

# FC-800

## Automatic Antenna Tuner for the FT-890 Transceiver

The FC-800 is a microprocessor-controlled antenna impedance matching network designed to provide all-amateur-band transmitting capability with the FT-890 HF transceiver and an end-fed random wire or long whip antenna (the FT-890 internal antenna tuner should be used with antennas requiring coaxial feedline, such as beams). The FC-800 makes use of the control circuitry built into the FT-890, which allows the operator to control and monitor automatic operation of the FC-800, mounted near the antenna feedpoint. The FC-800 uses specially selected thermally stable components and is housed in a waterproof casing to reliably withstand severe climatic extremes.

A carefully chosen combination of solid-state switching components and high-speed relays allows the FC-800 to match a wide variety of antennas to within a 1.5:1 SWR on any amateur band frequency in typically less than 3 seconds. Transmitter power required for matching can be as little as 10 watts, and matching settings are automatically stored in memory for instant recall when the same frequency range is reselected later.

This manual describes base and mobile installation and operation of the FC-800 with various types of antennas.

### *Specifications*

<b>Operating frequency range:</b>	1.8~30 MHz with 12-m+ end-fed wire, 3.5~30 MHz with 2.6-m whip
<b>Matching impedance:</b>	50 ohms (unbalanced)
<b>Maximum transmitter power:</b>	150-W PEP
<b>Maximum SWR after tuning:</b>	1.5:1 or better (if antenna is not a multiple of $\frac{1}{2}\lambda$ )
<b>Required RF power for tuning:</b>	$10 \pm 3$ W
<b>Tuning time:</b>	3 seconds typical, 10 seconds maximum
<b>Power supply:</b>	13.5-V DC $\pm$ 15% @ 700 mA (from jack on FT-890)
<b>Operating temperature range:</b>	-30 to +65 °C (-22 to +149 °F)
<b>Case size (WHD):</b>	264 × 80 × 264 mm
<b>Weight:</b>	2.1 kg

### *Supplied Accessories*

Coaxial Cable (5m), p/n T9101366

Control Cable, 4-wire (5m), p/n T9101419C

## Controls & Connectors

These switches and terminals are located inside the FC-800, and are accessible only when the cover is removed for initial installation or servicing.

### (1) PRESET Slide Switch

This switch must be kept in the ON position except when servicing the FC-800 using the (optional) Servicing LED Unit.

### (2) SO1 Slide Switch

This switches the memory backup battery on and off. It should be ON except when necessary during servicing.

### (3) Antenna Terminal Post

The antenna must be connected here at all times during operation.

### (4) Ground Terminal Post

For monopole antenna configurations this terminal must be connected to the antenna counterpoise (usually earth ground) through the shortest possible path. For di-

pole antenna configurations this terminal connects to one side of the dipole.

### (5) Coaxial Cable Terminals (two)

The coaxial feedline from the FT-890 connects to these terminals as illustrated (center conductor to J01, braid to J02).

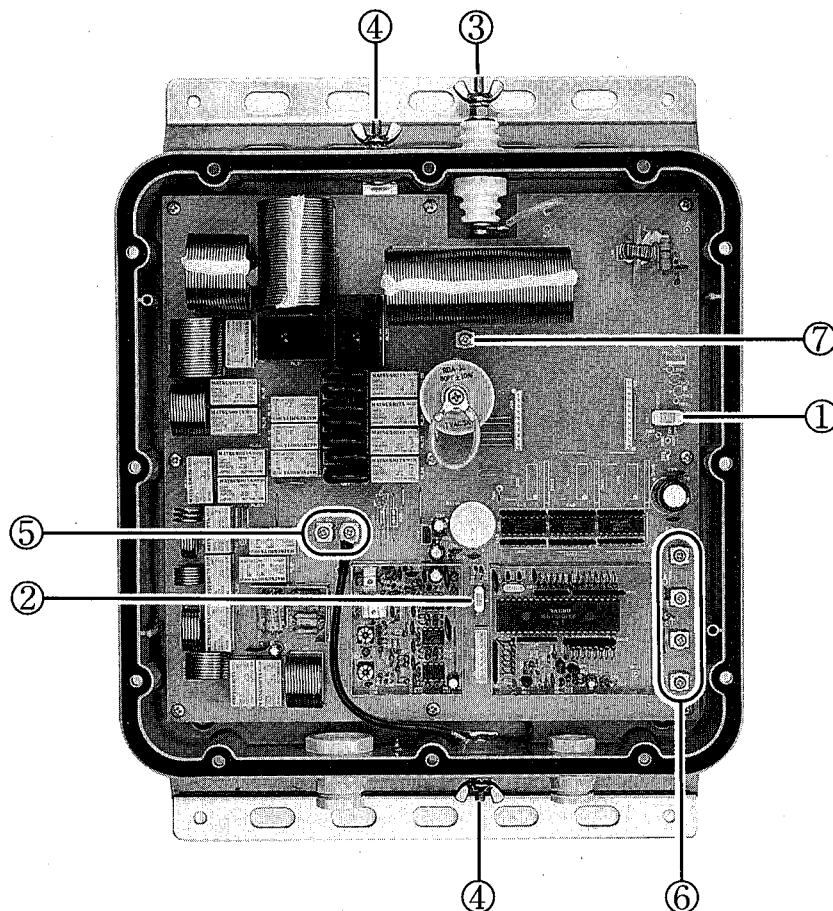
### (6) Control Cable Terminals (four)

The 4-conductor control cable from the **TUNER** jack on the rear of the FT-890 connects to these terminals as follows:

- J04 - Blue wire (AD)
- J05 - White wire (Data)
- J06 - Red wire (+13.5V)
- J07 - Black wire (Control ground)

### (7) Capacitance Tap (Terminal J10)

This tap may be used to add 50-pF capacitor C51 in parallel with the antenna, to effectively raise the resonant frequency of the antenna when it is necessary to obtain a proper match, but not practical to shorten the antenna physically.



1 METER = 39.37 INCHES

## Installation

### Antenna Considerations

The FC-800 is designed to match a wide variety of unbalanced, end-fed antennas over the HF spectrum from 1.8 to 30 MHz. For mobile installations we recommend a base-fed whip antenna at least 2.6 meters long. For base operation we recommend a single wire antenna, at least 12 meters long. The FC-800 is capable of matching a wire as short as 5 meters at 3.5 MHz, but in general, better performance will result from longer antennas. However, there are usually some frequencies at which an antenna cannot be matched, and these should be considered prior to antenna installation.

In general, if the full length of a monopole antenna (single end-fed radiating element) is close to a multiple of  $\frac{1}{2}$ -wavelength long, the antenna impedance will be too high to be matched. Use the following formula to determine which frequencies must be avoided with an antenna of a predetermined length (in meters):

$$f_{\text{bad}} = \frac{n \times 150}{\text{length}} \text{ (MHz)}$$

For example, if you plan to install a monopole antenna that is 21 meters long,

$$f_{1\text{bad}} = \frac{150}{21} = 7.14 \text{ MHz,}$$

$$f_{2\text{bad}} = \frac{2 \times 150}{21} = 14.29 \text{ MHz,}$$

$$f_{3\text{bad}} = \frac{3 \times 150}{21} = 21.42 \text{ MHz, and}$$

$$f_{4\text{bad}} = \frac{4 \times 150}{21} = 28.57 \text{ MHz.}$$

Clearly, a 21-meter wire is a bad choice if you want to operate on the 40-, 20-, 15- or 10-m bands! You would want to either change the length of the antenna, or connect capacitor C51 to terminal J10, which effectively shortens the antenna (electrically), if you cannot easily change its size.

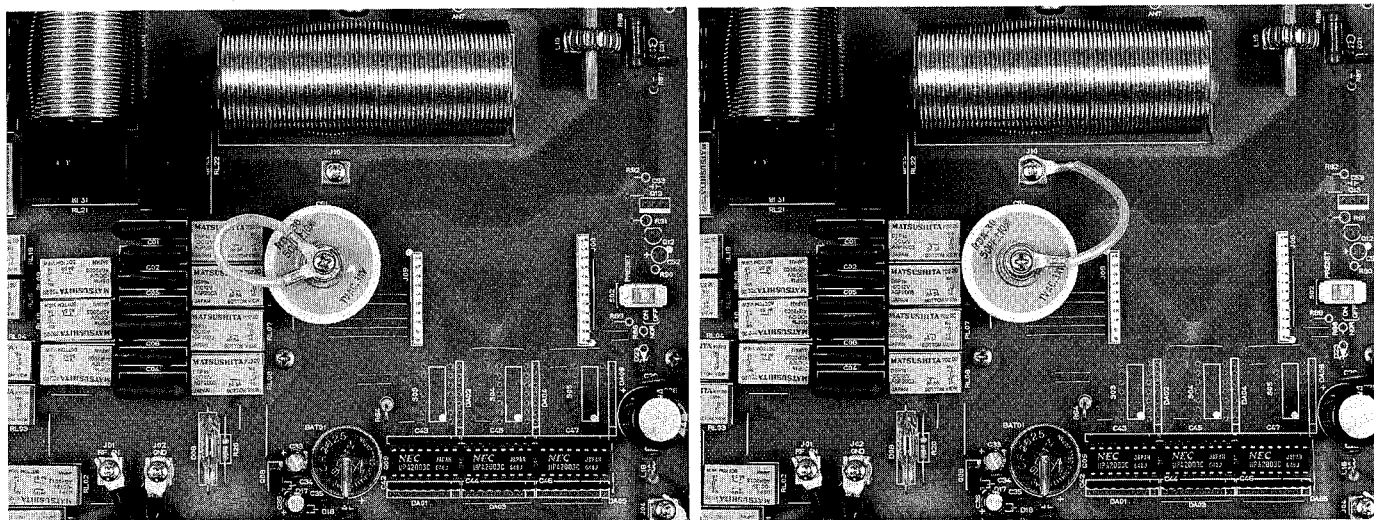
An alternative approach to this problem is to calculate unacceptable antenna lengths based on predetermined frequencies, using the following formula;

$$\text{length}_{\text{bad}} = \frac{n \times 150}{f \text{ (MHz)}}$$

For example, if you plan to use channel frequencies of 10.125 MHz, 14.200 MHz and 21.250 MHz, you would make the following calculations (assuming your maximum possible antenna length is less than 15 meters):

$$\text{len}_{1\text{bad}} = \frac{150}{10.125} = 14.81 \text{ meters}$$

$$\text{len}_{2\text{bad}} = \frac{150}{14.200} = 10.56 \text{ meters}$$



C51 Connection

$$len_{3bad} = \frac{150}{21.250 \text{ MHz}} = 7.06 \text{ meters}$$

If you are going to use higher frequencies or an antenna longer than 15 meters, you would need to also consider multiples of the calculated lengths. In any case, to operate on these frequencies, these lengths must either be avoided, or C51 connected to J10 as shown on the previous page.

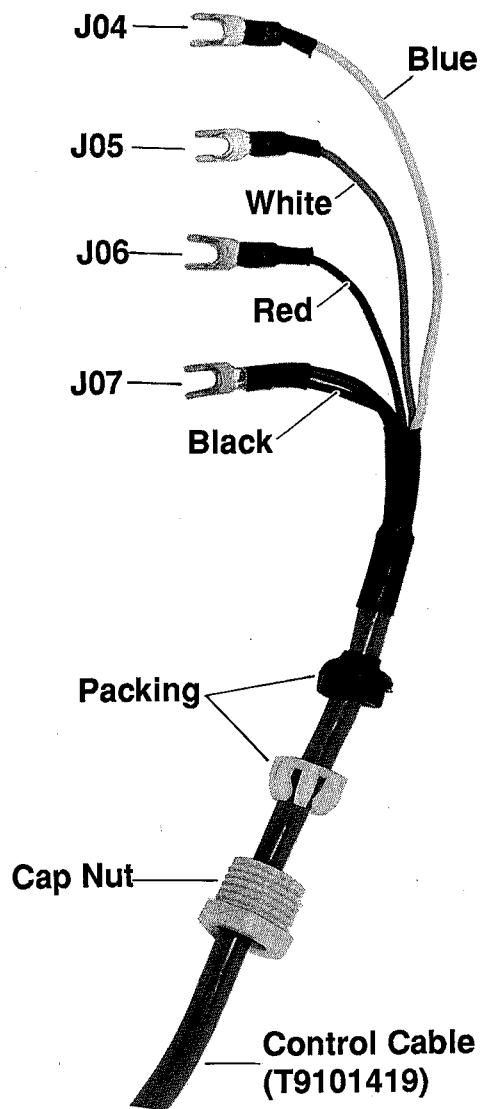
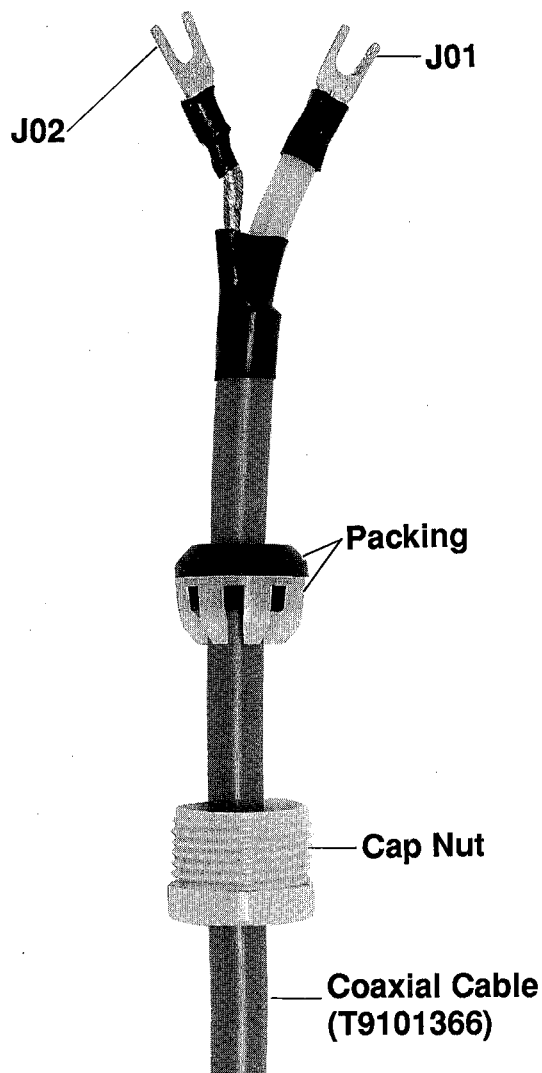
**Note!**

Operation on frequencies above 20 MHz is slightly degraded by the connection of C51, so if the higher frequencies are important, C51 should not be connected unless adjusting the length of the antenna is impractical, and calculations or actual performance indicate that it is necessary.

Regardless of the length of the antenna itself, you also need to consider its location relative to the transceiver. Of course the antenna should be as high and in the clear as possible for best performance, but also make sure to locate the feedpoint and route the antenna wire as far away as practical from the transceiver, to avoid RF feedback.

**FC-800 Cable Connections**

- Remove the 12 screws in the cover of the FC-800, and remove the cover.
- Set switch S01 to the ON position.
- Slide the supplied cap nut and packing over the dressed end of the coaxial feedline, as shown below, and then install the cable through the leftmost hole in the bottom edge of the FC-800.



- Connect the center conductor of the coaxial feedline to J01 in the FC-800, and the shield braid to J02. Tighten the screw terminals, and then tighten the cap nut to secure the cable.
- Repeat the last two steps with the 4-wire control cable, connecting the four terminated wires as shown below. Leave a little slack in the cable inside the FC-800 when tightening the cap nut.
- Replace the cover and tighten the 12 screws firmly.

**Mounting**

The mounting method for the FC-800 is determined by the antenna type and station location. In all installations, however, the FC-800 must be located at the intended feedpoint for the antenna. The drawings below show examples of placement of the FC-800 in typical mounting locations. Following are several important considerations to bear in mind during installation:

- The side of the FC-800 with the cables extruding is oriented downward (to minimize the chance of water leakage through the cable holes).
- The grounding wire (for monopoles) and part(s) of the antenna wire between the tuner terminals and the nearest antenna support should be as short as possible.
- The antenna must not touch anything except supporting insulators.
- If there is any chance of stress on the cables to the transceiver, they should be supported independently, with a loop of slack between their support and the FC-800.

For base stations, the FC-800 may be mounted either on a flat surface such as the wooden board shown in Figure 1, or on a 55 ~ 65-mm diameter mast using the optional U-bolt kit as shown in Figure 2.

For mobile installations, the FC-800 should be bolted to a flat surface using either bolts or

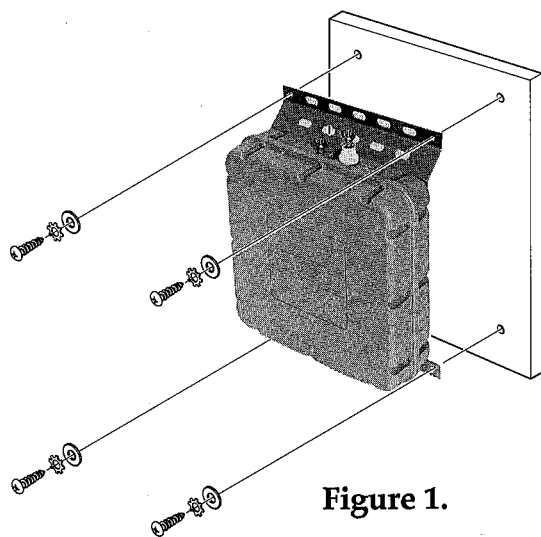


Figure 1.

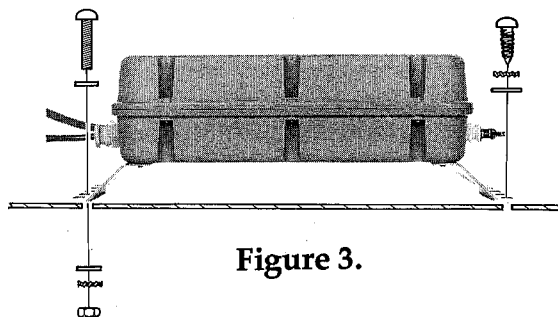


Figure 3.

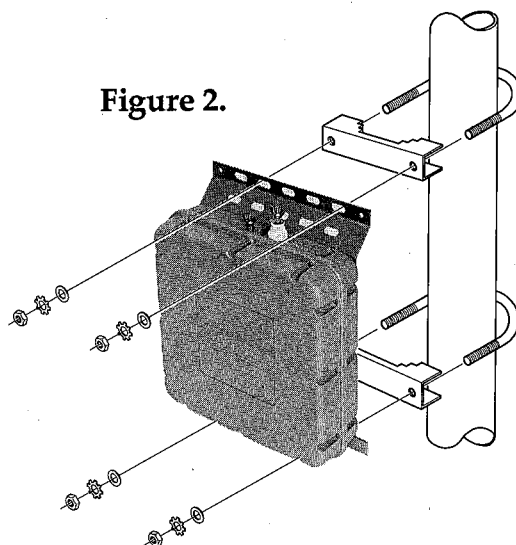
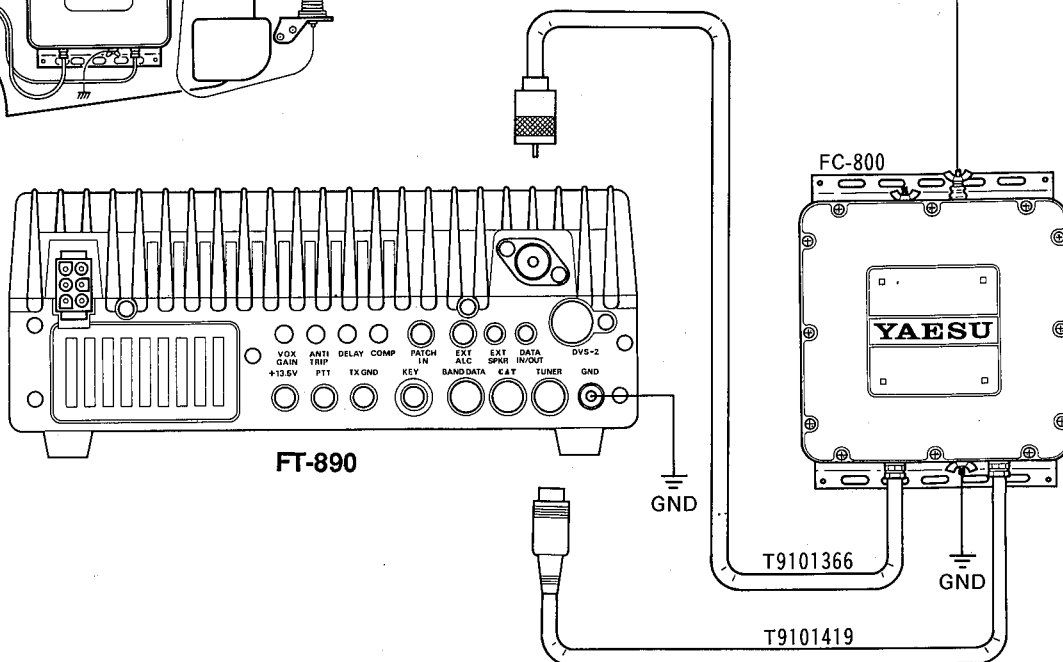
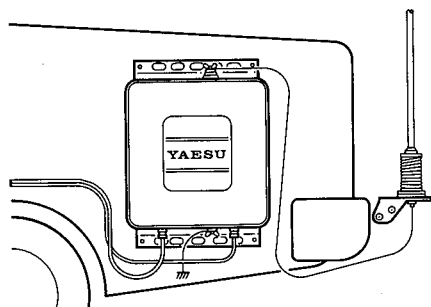
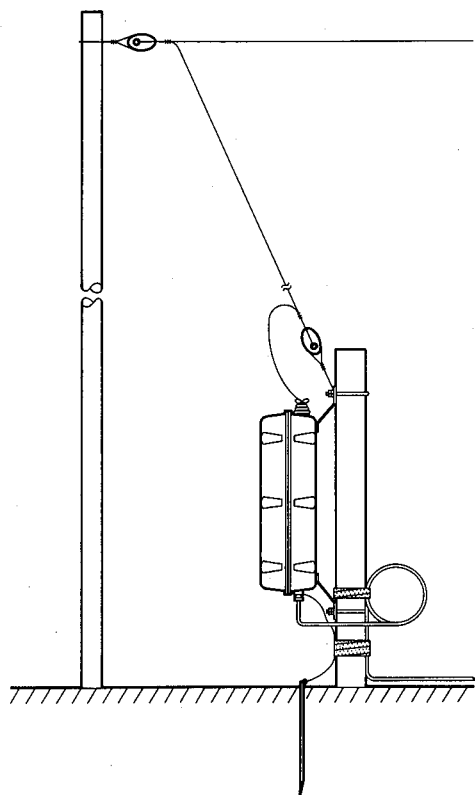


Figure 2.

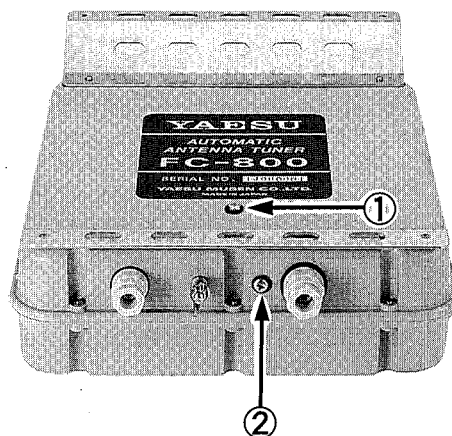
self-tapping screws (Figure 3) inside the trunk or cabin, as close to the base of the antenna as possible. Note that it can be mounted horizontally if well protected from the weather.

After mounting, connect the cables from the FC-800 to the **ANT** and **TUNER** jacks on the rear panel of the FT-890.



**Important!**

The FC-800 is provided with two ventilation holes, which are plugged with self-tapping screws and rubber packing grommets. At the time of installation, one (and only one) of these screws should be removed, to prevent condensation on the high-voltage parts during operation. The correct screw to remove is the one which will be on the bottom of the FC-800 in its final mounting position.



# Operation

To use the FC-800, just follow the *Automatic Antenna Matching* instructions on page 17 of the *FT-890 Operating Manual*. However, note that the FC-800 operates somewhat differently from the internal ATU-2 tuner. These differences are described here.

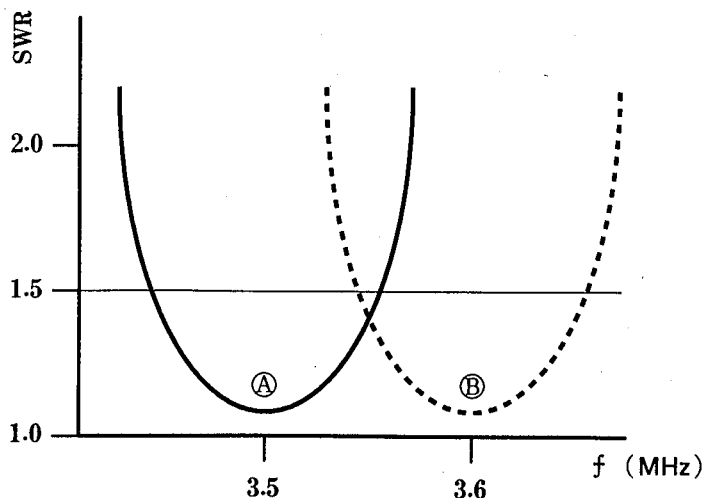
- The **HI SWR** indicator on the FT-890 is inoperative when using the FC-800, so you should monitor SWR on the meter to ensure that the match is successful.
- The FC-800 has 15 memories for impedance match settings. Each of these covers a specific frequency range, as shown in the following table. When you first tune to a range in which the FC-800 has not yet been activated, the corresponding memory is empty, and the **TUNER LED** does not light. Once the FC-800 has been activated to find a match in that range, the settings will be automatically stored, and the **TUNER LED** will subsequently light when tuning to the same frequency range later.

Band	Frequency Range(s), in MHz	
160m	1.8 ~ 2.0	
80m	3.5 ~ 4.0	
40m	7.0 ~ 7.2	7.2 ~ 7.3
30m	10.1 ~ 10.15	
20m	14.0 ~ 14.2	14.2 ~ 14.35
18m	18.068 ~ 18.168	
15m	21.0 ~ 21.2	21.2 ~ 21.45
12m	24.89 ~ 24.99	
10m	28.0 ~ 28.2	29.0 ~ 29.2
	28.2 ~ 29.0	29.2 ~ 29.7

- The auto-rematching feature (indicated by the flashing **WAIT** indicator when changing frequency) is not operative with the FC-800 is used: you must press **START** to rematch the antenna. When the **START** button is pressed, the tuner will only attempt a rematch if the detected SWR is above 1.5:1. For example, in the SWR graphs below, the tuner would not rematch when you tune from frequency A to B, since the SWR remains below 1.5:1.
- If the FC-800 is unable to lower the SWR of your antenna at a particular frequency, you may need to change the grounding configuration or the length of the antenna itself. Remember, even though the FC-800 provides a match to the transmitter, the performance (efficiency) of the antenna is ultimately determined by its size and location. The antenna tuner cannot improve the efficiency of the antenna.
- While the maximum power rating of the FC-800 is 150 watts PEP, the tuner may overheat with continuous-carrier modes such as RTTY and FM. When transmitting in these modes, reduce output power to 30 to 50 watts to protect the FC-800.

### Caution!

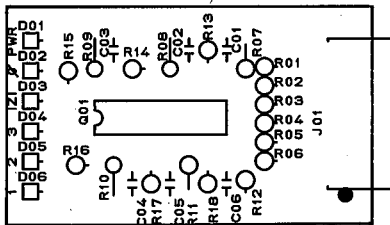
*High voltage may be present at the antenna terminal of the FC-800 when transmitting. Make certain that no person or animal comes into contact with this terminal or the antenna.*



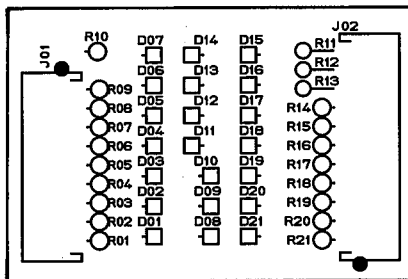
# Servicing

## Testing & Troubleshooting Procedure

- Install the FC-1000 Service Kit as described on the next page.
- Connect the FC-800 to the FT-890 transceiver as shown on page 6.
- Press the **START** button on the transceiver, and observe the indicators on the Service Kit boards to determine which relays are closed (LED Unit LED lit) and which matching parameters are being detected (DET Unit LEDs lit). See the tables at the right.



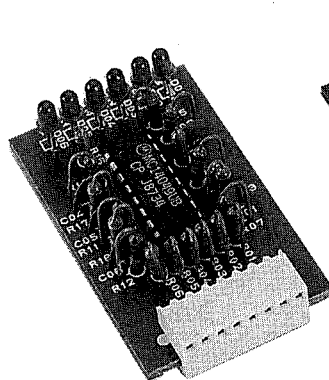
DETECTOR Unit



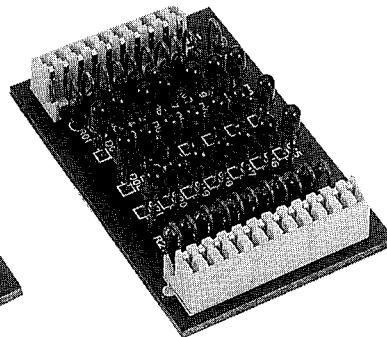
LED Unit

LED Unit Indicator Functions (LED on = Relay closed)			
LED	Relay	LED	Relay
D501	RL122	D511	RL115
D502	RL121	D512	RL116
D503	RL120	D513	RL117
D504	RL119	D514	RL111
D505	RL118	D515	RL110
D506	RL103	D516	RL109
D507	RL104	D517	RL108
D508	RL112	D518	RL107
D509	RL113	D519	RL106
D510	RL114	D520	RL105
		D521	RL101 & RL102

DET Unit Indicator Functions (LED on = true, off = false)	
LED	Indication when lit
PWR	RF power is greater than 3 watts
∅	Load impedance is inductive
Z	Load impedance is greater than 50 Ω
SWR3	SWR is greater than 3:1
SWR2	SWR is greater than 2:1
SWR1	SWR is greater than 1.5:1

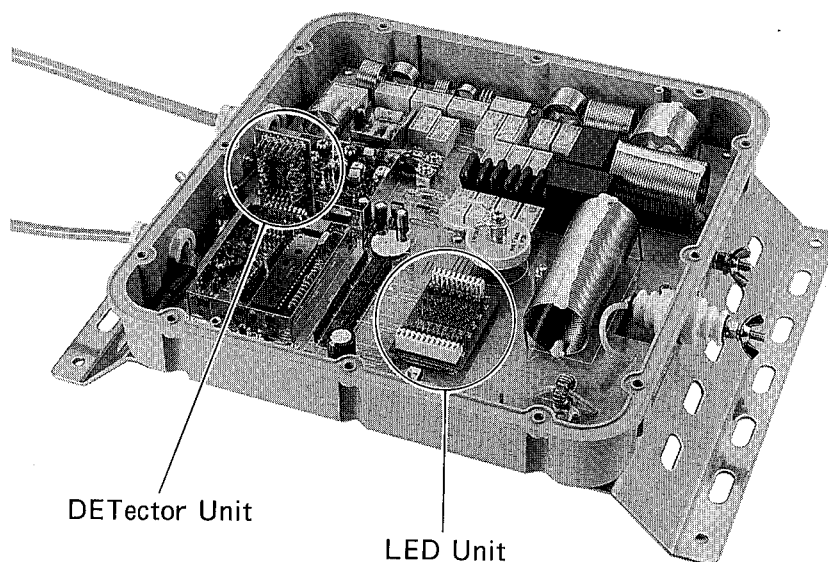


DETECTOR Unit



LED Unit



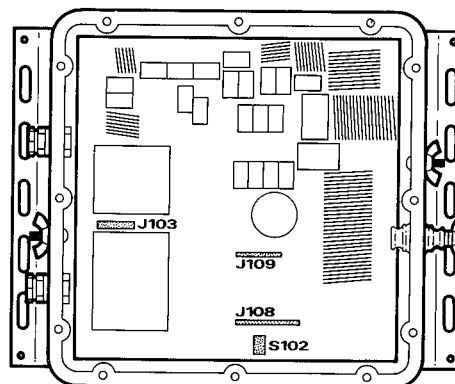
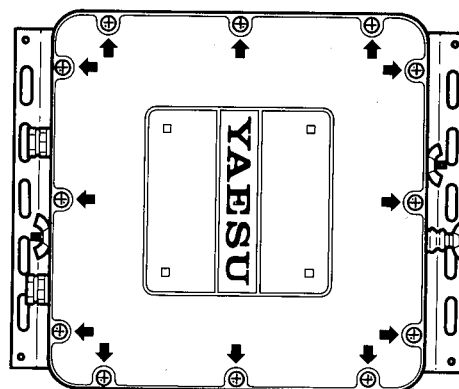


### FC-1000 Service Kit Connections in the FC-800

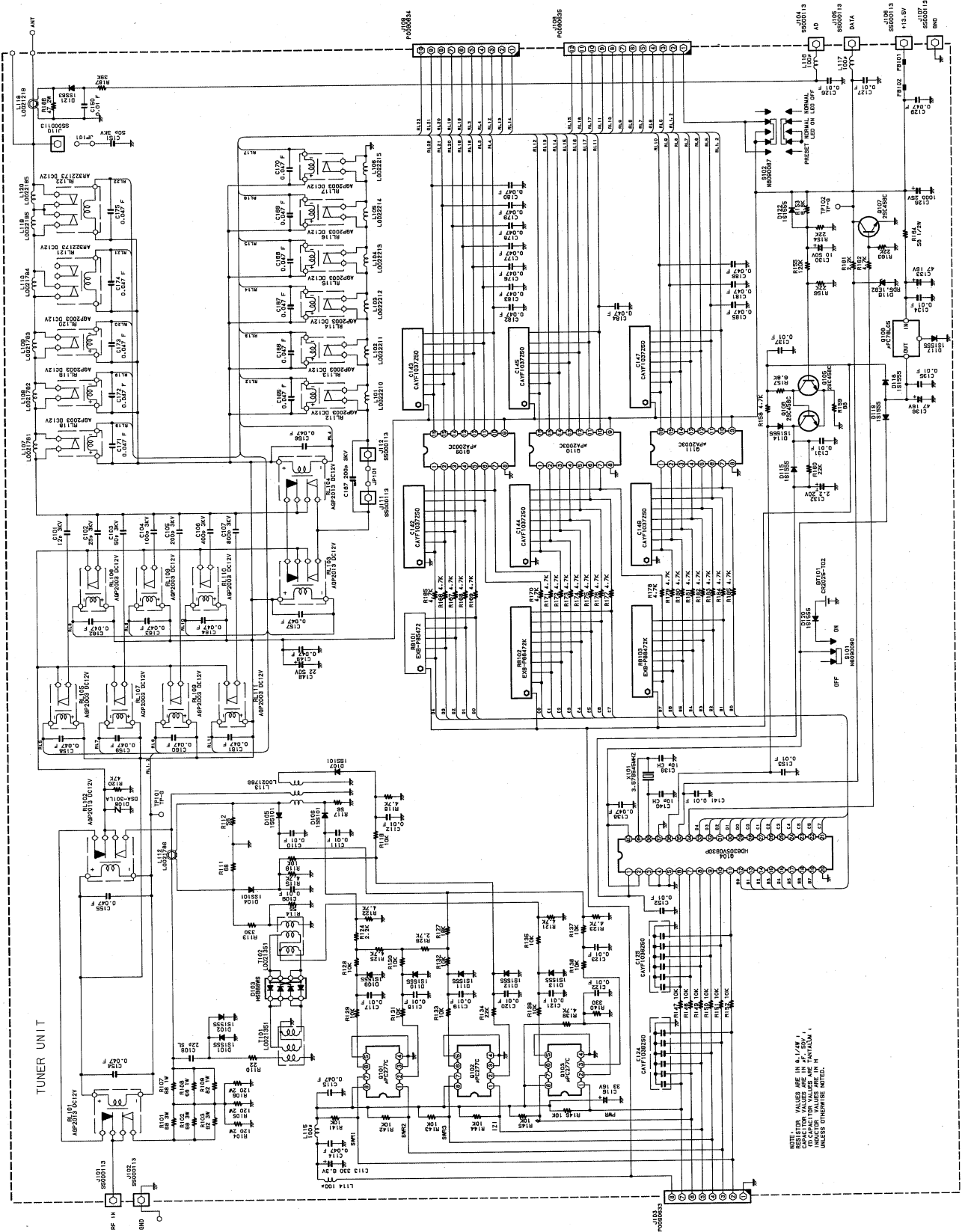
The FC-1000 Service Kit provides visual indication of the inductor selection relay states and matching network parameters, for troubleshooting the FC-800.

- Remove the 12 screws indicated at the right.
- Locate single-in-line pin connectors J108 and J109 near **PRESET** switch S102 and install the board labelled "LED Unit" on these two connectors.
- Now locate single-in-line connector J102 near microcontroller Q102, and install the board labelled "DET Unit" on this connector.
- Set **PRESET** switch S102 to the center (**ON**) position to activate the LEDs while the cover of the FC-800 is open.

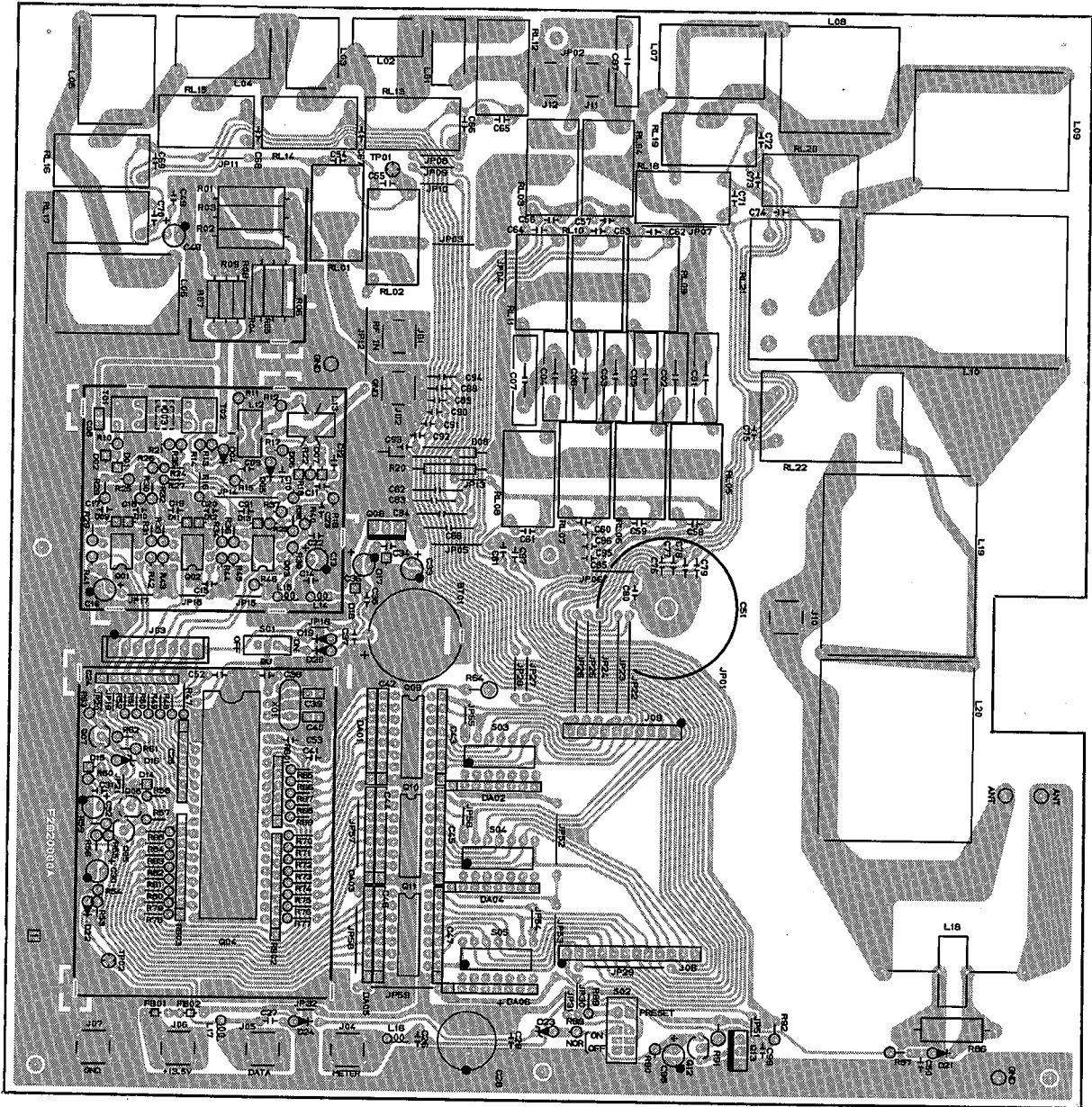
*When finished servicing, remember to remove the service boards and return S102 to the OFF position.*



# Circuit Diagram



# Parts Layout



# Parts List

REF.	MRGR'S DESIG	VALUE	WV	TOL.	DESCRIPTION	YAESU P/N
*** FC-800 ***						
PCB With Components						
Printed Circuit Board						
BT0101	LITHIUM BATTERY				CR-2025-T02	Q90000366
C 0101	MICA CAP.	12pF	3KV		DML4 120J30	K30355120
C 0102	MICA CAP.	25pF	3KV		DML4 250J30	K30355250
C 0103	MICA CAP.	50pF	3KV		DML4 500J30	K30355500
C 0104	MICA CAP.	100pF	3KV		DML4 101J30	K30355101
C 0105	MICA CAP.	200pF	3KV		DML4 201J30	K30355201
C 0106	MICA CAP.	400pF	3KV		DML4 401J30	K30355401
C 0107	MICA CAP.	800pF	3KV		DML4 801J30	K30355801
C 0108	CERAMIC CAP.	22pF	50V	SL	DD104SL220J50	K00175220
C 0109	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0110	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0111	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0112	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0113	AL. ELECTRO. CAP.	330uF	6.3V		RE2-6V331M	K40089019
C 0114	CERAMIC CAP.	0.047uF	50V	F	DD110F473Z50	K13179009
C 0115	CERAMIC CAP.	0.047uF	50V	F	DD110F473Z50	K13179009
C 0116	AL. ELECTRO. CAP.	33uF	16V		RE2-16V330M	K40129008
C 0117	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0118	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0119	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0120	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0121	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0122	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0123	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0124	CAPACITOR BLOCK				CAYF1036Z50	K80000002
C 0125	CAPACITOR BLOCK				CAYF1036Z50	K80000002
C 0126	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0127	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0128	AL. ELECTRO. CAP.	1000uF	25V		RE2-25V102M	K40149034
C 0129	CERAMIC CAP.	0.047uF	50V	F	DD110F473Z50	K13179009
C 0130	AL. ELECTRO. CAP.	10uF	16V		RE2-16V100M	K40179041
C 0131	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0132	TANTALUM CAP.	2.2uF	20V		DN1D2R2M1S	K70137225
C 0133	AL. ELECTRO. CAP.	47uF	16V		RE2-16V470M	K40129054
C 0134	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0135	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0136	AL. ELECTRO. CAP.	47uF	16V		RE2-16V470M	K40129054
C 0137	CERAMIC CAP.	0.01uF	50V	F	DD106F103Z50	K13179008
C 0138	CERAMIC CAP.	0.047uF	50V	F	DD110F473Z50	K13179009
C 0139	CERAMIC CAP.	10pF	50V	CH	DD104CH100D50	K02173100
C 0140	CERAMIC CAP.	10pF	50V	CH	DD104CH100D50	K02173100

# Parts List

REF.	MEGR'S DESIG	VALUE	WV	TOL.	DESCRIPTION	YAESU P/N
D 0101	DIODE	1S1555				
D 0102	DIODE	1S1555				
D 0103	DIODE	ND487C2-3R				
D 0104	DIODE	1SS101				
D 0105	DIODE	1SS101				
D 0106	DIODE	1SS101				
D 0107	DIODE	1SS101				
D 0108	SURGE ABSORBER	DSA-301LA				
D 0109	DIODE	1S1555				
D 0110	DIODE	1S1555				
D 0111	DIODE	1S1555				
D 0112	DIODE	1S1555				
D 0113	DIODE	1S1555				
D 0114	DIODE	1S1555				
D 0115	DIODE	1S1555				
D 0116	DIODE	1S1555				
D 0117	DIODE	RD5.1EB2				
D 0118	DIODE	1S1555				
D 0119	DIODE	1S1555				
D 0120	DIODE	1S1555				
D 0121	DIODE	1S1555				
D 0122	DIODE	1SS83				
J 0101	TERMINAL	0T-005				
J 0102	TERMINAL	0T-005				
J 0103	CONNECTOR	5245-08A				
J 0104	TERMINAL	0T-005				
J 0105	TERMINAL	0T-005				
J 0106	TERMINAL	0T-005				
J 0107	TERMINAL	0T-005				
J 0108	CONNECTOR	3022-12B				
J 0109	CONNECTOR	3022-10B				
J 0110	TERMINAL	0T-005				
J 0111	TERMINAL	0T-005				
J 0112	TERMINAL	0T-005				
L 0101	COIL	2.5T 10D1.6PVF R				
L 0102	COIL	3.5T 11D1.6PVF R				
L 0103	COIL	5.5T 11D1.6PVF R				
L 0104	COIL	6.5T 16D1.6PVF R				
L 0105	COIL	8.5T 19D1.6PVF R				
L 0106	COIL	10.5T 24D1.4PVF R				
L 0107	COIL	11.5T 20D1.2UEW R				
L 0108	COIL	19.5T 20D1.2UEW R				
L 0109	COIL	19.5T 30D1.2UEW R				
L 0110	COIL	35.5T 30D1.2UEW R				
L 0112	TOROID COIL	U 2001F FR9.5				
L 0113	TOROID COIL	U 2001F FR9.5				
L 0114	M. RFC	G2015550				
L 0115	M. RFC	G2015550				
L 0116	M. RFC	G2090135				
L 0117	M. RFC	G2090223				
L 0118	TOROID COIL	G2090223				
L 0119	COIL	G2090223				
L 0120	COIL	Q9000371				
Q 0101	IC	G2015550				
Q 0102	IC	G2015550				
Q 0103	IC	G2015550				
Q 0104	IC	G2015550				
Q 0105	TRANSISTOR	G2015550				
Q 0106	TRANSISTOR	G2015550				
Q 0107	TRANSISTOR	G2015550				
Q 0108	IC	G2090152				
Q 0109	IC	G2015550				
Q 0110	IC	G2015550				
Q 0111	IC	G2015550				
R 0101	METAL FILM RES.	G2090340				
R 0102	METAL FILM RES.	G2015550				
R 0103	METAL FILM RES.	S5000183				
R 0104	METAL FILM RES.	S5000183				
R 0105	METAL FILM RES.	P0090633				
R 0106	METAL FILM RES.	S5000183				
R 0107	METAL FILM RES.	S5000183				
R 0108	METAL FILM RES.	S5000183				
R 0109	METAL FILM RES.	S5000183				
R 0110	CARBON FILM RES.	P0090635				
R 0111	CARBON FILM RES.	P0090634				
R 0112	CARBON FILM RES.	S5000183				
R 0113	CARBON FILM RES.	S5000183				
R 0114	CARBON FILM RES.	S5000183				
R 0115	CARBON FILM RES.	S5000183				
R 0116	CARBON FILM RES.	L0022210				
R 0117	CARBON FILM RES.	L0022211				
R 0118	CARBON FILM RES.	L0022212				
R 0119	CARBON FILM RES.	L0022213				
R 0120	CARBON FILM RES.	L0022214				
R 0121	CARBON FILM RES.	L0022215				
R 0122	CARBON FILM RES.	L0021781				
R 0123	CARBON FILM RES.	L0021782				
R 0124	CARBON FILM RES.	L0021783				
R 0125	CARBON FILM RES.	L0021784				
R 0126	CARBON FILM RES.	L0021786				
R 0127	CARBON FILM RES.	L0021786				
R 0128	CARBON FILM RES.	L0021786				
REF. <th>MEGR'S DESIG</th> <th>VALUE</th> <th>WV</th> <th>TOL.</th> <th>DESCRIPTION</th> <th>YAESU P/N</th>	MEGR'S DESIG	VALUE	WV	TOL.	DESCRIPTION	YAESU P/N
L 0114	M. RFC	100uH			LAL04NA101K	L1190133
L 0115	M. RFC	100uH			LAL04NA101K	L1190133
L 0116	M. RFC	100uH			LAL04NA101K	L1190133
L 0117	M. RFC	100uH			LAL04NA101K	L1190133
L 0118	TOROID COIL				1.890U 250L FR14	L0021219
L 0119	COIL				30.5T 30D1.2UEW R	L0022195
L 0120	COIL				30.5T 30D1.2UEW R	L0022195
Q 0101	IC				UPC277C	G1090552
Q 0102	IC				UPC277C	G1090552
Q 0103	IC				UPC277C	G1090552
Q 0104	IC				HD6305V0B30P	G1090905
Q 0105	TRANSISTOR				2SC458C	G3304580C
Q 0106	TRANSISTOR				2SC458C	G3304580C
Q 0107	TRANSISTOR				UPC78L05J	G1090848
Q 0108	IC				UPA2003C	G1090554
Q 0109	IC				UPA2003C	G1090554
Q 0110	IC				UPA2003C	G1090554
Q 0111	IC				UPA2003C	G1090554
R 0101	METAL FILM RES.	68	3W		ERG-3SJ680	J22355680
R 0102	METAL FILM RES.	68	3W		ERG-3SJ680	J22355680
R 0103	METAL FILM RES.	82	3W		ERG-3SJ820	J22355820
R 0104	METAL FILM RES.	120	2W		ERG-2SJ121	J22335121
R 0105	METAL FILM RES.	120	2W		ERG-2SJ121	J22335121
R 0106	METAL FILM RES.	120	2W		ERG-2SJ121	J22335121
R 0107	METAL FILM RES.	68	1W		ERG-1SJ680	J22305680
R 0108	METAL FILM RES.	68	1W		ERG-1SJ680	J22305680
R 0109	METAL FILM RES.	82	1W		ERG-1SJ820	J22305820
R 0110	CARBON FILM RES.	22	1/4W		RD14SJ220	J02245220
R 0111	CARBON FILM RES.	68	1/4W		RD14SJ680	J02245680
R 0112	CARBON FILM RES.	56	1/4W		RD14SJ560	J02245560
R 0113	CARBON FILM RES.	330	1/4W		RD14SJ331	J02245331
R 0114	CARBON FILM RES.	56	1/4W		RD14SJ560	J02245560
R 0115	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0116	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0117	CARBON FILM RES.	56	1/4W		RD14SJ560	J02245560
R 0118	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0119	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0120	CARBON FILM RES.	47K	1/4W		RD14TJ473	J01245473
R 0121	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0122	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0123	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0124	CARBON FILM RES.	2.2K	1/4W		RD14SJ222	J02245222
R 0125	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0126	CARBON FILM RES.	2.7K	1/4W		RD14SJ272	J02245272
R 0127	CARBON FILM RES.	18K	1/4W		RD14SJ183	J02245183
R 0128	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103

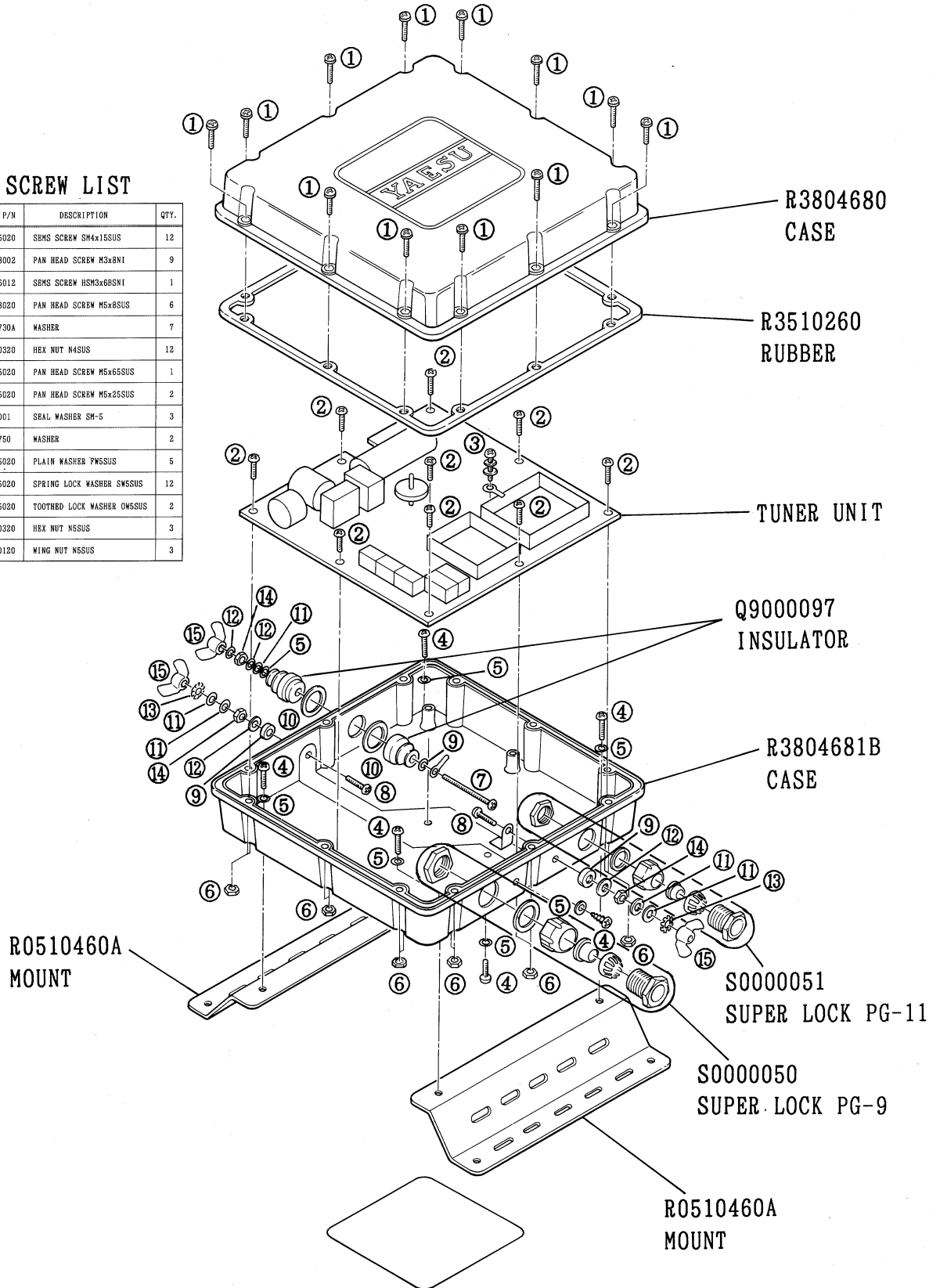
# Parts List

REF.	MFGR'S DESIG	VALUE	WV	TOL.	DESCRIPTION	YAESU P/N
R 0129	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0130	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0131	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0132	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0133	CARBON FILM RES.	22K	1/4W		RD14SJ223	J02245223
R 0134	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0135	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0136	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0137	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0138	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0139	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0140	CARBON FILM RES.	330	1/4W		RD14SJ331	J02245331
R 0141	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0142	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0143	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0144	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0145	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0146	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0147	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0148	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0149	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0150	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0151	CARBON FILM RES.	10K	1/4W		RD14SJ103	J02245103
R 0152	CARBON FILM RES.	6.8K	1/4W		RD14SJ682	J02245682
R 0153	CARBON FILM RES.	22K	1/4W		RD14SJ223	J02245223
R 0154	CARBON FILM RES.	120K	1/4W		RD14SJ124	J02245124
R 0155	CARBON FILM RES.	22K	1/4W		RD14SJ223	J02245223
R 0156	CARBON FILM RES.	6.8K	1/4W		RD14SJ682	J02245682
R 0157	CARBON FILM RES.	68	1/4W		RD14SJ680	J02245680
R 0158	CARBON FILM RES.	22K	1/4W		RD14SJ223	J02245223
R 0160	CARBON FILM RES.	2.2K	1/4W		RD14SJ222	J02245222
R 0161	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0162	CARBON FILM RES.	22K	1/4W		RD14SJ223	J02245223
R 0163	CARBON FILM RES.	56	1/2W		RD12TJ560	J01275560
R 0164	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0165	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0166	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0167	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0168	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0169	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0170	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0171	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0172	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0173	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0174	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0175	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0176	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0177	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0178	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0179	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0180	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0181	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0182	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0183	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0184	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0185	CARBON FILM RES.	4.7K	1/4W		RD14SJ472	J02245472
R 0186	METAL FILM RES.	47	2W		RS2B 2W K 47	J20336470
R 0187	CARBON FILM RES.	39K	1/4W		RD14SJ393	J02245393
RB0101	BLOCK RES.				EXB-F6E472J	J40900208
RB0102	BLOCK RES.				EXB-P88472K	J40900015
RB0103	BLOCK RES.				EXB-P88472K	J40900015
RL0101	RELAY		DC12V		G6B-2114P-1-US	M1190142
RL0102	RELAY		DC12V		G6B-2114P-1-US	M1190142
RL0103	RELAY		DC12V		G6B-2114P-1-US	M1190142
RL0104	RELAY		DC12V		G6B-2114P-1-US	M1190142
RL0105	RELAY		DC12V		AGP2003	M1190075
RL0106	RELAY		DC12V		AGP2003	M1190075
RL0107	RELAY		DC12V		AGP2003	M1190075
RL0108	RELAY		DC12V		AGP2003	M1190075
RL0109	RELAY		DC12V		AGP2003	M1190075
RL0110	RELAY		DC12V		AGP2003	M1190075
RL0111	RELAY		DC12V		AGP2003	M1190075
RL0112	RELAY		DC12V		AGP2003	M1190075
RL0113	RELAY		DC12V		AGP2003	M1190075
RL0114	RELAY		DC12V		AGP2003	M1190075
RL0115	RELAY		DC12V		AGP2003	M1190075
RL0116	RELAY		DC12V		AGP2003	M1190075
RL0117	RELAY		DC12V		AGP2003	M1190075
RL0118	RELAY		DC12V		AGP2003	M1190075
RL0119	RELAY		DC12V		AGP2003	M1190075
RL0120	RELAY		DC12V		AGP2003	M1190075
RL0121	RELAY		DC12V		AR322173	M1190076
RL0122	RELAY		DC12V		AR322173	M1190076
S 0101	SLIDE SWITCH				SSSS91012A	N6090090
S 0102	SLIDE SWITCH				SSSS92024A	N9090087
T 0101	COIL				4-1 2001F FR6	L0021351
T 0102	COIL				4-1 2001F FR6	L0021351
X 0101	XTAL	3.579545MHZ				H0102347

# Exploded View

## SCREW LIST

No	YAESU P/N	DESCRIPTION	QTY.
①	U02415020	SRMS SCREW SM4x15SUS	12
②	U00308002	PAN HEAD SCREW M3x8NT	9
③	U04306012	SRMS SCREW HSM3x6BSNT	1
④	U00508020	PAN HEAD SCREW M5x8SUS	6
⑤	R7122730A	WASHER	7
⑥	U60400320	HEX NUT M4SUS	12
⑦	U00565020	PAN HEAD SCREW M5x65SUS	1
⑧	U00525020	PAN HEAD SCREW M5x25SUS	2
⑨	U9900001	SEAL WASHER SM-5	3
⑩	R7122750	WASHER	2
⑪	U70005020	PLAIN WASHER FW5SUS	5
⑫	U71005020	SPRING LOCK WASHER SWSUS	12
⑬	U72005020	TOOTHED LOCK WASHER OWSUS	2
⑭	U60500320	HEX NUT M5SUS	3
⑮	U65500120	WING NUT M5SUS	3



Note: Only numbered items can be supplied.



**VERTEX STANDARD CO., LTD.**

4-8-8 Nakameguro, Meguro-Ku, Tokyo 153-8644, Japan

**VERTEX STANDARD**

**US Headquarters**

10900 Walker Street, Cypress, CA 90630, U.S.A.

**International Division**

8350 N.W. 52nd Terrace, Suite 201, Miami, FL 33166, U.S.A.

**YAESU EUROPE B.V.**

P.O. Box 75525, 1118 ZN Schiphol, The Netherlands

**YAESU UK LTD.**

Unit 12, Sun Valley Business Park, Winnall Close  
Winchester, Hampshire, SO23 0LB, U.K.

**VERTEX STANDARD HK LTD.**

Unit 5, 20/F., Seaview Centre, 139-141 Hoi Bun Road,  
Kwun Tong, Kowloon, Hong Kong



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