



**2m FM
HANDY TRANSCEIVER
Model TR-2300**



OPERATING MANUAL

INTRODUCTION

Your Model TR-2300 is a high-quality 2 m (144 MHz band) transceiver for use in amateur radio mobile stations as well as fixed stations.

It is small and light weight, and is equipped with PLL synthesizer control system for a wide coverage of 80 channels and one fixed channel. The type of wave is F3 and the transmit output is 1W.

Note:

Save the packing box and materials in case the unit needs to be shipped for repair or mobile operation.

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ACCESSORIES

The following accessories are supplied with TR-2300:

| | | | |
|--|---|---|---|
| (1) Dynamic microphone (with 4P plug) | 1 | (8) Battery case A (for six batteries) | 1 |
| (2) 1/4λ whip antenna (built-in) | 1 | (9) Battery case B (for four batteries) | 1 |
| (3) Dummy battery | 1 | (10) Battery charger | 1 |
| (4) External speaker plug | 1 | (11) Hook | 1 |
| (5) Soft case | 1 | (12) Screw, 3φ | 2 |
| (6) Shoulder strap | 1 | (13) Instruction manual | 1 |
| (7) Power plug with lead (external power cord) . . | 1 | | |

SPECIFICATIONS

GENERAL

| | | |
|--|--|--|
| Semiconductor | Transistors | 24 |
| | FETs | 7 |
| | ICs | 7 |
| | Diodes | 33 |
| Frequency Range | 144.0 to 146.0 MHz | |
| Operating Temperature | -20°C to +50°C | |
| Operating Voltage | External: | DC 13.0 V |
| | Internal: | Ni-Cd battery (UM-3 type) x 10 UM-3 dry battery x 9 |
| Operating Voltage Range | DC 9.6 ~ 16 V | |
| Grounding | Negative grounding | |
| Antenna Impedance | 50 ohms | |
| DC Current (at DC 13.0 V) | Approx. 45 mA in receive with no input signal Less than 450 mA in transmit (1 W, 50 ohm load) | |
| Dimensions | 122 (134) W x 51 (52) H x 175 (198) D mm Figure in () include projections. | |
| Weight | Approx. 1.2 kg (with 10 Ni-Cd batteries) | |

TRANSMIT SECTION

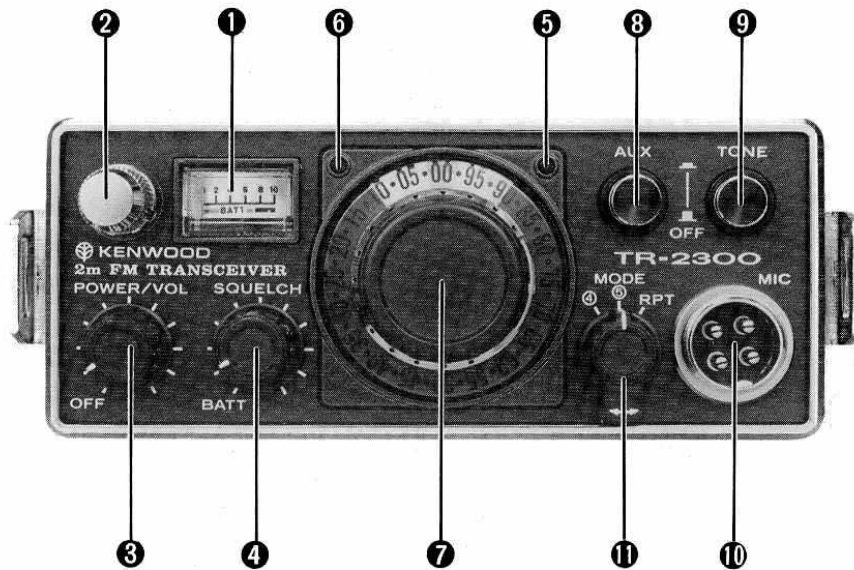
| | |
|---------------------------------------|--|
| Frequency | 144 MHz band, 40 channels 145 MHz band, 40 channels AUX, 1 channel |
| Type of Wave | F3 |
| RF Output | 1 W |
| Modulation | Reactance modulation (variable reactance frequency modulation) |
| Max. Frequency Deviation | ± 5 kHz |
| Spurious Radiation | Less than -60 dB (higher harmonic less than -50 dB) |
| Microphone | 500 ohms, dynamic type, with press-to-talk switch |

RECEIVE SECTION

| | |
|-------------------------------------|--|
| Frequency | 144 MHz band, 40 channels 145 MHz band, 40 channels AUX, 1 channel |
| Type of Wave | F3 |
| Receive System | Double superheterodyne |
| Intermediate Frequency | 1st IF: 10.7 MHz 2nd IF: 455 kHz |
| Sensitivity | 1μV for 30 dB S/N Less than 0.4μV for 20 dB noise suppression |
| Squelch Sensitivity | Less than 0.25μV |
| Passband Width | More than 14 kHz at 6 dB down |
| Selectivity | Less than 32 kHz at 60 dB down |
| Audio Output | More than 0.7 W across 8 ohm load (10% distortion) |

Note: The circuit and ratings may change without notice due to development in technology.

SECTION 1. OPERATING PARTS AND THEIR FUNCTIONS



1 Meter

This meter indicates the strength of receiver input signal (S) and transmitter output signal (RF). It is also used as a power voltage checker. The indications of input and output signals are automatically switched when the unit is set in the transmit or receive mode. When checking the power voltage, set the SQU knob (4) to the BATT position.

2 Whip Antenna

When the unit is used as a portable rig, pull out the whip antenna to its full length. The whip antenna can be removed from the unit by unscrewing it to the left. If an external antenna is to be used, do not remove the whip antenna but retract it until it is fully stored in the unit.

3 POWER/VOL Knob

This knob has two functions; power ON/OFF and receiver volume control. To turn off the power, rotate the knob fully counterclockwise.

4 SQUELCH Knob

This knob has two functions; battery check and squelch control. To check the battery voltage, rotate the knob fully counterclockwise (BATT position).

For squelch adjustments, rotate the knob clockwise. The squelch will be ON at about the center position of the turning range.

5 AUX Lamp

This lamp (light emitting diode) will light when the AUX switch is set to ON (). The lamp goes off when the lamp switch (12) is set to OFF.

6 ON AIR Lamp

This lamp (light emitting diode) will light when the unit is set in transmit mode.

7 MAIN Knob (frequency selector switch)

This knob is used to select the desired channels. It turns either clockwise or counterclockwise. It has 40 channel steps. The knob is calibrated from 00 to 05, 10 in 50 kHz increments ($\times 10$ kHz). One step represents 25 kHz (see Table 1).

The knob has a large notch at the "00" position for quick reference during operation.

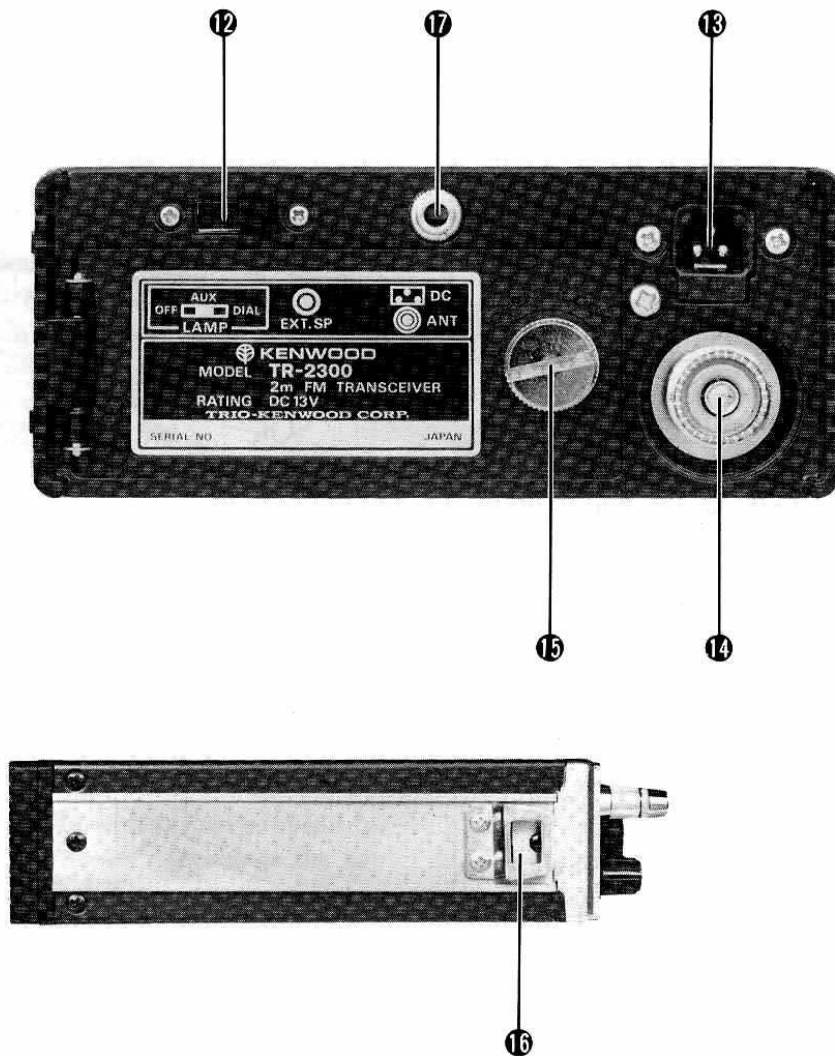
8 AUX Switch

This switch is used for fixed channel operation. When the switch is pressed (), the unit is set for fixed channel operation regardless of the position of the 4-5-RPT knob. By pressing the switch once again (), the unit is set to the frequency indicated on knobs.

(For the use of the AUX switch, refer to Section 4.)

9 TONE Switch

When this switch is pressed (), the repeater control tone signal (1750 Hz) circuit is activated and the unit is set in the transmit mode.



10 MIC Connector

Connect the accessory microphone to this connector. By pressing the microphone switch, the unit is set in the transmit mode.

11 4-5-RPT Knob

This switch is used for 144 MHz, 145 MHz band operation and repeater operation on 145 MHz band. At the RPT position, the main knob indicates a receive frequency. The transmit frequency is 600 kHz below the receive frequency. (For details, refer to Section 4.)

12 LAMP Switch

The lamp in the main knob and the AUX lamp will light when this switch is set to the DIAL (right) position. The AUX lamp will light at the AUX (center) position. In the OFF position, both lamps go off. (For details, refer to Section 4.)

13 External Power/Charge Terminal

Connect an external power supply (DC 13V) with the supplied power cable plug (DC cord) referring to Fig. 9. This terminal is also used to charge Ni-Cd batteries (see page 7).

14 External Antenna Terminal

An external antenna of 50-ohm impedance is connected to this terminal. For connection, use a UHF type connector.

15 Battery Removing Screw

To remove the battery, turn this screw using a coin.

16 Shoulder Strap Hook

Used to secure the supplied shoulder strap.

17 Earphone/External Speaker Terminal

For connection of an earphone or external speaker, use the supplied plug.

SECTION 2. PREPARATION FOR OPERATION

Your TR-2300 is used as a hand-carried operation, fixed station operation or mobile station operation. Before using, prepare the unit to insure correct operation.

BATTERY LOADING

To load batteries, proceed as follows.

- ① Turn the battery removing screw at the bottom of the case using a coin and open the lid of the battery case (Fig. 1).

- ② Load nine UM-3 batteries or alkaline batteries (1.5V per cell) and the supplied dummy battery into the battery case. The dummy battery may be inserted in any place in the case.

Note:

When loading, ascertain that the battery polarity is correct.

- ③ When Ni-Cd batteries (1.2V per cell) are to be used, load 10 batteries or accessory Ni-Cd Battery Pack "PB-15". Refer to the instructions on the lid of the battery case.

- ④ Close the lid of the battery case and lock the battery removing screw.

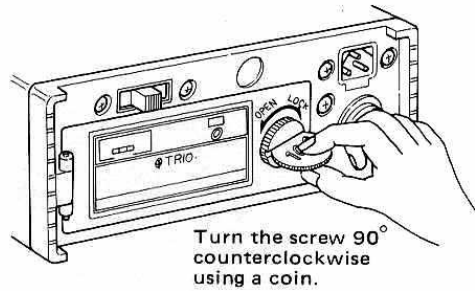


Fig. 1 How to Open the Lid

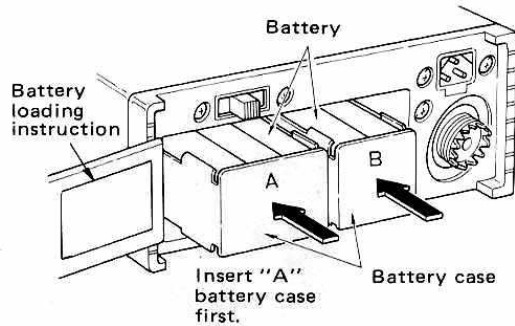


Fig. 2 Battery Case

VOLTAGE CHECK

After the batteries have been loaded, check the battery voltage according to the procedure below.

- ① Set the SQUELCH knob to the BATT position by turning it fully counterclockwise.
- ② Turn the power switch (POWER/VOL) to ON.
- ③ When the meter indication is as shown in Fig. 4 (a), it means that the batteries are weak. Replace all the batteries. In the case of Ni-Cd batteries, recharge the batteries referring to page 7.

Note:

When external power supply is used, the meter indicates the voltage of the external power.

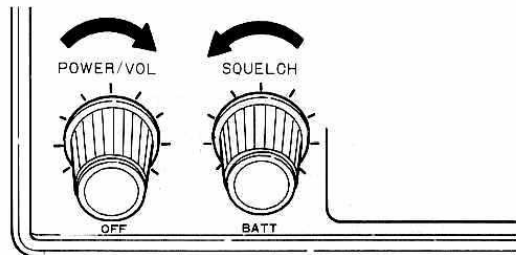


Fig. 3

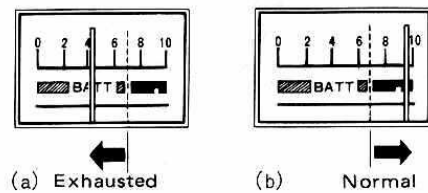


Fig. 4 Voltage Check

COMPARISON BETWEEN MANGANESE BATTERY AND Ni-Cd BATTERY

When the voltage of Ni-Cd battery decreases to 1.0V or less, the energy of the battery is reduced to less than 1/10 of the initial value and, therefore, the battery must be charged. Fully charged battery will last for about 3 hours when used at the rate of 1 minute transmission and 3 minutes reception (squelch ON), while manganese batteries will last for about 1 hour. For this reason, it is advisable to use Ni-Cd batteries to insure more satisfactory performance of the unit and longer battery life.

BATTERY CHARGING

- ① Check the battery voltage (see page 6) before charging. The battery should be recharged before the battery voltage is reduced to 9.6V (between red and black zones of meter).
- ② Before charging, be sure to turn the power switch (POWER/VOL) to OFF.
- ③ The unit is equipped with special terminals for charging Ni-Cd batteries. To charge the batteries, use the supplied battery charger as shown in Fig. 5. It takes about 15 hours until the batteries are fully charged.

Notes:

1. When the batteries have been fully charged, do not attempt to continue charging. The batteries should be charged at temperatures of 0°C ~ 45°C.
2. Never try to charge normal type dry batteries or alkaline batteries, since they are not designed to be charged. If charged, a gas will be developed which causes explosion of the batteries, resulting in damage to the unit.

USE OF COAXIAL CABLE

A coaxial cable should be used between the antenna and the transceiver. Since the coaxial cable is subject to loss in high frequency band such as a 144 MHz band, it must be of a low loss (thick) type, particularly for fixed station operation where a long cable is required. (Use the coaxial cable with 50 ohms).

The coaxial cable used in the antenna system should be less than 1.5 in SWR (standing wave ratio). Optimum SWR is obtained when the cable length is $\lambda \times 0.67$ (λ : wave length, 0.67 : cable reduction ratio) times integral number.

Table 1 Types of Batteries

| | |
|-------------------|---|
| Manganese battery | Normal type 1.5V dry battery (non-rechargeable). |
| Alkaline battery | This type of battery uses caustic potash as electrolyte and is superior in performance to manganese battery. It is interchangeable with manganese battery (alkaline battery is non-rechargeable). |
| Ni-Cd battery | Nickel-cadmium (Ni-Cd) battery (rechargeable). |

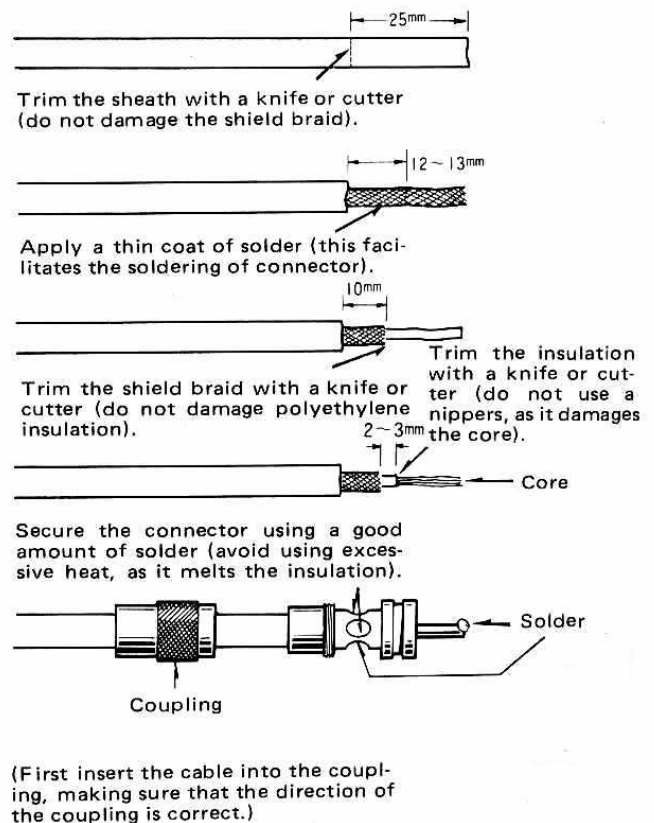
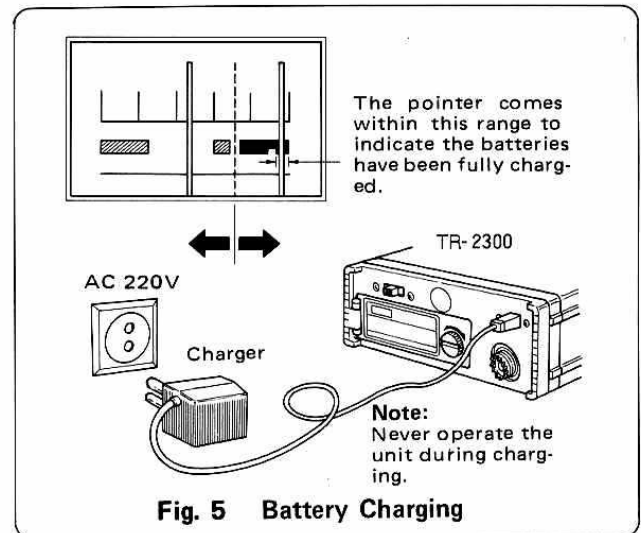


Fig. 6 Mounting the UHF Type Connector

SECTION 3. INSTALLATIONS

HAND-CARRIED OPERATION

- ① Load the batteries (see "Battery Loading").
- ② Attach the supplied carrying strap as shown in Fig. 7.
- ③ Attach the hook as shown in Fig. 7.
- ④ Insert the connector of the supplied microphone into the microphone jack. The microphone may be hung on the hook.

Note:

When the unit is to be moved from one location to another with the antenna left extended, care should be taken not to damage the antenna.

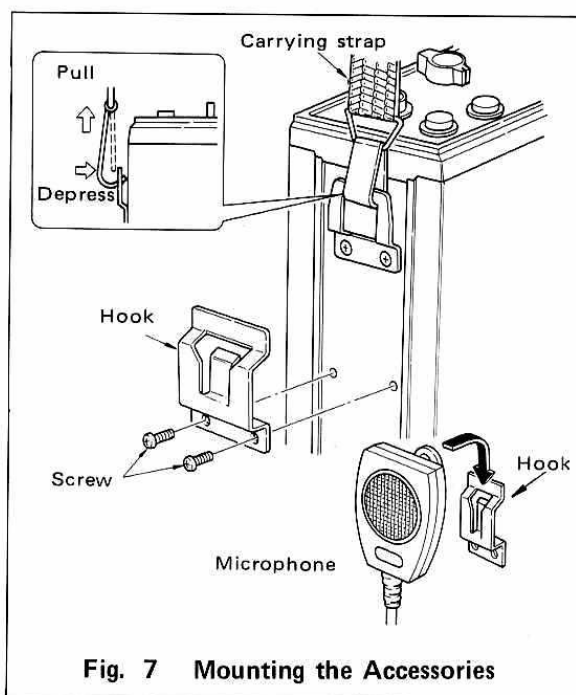


Fig. 7 Mounting the Accessories

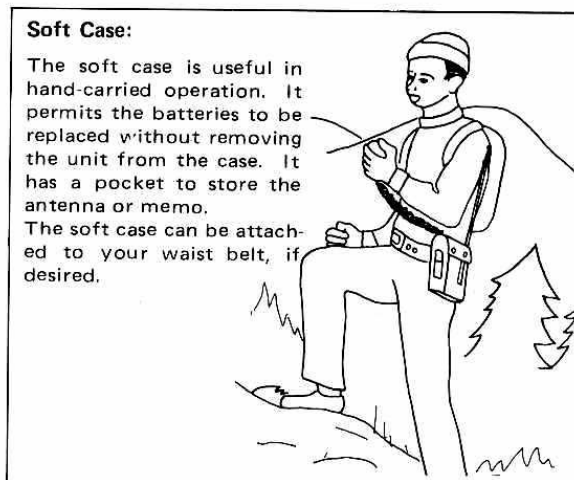
MOBILE STATION OPERATION

- ① For mobile station operation, the unit can be connected to a car battery (DC 13.8V) or accessory position on the fuse block. Make certain that the yellow lead is connected to the positive (+) post and the black lead to the negative (-) post. In this case, use a line filter between the unit and the battery to prevent noise generated from the power system. To supply the power from car battery, the unit may be connected to the cigarette lighter socket installed in the car (Fig. 8).

Note:

Be sure to use a fuse (1A) between car battery and the unit.

- ② Various types of car antennas are available from most radio shops. Install your car antenna correctly according to the instruction manual included with the antenna.



Soft Case:

The soft case is useful in hand-carried operation. It permits the batteries to be replaced without removing the unit from the case. It has a pocket to store the antenna or memo. The soft case can be attached to your waist belt, if desired.

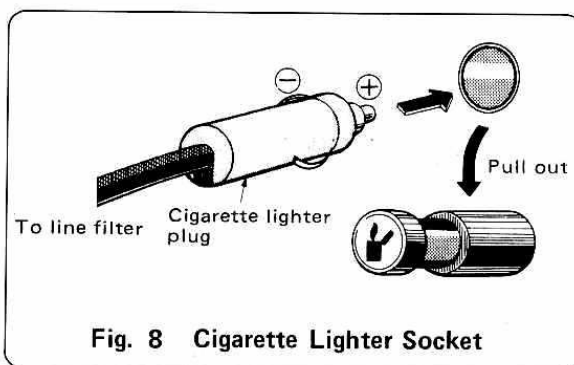


Fig. 8 Cigarette Lighter Socket

FIXED STATION OPERATION

- ① For fixed station operation, it is recommended that an external power supply be employed, though internal batteries may also be used. The external power supply has an advantage of eliminating the need for checking the power voltage. When using the external power supply, connect it to the unit using the supplied power cord as shown in Fig. 9. The ratings of the external power supply should be DC 13V, 0.5 A or higher. (A fuse should be used in the DC output circuit.)

Note:

Battery charger cannot be used as external power supply.

- ② When using an external antenna, connect it to the external antenna terminal at the rear. The whip antenna must be fully retracted into the unit. (See Fig. 6 for connection of the UHF type connector to the coaxial cable.)
- ③ For mounting the microphone hook, see Fig. 7.

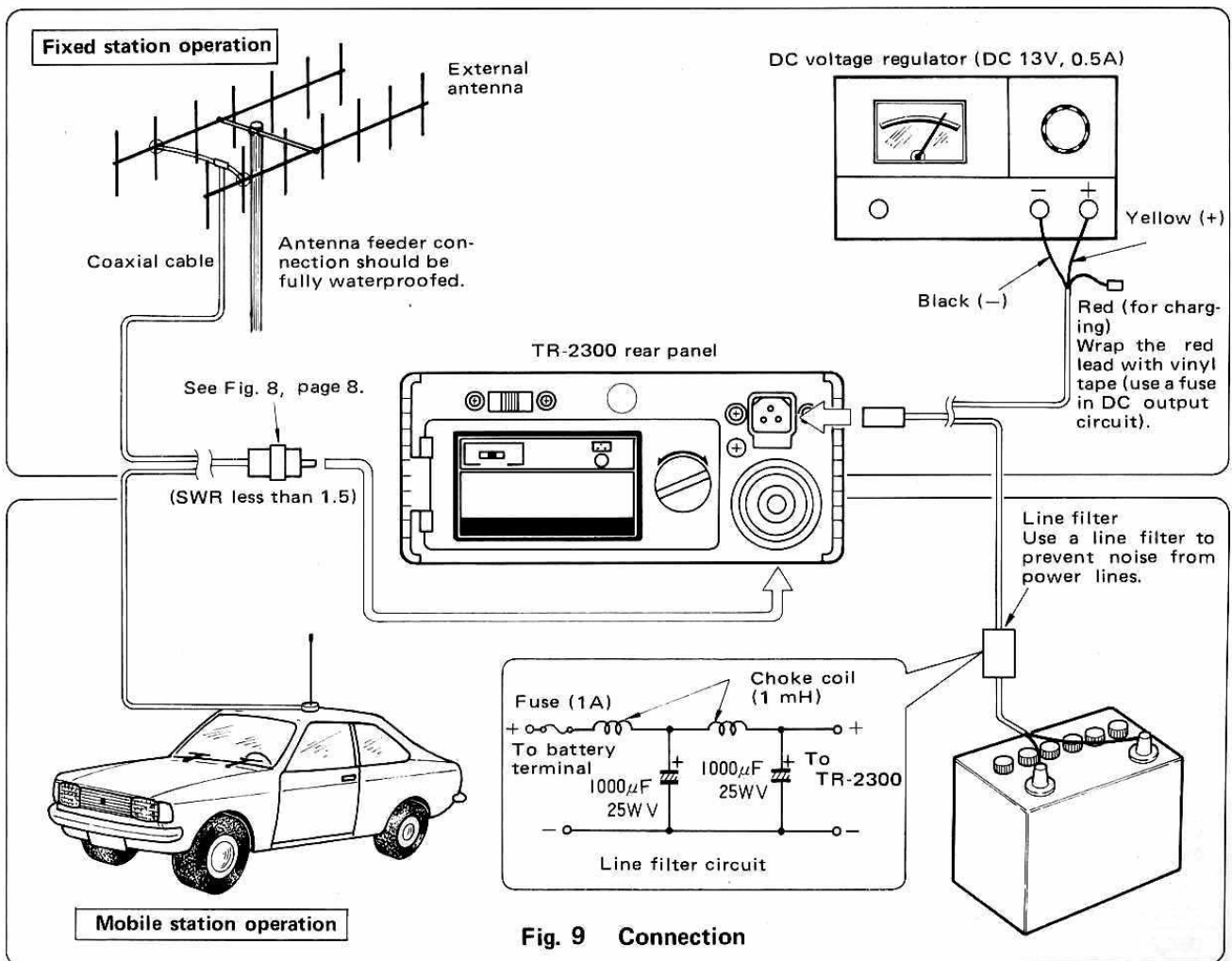


Fig. 9 Connection

SECTION 4. OPERATION

TRANSCIVE OPERATION

For transceive operation, use the following procedure:


- ① Check to make sure that the antenna (whip or external) and power supply (built-in or external) are properly connected.
- ② Turn POWER/VOL switch to ON.
- ③ Set the unit to the operating frequency using the 4-5-RPT knob and the main knob (see Table 2).
- ④ For operation, see Fig. 10 and Fig. 11.

USE OF SQUELCH KNOB

To eliminate noise while signals are absent, slowly turn the SQUELCH knob clockwise until the speaker is quieted (threshold point). This adjustment should be made when signals are not received. When properly adjusted, the current drain during

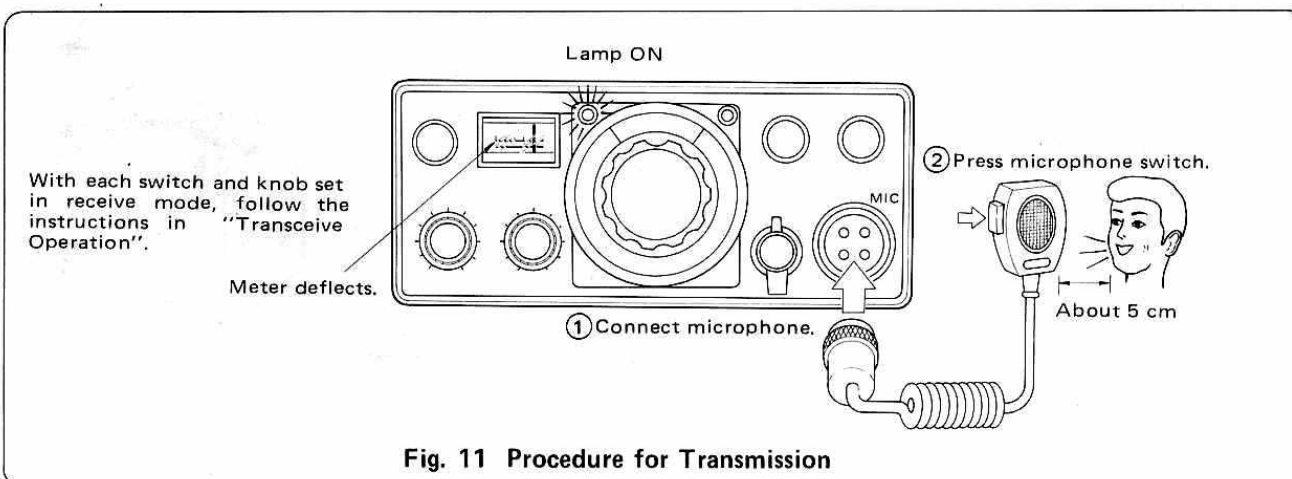
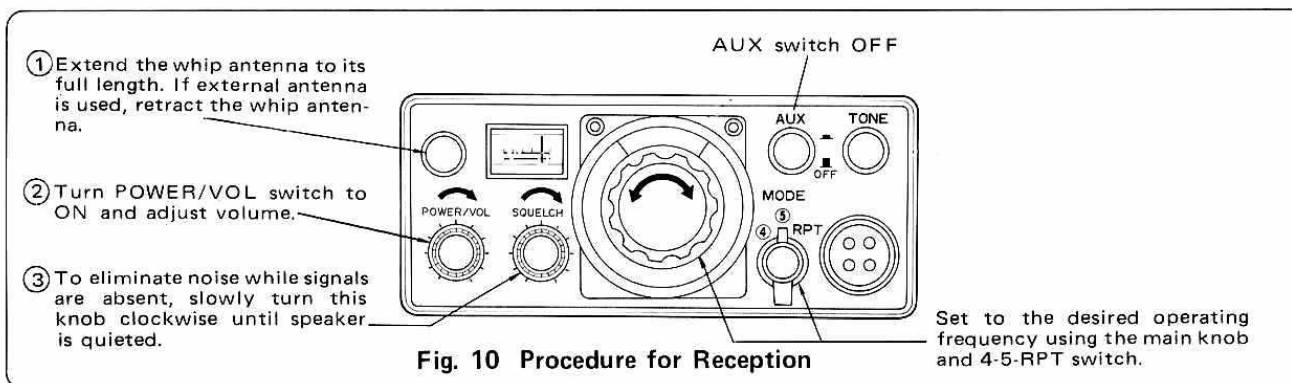
standby mode is minimized (about 45 mA). This control does not affect the receiver volume when signals are present. Adjust the knob for optimum reception according to the strength of the signal being received.

USE OF AUX SWITCH

When the AUX switch is set to ON () the unit operates on the frequency of AUX channel regardless of the position of the main knob and 4-5-RPT switch. Use this switch for club channel or private channel operation. For additional frequencies, refer to Section 5.

USE OF TONE SWITCH

This switch is used to transmit a TONE signal. Depress the switch and a signal modulated by TONE signal (1750 Hz) is transmitted to control the repeater station.



USE OF 4-5-RPT SWITCH

4 – This position permits the unit to operate on any of 40 channels of 144.000 ~ 144.975 MHz at 25 kHz intervals (operating frequency is common to transmission and reception).

5 – This position permits the unit to operate on any of 40 channels of 145.000 ~ 145.975 MHz at 25 kHz intervals (operating frequency is common to transmission and reception).

RPT – This position permits the unit to operate on any of 40 channels in 145 MHz band. In this case, the transmit frequency is 600 kHz below the receive frequency.

Notes:

Since the transceiver uses the PLL synthesizer, if it is in any of the following conditions, the PLL circuit is unlocked and the protective circuit is activated to stop the local oscillator signal to the transmitter and receiver, thus making the transceive operation impossible.

1. The unit is set in AUX mode with no crystal loaded in AUX channel.
2. The main knob is positioned between channel steps (40 CH).
3. The PLL circuit is defective.

REPEATER OPERATION

For repeater operation, set the 4-5-RPT switch to the RPT position. In this case, the transmit frequency is 600 kHz below the receive frequency (see Table 2).

When TONE signal is used for repeater operation, depress the TONE switch and the repeater station is operated by the 1750 kHz modulation signal.

USE OF LAMP SWITCH

This switch is used for indication of frequencies on the main knob or AUX channel. Use this switch as necessary to reduce the current drain during standby mode (squelch ON).




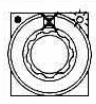

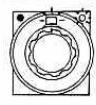
| Setting of lamp switch | Lamp ON | Current drain during standby mode |
|---|---|---|
| OFF AUX DIAL  |  | About 45 mA (current drain is minimized) |
| OFF AUX DIAL  |  | About 52 mA (45 + 7) |
| OFF AUX DIAL  |  | About 85 mA (45 + 7 + 33) |

Fig. 12

Table 2 Operating Frequencies

| Step | Freq. indicated | Frequency (MHz) | | | |
|---------------|-----------------|-----------------|---------|---------|----------|
| | | 4-5-RPT switch | | | |
| | | 4 | 5 | RPT | |
| | | | | Receive | Transmit |
| 1 | 00 | 144.000 | 145.000 | 145.000 | 144.400 |
| 2 | • | 144.025 | 145.025 | 145.025 | 144.425 |
| 3 | 05 | 144.050 | 145.050 | 145.050 | 144.450 |
| 4 | • | 144.075 | 145.075 | 145.075 | 144.475 |
| 5 | 10 | 144.100 | 145.100 | 145.100 | 144.500 |
| 6 | • | 144.125 | 145.125 | 145.125 | 144.525 |
| 7 | 15 | 144.150 | 145.150 | 145.150 | 144.550 |
| 8 | • | 144.175 | 145.175 | 145.175 | 144.575 |
| 9 | 20 | 144.200 | 145.200 | 145.200 | 144.600 |
| 10 | • | 144.225 | 145.225 | 145.225 | 144.625 |
| 11 | 25 | 144.250 | 145.250 | 145.250 | 144.650 |
| 12 | • | 144.275 | 145.275 | 145.275 | 144.675 |
| 13 | 30 | 144.300 | 145.300 | 145.300 | 144.700 |
| 14 | • | 144.325 | 145.325 | 145.325 | 144.725 |
| 15 | 35 | 144.350 | 145.350 | 145.350 | 144.750 |
| 16 | • | 144.375 | 145.375 | 145.375 | 144.775 |
| 17 | 40 | 144.400 | 145.400 | 145.400 | 144.800 |
| 18 | • | 144.425 | 145.425 | 145.425 | 144.825 |
| 19 | 45 | 144.450 | 145.450 | 145.450 | 144.850 |
| 20 | • | 144.475 | 145.475 | 145.475 | 144.875 |
| 21 | 50 | 144.500 | 145.500 | 145.500 | 144.900 |
| 22 | • | 144.525 | 145.525 | 145.525 | 144.925 |
| 23 | 55 | 144.550 | 145.550 | 145.550 | 144.950 |
| 24 | • | 144.575 | 145.575 | 145.575 | 144.975 |
| 25 | 60 | 144.600 | 145.600 | 145.600 | 145.000 |
| 26 | • | 144.625 | 145.625 | 145.625 | 145.025 |
| 27 | 65 | 144.650 | 145.650 | 145.650 | 145.050 |
| 28 | • | 144.675 | 145.675 | 145.675 | 145.075 |
| 27 | 70 | 144.700 | 145.700 | 145.700 | 145.100 |
| 30 | • | 144.725 | 145.725 | 145.725 | 145.125 |
| 31 | 75 | 144.750 | 145.750 | 145.750 | 145.150 |
| 32 | • | 144.775 | 145.775 | 145.775 | 145.175 |
| 33 | 80 | 144.800 | 145.800 | 145.800 | 145.200 |
| 34 | • | 144.825 | 145.825 | 145.825 | 145.225 |
| 35 | 85 | 144.850 | 145.850 | 145.850 | 145.250 |
| 36 | • | 144.875 | 145.875 | 145.875 | 145.275 |
| 37 | 90 | 144.900 | 145.900 | 145.900 | 145.300 |
| 38 | • | 144.925 | 145.925 | 145.925 | 145.325 |
| 39 | 95 | 144.950 | 145.950 | 145.950 | 145.350 |
| 40 | • | 144.975 | 145.975 | 145.975 | 145.375 |
| Fixed channel | AUX | | | | |

Enter additional frequencies for future reference. →

SECTION 5. ADDITIONAL FREQUENCIES

When additional frequencies and adjustments are required, the following points should be observed. Additional frequencies can be selected from the amateur band covering 144.00 ~ 146.00 MHz.

INSTALLATION OF ADDITIONAL FREQUENCIES

To install AUX CH frequencies (installation of crystal elements), use the following procedure.

1. Removal of Case

Remove the 4 screws (2 on bottom and 2 on side) from the lower case of the unit (removal of upper case is not required).

2. Crystal Element Oscillation Frequency

For operation on the desired frequency, the crystal element oscillation frequency can be obtained from the following equation.

$$f_o = \frac{f - 13.9}{3} \quad (\text{MHz})$$

f = Desired frequency (MHz)

f_o = Oscillation frequency (MHz)

(Example)

For operation on $f = 145.75$ MHz:

$$f_o = \frac{145.75 - 13.9}{3} = 43.95 \quad (\text{MHz})$$

Therefore, a 43.95 MHz crystal element should be inserted to the appropriate crystal socket (Fig. 13).

The crystal element used should be of the HC-25/u type (3rd over-tone).

The oscillating circuit is shown in the schematic diagram on page 15.

FREQUENCY ADJUSTMENT

The frequency of any additional channel must be adjusted correctly after the crystal element have been installed. For accurate adjustments, the use of a frequency counter is recommended.

1. Adjusting with Frequency Counter

For proper adjustments, refer to Fig. 13.

Requirements

- * External power supply (internal batteries may be used)
- * Frequency counter (capable of measuring up to about 150 MHz)
- * Insulated screwdriver

Connect the frequency counter to the RX synthesizer unit (X55-1220-61) at the LR terminal on the bottom of the unit.

Set the AUX switch to ON ().

Install a crystal element and turn the trimmer TC3 so that the frequency counter indicates the frequency of $f - 10.7$ (MHz).

2. When Frequency Counter is not Available.

With the unit set to the receive frequency of your party's station, have the party receive your transmit signal.

Adjust the trimmer (TC3) so that the signal can be heard most clearly (or the center meter of the party's station indicates about "0" point).

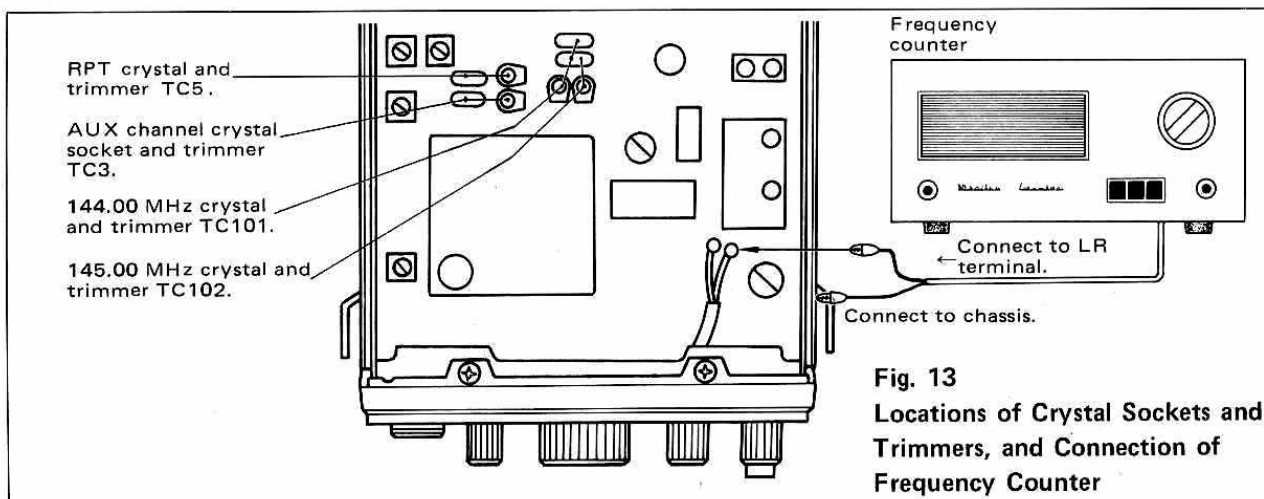


Fig. 13
Locations of Crystal Sockets and Trimmers, and Connection of Frequency Counter

OPTIONAL PARTS

The following accessories are available as options for more efficient use of your TR-2300.

1 Ni-Cd Battery Pack PB-15

The Ni-Cd battery pack PB-15 can be charged more than 300 times for economical operation of TR-2300.

2 Helical Antenna RA-1

The $1/4\lambda$ helical antenna is best suited for mobile station operation.

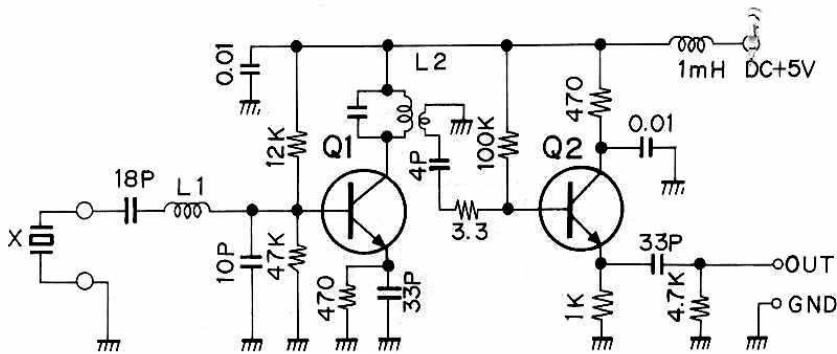


Fig. 14 Crystal Oscillation Circuit

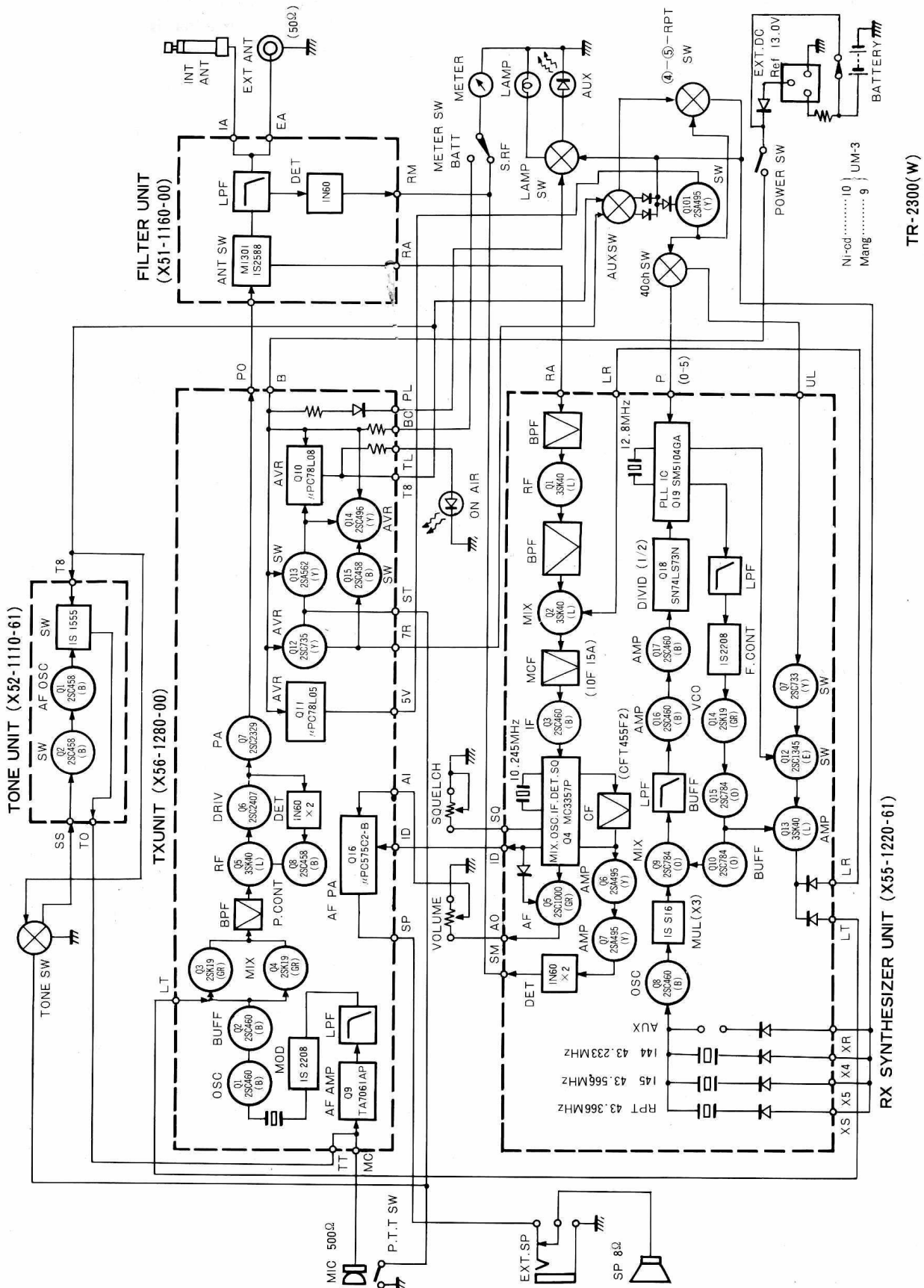
L1: L33-0605-05
L2: L32-0607-05 Q1, Q2: 2SC460(B)

Crystal Specifications

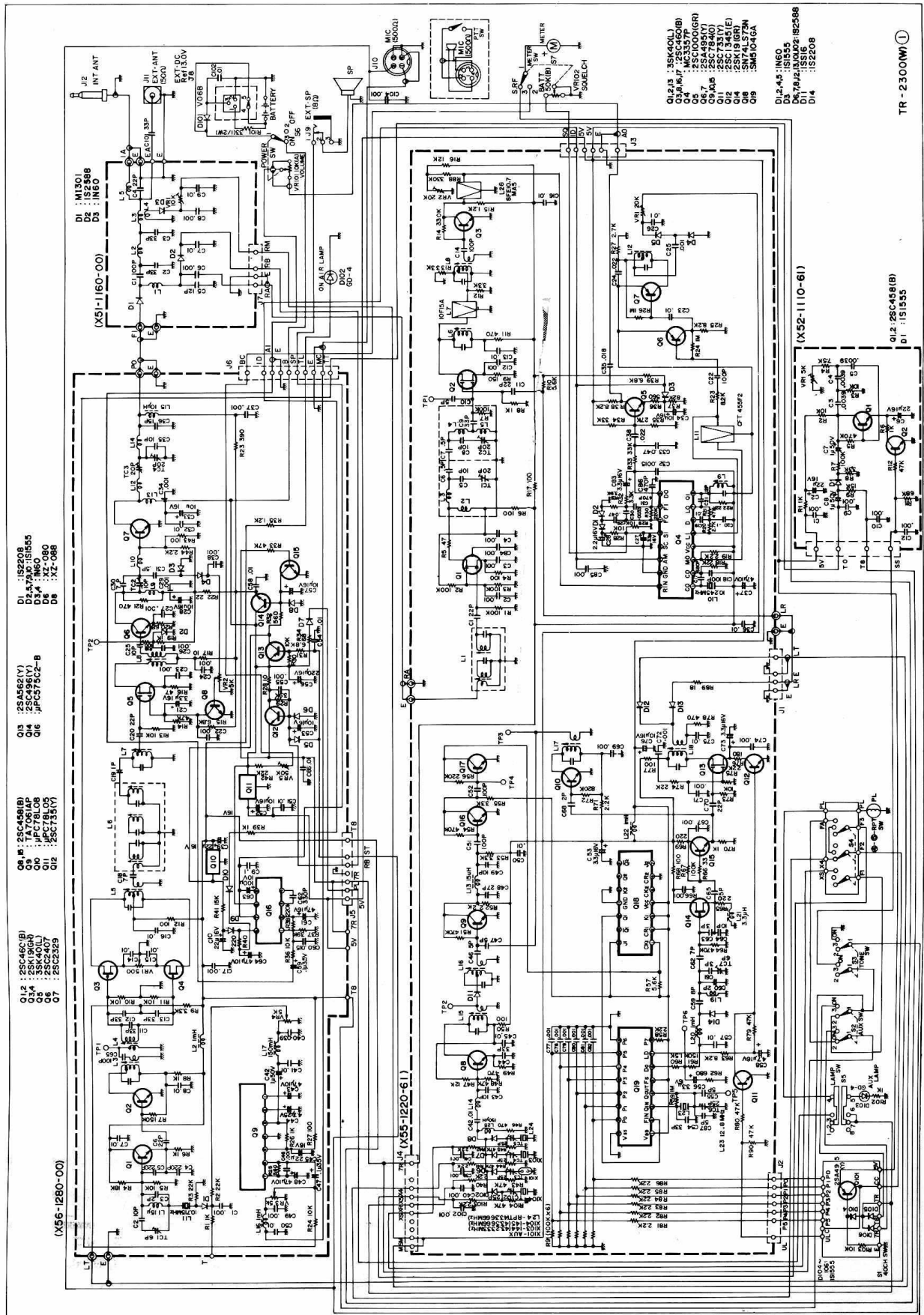
1. Type of holder: HC-25/u
2. Multiplication: 3rd over tone
3. Frequency tolerance: +0.002%, -0.001% at normal temperature.

MEMO

BLOCK DIAGRAM



SCHEMATIC DIAGRAM



A product of
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