

TR-3200

UHF TRANSCEIVER



OPERATING MANUAL

SECTION 1. PRIOR TO OPERATION

The Model TR-3200 is a handy transceiver designed for use in 430MHz amateur radio band. It is small and light weight, and is equipped with 12 crystal-controlled channels for transmission and reception on F3 (type of emission) waves.

The RF output power is switchable in 2 steps, either 2 watts or 0.4 watt.

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1-1 UNPACKING

After unpacking your TR-3200, check to see that the following accessories are included:

1. Dynamic microphone.....	1
2. $5/8\lambda$ whip antenna.....	1
3. Dummy battery.....	1
4. External speaker plug.....	1
5. Carrying strap.....	1
6. Power plug with lead (power cord).....	1
7. Battery case (A) (for six batteries, fitted in set).....	1
8. Battery case (B) (for four batteries, fitted in set).....	1
9. Hook.....	1
10. Screw, pan head (3ϕ).....	2
11. 9PMT plug.....	1
12. Battery charger.....	1
13. Carrying case.....	1

1-2 BATTERY INSTALLATION

1. Pull the battery snap button at the bottom of the case to open the lid of the battery case (see Fig. 1).
2. When using manganese or alkaline batteries (1.5V per cell), load 9 batteries and the supplied dummy battery into the battery case. The dummy battery may be inserted in any place in the case.
3. When using alkaline storage cells (1.2V per cell), load 10 cells into the battery case.

Note 1: When loading, ascertain that the battery polarity is correct; refer to the instructions provided on the battery case.

Note 2: Manganese battery General type dry battery furnishing a voltage of 1.5V (non-rechargeable).

Alkaline battery Non-rechargeable battery using caustic potash as electrolyte. It provides better performance than manganese batteries and is interchangeable with a manganese battery.

Nickel cadmium cell Sealed type rechargeable cell which is also called a Ni-Cd cell.

4. Install the loaded battery case into the unit, close the lid and depress the snap button (the battery case should be inserted correctly according to the instructions on the rear of the lid).

1-3 VOLTAGE CHECK

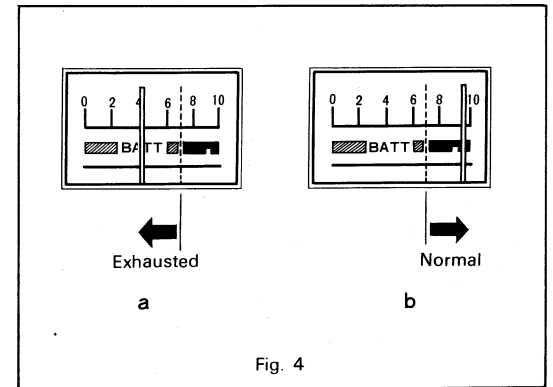
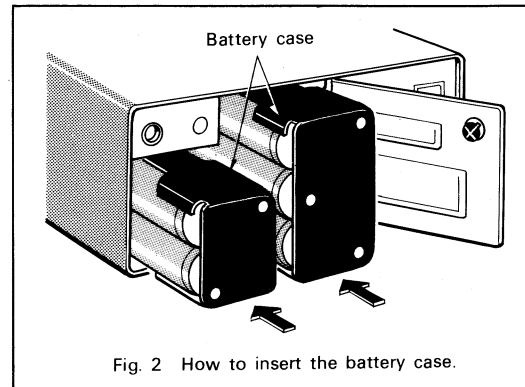
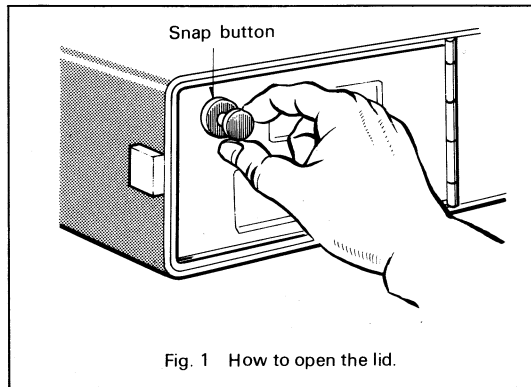
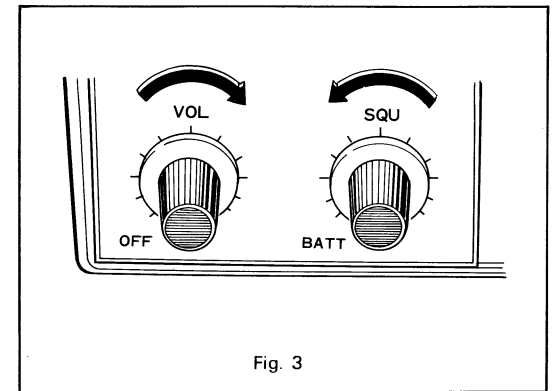
After the loaded battery case has been properly installed in the unit, check the battery voltage according to the procedure below.

1. Set the SQU knob to the "BATT" position by turning it fully counterclockwise.
2. Turn the power switch (VOL) to right to set it to ON (the meter pointer will deflect regardless of the ON/OFF positions of the VOL knob).
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 cells, recharge the cells according to the instructions on page 8.

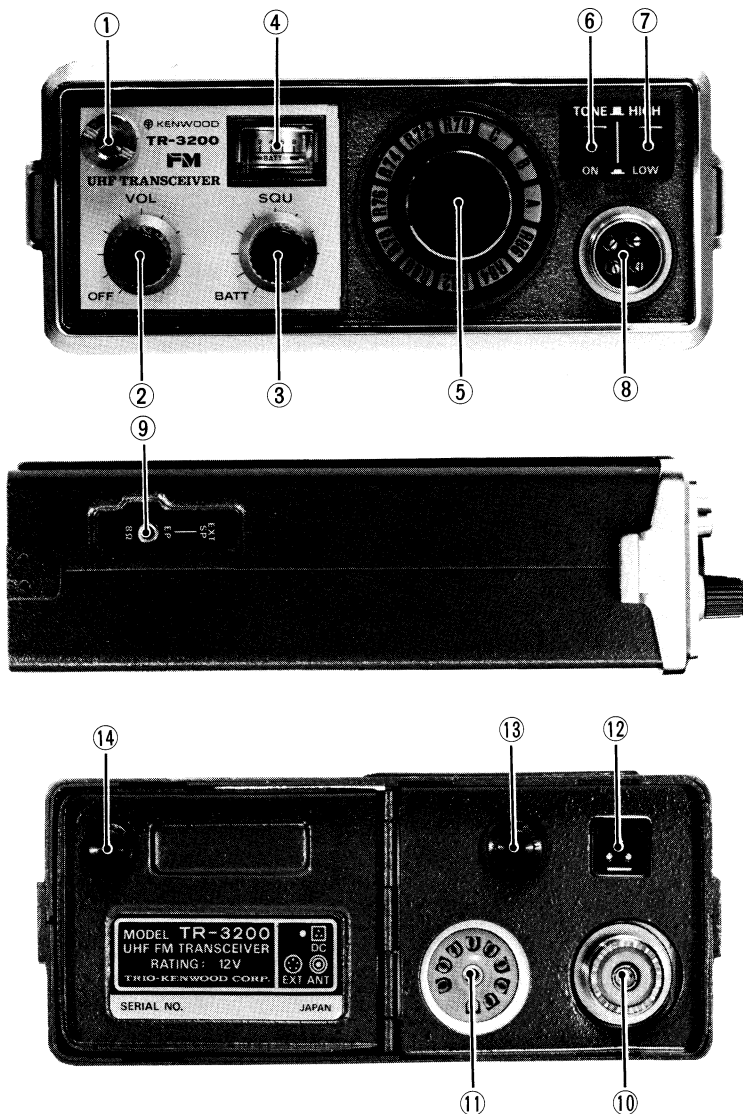
Note 1: If external power supply is used instead of internal batteries, the meter will not deflect at the OFF position of the power switch (when using external power supply, refer to the instructions on page 6).

Note 2: When external power supply is used, the meter will indicate the voltage of the external power.

Note 3: When checking the voltage of internal batteries at the "BATT" position of the SQU knob, the meter will indicate about 0.2mA of current drain even when the VOL knob is turned to OFF. Therefore, the SQU knob should not be left in the "BATT" position when the unit is not in use.



SECTION 2. CONTROLS



FUNCTIONS OF OPERATING PARTS

- ① **Antenna Terminal**
When the unit is used for handy, connect the supplied 5/8 λ rod antenna to the antenna terminal. The antenna must be fully extended.
- ② **VOL Knob**
This knob has two functions; power ON/OFF and receiver volume control. To turn off the power, rotate the knob fully counterclockwise.
- ③ **SQU Knob**
This knob also has two functions; battery check and squelch control. To check the power voltage (including battery voltage) or charging voltage, rotate the knob fully counterclockwise. For squelch adjustment, rotate the knob clockwise. The squelch will be ON at about the center position of the turning range.
- ④ **Meter**
This meter indicates the strength of receiver input signal (S) and transmitter output signal (RF). It is also used for checking power voltage or charging voltage. 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 or charging voltage, set the SQU knob to the BATT position.
- ⑤ **Channel Selector Knob**
This knob is used to select the desired channel. It turns both in the right and left directions and is calibrated in 12 channels.
- ⑥ **Tone Switch**
Depressing this switch makes the signal emitted, modulated by the tone OSC (1,750Hz), for calling a relay station.
- ⑦ **HIGH-LOW Switch**
This switch selects the transmit output power. Press this switch for "low power" and release it for "high power".

⑧ **MIC Terminal**

A microphone connector for the supplied microphone. Press the switch on the microphone and the unit will be set in the transmit mode.

⑨ **External Speaker (or earphone) Terminal**

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

⑩ **External Antenna Terminal**

An external antenna of 50Ω impedance is connected to this terminal. For connection, use an "M" type receptacle. Refer to Fig. 9.

⑪ **AUX Terminal**

This terminal is used for connection of a center meter. It is also used for remote operation.

⑫ **External Power/Charging Terminal**

Connect an external power supply (DC 13V) with the supplied power cord-plug (DC cord) by referring to Fig. 8. This terminal is also used for charging an alkaline storage battery (see page 8).

⑬ **Case Removing Snap**

To remove the case from the main unit.

⑭ **Battery Removing Snap**

Used to remove the battery.

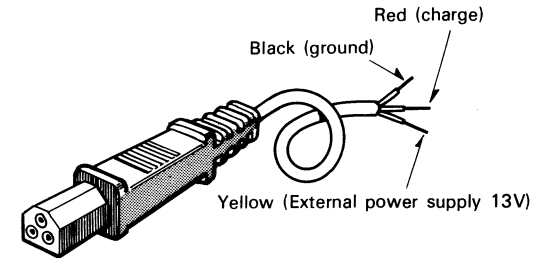


Fig. 8 Power plug with lead.

Installing M type receptacle

- ① Shape the top end of the coaxial cable as illustrated below. Use a sharp single-edged blade being very careful not to damage the center conductor or the braided wire.
- ② Insert the coaxial cable into the coupling, then screw in shaped top end of the cable into the connector body.
- ③ Solder the braided wire and connector body at four soldering holes by the use of a well-kept and clean soldering iron. Perform a pertinent soldering being careful not to melt the polyethylene insulation.
- ④ Solder the center conductor.
- ⑤ Using a tester ascertain the continuity and insulation. Finally move the coupling back to the counter body.

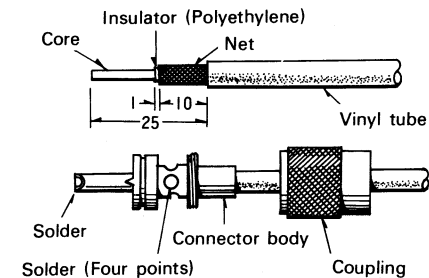


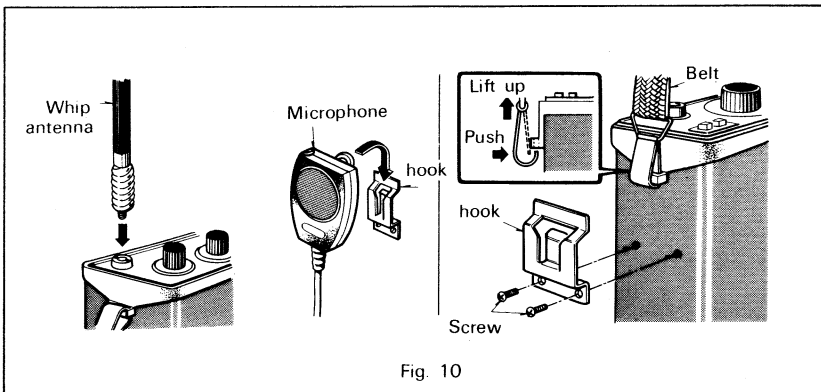
Fig. 9

SECTION 3. OPERATION

3-1 HANDY USE

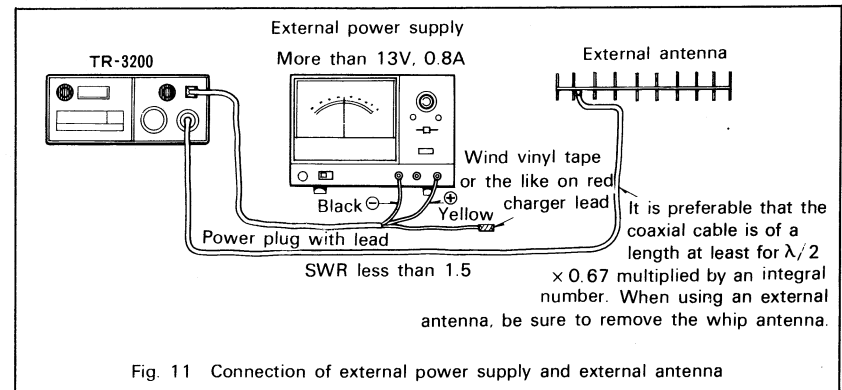
1. Load the batteries (see "Battery Loading" on page 3).
2. Attach the supplied carrying strap as shown in Fig. 10.
3. Firmly connect the supplied whip antenna to the antenna terminal.
The antenna should be fully extended when the unit is in use. Put the antenna in the case provided on the carrying case when it is not in use.
4. Attach the hook as shown in Fig. 10.
5. Insert the connector of the supplied microphone into the microphone jack. The microphone may be hung on the hook.

Note: The supplied whip antenna is of a $5/8\lambda$ type, providing a higher gain than the normal $1/4\lambda$ type antennas. The whip antenna has a matching coil at the insulation of the antenna base. Do not touch this coil with your hand, as it will deteriorate the performance of the antenna. The spring cushion at the antenna base protects the antenna from accidental trouble (breaking of antenna, etc.). 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.



3-2 FIXED STATION USE

1. For fixed station operation, it is recommended that an external power supply be used, 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. 11. The ratings of external power supply should be DC13V, 0.8A or higher.
2. If an external antenna is used, remove the whip antenna and connect the external antenna to the antenna terminal at the rear of the unit.
For connection, use an "M" type receptacle (refer to Fig. 9).



Note: The matching impedance of the antenna and coaxial cable should be 50Ω (5D-2V, 8D-2V, etc.). Use a low loss coaxial cable, since an antenna cable largely affects the transmit output and receive sensitivity. The antenna system to be used should be of a type of less than 1.5 SWR (standing wave ratio).

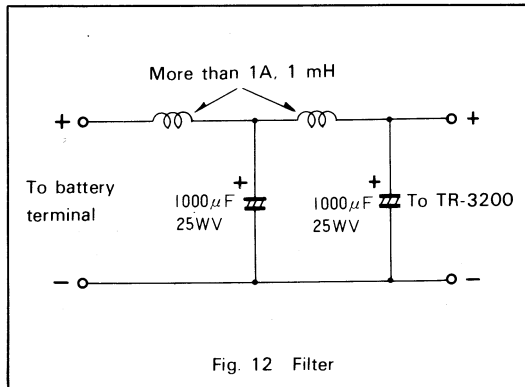
To obtain the best SWR effect, it is preferable that the coaxial cable is of a length for $\lambda/2 \times 0.67$ (λ : wave-length, 0.67: velocity factor of polyethylen coaxial cable) multiplied by an integral number.

If the signal-feed element of the antenna is insufficiently protected against rain or humidity, it will result in deterioration of insulation, which, in turn, deteriorates SWR affecting the strength of transmit signals. The signal-feed element should be fully protected using a self-adhesive tape.

3. Mount the microphone hook on the unit as shown in Fig. 10.

Note 1: The voltage of external power supply should be set to 13V (standard voltage). Do not operate the unit on 15.6V or the highest voltage of the rating (see Specifications). Note that a charger used for automobile batteries is not suitable and should not be used as an external power supply.

Note 2: If the unit is to be operated on external power supply for many hours, remove the internal batteries from the unit.

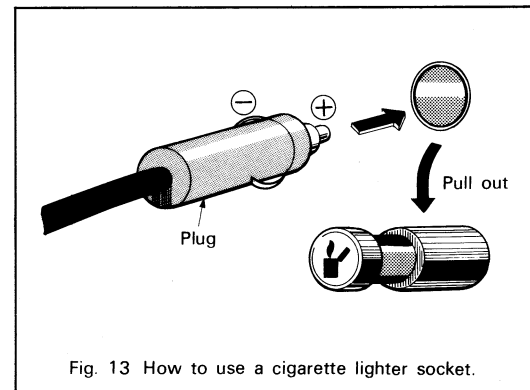


3-3 MOBILE STATION USE

1. For mobile station operation, the unit can be connected to a car battery (DC12V). In this case, use a line filter between the unit and the battery to prevent noise generated from the power system (see Fig. 12).

To supply the power from car battery, the unit may be connected to the cigarette lighter socket installed in the car (see Fig. 13).

2. Various types of car antennas are available from most of radio shops. Install your car antenna correctly according to the instruction manual included with the antenna.
3. Fix the microphone hook to the unit as shown in Fig. 10.



SECTION 4. HOW TO USE

4-1 RECEPTION

1. Check to see that the antenna (whip type or external type) and power (internal or external) connections are correct.
2. Turn the SQU knob counterclockwise to a point just before it clicks into the "BATT" position.
3. Turn the VOL knob clockwise and the power is turned to ON. Turn this knob further clockwise until noise can be heard and set it for suitable loudness.
4. Set the channel knob to "A" (433.50 MHz). If input signal is received, the meter will deflect and sound is heard from the speaker (the meter indicates the strength of input signal).
5. To eliminate the noise which is heard while no signal is being received, slowly turn the SQU knob clockwise and set it where the noise disappears (critical point). This setting should be made with the channel knob set to a channel receiving no signals.
The SQU knob should be adjusted properly according to the strength of input signals.

4-2 TRANSMISSION

1. Check the antenna and the power supply for correct connection as in the case of reception. When the whip antenna is used, be sure that it is fully extended.
2. Check that the microphone is plugged into the unit.
3. Set the channel knob to the desired channel.
4. Depress the push-switch on the microphone. The unit is now set to the transmit mode and the pointer of the meter (RF) swings. While depressing the push-switch, speak into the microphone and your voice will be transmitted. Hold the microphone about 5~10 cm from your mouth.
5. The transmitting output is controlled by the HIGH/LOW switch. Setting this switch to "HIGH" (knob in released position) delivers 2W of output, and the "LOW" (knob in depressed position), 0.4W of output. The "LOW" position of the switch may be used for communications with a local station because this minimizes interferences with other stations and also saves the life of internal batteries.

Note: The meter (RF) is factory adjusted so that it reads "7~9" at the "HIGH" position (2W output) and about "2" at the "LOW" position, when the antenna impedance is 50Ω. Use the feature of the meter for the check of antenna's SWR or transmitter output.

6. The unit may be used to call a repeater station. The built-in channel "R70" or "R80" has a frequency shift of 7.6 MHz between the transmit and receive frequencies.

When calling a repeater station controlled by a carrier frequency, do not press the tone switch.

For a repeater station controlled by a tone, press the tone switch; a signal tone modulated by 1750 Hz is transmitted while the tone switch is being pressed.

4-3 BATTERY CHARGING

Check the battery voltage (see page 3) before charging. The batteries should be recharged before the battery voltage is reduced to 9V (between red and black zones of meter). The unit is equipped with special terminals for charging alkaline storage batteries. To charge the batteries, use the supplied battery charger as shown in Fig. 14.

To check the batteries for proper charging, use the white marking in the black zone of the BATT indicator as an easy guide (see Fig. 15). Continue charging until the white marking is indicated.

The time required for the batteries to be fully charged is about 15 hours. When the batteries are charged for the first time, it is recommended that they be charged for about 20 hours.

Note 1: Do not attempt to continue charging after the batteries have been fully charged. The batteries should be charged at temperatures of 0°C~45°C.

Note 2: Never try to charge the general type dry batteries or alkaline dry batteries, since they are not designed to be recharged. If charged, a gas will be developed which causes explosion of the batteries, resulting in damage to the unit.

4-4 COMPARISON BETWEEN MANGANESE BATTERY AND ALKALINE STORAGE CELL

When the voltage of an alkaline storage cell decreases to 1.0V or less, the energy of the cell is reduced to less than 1/10 of the initial value, and therefore the cell must be charged.

Fully charged alkaline storage cells will last for more than 2 hours when used at the rate of 1 minute transmission and 3 minutes reception (see Fig. 16), while manganese batteries last for about 40 minutes (see Fig. 17). Accordingly, it is advisable to use alkaline storage cells from the standpoints of the performance of the unit and the service life of batteries. Alkaline storage cells have very low internal resistance and are subject to generation of heat when they are shorted or connected in wrong polarity, resulting in damage to the cells. Due care should be exercised when using alkaline storage cells.

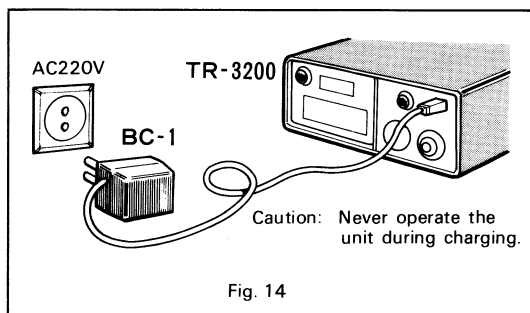


Fig. 14

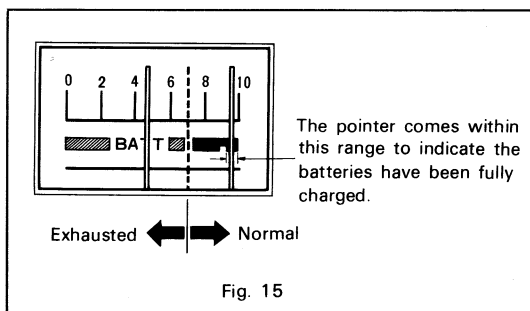


Fig. 15

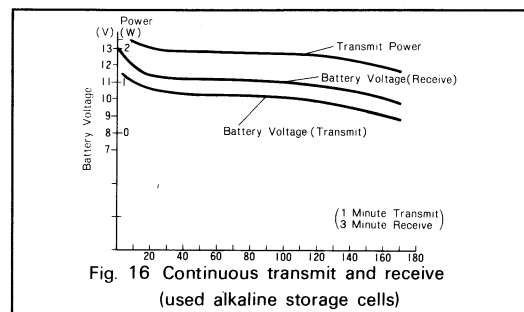


Fig. 16 Continuous transmit and receive (used alkaline storage cells)

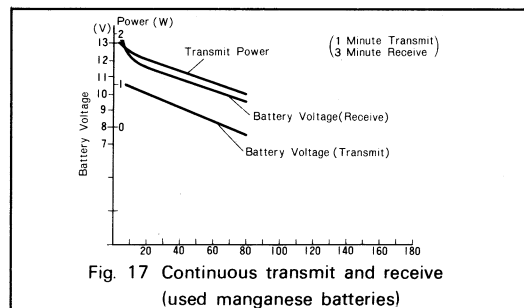


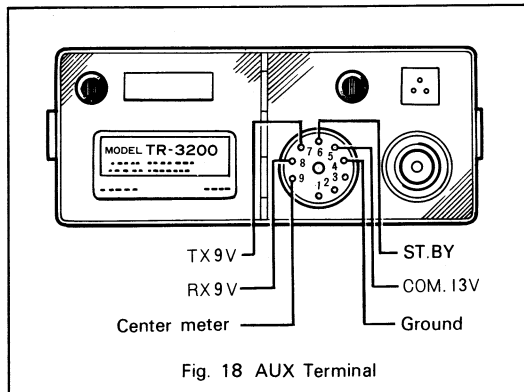
Fig. 17 Continuous transmit and receive (used manganese batteries)

4-5 AUX TERMINAL

The AUX terminal is wired as shown in Fig. 18.

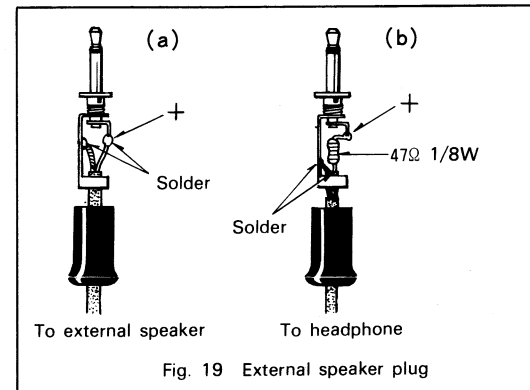
1. Use this terminal as a center meter terminal by connecting it in the manner shown in the illustration on page 12.
2. The AUX terminal may also be used as an external standby terminal. Connect an external switch to the #6 and #4 pins of the AUX terminal.
3. For other usage of the AUX terminal, use the #5 pin (COM 13V), #7 pin (TX 9V) and #8 pin (RX 9V) of the terminal for controlling an added circuit such as a booster.

In this case, the current flowing through each of these pins should be kept at 10 mA or less.



4-6 EXT. SP TERMINAL

If you desire to use an external speaker, use the supplied plug. The speaker should be rated at 8-ohm impedance. Care must be taken not to short the output circuit because it uses OTL system. Fig. 19(a) shows the method of connecting the speaker plug. When using a headphone, it should be connected through a 47Ω resistor as shown in Fig. 19(b).



4-7 CONSTRUCTION OF CHANNELS

In channel R70, R80 and A, crystals are provided as tabulated below. Other channels are empty channels. If expansion of channels is required, refer to 4-8 CHANNEL EXPANSION.

CHANNEL	TRANSMIT FREQ. (MHz)	RECEIVE FREQ. (MHz)
R70	431.050	438.650
R80	431.300	438.900
A	433.500	433.500

Table. 1 Channel Numbers and Frequencies

CHANNEL	R70	R72	R74	R76	R78	R80	R82	R84	R86	A	B	C
Plastic cover indication	1	2	3	4	5	6	7	8	9	10	11	12

Table. 2 Channel Numbers and Plastic cover indication

4-8 CHANNEL EXPANSION

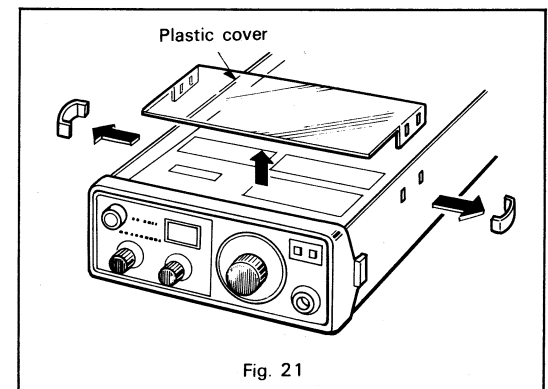
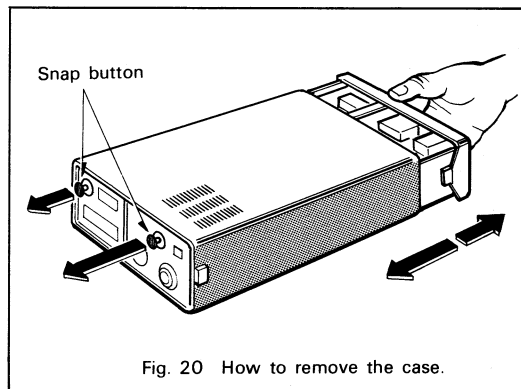
To install additional channels, proceed as follows:
Pull the snap button on the bottom of the case and then withdraw the case (see Fig. 20).

Next, remove the two sliding pieces as shown in Fig. 21 and take out the plastic cover. (see Table. 2).

Install additional crystal oscillating elements for the transmitter and receiver confirming their positions according to the instructions shown on the plastic cover. Make sure that they are correctly installed. The elements for transmitter are marked "T" and those for receiver marked "R". The oscillating frequencies of these elements can be obtained from the following equations:

$$\text{Transmit frequency (MHz)} = \frac{\text{Wanted transmit frequency}}{18}$$

$$\text{Receive frequency (MHz)} = \frac{\text{Wanted receive frequency} - 10.7}{12}$$



Both the transmitter and receiver crystal elements use 3rd over-tone of HC-25/U type for the oscillating frequencies. The frequencies of additional channels should be accurately adjusted by using a frequency counter after the installation of crystal elements. The locations of trimmers for adjusting the frequencies of the elements are illustrated on the plastic cover. Be sure to check the illustration before adjusting.

1. Adjusting with frequency counter

The frequency counter to be used should be capable of measuring frequencies up to about 150 MHz.

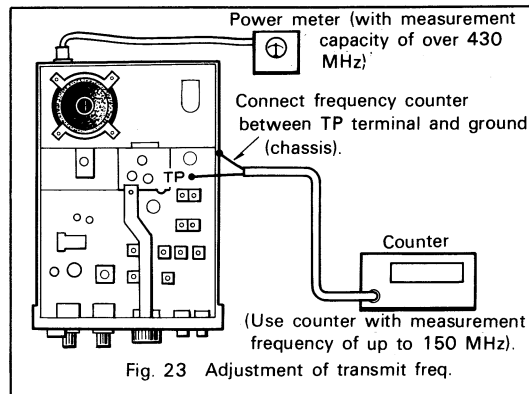
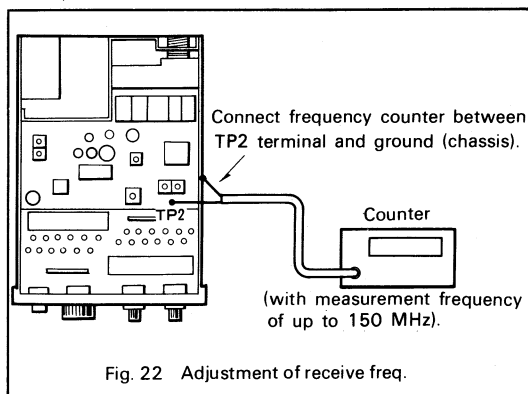
1) Receiver section

Connect the frequency counter as shown in Fig. 22.

$$\text{Counter frequency} = \frac{\text{Channel frequency (MHz)} - 10.7 \text{ (MHz)}}{4}$$

To set the channel frequency to 432.00 MHz for example, set the frequency counter as follows:

$$432.00 - 10.7 = \frac{421.300 \text{ MHz}}{4}$$



2) Transmitter section

Connect the frequency counter as shown in Fig. 23 and set the unit in the transmit mode. The frequency on the counter can be obtained from the following:

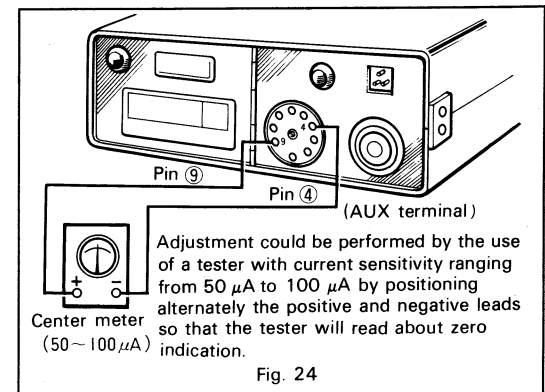
$$\text{Counter frequency} = \frac{\text{Channel frequency}}{3}$$

If you have a frequency counter capable of measuring frequencies up to 430 MHz band, connect it as shown in Fig. 23 and the channel frequency will be directly read on the counter.

2. When frequency counter is not available

The crystal oscillator elements for use in the TR-3200 can be adjusted for approximate frequencies at the center position of the trimmers.

For adjustment, connect a center meter ($\pm 50\mu\text{A} \sim \pm 100\mu\text{A}$) to the center meter terminal provided on the unit (see Fig. 24). A tester of less than $100\mu\text{A}$ range may be substituted for the center meter.



SECTION 5. PRECAUTION

1) Adjustment of receive frequency

With the unit set to the transmit frequency of your party's station, receive the incoming signal and adjust the trimmer of the receiver section until the center meter indicates about "0" point on the meter scale.

2) Adjustment of transmit frequency

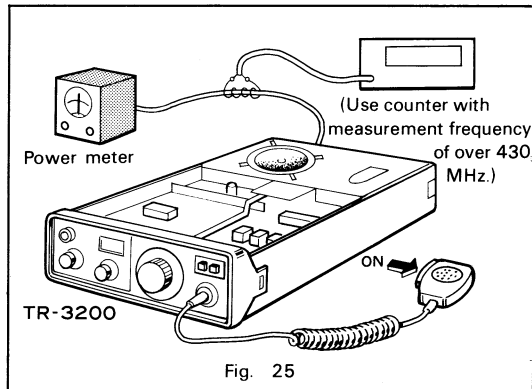
With the unit set to the receive frequency of your party's station, have the party receive your transmit signal. Adjust the trimmer of the transmitter section so that the signal can be heard most clearly or the center meter of the party's station indicates about "0" point.

5-1 GROUNDING SYSTEM

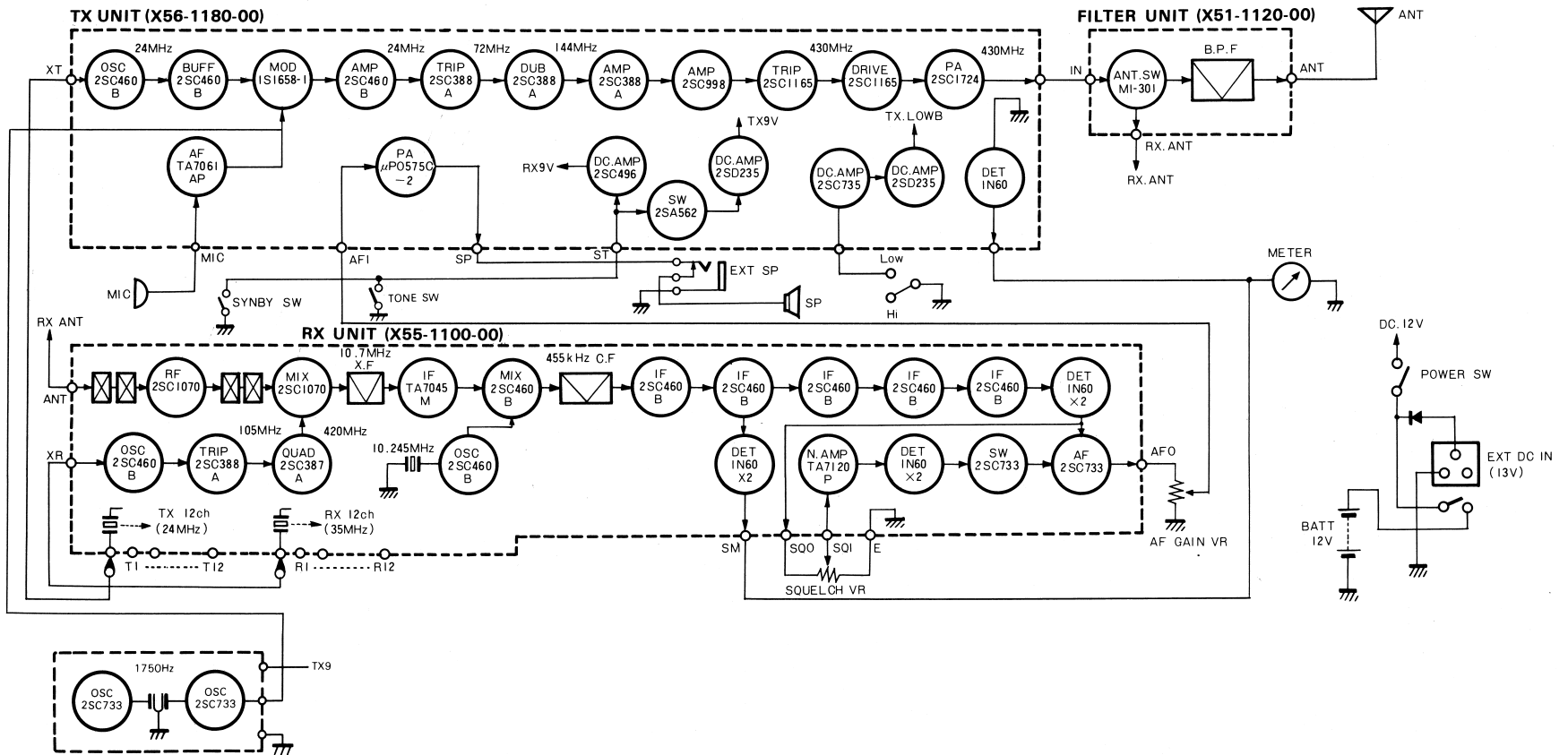
The unit uses negative grounding system. Care should be exercised when connecting an external power supply.

5-2 OPERATION IN LOW TEMPERATURE AREAS

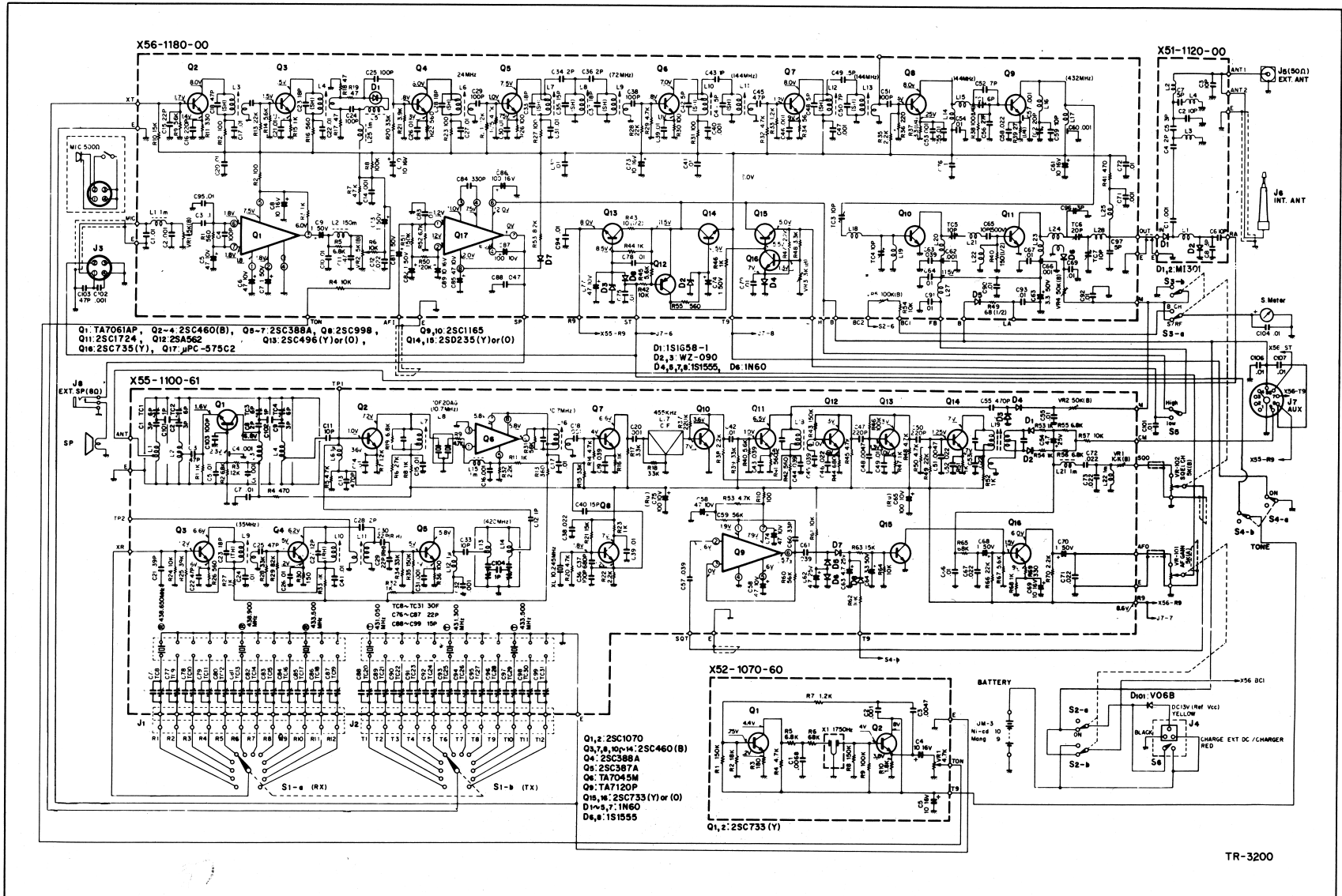
The unit is designed to provide optimum performance when used in areas of $-20^{\circ}\text{C} \sim +50^{\circ}\text{C}$ of temperatures. However, if it is to be operated in areas of -20°C , use a protective bag to cover the unit for protection of the internal batteries. Do not use conventional manganese dry batteries for operation in areas of 0°C or lower temperature, as it will deteriorate the performance of the batteries. Use of alkaline storage cells is recommended.



BLOCK DIAGRAM



SCHEMATIC DIAGRAM



SPECIFICATIONS

GENERAL

Frequency Range:	TX: 431.0 ~ 433.5 MHz RX: 431.0 ~ 439.5 MHz
Transmit/Receive Channels (built-in):	Receive 438.650 MHz 438.900 MHz 433.500 MHz Transmit 431.050 MHz 431.300 MHz 433.500 MHz
Operating Voltage:	9.6 to 15.6V DC (13.0V DC normal)
Operating Temperature:	-20°C ~ +50°C
Grounding:	Negative grounding
Antenna Impedance:	50Ω
Current Drain	
Receive (No signal):	Approx. 50mA (13.0V)
Transmit (High):	Approx. 750mA (13.0V)
(Low):	Approx. 550mA (13.0V)
Dimension:	5-1/3" (135 mm) wide 2-1/3" (58 mm) High 7-1/2" (191 mm) Deep
Weight:	Approx. 3.52 lbs. (1.6 kgs) (Ni-Cd battery cells (10) included)
Semiconductors:	Transistors 31 ICs 4 Diodes 18

TRANSMIT

RF Output Power:	2W (HIGH) and approx. 0.4W (LOW)
Modulation:	F3 (Variable reactance phase modulation)
Crystal Multiplication:	18 times
Deviation:	±7.5 kHz maximum
Spurious:	Less than -60 dB below carrier
Microphone:	Dynamic type with press-to-talk switch, 500Ω

RECEIVE

Circuitry:	Double superheterodyne
Intermediate Frequency:	10.7 MHz (1st IF) 455 kHz (2nd IF)
Sensitivity:	431.0 ~ 4835. MHz; Better than 1μV for 30 dB S/N Others; Better than 1.4μV for 30 dB S/N 431.0 ~ 438.5 MHz; Better than 0.7μV Others; Better than 1μV Better than 0.5μV
20 dB Noise Quieting:	More than 16 kHz (at -6 dB)
Squelch Sensitivity:	Less than 32 kHz (at -60 dB)
Pass Band Width:	More than 0.7W (at 10% distortion and 8Ω load)
Selectivity:	
Audio Output:	

* The above specifications are subject to change without notice for further improvement.



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