COMMUNICATIONS RECEIVER

IC-R70

MAINTENANCE MANUAL

ICOM

ICOM INCORPORATED

1-6-19, Kamikurazukuri Hirano-ku,
Osaka, Japan

Phone : (06) 793-5301
Telex : ICOM TR J63649

ICOM AMERICA, INC.
2112 116th Avenue N.E.
Bellevue, WA 98004
Phone : (206) 454-8155
Telex : 230-152210 ICOM AMER BVUE

331 Towerwood Dr., Suite 307
Dallas, Texas 75234
Phone : (214) 620-2781

ICOM EUROPE G.M.B.H.
Himmelgeister Strasse 100
4000 Duesseldorf 1
West Germany
Phone : 0211-346047
Telex : 41-8588082

ICOM CANADA LTD.
810 S.W. Marine Drive
Vancouver, BC Canada
Phone : (604) 321-1833
Telex : 21-454315

ICOM AUSTRALIA, PTY, Ltd.
7 Duke Street, Windsor 3181
Victoria Australia
Phone : (03) 529-7582
Telex : 71-35521 ICOMAS AA35521

TABLE OF CONTENTS

SECTION 1 SPECIFICATIONS

GENERAL

Number of semiconductors	:	Transistors	77
		FETs	14
		ICs (Including CPU)	43
		Diodes	180
Frequency coverage	:	Ham band	1.8 MHz ~ 2.0 MHz
			3.5 MHz ~ 4.1 MHz
			6.9 MHz ~ 7.5 MHz
			9.9 MHz ~ 10.5 MHz
			13.9 MHz ~ 14.5 MHz
			17.9 MHz ~ 18.5 MHz
			20.9 MHz ~ 21.5 MHz
			24.5 MHz ~ 25.1 MHz
			28.0 MHz ~ 30.0 MHz
		General coverage	0.1 MHz ~ 30.0 MHz
			(German version: 0.2 MHz ~ 26.1 MHz)
			Thirty 1-MHz segments
Frequency control	:	CPU based 10-Hz-step digital PLL synthesizer with dual VFO system	
Frequency readout	:	6-digit 100-Hz readout.	
Frequency stability	:	Less than 250 Hz after switch-on 1 min. to 60 mins., and less than 50 Hz after 1 hour. Less than 500 Hz in the range of −10°C to 60°C.	
Power supply requirements	:	117V or 235V ±10% 50 ~ 60 Hz 30 VA (100V/200V/220V use requires internal modification.)	
Antenna impedance	:	50 ohms, unbalanced (Single wire can be used on 0.1 ~ 1.6 MHz)	
Weight	:	7.4 kg (10.3 lbs.)	
Dimensions	:	111 (H) × 286 (W) × 276 (D) mm (4-3/8 × 11-1/4 × 10-7/8 inches)	

RECEIVER

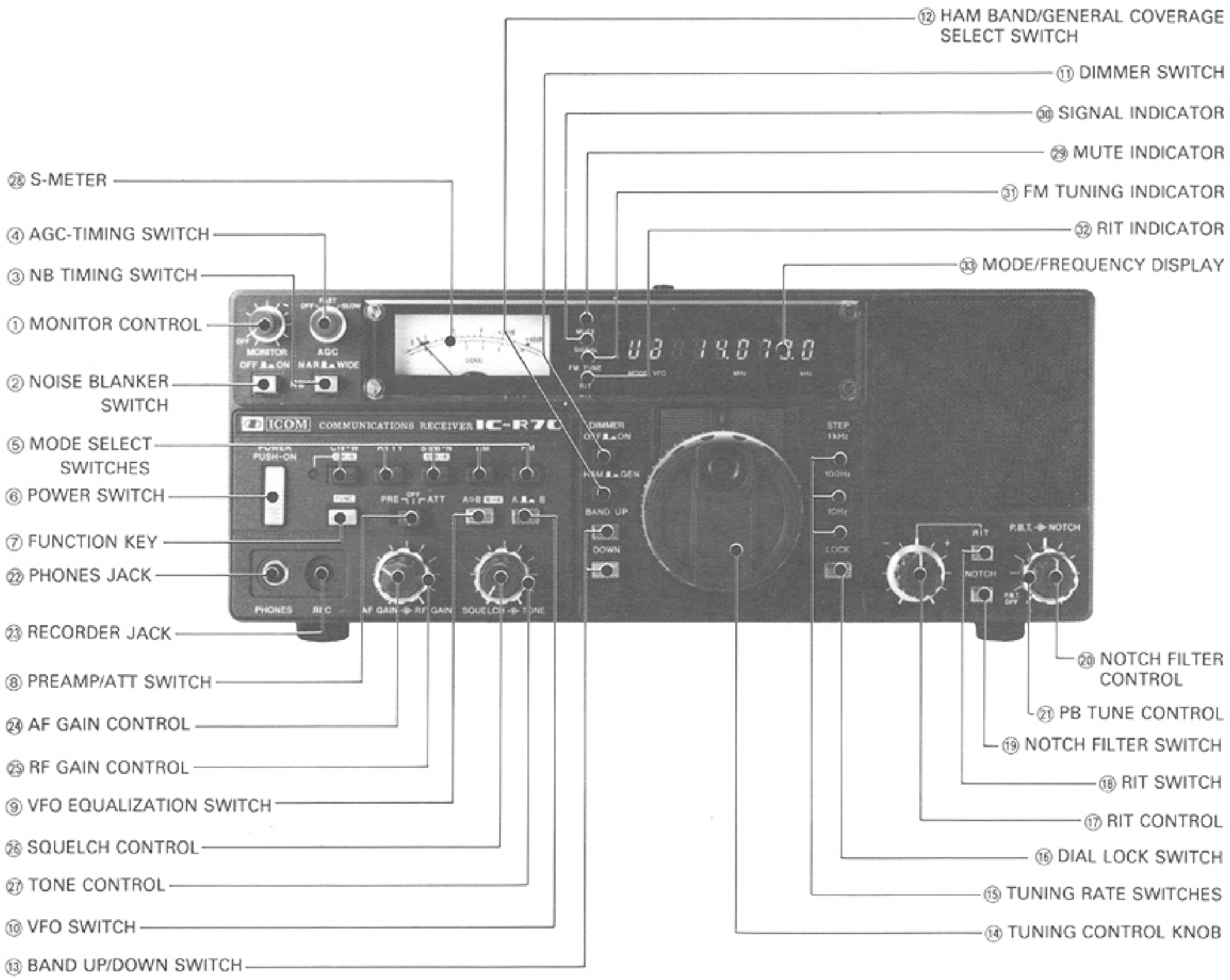
Receiving system	:	Quadruple conversion superheterodyne with continuous bandwidth control (F_3*: Triple conversion superheterodyne)
Receiving modes	:	A_1, A_3J (USB, LSB), F_1 (output FSK audio signal), A_3, F_3
IF frequencies	:	1st 70.4515 MHz 2nd 9.0115 MHz 3rd 455 kHz 4th 9.0115 MHz (except F_3*) with continuous bandwidth control (except F_3*)
2nd IF center frequency	:	SSB (A_3J) 9.0115 MHz CW (A_1) RTTY (F_1) 9.0106 MHz AM (A_3) FM* (F_3) 9.0100 MHz
Sensitivity (when preamplifier is ON):	:	SSB, CW, RTTY Less than 0.15 microvolts (0.1 ~ 1.6 MHz: 1 microvolt) for 10 dB S+N/N AM Less than 0.5 microvolts (0.1 ~ 1.6 MHz: 3 microvolts) FM* Less than 0.3 microvolts for 12 dB SINAD (1.6 ~ 30 MHz)
Selectivity	:	SSB, CW, RTTY 2.3 kHz at −6 dB (adjustable to 500 Hz min.) 4.2 kHz at −60 dB CW-N, RTTY-N 500 Hz at −6 dB 1.5 kHz at −60 dB AM 6 kHz at −6 dB (adjustable to 2.7 kHz min.) 18 kHz at −60 dB FM* 15 kHz at −6 dB 25 kHz at −60 dB
Spurious response rejection ratio	:	More than 60 dB
Audio output	:	More than 2 watts
Audio output impedance	:	8 ohms

* When optional FM unit is installed.

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

SECTION 2 CONTROLS AND THEIR FUNCTIONS

2-1 FRONT PANEL



1. MONITOR CONTROL

When using this set together with a transmitter or transceiver, actual transmitted signals can be monitored.

This control switches the monitor circuit ON and OFF, and controls its audio level. Use headphones or reduce monitor audio volume to prevent feedback to the transmitter microphone.

2. NB (NOISE BLANKER) SWITCH

When pulse-type noise such as automobile ignition noise is present, press this switch in. The noise will be reduced to provide comfortable reception.

3. NB TIMING SWITCH

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

4. AGC TIMING SWITCH

For changing the time-constant of the AGC (Automatic Gain Control) circuit. By setting the switch to the SLOW position, the AGC voltage is released more slowly. Set the switch to provide comfortable reception.

When the switch is in the OFF position, the AGC function is switched OFF and the S-meter does not move even if a signal has being received. (The AGC does not actuate in the FM mode.)

5. MODE-SELECT SWITCHES

Select any one of five operating modes by simply pressing the desired switch. Additionally, the CW and SSB switches have dual functions, as follows.

1. CW: For normal CW operation.
   CW-N: By pressing the FUNCTION key first and then the CW button, the narrow CW filter is selected.
   SSB-N: For normal SSB operation, upper sideband (USB) for the 10-MHz band and above, and lower side-

band (LSB) for the 9-MHz band and below.

SSB-R: For reverse SSB operation, lower sideband (LSB) for the 10-MHz band and above, and upper sideband (USB) for the 9-MHz band and below.

6. POWER SWITCH

This switch is a push-lock type switch which controls the AC power to the unit. When the switch is pressed in and locked, power is supplied to the unit. When the switch is pressed again and released, power to all circuits is cut. (If the MEMORY switch on the rear panel is switched ON, power will be continuously supplied to the CPU to memorize the operating frequency, mode, etc.)

7. FUNCTION KEY

Increase the function of the CW and SSB MODE SELECT and the VFO EQUALIZATION switch by pressing this key switch first.

8. PREAMP/ATT (Attenuator) SWITCH

Switches the RF preamplifier and attenuator in the RF circuit.

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

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

When nearby signals interfere with reception, or when receiving a very strong signal, set this switch to 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 at the "OFF" position.

9. VFO EQUALIZATION SWITCH

When "A" VFO and "B" VFO are different frequencies, by pressing this switch, "B" VFO will have the same frequency as "A" VFO. This switch has dual functions: by pressing the FUNCTION key first and then this switch, "A" VFO will have the same frequency as "B" VFO.

10. VFO SWITCH

You can select either of the two built-in VFOs ("A" VFO or "B") VFO with this switch.

In addition, when the VFO is switched from "A" VFO to "B" VFO, the frequency indicated on the frequency display just prior to switching goes into the memory inside the CPU. Thus, even if "B" VFO is being used, switching to "A" again will enable you to operate at the initial frequency. Switching from "B" to "A" results in the same operation.

11. DIMMER SWITCH

By pressing this switch in, the intensity of the meter illumination and frequency display is reduced. Use this in the dark to prevent glare.

12. HAM BAND/GENERAL COVERAGE SELECT SWITCH

Selects the function of the set. In the HAM (out) position, the receiver functions in any of nine HAM bands between 1.8 MHz and 28 MHz. In the GENERAL COVER (in) position, the set functions as a general coverage receiver between 0.1 MHz and 30 MHz.

13. BAND UP/DOWN SWITCHES

Change the operating band upward or downward. During HAM BAND operation, the band skips to the next upper or lower band with each push. (The 28-MHz band is divided into two segments, 28 ~ 29 MHz and 29 ~ 30 MHz.) During GENERAL COVERAGE operation, the band changes to the next upper or lower 1-MHz segment. When the band reaches the highest band, the next is the lowest band, and when the band reaches the lowest band, the next is the highest band.

14. TUNING CONTROL KNOB

Rotating the TUNING CONTROL KNOB clockwise increases the frequency, while rotating it counterclockwise decreases the frequency. The frequency is changed in 10-Hz, 100-Hz or 1-kHz steps, according to the TUNING RATE switches. One complete rotation of the tuning knob results in a 1-kHz frequency increase or decrease in 10-Hz steps, 10 kHz in 100-Hz steps and 100 kHz in 1-kHz steps.

15. TUNING RATE SWITCHES

The small vernier marks on the tuning knob are changed to correspond to 10-Hz, 100-Hz or 1-kHz steps selected by pressing the 10 Hz, 100 Hz or 1 kHz switch.

16. DIAL LOCK SWITCH

After the IC-R70 is set to a certain frequency by pressing the DIAL LOCK switch, the VFO is electronically locked to the displayed frequency, thus inactivating the operation of the tuning knob. To change frequency, the dial lock must first be disengaged by pressing and releasing the DIAL LOCK switch again.

17. RIT CONTROL

Shifts the receiving frequency ±800 Hz to either side of the displayed frequency. When the RIT is ON, the RIT INDICATOR is illuminated. Rotating the control to the (+) side increases the receiving frequency, and rotating to the (−) side decreases the receive frequency. With the RIT ON, if the TUNING CONTROL KNOB is moved one increment, the RIT circuit is automatically pulsed OFF. Therefore it is

unnecessary to manually switch OFF the RIT when changing the operation frequency. The frequency shift by turning the RIT Control is not indicated on the frequency display.

18. RIT SWITCH
Press once for ON; for OFF, press the switch again.
When the RIT is ON, the RIT INDICATOR will illuminate. (Note: The RIT will also pulse OFF when the TUNING CONTROL knob is turned.)

19. NOTCH FILTER SWITCH
Switches the notch filter function ON and OFF.

20. NOTCH FILTER CONTROL
Shifts the notch filter frequency. Adjust the control so that the interference is reduced.

21. P.B. TUNE (PASS BAND TUNING) CONTROL
Allows continuous tuning of the pass-band selectivity by moving the filter up to 500Hz from the upper to lower side in SSB, CW and RTTY, and 2.7 kHz in AM. Not only improves selectivity, but also can improve the audio tone. Normal position is the center (12 o'clock) or OFF position and is 2.3-kHz wide in SSB, and 6-kHz wide in AM.

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

23. RECORDER JACK
Accepts a 3.5 mm mini plug for a tape recorder to record receiving signals. The output is a fixed level regardless of the position of the AF GAIN control.

24. AF GAIN CONTROL
Controls the audio output level. Clockwise rotation increases the level.

25. RF GAIN CONTROL
Controls the gain of the RF section. Clockwise rotation gives the maximum gain. As the control is rotated counterclockwise, the needle of the METER rises, and only signals stronger than the level indicated by the needle will be heard.

26. SQUELCH CONTROL
Sets the squelch threshold level. To switch OFF the squelch function, rotate this control completely counterclockwise. To set the threshold level higher, rotate the control clockwise.

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

28. S-METER
Signal strength of an incoming signal is indicated on a scale of S1 ~ S9 and S9 to S9 + 40 dB, and a linear scale divided into five.

29. MUTE INDICATOR
Illuminates when the receiver is in the mute mode for an external transmitter or transceiver.

30. SIGNAL INDICATOR
Illuminates when the squelch is opened.

31. FM TUNING INDICATOR
Illuminates when the set is tuned to an incoming signal frequency within 1 kHz (when optional FM unit is installed).

32. RIT INDICATOR
Illuminates when RIT is switched ON.

33. MODE/FREQUENCY DISPLAY
The frequency of the IC-R70 is displayed on a luminescent display tube. Because the 1-MHz and 1-kHz decimal points are displayed, the frequency can easily be read. The frequencies indicated are the carrier frequencies of each mode in AM, USB, LSB and CW. In the RTTY mode, the mark frequency (2125 Hz beat tone) is displayed.

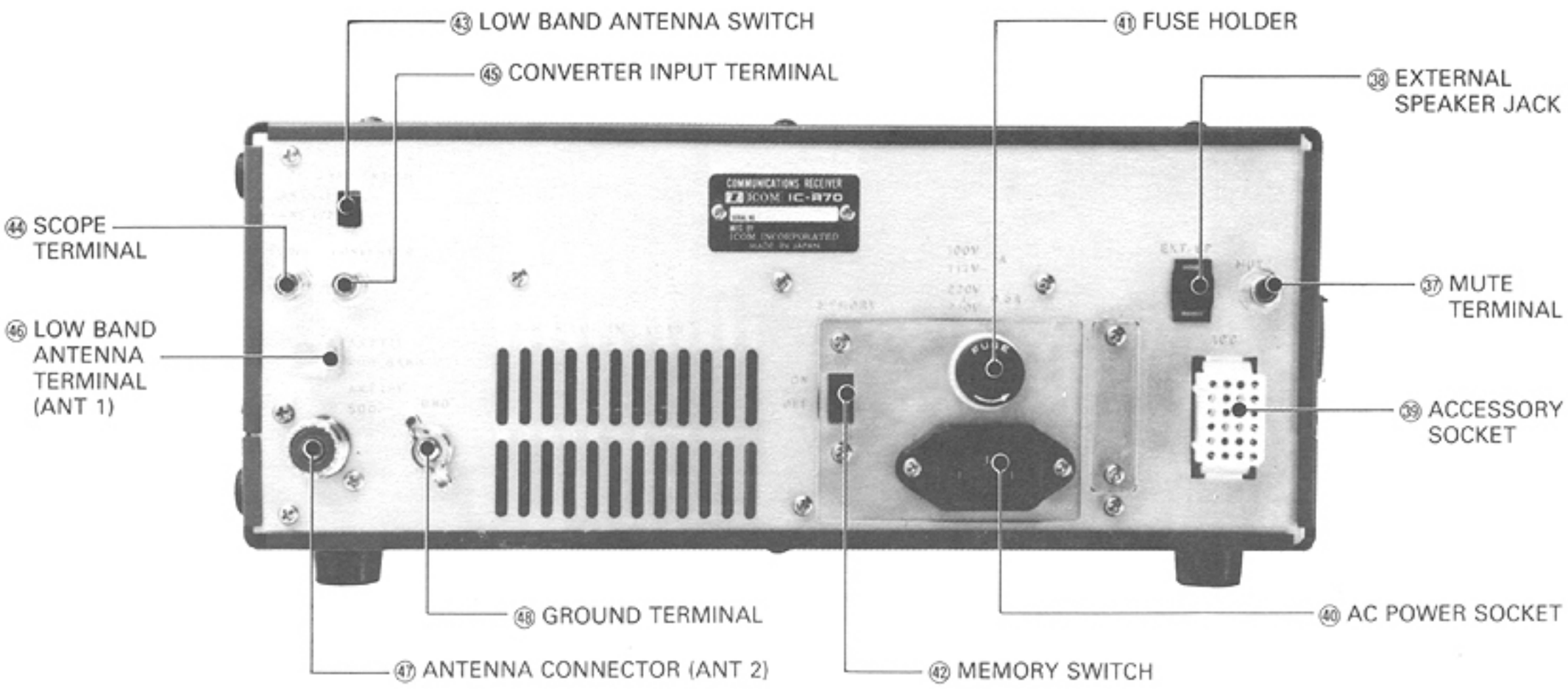
2-2 UNDER THE ACCESS COVER

34. MONITOR GAIN SWITCH
Switches the gain of the receiver (monitor) in the mute mode, High and Low. Set the switch for comfortable monitoring.

35. RTTY FILTER SWITCH
Switches the crystal filters, 500 Hz/−6 dB (for CW) and 2.3 kHz/−6 dB (for SSB) in the RTTY mode. The selected filter is provided for RTTY reception when RTTY mode-select switch on the front panel is pushed.

36. FREQUENCY SET CONTROL
This control is for fine adjustment of the reference frequency of the PLL unit, which is the local oscillator frequency. Do not turn it unless you want to change the frequency.

2-3 REAR PANEL



37. MUTE TERMINAL

When you wish to use the unit together with a transmitter or transceiver, ground this terminal in the transmit mode; the unit is muted and monitors the transmitted signals.

38. EXTERNAL SPEAKER JACK

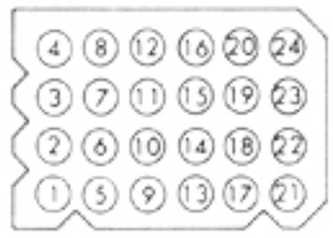
When an external speaker is used, connect it to this jack. Use a speaker with an impedance of 8 ohms. When the external speaker is connected, the built-in speaker does not function.

39. ACCESSORY (ACC) SOCKET

Various functions are available through the accessory socket, such as frequency control, receiver output, T/R changeover, etc. The table below shows those terminals.

PIN NO.	FUNCTION
1.	8 volts DC is available when the squelch is closed.
2.	13.8 volts DC in conjunction with the power switch operation
3.	When this terminal is grounded, the unit becomes the mute mode.
4.	Output from the receiver detector stage. Fixed output regardless of AF output or AF gain.
5.	NC (no connection)
6.	8 volts DC is available when pin 3 is grounded. (Relay cannot be directly actuated. Max. 5 mA)
7.	NC
8.	Ground
9.	NC
10.	Input for TRVA converter control signal
11.	Input for TRVB converter control signal
12.	Output reference voltage for band switching
13.	INPUT/OUTPUT for external band switching
14.	NC
15.	NC
16.	Input for external control (DBC signal)
17.	NC
18.	Input for external control (RC signal)
19.	Output for external control (DV signal)
20.	Input for external control (RT signal)
21.	Input/output for external control (DB1)
22.	Input/output for external control (DB2)
23.	Input/output for external control (DB4)
24.	Input/output for external control (DB8)

ACC SOCKET CONNECTIONS



Outside view

40. AC POWER SOCKET

For connection of the supplied AC power cable.

41. FUSE HOLDER

This holds a fuse for the AC power circuit. If the fuse is blown, replace it with a new 1A fuse for 100/117V operation, or 0.5A fuse for 200/220/235V operation, after checking the cause. Open the fuse holder with a philips head (+) screwdriver.

42. MEMORY SWITCH

When this switch is at the ON (up) position, the power to the CPU of the set is supplied continuously, even when the POWER SWITCH on the front panel is switched OFF, in order to retain all the operating frequencies of the two VFO's, etc. When this switch is set to the OFF position, all the power, including that to the CPU, is switched OFF by switching OFF the POWER SWITCH, so that all operating frequencies of the two VFOs, etc. are erased.

43. LOW BAND ANTENNA SWITCH

Switches the low band (1600-kHz and below) antenna terminals; ANT 1 (㊻ LOW BAND ANTENNA TERMINAL) for a high-impedance antenna such as a long-wire antenna, and ANT 2 (㊼ 50-ohm ANTENNA CONNECTOR) for a 50-ohm coaxial cable.

44. SCOPE TERMINAL

This terminal brings out the 70.4515-MHz IF signal from the mixer in the receiver. Not only observes the received signal, but also those signals of a selected band width by using a panadaptor or panascope.

45. CONVERTER INPUT TERMINAL

VHF and UHF operation (by using a suitable converter with the IC-R70) is possible. This terminal is for converter connection.

46. LOW BAND ANTENNA TERMINAL (ANT 1)

For connection of a low band antenna to receive 1600 kHz and below. When the operating frequency goes to 1600 kHz and below, the antenna terminal will be changed from the (47) ANTENNA connector to this terminal automatically (when the (43) LOW BAND ANTENNA SWITCH is set at the ANT 1 position).

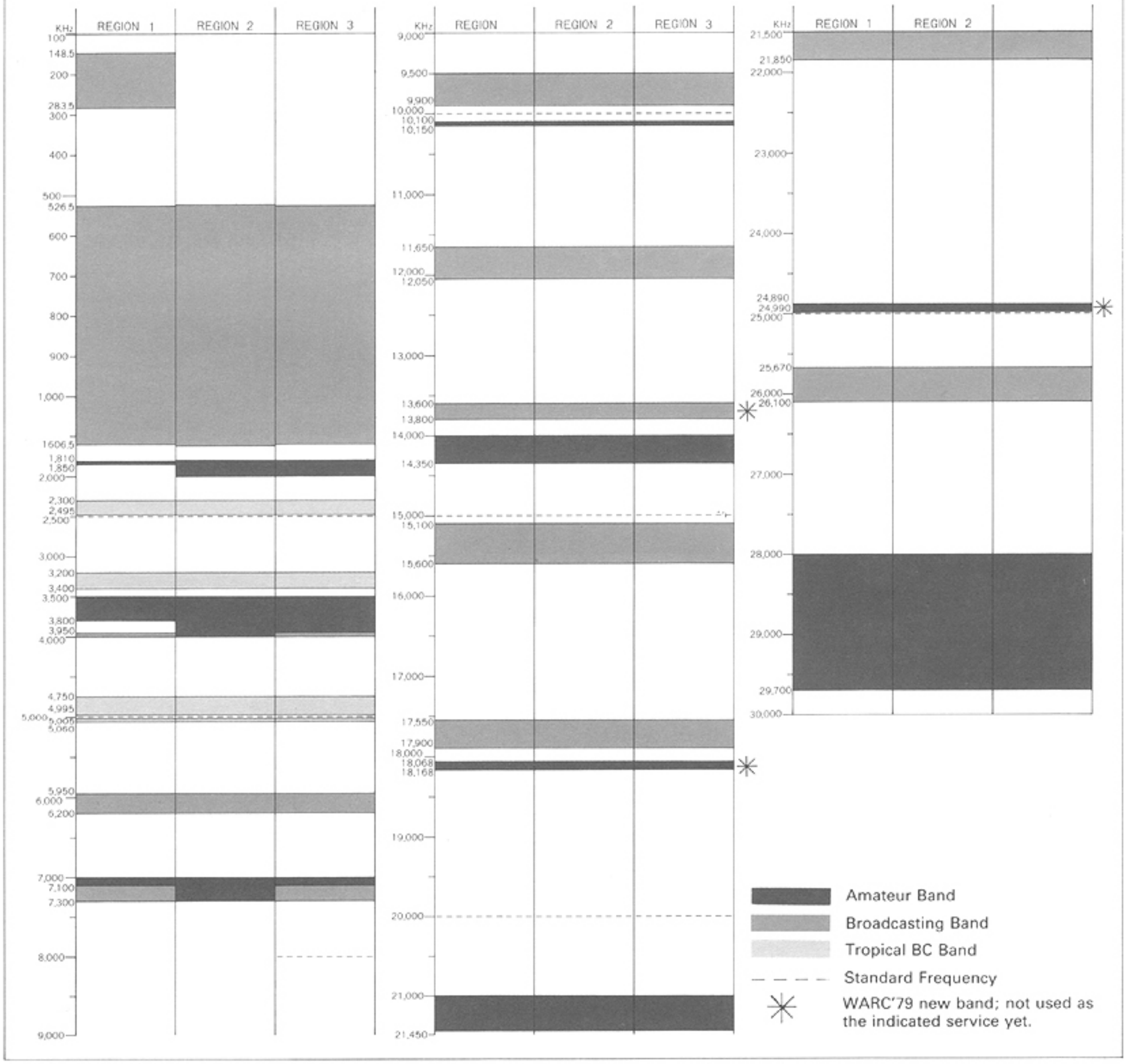
47. ANTENNA CONNECTOR (ANT 2)

This is used to connect the antenna to the unit. Its impedance is 50 ohms, and it connects with a PL-259 connector.

48. GROUND TERMINAL

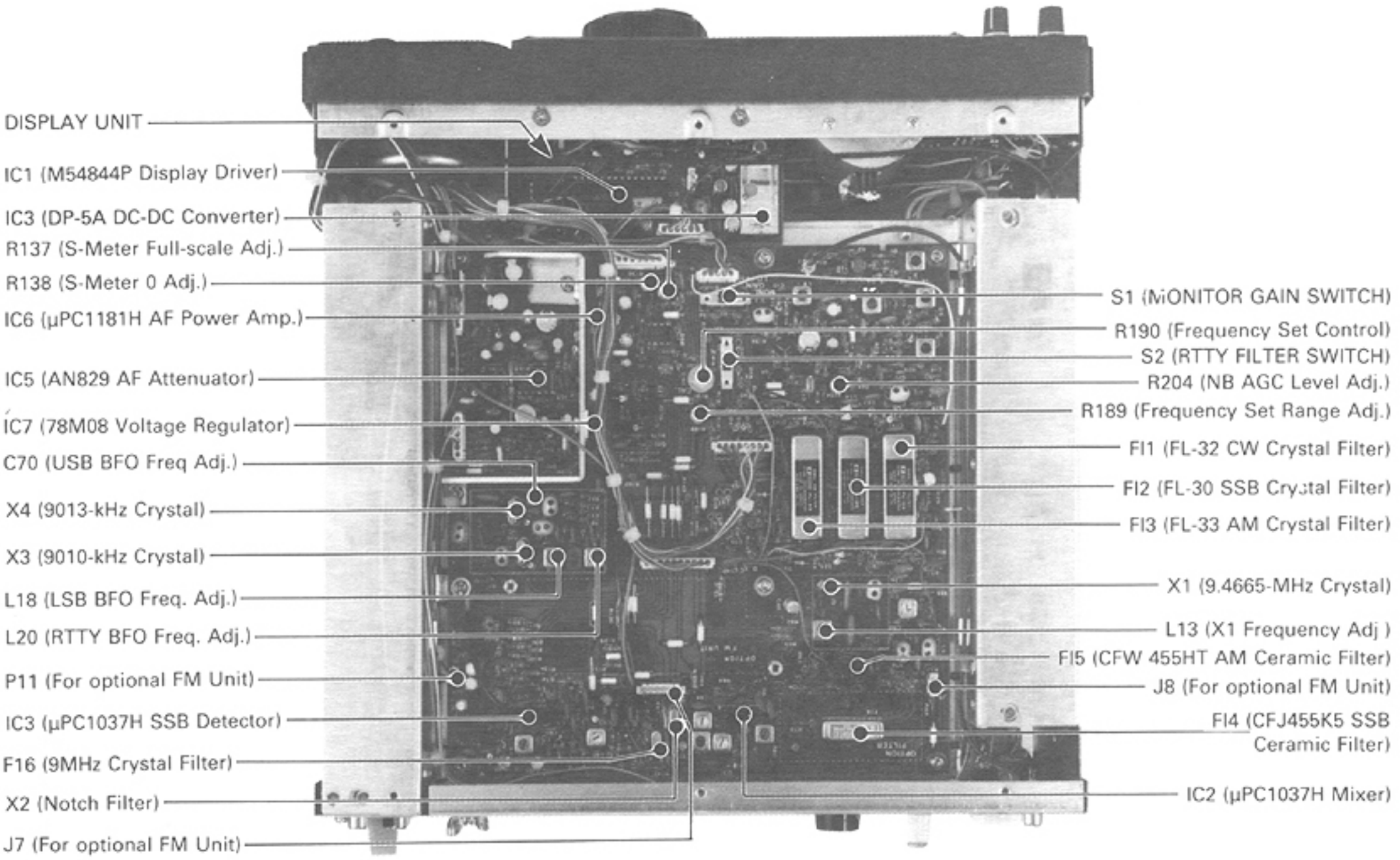
To prevent electrical shock and other problems, be sure to ground the equipment through the GROUND TERMINAL. For best results, use as heavy a gauge wire or strap as possible and make the connection as short as possible.

FREQUENCY ALLOCATION CHART

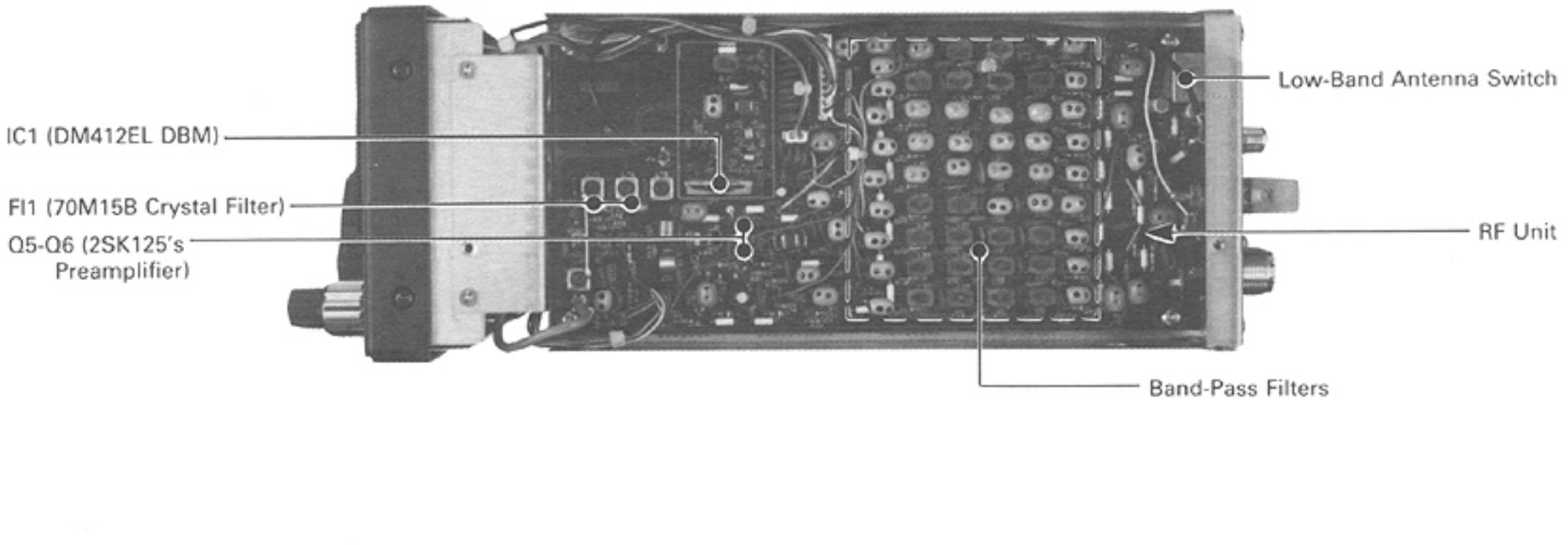


SECTION 3 INSIDE VIEWS

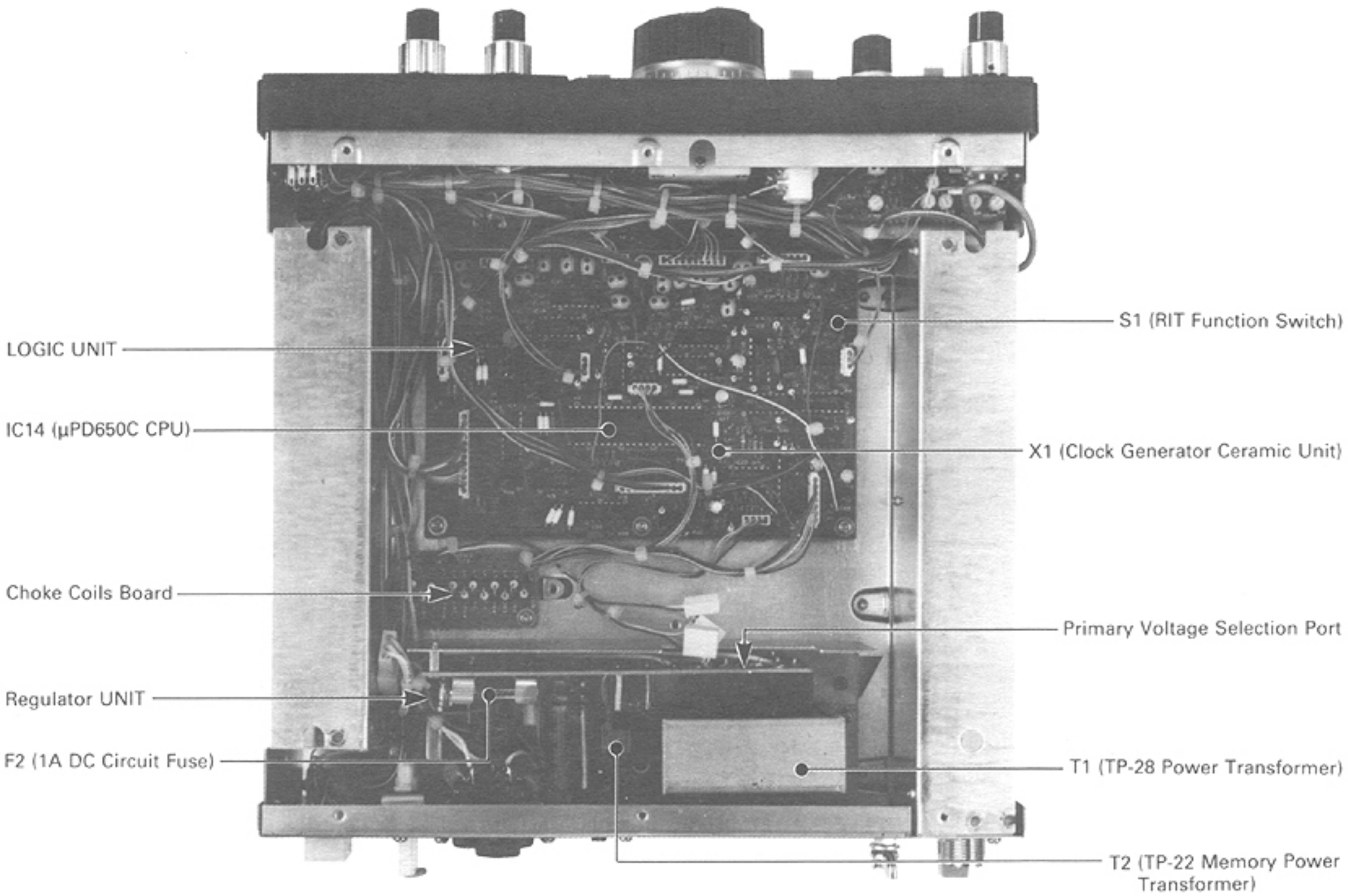
3-1 TOP VIEW



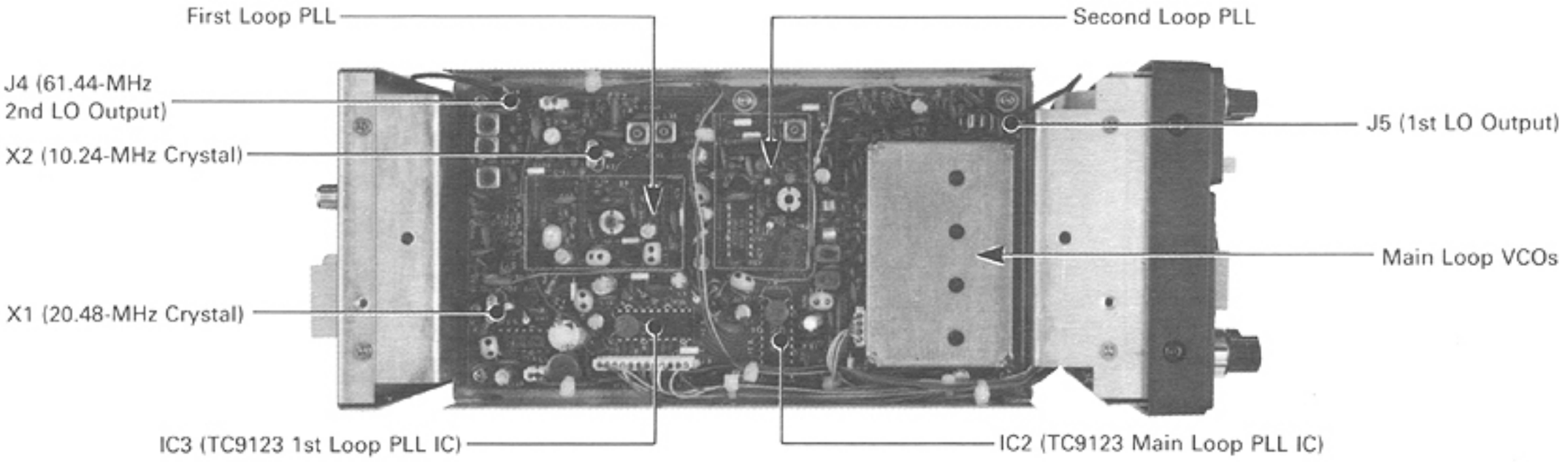
3-2 RF UNIT



3-3 BOTTOM VIEW

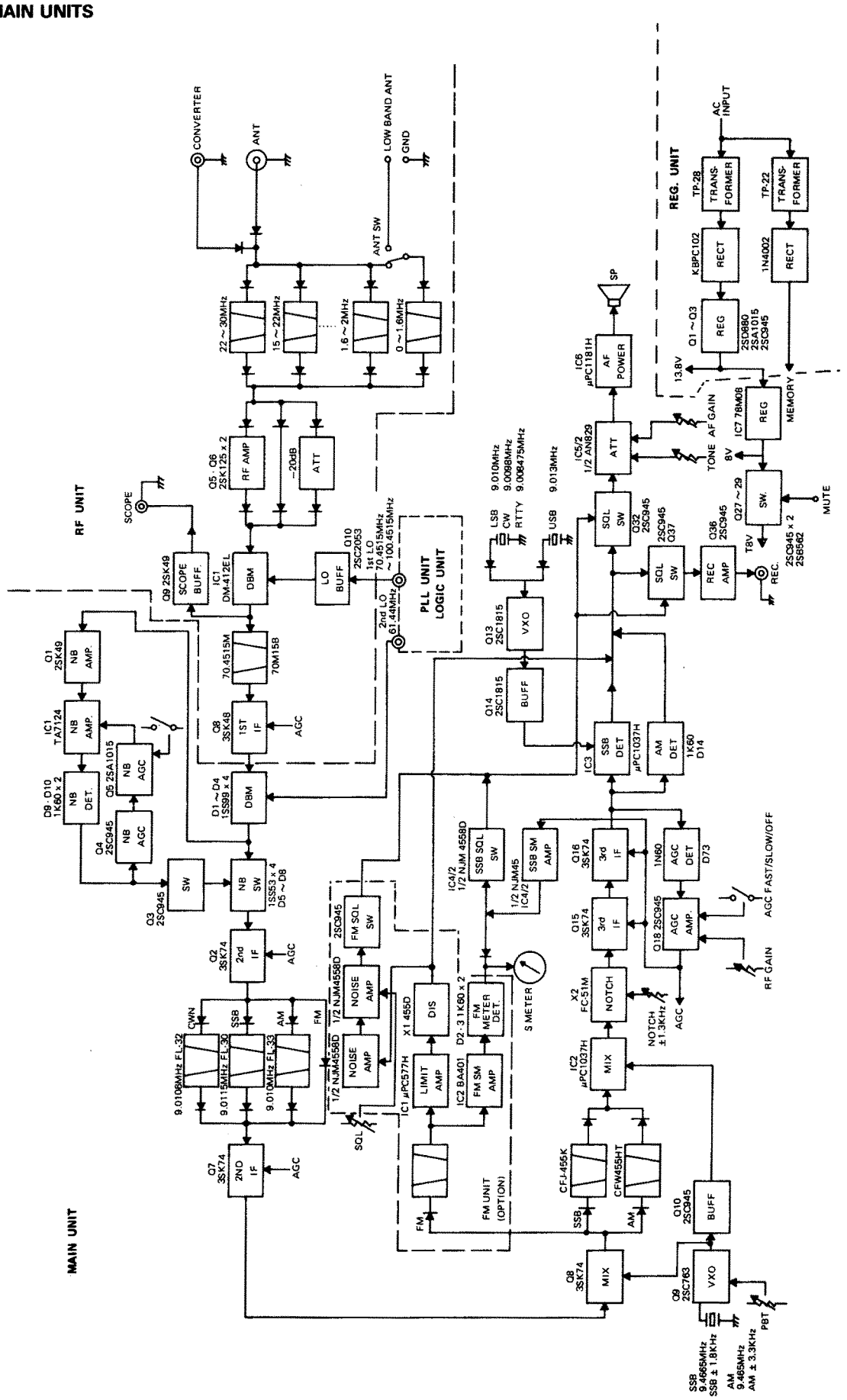


3-4 PLL UNIT

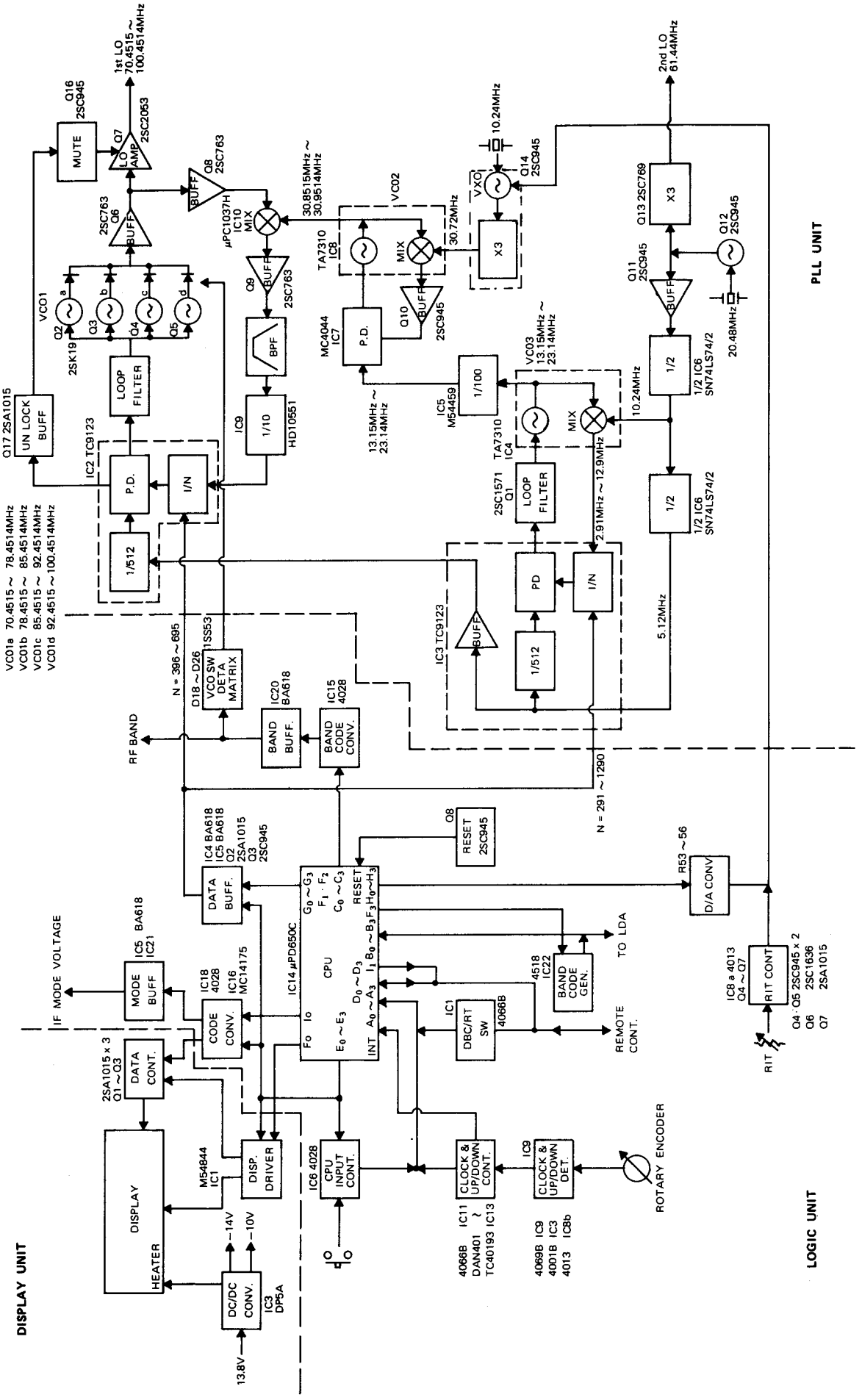


SECTION 4 BLOCK DIAGRAM

RF/MAIN UNITS



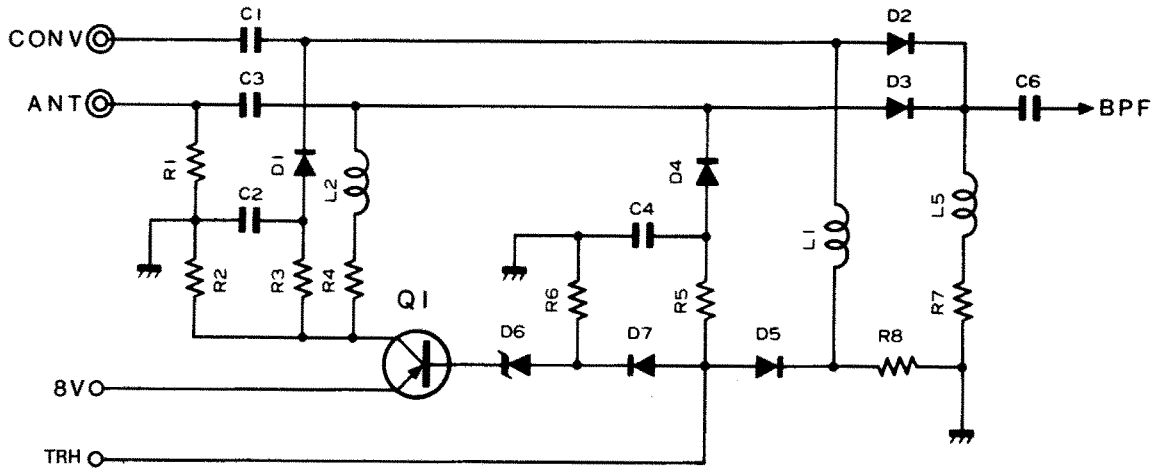
PLL/LOGIC UNITS



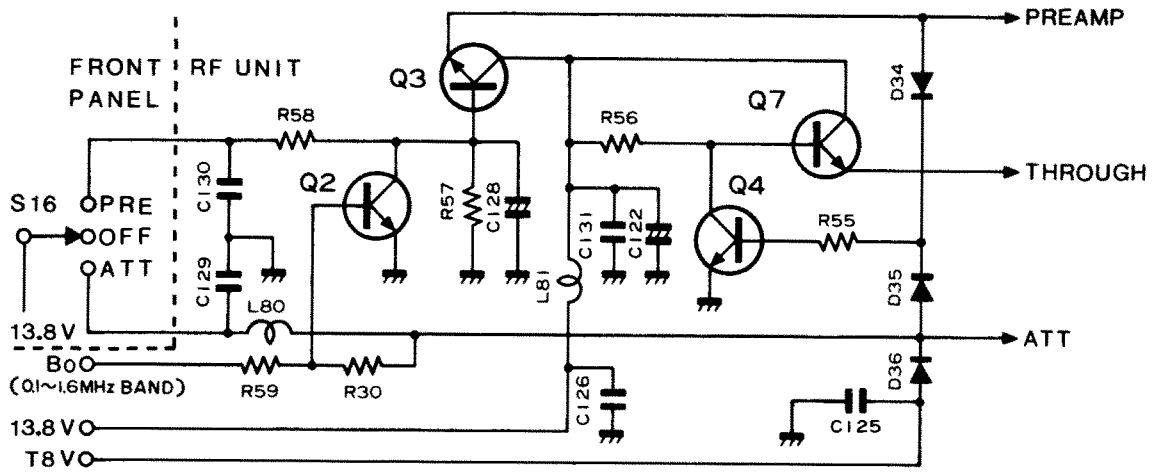
SECTION 5 CIRCUIT DESCRIPTION

5-1 RF UNIT

1. RF stage



The signal (1.6 ~ 30 MHz) received from the antenna connector (ANT2) is fed to the input selecting circuit.
Usually, the TRH signal from the logic unit is "L" level, so Q1 is turned ON, D3 is turned ON, current flows to R7, and the signal from the antenna connector signal is fed to the BPF (band-pass filter).
Note that current flows from Q1 to R3, D1 and R8; D1 is turned ON; and the input signal from the converter terminal is shunted to ground through C2.
If the converter terminal is used, Q1 is turned OFF because the TRH signal from the logic unit is "H" level; D5 is turned ON, D2 is also turned ON, current flows to R7, and the signal from the converter terminal is fed to the BPF.
The TRH signal also flows to R5, D4 and R2; and the input signal from the antenna connector is shunted to ground through C4.
Good isolation is provided between the antenna connector and the converter terminal by this circuit.
The signal received from the input-selecting circuit is fed to the BPF, where unwanted signals outside of each band width are removed.
BPF switching signals from the logic unit are supplied to J5, the BPF input/output switching diodes (D8 ~ D25) are turned ON according to each band, and the BPF corresponding to the band is selected, causing the received signal to pass.
The received signal which has passed through the BPF is fed to the PREAMP/ATT switching circuit. These can be selected by a switch on the front panel.



When the OFF position is selected, only Q7 is turned ON, and voltage is supplied to the through circuit.
When PREAMP is selected, the 13.8V from the PRE/ATT switch is divided at R57 and R58, is applied to the Q3 base, Q3 is turned ON, and the preamplifier circuit which employs push-pull of junction-type FETs Q5 and Q6 operates.
One part of this voltage is passed through D34 and R55, is applied to the Q4 base, turning it ON; the Q7 base is grounded, turning it OFF; and only the preamplifier circuit operates.
When ATT is selected, the 13.8V from the PRE/ATT switch is directly applied to the ATT circuit, D35, R55 and Q4 in that order, and only the attenuation circuit is switched ON. An attenuation of approximately 20 dB is obtained by R36 ~ R38.
When the receiving frequency is 100 kHz ~ 1.6 MHz, even if the PRE/ATT switch is at the "pre-amp" position, a part of the BPF switching voltage from the logic unit passes through R59, is applied to the Q2 base, Q2 is turned ON, and Q3 OFF. Note that there is operation, regardless of the receiving frequency, when the setting is the "through" or "attenuation" position.
When this unit is monitoring the transmission of some other unit with which it is transceiving, when T8V is applied it passes through D36, D35, R55 and R30 (regardless of the position of the PRE/ATT switch), and the attenuator circuit only is forced to operate so that Q2 and Q4 are not turned ON.

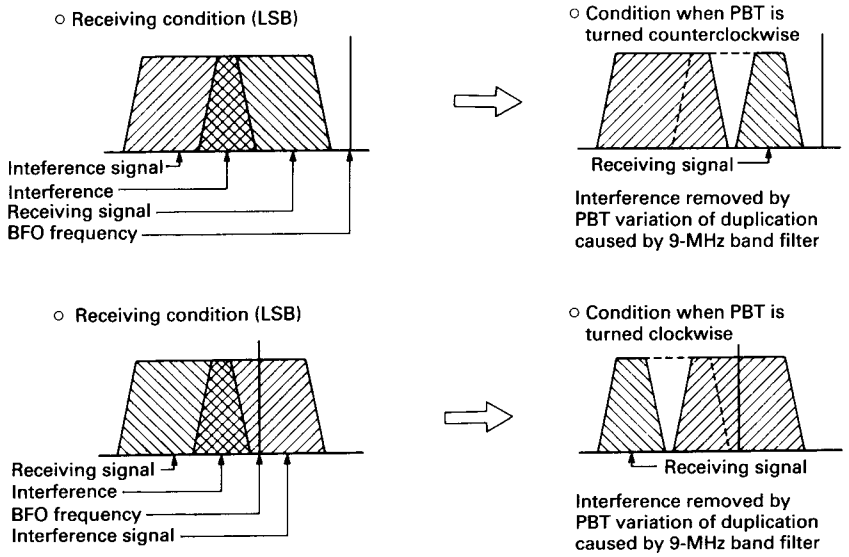
2. 1st IF stage

The signal through the preamplifier, attenuator or directly, and the 1st LO (70.4515 ~ 100.4515 MHz) from the PLL unit, buffer-amplified at Q10, are fed to the 1st mixer to convert into 70.4515 MHz 1st IF signals.
The signal converted to the 70.4515-MHz 1st IF by the DBM (double-balanced mixer) is amplified at Q8 after passing through the FI1 (±7.5 kHz/3 dB) monolithic crystal filter. AGC is applied to the 2nd gate.
The amplified signal is supplied to the main unit via J4.
In this amplification circuit, during transmission monitoring, the muting voltage from the main unit passes through R54 and D33, is applied to Q8, and its gain is changed. Gain can be adjusted by S1 on the main unit.

5-2 MAIN UNIT

1. 2nd ~ 4th IF stages

The 1st IF signal (70-MHz band) input from P1 passes through the T-type attenuator (R1 ~ R3), is mixed with the 2nd LO (61.44 MHz) signal by the DBM (D1 ~ D4), and is converted to the 2nd IF (9.0115 MHz) signal.
The signal converted to the 2nd IF passes through the NB gate (D5 ~ D8), and, after amplification by Q2, passes through the filters (FI1 ~ FI3) corresponding to the receiving mode and is amplified at Q7.
The IF signal amplified at Q7 is mixed by Q8 with the 3rd LO (9.4665 MHz ± PBT change amount) oscillated by Q9 and X1, and is converted to the 3rd IF (455 kHz ± PBT change amount).
The 3rd IF signal performs PBT (pass-band tuning) by the duplication of the 455-kHz filters (FI4 and FI5) and the 9-MHz filters (FI1 ~ FI3) being varied by the 3rd LO.



Signals to the optional FM unit are taken out through J8 as wide-band signals prior to the 455-kHz filters.
The SSB, CW, RTTY or AM signal which has passed through the 455-kHz filter is, after tuning by L14, fed to the DBM IC2. It is mixed with the 3rd LO (9.4665 MHz ± PBT change amount) signal, the same one to Q8, and becomes the 4th IF (9.0115 MHz ± PBT change amount) signal.
After tuning to 9 MHz by L15, it is fed to the notch filter (composed of L16, L17, D34 and X2).
By using a crystal, this filter is abie to obtain deep attenuation without damaging the IF characteristics.
A bias voltage is applied to D34, and this voltage is controlled by the NOTCH FILTER control on the front panel, and the frequency is varied.
The range of variation is ±1.3 kHz.
The spurious component generated during mixing at IC2 is removed by FI6 from the signals which have passed through the notch filter, and, after amplification at Q15 and Q16, the signals are divided into 3 and supplied to the detector corresponding to each mode.
One is fed to the AM-detection circuit through C92, another is fed to the SSB and CW detection circuit through C91; and the other is fed to the AGC detection circuit.

2. AF stage

The SSB, CW or RTTY signal fed to IC3 by C91 is product-detected with the BFO signal.
The AM signal is input by C92 to D74 and detected.
Except for the AM mode, Q19 performs switching to stop the AM detection by D74. During the AM mode, the BFO oscillation stops and there is no output from IC3.
Each of the detection outputs, including AM and FM (when the optional FM unit is installed), is fed to the same line, and squelch is applied by Q32.
IC5 is an IC for the electronic attenuation element; the pin 1 input side is for receiver and the pin 8 input side is for transmission monitoring. The various operations are selected by Q34 and Q35. Tone control is also accomplished by using the terminal (pin 2) for frequency compensation.
A part of each detection output is taken out through C156, and, after amplification at Q36, AF OUT signals to ACC and the REC terminal on the front panel are obtained.
Squelch is also applied by Q37 to these two types of AF output.
IC5 output is amplified at IC6 and is fed to the speaker.

3. Other circuits

(a) Noise-blanker circuit

The signal converted to the 2nd IF at the 2nd mixer passes through C3, is amplified at FET Q1 (in the first noise-amplifier stage), and is amplified to a sufficient level by the high-gain IC, IC1.
After the noise signal tuned at L8 is subjected to voltage-doubling rectification at C10, D9 and D10, it is divided in 2, one part of which passes through R17 and is fed to the Q4 ~ Q6 AGC circuit.
The AGC in this stage is obtained by increasing the voltage applied to pin 3 of IC1. This provides a wide dynamic range.
For woodpecker noise, etc., the AGC voltage rise time-constant is switched by the NB N/W select switch on the front panel, thus providing excellent blanking.
Noise signals rectified at D9 and D10 are applied to the Q3 base and are current-amplified; bias current from R7 to D5 ~ D8 is bypassed at R8. As a result, D5 ~ D8 are turned off and the received signal is not fed to the following circuit.

(b) Filter-select circuit

This circuit selects the appropriate filter for the operating mode by turning input/output switching diodes of D39 ~ D46, with mode signals input from J10.
At this time, RTTY is caused, by S2 in the main unit, to pass through FI1 (500 Hz/6 dB) during narrow shift or FI2 (2.2 kHz/6 dB) during wide shift. During the FM mode, it does not pass through a filter, but passes through a by-pass circuit consisting of D19 and D20.
FI3 is 6 kHz/6 dB, and is for the AM mode.

(c) AGC circuit

Signals output from the secondary side of L24 are amplified at Q18 after detection at D73, and then an AGC voltage is obtained from the collector.
When there are no signals, the AGC voltage is offset, through D72, to the voltage (approx. 4V) set by R125 and R123.
When there are signals, Q18 is ON, collector voltage (i.e., AGC voltage) is decreased, the 2nd gate voltage of each FET connected to the AGC line is also decreased, and the gain of each amplifier stage falls.

For the time-constants of AGC, the attack time is set by R106 and C160, and the release time is set by R103, R105, C77 and C79.
In order to provide full break-in during transmission, AGC voltage is held by the switching circuit consisting of Q22 and Q24.
When the AGC switch is set at FAST, the AGC voltage passes through R109 switched by Q20 and is quickly discharged.

(d) BFO circuit

Mode signals from J10 pass through the respective diode (one of D61 ~ D65) for each mode, and switch 2 crystals and shunt coils in series with a crystal, and the proper BFO frequency for each mode is obtained.
Q13 is a crystal oscillator and Q14 is a buffer-amplifier.

(e) S-meter circuit and squelch circuit

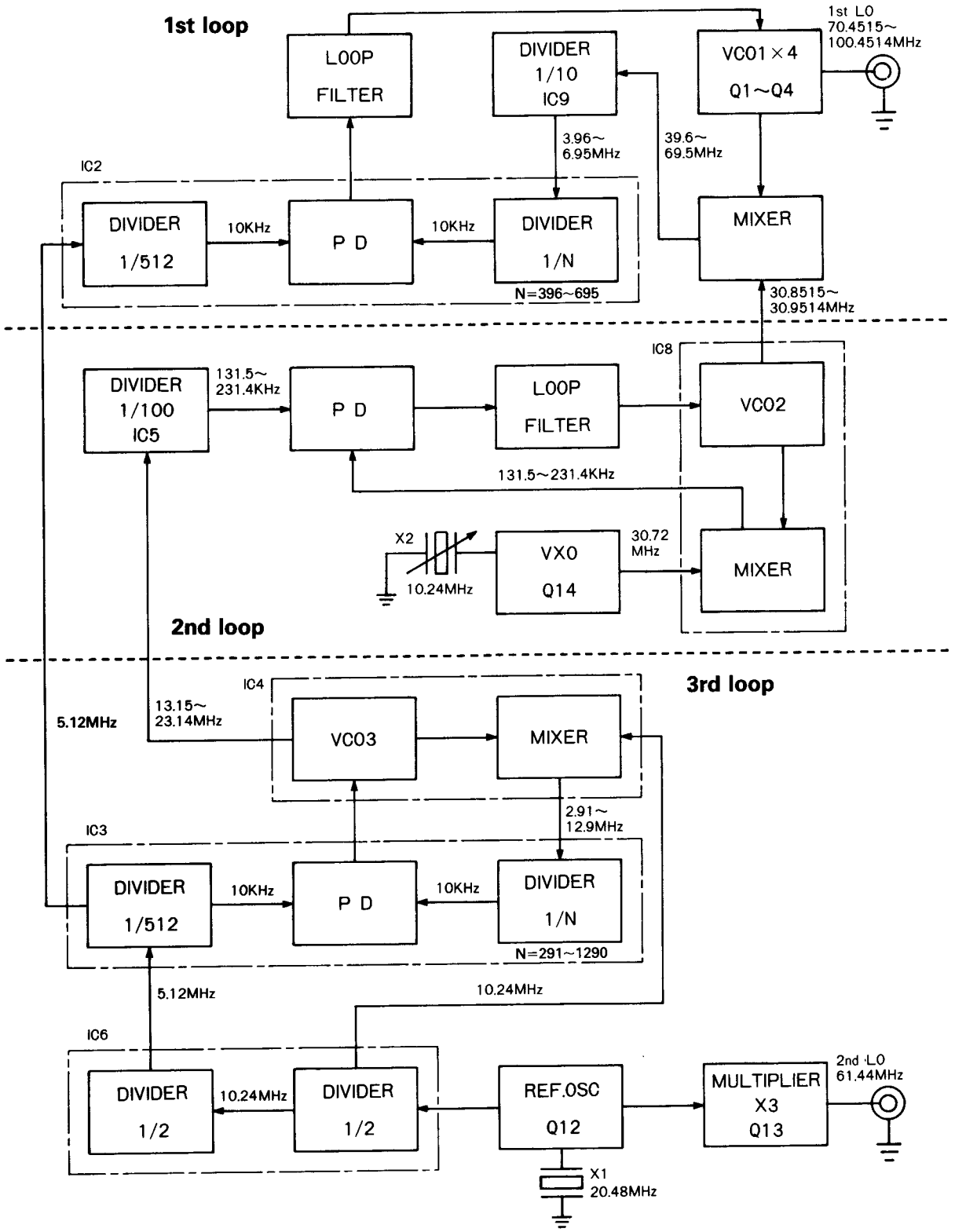
AGC voltage is fed to IC4B, inverting the amplifier, giving a wide dynamic range and high linearity, and causing the S-meter to move.
Part of S-meter voltage is fed to IC4A, comparator, and this circuit provides a stable squelch function for modes other than FM.
Q32 and Q31 are a circuit to produce squelch (SQL S) voltage; the signal LED is illuminated by Q30.

(f) Other circuits

IC7 is a voltage regulator supplying 8V to each part.
D52 and Q27 ~ Q29 are provided for use with a transmitter; the T8 signal which controls receiver operation is obtained by the signal from the SEND terminal.

5-3 PLL UNIT

This unit is composed of the 1st LO circuit for the 1st mixer, and the 2nd LO circuit for the 2nd mixer. The 1st LO circuit covers 70.4515 ~ 100.4515 MHz with three phase-locked loops, and the local oscillator of the 2nd loop provides 10-Hz steps with the DA signals from the logic unit. The 2nd LO circuit provides a 61.44-MHz signal by multiplying the reference frequency (20.48 MHz).



1. Reference oscillation circuit and 2nd LO circuit

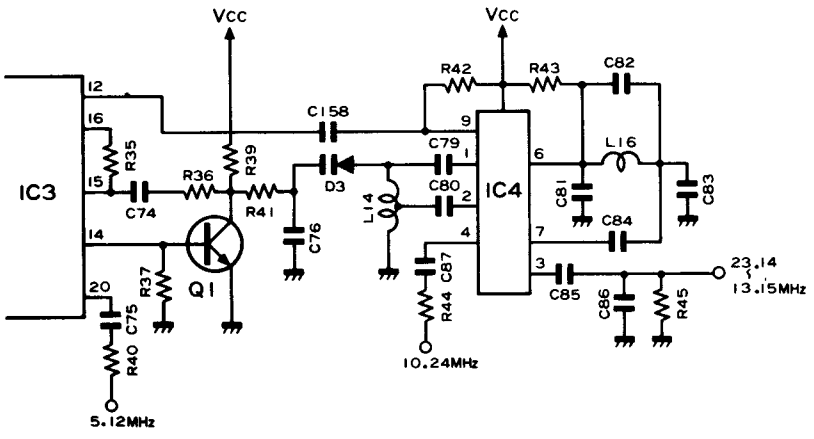
The output (20.48 MHz) obtained at the oscillation circuit (composed of X1 and Q12) is used as the 2nd LO and the Local Oscillator and reference frequency for the 3rd loop.
The oscillation output of Q12 is tripled at Q13, and 61.44-MHz 2nd LO output is obtained.
The oscillation output of Q12 also is fed to the Q11 buffer-amplifier and is supplied to IC6. Here there is a 2-stage 1/2-frequency divider, and the 10.24 MHz obtained at the first stage is output from pin 9 as LO for the 3rd loop; the 5.12 MHz obtained at the next stage is output from pin 5 as the reference frequency of the 1st loop and the 2nd loop.

2. 3rd loop

This loop is a mixed-down type PLL composed of IC3, IC4, Q1, etc.
IC4 has a built-in oscillator circuit, DBM and amplifier circuit.
The built-in oscillator circuit of IC4 is employed as the VCO, and one part of that output is fed to the DBM in the next stage.
The 10.24 MHz from IC6 is injected to pin 4, and mixed with the VCO output. The mixed-down signal is output from pin 6. This output passes through the low-pass filter composed of L16 and C81 ~ C83, and is then again fed to pin 7 to IC4. Then, after amplification by the amplifier circuit built into IC4, the signal is output from pin 9 and then fed to pin 12 of IC3.
The 13.15 ~ 23.14-MHz signal from pin 3 is fed to IC5, becoming the reference frequency of the 2nd loop.
IC3 is a multi-function IC which has a built-in programmable divider, fixed frequency divider, phase comparator, etc.
After signal input to pin 12 is 1/N frequency divided by N data from the logic unit, it is fed to the phase comparator.
The 5.12 MHz signal fed to pin 20 from IC6 is divided to 1/512, and the 10-kHz reference frequency is fed to the phase comparator.
The phase-difference pulses resulting from the two input signals are output from pin 16, and, after conversion to a DC voltage by the Q1 loop filter, are provided as the control voltage for D3 (varactor diode).
After the 5.12 MHz from IC6 is amplified, it is supplied from pin 21 to the 1st loop as the reference frequency.

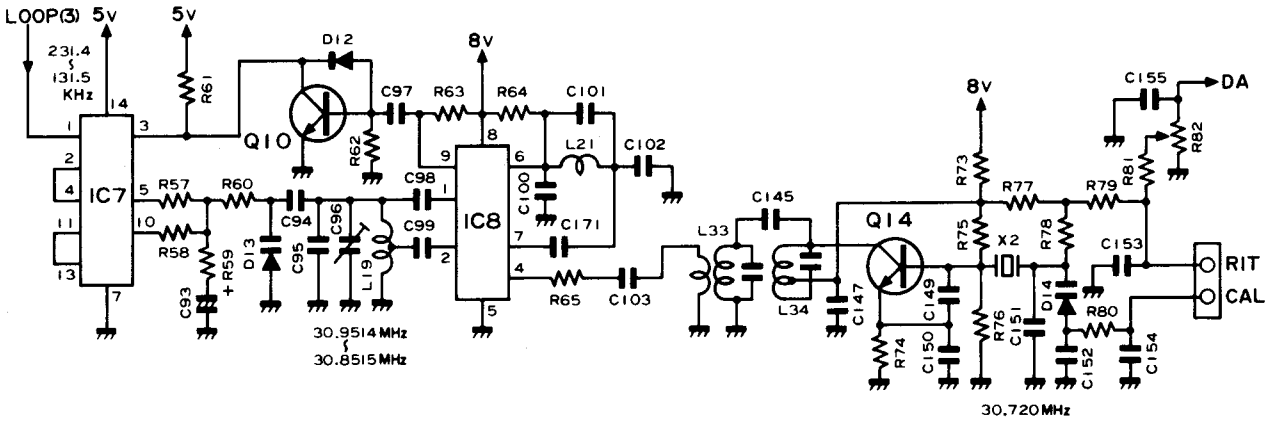
Relationship of 3rd loop PLL and oscillation frequency

Display frequency (kHz)	PLL N	Oscillation frequency (MHz)	Remarks
00.0	291	13.15	Oscillation frequency = 10.24 + 0.01 × N
00.1	292	13.16	
00.2	293	13.17	
01.0	301	13.25	N changes 1 for each 100-kHz change of display frequency.
02.0	311	13.35	
10.0	391	14.15	
20.0	491	15.15	
30.0	591	16.15	For information concerning the offset of the display frequency and the oscillation frequency in each mode, refer to the "Display unit" section.
90.0	1191	22.15	
99.0	1281	23.05	
99.9	1290	23.14	

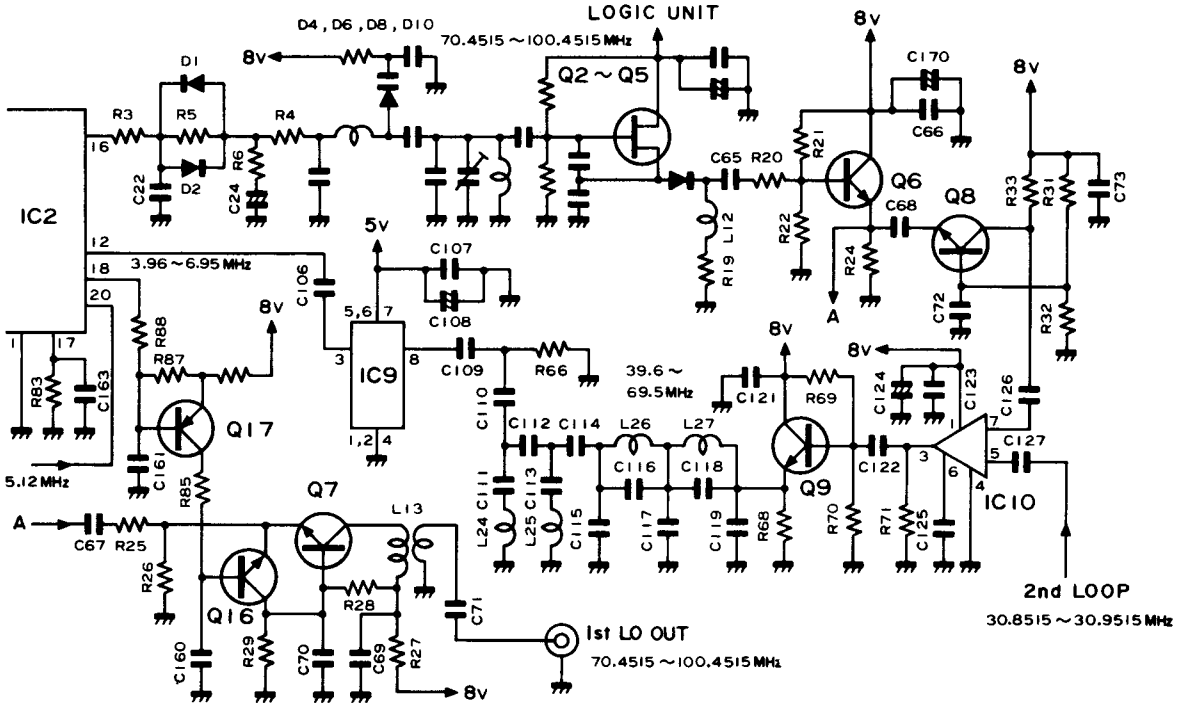


3. 2nd loop

This loop is a mixed-down type PLL loop composed of IC7, IC8, Q10 and Q14.
X2 and Q14 are an oscillation circuit for VXO (Variable Crystal Oscillator) use; control is by the DA signal from the logic unit and provides 10-Hz steps; RIT and CAL (frequency calibration), etc. are controlled by D14.
Because IC8 is the same as IC4 used in the 3rd loop, it has the same block configuration. The VCO is composed of the oscillator circuit built into this IC. Its output and the Q14 VXO output (30.72 MHz) signal are mixed at the DBM, and the mixed-down signal is output from pin 6.
This output passes through the low-pass filter composed of L21 and C100 ~ C102, and is then fed to pin 7 of IC8 again. Then, after amplification at the amplifier circuit in IC8, it is fed from pin 9 through Q10 to pin 3 of IC7.



IC7 is a phase comparator; the reference frequency (131.5 ~ 231.4 kHz) divided to 1/100 the 3rd loop output by IC5 is applied to pin 1.
Pulses produced by the phase-difference of the two signals injected to pin 3 and pin 1 are output from pin 5 and pin 10, pass through the loop filter composed of R57 ~ R59 and C93, and are provided as control voltage for D13.



4. 1st loop

This loop is a mixer/prescaler type PLL composed of IC2, IC9, IC10, Q2 ~ Q5, D1 ~ D11, etc.
Q2 ~ Q5 are VCOs which divide the entire band into four segments and obtain the 1st LO output; each VCO is switched by VCO SW data from the logic unit.
VCO output, after amplification at Q6 and Q8, is fed to IC10, and is mixed with the output frequency of the 2nd loop. The mixed signal is fed to pin 8 of IC9 through the BPF consisting of L24 ~ L27 and C110 ~ C119.
Here, after 1/10 frequency division, it is fed to pin 12 of IC2.
IC2 is the same type of IC as used for IC3 of the 3rd loop; the signal fed at pin 12 is frequency-divided to 1/N and fed to the internal phase comparator.
The 5.12 MHz input to pin 20 becomes the 10-kHz reference frequency at the internal 1/512 frequency divider, and is fed to the internal phase comparator.
The pulse produced by the phase difference of the two input signals is output from pin 16, and, after it is converted to a DC voltage by the loop filter consisting of R3 ~ R6, D1, D2, C22 and C24, it is provided to each varactor diode (D4, D6, D8 and D10) of the VCO as control voltage.
The VCO output is amplified at Q7, and then output from J3 as the 1st LO. Note that, although the reference frequency of the 1st loop is 10 kHz, the output from IC10 is frequency-divided to 1/10 at IC9; the result is a loop locked at 100 kHz.
For Q16 and Q17, when the frequency changes greatly, PLL output is stopped by the IC2 unlock-detection circuit for the period of the R83 and C163 time-constants.

Frequency (MHz)	PLL N	VCO	Oscillation frequency (MHz)	MIX output (MHz)	Remarks
0 ~ 7.9	396 ~ 475	a	70.4515 ~ 78.4514	39.6 ~ 47.5	Oscillation frequency = 2nd loop + 0.01 × N × 10 2 nd loop: 30.8515 ~ 30.9514 MHz N changes 1 for each 100-kHz change of display frequency.
8.0 ~ 14.9	476 ~ 545	b	78.4515 ~ 85.4514	47.6 ~ 54.5	
15.0 ~ 21.9	546 ~ 615	c	85.4515 ~ 92.4514	54.6 ~ 61.5	
22.0 ~ 29.9	616 ~ 695	d	92.4515 ~ 100.4514	61.6 ~ 69.5	

5-4 LOGIC UNIT

This unit controls the frequency, processes the band signals and mode signals, outputs data to the PLL, etc, and is designed for low power consumption and high speed operation by using a CMOS 4-bit CPU.

1. CPU

IC14 is the CPU, in a 42-pin plastic package.
Pin 1 and pin 42, CL_1 and CL_0, are the clock terminals for this CPU, oscillating about 400 kHz with a ceralock (ceramic oscillation unit). This CPU has 9 input/output ports, each sharing its own function.

A port 4-bit input
As shown in the matrix table, decodes E port output to expand input functions with time sharing.

B port 4-bit output
Used for band-pass filter switching.

D port 4-bit input/output
Used as input/output terminal for external remote-control.

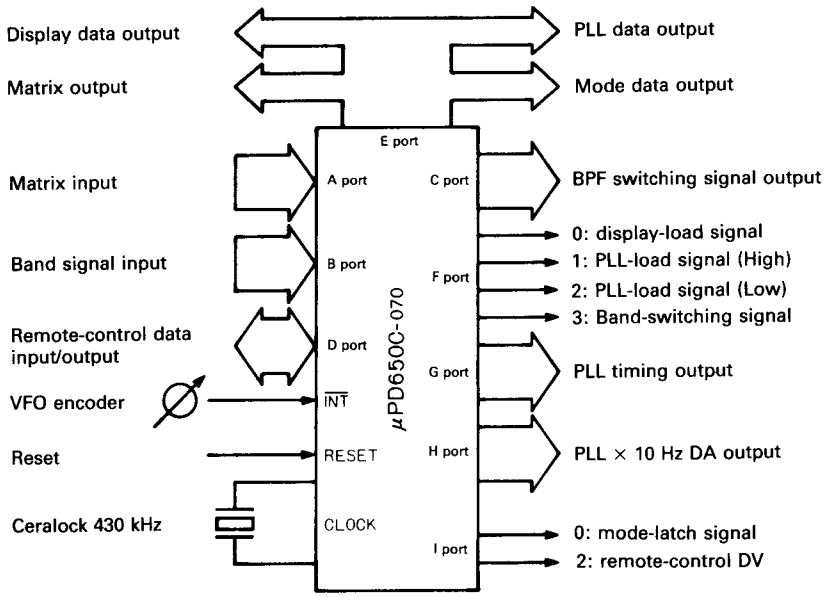
E port 4-bit output
Outputs various data as a general-purpose output terminal.

F port 4-bit output
F_0 ... Strobe signal output for display.
F_1 ... Load signal output for PLL above 100 kHz digit.
F_2 ... Load signal output for PLL below 100 kHz digit.
F_3 ... Relay-drive output

G port 4-bit output
PLL digit designating output

H port 4-bit output
PLL 10 Hz D/A converting output.

I port 2-bit output
I_0 ... Load signal for mode output
I_2 ... DV output for remote-control unit



2. Input matrix circuit

① $Q_0 \rightarrow A_0 \sim A_2$ (count 1 ~ 3)
Signals from the encoder are input to the CPU through these counters. Data to be added to or subtracted from the preset frequency of the CPU can be expressed in the range of 0 ~ 7.

Add/substract data	0	1	2	3	4	5	6	7
Count 1	0	1	0	1	0	1	0	1
Count 2	0	0	1	1	0	0	1	1
Count 3	0	0	0	0	1	1	1	1

② $Q_0 \rightarrow A_3$ (UP or DOWN)
Determines whether to add to (UP) or subtract from (DOWN) the frequency depending on the direction of the encoder rotation.
UP for H-level (with input) and DOWN for L-level (without input).

③ $Q_1 \rightarrow A_0$ (A ◊ B)
By pressing the A ◊ B switch, the frequency of the VFO A is transferred to the VFO B. The content of VFO A is retained.
When the FUNC switch is ON ($Q_2 \rightarrow A_0$), the opposite function (B ◊ A) will occur.

④ $Q_1 \rightarrow A_1 \sim A_2$ (BAND UP or DOWN)
Change-over of one amateur band to another where ham band operation is designated; UP/DOWN of every 1 MHz where general coverage operation is designated.
This operation takes place only when either $Q_1 \rightarrow A_1$ or $Q_1 \rightarrow A_2$ becomes H-level.

⑤ $Q_1 \rightarrow A_3$ (POWER ON)
Becomes H-level when power ON, indicating normal operation. When OFF, becomes L-level if there is a back-up power supply; original data will remain the same.

⑥ $Q_2 \rightarrow A_0$ (FUNCTION)
When this line is H-level due to operation of the FUNC switch, the CW, SSB and A ◊ B switches perform their secondary function respectively. When any other switch has been depressed, this function is cleared and this line becomes L-level.

⑦ $Q_2 \rightarrow A_1$ (REMOTE CONT. IN)
Becomes H-level when remote-control unit is connected; VFO A, VFO B and HAM/GENE switches on the set become inoperative.

⑧ $Q_3 \rightarrow A_0$ (VFO A or B)
When this line is L-level, VFO A is selected.
When this line is H-level, VFO B is selected.

⑨ $Q_3 \rightarrow A_2 \sim A_3$ (RT/DBC)
Used as remote-control unit status.

⑩ $Q_4 \rightarrow A_0$ (SSB MODE)
Designates the SSB mode. USB is usually selected automatically on 10 MHz or a higher band, and LSB on 9 MHz or a lower band. However, when $Q_2 \rightarrow A_0$ (FUNC) is H-level, USB and LSB are reversed at every input. This function is cleared when the BAND UP or DOWN signal is input.

⑪ $Q_4 \rightarrow A_1$ (CW MODE)
Designates the CW mode; becomes CW-N mode when $Q_2 \rightarrow A_0$ (FUNC) is H-level.

⑫ $Q_4 \rightarrow A_2$ (RTTY MODE)
Designates the RTTY mode.

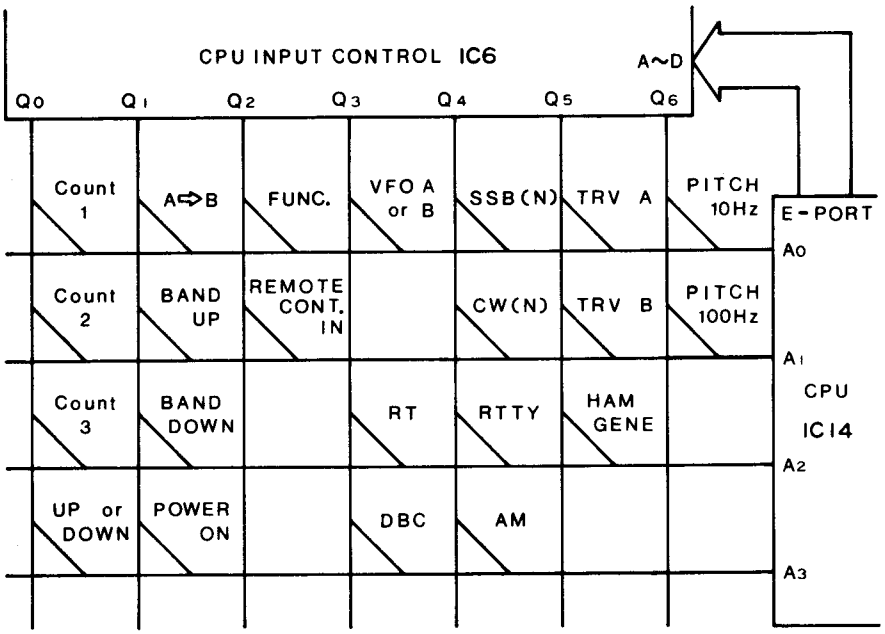
⑬ $Q_4 \rightarrow A_3$ (AM MODE)
Designates the AM mode.

⑭ $Q_5 \rightarrow A_0 \sim A_1$ (TRV A/B)
When a transverter signal is input through pin 11 (TRV B) and pin 10 (TRV A) of the ACC socket, the set receives a converted signal from a VHF/UHF transverter or converter. When a transverter signal is input however, the result is general coverage, regardless of the setting of the HAM/GENE select switch.

TRV A	TRV B	Object frequency	Input/output frequency	Remarks
L	L	Ordinany condition	0 ~ 30 MHz	10-MHz digit display "2" is extinguished.
H	L	50 MHz	20 ~ 23 MHz	
L	H	144 MHz	24 ~ 25 MHz	
H	H	430 MHz	20 ~ 29 MHz	

⑮ $Q_5 \rightarrow A_2$ (HAM or GENE)
When input is L-level by the HAM/GENE select switch, the ham band mode is selected; when input is H-level, the general coverage mode is selected.

⑯ $Q_6 \rightarrow A_0 \sim A_1$ (10 Hz/100 Hz STEP)
Designates frequency resolution: 10-Hz step when $Q_6 \rightarrow A_0$ is H-level, 100-Hz step when $Q_6 \rightarrow A_1$ is H-level.
When the TS switch is switched ON, both become L-level, and 1-kHz step is selected.



3. Sensor signal processing circuit

The two signals from the encoder are input to SENS A and SENS B; each is subjected to waveform shaping at the Schmitt trigger (consisting of two IC9 inverters); they are differentiated at C34, C35, R44 and R45, and are input to pin 8 and pin 9 of IC3.

The sensor outputs 50 pulses per revolution while pin 10 of IC3 outputs both leading edge and trailing edge, resulting in an output of 100 pulses per revolution.

IC13 is a 3-bit counter which can count up to a maximum of 7 pulses, and serves as a timing buffer between the encoder and the display in relation to reading by the CPU.

If there is any output at the IC13 counter, the IC12 (diode array) output becomes H-level, and it is input to pin 5 of IC3, inverted, and input to the INT terminal of IC14 at L-level.

This terminal is the interrupt terminal; it stops other operations and gives priority to sensor processing.

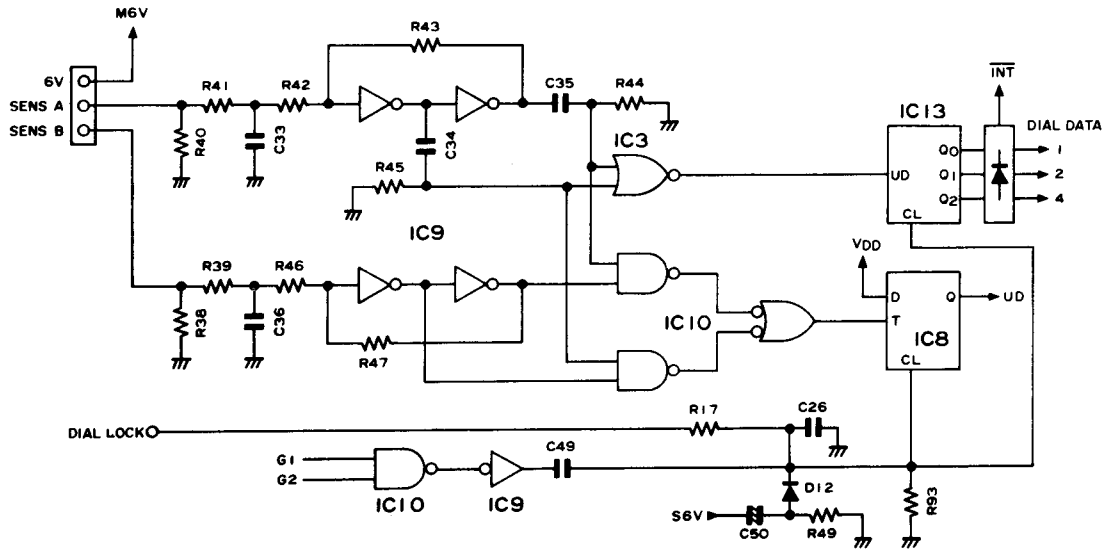
When the interrupt routine is started, IC13 counter data and up/down data from IC8 (pin 13) are read out at IC11 switching gate by digit 0 timing, and all data relative to sensor are performed.

Immediately after sensor data is read, pulses are sent to the G1 and G3 output ports; after these pulses pass through pins 11 ~ 13 of IC10 and pin 9 and pin 8 of IC9, their width is further narrowed by C49 and R93, and IC13 and IC8-B are cleared, awaiting the next sensor input.

The IC8 flip-flops (pins 9 ~ 11 and 13) hold only the UP signals; DOWN signals are not input.

IC6 is the decoder for the matrix; it decodes signals from E output and distributes to digit 0 to 9 signals.

The dial lock signal passes through J3 from the LOCK switch on the front panel, and locks by the reset line (CL) of IC8-B and IC13, becoming H-level.



4. Band signals

When the power switch of this unit is switched ON, the band-switching signal from port F_3 is counted by the IC22 BCD UP counter and that 4-bit count output is read in as the band signal at the B port of the CPU.
This signal is compared with the original band signal within the CPU, and pulses are sent to the F_3 port until there is coincidence.
A part of this signal buffered at IC5 is fed to Q1 of the display unit, and the mode indication is extinguished until the band signal is acknowledged by the CPU.
The 4-bit count-output from IC22 passes through BA1 ~ BA4 of P5, and is supplied to the optional LDA unit.
Note that the band signals relative to each frequency are as follows.

Frequency (MHz)	Band signal (4 bit)	B_0	B_1	B_2	B_3
0 ~ 1.999	1	1	0	0	0
2.0 ~ 3.999	2	0	1	0	0
4.0 ~ 7.999	3	1	1	0	0
8.0 ~ 10.999	8	0	0	0	1
11.0 ~ 14.999	4	0	0	1	0
15.0 ~ 21.999	5	1	0	1	0
22.0 ~ 29.999	6	0	1	1	0

5. Band-pass filter and VCO switching signal

Band-pass filter switching signals corresponding to display output signals of the CPU are output from C_0 ~ C_3 terminals. IC15 is the decoder for these 4-bit signals. These signals are multiplexed into signals, 0 ~ 9, and output to the RF unit and PLL unit through buffers, IC20 and IC21, for use as band-pass filter switching and VCO switching signals.
The band-pass filter switching signal for each frequency is as follows:

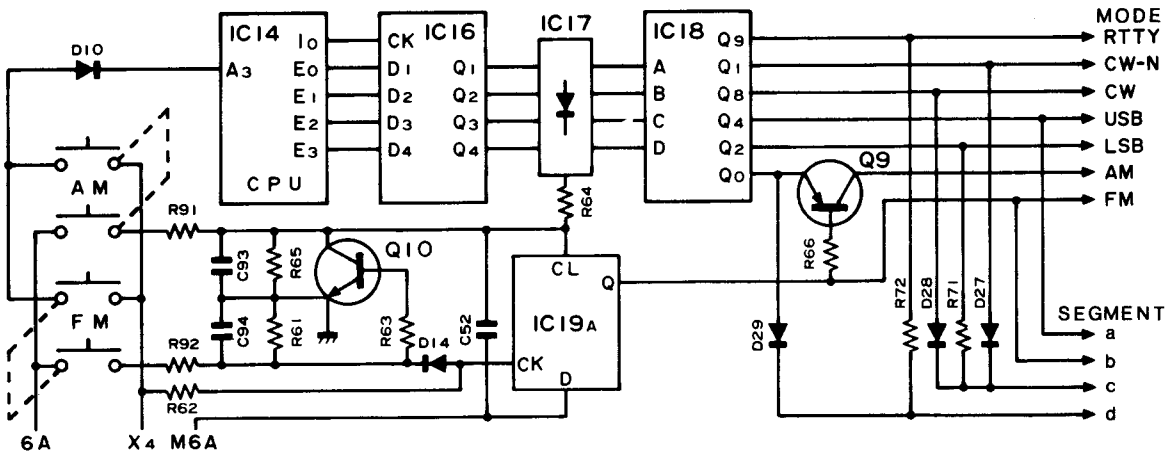
Frequency (MHz)	Signal (4-bit)		C_0	C_1	C_2	C_3
	BPF	VCO				
0 ~ 1.599	0	V_0	0	0	0	0
1.6 ~ 1.999	1		1	0	0	0
2.0 ~ 2.999	2		0	1	0	0
3.0 ~ 4.999	3		1	1	0	0
5.0 ~ 7.999	4		0	0	1	0
8.0 ~ 10.999	5	V_1	1	0	1	0
11.0 ~ 14.999	6		0	1	1	0
15.0 ~ 21.999	7	V_2	1	1	1	0
22.0 ~ 27.999	8	V_3	0	0	0	1
28.0 ~ 29.999	9		1	0	0	1

6. Mode signal circuit

Mode signals are output from the CPU's E port, and are latched at IC16 by the load signals from the I_O terminal. IC18 is the decoder for this operation, where the signal is decoded into each mode signal and output through buffers IC5 and IC21. Note that, because there is no program in the CPU, FM mode signals are produced by IC19, Q9, Q10, etc.
The mode signals also produce segment signals a ~ d to extinguish those segments unnecessary for display of the mode by the display unit.

The mode signals relative to each mode are as shown below.

Mode	Mode signal (4-bit)	E_0	E_1	E_2	E_3
AM (FM)	0	0	0	0	0
CW-N	1	1	0	0	0
LSB	2	0	1	0	0
USB	4	0	0	1	0
CW	8	0	0	0	1
RTTY	9	1	0	0	1



7. PLL data output circuit

The output data are separated into higher digits than 100 kHz and the lower digits, and fed to each programmable divider of the loop. There are three kinds of signal output to the PLL: numerical data, digit designation data and load enable signal.

Numerical data are output from the general purpose E port and are buffered by IC4.

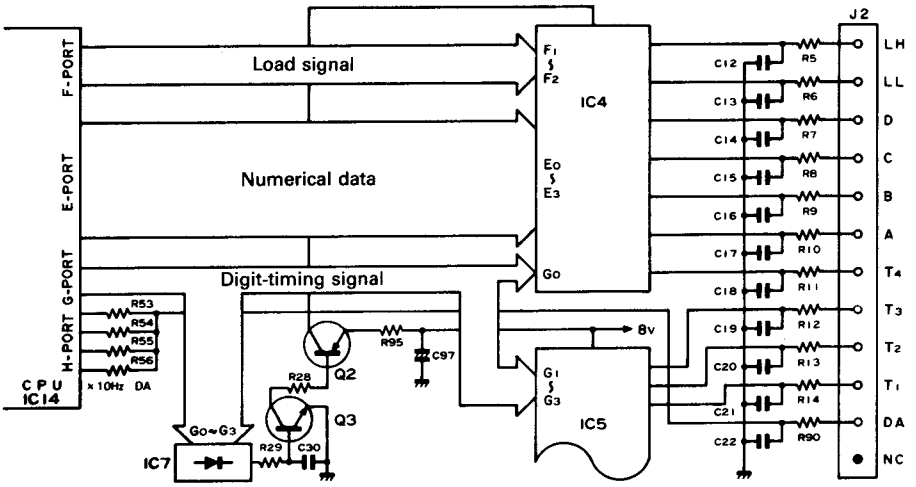
IC4 also functions as a gate to feed these data to the PLL only at the moment the digit designation data are emitted from the G port of the CPU.

One of the digit designation data signals passes through IC7, OR gate, switches Q2, Q3 and the power voltage of IC4, and controls the gate function. Load signals emitted from F_2 and F_1 terminals are fed to the PLL through IC4, buffer/gate. IC5 is the buffer for the digit designation data from G port, and feeds them to the PLL.

The 10-Hz digit data are output from the H port, and, after conversion to an analog value (DC voltage) at the D/A converter, R53 ~ R56, pass through J2 and are supplied to the PLL unit.

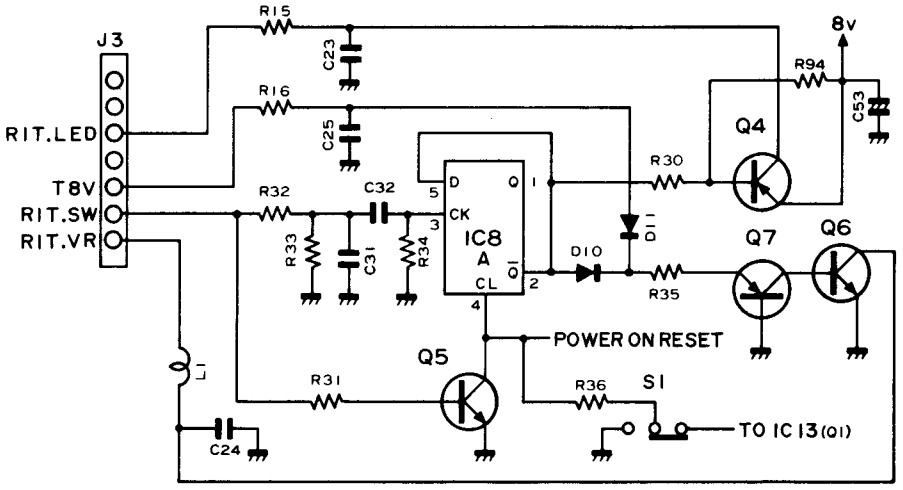
HIGH and LOW load signals N are as described below.

High N-DATA × 10MHz, × 1MHz, × 100KHz			Low N-DATA × 10KHz, × 1KHz, × 100Hz		
Frequency	CPU-N	PLL-N	Frequency	CPU-N	PLL-N
0MHz	289	396	0Hz	184	291
0.1MHz	290	397	100Hz	185	292
1MHz	299	406	200Hz	186	293
10MHz	389	496	1KHz	194	301
20MHz	389	596	2KHz	204	311
29.9MHz	588	695	10KHz	284	391
Remarks			20KHz	384	491
CPU High N = 100KHz × 289			30KHz	484	591
PLL High N = CPU High N + 107			90KHz	1084	1191
CPU Low N = 100Hz ~ 10KHz + 184			99KHz	1174	1281
PLL Low N = CPU Low N + 107			99.9KHz	1183	1290



8. RIT ON/OFF circuit

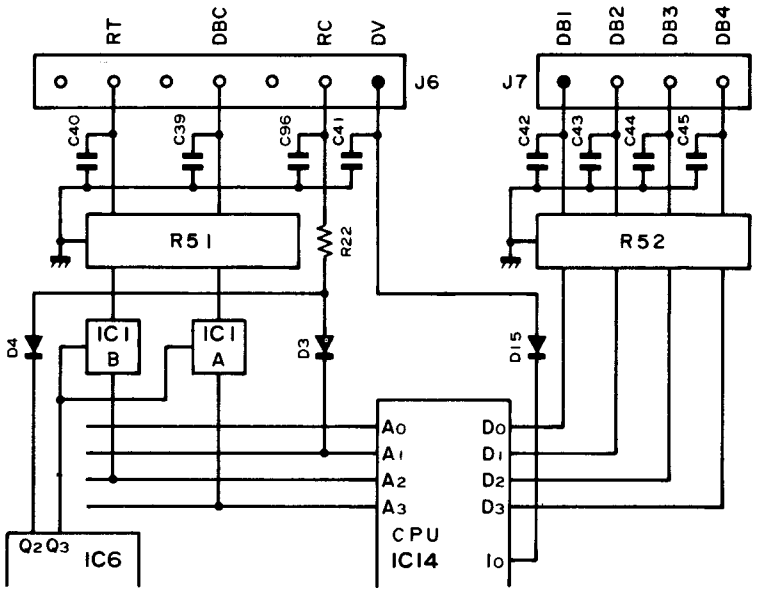
The RIT SW signal of J2 is passed through the chattering absorbing circuit (composed of R32 ~ R34, C31 and C32), and then fed to the IC8A flip-flop. Its Q output and T8V are fed to the OR gate, consisting of D10 and D11, and that output switches Q7 and Q6, resulting in RIT ON/OFF.
When the tuning control is turned, the IC13 Q1 output signal passed through S1 and R36 is fed to the IC8A CL terminal, and RIT is turned OFF.
R31 and Q5 function to stop this operation while the RIT switch is depressed. IC8A Q output switches Q4 and illuminates the RIT LED.



9. Other circuits

(a) Remote control bus circuit

The RC signal from J6 is fed to A_1 input terminal of the CPU through the AND gate consisting of R22, D3 and D4. The RC signal is only fed to the CPU when IC6 Q2 is H-level. This input causes remote control operation. The input/output data of the remote control is transferred on the bus line DB1 ~ DB4. Control signals RT and DBC, which control that input/output, are input from the J6 terminals, and switched at A and B of IC1, switching gates synchronizing with Q3 output of IC6, and are then fed to the CPU.
Control output DV is output from I_2 port, passes through D15, and is output to the J6 DV terminal.



(b) Transverter control circuit

TTL level signals input to TRV A and TRV B terminals of J6 are fed to two switching gates (C and D of IC1) synchronized to Q5 output of IC6, and fed to the CPU.

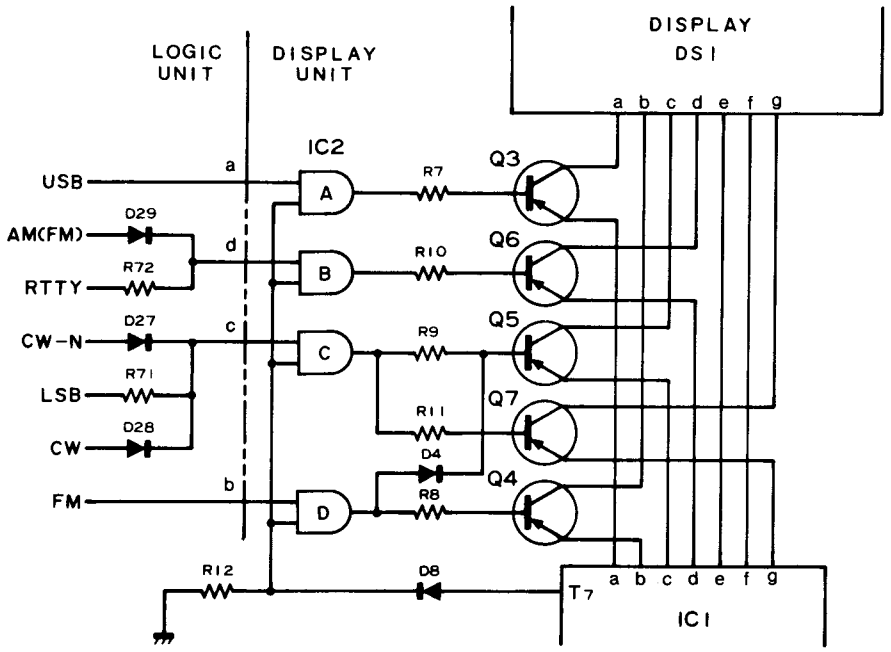
(c) Reset circuit

The CPU reset circuit is composed of Q8, R58 ~ R60 and C51. It functions to assure activation when the CPU power supply is switched ON.

(d) Display unit

IC1 is a seven-segment display IC capable of displaying 8 digits, with latch buffers, to provide a dynamic illumination display with these data in sequence. C18 is a clock timing capacitor, and IC1 outputs $T_0 \sim T_7$ signals in sequence by means of the clock oscillator in the IC1. The dynamic illumination display is made by outputting 7-segment data, a ~ g synchronized to $T_0 \sim T_7$ signals.
To display a frequency and mode, data are input to $S_0 \sim S_3$ terminals, the load signal to CTL terminal and these are repeated eight times until inputting in full digits is completed.
The circuit composed of three AND gates of IC2 and Q3 ~ Q7 is used to display those letters which are not available in the characters prepared in expressing operating modes, as follows:

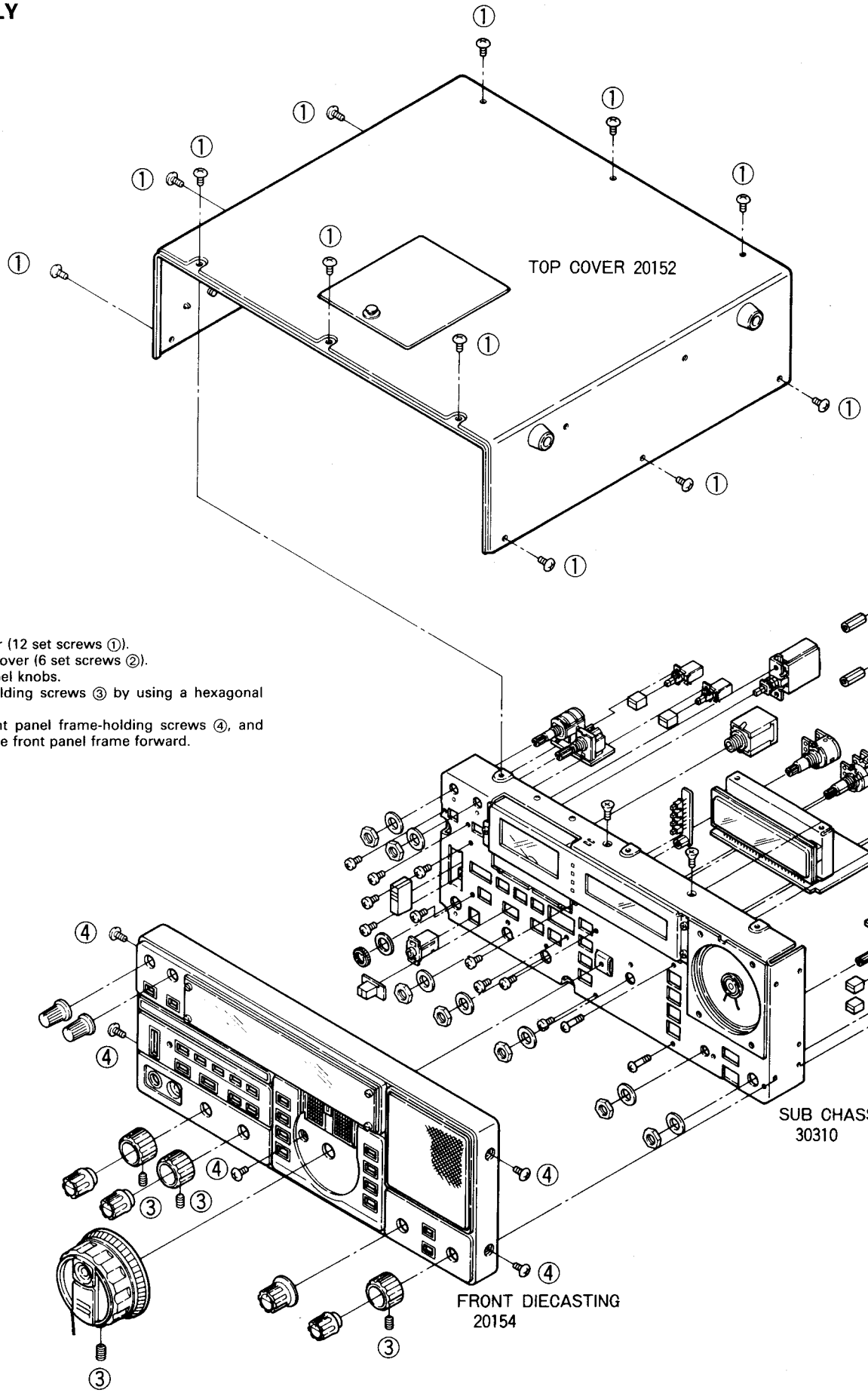
Mode	Display	Character	Unused segment
USB	U	0	a
LSB	L	b	c, g
CW	C	6	c, g
AM	A	8	d
RTTY	r	c	d
FM	F	8	b,c,d



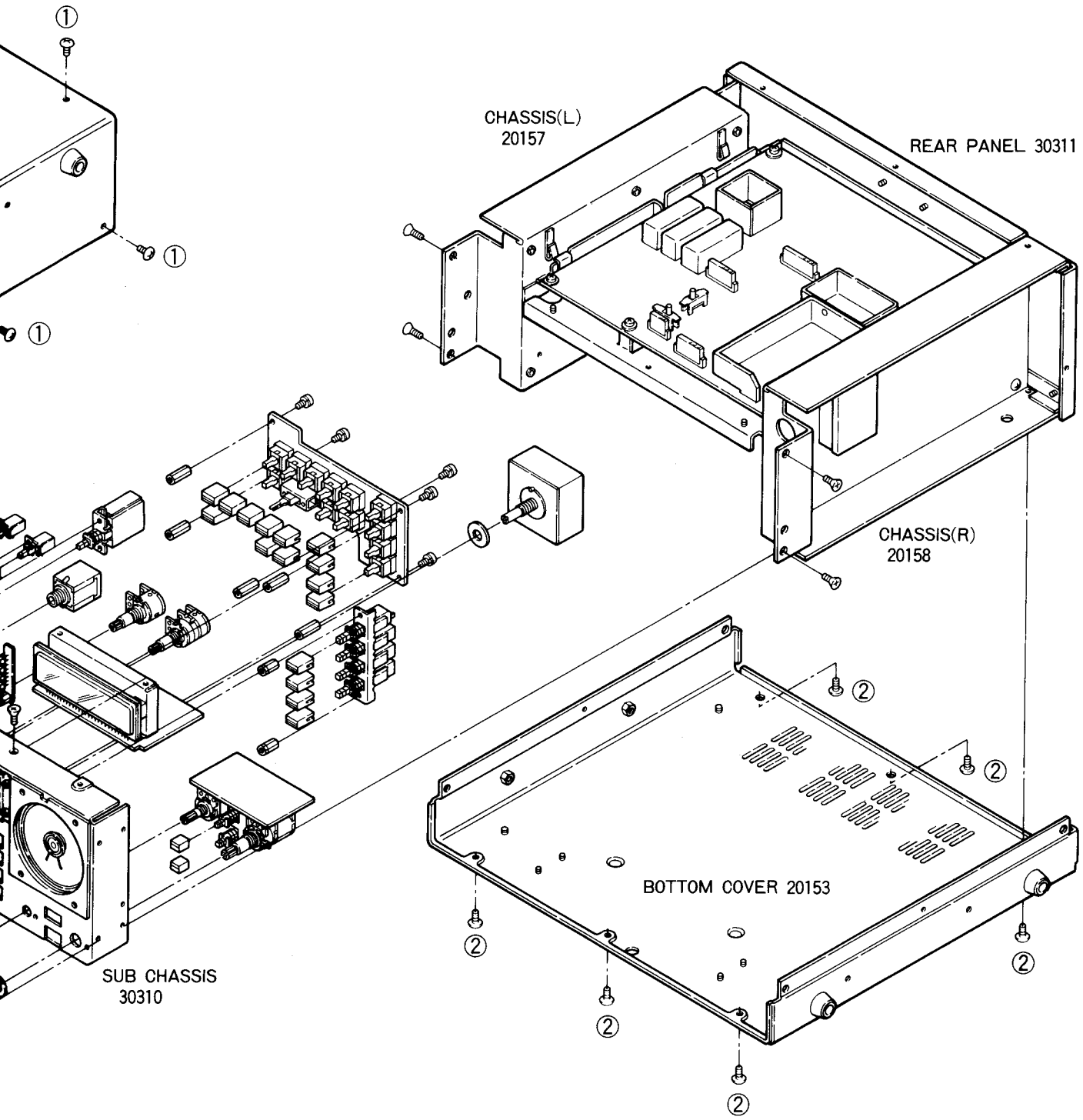
The four AND gates (IC2A ~ D) are controlled by the timing signals (a ~ d) from the logic unit and T_7 of IC1.
Q2 is controlled by the TRV D signal during transverter input, 10-MHz digit indication is erased, and Q1 extinguishes the mode indication, by the RC signal from the logic unit, until the band signal is acknowledged within the CPU.
IC3 is for display; it is a DC-DC converter (−10V power supply). Display tube heater voltage is from H output; negative voltage for display is output at −14V and supplied. The −10V is output from J1 to the negative power supply necessary at each part.

SECTION 6 DISASSEMBLY

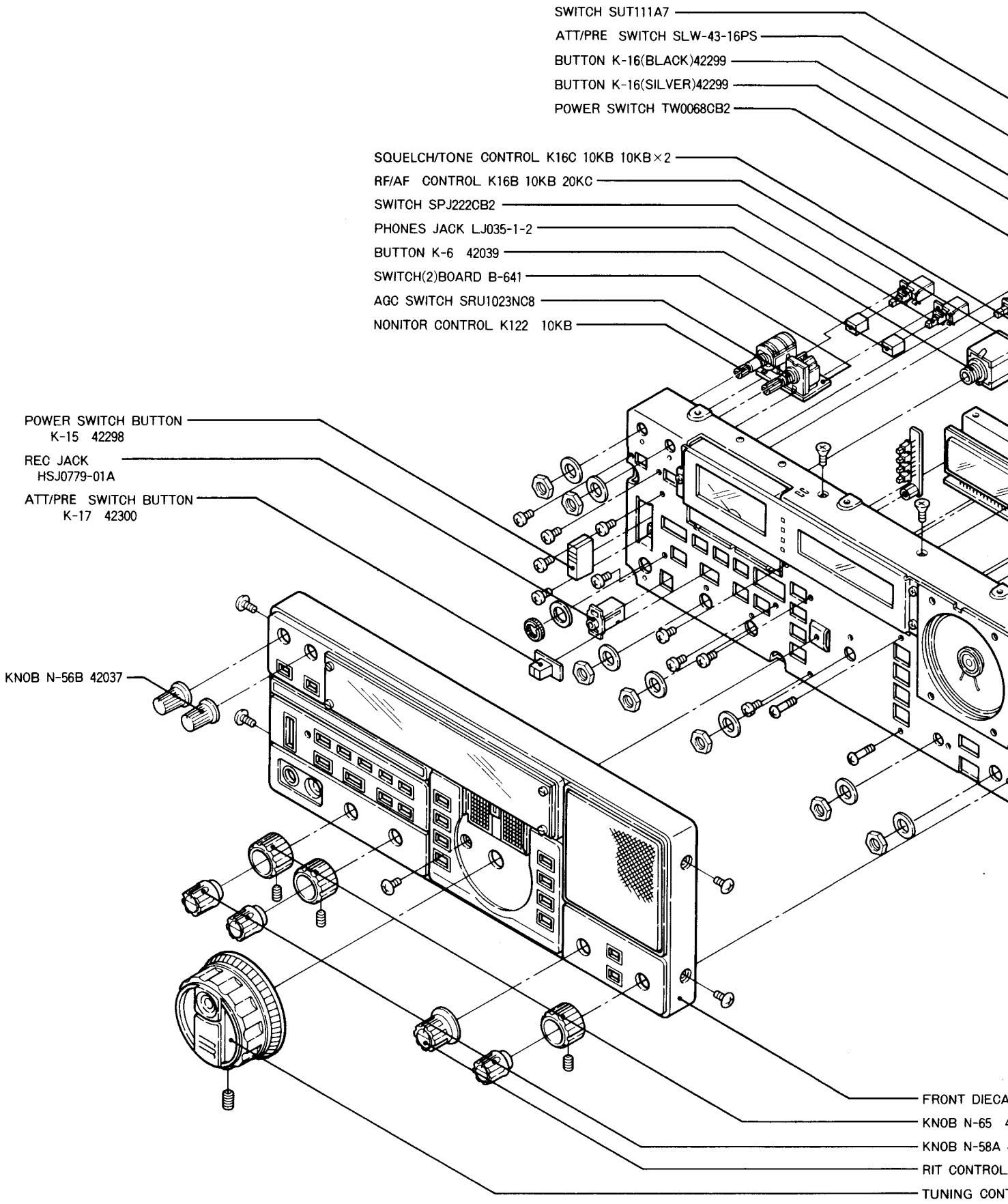
6-1 DISASSEMBLY

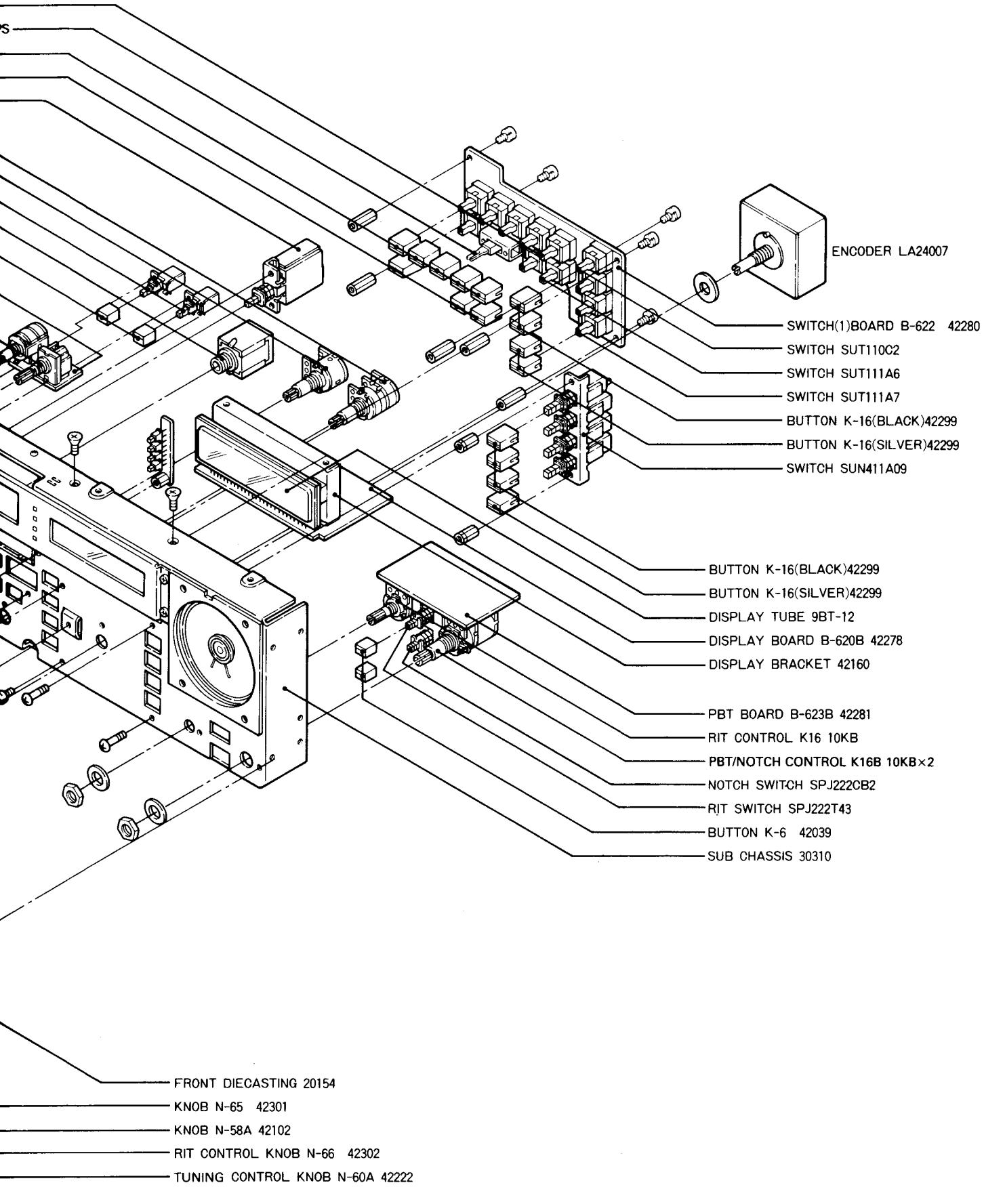


1. Remove the top cover (12 set screws ①).
2. Remove the bottom cover (6 set screws ②).
3. Remove the front panel knobs.
   (Remove the four holding screws ③ by using a hexagonal wrench.)
4. Remove the five front panel frame-holding screws ④, and then remove the entire front panel frame forward.

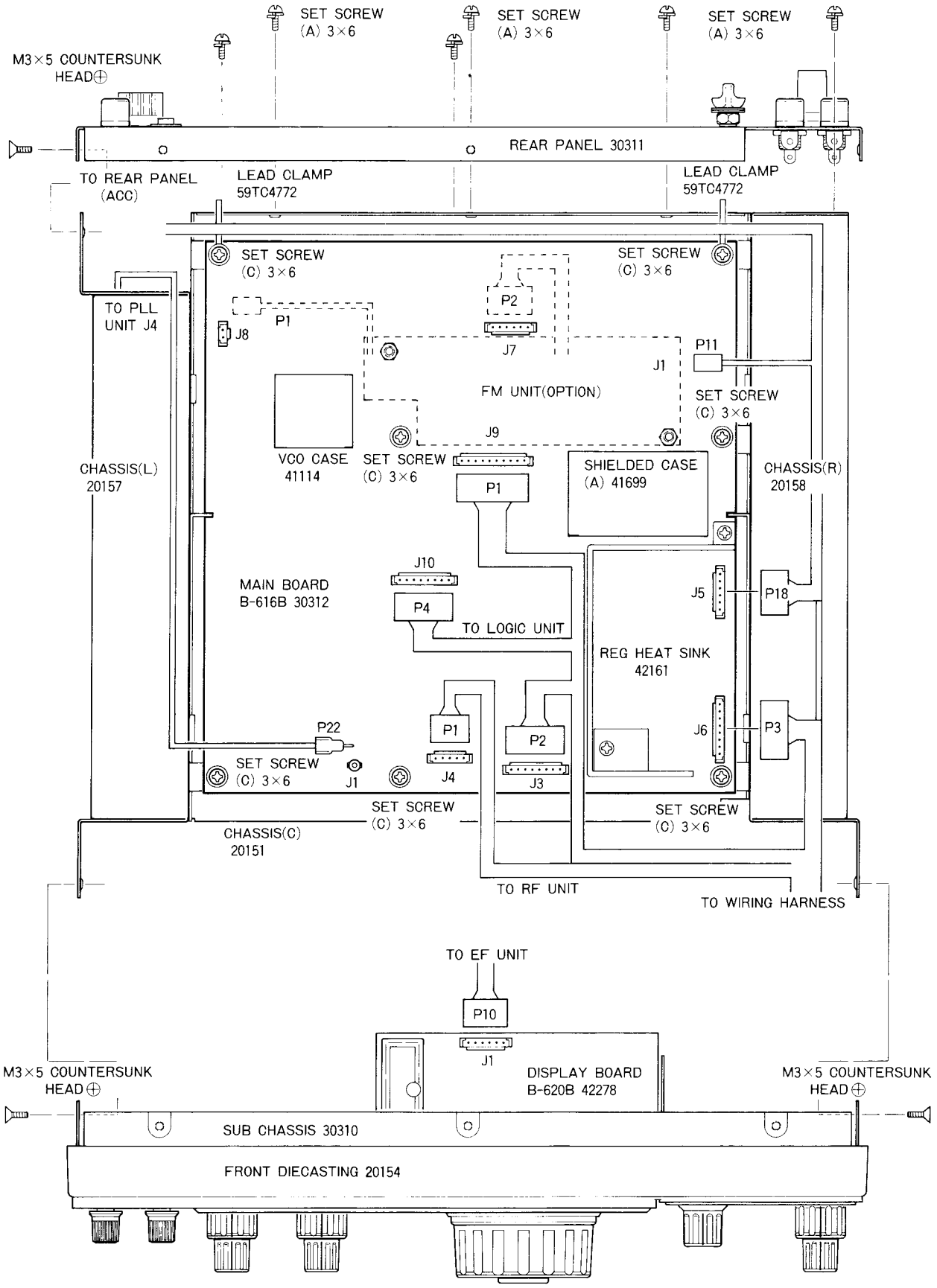

①
①
①
CHASSIS(L)
20157
REAR PANEL 30311
CHASSIS(R)
20158
②
②
②
②
②
BOTTOM COVER 20153
SUB CHASSIS
30310

6-2 FRONT PANEL PARTS IDENTIFICATION

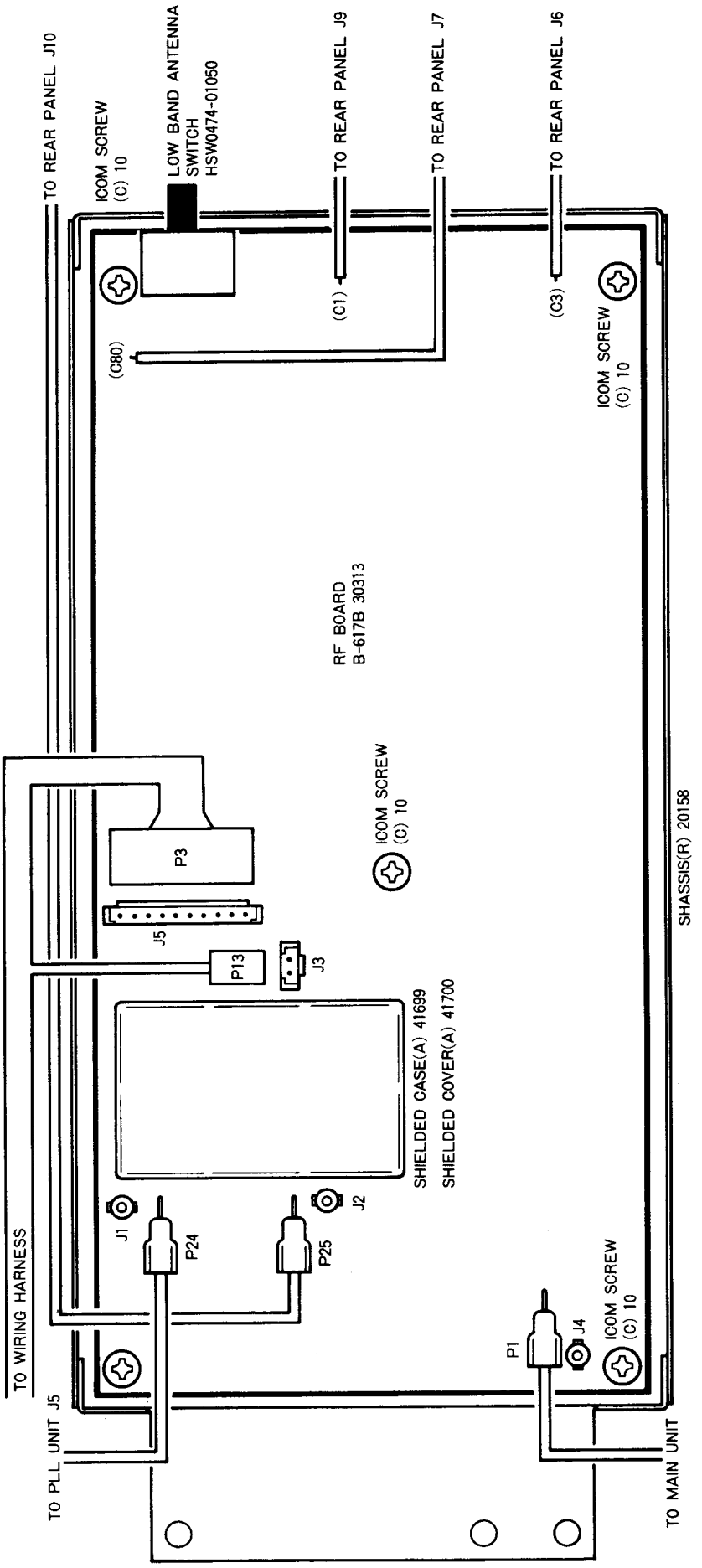



ENCODER LA24007
SWITCH(1)BOARD B-622 42280
SWITCH SUT110C2
SWITCH SUT111A6
SWITCH SUT111A7
BUTTON K-16(BLACK)42299
BUTTON K-16(SILVER)42299
SWITCH SUN411A09
BUTTON K-16(BLACK)42299
BUTTON K-16(SILVER)42299
DISPLAY TUBE 9BT-12
DISPLAY BOARD B-620B 42278
DISPLAY BRACKET 42160
PBT BOARD B-623B 42281
RIT CONTROL K16 10KB
PBT/NOTCH CONTROL K16B 10KB×2
NOTCH SWITCH SPJ222CB2
RIT SWITCH SPJ222T43
BUTTON K-6 42039
SUB CHASSIS 30310
FRONT DIECASTING 20154
KNOB N-65 42301
KNOB N-58A 42102
RIT CONTROL KNOB N-66 42302
TUNING CONTROL KNOB N-60A 42222

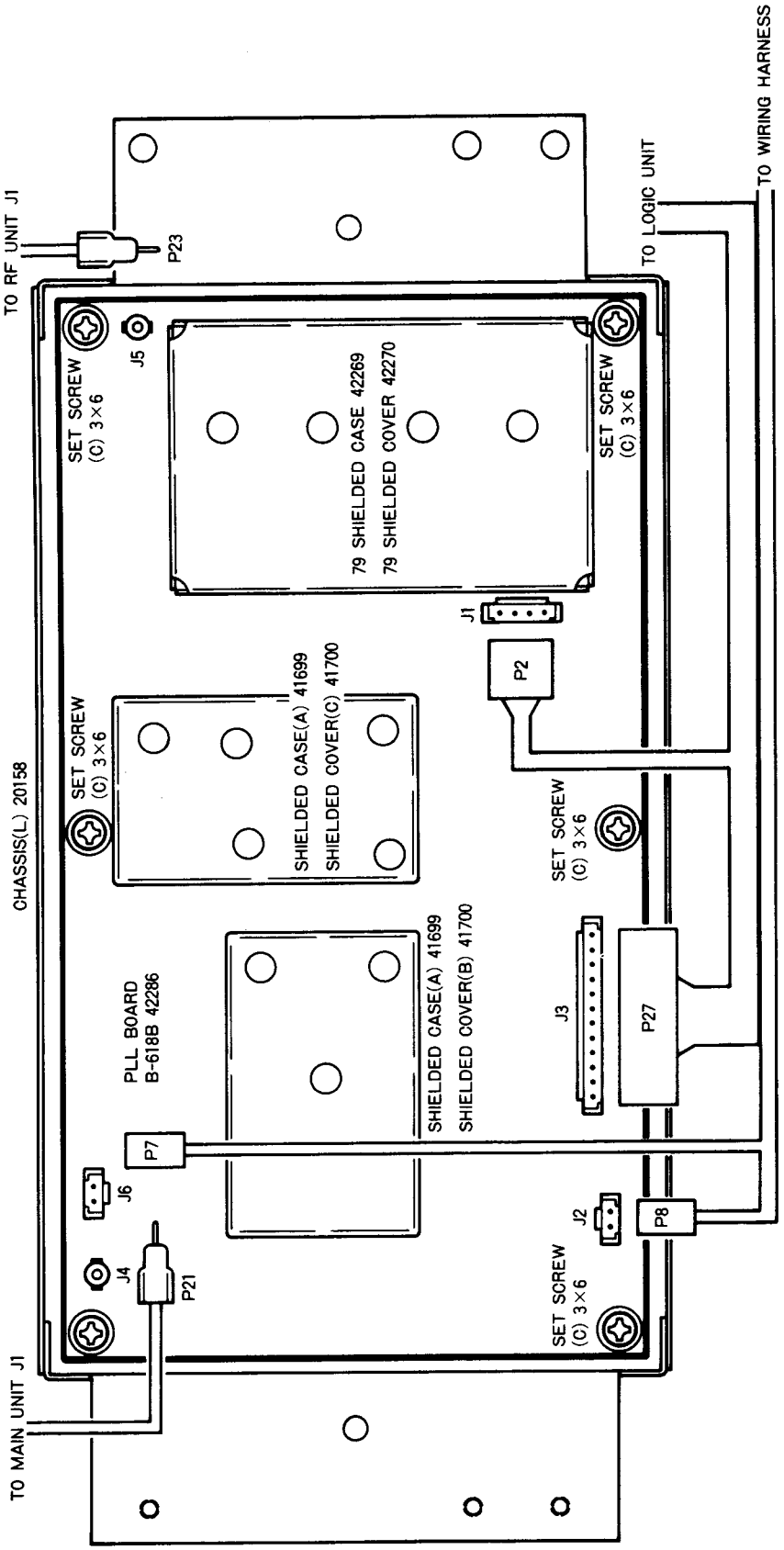
6-3 MAIN UNIT CONNECTOR CONNECTIONS



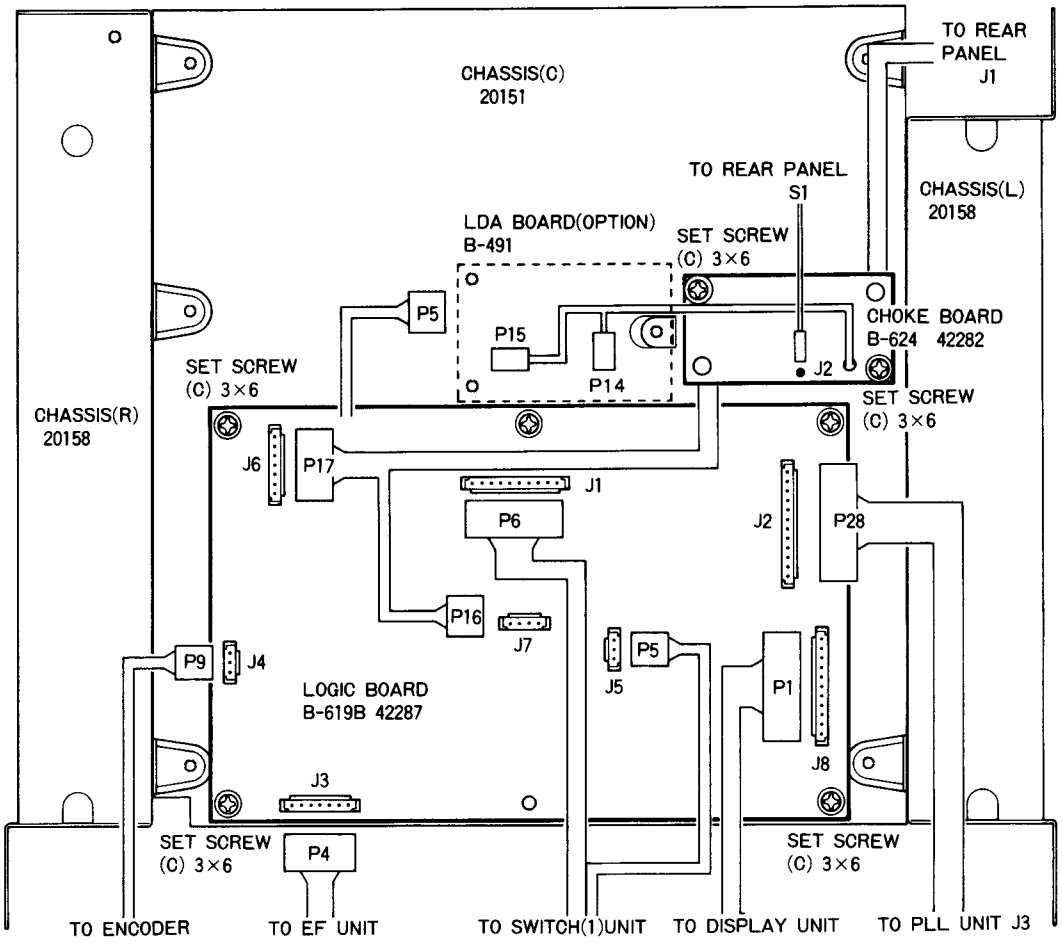
6-4 RF UNIT CONNECTOR CONNECTIONS



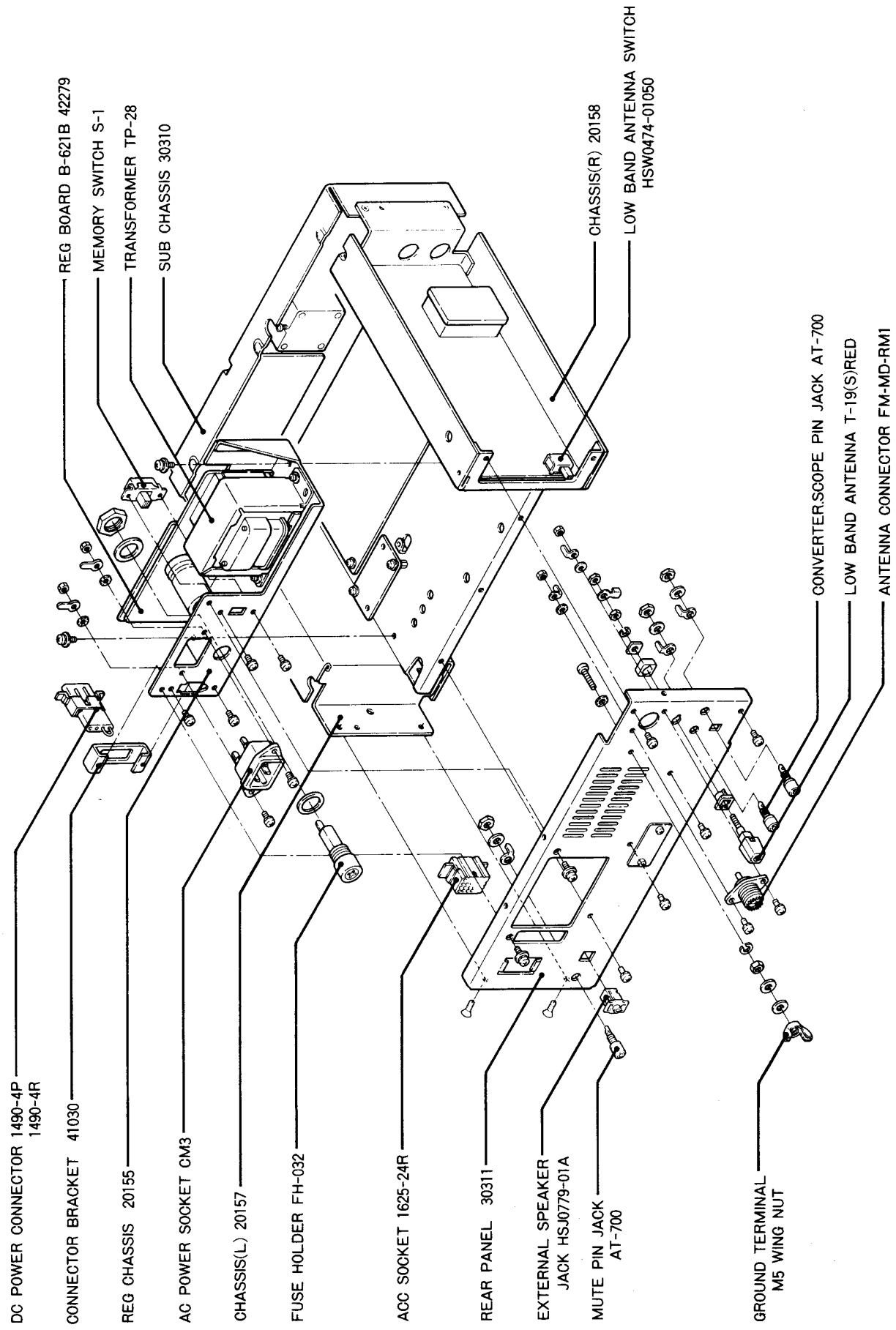
6-5 PLL UNIT CONNECTOR CONNECTIONS



6-6 LOGIC UNIT CONNECTOR CONNECTIONS



6-7 REAR PANEL PARTS IDENTIFICATION

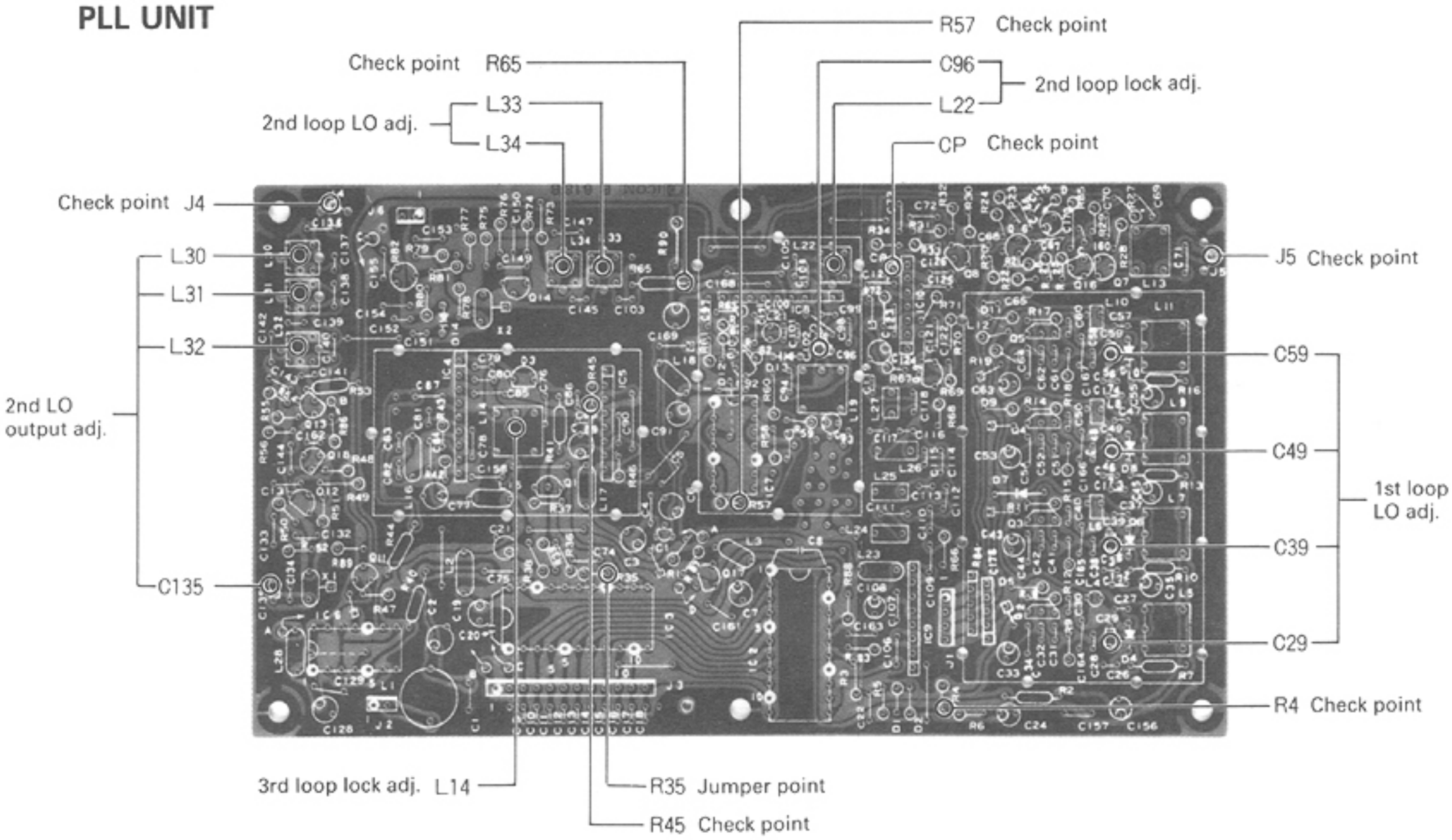


SECTION 7 ADJUSTMENTS

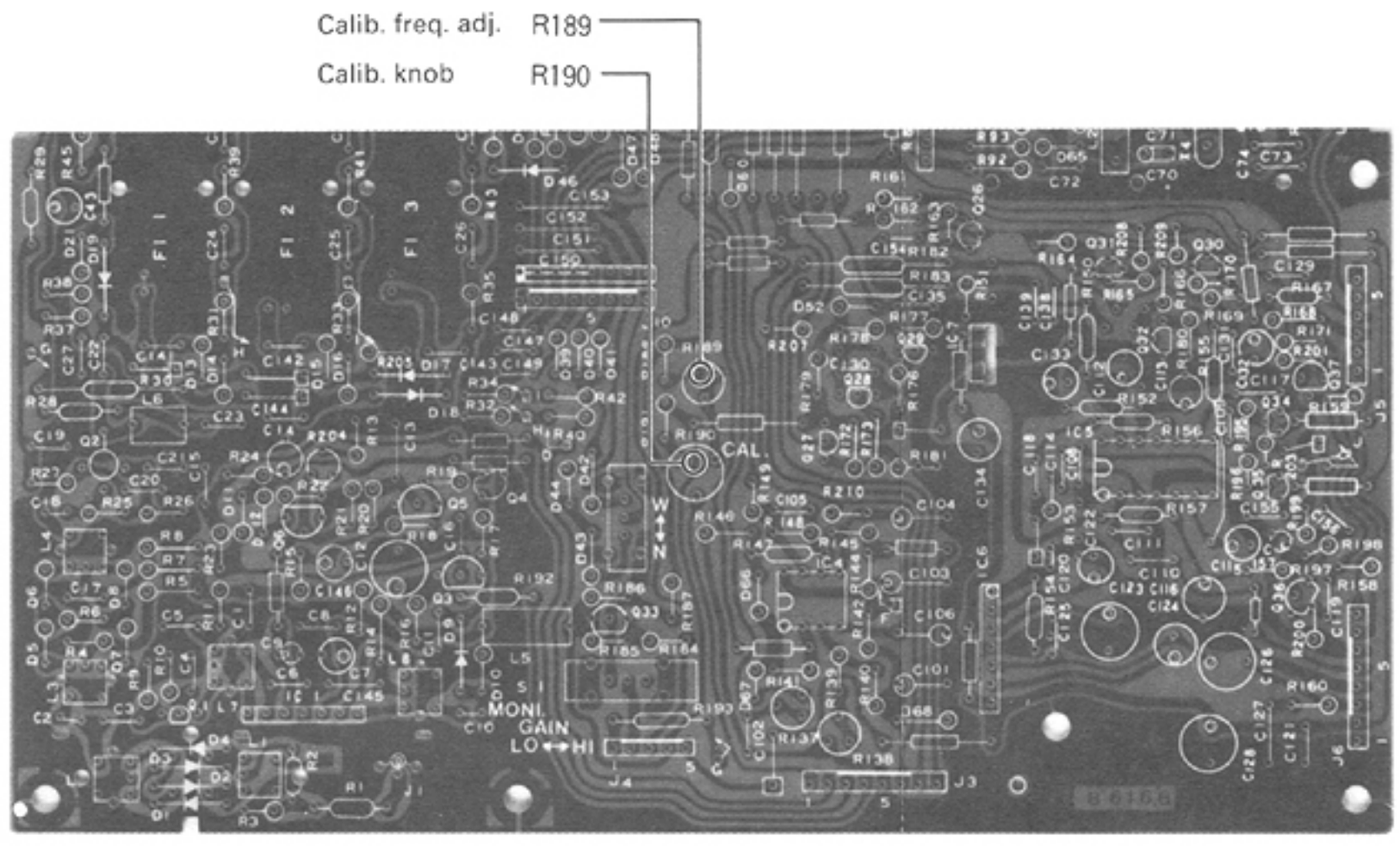
7-1 PLL ADJUSTMENT

Adjustment item		Conditions for adjustment	Unit	Measurement location	Adjustment value	Unit	Adjustment location
2nd LO output	1.	• Mode: any • Display frequency: any • RIT: OFF	PLL	Connect RF voltmeter to J4.	Adjust output to maximum.	PLL	L30 ~ L32
	2.			Connect frequency counter to J4.	61.4400 MHz		C135
3rd loop lock	1.	• Mode: any • Display frequency: any; shunt R35 to ground.	PLL	Connect frequency counter to R45.	24.300 MHz	PLL	L14
	2.	• Mode: USB • Display frequency: 15.9984 MHz; disconnect R35-to-ground jumper.			23.140 MHz		Verification
	3.	• Display frequency: 15.9985 MHz			13.150 MHz		
2nd loop LO ⓐ Calibration frequency ⓑ D/A frequency for 10 Hz ⓒ RIT frequency	1.	• Mode: USB • Display frequency: 15.9985 MHz	PLL	Connect RF voltmeter to R65 (IC8 pin 4 side)	Adjust output to maximum.	PLL	L33, L34
	2.	• CAL. (main unit/ R190): center		Connect frequency counter to R65 (IC8 pin 4 side).	30.72000 MHz	MAIN	R189
	3.	• Step: 10 Hz Decrease frequency 10 Hz, but do not change display frequency.			30.72009 MHz	PLL	R82
	4.	• Display frequency: 15.1000 MHz • Step: 100 Hz • RIT: center ON			30.72000 MHz	EF	R10
2nd loop lock	1.	• Mode: USB • Display frequency: 15.9985 MHz	PLL	Connect DC voltmeter to R57.	1V	PLL	C96
	2.	• Display frequency: 15.9984 MHz			1.5 ~ 1.8V		Verification
		Note: Adjustments 1 and 2 must be made with the shield case for VCO covered.					
	3.	• Mode: LSB • Display frequency: 0.0015 MHz	PLL	Connect RF voltmeter to C.P. (check point/ IC10 pin 5).	Approx. 20 ~ 25 mV	PLL	L22
		Note: For adjustment 3, set to within adjustment value by direction core pulled out from maximum adjustment point.					
1st loop LO	1.	• Mode: SSB-N • Display frequency: 7.9980 MHz	PLL	Connect DC voltmeter to R4.	1.0V	PLL	C29
	2.	• Display frequency: 14.9980 MHz					C39
	3.	• Display frequency 21.9980 MHz					C49
	4.	• Display frequency: 29.9980 MHz					C59
	5.	• Display frequency: 0.0015 MHz			5 ~ 6.5 V		Verification
	6.	• Display frequency: 8.0015 MHz					
	7.	• Display frequency: 15.0015 MHz					
	8.	• Display frequency: 22.0015 MHz					
	9.	Each display frequency: (5 ~ 8)		Terminate J5 output to 50Ω; connect RF voltmeter.	158 mV (−3 dBm) or more		

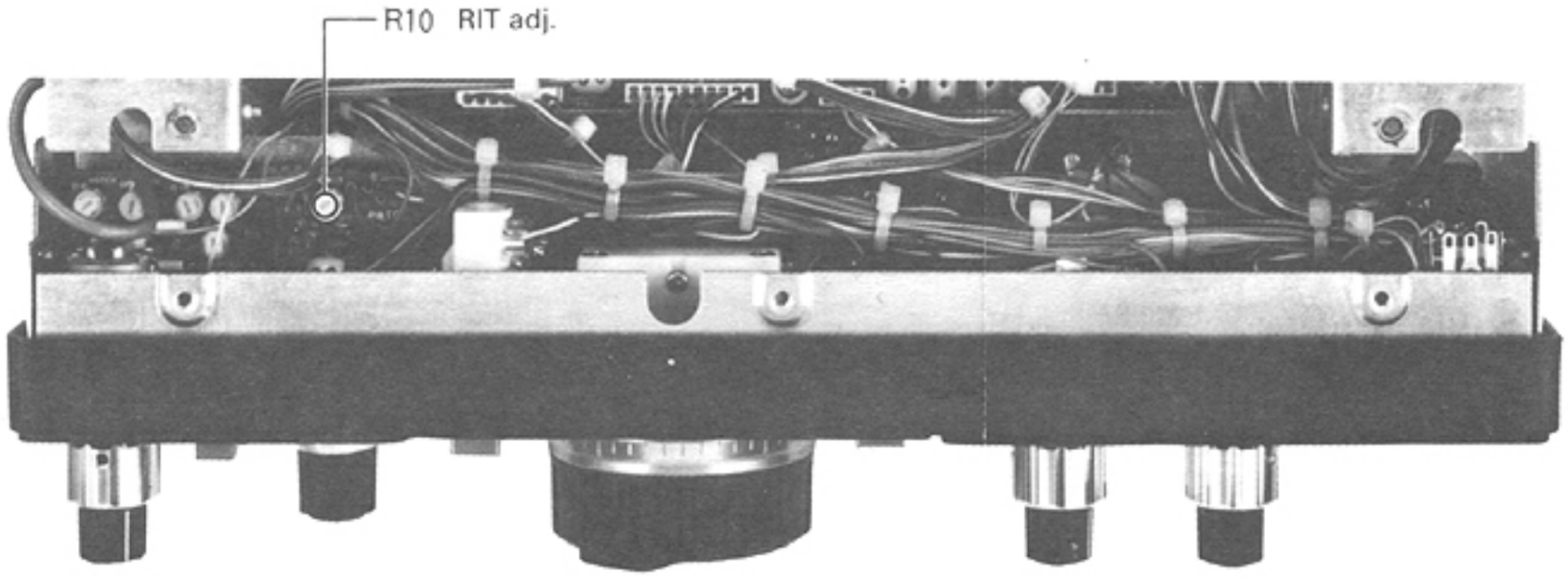
PLL UNIT



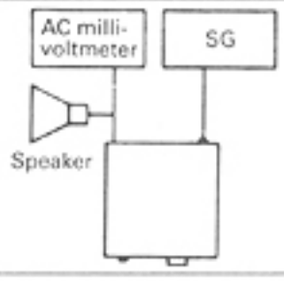
MAIN UNIT



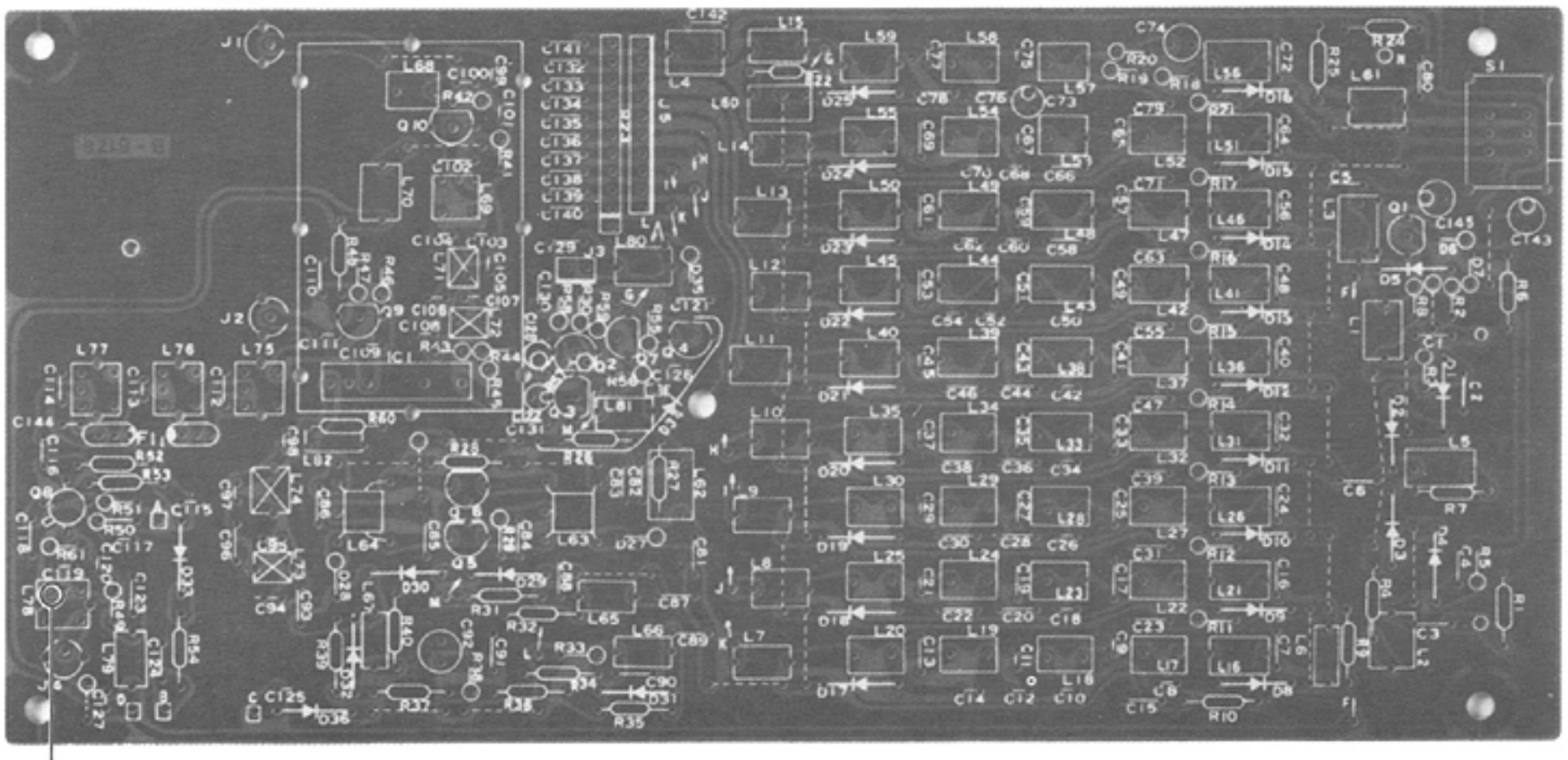
EF UNIT



7-2 RECEIVER ADJUSTMENT

Adjustment item		Conditions for adjustment	Unit	Measurement location	Adjustment value	Unit	Adjustment location
Measurement instrument connections	1.	Connect RF signal generator (SSG) to rear panel ANT connector, and speaker (8Ω) and AC millivolt meter to EXT SP terminal. SSG outputs all at load.					
Total gain	1.	• Mode: LSB • HAM/GEN: HAM • Display frequency: 7.1000 MHz • RF GAIN: completely to right • PRE/ATT: PRE ON • NOTCH: OFF • PBT: OFF • TONE: center • SQL: completely to left • AGC: FAST • RIT: OFF Input −16 dBμ signal from SSG.		AC Millivolt meter	Adjust audio level to maximum.	RF MAIN	L78 L2 ~ L4, L10, L14 L15, L23 L24
	2.	Input +34 dBμ signal from SSG.			Adjust audio level to 2.5V.	Front panel	AF GAIN
	3.	SSG output OFF (during no signal)			Adjust noise output to 30 dB less than 2.5V (approx. 80 mV).	MAIN	L24
		Note: For adjustment 3, set to adjustment value by direction of core pull-out.					
S-meter	1.	• PRE/ATT: PRE ON SSG output OFF (during no signal)		Built-in S-meter	Adjust to point where S-meter begins to move.	MAIN	R138
	2.	SSG output: +7 dBμ			S9 + 40 dB		R137
	3.	SSG output: +34 dBμ			S9		Verification
		Note: Repeat adjustments 1 ~ 3.					
	4.	Verification: S-meter indicates approx. −10dB when PRE/ATT is OFF, and approx. −30 dB when ATT is ON.					

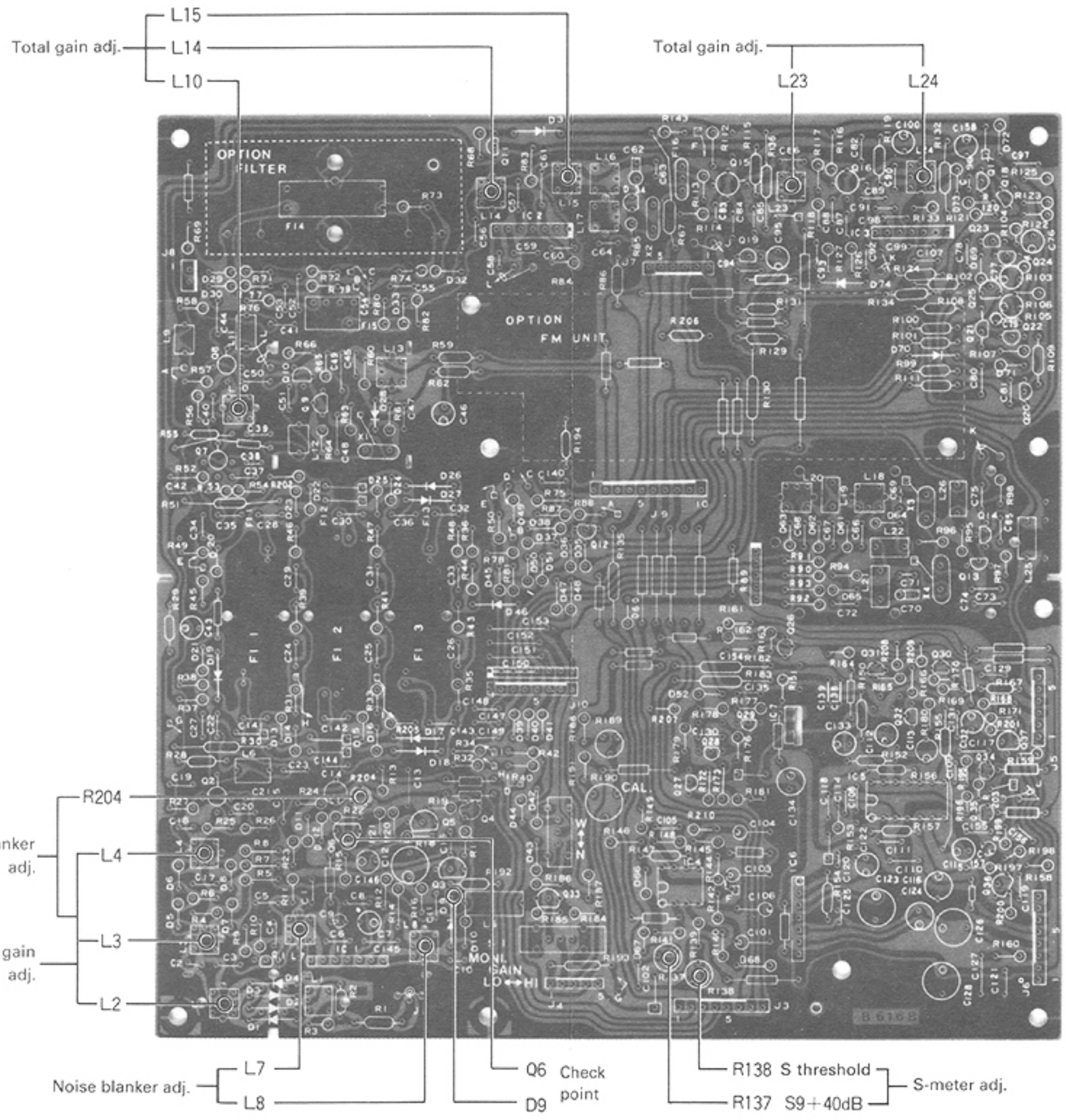
RF UNIT



L78 Total gain adj.

Adjustment item		Conditions for adjustment	Unit	Measurement location	Adjustment value	Unit	Adjustment location
Noise blanker	1.	• RF GAIN: completely to left • NB: OFF	MAIN	Connect DC voltmeter to Q6 collector.	4.3 V	MAIN	R204
	2.	Input pulse-like noise from ANT.		Connect oscilloscope to D9.	Maximum pulse-like noise waveform		L7, L8
	3.	• NB: ON			Minimum pulse-like noise waveform		L3, L4
		Note: If adjustment 3 location is turned too much, reception sensitivity will be affected, requiring checking of reception sensitivity and readjustment of total gain.					

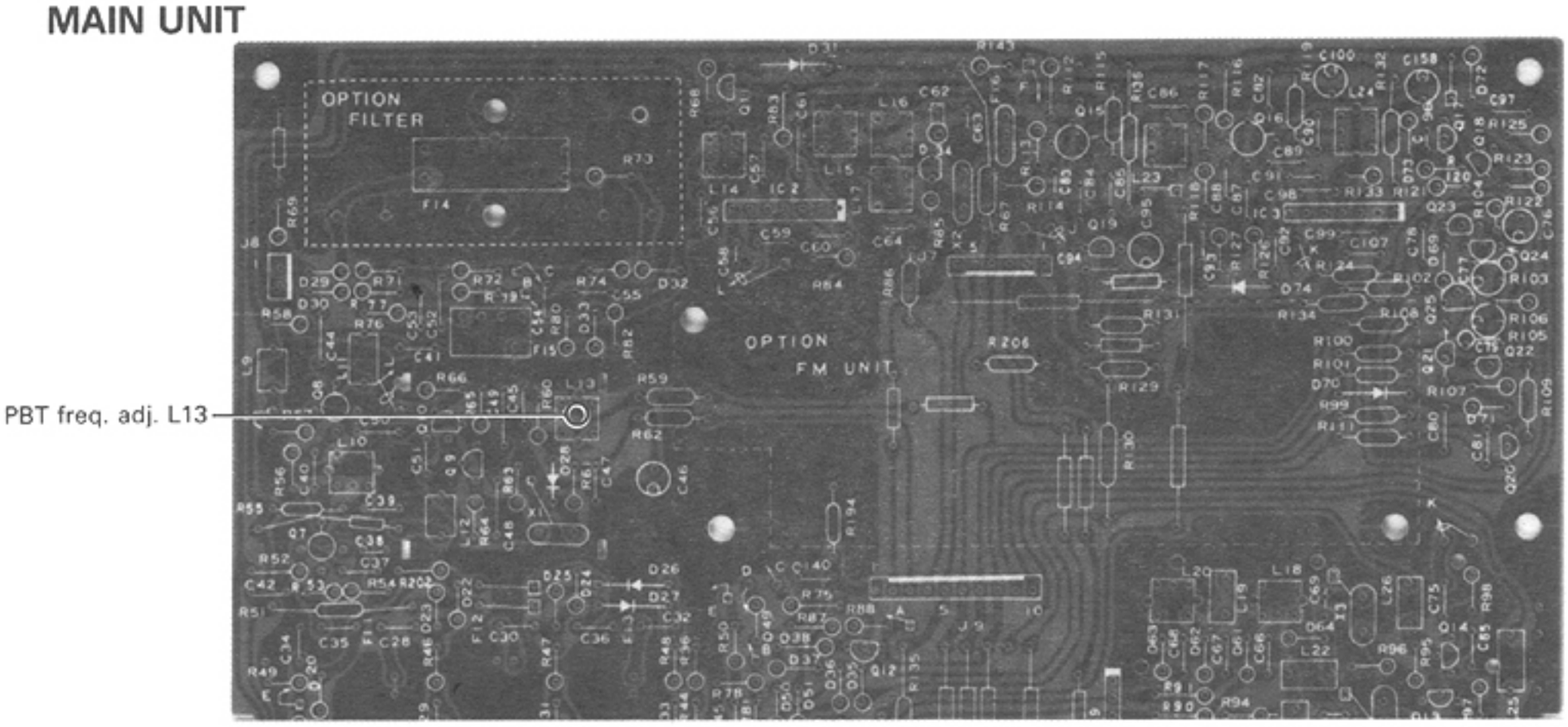
MAIN UNIT



RECEIVER ADJUSTMENT (Continued)

Adjustment item		Conditions for adjustment	Unit	Measurement location	Adjustment value	Unit	Adjustment location
PBT frequency	1.	• Mode: AM • PBT: ON (completely left)	MAIN	Connect frequency counter to R66.	9.46070 MHZ	MAIN	L13
	2.	• PBT: ON (completely right)			9.46930 MHz	EF	R9
	3.	• Mode: SSB • PBT: ON (completely left)			9.46350 MHz		R11
	4.	• Mode: AM • PBT: OFF			9.46500 MHz		R18
	5.	• Mode: SSB			9.46650 MHz		R19
	6.	• PBT: ON center			9.46650 MHz ± 200 Hz		Verification
	7.	• Mode: AM			9.46500 MHz ± 500 Hz		
Monitor operation check	1.	• Monitor: ON		MUTE LED	Illumination		Verification
	2.	• MONI. GAIN: HI (main unit/s1) Input +74 dBμ signal from SSG.		Built-in S-meter	Approx. S9 + 10 dB		
		Note: For adjustments 1 ~ 3, connect MUTE terminal (rear panel) to ground; monitor circuit should be in operation condition.					
	3.	• MONI. GAIN: LOW		Built-in S-meter	S1		Verification
		Note: MONI. GAIN must be returned to HI after adjustment 3 completed.					
* NOTCH	1.	A special tool is needed for adjustment; please contact our service representative.					

MAIN UNIT

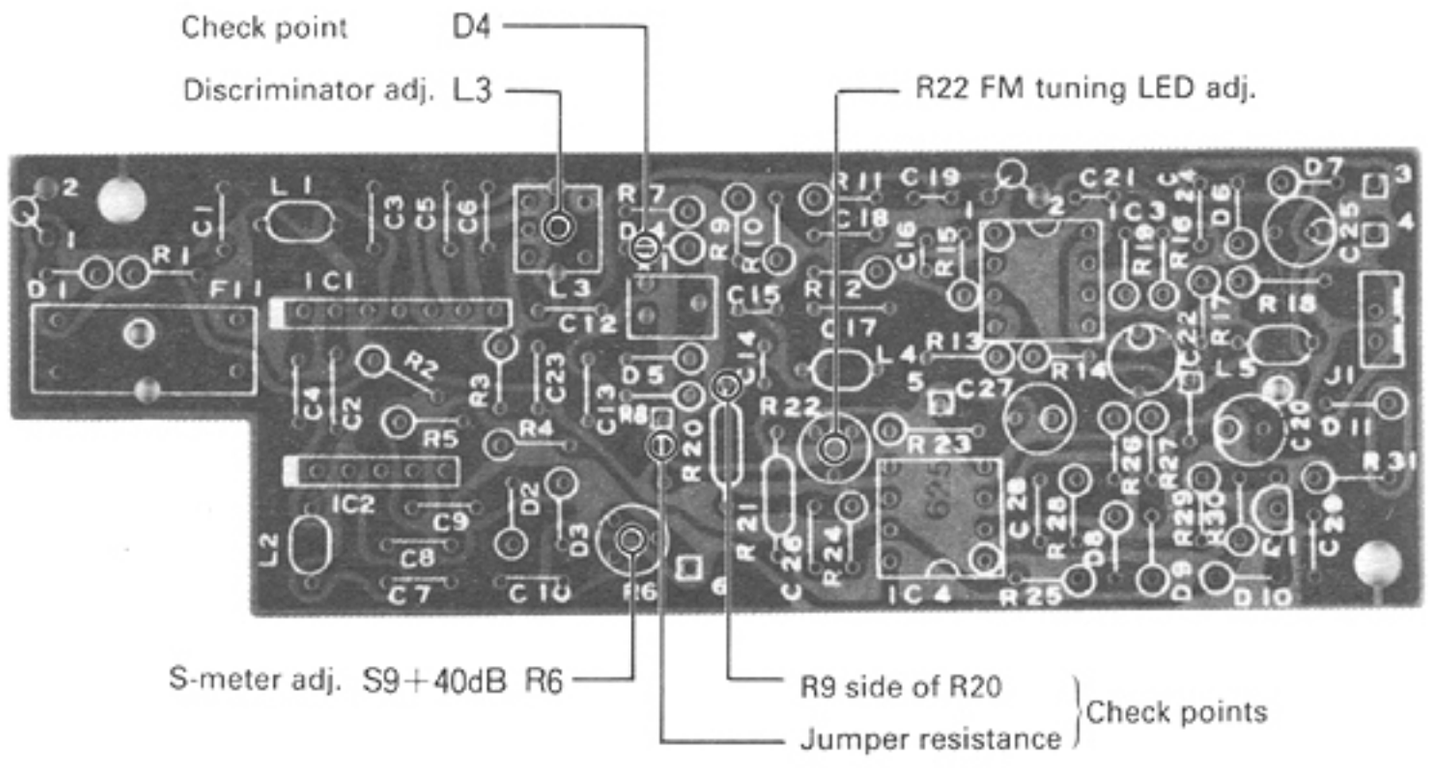


EF UNIT

7-3 FM UNIT ADJUSTMENT (OPTIONAL)

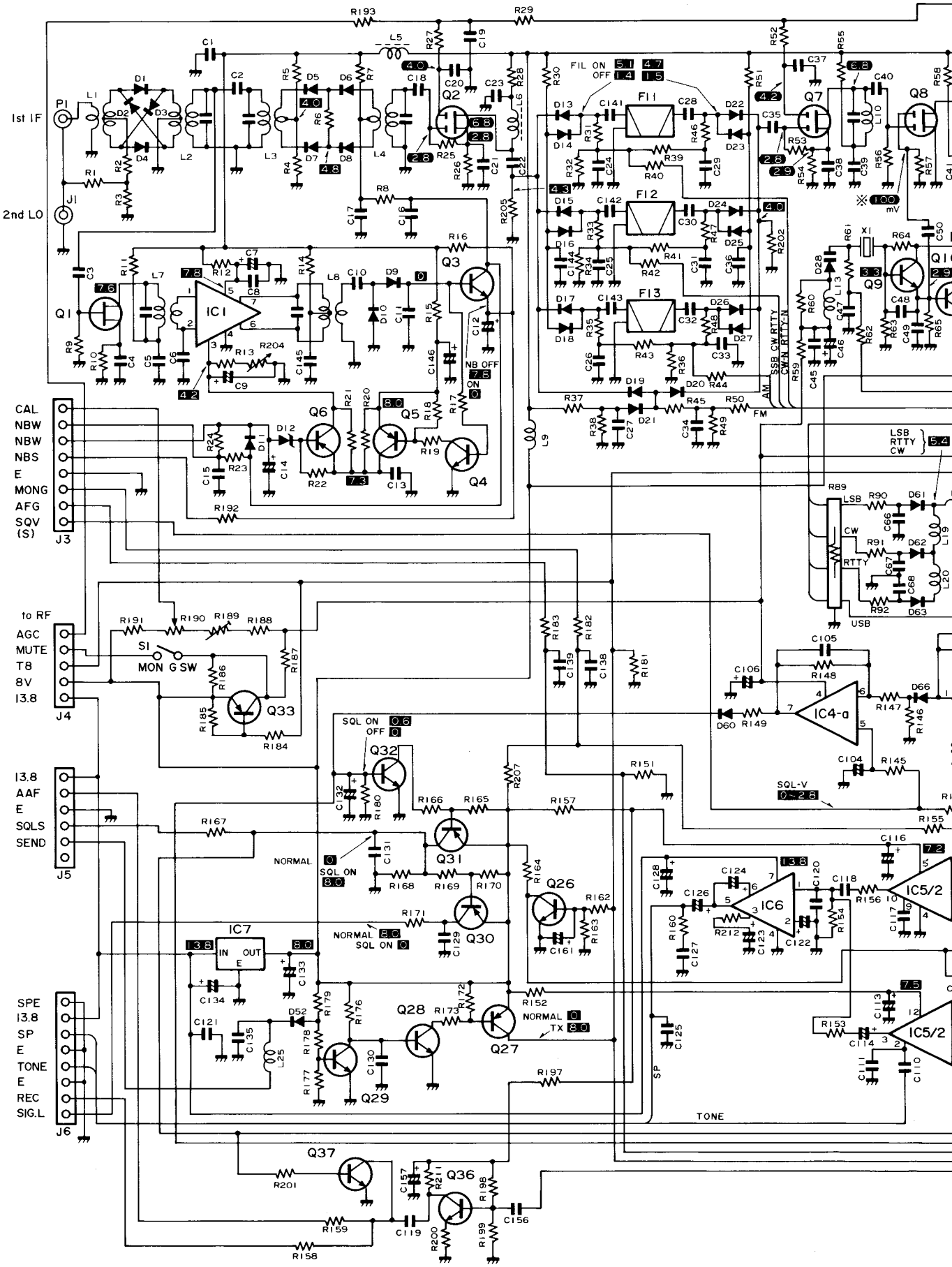
Adjustment item		Conditions for adjustment	Unit	Measurement location	Adjustment value	Unit	Adjustment location
Receiving gain	1.	• Display frequency: near 28 MHz • PRE/ATT: PRE ON • RF GAIN: completely to right • NOTCH: OFF • MODE: FM • TONE: center • PBT: center • SQL: completely to left • AGC: FAST SSG output OFF (during no signal)		AC Millivolt Meter	Adjust noise level to 2.5V.	Front panel	AF GAIN
⑧ Discriminator	2.	Input +14 dBμ non-modulated signal from SSG.	FM	Connect DC voltmeter between R20 (R9 side) and jumper resistor to its left.	0V	FM	L3
		Note: SSG output in 2 must be zeroed-in to within 100 Hz of display frequency.					
FM tuning	1.	Input +14 dBμ modulated signal from SSG.	FM	Connect frequency counter to D4.	455 kHz	Front panel	Main dial
	2.			FM TUNE LED	Illumination	FM	R22
	3.	Verification: FM tuning LED illuminates with ±1 kHz displayed frequency in adjustment 1, and no illumination when ± 1 kHz exceeded.					
S-meter	1.	SSG output: +34 dBμ		Built-in S-meter	S9 + 40 dB	FM	R6

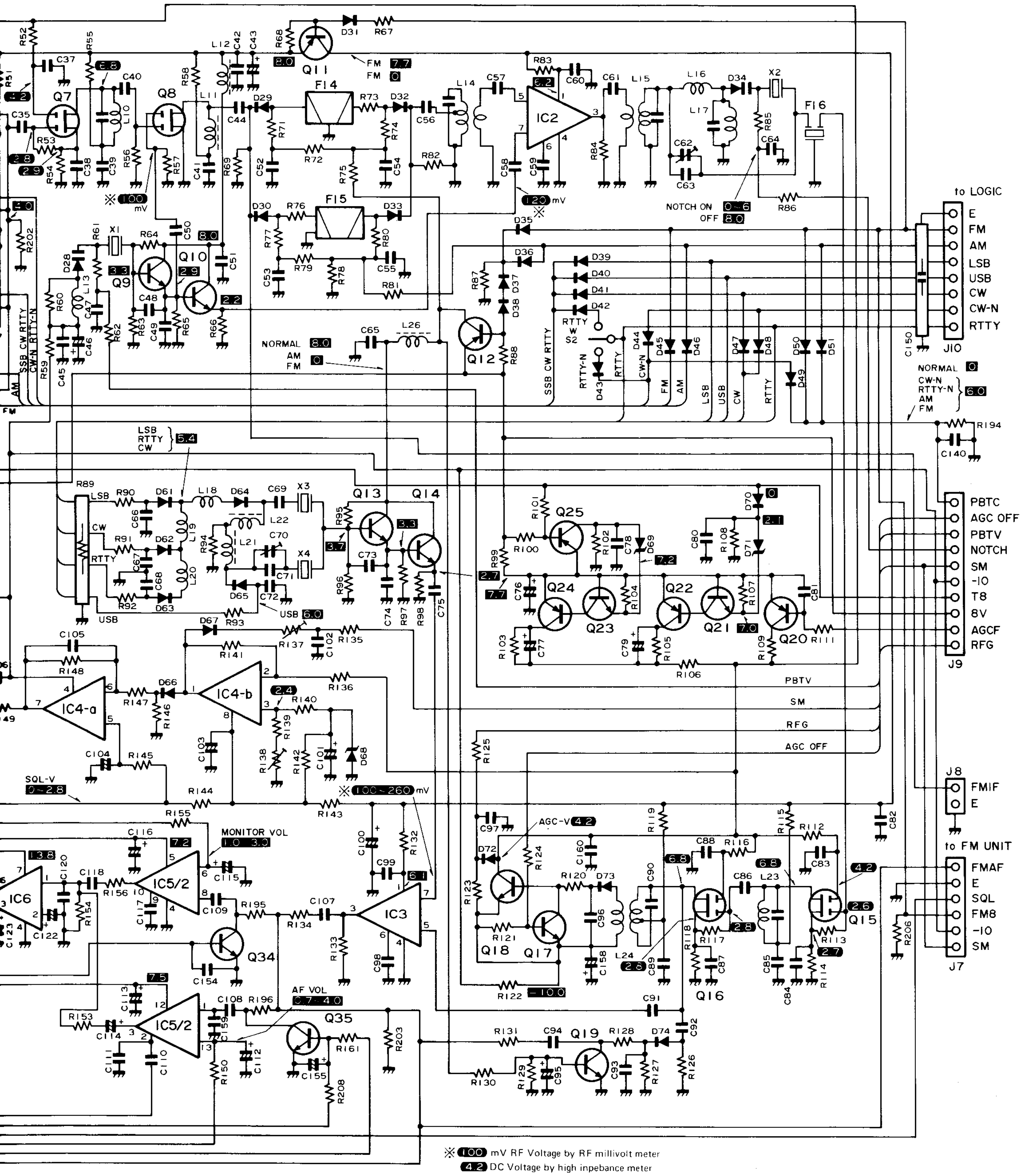
FM UNIT



SECTION 8 VOLTAGE DIAGRAM

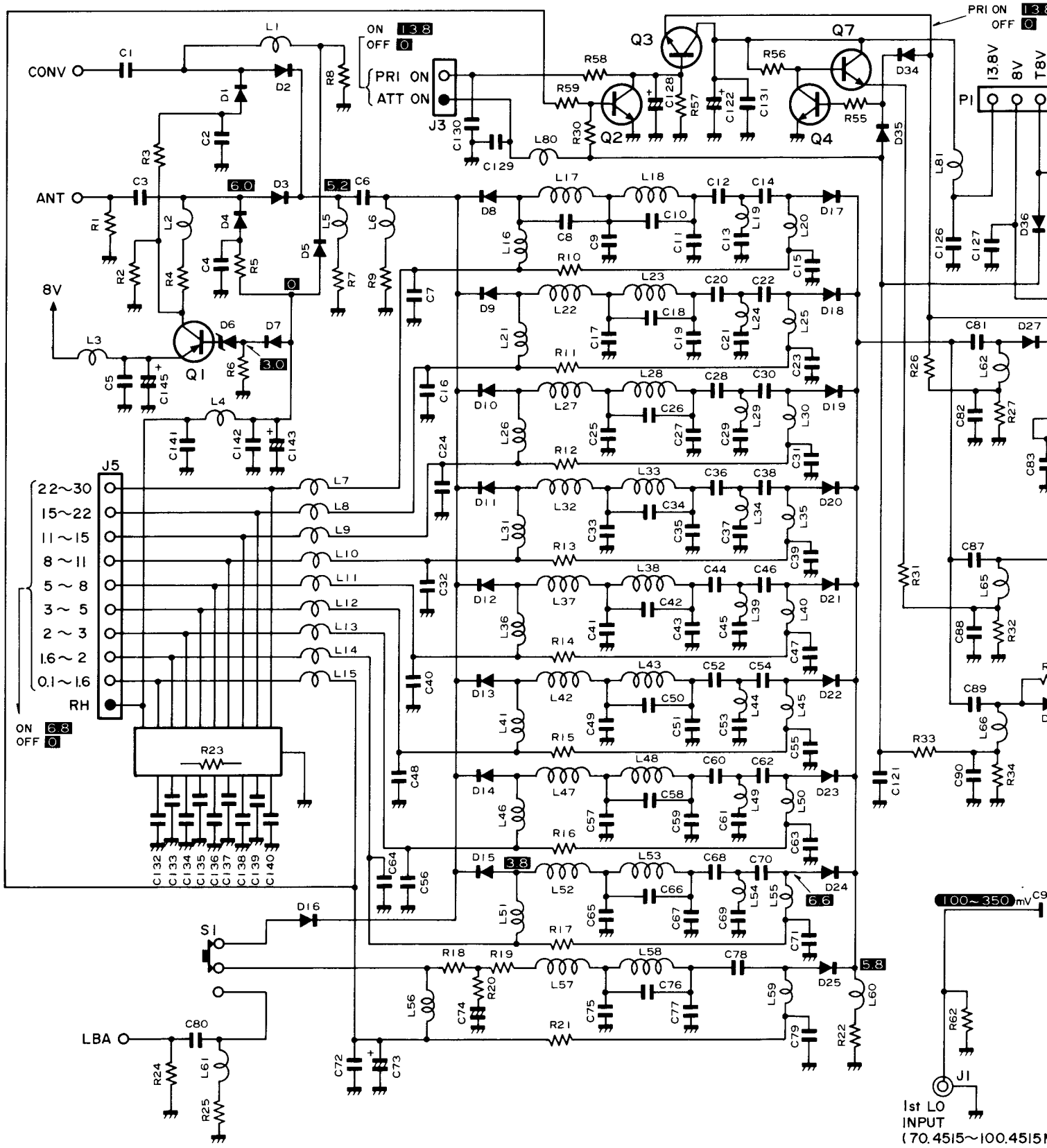
8-1 MAIN UNIT CIRCUITS AND VOLTAGES

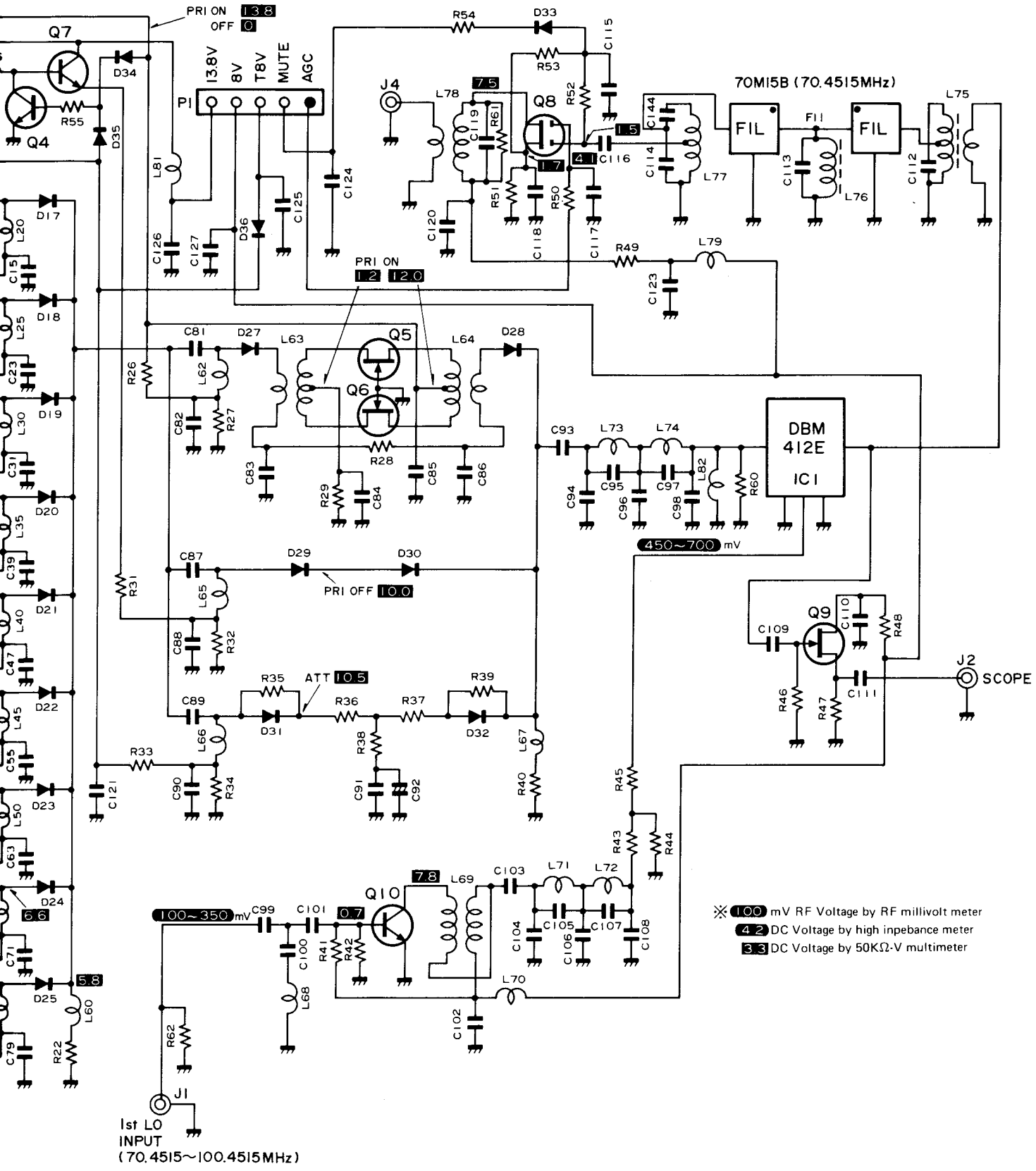




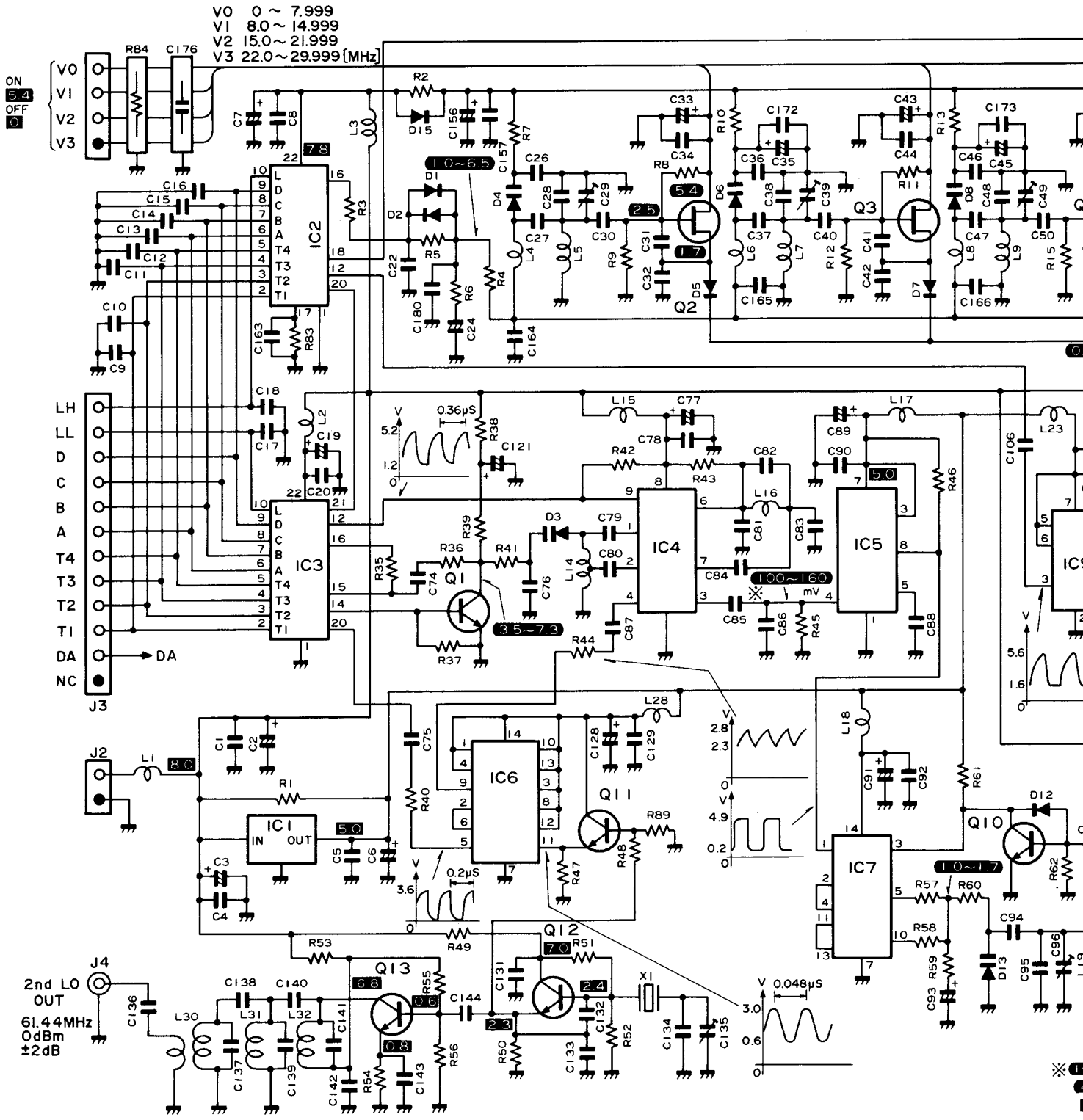
※100 mV RF Voltage by RF millivolt meter
4.2 DC Voltage by high inpebance meter
3.3 DC Voltage by 50KΩ-V multimeter

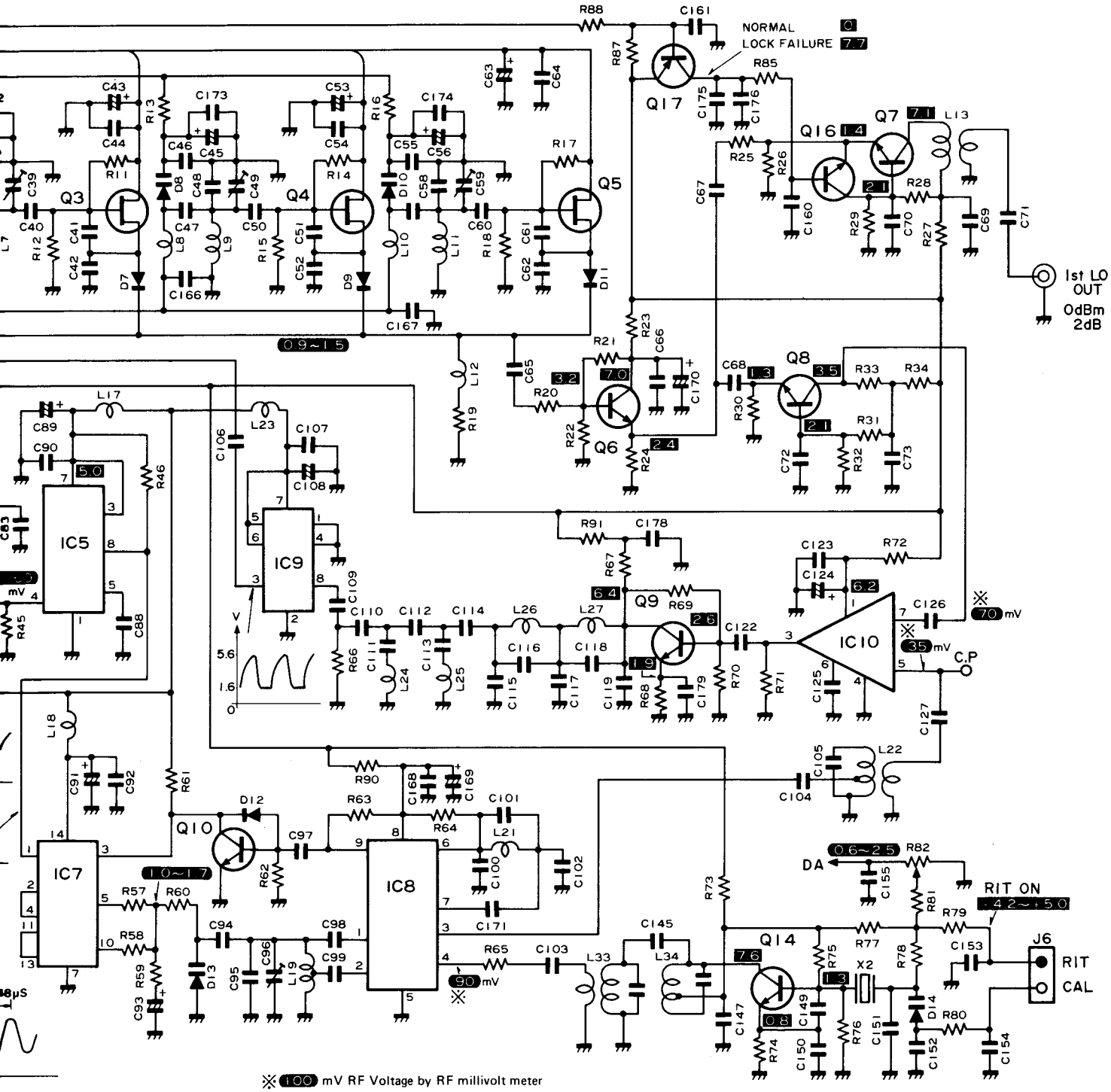
8-2 RF UNIT CIRCUITS AND VOLTAGES



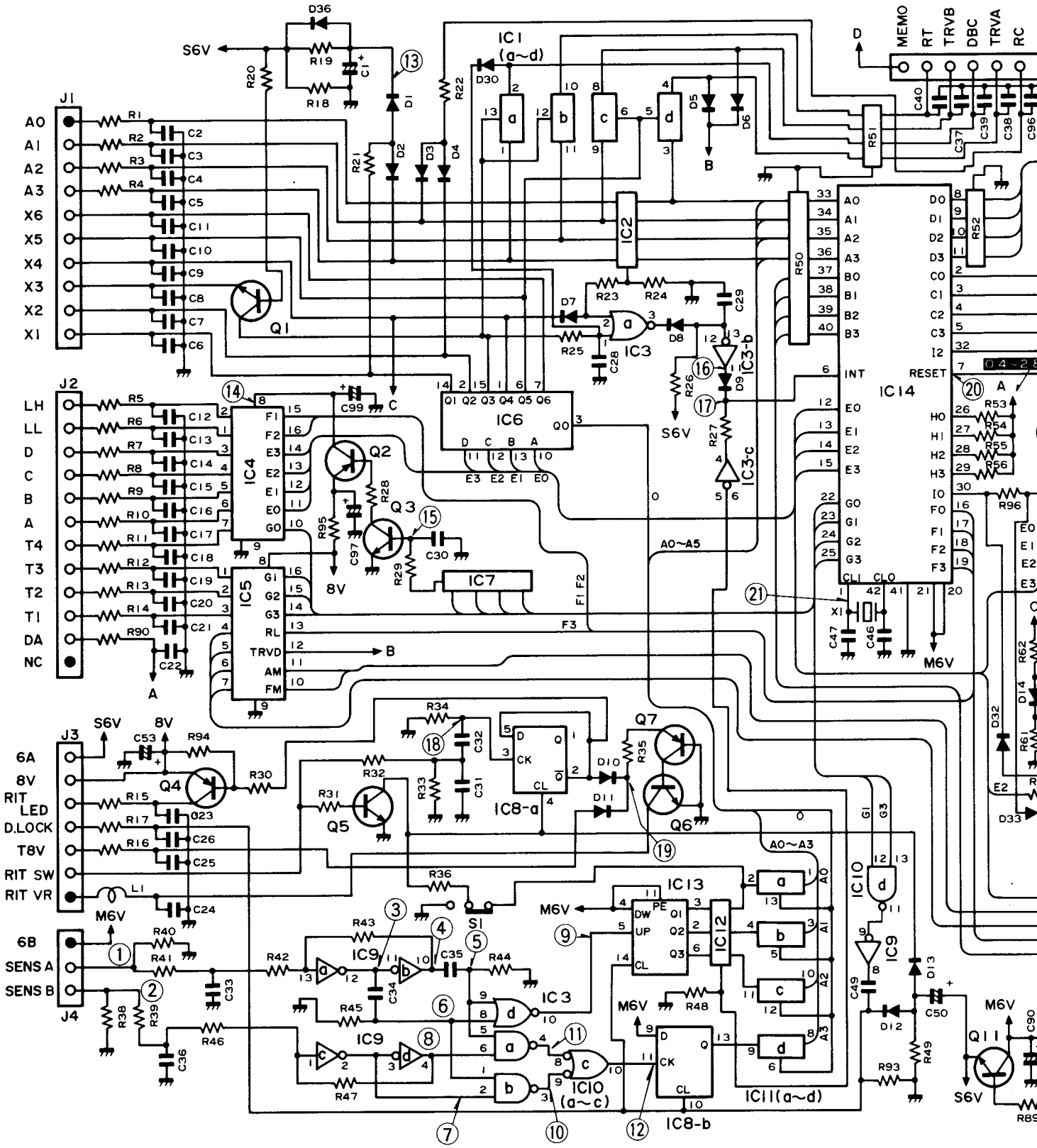

PRI ON 13.8
OFF 0
Q7
Q4
D34
D35
R55
P1
13.8V
8V
T8V
MUTE
AGC
R54
D33
R53
C115
J4
L78
7.5
Q8
R52
C119
R61
1.5
C116
4.1
1.7
C144
C114
L77
70M15B (70.4515MHz)
FIL
FI1
FIL
L75
C113
L76
C112
R51
R50
C118
C117
C120
R49
L79
C123
PRI ON 1.2 12.0
D17
D18
D19
D20
D21
D22
D23
D24
6.6
D25
5.8
L20
L25
L30
L35
L40
L45
L50
L60
C15
C23
C31
C39
C47
C55
C63
C71
C79
R22
L81
C126
C127
D36
C125
C124
C81
D27
L63
Q5
Q6
L64
D28
R26
L62
C82
R27
R28
C83
R29
C84
C85
C86
C93
L73
L74
DBM
412E
IC1
C94
C95
C96
C97
C98
L82
R60
450~700 mV
C87
D29
D30
PRI OFF 10.0
R31
L65
C88
R32
C89
R35
ATT 10.5
R36
R37
R39
D31
D32
R33
L66
R34
C90
C121
R38
C91
C92
L67
R40
Q9
C109
C110
R48
C111
J2
SCOPE
R46
R47
R45
R43
R44
Q10
7.8
L69
C103
L71
L72
100~350 mV
C99
C101
0.7
C100
R41
R42
C104
C105
C106
C107
C108
L68
L70
C102
R62
J1
1st LO
INPUT
(70.4515~100.4515MHz)
※ 100 mV RF Voltage by RF millivolt meter
4.2 DC Voltage by high inpebance meter
3.3 DC Voltage by 50KΩ-V multimeter

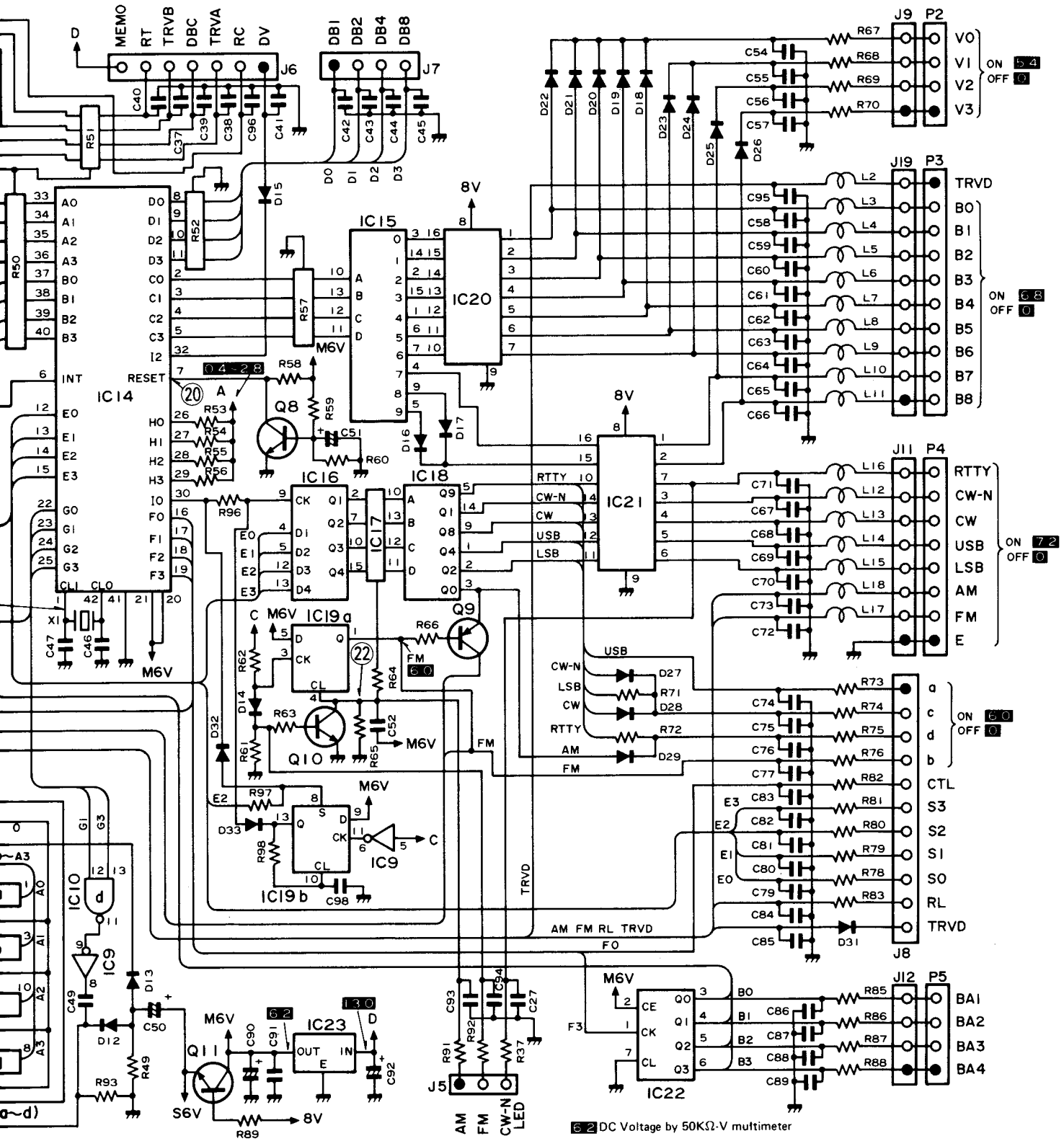
8-3 PLL UNIT CIRCUITS AND VOLTAGES

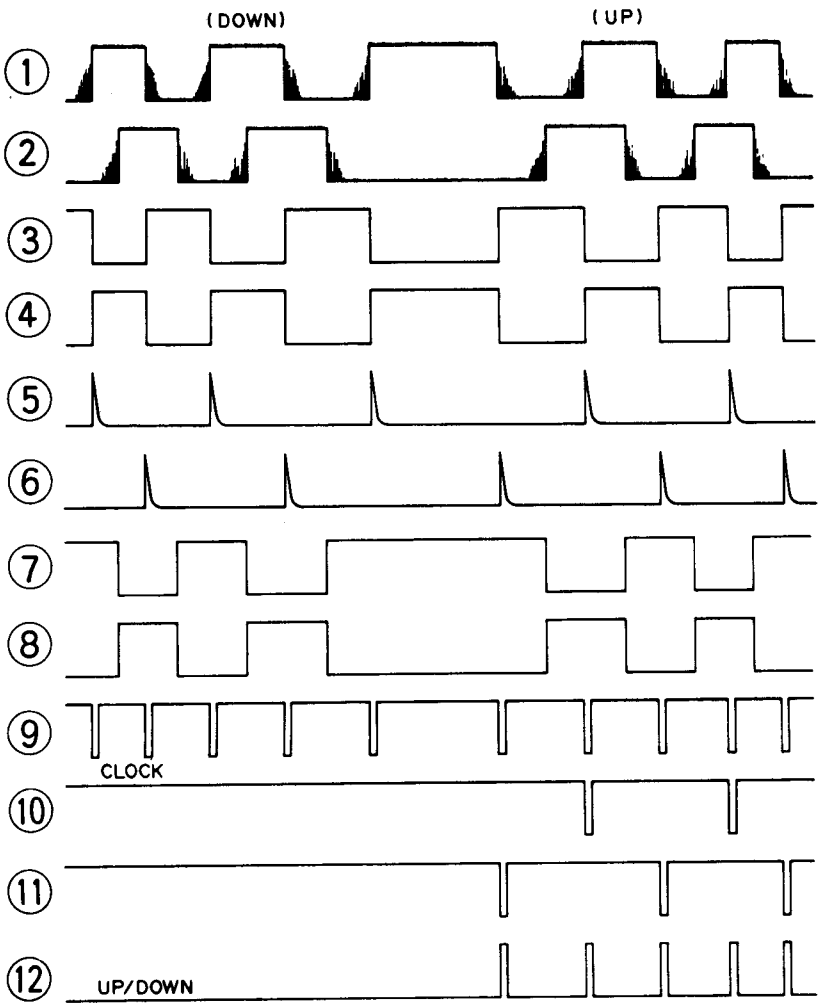


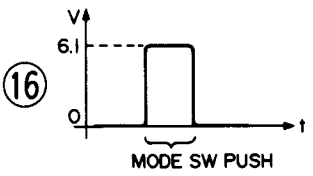

NORMAL 0
LOCK FAILURE 7.7
Q17
Q16 1.4
Q7 7.1
L13
1st LO OUT
0dBm 2dB
Q5
Q4
Q3
0.9~1.5
Q8
Q6
IC5
IC9
IC10
C.P
70 mV
35 mV
Q9
Q10
IC7
IC8
0.6~2.5
DA
RIT ON
-4.2~+5.0
RIT CAL
J6
Q14
X2
90 mV
1.0~1.7
V
5.6
1.6
0
※ 100 mV RF Voltage by RF millivolt meter
4.2 DC Voltage by high inpebance meter
3.3 DC Voltage by 50KΩ·V multimeter

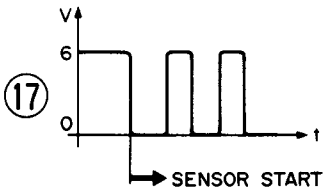
8-4 LOGIC UNIT CIRCUITS

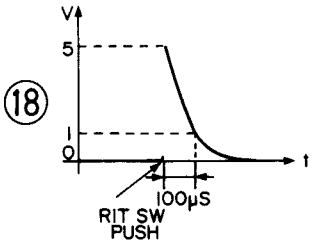


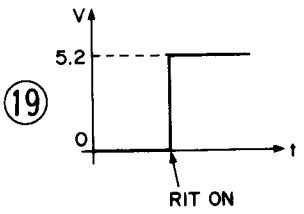

D
MEMO
RT
TRVB
DBC
TRVA
RC
DV
J6
DB1
DB2
DB4
DB8
J7
IC14
IC15
IC16
IC17
IC18
IC19a
IC19b
IC20
IC21
IC22
IC23
IC9
IC10
8V
M6V
S6V
RESET
INT
XI
Q8
Q9
Q10
Q11
J9
P2
V0
V1
V2
V3
ON 54
OFF 0
J19
P3
TRVD
B0
B1
B2
B3
B4
B5
B6
B7
B8
ON 68
OFF 0
J11
P4
RTTY
CW-N
CW
USB
LSB
AM
FM
E
ON 72
OFF 0
J8
a
c
d
b
CTL
S3
S2
S1
S0
RL
TRVD
ON 60
OFF 0
J12
P5
BA1
BA2
BA3
BA4
J5
AM
FM
CW-N
LED
AM FM RL TRVD
F0
62 DC Voltage by 50KΩ·V muttimeter

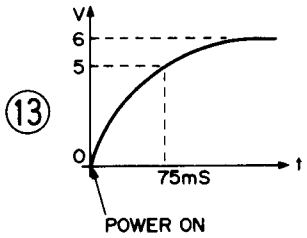

(DOWN)
(UP)
①
②
③
④
⑤
⑥
⑦
⑧
⑨
CLOCK
⑩
⑪
⑫
UP/DOWN

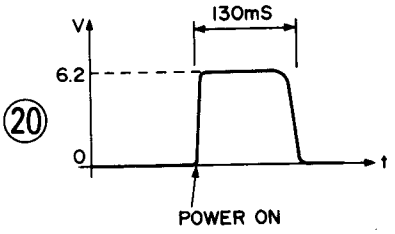

⑯
V
6.1
0
t
MODE SW PUSH

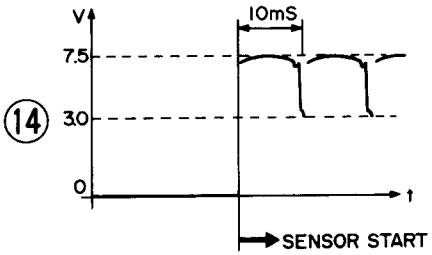

⑰
V
6
0
t
SENSOR START

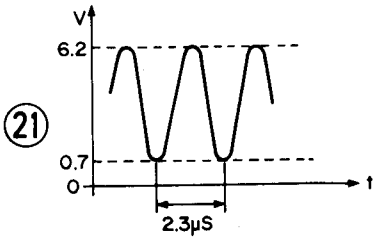

⑱
V
5
1
0
t
100μS
RIT SW
PUSH

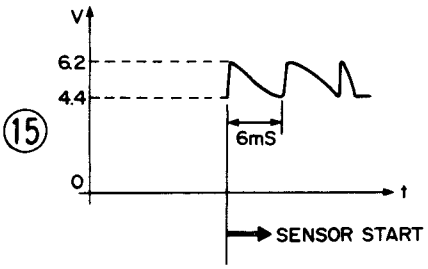

⑲
V
5.2
0
t
RIT ON

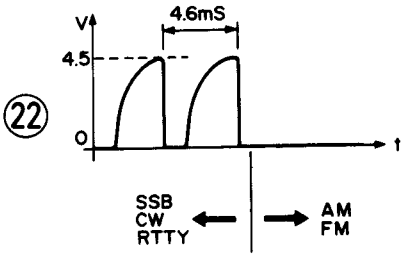

⑬
V
6
5
0
t
75mS
POWER ON


⑳
130mS
V
6.2
0
t
POWER ON

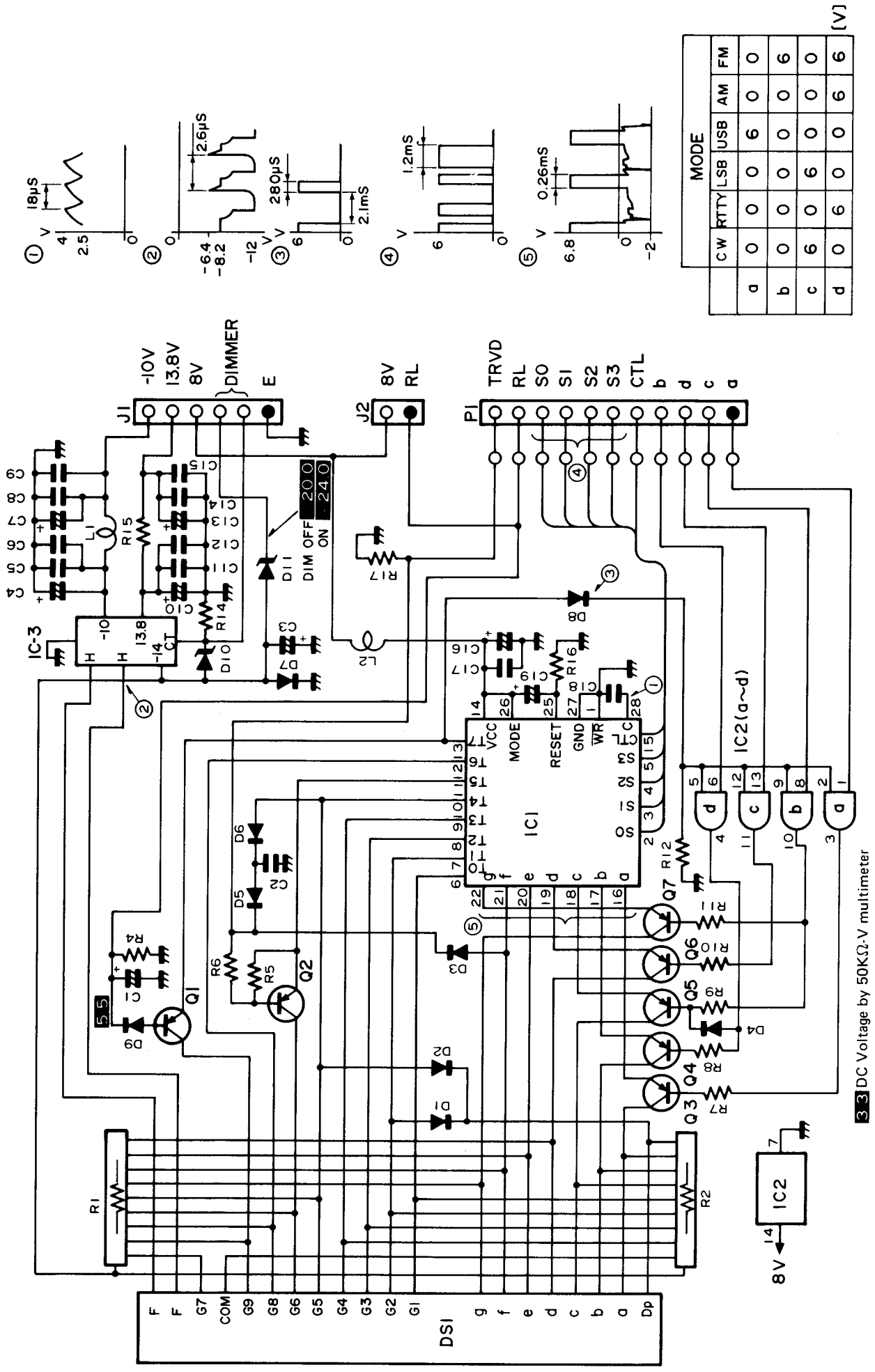

⑭
10mS
V
7.5
3.0
0
t
SENSOR START


㉑
V
6.2
0.7
0
t
2.3μS

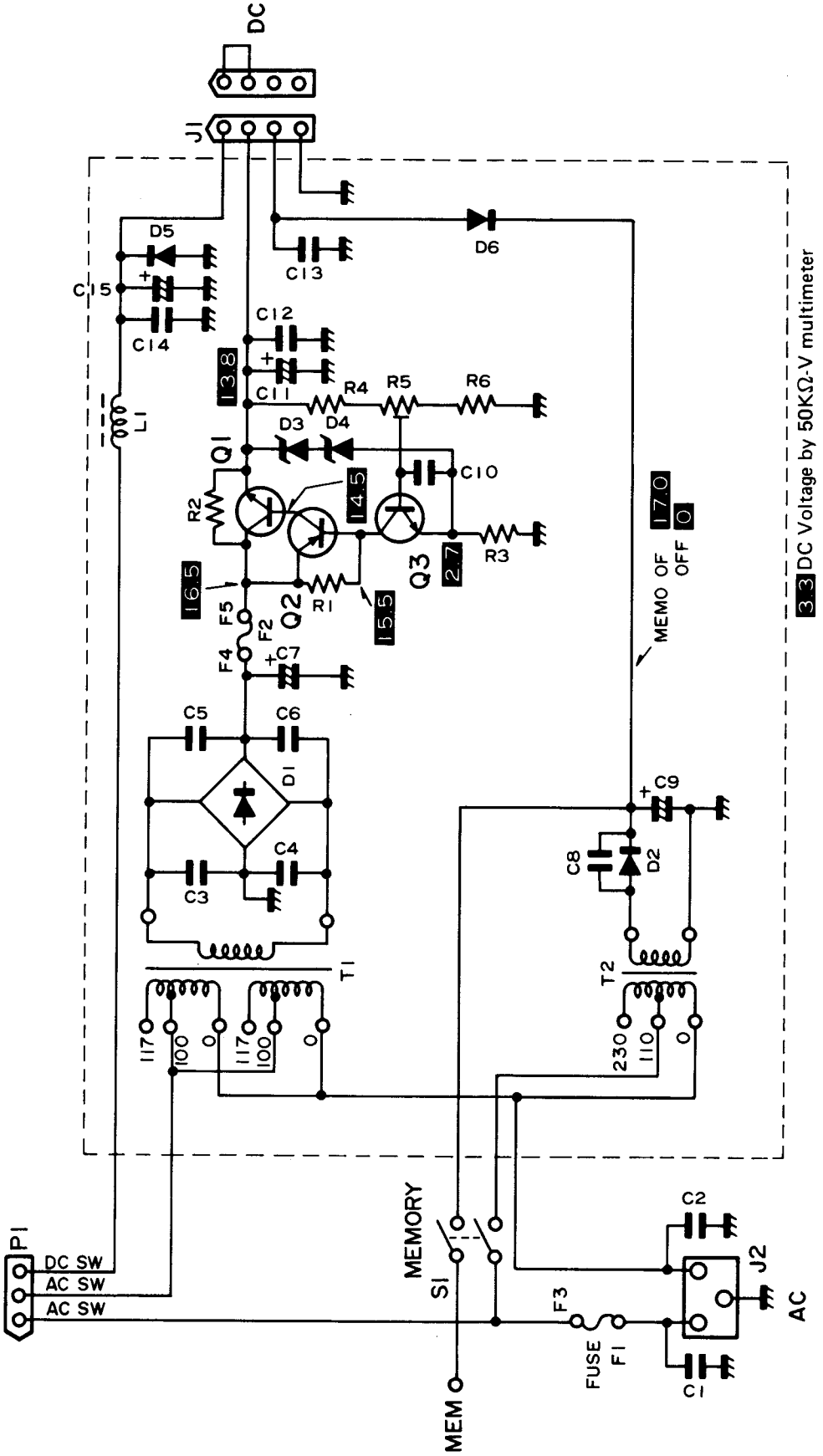

⑮
V
6.2
4.4
6mS
0
t
SENSOR START


㉒
4.6mS
V
4.5
0
t
SSB
CW
RTTY
AM
FM

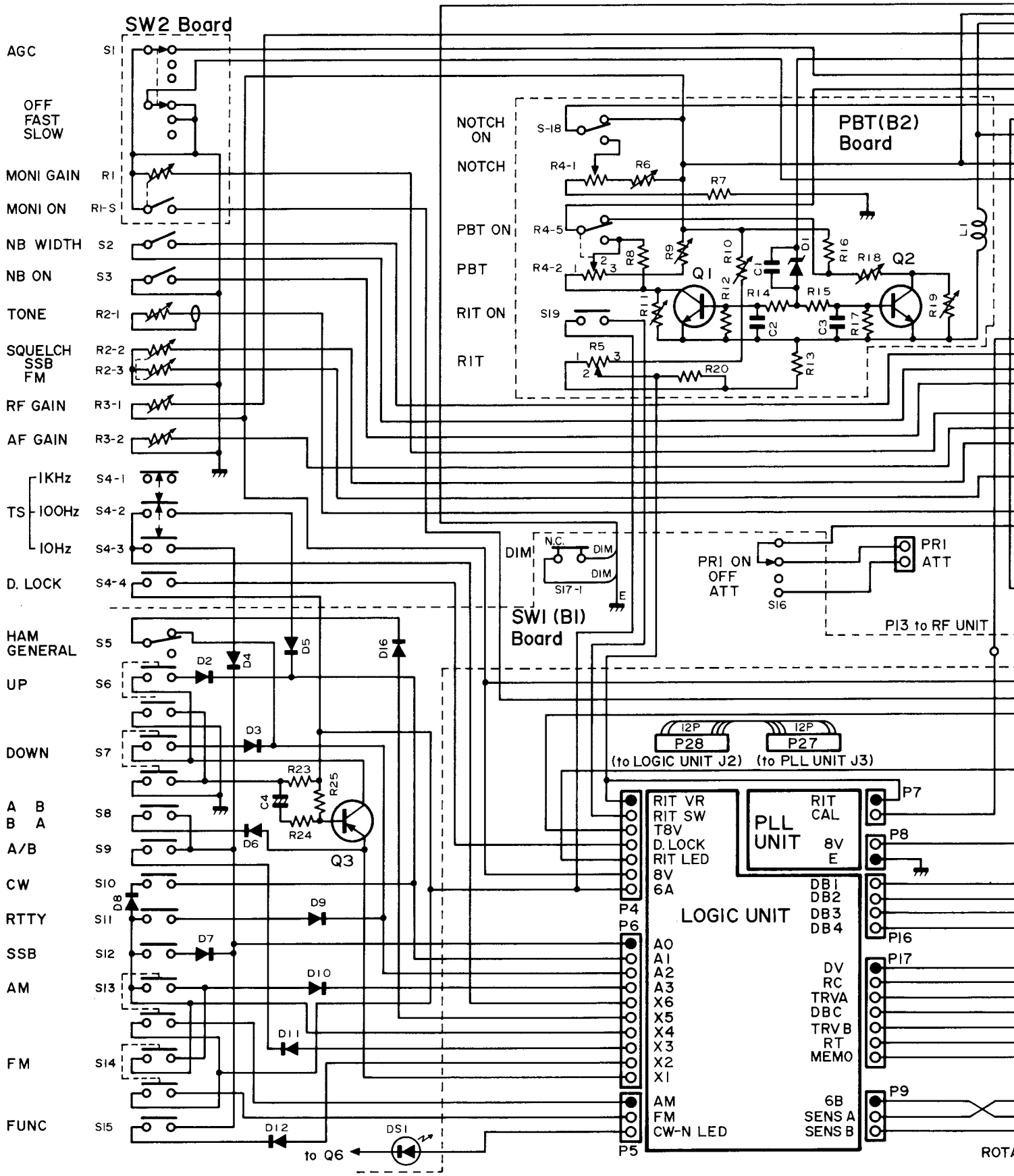
8-5 DISPLAY UNIT CIRCUITS AND VOLTAGES

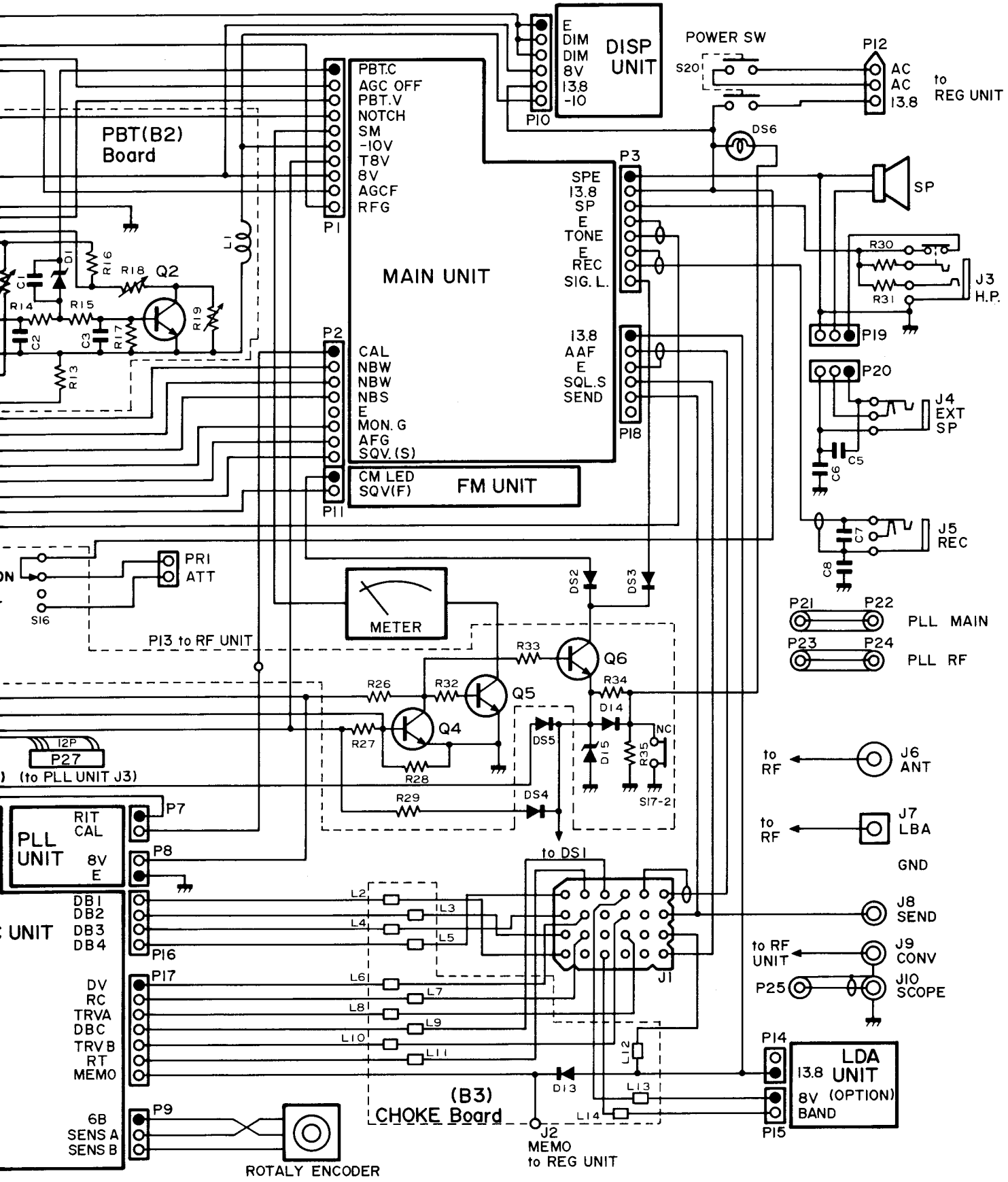


8-6 REG UNIT CIRCUITS AND VOLTAGES



8-7 EF UNIT CIRCUITS

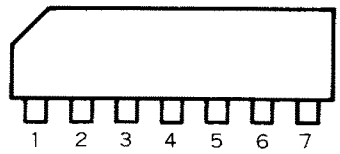



PBT(B2)
Board
PBT.C
AGC OFF
PBT.V
NOTCH
SM
-10V
T8V
8V
AGCF
RFG
P1
MAIN UNIT
SPE
13.8
SP
E
TONE
E
REC
SIG. L.
P3
P2
CAL
NBW
NBW
NBS
E
MON. G
AFG
SQV. (S)
13.8
AAF
E
SQL.S
SEND
P18
CM LED
SQV(F)
FM UNIT
P11
E
DIM
DIM
8V
13.8
-10
DISP
UNIT
P10
POWER SW
S20
P12
AC
AC
13.8
to
REG UNIT
DS6
SP
R30
R31
J3
H.P.
P19
P20
J4
EXT
SP
C5
C6
C7
C8
J5
REC
PRI
ATT
S16
PI3 to RF UNIT
METER
DS2
DS3
P21
P22
PLL MAIN
P23
P24
PLL RF
R33
Q6
R26
R32
Q5
R34
D14
Q4
R27
R28
DS5
D15
R35
NC
S17-2
R29
DS4
12P
P27
(to PLL UNIT J3)
to
RF
J6
ANT
to
RF
J7
LBA
GND
PLL
UNIT
RIT
CAL
8V
E
P7
P8
to DS1
DB1
DB2
DB3
DB4
P16
L2
L3
L4
L5
J8
SEND
to RF
UNIT
J9
CONV
P25
J10
SCOPE
J1
DV
RC
TRVA
DBC
TRV B
RT
MEMO
P17
L6
L7
L8
L9
L10
L11
L12
L13
L14
P14
LDA
UNIT
13.8
8V (OPTION)
BAND
P15
D13
(B3)
CHOKE Board
6B
SENS A
SENS B
P9
ROTALY ENCODER
J2
MEMO
to REG UNIT

SECTION 9 IC RATINGS

μPC1037H (DOUBLE BALANCED MODULATOR)

PIN CONNECTION



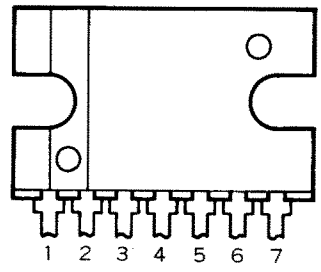
Terminal no.	Connection
1	Vcc
2	Output 1
3	Output 2
4	GND
5	Signal Input
6	Bypass
7	Carrier Input

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 CONNECTION



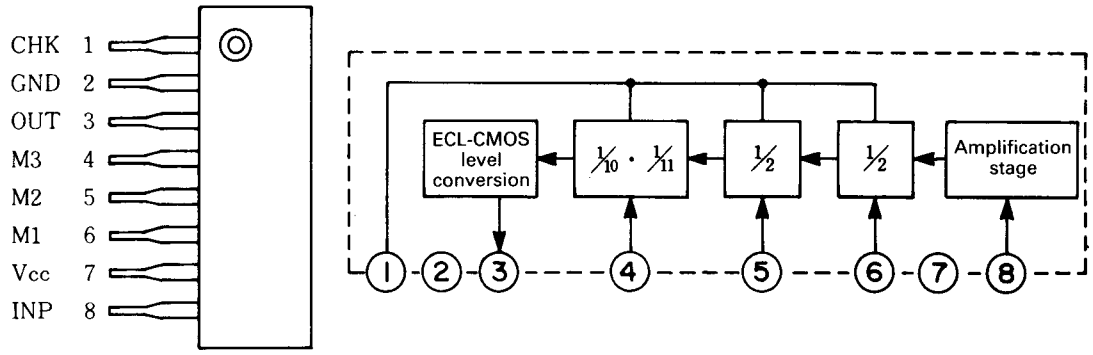
Maximum Ratings

Item	Symbol	Rating	Unit
Peak power supply voltage (200 ms)	$V_{CC(SURGE)}$	40	V
Power supply voltage (when 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)

HD 10551 (PRE-SCALER FOR DIGITAL TUNING SYSTEM)

PIN CONNECTIONS



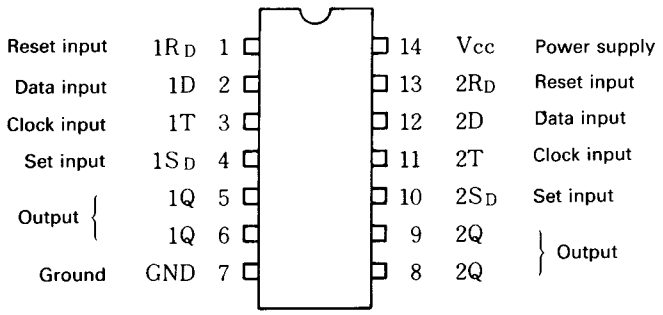
Maximum ratings (Ta = 25°C)

Item	Symbol	Rating	Unit
Power supply voltage	V_{CC}	8	V
Input voltage	V_{IN}	8	V
Allowable loss *1	P_D	350	mV
Operation temperature	T_{OPR}	−30 ~ +75	°C
Storage temperature	T_{STG}	−55 ~ +125	°C

*1 Allowable value at Ta = 75°C

SN74LS74 (DUAL D-TYPE POSITIVE EDGE-TRIGGERED FLIP-FLOP WITH SET AND RESET

PIN CONNECTIONS



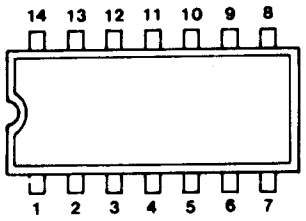
Maximum ratings (Ta = −20 ~ +75°C unless otherwise specified)

Item	Symbol	Rating	Unit
Power supply voltage	V_{CC}	−0.5 ~ +7	V
Input voltage	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"

TC4001 (QUAD 2-INPUT POSITIVE NOR GATE)
TC4011 (QUAD 2-INPUT POSITIVE NOR GATE)
TC4013 (DUAL D-TYPE FLIP-FLOP)
TC4028 (BCD TO DECIMAL DECODER)
TC4069 (HEX INVERTER)
TC4081 (QUAD 2-INPUT POSITIVE AND GATE)

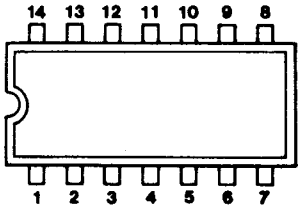
PIN CONNECTIONS



Maximum ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{DD}	V_{SS} −0.5 ~ V_{SS} +20	V
Input voltage	V_{IN}	V_{SS} −0.5 ~ V_{DD} +0.5	V
Output voltage	V_{OUT}	V_{SS} −0.5 ~ V_{DD} +0.5	V
Input current	I_{IN}	±10	mA
Allowable loss	P_D	300	mW
Storage temperature	T_{STG}	−65 ~ 150	°C
Lead temperature/time	T_{SOL}	260 °C/10 sec.	

TC4066 (QUAD BILATERAL SWITCH)

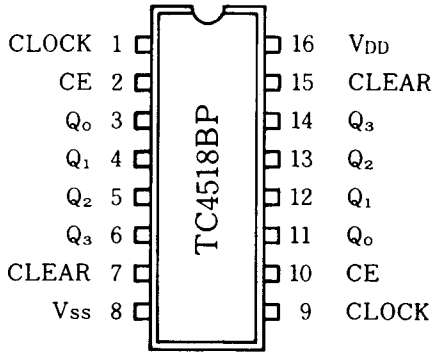


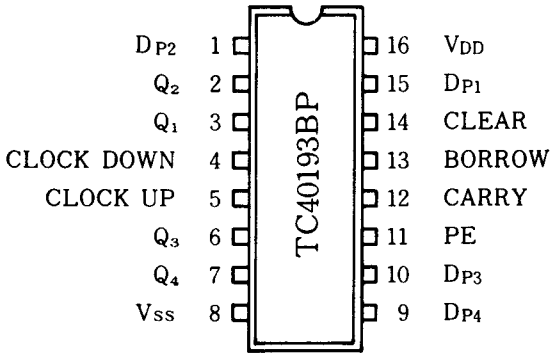
Maximum ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{DD}	V_{SS} −0.5 ~ V_{SS} +20	V
Control input voltage	$V_{C\ IN}$	V_{SS} −0.5 ~ V_{DD} +0.5	V
Switching input/output voltage	$V_{I/O}$	V_{SS} −0.5 ~ V_{DD} +0.5	V
Control input current	$I_{C\ IN}$	±10	mA
Allowable loss	P_D	300	mW
Storage temperature	T_{STG}	−65 ~ 150	°C
Lead temperature/time	T_{SOL}	260°C/10 sec.	

TC4518 (DUAL BCD UP COUNTER)
TC40193BP (SYNCHRONOUS 4-BIT BINARY UP/DOWN COUNTER)

PIN CONNECTIONS



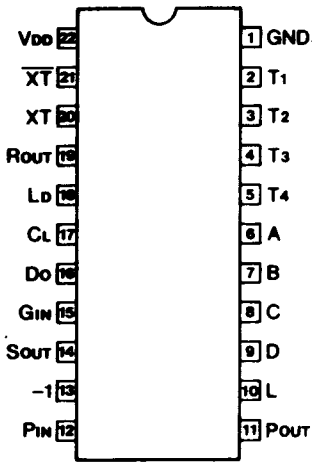


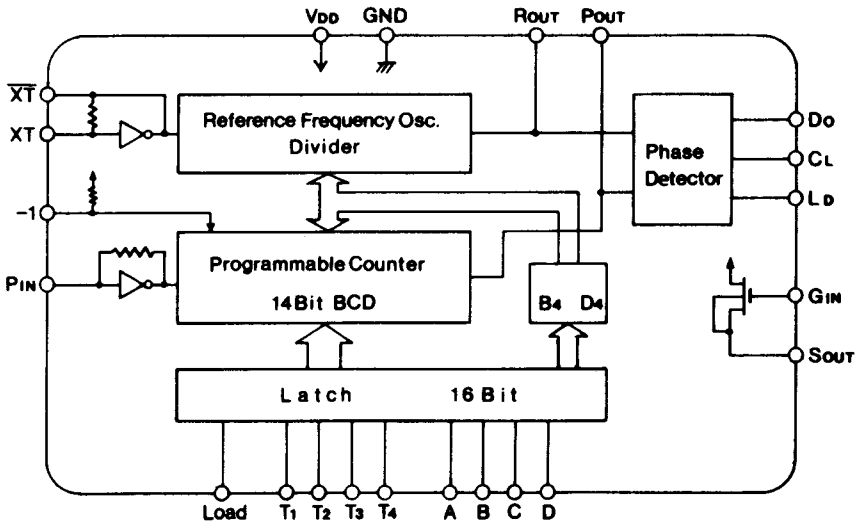
Maximum ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{DD}	V_{SS} −0.5 ~ V_{SS} +20	V
Input voltage	V_{IN}	V_{SS} −0.5 ~ V_{DD} + 0.5	V
Output voltage	V_{OUT}	V_{SS} −0.5 ~ V_{DD} +0.5	V
Input current	I_{IN}	±10	mA
Allowable loss	P_D	300	mW
Storage temperature	T_{STG}	−65 ~ 150	°C
Lead temperature/time	T_{SOL}	260°C/10 sec.	

TC-9123P (FM/AM SYNTHESIZER TUNER PLL)

PIN CONNECTION BLOCK DIAGRAM



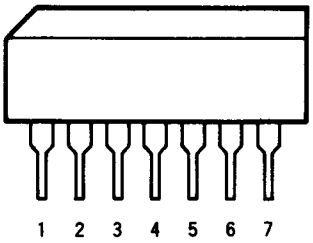


Maximum ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{DD}	−0.3 ~ 9.0	V
Input voltage	V_{IN}	−0.3 ~ V_{DD} + 0.3	V
Operation temperature	T_{OPR}	−30 ~ +70	°C
Storage temperature	T_{STG}	−55 ~ +125	°C

TA7124P (BIPOLAR MONOLITHIC LINEAR INTEGRATED CIRCUIT)

PIN CONNECTIONS

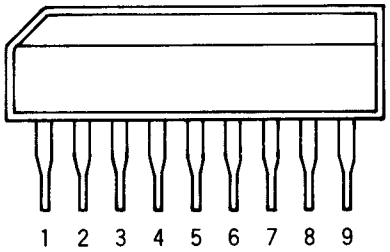


Maximum ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{CC}	15	V
Output terminal voltage	V_6 V_7	18	V
AGC input terminal voltage	V_3	0 ~ V_{CC}	V
Input terminal voltage	V_1 V_2	10	V_{P-P}
Power consumption	P_D	400	mW
Operation temperature	T_{OPR}	−20 ~ 65	°C
Storage temperature	T_{STG}	−55 ~ 125	°C

TA7310P (PLL FREQUENCY SYNTHESIZER IC)

PIN CONNECTION



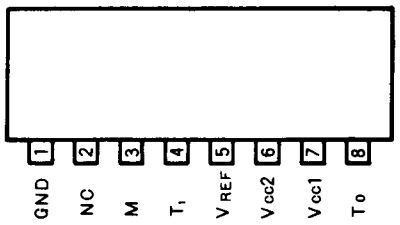
Maximum ratings (Ta = 25°C)

Item	Symbol	Rating	Unit
Power supply voltage	V_{CC}	10	V
Pin 6 voltage	V_6	14	V
Pin 9 voltage	V_9	20	V
Power consumption *1	P_D	600	mW
Operation temperature	T_{OPR}	−30 ~ 75	°C
Storage temperature	T_{STG}	−55 ~ 150	°C

*1 If used at 25°C or above, 4.8 mW less per 1°C.

M54459 (1/20, 1/100 HIGH-SPEED DIVIDER)

PIN CONNECTIONS

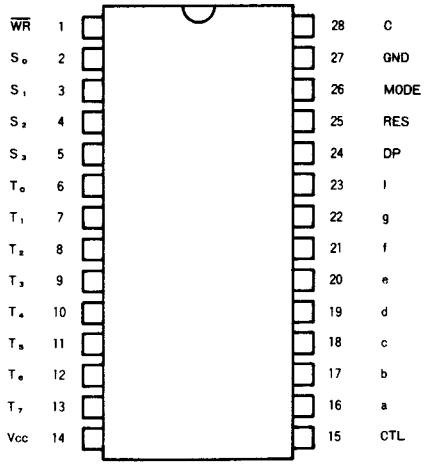


Maximum ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{CC}	9	V
Input voltage	V_I	1.5	V
Operation temperature	T_{OPR}	−10 ~ +75	°C
Storage temperature	T_{STG}	−55 ~ +125	°C

M54844P (PROGRAMMABLE DISPLAY CONTROLLER)

PIN CONNECTIONS

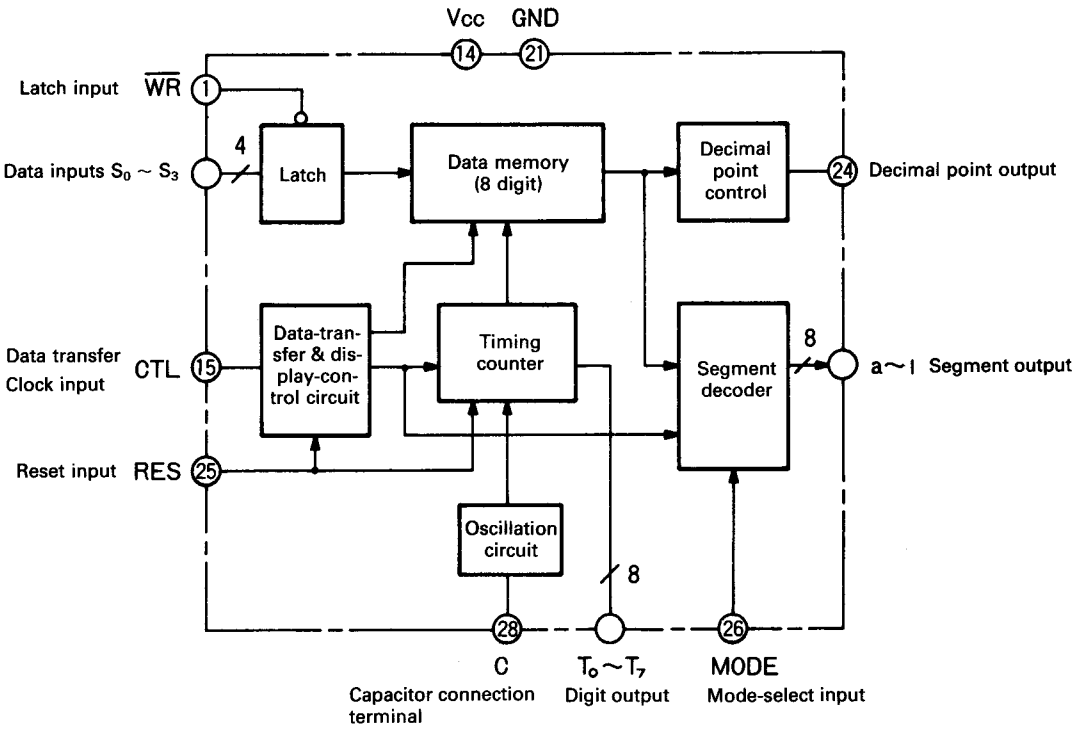


Maximum ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{CC}	−0.3 ~ +15	V
Input voltage	V_I	−0.3 ~ V_{CC}	V
Voltage between power supply and output terminal *1	V_{CC}-V_O	−0.3 ~ +35	V
Operation ambient temperature	T_{OPR}	−30 ~ +85	°C
Storage temperature	T_{STG}	−55 ~ +125	°C

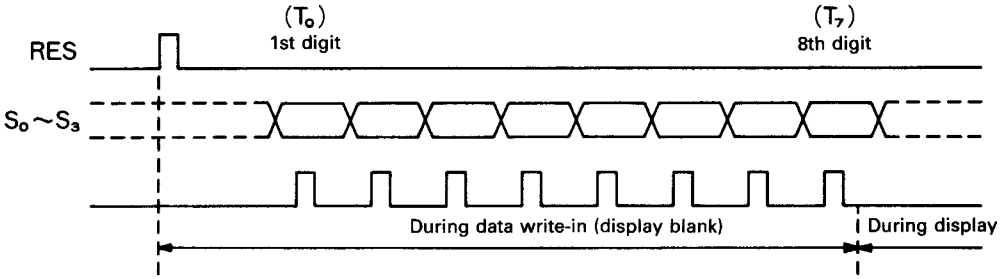
*1 When output OFF

M54844P
BLOCK DIAGRAM



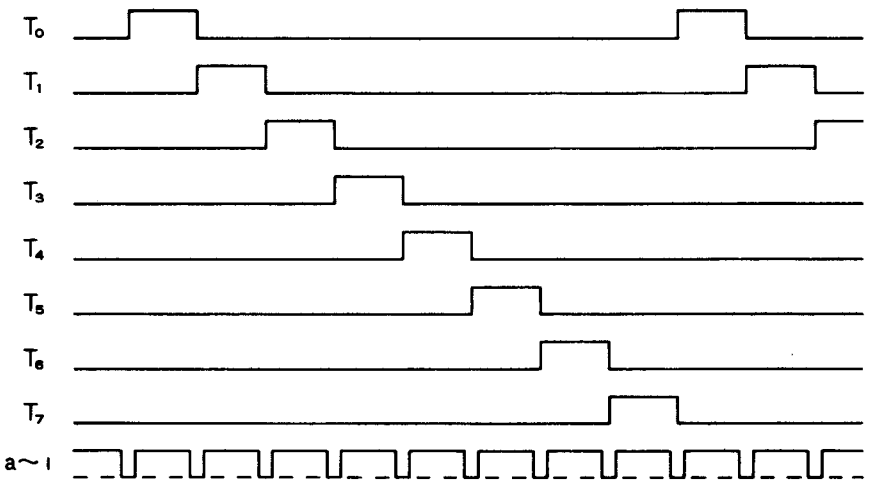
Operation timing

(1) Data write-in



- Data write-in after reset immediately after power ON.
- There is no necessity for reset when writing in data second time and thereafter. When the first pulse of CTL input is input, the display is blanked; when the eighth pulse is input and the write-in is input, the display starts again.

(2) Output timing



SECTION 10 PARTS LIST

[EF UNIT]

REF NO.	DESCRIPTION	PARTS NO.
Q1	Transistor	2SC1740
Q2	Transistor	2SC1740
Q3	Transistor	2SA1015Y
Q4	Transistor	2SC1740
Q5	Transistor	2SC1740
Q6	Transistor	2SC2458
DS1	LED	SLC-26UR
DS2	LED	SLB-22UR
DS3	LED	SLB-22GG
DS4	LED	SLB-22UR
DS5	LED	SLB-22UR
DS6	Lamp	BQ044-32582A
D1	Zener	XZ-117
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	1N4002
D14	Diode	1SS53
D15	Zener	MZ304B
D16	Diode	1SS53
L1	Choke	EL0810SKI-101K
L2	Choke	TB01RN1-A61
L3	Choke	TB01RN1-A61
L4	Choke	TB01RN1-A61
L5	Choke	TB01RN1-A61
L6	Choke	TB01RN1-A61
L7	Choke	TB01RN1-A61
L8	Choke	TB01RN1-A61
L9	Choke	TB01RN1-A61
L10	Choke	TB01RN1-A61
L11	Choke	TB01RN1-A61
L12	Choke	TB01RN1-A61
L13	Choke	TB01RN1-A61
L14	Choke	TB01RN1-A61
R1	Variable	K122 10KB
R2	Variable	K16C 10KB10KB x 2
R3	Variable	K16B 10KB20KC
R4	Variable	K16B 10KB x 2
R5	Variable	K16 10KB
R6	Trimmer	H0651A 10K
R7	Resistor	100 R25
R8	Resistor	22K R25
R9	Trimmer	H0651A 3.3K
R10	Trimmer	H0651A 10K
R11	Trimmer	H0651A 10K
R12	Resistor	47K ELR25
R13	Resistor	4.7K R25
R14	Resistor	47K ELR25
R15	Resistor	47K ELR25
R16	Resistor	100K ELR25

[EF UNIT]

REF NO.	DESCRIPTION	PART NO.
R17	Resistor	47K ELR25
R18	Trimmer	H0651A 100K
R19	Trimmer	H0651A 100K
R20	Resistor	10K R25
R23	Resistor	4.7K ELR25
R24	Resistor	22K ELR25
R25	Resistor	47K R25
R26	Resistor	4.7K ELR25
R27	Resistor	4.7K ELR25
R28	Resistor	2.2K ELR25
R29	Resistor	1.5K ELR25
R30	Resistor	100 R25
R31	Resistor	100 R25
R32	Resistor	10K ELR25
R33	Resistor	10K R25
R34	Resistor	220 ELR25
R35	Resistor	150 R50
C1	Barrier Lay	0.047 25V
C2	Barrier Lay	0.1 16V
C3	Barrier Lay	0.1 16V
C4	Electrolytic	1 50V
C5	Ceramic	0.001 50V
C6	Ceramic	0.0047 50V
C7	Ceramic	0.0047 50V
C8	Ceramic	0.0047 50V
J1	Connector	1625-24R (ACC)
J2	Connector	RT-01T-1.3B (MEMO)
J3	Connector	LJ035-1-2 (PHONE)
J4	Connector	HSJ0779-01A (EX SP)
J5	Connector	HSJ0779-01A (REC)
J6	Connector	FM-MD-RM1 (ANT)
J7	Connector	T-19 (S) RED (LB ANT)
J8	Connector	AT-700 (SEND)
J9	Connector	AT-700 (CONV)
J10	Connector	AT-700 (SCOPE)
SP1	Speaker	EAS-65P65S
EP1	Encorder	LA24007
P1	Connector	TL-25H-10-B1
P2	Connector	TL-25H-08-B1
P3	Connector	TL-25H-08-B1
P4	Connector	TL-25H-07-B1
P5	Connector	TL-25H-03-B1
P6	Connector	TL-25H-10-B1
P7	Connector	TL-25H-02-B1
P8	Connector	TL-25H-02-B1
P9	Connector	TL-25H-03-B1
P10	Connector	TL-25H-06-B1
P11	Connector	TL-25H-02-B1
P12	Connector	1625-03P1
P13	Connector	TL-25H-02-B1
P14	Connector	5250-02
P15	Connector	5250-02
P16	Connector	TL-25H-04-B1
P17	Connector	TL-25H-07-B1
P18	Connector	TL-25H-06-B1
P19	Connector	SMP-03V-B
P20	Connector	SMR-03V-B

[EF UNIT]

REF NO.	DESCRIPTION	PARTS NO.
P21	Connector	TMP-P01X-A1
P22	Connector	TMP-P01X-A1
P23	Connector	TMP-P01X-A1
P24	Connector	TMP-P01X-A1
P25	Connector	TMP-P01X-A1
P27	Connector	TL-25H-12-B1
P28	Connector	TL-25H-12-B1
S1	Switch	SRU1023NC8
S2	Switch	SPJ222CB2
S3	Switch	SPJ222CB2
S4	Switch	SUN411A09
S5	Switch	SUT110C2
S6	Switch	SUT111A7
S7	Switch	SUT111A7
S8	Switch	SUT111A7
S9	Switch	SUT111A6
S10	Switch	SUT111A7
S11	Switch	SUT111A7
S12	Switch	SUT111A7
S13	Switch	SUT111A7
S14	Switch	SUT111A7
S15	Switch	SUT111A7
S16	Switch	SLW-43-16PS
S17	Switch	SUT110C2
S18	Switch	SPJ222CB2
S19	Switch	SPJ222T43
S20	Switch	TW0068CB2
M1	Meter	M-79
B1	SW1 P.C.B	B-622A
B2	PBT P.C.B	B-623A
B3	CHOKE P.C.B	B-624A
B4	LED P.C.B	B-631
B5	SW2 P.C.B	B-641

[MAIN UNIT]

REF NO.	DESCRIPTION	PART NO.
IC1	IC	TA7124P
IC2	IC	μPC1037H
IC3	IC	μPC1037H
IC4	IC	4558D
IC5	IC	AN829
IC6	IC	μPC1181H
IC7	IC	78M08
Q1	FET	2SK49H2
Q2	FET	3SK74M
Q3	Transistor	2SC945P
Q4	Transistor	2SC945
Q5	Transistor	2SA1015Y
Q6	Transistor	2SA1015Y
Q7	FET	3SK74M
Q8	FET	3SK74M
Q9	Transistor	2SC763C
Q10	Transistor	2SC945
Q11	Transistor	2SB562C
C12	Transistor	2SA1015Y
Q13	Transistor	2SC18150
Q14	Transistor	2SC18150
Q15	FET	3SK74M
Q16	FET	3SK74M
Q17	Transistor	2SC945
Q18	Transistor	2SC945
Q19	Transistor	2SC945
Q20	Transistor	2SA1015Y
Q21	Transistor	2SC945
Q22	Transistor	2SA1015Y
Q23	Transistor	2SC945
Q24	Transistor	2SA1015Y
Q25	Transistor	2SA1015Y
Q26	Transistor	2SC945
Q27	Transistor	2SB562C
Q28	Transistor	2SC945
Q29	Transistor	2SC945
Q30	Transistor	2SA1015Y
Q31	Transistor	2SA1015Y
Q32	Transistor	2SC945
Q33	Transistor	2SA1015Y
Q34	Transistor	2SC1740
Q35	Transistor	2SC1740
Q36	Transistor	2SC945
Q37	Transistor	2SC1740
D1	Diode	1SS99
D2	Diode	1SS99
D3	Diode	1SS99
D4	Diode	1SS99
D5	Diode	1SS53
D6	Diode	1SS53
D7	Diode	1SS53
D8	Diode	1SS53
D9	Diode	1K60
D10	Diode	1K60
D11	Diode	1S953
D12	Zener	MZ304B
D13	Diode	1SS53
D14	Diode	1SS53
D15	Diode	1SS53
D16	Diode	1SS53
D17	Diode	1SS53
D18	Diode	1SS53

[MAIN UNIT]

REF NO.	DESCRIPTION	PARTS NO.
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	Varicap	1SV50
D29	Diode	1SS53
D30	Diode	1SS53
D31	Diode	1SS53
D32	Diode	1SS53
D33	Diode	1SS53
D34	Varicap	FC51M
D35	Diode	1SS53
D36	Diode	1SS53
D37	Diode	1SS53
D38	Diode	1SS53
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
D60	Diode	1SS53
D61	Diode	1SS53
D62	Diode	1SS53
D63	Diode	1SS53
D64	Diode	1SS53
D65	Diode	1SS53
D66	Diode	1SS53
D67	Diode	1SS53
D68	Zener	WZ061
D69	Zener	XZ055
D70	Diode	1SS53
D71	Zener	XZ055
D72	Diode	1SS53
D73	Diode	1K60
D74	Diode	1K60
FI1	MC	FL-32
FI2	MC	FL-30
FI3	MC	FL-33
FI4	Ceramic	CFJ455K-5
FI5	Ceramic	CFW455HT
FI6	MC	9M15A
X1	Xtal	9.4665MHz
X2	Xtal	9.0115MHz
X3	Xtal	9.0115MHz
X4	Xtal	9.0145MHz
L1	Transformer	LR-116
L2	Coil	LS-90A

[MAIN UNIT]

REF NO.	DESCRIPTION	PARTS NO.
L3	Coil	LS-90A
L4	Coil	LS-90A
L5	Choke	EL0810SKI-101K
L6	Choke	EL0810SKI-101K
L7	Coil	LS-137
L8	Coil	LS-137
L9	Choke	EL0810SKI-10K
L10	Coil	LS-175
L11	Choke	EL0810SKI-102K
L12	Choke	EL0810SKI-101K
L13	Coil	LS-133A
L14	Coil	LS-20
L15	Coil	LS-175
L16	Coil	LS-133A
L17	Coil	LS-175
L18	Coil	LS-168
L19	Coil	R70K LB4
L20	Coil	LS-93
L21	Choke	EL0810SKI-101K
L22	Choke	EL0810SKI-101K
L23	Coil	LS-175
L24	Coil	LS-67
L25	Choke	EL0810SKI-102K
L26	Choke	EL0810SKI-101K
R1	Resistor	15 R25
R2	Resistor	15 R10
R3	Resistor	68 R10
R4	Resistor	2.2K ELR25
R5	Resistor	4.7K ELR25
R6	Resistor	220 ELR25
R7	Resistor	2.2K ELR25
R8	Resistor	220 ELR25
R9	Resistor	100K ELR25
R10	Resistor	150 ELR25
R11	Resistor	100 ELR25
R12	Resistor	22 ELR25
R13	Resistor	180K ELR25
R14	Resistor	100 R25
R15	Resistor	100 R25
R16	Resistor	10K ELR25
R17	Resistor	10K ELR25
R18	Resistor	10K ELR25
R19	Resistor	47K ELR25
R20	Resistor	47K ELR25
R21	Resistor	100K ELR25
R22	Resistor	22K ELR25
R23	Resistor	1K ELR25
R24	Resistor	22K ELR25
R25	Resistor	47K ELR25
R26	Resistor	330 ELR25
R27	Resistor	10K ELR25
R28	Resistor	100 R25
R29	Resistor	470K R25
R30	Resistor	10K R25
R31	Resistor	820 ELR25
R32	Resistor	2.2K ELR25
R33	Resistor	820 ELR25
R34	Resistor	2.2K ELR25
R35	Resistor	820 ELR25
R36	Resistor	2.2K ELR25
R37	Resistor	3.3K ELR25
R38	Resistor	2.2K ELR25
R39	Resistor	470 ELR25

[MAIN UNIT]

REF NO.	DESCRIPTION	PARTS NO.
R40	Resistor	100 ELR25
R41	Resistor	470 ELR25
R42	Resistor	100 ELR25
R43	Resistor	470 ELR25
R44	Resistor	100 ELR25
R45	Resistor	1K ELR25
R46	Resistor	820 ELR25
R47	Resistor	820 ELR25
R48	Resistor	820 ELR25
R49	Resistor	2.2K ELR25
R50	Resistor	100 ELR25
R51	Resistor	10K R25
R52	Resistor	100K ELR25
R53	Resistor	100K ELR25
R54	Resistor	330 ELR25
R55	Resistor	100 R25
R56	Resistor	3.3K ELR25
R57	Resistor	100K ELR25
R58	Resistor	100 ELR25
R59	Resistor	1K R25
R60	Resistor	33K ELR25
R61	Resistor	100K ELR25
R62	Resistor	1K R25
R63	Resistor	47K ELR25
R64	Resistor	47K ELR25
R65	Resistor	2.2K ELR25
R66	Resistor	470 R25
R67	Resistor	4.7K R25
R68	Resistor	10K ELR25
R69	Resistor	10K ELR25
R71	Resistor	4.7K ELR25
R72	Resistor	330 ELR25
R73	Resistor	470 ELR25
R74	Resistor	4.7K ELR25
R75	Resistor	100 ELR25
R76	Resistor	470 ELR25
R77	Resistor	4.7K ELR25
R78	Resistor	47K ELR25
R79	Resistor	330 ELR25
R80	Resistor	2.2K ELR25
R81	Resistor	100 ELR25
R82	Resistor	10K ELR25
R83	Resistor	100 ELR25
R84	Resistor	3.3K ELR25
R85	Resistor	100K ELR25
R86	Resistor	4.7K R25
R87	Resistor	4.7K ELR25
R88	Resistor	10K ELR25
R89	Array	RM4-473
R90	Resistor	1K ELR25
R91	Resistor	1K ELR25
R92	Resistor	1K ELR25
R93	Resistor	1K ELR25
R94	Resistor	4.7K ELR25
R95	Resistor	47K ELR25
R96	Resistor	47K ELR25
R97	Resistor	10K ELR25
R98	Resistor	470 R25
R99	Resistor	100 R25
R100	Resistor	100K R25
R101	Resistor	100K R25
R102	Resistor	4.7K R25
R103	Resistor	1M ELR25
R104	Resistor	47K ELR25

[MAIN UNIT]

REF NO.	DESCRIPTION	PARTS NO.
R105	Resistor	1M ELR25
R106	Resistor	220 ELR25
R107	Resistor	47K ELR25
R108	Resistor	4.7K R25
R109	Resistor	180K R25
R111	Resistor	100K R25
R112	Resistor	10K ELR25
R113	Resistor	3.9K ELR25
R114	Resistor	330 ELR25
R115	Resistor	100 R25
R116	Resistor	10K ELR25
R117	Resistor	1K ELR25
R118	Resistor	330 ELR25
R119	Resistor	100 R25
R120	Resistor	10K ELR25
R121	Resistor	47K ELR25
R122	Resistor	100 ELR25
R123	Resistor	15K ELR25
R124	Resistor	47K R25
R125	Resistor	4.7K ELR25
R126	Resistor	2.2K ELR25
R127	Resistor	47K ELR25
R128	Resistor	22K R25
R129	Resistor	4.7K R25
R130	Resistor	22K R25
R131	Resistor	10K R25
R132	Resistor	100 R25
R133	Resistor	3.3K ELR25
R134	Resistor	15K R25
R135	Resistor	1K R25
R136	Resistor	10M ERC14GJ
R137	Trimmer	EVN 5AC 47K
R138	Trimmer	EVN 5AC 10K
R139	Resistor	1K ELR25
R140	Resistor	10K ELR25
R141	Resistor	10M ERC14GJ
R142	Resistor	100 ELR25
R143	Resistor	100 ELR25
R144	Resistor	12K ELR25
R145	Resistor	10K ELR25
R146	Resistor	10K ELR25
R147	Resistor	47K R25
R148	Resistor	3.3M ELR25
R149	Resistor	22K ELR25
R150	Resistor	470 R25
R151	Resistor	220K ELR25
R152	Resistor	100 R25
R153	Resistor	100 ELR25
R154	Resistor	10K R25
R155	Resistor	470 R25
R156	Resistor	3.3K R25
R157	Resistor	100 R25
R158	Resistor	10K ELR25
R159	Resistor	10K ELR25
R160	Resistor	2.2 ELR25
R161	Resistor	10K ELR25
R162	Resistor	47K ELR25
R163	Resistor	47K ELR25
R164	Resistor	10K ELR25
R165	Resistor	15K ELR25
R166	Resistor	68K ELR25
R167	Resistor	4.7K R25
R168	Resistor	1K ELR25
R169	Resistor	22K ELR25

[MAIN UNIT]

REF NO.	DESCRIPTION	PART NO.
R170	Resistor	6.8K ELR25
R171	Resistor	820 ELR25
R172	Resistor	10K ELR25
R173	Resistor	2.2K ELR25
R176	Resistor	22K ELR25
R177	Resistor	15K ELR25
R178	Resistor	47K ELR25
R179	Resistor	4.7K ELR25
R180	Resistor	22K ELR25
R181	Resistor	2.2K ELR25
R182	Resistor	4.7K R25
R183	Resistor	3.3K R25
R184	Resistor	100K ELR25
R185	Resistor	100K ELR25
R186	Resistor	33K ELR25
R187	Resistor	22K ELR25
R188	Resistor	39K ELR25
R189	Trimmer	EVN 5AC 33K
R190	Trimmer	H1051C 10K25
R191	Resistor	47K ELR25
R192	Resistor	220 R25
R193	Resistor	4.7K R25
R194	Resistor	47K R25
R195	Resistor	22K ELR25
R196	Resistor	22K ELR25
R197	Resistor	220 ELR25
R198	Resistor	470K ELR25
R199	Resistor	220K ELR25
R200	Resistor	150 R25
R201	Resistor	22K ELR25
R202	Resistor	4.7K ELR25
R203	Resistor	470K ELR25
R204	Trimmer	EVN 5AC 50K
R205	Resistor	4.7K ELR25
R206	Resistor	1K R25
R207	Resistor	68K ELR25
R208	Resistor	10K ELR25
R211	Resistor	1K ELR25
R212	Resistor	47 R25
C1	Ceramic	0.0047 50V
C2	Ceramic	1P 50V
C3	Ceramic	10P 50V
C4	Ceramic	0.0047 50V
C5	Ceramic	0.0047 50V
C6	Ceramic	0.0047 50V
C7	Electrolytic	47 16V
C8	Ceramic	0.0047 50V
C9	Tantalum	4.7 35V
C10	Ceramic	0.001 50V
C11	Ceramic	150P 50V
C12	Electrolytic	220 10V
C13	Mylar	0.033 50V
C14	Tantalum	1 35V
C15	Barrier Lay	0.1 16V
C16	Ceramic	330P 50V
C17	Mylar	0.01 50V
C18	Ceramic	0.001 50V
C19	Mylar	0.022 50V
C20	Ceramic	0.001 50V
C21	Ceramic	0.0047 50V
C22	Ceramic	0.0047 50V
C23	Ceramic	0.0047 50V
C24	Barrier Lay	0.047 25V

[MAIN UNIT]

REF NO.	DESCRIPTION	PART NO.
C25	Barrier Lay	0.047 25V
C26	Barrier Lay	0.047 25V
C27	Barrier Lay	0.047 25V
C28	Ceramic	0.0047 50V
C29	Barrier Lay	0.047 25V
C30	Ceramic	0.0047 50V
C31	Barrier Lay	0.047 25V
C32	Ceramic	0.0047 50V
C33	Barrier Lay	0.047 25V
C34	Ceramic	0.0047 50V
C35	Ceramic	0.001 50V
C36	Barrier Lay	0.047 25V
C37	Mylar	0.022 50V
C38	Ceramic	0.0047 50V
C39	Ceramic	0.0047 50V
C40	Ceramic	0.001 50V
C41	Ceramic	0.0047 50V
C42	Barrier Lay	0.1 16V
C43	Electrolytic	10 16V
C44	Ceramic	0.0047 50V
C45	Ceramic	0.0047 50V
C46	Electrolytic	10 16V
C47	Ceramic	0.0047 50V
C48	Dip Mica	330P 50V
C49	Dip Mica	330P 50V
C50	Ceramic	100P 50V
C51	Ceramic	0.0047 50V
C52	Barrier Lay	0.047 25V
C53	Barrier Lay	0.047 25V
C54	Barrier Lay	0.047 25V
C55	Barrier Lay	0.047 25V
C56	Ceramic	0.0047 50V
C57	Barrier Lay	0.047 25V
C58	Ceramic	0.0047 50V
C59	Barrier Lay	0.1 16V
C60	Barrier Lay	0.1 16V
C61	Ceramic	120P 50V
C62	Trimmer	CTZ31C
C63	Dip Mica	10P 50V
C64	Ceramic	0.0047 50V
C65	Ceramic	0.0047 50V
C66	Ceramic	0.0047 50V
C67	Ceramic	0.0047 50V
C68	Ceramic	0.0047 50V
C69	Dip Mica	33P 50V
C70	Trimmer	CTZ31F
C71	Dip Mica	51P 50V
C72	Ceramic	0.0047 50V
C73	Dip Mica	150P 50V
C74	Dip Mica	150P 50V
C75	Ceramic	100P 50V
C76	Electrolytic	47 10V
C77	Electrolytic	10 16V
C78	Mylar	0.022 50V
C79	Electrolytic	10 16V
C80	Mylar	0.022 50V
C81	Barrier Lay	0.047 25V
C82	Ceramic	0.0047 50V
C83	Ceramic	0.001 50V
C84	Ceramic	0.0047 50V
C85	Ceramic	0.0047 50V
C86	Ceramic	0.001 50V
C87	Ceramic	0.0047 50V
C88	Ceramic	0.0047 50V

[MAIN UNIT]

REF NO.	DESCRIPTION	PART NO.	
C89	Ceramic	0.0047	50V
C90	Ceramic	100P	50V
C91	Ceramic	10P	50V
C92	Ceramic	100P	50V
C93	Ceramic	330P	50V
C94	Barrier Lay	0.1	16V
C95	Electrolytic	0.47	50V
C96	Ceramic	100P	50V
C97	Ceramic	0.0047	50V
C98	Ceramic	0.0047	50V
C99	Ceramic	0.0047	50V
C100	Electrolytic	47	10V
C101	Electrolytic	10	16V
C102	Ceramic	0.0047	50V
C103	Electrolytic	47	10V
C104	Electrolytic	0.47	50V
C105	Mylar	0.022	50V
C106	Electrolytic	47	10V
C107	Barrier Lay	0.1	16V
C108	Barrier Lay	0.1	16V
C109	Barrier Lay	0.1	16V
C110	Mylar	0.056	50V
C111	Mylar	0.01	50V
C112	Electrolytic	0.47	50V
C113	Electrolytic	220	10V
C114	Electrolytic	0.47	35V
C115	Electrolytic	0.47	50V
C116	Electrolytic	220	10V
C117	Mylar	0.01	50V
C118	Barrier Lay	0.1	16V
C119	Barrier Lay	0.1	16V
C120	Ceramic	0.001	50V
C121	Barrier Lay	0.1	16V
C122	Electrolytic	47	16V
C123	Electrolytic	220	10V
C124	Electrolytic	47	16V
C125	Ceramic	0.0047	50V
C126	Electrolytic	470	16V
C127	Mylar	0.1	50V
C128	Electrolytic	470	16V
C129	Ceramic	0.0047	50V
C130	Ceramic	0.0047	50V
C131	Ceramic	0.0047	50V
C132	Electrolytic	22	16V
C133	Electrolytic	0.47	50V
C134	Electrolytic	10	16V
C135	Ceramic	0.0047	50V
C138	Ceramic	0.0047	50V
C139	Ceramic	0.0047	50V
C140	Ceramic	0.0047	50V
C141	Ceramic	0.0047	50V
C142	Ceramic	0.0047	50V
C143	Ceramic	0.0047	50V
C144	Ceramic	0.0047	50V
C145	Ceramic	0.0047	50V
C146	Electrolytic	1	25V
C150	Array	B8ZC0111-32	
C154	Barrier Lay	0.1	16V
C155	Electrolytic	0.47	50V
C156	Barrier Lay	0.047	25V
C157	Electrolytic	22	16V
C158	Electrolytic	47	10V
C159	Mylar	0.0047	50V
C160	Ceramic	0.0047	50V

[MAIN UNIT]

REF NO.	DESCRIPTION	PART NO.	
C161	Electrolytic	1	50V
J1	Connector	TMP-J01X-V1	
J3	Connector	TL-25P-08-V1	
J4	Connector	TL-25P-05-V1	
J5	Connector	TL-25P-06-V1	
J6	Connector	TL-25P-08-V1	
J7	Connector	TL-25P-06-V1	
J8	Connector	TL-25P-02-V1	
J9	Connector	TL-25P-10-V1	
J10	Connector	TL-25P-08-V1	
P1	Connector	TMP-P01X-A1	
S1	Switch	HSW0567-01-310	
S2	Switch	HSW0567-01-310	
B1	Main P.C.B	B-616B	

[RF UNIT]

REF NO.	DESCRIPTION	PART NO.
IC1	IC	DM-412EL
Q1	Transistor	2SA1015Y
Q2	Transistor	2SC945P
Q3	Transistor	2SC945P
Q4	Transistor	2SC945P
Q5	FET	2SK125
Q6	FET	2SK125
Q7	Transistor	2SC945P
Q8	FET	3SK48
Q9	FET	2SK49H
Q10	Transistor	2SC2053
D1	Diode	1SS53
D2	Diode	1SS53
D3	Diode	1SS53
D4	Diode	1SS53
D5	Diode	1SS53
D6	Zener	WZ046
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
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
FI1	MC	70M15B
L1	Choke	EL0810SKI-101
L2	Choke	EL0810SKI-102
L3	Choke	EL0810SKI-101
L4	Choke	EL0810SKI-102
L5	Choke	EL0810SKI-102
L6	Choke	EL0810SKI-102
L7	Choke	EL0810SKI-101
L8	Choke	EL0810SKI-101
L9	Choke	EL0810SKI-101
L10	Choke	EL0810SKI-101
L11	Choke	EL0810SKI-101
L12	Choke	EL0810SKI-101
L13	Choke	EL0810SKI-101

[RF UNIT]

REF NO.	DESCRIPTION	PART NO.
L14	Choke	EL0810SKI-101
L15	Choke	EL0810SKI-102
L16	Choke	EL0810SKI-101
L17	Choke	LB4 R36
L18	Choke	LB4 R30
L19	Choke	LB4 R36
L20	Choke	LB4 R34
L21	Choke	EL0810SKI-101
L22	Choke	LB4 R65
L23	Choke	LB4 R50
L24	Choke	LB4 R45
L25	Choke	LB4 R41
L26	Choke	EL0810SKI-101
L27	Choke	LB4 R83
L28	Choke	LB4 R65
L29	Choke	LB4 R65
L30	Choke	LB4 R54
L31	Choke	EL0810SKI-101
L32	Choke	EL0810SKI-1R0
L33	Choke	EL0810SKI-1R0
L34	Choke	LB4 R83
L35	Choke	LB4 R70
L36	Choke	EL0810SKI-101
L37	Choke	EL0810SKI-1R5
L38	Choke	EL0810SKI-1R2
L39	Choke	EL0810SKI-1R5
L40	Choke	EL0810SKI-1R2
L41	Choke	EL0810SKI-101
L42	Choke	EL0810SKI-2R2
L43	Choke	EL0810SKI-2R2
L44	Choke	EL0810SKI-2R2
L45	Choke	EL0810SKI-1R8
L46	Choke	EL0810SKI-101
L47	Choke	EL0810SKI-3R9
L48	Choke	EL0810SKI-3R3
L49	Choke	EL0810SKI-3R3
L50	Choke	EL0810SKI-2R7
L51	Choke	EL0810SKI-101
L52	Choke	LB4 6R2
L53	Choke	LB4 5R1
L54	Choke	LB4 4R3
L55	Choke	LB4 3R6
L56	Choke	EL0810SKI-102
L57	Choke	LB4 7R5
L58	Choke	LB4 6R2
L59	Choke	EL0810SKI-102
L60	Choke	EL0810SKI-101
L61	Choke	EL0810SKI-102
L62	Choke	EL0810SKI-102
L63	Coil	LR-129
L64	Coil	LR-130
L65	Choke	EL0810SKI-102
L66	Choke	EL0810SKI-102
L67	Choke	EL0810SKI-102
L68	Choke	LB4 R15
L69	Coil	LR-85A
L70	Choke	EL0810SKI-101
L71	Coil	LA-121
L72	Coil	LA-127
L73	Coil	LA-35
L74	Coil	LA-106
L75	Coil	LS-254
L76	Coil	LS-254
L77	Coil	LS-254

[RF UNIT]

REF NO.	DESCRIPTION	PART NO.
L78	Coil	LS-114
L79	Choke	EL0810SKI-100
L80	Choke	EL0810SKI-102
L81	Choke	EL0810SKI-101
L82	Choke	EL0810SKI-102
R1	Resistor	10K R25
R2	Resistor	1K ELR25
R3	Resistor	1K ELR25
R4	Resistor	100 R25
R5	Resistor	1K ELR25
R6	Resistor	1.5K R25
R7	Resistor	330 R25
R8	Resistor	1K ELR25
R9	Resistor	100 R50
R10	Resistor	100 R25
R11	Resistor	100 ELR25
R12	Resistor	100 ELR25
R13	Resistor	100 ELR25
R14	Resistor	100 ELR25
R15	Resistor	100 ELR25
R16	Resistor	100 ELR25
R17	Resistor	100 ELR25
R18	Resistor	22 ELR25
R19	Resistor	33 ELR25
R20	Resistor	330 ELR25
R21	Resistor	100 ELR25
R22	Resistor	220 R50
R23	Array	10K RM10
R24	Resistor	10K R25
R25	Resistor	100 R50
R26	Resistor	100 R25
R27	Resistor	22K R25
R28	Resistor	100 R25
R29	Resistor	22 ELR25
R30	Resistor	10K ELR25
R31	Resistor	100 R25
R32	Resistor	22K R25
R33	Resistor	100 ELR25
R34	Resistor	22K R25
R35	Resistor	100K R25
R36	Resistor	39 R25
R37	Resistor	39 R25
R38	Resistor	10 ELR25
R39	Resistor	100K R25
R40	Resistor	470 R25
R41	Resistor	10K ELR25
R42	Resistor	2.2K ELR25
R43	Resistor	8.2 ELR25
R44	Resistor	150 ELR25
R45	Resistor	8.2 ELR25
R46	Resistor	100K ELR25
R47	Resistor	220 ELR25
R48	Resistor	100 R25
R49	Resistor	100 ELR25
R50	Resistor	10K ELR25
R51	Resistor	470 ELR25
R52	Resistor	100K R25
R53	Resistor	100K R25
R54	Resistor	1K R25
R55	Resistor	10K ELR25
R56	Resistor	3.3K ELR25
R57	Resistor	47K ELR25
R58	Resistor	1K ELR25

[RF UNIT]

REF NO.	DESCRIPTION	PART NO.
R59	Resistor	10K ELR25
R60	Resistor	150 R25
R61	Resistor	4.7K ELR25
R62	Resistor	330 R25
C1	Barrier Lay	0.047 25V
C2	Barrier Lay	0.1 16V
C3	Barrier Lay	0.047 25V
C4	Barrier Lay	0.1 16V
C5	Barrier Lay	0.1 16V
C6	Barrier Lay	0.047 25V
C7	Ceramic	0.0047 50V
C8	Ceramic	DD104SL300J50V02
C9	Ceramic	100P 50V
C10	Ceramic	68P 50V
C11	Ceramic	100P 50V
C12	Ceramic	120P 50V
C13	Barrier Lay	UFD08SA821K-L2A
C14	Ceramic	100P 50V
C15	Ceramic	0.0047 50V
C16	Ceramic	0.0047 50V
C17	Ceramic	DD106SL181J50V02
C18	Ceramic	DD104SL240J50V02
C19	Ceramic	DD106SL181J50V02
C20	Ceramic	DD106SL181J50V02
C21	Barrier Lay	TBD04V122K-L0B
C22	Ceramic	150P 50V
C23	Ceramic	0.0047 50V
C24	Barrier Lay	0.047 25V
C25	Ceramic	DD107SL301J50V02
C26	Ceramic	DD104SL390J50V02
C27	Ceramic	DD107SL301J50V02
C28	Ceramic	220P 50V
C29	Barrier Lay	TBD04V182K-L0B
C30	Ceramic	DD106SL201J50V02
C31	Barrier Lay	0.047 25V
C32	Barrier Lay	0.047 25V
C33	Ceramic	DD108SL331J50V02
C34	Ceramic	DD104SL510J50V02
C35	Ceramic	DD108SL331J50V02
C36	Ceramic	DD108SL331J50V02
C37	Barrier Lay	TBD05V272K-L0B
C38	Ceramic	DD107SL301J50V02
C39	Barrier Lay	0.047 25V
C40	Barrier Lay	0.047 25V
C41	Barrier Lay	UFD08SA561K-L2A
C42	Ceramic	DD104SL750J50V02
C43	Ceramic	DD109SL511J50V02
C44	Barrier Lay	UFD08SA681K-L2A
C45	Barrier Lay	TBD05V332K-L0B
C46	Ceramic	DD109SL511J50V02
C47	Barrier Lay	0.047 25V
C48	Barrier Lay	0.1 16V
C49	Barrier Lay	UFD08SA821K-L2A
C50	Ceramic	100P 50V
C51	Barrier Lay	UFD08SA681K-L2A
C52	Barrier Lay	TBD04V122K-L0B
C53	Barrier Lay	TBD06V682K-L2A
C54	Barrier Lay	TBD04V102K-L0B
C55	Barrier Lay	0.1 16V
C56	Barrier Lay	0.1 16V
C57	Barrier Lay	TBD04V152K-L0B
C58	Ceramic	DD106SL201J50V02
C59	Barrier Lay	TBD04V152K-L0B

[RF UNIT]

REF NO.	DESCRIPTION	PART NO.		
C60	Barrier Lay	TBD04V182K-L0B		
C61	Barrier Lay	TBD06V103K-L2A		
C62	Barrier Lay	TBD04V122K-L0B		
C63	Barrier Lay	0.1	16V	
C64	Barrier Lay	0.1	16V	
C65	Barrier Lay	TBD04V222K-L0B		
C66	Ceramic	DD107SL271J50V02		
C67	Barrier Lay	TBD04V222K-L0B		
C68	Barrier Lay	TBD04V222K-L0B		
C69	Barrier Lay	TBD08V123K-L2A		
C70	Barrier Lay	TBD04V152K-L0B		
C71	Barrier Lay	0.1	16V	
C72	Barrier Lay	0.1	16V	
C73	Electrolytic	10	16V	RC2
C74	Electrolytic	1	50V	BP
C75	Barrier Lay	TBD05V332K-L0B		
C76	Ceramic	DD108SL391J50V02		
C77	Barrier Lay	TBD05V332K-L0B		
C78	Barrier Lay	0.047	25V	
C79	Barrier Lay	0.1	16V	
C80	Barrier Lay	0.047	25V	
C81	Barrier Lay	0.047	25V	
C82	Barrier Lay	0.1	16V	
C83	Barrier Lay	0.047	25V	
C84	Barrier Lay	0.047	25V	
C85	Barrier Lay	0.047	25V	
C86	Barrier Lay	0.047	25V	
C87	Barrier Lay	0.047	25V	
C88	Barrier Lay	0.1	16V	
C89	Barrier Lay	0.047	25V	
C90	Barrier Lay	0.1	16V	
C91	Barrier Lay	0.1	16V	
C92	Electrolytic	1	50V	BP
C93	Barrier Lay	0.047	25V	
C94	Ceramic	100P	50V	
C95	Ceramic	18P	50V	
C96	Ceramic	150P	50V	
C97	Ceramic	7P	50V	
C98	Ceramic	100P	50V	
C99	Ceramic	39P	50V	
C100	Ceramic	270P	50V	
C101	Ceramic	39P	50V	
C102	Ceramic	0.0047	50V	
C103	Ceramic	470P	50V	
C104	Ceramic	39P	50V	
C105	Ceramic	7P	50V	
C106	Ceramic	62P	50V	
C107	Ceramic	3P	50V	
C108	Ceramic	39P	50V	
C109	Ceramic	3P	50V	
C110	Ceramic	0.0047	50V	
C111	Ceramic	470P	50V	
C112	Ceramic	8P	50V	
C113	Ceramic	10P	50V	
C114	Ceramic	10P	50V	
C115	Ceramic	0.001	50V	
C116	Ceramic	0.001	50V	
C117	Ceramic	0.001	50V	
C118	Ceramic	0.0047	50V	
C119	Ceramic	5P	50V	
C120	Ceramic	0.001	50V	
C121	Barrier Lay	0.047	25V	
C122	Electrolytic	10	16V	RC2
C123	Ceramic	0.0047	50V	

[RF UNIT]

REF NO.	DESCRIPTION	PART NO.		
C124	Ceramic	0.001	50V	
C125	Ceramic	0.001	50V	
C126	Ceramic	0.001	50V	
C127	Ceramic	0.001	50V	
C128	Electrolytic	1	50V	RC2
C129	Barrier Lay	0.1	16V	
C130	Barrier Lay	0.1	16V	
C131	Barrier Lay	0.1	16V	
C132	Barrier Lay	0.047	25V	
C133	Barrier Lay	0.047	25V	
C134	Barrier Lay	0.047	25V	
C135	Barrier Lay	0.047	25V	
C136	Ceramic	0.0047	50V	
C137	Ceramic	0.0047	50V	
C138	Ceramic	0.0047	50V	
C139	Ceramic	0.0047	50V	
C140	Ceramic	0.0047	50V	
C141	Barrier Lay	0.1	16V	
C142	Barrier Lay	0.1	16V	
C143	Electrolytic	10	10V	
C144	Ceramic	10P	50V	
C145	Electrolytic	10	16V	
J1	Connector	TMP-J01X-V1		
J2	Connector	TMP-J01X-V1		
J3	Connector	TL-25P-02-V1		
J4	Connector	TMP-J01X-V1		
J5	Connector	TL-25P-10-V1		
P1	Connector	TL-25H-05-B1		
S1	Switch	HSW0474-01050		
B1	RF P.C.B	B-617B		

[PLL UNIT]

REF NO.	DESCRIPTION	PART NO.
IC1	IC	μA78L-05
IC2	IC	TC-9123BP
IC3	IC	TC-9123BP
IC4	IC	TA-7310P
IC5	IC	M54459L
IC6	IC	SN74LS74
IC7	IC	MC4044L5
IC8	IC	TA-7310P
IC9	IC	HD10551
IC10	IC	μPC1037H
Q1	Transistor	2SC1571-G
Q2	FET	2SK192-GR
Q3	FET	2SK192-GR
Q4	FET	2SK192-GR
Q5	FET	2SK192-GR
Q6	Transistor	2SC763-C
Q7	Transistor	2SC2053
Q8	Transistor	2SC763-C
Q9	Transistor	2SC763-C
Q10	Transistor	2SC945-P or Q
Q11	Transistor	2SC945-P or Q
Q12	Transistor	2SC945-P
Q13	Transistor	2SC763-C
Q14	Transistor	2SC945-P
Q16	Transistor	2SC945-P or Q
Q17	Transistor	2SA1015-Y
D1	Diode	1SS53
D2	Diode	1SS53
D3	Varicap	SVC-303Y
D4	Varicap	1SV50
D5	Diode	1SS53
D6	Varicap	1SV50
D7	Diode	1SS53
D8	Varicap	1SV50
D9	Diode	1SS53
D10	Varicap	1SV50
D11	Diode	1SS53
D12	Diode	1K60
D13	Varicap	1T25
D14	Varicap	1SV50
D15	Diode	1SS53
X1	Xtal	20.48MHz HC-43/U
X2	Xtal	10.24MHz HC-43/U
L1	Choke	LW-16
L2	Choke	EL0810SKI-101K
L3	Choke	EL0810SKI-101K
L4	Choke	220 (L4)
L5	Coil	LB-135
L6	Choke	LR-79
L7	Coil	LB-135
L8	Choke	LR-79
L9	Coil	LB-135
L10	Choke	LR-79
L11	Coil	LB-135
L12	Choke	LW-19
L13	Transformer	LR-87
L14	Coil	LB-116
L15	Choke	EL0810SKI-101K

[PLL UNIT]

REF NO.	DESCRIPTION	PART NO.
L16	Choke	EL0810SKI-3R9K
L17	Choke	EL0810SKI-101K
L18	Choke	EL0810SKI-101K
L19	Coil	LB-139
L21	Choke	FL 4H100K
L22	Coil	LS-94
L23	Choke	EL0810SKI-101K
L24	Choke	0R23 (LB4)
L25	Choke	0R34 (LB4)
L26	Coil	LA-161
L27	Coil	LA-160
L28	Choke	EL0810SKI-101K
L30	Coil	LS-112
L31	Coil	LS-112
L32	Coil	LS-112
L33	Coil	LS-162
L34	Coil	LS-162
R1	Resistor	330 ELR25
R2	Resistor	4.7K R25
R3	Resistor	3.3K ELR25
R4	Resistor	100 R25
R5	Resistor	4.7K ELR25
R6	Resistor	5.6K ELR25
R7	Resistor	100 R25
R8	Resistor	470K ELR25
R9	Resistor	470K ELR25
R10	Resistor	100 R10
R11	Resistor	470K ELR25
R12	Resistor	470K ELR25
R13	Resistor	100 R10
R14	Resistor	470K ELR25
R15	Resistor	470K ELR25
R16	Resistor	100 R10
R17	Resistor	470K ELR25
R18	Resistor	470K ELR25
R19	Resistor	150 ELR25
R20	Resistor	100 ELR25
R21	Resistor	4.7K ELR25
R22	Resistor	4.7K ELR25
R23	Resistor	100 ELR25
R24	Resistor	330 ELR25
R25	Resistor	33 ELR25
R26	Resistor	220 ELR25
R27	Resistor	100 ELR25
R28	Resistor	10K ELR25
R29	Resistor	5.6K ELR25
R30	Resistor	220 ELR25
R31	Resistor	4.7K ELR25
R32	Resistor	2.2K ELR25
R33	Resistor	560 ELR25
R34	Resistor	560 ELR25
R35	Resistor	10K R25
R36	Resistor	2.2K R25
R37	Resistor	22K ELR25
R38	Resistor	47 ELR25
R39	Resistor	1K ELR25
R40	Resistor	470 R25
R41	Resistor	47K R25
R42	Resistor	470 ELR25
R43	Resistor	470 ELR25
R44	Resistor	4.7K R25
R45	Resistor	47K R25
R46	Resistor	4.7K ELR25

[PLL UNIT]

REF NO.	DESCRIPTION	PART NO.	
R47	Resistor	330	ELR25
R48	Resistor	100	ELR25
R49	Resistor	100	ELR25
R50	Resistor	470	ELR25
R51	Resistor	10K	ELR25
R52	Resistor	5.6K	ELR25
R53	Resistor	100	R25
R54	Resistor	100	ELR25
R55	Resistor	22K	ELR25
R56	Resistor	4.7K	ELR25
R57	Resistor	100K	R10
R58	Resistor	100K	ELR25
R59	Resistor	2.2K	ELR25
R60	Resistor	47K	ELR25
R61	Resistor	1K	ELR25
R62	Resistor	100K	ELR25
R63	Resistor	470	ELR25
R64	Resistor	470	ELR25
R65	Resistor	1K	R25
R66	Resistor	47	ELR25
R67	Resistor	100	ELR25
R68	Resistor	220	ELR25
R69	Resistor	10K	ELR25
R70	Resistor	10K	ELR25
R71	Resistor	3.3K	ELR25
R72	Resistor	100	ELR25
R73	Resistor	100	ELR25
R74	Resistor	1K	ELR25
R75	Resistor	22K	ELR25
R76	Resistor	4.7K	ELR25
R77	Resistor	47K	ELR25
R78	Resistor	15K	ELR25
R79	Resistor	47K	ELR25
R80	Resistor	100K	ELR25
R81	Resistor	150K	ELR25
R82	Trimmer	EVN 54C 100K	
R83	Resistor	680K	ELR25
R84	Resistor	RM-4 222	
R85	Resistor	10K	ELR25
R87	Resistor	22K	ELR25
R88	Resistor	47K	ELR25
R89	Resistor	820	ELR25
R90	Resistor	33	ELR25
R91	Resistor	47	ELR25
C1	Barrier Lay	0.1	16V
C2	Electrolytic	470μ	10V
C3	Electrolytic	47μ	10V
C4	Barrier Lay	0.1	25V
C5	Ceramic	0.0047	50V
C6	Electrolytic	0.47μ	50V
C7	Electrolytic	47μ	10V
C8	Barrier Lay	0.1	16V
C9	Ceramic	470P	50V
C10	Ceramic	470P	50V
C11	Ceramic	470P	50V
C12	Ceramic	470P	50V
C13	Ceramic	470P	50V
C14	Ceramic	470P	50V
C15	Ceramic	470P	50V
C16	Ceramic	470P	50V
C17	Ceramic	470P	50V

[PLL UNIT]

REF NO.	DESCRIPTION	PART NO.	
C18	Ceramic	470P	50V
C19	Electrolytic	47μ	10V
C20	Barrier Lay	0.1	16V
C21	Electrolytic	100μ	10V
C22	Barrier Lay	0.047	25V
C24	Tantalum	1μ	25V
C26	Ceramic	0.001	50V
C27	Ceramic	120P	50V
C28	Ceramic	18P	50V
C29	Trimmer	CTZ31C	
C30	Ceramic	56P	50V
C31	Ceramic	12P	50V
C32	Ceramic	12P	50V
C33	Electrolytic	100μ	10V
C34	Ceramic	0.0047	50V
C35	Electrolytic	47μ	10V
C36	Ceramic	0.001	50V
C37	Ceramic	56P	50V
C38	Ceramic	15P	50V
C39	Trimmer	CTZ31C	
C40	Ceramic	47P	50V
C41	Ceramic	12P	50V
C42	Ceramic	12P	50V
C43	Electrolytic	100μ	10V
C44	Ceramic	0.0047	50V
C45	Electrolytic	47μ	10V
C46	Ceramic	0.001	50V
C47	Ceramic	56P	50V
C48	Ceramic	10P	50V
C49	Trimmer	CTZ31A	
C50	Ceramic	39P	50V
C51	Ceramic	12P	50V
C52	Ceramic	8P	50V
C53	Electrolytic	100μ	10V
C54	Ceramic	0.0047	50V
C55	Electrolytic	47μ	10V
C56	Ceramic	0.001	50V
C57	Ceramic	39P	50V
C58	Ceramic	8P	50V
C59	Trimmer	CTZ31A	
C60	Ceramic	33P	50V
C61	Ceramic	12P	50V
C62	Ceramic	3P	50V
C63	Electrolytic	100μ	10V
C64	Ceramic	0.0047	50V
C65	Ceramic	1P	50V
C66	Ceramic	0.0047	50V
C67	Ceramic	0.0047	50V
C68	Ceramic	18P	50V
C69	Ceramic	0.0047	50V
C70	Ceramic	0.0047	50V
C71	Ceramic	0.0047	50V
C72	Ceramic	0.0047	50V
C73	Ceramic	0.0047	50V
C74	Barrier Lay	0.1	16V
C75	Ceramic	0.0047	50V
C76	Ceramic	330P	50V
C77	Electrolytic	47μ	10V
C78	Ceramic	0.0047	50V
C79	Ceramic	47P	50V
C80	Ceramic	470P	50V
C81	Ceramic	39P	50V
C82	Ceramic	12P	50V
C83	Ceramic	39P	50V

[PLL UNIT]

REF NO.	DESCRIPTION	PART NO.		
C84	Ceramic	0.0047	50V	
C85	Ceramic	22P	50V	
C86	Ceramic	33P	50V	
C87	Ceramic	0.0047	50V	
C88	Ceramic	0.001	50V	
C89	Electrolytic	47μ	10V	
C90	Ceramic	0.0047	50V	
C91	Electrolytic	47μ	10V	
C92	Ceramic	0.0047	50V	
C93	Tantalum	0.1	35V	
C94	Ceramic	15P	50V	CH
C95	Ceramic	62P	50V	CH
C96	Trimmer	CTZ31A		
C97	Ceramic	0.0047	50V	
C98	Ceramic	47P	50V	CH
C99	Ceramic	470P	50V	
C100	Ceramic	470P	50V	
C101	Ceramic	100P	50V	
C102	Ceramic	470P	50V	
C103	Ceramic	100P	50V	
C104	Ceramic	0.001	50V	
C105	Ceramic	68P	50V	
C106	Ceramic	0.0047	50V	
C107	Ceramic	0.0047	50V	
C108	Electrolytic	47μ	10V	
C109	Ceramic	0.0047	50V	
C110	Ceramic	62P	50V	
C111	Ceramic	300P	50V	
C112	Ceramic	47P	50V	
C113	Ceramic	120P	50V	
C114	Ceramic	100P	50V	
C115	Ceramic	62P	50V	
C116	Ceramic	12P	50V	
C117	Ceramic	75P	50V	
C118	Ceramic	39P	50V	
C119	Ceramic	47P	50V	
C122	Ceramic	0.0047	50V	
C123	Ceramic	0.0047	50V	
C124	Electrolytic	47μ	10V	
C125	Ceramic	0.0047	50V	
C126	Ceramic	0.001	50V	
C127	Ceramic	0.0047	50V	
C128	Electrolytic	47μ	10V	
C129	Ceramic	0.0047	50V	
C131	Ceramic	0.0047	50V	
C132	Dip Mica	150P	50V	
C133	Dip Mica	82P	50V	
C134	Ceramic	22P	50V	
C135	Trimmer	CTZ31A		
C136	Ceramic	0.0047	50V	
C137	Ceramic	27P	50V	
C138	Ceramic	0.5P	50V	
C139	Ceramic	27P	50V	
C140	Ceramic	0.5P	50V	
C141	Ceramic	27P	50V	
C142	Ceramic	0.0047	50V	
C143	Ceramic	0.0047	50V	
C144	Ceramic	0.0047	50V	
C145	Ceramic	1P	50V	
C147	Ceramic	0.0047	50V	
C149	Dip Mica	150P	50V	
C150	Dip Mica	150P	50V	
C151	Ceramic	20P	50V	CH
C152	Ceramic	0.001	50V	

[PLL UNIT]

REF NO.	DESCRIPTION	PART NO.	
C153	Ceramic	0.0047	50V
C154	Ceramic	0.0047	50V
C155	Ceramic	0.0047	50V
C156	Electrolytic	100μ	10V
C157	Ceramic	0.0047	50V
C158	Ceramic	220P	50V
C160	Ceramic	0.001	50V
C161	Ceramic	0.0047	50V
C163	Barrier Lay	0.1	16V
C164	Ceramic	0.0022	50V
C165	Ceramic	0.0022	50V
C166	Ceramic	0.0022	50V
C167	Ceramic	0.0022	50V
C168	Ceramic	0.0047	50V
C169	Electrolytic	100μ	10V
C170	Electrolytic	47μ	10V
C171	Ceramic	0.0047	50V
C172	Ceramic	470P	50V
C173	Ceramic	470P	50V
C174	Ceramic	470P	50V
C175	Ceramic	0.001	50V
C176	Array	B5RC0124-32N	
C177	Ceramic	0.0047	50V
C178	Ceramic	0.001	50V
C179	Ceramic	470P	50V
C180	Barrier Lay	0.047	25V
J1	Connector	TL-25P-04-V1	
J2	Connector	TL-25P-02-V1	
J3	Connector	TL-25P-12-V1	
J4	Connector	TMP-J01X-V1	
J5	Connector	TMP-J01X-V1	
J6	Connector	TL-25P-02-V1	
B1	PLL P.C.B	B-618B	

[LOGIC UNIT]

REF NO.	DESCRIPTION	PART NO.
IC1	IC	4066B
IC2	Diode Array	DAN 401
IC3	IC	4001 UBP or C
IC4	IC	BA 618
IC5	IC	BA 618
IC6	IC	4028
IC7	Diode Array	DAN 401
IC8	IC	4013B
IC9	IC	4069B
IC10	IC	4011B
IC11	IC	4066B
IC12	Diode Array	DAN 401
IC13	IC	TC 40193
IC14	IC	μPD 650C 0-70
IC15	IC	4028
IC16	IC	MC 14175
IC17	Diode Array	DAN 401
IC18	IC	4028
IC19	IC	4013B
IC20	IC	BA 618
IC21	IC	BA 618
IC22	IC	4518
IC23	IC	μA78L62AWC
Q1	Transistor	2SC945-P
Q2	Transistor	2SA1015-Y
Q3	Transistor	2SC945-P
Q4	Transistor	2SA1015-Y
Q5	Transistor	2SC945-P
Q6	Transistor	2SC1636
Q7	Transistor	2SA1015-Y
Q8	Transistor	2SC945-P
Q9	Transistor	2SA1015-Y
Q10	Transistor	2SC945-P
Q11	Transistor	2SC945-P
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

[LOGIC UNIT]

REF NO.	DESCRIPTION	PART NO.
D29	Diode	1SS53
D30	Diode	1SS53
D31	Diode	1SS53
D32	Diode	1SS53
D33	Diode	1SS53
D36	Diode	1SS53
X1	Ceralock	CSB 430A
L1	Choke	EL0810SKI-101K
L2	Choke	EL0810SKI-101K
L3	Choke	EL0810SKI-101K
L4	Choke	EL0810SKI-101K
L5	Choke	EL0810SKI-101K
L6	Choke	EL0810SKI-101K
L7	Choke	EL0810SKI-101K
L8	Choke	EL0810SKI-101K
L9	Choke	EL0810SKI-101K
L10	Choke	EL0810SKI-101K
L11	Choke	EL0810SKI-101K
L12	Choke	EL0810SKI-101K
L13	Choke	EL0810SKI-101K
L14	Choke	EL0810SKI-101K
L15	Choke	EL0810SKI-101K
L16	Choke	EL0810SKI-101K
L17	Choke	EL0810SKI-101K
L18	CHoke	EL0810SKI-101K
R1	Resistor	1K ELR25
R2	Resistor	1K ELR25
R3	Resistor	1K ELR25
R4	Resistor	1K ELR25
R5	Resistor	1K ELR25
R6	Resistor	1K ELR25
R7	Resistor	1K ELR25
R8	Resistor	1K ELR25
R9	Resistor	1K ELR25
R10	Resistor	1K ELR25
R11	Resistor	1K ELR25
R12	Resistor	1K ELR25
R13	Resistor	1K ELR25
R14	Resistor	1K ELR25
R15	Resistor	1.5K ELR25
R16	Resistor	1K ELR25
R17	Resistor	1K ELR25
R18	Resistor	1K ELR25
R19	Resistor	3.3K ELR25
R20	Resistor	10K ELR25
R21	Resistor	10K ELR25
R22	Resistor	10K ELR25
R23	Resistor	470K ELR25
R24	Resistor	470K R25
R25	Resistor	680K ELR25
R26	Resistor	470K R25
R27	Resistor	47K R25
R28	Resistor	10K ELR25
R29	Resistor	47K ELR25
R30	Resistor	10K ELR25
R31	Resistor	47K ELR25
R32	Resistor	10 ELR25
R33	Resistor	1M ELR25
R34	Resistor	47K ELR25

[LOGIC UNIT]

REF NO.	DESCRIPTION	PART NO.	
R35	Resistor	10K	ELR25
R36	Resistor	47K	ELR25
R37	Resistor	1.5K	R25
R38	Resistor	100K	ELR25
R39	Resistor	120K	ELR25
R40	Resistor	100K	ELR25
R41	Resistor	120K	ELR25
R42	Resistor	560K	ELR25
R43	Resistor	1M	ELR25
R44	Resistor	120K	ELR25
R45	Resistor	120K	R25
R46	Resistor	560K	ELR25
R47	Resistor	1M	ELR25
R48	Resistor	47K	ELR25
R49	Resistor	47K	ELR25
R50	Array	RM-8 473	
R51	Array	RM-4 473	
R52	Array	RM-4 473	
R53	Resistor	800K	CRB1/4FX
R54	Resistor	400K	CRA1/8
R55	Resistor	200K	CRA1/8
R56	Resistor	100K	CRA1/8
R57	Array	RM-4 473	
R58	Resistor	1K	ELR25
R59	Resistor	100K	ELR25
R60	Resistor	47K	ELR25
R61	Resistor	10K	ELR25
R62	Resistor	47K	ELR25
R63	Resistor	10K	ELR25
R64	Resistor	10K	ELR25
R65	Resistor	47K	ELR25
R66	Resistor	47K	ELR25
R67	Resistor	100	ELR25
R68	Resistor	100	ELR25
R69	Resistor	100	ELR25
R70	Resistor	100	ELR25
R71	Resistor	47K	ELR25
R72	Resistor	47K	ELR25
R73	Resistor	1K	ELR25
R74	Resistor	1K	ELR25
R75	Resistor	1K	ELR25
R76	Resistor	1K	ELR25
R78	Resistor	1K	ELR25
R79	Resistor	1K	ELR25
R80	Resistor	1K	ELR25
R81	Resistor	1K	ELR25
R82	Resistor	1K	ELR25
R83	Resistor	1K	R25
R85	Resistor	1K	ELR25
R86	Resistor	1K	ELR25
R87	Resistor	1K	ELR25
R88	Resistor	1K	ELR25
R89	Resistor	10K	ELR25
R90	Resistor	10K	ELR25
R91	Resistor	1K	ELR25
R92	Resistor	1K	ELR25
R93	Resistor	47K	ELR25
R94	Resistor	3.3K	ELR25
R95	Resistor	100	ELR25
R96	Resistor	47K	R25
R97	Resistor	47K	ELR25
R98	Resistor	22K	ELR25
C1	Electrolytic	100μ	10V

[LOGIC UNIT]

REF NO.	DESCRIPTION	PART NO.	
C2	Ceramic	470P	50V
C3	Ceramic	470P	50V
C4	Ceramic	470P	50V
C5	Ceramic	470P	50V
C6	Ceramic	470P	50V
C7	Ceramic	470P	50V
C8	Ceramic	470P	50V
C9	Ceramic	470P	50V
C10	Ceramic	470P	50V
C11	Ceramic	470P	50V
C12	Ceramic	470P	50V
C13	Ceramic	470P	50V
C14	Ceramic	470P	50V
C15	Ceramic	470P	50V
C16	Ceramic	470P	50V
C17	Ceramic	470P	50V
C18	Ceramic	470P	50V
C19	Ceramic	470P	50V
C20	Ceramic	470P	50V
C21	Ceramic	470P	50V
C22	Ceramic	0.0047	50V
C23	Ceramic	470P	50V
C24	Ceramic	0.0047	50V
C25	Ceramic	470P	50V
C26	Ceramic	470P	50V
C27	Ceramic	0.001	50V
C28	Ceramic	0.0047	50V
C29	Barrier Lay	0.1	16V
C30	Ceramic	0.0047	50V
C31	Barrier Lay	0.1	16V
C32	Ceramic	0.001	50V
C33	Ceramic	0.001	50V
C34	Ceramic	0.0047	50V
C35	Ceramic	0.0047	50V
C36	Ceramic	0.001	50V
C37	Ceramic	0.001	50V
C38	Ceramic	0.001	50V
C39	Ceramic	470P	50V
C40	Ceramic	470P	50V
C41	Ceramic	470P	50V
C42	Ceramic	470P	50V
C43	Ceramic	470P	50V
C44	Ceramic	470P	50V
C45	Ceramic	470P	50V
C46	Ceramic	100P	50V
C47	Ceramic	100P	50V
C49	Ceramic	0.001	50V
C50	Electrolytic	1μ	50V
C51	Electrolytic	10μ	16V
C52	Barrier Lay	0.1	16V
C53	Electrolytic	100μ	10V
C54	Ceramic	0.0047	50V
C55	Ceramic	0.0047	50V
C56	Ceramic	0.0047	50V
C57	Ceramic	0.0047	50V
C58	Barrier Lay	0.1	16V
C59	Barrier Lay	0.1	16V
C60	Ceramic	0.0047	50V
C61	Ceramic	0.0047	50V
C62	Ceramic	0.0047	50V
C63	Ceramic	0.0047	50V
C64	Ceramic	0.0047	50V
C65	Ceramic	0.0047	50V
C66	Ceramic	0.0047	50V

[LOGIC UNIT]

REF NO.	DESCRIPTION	PART NO.	
C67	Ceramic	0.0047	50V
C68	Ceramic	0.0047	50V
C69	Ceramic	0.0047	50V
C70	Ceramic	0.0047	50V
C71	Ceramic	0.0047	50V
C72	Ceramic	0.0047	50V
C73	Ceramic	0.0047	50V
C74	Ceramic	0.0047	50V
C75	Ceramic	0.0047	50V
C76	Ceramic	0.0047	50V
C77	Ceramic	0.0047	50V
C79	Ceramic	470P	50V
C80	Ceramic	470P	50V
C81	Ceramic	470P	50V
C82	Ceramic	470P	50V
C83	Ceramic	470P	50V
C84	Ceramic	470P	50V
C85	Ceramic	0.0047	50V
C86	Ceramic	470P	50V
C87	Ceramic	470P	50V
C88	Ceramic	470P	50V
C89	Ceramic	470P	50V
C90	Electrolytic	3.3μ	50V
C91	Barrier Lay	0.1	16V
C92	Electrolytic	1μF	50V
C93	Ceramic	470P	50V
C94	Ceramic	470P	50V
C95	Ceramic	0.0047	50V
C96	Ceramic	0.001	50V
C97	Ceramic	100μ	10V
C98	Ceramic	0.0047	50V
C99	Electrolytic	0.47μ	50V
J1	Connector	TL-25P-10-V1	
J2	Connector	TL-25P-12-V1	
J3	Connector	TL-25P-07-V1	
J4	Connector	TL-25P-03-V1	
J5	Connector	TL-25P-03-V1	
J6	Connector	TL-25P-07-V1	
J7	Connector	TL-25P-04-V1	
J8	Connector	TL-25P-11-V1	
J9	Board IN	TLB-P04H-B1	
J10	Board IN	TLB-P10H-B1	
J11	Board IN	TLB-P08H-B1	
J12	Board IN	TLB-P04H-B1	
P2	Connector	TL-25H-04-B1	
P3	Connector	TL-25H-10-B1	
P4	Connector	TL-25H-08-B1	
P5	Connector	5250-04	
S1	Switch	SSS 012	
B1	LOGIC P.C.B	B-619A	

[DISPLAY UNIT]

REF NO.	DESCRIPTION	PART NO.	
IC1	IC	M5484P	
IC2	IC	4081B	
IC3	DC CON.	DP-5A	
Q1	Transistor	2SA1015Y	
Q2	Transistor	2SA1015Y	
Q3	Transistor	2SA1015Y	
Q4	Transistor	2SA1015Y	
Q5	Transistor	2SA1015Y	
Q6	Transistor	2SA1015Y	
Q7	Transistor	2SA1015Y	
DS1	FLD	9BT-12	
D1	Diode	1SS53	
D2	Diode	1SS53	
D3	Diode	1SS53	
D4	Diode	1SS53	
D5	Diode	1SS53	
D6	Diode	1SS53	
D7	Diode	1K60	
D8	Diode	1SS53	
D9	Diode	1SS53	
D10	Zener	XZ-117	
D11	Zener	WZ-040	
L1	Choke	EL0810SKI-102K	
L2	Choke	EL0810SKI-102K	
R1	Array	RM10 473	
R2	Array	RM10 473	
R4	Resistor	220K	ELR25
R5	Resistor	22K	ELR25
R6	Resistor	47K	ELR25
R7	Resistor	47K	R25
R8	Resistor	47K	ELR25
R9	Resistor	47K	R25
R10	Resistor	47K	R25
R11	Resistor	47K	R25
R12	Resistor	47K	R25
R14	Resistor	47K	ELR25
R15	Resistor	47	ELR25
R16	Resistor	4.7K	ELR25
R17	Resistor	47K	R25
C1	Electrolytic	10	16V
C2	Ceramic	0.0022	50V
C3	Electrolytic	47	16V
C4	Electrolytic	100	10V
C5	Barrier Lay	0.1	16V
C6	Ceramic	0.0047	50V
C7	Electrolytic	100	10V
C8	Barrier Lay	0.1	16V
C9	Ceramic	0.0047	50V
C10	Electrolytic	47	16V
C11	Barrier Lay	0.1	16V
C12	Ceramic	0.0047	50V
C13	Electrolytic	47	16V
C14	Barrier Lay	0.1	16V
C15	Ceramic	0.0047	50V
C16	Electrolytic	22	16V
C17	Barrier Lay	0.1	16V
C18	Ceramic	0.001	50V
C19	Barrier Lay	1	50V

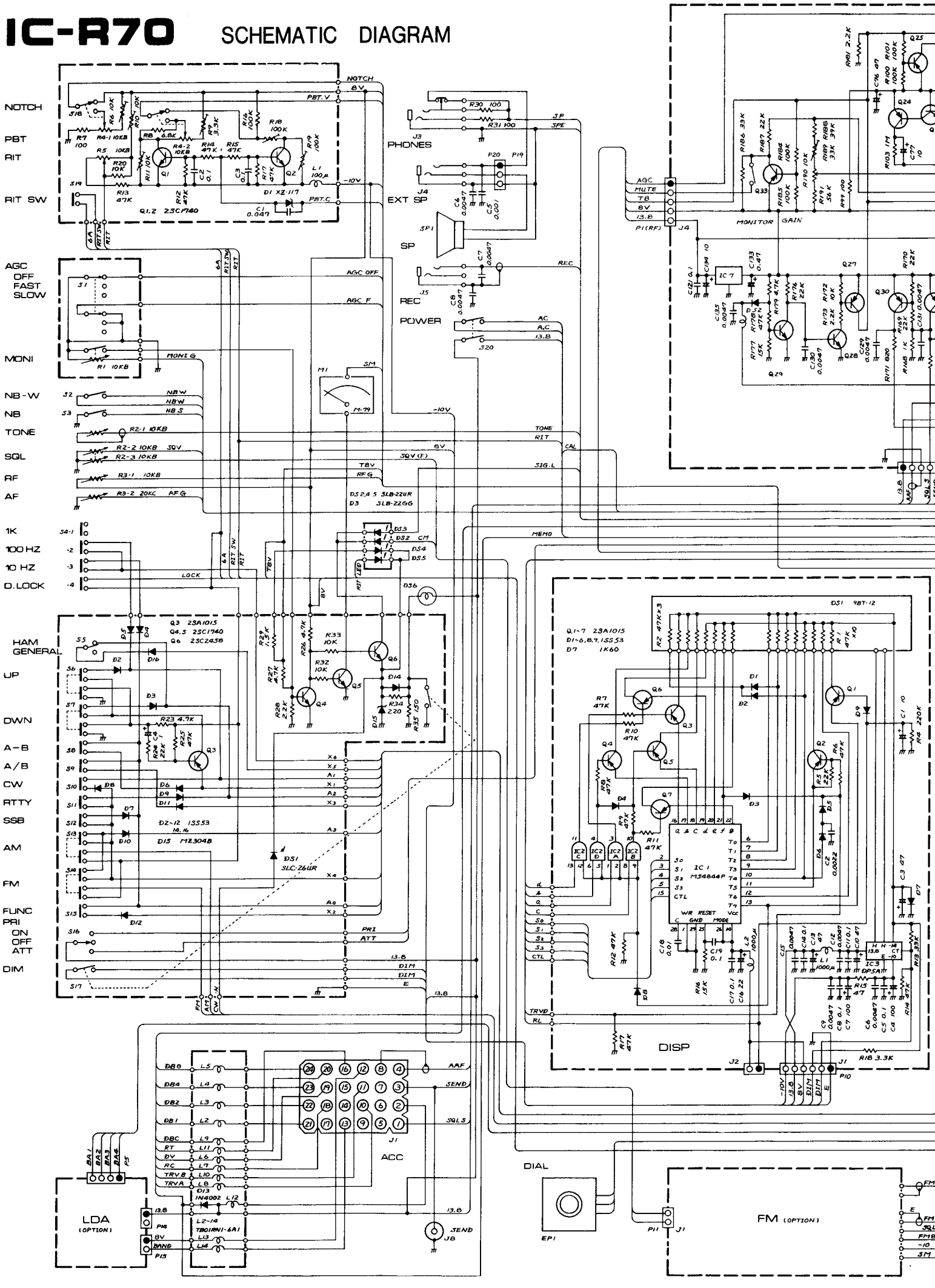
[DISPLAY UNIT]

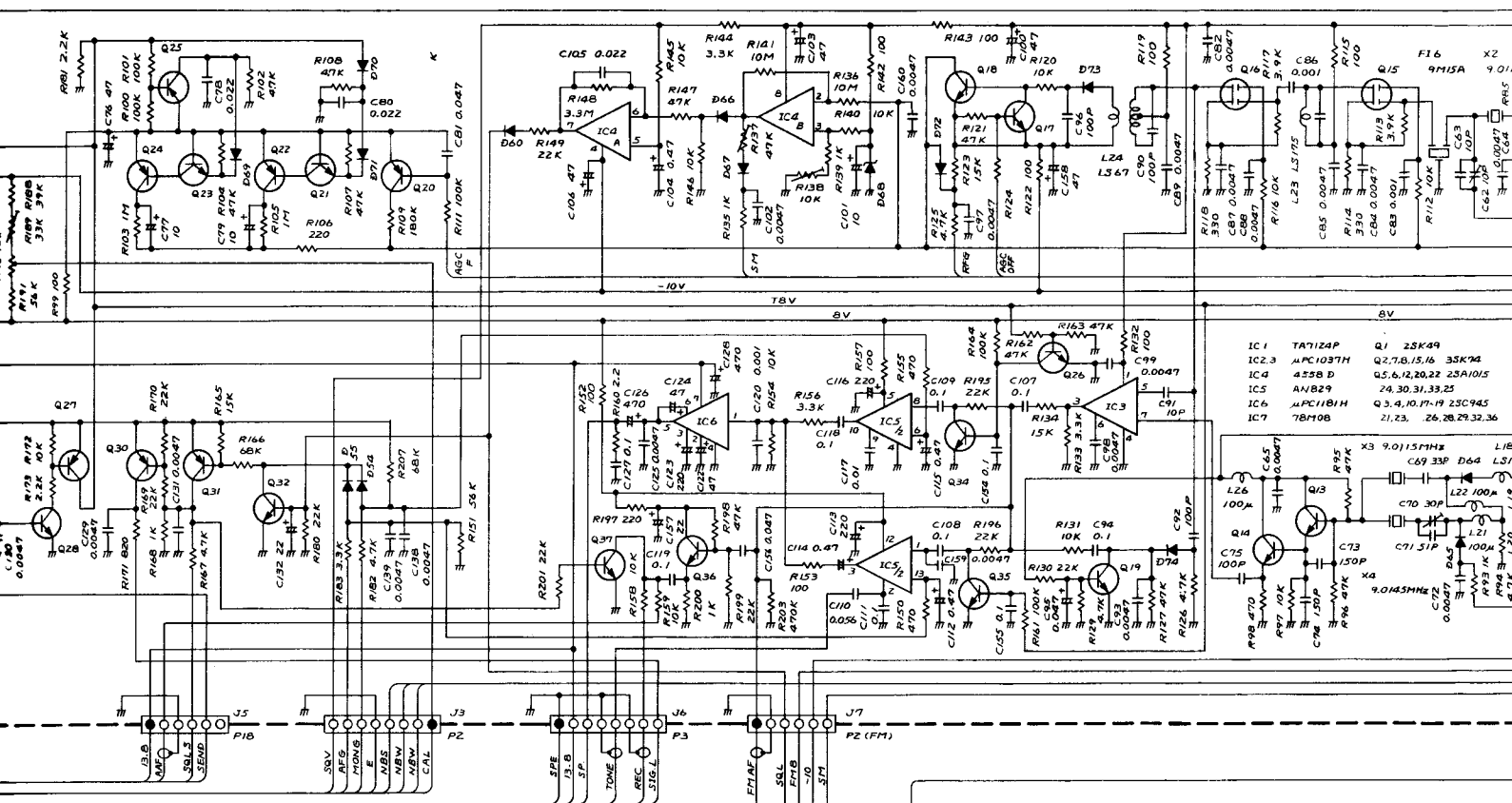
REF NO.	DESCRIPTION	PART NO.
J1	Connector	TL-25P-06-V1
P1	Connector	TL-25H-11-B1
B1	DISPLAY P.C.B	B-620A

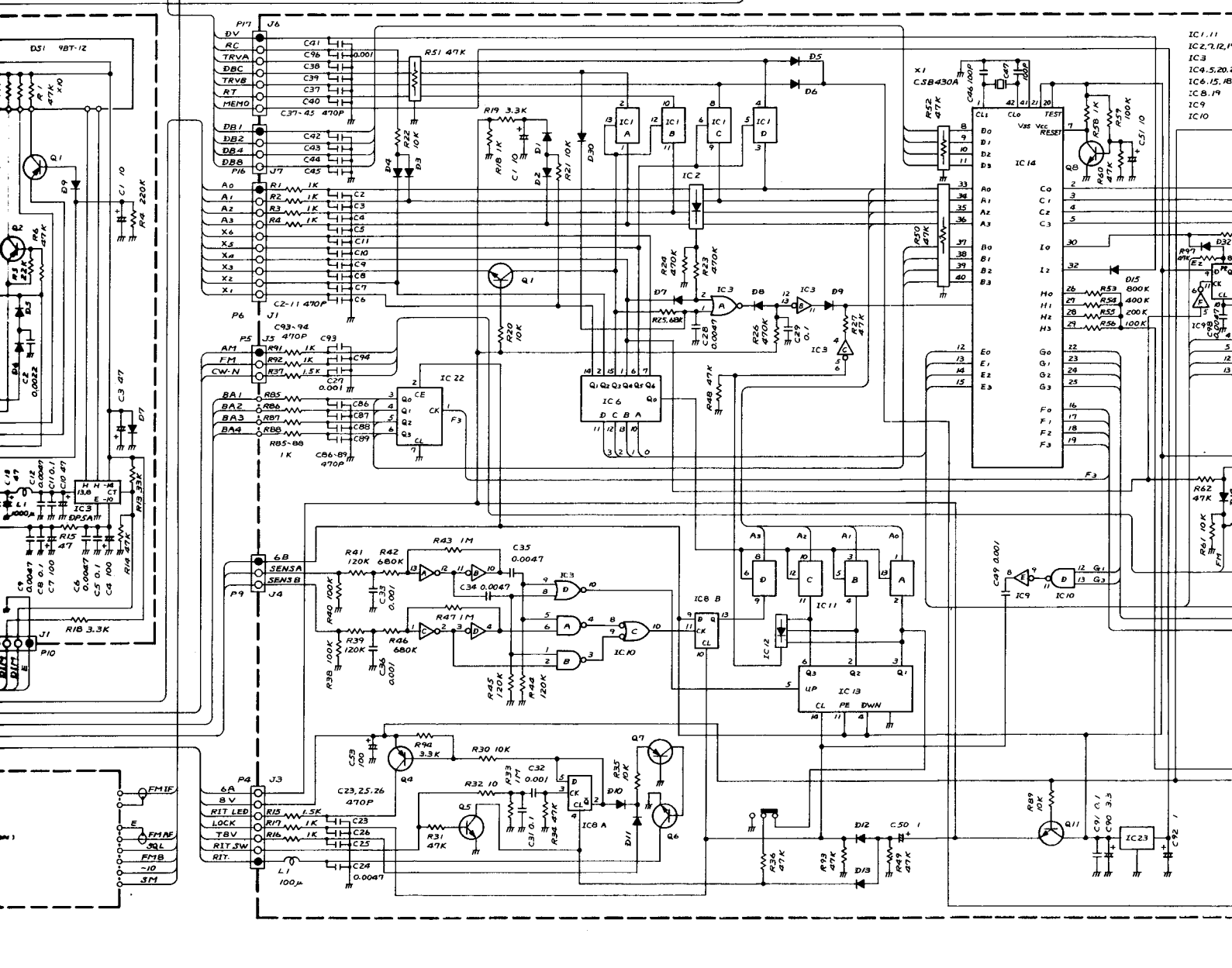
[REG UNIT]

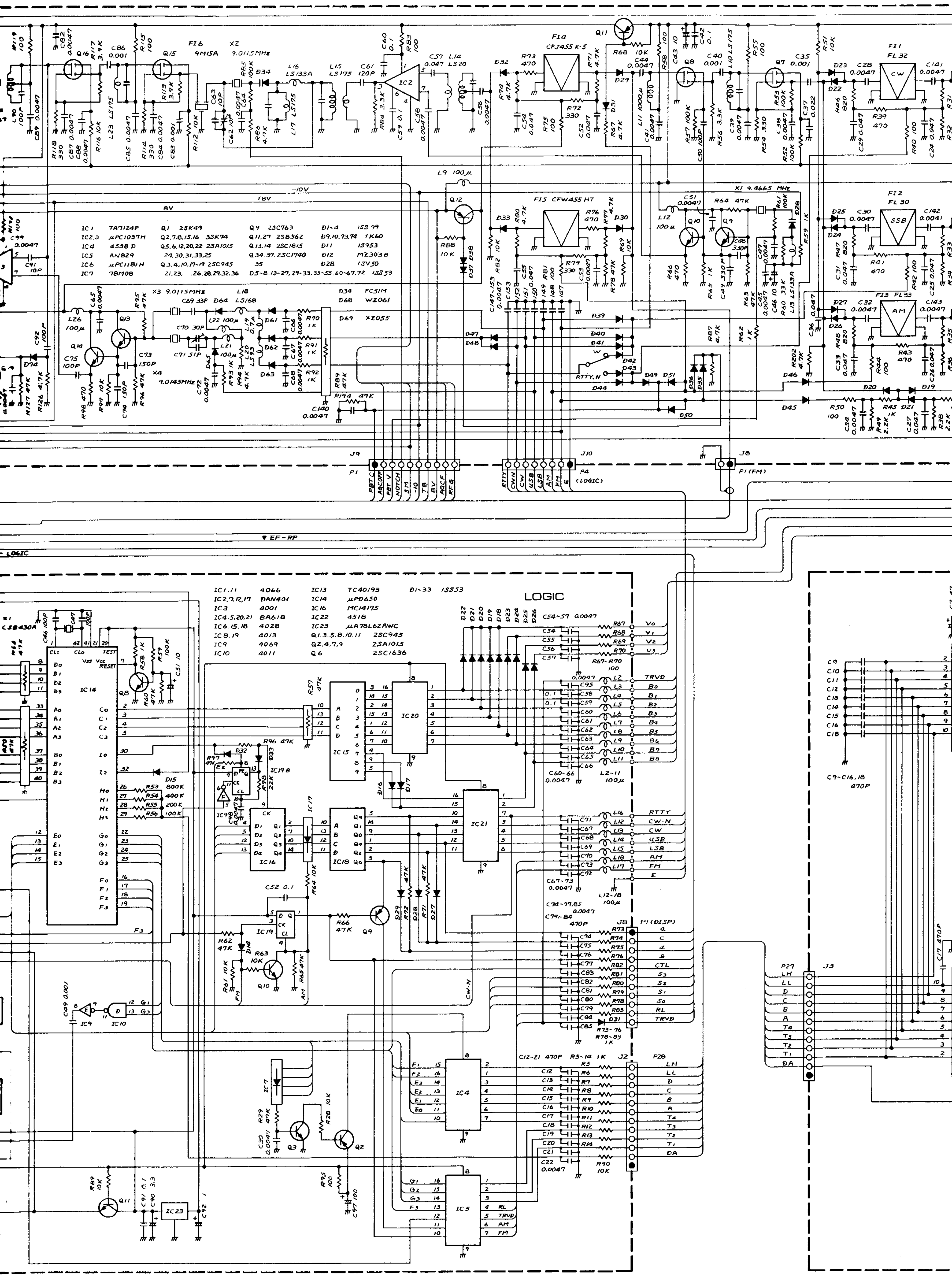
REF NO.	DESCRIPTION	PART NO.
Q1	Transistor	2SD880Y
Q2	Transistor	2SA1015Y
Q3	Transistor	2SC945P
D1	Diode	KBPC102
D2	Diode	1N4002
D3	Zener	XZ051
D4	Zener	XZ051
D5	Diode	U05B
D6	Diode	1N4002
L1	Choke	LW-16
R1	Resistor	10K ELR25
R2	Resistor	SRW3P 100J
R3	Resistor	100 R25
R4	Resistor	2.7K ELR25
R5	Trimmer	EVN5AC500
R6	Resistor	1K ELR25
C1	Ceramic	DE7090B102K
C2	Ceramic	DE7090B102K
C3	Ceramic	DD112B103K50V02
C4	Ceramic	DD112B103K50V02
C5	Ceramic	DD112B103K50V02
C6	Ceramic	DD112B103K50V02
C7	Electrolytic	4700 25V
C8	Ceramic	DD112B103K50V02
C9	Electrolytic	470 25V
C10	Ceramic	0.0047 50V
C11	Electrolytic	470 16V
C12	Barrier Lay	0.1 16V
C13	Barrier Lay	0.1 16V
C14	Barrier Lay	0.1 16V
C15	Electrolytic	470 16V
J1	Connector	1490-4P
J2	Connector	CM3
P1	Connector	1625-03R1
F1	Fuse	1A (EUR 0.5A)
F2	Fuse	2A
F3	Holder	FH-032
F4	Holder	S-N5051
F5	Holder	S-N5051
S1	Switch	S-1
T1	Transformer	TP-28
T2	Transformer	TP-22
B1	REG P.C.B	B-621A

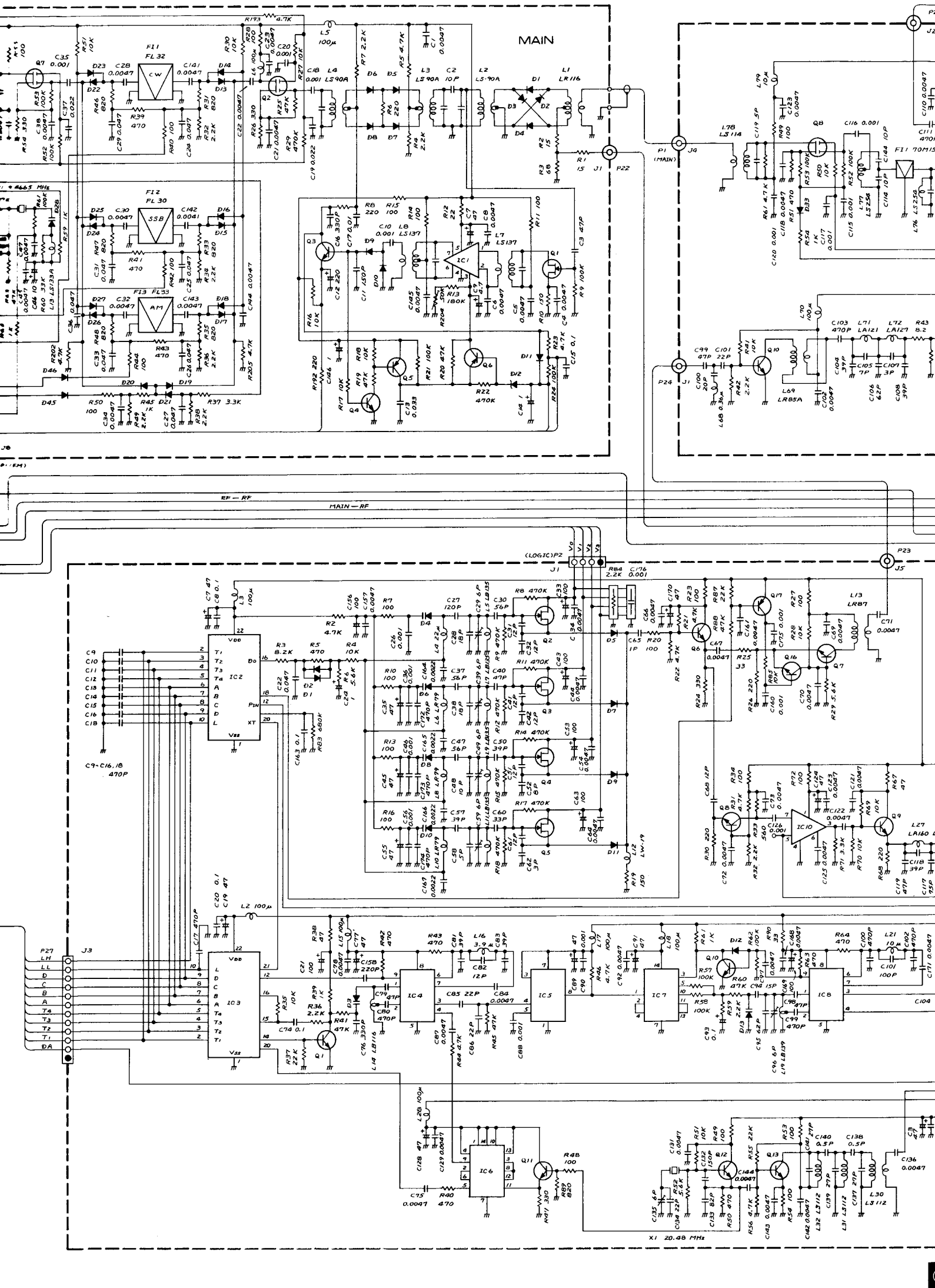
IC-R70 SCHEMATIC DIAGRAM

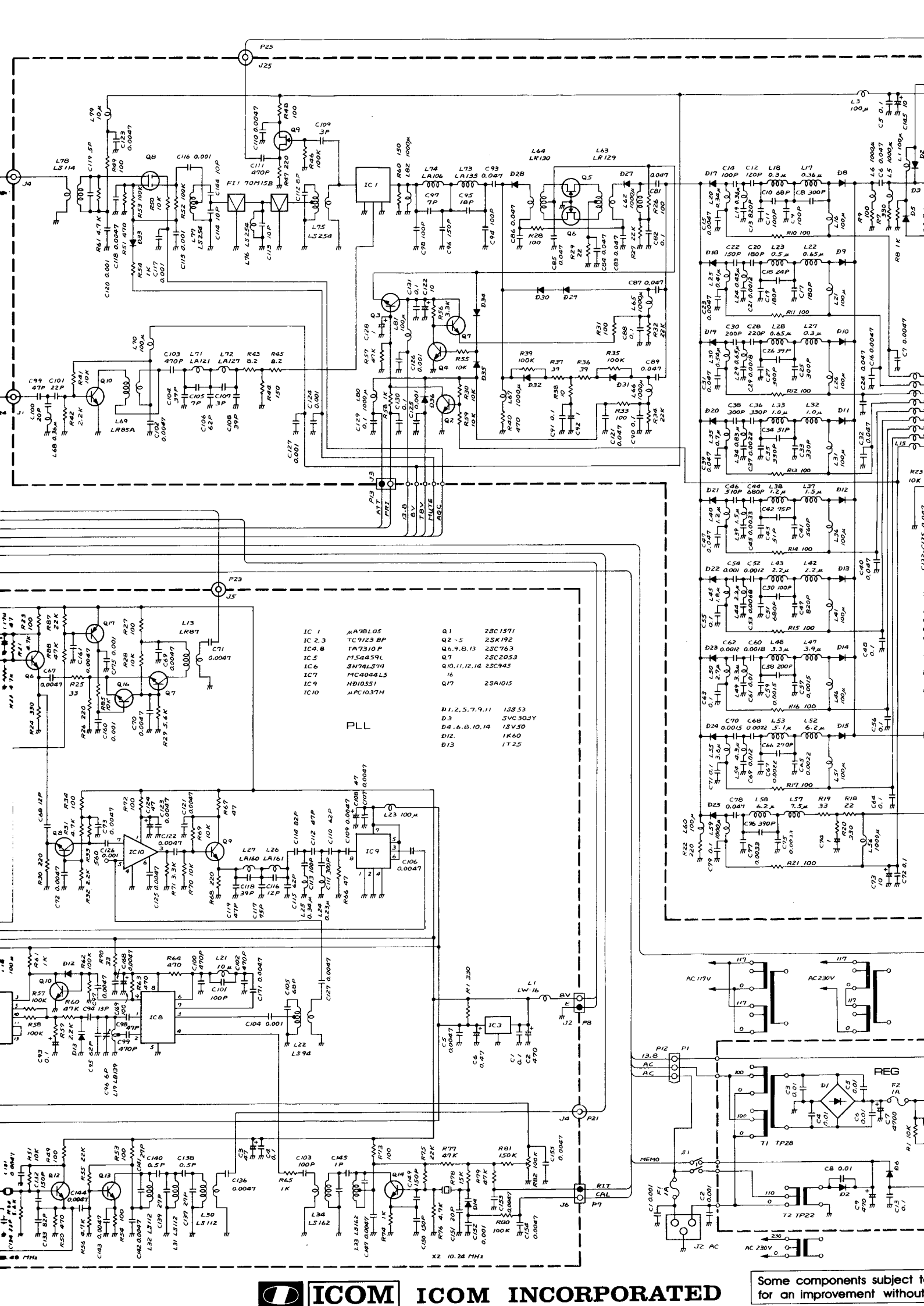



IC1 TA7124P
IC2,3 μPC1037H
IC4 4558 D
IC5 AN829
IC6 μPC1181H
IC7 78M08
Q1 2SK49
Q2,7,8,15,16 3SK74
Q5,6,12,20,22 2SA1015
Q4,30,31,33,25
Q3,4,10,17-19 2SC945
21,23, 26,28,29,32,36
9.0145MHz
J5 P18
J3 P2
J6 P3
J7 P2 (FM)
FM IF
DISP — LOGIC


DS1 9BT-12
IC 14
IC 22
IC 13
IC 11
IC 12
IC 23
P17 J6
P16 J7
P6 J1
P5 J5
P9 J4
P4 J3
P10 J1
FM IF
SQL
FMB
~10
SM

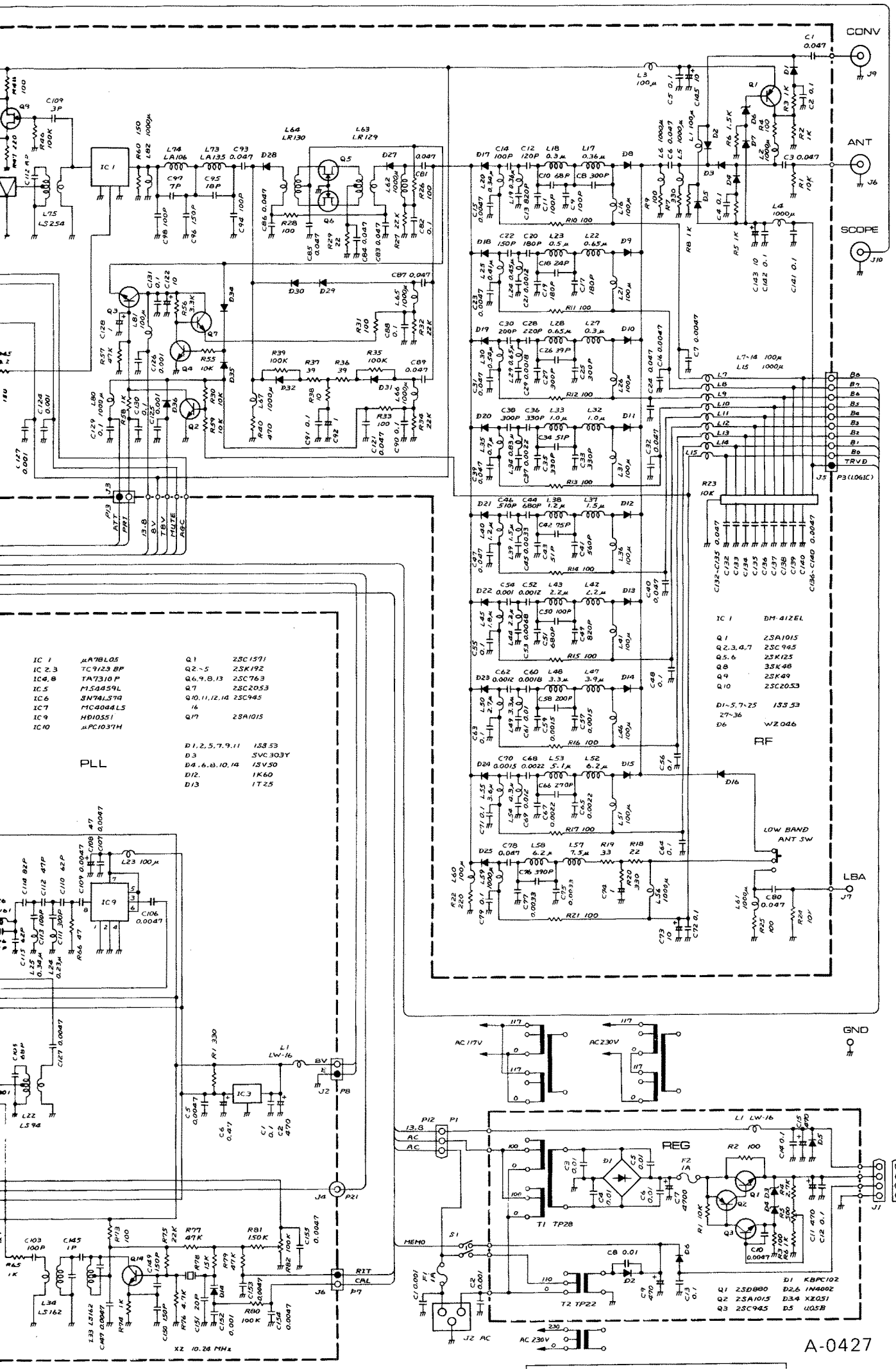

IC1 TA7124P
IC2,3 µPC1037H
IC4 4558D
IC5 AN829
IC6 µPC1181H
IC7 78M08
Q1 2SK49
Q2,7,8,15,16 3SK74
Q5,6,12,20,22 2SA1015
24,30,31,33,25
Q3,4,10,17~19 2SC945
21,23, 26,28,29,32,36
Q9 2SC763
Q11,27 2SB562
Q13,14 2SC1815
Q34,37, 2SC1740
35
D1~4 1SS99
D9,10,73,74 1K60
D11 1S953
D12 MZ303B
D28 1SV50
D5~8,13~27,29~33,35~55,60~67,72 1SS53
D34 FC51M
D68 WZ061
D69 XZ055
F14 CFJ455K-5
F15 CFW455HT
F11 FL32
F12 FL30
F13 FL33
X1 9.4665 MHz
X2 9.0115MHz
X3 9.0115MHz
X4 9.0145MHz
-10V
T8V
8V
EF-RF
LOGIC
PBT C
AGCOFF
PBT V
NOTCH
SM
-10
T8
8V
AGCF
RF G
RTTY
CWN
CW
USB
LSB
AM
FM
E
(LOGIC)
P1 (FM)
J8
J9
J10
LOGIC
IC1,11 4066
IC2,7,12,17 DAN401
IC3 4001
IC4,5,20,21 BA618
IC6,15,18 4028
IC8,19 4013
IC9 4069
IC10 4011
IC13 TC40193
IC14 µPD650
IC16 MC14175
IC22 4518
IC23 µA78L62AWC
Q1,3,5,8,10,11 2SC945
Q2,4,7,9 2SA1015
Q6 2SC1636
D1~33 1SS53
Vo
V1
V2
V3
TRVD
B0
B1
B2
B3
B4
B5
B6
B7
B8
RTTY
CW-N
CW
USB
LSB
AM
FM
E
P1 (DISP)
a
c
d
g
CTL
S3
S2
S1
S0
RL
TRVD
P28
LH
LL
D
C
B
A
T4
T3
T2
T1
DA
P27
J2
J3


MAIN
F11 FL 32
CW
F12 FL 30
SSB
F13 FL33
AM
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC10
P1 (MAIN)
J4
P22
J1
P24
J2
P23
J5
(LOGIC)P2
J3
P27
MAIN — RF
EP — RF
X1 20.48 MHz



ICOM ICOM INCORPORATED

Some components subject t
for an improvement without



ICOM ICOM INCORPORATED

Some components subject to change for an improvement without notice.