



MODIFICA

5 KHz

RR-3/90

PAG. 39

430MHz FM TRANSCEIVER

Model TR-8400



INSTRUCTION MANUAL

INTRODUCTION

You are the owner of our latest product, the new TR-8400 transceiver. Please read this instruction manual carefully before placing your transceiver in service. The unit has been carefully engineered and manufactured to rigid quality standards, and should give you satisfactory and dependable operation for many years.

AFTER UNPACKING

- Shipping container:
Save the box and packing in the event your unit needs to be transported for remote operation, maintenance, or service.
- 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.

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ACCESSORIES

Carefully unpack your TR-8400 and check that it is supplied with the following accessories:

- 1 Dynamic microphone (with U/D switch)
(T91-0313-05)..... 1 piece
- 2 Mounting bracket (A13-0618-12)..... 1 piece
 Mounting boss (J32-0748-04)..... 4 pieces
 Machine screw (3 ϕ × 6)..... 6 pieces
 Machine screw (3 ϕ × 12)..... 4 pieces
 Pan head screw (6 ϕ × 8)..... 4 pieces
 Flat washer (6 ϕ)..... 4 pieces
 Spring washer (6 ϕ)..... 4 pieces
 Flange nut (6 ϕ)..... 4 pieces
 (For installation, see page 6 and 12)
- 3 Leg
 Front bail (J02-0420-04)..... 1 piece
 Bail mounting hardware (J21-2676-04).... 2 pieces
 Rear foot (J02-0022-05)..... 2 pieces
- 4 DC power cord (with 2P plug, fuse)
(E30-1648-05)..... 1 piece
- 5 Fuse (4A) (F05-4022-05)..... 1 piece
- 6 Miniature plug (for external speaker)
(E12-0001-05)..... 1 piece

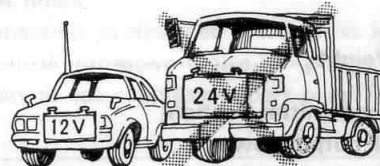
SECTION 2 FEATURES FOR USE

1. Compact and lightweight design.
2. Rotary encoder, 25 kHz-step digital Dual VFO system specifically designed for mobile operation.
3. High sensitivity, 2-stage RF amplifier using a low noise dual gate MOS FET 3SK92.
4. PLL circuit for direct VCO (Voltage Controlled Oscillator) output at 400 MHz.
The use of a DBM (Double Balanced Mixer) circuit assures excellent spurious characteristic.
5. BUSY and MEMORY scan functions stop scan operation when a signal is present.
6. Five memory channels. Two different frequencies (transmit and receive) are stored in CH5, permitting "odd-split" repeater operation.
7. Hand microphone with UP-DOWN switch.
8. TX OFFSET Switch shifts frequencies -7.6 MHz in the high band and -1.6 MHz in the low band for standard repeater operation.
9. RF POWER HI(10W) — LOW(1W) select switch.
10. Red LED frequency display.
11. S and RF METER is an LED bar indicator.

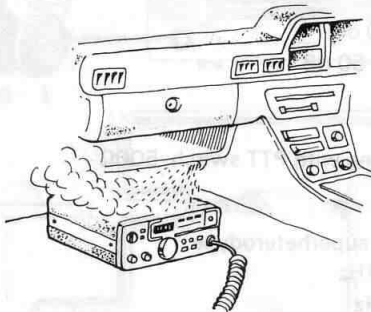
BEFORE USE



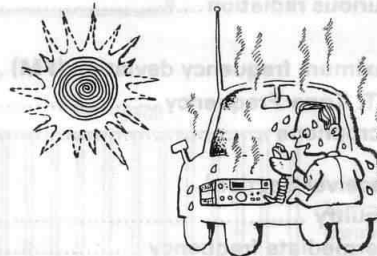
Do not adjust coils, trimmers, or pots!
These are factory adjustments.



This unit is designed for 12V, negative ground ONLY.



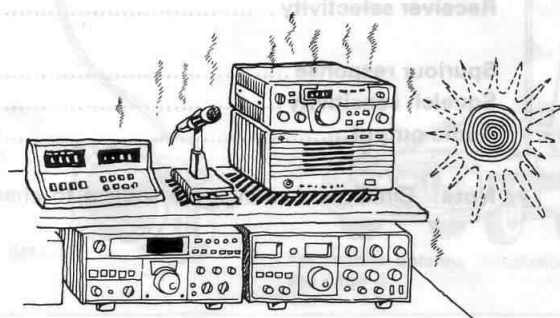
Do not install near heater outlet.



After parking in the sun, and inside temperature is HOT,
cool this unit BEFORE transmitting.



BEFORE connection, check polarity.



Keep equipment away from heat and out of direct
sunlight.

SPECIFICATIONS

[General]

Semiconductors	MPU 1 ICs .13 Transistors 54 FETs 6 Diodes 80
Frequency range	430.000 to 439.975 MHz
Frequency synthesizer	Digital control, phase locked VCO
Mode	FM (F3)
Antenna impedance	50 ohms
Power requirement	13.8V DC \pm 15%
Grounding	Negative
Operating temperature	-20°C to +50°C
Current drain	0.45A in receive mode with no input signal 3.4A in HI transmit mode (Approx.) 1.4A in LOW transmit mode (Approx.) Less than 3 mA for memory back up (from power supply)
Dimensions	147.5 mm (5 - 13/16") wide 51.5 mm (2") high 193.0 mm (7 - 5/8") deep (projections excluded)
Weight	1.5 kg (3.3 lbs) (approx.)

[Transmitter Section]

RF output power (at 13.8V DC, 50 Ω load)	HI 10 Watts min. LOW 1 Watt approx. (Adjustable)
Modulation	Variable reactance direct shift
Frequency tolerance	Less than $\pm 15 \times 10^{-6}$
(-20°C ~ +50°C)	
Spurious radiation	HI Less than -60 dB LOW Less than -50 dB
Maximum frequency deviation (FM)	± 5 kHz
RPT. Tone Frequency	1,750 Hz
Microphone	Dynamic microphone with PTT switch, 500 Ω

[Receiver Section]

Circuitry	Double conversion superheterodyne
Intermediate frequency	1st IF 21.6 MHz 2nd IF 455 kHz
Receiver sensitivity	Better than 1 μ V for 30 dB S/N Better than 0.4 μ V for 12 dB SINAD
Receiver selectivity	More than 14 kHz (-6 dB) Less than 30 kHz (-60 dB)
Spurious response	Better than 60 dB
Squelch sensitivity	0.35 μ V (threshold)
Audio output	More than 2.0 watts across 8 ohm load (10% dist.)

Note: Circuit and ratings are subject to change without notice due to developments in technology.

SECTION 1. PREPARATION FOR USE

1.1 INSTALLATION

1.1.1 Interconnection

Connect the antenna and power supply as shown in Fig. 1-1 for fixed station or mobile operation.

1.1.2. MOBILE installation

● Installation location

Using the supplied mounting bracket, install the transceiver under the dashboard or on the side of the console in your car.

Refer to Fig. 1-2.

If your car is equipped with an electronic fuel injector, the transceiver should be as far from the control equipment as possible.

● Antenna installation

Various types of antennas for 70 cm meters mobile operation are available.

NOTE:

For gutter-mount installation, the antenna bracket must be grounded to the car body as shown in Fig. 1-2. Affix the antenna securely, referring to the antenna instruction.

● Power supply

Connect the supplied power cord with fuse directly to the battery terminals. Connecting to the cigarette lighter socket can cause a poor connection, and excessive voltage drop.

● Back up power for the micro-processor

With power supplied from battery, the micro-processor keeps operating even when the power switch is OFF. In this case, current drain is very low, approximately 2.5 mA.

The car can be parked overnight with little battery power consumed.

However, when the car is to be parked for a long period of time (more than 1 month), it is advisable to disconnect the power plug. In this case, the back up function is disabled.

If power is disconnected, the back-up function is retained for only 1 — 1.5 sec. If instantaneous voltage drop at engine-starting continues for more than 2 sec, the micro processor will be reset and the memory cleared.

● Ignition noise

The transceiver is designed to suppress ignition noise; however, if excessive noise is present, it may be necessary to use suppressor spark plugs (with resistors).

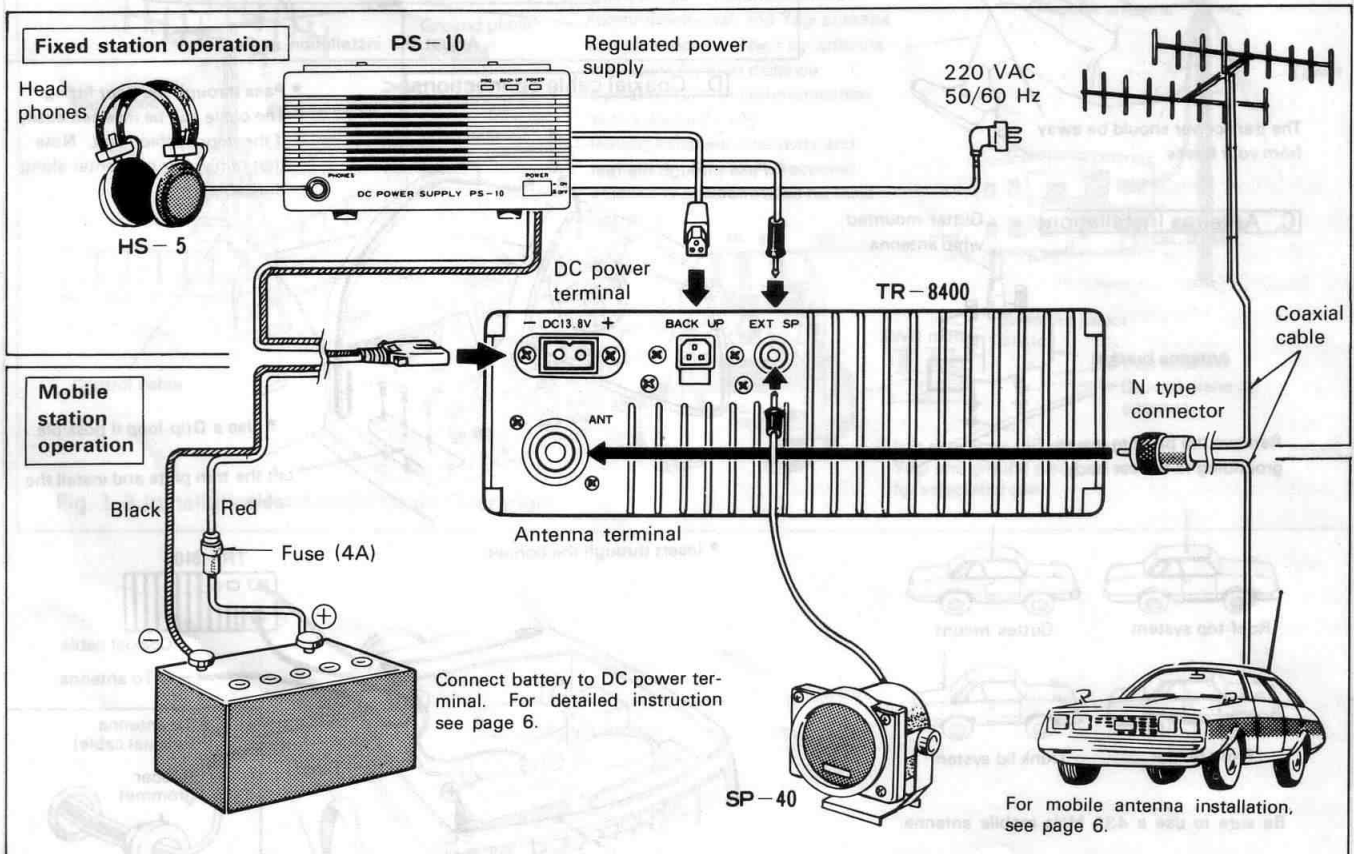


Fig. 1-1 Installation

SECTION 1- PREPARATION FOR USE

1.1.3. FIXED STATION installation

● Power supply (See Fig. 4)

The PS-10 power supply is available as an optional accessory. It is complete with a backup power cord and a speaker, and perfectly matches the design of your transceiver.

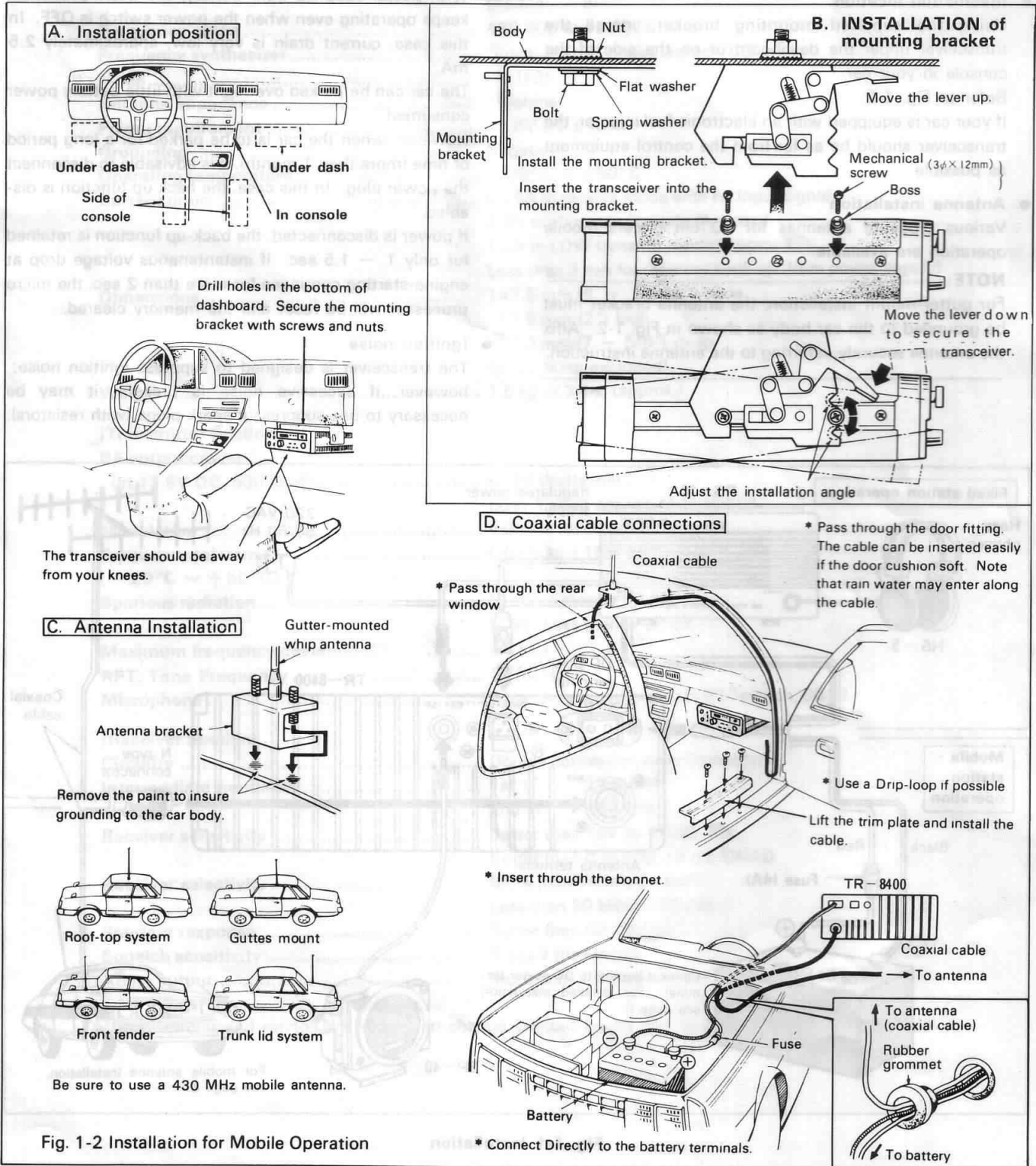


Fig. 1-2 Installation for Mobile Operation

● **Antenna (Fig. 1-3)**

Various types of fixed station antennas are commercially available. Select your antenna according to installation space and application (DX, local QSO, etc.). Note that the SWR of your antenna should be less than 1.5. A high SWR will cause the TR-8400 protective circuit to operate, reducing the transmit output power.

The TR-8400 is factory adjusted to deliver the rated RF output (10W) at about 435 MHz, where the RF meter indicates "6" on the 10-division scale. The RF meter will indicate about this point when the antenna SWR is less than 1.5.

● **Backup power for Micro-Processor (memory hold)**
With power supplied from battery, the micro-processor keeps operating even when the TR-8400 power switch is OFF.

If you desire to use the PS-10, connect the backup power cord to the BACKUP terminals at the rear of the TR-8400.

Backup function is retained even when the PS-10 power switch is OFF. If power is supplied from another power supply, the backup function is disabled when the power switch is OFF unless it is connected to the backup power terminal.

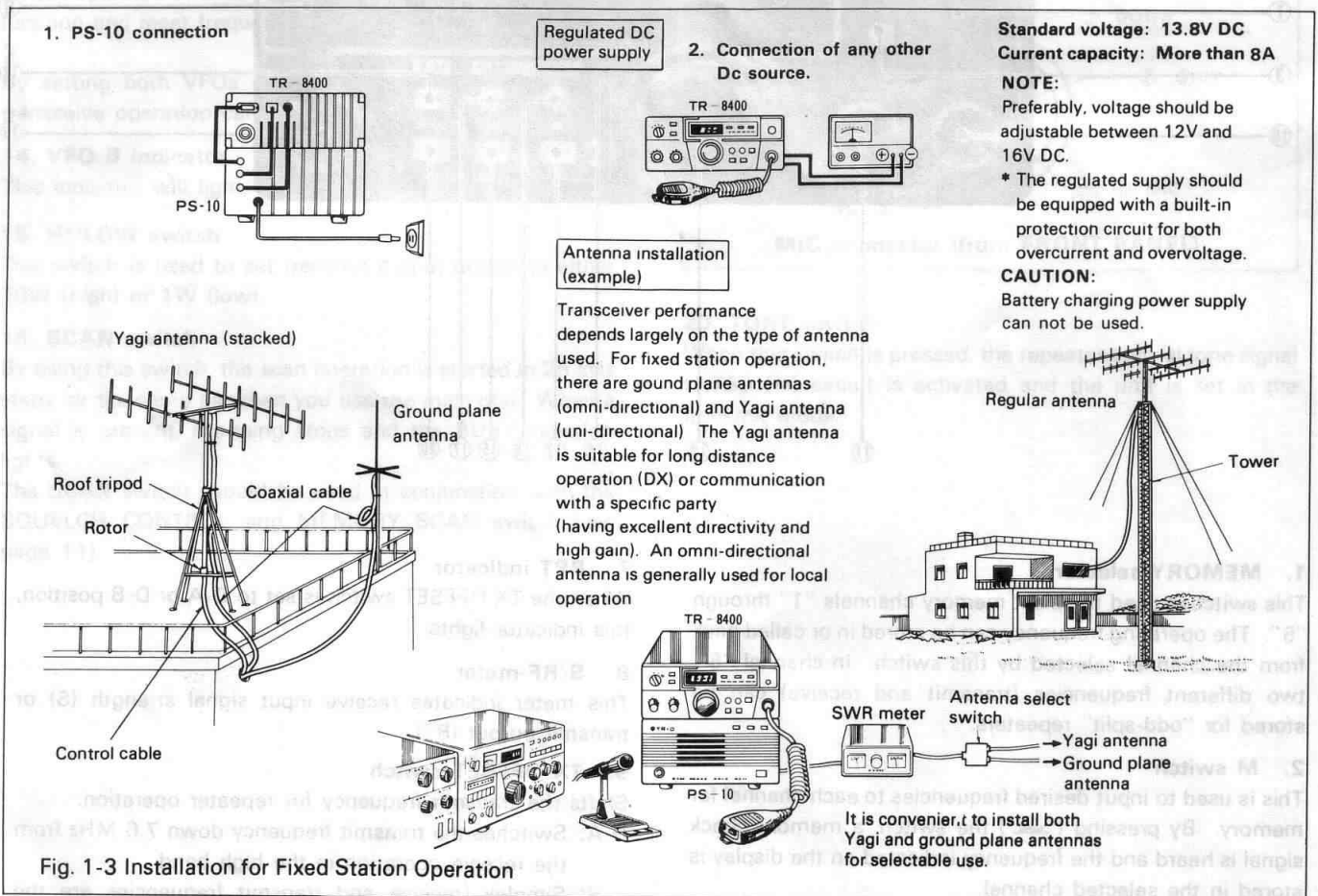
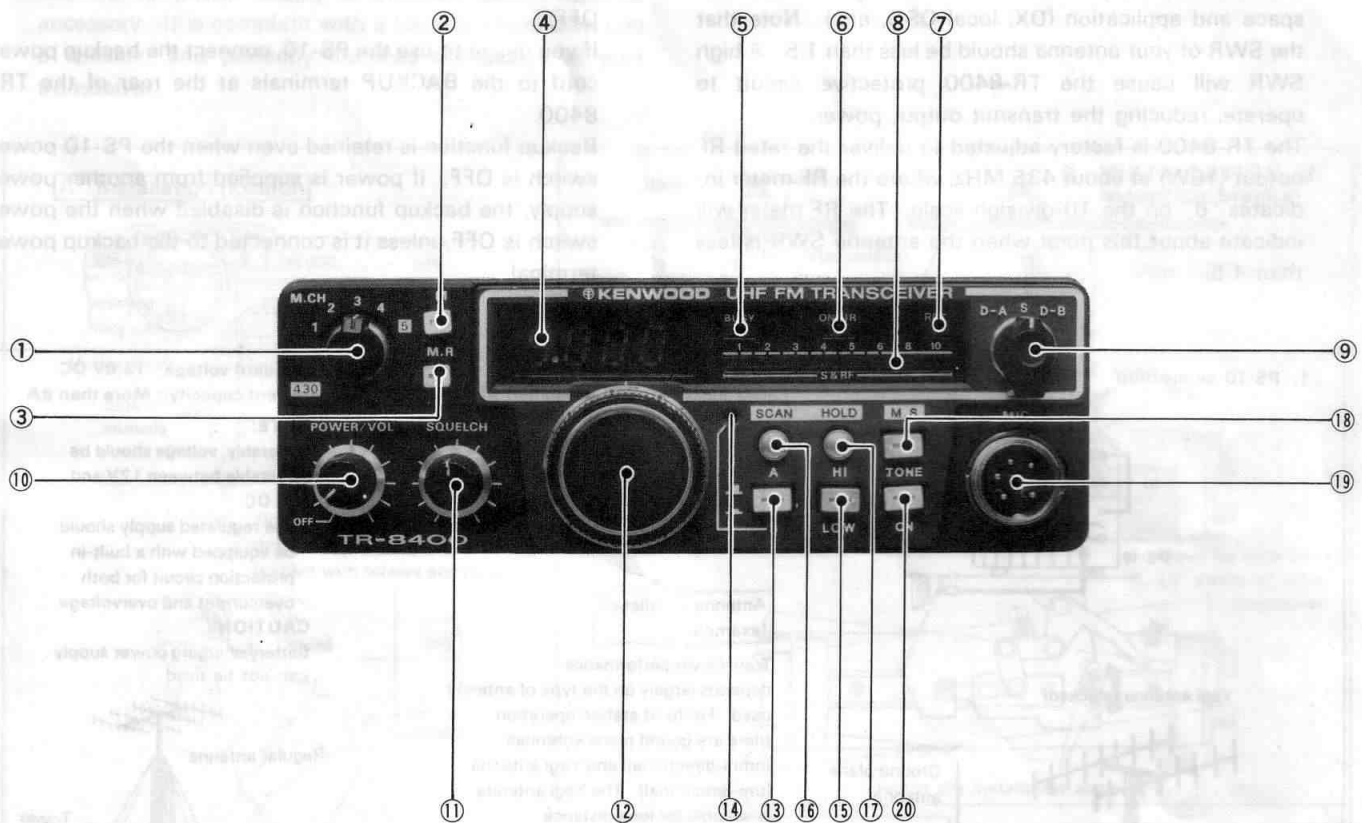


Fig. 1-3 Installation for Fixed Station Operation

10 POWER VOL
Power ON-OFF switch and volume control are combined
turning the control fully counterclockwise will turn the
power OFF. Clockwise rotation will increase the volume. In
the power OFF position, about 2 mA current is drawn to
back-up the micro-processor, provided the power cable is
connected to a constant power source.
To completely disable the transceiver, disconnect the power
cable.

3. MR switch
This is used to output memory frequencies from work
channel.
4. Frequency display
LEDs display the operating frequency in 4 digits (MHz -
kHz).
5. BUSY indicator
This lamp will light when the squelch is open to receive
mode.
6. ON AIR indicator
A light emitting diode (LED) will light in the transmit mode.


SECTION 2. CONTROLS AND TERMINALS



1. MEMORY selector

This switch is used to select memory channels "1" through "5". The operating frequency can be stored in or called back from the channel selected by this switch. In channel "5", two different frequencies (transmit and receive) can be stored for "odd-split" repeaters.

2. M switch

This is used to input desired frequencies to each channel for memory. By pressing () the switch, a memory check signal is heard and the frequency indicated on the display is stored in the selected channel.

3. MR switch

This is used to output memory frequencies from each channel.

4. Frequency display

LEDs display the operating frequency in 4 digits (MHz — 1 kHz).

5. BUSY indicator

This lamp will light when the squelch is open in receive mode.

6. ON AIR indicator

A light emitting diode (L.E.D.) will light in the transmit mode.

7. RPT indicator

When the TX OFFSET switch is set to D-A or D-B position, this indicator lights.

8. S/RF-meter

This meter indicates receive input signal strength (S) or transmit output (RF).

9. TX OFFSET switch

Shifts the transmit frequency for repeater operation.

D-A: Switches the transmit frequency down 7.6 MHz from the receive operation in the high band.

S: Simplex (receive and transmit frequencies are the same.)

D-B: Switches the transmit frequency down 1.6 MHz from the receive frequency in the low band.

10. POWER/VOL

Power ON-OFF switch and volume control are combined. Turning the control fully counterclockwise will turn the power OFF. Clockwise rotation will increase the volume. In the power OFF position, about 2.5 mA current is drawn to back-up the micro-processor, provided the power cable is connected to a constant power source.

To completely disable the transceiver, disconnect the power cable.

SECTION 3. OPERATION

11 SQUELCH

The squelch control is used to eliminate noise during no-signal time. Normally, this control is adjusted clockwise until the noise disappears and the BUSY indicator goes off (threshold level).

12. Main tuning

A click-type rotary digital VFO control selects transmit and receive frequencies. Frequency is changed in 25 kHz steps. This digital VFO control is continuous, changing frequency from the upper to lower end of the band.

13. VFO A/B SWITCH

This switch is used to select VFO-A or VFO-B. Pressing the switch operates VFO-B. VFO-A and VFO-B are the same in function and reset frequency (440.000 MHz). See Note 5-3.

By setting both VFOs to your desired frequencies, quick transceive operation can be achieved.

14. VFO-B indicator

This indicator will light when VFO-B is in operation.

15. HI/LOW switch

This switch is used to set transmit output power to either 10W (high) or 1W (low).

16. SCAN switch

By using this switch, the scan operation is started in 25 kHz steps, or the same as when you use the main dial. When a signal is present, scanning stops and the BUSY indicator lights.

The SCAN switch should be used in conjunction with the SQUELCH CONTROL and MEMORY SCAN switch (see page 11).

17. HOLD switch

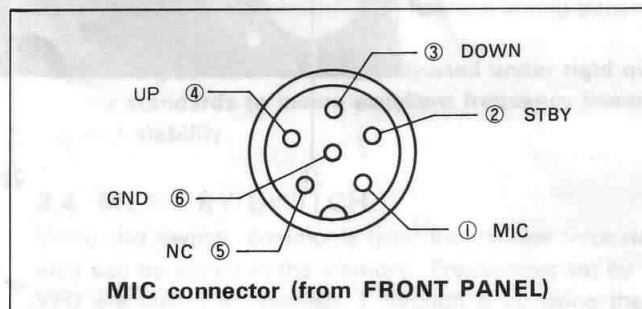
Pressing this switch releases scan operation or stops memory scan. The microphone PTT switch is also used to stop memory scan.

18. M.S (MEMORY SCAN) switch

Press this switch and the memory channels 1 ~ 5 are scanned. The scan operation stops at a channel where signal is present. This switch should be used in conjunction with the SQUELCH control (see page 11).

19. MIC connector (6-pin)

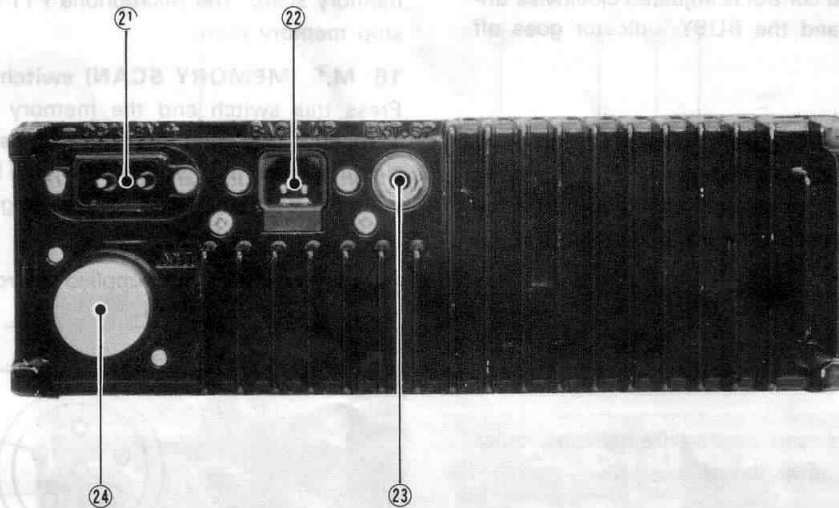
For connection of the supplied microphone.



20. TONE switch

When this switch is pressed, the repeater control tone signal (1,750 Hz) circuit is activated and the unit is set in the transmit mode.

SECTION 2. CONTROLS AND TERMINALS



21. DC power terminal

DC power input terminal. Connect the supplied power cord with plug. Input voltage is 13.8V DC. Observe correct plus (+) and minus (-) polarity.

22. Back up power terminal

This connector is used for back-up in fixed station operation. The micro-processor retains the VFO frequency memory function even when the power switch is turned OFF, when back-up power is supplied.

23. EXT terminal

External speaker terminal. Connect a 8 ohm speaker using the supplied plug.

24. ANT terminal

Connect 50Ω for 70 cm.

25. PTT switch

Press-to-talk switch used for transmission. This will also release scan operation.

26. DWN switch

This switch is used to step down the digital VFO frequency. When operating the switch, tone will sound.

27. UP switch

This switch is used to step up the digital VFO frequency. When operated, a tone will sound. When the DWN or UP switch is depressed continuously frequency shifts rapidly. Pressing both the UP and DOWN switches simultaneously results in stopping the VFO operation.

SECTION 3. OPERATION

3.1 TRANSMITTER PRECAUTIONS

1. The TR-8400 antenna impedance is 50 ohms. Be sure to connect an antenna of 50 ohms impedance.
2. Check the transmit frequency before operating to insure that you do not interfere with other stations.
3. By pressing the microphone PTT switch. The TR-8400 is set in transmit mode; the ON AIR indicator will light and the meter indicates transmit power. Hold the microphone at about 5 cm when speaking.

3.2 FREQUENCY SELECTION AND THE 2-VFO SYSTEM

The TR-8400 uses a PLL synthesizer circuit controlled by micro-processor. The VFO frequency is shifted in 25 kHz steps by turning the click-type main dial. Eight revolutions of the dial covers the frequency range from 430.000 to 439.975 MHz.

The TR-8400 incorporates two VFO, VFO-A and VFO-B. Selection is by the VFO A/B switch. VFO-A and VFO-B are the same in function and each can be set to the desired frequency.

The main dial is a continuous rotary selector, changing frequency continuously from the upper to the lower end of the band. Operating frequencies are basically tuned by the main dial. Turning the dial to the right will shift the frequency up, and vice versa.

The VFO frequency can also be step-tuned by the microphone UP/DOWN switch. A tone will sound at each switch press.

The VFO frequency shifts rapidly when the switch is continuously depressed. The tone will then become continuous.

[NOTE]

If the transceiver is not connected for backup function (e.g. the TR-8400 power cord is disconnected or the BC-1 AC cord is not plugged in the backup power terminal), VFO-A and VFO-B will be reset to 0.000 (430.000 MHz) or 5.000 (435.00 MHz), depending on the initial operating condition of the micro-processor when the power switch is again turned ON.

3.3 PRIORITY OF CONTROLS

1. Since all the functions are controlled by a micro-processor, the transceiver must be operated in the priority order given in the following Table. For example, the digital VFO will not operate when the main dial is turned during MR operation. Also, it will not operate unless scan operation is released by the HOLD switch or the microphone PTT switch, even if scan is stopped for a brief period of time in receive mode.

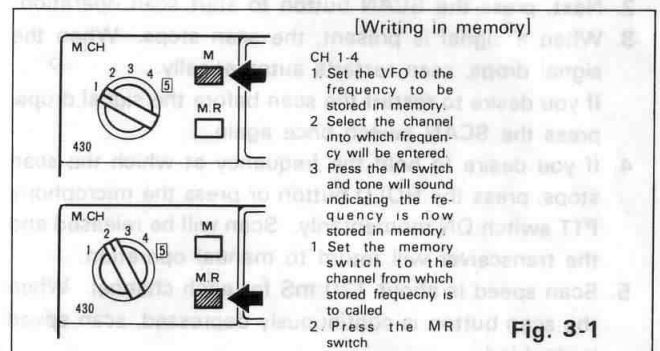
Sequence/Operation	Function	Switch or Controls
1	Memory recall	MR ON
2	Scan operation	SCAN, HOLD ON
3	UP/DOWN operation	UP/DOWN ON
4	Digital VFO	Main dial
5	Memory Write	M ON

Table 3-1

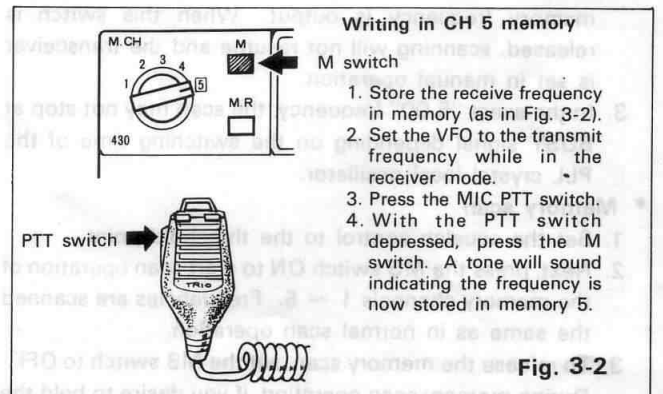
2. The micro-processor is programmed to operate in receive mode, except one transmit frequency is also stored in memory channel '5'. Note that the main dial and UP/DWN controls do not function during transmission.
3. **The digital VFO is factory adjusted under rigid quality standards to insure excellent frequency linearity and stability.**

3.4 MEMORY SWITCH

Using this switch, commonly used frequencies (repeaters, etc.) can be stored in the memory. Frequencies set by the VFO are stored in channels 1 through 5 by using the M switch. Stored frequencies can be called-up by placing the MR switch ON.



Two different frequencies (transmit and receive) can be stored in channel 5, so the transceiver will operate on any repeater split. The receiver frequency is stored in memory just as for channels 1-4. To store the transmit frequency in memory, set the transmit frequency in the receiver mode and then press the M switch in the transmit mode. (See Fig. 3-2)



[Note]

1. When a memory is vacant, the memory frequency is 430.000 MHz. By pressing the MR switch or MS switch to ON, to indicate that the memory frequency is 430.000 MHz.
2. To clear a frequency stored in memory, simply store a new frequency in that memory channel. The frequency is also cleared by setting the power switch to OFF provided that the TR-8400 is not connected for backup operation.
3. In the "CH 5" position, if a tone is heard and the frequency display indicated "5.00" when the transceiver is switched from receive to transmit mode, reset by momentarily setting the transceiver in the receive mode.

3.5 SCAN OPERATION

The TR-8400 scan operation is classified into normal scan (scan stops at a signal and restarts when the signal is absent) and memory scan (CH 1 ~ 5 Receive).

*** Normal scan**

1. Set the squelch control to the threshold point (noise disappears at no signal time and the BUSY indicator goes off).
2. Next, press the SCAN button to start scan operation.
3. When a signal is present, the scan stops. When the signal drops, scan restarts automatically.
If you desire to restart the scan before the signal drops, press the SCAN switch once again.
4. If you desire to hold the frequency at which the scan stops, press the HOLD button or press the microphone PTT switch ON momentarily. Scan will be released and the transceiver will return to manual operation.
5. Scan speed is about 120 mS for each channel. When the scan button is continuously depressed, scan speed is doubled.

[Note]

1. During scan operation, including temporary scan stop, the frequency cannot be changed by the main dial or the microphone UP/DOWN switch. To change frequency, it is first necessary to release the scan by pressing the HOLD button or MIC PTT switch.
2. If the MR switch is pressed during scan operation, the memory frequency is output. When this switch is released, scanning will not resume and the transceiver is set in manual operation.
3. In the exact "5.00" frequency, the scan may not stop at BUSY signal depending on the switching time of the PLL crystal local oscillator.

*** Memory scan**

1. Set the squelch control to the threshold point.
2. Next, press the MS switch ON to start scan operation of the memory channels 1 ~ 5. Frequencies are scanned the same as in normal scan operation.
3. To release the memory scan, set the MS switch to OFF. During memory scan operation, if you desire to hold the

frequency at which the scan stops, press the HOLD button. If you wish to use any frequency other than the memory frequency, the scan operation should be released by setting the MS switch to OFF.

3.6 TX OFFSET SWITCH

The TX OFFSET switch, used for selecting simplex or repeater operation, has three positions.

If the transmitter frequency is shifted beyond the high or low frequency limits, the transceiver will operate in simplex mode, and a warning tone will sound during transmit.

D-A: The transmitter frequency is 7.6 MHz lower than the receiver frequency in the high band (435.000 ~ 439.975 MHz).

S: The TR-8400 operates in the usual simplex mode. That is, receive and transmit frequencies are the same.

D-B: The transmitter frequency is 1.6 MHz lower than the receiver frequency in the low band (430.000 ~ 434.975 MHz).

3.7 SQUELCH

To eliminate the noise at no-signal condition turn the squelch slowly clockwise until the noise disappears and the BUSY lamp goes off (threshold point).

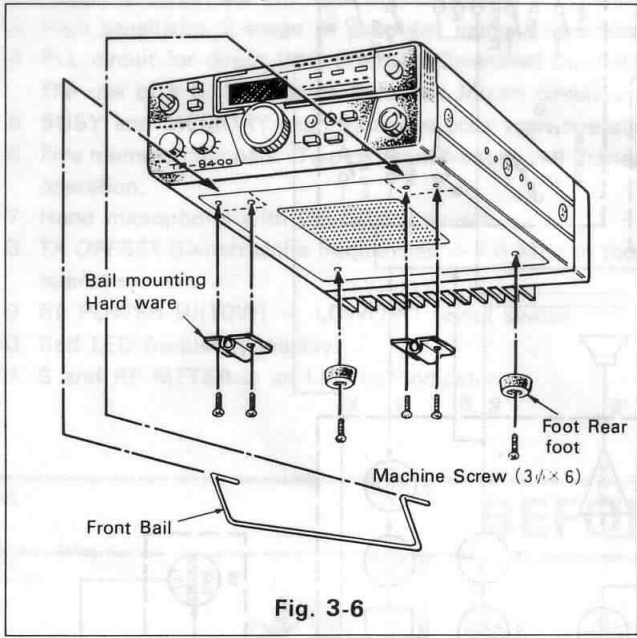
Adjust the VFO to an empty frequency. The BUSY lamp will light and the speaker will operate when a signal is received. The squelch control is also used for auto scan operation control.

If the signal is weak or fades during mobile operation, readjust the squelch for best operation.

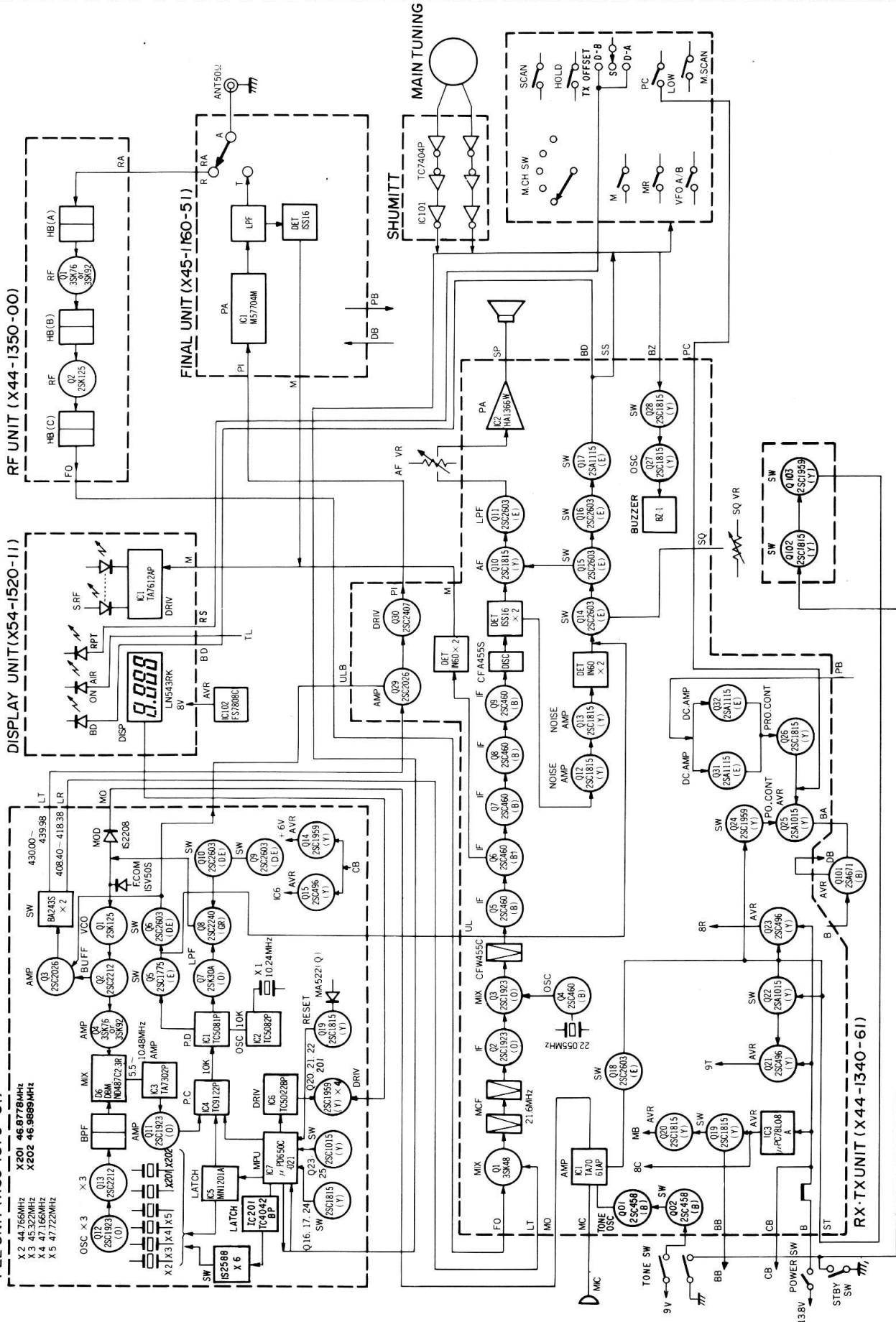
3.8 HI/LOW SWITCH

For local FM communication, it is recommended that power be reduced to eliminate interference to other stations and to minimize power consumption. By pressing the HI/LOW switch, transmit power is reduced from 10W to about 1W, while the RF meter reading is about 2 or 3.

3.9 BAIL AND FOOT INSTALLATION



BLOCK DIAGRAM



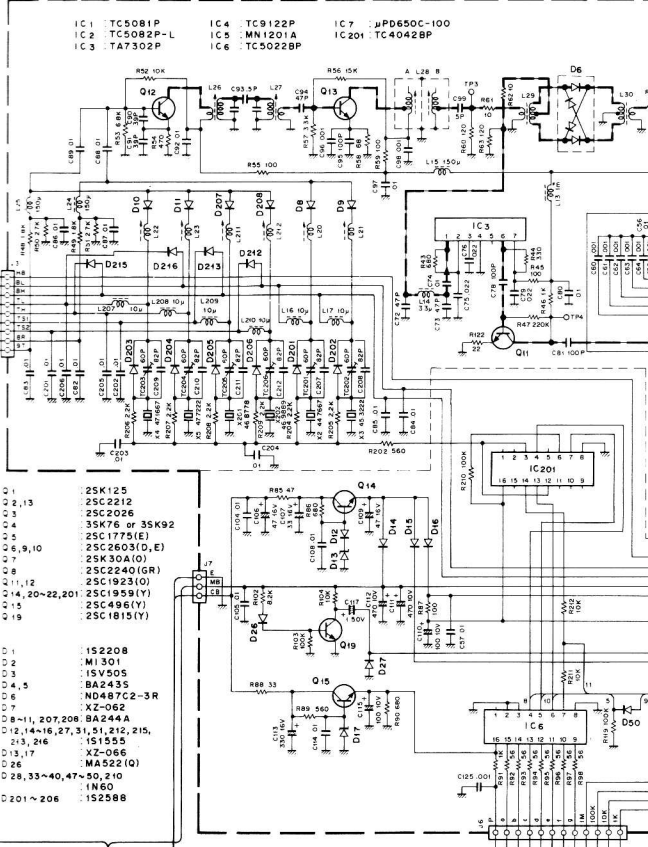
ROBINE 000-50
 computer 25-75

TX HI
 TX HI
 TX HI
 TX HI
 TX HI
 TX HI
 TX HI

SCHEMATIC DIAGRAM

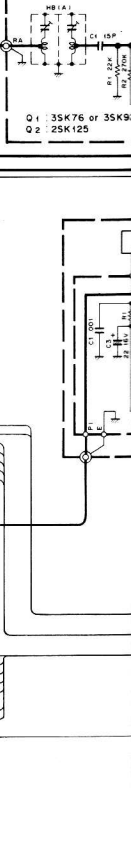
1004F TP2

PLL UNIT (X50-1670-61)

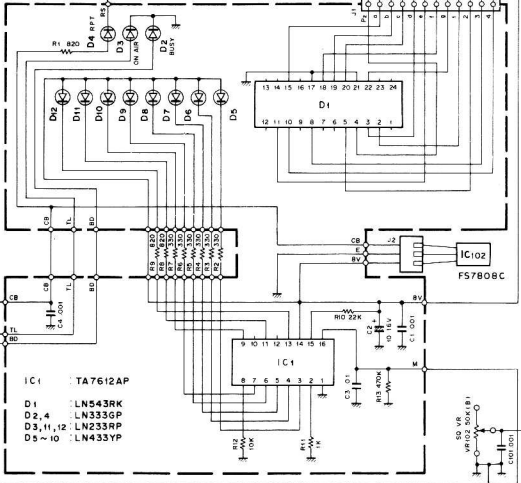


- 25K125
- 25C2262
- 25C2026
- 25C1775(E)
- 25C2603(D,E)
- 25K30A(O)
- 25C2240(GR)
- 25C1923(O)
- 25C1959(Y)
- 25C496(Y)
- 25C1815(Y)
- 1S2208
- M1301
- 1SV505
- BA2435
- ND487C2-3R
- XZ-062
- BA244A
- 12,14,16,27,31,51,212,215,218,246 1S1525
- XZ-066
- MA522(O)
- 28,33-40,47-50,210 1N60
- D201-206 1S2588

RF UNIT (X44-1350-00)

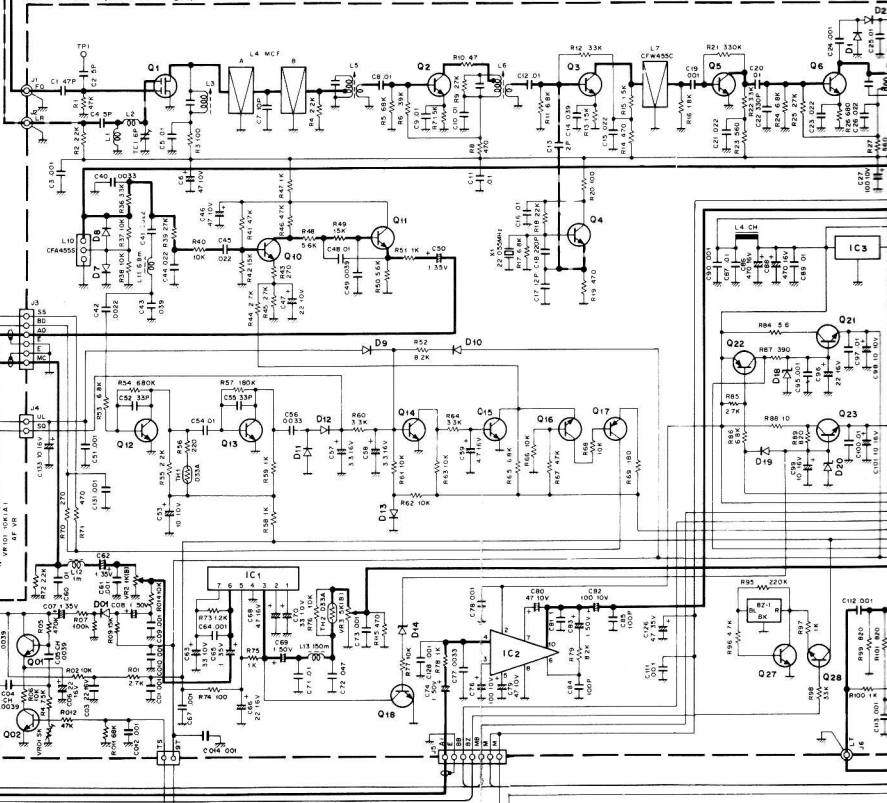


INDICATOR UNIT (X54-1520-00)

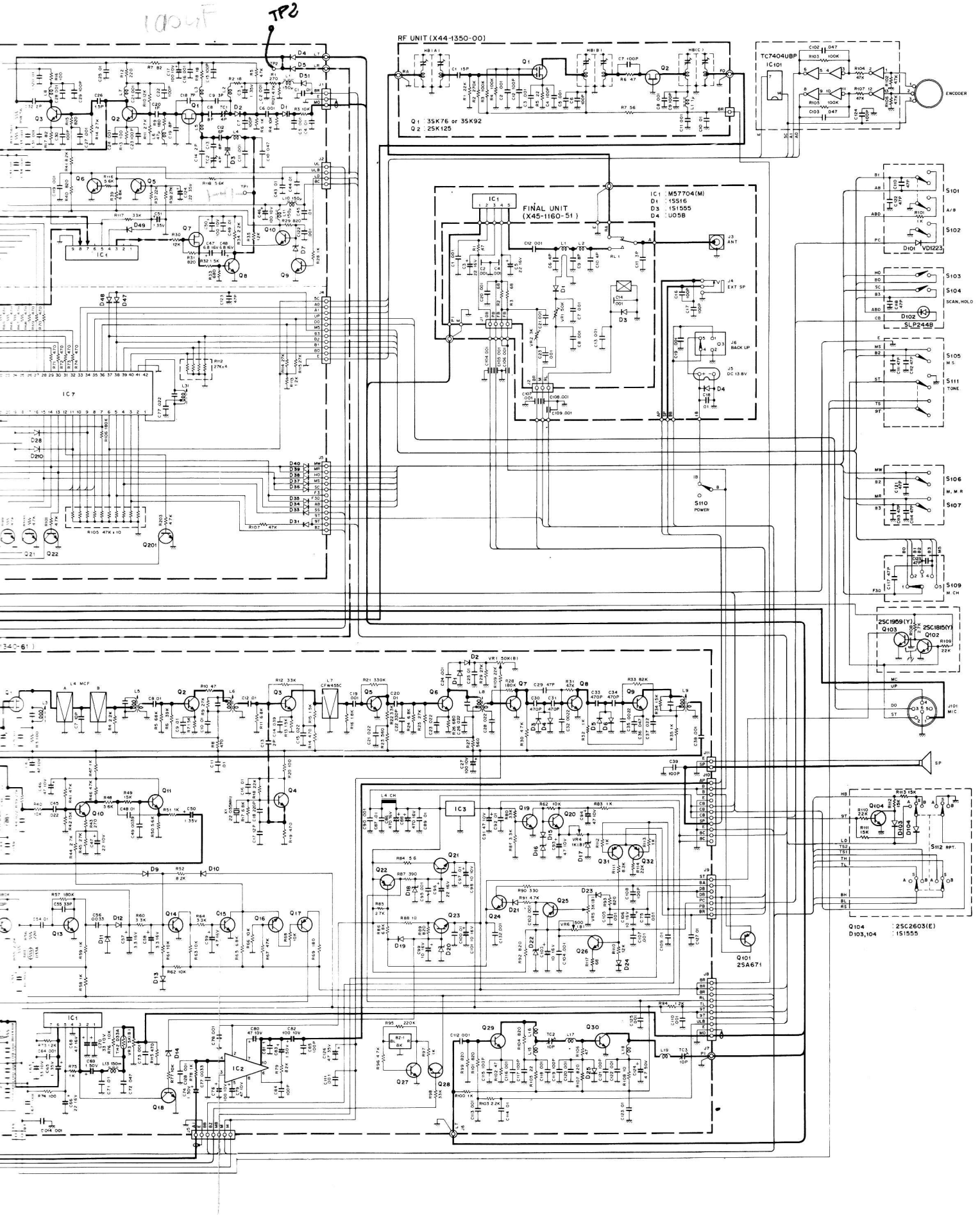


- Q1 35K48
- Q2,3 25C1923(O)
- Q4-9 25C4601(B)
- Q10,12,13,19,20,27,28 25C1815(Y)
- Q11,14-16,26 25C2603(E)
- Q17,31,32 25A1115(E)
- Q21,23 25C496(Y)
- Q22,25 25A1015(Y)
- Q24 25C1959(Y)
- Q29 25C2026
- Q30 25C2407
- Q01,02 25C4968
- D1,2,11,12 1N60
- D3,6,9,10,15,19,21,23-25,27,8 1S1555
- D7,8 1S1516
- D13 1S1212
- D14 WZ-040
- D16 XZ-066
- D17 XZ-070
- D18 WZ-100
- D20 XZ-094
- D22 XZ-060
- IC1 TA7061AP
- IC2 HA1366W
- IC3 μ PC7810BA

RX TX UNIT (X44-1340-61)



SCHEMATIC DIAGRAM



A product of
TRIO-KENWOOD CORPORATION

17-5, 2-chome, Shibuya, Shibuya-ku, Tokyo, 150, Japan

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