.   | 30W  | FRONT PANEL  | MIC GAIN CONTROL |
|                     |                       |  |   |   | 80~100W  |  |                  |
| ③ Po METER          | 5                     | <ul style="list-style-type: none"> <li>RTTY mode</li> <li>COMP SWITCH: OFF</li> <li>METER SWITCH: Po</li> <li>Transmit mode</li> </ul>   |   | Connect an RF meter to the ANTENNA CONNECTOR.   | 100W   |  |                  |
|                     |                       |  | FRONT PANEL   |  <p>Multifunction meter (Po scale)</p>  | 100% (Po scale)  | MAIN   | R91              |
| ⑤ ALC METER         | 6                     | <ul style="list-style-type: none"> <li>USB mode</li> <li>METER SWITCH: ALC</li> <li>Apply an AF signal to the MIC CONNECTOR:<br/>1.5kHz 3mV</li> </ul>   |   |  <p>Multifunction meter (Ic scale)</p>  | 2A (Ic scale)  | FRONT PANEL  | MIC GAIN CONTROL |
|                     |                       |  | <ul style="list-style-type: none"> <li>Apply an AF signal to the MIC CONNECTOR:<br/>1.5kHz 9.4mV (10dB up)</li> </ul> |  <p>Multifunction meter (ALC scale)</p> | Full scale in the ALC zone   | MAIN   | R68              |

# MAIN UNIT



R103 Ic Meter adjustment point

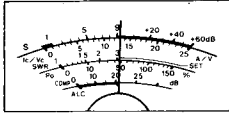
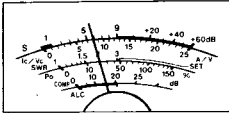
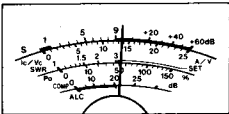
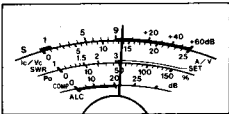
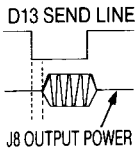
R98 Ic Meter adjustment point

R68 Po Meter adjustment point

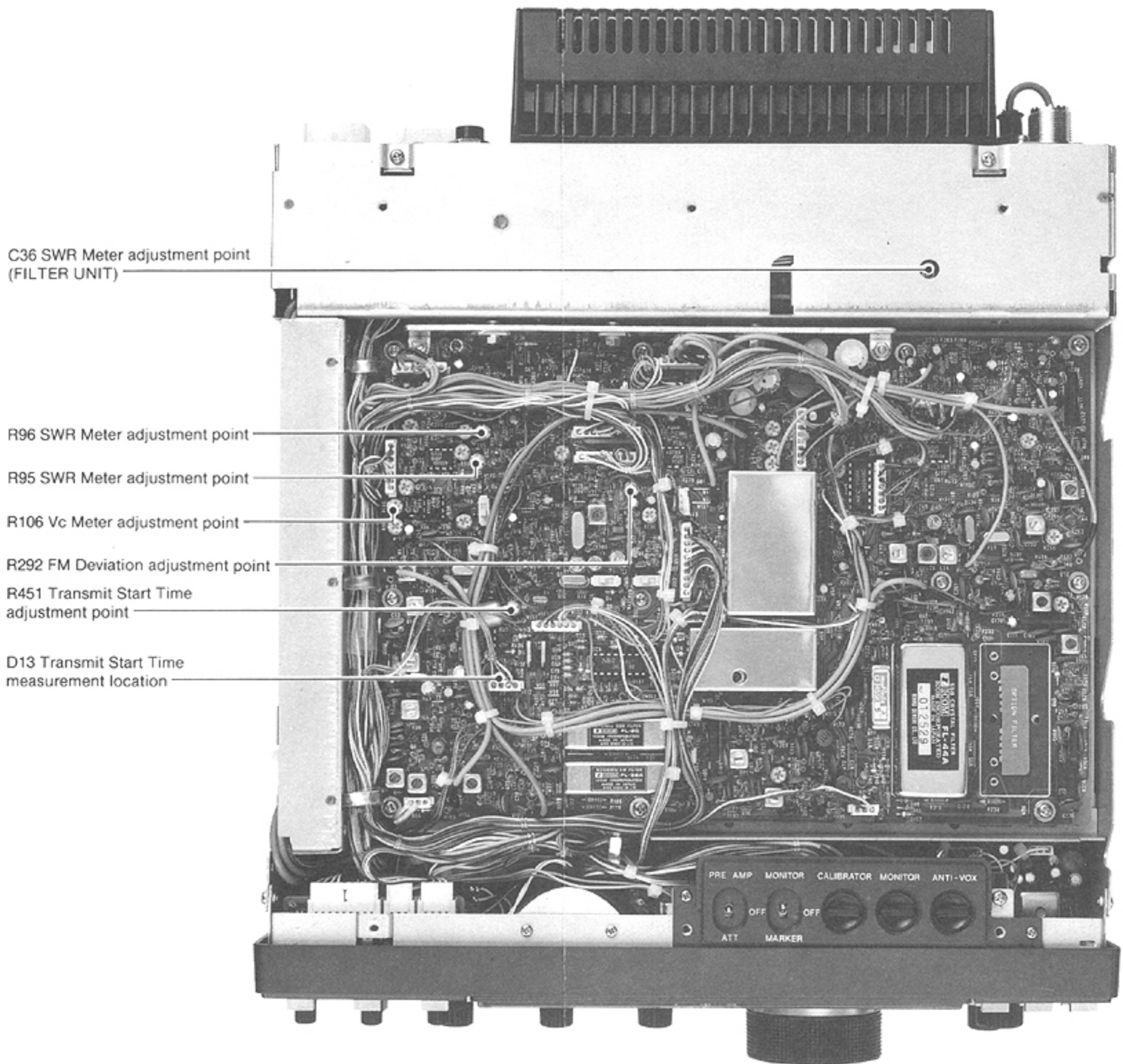
R91 Po Meter adjustment point

R196 COMP Meter adjustment point

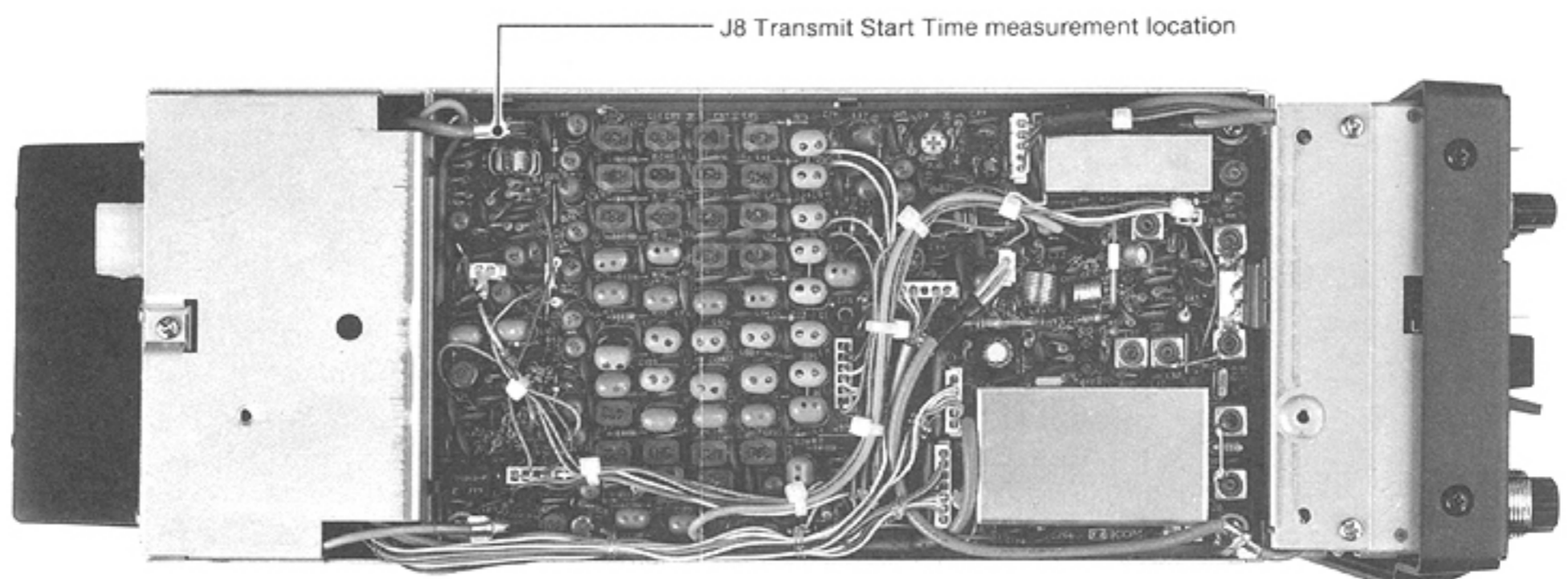
# TRANSMITTER ADJUSTMENT

| ADJUSTMENT          | ADJUSTMENT CONDITIONS | MEASUREMENT |  | VALUE   | ADJUSTMENT POINT |                  |
|---------------------|-----------------------|-------------|--|---|------------------|------------------|
|                     |                       | UNIT        | LOCATION   |   | UNIT             | ADJUST           |
| Ⓢ SWR METER         | 6                     | FRONT PANEL | Po METER<br><br>Multifunction meter (SWR scale)  | Adjust RF POWER CONTROL until the meter needle is at "SWR SET".   | FRONT PANEL      | RF POWER CONTROL |
|                     |                       |             | SWR METER  | Adjust to MIN. SWR (less than 1.2).   |                  |                  |
|                     | 7                     |             | SWR METER<br><br>Multifunction meter (SWR scale) | SWR 2   | MAIN             | R96              |
|                     | 8                     |             | SWR METER<br><br>Multifunction meter (SWR scale) | SWR 3   |                  | R95              |
| Ⓢ Vc METER          | 9                     | FRONT PANEL | Vc METER<br><br>Multifunction meter (Vc scale)   | 13.8V   | MAIN             | R106             |
|                     | 10                    |             | REAR PANEL   | Connect an ammeter between the AC POWER SUPPLY and the transceiver.   |                  | Less than 12A    |
| TRANSMIT START TIME | 1                     | MAIN        | Connect lead of an oscilloscope to the cathode of D13.   | 19ms<br><br>D13 SEND LINE<br>J8 OUTPUT POWER | MAIN             | R451             |
|                     |                       |             | Connect other lead of an oscilloscope to J8.   |   |                  |                  |
| FM DEVIATION        | 1                     | REAR PANEL  | Connect a deviation meter to the ANTENNA CONNECTOR through an attenuator.  | ±4.7kHz   | MAIN             | R292             |

## MAIN UNIT

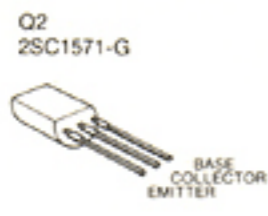
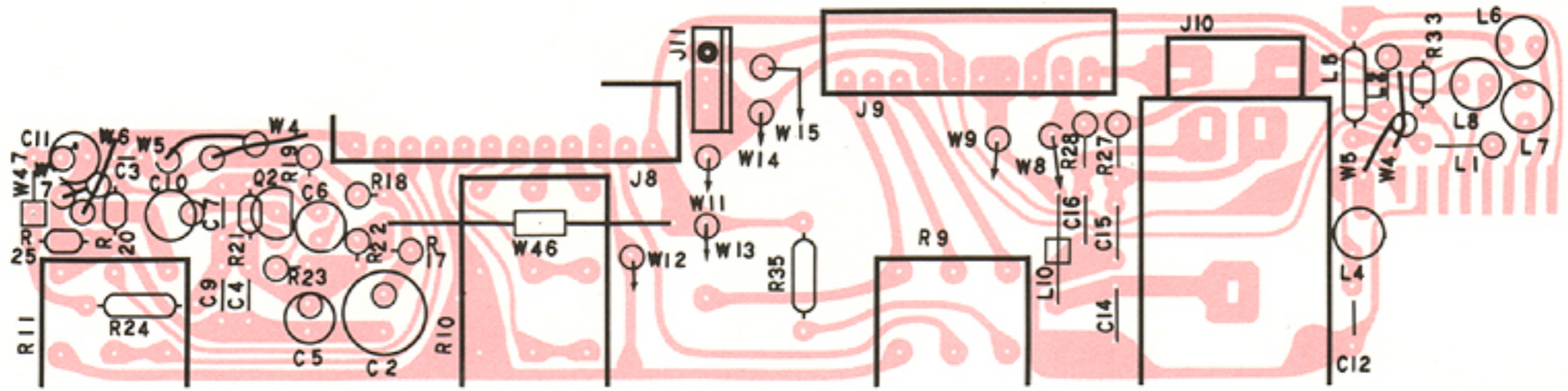


## RF UNIT

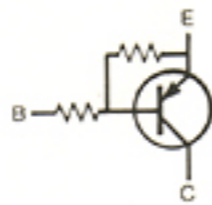
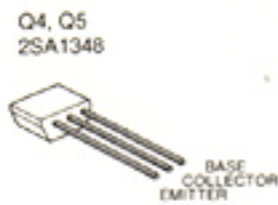
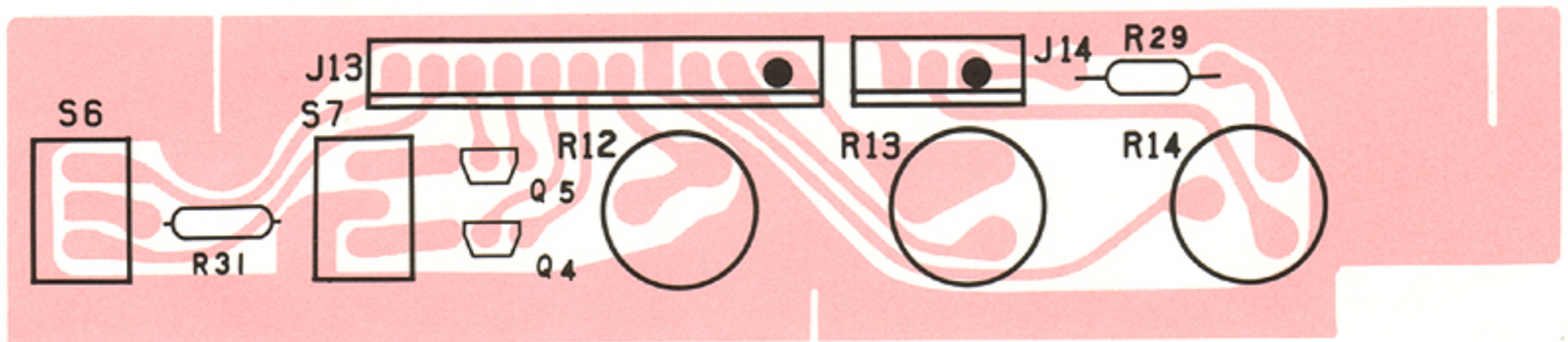


# SECTION 7 BOARD LAYOUTS

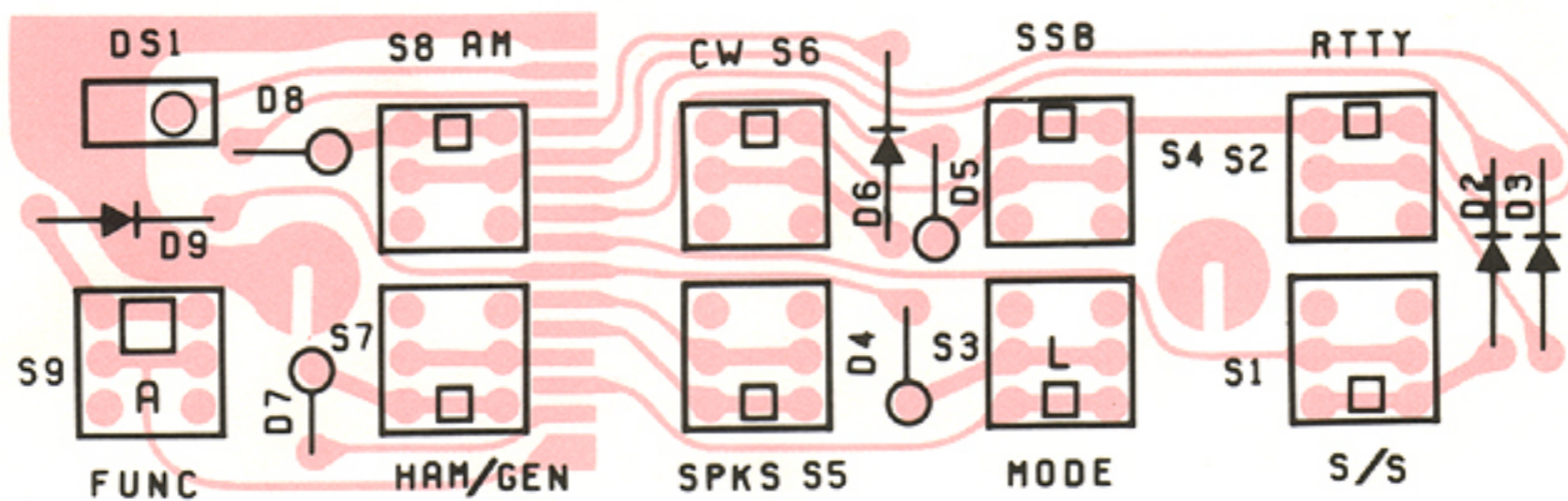
## 7 - 1 FRONT AF UNIT



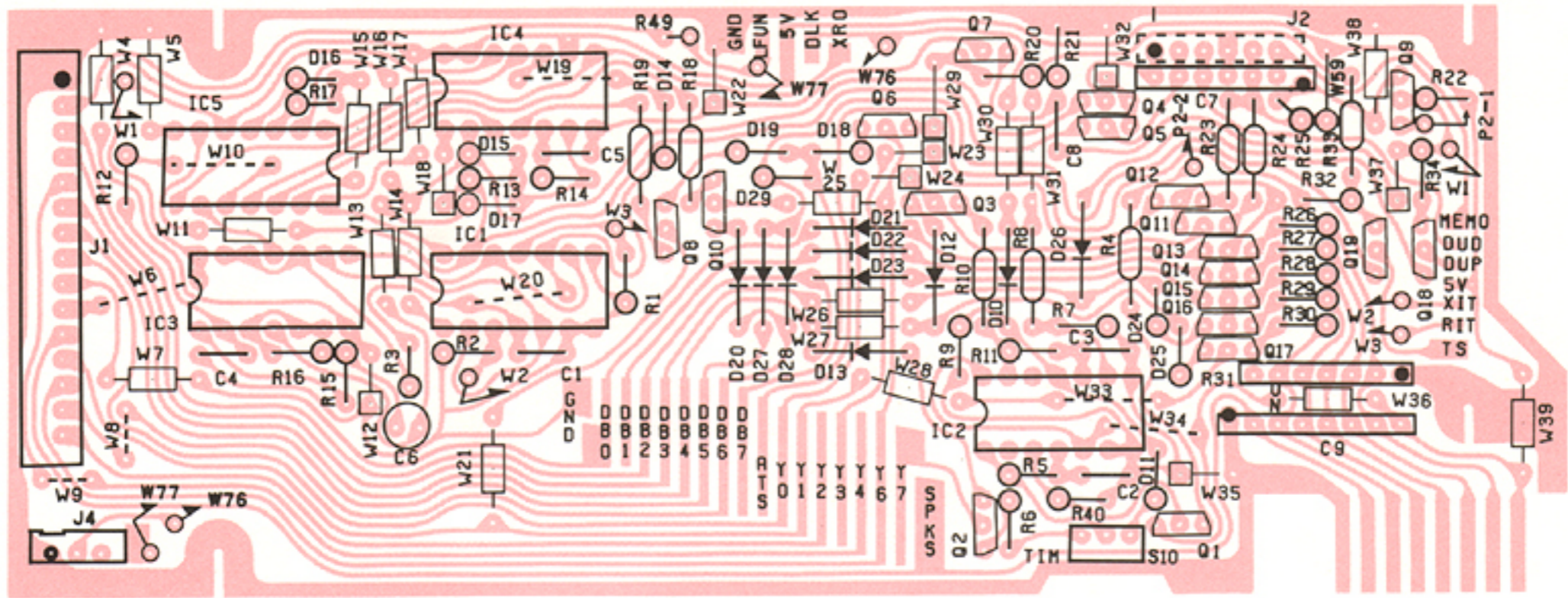
## 7 - 2 FRONT MARKER UNIT



## 7 - 3 FRONT MODE SWITCH UNIT



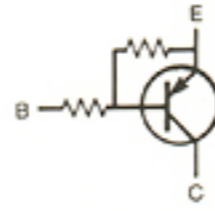
# 7 - 4 MATRIX UNIT



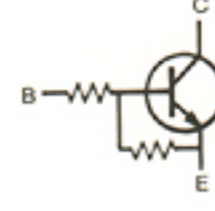
Q2, Q3, Q6, Q8, Q10, Q13-Q19  
2SC2458-GR



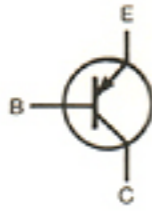
Q23, Q24  
2SA1348



Q4, Q5, Q9  
2SC3399



Q1, Q7  
2SA1048

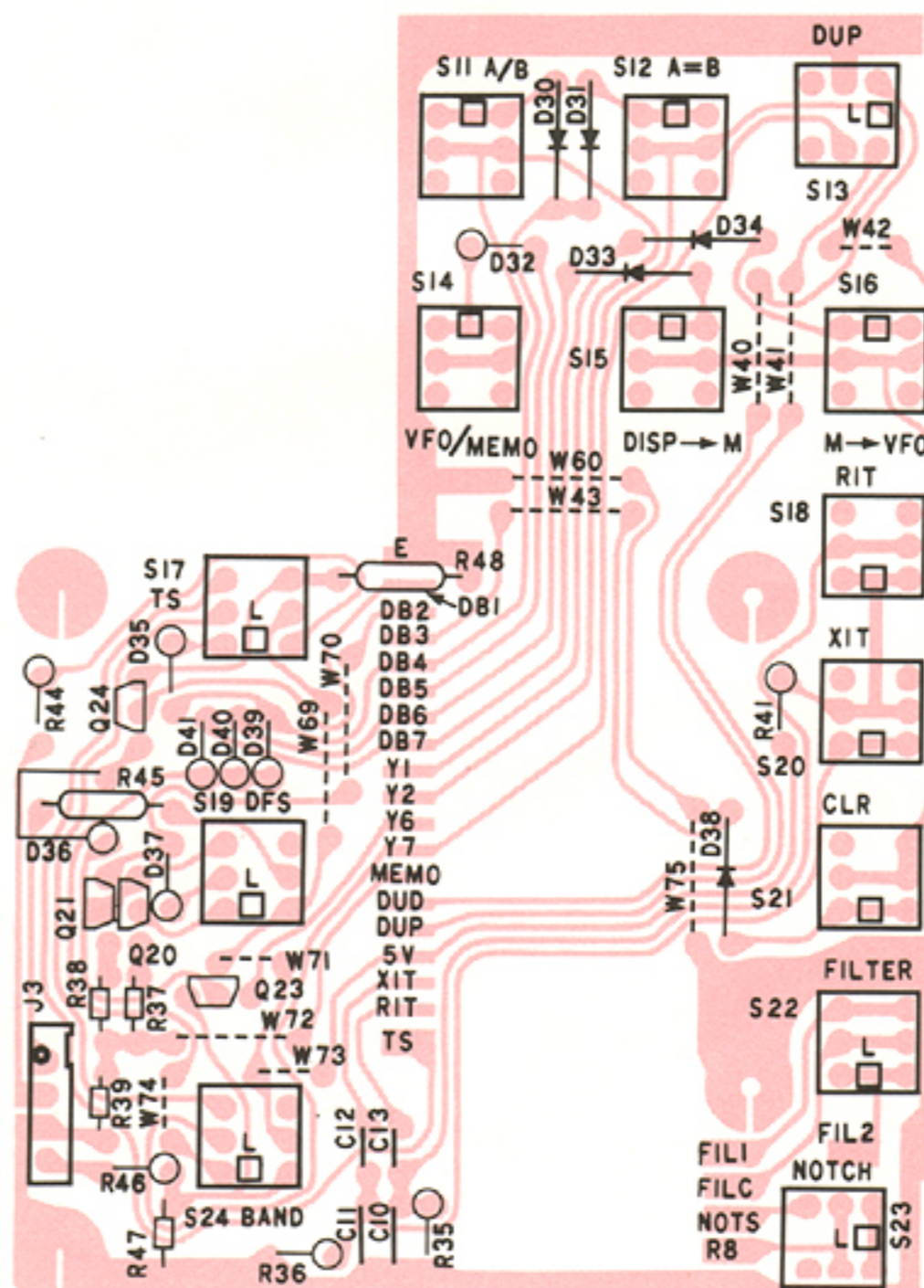
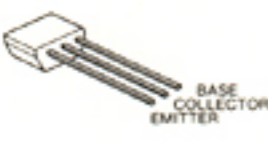


# 7 - 5 MATRIX SWITCH UNIT

Q20  
2SA1048

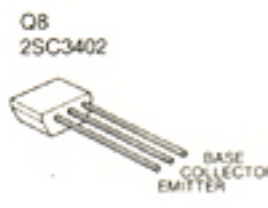
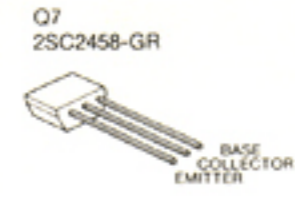
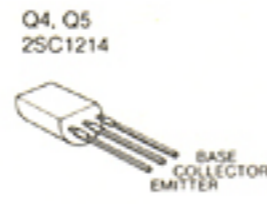
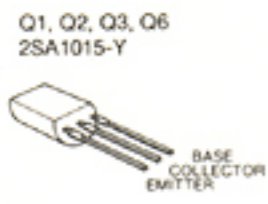
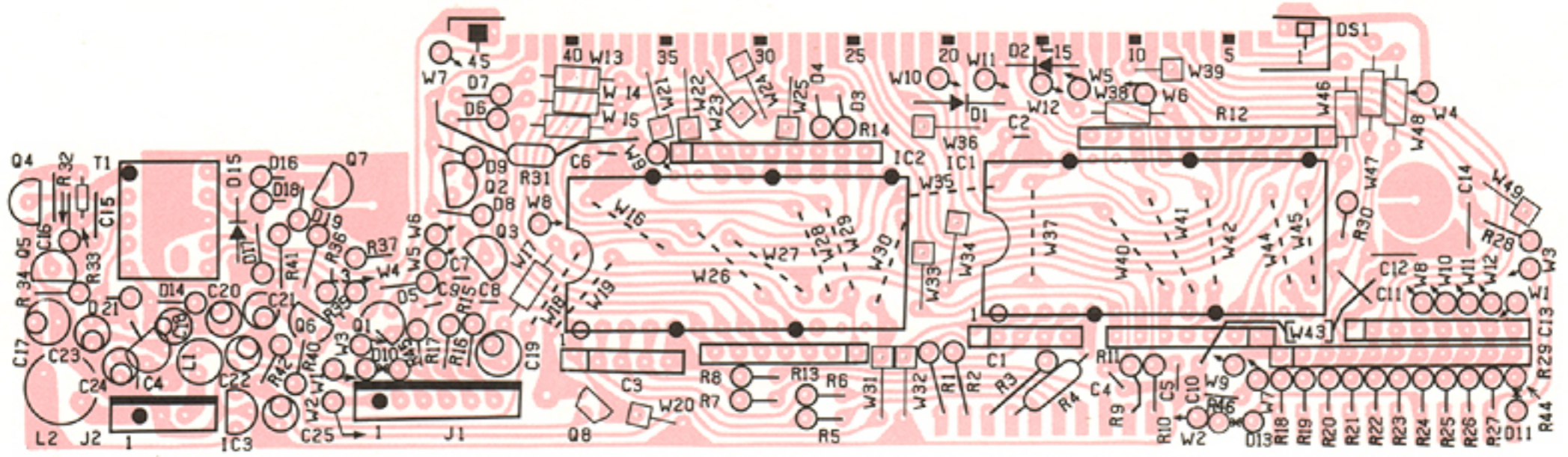


Q21  
2SC2458-GR

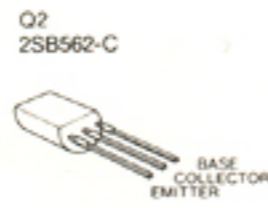
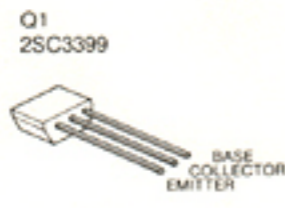
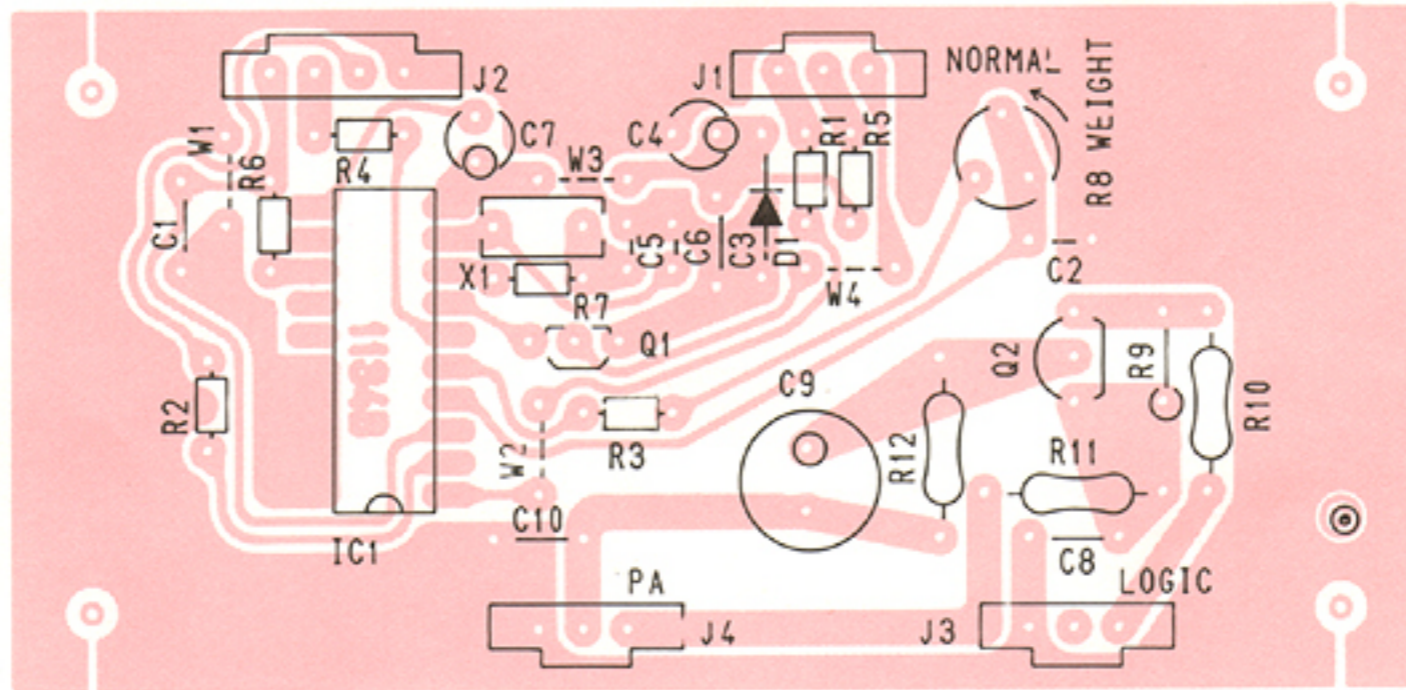


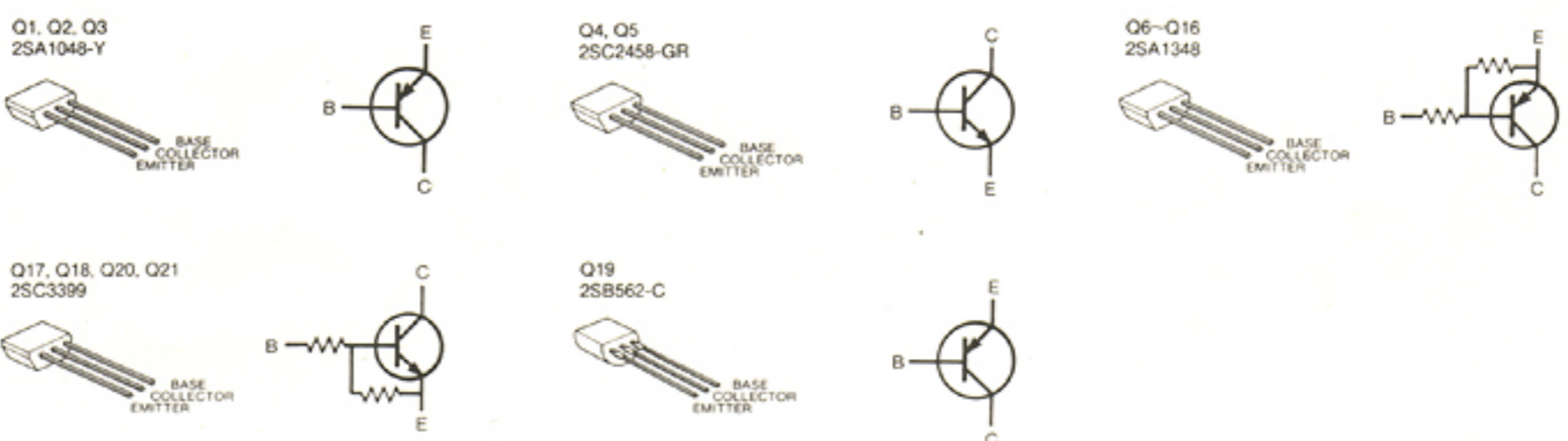
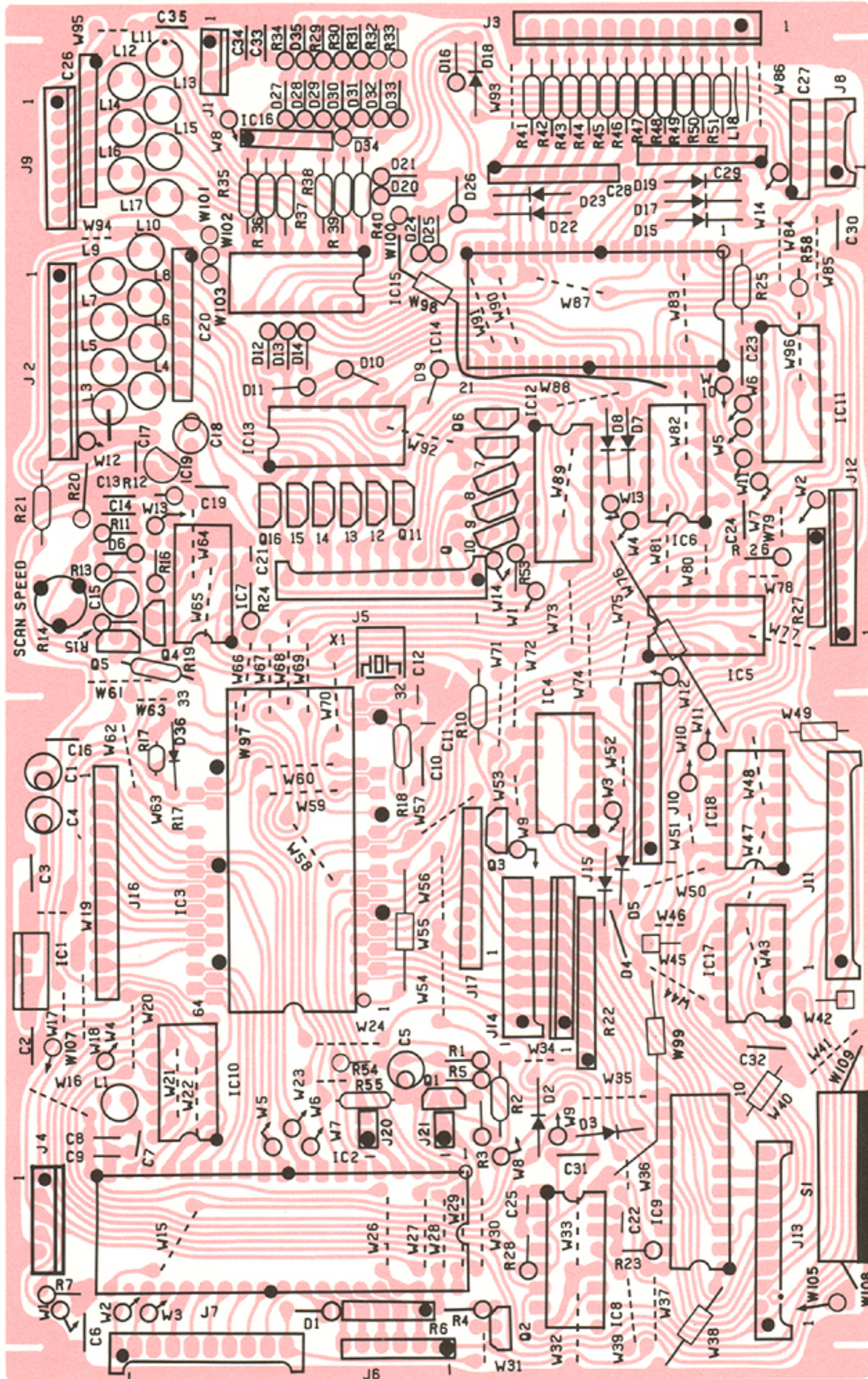


# 7-6 DISPLAY UNIT

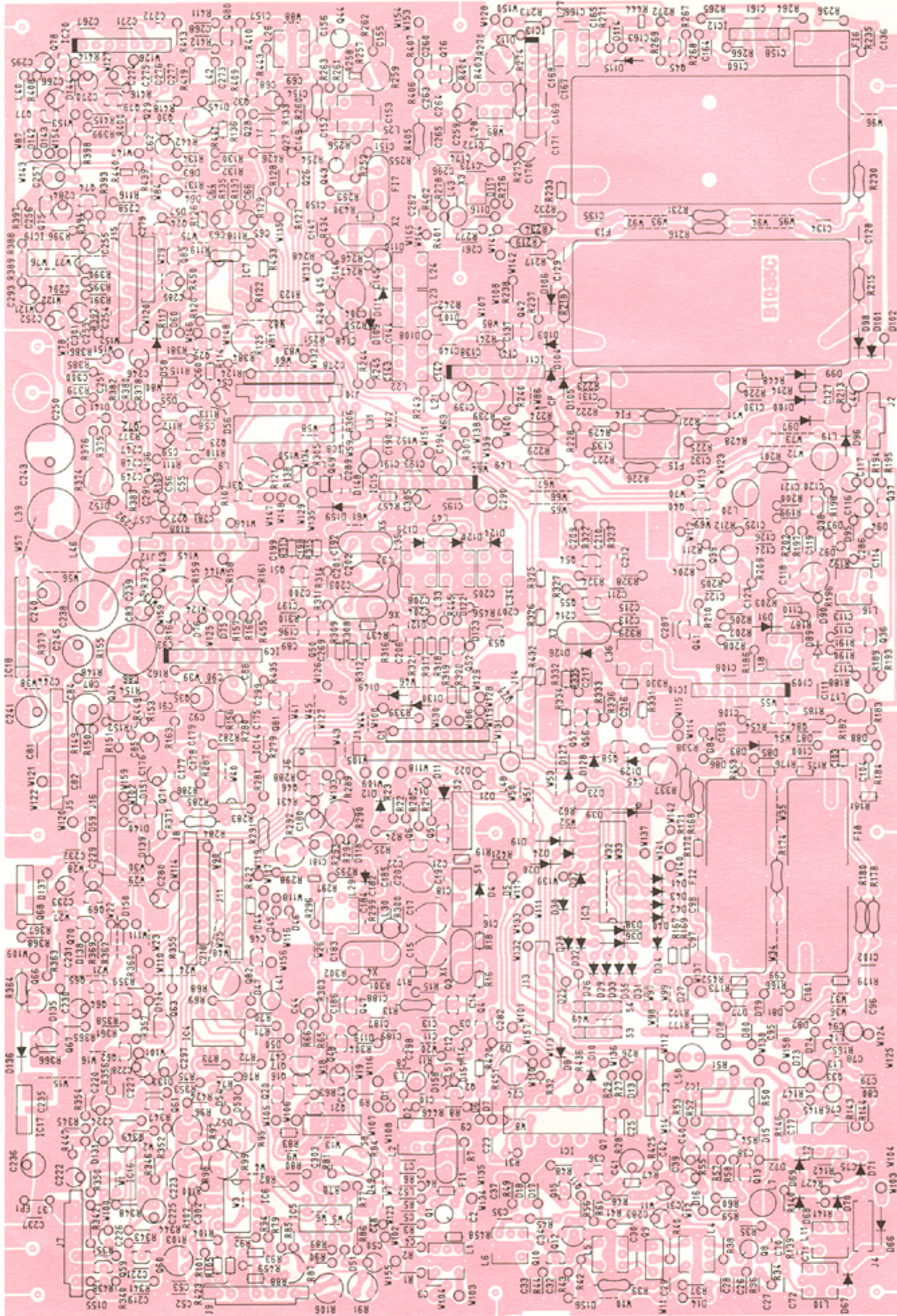


# 7-7 KEYSER UNIT

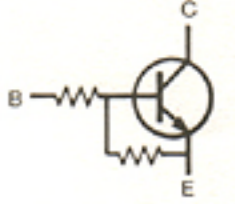




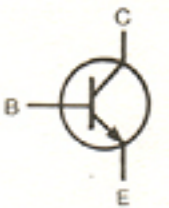
# 7-9 MAIN UNIT



Q4, Q5, Q20, Q21, Q25,  
Q41, Q48, Q52, Q53, Q56  
Q57, Q69, Q74, Q75, Q81  
25C3402



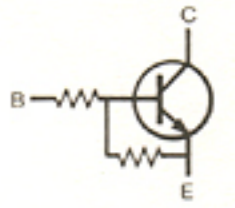
Q6, Q7, Q11, Q22, Q23, Q32,  
Q35, Q37, Q46, Q60, Q62, Q64,  
Q65, Q67, Q70, Q76, Q78, Q79  
25C2458



Q12, Q15, Q17  
25C2878



Q29, Q31, Q40  
Q71, Q77, Q83  
25C3399



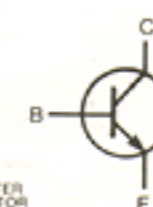
Q34  
25C1571



Q63, Q66  
25D468-C



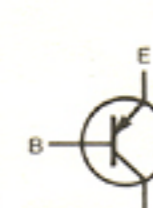
Q68  
25D880-Y



Q2, Q49  
25K241-Y



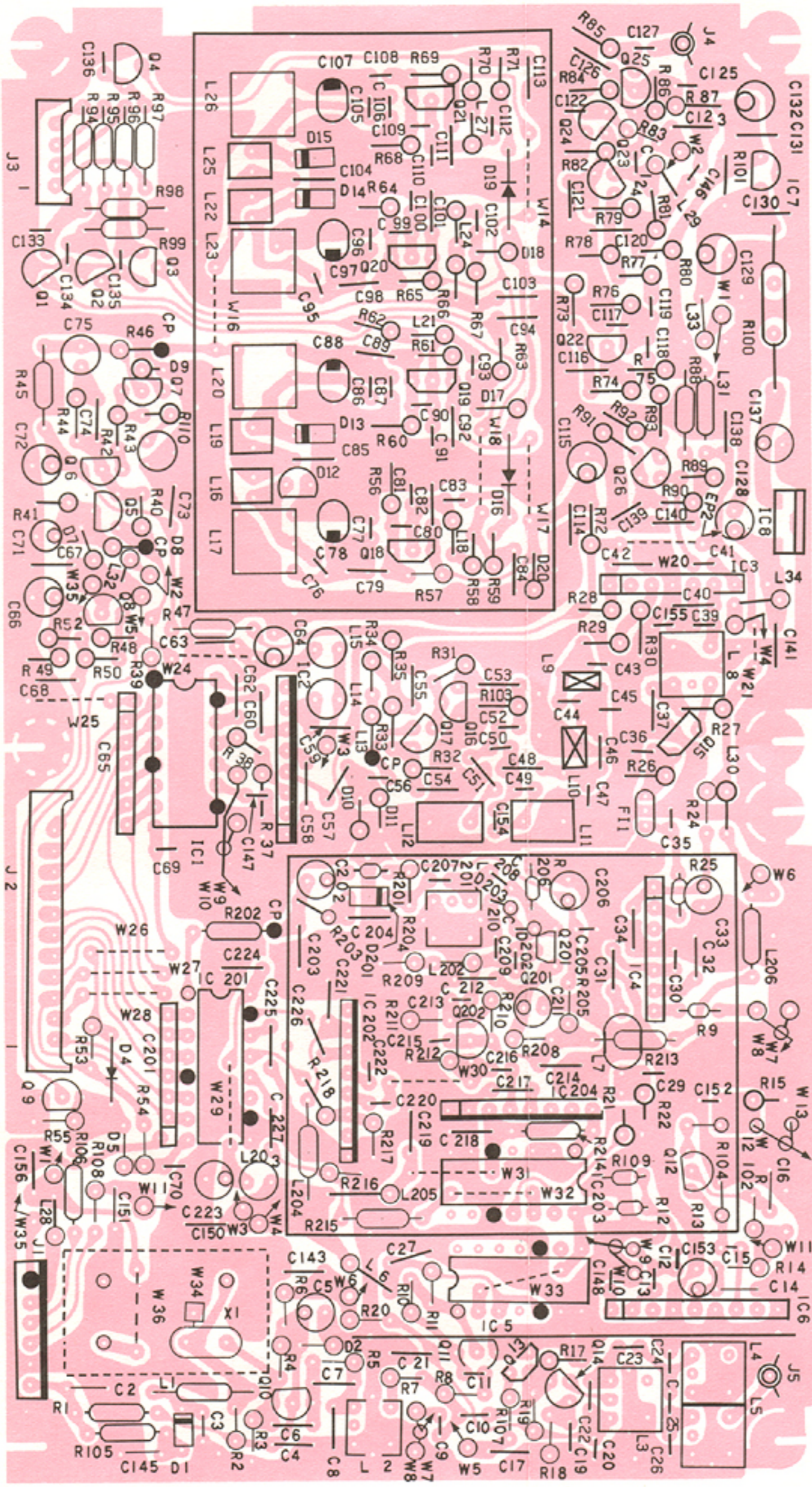
Q13, Q26, Q27, Q28,  
Q58, Q61, Q82  
25A1048-GR



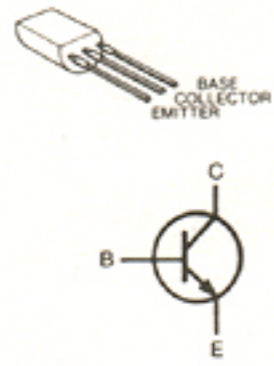
Q1, Q8, Q33, Q39,  
Q43, Q44  
3SK74-M (FET)



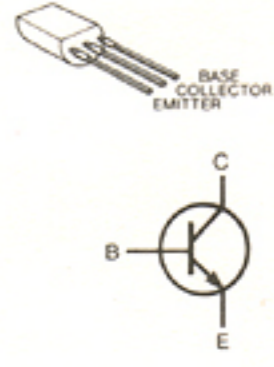
7-10 PLL UNIT



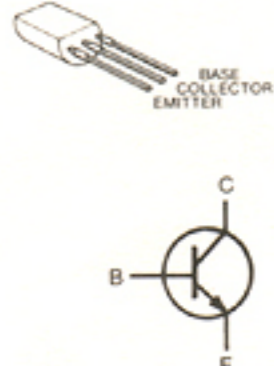
Q1-Q4, Q9, Q10  
2SC945-P



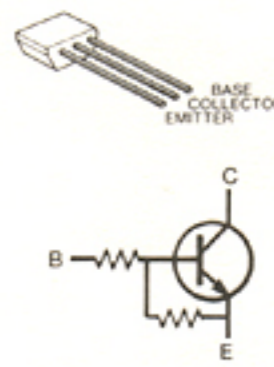
Q7  
2SC1571-G



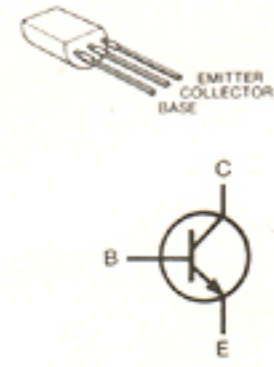
Q11, Q14, Q16, Q17  
Q22, Q23, Q25, Q26  
2SC383-TM



Q13  
2SC3399



Q202  
2SC763-C



Q5, Q6  
2SK30A-Y



Q201  
2SK192A-GR



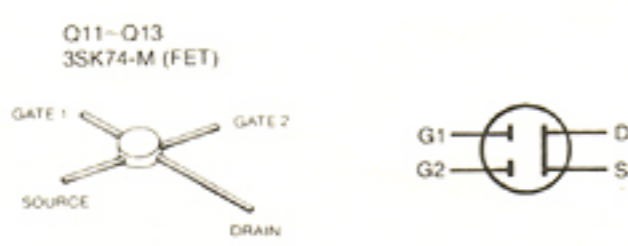
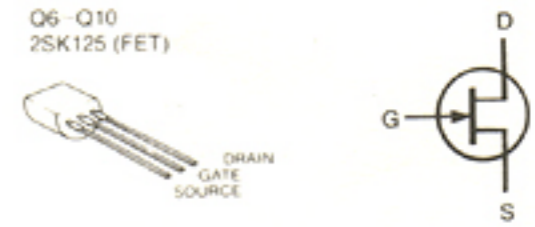
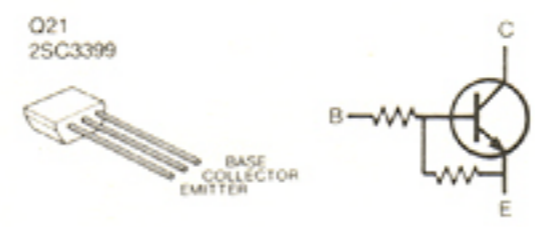
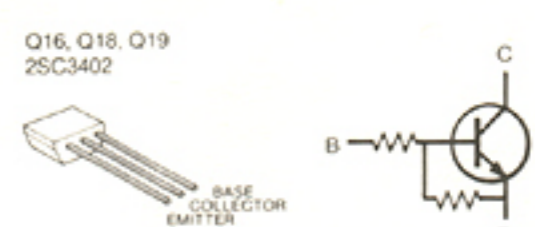
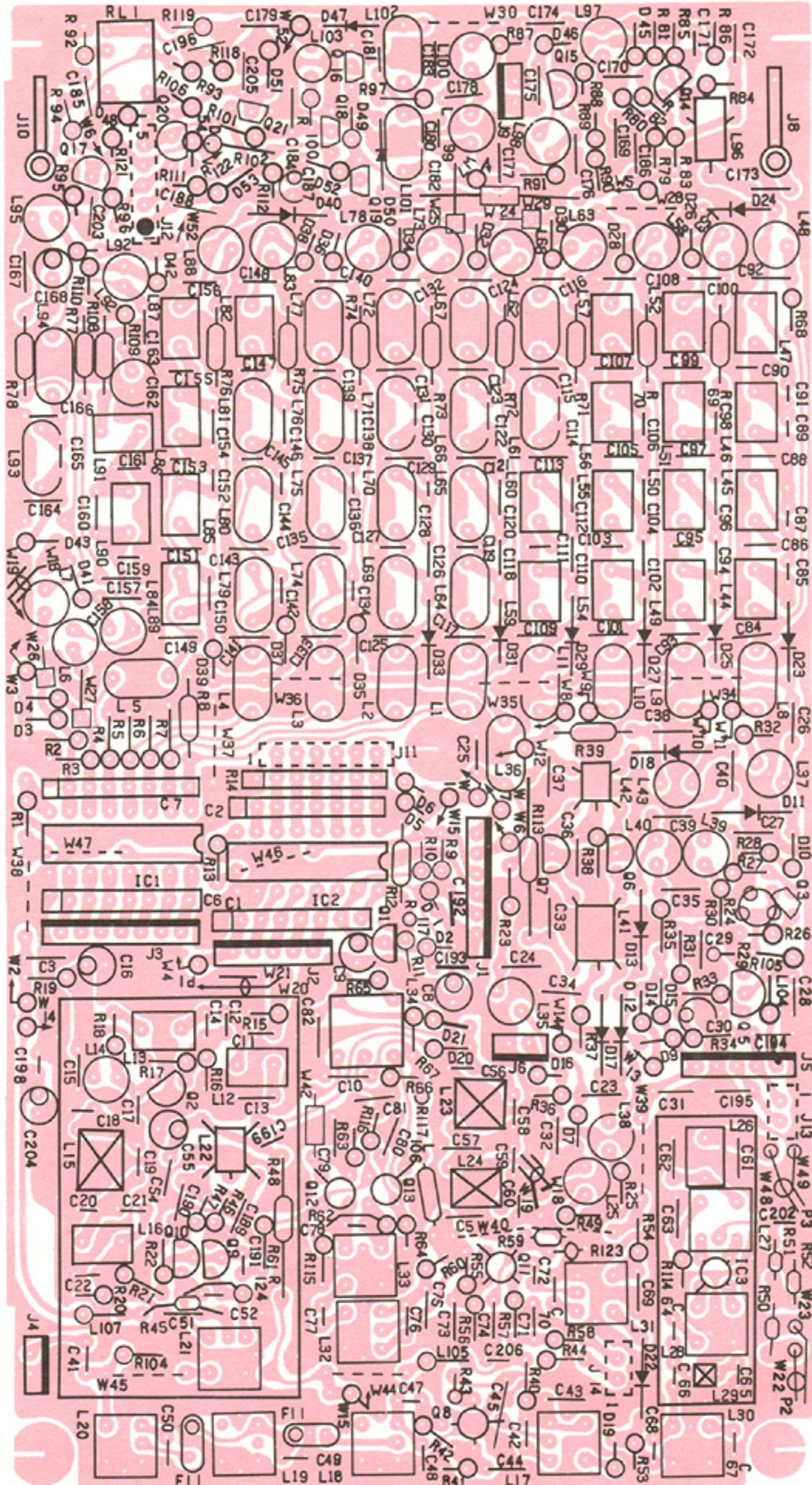
Q15  
2SK241-Y

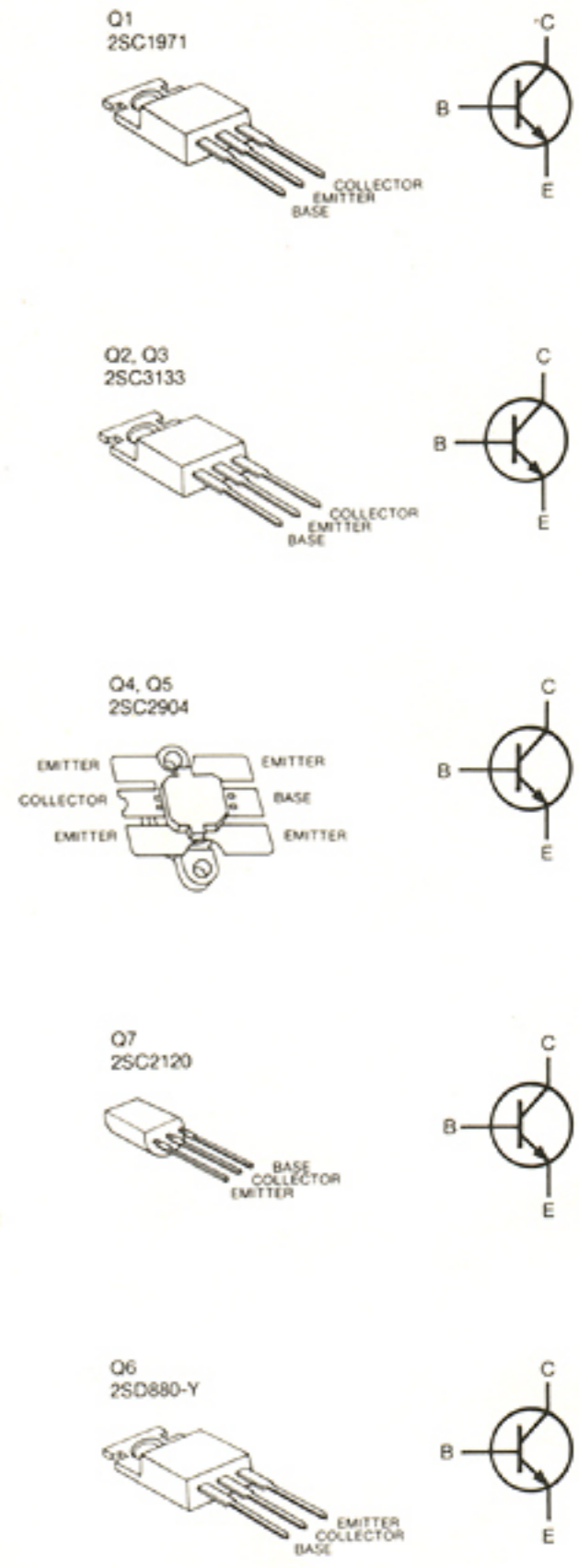
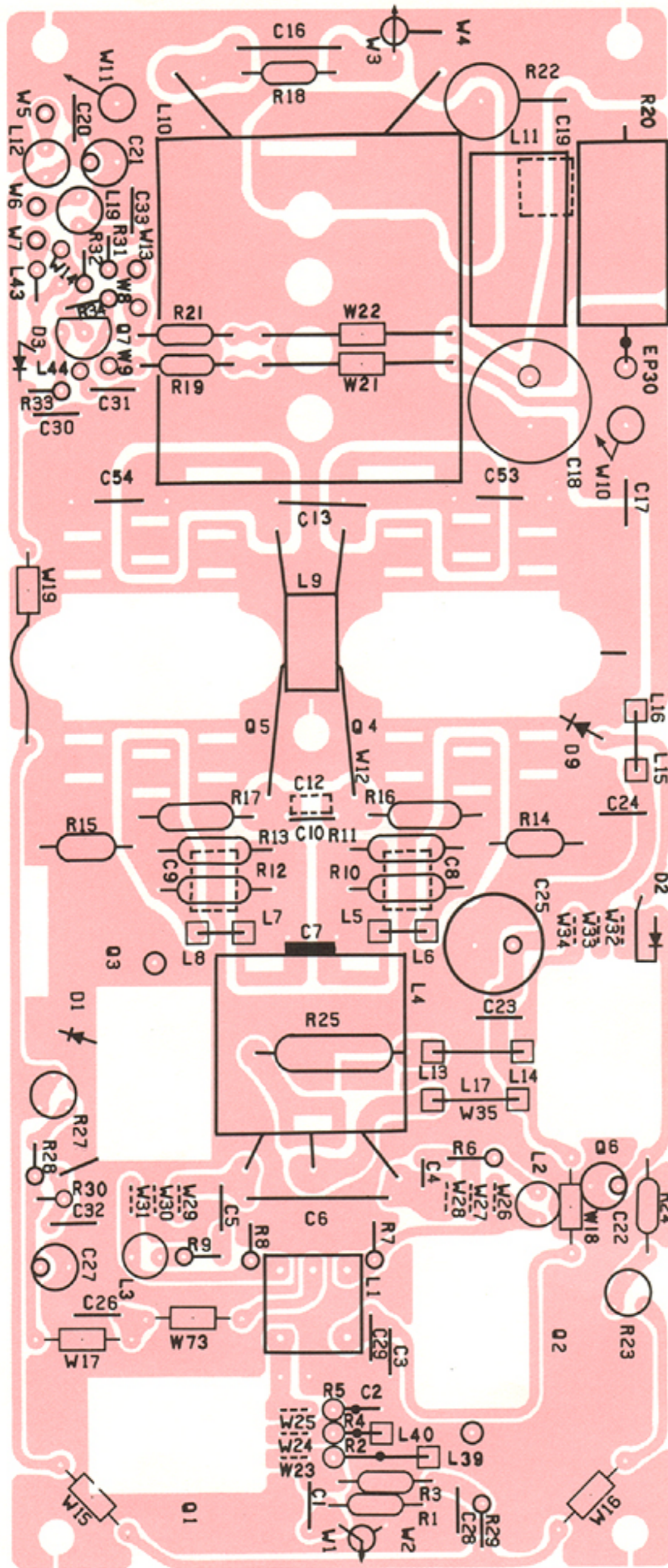


Q8  
2SA1015-Y

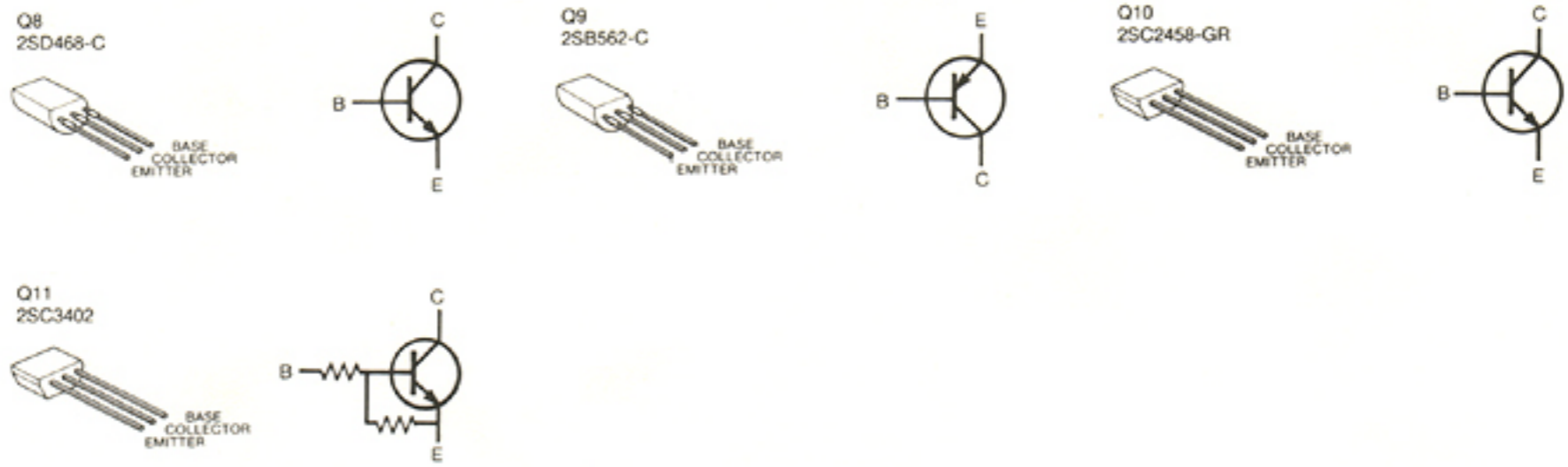
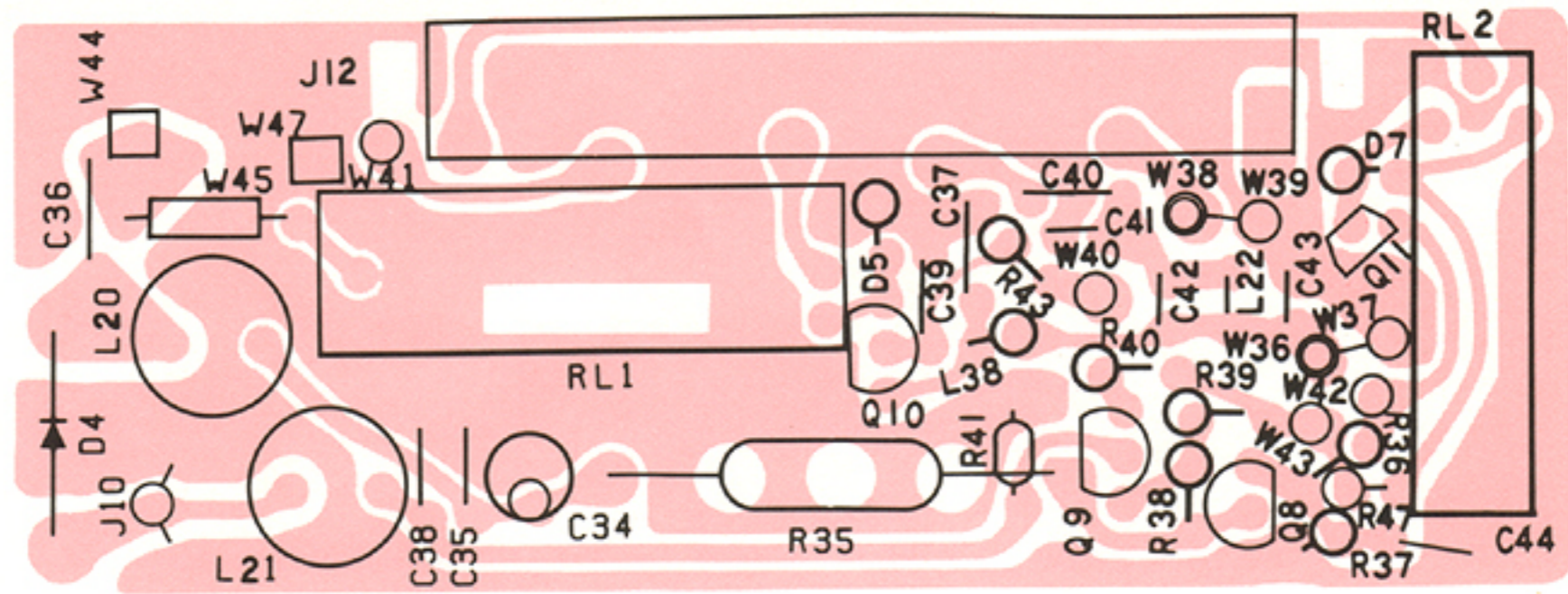


# 7-11 RF UNIT

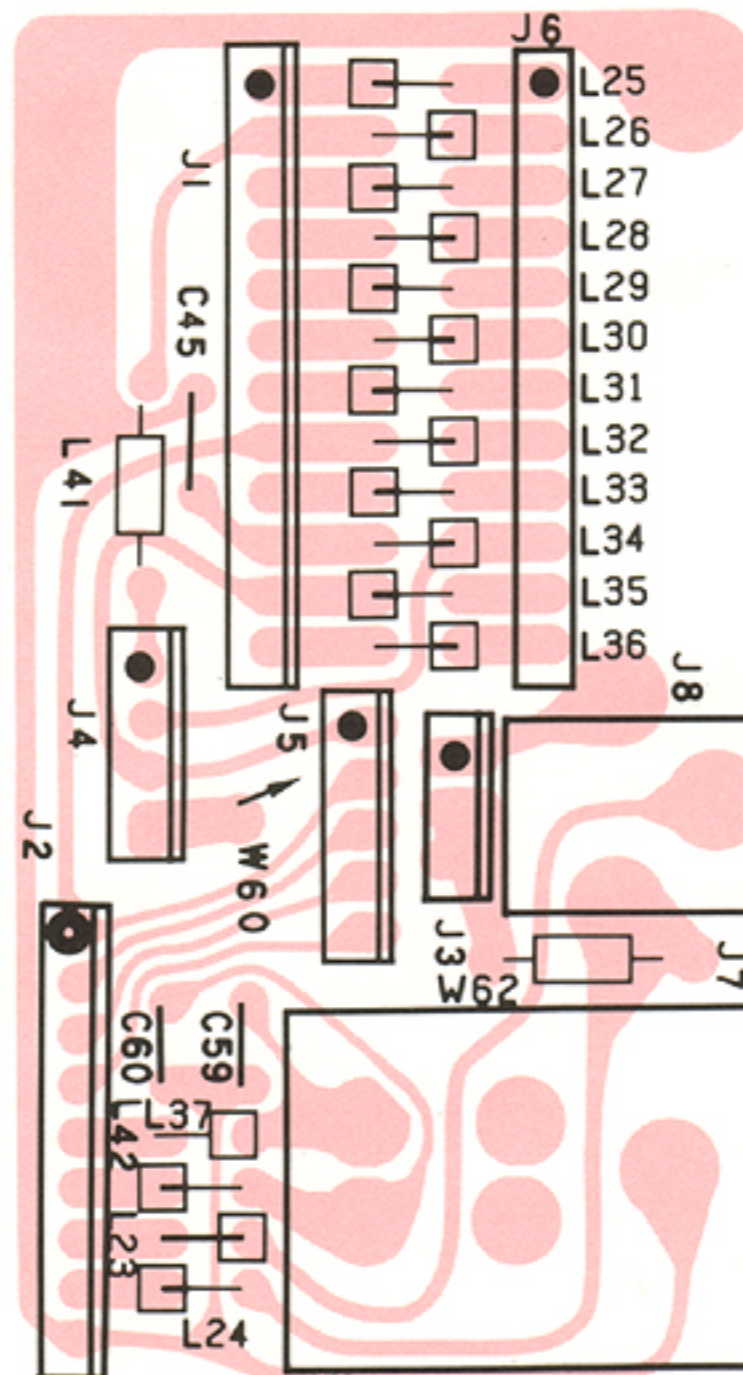




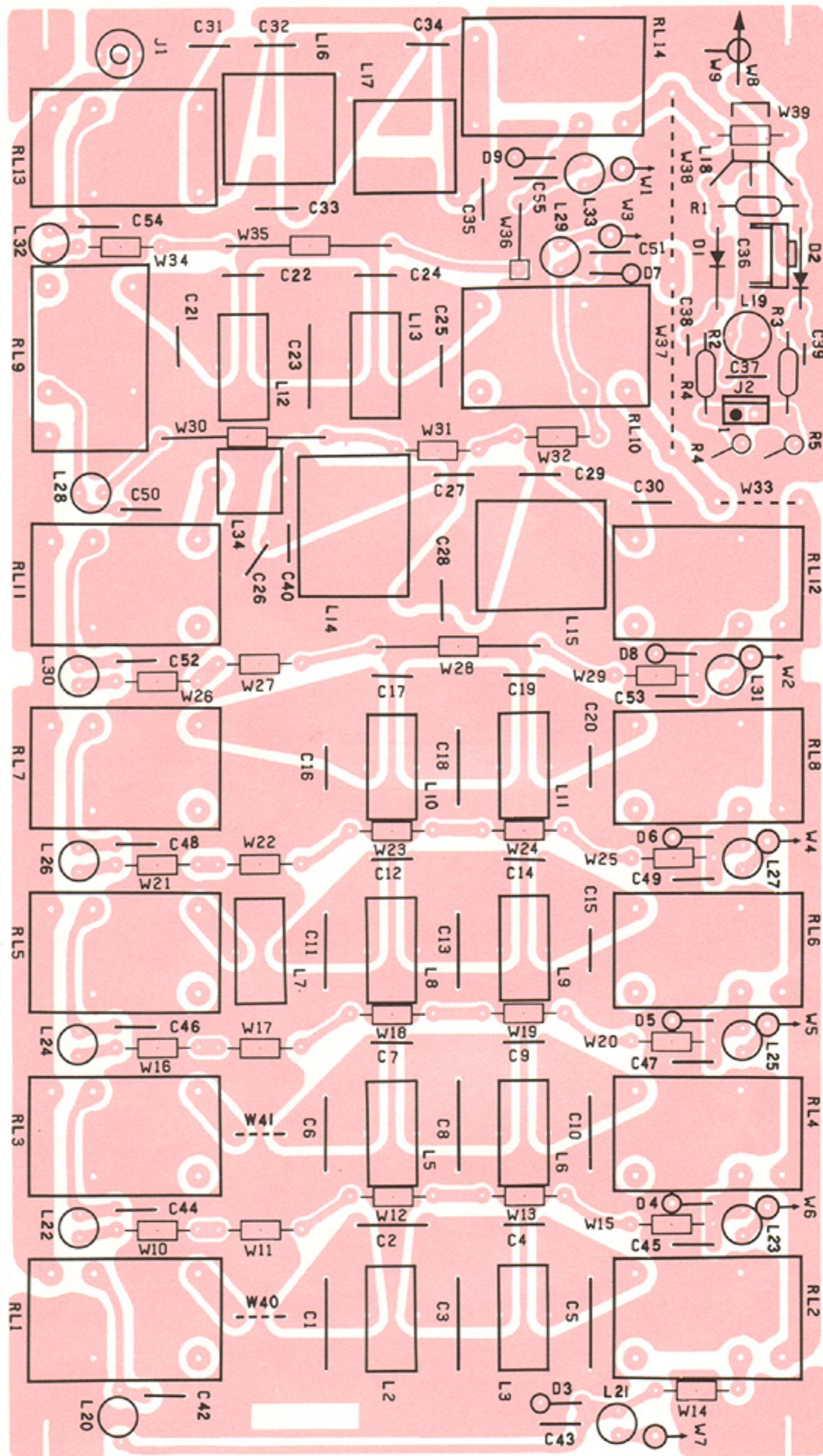
# 7 - 13 PA CONNECTOR UNIT



# 7 - 14 PA CHOKE UNIT



7 - 15 FILTER UNIT





# SECTION 8 VOLTAGE/CIRCUIT DIAGRAMS

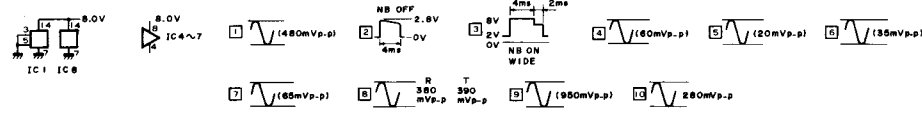
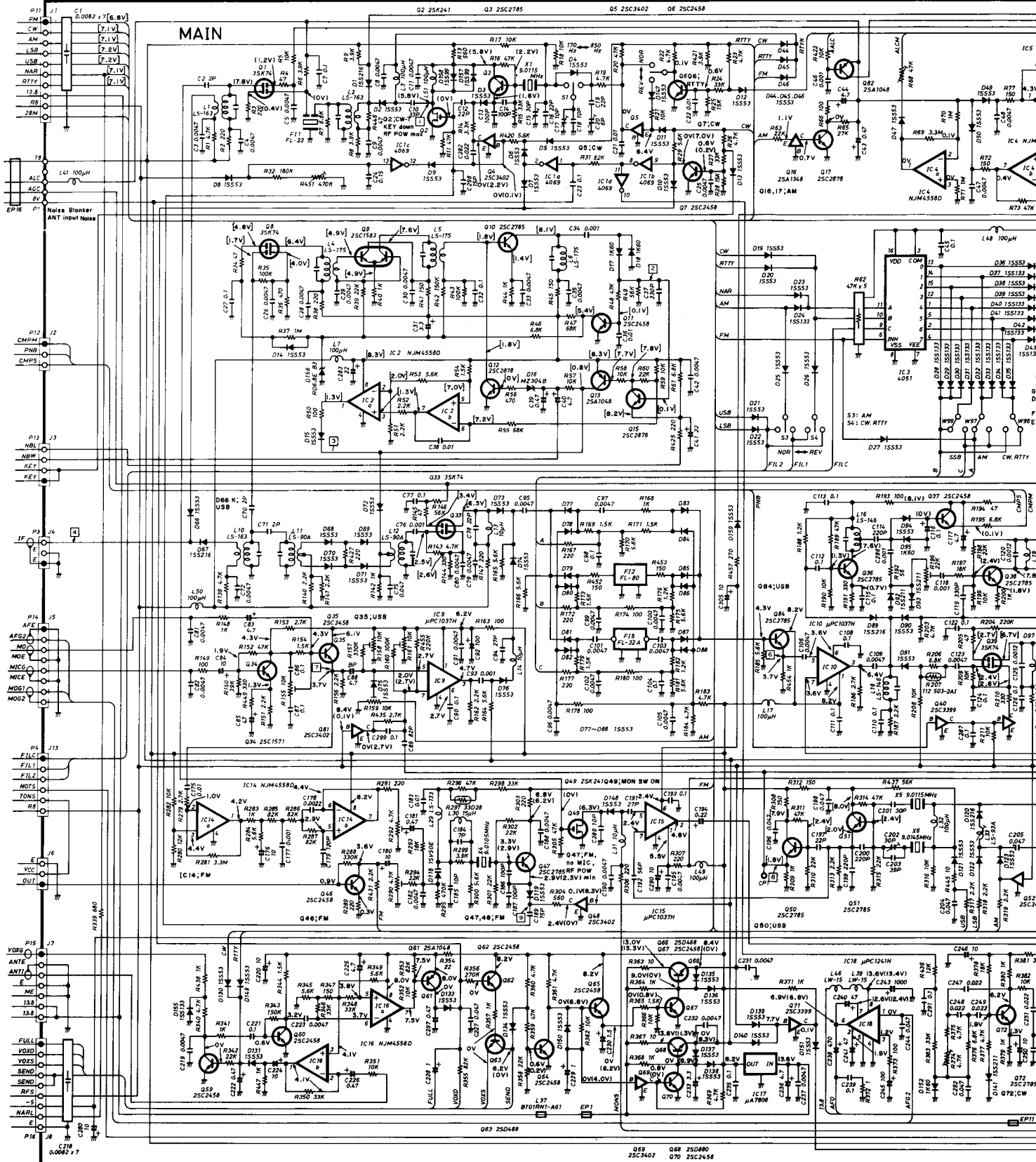
## 8-1 MAIN UNIT

Condition of Measurement

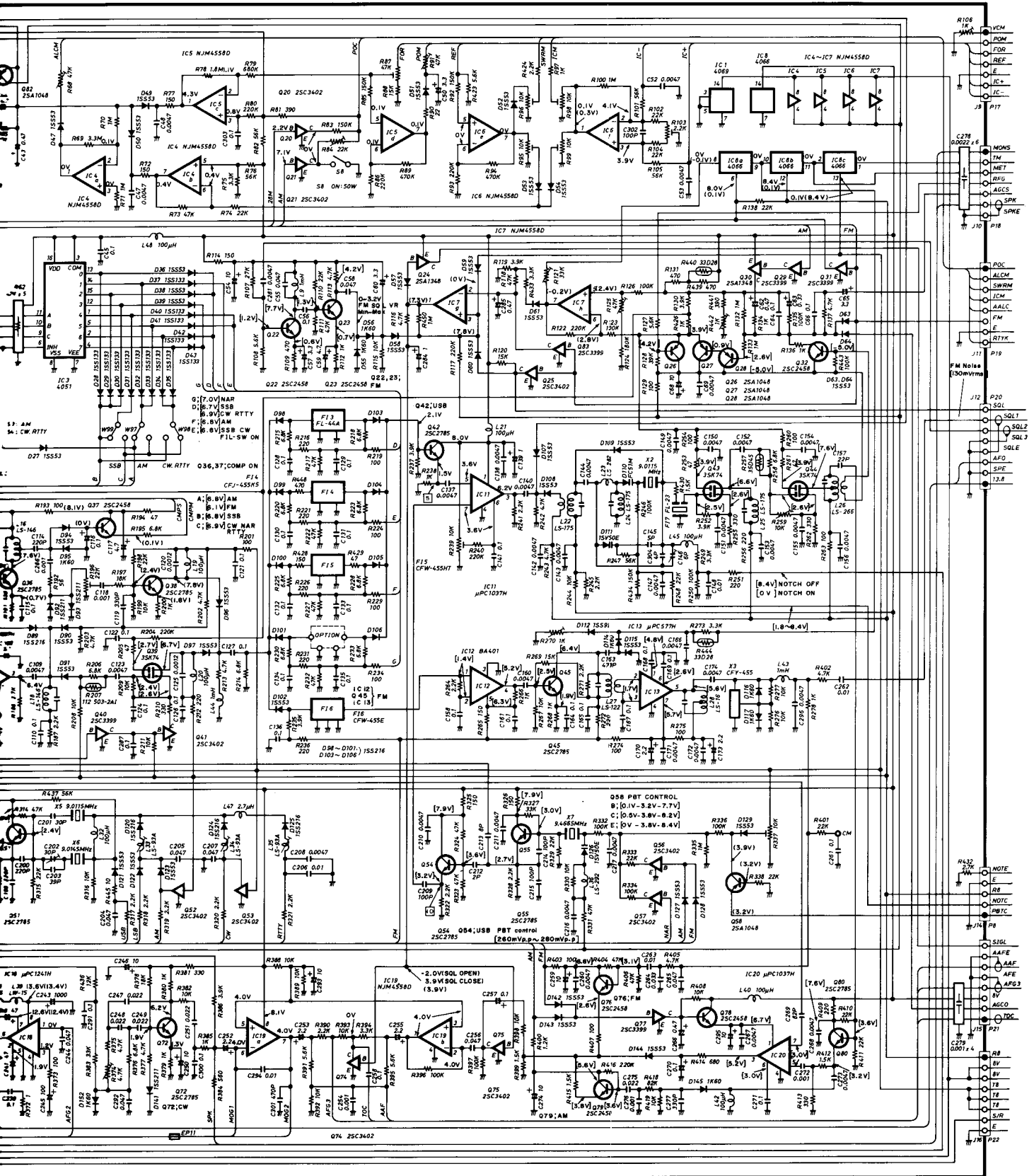
.TX  
USB 14.097MHz no modulation  
(RF POWER CONT. MAX DELAY: FULL)  
MIC GAIN: CENTER  
VOX GAIN: OFF

.RX  
USB 14.097MHz  
(RF GAIN: MAX AGC: OFF)  
TONE CONTROL: CENTER NR: OFF

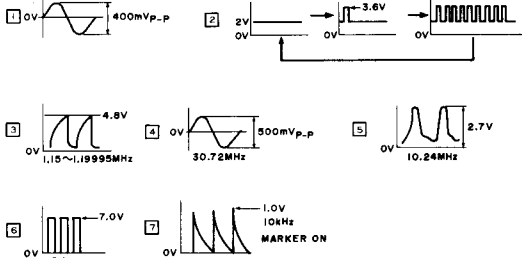
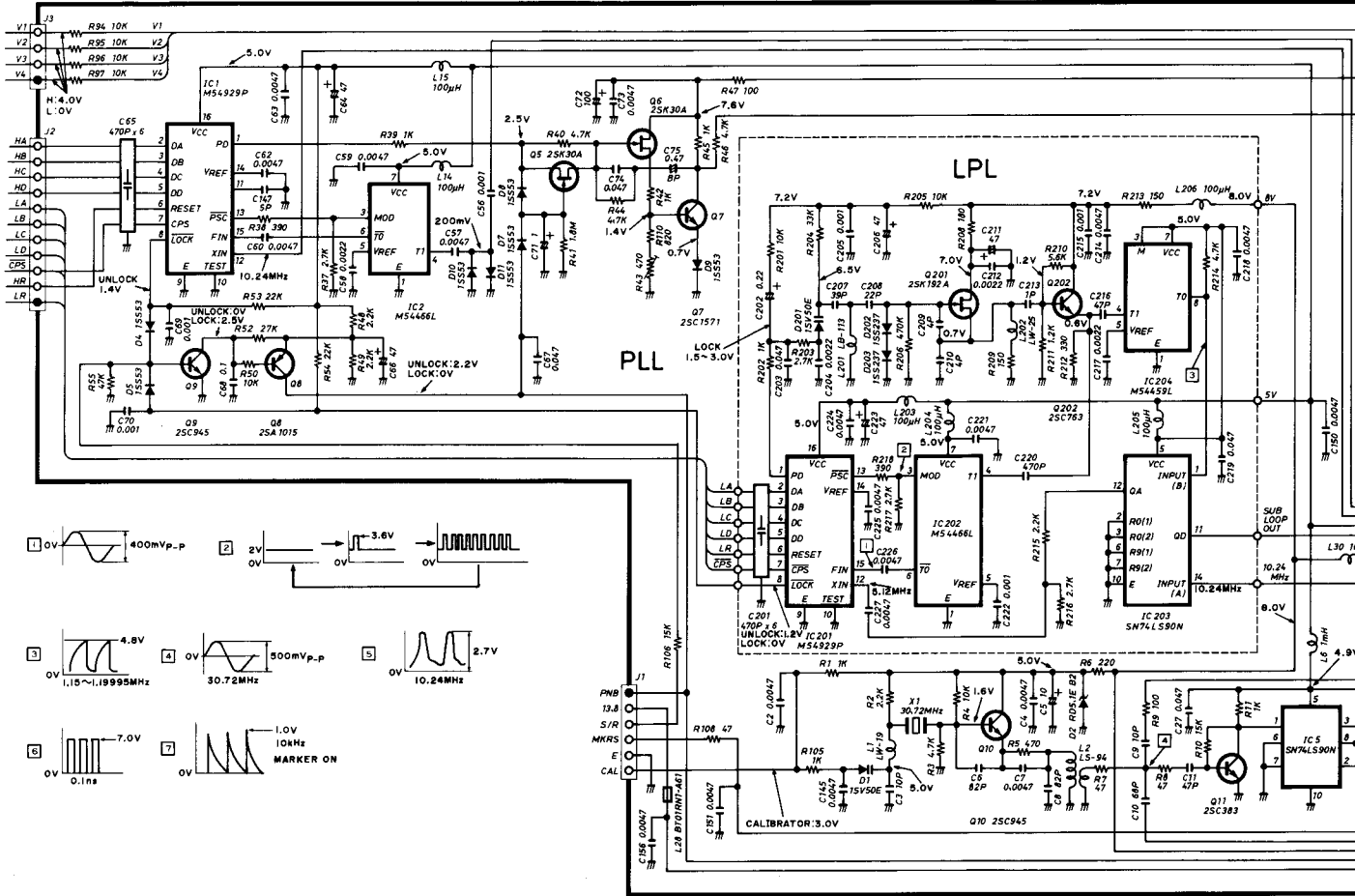
Note  
1: Measure with Tester 50Ω/V  
L = R X  
A(B) = A - RX, B - TX  
C = RX, TX common.



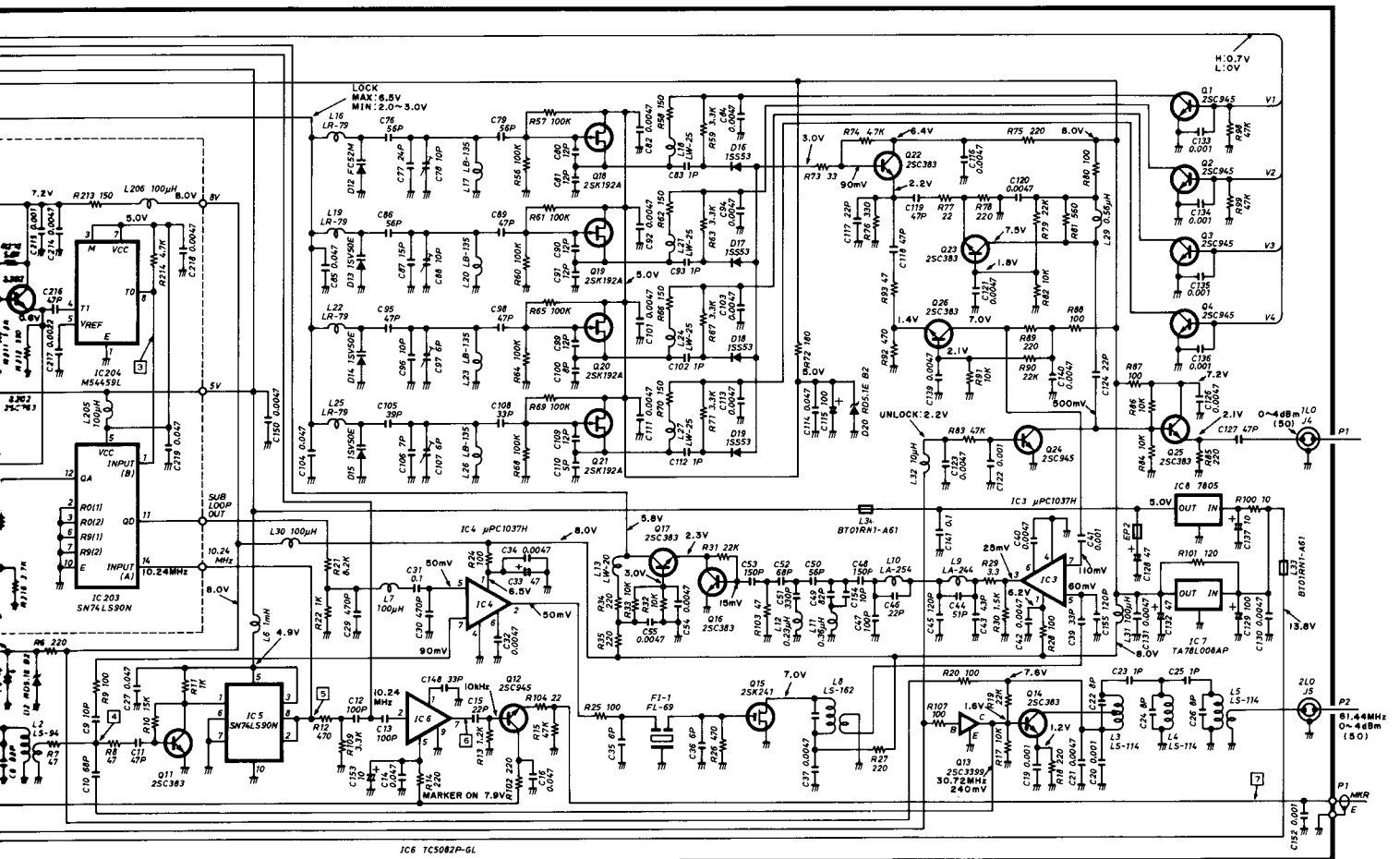
| IC7  | SQL open | SQL closed |
|------|----------|------------|
| HIGH | 3.4V     | 7.3V       |
| 2    | 0V       | 0V         |
| 3    | 0.4V     | 2.4V(max)  |
| 4    | 5.0V     | 5.0V       |
| 5    | 2.4V     | 2.4V       |
| 6    | 2.8V     | 2.8V       |
| 7    | 0.1V     | 0.1V       |
| 8    | 8.1V     | 8.1V       |

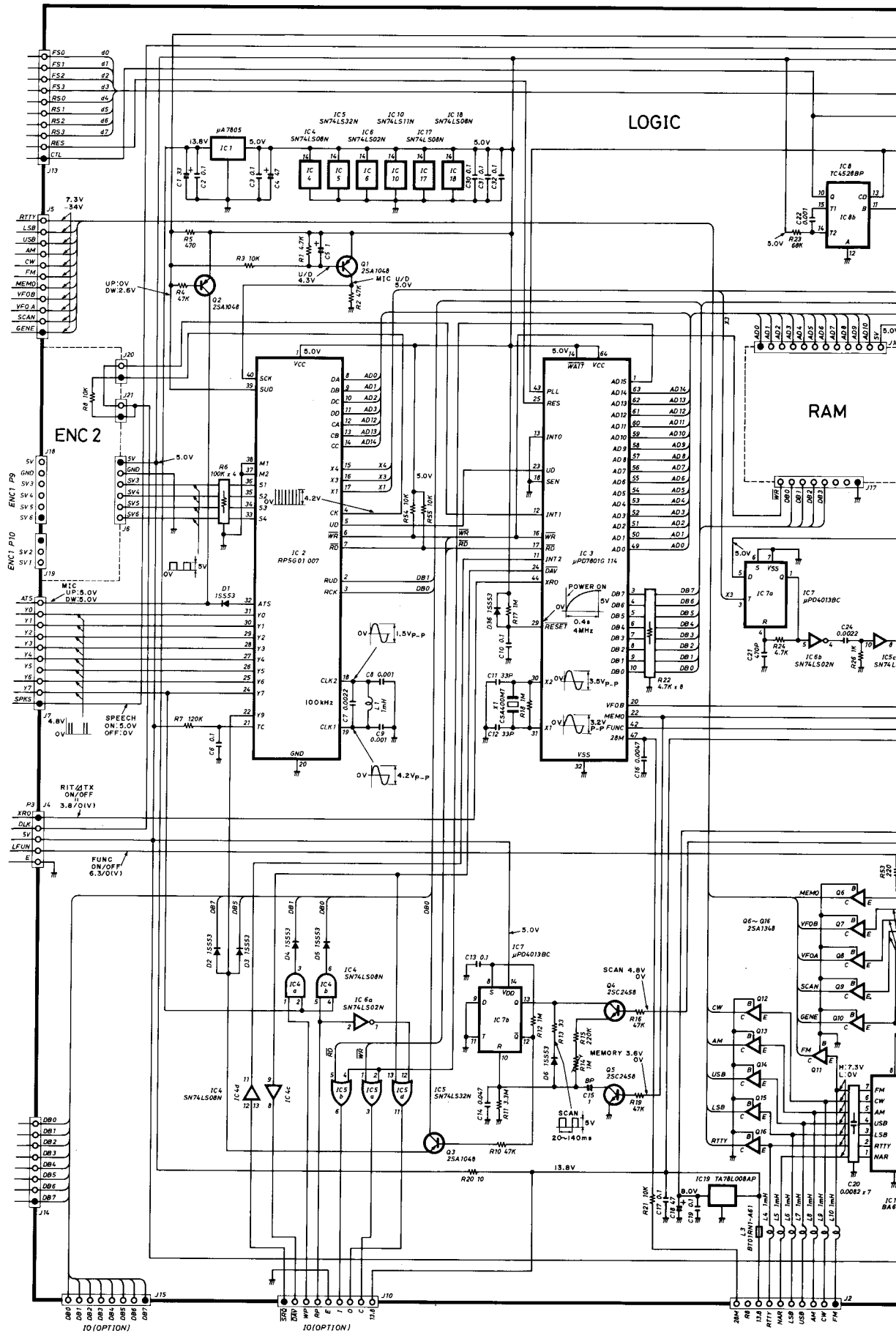


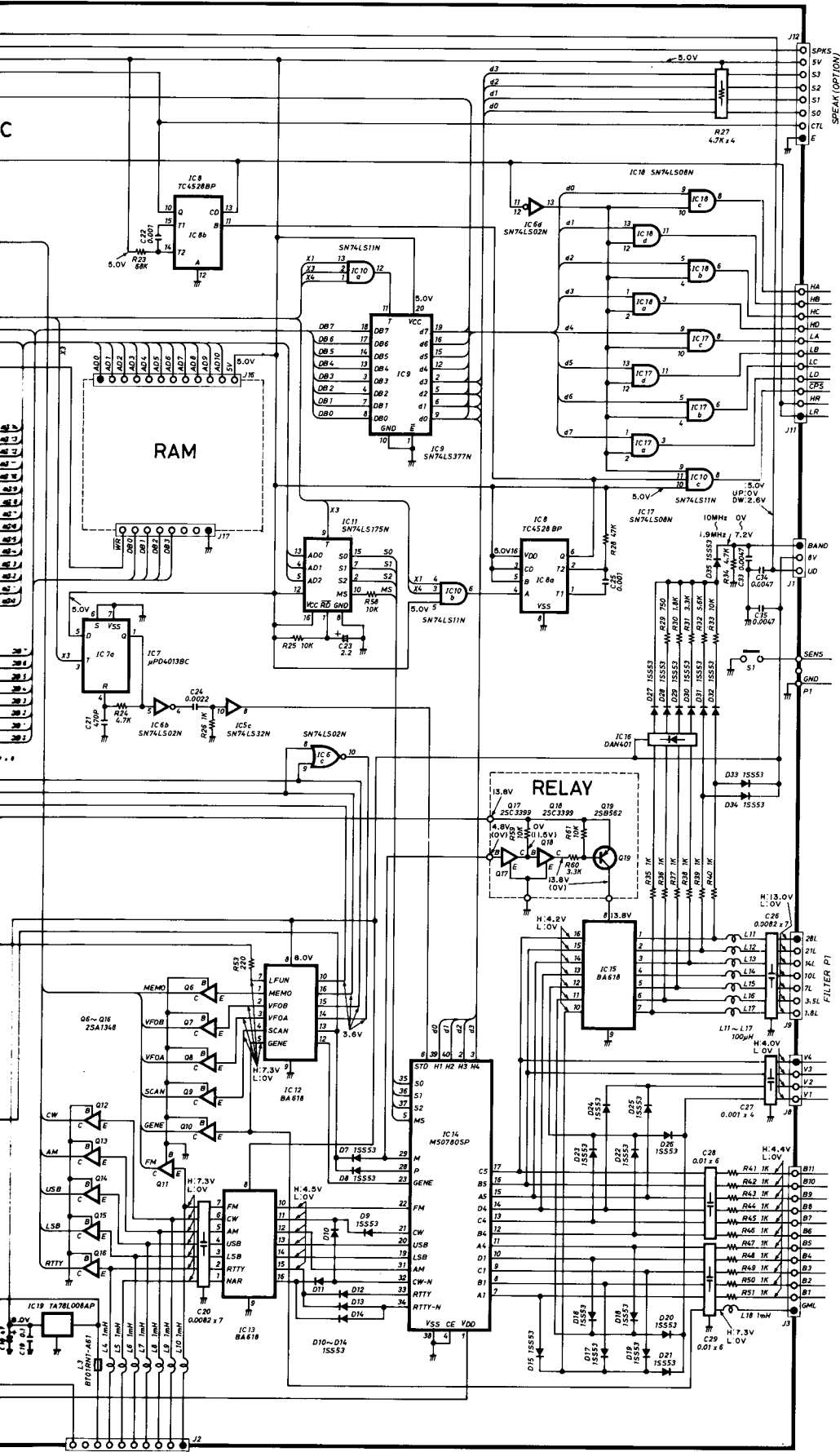
# 8-2 PLL UNIT

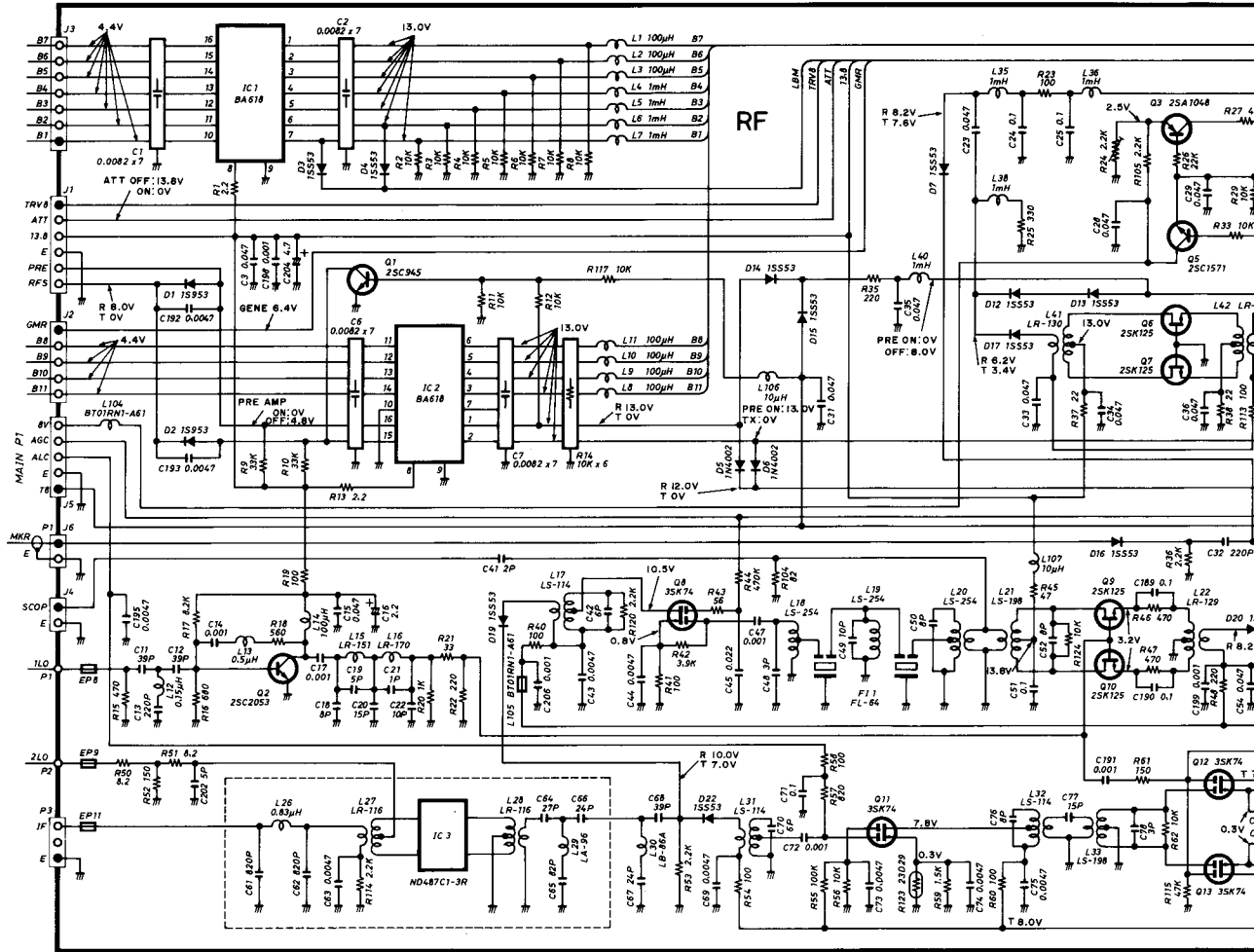


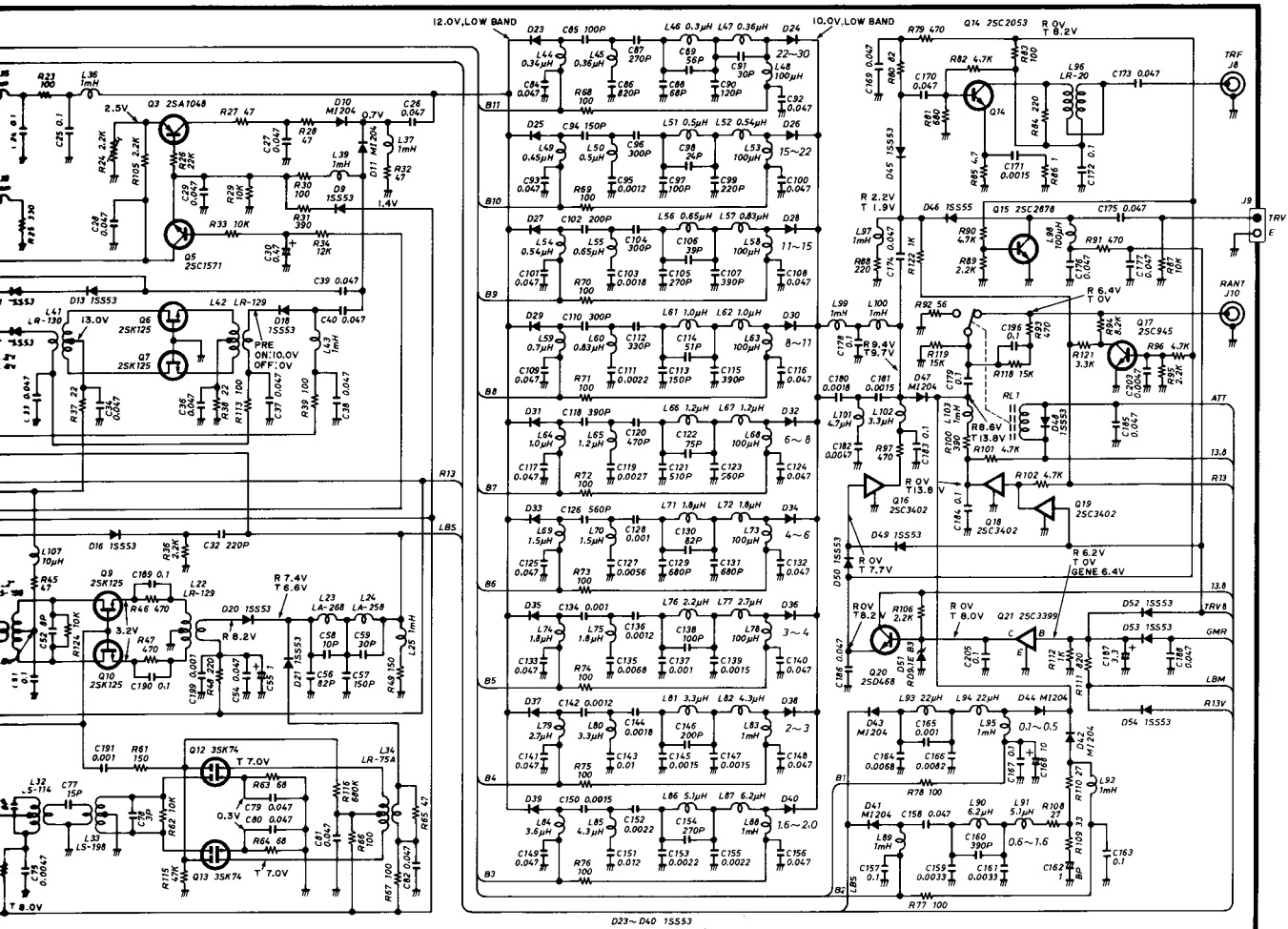
CALIBRATOR: 3.0V





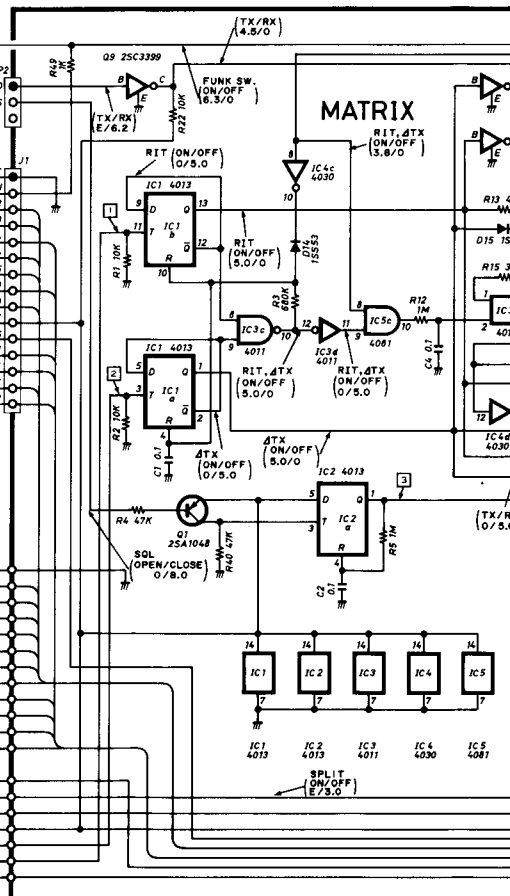
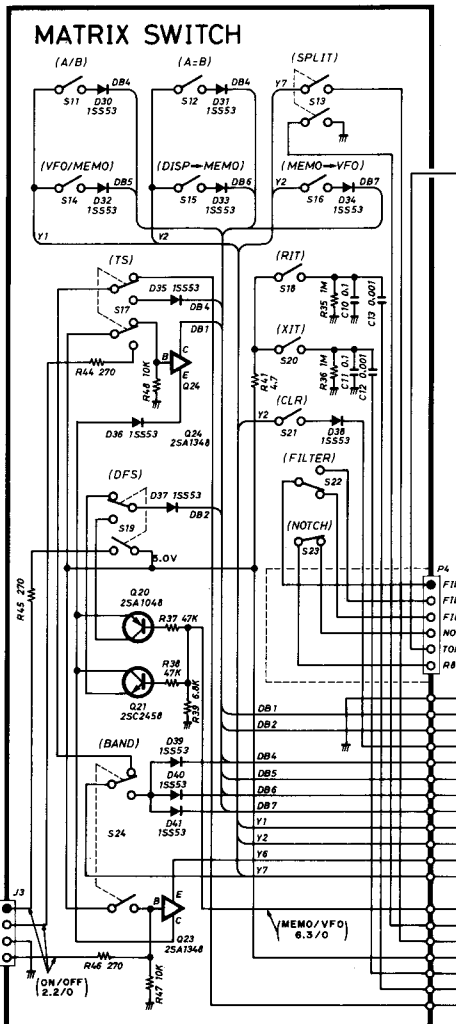
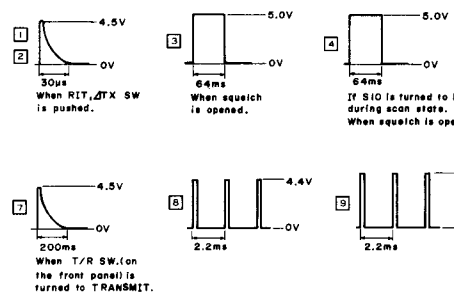
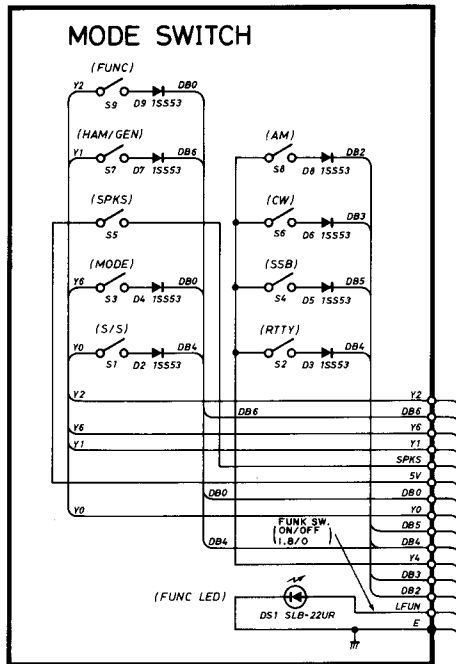




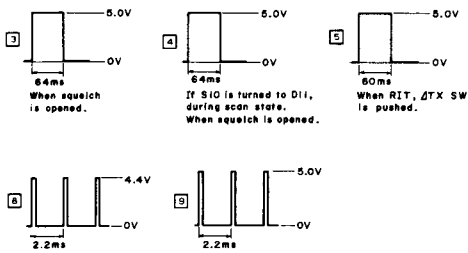


D23-D40 1S553

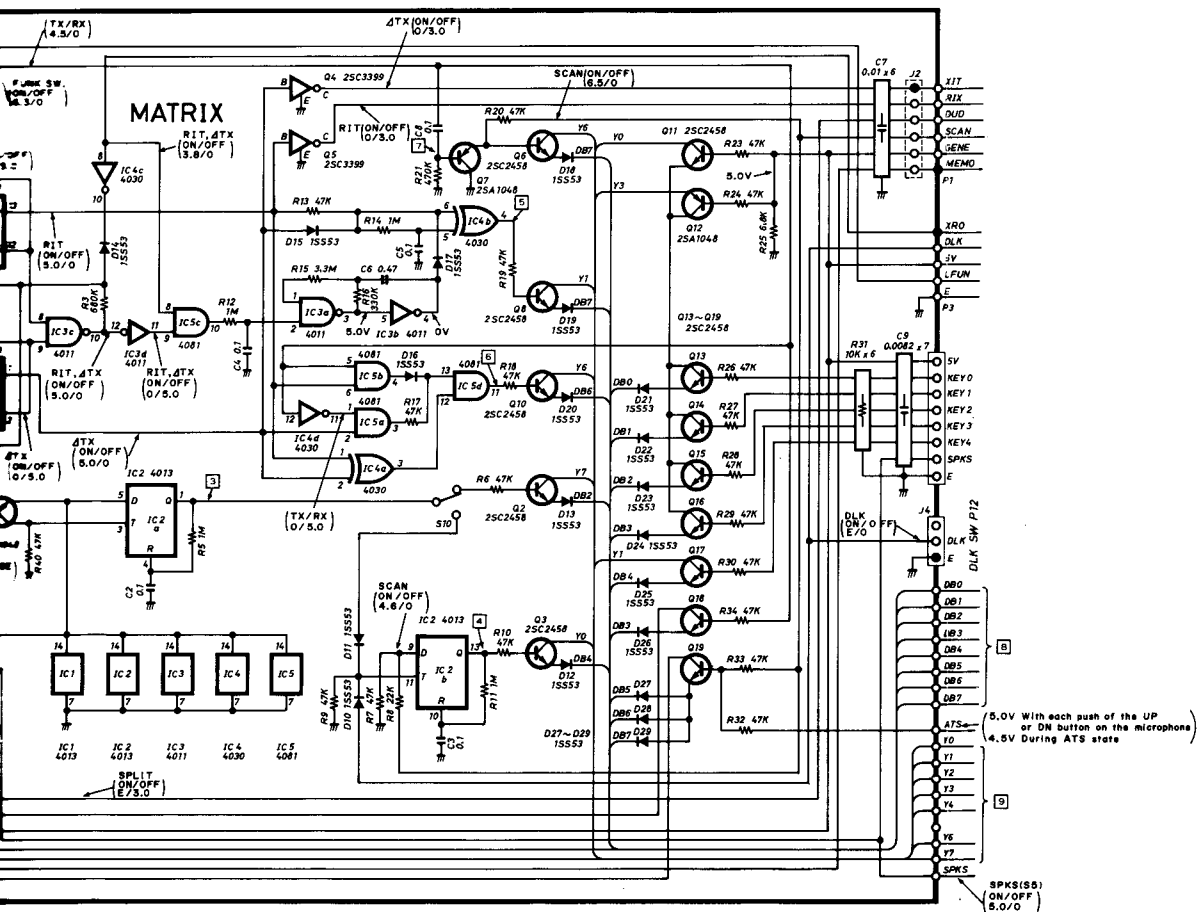


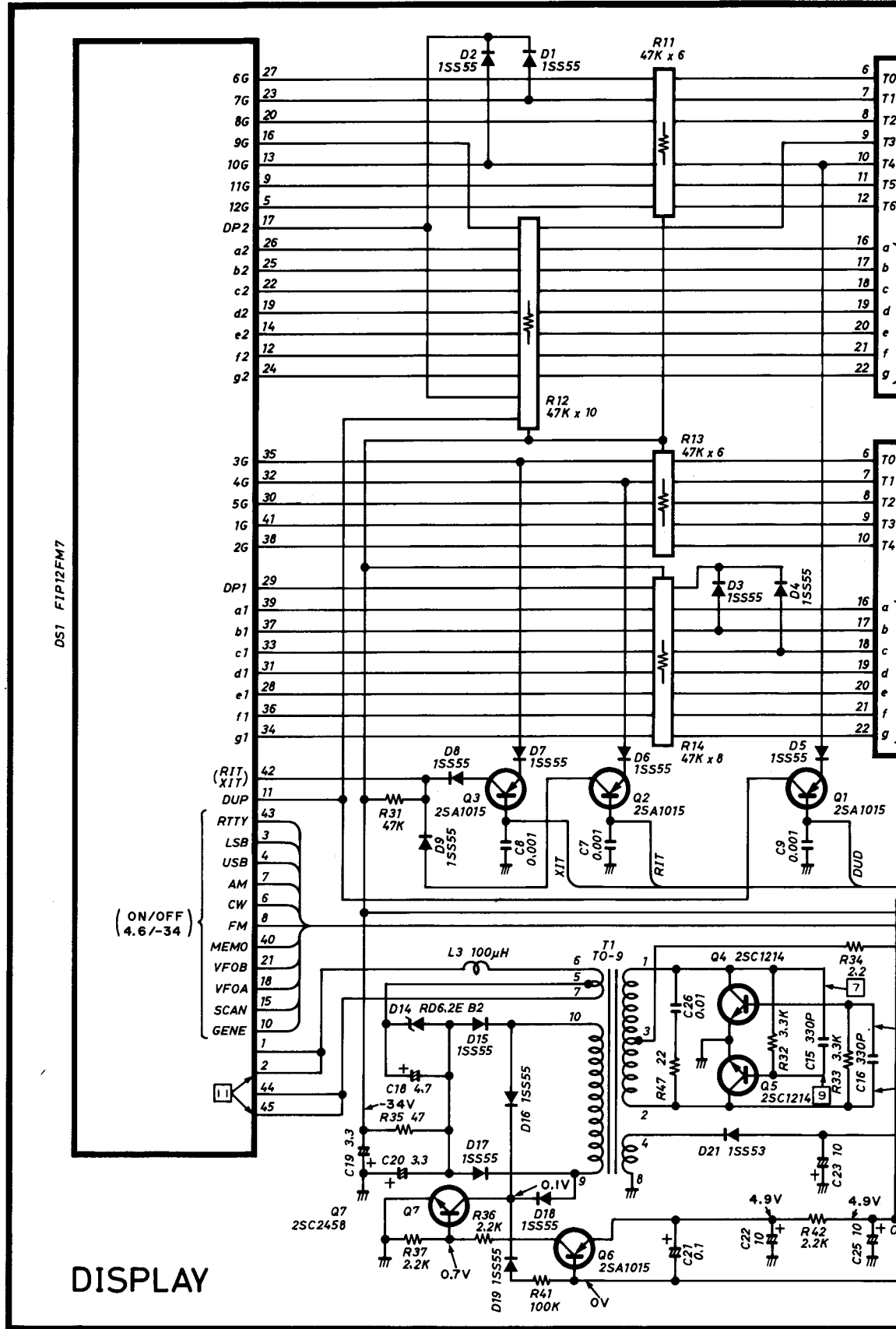


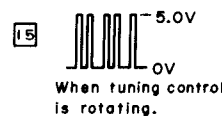
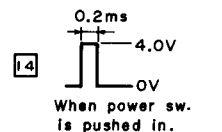
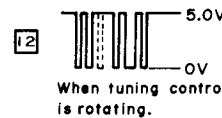
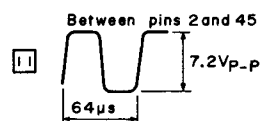
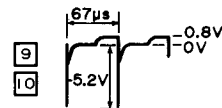
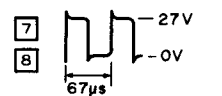
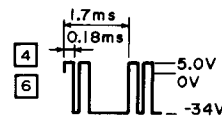
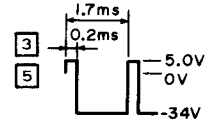
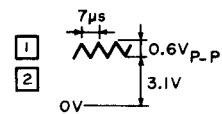
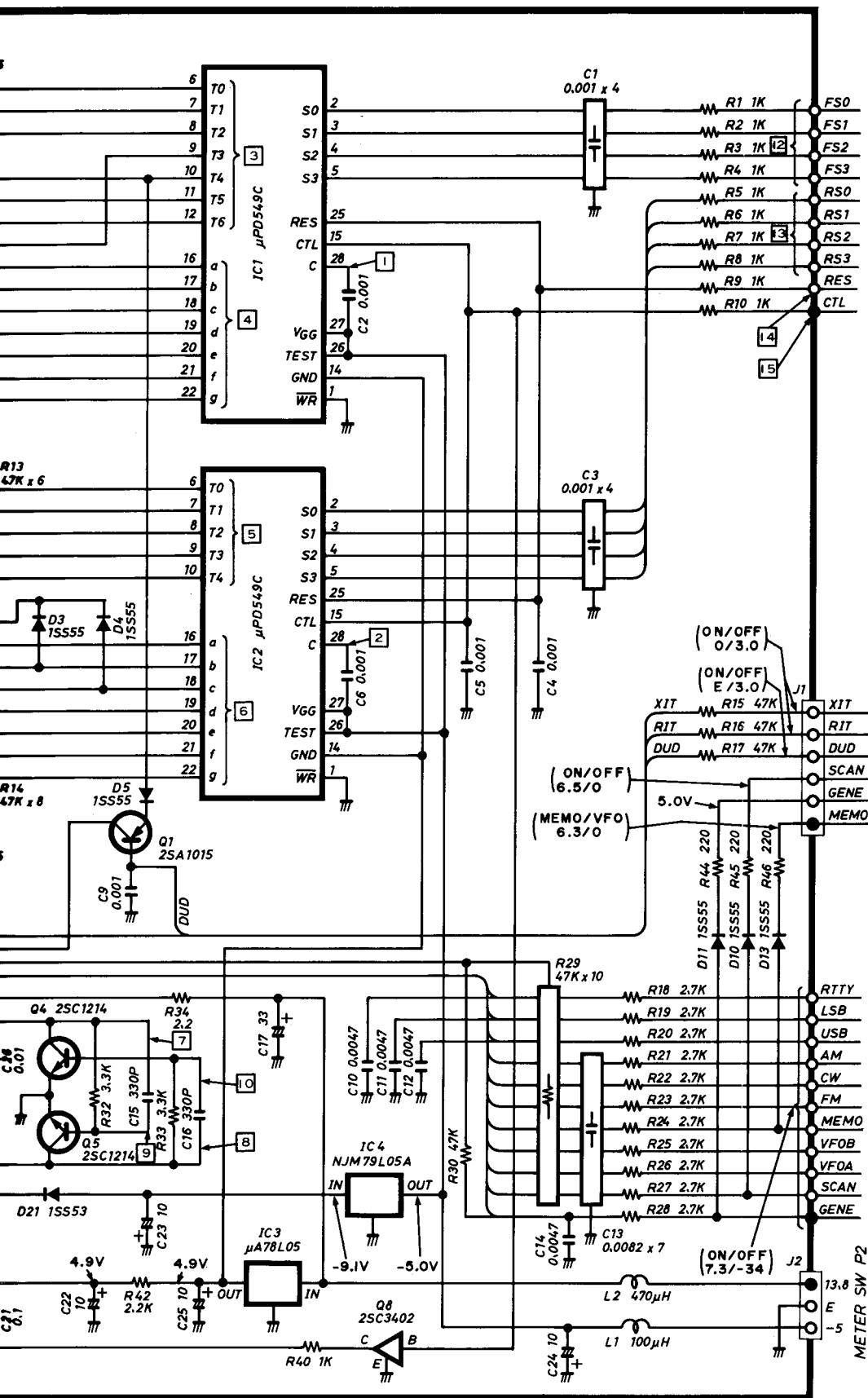
LED P11  
LDFS  
LTS  
E  
LBND

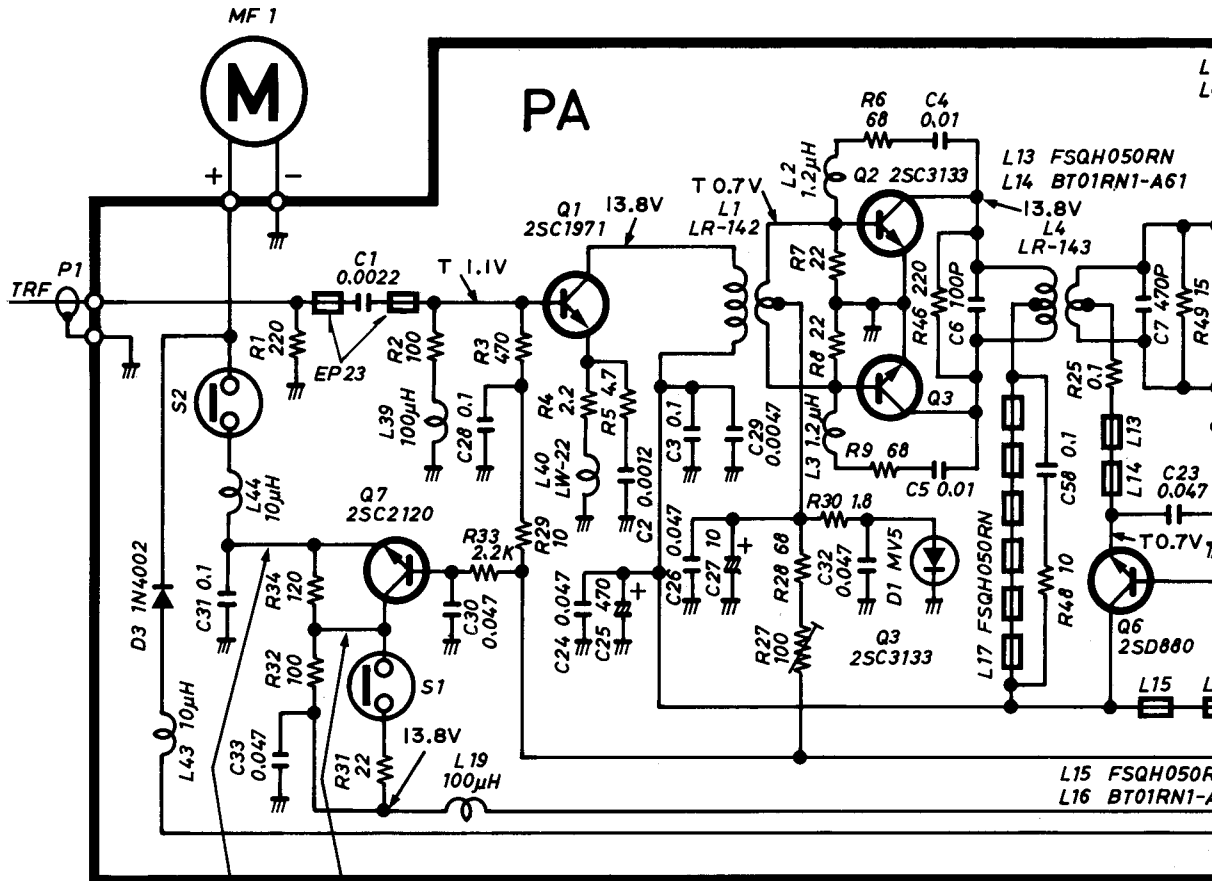


| RIT | ΔTX | T/X | E   |
|-----|-----|-----|-----|
| OFF | OFF | RX  | 0   |
| OFF | OFF | TX  | 0   |
| ON  | OFF | RX  | 0   |
| ON  | OFF | TX  | 5.0 |
| OFF | ON  | RX  | 5.0 |
| OFF | ON  | TX  | 0   |
| ON  | ON  | RX  | 0   |
| ON  | ON  | TX  | 0   |

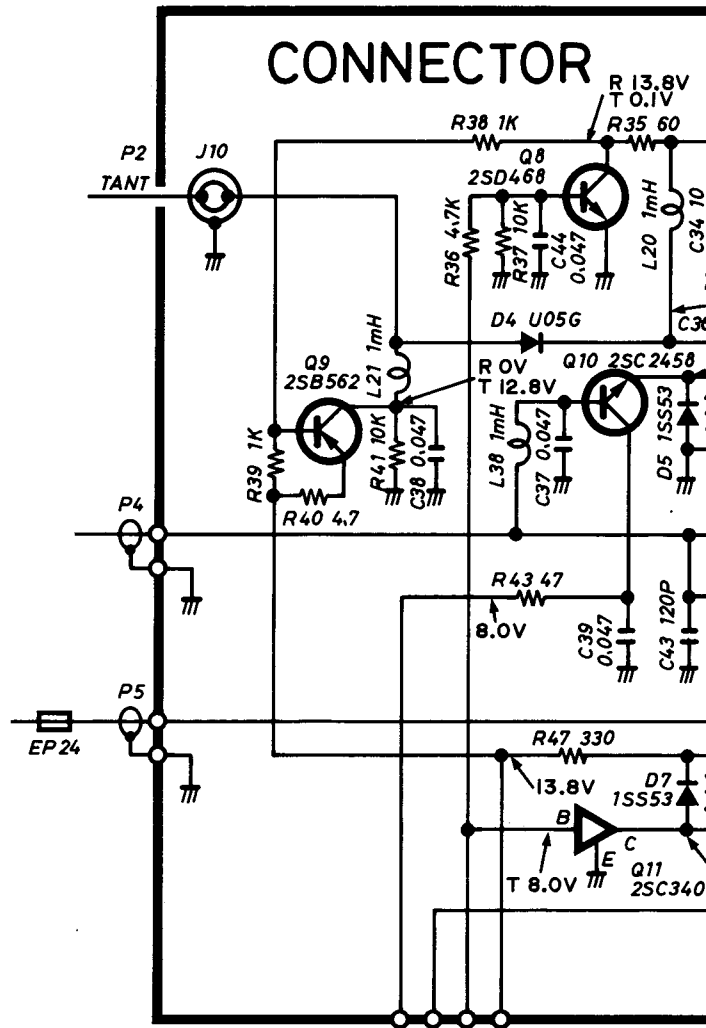


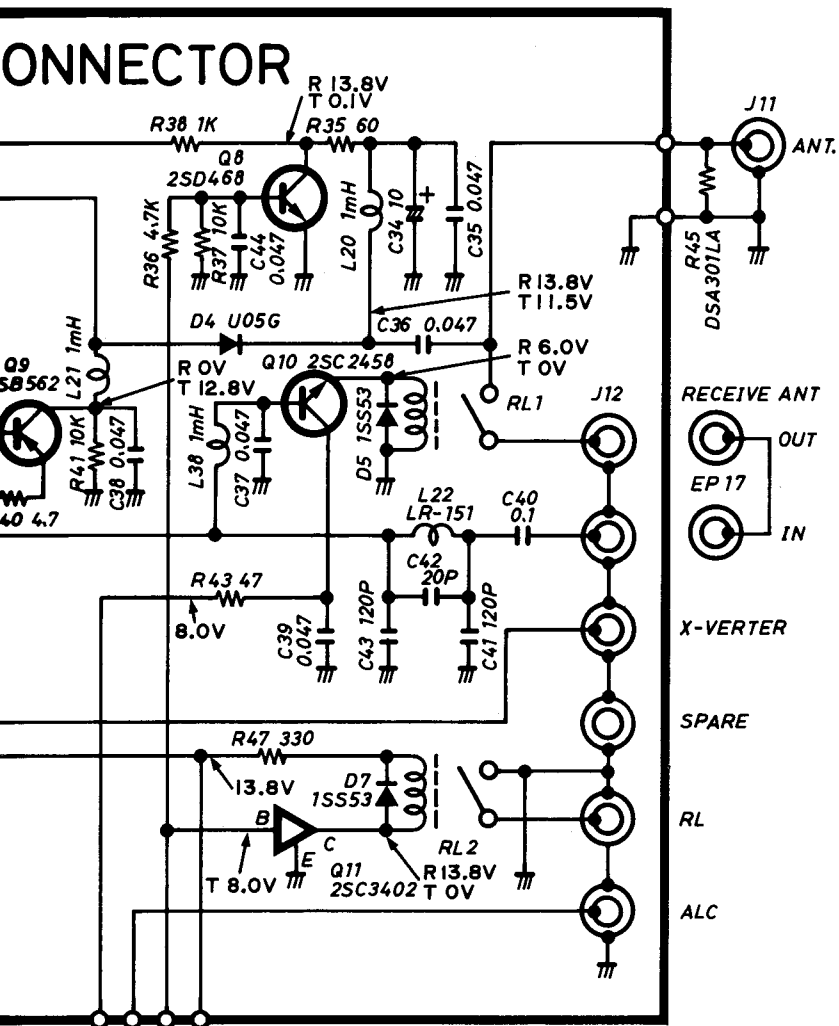
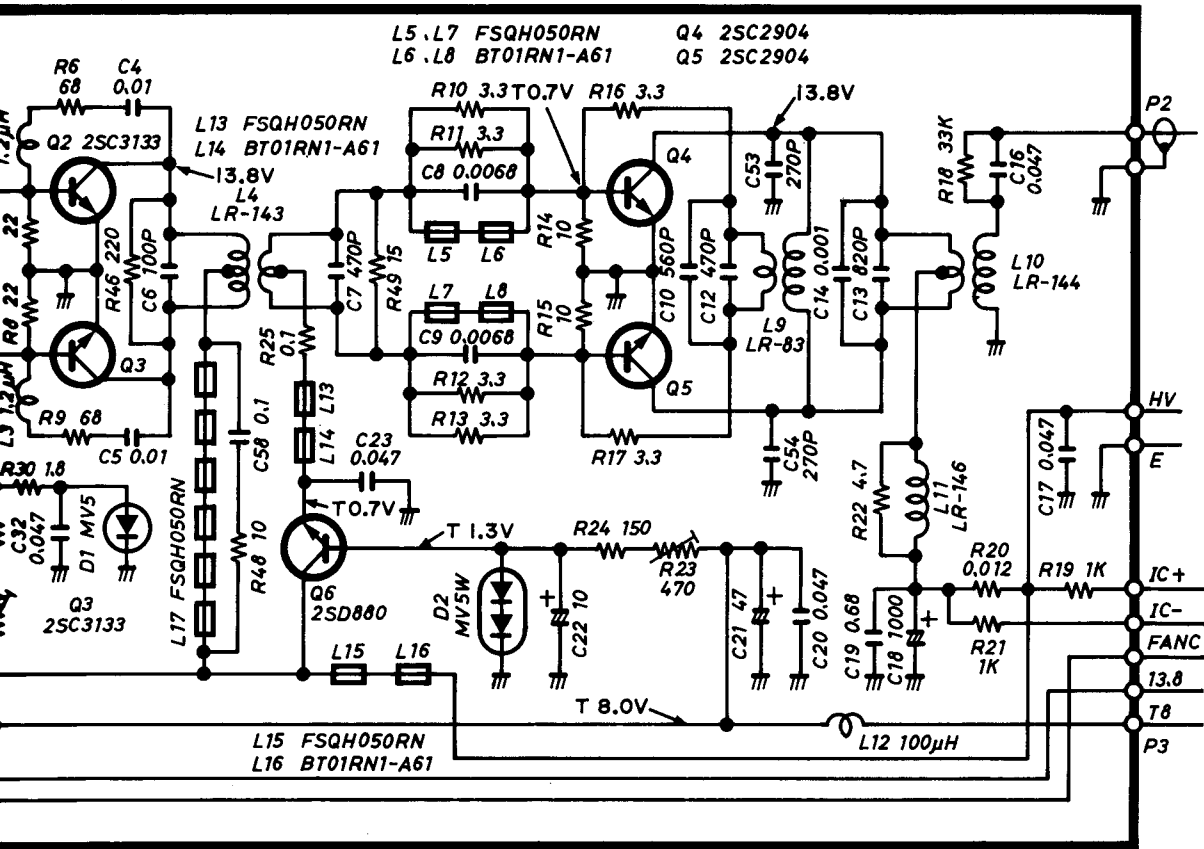


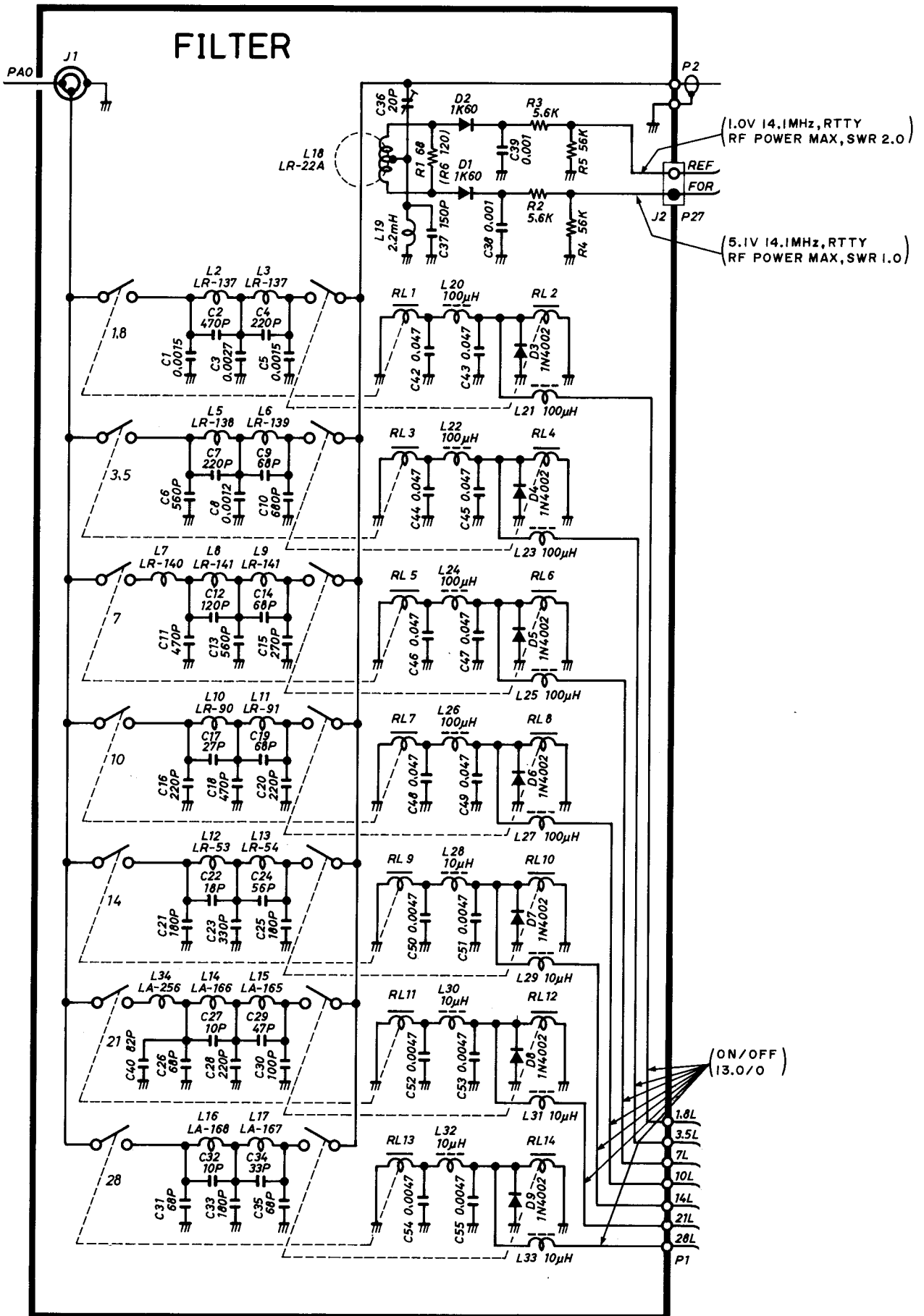




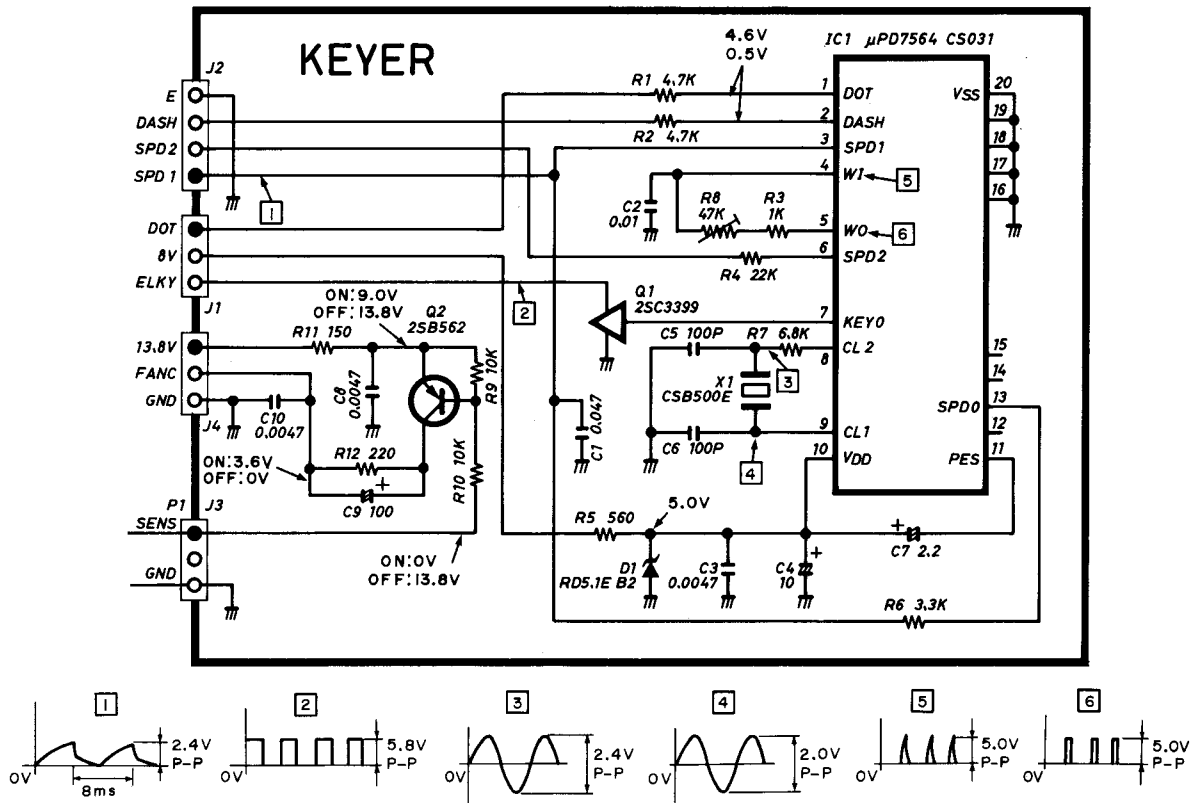
|                 | R   | T   | R    | T    |
|-----------------|-----|-----|------|------|
| S1 OFF<br>S2 ON | 4.0 | 6.0 | 9.5  | 6.5  |
| S1 ON<br>S2 ON  | 5.5 | 7.0 | 12.5 | 12.0 |



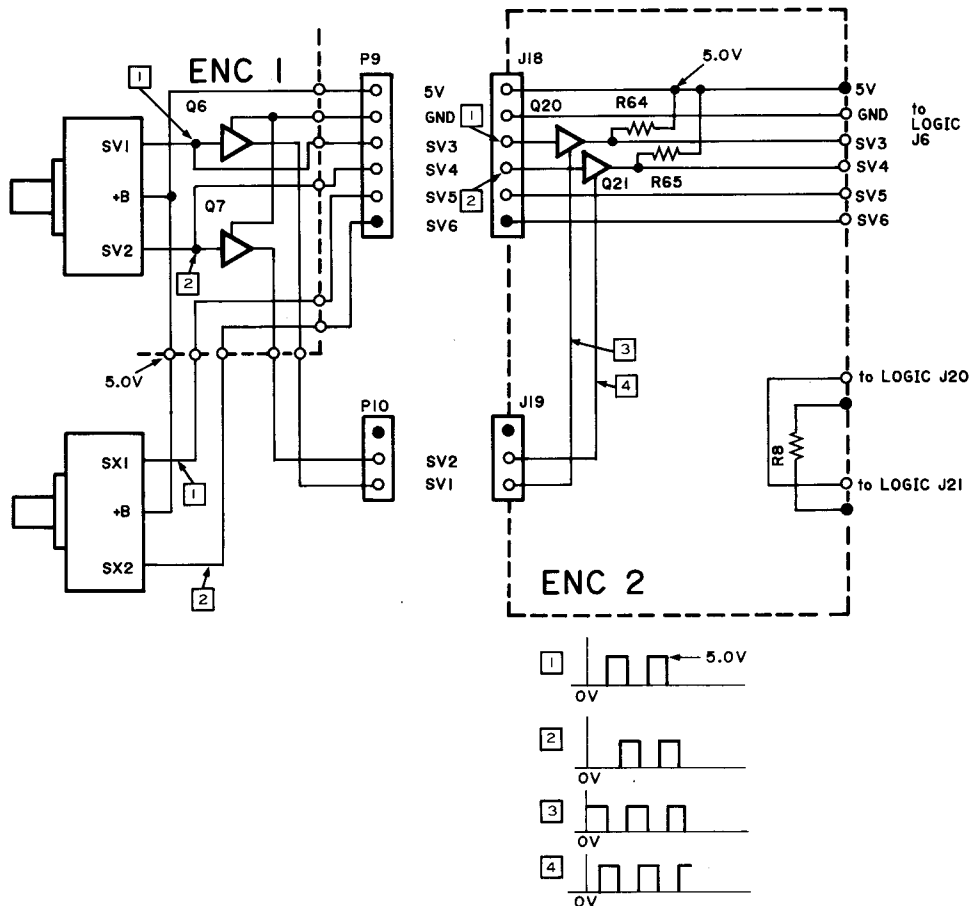




## 8 - 9 KEYSER UNIT

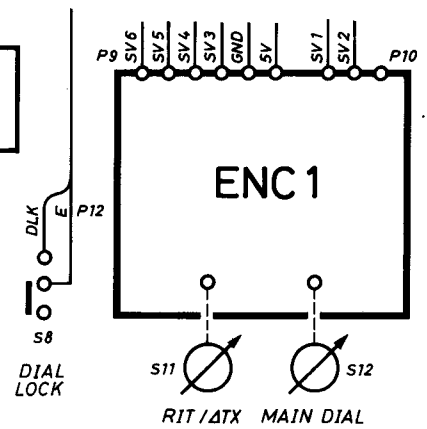
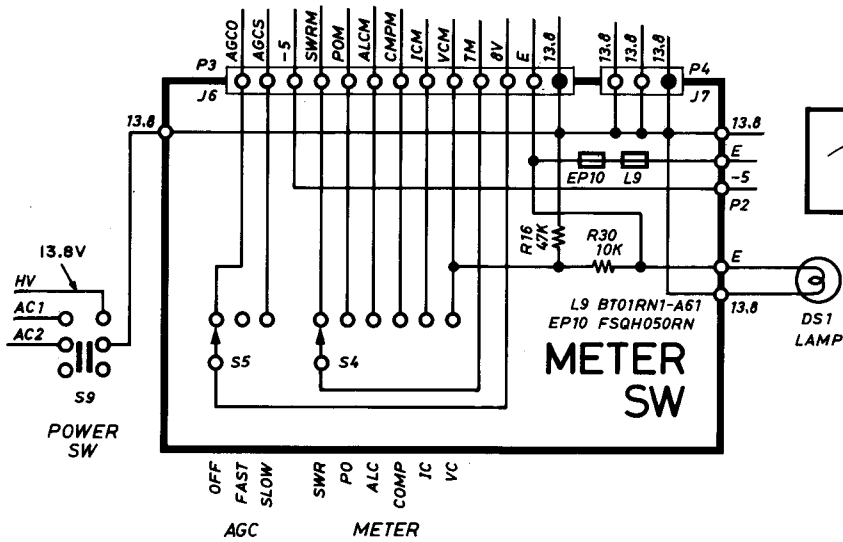
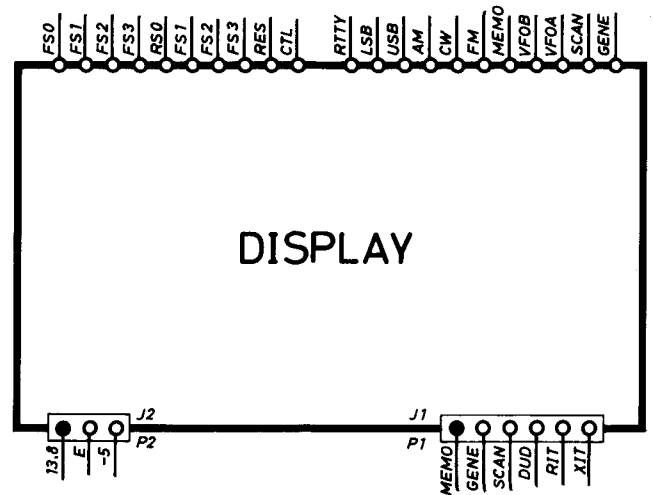
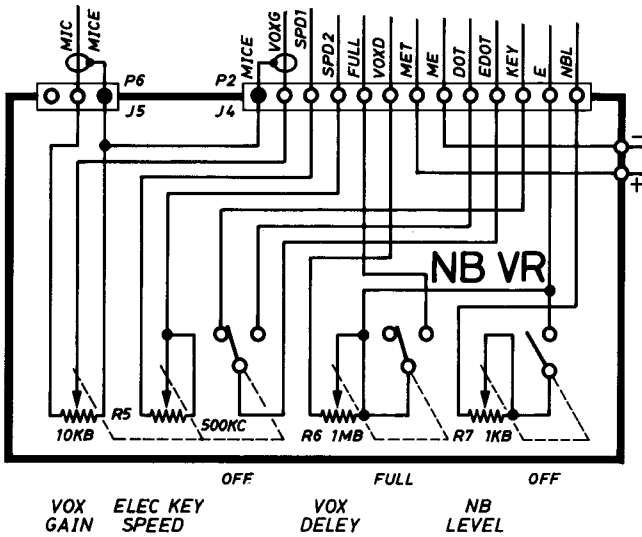
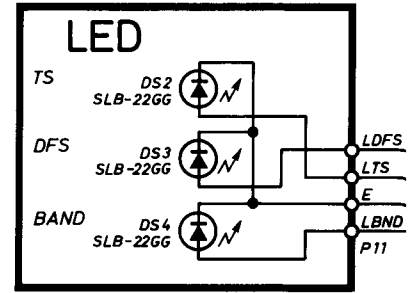
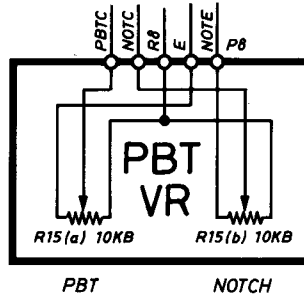
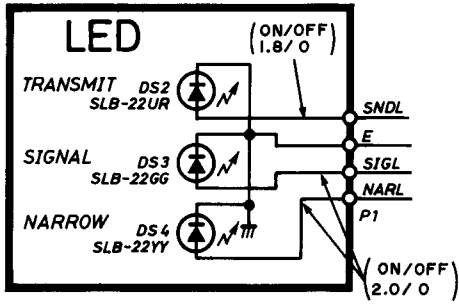


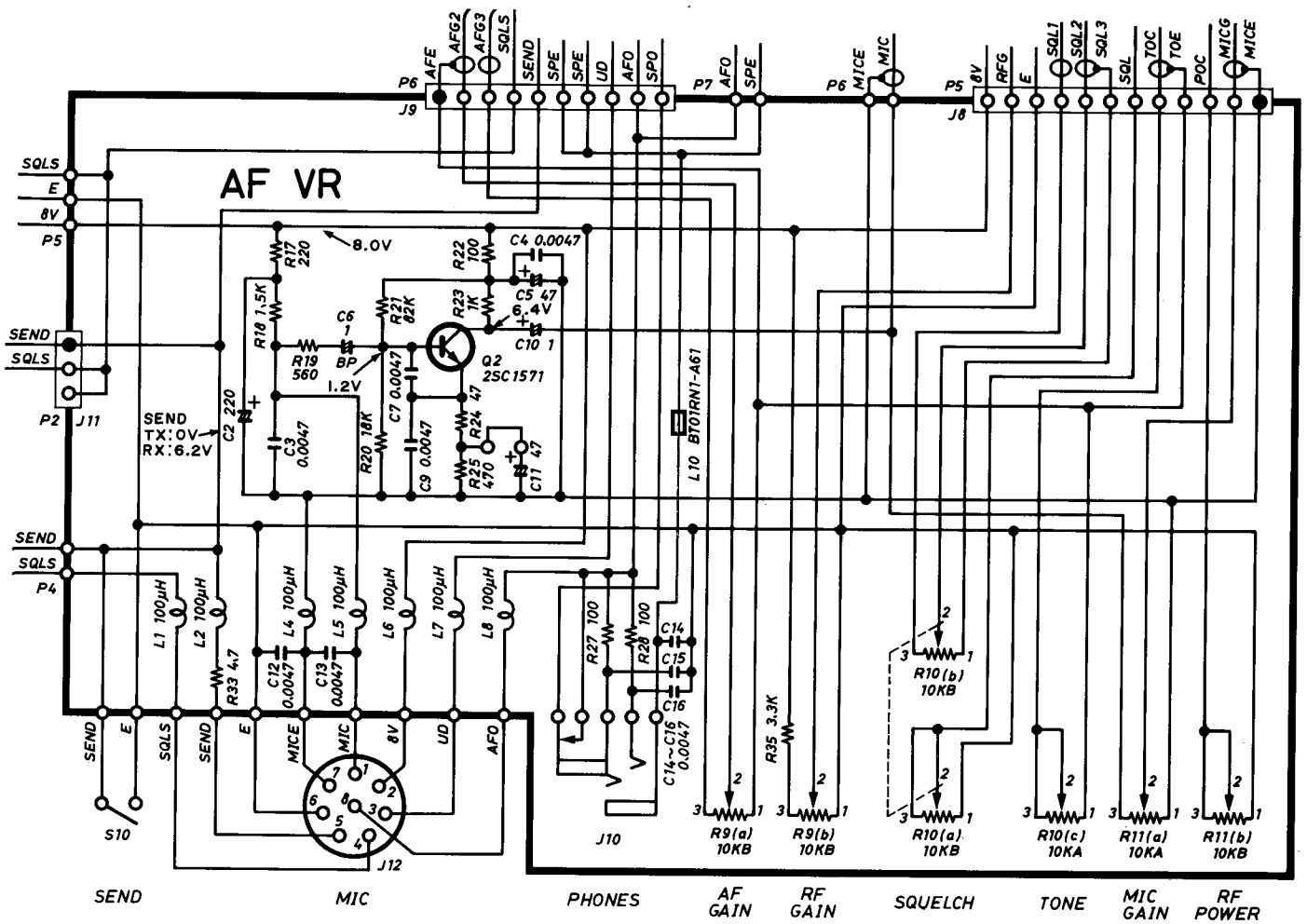
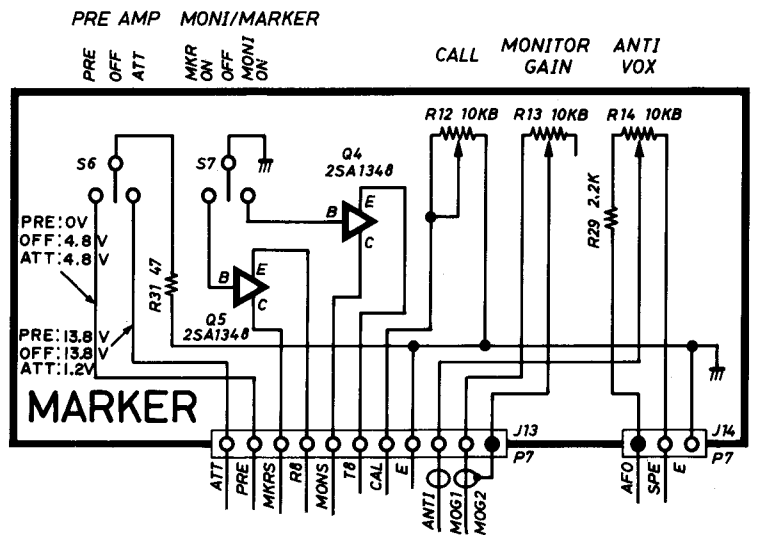
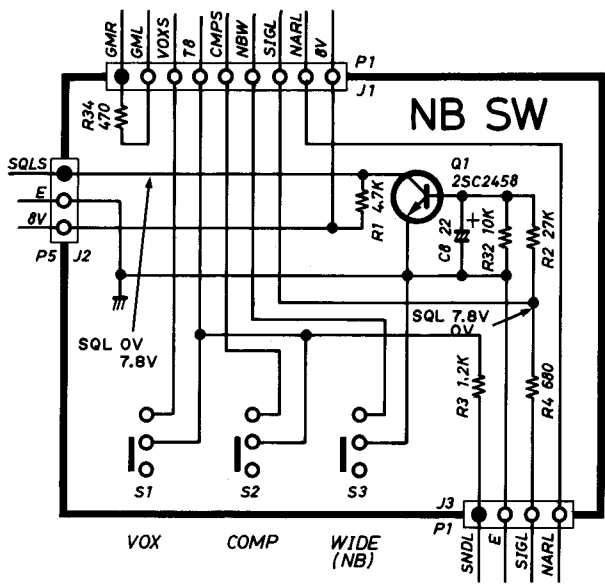
## 8 - 10 FRONT ENCODER UNITS





# 8 - 11 FRONT UNIT WIRING DIAGRAM



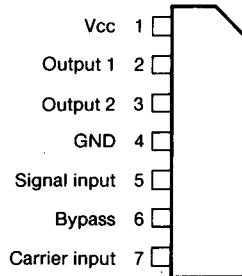


# SECTION 9 IC SPECIFICATIONS

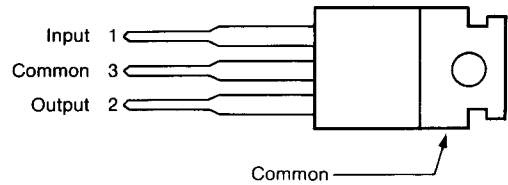
## 9 - 1 LINEAR ICs

### $\mu$ PC1037H (DOUBLE BALANCED MODULATOR) $\mu$ A7805 (5V POSITIVE VOLTAGE REGULATOR)

#### PIN CONNECTIONS

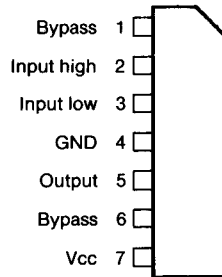


#### PIN CONNECTIONS



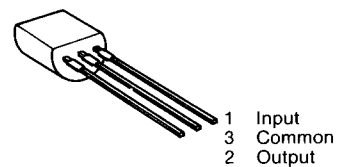
### $\mu$ PC577H (FM-IF AMPLIFIER)

#### PIN CONNECTIONS



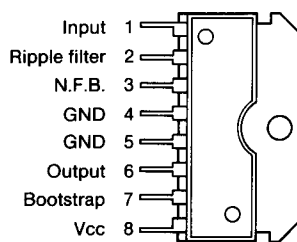
### $\mu$ A78L05 (POSITIVE VOLTAGE REGULATOR)

#### PIN CONNECTIONS



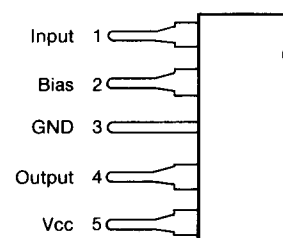
### $\mu$ PC1241H (AUDIO POWER AMPLIFIER)

#### PIN CONNECTIONS



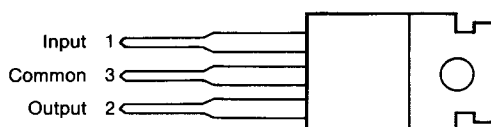
### BA401 (FM-IF AMPLIFIER)

#### PIN CONNECTIONS



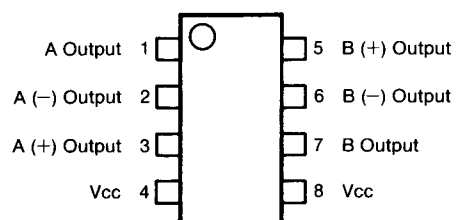
### $\mu$ A7808 (POSITIVE VOLTAGE REGULATOR)

#### PIN CONNECTIONS



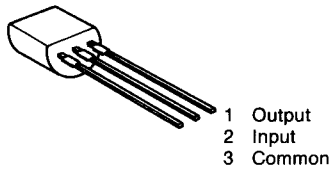
### NJM4558D (DUAL LOW NOISE AMP)

#### PIN CONNECTIONS (Top View)



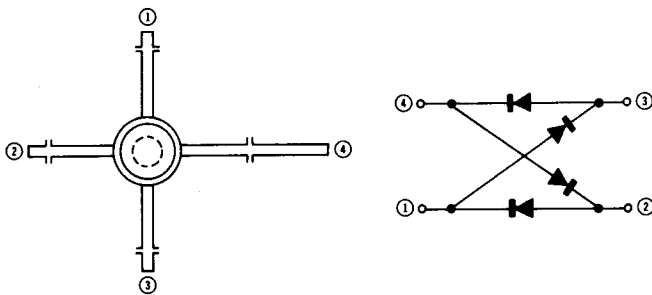
## NJM79L05A (NEGATIVE VOLTAGE REGULATOR)

### PIN CONNECTIONS



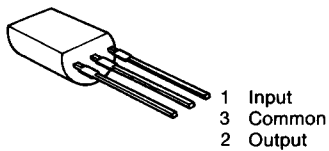
## ND487C1-3R (DOUBLE BALANCED MIXER)

### PIN CONNECTIONS



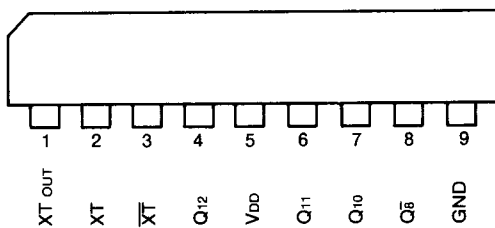
## TA78L008AP (8V POSITIVE VOLTAGE REGULATOR)

### PIN CONNECTIONS



## TC-5082P-GL (OSCILLATOR AND 12 STAGE DIVIDER)

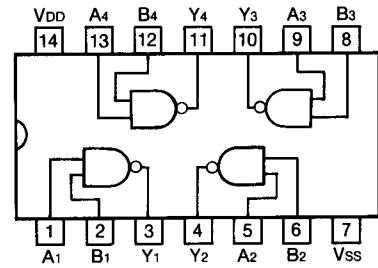
### PIN CONNECTIONS



## 9 - 2 LOGIC ICs

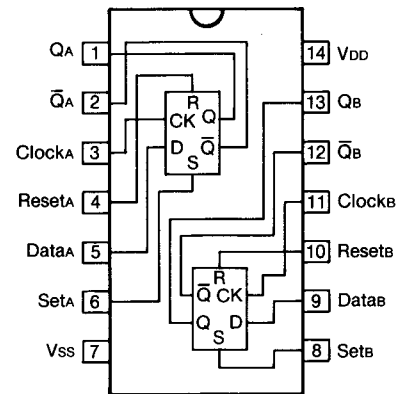
## μPD4011BC (QUAD 2-INPUT NAND GATE)

### PIN CONNECTIONS (Top View)



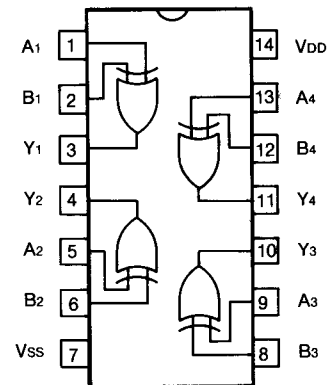
## μPD4013BC (DUAL D-TYPE FLIP-FLOP)

### PIN CONNECTIONS (Top View)



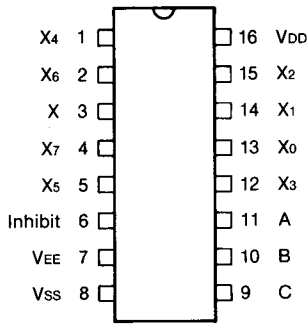
## μPD4030BC (QUAD EXCLUSIVE OR GATE)

### PIN CONNECTIONS (Top View)



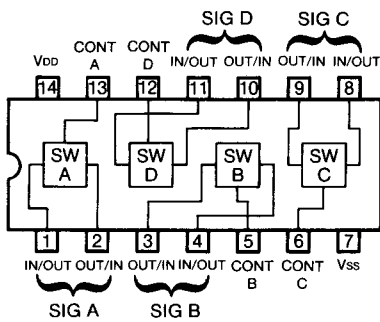
**μPD4051BC (SINGLE 8-CHANNEL MULTIPLEXER)**

**PIN CONNECTIONS (Top View)**



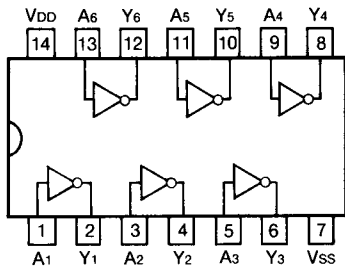
**μPD4066BC (8-INPUT NAND GATE)**

**PIN CONNECTIONS (Top View)**



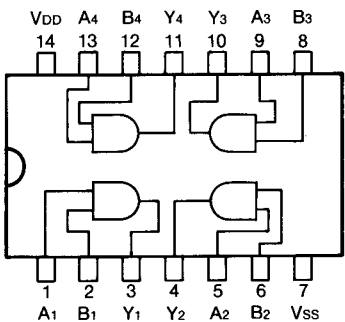
**μPD4069UBC (HEX INVERTER)**

**PIN CONNECTIONS (Top View)**



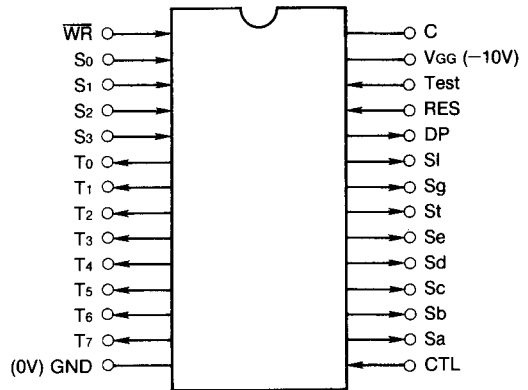
**μPD4081BC (QUAD 2-INPUT AND GATE)**

**PIN CONNECTIONS (Top View)**



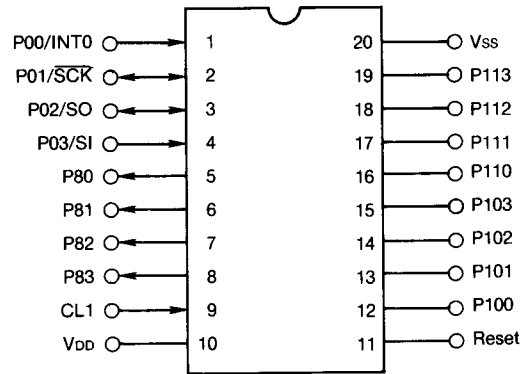
**μPD549C (PROGRAMMABLE DISPLAY CONTROLLER)**

**PIN CONNECTIONS (Top View)**



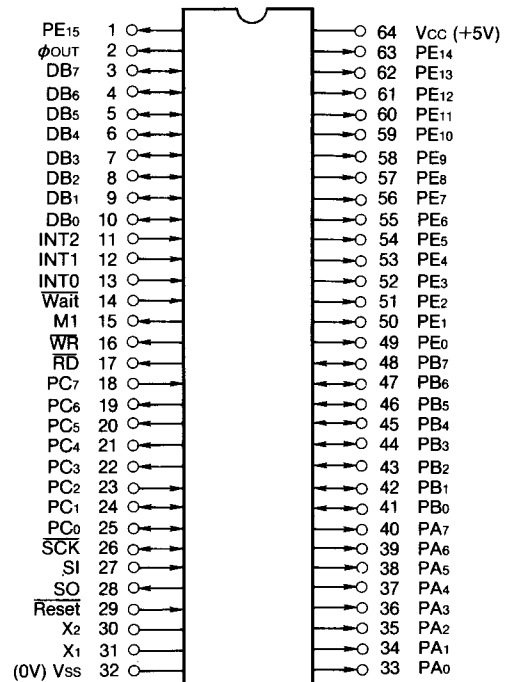
**μPD7564 (1-CHIP 4-BIT MICRO COMPUTER)**

**PIN CONNECTIONS (Top View)**



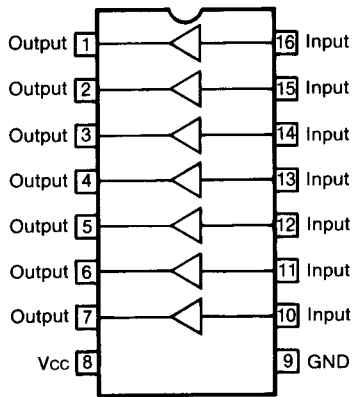
**μPD7801G-114 (1 CHIP 8-BIT MICRO COMPUTER)**

**PIN CONNECTIONS (Top View)**



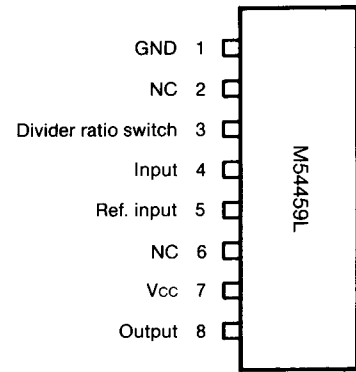
## BA618 (CURRENT DRIVER)

### PIN CONNECTIONS (Top View)



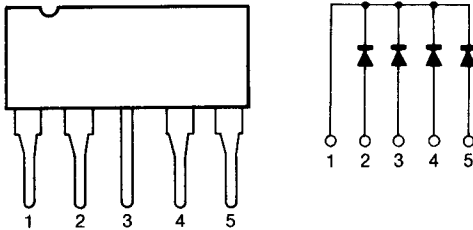
## M54459L (1/20, 1/100 HIGH SPEED DIVIDER)

### PIN CONNECTIONS



## DAN401 (HIGH-SPEED SWITCHING DIODE ARRAY)

### PIN CONNECTIONS

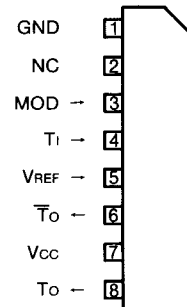


### Frequency-division ratio switching input and frequency division ratio

| DIVIDER RATIO SWITCH     | LOW  | HIGH  |
|--------------------------|------|-------|
| Frequency division ratio | 1/20 | 1/100 |

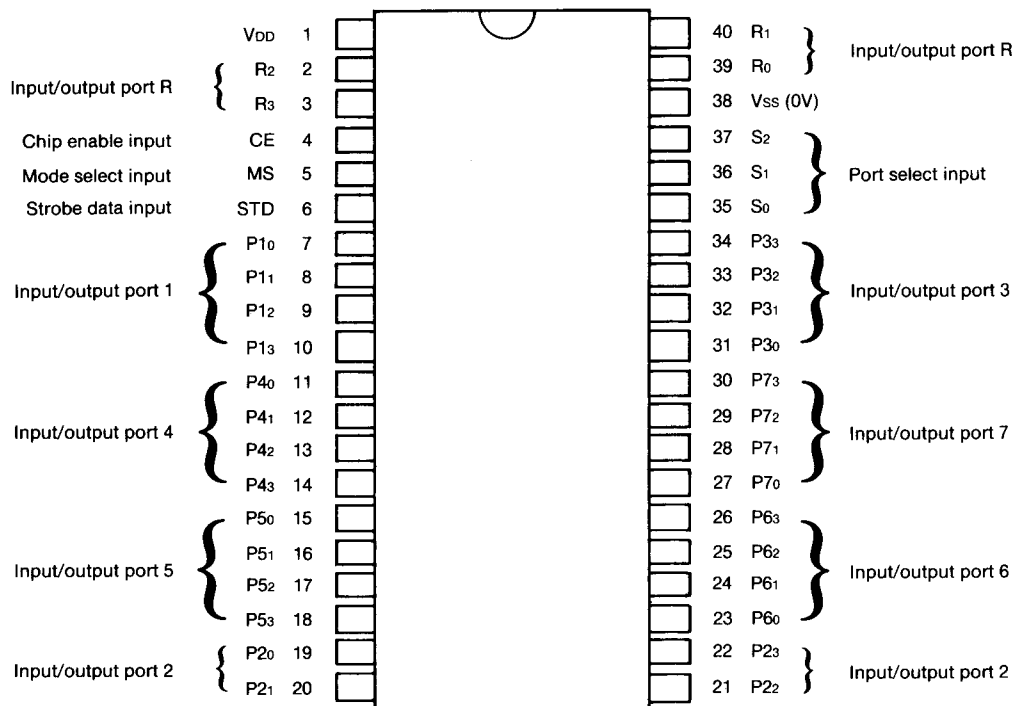
## M54466L (1/10, 1/11 HIGH SPEED DIVIDER WITH ECL OUTPUT)

### PIN CONNECTIONS



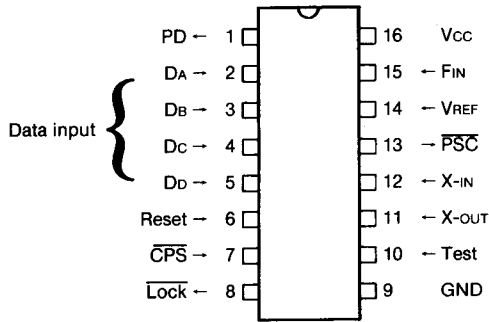
## M50780SP (INPUT/OUTPUT EXPANDER)

### PIN CONNECTIONS (Top View)



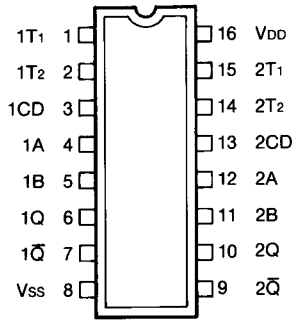
### M54929P (PLL FREQUENCY SYNTHESIZER)

PIN CONNECTIONS (Top View)



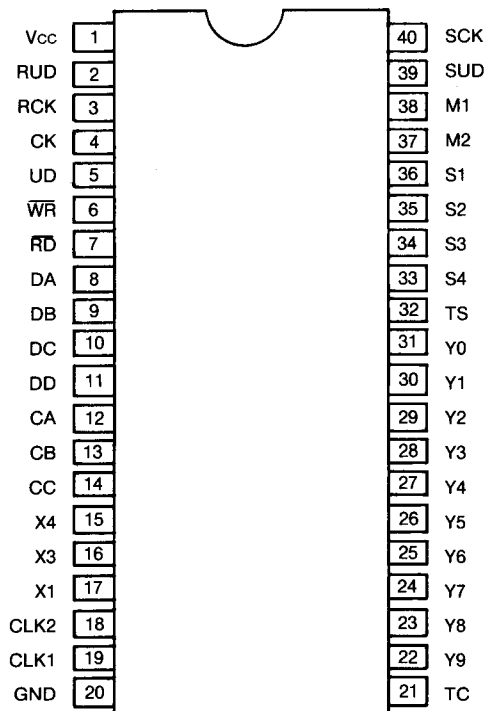
### TC4528BP (DUAL MONOSTABLE MULTIVIBRATOR)

PIN CONNECTIONS (Top View)



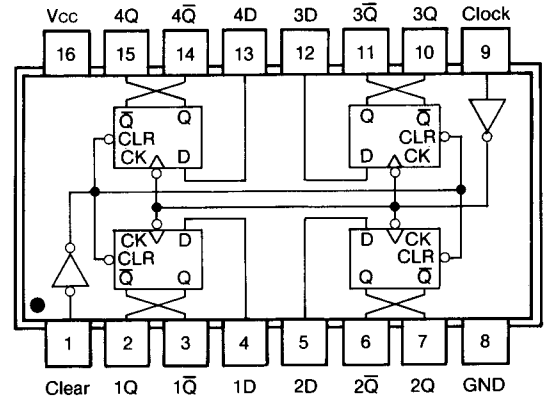
### RP5G01-007 (ICOM DEVELOPED IC)

PIN CONNECTIONS (Top View)



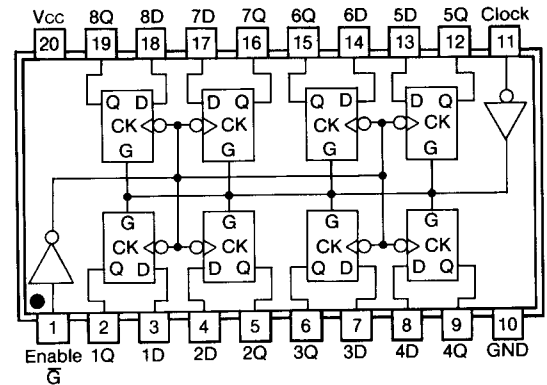
### SN74LS175N (QUADRUPLE D-TYPE FLIP FLOP WITH RESET)

PIN CONNECTIONS (Top View)



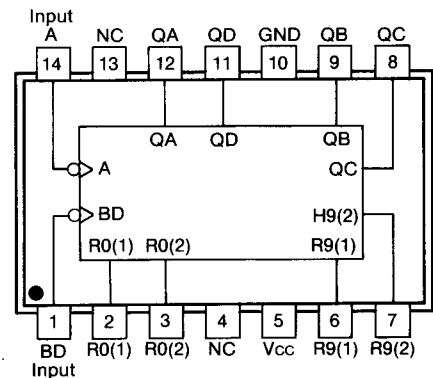
### SN74LS377N (OCTAL POSITIVE EDGE-TRIGGERED D-TYPE FLIP FLOP WITH ENABLE)

PIN CONNECTIONS (Top View)



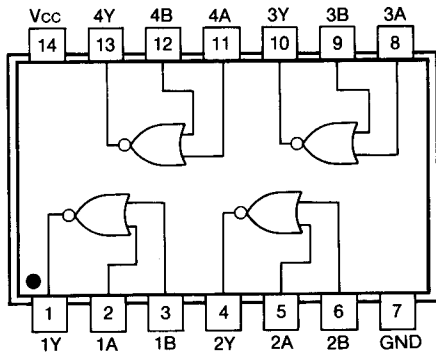
### SN74LS90N (DECODE COUNTER)

PIN CONNECTIONS (Top View)



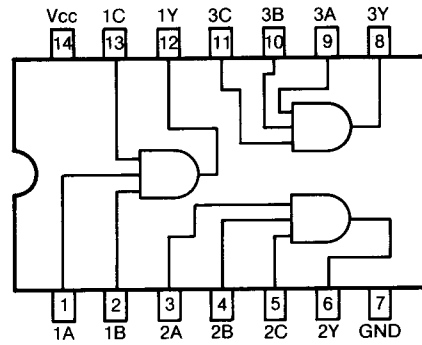
**SN74LS02N (QUADRUPLE 2-INPUT POSITIVE NOR GATE)**

**PIN CONNECTIONS (Top View)**



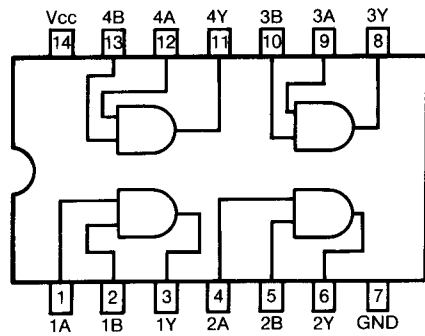
**SN74LS11N (TRIPLE 3-INPUT POSITIVE AND GATE)**

**PIN CONNECTIONS (Top View)**



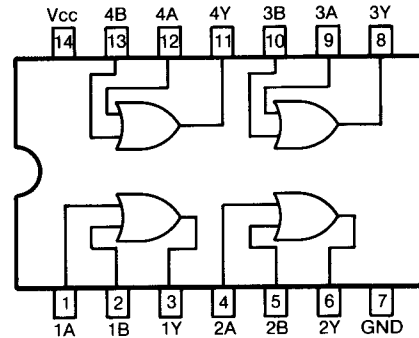
**SN74LS08N (QUADRUPLE 2-INPUT POSITIVE AND GATE)**

**PIN CONNECTIONS (Top View)**



**SN74LS32N (QUADRUPLE 2-INPUT POSITIVE OR GATE)**

**PIN CONNECTIONS (Top View)**





## SECTION 10 PARTS LIST

### 10 - 1 EF UNIT

| REF. NO. | DESCRIPTION  | PART NO.     |
|----------|--------------|--------------|
| P1       | Connector    | TL25H-09-B1  |
| P2       | Connector    | TL25H-13-B1  |
| P3       | Connector    | TL25H-13-B1  |
| P4       | Connector    | TL25H-03-B1  |
| P5       | Connector    | TL25H-12-B1  |
| P6       | Connector    | TL25H-10-B1  |
| P7       | Connector    | TL25H-11-B1  |
| P8       | Connector    | TL25H-06-B1  |
| P9       | Connector    | TL25H-05-B1  |
| P10      | Connector    | TL25H-07-B1  |
| P11      | Connector    | TL25H-10-B1  |
| P12      | Connector    | TL25H-03-B1  |
| P13      | Connector    | TL25H-04-B1  |
| P14      | Connector    | TL25H-08-B1  |
| P15      | Connector    | TL25H-07-B1  |
| P16      | Connector    | TL25H-09-B1  |
| P17      | Connector    | TL25H-07-B1  |
| P18      | Connector    | TL25H-07-B1  |
| P19      | Connector    | TL25H-08-B1  |
| P20      | Connector    | TL25H-08-B1  |
| P21      | Connector    | TL25H-08-B1  |
| P22      | Connector    | TL25H-08-B1  |
| P23      | Connector    | TL25H-06-B1  |
| P24      | Connector    | TL25H-03-B1  |
| P25      | Connector    | TL25H-10-B1  |
| P26      | Connector    | TL25H-12-B1  |
| P27      | Connector    | TL25H-02-B1  |
| P28      | Connector    | TL25H-12-B1  |
| P29      | Connector    | TL25H-09-B1  |
| P30      | Connector    | TL25H-03-B1  |
| P31      | Connector    | TL25H-02-B1  |
| P32      | Connector    | TL25H-03-B1  |
| P33      | Connector    | TL25H-03-B1  |
| P34      | Connector    | TL25H-04-B1  |
| F1       | Fuse         | 3A           |
| SP1      | Speaker      | C065K1210810 |
| EP1      | Ferrite Bead | FSQH070RN    |

### 10 - 2 FRONT UNIT

| REF. NO. | DESCRIPTION | PART NO.     |
|----------|-------------|--------------|
| Q1       | Transistor  | 2SC2458-Y    |
| Q2       | Transistor  | 2SC1571-G    |
| Q4       | Transistor  | 2SA1348      |
| Q5       | Transistor  | 2SA1348      |
| Q6       | Transistor  | 2SC3399      |
| Q7       | Transistor  | 2SC3399      |
| L1       | Coil        | LAL04NA 101K |
| L2       | Coil        | LAL04NA 101K |
| L4       | Coil        | FL5H 101K    |
| L5       | Coil        | LAL04NA 101K |
| L6       | Coil        | FL5H 101K    |
| L7       | Coil        | FL5H 101K    |
| L8       | Coil        | FL5H 101K    |

### FRONT UNIT

| REF. NO. | DESCRIPTION   | PART NO.               |
|----------|---------------|------------------------|
| L9       | Coil          | BT01RN1-A61            |
| L10      | Coil          | BT01RN1-A61            |
| R1       | Resistor      | 4.7k R25               |
| R2       | Resistor      | 27k ELR25              |
| R3       | Resistor      | 1.2k R25               |
| R4       | Resistor      | 680 R25                |
| R5       | Variable      | RKBB21004A 10KB 500KC  |
| R6       | Variable      | RKBA11013A 1MB         |
| R7       | Variable      | RKBA11011A 1KB         |
| R9       | Variable      | RKDEB0008A 10KBx2      |
| R10      | Variable      | RKDEC000DA 10KA 10KBx2 |
| R11      | Variable      | RKDEB0007A 10KA 10KB   |
| R12      | Trimmer       | RHA3A140SA 10KB        |
| R13      | Trimmer       | RHA3A140SA 10KB        |
| R14      | Trimmer       | RHA3A140SA 10KB        |
| R15      | Variable      | RKBBB001PA 10KBx2      |
| R16      | Resistor      | 47k R25                |
| R17      | Resistor      | 220 ELR20              |
| R18      | Resistor      | 1.5k ELR20             |
| R19      | Resistor      | 560 ELR20              |
| R20      | Resistor      | 18k R20                |
| R21      | Resistor      | 82k R20                |
| R22      | Resistor      | 100 ELR20              |
| R23      | Resistor      | 1k ELR20               |
| R24      | Resistor      | 47 R25                 |
| R25      | Resistor      | 470 R20                |
| R27      | Resistor      | 100 ELR25              |
| R28      | Resistor      | 100 ELR25              |
| R29      | Resistor      | 2.2k R25               |
| R30      | Resistor      | 10k R25                |
| R31      | Resistor      | 47 R25                 |
| R32      | Resistor      | 10k ELR25              |
| R33      | Resistor      | 4.7 R20                |
| R34      | Resistor      | 470 ELR20              |
| R35      | Resistor      | 3.3k R25               |
| C2       | Electrolytic  | 220 10V                |
| C3       | Barrier Layer | 0.0047 25V             |
| C4       | Ceramic       | 0.0047 50V             |
| C5       | Electrolytic  | 47 10V                 |
| C6       | Electrolytic  | 1 50V BP               |
| C7       | Ceramic       | 0.0047 50V             |
| C8       | Electrolytic  | 22 16V MS7             |
| C9       | Ceramic       | 0.0047 50V             |
| C10      | Electrolytic  | 1 50V                  |
| C11      | Electrolytic  | 47 10V                 |
| C12      | Ceramic       | 0.0047 50V             |
| C13      | Ceramic       | 0.0047 50V             |
| C14      | Ceramic       | 0.0047 50V             |
| C15      | Ceramic       | 0.0047 50V             |
| C16      | Ceramic       | 0.0047 50V             |
| J1       | Connector     | TL25P-09-L1            |
| J2       | Connector     | TL25P-03-L1            |
| J3       | Connector     | TL25P-04-L1            |
| J4       | Connector     | TL25P-13-L1            |
| J5       | Connector     | TL25P-03-L1            |
| J6       | Connector     | TL25P-13-L1            |
| J7       | Connector     | TL25P-03-V1            |
| J8       | Connector     | TL25P-12-L1            |

**FRONT UNIT**

| REF. NO. | DESCRIPTION  | PART NO.                |
|----------|--------------|-------------------------|
| J9       | Connector    | TL25P-10-L1             |
| J10      | Connector    | HLJ4815-01-030          |
| J11      | Connector    | TL25P-03-V1             |
| J12      | Connector    | 8S-S-E                  |
| J13      | Connector    | TL25P-11-V1             |
| J14      | Connector    | TL25P-03-V1             |
| P2       | Connector    | TL25H-03-B1             |
| P3       | Connector    | 1545P-1                 |
| P4       | Connector    | TL25H-02-B1             |
| P5       | Connector    | TL25H-03-B1             |
| P6       | Connector    | TL25H-03-B1             |
| P7       | Connector    | TL25H-03-B1             |
| P8       | Connector    | TL25H-05-B1             |
| P9       | Connector    | TL25H-06-B1             |
| P10      | Connector    | TL25H-03-B1             |
| P11      | Connector    | TSL-P04P-B1             |
| P12      | Connector    | TSL-P03P-B1             |
| F1       | Holder       | TFH-S30                 |
| DS1      | Lamp         | BQ044-32582A            |
| DS2      | LED          | SLB-22GG                |
| DS3      | LED          | SLB-22GG                |
| DS4      | LED          | SLB-22GG                |
| ME1      | Meter        | M263A                   |
| S1       | Switch       | SPPJ31116A              |
| S2       | Switch       | SPPJ31116A              |
| S3       | Switch       | SPPJ31116A              |
| S4       | Switch       | SRBU16003A              |
| S5       | Switch       | SRRU13071A              |
| S6       | Switch       | MS-621C                 |
| S7       | Switch       | MS-621C                 |
| S8       | Switch       | SPPJ31012A              |
| S9       | Switch       | TW-0068                 |
| S10      | Switch       | M2012J-1K               |
| S11      | Encoder      | RABF10J02A              |
| S12      | Encoder      | RABH10J01A              |
| EP1      | P.C. Board   | B-722E                  |
| EP2      | P.C. Board   | B-723C                  |
| EP3      | P.C. Board   | B-724C                  |
| EP4      | P.C. Board   | B-727E                  |
| EP5      | P.C. Board   | B-792                   |
| EP6      | P.C. Board   | B-731E                  |
| EP7      | P.C. Board   | B-741C                  |
| EP8      | P.C. Board   | B-1130A                 |
| EP9      | P.C. Board   | B-1133B                 |
| EP10     | Ferrite Bead | FSQH050RN               |
| W1       | Jumper       | JPW-02A                 |
| W2       | Jumper       | 23/02/050/W02/W02       |
| W3       | Jumper       | 23/03/050/W02/W02       |
| W4       | Jumper       | [ 51/99/160/W13A/W99A ] |
| W5       | Jumper       | [ 08 A A ]              |
| W6       | Jumper       | [ 51/99/250/W13A/C01A ] |
| W7       | Jumper       | [ 08 A A ]              |
| W8       | Jumper       | 23/08/350/C01/D21       |
| W9       | Jumper       | 23/09/350/C01/D21       |
| W11      | Jumper       | 23/01/260/C01/D21       |

**FRONT UNIT/DISPLAY UNIT**

| REF. NO. | DESCRIPTION | PART NO.                |
|----------|-------------|-------------------------|
| W12      | Jumper      | 23/02/260/C01/D21       |
| W13      | Jumper      | 23/03/260/C01/D21       |
| W14      | Jumper      | [ 51/99/400/C01A/W13A ] |
| W15      | Jumper      | [ 08 A A ]              |
| W16      | Jumper      | 23/04/160/W02/D21       |
| W17      | Jumper      | 23/00/160/W02/D21       |
| W18      | Jumper      | 74/98/015/X98/X98       |
| W19      | Jumper      | 23/09/400/C01/D21       |
| W20      | Jumper      | 23/00/400/C01/D21       |
| W21      | Jumper      | 23/01/400/C01/D21       |
| W22      | Jumper      | 23/02/520/C01/D21       |
| W23      | Jumper      | 23/03/520/C01/D21       |
| W24      | Jumper      | 23/04/520/C01/D21       |
| W25      | Jumper      | 23/05/520/C01/D21       |
| W26      | Jumper      | 23/06/520/C01/D21       |
| W31      | Jumper      | 23/01/300/C01/D21       |
| W32      | Jumper      | 23/02/300/C01/D21       |
| W33      | Jumper      | 23/03/300/C01/D21       |
| W34      | Jumper      | 23/04/300/C01/D21       |
| W35      | Jumper      | 23/05/300/C01/D21       |
| W36      | Jumper      | 23/06/300/C01/D21       |
| W37      | Jumper      | 23/07/300/C01/D21       |
| W38      | Jumper      | 23/08/300/C01/D21       |
| W40      | Jumper      | 13/00/120/W03/A07       |
| W41      | Jumper      | 13/01/120/W03/A07       |
| W42      | Jumper      | 13/02/250/W03/X99       |
| W43      | Jumper      | 23/01/150/W02/D21       |
| W44      | Jumper      | 23/02/150/W02/D21       |
| W45      | Jumper      | 23/03/150/W02/D21       |
| W46      | Jumper      | JPW-02A                 |
| W47      | Jumper      | JPW-02H                 |
| W49      | Jumper      | IPS-1041-2              |
| W50      | Jumper      | 23/00/110/W02/C02       |
| W52      | Jumper      | 23/02/160/C02/W01       |
| W53      | Jumper      | 23/03/140/C02/W01       |
| W54      | Jumper      | 23/04/120/C02/W01       |
| W55      | Jumper      | 23/05/125/C02/W01       |
| W56      | Jumper      | 23/06/110/C02/W02       |

**10 - 3 DISPLAY UNIT**

| REF. NO. | DESCRIPTION | PART NO.   |
|----------|-------------|------------|
| IC1      | IC          | μPD549C    |
| IC2      | IC          | μPD549C    |
| IC3      | IC          | μA78L05    |
| IC4      | IC          | NJM79L05A  |
| Q1       | Transistor  | 2SA1015-Y  |
| Q2       | Transistor  | 2SA1015-Y  |
| Q3       | Transistor  | 2SA1015-Y  |
| Q4       | Transistor  | 2SC1214    |
| Q5       | Transistor  | 2SC1214    |
| Q6       | Transistor  | 2SA1015-Y  |
| Q7       | Transistor  | 2SC2458-GR |
| Q8       | Transistor  | 2SC3402    |
| D1       | Diode       | 1SS55      |
| D2       | Diode       | 1SS55      |
| D3       | Diode       | 1SS55      |
| D4       | Diode       | 1SS55      |

**DISPLAY UNIT**

| REF. NO. | DESCRIPTION | PART NO. |       |
|----------|-------------|----------|-------|
| D5       | Diode       | 1SS55    |       |
| D6       | Diode       | 1SS55    |       |
| D7       | Diode       | 1SS55    |       |
| D8       | Diode       | 1SS55    |       |
| D9       | Diode       | 1SS55    |       |
| D10      | Diode       | 1SS55    |       |
| D11      | Diode       | 1SS55    |       |
| D13      | Diode       | 1SS55    |       |
| D14      | Zener       | RD6.2E   | B2    |
| D15      | Diode       | 1SS55    |       |
| D16      | Diode       | 1SS55    |       |
| D17      | Diode       | 1SS55    |       |
| D18      | Diode       | 1SS55    |       |
| D19      | Diode       | 1SS55    |       |
| D21      | Diode       | 1SS53    |       |
| L1       | Coil        | FL5H     | 101K  |
| L2       | Coil        | FL9H     | 471K  |
| L3       | Coil        | LAL04NA  | 101K  |
| R1       | Resistor    | 1k       | ELR25 |
| R2       | Resistor    | 1k       | ELR25 |
| R3       | Resistor    | 1k       | ELR25 |
| R4       | Resistor    | 1k       | R25   |
| R5       | Resistor    | 1k       | ELR25 |
| R6       | Resistor    | 1k       | ELR25 |
| R7       | Resistor    | 1k       | ELR25 |
| R8       | Resistor    | 1k       | ELR25 |
| R9       | Resistor    | 1k       | ELR25 |
| R10      | Resistor    | 1k       | ELR25 |
| R11      | Array       | RMX-6    | 47k   |
| R12      | Array       | RMX-10   | 47k   |
| R13      | Array       | RMX-6    | 47k   |
| R14      | Array       | RMX-8    | 47k   |
| R15      | Resistor    | 47k      | ELR25 |
| R16      | Resistor    | 47k      | ELR25 |
| R17      | Resistor    | 47k      | ELR25 |
| R18      | Resistor    | 2.7k     | ELR25 |
| R19      | Resistor    | 2.7k     | ELR25 |
| R20      | Resistor    | 2.7k     | ELR25 |
| R21      | Resistor    | 2.7k     | ELR25 |
| R22      | Resistor    | 2.7k     | ELR25 |
| R23      | Resistor    | 2.7k     | ELR25 |
| R24      | Resistor    | 2.7k     | ELR25 |
| R25      | Resistor    | 2.7k     | ELR25 |
| R26      | Resistor    | 2.7k     | ELR25 |
| R27      | Resistor    | 2.7k     | ELR25 |
| R28      | Resistor    | 2.7k     | ELR25 |
| R29      | Array       | RMX-10   | 47k   |
| R30      | Resistor    | 47k      | ELR25 |
| R31      | Resistor    | 47k      | R25   |
| R32      | Resistor    | 3.3k     | ELR25 |
| R33      | Resistor    | 3.3k     | R20   |
| R34      | Resistor    | 2.2      | ELR25 |
| R35      | Resistor    | 47       | ELR25 |
| R36      | Resistor    | 2.2k     | ELR25 |
| R37      | Resistor    | 2.2k     | ELR25 |
| R40      | Resistor    | 1k       | ELR25 |
| R41      | Resistor    | 100k     | ELR25 |
| R42      | Resistor    | 2.2k     | ELR25 |
| R44      | Resistor    | 220      | R25   |
| R45      | Resistor    | 220      | R25   |

**DISPLAY UNIT**

| REF. NO. | DESCRIPTION  | PART NO.              |         |
|----------|--------------|-----------------------|---------|
| R46      | Resistor     | 220                   | R25     |
| R47      | Resistor     | 22                    | R20     |
| C1       | Array        | B5RC0124-32N 0.001x4  |         |
| C2       | Ceramic      | 0.001                 | 50V     |
| C3       | Array        | B5RC0124-32N 0.001x4  |         |
| C4       | Ceramic      | 0.001                 | 50V     |
| C5       | Ceramic      | 0.001                 | 50V     |
| C6       | Ceramic      | 0.001                 | 50V     |
| C7       | Ceramic      | 0.001                 | 50V     |
| C8       | Ceramic      | 0.001                 | 50V     |
| C9       | Ceramic      | 0.001                 | 50V     |
| C10      | Ceramic      | 0.0047                | 50V     |
| C11      | Ceramic      | 0.0047                | 50V     |
| C12      | Ceramic      | 0.0047                | 50V     |
| C13      | Array        | B8ZC0111-32N 0.0082x7 |         |
| C14      | Ceramic      | 0.0047                | 50V     |
| C15      | Ceramic      | 330P                  | 50V     |
| C16      | Ceramic      | 330P                  | 50V     |
| C17      | Electrolytic | 33                    | 16V     |
| C18      | Electrolytic | 4.7                   | 25V RC2 |
| C19      | Electrolytic | 3.3                   | 50V RC2 |
| C20      | Electrolytic | 3.3                   | 50V RC2 |
| C21      | Electrolytic | 0.1                   | 50V RC2 |
| C22      | Electrolytic | 10                    | 16V RC2 |
| C23      | Electrolytic | 10                    | 16V RC2 |
| C24      | Electrolytic | 10                    | 16V RC2 |
| C25      | Electrolytic | 10                    | 16V RC2 |
| C26      | Mylar        | 0.01                  | 50V     |
| J1       | Connector    | TL25P-06-V1           |         |
| J2       | Connector    | TL25P-03-V1           |         |
| P1       | Connector    | TL25H-04-B1           |         |
| DS1      | FLD          | FIP12FM7              |         |
| DS2      | LED          | SLB-22UR              |         |
| DS3      | LED          | SLB-22GG              |         |
| DS4      | LED          | SLB-22YY              |         |
| T1       | Transformer  | TO-9                  |         |
| EP1      | P.C. Board   | B-706D                |         |
| EP2      | P.C. Board   | B-729A                |         |
| EP3      | Ribbon Cable | B-785                 |         |
| EP4      | Ribbon Cable | B-786                 |         |
| W1       | Jumper       | 23/01/180/W07/W07     |         |
| W2       | Jumper       | 23/02/150/W07/W07     |         |
| W3       | Jumper       | 23/03/180/W07/W07     |         |
| W4       | Jumper       | 23/04/190/W07/W02     |         |
| W5       | Jumper       | 23/05/150/W07/W07     |         |
| W6       | Jumper       | 23/06/150/W07/W07     |         |
| W7       | Jumper       | 23/07/160/W07/W07     |         |
| W8       | Jumper       | 23/08/160/W07/W07     |         |
| W9       | Jumper       | 23/09/160/W07/W07     |         |
| W10      | Jumper       | 23/00/120/W07/W07     |         |
| W11      | Jumper       | 23/01/120/W07/W07     |         |
| W12      | Jumper       | 23/02/120/W07/W07     |         |
| W13      | Jumper       | JPW-02A               |         |
| W14      | Jumper       | JPW-02A               |         |
| W15      | Jumper       | JPW-02A               |         |

**DISPLAY UNIT/LOGIC UNIT**

| REF. NO. | DESCRIPTION | PART NO.          |
|----------|-------------|-------------------|
| W16      | Jumper      | IPS-1041-4        |
| W17      | Jumper      | JPW-02A           |
| W18      | Jumper      | IPS-1041-4        |
| W19      | Jumper      | IPS-1041-4        |
| W20      | Jumper      | JPW-02H           |
| W21      | Jumper      | JPW-02H           |
| W22      | Jumper      | JPW-02H           |
| W23      | Jumper      | JPW-02H           |
| W24      | Jumper      | JPW-02H           |
| W25      | Jumper      | JPW-02H           |
| W26      | Jumper      | IPS-1041-4        |
| W27      | Jumper      | IPS-1041-4        |
| W28      | Jumper      | IPS-1041-4        |
| W29      | Jumper      | IPS-1041-4        |
| W30      | Jumper      | IPS-1041-4        |
| W31      | Jumper      | JPW-02H           |
| W32      | Jumper      | JPW-02H           |
| W33      | Jumper      | JPW-02H           |
| W34      | Jumper      | JPW-02H           |
| W35      | Jumper      | IPS-1041-4        |
| W36      | Jumper      | JPW-02H           |
| W37      | Jumper      | IPS-1041-4        |
| W38      | Jumper      | JPW-02A           |
| W39      | Jumper      | JPW-02H           |
| W40      | Jumper      | IPS-1041-4        |
| W41      | Jumper      | IPS-1041-4        |
| W42      | Jumper      | IPS-1041-4        |
| W43      | Jumper      | JPW-02A           |
| W44      | Jumper      | IPS-1041-4        |
| W45      | Jumper      | IPS-1041-4        |
| W46      | Jumper      | JPW-02A           |
| W47      | Jumper      | JPW-02A           |
| W48      | Jumper      | JPW-02A           |
| W49      | Jumper      | JPW-02H           |
| W50      | Jumper      | 23/00/190/C01/W02 |
| W51      | Jumper      | 23/01/190/C01/W02 |
| W52      | Jumper      | 23/02/190/C01/W02 |
| W53      | Jumper      | 23/03/190/C01/W02 |

**10 - 4 LOGIC UNIT**

| REF. NO. | DESCRIPTION | PART NO.          |
|----------|-------------|-------------------|
| IC1      | IC          | $\mu$ A7805       |
| IC2      | IC          | RP5G01 007        |
| IC3      | IC          | $\mu$ PD7801G 114 |
| IC4      | IC          | SN74LS08N         |
| IC5      | IC          | SN74LS32N         |
| IC6      | IC          | SNS74LS02N        |
| IC7      | IC          | $\mu$ PD4013BC    |
| IC8      | IC          | TC4528BP          |
| IC9      | IC          | SN74LS377N        |
| IC10     | IC          | SN74LS11N         |
| IC11     | IC          | SN74LS175N        |
| IC12     | IC          | BA618             |
| IC13     | IC          | BA618             |
| IC14     | IC          | M50780SP          |
| IC15     | IC          | BA618             |
| IC16     | IC          | DAN401            |
| IC17     | IC          | SN74LS08N         |
| IC18     | IC          | SN74LS08N         |
| IC19     | IC          | TA78L008AP        |

**LOGIC UNIT**

| REF. NO. | DESCRIPTION       | PART NO.    |
|----------|-------------------|-------------|
| Q1       | Transistor        | 2SA1048-Y   |
| Q2       | Transistor        | 2SA1048-Y   |
| Q3       | Transistor        | 2SA1048-Y   |
| Q4       | Transistor        | 2SC2458-GR  |
| Q5       | Transistor        | 2SC2458-GR  |
| Q6       | Transistor        | 2SA1348     |
| Q7       | Transistor        | 2SA1348     |
| Q8       | Transistor        | 2SA1348     |
| Q9       | Transistor        | 2SA1348     |
| Q10      | Transistor        | 2SA1348     |
| Q11      | Transistor        | 2SA1348     |
| Q12      | Transistor        | 2SA1348     |
| Q13      | Transistor        | 2SA1348     |
| Q14      | Transistor        | 2SA1348     |
| Q15      | Transistor        | 2SA1348     |
| Q16      | Transistor        | 2SA1348     |
| Q17      | Transistor        | 2SC3399     |
| Q18      | Transistor        | 2SC3399     |
| Q19      | Transistor        | 2SB562-C    |
| Q20      | Transistor        | 2SC3399     |
| Q21      | Transistor        | 2SC3399     |
| D1       | Diode             | 1SS53       |
| D2       | Diode             | 1SS53       |
| D3       | Diode             | 1SS53       |
| D4       | Diode             | 1SS53       |
| D5       | Diode             | 1SS53       |
| D6       | Diode             | 1SS53       |
| D7       | Diode             | 1SS53       |
| D8       | Diode             | 1SS53       |
| D9       | Diode             | 1SS53       |
| D10      | Diode             | 1SS53       |
| D11      | Diode             | 1SS53       |
| D12      | Diode             | 1SS53       |
| D13      | Diode             | 1SS53       |
| D14      | Diode             | 1SS53       |
| D15      | Diode             | 1SS53       |
| D16      | Diode             | 1SS53       |
| D17      | Diode             | 1SS53       |
| D18      | Diode             | 1SS53       |
| D19      | Diode             | 1SS53       |
| D20      | Diode             | 1SS53       |
| D21      | Diode             | 1SS53       |
| D22      | Diode             | 1SS53       |
| D23      | Diode             | 1SS53       |
| D24      | Diode             | 1SS53       |
| D25      | Diode             | 1SS53       |
| D26      | Diode             | 1SS53       |
| D27      | Diode             | 1SS53       |
| D28      | Diode             | 1SS53       |
| D29      | Diode             | 1SS53       |
| D30      | Diode             | 1SS53       |
| D31      | Diode             | 1SS53       |
| D32      | Diode             | 1SS53       |
| D33      | Diode             | 1SS53       |
| D34      | Diode             | 1SS53       |
| D35      | Diode             | 1SS53       |
| D36      | Diode             | 1SS53       |
| X1       | Ceramic Resonator | CSA400MT    |
| L1       | Coil              | FL5H 102K   |
| L3       | Coil              | BT01RN1-A61 |

**LOGIC UNIT**

| REF. NO. | DESCRIPTION | PART NO.   |         |
|----------|-------------|------------|---------|
| L4       | Coil        | FL5H       | 102K    |
| L5       | Coil        | FL5H       | 102K    |
| L6       | Coil        | FL5H       | 102K    |
| L7       | Coil        | FL5H       | 102K    |
| L8       | Coil        | FL5H       | 102K    |
| L9       | Coil        | FL5H       | 102K    |
| L10      | Coil        | FL5H       | 102K    |
| L11      | Coil        | FL5H       | 101K    |
| L12      | Coil        | FL5H       | 101K    |
| L13      | Coil        | FL5H       | 101K    |
| L14      | Coil        | FL5H       | 101K    |
| L15      | Coil        | FL5H       | 101K    |
| L16      | Coil        | FL5H       | 101K    |
| L17      | Coil        | FL5H       | 101K    |
| L18      | Coil        | EL0810SKI  | 102K    |
| R1       | Resistor    | 4.7k       | ELR25   |
| R2       | Resistor    | 47k        | R25     |
| R3       | Resistor    | 10k        | R20     |
| R4       | Resistor    | 47k        | R20     |
| R5       | Resistor    | 470        | ELR25   |
| R6       | Array       | RMX-4      | 100k    |
| R7       | Resistor    | 120k       | ELR25   |
| R8       | Resistor    | 10k        | R25     |
| R10      | Resistor    | 47k        | R25     |
| R11      | Resistor    | 3.3M       | ELR25   |
| R12      | Resistor    | 1M         | ELR20   |
| R13      | Resistor    | 33         | ELR25   |
| R14      | Trimmer     | RHA3A160AA | 1MB     |
| R15      | Resistor    | 220k       | ELR25   |
| R16      | Resistor    | 47k        | ELR25   |
| R17      | Resistor    | 1M         | R20     |
| R18      | Resistor    | 1M         | R25     |
| R19      | Resistor    | 47k        | R25     |
| R20      | Resistor    | 10         | R50X    |
| R21      | Resistor    | 10k        | R25     |
| R22      | Array       | RMX-8      | 4.7k    |
| R23      | Resistor    | 68k        | ELR20   |
| R24      | Resistor    | 4.7k       | ELR25   |
| R25      | Resistor    | 10k        | R25     |
| R26      | Resistor    | 1k         | ELR25   |
| R27      | Array       | RMX-4      | 4.7k    |
| R28      | Resistor    | 47k        | R20     |
| R29      | Resistor    | 750        | CRB25FX |
| R30      | Resistor    | 1.8k       | CRB25FX |
| R31      | Resistor    | 3.3k       | CRB25FX |
| R32      | Resistor    | 5.6k       | CRB25FX |
| R33      | Resistor    | 10k        | CRB25FX |
| R34      | Resistor    | 4.7k       | CRB25FX |
| R35      | Resistor    | 1k         | R25     |
| R36      | Resistor    | 1k         | R25     |
| R37      | Resistor    | 1k         | R25     |
| R38      | Resistor    | 1k         | R25     |
| R39      | Resistor    | 1k         | R25     |
| R40      | Resistor    | 1k         | R25     |
| R41      | Resistor    | 1k         | R25     |
| R42      | Resistor    | 1k         | R25     |
| R43      | Resistor    | 1k         | R25     |
| R44      | Resistor    | 1k         | R25     |
| R45      | Resistor    | 1k         | R25     |
| R46      | Resistor    | 1k         | R25     |
| R47      | Resistor    | 1k         | R25     |

**LOGIC UNIT**

| REF. NO. | DESCRIPTION   | PART NO.     |          |
|----------|---------------|--------------|----------|
| R48      | Resistor      | 1k           | R25      |
| R49      | Resistor      | 1k           | R25      |
| R50      | Resistor      | 1k           | R25      |
| R51      | Resistor      | 1k           | R25      |
| R53      | Resistor      | 220          | ELR25    |
| R54      | Resistor      | 10k          | ELR25    |
| R55      | Resistor      | 10k          | R25      |
| R58      | Resistor      | 10k          | ELR20    |
| R59      | Resistor      | 10k          | R20      |
| R60      | Resistor      | 3.3k         | R20      |
| R61      | Resistor      | 10k          | R20      |
| R64      | Resistor      | 10k          | R20      |
| R65      | Resistor      | 10k          | R20      |
| C1       | Electrolytic  | 33           | 16V      |
| C2       | Barrier Layer | 0.1          | 16V      |
| C3       | Barrier Layer | 0.1          | 16V      |
| C4       | Electrolytic  | 47           | 10V      |
| C5       | Electrolytic  | 1            | 50V      |
| C6       | Barrier Layer | 0.1          | 16V      |
| C7       | Mylar         | 0.0022       | 50V      |
| C8       | Mylar         | 0.001        | 50V      |
| C9       | Mylar         | 0.001        | 50V      |
| C10      | Barrier Layer | 0.1          | 16V      |
| C11      | Ceramic       | 33P          | 50V      |
| C12      | Ceramic       | 33P          | 50V      |
| C13      | Barrier Layer | 0.1          | 16V      |
| C14      | Barrier Layer | 0.047        | 25V      |
| C15      | Electrolytic  | 1            | 50V BP   |
| C16      | Ceramic       | 0.0047       | 50V      |
| C17      | Barrier Layer | 0.1          | 16V      |
| C18      | Electrolytic  | 47           | 10V      |
| C19      | Barrier Layer | 0.1          | 16V      |
| C20      | Array         | B8ZC0111-32N | 0.0082x7 |
| C21      | Ceramic       | 470P         | 50V      |
| C22      | Ceramic       | 0.001        | 50V      |
| C23      | Electrolytic  | 2.2          | 50V MS7  |
| C24      | Ceramic       | 0.0022       | 50V      |
| C25      | Ceramic       | 0.001        | 50V      |
| C26      | Array         | B8ZC0111-32N | 0.0082x7 |
| C27      | Array         | B5RC0124-32N | 0.001x4  |
| C28      | Array         | B7ZC0711-32N | 0.01x6   |
| C29      | Array         | B7ZC0711-32N | 0.01x6   |
| C30      | Barrier Layer | 0.1          | 16V      |
| C31      | Barrier Layer | 0.1          | 16V      |
| C32      | Barrier Layer | 0.1          | 16V      |
| C33      | Ceramic       | 0.0047       | 50V      |
| C34      | Ceramic       | 0.0047       | 50V      |
| C35      | Ceramic       | 0.0047       | 50V      |
| J1       | Connector     | TL25P-03-V1  |          |
| J2       | Connector     | TL25P-10-V1  |          |
| J3       | Connector     | TL25P-12-V1  |          |
| J4       | Connector     | TL25P-05-V1  |          |
| J5       | Connector     | 5138-11CPB   |          |
| J6       | Connector     | 3022-06B     |          |
| J7       | Connector     | 5138-10CPB   |          |
| J8       | Connector     | 5138-04CPB   |          |
| J9       | Connector     | TL25P-07-V1  |          |
| J10      | Connector     | TL25P-09-V1  |          |
| J11      | Connector     | 5138-11CPB   |          |
| J12      | Connector     | TL25P-08-V1  |          |

**LOGIC UNIT**

| REF. NO. | DESCRIPTION | PART NO.          |
|----------|-------------|-------------------|
| J13      | Connector   | 5138-10CPB        |
| J14      | Connector   | 5138-08CPB        |
| J15      | Connector   | TL25P-08-V1       |
| J16      | Connector   | 3022-12B          |
| J17      | Connector   | 3022-08B          |
| J18      | Connector   | TL25P-06-L1       |
| J19      | Connector   | TL25P-03-L1       |
| J20      | Connector   | 3022-02B          |
| J21      | Connector   | 3022-02B          |
| P1       | Connector   | TL25H-03-B1       |
| S1       | Thermal     | OHD3-50M          |
| EP1      | P.C. Board  | B-705E            |
| EP2      | P.C. Board  | B-1036A           |
| EP3      | Ram Unit    | EX-314-01         |
| EP8      | P.C. Board  | B-1131A           |
| W1       | Jumper      | 23/00/200/D21/D21 |
| W2       | Jumper      | 23/01/200/D21/D21 |
| W3       | Jumper      | 23/02/140/D21/D21 |
| W4       | Jumper      | 23/03/180/D21/D21 |
| W5       | Jumper      | 23/04/170/D21/D21 |
| W6       | Jumper      | 23/05/170/D21/D21 |
| W7       | Jumper      | 23/06/160/D21/D21 |
| W8       | Jumper      | 23/07/220/D21/D21 |
| W9       | Jumper      | 23/08/080/D21/D21 |
| W10      | Jumper      | 23/09/080/D21/D21 |
| W11      | Jumper      | 23/00/070/D21/D21 |
| W12      | Jumper      | 23/01/140/D21/D21 |
| W13      | Jumper      | 23/02/100/D21/D21 |
| W14      | Jumper      | 23/03/100/D21/D21 |
| W15      | Jumper      | IPS-1041-4        |
| W16      | Jumper      | IPS-1041-4        |
| W17      | Jumper      | IPS-1041-2        |
| W18      | Jumper      | IPS-1041-4        |
| W19      | Jumper      | IPS-1041-2        |
| W20      | Jumper      | IPS-1041-4        |
| W21      | Jumper      | IPS-1041-4        |
| W22      | Jumper      | IPS-1041-4        |
| W23      | Jumper      | IPS-1041-2        |
| W24      | Jumper      | IPS-1041-4        |
| W26      | Jumper      | IPS-1041-4        |
| W27      | Jumper      | IPS-1041-4        |
| W28      | Jumper      | IPS-1041-4        |
| W29      | Jumper      | IPS-1041-4        |
| W30      | Jumper      | IPS-1041-4        |
| W31      | Jumper      | IPS-1041-2        |
| W32      | Jumper      | IPS-1041-4        |
| W33      | Jumper      | IPS-1041-4        |
| W34      | Jumper      | IPS-1041-2        |
| W35      | Jumper      | IPS-1041-4        |
| W36      | Jumper      | IPS-1041-2        |
| W37      | Jumper      | IPS-1041-4        |
| W38      | Jumper      | JPW-02A           |
| W39      | Jumper      | IPS-1041-4        |
| W40      | Jumper      | JPW-02A           |
| W41      | Jumper      | IPS-1041-4        |
| W42      | Jumper      | JPW-02H           |
| W43      | Jumper      | IPS-1041-4        |
| W44      | Jumper      | IPS-1041-4        |

**LOGIC UNIT**

| REF. NO. | DESCRIPTION | PART NO.          |
|----------|-------------|-------------------|
| W45      | Jumper      | JPW-02H           |
| W46      | Jumper      | IPS-1041-2        |
| W47      | Jumper      | IPS-1041-4        |
| W48      | Jumper      | IPS-1041-4        |
| W49      | Jumper      | JPW-02A           |
| W50      | Jumper      | IPS-1041-4        |
| W51      | Jumper      | IPS-1041-2        |
| W52      | Jumper      | IPS-1041-2        |
| W53      | Jumper      | IPS-1041-2        |
| W54      | Jumper      | IPS-1041-4        |
| W55      | Jumper      | JPW-02A           |
| W56      | Jumper      | IPS-1041-4        |
| W57      | Jumper      | IPS-1041-4        |
| W58      | Jumper      | IPS-1041-4        |
| W59      | Jumper      | IPS-1041-4        |
| W60      | Jumper      | IPS-1041-4        |
| W61      | Jumper      | IPS-1041-4        |
| W62      | Jumper      | IPS-1041-4        |
| W63      | Jumper      | IPS-1041-2        |
| W64      | Jumper      | IPS-1041-4        |
| W65      | Jumper      | IPS-1041-4        |
| W66      | Jumper      | IPS-1041-4        |
| W67      | Jumper      | IPS-1041-4        |
| W68      | Jumper      | IPS-1041-4        |
| W69      | Jumper      | IPS-1041-4        |
| W70      | Jumper      | IPS-1041-4        |
| W71      | Jumper      | IPS-1041-4        |
| W72      | Jumper      | IPS-1041-4        |
| W73      | Jumper      | IPS-1041-4        |
| W74      | Jumper      | IPS-1041-4        |
| W75      | Jumper      | IPS-1041-4        |
| W76      | Jumper      | JPW-02A           |
| W77      | Jumper      | IPS-1041-4        |
| W78      | Jumper      | IPS-1041-2        |
| W79      | Jumper      | IPS-1041-2        |
| W80      | Jumper      | IPS-1041-2        |
| W81      | Jumper      | IPS-1041-4        |
| W82      | Jumper      | IPS-1041-4        |
| W83      | Jumper      | IPS-1041-4        |
| W84      | Jumper      | IPS-1041-4        |
| W85      | Jumper      | IPS-1041-4        |
| W86      | Jumper      | IPS-1041-4        |
| W87      | Jumper      | IPS-1041-4        |
| W88      | Jumper      | IPS-1041-4        |
| W89      | Jumper      | IPS-1041-4        |
| W90      | Jumper      | IPS-1041-4        |
| W91      | Jumper      | IPS-1041-4        |
| W92      | Jumper      | IPS-1041-4        |
| W93      | Jumper      | IPS-1041-4        |
| W94      | Jumper      | IPS-1041-2        |
| W95      | Jumper      | IPS-1041-2        |
| W96      | Jumper      | IPS-1041-4        |
| W97      | Jumper      | IPS-1041-2        |
| W98      | Jumper      | JPW-02A           |
| W99      | Jumper      | JPW-02A           |
| W100     | Jumper      | JPW-02A           |
| W101     | Jumper      | JPW-02A           |
| W102     | Jumper      | JPW-02A           |
| W103     | Jumper      | JPW-02A           |
| W104     | Jumper      | IPS-1041-4        |
| W105     | Jumper      | 23/05/320/D21/C01 |
| W107     | Jumper      | 23/07/250/D21/C01 |

**LOGIC UNIT/MATRIX UNIT**

| REF. NO. | DESCRIPTION | PART NO.   |
|----------|-------------|------------|
| W108     | Jumper      | JPW-02A    |
| W109     | Jumper      | JPW-02A    |
| W110     | Jumper      | IPS-1041-2 |
| W111     | Jumper      | IPS-1041-2 |
| W112     | Jumper      | IPS-1041-2 |
| W113     | Jumper      | IPS-1041-2 |
| W114     | Jumper      | IPS-1041-4 |
| W115     | Jumper      | IPS-1041-4 |

**10 - 5 MATRIX UNIT**

| REF. NO. | DESCRIPTION | PART NO.   |
|----------|-------------|------------|
| IC1      | IC          | μPD4013BC  |
| IC2      | IC          | μPD4013BC  |
| IC3      | IC          | μPD4011BC  |
| IC4      | IC          | μPD4030BC  |
| IC5      | IC          | μPD4081BC  |
| Q1       | Transistor  | 32SA1048-Y |
| Q2       | Transistor  | 2SC2458-GR |
| Q3       | Transistor  | 2SC2458-GR |
| Q4       | Transistor  | 2SC3399    |
| Q5       | Transistor  | 2SC3399    |
| Q6       | Transistor  | 2SC2458-GR |
| Q7       | Transistor  | 2SA1048-Y  |
| Q8       | Transistor  | 2SC2458-GR |
| Q9       | Transistor  | 2SC3399    |
| Q10      | Transistor  | 2SC2458-GR |
| Q13      | Transistor  | 2SC2458-GR |
| Q14      | Transistor  | 2SC2458-GR |
| Q15      | Transistor  | 2SC2458-GR |
| Q16      | Transistor  | 2SC2458-GR |
| Q17      | Transistor  | 2SC2458-GR |
| Q18      | Transistor  | 2SC2458-GR |
| Q19      | Transistor  | 2SC2458-GR |
| Q20      | Transistor  | 2SA1048-Y  |
| Q21      | Transistor  | 2SC2458-GR |
| Q23      | Transistor  | 2SA1348    |
| Q24      | Transistor  | 2SA1348    |
| D2       | Diode       | 1SS53      |
| D3       | Diode       | 1SS53      |
| D4       | Diode       | 1SS53      |
| D5       | Diode       | 1SS53      |
| D6       | Diode       | 1SS53      |
| D7       | Diode       | 1SS53      |
| D8       | Diode       | 1SS53      |
| D9       | Diode       | 1SS53      |
| D10      | Diode       | 1SS53      |
| D11      | Diode       | 1SS53      |
| D12      | Diode       | 1SS53      |
| D13      | Diode       | 1SS53      |
| D14      | Diode       | 1SS53      |
| D15      | Diode       | 1SS53      |
| D16      | Diode       | 1SS53      |
| D17      | Diode       | 1SS53      |
| D18      | Diode       | 1SS53      |
| D19      | Diode       | 1SS53      |
| D20      | Diode       | 1SS53      |
| D21      | Diode       | 1SS53      |

**MATRIX UNIT**

| REF. NO. | DESCRIPTION | PART NO.   |
|----------|-------------|------------|
| D22      | Diode       | 1SS53      |
| D23      | Diode       | 1SS53      |
| D24      | Diode       | 1SS53      |
| D25      | Diode       | 1SS53      |
| D26      | Diode       | 1SS53      |
| D27      | Diode       | 1SS53      |
| D28      | Diode       | 1SS53      |
| D29      | Diode       | 1SS53      |
| D30      | Diode       | 1SS53      |
| D31      | Diode       | 1SS53      |
| D32      | Diode       | 1SS53      |
| D33      | Diode       | 1SS53      |
| D34      | Diode       | 1SS53      |
| D35      | Diode       | 1SS53      |
| D36      | Diode       | 1SS53      |
| D37      | Diode       | 1SS53      |
| D38      | Diode       | 1SS53      |
| D39      | Diode       | 1SS53      |
| D40      | Diode       | 1SS53      |
| D41      | Diode       | 1SS53      |
| R1       | Resistor    | 10k ELR25  |
| R2       | Resistor    | 10k ELR25  |
| R3       | Resistor    | 680k ELR25 |
| R4       | Resistor    | 47k R25    |
| R5       | Resistor    | 1M ELR25   |
| R6       | Resistor    | 47k ELR25  |
| R7       | Resistor    | 47k ELR25  |
| R8       | Resistor    | 22k R25    |
| R9       | Resistor    | 47k ELR25  |
| R10      | Resistor    | 47k R25    |
| R11      | Resistor    | 1M ELR25   |
| R12      | Resistor    | 1M ELR25   |
| R13      | Resistor    | 47k ELR25  |
| R14      | Resistor    | 1M ELR25   |
| R15      | Resistor    | 3.3M ELR25 |
| R16      | Resistor    | 330k ELR25 |
| R17      | Resistor    | 47k ELR25  |
| R18      | Resistor    | 47k R25    |
| R19      | Resistor    | 47k R25    |
| R20      | Resistor    | 47k ELR25  |
| R21      | Resistor    | 470k ELR25 |
| R22      | Resistor    | 10k ELR25  |
| R26      | Resistor    | 47k ELR25  |
| R27      | Resistor    | 47k ELR25  |
| R28      | Resistor    | 47k ELR25  |
| R29      | Resistor    | 47k ELR25  |
| R30      | Resistor    | 47k ELR25  |
| R31      | Array       | RMX-6 10k  |
| R32      | Resistor    | 47k ELR25  |
| R33      | Resistor    | 47k R25    |
| R34      | Resistor    | 47k ELR25  |
| R35      | Resistor    | 1M ELR25   |
| R36      | Resistor    | 1M ELR25   |
| R37      | Resistor    | 47k R20    |
| R38      | Resistor    | 47k R20    |
| R39      | Resistor    | 6.8k R20   |
| R40      | Resistor    | 47k ELR25  |
| R41      | Resistor    | 4.7 ELR25  |
| R44      | Resistor    | 270 ELR25  |
| R45      | Resistor    | 270 R25    |
| R46      | Resistor    | 270 ELR25  |

**MATRIX UNIT**

| REF. NO. | DESCRIPTION   | PART NO.              |        |
|----------|---------------|-----------------------|--------|
| R47      | Resistor      | 10k                   | R20    |
| R48      | Resistor      | 10k                   | R25    |
| R49      | Resistor      | 1k                    | ELR20  |
| C1       | Barrier Layer | 0.1                   | 16V    |
| C2       | Barrier Layer | 0.1                   | 16V    |
| C3       | Barrier Layer | 0.1                   | 16V    |
| C4       | Barrier Layer | 0.1                   | 16V    |
| C5       | Barrier Layer | 0.1                   | 16V    |
| C6       | Electrolytic  | 0.47                  | 50V BP |
| C7       | Array         | B7ZC0711-32N 0.01x6   |        |
| C8       | Barrier Layer | 0.1                   | 16V    |
| C9       | Array         | B8ZC0111-32N 0.0082x7 |        |
| C10      | Barrier Layer | 0.1                   | 16V    |
| C11      | Barrier Layer | 0.1                   | 16V    |
| C12      | Ceramic       | 0.001                 | 50V    |
| C13      | Ceramic       | 0.001                 | 50V    |
| J1       | Connector     | 5138-15APB            |        |
| J2       | Connector     | TLB-P06H-B1           |        |
| J3       | Connector     | TSL-P04P-B1           |        |
| J4       | Connector     | TSL-P03P-B1           |        |
| P1       | Connector     | TL25H-06-B1           |        |
| P2       | Connector     | TL25H-03-B1           |        |
| P3       | Connector     | TL25H-05-B1           |        |
| P4       | Connector     | TL25H-06-B1           |        |
| DS1      | LED           | SLB-22UR              |        |
| S1       | Switch        | SPPH15029A            |        |
| S2       | Switch        | SPPH15029A            |        |
| S3       | Switch        | SPPH15009A            |        |
| S4       | Switch        | SPPH15029A            |        |
| S5       | Switch        | SPPH15029A            |        |
| S6       | Switch        | SPPH15029A            |        |
| S7       | Switch        | SPPH15029A            |        |
| S8       | Switch        | SPPH15029A            |        |
| S9       | Switch        | SPPH11163A            |        |
| S10      | Switch        | SSSS21148A            |        |
| S11      | Switch        | SPPH15029A            |        |
| S12      | Switch        | SPPH15029A            |        |
| S13      | Switch        | SPPH15009A            |        |
| S14      | Switch        | SPPH15029A            |        |
| S15      | Switch        | SPPH15029A            |        |
| S16      | Switch        | SPPH15029A            |        |
| S17      | Switch        | SPPH15009A            |        |
| S18      | Switch        | SPPH15029A            |        |
| S19      | Switch        | SPPH15009A            |        |
| S20      | Switch        | SPPH15029A            |        |
| S21      | Switch        | SPPH15029A            |        |
| S22      | Switch        | SPPH15009A            |        |
| S23      | Switch        | SPPH15009A            |        |
| S24      | Switch        | SPPH15009A            |        |
| EP1      | P.C. Board    | B-728C                |        |
| EP2      | P.C. Board    | B-726G                |        |
| EP3      | P.C. Board    | B-725A                |        |
| EP4      | Ribbon Cable  | B-787                 |        |
| EP5      | Ribbon Cable  | B-788                 |        |
| EP6      | Ribbon Cable  | B-789                 |        |

**MATRIX UNIT**

| REF. NO. | DESCRIPTION | PART NO.          |
|----------|-------------|-------------------|
| W1       | Jumper      | 23/01/160/D21/D21 |
| W2       | Jumper      | 23/02/120/D21/D21 |
| W3       | Jumper      | 23/03/100/D21/D21 |
| W4       | Jumper      | IPS-1041-4        |
| W5       | Jumper      | IPS-1041-4        |
| W6       | Jumper      | IPS-1041-4        |
| W7       | Jumper      | IPS-1041-4        |
| W8       | Jumper      | IPS-1041-2        |
| W9       | Jumper      | IPS-1041-2        |
| W10      | Jumper      | IPS-1041-4        |
| W11      | Jumper      | IPS-1041-4        |
| W12      | Jumper      | IPS-1041-2        |
| W13      | Jumper      | IPS-1041-4        |
| W14      | Jumper      | IPS-1041-4        |
| W15      | Jumper      | IPS-1041-4        |
| W16      | Jumper      | IPS-1041-4        |
| W17      | Jumper      | IPS-1041-4        |
| W18      | Jumper      | IPS-1041-2        |
| W19      | Jumper      | IPS-1041-4        |
| W20      | Jumper      | IPS-1041-4        |
| W21      | Jumper      | JPW-02A           |
| W22      | Jumper      | IPS-1041-2        |
| W23      | Jumper      | IPS-1041-2        |
| W24      | Jumper      | IPS-1041-2        |
| W25      | Jumper      | IPS-1041-4        |
| W26      | Jumper      | IPS-1041-4        |
| W27      | Jumper      | IPS-1041-4        |
| W28      | Jumper      | IPS-1041-4        |
| W29      | Jumper      | JPW-02H           |
| W30      | Jumper      | IPS-1041-4        |
| W31      | Jumper      | IPS-1041-4        |
| W32      | Jumper      | IPS-1041-2        |
| W33      | Jumper      | IPS-1041-4        |
| W34      | Jumper      | IPS-1041-4        |
| W35      | Jumper      | IPS-1041-2        |
| W36      | Jumper      | IPS-1041-4        |
| W37      | Jumper      | IPS-1041-2        |
| W38      | Jumper      | IPS-1041-4        |
| W39      | Jumper      | IPS-1041-4        |
| W40      | Jumper      | IPS-1041-4        |
| W41      | Jumper      | IPS-1041-4        |
| W42      | Jumper      | IPS-1041-2        |
| W43      | Jumper      | IPS-1041-4        |
| W46      | Wire        | 23/00/240/C01/D21 |
| W47      | Wire        | 23/01/210/C01/D21 |
| W48      | Wire        | 23/00/380/C01/C22 |
| W49      | Wire        | 23/01/380/C01/C22 |
| W50      | Wire        | 23/02/380/C01/C22 |
| W51      | Wire        | 23/03/380/C01/C22 |
| W52      | Wire        | 23/04/380/C01/C22 |
| W53      | Wire        | 23/05/380/C01/C22 |
| W54      | Wire        | 23/00/200/C01/W02 |
| W55      | Wire        | 23/01/200/C01/W02 |
| W56      | Wire        | 23/02/200/C01/W02 |
| W57      | Wire        | 23/03/200/C01/W02 |
| W58      | Wire        | 23/04/200/C01/W02 |
| W59      | Jumper      | JPW-02H           |
| W60      | Jumper      | IPS-1041-4        |
| W62      | Wire        | 23/02/490/C01/W02 |
| W63      | Wire        | 23/03/490/C01/W02 |
| W64      | Wire        | 23/04/490/C01/W02 |



**MATRIX UNIT/PLL UNIT**

| REF. NO. | DESCRIPTION | PART NO.          |
|----------|-------------|-------------------|
| W65      | Wire        | 23/05/490/C01/W02 |
| W66      | Wire        | 23/06/490/C01/W02 |
| W67      | Wire        | 23/07/490/C01/W02 |
| W69      | Jumper      | IPS-1041-4        |
| W70      | Jumper      | IPS-1041-4        |
| W71      | Jumper      | IPS-1041-2        |
| W72      | Jumper      | IPS-1041-4        |
| W73      | Jumper      | IPS-1041-2        |
| W74      | Jumper      | IPS-1041-2        |
| W75      | Jumper      | IPS-1041-4        |
| W76      | Wire        | 23/06/115/D21/D21 |
| W77      | Wire        | 23/07/110/D21/D21 |

**PLL UNIT**

| REF. NO. | DESCRIPTION | PART NO.  |
|----------|-------------|-----------|
| D5       | Diode       | 1SS53     |
| D7       | Diode       | 1SS53     |
| D8       | Diode       | 1SS53     |
| D9       | Diode       | 1SS53     |
| D10      | Diode       | 1SS53     |
| D11      | Diode       | 1SS53     |
| D12      | Varicap     | FC52M     |
| D13      | Varicap     | 1SV50E    |
| D14      | Varicap     | 1SV50E    |
| D15      | Varicap     | 1SV50E    |
| D16      | Diode       | 1SS53     |
| D17      | Diode       | 1SS53     |
| D18      | Diode       | 1SS53     |
| D19      | Diode       | 1SS53     |
| D20      | Zener       | RD5.1E B2 |
| D201     | Varicap     | 1SV50E    |
| D202     | Diode       | 1SS237    |
| D203     | Diode       | 1SS237    |

**10 - 6 PLL UNIT**

**REF. NO. DESCRIPTION PART NO.**

|       |    |            |
|-------|----|------------|
| IC1   | IC | M54929P    |
| IC2   | IC | M54466L    |
| IC3   | IC | μPC1037H   |
| IC4   | IC | μPC1037H   |
| IC5   | IC | SN74LS90N  |
| IC6   | IC | TC5082P-GL |
| IC7   | IC | TA78L008AP |
| IC8   | IC | μA7805     |
| IC201 | IC | M54929P    |
| IC202 | IC | M54466L    |
| IC203 | IC | SN74LS90N  |
| IC204 | IC | M54459L    |

|      |            |            |
|------|------------|------------|
| Q1   | Transistor | 2SC945-P   |
| Q2   | Transistor | 2SC945-P   |
| Q3   | Transistor | 2SC945-P   |
| Q4   | Transistor | 2SC945-P   |
| Q5   | FET        | 2SK30A-Y   |
| Q6   | FET        | 2SK30A-Y   |
| Q7   | Transistor | 2SC1571-G  |
| Q8   | Transistor | 2SA1015-Y  |
| Q9   | Transistor | 2SC945-P   |
| Q10  | Transistor | 2SC945-R   |
| Q11  | Transistor | 2SC383-TM  |
| Q12  | Transistor | 2SC945-P   |
| Q13  | Transistor | 2SC3399    |
| Q14  | Transistor | 2SC383-TM  |
| Q15  | FET        | 2SK241-Y   |
| Q16  | Transistor | 2SC383-TM  |
| Q17  | Transistor | 2SC383-TM  |
| Q18  | FET        | 2SK192A-GR |
| Q19  | FET        | 2SK192A-GR |
| Q20  | FET        | 2SK192A-GR |
| Q21  | FET        | 2SK192A-GR |
| Q22  | Transistor | 2SC383-TM  |
| Q23  | Transistor | 2SC383-TM  |
| Q24  | Transistor | 2SC945-P   |
| Q25  | Transistor | 2SC383-TM  |
| Q26  | Transistor | 2SC383-TM  |
| Q201 | FET        | 2SK192A-GR |
| Q202 | Transistor | 2SC763-C   |

|    |         |           |
|----|---------|-----------|
| D1 | Varicap | 1SV50E    |
| D2 | Zener   | RD5.1E B2 |
| D4 | Diode   | 1SS53     |

|      |            |                |
|------|------------|----------------|
| FL1  | Monolithic | FL-69          |
| X1   | Crystal    | CR-21          |
| L1   | Coil       | LW-19          |
| L2   | Coil       | LS-94          |
| L3   | Coil       | LS-114         |
| L4   | Coil       | LS-114         |
| L5   | Coil       | LS-114         |
| L6   | Coil       | LAL04NA 102K   |
| L7   | Coil       | EL0810SKI 101K |
| L8   | Coil       | LS-162         |
| L9   | Coil       | LA-244         |
| L10  | Coil       | LA-254         |
| L11  | Coil       | LB4 R36        |
| L12  | Coil       | LB4 R23        |
| L13  | Coil       | LW-20          |
| L14  | Coil       | FL5H 101K      |
| L15  | Coil       | FL5H 101K      |
| L16  | Coil       | LR-79          |
| L17  | Coil       | LB-135         |
| L18  | Coil       | LW-25          |
| L19  | Coil       | LR-79          |
| L20  | Coil       | LB-135         |
| L21  | Coil       | LW-25          |
| L22  | Coil       | LR-79          |
| L23  | Coil       | LB-135         |
| L24  | Coil       | LW-25          |
| L25  | Coil       | LR-79          |
| L26  | Coil       | LB-135         |
| L27  | Coil       | LW-25          |
| L28  | Coil       | BT01RN1-A61    |
| L29  | Coil       | LAL03NA R56M   |
| L30  | Coil       | LAL04NA 101K   |
| L31  | Coil       | LAL04NA 101K   |
| L32  | Coil       | LAL03NA 100K   |
| L33  | Coil       | BT01RN1-A61    |
| L34  | Coil       | BT01RN1-A61    |
| L201 | Coil       | LB-113         |
| L202 | Coil       | LW-25          |
| L203 | Coil       | FL5H 101K      |
| L204 | Coil       | LAL03NA 101K   |
| L205 | Coil       | LAL04NA 101K   |
| L206 | Coil       | LAL04NA 101K   |

**PLL UNIT**

| REF. NO. | DESCRIPTION | PART NO.        |
|----------|-------------|-----------------|
| R1       | Resistor    | 1k R25          |
| R2       | Resistor    | 2.2k ELR25      |
| R3       | Resistor    | 4.7k ELR25      |
| R4       | Resistor    | 10k ELR25       |
| R5       | Resistor    | 470 ELR25       |
| R6       | Resistor    | 220 ELR25       |
| R7       | Resistor    | 47 R25          |
| R8       | Resistor    | 47 ELR25        |
| R9       | Resistor    | 100 R20         |
| R10      | Resistor    | 15k ELR25       |
| R11      | Resistor    | 1k R25          |
| R12      | Resistor    | 470 R20         |
| R13      | Resistor    | 1.2k ELR20      |
| R14      | Resistor    | 220 ELR25       |
| R15      | Resistor    | 47k ELR25       |
| R17      | Resistor    | 10k ELR25       |
| R18      | Resistor    | 220 ELR25       |
| R19      | Resistor    | 22k ELR25       |
| R20      | Resistor    | 100 ELR25       |
| R21      | Resistor    | 8.2k ELR25      |
| R22      | Resistor    | 1k ELR25        |
| R24      | Resistor    | 100 ELR25       |
| R25      | Resistor    | 100 R20         |
| R26      | Resistor    | 470 ELR25       |
| R27      | Resistor    | 220 ELR25       |
| R28      | Resistor    | 100 ELR25       |
| R29      | Resistor    | 3.3 ELR25       |
| R30      | Resistor    | 1.5k ELR25      |
| R31      | Resistor    | 22k ELR25       |
| R32      | Resistor    | 10k ELR25       |
| R33      | Resistor    | 10k ELR25       |
| R34      | Resistor    | 220 ELR25       |
| R35      | Resistor    | 220 ELR25       |
| R37      | Resistor    | 2.7k ELR25      |
| R38      | Resistor    | 390 ELR25       |
| R39      | Resistor    | 1k ELR25        |
| R40      | Resistor    | 4.7k ELR25      |
| R41      | Resistor    | 1.8M ELR25      |
| R42      | Resistor    | 1k ELR25        |
| R43      | Trimmer     | RHB0CS21LA 470B |
| R44      | Resistor    | 4.7k ELR25      |
| R45      | Resistor    | 1k R25          |
| R46      | Resistor    | 4.7k R25        |
| R47      | Resistor    | 100 R25         |
| R48      | Resistor    | 2.2k ELR25      |
| R49      | Resistor    | 2.2k ELR25      |
| R50      | Resistor    | 10k ELR25       |
| R52      | Resistor    | 27k ELR25       |
| R53      | Resistor    | 22k ELR25       |
| R54      | Resistor    | 22k ELR25       |
| R55      | Resistor    | 47k ELR25       |
| R56      | Resistor    | 100k ELR25      |
| R57      | Resistor    | 100k ELR25      |
| R58      | Resistor    | 150 ELR25       |
| R59      | Resistor    | 3.3k ELR25      |
| R60      | Resistor    | 100k ELR25      |
| R61      | Resistor    | 100k ELR25      |
| R62      | Resistor    | 150 ELR25       |
| R63      | Resistor    | 3.3k ELR25      |
| R64      | Resistor    | 100k ELR25      |
| R65      | Resistor    | 100k ELR25      |
| R66      | Resistor    | 150 ELR25       |

**PLL UNIT**

| REF. NO. | DESCRIPTION | PART NO.   |
|----------|-------------|------------|
| R67      | Resistor    | 3.3k ELR25 |
| R68      | Resistor    | 100k ELR25 |
| R69      | Resistor    | 100k ELR25 |
| R70      | Resistor    | 150 ELR25  |
| R71      | Resistor    | 3.3k ELR25 |
| R72      | Resistor    | 180 ELR25  |
| R73      | Resistor    | 33 ELR25   |
| R74      | Resistor    | 4.7k ELR25 |
| R75      | Resistor    | 220 ELR25  |
| R76      | Resistor    | 330 ELR25  |
| R77      | Resistor    | 22 ELR25   |
| R78      | Resistor    | 220 ELR25  |
| R79      | Resistor    | 22k ELR25  |
| R80      | Resistor    | 100 ELR25  |
| R81      | Resistor    | 560 ELR25  |
| R82      | Resistor    | 10k ELR25  |
| R83      | Resistor    | 47k ELR25  |
| R84      | Resistor    | 10k ELR25  |
| R85      | Resistor    | 220 ELR25  |
| R86      | Resistor    | 10k ELR25  |
| R87      | Resistor    | 100 ELR25  |
| R88      | Resistor    | 100 R25    |
| R89      | Resistor    | 220 ELR25  |
| R90      | Resistor    | 22k ELR25  |
| R91      | Resistor    | 10k ELR25  |
| R92      | Resistor    | 470 ELR25  |
| R93      | Resistor    | 47 ELR25   |
| R94      | Resistor    | 10k R25    |
| R95      | Resistor    | 10k R25    |
| R96      | Resistor    | 10k R25    |
| R97      | Resistor    | 10k R25    |
| R98      | Resistor    | 47k R25    |
| R99      | Resistor    | 47k R25    |
| R100     | Resistor    | SRW1P10-J  |
| R101     | Resistor    | 120 R50X   |
| R102     | Resistor    | 220 ELR25  |
| R103     | Resistor    | 47 ELR25   |
| R104     | Resistor    | 22 ELR20   |
| R105     | Resistor    | 1k R25     |
| R106     | Resistor    | 15k R25    |
| R107     | Resistor    | 100 ELR25  |
| R108     | Resistor    | 47 ELR25   |
| R109     | Resistor    | 3.3k R20   |
| R110     | Resistor    | 820 R20    |
| R201     | Resistor    | 10k R20    |
| R202     | Resistor    | 1k R25     |
| R203     | Resistor    | 2.7k ELR20 |
| R204     | Resistor    | 33k ELR25  |
| R205     | Resistor    | 10k ELR25  |
| R206     | Resistor    | 470k R20   |
| R208     | Resistor    | 180 ELR25  |
| R209     | Resistor    | 150 ELR25  |
| R210     | Resistor    | 5.6k ELR25 |
| R211     | Resistor    | 1.2k ELR25 |
| R212     | Resistor    | 330 ELR25  |
| R213     | Resistor    | 150 R25    |
| R214     | Resistor    | 4.7k R25   |
| R215     | Resistor    | 2.2k R25   |
| R216     | Resistor    | 2.7k ELR25 |
| R217     | Resistor    | 2.7k ELR25 |
| R218     | Resistor    | 390 ELR25  |

**PLL UNIT**

| REF. NO. | DESCRIPTION   | PART NO.            |
|----------|---------------|---------------------|
| C2       | Ceramic       | 0.0047 50V          |
| C3       | Ceramic       | 10P 50V CH          |
| C4       | Ceramic       | 0.0047 50V          |
| C5       | Electrolytic  | 10 16V              |
| C6       | Ceramic       | 82P 50V TH          |
| C7       | Ceramic       | 0.0047 50V          |
| C8       | Ceramic       | 82P 50V TH          |
| C9       | Ceramic       | 10P 50V             |
| C10      | Ceramic       | 68P 50V             |
| C11      | Ceramic       | 47P 50V             |
| C12      | Ceramic       | 100P 50V            |
| C13      | Ceramic       | 100P 50V            |
| C14      | Barrier Layer | 0.047 25V           |
| C15      | Ceramic       | 22P 50V             |
| C16      | Barrier Layer | 0.047 25V           |
| C19      | Ceramic       | 0.001 50V           |
| C20      | Ceramic       | 0.001 50V           |
| C21      | Ceramic       | 0.0047 50V          |
| C22      | Ceramic       | 8P 50V              |
| C23      | Ceramic       | 1P 50V              |
| C24      | Ceramic       | 8P 50V              |
| C25      | Ceramic       | 1P 50V              |
| C26      | Ceramic       | 8P 50V              |
| C27      | Barrier Layer | 0.047 25V           |
| C29      | Ceramic       | 470P 50V            |
| C30      | Ceramic       | 470P 50V            |
| C31      | Barrier Layer | 0.1 16V             |
| C32      | Ceramic       | 0.0047 50V          |
| C33      | Electrolytic  | 47 10V              |
| C34      | Ceramic       | 0.0047 50V          |
| C35      | Ceramic       | 6P 50V              |
| C36      | Ceramic       | 6P 50V              |
| C37      | Ceramic       | 0.0047 50V          |
| C39      | Ceramic       | 33P 50V             |
| C40      | Ceramic       | 0.0047 50V          |
| C41      | Ceramic       | 0.001 50V           |
| C42      | Ceramic       | 0.0047 50V          |
| C43      | Ceramic       | 43P 50V             |
| C44      | Ceramic       | 51P 50V             |
| C45      | Ceramic       | 120P 50V            |
| C46      | Ceramic       | 22P 50V             |
| C47      | Ceramic       | 100P 50V            |
| C48      | Ceramic       | 150P 50V            |
| C49      | Ceramic       | 82P 50V             |
| C50      | Ceramic       | 56P 50V             |
| C51      | Ceramic       | 330P 50V            |
| C52      | Ceramic       | 68P 50V             |
| C53      | Ceramic       | 150P 50V            |
| C54      | Ceramic       | 0.0047 50V          |
| C55      | Ceramic       | 0.0047 50V          |
| C56      | Ceramic       | 0.001 50V           |
| C57      | Ceramic       | 0.0047 50V          |
| C58      | Ceramic       | 0.0022 50V          |
| C59      | Ceramic       | 0.0047 50V          |
| C60      | Ceramic       | 0.0047 50V          |
| C62      | Ceramic       | 0.0047 50V          |
| C63      | Ceramic       | 0.0047 50V          |
| C64      | Electrolytic  | 47 10V              |
| C65      | Array         | B7ZC0717-32N 470Px6 |
| C66      | Electrolytic  | 47 10V              |
| C67      | Barrier Layer | 0.047 25V           |
| C68      | Barrier Layer | 0.1 16V             |

**PLL UNIT**

| REF. NO. | DESCRIPTION   | PART NO.       |
|----------|---------------|----------------|
| C69      | Ceramic       | 0.001 50V      |
| C70      | Ceramic       | 0.001 50V      |
| C71      | Electrolytic  | 1 50V          |
| C72      | Electrolytic  | 100 10V        |
| C73      | Ceramic       | 0.0047 50V     |
| C74      | Barrier Layer | 0.047 25V      |
| C75      | Electrolytic  | 0.47 50V BP    |
| C76      | Ceramic       | 56P 50V        |
| C77      | Ceramic       | 24P 50V        |
| C78      | Trimmer       | VCT51C143A 10P |
| C79      | Ceramic       | 56P 50V CH     |
| C80      | Ceramic       | 12P 50V CH     |
| C81      | Ceramic       | 12P 50V CH     |
| C82      | Ceramic       | 0.0047 50V     |
| C83      | Ceramic       | 1P 50V         |
| C84      | Ceramic       | 0.0047 50V     |
| C85      | Barrier Layer | 0.047 25V      |
| C86      | Ceramic       | 56P 50V        |
| C87      | Ceramic       | 15P 50V        |
| C88      | Trimmer       | VCT51C143A 10P |
| C89      | Ceramic       | 47P 50V CH     |
| C90      | Ceramic       | 12P 50V CH     |
| C91      | Ceramic       | 12P 50V CH     |
| C92      | Ceramic       | 0.0047 50V     |
| C93      | Ceramic       | 1P 50V         |
| C94      | Ceramic       | 0.0047 50V     |
| C95      | Ceramic       | 47P 50V        |
| C96      | Ceramic       | 10P 50V        |
| C97      | Trimmer       | VCT51A123A 6P  |
| C98      | Ceramic       | 47P 50V CH     |
| C99      | Ceramic       | 12P 50V CH     |
| C100     | Ceramic       | 8P 50V CH      |
| C101     | Ceramic       | 0.0047 50V     |
| C102     | Ceramic       | 1P 50V         |
| C103     | Ceramic       | 0.0047 50V     |
| C104     | Barrier Layer | 0.047 25V      |
| C105     | Ceramic       | 39P 50V        |
| C106     | Ceramic       | 7P 50V         |
| C107     | Trimmer       | VCT51A123A 6P  |
| C108     | Ceramic       | 33P 50V CH     |
| C109     | Ceramic       | 12P 50V CH     |
| C110     | Ceramic       | 5P 50V CH      |
| C111     | Ceramic       | 0.0047 50V     |
| C112     | Ceramic       | 1P 50V         |
| C113     | Ceramic       | 0.0047 50V     |
| C114     | Barrier Layer | 0.047 25V      |
| C115     | Electrolytic  | 100 10V        |
| C116     | Ceramic       | 0.0047 50V     |
| C117     | Ceramic       | 22P 50V        |
| C118     | Ceramic       | 47P 50V        |
| C119     | Ceramic       | 47P 50V        |
| C120     | Ceramic       | 0.0047 50V     |
| C121     | Ceramic       | 0.0047 50V     |
| C122     | Ceramic       | 0.001 50V      |
| C123     | Ceramic       | 0.0047 50V     |
| C124     | Ceramic       | 22P 50V        |
| C126     | Ceramic       | 0.0047 50V     |
| C127     | Ceramic       | 47P 50V        |
| C128     | Electrolytic  | 47 10V         |
| C129     | Electrolytic  | 100 16V        |
| C130     | Ceramic       | 0.0047 50V     |
| C131     | Ceramic       | 0.0047 50V     |

**PLL UNIT**

| REF. NO. | DESCRIPTION   | PART NO.            |
|----------|---------------|---------------------|
| C132     | Electrolytic  | 47 10V              |
| C133     | Ceramic       | 0.001 50V           |
| C134     | Ceramic       | 0.001 50V           |
| C135     | Ceramic       | 0.001 50V           |
| C136     | Ceramic       | 0.001 50V           |
| C137     | Electrolytic  | 10 16V              |
| C139     | Ceramic       | 0.0047 50V          |
| C140     | Ceramic       | 0.0047 50V          |
| C141     | Barrier Layer | 0.1 16V             |
| C145     | Ceramic       | 0.0047 50V          |
| C147     | Ceramic       | 5P 50V              |
| C148     | Ceramic       | 33P 50V             |
| C150     | Ceramic       | 0.0047 50V          |
| C151     | Ceramic       | 0.0047 50V          |
| C152     | Ceramic       | 0.001 50V           |
| C153     | Electrolytic  | 10 16V MS7          |
| C154     | Ceramic       | 10P 50V             |
| C155     | Ceramic       | 120P 50V            |
| C156     | Ceramic       | 0.0047 50V          |
| C201     | Array         | B7ZC0717-32N 470P×6 |
| C202     | Electrolytic  | 0.22 50V RC2        |
| C203     | Barrier Layer | 0.047 25V           |
| C204     | Ceramic       | 0.0022 50V          |
| C205     | Ceramic       | 0.001 50V           |
| C206     | Electrolytic  | 47 10V              |
| C207     | Ceramic       | 39P 50V UJ          |
| C208     | Ceramic       | 22P 50V             |
| C209     | Ceramic       | 4P 50V              |
| C210     | Ceramic       | 4P 50V              |
| C211     | Electrolytic  | 47 10V              |
| C212     | Ceramic       | 0.0022 50V          |
| C213     | Ceramic       | 1P 50V              |
| C214     | Ceramic       | 0.0047 50V          |
| C215     | Ceramic       | 0.001 50V           |
| C216     | Ceramic       | 47P 50V             |
| C217     | Ceramic       | 0.0022 50V          |
| C218     | Ceramic       | 0.0047 50V          |
| C219     | Barrier Layer | 0.047 25V           |
| C220     | Ceramic       | 470P 50V            |
| C221     | Ceramic       | 0.0047 50V          |
| C222     | Ceramic       | 0.001 50V           |
| C223     | Electrolytic  | 47 10V              |
| C224     | Ceramic       | 0.0047 50V          |
| C225     | Ceramic       | 0.0047 50V          |
| C226     | Ceramic       | 0.0047 50V          |
| C227     | Ceramic       | 0.0047 50V          |
| J1       | Connector     | TL25P-06-V1         |
| J2       | Connector     | 5138-11CPB          |
| J3       | Connector     | 5138-04CPB          |
| J4       | Connector     | TMP-J01X-V2         |
| J5       | Connector     | TMP-J01X-V2         |
| P1       | Connector     | TL25H-02-B1         |
| EP1      | P.C.Board     | B-704F              |
| EP2      | Ferrite Bead  | DL2-OP-2.6-3-1.2H   |
| W1       | Jumper        | 23/01/230/D21/D21   |
| W2       | Jumper        | 23/02/165/D21/D21   |
| W3       | Jumper        | 23/03/105/D21/D21   |
| W4       | Jumper        | 23/04/165/D21/D21   |

**PLL UNIT/MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.                |
|----------|-------------|-------------------------|
| W5       | Jumper      | 23/05/170/D21/D21       |
| W6       | Jumper      | 23/06/135/D21/D21       |
| W7       | Jumper      | [ 61/99/125/W13A/W13A ] |
| W8       | Jumper      | [ 08 A A ]              |
| W9       | Jumper      | [ 61/99/140/W13A/W13A ] |
| W10      | Jumper      | [ 08 A A ]              |
| W11      | Jumper      | 23/07/110/D21/D21       |
| W12      | Jumper      | [ 62/99/350/C01/W13A ]  |
| W13      | Jumper      | [ 08 A A ]              |
| W14      | Jumper      | IPS-1041-4              |
| W16      | Jumper      | IPS-1041-4              |
| W17      | Jumper      | IPS-1041-4              |
| W18      | Jumper      | IPS-1041-4              |
| W20      | Jumper      | IPS-1041-4              |
| W21      | Jumper      | IPS-1041-2              |
| W24      | Jumper      | IPS-1041-4              |
| W25      | Jumper      | IPS-1041-4              |
| W26      | Jumper      | IPS-1041-4              |
| W27      | Jumper      | IPS-1041-4              |
| W28      | Jumper      | IPS-1041-4              |
| W29      | Jumper      | IPS-1041-4              |
| W30      | Jumper      | IPS-1041-4              |
| W31      | Jumper      | IPS-1041-4              |
| W32      | Jumper      | IPS-1041-4              |
| W33      | Jumper      | IPS-1041-4              |
| W34      | Jumper      | JPW-02A                 |
| W36      | Jumper      | IPS-1041-4              |

**10 - 7 MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.   |
|----------|-------------|------------|
| IC1      | IC          | μPD4069UBC |
| IC2      | IC          | NJM4558D   |
| IC3      | IC          | μPD4051BC  |
| IC4      | IC          | NJM4558D   |
| IC5      | IC          | NJM4558D   |
| IC6      | IC          | NJM4558D   |
| IC7      | IC          | NJM4558D   |
| IC8      | IC          | μPD4066BC  |
| IC9      | IC          | μPC1037H   |
| IC10     | IC          | μPC1037H   |
| IC11     | IC          | μPC1037H   |
| IC12     | IC          | BA401      |
| IC13     | IC          | μPC577H    |
| IC14     | IC          | NJM4558D   |
| IC15     | IC          | μPC1037H   |
| IC16     | IC          | NJM4558D   |
| IC17     | IC          | μA7808     |
| IC18     | IC          | μPC1241H   |
| IC19     | IC          | NJM4558D   |
| IC20     | IC          | μPC1037H   |
| Q1       | FET         | 3SK74-M    |
| Q2       | FET         | 2SK241-Y   |
| Q3       | Transistor  | 2SC2785-FF |
| Q4       | Transistor  | 2SC3402    |
| Q5       | Transistor  | 2SC3402    |
| Q6       | Transistor  | 2SC2458-GR |
| Q7       | Transistor  | 2SC2458-GR |
| Q8       | FET         | 3SK74-M    |

**MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.     |
|----------|-------------|--------------|
| Q9       | Transistor  | 2SC1583-G    |
| Q10      | Transistor  | 2SC2785-FF   |
| Q11      | Transistor  | 2SC2458-GR   |
| Q12      | Transistor  | 2SC2878      |
| Q13      | Transistor  | 2SA1048-GR   |
| Q15      | Transistor  | 2SC2878      |
| Q16      | Transistor  | 2SA1348      |
| Q17      | Transistor  | 2SC2878      |
| Q20      | Transistor  | 2SC3402      |
| Q21      | Transistor  | 2SC3402      |
| Q22      | Transistor  | 2SC2458-GR   |
| Q23      | Transistor  | 2SC2458-GR   |
| Q24      | Transistor  | 2SA1348      |
| Q25      | Transistor  | 2SC3402      |
| Q26      | Transistor  | 2SA1048-GR   |
| Q27      | Transistor  | 2SA1048-GR   |
| Q28      | Transistor  | 2SA1048-GR   |
| Q29      | Transistor  | 2SC3399      |
| Q30      | Transistor  | 2SA1348      |
| Q31      | Transistor  | 2SC3399      |
| Q32      | Transistor  | 2SC2458-GR   |
| Q33      | FET         | 3SK74-M      |
| Q34      | Transistor  | 2SC1571-G    |
| Q35      | Transistor  | 2SC2458-GR   |
| Q36      | Transistor  | 2SC2785-FF   |
| Q37      | Transistor  | 2SC2458-Y/GR |
| Q38      | Transistor  | 2SC2785-FF   |
| Q39      | FET         | 3SK74-M      |
| Q40      | Transistor  | 2SC3399      |
| Q41      | Transistor  | 2SC3402      |
| Q42      | Transistor  | 2SC2785-FF   |
| Q43      | FET         | 3SK74-M      |
| Q44      | FET         | 3SK74-M      |
| Q45      | Transistor  | 2SC2785-FF   |
| Q46      | Transistor  | 2SC2458-Y/GR |
| Q47      | Transistor  | 2SC2785-FF   |
| Q48      | Transistor  | 2SC3402      |
| Q49      | FET         | 2SK241-Y     |
| Q50      | Transistor  | 2SC2785-FF   |
| Q51      | Transistor  | 2SC2785-FF   |
| Q52      | Transistor  | 2SC3402      |
| Q53      | Transistor  | 2SC3402      |
| Q54      | Transistor  | 2SC2785-FF   |
| Q55      | Transistor  | 2SC2785-FF   |
| Q56      | Transistor  | 2SC3402      |
| Q57      | Transistor  | 2SC3402      |
| Q58      | Transistor  | 2SA1048-Y/GR |
| Q59      | Transistor  | 2SC2878      |
| Q60      | Transistor  | 2SC2458-Y    |
| Q61      | Transistor  | 2SA1048-GR   |
| Q62      | Transistor  | 2SC2458-Y/GR |
| Q63      | Transistor  | 2SD468-C     |
| Q64      | Transistor  | 2SC2458-GR   |
| Q65      | Transistor  | 2SC2458-GR   |
| Q66      | Transistor  | 2SD468-C     |
| Q67      | Transistor  | 2SC2458-GR   |
| Q68      | Transistor  | 2SD880-Y     |
| Q69      | Transistor  | 2SC3402      |
| Q70      | Transistor  | 2SC2458-GR   |
| Q71      | Transistor  | 2SC3399      |
| Q72      | Transistor  | 2SC2785-FF   |
| Q74      | Transistor  | 2SC3402      |

**MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.     |
|----------|-------------|--------------|
| Q75      | Transistor  | 2SC3402      |
| Q76      | Transistor  | 2SC2458-GR   |
| Q77      | Transistor  | 2SC3399      |
| Q78      | Transistor  | 2SC2458-GR   |
| Q79      | Transistor  | 2SC2458-GR   |
| Q80      | Transistor  | 2SC2785-FF   |
| Q81      | Transistor  | 2SC3402      |
| Q82      | Transistor  | 2SA1048-Y/GR |
| Q83      | Transistor  | 2SC3399      |
| Q84      | Transistor  | 2SC2785-FF   |
| D1       | Diode       | 1SS216       |
| D2       | Diode       | 1SS53        |
| D3       | Diode       | 1SS53        |
| D4       | Diode       | 1SS53        |
| D5       | Diode       | 1SS53        |
| D6       | Diode       | 1SS53        |
| D7       | Diode       | 1SS53        |
| D8       | Diode       | 1SS53        |
| D9       | Diode       | 1SS53        |
| D10      | Diode       | 1SS53        |
| D11      | Diode       | 1SS53        |
| D12      | Diode       | 1SS53        |
| D13      | Diode       | 1SS53        |
| D14      | Diode       | 1SS53        |
| D15      | Diode       | 1SS53        |
| D16      | Zener       | MZ304 B      |
| D17      | Diode       | 1K60         |
| D18      | Diode       | 1K60         |
| D19      | Diode       | 1SS53        |
| D20      | Diode       | 1SS53        |
| D21      | Diode       | 1SS53        |
| D22      | Diode       | 1SS53        |
| D23      | Diode       | 1SS53        |
| D24      | Diode       | 1SS133       |
| D25      | Diode       | 1SS53        |
| D26      | Diode       | 1SS53        |
| D27      | Diode       | 1SS53        |
| D28      | Diode       | 1SS133       |
| D29      | Diode       | 1SS133       |
| D30      | Diode       | 1SS133       |
| D31      | Diode       | 1SS133       |
| D32      | Diode       | 1SS133       |
| D33      | Diode       | 1SS133       |
| D34      | Diode       | 1SS133       |
| D35      | Diode       | 1SS133       |
| D36      | Diode       | 1SS53        |
| D37      | Diode       | 1SS133       |
| D38      | Diode       | 1SS53        |
| D39      | Diode       | 1SS53        |
| D40      | Diode       | 1SS133       |
| D41      | Diode       | 1SS133       |
| D42      | Diode       | 1SS133       |
| D43      | Diode       | 1SS133       |
| D44      | Diode       | 1SS53        |
| D45      | Diode       | 1SS53        |
| D46      | Diode       | 1SS53        |
| D47      | Diode       | 1SS53        |
| D49      | Diode       | 1SS53        |
| D50      | Diode       | 1SS53        |
| D51      | Diode       | 1SS53        |
| D52      | Diode       | 1SS53        |

**MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|----------|
| D53      | Diode       | 1SS53    |
| D54      | Diode       | 1SS53    |
| D55      | Diode       | 1K60     |
| D56      | Diode       | 1K60     |
| D57      | Diode       | 1SS53    |
| D58      | Diode       | 1S953    |
| D59      | Diode       | 1SS53    |
| D60      | Diode       | 1SS53    |
| D63      | Diode       | 1SS53    |
| D64      | Diode       | 1SS53    |
| D66      | Diode       | 1SS53    |
| D67      | Diode       | 1SS216   |
| D68      | Diode       | 1SS216   |
| D69      | Diode       | 1SS216   |
| D70      | Diode       | 1SS216   |
| D71      | Diode       | 1SS216   |
| D72      | Diode       | 1SS53    |
| D73      | Diode       | 1SS53    |
| D74      | Diode       | 1SS53    |
| D75      | Diode       | 1SS53    |
| D76      | Diode       | 1SS53    |
| D77      | Diode       | 1SS53    |
| D78      | Diode       | 1SS53    |
| D79      | Diode       | 1SS53    |
| D80      | Diode       | 1SS53    |
| D81      | Diode       | 1SS53    |
| D82      | Diode       | 1SS53    |
| D83      | Diode       | 1SS53    |
| D84      | Diode       | 1SS53    |
| D85      | Diode       | 1SS53    |
| D86      | Diode       | 1SS53    |
| D87      | Diode       | 1SS53    |
| D88      | Diode       | 1SS53    |
| D89      | Diode       | 1SS216   |
| D90      | Diode       | 1SS53    |
| D91      | Diode       | 1SS53    |
| D92      | Diode       | 1SS211   |
| D93      | Diode       | 1SS211   |
| D94      | Diode       | 1SS53    |
| D95      | Diode       | 1K60     |
| D96      | Diode       | 1SS53    |
| D97      | Diode       | 1SS53    |
| D98      | Diode       | 1SS216   |
| D99      | Diode       | 1SS216   |
| D100     | Diode       | 1SS216   |
| D101     | Diode       | 1SS216   |
| D102     | Diode       | 1SS53    |
| D103     | Diode       | 1SS216   |
| D104     | Diode       | 1SS216   |
| D105     | Diode       | 1SS216   |
| D106     | Diode       | 1SS216   |
| D107     | Diode       | 1SS53    |
| D108     | Diode       | 1SS53    |
| D109     | Diode       | 1SS53    |
| D110     | Varicap     | FC51M    |
| D111     | Varicap     | 1SV50E   |
| D112     | Diode       | 1SS99    |
| D114     | Diode       | 1SS53    |
| D115     | Diode       | 1SS53    |
| D116     | Diode       | 1K60     |
| D117     | Diode       | 1K60     |
| D118     | Varicap     | 1SV50E   |

**MAIN UNIT**

| REF. NO. | DESCRIPTION   | PART NO.         |
|----------|---------------|------------------|
| D119     | Diode         | 1SS53            |
| D120     | Diode         | 1SS216           |
| D121     | Diode         | 1SS53            |
| D122     | Diode         | 1SS53            |
| D123     | Diode         | 1SS53            |
| D124     | Diode         | 1SS216           |
| D125     | Diode         | 1SS216           |
| D126     | Varicap       | 1SV50E           |
| D127     | Diode         | 1SS53            |
| D128     | Diode         | 1SS53            |
| D129     | Diode         | 1SS53            |
| D130     | Diode         | 1SS53            |
| D131     | Diode         | 1SS53            |
| D133     | Diode         | 1SS53            |
| D134     | Diode         | 1SS53            |
| D135     | Diode         | 1SS53            |
| D136     | Diode         | 1SS53            |
| D137     | Diode         | 1SS53            |
| D138     | Diode         | 1SS53            |
| D139     | Diode         | 1SS53            |
| D140     | Diode         | 1SS53            |
| D141     | Diode         | 1SS211           |
| D142     | Diode         | 1SS53            |
| D143     | Diode         | 1SS53            |
| D144     | Diode         | 1SS53            |
| D145     | Diode         | 1K60             |
| D147     | Diode         | 1SS53            |
| D148     | Diode         | 1SS53            |
| D149     | Diode         | 1SS53            |
| D150     | Diode         | 1SS53            |
| D151     | Diode         | 1SS53            |
| D152     | Diode         | 1SS53            |
| D155     | Diode         | 1SS133           |
| D157     | Diode         | 1SS99            |
| D158     | Diode         | 1SS99            |
| D159     | Diode         | 1SS53            |
| FI1      | Monolithic    | FL-87            |
| FI2      | Monolithic    | FL-80            |
| FI3      | Crystal       | FL-44A           |
| FI4      | Ceramic       | CFJ-455K5        |
| FI5      | Ceramic       | CFW-455HT        |
| FI6      | Ceramic       | CFW-455E         |
| FI7      | Monolithic    | FL-23            |
| FI8      | Monolithic    | FL-32A           |
| X1       | Crystal       | CR-168           |
| X2       | Crystal       | CR-168           |
| X3       | Discriminator | CFY-455S         |
| X4       | Crystal       | HC12/U 9.0105MHz |
| X5       | Crystal       | CR-168           |
| X6       | Crystal       | CR-169           |
| X7       | Crystal       | CR-1             |
| L1       | Coil          | LS-163           |
| L2       | Coil          | LS-163           |
| L3       | Coil          | LAL03NA 101K     |
| L4       | Coil          | LS-175           |
| L5       | Coil          | LS-175           |
| L6       | Coil          | LS-175           |
| L7       | Coil          | FL5H 101K        |
| L9       | Coil          | FL5H 102K        |

**MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.     |
|----------|-------------|--------------|
| L10      | Coil        | LS-163       |
| L11      | Coil        | LS-90A       |
| L12      | Coil        | LS-90A       |
| L13      | Coil        | LAL03NA 100K |
| L14      | Coil        | LAL03NA 100K |
| L16      | Coil        | LS-146       |
| L17      | Coil        | LAL04NA 101K |
| L18      | Coil        | LS-146       |
| L19      | Coil        | S4 101K      |
| L20      | Coil        | S4 101K      |
| L21      | Coil        | LAL03NA 101K |
| L22      | Coil        | LS-175       |
| L23      | Coil        | LS-282       |
| L24      | Coil        | LS-175       |
| L25      | Coil        | LS-175       |
| L26      | Coil        | LS-266       |
| L27      | Coil        | LS-122       |
| L28      | Coil        | LS-16        |
| L29      | Coil        | LS-133       |
| L30      | Coil        | LAL03NA 150K |
| L31      | Coil        | LAL03NA 100K |
| L32      | Coil        | LAL03NA 101K |
| L33      | Coil        | LS-93A       |
| L34      | Coil        | LS-93A       |
| L35      | Coil        | LS-93A       |
| L36      | Coil        | LS-292       |
| L37      | Coil        | BT01RN1-A61  |
| L39      | Coil        | LW-15        |
| L40      | Coil        | LAL04NA 101K |
| L41      | Coil        | LAL03NA 101K |
| L42      | Coil        | LAL03NA 101K |
| L43      | Coil        | LAL04NA 102K |
| L44      | Coil        | LAL04NA 102K |
| L45      | Coil        | LAL03NA 101K |
| L46      | Coil        | LW-15        |
| L47      | Coil        | LAL03NA 3R3K |
| L48      | Coil        | LAL03NA 101K |
| L49      | Coil        | LAL04NA 101K |
| L50      | Coil        | FL5H 101K    |
| L51      | Coil        | LAL03NA 101K |
| L52      | Coil        | LAL03NA 390K |
| L53      | Coil        | LAL03NA 101K |
| R1       | Resistor    | 4.7k ELR25   |
| R2       | Resistor    | 220 ELR25    |
| R3       | Resistor    | 220 ELR25    |
| R4       | Resistor    | 47 R20       |
| R5       | Resistor    | 10k ELR25    |
| R6       | Resistor    | 10k ELR25    |
| R7       | Resistor    | 10k ELR25    |
| R8       | Resistor    | 3.9k ELR25   |
| R9       | Resistor    | 3.9k ELR25   |
| R11      | Resistor    | 47k ELR25    |
| R13      | Resistor    | 560 R25      |
| R14      | Resistor    | 3.3k ELR20   |
| R15      | Resistor    | 33k ELR25    |
| R16      | Resistor    | 47k R20      |
| R17      | Resistor    | 10k R20      |
| R18      | Resistor    | 10k R20      |
| R19      | Resistor    | 4.7k R20     |
| R20      | Resistor    | 47k ELR25    |
| R21      | Resistor    | 10k ELR25    |

**MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.       |
|----------|-------------|----------------|
| R22      | Resistor    | 4.7k ELR25     |
| R23      | Resistor    | 4.7k ELR25     |
| R24      | Resistor    | 33k ELR25      |
| R25      | Resistor    | 15k ELR25      |
| R26      | Resistor    | 4.7k ELR20     |
| R27      | Resistor    | 33k ELR25      |
| R28      | Resistor    | 15k ELR25      |
| R29      | Resistor    | 5.6k ELR25     |
| R31      | Resistor    | 82k ELR20      |
| R32      | Resistor    | 180k ELR20     |
| R34      | Resistor    | 47 ELR25       |
| R35      | Resistor    | 100k ELR25     |
| R36      | Resistor    | 470 ELR25      |
| R37      | Resistor    | 1M ELR25       |
| R38      | Resistor    | 220 ELR25      |
| R39      | Resistor    | 22k R25        |
| R40      | Resistor    | 1k ELR25       |
| R41      | Resistor    | 150 ELR25      |
| R42      | Resistor    | 100k ELR20     |
| R43      | Resistor    | 100k ELR20     |
| R44      | Resistor    | 1k ELR25       |
| R45      | Resistor    | 150 ELR25      |
| R46      | Resistor    | 6.8k ELR25     |
| R47      | Resistor    | 68k R20        |
| R48      | Resistor    | 47k ELR25      |
| R49      | Resistor    | 56k ELR25      |
| R50      | Resistor    | 100 ELR25      |
| R51      | Resistor    | 2.2k ELR25     |
| R52      | Resistor    | 2.2k ELR25     |
| R53      | Resistor    | 5.6k ELR25     |
| R54      | Resistor    | 1.5k R25       |
| R55      | Resistor    | 68k ELR25      |
| R56      | Resistor    | 470 ELR25      |
| R57      | Resistor    | 10k ELR25      |
| R58      | Resistor    | 10k ELR25      |
| R59      | Resistor    | 10k ELR25      |
| R60      | Resistor    | 22k ELR25      |
| R61      | Resistor    | 6.8k ELR25     |
| R62      | Array       | RMX-5 47K      |
| R63      | Resistor    | 22k ELR25      |
| R65      | Resistor    | 27k ELR25      |
| R66      | Resistor    | 100 ELR25      |
| R68      | Trimmer     | RHB0CS42BA 47k |
| R69      | Resistor    | 3.3M ELR25     |
| R70      | Resistor    | 1M ELR25       |
| R71      | Resistor    | 1M ELR25       |
| R72      | Resistor    | 150 ELR25      |
| R73      | Resistor    | 47k ELR25      |
| R74      | Resistor    | 22k ELR25      |
| R75      | Resistor    | 3.3k ELR25     |
| R76      | Resistor    | 56k ELR25      |
| R77      | Resistor    | 150 ELR25      |
| R78      | Resistor    | 1.8M ELR25     |
| R79      | Resistor    | 680k ELR25     |
| R80      | Resistor    | 220k ELR25     |
| R81      | Resistor    | 390 ELR20      |
| R82      | Resistor    | 56k ELR25      |
| R83      | Resistor    | 150k R20       |
| R84      | Trimmer     | RHB0CJ401A 22k |
| R85      | Resistor    | 150k ELR25     |
| R86      | Resistor    | 220k ELR25     |
| R87      | Trimmer     | RHB0CS42BA 47k |

**MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.           |
|----------|-------------|--------------------|
| R88      | Resistor    | 15k R20            |
| R89      | Resistor    | 470k ELR25         |
| R90      | Resistor    | 22 ELR25           |
| R91      | Trimmer     | RHBOCS42BA 47k     |
| R92      | Resistor    | 150k ELR25         |
| R93      | Resistor    | 220k R20           |
| R94      | Resistor    | 470k ELR25         |
| R95      | Trimmer     | RHBOC1431A 10k     |
| R96      | Trimmer     | RHBOC1431A 10k     |
| R97      | Resistor    | 1k ELR25           |
| R98      | Trimmer     | RHBOC1431A 10k     |
| R99      | Trimmer     | RHBOC1431A 10k     |
| R100     | Resistor    | 1M ELR20           |
| R101     | Resistor    | 56k ELR25          |
| R102     | Resistor    | 22k ELR25          |
| R103     | Trimmer     | RHBOCJ30EA 2.2k    |
| R104     | Resistor    | 22k ELR25          |
| R105     | Resistor    | 56k R20            |
| R106     | Trimmer     | RHBOC1324A 1k      |
| R107     | Resistor    | 27k ELR20          |
| R108     | Resistor    | 5.6k ELR20         |
| R109     | Resistor    | 470 ELR25          |
| R110     | Resistor    | 22k ELR25          |
| R111     | Resistor    | 4.7k ELR25         |
| R112     | Resistor    | 1k ELR25           |
| R113     | Resistor    | 4.7k ELR25         |
| R114     | Resistor    | 150 R20            |
| R115     | Resistor    | 10k R20            |
| R116     | Resistor    | 4.7k ELR25         |
| R117     | Resistor    | 220k ELR25         |
| R118     | Resistor    | 47k ELR25          |
| R119     | Resistor    | 3.3k R25           |
| R120     | Resistor    | 15k ELR25          |
| R121     | Trimmer     | RHBOCN40YA 33k     |
| R122     | Resistor    | 180k ELR25         |
| R123     | Resistor    | 100k R25           |
| R124     | Resistor    | 120k ELR20         |
| R125     | Trimmer     | RH0521C15J05A 100k |
| R126     | Resistor    | 100k R20           |
| R127     | Resistor    | 5.6k ELR25         |
| R128     | Resistor    | 39k ELR25          |
| R129     | Resistor    | 100 ELR25          |
| R130     | Resistor    | 3.9k ELR25         |
| R131     | Resistor    | 330 ELR25          |
| R132     | Resistor    | 1M ELR25           |
| R133     | Resistor    | 1M ELR25           |
| R134     | Resistor    | 1k ELR25           |
| R135     | Resistor    | 100k ELR25         |
| R136     | Resistor    | 1k ELR25           |
| R137     | Resistor    | 4.7k ELR25         |
| R138     | Resistor    | 22k R20            |
| R139     | Resistor    | 4.7k ELR25         |
| R140     | Resistor    | 2.2k ELR25         |
| R141     | Resistor    | 2.2k ELR20         |
| R142     | Resistor    | 1k ELR25           |
| R143     | Resistor    | 4.7k ELR25         |
| R144     | Resistor    | 330 ELR25          |
| R145     | Resistor    | 47 ELR25           |
| R146     | Resistor    | 56k ELR25          |
| R147     | Resistor    | 220 ELR25          |
| R148     | Resistor    | 1k ELR25           |
| R149     | Resistor    | 100 ELR25          |

**MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.       |
|----------|-------------|----------------|
| R150     | Resistor    | 39k ELR25      |
| R151     | Resistor    | 2.2k ELR20     |
| R152     | Resistor    | 47k ELR20      |
| R153     | Resistor    | 2.7k R20       |
| R154     | Resistor    | 1.5k ELR25     |
| R155     | Trimmer     | RHA3A140SA 10k |
| R156     | Resistor    | 2.2k R20       |
| R157     | Resistor    | 330k ELR25     |
| R158     | Trimmer     | RHBOC1431A 10k |
| R159     | Trimmer     | RHBOC1431A 10k |
| R160     | Resistor    | 100k ELR25     |
| R161     | Trimmer     | RHBOC1431A 10k |
| R162     | Resistor    | 2.2k ELR25     |
| R163     | Resistor    | 100 ELR25      |
| R164     | Resistor    | 5.6k ELR20     |
| R165     | Resistor    | 5.6k ELR25     |
| R166     | Resistor    | 5.6k ELR20     |
| R167     | Resistor    | 220 R20        |
| R168     | Resistor    | 1k R25         |
| R169     | Resistor    | 1.5k R20       |
| R170     | Resistor    | 5.6k R20       |
| R171     | Resistor    | 1.5k R25       |
| R172     | Resistor    | 220 R20        |
| R173     | Resistor    | 1.5k R20       |
| R174     | Resistor    | 100 R25        |
| R175     | Resistor    | 5.6k R20       |
| R176     | Resistor    | 1.2k R20       |
| R177     | Resistor    | 220 R20        |
| R178     | Resistor    | 100 R25        |
| R179     | Resistor    | 1.5k R20       |
| R180     | Resistor    | 100 R25        |
| R181     | Resistor    | 5.6k R20       |
| R182     | Resistor    | 1.2k R20       |
| R183     | Resistor    | 4.7k ELR25     |
| R184     | Resistor    | 4.7k ELR25     |
| R185     | Resistor    | 5.6k ELR25     |
| R186     | Resistor    | 2.7k ELR25     |
| R187     | Resistor    | 2.2k ELR25     |
| R188     | Resistor    | 1.2k ELR25     |
| R189     | Resistor    | 47k ELR25      |
| R190     | Resistor    | 10k ELR25      |
| R191     | Resistor    | 330 ELR25      |
| R192     | Resistor    | 56 ELR25       |
| R193     | Resistor    | 100 ELR25      |
| R194     | Resistor    | 47 ELR25       |
| R195     | Resistor    | 6.8k ELR25     |
| R196     | Trimmer     | RHBOCJ401A 22k |
| R197     | Resistor    | 18k ELR25      |
| R198     | Resistor    | 22k ELR25      |
| R199     | Resistor    | 10k ELR25      |
| R200     | Resistor    | 1k ELR25       |
| R201     | Resistor    | 100 R25        |
| R202     | Resistor    | 4.7k ELR25     |
| R203     | Resistor    | 4.7k ELR25     |
| R204     | Resistor    | 220k ELR25     |
| R205     | Resistor    | 47 ELR25       |
| R206     | Resistor    | 6.8k ELR25     |
| R207     | Thermistor  | 112 503-2AI    |
| R208     | Resistor    | 10k ELR25      |
| R209     | Resistor    | 10k ELR25      |
| R210     | Resistor    | 330 ELR25      |



**MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.       |
|----------|-------------|----------------|
| R211     | Resistor    | 10k ELR20      |
| R212     | Resistor    | 220 ELR25      |
| R213     | Resistor    | 4.7k R25       |
| R214     | Resistor    | 6.8k R20       |
| R215     | Resistor    | 6.8k R25       |
| R216     | Resistor    | 220 R25        |
| R217     | Resistor    | 47k ELR25      |
| R218     | Resistor    | 6.8k R25       |
| R219     | Resistor    | 100 R25        |
| R220     | Resistor    | 6.8k ELR25     |
| R221     | Resistor    | 220 R25        |
| R222     | Resistor    | 47k ELR25      |
| R223     | Resistor    | 6.8k R20       |
| R224     | Resistor    | 100 R25        |
| R225     | Resistor    | 6.8k ELR25     |
| R226     | Resistor    | 220 R25        |
| R227     | Resistor    | 47k ELR25      |
| R228     | Resistor    | 6.8k ELR25     |
| R229     | Resistor    | 100 R25        |
| R230     | Resistor    | 6.8k R25       |
| R231     | Resistor    | 220 R25        |
| R232     | Resistor    | 47k ELR25      |
| R233     | Resistor    | 6.8k R20       |
| R234     | Resistor    | 100 R25        |
| R235     | Resistor    | 3.9k ELR25     |
| R236     | Resistor    | 220 ELR25      |
| R237     | Resistor    | 3.9k ELR25     |
| R238     | Resistor    | 1k ELR25       |
| R239     | Trimmer     | RHB0C1431A 10k |
| R240     | Resistor    | 220k ELR25     |
| R241     | Resistor    | 2.2k ELR25     |
| R242     | Resistor    | 4.7k ELR25     |
| R243     | Resistor    | 4.7k ELR25     |
| R244     | Resistor    | 10k ELR25      |
| R245     | Resistor    | 2.2k ELR25     |
| R246     | Resistor    | 100k ELR25     |
| R247     | Resistor    | 56k ELR25      |
| R248     | Resistor    | 22k ELR20      |
| R249     | Resistor    | 3.3k ELR20     |
| R250     | Resistor    | 100k ELR20     |
| R251     | Resistor    | 220 ELR25      |
| R252     | Resistor    | 3.9k ELR25     |
| R253     | Resistor    | 47 ELR25       |
| R254     | Resistor    | 100 ELR25      |
| R255     | Resistor    | 330 ELR25      |
| R256     | Resistor    | 220 ELR25      |
| R257     | Thermistor  | 35D45          |
| R258     | Resistor    | 6.8k ELR25     |
| R259     | Trimmer     | RHB0C1431A 10k |
| R260     | Resistor    | 100 ELR25      |
| R261     | Resistor    | 47 ELR25       |
| R262     | Resistor    | 330 ELR25      |
| R263     | Resistor    | 100 R25        |
| R264     | Resistor    | 2.2k ELR25     |
| R265     | Resistor    | 150 ELR25      |
| R266     | Resistor    | 1k ELR25       |
| R267     | Resistor    | 10k ELR25      |
| R268     | Resistor    | 1k ELR25       |
| R269     | Resistor    | 15k ELR25      |
| R270     | Trimmer     | RHB0C1324A 1k  |
| R271     | Resistor    | 2.2k ELR25     |
| R272     | Resistor    | 220 ELR20      |

**MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.        |
|----------|-------------|-----------------|
| R273     | Resistor    | 3.3k ELR25      |
| R274     | Resistor    | 100 R20         |
| R275     | Resistor    | 100 R20         |
| R276     | Resistor    | 10k ELR25       |
| R277     | Resistor    | 10k ELR25       |
| R278     | Resistor    | 1k ELR25        |
| R279     | Resistor    | 2.7k ELR25      |
| R280     | Resistor    | 12k ELR20       |
| R281     | Resistor    | 3.3M ELR25      |
| R282     | Resistor    | 10k ELR25       |
| R283     | Resistor    | 1k ELR25        |
| R284     | Resistor    | 5.6k R25        |
| R285     | Resistor    | 82k ELR25       |
| R286     | Resistor    | 82k ELR25       |
| R287     | Resistor    | 82k ELR25       |
| R288     | Resistor    | 330k ELR20      |
| R289     | Resistor    | 220 ELR20       |
| R290     | Trimmer     | RHB0CS32UA 4.7k |
| R291     | Resistor    | 220 R25         |
| R292     | Trimmer     | RHB0CS32UA 4.7k |
| R293     | Resistor    | 18k ELR25       |
| R294     | Resistor    | 22k ELR25       |
| R295     | Resistor    | 470k ELR25      |
| R296     | Resistor    | 47k ELR25       |
| R297     | Thermistor  | 33D28           |
| R298     | Resistor    | 33k ELR25       |
| R299     | Resistor    | 3.9k ELR25      |
| R300     | Resistor    | 5.6k ELR25      |
| R301     | Resistor    | 22k ELR25       |
| R302     | Resistor    | 22k ELR25       |
| R303     | Resistor    | 220 ELR25       |
| R304     | Resistor    | 560 ELR25       |
| R305     | Resistor    | 47k R20         |
| R306     | Resistor    | 220 ELR25       |
| R307     | Resistor    | 220 ELR25       |
| R308     | Resistor    | 150 R20         |
| R309     | Resistor    | 1k R20          |
| R310     | Resistor    | 22k ELR25       |
| R311     | Resistor    | 47k ELR25       |
| R312     | Resistor    | 150 R20         |
| R313     | Resistor    | 2.2k R20        |
| R314     | Resistor    | 22k R20         |
| R315     | Resistor    | 22k R20         |
| R316     | Resistor    | 10k R20         |
| R317     | Resistor    | 2.2k R20        |
| R318     | Resistor    | 2.2k R20        |
| R319     | Resistor    | 2.2k R20        |
| R320     | Resistor    | 2.2k R20        |
| R321     | Resistor    | 2.2k R20        |
| R322     | Resistor    | 2.2k R25        |
| R323     | Resistor    | 47k ELR25       |
| R324     | Resistor    | 47k ELR25       |
| R325     | Resistor    | 150 R20         |
| R326     | Resistor    | 150 R20         |
| R327     | Resistor    | 33k ELR25       |
| R328     | Resistor    | 2.2k ELR25      |
| R329     | Resistor    | 22k ELR25       |
| R330     | Resistor    | 10k R20         |
| R331     | Resistor    | 47k R20         |
| R332     | Resistor    | 100k R20        |
| R333     | Resistor    | 22k ELR25       |
| R334     | Resistor    | 100k R20        |

**MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.        |
|----------|-------------|-----------------|
| R335     | Resistor    | 3.3M ELR25      |
| R336     | Resistor    | 100k ELR25      |
| R337     | Trimmer     | RHB0C1431A 10k  |
| R338     | Resistor    | 22k ELR25       |
| R339     | Resistor    | 680 ELR25       |
| R340     | Resistor    | 4.7k ELR20      |
| R341     | Resistor    | 1k ELR25        |
| R342     | Resistor    | 22k ELR25       |
| R343     | Resistor    | 150k ELR25      |
| R344     | Resistor    | 1.5k ELR25      |
| R345     | Resistor    | 5.6k ELR25      |
| R346     | Resistor    | 33k ELR25       |
| R347     | Resistor    | 150 ELR25       |
| R348     | Resistor    | 33k ELR25       |
| R349     | Resistor    | 5.6k ELR25      |
| R350     | Resistor    | 33k ELR25       |
| R351     | Resistor    | 10k ELR25       |
| R352     | Resistor    | 10k ELR25       |
| R353     | Resistor    | 82k ELR25       |
| R354     | Resistor    | 22 ELR25        |
| R355     | Resistor    | 82k ELR25       |
| R356     | Resistor    | 270k ELR25      |
| R357     | Resistor    | 1k ELR25        |
| R358     | Resistor    | 22k ELR25       |
| R359     | Resistor    | 47k ELR25       |
| R360     | Resistor    | 4.7k ELR25      |
| R361     | Resistor    | 4.7k ELR25      |
| R362     | Resistor    | 10k ELR25       |
| R363     | Resistor    | 10 ELR25        |
| R364     | Resistor    | 1k R25          |
| R365     | Resistor    | 1.5k ELR25      |
| R366     | Resistor    | 10k ELR25       |
| R367     | Resistor    | 5.6 ELR25       |
| R368     | Resistor    | 1k ELR25        |
| R369     | Resistor    | 4.7k ELR25      |
| R371     | Resistor    | 1k ELR25        |
| R372     | Resistor    | 1 ELR25         |
| R373     | Resistor    | 100 ELR25       |
| R374     | Trimmer     | RHB0CS32UA 4.7k |
| R375     | Resistor    | 3.3k ELR25      |
| R376     | Resistor    | 6.8k ELR25      |
| R377     | Resistor    | 4.7k ELR25      |
| R378     | Resistor    | 18k ELR25       |
| R379     | Resistor    | 390 ELR25       |
| R380     | Resistor    | 1k ELR25        |
| R381     | Resistor    | 330 ELR25       |
| R382     | Resistor    | 10k ELR25       |
| R383     | Resistor    | 33k ELR25       |
| R384     | Resistor    | 560 R25         |
| R385     | Resistor    | 1k ELR25        |
| R386     | Resistor    | 3.9k ELR25      |
| R388     | Resistor    | 10k ELR20       |
| R389     | Resistor    | 10k ELR20       |
| R390     | Resistor    | 2.2k ELR25      |
| R391     | Resistor    | 5.6k ELR25      |
| R392     | Resistor    | 10k ELR25       |
| R393     | Resistor    | 10k ELR20       |
| R394     | Resistor    | 3.3k ELR20      |
| R395     | Resistor    | 5.6k ELR25      |
| R396     | Resistor    | 100k ELR25      |
| R397     | Resistor    | 100k ELR25      |

**MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.        |
|----------|-------------|-----------------|
| R398     | Resistor    | 10k R25         |
| R399     | Resistor    | 1.5k ELR25      |
| R400     | Resistor    | 1.2k ELR25      |
| R401     | Resistor    | 22k R25         |
| R402     | Resistor    | 4.7k ELR25      |
| R403     | Resistor    | 100 ELR25       |
| R404     | Resistor    | 47k ELR25       |
| R405     | Resistor    | 4.7k R25        |
| R406     | Resistor    | 47k ELR25       |
| R407     | Resistor    | 100 ELR25       |
| R408     | Resistor    | 10k ELR25       |
| R409     | Resistor    | 220 ELR25       |
| R410     | Resistor    | 22k ELR25       |
| R411     | Resistor    | 22k ELR25       |
| R412     | Resistor    | 1.5k ELR25      |
| R413     | Resistor    | 330 ELR25       |
| R414     | Resistor    | 680 ELR25       |
| R415     | Resistor    | 1.5k ELR25      |
| R416     | Resistor    | 220k ELR25      |
| R418     | Resistor    | 82k ELR25       |
| R419     | Resistor    | 10k ELR25       |
| R420     | Resistor    | 5.6k R20        |
| R421     | Resistor    | 3.9k R20        |
| R422     | Resistor    | 10k R20         |
| R423     | Resistor    | 5.6k R20        |
| R424     | Resistor    | 2.2k ELR25      |
| R425     | Resistor    | 220 ELR25       |
| R426     | Resistor    | 1k ELR25        |
| R427     | Resistor    | 220 ELR20       |
| R428     | Resistor    | 150 R25         |
| R429     | Resistor    | 47 ELR25        |
| R430     | Resistor    | 1.5k R20        |
| R431     | Resistor    | 2.2k ELR20      |
| R432     | Resistor    | 2.7k R20        |
| R433     | Resistor    | 2.7k R20        |
| R434     | Resistor    | 150k ELR20      |
| R435     | Resistor    | 2.7k ELR20      |
| R436     | Resistor    | 12k ELR20       |
| R438     | Resistor    | 1k ELR20        |
| R439     | Resistor    | 680 ELR20       |
| R440     | Thermistor  | 33D28           |
| R441     | Resistor    | 390 R20         |
| R442     | Trimmer     | RHB0C1324A 1k   |
| R443     | Resistor    | 100k ELR25      |
| R444     | Thermistor  | 33D28           |
| R445     | Resistor    | 15 ELR20        |
| R446     | Resistor    | 47 ELR20        |
| R447     | Resistor    | 1k ELR20        |
| R448     | Resistor    | 470 R20         |
| R449     | Resistor    | 330 ELR20       |
| R450     | Resistor    | 1M ELR20        |
| R451     | Trimmer     | RHB0CS511A 470k |
| R452     | Resistor    | 150 R20         |
| R453     | Resistor    | 150 ELR20       |
| R454     | Resistor    | 1k ELR20        |
| R455     | Resistor    | 220k ELR25      |
| R456     | Resistor    | 47k ELR20       |
| R457     | Resistor    | 270 R20         |
| R458     | Resistor    | 6.8k R20        |
| R459     | Resistor    | 56k ELR20       |

**MAIN UNIT**

| REF. NO. | DESCRIPTION   | PART NO.              |
|----------|---------------|-----------------------|
| C1       | Array         | B8ZC0111-32N 0.0082x7 |
| C2       | Ceramic       | 2P 50V                |
| C3       | Ceramic       | 0.0047 50V            |
| C4       | Ceramic       | 0.0047 50V            |
| C5       | Ceramic       | 0.0047 50V            |
| C7       | Barrier Layer | 0.1 16V               |
| C8       | Ceramic       | 0.0047 50V            |
| C9       | Ceramic       | 0.0047 50V            |
| C10      | Ceramic       | 33P 50V               |
| C11      | Ceramic       | 0.0047 50V            |
| C12      | Ceramic       | 22P 50V CH            |
| C13      | Ceramic       | 100P 50V CH           |
| C14      | Ceramic       | 100P 50V CH           |
| C15      | Trimmer       | VCT51F126A 30P        |
| C16      | Ceramic       | 22P 50V CH            |
| C17      | Trimmer       | VCT51C143A 10P        |
| C18      | Ceramic       | 10P 50V CH            |
| C19      | Ceramic       | 22P 50V CH            |
| C20      | Trimmer       | VCT51A123A 6P         |
| C21      | Barrier Layer | 0.01 25V              |
| C22      | Barrier Layer | 0.01 25V              |
| C23      | Mylar         | 0.1 50V               |
| C24      | Mylar         | 0.15 50V              |
| C25      | Ceramic       | 0.0047 50V            |
| C26      | Ceramic       | 0.0047 50V            |
| C27      | Barrier Layer | 0.1 16V               |
| C28      | Ceramic       | 0.0047 50V            |
| C29      | Ceramic       | 0.0047 50V            |
| C30      | Ceramic       | 0.0047 50V            |
| C31      | Electrolytic  | 2.2 50V MS7           |
| C32      | Barrier Layer | 0.1 16V               |
| C33      | Ceramic       | 0.0047 50V            |
| C34      | Ceramic       | 0.001 50V             |
| C35      | Ceramic       | 0.0047 50V            |
| C36      | Mylar         | 0.01 50V              |
| C37      | Ceramic       | 330P 50V              |
| C38      | Mylar         | 0.01 50V              |
| C39      | Tantalum      | 0.47 35V              |
| C40      | Electrolytic  | 4.7 25V MS7           |
| C41      | Electrolytic  | 22 16V                |
| C42      | Ceramic       | 0.0047 50V            |
| C43      | Electrolytic  | 0.47 50V MS7          |
| C44      | Electrolytic  | 4.7 25V MS7           |
| C45      | Barrier Layer | 0.1 16V               |
| C46      | Ceramic       | 0.001 50V             |
| C47      | Ceramic       | 0.0047 50V            |
| C48      | Ceramic       | 0.0047 50V            |
| C50      | Electrolytic  | 3.3 50V MS7           |
| C52      | Ceramic       | 0.0047 50V            |
| C53      | Ceramic       | 0.0047 50V            |
| C54      | Electrolytic  | 10 16V MS7            |
| C55      | Barrier Layer | 0.047 25V             |
| C56      | Barrier Layer | 0.1 16V               |
| C57      | Electrolytic  | 3.3 50V MS7           |
| C58      | Barrier Layer | 0.047 25V             |
| C59      | Electrolytic  | 4.7 25V MS7           |
| C60      | Electrolytic  | 3.3 50V MS7           |
| C62      | Electrolytic  | 0.47 50V MS7          |
| C63      | Electrolytic  | 0.33 50V MS7          |
| C64      | Barrier Layer | 0.1 16V               |
| C65      | Electrolytic  | 3.3 50V MS7           |
| C66      | Barrier Layer | 0.1 16V               |

**MAIN UNIT**

| REF. NO. | DESCRIPTION   | PART NO.    |
|----------|---------------|-------------|
| C68      | Electrolytic  | 10 16V MS7  |
| C69      | Ceramic       | 0.0047 50V  |
| C70      | Ceramic       | 3P 50V      |
| C71      | Ceramic       | 2P 50V      |
| C72      | Ceramic       | 0.0047 50V  |
| C75      | Barrier Layer | 0.047 25V   |
| C76      | Ceramic       | 0.001 50V   |
| C77      | Barrier Layer | 0.1 16V     |
| C78      | Ceramic       | 22P 50V     |
| C79      | Ceramic       | 0.0047 50V  |
| C80      | Ceramic       | 0.0047 50V  |
| C81      | Ceramic       | 0.0047 50V  |
| C82      | Ceramic       | 0.0047 50V  |
| C83      | Electrolytic  | 4.7 25V MS7 |
| C84      | Electrolytic  | 10 16V MS7  |
| C85      | Electrolytic  | 47 16V      |
| C86      | Barrier Layer | 0.1 16V     |
| C87      | Barrier Layer | 0.1 16V     |
| C88      | Electrolytic  | 4.7 25V BP  |
| C89      | Ceramic       | 82P 50V     |
| C90      | Barrier Layer | 0.1 16V     |
| C91      | Ceramic       | 0.0047 50V  |
| C92      | Electrolytic  | 100 10V     |
| C93      | Ceramic       | 0.001 50V   |
| C94      | Ceramic       | 27P 50V     |
| C95      | Ceramic       | 0.0047 50V  |
| C96      | Ceramic       | 0.0047 50V  |
| C97      | Ceramic       | 0.0047 50V  |
| C98      | Barrier Layer | 0.1 16V     |
| C99      | Ceramic       | 0.0047 50V  |
| C100     | Ceramic       | 0.0047 50V  |
| C101     | Ceramic       | 0.0047 50V  |
| C102     | Ceramic       | 0.0047 50V  |
| C103     | Ceramic       | 0.0047 50V  |
| C104     | Barrier Layer | 0.1 16V     |
| C105     | Ceramic       | 0.0047 50V  |
| C106     | Ceramic       | 0.0047 50V  |
| C108     | Barrier Layer | 0.1 16V     |
| C109     | Ceramic       | 0.0047 50V  |
| C110     | Barrier Layer | 0.1 16V     |
| C111     | Barrier Layer | 0.1 16V     |
| C112     | Barrier Layer | 0.1 16V     |
| C113     | Barrier Layer | 0.1 16V     |
| C114     | Ceramic       | 220P 50V    |
| C115     | Barrier Layer | 0.1 16V     |
| C116     | Electrolytic  | 0.1 50V MS7 |
| C117     | Electrolytic  | 4.7 25V MS7 |
| C118     | Ceramic       | 0.001 50V   |
| C119     | Ceramic       | 330P 50V    |
| C120     | Barrier Layer | 0.0012 25V  |
| C121     | Barrier Layer | 0.1 16V     |
| C122     | Barrier Layer | 0.1 16V     |
| C123     | Ceramic       | 0.0047 50V  |
| C124     | Barrier Layer | 0.1 16V     |
| C125     | Barrier Layer | 0.0012 25V  |
| C126     | Barrier Layer | 0.1 16V     |
| C127     | Barrier Layer | 0.1 16V     |
| C128     | Barrier Layer | 0.1 16V     |
| C129     | Barrier Layer | 0.1 16V     |
| C130     | Barrier Layer | 0.1 16V     |
| C131     | Barrier Layer | 0.1 16V     |
| C132     | Barrier Layer | 0.1 16V     |

**MAIN UNIT**

| REF. NO. | DESCRIPTION   | PART NO.   |         |
|----------|---------------|------------|---------|
| C133     | Barrier layer | 0.1        | 16V     |
| C134     | Barrier Layer | 0.1        | 16V     |
| C135     | Barrier Layer | 0.1        | 16V     |
| C136     | Barrier Layer | 0.1        | 16V     |
| C137     | Ceramic       | 0.0047     | 50V     |
| C138     | Ceramic       | 0.0047     | 50V     |
| C139     | Electrolytic  | 1          | 50V MS7 |
| C140     | Ceramic       | 0.0047     | 50V     |
| C141     | Barrier Layer | 0.1        | 16V     |
| C142     | Ceramic       | 0.0047     | 50v     |
| C143     | Ceramic       | 0.0047     | 50V     |
| C144     | Ceramic       | 0.0047     | 50V     |
| C145     | Ceramic       | 5P         | 50V CH  |
| C146     | Trimmer       | VCT51A123A | 6P      |
| C147     | Ceramic       | 0.0047     | 50V     |
| C148     | Barrier Layer | 0.01       | 25V     |
| C149     | Ceramic       | 0.0047     | 50V     |
| C150     | Ceramic       | 0.0047     | 50V     |
| C151     | Ceramic       | 0.0047     | 50V     |
| C152     | Ceramic       | 0.0047     | 50V     |
| C153     | Ceramic       | 0.0047     | 50V     |
| C154     | Ceramic       | 0.0047     | 50V     |
| C155     | Ceramic       | 0.0047     | 50V     |
| C156     | Ceramic       | 0.0047     | 50V     |
| C157     | Ceramic       | 22P        | 50V     |
| C158     | Barrier Layer | 0.1        | 16V     |
| C160     | Ceramic       | 0.0047     | 50V     |
| C161     | Barrier Layer | 0.1        | 16V     |
| C163     | Ceramic       | 470P       | 50V     |
| C164     | Barrier Layer | 0.1        | 16V     |
| C165     | Barrier Layer | 0.1        | 16V     |
| C166     | Ceramic       | 0.0047     | 50V     |
| C167     | Barrier Layer | 0.1        | 16V     |
| C168     | Barrier Layer | 0.1        | 16V     |
| C169     | Barrier Layer | 0.1        | 16V     |
| C170     | Electrolytic  | 2.2        | 50V MS7 |
| C171     | Ceramic       | 0.0047     | 50V     |
| C172     | Ceramic       | 0.0047     | 50V     |
| C173     | Electrolytic  | 2.2        | 50V MS7 |
| C174     | Ceramic       | 0.0047     | 50V     |
| C175     | Mylar         | 0.01       | 50V     |
| C176     | Electrolytic  | 10         | 16V MS7 |
| C177     | Mylar         | 0.001      | 50V     |
| C178     | Mylar         | 0.0022     | 50V     |
| C179     | Ceramic       | 120P       | 50V     |
| C180     | Electrolytic  | 10         | 16V MS7 |
| C181     | Electrolytic  | 0.47       | 50V MS7 |
| C182     | Ceramic       | 0.0047     | 50V     |
| C183     | Barrier Layer | 0.01       | 25V     |
| C184     | Ceramic       | 7P         | 50V CH  |
| C185     | Ceramic       | 10P        | 50V CH  |
| C186     | Ceramic       | 100P       | 50V CH  |
| C187     | Ceramic       | 100P       | 50V CH  |
| C188     | Ceramic       | 0.0047     | 50V     |
| C189     | Ceramic       | 15P        | 50V CH  |
| C190     | Ceramic       | 0.0047     | 50V     |
| C191     | Ceramic       | 27P        | 50V     |
| C192     | Ceramic       | 56P        | 50V     |
| C193     | Barrier Layer | 0.1        | 16V     |
| C194     | Electrolytic  | 0.22       | 50V MS7 |
| C195     | Ceramic       | 0.0047     | 50V     |
| C196     | Barrier Layer | 0.047      | 25V     |

**MAIN UNIT**

| REF. NO. | DESCRIPTION   | PART NO.     |          |
|----------|---------------|--------------|----------|
| C197     | Ceramic       | 22P          | 50V      |
| C198     | Barrier Layer | 0.047        | 25V      |
| C199     | Ceramic       | 220P         | 50V CH   |
| C200     | Ceramic       | 220P         | 50V CH   |
| C201     | Ceramic       | 30P          | 50V CH   |
| C202     | Trimmer       | VCT51F126A   | 30P      |
| C203     | Ceramic       | 39P          | 50V CH   |
| C204     | Barrier Layer | 0.047        | 25V      |
| C205     | Barrier Layer | 0.047        | 25V      |
| C206     | Cylinder      | TP125X       | 103M     |
| C207     | Barrier layer | 0.047        | 25V      |
| C208     | Ceramic       | 180P         | 50V      |
| C209     | Ceramic       | 100P         | 50V      |
| C210     | Ceramic       | 0.0047       | 50V      |
| C211     | Ceramic       | 0.0047       | 50V      |
| C212     | Ceramic       | 2P           | 50V      |
| C213     | Ceramic       | 8P           | 50V      |
| C214     | Ceramic       | 100P         | 50V CH   |
| C215     | Ceramic       | 100P         | 50V CH   |
| C216     | Ceramic       | 0.0047       | 50V      |
| C217     | Ceramic       | 0.0047       | 50V      |
| C218     | Array         | B8ZC0111-32N | 0.0082x7 |
| C219     | Ceramic       | 0.0047       | 50V      |
| C220     | Electrolytic  | 10           | 16V MS7  |
| C221     | Barrier Layer | 0.1          | 16V      |
| C222     | Electrolytic  | 0.47         | 50V MS7  |
| C223     | Ceramic       | 0.0047       | 50V      |
| C224     | Electrolytic  | 10           | 16V MS7  |
| C225     | Electrolytic  | 4.7          | 25V MS7  |
| C226     | Electrolytic  | 0.47         | 50V MS7  |
| C227     | Mylar         | 0.047        | 50V      |
| C228     | Electrolytic  | 1            | 50V MS7  |
| C229     | Tantalum      | 1            | 35V      |
| C230     | Tantalum      | 1.5          | 35V      |
| C231     | Ceramic       | 0.0047       | 50V      |
| C232     | Ceramic       | 0.0047       | 50V      |
| C233     | Tantalum      | 3.3          | 35V      |
| C235     | Barrier Layer | 0.1          | 16V      |
| C236     | Electrolytic  | 4.7          | 25V      |
| C237     | Ceramic       | 0.0047       | 50V      |
| C238     | Electrolytic  | 470          | 16V      |
| C239     | Barrier Layer | 0.1          | 16V      |
| C240     | Electrolytic  | 47           | 16V      |
| C241     | Electrolytic  | 47           | 16V      |
| C243     | Electrolytic  | 1000         | 16V MS16 |
| C244     | Barrier Layer | 0.047        | 25V      |
| C245     | Electrolytic  | 100          | 16V      |
| C246     | Electrolytic  | 10           | 16V MS7  |
| C247     | Mylar         | 0.022        | 50V      |
| C248     | Mylar         | 0.022        | 50V      |
| C249     | Mylar         | 0.022        | 50V      |
| C250     | Tantalum      | 10           | 10V      |

**MAIN UNIT**

| REF. NO. | DESCRIPTION   | PART NO.              |
|----------|---------------|-----------------------|
| C251     | Mylar         | 0.022 50V             |
| C252     | Electrolytic  | 2.2 50V MS7           |
| C253     | Electrolytic  | 2.2 50V MS7           |
| C254     | Ceramic       | 0.001 50V             |
| C255     | Electrolytic  | 2.2 50V MS7           |
| C256     | Barrier Layer | 0.047 25V             |
| C257     | Electrolytic  | 0.1 50V MS7           |
| C258     | Barrier Layer | 0.1 16V               |
| C259     | Electrolytic  | 10 16V MS7            |
| C260     | Ceramic       | 0.0047 50V            |
| C261     | Barrier Layer | 0.1 16V               |
| C262     | Mylar         | 0.01 50V              |
| C263     | Mylar         | 0.01 50V              |
| C264     | Mylar         | 0.033 50V             |
| C265     | Barrier Layer | 0.047 25V             |
| C266     | Electrolytic  | 0.47 50V MS7          |
| C267     | Ceramic       | 0.0047 50V            |
| C268     | Ceramic       | 0.0047 50V            |
| C269     | Ceramic       | 82P 50V               |
| C270     | Electrolytic  | 0.1 50V MS7           |
| C271     | Barrier Layer | 0.1 16V               |
| C272     | Ceramic       | 0.001 50V             |
| C273     | Ceramic       | 0.0047 50V            |
| C274     | Electrolytic  | 10 16V MS7            |
| C275     | Mylar         | 0.022 50V             |
| C276     | Mylar         | 0.001 50V             |
| C277     | Ceramic       | 330P 50V              |
| C278     | Array         | B7ZC0715-32N 0.0022x6 |
| C279     | Array         | B5RC0124-32N 0.001x4  |
| C280     | Electrolytic  | 10 16V MS7            |
| C281     | Ceramic       | 0.0047 50V            |
| C282     | Mylar         | 0.022 50V             |
| C283     | Electrolytic  | 22 16V                |
| C284     | Electrolytic  | 1 50V MS7             |
| C285     | Electrolytic  | 0.47 50V MS7          |
| C286     | Ceramic       | 0.001 50V             |
| C287     | Barrier Layer | 0.1 16V               |
| C289     | Ceramic       | 10P 50V               |
| C290     | Electrolytic  | 10 16V MS7            |
| C291     | Barrier Layer | 0.1 16V               |
| C292     | Barrier Layer | 0.047 25V             |
| C293     | Electrolytic  | 10 16V MS7            |
| C294     | Mylar         | 0.01 50V              |
| C295     | Electrolytic  | 10 16V MS7            |
| C296     | Ceramic       | 0.0047 50V            |
| C297     | Electrolytic  | 0.47 50V MS7          |
| C298     | Ceramic       | 15P 50V UJ            |
| C299     | Barrier Layer | 0.1 16V               |
| C300     | Barrier Layer | 0.1 16V               |
| C301     | Ceramic       | 470P 50V              |
| C302     | Ceramic       | 100P 50V              |
| C303     | Barrier Layer | 0.1 16V               |
| C304     | Ceramic       | 4P 50V CH             |
| C305     | Electrolytic  | 10 16V MS7            |
| C306     | Electrolytic  | 1 50V MS7             |
| C307     | Barrier Layer | 0.1 16V               |
| CP1      | Check Point   | IPS-1136              |
| J1       | Connector     | TL25P-10-V1           |
| J2       | Connector     | TL25P-03-V1           |
| J3       | Connector     | TL25P-04-V1           |

**MAIN UNIT**

| REF. NO. | DESCRIPTION    | PART NO.    |
|----------|----------------|-------------|
| J4       | Connector      | TMP-J01X-A2 |
| J5       | Connector      | TL25P-08-V1 |
| J6       | Connector      | TSL-P03P-B1 |
| J7       | Connector      | TL25P-07-V1 |
| J8       | Connector      | TL25P-09-V1 |
| J9       | Connector      | TL25P-07-V1 |
| J10      | Connector      | TL25P-07-V1 |
| J11      | Connector      | TL25P-08-V1 |
| J12      | Connector      | TL25P-08-V1 |
| J13      | Connector      | TL25P-06-V1 |
| J14      | Connector      | TL25P-05-V1 |
| J15      | Connector      | TL25P-08-V1 |
| J16      | Connector      | TL25P-08-V1 |
| P1       | Connector      | TL25H-05-B1 |
| S1       | Switch         | SSSS31124A  |
| S2       | Switch         | SSSS31124A  |
| S3       | Switch         | EVQ-RBA     |
| S4       | Switch         | EVQ-RBA     |
| S8       | Switch         | SSSS31124A  |
| S01      | Socket         | 380598-2    |
| S02      | Socket         | 380598-2    |
| S03      | Socket         | 380598-2    |
| S04      | Socket         | 380598-2    |
| EP1      | Ferrite Bead   | FSQH050RN   |
| EP2      | P.C.Board      | B-1035C     |
| EP3      | P.C.Board      | B-1169      |
| EP9      | Rubber Grommet | B-312       |
| EP10     | Mica Plate     | P-103KD     |
| EP11     | Ferrite Bead   | FSQH070RN   |
| EP16     | Ferrite Bead   | FSQH070RN   |
| W1       | Jumper         | IPS-1041-2  |
| W2       | Jumper         | IPS-1041-2  |
| W3       | Jumper         | IPS-1041-2  |
| W4       | Jumper         | IPS-1041-2  |
| W5       | Jumper         | IPS-1041-2  |
| W6       | Jumper         | IPS-1041-2  |
| W7       | Jumper         | IPS-1041-4  |
| W8       | Jumper         | IPS-1041-2  |
| W9       | Jumper         | IPS-1041-2  |
| W10      | Jumper         | IPS-1041-2  |
| W11      | Jumper         | JPW-02A     |
| W12      | Jumper         | IPS-1041-2  |
| W13      | Jumper         | IPS-1041-2  |
| W14      | Jumper         | IPS-1041-2  |
| W15      | Jumper         | IPS-1041-4  |
| W16      | Jumper         | IPS-1041-2  |
| W18      | Jumper         | IPS-1041-4  |
| W19      | Jumper         | IPS-1041-2  |
| W20      | Jumper         | IPS-1041-2  |
| W21      | Jumper         | IPS-1041-4  |
| W22      | Jumper         | IPS-1041-4  |
| W23      | Jumper         | IPS-1041-2  |
| W24      | Jumper         | IPS-1041-4  |
| W25      | Jumper         | IPS-1041-4  |
| W26      | Jumper         | IPS-1041-2  |
| W27      | Jumper         | IPS-1041-2  |
| W28      | Jumper         | IPS-1041-2  |

**MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.   |
|----------|-------------|------------|
| W29      | Jumper      | IPS-1041-2 |
| W30      | Jumper      | IPS-1041-2 |
| W32      | Jumper      | IPS-1041-4 |
| W33      | Jumper      | IPS-1041-2 |
| W34      | Jumper      | IPS-1041-4 |
| W35      | Jumper      | IPS-1041-4 |
| W36      | Jumper      | IPS-1041-2 |
| W37      | Jumper      | IPS-1041-2 |
| W38      | Jumper      | IPS-1041-2 |
| W39      | Jumper      | IPS-1041-2 |
| W40      | Jumper      | IPS-1041-2 |
| W41      | Jumper      | IPS-1041-4 |
| W43      | Jumper      | IPS-1041-2 |
| W44      | Jumper      | IPS-1041-2 |
| W45      | Jumper      | IPS-1041-4 |
| W46      | Jumper      | IPS-1041-4 |
| W47      | Jumper      | IPS-1041-2 |
| W48      | Jumper      | IPS-1041-2 |
| W49      | Jumper      | IPS-1041-2 |
| W50      | Jumper      | IPS-1041-2 |
| W51      | Jumper      | IPS-1041-4 |
| W52      | Jumper      | IPS-1041-2 |
| W53      | Jumper      | IPS-1041-4 |
| W54      | Jumper      | JPW-02A    |
| W55      | Jumper      | IPS-1041-2 |
| W56      | Jumper      | IPS-1041-4 |
| W57      | Jumper      | IPS-1041-4 |
| W58      | Jumper      | IPS-1041-2 |
| W59      | Jumper      | IPS-1041-4 |
| W60      | Jumper      | IPS-1041-2 |
| W61      | Jumper      | IPS-1041-2 |
| W62      | Jumper      | IPS-1041-2 |
| W63      | Jumper      | IPS-1041-2 |
| W64      | Jumper      | IPS-1041-2 |
| W65      | Jumper      | IPS-1041-4 |
| W66      | Jumper      | IPS-1041-4 |
| W67      | Jumper      | IPS-1041-4 |
| W69      | Jumper      | IPS-1041-2 |
| W70      | Jumper      | IPS-1041-2 |
| W71      | Jumper      | IPS-1041-2 |
| W72      | Jumper      | IPS-1041-4 |
| W73      | Jumper      | IPS-1041-4 |
| W75      | Jumper      | IPS-1041-2 |
| W76      | Jumper      | IPS-1041-2 |
| W77      | Jumper      | IPS-1041-4 |
| W78      | Jumper      | IPS-1041-2 |
| W79      | Jumper      | IPS-1041-2 |
| W80      | Jumper      | IPS-1041-2 |
| W81      | Jumper      | IPS-1041-4 |
| W82      | Jumper      | IPS-1041-4 |
| W83      | Jumper      | IPS-1041-4 |
| W84      | Jumper      | IPS-1041-4 |
| W85      | Jumper      | IPS-1041-2 |
| W86      | Jumper      | JPW-02H    |
| W87      | Jumper      | IPS-1041-2 |
| W88      | Jumper      | IPS-1041-2 |
| W89      | Jumper      | IPS-1041-2 |
| W90      | Jumper      | IPS-1041-2 |
| W92      | Jumper      | IPS-1041-4 |
| W93      | Jumper      | IPS-1041-4 |
| W94      | Jumper      | IPS-1041-4 |
| W95      | Jumper      | IPS-1041-4 |
| W96      | Jumper      | IPS-1041-2 |
| W97      | Jumper      | IPS-1041-2 |

**MAIN UNIT**

| REF. NO. | DESCRIPTION | PART NO.                |
|----------|-------------|-------------------------|
| W98      | Jumper      | IPS-1041-2              |
| W99      | Jumper      | IPS-1041-2              |
| W100     | Jumper      | 23/00/170/D21/D21       |
| W101     | Jumper      | 23/01/105/D21/D21       |
| W102     | Jumper      | 23/02/155/D21/D21       |
| W103     | Jumper      | [ 61/99/150/W13A/W13A ] |
| W104     | Jumper      | 08 A A                  |
| W105     | Jumper      | 23/05/145/D21/D21       |
| W106     | Jumper      | 23/06/170/D21/D21       |
| W107     | Jumper      | [ 61/99/305/W13A/W13A ] |
| W108     | Jumper      | 08 A A                  |
| W109     | Jumper      | 23/09/120/D21/D21       |
| W110     | Jumper      | 23/00/110/D21/D21       |
| W111     | Jumper      | 23/01/150/D21/D21       |
| W112     | Jumper      | 23/02/180/D21/D21       |
| W113     | Jumper      | 23/03/220/D21/D21       |
| W114     | Jumper      | 23/04/140/D21/D21       |
| W115     | Jumper      | 23/05/200/D21/D21       |
| W116     | Jumper      | 23/06/060/D21/D21       |
| W117     | Jumper      | 23/07/120/D21/D21       |
| W118     | Jumper      | 23/08/070/D21/D21       |
| W119     | Jumper      | 23/09/100/D21/D21       |
| W120     | Jumper      | 23/00/140/D21/D21       |
| W121     | Jumper      | [ 51/99/150/W13A/W13A ] |
| W122     | Jumper      | 08 A A                  |
| W123     | Jumper      | 23/03/250/D21/D21       |
| W124     | Jumper      | [ 61/99/280/W13A/W13A ] |
| W125     | Jumper      | 08 A A                  |
| W126     | Jumper      | [ 61/99/230/W13A/W13A ] |
| W127     | Jumper      | 08 A A                  |
| W128     | Jumper      | 23/08/180/D21/D21       |
| W129     | Jumper      | 23/09/130/D21/D21       |
| W130     | Jumper      | 23/00/105/D21/D21       |
| W131     | Jumper      | 23/01/155/D21/D21       |
| W132     | Jumper      | 23/02/235/D21/D21       |
| W133     | Jumper      | 23/03/125/D21/D21       |
| W134     | Jumper      | [ 61/99/300/W13A/W13A ] |
| W135     | Jumper      | 08 A A                  |
| W136     | Jumper      | 23/06/300/D21/D21       |
| W137     | Jumper      | 23/07/065/D21/D21       |
| W138     | Jumper      | 23/08/205/D21/D21       |
| W139     | Jumper      | 23/09/150/D21/D21       |
| W140     | Jumper      | 23/00/140/D21/D21       |
| W141     | Jumper      | 23/01/165/D21/D21       |
| W142     | Jumper      | 23/02/165/D21/D21       |
| W143     | Jumper      | 23/03/120/D21/D21       |
| W144     | Jumper      | [ 51/99/210/W13A/W13A ] |
| W145     | Jumper      | 08 A A                  |
| W146     | Jumper      | 23/06/070/D21/D21       |
| W147     | Jumper      | 23/07/100/D21/D21       |
| W148     | Jumper      | 23/08/070/D21/D21       |
| W150     | Jumper      | 23/00/150/D21/D21       |
| W151     | Jumper      | [ 51/99/135/W13A/W13A ] |
| W152     | Jumper      | 08 A A                  |
| W153     | Jumper      | [ 51/99/105/W13A/W13A ] |
| W154     | Jumper      | 08 A A                  |
| W155     | Jumper      | 23/05/280/D21/C01       |
| W156     | Jumper      | 23/06/300/D21/C01       |
| W157     | Jumper      | 23/07/255/D21/C01       |
| W158     | Jumper      | 23/08/200/D21/C01       |
| W159     | Jumper      | 23/09/065/D21/D21       |
| W160     | Jumper      | 72/99/005/X98/X98       |
| W161     | Jumper      | 74/98/015/X98/X98       |
| W162     | Jumper      | 74/98/020/X98/X98       |

## 10 - 8 RF UNIT

| REF. NO. | DESCRIPTION | PART NO.   |
|----------|-------------|------------|
| IC1      | IC          | BA618      |
| IC2      | IC          | BA618      |
| IC3      | IC          | ND487C1-3R |
| Q1       | Transistor  | 2SC945-P/Q |
| Q2       | Transistor  | 2SC2053    |
| Q3       | Transistor  | 2SA1048-Y  |
| Q5       | Transistor  | 2SC1571-G  |
| Q6       | FET         | 2SK125     |
| Q7       | FET         | 2SK125     |
| Q8       | FET         | 3SK74-M    |
| Q9       | FET         | 2SK125     |
| Q10      | FET         | 2SK125     |
| Q11      | FET         | 3SK74-M    |
| Q12      | FET         | 3SK74-K    |
| Q13      | FET         | 3SK74-K    |
| Q14      | Transistor  | 2SC2053    |
| Q15      | Transistor  | 2SC2878    |
| Q16      | Transistor  | 2SC3402    |
| Q17      | Transistor  | 2SC945-P/Q |
| Q18      | Transistor  | 2SC3402    |
| Q19      | Transistor  | 2SC3402    |
| Q20      | Transistor  | 2SD468-C   |
| Q21      | Transistor  | 2SC3399    |
| D1       | Diode       | 1S953      |
| D2       | Diode       | 1S953      |
| D3       | Diode       | 1SS53      |
| D4       | Diode       | 1SS53      |
| D5       | Diode       | 1N4002     |
| D6       | Diode       | 1N4002     |
| D7       | Diode       | 1SS53      |
| D9       | Diode       | 1SS53      |
| D10      | Diode       | MI204      |
| D11      | Diode       | MI204      |
| D12      | Diode       | 1SS53      |
| D13      | Diode       | 1SS53      |
| D14      | Diode       | 1SS53      |
| D15      | Diode       | 1SS53      |
| D16      | Diode       | 1SS53      |
| D17      | Diode       | 1SS53      |
| D18      | Diode       | 1SS53      |
| D19      | Diode       | 1SS53      |
| D20      | Diode       | 1SS53      |
| D21      | Diode       | 1SS53      |
| D22      | Diode       | 1SS53      |
| D23      | Diode       | 1SS53      |
| D24      | Diode       | 1SS53      |
| D25      | Diode       | 1SS53      |
| D26      | Diode       | 1SS53      |
| D27      | Diode       | 1SS53      |
| D28      | Diode       | 1SS53      |
| D29      | Diode       | 1SS53      |
| D30      | Diode       | 1SS53      |
| D31      | Diode       | 1SS53      |
| D32      | Diode       | 1SS53      |
| D33      | Diode       | 1SS53      |
| D34      | Diode       | 1SS53      |
| D35      | Diode       | 1SS53      |
| D36      | Diode       | 1SS53      |
| D37      | Diode       | 1SS53      |
| D38      | Diode       | 1SS53      |

## RF UNIT

| REF. NO. | DESCRIPTION | PART NO.       |
|----------|-------------|----------------|
| D39      | Diode       | 1SS53          |
| D40      | Diode       | 1SS53          |
| D41      | Diode       | MI204          |
| D42      | Diode       | MI204          |
| D43      | Diode       | MI204          |
| D44      | Diode       | MI204          |
| D45      | Diode       | 1SS53          |
| D46      | Diode       | 1SS55          |
| D47      | Diode       | MI204          |
| D48      | Diode       | 1SS53          |
| D49      | Diode       | 1SS53          |
| D50      | Diode       | 1SS53          |
| D51      | Zener       | RD9.1E B3      |
| D52      | Diode       | 1SS53          |
| D53      | Diode       | 1SS53          |
| D54      | Diode       | 1SS53          |
| FI1      | Monolithic  | FL-64          |
| L1       | Coil        | EL0810SKI 101K |
| L2       | Coil        | EL0810SKI 101K |
| L3       | Coil        | EL0810SKI 101K |
| L4       | Coil        | EL0810SKI 102K |
| L5       | Coil        | EL0810SKI 102K |
| L6       | Coil        | FL5H 102K      |
| L7       | Coil        | FL5H 102K      |
| L8       | Coil        | EL0810SKI 101K |
| L9       | Coil        | EL0810SKI 101K |
| L10      | Coil        | EL0810SKI 101K |
| L11      | Coil        | EL0810SKI 101K |
| L12      | Coil        | LB4 R15        |
| L13      | Coil        | LB4 R50        |
| L14      | Coil        | FL5H 101K      |
| L15      | Coil        | LR-151         |
| L16      | Coil        | LR-170         |
| L17      | Coil        | LS-114         |
| L18      | Coil        | LS-254         |
| L19      | Coil        | LS-254         |
| L20      | Coil        | LS-254         |
| L21      | Coil        | LS-198         |
| L22      | Coil        | LR-171         |
| L23      | Coil        | LA-268         |
| L24      | Coil        | LA-258         |
| L25      | Coil        | S4 102K        |
| L26      | Coil        | LB4 R83        |
| L27      | Coil        | LR-116         |
| L28      | Coil        | LR-116         |
| L29      | Coil        | LA-96          |
| L30      | Coil        | LB-86A         |
| L31      | Coil        | LS-114         |
| L32      | Coil        | LS-114         |
| L33      | Coil        | LS-198         |
| L34      | Coil        | LR-75A         |
| L35      | Coil        | FL5H 102K      |
| L36      | Coil        | EL0810SKI 102K |
| L37      | Coil        | FL5H 102K      |
| L38      | Coil        | FL5H 102K      |
| L39      | Coil        | FL5H 102K      |
| L40      | Coil        | FL5H 102K      |
| L41      | Coil        | LR-130         |
| L42      | Coil        | LR-129         |
| L43      | Coil        | FL5H 102K      |

**RF UNIT**

| REF. NO. | DESCRIPTION | PART NO.       |
|----------|-------------|----------------|
| L44      | Coil        | LB4 R34        |
| L45      | Coil        | LB4 R36        |
| L46      | Coil        | LB4 R30        |
| L47      | Coil        | LB4 R36        |
| L48      | Coil        | FL5H 101K      |
| L49      | Coil        | LB4 R45        |
| L50      | Coil        | LB4 R50        |
| L51      | Coil        | LB4 R50        |
| L52      | Coil        | LB4 R54        |
| L53      | Coil        | FL5H 101K      |
| L54      | Coil        | LB4 R54        |
| L55      | Coil        | LB4 R65        |
| L56      | Coil        | LB4 R65        |
| L57      | Coil        | LB4 R83        |
| L58      | Coil        | FL5H 101K      |
| L59      | Coil        | LB4 R70        |
| L60      | Coil        | LB4 R83        |
| L61      | Coil        | EL0810SKI 1R0K |
| L62      | Coil        | EL0810SKI 1R0K |
| L63      | Coil        | FL5H 101K      |
| L64      | Coil        | EL0810SKI 1R0K |
| L65      | Coil        | EL0810SKI 1R2K |
| L66      | Coil        | EL0810SKI 1R2K |
| L67      | Coil        | EL0810SKI 1R2K |
| L68      | Coil        | FL5H 101K      |
| L69      | Coil        | EL0810SKI 1R5K |
| L70      | Coil        | EL0810SKI 1R5K |
| L71      | Coil        | EL0810SKI 1R8K |
| L72      | Coil        | EL0810SKI 1R8K |
| L73      | Coil        | FL5H 101K      |
| L74      | Coil        | EL0810SKI 1R8K |
| L75      | Coil        | EL0810SKI 1R8K |
| L76      | Coil        | EL0810SKI 2R2K |
| L77      | Coil        | EL0810SKI 2R7K |
| L78      | Coil        | FL5H 101K      |
| L79      | Coil        | EL0810SKI 2R7K |
| L80      | Coil        | EL0810SKI 3R3K |
| L81      | Coil        | EL0810SKI 3R3K |
| L82      | Coil        | LB4 4R3        |
| L83      | Coil        | FL5H 102K      |
| L84      | Coil        | LB4 3R6        |
| L85      | Coil        | LB4 4R3        |
| L86      | Coil        | LB4 5R1        |
| L87      | Coil        | LB4 6R2        |
| L88      | Coil        | FL5H 102K      |
| L89      | Coil        | FL5H 102K      |
| L90      | Coil        | LB4 6R2        |
| L91      | Coil        | LB4 5R1        |
| L92      | Coil        | FL5H 102K      |
| L93      | Coil        | EL0810SKI 220K |
| L94      | Coil        | EL0810SKI 220K |
| L95      | Coil        | S4 102K        |
| L96      | Coil        | LR-20          |
| L97      | Coil        | FL5H 102K      |
| L98      | Coil        | FL5H 101K      |
| L99      | Coil        | FL5H 102K      |
| L100     | Coil        | FL5H 102K      |
| L101     | Coil        | EL0810SKI 4R7K |
| L102     | Coil        | EL0810SKI 3R3K |
| L103     | Coil        | S4 102K        |
| L104     | Coil        | BT01RN1-A61    |
| L105     | Coil        | BT01RN1-A61    |

**RF UNIT**

| REF. NO. | DESCRIPTION | PART NO.        |
|----------|-------------|-----------------|
| L106     | Coil        | LAL03NA 100K    |
| L107     | Coil        | LAL03NA 100K    |
| R1       | Resistor    | 2.2 ELR20       |
| R2       | Resistor    | 10k R20         |
| R3       | Resistor    | 10k ELR25       |
| R4       | Resistor    | 10k ELR25       |
| R5       | Resistor    | 10k ELR25       |
| R6       | Resistor    | 10k ELR25       |
| R7       | Resistor    | 10k ELR25       |
| R8       | Resistor    | 10k R25         |
| R9       | Resistor    | 33k ELR25       |
| R10      | Resistor    | 33k ELR25       |
| R11      | Resistor    | 10k ELR20       |
| R12      | Resistor    | 10k R25         |
| R13      | Resistor    | 2.2 ELR20       |
| R14      | Array       | RMX-6 10k       |
| R15      | Resistor    | 470 ELR25       |
| R16      | Resistor    | 680 ELR25       |
| R17      | Resistor    | 8.2k ELR25      |
| R18      | Resistor    | 560 ELR25       |
| R19      | Resistor    | 100 ELR25       |
| R20      | Resistor    | 1k ELR25        |
| R21      | Resistor    | 33 ELR25        |
| R22      | Resistor    | 220 ELR25       |
| R23      | Resistor    | 100 ELR25       |
| R24      | Trimmer     | RHB0CJ30EA 2.2k |
| R25      | Resistor    | 330 ELR25       |
| R26      | Resistor    | 22k ELR25       |
| R27      | Resistor    | 47 ELR25        |
| R28      | Resistor    | 47 ELR25        |
| R29      | Resistor    | 10k ELR20       |
| R30      | Resistor    | 100 ELR25       |
| R31      | Resistor    | 390 ELR25       |
| R32      | Resistor    | 47 ELR25        |
| R33      | Resistor    | 10k ELR25       |
| R34      | Resistor    | 12k ELR25       |
| R35      | Resistor    | 220 ELR25       |
| R36      | Resistor    | 2.2k ELR25      |
| R37      | Resistor    | 22 ELR25        |
| R38      | Resistor    | 22 ELR25        |
| R39      | Resistor    | 100 R25         |
| R40      | Resistor    | 100 ELR25       |
| R41      | Resistor    | 100 ELR25       |
| R42      | Resistor    | 3.9k R20        |
| R43      | Resistor    | 56 ELR20        |
| R44      | Resistor    | 470k ELR25      |
| R45      | Resistor    | 47 R25          |
| R46      | Resistor    | 560 R20         |
| R47      | Resistor    | 560 R20         |
| R48      | Resistor    | 220 R25         |
| R49      | Resistor    | 150 ELR20       |
| R50      | Resistor    | 8.2 R20         |
| R51      | Resistor    | 8.2 R20         |
| R52      | Resistor    | 150 R20         |
| R53      | Resistor    | 2.2k ELR25      |
| R54      | Resistor    | 100 ELR20       |
| R55      | Resistor    | 100k ELR25      |
| R56      | Resistor    | 10k ELR25       |
| R57      | Resistor    | 820 ELR25       |
| R58      | Resistor    | 100 ELR25       |
| R59      | Resistor    | 1.5k R20        |



## RF UNIT

| REF. NO. | DESCRIPTION | PART NO.   |       |
|----------|-------------|------------|-------|
| R60      | Resistor    | 100        | ELR25 |
| R61      | Resistor    | 150        | ELR25 |
| R62      | Resistor    | 10k        | ELR25 |
| R63      | Resistor    | 68         | ELR25 |
| R64      | Resistor    | 68         | ELR25 |
| R65      | Resistor    | 47         | ELR25 |
| R66      | Resistor    | 100        | ELR25 |
| R67      | Resistor    | 100        | ELR20 |
| R68      | Resistor    | 100        | ELR25 |
| R69      | Resistor    | 100        | R25   |
| R70      | Resistor    | 100        | R25   |
| R71      | Resistor    | 100        | R25   |
| R72      | Resistor    | 100        | R25   |
| R73      | Resistor    | 100        | R25   |
| R74      | Resistor    | 100        | R25   |
| R75      | Resistor    | 100        | R25   |
| R76      | Resistor    | 100        | R25   |
| R77      | Resistor    | 100        | R25   |
| R78      | Resistor    | 100        | R25   |
| R79      | Resistor    | 470        | ELR25 |
| R80      | Resistor    | 82         | ELR25 |
| R81      | Resistor    | 680        | ELR25 |
| R82      | Resistor    | 4.7k       | ELR25 |
| R83      | Resistor    | 100        | ELR25 |
| R84      | Resistor    | 220        | ELR20 |
| R85      | Resistor    | 4.7        | ELR25 |
| R86      | Resistor    | 1          | ELR25 |
| R87      | Resistor    | 10k        | ELR25 |
| R88      | Resistor    | 220        | ELR25 |
| R89      | Resistor    | 2.2k       | ELR25 |
| R90      | Resistor    | 4.7k       | ELR25 |
| R91      | Resistor    | 470        | ELR25 |
| R92      | Resistor    | 56         | ELR25 |
| R93      | Resistor    | 470        | ELR20 |
| R94      | Resistor    | 8.2k       | ELR20 |
| R95      | Resistor    | 2.2k       | ELR25 |
| R96      | Resistor    | 4.7k       | ELR20 |
| R97      | Resistor    | 470        | R20   |
| R100     | Resistor    | 390        | ELR20 |
| R101     | Resistor    | 4.7k       | ELR25 |
| R102     | Resistor    | 4.7k       | R25   |
| R104     | Resistor    | 82         | ELR25 |
| R105     | Resistor    | 2.2k       | R25   |
| R106     | Resistor    | 2.2k       | ELR25 |
| R108     | Resistor    | 27         | R25   |
| R109     | Resistor    | 33         | ELR25 |
| R110     | Resistor    | 27         | ELR25 |
| R111     | Resistor    | 820        | ELR20 |
| R112     | Resistor    | 1k         | ELR20 |
| R113     | Resistor    | 100        | R25   |
| R114     | Resistor    | 2.2k       | ELR25 |
| R115     | Resistor    | 47k        | ELR25 |
| R116     | Resistor    | 680k       | ELR25 |
| R117     | Resistor    | 10k        | R25   |
| R118     | Resistor    | 15k        | ELR20 |
| R119     | Resistor    | 15k        | ELR25 |
| R120     | Resistor    | 2.2k       | R20   |
| R121     | Resistor    | 3.3k       | ELR20 |
| R122     | Resistor    | 1k         | R25   |
| R123     | Thermistor  | 23D29      |       |
| R124     | Resistor    | 10k        | ELR25 |
| R125     | Trimmer     | RHM0AS304A | 4.7k  |

## RF UNIT

| REF. NO. | DESCRIPTION   | PART NO.     |               |
|----------|---------------|--------------|---------------|
| C1       | Array         | B8ZC0111-32N | 0.0082x7      |
| C2       | Array         | B8ZC0111-32N | 0.0082x7      |
| C3       | Barrier Layer | 0.047        | 25V           |
| C6       | Array         | B8ZC0111-32N | 0.0082x7      |
| C7       | Array         | B8ZC0111-32N | 0.0082x7      |
| C11      | Ceramic       | 39P          | 50V           |
| C12      | Ceramic       | 39P          | 50V           |
| C13      | Ceramic       | 220P         | 50V           |
| C14      | Ceramic       | 0.001        | 50V           |
| C15      | Barrier Layer | 0.047        | 25V           |
| C16      | Electrolytic  | 2.2          | 50V MS7       |
| C17      | Ceramic       | 0.001        | 50V           |
| C18      | Ceramic       | 8P           | 50V           |
| C19      | Ceramic       | 5P           | 50V           |
| C20      | Ceramic       | 15P          | 50V           |
| C21      | Ceramic       | 1P           | 50V           |
| C22      | Ceramic       | 10P          | 50V           |
| C23      | Barrier Layer | 0.047        | 25V           |
| C24      | Barrier Layer | 0.1          | 16V           |
| C25      | Barrier Layer | 0.1          | 16V           |
| C26      | Barrier Layer | 0.047        | 25V           |
| C27      | Barrier Layer | 0.047        | 25V           |
| C28      | Barrier Layer | 0.047        | 25V           |
| C29      | Barrier Layer | 0.047        | 25V           |
| C30      | Electrolytic  | 0.47         | 50V MS7       |
| C31      | Barrier Layer | 0.047        | 25V           |
| C32      | Ceramic       | 220P         | 50V           |
| C33      | Barrier Layer | 0.047        | 25V           |
| C34      | Barrier Layer | 0.047        | 25V           |
| C35      | Barrier Layer | 0.047        | 25V           |
| C36      | Barrier Layer | 0.047        | 25V           |
| C37      | Barrier Layer | 0.047        | 25V           |
| C38      | Barrier Layer | 0.047        | 25V           |
| C39      | Barrier Layer | 0.047        | 25V           |
| C40      | Barrier Layer | 0.047        | 25V           |
| C41      | Ceramic       | 2P           | 50V           |
| C42      | Ceramic       | 6P           | 50V           |
| C43      | Ceramic       | 0.0047       | 50V           |
| C44      | Ceramic       | 0.0047       | 50V           |
| C45      | Mylar         | 0.022        | 50V           |
| C47      | Ceramic       | 0.001        | 50V           |
| C48      | Ceramic       | 3P           | 50V           |
| C49      | Ceramic       | 10P          | 50V           |
| C50      | Ceramic       | 8P           | 50V           |
| C51      | Barrier Layer | 0.1          | 16V           |
| C52      | Ceramic       | 8P           | 50V           |
| C54      | Barrier Layer | 0.047        | 25V           |
| C55      | Electrolytic  | 1            | 50V           |
| C56      | Ceramic       | 82P          | 50V           |
| C57      | Ceramic       | 150P         | 50V           |
| C58      | Ceramic       | 10P          | 50V           |
| C59      | Ceramic       | 30P          | 50V           |
| C61      | Barrier Layer | RAU08SA      | 821K 50V 820P |
| C62      | Barrier Layer | RAU08SA      | 821K 50V 820P |
| C63      | Ceramic       | 0.0047       | 50V           |
| C64      | Ceramic       | 27P          | 50V           |
| C65      | Ceramic       | 82P          | 50V           |
| C66      | Ceramic       | 24P          | 50V           |
| C67      | Ceramic       | 24P          | 50V           |
| C68      | Ceramic       | 39P          | 50V           |
| C69      | Ceramic       | 0.0047       | 50V           |
| C70      | Ceramic       | 6P           | 50V           |

## RF UNIT

| REF. NO. | DESCRIPTION   | PART NO.               |
|----------|---------------|------------------------|
| C71      | Barrier Layer | 0.1 16V                |
| C72      | Ceramic       | 0.001 50V              |
| C73      | Ceramic       | 0.0047 50V             |
| C74      | Ceramic       | 0.0047 50V             |
| C75      | Ceramic       | 0.0047 50V             |
| C76      | Ceramic       | 8P 50V UJ              |
| C77      | Ceramic       | 15P 50V                |
| C78      | Ceramic       | 3P 50V                 |
| C79      | Barrier Layer | 0.047 25V              |
| C80      | Barrier Layer | 0.047 25V              |
| C81      | Barrier Layer | 0.047 25V              |
| C82      | Barrier Layer | 0.047 25V              |
| C84      | Barrier Layer | 0.047 25V              |
| C85      | Ceramic       | 100P 50V               |
| C86      | Barrier Layer | RAU08SA 821K 50V 820P  |
| C87      | Ceramic       | 270P 50V               |
| C88      | Ceramic       | 68P 50V                |
| C89      | Ceramic       | 56P 50V                |
| C90      | Ceramic       | 120P 50V               |
| C91      | Ceramic       | 30P 50V                |
| C92      | Barrier Layer | 0.047 25V              |
| C93      | Barrier Layer | 0.047 25V              |
| C94      | Ceramic       | 150P 50V               |
| C95      | Barrier Layer | UAT04V 122K 50V 0.0012 |
| C96      | Ceramic       | 300P 50V               |
| C97      | Ceramic       | 100P 50V               |
| C98      | Ceramic       | 24P 50V                |
| C99      | Ceramic       | 220P 50V               |
| C100     | Barrier Layer | 0.047 25V              |
| C101     | Barrier Layer | 0.047 25V              |
| C102     | Ceramic       | 200P 50V               |
| C103     | Barrier Layer | UAT04V 182K 50V 0.0018 |
| C104     | Ceramic       | 300P 50V               |
| C105     | Ceramic       | 270P 50V               |
| C106     | Ceramic       | 39P 50V                |
| C107     | Ceramic       | 390P 50V               |
| C108     | Barrier Layer | 0.047 25V              |
| C109     | Barrier Layer | 0.047 25V              |
| C110     | Ceramic       | 300P 50V               |
| C111     | Barrier Layer | UAT04V 222K 50V 0.0022 |
| C112     | Ceramic       | 330P 50V               |
| C113     | Ceramic       | 150P 50V               |
| C114     | Ceramic       | 51P 50V                |
| C115     | Ceramic       | 390P 50V               |
| C116     | Barrier Layer | 0.047 25V              |
| C117     | Barrier Layer | 0.047 25V              |
| C118     | Ceramic       | 390P 50V               |
| C119     | Barrier Layer | UAT05V 272K 50V 0.0027 |
| C120     | Ceramic       | DD109SL471J50V02 470P  |
| C121     | Ceramic       | DD109SL511J50V02 510P  |
| C122     | Ceramic       | 75P 50V                |
| C123     | Barrier Layer | RAU06SA 561K 50V 560P  |
| C124     | Barrier Layer | 0.047 25V              |
| C125     | Barrier Layer | 0.047 25V              |
| C126     | Barrier Layer | RAU06SA 561K 50V 560P  |
| C127     | Barrier Layer | UAT06V 562K 50V 0.0056 |
| C128     | Barrier Layer | UAT04V 102K 50V 0.001  |
| C129     | Barrier Layer | RAU08SA 681K 50V 680P  |
| C130     | Ceramic       | 82P 50V                |
| C131     | Barrier Layer | RAU08SA 681K 50V 680P  |
| C132     | Barrier Layer | 0.047 25V              |
| C133     | Barrier Layer | 0.047 25V              |

## RF UNIT

| REF. NO. | DESCRIPTION   | PART NO.               |
|----------|---------------|------------------------|
| C134     | Barrier Layer | UAT04V 102K 50V 0.001  |
| C135     | Barrier Layer | UAT06V 682K 50V 0.0068 |
| C136     | Barrier Layer | UAT04V 122K 50V 0.0012 |
| C137     | Barrier Layer | UAT04V 102K 50V 0.001  |
| C138     | Ceramic       | 150P 50V               |
| C139     | Barrier Layer | UAT04V 152K 50V 0.0015 |
| C140     | Barrier Layer | 0.047 25V              |
| C141     | Barrier Layer | 0.047 25V              |
| C142     | Barrier Layer | UAT04V 122K 50V 0.0012 |
| C143     | Barrier Layer | UAT06V 103K 50V 0.01   |
| C144     | Barrier Layer | UAT04V 182K 50V 0.0018 |
| C145     | Barrier Layer | UAT04V 152K 50V 0.0015 |
| C146     | Ceramic       | 200P 50V               |
| C147     | Barrier Layer | UAT04V 152K 50V 0.0015 |
| C148     | Barrier Layer | 0.047 25V              |
| C149     | Barrier Layer | 0.047 25V              |
| C150     | Barrier Layer | UAT04V 152K 50V 0.0015 |
| C151     | Barrier Layer | UAT06V 123K 50V 0.012  |
| C152     | Barrier Layer | UAT04V 222K 50V 0.0022 |
| C153     | Barrier Layer | UAT04V 222K 50V 0.0022 |
| C154     | Ceramic       | 270P 50V               |
| C155     | Barrier Layer | UAT04V 222K 50V 0.0022 |
| C156     | Barrier Layer | 0.047 25V              |
| C157     | Barrier Layer | 0.1 16V                |
| C158     | Barrier Layer | 0.047 25V              |
| C159     | Barrier Layer | UAT05V 332K 50V 0.0033 |
| C160     | Ceramic       | 390P 50V               |
| C161     | Barrier Layer | UAT05V 332K 50V 0.0033 |
| C162     | Electrolytic  | 1 50V BP               |
| C163     | Barrier Layer | 0.1 16V                |
| C164     | Barrier Layer | UAT06V 682K 50V 0.0068 |
| C165     | Barrier Layer | UAT04V 102K 50V 0.001  |
| C166     | Barrier Layer | UAT06V 822K 50V 0.0082 |
| C167     | Barrier Layer | 0.1 16V                |
| C168     | Electrolytic  | 10 16V                 |
| C169     | Barrier Layer | 0.047 25V              |
| C170     | Barrier Layer | 0.047 25V              |
| C171     | Barrier Layer | UAT04V 152K 50V 0.0015 |
| C172     | Barrier Layer | 0.1 16V                |
| C173     | Barrier Layer | 0.047 25V              |
| C174     | Barrier Layer | 0.047 25V              |
| C175     | Barrier Layer | 0.047 25V              |
| C176     | Barrier Layer | 0.047 25V              |
| C177     | Barrier Layer | 0.047 25V              |
| C178     | Barrier Layer | 0.1 16V                |
| C179     | Barrier Layer | 0.1 16V                |
| C180     | Barrier Layer | UAT04V 182K 50V 0.0018 |
| C181     | Barrier Layer | UAT04V 152K 50V 0.0015 |
| C182     | Barrier Layer | UAT05V 472K 50V 0.0047 |
| C183     | Barrier Layer | 0.1 16V                |
| C184     | Barrier Layer | 0.1 16V                |
| C185     | Barrier Layer | 0.047 25V              |
| C186     | Barrier Layer | 0.047 25V              |
| C187     | Tantalum      | 3.3 16V                |
| C188     | Barrier Layer | 0.047 25V              |
| C189     | Barrier Layer | 0.1 16V                |
| C190     | Barrier Layer | 0.1 16V                |
| C191     | Ceramic       | 0.001 50V              |
| C192     | Ceramic       | 0.0047 50V             |
| C193     | Ceramic       | 0.0047 50V             |
| C195     | Ceramic       | 0.0047 50V             |
| C196     | Barrier Layer | 0.1 16V                |

**RF UNIT**

| REF. NO. | DESCRIPTION   | PART NO.                |
|----------|---------------|-------------------------|
| C198     | Ceramic       | 0.001 50V               |
| C199     | Ceramic       | 0.001 50V               |
| C202     | Ceramic       | 5P 50V                  |
| C203     | Ceramic       | 0.0047 50V              |
| C204     | Tantalum      | 4.7 16V                 |
| C205     | Barrier Layer | 0.1 16V                 |
| C206     | Ceramic       | 0.001 50V               |
| RL1      | Relay         | FBR21D12-P              |
| J1       | Connector     | TL25P-06-V1             |
| J2       | Connector     | TL25P-05-V1             |
| J3       | Connector     | TL25P-07-V1             |
| J4       | Connector     | TL25P-02-V1             |
| J5       | Connector     | TL25P-05-V1             |
| J6       | Connector     | TL25P-02-V1             |
| J8       | Connector     | TMP-J01X-A2             |
| J9       | Connector     | TL25P-02-V1             |
| J10      | Connector     | TMP-J01X-A2             |
| J11      | Connector     | TLB-P06H-B1             |
| J12      | Connector     | TLB-P05H-B1             |
| J13      | Connector     | TLB-P02H-B1             |
| J14      | Connector     | TLB-P02H-B1             |
| P1       | Connector     | TMP-P01X-A1             |
| P2       | Connector     | TMP-P01X-A1             |
| P3       | Connector     | TMP-P01X-A1             |
| EP1      | P.C. Board    | B-701E                  |
| EP8      | Ferrite Bead  | FSQH070RN               |
| EP9      | Ferrite Bead  | FSQH070RN               |
| EP11     | Ferrite Bead  | FSQH070RN               |
| W1       | Jumper        | 23/01/190/C22/D21       |
| W2       | Jumper        | 23/02/130/C22/D21       |
| W3       | Jumper        | 23/03/100/C22/D21       |
| W4       | Jumper        | 23/04/150/C22/D21       |
| W5       | Jumper        | 23/05/095/C22/D21       |
| W6       | Jumper        | 23/06/175/D21/D21       |
| W7       | Jumper        | 23/07/210/D21/D21       |
| W8       | Jumper        | 23/01/075/C22/D21       |
| W9       | Jumper        | 23/02/075/C22/D21       |
| W10      | Jumper        | 23/03/085/C22/D21       |
| W11      | Jumper        | 23/04/085/C22/D21       |
| W12      | Jumper        | 23/05/060/C22/D21       |
| W13      | Jumper        | 23/06/100/C22/D21       |
| W14      | Jumper        | 23/02/155/D21/D21       |
| W15      | Jumper        | 23/01/155/D21/D21       |
| W16      | Jumper        | 23/09/090/C22/C22       |
| W17      | Jumper        | 23/08/090/C22/C22       |
| W18      | Jumper        | [ 61/99/190/W13A/W13A ] |
| W19      | Jumper        | [ 08 A A ]              |
| W20      | Jumper        | [ 62/99/310/C31/W13D ]  |
| W21      | Jumper        | [ 08 C31 D ]            |
| W22      | Jumper        | [ 62/99/205/C31/W13D ]  |
| W23      | Jumper        | [ 08 C31 D ]            |
| W24      | Jumper        | JPW-02H                 |
| W25      | Jumper        | JPW-02H                 |
| W26      | Jumper        | JPW-02H                 |
| W27      | Jumper        | JPW-02H                 |
| W28      | Jumper        | IPS-1041-4              |
| W29      | Jumper        | JPW-02A                 |
| W30      | Jumper        | IPS-1041-4              |

**RF UNIT/FILTER UNIT**

| REF. NO. | DESCRIPTION | PART NO.               |
|----------|-------------|------------------------|
| W34      | Jumper      | IPS-1041-4             |
| W35      | Jumper      | IPS-1041-4             |
| W36      | Jumper      | IPS-1041-4             |
| W37      | Jumper      | IPS-1041-4             |
| W38      | Jumper      | IPS-1041-4             |
| W39      | Jumper      | IPS-1041-4             |
| W40      | Jumper      | JPW-02A                |
| W42      | Jumper      | JPW-02A                |
| W44      | Jumper      | IPS-1041-4             |
| W45      | Jumper      | IPS-1041-4             |
| W46      | Jumper      | IPS-1041-4             |
| W47      | Jumper      | IPS-1041-4             |
| W48      | Jumper      | [ 62/99/190/C31/W13D ] |
| W49      | Jumper      | [ 08 D ]               |
| W52      | Jumper      | 23/07/080/D21/D21      |
| W53      | Jumper      | 74/99/010/X98/X98      |
| W54      | Jumper      | JPW-02A                |
| W56      | Jumper      | 74/99/010/X98/X98      |

**10 - 9 FILTER UNIT**

| REF. NO. | DESCRIPTION | PART NO.  |
|----------|-------------|-----------|
| D1       | Diode       | 1K60      |
| D2       | Diode       | 1K60      |
| D3       | Diode       | 1N4002    |
| D4       | Diode       | 1N4002    |
| D5       | Diode       | 1N4002    |
| D6       | Diode       | 1N4002    |
| D7       | Diode       | 1N4002    |
| D8       | Diode       | 1N4002    |
| D9       | Diode       | 1N4002    |
| L2       | Coil        | LR-137    |
| L3       | Coil        | LR-137    |
| L5       | Coil        | LR-138    |
| L6       | Coil        | LR-139    |
| L7       | Coil        | LR-140    |
| L8       | Coil        | LR-141    |
| L9       | Coil        | LR-141    |
| L10      | Coil        | LR-90     |
| L11      | Coil        | LR-91     |
| L12      | Coil        | LR-53     |
| L13      | Coil        | LR-54     |
| L14      | Coil        | LA-166    |
| L15      | Coil        | LA-165    |
| L16      | Coil        | LA-168    |
| L17      | Coil        | LA-167    |
| L18      | Coil        | LR-22A    |
| L19      | Coil        | L6 222    |
| L20      | Coil        | FL5H 101K |
| L21      | coil        | FL5H 101K |
| L22      | Coil        | FL5H 101K |
| L23      | Coil        | FL5H 101K |
| L24      | Coil        | FL5H 101K |
| L25      | Coil        | FL5H 101K |
| L26      | Coil        | FL5H 101K |
| L27      | Coil        | FL5H 101K |
| L28      | Coil        | FL4H 100K |
| L29      | Coil        | FL4H 100K |
| L30      | Coil        | FL4H 100K |

**FILTER UNIT**

| REF. NO. | DESCRIPTION   | PART NO.             |
|----------|---------------|----------------------|
| L31      | Coil          | FL4H 100K            |
| L32      | Coil          | FL4H 100K            |
| L33      | Coil          | FL4H 100K            |
| L34      | Coil          | LA-256               |
| R1       | Resistor      | 68 R50X              |
| R2       | Resistor      | 5.6K R25             |
| R3       | Resistor      | 5.6K R25             |
| R4       | Resistor      | 56K ELR25            |
| R5       | Resistor      | 56K ELR25            |
| R6       | Resistor      | 120 R25              |
| C1       | Dip Mica      | DM20C152J51CR 0.0015 |
| C2       | Dip Mica      | DM19C471J51CR 470P   |
| C3       | Dip Mica      | DM20C272J51CR 0.0027 |
| C4       | Ceramic       | 220P 500V            |
| C5       | Dip Mica      | DM20C152J51CR 0.0015 |
| C6       | Dip Mica      | DM19C561J51CR 560P   |
| C7       | Ceramic       | 220P 500V            |
| C8       | Dip Mica      | DM20C122J51CR 0.0012 |
| C9       | Ceramic       | 68P 500V             |
| C10      | Dip Mica      | DM19C681J51CR 680P   |
| C11      | Dip Mica      | DM19C471J51CR 470P   |
| C12      | Ceramic       | 120P 500V            |
| C13      | Dip Mica      | DM19C561J51CR 560P   |
| C14      | Ceramic       | 68P 500V             |
| C15      | Ceramic       | 270P 500V            |
| C16      | Ceramic       | 220P 500V            |
| C17      | Ceramic       | 27P 500V             |
| C18      | Dip Mica      | DM19C471J51CR 470P   |
| C19      | Ceramic       | 68P 500V             |
| C20      | Ceramic       | 220P 500V            |
| C21      | Ceramic       | 180P 500V            |
| C22      | Ceramic       | 18P 500V             |
| C23      | Ceramic       | 330P 500V            |
| C24      | Ceramic       | 56P 500V             |
| C25      | Ceramic       | 180P 500V            |
| C26      | Ceramic       | 68P 500V             |
| C27      | Ceramic       | 10P 500V             |
| C28      | Ceramic       | 220P 500V            |
| C29      | Ceramic       | 47P 500V             |
| C30      | Ceramic       | 100P 500V            |
| C31      | Ceramic       | 68P 500V             |
| C32      | Ceramic       | 10P 500V             |
| C33      | Ceramic       | 180P 500V            |
| C34      | Ceramic       | 33P 500V             |
| C35      | Ceramic       | 68P 500V             |
| C36      | Trimmer       | ECV-1ZW20x40         |
| C37      | Ceramic       | 150P 50V             |
| C38      | Ceramic       | 0.001 50V            |
| C39      | Ceramic       | 0.001 50V            |
| C40      | Ceramic       | 82P 500V             |
| C42      | Barrier Layer | 0.047 25V            |
| C43      | Barrier Layer | 0.047 25V            |
| C44      | Barrier Layer | 0.047 25V            |
| C45      | Barrier Layer | 0.047 25V            |
| C46      | Barrier Layer | 0.047 25V            |
| C47      | Barrier Layer | 0.047 25V            |
| C48      | Barrier Layer | 0.047 25V            |
| C49      | Barrier Layer | 0.047 25V            |
| C50      | Ceramic       | 0.0047 50V           |

**FILTER UNIT**

| REF. NO. | DESCRIPTION | PART NO.                           |
|----------|-------------|------------------------------------|
| C51      | Ceramic     | 0.0047 50V                         |
| C52      | Ceramic     | 0.0047 50V                         |
| C53      | Ceramic     | 0.0047 50V                         |
| C54      | Ceramic     | 0.0047 50V                         |
| C55      | Ceramic     | 0.0047 50V                         |
| RL1      | Relay       | FBR313D012-22                      |
| RL2      | Relay       | FBR313D012-22                      |
| RL3      | Relay       | FBR313D012-22                      |
| RL4      | Relay       | FBR313D012-22                      |
| RL5      | Relay       | FBR313D012-22                      |
| RL6      | Relay       | FBR313D012-22                      |
| RL7      | Relay       | FBR313D012-22                      |
| RL8      | Relay       | FBR313D012-22                      |
| RL9      | Relay       | FBR313D012-22                      |
| RL10     | Relay       | FBR313D012-22                      |
| RL11     | Relay       | FBR313D012-22                      |
| RL12     | Relay       | FBR313D012-22                      |
| RL13     | Relay       | FBR313D012-22                      |
| RL14     | Relay       | FBR313D012-22                      |
| J1       | Connector   | TMP-J01X-V2                        |
| J2       | Connector   | TL25P-02-V1                        |
| P1       | Connector   | TL25H-07-B1                        |
| P2       | Connector   | TMP-P01X-A1                        |
| EP1      | P.C. Board  | B-703D                             |
| W1       | Jumper      | 23/01/150/C01/D21                  |
| W2       | Jumper      | 23/02/240/C01/D21                  |
| W3       | Jumper      | 23/03/190/C01/D21                  |
| W4       | Jumper      | 23/04/260/C01/D21                  |
| W5       | Jumper      | 23/05/280/C01/D21                  |
| W6       | Jumper      | 23/06/300/C01/D21                  |
| W7       | Jumper      | 23/07/330/C01/D21                  |
| W8       | Jumper      | [ 62/99/110/C31/W13D<br>08 C31 D ] |
| W9       | Jumper      |                                    |
| W10      | Jumper      | JPW-02A                            |
| W11      | Jumper      | JPW-02A                            |
| W12      | Jumper      | JPW-02A                            |
| W13      | Jumper      | JPW-02A                            |
| W14      | Jumper      | JPW-02A                            |
| W15      | Jumper      | JPW-02A                            |
| W16      | Jumper      | JPW-02A                            |
| W17      | Jumper      | JPW-02A                            |
| W18      | Jumper      | JPW-02A                            |
| W19      | Jumper      | JPW-02A                            |
| W20      | Jumper      | JPW-02A                            |
| W21      | Jumper      | JPW-02A                            |
| W22      | Jumper      | JPW-02A                            |
| W23      | Jumper      | JPW-02A                            |
| W24      | Jumper      | JPW-02A                            |
| W25      | Jumper      | JPW-02A                            |
| W26      | Jumper      | JPW-02A                            |
| W27      | Jumper      | JPW-02A                            |
| W28      | Jumper      | JPW-02A                            |
| W29      | Jumper      | JPW-02A                            |
| W30      | Jumper      | JPW-02A                            |
| W31      | Jumper      | JPW-02A                            |
| W32      | Jumper      | JPW-02A                            |
| W33      | Jumper      | 74/98/040/X98/X98                  |
| W34      | Jumper      | JPW-02A                            |

**FILTER UNIT/PA UNIT**

| REF. NO. | DESCRIPTION | PART NO.          |
|----------|-------------|-------------------|
| W35      | Jumper      | JPW-02A           |
| W36      | Jumper      | JPW-02H           |
| W37      | Jumper      | 74/98/050/X98/X98 |
| W38      | Jumper      | 74/98/050/X98/X98 |
| W39      | Jumper      | JPW-02A           |
| W40      | Jumper      | 73/98/040/X98/X98 |
| W41      | Jumper      | 73/98/040/X98/X98 |

**10 - 10 PA UNIT**

| REF. NO. | DESCRIPTION | PART NO.    |
|----------|-------------|-------------|
| Q1       | Transistor  | 2SC1971     |
| Q2       | Transistor  | 2SC3133     |
| Q3       | Transistor  | 2SC3133     |
| Q4       | Transistor  | 2SC2904     |
| Q5       | Transistor  | 2SC2904     |
| Q6       | Transistor  | 2SD880-Y    |
| Q7       | Transistor  | 2SC2120     |
| Q8       | Transistor  | 2SD468-C    |
| Q9       | Transistor  | 2SB562-C    |
| Q10      | Transistor  | 2SC2458-GR  |
| Q11      | Transistor  | 2SC3402     |
| D1       | Diode       | MV5         |
| D2       | Diode       | MV5         |
| D3       | Diode       | 1N4002      |
| D4       | Diode       | U05G        |
| D5       | Diode       | 1SS53       |
| D7       | Diode       | 1SS53       |
| D8       | Diode       | 15CD11      |
| D9       | Diode       | MV5         |
| L1       | Coil        | LR-142      |
| L2       | Coil        | FL4H 1R2M   |
| L3       | Coil        | FL4H 1R2M   |
| L4       | Coil        | LR-143      |
| L5       | Coil        | FSQH050RN   |
| L6       | Coil        | BT01RN1-A61 |
| L7       | Coil        | FSQH050RN   |
| L8       | Coil        | BT01RN1-A61 |
| L9       | Coil        | LR-83       |
| L10      | Coil        | LR-144      |
| L11      | Coil        | LR-146      |
| L12      | Coil        | FL5H 101K   |
| L13      | Coil        | FSQH050RN   |
| L14      | Coil        | BT01RN1-A61 |
| L15      | Coil        | FSQH050RN   |
| L16      | Coil        | BT01RN1-A61 |
| L17      | Coil        | FSQH050RN   |
| L19      | Coil        | FL5H 101K   |
| L20      | Coil        | FL7H 102J   |
| L21      | Coil        | FL7H 102J   |
| L22      | Coil        | LR-151      |
| L23      | Coil        | BT01RN1-A61 |
| L24      | Coil        | BT01RN1-A61 |
| L25      | Coil        | BT01RN1-A61 |
| L26      | Coil        | BT01RN1-A61 |

**PA UNIT**

| REF. NO. | DESCRIPTION | PART NO.           |
|----------|-------------|--------------------|
| L27      | Coil        | BT01RN1-A61        |
| L28      | Coil        | BT01RN1-A61        |
| L29      | Coil        | BT01RN1-A61        |
| L30      | Coil        | BT01RN1-A61        |
| L31      | Coil        | BT01RN1-A61        |
| L32      | Coil        | BT01RN1-A61        |
| L33      | Coil        | BT01RN1-A61        |
| L34      | Coil        | BT01RN1-A61        |
| L35      | Coil        | BT01RN1-A61        |
| L36      | Coil        | BT01RN1-A61        |
| L37      | Coil        | BT01RN1-A61        |
| L38      | Coil        | LAL04NA 102K       |
| L39      | Coil        | LAL04NA 101K       |
| L40      | Coil        | LW-22              |
| L41      | Coil        | LAL04NA 101K       |
| L42      | Coil        | BT01RN1-A61        |
| L43      | Coil        | LAL04NA 100K       |
| L44      | Coil        | LAL04NA 100K       |
| R1       | Resistor    | 220 R25            |
| R2       | Resistor    | 100 R25            |
| R3       | Resistor    | 470 R25            |
| R4       | Resistor    | 2.2 R25            |
| R5       | Resistor    | 4.7 R25            |
| R6       | Resistor    | 68 ELR25           |
| R7       | Resistor    | 22 ELR25           |
| R8       | Resistor    | 22 ELR25           |
| R9       | Resistor    | 68 ELR25           |
| R10      | Resistor    | RSS1P3.3-J         |
| R11      | Resistor    | RSS1P3.3-J         |
| R12      | Resistor    | RSS1P3.3-J         |
| R13      | Resistor    | RSS1P3.3-J         |
| R14      | Resistor    | 10 R50X            |
| R15      | Resistor    | 10 R50X            |
| R16      | Resistor    | RSS1P3.3-J         |
| R17      | Resistor    | RSS1P3.3-J         |
| R18      | Resistor    | 33k R25            |
| R19      | Resistor    | 1k R25             |
| R20      | Resistor    | SQ5L0.012-J        |
| R21      | Resistor    | 1k R25             |
| R22      | Resistor    | CRH200R-02J4R7 4.7 |
| R23      | Trimmer     | RHB0CS21LA 470B    |
| R24      | Resistor    | 100 R50X           |
| R25      | Resistor    | SRW1P0.1-J         |
| R27      | Trimmer     | RHB0C1204A 100B    |
| R28      | Resistor    | 68 R50X            |
| R29      | Resistor    | 10 ELR25           |
| R30      | Resistor    | 1.8 ELR25          |
| R31      | Resistor    | 22 ELR25           |
| R32      | Resistor    | 100 R50X           |
| R33      | Resistor    | 2.2k ELR25         |
| R34      | Resistor    | 120 R50X           |
| R35      | Resistor    | SRW3P60-J          |
| R36      | Resistor    | 4.7k ELR25         |
| R37      | Resistor    | 10k ELR20          |
| R38      | Resistor    | 1k ELR25           |
| R39      | Resistor    | 1k ELR25           |
| R40      | Resistor    | 4.7 ELR25          |
| R41      | Resistor    | 10k R20            |
| R43      | Resistor    | 47 ELR25           |

**PA UNIT**

| REF. NO. | DESCRIPTION   | PART NO.               |
|----------|---------------|------------------------|
| R45      | Absorber      | DSA301LA               |
| R46      | Resistor      | RSF1B220-J             |
| R47      | Resistor      | 330 ELR20              |
| R48      | Resistor      | 10 R50X                |
| R49      | Resistor      | RSF2B15-J              |
| C1       | Ceramic       | 0.0022 50V             |
| C2       | Barrier Layer | UAT04V 122K 50V 0.0012 |
| C3       | Barrier Layer | 0.1 16V                |
| C4       | Mylar         | 0.01 50V               |
| C5       | Mylar         | 0.01 50V               |
| C6       | Cylinder      | 100P 50V               |
| C7       | Monolithic    | GR43CH471K 50V 470P    |
| C8       | Monolithic    | GR44CH682K 50V 0.0068  |
| C9       | Monolithic    | GR44CH682K 50V 0.0068  |
| C10      | Barrier Layer | 560P 50V               |
| C12      | Monolithic    | GR43CH471K 50V 470P    |
| C13      | Dip Mica      | DM19C821J51CR 820P     |
| C14      | Monolithic    | GR44CH102K 50V 0.001   |
| C16      | Ceramic       | DD112 F 473Z 50V02     |
| C17      | Barrier Layer | 0.047 25V              |
| C18      | Electrolytic  | 1000 16V MS16          |
| C19      | Monolithic    | GR44Y5V684Z 25V 0.68   |
| C20      | Barrier Layer | 0.047 25V              |
| C21      | Electrolytic  | 47 10V                 |
| C22      | Electrolytic  | 10 16V                 |
| C23      | Barrier Layer | 0.047 25V              |
| C24      | Barrier Layer | 0.047 25V              |
| C25      | Electrolytic  | 470 16V                |
| C26      | Barrier Layer | 0.047 25V              |
| C27      | Electrolytic  | 10 16V                 |
| C28      | Barrier Layer | 0.1 16V                |
| C29      | Ceramic       | 0.0047 50V             |
| C30      | Barrier Layer | 0.047 25V              |
| C31      | Barrier Layer | 0.1 16V                |
| C32      | Barrier Layer | 0.047 25V              |
| C33      | Barrier Layer | 0.047 25V              |
| C34      | Electrolytic  | 10 16V                 |
| C35      | Barrier Layer | 0.047 25V              |
| C36      | Ceramic       | DD112 F 473Z 50V02     |
| C37      | Barrier Layer | 0.047 25V              |
| C38      | Barrier Layer | 0.047 25V              |
| C39      | Barrier Layer | 0.047 25V              |
| C40      | Barrier Layer | 0.1 16V                |
| C41      | Ceramic       | 120P 50V               |
| C42      | Ceramic       | 20P 50V                |
| C43      | Ceramic       | 120P 50V               |
| C44      | Barrier Layer | 0.047 25V              |
| C45      | Ceramic       | 220P 50V               |
| C46      | Feed Through  | TF318-452E102GMV 50V   |
| C47      | Feed Through  | TF318-452E102GMV 50V   |
| C48      | Feed Through  | TF318-452E102GMV 50V   |
| C49      | Feed Through  | TF318-452E102GMV 50V   |
| C50      | Barrier Layer | 0.047 25V              |
| C51      | Barrier Layer | 0.047 25V              |
| C52      | Barrier Layer | 0.1 16V                |
| C53      | Ceramic       | 270P 500V              |
| C54      | Ceramic       | 270P 500V              |
| C56      | Tantalum      | 4.7 16V                |
| C57      | Tantalum      | 4.7 16V                |
| C58      | Barrier Layer | 0.1 16V                |
| C59      | Ceramic       | 0.001 50V              |

**PA UNIT**

| REF. NO. | DESCRIPTION | PART NO.               |
|----------|-------------|------------------------|
| C60      | Ceramic     | 0.001 50V              |
| C61      | Array       | B8ZC0111-32N 0.0082x7  |
| C62      | Ceramic     | 0.0047 50V             |
| RL1      | Relay       | UPM-12905Y             |
| RL2      | Relay       | OMR-109F               |
| J1       | Connector   | TL25P-12-V1            |
| J2       | Connector   | TL25P-09-V1            |
| J3       | Connector   | TL25P-03-V1            |
| J4       | Connector   | TL25P-04-V1            |
| J5       | Connector   | TL25P-05-V1            |
| J6       | Connector   | TL B-P12H-B1           |
| J7       | Connector   | HLJ4306-01-3080        |
| J8       | Connector   | HSJ0805-01-020         |
| J9       | Connector   | 1625-24R               |
| J10      | Connector   | TMP-J01X-V2            |
| J11      | Connector   | FMMD-RM1               |
| J12      | Connector   | KC21-0060              |
| J13      | Connector   | LLR-6                  |
| P1       | Connector   | TMP-P01X-A1            |
| P2       | Connector   | TMP-P01X-A1            |
| P3       | Connector   | TL25H-05-B1            |
| P4       | Connector   | TMP-P01X-A1            |
| P5       | Connector   | TL25H-02-B1            |
| P6       | Connector   | TL25H-04-B1            |
| P7       | Connector   | 1545R-1                |
| F1       | Fuse        | 3A                     |
| F2       | Holder      | TFH-S30                |
| S1       | Thermal     | OHD-90M                |
| S2       | Thermal     | OHD-50M                |
| MF1      | Motor       | M6B 12U22              |
| EP1      | P.C. Board  | B-702D                 |
| EP2      | P.C. Board  | B-720E                 |
| EP3      | P.C. Board  | B-721E                 |
| W1       | Jumper      | [ 62/99/280/C31/W13D ] |
| W2       | Jumper      | [ 08 D ]               |
| W3       | Jumper      | [ 62/99/240/C31/W13D ] |
| W4       | Jumper      | [ 08 D ]               |
| W5       | Jumper      | 23/05/420/C01/D21      |
| W6       | Jumper      | 23/06/420/C01/D21      |
| W7       | Jumper      | 23/07/420/C01/D21      |
| W8       | Jumper      | 23/08/420/C01/D21      |
| W9       | Jumper      | 23/09/420/C01/D21      |
| W10      | Jumper      | 36/02/460/W03/W03      |
| W11      | Jumper      | 36/00/360/W03/W03      |
| W12      | Jumper      | 31/02/070/W07/W07      |
| W13      | Jumper      | 23/03/075/D21/W02      |
| W14      | Jumper      | 23/04/100/D21/W02      |
| W15      | Jumper      | JPW-02A                |
| W16      | Jumper      | JPW-02A                |
| W17      | Jumper      | JPW-02A                |
| W18      | Jumper      | JPW-02A                |
| W19      | Jumper      | JPW-02A                |
| W21      | Jumper      | JPW-02A                |
| W22      | Jumper      | JPW-02A                |

**PA UNIT/KEYER UNIT**

| REF. NO. | DESCRIPTION | PART NO.               |
|----------|-------------|------------------------|
| W23      | Jumper      | 72/98/010/X98/X98      |
| W24      | Jumper      | 72/98/010/X98/X98      |
| W25      | Jumper      | 72/98/010/X98/X98      |
| W26      | Jumper      | 72/98/010/X98/X98      |
| W27      | Jumper      | 72/98/010/x98/X98      |
| W28      | Jumper      | 72/98/010/X98/X98      |
| W29      | Jumper      | 72/98/010/X98/X98      |
| W30      | Jumper      | 72/98/010/X98/X98      |
| W31      | Jumper      | 72/98/010/X98/X98      |
| W32      | Jumper      | 72/98/010/X98/X98      |
| W33      | Jumper      | 72/98/010/X98/X98      |
| W34      | Jumper      | 72/98/010/X98/X98      |
| W35      | Jumper      | 73/98/070/X98/X98      |
| W36      | Jumper      | [ 61/99/400/C31/W13A ] |
| W37      | Jumper      | [ 99 A A ]             |
| W38      | Jumper      | [ 61/99/490/C01/W13A ] |
| W39      | Jumper      | [ 99 A A ]             |
| W40      | Jumper      | 23/00/400/C01/D21      |
| W41      | Jumper      | 23/01/450/C01/D21      |
| W42      | Jumper      | 23/02/400/C01/D21      |
| W43      | Jumper      | 23/03/400/C01/D21      |
| W44      | Jumper      | JPW-02A                |
| W45      | Jumper      | JPW-02A                |
| W47      | Jumper      | JPW-02A                |
| W48      | Jumper      | 23/08/090/C22/A04      |
| W49      | Jumper      | 23/09/090/C22/A04      |
| W50      | Jumper      | 23/00/090/C22/A04      |
| W51      | Jumper      | 23/01/090/C22/A04      |
| W52      | Jumper      | [ 51/02/090/C22/A04 ]  |
| W53      | Jumper      | [ 08 A A ]             |
| W54      | Jumper      | 23/04/090/C22/A04      |
| W55      | Jumper      | 23/05/090/C22/A04      |
| W56      | Jumper      | 23/06/090/C22/A04      |
| W57      | Jumper      | 23/07/090/C22/A04      |
| W58      | Jumper      | 23/08/090/C22/A04      |
| W59      | Jumper      | 23/09/090/C22/A04      |
| W60      | Jumper      | 31/02/130/D21/W02      |
| W62      | Jumper      | JPW-02A                |
| W66      | Jumper      | 35/02/055/B03/W04      |
| W67      | Jumper      | 35/02/055/B03/W04      |
| W68      | Jumper      | 35/00/040/B03/W04      |
| W69      | Jumper      | 35/00/040/B03/W04      |
| W70      | Jumper      | 13/02/420/B03/A08      |
| W71      | Jumper      | 13/00/420/B03/A08      |
| W72      | Jumper      | 13/02/170/W02/X99      |
| W73      | Jumper      | JPW-02A                |
| W74      | Jumper      | 74/98/020/X98/X98      |
| W75      | Jumper      | 74/98/020/X98/X98      |

**10 - 11 KEYER UNIT**

| REF. NO. | DESCRIPTION | PART NO.      |
|----------|-------------|---------------|
| IC1      | IC          | μPD7564 CS031 |
| Q1       | Transistor  | 2SC3399       |
| Q2       | Transistor  | 2SB562 C      |
| D1       | Zener       | RD5.1E B2     |

**KEYER UNIT/MUTE UNIT**

| REF. NO. | DESCRIPTION       | PART NO.       |
|----------|-------------------|----------------|
| X1       | Ceramic Resonator | CSB500E        |
| R1       | Resistor          | 4.7k R20       |
| R2       | Resistor          | 4.7k R20       |
| R3       | Resistor          | 1k R20         |
| R4       | Resistor          | 22k R20        |
| R5       | Resistor          | 560 R20        |
| R6       | Resistor          | 3.3k R20       |
| R7       | Resistor          | 6.8k R20       |
| R8       | Trimmer           | RHB0CS42BA 47k |
| R9       | Resistor          | 10k ELR25      |
| R10      | Resistor          | 10k R25        |
| R11      | Resistor          | 150 R25        |
| R12      | Resistor          | 220 R50X       |
| C1       | Mylar             | 0.047 50V      |
| C2       | Mylar             | 0.01 50V       |
| C3       | Ceramic           | 0.0047 50V     |
| C4       | Electrolytic      | 10 16V MS7     |
| C5       | Ceramic           | 100P 50V       |
| C6       | Ceramic           | 100P 50V       |
| C7       | Electrolytic      | 2.2 50V MS7    |
| C8       | Ceramic           | 0.0047 50V     |
| C9       | Electrolytic      | 100 16V        |
| C10      | Ceramic           | 0.0047 50V     |
| J1       | Connector         | TL25P-03-V1    |
| J2       | Connector         | TL25P-04-V1    |
| J3       | Connector         | TL25P-03-V1    |
| J4       | Connector         | TL25P-03-V1    |
| EP1      | P.C.Board         | B-1134B        |
| W1       | Jumper            | IPS-1041-2     |
| W2       | Jumper            | IPS-1041-2     |
| W3       | Jumper            | IPS-1041-2     |
| W4       | Jumper            | IPS-1041-2     |

**10 - 12 MUTE UNIT (AUSTRALIA, FRANCE VERSIONS)**

| REF. NO. | DESCRIPTION | PART NO.          |
|----------|-------------|-------------------|
| Q1       | Transistor  | 2SC3395           |
| Q2       | Transistor  | 2SC2412K BS       |
| R1       | Chip        | 47k MCR10         |
| R2       | Chip        | 10k MCR10         |
| R3       | Chip        | 100k MCR10        |
| EP1      | P.C.Board   | B-1037A           |
| W1       | Jumper      | JPW-02A           |
| W2       | Jumper      | JPW-02A           |
| W3       | Jumper      | 71/98/005/X98/X98 |
| W4       | Jumper      | 71/98/005/X98/X98 |
| W5       | Jumper      | 71/98/005/X98/X98 |

## SECTION 11 OPTIONS INSTALLATION

**WARNING:** Disconnect the power cable from the IC-751A before performing any work.

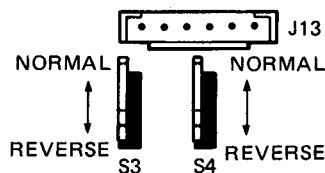
### 11 - 1 OPTIONAL FILTERS

#### • FILTER REVERSE SWITCHES

The [FILTER] SWITCH on the front panel of the IC-751A selects two receive filter systems for SSB, CW, RTTY or AM mode when it is switched to either the IN or OUT position. The IN/OUT relationship of the [FILTER] SWITCH may be reversed by using the internal FILTER REVERSE SWITCHES on the MAIN UNIT.

S3: Reverses the IN and OUT positions of the [FILTER] SWITCH when using AM mode.

S4: Reverses the IN and OUT positions of the [FILTER] SWITCH when using CW or RTTY mode.



#### (1) FL-52A, FL-53A FILTER INSTALLATION

These are 455kHz filters for use with CW NARROW or RTTY NARROW mode.

No special tools are required to successfully complete the installation of these filters. Install them at position [F] in the photo on p.11-5.

- 1) First, remove the top cover.
- 2) Insert the optional FL-52A or FL-53A into position [F] as shown in the photo on p.11-5.
- 3) Check the operation of the filter using the FILTER COMBINATIONS TABLE for a guide (p.11-5).

#### (2) FL-63A FILTER INSTALLATION

This is a 9MHz narrow filter for CW or RTTY mode. The filter replaces the standard FL-32A which is supplied with the IC-751A. Install this filter at [A] position as shown on p.11-5.

- 1) Remove the transceiver top cover, then the 11 screws from the MAIN UNIT.
- 2) Lift the right edge of the MAIN UNIT upwards taking care not to damage the sockets and plugs that are installed on the unit.

- 3) The filter must be installed at position [A] in the photo as shown on p.11-5.

Remove the FL-32A original filter from the MAIN UNIT using a de-soldering braid.

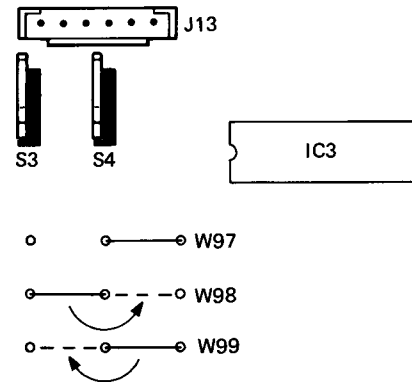
- 4) Install the FL-63A at position [A]. Orient the label on the filter in the same manner as the other filters already installed.

- 5) Bend the leads and mounting tabs flush against the opposite side of the printed circuit board, and solder. Trim the ends of the leads with diagonal cutters.

- 6) Replace the MAIN UNIT and screws, and the top cover.

There are no adjustments required after installation is completed.

#### (3) FL-70 FILTER INSTALLATION



The FL-70 is a 9MHz wide filter for SSB mode which may be installed for either of the following two reasons:

- a) To replace the standard FL-80.
- b) To replace the standard FL-32A.

- a: Use the FL-63A installation method given previously. Place the FL-70 in the position where the FL-80 is now installed.

- b: 1) Use the FL-63A installation method given previously. Place the FL-70 in the position where the FL-32A is now installed.

- 2) The FL-70 operates only in CW or RTTY mode if it is installed in the FL-32A location.

Therefore, perform the following modification so the FL-70 may or may not be used as desired.

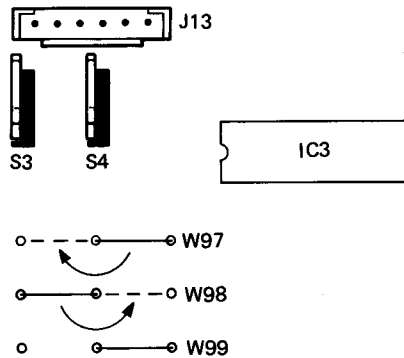
- 3) W98 and W99 jumper wires on the MAIN UNIT must be changed as shown in the diagram above.

- 4) The FL-70 and FI14 (CFJ-455K5) can now be selected by pushing the [FILTER] SWITCH on the front panel IN. The receive bandwidth will be 2.8kHz.



FL-80 and FL-44A can be selected by placing the [FILTER] SWITCH in the OUT position. The bandwidth will then be 2.3kHz.

#### (4) FL-33 INSTALLATION



This is a 9MHz filter for AM mode. FL-33 replaces FL-32A and requires the relocation of jumper wires.

- 1) Use the FL-63A installation method given previously. Install FL-33 where FL-32A is now installed.
- 2) Change the jumper wires as shown in the diagram above.
- 3) This installation causes FL-33 to be selected whether the [FILTER] SWITCH is in the IN or OUT position when using AM mode. Only 455kHz filters will be changed by the [FILTER] SWITCH.

## 11 - 2 OPTIONAL IC-PS35 INTERNAL POWER SUPPLY

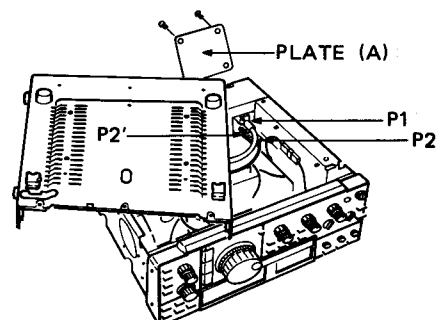
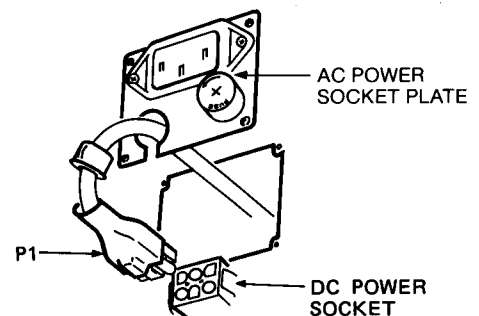
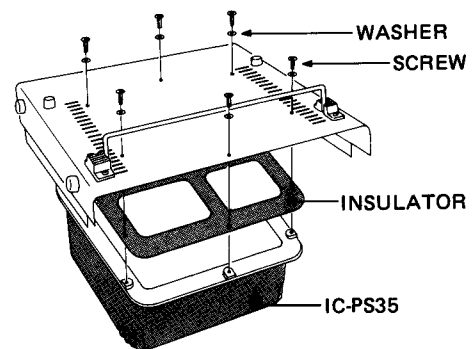
**WARNING:** Disconnect the power cable from the IC-751A before performing any work.

### • INSTALLATION

Refer to diagrams at right.

- 1) Turn the transceiver upside down. Remove PLATE (A) attached to the rear panel by unscrewing the four screws. These screws will be used later.
- 2) Attach the IC-PS35 INTERNAL POWER SUPPLY to the bottom cover with the supplied screws and insulating washers. Also insert the insulating gasket between the IC-PS35 and the bottom cover.
- 3) The IC-PS35 comes with an AC POWER SOCKET PLATE. Pass the DC power cable attached to P1 through the hole on the AC POWER SOCKET PLATE then insert the bushing into the hole. Exchange the AC POWER SOCKET PLATE at the PLATE (A) position using the screws which previously held PLATE (A). The AC POWER SOCKET should be near the bottom of the transceiver.

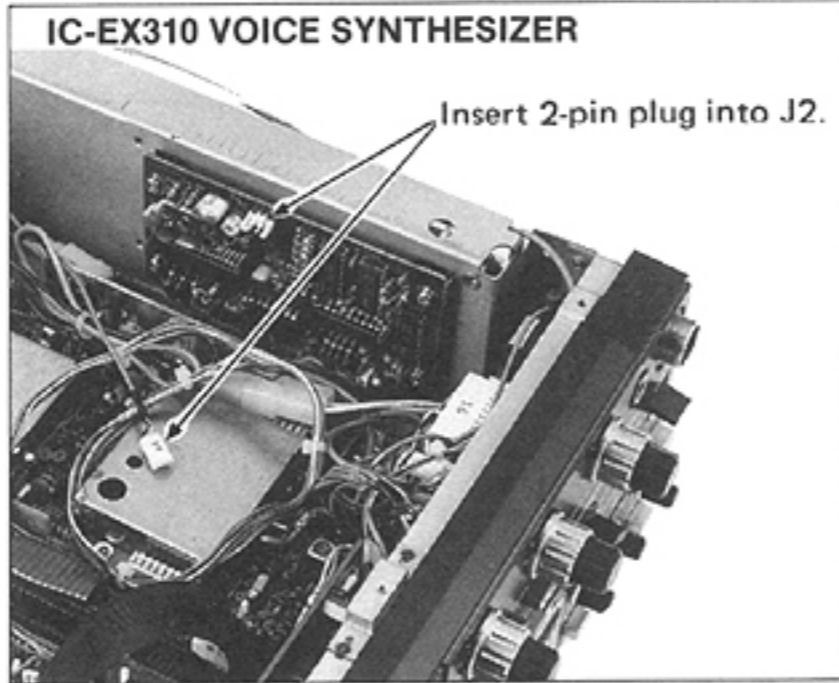
- 4) Pass the P2' connector from the AC POWER SOCKET unit to the inner chassis through the hole in the rear chassis. Connect P2' with the P2 connector from the IC-PS35.
- 5) Position the cables in the rear chassis. This prevents magnetic coupling between the cables and the VCO coil cores.
- 6) Replace the top and bottom covers of the transceiver. Plug P1 from the IC-PS35 into the DC POWER SOCKET on the transceiver.
- 7) Connect the supplied AC power cable into the newly installed AC POWER SOCKET on the rear panel of the IC-751A. Connect the AC power plug into an AC power outlet.
- 8) Push the IC-751A [POWER] SWITCH to apply power to the transceiver.



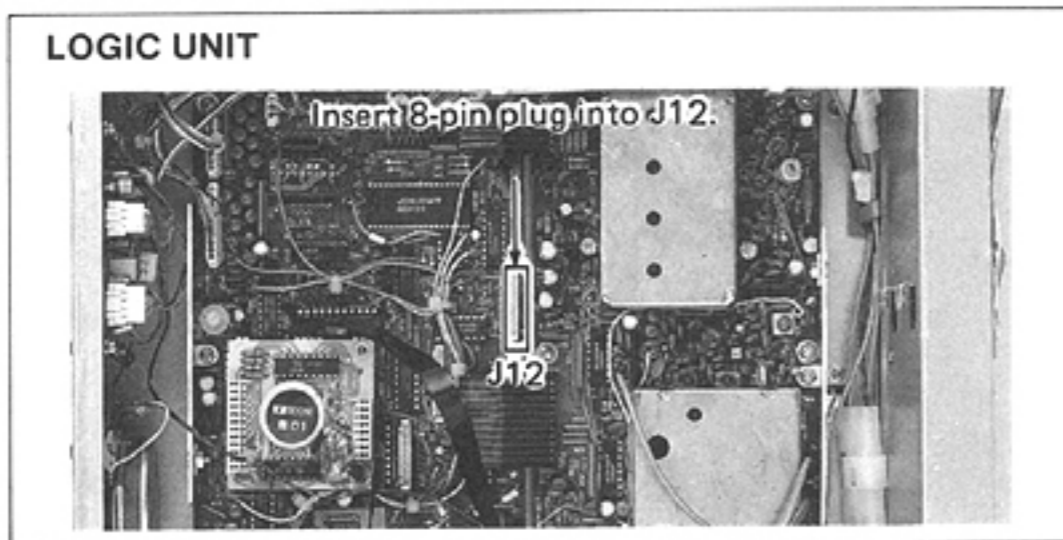
### 11 - 3 OPTIONAL IC-EX310 VOICE SYNTHESIZER UNIT

After installation the voice synthesizer announces the displayed frequency when the [SPEECH] SWITCH on the front panel is pushed.

#### • INSTALLATION



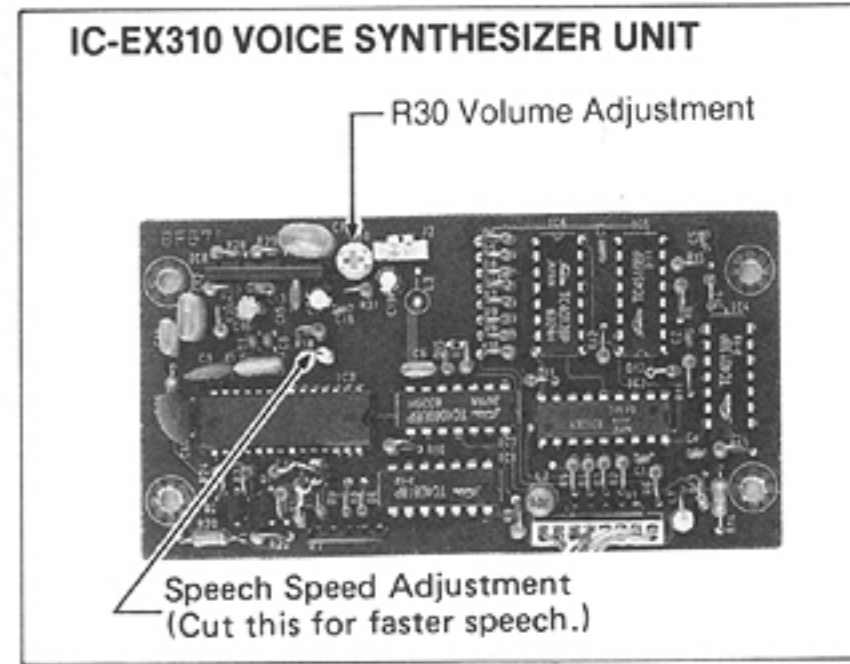
- 1) Turn the transceiver upside down.
- 2) Install the IC-EX310 unit in the position on the chassis as shown in the photo above using the four supplied screws. Insert the 2-pin plug into J2 on the IC-EX310 unit.
- 3) Plug the 8-pin plug from the IC-EX310 unit into J12 on the LOGIC UNIT. See photo below for the position of J12 on the LOGIC UNIT.



- 4) Adjust the volume and speech speed if necessary. The procedure is described below.
- 5) Replace the top and bottom covers on the IC-751A.

#### • ADJUSTMENT

- 1) Adjust the speech volume and speech speed, if necessary, before the top and bottom covers are replaced.
- 2) Connect a power source to the transceiver and push IN the [POWER] SWITCH. Push the [SPEECH] SWITCH on the front panel to have the displayed frequency announced in English.
- 3) The volume of the announcement is adjustable with R16 on the voice synthesizer unit. Adjust R30 to a comfortable audio level.

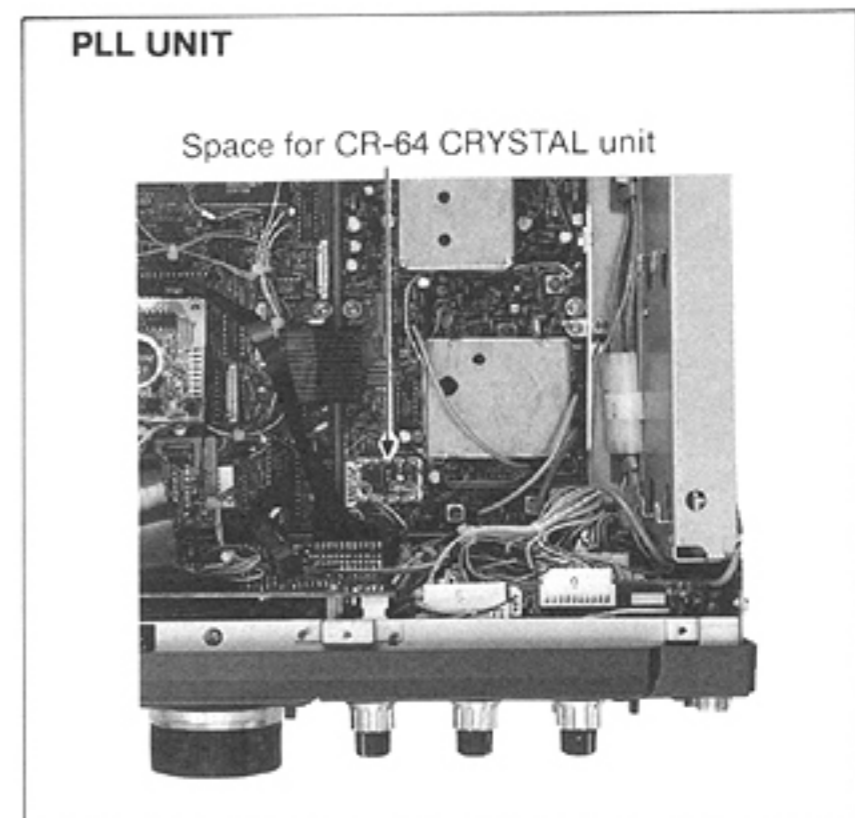


- 4) The W1 jumper wire controls the speech speed. Cut W1 to increase the speech speed.
- 5) Replace the top and bottom covers of the transceiver when adjustments are completed.

### 11 - 4 OPTIONAL CR-64 HIGH-STABILITY CRYSTAL UNIT

#### • INSTALLATION

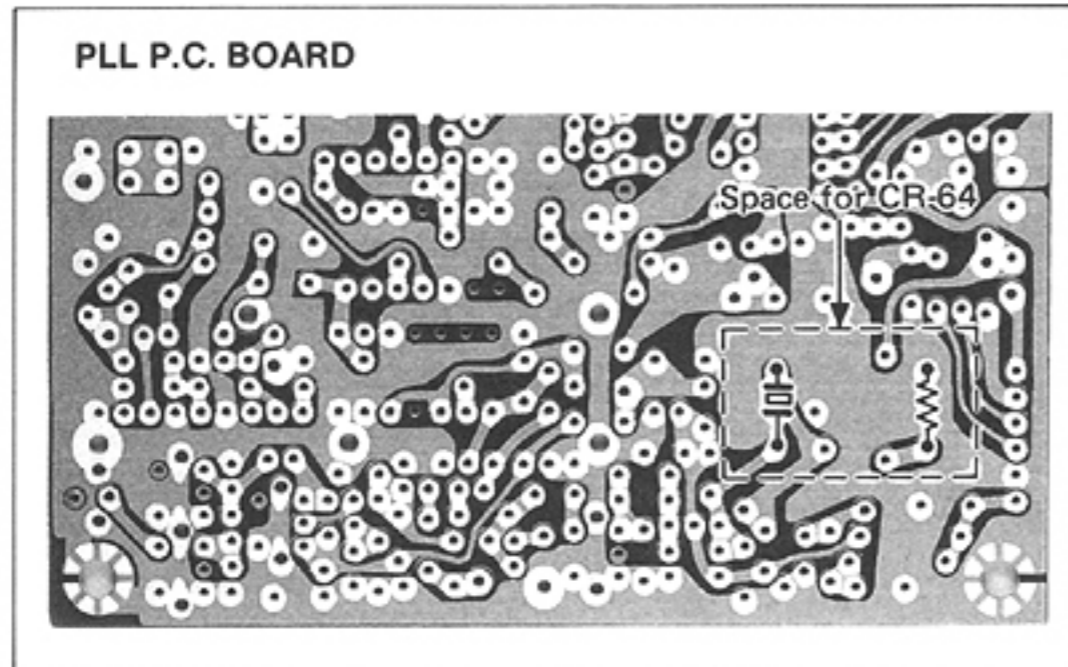
- 1) Turn the transceiver upside down.
- 2) Unscrew the six screws on the PLL UNIT. Unplug all connectors then turn the unit over to view the printed circuit side shown on p.11-5.
- 3) Use a de-soldering braid to remove solder from the original crystal unit terminals and grounding lead. Remove the original crystal unit and grounding lead from the PLL UNIT.
- 4) The mounting location for the high-stability crystal unit is shown in the photo below. The holes for the unit terminals are predrilled. If the holes are filled with solder, remove the solder using a desoldering braid.



- 5) Orient the unit so that the crystal and heater terminals are inserted into the correct holes as indicated in the photo below. The terminals are labelled on the bottom of the unit.

Position the crystal unit flush with the PLL P.C.Board and bend the leads against the foil on the board and solder.

- 6) Trim the terminals even with the solder points.
- 7) Replace the PLL P.C. Board and re-install the connectors. Replace the top and bottom covers of the transceiver.



- 4) Program the UT-30 for the frequency required using the programming chart below. The UT-30 is factory programmed at 88.5Hz.

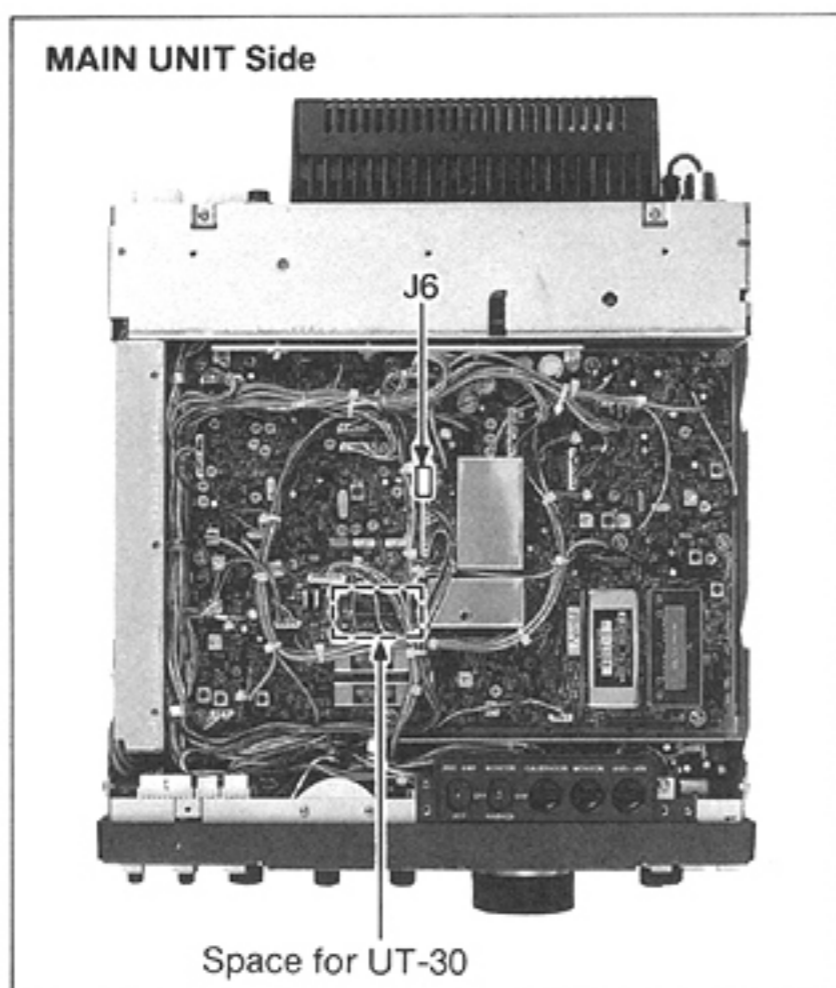
- 5) Replace the transceiver cover.

**NOTE:** Install and solder a jumper wire in each position indicated by "1" in the table below.

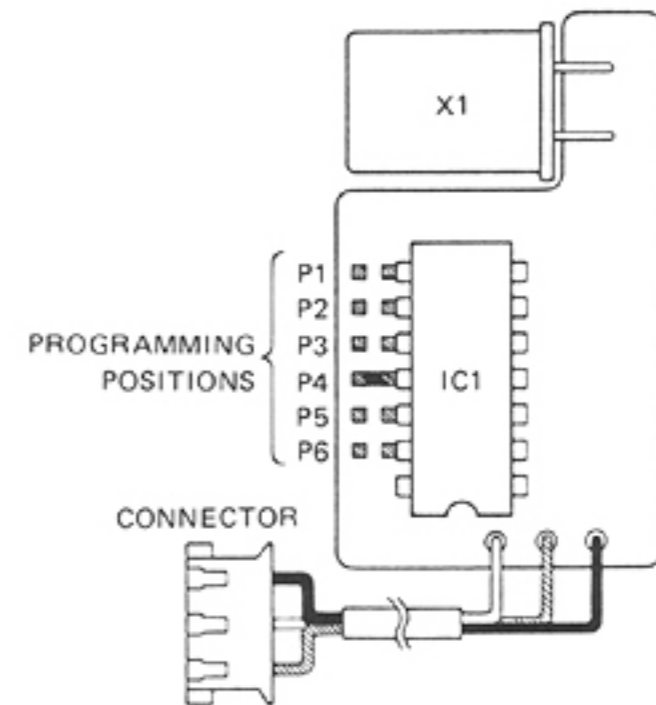
| SUBAUDIBLE TONE ENCODER PROGRAMMING CHART |    |    |    |    |    |    |            |    |    |    |    |    |    |
|---|----|----|----|----|----|----|------------|----|----|----|----|----|----|
| FRE-QUENCY                                | P1 | P2 | P3 | P4 | P5 | P6 | FRE-QUENCY | P1 | P2 | P3 | P4 | P5 | P6 |
| 67.0                                      | 1  |    |    |    |    |    | 131.8      |    |    | 1  |    | 1  |    |
| 71.9                                      |    | 1  |    |    |    |    | 136.5      | 1  |    | 1  |    | 1  |    |
| 74.4                                      | 1  | 1  |    |    |    |    | 141.3      |    | 1  | 1  |    | 1  |    |
| 77.0                                      |    |    | 1  |    |    |    | 146.2      | 1  | 1  | 1  |    | 1  |    |
| 79.7                                      | 1  |    | 1  |    |    |    | 151.4      |    |    |    | 1  | 1  |    |
| 82.5                                      |    | 1  | 1  |    |    |    | 156.7      | 1  |    |    | 1  | 1  |    |
| 85.4                                      | 1  | 1  | 1  |    |    |    | 162.2      |    | 1  |    | 1  | 1  |    |
| 88.5                                      |    |    |    | 1  |    |    | 167.9      | 1  | 1  |    | 1  | 1  |    |
| 91.5                                      | 1  |    |    | 1  |    |    | 173.8      |    |    | 1  | 1  | 1  |    |
| 94.8                                      |    | 1  |    | 1  |    |    | 179.9      | 1  |    | 1  | 1  | 1  |    |
| 97.4                                      | 1  | 1  |    | 1  |    |    | 186.2      |    | 1  | 1  | 1  | 1  |    |
| 100.0                                     |    |    | 1  | 1  |    |    | 192.8      | 1  | 1  | 1  | 1  | 1  |    |
| 103.5                                     | 1  |    | 1  | 1  |    |    | 203.5      |    |    |    |    |    | 1  |
| 107.2                                     |    | 1  | 1  | 1  |    |    | 210.7      | 1  |    |    |    |    | 1  |
| 110.9                                     | 1  | 1  | 1  | 1  |    |    | 218.1      |    | 1  |    |    |    | 1  |
| 114.8                                     |    |    |    |    | 1  |    | 225.7      | 1  | 1  |    |    |    | 1  |
| 118.8                                     | 1  |    |    |    | 1  |    | 233.6      |    |    | 1  |    |    | 1  |
| 123.0                                     |    | 1  |    |    | 1  |    | 241.8      | 1  |    | 1  |    |    | 1  |
| 127.3                                     | 1  | 1  |    |    | 1  |    | 250.3      |    | 1  | 1  |    |    | 1  |

## 11 - 5 OPTIONAL UT-30 PROGRAMMABLE ENCODER UNIT

### • INSTALLATION



- 1) Remove the transceiver top cover.
- 2) Install the UT-30 where IC3 is located on the MAIN UNIT using the supplied doublesided tape.
- 3) Plug the 3-pin connector from the UT-30 into J6 on the MAIN UNIT.



• Above unit is programmed for an 88.5Hz tone at the factory.

### • FILTER CHARACTERISTICS

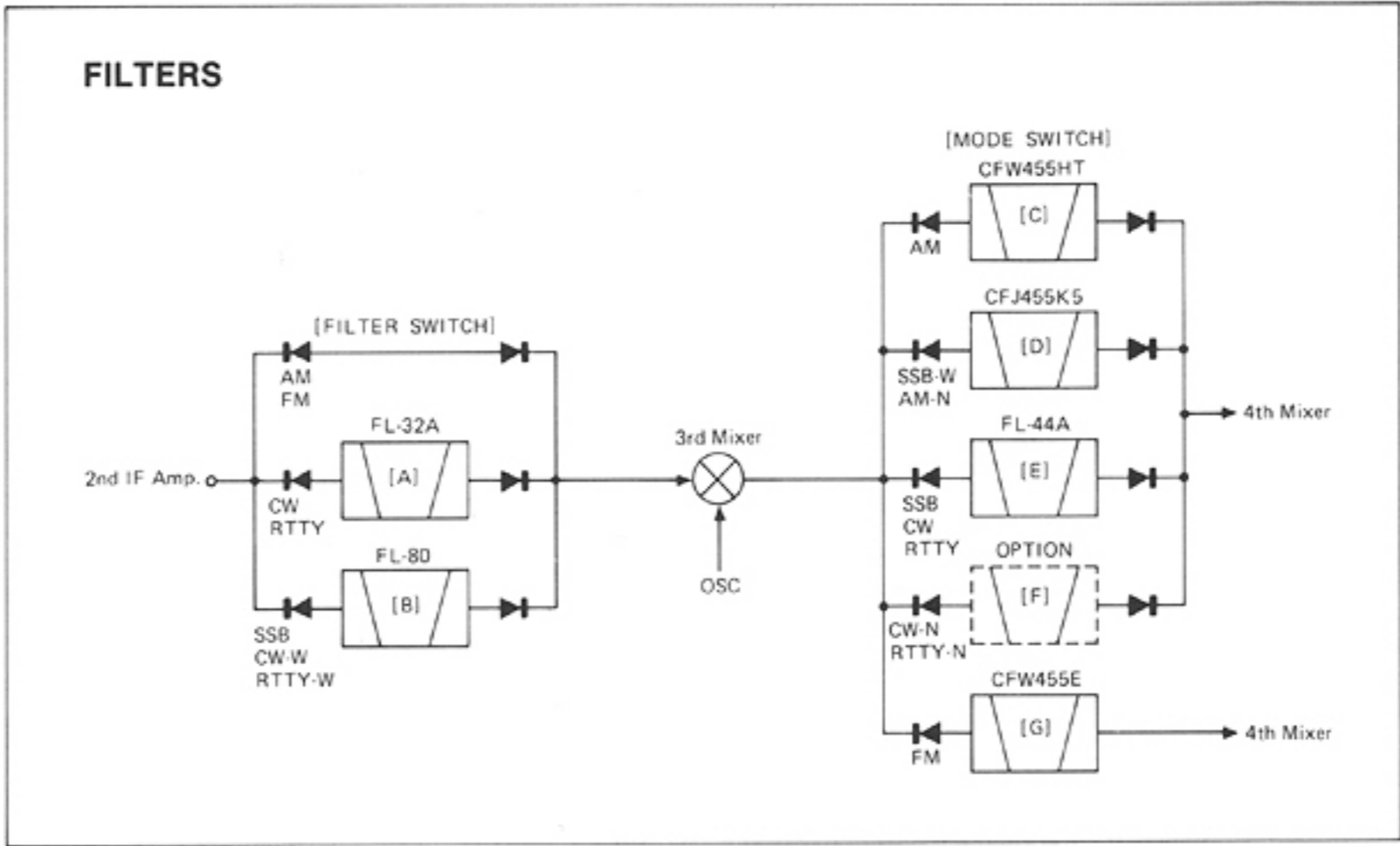
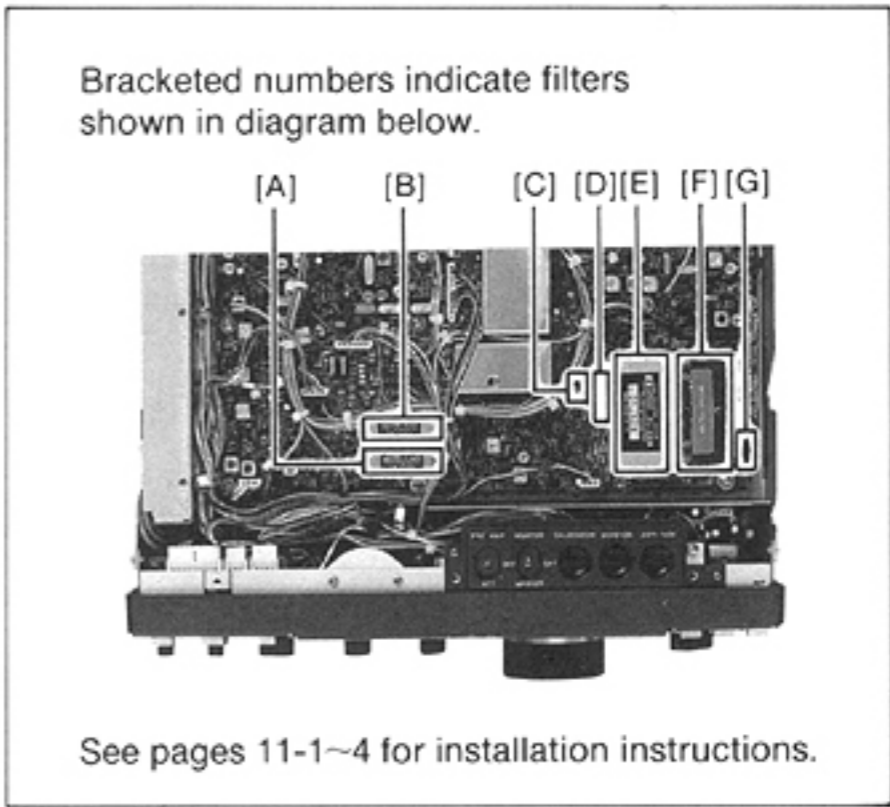
| MODE    | FILTER  | CHARACTERISTICS  |            |             |
|---------|---------|------------------|------------|-------------|
|         |         | Center Frequency | -6dB point | -60dB point |
| CW/RTTY | FL-52A  | 455kHz           | 500Hz      | 1kHz        |
| CW/RTTY | FL-53A  | 455kHz           | 250Hz      | 480Hz       |
| CW/RTTY | FL-63A  | 9.0106MHz        | 250Hz      | 800Hz       |
| CW/RTTY | *FL-32A | 9.0106MHz        | 500Hz      | 1.34kHz     |
| SSB     | FL-70   | 9.0115MHz        | 2.8kHz     | 5kHz        |
| SSB     | *FL-80  | 9.0115MHz        | 2.6kHz     | 3.8kHz      |
| SSB     | *FL-44A | 455kHz           | 2.3kHz     | 4.2kHz      |
| AM      | FL-33   | 9.0100MHz        | 6kHz       | 20kHz       |

**NOTE:** The filters marked with "\*" are supplied with the IC-751A.

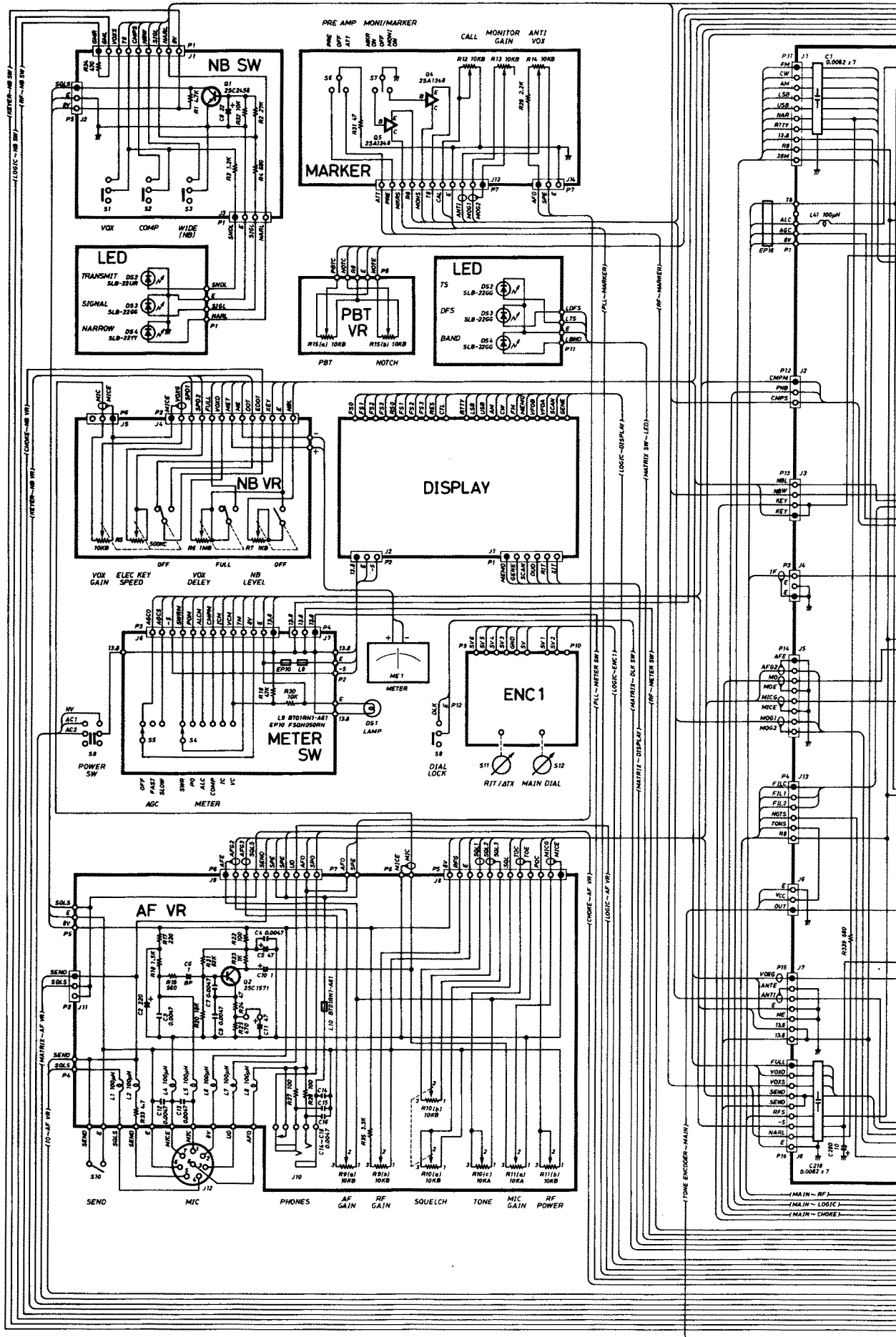
• FILTER COMBINATIONS

| MODE           | FILTER SWITCH | 9MHz FILTER | 455kHz FILTER     | STANDARD BANDWIDTH | P.B.T.   |
|----------------|---------------|-------------|-------------------|--------------------|----------|
| USB/LSB        | OUT           | FL-80       | FL-44A            | 2.3kHz             | YES      |
|                | IN            | FL-80       | CFJ455K5          | 2.6kHz             | YES      |
| CW/RTTY        | OUT           | FL-32A      | FL-44A            | 500Hz              | YES      |
|                | IN            | FL-80       | FL-44A            | 2.3kHz             | YES      |
| CW/RTTY NARROW | OUT           | FL-32A      | FL-52A/<br>FL-53A | 500Hz/<br>250Hz    | YES      |
|                | IN            | FL-80       | FL-52A/<br>FL-53A | 500Hz/<br>250Hz    | IF SHIFT |
| AM             | OUT           | THROUGH     | CFW455HT          | 8kHz               | NO       |
|                | IN            | THROUGH     | CFJ455K5          | 3kHz               | NO       |
| FM             | OUT           | THROUGH     | CFW455E           | 15kHz              | NO       |
|                | IN            | THROUGH     | CFW455E           | 15kHz              | NO       |

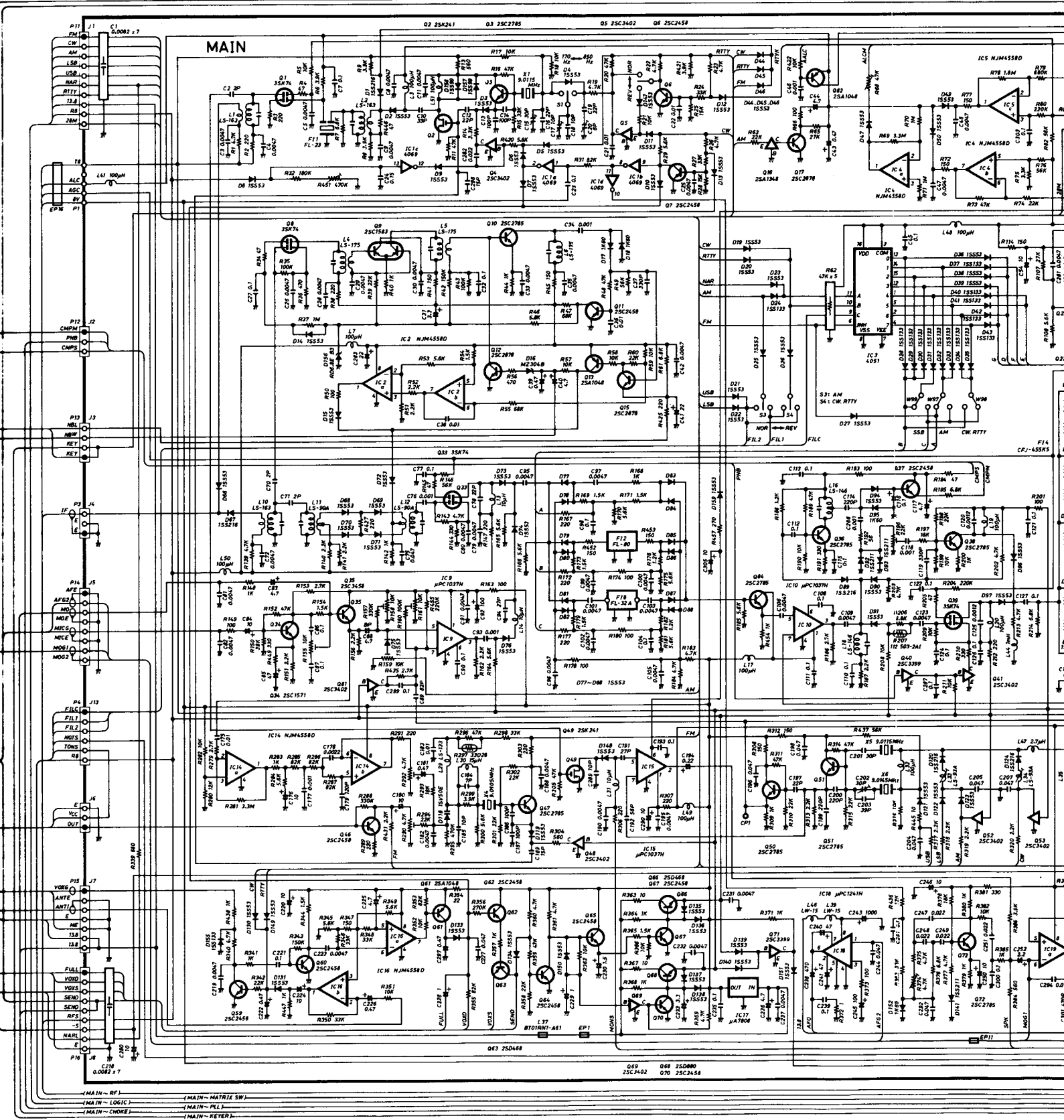
• FILTER SYSTEM

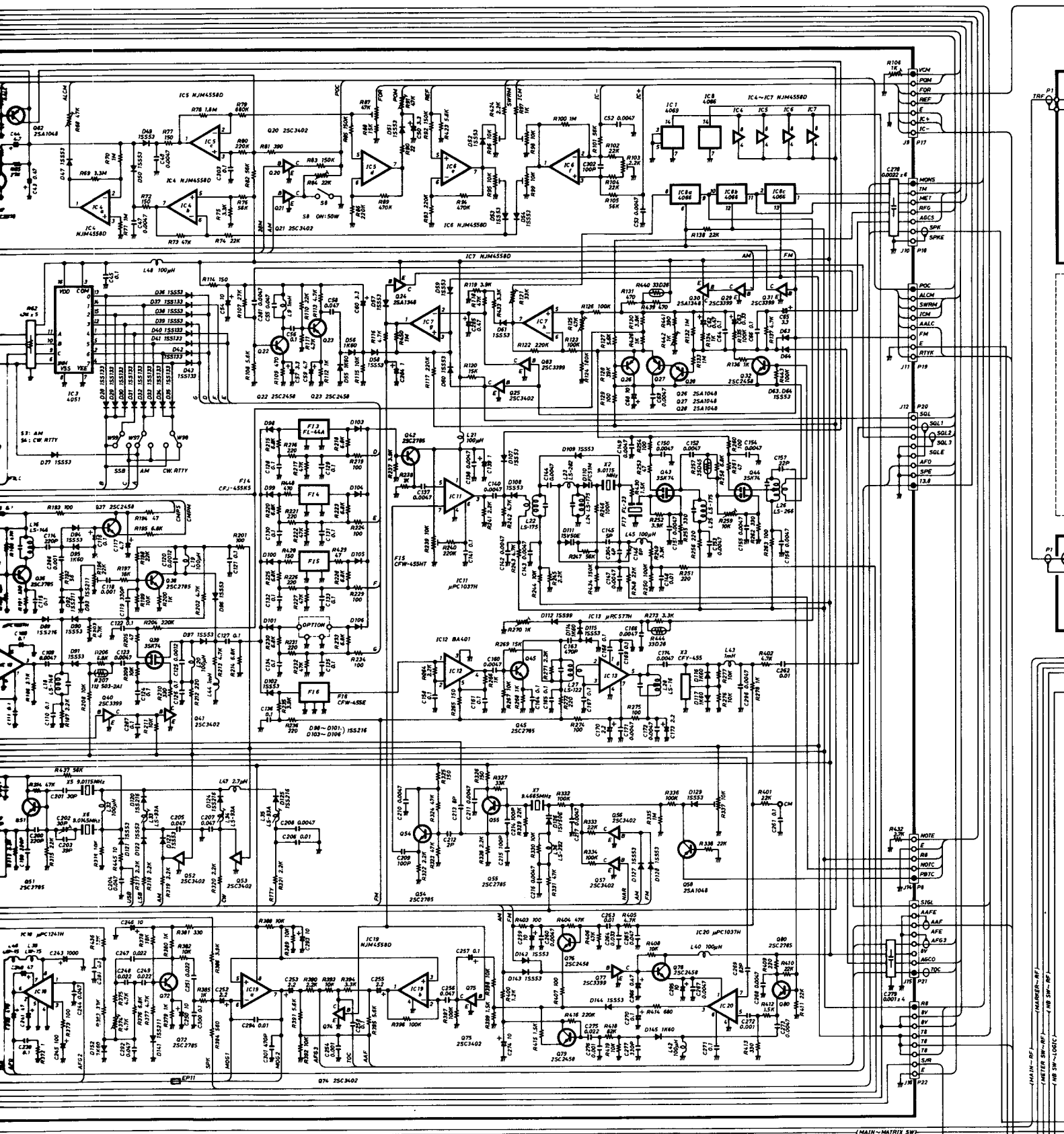


# IC-751A SCHEMATIC DIAGRAM



# TIC DIAGRAM





(MAIN-MATRIX SW)

(MAIN-REF)  
 (METER SW-REF)  
 (METER SW-LOGIC)

