



# SERVICE MANUAL

SURVIVAL CRAFT 2-WAY RADIO

**IC-GM1500**  
**IC-GM1500E**

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## INTRODUCTION

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This service manual describes the latest information for the **IC-GM1500** and **IC-GM1500E** SURVIVAL CRAFT 2-WAY RADIO at the time of publication.

MODEL	VERSION NUMBER	VERSION
IC-GM1500	#01, #02	USA
IC-GM1500E	#04, #05	UK
	#06, #07	EUR

To upgrade quality, any electrical or mechanical parts and internal circuits are subject to change without notice or obligation.

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## DANGER

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**NEVER** connect the transceiver to an AC outlet or to a DC power supply that uses more than 9 V. This will ruin the transceiver.

**DO NOT** expose the transceiver to rain, snow or any liquids.

**DO NOT** reverse the polarities of the power supply when connecting the transceiver.

**DO NOT** apply an RF signal of more than 20 dBm (100 mW) to the antenna connector. This could damage the transceiver's front end.

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## ORDERING PARTS

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Be sure to include the following four points when ordering replacement parts:

1. 10-digit order numbers
2. Component part number and name
3. Equipment model name and unit name
4. Quantity required

### <SAMPLE ORDER>

1140004740 S. IC HD404818C72H IC-GM1500 MAIN UNIT 5 pieces  
8810008320 Screw FH M2 x 4 SUS IC-GM1500 Top panel 10 pieces

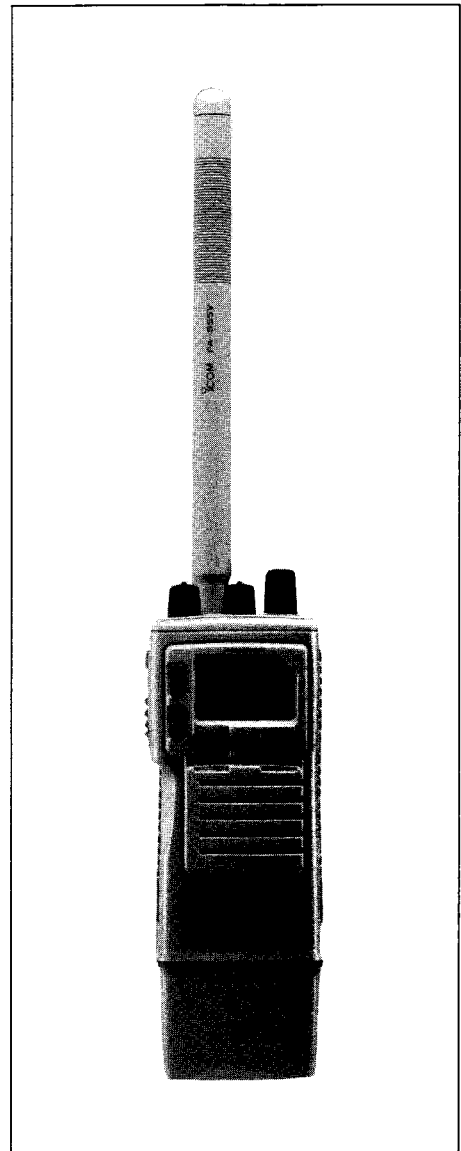
Addresses are provided on the inside back cover for your convenience.

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## REPAIR NOTES

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1. Make sure a problem is internal before disassembling the transceiver.
2. **DO NOT** open the transceiver until the transceiver is disconnected from its power source.
3. **DO NOT** force any of the variable components. Turn them slowly and smoothly.
4. **DO NOT** short any circuits or electronic parts. An insulated tuning tool **MUST** be used for all adjustments.
5. **DO NOT** keep power ON for a long time when the transceiver is defective.
6. **DO NOT** transmit power into a signal generator or a sweep generator.
7. **ALWAYS** connect a 40 dB to 50 dB attenuator between the transceiver and a deviation meter or spectrum analyzer when using such test equipment.
8. **READ** the instructions of test equipment thoroughly before connecting equipment to the transceiver.



# TABLE OF CONTENTS

<b>SECTION 1</b>	<b>SPECIFICATIONS</b> .....	<b>1 - 1</b>
<b>SECTION 2</b>	<b>INSIDE VIEWS</b> .....	<b>2 - 1</b>
<b>SECTION 3</b>	<b>CIRCUIT DESCRIPTION</b> .....	<b>3 - 1 to 3 - 4</b>
3 - 1	RECEIVER CIRCUITS .....	3 - 1
3 - 2	TRANSMITTER CIRCUITS .....	3 - 2
3 - 3	PLL CIRCUIT .....	3 - 3
3 - 4	POWER SUPPLY CIRCUITS .....	3 - 4
3 - 5	PORT ALLOCATIONS .....	3 - 4
<b>SECTION 4</b>	<b>ADJUSTMENT PROCEDURES</b> .....	<b>4 - 1 to 4 - 2</b>
4 - 1	PLL AND TRANSMITTER ADJUSTMENTS .....	4 - 1
4 - 2	RECEIVER ADJUSTMENT .....	4 - 2
<b>SECTION 5</b>	<b>PARTS LIST</b> .....	<b>5 - 1 to 5 - 5</b>
<b>SECTION 6</b>	<b>MECHANICAL PARTS AND DISASSEMBLY</b> .....	<b>6 - 1 to 6 - 2</b>
<b>SECTION 7</b>	<b>SEMI-CONDUCTOR INFORMATION</b> .....	<b>7 - 1</b>
<b>SECTION 8</b>	<b>BOARD LAYOUTS</b> .....	<b>8 - 1 to 8 - 3</b>
8 - 1	LOGIC AND MAIN UNITS .....	8 - 1 to 8 - 2
8 - 2	VR, SENSOR, PTT AND JACK UNITS .....	8 - 3
<b>SECTION 9</b>	<b>OPTIONAL UNIT</b> .....	<b>9 - 1</b>
<b>SECTION 10</b>	<b>BLOCK DIAGRAM</b> .....	<b>10 - 1</b>
<b>SECTION 11</b>	<b>VOLTAGE DIAGRAM</b> .....	<b>11 - 1</b>

# SECTION 1 SPECIFICATIONS

## ■ GENERAL

- Frequency range : 156.3-156.875 MHz
- Mode : FM (16K0G3E)
- Channel spacing : 25 kHz
- Power supply requirement : 7.5 V DC
- Current drain (at 7.5 V) :

RECEIVE	Power saved	15 mA
	Max. audio	500 mA
TRANSMIT	High	1.5 A
	Low	1.0 A

- Antenna impedance : 50  $\Omega$  (nominal)
- Usable temperature range :  $-20^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$  ( $-4^{\circ}\text{F}$  to  $+140^{\circ}\text{F}$ )
- Frequency stability :  $\pm 0.0005\%$  ( $-20^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$ )
- Dimensions : 61 (W)  $\times$  165.5 (H)  $\times$  44 (D) mm; 2.4 (W)  $\times$  6.5 (H)  $\times$  1.7 (D) in
- Weight : 515 g; 1.1 lb oz

## ■ TRANSMITTER

- Output power (at 7.5 V) : High 2.0 W  
Low 0.8 W
- Modulation system : Variable reactance phase modulation
- Maximum frequency deviation :  $\pm 5$  kHz
- Spurious emissions : Less than 0.25  $\mu\text{W}$
- FM noise and hum : More than 40 dB
- Audio frequency response :  $+1$  dB to  $-3$  dB of  $+6$  dB/octave with 300 Hz to 3000 Hz input

## ■ RECEIVER

- Receive system : Double conversion superheterodyne
- Sensitivity : 0.35  $\mu\text{V}$  for 20 dB SINAD
- Intermediate frequencies : 1st 30.875 MHz  
2nd 455 kHz
- Squelch sensitivity (at threshold) : Less than 0.3  $\mu\text{V}$
- Adjacent channel selectivity : More than 70 dB
- Intermodulation rejection : More than 68 dB
- Spurious rejection : More than 70 dB
- Spurious emissions : Less than 2 nW
- Audio output power : 500 mW at 10% distortion with 8  $\Omega$  load
- FM noise and hum : More than 40 dB
- Audio frequency response :  $+1$  dB to  $-3$  dB of  $+6$  dB/octave with 300 Hz to 3000 Hz modulation

## ■ CHANNEL LIST (varies according to version)

Channel number	Frequency (MHz)	Channel number	Frequency (MHz)	Channel number	Frequency (MHz)
06	156.300	13	156.650	67	156.375
08	156.400	14	156.700	68	156.425
09	156.450	15*	156.750	69	156.475
10	156.500	16	156.800	71	156.575
11	156.550	17*	156.850	72	156.625
12	156.600			73	156.675
				74	156.725
				77	156.875

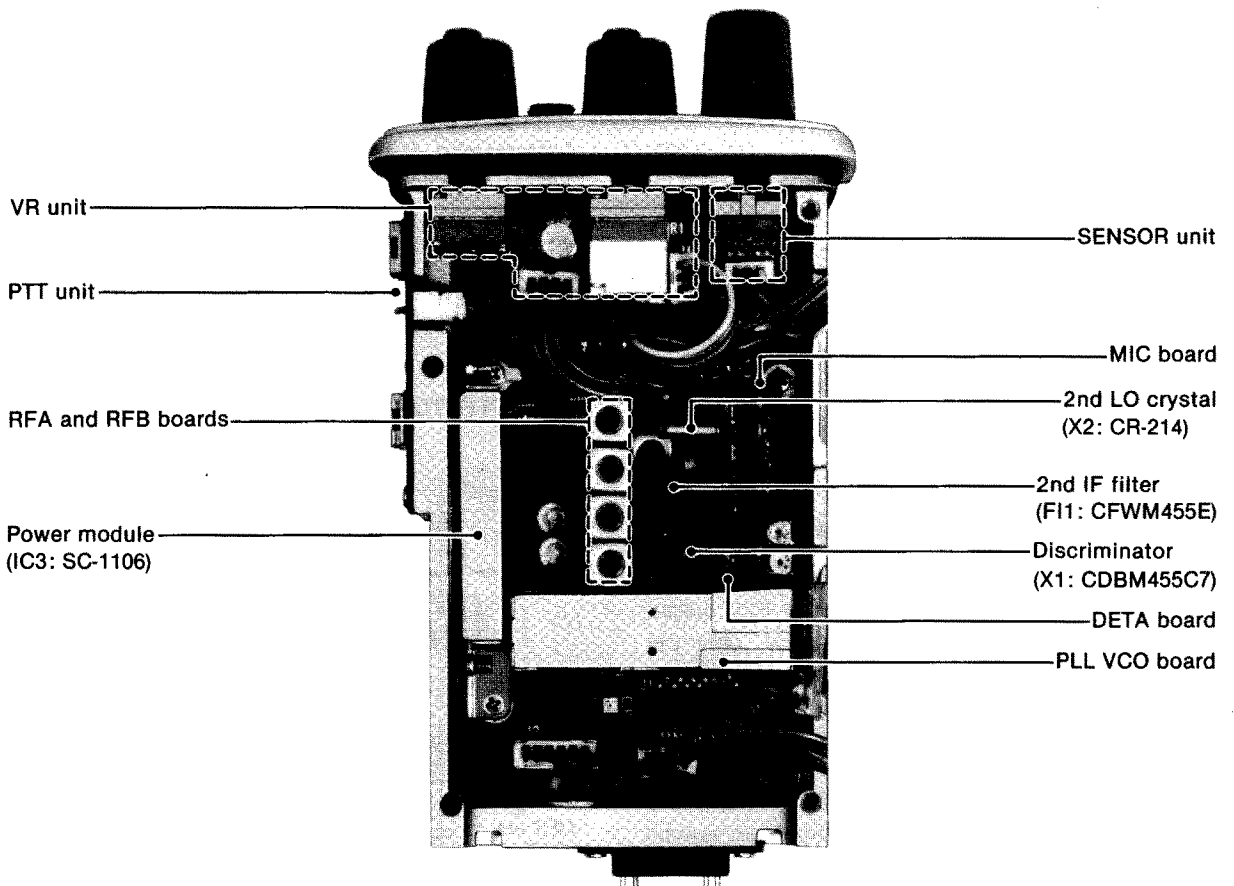
\*Low power only

All stated specifications are subject to change without notice or obligation.

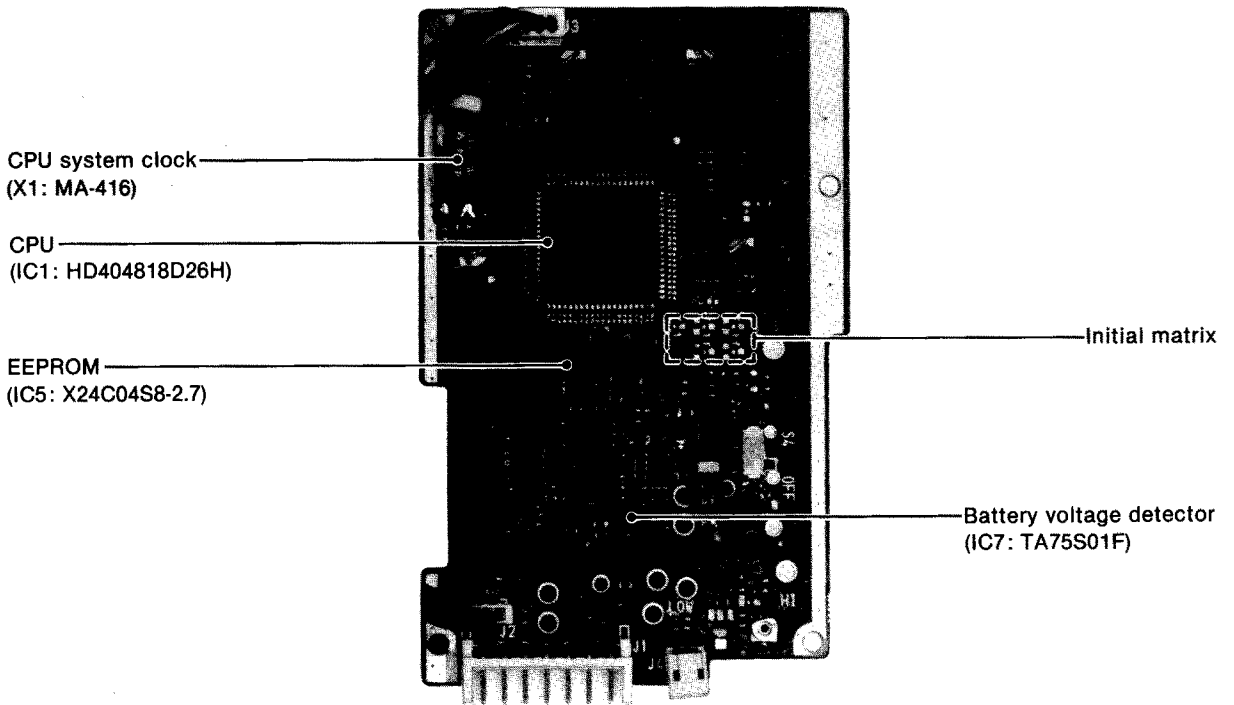


## SECTION 2 INSIDE VIEWS

### • MAIN unit



### • LOGIC unit



## SECTION 3 CIRCUIT DESCRIPTION

### 3-1 RECEIVER CIRCUITS

#### 3-1-1 ANTENNA SWITCHING CIRCUIT (MAIN UNIT)

The antenna switching circuit functions as a low-pass filter while receiving and a resonator circuit while transmitting. The circuit does not allow transmit signals to enter receiver circuits.

Received signals enter the antenna connector and then pass through the low-pass filter (L4, L5, C1—C6). The filtered signals are passed through the  $\lambda/4$  type antenna switching circuit (D4, L1, L2, C7—C9) and are then applied to the RFA board.

#### 3-1-2 RF AND 1ST MIXER CIRCUITS (RFA/RFB BOARDS AND MAIN UNIT)

The 1st mixer circuit converts the received signal to a fixed frequency of the 1st IF signal with a PLL output frequency. By changing the PLL frequency, only the desired frequency will be passed through a pair of crystal filters at the next stage of the 1st mixer.

The signals from the antenna switching circuit are passed through the tunable bandpass filter (L1, L2, D1, D2) and amplified at the RF amplifier (Q1). The amplified signals are again passed through the tunable bandpass filter (L3, L4, D3, D4) and applied to the MAIN unit. The signals are then mixed at the double balanced mixer (Q12a, Q12b) with a 1st LO signal coming from the PLL circuit to produce a 30.875 MHz 1st IF signal. The 1st IF signal is passed through a pair of crystal filters (F1) and is then applied to the DETA board.

#### 3-1-3 2ND IF AND DEMODULATOR CIRCUITS (DETA BOARD)

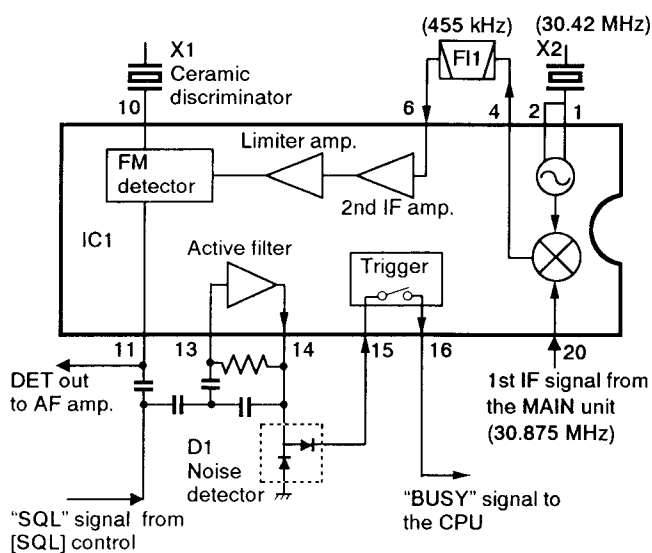
The 2nd mixer circuit converts the 1st IF signal to a 2nd IF signal. A double superheterodyne system (which converts receive signal twice) improves the image rejection ratio and obtains stable receiver gain.

The 1st IF signal from the MAIN unit is amplified at Q1 and applied to a 2nd mixer section of IC1 (pin 20). The signal is then mixed with a 2nd LO signal for conversion to a 455 kHz 2nd IF signal.

IC1 contains the 2nd mixer, local oscillator, limiter amplifier, quadrature detector and active filter. The local oscillator section generates 30.42 MHz using X2.

The 2nd IF signal from the 2nd mixer (IC1, pin 4) passes through a pair of ceramic filter (F1) to remove unwanted heterodyned frequencies. It is then amplified at the limiter amplifier (IC1, pin 6) and applied to the quadrature detector (IC1, pins 9, 10 and X1) to demodulate the 2nd IF signal into AF signals. The AF signals (detector signals) are output from pin 11 and applied to the MAIN unit via the "DETO" line.

#### FM DETECTOR AND SQUELCH CIRCUITS



#### 3-1-4 AF CIRCUIT (AF BOARD)

AF signals from the DETA board are amplified at the active filters (Q4 HPF; Q5 LPF) and passed through the AF mute switch (Q6) and the [VOL] control (VR unit). The mute switch (Q6) cuts the audio line when the squelch closes.

The passed signals (via "AF2") are amplified at the AF power amplifier (IC1a/b) to a level needed to drive the speaker.

For power conservation, the power supply circuit (Q1, Q2, Q3, D1) does not supply Vcc voltage to the AF power amplifier (IC1) when the squelch closes.

### 3-1-5 SQUELCH CIRCUIT (DETA and AF BOARDS)

A squelch circuit cuts out AF signals when no RF signal is received. By detecting noise components in the AF signals, the squelch circuit switches the AF mute switch in the AF board.

A portion of the AF signals from the FM IF IC (IC1, pin 11) are applied to the active filter (IC1, pin 13) where noise components above 20 kHz are amplified and output from pin 14. The [SQL] control is connected in parallel to the active filter input (pin 13) to control the input noise level. The output signals are rectified at the noise detector (D1) and then applied to the trigger circuit (pin 15).

The trigger circuit converts the rectified signals to a HIGH or LOW signal and applies this to the CPU (LOGIC unit IC1, pin 27) as the "SQBUSY" signal. When the CPU receives HIGH, the CPU outputs the "RMUT" signal via the I/O expander IC (LOGIC unit IC4, pin 13) to cut the AF signals.

The "RMUT" signal is applied to the AF board and switches the AF mute switch (Q6). At the same time, the "AFON" signal disappears to deactivate the power supply circuit of the AF amplifier (Q1—Q3). However, it activates while emitting beeps.

## 3-2 TRANSMITTER CIRCUITS

### 3-2-1 MICROPHONE AMPLIFIER (MIC BOARD)

The microphone amplifier circuit amplifies audio signals with +6 dB/octave pre-emphasis characteristics from the microphone to a level needed for the modulation circuit.

The AF signals from the microphone are amplified at the limiter amplifier (MIC board IC1b) which has a negative feedback circuit for +6 dB/octave pre-emphasis.

The signals are amplified at the buffer amplifier (IC2). RF components are then filtered out at the splatter filter (IC1a) and applied to the PLL VCO board as the "MOD" signal.

### 3-2-2 MODULATION CIRCUIT (PLL VCO BOARD)

The modulation circuit modulates the VCO oscillating signal (RF signal) using the microphone audio signals.

The audio signals (MOD) change the reactance of D3 on the PLL VCO board to modulate the oscillated signal at the transmitter VCO (Q7). The oscillated signal is amplified at the buffer amplifier (Q8, Q10), then applied to the drive amplifiers on the MAIN unit.

### 3-2-3 DRIVE/POWER AMPLIFIER CIRCUITS (MAIN UNIT)

The signal from the PLL VCO board is passed through the transmit/receive switching circuit (D5) and amplified by the pre-driver (Q1), driver (Q3), and the power module (IC3) in sequence to obtain 2 W of RF power. The amplified signal is passed through the APC detector circuit (L8, D2), antenna switching circuit (D1), and low-pass filter (L4, L5, C1—C5) and is then applied to the antenna connector.

The bias current of the pre-drive and drive amplifiers (Q1, Q3) is controlled by the APC circuit to stabilize the output power.

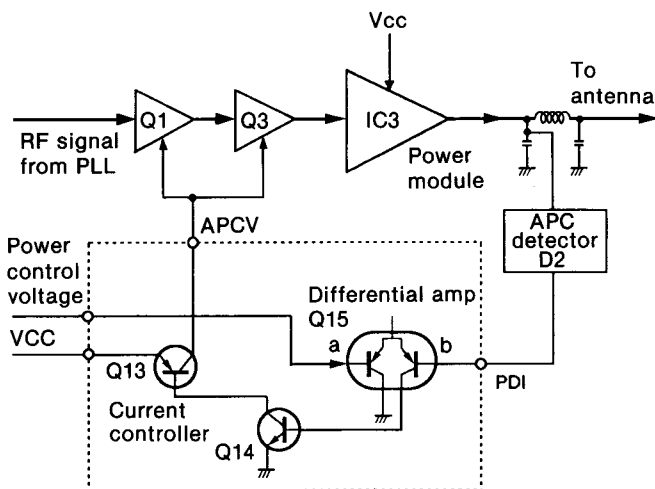
### 3-2-4 APC CIRCUIT (MAIN UNIT)

The APC circuit provides stable output power even when the input voltage or temperature changes; and selects high or low output power.

The APC detector circuit (L8, D2) detects the output power level. The detected voltage increases according to the output power level.

The detected voltage is applied to one of the differential amplifier inputs (Q15b) and a power setting voltage is applied to the other input (Q15a). When the output power is increased, the detected voltage exceeds the APC output current (Q13 collector) via Q14 to decrease the output power.

#### APC CIRCUIT



### 3-3 PLL CIRCUIT (PLL VCO BOARD)

A PLL circuit provides stable oscillation of the transmitter frequency and the receive frequency. The PLL output frequency is controlled by the divided ratio (N-data) of the programmable divider.

The IC-GM1500's PLL circuit contains a separate receiver VCO (Q6, D1) and transmitter VCO (Q7, D2). The oscillated signal is amplified at the buffer amplifier (Q8, Q9) and then applied to the PLL IC (IC1, pin 8).

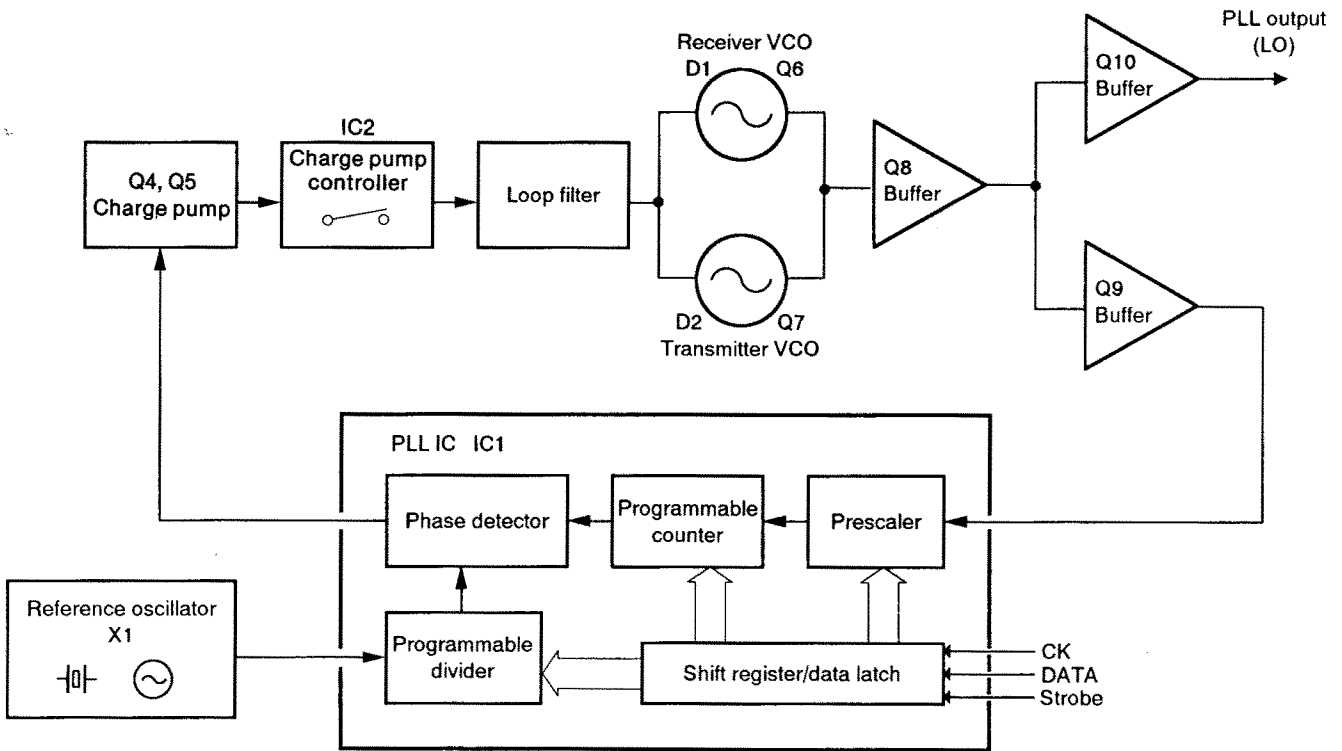
The PLL IC (IC1) contains a prescaler, two programmable dividers, and a phase detector, etc. The entered signal is divided at the prescaler and programmable counter sections by the N-data ratio from the CPU. The divided signals are detected on phase at the phase detector using the reference frequency.

If the oscillated signal drifts, the phase of its frequency changes from the reference frequency, causing a lock voltage change to compensate for the drift in the oscillated frequency.

One of VCO signals is amplified at the buffer amplifiers (Q8, Q10) and is then applied to the receive 1st mixer or transmit driver circuit.

The lock voltage is also used for the receiver tunable bandpass filter to match the filter's center frequency to the desired receive frequency. The lock voltage is amplified at the buffer amplifier (MAIN unit Q5) and then applied to the RFA board.

#### PLL CIRCUIT BLOCK DIAGRAM



### 3-4 POWER SUPPLY CIRCUITS

#### VOLTAGE LINES (MAIN UNIT)

LINE	DESCRIPTION
H.V	The voltage from the attached battery pack.
VCC	The same voltage as the H.V line (battery voltage) which is controlled by the power switch ([OFF/VOL] control).
+5	Common 5 V converted from the VCC line by the 5 V regulator circuit (Q10, Q11) using the reference regulator (IC4).
+5S	Common 5 V controlled by the power saver function. The "+5S" regulator circuit (Q6, Q7 $\frac{1}{2}$ ) produces 5 V from the VCC voltage using the power save controlled signal from the I/O expander IC (LOGIC unit IC4).
R+5S	5 V for receiver circuit controlled by the power saver function and the T/R switching signal, "SEND" from the I/O expander IC (LOGIC unit IC4). The "R+5S" regulator consists of Q8 and Q7 $\frac{1}{2}$ .
T+5	5 V for transmitter circuit controlled by the "TMUTE" signal from the I/O expander (LOGIC unit IC4). The "T+5" regulator circuit consists of Q16 and Q17.

### 3-5 PORT ALLOCATIONS

#### 3-5-1 EXPANDER IC (LOGIC UNIT IC4)

PIN NO.	PORT NAME	DESCRIPTION
1	STB	Input port for a strobe signal from the CPU.
2	DATA	Input port for a data signal from the CPU.
3	CK	Input port for a clock signal from the CPU.
6	PSC	Outputs a power save control signal to the MAIN unit.
7	CPC	Outputs a charge pump control signal to the PLL VCO board.
11	SEND	Outputs a transmit/receive switching signal. "HIGH" when transmitting.
12	TMUTE	Outputs a transmit mute signal. "LOW" to mute the transmit power.
13	RMUTE	Outputs a receive mute signal. "HIGH" to mute the receive audio.
14	AF ON	Outputs an AF power amp control signal. "HIGH" to activate the AF amp.

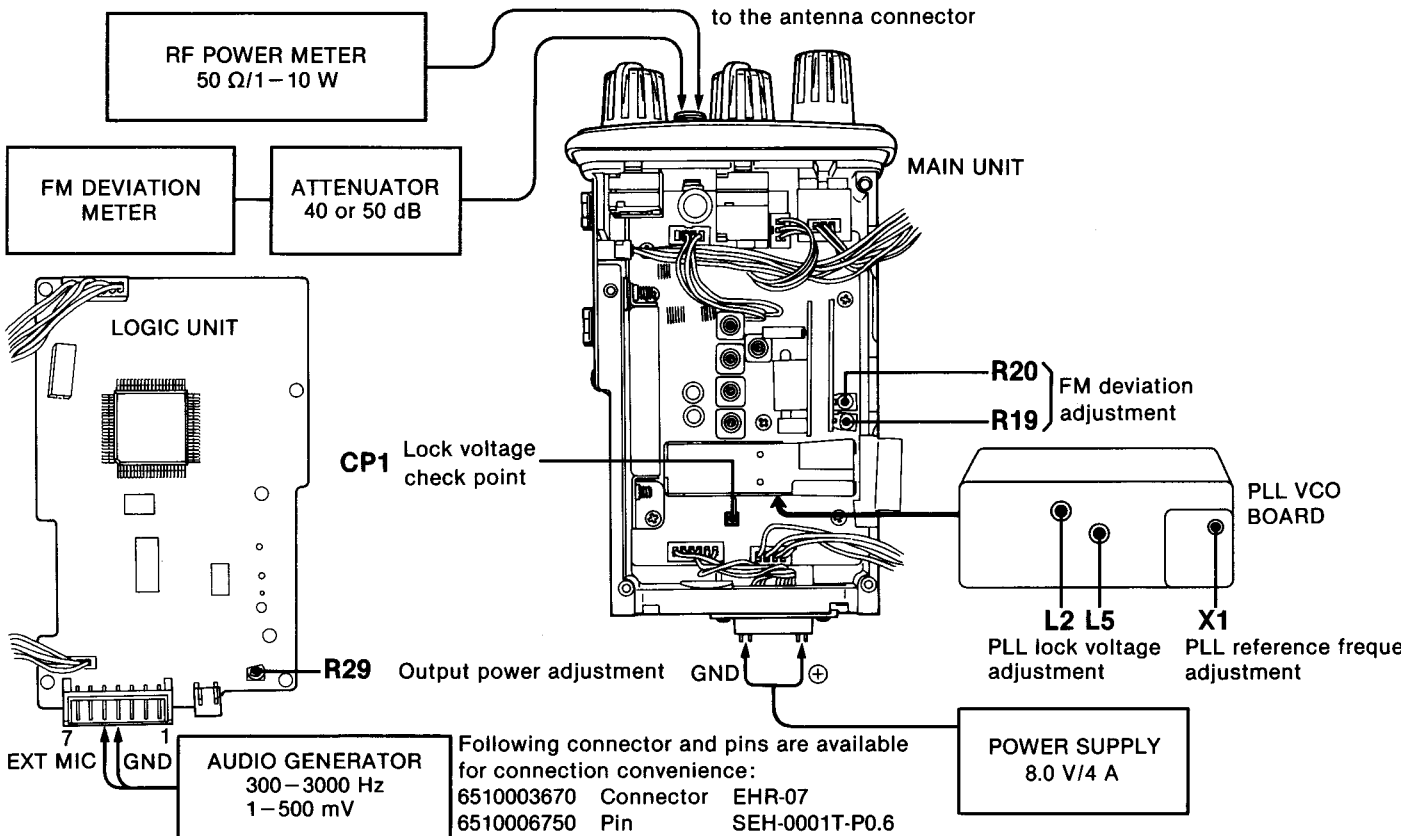
### 3-5-2 CPU (LOGIC UNIT IC1)

PIN NO.	PORT NAME	DESCRIPTION
1	EXSTB	Outputs a strobe signal to the I/O expander IC (IC4).
2	EPEDA	Used for the memory backup EPROM (IC5).
3	EPSC	
5	H/L CONT	Outputs a transmit high/low switching signal. "HIGH" for low power.
6	LAMPO	Outputs a display backlight signal. "HIGH" for backlight ON.
7	H/L KEY	Input port for the [HI/LOW] switch.
8	ENC /B	Input ports for the channel selector.
9	ENC B	
10	ENC A	
15-18	KS0-KS3	Output ports for the initial matrix and key matrix.
19-22	KI0-KI3	Input ports for the initial matrix and key matrix.
23	UNLK	Input port for the unlock signal from the PLL circuit.
27	SQBUSY	Input port for the noise squelch signal from the FM IF IC (DETA board IC1). "HIGH" when the squelch closes.
28	BEEP	Outputs beep tone signals.
29	INT0	Input port for the interrupt signal. "LOW" for CPU stand-by. "HIGH" for CPU operation.
32-56	SEG2-SEG26	Output the LCD drive signal.
63	COM1	Output a common signal for the LCD display.
64	COM2	
74	OSC1	Terminals for CPU clock.
75	OSC2	
76	RESET	Input port for the CPU reset signal.
80	PLSTB	Outputs a strobe signal to the PLL IC (PLL VCO board IC1).

# SECTION 4 ADJUSTMENT PROCEDURES

## 4-1 PLL AND TRANSMITTER ADJUSTMENTS

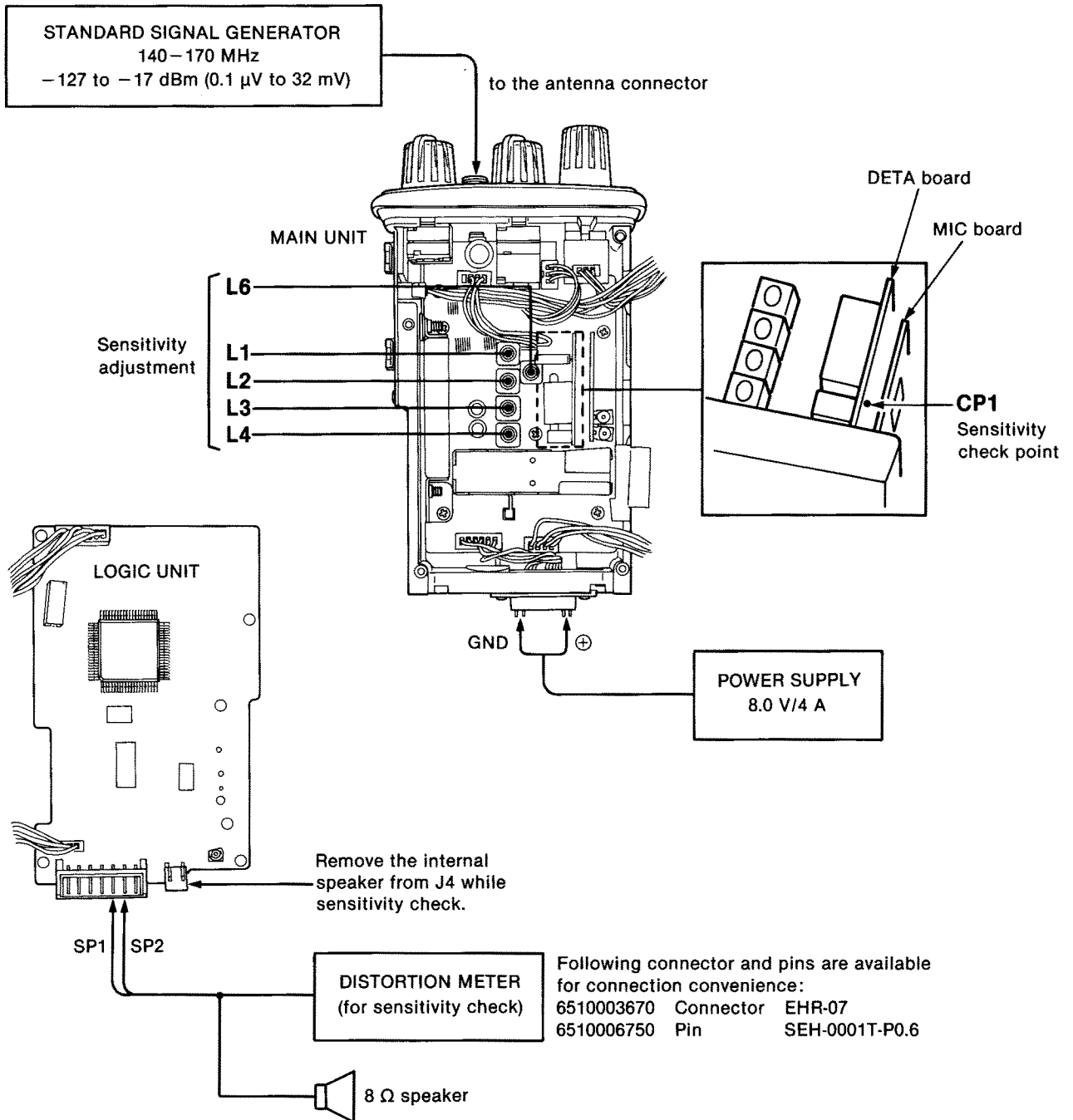
ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
PLL LOCK VOLTAGE	1 • Operating channel: 16 • Receiving	MAIN	Connect the digital multi-meter or oscilloscope to CP1.	2.0 V	PLL VCO	L2
	2 • Transmitting			2.8 V		L5
PLL REFERENCE FREQUENCY	1 • Operating channel: 16 • Transmitting	Top panel	Loosely couple the frequency counter to the antenna connector.	156.800 MHz	PLL VCO	X1
OUTPUT POWER	1 • Operating channel: 16 • [HI/LO] switch: HIGH • Transmitting	Top panel	Connect the RF power meter to the antenna connector.	2.0 W	LOGIC	R29
	2 • [HI/LO] switch: LOW			0.6–1.0 W		Verify
FM DEVIATION	1 • Operating channel: 16 • Apply an AF signal to J1 pins 4 and 5 (LOGIC UNIT): 1 kHz/50 mV • Connect the FM deviation meter to the antenna connector and set as: HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2 • [HI/LO] switch : HIGH • Transmitting	Top panel	Connect the FM deviation meter to the antenna connector through the attenuator.	±4.5 kHz	MIC	R19
	2 • Apply and AF signal to J1 pins 4 and 5 (LOGIC UNIT): 1 kHz/5 mV			±3.0 kHz		R20



## 4-2 RECEIVER ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
SENSITIVITY	1 <ul style="list-style-type: none"> <li>Operating channel: 16</li> <li>Connect the SSG to the antenna connector and set as:                          Frequency : 156.80 MHz                          Level : 3.2 <math>\mu\text{V}^*</math> (-97 dBm)                          Deviation : <math>\pm 3.5</math> kHz                          Modulation: 1 kHz</li> <li>Preset cores of coils with the flat surface to the coil (RFB: L1, L2, L3, L4).</li> <li>Receiving</li> </ul>	DETA	Connect the oscilloscope to CP1.	Maximum level	RFB	Adjust in squence L1, L2, L3, L4
					MAIN	L6

\* This output level of the standard signal generator (SSG) is indicated as SSG's open circuit.



# SECTION 5 PARTS LIST

## [LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1140005110	S.IC	HD404818D28H
IC2	1130004500	S.IC	TC4S11F (TE85R)
IC3	1180000810	S.IC	RH5VA42CA-T1
IC4	1130007700	S.IC	BU4094BCF-T1
IC5	1140003610	S.IC	X24C04S8-2.7
IC6	1130003610	S.IC	TC4SU69F (TE85R)
IC7	1110002750	S.IC	TA75S01F (TE85R)
Q1	1590000420	S.TRANSISTOR	RN1404 (TE85R)
Q2	1530002060	S.TRANSISTOR	2SC4081 T107 R
Q3	1590000420	S.TRANSISTOR	RN1404 (TE85R)
Q4	1590001040	S.TRANSISTOR	DTA113ZU T107
Q5	1590000420	S.TRANSISTOR	RN1404 (TE85R)
Q6	1590000420	S.TRANSISTOR	RN1404 (TE85R)
D1	1750000260	S.DIODE	1SS352 (TPH3)
D2	1750000260	S.DIODE	1SS352 (TPH3)
D3	1750000260	S.DIODE	1SS352 (TPH3)
D4	1750000260	S.DIODE	1SS352 (TPH3)
D5	1750000260	S.DIODE	1SS352 (TPH3)
D6	1180000050	S.DIODE	DAP202U T107 [Eur]
	1750000220	S.DIODE	DA113W T107 [Gen]
	1750000240	S.DIODE	DA112 T107 [UK]
D7	1750000220	S.DIODE	DA113W T107 [Eur],[UK],[Gen]
D9	1180000050	S.DIODE	DAP202U T107 [Eur]
	1750000220	S.DIODE	DA113W T107 [UK],[Gen]
D10	1750000220	S.DIODE	DA113W T107 [USA]
	1750000220	S.DIODE	DA113W T107 [UK],[Eur],[Gen]
D12	1750000260	S.DIODE	1SS352 (TPH3)
D13	1750000070	S.DIODE	1SS226 (TE85R)
X1	6050008420	S.XTAL	MA-416 4.194304MHz
R1	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 M $\Omega$ )
R2	7410000750	S.ARRAY	EXB-V4V 104JV (100 k $\Omega$ )
R3	7410000750	S.ARRAY	EXB-V4V 104JV (100 k $\Omega$ )
R4	7030003800	S.RESISTOR	ERJ3GEYJ 105 V (1 M $\Omega$ )
R5	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 k $\Omega$ )
R6	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 $\Omega$ )
R7	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 k $\Omega$ )
R8	7410000730	S.ARRAY	EXB-V8V 104JV (100 k $\Omega$ )
R9	7410000730	S.ARRAY	EXB-V8V 104JV (100 k $\Omega$ )
R10	7410000730	S.ARRAY	EXB-V8V 104JV (100 k $\Omega$ )
R11	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 k $\Omega$ )
R12	7030003380	S.RESISTOR	ERJ3GEYJ 331 V (330 $\Omega$ )
R13	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 k $\Omega$ )
R14	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 k $\Omega$ )
R15	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 k $\Omega$ )
R16	7410000820	S.ARRAY	EXB-V4V 223JV (22 k $\Omega$ )
R17	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 k $\Omega$ )
R18	7410000730	S.ARRAY	EXB-V8V 104JV (100 k $\Omega$ )
R19	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 k $\Omega$ )
R20	7410000750	S.ARRAY	EXB-V4V 104JV (100 k $\Omega$ )
R21	7030003800	S.RESISTOR	ERJ3GEYJ 223 V (22 k $\Omega$ )
R22	7410000750	S.ARRAY	EXB-V4V 104JV (100 k $\Omega$ )
R23	7030003550	S.RESISTOR	ERJ3GEYJ 822 V (8.2 k $\Omega$ )
R24	7030003530	S.RESISTOR	ERJ3GEYJ 562 V (5.6 k $\Omega$ )
R25	7030003820	S.RESISTOR	ERJ3GEYJ 333 V (33 k $\Omega$ )
R26	7030003490	S.RESISTOR	ERJ3GEYJ 272 V (2.7 k $\Omega$ )
R27	7030003570	S.RESISTOR	ERJ3GEYJ 123 V (12 k $\Omega$ )
R28	7030003580	S.RESISTOR	ERJ3GEYJ 153 V (15 k $\Omega$ )
R29	7310003900	S.TRIMMER	EVM-3SSX50 B34 (303)
R30	7030003260	S.RESISTOR	ERJ3GEYJ 330 V (33 $\Omega$ )
R31	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 k $\Omega$ )

## [LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R32	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 k $\Omega$ )
C1	4030006640	S.CERAMIC	C1608 SL 1H 180J-T-A
C2	4030006640	S.CERAMIC	C1608 SL 1H 180J-T-A
C3	4550000770	S.TANTALUM	TESVC 0J 226M-12L
C4	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C6	4030006830	S.CERAMIC	C1608 JF 1C 104Z-T-A
C7	4030006830	S.CERAMIC	C1608 JF 1C 104Z-T-A
C8	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A
C9	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C10	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C11	4030006830	S.CERAMIC	C1608 JF 1C 104Z-T-A
C12	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A
C13	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A
C15	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C16	4030006830	S.CERAMIC	C1608 JF 1C 104Z-T-A
C17	4030006830	S.CERAMIC	C1608 JF 1C 104Z-T-A
C18	4030006830	S.CERAMIC	C1608 JF 1C 104Z-T-A
C19	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C20	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C21	4550003040	S.TANTALUM	TEMSVB2 0J 106M-8L
C22	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C23	4030006830	S.CERAMIC	C1608 JF 1C 104Z-T-A
C24	4030006830	S.CERAMIC	C1608 JF 1C 104Z-T-A
C25	4030006830	S.CERAMIC	C1608 JF 1C 104Z-T-A
C26	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C27	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C28	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A
C29	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A
DS1	5040001940	S.LED	SML-110DT T86
DS2	5040001940	S.LED	SML-110DT T86
DS3	5030000950	LCD	LD-BU5579J
MC1	7700001750	MICROPHONE	EM-123TH
J1	6510003550	CONNECTOR	S07B-EH-S
J3	6510007860	CONNECTOR	PI28A-07M
J4	6510009460	CONNECTOR	S2B-ZR
J5	6510016610	S.CONNECTOR	52396-3090
S1	2260001560	S.SWITCH	SW-131 (SKHMPU)
S2	2260001560	S.SWITCH	SW-131 (SKHMPU)
S3	2260001560	S.SWITCH	SW-131 (SKHMPU)
S4	2220000500	S.SWITCH	SW-141 (SSSS81)
S5	2260001560	S.SWITCH	SW-131 (SKHMPU)
EP1	0910044081	PCB	B 4275A
EP2	8930033680	LCD CONTACT	SRCN-1540 SG

## [SENSOR UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C1	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A
C2	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A
S1	2250000220	ENCODER	TP90N937E20-15F-1540
EP1	0910044032	PCB	B 4060B

S.=Surface mount



## [VR UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R1	7210002530	VARIABLE	TP98N937N-15F-10KA-1540
R2	7210002540	VARIABLE	TP96N937-15F-10KB-1540
C1	4510002650	ELECTROLITIC	16 MS7 100UF
C2	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C3	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
J1	6510007170	CONNECTOR	PI28A-03M
J2	6510007090	CONNECTOR	PI28A-04M
EP1	0910044091	PCB	B 4276A

## [JACK UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C1	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C2	4030006890	S.CERAMIC	C1608 JF 1H 103Z-T-A
J1	6510016710	CONNECTOR	YM-263
EP1	0910044041	PCB	B 4062A

## [MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1130006800	S.IC	TC7W08F (TE12L)
IC2	1130003610	S.IC	TC4SU69F (TE85R)
IC3	1150000780	IC	SC1106
IC4	1180000800	S.IC	S-81350HG-KD-T1
IC5	1130007390	S.IC	TC7W02F(TE12L)
Q1	1530002560	S.TRANSISTOR	2SC4403-3-TR
Q2	1590000750	S.TRANSISTOR	UN511E(TX)
Q3	1530002340	S.TRANSISTOR	2SC2954-T2B
Q5	1580000540	S.FET	2SK880-Y (TE85R)
Q6	1590001170	S.TRANSISTOR	XP1501-(TX).AB
Q7	1590000620	S.TRANSISTOR	FMS1 T148
Q8	1590001170	S.TRANSISTOR	XP1501-(TX).AB
Q10	1590001170	S.TRANSISTOR	XP1501-(TX).AB
Q11	1520000450	S.TRANSISTOR	2SB1132 T100 Q
Q12	1590001530	S.TRANSISTOR	UMX5 TL
Q13	1510000890	S.TRANSISTOR	DTA143TU T107
Q14	1590000790	S.TRANSISTOR	DTC143TU T107
Q15	1590000620	S.TRANSISTOR	FMS1 T148
Q16	1520000450	S.TRANSISTOR	2SB1132 T100 Q
Q17	1590001170	S.TRANSISTOR	XP1501-(TX).AB
Q18	1590000660	S.TRANSISTOR	DTC144TU
D1	1750000080	S.DIODE	1SS153-T2
D2	1790001270	S.DIODE	MA741WA-(TX)
D4	1790000450	S.DIODE	MA862(TX)
D5	1790000450	S.DIODE	MA862(TX)
D10	1790000680	S.DIODE	SB20-03P-TD
D11	1750000130	S.DIODE	DA204U T107
D12	1160000060	S.DIODE	DAN202U
FI1	2010001600	XTAL	FL-199 UM-1 30.875MHZ
L1	6110002000	COIL	LA-226
L2	6110002070	COIL	LA-227
L3	6200002630	S.COIL	NL 252018T-R10J
L4	6110002120	COIL	LA-228
L5	6110002070	COIL	LA-227
L6	6150003570	COIL	LS-393

## [MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
L7	6200003380	S.COIL	B4F-617PT-1026=P3
L8	6110002070	COIL	LA-227
L9	6200002860	S.COIL	NL 252018T-4R7J
L10	6200002420	S.COIL	NL 252018T-068J
R1	7030006510	S.ARRAY	EXB-V4V 330JV (33 Ω)
R2	7030005900	S.ARRAY	EXB-V4V 331JV (330 Ω)
R3	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R4	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R5	7030003280	S.RESISTOR	ERJ3GEYJ 470 V (47 Ω)
R6	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R7	7030003470	S.RESISTOR	ERJ3GEYJ 182 V (1.8 kΩ)
R8	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R9	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R10	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R11	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R12	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R13	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R14	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R15	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R16	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R17	7030003410	S.RESISTOR	ERJ3GEYJ 561 V (560 Ω)
R18	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)
R19	7030003310	S.RESISTOR	ERJ3GEYJ 820 V (82 Ω)
R20	7030003280	S.RESISTOR	ERJ3GEYJ 470 V (47 Ω)
R21	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)
R22	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R23	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R24	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R25	7030003380	S.RESISTOR	ERJ3GEYJ 331 V (330 Ω)
R26	7030003620	S.RESISTOR	ERJ3GEYJ 333 V (33 kΩ)
R27	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R28	7030003630	S.RESISTOR	ERJ3GEYJ 393 V (39 kΩ)
R29	7030003550	S.RESISTOR	ERJ3GEYJ 822 V (8.2 kΩ)
R30	7030003620	S.RESISTOR	ERJ3GEYJ 333 V (33 kΩ)
R31	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R33	7030003340	S.RESISTOR	ERJ3GEYJ 151 V (150 Ω)
R34	7030003370	S.RESISTOR	ERJ3GEYJ 271 V (270 Ω)
R35	7030003230	S.RESISTOR	ERJ3GEYJ 180 V (18 Ω)
R36	7030003370	S.RESISTOR	ERJ3GEYJ 271 V (270 Ω)
R37	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R38	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)
R39	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R40	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R41	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R42	7030003280	S.RESISTOR	ERJ3GEYJ 470 V (47 Ω)
R43	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R44	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)
C1	4030006940	S.CERAMIC	C1608 CH 1H 030C-T-A
C2	4030006950	S.CERAMIC	C1608 CH 1H 040C-T-A
C3	4030006860	S.CERAMIC	C1608 SL 1H 220J-T-A
C4	4030006950	S.CERAMIC	C1608 CH 1H 040C-T-A
C5	4030006620	S.CERAMIC	C1608 SL 1H 120J-T-A
C6	4030009880	S.CERAMIC	C1608 JB 1H 682K-T-A
C7	4030006630	S.CERAMIC	C1608 SL 1H 150J-T-A
C8	4030006690	S.CERAMIC	C1608 SL 1H 330J-T-A
C9	4030006640	S.CERAMIC	C1608 SL 1H 180J-T-A
C10	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C11	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C12	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C13	4030006660	S.CERAMIC	C1608 SL 1H 220J-T-A
C14	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C15	4030006620	S.CERAMIC	C1608 SL 1H 120J-T-A
C16	4550000550	S.TANTALUM	TESVA 1V 224M1-8L
C17	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C18	4030006920	S.CERAMIC	C1608 CH 1H 010C-T-A
C19	4030006620	S.CERAMIC	C1608 SL 1H 120J-T-A
C20	4030006560	S.CERAMIC	C1608 SL 1H 050C-T-A
C21	4030006630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C22	4030006630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C23	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A
C24	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A
C25	4030006850	S.CERAMIC	C1608 JB 1H 471K-T-A

S.=Surface mount

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C26	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
C27	4030008680	S.CERAMIC	C2012 JF 1C 105Z-T-A
C29	4030008850	S.CERAMIC	C1808 JB 1H 471K-T-A
C30	4030008640	S.CERAMIC	C1808 SL 1H 180J-T-A
C31	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C32	4030008900	S.CERAMIC	C1808 JB 1E 103K-T-A
C33	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C34	4030008680	S.CERAMIC	C1808 JB 1H 102K-T-A
C35	4030007010	S.CERAMIC	C1808 CH 1H 100D-T-A
C36	4030008900	S.CERAMIC	C1808 JB 1E 103K-T-A
C37	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C38	4030008850	S.CERAMIC	C1808 JB 1H 471K-T-A
C39	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C40	4510003160	ELECTROLITIC	16 RC2 22UF (D=4.0)
C41	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C42	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C43	4510003160	ELECTROLITIC	16 RC2 22UF (D=4.0)
C44	4510003160	ELECTROLITIC	16 RC2 22UF (D=4.0)
C45	4030008850	S.CERAMIC	C1808 JB 1H 471K-T-A
C46	4030008850	S.CERAMIC	C1808 JB 1H 471K-T-A
C47	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C48	4030008850	S.CERAMIC	C1808 JB 1H 471K-T-A
C49	4510003190	ELECTROLITIC	6.3 RC2 47UF (D=4.0)
C50	4030008850	S.CERAMIC	C1808 JB 1H 471K-T-A
C51	4510003190	ELECTROLITIC	6.3 RC2 47UF (D=4.0)
C52	4030008850	S.CERAMIC	C1808 JB 1H 471K-T-A
C53	4550002890	S.TANTALUM	TESVA 1A 225M1-8L
C54	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C55	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C56	4550002890	S.TANTALUM	TESVA 1A 225M1-8L
C57	4030008850	S.CERAMIC	C1808 JB 1H 471K-T-A
C58	4510003190	ELECTROLITIC	6.3 RC2 47UF (D=4.0)
C59	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C60	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C61	4550002890	S.TANTALUM	TESVA 1A 225M1-8L
C62	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C63	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C64	4030008850	S.CERAMIC	C1808 JB 1H 471K-T-A
C65	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C66	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
C67	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
C68	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
C69	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
C70	4550002890	S.TANTALUM	TESVA 1A 225M1-8L
C71	4550002890	S.TANTALUM	TESVA 1A 225M1-8L
C72	4030008950	S.CERAMIC	C1808 CH 1H 040C-T-A
C73	4030008920	S.CERAMIC	C1808 CH 1H 010C-T-A
W1	7030003860	S.JUMPER	ERJ3GE JPW V
J2	8510009390	CONNECTOR	B6B-ZR
J3	8510009370	CONNECTOR	B4B-ZR
EP1	0910043522	PCB	B 4272D
EP2	0910041121	FPC	B 4132A

[RFA BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
Q1	1560000550	S.FET	2SK882-Y (TE85R)
D1	1790000640	S.VARICAP	MA363B(TX)
D2	1790000640	S.VARICAP	MA363B(TX)
D3	1790000640	S.VARICAP	MA363B(TX)
D4	1790000640	S.VARICAP	MA363B(TX)
R1	7030003700	S.RESISTOR	ERJ3GEYJ 154 V (150 kΩ)

[RFA BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
R2	7030003700	S.RESISTOR	ERJ3GEYJ 154 V (150 kΩ)
R3	7030003230	S.RESISTOR	ERJ3GEYJ 180 V (18 Ω)
R4	7030003700	S.RESISTOR	ERJ3GEYJ 154 V (150 kΩ)
R5	7030003700	S.RESISTOR	ERJ3GEYJ 154 V (150 kΩ)
R6	7030003320	S.RESISTOR	ERJ3GEYJ 101 V (100 Ω)
C1	4030006700	S.CERAMIC	C1808 SL 1H 390J-T-A
C2	4030008540	S.CERAMIC	C1808 SL 1H 030C-T-A
C3	4030008570	S.CERAMIC	C1808 SL 1H R75C-T-A
C4	4030008610	S.CERAMIC	C1808 SL 1H 100D-T-A
C5	4030008880	S.CERAMIC	C1808 JB 1H 102K-T-A
C6	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C7	4030008590	S.CERAMIC	C1808 SL 1H 080D-T-A
C8	4030008510	S.CERAMIC	C1808 SL 1H 0R5C-T-A
C9	4030008510	S.CERAMIC	C1808 SL 1H 0R5C-T-A
C10	4030008620	S.CERAMIC	C1808 SL 1H 120J-T-A
C11	4030008540	S.CERAMIC	C1808 SL 1H 030C-T-A
C12	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C14	4030008580	S.CERAMIC	C1808 SL 1H 050C-T-A
C15	4030008560	S.CERAMIC	C1808 SL 1H 050C-T-A
C16	4030008550	S.CERAMIC	C1808 SL 1H 040C-T-A
C17	4030008560	S.CERAMIC	C1808 SL 1H 050C-T-A
EP1	0910044050	PCB	B 4137
EP2	6910003110	LEADFRAM	HFB2.0-0.7-8 (N)

[RFB BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
L1	6150003580	COIL	LS-394
L2	6150003590	COIL	LS-395
L3	6150003600	COIL	LS-404
L4	6150003590	COIL	LS-395
EP1	0910024811	PCB	B 2384A

[DETA BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1120001650	S.IC	TK10487MTR
Q1	1530002020	S.TRANSISTOR	2SC3770-3-TA
D1	1790000490	S.DIODE	HSM88AS-TR
D2	1750000130	S.DIODE	DA204U T107
FI1	2020000920	CERAMIC	CFWM455E
X1	6070000060	DISCRIMINATOR	CDBM455C7
X2	6050005010	XTAL	CR-214
R1	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R2	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R3	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R4	7030003460	S.RESISTOR	ERJ3GEYJ 152 V (1.5 kΩ)
R5	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R6	7030003730	S.RESISTOR	ERJ3GEYJ 274 V (270 kΩ)
R7	7030003730	S.RESISTOR	ERJ3GEYJ 274 V (270 kΩ)
R8	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R9	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R10	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R11	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R13	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R14	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R15	7030003670	S.RESISTOR	ERJ3GEYJ 823 V (82 kΩ)

S.=Surface mount

## [DETA BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
R16	7030003430	S.RESISTOR	ERJ3GEYJ 821 V (820 Ω)
R17	7030003550	S.RESISTOR	ERJ3GEYJ 822 V (8.2 kΩ)
R18	7030003710	S.RESISTOR	ERJ3GEYJ 184 V (180 kΩ)
C1	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
C2	4030006730	S.CERAMIC	C1808 SL 1H 880J-T-A
C3	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
C4	4030008620	S.CERAMIC	C1808 JF 1H 153Z-T-A
C5	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
C6	4030006640	S.CERAMIC	C1808 SL 1H 180J-T-A
C7	4030006720	S.CERAMIC	C1808 SL 1H 560J-T-A
C8	4030006880	S.CERAMIC	C1808 JB 1H 102K-T-A
C9	4030006860	S.CERAMIC	C1808 JB 1H 102K-T-A
C10	4030006860	S.CERAMIC	C1808 JB 1H 102K-T-A
C11	4030006860	S.CERAMIC	C1808 JB 1H 102K-T-A
C12	4030006890	S.CERAMIC	C1808 SL 1H 330J-T-A
C13	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
C14	4030006850	S.CERAMIC	C1808 JB 1H 471K-T-A
C15	4030008880	S.CERAMIC	C1808 JB 1H 102K-T-A
C16	4550000550	S.TANTALUM	TESVA 1V 224M1-8L
C17	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
C19	4030006860	S.CERAMIC	C1808 JB 1H 102K-T-A
C20	4030006900	S.CERAMIC	C1808 JB 1E 103K-T-A
C21	4030006850	S.CERAMIC	C1808 JB 1H 471K-T-A
C22	4030006900	S.CERAMIC	C1808 JB 1E 103K-T-A
C23	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
W1	7030003860	S.JUMPER	ERJ3GE JPW V
EP1	0910044063	PCB	B 4273C
EP2	6910003110	LEADFRAM	HFB2.0-0.7-8 (N)

## [AF BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1110001510	IC	NJM2073D
Q1	1530002280	S.TRANSISTOR	2SC4081 T107 S
Q2	1530002280	S.TRANSISTOR	2SC4081 T107 S
Q3	1520000270	S.TRANSISTOR	2SB1182 TL Q
Q4	1530002280	S.TRANSISTOR	2SC4081 T107 S
Q5	1530002280	S.TRANSISTOR	2SC4081 T107 S
Q6	1590000520	S.FET	2SJ106-GR (TE85R)
D1	1750000260	S.DIODE	1SS352 (TPH3)
R1	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 kΩ)
R2	7030003800	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)
R3	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R4	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R5	7030003360	S.RESISTOR	ERJ3GEYJ 221 V (220 Ω)
R6	7030003610	S.RESISTOR	ERJ3GEYJ 273 V (27 kΩ)
R7	7030003620	S.RESISTOR	ERJ3GEYJ 333 V (33 kΩ)
R8	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)
R9	7030003710	S.RESISTOR	ERJ3GEYJ 184 V (180 kΩ)
R10	7030003630	S.RESISTOR	ERJ3GEYJ 393 V (39 kΩ)
R11	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R12	7030003760	S.RESISTOR	ERJ3GEYJ 474 V (470 kΩ)
R13	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R14	7030003610	S.RESISTOR	ERJ3GEYJ 273 V (27 kΩ)
R15	7030003610	S.RESISTOR	ERJ3GEYJ 273 V (27 kΩ)
R16	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R17	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R18	7410000900	S.ARRAY	EXB-V4V 105JV (1 MΩ)
R19	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)
R20	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)
R21	7030003450	S.RESISTOR	ERJ3GEYJ 122 V (1.2 kΩ)
R22	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)

## [AF BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
C1	4550000730	S.TANTALUM	TESVA 0J 225M1-8L
C2	4030006850	S.CERAMIC	C1808 JB 1H 471K-T-A
C3	4550006110	S.TANTALUM	TEMSVB2 0J 336M8L
C4	4030006860	S.CERAMIC	C1808 JB 1H 102K-T-A
C5	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
C6	4030008880	S.CERAMIC	C1808 JB 1C 223K-T-A
C7	4550006050	S.TANTALUM	TEMSVA 0J 106M8L
C8	4030006860	S.CERAMIC	C1808 JF 1C 104Z-T-A
C9	4030006860	S.CERAMIC	C1808 JB 1H 102K-T-A
C10	4030008880	S.CERAMIC	C1808 JB 1C 223K-T-A
C11	4030006900	S.CERAMIC	C1808 JB 1E 103K-T-A
C12	4030006850	S.CERAMIC	C1808 JB 1H 471K-T-A
C13	4030006860	S.CERAMIC	C1808 JB 1H 102K-T-A
C14	4550000460	S.TANTALUM	TESVA 1C 105M1-8L
C15	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
C16	4030008880	S.CERAMIC	C1808 JB 1C 223K-T-A
EP1	0910044101	PCB	B 4389A
EP2	6910003110	LEADFRAM	HFB2.0-0.7-8 (N)

## [MIC BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1110002490	S.IC	M5218FP-73A
IC2	1110002750	S.IC	TA75S01F (TE85R)
Q1	1590001660	S.TRANSISTOR	XP4312(TX)
R1	7030003670	S.RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R2	7030003670	S.RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R3	7030003700	S.RESISTOR	ERJ3GEYJ 154 V (150 kΩ)
R4	7030003410	S.RESISTOR	ERJ3GEYJ 561 V (560 Ω)
R5	7030003750	S.RESISTOR	ERJ3GEYJ 394 V (390 kΩ)
R6	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R7	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R8	7030003670	S.RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R9	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)
R10	7030003670	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R11	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)
R12	7030003670	S.RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R13	7030003750	S.RESISTOR	ERJ3GEYJ 394 V (390 kΩ)
R14	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)
R15	7030003730	S.RESISTOR	ERJ3GEYJ 274 V (270 kΩ)
R16	7510000180	S.THERMISTOR	TN20-3S223LT
R17	7030003570	S.RESISTOR	ERJ3GEYJ 123 V (12 kΩ)
R18	7030003540	S.RESISTOR	ERJ3GEYJ 882 V (6.8 kΩ)
R19	7310003510	S.TRIMMER	RV-222 (RH03AVAS4 )473
R20	7310003920	S.TRIMMER	RV-227 (RH03AVAN5J )334
R21	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R22	7030003780	S.RESISTOR	ERJ3GEYJ 684 V (680 kΩ)
C1	4030008890	S.CERAMIC	C1808 JB 1C 273K-T-A
C2	4030008630	S.CERAMIC	C1808 JF 1C 104Z-T-A
C3	4030008860	S.CERAMIC	C1808 JB 1H 102K-T-A
C4	4030006870	S.CERAMIC	C1808 JB 1H 222K-T-A
C5	4030008650	S.CERAMIC	C1808 JB 1H 332K-T-A
C6	4550000530	S.TANTALUM	TESVA 1V 104M1-8L
C7	4030006850	S.CERAMIC	C1808 JB 1H 471K-T-A
C8	4550000460	S.TANTALUM	TESVA 1C 105M1-8L
C9	4030008850	S.CERAMIC	C1808 JB 1H 471K-T-A
C10	4030006860	S.CERAMIC	C1808 JB 1H 102K-T-A
C11	4030009490	S.CERAMIC	C1808 JB 1H 821K-T-A
C12	4030006850	S.CERAMIC	C1808 JB 1H 471K-T-A
C13	4030006740	S.CERAMIC	C1808 SL 1H 820J-T-A
C14	4030006860	S.CERAMIC	C1808 JB 1H 102K-T-A
EP1	0910044071	PCB	B 4274A
EP2	6910003110	LEADFRAM	HFB2.0-0.7-8 (N)

S.=Surface mount

[PLL VCO BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1140001310	S.IC	MB1504PF-G-BND
IC2	1130004200	S.IC	TC4S66F (TE85R)
Q1	1590000440	S.TRANSISTOR	DTA143ZU T107
Q2	1590000430	S.TRANSISTOR	DTC144EU T107
Q3	1590000970	S.TRANSISTOR	FMA2 T148
Q4	1510000620	S.TRANSISTOR	2SA1576 T107 S
Q5	1530002280	S.TRANSISTOR	2SC4081 T107 S
Q6	1560000340	S.FET	2SK210-Y (TE85R)
Q7	1560000330	S.FET	2SK210-GR (TE85R)
Q8	1530002600	S.TRANSISTOR	2SC4215-O (TE85R)
Q9	1530002600	S.TRANSISTOR	2SC4215-O (TE85R)
Q10	1530002600	S.TRANSISTOR	2SC4215-O (TE85R)
D1	1790000640	S.VARICAP	MA363B(TX)
D2	1790000640	S.VARICAP	MA363B(TX)
D3	1790000640	S.VARICAP	MA363B(TX)
X1	6050008640	XTAL	CR-448 12.800MHZ
L1	6200000750	S.COIL	LQH 3N 4R7M
L2	6130002360	S.COIL	LB-257
L3	6200000750	S.COIL	LQH 3N 4R7M
L4	6200000750	S.COIL	LQH 3N 4R7M
L5	6130002370	S.COIL	LB-258
L6	6200000750	S.COIL	LQH 3N 4R7M
L7	6200000260	S.COIL	LQN 2A R10K
L8	6200000260	S.COIL	LQN 2A R10K
R1	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R2	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R3	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R4	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)
R5	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R6	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)
R7	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R8	7030003390	S.RESISTOR	ERJ3GEYJ 391 V (390 Ω)
R9	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R10	7030003550	S.RESISTOR	ERJ3GEYJ 822 V (8.2 kΩ)
R11	7030003310	S.RESISTOR	ERJ3GEYJ 820 V (82 Ω)
R12	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R13	7030003610	S.RESISTOR	ERJ3GEYJ 273 V (27 kΩ)
R14	7030003310	S.RESISTOR	ERJ3GEYJ 820 V (82 Ω)
R15	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)
R16	7030003420	S.RESISTOR	ERJ3GEYJ 681 V (680 Ω)
R17	7030003420	S.RESISTOR	ERJ3GEYJ 681 V (680 Ω)
R18	7030003660	S.RESISTOR	ERJ3GEYJ 683 V (68 kΩ)
R19	7030003650	S.RESISTOR	ERJ3GEYJ 583 V (58 kΩ)
R20	7030003390	S.RESISTOR	ERJ3GEYJ 391 V (390 Ω)
C1	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C2	4030008660	S.CERAMIC	C1608 JB 1H 102K-T-A
C3	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C4	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C5	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C6	4550006050	S.TANTALUM	TEMSVA 0J 106M8L
C7	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A
C8	4030008670	S.CERAMIC	C1608 SL 1H 270J-T-A
C9	4030008570	S.CERAMIC	C1608 SL 1H 060D-T-A
C10	4030008550	S.CERAMIC	C1608 SL 1H 040C-T-A
C11	4030008660	S.CERAMIC	C1608 JB 1H 102K-T-A
C12	4030008510	S.CERAMIC	C1608 SL 1H 0R5C-T-A
C13	4030008510	S.CERAMIC	C1608 SL 1H 0R5C-T-A
C14	4030008750	S.CERAMIC	C1608 SL 1H 101J-T-A
C15	4030008920	S.CERAMIC	C1608 CH 1H 010C-T-A
C16	4550000460	S.TANTALUM	TESVA 1C 105M1-8L
C17	4030008950	S.CERAMIC	C1608 CH 1H 040C-T-A
C18	4030008940	S.CERAMIC	C1608 CH 1H 030C-T-A
C19	4030008630	S.CERAMIC	C1608 JF 1C 104Z-T-A
C20	4030008510	S.CERAMIC	C1608 SL 1H 0R5C-T-A

[PLL VCO BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
C21	4030008510	S.CERAMIC	C1608 SL 1H 0R5C-T-A
C22	4030008660	S.CERAMIC	C1608 JB 1H 102K-T-A
C23	4030008550	S.CERAMIC	C1608 SL 1H 040C-T-A
C24	4030008640	S.CERAMIC	C1608 SL 1H 180J-T-A
C25	4030008620	S.CERAMIC	C1608 SL 1H 120J-T-A
C26	4030008660	S.CERAMIC	C1608 JB 1H 102K-T-A
C27	4030008620	S.CERAMIC	C1608 SL 1H 120J-T-A
C28	4030008660	S.CERAMIC	C1608 JB 1H 102K-T-A
W1	7030003860	S.JUMPER	ERJ3GE JPW V
J1	6510012250	CONNECTOR	TKX-P04P-A2
J2	6510012310	CONNECTOR	TKX-P10P-A2
EP1	0910039553	PCB	B 3844C

[PTT UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R1	7030003280	S.RESISTOR	ERJ3GEYJ 470 V (47 Ω)
J1	6510007090	CONNECTOR	PI28A-04M
S1	2230000770	S.SWITCH	SW-104 (SKHUPE004B)
S2	2230000770	S.SWITCH	SW-104 (SKHUPE004B)
EP1	0910044022	PCB	B 4059B

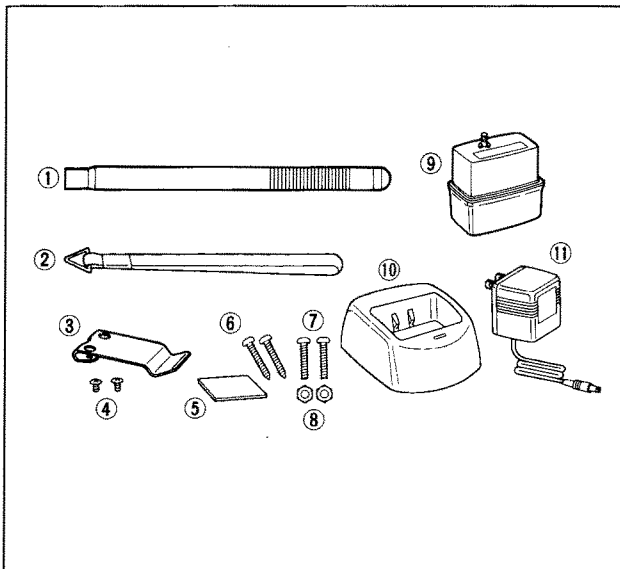
S.=Surface mount

## • CHASSIS PARTS

LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.
①	8930033740	1540 LCD holder	1
②	5030000950	LCD LD-BU5579J (E-5777)	1
③	8930033680	LCD contact SRCN-1540 SG-type	2
④	8810004850	Screw PH No. 0 M2 × 4	12
⑤	8930032710	1540 module holder	1
⑥	8510008240	1416 PLL case	1
⑦	8930026510	Aluminum sheet S	1
⑧	8510008210	1416 PLL cover	1
⑨	8510005830	CO-PLL cover	1
⑩	8610009270	Knob N218 [SQL], [OFF/VOL]	2
⑪	8810008320	Screw FH M2 × 4 SUS	1
⑫	6510017690	Connector [ANT] (incl. ground lug, nut)	1
⑬	8610009260	Knob N217 [CHANNEL]	1
⑭	8830000910	1301 VR nut	3
⑮	8930028880	O-ring (M)	3
⑯	8210011131	1301 top panel/chassis (A)-1	1
⑰	8810008000	Screw PH No. 0 M2.6 × 6	2
⑱	7210002540	Variable resistor TP96N937-15F-10KB-1540 [SQL]	1
⑲	7210002530	Variable resistor TP96N937N-15F-10KA-1540 [OFF/VOL]	1
⑳	2250000220	Encoder TP90N937E20-15F-1540 [CHANNEL]	1
㉑	8930035120	1540 seal	1
㉒	6510016710	Jack YM-263	1
㉓	8810008010	Screw PH No. 0-3 M1.6 × 4	3
㉔	8210011460	1540 Outer case (incl. Speaker)	1

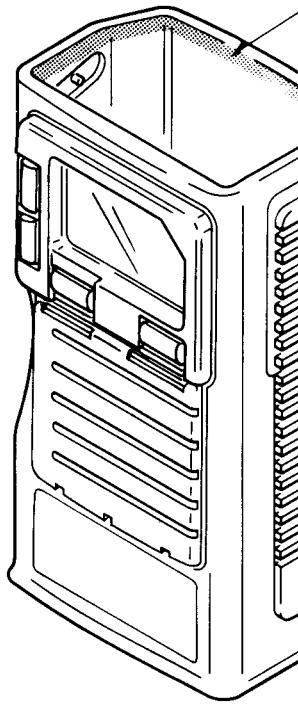
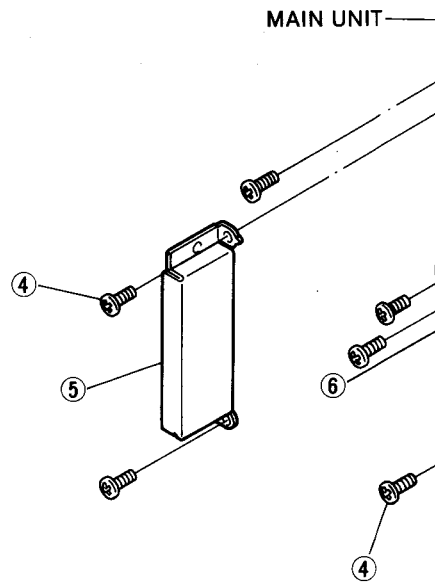
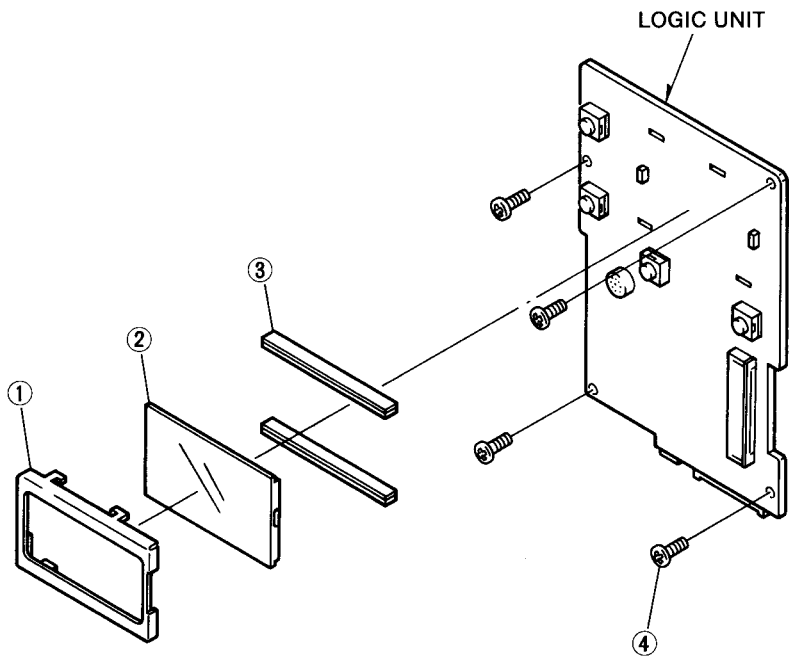
Screw abbreviations PH: Pan head FH: Flat head SUS: Stainless

## • ACCESSORIES



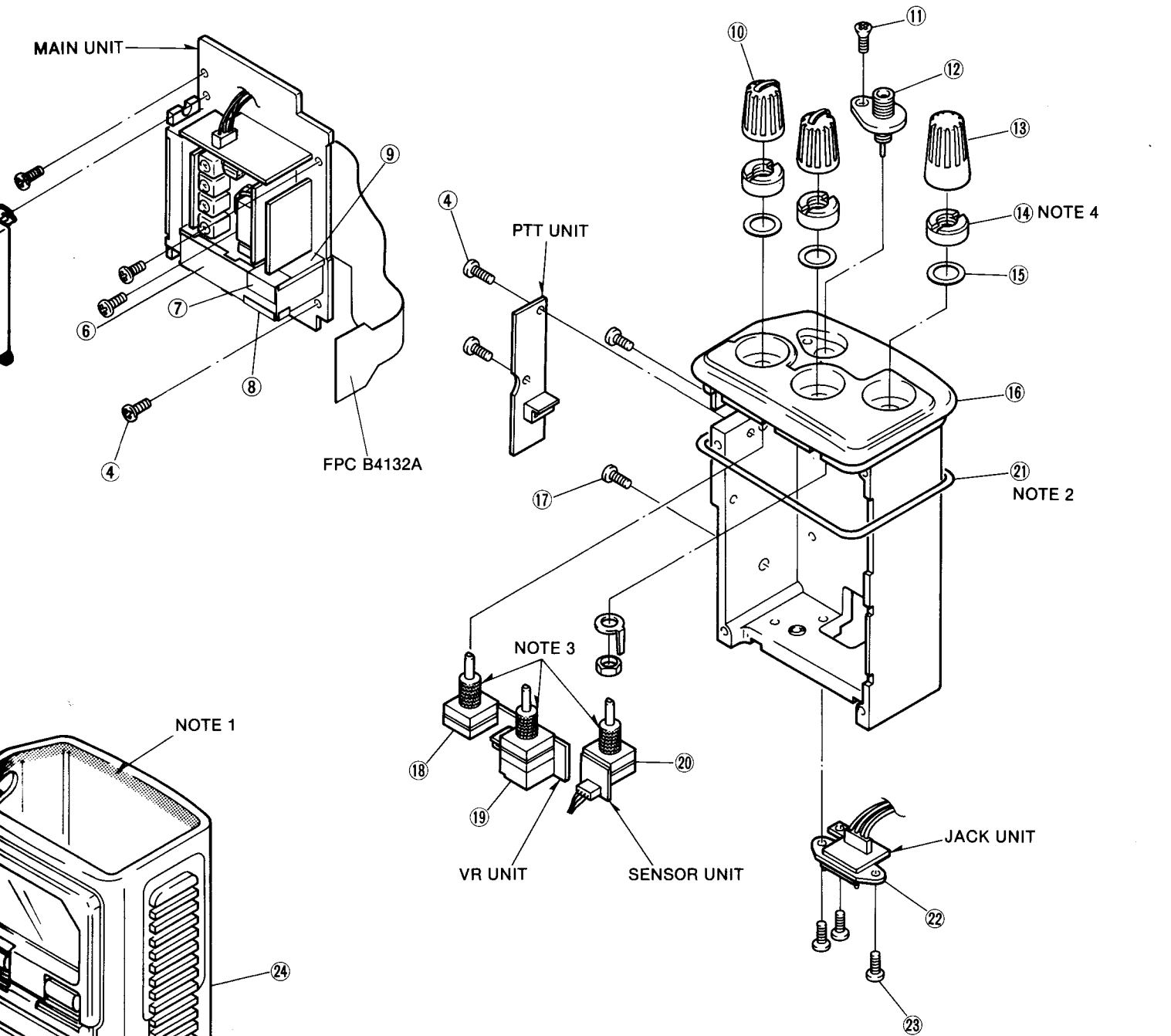
LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.
①	3310001410	FA-S55V FLEXIBLE ANTENNA	1
②	8810015370	Handstrap HK-008	1
③	8010005710	Belt clip	1
④	8810005730	Screw BuH M3 × 3 ZK BS	2
⑤	8930032690	Sheet AV	2
⑥	8810005050	Screw PH A M4 × 20 SUS	2
⑦	8810000670	Screw PH M4 × 15 SUS	2
⑧	8830000240	Nut M4 SUS	2
⑨	Optional product	CM-165 BATTERY PACK	1
⑩	Optional product	AD-49 BATTERY CHARGE ADAPTER (USA)	1
	Optional product	AD-53 BATTERY CHARGE ADAPTER (EUR)	
⑪	Optional product	BM-95U AC ADAPTER (USA)	1
	Optional product	BM-111E AC ADAPTER (EUR)	

Screw abbreviations BuH: Button head BS: Brass  
ZK: Black PH: Pan head  
SUS: Stainless



**NOTE 1:**  
 Once the outer case is removed, grease must be applied before assembly.  
 Manufacture: Shin-Etsu Chemical  
 Type: G-501

**NOTE 2:**  
 Be careful when reattaching ㊸ (1540 seal). This seal must fit snugly between the top panel and transceiver chassis (be sure to observe the correct orientation) to ensure water-tightness. Once the seal is removed, grease must be applied before assembly.  
 Manufacture: Shin-Etsu Chemical  
 Type: G-501



**NOTE 3:**

Once the variable resistors, ⑱ - ⑳ are removed, sealant must be applied before reattachment.

Manufacture: THREE BOND

Type: 1104 liquid gasket

Observe the following points when applying sealant to the variable resistors:

1. Use a soft-tipped painter's brush and apply sealant to the threaded part of the resistors ONLY.
2. Leave the variable resistors in an upright position for 12 hours to let the sealant set.
3. Make sure no sealant is applied to the moving part of the resistors: the sealant will bond here making movement impossible.
4. Read NOTE 4 for reassembly ⑭.

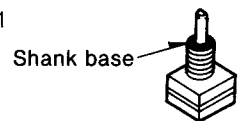
**NOTE 4:**

Once the VR nuts ⑭ are removed, grease must be applied and O-ring ⑮ must be inserted correctly.

1. Apply grease to the gap at the variable resistor's shank base.

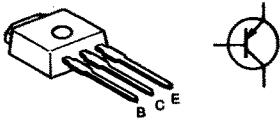








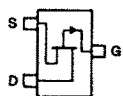
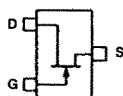
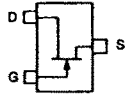
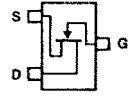
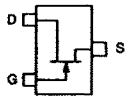
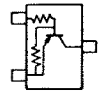
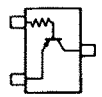
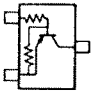









Manufacture: Shin-Etsu Chemical

Type: G-501














2. O-ring ⑮ must be inserted into concentric space of VR-nut ⑭ then gently poke along the entire diameter of ⑮ with a tweezers to ensure it is fully inserted. This procedure should be followed for each of the 3 O-rings to ensure watertightness.

• TRANSISTORS

<b>2SB1182</b> 		<b>2SA1576 S</b> (Symbol: FS) 	<b>2SB1132 Q</b> (Symbol: BA) 	<b>2SC2954</b> (Symbol: QK) 	<b>2SC3770 3</b> (Symbol: JY3) 
<b>2SC4081 R</b> (Symbol: BR) 	<b>2SC4081 S</b> (Symbol: BS) 	<b>2SC4215 0</b> (Symbol: Q0) 	<b>2SC4403 3</b> (Symbol: LY3) 	<b>2SJ106 GR</b> (Symbol: VG) 	<b>2SK210 GR</b> (Symbol: YG) 
<b>2SK210 Y</b> (Symbol: YY) 	<b>2SK880 Y</b> (Symbol: XY) 	<b>2SK882 Y</b> (Symbol: TY) 	<b>DTA113ZU</b> (Symbol: 111) 	<b>DTA143TU</b> (Symbol: 93) 	<b>DTA143ZU</b> (Symbol: 113) 
<b>DTC143TU</b> (Symbol: 03) 	<b>DTC144EU</b> (Symbol: 26) 	<b>FMA2</b> (Symbol: A2) 	<b>FMS1</b> (Symbol: SI) 	<b>RN1404</b> (Symbol: XD) 	<b>UMX5</b> (Symbol: X5) 
<b>UN511E</b> (Symbol: 6N) 	<b>XP1501</b> (Symbol: 5R) 	<b>XP4312</b> (Symbol: 7T) 			

• DIODES

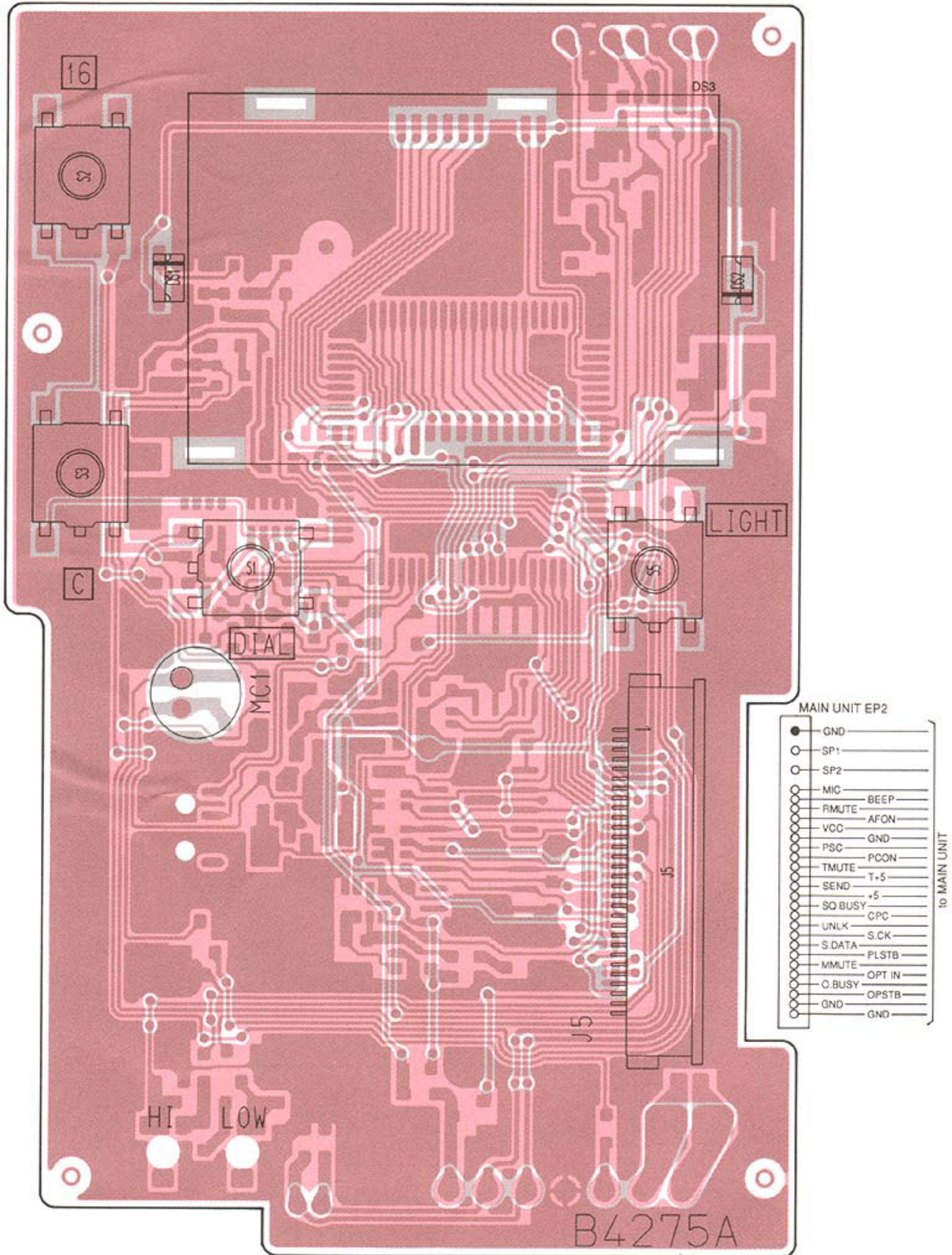
<b>1SS153</b> (Symbol: A9) 	<b>1SS226</b> (Symbol: C3) 	<b>DA112</b> (Symbol: AZ) 	<b>DA113W</b> (Symbol: AY) 	<b>DA204U</b> (Symbol: K) 	<b>DAN202U</b> (Symbol: N) 
<b>DAP202U</b> (Symbol: P) 	<b>HSM88AS</b> (Symbol: C1) 	<b>MA741WA</b> (Symbol: M2P) 	<b>MA862</b> (Symbol: M1I) 	<b>SB20 03P</b> (Symbol: SC) 	



# SECTION 8 BOARD LAYOUTS

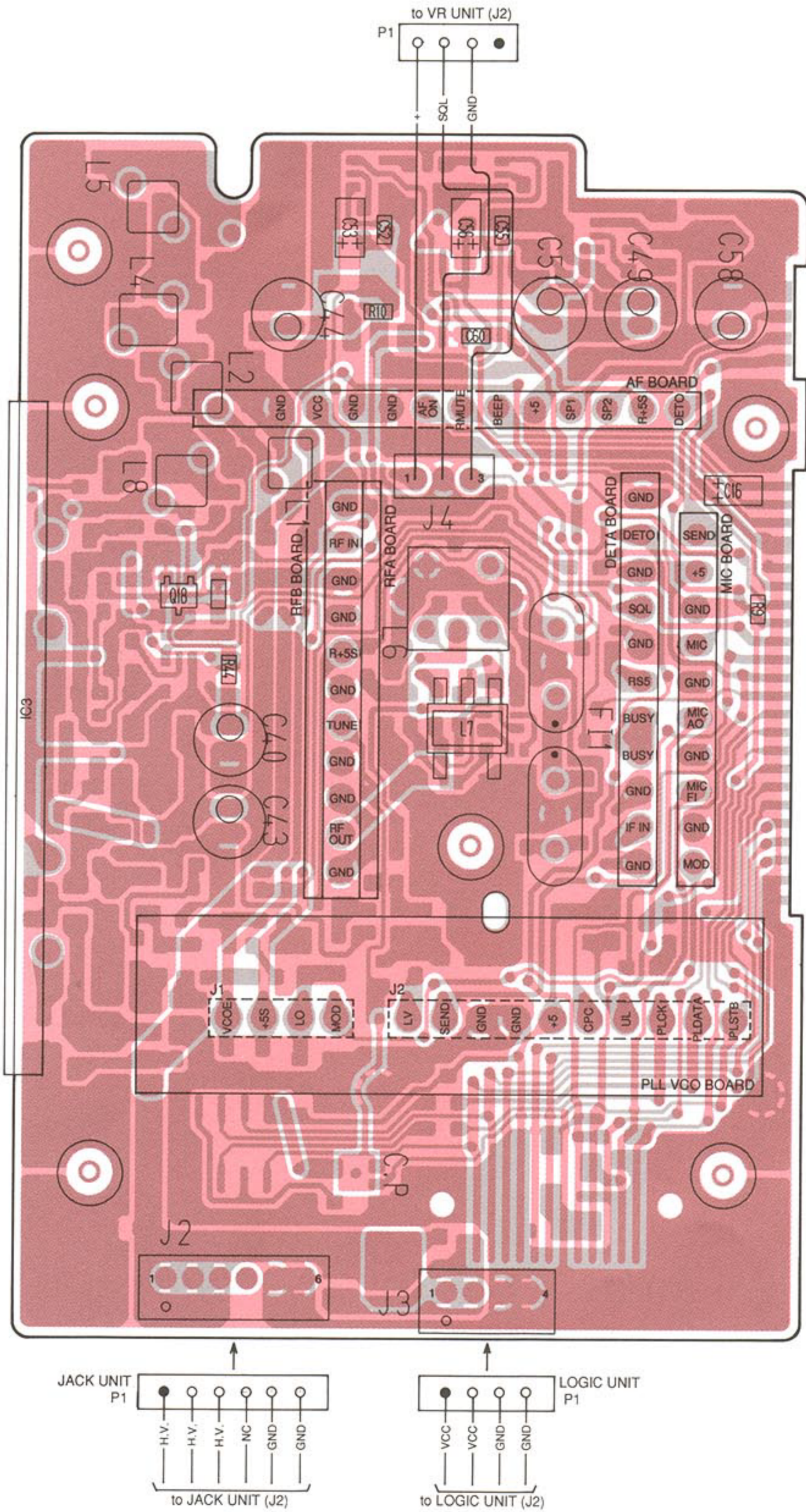
## 8-1 LOGIC AND MAIN UNITS

### • LOGIC UNIT



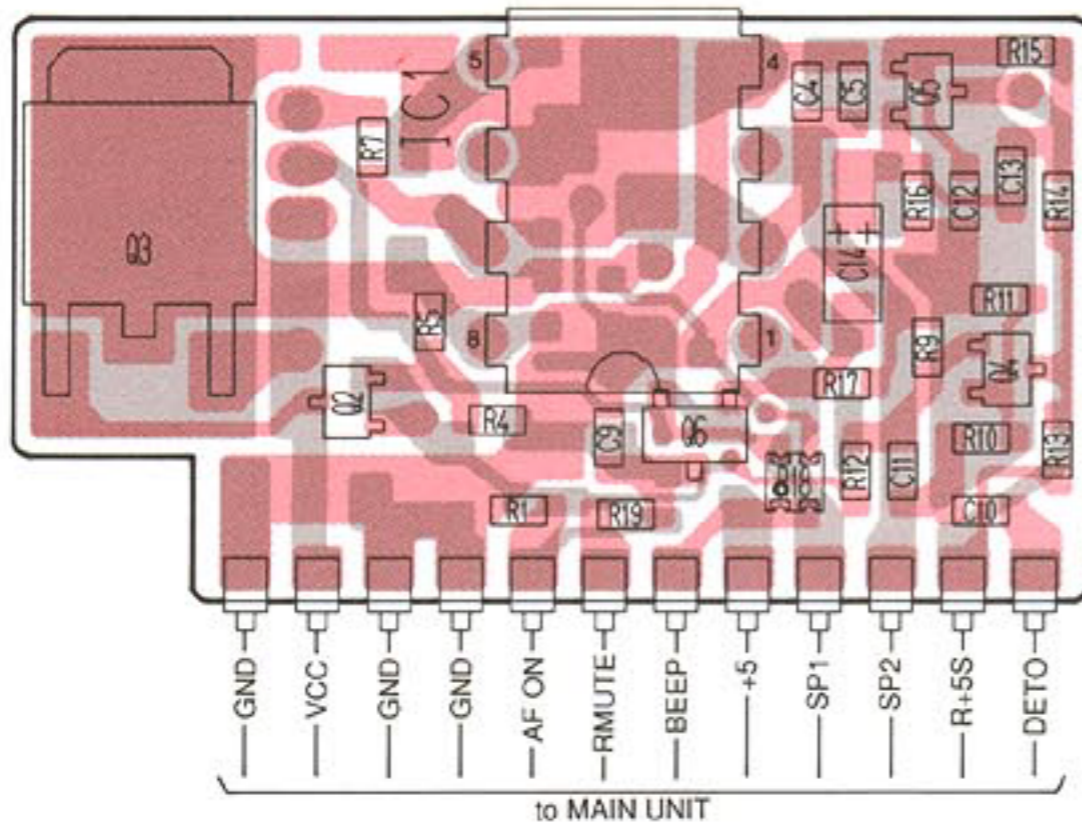


• MAIN UNIT

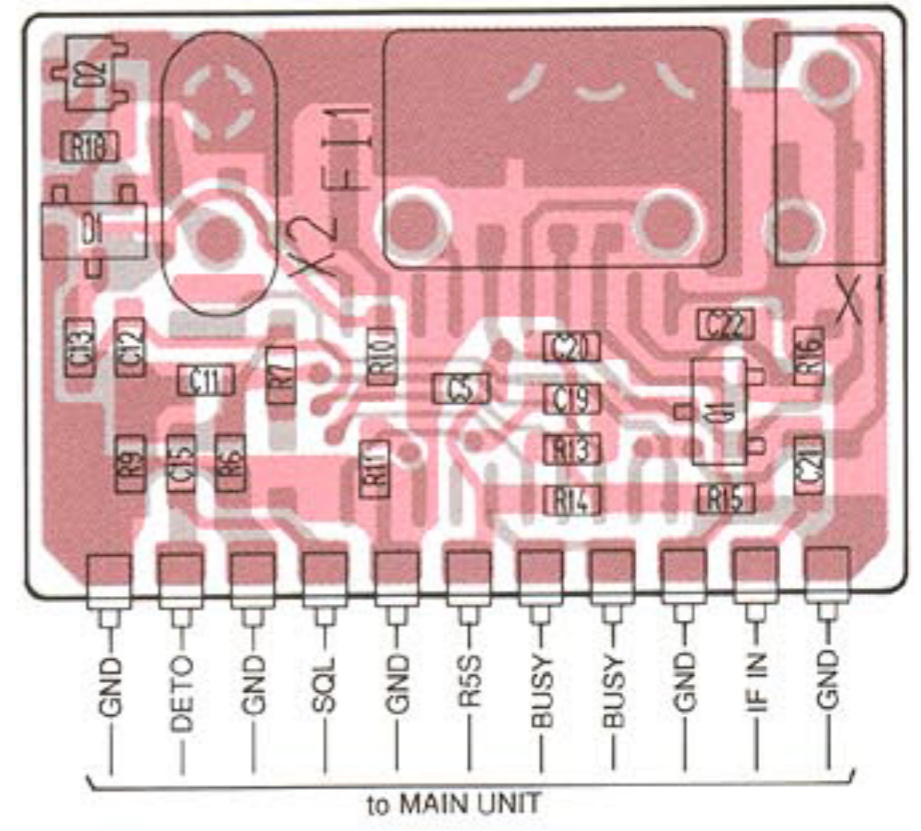




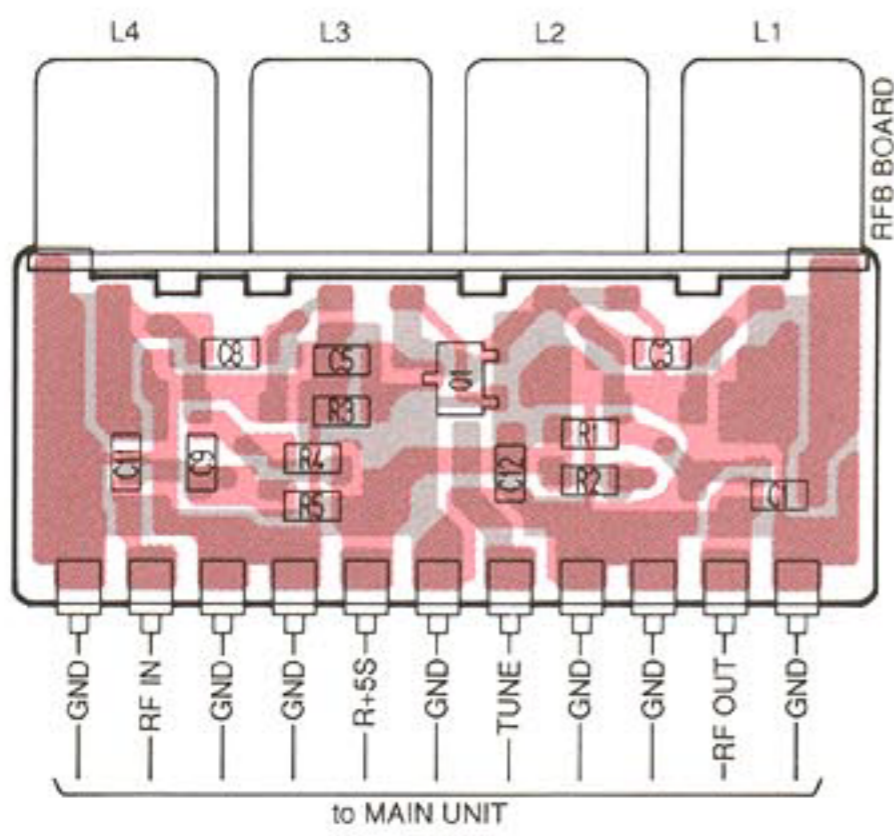
• AF BOARD



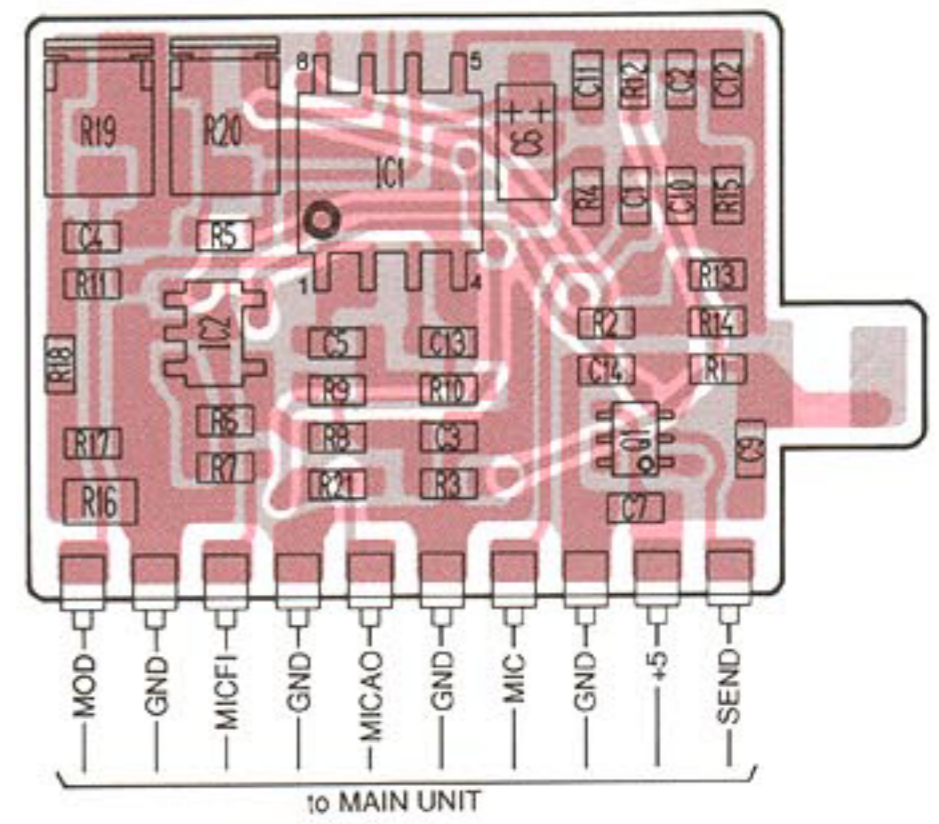
• DETA BOARD



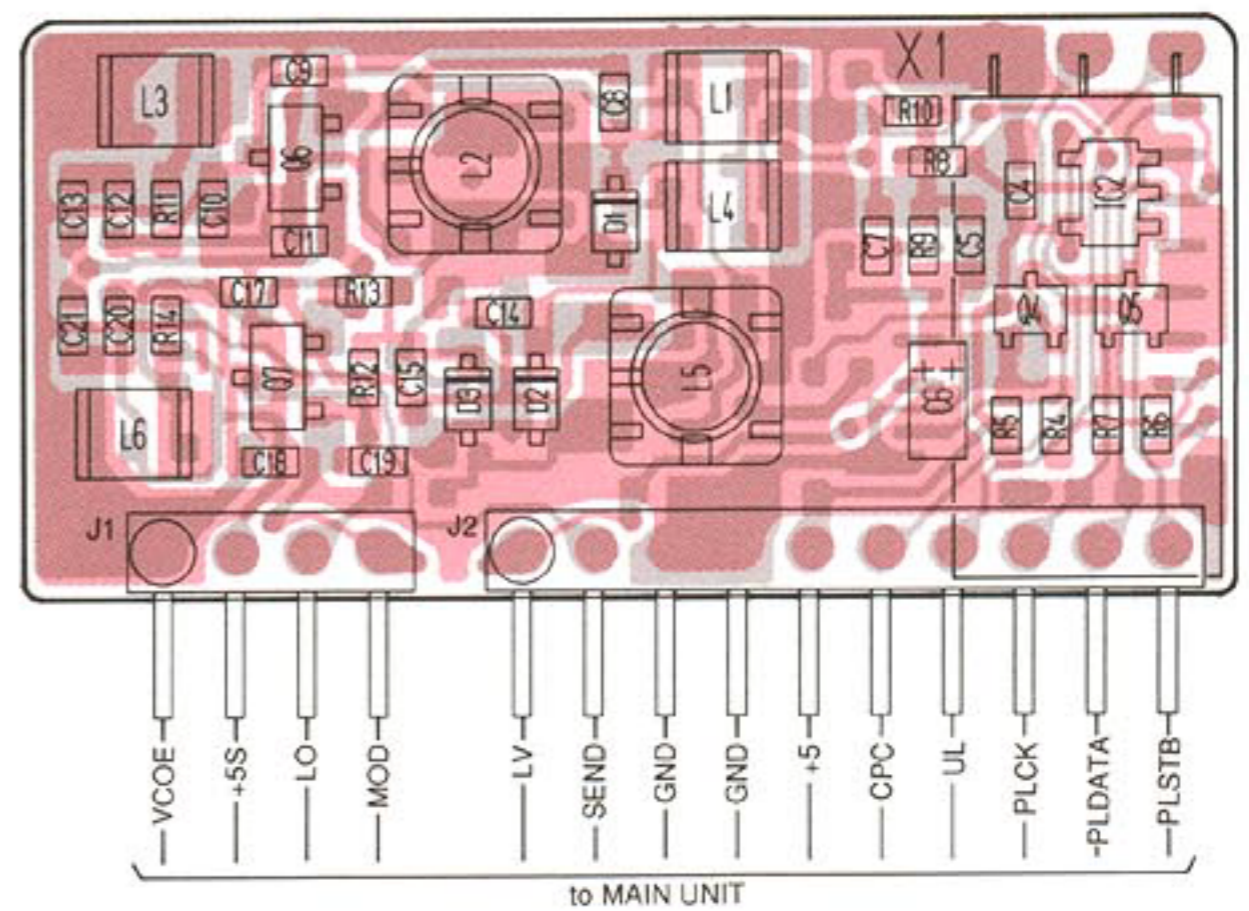
• RFA and RFB BOARDS



• MIC BOARD

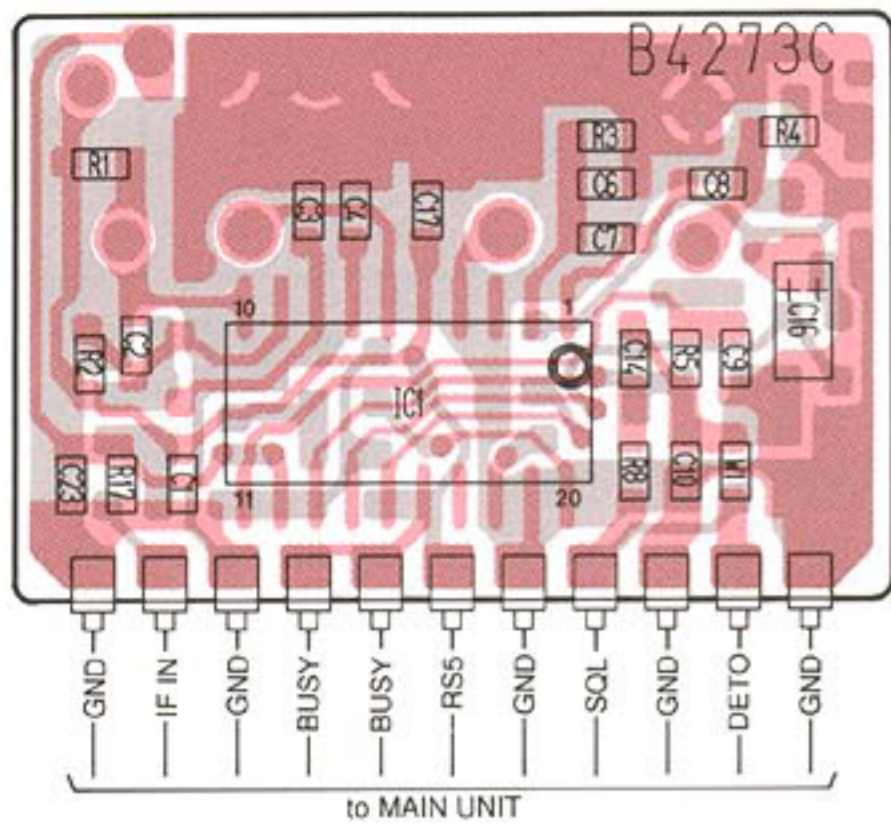


• PLL VCO BOARD

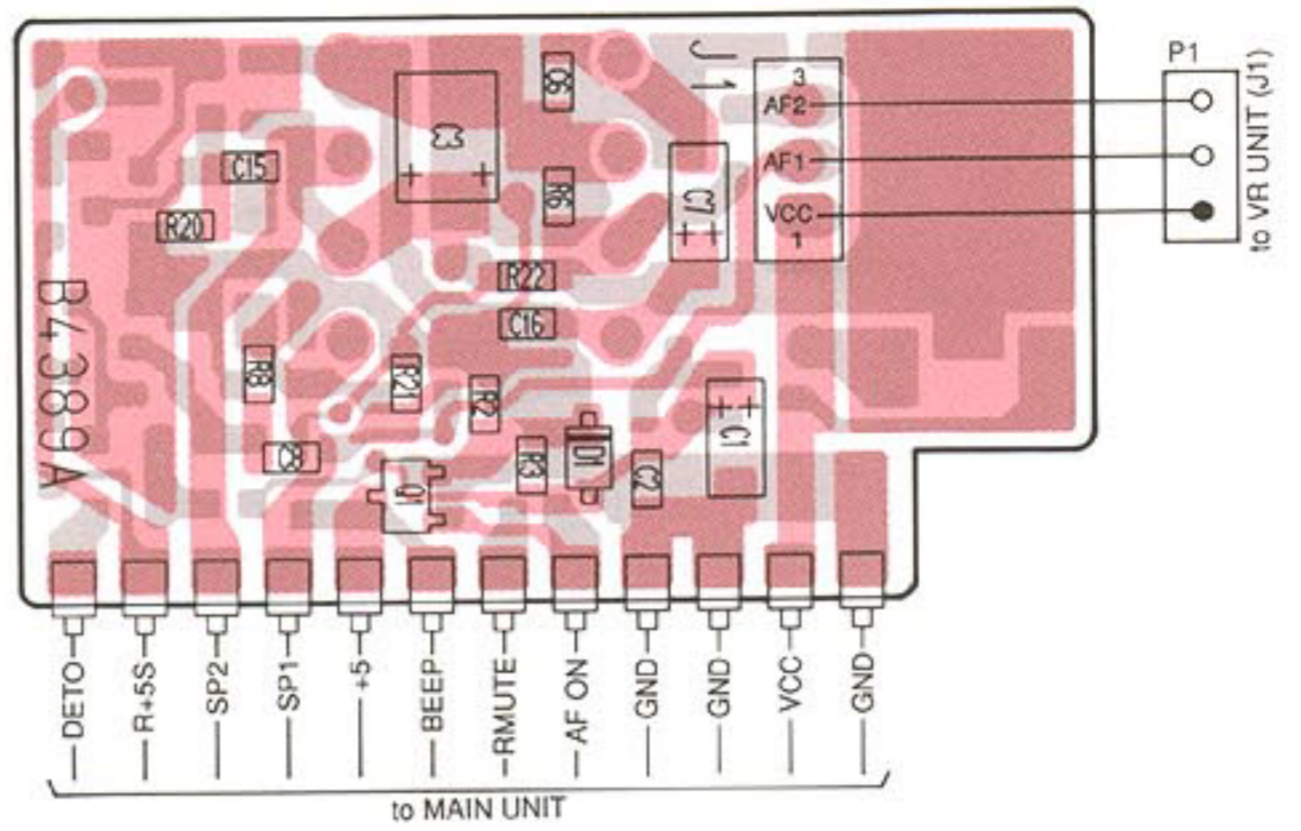




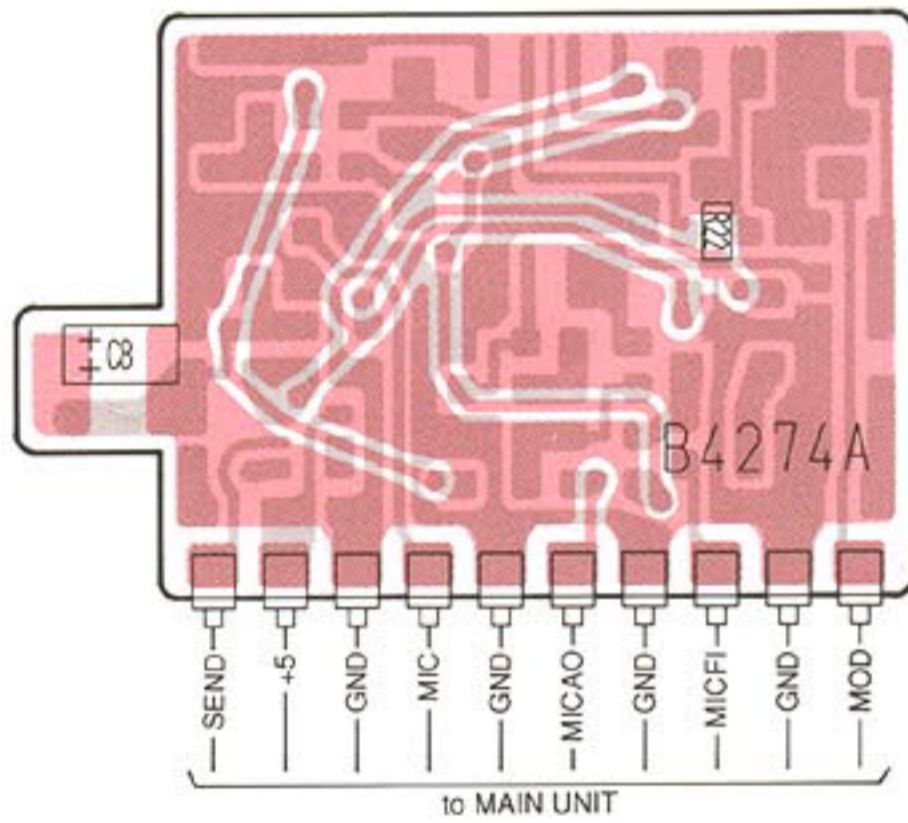
• DETA BOARD



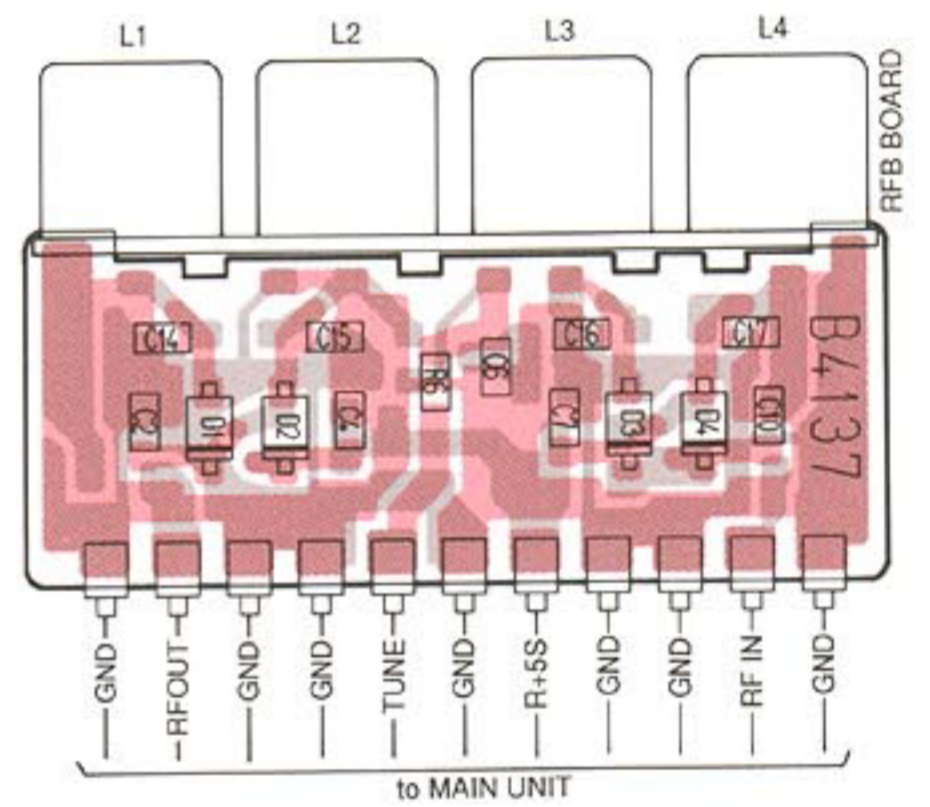
• AF BOARD



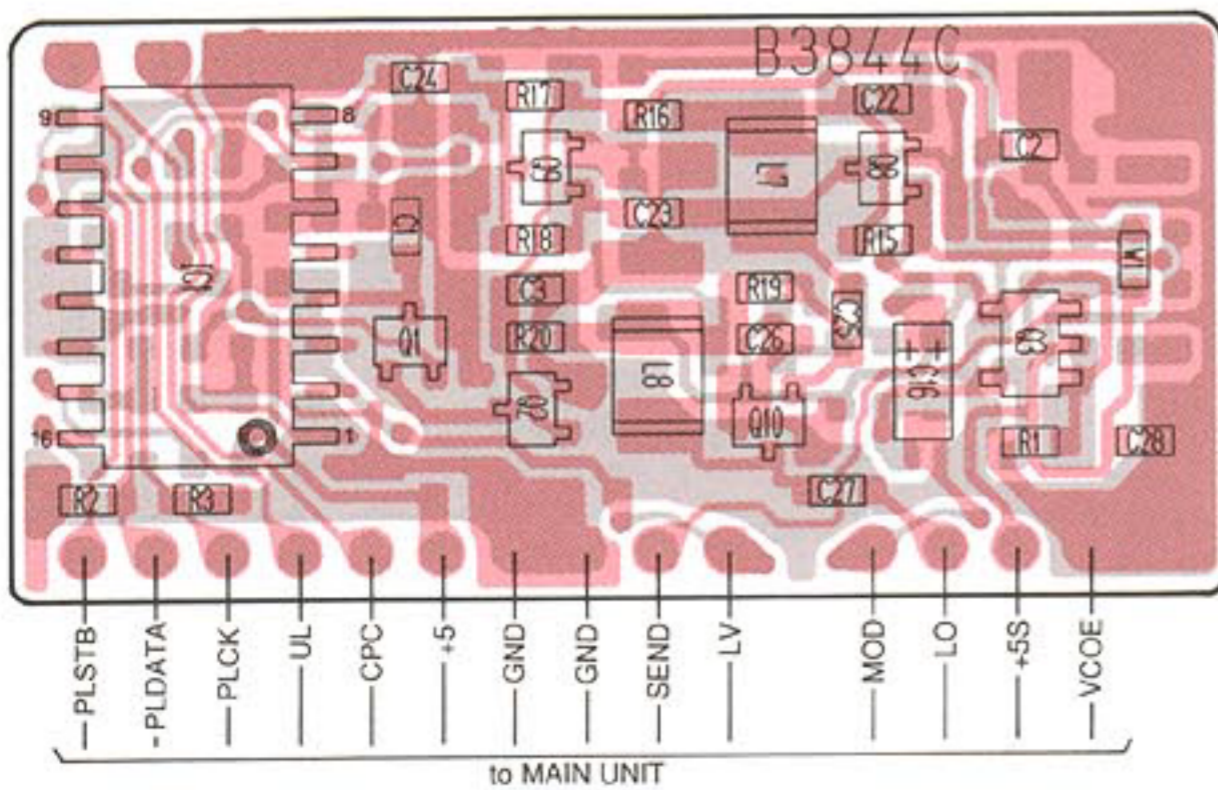
• MIC BOARD



• RFA and RFB BOARDS

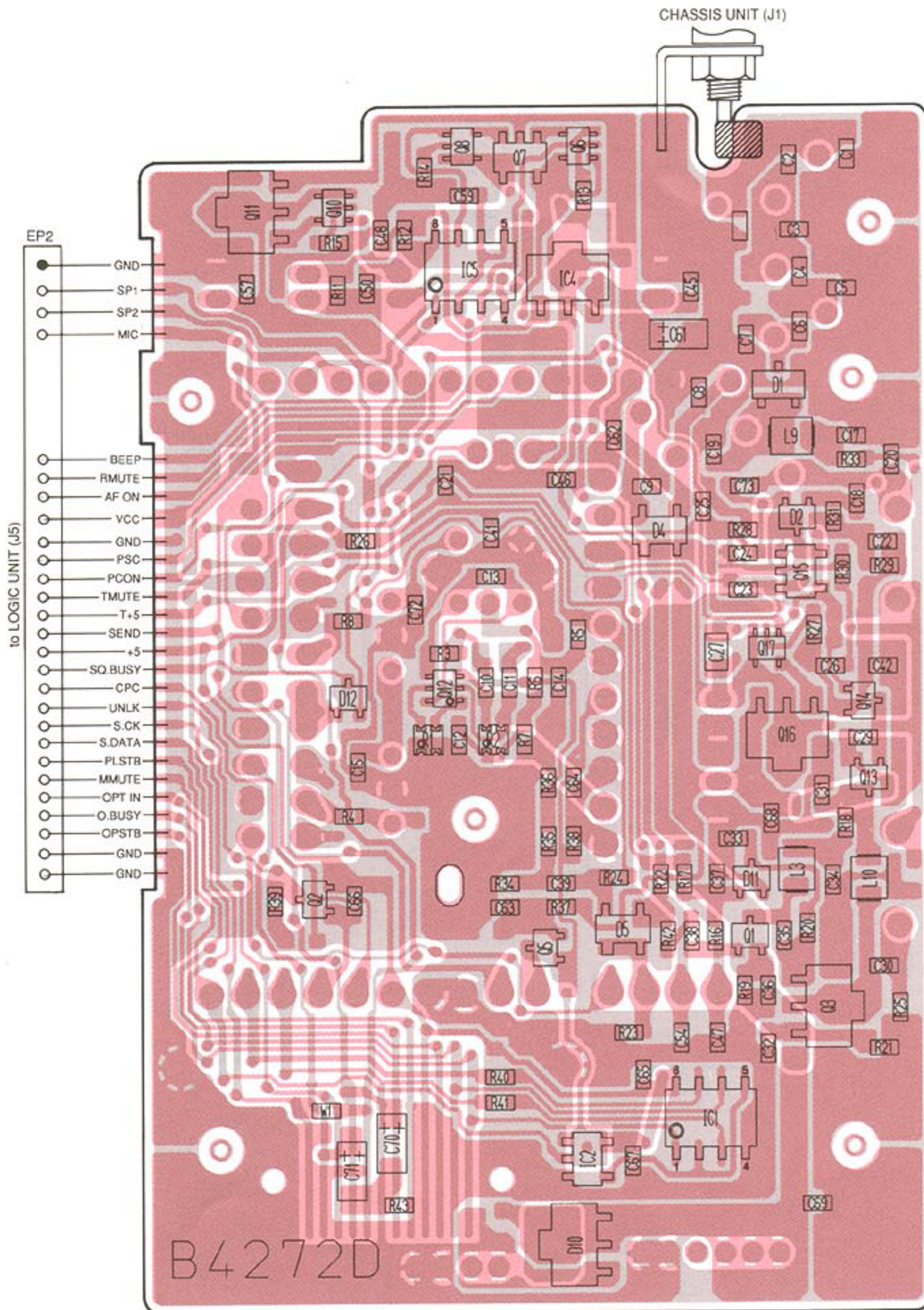


• PLL VCO BOARD



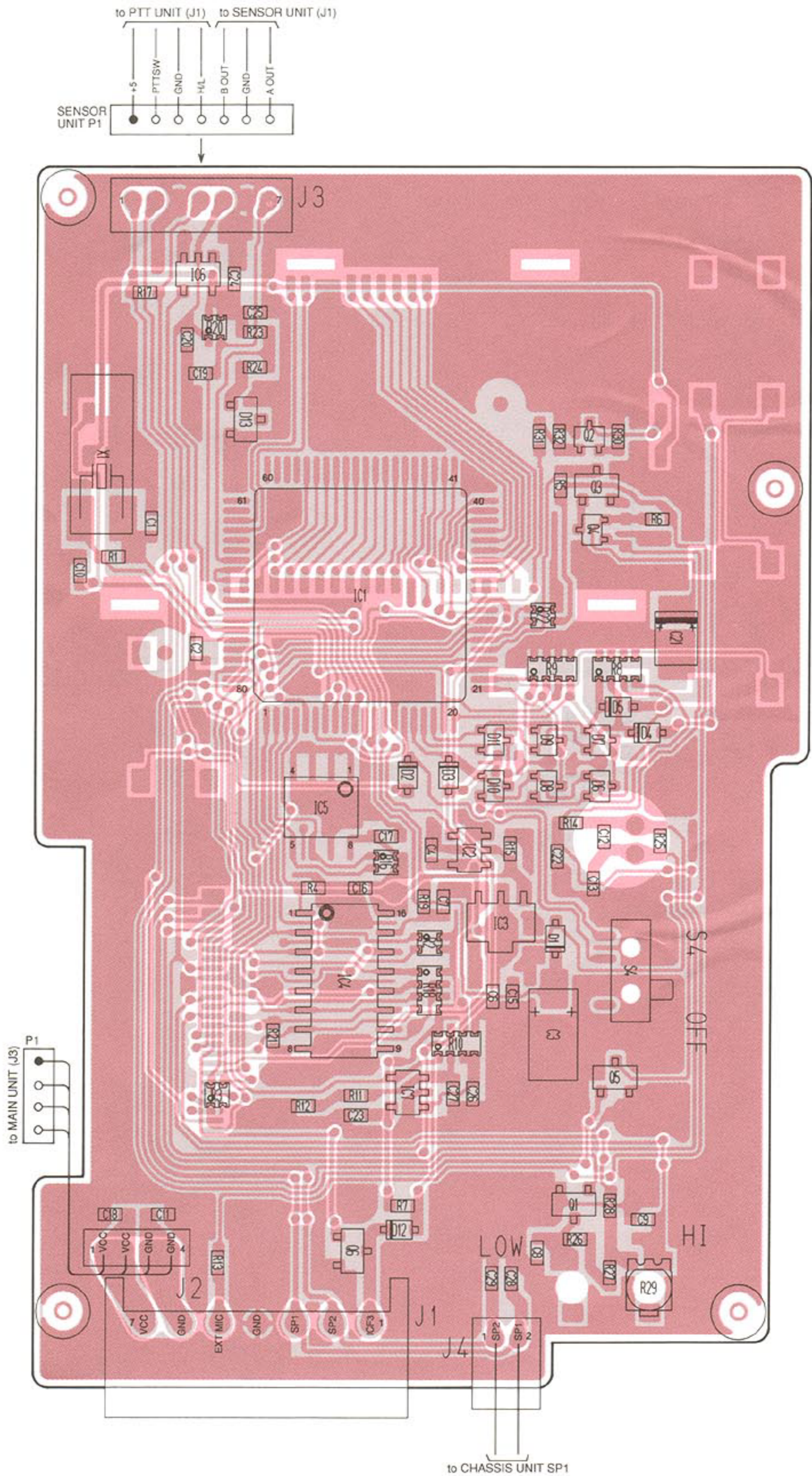


• MAIN UNIT





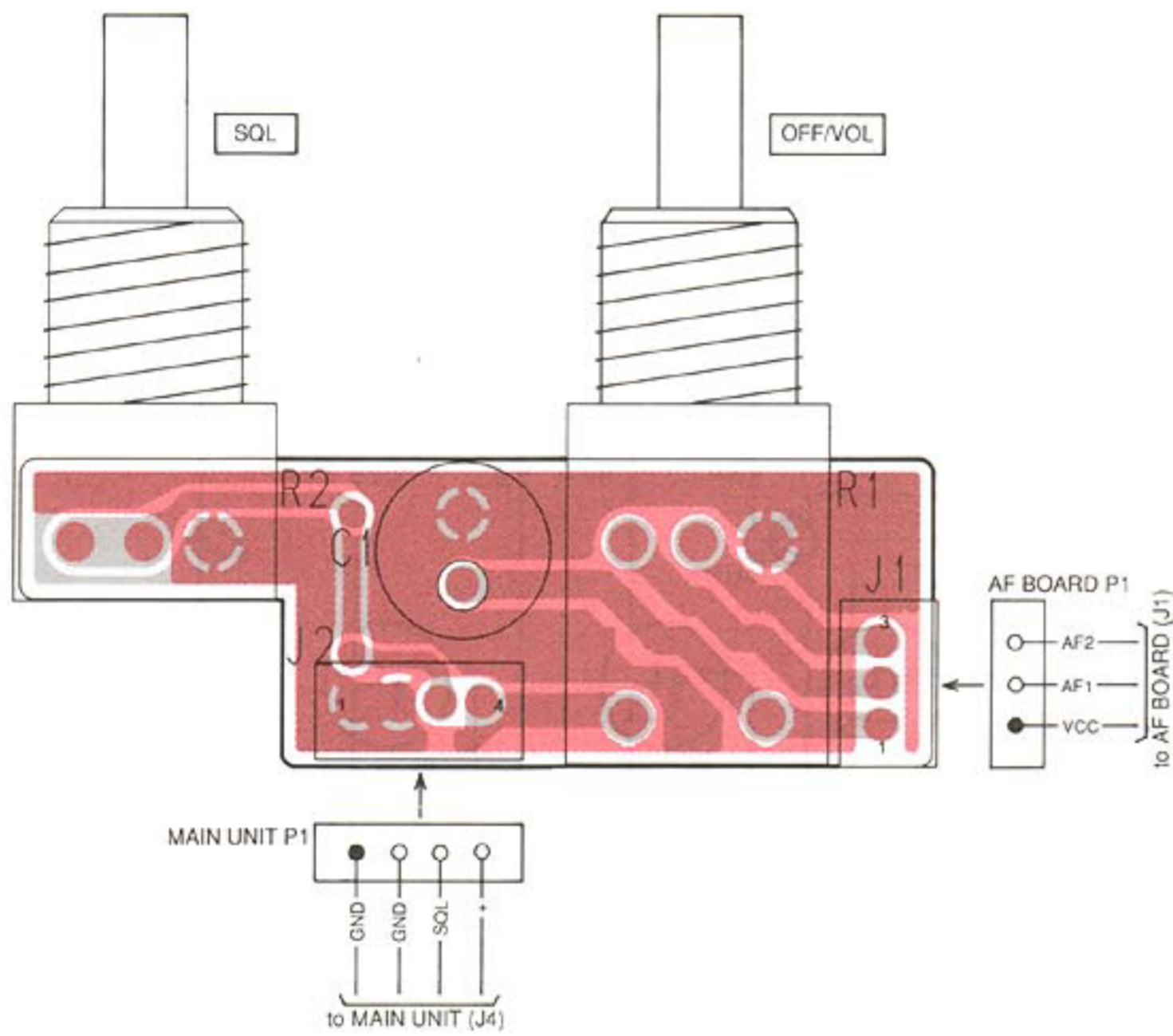
• LOGIC UNIT



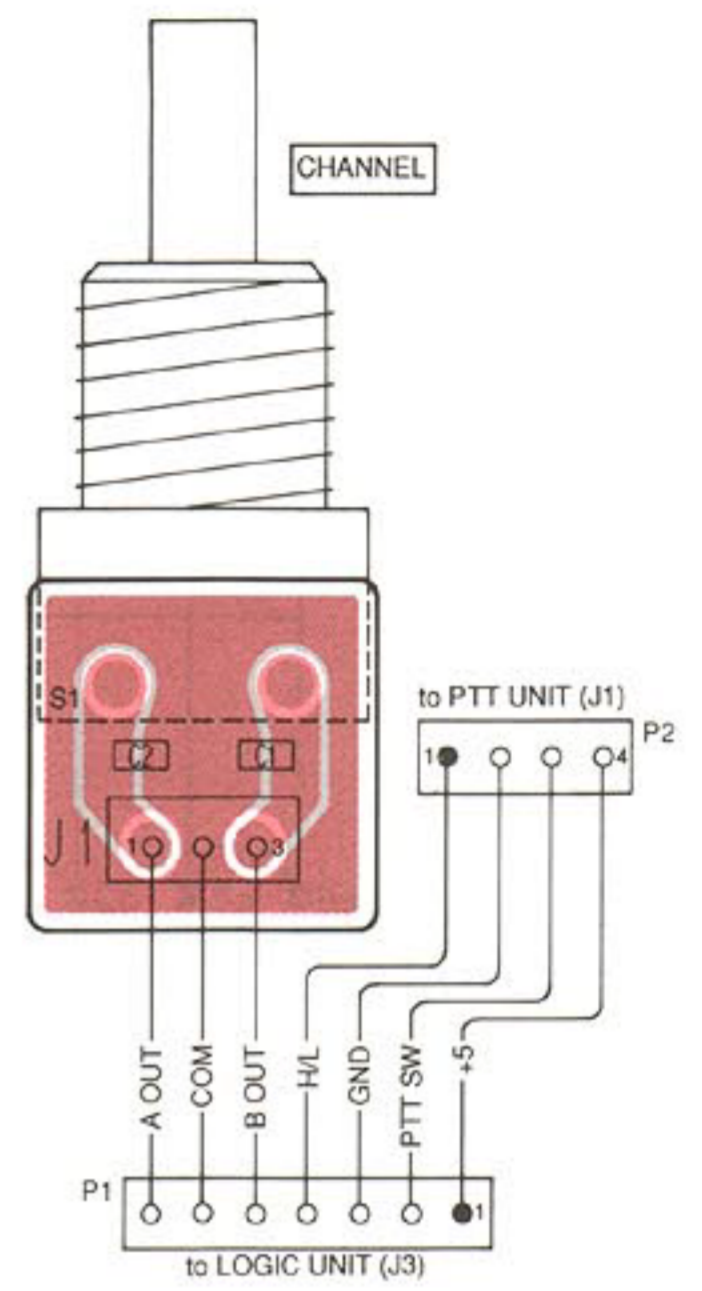


# 8-2 VR, SENSOR, PTT AND JACK UNITS

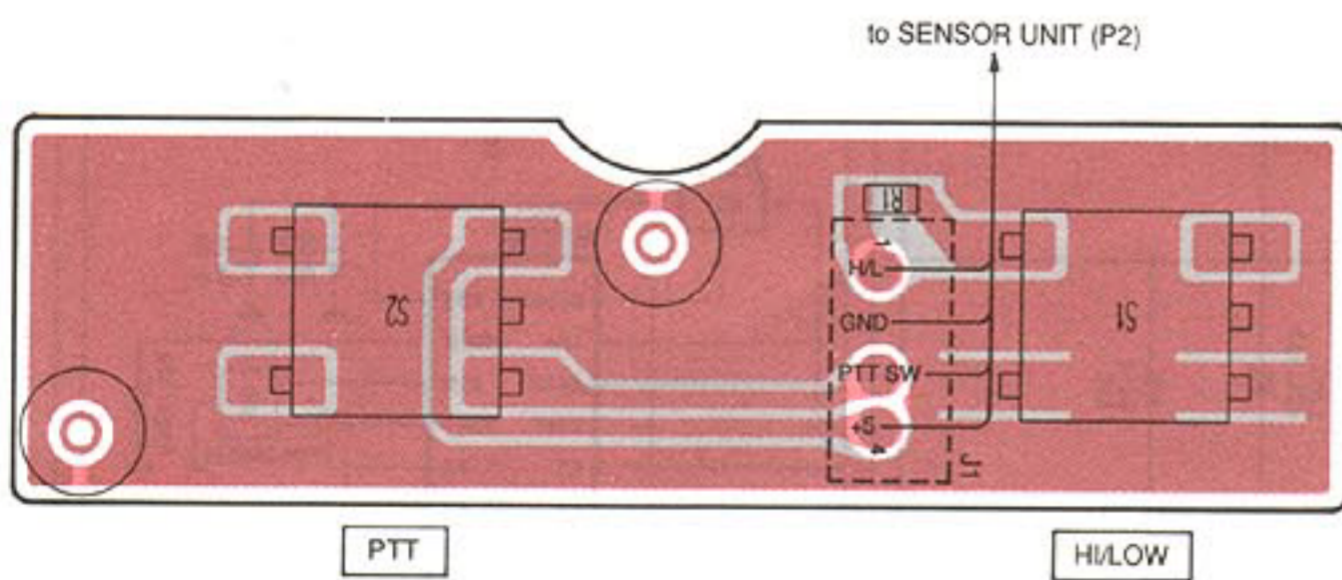
## • VR UNIT



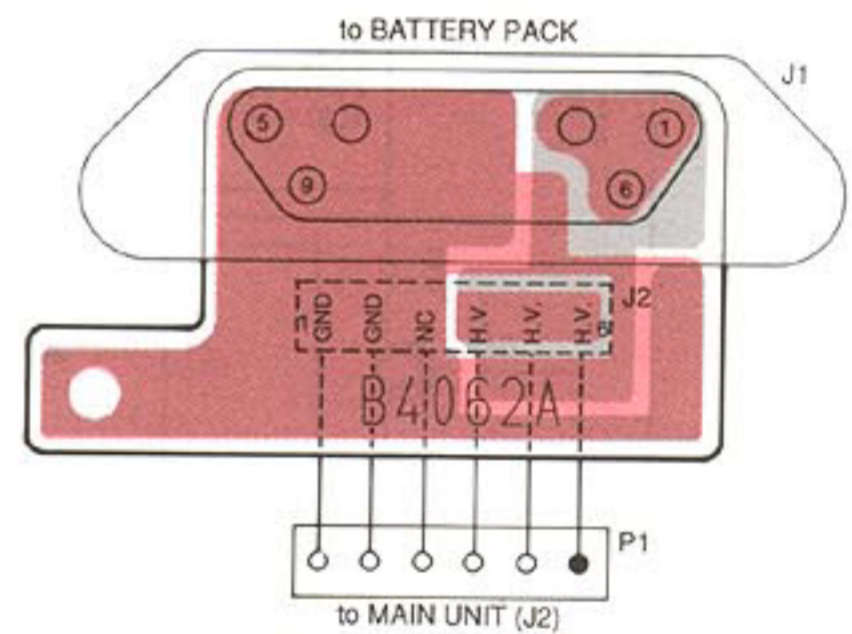
## • SENSOR UNIT



## • PTT UNIT

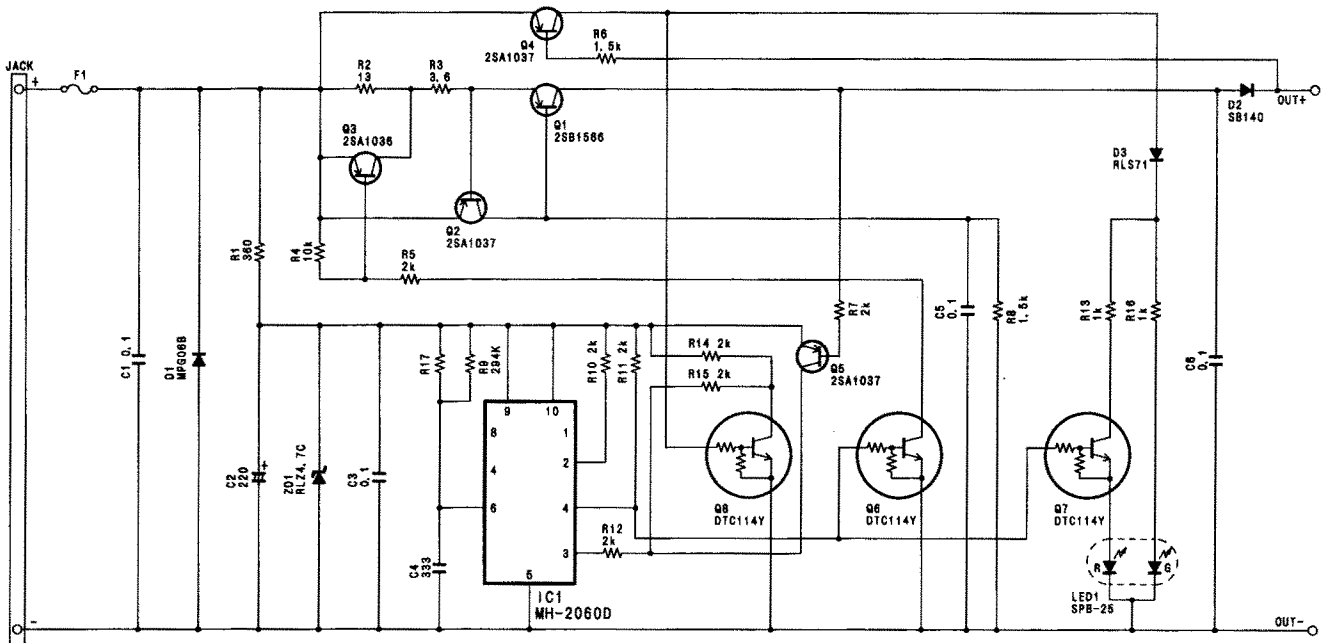


## • JACK UNIT

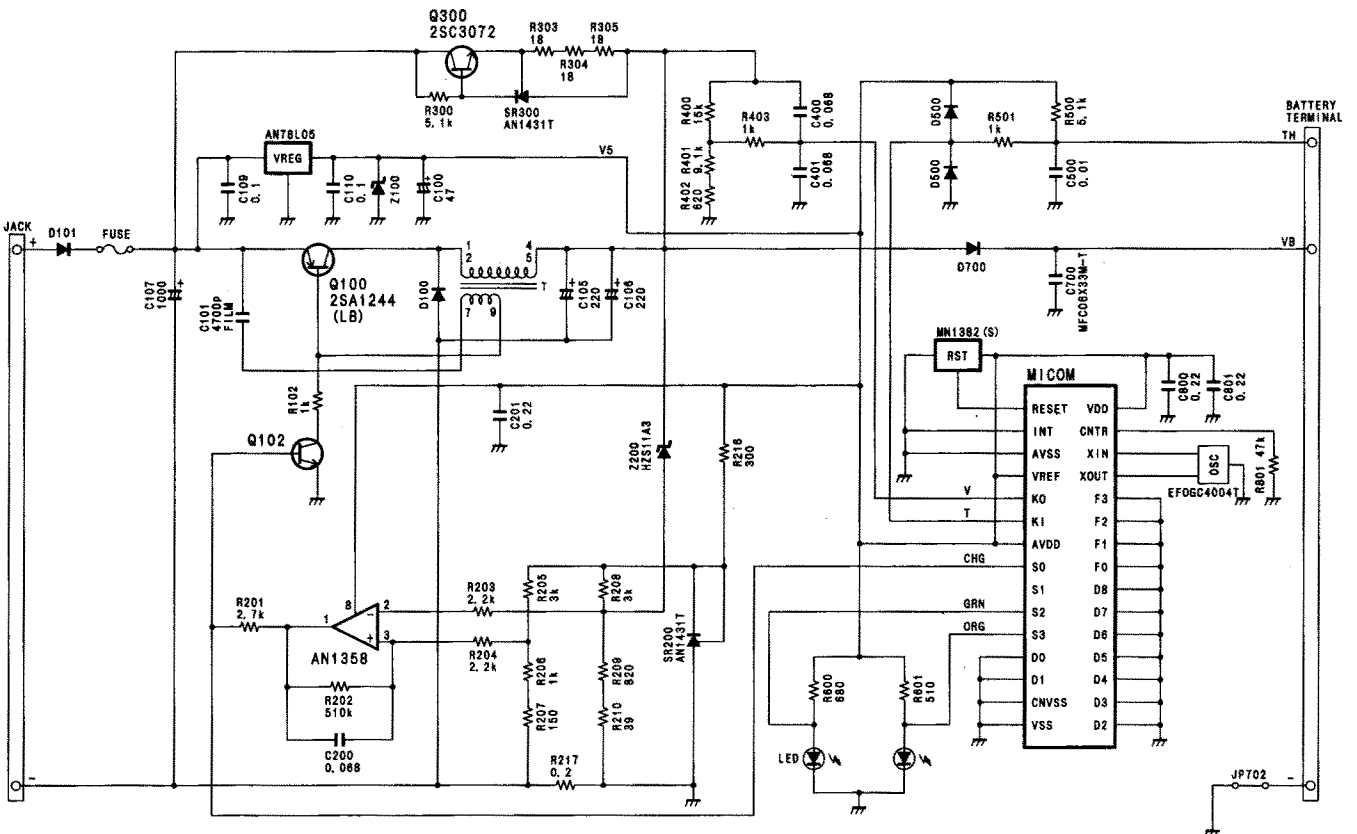


# SECTION 9 OPTIONAL UNIT

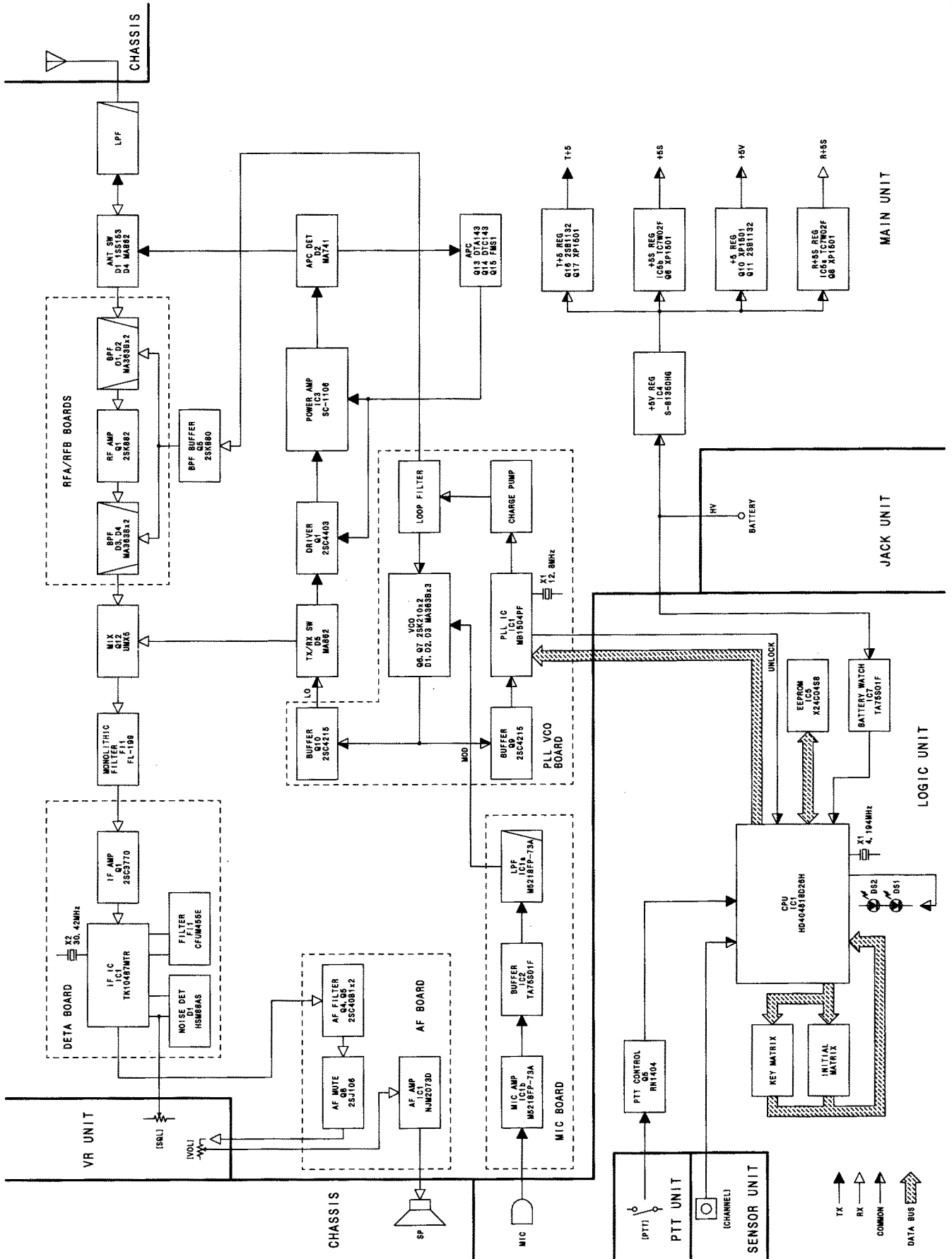
## • AD-49, AD-53 BATTERY CHARGER



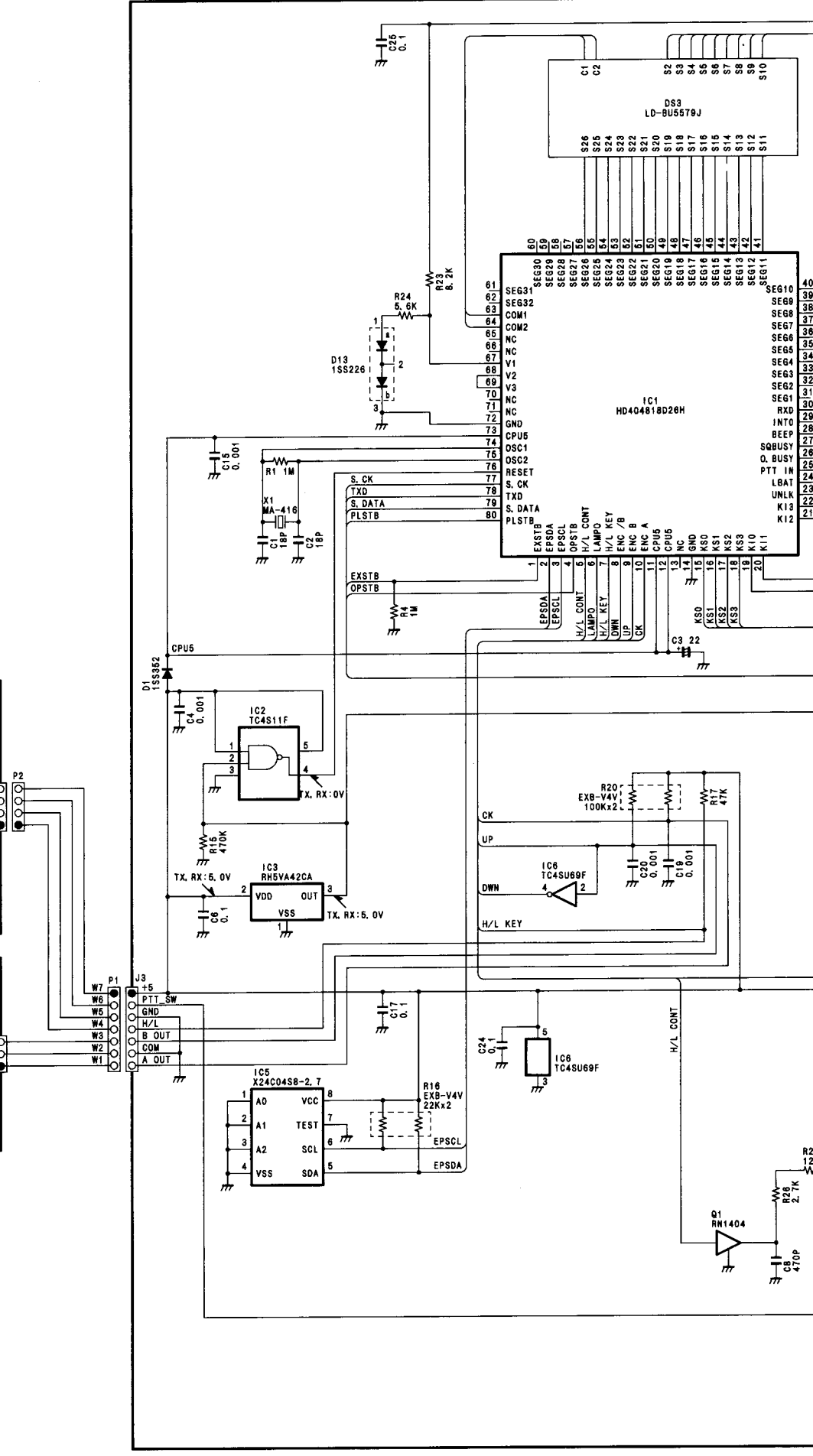
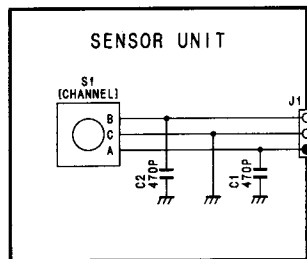
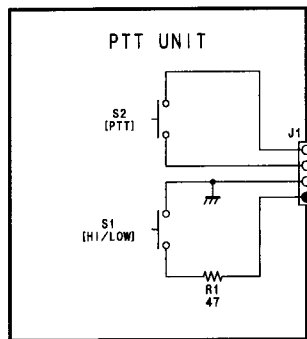
## • BM-103 DESKTOP CHARGER

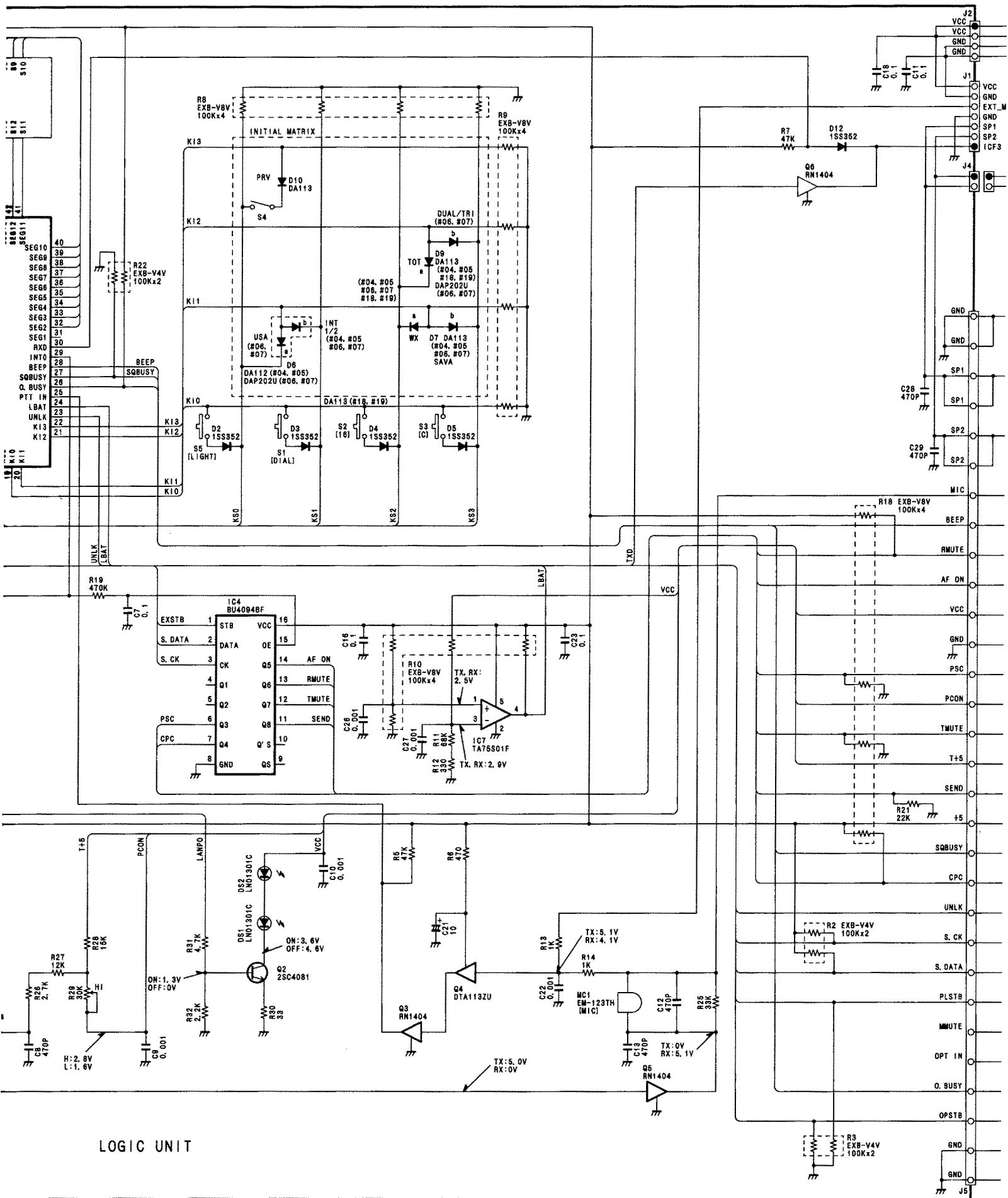






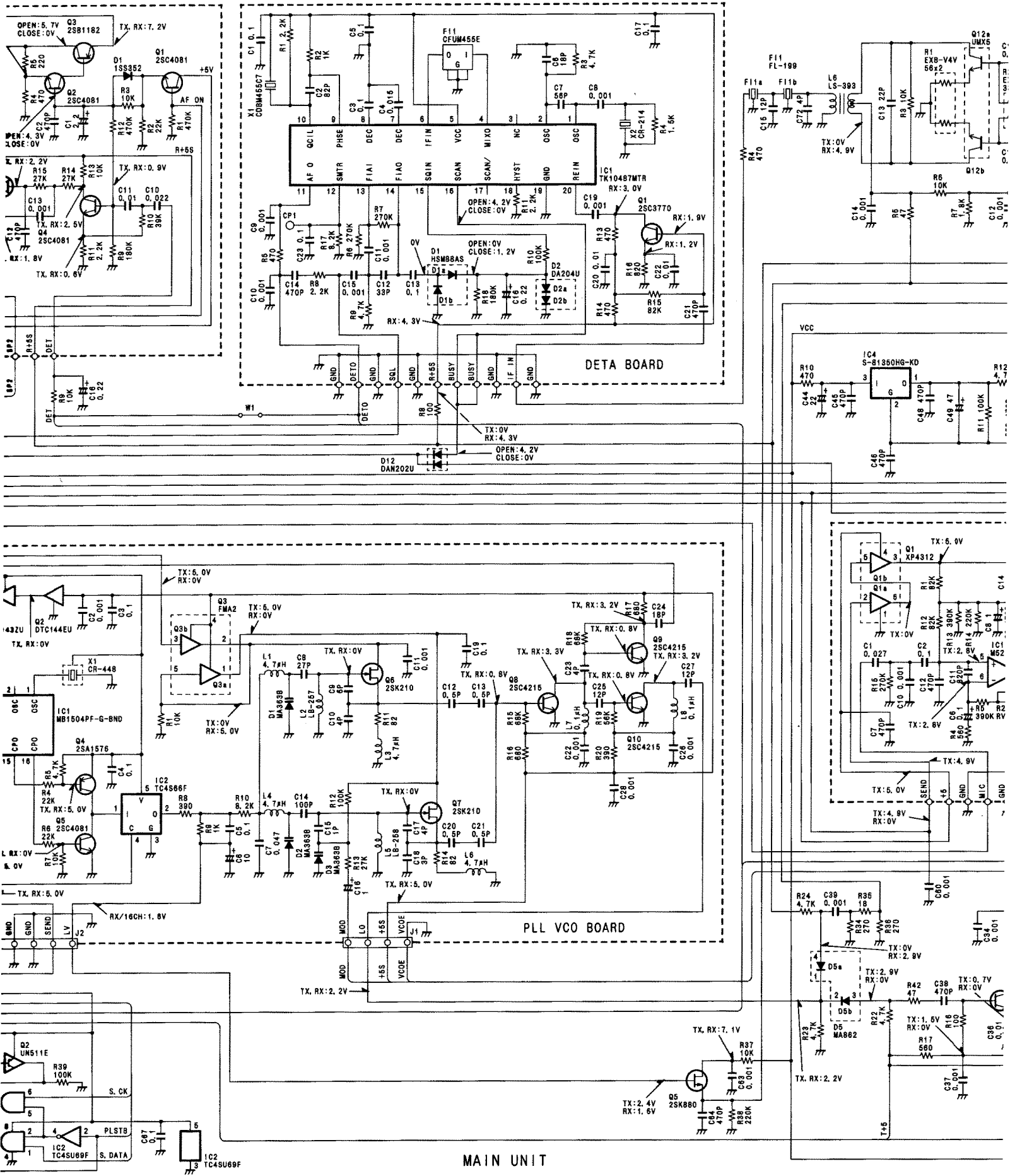
# SECTION 11 VOLTAGE DIAGRAM





LOGIC UNIT





DETA BOARD

PLL VCO BOARD

MAIN UNIT

OPEN: 5.7V  
CLOSE: 0V

RX: 2.2V  
TX, RX: 0.9V

RX: 1.8V  
TX, RX: 0.6V

TX, RX: 0V

TX, RX: 5.0V

S. CK  
PLSTB  
S. DATA

F11 FL-198  
C15 12P  
C16 47P  
C17 1.5K

TX: 0V  
RX: 4.9V

VCC

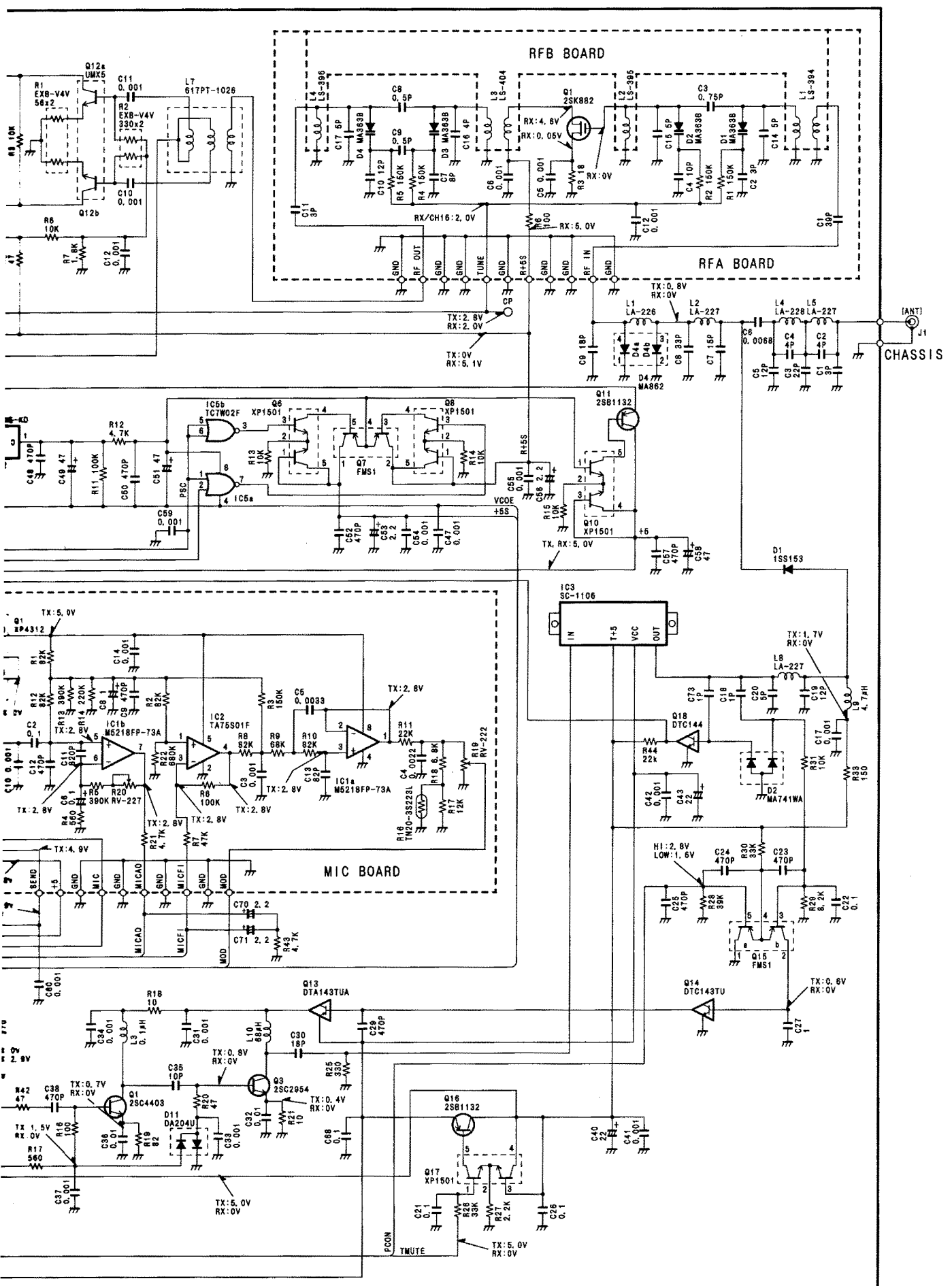
TX: 5.0V  
TX: 0V

TX: 5.0V  
TX: 4.9V  
TX: 2.6V

TX: 0V  
RX: 2.9V  
TX: 2.9V  
TX: 0V

TX: 0.7V  
TX: 0V  
TX: 1.6V  
TX: 0V

TX: 2.2V  
TX: 7.1V  
TX: 2.4V  
RX: 1.6V



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