

**KENWOOD**

AUTOMATIC ANTENNA TUNER

**MAT-100**

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**INSTRUCTION MANUAL**

KENWOOD CORPORATION

Thank you for your purchase.

**IMPORTANT:**

Please read this instruction manual carefully before the tuner in operation.

SAVE THIS INSTRUCTION MANUAL

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# 1. SPECIFICATIONS and ACCESSORIES

## SPECIFICATION

Frequency range	1.6 MHz to 30.0 MHz
Power Capability	150W PEP 100W continuous
Input Impedance	50 Ω
VSWR	less than 2.0
Tuning Power	10 W
Antenna Required	7 to 23 m(23 to 75 feet); 2 to 30 MHz 2.7m(9 feet)whip; 3.5 to 30 MHz
Tune-up Time	Within 2 to 15 sec (Within 0.5 sec on pre-tuned frequencies)
Power Supply requirement	13.6 VDC ± 15% Negative Ground max2 A ( supplied from radiotelephone)
Operating temperature	-30 °C to +60 °C (-4 °F to +140 °F)
Dimensions	W258×H425×D90 [mm]
Weight	3.0kg
Case Construction	Weather Proof
Control Cable	5 cables (Not supplied)

## ACCESSORIES

Unpack your new equipment carefully and examine it for visible damage. If the equipment has been damaged in shipment, notify the transportation company immediately. Save the boxes and packing materials for future shipping.

The following accessories should have been included in the box .

- 6P plug ..... E09-0672-08 ..... 1 ea.
- Pin plug ..... E23-0646-08 ..... 6 ea.
- Cap ..... F09-0427-08 ..... 1 ea.
- Rubber packing(ø7.5) .. G53-0597-08..... 1 ea.
- Rubber packing(ø10) ... G53-0592-08..... 1 ea.
- Mounting bracket ..... J21-4300-08 ..... 2 ea.
- U. bolt ..... N09-2095-08..... 2 ea.
- Hex. bolt ..... N09-2096-08..... 4 ea.
- Screw kit ..... N99-0344-08..... 1 ea.
- Self tapping screw .. 4 ea.
- Nut ..... 8 ea.
- Spring washer ..... 8 ea.
- Flat washer ..... 12 ea.
- Instruction manual B50-8357-08 ..... 1 copy
- Warranty card (U.S.A.version)  
..... B46-0420-00 ..... 1 sheet

The following explicit definitions apply in this manual;

**NOTE** If disregarded, inconvenience only, no risk of equipment damage or personal injury.

**CAUTION** Equipment damage may occur, but not personal injury.

# 2. INSTALLATION INSTRUCTIONS

## 2-1. ANTENNA

The type of antenna that is used will greatly affect the performance of the equipment. The antenna should be erected as high as possible.

Keep the antenna as far from any object which may affect its performance, such as metallic masts or other guy wires, as possible.

Insulator should be able to withstand leakage even when wet.

The base of the antenna is HIGH VOLTAGE.

It should be connected to the lead-in insulator.

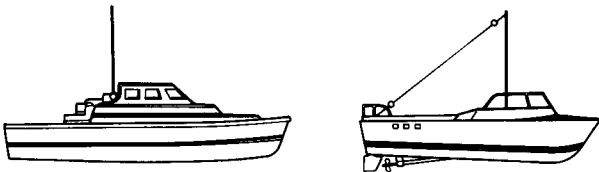
Do not touch the base of the antenna.

Certain lengths of antenna element are difficult for the system to tune.

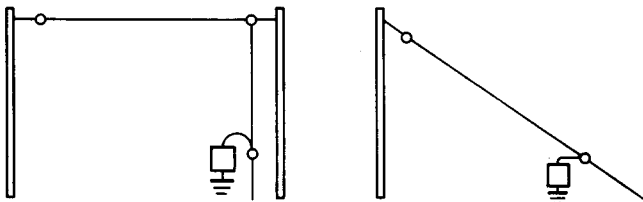
Element length to be avoided

$$= 300/\text{operating frequency (MHz)} \times 1/2 \times \text{integer}$$

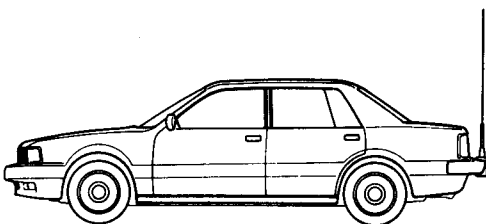
### SHIP STATION



### FIXED STATION



### VEHICLES



## 2-2. GROUND

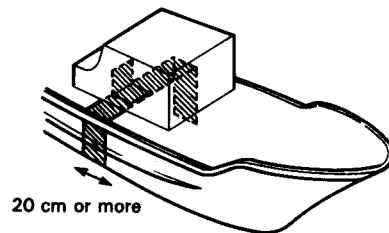
The MAT-100 must be connected to a good electrical ground. Without a good ground an SSB radio-telephone cannot work satisfactorily. It is of the utmost importance to ground the antenna coupler unit.

If boat provides a good ground, use less than 2 m of heavy gauge wire to connect. To extend the length use a copper strap.

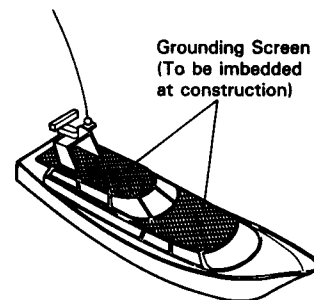
When good ground is not provided use a copper strap to run from the outside of the boat to the ground terminal of the antenna coupler.

### SHIPS WITH A NON-CONDUCTING STRUCTURE

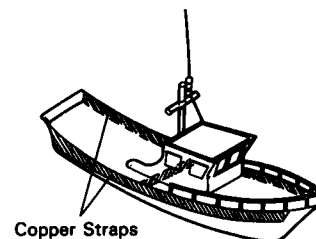
A



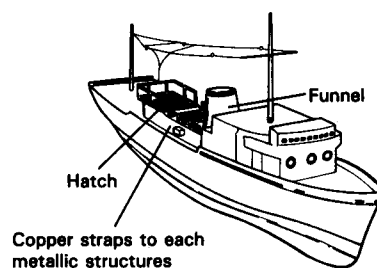
B



C



D



## 2-3. ANTENNA COUPLER

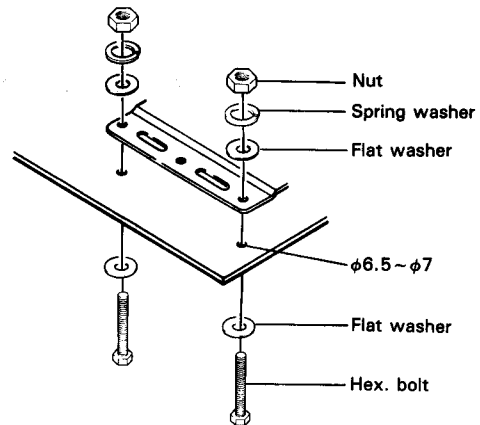
### INSTALLATION

The MAT-100 is protected by weather proof construction which permits the flexibility of interior or exterior instruction.

Before installation note the following precaution.

1. Good ground connection
2. Avoid water spray
3. The base of the antenna is HIGH VOLTAGE.
4. Use caution when tightening the wing nut on the GND and antenna terminal. Over tightening may cause twisting of the terminals inside the coupler.

### 3. Installation by Hex Head Screws

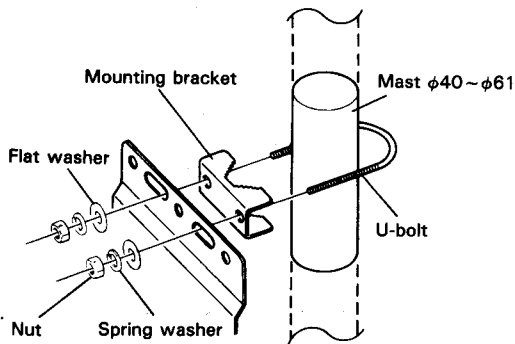


Two drain holes are provided.

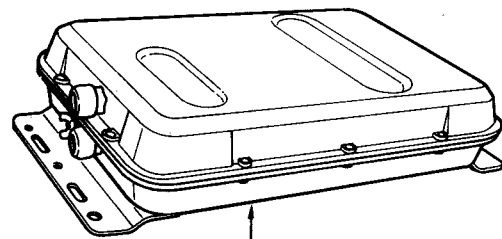
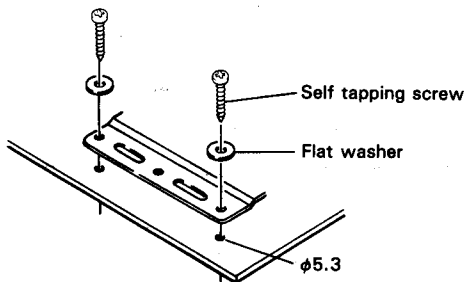
If the coupler is installed horizontally remove screw A, and if installed vertically remove screw B.

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

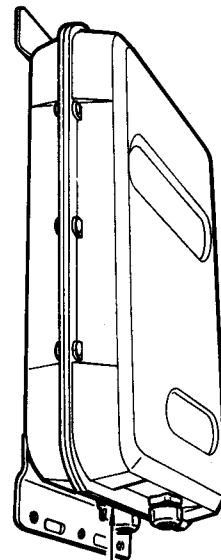
#### 1. Installation by U-clamp



#### 2. Installation by Self tapping Screws



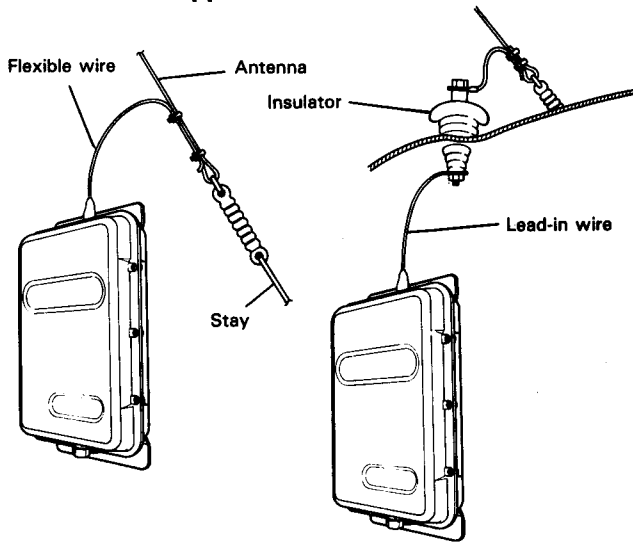
Remove screw A



Remove screw B

## 2-4.CONNECTION WIRE FOR ANTENNA

The insulator must be relieved from mechanical stress by using a short flexible wire between the insulator and a support.

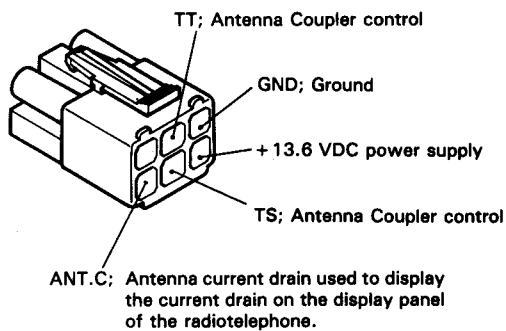


Lead-in insulator, such as GTO15 ( 15kV resisting presser ) should be able to withstand high voltage.

## CONTROL CABLES

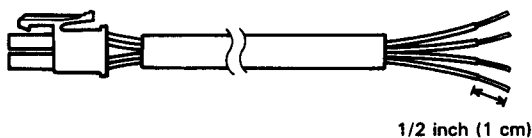
The MAT-100 requires a control cable consisting of between 4-5 wires of at least AWG24 gauge. The cable must be shielded.

1. Connect the 6-pin plug to rear of the radiotelephone.



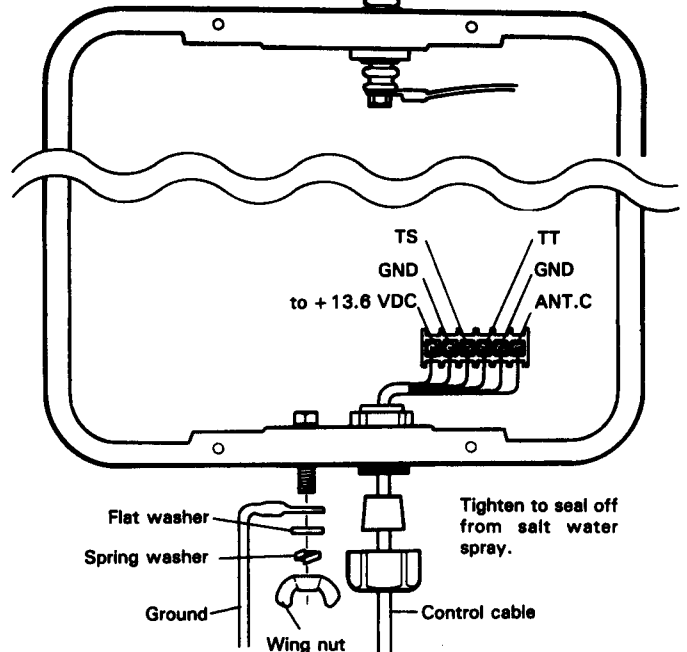
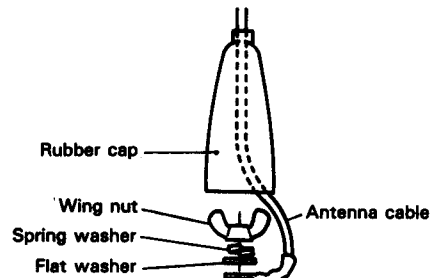
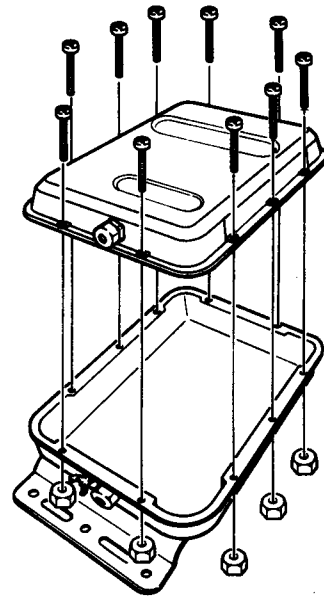
A 5 wire control cable is needed if you want to connect the ANT.C pin. Please refer to the MAT-100 Service Manual for further information on this function.

2. Strip the other side of the cable as shown below.

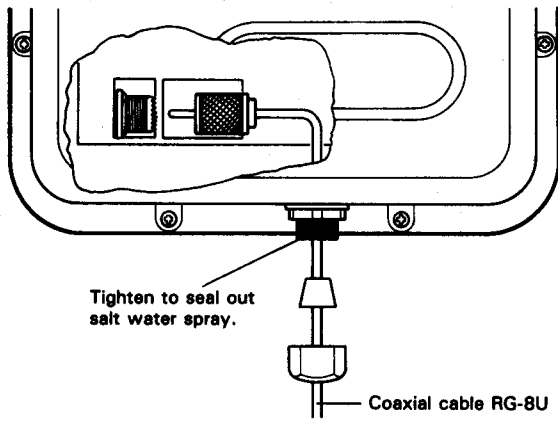


1/2 inch (1 cm)

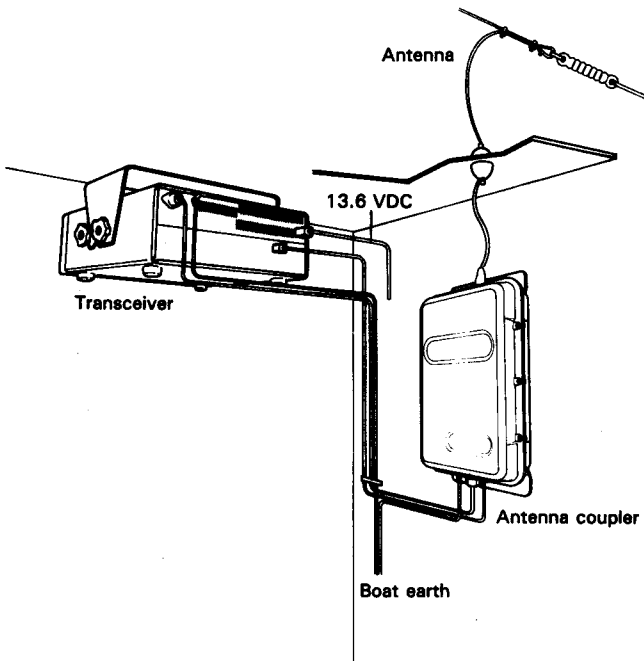
3. Connect the wires .  
Be sure none of the wires are shorting against the others.



4. Connect thru case of the Antenna coupler to Antenna connector of the radiotelephone with coaxial cable.



## TYPICAL INSTALLATION

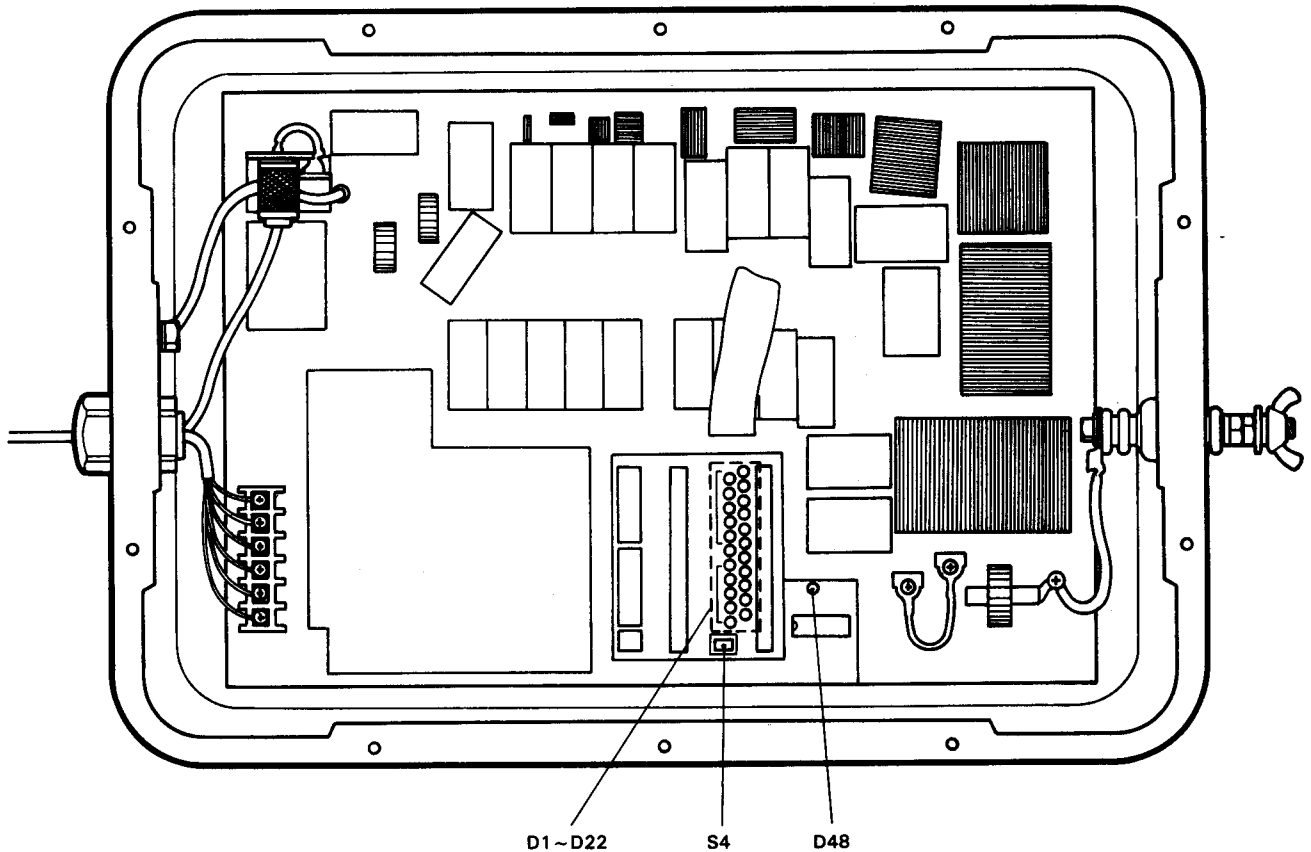


# 3. MANUAL TUNING

If the control circuit in the MAT-100 does not function properly, should an emergency arise, you can still transmit on 2182 kHz ;The MARINE MOBILE EMERGENCY CHANNEL by switching the coupler to MANUAL OPERATION.

1. Turn the radiotelephone power switch off.
2. Remove the top cover of the antenna coupler.
3. Confirm S4 is in AUTO position.
4. Turn the radiotelephone power switch on.  
Press the 2182 key and then the TUNE key.
5. After completing the tuning, D48 LED indicator of the antenna coupler will light.

6. Record the status of D1to D22 LED indicators on or off.
7. Set the S4 slide switch to MANUAL position.
8. Set the S1 to S3 dip switch as the same position as step 6.
9. Change the S4 switch back forth between AUTO and MANUAL position to confirm no change in the D1to D22 LED indicators.
10. Set S4 to be AUTO position.
11. Attach the top cover of the antenna coupler.



# 4. Circuit Description

## 4-1 General

The MAT-100 consists of the following circuits:

- Sensor Circuit
- Digital Circuit
- Switching Circuit
- Interface Circuit
- Matching Circuit

## 4-2 Sensor Circuit

The incoming transmit signal enters via J1 and is routed through attenuators R1 ~ R7. A portion of the output from the attenuator passes through R11 and the limiter and is then applied to IC1. IC2, IC3 and Q9 are used to sense the frequency of the incoming signal and apply appropriate control data to the microprocessor. The main output from the attenuator is applied to the detector circuit and IC4 where the Forward voltage, Reverse voltage, Phase, and Impedance are sensed. These signals are then applied to an Analog to Digital converter circuit. The resulting digital signal is applied to the microprocessor.

## 4-3 Digital Circuit

The digital circuit consists of a microprocessor, IC6, and other control circuits. IC5 determines the microprocessor operating mode. IC7 thru IC9 are used to latch the data drivers, the relays, and LED indicators. IC4 is used to initialize (or reset) the microprocessor when the power switch is turned OFF.

## 4-4 Switching Circuit

The switching circuit LED's are used to display the status of the Antenna Tuners matching efforts. Relays associated with the various LED's are controlled by the microprocessor during tuning, and by the position of switches S1 thru S3 when tuning manually. Switch S4 is used to switch between the Manual and Automatic tuning modes.

## 4-5 Interface Circuit

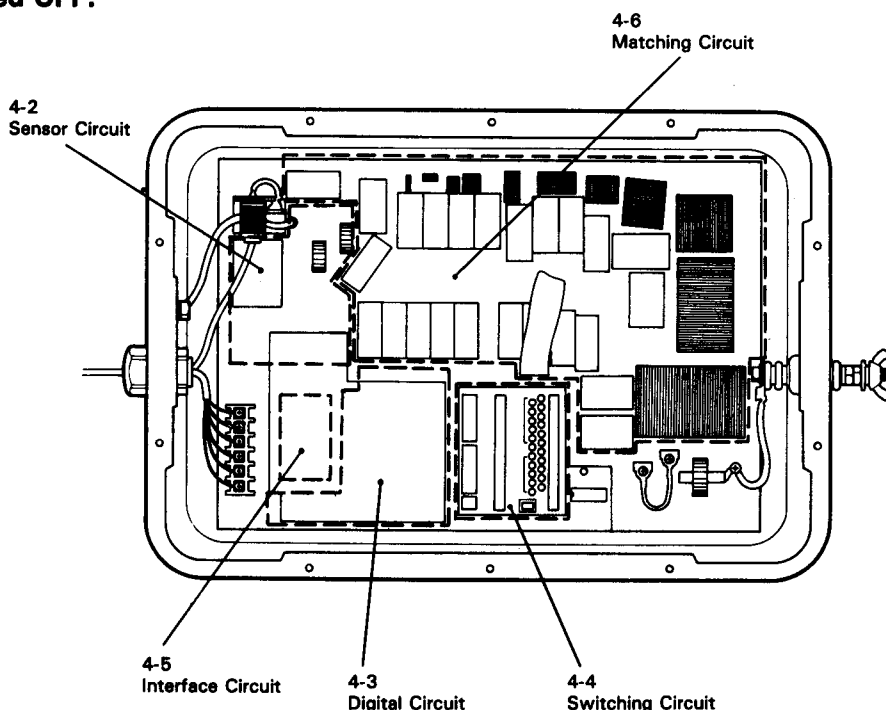
The MAT-100 is connected to the transceiver via a 6 pin control cable.

The TS, and TT pins of the 6 Pin connector are attached to the microprocessor INPUT/OUTPUT ports.

While tuning, both the TS and TT line voltage drops to 0 vdc. These pins are normally held at 5 volts.

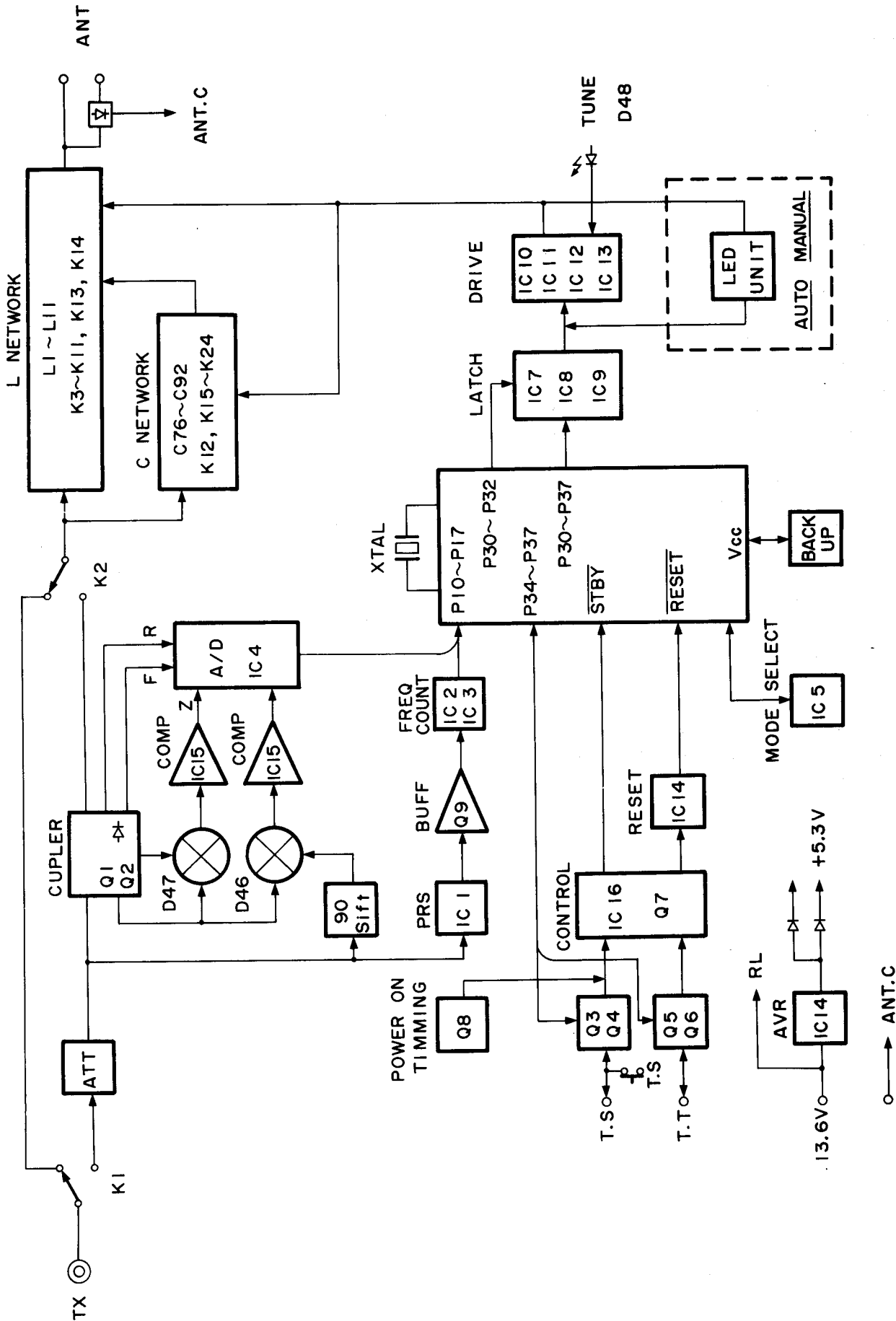
## 4-6 Matching Circuit

The actual matching circuit consists of an LC circuit which contains 11 coils and 17 capacitors connected sequentially. Additionally, 22 heavy duty relays are used to control the configuration of these components. The capacitors may be placed in the input or output circuits. Each of the relays is controlled via data provided by the microprocessor or manually via SW1 thru SW3.



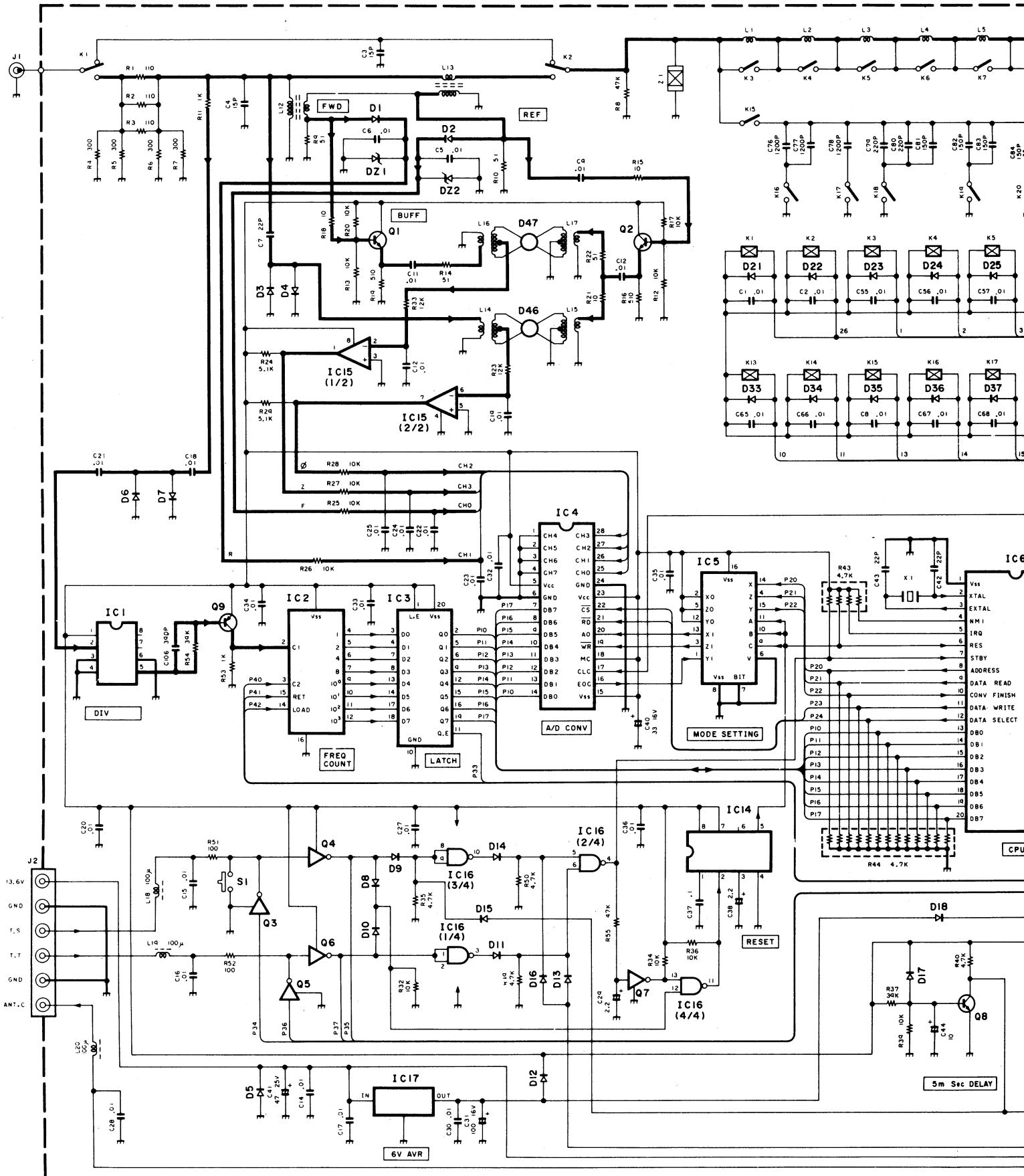


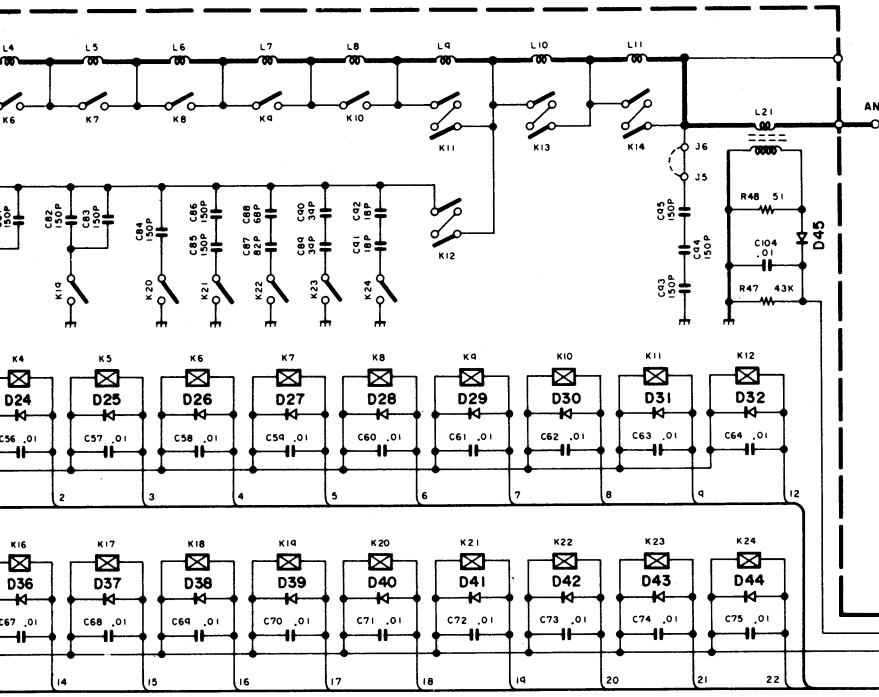
# MAT-100 BLOCK DIAGRAM



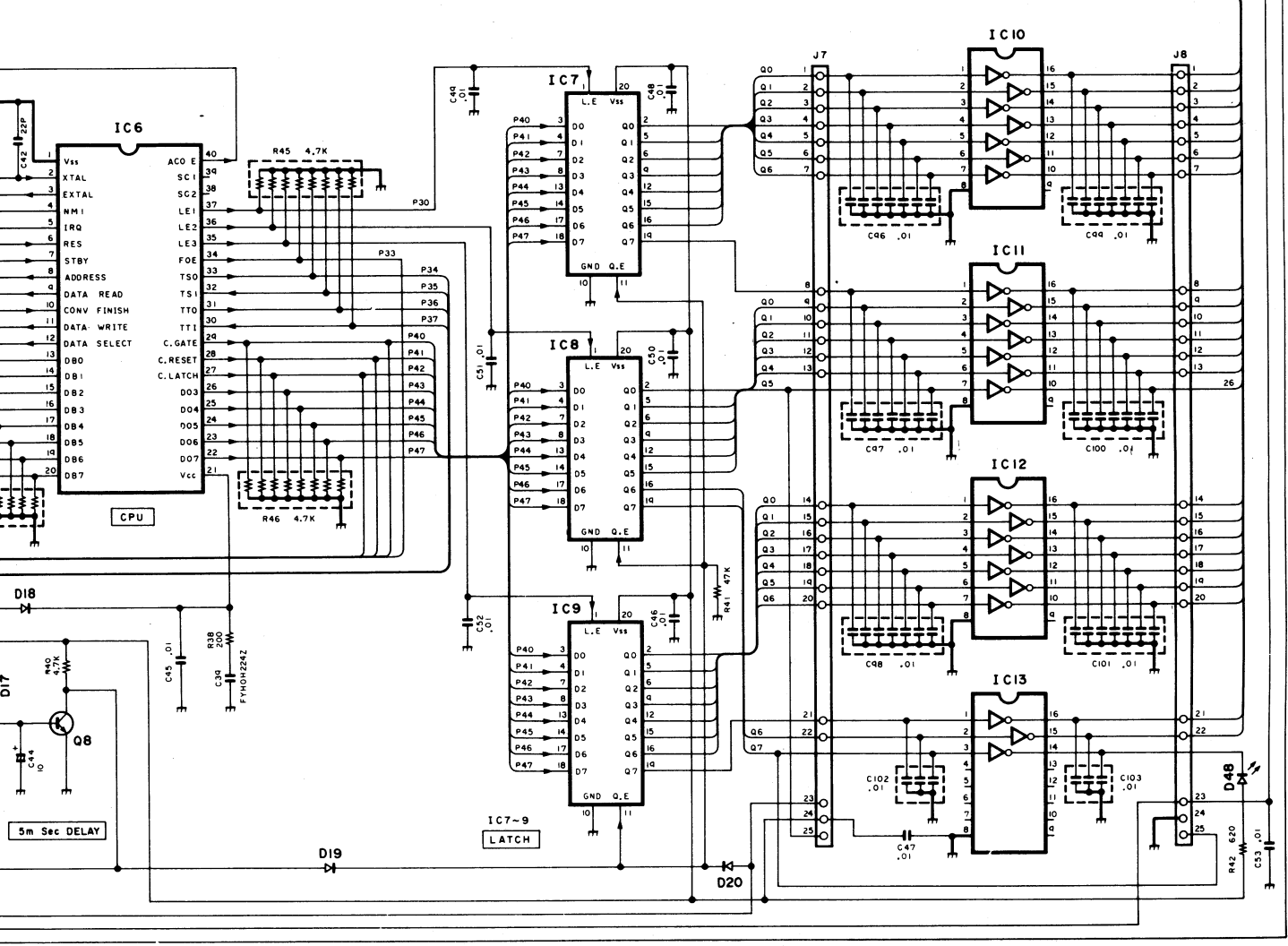
**Note:** Block Diagram is subject to change without notice due to advancements in technology.

# 4-6. MAT-100 SCHEMATIC DIAGRAM





- IC1 : μPB553AC
  - IC2 : MSM5501
  - IC3,7~9 : μPD74HC373
  - IC4 : μPD7004C
  - IC5 : μPD4053BC or TC4053
  - IC6 : HD6301VIK08PJ
  - IC10~13 : TD62003
  - IC14 : TL7705ACP
  - IC15 : μPC277C
  - IC16 : μPD4011B
  - IC17 : NJM7806H
- 
- Q1,2 : 2SC2408
  - Q3,5,7 : RN2001
  - Q4,6 : RN1001
  - Q8 : 2SC945
  - Q9 : 2SA733
- 
- D1,2,45 : 2-1K261(1)
  - D3,4,6~11,13~20 : 1S1588
  - D5 : U05B
  - D12 : 10D1
  - D46,47 : ND487C2-3R
  - D48 : GL3PR8
- 
- DZ1,2 : 05AZ3X



- IC1,2 : DRL8-472
- IC3 : DRL6-472

