

144MHz ALL MODE TRANSCEIVER

IC-290A/E/H

MAINTENANCE MANUAL

SECTION 1 SPECIFICATIONS	1 – 1
SECTION 2 CONTROLS AND THEIR FUNCTIONS	2 – 1 ~ 3
SECTION 3 INSIDE VIEWS	3 – 1 ~ 2
SECTION 4 BLOCK DIAGRAM	4 – 1 ~ 2
SECTION 5 CIRCUIT DESCRIPTION	5 – 1 ~ 15
5 – 1 OUTLINE	5 – 1
5 – 2 RECEIVER CIRCUITS	5 – 1
5 – 3 TRANSMITTER CIRCUITS	5 – 3
5 – 4 PLL UNIT	5 – 5
5 – 5 LOGIC UNIT	5 – 12
SECTION 6 DISASSEMBLY	6 – 1 ~ 12
SECTION 7 ADJUSTMENTS	7 – 1 ~ 10
7 – 1 PLL ADJUSTMENTS	7 – 1
7 – 2 RECEIVER ADJUSTMENTS	7 – 3
7 – 3 TRANSMITTER ADJUSTMENTS	7 – 6
7 – 4 OPERATION CHECKS	7 – 9
SECTION 8 VOLTAGE CHARTS	8 – 1 ~ 9
SECTION 9 TROUBLESHOOTING GUIDE	9 – 1 ~ 4
SECTION 10 IC RATINGS	10 – 1 ~ 6
SECTION 11 PARTS LISTS	11 – 1 ~ 12

SECTION 1 SPECIFICATIONS

GENERAL

Numbers of semiconductors	: Transistor	61	
	FET	6	
	IC	28	
	Diode	134 (IC-290A/H : 135)	
Frequency coverage	: 144.000 ~ 145.9999MHz		
	(IC-290A/H : 143.8000 ~ 148.1999MHz)		
Frequency resolution	: SSB 100Hz steps FM 5KHz steps		
	1KHz steps with 1KHz STEPS switch depressed		
Frequency control	: Microcomputer based 100Hz step Digital PLL synthesizer		
	Independent Dual VFO Capability		
Frequency readout	: 5 digit LED 100Hz readout		
Frequency stability	: Within ± 1.5 KHz		
Memory channels	: 5 channels with any inband frequency programmable		
Usable conditions	: Temperature: $-10^{\circ}\text{C} \sim 60^{\circ}\text{C}$ ($14^{\circ}\text{F} \sim 140^{\circ}\text{F}$)		
	Operational time: Continuous		
Antenna impedance	: 50 ohms unbalanced		
Power supply requirement	: 13.8V DC $\pm 15\%$ (negative ground) 3.5A (IC-290H : 6A) Max.		
Current drain (at 13.8V DC)	: Transmitting		
	SSB [PEP 10W (IC-290H : 25W)]	Approx. 2.2A (IC-290H : 4.8A)	
	CW, FM [10W (IC-290H : 25W)]	Approx. 3.1A (IC-290H : 5.0A)	
	FM (1W)	Approx. 1.6A	
	Receiving		
	At max audio output	Approx. 0.9A	
	Squelched	Approx. 0.7A	
Dimensions	: 64mm (H) x 170mm (W) x 218mm (D)		
Weight	: Approx. 2.5Kgs		

TRANSMITTER

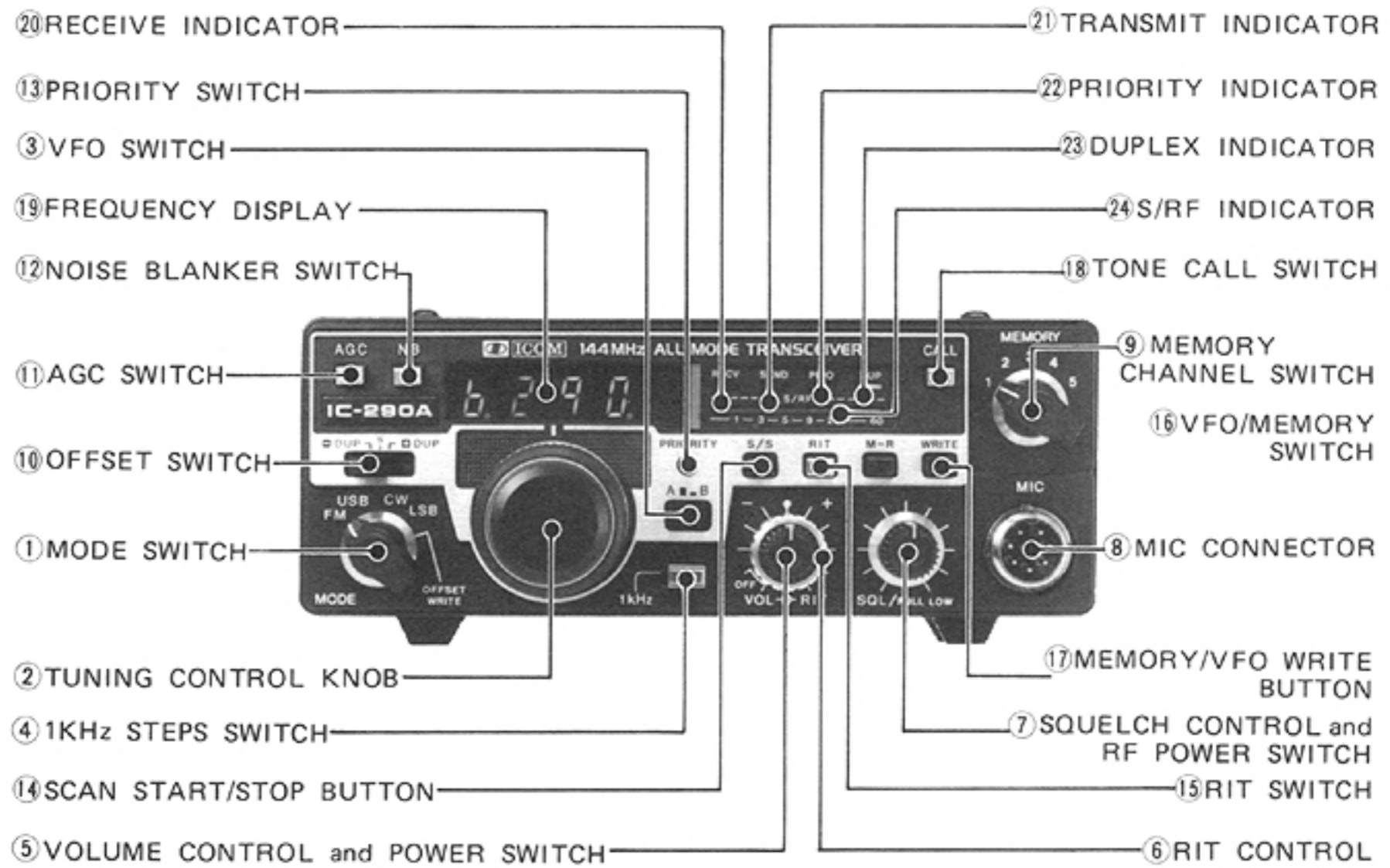
Output power	: SSB	High 10W (PEP) (IC-290H : 25W PEP) Low 1W (PEP)
	CW, FM	High 10W (IC-290H : 25W) Low 1W
Emission mode	: SSB (A3J, USB/LSB), CW (A1), FM (F3)	
Modulation system	: SSB	Balanced modulation
	FM	Variable reactance frequency modulation
Max. frequency deviation	: ± 5 KHz	
Spurious emission	: More than 60dB below peak power output	
Carrier suppression	: More than 40dB below peak power output	
Unwanted sideband	: More than 40dB down at 1000Hz AF input	
Microphone	: 1.3K ohm dynamic microphone with built-in preamplifier and push-to-talk switch.	
Operating mode	: Simplex, Duplex	
	(Any 100KHz steps inband frequency separation programmable)	
Tone burst	: 1750Hz ± 0.1 Hz (IC-290A/H : Not installed)	

RECEIVER

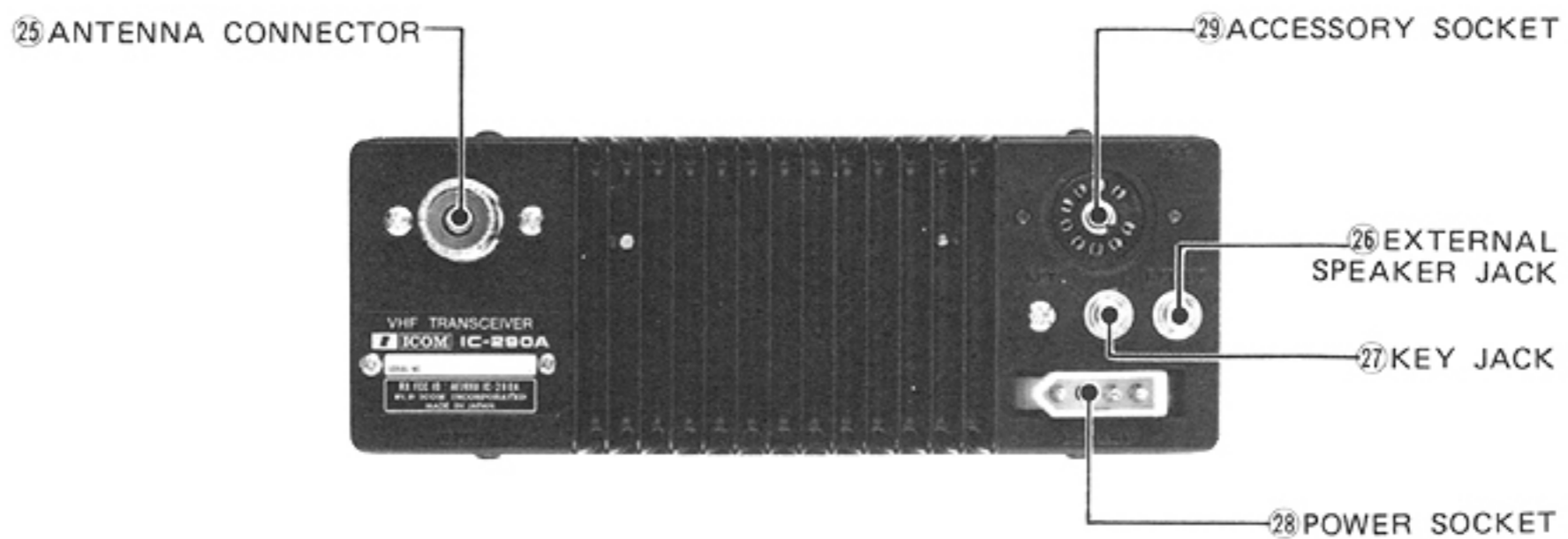
Receiving system	: SSB, CW	Single conversion superheterodyne
	FM	Double conversion superheterodyne
Receiving mode	: SSB (A3J, USB/LSB), CW (A1), FM (F3)	
Intermediate frequency	: SSB, CW	10.75MHz
	FM	10.75MHz, 455KHz
Sensitivity	: SSB, CW	Less than 0.5 microvolts for 10dB S+N/N
	FM	More than 30dB S+N+D/N at 1 microvolt
		Less than 0.6 microvolts for 20dB Noise quieting
Squelch sensitivity	: Less than 0.4 microvolts	
Spurious response rejection ratio	: More than 60dB	
Selectivity	: SSB, CW	More than ± 1.2 KHz at -6 dB point
		Less than ± 2.4 KHz at -60 dB point
	FM	More than ± 7.5 KHz at -6 dB point
		Less than ± 15 KHz at -60 dB point
Audio output power	: More than 2W	
Audio output impedance	: 4 ~ 8 ohms	

SECTION 2 CONTROLS AND THEIR FUNCTIONS

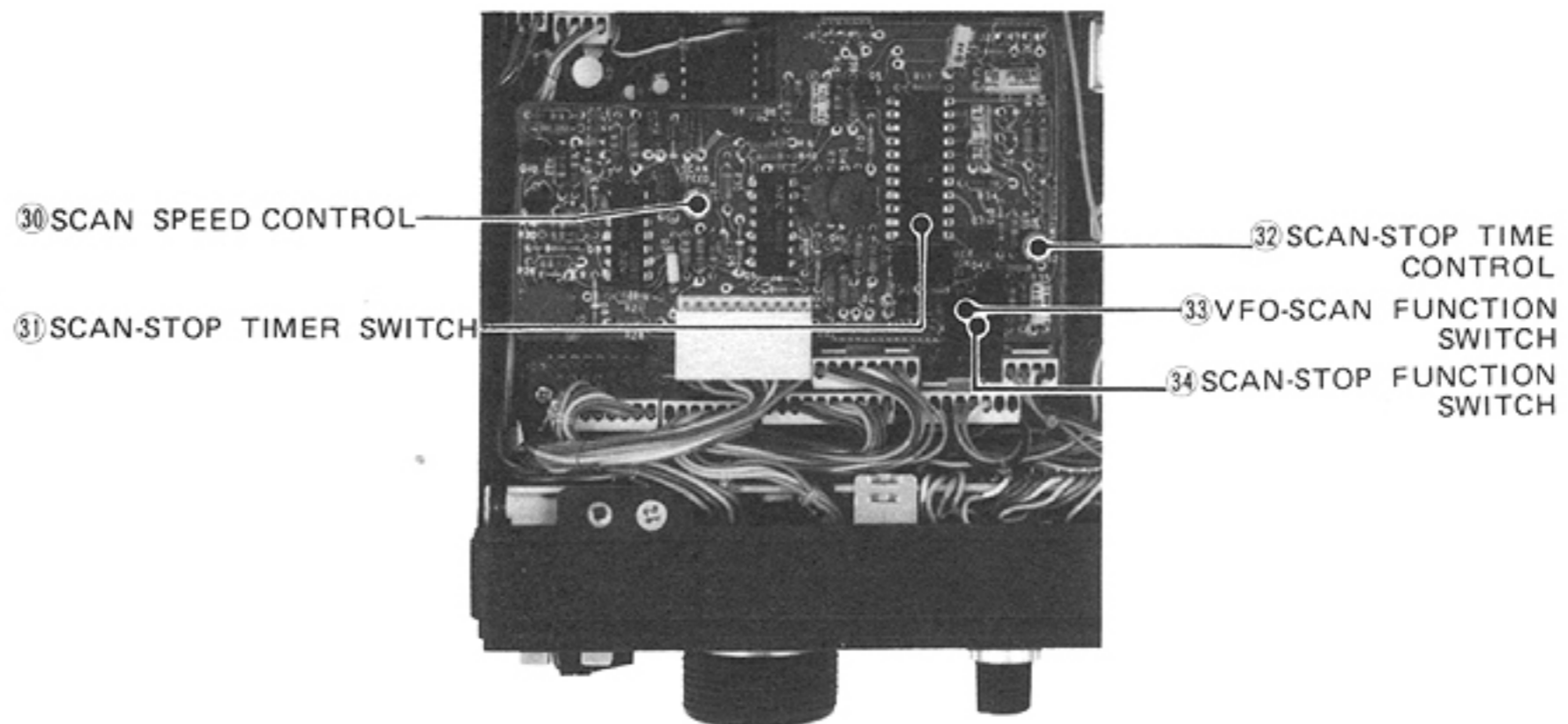
FRONT PANEL



REAR PANEL



UNDER THE TOP COVER



FRONT PANEL

① **MODE SWITCH**

Selects either side band, USB or LSB, for SSB operation. For FM or CW operation, set the switch in the desired mode.

In the "OW" position, any 100 kHz steps OFFSET frequency can be programmed into the CPU.

② **TUNING CONTROL KNOB**

Rotating the TUNING CONTROL KNOB clockwise increases the frequency, while rotating it counterclockwise decreases the frequency. The frequency is changed in 100 Hz steps in the SSB and CW modes and in 5 kHz steps in the FM mode which correspond to the click-stops. The smaller vernier marks on the knob each indicate a click-stop and the larger marks represent ten click-stops.

When tuning up past 145.9999 MHz, (145.999 MHz when 1 KHz STEPS Switch is pushed.) the frequency will automatically revert to 144.000 MHz. Likewise, when tuning down past 144.000 MHz, the frequency will automatically revert to 145.9999 MHz (145.999 MHz).

(IC-290A/H: 145.9999 MHz and 144.000 MHz should be read 148.1999 MHz and 143.8000 MHz.)

③ **VFO SWITCH**

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

④ **1 KHz STEPS SWITCH**

Pushing the 1 KHz STEPS Switch IN, and rotating the tuning knob will result in changing the frequency in 1 KHz steps in any mode. This switch will allow you to quickly QSY over a great frequency range in SSB and CW and to tune in FM signals which are off from 5 KHz-step frequencies.

⑮ **VOLUME CONTROL and POWER SWITCH**

When the control is turned completely counterclockwise, the power is OFF. By turning the control clockwise beyond the "click", the unit is turned ON and the audio level increases by further rotating it clockwise.

⑥ **RIT CONTROL**

Shifts the receive frequency ± 800 Hz either side of the transmit frequency. Rotating the control to the (+) side raises the receive frequency, and rotating to the (-) side lowers the receive frequency. The frequency shift by turning the RIT Control is not indicated on the frequency display.

This function can be turned ON and OFF by the ⑮ RIT SWITCH.

⑦ **SQUELCH CONTROL and RF POWER SWITCH**

Turning this control clockwise sets the squelch threshold higher. To turn OFF the squelch function, turn this control completely counterclockwise.

By pulling the Squelch control knob, the RF output power is reduced to 1 watt. By depressing the knob to the normal position, the RF output power returns to 10 watts. (IC-290H: 25 watts).

These functions activate in any mode.

⑧ **MIC CONNECTOR**

Connect the supplied microphone to this jack. If you wish to use a different microphone, refer to the drawing on page 6 of the instruction manual.

⑨ **MEMORY CHANNEL SWITCH**

Selects a memory channel, one of the channel 1 ~ channel 5.

⑩ **OFFSET SWITCH**

Selects the SIMPLEX operation (in the "S" position) or the DUPLEX operation (in the "+DUP" or "-DUP" position).

In the "+DUP" position, the transmitting frequency is set 600 KHz (This can be changed to any 100 kHz steps in-band frequency.) above the receiving frequency.

In the "-DUP" position, the transmitting frequency is set 600 KHz below the receiving frequency. Also the offset frequency can be changed to any 100 kHz steps in-band frequency.

These operations may be utilized with the VFO or any memory channels.

⑪ **AGC (AUTOMATIC GAIN CONTROL) SWITCH**

With this switch you can select the time constant of the AGC circuit. With the switch in the AGC (out) position, the AGC voltage is released slowly, and this is suitable for SSB reception. With the switch in the FAST (locked in) position, the AGC voltage is released faster, and the AGC is suitable for stations suffering from fast fading or when operating in the CW mode. (The AGC circuit does not activate in the FM mode.)

⑫ **NB (NOISE BLANKER) SWITCH**

When pulse type noise such as automobile ignition noise is audible, set this switch to the ON (locked in) position. The noise will be reduced to provide comfortable reception.

(The Noise Blanker does not activate in the FM mode.)

⑬ **PRIORITY SWITCH**

Turns the priority function ON and OFF.

During a QSO or receiving with VFO, if you would like to watch your favorite channel or a calling channel, that is busy or empty, set the memory channel switch to the favorite or calling channel which is memorized in a memory channel, and push

the priority switch, and the receiving frequency will go to the channel a moment at every five seconds.

14 SCAN START/STOP BUTTON

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

15 RIT SWITCH

Switches the RIT circuit ON and OFF.

16 VFO/MEMORY SWITCH

Selects operation with the tuning control (VFO A and VFO B) or operation with the memory channels (Channel 1 ~ 5).

17 MEMORY/VFO WRITE BUTION

By pushing this button, VFO A's frequency is written into a memory channel, or one VFO's frequency is transferred to the other VFO.

18 TONE CALL SWITCH

Most repeaters require a 1750 Hz Tone-burst for initial access. Depressing the Tone Call Switch for the required period for a repeater, puts the set in the transmit mode and the tone-burst generator actuates so you can then access the repeater. (IC-290A/H: The Tone Call unit is not installed, this switch can be used for a momentary Transmit/Receive switch.)

19 FREQUENCY DISPLAY

The five large 7 segment LED's represent the digits between 1 MHz and 100 Hz of the operating frequency. The frequency indicated is the carrier frequency of each mode. If you turn the RIT control ON to change the receive frequency and rotate the RIT control knob, the frequency display will not change.

20 RECEIVE INDICATOR

Illuminates when the squelch is opened in the receive mode.

21 TRANSMIT INDICATOR

Illuminates in the transmit mode.

22 PRIORITY INDICATOR

Illuminates when the priority function is turned ON.

23 DUPLEX INDICATOR

Illuminates when the set is in the duplex mode (the OFFSET Switch is in the "+DUP" or "-DUP" position).

24 S/RF INDICATOR

Indicates S-unit and RF output level with seven LED's in line. The numbers on the S-meter represent S1 through S9 and 20 and 60 dB over S9. The RF output level meter functions only as a relative output meter and does not indicate the wattage. These functions are switched automatically when T/R switching is made.

REAR PANEL

25 ANTENNA CONNECTOR

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

26 EXTERNAL SPEAKER JACK

When an external speaker is used, connect it to this jack. Use a speaker with an impedance of 4 ~ 8 ohms. When the external speaker is connected the built-in speaker does not function.

27 KEY JACK

For CW operation, connect a key here using the included key plug.

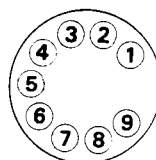
28 POWER SOCKET

Connect the supplied power cord to this socket.

29 ACCESSORY SOCKET

The table below shows terminal connections of this connector.

ACC SOCKET CONNECTIONS



Outside view

PIN No.	FUNCTION
1.	Output of the applied voltage to the meter.
2.	Connected to Push-To-Talk, T/R change-over switch. When grounded, the set operates in the transmit mode.
3.	13.8 Volts DC in conjunction with the power switch operation. (0.3 A Max.)
4.	Ground
5.~9.	NC (no connection).

UNDER THE TOP COVER

30 SCAN SPEED CONTROL

Controls the scanning speed in any scan mode. Adjust the control to desired scanning speed.

31 SCAN-STOP TIMER SWITCH

Switches the scan-stop interval function ON and OFF.

32 SCAN-STOP TIME CONTROL

Controls the interval of the scan auto-stopping time. Adjust the control to desired interval. It can be adjustable between 5 to 20 seconds.

33 VFO-SCAN FUNCTION SWITCH

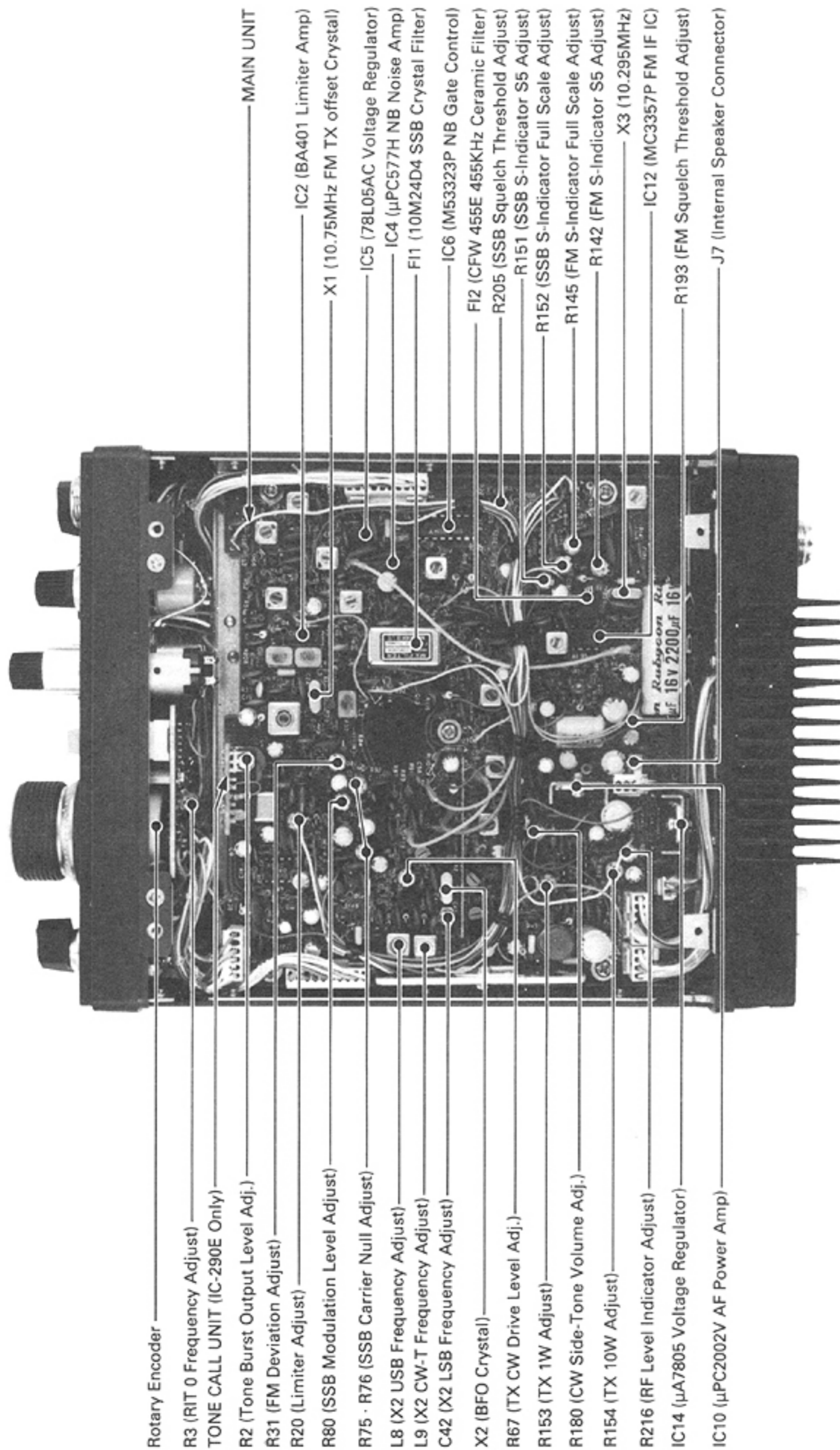
Switches the VFO-scan function to either the programmed scan or the full range scan.

34 SCAN-STOP FUNCTION SWITCH

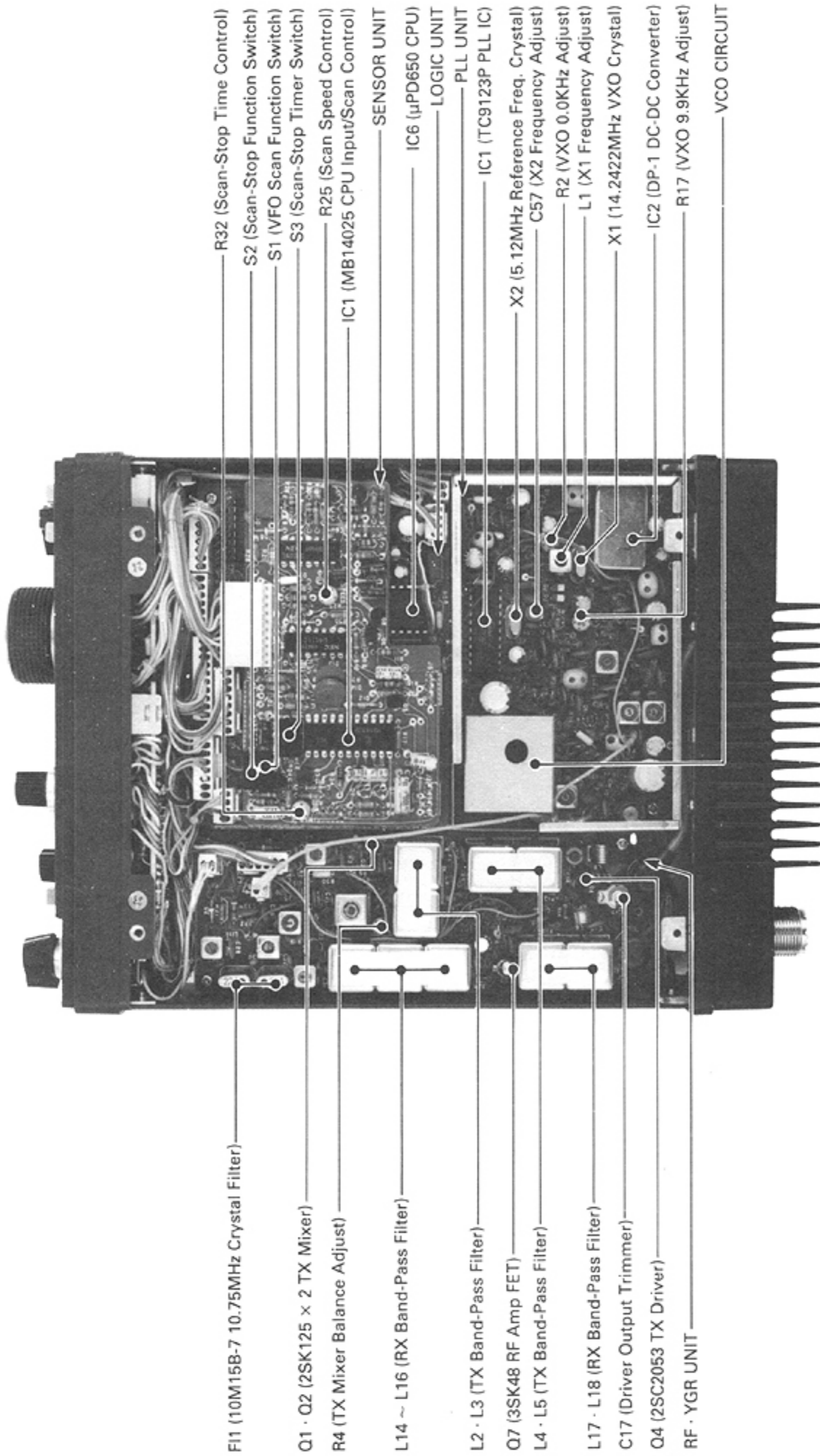
Switches the scan-stop function to either stop on a busy channel or stop on an empty channel.

SECTION 3 INSIDE VIEWS

MAIN UNIT SIDE

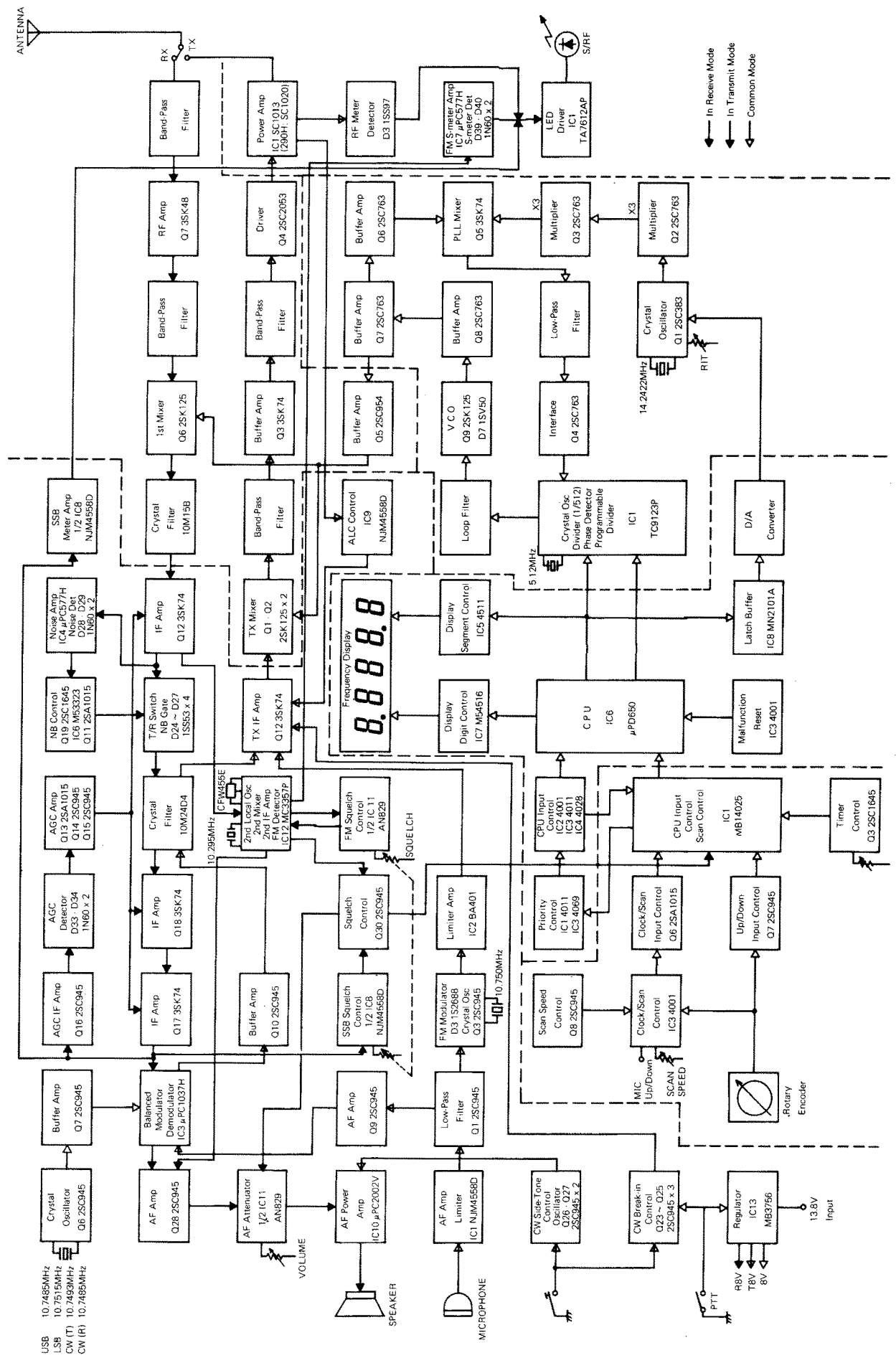


- Rotary Encoder
- R3 (RIT 0 Frequency Adjust)
- TONE CALL UNIT (IC-290E Only)
- R2 (Tone Burst Output Level Adj.)
- R31 (FM Deviation Adjust)
- R20 (Limiter Adjust)
- R80 (SSB Modulation Level Adjust)
- R75 - R76 (SSB Carrier Null Adjust)
- L8 (X2 USB Frequency Adjust)
- L9 (X2 CW-T Frequency Adjust)
- C42 (X2 LSB Frequency Adjust)
- X2 (BFO Crystal)
- R67 (TX CW Drive Level Adj.)
- R153 (TX 1W Adjust)
- R180 (CW Side-Tone Volume Adj.)
- R154 (TX 10W Adjust)
- R216 (RF Level Indicator Adjust)
- IC14 (µA7805 Voltage Regulator)
- IC10 (µPC2002V AF Power Amp)
- MAIN UNIT
- IC2 (BA401 Limiter Amp)
- X1 (10.75MHz FM TX offset Crystal)
- IC5 (78L05AC Voltage Regulator)
- IC4 (µPC577H NB Noise Amp)
- F11 (10M24D4 SSB Crystal Filter)
- IC6 (M53323P NB Gate Control)
- F12 (CFW 455E 455KHz Ceramic Filter)
- R205 (SSB Squelch Threshold Adjust)
- R151 (SSB S-Indicator S5 Adjust)
- R152 (SSB S-Indicator Full Scale Adjust)
- R145 (FM S-Indicator Full Scale Adjust)
- R142 (FM S-Indicator S5 Adjust)
- X3 (10.295MHz)
- IC12 (MC3357P FM IF IC)
- R193 (FM Squelch Threshold Adjust)
- J7 (Internal Speaker Connector)

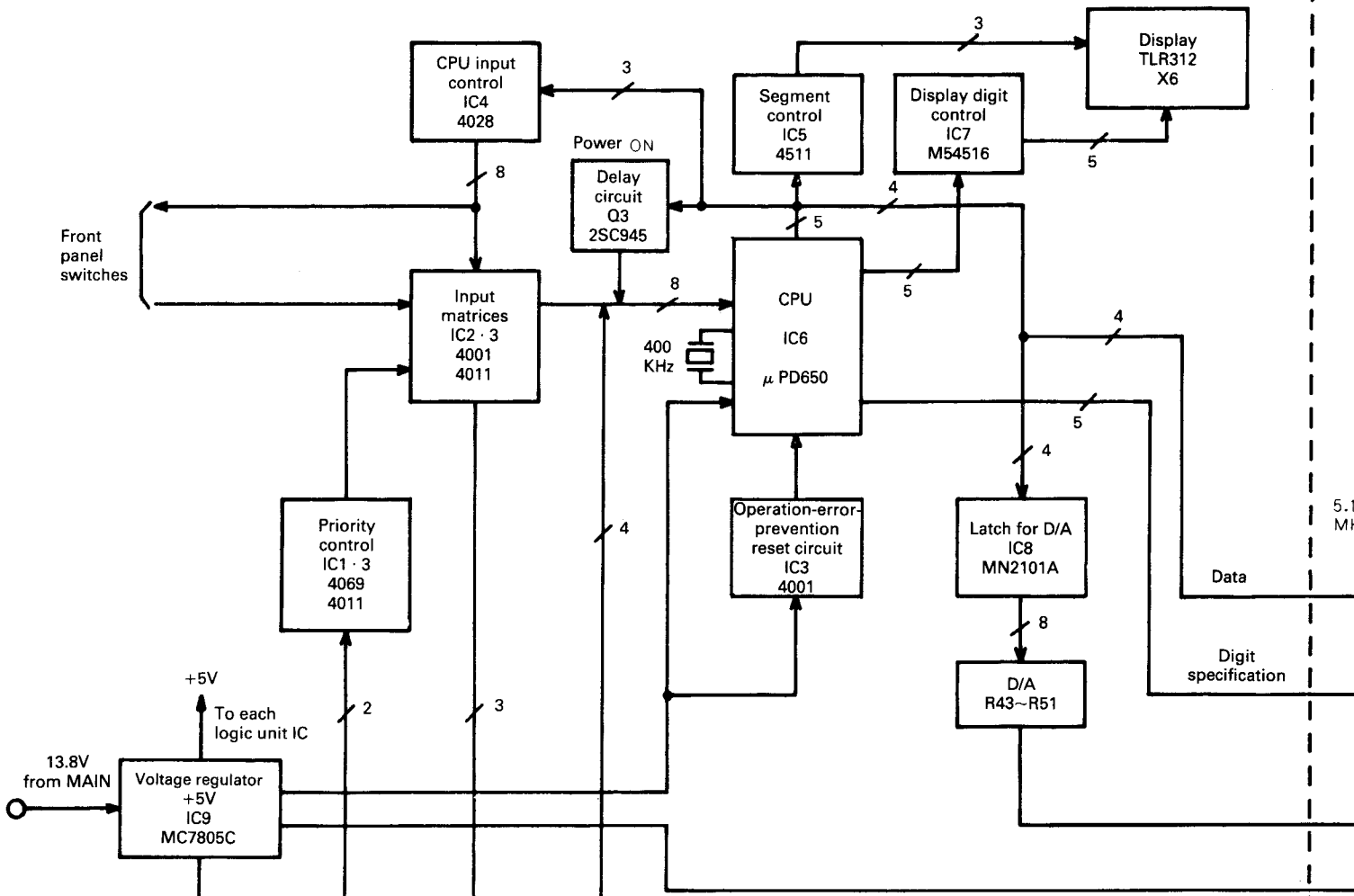


- F11 (10M15B-7 10.75MHz Crystal Filter)
- Q1 - Q2 (2SK125 x 2 TX Mixer)
- R4 (TX Mixer Balance Adjust)
- L14 ~ L16 (RX Band-Pass Filter)
- L2 - L3 (TX Band-Pass Filter)
- Q7 (3SK48 RF Amp FET)
- L4 - L5 (TX Band-Pass Filter)
- L17 - L18 (RX Band-Pass Filter)
- C17 (Driver Output Trimmer)
- Q4 (2SC2053 TX Driver)
- RF - YGR UNIT
- R32 (Scan-Stop Time Control)
- S2 (Scan-Stop Function Switch)
- S1 (VFO Scan Function Switch)
- S3 (Scan-Stop Timer Switch)
- R25 (Scan Speed Control)
- IC1 (MB14025 CPU Input/Scan Control)
- SENSOR UNIT
- IC6 (µPD650 CPU)
- LOGIC UNIT
- PLL UNIT
- IC1 (TC9123P PLL IC)
- X2 (5.12MHz Reference Freq. Crystal)
- C57 (X2 Frequency Adjust)
- R2 (VXO 0.0KHz Adjust)
- L1 (X1 Frequency Adjust)
- X1 (14.2422MHz VXO Crystal)
- IC2 (DP-1 DC-DC Converter)
- R17 (VXO 9.9KHz Adjust)
- VCO CIRCUIT

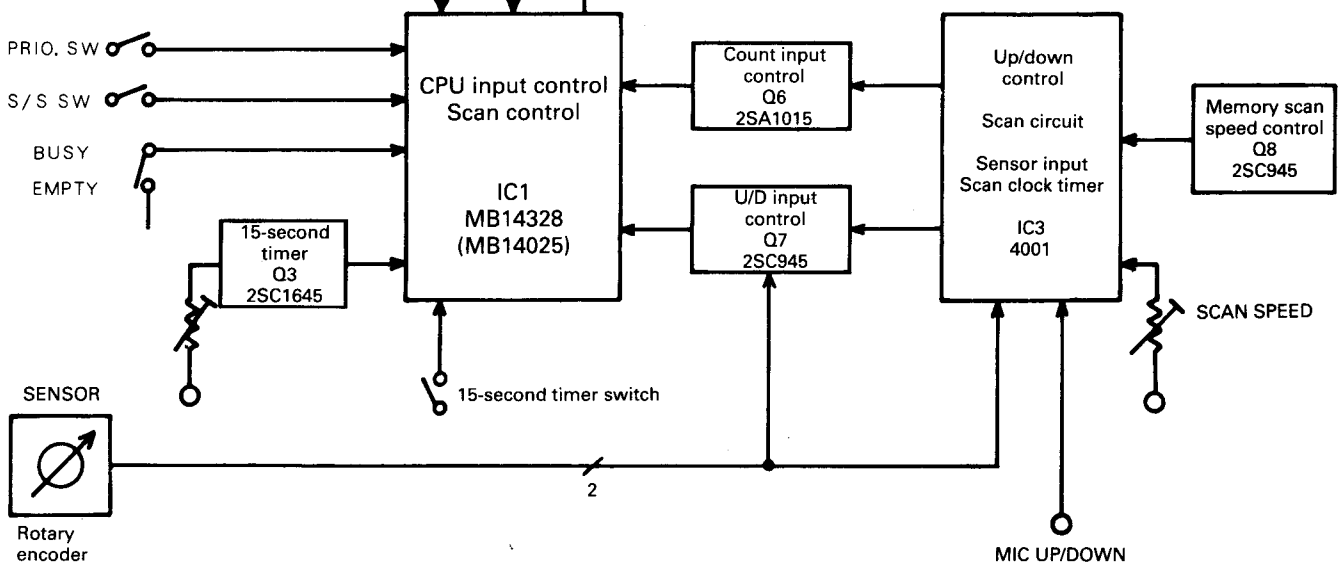
SECTION 4 BLOCK DIAGRAM



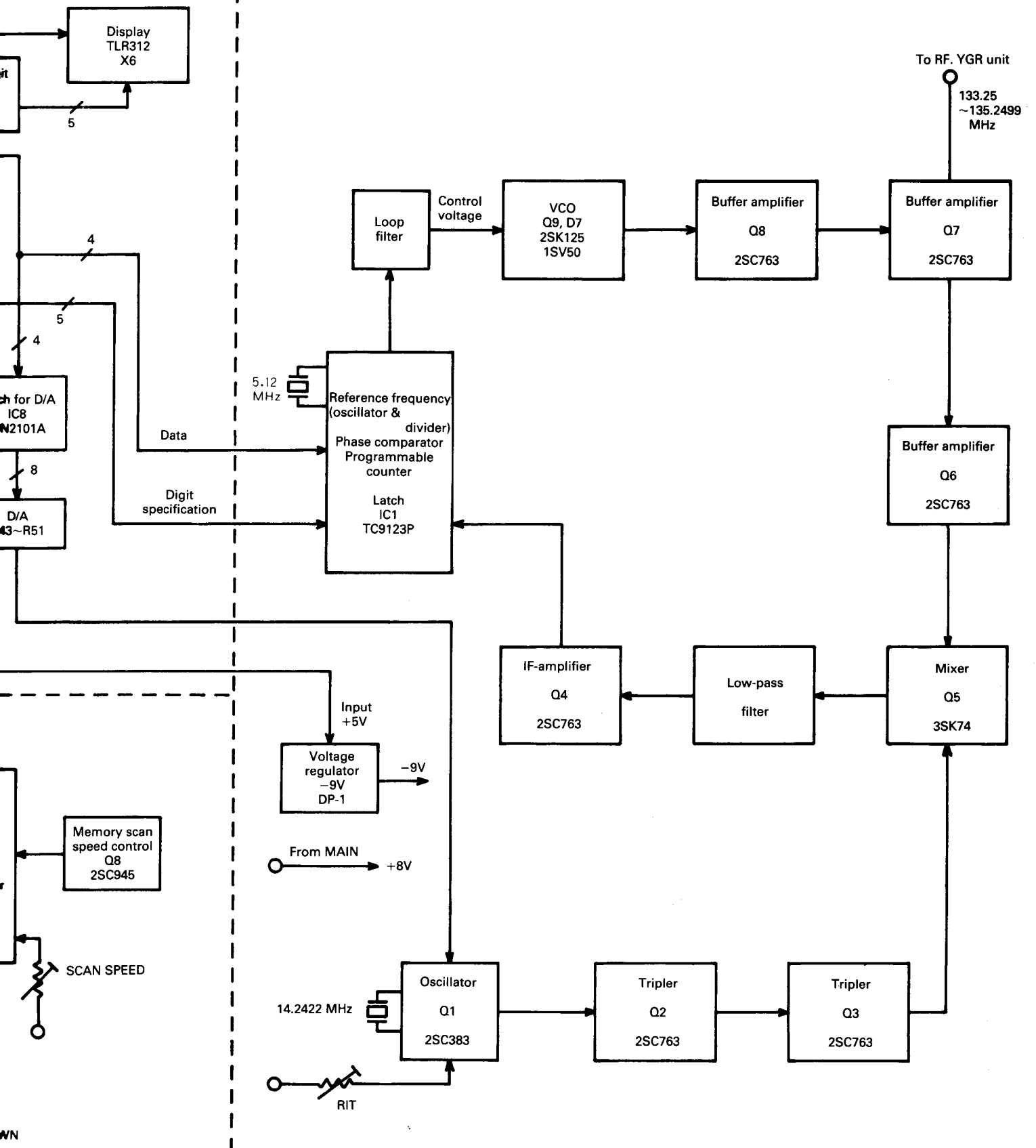
LOGIC UNIT



SENSOR UNIT



PLL UNIT



SECTION 5 CIRCUIT DESCRIPTION

5-1 OUTLINE

The IC-290A/E/H employs a digital phase locked loop (PLL) circuit as the local oscillator for both transmit and receive the output of the PLL circuit is approximately 10.75MHz below the receive frequency, thereby spurious is kept to a minimum.

The operating frequency is controlled by pulse signals, generated by the rotary encoder located at the tuning knob, being added to or subtracted from the preset frequency in the microcomputer.

The microcomputer controls the PLL circuit which determines the output frequency of the VCO (Voltage Controlled Oscillator).

In the receiver section, signals from the antenna are mixed with the local oscillator output from the PLL circuit. The circuits function as a single-conversion type with 10.75MHz IF in the SSB and CW modes, and as a dual-conversion type with an additional 455KHz IF in the FM modes.

In the USB and LSB modes, the transmitter uses a carrier of 10.7485MHz for USB and 10.7510 MHz for LSB. The carrier and the voice signal are sent to a balanced modulator where the DSB suppressed carrier signal is generated. The unwanted sideband is removed by a crystal filter, and an SSB signal of 10.75MHz is obtained.

In the CW mode, the set uses the carrier for USB which is shifted about +800Hz. This carrier is fed to the transmit mixer.

In the FM mode, the set uses another crystal oscillator to produce the 10.75MHz signals which are direct-frequency modulated.

The SSB, CW or FM signal is mixed with the local oscillator output from the PLL circuit, which is the same as that of the receiver section, and then amplified, filtered, and sent to the antenna.

5-2 RECEIVER CIRCUITS

ANTENNA SWITCHING CIRCUIT

Signals from the antenna connector are fed to the two-stage helical cavity filter L17 and L18 in the RF · YGR unit through low-pass filters in the PA unit. The switching diodes D1 and D2 in the PA unit, are turned OFF in the receive mode, and isolate the PA module from the receiver circuit.

RF CIRCUIT

Filtered signals from the double-helical cavity filter, which reduces interference and intermodulation from other radio signals or nearby signals, are amplified by the low-noise MOS FET Q7 and then sent to the gate of the first mixer Q6 through the three stage band pass filter L14 ~ L16. To the source of the wide dynamic range FET mixer Q6, a 133MHz signal is supplied from the PLL unit through the buffer amplifier Q5. The 10.75MHz signals are taken from Q6 through a monolithic crystal filter, FI1, then fed to the IF circuit in the MAIN unit.

IF CIRCUIT

10.75MHz 1st IF signals from the drain of Q6 are fed to the 1st gate of the dual gate MOS FET Q12, through monolithic crystal filter FI1 and the impedance-matching coil L11. AGC voltage is supplied to the 2nd gate of Q12 to improve the receiving characteristics.

Signals amplified by Q12 are fed through L12 to the FM circuit in the FM mode, and to the high-selectivity 4-stage monolithic crystal filter FI1 through L10 and D26 in the SSB and CW modes.

In the FM mode, the 1st IF signals are fed to IC12. IC12 is composed of 2nd local oscillator, 2nd mixer, limiter amplifier, quadrature detector and active filter circuits. The 2nd local oscillator oscillates 10.295MHz, and is fed to the 2nd mixer with the 1st IF signals to convert 455KHz 2nd IF signals. The 2nd IF signals are put out from Pin 3, and fed to external ceramic filter CFW-455E which has excellent selectivity, then fed to IC12 again to amplify and detect. The detected AF signals are put out from Pin 9 and fed to an AF amplifier Q28.

In the SSB and CW modes, D23 is turned ON and signals are amplified by a two-stage amplifier consisting of dual-gate MOS FET's Q18 and Q17. These amplifiers provide high gain and high stability, and the IF coils, L16 and L15 reject interference from outside the IF pass band and other wide-range noise. AGC voltage is supplied to the 2nd gate of the amplifiers for a wide AGC range.

SSB, CW DETECTOR CIRCUIT

Signals from the IF amplifiers are fed to Pin 5 of the balanced modulator, IC3. BFO signals are supplied to Pin 7 and the audio output signals appear at Pin 3. This audio signals are fed to an AF amplifier Q28.

BFO CIRCUIT

The BFO circuit consists of an oscillator Q6, a buffer Q7 and crystal X2. To shift the oscillating frequency according to the operating mode, the total inductance of L8 and L9 is changed by supplying a voltage to an anode of the switching diodes D14 ~ D17, depending on the operating mode.

AF CIRCUIT

Demodulated signals from IC3 or IC12 are amplified by Q28 and fed to Pin 1 of the AF attenuator, IC11, controlled by the VOLUME control on the front panel and then fed to Pin 1 of the AF power amplifier IC10 to obtain enough power to drive the speaker.

AGC CIRCUIT

IF signals amplified by Q18 and Q17 are fed to the buffer amplifier Q16, and rectified by the double voltage rectified by the double voltage rectifier D33 and D34. This DC voltage is fed to the DC amplifier Q15, then supplied as the AGC voltage. $\pm 8V$ is supplied to Q15 to increase the AGC range.

NOISE BLANKER CIRCUIT

Signals amplified by the IF amplifier Q12 are coupled by C184. Noise signals are amplified by IC4 and rectified by D28 and D29. A portion of the rectified signals are amplified by Q20 and intergrated by C82, and supplied to IC4 as its AGC voltage. The other part of the rectified signals are fed to the DC amplifier Q19. When a pulse noise is received, the pulse turns Q19 ON, and triggers the monostable multivibrator IC6. Pin 4 of IC6 goes to the ground level at a time determined by R134 and C111, and it turns Q11 and D24 ON, and turns D26 and D27 OFF. Thus the IF signals including pulse noise are not fed to the crystal filter during the pulse noise is present and provides comfortable reception.

SQUELCH CIRCUIT

This circuit is provided to silence the set until a signal is received.

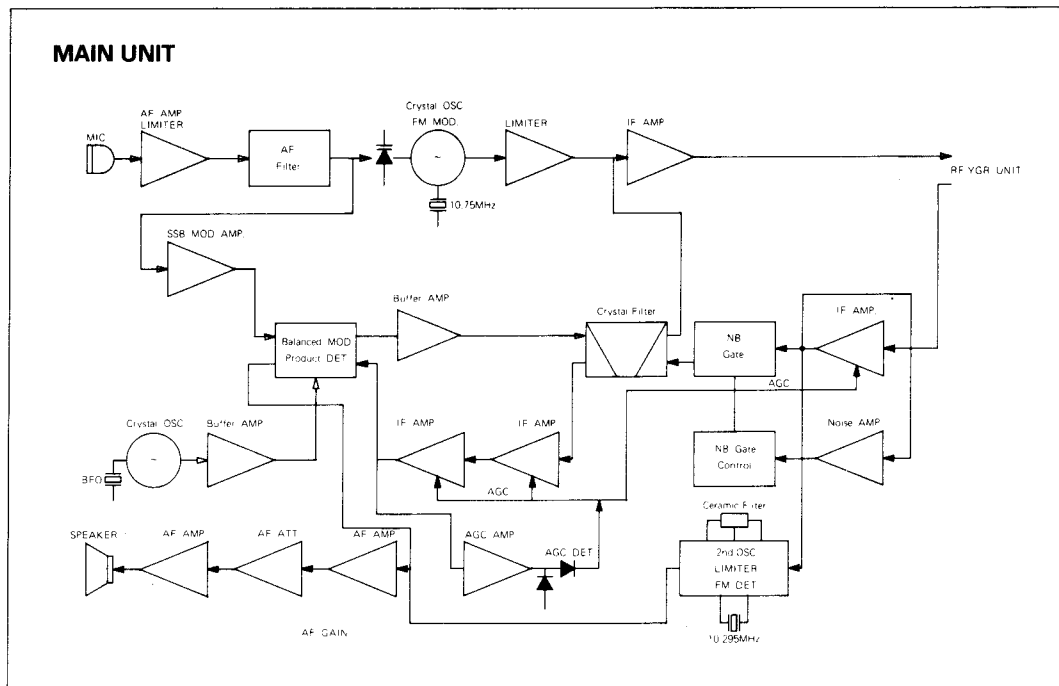
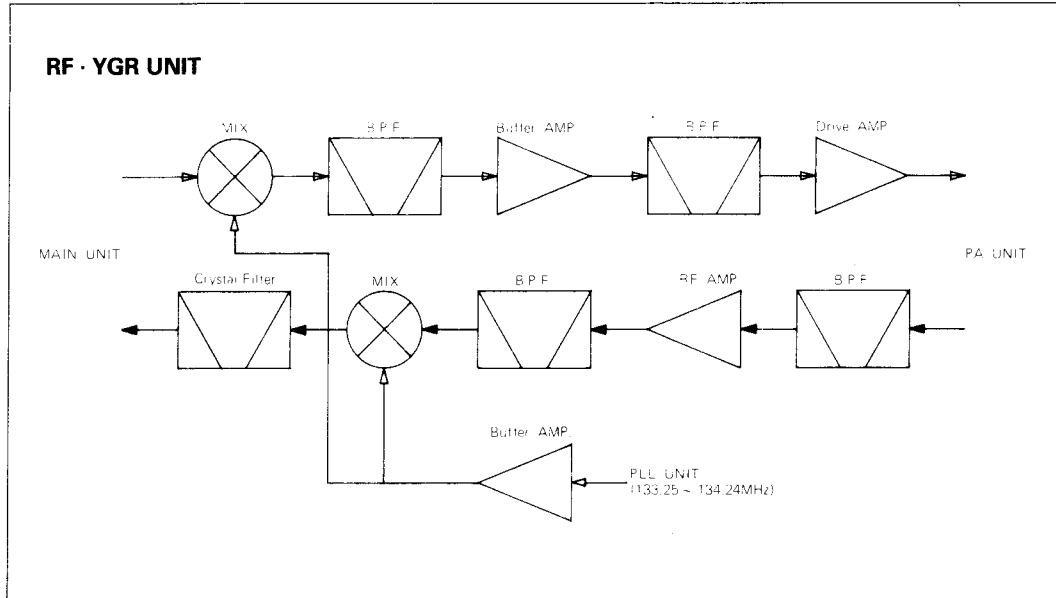
In the FM mode, noise components put out from Pin 9 of IC12 are fed to the AF attenuator, a half of IC11, which controls the squelch threshold level. The output of IC11 is fed to IC12 again, filtered about 20KHz signal (noise), and put out from Pin 11. This signal (noise) is rectified by D46 and D47, integrated by R197, R198 and C169, and turns Q30 ON. The collector of Q30 is connected to Pin 13 of IC11 through D45, and it makes maximum attenuation for receiver audio signals and silences the set. When a signal is received, the noise component is suppressed by the signal, the base voltage of Q30 is lowered, and Q30 is turned OFF. Thus the receiver audio attenuator, IC11, functions with normal condition, and the received signal can be heard from the speaker.

In the SSB and CW modes, the S-meter signal from Pin 7 of IC8, is fed to Pin 2 of IC8 which is the minus input terminal of the comparator, and the squelch threshold signal set by the squelch control, is fed to Pin 3 of IC8 which is the plus input terminal.

When the squelch is closed (when the S-meter signal voltage is less than the squelch threshold signal voltage), Pin 1 of IC8 puts out 8V and Q30 is turned ON, thus no audio can be heard from the speaker. When a signal is received and the S-meter signal voltage exceeds the squelch threshold voltage, Pin 1 of IC8 is lowered to ground level, Q30 is turned OFF, and the received signal can be heard from the speaker. In the FM mode 8V is applied to Pin 2 of IC8, the output is lowered to ground level, and IC8 is isolated from the Q30.

POWER SUPPLY CIRCUIT

This circuit employs a multipurpose voltage regulator, IC13. It puts out a constantly activated 8V, R8V which is operative during receive, and T8V which is operative during transmit. R8V is put out from Pin 6, and T8V is put out from Pin 8 of IC13. By grounding Pin 5, R8V goes 0V and T8V is actuated, thus the set will be turned to the transmit mode.



5-3 TRANSMITTER CIRCUITS

ANTENNA SWITCHING CIRCUIT

In the transmit mode, D1 and D2 are turned ON. D1 feeds the transmitting signals to antenna through the low-pass filter, and D2 grounds the input terminal of the receiver, thus the transmitting signals are prevented from flowing into the receiver circuits.

MICROPHONE AMPLIFIER AND LIMITER CIRCUIT

Audio signals from the microphone are fed to Pin 2 of the audio amplifier IC1. Amplified signals appear at Pin 1 and are sent through a differential circuit R14 and C6 to Pin 5 of IC1, which is a limiter amplifier and has 6dB/Octave response between 300Hz and 3KHz. This output is fed to either low-pass filter Q1, and then the FM modulator D3 in FM mode, or a buffer amplifier Q9 through an integral circuit R81 and C75.

FM MODULATOR CIRCUIT

Audio signals from Q1 are fed to varactor diode D3 through R31 level adjust trimmer. Q3 oscillates at 10.75MHz, and D3 modulates its frequency with the audio signals. The modulated signals are fed to the limiter amplifier IC2 and the buffer amplifier Q4, then the transmit mixer in the RF · YGR unit.

BALANCED MODULATOR CIRCUIT

In the SSB mode, the amplified audio signals from Q9 are fed to Pin 5 of the balanced modulator IC3 (same as the receiver detector), through R80 level adjust trimmer. The BFO signal is fed to Pin 7, resulting in a 10.75MHz suppressed carrier double side band signal brought out from Pin 2.

In the CW mode, a voltage is applied to Pin 5 of IC3 through D20 and R78, to unbalance the IC3 and put out a carrier signal. The carrier level can be adjustable with R67.

TRANSMIT IF AMPLIFIER CIRCUIT

DSB signals which appear at Pin 2 of IC3, are fed to the base of Q10, and amplified by Q10, and then fed to F11 through the switching diode D22, DSB signals are converted to SSB signals by the filter and sent to the buffer amplifier Q4 through D25 and D5, then the transmit mixer in the RF · YGR unit.

In the CW mode, during key up, a voltage is applied to the source of Q4, through D6, to cut off Q4, preventing RF output. During key down, the applied voltage is shunted to ground through D42, thus the source voltage of Q4 becomes normal and puts out RF signals.

TRANSMIT MIXER CIRCUIT

Wide dynamic range FET's Q1 and Q2, and coils L1 and L9 work as a double-balanced mixer to provide low spurious and excellent mixer characteristics. The local oscillator signals are supplied to L9 through the buffer amplifier, Q5, from the PLL circuit and mixed with the FM, SSB or CW signals fed from the MAIN unit. Both added and subtracted frequencies are generated by this mixer, but only the signals of the added frequency are filtered through the transmit band-pass filters L2 and L3.

BUFFER AMPLIFIER CIRCUIT

The filtered 144MHz signals, supplied to the first gate of the dual-gate FET Q3, are amplified to approximately 10mW PEP. The output of this buffer amplifier is sent through the transmit band-pass filter L4 and L5 to the other buffer amplifier Q4, whose output level is approximately 200mW PEP, then sent to the PA unit.

POWER AMPLIFIER CIRCUIT

The signals from Q4 in the MAIN unit are amplified by IC1 in the PA unit to obtain 10W PEP (IC-290H : 25W PEP). The heat from IC1 is transmitted to the diecast heat sink which radiates the heat very efficiently. IC1 is hybrid IC consisting of a two-stage RF power amplifier. The output signals of IC1 are fed to the antenna terminal through the T/R switching diode D1 and three-stage low-pass filter, which suppress harmonics by more than 60dB.

APC CIRCUIT

This circuit stabilizes the output power, even when the power voltage or the antenna load is fluctuating, and switches the output power 1 watt and 10 watts. The variation in the current of IC1 is detected at R4 in the PA unit and amplified by differential amplifier IC9 in the MAIN unit. The output voltage from Pin 7 of IC9 is fed to the first gate of Q4. This lowers input excitation level to the power amplifier module and reduces input power to the final stage, thus preventing damage to the module due to high current. The output power can be adjusted by R154 in normal power (10W or 25W), and by R153 in lower power (1W) conditions.

CW BREAK-IN CIRCUIT

This circuit provides semi-break-in function in the CW mode. When the key is down, the base of Q25 goes ground level through D43, and Q25 is turned OFF and Q24 is turned ON. The collector of Q24 is connected to the T/R switch control line and grounds it to switch in the transmit mode. When the key is up, after the time constant of C138 and R169, the base voltage of Q25 rises to turn Q25 ON, Q24 OFF, and the set is turned in the receive mode.

CW MONITOR CIRCUIT

Phase oscillator Q27 oscillates at approximately 800Hz. The positive line of the key jack is connected to the base of Q26 through R123. When the key is up, Q26 is ON and grounds the phase shift network to stop oscillation. When the positive line is grounded by keying, the base of Q26 is grounded and turned OFF, and the phase shift network works normally and Q27 oscillates CW side-tone. The oscillator signals are fed to Pin 1 of AF power amplifier IC10 through the level adjust resistor R180, C146 and R181.

METERING CIRCUIT

In the receive mode, the S/Rf indicator functions as an S-meter. The source voltage of Q17 drops according to the AGC voltage applied to the second gate of each IF amplifier. The voltage is fed to a differential amplifier IC8 through R152, then fed to the indicator driver IC. R152 adjusts indicator's full scale.

In the FM mode, a part of the 2nd IF signal is fed to the IF amplifier IC7, rectified by D39 and D40, then fed to the indicator driver IC through the level adjust resistor R145.

In the transmit mode, the S/Rf indicator functions as a relative RF power meter. A part of the RF power output is fed to D3 and rectified, then fed to the indicator driver IC through the level adjust resistor R216.

5-4 PLL (PHASE LOCKED LOOP) UNIT

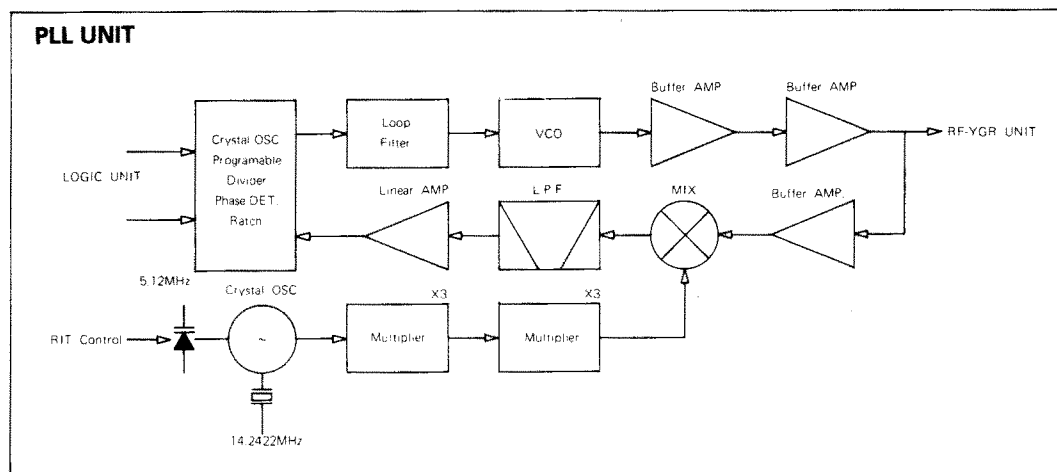
LOCAL OSCILLATOR CIRCUIT

This circuit is for the oscillation, in 100Hz steps, of the lowest two digits (0.0 ~ 9.9KHz) of the VCO output frequency of the PLL circuit. It consists of Q1 oscillator, and Q2, Q3 frequency triplers.

The crystal unit X1, a special VXO (Variable Xtal Oscillator) crystal, is connected to Q1's base and oscillates at about 14.242MHz. The oscillating frequency is altered in 100Hz steps by the voltage supplied to the cathode of D2 and D3 from the D/A (Digital to Analog) converter. The 14MHz signal is tripled at Q2 and Q3, thus the local oscillator output between 128.180MHz and 128.1899MHz is obtained. The anodes of D2 and D3 are connected to the RIT switch control Q1 and Q2 in the FSW board through the bias network R6 ~ R8.

When the set is in the transmit mode or the RIT is turned OFF, both Q1 and Q2 are turned ON and R7 is connected to ground through Q2. Thus a fixed voltage divided by R1, R2 and R3, is applied to D2 and D3.

When the set is in the receive mode and the RIT is turned ON, both Q1 and Q2 are turned OFF, and R7 is connected to the RIT control. A DC voltage from the RIT control is applied to D2 and D3, and the oscillating frequency will be shifted approximately ± 900 Hz.



MIXER, LOW PASS FILTER, AND AMPLIFIER CIRCUIT

The output signals from the local oscillator circuit and the VCO signals are mixed by the MOS FET mixer Q5. The output signals are fed to the low-pass filters to filter out only the signals below 15MHz. The output signals from the filter are amplified to the proper drive level (more than 3Vp-p) of the programmable divider IC1 by Q4. Then the signals are fed to Pin 12 of IC1 through C64.

PROGRAMMABLE DIVIDER CIRCUIT

The input signals at Pin 12 of the PLL IC, IC1, consists of programmable divider, reference frequency generator and phase detector, are divided by the BCD input signals at Pins 6 ~ 9 and its digit signals at Pins 2 ~ 5.

The programmable divider is also called the 1/N counter and the BCD input is N. The relationship between the display frequency and the divide number N is as follows:

DISPLAY FREQUENCY	CPU OUTPUT	DIVIDE NUMBER (N)
144.000MHz	400	507
144.010MHz	401	508
}	}	}
145.000MHz	500	607
}	}	}
146.000MHz	600	707
}	}	}
147.000MHz	700	807
}	}	}
148.000MHz	800	907

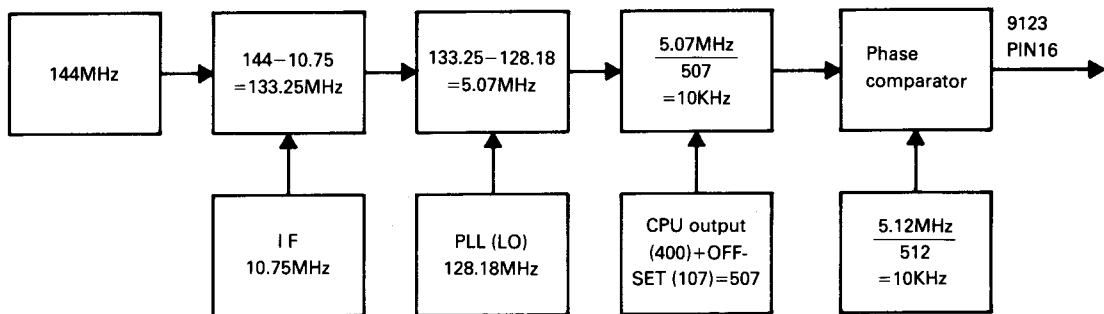
REFERENCE FREQUENCY GENERATOR CIRCUIT

Reference frequency generator consists of a crystal oscillator and a highspeed divider. X2 oscillates at 5.12MHz, which is divided by 512. The 10KHz reference frequency is fed to phase detector. This 10KHz reference frequency decides the variation step of the PLL output frequency and the divide number N decides the PLL output frequency.

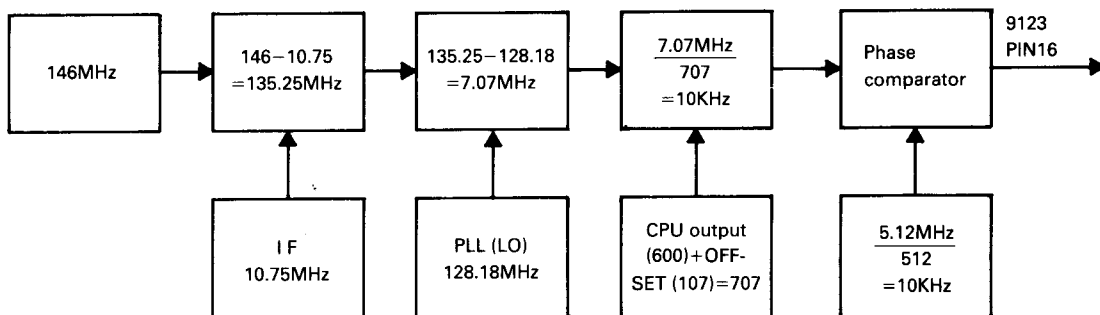
$$\text{PLL output freq.} = \text{local oscillator freq. (MHz)} + 0.01\text{MHz (the reference freq.)} \times N \text{ (divide number of programmable divider)}$$

When the last two digits of the display frequency are changed from 0 to 9.9KHz, the local oscillator frequency is changed from 128.180 to 128.1899MHz. When the display frequency reaches 10.0KHz, the local oscillator frequency is set back to 128.180 and 1 is added to N. Thus the frequency change by 10KHz steps is set by the divide number N and the frequency change below 10KHz steps is set by the 100Hz-step variation of the local oscillator (VXO) frequency.

Example: 144MHz FM operation



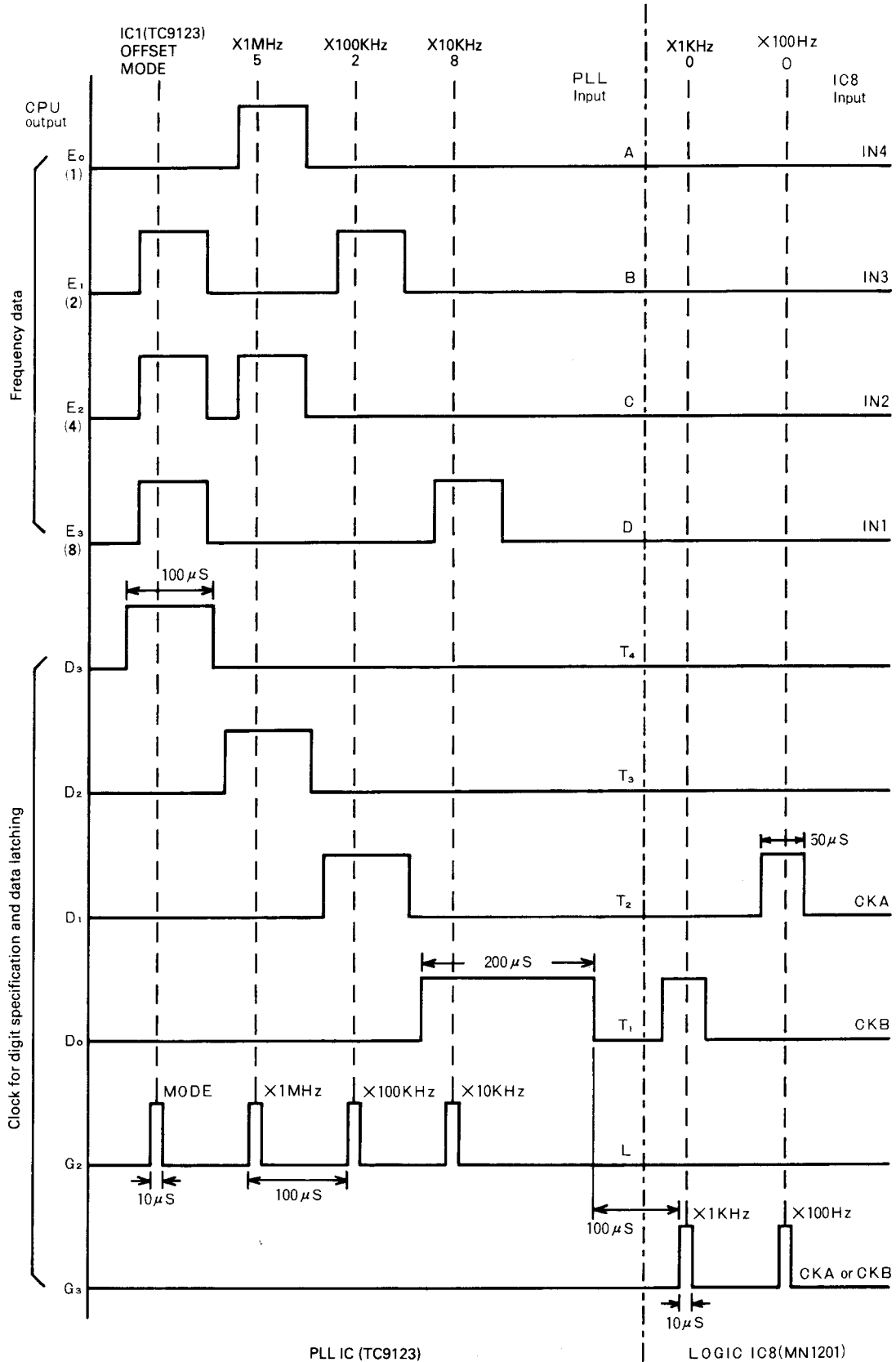
Example: 146MHz FM operation



● **CPU-to-PLL Frequency Data-Transfer Time Chart**

Frequency data is output from $E_0 \sim E_3$ of the CPU to IC1 (terminals A ~D) of the PLL. At the same time data is also input to $IN_4 \sim IN_1$ of the logic unit IC8. The 1-kHz and 100-kHz digit data are latched according to the timing shown in the chart below. The digital data to the PLL is output from $D_0 \sim D_3$ of the CPU and is input to $T_1 \sim T_4$ of PLL IC1. Load pulses are consecutively sent from G_2 of the CPU, and data is discriminated according to their timing. Note that IC8 functions for D/A conversion of the 0.0-kHz to 9.9-kHz data, and PLL local-oscillator is controlled by this DV voltage.

Example: 145.2800 MHz operation



PHASE DETECTOR AND LOOP FILTER CIRCUIT

Digital phase detector detects the phase difference of the pulse signals of the 10KHz reference frequency, and the output signal of the programmable divider, and proportionately puts out positive/negative pulse signals at Pin 16. Pin 18 is for detecting the lock failures and changes to ground level according to the phase difference of the two pulse signals.

The loop filter, consisting of R55 ~ R57 and C52, C55 and C56, converts the pulse signal from Pin 16 into a DC voltage and decides the response time of the whole loop. The output signals are fed to tuning diode D7 of the VCO unit as the control voltage for the VCO frequency set.

BUFFER AMPLIFIER CIRCUIT

The VCO output signals are fed to buffer amplifier Q7. They are then fed to the second gate of the mixer Q5 through isolation buffer amplifier Q6, and to the transmit and receive mixer in the RF · YGR unit.

VCO UNIT

The VCO (Voltage-Controlled Oscillator) is a Clapp circuit, using Q9, and oscillates in the 133MHz range. The oscillation frequency is controlled by a DC voltage which is supplied from the loop filter in the PLL unit to varactor diode D7, inserted in series with the oscillation coil.

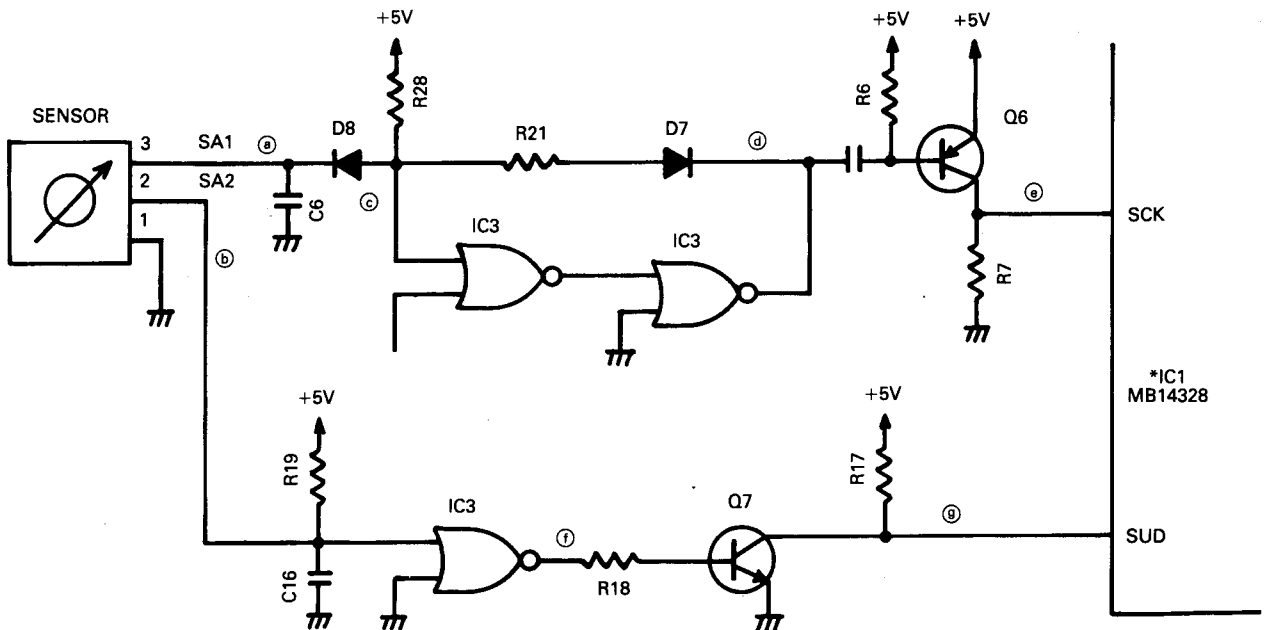
The oscillator output is taken from the source of Q9, and fed to buffer amplifiers Q8 and Q7 in the PLL unit to become the local oscillator signal for the transmitter and receiver, and to get a DC-voltage to control the frequency of the VCO.

SENSOR UNIT

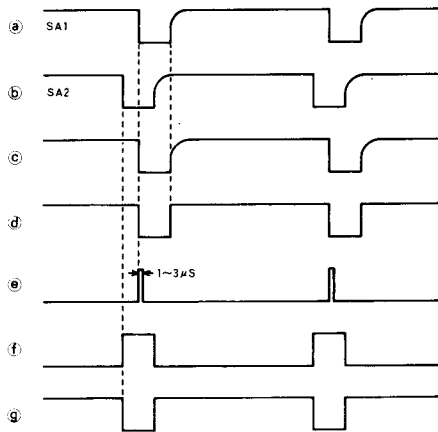
CLOCK PULSE GENERATE CIRCUIT

The input data for the microcomputer, is controlled by a custom-made LS type TTL IC, IC1.

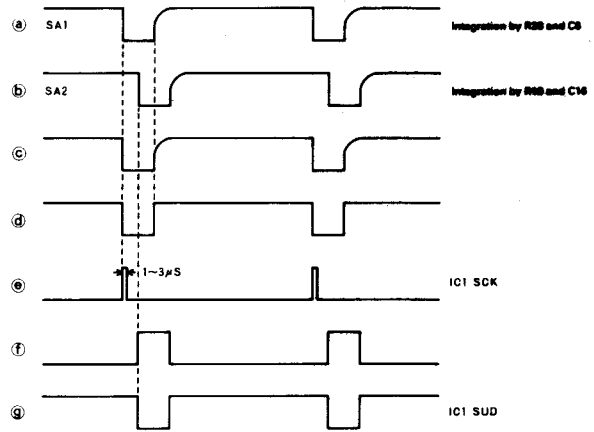
The clock pulses are generated by a mechanical rotary-encoder which is connected directly to the shaft of the tuning control knob. The rotary-encoder puts out two signals which are 90 degree out of phase signals. Clock pulse signals and UP/DOWN signals are generated by the UP/DOWN control circuit consisting of IC3. These signals are fed to Pins 3 and 4 of IC1 through level converters Q6 and Q7.



Up Count Timing Chart



Down Count Timing Chart

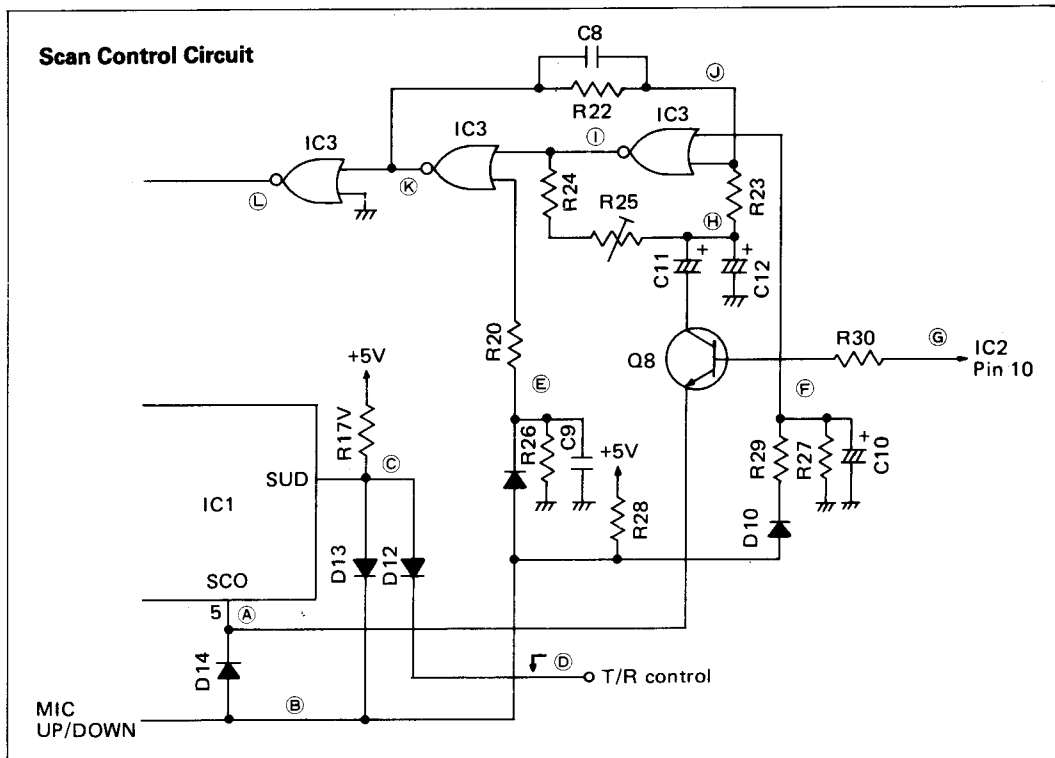


SCAN and MIC UP/DOWN CONTROL CIRCUIT

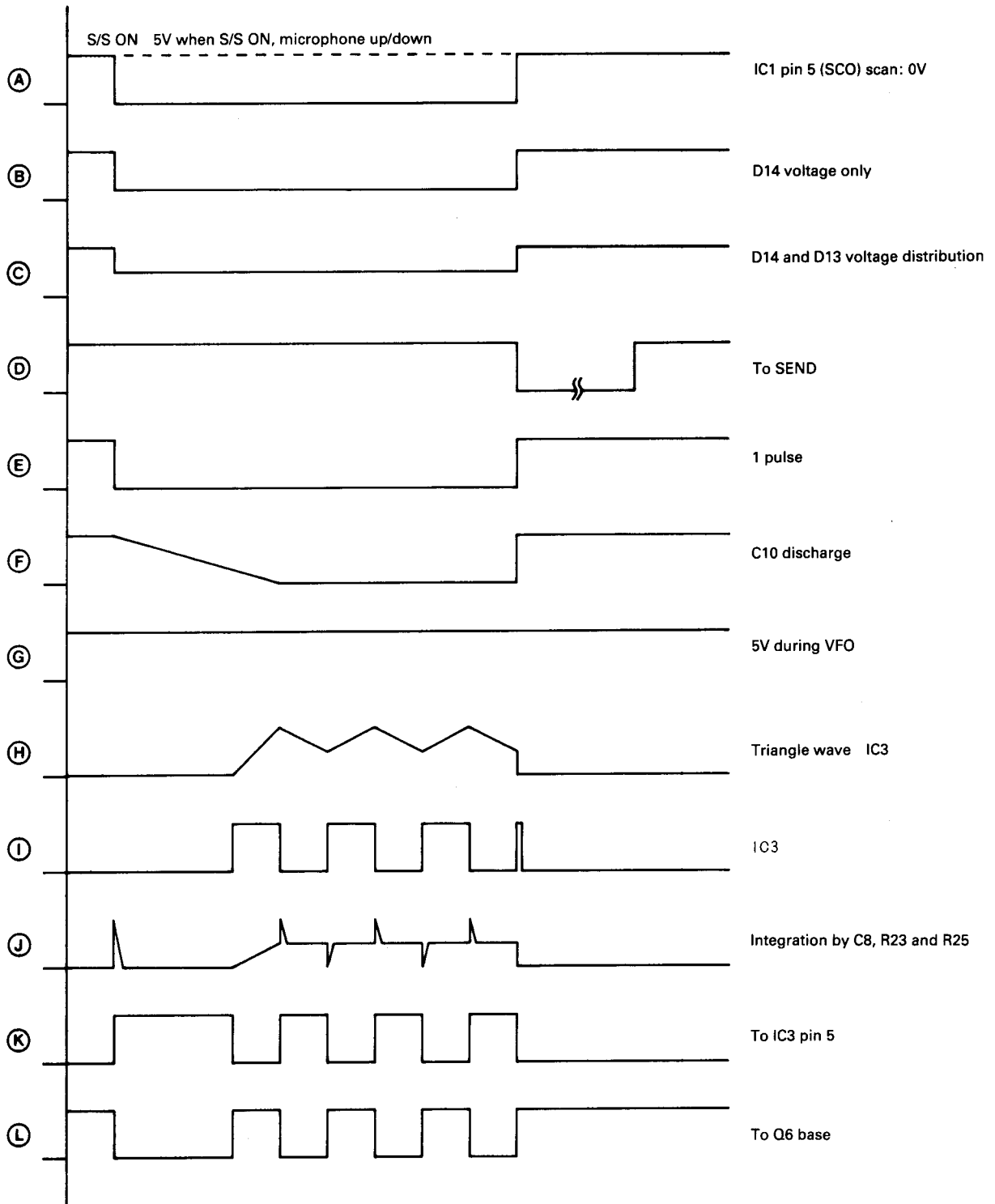
The scan function is provided by pushing the scan Start/Stop (S/S) button. When pushed the S/S button, Pin 5 of IC1 is lowered to ground level, the voltage at (E) and (F) are also lowered, and the multivibrator, consisting of IC3, starts oscillation for scanning, and the decimal points of the frequency display will blink. When Pin 5 of IC1 is lowered, Pin 3 (UP/DOWN control terminal) is also lowered, but its voltage is still 1V ~ 2V, so the downward scanning is selected.

The oscillation frequency (scan speed) can be adjusted by R25. When a VFO is selected (in the programmed scan or full range scan function), the voltage at (G) is ground level, and Q8 is turned OFF. So the oscillation frequency is decided by C12 only and the frequency is higher and the scan speed is fast. When a memory channel is selected (in the memory scan function), a voltage is applied to (G), Q8 is turned ON and C11 is paralleled to C12. Thus the oscillation frequency is lowered and the scan speed is slow.

In the MIC UP/DOWN function (when using an optional UP/DOWN microphone IC-HM10), as the UP button on the microphone is depressed, the (B) point is grounded and the multivibrator starts oscillation. In this case, Pin 3 is grounded through D13 only and near ground level. Thus the upward scanning is selected. When the DOWN button is depressed the (B) point is grounded through a 470 ohm resistor installed inside the microphone. So the voltage divided by R17 and the 470 ohm resistor, is applied to Pin 3 and the downward scanning is selected.



Scan operation when S/S switch On



• **Sensor unit IC1**

This IC is constructed of a custom LS type TTL, and the circuit, an original development by ICOM, is packaged in a plastic package. The main functions are sensor input and scan control. Each operation is controlled by a clock signal to pin 14 (STM).

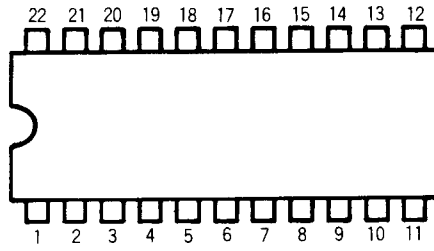
Notes regarding IC1

This IC1 was MB14328 in units produced until January 1982, and MB14025 may be used in units produced thereafter.

The descriptions given in this manual pertain to units in which the older type, MB14328, is used, but the circuit diagram may be used for reference if necessary.

Note that the main change made in the newer type vs. the older type is that sensor data SA1 and SA2 for the older type is input to IC1 pin 3 and pin 4, but for the newer type is input to pin 1 and pin 2.

Pin designations and functions



() indicates for MB14025

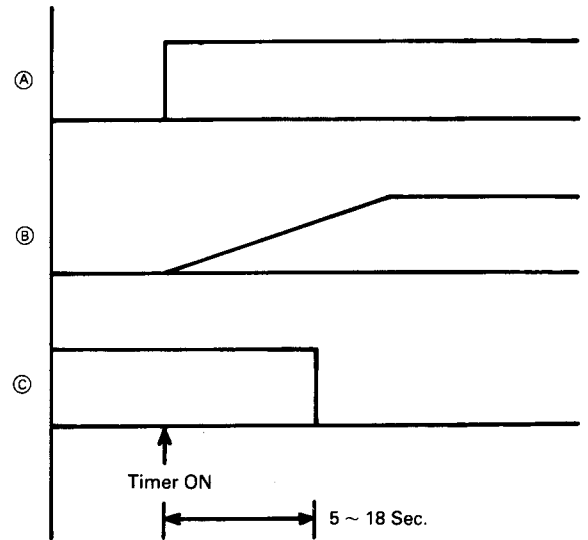
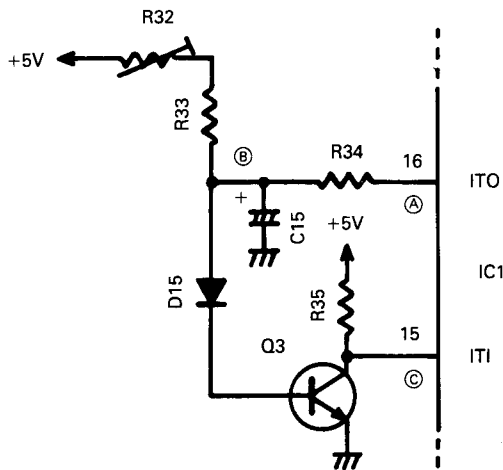
1. NC	Not used	11. GND	Ground
(S1)	(SA1 sensor input)	12. BUSY	Used as ground
2. NC	Not used	13. SQL	Squelch input
(S2)	(SA2 sensor input)	14. STM	Custom clock input
3. SUD	Up/down control	15. ITI	Timer input
4. SCK	Up/down clock input	16. ITO	Timer output
5. SCO	Output of S/S input (pin 8)	17. RIC	Internal latch output
6. MSL	For reset	18. RLD	For LED
7. MC	For reset	19. RCK	Control of up (pin 20) and CK (pin 21)
8. S/S	S/S switch input	20. UD	SUD output
9. RSW	Internal latch input	21. CK	SCK output
10. SEL	Timer ON/OFF input	22. +Vcc	Power supply (+4.5~5.5V)

IC1 peripheral circuitry

Timer circuit

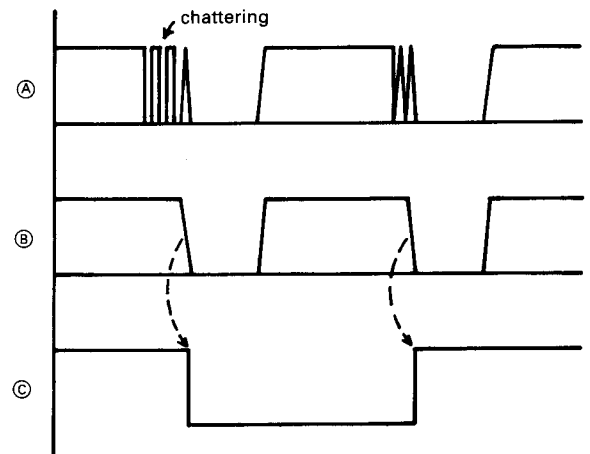
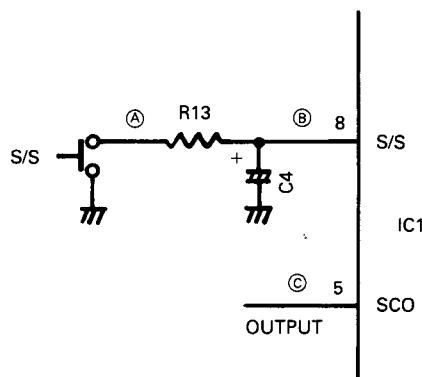
When IC1 pin 10 (SEL) is 0V, the timer is operative, and is inoperative when it is 5V.

The circuitry shown below is when the timer is operative.



Scan input

The internal flip-flop is inverted when the front panel S/S switch is pressed, and that output is sent to pin 5 (SCO).

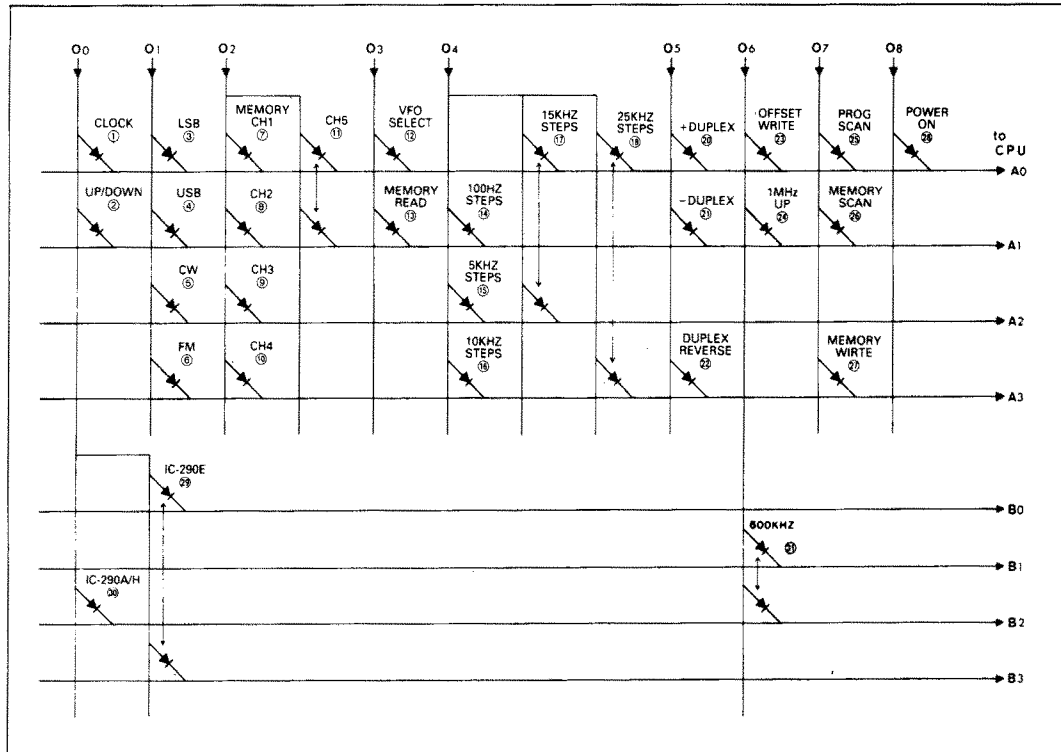


5-5 LOGIC UNIT

CPU CONTROL CIRCUIT

The CPU in the unit is a 4-bit CPU and the input terminals are A0 ~ A3 and B0 ~ B3.

Since the CPU cannot make many functions with the small number of A and B input signals, to increase the functions of the CPU, scanning E output signals and O0 ~ O7 signals decoded by IC4, and are fed to A and B input terminals through the matrix circuit. The CPU reads the relationship of E output, and A and B input signals to decide the function as follows:



① O0 → A0 (Clock)

This flow occurs when the frequency is moved up or down with each pulse input by turning the tuning control knob or scanning.

② O0 → A1 (Up/down)

This flow occurs when the frequency is moved up. When the frequency is moved down, the O0 signal is not fed to A1.

③ O1 → A0 (LSB)

This flow occurs when the MODE Switch is set at "LSB". When this happens, the display frequency is shifted +1.5KHz from the FM's one.

④ Q1 → A1 (USB)

This flow occurs when the MODE Switch is set at "USB". When this happens, the display frequency is shifted -1.5KHz from the FM's one.

⑤ O1 → A2 (CW)

This flow occurs when the MODE Switch is set at "CW". When this happens, the display frequency is shifted -0.7KHz from the FM's one.

⑥ O1 → A3 (FM)

This flow occurs when the MODE Switch is set at "FM". The display shows the carrier frequency.

⑦ O2 → A0 (Memory Channel 1)

This flow occurs when the Memory channel Switch is set at "1".

⑧ O2 → A1 (Memory channel 2)

This flow occurs when the Memory Channel Switch is set at "2".

⑨ O2 → A2 (Memory Channel 3)

This flow occurs when the Memory Channel Switch is set at "3".

⑩ **O2 → A3 (Memory Channel 4)**

This flow occurs when the Memory channel Switch is set at "4".

⑪ **O2 → A0, A1 (Memory Channel 5)**

This flow occurs when the Memory channel Switch is set at "5".

⑫ **O3 → A0 (VFO Select)**

This flow occurs when the VFO Switch is set in "B", and the unit operates at the frequency set by "B" VFO. When the VFO Switch is set in "A", the O3 signal is not fed to A0, and the unit operates at the frequency set by "A" VFO.

⑬ **O3 → A1 (Memory Read)**

This flow occurs when the VFO/MEMORY Switch is pushed in, and the unit operates at a memory channel set by the Memory Channel Switch. This function is prior to the function of ⑫.

⑭ **O4 → A1 (100Hz Steps)**

This flow occurs when the MODE Switch is set at "USB", "LSB" or "CW", and the operating frequency is moved up or down with 100Hz steps by turning the tuning control knob or scanning.

⑮ **O4 → A2 (5KHz Steps)**

This flow occurs when the MODE Switch is set at "FM", and the operating frequency is moved up or down with 5KHz steps.

⑯ **O4 → A1 (10KHz Steps)**

When this flow occurs, the operating frequency is moved up or down with 10KHz steps.
(This mode is not used for IC-290A/E/H.)

⑰ **O4 → A0, A2 (15KHz Steps)**

When this flow occurs, the operating frequency is moved up or down with 15KHz steps. (This mode is used for scanning of IC-290A/H.)

⑱ **O4 → A0, A3 (25KHz Steps)**

When this flow occurs, the operating frequency is moved up or down with 25KHz steps. (This mode is used for scanning of IC-290E.)

⑲ **(1KHz Steps)**

When the 1KHz Steps Switch is pushed in, these flows (⑭ ~ ⑱) do not occur, and the operating frequency is moved up or down with 1KHz steps in any mode by turning the tuning control knob or scanning.

⑳ **O5 → A0 (+Duplex)**

This flow occurs when the OFFSET Switch is set at "+DUP", and the transmit frequency becomes a frequency which is added the specified offset frequency to the receive frequency.

㉑ **O5 → A1 (-Duplex)**

This flow occurs when the OFFSET Switch is set at "-DUP", and the transmit frequency becomes a frequency which is subtracted the specified offset frequency from the receive frequency.

㉒ **O5 → A3 (Duplex Check)**

This flow occurs when the OFFSET Switch is set at "+DUP" or "-DUP" and during the MEMORY/VFO WRITE button is pushed, the receive frequency becomes a frequency which is added to, the specified offset frequency or subtracted it from the original receive frequency.

NOTE: If the "+DUP" or "-DUP" frequency becomes out of the band, this frequency will remain at the original receive frequency.

㉓ **O6 → A0 (Offset Write)**

This flow occurs when the MODE Switch is set at "OFFSET WRITE" position, and the offset frequency can be reset by turning the tuning control knob.

②④ **O6 → A1 (1MHz Up)**

When this flow occurs, the 1MHz digit of operating frequency is moved up with 1MHz steps. (This mode is not used for IC-290A/E/H.)

②⑤ **O7 → A0 (Programmed Scan)**

When this flow occurs, and the S/S button is depressed, the operating frequency scans between frequencies written into the Memory channels 1 and 2. (Memory channel 2 should be written higher frequency than Memory Channel 1, if not the scan function does not actuate.) When this flow does not occur and the S/S button is depressed, the operating frequency scans the entire band.

②⑥ **O7 → A1 (Memory Scan)**

When this flow occurs, the operating frequency scans on the memory channels and the VFO's A and B.

②⑦ **O7 → A3 (Memory Write)**

When a memory channel is selected and this flow occurs, a frequency of the VFO A is written into the selected memory channel.

When a VFO is selected and this flow occurs, a frequency of the other VFO is written into the selected VFO.

②⑧ **O8 → A0 (Power ON)**

This flow occurs when the POWER Switch is turned ON. When this flow does not occur, the CPU is in standby condition.

NOTE: The port B is used to initialize the CPU when the power is turned ON.

②⑨ **O0 → B2**

When this flow occurs, the operating frequency range is selected between 144.0000MHz and 145.9999MHz. (This mode is used for IC-290E).

③⑩ **O0 → B0, B3**

When this flow occurs, the operating frequency range is selected between 143.8000MHz and 148.1999MHz. (This mode is used for IC-290A/H.)

③⑪ **O6 → B1, B2**

When this flow occurs, the offset frequency is preset for 600KHz.

FREQUENCY CONTROL, DISPLAY AND I/O CIRCUIT

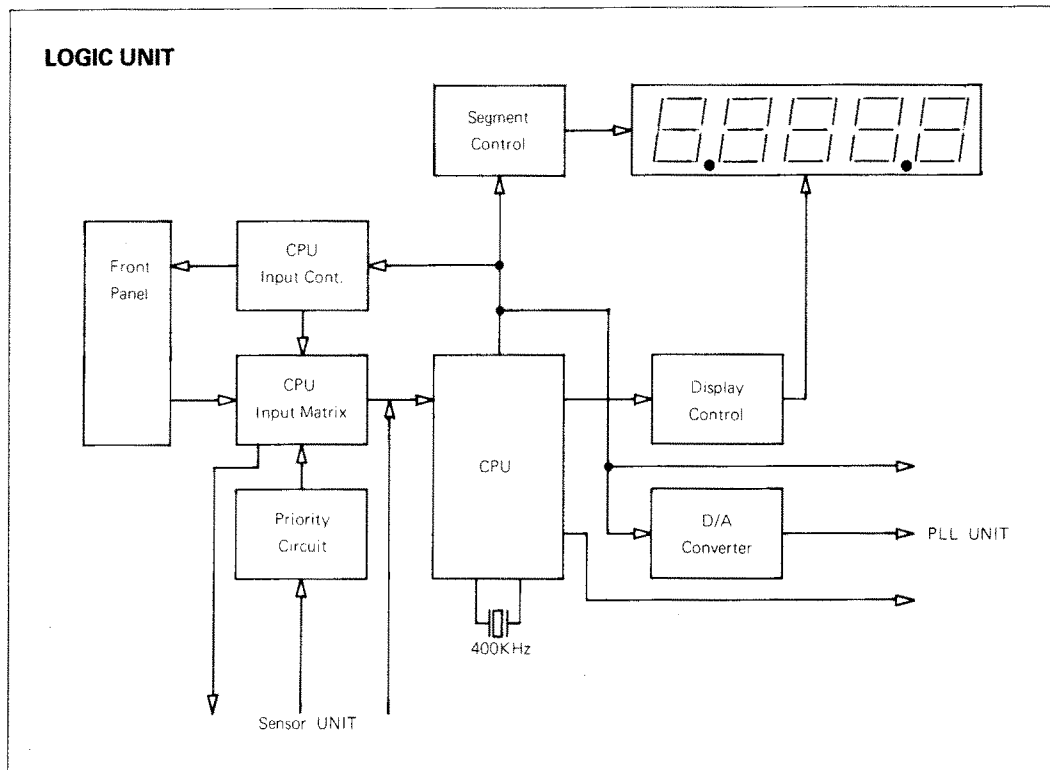
The dynamic lighting display functions with the 7-segment data output which are decoded by IC5 from BCD output at the E0 ~ E3 terminals of the CPU and the digit designation output signals at the F0 ~ F3 terminals. The two decimal points are illuminated with the current through scan blinking transistor Q10 in the sensor unit, only when the digit designation signals for the 1MHz and 1KHz order are put out. The E0 ~ E3 terminals also put out the divide number (N) for the PLL divider, and supplied to the CPU control circuit through IC4.

When the power is turned ON, the CPU is initialized and then reads the mode setting and memorizes it. Then the CPU reads the control data from the external controller in the order of the numbers of the matrix and controls the various necessary operations. The data of the display, "A" VFO, "B" VFO, the frequency shift, step pitch, Memories 1 ~ 5, and the divide number (N) are programmed in each RAM area for the initial presetting.

Then, at the CPU output terminals E0 ~ E3, the divide number and the VXO control data are put out in the BCD code. The data to designate the latch position (digit-position) are put out at the CPU output D0 ~ D3 and the signals from G3 are latched as the strobe pulse in the Input/Output port IC8, of which the terminals A01 ~ B04 provide the VXO control data.

D/A (DIGITAL TO ANALOG) CONVERTER CIRCUIT

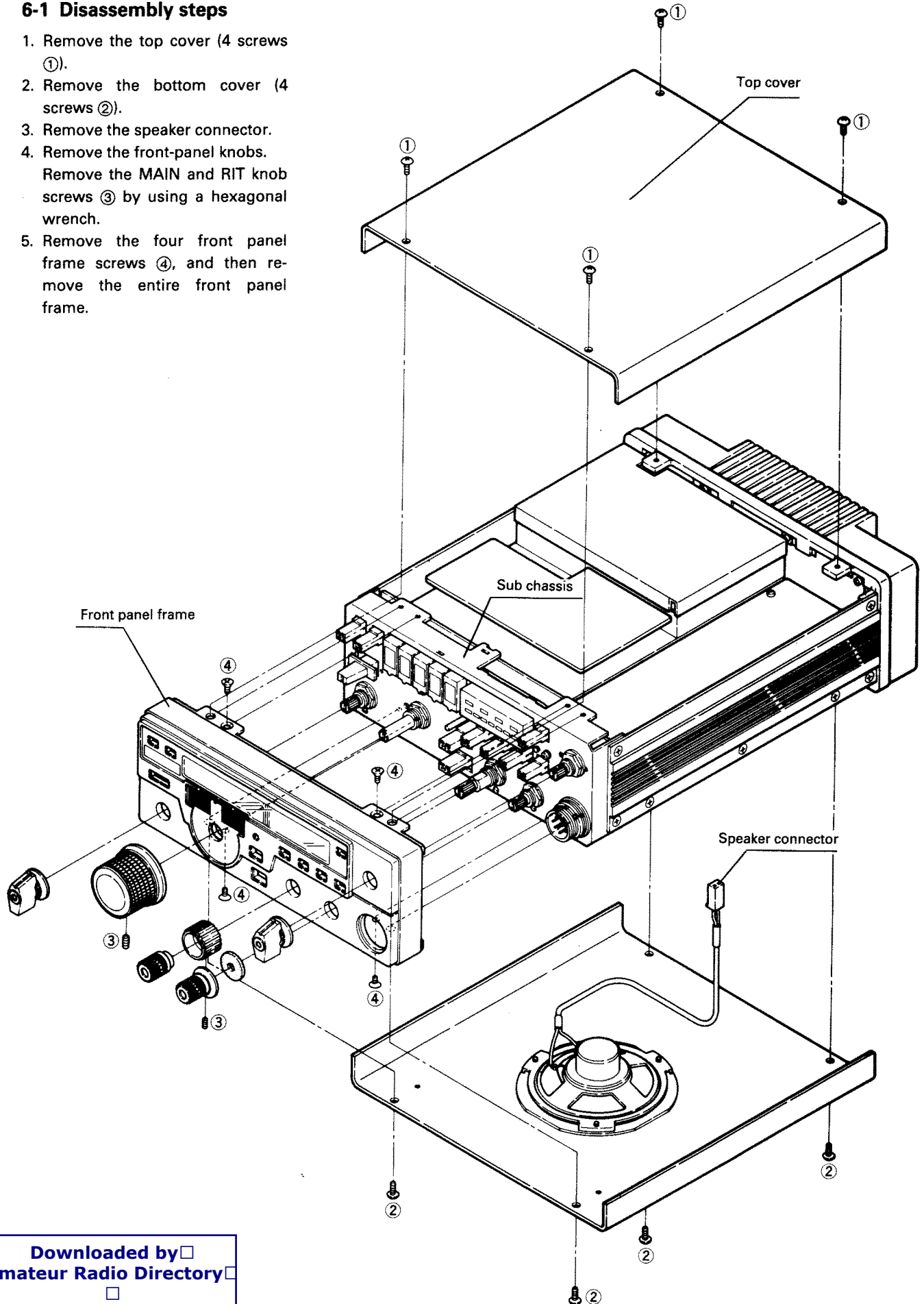
The signals from A01 ~ B04 of IC8 are supplied to R43 ~ R51 for D/A conversion. This D/A converted voltage is fed to the PLL unit and changes in steps to give 100Hz step variation to the VXO frequency.



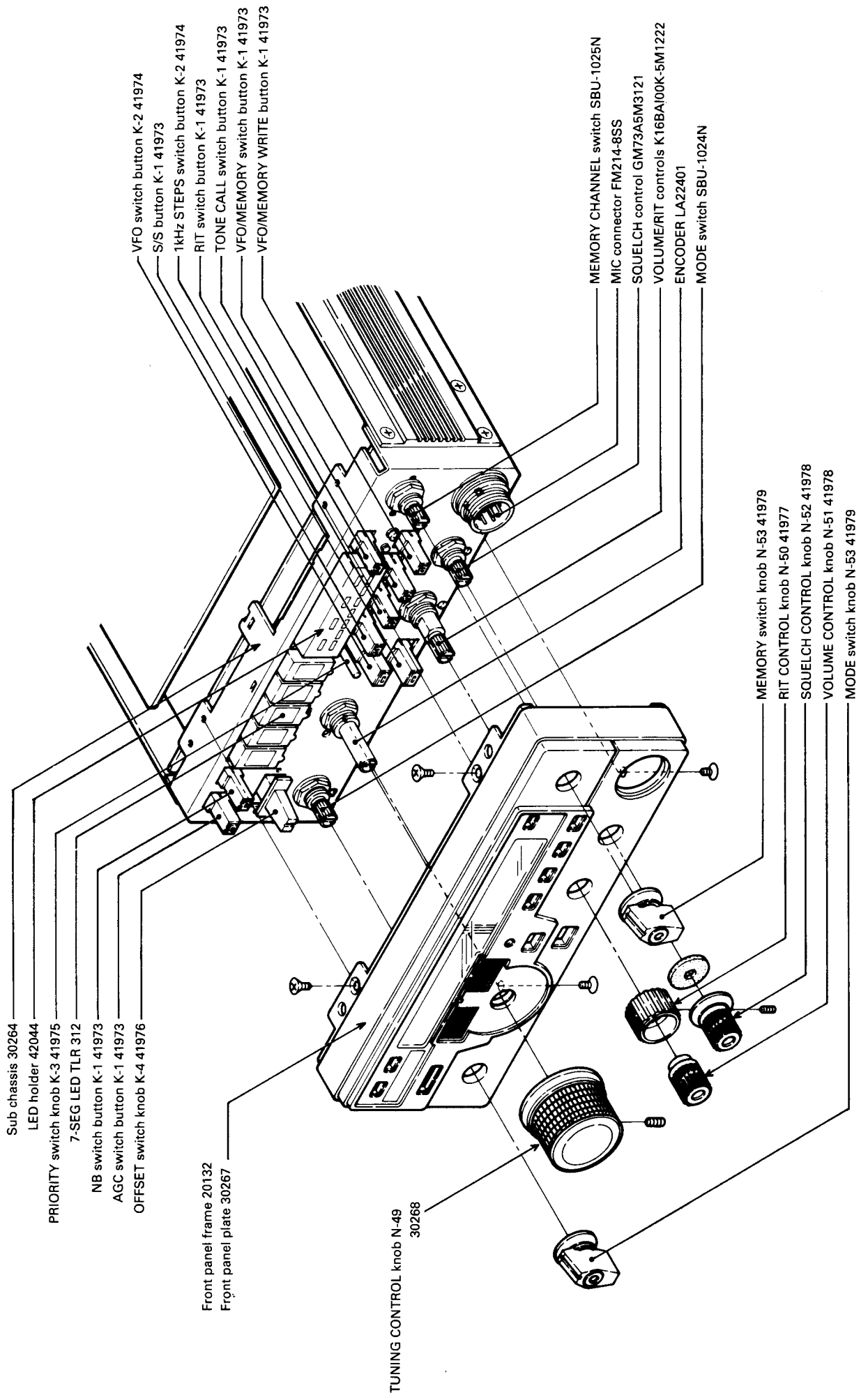
SECTION 6 DISASSEMBLY

6-1 Disassembly steps

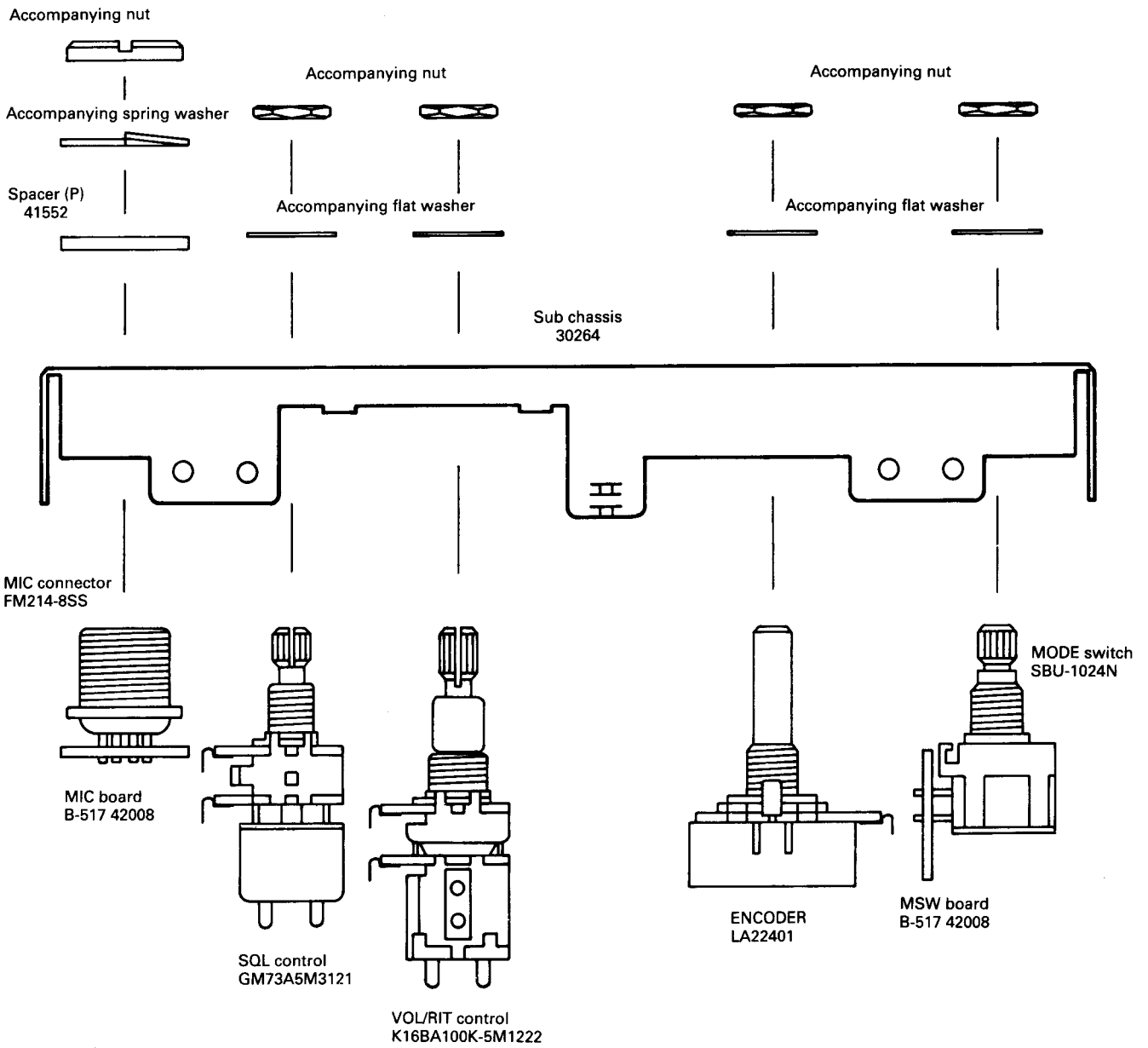
1. Remove the top cover (4 screws ①).
2. Remove the bottom cover (4 screws ②).
3. Remove the speaker connector.
4. Remove the front-panel knobs.
Remove the MAIN and RIT knob screws ③ by using a hexagonal wrench.
5. Remove the four front panel frame screws ④, and then remove the entire front panel frame.



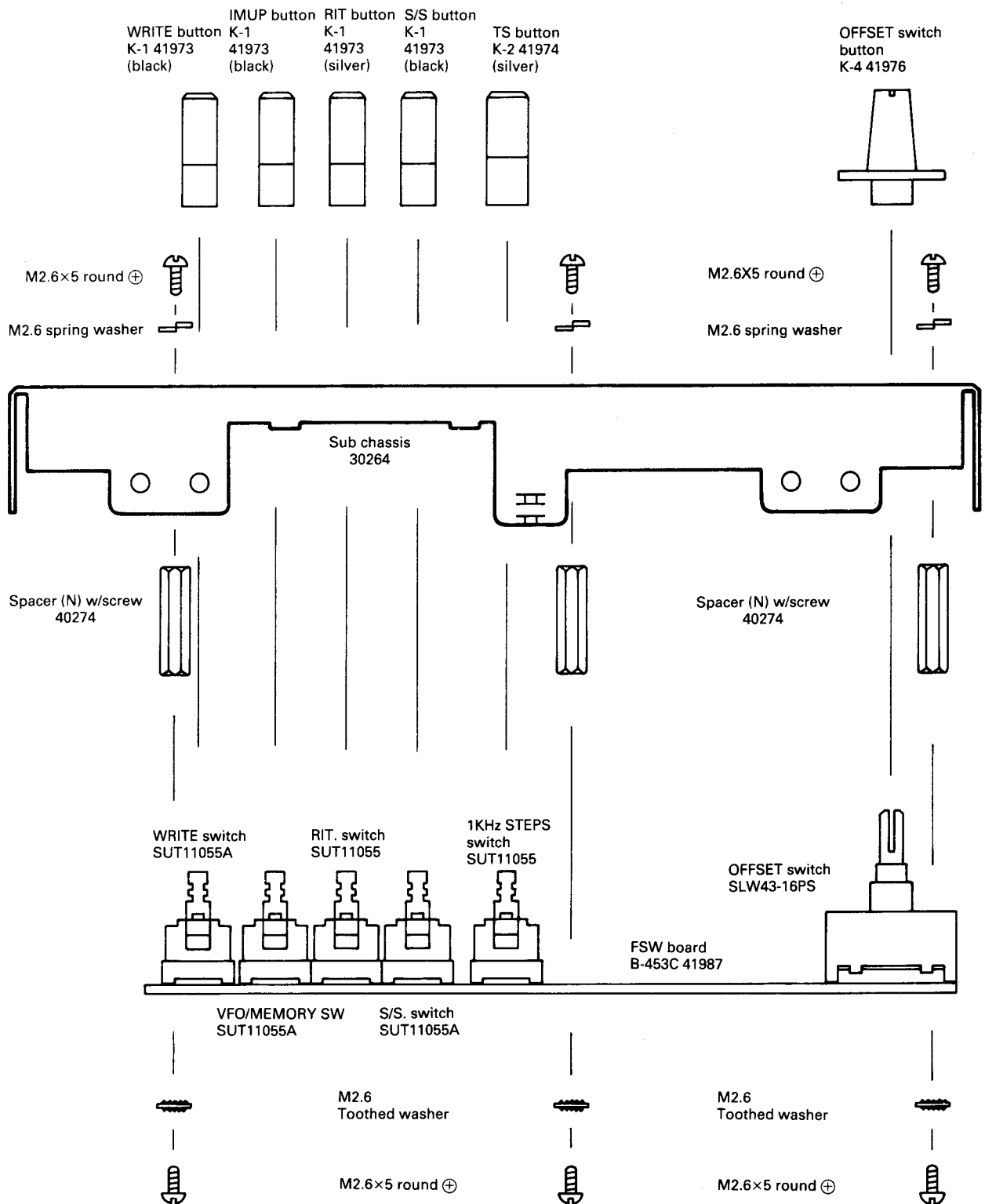
6-2 Front panel parts identification



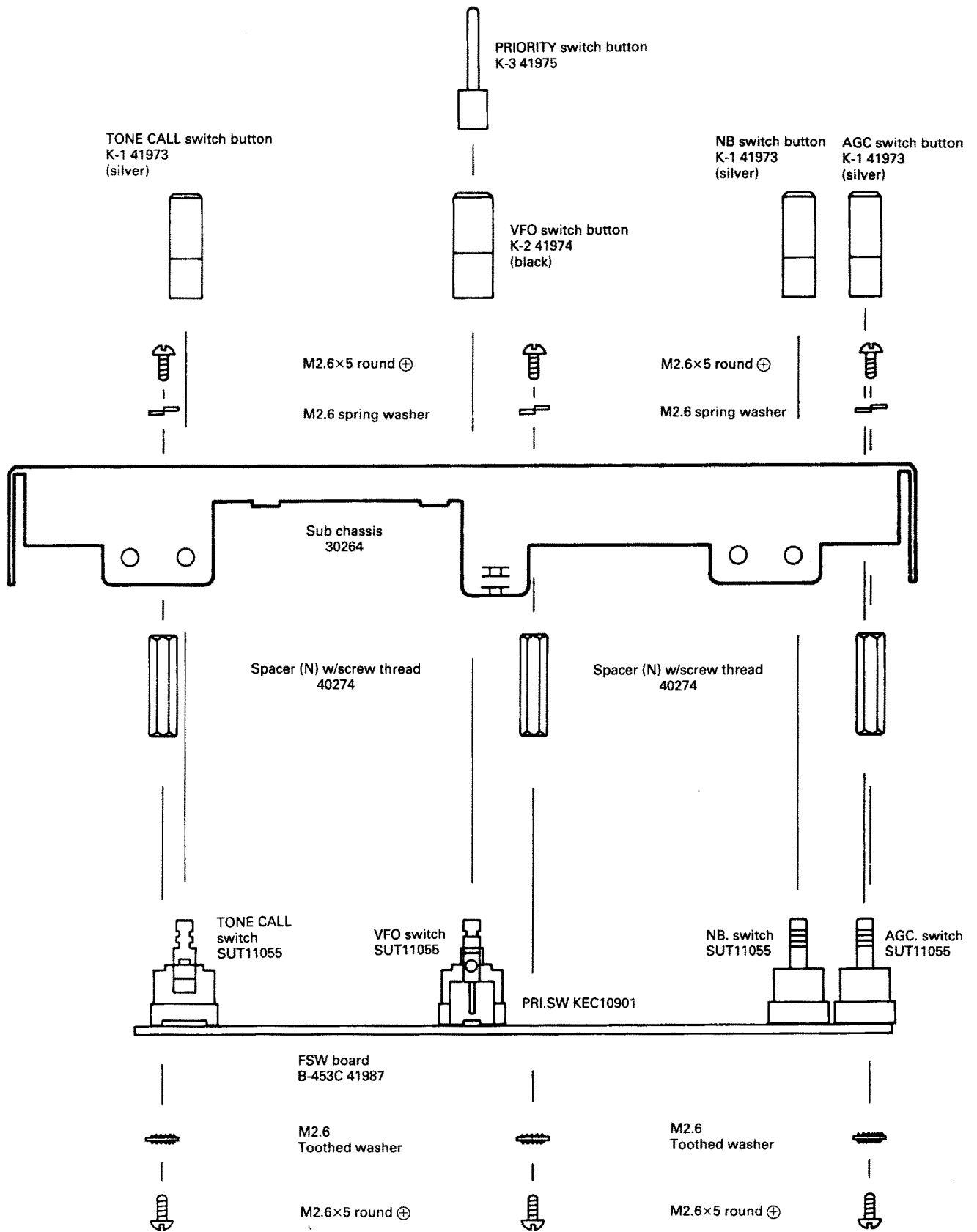
6-3 Disassembly of front panel controls/switches



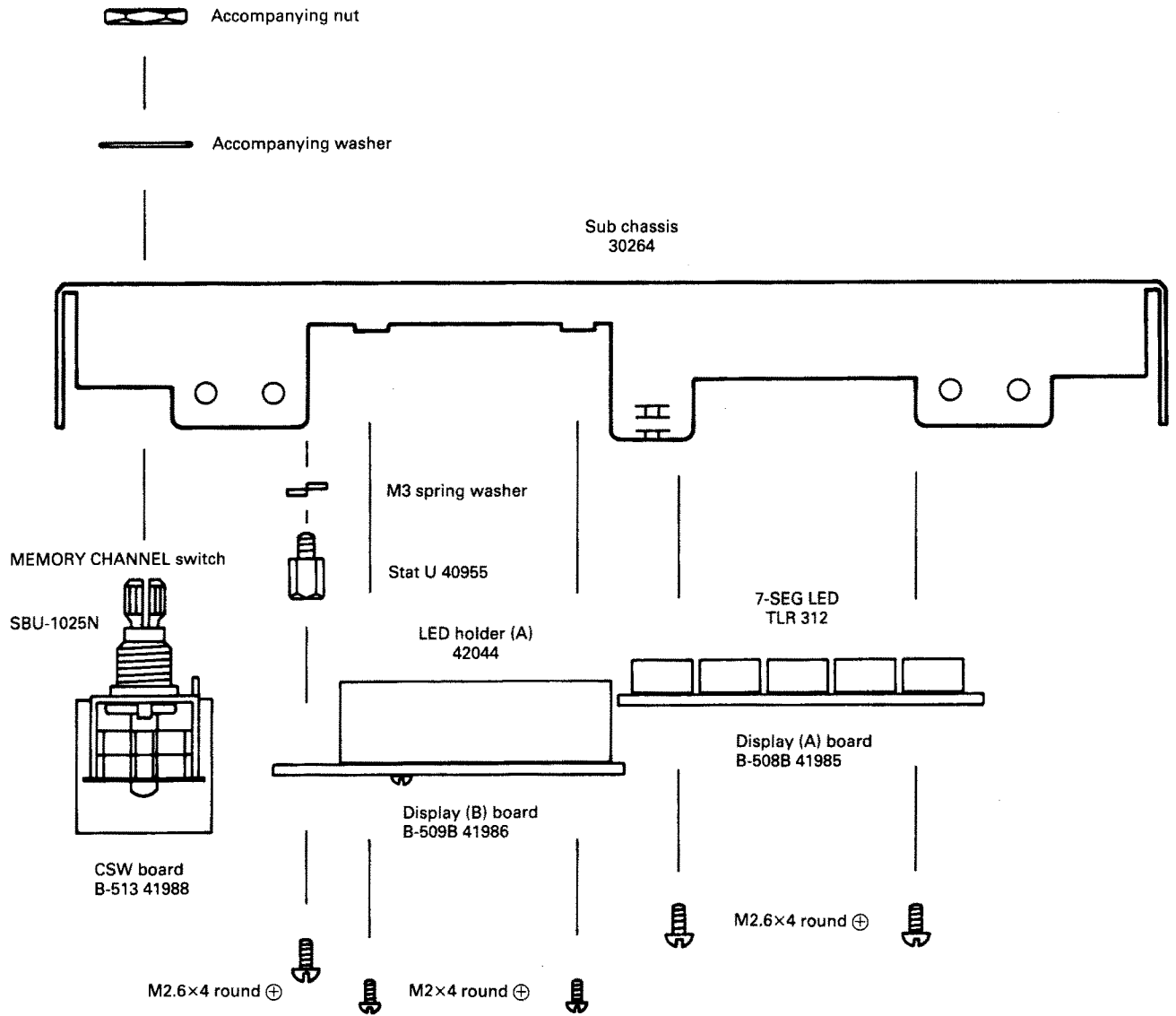
6-4 Disassembly of front panel pushbutton switches



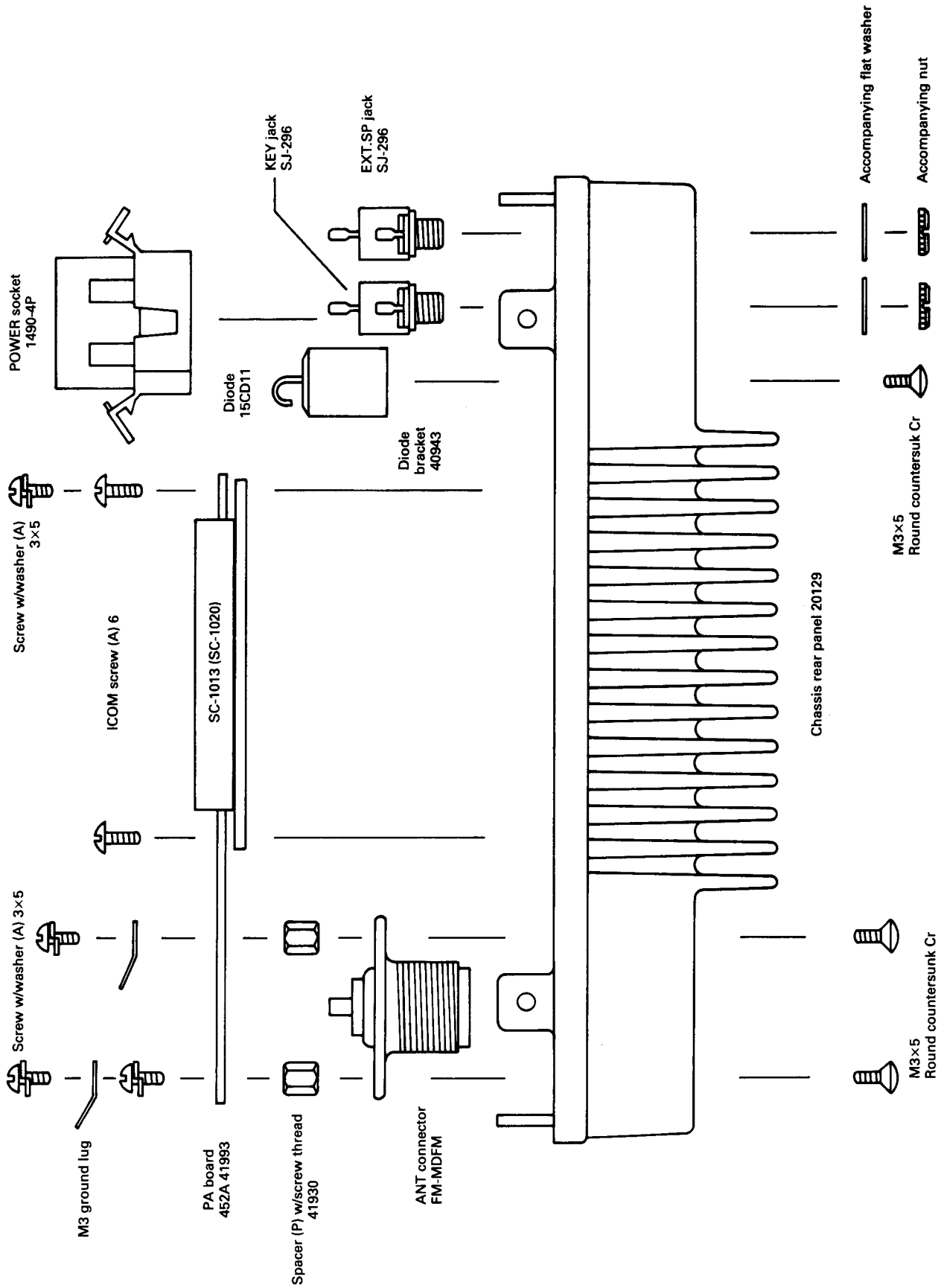
6-5 Disassembly of front panel pushbutton switches



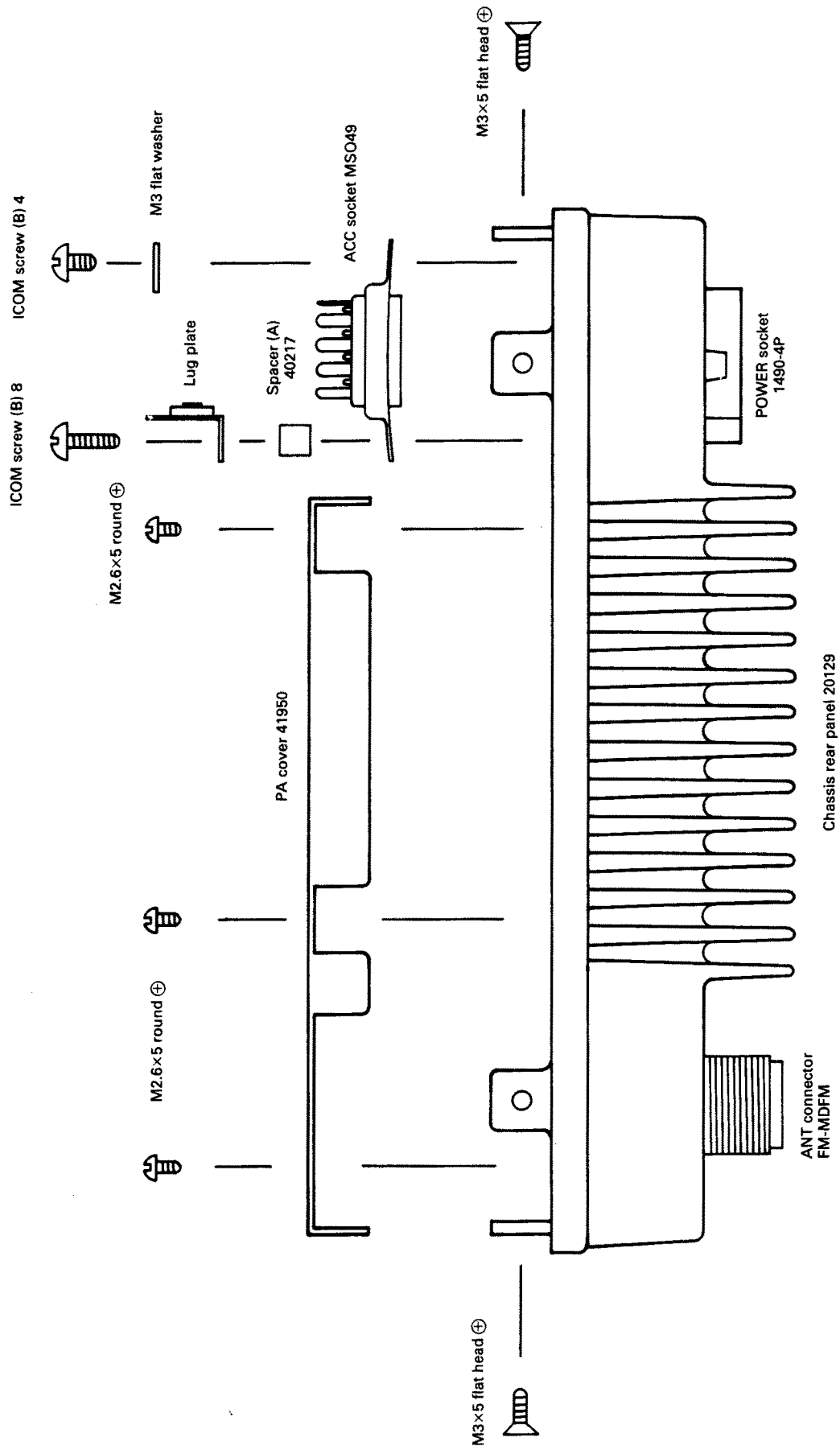
6-6 Disassembly of front panel display



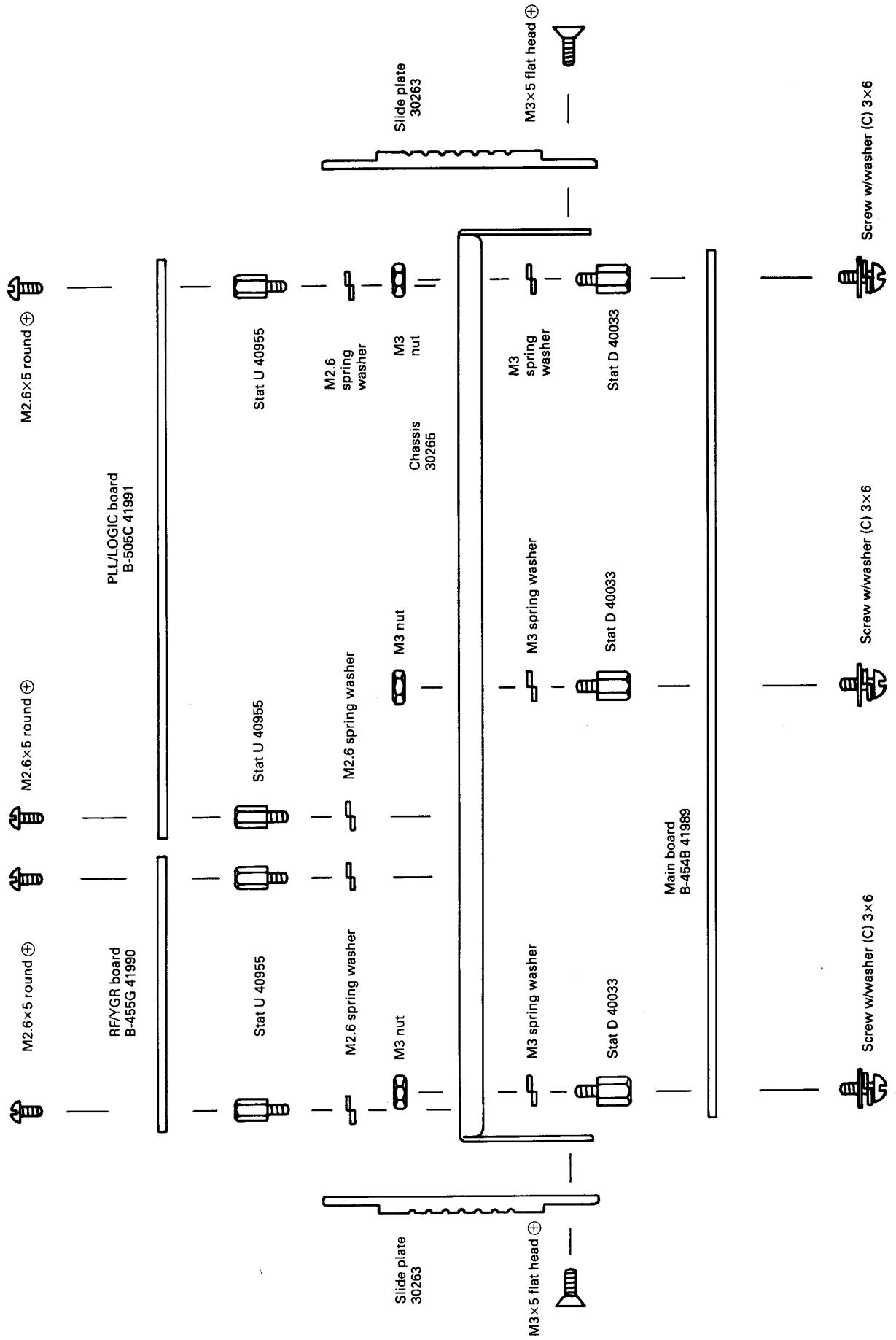
6-7 Disassembly of rear panel



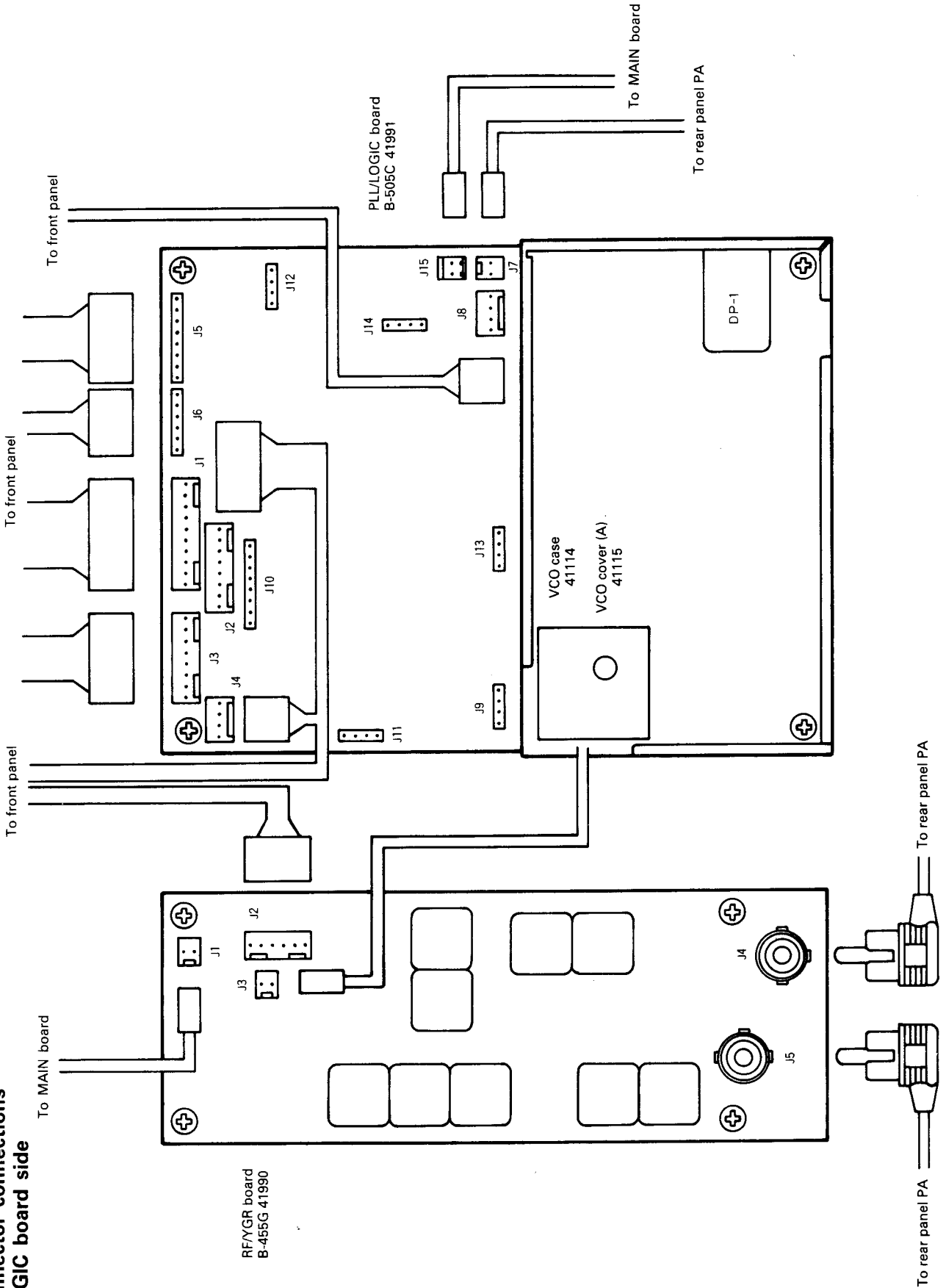
6-8 Disassembly of rear panel



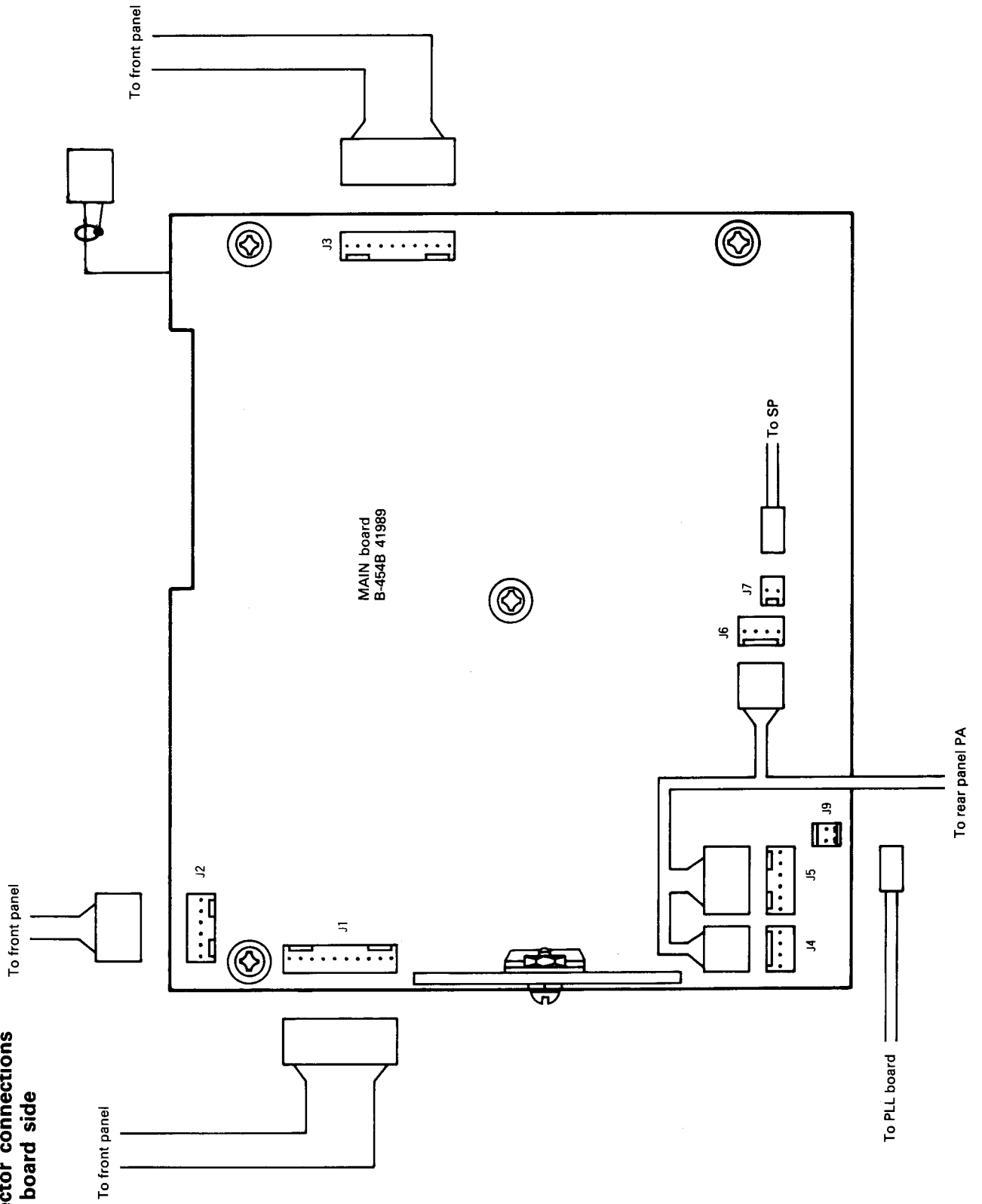
6-9 Disassembly of P.C. boards



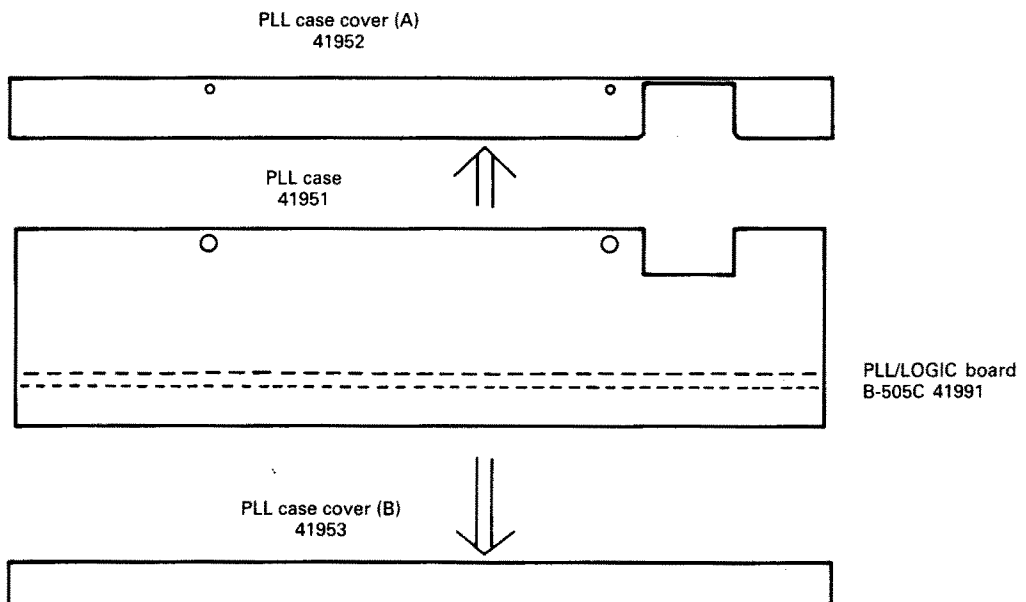
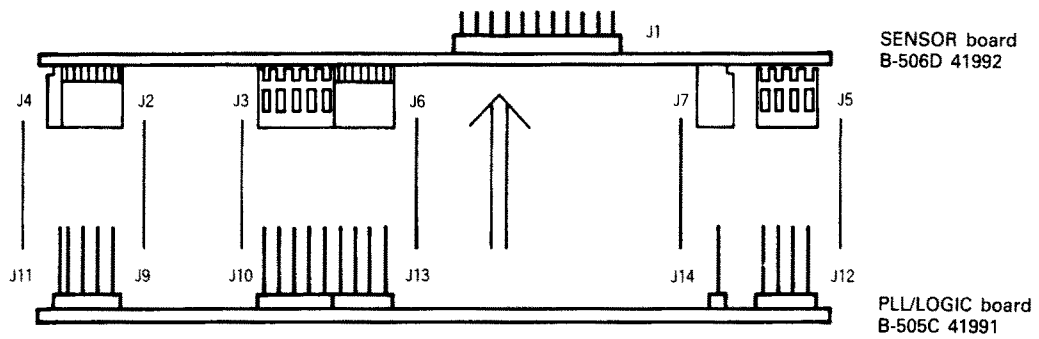
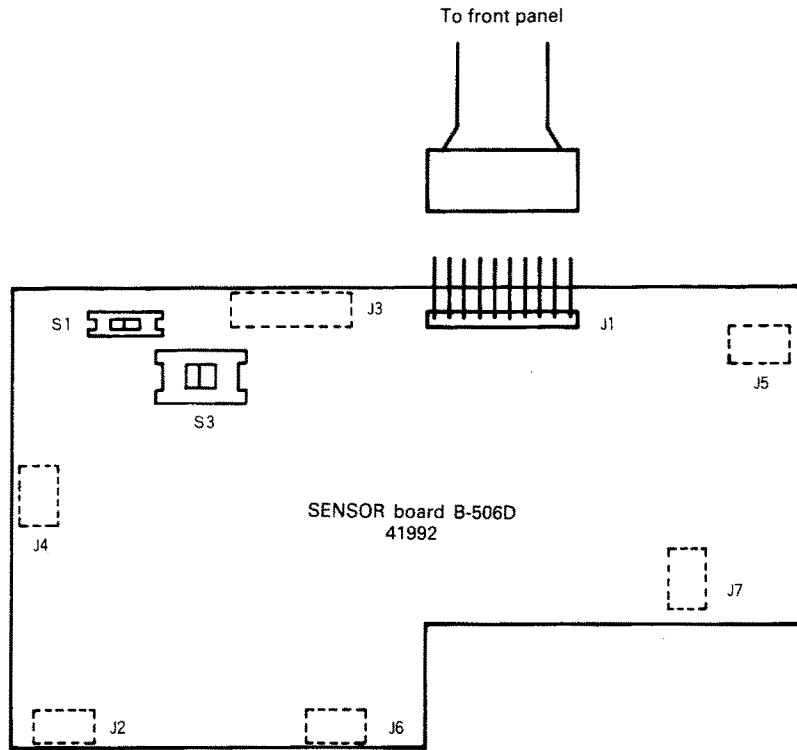
**6-10 Connector connections
LOGIC board side**



**6-11 Connector connections
MAIN board side**



Boards and connections



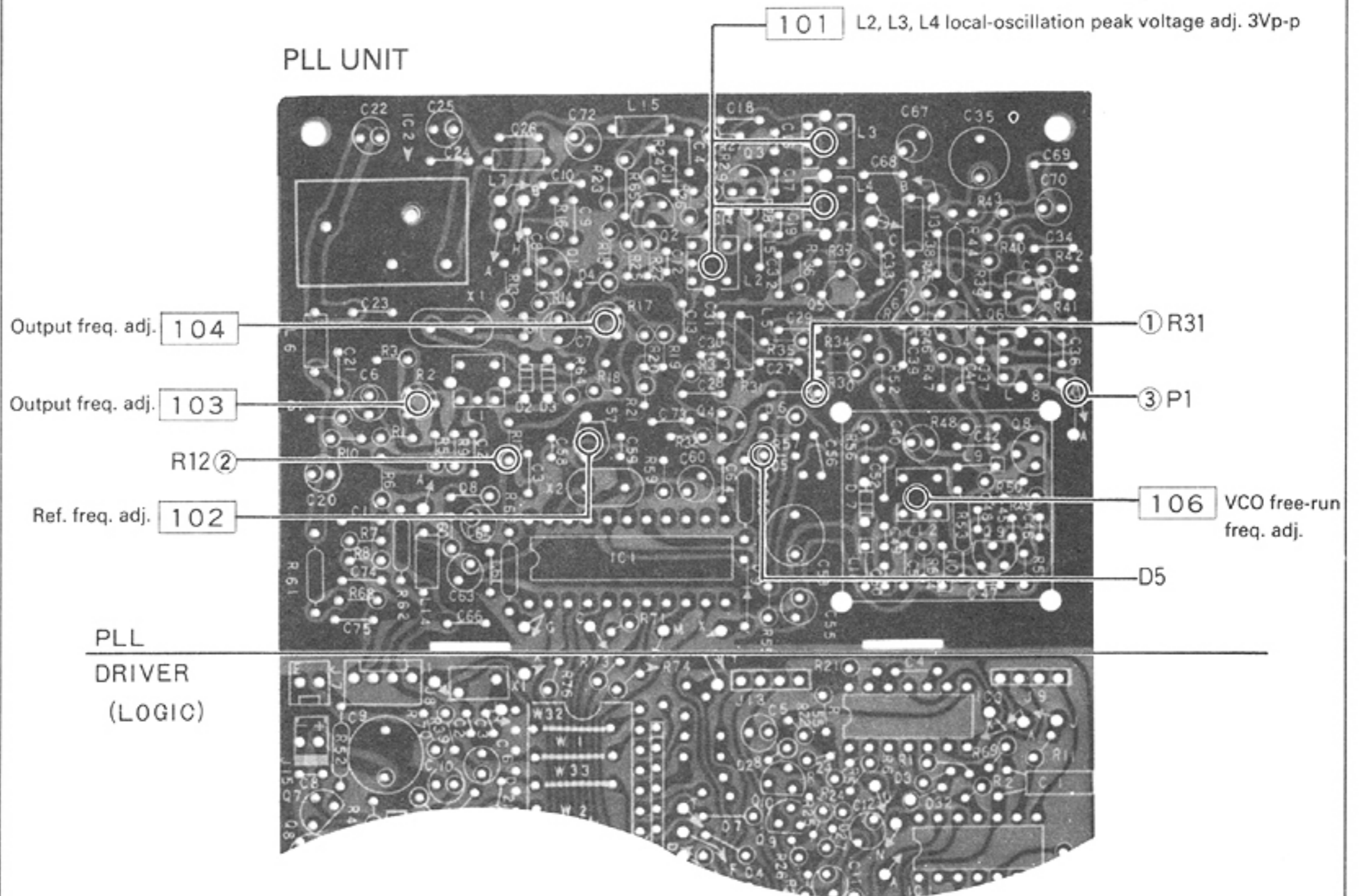
SECTION 7 ADJUSTMENTS

7-1 PLL ADJUSTMENTS

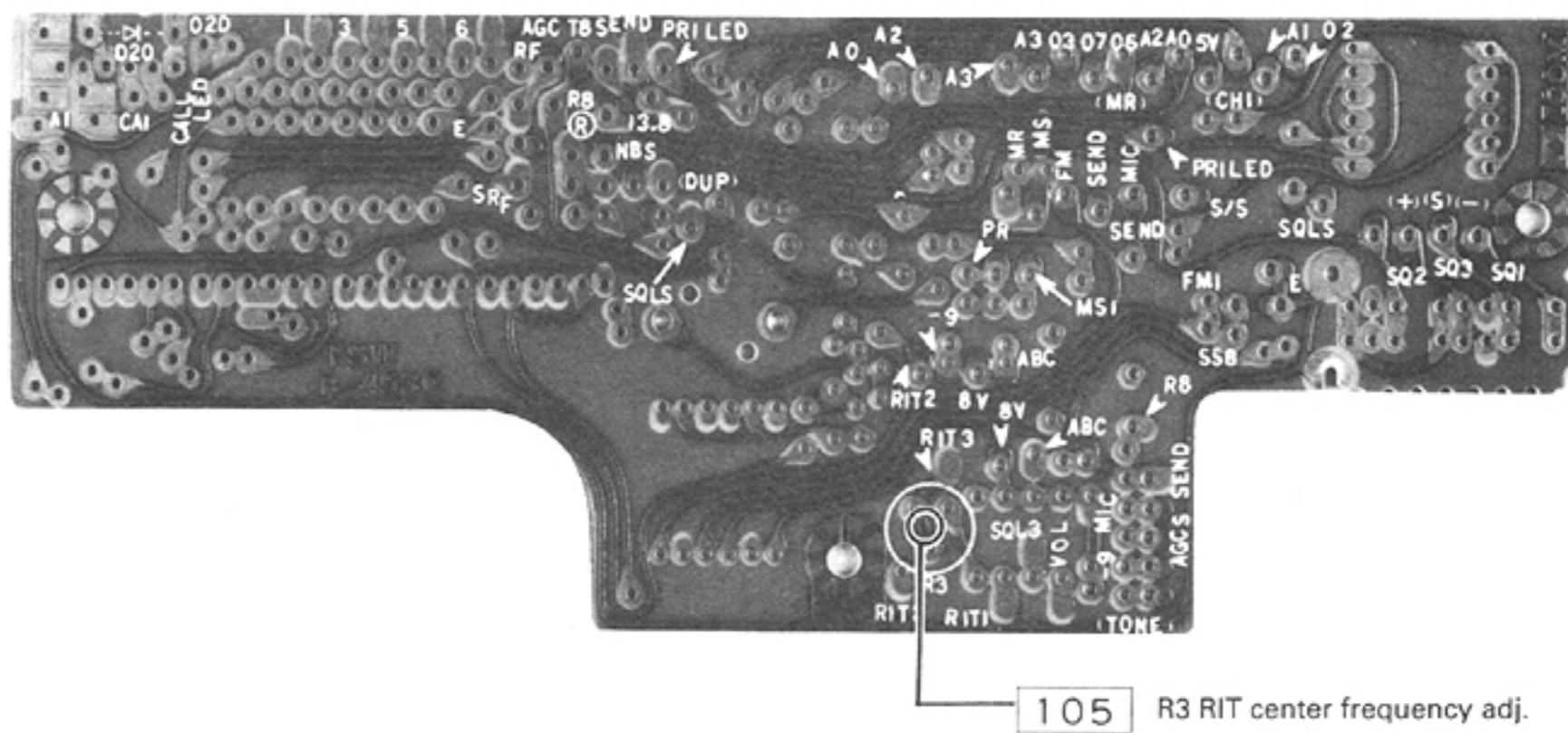
Figures in ○ or □ are illustration reference numbers.

Adjustment	Adjustment conditions	Measurement location			Adjustment location			Adjustment value	Adj. location no.
		Measuring instrument	Unit	Terminal	Unit	Part	Adjustment method		
Checking local oscillation peak voltage	<ul style="list-style-type: none"> MODE : FM 	Synchroscope or oscilloscope	PLL	R31	PLL	L2, L3, L4	*Very carefully adjusted before shipment; readjustments should not be necessary except under extraordinary conditions.	3V P-P	101
Checking D/A voltage	<ul style="list-style-type: none"> Mode: USB Frequency: 144.998.5 MHz ~ 145.008.5 MHz 	Synchroscope	PLL	R12	②		Check by changing D/A voltage continuously as shown below.		
Reference frequency:	<ul style="list-style-type: none"> Mode: FM Display frequency: 145.000.0 MHz 	Frequency counter	PLL	R31 (lead side)	①	C57	Adjust C57 so that the frequency counter reads 6.0700MHz.	6.0700MHz	102
Adjustment of output frequency	(1)	<ul style="list-style-type: none"> Mode: USB Display frequency: 144.998.5 MHz 	Frequency counter	P1 conductor of shielded wire	③	R2	Adjust by repeating (1) and (2). Very carefully adjusted before shipment; readjustments should not be necessary except under extraordinary conditions.	134.2500MHz	102
	(2)	<ul style="list-style-type: none"> Mode: USB Display frequency: 144.998.4 MHz 	Frequency counter			R17		134.2499MHz	104
Adjustment of RIT center frequency	<ul style="list-style-type: none"> Mode: FM RIT switch: ON RIT control: center position Display frequency: 145.000.0 MHz 	Frequency counter	PLL	P1	③	R3	Adjust R3 (on FSW board) so that frequency counter reads 134.2500 MHz when display frequency is 145.0000 MHz. *Checking Turn RIT control left and right and check to be sure there is a ± 1 kHz change.	134.2500MHz	105
Adjustment of VCO free-run frequency	<ul style="list-style-type: none"> Ground D5 cathode 	Frequency counter	PLL	P1	③	L12	Ground D5 cathode by a wire, and adjust L12 (in VCO) so that the counter frequency read-out is 141.500 MHz. *Checking Check to be sure that the PLL locks when the wire is removed.	141.500MHz	106
Frequency adjustment of BFO	<ul style="list-style-type: none"> Mode: LSB 	Frequency counter	MAIN	R73	④	C42	Adjust C42 (in main unit) to obtain frequency as shown.	10.7515MHz	107
	Mode : CW-T	"	"	"	"	L9	Adjust L9 (in main unit) to obtain frequency as shown.	10.7493MHz	
	Mode : USB	"	"	"	"	L8	Adjust L8 (in main unit) to obtain frequency as shown.	10.7485MHz	
	Mode : CW-R (check only)	"	"	"	"		Check to be sure of 10.7845 MHz.	10.7485MHz	

PLL Adjustments



FSW board



7-2 RECEIVER ADJUSTMENTS

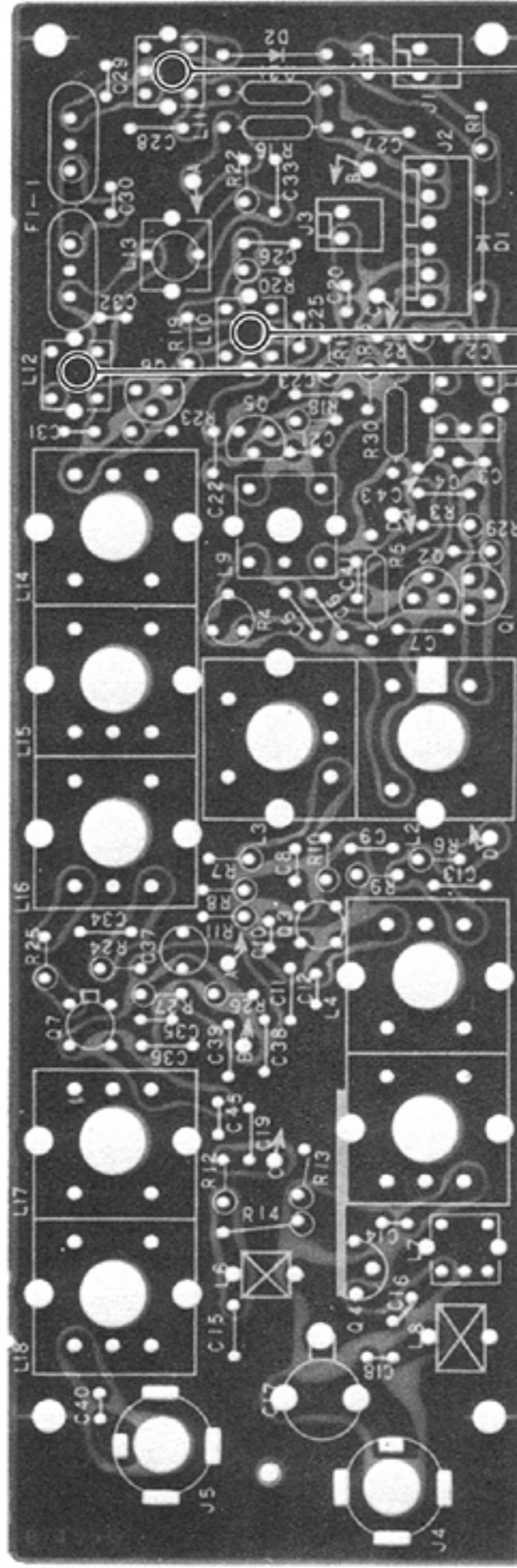
Adjustment	Adjustment conditions	Measurement location			Adjustment location			Adjustment value	Adj. location no.
		Measuring instrument	Unit	Terminal	Unit	Part	Adjustment method		
Adjustment of filter matching	<ul style="list-style-type: none"> Mode: FM Frequency: 145.000 MHz center Input 10 dB μ 1 kHz 5.0 kHz/DEV 	Signal Generator	MAIN RF · YGR	ANT. terminal	L13 L12, 11, 10	Adjust so that S-meter indication is maximum.		201	
Adjustment of sensitivity	<ul style="list-style-type: none"> SSB reception SG input: -10 dB Frequency: center and band edge 	SG AF millivolt-meter	MAIN	ANT. terminal SP terminal	L13, 12, 10 L16, 15	Adjust each coil for maximum AF output. SSB reception sensitivity measurements S/N SG input -20 dB μ -10 dB μ	8 dB or more 10 dB or more	202	
	FM reception <ul style="list-style-type: none"> SG input: +10 dBμ (1 kHz 5kHz/DEV.) Frequency: center and band edge 	Oscilloscope AF millivolt-meter	MAIN	SP terminal SP terminal	L19	Adjust L19 for maximum output; check to be sure there is no distortion or other abnormal condition in oscilloscope waveform.		203	
	S-meter reading S5 <ul style="list-style-type: none"> Frequency: center and band edge 		MAIN MAIN		R142 L13, 12	Adjust R142 so that S-meter reading is about S5; readjust L13 and L12 so that read-out is maximum.		204	
	S-meter reading S9+20dB~40dB <ul style="list-style-type: none"> Frequency: center and band edge 		MIAN		L17	Adjust SG output so that reading is S9+20dB~40dB; adjust L17 so that read-out is maximum.		205	
						FM reception sensitivity measurement value 20 dB noise quieting sensitivity input -10 dB S/N 1 kHz 3.5 kHz/DEV. input -10 dB input -16 dB	20 dB or more 20 dB or more 15 dB or more		
S-meter setting (1) S9 adjustment	<ul style="list-style-type: none"> Mode: FM +10 dB input (1 kHz 3.5 kHz/DEV.) 	SG	MAIN	ANT. terminal	R142	Adjust R142 to get S9 (4 LED's illuminate).	S-meter 4 LED's illuminate	206	
(2) Full scale	<ul style="list-style-type: none"> Mode: FM +30 dB input (1 kHz 3.5 kHz/DEV.) 	SG	MAIN	ANT. terminal	R145	Adjust R145 to get full-scale (all LED's illuminate).	S-meter All LED's illuminate	207	
(3)	Repeat adjustments (1) and (2) several times.								
(4) S5 adjustment	<ul style="list-style-type: none"> Mode: SSB 0 dB input 	SG	MAIN	ANT. terminal	R151	Adjust R151 to get S5 (3 LED's illuminate).	S-meter 3 LED's illuminate	208	

Adjustment	Adjustment conditions	Measurement location			Adjustment location			Adj. location no.	
		Measuring instrument	Unit	Terminal	Unit	Part	Adjustment method		
(5) Full-scale	<ul style="list-style-type: none"> Mode: SSB +60 dB input 	SG	MAIN	ANT. terminal	MAIN	R152	Adjust R152 to get full-scale.	S-meter All LED's illuminate	209
(6)	Repeat adjustments (4) and (5) several times.								
(7)	Check to be sure of return to 0 when SG input is OFF (both FM and SSB).								
Squelch adjustment	<ul style="list-style-type: none"> Set squelch control to 10 o'clock position. Mode: FM Mode: SSB 	SG	MAIN MAIN	ANT. terminal	MAIN MAIN	R193 R205	Set R193 to close squelch. Set R205 to close squelch.		210
Checking	<ul style="list-style-type: none"> Mode: FM SG input: 10 dB Mode: SSB SG input: 0 dB 						Squelch is open even if squelch control is turned fully clockwise		
Checking noise-blanker operation	SSB reception only	Noise generator		ANT. terminal			Check to be sure that noise is reduced when NB switch is switched ON.		
Checking RIT operation	<ul style="list-style-type: none"> Mode: SSB RIT control: center 						(1) Check to be sure that receiving tone does not change with RIT switch at ON and OFF. (2) Check to be sure that receiving tone (AF waveform) changes smoothly when RIT control is turned.		
Checking AGC operation	<ul style="list-style-type: none"> AGC switch: FAST/SLOW 						Check to be sure that meter indication returns to zero quickly at FAST and slowly at SLOW, when a signal goes off.		
Checking reception AF leakage	<ul style="list-style-type: none"> Mode: FM and SSB Volume control: minimum 						Check to be sure that AF output (8 Ω load) is 3mV or less when a signal of about 30 dB is received.	3mV or less	
Checking reception maximum output	<ul style="list-style-type: none"> Mode: FM and SSB Volume control: maximum 						Check to be sure that AF output (8 Ω load) is 4.0 V or more when a signal of about 30 dB is received.	4.0 V or more	

Receiver Adjustments

Main Unit
Parts Layout
YGR Unit

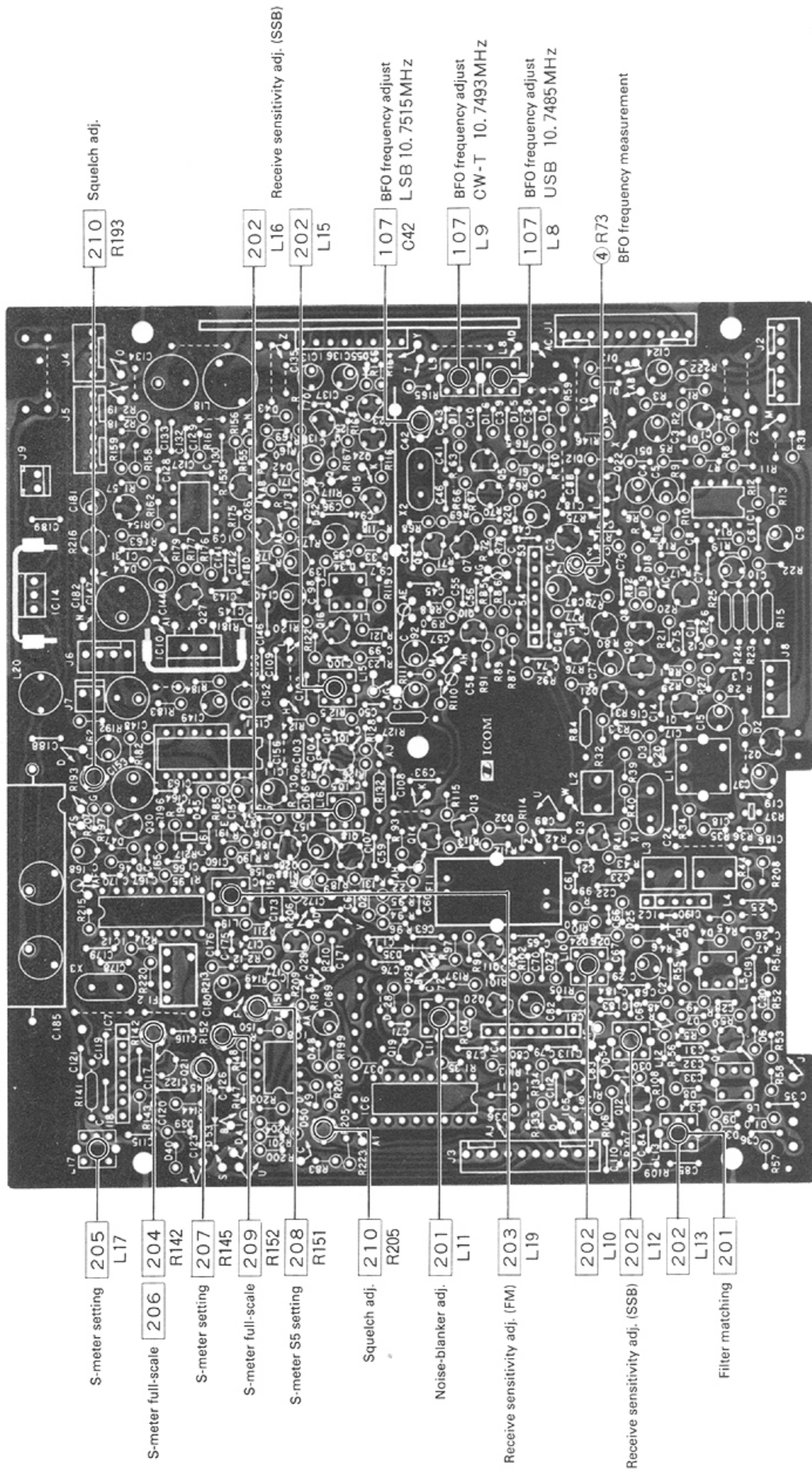
Y·G·R UNIT



201 Filter matching

- L10
- L11
- L12

MAIN UNIT



- S-meter setting 205 L17
- S-meter full-scale 206 R142
- S-meter setting 207 R145
- S-meter full-scale 209 R152
- S-meter S5 setting 208 R151
- Squelch adj. 210 R205
- Noise-blanker adj. 201 L11
- Receive sensitivity adj. (FM) 203 L19
- 202 L10
- 202 L12
- 202 L13
- Filter matching 201

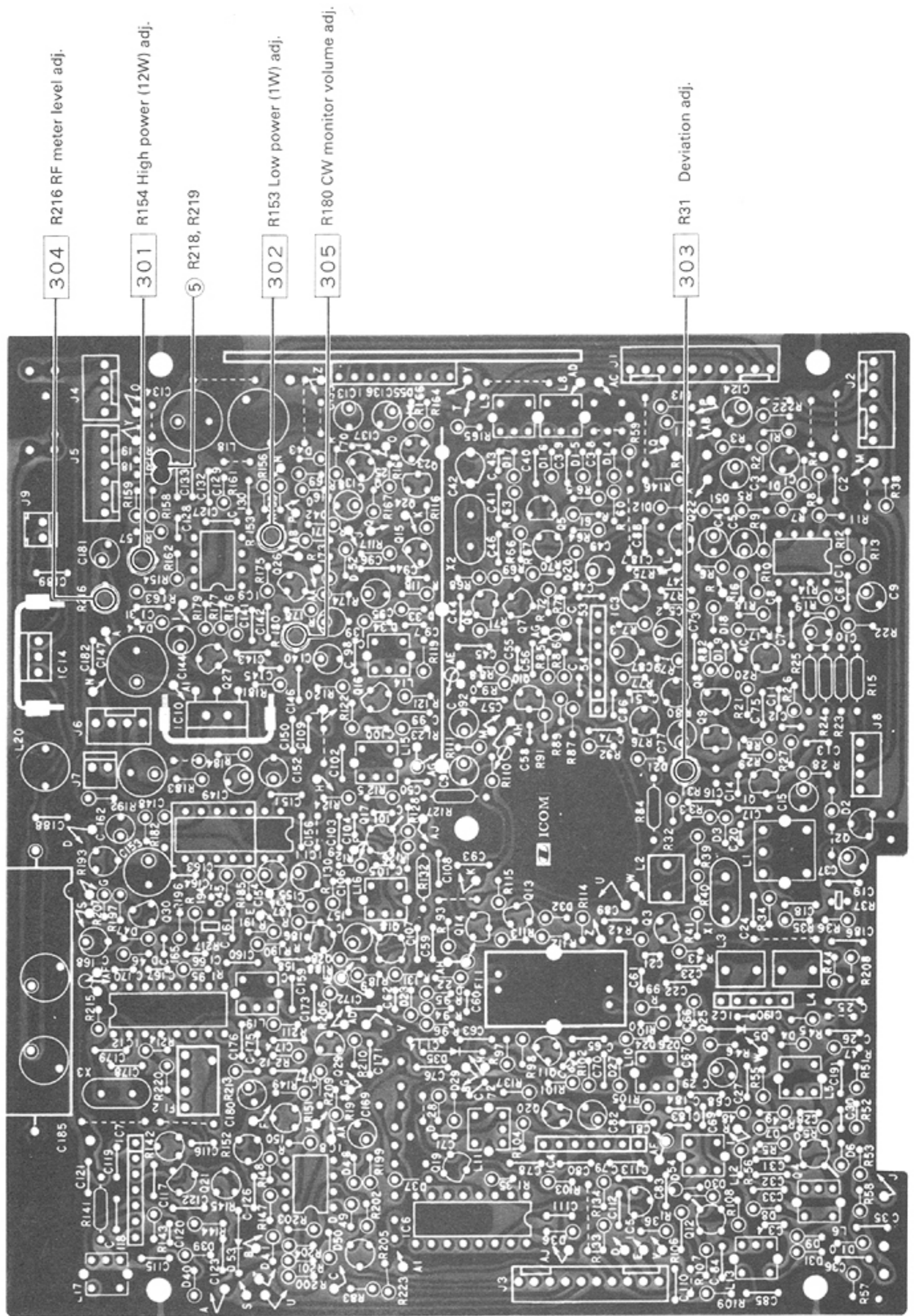
- Squelch adj. 210 R193
- 202 L16
- 202 L15
- 107 C42 BFO frequency adjust LSB 10.7515MHz
- 107 L9 BFO frequency adjust CW-T 10.7493MHz
- 107 L8 BFO frequency adjust USB 10.7485MHz
- 4 R73 BFO frequency measurement

7-3 TRANSMITTER ADJUSTMENTS

Adjustment	Adjustment conditions	Measurement location			Adjustment location			Adj. location no.	
		Measuring instrument	Unit	Terminal	Unit	Part	Adjustment method		
Power setting	<ul style="list-style-type: none"> ALC OFF (R218 & R219 short) 	Power meter Audio generator		ANT. terminal MIC. terminal R218, R219			Check to be sure that power is same for FM, SSB and CW modes. (SSB → MIC input 1.5 kHz 600 mV)	16W or more (IC-290H: 30W or more)	
(1) High power	<ul style="list-style-type: none"> ALC ON (R218 & R219 returned to original) Mode: FM Display frequency: 145.00 MHz 	Power meter		ANT. terminal	MAIN	R154	Adjust the power to 12W (IC-290H: 28W) by R154.	12 ± 0.5W (28 ± 1W)	301
(2) Low power	Same as above				MAIN	R153	Adjust the power to 1W by R153.	1 ± 0.5W	302
(3)	Adjust by alternately repeating (1) and (2) above a few times.								
(4)	Check power difference at HIGH and LOW for all frequencies in all modes.							HIGH within ± 1W LOW within ± 0.5 W	
Modulation adjustment	<ul style="list-style-type: none"> Mode: FM Microphone input: 1 kHz 600 mV Display frequency: 145.00 MHz 	Deviation meter Power meter Audio generator		ANT. terminal ANT. terminal MIC jack	MAIN	R31	Adjust R31 so that deviation is 4.8 kHz ± 0.2 kHz.	4.8KHz ± 0.2KHz	303
(1) Microphone gain check	<ul style="list-style-type: none"> Microphone input: 1 kHz 60 mV 						Check to be sure that deviation is 3.5 kHz ± 0.5 kHz.	3.5 KHz ± 0.5 KHz	
(2) Waveform check		Oscilloscope		Deviation meter output terminal			Check for abnormal waveform		
(3) Transmit S/N check	<ul style="list-style-type: none"> 0 dB 1 kHz 70% modulation 							40 dB or more	
RF level meter adjustment	<ul style="list-style-type: none"> High power Low power (check only) 				MAIN	R216	Adjust R216 so that RF meter is full scale (all LED's). Check to be sure that there is S5 (3 LED's) when switchover to low power. Opposite adjustment (adjust at low, check at high) also OK.	All meter LED's illuminate 3 illuminate	304

Adjustment	Adjustment conditions	Measurement location			Adjustment location			Adj. location no.	
		Measuring instrument	Unit	Terminal	Unit	Part	Adjustment method		Adjustment value
APC adjustment	<ul style="list-style-type: none"> • ANT terminal open or shorted • High power • Mode: FM-T 						Check to be sure that current is almost same as usual, or slight decrease.	3.2A or less (IC-290H); 5.2A or less)	
CW break-in monitor adjustment	<ul style="list-style-type: none"> • Mode: CW 	Key		Key jack	MAIN	R180	Check to be sure that power is emitted by keying, that monitor sound can be heard from speaker, and that volume can be adjusted; adjust R180.		305

Transmitter Adjustments Main Unit Parts Layout



7-4 OPERATION CHECKS

1. Display check

- With power switch ON and in FM mode, VFO A and B, and memory channels 1 ~ 5 all read 5.000.
- Check to be sure that display changes when mode switch setting is changed in order.

FM:	5.000
LSB:	4.998.5
CW:	4.999.3
USB:	5.001.5

2. Sensor check

- Check to be sure that display changes to up when the tuning control is turned clockwise, and to down when turned counterclockwise.
- Then check the following frequency steps:

FM:	5-kHz
CW/SSB:	100-Hz

3. 1kHz STEPS switch check

- Frequency step must be 1 kHz for any mode after 1kHz STEPS switch is pressed.

4. VFO and memory channel switching and memory check

- Write in any different frequencies to VFO A and B, and memory channels 1 ~ 5, and check to be sure that the written-in frequency is displayed when the VFO and memory channel switches are switched.

5. Priority check

- Check to be sure that operation is normal when memory switch is set to designated channel and the PRIORITY switch is pressed.
- Check illumination of the PRIO LED.

6. Scan check

- Scan start and stop (S/S switch)
Check to be sure that scan stop and start are normal when the S/S switch is pressed. During scanning, turn the tuning control or transmit and check to be sure scanning stops.
- Full range scan
Check to confirm all scan within band when sensor unit S1 (program scan ON/OFF switch) is OFF.
Example: Scan 145.999 ~ 144.000 MHz with 1kHz STEPS switch ON (FM mode)
- Scan speed
Check to be sure that scan speed can be adjusted by sensor unit R25.
- Decimal point
Check to confirm decimal point flashing during scanning operation.
- Busy-empty
Switch sensor unit S3 (SCAN-STOP TIMER switch) OFF, start the scan, turn the SQL control so as to switch the squelch ON and OFF (busy and empty), and check to confirm the following:

BUSY:	→ scan stops when there is a signal (SQL ON)
	→ scan restarts when there is no signal (SQL OFF)
EMPTY:	→ scan stops when there is no signal (SQL OFF)
	→ scan restarts when there is a signal (SQL ON)
- Timer
Switch sensor unit S3 (SCAN-STOP TIMER SWITCH) ON.
Then check to be sure that, at SQL ON-OFF, the stopped scan restarts, after a certain time has elapsed, regardless of whether there is a signal or not. Also check to confirm that the timer operation time can be varied (about 5 ~ 20 seconds) by sensor unit R32 (SCAN-STOP TIME CONTROL).

7. Memory scan

Check to be sure, with the memory channel switch setting of 1 ~ 5 and when the SCAN S/S button is pressed, that memory scan is VFO A → B → MEMORY 1 → 2 → 3 → 4 → 5 → VFO A.

8. A → B and B → A (equalization)

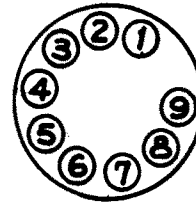
Check to be sure, when the MEMORY/VFO WRITE button is pressed (at the VFO A position), that VFO B data goes to A, and that VFO A data goes to B when the MEMORY/VFO WRITE button is pressed (at the VFO B position).

9. Connect IC-HM10 scanning microphone

Connect the IC-HM10 to the MIC connector, and check to confirm that up/down, automatic stop and manual stop are possible.

ACC socket

The various terminals are connected to internal circuits.
Functions and applications are as described below.

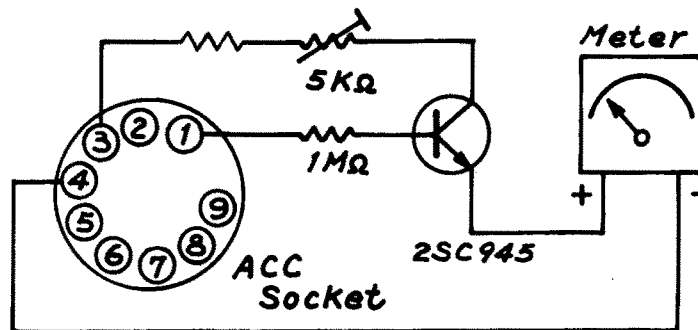


(Outside view)

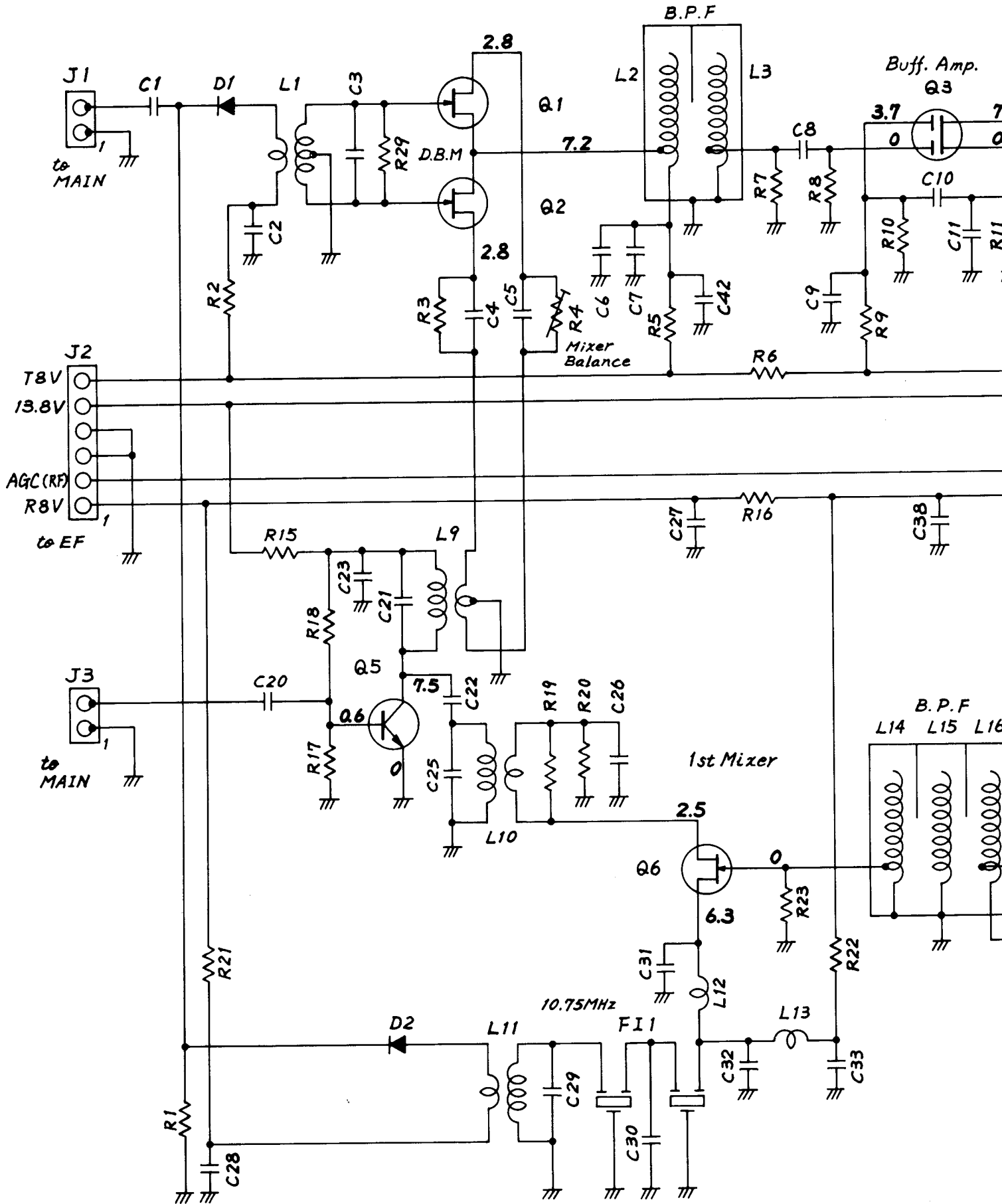
Terminal No.	Connections	Functions and applications
1	S, RF	For output of S-meter (during receive) and RF meter signals (during transmit)
2	SEND	Connected T/R switch (transmit/receive switching); transmit condition when this terminal is grounded
3	13.8 V	Connected to power switch; 13.8 V present
4	GND	Ground
5 ~ 9	NC	Not connected

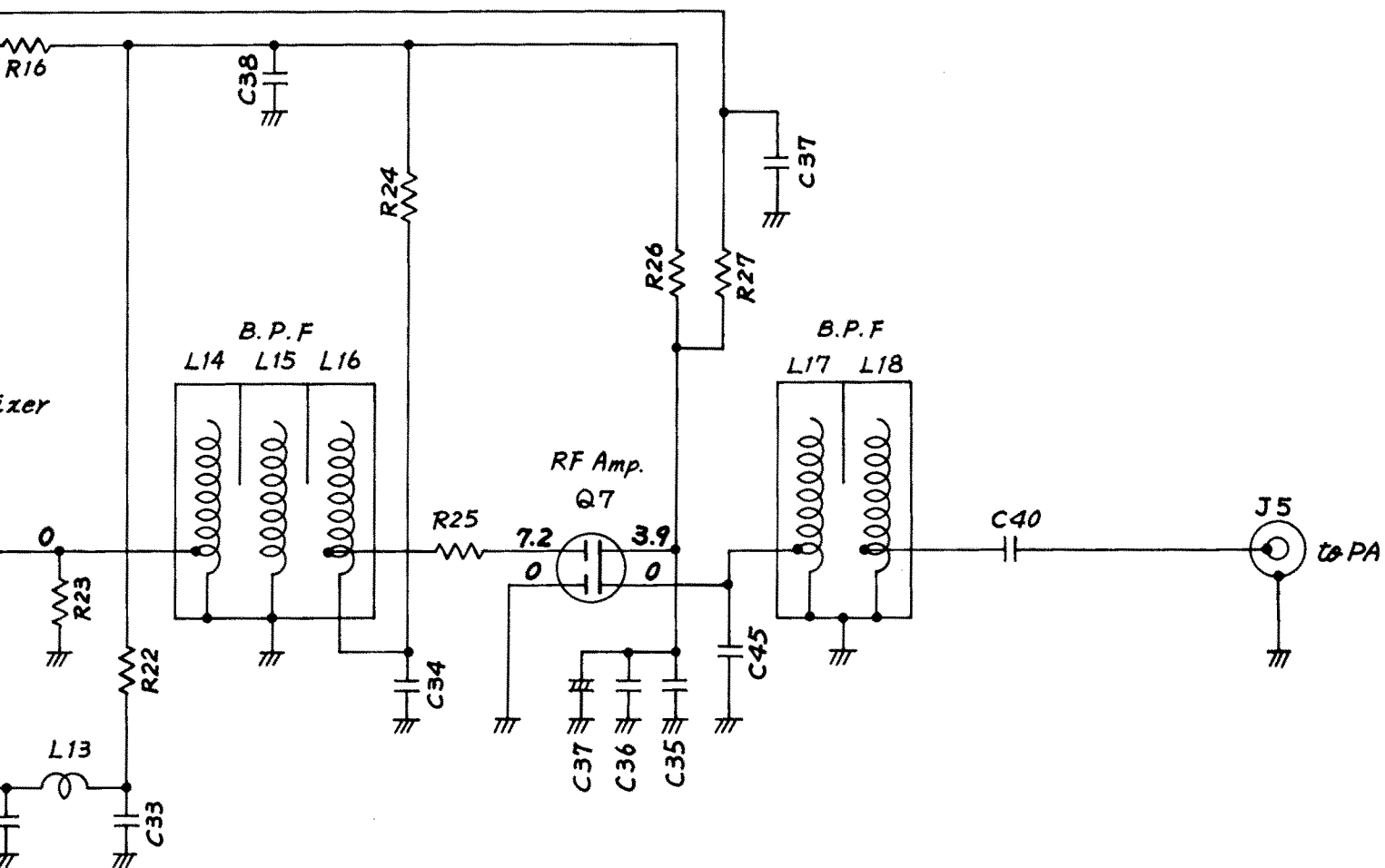
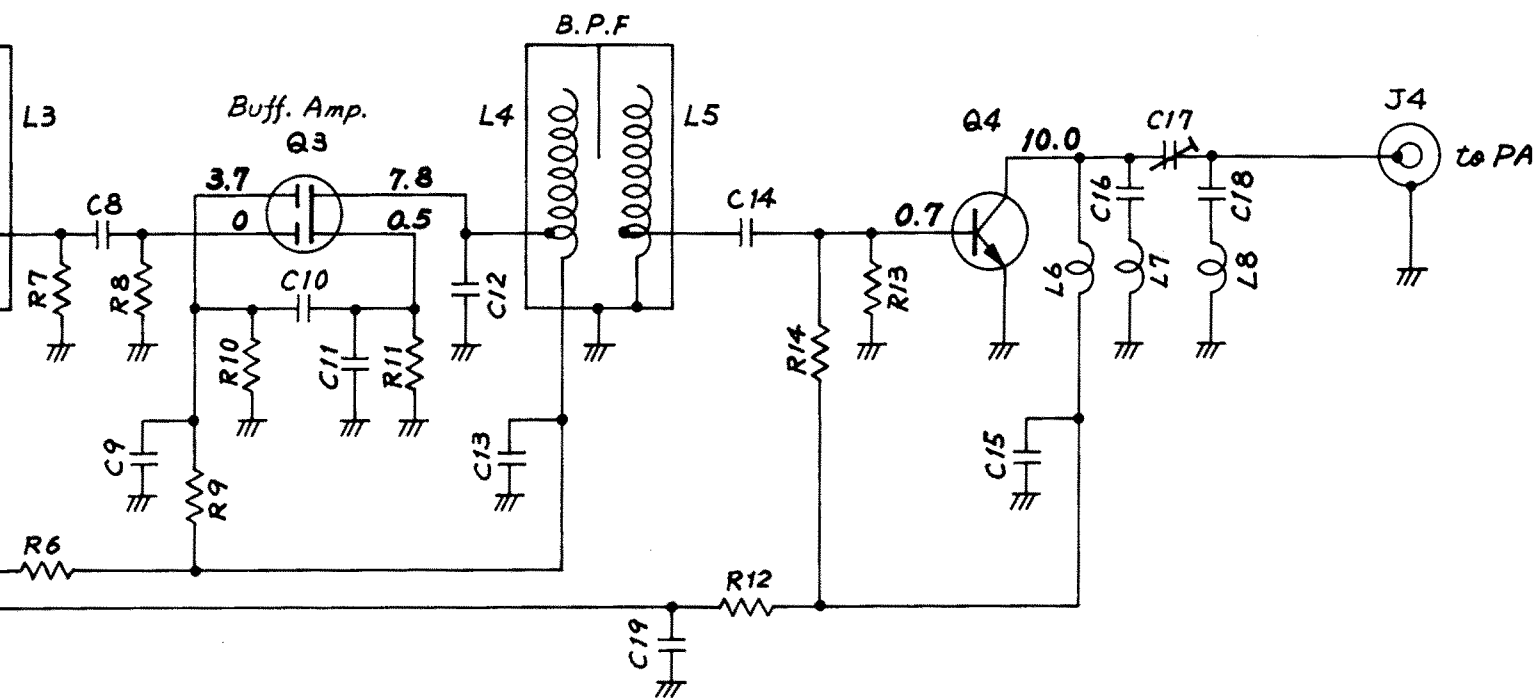
How to connect an external S-meter

The level meter of this unit is the LED type, but a conventional needle-indication type of S/RF meter can be connected. Connect to each circuit by connecting the meter to the ACC socket on the rear panel.

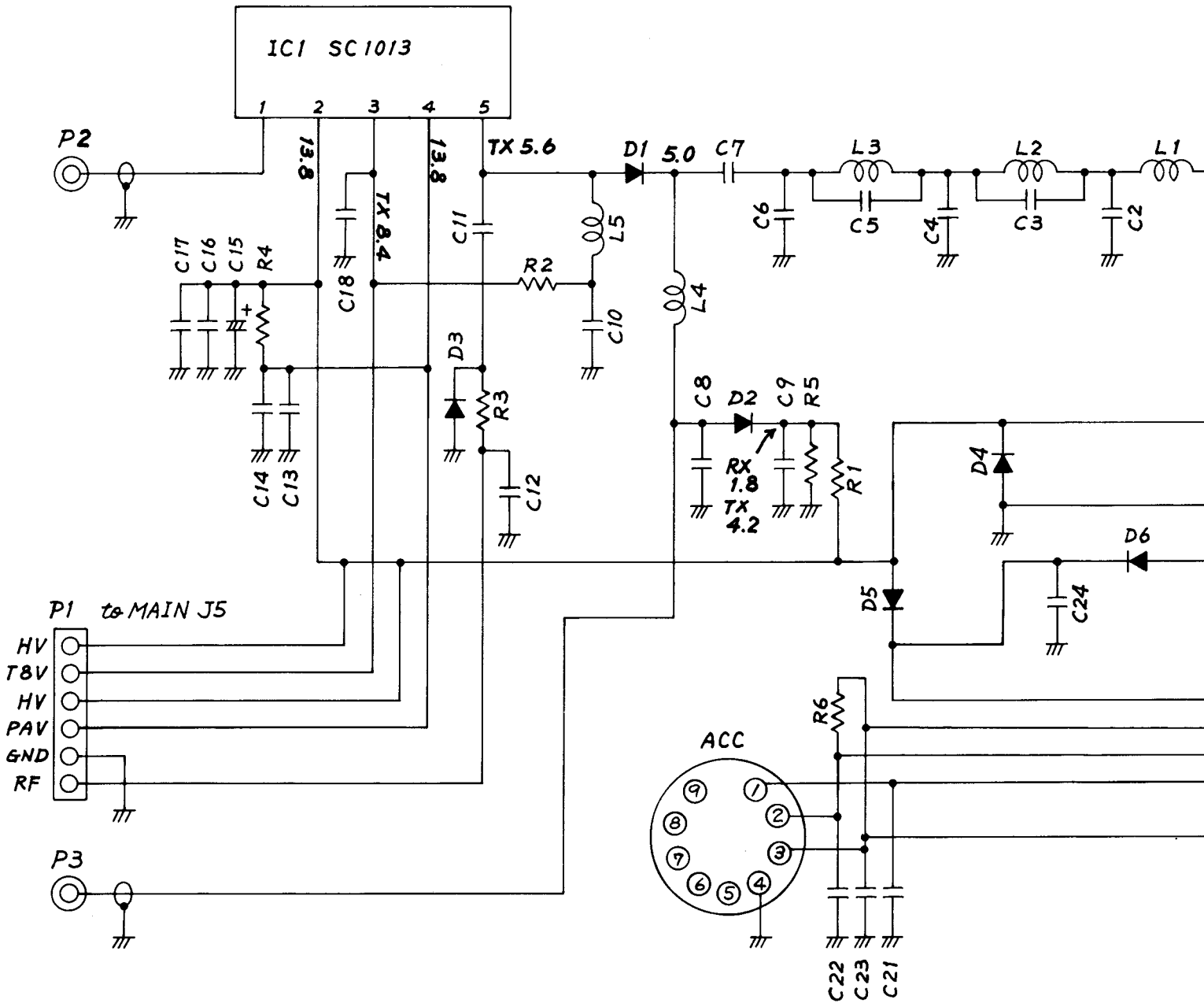


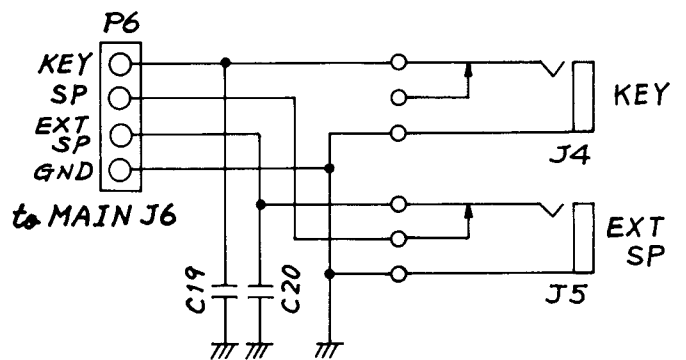
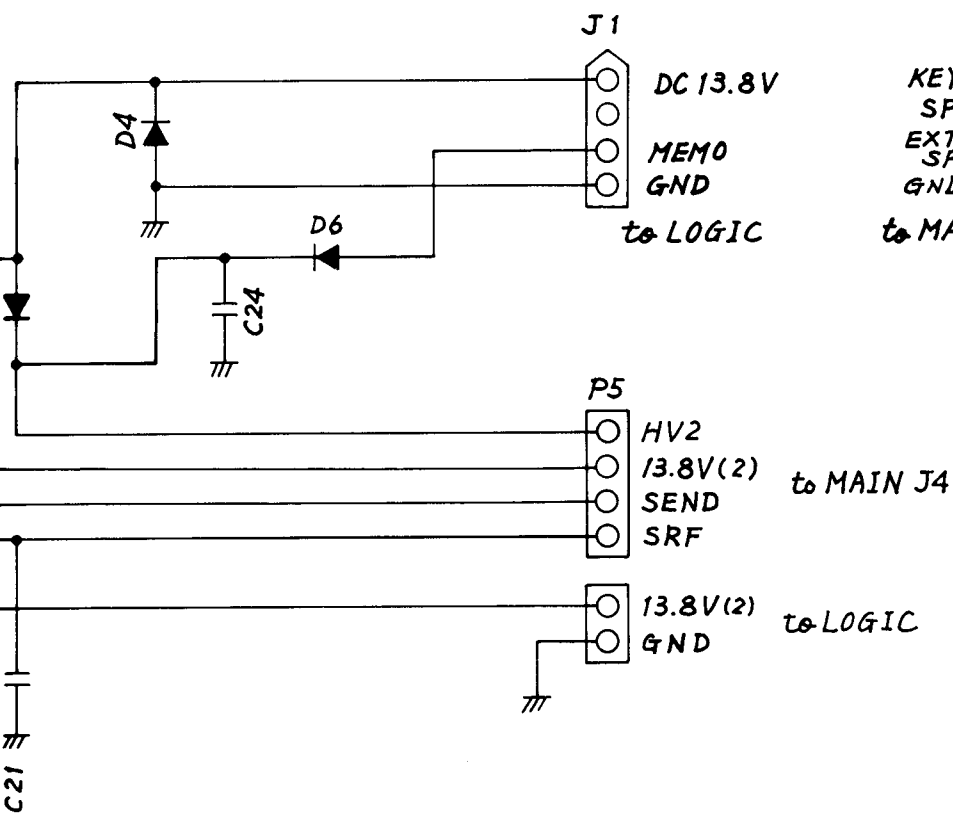
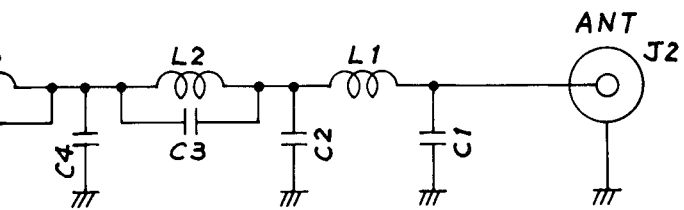
RF · YGR UNIT



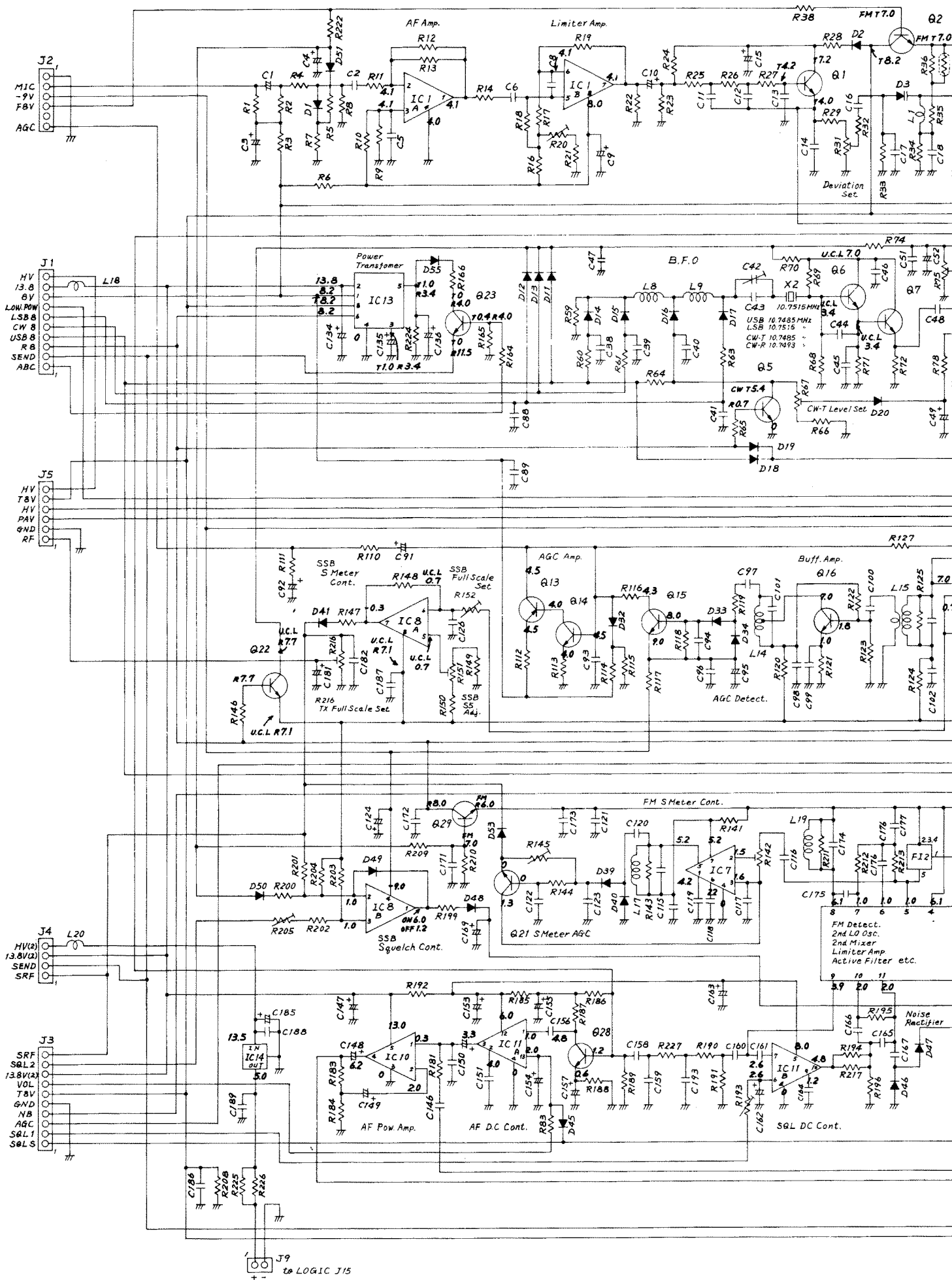


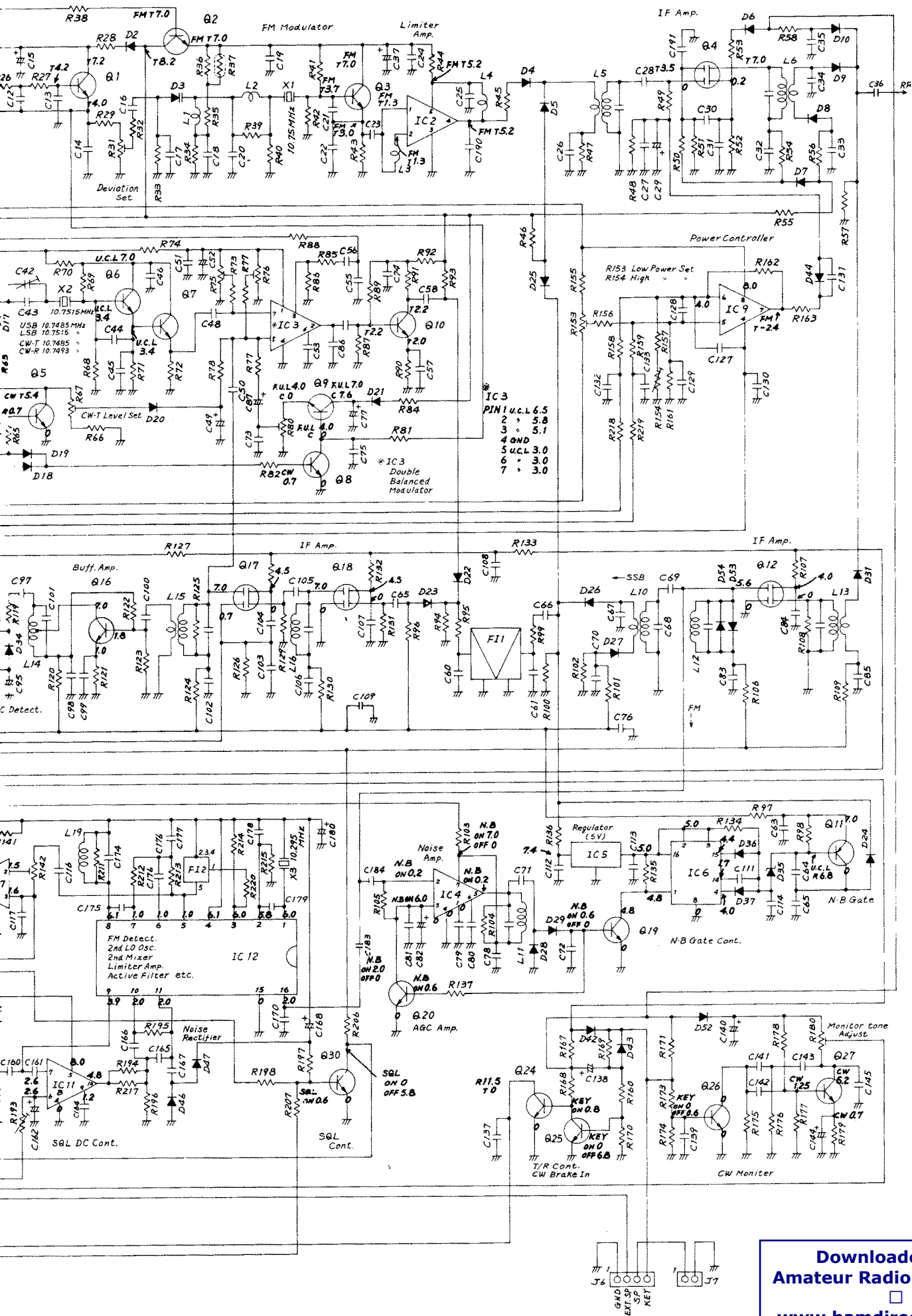
PA UNIT





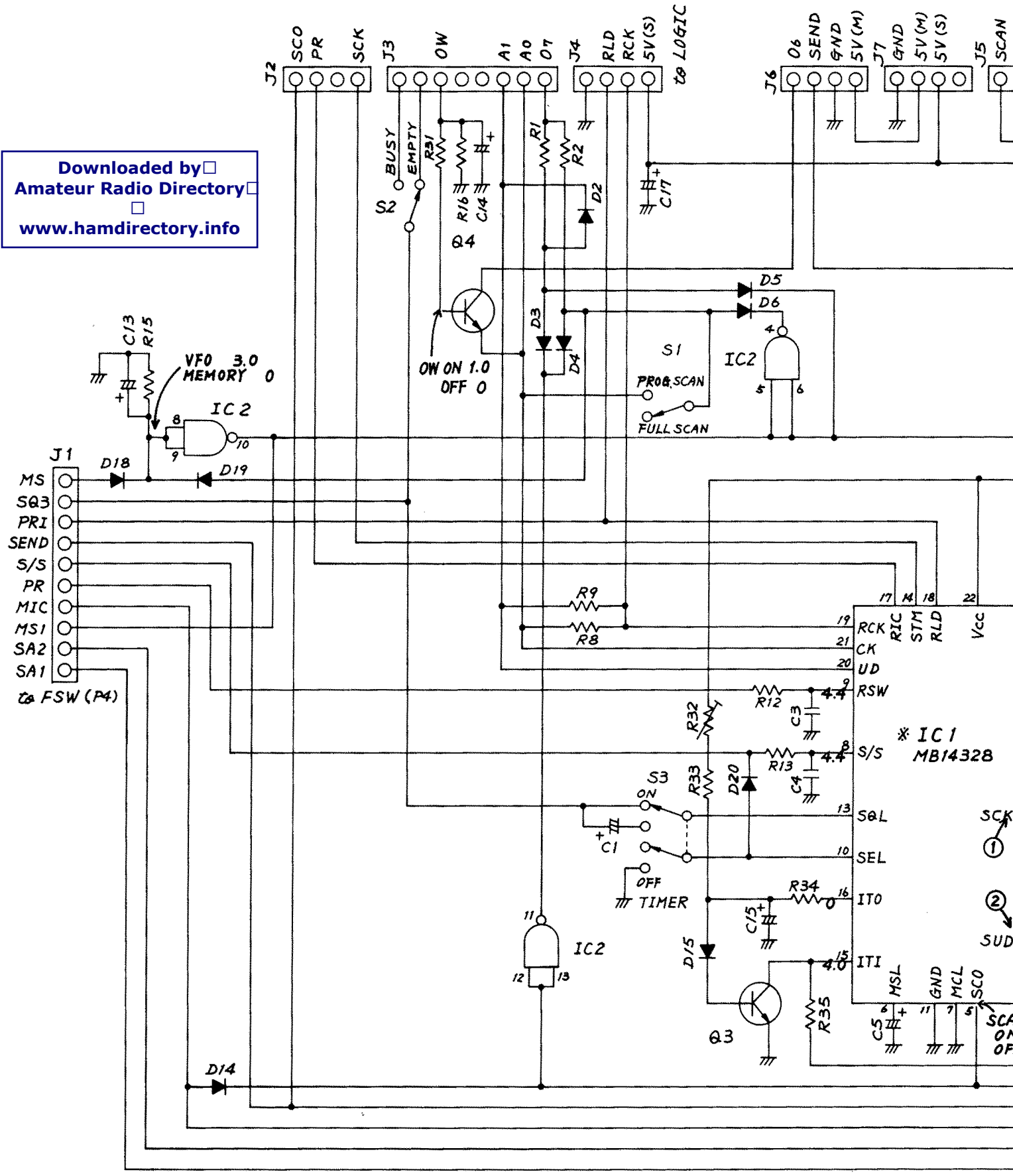
MAIN UNIT

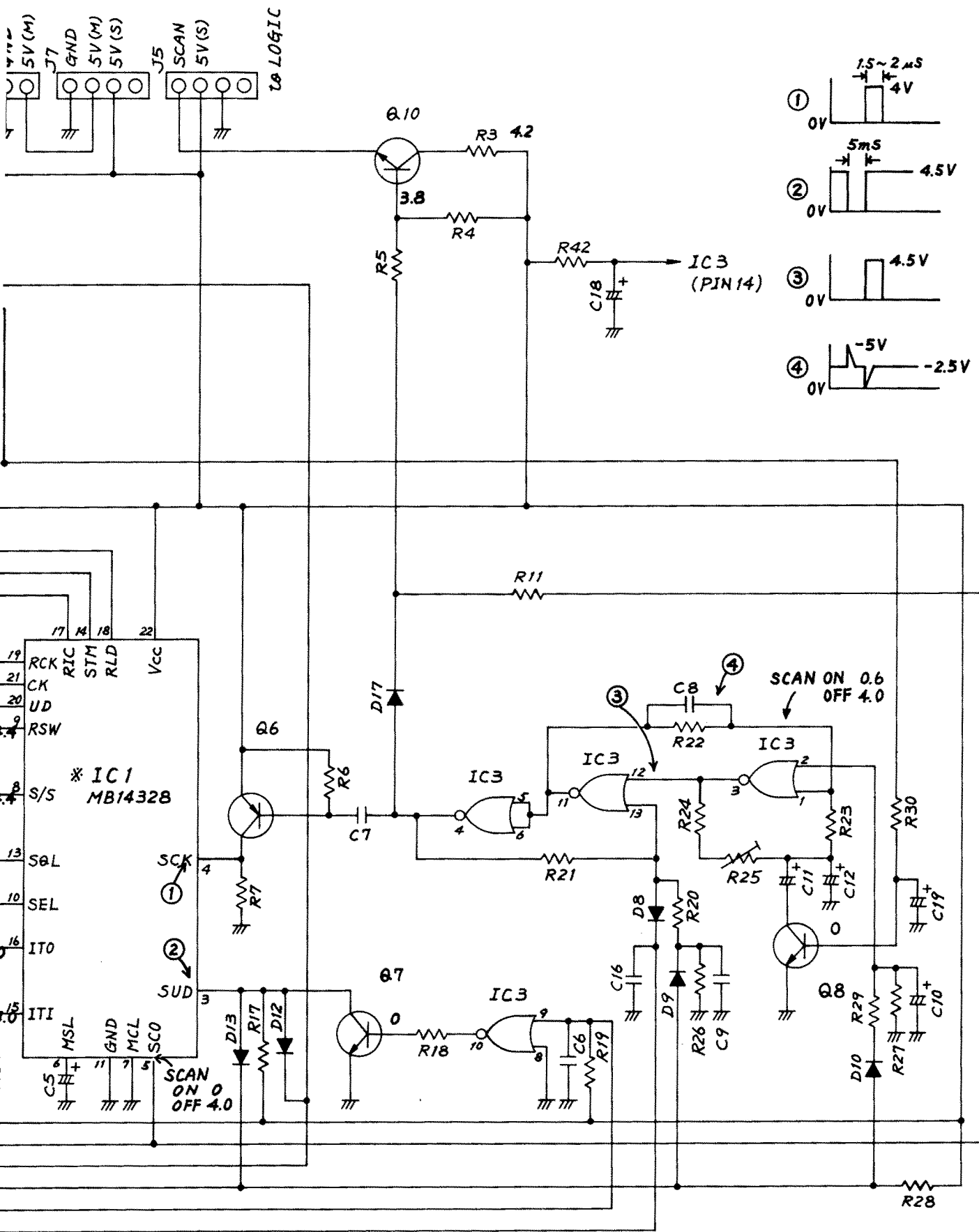




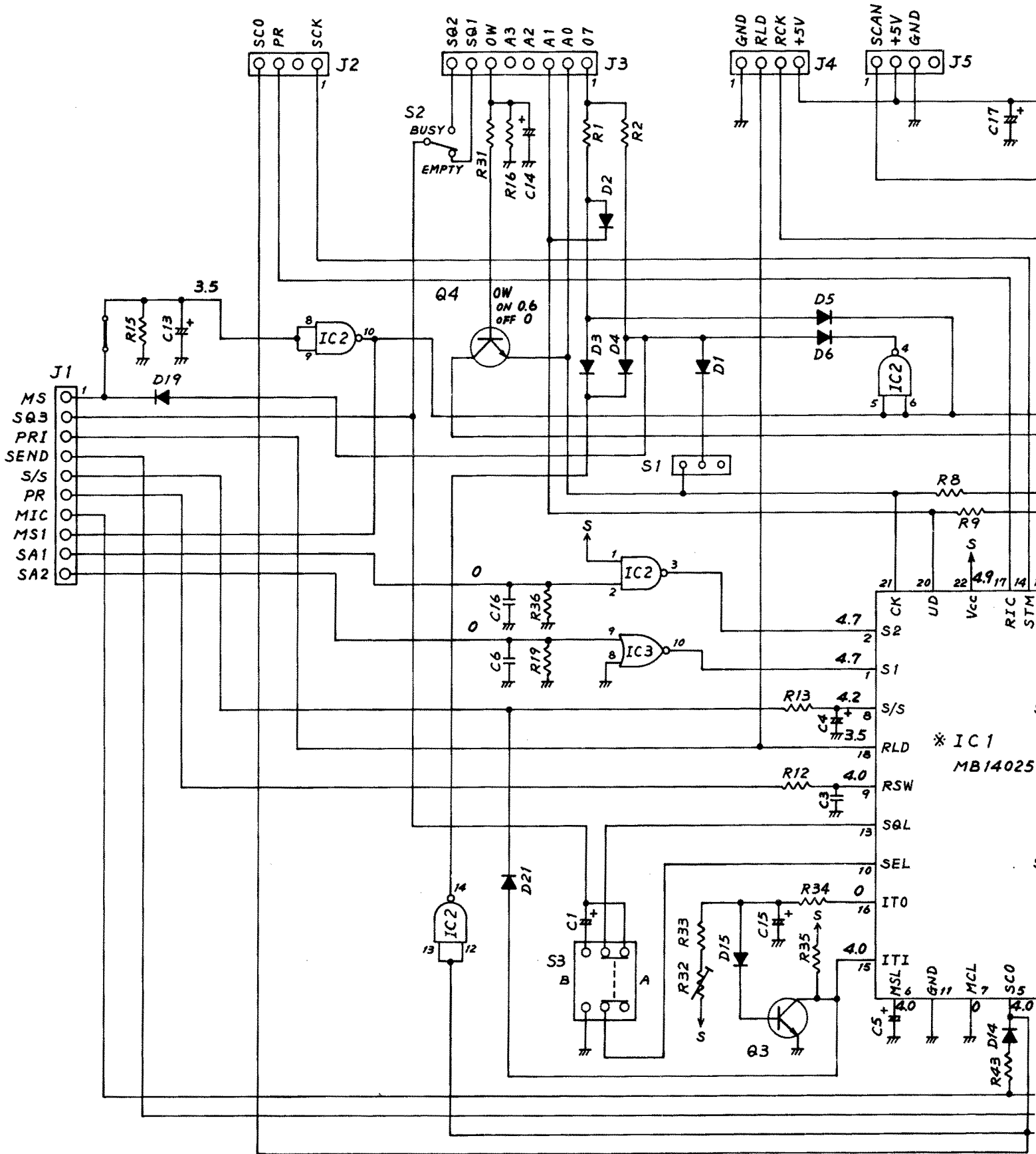
SENSOR UNIT (OLD)

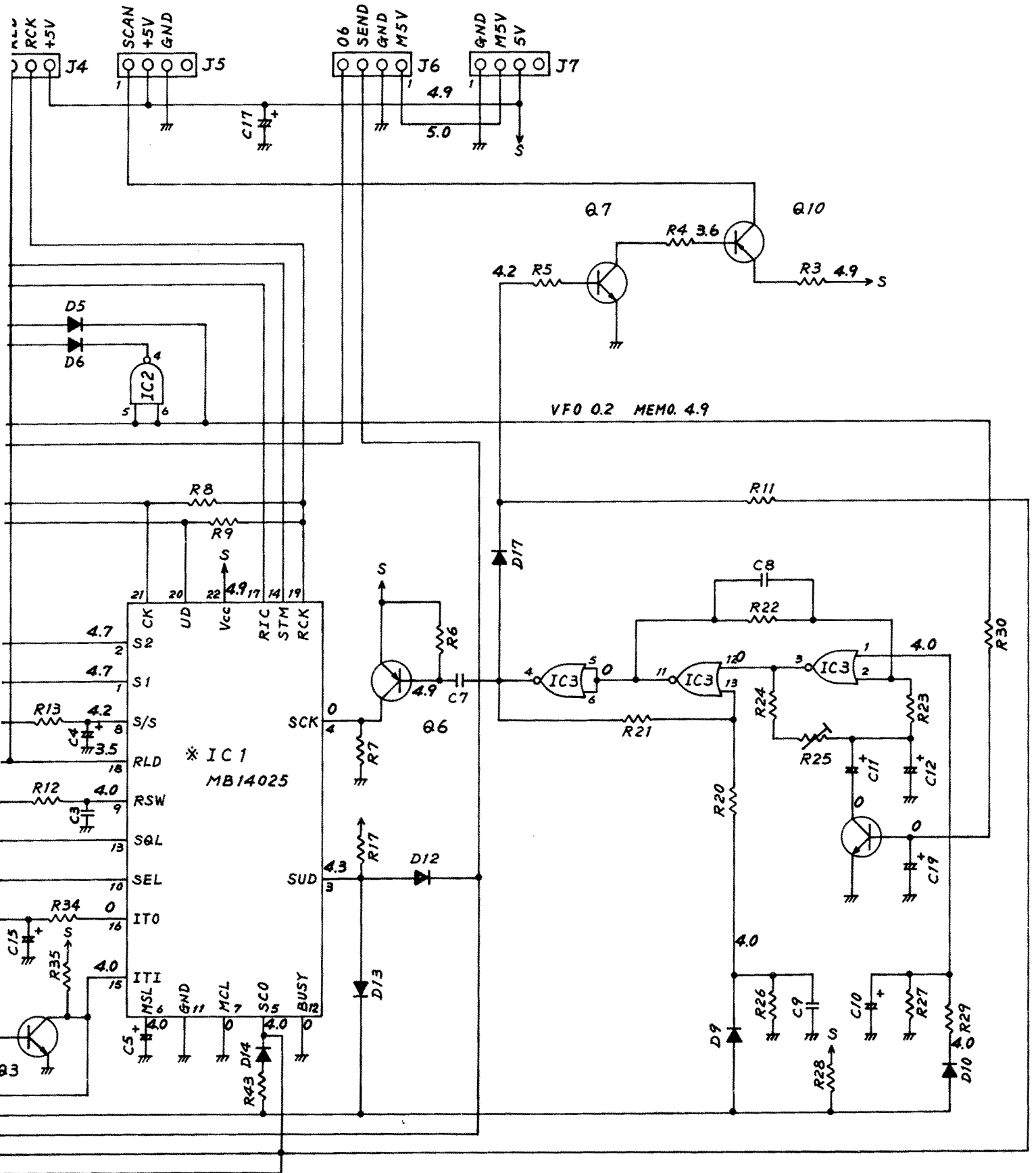
Downloaded by Amateur Radio Directory
www.hamdirectory.info





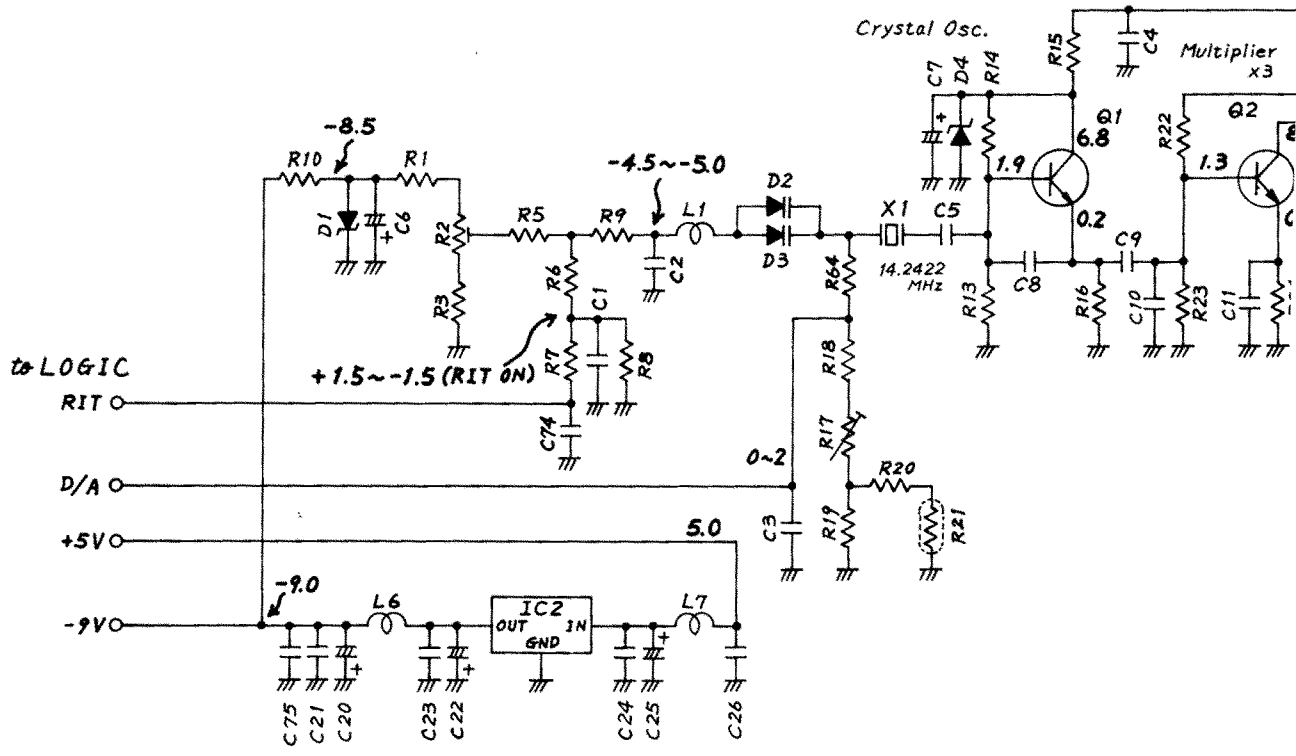
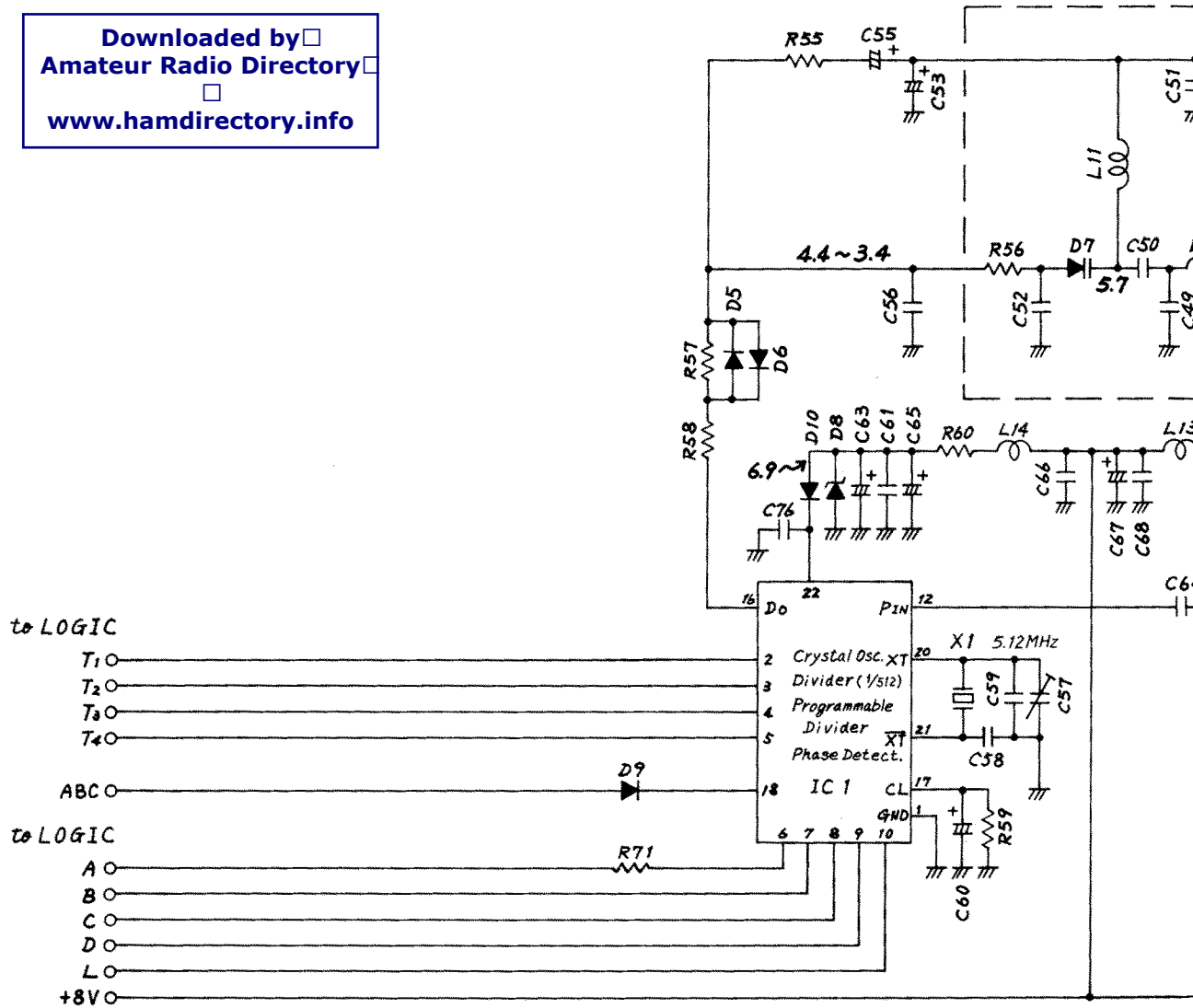
SENSOR UNIT (NEW)

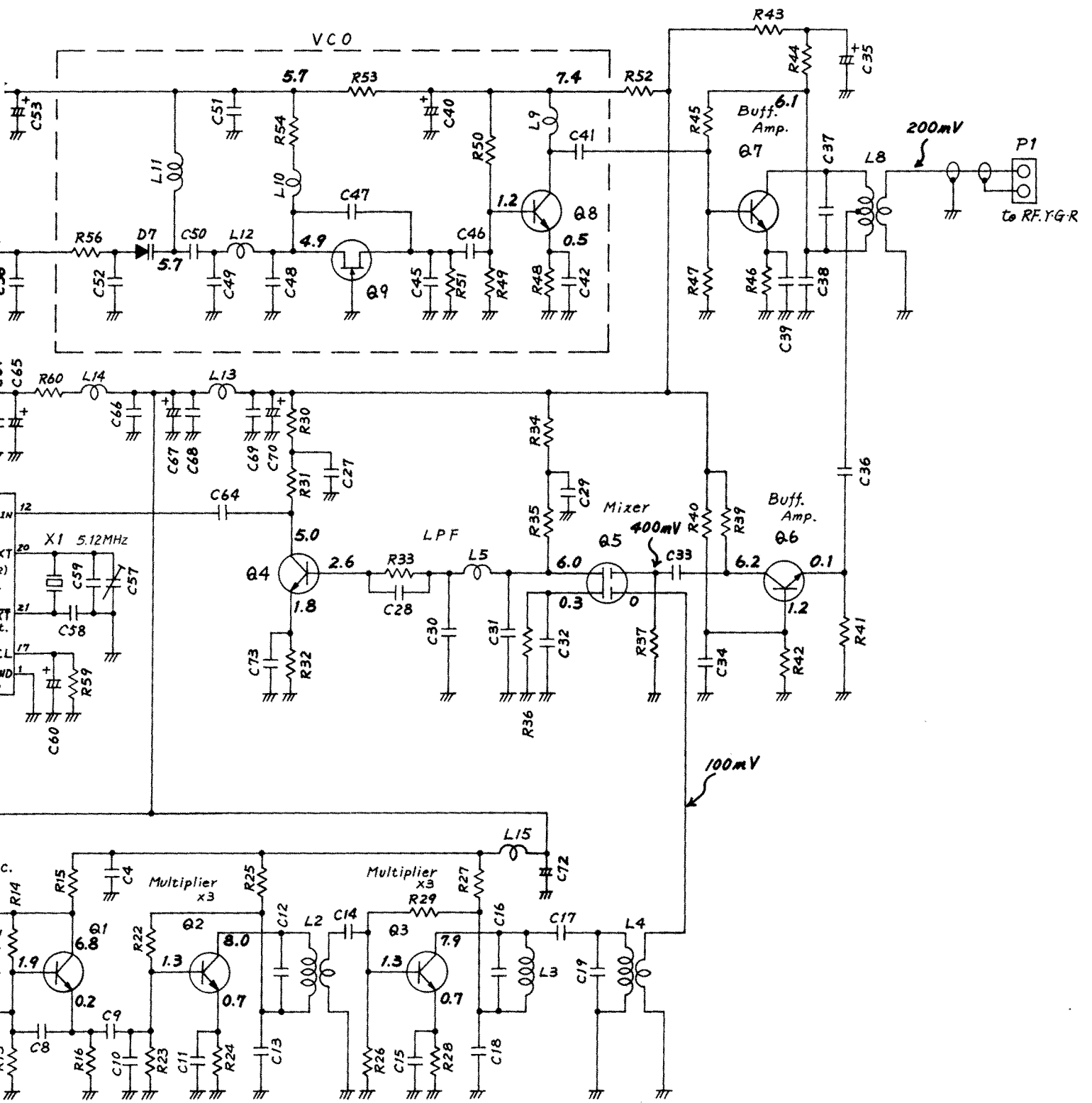




PLL UNIT

Downloaded by
 Amateur Radio Directory
www.hamdirectory.info

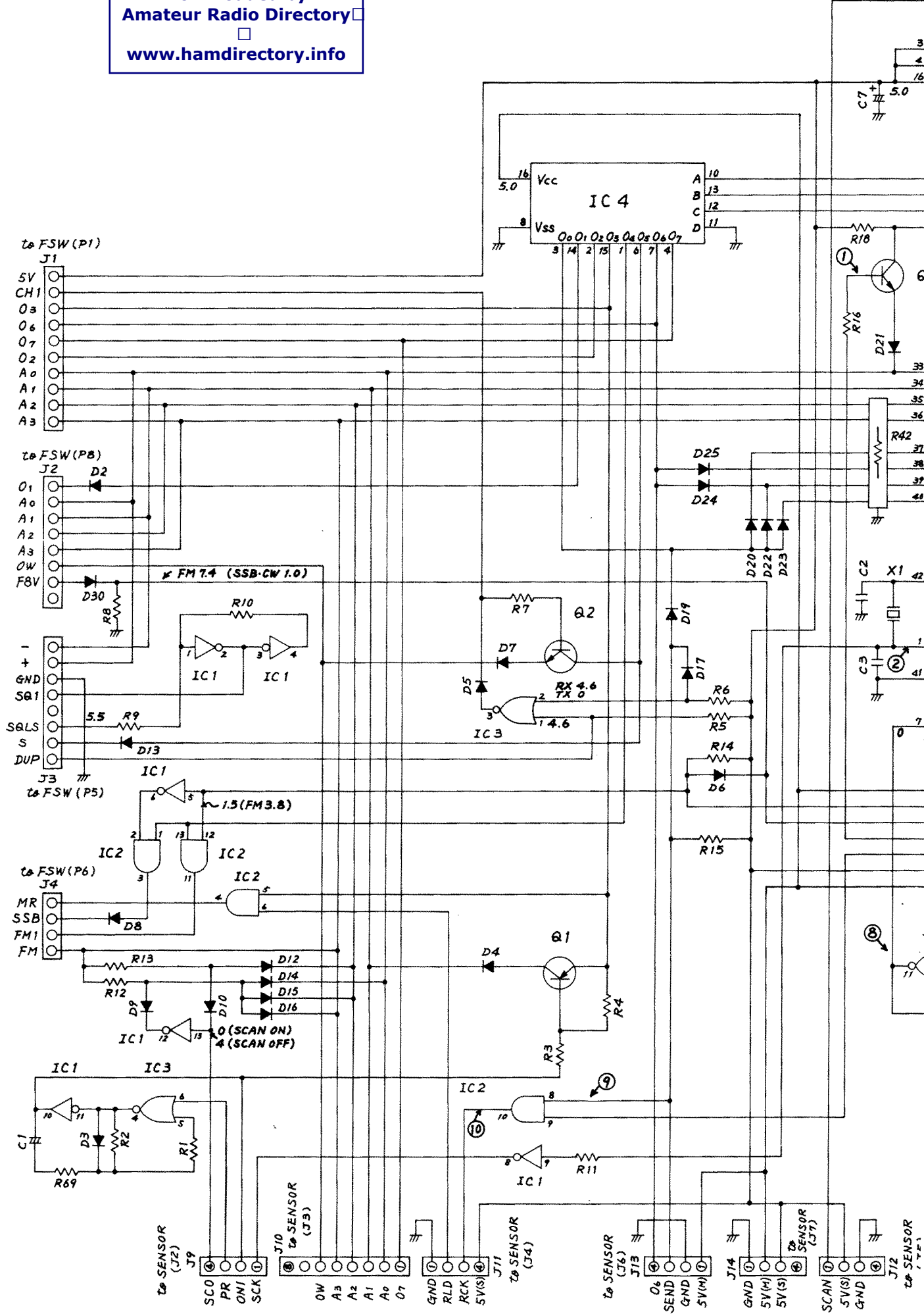


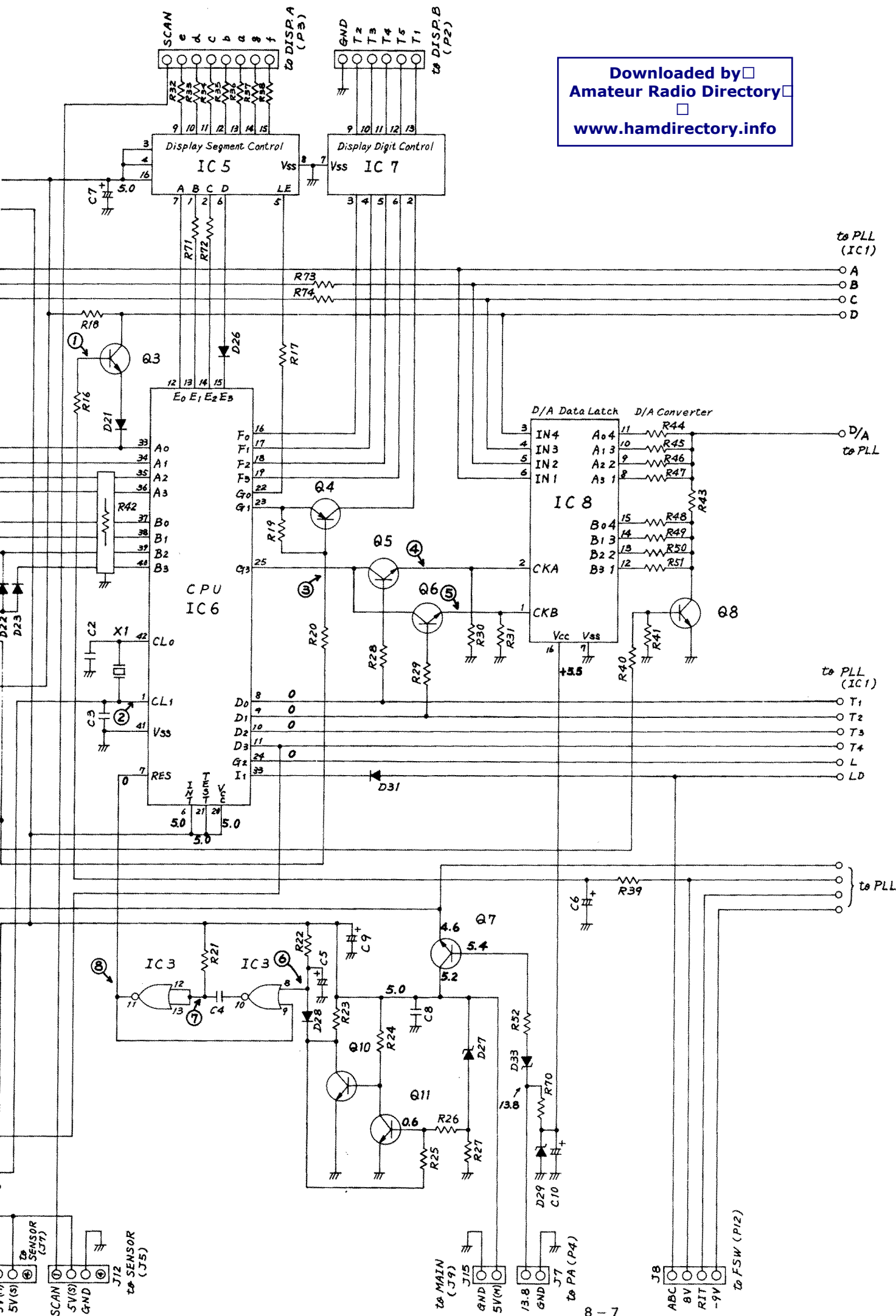


LOGIC UNIT

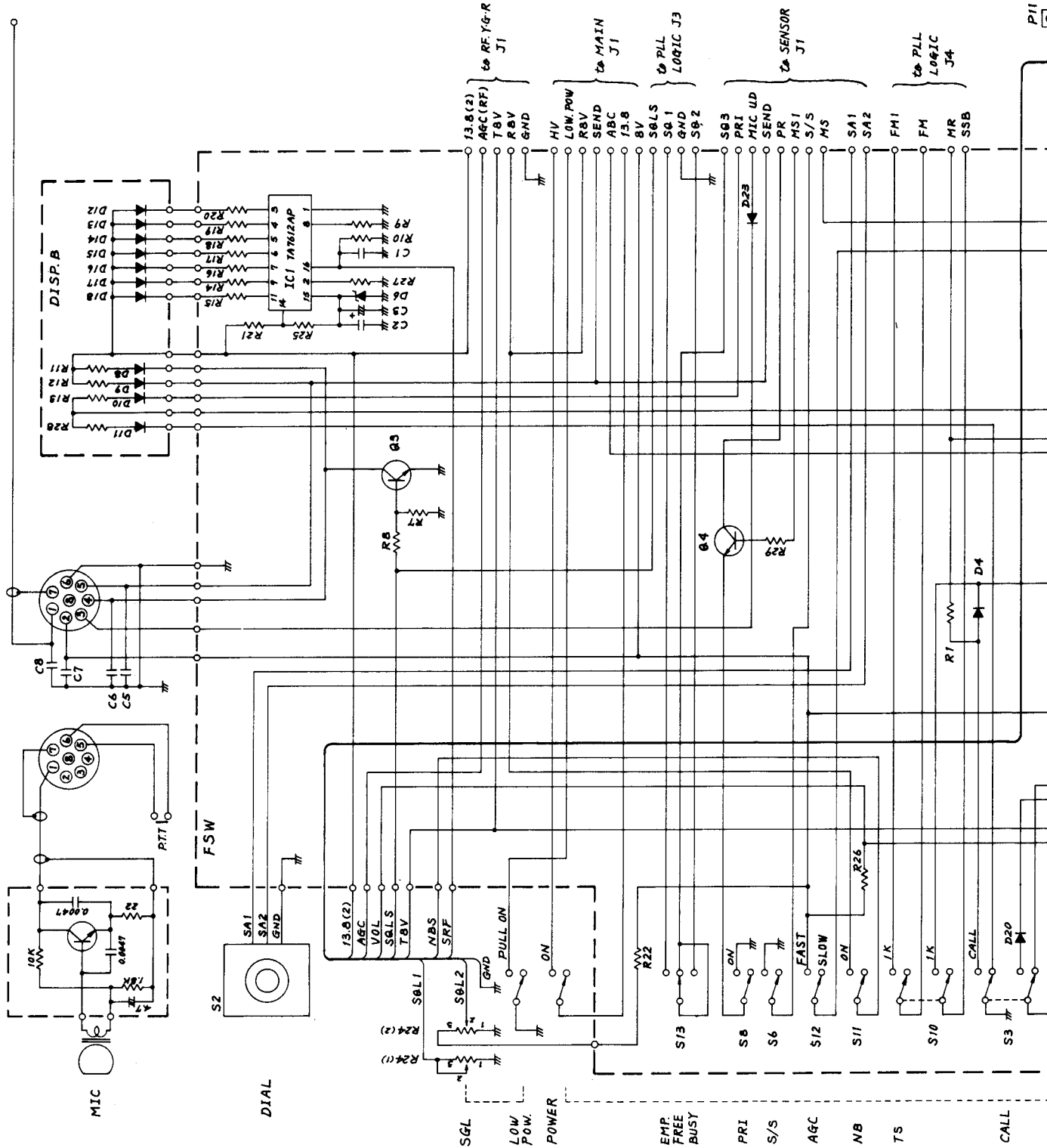
Downloaded by Amateur Radio Directory

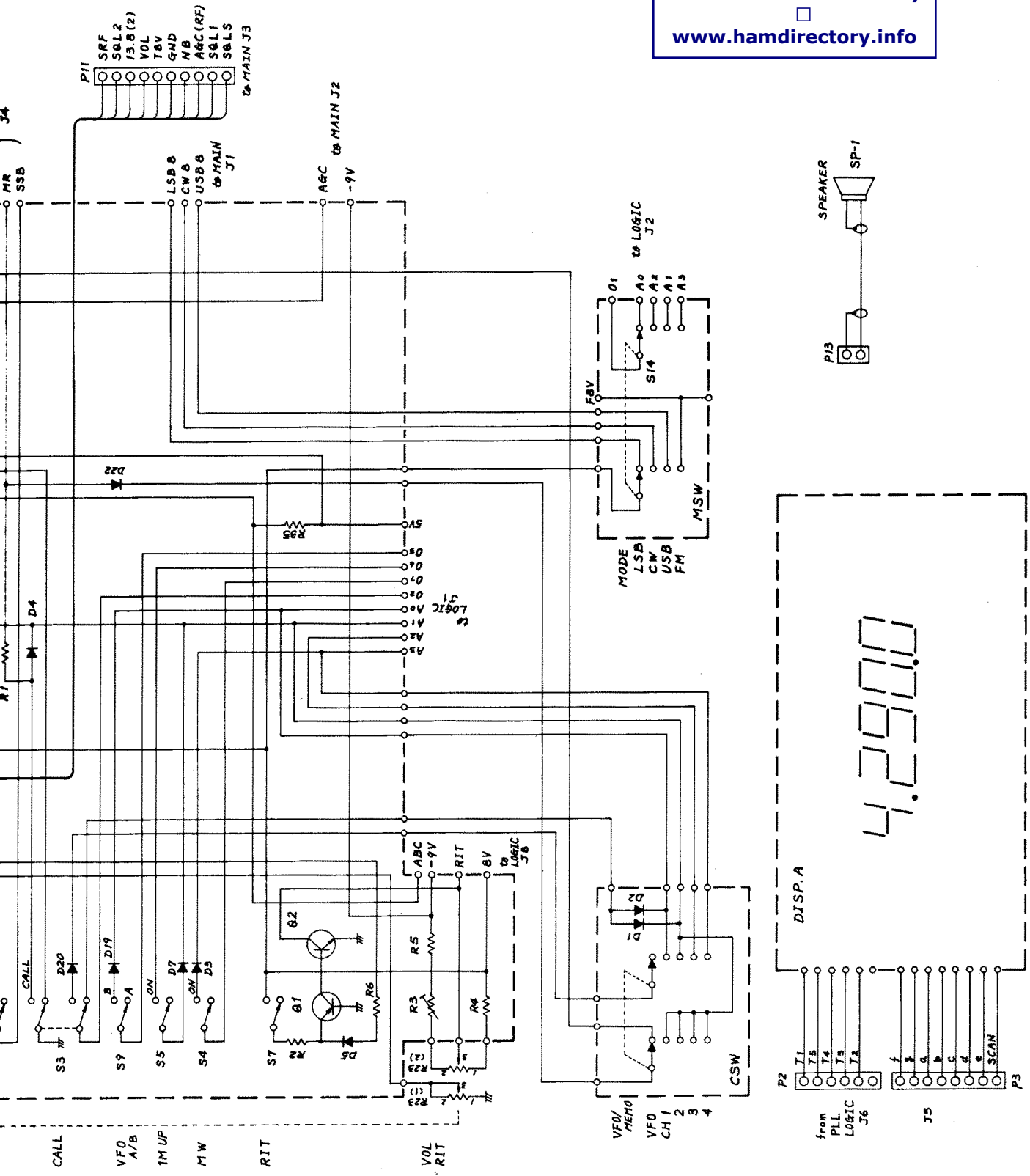
www.hamdirectory.info





EF UNIT





IC VOLTAGE CHART

UNIT	MODE	NO.	PIN NO.																REMARKS	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
LOGIC	TRANS.	IC1	GND	4.6	4.6	GND	GND	GND	GND	2.4	2.4	4.6	GND	GND	4.4	4.6			MODE FM, SQL OFF	
		IC2	0.4	GND	GND	0.6	0.6	3.0	GND	0.6	GND	GND	GND	4.0	GND	4.6				
		IC3	4.6	0.6	GND	GND	GND	4.0	GND	2.0	GND	GND	GND	1.2	1.2	5				
		IC4	GND	GND	2.0	0.6	GND	0.6	0.6	GND	GND	2.0	GND	2.0	2.2	GND	0.6	5.0		
		IC5	2.2	2.0	4.6	4.6	3.0	GND	2.0	GND	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.6		
		IC7	GND	GND	1.0	0.6	1.0	1.0	GND	GND	2.0	2.0	2.0	2.0	2.0	GND				
		IC8	GND	GND	1.0	2.0	2.0	2.0	GND	X	X	X	X	X	X	X	X	X	X	
		REC.	IC1	GND	4.6	4.6	GND	4.0	GND	GND	2.4	2.4	4.6	GND	GND	4.0	4.6			MODE FM, SQL OFF
			IC2	0.4	GND	GND	0.6	0.6	3.0	GND	2.0	GND	GND	GND	4.0	GND	4.6			
			IC3	4.6	4.6	GND	GND	GND	4.0	GND	2.0	GND	GND	GND	1.2	1.2	5.0			
	IC4		GND	GND	2.0	0.6	GND	0.6	0.6	GND	GND	2.0	GND	2.0	2.2	GND	0.6	5.0		
	IC5		2.2	2.0	4.6	4.6	3.0	GND	2.0	GND	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.6		
	IC7		GND	GND	1.0	0.6	1.0	1.0	GND	GND	2.0	2.0	2.0	2.0	2.0	GND				
	SENSOR	TRANS.	IC2	4.0	GND	GND	4.6	GND	GND	GND	3.6	3.6	GND	GND	4.0	4.0	4.6			VFO ON
			IC3	GND	4.0	GND	4.6	GND	GND	GND	GND	4.0	GND	GND	GND	3.4	4.6			
		REC.	IC2	4.0	GND	GND	4.6	GND	GND	GND	3.6	3.6	GND	GND	4.0	4.0	4.6			VFO ON
IC3			GND	4.0	GND	4.6	GND	GND	GND	GND	4.0	GND	GND	GND	3.4	4.6				

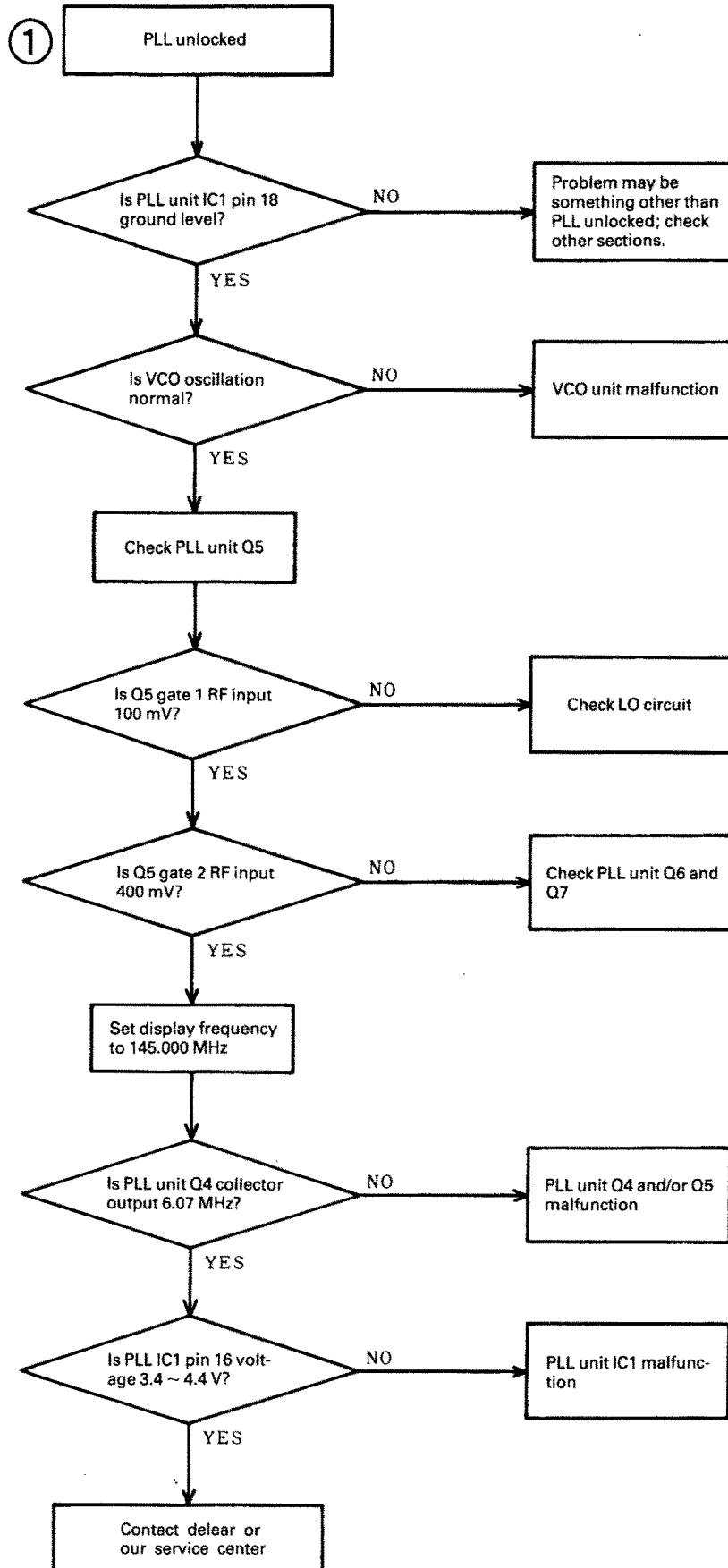
TRANSISTOR VOLTAGE CHART

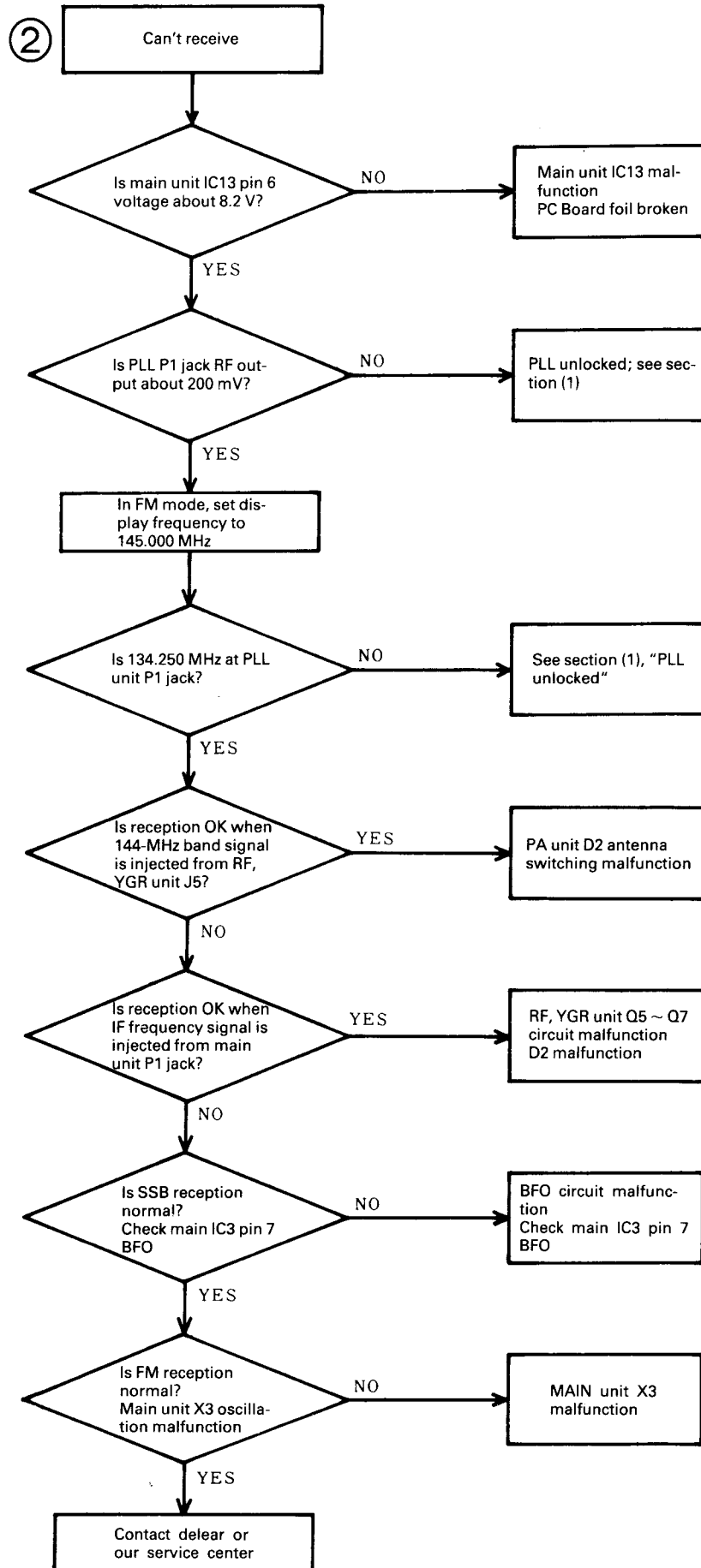
UNIT	NO.	TRANSMIT			RECIEVE			REMARKS
		BASE	COLLECTOR	EMITTER	BASE	COLLECTOR	EMITTER	
LOGIC	Q 1	1.15	GND	0.6	1.15	GND	0.6	
	Q 2	GND	0.6	GND	GND	0.6	GND	DUP OFF
		1.0	0.6	0.5	GND	0.6	GND	DUP ON
	Q 3	1.8	1.2	1.0	1.8	1.2	1.0	
	Q 4	2.2	GND	0.6	2.2	GND	0.6	FM ON
		1.0	1.0	1.0	1.0	1.0	1.0	FM OFF
	Q 5	GND	GND	GND	GND	GND	GND	
	Q 6	GND	GND	GND	GND	GND	GND	
	Q 7	5.4	5.2	4.6	5.4	5.2	4.6	
	Q 8	GND	GND	GND	GND	GND	GND	FM ON
0.4		X	GND	0.4	X	GND	FM OFF	
Q 9	0.6	GND	GND	0.6	GND	GND		
Q10	GND	4.8	GND	GND	4.8	GND		
SENSOR	Q 3	GND	0.4	GND	GND	0.4	GND	
	Q 4	GND	0.8	1.2	GND	0.8	1.2	OW OFF
		1.0	1.0	1.2	1.0	1.0	1.2	OW ON
	Q 6	4.6	GND	4.6	4.6	GND	4.6	
	Q 7	GND	4.4	GND	GND	4.4	GND	
	Q 8	GND	4.0	4.0	GND	4.0	4.0	
1.0		0.4	GND	4.0	0.4	GND	MEMORY SCAN ON	
Q10	3.8	4.2	3.6	3.8	4.2	3.6		

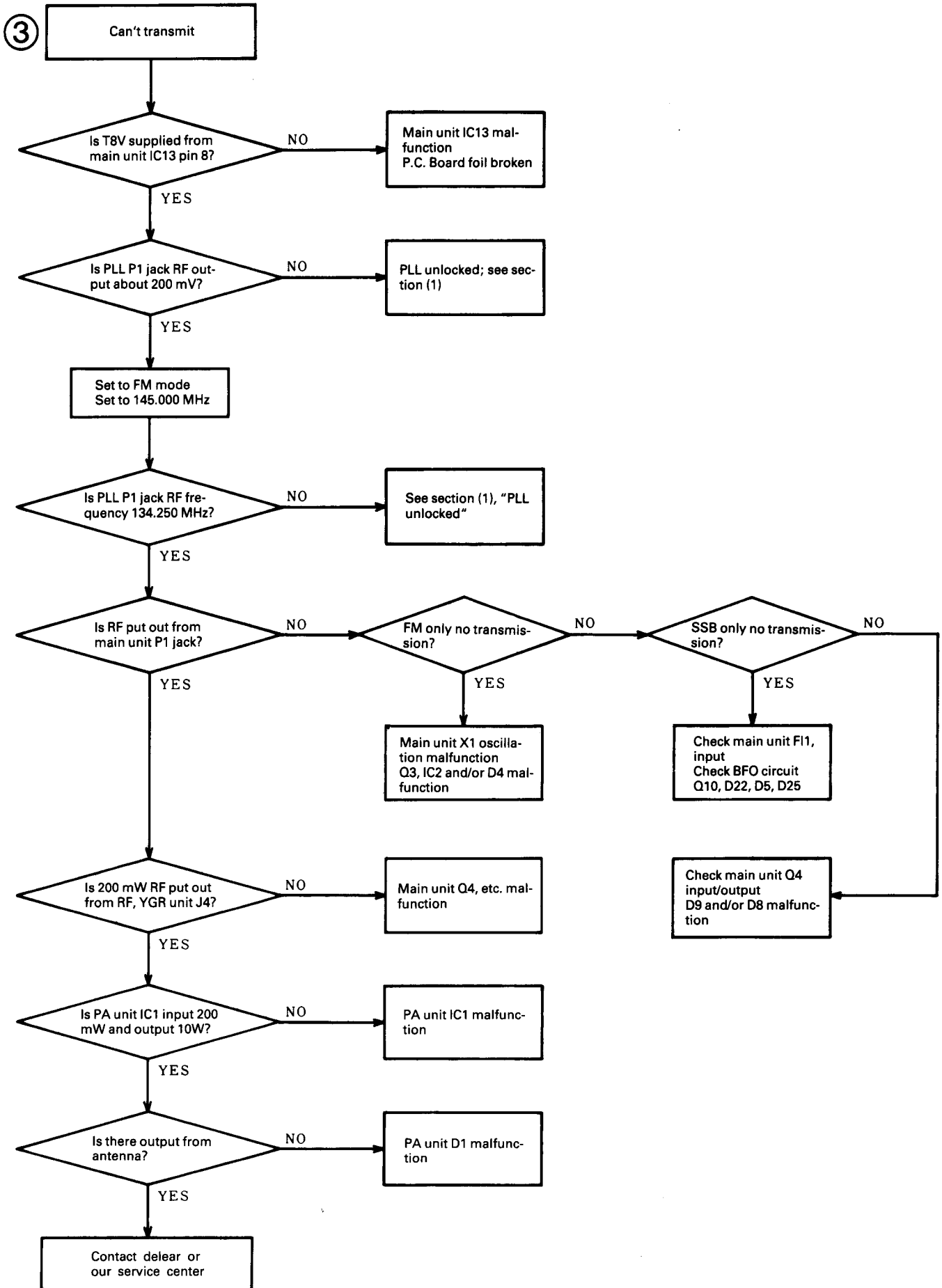
Downloaded by
 Amateur Radio Directory

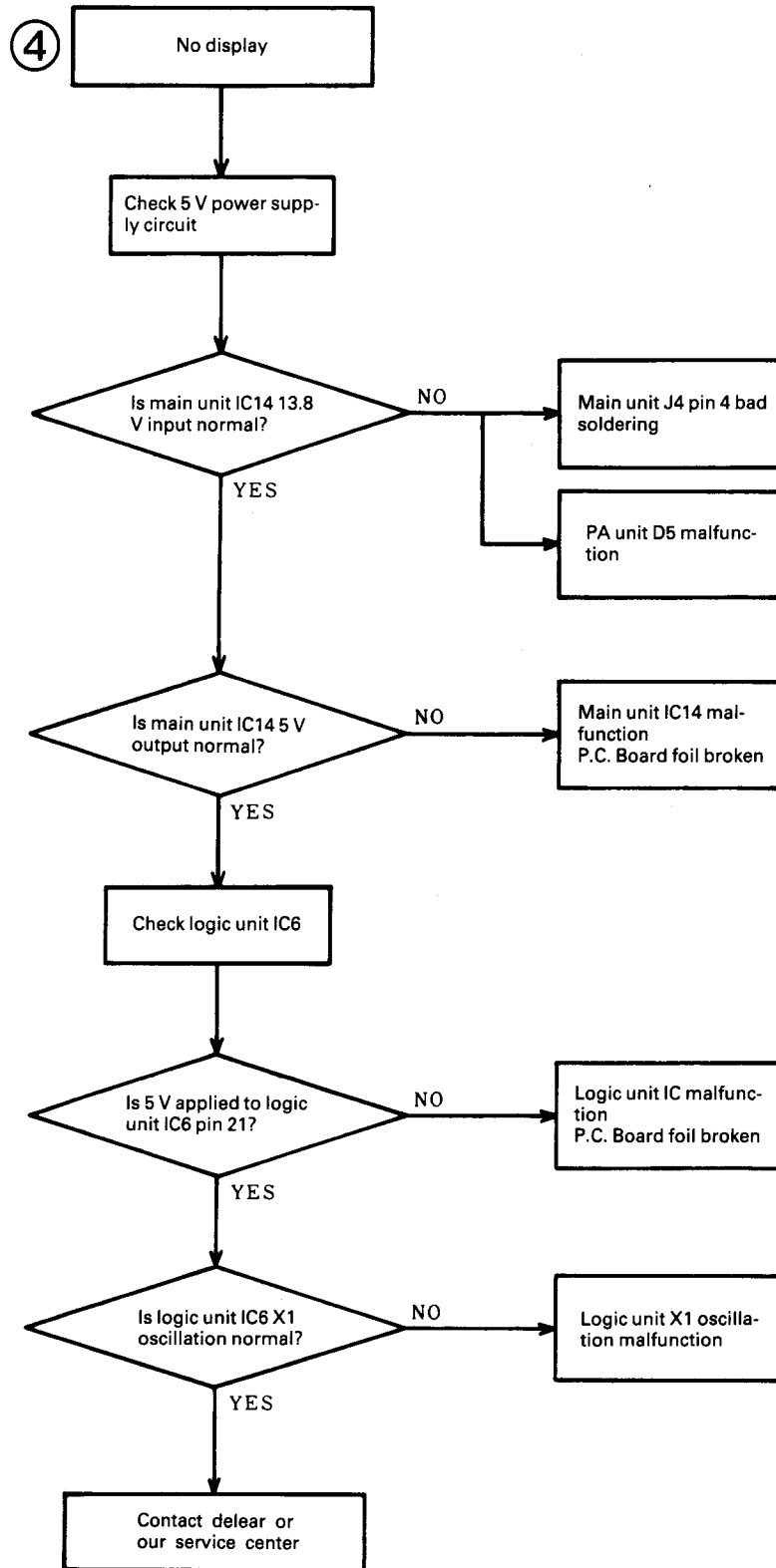
www.hamdirectory.info

SECTION 9 TROUBLESHOOTING GUIDE





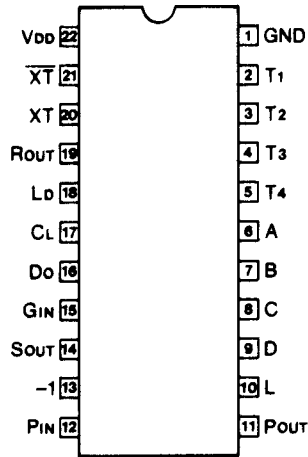




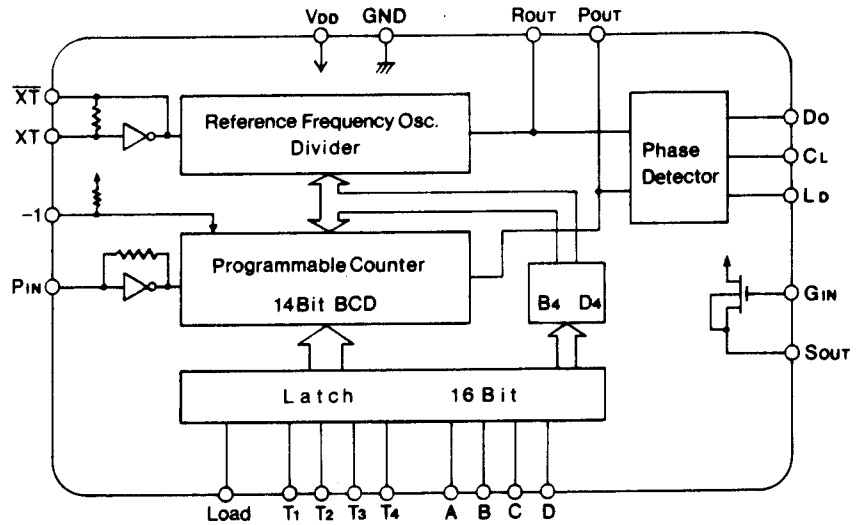
SECTION 10 IC RATINGS

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

PIN CONNECTION



BLOCK DIAGRAM



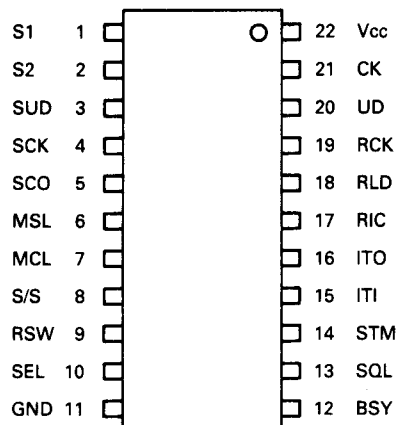
Maximum Ratings

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

MB-14328 (MB-14025)

Item	Symbol	Rating	Unit
Power supply voltage	V_{CC}	7	V
Input voltage	V_I	-0.5 ~ 7	V
Output voltage	V_O	-0.5 ~ 5.5	V
Power dissipation	P_D	1	W
Operation temperature	T_{OP}	-25 ~ +85	°C
Storage temperature	T_{STG}	-65 ~ +150	°C

PIN CONNECTION

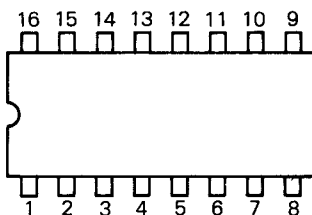


Downloaded by
 Amateur Radio Directory

www.hamdirectory.info

**TC4028 (BCD TO DECIMAL DECODER)
TC4511 (BCD 7-SEGMENT LATCH/DECODER/DRIVER)**

PIN CONNECTION

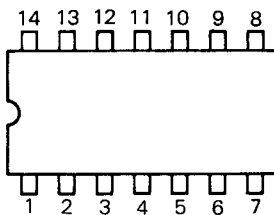


Maximum Ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{DD}	$V_{SS}-0.5 \sim V_{SS}+20$	V
Input voltage	V_{IN}	$V_{SS}-0.5 \sim V_{DD}+0.5$	V
Output voltage	V_{OUT}	$V_{SS}-0.5 \sim V_{DD}+0.5$	V
Input current	I_{IN}	± 10	mA
Power dissipation	P_D	300	mW
Storage temperature	T_{STG}	$-65 \sim +150$	$^{\circ}C$
Lead temperature/time	T_{SOI}	$260^{\circ}C \cdot 10sec$	

AN829 (DUAL ATTENUATOR)

PIN CONNECTION

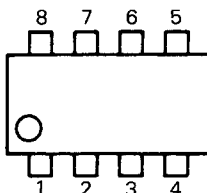


Maximum Ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{CC}	18	V
Control input voltage	V_C	0 ~ 6	V
Power dissipation	P_D	450	mW
Operation temperature	T_{OPR}	$-20 \sim +75$	$^{\circ}C$
Storage temperature	T_{STG}	$-55 \sim +150$	$^{\circ}C$

NJM4558D (DUAL LOW NOISE AMP.)

PIN CONNECTION

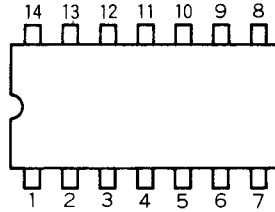


Maximum Ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{DD}	18	V
Input voltage	V_{IN}	15	V
Operation temperature	T_{OPT}	$-20 \sim +75$	$^{\circ}C$
Storage temperature	T_{STG}	$-40 \sim +125$	$^{\circ}C$

TC4001 (QUAD 2-INPUT POSITIVE NOR GATE)
 TC4011 (QUAD 2-INPUT POSITIVE NAND GATE)
 TC4069 (HEX INVERTER)
 TC4081 (QUAD 2-INPUT POSITIVE AND GATE)

PIN CONNECTION

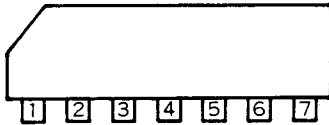


Maximum Ratings

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

μ PC1037H (DOUBLE BALANCED MODULATOR)

PIN CONNECTION



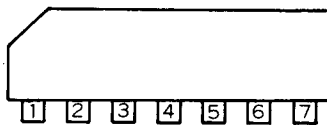
Terminal No.	Connection
1	Vcc
2	Out Put 1
3	Out Put 2
4	GND
5	Signal Input
6	Bypass
7	Carrier Input

Maximum Ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{CC}	9	V
Power dissipation	P_D	270	mW
Operation temperature	T_{OPT}	$-30 \sim +65$	$^{\circ}C$
Storage temperature	T_{STG}	$-40 \sim +125$	$^{\circ}C$

μ PC577H (FM-IF AMPLIFIER)

PIN CONNECTION



Maximum Ratings

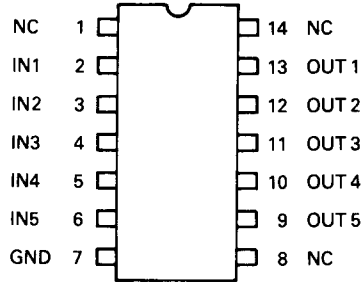
Item	Symbol	Rating	Unit
Power supply voltage	V_{CC}	15	V
Voltage between input terminals	V_{IN}	± 3.0	V
Power dissipation	P_D	300	mW
Operation temperature	T_{OPT}	$-20 \sim +75$	$^{\circ}C$
Storage temperature	T_{STG}	$-40 \sim +125$	$^{\circ}C$

M54516 (5-UNIT 500mA DARLINGTON TRANSISTOR ARRAY)

Maximum Ratings

Item	Symbol	Condition	Rating	Unit
Collector-emitter voltage	V_{CEO}		25	V
Collector current	I_c	Current for each circuit	500	mA
Input voltage	V_i		25	V
Power dissipation	P_c	$T_a = 25^\circ\text{C}$	1.47	W
Operation temperature	T_{OPR}		-20 ~ +75	$^\circ\text{C}$
Storage temperature	T_{STG}		-55 ~ +125	$^\circ\text{C}$

PIN CONNECTION

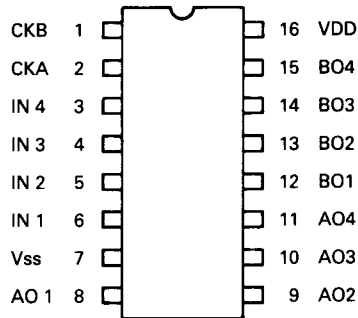


MN1201A (CMOS DUAL 4-BIT DATA LATCHES)

Maximum Ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{DD}	-0.3 ~ 8	V
Input voltage	V_i	-0.3 ~ 8	V
Output voltage	V_o	-0.3 ~ 8	V
Operation temperature	T_{OPR}	-30 ~ +70	$^\circ\text{C}$
Storage temperature	T_{STG}	-55 ~ +100	$^\circ\text{C}$

PIN CONNECTION

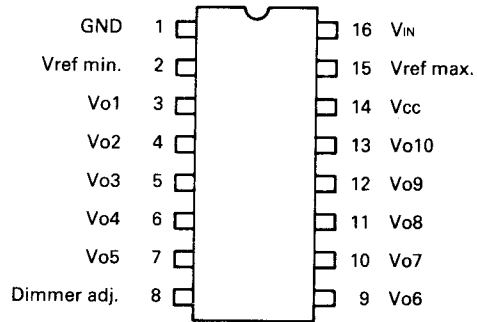


TA-7612AP (LEVEL METER DRIVER)

Maximum Ratings

Item	Symbol	Rating	Unit
Power supply voltage	V_{CC}	20	V
Power dissipation	P_D	500	mW
Operation temperature	T_{OPR}	-30 ~ +75	°C
Storage temperature	T_{STG}	-55 ~ +125	°C

PIN CONNECTION



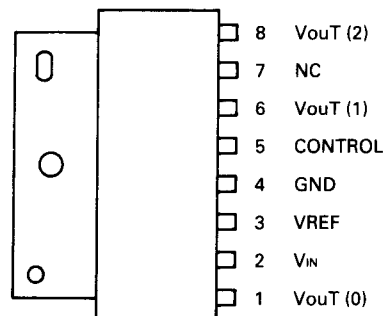
MB3756 (VOLTAGE REGULATOR with OUTPUT-SELECTOR)

Maximum Ratings

Item	Symbol	Rating	U-nit
Power supply voltage	V_{IN}	18	V
Power dissipation	P_D	1*	W
		4**	W
Operation temperature	T_{OP}	-30 ~ +80	°C
Storage temperature	T_{STG}	-55 ~ +150	°C

*NO Heat Sink $T_A \leq 70^\circ\text{C}$
 **Infinite Heat Sink $T_A \leq 70^\circ\text{C}$

PIN CONNECTION

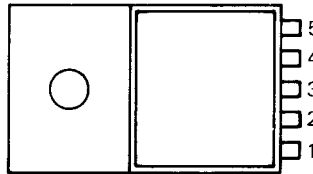


μPC2002 (5.4W AUDIO POWER AMP.)

Maximum Ratings

Item	Symbol	Rating	Unit
Power supply voltage (surge)	V _{cc1} (50ms)	40	V
Power supply voltage (no load)	V _{cc2}	28	V
Power supply voltage (in operation)	V _{cc3}	18	V
Circuit current (continuous pluses)	I _{cc} (PEAK) 1	3.5	A
Circuit current (single pulse)	I _{cc} (PEAK) 2	4.5	A
Package power dissipation	P _o (T _c = 90°C)	75	W
Operation temperature	T _{OPR}	-30 ~ +75	°C
Storage temperature	T _{STG}	-40 ~ +150	°C

PIN CONNECTION

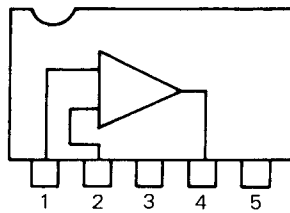


BA401 (FM/IF LIMITER)

Maximum Ratings

Item	Symbol	Rating	Unit
Power supply voltage	V _{CC}	15	V
Output voltage	V _{OUT}	24	V
Input voltage	V _{IN}	±3	V
Operation temperature	T _{OPR}	-25 ~ +75	°C
Storage temperature	T _{STG}	-55 ~ +125	°C

BLOCK DIAGRAM



SECTION 11 PARTS LIST

[EF] UNIT

REF. NO.	DESCRIPTION	PART NO.
IC1	IC	TA7612AP
IC2	LED	TLR312 (IC-290A/E) TLG312 (IC-290H)
IC3	LED	TLR312 (IC-290A/E) TLG312 (IC-290H)
IC4	LED	TLR312 (IC-290A/E) TLG312 (IC-290H)
IC5	LED	TLR312 (IC-290A/E) TLG312 (IC-290H)
IC6	LED	TLR312 (IC-290A/E) TLG312 (IC-290H)
Q1	Transistor	2SA1015-Y
Q2	Transistor	2SC1636
Q3	Transistor	2SC945 (Q, P, K)
Q4	Transistor	2SC945 (Q, P, K)
D1	Diode	1SS53
D2	Diode	1SS53
D3	Diode	1SS53
D5	Diode	1SS53
D6	Zener Diode	WZ036
D7	Diode	1SS53
D8	LED	SLP-251B
D9	LED	SLP-151B
D10	LED	SLP-451B
D11	LED	SLP-451B
D12	LED	LN433YP
D13	LED	LN433YP
D14	LED	LN433YP
D15	LED	LN433YP
D16	LED	LN433YP
D17	LED	LN233RP
D18	LED	LN233RP
D19	Diode	1SS53
D21	Diode	1SS53
D23	Diode	1N60
R2	Resistor	10K-J ELR10
R3	Trimmer	H0622A-473
R4	Resistor	15K-J R10
R5	Resistor	5.6K-J R10
R6	Resistor	10K-J ELR10
R7	Resistor	47K-J ELR10
R8	Resistor	47K-J ELR10
R9	Resistor	10K-J ELR10
R10	Resistor	470K-J ELR10
R11	Resistor	680-J ELR10
R12	Resistor	1K-J ELR10
R13	Resistor	220-J ELR10
R14	Resistor	1K-J ELR10
R15	Resistor	1K-J ELR10
R16	Resistor	1K-J ELR10
R17	Resistor	1K-J ELR10
R18	Resistor	1K-J ELR10
R19	Resistor	1K-J ELR10
R20	Resistor	1K-J ELR10
R21	Resistor	22 R25
R22	Resistor	22K-J R10
R23	Variable	K16BA 100K-5M1222 10KC (IN), 10KB (OUT)
R24	Variable	GM73A5M3121 10KB, 500B (SQL)

[EF] UNIT

REF. NO.	DESCRIPTION	PART NO.
R25	Resistor	1K-J ELR10
R26	Resistor	47K-J R10
R27	Resistor	1K-J ELR10
R28	Resistor	220-J ELR10
R29	Resistor	100K ELR10
R30	Resistor	6.8K R25
R35	Resistor	47K R25
C1	Barrier Lay	0.01 25V
C2	Ceramic	DD108B 472K 50V02
C3	Electrolytic	10 16V RC2
C4	Ceramic	0.001 50V
C5	Ceramic	0.001 50V
C6	Ceramic	0.001 50V
C7	Ceramic	0.001 50V
C8	Ceramic	0.001 50V
C9	Ceramic	0.001 50V
S1	Rotary Switch	SBU-1-02-5-N-00 (Mem Ch)
S2	Rotary Encoder	LA22401
S3	Switch	SUT11055A (Tone Call)
S4	Switch	SUT11055A (Mem Write)
S5	Switch	SUT11055 (VFO/Mem)
S6	Switch	SUT11055A (Scan S/S)
S7	Switch	SUT11055 (RIT)
S8	Switch	KEC10901 (PRI)
S9	Switch	SUT11055 (VFO)
S10	Switch	SUT11055 (1KHz Steps)
S11	Switch	SUT11055 (NB)
S12	Switch	SUT11055 (AGC)
S13	Switch	SLW43-16PS (OFF SET)
S14	Rotary Switch	SBU-1-02-5-N-00 (MODE)
J1	Connector	FM214-8SS (MIC)
P1	Connector	5250-10
P2	Connector	5250-06
P3	Connector	5250-08
P4	Connector	5250-10
P5	Connector	5250-08
P6	Connector	5250-04
P7	Connector	5250-06
P8	Connector	5250-08
P9	Connector	5250-10
P10	Connector	5250-06
P11	Connector	5250-10
P12	Connector	5250-04
P13	Connector	5250-02
P14	Connector	P1051 02F
P15	Connector	P1051 02F
B1	PC Board	B-512 (NSW)
B2	PC Board	B-513 (CSW)
B3	PC Board	B-453 (FSW)
B4	PC Board	B-508B (DISP A)
B5	PC Board	B-509B (DISP B)
B6	PC Board	B-517 (MIC)
SP1	Speaker	65S-03

[MAIN] UNIT

REF. NO.	DESCRIPTION	PART NO.
IC1	IC	NJM4558D
IC2	IC	BA401
IC3	IC	μPC1037H
IC4	IC	μPC577H
IC5	IC	78L05AC
IC6	IC	M53323P
IC7	IC	μPC577H
IC8	IC	NJM4558D
IC9	IC	NJM4558D
IC10	IC	μPC2002V
IC11	IC	AN829
IC12	IC	MC3357P
IC13	IC	MB3756
IC14	IC	μA7805
Q1	Transistor	2SC945 (Q, P, K)
Q2	Transistor	2SC945 (Q, P, K)
Q3	Transistor	2SC945P
Q4	FET	3SK74K
Q5	Transistor	2SC945 (Q, P, K)
Q6	Transistor	2SC945P
Q7	Transistor	2SC945P
Q8	Transistor	2SC945 (Q, P, K)
Q9	Transistor	2SC945P
Q10	Transistor	2SC945P
Q11	Transistor	2SA1015
Q12	FET	3SK74M
Q13	Transistor	2SA1015
Q14	Transistor	2SC945P (K)
Q15	Transistor	2SC945P (K)
Q16	Transistor	2SC945P
Q17	FET	3SK74K
Q18	FET	3SK74M
Q19	Transistor	2SC1645B
Q20	Transistor	2SC945P
Q21	Transistor	2SC945P
Q22	Transistor	2SC945 (Q, P, K)
Q23	Transistor	2SC945P
Q24	Transistor	2SC945P
Q25	Transistor	2SC945P
Q26	Transistor	2SC945 (Q, P, K)
Q27	Transistor	2SC945 (Q, P, K)
Q28	Transistor	2SC945P
Q29	Transistor	2SC945 (Q, P, K)
Q30	Transistor	2SC945 (Q, P, K)
Q31	Transistor	2SC945 (Q, P, K)
D1	Diode	1SS53
D2	Diode	1SS53
D3	Varactor Diode	1S2688-ES
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

[MAIN] UNIT

REF. NO.	DESCRIPTION	PART NO.
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	1N60
D29	Diode	1N60
D30	Diode	1SS53
D31	Diode	1SS53
D32	Diode	1SS53
D33	Diode	1N60
D34	Diode	1N60
D35	Zener Diode	WZ036
D36	Diode	1SS53
D37	Diode	1SS53
D39	Diode	1N60
D40	Diode	1N60
D41	Diode	1SS53
D42	Diode	1SS53
D43	Diode	1SS53
D44	Diode	1SS53
D45	Diode	1SS53
D46	Diode	1N60
D47	Diode	1SS97
D48	Diode	1SS53
D49	Diode	1SS53
D50	Diode	1SS53
D51	Diode	1SS53
D52	Diode	1SS53
D53	Diode	1SS53
D54	Diode	1SS53
D55	Diode	1SS53
D56	Diode	1SS53
D57	Diode	1SS53
F11	MC Filter	10M24D4
F12	Ceramic Filter	CFW-455E
X1	Crystal	10.750MHz HC-18/u
X2	Crystal	10.7515MHz HC-18/u
X3	Crystal	10.295MHz HC-43/u
L1	Coil	LS-80
L2	Choke Coil	100 LB-4
L3	Choke Coil	100 LB-4
L4	Choke Coil	100 LB-4
L5	Coil	LS-66A
L6	Coil	LS-66A
L8	Coil	LS-149A
L9	Coil	LS-150A
L10	Coil	LS-97
L11	Coil	LS-66A
L12	Coil	LS-66A
L13	Coil	LS-66A
L14	Coil	LS-66A
L15	Coil	LS-110A
L16	Coil	LS-151
L17	Coil	LS-121A
L18	Choke Coil	LW-15

[MAIN] UNIT

REF. NO.	DESCRIPTION	PART NO.
L19	Coil	LS-121
L20	Choke Coil	LW-12
J1	Connector	5045-10A
J2	Connector	5045-06A
J3	Connector	5045-10A
J4	Connector	5045-04A
J5	Connector	5045-06A
J6	Connector	5045-04A
J7	Connector	5045-02A
J8	Connector	5041-04A
J9	Connector	PI 051-02M
P1	Connector	5250-02
B1	PC Board	B-454B (or C)
R1	Resistor	1K ELR25
R2	Resistor	6.8K ELR25
R3	Resistor	100 ELR25
R4	Resistor	4.7K ELR25
R5	Resistor	1.5K ELR25
R6	Resistor	47 ELR25
R7	Resistor	1K ELR25
R8	Resistor	4.7K ELR25
R9	Resistor	4.7K ELR25
R10	Resistor	3.9K ELR25
R11	Resistor	2.2K ELR25
R12	Resistor	150K ELR25
R13	Resistor	15K R25
R14	Resistor	1K ELR25
R15	Resistor	10K R25
R16	Resistor	820 ELR25
R17	Resistor	12K ELR25
R18	Resistor	22K ELR25
R19	Resistor	560K ELR25
R20	Trimmer	1K H0651A
R21	Resistor	470 ELR25
R22	Resistor	10K ELR25
R23	Resistor	47K R25
R24	Resistor	22K R25
R25	Resistor	5.6K R25
R26	Resistor	5.6K ELR25
R27	Resistor	5.6K ELR25
R28	Resistor	47 ELR25
R29	Resistor	1K ELR25
R31	Trimmer	470 H0651A
R32	Resistor	2.2K R25
R33	Resistor	470K ELR25
R34	Resistor	4.7K ELR25
R35	Resistor	33K ELR25
R36	Resistor	47K ELR25
R37	Thermistor	23D29
R38	Resistor	10K ELR25
R39	Resistor	2.2K ELR25
R40	Resistor	22K ELR25
R41	Resistor	22K ELR25
R42	Resistor	27K ELR25
R43	Resistor	1K ELR25
R44	Resistor	470 ELR25
R45	Resistor	1K R25
R46	Resistor	4.7K ELR25
R47	Resistor	2.2K ELR10
R48	Resistor	10K ELR25

[MAIN] UNIT

REF. NO.	DESCRIPTION	PART NO.
R49	Resistor	100K ELR25
R50	Resistor	100K ELR25
R51	Resistor	100K ELR10
R52	Resistor	1K ELR25
R53	Resistor	470 ELR25
R54	Resistor	100 ELR25
R55	Resistor	100 ELR25
R56	Resistor	2.2K ELR25
R57	Resistor	1K ELR25
R58	Resistor	470 ELR25
R59	Resistor	1K ELR25
R60	Resistor	1K ELR25
R61	Resistor	1K ELR25
R63	Resistor	6.8 ELR25
R64	Resistor	1K ELR25
R65	Resistor	10K ELR25
R66	Resistor	4.7K ELR25
R67	Trimmer	4.7K H0651A
R68	Resistor	10K ELR25
R69	Resistor	10K ELR25
R70	Resistor	100 ELR25
R71	Resistor	2.2K ELR25
R72	Resistor	1K ELR25
R73	Resistor	10K R25
R74	Resistor	47 ELR25
R75	Trimmer	100K H0651A
R76	Trimmer	10K H0651A
R77	Resistor	100K ELR25
R78	Resistor	10K ELR25
R79	Resistor	3.3K ELR25
R80	Trimmer	1K H0651A
R81	Resistor	10K ELR25
R82	Resistor	2.2K ELR25
R83	Resistor	3.9K ELR25
R84	Resistor	100 R25
R85	Resistor	1K ELR25
R86	Resistor	10K ELR25
R87	Resistor	2.2K ELR25
R88	Resistor	4.7K ELR25
R89	Resistor	4.7K ELR25
R90	Resistor	470 ELR25
R91	Resistor	330 ELR25
R92	Resistor	100 ELR10
R93	Resistor	4.7K ELR25
R94	Resistor	1K ELR25
R95	Resistor	150 ELR25
R96	Resistor	4.7K ELR25
R97	Resistor	100 ELR25
R98	Resistor	22K ELR25
R99	Resistor	150 ELR25
R100	Resistor	1K ELR25
R101	Resistor	2.2K ELR25
R102	Resistor	2.2K ELR25
R103	Resistor	100 ELR25
R104	Resistor	10K ELR25
R105	Resistor	100 ELR25
R106	Resistor	220 ELR25
R107	Resistor	100K ELR25
R108	Resistor	2.2K ELR25
R109	Resistor	1K ELR25
R110	Resistor	10K ELR10
R111	Resistor	100K ELR25
R112	Resistor	1M ELR25
R113	Resistor	3.3M ELR25

[MIAN] UNIT

REF. NO.	DESCRIPTION	PART NO.	
R114	Resistor	10K	ELR25
R115	Resistor	10K	ELR25
R116	Resistor	1K	ELR25
R117	Resistor	330	ELR25
R118	Resistor	100K	ELR25
R119	Resistor	470	ELR25
R120	Resistor	100	ELR25
R121	Resistor	680	ELR25
R122	Resistor	15K	ELR25
R123	Resistor	4.7K	ELR25
R124	Resistor	47	ELR25
R125	Resistor	10K	ELR25
R126	Resistor	220	ELR25
R127	Resistor	1K	R25
R128	Resistor	10K	ELR25
R129	Resistor	2.2K	ELR25
R130	Resistor	47	ELR25
R131	Resistor	330	ELR25
R132	Resistor	10K	R25
R133	Resistor	1K	ELR25
R134	Resistor	22K	ELR25
R135	Resistor	10K	ELR25
R136	Resistor	22	ELR25
R137	Resistor	47K	ELR25
R141	Resistor	100	R25
R142	Trimmer	470	H0651A
R143	Resistor	10K	ELR25
R144	Resistor	330K	ELR25
R145	Trimmer	47K	H0651A
R146	Resistor	4.7K	ELR25
R147	Resistor	10K	ELR25
R148	Resistor	220K	ELR25
R149	Resistor	1K	ELR25
R150	Resistor	10K	ELR25
R151	Trimmer	1K	H0651A
R152	Trimmer	47K	H0651A
R153	Trimmer	47K	H0651A
R154	Trimmer	4.7K	H0651A
R155	Resistor	33K	ELR25
R156	Resistor	470K	ELR25
R157	Resistor	20K	ELR25
R158	Resistor	47K	ELR25
R159	Resistor	47K	ELR25
R160	Resistor	47K	ELR25
R161	Resistor	22K	ELR25
R162	Resistor	1M	ELR25
R163	Resistor	10K	ELR25
R164	Resistor	47K	ELR25
R165	Resistor	47K	ELR25
R166	Resistor	15K	R25
R167	Resistor	2.2K	ELR25
R168	Resistor	2.2K	ELR25
R169	Resistor	100K	ELR25
R170	Resistor	100K	ELR25
R171	Resistor	1K	ELR25
R173	Resistor	47K	ELR25
R174	Resistor	22K	ELR25
R175	Resistor	4.7K	ELR25
R176	Resistor	4.7K	ELR25
R177	Resistor	4.7K	ELR25
R178	Resistor	22K	ELR25
R179	Resistor	330	ELR10
R180	Trimmer	1K	H0651A
R181	Resistor	33K	ELR25

[MAIN] UNIT

REF. NO.	DESCRIPTION	PART NO.	
R183	Resistor	220	ELR25
R184	Resistor	4.7	ELR25
R185	Resistor	470	ELR25
R186	Resistor	150K	ELR25
R187	Resistor	3.3K	ELR25
R188	Resistor	1K	ELR25
R189	Resistor	39K	ELR25
R190	Resistor	120K	R25
R191	Resistor	3.3K	ELR25
R192	Resistor	330	ELR25
R193	Trimmer	33K	H0651A
R194	Resistor	2.2K	ELR25
R195	Resistor	33K	ELR25
R196	Resistor	2.2K	ELR25
R197	Resistor	1K	ELR25
R198	Resistor	10K	ELR25
R199	Resistor	470K	ELR25
R200	Resistor	1.8M	ELR25
R201	Resistor	470K	ELR25
R202	Resistor	470K	ELR25
R203	Resistor	1.8M	ELR25
R204	Resistor	1.8M	ELR25
R205	Trimmer	100K	H0651A
R206	Resistor	22K	ELR25
R207	Resistor	10K	ELR25
R208	Resistor	2.2K	ELR25
R209	Resistor	2.2K	ELR25
R210	Resistor	10K	ELR25
R211	Resistor	47K	ELR25
R212	Resistor	47K	ELR25
R213	Resistor	2.2K	ELR25
R214	Resistor	4.7K	ELR25
R215	Resistor	47K	ELR25
R216	Trimmer	100K	H0651A
R217	Thermistor	33D28	
R218	Resistor	1K	R25
R219	Resistor	1K	R25
R220	Resistor	1K	ELR25
R222	Resistor	47	ELR25
R225	Resistor	22	R50
R226	Resistor	22	R50
R227	Resistor	120K	R25
R228	Resistor	100K	ELR25
R229	Resistor	4.7K	ELR25
R230	Resistor	4.7K	ELR25
R231	Resistor	4.7K	ELR25
R232	Resistor	4.7K	ELR10
R233	Resistor	10K	ELR25
C1	Electrolytic	1 (BP)	50V
C2	Barrier Lay	0.1	25V
C3	Electrolytic	10	16V
C4	Electrolytic	47	10V
C5	Electrolytic	0.47	50V
C6	Ceramic	0.0047	50V
C7	Ceramic	0.0022	50V
C8	Ceramic	220P	50V
C9	Electrolytic	10	16V
C10	Electrolytic	0.47	50V
C11	Mylar	0.01	50V
C12	Mylar	0.01	50V
C13	Mylar	0.0022	50V
C14	Ceramic	100P	50V
C15	Electrolytic	10	16V

[MAIN] UNIT

REF. NO.	DESCRIPTION	PART NO.	
C16	Barrier Lay	0.1	25V
C17	Mylar	0.001	50V
C18	Ceramic	0.0047	50V
C19	Ceramic	0.0047	50V
C20	Ceramic	5P (CH)	50V
C21	Ceramic	100P (YL)	50V
C22	Ceramic	200P(XL)	50V
C23	Ceramic	0.001	50V
C24	Ceramic	0.0047	50V
C25	Ceramic	0.0047	50V
C26	Ceramic	0.0047	50V
C27	Ceramic	0.0047	50V
C28	Ceramic	47P	50V
C29	Electrolytic	3.3	50V
C30	Ceramic	0.001	50V
C31	Barrier Lay	0.047	25V
C32	Barrier Lay	0.047	25V
C33	Barrier Lay	0.047	25V
C34	Ceramic	100P	50V
C35	Ceramic	0.0047	50V
C36	Ceramic	220P	50V
C37	Electrolytic	10	16V
C38	Barrier Lay	0.047	25V
C39	Barrier Lay	0.047	25V
C40	Barrier Lay	0.047	25V
C41	Barrier Lay	0.047	25V
C42	Trimmer	CV05E3001	30P
C43	Dip Mica	30P	50V
C44	Ceramic	150P (XL)	50V
C45	Dip Mica	150P	50V
C46	Barrier Lay	0.1	25V
C47	Barrier Lay	0.047	25V
C48	Ceramic	47P	50V
C49	Electrolytic	0.47	50V
C50	Ceramic	10P	50V
C51	Ceramic	0.001	50V
C52	Electrolytic	4.7	50V
C53	Barrier Lay	0.047	25V
C54	Ceramic	100P	50V
C55	Mylar	0.001	50V
C56	Barrier Lay	0.1	25V
C57	Barrier Lay	0.047	25V
C58	Ceramic	0.001	50V
C59	Ceramic	0.0047	50V
C60	Ceramic	15P	50V
C61	Ceramic	15P	50V
C62	Ceramic	0.001	50V
C63	Ceramic	0.0047	50V
C64	Ceramic	470P	50V
C65	Ceramic	330P	50V
C66	Ceramic	0.001	50V
C67	Ceramic	47P	50V
C68	Ceramic	220P	50V
C69	Ceramic	5P	50V
C70	Ceramic	0.0047	50V
C71	Ceramic	68P	50V
C72	Ceramic	0.001	50V
C73	Ceramic	0.0047	50V
C74	Barrier Lay	0.047	25V
C75	Mylar	0.033	50V
C76	Barrier Lay	0.047	25V
C77	Electrolytic	10	16V
C78	Barrier Lay	0.1	25V
C79	Barrier Lay	0.047	25V

[MAIN] UNIT

REF. NO.	DESCRIPTION	PART NO.	
C80	Barrier Lay	0.047	25V
C81	Barrier Lay	0.047	25V
C82	Electrolytic	22	16V
C83	Barrier Lay	0.047	25V
C84	Barrier Lay	0.1	25V
C85	Ceramic	0.0047	50V
C86	Ceramic	100P	50V
C87	Electrolytic	1	50V
C88	Barrier Lay	0.047	25V
C89	Ceramic	0.0047	50V
C91	Electrolytic	4.7	50V
C92	Electrolytic	0.1	50V RC2
C93	Barrier Lay	0.047	25V
C94	Ceramic	470P	50V
C95	Electrolytic	10	16V
C96	Ceramic	0.0047	50V
C97	Ceramic	47P	50V
C98	Barrier Lay	0.047	25V
C99	Barrier Lay	0.047	25V
C100	Ceramic	47P	50V
C101	Ceramic	33P	50V
C102	Barrier Lay	0.047	25V
C103	Barrier Lay	0.047	25V
C104	Ceramic	0.001	50V
C105	Ceramic	47P	50V
C106	Barrier Lay	0.047	25V
C107	Barrier Lay	0.047	25V
C108	Barrier Lay	0.047	25V
C109	Barrier Lay	0.047	25V
C110	Barrier Lay	0.047	25V
C111	Mylar	0.022	50V
C112	Barrier Lay	0.1	25V
C113	Barrier Lay	0.1	25V
C114	Ceramic	0.0047	50V
C115	Barrier Lay	0.047	25V
C116	Ceramic	10P	50V
C117	Barrier Lay	0.1	25V
C118	Barrier Lay	0.047	25V
C119	Barrier Lay	0.047	25V
C120	Ceramic	0.001	50V
C121	Ceramic	0.0047	50V
C122	Barrier Lay	0.1	25V
C123	Electrolytic	2.2	25V
C124	Electrolytic	10	16V
C126	Ceramic	220P	50V
C127	Ceramic	220P	50V
C128	Ceramic	0.001	50V
C129	Ceramic	220P	50V
C130	Barrier Lay	0.1	25V
C131	Ceramic	0.0047	50V
C132	Ceramic	0.0047	50V
C133	Ceramic	0.0047	50V
C134	Electrolytic	470	16V
C135	Electrolytic	4.7	50V
C136	Electrolytic	2.2	50V
C137	Ceramic	0.001	50V
C138	Electrolytic	22	16V
C139	Electrolytic	0.47	50V
C140	Electrolytic	10	16V
C141	Mylar	0.022	50V
C142	Mylar	0.022	50V
C143	Mylar	0.022	50V
C144	Electrolytic	10	16V
C145	Ceramic	0.001	50V

[MAIN] UNIT

REF. NO.	DESCRIPTION	PART NO.	
C146	Barrier Lay	0.1	25V
C147	Electrolytic	470	16V
C148	Electrolytic	220	10V
C149	Electrolytic	100	10V
C150	Ceramic	0.0047	50V
C151	Barrier Lay	0.1	25V
C152	Electrolytic	0.47	50V RC2
C153	Electrolytic	220	10V
C154	Electrolytic	0.47	50V
C155	Electrolytic	10	16V
C156	Barrier Lay	0.047	25V
C157	Electrolytic	4.7	50V
C158	Barrier Lay	0.047	25V
C159	Barrier Lay	0.047	25V
C160	Barrier Lay	0.1	25V
C161	Ceramic	470P	50V
C162	Electrolytic	0.47	50V
C163	Electrolytic	470	16V
C164	Ceramic	0.001	50V
C165	Ceramic	0.001	50V
C166	Ceramic	470P	50V
C167	Ceramic	0.001	50V
C168	Electrolytic	2.2	50V
C169	Deleted		
C170	Ceramic	22P	50V
C171	Ceramic	0.0047	50V
C172	Ceramic	0.0047	50V
C173	Ceramic	0.0047	50V
C174	Ceramic	120P (SH)	50V
C175	Ceramic	10P	50V
C176	Barrier Lay	0.1	25V
C177	Barrier Lay	0.1	25V
C178	Dip Mica	200P	50V
C179	Ceramic	82P (CH)	50V
C180	Electrolytic	4.7	50V
C181	Electrolytic	2.2	50V
C182	Ceramic	0.0047	50V
C183	Ceramic	5P	50V
C184	Ceramic	10P	50V
C185	Electrolytic	2000	16V TT (MS)
C186	Ceramic	0.0047	50V
C187	Ceramic	0.0047	50V
C188	Barrier Lay	0.1	25V
C189	Barrier Lay	0.1	25V
C190	Ceramic	100P	50V
C191	Barrier Lay	0.047	25V
C193	Ceramic	0.0022	50V
C194	Electrolytic	4.7	10V
C195	Ceramic	47P	50V
C196	Barrier Lay	0.047	25V

[PLL] UNIT

REF. NO.	DESCRIPTION	PART NO.	
IC1	IC	TC-9123P	
IC2	DC-DC Converter	DP-1	
Q1	Transistor	2SC383TM	
Q2	Transistor	2SC763C	
Q3	Transistor	2SC763C	
Q4	Transistor	2SC763C	
Q5	FET	3SK74M	
Q6	Transistor	2SC763C	
Q7	Transistor	2SC763C	
Q8	Transistor	2SC763C	
Q9	FET	2SK125	
D1	Zener Diode	XZ086	
D2	Varactor Diode	1T25	
D3	Varactor Diode	1T25	
D4	Zener Diode	XZ068	
D5	Diode	1S953	
D6	Diode	1S953	
D7	Varactor Diode	1SV50	
D8	Zener Diode	XZ072	
D9	Diode	1SS53	
D10	Diode	1SS53	
X1	Crystal	14.2422 MHz HC-43/u	
X2	Crystal	5.120 MHz HC-43/u	
C1	Ceramic	0.0047	50V
C2	Ceramic	0.0047	50V
C3	Ceramic	0.0047	50V
C4	Barrier Lay	0.1	25V
C5	Ceramic	820P	50V
C6	Electrolytic	10	10V
C7	Electrolytic	10	10V
C8	Ceramic	220P	50V
C9	Ceramic	220P	50V
C10	Ceramic	220P	50V
C11	Ceramic	0.0047	50V
C12	Ceramic	22P (UJ)	50V
C13	Ceramic	0.0047	50V
C14	Ceramic	10P (SL)	50V
C15	Ceramic	0.0047	50V
C16	Ceramic	6P (SL)	50V
C17	Ceramic	0.5P	50V
C18	Ceramic	0.0047	50V
C19	Ceramic	10P (SL)	50V
C20	Electrolytic	100	10V
C21	Barrier Lay	0.1	12V
C22	Electrolytic	22	10V
C23	Ceramic	0.0047	50V
C24	Ceramic	0.0047	50V
C25	Electrolytic	100	10V
C26	Barrier Lay	0.1	12V
C27	Ceramic	0.0047	50V
C28	Ceramic	0.0047	50V
C29	Ceramic	0.0047	50V
C30	Ceramic	33P (SL)	50V
C31	Ceramic	33P (SL)	50V
C32	Ceramic	0.0047	50V
C33	Ceramic	470P	50V
C34	Ceramic	220P	50V
C35	Electrolytic	470	10V
C36	Ceramic	3P (SL)	50V

[PLL] UNIT

REF. NO.	DESCRIPTION	PART NO.	
C37	Ceramic	3P (SL)	50V
C38	Ceramic	220P	50V
C39	Ceramic	0.0047	50V
C40	Electrolytic	100	10V
C41	Ceramic	47P (SL)	50V
C42	Ceramic	220P	50V
C45	Ceramic	8P (SL)	50V
C46	Ceramic	1P (SL)	50V
C47	Ceramic	15P (SL)	50V
C48	Ceramic	3P (SL)	50V
C49	Ceramic	5P (CH)	50V
C50	Ceramic	30P (XL)	50V
C51	Ceramic	0.0022	50V
C52	Ceramic	470P	50V
C53	Electrolytic	470	10V
C55	Tantalum	1	35V
C56	Barrier Lay	0.1	12V
C57	Trimmer	30P	
C58	Dip Mica	33P	
C59	Dip Mica	22P	
C60	Electrolytic	47	10V
C61	Barrier Lay	0.1	12V
C63	Electrolytic	47	10V
C64	Barrier Lay	0.1	12V
C65	Electrolytic	10	10V
C66	Barrier Lay	0.1	12V
C67	Electrolytic	100	10V
C68	Ceramic	0.0047	50V
C69	Ceramic	470P	50V
C70	Electrolytic	220	10V
C72	Electrolytic	100	10V
C73	Ceramic	0.0047	50V
C74	Ceramic	0.0047	50V
C75	Barrier Lay	0.1	25V
C76	Barrier Lay	0.1	25V
L1	Coil	LS-109	
L2	Coil	LS-178	
L3	Coil	LS-145	
L4	Coil	LS-145	
L5	Choke Coil	EL0810SK1 (5R6-K)	
L6	Choke Coil	EL0810SK1 (102K)	
L7	Choke Coil	EL0810SK1 (101K)	
L8	Coil	LS-145	
L9	Choke Coil	LW-19	
L10	Choke Coil	LW-19	
L11	Choke Coil	LW-19	
L12	Coil	LB-73	
L13	Choke Coil	EL0810SK1 (100K)	
L14	Choke Coil	EL0810SK1 (100K)	
L15	Choke Coil	EL0810SK1 (100K)	
R1	Resistor	1K	ELR25
R2	Trimmer	4.7K	(H06510)
R3	Resistor	4.7K	ELR25
R5	Resistor	5.6K	ELR25
R6	Resistor	10K	ELR25
R7	Resistor	100K	ELR25
R8	Resistor	33K	ELR25
R9	Resistor	100K	ELR25
R10	Resistor	220	ELR25
R12	Jumper	JPW-02-H	
R13	Resistor	10K	ELR25
R14	Resistor	22K	ELR25

[PLL] UNIT

REF. NO.	DESCRIPTION	PART NO.	
R15	Resistor	220	ELR25
R16	Resistor	1K	ELR25
R17	Trimmer	100K	(H06510)
R18	Resistor	33K	ELR25
R19	Resistor	10K	ELR25
R20	Resistor	2.2K	ELR25
R21	Thermistor	33D28	
R22	Resistor	22K	ELR25
R23	Resistor	3.9K	ELR25
R24	Resistor	6.8K	ELR25
R25	Resistor	220	ELR25
R26	Resistor	4.7K	ELR25
R27	Resistor	220	ELR25
R28	Resistor	1K	ELR25
R29	Resistor	22K	ELR25
R30	Resistor	220	ELR25
R31	Resistor	560	R25
R32	Resistor	470	ELR25
R33	Resistor	68K	ELR25
R34	Resistor	220	ELR25
R35	Resistor	1.2K	ELR25
R36	Resistor	270	ELR25
R37	Resistor	1K	ELR25
R39	Resistor	470	ELR25
R40	Resistor	22K	ELR25
R41	Resistor	220	ELR25
R42	Resistor	5.6K	ELR25
R43	Resistor	220	ELR25
R44	Resistor	47	R25
R45	Resistor	5.6K	ELR25
R46	Resistor	33	ELR25
R47	Resistor	1.2K	ELR25
R48	Resistor	100	ELR25
R49	Resistor	1.2K	ELR25
R50	Resistor	5.6K	ELR25
R51	Resistor	330	ELR25
R52	Resistor	100	ELR25
R53	Resistor	100	R25
R54	Resistor	100	ELR25
R55	Resistor	2.2K	ELR25
R56	Resistor	470	ELR25
R57	Resistor	15K	ELR25
R58	Resistor	2.2K	R25
R59	Resistor	1K	ELR25
R60	Resistor	47	ELR25
R61	Jumper	JPW-02A	
R62	Jumper	JPW-02A	
R63	Jumper	JPW-02A	
R64	Resistor	10K	ELR25
R65	Jumper	JPW-02H	
R67	Jumper	JPW-02A	
R68	Jumper	JPW-02H	
R70	Resistor	47K	R25
R71	Resistor	1K	ELR10
B1	PC. Board	B-505C	
P1	Connector	5250-02	

[LOGIC] UNIT

REF. NO.	DESCRIPTION	PART NO.	
IC1	IC	4069UBP	
IC2	IC	4081	
IC3	IC	4001UBP	
IC4	IC	4028	
IC5	IC	4511	
IC6	IC	μPD-650-108	
IC7	IC	M54516	
IC8	IC	MN1201A	
Q1	Transistor	2SA1015-Y	
Q3	Transistor	2SC945 (Q, P, K)	
Q4	Transistor	2SC945 (Q, P, K)	
Q5	Transistor	2SC945 (Q, P, K)	
Q6	Transistor	2SC945 (Q, P, K)	
Q7	Transistor	2SD468 (B, C)	
Q8	Transistor	2SC945 (Q, P, K)	
Q9	Transistor	2SC945 (Q, P, K)	
Q10	Transistor	2SC945 (Q, P, K)	
D1	Diode	1SS53	
D2	Diode	1SS53	
D3	Diode	1SS53	
D4	Diode	1SS53	
D5	Diode	1SS53	
D7	Diode	1SS53	
D8	Diode	1SS53	
D9	Diode	1SS53	
D10	Diode	1SS53	
D12	Diode	1SS53	
D13	Diode	1SS53	
D14	Diode	1SS53	
D15	Diode	1SS53 (IC-290A/H only)	
D16	Diode	1SS53 (IC-290E only)	
D17	Diode	1SS53	
D19	Diode	1SS53	
D20	Diode	1SS53 (IC-290A/H only)	
D21	Diode	1SS53	
D22	Diode	1SS53 (IC-290E only)	
D23	Diode	1SS53 (IC-290A/H only)	
D24	Diode	1SS53	
D25	Diode	1SS53	
D26	Diode	1SS53	
D27	Zener Diode	YZ030	
D28	Diode	1SS53	
D29	Zener Diode	XZ055	
D30	Diode	1SS53	
D31	Diode	1SS53	
D32	Diode	1SS53 (IC-290E only)	
D33	Diode	WZ046	
X1	Ceralock	CSB400B	
C1	Electrolytic	4.7 BP	25V
C2	Ceramic	100P	50V
C3	Ceramic	100P	50V
C4	Barrier Lay	0.1	25V
C5	Electrolytic	1	50V RC2
C6	Electrolytic	10	16V
C7	Electrolytic	470	6.3V
C8	Ceramic	100P	50V
C9	Electrolytic	1000	6.3V
C10	Electrolytic	10	16V
C11	Electrolytic	4.7	50V RC2
C12	Electrolytic	3.3	25V RC2 (IC-290E only)

[LOGIC] UNIT

REF. NO.	DESCRIPTION	PART NO.	
C13	Barrier Lay	820P	12V
R1	Resistor	330K	ELR25
R2	Resistor	1M	ELR25
R3	Resistor	47K	ELR25
R4	Resistor	10K	ELR25
R5	Resistor	47K	ELR25
R6	Resistor	4.7K	ELR25
R7	Resistor	47K	ELR25
R8	Resistor	1.2K	ELR25
R9	Resistor	47K	ELR25
R10	Resistor	1M	ELR25
R11	Resistor	47K	ELR25
R12	Resistor	4.7K	R25
R13	Resistor	4.7K	R25
R15	Resistor	18K	ELR25
R16	Resistor	82K	ELR25
R17	Resistor	330K	R25
R18	Resistor	4.7K	ELR25
R19	Resistor	4.7K	ELR25
R20	Resistor	22K	ELR25
R21	Resistor	1.8M	ELM25
R22	Resistor	1M	ELR25
R23	Resistor	22K	ELR25
R24	Resistor	22K	ELR25
R25	Resistor	1M	ELR25
R26	Resistor	47K	ELR25
R27	Resistor	5.6K	ELR25
R28	Resistor	4.7K	ELR25
R29	Resistor	4.7K	ELR25
R30	Resistor	1K	ELR25
R31	Resistor	1K	ELR25
R32	Resistor	47	ELR25 (IC-290A/E) 22 ELR25 (IC-290H)
R33	Resistor	47	ELR25 (IC-290A/E) 22 ELR25 (IC-290H)
R34	Resistor	47	ELR25 (IC-290A/E) 22 ELR25 (IC-290H)
R35	Resistor	47	ELR25 (IC-290A/E) 22 ELR25 (IC-290H)
R36	Resistor	47	ELR25 (IC-290A/E) 22 ELR25 (IC-290H)
R37	Resistor	47	ELR25 (IC-290A/E) 22 ELR25 (IC-290H)
R38	Resistor	47	ELR25 (IC-290A/E) 22 ELR25 (IC-290H)
R39	Resistor	10K	ELR25
R40	Resistor	22K	ELR25
R41	Resistor	47K	ELR25
R42	Array	RM6 47K	
R43	Resistor	480K	CRA1/8
R44	Resistor	100K	CRA1/8
R45	Resistor	200K	CRA1/8
R46	Resistor	400K	CRA1/8
R47	Resistor	800K	CRB1/4FX
R48	Resistor	100K	CRA1/8
R49	Resistor	200K	CRA1/8
R50	Resistor	400K	CRA1/8
R51	Resistor	800K	CRB1/4FX
R52	Resistor	220	R25
R53	Jumper	JPW02H	
R54	Jumper	JPW02A	
R55	Jumper	JPW02H	
R57	Jumper	JPW02A	

[LOGIC] UNIT

REF. NO.	DESCRIPTION	PART NO.
R60	Jumper	JPW02H
R61	Jumper	JPW02H
R62	Jumper	JPW02H
R64	Jumper	JPW02A
R65	Jumper	JPW02H
R66	Jumper	JPW02H
R67	Jumper	JPW02A
R68	Jumper	JPW02H
R69	Resistor	15K ELR25
R70	Resistor	1K ELR25
R71	Resistor	1K ELR25
R72	Resistor	1K ELR25
R73	Resistor	1K ELR10
R74	Resistor	1K ELR10
R75	Jumper	JPW02A
R76	Resistor	3.3K ELR10
R77	Resistor	47K R25
R78	Resistor	47K R25
J1	Connector	5045-10A
J2	Connector	5045-08A
J3	Connector	5045-08A
J4	Connector	5045-04A
J5	Connector	3022-08A
J6	Connector	3022-06A
J7	Connector	5045-02A
J8	Connector	5045-04A
J9	Connector	3022-04A
J10	Connector	3022-08A
J11	Connector	3022-04A
J12	Connector	3022-04A
J13	Connector	3022-04A
J14	Connector	3022-04A
J15	Connector	PI051-02M

[PA] UNIT

REF. NO.	DESCRIPTION	PART NO.
IC1	IC	SC-1013 (IC-290A/E) SC-1020 (IC-290H)
D1	Diode	MI402
D2	Diode	MI402
D3	Diode	1SS97
D4	Diode	15CD11
D5	Diode	GP08B
D6	Diode	GP08B
L1	Coil	LA-76
L2	Coil	LA-9
L3	Coil	LA-71
L4	Coil	LA-2
L5	Coil	LW-10
R1	Resistor	1.5K R25
R2	Resistor	220 ELR25
R3	Resistor	47K ELR25
R4	Resistor	0.3 RGB2 (IC-290A/E) 0.15 RGB3 (IC-290H)
R5	Resistor	220 R25
R6	Resistor	4.7K R25
P1	Connector	5251-06
P4	Connector	3021-02
P5	Connector	5250-04
P6	Connector	5250-04
J1	Connector	1490-4P
J2	Connector	FM-MDFMI
J3	Socket	MS049
J4	Connector	SJ-296
J5	Connector	SJ-296
C1	Ceramic	15P 500V
C2	Ceramic	33P 500V
C3	Ceramic	2P 500V
C4	Ceramic	33P 500V
C5	Ceramic	3P 500V
C6	Ceramic	39P 500V
C7	Ceramic	0.001 500V
C8	Ceramic	15P 50V
C9	Ceramic	150P 50V
C10	Ceramic	0.0047 50V
C11	Ceramic	0.5P 500V
C12	Ceramic	0.0047 50V
C13	Ceramic	220P 50V
C14	Barrier Lay	0.1 25V
C15	Electrolytic	22 16V
C16	Ceramic	220P 50V
C17	Barrier Lay	0.1 25V
C18	Ceramic	220P 50V
C19	Ceramic	0.0047 50V
C20	Ceramic	0.0047 50V
C21	Ceramic	0.001 50V
C22	Ceramic	0.001 50V
C23	Ceramic	0.001 50V
C24	Barrier Lay	0.1 25V
	Terminal	TM201
B1	PC. Board	B-452A

[SENSOR] UNIT (OLD TYPE)

REF. NO.	DESCRIPTION	PART NO.
S1	Switch	SSS012
S2	Switch	SSS012
S3	Switch	SSS022
Q3	Transistor	2SC1645-B
Q4	Transistor	2SC945 (Q, P, K)
Q6	Transistor	2SA1015-Y
Q7	Transistor	2SC945 (Q, P, K)
Q8	Transistor	2SC945 (Q, P, K)
Q10	Transistor	2SA1015Y
J1	Connector	3094-10A
J2	Connector	3024-04CH
J3	Connector	3024-04CH
J4	Connector	3024-04CH
J5	Connector	3024-04CH
J6	Connector	3024-04CH
J7	Connector	3024-04CH
IC1	IC	MB14328
IC2	IC	4011 UPB
IC3	IC	4001 UPB
D1	Diode	1SS53
D2	Diode	1SS53
D3	Diode	1SS53
D4	Diode	1SS53
D5	Diode	1SS53
D6	Diode	1SS53
D8	Diode	1SS53
D9	Diode	1SS53
D10	Diode	1SS53
D12	Diode	1SS53
D13	Diode	1SS53
D14	Diode	1SS53
D15	Diode	1SS53
D17	Diode	1SS53
D19	Diode	1SS53
D21	Diode	1SS53
C1	Electrolytic	3.3 50V RC2
C3	Barrier Lay	0.1 25V
C4	Electrolytic	2.2 50V RC2
C5	Electrolytic	4.7 50V RC2
C6	Ceramic	0.001 50V
C7	Ceramic	0.001 50V
C8	Ceramic	0.0022 50V
C9	Barrier Lay	0.1 25V
C10	Electrolytic	4.7 50V RC2
C11	Electrolytic	10 16V RC2
C12	Electrolytic	3.3 50V RC2
C13	Electrolytic	1 50V RC2
C15	Electrolytic	47 10V
C16	Ceramic	0.001 50V
C17	Electrolytic	100 10V
C18	Electrolytic	47 10V
C19	Electrolytic	1 50V RC2
R1	Resistor	6.8K R25
R2	Resistor	6.8K R25
R3	Resistor	220 R25
R4	Resistor	22K R25
R5	Resistor	100K R25
R6	Resistor	1K R25

[SENSOR] UNIT

REF. NO.	DESCRIPTION	PART NO.
R7	Resistor	1K R25
R8	Resistor	47K R25
R9	Resistor	47K R25
R11	Resistor	100K R25
R12	Resistor	1K R25
R13	Resistor	100 R25
R15	Resistor	100K R25
R17	Resistor	15K R25
R18	Resistor	22K R25
R19	Resistor	100K R25
R20	Resistor	100K R25
R21	Resistor	390K R25
R22	Resistor	1M R25
R23	Resistor	180K R25
R24	Resistor	10K R25
R25	Trimmer	100K-H0651A
R26	Resistor	100K R25
R27	Resistor	150K R25
R28	Resistor	3.3K R25
R29	Resistor	1K R25
R30	Resistor	47K R25
R31	Resistor	220K R25
R32	Trimmer	470K-H0651A
R33	Resistor	220K R25
R34	Resistor	10 R25
R35	Resistor	22K R25
R40	Jumper	0.5φ
R42	Resistor	100 R25
R43	Resistor	220 R25
B1	PC Board	B-506C

[SENSOR] UNIT (NEW TYPE)

REF. NO.	DESCRIPTION	PART NO.
S1	Switch	SSS012
S2	Switch	SSS012
S3	Switch	SSS022
Q3	Transistor	2SC1645-B
Q4	Transistor	2SC945 (Q, P, K)
Q6	Transistor	2SA1015-Y
Q7	Transistor	2SC945 (Q, P, K)
Q8	Transistor	2SC945 (Q, P, K)
Q10	Transistor	2SA1015Y
J1	Connector	3094-10A
J2	Connector	3024-04CH
J3	Connector	3024-08CH
J4	Connector	3024-04CH
J5	Connector	3024-04CH
J6	Connector	3024-04CH
J7	Connector	3024-04CH
IC1	IC	MB14025
IC2	IC	4011 UPB
IC3	IC	4001 UBP
D1	Diode	1SS53
D2	Diode	1SS53
D3	Diode	1SS53
D4	Diode	1SS53
D5	Diode	1SS53
D6	Diode	1SS53
D9	Diode	1SS53
D10	Diode	1SS53
D12	Diode	1S953
D13	Diode	1S953
D14	Diode	1SS53
D15	Diode	1SS53
D17	Diode	1SS53
D18	Diode	1SS53
D19	Diode	1SS53
D21	Diode	1SS53
C1	Electrolytic	3.3 50V RC2
C3	Barrier Lay	0.1 25V
C4	Electrolytic	0.22 50V RC2
C5	Electrolytic	1 50V RC2
C6	Ceramic	0.001 50V
C7	Ceramic	0.001 50V
C8	Ceramic	0.0022 50V
C9	Barrier Lay	0.1 25V
C10	Electrolytic	4.7 50V RC2
C11	Electrolytic	10 16V RC2
C12	Electrolytic	3.3 50V RC2
C13	Electrolytic	1 50V RC2
C14	Electrolytic	1 50V RC2
C15	Electrolytic	47 10V
C16	Ceramic	0.001 50V
C17	Electrolytic	100 10V
C18	Electrolytic	47 10V
C19	Electrolytic	1 50V RC2
R1	Resistor	6.8K R25
R2	Resistor	6.8K R25
R3	Resistor	100 R25
R4	Resistor	22K R25
R5	Resistor	100K R25

[SENSOR] UNIT

REF. NO.	DESCRIPTION	PART NO.
R6	Resistor	1K R25
R7	Resistor	1K R25
R8	Resistor	47K R25
R9	Resistor	47K R25
R11	Resistor	100K R25
R12	Resistor	1K R25
R13	Resistor	100 R25
R15	Resistor	100K R25
R16	Resistor	100K R25
R17	Resistor	15K R25
R19	Resistor	100K R25
R20	Resistor	100K R25
R21	Resistor	390K R25
R22	Resistor	1M R25
R23	Resistor	180K R25
R24	Resistor	10K R25
R25	Trimmer	100K-H0651A
R26	Resistor	100K R25
R27	Resistor	150K R25
R28	Resistor	3.3K R25
R29	Resistor	1K R25
R30	Resistor	47K R25
R31	Resistor	470K R25
R32	Trimmer	470K-H0651A
R33	Resistor	220K R25
R34	Resistor	10 R25
R35	Resistor	22K R25
R36	Resistor	100K R25
R40	Jumper	0.5ø
R42	Resistor	100 R25
R43	Resistor	220 R25
B1	PC Board	B-506D

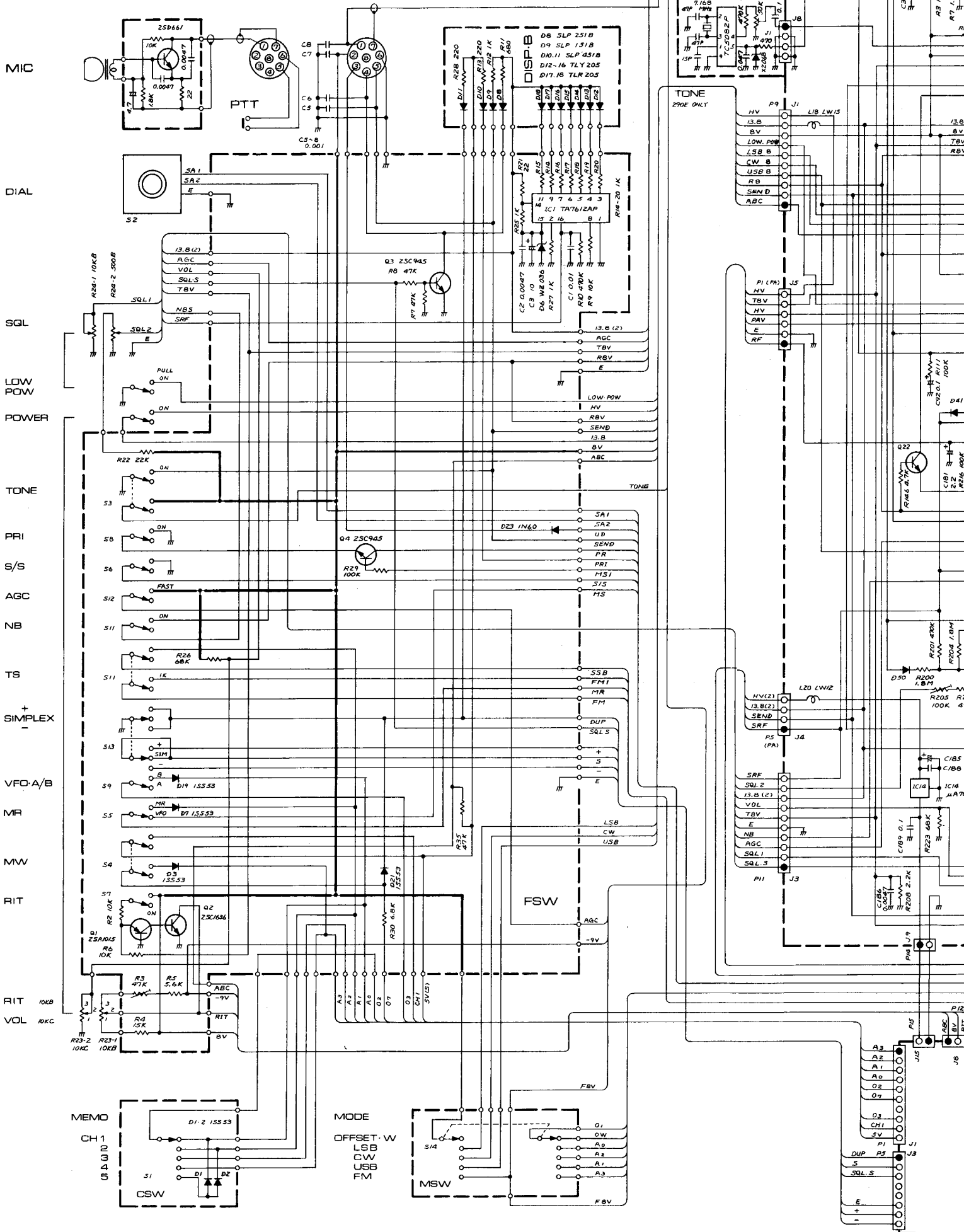
[RF, YGR] UNIT

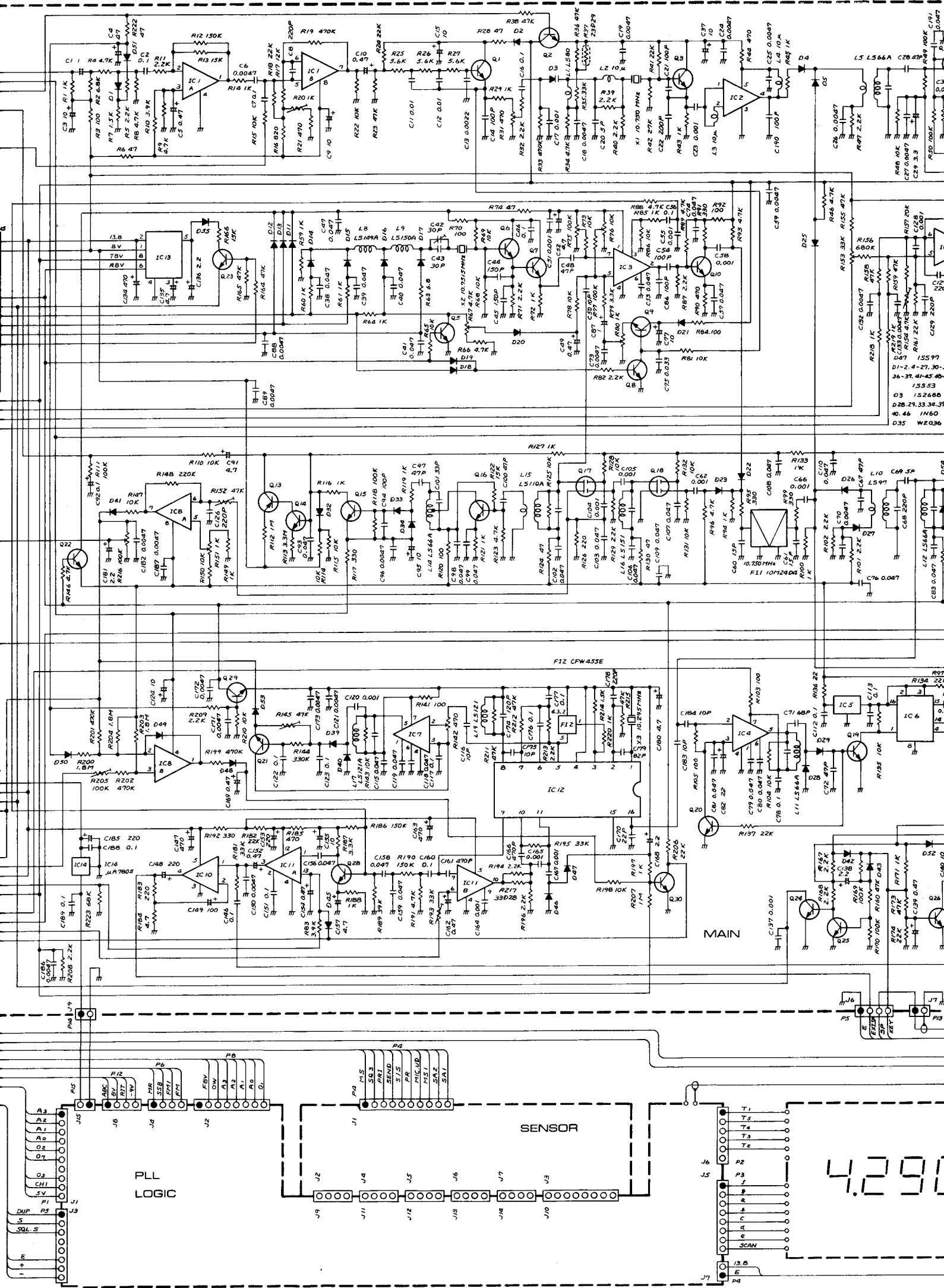
REF. NO.	DESCRIPTION	PART NO.
Q1	FET	2SK125
Q2	FET	2SK125
Q3	FET	3SK74K
Q4	Transistor	2SC2053
Q5	Transistor	2SC945P, K
Q6	FET	2SK125
Q7	FET	3SK48M
D1	Diode	1SS53
D2	Diode	1SS53
F1	MC Filter	10M15B-7
L1	Coil	LS-228
L2	Coil	LB-50A
L3	Coil	LB-34A
L4	Coil	LB-83
L5	Coil	LB-83
L6	Coil	LA-93
L7	Coil	LB-82
L8	Coil	LA-106
L9	Coil	LS-156
L10	Coil	LS-145
L11	Coil	LS-164
L12	Coil	LS-154
L13	Choke Coil	100 (L4)
L14	Coil	LB-34A
L15	Coil	LB-1-1A
L16	Coil	LB-34A
L17	Coil	LB-1-3B
L18	Coil	LB-50A
R1	Resistor	2.2K ELR25
R2	Resistor	2.2K ELR25
R3	Resistor	470 ELR10
R4	Trimmer	H0651A-1K
R5	Resistor	100 R25
R6	Resistor	47 ELR25
R7	Resistor	2.2K ELR25
R8	Resistor	100K ELR25
R9	Resistor	100K ELR25
R10	Resistor	100K ELR25
R11	Resistor	47 ELR25
R12	Resistor	47 ELR25
R13	Resistor	1K ELR25
R14	Resistor	4.7K ELR25
R15	Resistor	220 ELR25
R16	Resistor	47 R25
R17	Resistor	1K ELR25
R18	Resistor	10K ELR25
R19	Resistor	10 ELR25
R20	Resistor	330 ELR25
R21	Resistor	2.2K R25
R22	Resistor	220 ELR25
R23	Resistor	3.3K ELR25
R24	Resistor	100 ELR25
R25	Resistor	47 ELR25
R26	Resistor	10M ERC14GJ
R27	Resistor	1K ELR25
R29	Resistor	10K ELR10
R30	Jumper	JPW02A
C1	Ceramic	0.001 50V
C2	Ceramic	0.0047 50V

[RF, YGR] UNIT

REF. NO.	DESCRIPTION	PART NO.
C3	Ceramic	120P 50V
C4	Ceramic	0.0047 50V
C5	Ceramic	0.0047 50V
C6	Ceramic	0.0047 50V
C7	Ceramic	220P 50V
C8	Ceramic	100P 50V
C9	Ceramic	220P 50V
C10	Ceramic	0.001 50V
C11	Ceramic	0.0047 50V
C12	Ceramic	22P 50V
C13	Ceramic	220P 50V
C14	Ceramic	100P 50V
C15	Ceramic	0.0047 50V
C16	Ceramic	1P 50V
C17	Trimmer	CVE10-41
C18	Ceramic	10P 50V
C19	Ceramic	0.0047 50V
C20	Ceramic	47P 50V
C21	Ceramic	10P 50V
C22	Ceramic	5P 50V
C23	Ceramic	0.0047 50V
C25	Ceramic	10P 50V
C26	Ceramic	0.0047 50V
C27	Ceramic	0.0047 50V
C28	Ceramic	0.0047 50V
C29	Ceramic	120P 50V
C30	Ceramic	4P 50V
C31	Ceramic	120P 50V
C32	Ceramic	100P 50V
C33	Ceramic	0.0047 50V
C34	Ceramic	220P 50V
C35	Ceramic	0.001 50V
C36	Ceramic	0.0047 50V
C37	Electrolytic	1 BP 50V
C38	Ceramic	0.0047 50V
C39	Ceramic	0.0047 50V
C40	Ceramic	47P 50V
C42	Ceramic	220P 50V
C45	Ceramic	2P 50V
J1	Connector	5045-02A
J2	Connector	5045-06A
J3	Connector	5045-02A
J4	Connector	30HU7133
J5	Connector	30HU7133
B1	PC Board	B-455G

IC-290A/E SCHEMATIC DIAGRAM





- C1 10K
- C2 0.1
- C3 0.047
- C4 10K
- C5 0.0047
- C6 0.0047
- C7 10K
- C8 0.0047
- C9 10K
- C10 10K
- C11 0.01
- C12 0.01
- C13 0.0022
- C14 100P
- C15 470
- C16 2.2K
- C17 0.001
- C18 0.0047
- C19 0.0047
- C20 2.2K
- C21 100P
- C22 0.001
- C23 10K
- C24 0.0047
- C25 0.0047
- C26 100P
- C27 0.0047
- C28 47K
- C29 0.0047
- C30 0.0047
- C31 0.0047
- C32 0.0047
- C33 0.0047
- C34 0.0047
- C35 0.0047
- C36 0.0047
- C37 0.0047
- C38 0.0047
- C39 0.0047
- C40 0.0047
- C41 0.0047
- C42 0.0047
- C43 0.0047
- C44 100P
- C45 0.0047
- C46 0.0047
- C47 0.0047
- C48 0.0047
- C49 0.0047
- C50 0.0047
- C51 0.0047
- C52 0.0047
- C53 0.0047
- C54 0.0047
- C55 0.0047
- C56 0.0047
- C57 0.0047
- C58 0.0047
- C59 0.0047
- C60 0.0047
- C61 0.0047
- C62 0.0047
- C63 0.0047
- C64 0.0047
- C65 0.0047
- C66 0.0047
- C67 0.0047
- C68 0.0047
- C69 0.0047
- C70 0.0047
- C71 0.0047
- C72 0.0047
- C73 0.0047
- C74 0.0047
- C75 0.0047
- C76 0.0047
- C77 0.0047
- C78 0.0047
- C79 0.0047
- C80 0.0047
- C81 0.0047
- C82 0.0047
- C83 0.0047
- C84 0.0047
- C85 0.0047
- C86 0.0047
- C87 0.0047
- C88 0.0047
- C89 0.0047
- C90 0.0047
- C91 0.0047
- C92 0.0047
- C93 0.0047
- C94 0.0047
- C95 0.0047
- C96 0.0047
- C97 0.0047
- C98 0.0047
- C99 0.0047
- C100 0.0047

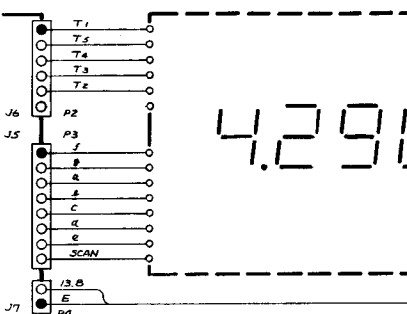
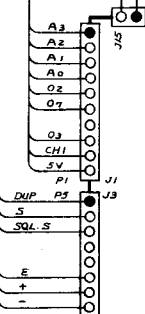
4.29

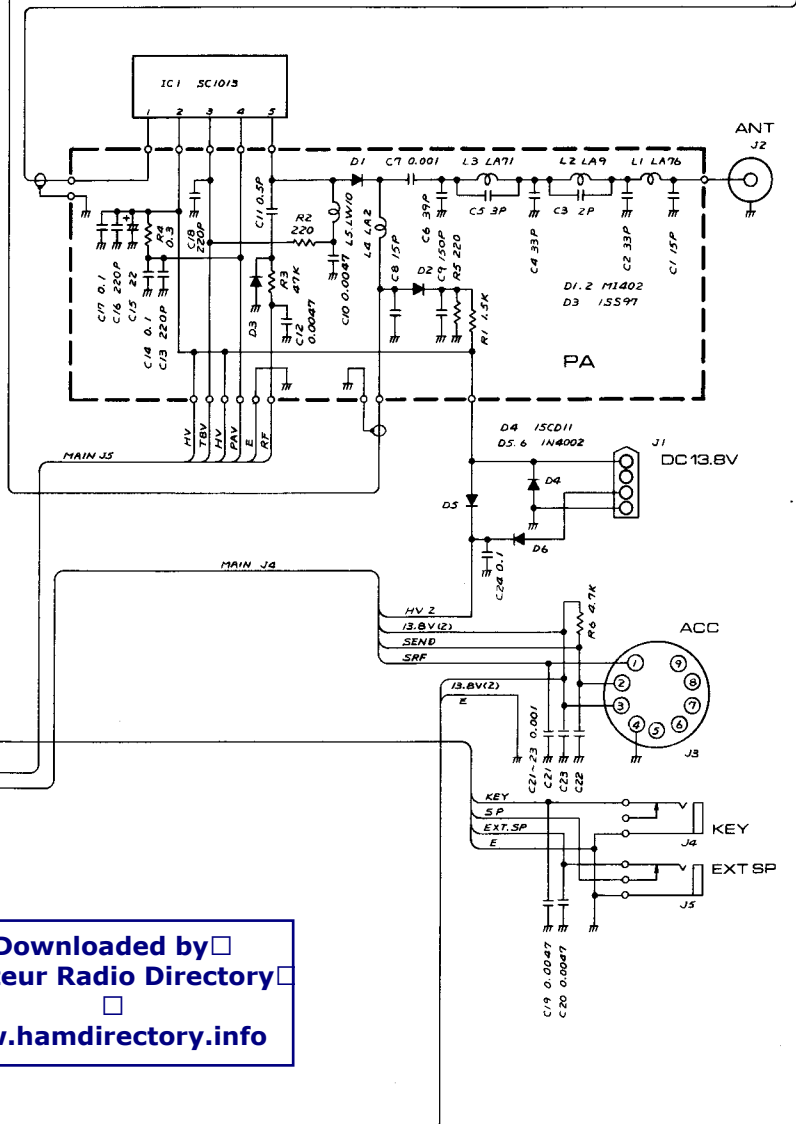
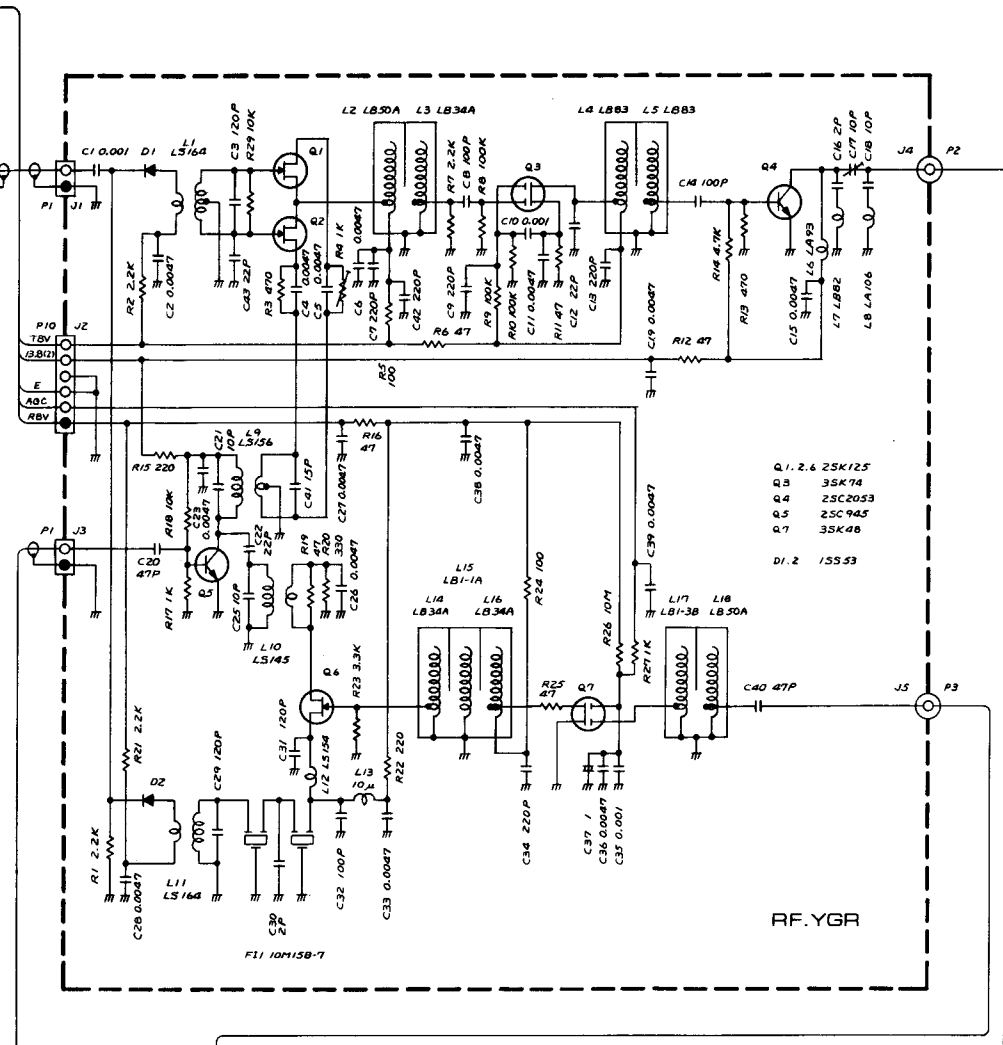
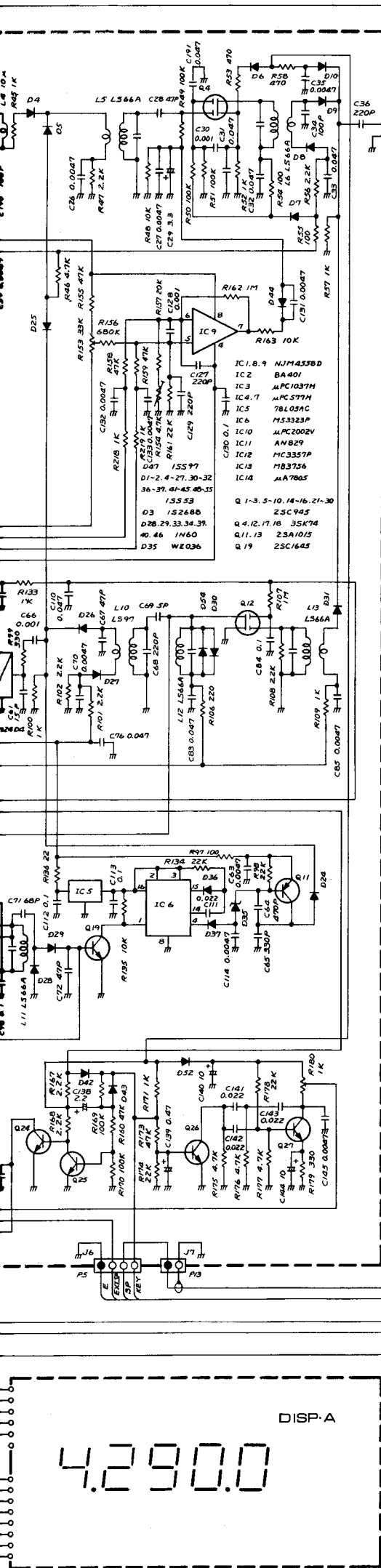
PLL LOGIC

SENSOR

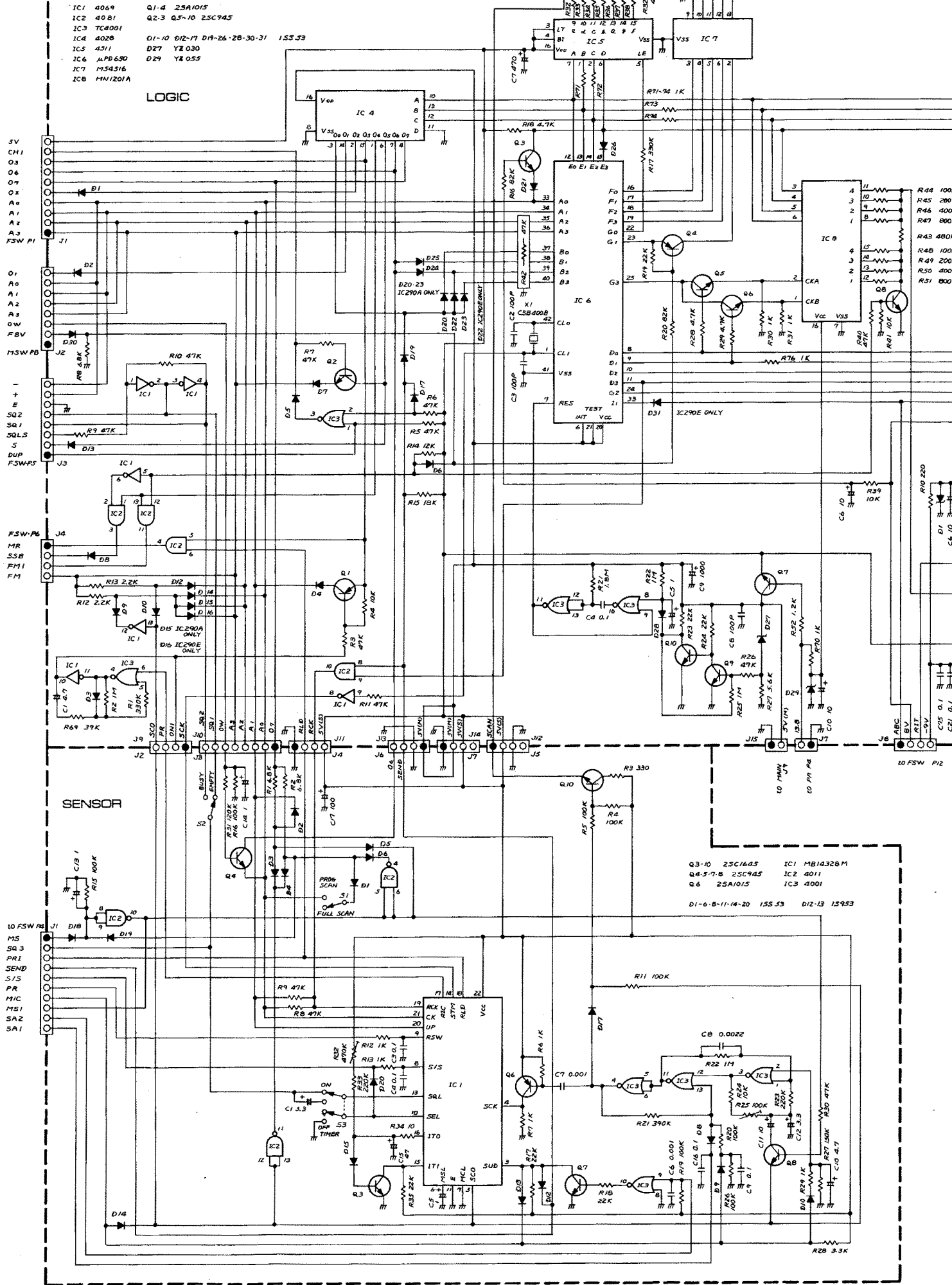
MAIN

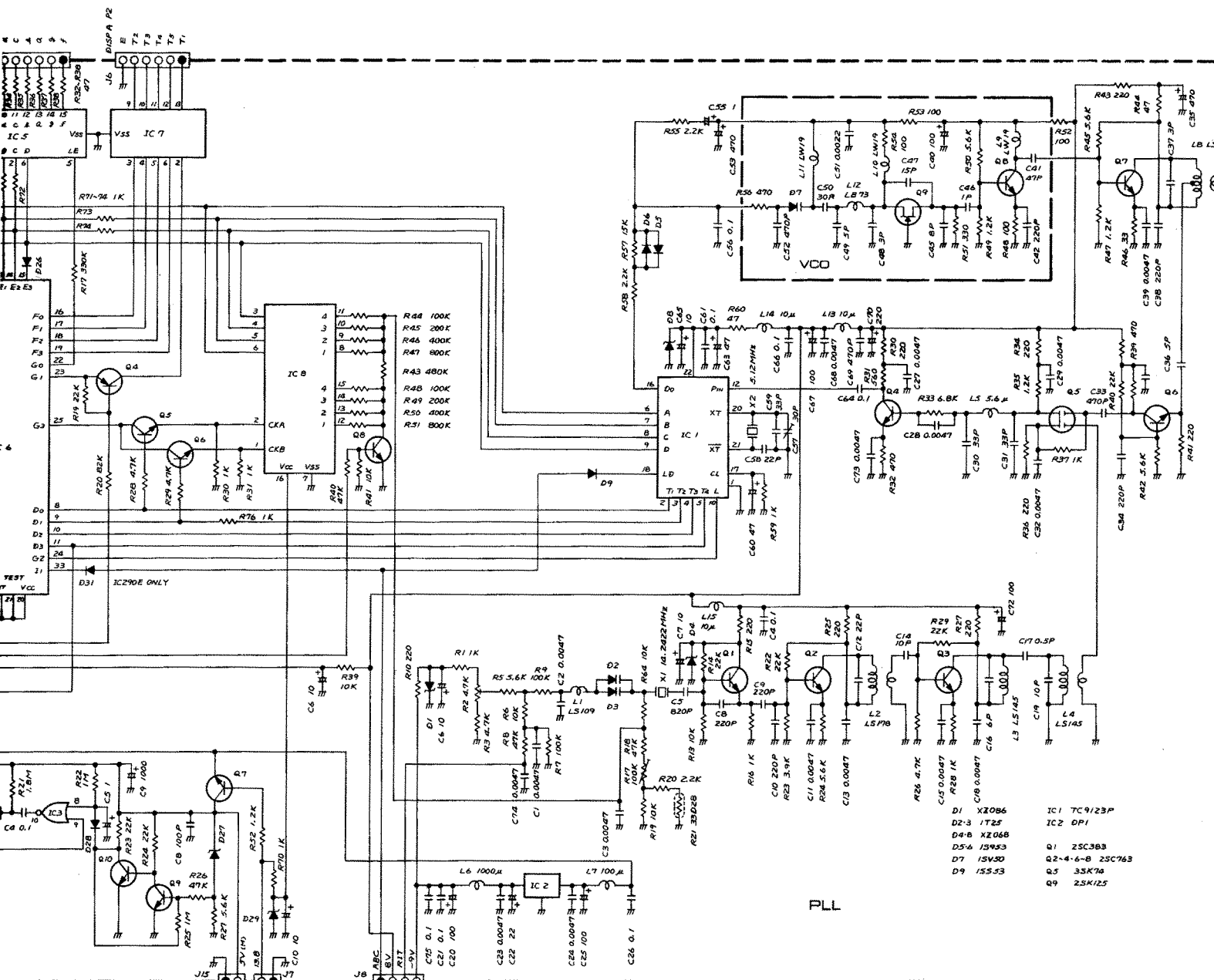
F12 CFWASSE



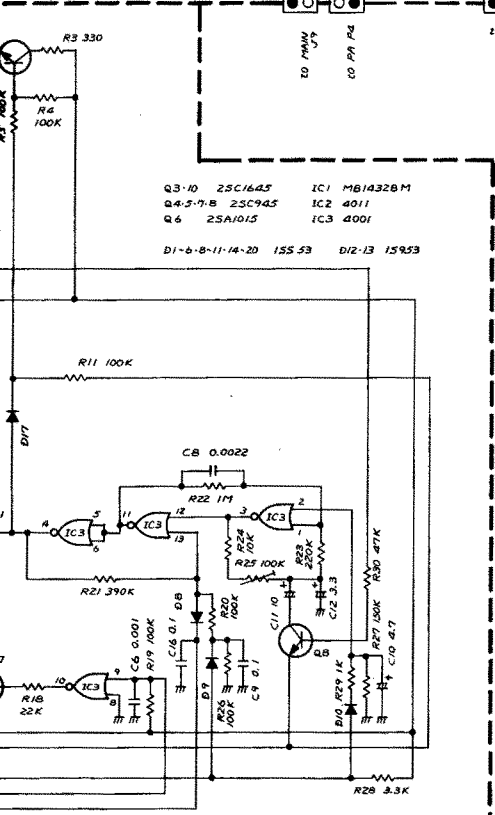


Downloaded by
 Amateur Radio Directory
 www.hamdirectory.info





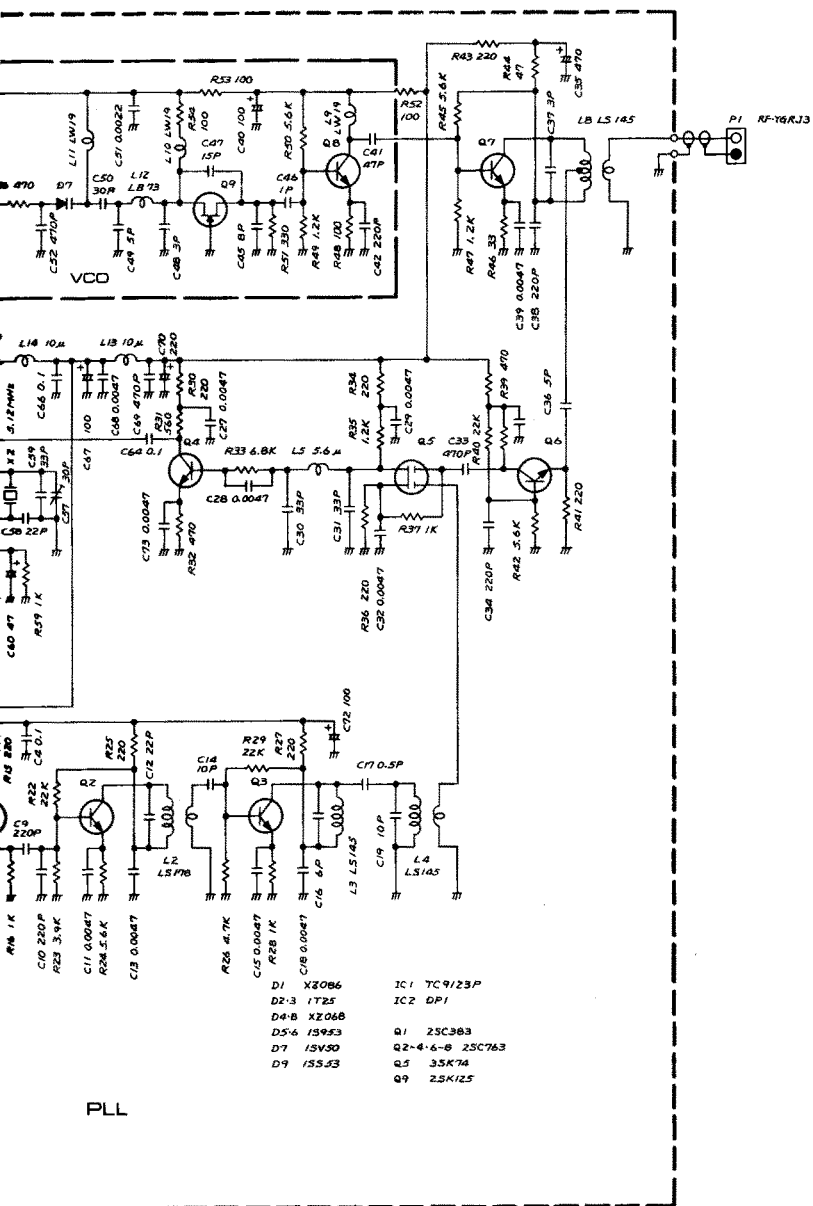
- D1 X2086
- D2-3 1T25
- D4-8 X2068
- D5-6 15953
- D7 15V30
- D9 155-33
- IC1 7C9123P
- IC2 DP1
- Q1 2SC383
- Q2-4-6-8 25C763
- Q5 35K74
- Q9 25K125



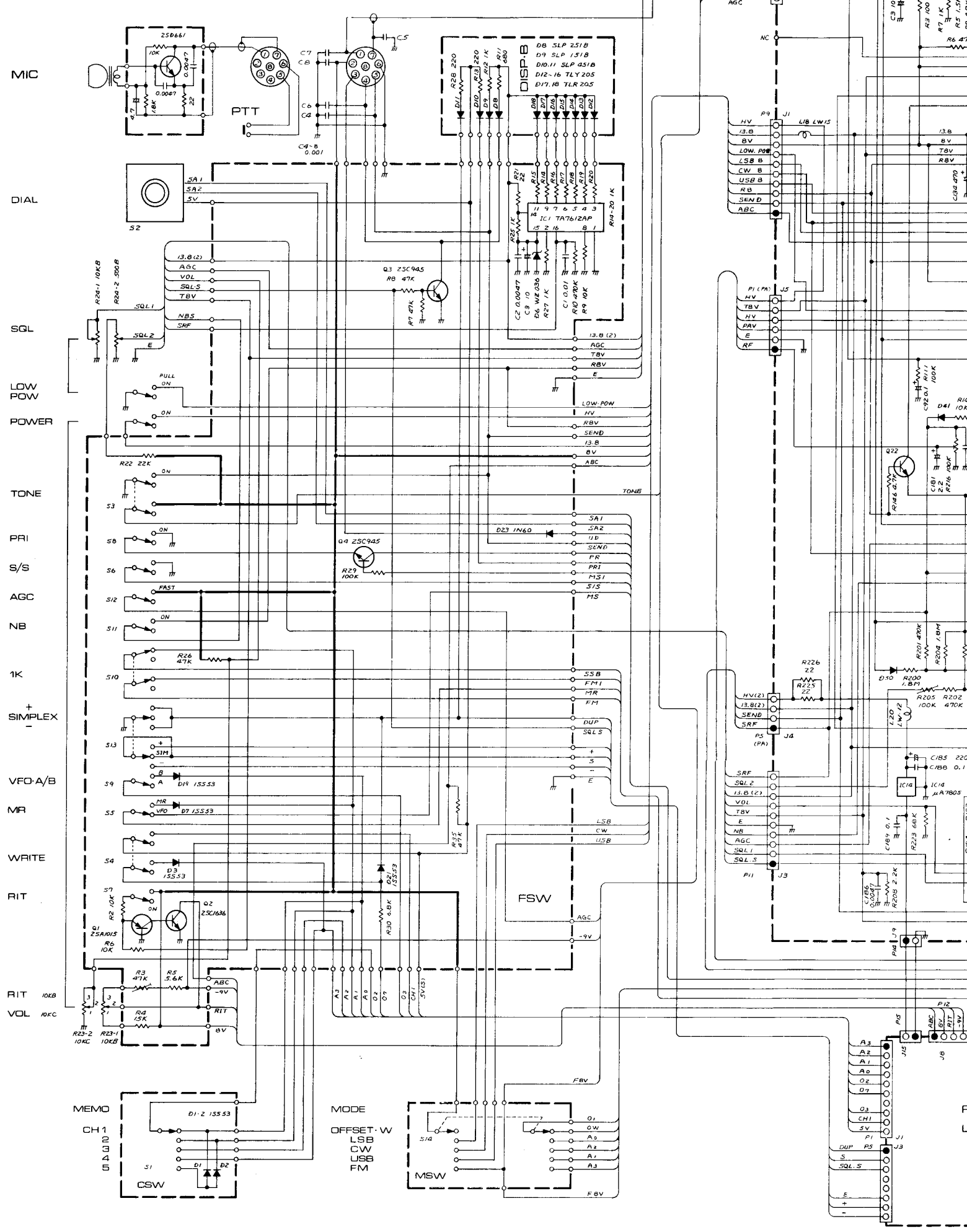
- Q3-10 25C1645
- Q4-5-7-8 25C945
- Q6 25A1015
- IC1 MB14328M
- IC2 4011
- IC3 4001
- D1-6-8-11-14-20 155-53
- D12-13 15953

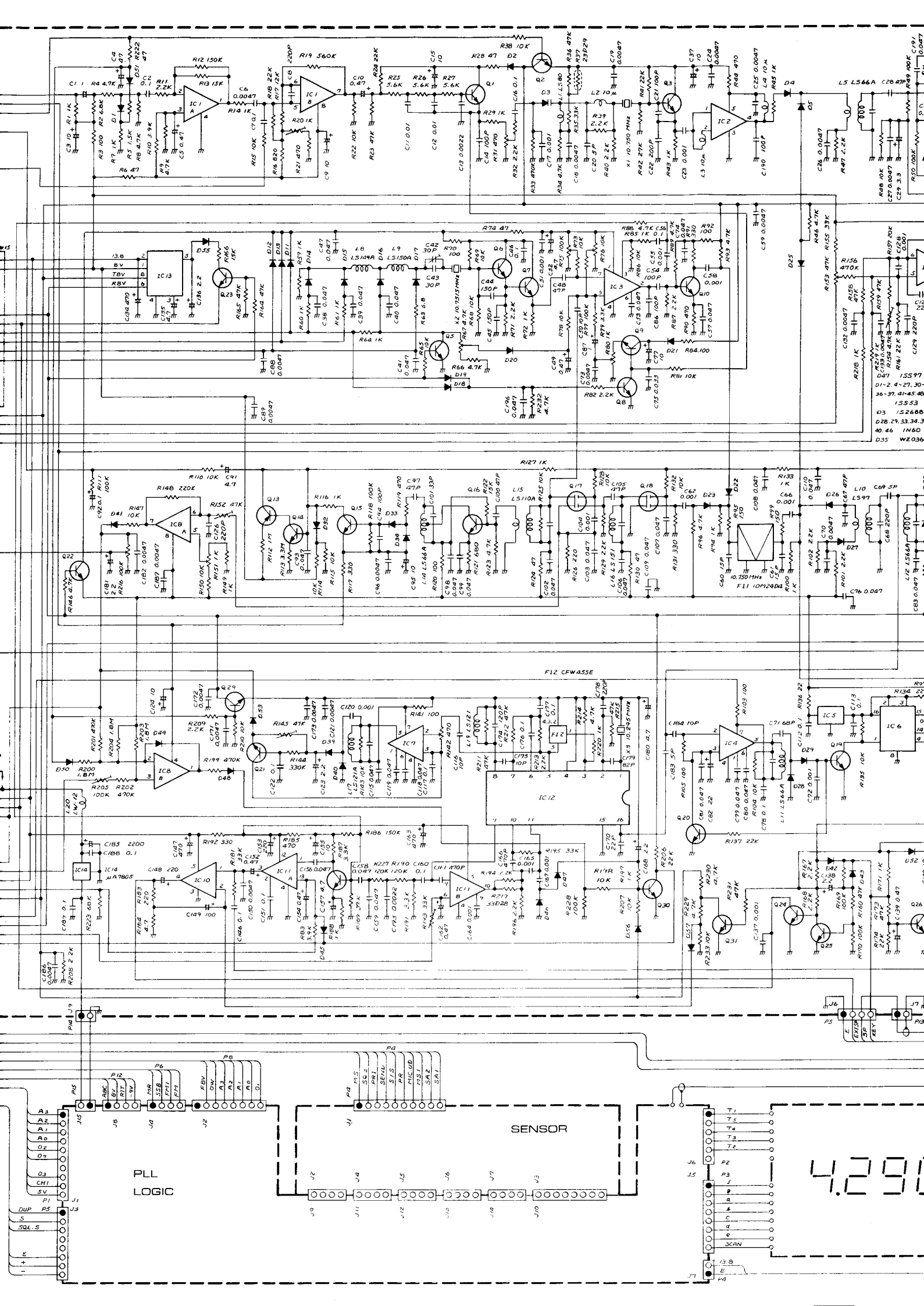
Downloaded by Amateur Radio Directory

www.hamdirectory.info



IC-290H SCHEMATIC DIAGRAM





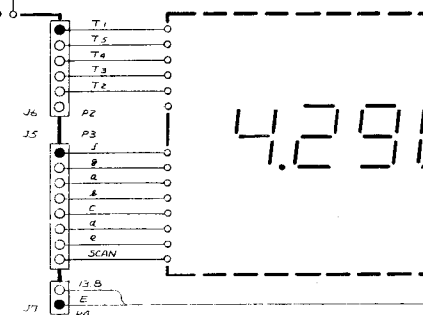
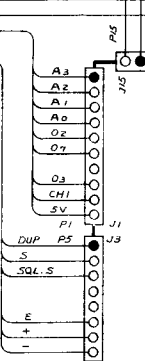
D01 15597
D1-2 4-27-30-
36-39-41-45-48
15553
D3 152688
D28 21-33-34-3
40-46 1N60
D35 W2036

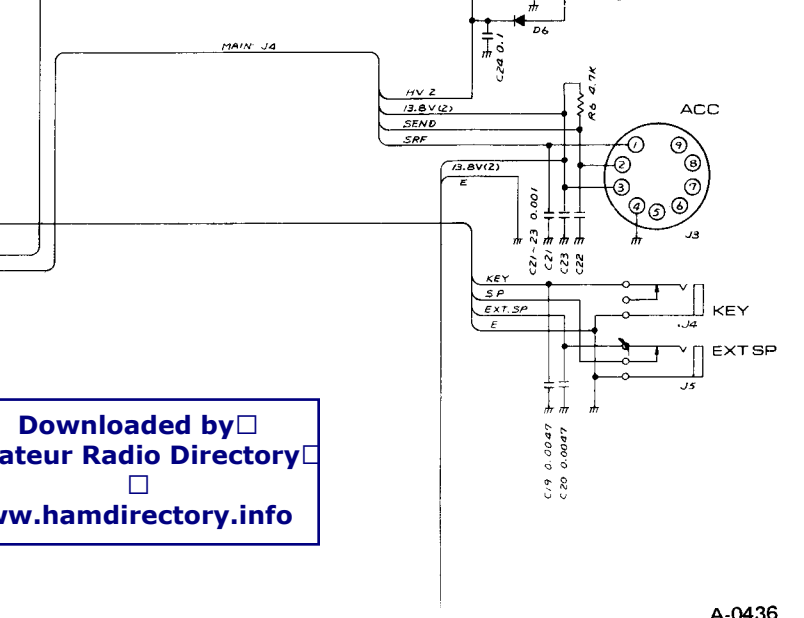
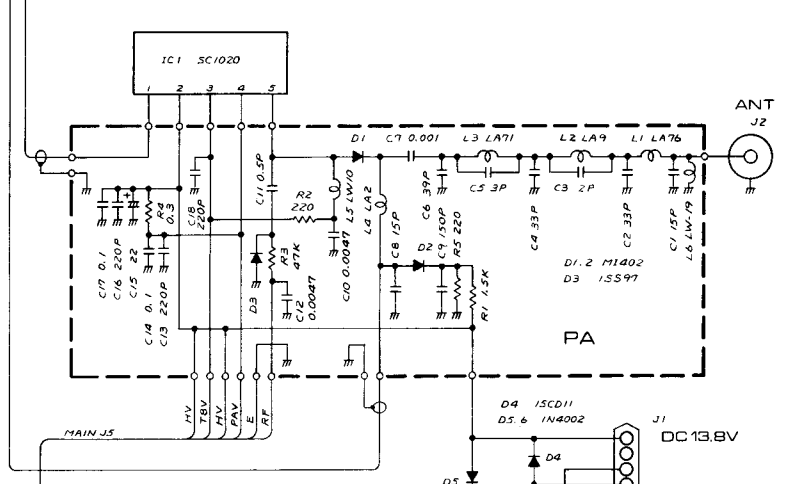
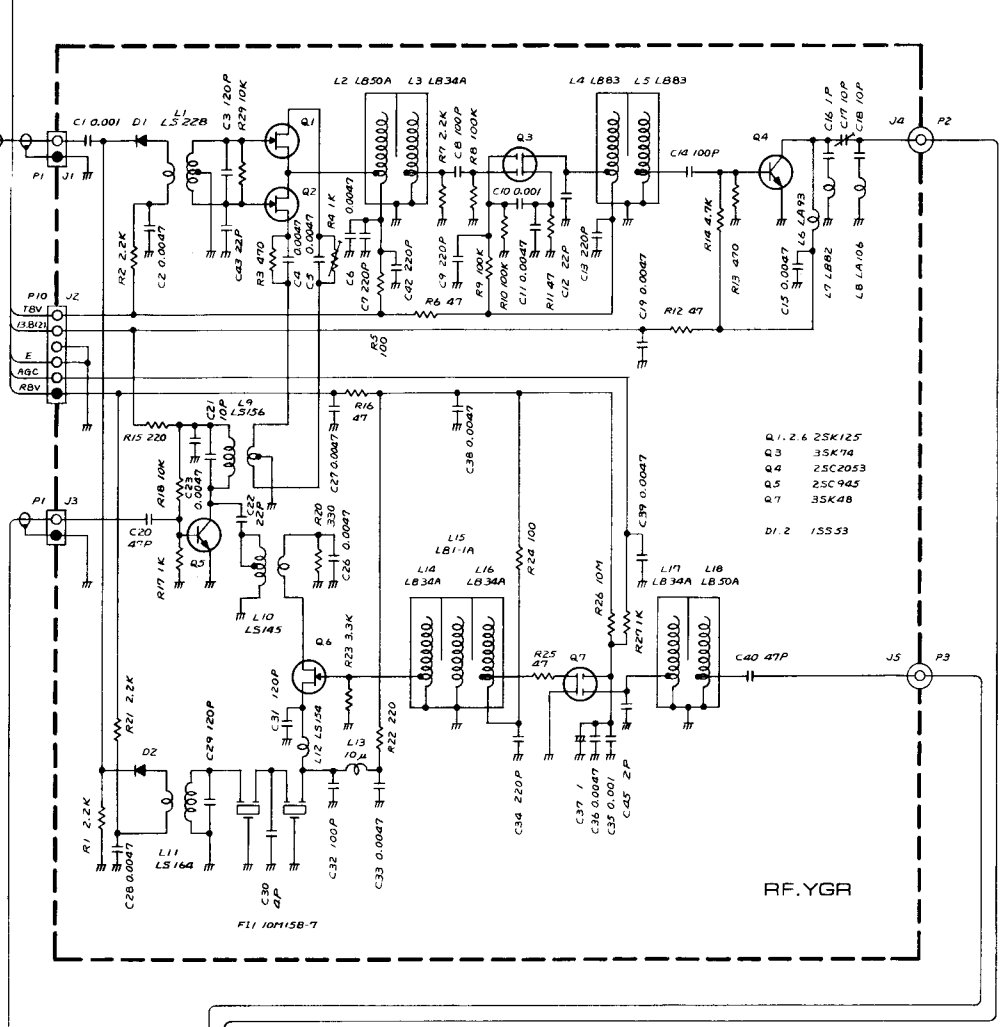
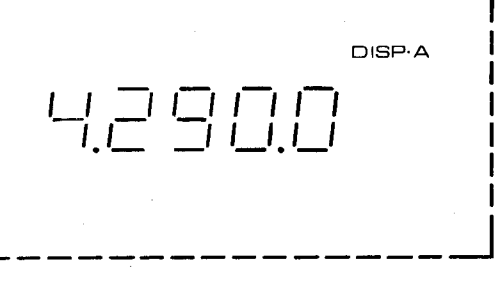
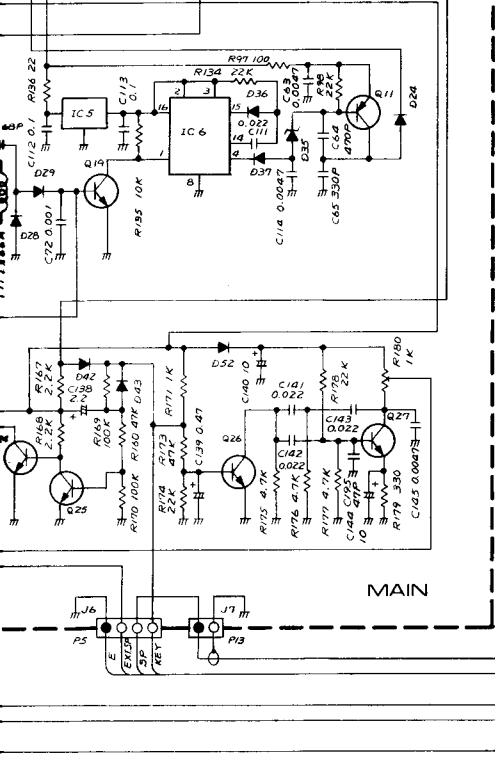
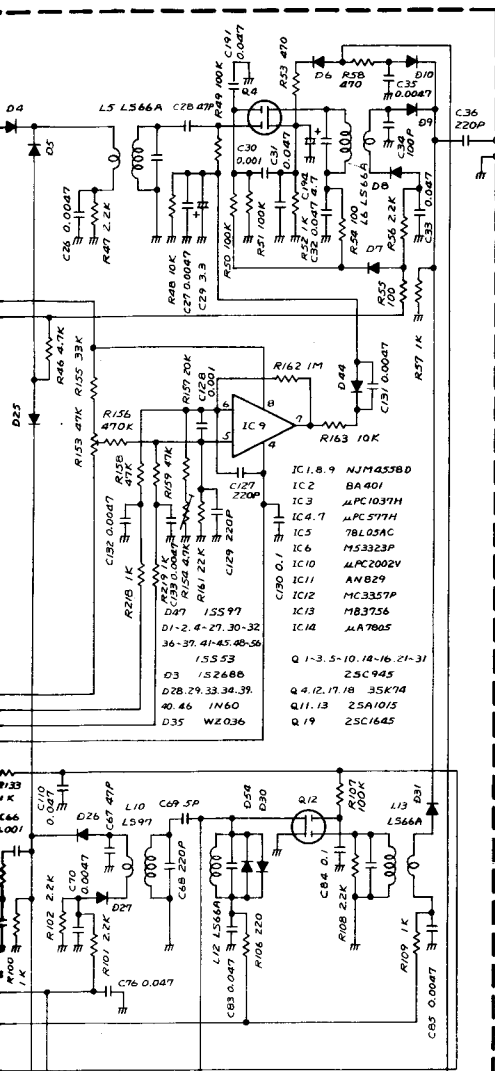
SENSOR

PLL LOGIC

4.291

F12 CFWASSE





Downloaded by
 Amateur Radio Directory

www.hamdirectory.info

IC1 4069 Q1 25A1015 Q7 ZSD46B
 IC2 4081 Q2-3 Q4-10 ZSC945
 IC3 TC4001
 IC4 4028 D1-10 D12-17 D19-26-28-30-32 155.53
 IC5 4311 D27 YZ 030
 IC6 μ PD650 D29 YE 055
 IC7 M54316 D33 WE046
 IC8 MN1201A

LOGIC

3V
 CH1
 O3
 O4
 O7
 O2
 A0
 A1
 A3
 FSW P1

O1
 A1
 A2
 A3
 O W
 F8V

MSW P8
 J2
 R8 4.7K
 R9 4.7K
 D13
 J3

FSW-P6
 J4
 MR
 SSB
 FM1
 FM

MS
 SQ3
 PR1
 SEND
 S/S
 PR
 MIC
 MS1
 SA2
 SA1

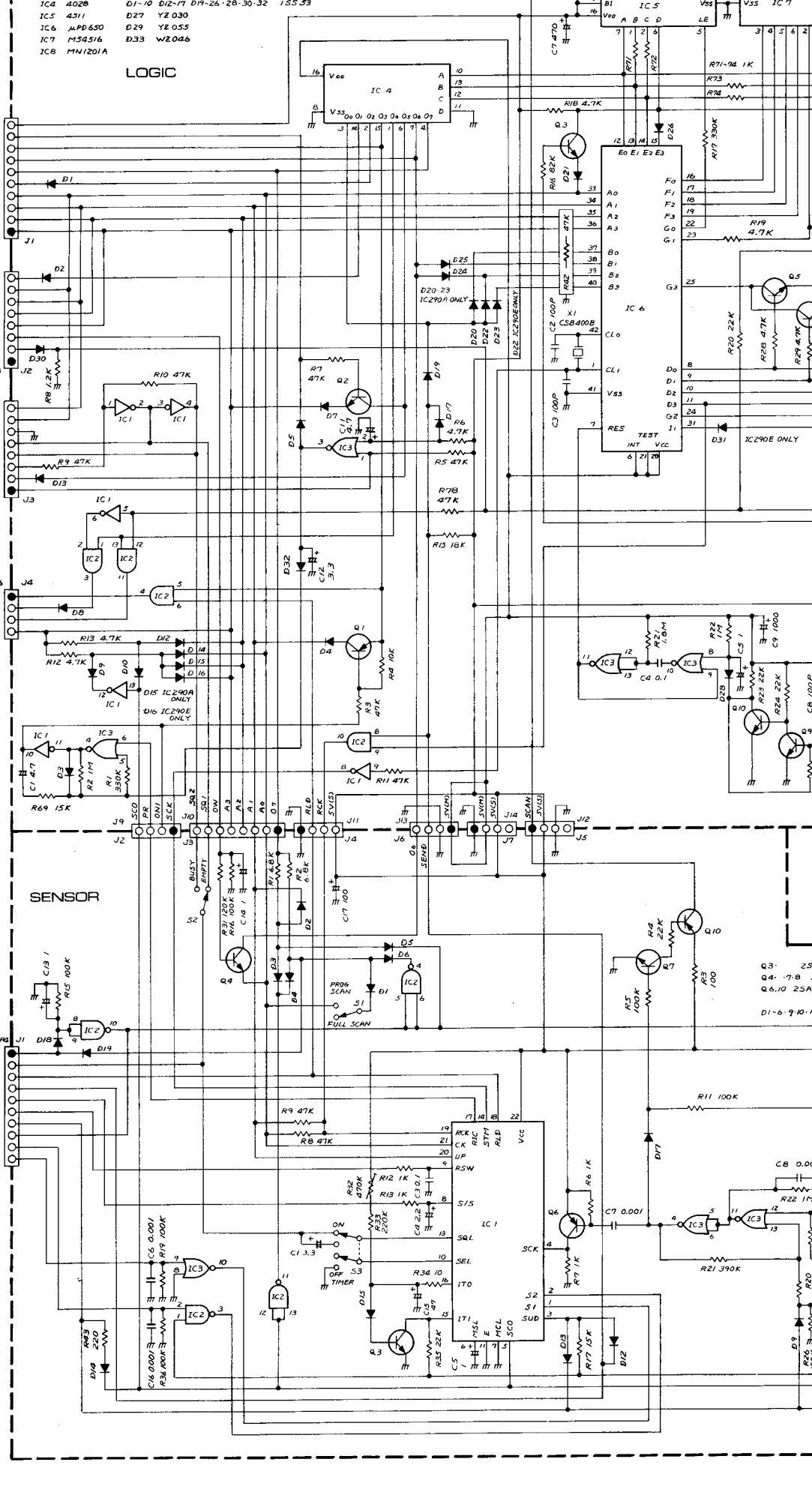
SENSOR

BUSY
 EMPTY
 S/L
 D/W
 A3
 A2
 A1
 A0
 O7
 RLB
 RCK
 S/V(S)
 J11
 J12
 J13
 J14
 J15
 J16
 J17
 J18
 J19
 J20
 J21
 J22
 J23
 J24
 J25
 J26
 J27
 J28
 J29
 J30
 J31
 J32
 J33
 J34
 J35
 J36
 J37
 J38
 J39
 J40
 J41
 J42
 J43
 J44
 J45
 J46
 J47
 J48
 J49
 J50
 J51
 J52
 J53
 J54
 J55
 J56
 J57
 J58
 J59
 J60
 J61
 J62
 J63
 J64
 J65
 J66
 J67
 J68
 J69
 J70
 J71
 J72
 J73
 J74
 J75
 J76
 J77
 J78
 J79
 J80
 J81
 J82
 J83
 J84
 J85
 J86
 J87
 J88
 J89
 J90
 J91
 J92
 J93
 J94
 J95
 J96
 J97
 J98
 J99
 J100

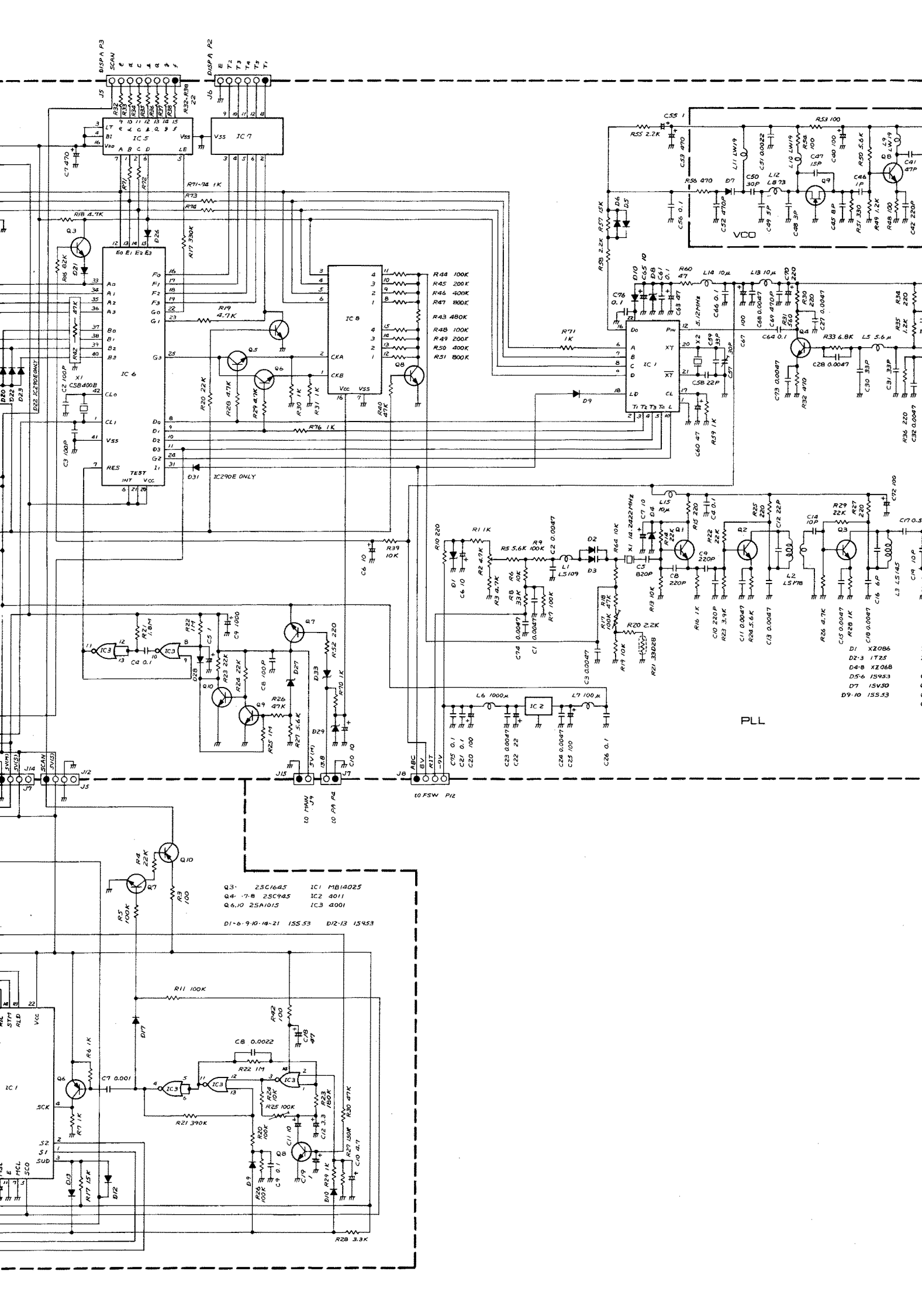
MS
 SQ3
 PR1
 SEND
 S/S
 PR
 MIC
 MS1
 SA2
 SA1

MS
 SQ3
 PR1
 SEND
 S/S
 PR
 MIC
 MS1
 SA2
 SA1

MS
 SQ3
 PR1
 SEND
 S/S
 PR
 MIC
 MS1
 SA2
 SA1

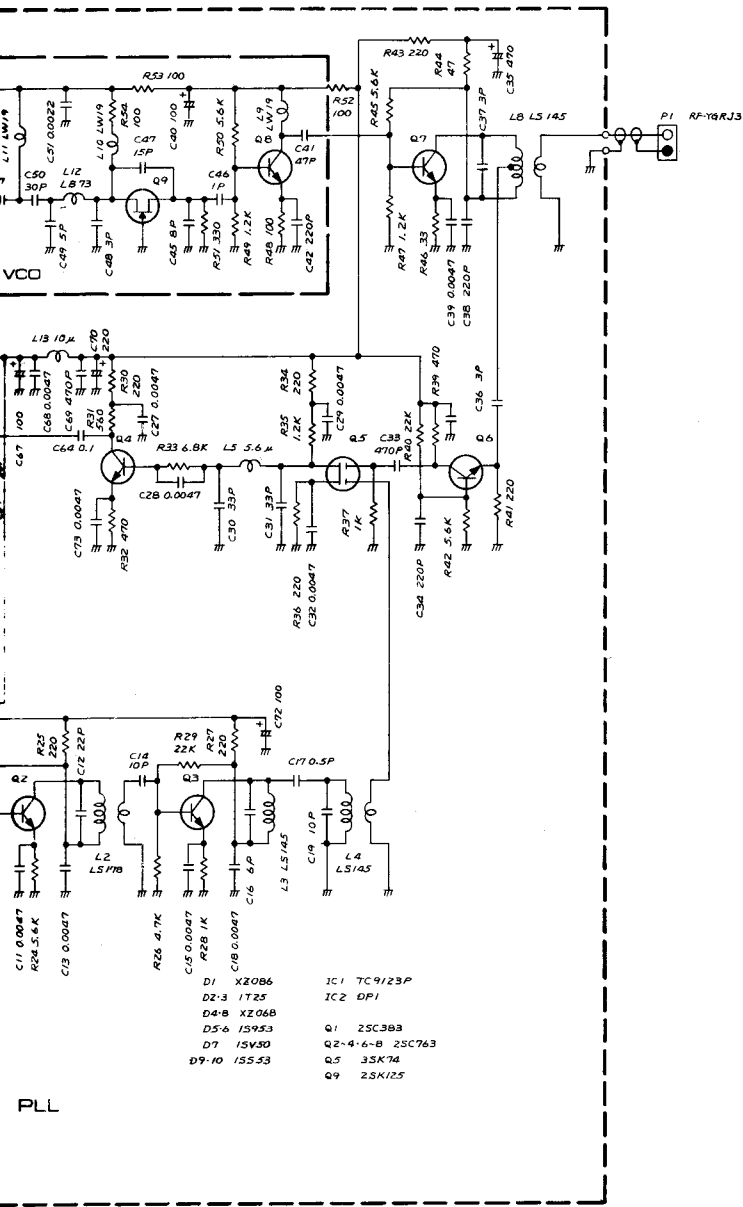


Q3- ZSC
 Q4- 7.8 2
 Q6,10 25A1
 D1-6 9.10.14



Q3- 2SC1645 IC1 MB14025
 Q4- 7-B 2SC945 IC2 4011
 Q6,10 2SA1015 IC3 4001
 D1-6-9-10-14-21 1SS53 D/2-13 15453

D1 X21086
 D2-3 1725
 D4-8 X2048
 D5-6 15453
 D7 15V30
 D9-10 15553

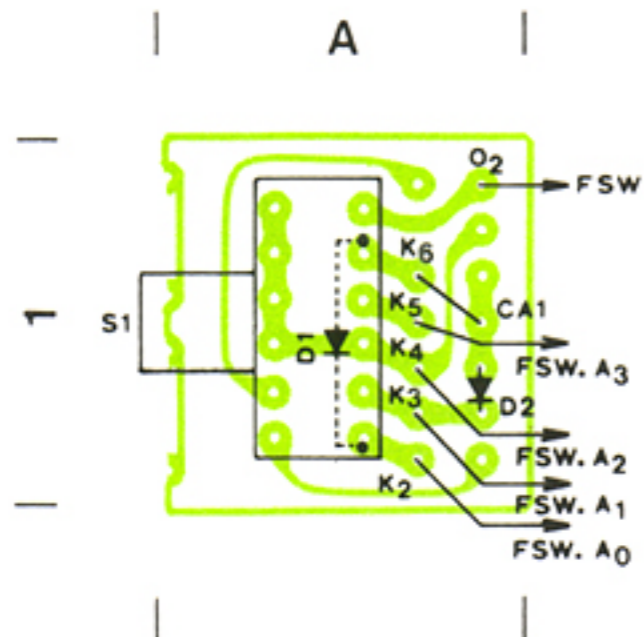


- | | |
|-------------|-----------------|
| D1 X2086 | IC1 TC9123P |
| D2-3 1725 | IC2 DP1 |
| D4-8 X2068 | Q1 25C388 |
| D5-6 15953 | Q2-4-6-B 25C763 |
| D7 15V30 | Q5 35K74 |
| D9-10 15553 | Q9 25K125 |

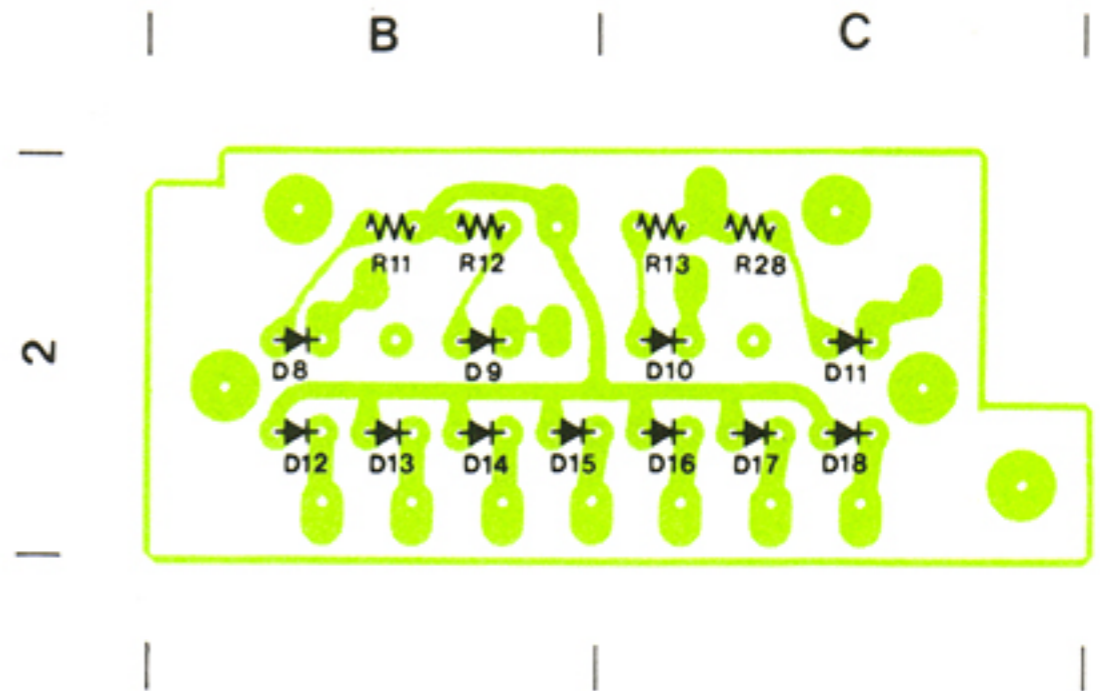
IC-290 H/E

EF UNIT

■ CH SW BOARD

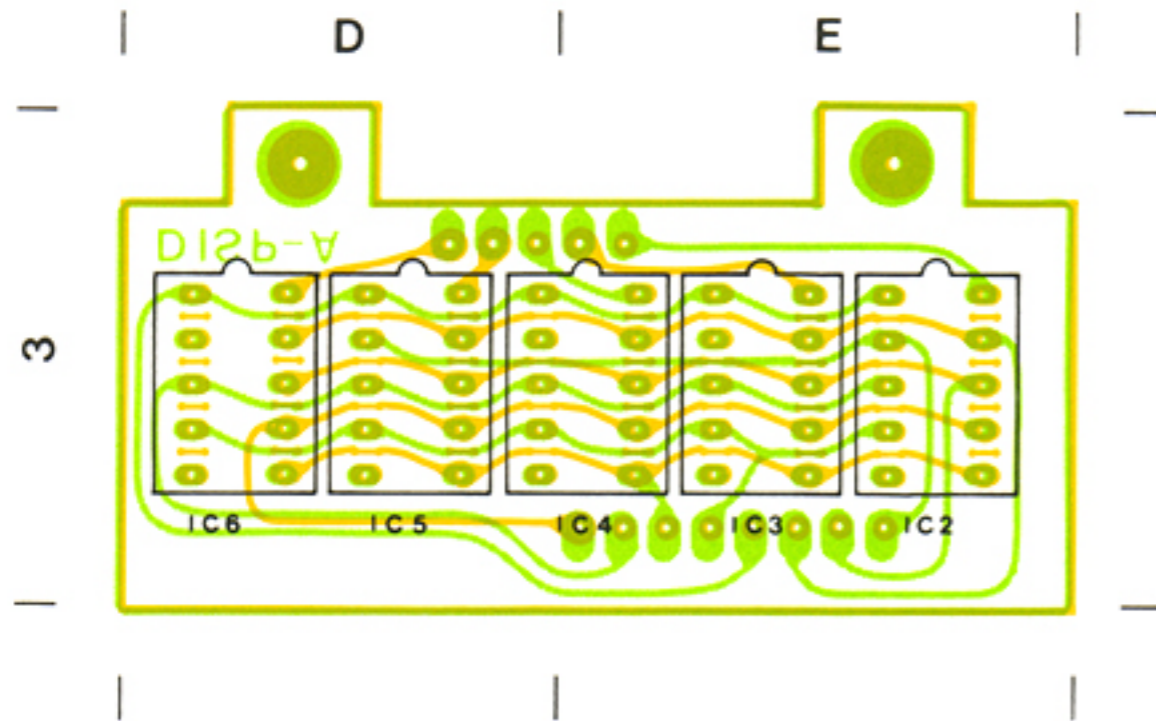


■ LED BOARD

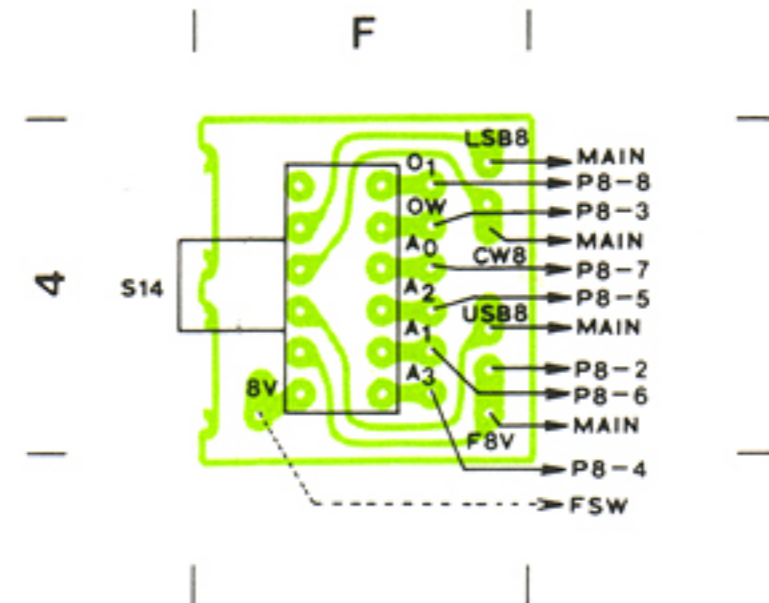


BOARD LAYOUT

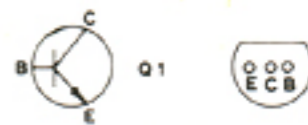
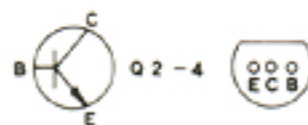
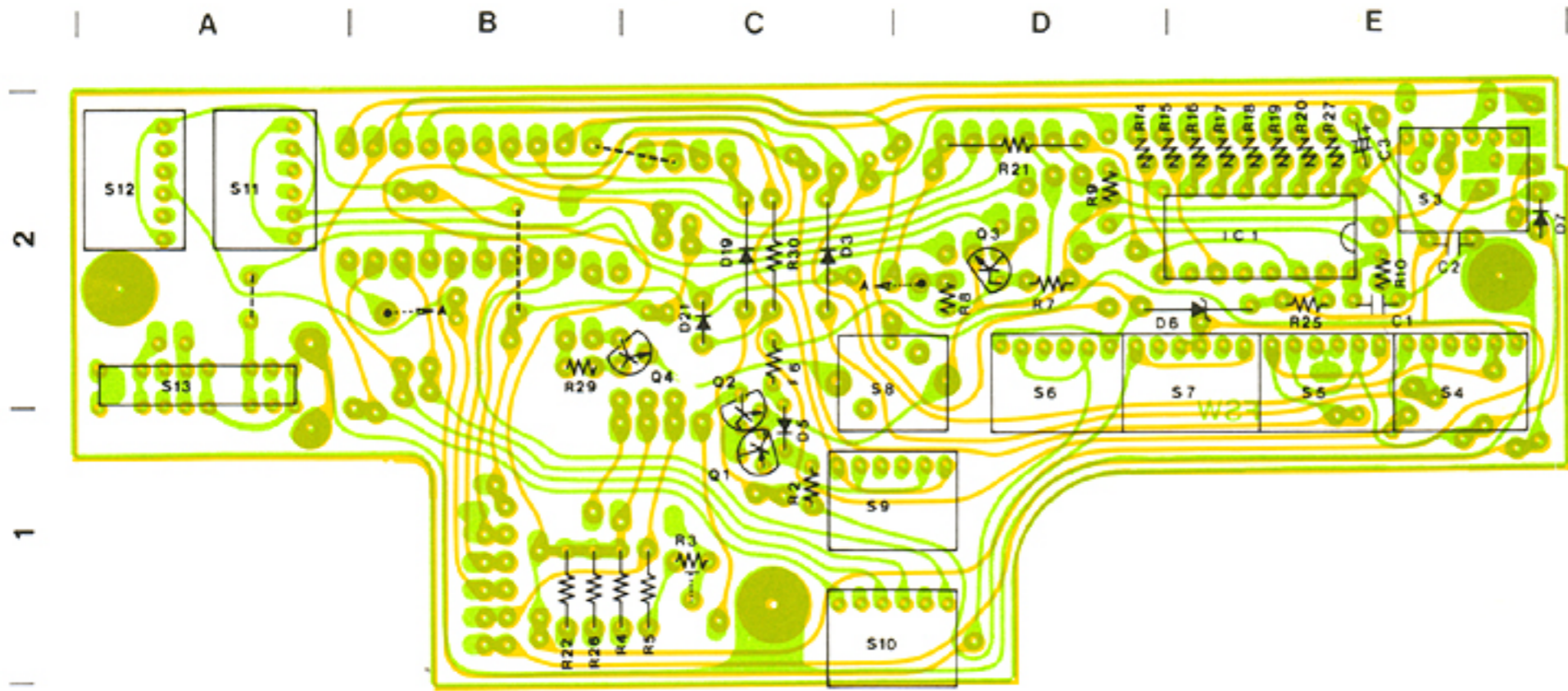
■ DISPLAY BOARD



■ M SW BOARD



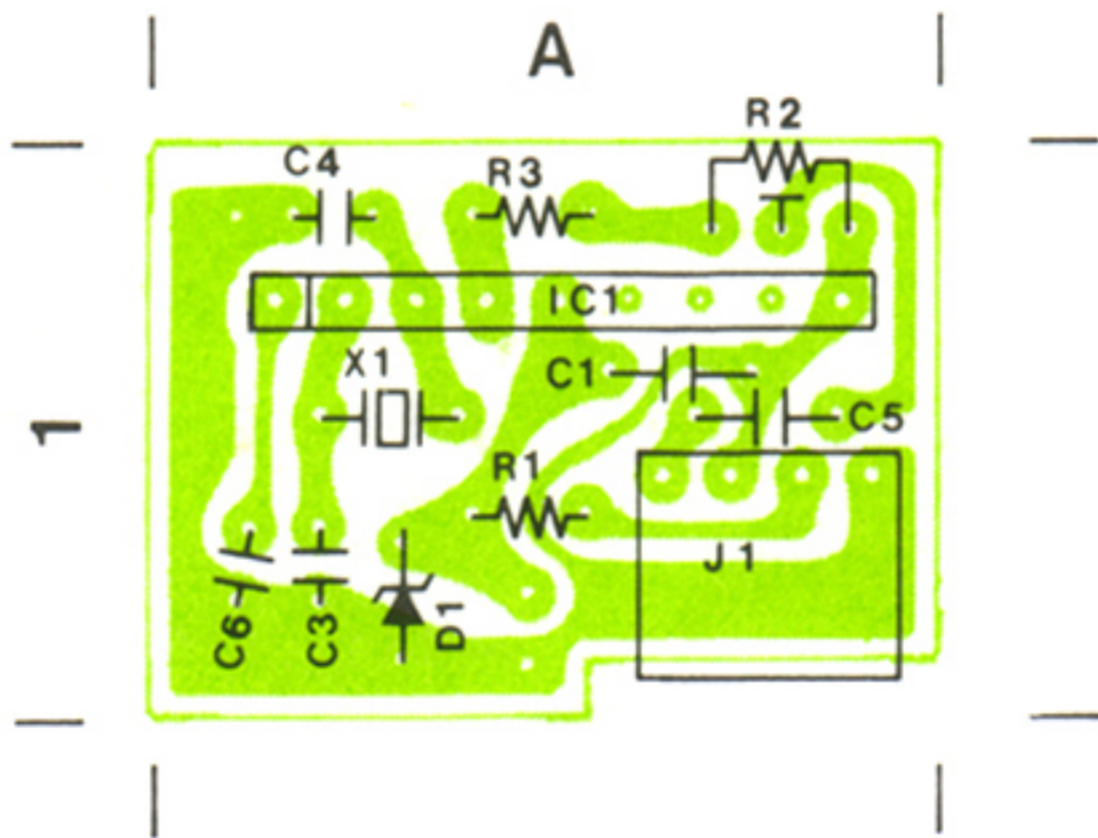
■ F SW BOARD



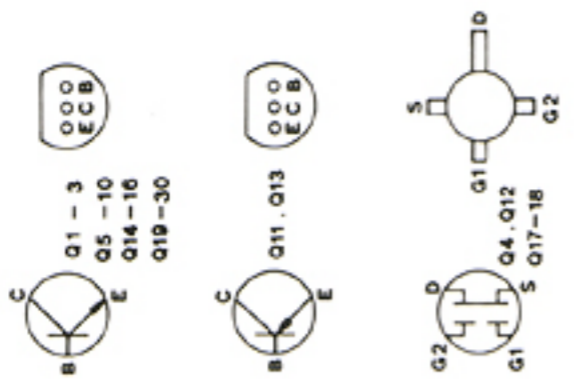
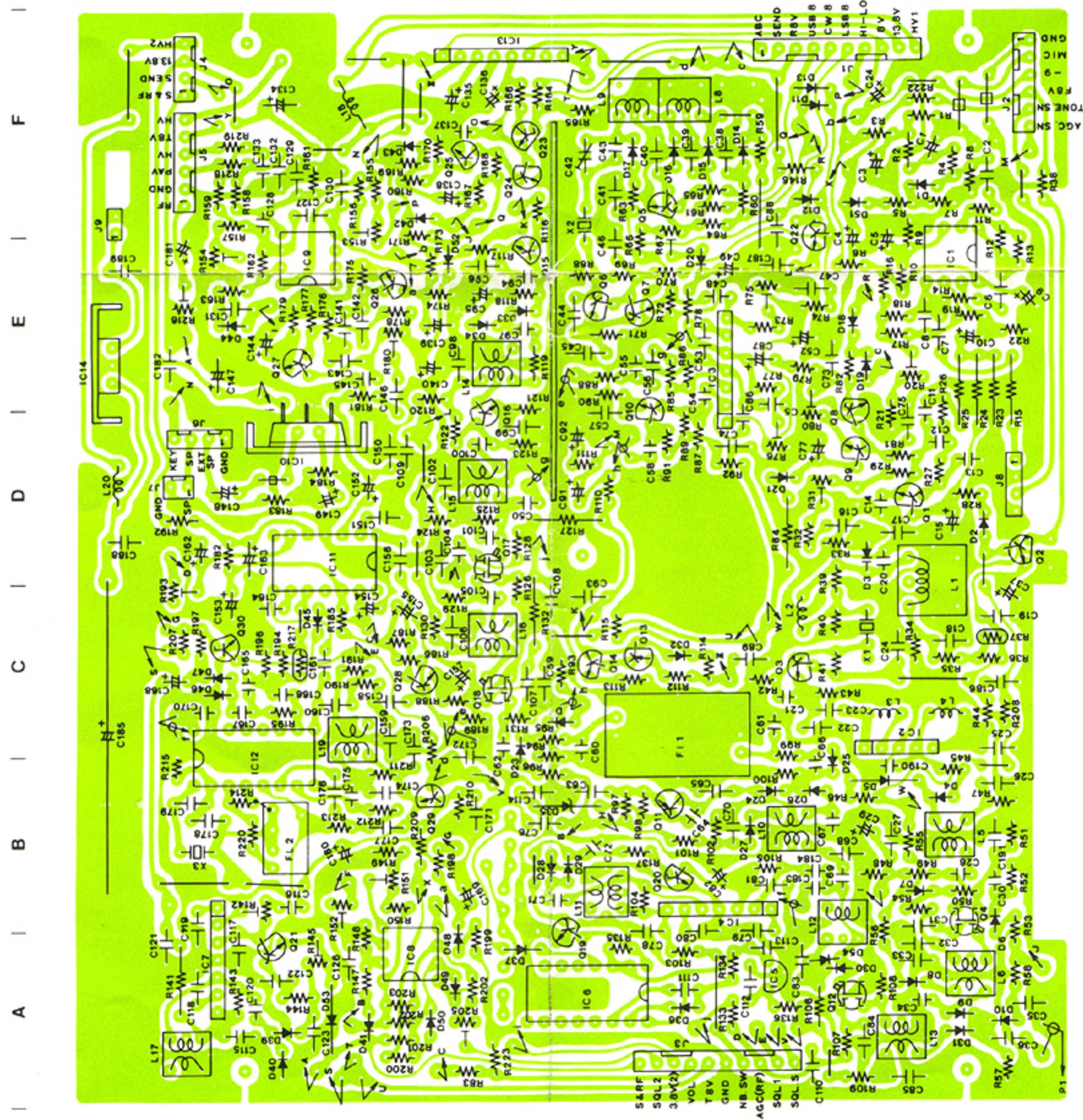


ICOM

TONE CALL UNIT



MAIN UNIT

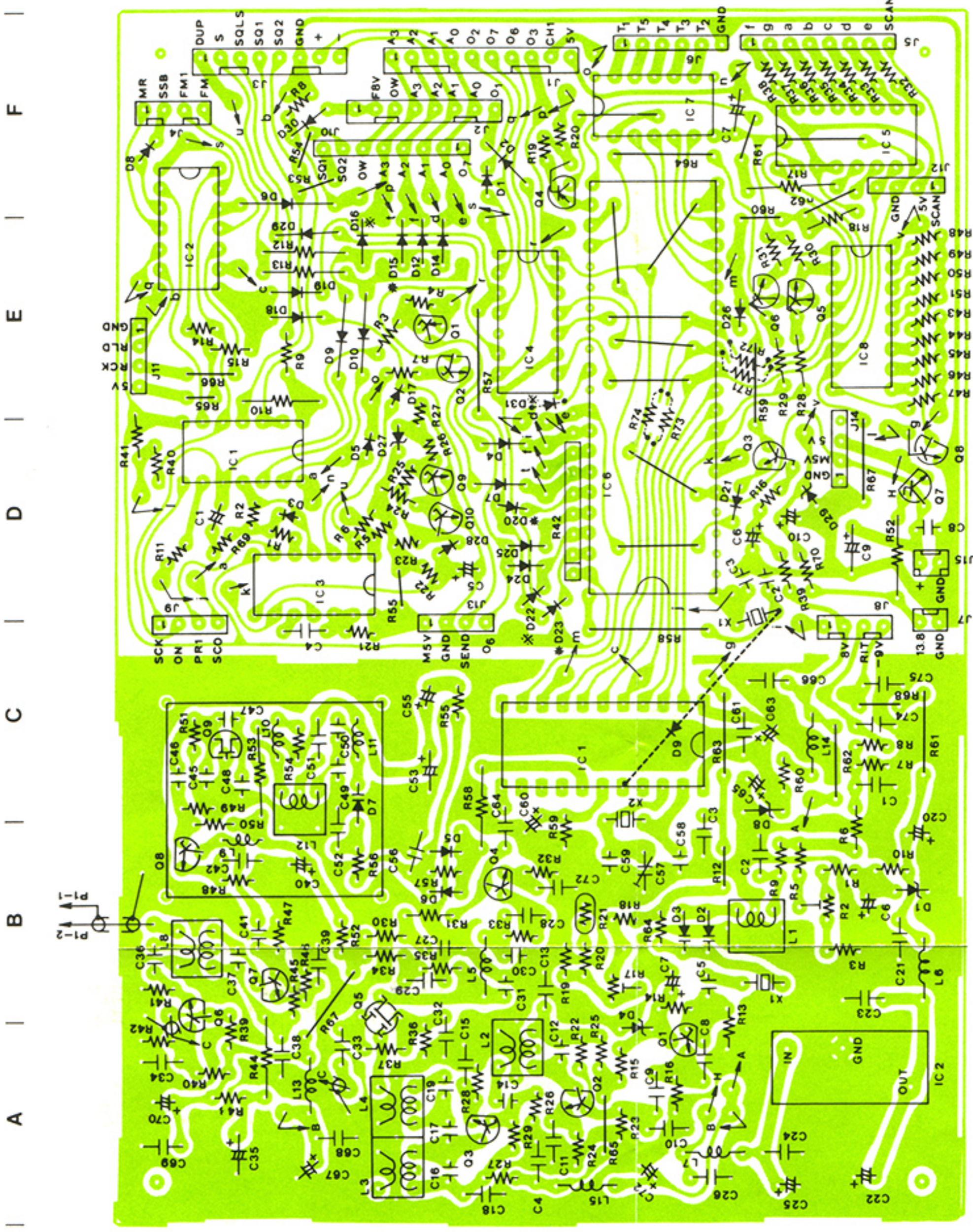


Downloaded by
Amateur Radio Directory
www.hamdirectory.info

A | B | C | D | E | F

5 | 4 | 3 | 2 | 1

PLL · LOGIC UNIT



PLL



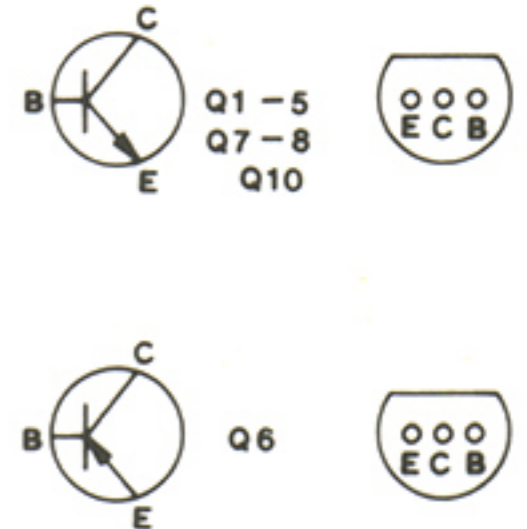
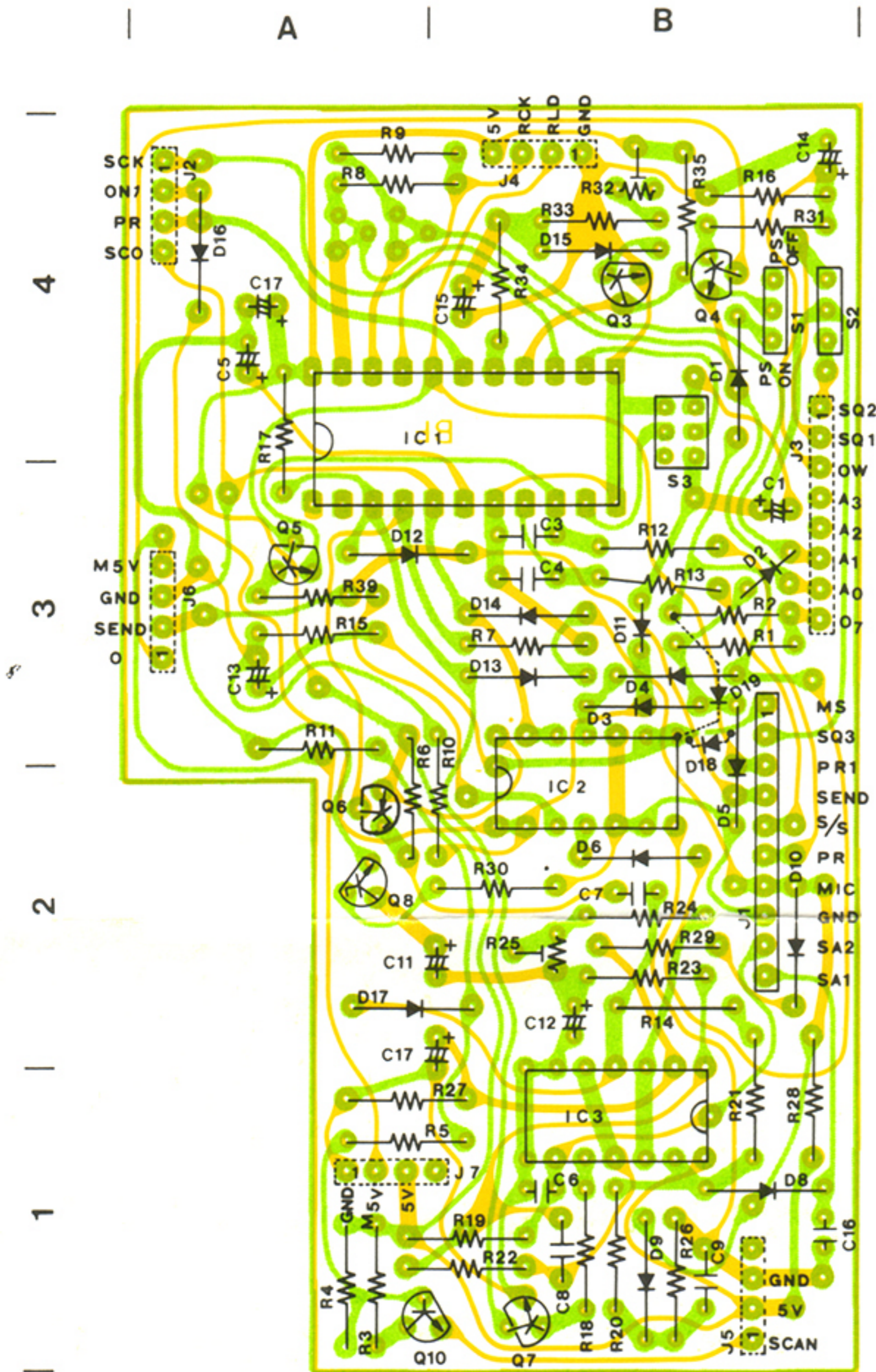
LOGIC



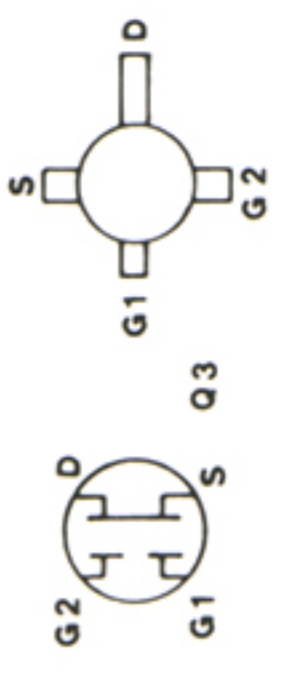
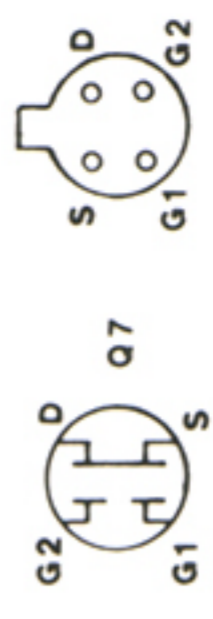
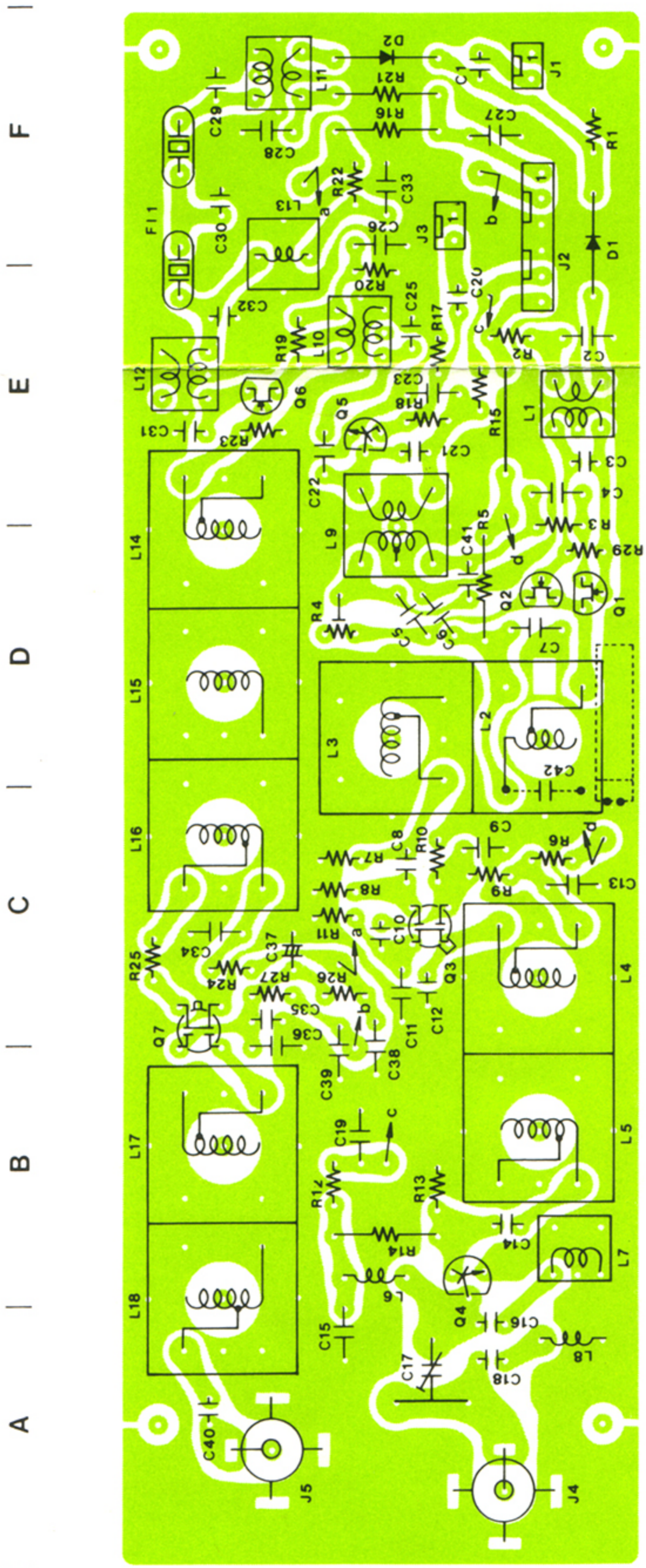
* USA ONLY

* EUR ONLY

SENSOR BOARD



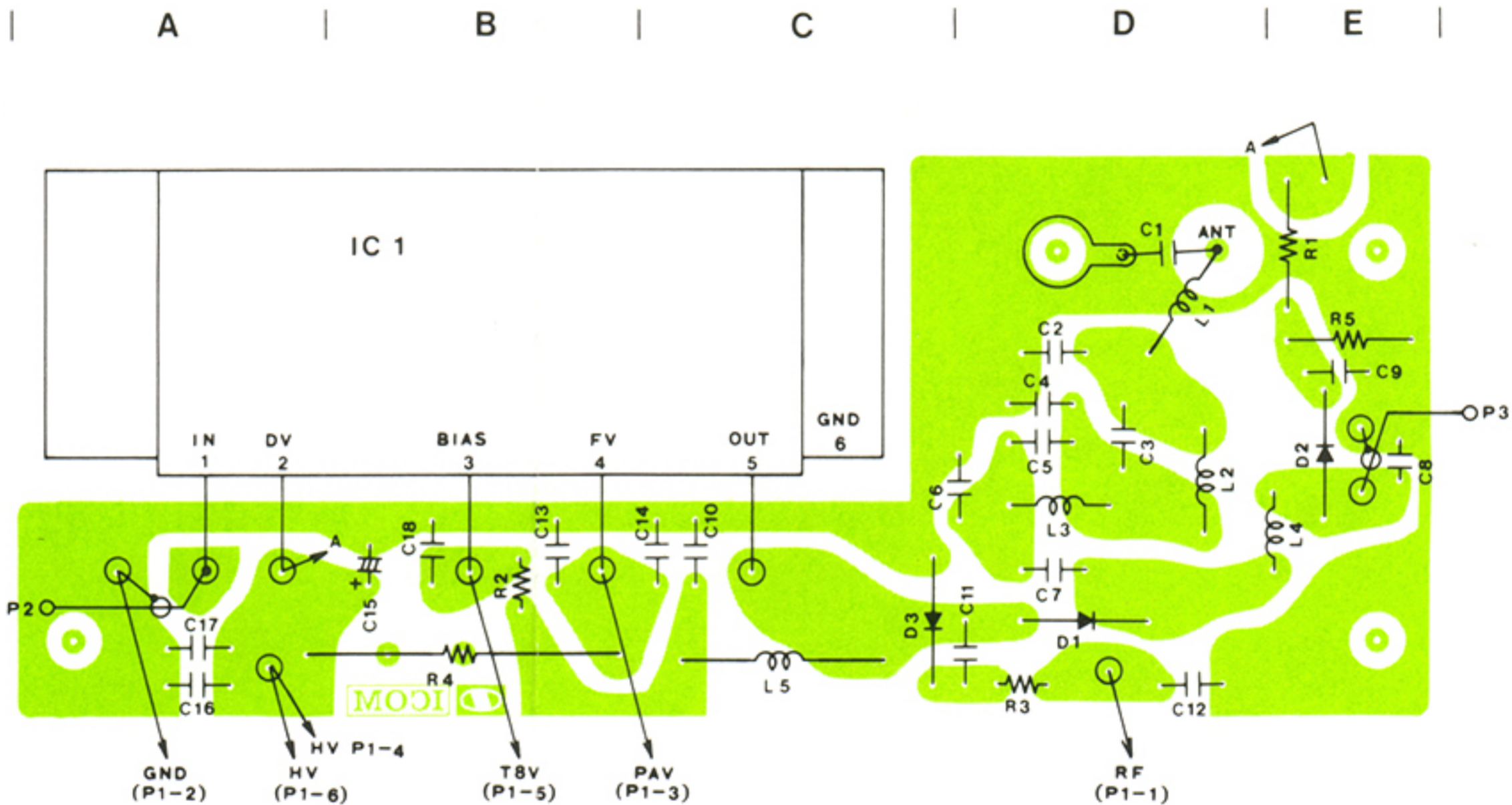
RF · YGR UNIT



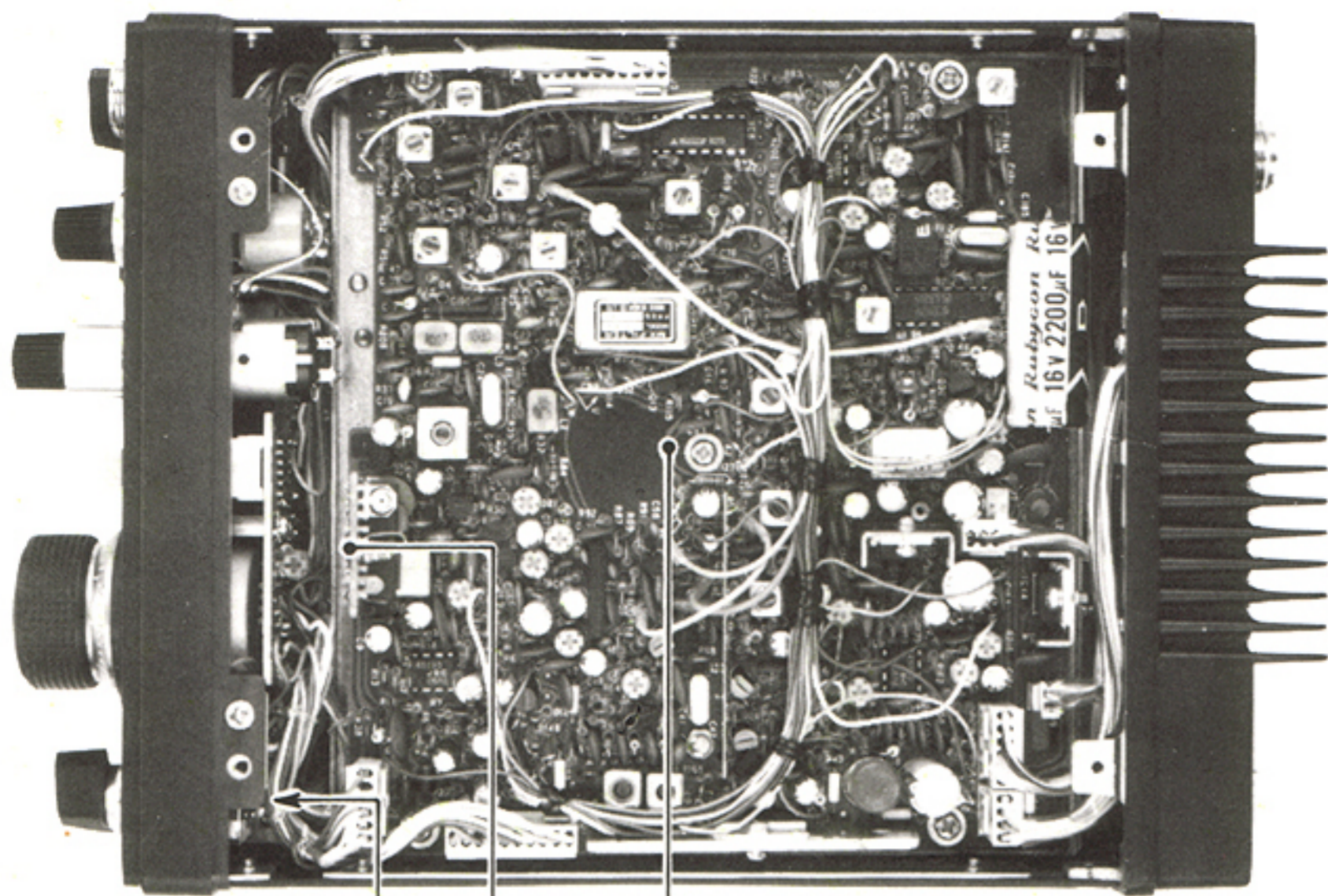
2

1

PA UNIT



UNIT LAYOUT



LED BOARD
DISPLAY BOARD

F SW BOARD

CH SW BOARD

SENSOR UNIT

RF·YGR UNIT

PLL·LOGIC UNIT

P A UNIT

M SW BOARD

TONE CALL UNIT

MAIN UNIT

ICOM INCORPORATED

Some components subject to change
for an improvement without notice.