



SERVICE MANUAL

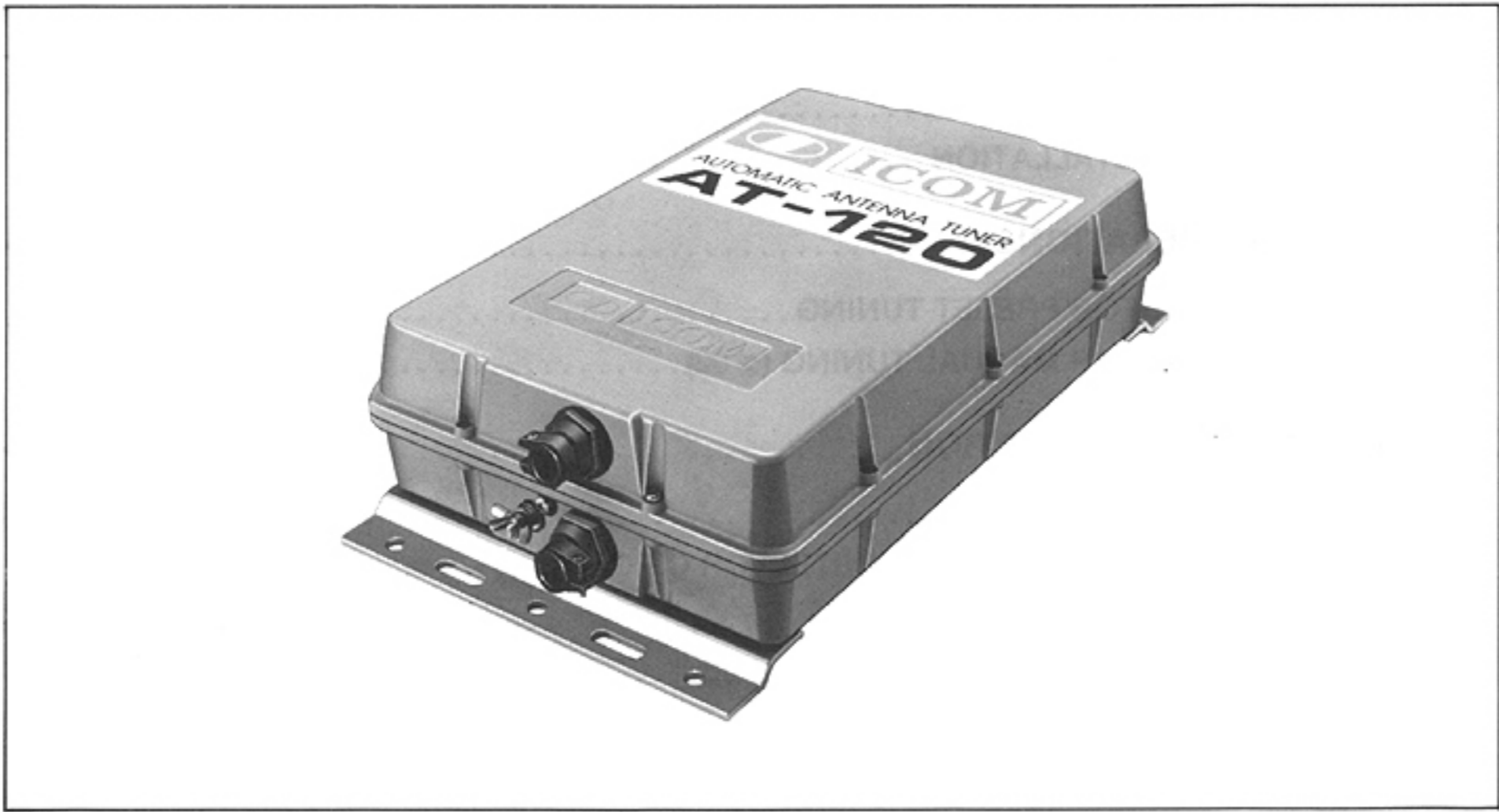
AT-120

HF AUTOMATIC ANTENNA TUNER

ICOM INCORPORATED

FOREWORD

The AT-120 HF AUTOMATIC ANTENNA TUNER was developed using both current commercial communications technology and ICOM's own advanced, state-of-the-art computer technology. It was designed primarily to be used with the IC-M700 series HF SSB TRANSCEIVERS.



ASSISTANCE

Two separate versions of the AT-120 have been designed for use in the GENERAL and FRANCE: the AT-120 and AT-120E, respectively. The AT-120E is designed for use with the IC-M700/F HF SSB TRANSCEIVER and it has a separated emergency tuner.

This service manual covers both versions.

When using the manual the models can be referred to by the following assigned version numbers:

#01: AT-120 (GENERAL version)

#02: AT-120E (FRANCE version)

“AT-120” refers to both AT-120 and AT-120E in the text unless a note is used to specifically describe a feature of the AT-120E (#02).

If you require assistance or information regarding the operation and capabilities of these automatic antenna tuners, please contact your nearest authorized ICOM Dealer or ICOM Service Center.

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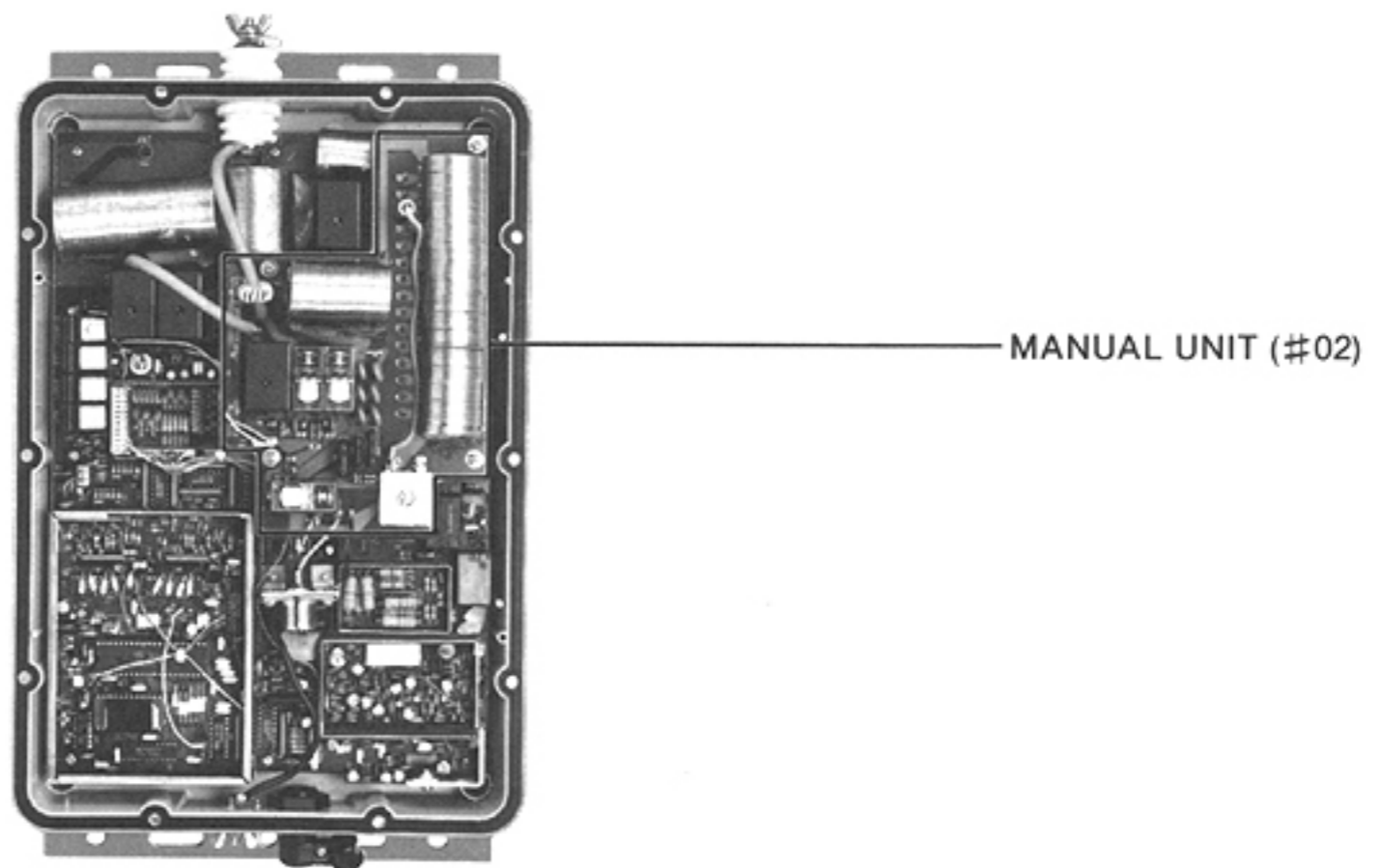
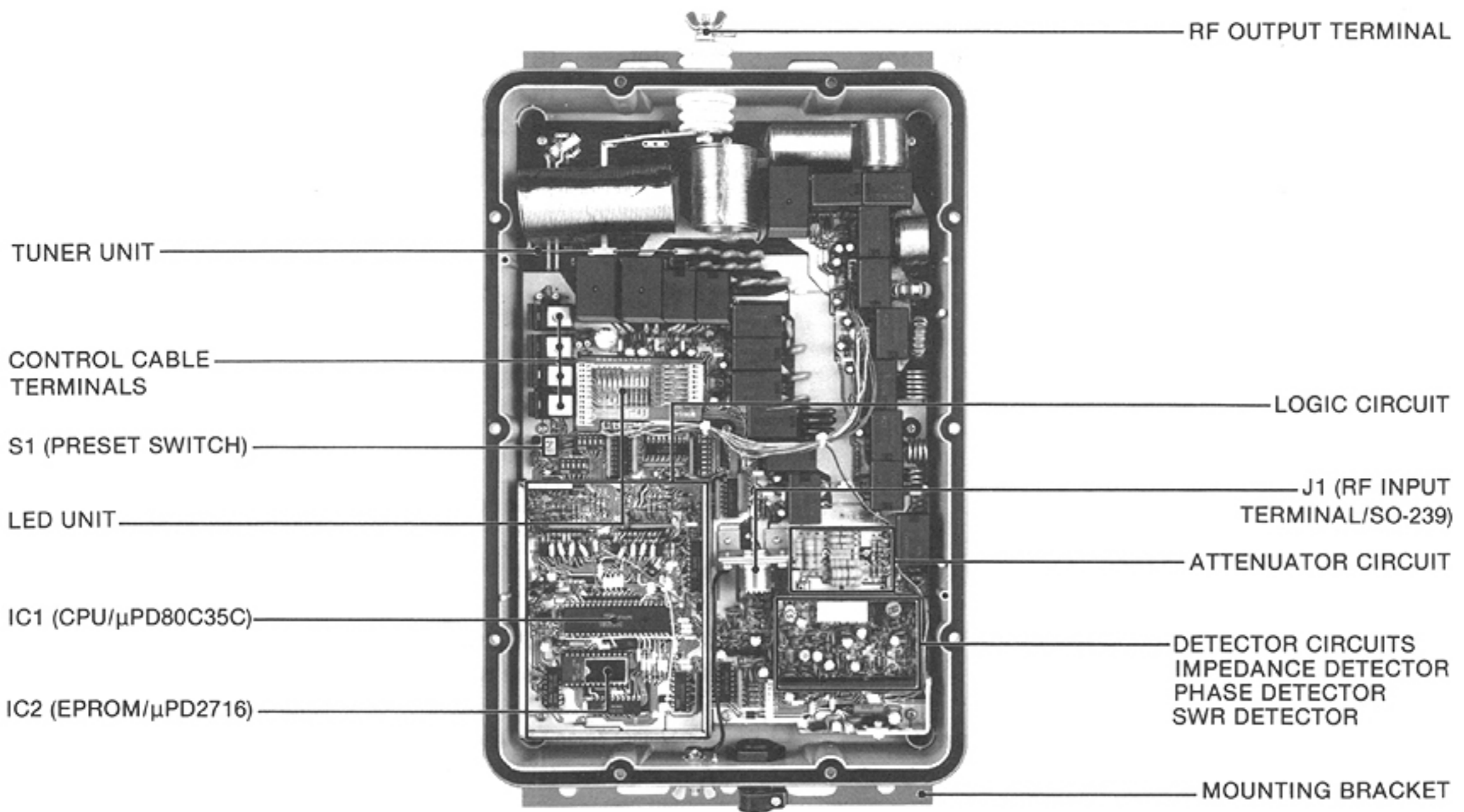
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SECTION 1 SPECIFICATIONS

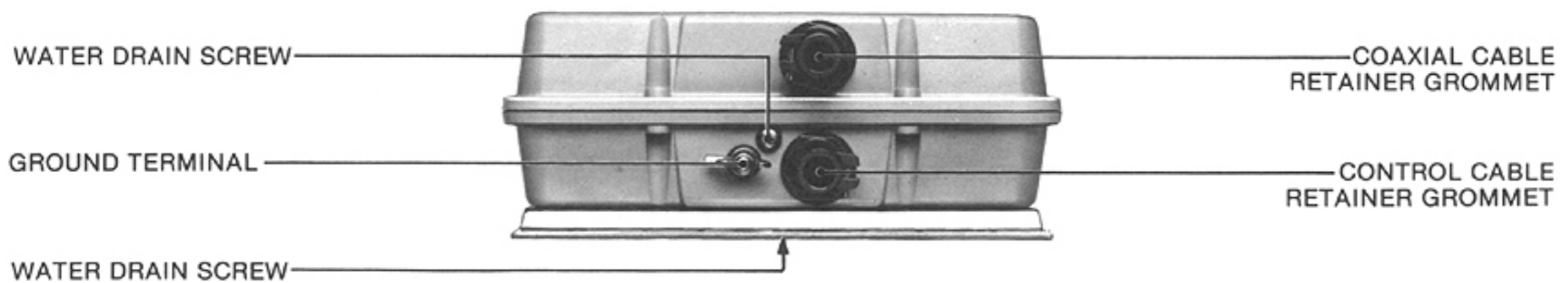
Number of Semiconductors	: Transistors 13 ICs 19 (CPU included) Diodes 38 (#01), 43 (#02)
Frequency Range	: 2MHz~24 MHz
Power Capability	: 150W PEP 100W continuous
Input Impedance	: 50Ω
Tune-up Power	: 5~15W
Tune-up Time	: Typically 2 to 3 seconds
Matching Accuracy (VSWR)	: Less than 2.0
Antenna Required	: Marconi-type with suitable RF ground (More than 23 feet suggested)
Power Supply Required	: 13.6V DC (negative ground) 2A maximum (supplied by the IC-M700)
Usable Temperature Range	: -30° C~ +60° C
Dimensions	: 230mm(W) × 340mm(D) × 80mm(H)
Case Construction	: Weatherproof
Weight	: 2.4kg (#01), 2.6kg (#02)
Control Cable	: AWG 14 × 4 conductors

SECTION 2 INSIDE VIEWS

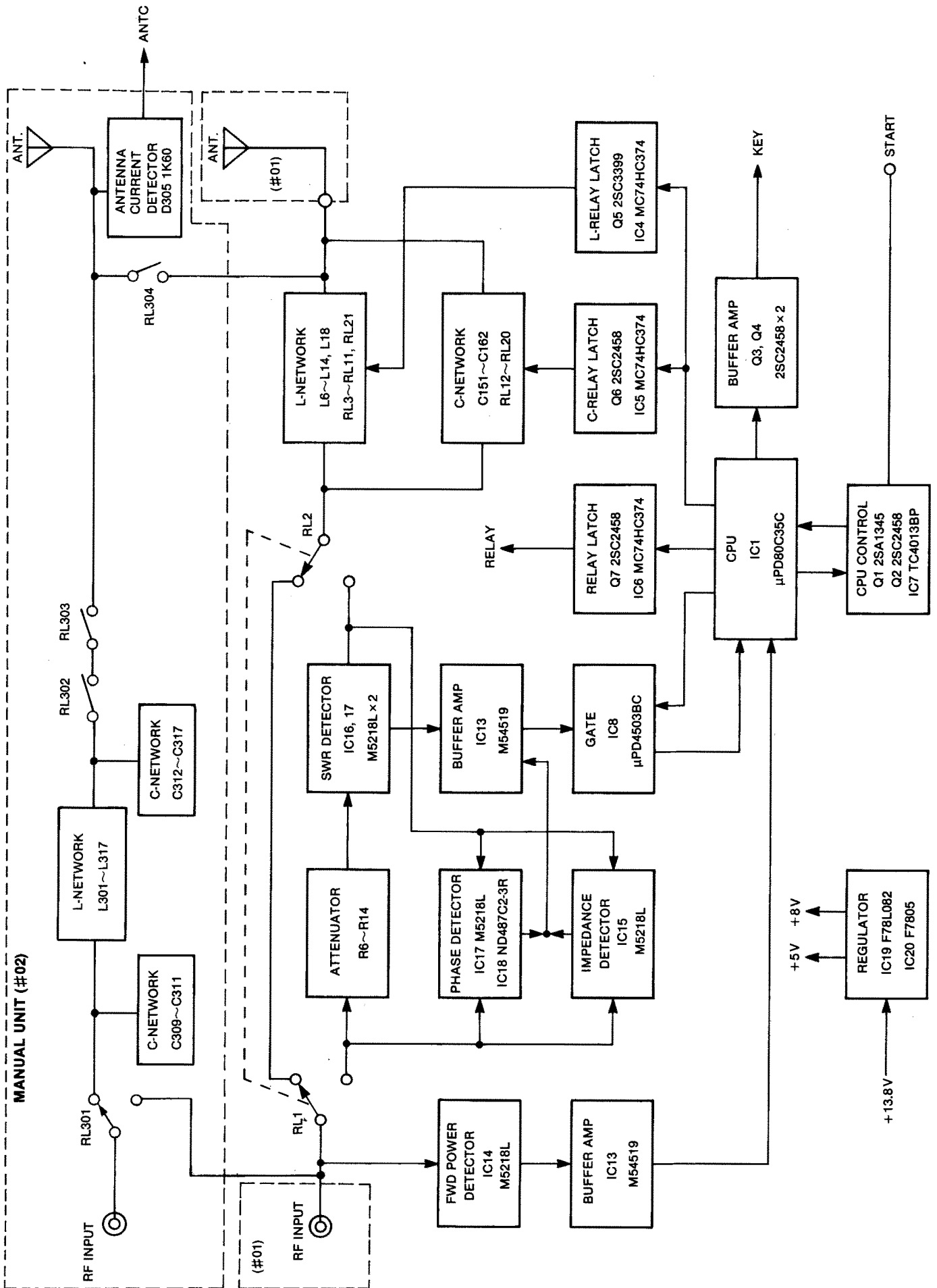
TOP VIEW



SIDE VIEW



SECTION 3 BLOCK DIAGRAM

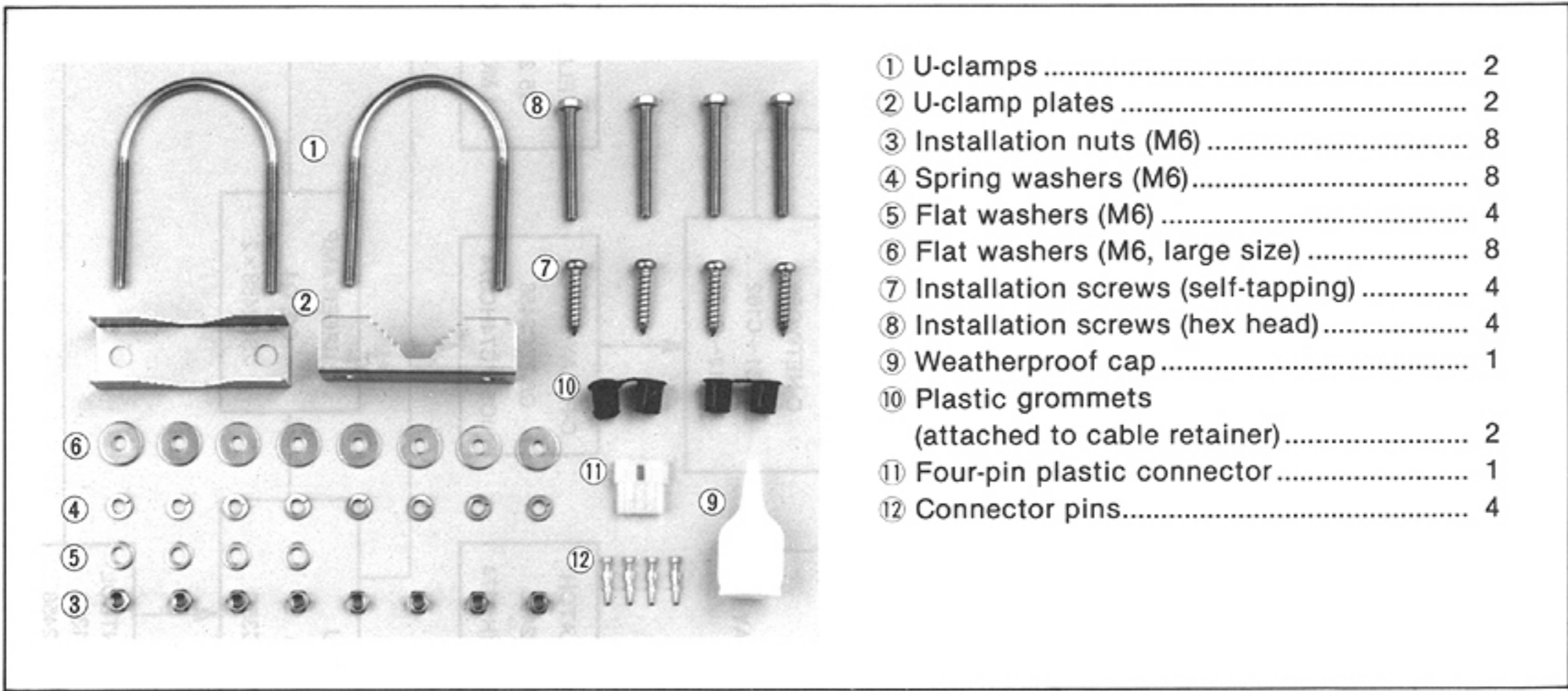


SECTION 4 INSTALLATION

4-1 UNPACKING

Carefully remove your tuner from the packing carton and examine it for signs of shipping damage. Notify the delivering carrier or dealer immediately, stating full details, should any damage be apparent. We recommend you keep the shipping carton for storing, moving

or reshipping the tuner if necessary. Accessory hardware, cables, etc. are packed with the tuner. Make sure you have removed all equipment and parts before discarding the packing carton.



① U-clamps	2
② U-clamp plates	2
③ Installation nuts (M6)	8
④ Spring washers (M6).....	8
⑤ Flat washers (M6)	4
⑥ Flat washers (M6, large size)	8
⑦ Installation screws (self-tapping)	4
⑧ Installation screws (hex head).....	4
⑨ Weatherproof cap	1
⑩ Plastic grommets (attached to cable retainer).....	2
⑪ Four-pin plastic connector	1
⑫ Connector pins.....	4

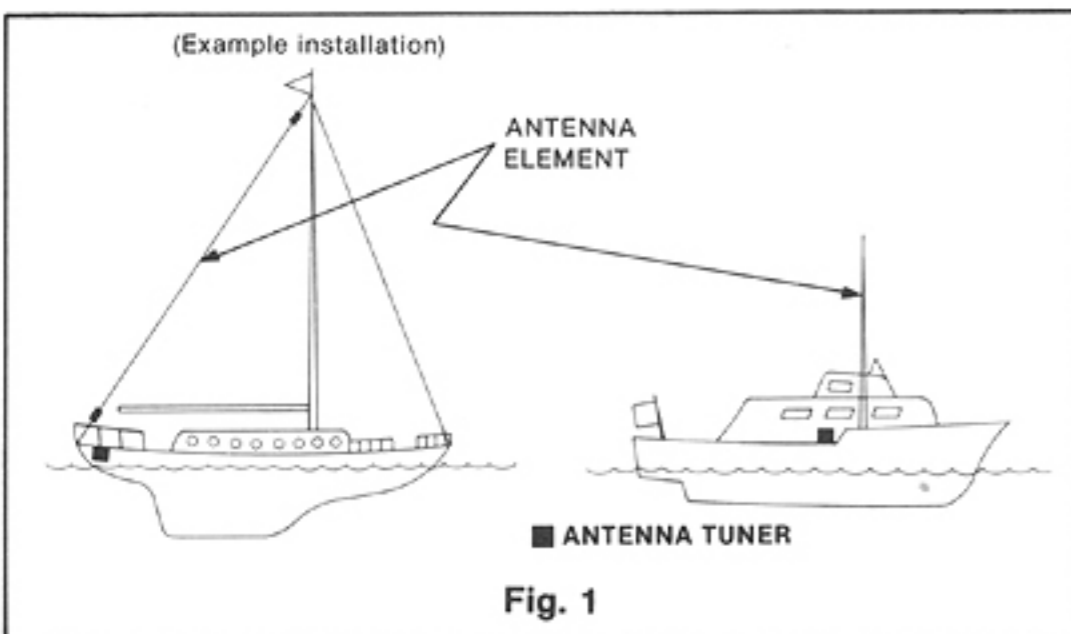
4-2 PLANNING

Select a location for the AT-120 where it will not be disturbed. Avoid long cable runs to the antenna and power source. Also, keep the cables as far from electrical pumps and other electrical apparatus as possible. **In particular, do not run the cables near magnetic compasses or electronic instruments.**

4-3 TUNER INSTALLATION

4-3-1 INSTALLATION RECOMMENDATIONS

- (1) Install the AT-120 on the deck or in the cabin near the antenna element base as shown in the figure. Try to install the tuner as close to an electrical ground as possible.



- (2) Attach the AT-120 either horizontally or vertically with one of the water drain screws down ward. See page 2-1 for location of water drain screws.

- (3) Remove the downward-facing drain screw to provide an escape path for trapped moisture.

- (4) Clamp the coaxial cable between the tuner and your transceiver to the antenna mast to prevent the weight of the cable from pulling on the AT-120.

- (5) The antenna element length should be more than 7 meters (23 feet) to achieve full performance from the IC-M700/AT-120 system. Certain lengths should be avoided since they are difficult for the system to tune. Final SWR, in these cases, may be too high for efficient operation and tuning may take longer.

Note the formula below:

L: Element length to be avoided

$$L \text{ (meters)} = \frac{300}{\text{Operating frequency (MHz)}} \times \frac{1}{2} \times \text{Integer (1, 2, \dots)}$$

(Example)

Operating frequency: 2.182 MHz (2182 kHz)

$$L = \frac{300}{2.182} \times \frac{1}{2} \times 1$$

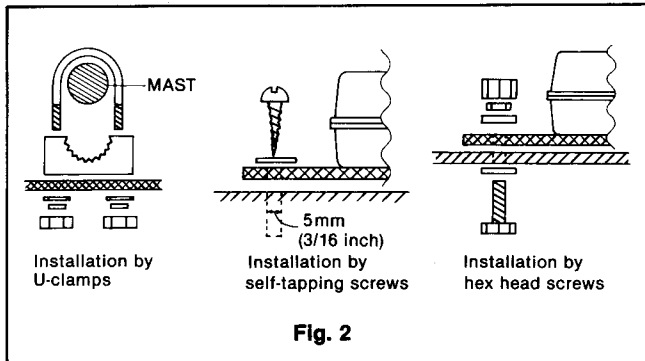
$$= 68.7 \text{ meters}$$

4-3-2 INSTALLATION

Three kinds of installation are available for any type of ship.

- Installation by U-clamps
- Installation by self-tapping screws
- Installation by hex head screws

- (1) Test the AT-120 to ensure it is operational before attempting to mount it permanently.
- (2) Attach the AT-120 to its mounting structure using the supplied hardware. Use the correct hardware for your installation location. See the figure below.

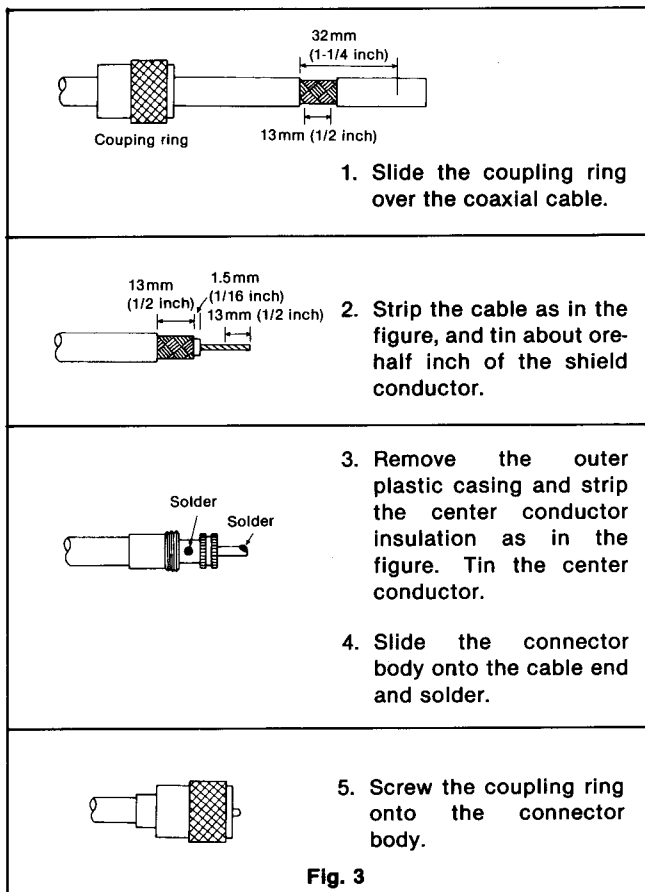


(3) The U-clamp mounting hardware fits 32 to 64 mm (1-1/4 to 2-1/2 inch) tubing. Antenna mast diameters outside this range require different hardware. This hardware is not supplied with the AT-120.

(4) PL-259 coaxial connectors are not supplied with the AT-120. Obtain the correct connectors for the type of cable you are using in your installation. The following procedure illustrates the proper method for attaching the connectors.

NOTE: Refer to SECTION 4-3-3 before attaching the connectors.

■ SOLDERING PL-259



4-3-3 COAXIAL CABLE CONNECTION

- (1) Prepare the coaxial cable and the two PL-259 connectors you intend to use.
Recommended coaxial cable: RG-8/U
- (2) Insert one end of the coaxial cable through the hole with the plastic grommet located on one end of the AT-120 cover. Install the two connectors on the ends of the cable.
- (3) Tighten the screw on the outside of the grommet to prevent water from entering the unit. This also acts as a strain relief for the cable.

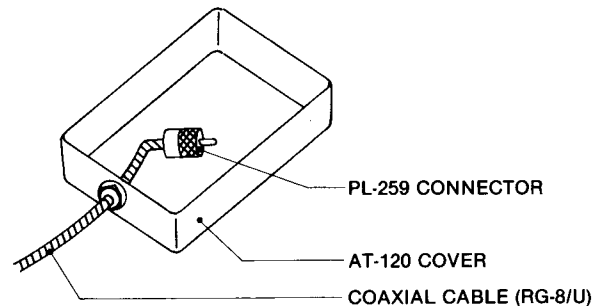
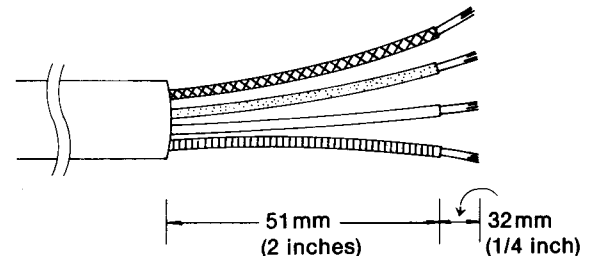


Fig. 4

4-3-4 CONTROL CABLE CONNECTION

- (1) Prepare the control cable and the four-pin connector that joins the AT-120 to the IC-M700. The connector and pins are supplied with the IC-M700.
- (2) Strip both ends of the cable as shown in the figure.



Control cable: AWG 14×4 conductors

Fig. 5

- (3) Solder or crimp the pins onto each wire. Insert the pins into the plastic connector. Feed the other end of the cable through the hole on the end of the main body of the AT-120 with the plastic grommet as shown.
- (4) Make sure the wires do not touch any adjacent parts or metal objects.

■ TERMINAL DESCRIPTIONS

• J8 (#01)	E Ground
• J8 (#02)	ANTENNA CURRENT OUTPUT [ANTC] Outputs the detected voltage of the RF output power for application to the antenna current meter.

•J9	POWER SOURCE INPUT [13.6V] Inputs 13.6V with a 2A power source.
•J10	START INPUT [START] Inputs the tuning start signal. Normally this terminal should be approximately 6V. The AT-120 should be 0V for more than 200msec. when starting.
•J11	KEY OUTPUT [KEY] This terminal is an open collector. When the tuning start signal is received, the terminal is at a "LOW" level and the transceiver transmits 10W of checking power until the antenna tuner finds the lowest SWR condition.

■ CONNECTIONS

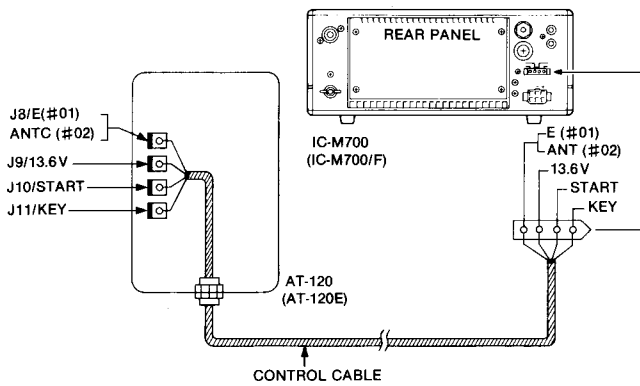


Fig. 6

4-3-5 REPLACING THE COVER

- (1) After making all other connections, connect the PL-259 plug into the SO-239 jack on the TUNER UNIT.
- (2) Confirm that the cover gasket makes good contact with the body and the cover for a water-tight seal.
- (3) Fit the cover onto the base and fasten it with 10 screws as illustrated in the figure.
- (4) Tighten the screws on the cable retainers.
- (5) The AT-120 is now ready for final installation aboard your vessel.

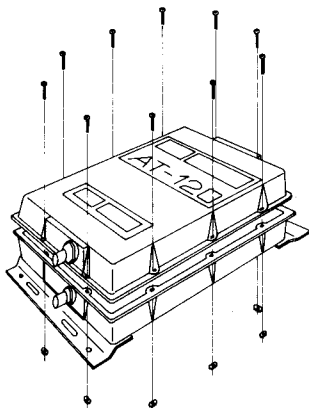


Fig. 7

4-3-6 GROUND SYSTEM

- (1) The AT-120 must be connected to a good electrical ground. A good ground prevents shocks, interference and numerous other problems. One example of a good ground is the nearest metal member on a metal vessel. For best results, use the heaviest gauge wire or metal strap available. Make the length of wire as short as possible.
- (2) Good ground systems on wood or fiberglass boats are more difficult to install. For best results, use a heavy gauge wire or strap connected to the engine block or another large metal object. This may be adequate for operation on frequencies in the 2 to 4 MHz range.

Install a counterpoise for each band of frequencies used above 4MHz, as shown in the figure.

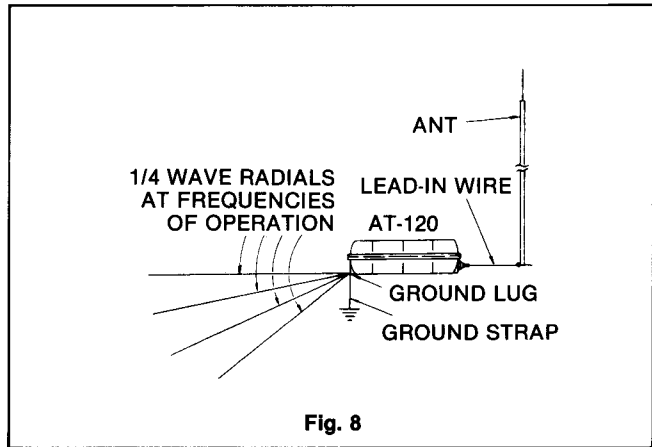


Fig. 8

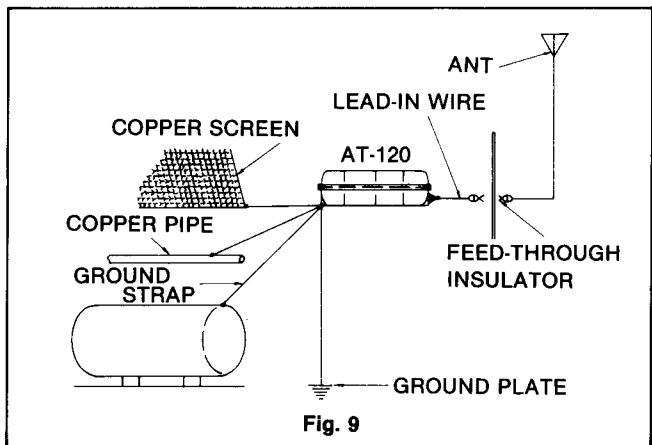


Fig. 9

NOTE 1: Insulate the ends of each counterpoise from other metal objects.

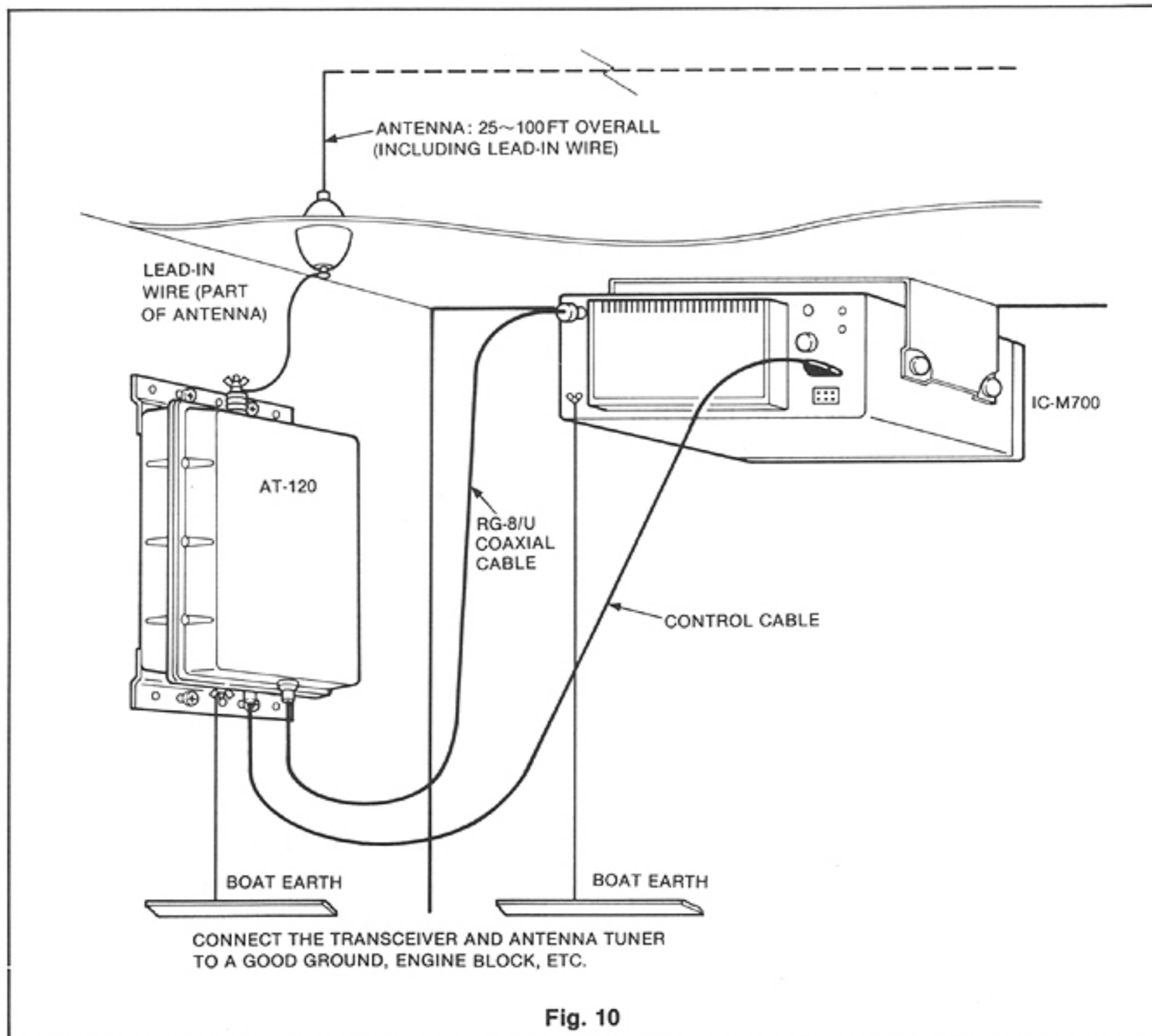
NOTE 2: Lay out the wires horizontally and as straight as possible.

4-3-7 CABLE CONNECTIONS

- (1) Connect the control cable to the ANTENNA TUNER CONNECTOR on the rear panel of the IC-M700 as shown in the figure.
- (2) Connect the antenna coaxial cable to the ANTENNA CONNECTOR.
- (3) Route the cables as planned earlier.
- (4) The antenna element or wire from the RF output terminal on the transceiver must be insulated from other metal objects.

- (5) The IC-M700 provides the necessary connector to output or input control signals to an automatic antenna tuner. Internal switches select the control signal levels; therefore, most existing antenna tuners may be used.

CAUTION: Avoid long cable runs to the antenna and power source. Also, keep the cables as far as possible from electrical pumps and other electrical equipment possible. **In particular, do not run the cables near magnetic compasses or electronic instruments.**



SECTION 5 PRE-OPERATIONS

5-1 SETTING FOR PRESET TUNING

WARNING: Before setting PRESET TUNING, connect and ground the AT-120 and IC-M700 to an antenna to prevent electrical accidents.

- (1) Connect the SWR meter between the IC-M700 and AT-120 as shown in Fig. 1.

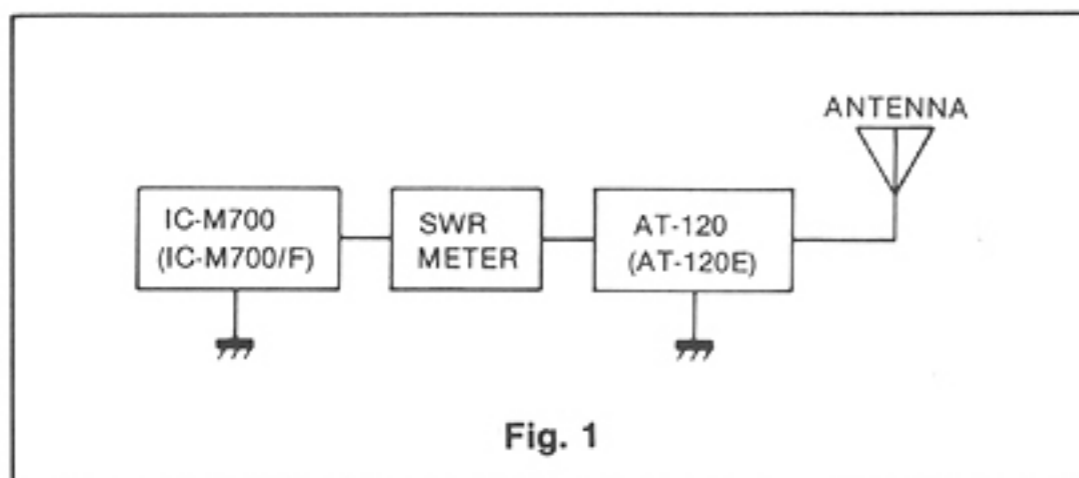


Fig. 1

- (2) Be sure the S1 PRESET SWITCH on the AT-120 is set in the [NORMAL] position.
- (3) Set the IC-M700 to your most used channel.
- (4) Push the TUNE SWITCH of the IC-M700 to tune the AT-120. Be sure the SWR reading is less than 1 : 2.0.
- (5) Make a note of which LED lights up on the AT-120.
- (6) Set S1 on the AT-120 to the [PRESET] position.
- (7) Set S2, S3 and S4 at the same location where the LED lights up.
 - S2: L1~L5
 - S3: L6~L10
 - S4: C1~C8

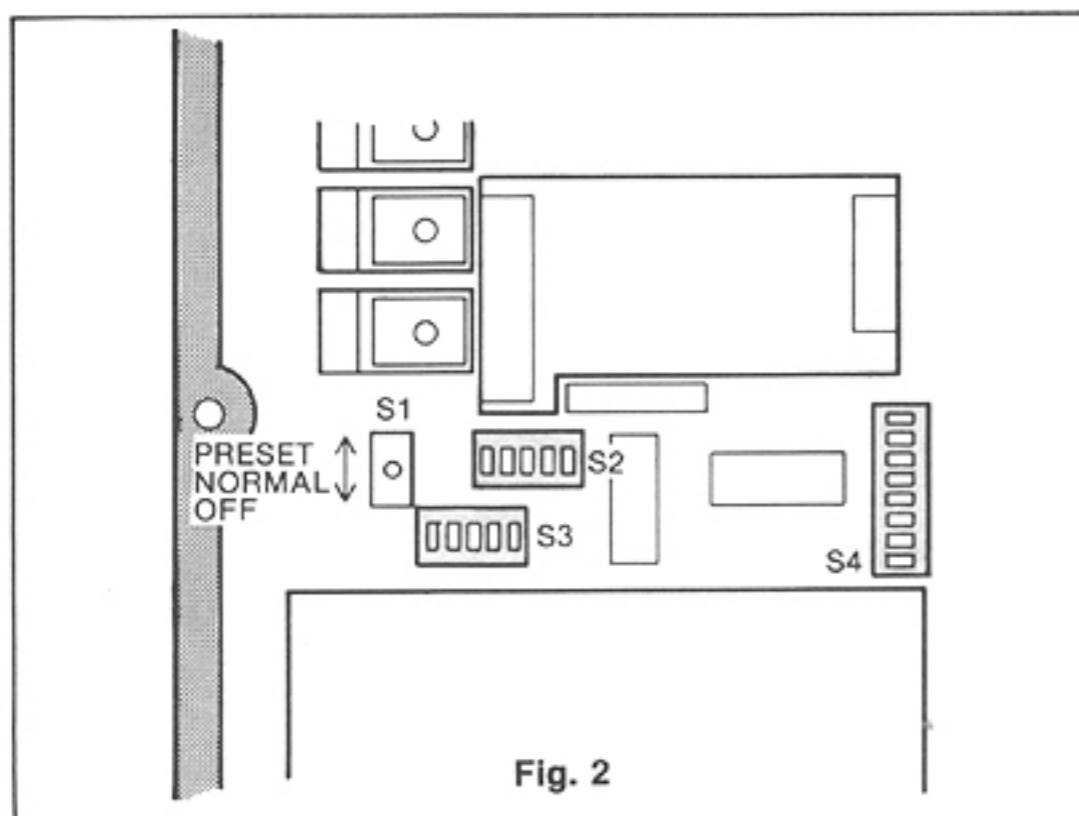


Fig. 2

- (8) After the above settings are complete, set S1 to the [NORMAL] position.

5-2 SETTING FOR MANUAL TUNING (#02)

MANUAL TUNING operates when the GROUP SWITCH on the IC-M700/F is set in the [2182] position.

WARNING: Before setting MANUAL TUNING, connect and ground the AT-120E and IC-M700/F to an antenna to prevent electrical accidents.

- (1) Connect the SWR METER between IC-M700/F and AT-120E as shown in Fig. 1.
- (2) Set the GROUP SWITCH on the IC-M700/F to the [2182] position.
- (3) Remove the wire from J9 and tape the ends of the wire.

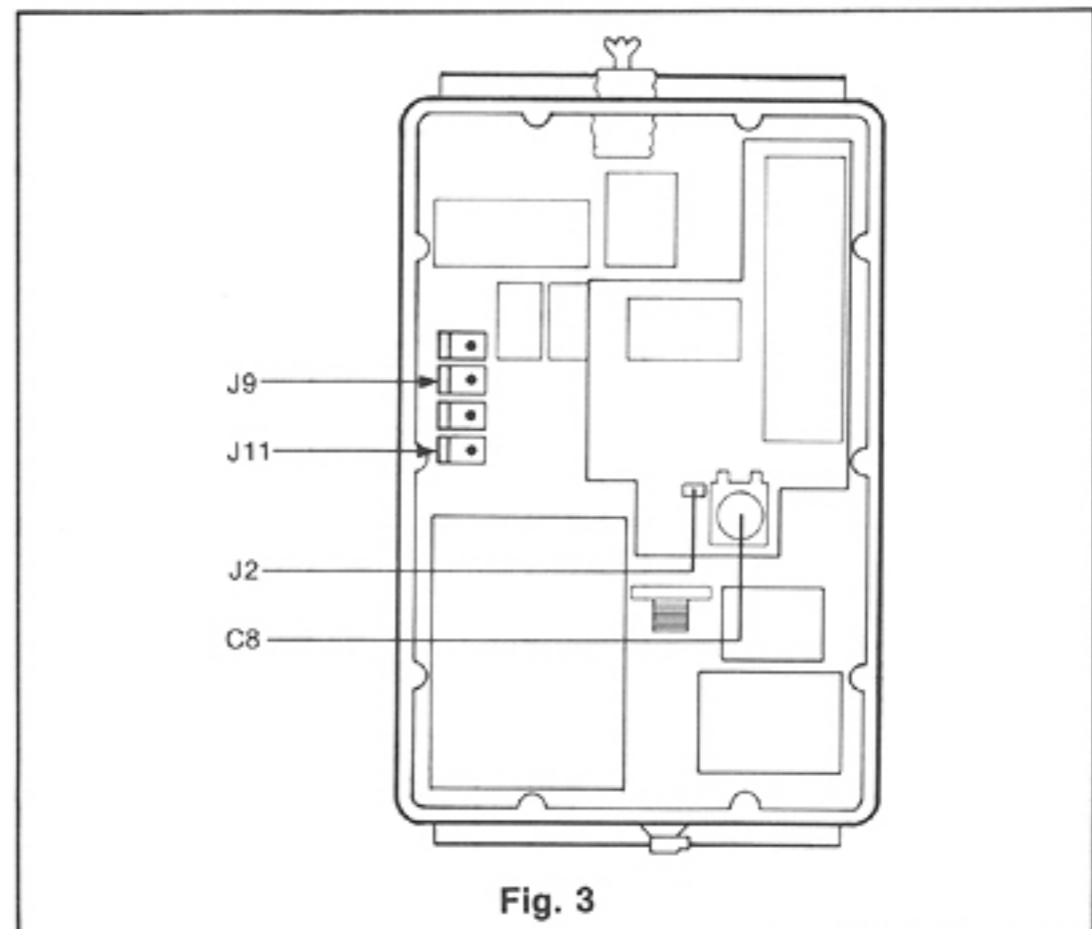


Fig. 3

CAUTION: DO NOT short the wire by letting it touch other parts of the AT-120E. This wire is a 13.6V power source from the IC-M700/F.

- (4) Unplug J2 and rotate C8 counterclockwise at least 3 full turns.

CAUTION: Damage to the AT-120E could occur if the GROUP SWITCH on the IC-M700/F is not set in the [2182] position. Set the GROUP SWITCH in the 2182 position.

- (5) See the SWR meter and ground J11 below 5 seconds to transmit 10W of checking power.

CAUTION: To avoid damage to the IC-M700/F, do not transmit more than 5 seconds on each check transmission.

(6) Adjust as follows to obtain a minimum SWR reading with a check transmission:

WARNING: To avoid electric accidents, do not transmit while making adjustments.

CAUTION: The location for connecting the red wire in step ③ below is shown in Fig. 4. Use of an improper location could result in fire risk.

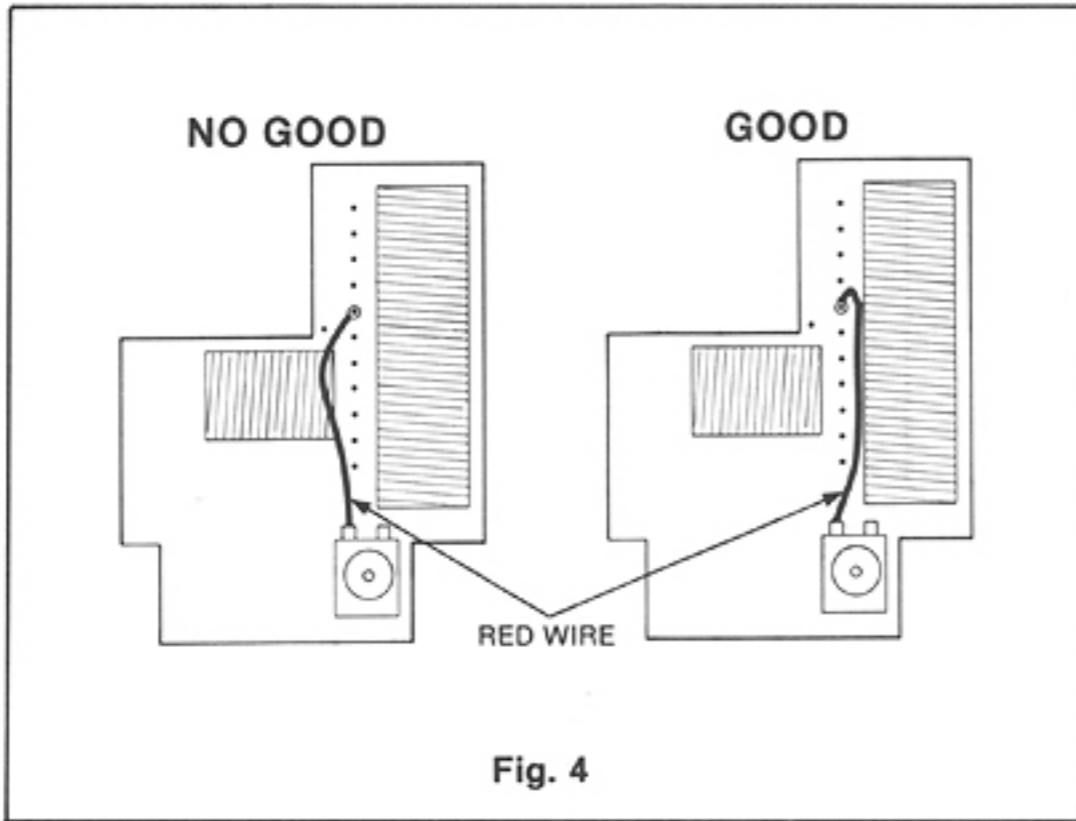


Fig. 4

③ Connect P5 (red wire) to any of pins J7 through J22.

⑥ Arrange the configuration of J2 into any of the combinations below (See Fig. 5).

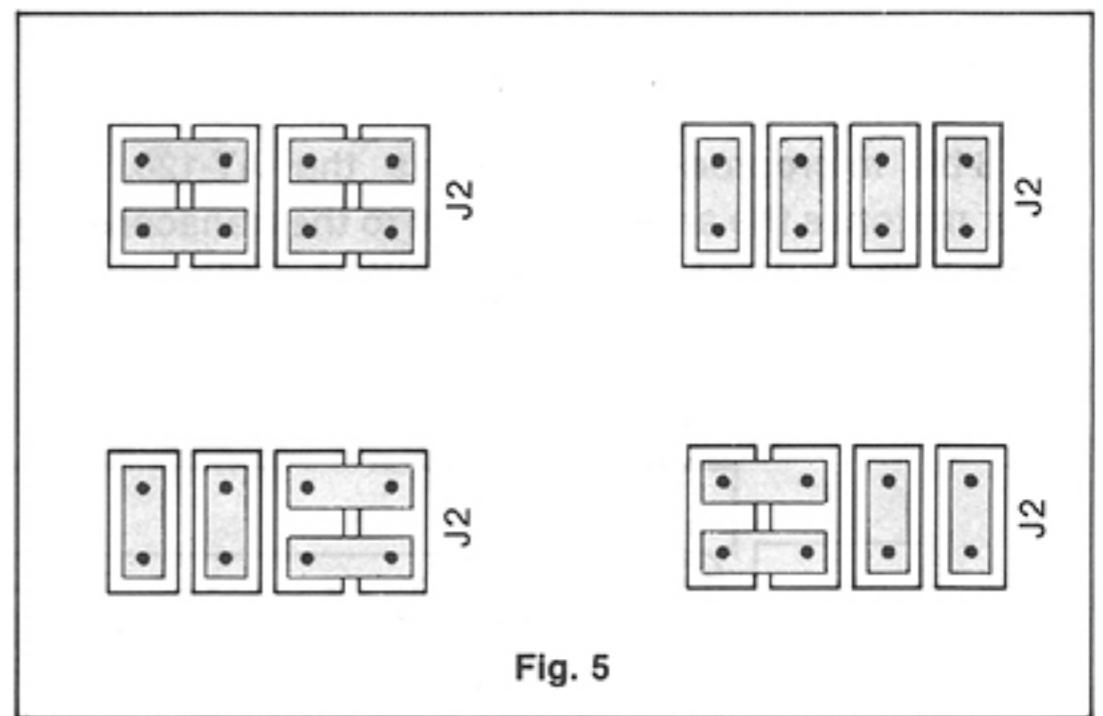


Fig. 5

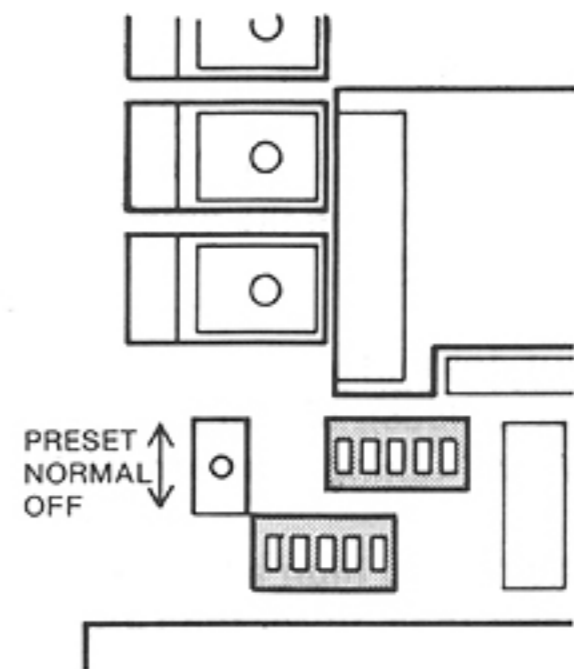
④ Adjust C8.

⑤ Readjust steps 1 and 3 until the SWR reading is less than 1 : 1.5.

(7) After obtaining the minimum SWR reading, reconnect the wire to J9.

PRESET SWITCH (S1) OPERATIONS

- PRESET : The AT-120 does not operate AUTOMATIC TUNING. This setting must be used when setting PRESET TUNING.
- NORMAL (#01) : The AT-120 operates AUTOMATIC TUNING and PRESET TUNING.
- (#02) : The AT-120E operates AUTOMATIC TUNING, MANUAL TUNING and PRESET TUNING.
- OFF : The AT-120 operates AUTOMATIC TUNING only.



SECTION 6 CIRCUIT DESCRIPTION

6-1 GENERAL

An 8-bit microprocessor controls the AT-120. The tuner matches the antenna system to the transceiver by using four kinds of detector circuits. These circuits are:

- (1) FORWARD POWER DETECTOR
- (2) SWR DETECTOR
- (3) PHASE DETECTOR
- (4) IMPEDANCE DETECTOR

Detailed descriptions of each circuit follows.

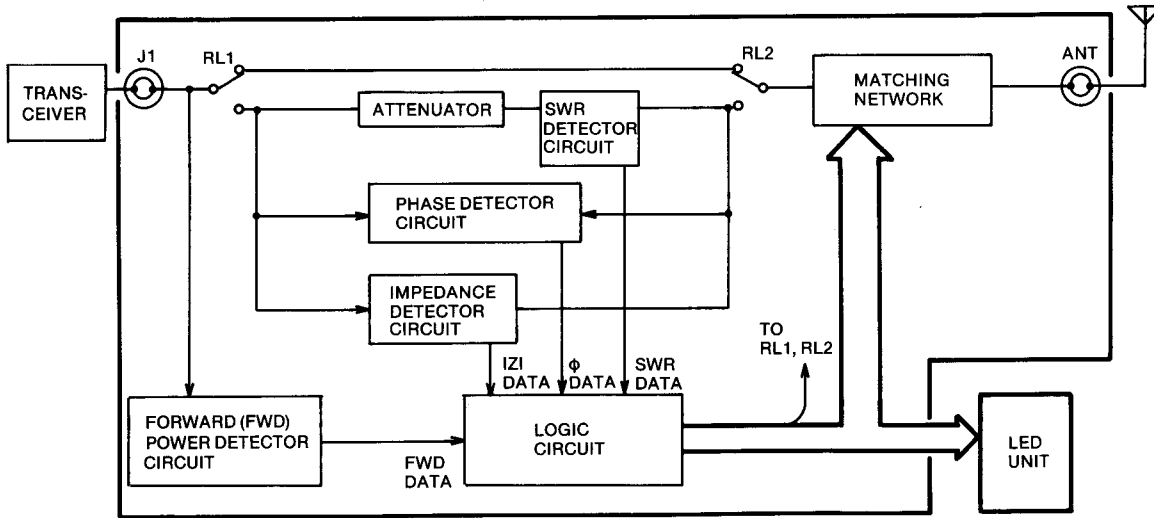


Fig. 1

6-2 FORWARD (FWD) POWER DETECTOR CIRCUIT

This circuit ensures the input power from the transceiver is low enough to be handled by the attenuator within the tuner.

On the TUNER UNIT, L1 and D1 detects the RF input current. C1 and C2 divide the detected voltage and feed it to IC14a through CP1.

If the input terminal receives an appropriate power (about 10W or less), the CP2 voltage is LOW and the CPU allows the tuning function.

If power that is too high appears at the input terminal (much greater than 10W), the CP2 voltage stays HIGH and the CPU does not respond.

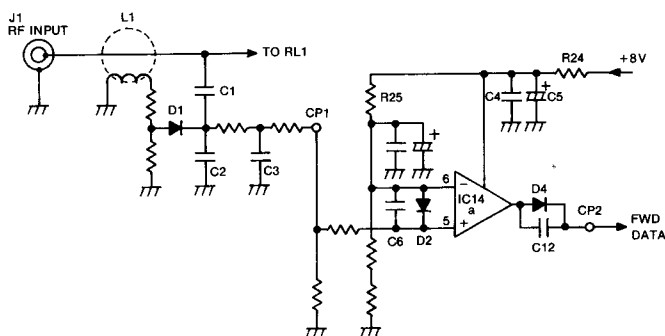


Fig. 2

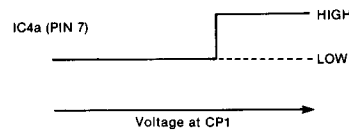


Fig. 3

6-3 SWR DETECTOR CIRCUIT

The reflected power from the antenna system provides a detection voltage.

The voltage doubler, consisting of D12 and D13, rectifies this voltage and passes it to comparators IC16a, IC16b and IC17b through the voltage divider formed by R69, R70 and R71.

These SWR data from the comparator chips feed into IC1, the CPU. The CPU controls the setting of the coils and capacitors in the matching network.

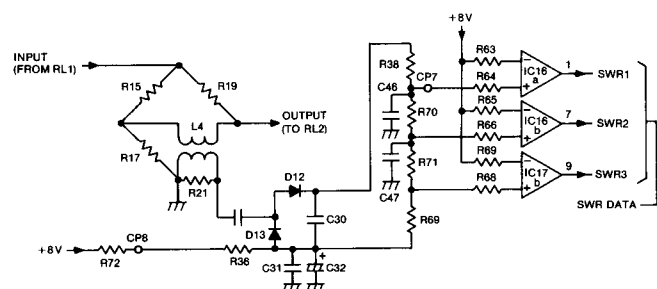


Fig. 4

6-4 PHASE DETECTOR CIRCUIT

This circuit consists of L2, L3 and IC18. The phase detector's purpose is to detect reactance components and provide a pure resistance.

The output of IC18 is a reference voltage of approximately 4V when the load of L3 is a pure resistance with no reactance. An inductive load produces an output voltage from IC18 which is lower than the reference voltage, whereas, a capacitive load produces an output voltage higher than the reference voltage. IC17a amplifies the output voltage and passes it to comparator IC15a. The CP14 voltage is LOW level with an inductive load and HIGH level with a capacitive load.

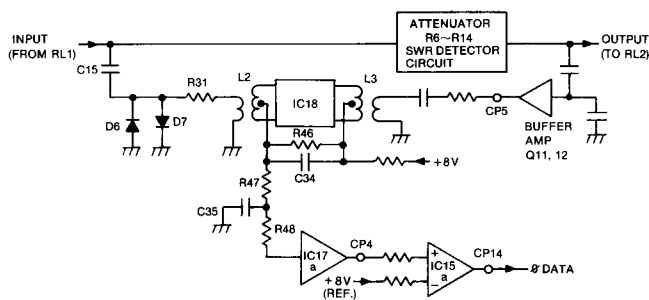


Fig. 5

6-5 IMPEDANCE DETECTOR CIRCUIT

The tuner uses an attenuator to reduce the transmit power to a very low level. The low power minimizes the risk of interference to other stations while matching an antenna to the transmitter.

The VSWR at the input terminal is usually close to 1 : 1 even with a large change of impedance at the attenuator output due to the 16dB of isolation between the input and the matching network.

The circuit uses the constant voltage at D8 and D9 on the TUNER unit as a reference. If the impedance of the attenuator output is higher than 50Ω, the detected voltage by D10 and D11 is HIGH. If the impedance is lower than 50Ω, the voltage is LOW. Both the reference and detected voltages feed to comparator IC15b.

The CP15 voltage is HIGH if the output impedance is lower than 50Ω, and LOW if the impedance is higher than 50Ω.

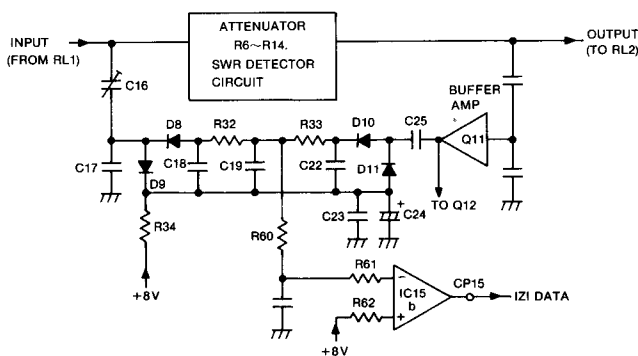


Fig. 6

6-6 LOGIC CIRCUIT

IC1, the CPU, controls the antenna matching network. The CPU receives +5V through Q1, Q2 and IC7 when DC power is applied to the tuner. This voltage initializes the CPU. The ALE signal from the CPU then transfers the program address from the CPU into IC3. The stored program in the Read Only Memory (ROM) IC2 sets each relay to the initial condition.

The tuning program begins only if the START line is at LOW level. RL1 and RL2 activate when RF power at the input antenna connector from the transceiver is present at an appropriate level (See Section 6-2).

The data from the previously described detectors (input RF power, reflected RF power, phase difference, impedance difference) feed into the CPU through buffer IC8. The coil data then passes to IC4, the capacitor data to IC5 and the control data to IC6 according to the tuning program.

The CPU halts when all of the above procedures are complete. The CPU oscillator also stops to avoid causing interference to the receiver.

6-7 LED CIRCUIT (LED UNIT)

The LEDs display the status of the relays. A LED lights whenever its associated relay turns ON. The activated relay connects a coil or capacitor into the tuning circuit.

The LED unit may be removed from the AT-120 to save power, if desired, since the display is for monitoring purposes only.

6-8 ANTENNA CURRENT DETECTOR CIRCUIT (MANUAL UNIT: #02)

On the MANUAL UNIT, L319 detects the antenna current. D305 rectifies the detected voltage and feed it to J301 through low-pass filter comprising R305, C305 and C306.

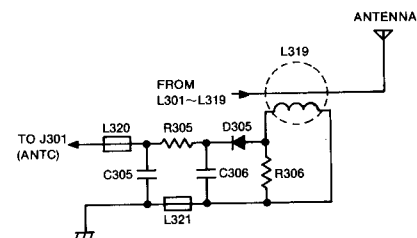


Fig. 7

SECTION 7 MAINTENANCE AND ADJUSTMENT

7-1 PREPARATION BEFORE SERVICING

1. DO NOT short circuit components while making adjustments.
2. Use an insulated tuning tool for all adjustments.
3. DO NOT force any of the variable components. Tune them slowly and smoothly.
4. Follow the instructions exactly. If an indicated result is not obtained, repeat the instruction until the correct result is obtained.
5. Check the condition of connectors, solder joints and screws when adjustments are complete. Confirm that components do not touch each other.
6. Confirm defective operation of the antenna tuner first when checking an out-of-service unit.
7. Use the correct tools and test equipment.
8. To remove the cover of the antenna tuner, remove 10 screws as shown in Fig. 1.

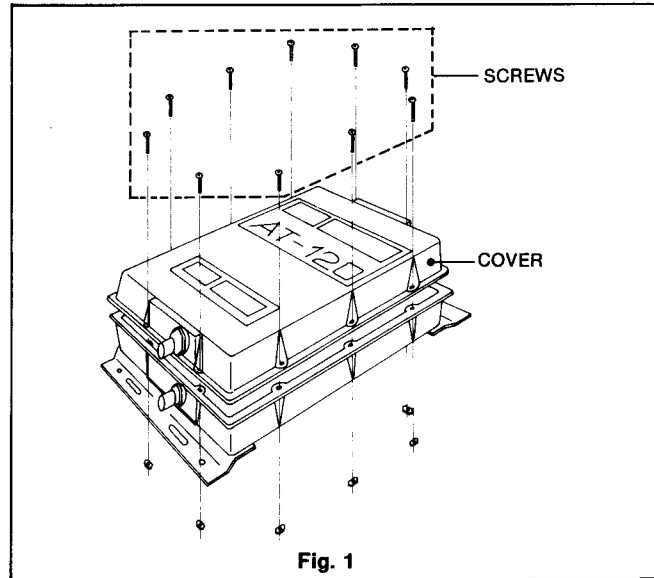


Fig. 1

9. Connect test equipments as shown in Fig. 2.
10. Re-check for the suspected malfunction with the POWER SWITCH ON.
11. Check the defective circuit. Measure the DC voltages of the collector, base and emitter of each transistor.

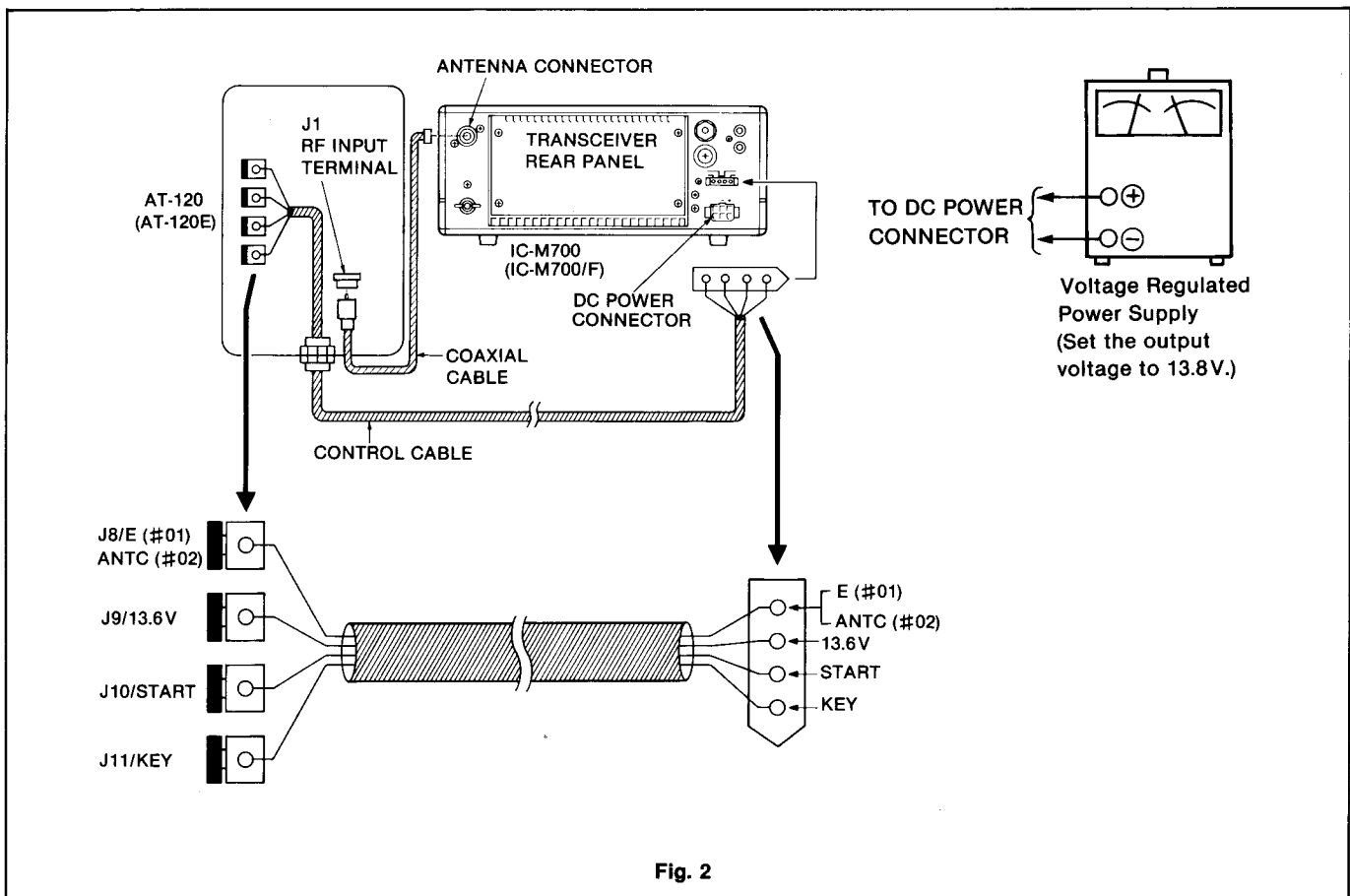
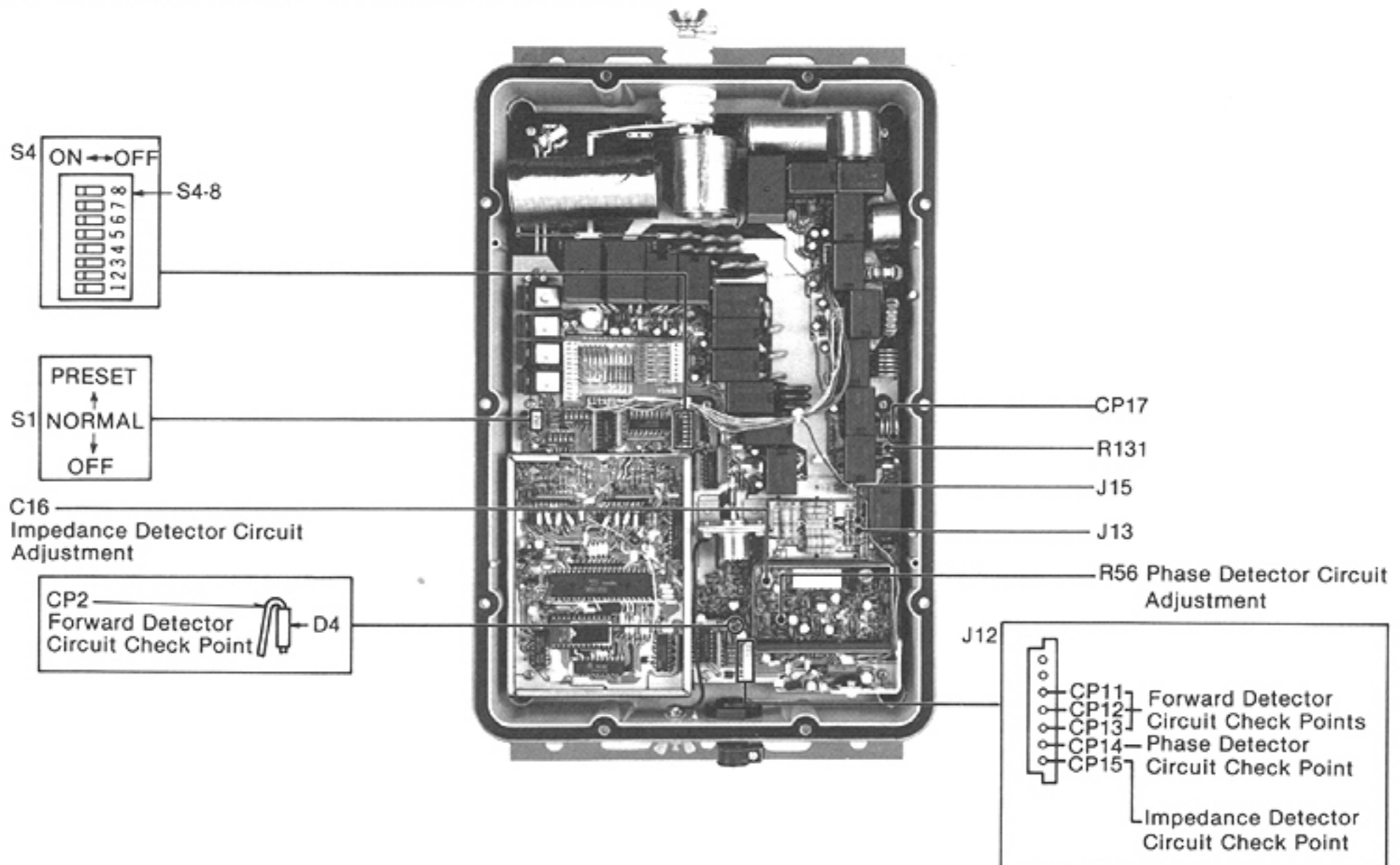


Fig. 2

7-2 ANTENNA TUNER ADJUSTMENT

INSTRUMENTS REQUIRED		CONNECTIONS				
(1) TRANSCEIVER • IC-M700 (For AT-120) • IC-M700/F (For AT-120E) (2) OSCILLOSCOPE • FREQUENCY RANGE : DC~20MHz • MEASURING RANGE : 0.01~10V (3) DC VOLTMETER • MEASURING RANGE : 0.01~10V						
ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	UNIT	ADJUST
		UNIT	LOCATION			
PHASE DETECTOR CIRCUIT	1	TUNER	Connect an oscilloscope to CP14.	8V (Turn R56 just before drops.)	TUNER	R56
IMPEDANCE DETECTOR CIRCUIT	2		Connect an oscilloscope to CP15.	8V (Turn C16 just before drops.)		C16
FORWARD DETECTOR CIRCUIT	3		Connect a DC voltmeter to CP2.	Less than 1.5V		Verify
		Connect a DC voltmeter to CP11.				
		Connect a DC voltmeter to CP12.				
		Connect a DC voltmeter to CP13.				
NOTE: • After adjustment, remove the jumper wires from J13, J15, CP17 and the ground terminal. • After adjustment, reconnect the portion of R131 cut in step 1 and set S1 to [NORMAL] position.						

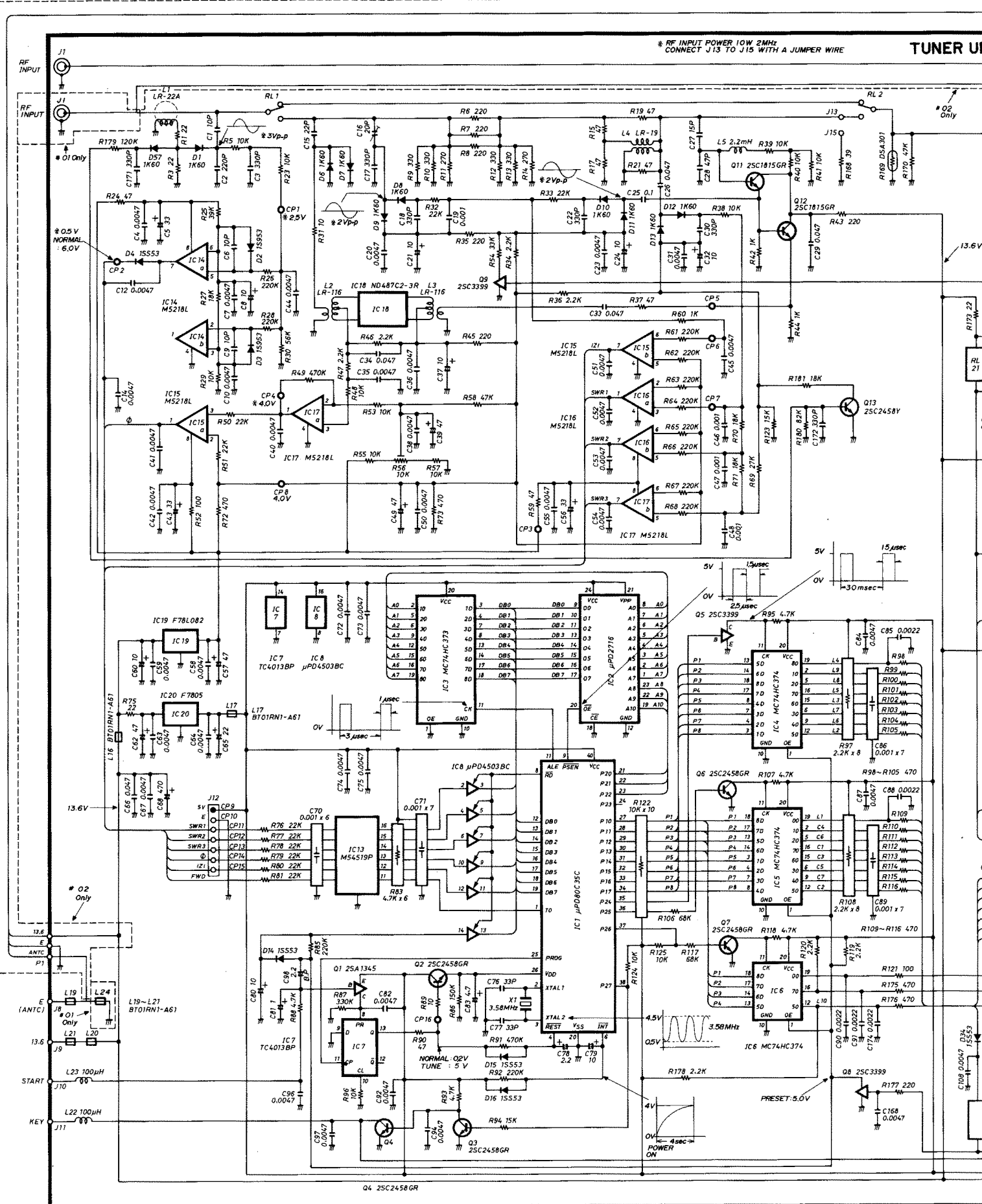
ADJUSTMENT AND MEASUREMENT PARTS LOCATION



SECTION 8 VOLTAGE DIAGRAMS

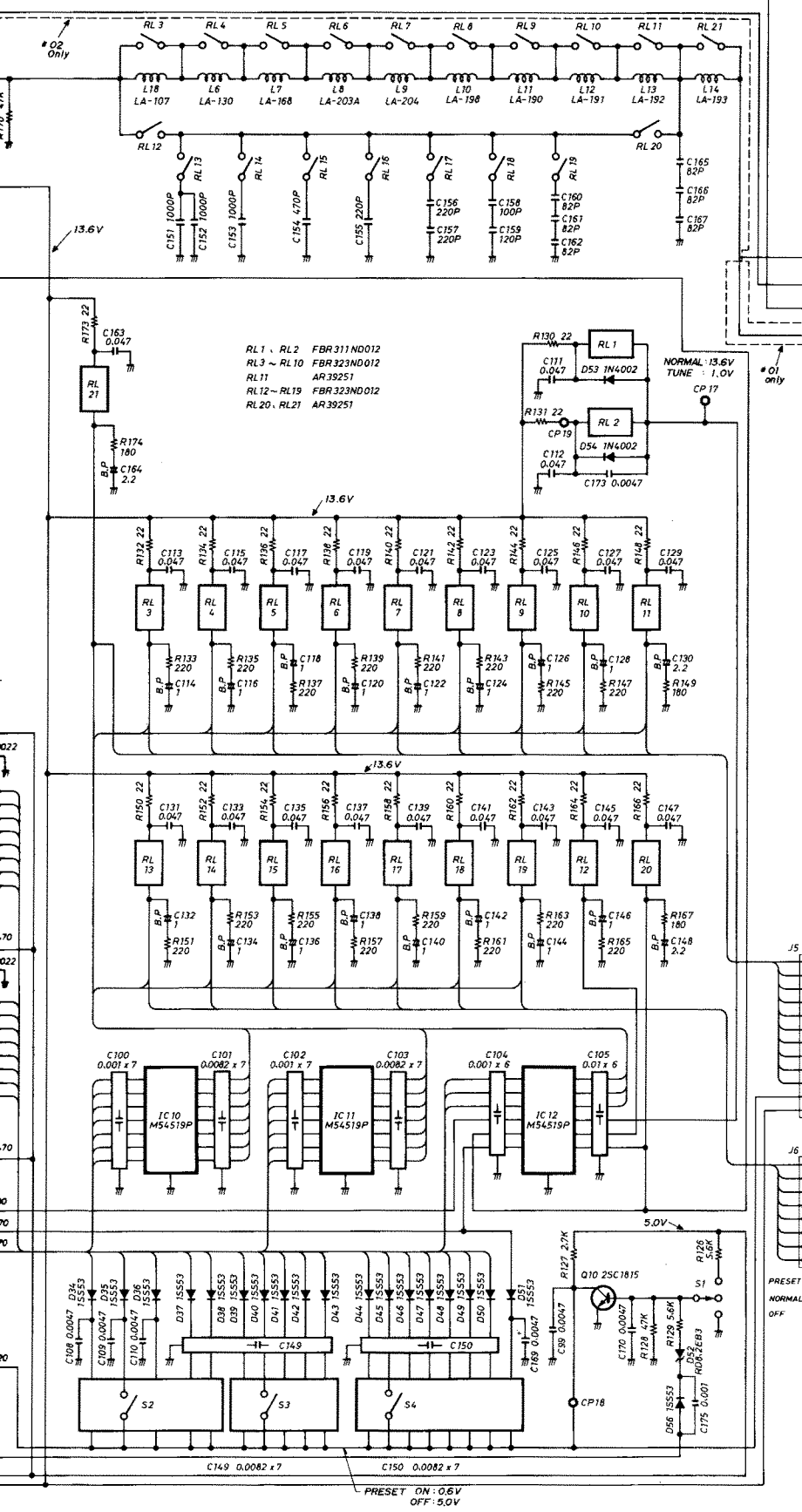
* RF INPUT POWER 10W 2MHz
CONNECT J13 TO J15 WITH A JUMPER WIRE

TUNER UI

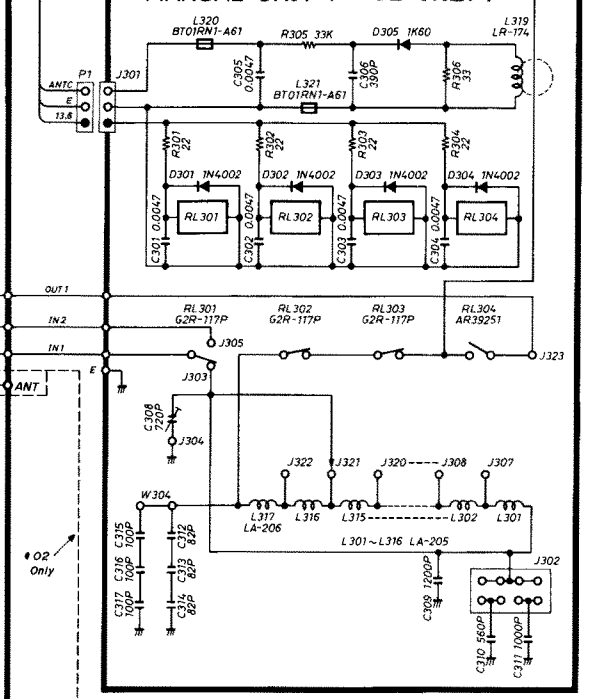


Q4 2SC2458GR

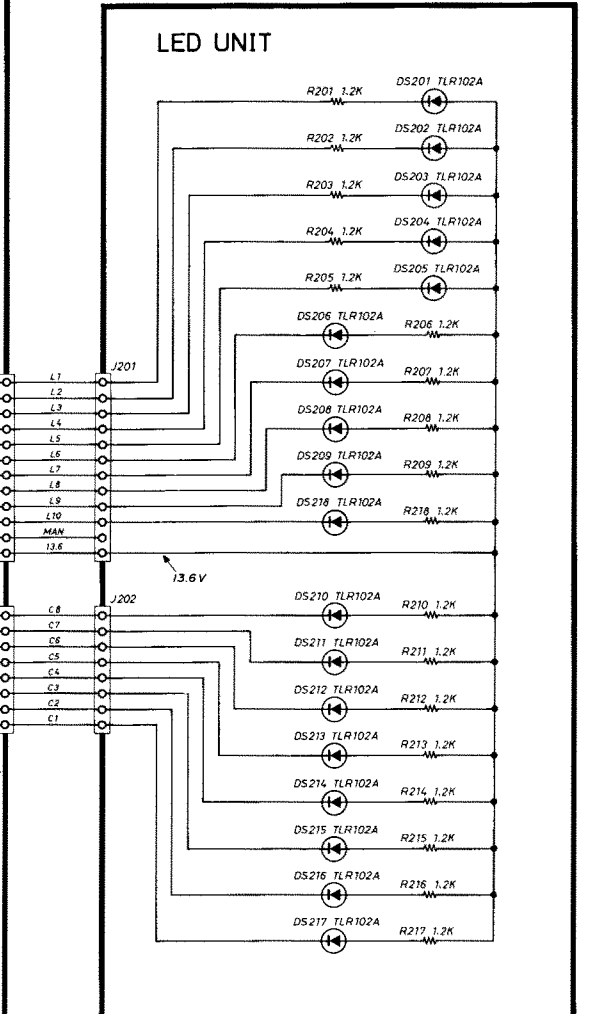
TUNER UNIT



MANUAL UNIT (# 02 ONLY)



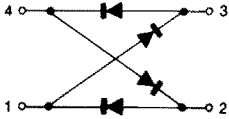
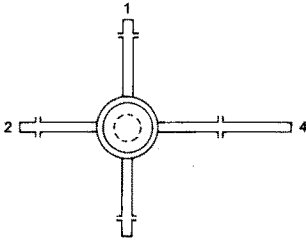
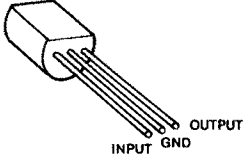
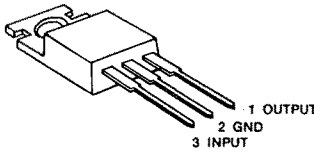
LED UNIT



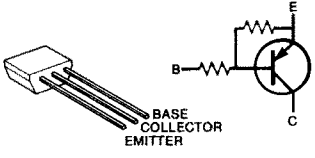
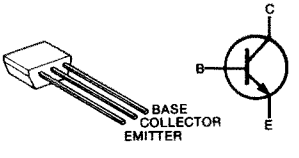
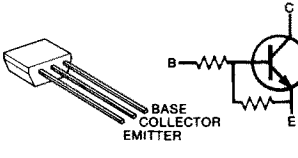
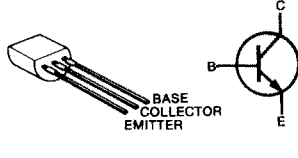
SECTION 9 BOARD LAYOUTS

9-1 TUNER UNIT

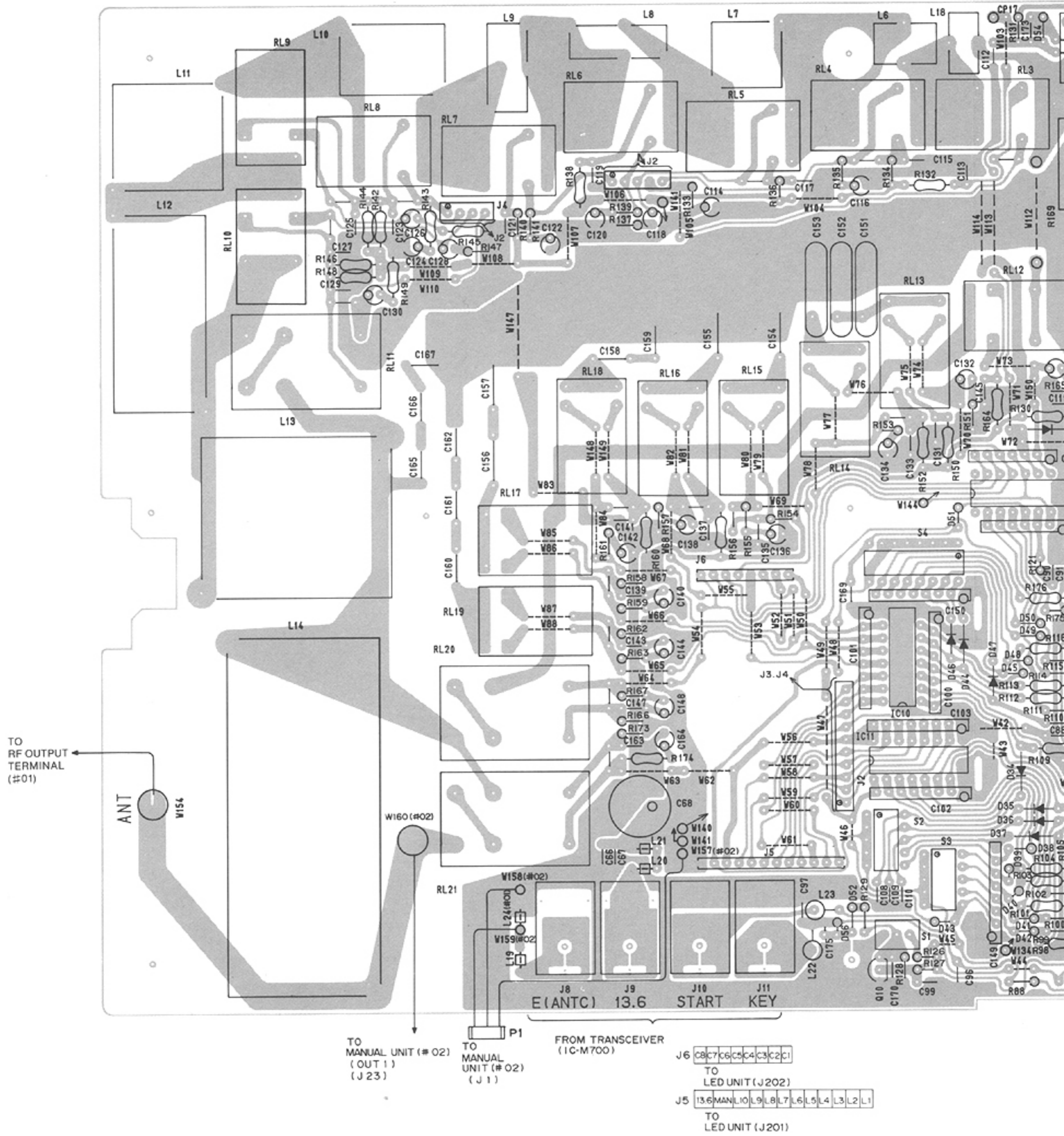
ICS		
IC1	μ PD80C35C (CPU)	
IC2	μ PD2716 (EPROM)	
IC3, IC4, IC5, IC6	MC74HC373 (OCTAL 3-STATE NON-INVERTING D-TYPE FLIP-FLOP)	
IC7	TC4013BP (DUAL "D" FLIP-FLOP WITH SET/RESET CAPABILITY)	
IC8	μ PD4503BC (HEX NON-INVERTING 3-STATE BUFFER)	
IC10, IC11, IC12, IC13	M54519P (7-UNIT TRANSISTOR ARRAY)	
IC14, IC15, IC16, IC17	M5218L (LOW NOISE DUAL OPERATIONAL AMPLIFIER)	

ICS		
IC18	ND487C1-3R (DOUBLE-BALANCED MIXER)	 
IC19	F78L082 (3-TERMINAL 8.2V REGULATOR)	
IC20	F7805 (3-TERMINAL 5V REGULATOR)	

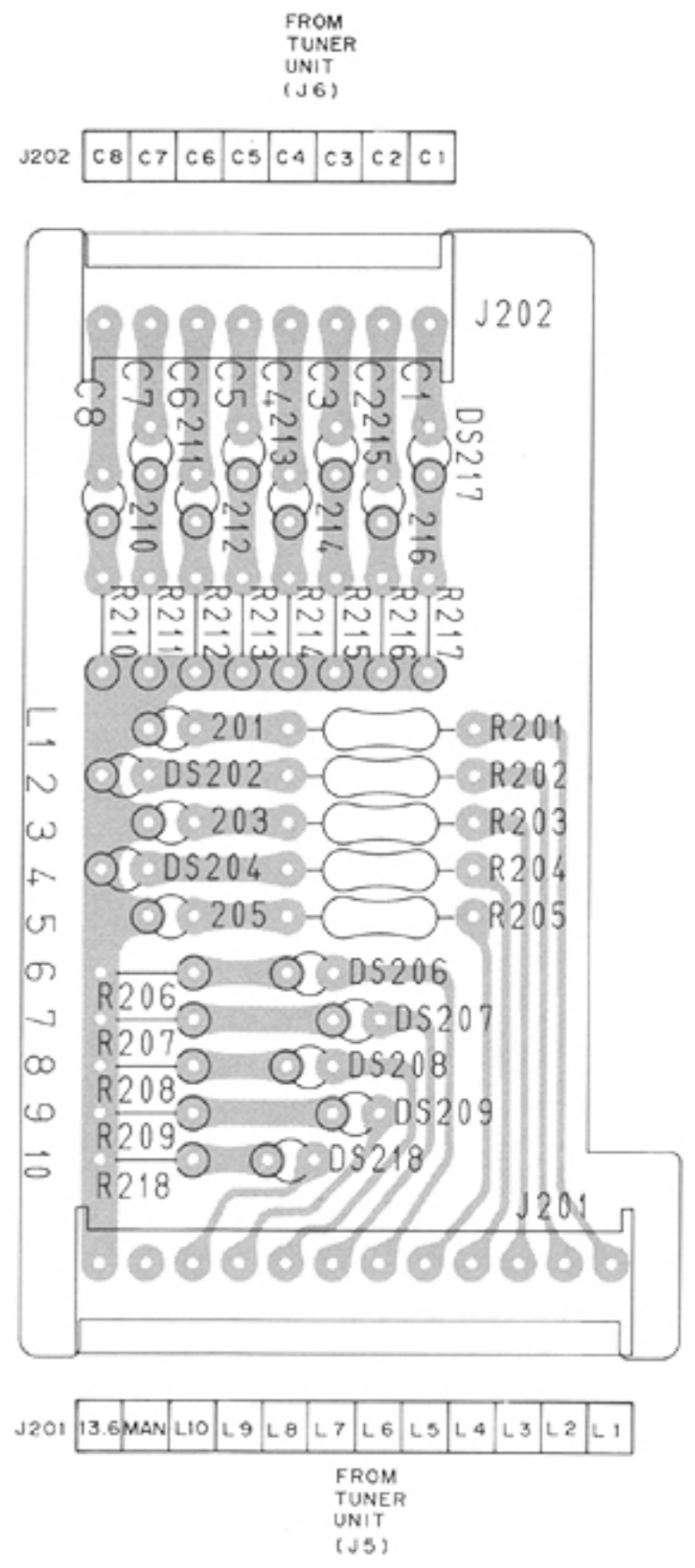
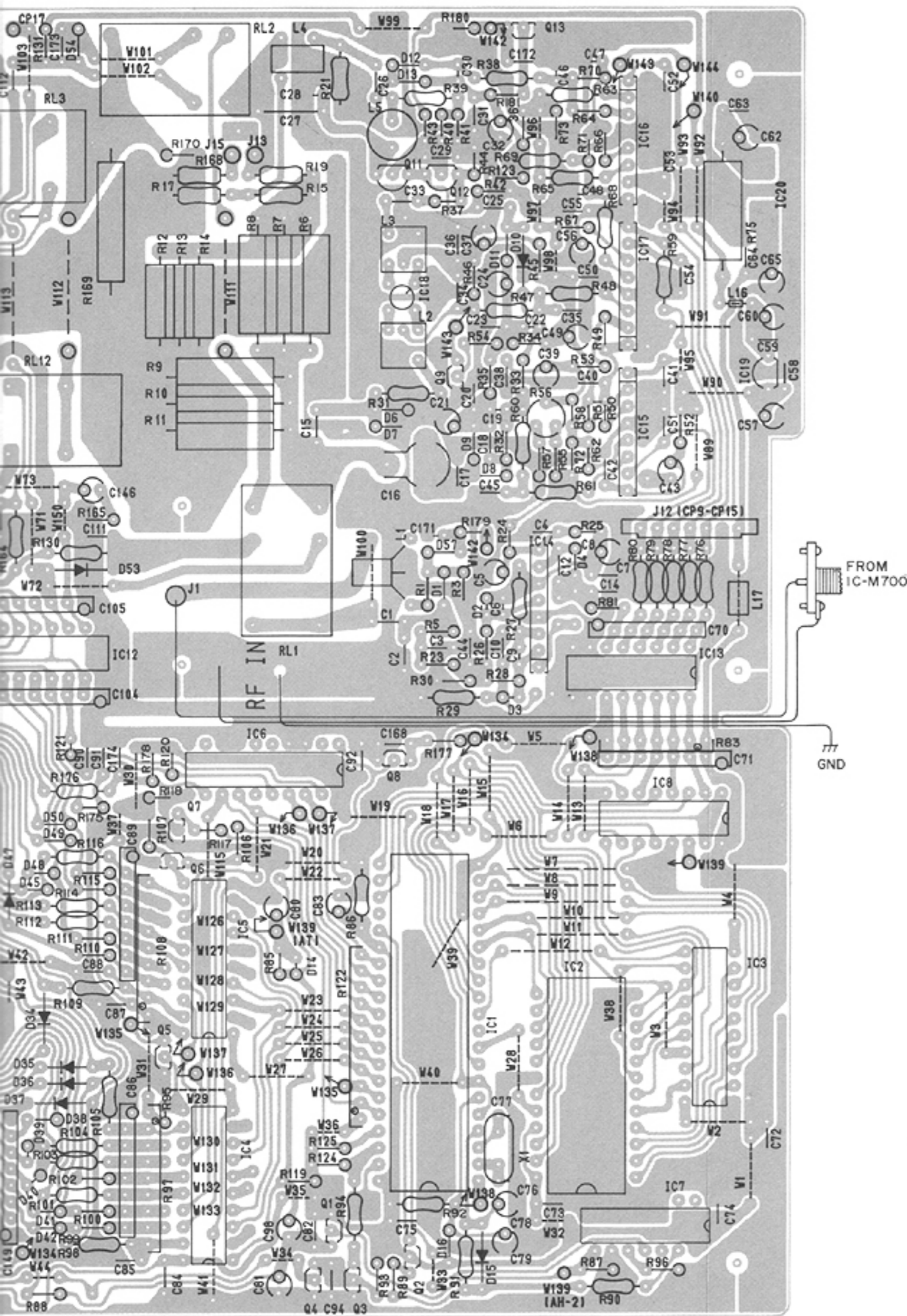
TRANSISTORS

<p>2SA1345 Q1</p> 	<p>2SC2458 Q2, Q3, Q4, Q6, Q7, Q13</p> 	<p>2SC3399 Q5, Q8, Q9</p> 	<p>2SC1815 Q10, Q11, Q12</p> 
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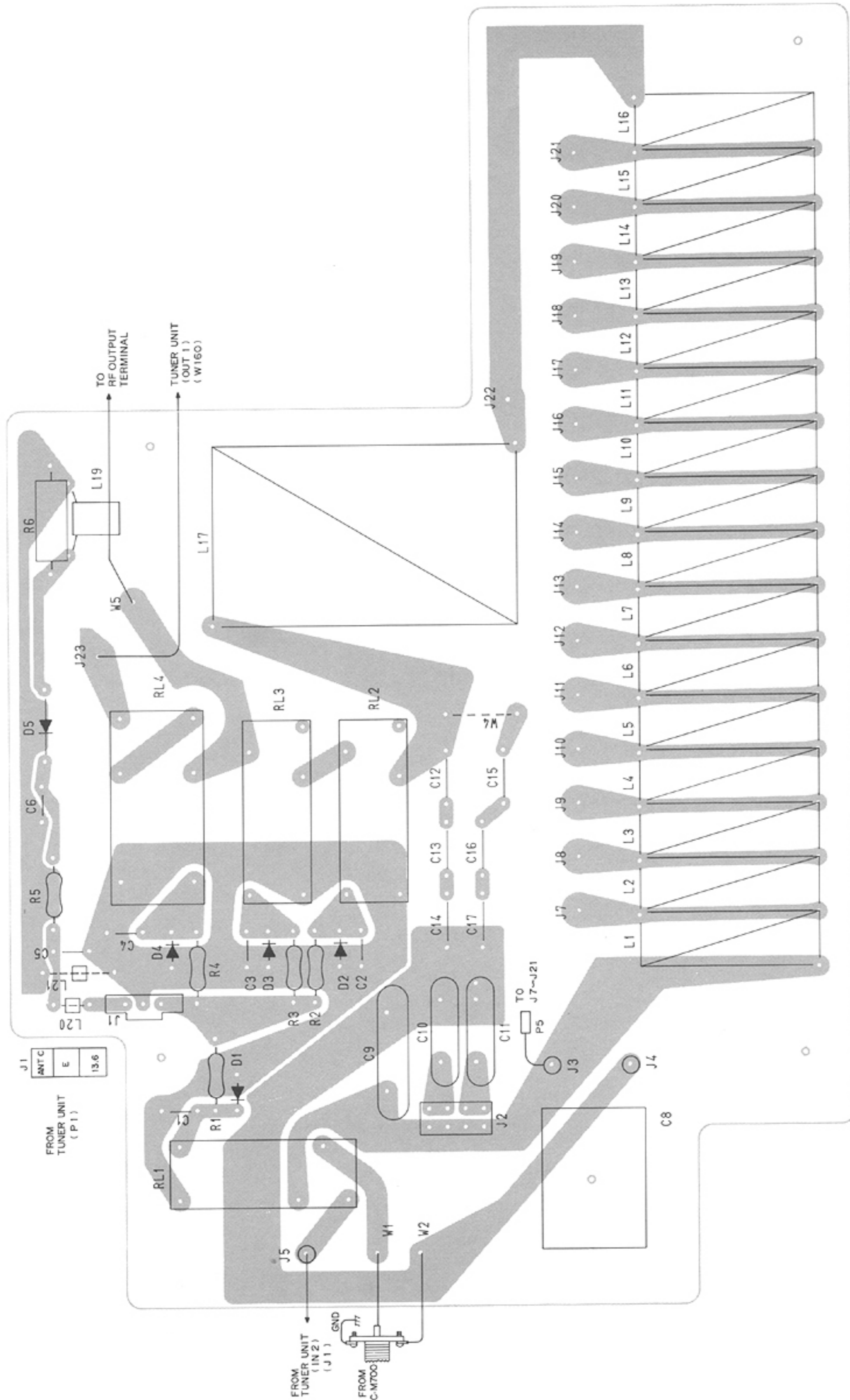
• TUNER UNIT



• LED UNIT



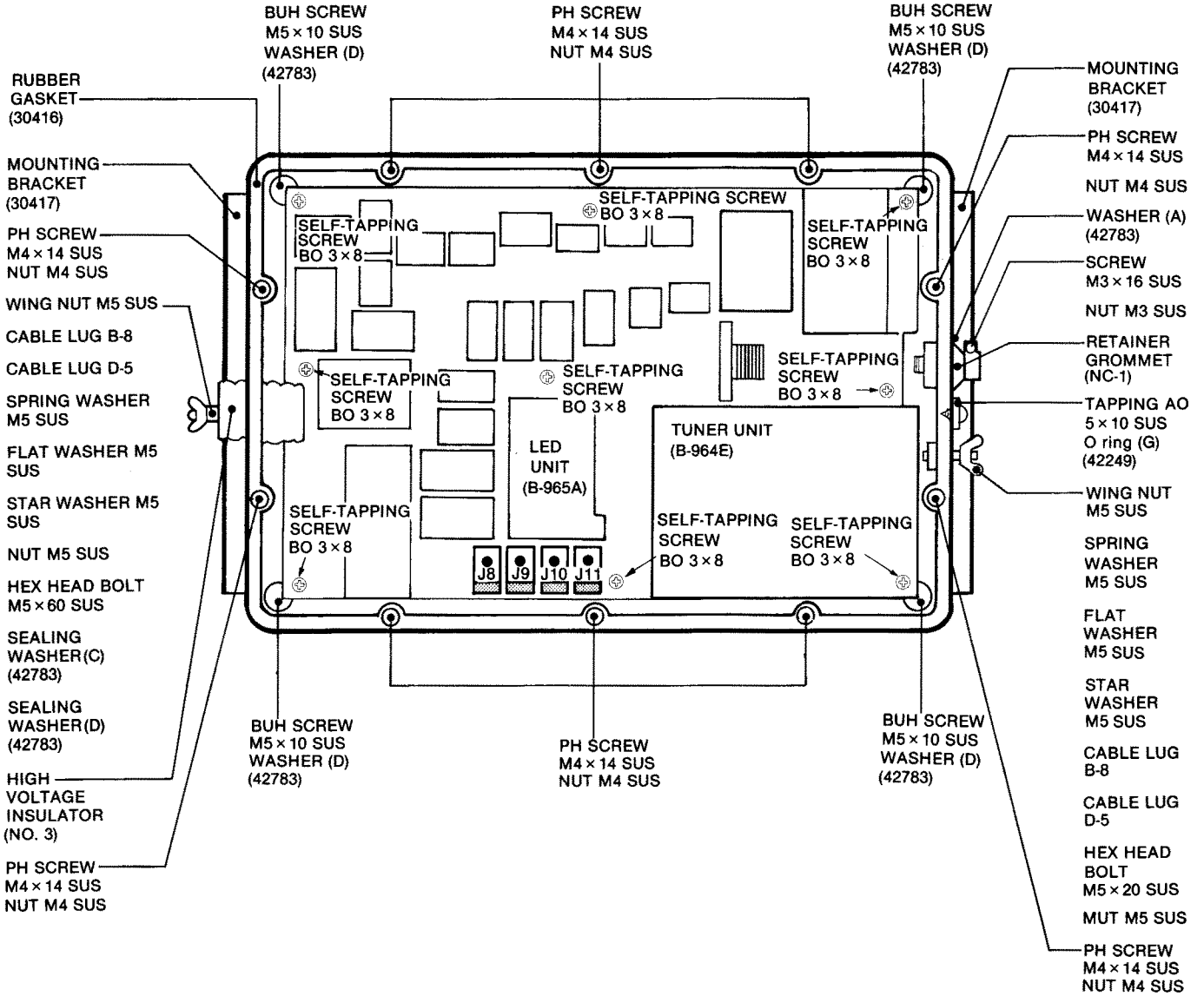
9-2 MANUAL UNIT (#02)



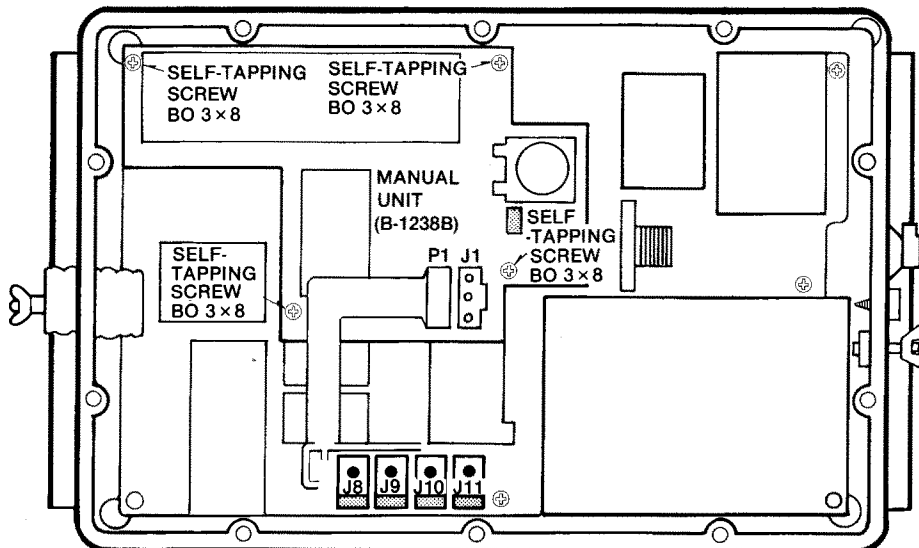
NOTE: Add "300" to the indicated number on the unit for actual part number.

SECTION 10 PARTS LOCATION AND PARTS LIST

10-1 PARTS LOCATION



• #02



10-2 PARTS LIST

[AB PARTS]

REF. NO.	DESCRIPTION	PART NO.
MP1	Case (A) (10006)	
MP2	Case (B) (10006)	
MP3	Mounting Bracket (30417)	
MP4	Rubber Gasket (30416)	
MP5	O ring (G) (42249)	
MP6	Sealing Washer (A) (42783)	
MP7	Sealing Washer (B) (42783)	
MP8	Sealing Washer (D) (42783)	
MP9	High Voltage Insulator (No. 3)	
MP10	Retainer Grommet (NC-1)	

[D PARTS]

REF. NO.	DESCRIPTION	PART NO.	QTY
	Hex Head Bolt	M5×60 SUS	1
	Hex Head Bolt	M5×20 SUS	1
	Wing Nut	M5 SUS	2
	Spring Washer	M5 SUS	2
	Flat Washer	M5 SUS	2
	Star Washer	M5 SUS	2
	Cable Lug	B-8 BSP	2
	Cable Lug	D-5 BSP	1
	Nut	M3	2
	Nut	M4	10
	Nut	M5	2
	Bush Screw	M5×10 SUS	4
	PH Screw	M4×14 SUS	10
	Tapping AO	5×10 SUS	2
	Self-Tapping BO	3×8 SUS	9
	(#01 Only)		
	Self-Tapping BO	3×8 SUS	6
	(#02 Only)		

[TUNER UNIT]

REF. NO.	DESCRIPTION	PART NO.
IC1	IC	μPD80C35C
IC2	IC	μPD2716 (SC-1039)
IC3	IC	MC74HC373
IC4	IC	MC74HC374
IC5	IC	MC74HC374
IC6	IC	MC74HC374
IC7	IC	TC4013BP
IC8	IC	μPD4503BC
IC10	IC	M54519P
IC11	IC	M54519P
IC12	IC	M54519P
IC13	IC	M54519P
IC14	IC	M5218L
IC15	IC	M5218L
IC16	IC	M5218L
IC17	IC	M5218L
IC18	IC	ND487C2-3R
IC19	IC	F78L082
IC20	IC	F7805
Q1	Transistor	2SA1345
Q2	Transistor	2SC2458 GR
Q3	Transistor	2SC2458 GR
Q4	Transistor	2SC2458 GR
Q5	Transistor	2SC3399
Q6	Transistor	2SC2458 GR
Q7	Transistor	2SC2458 GR
Q8	Transistor	2SC3399
Q9	Transistor	2SC3399
Q10	Transistor	2SC1815
Q11	Transistor	2SC1815 GR
Q12	Transistor	2SC1815 GR
Q13	Transistor	2SC2458 Y
D1	Diode	1K60
D2	Diode	1S953
D3	Diode	1S953
D4	Diode	1SS53
D6	Diode	1K60
D7	Diode	1K60
D8	Diode	1K60
D9	Diode	1K60
D10	Diode	1K60
D11	Diode	1K60
D12	Diode	1K60
D13	Diode	1K60
D14	Diode	1SS53
D15	Diode	1SS53
D16	Diode	1SS53
D34	Diode	1SS53
D35	Diode	1SS53
D36	Diode	1SS53
D37	Diode	1SS53
D38	Diode	1SS53
D39	Diode	1SS53
D40	Diode	1SS53
D41	Diode	1SS53
D42	Diode	1SS53
D43	Diode	1SS53
D44	Diode	1SS53
D45	Diode	1SS53

[TUNER UNIT]

REF. NO.	DESCRIPTION	PART NO.
D46	Diode	1SS53
D47	Diode	1SS53
D48	Diode	1SS53
D49	Diode	1SS53
D50	Diode	1SS53
D51	Diode	1SS53
D52	Zener	RD8.2E B3
D53	Diode	IN4002
D54	Diode	IN4002
D56	Diode	1SS53
D57	Diode	1K60
X1	Ceramic Resonator	CSA3.58MG18
L1	Coil	LR-22A
L2	Coil	LR-116
L3	Coil	LR-116
L4	Coil	LR-19
L5	Coil	L6 222
L6	Coil	LA-130
L7	Coil	LA-168
L8	Coil	LA-203A
L9	Coil	LA-204
L10	Coil	LA-198
L11	Coil	LA-190
L12	Coil	LA-191
L13	Coil	LA-192
L14	Coil	LA-193
L16	Coil	BT01RN1-A61
L17	Coil	BT01RN1-A61
L18	Coil	LA-107
L19	Coil	BT01RN1-A61
L20	Coil	BT01RN1-A61
L21	Coil	BT01RN1-A61
L22	Coil	101K LAL03NA
L23	Coil	101K LAL03NA
L24	Coil	BT01RN1-A61 (#01 Only)
R1	Resistor	22 R50X
R3	Resistor	22 R50X
R5	Resistor	10k ELR25
R6	Resistor	RSF2B220-J
R7	Resistor	RSF2B220-J
R8	Resistor	RSF2B220-J
R9	Resistor	RSF2B330-J
R10	Resistor	RSF2B330-J
R11	Resistor	RSF2B270-J
R12	Resistor	RSF1B330-J
R13	Resistor	RSF1B330-J
R14	Resistor	RSF1B270-J
R15	Resistor	47 R50X
R17	Resistor	47 R50X
R19	Resistor	47 R50X
R21	Resistor	47 R50X
R23	Resistor	10k R25
R24	Resistor	47 ELR25
R25	Resistor	39k ELR25
R26	Resistor	220k ELR25
R27	Resistor	18k R25
R28	Resistor	220k ELR25

[TUNER UNIT]

REF. NO.	DESCRIPTION	PART NO.	
R29	Resistor	10k	R25
R30	Resistor	56k	ELR25
R31	Resistor	10	R25
R32	Resistor	22k	ELR25
R33	Resistor	22k	ELR25
R34	Resistor	2.2k	ELR25
R35	Resistor	220	ELR25
R36	Resistor	2.2k	ELR25
R37	Resistor	47	R25
R38	Resistor	10k	R25
R39	Resistor	10k	R25
R40	Resistor	10k	ELR25
R41	Resistor	10k	ELR25
R42	Resistor	1k	ELR25
R43	Resistor	220	ELR25
R44	Resistor	1k	ELR25
R45	Resistor	220	ELR25
R46	Resistor	2.2k	ELR25
R47	Resistor	2.2k	R25
R48	Resistor	10k	R25
R49	Resistor	470k	R25
R50	Resistor	22k	ELR25
R51	Resistor	22k	ELR25
R52	Resistor	100	R25
R53	Resistor	10k	ELR25
R54	Resistor	33k	ELR25
R55	Resistor	10k	ELR25
R56	Trimmer	10k	H0651A
R57	Resistor	10k	ELR25
R58	Resistor	47k	ELR25
R59	Resistor	47	R25
R60	Resistor	1k	R25
R61	Resistor	220k	R25
R62	Resistor	220k	ELR25
R63	Resistor	220k	R25
R64	Resistor	220k	R25
R65	Resistor	220k	R25
R66	Resistor	220k	ELR25
R67	Resistor	220k	ELR25
R68	Resistor	220k	R25
R69	Resistor	27k	R25
R70	Resistor	18k	ELR25
R71	Resistor	18k	ELR25
R72	Resistor	470	ELR25
R73	Resistor	470	ELR25
R75	Resistor	SRW2P22-J	
R76	Resistor	22k	R25
R77	Resistor	22k	R25
R78	Resistor	22k	R25
R79	Resistor	22k	R25
R80	Resistor	22k	R25
R81	Resistor	22k	ELR25
R83	Array	4.7k × 6	RM-6
R85	Resistor	220k	ELR25
R86	Resistor	150k	R25
R87	Resistor	330k	ELR25
R88	Resistor	4.7k	ELR25
R89	Resistor	10	R25
R90	Resistor	47	R25
R91	Resistor	470k	R25
R92	Resistor	220k	R25
R93	Resistor	4.7k	ELR25
R94	Resistor	15k	R25
R95	Resistor	4.7k	ELR25

[TUNER UNIT]

REF. NO.	DESCRIPTION	PART NO.	
R96	Resistor	10k	ELR25
R97	Array	2.2k × 8	RM-8
R98	Resistor	470	R25
R99	Resistor	470	ELR25
R100	Resistor	470	ELR25
R101	Resistor	470	R25
R102	Resistor	470	ELR25
R103	Resistor	470	R25
R104	Resistor	470	R25
R105	Resistor	470	R25
R106	Resistor	68k	ELR25
R107	Resistor	4.7k	R25
R108	Array	2.2k × 8	RM-8
R109	Resistor	470	R25
R110	Resistor	470	ELR25
R111	Resistor	470	ELR25
R112	Resistor	470	R25
R113	Resistor	470	R25
R114	Resistor	470	ELR25
R115	Resistor	470	ELR25
R116	Resistor	470	R25
R117	Resistor	68k	ELR25
R118	Resistor	4.7k	ELR25
R119	Resistor	2.2k	ELR25
R120	Resistor	2.2k	ELR25
R121	Resistor	100	ELR25
R122	Array	10k × 10	RM-10
R123	Resistor	15k	ELR25
R124	Resistor	10k	ELR25
R125	Resistor	10k	ELR25
R126	Resistor	5.6k	ELR25
R127	Resistor	2.7k	ELR25
R128	Resistor	47k	ELR25
R129	Resistor	5.6k	ELR25
R130	Resistor	22	R25
R131	Resistor	22	R25
R132	Resistor	22	R25
R133	Resistor	220	ELR25
R134	Resistor	22	ELR25
R135	Resistor	220	ELR25
R136	Resistor	22	ELR25
R137	Resistor	220	ELR25
R138	Resistor	22	R25
R139	Resistor	220	ELR25
R140	Resistor	22	ELR25
R141	Resistor	220	ELR25
R142	Resistor	22	R25
R143	Resistor	220	R25
R144	Resistor	22	R25
R145	Resistor	220	R25
R146	Resistor	22	R25
R147	Resistor	220	ELR25
R148	Resistor	22	R25
R149	Resistor	180	R25
R150	Resistor	22	R25
R151	Resistor	220	ELR25
R152	Resistor	22	R25
R153	Resistor	220	ELR25
R154	Resistor	22	ELR25
R155	Resistor	220	ELR25
R156	Resistor	22	R25
R157	Resistor	220	ELR25
R158	Resistor	22	ELR25
R159	Resistor	220	ELR25

[TUNER UNIT]

REF. NO.	DESCRIPTION	PART NO.	
R160	Resistor	22	R25
R161	Resistor	220	ELR25
R162	Resistor	22	ELR25
R163	Resistor	220	ELR25
R164	Resistor	22	R25
R165	Resistor	220	ELR25
R166	Resistor	22	ELR25
R167	Resistor	180	ELR25
R168	Resistor	39	R50X
R169	Absorber	DSA301	
R170	Resistor	47k	ELR25
R173	Resistor	22	ELR25
R174	Resistor	180	R25
R175	Resistor	470	ELR25
R176	Resistor	470	R25
R177	Resistor	220	ELR25
R178	Resistor	2.2k	ELR25
R179	Resistor	120k	ELR25
R180	Resistor	82k	ELR25
R181	Resistor	18k	ELR25
C1	Ceramic	10P	500V SL
C2	Ceramic	220P	50V
C3	Ceramic	330P	50V
C4	Ceramic	0.0047	50V
C5	Electrolytic	33	10V
C6	Ceramic	10P	50V
C7	Ceramic	0.0047	50V
C8	Electrolytic	10	16V
C9	Ceramic	10P	50V
C10	Ceramic	0.0047	50V
C12	Ceramic	0.0047	50V
C14	Ceramic	0.0047	50V
C15	Ceramic	22P	500V SL
C16	Trimmer	ECV-1ZW20X32E	
C17	Ceramic	330P	50V
C18	Ceramic	330P	50V
C19	Ceramic	0.001	50V
C20	Ceramic	0.0047	50V
C21	Electrolytic	10	16V
C22	Ceramic	330P B	50V
C23	Ceramic	0.0047	50V
C24	Electrolytic	10	16V
C25	Barrier Layer	0.1	16V
C26	Barrier Layer	0.047	25V
C27	Cylinder	UP125SL150J-NA	
C28	Ceramic	47P	50V
C29	Barrier Layer	0.047	25V
C30	Ceramic	330P B	50V
C31	Ceramic	0.0047	50V
C32	Electrolytic	10	16V
C33	Barrier Layer	0.047	25V
C34	Barrier Layer	0.047	25V
C35	Ceramic	0.0047	50V
C36	Ceramic	0.0047	50V
C37	Electrolytic	10	16V
C38	Ceramic	0.0047	50V
C39	Electrolytic	47	10V
C40	Ceramic	0.0047	50V
C41	Ceramic	0.0047	50V
C42	Ceramic	0.0047	50V
C43	Electrolytic	33	10V
C44	Ceramic	0.0047	50V

[TUNER UNIT]

REF. NO.	DESCRIPTION	PART NO.	
C45	Ceramic	0.0047	50V
C46	Ceramic	0.001	50V
C47	Ceramic	0.001	50V
C48	Ceramic	0.001	50V
C49	Electrolytic	47	10V
C50	Ceramic	0.0047	50V
C51	Ceramic	0.0047	50V
C52	Ceramic	0.0047	50V
C53	Ceramic	0.0047	50V
C54	Ceramic	0.0047	50V
C55	Ceramic	0.0047	50V
C56	Electrolytic	33	10V
C57	Ceramic	47	10V
C58	Ceramic	0.0047	50V
C59	Ceramic	0.0047	50V
C60	Electrolytic	10	16V
C62	Electrolytic	47	16V
C63	Ceramic	0.0047	50V
C64	Ceramic	0.0047	50V
C65	Electrolytic	22	16V
C66	Barrier Layer	0.047	25V
C67	Ceramic	0.0047	50V
C68	Electrolytic	470	16V
C70	Array	B7ZC0716-32N	
C71	Array	B8XC0114-32N	
C72	Ceramic	0.0047	50V
C73	Ceramic	0.0047	50V
C74	Ceramic	0.0047	50V
C75	Ceramic	0.0047	50V
C76	Ceramic	33P	50V
C77	Ceramic	33P	50V
C78	Tantalum	2.2	16V
C79	Electrolytic	10	16V
C80	Tantalum	10	16V
C81	Electrolytic	1	50V
C82	Ceramic	0.0047	50V
C83	Electrolytic	4.7	50V
C84	Ceramic	0.0047	50V
C85	Ceramic	0.0022	50V
C86	Array	B8XC0114-32N	
C87	Ceramic	0.0047	50V
C88	Ceramic	0.0022	50V
C89	Array	B8XC0114-32N	
C90	Ceramic	0.0022	50V
C91	Ceramic	0.0022	50V
C92	Ceramic	0.0047	50V
C94	Ceramic	0.0047	50V
C96	Ceramic	0.0047	50V
C97	Ceramic	0.0047	50V
C98	Electrolytic	2.2	50V B.P
C99	Ceramic	0.0047	50V
C100	Array	B8XC0114-32N	
C101	Array	B8ZC0111-32N	
C102	Array	B8XC0114-32N	
C103	Array	B8ZC0111-32N	
C104	Array	B7ZC0716-32N	
C105	Array	B7ZC0711-32N	
C108	Ceramic	0.0047	50V
C109	Ceramic	0.0047	50V
C110	Ceramic	0.0047	50V
C111	Barrier Layer	0.047	25V
C112	Barrier Layer	0.047	25V
C113	Barrier Layer	0.047	25V
C114	Electrolytic	1	50V B.P

[TUNER UNIT]

REF. NO.	DESCRIPTION	PART NO.	
C115	Barrier Layer	0.047	25V
C116	Electrolytic	1	50V B.P
C117	Barrier Layer	0.047	25V
C118	Electrolytic	1	50V B.P
C119	Barrier Layer	0.047	25V
C120	Electrolytic	1	50V B.P
C121	Barrier Layer	0.047	25V
C122	Electrolytic	1	50V B.P
C123	Barrier Layer	0.047	25V
C124	Electrolytic	1	50V B.P
C125	Barrier Layer	0.047	25V
C126	Electrolytic	1	50V B.P
C127	Barrier Layer	0.047	25V
C128	Electrolytic	1	50V B.P
C129	Barrier Layer	0.047	25V
C130	Electrolytic	2.2	50V B.P
C131	Barrier Layer	0.047	25V
C132	Electrolytic	1	50V B.P
C133	Barrier Layer	0.047	25V
C134	Electrolytic	1	50V B.P
C135	Barrier Layer	0.047	25V
C136	Electrolytic	1	50V B.P
C137	Barrier Layer	0.047	25V
C138	Electrolytic	1	50V B.P
C139	Barrier Layer	0.047	25V
C140	Electrolytic	1	50V B.P
C141	Barrier Layer	0.047	25V
C142	Electrolytic	1	50V B.P
C143	Barrier Layer	0.047	25V
C144	Electrolytic	1	50V B.P
C145	Barrier Layer	0.047	25V
C146	Electrolytic	1	50V B.P
C147	Barrier Layer	0.047	25V
C148	Electrolytic	2.2	50V B.P
C149	Array	B8ZC0111-32N	
C150	Array	B8ZC0111-32N	
C151	Dip Mica	DM20C102J51CR	
C152	Dip Mica	DM20C102J51CR	
C153	Dip Mica	DM20C102J51CR	
C154	Ceramic	DE1310SL471J	1kV
C155	Ceramic	DE1410SL221J	3kV
C156	Ceramic	DE1410SL221J	3kV
C157	Ceramic	DE1410SL221J	3kV
C158	Ceramic	DE1007SL101J	3kV
C159	Ceramic	DE1007SL121J	3kV
C160	Ceramic	DE0907SL820J	3kV
C161	Ceramic	DE0907SL820J	3kV
C162	Ceramic	DE0907SL820J	3kV
C163	Barrier Layer	0.047	25V
C164	Electrolytic	2.2	50V B.P
C165	Ceramic	DE0907SL820J	3kV
C166	Ceramic	DE0907SL820J	3kV
C167	Ceramic	DE0907SL820J	3kV
C168	Ceramic	0.0047	50V
C169	Ceramic	0.0047	50V
C170	Ceramic	0.0047	50V
C171	Ceramic	330P B	50V
C172	Ceramic	330P	50V
C173	Ceramic	0.0047	50V
C174	Ceramic	0.0022	50V
C175	Ceramic	0.001	50V

[TUNER UNIT]

REF. NO.	DESCRIPTION	PART NO.
RL1	Relay	FBR311ND012
RL2	Relay	FBR311ND012
RL3	Relay	FBR323ND012
RL4	Relay	FBR323ND012
RL5	Relay	FBR323ND012
RL6	Relay	FBR323ND012
RL7	Relay	FBR323ND012
RL8	Relay	FBR323ND012
RL9	Relay	FBR323ND012
RL10	Relay	FBR323ND012
RL11	Relay	AR39251
RL12	Relay	FBR323ND012
RL13	Relay	FBR323ND012
RL14	Relay	FBR323ND012
RL15	Relay	FBR323ND012
RL16	Relay	FBR323ND012
RL17	Relay	FBR323ND012
RL18	Relay	FBR323ND012
RL19	Relay	FBR323ND012
RL20	Relay	AR39251
RL21	Relay	AR39251
CP11	Check Point	(J12-3)
CP12	Check Point	(J12-4)
CP13	Check Point	(J12-5)
CP14	Check Point	(J12-6)
CP15	Check Point	(J12-7)
CP17	Check Point	IPS-1136
J1	Connector	FM-MDR MI
J2	Connector	TLB-P10H-B1
J3	Connector	TLB-P05H-B1
J4	Connector	TLB-P04H-B1
J5	Connector	3022-12B
J6	Connector	3022-08B
J8	Connector	S-Q2054
J9	Connector	S-Q2054
J10	Connector	S-Q2054
J11	Connector	S-Q2054
J12	Connector	TL25P-07-V1
J13	Connector	RT-01T-1.3B
J15	Connector	RT-01T-1.3B
J16	Connector	ICC05-024-360T
P1	Connector	TL-25H-03-B1 (#02 Only)
S1	Switch	MS-621C
S2	Switch	SGK1052007
S3	Switch	SGK1052007
S4	Switch	SGK1082018
EP1	P.C. Board	B-964E
MP1	Plate (42917)	
MP2	RF Case (B) (30216)	
MP3	RF Case (B) (41696)	
MP4	Shield Case (41699)	

[TUNER UNIT]

REF. NO.	DESCRIPTION	PART NO.
MP5	Shield Case Cover (41700)	
MP6	79 Shield Case (42269)	
MP7	MIX Shield Case (41883)	
MP8	Heat Sink (42092)	
MP9	Screw (A) 3×6	
MP10	Screw (A) 3×6	
MP11	Screw (A) 3×8	
MP12	Nut M3 Ni	
MP13	RF Case (41697)	
MP14	Shield	
MP16	Screw (A) 3×6	
MP17	GND Terminal (B-5)	
MP19	GND Terminal (B-5) (#02 Only)	
MP20	Bolt L=28 (40955) (#02 Only)	
MP21	Nut M3 (#02 Only)	
W1	Jumper	JPW-02A
W2	Jumper	JPW-02A
W3	Jumper	JPW-02A
W4	Jumper	JPW-02A
W5	Jumper	JPW-02A
W6	Jumper	JPW-02A
W7	Jumper	JPW-02A
W8	Jumper	JPW-02A
W9	Jumper	JPW-02A
W10	Jumper	JPW-02A
W11	Jumper	JPW-02A
W12	Jumper	JPW-02A
W13	Jumper	JPW-02A
W14	Jumper	JPW-02A
W15	Jumper	JPW-02A
W16	Jumper	JPW-02A
W17	Jumper	JPW-02A
W18	Jumper	JPW-02A
W19	Jumper	JPW-02A
W20	Jumper	JPW-02A
W21	Jumper	JPW-02A
W22	Jumper	JPW-02A
W23	Jumper	JPW-02A
W24	Jumper	JPW-02A
W25	Jumper	JPW-02A
W26	Jumper	JPW-02A
W27	Jumper	JPW-02A
W28	Jumper	JPW-02A
W29	Jumper	JPW-02A
W30	Jumper	JPW-02A
W31	Jumper	JPW-02A
W32	Jumper	JPW-02H
W33	Jumper	JPW-02H
W34	Jumper	JPW-02H
W35	Jumper	JPW-02H
W36	Jumper	JPW-02H
W37	Jumper	JPW-02H
W38	Jumper	IPS-1041-4
W39	Jumper	IPS-1041-4
W40	Jumper	IPS-1041-4
W41	Jumper	IPS-1041-4
W42	Jumper	IPS-1041-4
W43	Jumper	IPS-1041-2
W44	Jumper	JPW-02H

[TUNER UNIT]

REF. NO.	DESCRIPTION	PART NO.
W45	Jumper	JPW-02H
W46	Jumper	IPS-1041-2
W47	Jumper	JPW-02A
W48	Jumper	JPW-02A
W49	Jumper	JPW-02A
W50	Jumper	JPW-02A
W51	Jumper	JPW-02A
W52	Jumper	JPW-02A
W53	Jumper	JPW-02A
W54	Jumper	JPW-02A
W55	Jumper	JPW-02A
W56	Jumper	JPW-02A
W57	Jumper	JPW-02A
W58	Jumper	JPW-02A
W59	Jumper	JPW-02A
W60	Jumper	JPW-02A
W61	Jumper	JPW-02A
W62	Jumper	JPW-02A
W63	Jumper	JPW-02A
W64	Jumper	JPW-02A
W65	Jumper	JPW-02A
W66	Jumper	JPW-02A
W67	Jumper	JPW-02A
W68	Jumper	JPW-02A
W69	Jumper	JPW-02A
W70	Jumper	JPW-02A
W71	Jumper	JPW-02A
W72	Jumper	JPW-02A
W73	Jumper	JPW-02A
W74	Jumper	IPS-1041-4
W75	Jumper	IPS-1041-4
W76	Jumper	IPS-1041-4
W77	Jumper	IPS-1041-4
W78	Jumper	IPS-1041-4
W79	Jumper	IPS-1041-4
W80	Jumper	IPS-1041-4
W81	Jumper	IPS-1041-4
W82	Jumper	IPS-1041-4
W83	Jumper	IPS-1041-4
W84	Jumper	IPS-1041-4
W85	Jumper	IPS-1041-4
W86	Jumper	IPS-1041-4
W87	Jumper	IPS-1041-4
W88	Jumper	IPS-1041-4
W89	Jumper	JPW-02A
W90	Jumper	JPW-02A
W91	Jumper	JPW-02A
W92	Jumper	JPW-02A
W93	Jumper	JPW-02A
W94	Jumper	JPW-02H
W95	Jumper	JPW-02H
W96	Jumper	JPW-02H
W97	Jumper	JPW-02H
W98	Jumper	JPW-02H
W99	Jumper	JPW-02A
W100	Jumper	JPW-02A
W101	Jumper	IPS-1041-4
W102	Jumper	IPS-1041-4
W103	Jumper	JPW-02A
W104	Jumper	JPW-02A
W105	Jumper	JPW-02A
W106	Jumper	JPW-02A
W107	Jumper	JPW-02A
W108	Jumper	JPW-02A

[TUNER UNIT]

REF. NO.	DESCRIPTION	PART NO.
W109	Jumper	JPW-02A
W110	Jumper	JPW-02A
W111	Jumper	74/98/050/X98/X98
W112	Jumper	74/98/050/X98/X98
W113	Jumper	JPW-02A
W114	Jumper	JPW-02A
W115	Jumper	IPS-1041-4
W116	Jumper	23/01/240/C22/C22
W117	Jumper	23/02/190/C22/C22
W118	Jumper	23/03/230/C22/C22
W119	Jumper	23/04/195/C22/C22
W120	Jumper	23/05/240/C22/C22
W122	Jumper	23/06/230/C22/C22
W123	Jumper	23/07/180/C22/C22
W124	Jumper	23/08/180/C22/C22
W125	Jumper	23/09/180/C22/C22
W126	Jumper	JPW-02A
W127	Jumper	JPW-02A
W128	Jumper	JPW-02A
W129	Jumper	JPW-02A
W130	Jumper	JPW-02A
W131	Jumper	JPW-02A
W132	Jumper	JPW-02A
W133	Jumper	JPW-02A
W134	Jumper	23/06/140/C21/C21
W135	Jumper	23/05/055/C21/C21
W136	Jumper	23/02/080/C21/C21
W137	Jumper	23/01/080/C21/C21
W138	Jumper	23/04/100/C21/C21
W139	Jumper	23/09/090/C21/C21
W140	Jumper	23/02/330/C21/C21
W141	Jumper	23/02/260/C21/C21
W142	Jumper	23/07/150/C21/C21
W143	Jumper	23/05/070/C21/C21
W144	Jumper	23/06/240/C21/C21
W147	Jumper	JPW-02A
W148	Jumper	IPS-1041-4
W149	Jumper	IPS-1041-4
W150	Jumper	JPW-02H
W153	Jumper	35/00/140/W06/W06
W154	Jumper	35/02/070/W06/W06
W155	Jumper	74/98/060/X98/X98 (#02 Only)
W156	Jumper	74/98/040/X98/X98
W157	Jumper	23/03/150/W02/C01 (#02 Only)
W158	Jumper	23/00/150/W02/C01 (#02 Only)
W159	Jumper	23/04/150/W02/C01 (#02 Only)
W160	Jumper	99/02/125/W05/W05 (#02 Only)

[LED UNIT]

REF. NO.	DESCRIPTION	PART NO.
R201	Resistor	1.2k R25
R202	Resistor	1.2k R25
R203	Resistor	1.2k R25
R204	Resistor	1.2k R25
R205	Resistor	1.2k R25
R206	Resistor	1.2k ELR25
R207	Resistor	1.2k ELR25
R208	Resistor	1.2k ELR25
R209	Resistor	1.2k ELR25
R210	Resistor	1.2k ELR25
R211	Resistor	1.2k ELR25
R212	Resistor	1.2k ELR25
R213	Resistor	1.2k ELR25
R214	Resistor	1.2k ELR25
R215	Resistor	1.2k ELR25
R216	Resistor	1.2k ELR25
R217	Resistor	1.2k ELR25
R218	Resistor	1.2k ELR25
J201	Connector	5124-12BH
J202	Connector	5124-08BH
DS201	LED	TLR102A
DS202	LED	TLR102A
DS203	LED	TLR102A
DS204	LED	TLR102A
DS205	LED	TLR102A
DS206	LED	TLR102A
DS207	LED	TLR102A
DS208	LED	TLR102A
DS209	LED	TLR102A
DS210	LED	TLR102A
DS211	LED	TLR102A
DS212	LED	TLR102A
DS213	LED	TLR102A
DS214	LED	TLR102A
DS215	LED	TLR102A
DS216	LED	TLR102A
DS217	LED	TLR102A
DS218	LED	TLR102A
EP201	P.C. Board	B-965A

[MANUAL UNIT] (#02)

REF. NO.	DESCRIPTION	PART NO.	
D301	Diode	1N4002	
D302	Diode	1N4002	
D303	Diode	1N4002	
D304	Diode	1N4002	
D305	Diode	1K60	
L301	Coil	LA-205	
L302	Coil	LA-205	
L303	Coil	LA-205	
L304	Coil	LA-205	
L305	Coil	LA-205	
L306	Coil	LA-205	
L307	Coil	LA-205	
L308	Coil	LA-205	
L309	Coil	LA-205	
L310	Coil	LA-205	
L311	Coil	LA-205	
L312	Coil	LA-205	
L313	Coil	LA-205	
L314	Coil	LA-205	
L315	Coil	LA-205	
L316	Coil	LA-205	
L317	Coil	LA-206	
L319	Coil	LR-174	
L320	Coil	BT01RN1-A61	
L321	Coil	BT01RN1-A61	
R301	Resistor	22	R25
R302	Resistor	22	R25
R303	Resistor	22	R25
R304	Resistor	22	R25
R305	Resistor	33k	R25
R306	Resistor	CRH100XR-02J330	
C301	Ceramic	0.0047	50V
C302	Ceramic	0.0047	50V
C303	Ceramic	0.0047	50V
C304	Ceramic	0.0047	50V
C305	Ceramic	0.0047	50V
C306	Ceramic	390P	50V
C308	Trimmer	E-43B	
C309	Dip Mica	DM20C122J51CR	
C310	Dip Mica	DM20C561J51CR	
C311	Dip Mica	DM20C102J51CR	
C312	Ceramic	DE1007SL820J	3kV
C313	Ceramic	DE1007SL820J	3kV
C314	Ceramic	DE1007SL820J	3kV
C315	Ceramic	DE1007SL101J	3kV
C316	Ceramic	DE1007SL101J	3kV
C317	Ceramic	DE1007SL101J	3kV
RL301	Relay	G2R-117P-V-US	
RL302	Relay	G2R-117P-V-US	
RL303	Relay	G2R-117P-V-US	
RL304	Relay	AR39251	
J301	Connector	TL25P-03-V1	
J302	Connector	IMSA-9201B-2-04-T	
J303	Connector	RT-01T-1.3B	

[MANUAL UNIT] (#02)

REF. NO.	DESCRIPTION	PART NO.	
J304	Connector	RT-01T-1.3B	
J305	Connector	RT-01T-1.3B	
J307	Connector	RT-01N-2.3A	
J308	Connector	RT-01N-2.3A	
J309	Connector	RT-01N-2.3A	
J310	Connector	RT-01N-2.3A	
J311	Connector	RT-01N-2.3A	
J312	Connector	RT-01N-2.3A	
J313	Connector	RT-01N-2.3A	
J314	Connector	RT-01N-2.3A	
J315	Connector	RT-01N-2.3A	
J316	Connector	RT-01N-2.3A	
J317	Connector	RT-01N-2.3A	
J318	Connector	RT-01N-2.3A	
J319	Connector	RT-01N-2.3A	
J320	Connector	RT-01N-2.3A	
J321	Connector	RT-01N-2.3A	
J322	Connector	RT-01N-2.3A	
J323	Connector	RT-01N-2.3A	
P301	Connector	IMSA-9201-HT	
P302	Connector	IMSA-9201-HT	
P303	Connector	IMSA-9201-HT	
P304	Connector	IMSA-9201-HT	
P305	Connector	S1P-LV	
EP301	P.C. Board	B-1238B	
W301	Jumper	13/02/045/W05/W05	
W302	Jumper	13/00/045/W05/W05	
W303	Jumper	13/02/150/W04/Y99	
W304	Jumper	76/98/035/X98/X98	
W305	Jumper	99/02/120/W06/W06	



ICOM INCORPORATED

1-6-19, Kamikuratsukuri, Hirano-ku, Osaka 547, Japan
Phone: (06) 793-5301
Telex : 05277822 ICOMTR J
Fax : (06) 793-0013

ICOM AMERICA, INC.,
2380 116th Avenue N.E.,
Bellevue, WA 98004
Phone: (206) 454-8155
Telex : 230-152210 ICOM AMER BVUE
Fax : (206) 454-1509

3150 Premier Drive, Suite 126,
Irving, TX 75063
Phone: (214) 550-7525
Fax : (214) 550-7423

1777 Phoenix Parkway, Suite 201,
Atlanta, GA 30349
Phone: (404) 991-6166

ICOM CANADA, LTD.,
3071-#5 Road, Unit 9,
Richmond, B.C.,
V6X 2T4 Canada
Phone: (604) 273-7400
Fax : (604) 273-1900

ICOM (EUROPE) GmbH,
Himmelgeister Strasse 100,
4000 Düsseldorf 1,
West Germany
Phone: 0211-346047
Telex : 41-8588082 ICOM D
Fax : 0211-333639

ICOM AUSTRALIA, PTY., LTD.,
7 Duke Street, Windsor 3181,
Victoria, Australia
Phone: (03) 529-7582
Telex : 71-35521 ICOMAS
Fax : (03) 529-8485