

ALL COPS

C78- 918-01719 (6A)
C88- " " "
C97- 918-01729 (12A)
C107- " " "

HF ALL BAND TRANSCEIVER GENERAL COVERAGE RECEIVER

RIT/XIT ROTARY ENCODER 91509334

MAIN ROTARY ENCODER
91504463

IC-751

MAINTENANCE MANUAL

AF/RF GAIN

R9- 915-01316

Power SW -
939-02821



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SECTION 1 SPECIFICATIONS

GENERAL

Number of Semiconductors:

| | |
|-------------------|-----|
| Transistors | 105 |
| FET | 16 |
| IC (Includes CPU) | 51 |
| Diodes | 219 |

Frequency Coverage:

| | |
|----------|--------------------|
| Ham Band | 1.8 MHz ~ 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 Cover (Receive Only)

0.1MHz ~ 30.0MHz

Thirty 1MHz Segments (or Continuous)

RIT/XIT Coverage ±9.9KHz

Frequency Control:

CPU based 10Hz step Digital PLL synthesizer.

Independent Transmit-Receive Frequency Available on same band.

Frequency Readout:

6 digit 100Hz readout.

Frequency Stability:

Less than ±200Hz after switch on 1 min to 60 mins, and less than ±30Hz after 1 hour. Less than ±500Hz in the range of 0°C ~ +50°C.

Power Supply Requirements:

DC 13.8V ±15% Negative ground Current drain 20A max. (at 200W input)

AC power supply is available for AC operation.

Antenna Impedance:

50 ohms Unbalanced

Weight:

8.5Kg

Dimensions:

115mm(H) x 306mm(W) x 355mm(D)

TRANSMITTER

RF Power:

| | |
|--|---------------------|
| SSB (A ₃ J) | 200 Watts PEP input |
| CW (A ₁), RTTY (F ₁) | 200 Watts input |
| FM (F ₃) | 200 Watts input |
| AM (A ₃) | 40 Watts output |
| Continuously Adjustable Output power 10 Watts ~ Max. | |

Emission Mode:

| | |
|------------------|---|
| A ₃ J | SSB (Upper sideband and Lower sideband) |
| A ₁ | CW |
| F ₁ | RTTY (Frequency Shift Keying) |
| A ₃ | AM |
| F ₃ | FM |

Harmonic Output:

More than 40dB below peak power output

Spurious Output:

More than 60dB below peak power output

Carrier Suppression:

More than 40dB below peak power output

Unwanted Sideband:

More than 55dB down at 1000Hz AF input

Microphone:

Impedance 600 ohms

Input Level 12 millivolts typical

Dynamic or Electret Condenser Microphone

(Optional desk mic IC-SM6 and SM-8 can be used.)

RECEIVER

Receiving System:

SSB, CW, RTTY, AM

Quadruple Conversion Superheterodyne with continuous Bandwidth Control.

FM Triple Conversion Superheterodyne

Receiving Mode:

A₁, A₃J (USB, LSB) F₁ (Output FSK audio signal), A₃, F₃

Intermediate Frequencies:

| | |
|-----|---|
| 1st | 70.4515MHz |
| 2nd | 9.0115MHz (SSB), 9.0106MHz (CW, RTTY) 9.0100MHz (AM, FM) |
| 3rd | 455KHz |
| 4th | 350KHz (except FM) |

with continuous Bandwidth Control

Sensitivity:

SSB, CW, RTTY

| | |
|-----------------|-------------------------------|
| 0.1 ~ 0.5MHz | Less than 0.5μV for 10dB S/N |
| 0.5 ~ 1.6MHz | Less than 1.0μV for 10dB S/N |
| 1.6 ~ 30MHz | Less than 0.15μV for 10dB S/N |
| AM 0.1 ~ 0.5MHz | Less than 3μV for 10dB S/N |
| 0.5 ~ 1.6MHz | Less than 6μV for 10dB S/N |
| 1.6 ~ 30MHz | Less than 1μV for 10dB S/N |
| FM 1.6 ~ 30MHz | Less than 3μV for 12dB SINAD. |

Squelch Sensitivity:

1.6 ~ 30MHz Less than 0.3μV

Selectivity:

SSB, CW, RTTY

2.3KHz (Adjustable to 0.8KHz Min)
at -6dB

4.0KHz at -60dB

AM 2.4KHz at -6dB, 4.2KHz at -60dB
(When Filter switch ON)

4.0KHz at -6dB, 15KHz at -50dB

FM 15KHz at -6dB, 30KHz at -60dB

Notch Filter Attenuation:

More than 45dB

Spurious Response Rejection Ratio:

More than 60dB

Audio Output:

More than 3 Watts

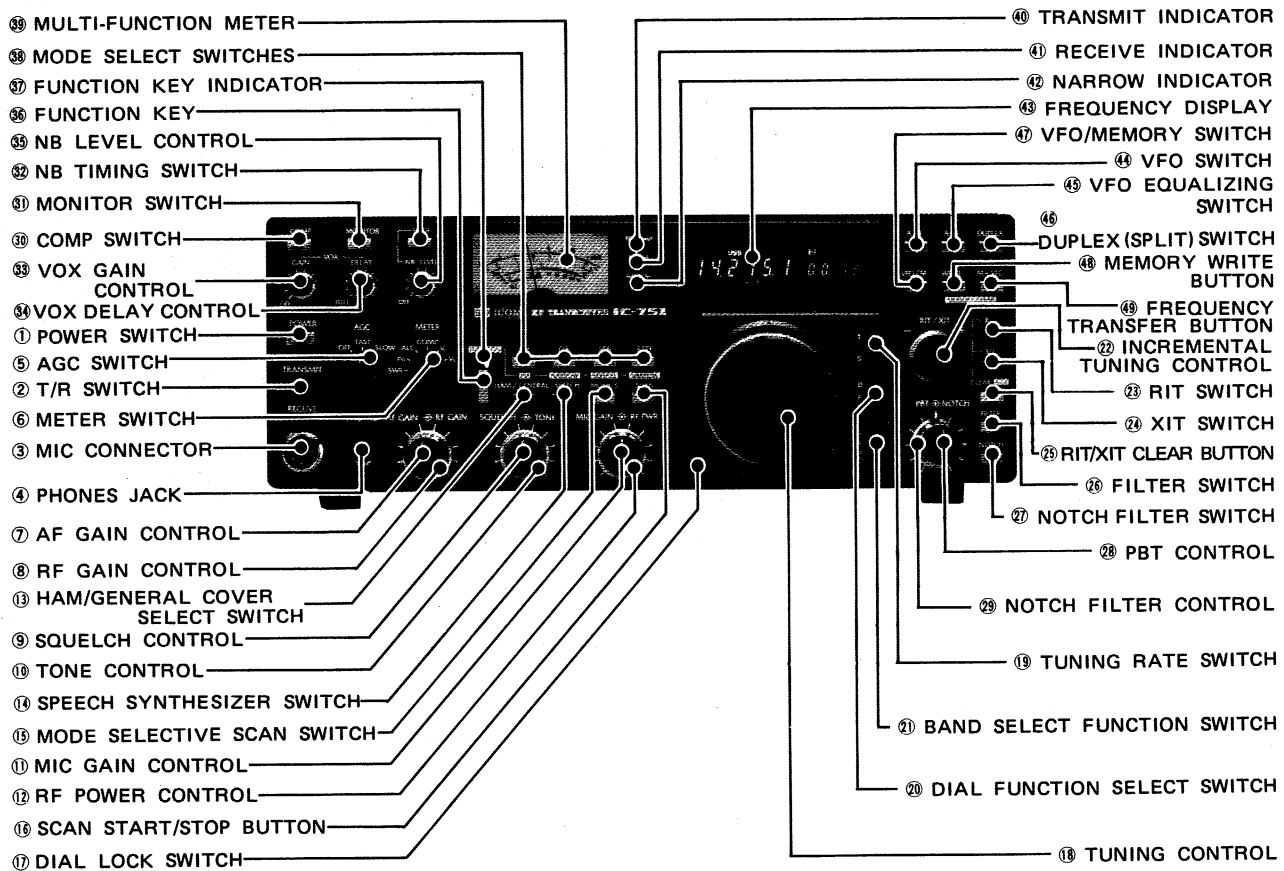
Audio Output Impedance:

8 ohms

Specifications are approximate and are subject to change without notice or obligation.

SECTION 2 OPERATING CONTROLS

2-1 FRONT PANEL



1. POWER SWITCH

The POWER SWITCH is a push-lock type switch which controls the input DC power to the IC-751. When the external AC power supply (IC-PS15) or optional built-in AC power supply (IC-PS35) is used, the switch also acts as the AC power supply switch. When the switch is pushed in and locked, power is supplied to the set. When the switch is pushed again and released, power is cut to all circuits (except the PA unit when using an external DC power supply).

2. T/R (TRANSMIT/RECEIVE) SWITCH

This switch is for manually switching from transmit to receive and vice versa. Set the switch to RECEIVE (down) and the IC-751 is in the receive mode. Set the switch to TRANSMIT (up) and it switches to transmit. When switching with the PTT switch on the microphone or with the VOX switch set to ON, the T/R switch must be in the RECEIVE position.

3. MIC CONNECTOR

Connect a suitable microphone to this jack. The supplied hand microphone IC-HM12 or optional desk mic IC-SM6

can be used. If you wish to use a different microphone, refer to the drawings on page 4.

4. PHONES JACK

Accepts a standard 1/4 inch headphone plug for headphones of 4 ~ 16 ohms. Stereo phones can be used without modification.

5. AGC (AUTOMATIC GAIN CONTROL) SWITCH

For changing the time-constant of the AGC circuit. With the switch in the SLOW position the AGC voltage is released slowly, and thus is suitable for SSB reception. With the switch in the FAST position, the AGC voltage is released faster, and the AGC is suitable for stations suffering from fast fading or when operating in the CW mode.

When the control is in the OFF position, the AGC function is turned OFF and the S-meter does not swing even if a signal has been received. (The AGC does not actuate in the FM mode.)

6. METER SWITCH

In the transmit mode, the meter has six functions.

1. **Vc** Indicates the collector voltage of the final transistors.
2. **Ic** Indicates the collector current of the final transistors.
3. **COMP** Indicates the compression level when the speech processor is in use.
4. **ALC** Indicates the ALC level. The meter begins to function when the RF output power reaches a certain level.
5. **Po** Indicates an approximate RF output power.
6. **SWR** SWR can be measured by setting this switch to the Po position and calibrating the meter needle to the "SET" position with the RF POWER control, then setting this switch to the SWR position.

7. AF GAIN CONTROL

Controls the audio output level in the receive mode. Clockwise rotation increases the level.

8. RF GAIN CONTROL

Controls the gain of the RF section in the receive mode. Clockwise rotation gives the maximum gain. As the control is rotated counterclockwise, the needle of the MULTI-FUNCTION METER rises, and only signals stronger than the level indicated by the needle will be heard. (In the FM mode, regardless of the control setting, the RF gain is fixed at the maximum.)

9. SQUELCH CONTROL

Sets the squelch threshold level. To turn OFF the squelch function, rotate this control completely counterclockwise. To set the threshold level higher, rotate the control clockwise.

10. TONE CONTROL

Controls the receiver audio tone. Adjust the control to provide comfortable reception.

11. MIC GAIN CONTROL

Adjusts the level of modulation according to the input of the microphone. Clockwise rotation increases the microphone gain. As the input will vary with different microphone and different voices, the knob should be turned until the Meter needle, in the ALC mode, begins to move slightly within the ALC zone. In the SSB mode when the speech processor is in use, the MIC GAIN CONTROL sets a clipping limit, while the RF POWER CONTROL sets the RF drive level to the maximum power level, where ALC starts at the saturation point of the amplifiers.

12. RF POWER CONTROL

Controls the RF output power 10 Watts to maximum (SSB: 100 Watts PEP, CW, RTTY, FM: 100 Watts, AM: 40 Watts). Clockwise rotation increases the output power.

13. HAM BAND/GENERAL COVER SELECT SWITCH

Each push selects the function of the set alternately. In the HAM BAND mode, the transceiver functions in any of nine

HAM bands between 1.8MHz and 28MHz. In the GENERAL COVERAGE mode the set functions as a general coverage receiver between 0.1MHz and 30MHz. (The set will not transmit in this mode.)

14. SPEECH SYNTHESIZER SWITCH

When the optional speech synthesizer unit is installed, this switch turns on the unit which announces the displayed frequency in English.

15. MODE SELECTIVE SCAN SWITCH

When this switch is pushed, only memory channels stored with the operating mode which is displayed on the frequency display just prior to pushing this switch, are selected by turning the tuning control or scanning.

16. SCAN START/STOP BUTTON

Starts and stops any of the scan functions. When depressing it again to restart the scan, it will start from the stopped frequency in the programmed scan, or from the highest memory channel in the other memory scans.

17. DIAL LOCK SWITCH

After the IC-751 is set to a certain frequency for rag chewing, mobile operation, etc., by pushing this switch, the VFO is electronically locked at the display frequency, thus inactivating the operation of the tuning control. To change frequency, the dial lock must first be disengaged by pushing and releasing this switch again.

18. TUNING CONTROL

Rotating this control clockwise increases the frequency or the memory channel number, while rotating it counterclockwise decreases it. The frequency changes by 10Hz in any mode. In 10Hz step tuning rate, by turning the tuning control faster, the 50Hz step tuning rate is automatically selected. This makes it very convenient to make a QSY over a wide frequency range.

This control is also used to select the operating band while the BAND SELECT FUNCTION switch is depressed.

19. TUNING RATE SWITCH

By pushing in this switch, the operating frequency is changed to correspond to 1KHz increments in any mode.

At the same time, the 100Hz digit on the display is cleared to show "0". When this switch is pushed again and released, the frequency is changed normally. This switch allows you to quickly QSY over a great frequency range.

20. DIAL FUNCTION SELECT SWITCH

In the VFO operation, by pushing in this switch, the operating frequency (displayed VFO frequency) is locked and the memory channel number (displayed on the frequency display) can be changed by turning the tuning control.

In the MEMORY CHANNEL mode, by pushing in this

switch, the memory channel is locked and the operating frequency (displayed frequency) can be changed by turning the tuning control.

21. BAND SELECT FUNCTION SWITCH

By pushing in this switch, the operating band is changed by turning the TUNING CONTROL.

In the HAM BAND mode, each initialized frequency of the band is selected. In the GENERAL COVERAGE mode, the operating frequency is changed in 1MHz steps but the lower digits do not change.

22. INCREMENTAL TUNING CONTROL

Shifts the receive frequency 9.9KHz (maximum) to either side of the transmit frequency when the RIT is ON, and shifts the transmit frequency to either side of the receive frequency when the XIT is ON.

Rotating this control clockwise (+ side) raises the receive or transmit frequency and counterclockwise (- side) lowers the frequency with 10Hz steps, and 1KHz and 100Hz digits of the frequency shifted are displayed on the frequency display.

When both the RIT and XIT switches are ON, the receive and transmit frequencies are the same, and this frequency can be shifted either side from the displayed frequency by the control.

23. RIT SWITCH

Switches the RIT (Receiver Incremental Tuning) circuit ON and OFF.

To turn ON the RIT, push this button once. At this time, the letters "RIT" and shifted frequency are displayed on the frequency display. If you desire to turn OFF the RIT, push the button again. The letters "RIT" and shifted frequency are no longer displayed, however, the shifted frequency is stored in the memory and if you turn ON the RIT again, the shifted frequency appears on the display again.

24. XIT SWITCH

Switches the XIT (Transmitter Incremental Tuning) circuit ON and OFF.

To turn ON the XIT, push this button once. At this time, the letters "XIT" and shifted frequency are displayed on the frequency display. The other functions are in like manners.

25. RIT/XIT CLEAR BUTTON

By pushing this button, a frequency shifted by turning the INCREMENTAL TUNING control is cleared to "0.0".

When pushing the FUNCTION KEY first, then this button, the shifted frequency is added to the displayed one, and the shifted frequency is cleared to "0.0".

26. FILTER SWITCH

Selects the combination of the second IF (9MHz) filter and the third IF (455KHz) filter to improve the selectivity.

27. NOTCH FILTER SWITCH

Switches the notch filter function ON and OFF.

28. P.B. TUNE (PASS BAND TUNING) CONTROL

Allows continuous tuning of the pass-band selectivity by moving the filter up to 800Hz from the upper or lower side in SSB, CW and RTTY. Not only improves selectivity, but also can improve the audio tone. Normal position is in the center (12 o'clock) position and is 2.3KHz wide in SSB.

29. NOTCH FILTER CONTROL

Shifts the notch filter frequency. Adjust the control so that the interference is reduced.

30. COMP (SPEECH PROCESSOR) SWITCH

Switches the speech processor circuit ON and OFF. This circuit enables greater talk power and better results in DX operation.

31. MONITOR SWITCH

In the SSB transmit mode, the transmitting IF signals can be monitored by turning this switch ON. At this time, use headphones or reduce receiver audio volume to prevent howling.

This switch also turns the CW side-tone circuit ON and OFF in the CW mode.

32. NB TIMING SWITCH

The noise blanker blanking time can be selected NORMAL and WIDE by this switch. It will be effective against any types of noises.

33. VOX GAIN CONTROL

When the control is turned completely counterclockwise, the VOX circuit is OFF. By turning the control clockwise beyond the "click", the VOX circuit is turned ON and the VOX gain increases by further rotating it clockwise.

When the VOX is turned ON, in SSB, AM or FM, T/R switching is accomplished by means of a voice signal. In CW operation, semi-break-in or full-break-in switching by means of keying possible.

For VOX operation in SSB, AM or FM, adjust the control so that the VOX circuit will operate with normal speech.

34. VOX DELAY (VOX time constant) CONTROL

This controls the transmit to receive switching time. Adjust it so transmit to receive switching will not occur during short pauses in normal speech.

In the CW operation, adjust this control to suit your keying speed. If the control is set at the "FULL" (completely counterclockwise) position, it will reach full-break-in CW.

35. NB LEVEL CONTROL

Controls the threshold level of the noise blanker. Adjust the control so that incoming noises will be disappeared.

36. FUNCTION KEY

Increases the function of the MODE SELECT switches, MEMORY WRITE button, FREQUENCY TRANSFER button and RIT/XIT CLEAR button by pushing this key switch first.

37. FUNCTION KEY INDICATOR

This indicator is lit by pushing the FUNCTION KEY to indicate the second function will be selected, and turned off by pushing one of the dual function switches or buttons.

38. MODE SELECT SWITCHES

Selects any one of four operating modes by simply pushing the desired switch. Additionally, these switches have dual functions as follows.

1. AM For AM operation.

FM Pushing the FUNCTION KEY first, then the AM switch, the FM mode is selected.
2. CW For normal CW operation.

NARROW Pushing the FUNCTION KEY first, then the CW switch when the optional 455KHz narrow CW filter is installed. (No sound can be heard when the optional filter is not installed.)
3. SSB Upper sideband (USB) for 10MHz band and above, and lower sideband (LSB) for 7MHz (in the GENERAL COVERAGE operation: 9MHz) band and below (normal SSB operation) will be selected.

REVERSE Lower sideband (LSB) for 10MHz band and above, and upper sideband (USB) for 7MHz (in the GENERAL COVERAGE operation: 9MHz) band and below will be selected.

4. RTTY For normal RTTY operation.

NARROW Pushing the FUNCTION KEY first, then the RTTY switch, filter is switched to the narrow CW filter when the optional 455KHz narrow CW filter is installed. (No sound can be heard when the optional narrow CW filter is not installed.)

39. MULTI-FUNCTION METER

When in the receive mode the meter acts as an S-meter regardless of the position of the meter switch. Signal strength is indicated on a scale of S1-S9, and S9 to S9+60dB.

In the transmit mode the meter has six functions which are selected by the Meter Switch (6).

40. TRANSMIT INDICATOR

Illuminates when the transceiver is in the transmit mode.

41. RECEIVE INDICATOR

Illuminates when the squelch is opened in the receive mode.

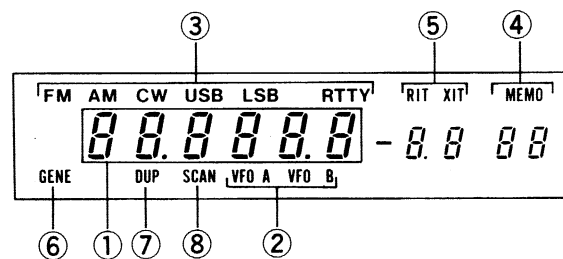
42. NARROW INDICATOR

Illuminates when the set is on CW-Narrow or RTTY-Narrow mode. This indicator illuminates not only when the optional CW filter is installed, but also if it is not installed.

43. FREQUENCY DISPLAY

The frequency of the IC-751 is displayed on a luminescent display tube. Since the 1MHz and 1KHz decimal points are displayed, the frequency can easily be read. The frequency indicated is the carrier frequency of each mode in, USB, LSB, CW, AM and FM, and the mark frequency in RTTY.

The FREQUENCY DISPLAY shows not only the operating frequency but also mode, duplex (split frequency) mode, selected VFO or memory channel, RIT/XIT functions and their shifted frequency, and the set is in SCAN mode and in HAM band or GENERAL COVERAGE mode.



- ① Shows operating frequency in 6 digits between 10MHz and 100Hz.
- ② Shows selected VFO; VFO A or VFO B.
- ③ Shows operating mode; one of FM, AM, CW, USB, LSB, and RTTY.
- ④ Shows that the set is in the MEMORY CHANNEL MODE or not, and the selected memory channel number. When the set is in the MEMORY CHANNEL MODE, the letters "MEMO" are displayed here.
- ⑤ Shows that the RIT and XIT are ON or OFF, and their shifted frequency.

When the RIT and/or XIT are ON, the letters "RIT" and/or "XIT" are displayed here.

When both the RIT and XIT are OFF, any letters and shifted frequency are no longer displayed.

- ⑥ Shows that the set is in the HAM BAND mode or GENERAL COVERAGE mode.

When the set is in the GENERAL COVERAGE mode, the letters "GENE" are shown here.

⑦ Shows that the set is in the DUPLEX (SPLIT FREQUENCY) mode or not. When the set is in the DUPLEX mode, the letters "DUP" are displayed here.

⑧ Shows that the set is in the SCAN mode or not. When the set is in the SCAN mode, the letters "SCAN" are displayed here.

44. VFO SWITCH

Selects either VFO, "A" or "B", for tuning. Each push of this button selects VFO A and B alternately.

45. VFO EQUALIZING SWITCH

Instantly sets the frequency, mode and HAM/GENE operation of a VFO to the same as those of the other VFO.

46. DUPLEX (SPLIT) SWITCH

Selects the relationship of the two VFO's. In the OFF position, one VFO is for both receive and transmit. By pushing in this switch, one VFO is for receive and the other VFO is for transmit.

47. VFO/MEMORY SWITCH

Switches the VFO operation and MEMORY CHANNEL operation.

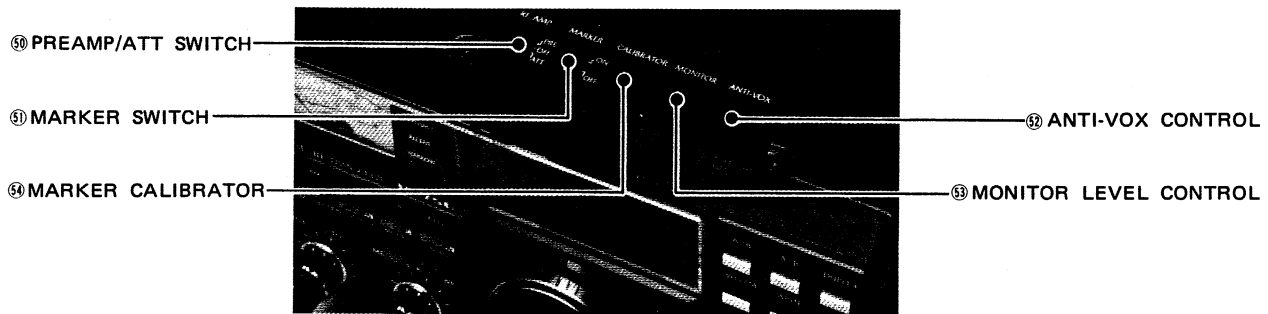
48. MEMORY WRITE BUTTON

By pushing this button, a displayed frequency, mode and HAM/GENE operation are stored into a memory channel displayed on the frequency display.

49. FREQUENCY TRANSFER BUTTON

In the VFO operation, the frequency, mode and HAM/GENE operation stored in a memory channel (displayed its channel number on the frequency display), are transfer to the selected VFO.

2 - 2 TOP COVER



50. PREAMP/ATT (Attenuator) SWITCH

Switches RF preamplifier and attenuator in the RF circuit.

When the switch is in the OFF position, both preamplifier and attenuator are removed from the circuit, and incoming signals will be fed to the receiver directly.

When using a small antenna or receiving a weak signal, set the switch in the "PRE" position, and the preamplifier is put in the RF circuit and provides higher sensitivity.

When nearby signals interfere with reception, or receiving a very strong signal, set this switch in the "ATT" position. This removes the preamplifier from the circuit and inserts the attenuator into the circuit. This gives about 20dB attenuation.

For normal operation leave this switch in the "OFF" position.

51. MARKER SWITCH

Turns the marker circuit ON or OFF. The marker frequency is available on every 10KHz.

52. ANTI-VOX CONTROL

In VOX operation, the VOX circuit may be operated by sound from the speaker causing a switch to transmit. This trouble can be prevented by adjusting the input level of the ANTI-VOX circuit with this control along with the VOX gain control so that the VOX circuit only operates by the operator's voice, not by sound from the speaker.

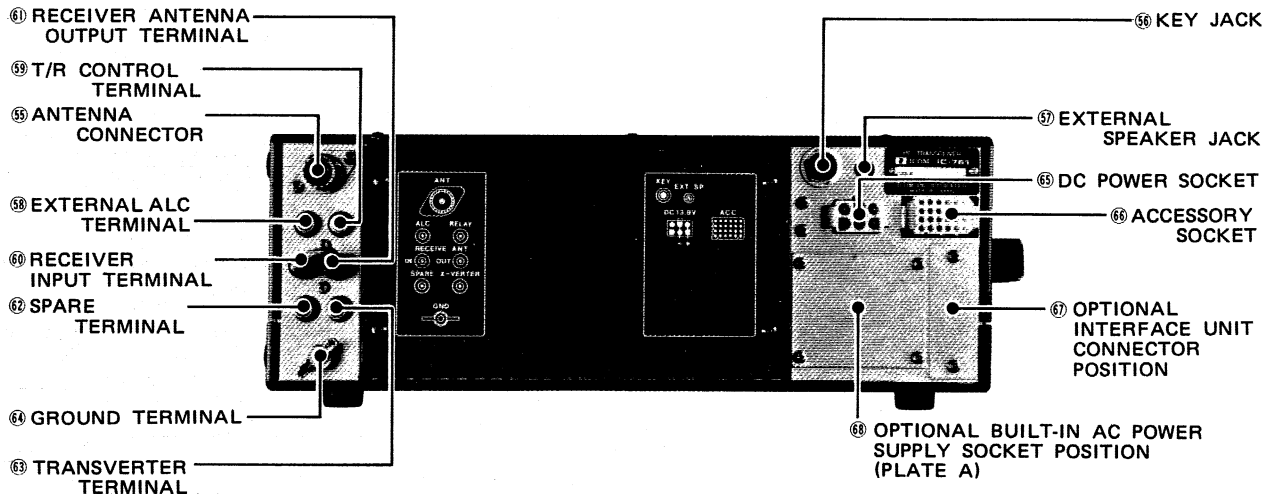
53. MONITOR LEVEL CONTROL

Controls the audio level of the monitoring SSB or CW side-tone when the MONITOR switch on the front panel is turned ON. Adjust the control for comfortable monitoring.

54. MARKER CALIBRATOR

Calibrates the marker frequency with a standard frequency such as the WWV.

2-3 REAR PANEL CONNECTIONS



55. ANTENNA (ANT) CONNECTOR

This is used to connect an antenna to the set. Its impedance is 50 ohms and connect with a PL-259 connector.

56. KEY JACK

For CW operation, connect a key here using a standard 1/4 inch plug. For electronic keying the terminal voltage must be less than 0.4V DC.

57. EXTERNAL SPEAKER JACK

When an external speaker is used, connect it to this jack. Use a speaker with an impedance of 8 ohms. When the external speaker is connected, the built-in speaker does not function.

58. EXTERNAL ALC TERMINAL

This terminal can be used for input terminal of external ALC signal from a linear amplifier or transverter. The ALC voltage should be in 0V ~ -4V.

59. T/R CONTROL TERMINAL

Controls Transmit/Receive for an external linear amplifier or transverter. This terminal can be used to switch 24V 1A DC. Don't exceed this limit.

60. RECEIVER INPUT TERMINAL

This is an input terminal which is connected directly to the receiver.

61. RECEIVER ANTENNA OUTPUT TERMINAL

This is a terminal to which received signals from the antenna connector are conducted after the signal passes through the transmit/receive antenna switching circuit. Usually the receiver IN and OUT terminals are jumpered. The receiver antenna output terminal is usually used when another receiver is used or a preamplifier is connected to the IC-751.

62. SPARE TERMINAL

This terminal is available for your personal use, such as for adding accessory circuit, etc., if desired.

63. TRANSVERTER TERMINAL

VHF and UHF operation using a suitable transverter with the IC-751 is possible. This terminal is for Transverter connection. The output is about 30mV.

64. GROUND TERMINAL

To prevent electrical shock, TVI, BCI and other problems, be sure to ground the equipment through the GROUND TERMINAL. For best results use as heavy a gauge wire or strap as possible and make the connection as short as possible, even in mobile installations.

65. DC POWER SOCKET

For connection of the IC-PS15's DC power cord, or other suitable power supply.

66. ACCESSORY (ACC) SOCKET

Various functions are available through the accessory socket such as modulation output, receiver output, T/R change-over, and so forth. Refer to the ACCESSORY SOCKET CONNECTION on page 3-17.

67. OPTIONAL INTERFACE UNIT CONNECTOR POSITION

This is provided to install the DP-25 connector of the optional interface unit.

68. OPTIONAL BUILT-IN AC POWER SUPPLY SOCKET POSITION

This is provided to install AC power socket plate of the optional built-in AC power supply, IC-PS35.

SECTION 3 OPERATING INSTRUCTIONS

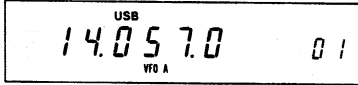
3-1 HOW TO TUNE

The following instructions are for tuning in any mode. Please read carefully and understand fully before turning ON your unit. Proper tuning is necessary for optimum operation.

3-1-1 PRESET

When the power switch is turned ON, the frequency display shows frequency, HAM/GENE (HAM BAND mode or GENERAL COVERAGE mode) mode and mode stored in the VFO A, letters "VFO A" and "01" representing memory channel 1, and the set operates with the VFO A and displayed mode, even if the previous operating mode was different. In addition, the RIT/XIT, DUPLEX mode and SCAN are turned OFF.

FOR EXAMPLE:



3-1-2 HAM BAND/GENERAL COVERAGE SELECTION

Each push of the HAM/GENERAL COVER SELECT switch changes the set in the HAM BAND MODE and GENERAL COVERAGE MODE alternately.

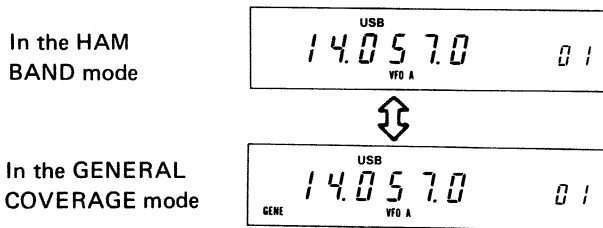
In the HAM BAND MODE, the frequencies available are those of the nine amateur bands between 1.8MHz and 28MHz including new three bands for both transmit and receive.

In the GENERAL COVERAGE MODE, the set operates as a receiver in the range of 0.1MHz to 30MHz continuously.

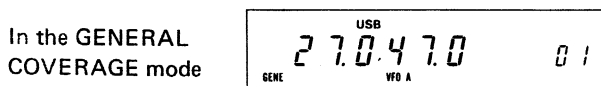
When you change the mode from the HAM BAND to GENERAL COVERAGE, the set maintains the frequency that was in the HAM BAND mode.

When you change the mode from the GENERAL COVERAGE to HAM BAND, if previous frequency was that of a HAM BAND, the set maintains that frequency.

FOR EXAMPLE:



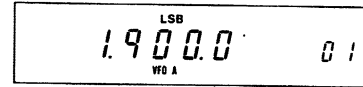
If the previous frequency was not of any HAM BAND, the frequency is initialized to "1.900.0MHz".



Pushing the HAM/
GENERAL COVER SELECT
switch



In the HAM
BAND mode



3-1-3 BAND SWITCHING

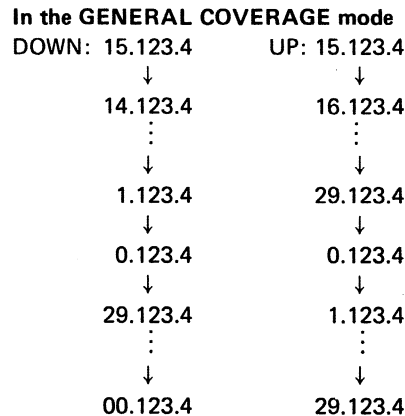
To change the operating band, push the BAND SELECT FUNCTION switch in and rotate the TUNING CONTROL.

In the HAM BAND mode, by turning the TUNING CONTROL clockwise the operating band changes to the next upper band, and counterclockwise changes to the next lower band, and the operating frequency is initialized as follows.

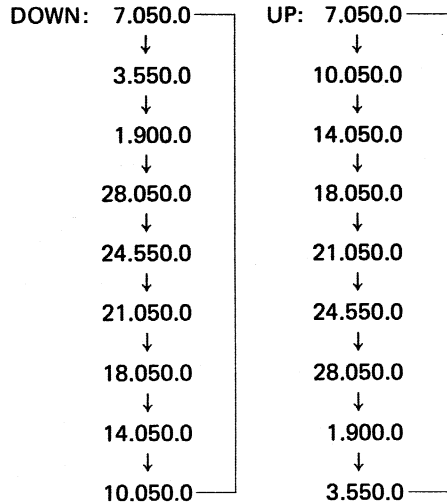
| Band | Displayed Frequency (MHz) | | |
|--------|---------------------------|----------|----------|
| | LSB·AM·FM | CW·RTTY | USB |
| 1.8MHz | 1.900.0 | 1.899.4 | 1.897.0 |
| 3.5 | 3.550.0 | 3.549.4 | 3.547.0 |
| 7 | 7.050.0 | 7.049.4 | 7.047.0 |
| 10 | 10.050.0 | 10.049.4 | 10.047.0 |
| 14 | 14.050.0 | 14.049.4 | 14.047.0 |
| 18 | 18.050.0 | 18.049.4 | 18.047.0 |
| 21 | 21.050.0 | 21.049.4 | 21.047.0 |
| 24.5 | 24.550.0 | 24.549.4 | 24.547.0 |
| 28 | 28.050.0 | 28.049.4 | 28.047.0 |

In the GENERAL COVERAGE mode, by turning the TUNING CONTROL clockwise the operating frequency changes to a frequency that is added 1MHz to the previous one. (100KHz and lower digits of the frequency will remain as it had in the previous one.) By turning the TUNING CONTROL counterclockwise, the operating frequency changes to a frequency that is subtracted 1MHz from the previous one.

When the band reaches to the highest one in either mode, it will automatically return to the lowest one, or vice versa, as per the following charts.



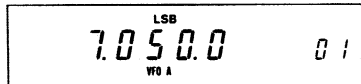
In the HAM BAND mode



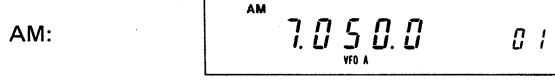
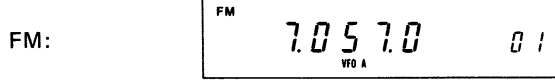
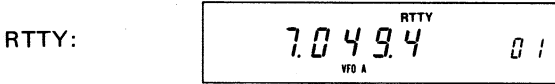
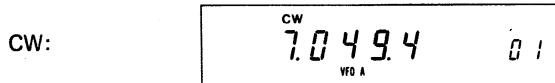
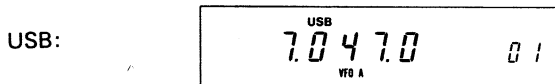
However, in the GENERAL COVERAGE mode, when the operating frequency reaches the highest or lowest edge, of that MHz range by turning the TUNING CONTROL continuously (at this time the BAND SELECT FUNCTION switch is not pushed in), the operating frequency will go to the next MHz range.

3 - 1 - 4 FREQUENCY DISPLAY ON EACH MODE

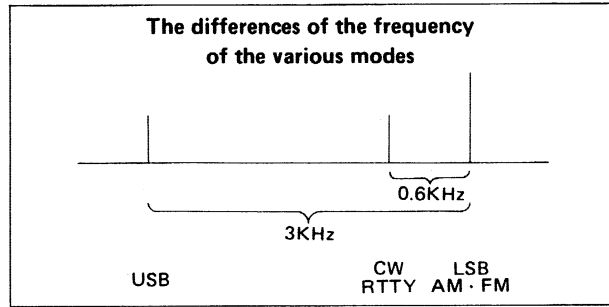
When the 7MHz band and LSB are selected, the display will be as follow:



When changing to other modes, the display will be as follows:



The displayed frequency shows the carrier frequency. To avoid the trouble of recalibrating the dial when you change the operating mode, the displayed frequency is set to shift to the carrier frequency of each mode automatically. For the differences of frequency shifts of the various modes, refer to the following figure.



In the HAM BAND SSB mode, the sideband will be automatically selected to the one usually used on the band, i.e., upper sideband (USB) for the 10MHz band and above, and lower sideband (LSB) for the 7MHz band and below. If reverse sideband is desired, push the FUNCTION key first, then push the SSB switch.

3 - 1 - 5 TUNING CONTROL

Rotating the TUNING CONTROL clockwise increases the frequency, while turning counterclockwise decreases the frequency in 10Hz steps. By turning the tuning control faster, the 50Hz steps tuning rate is automatically selected.

When the TUNING RATE switch is pushed in, the 1KHz steps tuning rate is selected in any mode. At this time, the 100Hz digit of the frequency display is cleared to "0".

The frequency range of each band in the HAM band mode is shown in the following chart.

| Band | Frequency Range |
|------|---------------------|
| 1.8 | 1.800.0 ~ 1.999.9 |
| 3.5 | 3.440.0 ~ 4.099.9 |
| 7.0 | 6.950.0 ~ 7.499.9 |
| 10.0 | 9.950.0 ~ 10.499.9 |
| 14.0 | 13.950.0 ~ 14.499.9 |
| 18.0 | 17.950.0 ~ 18.499.9 |
| 21.0 | 20.950.0 ~ 21.499.9 |
| 24.0 | 24.450.0 ~ 25.099.9 |
| 28.0 | 27.950.0 ~ 29.999.9 |

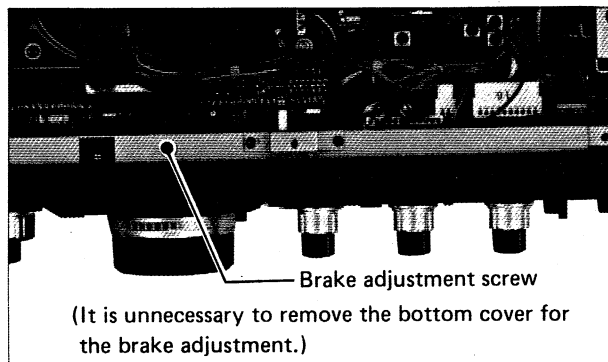
In the HAM BAND mode, by turning the TUNING CONTROL clockwise, the operating frequency reaches to the high edge of the band (for example; 14.499.9MHz), and further turning of the control brings the frequency to the low edge of the band (13.950.0MHz) then continues up the frequency from there. Likewise, by continuing to turn the TUNING CONTROL counterclockwise beyond the low edge of the band, the frequency jumps up to the high edge and goes down from that frequency.

In the GENERAL COVERAGE mode, by turning the TUNING CONTROL clockwise, the operating frequency reaches the highest one of that MHz range (for example; 14.999.9

MHz), and further turning of the control brings the frequency to the next upper MHz range (15.000.0MHz) and continues up the frequency from there. By turning the control counterclockwise, the operating frequency changes in like manner to the next lower MHz range.

Brake Adjustment

If the control is too loose or too stiff for comfortable use, you can adjust the torque by tightening or loosening the brake adjustment screw accessible from underneath the set.



The following instructions should be used to adjust the tension of the Tuning control.

1. The Tuning control tension will become tighter by turning the brake adjustment screw clockwise, and will become looser by turning the screw counterclockwise.
2. While performing this adjustment, the Tuning control must be turned continuously as the screw is adjusted in order to set the tension for a comfortable touch.

NOTE: When the letters "VFO A" or "VFO B" are displayed on the frequency display, we call this condition as "VFO MODE", when the letters "MEMO" are displayed above the memory channel number, we call as "MEMORY CHANNEL MODE".

These can be changed by pushing the VFO/MEMORY switch alternately.

3-1-6 DIAL LOCK SWITCH

After the IC-751 is set at a certain frequency for rag chewing, mobile operation, etc., by pushing the Dial Lock switch the VFO is locked at the displayed frequency, thus inactivating the operation of the tuning control. To change the frequency, the Dial Lock must first be disengaged by pushing and releasing the Dial Lock switch again.

3-1-7 VFO SWITCH

The IC-751 contains two VFO's for both receiving and transmitting. The VFO's are labeled "VFO A" and "VFO B", and are selectable by pushing the VFO switch alternately in the VFO MODE. The dual VFO system gives the IC-751 many very convenient features. Please read this

section very carefully and perform the operation several times until you are comfortable with the system. Try the example for practice!

1. "VFO A" is for both receiving and transmitting, and selected by pushing the VFO switch. The receive and transmit frequency will be controlled by the "VFO A", displayed on the frequency display, and stored in the "A" memory.
2. "VFO B" is for both receiving and transmitting, and selected by pushing the VFO switch. The receive and transmit frequency will be controlled by the "VFO B", displayed on the frequency display, and stored in the "B" memory.

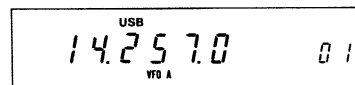
Switching from one VFO to the other VFO does not clear the first VFO. The frequency, operating mode and HAM/GENE mode are retained in the VFO's memory.

FOR EXAMPLE:

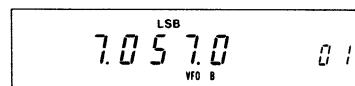
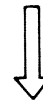
If 14.252MHz and USB are set with the "VFO A", then the VFO switch is pushed to select the "VFO B", the frequency display will show VFO B's frequency and mode, but 14.257MHz and USB are still stored in the VFO A's memory.

Pushing the VFO switch again to return the VFO A, "14.257.0" and "USB" will be displayed on the frequency display.

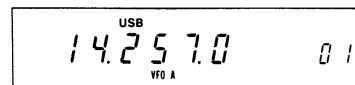
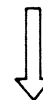
Accordingly, if the VFO switch is pushed again to the VFO B, the frequency and mode that were set with the VFO B will appear.



Pushing the VFO switch to select the VFO B.



Pushing the VFO switch again to return the VFO A.



This allows you to set a certain frequency with one VFO, work up and down the band with the other VFO, and periodically check the set frequency simply by switching between VFO "A" and "B".

It also allows you to search for a clear frequency with one VFO, while keeping your operating frequency on the other VFO. When you have found a clear frequency, switch back to your operating frequency, inform the station you are in contact with of the new frequency, and switch back. It's that simple!

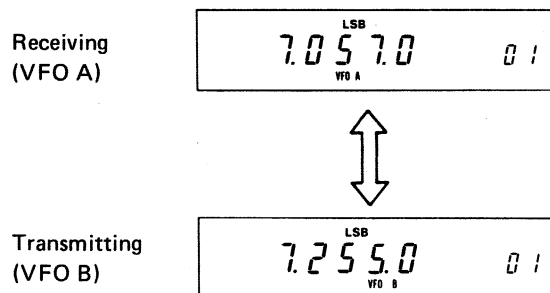
3-1-8 DUPLEX (SPLIT) SWITCH

The DUPLEX (SPLIT) switch changes the relationship of the two VFO's. Each push turns the function ON and OFF alternately.

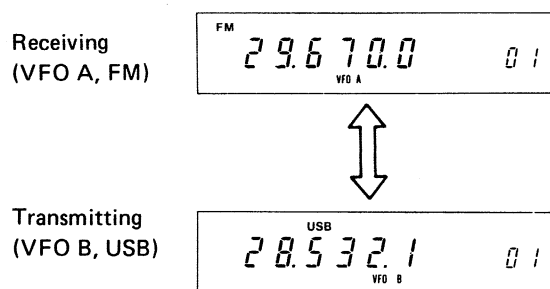
When the function is OFF, one VFO is for both receive and transmit. When the function is ON, the letters "DUP" are displayed on the frequency display, and one VFO is for receive and the other VFO is for transmit. So that this will allow you to operate on split receive/transmit frequencies.

FOR EXAMPLE:

Set VFO A to 7.057MHz and VFO B to 7.255MHz. Push the VFO switch to return VFO A then the DUPLEX (SPLIT) switch to ON. 7.057MHz will be shown on the display during receive (VFO A) and 7.255MHz during transmit (VFO B). You are now receiving on 7.057MHz and transmitting on 7.255MHz. Pushing the VFO switch to reverse the above.



Each VFO stores operating mode too. If different mode is stored in each VFO, a crossmode QSO can be possible as well.

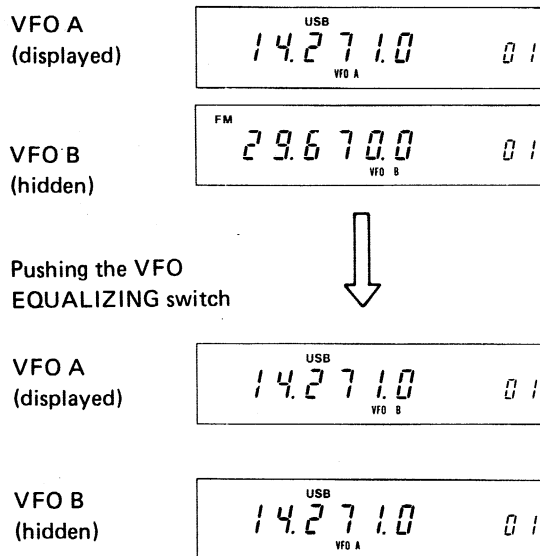


3-1-9 TRANSFERRING VFO FREQUENCY

The VFO EQUALIZING switch allows either VFO's to be brought to the exact frequency of the other VFO without turning the tuning control, and the operating mode.

FOR EXAMPLE:

When VFO A is 14.271MHz and USB, and VFO B is 29.670MHz and FM, pushing the VFO switch to select VFO A, then the VFO EQUALIZING switch, VFO B's frequency and operating mode become the same as VFO A's (14.271MHz and USB). Now the VFO A's frequency is memorized in the VFO B, and you can operate anywhere with VFO A or B. When you want to return to the previous frequency (14.271MHz), switch back to the other VFO. To reverse this (A the same as B), select VFO B first, then the VFO EQUALIZING switch.

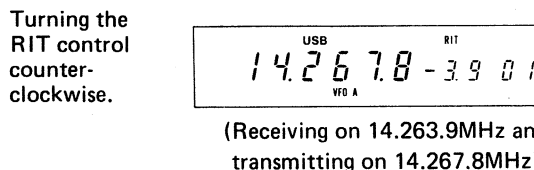
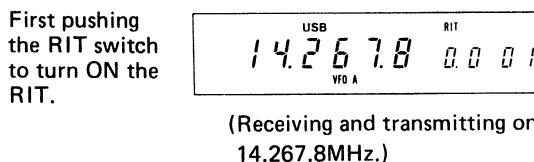


3-1-10 RIT (RECEIVE INCREMENTAL TUNING)

By using the RIT circuit, you can shift the receive frequency 9.9KHz (maximum) either side of the transmit frequency without moving the transmit frequency itself. Therefore, when you get a call slightly off frequency, or when the other station's frequency has been drifted, you can tune in the frequency without disturbing the transmitting frequency.

By pushing the RIT switch, the RIT circuit is turned ON and the letters "RIT" and shifted frequency are displayed on the frequency display.

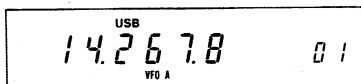
The receive frequency can be shifted 10Hz steps by turning the INCREMENTAL TUNING CONTROL.



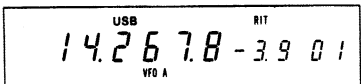
Rotating the control to the (+) direction raises the receiving frequency, and to the (-) direction lowers one.

To turn OFF the RIT function, push again the RIT switch and the letters "RIT" and shifted frequency displayed on the frequency display are no longer displayed. When the RIT circuit is OFF, the transmit and receive frequencies are the same regardless of the shifted frequency. However, the shifted frequency is stored in the memory and it will reappear when the RIT switch is pushed again.

Pushing the RIT switch to turn OFF the RIT.

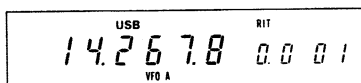


Pushing the RIT switch again to turn ON the RIT.

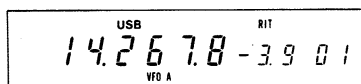


To clear the shifted frequency, push the RIT/XIT CLEAR button and the shifted frequency becomes "0.0" (The receive and transmit frequencies become the same.), regardless the RIT circuit is turned ON or OFF.

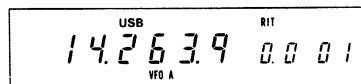
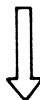
Pushing the RIT/XIT CLEAR button.



If you want to change the operating frequency (displayed frequency) to the receive frequency which is shifted by the RIT function, push the FUNCTION KEY first then the RIT/XIT CLEAR button, and the shifted frequency is added to the previous displayed frequency and the operating frequency is changed to the previous receive frequency. At the same time the shifted frequency is cleared to "0.0" and the set operates on the new displayed frequency for both the transmitting and receiving.



Pushing the RIT/XIT CLEAR button.



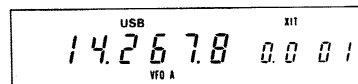
NOTE: The RIT circuit is operational when the frequency has been locked with the DIAL LOCK button as well as in the MEMORY CHANNEL MODE. When the transmitting and receiving frequencies differ by more than 10KHz, use VFO A and B in the DUPLEX (SPLIT) mode.

3 - 1 - 11 XIT (TRANSMIT INCREMENTAL TUNING)

By using the XIT circuit, you can shift the transmit frequency 9.9KHz (maximum) either side of the receive frequency without moving the receive frequency itself in like manner as the RIT function.

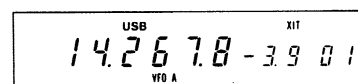
By pushing the XIT switch, the XIT circuit is turned ON and the letters "XIT" and shifted frequency are displayed on the frequency display. The transmit frequency can be shifted 10Hz steps by turning the INCREMENTAL TUNING CONTROL.

First pushing the XIT switch to turn ON the XIT.



(Receiving and transmitting on 14.267.8MHz.)

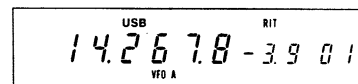
Turning the INCREMENTAL TUNING control counterclockwise.



(Receiving on 14.267.8MHz and transmitting on 14.263.9MHz)

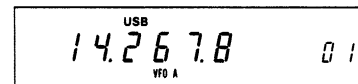
If the RIT has been turned ON before and the shifted frequency is stored in its memory (now the RIT is OFF), then the XIT is turned ON, the shifted frequency stored in the RIT memory is reappeared on the display and it becomes the shifted frequency of the XIT.

The RIT has been turned ON.



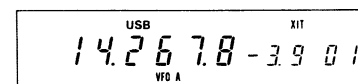
(Receiving on 14.263.9MHz and transmitting on 14.267.8MHz.)

Pushing the RIT switch to turn OFF the RIT.



(Receiving and transmitting on 14.267.8MHz.)

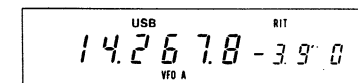
Pushing the XIT switch to turn ON the XIT.



(Receiving on 14.267.8MHz and transmitting on 14.263.9MHz.)

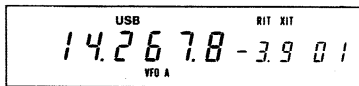
If you push the XIT switch to turn the XIT ON when the RIT has been turned ON already, the XIT is also turned ON, however, its shifted frequency will be the same as that of the RIT. So the set will operate on the same frequency which is shifted from the displayed frequency and it can be changed by turning the INCREMENTAL TUNING CONTROL, in both the transmitting and receiving.

The RIT has been turned ON already.



(Receiving on 14.263.9MHz and transmitting on 14.267.8MHz.)

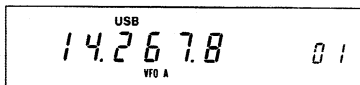
Pushing the XIT switch to turn ON the XIT.



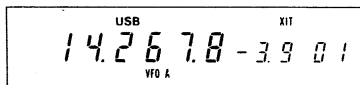
(Receiving and transmitting on 14.263.9MHz.)

To turn OFF the XIT function, push again the XIT switch and the letters "XIT" and shifted frequency displayed on the frequency display are no longer displayed. (If the RIT is ON the shifted frequency will remain.) When the XIT circuit is OFF, the transmit and receive frequencies are the same regardless of the shifted frequency. However, the shifted frequency is stored in the memory and it will be reappear when the XIT switch is pushed again.

Pushing the XIT switch to turn OFF the XIT.



Pushing the XIT switch again to turn ON the XIT.



To clear the shifted frequency or to add the shifted frequency to the displayed one, you can make it in like manner as the RIT.

3 - 1 - 12 DIAL FUNCTION SELECT SWITCH (IN VFO MODE)

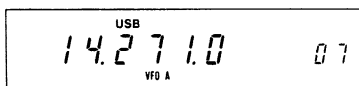
In the VFO mode, by pushing the DFS (DIAL FUNCTION SELECT) switch in, the operating frequency locked on the displayed frequency and by turning the TUNING CONTROL, the MEMORY CHANNEL NUMBER displayed on the frequency display can be changed. This is very convenient to memorize the operating frequency and modes into a memory channel, or to change the operating frequency and modes to ones in a memory channel.

FOR EXAMPLE:

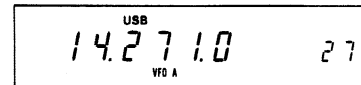
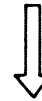
Now you are operating on 14.271MHz and USB, and memory channel number "7" is displayed. If you want to memorize these into the memory channel 27, push the DFS switch in and you can change the displayed memory channel number by turning the tuning control.

Turn the tuning control to obtain the desired memory channel number (at this time "27"), then push the MEMORY WRITE button, and the operating frequency "14.271MHz" and mode "USB" are memorized into the memory channel 27. To change the operating frequency again, push and release the DFS switch.

On the display



Pushing the DFS switch and turning the TUNING CONTROL.

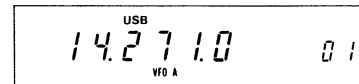


By pushing the MEMORY WRITE button, the frequency and mode are memorized into the MEMORY CHANNEL 27.

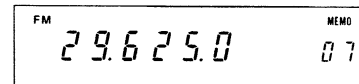
FOR EXAMPLE:

Now you are operating on 14.271MHz USB and memory channel 7 memorizes "29.625MHz" and "FM". If you wish to operate with the frequency and modes which are memorized in the memory channel 7, push the DFS switch in and turn the tuning control to be displayed memory channel number "7". Then push the FREQUENCY TRANSFER button, and "29.625.0" and "FM" are appeared on the frequency display. Now you can operate on these frequency and mode, and by pushing and releasing the DFS switch, the displayed frequency can be changed by turning the tuning control.

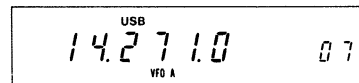
On the display



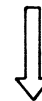
Contents of the memory channel 7 (hidden)



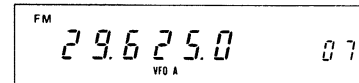
Pushing the DFS switch and turning the TUNING CONTROL.



Pushing the FREQUENCY TRANSFER button.



The contents of the channel 7 are transferred to the VFO A.



3 - 2 MEMORY CHANNEL OPERATION

3 - 2 - 1 MEMORY CHANNEL SELECTION

When the power switch is turned ON, the set initially operates with the VFO A and memory channel number "01" is displayed. By pushing the VFO/MEMORY switch, the set is switched into the MEMORY CHANNEL MODE and frequency, mode and HAM/GENE mode which have been stored in the "MEMORY CHANNEL 1" are displayed

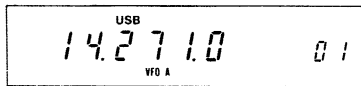
on the frequency display. In addition, the letters "MEMO" are also displayed above the memory channel number to indicate the set is in the MEMORY CHANNEL MODE.

FOR EXAMPLE:

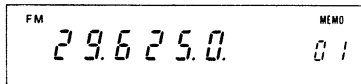
When "14.271MHz" and USB are memorized in VFO A, and "29.625MHz" and "FM" are in MEMORY CHANNEL 1, by pushing the power switch ON, the frequency display shows "14.271.0", "USB", "VFO A" and memory channel number "01".

By pushing the VFO/MEMORY switch, the display will show "29.625.0" and "FM", memory channel number "01", and the letters "MEMO" above the channel number.

When the power is turned ON.



Pushing the VFO/MEMORY switch



By turning the TUNING CONTROL, memory channels can be selected. Turning clockwise increases the channel number and counterclockwise decreases the number, and the respective frequency, mode and HAM/GENE mode are displayed on the display.

When you select a memory channel that has never been stored any frequency, the frequency display does not show any frequency, but MHz and KHz decimals. However, the set works with the frequency and mode of the memory channel (or VFO), which was previously displayed.

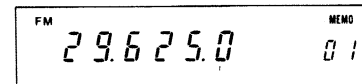
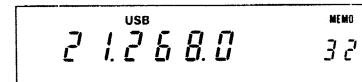
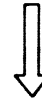
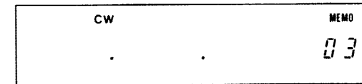
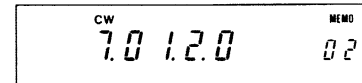
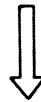
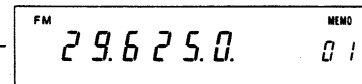
FOR EXAMPLE:

When "7.012MHz" and "CW" are memorized in memory channel 2, and no frequency is in channel 3, by turning the TUNING CONTROL clockwise, the frequency display will show "7.012.0" "CW", "MEMO" and memory channel number "02".

By turning the TUNING CONTROL clockwise furthermore, the memory channel number will change to "03", but the channel has never memorized any frequency, thus the display shows "CW" and only the MHz and KHz decimals. However, the set works with the frequency and mode of channel 2, i.e., "7.012MHz" and "CW".

When memory channel limits are reached (i.e., "01" or "32"), the next memory channel entered will be the opposite limit (i.e., "32" or "01").

Turning the TUNING CONTROL clockwise.



3-2-2 DIAL FUNCTION SELECT SWITCH (IN MEMORY CHANNEL MODE)

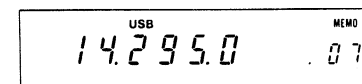
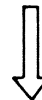
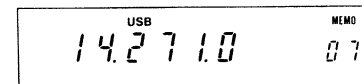
In the MEMORY CHANNEL MODE, by pushing the DFS (DIAL FUNCTION SELECT) switch in, the operating memory channel is locked on the displayed one and by turning the TUNING CONTROL, the OPERATING FREQUENCY displayed on the frequency display can be changed. This is very convenient for tuning a slightly off frequency or to change the operating frequency, or to rewrite the memorized frequency in the selected memory channel.

FOR EXAMPLE:

Now you are operating on 14.271MHz and USB with memory channel 7. If you want to change this frequency, push the DFS switch in, now you can change the displayed frequency. By turning the TUNING CONTROL clockwise increases the frequency and counterclockwise decreases one, the same as a VFO.

To tune to "14.295MHz", turn the TUNING CONTROL clockwise to obtain the desired frequency "14.295.0" on the display.

Pushing the DFS switch in, and turning the TUNING CONTROL.



If you wish to transfer this operating frequency (14.295 MHz) and mode (USB) into a VFO, push the FREQUENCY TRANSFER button, and the operating frequency "14.295 MHz" and mode "USB" are transferred into the VFO previously selected.

NOTE: Don't push the VFO/MEMORY switch before pushing the FREQUENCY TRANSFER button to transfer the operating frequency (at this time, 14.295MHz), or the operating frequency is erased and the original memorized frequency (14.271 MHz) will be transferred into the VFO.

If you wish to rewrite the memorized frequency in the selected channel (at this time, "07") to this frequency ("14.295.0"), push the MEMORY WRITE button, and the operating frequency "14.295MHz" and mode "USB" are memorized into the memory channel 7.

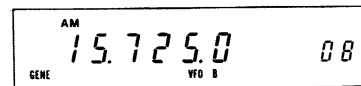
To change the operating memory channel again, push and release the DFS switch, then turn the TUNING CONTROL.

3-2-3 MEMORY-WRITE (PROGRAMMING THE MEMORY CHANNELS)

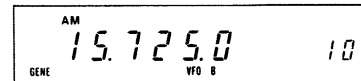
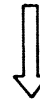
Any operating frequency, mode and HAM/GENE mode can be memorized into a memory channel.

1. Set the operating frequency, mode and HAM/GENE mode to desired ones by a VFO. For example, set them for "15.725MHz", "AM" and "GENE" by using VFO B.
2. Push the DFS switch in, then select a memory channel to be memorized by turning the TUNING CONTROL. For example, select it at memory channel 10.
3. To check the contents in the memory channel, push the VFO/MEMORY switch, and the contents are displayed on the frequency display. If you don't like to rewrite these contents, select another memory channel which has contents erasable or no memorized frequency. (When no frequency has been memorized, only the MHz and KHz decimals are displayed at the frequency position.) After checking, push the VFO/MEMORY switch again to return to the VFO.
4. One push of the MEMORY WRITE button erases the previous memorized contents (if any) and memorizes the displayed frequency, mode and HAM/GENE mode into the selected memory channel (at this time channel 10).
5. Memorize other desired frequencies and so on into memory channels in the same manner. Memory channel 1 and 2 are used also for the PROGRAMMED SCAN. For PROGRAMMED SCAN operation, refer to "SCANNING OPERATION."

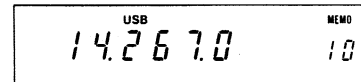
Frequency, mode and HAM/GENE mode to be memorized.



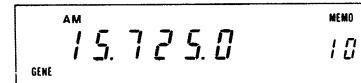
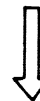
Pushing the DFS switch in, and turning the TUNING CONTROL.



Pushing the VFO/MEMORY switch to check contents of the channel.



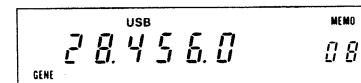
Pushing the VFO/MEMORY switch to return to the VFO, then pushing the MEMORY WRITE button.



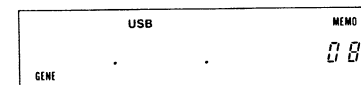
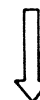
(This is displayed after pushing the VFO/MEMORY switch.)

3-2-4 MEMORY CLEARING

If you want to clear contents of a memory channel, the first, select the channel to be cleared, the second, push the FUNCTION KEY then the MEMORY WRITE or FREQUENCY TRANSFER button. The contents of the channel will be cleared.



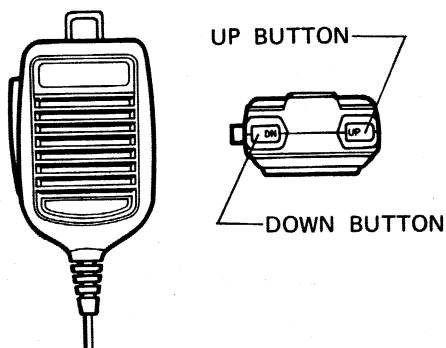
Pushing the FUNCTION KEY first, then the MEMORY WRITE or FREQUENCY TRANSFER button.



3-3 TUNING BY UP/DOWN BUTTONS ON THE MICROPHONE

3-3-1 FREQUENCY CONTROL

With each push of the UP or DN (down) button on the supplied microphone, the operating frequency is changed one increment up or down respectively. In the same way, by depressing the button continuously, the operating frequency is changed up or down the same as turning the TUNING CONTROL. The tuning rate is according to the setting of the TUNING RATE switch.



This function is effective in the VFO mode and when the DFS switch is pushed in to change the operating frequency in the MEMORY CHANNEL mode.

3-3-2 MEMORY CHANNEL SELECTING

In the MEMORY CHANNEL mode or when the DFS switch is pushed in to change the displayed memory channel number in the VFO mode, by depressing the UP or DN (down) button on the microphone continuously, the operating MEMORY CHANNEL or displayed channel number is changed up or down respectively every two seconds.

3-4 SCANNING OPERATION

The IC-751 provides various scanning operations. Please read the following instructions carefully to fully enjoy the IC-751's many capabilities.

3-4-1 MEMORY SCAN

This is used to scan all programmed memory channels continuously.

1. Program your desired frequencies into memory channels.
2. Select a memory channel programmed with a frequency. (The scan cannot start from a blank channel.)
3. Depress the SCAN START/STOP button, and the frequency starts scanning the programmed frequencies in the memory channels from the highest channel to lowest. At this time, the scan skips blank channels, if any.
4. If the SQUELCH is engaged, the scan stops when the squelch is opened and receives a signal. This restarts after passing a specified time.

To stop scanning without opening the squelch, depress the SCAN START/STOP button. Depress it again to restart the scanning.

3-4-2 MODE SELECTIVE SCAN

In the memory scan mode, by pushing the MODE SELECTIVE SCAN switch in, the scan scans only on channels having the desired operating mode.

To be in this scan mode, first, select a channel that has your desired mode, second, push the MODE SELECTIVE switch in, then the SCAN START/STOP button.

When the set is scanning in the normal memory scan mode, push the MODE SELECTIVE switch in at the moment that your desired mode is displayed on the display.

3-4-3 PROGRAMMED SCAN

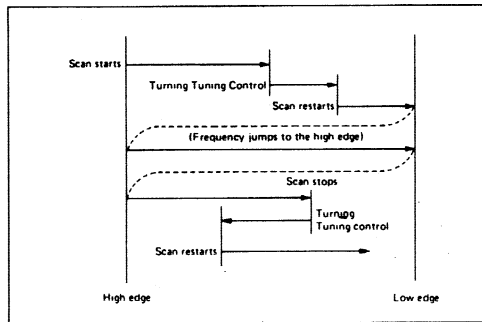
This is to scan between two desired frequencies, which are memorized in the memory channels "1" and "2".

CAUTION The programmed scan does not start when the contents of memory channels 1 and 2, and frequency display differ from which are described below.

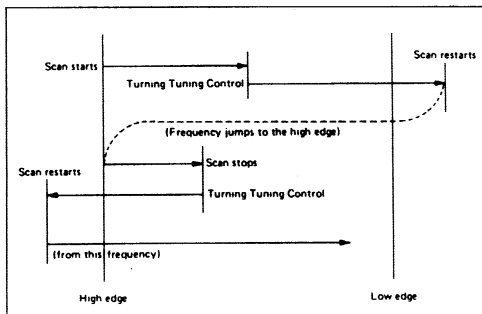
1. The same operation mode (HAM BAND or GENERAL COVERAGE mode) should be stored into memory channels 1 and 2. To start the scan, the set should be in the same operation mode as the memory channels.
2. Stored frequencies in memory channels 1 and 2 should be in the same band, if the HAM BAND mode is stored in both memory channels 1 and 2. To start the scan, the set should be in the HAM BAND mode and in the same band as the memory channels.

1. Memorize the frequencies of the high and low edges of the desired scanning range into the memory channels 1 and 2. Regardless of which channel the higher frequency is memorized in, the scan starts from the high edge of the range.
For example, 14.200MHz is in the memory channel 1 and 14.300MHz in the channel 2.
2. Place the unit in the VFO MODE and select operation mode the same as the channels 1 and 2, and a VFO you desire. Pushing the SCAN START/STOP button starts the scan from the high edge (14.300MHz) to the low edge (14.200MHz). The scanning frequency increments depend on the TUNING RATE SELECT switch setting.
3. When the scanning frequency reaches the low edge (14.200MHz), it automatically returns to the high edge (14.300MHz) and continues scanning down to provide endless scanning operation.
4. While the SQUELCH is engaged, the squelch opens when a signal is received and will stop the scanning automatically on the frequency, and the signal can be monitored. After approximately 10 seconds, the scan restarts from the frequency the scan stopped at, continuing to the low edge.
If the RECEIVE indicator is lit because the SQUELCH is not engaged, the scan does not stop at any signals.
5. Depressing the SCAN START/STOP button while the scan is operating or during the 10 seconds of monitoring, clears the scanning operation and the VFO goes back to normal operation.

6. By turning the set into the transmit mode, or rotating the TUNING CONTROL, or pushing the VFO switch, RIT or XIT switch, VFO/MEMORY switch, or one of the MODE SELECT switches the scan stops and clears.



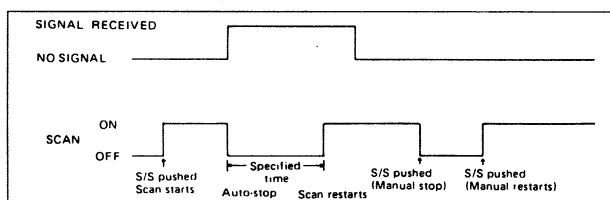
7. When the operating frequency is higher than the high edge (14.300MHz) and the SCAN START/STOP button is pushed, the scan starts from the operating frequency and scan down to the low edge, but it will return to the memorized high edge frequency (14.300MHz) and continue the scanning to the low edge. If the operating frequency is below the low edge frequency (14.200MHz), the scan frequency jumps to the high edge frequency (14.300MHz) and starts from the high edge.



NOTE: The auto-stop functions with SSB or CW signals, but the scan does not always stop at the exact carrier frequency. When the scan stops on a signal, tune into the signal for better reception by pushing a MODE switch for the proper mode (if different) and by rotating the TUNING CONTROL.

3 - 4 - 4 RESUMING SCAN

All scan modes are provided with the resume scan function. When the scan has been stopped by the auto-stop function, the scan will restart after passing a specified time (about 10 seconds).



3 - 5 SSB OPERATION

3 - 5 - 1 RECEIVING

After connecting an antenna, microphone, etc., set knobs and switches as follows.

| | |
|-----------------------------|--|
| POWER SWITCH | OFF (OUT) |
| T/R SWITCH | RECEIVE (DOWN) |
| VOX GAIN CONTROL | Completely Counterclockwise (OFF position) |
| NB LEVEL CONTROL | Completely Counterclockwise (OFF position) |
| AGC SWITCH | SLOW |
| AF GAIN CONTROL | Completely Counterclockwise |
| RF GAIN CONTROL | Completely Clockwise |
| SQUELCH CONTROL | Completely Counterclockwise |
| TONE CONTROL | Center (12 o'clock) Position |
| TUNING RATE SWITCH | OFF (OUT) |
| DFS SWITCH | OFF (OUT) |
| BAND SELECT FUNCTION SWITCH | OFF (OUT) |
| DIAL LOCK SWITCH | OFF (OUT) |
| FILTER SWITCH | OFF (OUT) |
| PBT CONTROL | Center (12 o'clock) Position |
| NOTCH FILTER SWITCH | OFF (OUT) |
| NOTCH FILTER CONTROL | Center (12 o'clock) Position |
| DUPLEX (SPLIT) SWITCH | OFF (OUT) |
| PREAMP/ATT SWITCH | OFF |

Now push the POWER switch in. The meter lamp will be illuminated, after a few seconds, a frequency, mode and HAM/GENE mode memorized in the VFO A, and memory channel number "01" will be shown on the frequency display.

In SSB operation there is both a USB (upper side band) and an LSB (lower side band). In the HAM bands, LSB is usually used on the 1.8, 3.5 and 7MHz bands, while USB is usually used on the 10MHz band and above. The IC-751 selects the normally used sideband according to the band in which you are operating.

If you wish to operate with the opposite sideband, first push the FUNCTION KEY then the SSB switch and the opposite sideband will be selected.

When you wish to operate on another band than the displayed one (If the desired band is not a HAM band, push the HAM/GENERAL switch so that the letters "GENE" are displayed.), push the BAND SELECT FUNCTION switch in, then turn the TUNING CONTROL so that the desired band is displayed.

Slowly turn the AF GAIN control clockwise to a comfortable level. Rotate the tuning knob until a signal is received. The meter needle will move according to the signal strength, so tune for the highest possible meter reading and the clearest audio. If you cannot get a clear signal, you may be receiving in the opposite sideband. If so, change the mode to the proper sideband.

Adjust the RF GAIN control and TONE control for comfortable reception.

If squelch operation is required to cut out noise when no signal is received, turn the SQUELCH control clockwise until the noise from the speaker stops and leave it just below this threshold.

For tuning, memory channel operation and scanning operation, please refer to 3 - 1 HOW TO TUNE, 3 - 2 MEMORY CHANNEL OPERATION, and 3 - 4 SCANNING OPERATION.

3 - 5 - 2 NB (NOISE BLANKER)

When there is pulse type noise, such as ignition noise from automobile motors, turn the NB LEVEL control clockwise further click ON, so that noise will be suppressed and even weak signals will be received comfortably.

When the NB switch is set in the WIDE (locked in) position, the noise blanker will effectively work for "woodpecker's noise", however, if the receiving signal is too strong, the noise blanker may work with the receiving signal itself, and some distortion may cause in the receiving audio or keying form. At this time, set the N.B. Switch in the out position, or turn the NB LEVEL control completely counterclockwise (OFF position).

3 - 5 - 3 AGC (AUTOMATIC GAIN CONTROL)

The IC-751 has a fast attack/slow release AGC system which holds the peak voltage of rectified IF signals from the IF amp circuit for a certain period. Therefore, during the pauses in normal speech of the received signal, uncomfortable noise will not be heard. The meter indicates the peak value for a certain period, facilitating reading of the meter "S" function.

For normal SSB reception, turn the AGC control clockwise to the SLOW position. Turn the AGC control counterclockwise to the FAST position, when tuning or receiving signals with short interval fading. When in the FAST position, the time constant is shortened.

When this control is set at the OFF position, the AGC circuit is turned OFF, and the S-meter does not work even if a signal is received. However the RF GAIN control is still active and the needle of the meter moves depending on the control position.

3 - 5 - 4 PREAMP/ATT SWITCH

Place the PREAMP/ATT Switch on the TOP to the PRE position when receiving weak signals. In the PRE position, an RF preamplifier is inserted into the receiving antenna circuit, increasing sensitivity and giving easy reception.

Place the PREAMP/ATT switch to the ATT position when strong nearby signals disturb signal reception or make "S" reading difficult. In the ATT position, the RF amplifier is removed from the circuit and a 20dB attenuator is inserted

into the receiving antenna circuit, reducing interfering signals and giving more stable reception. In normal operation the PREAMP/ATT switch is left in the OFF position.

3 - 5 - 5 P.B. (PASS-BAND) TUNING

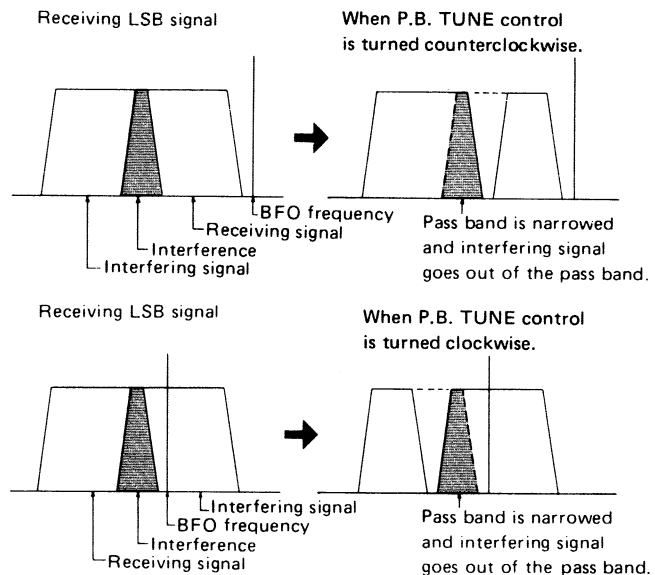
Pass-Band Tuning is a system to narrow the bandwidth (selectivity) of the frequencies that will pass through the crystal filter electronically from either the upper or lower side continuously by up to 800Hz. This is very effective in reducing interference from nearby signals.

The PBT control has a click-stop at the center (12 o'clock) position. This is the widest pass band position and use the set at this position usually.

While receiving in the LSB mode, if you get interference from a lower frequency (interfering signals are high-pitched tones), narrow the band width by turning the P.B. tuning control counterclockwise. When the interfering signals are low-pitched tones, they are from a higher frequency, and you should narrow the bandwidth by turning the P.B. tuning control clockwise.

When receiving in the USB mode, the bandwidth is narrowed in the opposite manner. Interference from a higher frequency will be high-pitched tones, and the P.B. tuning control should be turned clockwise. Interference from a lower frequency will be low-pitched tones and the P.B. tuning control is turned counterclockwise.

This control can also be used for audio tone adjustment, so it may be set for the most comfortable reception.



3 - 5 - 6 FILTER SWITCH

This switch selects the combination of the internal filters. When an optional filter is installed, this function will be more effective. Select and install the optional filter(s) to suit your favorite mode(s). Refer to 7 - 1 OPTIONAL FILTERS.

3-5-7 NOTCH FILTER

This circuit notches a frequency in the IF pass-band, so this is effective to reduce interference such as a beat-tone signal.

To use this function, push the NOTCH FILTER switch ON and turn the NOTCH FILTER control so that the interference is reduced.

3-5-8 TRANSMITTING

Before transmitting, listen in the receive mode to make sure your transmission will not interfere with other communications. If possible, use a dummy load for adjustment instead of an antenna. Set knobs and switches as follows.

MIC GAIN CENTER (12 o'clock) position
RF POWER CONTROL FULLY COUNTERCLOCKWISE
METER SWITCH ALC

Other knobs and switches are left in the same positions as for receiving. When the T/R switch is moved to transmit, or when the PTT (push to talk) switch on the microphone is depressed, the TRANSMIT Indicator is illuminated. By speaking into the microphone, the meter needle will move according to the strength of your voice and SSB signals will be transmitted. Set the MIC GAIN control so that the meter needle stays well within the ALC zone at voice peaks. If you wish to increase the output power, turn the RF POWER Control clockwise and adjust to obtain the desired RF output power of between 10 watts and 100 watts (approximately).

Change to the receive mode by moving the T/R switch to receive, or release the microphone PTT switch.

3-5-9 HOW TO USE THE SPEECH PROCESSOR

The IC-751 has a low distortion RF speech processor which enables greater talk power and better results in DX operation. Follow the steps below for use of the Speech Processor:

MIC GAIN CONTROL CENTER (12 o'clock) position
RF POWER CONTROL Fully Counterclockwise
COMP SWITCH ON
METER SWITCH COMP

Switch to transmit and turn the RF POWER CONTROL clockwise while speaking into the microphone until you obtain the desired RF "PEAK" output power of between 10 watts and 100 watts (approximately).

Adjust the MIC GAIN CONTROL to a point where the meter needle swings between 10dB and 20dB on the COMP scale.

The Speech Processor should be turned OFF or MIC GAIN CONTROL carefully set for minimum compression for all

communication other than DX operation for a very natural voice quality.

3-5-10 HOW TO USE THE VOX CIRCUIT

The IC-751 has a built-in VOX (voice operated relay) which allows automatic T/R switching by voice signals into the microphone. For VOX use, set the knobs and switch as follows:

VOX GAIN CONTROL
 FULLY COUNTERCLOCKWISE (OFF position)
VOX DELAY CONTROL
 FULLY CLOCKWISE
ANTI VOX CONTROL (on the top)
 FULLY COUNTERCLOCKWISE

Turn the VOX GAIN CONTROL on the front panel to click ON. Leaving the T/R switch in the RECEIVE position and without pushing the PTT switch, turn the VOX GAIN control further clockwise while speaking into the microphone. At a certain point, the T/R switching circuit will be activated by your voice. This is the proper position for the VOX GAIN control. Set the VOX GAIN control at a level which provides for T/R switching at your normal voice level. Transmit-release time (the delay before the set automatically returns to receive when you stop talking) is controlled by the VOX DELAY control. Turning the control counterclockwise makes the time shorter. Set it at a position which is comfortable and which allows for short pauses in normal speech.

Adjust the ANTI VOX control on the top so that the VOX circuit is not activated by sounds from the speaker by turning the control clockwise while receiving a signal.

3-5-11 MONITOR

The transmitting IF signals can be monitored in the SSB mode. So you can check the quality of the transmitting signals and conditions of the speech processor and so on.

To use this function, push the MONITOR switch in on the front panel and adjust the MONITOR LEVEL control on the top to a comfortable audio level. At this time, use headphones to prevent howling which will be caused by picking up sounds from the speaker.

3-6 CW OPERATION

3-6-1 RECEIVING

For CW reception, push the MODE SELECT Switch for CW mode, or CW-N mode (first the FUNCTION key, then the CW switch when an optional CW narrow filter is installed). Other switches and knobs are set the same as for SSB reception.

In addition to the crystal band pass filter, CW Narrow filters are optional for this unit. Refer to 7-1 OPTIONAL FILTERS.

Switch is set at the CW-N mode, this filter is activated and

the total selectivity of CW reception is improved (250Hz or 500Hz/-6dB). Also, with this filter, internal noise is reduced for comfortable CW reception and an improved signal to noise (S/N) ratio.

If the optional CW filter is not installed the set does not work in the CW-N mode.

The Pass Band Tuning system can be used to narrow the bandwidth up to 800Hz, the same as in the SSB mode.

Also, use the Noise Blanker, AGC switch and/or PREAMP/ATT switch depending on the receiving conditions, the same as SSB reception.

3-6-2 TRANSMITTING

Insert the keyer plug into the KEY Jack on the rear panel of the unit, and set knobs and switches as follows:

| | |
|------------------|-----------------------------------|
| RF POWER CONTROL | Fully counterclockwise |
| METER SWITCH | Po |
| VOX GAIN CONTROL | OFF (Completely Counterclockwise) |

Other knobs and switches are set the same as for CW reception.

By setting the T/R switch to TRANSMIT, the TRANSMIT indicator is lit and shows that you are ready for CW transmission. When you key the keyer, the meter needle moves and your CW signal is transmitted. To increase the transmitting power, turn the RF POWER Control clockwise to adjust while watching the meter needle on the Po scale for the desired output power.

3-6-3 CW SIDE-TONE (MONITOR)

When the MONITOR switch is pushed in, by keying the key, the side-tone oscillator is activated and an 800Hz tone will be heard. The loudness of the tone is controlled by the MONITOR LEVEL Control located on the top. Rotating the control clockwise will increase the loudness.

3-6-4 BREAK-IN OPERATION

The IC-751 has Break-In CW capability when using the VOX function. When keying, the unit is automatically set in the transmit mode. After keying, it is returned to the receive mode, also automatically, after a given transmit-release delay time constant. Leave the T/R switch in the RECEIVE position, and turn the VOX GAIN control clockwise to click ON.

The transmit release delay time constant is set by adjusting the VOX DELAY Control. Turning the VOX DELAY Control clockwise will make the transmit release time longer. Set it for your own keying speed.

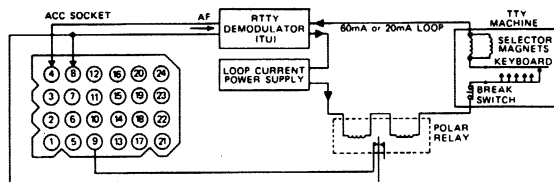
By turning the VOX DELAY control fully counterclockwise and click OFF to the "FULL" position, the break-in

function reaches "FULL-BREAK-IN". So you can watch on the receiving frequency in the interval of each dot or dash.

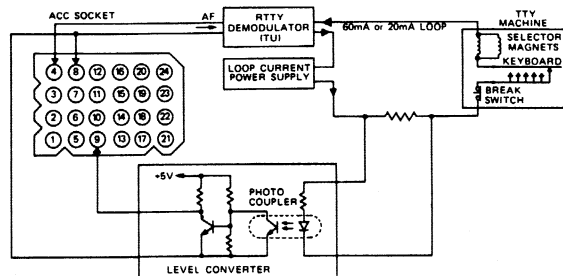
3-7 RTTY OPERATION

For RTTY operation, a teletypewriter (or an equivalent) and a demodulator (terminal unit) which is operational with audio input are required. Any demodulator with 2125/2295Hz filters (narrow, 170Hz shift) can be used with the IC-751.

When a highspeed relay is used.



When a level converter is used.



3-7-1 RECEIVING

Audio signals for the demodulator can be supplied from Pin 4 of the ACC socket on the rear panel, or from the PHONES jack on the front panel. The level of the audio signals from Pin 4 of the ACC socket does not vary by turning the AF GAIN Control, and the level is about 300mVp-p maximum.

Set the operating mode for RTTY, by pushing the MODE SELECT switch "RTTY". The other controls are the same as those for SSB reception. When tuning a RTTY signal, set the TUNING RATE SELECT switch OFF (out) position, and tune to get audio signals of 2125Hz for MARK and 2295Hz for SPACE. (Use the tuning indicator of the terminal unit for easy tuning.) Also adjust the P.B. Tune control for clear reception.

When an optional CW narrow filter is installed, by setting the set in the RTTY NARROW mode (By pushing the FUNCTION KEY first then the RTTY switch.), the narrow filter is activated and the total selectivity of the RTTY reception is improved (250Hz or 500Hz/-6dB) the same as the CW mode.

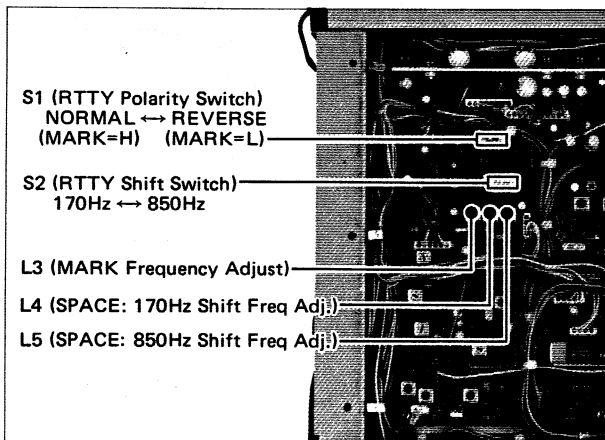
If you wish to receive RTTY signals which have wider shift such as 425Hz and 850Hz shifts, prepare a demodulator suits for the shift and use normal RTTY mode.

3-7-2 TRANSMITTING

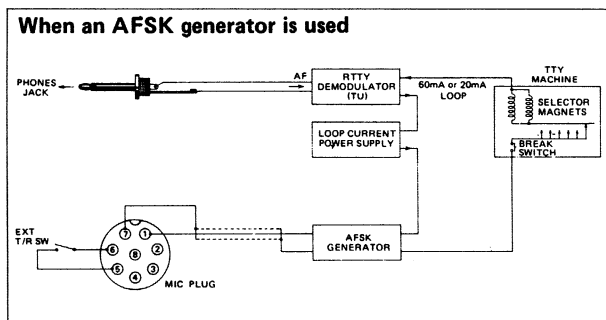
For keying of the Frequency Shift Keying (FSK) circuit insert a high speed relay's coil into the loop current circuit of the teletypewriter, and connect the relay contacts to Pins, 8 and 9 of the ACC Socket on the rear panel. The relay contacts make during the Space and break during the Mark, as shown in the drawing. Fine adjustment of the MARK and SPACE frequencies can be done by adjusting the coil cores in the MAIN unit.

When a level converter for TTL level signals is used, connect the output of the converter to Pins 8 (ground) and 9 of the ACC Socket, apply High level (5V) signals for the Mark, and Low (0V) for the Space.

If your teletype machine puts out signals which are reverse polarity (LOW level; 0V, is for MARK and HIGH level; 5V, is for SPACE), slide S1 on the MAIN unit board to arrow direction as shown in the photo below.



When using an AFSK generator that has 2125Hz for Mark and 2295MHz for Space, connect the output signals for the AFSK to the Mic connector on the front panel and set the Mode to LSB. (See Other Operations chapter.) Doing this, you can use the VOX operation available in this mode, and receive/transmit changeover is very easy.



3-8 AM OPERATION

3-8-1 RECEIVING

Set the operating mode for AM, by pushing the MODE SELECT switch "AM". The other controls are the same as those for SSB reception, except the Pass Band Tuning. The

Pass Band Tuning control does not work in this mode. The optional crystal filter FL-33 will provide good selectivity for AM reception. Refer to the installation instructions SECTION 7 OPTION INSTALLATION.

When tuning an AM signal, tune for maximum signal strength as indicated on the meter.

3-8-2 TRANSMITTING

Transmitting AM signals is essentially the same as SSB transmission.

Set knobs and switches the same as for SSB operation. The RF output power can be adjusted between 10 Watts and 40 Watts by the RF POWER control. Also the speech processor can be used on this mode.

When transmitting the AM signals, the meter (in Po position) will indicate the carrier power, and the meter needle will move slightly according to your voice.

3-9 FM OPERATION

3-9-1 RECEIVING

Set the operating mode for FM, by pushing the FUNCTION KEY first, then the MODE SELECT switch "AM". The other controls are the same as those for SSB reception, however, the Pass Band Tuning control, Notch Filter, Noise Blanker, AGC circuits and FILTER SWITCH do not work in this mode.

When tuning an FM signal, tune for maximum signal strength as indicated on the meter and the clearest audio.

3-9-2 TRANSMITTING

Transmitting FM signals is essentially the same as SSB transmission.

Set knobs and switches the same as for SSB operation. However the speech processor can not be used on this mode.

When transmitting the FM signals, the meter (in Po position) will indicate the carrier power, but the meter needle does not move according to your voice such as SSB transmitting.

NOTE: Most countries may not allow to use the FM mode on HF HAM bands except 28MHz.

3-10 GENERAL COVERAGE RECEIVER

In this mode, the set does not transmit on any frequency, even if the frequency is on the HAM band.

Set knobs and switches as follows.

| | |
|------------------|--|
| POWER SWITCH | OFF (OUT) |
| T/R SWITCH | RECEIVE (DOWN) |
| VOX GAIN CONTROL | Completely Counterclockwise (OFF position) |

| | |
|-----------------------------|---|
| NB LEVEL CONTROL | Completely Counterclockwise (OFF position) |
| AGC SWITCH | SLOW |
| AF GAIN CONTROL | Completely Counterclockwise |
| RF GAIN CONTROL | Completely Clockwise |
| SQUELCH CONTROL | Completely Counterclockwise |
| TONE CONTROL | Center (12 o'clock) Position |
| TUNING RATE SWITCH | OFF (OUT) |
| DFS SWITCH | OFF (OUT) |
| BAND SELECT FUNCTION SWITCH | OFF (OUT) |
| DIAL LOCK SWITCH | OFF (OUT) |
| FILTER SWITCH | OFF (OUT) |
| PBT CONTROL | Center (12 o'clock) Position |
| NOTCH FILTER SWITCH | OFF (OUT) |
| NOTCH FILTER CONTROL | Center (12 o'clock) Position |
| DUPLEX (SPLIT) SWITCH | OFF (OUT) |
| PREAMP/ATT SWITCH | OFF |

The other controls are unrelated and need not be set for this operation.

Now push the POWER switch in. The meter lamp will be illuminated and after a few seconds a frequency, mode and HAM/GENERAL mode memorized in the VFO A and memory channel number "01" will be shown on the frequency display.

If the operation mode is in the HAM band mode (The letters "GENE" are not displayed.), push the HAM/GENERAL COVER SELECT switch, and the letters "GENE" will be displayed on the frequency display and the set will work in the GENERAL COVERAGE mode.

In SSB operation there are both a USB (upper side band) and an LSB (lower side band). USB is selected on the 10MHz band and above, and LSB on the 9MHz band and below, by pushing the MODE SELECT switch SSB. When you wish to operate on the opposite sideband, push the FUNCTION KEY first, then the SSB switch.

However, the selected mode does not change on the entire band. For example, LSB has been selected on 8MHz band then the operating band is changed to 10MHz band or above, the operating mode, "LSB", will be kept.

When you wish to operate on a band other than the initialized band, push the BAND SELECT FUNCTION switch, then turn the TUNING CONTROL to select the band you wish to operate. Slowly turn the AF GAIN control clockwise to a comfortable level. After releasing the BAND SELECT FUNCTION switch, rotate the TUNING CONTROL until a signal is received.

The multi-function meter needle will move according to the signal strength, so tune for the highest possible meter reading and the clearest audio.

Refer to 3 - 5 - 2 ~ 7 for other functions, 3 - 6 - 1 for CW reception, 3 - 7 - 1 for RTTY reception, 3 - 8 - 1 for AM reception and 3 - 9 - 1 for FM reception.

3 - 11 OTHER OPERATIONS

3 - 11 - 1 VSWR READING

The IC-751 has a built-in VSWR meter for checking antenna matching in order to avoid problems caused by VSWR. Set the METER switch to the Po position. Set the operating mode to RTTY, and place the TRANSMIT/RECEIVE switch to TRANSMIT.

Adjust the RF POWER control located on the front panel so that the meter needle points to "SET" on the meter scale. Set the METER switch to the SWR position. With the switch in the SWR position, SWR reading can be seen on the meter. Although this unit is built to handle VSWR of up to 2:1, it is recommended that the antenna(s) be adjusted for the lowest possible VSWR. After taking the reading, return the METER switch to the Po position. ALSO BE SURE THAT THE ANTENNA IMPEDANCE IS 50 OHMS OR THERE MAY NOT BE ANY OUTPUT. OTHERWISE THERE WILL BE DAMAGE TO THE TRANSCEIVER.

The final transistors used in the IC-751 are of good design and are protected to a reasonable extent by circuits incorporated in the set. These devices can be expected to have an indefinite lifetime since there are no cathodes to burn out.

When in doubt about antenna systems, use the lowest power setting possible to achieve meaningful readings. Use a good tuner or transmatch when necessary. Always use caution and exercise judgement when testing RF power generators.

3 - 11 - 2 WWV RECEPTION

To receive WWV (or other standard frequency station), set the operating band to 10MHz in the HAM band mode or GENERAL COVERAGE mode, and the MODE to any mode. Tune to 10.000.0MHz on the frequency display.

Since the IC-751 has a General Coverage receiver built-in, any frequency's WWV can be received. Merely set to the GENERAL COVERAGE mode and tune to the desired frequency.

The WWV signal can be used for alignment of a frequency counter, marker oscillator, or the frequency display.

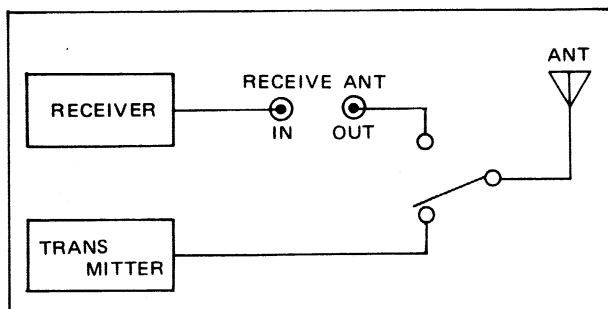
3 - 11 - 3 SIMPLE FREQUENCY ALIGNMENT

A very accurate frequency counter is necessary to align the frequency of the IC-751. However, the frequency can be aligned simply by receiving the WWV signal.

1. Set the frequency display to 10.000.0MHz (or other standard frequency you can receive clearly) in the GENERAL COVERAGE mode and the operating mode to AM, then make sure that you are receiving the WWV signal.
2. Turn ON the MARKER switch on the top.
3. Since a beat tone will be heard, adjust the MARKER CALIBRATOR on the top so that the beat tone becomes zero beat (When the standard frequency signal is modulated with a single audio tone, it makes more easily.).
4. This calibrates the reference oscillator frequency, so it is not necessary to calibrate on any other frequency, even if the operating band is different.
5. Turn OFF the MARKER switch.

3-11-4 RECEIVE ANTENNA TERMINALS

The RECEIVE ANT IN jack is connected to the input terminal of the receiving section, and the RECEIVE ANT OUT jack is connected to the antenna connector through the internal T/R antenna switching circuit.



These two jacks are normally jumpered with a cable, but can be used for:

1. A receiving preamplifier.
2. A separate receiver.
3. Separate receiver and transmitter antennas.

If you wish to use a receiver preamplifier, connect it between the receiver input and antenna output terminals.

If a separate receiver is used, connect it to the receiver antenna output terminal. For a separate receive antenna connect it to the receiver input terminal.

3-11-5 TRANSVERTER CONNECTION

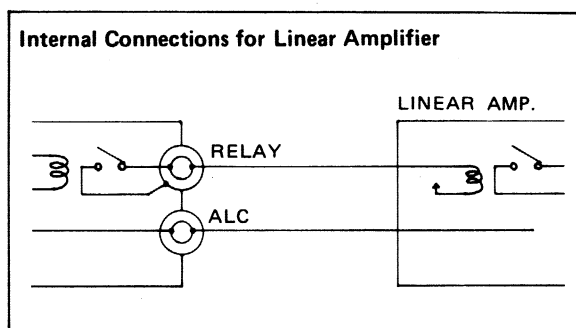
When a transverter control signal (+8V) is applied to Pin 11 of the ACCESSORY socket, the TRANSVERTER terminal can be used for a VHF/UHF transverter INPUT/OUTPUT terminal.

The transverter's input/output frequency and signal level should be as follows:

- Transverter INPUT/OUTPUT Frequency
28 ~ 30MHz
- Input/Output Level
Transmit (Output) : Max. 30mV across a 50 ohm load
Receive (Input) : 1 μ V for S/N 10dB

3-11-6 LINEAR AMPLIFIER CONNECTION

The jacks on the rear panel marked "RELAY" and "ALC" are a relay built-in for keying a linear amplifier and the input for ALC from the linear amplifier. For linear amplifier hookup the RELAY jack is for an internal relay and the ALC jack is for ALC input. The capacity of the relay is DC 24V 1A. Do not exceed this limit.



The optional linear amplifier IC-2KL and automatic antenna tuner IC-AT100/AT500 can be connected to the IC-751 with their accessory cables as same as other ICOM HF transceivers. Refer to their instruction manuals for detail.

The IC-751 puts out the band control voltage to change operating band automatically for external equipment such as a linear amplifier and antenna tuner. The voltage is put out from Pin 13 of the accessory socket.

Band Control Voltage Chart

| BAND (MHz) | Band Control Voltage |
|------------|----------------------|
| 1.8 | 7.0 ~ 8.0V |
| 3.5 | 6.0 ~ 6.5V |
| 7 | 5.0 ~ 5.5V |
| 14 | 4.0 ~ 4.5V |
| 18 - 21 | 3.0 ~ 3.5V |
| 24 - 28 | 2.0 ~ 2.5V |
| 10 | 0 ~ 1.2V |

3-11-7 COOLING FAN

The rear of the PA unit is designed to provide for adequate cooling, but with 200 Watts input the final stage produces quite a bit of heat, and its temperature may rise during prolonged transmissions. The fan is connected to a temperature monitoring circuit which monitors the temperature of the final stage. The fan operates as follows:

1. The fan does not operate both in the receive and transmit modes.

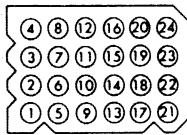
2. When the temperature rises to a point (50°C) detected by the monitor circuit the fan will operate during both transmit and receive to provide additional cooling.
3. If the temperature rises to a danger limit (90°C) the fan will run much more rapidly. Investigate the cause of overheating i.e. antenna mismatch, etc. and correct the cause of the overheating before starting to transmit again.

Ground all measuring instruments, the soldering iron, and other tools. Do not connect or disconnect the C-MOS IC from its socket, or solder it when the power is on. Do not apply voltage of less than -0.5 or more than +5 Volts to the input terminals of the IC. DO NOT MEASURE WITH AN OHMMETER.

3 - 11 - 8 ACCESSORY (ACC) SOCKET ET

Various functions are available through the accessory socket such as modulation output, receiver output, T/R change-over, and so forth. The table below shows those terminals.

ACC SOCKET CONNECTIONS



Outside view

| PIN No. | FUNCTION |
|---------|---|
| 1. | Output from the squelch control stage. (+8V when the squelch is ON) |
| 2. | 13.8 Volts DC in conjunction with the power switch operation. |
| 3. | Connected to Push-to-talk, T/R change-over switch. When grounded, the set operates in the transmit mode. |
| 4. | Output from the receive detector stage. Fixed output regardless of AF output or AF gain. |
| 5. | Output from Transmitter MIC amplifier stage. (Input for MIC gain control stage.) |
| 6. | 8 Volts DC available when transmitting. (relay can not be directly actuated. Max. 5mA). |
| 7. | Input for external ALC voltage. |
| 8. | Ground |
| 9. | Input for RTTY keying (MARK: HIGH level, SPACE: LOW level: This can be reversed by the internal switch.). |
| 10. | NC (No Connection) |
| 11. | Input for TRANSVERTER control. When 8 Volts DC is applied, the set can operate with a transverter. |
| 12. | Output reference voltage for band switching. |
| 13. | Output for external band switching. |
| 14.~24. | NC |

3 - 11 - 9 CAUTIONS

As the unit has already been closely adjusted with highly sophisticated measuring instruments, never tamper with the turnable resistors, coils, trimmers, etc.

C-MOS is used in the Logic unit as well as the PLL. C-MOS ICs are very susceptible to excessive static charges and over current and care must be used when handling them. Therefore, avoid touching the Logic unit and the nearby circuitry unless absolutely necessary. When it is necessary to check the circuitry, observe the following points.

SECTION 4 CIRCUIT DESCRIPTION

4-1 RECEIVER CIRCUITS

4-1-1 RF CIRCUITS(CONNECTOR/RF UNITS)

Receiving signal from the antenna connector is fed to J10 of the RF unit in the receiver circuit when D4 is turned off and RL1 is turned on.

For full break-in operation, a reed relay is used for RL1 to provide less than 1 millisecond T/R switching time, compared to more than 12 milliseconds with a regular relay.

The incoming signal to the RF unit passes through an L-type attenuator, consisting of R92 and R93, for 20dB attenuation, when the PREAMP/ATT switch is set at the ATT position.

Depending on the receiving frequency range, the incoming signal is fed to one of three different circuits.

- (1) 100 ~ 500KHz : Signal is fed to a low-pass filter by D44.
- (2) 500 ~ 1600KHz : To attenuate strong signals from AM broadcasting stations, signal is fed to a 10dB attenuator, and then to a low-pass filter.
- (3) Above 1.6MHz : signal is fed by D47 to a high-pass filter, consisting of L101, L102, and C180-C182, which attenuate strong radio signals on the BC band, and then to one of the nine band pass filters for various frequency ranges.

The filtered signal is fed to an L-type attenuator, consisting of R28 and PIN diodes D10 and D11, controlled by AGC bias voltage from Q3-Q5. When the AGC functions according to the receiving signals, the emitter voltage of Q4 is lowered accordingly, and then the decrease in the current flow of D11 makes the resistance higher. This turns on Q3 to let a current flow through D10 for lower resistance. This operation provides variable attenuation up to 40dB.

When the PREAMP/ATT switch is at the PRE position, the signal from the attenuator is fed to a broad-band amplifier consisting of Q6 and Q7, of which the gain is approximately 8 to 10dB and the intercept point is about +22dBm. If the PREAMP/ATT switch is at OFF or ATT, the signal bypasses the amplifier.

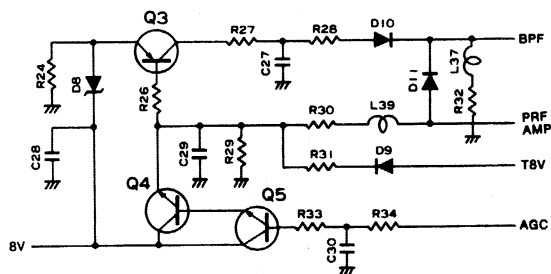
Signal is fed through one of the two filters depending on if the frequency is above or below 1.6MHz, and to a low-pass filter, which improves the image rejection characteristics of the receiver and reduces the spurious emission of the local oscillator from the antenna connector.

The signal is then fed to the receiver first mixer through the T/R switching diode D20.

The BPF switching voltage is obtained with IC1 and IC2 by decoding the band signals B1-B11 from the LOGIC unit.

The on/off switching voltage is provided by IC2. R13V is provided from the OR gate consisting of D5 and D6. The attack time of this control voltage is determined by R9, C8,

L-type Attenuator Circuit



R10 and C9. The immediate release is provided by D1 and D2 when switching to the transmit mode.

4-1-2 IF CIRCUITS

1. RF UNIT

Q9 and Q10 comprise a double-balanced mixer, using low-noise transistor 2SK125's and driven with 13.8V to provide an excellent noise figure, and convert the incoming signal to the 70.4515MHz first IF signal.

The first 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 applied to the first mixer as its local oscillator signal (70.5515~100.4515MHz). R18, L13, and C14 are for feedback to improve the frequency characteristics of Q2.

The first IF signal is filtered by a monolithic crystal filter F11 ($\pm 7.5\text{KHz}/-3\text{dB}$) and then amplified by a dual-gate FET Q8, of which the second gate is controlled by the AGC voltage.

The signal is fed through T/R switching diode D19 and a high-pass filter to the second IF mixer of IC3 double balanced mixer, where the signal is converted to the 9.0115 MHz second IF signal. Then signal is filtered to remove the local oscillation components by a low-pass filter, and then fed to the MAIN unit through P3.

The second LO signal (61.44MHz) from the PLL unit is fed to IC3 as the local oscillator signal for the second mixer.

2. MAIN UNIT

The 9.0115MHz 2nd IF signal from J13 passes through noise blanker gates D42-D45 and an amplifier Q14, after which it is fed through a filter select switching circuit to the 9MHz IF filter.

The filtered signal through D60 is amplified by Q19 and fed to 3rd mixer Q24 by D61.

A 9.4665MHz ($\pm\text{SHIFT}$ frequency) signal is supplied as the local oscillator signal from Q26 to the 2nd gate of Q24 to obtain the 455kHz 3rd IF signal. In FM mode, the signal is fed to the FM unit through C43 by D33, and in other

modes, the signal is fed to balanced mixer IC1.

One of the two different frequency signals is supplied to IC1 as its local oscillator depending on whether in the transmit or receive mode. An 805kHz signal is supplied to obtain a 350kHz 4th IF signal in the receive mode. The signal through a tuning circuit of L14, C103 and L15 is fed to the notch filter circuit.

The T-type notch filter, consisting of X6, C107, C108, R222 and R390, provides as much as 60dB rejection by adjusting R222. To turn off the notch filter, X6 is shunted by Q34. The filtered signal is amplified by Q35 and Q36, and fed to a detector through L17.

(a) NOISE BLANKER CIRCUIT

To provide both high sensitivity and wide dynamic range, a dual-gate MOS FET is used for the noise amplifier (Q7) and a dual-transistor for a differential amplifier (Q8).

Both Q7 and Q8 are AGC-controlled to provide stable noise-blanking operation for an extremely wide level of noise. To cope with pulse-type noise in particular, the attack time and release time for the noise blanker AGC are longer than conventional, and the noise amplifier operates for a wide dynamic range of more than 100dB without saturation.

The noise signal from Q9 is rectified by D17 and D18, and fed to Q11 to control the noise blanker AGC line to make the mean level of the noise amplifier output constant for sufficient time constant to deal with "woodpecker noise."

The rectified noise signal from D17 and D18 is fed also to the base of Q10. When a pulse-type noise with a higher voltage than the voltage of VBE+VE of Q10 comes in, Q10 is turned on and 8V appears at the collector of Q12. The blanking level is determined by setting the NB LEVEL control on the front panel, thus changing the emitter voltage of Q10 and adjusting the comparative voltage for Q10. Q13 controls the blanking time. The NB timing switch is set at the NARROW position, the maximum blanking time is set at about 1 millisecond, and at the WIDE position, it is set at 5 milliseconds. Thus, minimizing the amount of received signal to be blanked and reducing the distortion of the received audio when the noise blanker is used. Furthermore, the noise blanking gate uses a balanced gate with very high isolation performance.

(b) FILTER SELECT CIRCUIT

Transistors Q15, Q16, Q17 and Q18 constitute circuits

to provide switching voltages for the 9MHz and 455kHz filters, corresponding to the mode selection and the filter switch selection on the front panel.

The 9MHz filters are not changed by the filter switch for AM and FM. For other modes, either the FL-30 or the FL-32 (or a user's optional filter) is selected.

For the 455kHz filter in the AM mode, the filter switch selects either CFW4551T dedicated to AM or the narrow band filter. Since the narrow band filter uses a filter designed for SSB, excellent selectivity performance is obtained.

For the narrow mode of CW and RTTY, the optional CW filter (FL-52A or FL-53A) is selected regardless of the selection by the filter switch, and the PBT control operates as the IF shift control. For the FM mode, the filter switch does not function.

Note that, for the position of 9MHz FL-32, a user can install a wideband filter for SSB (FL-70, 2.8kHz/-6dB), a filter for AM (FL-33, 6kHz/-6dB), or a narrow band filter for CW (FL-63, 250Hz/-6dB) if desired. In the case of FL-33, the jumper wire next to Q18 on the main board has to be cut so that the filter switch can function. Moreover, in the case of FL-32 or FL-63, there may be a case, depending on the position of the PBT control, where pass band does not exist for the narrow mode of CW or RTTY if the filter is selected, so that the available range of the PBT control on the front panel is restricted to the central part.

When the high performance 455kHz filter (FL-44A) is to be used, resistors R203 and R189 have to be cut; otherwise, two filters would be connected in parallel and normal operation would not be possible. Figure 1 shows the signal flow paths of this transceiver for each mode.

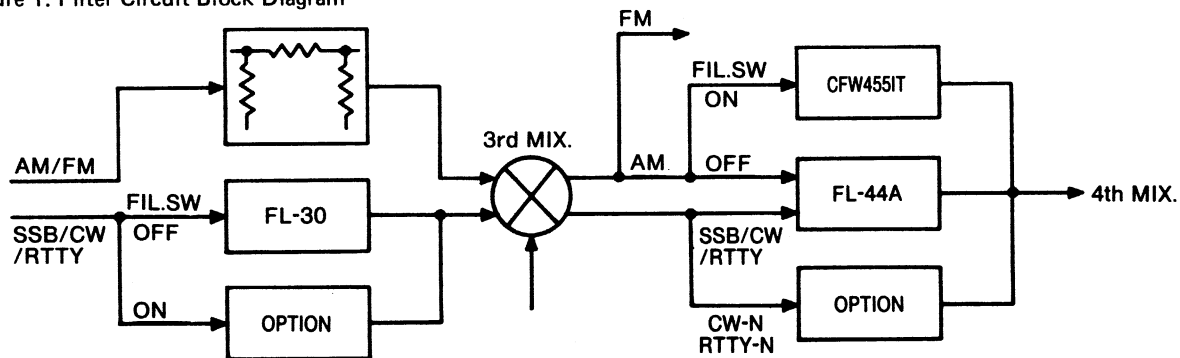
3. FM UNIT

The received FM signal of 455kHz coming through Pin 1 and Pin 2 of P2 is passed through the ceramic filter F11 to enhance the selectivity. The signal is then amplified about 50 to 60 dB in the IF amplifiers of Q4-Q6, and about 20dB more by Q3. The signal is then input to the limiter IC3.

The limited signal is detected by the discriminator composed of X2, D3, D4, R31 and R32, and is passed through the de-emphasis filter consisting of R27 and C19. The signal is amplified by the low noise amplifier Q2 and output to the AF attenuator, IC6 of the MAIN unit through P3.

Diodes D5-D8 are provided for the S-meter circuit around Q3. When the rectified output appears at D5 and

Figure 1. Filter Circuit Block Diagram



| | Type | Description | Center Frequency | Band width | | Insertion Loss |
|----------|----------|-----------------------|------------------|------------|---------------|----------------|
| | | | | at -6dB | at -60dB | |
| Standard | FL-30 | SSB Filter | 9.0115MHz | 2.3KHz | 4.2KHz | 6dB |
| | FL-44A | High grade SSB Filter | 455KHz | 2.4KHz | 4.0KHz | 6dB |
| | CFW455IT | AM Ceramic Filter | 455KHz | 6KHz | 15KHz (-50dB) | 7dB |
| Option | FL-52A | CW Narrow Filter | 455KHz | 500Hz | 1.0KHz | 6dB |
| | FL-53A | CW Narrow Filter | 455KHz | 250Hz | 0.48KHz | 6dB |
| | FL-32 | CW Narrow Filter | 9.0106MHz | 500Hz | 1.6KHz | 8dB |
| | FL-63 | CW Narrow Filter | 9.0106MHz | 250Hz | 1.1KHz | 12dB |
| | FL-33 | AM Wide Filter | 9.0100MHz | 6KHz | 20KHz | 6dB |
| | FL-70 | SSB Wide Filter | 9.0115MHz | 2.8KHz | 5KHz | 6dB |

D6, the S-meter starts moving. This threshold is upon the gain of Q3 adjusted by R40. The output of D7 and D8 is detected for the reception of strong signals to provide a wider dynamic range.

Q10 is provided so that the AGC is not applied in the FM mode by creating a shunt for the AGC circuit.

The detected signal is passed through the SQUELCH control and led to this unit. Only the noise components of the incoming signal whose frequency is higher than voice frequency is amplified by Q7, and rectified by D9 and D10. The rectified signal switches Q9 which then turns on/off the squelch control circuit on the MAIN unit.

4-1-3 AF CIRCUITS (MAIN UNIT)

The 4th IF signal is fed to the AM detector circuit through C235, to the SSB/CW detector circuit through C217, and to the AGC detector circuit through the secondary coil of L17.

The SSB, CW, or RTTY signal is fed through C217 to IC5, in which the signal is mixed with BFO signal for detection.

The AM signal is fed through C235 to D105 for detection, and then amplified by Q49. Detected signal from IC5 or D105/Q49 is fed to IC6A. The detected signal from FM unit is also fed to IC6A through J15. IC5 functions in all modes but AM; however no signal is output in the FM mode due to no input signal from the IF circuit.

A portion of these detector outputs, after being picked up by C228 and amplified by Q50, appears at the accessory connector on the rear panel.

IC6A is an electronic controlled volume control which is DC controlled by Q51 and allows about 80dB audio volume control by changing the applied voltage from 0V to 4V. Audio tone control is provided using the frequency compensation terminal of this IC. The output from IC6A is fed to the AF power amplifier IC9 through the squelch gate explained below to provide sufficient power to drive a speaker.

1. AGC and SQUELCH CIRCUITS

The IF signal passed through L17 is rectified by D78 and

the output drives Q37, which draws down its collector voltage to a negative level according to the incoming signal level. Since the cathode of D79 is normally given an 8V bias voltage through D77, the transistor Q40 is turned off. The cathode voltage of D79 drops due to the signal through R125. If the cathode voltage becomes lower than 4V, the emitter voltage of Q40 is reduced, i.e., the AGC line voltage is reduced, so that the gain of each amplifier applied the AGC voltage is decreased to maintain a constant output level. Capacitors C52, C53 and C54 are provided to hold the AGC voltage, each amplifier of which has a series resistor to get an optimum attacking time. The AGC is turned off by applying 8V through D76 and turning off the AGC buffer Q40. At this time, the time constant circuit is removed from the AGC control circuit.

To prevent time delay due to the time constant of the AGC when the RF GAIN control is rotated, Q41 is provided in parallel with Q40 to allow the RF gain to be set immediately.

The AGC voltage is discharged through R234 while receiving. While transmitting in the full break-in mode, in addition, D77 is provided to hold the AGC voltage of the receiving mode.

A voltage of about 8 volts stabilized by D38 is applied through R116 to the AGC line when no signal is received.

The variation of the AGC voltage is DC amplified by IC10A to drive the S-meter. A portion of the voltage to drive the S-meter is compared with the squelch voltage by IC10B and amplified to drive Q42 and turn on/off the gate of IC7D.

A bipolar digital IC is used for the squelch gate. Since the resistance of this IC when turned on is negligibly small, i.e., the forward resistance is negligible, and the resistance when turned off is greater than 10 meg ohms, this squelch circuit is free from signal leakage, and high performance is guaranteed.

4-2 TRANSMITTER CIRCUITS

4-2-1 AF CIRCUITS

1. MAIN UNIT

AF signal from the mic connector is fed through the MIC GAIN control and J7 to Q47 on the MAIN unit, where the signal is amplified about 30dB by Q47. After the current is amplified by Q65, this signal is fed to IC4 through R371 for modulation. C165 and R267 connected to the base of Q65 are for controlling the transmitting audio tone, and allow the treble portion of the voice to be varied by about 15dB.

IC4 is a double balanced mixer which provides more than 60dB of carrier suppression by adjusting both R270 and R273. It operates as a sufficiently balanced mixer for SSB. However, an offset voltage is given to the modulating AF line for the AM mode so that the carrier level is controlled by adjusting the offset voltage.

(a) VOX CIRCUIT

Mic input level is adjusted by the VOX GAIN control and fed through J3 to IC11B, where signal is amplified about 60dB, and the output is rectified by D95 and charges C195.

A portion of output signal from the AF power amplifier through the ANTI VOX GAIN control is amplified by VOX amplifier IC11A and R284, C188 and R292 allow the anti-VOX level to vary with respect to the mean level.

IC12 is a comparator to compare the output voltages of VOX and ANTI VOX amplifiers. At no signal, the ANTI VOX output voltage becomes higher than the other and the level of the IC12 Pin 1 becomes low. While both of the signals from the mic and AF amplifier vary, when the voltage at Pin 3 (VOX) of IC12 becomes higher than that of Pin 2 (ANTI VOX), Pin 1 becomes high level to turn Q54 on. When the VOX switch is on, the SEND line becomes grounded for transmit mode.

For CW transmission, keying signals pass through the buffer Q53 and D97 to key the carrier, passing through D98 and charging C196 and C197 to enter the same comparator as the VOX voltages. In the full break-in operation, C197 is opened to respond to high-speed keying. In this case, there is only C196 which is to prevent chattering for high speed keying.

2. FM UNIT

The audio signal input from J1 is filtered by the differentiating circuit composed of R56 and C39 for pre-emphasis (6dB/oct). The signal is then applied to the limiter amplifier IC1 which reduces splatter by limiting the frequency deviation.

The output from this IDC circuit is applied to the anode of D1 and the signal oscillated by Q1 is frequency modulated.

The frequency modulated output from Q1 is passed through the limiter amplifier IC2 to eliminate the residual AM components. Then, the FM signal is selected by RL1 with the signals of CW, SSB, and RTTY coming from the

MAIN unit, and is output to the MAIN unit through J4.

4-2-2 IF CIRCUITS

1. MAIN UNIT

The DSB signal output from balanced modulator IC4 passes through a 9MHz filter, to remove a side band for SSB signal, and fed to an amplifier Q20 through D106.

Q20 operates also as a compressor amplifier. When the COMP switch is at off, the 2nd gate of Q20 is about 1V to set the gain of the amplifier at 0dB to keep the level below the clipping level of the diode clipper D63 and D64.

When the COMP switch is at on, T8V is applied through D108 and the 2nd gate voltage becomes about 4V to increase the gain of Q20 to 20-25dB for efficient clipping by D63 and D64. Meanwhile, C92 is grounded by Q23 to reduce the output level, and the signal is output to Q24 through D62.

A portion of the SSB signal led by D106 is amplified by Q21, rectified by D65 and D66, and DC amplified by Q24 to drive the compressor meter.

The output signal of Q20 is mixed with the 9.4665MHz local oscillator signal at Q24 to convert to a 455kHz signal, and fed to the double balanced mixer IC1 through F14 crystal filter.

The signal is converted back to 9.0115MHz by mixing with 9.4665MHz local oscillator and fed through D71 and D3 to the crystal filter F11.

In CW or RTTY mode, the carrier signal is applied through D2. In FM mode, the FM signal is fed from J4 of the FM unit through D1.

F11 removes unwanted signals and feeds its output signal to the transmit amplifier Q1, where the ALC signal is also applied. A portion of the drain output signal is sampled through C4 for the monitor operation. The output signal passes through the impedance transformer L1 and is fed through J13 to the RF unit.

(a) CW and RTTY CARRIER OSCILLATOR CIRCUIT

Q2 and Q3 are provided for oscillating the transmitting carrier. For CW and the mark signal of RTTY, a frequency which is adjusted by L3 (9.0106MHz) is oscillated. For the space signal of RTTY, the wide shift, 850Hz, or the narrow shift, 170Hz, space carrier which is adjusted by L4 or L5, respectively, is oscillated. The wide or narrow shift is selected by S2. In addition, by tuning the coil, it is possible to oscillate a 425Hz shift which is sometimes used. Note that switching S1 allows this transceiver to accommodate correct reception by an RTTY terminal unit which outputs marks and spaces reversed.

(b) TRANSMIT MONITOR CIRCUIT

The transmission monitor circuit, on the other hand, is not simply a modulation monitor but a monitor which gets the signal from the stage where ALC is applied, allowing accurate monitoring. After a portion of the transmitting signal is amplified by Q64, it is detected by IC8 and fed to pin 8 of the volume control IC6B, of which pin 6 is controlled by the MONITOR control, for controlling the monitor gain.

IC7C provides four switching circuits, two are used for the squelch and monitor circuits and two for the meter switching circuit. The MONITOR switch turns IC7C on/off to drive the output signal of IC6B to IC9 AF power amplifier so that no load variation occurs at the transmit output line.

(c) ALC and METERING CIRCUITS

The forward (FOR) and reflect (REF) voltages detected by the filter unit are amplified by IC13 and drive the multi-function meter as Po voltage and SWR voltage, respectively. A portion of the FOR voltage is input to IC14B and compared with the voltage of Pin 3 to generate the ALC voltage. Since the voltage of Pin 3 can be adjusted by rotating the RF POWER control on the front panel, the power can be easily controlled.

For the Ic meter, the voltage across R20 (0.012 ohms), of the PA unit is detected using the differential amplifier IC15B.

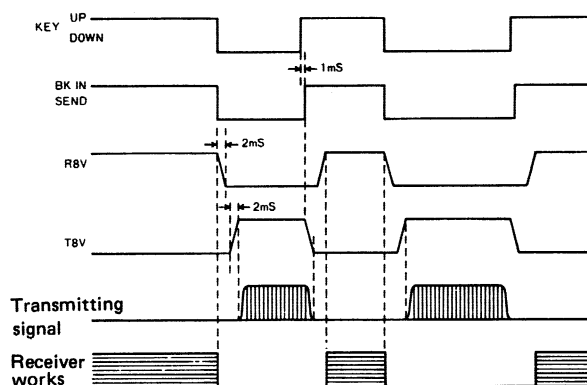
IC14A is provided for detecting signals for the automatic power control (APC), which detects a high SWR state from the output of IC13B and excessive collector current of the PA from the output of IC15B so as to output an appropriate negative voltage to the ALC line for reducing output RF power. The APC for high SWR starts to function when VSWR is about 2 or more. It is noted, however, that within the allowable rating of the transistors corresponding to the cases where output power is reduced, etc, the APC need not function even for a high SWR level and so the APC is designed not to operate for these cases.

The ALC voltage is obtained through R31 and amplified by the inverted amplifier to drive the meter.

(d) POWER SUPPLY CIRCUIT

To respond to break-in operation, accurate transmit/receive change-over timing is required for this transceiver. Transistors Q55 through Q61 form the conventional clamping-type voltage regulator where the timing control circuit is added and operate according to the timing chart shown in Fig. 2. As for the control of the SEND terminal, a voltage lower than 0.8V applied to the terminal sets the transceiver in the transmit mode and a voltage higher than 2V in the receive mode. The short circuit current of the SEND terminal is less than 2mA, allowing a TTL directly connected to the terminal to control the transceiver. Since all the circuits must start operation only after the transmitting and the receiving circuits have been switched, it is necessary to set all the rise times and the fall times of voltage sufficiently short and, moreover, to make them less sensitive to the variations of the load. This transceiver is designed so that sufficient current flows through the bases of Q61 and Q59, and D101 and D103 are provided for voltage clamping as well as temperature compensation to supply a constant voltage for the three-terminal regulator IC16. Transistors Q60 and Q58 are provided for switching. When transmitting, Q60 reduces the base voltage of Q61 and immediately discharges the line voltage of R8V to be less than 0.6V through D100 at the same time. When receiving, on the other hand, Q58 and D102 do the same operation.

Fig. 2 Timing chart for full break-in operation



2. RF UNIT

The 9.0115MHz IF signal from the MAIN unit is passed through the LPF and converted to the 70.4515MHz IF signal by the diode double balanced mixer IC3.

The output from the mixer is passed through the HPF to eliminate the 9.0115MHz component. The serial resonant circuit composed of L30 and C67 also eliminates the 61.44MHz second LO component from the output. The signal is then passed through the T/R switching diode D22 and amplified by the dual-gate FET Q11. The ALC voltage is applied to the first gate of Q11.

The amplified signal is fed through a double-tuned filter composed of L32, C77 and L33, to eliminate spurious components, and then fed to a transmit mixer of Q12 and Q13. This mixer is a balanced mixer with superior low spurious performance. In order to improve the spurious performance, the local oscillator signal is injected to the second gates with a DC bias voltage. The frequency of the local oscillator ranges from 70.5515 to 100.4515MHz which converts the IF signal to the desired frequency of 0.1-30MHz.

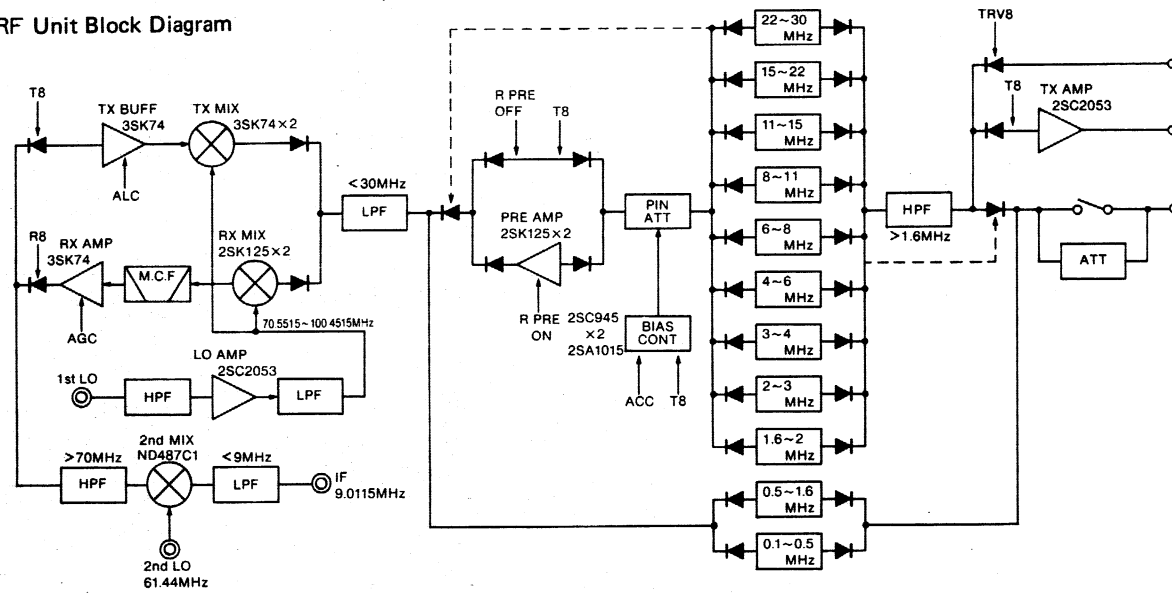
The converted signal is passed through the LPF to eliminate the local oscillator component and fed to the attenuator circuit composed of pin diodes through the receiver preamplifier bypassing circuit composed of D12 and D13. This circuit is given a bias voltage by D9 in the transmit mode so that it passes the signal. Then, the signal is passed through one of the nine BPFs which are selected by a voltage from the LOGIC unit to eliminate spurious components and then passed through the HPF.

Diode D47 is turned on in the receive mode, but it is turned off in the transmit mode since Q16 is turned on and Q18 is turned off to reversally bias the diode. Transistors Q16 and Q18 are the BPF switching transistors which also control diodes D26, D28, D30, D32, D34, D36, D38 and D40. Note that a current flows through L99 and L100.

In the transmit mode, D45 is turned on and the signal is wideband-amplified about 20dB by Q14 and output to the PA unit through J8. C171 and R86 are provided to compensate the frequency characteristics.

When a transverter is used, D46 is turned on to allow

RF Unit Block Diagram



input a converted receive signal to the transceiver, or output a low level transmit signal from the transceiver through the TRANSVERTER terminal.

Transistors Q15 and Q17 prevent the transmitted signal from re-entering through J9 and J10. Transistors with a low saturation voltage between the collector and emitter are used for this circuit.

4-2-3 RF CIRCUITS

1. PA UNIT

The RF signal input from the RF unit through P1 is amplified by the class A amplifier Q1. The output from Q1 is converted to a balanced output by L1 and amplified by the class AB push-pull amplifier Q2 and Q3. The negative feedback circuits inserted between the collector and the base of Q2 and Q3 provides 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 is to prevent the adjusting point from deviating due to variations of D1 characteristics.

The output of Q2 and Q3 is fed to the impedance matching section L4 and amplified by the class AB push-pull amplifier Q4 and Q5 to provide 100 watts output power.

A portion of the output power from Q4 and Q5 is applied to the bases of these transistors through the negative feedback transformer L9 to provide stability and broadband characteristics over the frequency range from 1.8MHz to 30MHz. R23 is provided to adjust the idling current and set so that the current is 600mA.

The output from Q4 and Q5 is then led to L10 for impedance conversion and output to the FILTER unit from P2.

Thermal switches S1 and S2 detect the temperature of the package of Q4 and Q5, and control the cooling fan and the output power reduction.

If the temperature increases in the transmit mode, S2 is turned on around 50 deg. C and the cooling fan starts to rotate. The fan continues to rotate even after the mode is switched to the receive mode, until the temperature decreases to below 50 deg. C. But the rotation during this receiving period is a little slower than that of the transmitting period.

Switch S1 is turned on if the temperature becomes more than about 90 deg. C due to the air temperature rise or the increase of Ic arising from antenna mismatching, etc. The fan rotation speed increases if S1 is turned on. At the same time, this switch sends a signal to the MAIN unit through R26 to reduce the transmit power to 50 watts. This power reduction prevents Q4 and Q5 from heat breakdown due to the excessive temperature rise.

| temperature (°C) | | ~ 50 | 50 ~ 90 | 90 ~ |
|------------------------|----------|------|----------|------|
| thermal switch | S1 | off | off | on |
| | S2 | off | on | on |
| cooling fan speed | receive | off | low | mid |
| | transmit | off | mid high | high |
| transmit power (Watts) | | 100 | 100 | 50 |

2. FILTER/CONNECTOR UNIT

The RF output of the PA unit is fed to J1 of the FILTER unit to eliminate harmonic components. The filtered output signal passes through the SWR detecting transformer L18 to the connector unit through P2.

The forward wave component detected by L18 is rectified by D1, filtered by C38, divided by R2 and R4, and fed to J7 of the MAIN unit. The reflected wave component also detected by L18 is rectified by D2, processed by C39, R3 and R5 in the same way, and sent also to the MAIN unit.

The RF output fed to the connector unit passes through diode switch D4 to the antenna connector J11.

4.3 PLL UNIT

The PLL unit outputs two oscillator signals for the RF unit, i.e., the variable first local oscillator output (1st LO) of 70.55-100.45MHz necessary for the first mixer, and the fixed local oscillator output (2nd LO) of 61.44MHz necessary for the second mixer. In addition, the marker signal is also generated in this unit and 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 the signals generated in the PLL unit can be calibrated simply by adjusting the reference frequency oscillator.

4.3-1 REFERENCE FREQUENCY OSCILLATOR AND MARKER CIRCUITS

The frequency of the reference frequency oscillator Q10

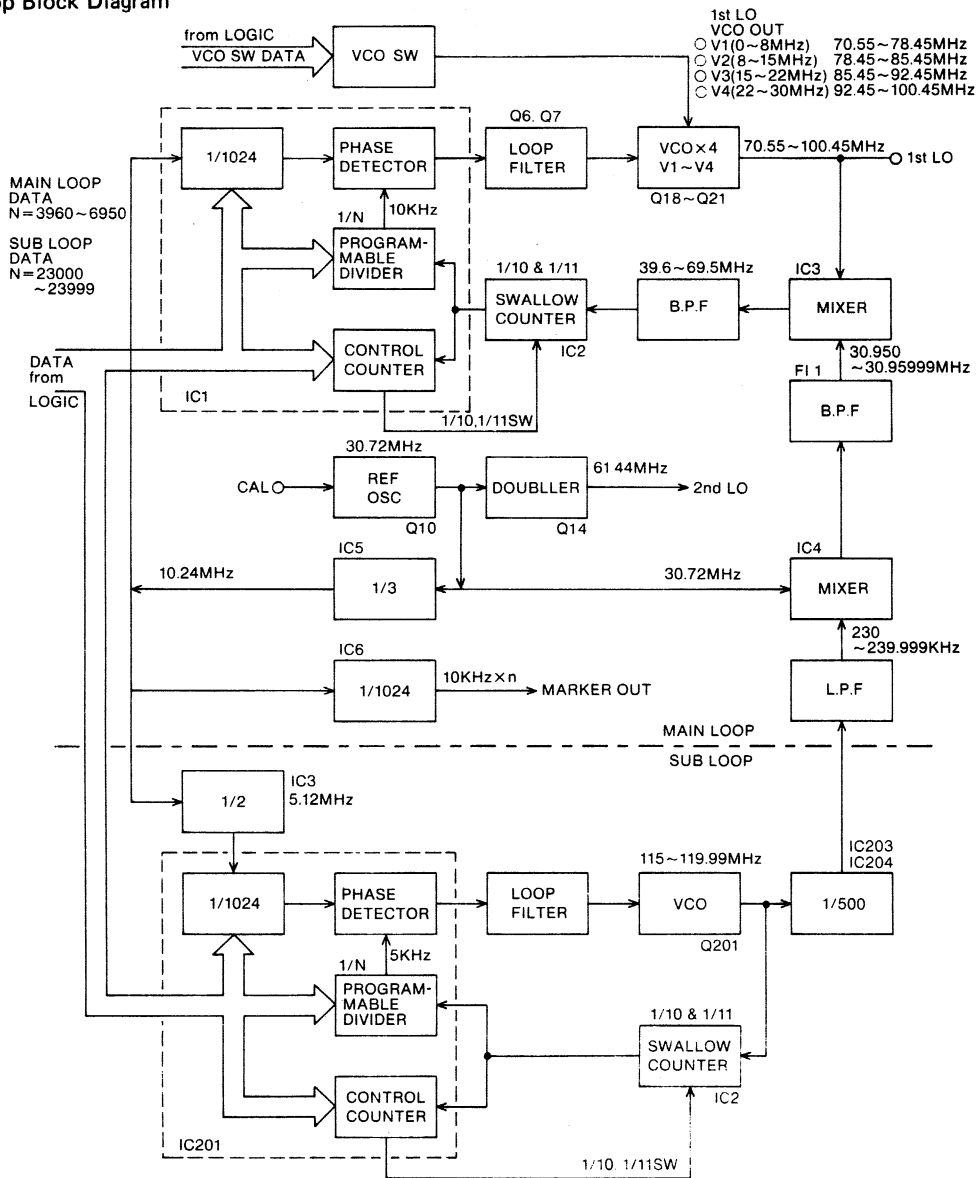
is the base of all the frequencies of the signals in the PLL unit so that it must be sufficiently stabilized. Therefore, C3, C6 and C8 are provided for temperature compensation, and the regulator output voltage of 8 volts is further stabilized by the 5V Zener diode.

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

In order to provide the 2nd LO output, the reference frequency oscillator output is doubled and amplified by Q14, and the spurious is sufficiently reduced by L3, L4 and L5. The output signal (about 3dBm/50ohms) is fed to the RF unit from J5. In addition, the mute signal is applied to this stage when the PLL is unlocked.

In order to obtain the reference signal (10kHz) for the main loop, IC5 divides the reference frequency oscillator signal by three and applies a 10.24MHz signal to IC1. For

PLL Sub-loop Block Diagram

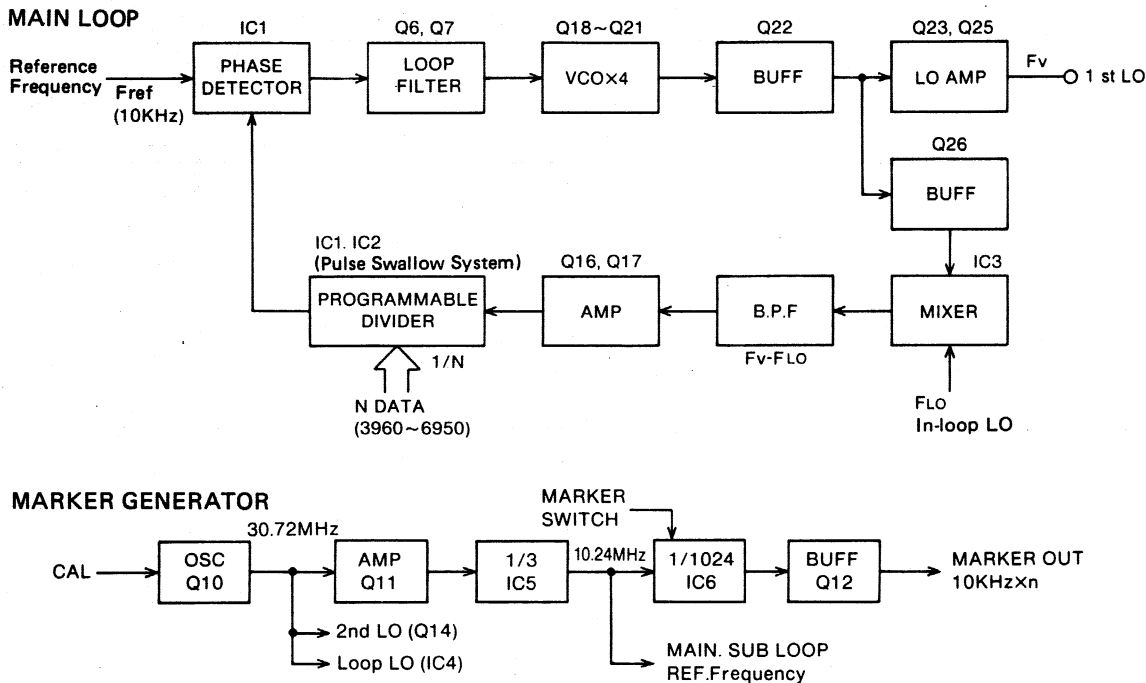


the sub-loop reference signal (5kHz), IC203 divides the output signal of IC5 by two and applies a 5.12MHz signal to IC201.

For the marker signal, a 10kHz signal generated by dividing the IC5 output signal (10.24MHz) by 1024 in IC6, and its harmonics are fed through buffer amplifier Q12 and fed to the RF unit through P1. Since the marker signal is derived from the 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.

4-3-2 MAIN LOOP CIRCUITS

The main loop forms the PLL loop to provide the 1st



(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 can perform 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 ones, 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. In order to obtain a high carrier-to-noise (C/N) ratio and a stable oscillator output in this radio, therefore, four separate VCOs are used, each assigned for a quarter of the whole necessary bandwidth. The division of the VCOs

LO output, consisting of the combination of a mixed down and divided systems.

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 10-kHz 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 30 MHz entire range of the PLL can be varied in 10 Hz steps.

reduces the burden of one VCO that would otherwise provide frequency changes over the entire bandwidth.

The power supply for the VCOs is doubly regulated as that for 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.

In addition to these features of the circuit, the care for grounding points on the printed circuit board and allocation of components, and utilization of the stout shielding case give a high C/N ratio.

(c) LOOP SYSTEM

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

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

The other part is fed back to the PLL loop through the

buffer amplifier Q26. A common base amplifier circuit providing a high isolation performance is used for the buffer amplifier so as to prevent the spurious components from leaking to the 1st LO; the spurious components arise from various frequency components in the PLL loop. The VCO signal is then mixed with the in-loop LO(F_{LO}) by IC3 for mixed down. The output from the mixer is passed through the bandpass filter with a bandwidth about 35-75 MHz to eliminate the spurious components. The output is then amplified by the cascade amplifier Q16 and Q17, and input to IC2 to form the PLL. It is noted that a pair of diodes D10 and D11 is added to the input of IC2 in order

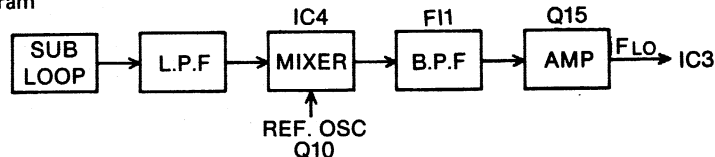
to limit excessive input voltages.

(d) IN-LOOP LOCAL OSCILLATOR CIRCUIT

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

The output frequency of the subloop is too low to use (230.00~239.99kHz). Therefore, the output is mixed with the reference frequency oscillator output by IC4 and converted to an appropriate frequency by heterodyning to give the in-loop LO. The heterodyned output is passed through the monolithic filter F11 to eliminate the spurious and fed to IC3 after amplified by Q15.

In-loop Local Oscillator Block Diagram



(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 as well as the VCO is important for the performance of the PLL, and it determines the lock-up time and the C/N(Carrier/Noise) ratio. The lock-up time and the C/N ratio are a conflicting relation to each other. That is, if the time constant of the loop filter is determined so as to make the lock-up time faster, the C/N ratio will be decreased. In order to solve this problem, a variable resistor composed of an FET is inserted in the loop filter in the PLL. Thus, if the frequency is changed more than a certain level at one time the lock-up time becomes faster by making the time constant of the loop filter smaller, while making the C/N ratio greater by setting the time constant larger for normal operation.

The circuit to change the time constant Q5 is driven by the mute signal. Namely, if the mute signal is generated by the main loop or the subloop because the loop is unlocked or the frequency is changed more than a certain level at one time, the circuit starts operating.

The mute signal coming from IC1 and IC201 of the main loop and the subloop is processed by Q8 and Q9 to have an appropriate voltage and a time constant and is fed to Q5, Q13 and Q24. Q13 and Q24 switch the bases of the transistors of the output amplifier for the 1st LO and the 2nd LO, so as to halt the LO outputs, respectively.

Because of this switching operation, even if the PLL is

unlocked or the frequency is changed more than a certain level at one time, the system does not transmit/receive a frequency other than the desired one and the locking operation is completed faster.

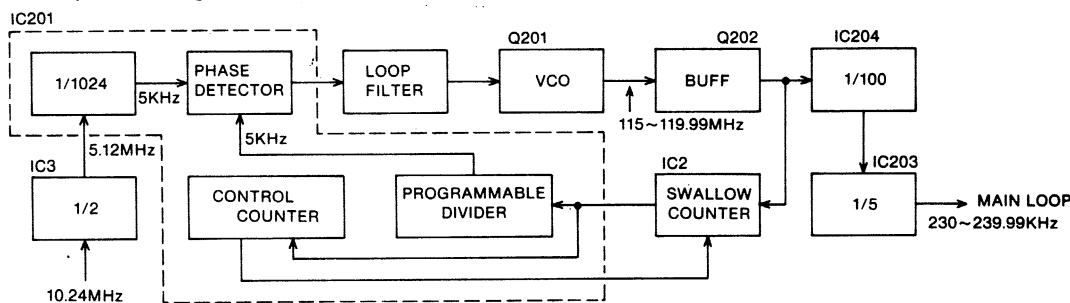
4-3-3 SUB-LOOP

This loop forms the locked loop using the 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 115.00~119.995 MHz. The output signal of the 4.995MHz bandwidth with a 5kHz resolution is divided in 1/500 by IC204 and IC203 to provide an output ranging from 230.00 to 239.99kHz (i.e., 9.99kHz bandwidth) in 10Hz steps. This output is led to the main loop.

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

Sub-loop Block Diagram



4-3-4 PLL DATA

The data for setting the dividing ratio N of the programmable divider is sent from the logic unit. The control data to switch the VCOs is also sent from the logic unit. The data to set the dividing ratio, called the N-DATA, is sent dynamically, while the 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 THE N-DATA

Since there are two locked loops, two kinds of N-data are necessary. Even if the output frequencies from the PLL in all the modes are the same, the display frequencies are different depending on the operating mode. Namely, the same frequency is displayed for CW, RTTY, AM and FM, while displayed are the frequencies 1.5kHz higher for LSB, and 1.5kHz lower for USB.

The method to derive the N-DATA for all the modes but SSB 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

Let the frequency shown in the digits equal to or lower than 1kHz of 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 1.5kHz for USB and subtract 1.5kHz for LSB to and from the displayed frequency, and then follow the steps shown above.

For the value of N as derive in the above way, the dividing ratio of the programmable divider is 1/N.

4-4 LOGIC UNIT

The functions of this unit include the control of frequency, the processing of BPF and LPF signals and mode signals, data outputs for the PLL unit and display unit, etc. This unit is composed of an 8-bit N-MOS CPU, a 4-bit 1k word C MOS RAM, a multi-purpose custom IC, I/O expander IC's, etc.

4-4-1 CPU

Functions are assigned to the pins of the CPU as shown below. The interrupt pins are assigned to the tuning control to which the highest priority is given. The pins where no function is 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. 1 and Fig. 2.

4-4-2 CPU INPUT CONTROL CIRCUIT

A multi-function custom IC, 40-pin DIL package C MOS IC, is used. (Refer to Fig. 3)

- (a) An external L and C are connected to Pin 18 and Pin 19 to give about a 100kHz clock signal.
- (b) ATS of Pin 32 gives a high level if the tuning control is rotated faster than a certain speed, which 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.
- (c) 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 x 4 (quadri-speed mode). For RIT/XIT control, the multiplication factor is fixed to be a double to give 50 pulses x 2 =100 pulses per one rotation.

Fig. 1 CPU Pin Connection

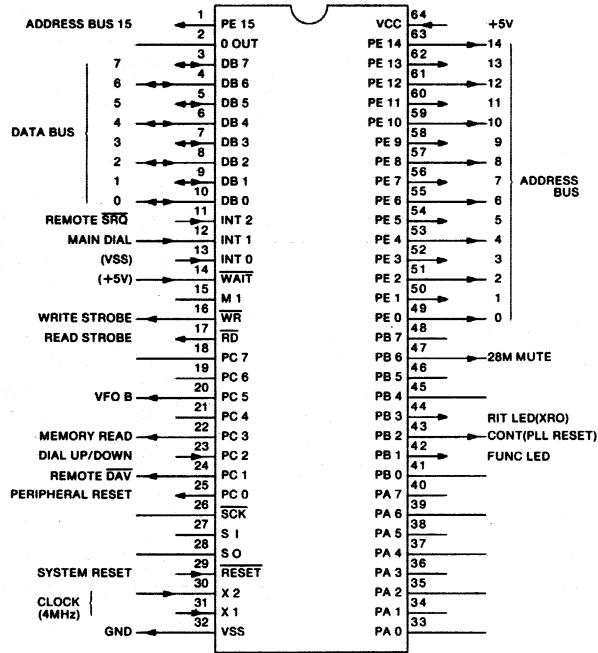
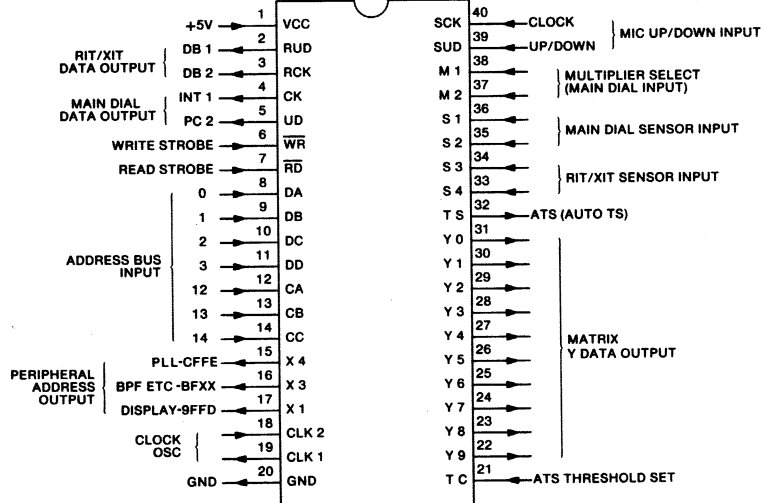


Fig. 2 CPU Memory Map

| | |
|---------|--|
| 0 0 0 0 | CPU INTERNAL ROM 8bit x4096W |
| 0 F F F | |
| 7 F F F | REMOTE CONTROL |
| 8 F F 0 | |
| 1 | |
| 2 | |
| 3 | |
| 4 | Input |
| 5 | Matrix |
| 6 | |
| 7 | |
| 8 | |
| 8 F F 9 | |
| 9 F F D | Display Data Out(μ 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 4bit x1024W(μ PD444C) |
| F B F F | |
| F F 8 0 | CPU INTERNAL RAM 8bit x128W |
| F F F F | |

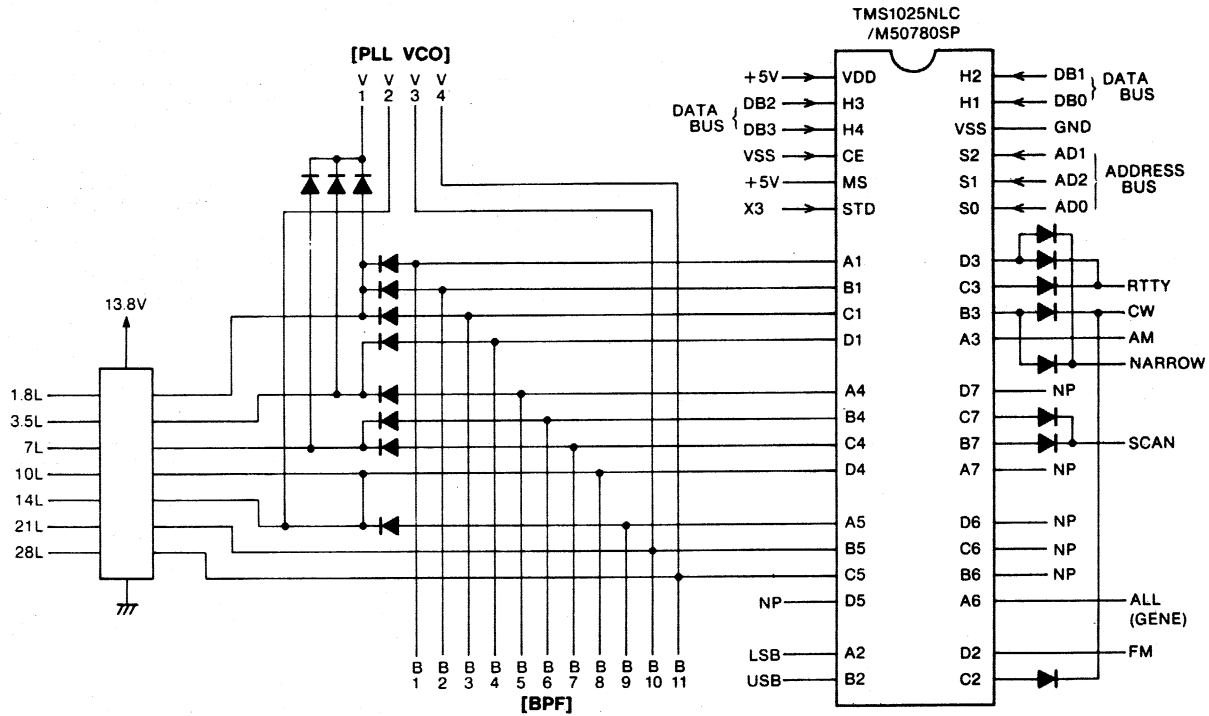
Fig. 3 Custom IC Pin Connection



4-4-3 I/O EXPANDER CIRCUIT

This circuit controls data outputs for BPF, PLL, VCO and MODE, etc.

Fig. 4 I/O Expander Circuit



4-4-4 N-DATA OF PLL

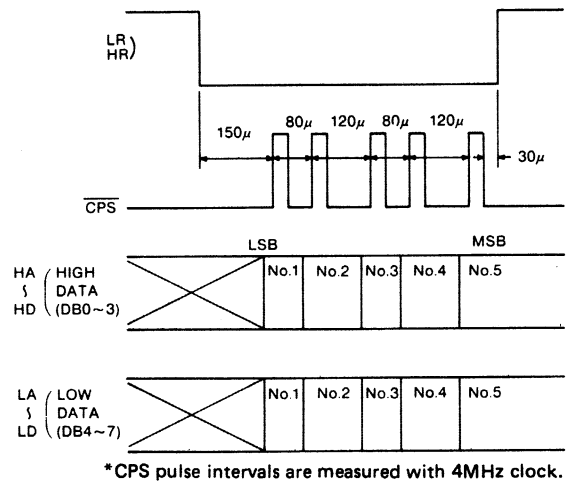
Since the PLL uses the double loop construction, two N-DATA of high and low are sent from the LOGIC unit to the PLL unit.

The data lines, HA-HD and LA-LD are switched by the gates of IC17 and IC18. The lines are shared by signals for the PLL, the DISPLAY, the BPF, etc. Therefore, this switching prevents the VCOs of the PLL unit from introducing noise when the lines are not used for the data of the PLL.

High & Low N-DATA Table

| High N-DATA X10M, X1M, X100K, X10K | | Low N-DATA X1K, X100Hz, X10Hz | |
|---------------------------------------|--------|----------------------------------|--------|
| Disp. freq. | N-DATA | Disp. freq. | N-DATA |
| 0.10MHz | 3960 | 0 Hz | 23000 |
| 0.11MHz | 3961 | 10 Hz | 23001 |
| 0.12MHz | 3962 | 20 Hz | 23002 |
| 0.13MHz | 3963 | 50 Hz | 23005 |
| 0.14MHz | 3964 | 100 Hz | 23010 |
| 0.15MHz | 3965 | 1 KHz | 23100 |
| 1 MHz | 4060 | 2 KHz | 23200 |
| 10MHz | 4950 | 3 KHz | 23300 |
| 20MHz | 5950 | 4 KHz | 23400 |
| 30MHz | 6950 | 5 KHz | 23500 |
| | | 9.99 KHz | 23999 |

Fig. 5 N-DATA Output Timing Chart

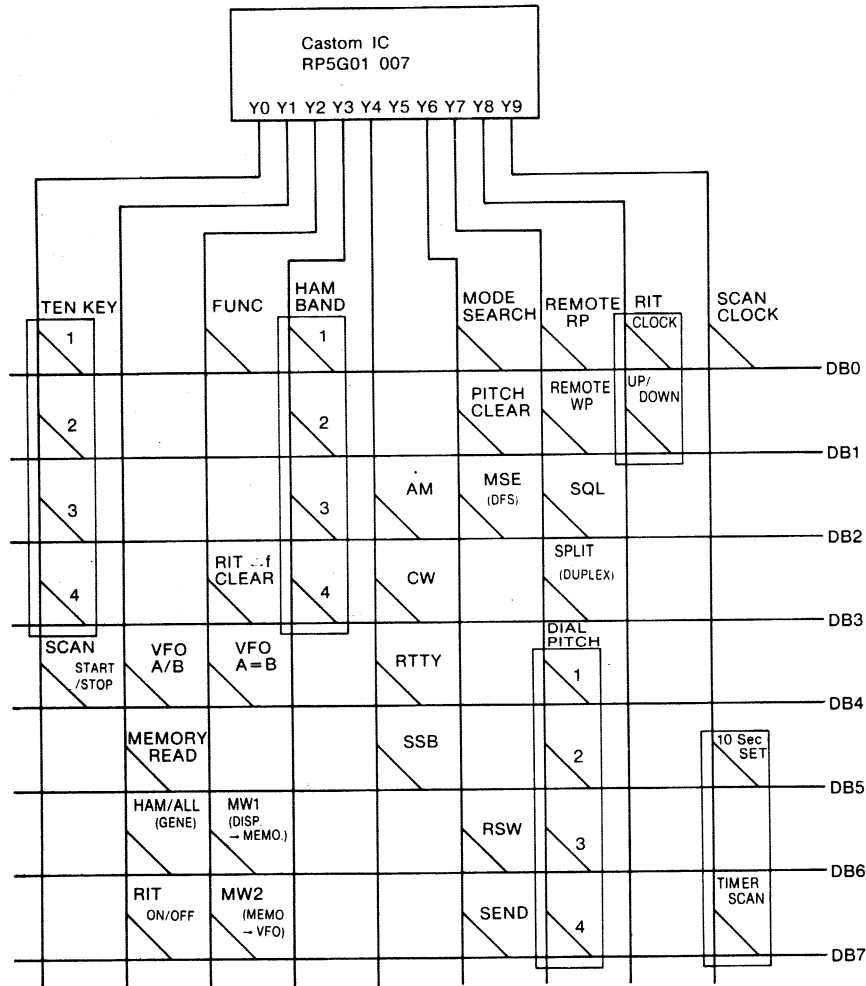


4-4-5 MATRIX UNIT

switch board, and the mode switch board. It processes the front panel matrix input and the data of RIT/XIT.

This unit is composed of the matrix board, the matrix

MATRIX TABLE



(1) Y0 → DB0-DB3 (TEN KEY)

Matrix for operating frequency setting/band changing by an optional ten key unit RC-10 externally.

| Y0→ KEY | DB0 | DB1 | DB2 | DB3 | BAND | Hex 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)

Matrix to start and stop the scan, which is controlled not only by the SCAN switch but also by squelch and the dial lock switch through IC2b and Q3. When the SCAN switch is pushed, one pulse signal is input to this matrix to start and stop the scan operation repeatedly.

Three types of scanning operations, Memory Scan, Programmed Scan, and Mode Selected Scan, are available. During the VFO operation, Programmed Scan is automatically selected, and during the memory channel operation, Memory Scan is selected. S10 is to select if the scan is completely stopped or started 10 seconds after the scan is interrupted when the squelch is opened. R14 in the LOGIC unit is to adjust the scanning speed.

(3) Y1 → DB4 (VFO A/B)

Matrix to select VFO A or VFO B by the VFO switch. When VFO B is selected, pin 20 of the CPU becomes high

level. To each of VFO A and VFO B, the operation mode, frequency, and the HAM/GENERAL selection are stored independently.

(4) Y1 → DB5 (MEMORY READ)

Matrix to select the VFO mode or the Memory Channel mode switched by the VFO/MEMORY switch. Pin 22 of the CPU is high when the Memory Channel mode is selected. There are 32 memory channels available to store the mode, frequency, and HAM/GENERAL in each of them.

(5) Y1 → DB6 (HAM/GENERAL)

Matrix to select the HAM band mode or general coverage mode by the HAM/GENERAL COVER SELECT switch.

(6) Y1 → DB7 (RIT ON/OFF)

Matrix to turn on/off RIT (XIT) by the RIT (XIT) switch. The binary counter IC1b (IC1a) outputs RIT (XIT) signal from pin 13 (pin 1) by turning the RIT (XIT) switch on.

The output signal passes through the OR gate of R13 and D15 and is fed to the one-shot circuit consisting of IC4b, R14 and C5, which outputs a pulse signal to control Q8 to turn on the RIT matrix (Y1 → DB7), and the XRO output (pin 44) becomes high to turn on RIT (XIT). When no RIT input signal is applied, XRO outputs no signal to turn on the reset circuit, consisting of IC3c, IC4c, D14, R3 and C1. Thus RIT (XIT) is turned off by IC1b (IC1a).

The digital transistors Q4 and Q5 turn on/off the RIT and XIT indicators on the display unit. When both pin 1 (XIT) and pin 13 (RIT) of IC1 are off but the RIT setting of the CPU is on, the matrix reset circuit, consisting of IC3c, IC3d, IC5c, IC3a, IC3b, etc., drives IC4b to switch the CPU RIT matrix on/off to match the condition of the CPU and the front panel display. The RIT matrix is turned

on/off by the multi-vibrator of IC3a and IC3b, instead of being left on, to provide other matrix entries can be possible.

(7) Y2 → DB0 (FUNCTION)

Matrix to select a function by combining with the switches as shown in the following table.

| Combination | 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/XIT Δf to display frequency. |
| FUNC + WRITE | Clears (blanks) the displayed memory channel frequency. |
| FUNC + M ► VFO | |

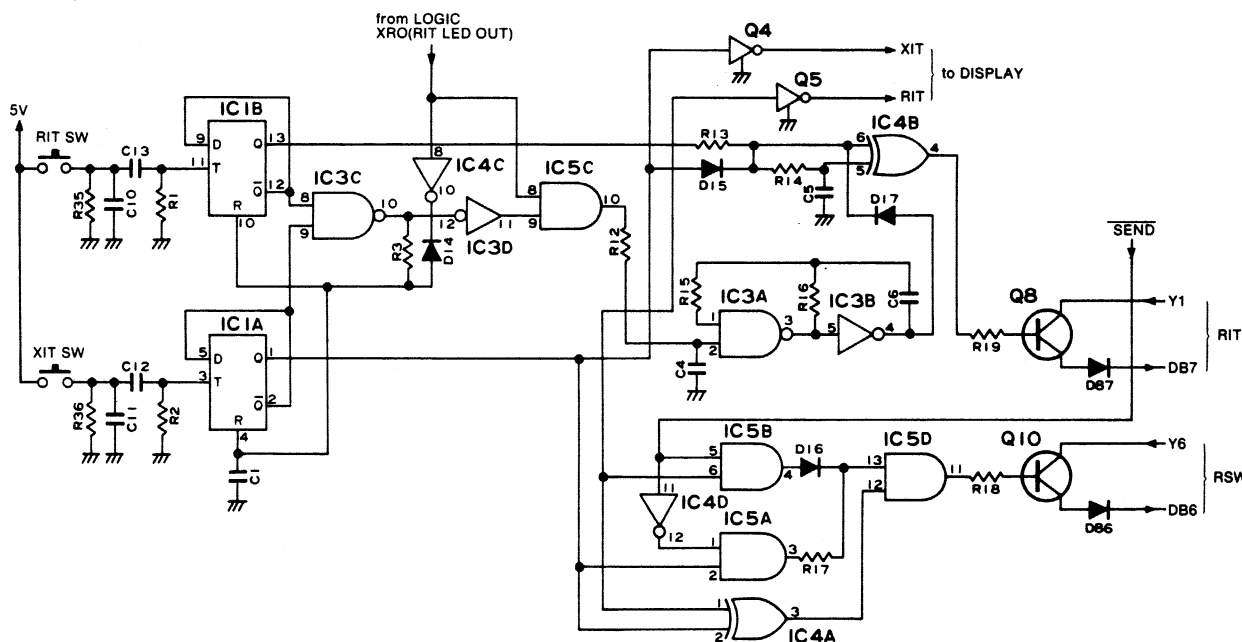
(8) Y2 → DB3 (RIT/XIT CLEAR)

Matrix to clear the RIT/XIT shift frequency. When combined with the FUNC switch, the shift frequency is added to/subtracted from the displayed frequency.

(9) Y2 → DB4 (VFO A = B)

Matrix to transfer the frequency of VFO A/B to the

RIT/XIT Circuit



other VFO. When combined with the FUNC switch, the original VFO is reversed.

| | |
|------------------|---------------|
| Pushing Switch | 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)

Matrix for the memory write and the memory data transfer by the MEMORY WRITE and FREQUENCY TRANSFER switches. When combined with the FUNC switch, the data in the displayed memory channel is cleared and the channel is blanked.

| Condition | Pushing Switch | 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 | 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)

Matrix to switch the tuning control to a band selector by the BAND switch. When the HAM/GENERAL switch is at GENERAL, the frequency is changed in 1MHz increments.

Matrix to select the operation mode when combined with the MODE switch or FUNC switch. The display frequency is shifted depending on the selected operation mode as shown in the below figure.

| 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 |

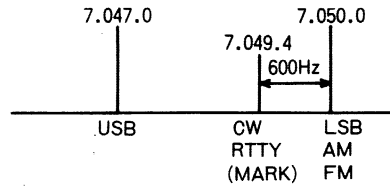
(12) Y4 → DB2 (AM)

(13) Y4 → DB3 (CW)

(14) Y4 → DB4 (RTTY)

(15) Y4 → DB5 (SSB)

The differences of the frequency on various modes



(16) Y6 → DB0 (MODE SEARCH)

Matrix for the mode selected scan by the MODE-S switch. Only the memory channels with the desired operation mode are selected in the memory scan mode or by the tuning control.

(17) Y6 → DB1 (PITCH CLEAR)

Matrix to set the frequency increment to 1kHz in all modes by the TS(TUNING RATE) switch. When the TS switch is on, also the matrix at Y7→DB4 is turned on.

(18) Y6 → DB2 (DFS)

Matrix for the dial function select by the DFS switch as shown in the following table.

| DFS switch | OFF | ON |
|--------------------------|---|---|
| Condition | | |
| 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)

Matrix to reset RIT data or to output N-data. IC4a, IC4b, IC5a, IC5b, IC5d, R17 and D16 are for the RSW input circuit.

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

(20) Y6 → DB7 (SEND)

Matrix for the transmit mode recognition to stop the scanning.

(21) Y7 → DB0 (REMOTE RP)

Matrix for remote-control read pulse.

(22) Y7 → DB1 (REMOTE WP)

Matrix for remote-control write pulse.

(23) Y7 → DB2 (SQL)

Matrix to input one pulse when the squelch is closed, and to control the scanning operation.

(24) Y7 → DB3 (SPLIT/DUPLEX)

Matrix for split or duplex operation using VFO A and B by the DUPLEX switch.

(25) Y7 → DB4-DB7 (DIAL PITCH 1-4)

Matrix to set 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 Switching |
|-----|---|--------------------|-------------------------------|
| OFF | 10Hz steps (2kHz/1 rotation) By faster rotation 50Hz steps (10kHz/1 rotation) | 8CH /1 rotation | HAM: 8 BAND /1 rotation |
| ON | 1kHz steps (200kHz/1 rotation) 100Hz and lower digits will be cleared as "0". | | GENE.: 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)

Data matrix for RIT, which is processed by IC2 in the LOGIC unit.

(27) Y9 → DB0 (SCAN CLOCK)

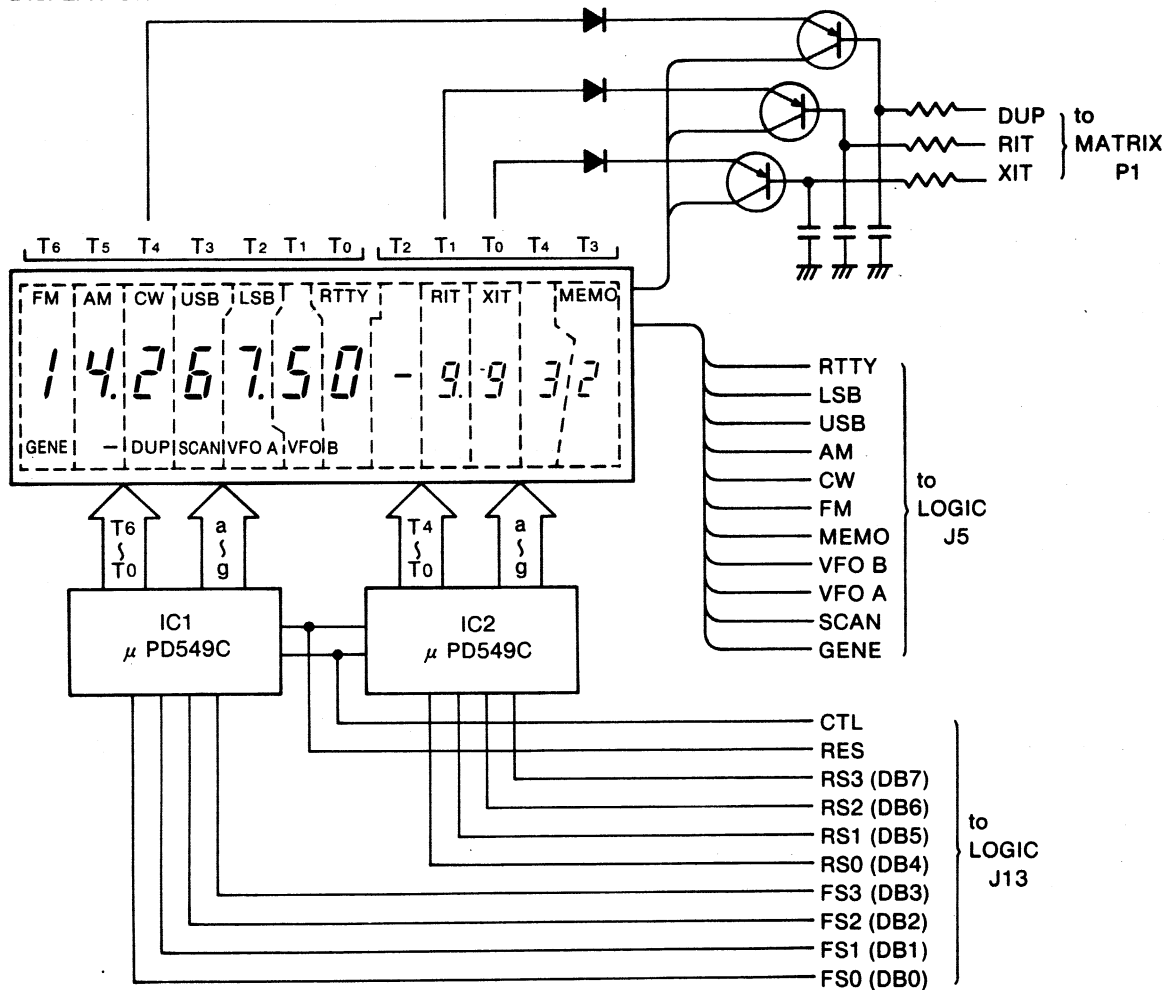
Matrix for the scan control clock from the circuit of Q4, IC7b and R14 in the logic unit.

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

Matrix for 10-second timer to resume scanning after a stop. The matrix Y9 → DB7 is on while the timer scan is operating.

4-5 DISPLAY UNIT

DISPLAY UNIT Circuit



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

The display tube uses a newly developed luminescent display tube. It displays centralized information of frequency, mode, RIT/XIT condition, memory channel, operating mode (VFO A/B, GENE, DUP, SCAN), etc. The operating conditions of the transceiver can be easily understood because of this centralized display. In addition, the display is shown in two colors, red and white, using color filters. Furthermore, LEDs to show transmit/receive and the narrow mode in the CW or RTTY operation are also a part of this unit.

(a) DISPLAY SECTION

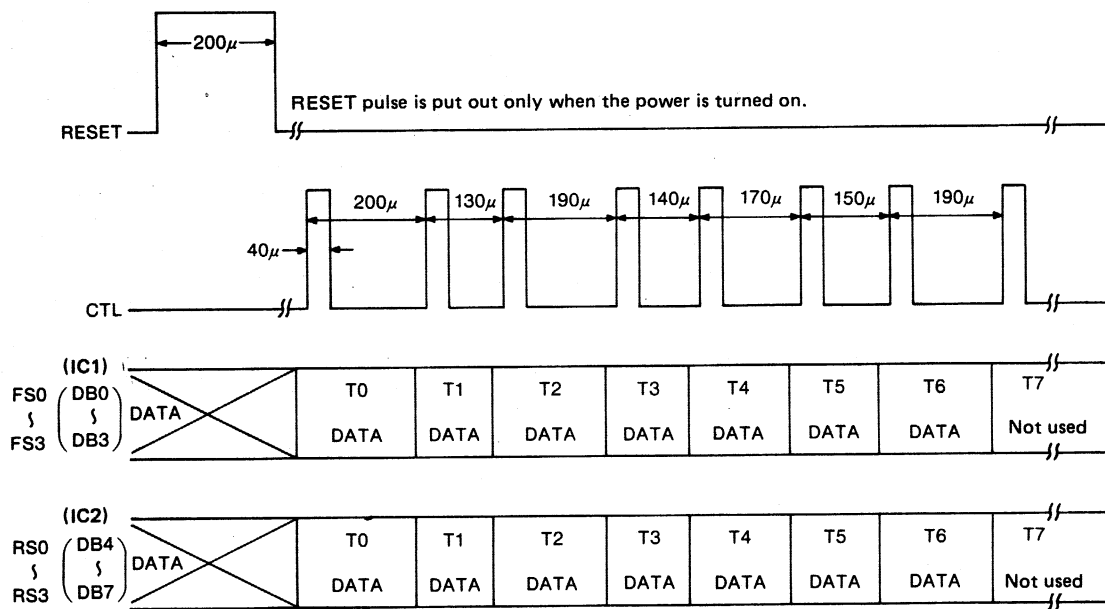
The luminescent display tube (DS1) is driven by the

drivers IC1 and IC2, and lights dynamically. These ICs contain such functions as input data latch, clock oscillator, timing counters, segment decoders, etc. The clock frequency is set by C2 and C6.

Displays for the RIT/XIT shift frequency and memory channel are driven by IC2, and other displays are driven by IC1.

The signals for the display of RTTY through GENE are sent from the LOGIC unit to each segment. These are switched by the digit signals, T0 to T6 from IC1 and T3 from IC2, and lighted dynamically. The words of RIT, XIT, “—” and DUP are connected to the same digit in the tube, thus, the necessary word is selected by T4, T1, and T0 digit signals and dynamically lighted.

DISPLAY DATA Timing Chart



*CTL pulse intervals are measured with 4MHz clock.

(b) DC-DC CONVERTOR SECTION

The +5 volts voltage source is produced from 13.8 volts by the voltage regulator IC3.

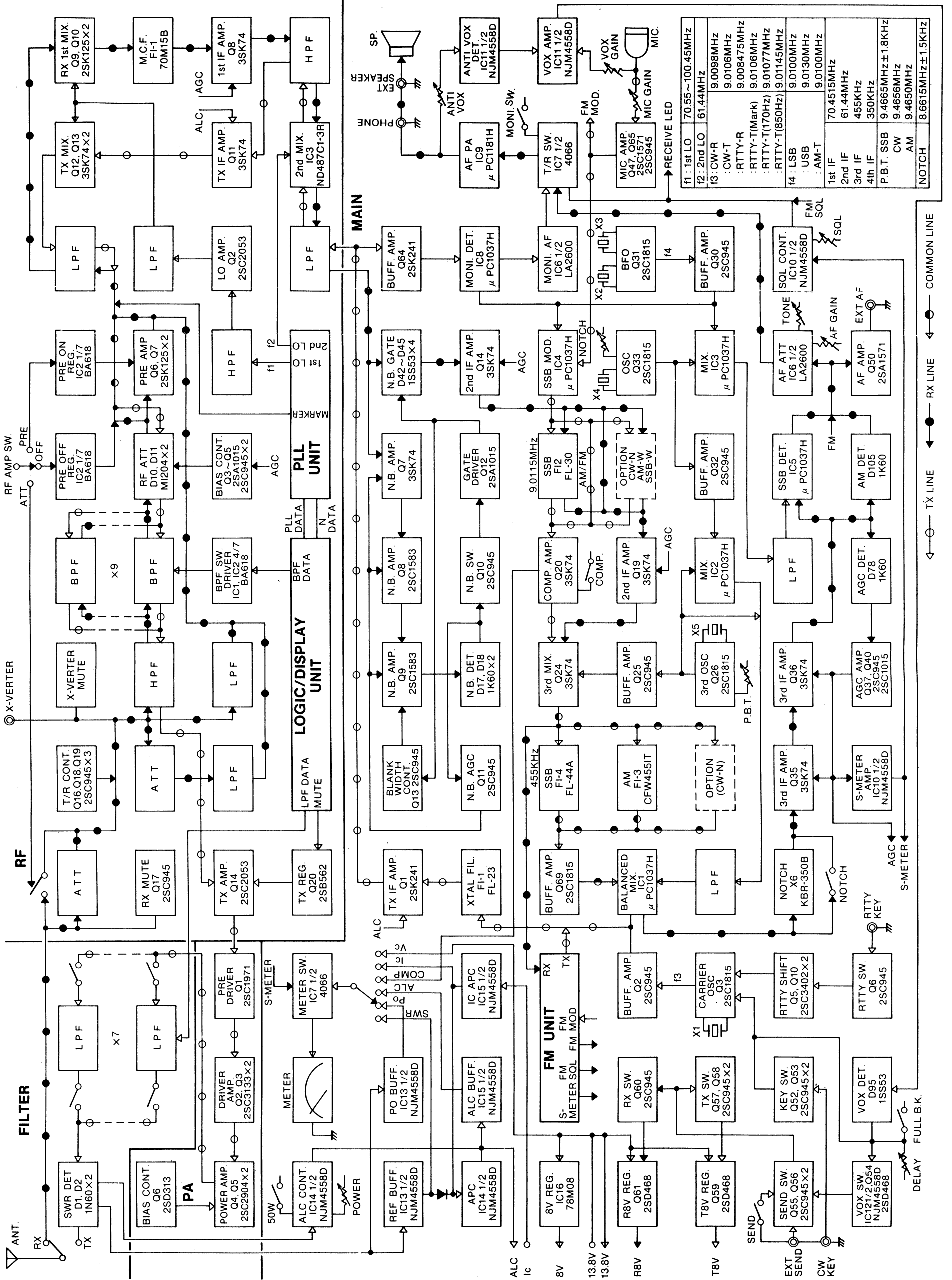
The DC-DC convertor is composed of Q4, Q5 and T1 to generate rectangular pulses of about 15kHz. The pulses are applied to T1 to obtain -5V, -35V, 3.5V AC from the corresponding coils.

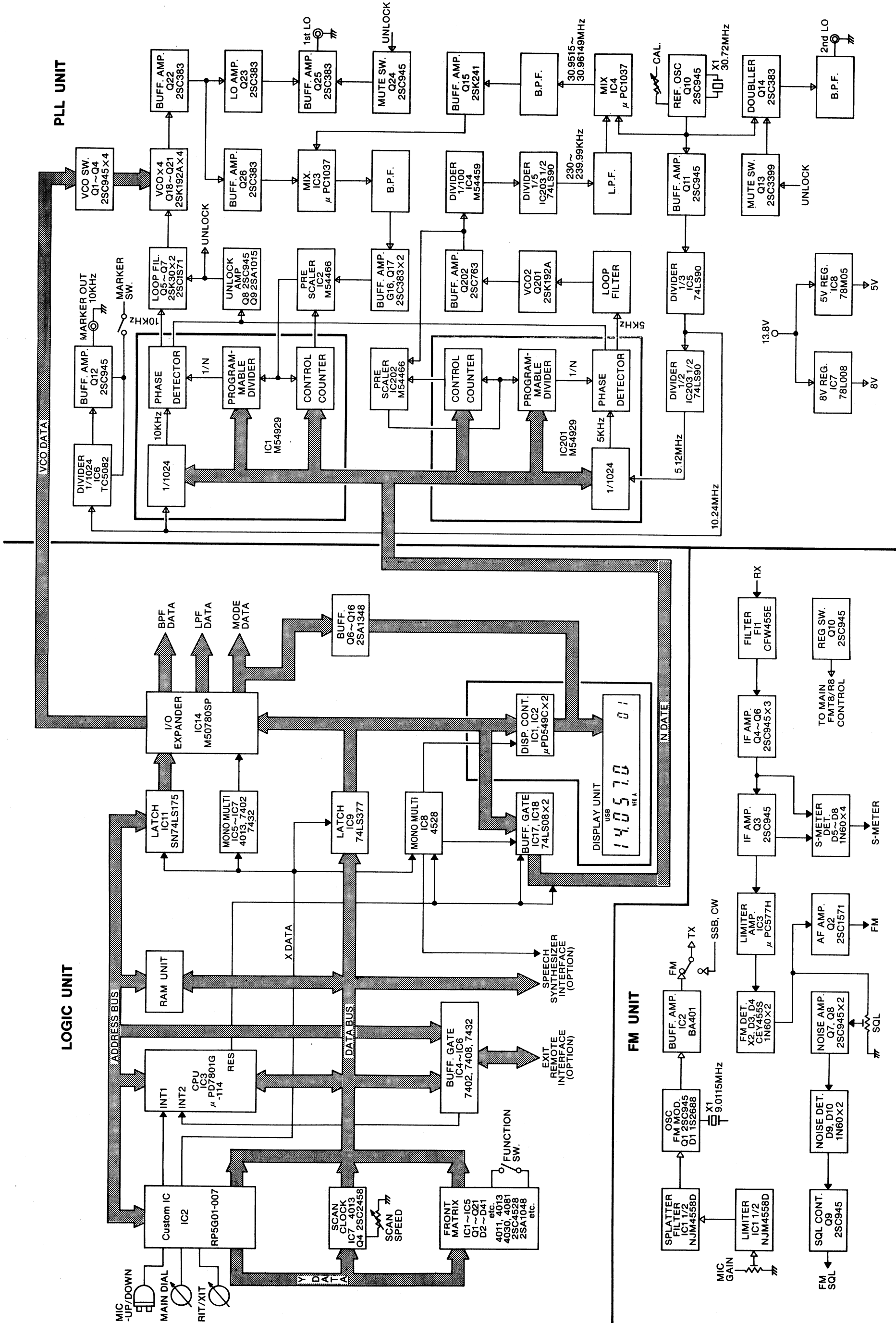
Except for the 3.5V AC which is provided for the filament of the display tube, all the voltages are rectified for DC voltages. As for -5 volts, the rectified DC-DC convertor output is regulated by R43 and D22, and supplied to IC1, IC2, and the MAIN unit.

Q6-Q8 comprise a circuit to keep 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 the data (CTL) are supplied from the LOGIC unit when the reset is completed, Q8 is turned on, and then Q6 and Q7 are turned on for -35V output for the display.

The components Q6, Q7, R19 and R41 form a latch circuit, so that once the circuit is turned on it holds the state to keep providing -35 volts. Note that R42, C21 and C22 are provided to prevent erroneous operation.

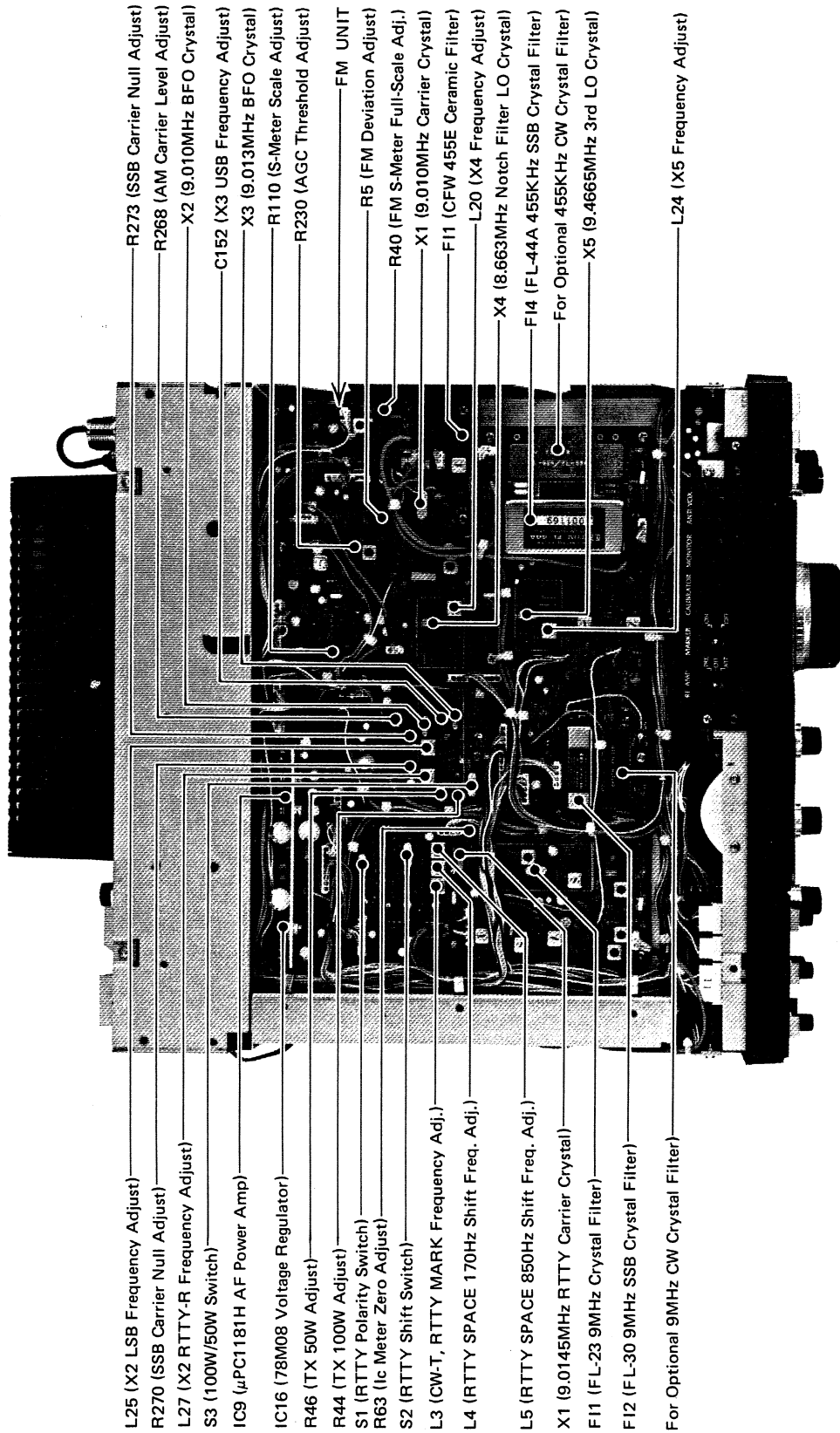
SECTION 5 BLOCK DIAGRAM





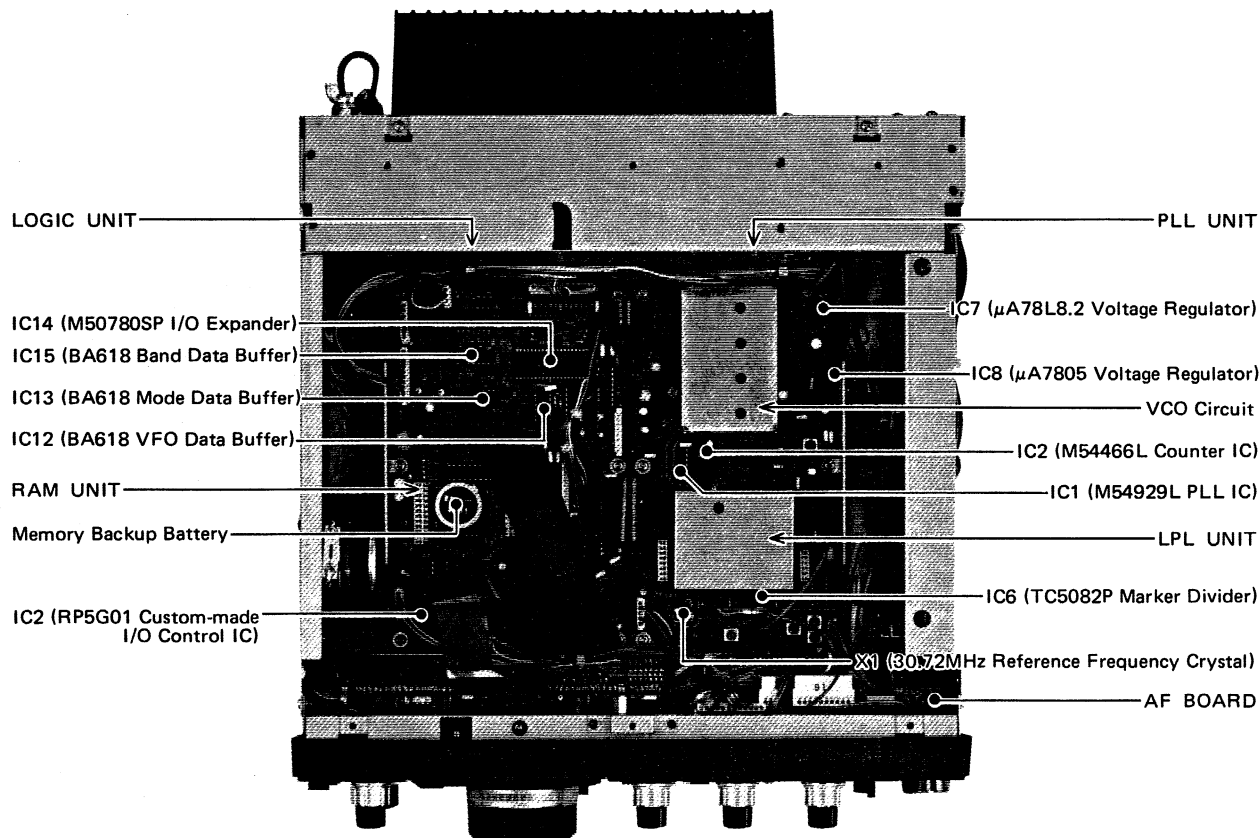
SECTION 6 INSIDE VIEWS

6-1 TOP VIEW

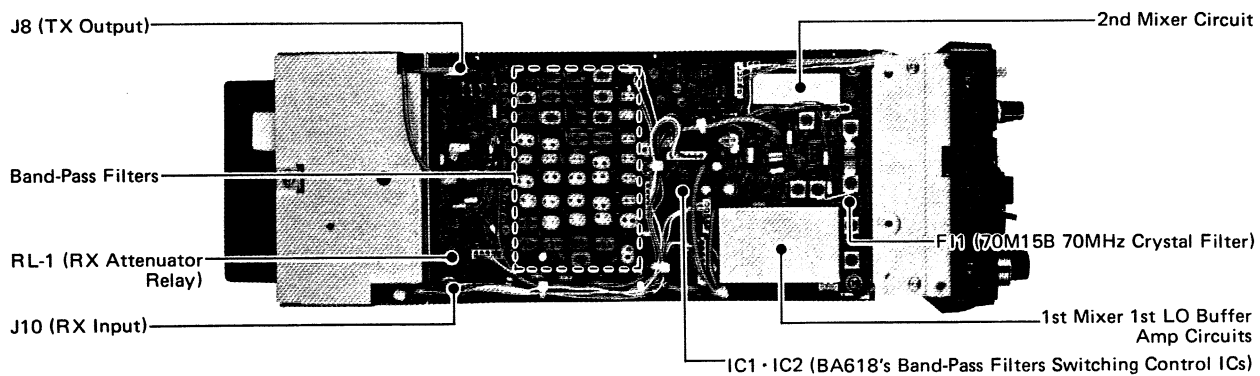


- L25 (X2 LSB Frequency Adjust)
- R270 (SSB Carrier Null Adjust)
- L27 (X2 RTTY-R Frequency Adjust)
- S3 (100W/50W Switch)
- IC9 (μ PC1181H AF Power Amp)
- IC16 (78M08 Voltage Regulator)
- R46 (TX 50W Adjust)
- R44 (TX 100W Adjust)
- S1 (RTTY Polarity Switch)
- R63 (Ic Meter Zero Adjust)
- S2 (RTTY Shift Switch)
- L3 (CW-T, RTTY MARK Frequency Adj.)
- L4 (RTTY SPACE 170Hz Shift Freq. Adj.)
- L5 (RTTY SPACE 850Hz Shift Freq. Adj.)
- X1 (9.0145MHz RTTY Carrier Crystal)
- F11 (FL-23 9MHz Crystal Filter)
- F12 (FL-30 9MHz SSB Crystal Filter)
- For Optional 9MHz CW Crystal Filter)
- R273 (SSB Carrier Null Adjust)
- R268 (AM Carrier Level Adjust)
- X2 (9.010MHz BFO Crystal)
- C152 (X3 USB Frequency Adjust)
- X3 (9.013MHz BFO Crystal)
- R110 (S-Meter Scale Adjust)
- R230 (AGC Threshold Adjust)
- FM UNIT
- R5 (FM Deviation Adjust)
- R40 (FM S-Meter Full-Scale Adj.)
- X1 (9.010MHz Carrier Crystal)
- F11 (CFW 455E Ceramic Filter)
- L20 (X4 Frequency Adjust)
- X4 (8.663MHz Notch Filter LO Crystal)
- F14 (FL-44A 455KHz SSB Crystal Filter)
- For Optional 455KHz CW Crystal Filter)
- X5 (9.4665MHz 3rd LO Crystal)
- L24 (X5 Frequency Adjust)

6-2 BOTTOM VIEW



6-3 RF UNIT



SECTION 7 OPTION INSTALLATIONS

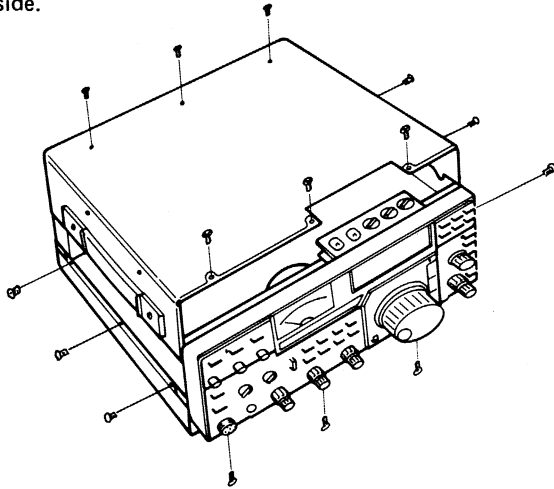
The following tools are needed for the installation of the options:

Philips Screwdriver
Screwdriver
Soldier
De-soldering braid

Diagonal cutters
Soldering Iron (40W)
Soldering tool

Before performing any work on the set, make sure that the power cord is detached from the transceiver.

Remove the top and bottom covers by unscrewing the six screws each on the top and bottom, and the three screws on each side.



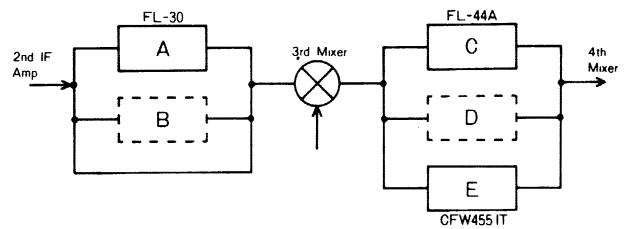
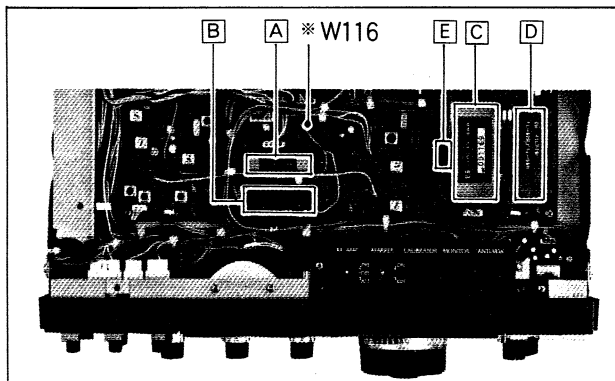
7-1 INSTALLATION OF OPTIONAL FILTER

7-1-1 OPTIONAL FILTERS PREPARED

We have prepared various optional filters as follows.

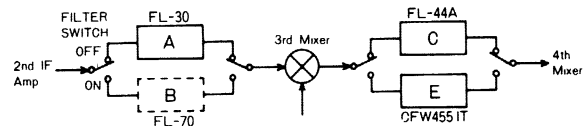
| | CENTER FREQUENCY | CHARACTERISTICS | USABLE MODE |
|--------|------------------|---------------------------|-------------|
| FL-32 | 9.0106MHz | 500Hz/-6dB, 1.6KHz/-60dB | CW-RTTY |
| FL-63 | 9.0106MHz | 250Hz/-6dB, 1.1KHz/-60dB | CW-RTTY |
| FL-33 | 9.0100MHz | 6KHz/-6dB, 20KHz/-60dB | AM |
| FL-70 | 9.0115MHz | 2.8KHz/-6dB, 5.0KHz/-60dB | SSB (Wide) |
| FL-52A | 455.0KHz | 500Hz/-6dB, 1.0KHz/-60dB | CW-RTTY |
| FL-53A | 455.0KHz | 250Hz/-6dB, 480Hz/-60dB | CW-RTTY |

The IC-751 has two positions for installing optional filters. The "B" position is for a 9MHz filter, one of the FL-32, FL33, FL-63 and FL-70, and the "D" position is for a 455KHz filter, one of the FL-52A and FL-53A.



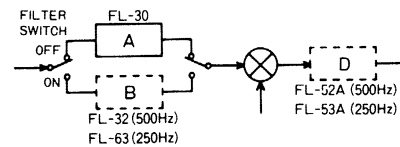
After optional filters are installed, the FILTER switch and PBT control function as follows:

- When the FL-70 SSB wide filter is installed.



| FILTER SWITCH | BANDWIDTH | PBT CONTROL |
|---------------|-----------|-------------|
| OFF | NARROW | EFFECTIVE |
| ON | WIDE | NO WORK |

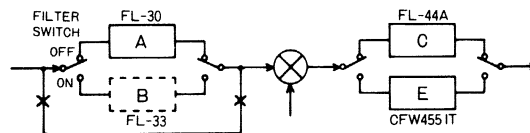
- When CW narrow filter is installed.



| FILTER SWITCH | BANDWIDTH | PBT CONTROL |
|---------------|-----------|-------------|
| OFF | WIDE | EFFECTIVE* |
| ON | NARROW | EFFECTIVE |

* The control works as IF SHIFT function and tone pitch can be adjusted.

- When FL-33 AM filter is installed.



* When installing FL-33, cut the lead of W116 on the MAIN unit board. (Refer the photo.)

| FILTER SWITCH | BANDWIDTH | PBT CONTROL |
|---------------|-----------|-------------|
| OFF | NARROW | NO WORK |
| ON | WIDE | NO WORK |

Please choose an optional filter which is suitable to your needs.

7-1-2 ASSEMBLY PROCEDURE

When installing FL-52A or FL-53A, simply plug it into the specified position.

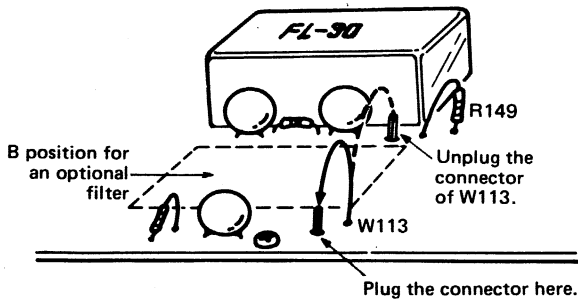
When installing a 9MHz filter;

- Remove nine screws at each edge and the center of the MAIN unit board, and four screws at each corner of the FM unit board.

2. Tilt the units back toward left, being careful not to damage the sockets and plugs that are installed on the units.

3. The position for the filter is shown as "OPTION FILTER" on the MAIN unit board. The holes for mounting the legs and the leads of the filter are pre-drilled. Be sure to orient the filter so that the label on the top of the filter is facing the same direction as the other filter already mounted. Insert the filter flush with the board, bend the leads and legs flush with the opposite side of the board and solder them in. Trim the leads even with the solder points.

4. Change the connecting position of the jumper wire W113 as shown in the illustration. This completes the installation. Replace the units with the screws removed before, and top and bottom covers.



| | |
|---------------------|---|
| AC Power Cord | 1 |
| Spare Fuse | 2 |
| Installation Screws | 6 |
| Insulation Washers | 6 |

7 - 2 - 2 PREPARATION

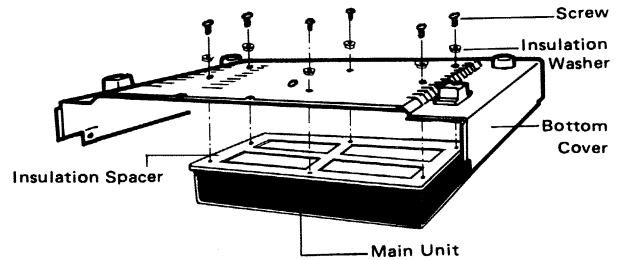
Before performing any work on the set, make sure that the power cord is unplugged from the transceiver.

Remove the top and bottom covers by unscrewing the six screws each on the top and bottom, and the three screws on each side.

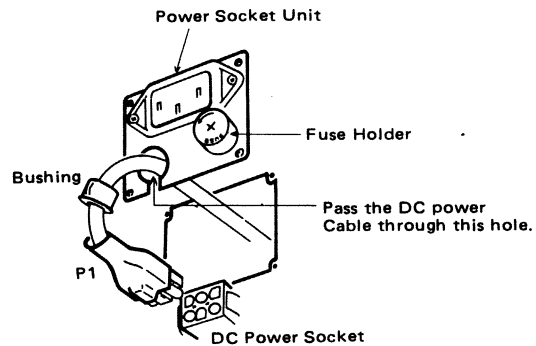
7 - 2 - 3 ASSEMBLY PROCEDURE

① Turn the transceiver upside down. Remove the "PLATE (A)" attached to the rear panel by unscrewing four screws. These screws will be used later.

② Attach the main unit (power supply) to the bottom cover with supplied screws and insulation washers. At this time, insert the insulation spacer between the main unit and the bottom cover.



③ Pass the DC power cable attached to P1 through the hole of the AC power socket plate as shown in the illustration, then insert the bushing into the hole. Attach the AC power socket plate to the position which was attached the PLATE (A) before, by using the screws described in ①, so that the AC power socket is toward the bottom of the set.



④ Pass the connector, P2', from the power socket unit to the inner chassis through the hole of the rear chassis. Then connect it with the connector, P2, from the main unit of the power supply.

7 - 2 BUILT-IN POWER SUPPLY UNIT IC-PS35

7 - 2 - 1 SPECIFICATIONS

Number of Semiconductors

| | |
|------------|---|
| Transistor | 5 |
| IC | 2 |
| Diode | 4 |

Input Voltage

110/220V AC (50/60Hz)

Allowable Voltage Fluctuation

±10% of input voltage
(suitable line voltage)

Input Capacity

550VA (at 20A load)

Output Voltage

13.8V DC Negative ground

Max. Load Current

20A (10 mins ON/10 mins OFF)

Dimensions

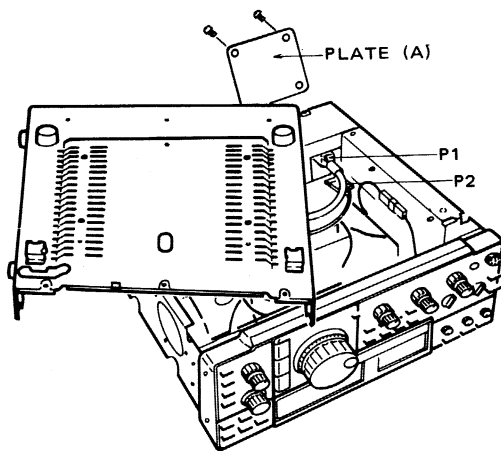
194(W) x 50(H) x 186(D) mm

Weight

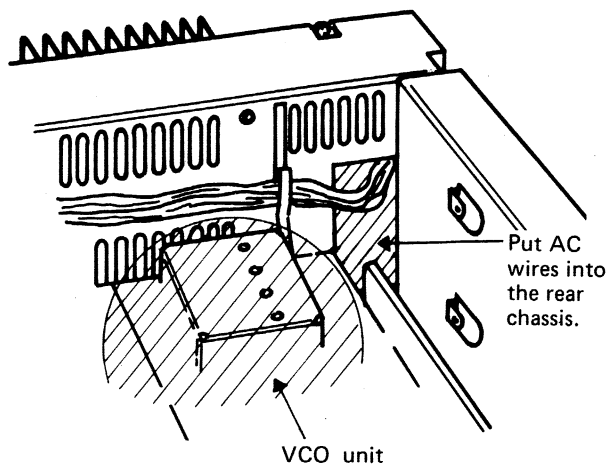
Approx. 2.3kg

Kit Included

| | |
|-------------------|---|
| Main Unit | 1 |
| Insulation Spacer | 1 |
| Power Socket Unit | 1 |



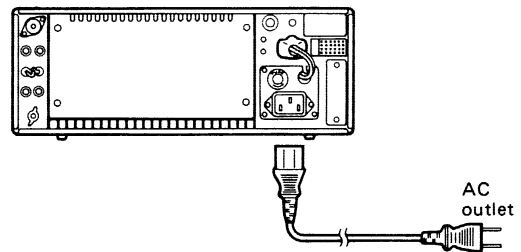
- ⑤ Put these AC wires into the rear chassis as long as possible as shown in the illustration. This will prevent to cause magnetic coupling between the AC wires and the VCO coil cores.



- ⑥ Replace the bottom and top covers of the set. Plug P1 of the power supply unit to the DC Power Socket of the set.

7 - 2 - 4 OPERATION

1. Connect the DC output plug, P1, of this unit into the transceiver DC power Socket securely. At this time, make sure that:
 - A. The power switch on the transceiver is OFF.
 - B. The T/R switch is in the RECEIVE position.
 - C. The PTT switch on the microphone is not depressed.
 - D. The VOX switch is in the OFF position.
2. Connect the supplied AC power cord into the AC power socket (newly installed) on the rear panel of the transceiver. Then connect the AC power plug into an AC power outlet.



3. By turning the transceiver power switch ON, this unit will be turned ON and supply a DC 13.8V to the transceiver.

7 - 2 - 5 CAUTION

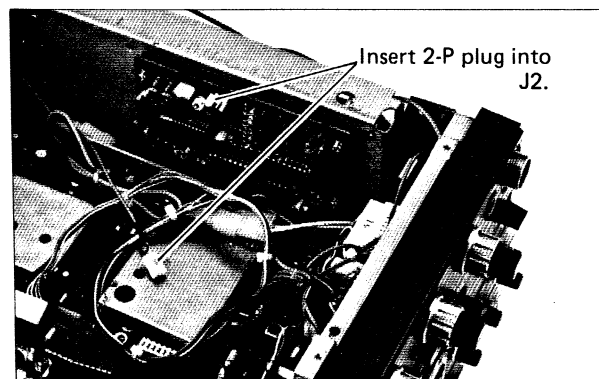
1. Ground the GROUND TERMINAL of the set with as short a wire as possible to prevent electrical shock, TVI, BCI and other problems.
2. This unit stops the output voltage with a protection circuit, when output voltage is shorted or consumed load current exceeds 25A. When the output voltage is stopped, turn the power switch of the transceiver OFF and remove the cause of the problem.
3. If the fuse blows, replace it with a 10A (at 117V) or 5A (at 240V) fuse after checking the cause of the problem. Use a Philips (+) screwdriver to open the holder. The outside ring of the holder cannot be rotated.

7 - 3 VOICE SYNTHESIZER UNIT IC-EX310

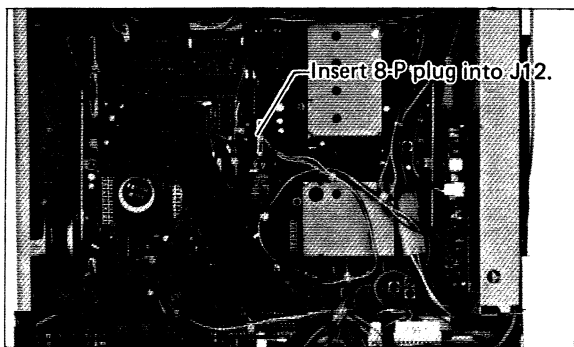
When this unit is installed, the set announces the displayed frequency by pushing the SPEECH switch on the front panel.

7 - 3 - 1 ASSEMBLY PROCEDURE

1. Turn the transceiver upside down.
2. Insert 2-P plug shown in the photo into J2 of this unit, then install the unit with the supplied four screws as shown in the photo.



3. Plug 8-P plug of this unit into J12 of the LOGIC unit.

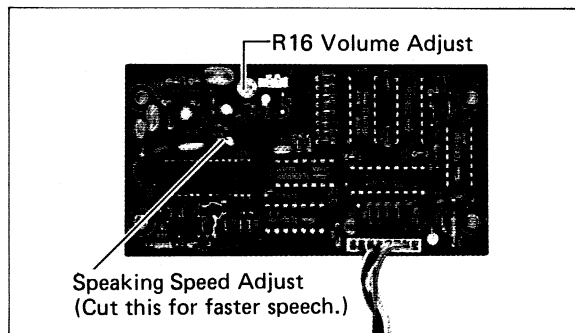


4. Adjust its volume and speaking speed if necessary. (Described later.)

5. Replace the top and bottom covers of the set.

7 - 3 - 2 ADJUSTMENT

1. Adjust the volume of the speech and speaking speed before the top and bottom covers are replaced, if necessary.
2. Connect a power source and turn on the power switch.
3. By pushing the SPEECH switch, the unit is actuated and announces the displayed frequency in English.
4. The volume of the announce is adjustable with R16 in the unit. Adjust it for comfortable level.
5. By cutting W1 jumper wire, the speaking speed becomes faster.
6. When finished the adjustment, replace the top and bottom covers of the set.



7 - 3 - 3 HOW THE VOICE SYNTHESIZER UNIT WORKS

1. When "14.231.5MHz" is displayed, by pushing the SPEECH switch. "ONE FOUR POINT TWO THREE ONE FIVE MHz", will be heard.
2. When a blanked memory channel is selected; "POINT MHz", will be heard.

7 - 4 HIGH-STABILITY CRYSTAL UNIT CR-64

7 - 4 - 1 FEATURES

This high-stability crystal unit is consisted of a temperature-compensating oven heater and a crystal unit. By replacing the original crystal unit with this unit, the total frequency stability of the set will be improved.

The specifications of the unit itself are as follows:

Oscillation frequency: 30.72MHz \pm 10ppm

Stability: \pm 0.5ppm in the range of $-30^{\circ}\text{C} \sim +60^{\circ}\text{C}$

7 - 4 - 2 ASSEMBLY PROCEDURE

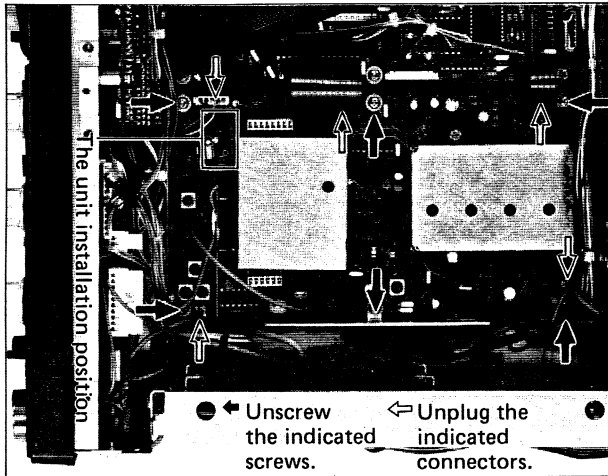
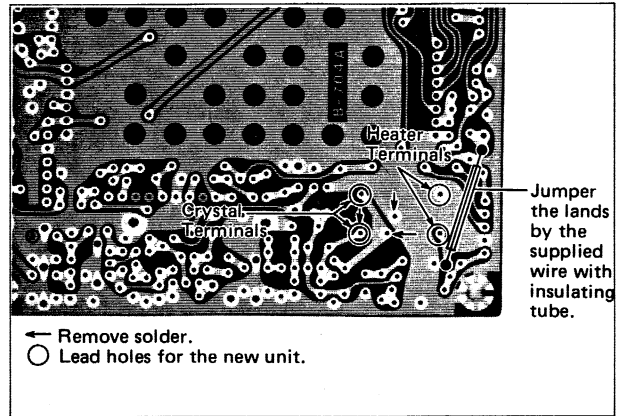
1. Turn the transceiver upside down.
2. Unscrew the six screws retaining the PLL board and unplug the connectors and flat cables indicated in the photo, then turn the board over so that foil side can be seen.
3. Remove the solder of the original crystal unit terminal pins and grounding lead on the foil of the PLL board, by a de-soldering braid, then take off the crystal unit and grounding lead.
4. The location for the high-stability crystal unit is shown in the photo. The holes for the terminal leads of the unit are predrilled. If the holes are filled with solder, remove the solder with a de-soldering braid.

Be sure to orient the unit so that the crystal and heater terminal leads (indicated on the bottom of the unit) are the same direction as shown on the photo.

Insert the unit flush with the board, bend the leads flush with foil side of the board and solder them in.

5. Trim the leads even with the solder points.

6. Jumper the lands of the foil indicated in the photo by using supplied wire with insulating tube. At this time, take care to don't make short circuits with other lands of the foil.
7. This completes the installation. Replace the PLL board and plug the connectors and flat cables unplugged before. Then replace the top and bottom covers.



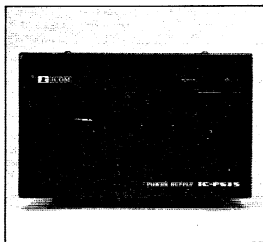
7-4-3 OPERATION

No adjustment is required and the unit improves the frequency stability of the set as follows:

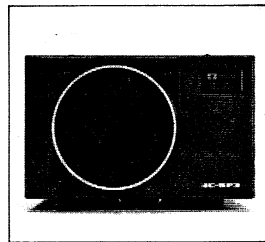
Frequency Stability:

Less than $\pm 50\text{Hz}$ after switch on 1min to 60mins, and less than $\pm 10\text{Hz}$ after 1hour at normal room temperature. Less than $\pm 100\text{Hz}$ in the range of $-10^{\circ}\text{C} \sim +60^{\circ}\text{C}$.

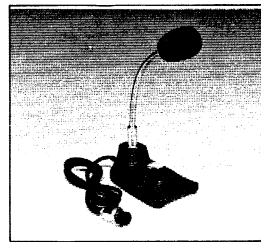
7-5 OTHER OPTIONS



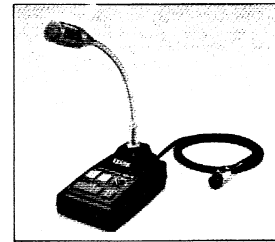
IC-PS15
AC POWER SUPPLY



IC-SP3
EXTERNAL SPEAKER



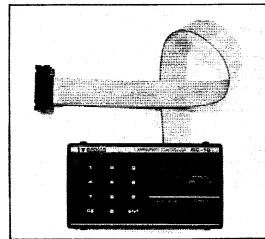
IC-SM6
ELECTRET CONDENSER TYPE
DESK MICROPHONE



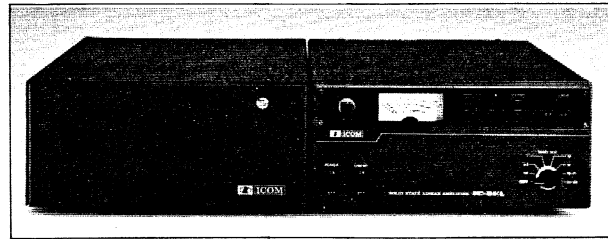
SM-8
ELECTRET CONDENSER TYPE
DESK MICROPHONE
(2-LINE SELECTABLE)



IC-HP1
HEADPHONES



RC-10
FREQUENCY
CONTROLLER

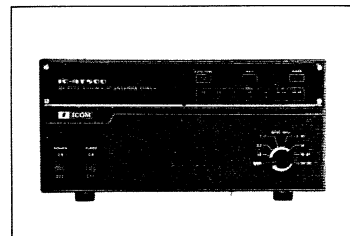


IC-2KLPS
ATTENDANT POWER SUPPLY
FOR IC-2KL

IC-2KL
500W SOLID-STATE
LINEAR AMPLIFIER

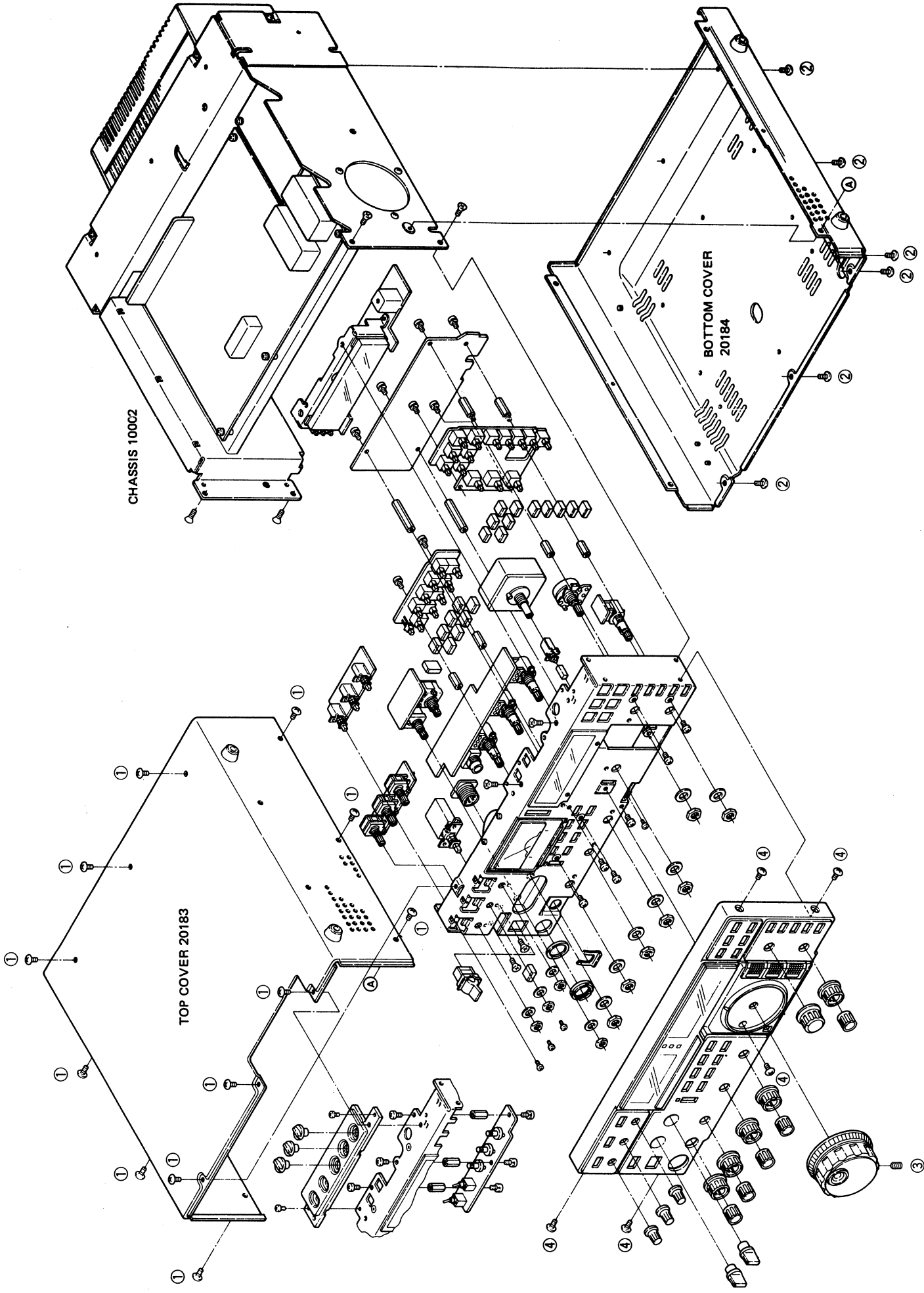


IC-PS30
AC SYSTEM POWER SUPPLY
13.8V 25A



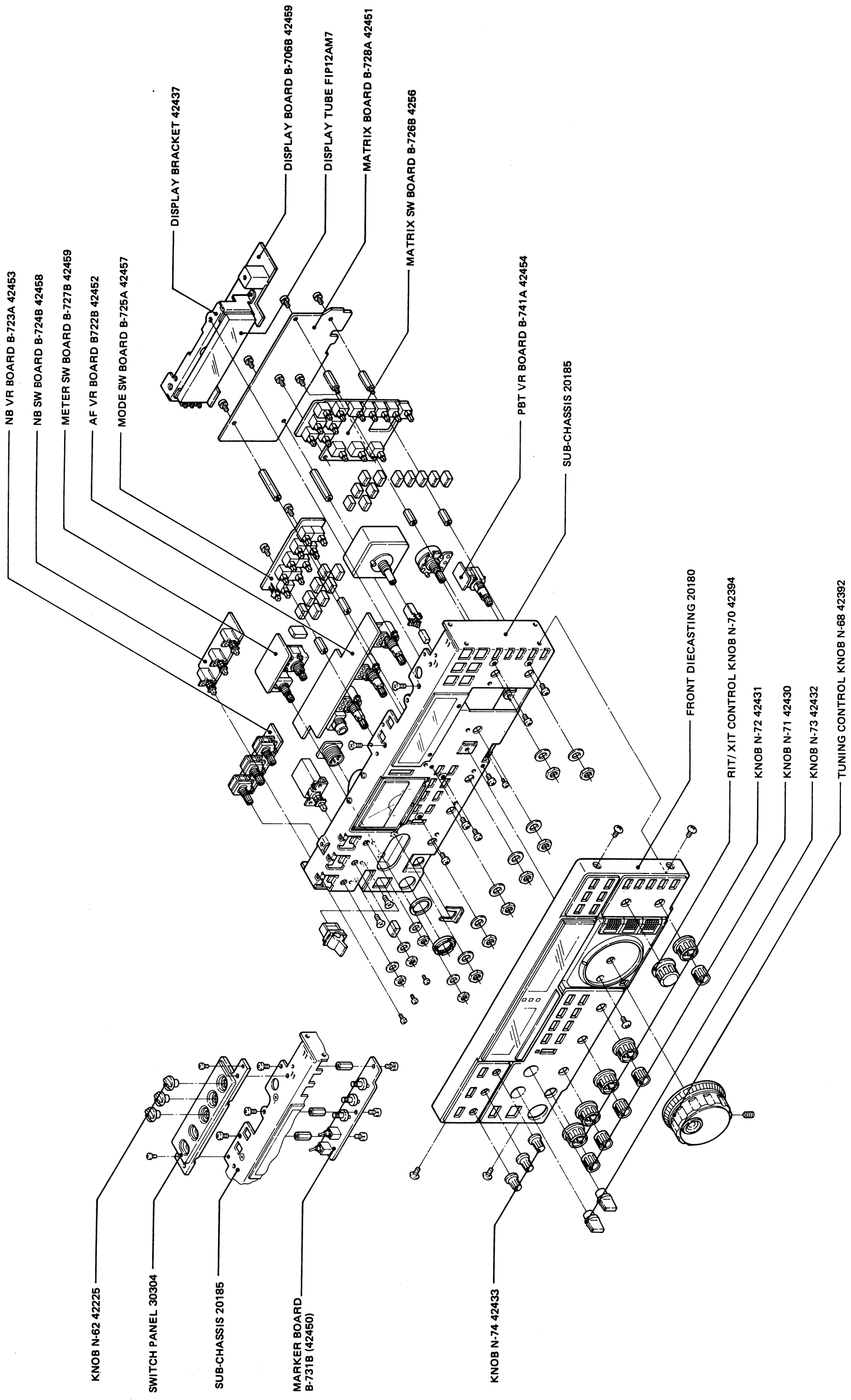
IC-AT100
(100W)
IC-AT500
(500W)
AUTOMATIC
ANTENNA TUNER

SECTION 8 MECHANICAL PARTS AND DISASSEMBLY

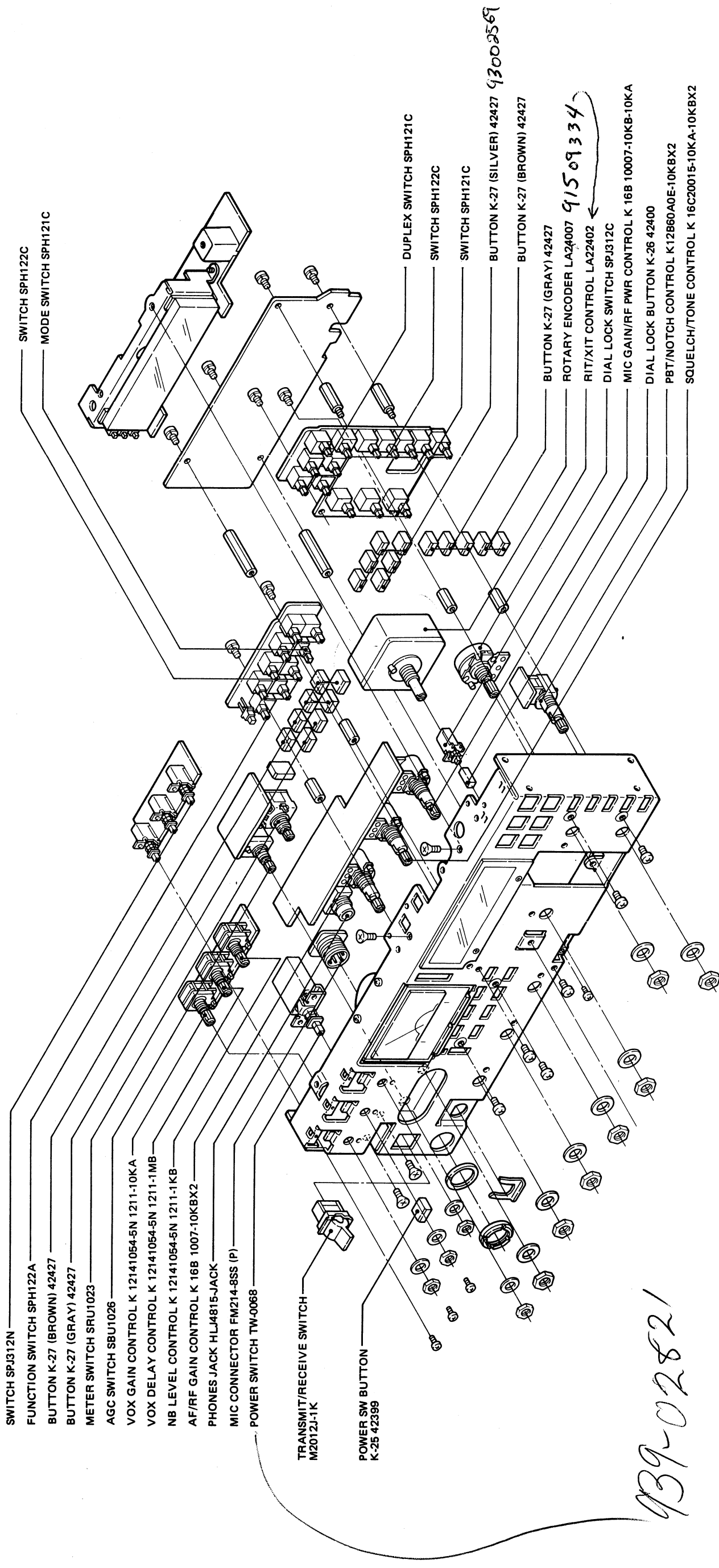


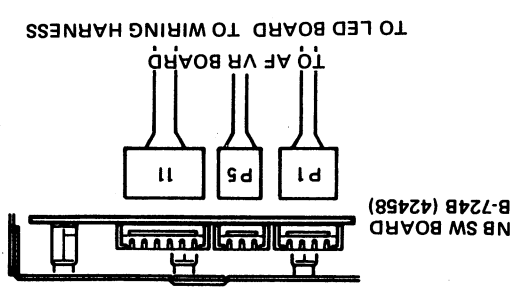
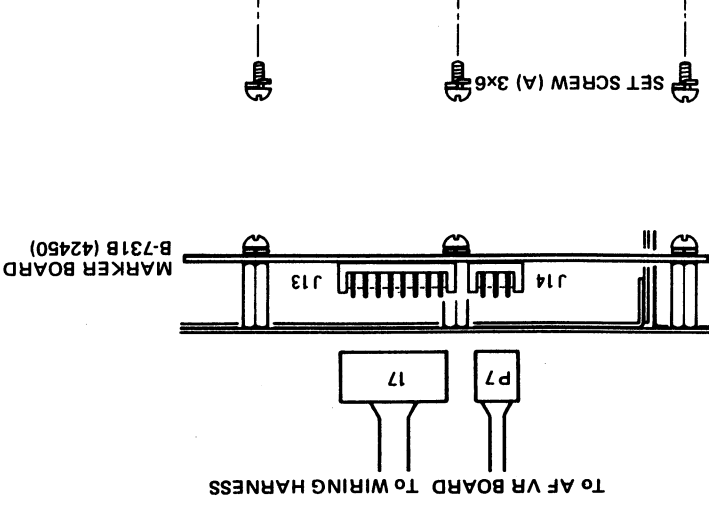
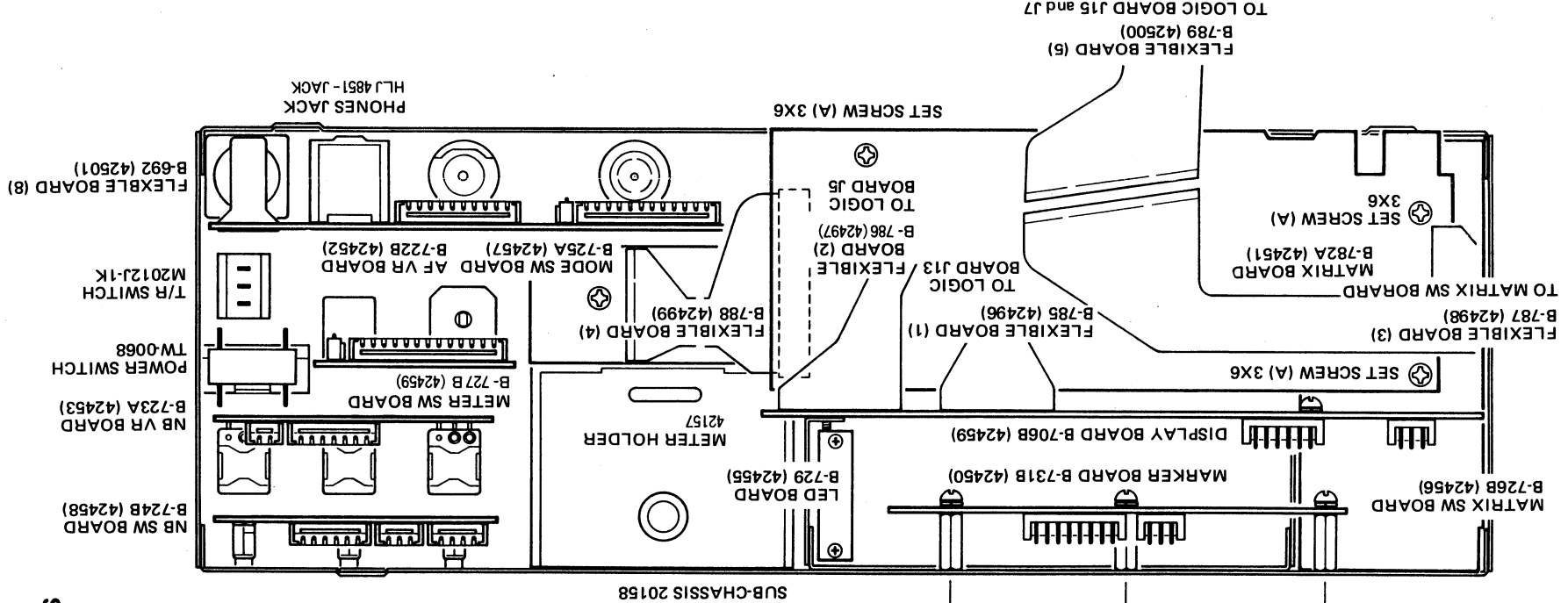
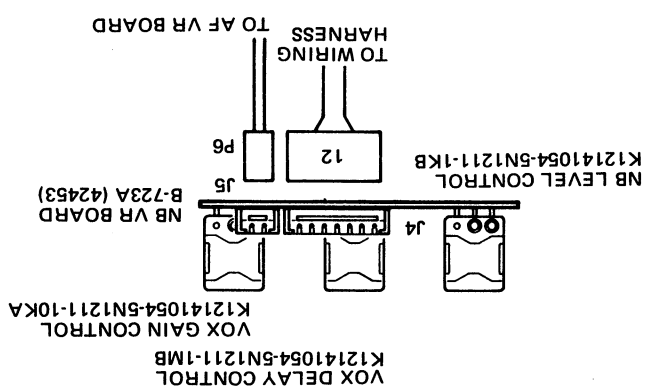
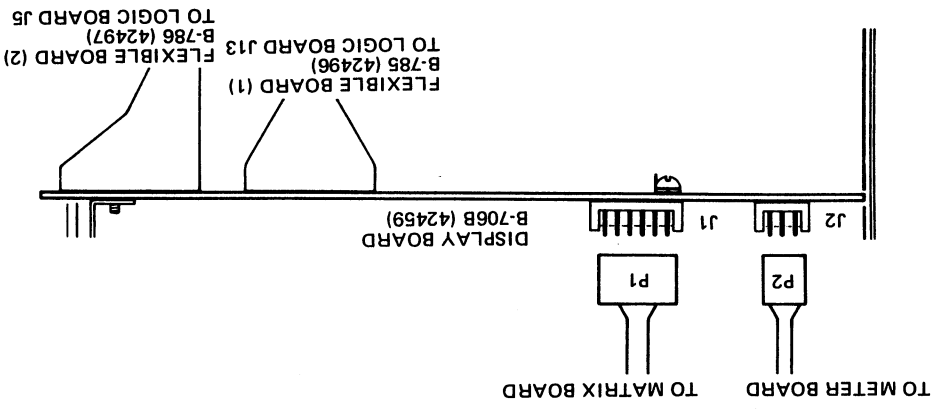
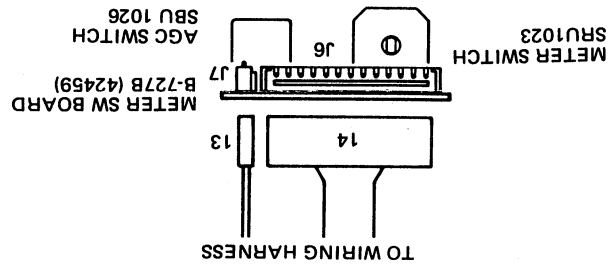
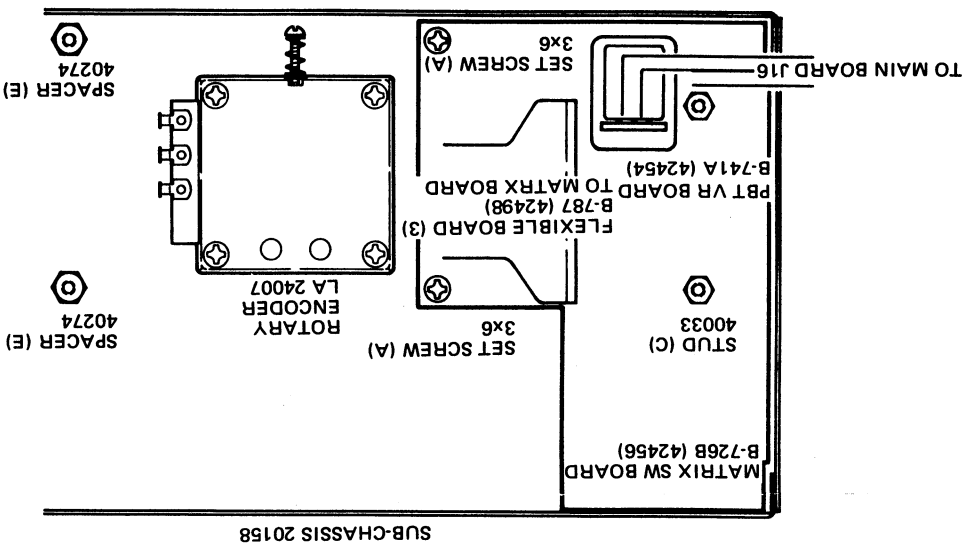
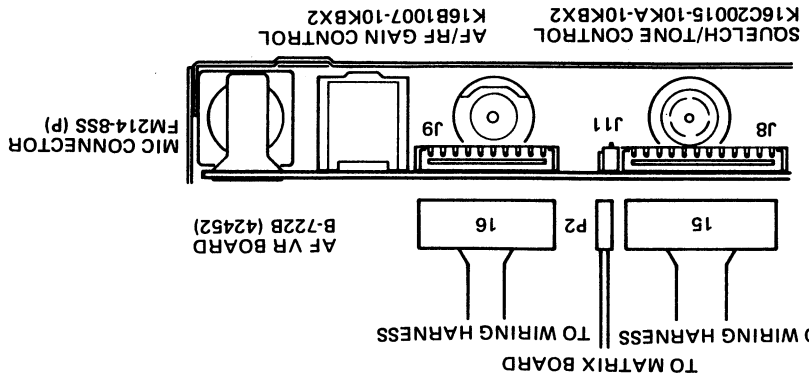
1. Remove the top cover. (12 set screws (1)).
2. Remove the bottom cover. (6 set screws (2)).
3. Remove the front panel control knobs, etc. (Use a hexagonal wrench to remove the four knob screws (3).)
4. Remove the four frame-holding screws (4), and then remove the front panel frame by pulling it forward.

FRONT PANEL PARTS 1



FRONT PANEL PARTS 2

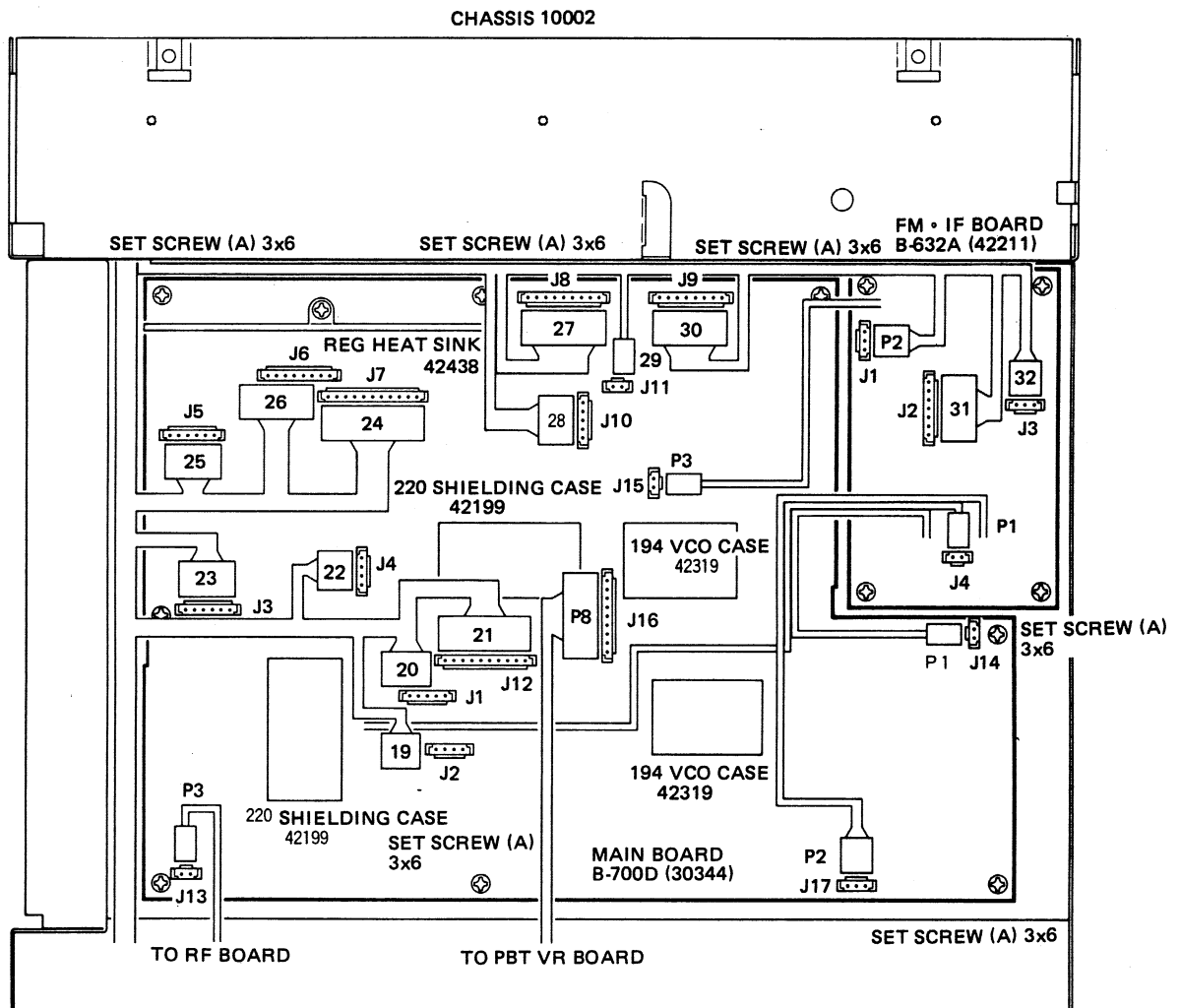




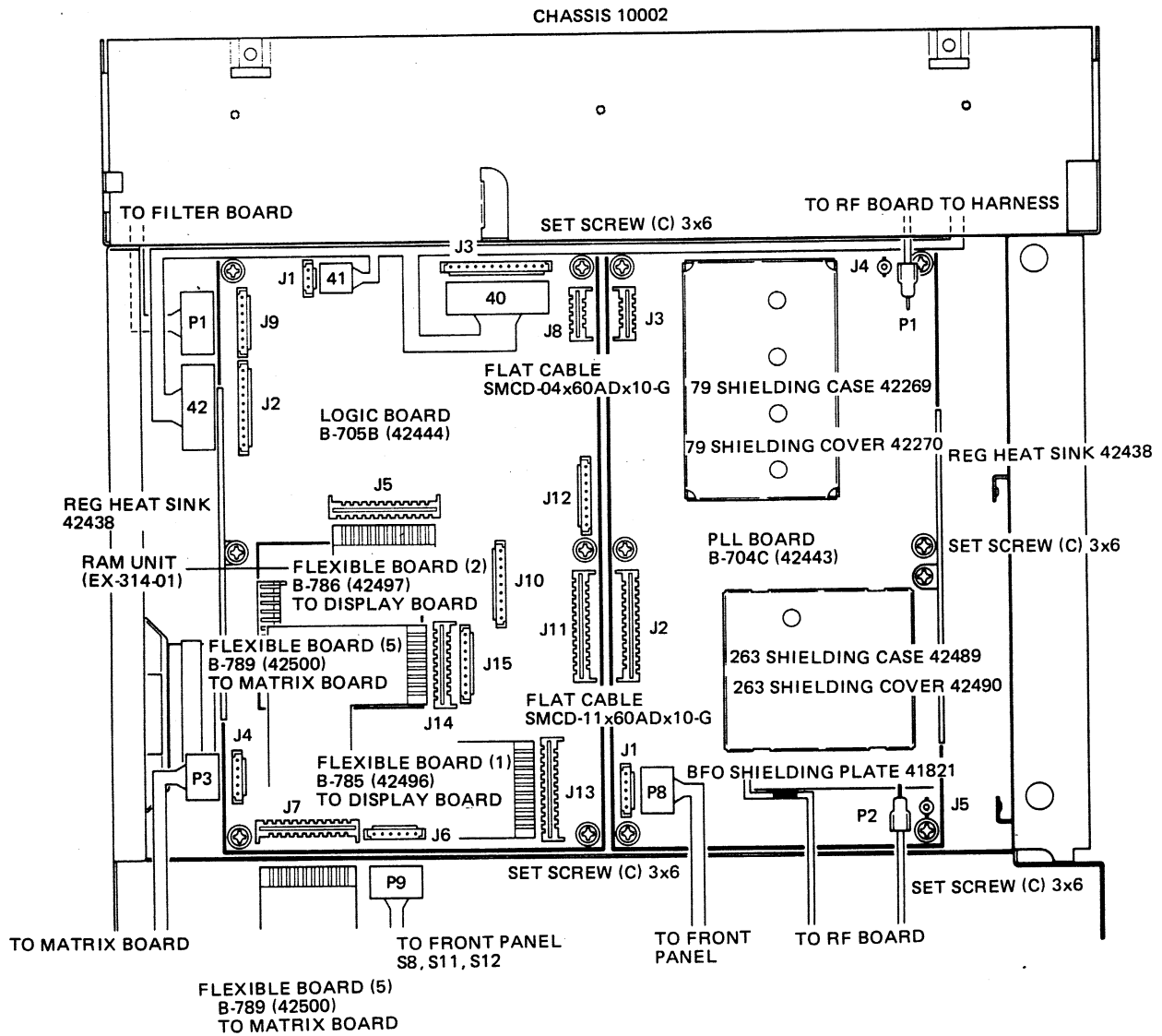
FRONT PANEL CONNECTOR CONNECTIONS

B785-951-03236
951-03237

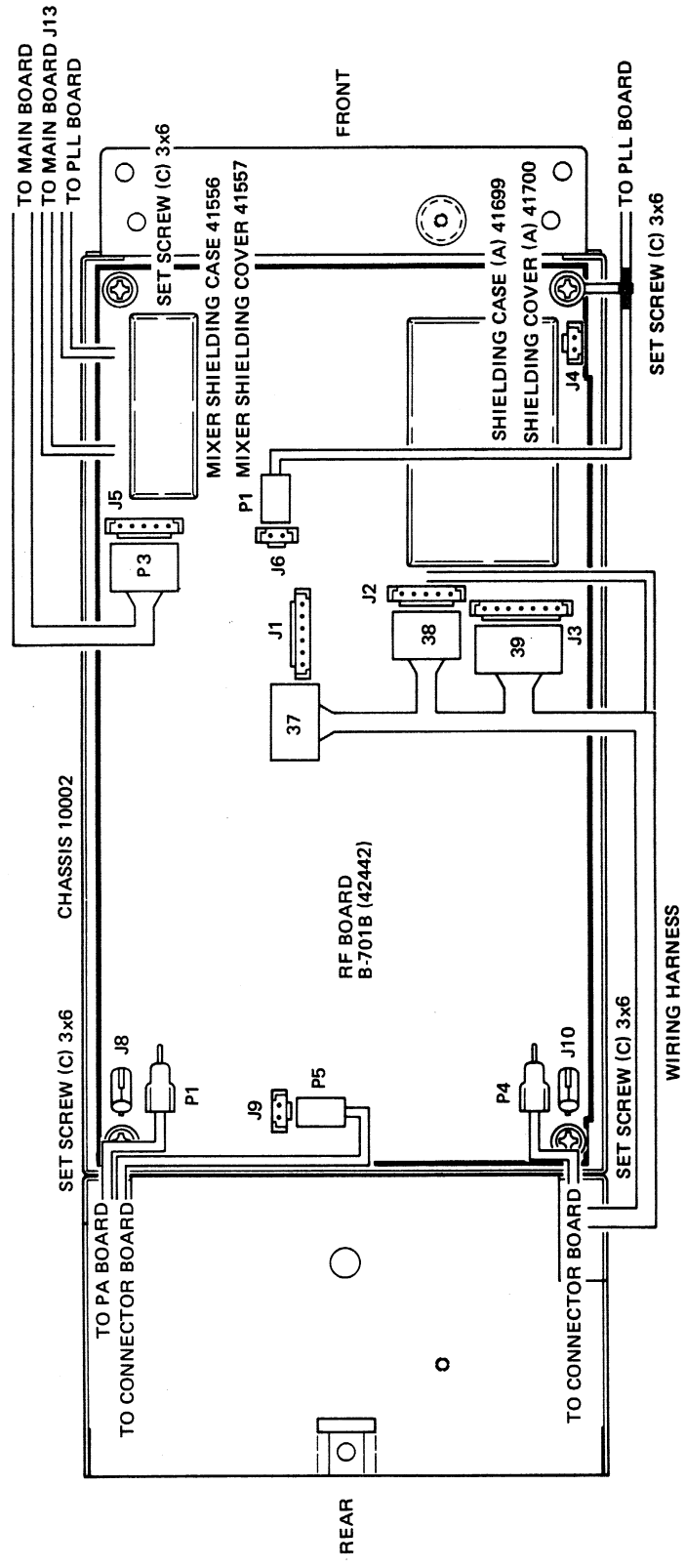
MAIN UNIT SIDE CONNECTOR CONNECTIONS



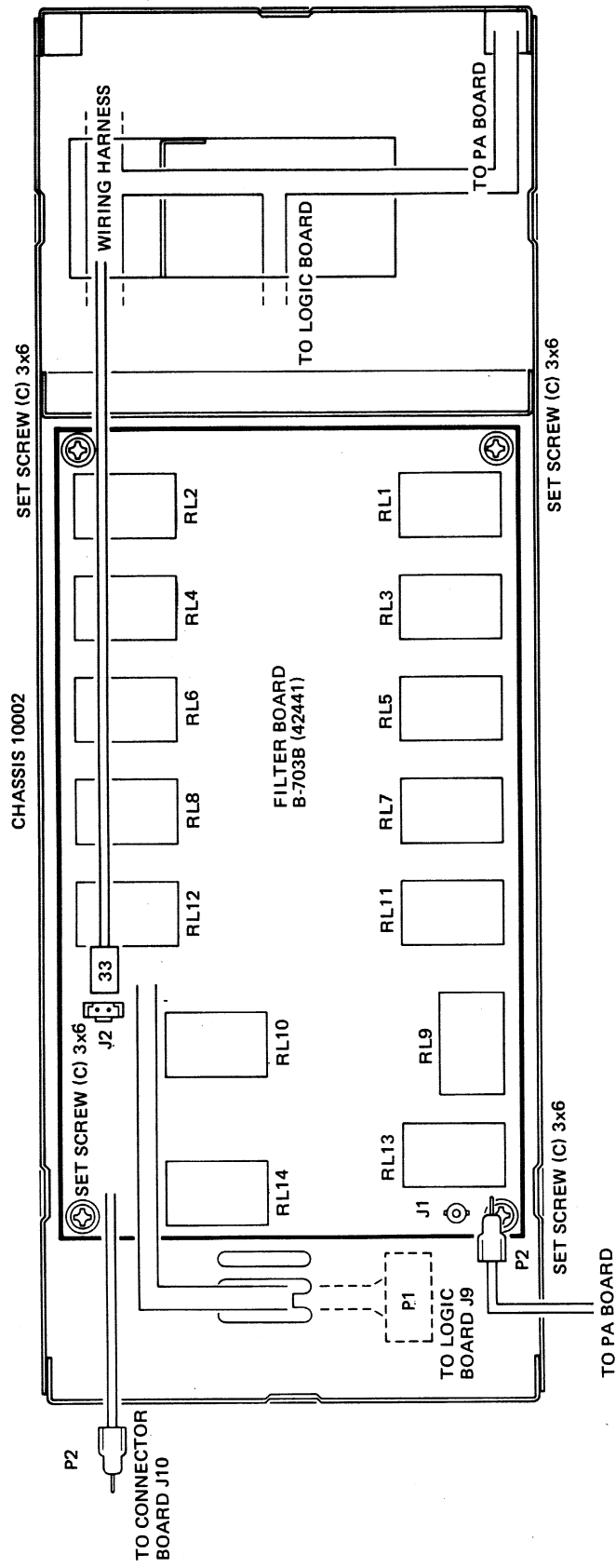
LOGIC · PLL UNIT SIDE CONNECTOR CONNECTIONS



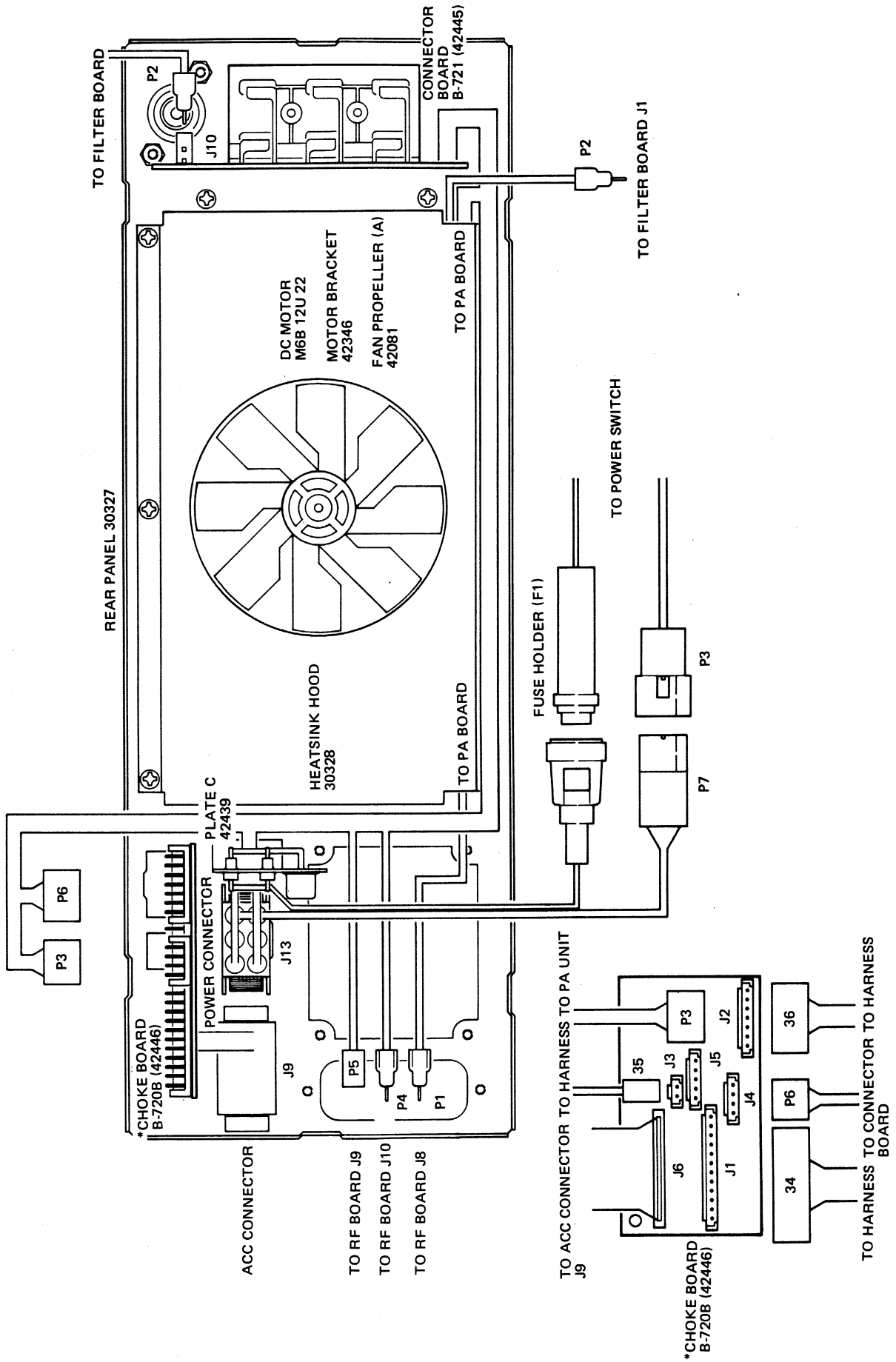
RF UNIT SIDE CONNECTOR CONNECTIONS



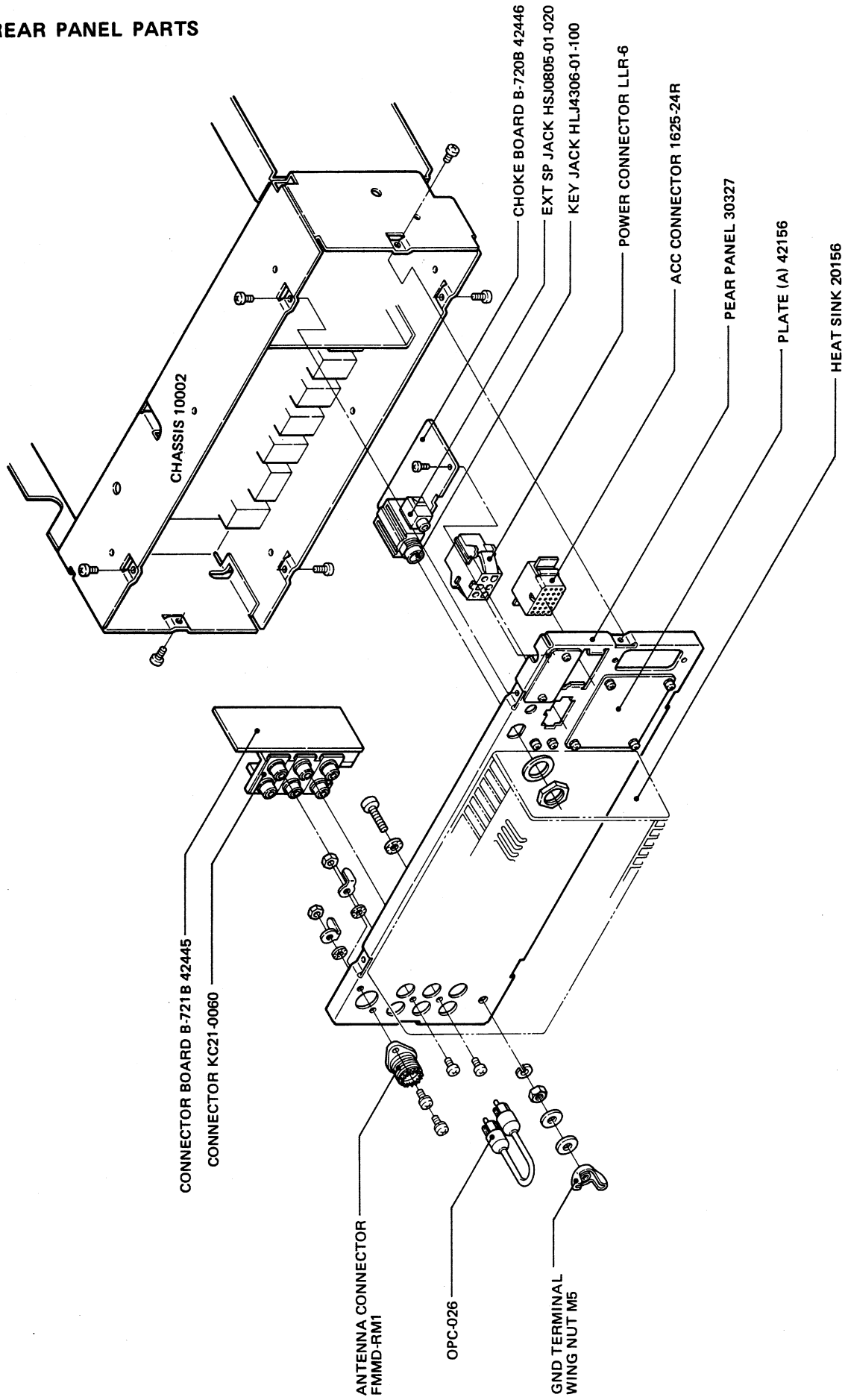
FILTER UNIT SIDE CONNECTOR CONNECTIONS



REAR PANEL CONNECTOR CONNECTIONS



REAR PANEL PARTS



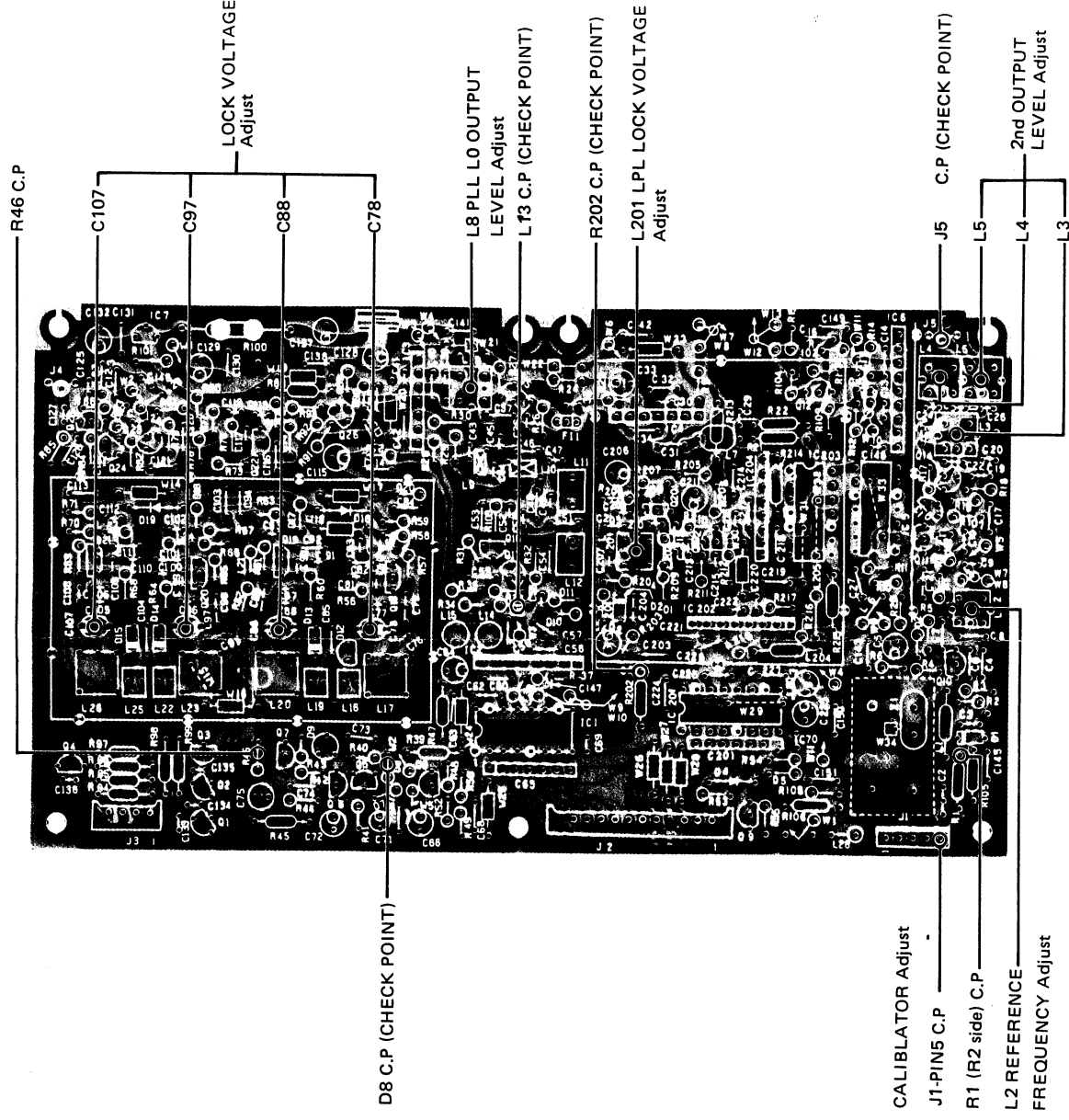
PLL UNIT

SECTION 9 MAINTENANCE AND ADJUSTMENT

9 - 1 PLL ADJUSTMENT

| INSTRUMENTS REQUIRED | | CONNECTIONS | | | | |
|--|--|--|---|--|-----------|---|
| (1) VOLTAGE REGULATED POWER SUPPLY OR ATTENDANT : OUTPUT VOLTAGE DC 13.8V : CURRENT CAPACITY 20A or more | | To PLL UNIT J1-PIN5 R202 (R3) OSCILLOSCOPE R46 D8-CATHODE (2) | | | | |
| (2) OSCILLOSCOPE : FREQUENCY RANGE DC ~ 20MHz : MEASURING RANGE 0.01 ~ 10V | | To PLL UNIT R1 (R2 side) R46 D8-CATHODE (3) | | | | |
| (3) FREQUENCY COUNTER : FREQUENCY RANGE 0.1 ~ 90MHz : ACCURACY ± 1ppm or better : SENSITIVITY 100mV or better | | To DC POWER SOCKET (1) VOLTAGE REGULATED POWER SUPPLY PLL UNIT | | | | |
| (4) RF VOLT METER : FREQUENCY RANGE 0.1 ~ 80MHz : MEASURING RANGE 0.01 ~ 10V | | To PLL UNIT J5 L13 (4) RF VOLT METER | | | | |
| Adjustment | Adjustment conditions | Unit | Measurement location | Adjustment value | Unit | Adjustment point |
| CALIBRATOR | 1. ● Display frequency: 8.0000MHz ● MODE: LSB-GENERAL | PLL | Connect the oscilloscope to J1 pin 5. | 3V | Top panel | CALIB. control |
| REFERENCE FREQUENCY | 1. ● Display frequency: 8.0000MHz ● MODE: LSB-GENERAL | PLL | Connect the frequency counter to R1 (R2 side). | 30.7200MHz | PLL | L2 |
| PLL LO OUTPUT LEVEL | 1. ● Display frequency: 8.0000MHz ● MODE: LSB-GENERAL | PLL | Connect the RF voltmeter to L13. | Adjust to maximum output: 400mV ~ 1Vpp | PLL | L8 |
| LOCK VOLTAGE | 1. ● Display frequency: 8.0000MHz ● MODE: LSB-GENERAL 2. ● Display frequency: 7.9999MHz | PLL(LPL) | Connect the oscilloscope to R202 (R3). | 3V 1.5 ~ 2V | PLL(LPL) | L201(L1) Confirming |
| HPL LOCK VOLTAGE | 1. ● Display frequency: 7.9999MHz ● MODE: LSB-GENERAL 2. ● Display frequency: 14.9999MHz ● MODE: USB-GENERAL 3. ● Display frequency: 21.9999MHz 4. ● Display frequency: 29.9999MHz 5. ● Display frequency: 8.0000MHz 6. ● Display frequency: 15.0000MHz 7. ● Display frequency: 22.0000MHz 8. ● Display frequency: 7.9999MHz ● MODE: LSB-GENERAL | PLL | Connect the oscilloscope to R46. | 6.5V Approx. 3V 2.1 ~ 2.5V | PLL | C78 C88 C97 C107 Confirming |
| 2nd LO OUTPUT LEVEL | 1. ● Display frequency: 8.0000MHz ● MODE: LSB-GENERAL | PLL | Connect the oscilloscope to D8 cathode. Terminate J5 with a 50Ω resistor and connect the RF voltmeter there. | Adjust to maximum output: 250 ~ 400mVrms | PLL | L3 ~ L5 |

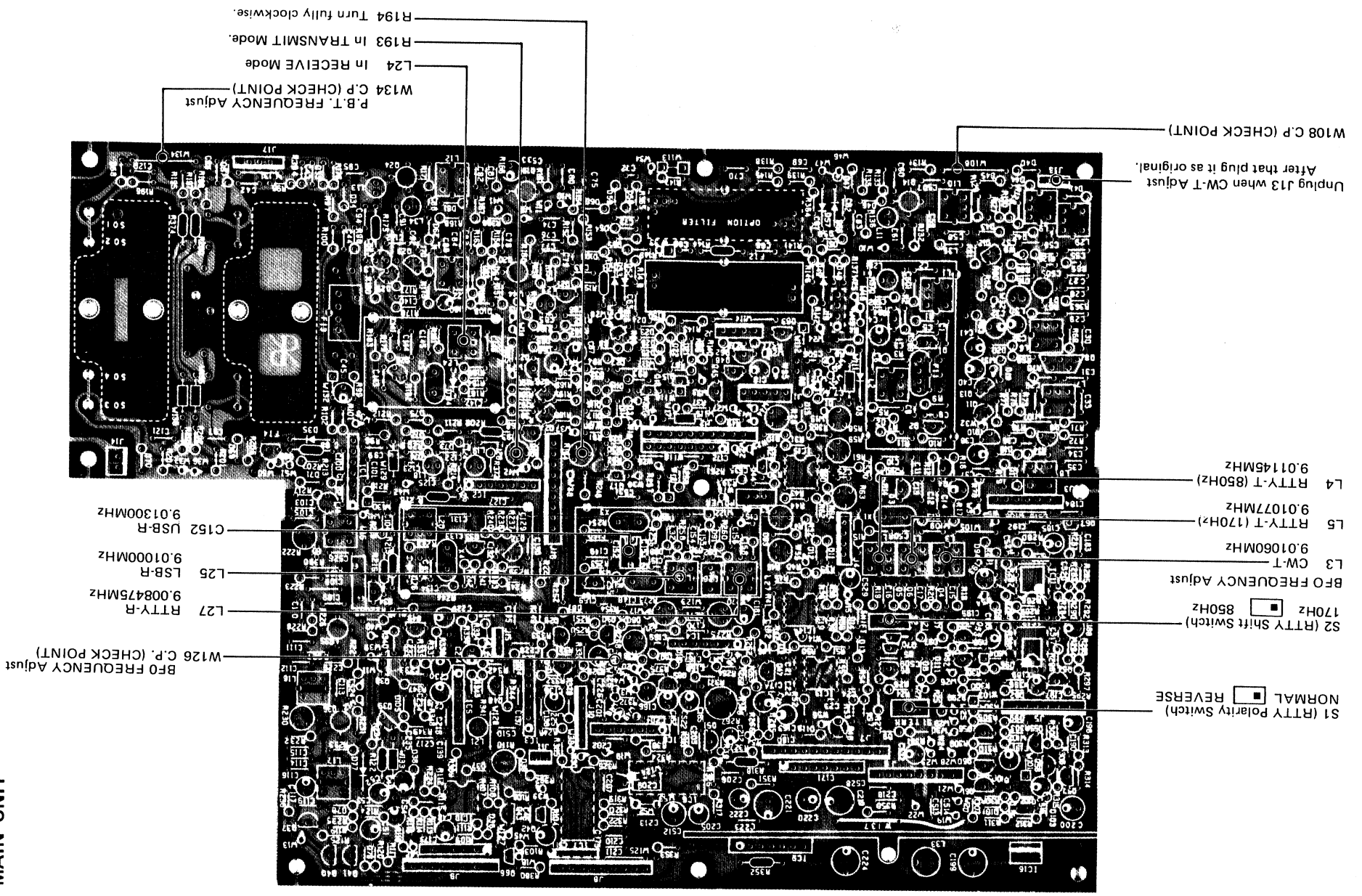
Note: After completed the adjustment, make J5 in original condition.



9-2 MAIN UNIT (COMMON CIRCUITS) ADJUSTMENT

| INSTRUMENTS | | CONNECTIONS | | | | |
|--|--|-------------|--|---|------|------------------|
| (1) VOLTAGE REGULATED POWER SUPPLY OR ATTENDANT POWER SUPPLY : OUTPUT VOLTAGE DC 13.8V : CURRENT CAPACITY 20A or more | | MAIN | Adjustment conditions | Adjustment value | Unit | Adjustment point |
| (2) FREQUENCY COUNTER : FREQUENCY RANGE 0.1 ~ 90MHz : ACCURACY ± 1ppm or better : SENSITIVITY 100mV or better | | | | | | |
| (3) RF POWER METER (TERMINATED TYPE) : MEASURING RANGE 20 ~ 200W : FREQUENCY RANGE 1.8 ~ 30MHz : IMPEDANCE 50Ω : SWR 1.1 or less | | | | | | |
| Adjustment | Adjustment conditions | Unit | Measurement location | Adjustment value | Unit | Adjustment point |
| BFO FREQUENCY | 1. Display frequency: 14MHz • MODE: USB Set in RECEIVE mode | MAIN | Connect the frequency counter to W126. | 9.01300MHz | MAIN | C152 |
| | 2. • MODE: LSB | | | 9.01000MHz | | L25 |
| | 3. • MODE: CW | | | 9.00980MHz ± 100Hz | | Confirming |
| | 4. • MODE: RTTY | | | 9.008475MHz | | L27 |
| | 5. • MODE: AM | | | No output | | Confirming |
| | 6. After confirming the RF POWER METER is connected to the ANT connector, set in TRANSMIT mode. | | | 9.01000MHz ± 100Hz | | |
| | 7. • MODE: CW Unplug the connector inserted to J13, then make key down. | | Connect the frequency counter to W108. | 9.01060MHz | | L3 |
| | 8. • MODE: RTTY • S1: Right (REVERSE side) • S2: Left (170Hz side) | | | 9.01077MHz | | L5 |
| | 9. • S2: Right (850Hz side) Note: Repeat adjustments of 6 ~ 9 several times. | | | 9.01145MHz | | L4 |
| | 10. • S1: Left (NORMAL side) • S2: Left/Right | MAIN | Connect the frequency counter to W108. | Switch S2 the left side and right side alternately, and confirm the frequency is 9.01060 MHz in any side. | | Confirming |
| P.B.T. FREQUENCY | Note: After adjustment of 7, plug the connector of J13 in original condition. | MAIN | Connect the frequency counter to W134. | 9.46650MHz | MAIN | L24 |
| | 1. • Display frequency: 14MHz • MODE: USB • FILTER: ON • P.B.T. CONTROL: Center Turn R194 fully clockwise and set in RECEIVE mode. | | | 9.46800MHz or higher 9.46500MHz or lower 9.46650MHz | | Confirming |
| | 2. • P.B.T. CONTROL: Fully clockwise | | | | | |
| | 3. • P.B.T. CONTROL: Fully counterclockwise | | | | | |
| | 4. • P.B.T. CONTROL: Center Set in TRANSMIT mode. | | | | | R193 |

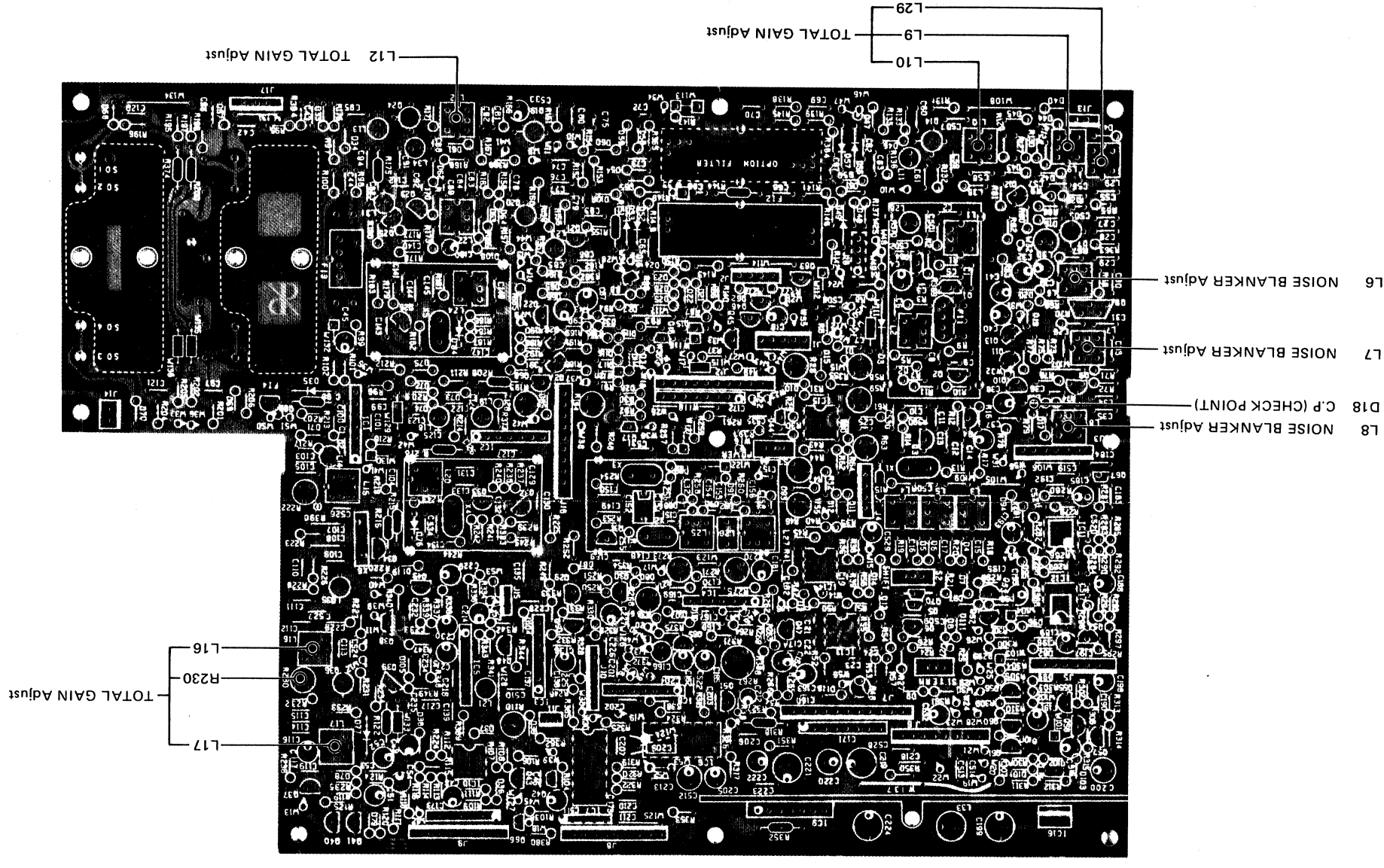
MAIN UNIT



9-3 RECEIVER ADJUSTMENT

| INSTRUMENTS REQUIRED | | CONNECTIONS | | | | | |
|--|---|--|---|--|-------------|-----------------------------|--|
| (1) VOLTAGE REGULATED POWER SUPPLY OR ATTENDANT : OUTPUT VOLTAGE DC 13.8V : OUTPUT CURRENT 20A or more | (2) STANDARD SIGNAL GENERATOR (SSG) : FREQUENCY RANGE 0.1 ~ 40MHz : OUTPUT LEVEL (Loaded value) -20 ~ +90dB (0dB = 1μV) | (3) AC MILLIVOLTMETER : MEASURING RANGE 10mV ~ 3V | (4) EXTERNAL SPEAKER : IMPEDANCE 8Ω | (5) OSCILLOSCOPE : FREQUENCY RANGE DC ~ 20MHz : MEASURING RANGE 0.01 ~ 10V | | | |
| Adjustment | Adjustment conditions | Unit | Measurement location | Adjustment value | Unit | Adjustment point | |
| TOTAL GAIN | 1. | <ul style="list-style-type: none"> Display frequency: 14MHz MODE: USB RF GAIN: Fully clockwise RF AMP: OFF FILTER: OFF NOTCH: OFF P.B.T.: Center STONE: Center SCL: Fully counterclockwise AGC: FAST RIT: OFF NB: OFF Set the output level of the SSG to -10dBμ. | Connect the AC millivoltmeter to the EXT SP jack. | Adjust to maximum AF output. | MAIN | L9, L10, L12, L16, L17, L29 | |
| | 2. | Set the output level of the SSG to +40 ~ 60dBμ. | | Adjust the AF GAIN control to get 2.5V AF output. | FRONT PANEL | | |
| | 3. | Turn off the output of the SSG. | | Adjust R230 so that the noise level is 30dB down (about 80mV) from 2.5V. | MAIN | R230 | |
| NOISE BLANKER | 1. | <ul style="list-style-type: none"> Display frequency: 14MHz MODE: USB RF AMP: OFF NB TIMING SW: ON NB: ON Apply pulse noise to the ANT connector. | Connect the oscilloscope to D18. | Adjust to maximum noise waveform on the scope. | MAIN | L6 ~ L8 | |
| | Note: When the NB TIMING SWITCH is turned off, the noise blanker should not function for wide noises (pulse width: about 5 milli seconds). When receiving narrow noises (pulse width: 0.4 ~ 0.5 milliseconds), the noise blanker should function regardless of the NB TIMING SWITCH position (turned ON or OFF). | | | | | | |

MAIN UNIT

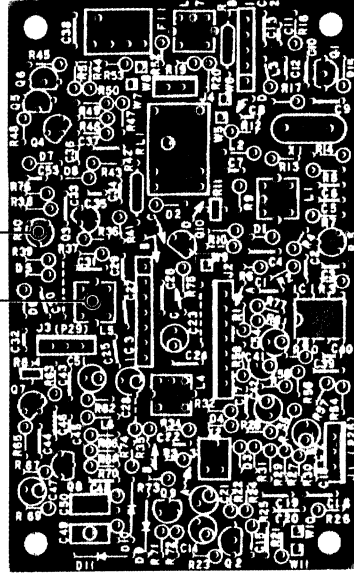


9 - 3 RECEIVER ADJUSTMENT (Continued)

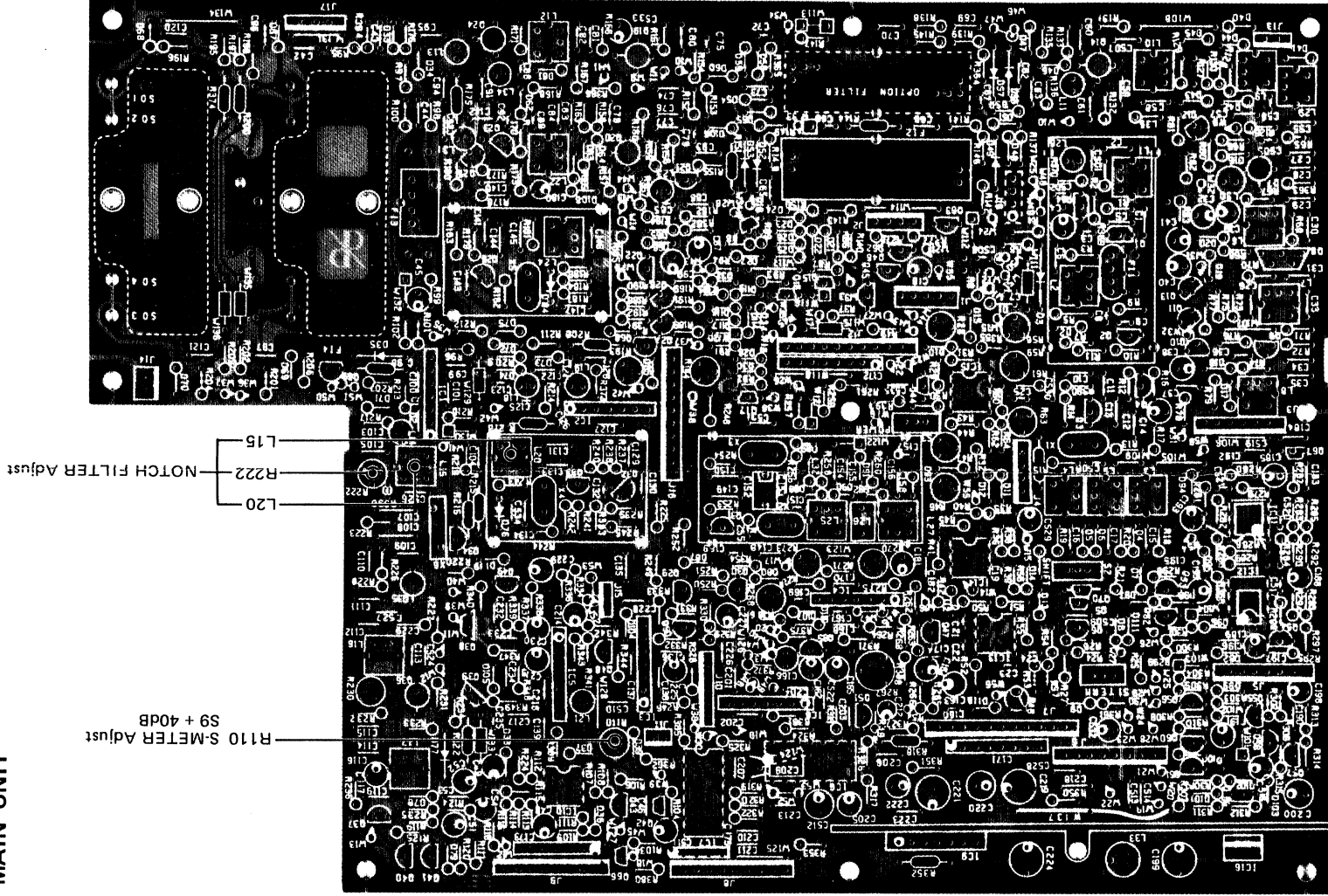
| Adjustment | Adjustment conditions | Unit | Measurement location | Adjustment value | Unit | Adjustment point | |
|--|---|-------------|---|---|---|------------------|------------|
| S-METER | <ul style="list-style-type: none"> Display frequency: 14MHz MODE: USB RF GAIN: Fully clockwise RF AMP: OFF FILTER: OFF NOTCH: OFF P.B.T.: Center STONE: Center SOL: Fully counterclockwise AGC: FAST Confirm that the S-meter points zero-point when power is off and no signal is received. Then apply +74dBμ signal from the SSG. | FRONT PANEL | S-METER | S9 + 40dB | MAIN | R110 | |
| | | 2. | Set the output level of the SSG to +34dBμ. | | S8 ~ S9 | | Confirming |
| | | 3. | Set the output level of the SSG to +14dBμ. | | S2 ~ S3 | | |
| | | 4. | <ul style="list-style-type: none"> Display frequency: 29.6250MHz RF AMP: ON Set the output level of the SSG to +6dBμ. | | Adjust to get maximum meter deflection. | FM | L5 |
| | | 5. | | | S5 | | R40 |
| Note: Repeat the adjustments of 4. and 5. several times. | | | | | | | |
| NOTCH FILTER | <ul style="list-style-type: none"> Display frequency: 14.0485MHz MODE: USB RF GAIN: Fully clockwise RF AMP: OFF FILTER: OFF MARKER: ON NOTCH: ON Center SOL: Fully counterclockwise AGC: FAST Receive the marker's signal. | FRONT PANEL | S-METER | Adjust to get maximum meter deflection. | MAIN | L20 R222 | |
| | | 2. | <ul style="list-style-type: none"> NOTCH: Fully clockwise and counterclockwise. | | Turn the NOTCH control fully clockwise and counterclockwise alternately, and adjust to get the same meter deflection. | | L15 |

FM UNIT

S-METER Adjust
L5 TUNE (485KHz)
R40 FM S5 Adjust



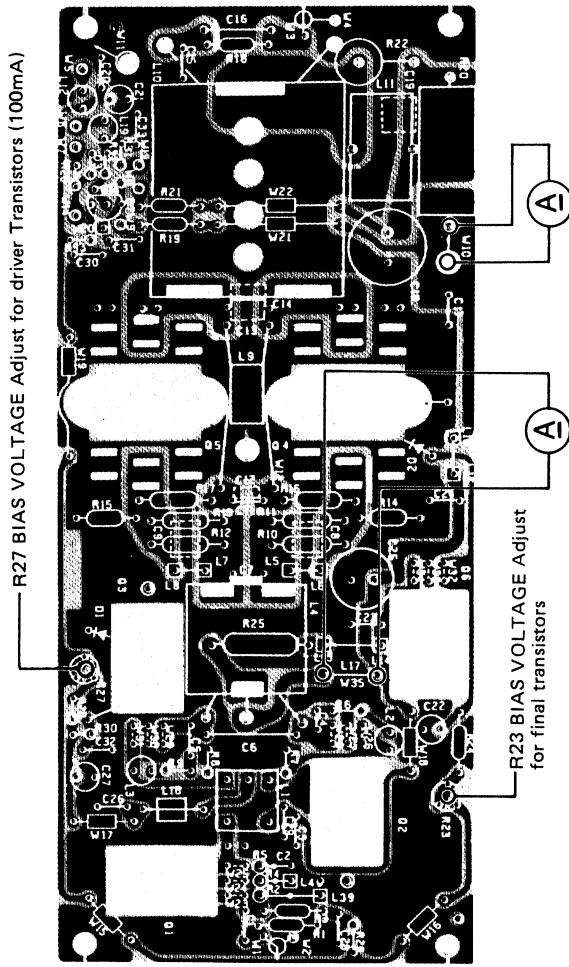
MAIN UNIT



9 - 4 TRANSMITTER ADJUSTMENT

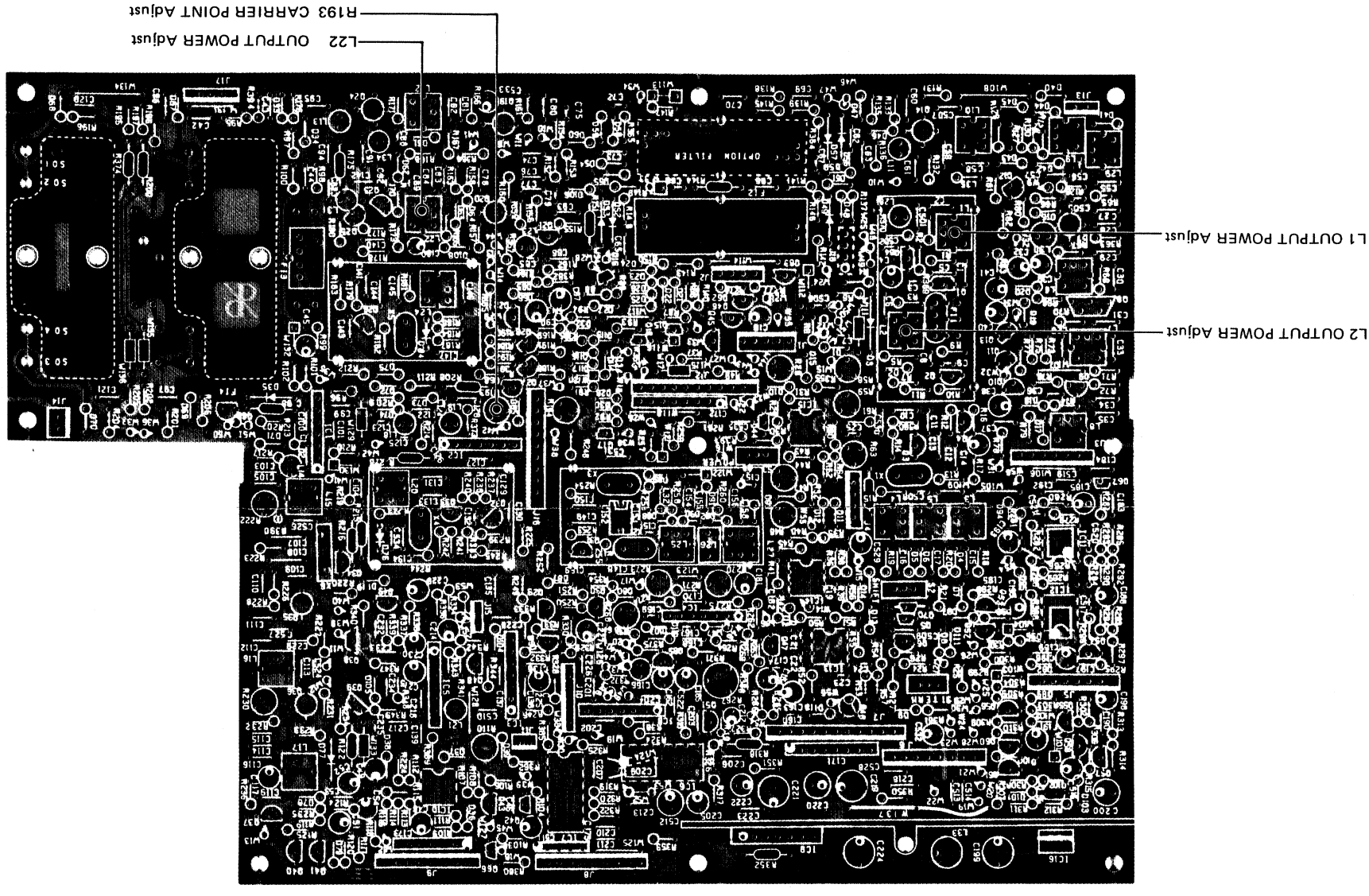
| INSTRUMENT REQUIRED | | CONNECTIONS | | | |
|--|--|--|---|--|------------------|
| Adjustment | Adjustment conditions | Measurement location | Adjustment value | Unit | Adjustment point |
| (1) VOLTAGE REGULATED POWER SUPPLY OR ATTENDANT : POWER SUPPLY : DC 13.8V : OUTPUT VOLTAGE : 20A or more : CURRENT CAPACITY : 20 ~ 200W : MEASURING RANGE : 1.8 ~ 30MHz : FREQUENCY RANGE : 50Ω : IMPEDANCE : 1.1 (2) RF POWER METER (TERMINATED TYPE) : MEASURING RANGE : 20 ~ 200W : FREQUENCY RANGE : 1.8 ~ 30MHz : IMPEDANCE : 50Ω : SWR : 1.1 (3) AF GENERATOR (AG) : FREQUENCY RANGE : 200 ~ 3000Hz : OUTPUT LEVEL : 0 ~ 300mV (4) AC MILLIVOLTMETER : MEASURING RANGE : 10mV ~ 3V | | To DC POWER SOCKET | To ANT CONNECTOR | | |
| | | (1) VOLTAGE REGULATED POWER SUPPLY (2) RF POWER METER (3) AF GENERATOR (AG) (4) AC MILLIVOLTMETER | To MIC CONNECTOR To MIC CONNECTION To DC MILLIVOLTMETER (MIC CONNECTION) | To DC MILLIVOLTMETER To DC MILLIVOLTMETER (MIC CONNECTION) | |
| | | | | | |
| BIAS VOLTAGE | 1. Display frequency: 14MHz MODE: SSB MIC GAIN: Fully counterclockwise After confirming no MIC input, set in TRANSMIT mode. 2. Note: After adjustments of 1. and 2., solder W35 and W10 as original conditions. | Desolder at the center at W35 (jumper wire with 6 bead cores), and connect a DC ammeter there in series. | 100mA | PA | R27 |
| OUTPUT POWER | 1. Display frequency: 14MHz MODE: USB COMP: OFF Apply 1.5KHz/3mV signal from the AG, then adjust the MIC GAIN control to get 30W output power. 2. COMP: ON | Desolder W10, and connect a DC ammeter between W10 and R20. | 600mA | | R23 |
| CARRIER POINT | 1. Display frequency: 14MHz MODE: USB/LSB COMP: OFF Apply 270Hz/3mV signal from the AG, then adjust the MIC GAIN control to get 30W output power. | Connect the RF POWER METER to the ANT connector. | | MAIN | L1, L2 |
| | | Connect the RF POWER METER to the ANT connector. | | MAIN | L22, R193 |

PA UNIT



W35 C.P for driver transistors W10, R20 C.P for final transistors

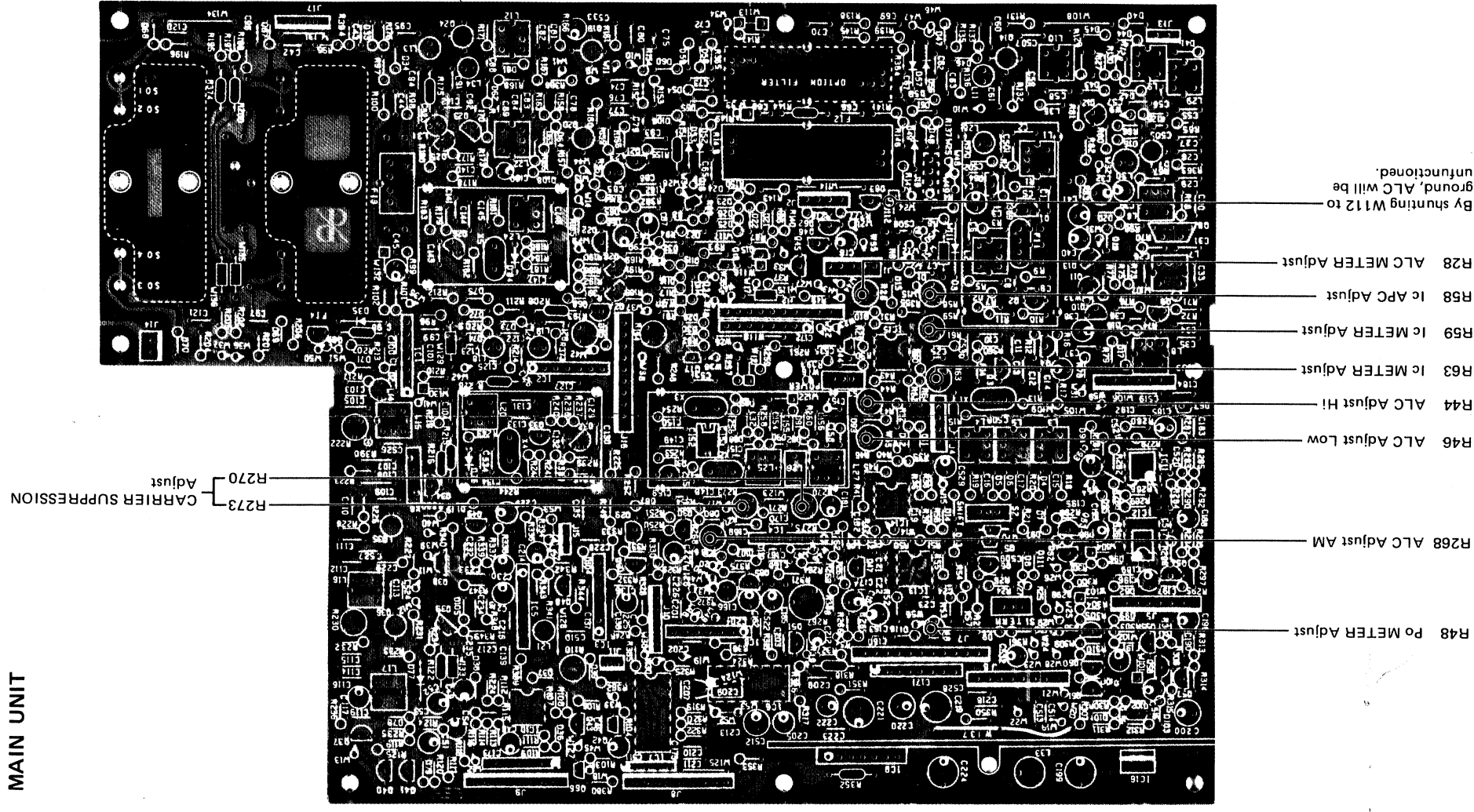
MAIN UNIT



9 - 4 TRANSMITTER ADJUSTMENT (Continued)

| Adjustment | Adjustment conditions | Unit | Measurement location | Adjustment value | Unit | Adjustment point |
|-----------------------|---|------|--|--|------|-------------------|
| Ic · APC | 1. Display frequency: 14MHz • MODE: CW • R44 (MAIN UNIT): Fully counterclockwise • R46 (MAIN UNIT): Fully clockwise Set in TRANSMIT mode and key down. | | Read the ammeter provided in the power supply, or connect an ammeter to the power cable in series. | 22A | MAIN | R58 |
| | 1. Display frequency: 14MHz • MODE: CW • RF POWER: Fully counterclockwise Set in TRANSMIT mode and key down. | | Connect the RF POWER METER to the ANT connector. | 10W | MAIN | R46 |
| | 2. RF POWER: Fully clockwise | | | 100W | | R44 |
| | <p>Note: Check RF OUTPUT POWER on each band (90 ~ 100W), and current drain (less than 20A).</p> <p>• MODE: AM Make ALC unfunction by shunting W112 to ground.</p> <p>Note: After adjustment, remove shunting jumper of W112. Set in TRANSMIT mode with no MIC input, the OUTPUT power should be 40 ~ 60W.</p> | | | | | |
| CARRIER SUPPRESSION | 1. Display frequency: 14MHz • MODE: USB/LSB • COMP: OFF • MIC GAIN: Fully counterclockwise Set in TRANSMIT mode. | | Connect the RF voltmeter or spectrum analyzer to the ANT connector. | | MAIN | R270 R273 |
| | 2. COMP: ON | | Read the ammeter provided in the power supply, or connect an ammeter to the power cable in series. | Less than -50dB. Adjust to total current minus 3A. | MAIN | Confirming R59 |
| METER (a) Ic METER | 1. Display frequency: 14MHz • MODE: RTTY • RF POWER: Fully clockwise • METER SWITCH: Ic Set in TRANSMIT mode. | | Ic METER | 0.6A | | R63 |
| | 2. MODE: CW TRANSMIT mode and key up. | | COMP METER | By turning COMP switch ON, the meter deflection and output power will be increased slightly. | | Confirming |
| | 3. MODE: SSB • COMP: OFF • METER SWITCH: COMP Apply 270Hz/3mV signal from the AG, then adjust the MIC GAIN control to get 30W output power. | | Po METER | 100% | | R48 |
| (c) Po METER | 4. MODE: RTTY • COMP: OFF • METER SWITCH: Po Set in TRANSMIT mode. | | ALC METER | ALC ZONE Full level: (Center of meter scale) | | R28 |
| (d) ALC METER | 5. MODE: USB • MIC GAIN: Fully clockwise • RF POWER: Fully counterclockwise • METER SWITCH: ALC Apply 1.5KHz/100 ~ 300 mV signal from the AG. | | | | | |

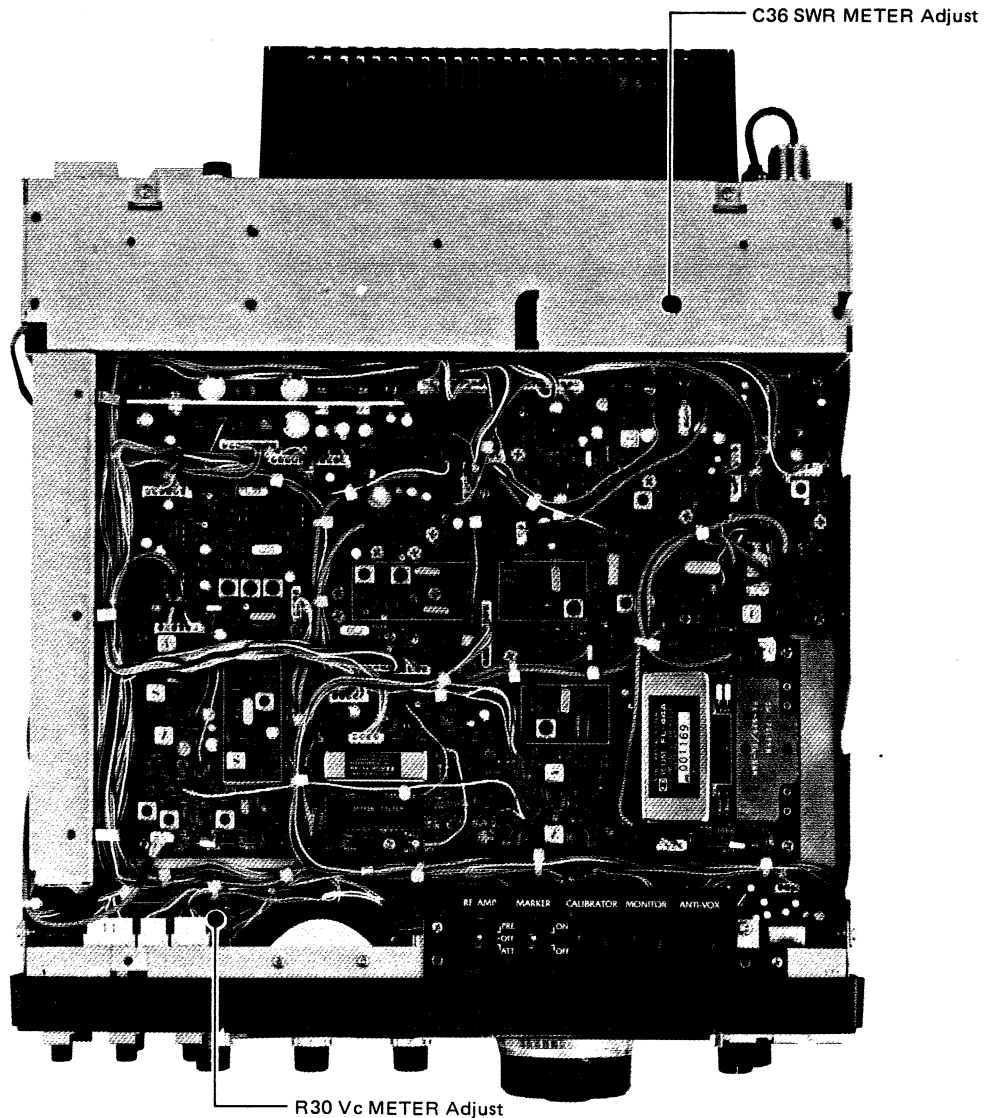
MAIN UNIT



9 - 4 TRANSMITTER ADJUSTMENT (Continued)

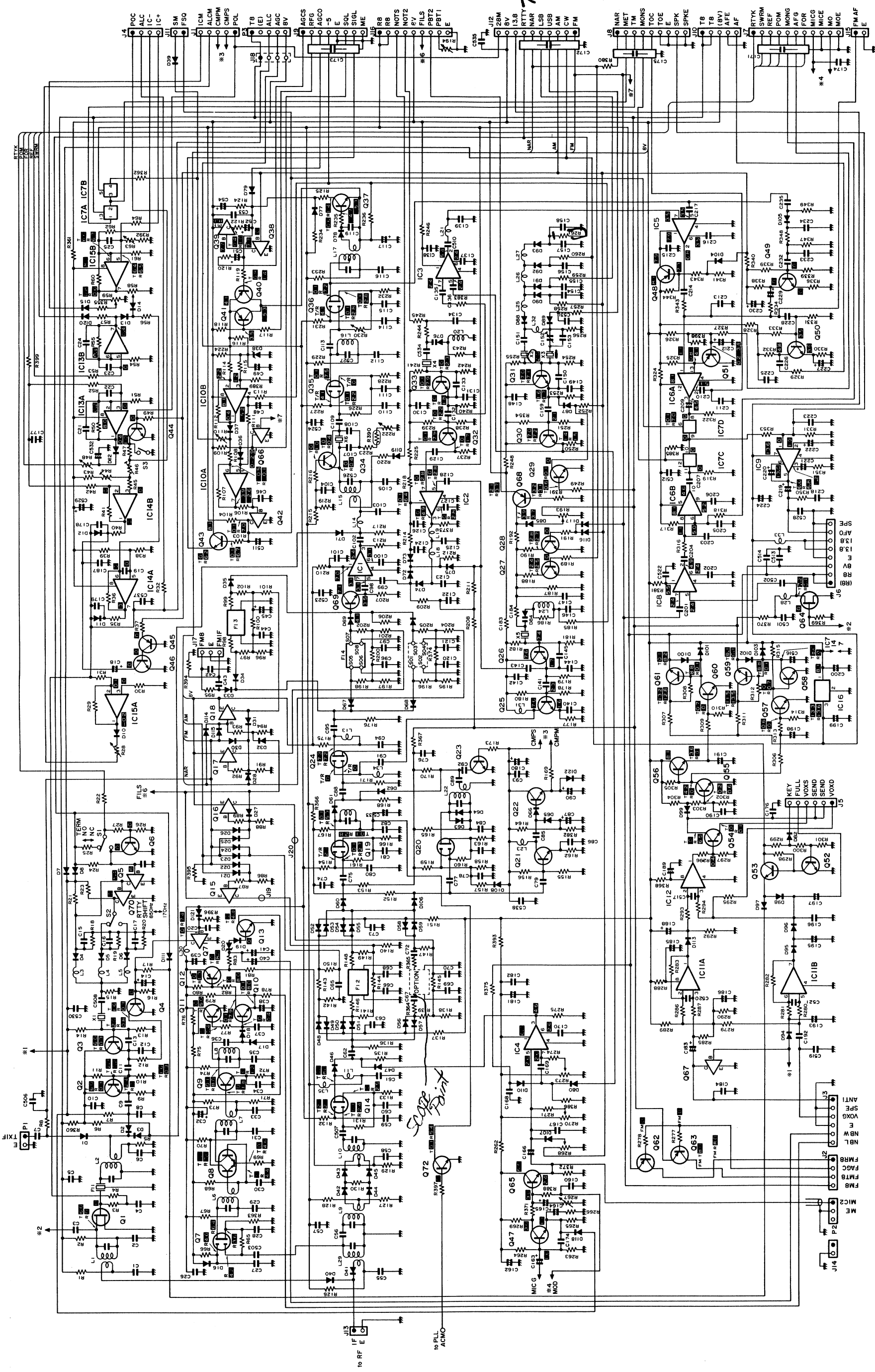
| Adjustment | Adjustment conditions | Unit | Measurement location | Adjustment value | Unit | Adjustment point |
|---|---|------|--|---|--------------|------------------|
| (e) SWR METER | 6. <ul style="list-style-type: none"> ● Display frequency: 14MHz ● MODE: RTTY ● METER SWITCH: Po Set in TRANSMIT mode. | | Po METER | Adjust RF POWER to point the meter needle to "SWR SET". | FRONT PANEL | RF POWER control |
| | 7. <ul style="list-style-type: none"> ● METER SWITCH: SWR Set in TRANSMIT mode. | | SWR METER | Adjust to minimum SWR (less than 1.2). | FILTER | C36 |
| Note: Confirm SWR is less than 1.2 on any band. | | | | | | |
| (f) Vc METER | 8. <ul style="list-style-type: none"> ● MODE: SSB ● MIC GAIN: Fully counterclockwise ● METER SWITCH: Vc Set in TRANSMIT mode with no MIC input. | | Vc METER | 13.8V | METER-SWITCH | R30 |
| SWR APC | 1. <ul style="list-style-type: none"> ● Display frequency: 14MHz ● MODE: RTTY ● RF POWER: Fully clockwise Set in TRANSMIT mode with full output power, and do not connect anything to the ANT connector. | | Read the ammeter provided in the power supply, or connect an ammeter to the power cable in series. | Less than 12A | | Confirming |

METER SWITCH/FILTER UNITS



SECTION 10 VOLTAGE (CIRCUIT) DIAGRAMS

MAIN UNIT CIRCUIT AND VOLTAGE DIAGRAM



VOLTAGE CHART FOR MODE VS FILTER SWITCH

● When shipping

| MODE | FIL SW | Q15 (C) | Q16 (C) | Q17 (C) | Q18 (C) |
|--------|--------|---------|---------|---------|---------|
| USB | ON | 6.4 | 6.4 | 0.0 | 8.0 |
| | OFF | 8.0 | 8.0 | 8.0 | 0.0 |
| LSB | ON | 6.4 | 6.4 | 0.0 | 8.0 |
| | OFF | 8.0 | 8.0 | 8.0 | 0.0 |
| CW | ON | 6.4 | 6.4 | 0.0 | 8.0 |
| | OFF | 8.0 | 8.0 | 8.0 | 0.0 |
| CW-N | ON | 6.4 | 6.4 | 0.1 | 0.0 |
| | OFF | 8.0 | 8.0 | 0.1 | 0.0 |
| RTTY | ON | 6.4 | 6.4 | 0.0 | 8.0 |
| | OFF | 8.0 | 8.0 | 8.0 | 0.0 |
| RTTY-N | ON | 6.4 | 6.4 | 0.1 | 0.0 |
| | OFF | 8.0 | 8.0 | 0.1 | 0.0 |
| AM | ON | 1.2 | 1.2 | 0.0 | 8.0 |
| | OFF | 1.2 | 1.2 | 8.0 | 0.0 |
| FM | ON | 1.2 | 1.2 | 0.1 | 0.0 |
| | OFF | 1.2 | 1.2 | 0.1 | 0.0 |

● When optional filter installed

| MODE | FIL SW | Q15 (C) | Q16 (C) | Q17 (C) | Q18 (C) |
|--------|--------|---------|---------|---------|---------|
| USB | ON | 1.1 | 8.0 | 0.0 | 8.0 |
| | OFF | 8.0 | 1.2 | 8.0 | 0.0 |
| LSB | ON | 1.1 | 8.0 | 0.0 | 8.0 |
| | OFF | 8.0 | 1.2 | 8.0 | 0.0 |
| CW | ON | 1.1 | 8.0 | 0.0 | 8.0 |
| | OFF | 8.0 | 1.2 | 8.0 | 0.0 |
| CW-N | ON | 1.1 | 8.0 | 0.1 | 0.0 |
| | OFF | 8.0 | 1.2 | 0.1 | 0.0 |
| RTTY | ON | 1.1 | 8.0 | 0.0 | 8.0 |
| | OFF | 8.0 | 1.2 | 8.0 | 0.0 |
| RTTY-N | ON | 1.1 | 8.0 | 0.1 | 0.0 |
| | OFF | 8.0 | 1.2 | 0.1 | 0.0 |
| AM | ON | 1.2 | 1.2 | 0.0 | 8.0 |
| | OFF | 1.2 | 1.2 | 8.0 | 0.0 |
| FM | ON | 1.2 | 1.2 | 0.1 | 0.0 |
| | OFF | 1.2 | 1.2 | 0.1 | 0.0 |

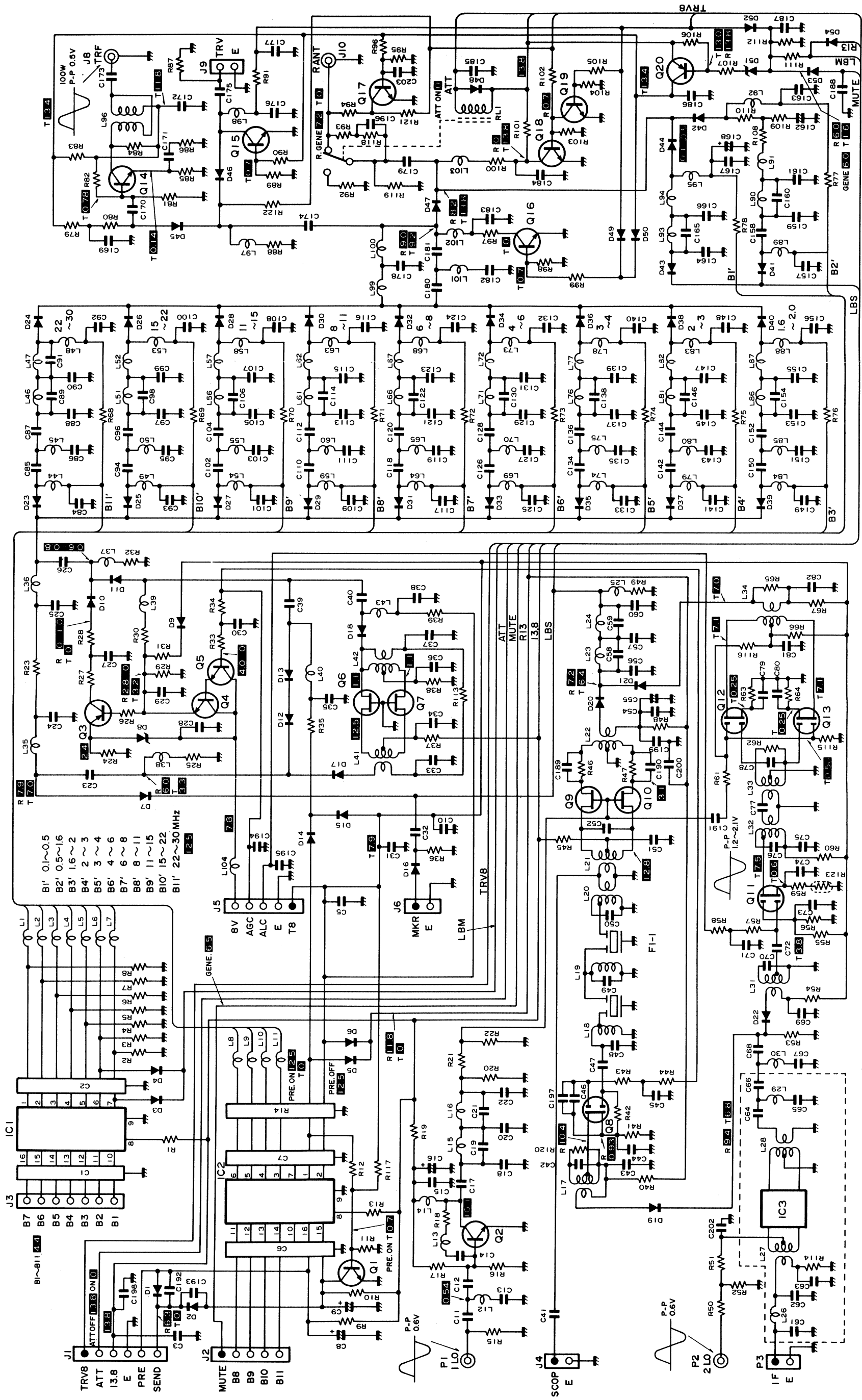
| No. | TRANSMIT | | | | RECEIVE | | | | REMARKS |
|-------|---|--------|--------------------|-------------------|----------------|--------|--------------------|-------------------|-----------|
| | BASE or GATE 1 | GATE 2 | COLLECTOR or DRAIN | EMITTER or SOURCE | BASE or GATE 1 | GATE 2 | COLLECTOR or DRAIN | EMITTER or SOURCE | |
| Q20 | 0.4 | 0.3 | 7.5 | 0.5 | — | — | — | — | COMP OFF |
| | 1.5 | 3.8 | 5.8 | 2.2 | — | — | — | — | ON |
| Q21 | 0.0 | — | 0.0 | 0.0 | — | — | — | — | OFF |
| | 1.8 | — | 8.1 | 1.6 | — | — | — | — | ON |
| Q22 | 0.0 | — | 0.0 | 0.1 | — | — | — | — | OFF |
| | 0.4 | — | 8.1 | 0.1 | — | — | — | — | ON |
| Q23 | 0.0 | — | 0.0 | E | — | — | — | — | OFF |
| | 0.6 | — | 0.0 | E | — | — | — | — | ON |
| Q51 | — | — | — | — | 0.2 ~ 3.4 | — | E | 0.8 ~ 4.1 | AF VOLUME |
| Q52 | 0.6 | — | 0.1 | E | — | — | — | — | KEY OPEN |
| | 0.2 | — | 7.1 | E | — | — | — | — | KEY DOWN |
| Q53 | 0.1 | — | 7.3 | 0.0 | — | — | — | — | KEY OPEN |
| | 7.1 | — | 7.3 | 6.7 | — | — | — | — | KEY DOWN |
| NOTE: | <ul style="list-style-type: none"> ● Measure with Multimeter 50KΩ/V 0.3, 3, 12, 60V Range ● E shows the terminal is grounded. | | | | | | | | |

LOCAL OSCILLATOR OSCILLATING LEVEL

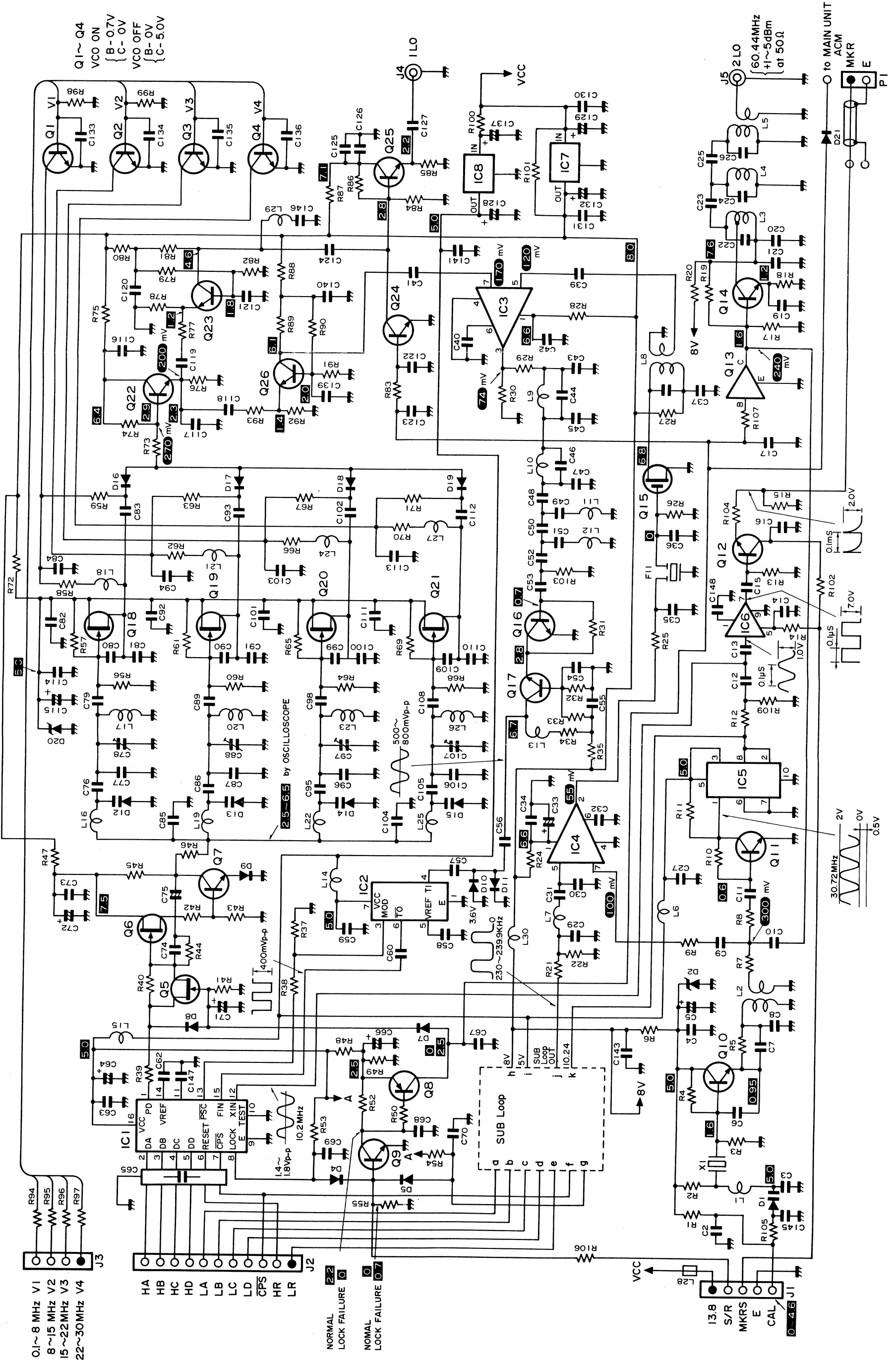
(Measured with an oscilloscope 20MHz 1M Ω probe)

| MEASURING POINT | MODE | LEVEL (mVp-p) |
|-----------------|----------|---------------|
| D40 ANODE | AM | 26.5 |
| | RTTY, CW | 60 |
| | FM | 250 |
| | | |
| Q25 COLLECTOR | USB (TX) | 2400 |
| Q32 EMITTER | USB | 230 |
| Q30 EMITTER | | 250 ~ 450 |
| IC5 PIN 7 | RTTY | 170 |
| | USB | 300 |

RF UNIT CIRCUIT AND VOLTAGE DIAGRAM



PLL UNIT CIRCUIT AND VOLTAGE DIAGRAM



J3
 R94
 R95
 R96
 R97

0.1~8 MHz V1
 8~15 MHz V2
 15~22 MHz V3
 22~30 MHz V4

 HA
 HB
 HC
 HD
 LA
 LB
 LC
 LD
 CPS
 HR
 LR

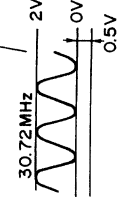
2.2
 0
 0.7

NORMAL
 LOCK FAILURE
 NORMAL
 LOCK FAILURE

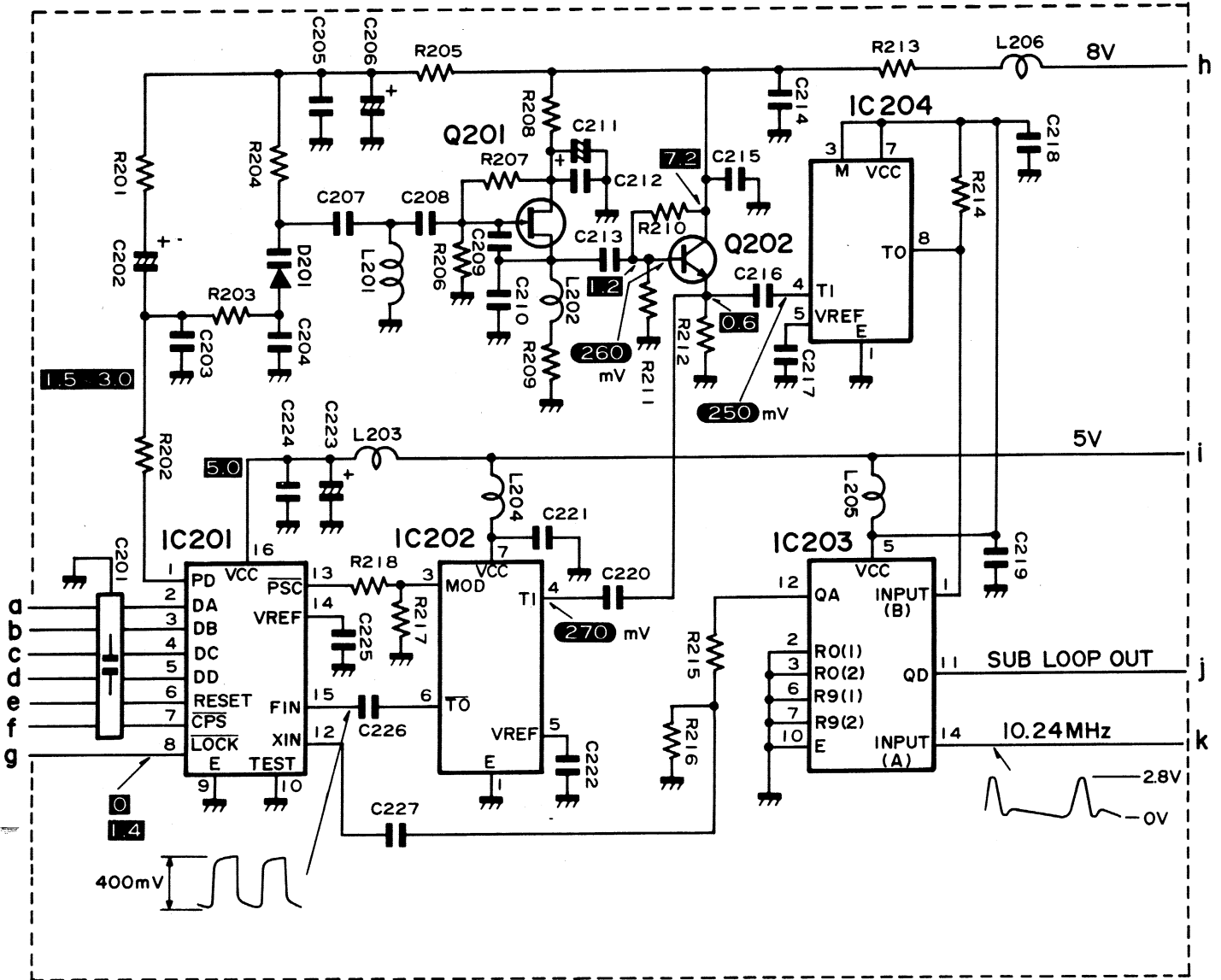
Q1~Q4
 VCO ON
 { B-0.7V
 { C-0V
 VCO OFF
 { B-0V
 { C-5.0V

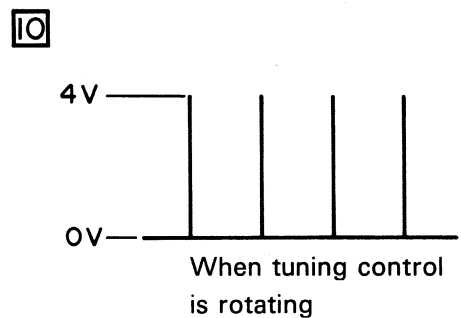
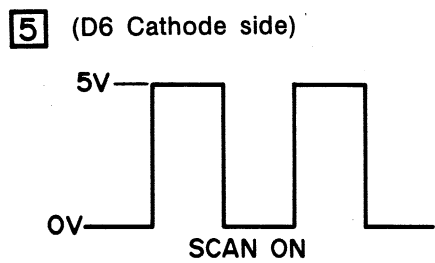
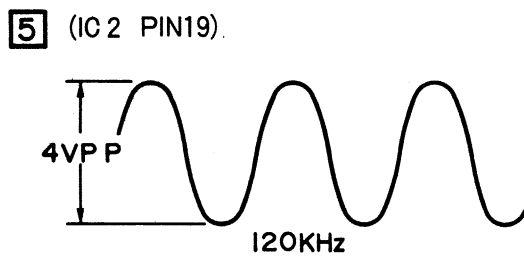
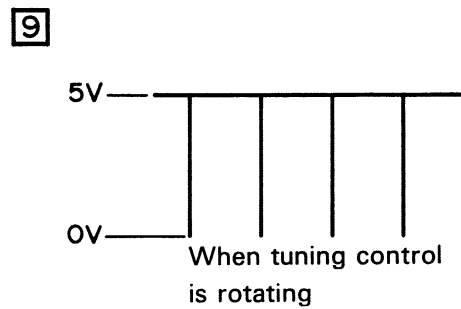
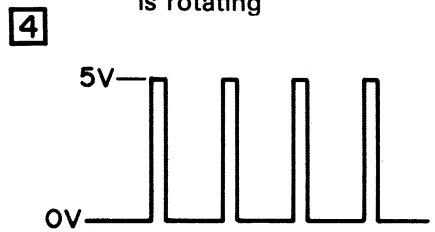
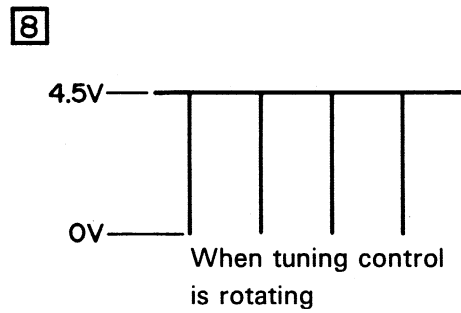
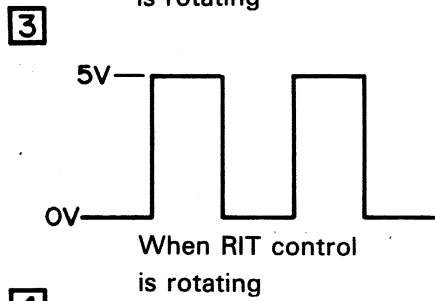
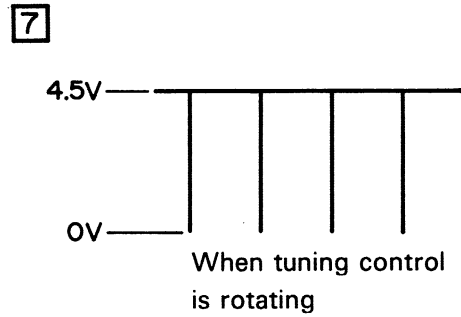
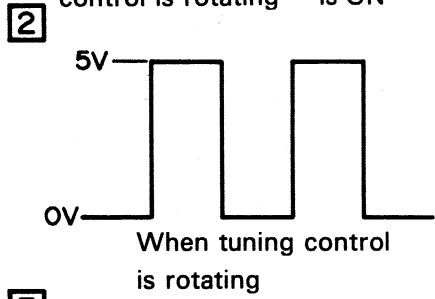
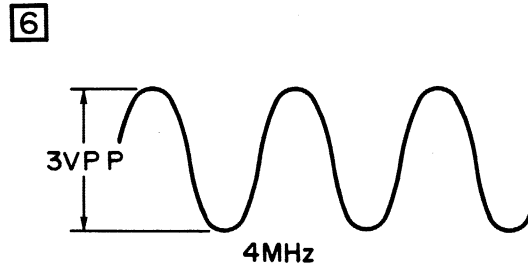
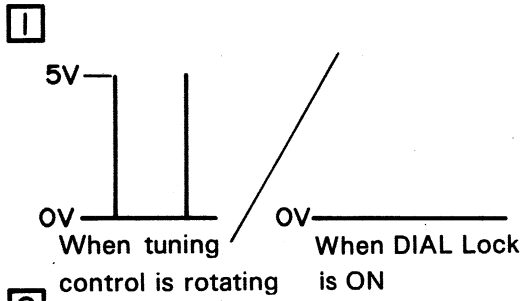
J1
 R106
 C2
 R4
 Q10
 R5
 C7
 C14
 C15

13.8
 S/R
 MKRS
 E
 CAL
 4.6

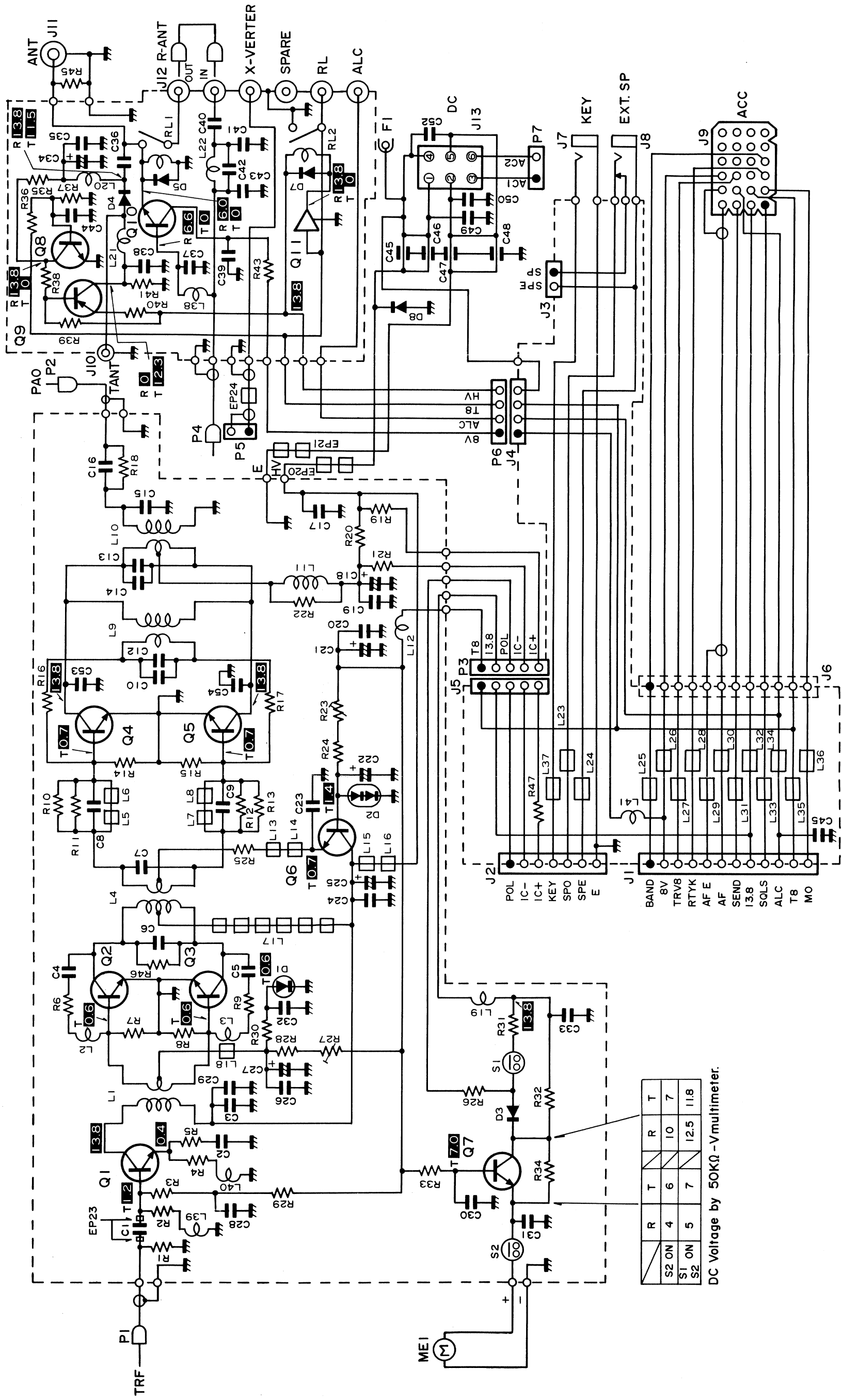


PLL SUB-LOOP CIRCUIT AND VOLTAGE DIAGRAM





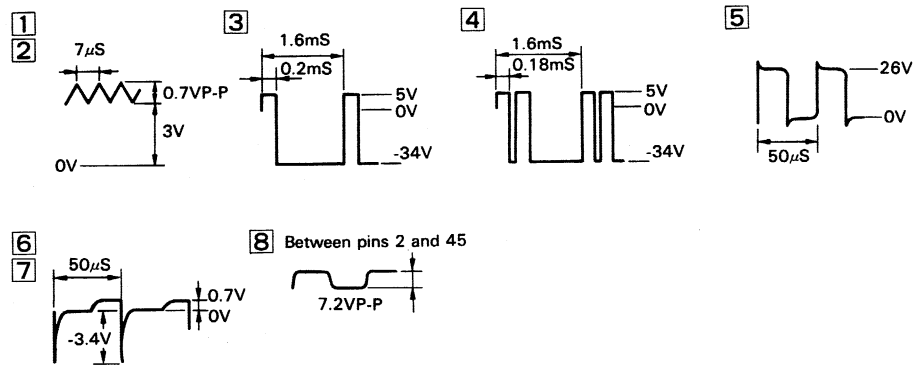
PA UNIT CIRCUIT AND VOLTAGE DIAGRAM



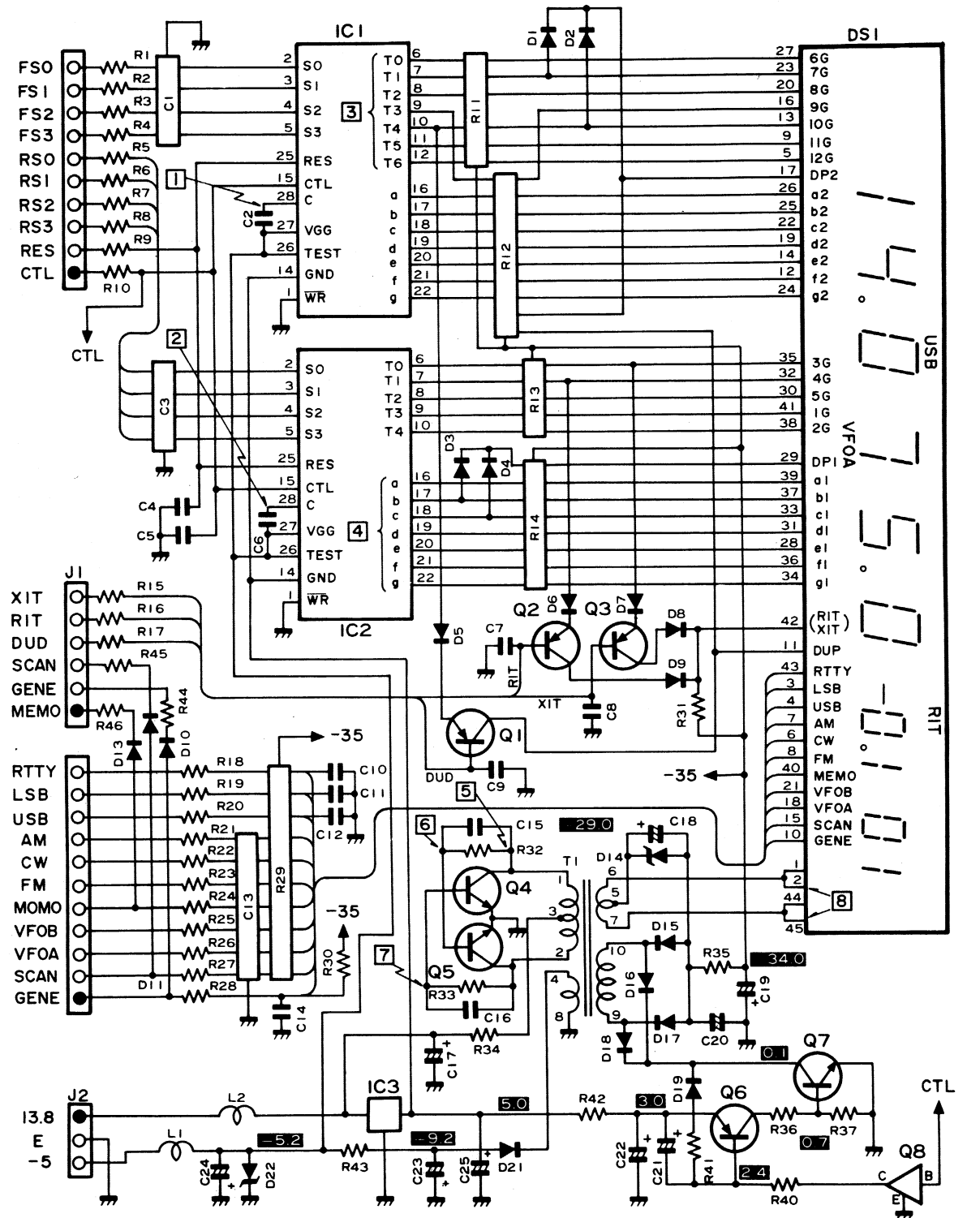
| | | | | |
|-------|---|---|------|------|
| | R | T | R | T |
| S2 ON | 4 | 6 | 10 | 7 |
| S1 | | | | |
| S2 ON | 5 | 7 | 12.5 | 11.8 |

DC Voltage by 50K Ω -Vmultimeter.

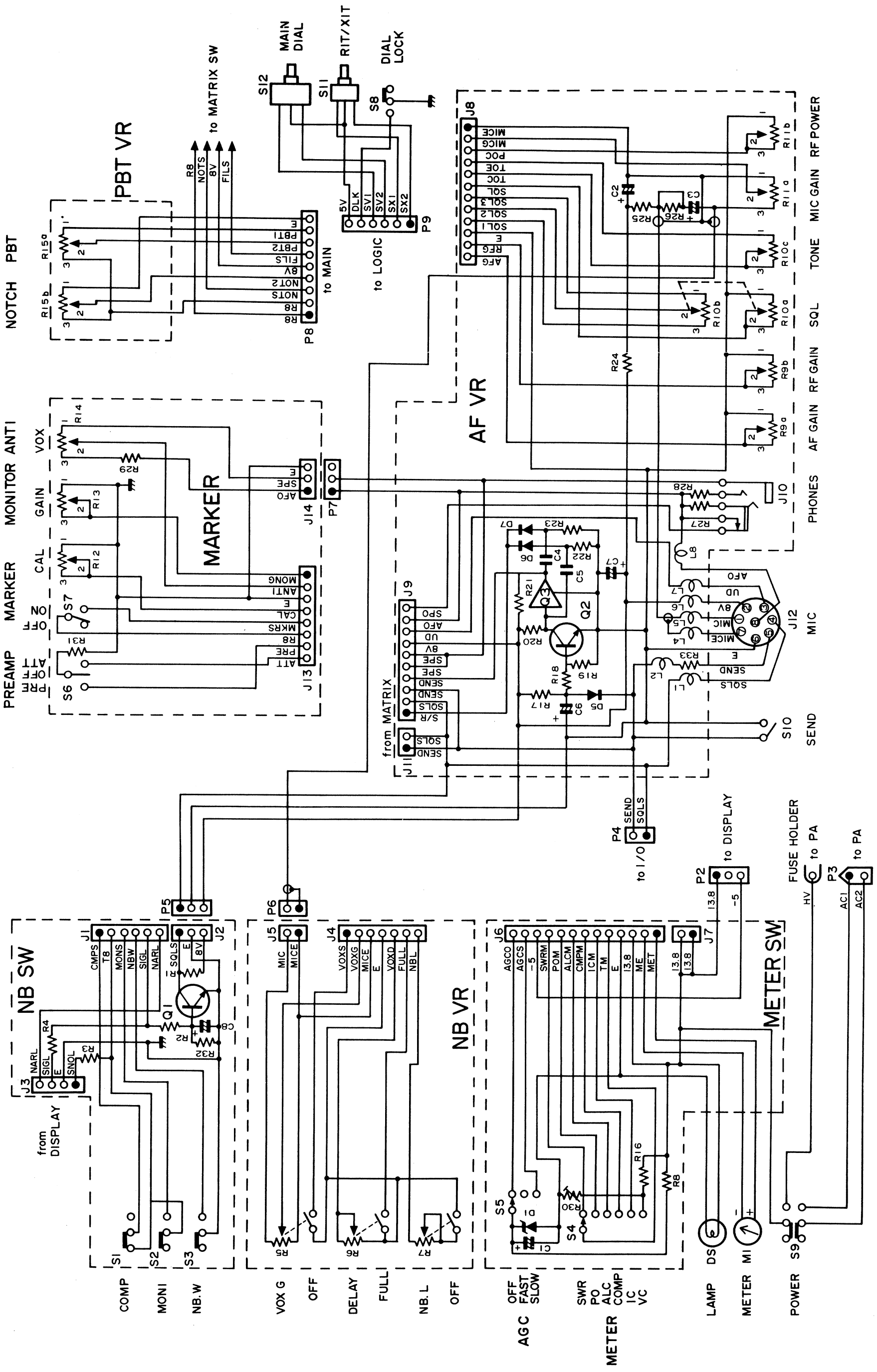
DISPLAY UNIT CIRCUIT AND VOLTAGE DIAGRAM



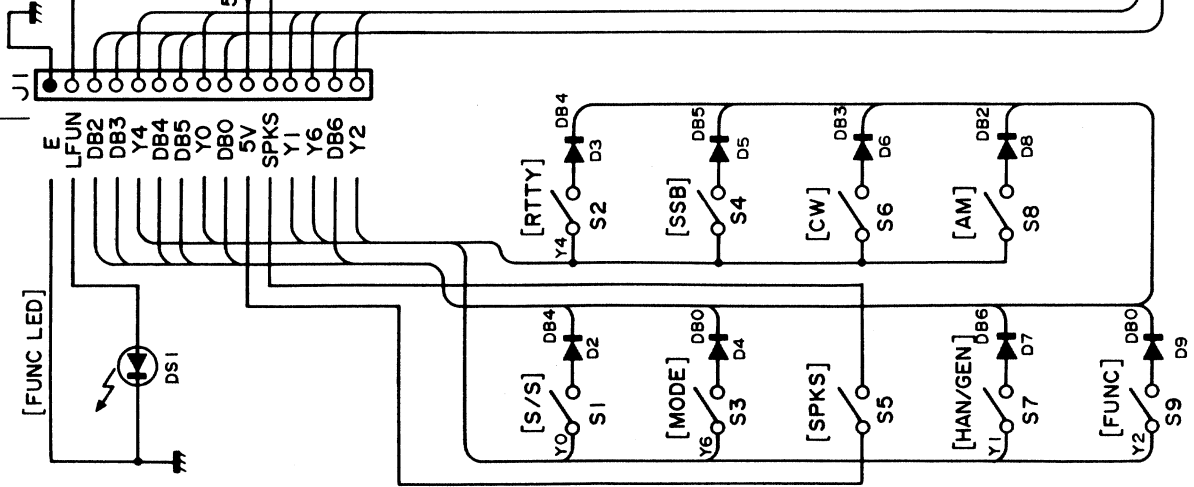
401



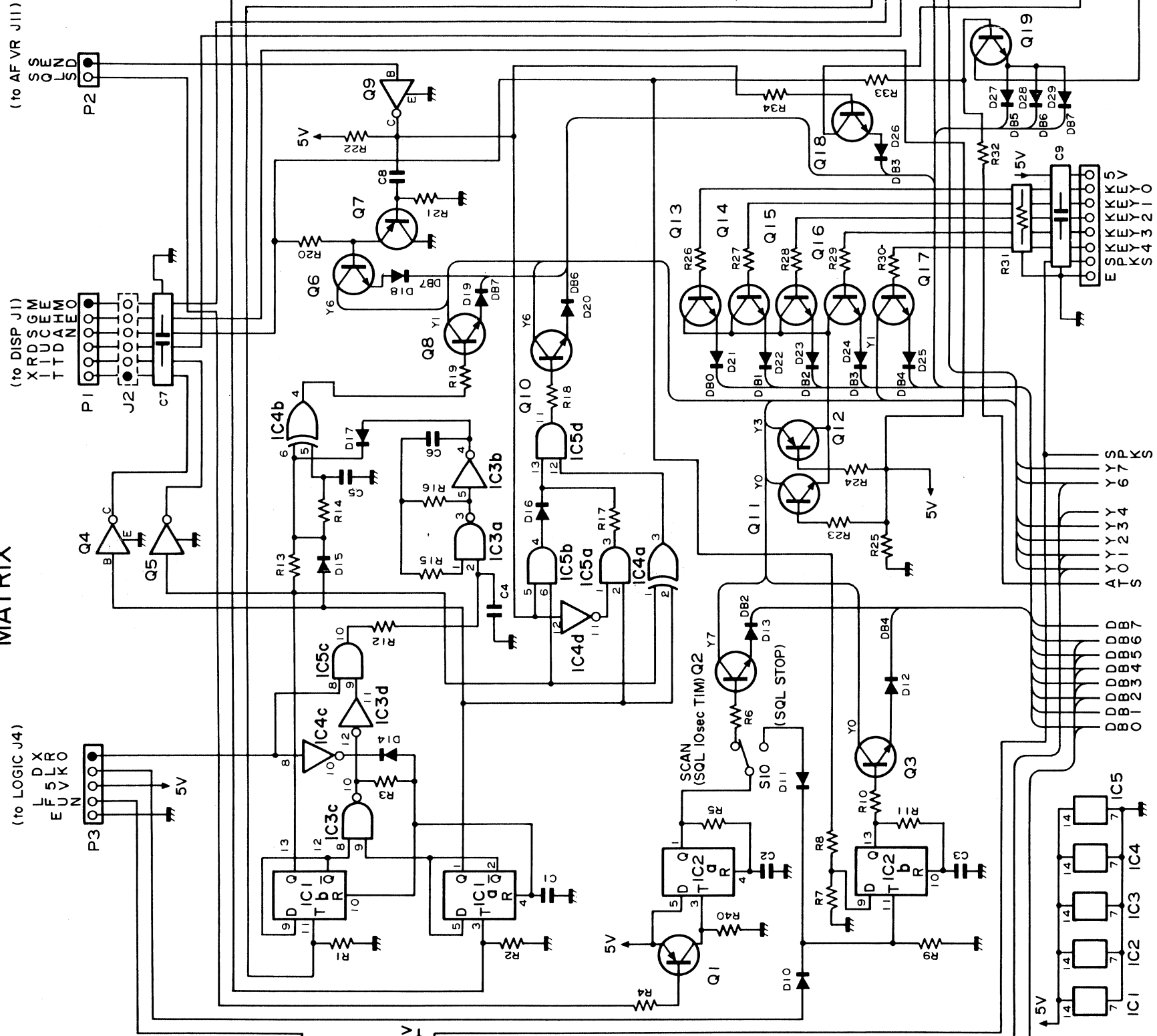
FRONT UNIT CIRCUIT DIAGRAM



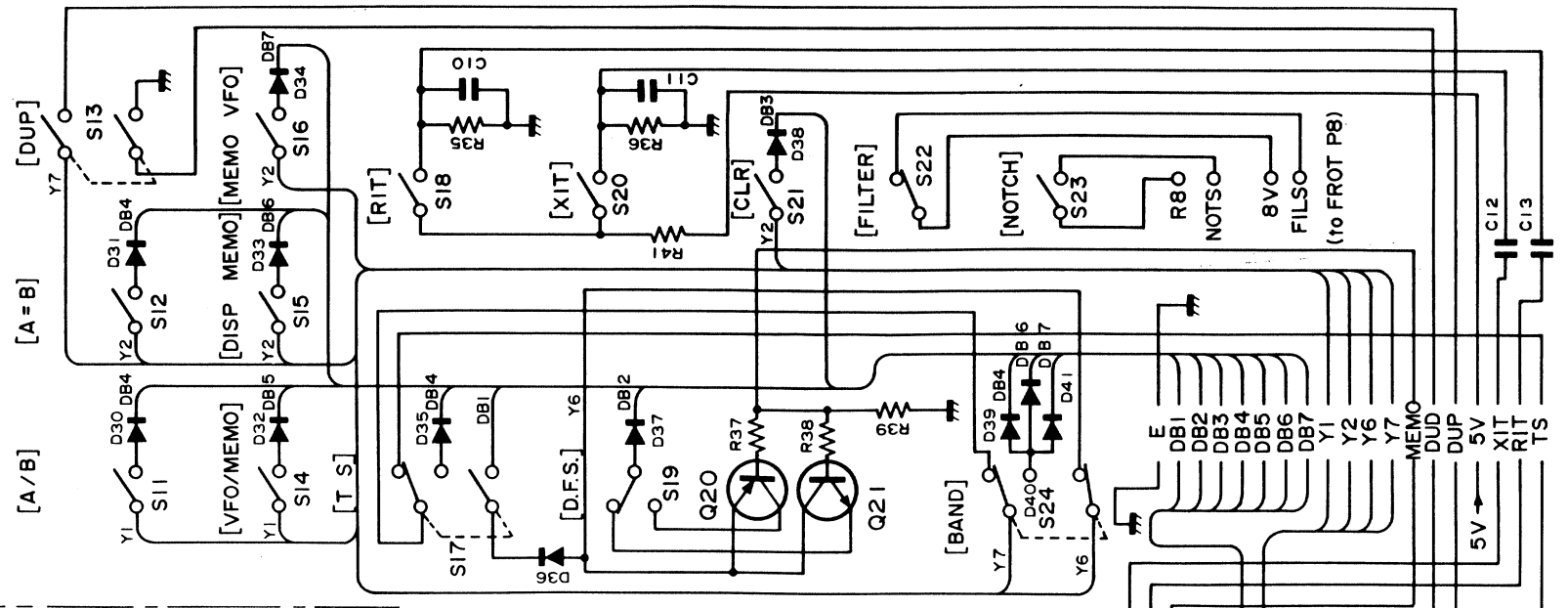
MODE SWITCH



MATRIX

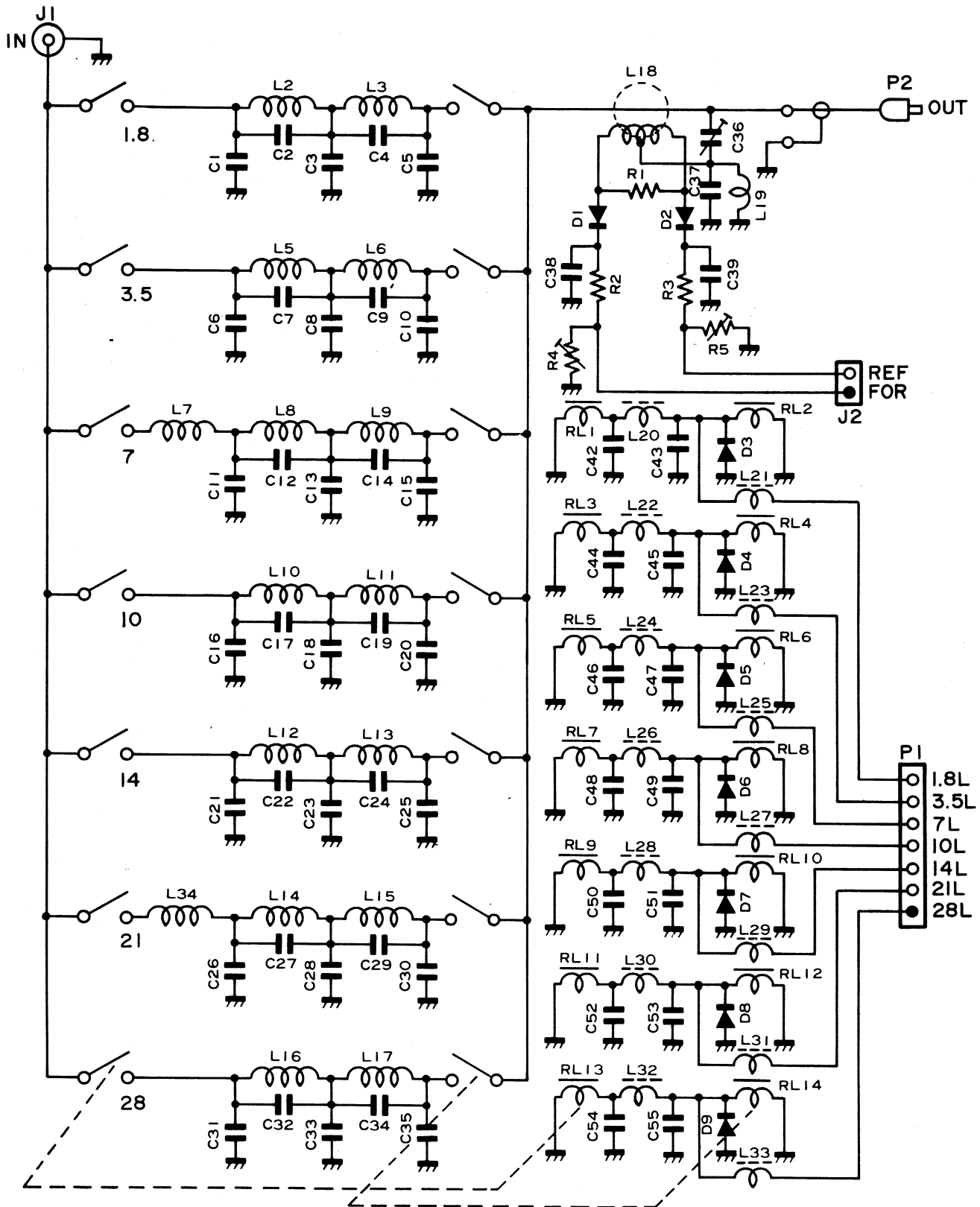


MATRIX SWITCH

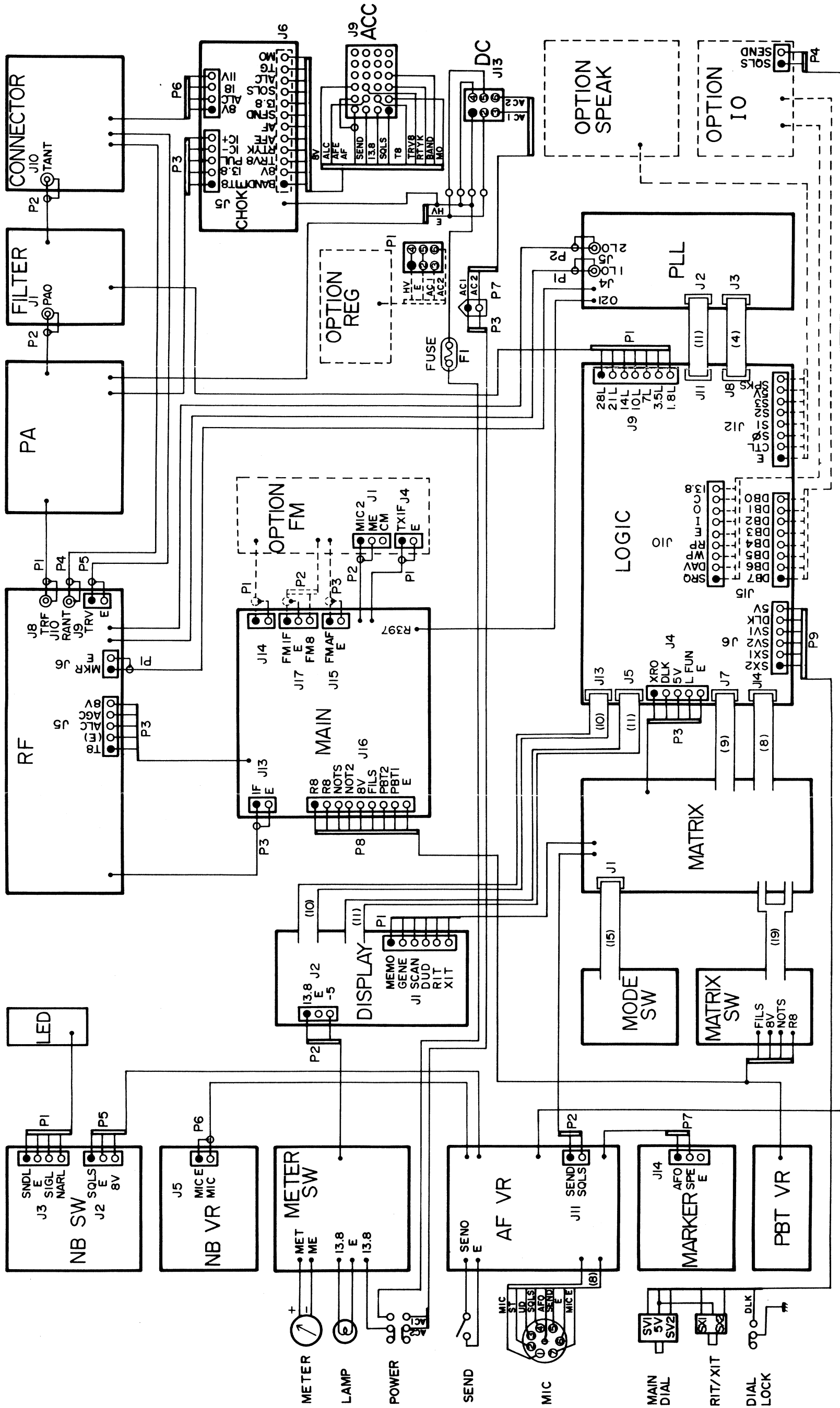


(to LOGIC J14) (to LOGIC J7)

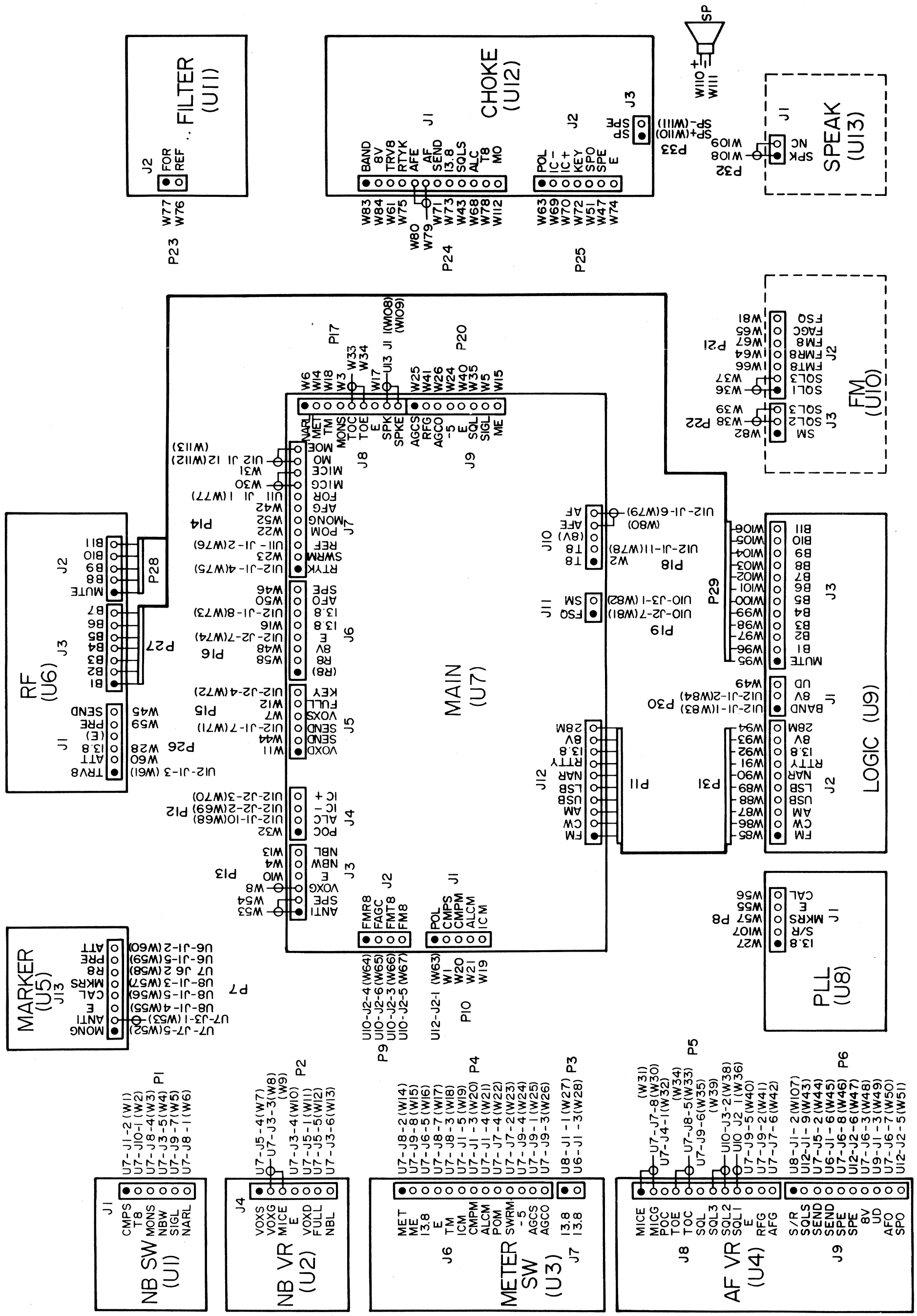
FILTER UNIT CIRCUIT DIAGRAM



UNIT WIRING DIAGRAM (1)



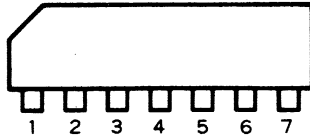
UNIT WIRING DIAGRAM (2)



SECTION 11 IC RATINGS

μPC1037H (DOUBLE BALANCED MODULATOR)

PIN CONNECTION



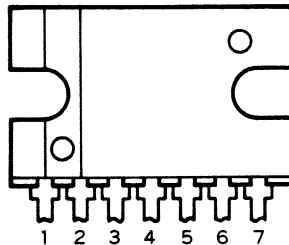
| Terminal no. | Connection |
|--------------|-----------------|
| 1 | V _{CC} |
| 2 | Output 1 |
| 3 | Output 2 |
| 4 | GND |
| 5 | Signal input |
| 6 | Bypass |
| 7 | Carrier input |

Maximum Ratings

| Item | Symbol | Rating | Unit |
|------------------------|------------------|------------|------|
| Power supply voltage | V _{CC} | 9 | V |
| Package allowable loss | P _D | 270 | mW |
| Operation temperature | T _{OPT} | -30 ~ +65 | °C |
| Storage temperature | T _{STG} | -40 ~ +125 | °C |

μPC1181H (AUDIO POWER AMPLIFIER)

PIN CONNECTIONS



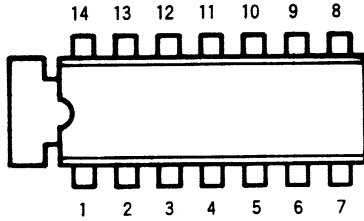
Maximum Ratings

| Item | Symbol | Rating | Unit |
|--|-------------------------|------------|------|
| Peak power supply voltage (200 mS) | V _{CC (SURGE)} | 40 | V |
| Power supply voltage (at no signal) | V _{CC1} | 25 | V |
| Power supply voltage (during operation) *1 | V _{CC2} | 18 | V |
| Circuit current | I _{CC (PEAK)} | 4.5 | A |
| Package allowable loss | P _D | 12 | W |
| Operation ambient temperature *2 | T _{OPR} | -30 ~ +75 | °C |
| Storage temperature | T _{STG} | -55 ~ +150 | °C |

*1 *2 Aluminum heat sink (100 × 100 × 1 mm)

LA2600 (DUAL ATTENUATOR)

PIN CONNECTION



- | | |
|---------------------|---------------------|
| 1. CH1 INPUT | 8. CH2 INPUT |
| 2. CH1 COMPENSATION | 9. CH2 COMPENSATION |
| 3. CH1 OUTPUT | 10. CH3 OUTPUT |
| 4. GND | 11. — |
| 5. CH2 Vcc | 12. CH1 Vcc |
| 6. CH2 CONTROL | 13. CH1 CONTROL |
| 7. — | 14. — |

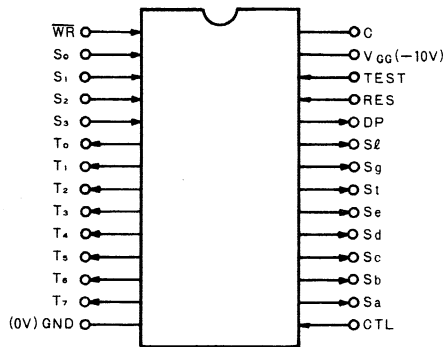
Maximum Ratings (Ta = 25°C)

| Item | Symbol | Rating | Unit |
|-----------------------|------------------|------------|------|
| Power supply voltage | V _{CC} | 16 | V |
| Control input voltage | V _C | 0 ~ 6 | V |
| Power dissipation | P _D | *1 500 | mW |
| Operating temperature | T _{OPR} | -30 ~ +75 | °C |
| Storage temperature | T _{STG} | -55 ~ +125 | °C |

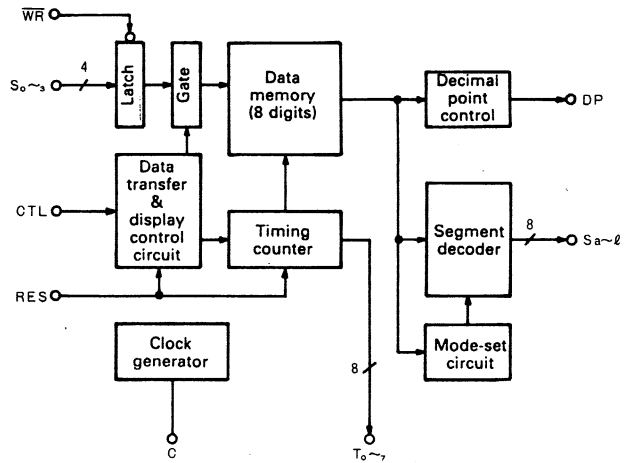
*1 Ta ≤ 75°C

μPD549C (PROGRAMMABLE DISPLAY CONTROLLER)

PIN CONNECTION



BLOCK DIAGRAM

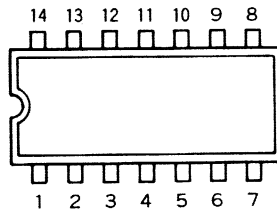


Maximum Ratings

| Item | Symbol | Rating | Unit |
|-----------------------|------------------|------------|------|
| Power supply voltage | V _{GG} | -15 ~ +0.3 | V |
| Input voltage | V _I | -20 ~ +0.3 | V |
| Output voltage | V _O | -42 ~ +0.3 | V |
| Operation temperature | T _{OPR} | -10 ~ +70 | °C |
| Storage temperature | T _{STG} | -40 ~ +125 | °C |

- TC4011 (QUAD 2-INPUT POSITIVE NOR GATE)
- TC4013 (DUAL D-TYPE FLIP FLOP)
- TC4030 (QUAD EXCLUSIVE-OR GATE)
- TC4081 (QUAD 2-INPUT POSITIVE AND GATE)
- TC4066 (QUAD BILATERAL SWITCH)

PIN CONNECTION

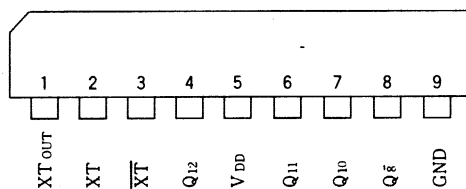


Maximum Ratings

| Item | Symbol | Rating | Unit |
|---------------------------|-----------|--------------------------------------|-------------|
| Power supply voltage | V_{DD} | $V_{SS} - 0.5 \sim V_{SS} + 20$ | V |
| Input voltage | V_{IN} | $V_{SS} - 0.5 \sim V_{DD} + 0.5$ | V |
| Output voltage | V_{OUT} | $V_{SS} - 0.5 \sim V_{DD} + 0.5$ | V |
| Input current | I_{IN} | ± 10 | mA |
| Allowable loss | P_D | 300 | mW |
| Storage temperature | T_{STG} | $-65 \sim 150$ | $^{\circ}C$ |
| Read temperature and time | T_{SOL} | $260^{\circ}C \cdot 10 \text{ sec.}$ | |

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

PIN CONNECTION

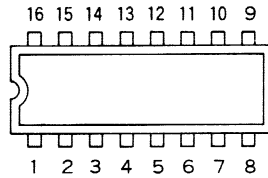


Maximum Ratings ($T_a = 25^{\circ}C$)

| Item | Symbol | Rating | Unit |
|-----------------------|-----------|--------------------------|-------------|
| Supply voltage | V_{DD} | 10 | V |
| Input voltage | V_{IN} | $-0.3 \sim V_{DD} + 0.3$ | V |
| Operating temperature | T_{OPR} | $-30 \sim 75$ | $^{\circ}C$ |
| Storage temperature | T_{STG} | $-55 \sim 125$ | $^{\circ}C$ |

TC4528BP (DUAL MONOSTABLE MULTIVIBRATOR)

PIN CONNECTION



Maximum Ratings

| Item | Symbol | Rating | Unit |
|---------------------------|-----------|---|--------------------|
| Power supply voltage | V_{DD} | $V_{SS} - 0.5 \sim V_{SS} + 20$ | V |
| Input voltage | V_{IN} | $V_{SS} - 0.5 \sim V_{DD} + 0.5$ | V |
| Output voltage | V_{OUT} | $V_{SS} - 0.5 \sim V_{DD} + 0.5$ | V |
| Input current | I_{IN} | ± 10 | mA |
| Allowable loss | P_D | 300 | mW |
| Storage temperature | T_{STG} | $-65 \sim 150$ | $^{\circ}\text{C}$ |
| Read temperature and time | T_{SOL} | $260^{\circ}\text{C} \cdot 10 \text{ sec.}$ | |

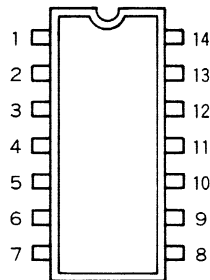
SN74LS02N (QUADRUPLE 2-INPUT POSITIVE NOR GATE)

SN74LS08N (QUADRUPLE 2-INPUT POSITIVE AND GATE)

SN74LS11N (TRIPLE 3-INPUT POSITIVE AND GATE)

SN74LS32N (QUADRUPLE 2-INPUT POSITIVE OR GATE)

PIN CONNECTION



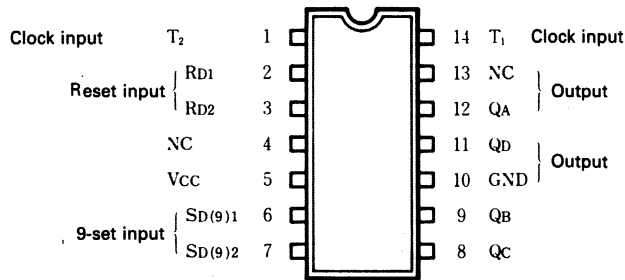
Maximum Ratings

| Item | Symbol | Rating | Unit |
|-------------------------------|-----------|--------------------|--------------------|
| Power supply voltage | V_{CC} | $-0.5 \sim +7$ | V |
| Input voltage | V_I | $-0.5 \sim +15$ | V |
| Output voltage *1 | V_O | $-0.5 \sim V_{CC}$ | V |
| Operation ambient temperature | T_{OPR} | $-20 \sim +75$ | $^{\circ}\text{C}$ |
| Storage temperature | T_{STG} | $-65 \sim +150$ | $^{\circ}\text{C}$ |

*1 When output is H

SN74LS90N (DECODE COUNTER)

PIN CONNECTION



Maximum Ratings

| Item | Symbol | Rating | Unit |
|-------------------------------|-----------|-----------------|------|
| Power supply voltage | V_{CC} | -0.5 ~ +7 | V |
| Input voltage | V_I | -0.5 ~ +5.5 | V |
| | V_I | -0.5 ~ +15 | |
| Output voltage *1 | V_O | -0.5 ~ V_{CC} | V |
| Operation ambient temperature | T_{OPR} | -20 ~ +75 | °C |
| Storage temperature | T_{STG} | -65 ~ +150 | °C |

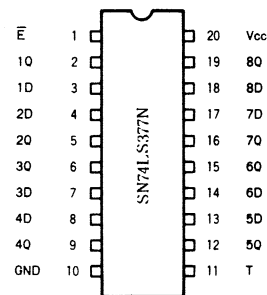
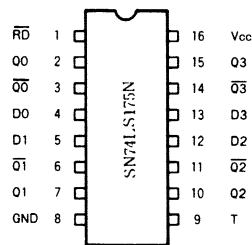
*1 Inputs T_1 and T_2

*2 Inputs R_{D1} , R_{D2} , $S_{D(9)1}$ and $S_{D(9)2}$

SN74LS175N (QUADRUPLE D-TYPE FLIP FLOP WITH RESET)

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

PIN CONNECTION



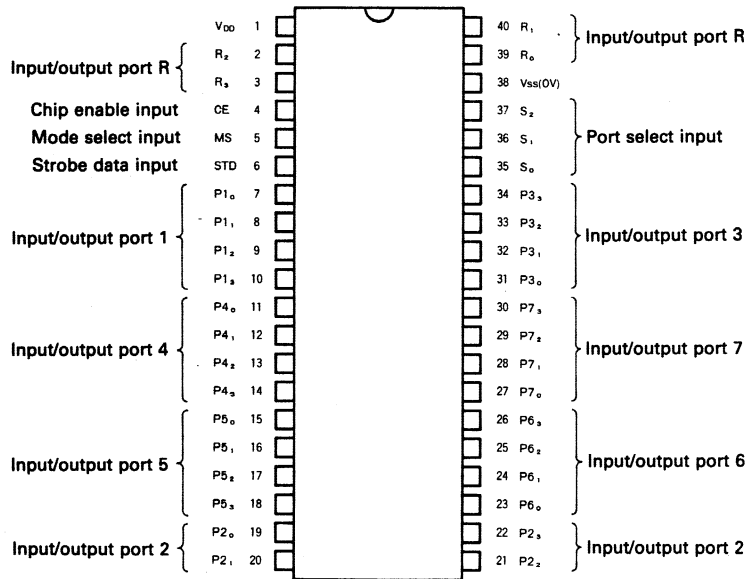
Maximum Ratings

| Item | Symbol | Rating | Unit |
|-------------------------------|-----------|-----------------|------|
| Power supply voltage | V_{CC} | -0.5 ~ +7 | V |
| Input voltage *1 | V_I | -0.5 ~ +15 | V |
| Output voltage *1 | V_O | -0.5 ~ V_{CC} | V |
| Operation ambient temperature | T_{OPR} | -20 ~ +75 | °C |
| Storage temperature | T_{STG} | -65 ~ +150 | °C |

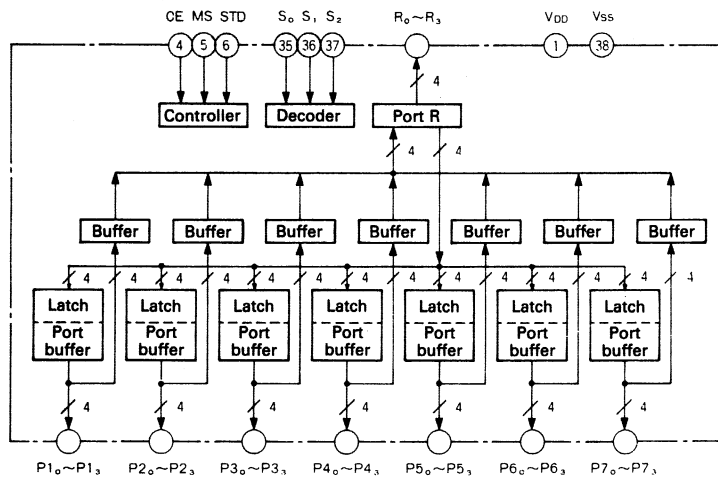
*1 When output is H

M50780SP (INPUT/OUTPUT EXPANDER)

PIN CONNECTION



BLOCK DIAGRAM



Maximum Ratings

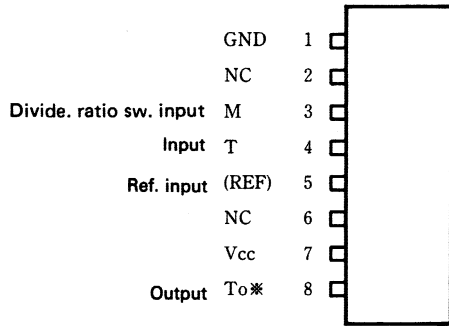
| Item | Symbol | Rating | Unit |
|-------------------------------|-----------|----------------------------------|------|
| Power supply voltage | V_{DD} | -0.3 ~ 15 | V |
| Input voltage | V_I | $V_{SS} - 0.3 \sim V_{DD} + 0.3$ | V |
| Output voltage *1 | V_O | $V_{SS} - 0.3 \sim V_{DD} + 0.3$ | V |
| Maximum power consumption *2 | P_D | 600 | mW |
| Operation ambient temperature | T_{OPR} | -10 ~ +70 | °C |
| Storage temperature | T_{STG} | -40 ~ +125 | °C |

*1 If V_{SS} terminal is standard

*2 $T_a=25^\circ\text{C}$

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

PIN CONNECTION



* Open collector output
 NC unconnected

Frequency-division ratio switching input (M) and frequency division ratio

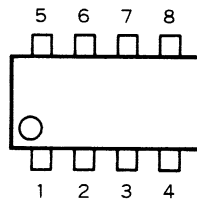
| M | L | H |
|--------------------|------|-------|
| Freq.-div'n. ratio | 1/20 | 1/100 |

Maximum Ratings

| Item | Symbol | Rating | Unit |
|-------------------------------|------------------|------------|------|
| Power supply voltage | V _{CC} | 7 | V |
| Input voltage | V _I | 2.5 | V |
| Output voltage | V _O | 5.5 | V |
| Power consumption | P _D | 1.33 | W |
| Operation ambient temperature | T _{OPR} | -10 ~ +75 | °C |
| Storage temperature | T _{STG} | -55 ~ +125 | °C |

NJM4558D (DUAL LOW NOISE AMP.)

PIN CONNECTION



Maximum Ratings

| Item | Symbol | Rating | Unit |
|-----------------------|------------------|------------|------|
| Power supply voltage | V _{DD} | 18 | V |
| Input voltage | V _{IN} | 15 | V |
| Operation temperature | T _{OPT} | -20 ~ +75 | °C |
| Storage temperature | T _{STG} | -40 ~ +125 | °C |

SECTION 12 PARTS LIST

[EF] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|--------------|
| P1 | Connector | TL25H-06-B1 |
| P2 | Connector | TL25H-07-B1 |
| P3 | Connector | TL25H-02-B1 |
| P4 | Connector | TL25H-13-B1 |
| P5 | Connector | TL25H-12-B1 |
| P6 | Connector | TL25H-10-B1 |
| P7 | Connector | TL25H-08-B1 |
| P8 | Connector | TL25H-05-B1 |
| P9 | Connector | TL25H-04-B1 |
| P10 | Connector | TL25H-05-B1 |
| P11 | Connector | TL25H-10-B1 |
| P12 | Connector | TL25H-04-B1 |
| P13 | Connector | TL25H-06-B1 |
| P14 | Connector | TL25H-11-B1 |
| P15 | Connector | TL25H-06-B1 |
| P16 | Connector | TL25H-08-B1 |
| P17 | Connector | TL25H-09-B1 |
| P18 | Connector | TL25H-05-B1 |
| P19 | Connector | TL25H-01-B1 |
| P20 | Connector | TL25H-08-B1 |
| P21 | Connector | TL25H-07-B1 |
| P22 | Connector | TL25H-03-B1 |
| P23 | Connector | TL25H-02-B1 |
| P24 | Connector | TL25H-12-B1 |
| P25 | Connector | TL25H-07-B1 |
| P26 | Connector | TL25H-06-B1 |
| P27 | Connector | TL25H-07-B1 |
| P28 | Connector | TL25H-05-B1 |
| P29 | Connector | TL25H-12-B1 |
| P30 | Connector | TL25H-03-B1 |
| P31 | Connector | TL25H-10-B1 |
| P32 | Connector | TL25H-02-B1 |
| P33 | Connector | TL25H-02-B1 |
| SP1 | Speaker | C065KX669108 |
| F1 | Fuse | 3A |
| EP1 | Bead Core | FSQ H070RN |

[FRONT] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|------------------------|
| L1 | Coil | 101 FL5H |
| L2 | Coil | 101K LAL04NA |
| L4 | Coil | 101 FL5H |
| L5 | Coil | 102 FL5H |
| L6 | Coil | 101 FL5H |
| L7 | Coil | 101 FL5H |
| L8 | Coil | 101 FL5H |
| R1 | Resistor | 4.7K R25 |
| R2 | Resistor | 27K ELR25 |
| R3 | Resistor | 1.2K R25 |
| R4 | Resistor | 680 R25 |
| R5 | Variable | K12141054-5N1211-10KA |
| R6 | Variable | K12141054-5N1211-1MB |
| R7 | Variable | K12141054-5N1211-1KB |
| R8 | Resistor | 1K ELR25 |
| R9 | Variable | K16B1007-10KBx2 |
| R10 | Variable | K16C20015-10KA, 10KBx2 |
| R11 | Variable | K16B10007-10KB, 10KA |
| R12 | Trimmer | 10K H1051C(SR19D) |
| R13 | Trimmer | 10K H1051C(SR19D) |
| R14 | Trimmer | 10K H1051C(SR19D) |
| R15 | Variable | K12B60AOE-10KBx2 |
| R16 | Resistor | 47K R25 |
| R17 | Resistor | 4.7K ELR25 |
| R18 | Resistor | 47K ELR25 |
| R19 | Resistor | 15K ELR25 |
| R20 | Resistor | 15K ELR25 |
| R21 | Resistor | 15K ELR25 |
| R22 | Resistor | 100K ELR25 |
| R23 | Resistor | 100K ELR25 |
| R24 | Resistor | 220 R25 |
| R25 | Resistor | 1K ELR25 |
| R26 | Resistor | 22K ELR25 |
| R27 | Resistor | 100 ELR25 |
| R28 | Resistor | 100 ELR25 |
| R29 | Resistor | 2.2K R25 |
| R30 | Trimmer | 1K RGP05 |
| R31 | Resistor | 47 R25 |
| R32 | Resistor | 10K ELR25 |
| R33 | Resistor | 4.7 R25 |

*MARER
UNIT*

[FRONT] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|----------|
| Q1 | Transistor | 2SC945P |
| Q2 | Transistor | 2SC945P |
| Q3 | Transistor | 2SC3399 |
| D1 | Zener | XZ082 |
| D5 | Diode | 1SS53 |
| D6 | Diode | 1SS53 |
| D7 | Diode | 1SS53 |

| | | |
|----|--------------|-----------|
| C1 | Electrolytic | 10 16V |
| C2 | Electrolytic | 47 10V |
| C3 | Electrolytic | 1 50V |
| C4 | Ceramic | 0.001 50V |
| C5 | Ceramic | 0.001 50V |
| C6 | Tantalum | 1.5 16V |
| C7 | Electrolytic | 47 10V |
| C8 | Electrolytic | 22 10V |
| S1 | Push-SW | SPJ312N |
| S2 | Push-SW | SPJ312N |
| S3 | Push-SW | SPJ312N |
| S4 | Rotary-SW | SRU1023 |
| S5 | Rotary-SW | SBU1026 |
| S6 | Lever-SW | MS-621C |

*939-0504
-025824*

[FRONT] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|----------------|---------------------------------|
| S7 | Lever-SW | MS-611A |
| S8 | Push-SW | SPJ312C |
| S9 | Push-SW | TW-0068 |
| S10 | Lever-SW | M2012J-1K |
| S11 | Rotary encoder | LA22402 |
| S12 | Rotary encoder | LA24007 |
| | | |
| J1 | Connector | TL25P-06-L1 |
| J2 | Connector | TL25P-03-L1 |
| J3 | Connector | TL25P-04-L1 |
| J4 | Connector | TL25P-07-L1 |
| J5 | Connector | TL25P-02-L1 |
| J6 | Connector | TL25P-13-L1 |
| J7 | Connector | TL25P-02-V1 |
| J8 | Connector | TL25P-12-V1 |
| J9 | Connector | TL25P-10-L1 |
| J10 | Connector | HLJ4815-JACK |
| J11 | Connector | TL25P-02-V1 |
| J12 | Connector | FM214-8SS(P) |
| J13 | Connector | TL25P-08-V1 |
| J14 | Connector | TL25P-03-V1 |
| | | |
| M1 | Meter | M263 |
| | | |
| DS1 | Lamp | BQ044-32582A |
| | | |
| P2 | Connector | TL-25H-03-B1 |
| P3 | Connector | 1545P-1 |
| P4 | Connector | TL-25H-02-B1 |
| P5 | Connector | TL-25H-03-B1 |
| P6 | Connector | TL-25H-02-B1 |
| P7 | Connector | TL-25H-03-B1 |
| P8 | Connector | TL-25H-09-B1 |
| P9 | Connector | TL-25H-06-B1 |
| | | |
| B1 | P.C. Board | <i>Cables</i> B-722A (42452) |
| B2 | P.C. Board | B-723A (42453) |
| B3 | P.C. Board | B-724A (42458) |
| B4 | P.C. Board | B-727A (42459) |
| B5 | P.C. Board | B-792A (42501) |
| B6 | P.C. Board | B-731A (42450) |
| B7 | P.C. Board | B-741A (42454) |
| | | |
| W1 | Jumper | JPW-02H |
| W43 | Jumper | JPW-02A |
| W44 | Jumper | JPW-02A |

[DISPLAY] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|----------|
| IC1 | IC | μ PD549C |
| IC2 | IC | μ PD549C |
| IC3 | IC | μ A78L05 |

[DISPLAY] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|------------|
| Q1 | Transistor | 2SA1015Y |
| Q2 | Transistor | 2SA1015Y |
| Q3 | Transistor | 2SA1015Y |
| Q4 | Transistor | 2SC1214 |
| Q5 | Transistor | 2SC1214 |
| Q6 | Transistor | 2SA1015Y |
| Q7 | Transistor | 2SC945P |
| Q8 | Transistor | 2SC3402 |
| | | |
| D1 | Diode | 1SS55 |
| D2 | Diode | 1SS55 |
| D3 | Diode | 1SS55 |
| D4 | Diode | 1SS55 |
| 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 | XZ-062 |
| D15 | Diode | 1SS55 |
| D16 | Diode | 1SS55 |
| D17 | Diode | 1SS55 |
| D18 | Diode | 1SS55 |
| D19 | Diode | 1SS55 |
| D21 | Diode | 1SS53 |
| D22 | Zener | XZ-051 |
| | | |
| DS1 | FLD | FIP12AM7 |
| DS2 | LED | SLB-22UR |
| DS3 | LED | SLB-22GG |
| DS4 | LED | SLB-22YY |
| | | |
| R1 | Resistor | 1K ELR25 |
| R2 | Resistor | 1K ELR25 |
| R3 | Resistor | 1K ELR25 |
| R4 | Resistor | 1K R25 |
| R5 | Resistor | 1K ELR25 |
| R6 | Resistor | 1K E LR25 |
| R7 | Resistor | 1K ELR25 |
| R8 | Resistor | 1K ELR25 |
| R9 | Resistor | 1K ELR25 |
| R10 | Resistor | 1K SELR25 |
| R11 | Array | 473 RM-6 |
| R12 | Array | 473 RM-10 |
| R13 | Array | 473 RM-6 |
| R14 | Array | 473 RM-8 |
| 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 |

[DISPLAY] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|--------------|
| R29 | Array | 473 RM-10 |
| R30 | Resistor | 47K ELR25 |
| R31 | Resistor | 47K R25 |
| R32 | Resistor | 3.3K ELR25 |
| R33 | Resistor | 3.3K ELR25 |
| 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 |
| R43 | Resistor | 39 ELR25 |
| R44 | Resistor | 220 R25 |
| R45 | Resistor | 220 R25 |
| R46 | Resistor | 220 R25 |
| | | |
| C1 | Array | B5RC0124-32N |
| C2 | Ceramic | 0.001 50V |
| C3 | Array | B5RC0124-32N |
| 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 |
| 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 |

Disp In Caps

[DISPLAY] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|------------|
| W13 | Jumper | JPW-02A |
| W14 | Jumper | JPW-02A |
| W15 | Jumper | JPW-02A |
| 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 |

[LOGIC] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|-----------------|
| L1 | Coil | 101K FL5H |
| L2 | Coil | 471K FL9H |
| | | |
| T1 | Transformer | TO-9 - 924-0244 |
| | | |
| J1 | Connector | TL25P-06-V1 |
| J2 | Connector | TL25P-03-V1 |
| | | |
| P1 | Connector | TL25H-04-B1 |
| | | |
| B1 | P.C. Board | B-706A (42449) |
| B2 | P.C. Board | B-729 (42455) |
| B3 | P.C. Board | B-785 (42496) |
| B4 | P.C. Board | B-786 (42497) |
| | | |
| IC1 | IC | μA78M05 |
| IC2 | IC | RP5G01 007 |
| IC3 | IC | μPD7801G 114 |
| IC4 | IC | SN74LS08N |
| IC5 | IC | SN74LS32N |
| IC6 | IC | SN74LS02N |
| IC7 | IC | 4013B |
| 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 | μA78L82AWC |

[LOGIC] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|------------|
| Q1 | Transistor | 2SA1048Y |
| Q2 | Transistor | 2SA1048Y |
| Q3 | Transistor | 2SA1048Y |
| Q4 | Transistor | 2SC2458GR |
| Q5 | Transistor | 2SC2458GR |
| 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 | 2SC2458GR |
| | | |
| 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 unit | CSA400MT |
| | | |
| R1 | Resistor | 4.7K ELR25 |
| R2 | Resistor | 47K R25 |
| R3 | Resistor | 10K ELR25 |
| R4 | Resistor | 47K ELR25 |
| R5 | Resistor | 470 ELR25 |

[LOGIC] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|--------------|
| R6 | Array | 104 RM-4 |
| R7 | Resistor | 120K ELR25 |
| R8 | Resistor | 10K R25 |
| R10 | Resistor | 47K R25 |
| R11 | Resistor | 3.3M ELR25 |
| R12 | Resistor | 1M ELR25 |
| R13 | Resistor | 33 ELR25 |
| R14 | Trimmer | 1M H1051C |
| R15 | Resistor | 220K ELR25 |
| R16 | Resistor | 47K ELR25 |
| R17 | Resistor | 1M R25 |
| R18 | Resistor | 1M R25 |
| R19 | Resistor | 47K R25 |
| R20 | Resistor | 10 R50 |
| R21 | Resistor | 10K R25 |
| R22 | Array | 472 RM-8 |
| R23 | Resistor | 68K ELR25 |
| R24 | Resistor | 4.7K ELR25 |
| R25 | Resistor | 10K R25 |
| R26 | Resistor | 1K ELR25 |
| R27 | Array | 472 RM-4 |
| R28 | Resistor | 47K ELR25 |
| 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 |
| R48 | Resistor | 1K R25 |
| R49 | Resistor | 1K R25 |
| R50 | Resistor | 1K R25 |
| R51 | Resistor | 1K R25 |
| R53 | Resistor | 1.2K ELR25 |
| R54 | Resistor | 10K R25 |
| R55 | Resistor | 10K R25 |
| R58 | Resistor | 47K R10 |
| R59 | Resistor | 10K R10 |
| R60 | Resistor | 10K R10 |
| R61 | Resistor | 100K R10 |
| | | |
| C1 | Electrolytic | 33 16V |
| C2 | Barrier Lay | 0.1 16V |
| C3 | Barrier Lay | 0.1 16V |
| C4 | Electrolytic | 47 10V |
| C5 | Electrolytic | 1 50V |
| C6 | Barrier Lay | 0.1 16V |
| C7 | Mylar | 0.0022 50V |
| C8 | Mylar | 0.001 50V |
| C9 | Mylar | 0.001 50V |
| C10 | Barrier Lay | 0.1 16V |
| C11 | Ceramic | 33P 50V |
| C12 | Ceramic | 33P 50V |

[LOGIC] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|---------------|
| C13 | Barrier Lay | 0.1 16V |
| C14 | Barrier Lay | 0.047 25V |
| C15 | Electrolytic | 1 50V BP |
| C16 | Ceramic | 0.0047 50V |
| C17 | Barrier Lay | 0.1 16V |
| C18 | Electrolytic | 47 10V |
| C19 | Barrier Lay | 0.1 16V |
| C20 | Array | B8ZC0111-32N |
| C21 | Ceramic | 470P 50V |
| C22 | Ceramic | 0.001 50V |
| C23 | Barrier Lay | 0.1 16V |
| C24 | Ceramic | 0.0022 50V |
| C25 | Ceramic | 0.001 50V |
| C26 | Array | B8ZC0111-32N |
| C27 | Array | B5RC0124-32N |
| C28 | Array | B7ZC0711-32N |
| C29 | Array | B7ZC0711-32N |
| C30 | Barrier Lay | 0.1 16V |
| C31 | Barrier Lay | 0.1 16V |
| C32 | Barrier Lay | 0.1 16V |
| C33 | Ceramic | 0.0047 50V |
| C34 | Ceramic | 0.0047 50V |
| C35 | Ceramic | 0.0047 50V |
| L1 | Coil | 102K FL5H |
| L3 | Coil | BT01RN1-A61 |
| L4 | Coil | 102K FL5H |
| L5 | Coil | 102K FL5H |
| L6 | Coil | 102K FL5H |
| L7 | Coil | 102K FL5H |
| L8 | Coil | 102K FL5H |
| L9 | Coil | 102K FL5H |
| L10 | Coil | 102K FL5H |
| L11 | Coil | 101K FL5H |
| L12 | Coil | 101K FL5H |
| L13 | Coil | 101K FL5H |
| L14 | Coil | 101K FL5H |
| L15 | Coil | 101K FL5H |
| L16 | Coil | 101K FL5H |
| L17 | Coil | 101K FL5H |
| L18 | Coil | EL0810SK1-102 |
| J1 | Connector | TL-25P-05-V1 |
| J2 | Connector | TL-25P-10-V1 |
| J3 | Connector | TL-25P-12-V1 |
| J4 | Connector | TL-25P-05-V1 |
| J5 | Connector | 5138-11CPB |
| J6 | Connector | TL-25P-06-V1 |
| J7 | Connector | 5138-10CPB |
| J8 | Connector | 5138-04CPB |
| J9 | Connector | TL-25P-07-V1 |
| J10 | Connector | TL-25P-09-V1 |
| J11 | Connector | 5138-11CPB |
| J12 | Connector | TL-25P-08-V1 |
| J13 | Connector | 5138-10CPB |
| J14 | Connector | 5138-08CPB |
| J15 | Connector | TL-25P-08-V1 |
| J16 | Connector | 3022-12B |
| J17 | Connector | 3022-08B |
| W15 | Jumper | IPS-1041-4 |
| W16 | Jumper | JPW-02A |
| W17 | Jumper | JPW-02H |

[LOGIC] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|------------|
| W18 | Jumper | JPW-02A |
| W19 | Jumper | JPW-02H |
| W20 | Jumper | JPW-02A |
| W21 | Jumper | IPS-1041-4 |
| W22 | Jumper | IPW-1041-4 |
| W23 | Jumper | JPW-02H |
| W24 | Jumper | JPW-02A |
| W25 | Jumper | JPW-02A |
| 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 | IPS-1041-4 |
| W33 | Jumper | IPS-1041-4 |
| W34 | Jumper | JPW-02H |
| W35 | Jumper | JPW-02A |
| W36 | Jumper | JPW-02H |
| W37 | Jumper | JPW-02A |
| W38 | Jumper | JPW-02A |
| W39 | Jumper | JPW-02H |
| W40 | Jumper | JPW-02A |
| W41 | Jumper | JPW-02A |
| W42 | Jumper | JPW-02H |
| W43 | Jumper | IPS-1041-4 |
| W44 | Jumper | JPW-02A |
| W45 | Jumper | JPW-02H |
| W46 | Jumper | JPW-02H |
| W47 | Jumper | IPS-1041-4 |
| W48 | Jumper | IPS-1041-4 |
| W49 | Jumper | JPW-02A |
| W50 | Jumper | JPW-02A |
| W51 | Jumper | JPW-02H |
| W52 | Jumper | JPW-02H |
| W53 | Jumper | JPW-02H |
| W54 | Jumper | JPW-02A |
| W55 | Jumper | JPW-02A |
| W56 | Jumper | JPW-02A |
| W57 | Jumper | JPW-02A |
| W58 | Jumper | IPS-1041-4 |
| W59 | Jumper | IPS-1041-4 |
| W60 | Jumper | IPS-1041-4 |
| W61 | Jumper | JPW-02H |
| W62 | Jumper | JPW-02A |
| W63 | Jumper | JPW-02A |
| 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 | JPW-02A |
| W72 | Jumper | JPW-02A |
| W73 | Jumper | JPW-02A |
| W74 | Jumper | JPW-02A |
| W75 | Jumper | JPW-02A |
| W76 | Jumper | JPW-02A |
| W77 | Jumper | IPS-1041-4 |
| W78 | Jumper | JPW-02H |
| W79 | Jumper | JPW-02H |
| W80 | Jumper | JPW-02H |
| W81 | Jumper | IPS-1041-4 |
| W82 | Jumper | IPS-1041-4 |
| W83 | Jumper | IPS-1041-4 |

[LOGIC] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|----------------|
| W84 | Jumper | JPW-02A |
| W85 | Jumper | JPW-02A |
| W86 | Jumper | JPW-02A |
| W87 | Jumper | IPS-1041-4 |
| W88 | Jumper | JPW-02A |
| W89 | Jumper | IPS-1041-4 |
| W90 | Jumper | IPS-1041-4 |
| W91 | Jumper | IPS-1041-4 |
| W92 | Jumper | IPS-1041-4 |
| W93 | Jumper | JPW-02A |
| W94 | Jumper | JPW-02A |
| W95 | Jumper | JPW-02H |
| W96 | Jumper | IPS-1041-4 |
| B1 | P.C. Board | B-705B (42444) |
| B2 | RAM Unit | EX-314-01 |

[MATRIX] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|-----------|
| IC1 | IC | 4013B |
| IC2 | IC | 4013B |
| IC3 | IC | 4011B |
| IC4 | IC | 4030B |
| IC5 | IC | 4081B |
| Q1 | Transistor | 2SA1048Y |
| Q2 | Transistor | 2SC2458GR |
| Q3 | Transistor | 2SC2458GR |
| Q4 | Transistor | 2SC3399 |
| Q5 | Transistor | 2SC3399 |
| Q6 | Transistor | 2SC2458GR |
| Q7 | Transistor | 2SA1048Y |
| Q8 | Transistor | 2SC2458GR |
| Q9 | Transistor | 2SC3399 |
| Q10 | Transistor | 2SC2458GR |
| Q11 | Transistor | 2SC2458GR |
| Q12 | Transistor | 2SA1048Y |
| Q13 | Transistor | 2SC2458GR |
| Q14 | Transistor | 2SC2458GR |
| Q15 | Transistor | 2SC2458GR |
| Q16 | Transistor | 2SC2458GR |
| Q17 | Transistor | 2SC2458GR |
| Q18 | Transistor | 2SC2458GR |
| Q19 | Transistor | 2SC2458GR |
| Q20 | Transistor | 2SA1048Y |
| Q21 | Transistor | 2SC2458GR |
| DS1 | LED | SLB-22UR |
| D2 | Diode | 1SS53 |
| D3 | Diode | 1SS53 |
| D4 | Diode | 1SS53 |
| D5 | Diode | 1SS53 |
| D6 | Diode | 1SS53 |
| D7 | Diode | 1SS53 |
| D8 | Diode | 1SS53 |

[MATRIX] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|------------|
| 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 |
| 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 |
| R23 | Resistor | 47K R25 |
| R24 | Resistor | 47K R25 |
| R25 | Resistor | 6.8K R25 |
| R26 | Resistor | 47K ELR25 |
| R27 | Resistor | 47K ELR25 |
| R28 | Resistor | 47K ELR25 |
| R29 | Resistor | 47K ELR25 |
| R30 | Resistor | 47K ELR25 |
| R31 | Array | 103 RM-6 |

[MATRIX] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|------------------|
| R32 | Resistor | 47K ELR25 |
| R33 | Resistor | 47K R25 |
| R34 | Resistor | 47K ELR25 |
| R35 | Resistor | 1M ELR25 |
| R36 | Resistor | 1M ELR25 |
| R37 | Resistor | 47K R25 |
| R38 | Resistor | 47K R25 |
| R39 | Resistor | 6.8K R25 |
| R40 | Resistor | 47K ELR25 |
| R41 | Resistor | 4.7 ELR25 |
| C1 | Barrier Lay | 0.1 16V |
| C2 | Barrier Lay | 0.1 16V |
| C3 | Barrier Lay | 0.1 16V |
| C4 | Barrier Lay | 0.1 16V |
| C5 | Barrier Lay | 0.1 16V |
| C6 | Electrolytic | 0.47 50V BP |
| C7 | Array | B7ZC0711-32N |
| C8 | Barrier Lay | 0.1 16V |
| C9 | Array | B8ZC0111-32N |
| C10 | Barrier Lay | 0.1 16V |
| C11 | Barrier Lay | 0.1 16V |
| C12 | Ceramic | 0.001 50V |
| C13 | Ceramic | 0.001 50V |
| J1 | Connector | 5138-15APB |
| J2 | Connector | TLB-P06H-B1 |
| P1 | Connector | TL-25H-06-B1 |
| P2 | Connector | TL-25H-02-B1 |
| P3 | Connector | TL-25H-05-B1 |
| B1 | P.C. Board | B728A (42450) |
| B2 | P.C. Board | B726B (42456) |
| B3 | P.C. Board | B725A (42457) |
| B4 | P.C. Board | B787 (42498) |
| B5 | P.C. Board | B788 (42499) |
| B6 | P.C. Board | B789 (42500) |
| S1 | Switch | SPH122C |
| S2 | Switch | SPH122C |
| S3 | Switch | SPH121C |
| S4 | Switch | SPH122C |
| S5 | Switch | SPH122C |
| S6 | Switch | SPH122C |
| S7 | Switch | SPH122C |
| S8 | Switch | SPH122C |
| S9 | Switch | SPH122A |
| S10 | Switch | SSS212167 TYPE B |
| S11 | Switch | SPH122C |
| S12 | Switch | SPH122C |
| S13 | Switch | SPH121C |
| S14 | Switch | SPH122C |
| S15 | Switch | SPH122C |
| S16 | Switch | SPH122C |
| S17 | Switch | SPH121C |
| S18 | Switch | SPH122C |
| S19 | Switch | SPH121C |
| S20 | Switch | SPH122C |
| S21 | Switch | SPH122C |
| S22 | Switch | SPH121C |

[MATRIX] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|------------|
| S23 | Switch | SPH121C |
| S24 | Switch | SPH121C |
| W4 | Jumper | JPW-02A |
| W5 | Jumper | JPW-02A |
| W6 | Jumper | IPS-1041-4 |
| W7 | Jumper | JPW-02A |
| W8 | Jumper | JPW-02A |
| W9 | Jumper | JPW-02A |
| W10 | Jumper | IPS-1041-4 |
| W11 | Jumper | JPW-02A |
| W12 | Jumper | JPW-02H |
| W13 | Jumper | JPW-02A |
| W14 | Jumper | JPW-02A |
| W15 | Jumper | JPW-02A |
| W16 | Jumper | JPW-02A |
| W17 | Jumper | JPW-02A |
| W18 | Jumper | JPW-02H |
| W19 | Jumper | IPS-1041-4 |
| W20 | Jumper | IPS-1041-4 |
| W21 | Jumper | JPW-02A |
| W22 | Jumper | JPW-02H |
| W23 | Jumper | JPW-02H |
| W24 | Jumper | JPW-02H |
| W25 | Jumper | JPW-02A |
| W26 | Jumper | JPW-02A |
| W27 | Jumper | JPW-02A |
| W28 | Jumper | JPW-02A |
| W29 | Jumper | JPW-02H |
| W30 | Jumper | JPW-02A |
| W31 | Jumper | JPW-02A |
| W32 | Jumper | JPW-02H |
| W33 | Jumper | IPS-1041-4 |
| W34 | Jumper | IPS-1041-4 |
| W35 | Jumper | JPW-02H |
| W36 | Jumper | JPW-02A |
| W37 | Jumper | JPW-02H |
| W38 | Jumper | JPW-02A |
| W39 | Jumper | JPW-02A |
| W40 | Jumper | JPW-02A |
| W41 | Jumper | JPW-02A |
| W42 | Jumper | JPW-02H |
| W43 | Jumper | JPW-02A |
| W45 | Jumper | JPW-02A |
| W59 | Jumper | JPW-02A |

[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 | 7805 |
| IC201 | IC | M54929P |
| IC202 | IC | M54466L |
| IC203 | IC | SN74LS90N |

[PLL] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|----------------|---------------|
| IC204 | IC | M54459L |
| Q1 | Transistor | 2SC945P |
| Q2 | Transistor | 2SC945P |
| Q3 | Transistor | 2SC945P |
| Q4 | Transistor | 2SC945P |
| Q5 | FET | 2SK30A-Y |
| Q6 | FET | 2SK30A-Y |
| Q7 | Transistor | 2SC1571G |
| Q8 | Transistor | 2SA1015Y |
| Q9 | Transistor | 2SC945P |
| Q10 | Transistor | 2SC945R |
| Q11 | Transistor | 2SC383TM |
| Q12 | Transistor | 2SC945P |
| Q13 | Transistor | 2SC3399 |
| Q14 | Transistor | 2SC383TM |
| Q15 | FET | 2SK241-Y |
| Q16 | Transistor | 2SC383TM |
| Q17 | Transistor | 2SC383TM |
| Q18 | FET | 2SK192A-GR |
| Q19 | FET | 2SK192A-GR |
| Q20 | FET | 2SK192A-GR |
| Q21 | FET | 2SK192A-GR |
| Q22 | Transistor | 2SC383TM |
| Q23 | Transistor | 2SC383TM |
| Q24 | Transistor | 2SC945P |
| Q25 | Transistor | 2SC383TM |
| Q26 | Transistor | 2SC383TM |
| Q201 | FET | 2SK192A-GR |
| Q202 | Transistor | 2SC763C |
| D1 | Varactor Diode | 1SV50-E |
| D2 | Zener | XZ-051 |
| D4 | Diode | 1SS53 |
| D5 | Diode | 1SS53 |
| D7 | Diode | 1SS53 |
| D8 | Diode | 1SS53 |
| D9 | Diode | 1SS53 |
| D10 | Diode | 1SS53 |
| D11 | Diode | 1SS53 |
| D12 | Varactor Diode | FC52M |
| D13 | Varactor Diode | 1SV50-E |
| D14 | Varactor Diode | 1SV50-E |
| D15 | Varactor Diode | 1SV50-E |
| D16 | Diode | 1SS53 |
| D17 | Diode | 1SS53 |
| D18 | Diode | 1SS53 |
| D19 | Diode | 1SS53 |
| D20 | Zener | XZ051 |
| D21 | Diode | 1SS53 |
| D201 | Varactor Diode | 1SV50-E |
| L1 | Coil | LW-19 |
| L2 | Coil | LS-94 |
| L3 | Coil | LS-114 |
| L4 | Coil | LS-114 |
| L5 | Coil | LS-114 |
| L6 | Coil | 102K LAL04NA |
| L7 | Coil | EL0810SKI-101 |
| L8 | Coil | LS-162 |
| L9 | Coil | LA-244 |
| L10 | Coil | LA-254 |
| L11 | Coil | LB4 R36 |

[PLL] UNIT

| REF. NO. | DESCRIPTION | PAPT NO. |
|----------|-------------|--------------|
| L12 | Coil | LB4 R23 |
| L13 | Coil | LW-17 |
| L14 | Coil | 101K FL5H |
| L15 | Coil | 101K FL5H |
| L16 | Coil | LR-79 |
| L17 | Coil | LB-135 |
| L18 | Coil | LW-19 |
| L19 | Coil | LR-79 |
| L20 | Coil | LB-135 |
| L21 | Coil | LW-19 |
| L22 | Coil | LR-79 |
| L23 | Coil | LB-135 |
| L24 | Coil | LW-19 |
| L25 | Coil | LR-79 |
| L26 | Coil | LB-135 |
| L27 | Coil | LW-19 |
| L28 | Coil | BT01RN1-A61 |
| L29 | Coil | LAL03 NAR56M |
| L30 | Coil | 101K LAL04NA |
| L201 | Coil | LB-113 |
| L202 | Coil | LW-19 |
| L203 | Coil | 101K FL5H |
| L204 | Coil | 101K LAL04NA |
| L205 | Coil | 101K LAL04NA |
| L206 | Coil | 101K LAL04NA |
| 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 ELR25 |
| R10 | Resistor | 15K ELR25 |
| R11 | Resistor | 1K R25 |
| R12 | Resistor | 470 ELR25 |
| R13 | Resistor | 1.2K ELR25 |
| 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 R25 |
| R22 | Resistor | 1K R25 |
| R24 | Resistor | 100 ELR25 |
| R25 | Resistor | 100 ELR25 |
| R26 | Resistor | 470 ELR25 |
| R27 | Resistor | 220 ELR25 |
| R28 | Resistor | 100 ELR25 |
| R29 | Resistor | 47 ELR25 |
| R30 | Resistor | 3.3K ELR25 |
| R31 | Resistor | 47K 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 R25 |
| R40 | Resistor | 4.7K ELR25 |
| R41 | Resistor | 1.8M ELR25 |
| R42 | Resistor | 1K ELR25 |

[PLL] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|------------|
| R43 | Resistor | 1.2K ELR25 |
| 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 |
| 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 | 1 0K R25 |
| R96 | Resistor | 10K R25 |
| R97 | Resistor | 10K R25 |
| R98 | Resistor | 47K R25 |
| R99 | Resistor | 47K R25 |
| R100 | Resistor | 10 SRW 1P |
| R101 | Resistor | 120 R50 |
| R102 | Resistor | 220 ELR25 |
| R103 | Resistor | 47 ELR25 |
| R104 | Resistor | 22 ELR25 |
| R105 | Resistor | 1K R25 |
| R106 | Resistor | 15K R25 |
| R107 | Resistor | 47K ELR25 |
| R108 | Resistor | 47 ELR25 |
| R109 | Resistor | 3.3K ELR25 |

[PLL] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|-------------|
| R201 | Resistor | 10K ELR25 |
| R202 | Resistor | 1K R25 |
| R203 | Resistor | 2.7K ELR25 |
| R204 | Resistor | 33K ELR25 |
| R205 | Resistor | 10K E LR25 |
| R206 | Resistor | 470K ELR25 |
| R207 | Resistor | 470K ELR25 |
| 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 E LR25 |
| R217 | Resistor | 2.7K ELR25 |
| R218 | Resistor | 390 ELR25 |
| 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 Lay | 0.047 25V |
| C15 | Ceramic | 15P 50V |
| C16 | Barrier Lay | 0.047 25V |
| C17 | Ceramic | 0.0047 50V |
| 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 Lay | 0.047 25V |
| C29 | Ceramic | 470P 50V |
| C30 | Ceramic | 470P 50V |
| C31 | Barrier Lay | 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 | 47P 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 | 82P 50V |
| C46 | Ceramic | 15P 50V |
| C47 | Ceramic | 62P 50V |
| C48 | Ceramic | 150P 50V |
| C49 | Ceramic | 120P 50V |
| C50 | Ceramic | 56P 50V |

[PLL] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|--------------|
| 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 |
| C66 | Electrolytic | 47 10V |
| C67 | Barrier Lay | 0.047 25V |
| C68 | Barrier Lay | 0.1 16V |
| 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 Lay | 0.047 25V |
| C75 | Electrolytic | 0.47 50V BP |
| C76 | Ceramic | 56P 50V |
| C77 | Ceramic | 24P 50V |
| C78 | Trimmer | CT51C |
| 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 Lay | 0.047 25V |
| C86 | Ceramic | 56P 50V |
| C87 | Ceramic | 15P 50V |
| C88 | Trimmer | CTZ51C |
| C89 | Ceramic | 47P 50V CH |
| C90 | Ceramic | 12P 50V CH |
| C91 | Ceramic | 12P 50V CH |
| C92 | Ceramic | 0.0047 50V |
| C93 | Ceramic | 1 P 50V |
| C94 | Ceramic | 0.0047 50V |
| C95 | Ceramic | 47P 50V |
| C96 | Ceramic | 10P 50V |
| C97 | Trimmer | CTZ51A |
| 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 Lay | 0.047 25V |
| C105 | Ceramic | 39P 50V |
| C106 | Ceramic | 7P 50V |
| C107 | Trimmer | CTZ51A |
| 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 Lay | 0.047 25V |
| C115 | Electrolytic | 100 10V |
| C116 | Ceramic | 0.0047 50V |
| C117 | Ceramic | 22P 50V |

[PLL] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|--------------|
| C118 | Ceramic | 22P 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 | 5P 50V |
| C125 | Ceramic | 0.001 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 |
| 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 | Ceramic | 0.0047 50V |
| C143 | Ceramic | 0.0047 50V |
| C145 | Ceramic | 0.0047 50V |
| C146 | Ceramic | 100P 50V |
| C147 | Ceramic | 5P 50V |
| C148 | Ceramic | 15P 50V |
| C151 | Ceramic | 0.0047 50V |
| C201 | Array | B7ZC0717-32N |
| C202 | Electrolytic | 0.22 50V RC2 |
| C203 | Barrier Lay | 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 Lay | 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-05-V1 |
| J2 | Connector | 5138-11CPB |
| J3 | Connector | 5138-04CPB |
| J4 | Connector | TMP-J01X-V1 |
| J5 | Connector | TMP-J01X-V1 |
| P1 | Connector | TL25H-02-B1 |

[PLL] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|----------------|-------------------|
| X1 | Crystal | CR-21 (30.720MHz) |
| FI1 | Crystal Filter | FL-69 (30M15A) |
| B1 | P.C. Board | B-704C (42443) |
| W14 | Jumper | JPW-02A |
| W15 | Jumper | IPS-1041-4 |
| W16 | Jumper | JPW-02A |
| W17 | Jumper | JPW-02A |
| W18 | Jumper | JPW-02A |
| W19 | Jumper | JPW-02A |
| W20 | Jumper | JPW-02A |
| W21 | Jumper | JPW-02H |
| W24 | Jumper | JPW-02A |
| W25 | Jumper | JPW-02A |
| W26 | Jumper | JPW-02A |
| W27 | Jumper | JPW-02A |
| W28 | Jumper | JPW-02A |
| W29 | Jumper | IPS-1041-4 |
| W30 | Jumper | JPW-02A |
| W31 | Jumper | IPS-1041-4 |
| W32 | Jumper | IPS-1041-4 |
| W33 | Jumper | IPS-1041-4 |
| W34 | Jumper | JPW-02A |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|---------------|
| IC1 | IC | μ PC1037H |
| IC2 | IC | μ PC1037H |
| IC3 | IC | μ PC1037H |
| IC4 | IC | μ PC1037H |
| IC5 | IC | μ PC1037H |
| IC6 | IC | LA2600 |
| IC7 | IC | 4066B |
| IC8 | IC | μ PC1037H |
| IC9 | IC | μ PC1181H |
| IC10 | IC | NJM4558D |
| IC11 | IC | NJM4558D |
| IC12 | IC | NJM4558D |
| IC13 | IC | NJM4558D |
| IC14 | IC | NJM4558D |
| IC15 | IC | NJM4558D |
| IC16 | IC | 78M08 |
| Q1 | FET | 2SK241Y |
| Q2 | Transistor | 2SC945P |
| Q3 | Transistor | 2SC1815Y |
| Q4 | Transistor | 2SC945P |
| Q5 | Transistor | 2SC3402 |
| Q6 | Transistor | 2SC945P |
| Q7 | FET | 3SK74M |
| Q8 | Transistor | 2SC1583G |
| Q9 | Transistor | 2SC945P |
| Q10 | Transistor | 2SC945P |
| Q11 | Transistor | 2SC945P |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|----------|
| Q12 | Transistor | 2SA1015Y |
| Q13 | Transistor | 2SC945P |
| Q14 | FET | 3SK74M |
| Q15 | Transistor | 2SA1348 |
| Q16 | Transistor | 2SA1348 |
| Q17 | Transistor | 2SA1348 |
| Q18 | Transistor | 2SA1348 |
| Q19 | FET | 3SK74M |
| Q20 | FET | 3SK74M |
| Q21 | Transistor | 2SC945P |
| Q22 | Transistor | 2SC945P |
| Q23 | Transistor | 2SC945P |
| Q24 | FET | 3SK74M |
| Q25 | Transistor | 2SC945P |
| Q26 | Transistor | 2SC1815Y |
| Q27 | Transistor | 2SC945P |
| Q28 | Transistor | 2SC945P |
| Q29 | Transistor | 2SC945P |
| Q30 | Transistor | 2SC945P |
| Q31 | Transistor | 2SC1815Y |
| Q32 | Transistor | 2SC945P |
| Q33 | Transistor | 2SC1815Y |
| Q34 | Transistor | 2SC945P |
| Q35 | FET | 3SK74M |
| Q36 | FET | 3SK74M |
| Q37 | Transistor | 2SC945P |
| Q38 | Transistor | 2SC3399 |
| Q39 | Transistor | 2SA1348 |
| Q40 | Transistor | 2SA1015Y |
| Q41 | Transistor | 2SA1015Y |
| Q42 | Transistor | 2SC3402 |
| Q43 | Transistor | 2SC945P |
| Q44 | Transistor | 2SC2458 |
| Q45 | Transistor | 2SC1015Y |
| Q46 | Transistor | 2SC945P |
| Q47 | Transistor | 2SC1571G |
| Q48 | Transistor | 2SC1015Y |
| Q49 | Transistor | 2SC1571G |
| Q50 | Transistor | 2SC1571G |
| Q51 | Transistor | 2SA1015Y |
| Q52 | Transistor | 2SC945P |
| Q53 | Transistor | 2SC945P |
| Q54 | Transistor | 2SD468C |
| Q55 | Transistor | 2SC945P |
| Q56 | Transistor | 2SC945P |
| Q57 | Transistor | 2SC945P |
| Q58 | Transistor | 2SC945P |
| Q59 | Transistor | 2SD468C |
| Q60 | Transistor | 2SC945P |
| Q61 | Transistor | 2SD468C |
| Q62 | Transistor | 2SA1015Y |
| Q63 | Transistor | 2SA1015Y |
| Q64 | FET | 2SK241Y |
| Q65 | Transistor | 2SC945P |
| Q66 | Transistor | 2SC3399 |
| Q67 | Transistor | 2SC3402 |
| Q68 | Transistor | 2SA1048Y |
| Q69 | Transistor | 2SC1815Y |
| Q70 | Transistor | 2SC3402 |
| Q71 | Transistor | 2SC3399 |
| Q72 | Transistor | 2SC945P |
| D1 | Diode | 1SS53 |
| D2 | Diode | 1SS53 |
| D3 | Diode | 1SS53 |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|----------|
| D4 | Diode | 1SS53 |
| D5 | Diode | 1SS53 |
| D6 | Diode | 1SS53 |
| D7 | Diode | 1SS53 |
| D8 | 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 | 1K60 |
| D18 | Diode | 1K60 |
| D19 | Diode | 1SS53 |
| D20 | Zener | MZ304B |
| D21 | Diode | 1SS53 |
| D22 | Diode | 1SS53 |
| D23 | Diode | 1SS53 |
| D24 | Diode | 1SS53 |
| D25 | Diode | 1SS53 |
| D26 | Diode | 1SS53 |
| D27 | Diode | 1SS53 |
| D28 | 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 | 1S953 |
| D38 | Zener | WZ046 |
| D39 | Diode | 1SS53 |
| D40 | Diode | 1SS53 |
| D41 | Diode | 1SS53 |
| D42 | Diode | 1SS53 |
| D43 | Diode | 1SS53 |
| D44 | Diode | 1SS53 |
| D45 | Diode | 1SS53 |
| D46 | Diode | 1SS53 |
| D47 | Diode | 1SS53 |
| D48 | Diode | 1SS53 |
| D49 | Diode | 1SS53 |
| D50 | Diode | 1SS53 |
| D51 | Diode | 1SS53 |
| D52 | Diode | 1SS53 |
| D53 | Diode | 1SS53 |
| D54 | Diode | 1SS53 |
| D55 | Diode | 1SS53 |
| D56 | Diode | 1SS53 |
| D57 | Diode | 1SS53 |
| D58 | Diode | 1SS53 |
| D59 | Diode | 1SS53 |
| D60 | Diode | 1SS53 |
| D61 | Diode | 1SS53 |
| D62 | Diode | 1SS53 |
| D63 | Diode | 1SS211 |
| D64 | Diode | 1SS211 |
| D65 | Diode | 1K60 |
| D66 | Diode | 1K60 |
| D67 | Diode | 1SS53 |
| D68 | Diode | 1SS53 |
| D69 | Diode | 1SS53 |
| D70 | Diode | 1SS53 |
| D71 | Diode | 1SS53 |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|----------------|---------------------|
| D72 | Diode | 1SS53 |
| D73 | Diode | 1SS53 |
| D74 | Diode | 1SS53 |
| D75 | Diode | 1SS53 |
| D76 | Varactor Diode | 1SV50 |
| D77 | Diode | 1SS53 |
| D78 | Diode | 1K60 |
| D79 | Diode | 1SS53 |
| D80 | Diode | 1SS53 |
| D82 | Diode | 1SS53 |
| D84 | Varactor Diode | 1SV50 |
| D85 | Diode | 1SS53 |
| D87 | Diode | 1SS53 |
| D88 | Diode | 1SS53 |
| D89 | Diode | 1SS53 |
| D90 | Diode | 1SS53 |
| D91 | Diode | 1SS53 |
| D92 | Diode | 1SS53 |
| D93 | Diode | 1SS53 |
| D94 | Diode | 1SS53 |
| D95 | Diode | 1SS53 |
| D96 | Diode | 1SS53 |
| D97 | Diode | 1SS53 |
| D98 | Diode | 1SS53 |
| D99 | Diode | 1SS53 |
| D100 | Diode | 1SS53 |
| D101 | Diode | 1SS53 |
| D102 | Diode | 1SS53 |
| D103 | Diode | 1SS53 |
| D104 | Diode | 1SS53 |
| D105 | Diode | 1K60 |
| D106 | Diode | 1SS53 |
| D107 | Diode | 1SS53 |
| D108 | Diode | 1SS53 |
| D110 | Diode | 1SS53 |
| D111 | Diode | 1SS53 |
| D112 | Diode | 1SS53 |
| D113 | Diode | 1SS53 |
| D114 | Diode | 1SS53 |
| D115 | Diode | 1SS53 |
| D116 | Diode | 1SS53 |
| D117 | Diode | 1SS53 |
| D118 | Diode | 1SS53 |
| D119 | Diode | 1SS53 |
| D120 | Diode | 1SS53 |
| D121 | Diode | 1SS53 |
| D122 | Diode | 1SS53 |
| F11 | Crystal Filter | FL-23 (9M15A) |
| F12 | Crystal Filter | FL-30 (9M22D2) |
| F13 | Ceramic Filter | CFW4551T |
| F14 | Crystal Filter | FL-44A (X00F24A) |
| X1 | Crystal | 9.0145MHz (CR-49) |
| X2 | Crystal | 9.0115MHz (CR-48) |
| X3 | Crystal | 9.0145MHz (CR-49) |
| X4 | Crystal | 8.6630MHz (CR-20) |
| X5 | Crystal | 9.4665MHz (CR-1) |
| X6 | Ceramic Unit | KBR-350B |
| L1 | Coil | LS-175 |
| L2 | Coil | LS-163 |
| L3 | Coil | LS-133A → 924-02307 |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|--------------|
| L4 | Coil | LS-133A |
| L5 | Coil | LS-133A |
| L6 | Coil | LS-175 |
| L7 | Coil | LS-175 |
| L8 | Coil | LS-175 |
| L9 | Coil | LS-90A |
| L10 | Coil | LS-90A |
| L11 | Coil | 101 FL5H |
| L12 | Coil | LS-175 |
| L13 | Coil | 102 FL5H |
| L14 | Coil | 101 FL5H |
| L15 | Coil | LS-238 |
| L16 | Coil | LS-239 |
| L17 | Coil | LS-240 |
| L18 | Coil | 100 FL5H |
| L19 | Coil | 100 FL5H |
| L20 | Coil | LS-133A |
| L21 | Coil | 100 FL5H |
| L22 | Coil | LS-175 |
| L23 | Coil | 101 FL5H |
| L24 | Coil | LS-133A |
| L25 | Coil | LS-168 |
| L26 | Coil | LB4 R70 |
| L27 | Coil | LS-260 |
| L28 | Coil | 101 FL5H |
| L29 | Coil | LS-163 |
| L30 | Coil | 101 FL5H |
| L31 | Coil | 101 FL5H |
| L32 | Coil | 101M LAL04SK |
| L33 | Coil | LW-15 |
| L34 | Coil | 101 FL5H |
| L35 | Coil | 101M LAL04SK |
| R1 | Resistor | 4.7K ELR25 |
| R2 | Resistor | 220 ELR25 |
| R3 | Resistor | 3.9K ELR25 |
| R4 | Resistor | 220 ELR25 |
| R5 | Resistor | 4.7K ELR25 |
| R6 | Resistor | 4.7K ELR25 |
| R7 | Resistor | 220 ELR25 |
| R8 | Resistor | 47 ELR25 |
| R9 | Resistor | 6.8K ELR25 |
| R10 | Resistor | 47K ELR25 |
| R11 | Resistor | 47K ELR25 |
| R12 | Resistor | 3.3K ELR25 |
| R13 | Resistor | 47K ELR25 |
| R14 | Resistor | 100K ELR25 |
| R15 | Resistor | 10K ELR25 |
| R16 | Resistor | 22K ELR25 |
| R17 | Resistor | 10K ELR25 |
| R18 | Resistor | 100K ELR25 |
| R19 | Resistor | 100K ELR25 |
| R20 | Resistor | 100K ELR25 |
| R21 | Resistor | 1K ELR25 |
| R22 | Resistor | 1K ELR25 |
| R23 | Resistor | 1K R10 |
| R24 | Resistor | 15K ELR25 |
| R25 | Resistor | 15K ELR25 |
| R26 | Resistor | 10K ELR25 |
| R27 | Resistor | 22K ELR25 |
| R28 | Trimmer | 47K H0651A |
| R29 | Resistor | 3.3M ELR25 |
| R30 | Resistor | 1M ELR25 |
| R31 | Resistor | 1M ELR25 |
| R32 | Resistor | 1K ELR25 |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|-------------|
| R35 | Resistor | 2.2K ELR25 |
| R36 | Resistor | 3.3M ELR25 |
| R37 | Resistor | 47K ELR25 |
| R38 | Resistor | 22K ELR25 |
| R39 | Resistor | 47K ELR25 |
| R40 | Resistor | 470 ELR25 |
| R41 | Resistor | 3.3M ELR25 |
| R42 | Resistor | 220K ELR25 |
| R43 | Resistor | 56K ELR25 |
| R44 | Trimmer | 47K H0651A |
| R45 | Resistor | 470K ELR25 |
| R46 | Trimmer | 4.7K H0651A |
| R47 | Resistor | 15K ELR25 |
| R48 | Trimmer | 47K H0651A |
| R49 | Resistor | 100K ELR25 |
| R50 | Resistor | 3.3M ELR25 |
| R51 | Resistor | 1M ELR25 |
| R52 | Resistor | 1.8M ELR25 |
| R53 | Resistor | 1M ELR25 |
| R54 | Resistor | 470K ELR25 |
| R55 | Resistor | 3.3M ELR25 |
| R56 | Resistor | 10K ELR25 |
| R57 | Resistor | 22K ELR25 |
| R58 | Trimmer | 10K H0651A |
| R59 | Trimmer | 10K H0651A |
| R60 | Resistor | 1M ELR25 |
| R61 | Resistor | 47K ELR25 |
| R62 | Resistor | 47K ELR25 |
| R63 | Trimmer | 3.3K H0651A |
| R64 | Resistor | 47K ELR25 |
| R65 | Resistor | 100K ELR25 |
| R66 | Resistor | 1M ELR25 |
| R67 | Resistor | 220 ELR25 |
| R68 | Resistor | 22K ELR25 |
| R69 | Resistor | 1K ELR25 |
| R70 | Resistor | 100 ELR25 |
| R71 | Resistor | 100K ELR25 |
| R72 | Resistor | 1K ELR25 |
| R73 | Resistor | 150K ELR25 |
| R74 | Resistor | 100 ELR25 |
| R75 | Resistor | 6.8K ELR25 |
| R76 | Resistor | 68K ELR25 |
| R77 | Resistor | 47K ELR25 |
| R78 | Resistor | 100 ELR25 |
| R79 | Resistor | 8.2K ELR25 |
| R80 | Resistor | 4.7K ELR25 |
| R81 | Resistor | 100 ELR25 |
| R82 | Resistor | 10K ELR25 |
| R83 | Resistor | 10K ELR25 |
| R86 | Resistor | 10K ELR25 |
| R87 | Resistor | 10K ELR25 |
| R88 | Resistor | 10K ELR25 |
| R89 | Resistor | 10K ELR25 |
| R91 | Resistor | 10K ELR25 |
| R92 | Resistor | 10K ELR25 |
| R93 | Resistor | 10K ELR25 |
| R94 | Resistor | 10K ELR25 |
| R95 | Resistor | 2.2K ELR25 |
| R96 | Resistor | 10K ELR25 |
| R97 | Resistor | 1.5K ELR25 |
| R98 | Resistor | 470 ELR25 |
| R99 | Resistor | 470 ELR25 |
| R100 | Resistor | 1K ELR25 |
| R101 | Resistor | 220 ELR25 |
| R102 | Resistor | 10K ELR25 |
| R103 | Resistor | 10K ELR25 |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|------------|
| R104 | Resistor | 1K ELR25 |
| R106 | Resistor | 10K ELR25 |
| R107 | Resistor | 3.3M ELR25 |
| R108 | Resistor | 100K ELR25 |
| R109 | Resistor | 15K ELR25 |
| R110 | Trimmer | 33K H0651A |
| R111 | Resistor | 220K ELR25 |
| R112 | Resistor | 1.8M ELR25 |
| R113 | Resistor | 10 ELR25 |
| R114 | Resistor | 1M ELR25 |
| R115 | Resistor | 1M ELR25 |
| R116 | Resistor | 10K ELR25 |
| R117 | Resistor | 22 ELR25 |
| R118 | Resistor | 12K ELR25 |
| R119 | Resistor | 1M ELR25 |
| R120 | Resistor | 2.2K ELR25 |
| R122 | Resistor | 1K R25 |
| R124 | Resistor | 22K ELR25 |
| R125 | Resistor | 10K ELR25 |
| R126 | Resistor | 4.7K ELR25 |
| R127 | Resistor | 2.2K ELR25 |
| R128 | Resistor | 2.2K ELR25 |
| R129 | Resistor | 1K ELR25 |
| R130 | Resistor | 220 ELR25 |
| R131 | Resistor | 4.7K ELR25 |
| R132 | Resistor | 470K ELR25 |
| R133 | Resistor | 330 ELR25 |
| R135 | Resistor | 10K ELR25 |
| R136 | Resistor | 10K ELR25 |
| R137 | Resistor | 10K ELR25 |
| R138 | Resistor | 2.2K ELR25 |
| R139 | Resistor | 1.5K ELR25 |
| R140 | Resistor | 2.2K ELR25 |
| R141 | Resistor | 1.5K ELR25 |
| R142 | Resistor | 2.2K ELR25 |
| R143 | Resistor | 470 ELR25 |
| R144 | Resistor | 100 R25 |
| R145 | Resistor | 100 ELR25 |
| R146 | Resistor | 150 ELR25 |
| R147 | Resistor | 1.5K ELR25 |
| R148 | Resistor | 150 ELR25 |
| R149 | Resistor | 1.5K ELR25 |
| R150 | Resistor | 2.2K ELR25 |
| R151 | Resistor | 10K R25 |
| R152 | Resistor | 10K ELR25 |
| R153 | Resistor | 10K ELR25 |
| R154 | Resistor | 470K ELR25 |
| R155 | Resistor | 220K ELR25 |
| R156 | Resistor | 470K ELR25 |
| R157 | Resistor | 4.7K ELR25 |
| R158 | Resistor | 4.7K ELR25 |
| R159 | Resistor | 100K ELR25 |
| R160 | Resistor | 47K ELR25 |
| R161 | Resistor | 1K ELR25 |
| R162 | Resistor | 470 ELR25 |
| R163 | Resistor | 330 ELR25 |
| R164 | Resistor | 10K ELR25 |
| R165 | Resistor | 100 ELR25 |
| R166 | Resistor | 330 ELR25 |
| R167 | Resistor | 100 ELR25 |
| R168 | Resistor | 10K ELR25 |
| R169 | Resistor | 2.7K ELR25 |
| R170 | Resistor | 4.7K ELR25 |
| R171 | Resistor | 1K ELR25 |
| R173 | Resistor | 47K ELR25 |
| R175 | Resistor | 220 R25 |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|-------------|
| R176 | Resistor | 10K ELR25 |
| R177 | Resistor | 2.2K ELR25 |
| R178 | Resistor | 10K ELR25 |
| R179 | Resistor | 2.2K ELR25 |
| R180 | Resistor | 22K ELR25 |
| R181 | Resistor | 47K ELR25 |
| R182 | Resistor | 100K ELR25 |
| R183 | Resistor | 100 ELR25 |
| R184 | Resistor | 100K ELR25 |
| R185 | Resistor | 100K ELR25 |
| R186 | Resistor | 10K ELR25 |
| R187 | Resistor | 1M ELR25 |
| R188 | Resistor | 100K ELR25 |
| R189 | Resistor | 47K ELR25 |
| R190 | Resistor | 22K ELR25 |
| R191 | Resistor | 47K ELR25 |
| R192 | Resistor | 100K ELR25 |
| R193 | Resistor | 10K H0651A |
| R194 | Resistor | 4.7K H0651A |
| R195 | Resistor | 10K ELR25 |
| R196 | Resistor | 1.5K ELR25 |
| R197 | Resistor | 10K ELR25 |
| R198 | Resistor | 1.5K ELR25 |
| R200 | Resistor | 1K R25 |
| R201 | Resistor | 220 ELR25 |
| R202 | Resistor | 10K ELR25 |
| R204 | Resistor | 220 ELR25 |
| R205 | Resistor | 10K ELR25 |
| R206 | Resistor | 15K ELR25 |
| R207 | Resistor | 1K ELR25 |
| R208 | Resistor | 220 R25 |
| R209 | Resistor | 3.3K ELR25 |
| R210 | Resistor | 47 ELR25 |
| R211 | Resistor | 3.3K ELR25 |
| R212 | Resistor | 3.3K ELR25 |
| R213 | Resistor | 2.2K ELR25 |
| R214 | Resistor | 3.3K ELR25 |
| R215 | Resistor | 10K R25 |
| R216 | Resistor | 22K R25 |
| R217 | Resistor | 3.3K ELR25 |
| R218 | Resistor | 100 R25 |
| R219 | Resistor | 10K ELR25 |
| R220 | Resistor | 1K R25 |
| R222 | Trimmer | 22K H0651A |
| R223 | Resistor | 4.7K ELR25 |
| R224 | Resistor | 1K ELR25 |
| R225 | Resistor | 100 R10 |
| R226 | Resistor | 1K ELR25 |
| R227 | Resistor | 220 ELR25 |
| R228 | Resistor | 330 ELR25 |
| R229 | Resistor | 100 ELR25 |
| R230 | Trimmer | 10K H0651A |
| R231 | Resistor | 220 ELR25 |
| R232 | Resistor | 330 ELR25 |
| R233 | Resistor | 100 ELR25 |
| R234 | Resistor | 3.3M ELR25 |
| R235 | Resistor | 10K ELR25 |
| R236 | Resistor | 100 ELR25 |
| R237 | Resistor | 1K ELR25 |
| R238 | Resistor | 47K ELR25 |
| R239 | Resistor | 100K ELR25 |
| R240 | Resistor | 2.2K ELR25 |
| R241 | Resistor | 100K ELR25 |
| R242 | Resistor | 47K ELR25 |
| R243 | Resistor | 10K ELR25 |
| R244 | Resistor | 100K ELR25 |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|------------|
| R245 | Resistor | 100K ELR25 |
| R246 | Resistor | 220 ELR25 |
| R248 | Resistor | 220 ELR25 |
| R249 | Resistor | 100K ELR25 |
| R250 | Resistor | 470 ELR25 |
| R251 | Resistor | 10K ELR25 |
| R252 | Resistor | 1K ELR25 |
| R253 | Resistor | 2.2K ELR25 |
| R254 | Resistor | 47K ELR25 |
| R255 | Resistor | 100K ELR25 |
| R256 | Resistor | 10K ELR25 |
| R257 | Resistor | 2.2K ELR25 |
| R258 | Resistor | 2.2K ELR25 |
| R259 | Resistor | 2.2K ELR25 |
| R260 | Resistor | 2.2K ELR25 |
| R261 | Resistor | 2.2K ELR25 |
| R262 | Resistor | 220 ELR25 |
| R263 | Resistor | 47K ELR25 |
| R264 | Resistor | 100K ELR25 |
| R265 | Resistor | 2.2K ELR25 |
| R266 | Resistor | 220 ELR25 |
| R267 | Trimmer | 10K H1051C |
| R268 | Trimmer | 10K H0651A |
| R269 | Resistor | 4.7K ELR25 |
| R270 | Trimmer | 10K H0651A |
| R271 | Resistor | 100K ELR25 |
| R273 | Trimmer | 10K H0651A |
| R274 | Resistor | 100K ELR25 |
| R275 | Resistor | 3.3K ELR25 |
| R277 | Resistor | 10K ELR25 |
| R278 | Resistor | 10K ELR25 |
| R279 | Resistor | 22K ELR25 |
| R280 | Resistor | 10K ELR25 |
| R281 | Resistor | 1K ELR25 |
| R282 | Resistor | 3.3M ELR25 |
| R283 | Resistor | 100K ELR25 |
| R285 | Resistor | 47K ELR25 |
| R286 | Resistor | 100K ELR25 |
| R287 | Resistor | 100K ELR25 |
| R288 | Resistor | 10 ELR25 |
| R289 | Resistor | 1K ELR25 |
| R290 | Resistor | 470 ELR25 |
| R292 | Resistor | 1.8M ELR25 |
| R293 | Resistor | 1M ELR25 |
| R294 | Resistor | 1M ELR25 |
| R295 | Resistor | 100K ELR25 |
| R296 | Resistor | 4.7K ELR25 |
| R297 | Resistor | 2.2K ELR25 |
| R298 | Resistor | 1 0K ELR25 |
| R299 | Resistor | 4.7K ELR25 |
| R300 | Resistor | 47K ELR25 |
| R301 | Resistor | 15K ELR25 |
| R302 | Resistor | 15K ELR25 |
| R303 | Resistor | 47K ELR25 |
| R304 | Resistor | 4.7K ELR25 |
| R305 | Resistor | 4.7K ELR25 |
| R306 | Resistor | 3.3K ELR25 |
| R307 | Resistor | 10 ELR25 |
| R308 | Resistor | 1K ELR25 |
| R309 | Resistor | 1K ELR25 |
| R310 | Resistor | 10K ELR25 |
| R311 | Resistor | 10 ELR25 |
| R312 | Resistor | 1K ELR25 |
| R313 | Resistor | 1K ELR25 |
| R314 | Resistor | 1K ELR25 |
| R315 | Resistor | 4.7K ELR25 |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|------------|
| R316 | Resistor | 2.2K ELR25 |
| R317 | Resistor | 10K R25 |
| R318 | Resistor | 220 R25 |
| R319 | Resistor | 1K ELR25 |
| R322 | Resistor | 1K ELR25 |
| R324 | Resistor | 47 ELR25 |
| R325 | Resistor | 1K ELR25 |
| R326 | Resistor | 6.8K ELR25 |
| R327 | Resistor | 100 ELR25 |
| R328 | Resistor | 470 R10 |
| R329 | Resistor | 10K ELR25 |
| R330 | Resistor | 2.2K ELR |
| R331 | Resistor | 47K ELR25 |
| R332 | Resistor | 2.2K ELR25 |
| R333 | Resistor | 47K ELR25 |
| R334 | Resistor | 4.7K ELR25 |
| R336 | Resistor | 220 ELR25 |
| R337 | Resistor | 47K ELR25 |
| R338 | Resistor | 4.7K ELR25 |
| R339 | Resistor | 330K ELR25 |
| R340 | Resistor | 220 ELR25 |
| R341 | Resistor | 10K ELR25 |
| R342 | Resistor | 10K ELR25 |
| R343 | Resistor | 4.7K ELR25 |
| R344 | Resistor | 4.7K ELR25 |
| R347 | Resistor | 10K ELR25 |
| R348 | Resistor | 10K R25 |
| R349 | Resistor | 2.2K ELR25 |
| R350 | Resistor | 2.2K ELR25 |
| R351 | Resistor | 68 ELR25 |
| R352 | Resistor | 3.3K R25 |
| R353 | Resistor | 470 ELR25 |
| R354 | Resistor | 22K ELR25 |
| R355 | Resistor | 22K ELR25 |
| R360 | Resistor | 4.7K ELR25 |
| R361 | Resistor | 10 ELR25 |
| R362 | Resistor | 3.9K ELR25 |
| R363 | Resistor | 470 ELR25 |
| R364 | Resistor | 150 ELR25 |
| R365 | Resistor | 150 ELR25 |
| R366 | Resistor | 220 ELR25 |
| R367 | Resistor | 220 ELR25 |
| R368 | Resistor | 100 ELR25 |
| R369 | Resistor | 100K ELR25 |
| R370 | Resistor | 220 ELR25 |
| R371 | Resistor | 470 ELR25 |
| R372 | Resistor | 1K ELR25 |
| R373 | Resistor | 4.7K ELR25 |
| R374 | Resistor | 1K R25 |
| R375 | Resistor | 1K R25 |
| R380 | Resistor | 680 ELR25 |
| R381 | Resistor | 220 ELR25 |
| R382 | Resistor | 470 ELR25 |
| R383 | Resistor | 1K ELR25 |
| R385 | Resistor | 47K ELR25 |
| R386 | Resistor | 1K ELR25 |
| R388 | Resistor | 470 ELR25 |
| R389 | Resistor | 1.8M ELR25 |
| R390 | Thermistor | 33D28 |
| R391 | Resistor | 22K ELR25 |
| R392 | Resistor | 47K R25 |
| R392 | Resistor | 100 ELR25 |
| R394 | Resistor | 1K ELR25 |
| R395 | Resistor | 4.7K ELR25 |
| R396 | Resistor | 10K R10 |
| R397 | Resistor | 470 R10 |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|--------------|
| R398 | Resistor | 10K ELR25 |
| R399 | Resistor | 1K R10 |
| C1 | Ceramic | 0.0047 50V |
| C2 | Ceramic | 0.0047 50V |
| C3 | Ceramic | 0.5P 50V |
| C4 | Electrolytic | 0.47 50V |
| C5 | Ceramic | 0.0047 50V |
| C6 | Ceramic | 0.0047 50V |
| C7 | Ceramic | 100P 50V |
| C8 | Ceramic | 200P 50V YL |
| C9 | Ceramic | 22P 50V CH |
| C10 | Ceramic | 0.0047 50V |
| C11 | Ceramic | 47P 50V CH |
| C12 | Dip Mica | 120P 50V |
| C13 | Dip Mica | 120P 50V |
| C14 | Electrolytic | 4.7 50V |
| C15 | Ceramic | 0.0047 50V |
| C16 | Ceramic | 0.0047 50V |
| C17 | Ceramic | 0.0047 50V |
| C18 | Electrolytic | 4.7 50V BP |
| C19 | Ceramic | 470P 50V |
| C20 | Electrolytic | 1 50V RC2 |
| C21 | Ceramic | 470P 50V |
| C22 | Ceramic | 470P 50V |
| C23 | Ceramic | 470P 50V |
| C24 | Ceramic | 470P 50V |
| C25 | Ceramic | 0.001 50V |
| C26 | Ceramic | 0.0047 50V |
| C27 | Barrier Lay | 0.1 16V |
| C28 | Ceramic | 0.0047 50V |
| C29 | Ceramic | 0.0047 50V |
| C30 | Ceramic | 0.0047 50V |
| C31 | Ceramic | 0.0047 50V |
| C32 | Electrolytic | 3.3 50V RC2 |
| C33 | Ceramic | 0.0047 50V |
| C34 | Ceramic | 0.0047 50V |
| C35 | Ceramic | 0.0047 50V |
| C36 | Ceramic | 0.001 50V |
| C37 | Ceramic | 330P 50V |
| C38 | Electrolytic | 10 16V |
| C39 | Electrolytic | 47 10V |
| C40 | Electrolytic | 2.2 50V |
| C41 | Tantulum | 0.1 35V |
| C42 | Barrier Lay | 0.047 25V |
| C43 | Ceramic | 47P 50V |
| C44 | Barrier Lay | 0.1 16V |
| C45 | Electrolytic | 3.3 50V RC2 |
| C46 | Barrier Lay | 0.1 16V |
| C48 | Electrolytic | 10 16V |
| C49 | Electrolytic | 47 10V |
| C51 | Electrolytic | 2.2 50V |
| C52 | Electrolytic | 0.47 50V |
| C53 | Mylar | 0.033 50V |
| C54 | Electrolytic | 0.47 50V RC2 |
| C55 | Ceramic | 0.0047 50V |
| C56 | Ceramic | 1P 50V |
| C57 | Ceramic | 0.0047 50V |
| C58 | Ceramic | 0.0047 50V |
| C59 | Mylar | 0.033 50V |
| C60 | Ceramic | 0.0047 50V |
| C61 | Ceramic | 0.0047 50V |
| C62 | Ceramic | 0.0047 50V |
| C63 | Ceramic | 0.0047 50V |
| C65 | Ceramic | 0.0047 50V |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|-------------|
| C66 | Barrier Lay | 0.0047 25V |
| C67 | Ceramic | 0.001 50V |
| C68 | Barrier Lay | 0.0047 50V |
| C69 | Barrier Lay | 0.047 25V |
| C70 | Barrier Lay | 0.047 25V |
| C72 | Ceramic | 0.001 50V |
| C73 | Ceramic | 0.0047 50V |
| C74 | Ceramic | 0.0047 50V |
| C75 | Ceramic | 22P 50V |
| C76 | Ceramic | 0.0047 50V |
| C77 | Ceramic | 0.0047 50V |
| C78 | Ceramic | 0.0047 50V |
| C79 | Ceramic | 100P 50V |
| C80 | Mylar | 0.01 50V |
| C81 | Ceramic | 0.0047 50V |
| C82 | Ceramic | 0.0047 50V |
| C83 | Ceramic | 0.0047 50V |
| C84 | Ceramic | 0.0047 50V |
| C85 | Ceramic | 0.001 50V |
| C86 | Ceramic | 0.0047 50V |
| C87 | Electrolytic | 2.2 50V RC2 |
| C88 | Ceramic | 470P 50V |
| C89 | Ceramic | 15P 50V |
| C90 | Electrolytic | 47 16V |
| C91 | Ceramic | 0.0047 50V |
| C92 | Ceramic | 100P 50V |
| C93 | Ceramic | 0.0047 50V |
| C94 | Barrier Lay | 0.047 25V |
| C95 | Ceramic | 0.0047 50V |
| C96 | Barrier Lay | 0.1 16V |
| C97 | Barrier Lay | 0.1 16V |
| C98 | Silinder | 0.0047 50V |
| C99 | Ceramic | 0.0047 50V |
| C100 | Barrier Lay | 0.047 25V |
| C101 | Barrier Lay | 0.047 25V |
| C102 | Ceramic | 0.0047 50V |
| C103 | Barrier Lay | 0.047 25V |
| C104 | Barrier Lay | 0.047 25V |
| C105 | Barrier Lay | 0.047 25V |
| C107 | Dip Mica | 330P 50V |
| C108 | Dip Mica | 330P 50V |
| C109 | Ceramic | 0.0047 50V |
| C110 | Mylar | 0.01 50V |
| C111 | Barrier Lay | 0.047 25V |
| C112 | Barrier Lay | 0.047 25V |
| C113 | Ceramic | 0.0047 50V |
| C114 | Barrier Lay | 0.047 25V |
| C115 | Barrier Lay | 0.047 25V |
| C116 | Barrier Lay | 0.047 25V |
| C117 | Electrolytic | 100 10V |
| C119 | Ceramic | 330P 50V |
| C120 | Barrier Lay | 0.1 16V |
| C121 | Barrier Lay | 0.1 16V |
| C122 | Barrier Lay | 0.1 16V |
| C123 | Ceramic | 470P 50V |
| C124 | Ceramic | 0.001 50V |
| C125 | Ceramic | 470P 50V |
| C126 | Barrier Lay | 0.047 25V |
| C127 | Barrier Lay | 0.047 25V |
| C128 | Ceramic | 150P 50V |
| C129 | Ceramic | 150P 50V |
| C130 | Ceramic | 0.0047 50V |
| C131 | Dip Mica | 200P 50V |
| C132 | Ceramic | 22P 50V |
| C133 | Dip Mica | 200P 50V |
| C134 | Ceramic | 0.0047 50V |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|---------------|
| C135 | Ceramic | 330P 50V |
| C136 | Ceramic | 330P 50V |
| C137 | Barrier Lay | 0.047 25V |
| C138 | Barrier Lay | 0.047 25V |
| C139 | Ceramic | 330P 50V |
| C140 | Ceramic | 0.0047 50V |
| C141 | Ceramic | 150P 50V |
| C142 | Ceramic | 0.1 16V |
| C143 | Ceramic | 150P 50V |
| C144 | Dip Mica | 150P 50V |
| C145 | Dip Mica | 150P 50V |
| C146 | Ceramic | 0.0047 50V |
| C147 | Ceramic | 0.0047 50V |
| C148 | Barrier Lay | 0.047 25V |
| C149 | Dip Mica | 200P 50V |
| C150 | Dip Mica | 200P 50V |
| C151 | Dip Mica | 33P 50V |
| C152 | Trimmer | CTZ51F |
| C153 | Dip Mica | 39P 50V |
| C154 | Ceramic | 0.0047 50V |
| C156 | Ceramic | 0.0047 50V |
| C157 | Ceramic | 0.0047 50V |
| C158 | Cylinder | 472 UP125 |
| C159 | Ceramic | 220P 50V |
| C160 | Ceramic | 15P 50V |
| C162 | Ceramic | 472K UAT05X |
| C163 | Electrolytic | 33 16V |
| C164 | Electrolytic | 1 50V |
| C165 | Electrolytic | 10 16V |
| C165 | Electrolytic | 0.1 50V RC2 |
| C166 | Electrolytic | 4.7 25V BP |
| C167 | Ceramic | 0.001 50V |
| C168 | Barrier Lay | 0.047 25V |
| C169 | Ceramic | 120P 50V |
| C170 | Ceramic | 0.0047 50V |
| C171 | Ceramic | B8ZC01 11-32N |
| C172 | Ceramic | B8ZC0111-32N |
| C173 | Ceramic | B7ZC0711-32N |
| C174 | Ceramic | UAT05X472K |
| C175 | Array | B5RC0124-32N |
| C176 | Ceramic | 0.0047 50V |
| C177 | Ceramic | 220P 50V |
| C178 | Ceramic | 0.001 50V |
| C179 | Ceramic | 0.001 50V |
| C180 | Electrolytic | 10 16V RC2 |
| C181 | Electrolytic | 100 10V |
| C182 | Ceramic | 0.0047 50V |
| C183 | Barrier Lay | 0.1 16V |
| C184 | Ceramic | 0.0047 50V |
| C185 | Electrolytic | 47 10V |
| C186 | Electrolytic | 100 10V |
| C187 | Barrier Lay | 0.1 16V |
| C188 | Electrolytic | 2.2 50V RC2 |
| C189 | Electrolytic | 100 10V |
| C190 | Barrier Lay | 0.047 25V |
| C191 | Tantalum | 1 16V |
| C192 | Barrier Lay | 0.1 16V |
| C193 | Electrolytic | 1 50V |
| C195 | Electrolytic | 1 50V |
| C196 | Mylar | 0.022 50V |
| C197 | Electrolytic | 1 50V |
| C198 | Tantalum | 2.2 16V |
| C199 | Electrolytic | 1000 16V MS16 |
| C200 | Electrolytic | 220 10V |
| C201 | Ceramic | 150P 50V |
| C202 | Ceramic | 0.0047 50V |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|---------------|
| C203 | Barrier Lay | 0.047 25V |
| C204 | Barrier Lay | 0.1 16V |
| C205 | Electrolytic | 4.7 50V |
| C206 | Mylar | 0.033 50V |
| C207 | Barrier Lay | 0.1 16V |
| C209 | Electrolytic | 0.22 50V RC2 |
| C210 | Barrier Lay | 0.1 16V |
| C211 | Mylar | 0.01 50V |
| C212 | Electrolytic | 10 16V |
| C213 | Mylar | 0.022 50V |
| C214 | Electrolytic | 3.3 50V |
| C215 | Electrolytic | 47 10V |
| C216 | Barrier Lay | 0.047 25V |
| C217 | Ceramic | 150P 50V |
| C218 | Mylar | 0.1 50V |
| C219 | Electrolytic | 470 16V |
| C220 | Electrolytic | 47 16V |
| C221 | Electrolytic | 220 10V |
| C222 | Electrolytic | 47 16V |
| C223 | Barrier Lay | 0.1 16V |
| C224 | Electrolytic | 1000 16V MS16 |
| C225 | Electrolytic | 10 16V |
| C226 | Barrier Lay | 0.1 16V |
| C227 | Electrolytic | 0.22 50V RC2 |
| C228 | Barrier Lay | 0.1 16V |
| C229 | Electrolytic | 3.3 50V |
| C230 | Electrolytic | 10 16V |
| C232 | Barrier Lay | 0.1 16V |
| C233 | Ceramic | 0.0047 50V |
| C234 | Ceramic | 0.0047 50V |
| C235 | Ceramic | 68P 50V |
| C501 | Ceramic | 0.0047 50V |
| C502 | Ceramic | 0.001 50V |
| C503 | Ceramic | 3P 50V |
| C506 | Ceramic | 0.001 50V |
| C507 | Ceramic | 0.0047 50V |
| C508 | Ceramic | 30P 50V |
| C509 | Barrier Lay | 0.047 25V |
| C510 | Barrier Lay | 0.047 25V |
| C511 | Electrolytic | 10 16V |
| C512 | Electrolytic | 100 10V |
| C513 | Ceramic | 0.0047 50V |
| C514 | Ceramic | 0.0047 50V |
| C516 | Electrolytic | 3.3 50V |
| C517 | Ceramic | 470P 50V |
| C519 | Ceramic | 0.0047 50V |
| C520 | Ceramic | 470P 50V |
| C521 | Ceramic | 470P 50V |
| C522 | Ceramic | 0.0047 50V |
| C523 | Barrier Lay | 0.047 25V |
| C524 | Barrier Lay | 0.047 25V |
| C526 | Ceramic | 150P 50V |
| C527 | Ceramic | 150P 50V |
| C528 | Ceramic | 0.0047 50V |
| C529 | Electrolytic | 47 10V |
| C530 | Barrier Lay | 0.1 16V |
| C531 | Ceramic | 0.0047 50V |
| C532 | Electrolytic | 4.7 50V |
| C534 | Electrolytic | 22 10V |
| C535 | Dip Mica | 51P 50V |
| C537 | Ceramic | 0.0047 50V |
| C538 | Ceramic | 0.0047 50V |
| C538 | Ceramic | 0.0047 50V |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|----------------|
| J1 | Connector | TL-25P-05-V1 |
| J2 | Connector | TL-25P-04-V1 |
| J3 | Connector | TL-25P-06-V1 |
| J4 | Connector | TL-25P-04-V1 |
| J5 | Connector | TL-25P-06-V1 |
| J6 | Connector | TL-25P-08-V1 |
| J7 | Connector | TL-25P-11-V1 |
| J8 | Connector | TL-25P-09-V1 |
| J9 | Connector | TL-25P-08-V1 |
| J10 | Connector | TL-25P-05-V1 |
| J11 | Connector | TL-25P-02-V1 |
| J12 | Connector | TL-25P-10-V1 |
| J13 | Connector | TL-25P-02-V1 |
| J14 | Connector | TL-25P-02-V1 |
| J15 | Connector | TL-25P-02-V1 |
| J16 | Connector | TL-25P-09-V1 |
| J17 | Connector | TL-25P-03-V1 |
| J18 | Connector | TLB-P04H-B1 |
| J19 | Connector | RT-01T-1.0B |
| J20 | Connector | RT-01 T-1.0B |
| | | |
| P1 | Connector | TL-25H-02-B1 |
| P2 | Connector | TL-25H-03-B1 |
| P3 | Connector | TL-25H-05-B1 |
| | | |
| S1 | Switch | SSS312 |
| S2 | Switch | SSS312 |
| S3 | Switch | SSS312 |
| | | |
| SO1 | Socket | 380598-2 |
| SO2 | Socket | 380598-2 |
| SO3 | Socket | 380598-2 |
| SO4 | Socket | 380598-2 |
| SO5 | Socket | 380598-2 |
| SO6 | Socket | 380598-2 |
| SO7 | Socket | 380598-2 |
| SO8 | Socket | 380598-2 |
| | | |
| B1 | P.C. Board | B-700D (30344) |
| | | |
| W101 | Jumper | JPW-02H |
| W102 | Jumper | JPW-02H |
| W103 | Jumper | JPW-02H |
| W104 | Jumper | JPW-02H |
| W105 | Jumper | JPW-02A |
| W106 | Jumper | IPS-4041-4 |
| W107 | Jumper | IPS-4041-4 |
| W108 | Jumper | JPW-02A |
| W109 | Jumper | JPW-02H |
| W111 | Jumper | JPW-02A |
| W112 | Jumper | JPW-02H |
| W115 | Jumper | JPW-02A |
| W116 | Jumper | JPW-02H |
| W120 | Jumper | JPW-02H |
| W121 | Jumper | JPW-02H |
| W122 | Jumper | JPW-02H |
| W123 | Jumper | JPW-02H |
| W124 | Jumper | IPS-4041-4 |
| W125 | Jumper | IPS-4041-4 |
| W126 | Jumper | JPW-02H |
| W127 | Jumper | JPW-02H |

[MAIN] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|------------|
| W129 | Jumper | JPW-02A |
| W130 | Jumper | JPW-02H |
| W131 | Jumper | IPS-4041-4 |
| W132 | Jumper | JPW-02H |
| W133 | Jumper | JPW-02A |
| W134 | Jumper | JPW-02A |
| W135 | Jumper | JPW-02A |
| W136 | Jumper | JPW-02A |
| W137 | Jumper | JPW-02A |
| W138 | Jumper | JPW-02A |
| W139 | Jumper | JPW-02A |
| W140 | Jumper | JPW-02A |
| W141 | Jumper | JPW-02A |
| | | |
| EP2 | Bead Core | FSQH070RN |
| EP3 | Bead Core | FSQH070RN |

[RF] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|------------|
| IC1 | IC | BA618 |
| IC2 | IC | BA618 |
| IC3 | IC | ND487C1-3R |
| | | |
| Q1 | Transistor | 2SC945 |
| Q2 | Transistor | 2SC2053 |
| Q3 | Transistor | 2SA1015Y |
| Q4 | Transistor | 2SC945K |
| Q5 | Transistor | 2SC945K |
| Q6 | FET | 2SK125 |
| Q7 | FET | 2SK125 |
| Q8 | FET | 3SK74M |
| Q9 | FET | 2SK125 |
| Q10 | FET | 2SK125 |
| Q11 | FET | 3SK74M |
| Q12 | FET | 3SK74K |
| Q13 | FET | 3SK74K |
| Q14 | Transistor | 2SC2053 |
| Q15 | Transistor | 2SC1636 |
| Q16 | Transistor | 2SC945 |
| Q17 | Transistor | 2SC945P |
| Q18 | Transistor | 2SC945 |
| Q19 | Transistor | 2SC945 |
| Q20 | Transistor | 2SB562C |
| | | |
| D1 | Diode | 1S953 |
| D2 | Diode | 1S953 |
| D3 | Diode | 1SS53 |
| D4 | Diode | 1SS53 |
| D5 | Diode | 1N4002 |
| D6 | Diode | 1N4002 |
| D7 | Diode | 1SS53 |
| D8 | Zener | XZ055 |
| D9 | Diode | 1SS53 |
| D10 | Diode | MI204 |
| D11 | Diode | MI204 |
| D12 | Diode | 1SS53 |
| D13 | Diode | 1SS53 |

[RF] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|----------------|----------------|
| 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 |
| D39 | Diode | 1SS53 |
| D40 | Diode | 1SS53 |
| D41 | Diode | MI204 |
| D42 | Diode | MI204 |
| D43 | Diode | MI204 |
| D44 | Diode | MI204 |
| D45 | Diode | 1SS53 |
| D46 | Diode | 1SS53 |
| D47 | Diode | MI204 |
| D48 | Diode | 1SS53 |
| D49 | Diode | 1SS53 |
| D50 | Diode | 1SS53 |
| D51 | Zener | XZ096 |
| D52 | Diode | 1SS53 |
| D53 | Diode | 1SS53 |
| D54 | Diode | 1SS53 |
| D55 | Diode | 1SS53 |
| F11 | Crystal Filter | 70M15B |
| L1 | Coil | EL0810SKI-101K |
| L2 | Coil | EL0810SKI-101K |
| L3 | Coil | EL0810SKI-101K |
| L4 | Coil | EL0810SKI-102K |
| L4 | Coil | EL0810SKI-102K |
| L5 | Coil | 102K FL5H |
| L6 | Coil | 102K FL5H |
| 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 | 101K FL5H |
| L15 | Coil | LA-267 |
| L16 | Coil | LB4 R30 |
| L17 | Coil | LS-114 |
| L18 | Coil | LS-254 |
| L19 | Coil | LS-254 |

[RF] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|----------------|
| L20 | Coil | LS-254 |
| L21 | Coil | LS-198 |
| L22 | Coil | LR-129 |
| L23 | Coil | LA-258 |
| L24 | Coil | LA-257 |
| L25 | Coil | 102K FL5H |
| 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 | 102K FL5H |
| L36 | Coil | EL0810SKI-102K |
| L37 | Coil | 102K FL5H |
| L38 | Coil | 102K FL5H |
| L39 | Coil | 102K FL5H |
| L40 | Coil | 102K FL5H |
| L41 | Coil | LR-130 |
| L42 | Coil | LR-129 |
| L43 | Coil | 102K FL5H |
| L44 | Coil | LB4 R34 |
| L45 | Coil | LB4 R36 |
| L46 | Coil | LB4 R30 |
| L47 | Coil | LB4 R36 |
| L48 | Coil | 101K FL5H |
| L49 | Coil | LB4 R45 |
| L50 | Coil | LB4 R50 |
| L51 | Coil | LB4 R50 |
| L52 | Coil | LB4 R54 |
| L53 | Coil | 101K FL5H |
| L54 | Coil | LB4 R54 |
| L55 | Coil | LB4 R65 |
| L56 | Coil | LB4 R65 |
| L57 | Coil | LB4 R83 |
| L58 | Coil | 101K FL5H |
| L59 | Coil | LB4 R70 |
| L60 | Coil | LB4 R83 |
| L61 | Coil | EL0810SKI-1R0K |
| L62 | Coil | EL0810SKI-1R0K |
| L63 | Coil | 101K FL5H |
| L64 | Coil | EL0810SKI-1R0K |
| L65 | Coil | EL0810SKI-1R2K |
| L66 | Coil | EL0810SKI-1R2K |
| L67 | Coil | EL0810SKI-1R2K |
| L68 | Coil | 101K FL5H |
| L69 | Coil | EL0810SKI-1R5K |
| L70 | Coil | EL0810SKI-1R5K |
| L71 | Coil | EL0810SKI-1R8K |
| L72 | Coil | EL0810SKI-1R8K |
| L73 | Coil | 101K FL5H |
| L74 | Coil | EL0810SKI-1R8K |
| L75 | Coil | EL0810SKI-1R8K |
| L76 | Coil | EL0810SKI-2R2K |
| L77 | Coil | EL0810SKI-2R7K |
| L78 | Coil | 101K FL5H |
| L79 | Coil | EL0810SKI-2R7K |
| L80 | Coil | EL0810SKI-3R3K |
| L81 | Coil | EL0810SKI-3R3K |
| L82 | Coil | LB4 4R3 |
| L83 | Coil | 102K FL5H |
| L84 | Coil | LB4 3R6 |
| L85 | Coil | LB4 4R3 |

[RF] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|----------------|
| L86 | Coil | LB4 5R1 |
| L87 | Coil | LB4 6R2 |
| L88 | Coil | 102K FL5H |
| L89 | Coil | 102K FL5H |
| L90 | Coil | LB4 6R2 |
| L91 | Coil | LB4 5R1 |
| L92 | Coil | 102K FL5H |
| L93 | Coil | EL0810SKI-220K |
| L94 | Coil | EL0810SKI-220K |
| L95 | Coil | 102K FL5H |
| L96 | Coil | LR-20 |
| L97 | Coil | 102K FL5H |
| L98 | Coil | 101K FL5H |
| L99 | Coil | 102K FL5H |
| L100 | Coil | 102K FL5H |
| L101 | Coil | EL0810SKI-4R7K |
| L102 | Coil | EL0810SKI-3R3K |
| L103 | Coil | 102K FL5H |
| L104 | Coil | BT01RN1-A61 |

| | | |
|-----|----------|-----------|
| R1 | Resistor | 2.2 ELR10 |
| R2 | Resistor | 10K ELR25 |
| 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 ELR25 |
| R12 | Resistor | 10K R25 |
| R13 | Resistor | 2.2 ELR10 |
| R14 | Array | 10K RM6 |
| 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 | Resistor | 3.3K ELR25 |
| R25 | Resistor | 330 ELR25 |
| R26 | Resistor | 22K ELR25 |
| R27 | Resistor | 47 ELR25 |
| R28 | Resistor | 47 ELR25 |
| R29 | Resistor | 10K ELR25 |
| R30 | Resistor | 100 ELR25 |
| R31 | Resistor | 390 ELR25 |
| R32 | Resistor | 47 ELR25 |
| R33 | Resistor | 10K ELR25 |
| R34 | Resistor | 1M 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 ELR25 |
| R43 | Resistor | 10K ELR25 |

[RF] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|------------|
| R44 | Resistor | 470K ELR25 |
| R45 | Resistor | 47 R25 |
| R46 | Resistor | 470 ELR25 |
| R47 | Resistor | 470 ELR25 |
| R48 | Resistor | 220 R25 |
| R49 | Resistor | 150 ELR25 |
| R50 | Resistor | 8.2 ELR25 |
| R51 | Resistor | 8.2 R25 |
| R52 | Resistor | 150 R25 |
| R53 | Resistor | 2.2K ELR25 |
| R54 | Resistor | 100 ELR25 |
| R55 | Resistor | 100K ELR25 |
| R56 | Resistor | 10K ELR25 |
| R57 | Resistor | 820 ELR25 |
| R58 | Resistor | 100 ELR25 |
| R59 | Resistor | 56 R25 |
| R60 | Resistor | 100 ELR25 |
| R61 | Resistor | 150 ELR25 |
| R62 | Resistor | 10K ELR25 |
| R63 | Resistor | 100 ELR25 |
| R64 | Resistor | 100 ELR25 |
| R65 | Resistor | 47 ELR25 |
| R66 | Resistor | 100 ELR25 |
| R67 | Resistor | 100 ELR25 |
| 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 | 8.2K ELR25 |
| R83 | Resistor | 100 ELR25 |
| R84 | Resistor | 220 R10 |
| 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 ELR10 |
| R94 | Resistor | 8.2K R20 |
| R95 | Resistor | 2.2K ELR25 |
| R96 | Resistor | 4.7K ELR25 |
| R97 | Resistor | 470 ELR25 |
| R98 | Resistor | 4.7K ELR25 |
| R99 | Resistor | 4.7K ELR25 |
| R100 | Resistor | 390 ELR25 |
| R101 | Resistor | 4.7K ELR25 |
| R102 | Resistor | 4.7K R25 |
| R103 | Resistor | 4.7K ELR25 |
| R104 | Resistor | 22K ELR25 |
| R105 | Resistor | 22K ELR25 |
| R106 | Resistor | 3.3K ELR25 |
| R107 | Resistor | 1K ELR25 |
| R108 | Resistor | 27 R25 |
| R109 | Resistor | 33 ELR25 |

[RF] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|---------------|
| R110 | Resistor | 27 ELR25 |
| R111 | Resistor | 820 ELR25 |
| R112 | Resistor | 1K ELR25 |
| R113 | Resistor | 100 R25 |
| R114 | Resistor | 2.2K ELR25 |
| R115 | Resistor | 47K ELR25 |
| R116 | Resistor | 680K ELR25 |
| R117 | Resistor | 10K R25 |
| R118 | Resistor | 15K ELR10 |
| R119 | Resistor | 15K ELR25 |
| R120 | Resistor | 2.2K R10 |
| R121 | Resistor | 1.8K R25 |
| R122 | Resistor | 1K R25 |
| R123 | Thermistor | 23D29 |
| C1 | Array | B8ZC0111N-32N |
| C2 | Array | B8ZC0111-32N |
| C3 | Barrier Lay | 0.047 25V |
| C5 | Barrier Lay | 0.047 25V |
| C6 | Array | B8ZC0111N-32N |
| C7 | Array | B8ZC0111-32N |
| C8 | Electrolytic | 1 50V |
| C9 | Electrolytic | 0.47 50V |
| C10 | Barrier Lay | 0.047 25V |
| C11 | Ceramic | 39P 50V |
| C12 | Ceramic | 39P 50V |
| C13 | Ceramic | 220P 50V |
| C14 | Ceramic | 0.001 50V |
| C15 | Barrier Lay | 0.047 25V |
| C16 | Electrolytic | 2.2 50V |
| C17 | Ceramic | 0.001 50V |
| C18 | Ceramic | 8P 50V |
| C19 | Ceramic | 5P 50V |
| C20 | Ceramic | 15P 50V |
| C21 | Ceramic | 1.5P 50V |
| C22 | Ceramic | 10P 50V |
| C23 | Barrier Lay | 0.047 25V |
| C24 | Barrier Lay | 0.1 16V |
| C25 | Barrier Lay | 0.1 16V |
| C26 | Barrier Lay | 0.047 25V |
| C27 | Barrier Lay | 0.047 25V |
| C28 | Barrier Lay | 0.047 25V |
| C29 | Barrier Lay | 0.047 25V |
| C30 | Mylar | 0.022 50V |
| C31 | Barrier Lay | 0.047 25V |
| C32 | Ceramic | 220P 50V |
| C33 | Barrier Lay | 0.047 25V |
| C34 | Barrier Lay | 0.047 25V |
| C35 | Barrier Lay | 0.047 25V |
| C36 | Barrier Lay | 0.047 25V |
| C37 | Barrier Lay | 0.047 25V |
| C38 | Barrier Lay | 0.047 25V |
| C39 | Barrier Lay | 0.047 25V |
| C40 | Barrier Lay | 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 |
| C46 | Ceramic | 0.001 50V |
| C47 | Ceramic | 0.001 50V |
| C48 | Ceramic | 3P 50V |
| C49 | Ceramic | 10P 50V |
| C50 | Ceramic | 8P 50V |
| C51 | Barrier Lay | 0.1 16V |

[RF] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|-----------------|
| C52 | Barrier Lay | 8P 50V |
| C54 | Electrolytic | 0.047 25V |
| C55 | Ceramic | 1 50V |
| C56 | Ceramic | 120P 50V |
| C57 | Ceramic | 150P 50V |
| C58 | Ceramic | 10P 50V |
| C59 | Ceramic | 30P 50V |
| C60 | Barrier Lay | 120P 50V |
| C61 | Barrier Lay | UFD08SA681K-L2A |
| C62 | Ceramic | UFD08SA681K-L2A |
| 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 | Barrier Lay | 6P 50V |
| C71 | Ceramic | 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 |
| C77 | Ceramic | 15P 50V |
| C78 | Ceramic | 3P 50V |
| C79 | Barrier Lay | 0.047 25V |
| C80 | Barrier Lay | 0.047 25V |
| C81 | Barrier Lay | 0.047 25V |
| C82 | Barrier Lay | 0.047 25V |
| C84 | Barrier Lay | 0.047 25V |
| C85 | Ceramic | 100P 50V |
| C86 | Barrier Lay | UFD08SA821K-L2A |
| C87 | Ceramic | 120P 50V |
| C88 | Ceramic | 100P 50V |
| C89 | Ceramic | 68P 50V |
| C90 | Ceramic | 100P 50V |
| C91 | Ceramic | 30P 50V |
| C92 | Barrier Lay | 0.047 25V |
| C93 | Barrier Lay | 0.047 25V |
| C94 | Ceramic | 150P 50V |
| C95 | Barrier Lay | TBD04V122K-LOB |
| C96 | Ceramic | 220P 50V |
| C97 | Ceramic | 180P 50V |
| C98 | Ceramic | 24P 50V |
| C99 | Ceramic | 180P 50V |
| C100 | Barrier Lay | 0.047 25V |
| C101 | Barrier Lay | 0.047 25V |
| C102 | Ceramic | 200P 50V |
| C103 | Barrier Lay | TBD04V182K-LOB |
| C104 | Ceramic | 220P 50V |
| C105 | Ceramic | 300P 50V |
| C106 | Ceramic | 39P 50V |
| C107 | Ceramic | 300P 50V |
| C108 | Barrier Lay | 0.047 25V |
| C109 | Barrier Lay | 0.047 25V |
| C110 | Ceramic | 300P 50V |
| C111 | Barrier Lay | TBD04V222K-LOB |
| C112 | Ceramic | 330P 50V |
| C113 | Ceramic | 330P 50V |
| C114 | Ceramic | 51P 50V |
| C115 | Ceramic | 330P 50V |
| C116 | Barrier Lay | 0.047 25V |
| C117 | Barrier Lay | 0.047 25V |
| C118 | Ceramic | 390P 50V |
| C119 | Barrier Lay | TBD05V272K-LOB |

[RF] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|--------------|------------------|
| C120 | Ceramic | DD109SL471J50V02 |
| C121 | Ceramic | DD109SL511J50V02 |
| C122 | Ceramic | 75P 50V |
| C123 | Barrier Lay | UFD08SA561K-L2A |
| C124 | Barrier Lay | 0.047 25V |
| C125 | Barrier Lay | 0.047 25V |
| C126 | Barrier Lay | UFD08SA561K-L2A |
| C127 | Barrier Lay | TBD06V562K-L2A |
| C128 | Barrier Lay | TBD04V102K-LOB |
| C129 | Barrier Lay | UFD08SA681K-L2A |
| C130 | Ceramic | 82P 50V |
| C131 | Barrier Lay | UFD08SA681K-L2A |
| C132 | Barrier Lay | 0.047 25V |
| C133 | Barrier Lay | 0.047 25V |
| C134 | Barrier Lay | TBD04V102K-LOB |
| C135 | Barrier Lay | TBD06V682K-L2A |
| C136 | Barrier Lay | TBD04V122K-LOB |
| C137 | Barrier Lay | TBD04V102K-LOB |
| C138 | Ceramic | 150P 50V |
| C139 | Barrier Lay | TBD04V152K-LOB |
| C140 | Barrier Lay | 0.047 25V |
| C141 | Barrier Lay | 0.047 25V |
| C142 | Barrier Lay | TBD04V122K-LOB |
| C143 | Barrier Lay | TBD06V103K-L2A |
| C144 | Barrier Lay | TBD04V182K-LOB |
| C145 | Barrier Lay | TBD04V152K-LOB |
| C146 | Ceramic | 200P 50V |
| C147 | Barrier Lay | TBD04V152K-LOB |
| C148 | Barrier Lay | 0.047 25V |
| C149 | Barrier Lay | 0.047 25V |
| C150 | Barrier Lay | TBD04V152K-LOB |
| C151 | Barrier Lay | TBD08V123K-L2A |
| C152 | Barrier Lay | TBD04V222K-LOB |
| C153 | Barrier Lay | TBD04V222K-LOB |
| C154 | Ceramic | 270P 50V |
| C155 | Barrier Lay | TBD04V222K-LOB |
| C156 | Barrier Lay | 0.047 25V |
| C157 | Barrier Lay | 0.1 16V |
| C158 | Barrier Lay | 0.047 25V |
| C159 | Barrier Lay | TBD05V332K-LOB |
| C160 | Ceramic | 390P 50V |
| C161 | Barrier Lay | TBD05V332K-LOB |
| C162 | Electrolytic | 1 50V BP |
| C163 | Barrier Lay | 0.1 16V |
| C164 | Barrier Lay | TBD06V682K-L2A |
| C165 | Barrier Lay | TBD04V102K-LOB |
| C166 | Barrier Lay | TBD06V822K-L2A |
| C167 | Barrier Lay | 0.1 16V |
| C168 | Electrolytic | 10 16V |
| C169 | Barrier Lay | 0.047 25V |
| C170 | Barrier Lay | 0.047 25V |
| C171 | Barrier Lay | TBD04V152K-LOB |
| C172 | Barrier Lay | 0.1 16V |
| C173 | Barrier Lay | 0.047 25V |
| C174 | Barrier Lay | 0.047 25V |
| C175 | Barrier Lay | 0.047 25V |
| C176 | Barrier Lay | 0.047 25V |
| C177 | Barrier Lay | 0.047 25V |
| C178 | Barrier Lay | 0.1 16V |
| C179 | Barrier Lay | 0.1 16V |
| C180 | Barrier Lay | TBD04V182K-LOB |
| C181 | Barrier Lay | TBD04V152K-LOB |
| C182 | Barrier Lay | TBD06V472K-L2A |
| C183 | Barrier Lay | 0.1 16V |
| C184 | Barrier Lay | 0.1 16V |
| C185 | Barrier Lay | 0.047 25V |

[RF] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|--------------------|
| C186 | Barrier Lay | 0.047 25V |
| C187 | Tantalum | 3.3 10V |
| C188 | Barrier Lay | 0.047 25V |
| C189 | Barrier Lay | 0.1 16V |
| C190 | Barrier Lay | 0.1 16V |
| C191 | Ceramic | 0.001 50V |
| C192 | Ceramic | 0.0047 50V |
| C193 | Ceramic | 0.0047 50V |
| C194 | Ceramic | 0.0047 50V |
| C196 | Ceramic | 0.0047 50V |
| C197 | Barrier Lay | 0.1 16V |
| C198 | Ceramic | 0.0047 50V |
| C199 | Ceramic | 0.001 50V |
| C200 | Ceramic | 0.001 50V |
| C202 | Ceramic | 0.001 50V |
| C203 | Ceramic | 5P 50V |
| C203 | Ceramic | 0.0047 50V |
| P1 | Pin Plug | TMP-P01X-A1 |
| P2 | Pin Plug | TMP-P01X-A1 |
| P3 | Connector | TL-25H-02-B1 |
| J1 | Connector | TL-25P-06-V1 |
| J2 | Connector | TL-25P-05-V1 |
| J3 | Connector | TL-25P-07-V1 |
| J4 | Connector | TL-25P-02-V1 |
| J5 | Connector | TL-25P-05-V1 |
| J6 | Connector | TL-25P-02-V1 |
| J8 | Pin Jack | TMP-J01X-A1 |
| J9 | Connector | TL-25P-02-V1 |
| J10 | Pin Jack | TMP-J01X-A1 |
| J11 | Connector | TLB-P06H-B1 |
| J12 | Connector | TLB-P05H-B1 |
| J13 | Connector | TLB-P02H-B1 |
| J14 | Connector | TLB-P02H-B1 |
| RL1 | Relay | FBR21 D12 92101857 |
| B1 | P.C.Board | B-701B (42442) |
| W24 | Jumper | JPW-02H |
| W25 | Jumper | JPW-02H |
| W26 | Jumper | JPW-02H |
| W27 | Jumper | JPW-02H |
| W28 | Jumper | JPW-02A |
| W29 | Jumper | JPW-02A |
| W30 | Jumper | JPW-02A |
| W31 | Jumper | JPW-02A |
| W32 | Jumper | JPW-02A |
| W33 | Jumper | JPW-02A |
| W34 | Jumper | JPW-02A |
| W35 | Jumper | JPW-02A |
| W36 | Jumper | JPW-02A |
| W37 | Jumper | JPW-02A |
| W38 | Jumper | JPW-02A |
| W39 | Jumper | JPW-02A |
| W40 | Jumper | JPW-02A |
| W41 | Jumper | JPW-02A |
| W42 | Jumper | JPW-02A |
| W43 | Jumper | JPW-02A |
| W44 | Jumper | JPW-02A |

[RF] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|-----------|
| W45 | Jumper | JPW-02A |
| W46 | Jumper | IPS1041-4 |
| W47 | Jumper | IPS1041-4 |
| W50 | Jumper | JPW-02A |

[FILTER] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|---------------------|
| C1 | Dip Mica | 1000P 500V DM20 1CR |
| C2 | Dip Mica | 390P 500V DM19 1CR |
| C3 | Dip Mica | 2200P 500V DM20 1CR |
| C4 | Ceramic | 120P 500V SL |
| C5 | Dip Mica | 1200P 500V DM20 1CR |
| C6 | Dip Mica | 560P 500V DM19 1CR |
| C7 | Ceramic | 220P 500V SL |
| C8 | Dip Mica | 1200P 500V DM20 1CR |
| C9 | Ceramic | 68P 500V SL |
| C10 | Dip Mica | 680P 500V DM19 1CR |
| C11 | Dip Mica | 470P 500V DM19 1CR |
| C12 | Ceramic | 120P 500V SL |
| C13 | Dip Mica | 560P 500V DM19 1CR |
| C14 | Ceramic | 68P 500V |
| C15 | Ceramic | 270P 500V SL |
| C16 | Ceramic | 220P 500V SL |
| C17 | Ceramic | 27P 500V |
| C18 | Dip Mica | 470P 500V DM19 1CR |
| C19 | Ceramic | 68P 500V |
| C20 | Ceramic | 220P 500V SL |
| C21 | Ceramic | 150P 500V SL |
| C22 | Ceramic | 18P 500V |
| C23 | Ceramic | 330P 500V SL |
| C24 | Ceramic | 56P 500V |
| C25 | Ceramic | 200P 500V SL |
| C26 | Ceramic | 120P 500V SL |
| C27 | Ceramic | 10P 500V |
| C28 | Ceramic | 220P 500V SL |
| C29 | Ceramic | 33P 500V |
| C30 | Ceramic | 100P 500V SL |
| C31 | Ceramic | 82P 500V |
| C32 | Ceramic | 10P 500V |
| C33 | Ceramic | 180P 500V SL |
| C34 | Ceramic | 27P 500V |
| C35 | Ceramic | 68P 500V |
| C36 | Trimmer | ECV-1ZW20×40 |
| C37 | Ceramic | 220P 50V |
| C38 | Ceramic | 100P 50V |
| C39 | Ceramic | 100P 50V |
| C42 | Barrier Lay | 0.047 25V |
| C43 | Barrier Lay | 0.047 25V |
| C44 | Barrier Lay | 0.047 25V |
| C45 | Barrier Lay | 0.047 25V |
| C46 | Barrier Lay | 0.047 25V |
| C47 | Barrier Lay | 0.047 25V |
| C48 | Barrier Lay | 0.047 25V |
| C49 | Barrier Lay | 0.047 25V |
| C50 | Ceramic | 0.0047 50V |
| 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 |

[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-136 |
| 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 | 222 L6 |
| L20 | Coil | 101 FL5H |
| L21 | Coil | 101 FL5H |
| L22 | Coil | 101 FL5H |
| L23 | Coil | 101 FL5H |
| L24 | Coil | 101 FL5H |
| L25 | Coil | 101 FL5H |
| L26 | Coil | 101 FL5H |
| L27 | Coil | 101 FL5H |
| L28 | Coil | 100 FL5H |
| L29 | Coil | 100 FL5H |
| L30 | Coil | 100 FL5H |
| L31 | Coil | 100 FL5H |
| L32 | Coil | 100 FL5H |
| L33 | Coil | 100 FL5H |
| L34 | Coil | LA-24 |
| R1 | Resistor | 68 R50X (10W TYPE:120 R25) |
| R2 | Resistor | 47K R25 |
| R3 | Resistor | 47K R25 |
| R4 | Resistor | 47K H0651A |
| R5 | Resistor | 47K H0651A |

| | | |
|------|-------|---------------|
| 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 |

[FILTER] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|----------------|
| RL12 | Relay | FBR313D012-22 |
| RL13 | Relay | FBR313D012-22 |
| RL14 | Relay | FBR313D012-22 |
| J1 | Connector | TMP-J01X-V1 |
| J2 | Connector | TL-25P-02-V1 |
| P1 | Connector | TL-25H-07-B1 |
| P2 | Connector | TMP-P01X-A1 |
| B1 | P.C. Board | B-703B (42441) |
| 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 |
| W34 | Jumper | JPW-02A |
| W35 | Jumper | JPW-02A |
| W36 | Jumper | JPW-02A |
| W39 | Jumper | JPW-02A |

[PA] UNIT

REF. NO. DESCRIPTION PART NO.

| | | |
|-----|------------|---------|
| Q1 | Transistor | 2SC1971 |
| Q2 | Transistor | 2SC3133 |
| Q3 | Transistor | 2SC3133 |
| Q4 | Transistor | 2SC2904 |
| Q5 | Transistor | 2SC2904 |
| Q6 | Transistor | 2SD313 |
| Q7 | Transistor | 2SC2120 |
| Q8 | Transistor | 2SD468 |
| Q9 | Transistor | 2SB562 |
| Q10 | Transistor | 2SC945P |
| Q11 | Transistor | 2SC3402 |

[PA] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|-------------|--------------|
| D1 | Varistor | MV5 |
| D2 | Varistor | MV5W |
| D3 | Diode | 1N4002 |
| D4 | Diode | U05G |
| D5 | Diode | 1SS53 |
| D7 | Diode | 1SS53 |
| D8 | Diode | 15CD11 |
| L1 | Coil | LR-142 |
| L2 | Coil | 1R2 FL5H |
| L3 | Coil | 1R2 FL5H |
| 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 | 101 FL5H |
| L13 | Coil | FSQH050RN |
| L14 | Coil | BT01RN1-A61 |
| L15 | Coil | FSQH050RN |
| L16 | Coil | BT01RN1-A61 |
| L17 | Coil | FSQH050RN |
| L18 | Coil | BT01RN1-A61 |
| L19 | Coil | 101 FL5H |
| L20 | Coil | 102 FL9H |
| L21 | Coil | 102 FL9H |
| L22 | Coil | LR-151 |
| L23 | Coil | BT01RN1-A61 |
| L24 | Coil | BT01RN1-A61 |
| L25 | Coil | BT01RN1-A61 |
| L26 | Coil | BT01RN1-A61 |
| 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 | 102K LAL04NA |
| L39 | Coil | 101K LAL04NA |
| L40 | Coil | LW-22 |
| L41 | Coil | 101K LAL04NA |

| | | | |
|-----|----------|-----|-------|
| 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 | 2.2 | 1W |
| R11 | Resistor | 2.2 | 1W |
| R12 | Resistor | 2.2 | 1W |
| R13 | Resistor | 2.2 | 1W |
| R14 | Resistor | 10 | R50X |

[PA] UNIT

| REF. NO. | DESCRIPTION | PART NO. |
|----------|----------------|---------------------|
| R15 | Resistor | 10 R50X |
| R16 | Resistor | 3.3 1W |
| R17 | Resistor | 3.3 1W |
| R18 | Resistor | 33K R25 |
| R19 | Resistor | 1K R25 |
| R20 | Resistor | 0.012 5W SQ5L |
| R21 | Resistor | 1K R25 |
| R22 | Resistor | 4.7 2W R2J |
| R23 | Trimmer | 470 H0651A |
| R24 | Resistor | 150 R25 |
| R25 | Resistor | 0.1 1W SRW1P |
| R26 | Resistor | 10K ELR25 |
| R27 | Trimmer | 100 H0651A |
| 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 | 60 3W SRW3P |
| R36 | Resistor | 4.7K ELR25 |
| R37 | Resistor | 10K ELR25 |
| R38 | Resistor | 1K ELR25 |
| R39 | Resistor | 1K ELR25 |
| R40 | Resistor | 4.7 ELR25 |
| R41 | Resistor | 10K ELR25 |
| R43 | Resistor | 47 ELR25 |
| R45 | Serge Absorber | DSA301 |
| R46 | Resistor | 220 R50 |
| R47 | Resistor | 3.3K ELR25 |
| C1 | Ceramic | 0.0022 50V |
| C2 | Barrier Lay | 0.0012 50V |
| C3 | Barrier Lay | 0.1 16V |
| C4 | Mylar | 0.01 50V |
| C5 | Mylar | 0.01 50V |
| C6 | Cylinder | 100P 50V |
| C7 | Monolithic | 470P 50V |
| C8 | Monolithic | 6800P 50V |
| C9 | Monolithic | 6800P 50V |
| C10 | Barrier Lay | 560P 50V |
| C12 | Monolithic | 470P 50V |
| C13 | Monolithic | 1000P 50V |
| C14 | Dip Mica | DM19 560P 500V 1CR |
| C15 | Ceramic | 47P 500V |
| C16 | Dip Mica | 4700P 500V DM20 1CR |
| C17 | Barrier Lay | 0.047 25V |
| C18 | Electrolytic | 470 16V |
| C19 | Monolythic | 0.68 25V |
| C20 | Barrier Lay | 0.047 25V |
| C21 | Electrolytic | 47 10V |
| C22 | Electrolytic | 10 16V |
| C23 | Barrier Lay | 0.047 25V |
| C24 | Barrier Lay | 0.047 25V |
| C25 | Electrolytic | 470 16V |
| C26 | Barrier Lay | 0.047 25V |
| C27 | Electrolytic | 10 16V |
| C28 | Barrier Lay | 0.1 16V |
| C29 | Ceramic | 0.0047 50V |
| C30 | Barrier Lay | 0.047 25V |
| C31 | Barrier Lay | 0.1 16V |
| C32 | Barrier Lay | 0.047 25V |
| C33 | Barrier Lay | 0.047 25V |
| C34 | Electrolytic | 10 16V |

[PA] UNIT

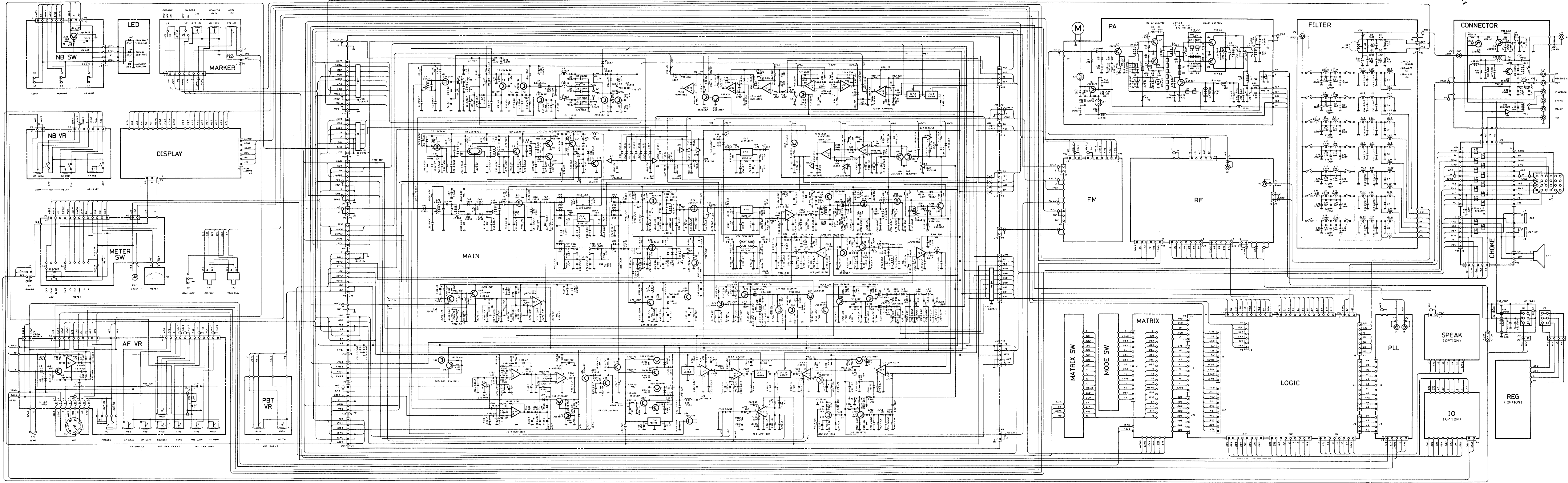
| REF. NO. | DESCRIPTION | PART NO. |
|----------|----------------|------------------|
| C35 | Barrier Lay | 0.047 25V |
| C36 | Ceramic | 0.047 50V |
| C37 | Barrier Lay | 0.047 25V |
| C38 | Barrier Lay | 0.047 25V |
| C39 | Barrier Lay | 0.047 25V |
| C40 | Barrier Lay | 0.1 16V |
| C41 | Ceramic | 120P 50V |
| C42 | Ceramic | 20P 50V |
| C43 | Ceramic | 120P 50V |
| C44 | Barrier Lay | 0.047 25V |
| C45 | Ceramic | 220P 50V |
| C46 | Feed Through | TF318-452E102GMV |
| C47 | Feed Through | TF318-452E102GMV |
| C48 | Feed Through | TF318-452E102GMV |
| C49 | Feed Through | TF318-452E102GMV |
| C50 | Barrier Lay | 0.047 25V |
| C51 | Barrier Lay | 0.047 25V |
| C52 | Barrier Lay | 0.1 16V |
| C53 | Ceramic | 180P 500V SL |
| C54 | Ceramic | 180P 500V SL |
| RL1 | Relay | FRL-764D06/1AS-T |
| RL2 | Relay | FBR211BD012-M |
| J1 | Connector | TL25P-12-V1 |
| J2 | Connector | TL25P-07-V1 |
| J3 | Connector | TL25P-02-V1 |
| J4 | Connector | TL25P-04-V1 |
| J5 | Connector | TL25P-05-V1 |
| J6 | Connector | TLB-P12H-B1 |
| J7 | Connector | HLJ4306-01-100 |
| J8 | Connector | HSJ0805-01-020 |
| J9 | Connector | 1625-24R |
| J10 | Connector | TMP-J01X-V1 |
| 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 Holder | TFH-S30 |
| S1 | Thermal Switch | OHD-90M |
| S2 | Thermal Switch | OHD-50M |
| MF1 | DC Motor | M6B 12U22 |
| B1 | P.C. Board | B-702B (42447) |
| B2 | P.C. Board | B-720B (42446) |
| B3 | P.C. Board | B-721B (42445) |

[PA] UNIT

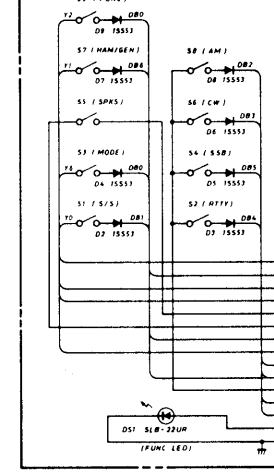
| REF. NO. | DESCRIPTION | PART NO. |
|-----------------|--------------------|-----------------|
| EP20 | Bead Core | FSQH090RN |
| EP21 | Bead Core | FSQH090RN |
| EP23 | Bead Core | DL20P2.6-3-1.2 |
| EP24 | Bead Core | FSQ070RN |
| | | |
| W15 | Jumper | JPW-02A |
| W16 | Jumper | JPW-02A |
| W17 | Jumper | JPW-02A |
| W18 | Jumper | JPW-02A |
| W19 | Jumper | JPW-02A |
| W20 | Jumper | JPW-02A |
| W21 | Jumper | JPW-02A |
| W22 | Jumper | JPW-02A |
| W44 | Jumper | JPW-02A |
| W45 | Jumper | JPW-02A |
| W46 | Jumper | JPW-02A |
| W47 | Jumper | JPW-02A |
| W62 | Jumper | JPW-02A |
| W63 | Jumper | JPW-02H |
| W64 | Jumper | JPW-02H |

IC-751 SCHEMATIC DIAGRAM

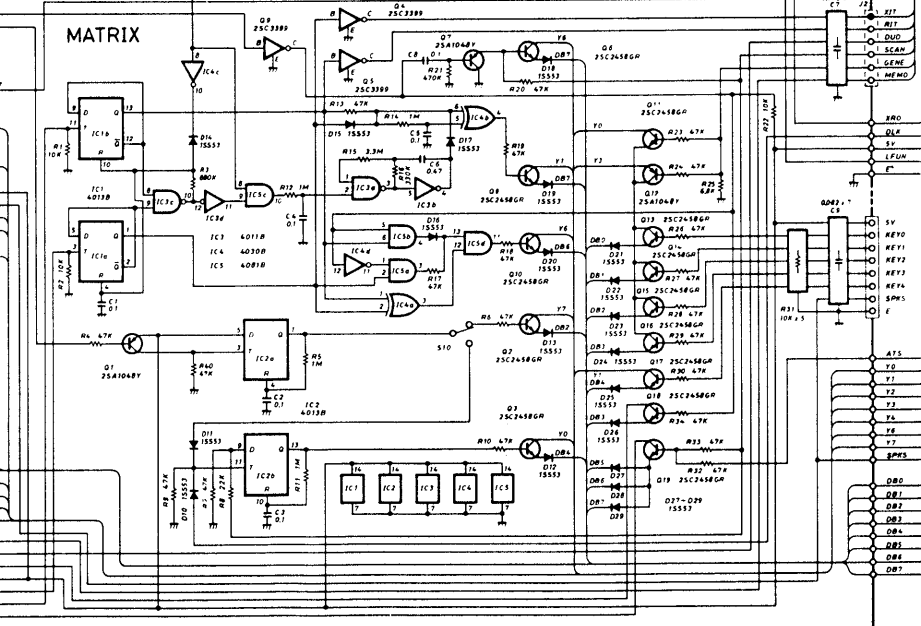
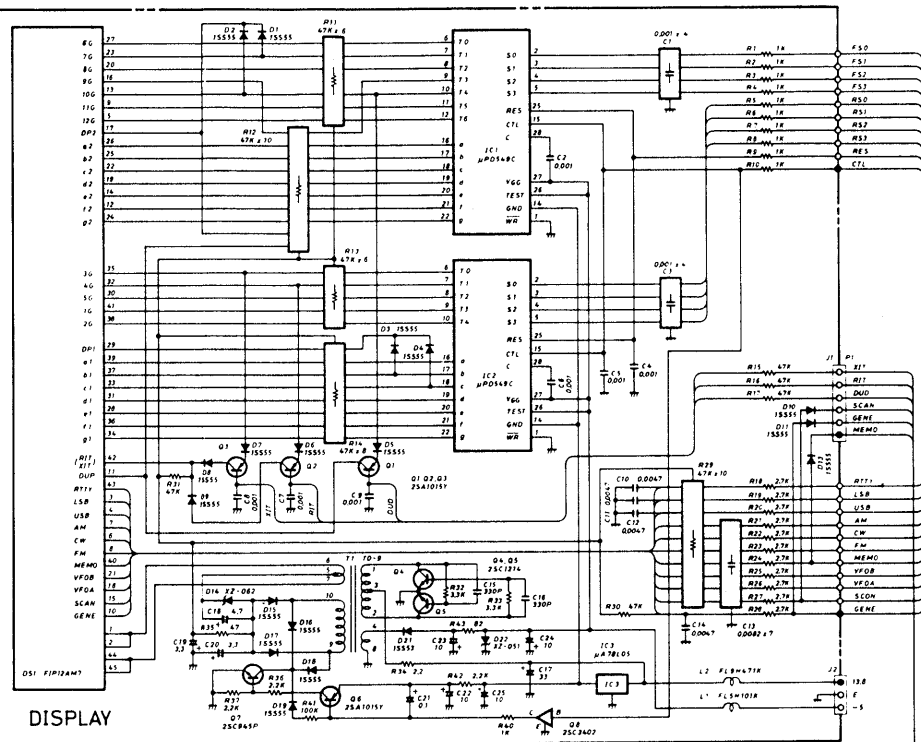
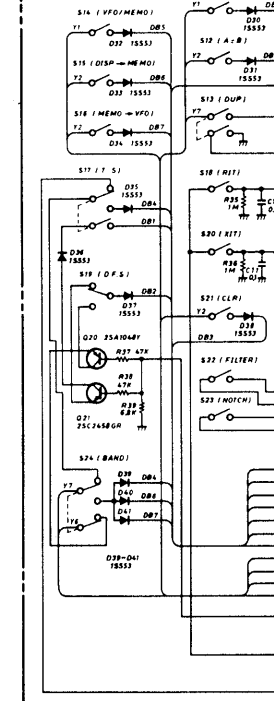
FL5H 102K
92402103
L20 L21



MODE SWITCH



MATRIX SWITCH



LOGIC

