

Congratulations on your selection of the NFG-230 Automatic Antenna Tuner.

It is a high quality antenna tuner with the latest digital circuits and semiconductors developed from many years of JRC's experiences and achievements in the field of radio communication.

Please read through this manual before use. Your NFG-230 is produced under the strict quality control. Should you find any trouble or damage, please contact with the nearby JRC branch or dealer as soon as possible.

The NFG-230 consists of the following accessories. Please check them after unpacking.

□ Instruction manual	1
□ Control cable (4 cores, 20 m)	1
□ Terminal (Small) (2-3)	2
□ Terminal (Large) (5.5-3)	2
□ Wood screw (6.5 × 25)	2
□ Washer (W6)	2
□ U bolt	2
□ Mast mounting bracket	2
□ Spring washer (SW8)	4
□ Nut (N8)	4

It is recommended to keep the shipping box for the transportation of after services, etc..

PRECAUTION

Very high voltage is generated at the antenna and antenna terminal of the tuner during transmission. For the safety operation, carefully select the installation place where no one can easily touch the antenna system.

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1. FEATURES

—Fully Automatic Antenna Tuner NFG-230 specially

designed for JST-135—

1. Microcomputer-Controlled Full Automatic Tuning

The full automatic tuning has been realized by a 1-chip 8-bit microcomputer, which controls an LC tuning circuit with the aid of various sensors. The perfect tuning is obtained only by the switch operation on the front panel of JST-135.

2. Wide Tuning Range

Since the NFG-230 tunes to the various types of antennas such as dipole, whip or long-wire antenna in the wide frequency range of 1.8 MHz to 30 MHz, the multi-band operation is possible with a single antenna.

The SWR after tuning is 1.5 or less.

3. Memory Function

Since the tuner memorizes the tuning data for the operating frequency, the perfect tuning is obtained when the same frequency is selected. The data is backed up by a lithium battery for five years or more.

4. Use of Custom Hybrid IC

The use of a custom hybrid IC in the sensors, the heart of automatic tuner, has realized the compact and high reliable tuner.

5. Functions for enhanced availability.

① Tuner "Through" Function

The tuner can be made as "through" to prevent the sensitivity reduction when the receiving frequency is out of the ham bands.

② Tuning Interrupt Function

Even if the tuning has started, the operation can be interrupted by the switch operation of the transceiver. At this time, the original tuning data is retained. This function is provided to protect the tuning data from unwanted change due to inadvertent operation.

6. Compact and Waterproof Construction

The tuner has been designed to be compact and waterproof to withstand severe environmental conditions, especially considering the close installation to an antenna.

2. SPECIFICATIONS

Frequency range	: 1.8 to 30 MHz
Maximum input power	: 200W PEP
Tuning range	: Resistance value 5Ω to $1k\Omega$ Capacitance value more than $150pF$
Input SWR after tuning	: Less than 1:1.5 or less (Depends on the antenna used.)
Tuning power	: More than 5W, less than 30W
Tuning time	: 2 to 4 seconds typical (Max. less than 10 seconds) Less than 50 milliseconds at presetting
Input voltage	: 13.8/24V DC $\pm 15\%$, negative ground (No input voltage selection is required.)
Dimensions	: 230 (230)W \times 90 (100)H \times 380 (430)D mm () includes projections.
Weight	: Approx. 3.5 kg

The circuit and specifications are subject to change without notice.

3. OUTLINE DESCRIPTIONS

3.1 Appearance

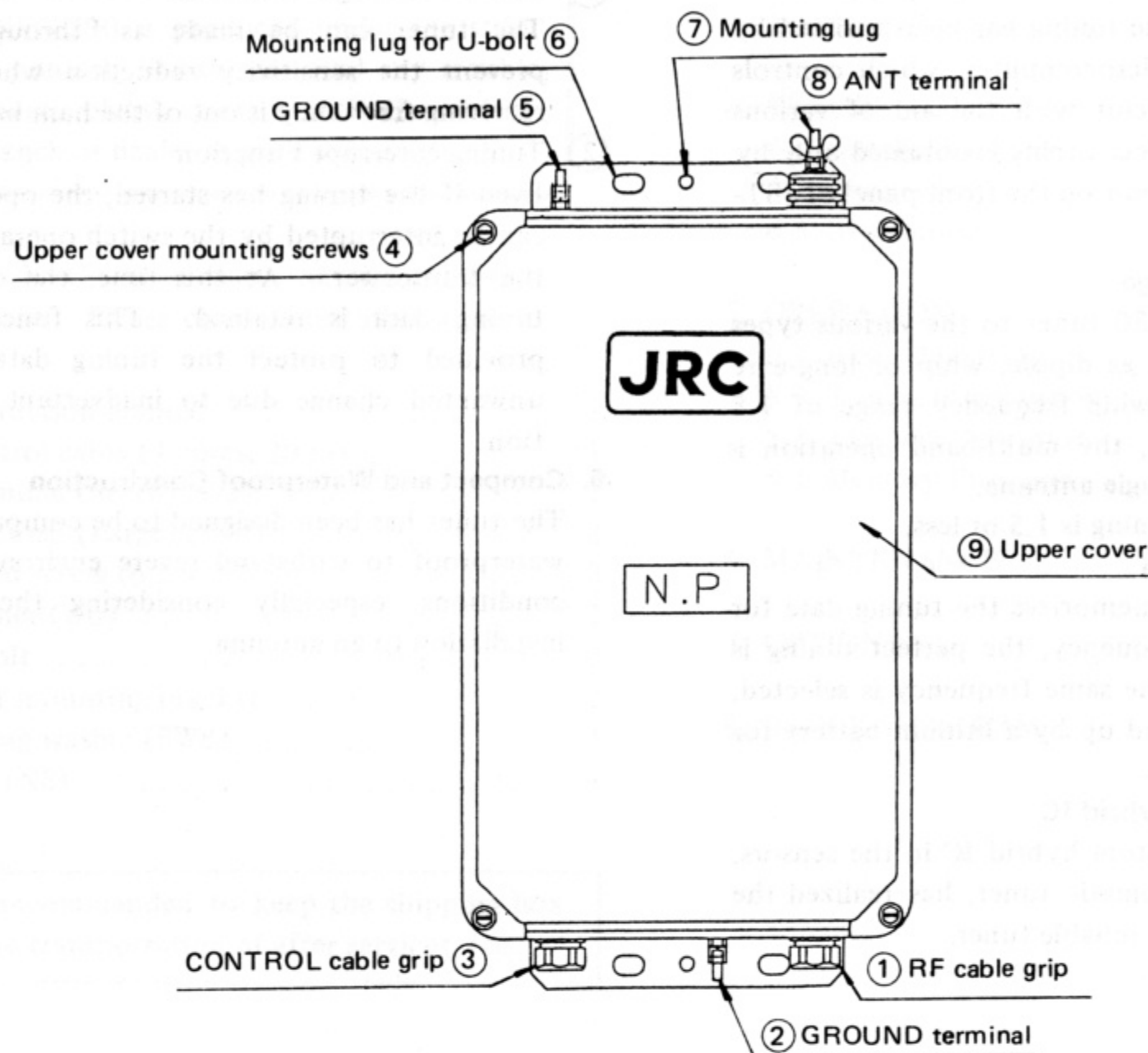


Figure 3.1 Appearance of NFG-230 (Upper View)

- | | |
|---|--|
| <p>① RF cable grip
When connecting the coaxial cable from the transceiver, it must be fixed and waterproofed through this grip.</p> <p>② and ⑤ GROUND terminals
Ground terminals of NFG-230. Be sure to connect the grounding wire to this terminal. Since the terminals ② and ⑤ are internally connected, any of them can be used.</p> <p>③ CONTROL cable grip
When connecting the attached control cable, it must be fixed and waterproofed through this grip.</p> <p>④ Upper cover mounting screws
Loosen these four screws with a screwdriver to remove the upper cover.</p> <p>⑥ Mounting lug for U-bolt
Used when fixing the NFG-230 to a mast with U-bolts. (2 places)</p> | <p>⑦ Mounting lug
Used when fixing the NFG-230 on a wall. (2 places)</p> <p>⑧ ANT terminal
Antenna terminal to connect antennas such as long-wire, whip antenna, etc.. The coaxial cable must not be connected.</p> <p>⑨ Upper cover
Upper cover of NFG-230. Open this cover when connecting cables, etc..</p> |
|---|--|

3.2 Inside

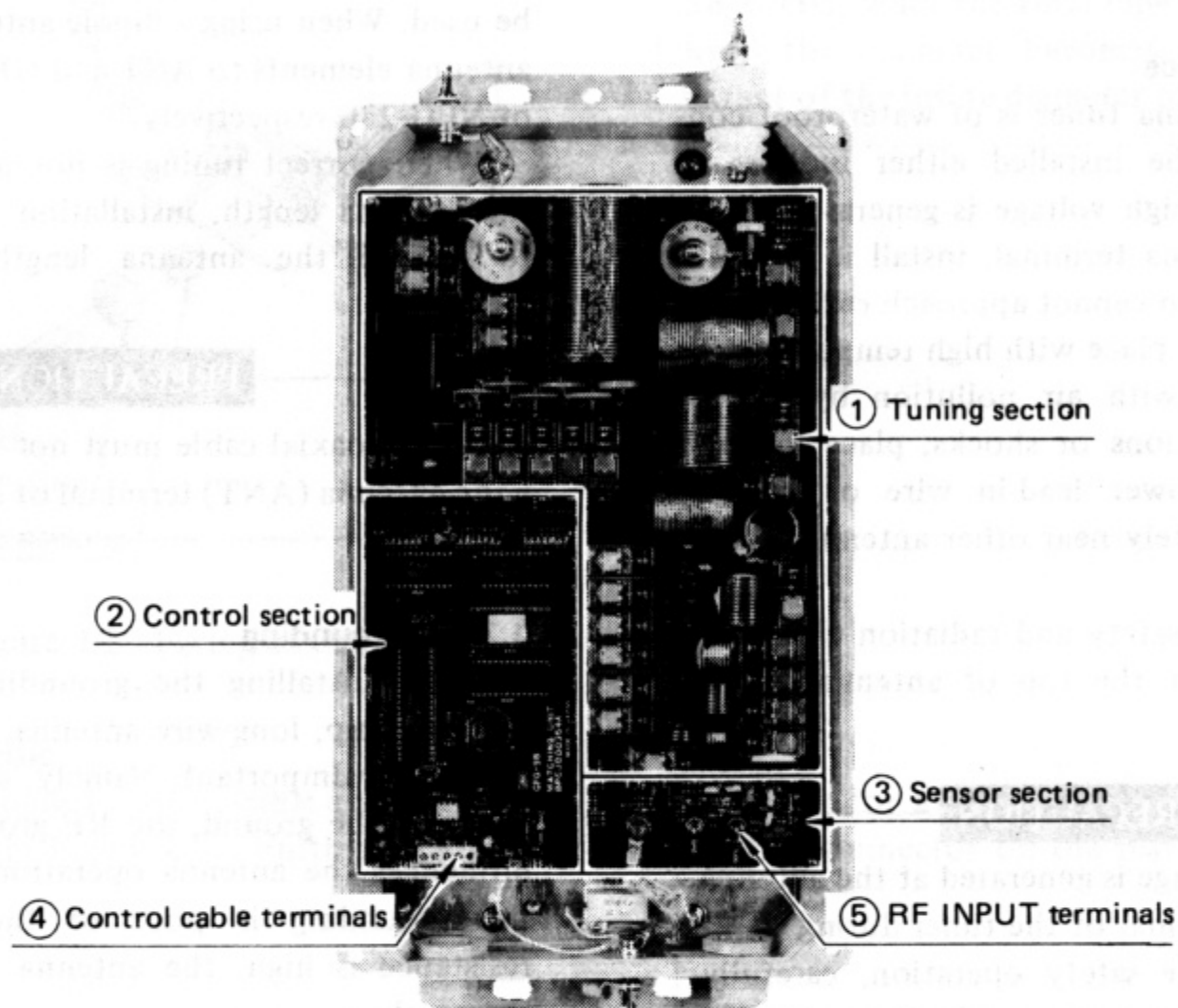


Figure 3.2 Inside of the Tuner

- ① **Tuning section**
The tuning LC network and switching relays are mounted.
- ② **Control section**
The microcomputer to control the tuning LC network, lithium battery for memory backup, etc. are mounted.
- ③ **Sensor section**
Three sensors, SWR, LOAD and PHASE, are mounted.
- ④ **Control cable terminals**
Screw fastening type terminals to connect the attached control cable. For the detailed connection, refer to Figure 4.3.
- ⑤ **RF INPUT terminals**
Terminals to connect the coaxial cable from the transceiver. For the detailed connection, refer to Figure 4.3.

4. BEFORE USE

4.1 Installation Place

Since this antenna tuner is of waterproof construction, it can be installed either indoors or outdoors. As the high voltage is generated at the antenna and antenna terminal, install it in a safe place where a person cannot approach easily.

Further, avoid a place with high temperature or low temperature, with air pollution by smoke, with violent vibrations or shocks, place immediately near the power lead-in wire or metallic structure, immediately near other antenna, and so on.

In view of the safety and radiation efficiency, the mounting near the top of antenna mast is recommended.

PRECAUTION

Very high voltage is generated at the antenna and antenna terminal of the tuner during transmission. For the safety operation, carefully select the installation place where no one can easily touch the antenna system.

4.2 Connection

Loosen the cover mounting screws (4 pieces) and remove the upper cover as shown in Figure 4.1.

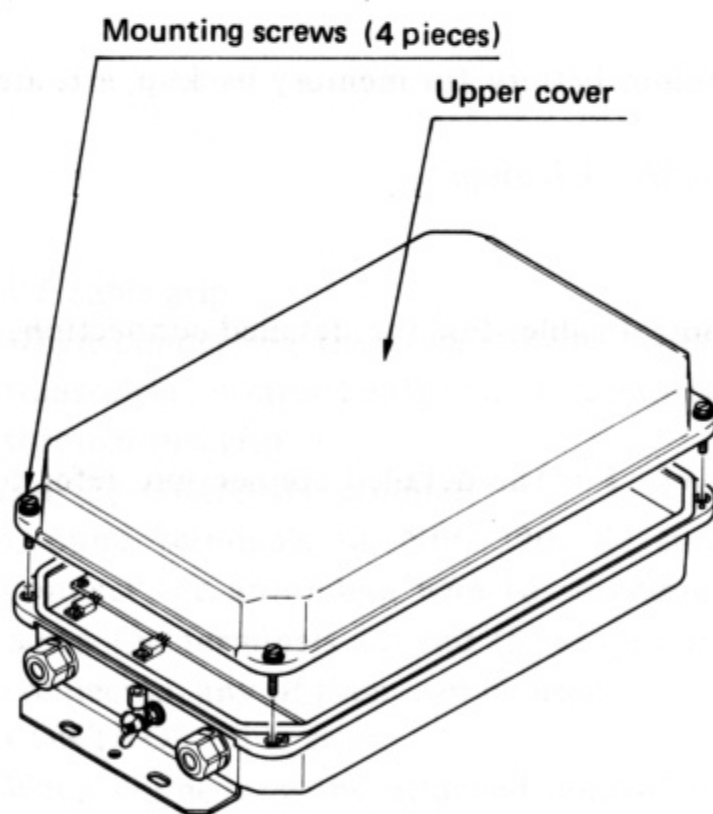


Figure 4.1 Removal of Upper Cover

The basic connection is shown in Figure 4.3. Refer to the figure together with the following explanations.

4.2.1 Antenna

Either kind of vertical type or horizontal type antenna, such as whip, long-wire antenna, etc. can be used. When using a dipole antenna, connect the antenna elements to ANT and GROUND terminals of NFG-230 respectively.

When correct tuning is not performed due to the antenna length, installation method, etc., try to change the antenna length or installation method.

PRECAUTION

The coaxial cable must not be connected to the antenna (ANT) terminal of NFG-230.

4.2.2 Grounding

When installing the grounding type antenna, such as whip, long-wire antenna, etc., the grounding is very important. Namely, as the RF current flows to the ground, the RF grounding resistance influences the antenna operation seriously. When the grounding is poor or the RF grounding resistance is high, the antenna efficiency lowers extremely.

The actual grounding methods are:

- ① To bury copper plates, grounding rods, conduit pipes, etc. in the ground.
- ② Counterpoise
- ③ Radial ground

In any method, if the RF grounding resistance is high, the loss will increase. Carry out the grounding work in such a manner that sufficiently low RF grounding resistance is obtained. When connecting the ground and the GROUND terminal of NFG-230, use a copper tape or copper braided wire with the shortest run in order to make the RF impedance low. Even if the good grounding is provided, the long lead wire to the ground will increase the RF impedance and will loose the grounding effects, resulting in causing the TVI, etc., so be careful of it.

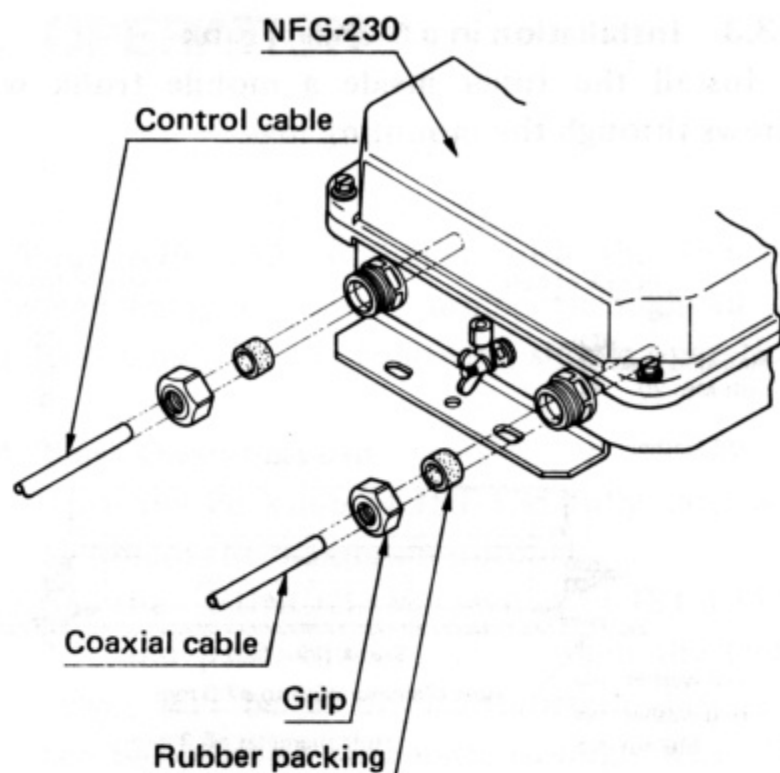
PRECAUTION

The incomplete grounding will cause the radio wave interference such as TVI, etc. and lower the antenna radiation efficiency.

4.2.3 RF INPUT

Connect the coaxial cable from the transceiver. Use the RG-59/U coaxial cable or equivalent in diameter, having 50Ω impedance.

Be sure to fix the cable grip firmly for waterproof as shown in Figure 4.2.



PRECAUTION

When using the small size cable such as RG-58/U etc., wind the vinyl tape around the cable until the diameter becomes the size to the extent of the inside diameter of rubber packing.

Figure 4.2 Fixing of Cables

4.2.4 Control Cable

Connect the supplied control cable according to the colors shown in Figure 4.3. Further, connect

the connector at one end of cable to the **ANT TUNER** connector on the rear panel of JST-135.

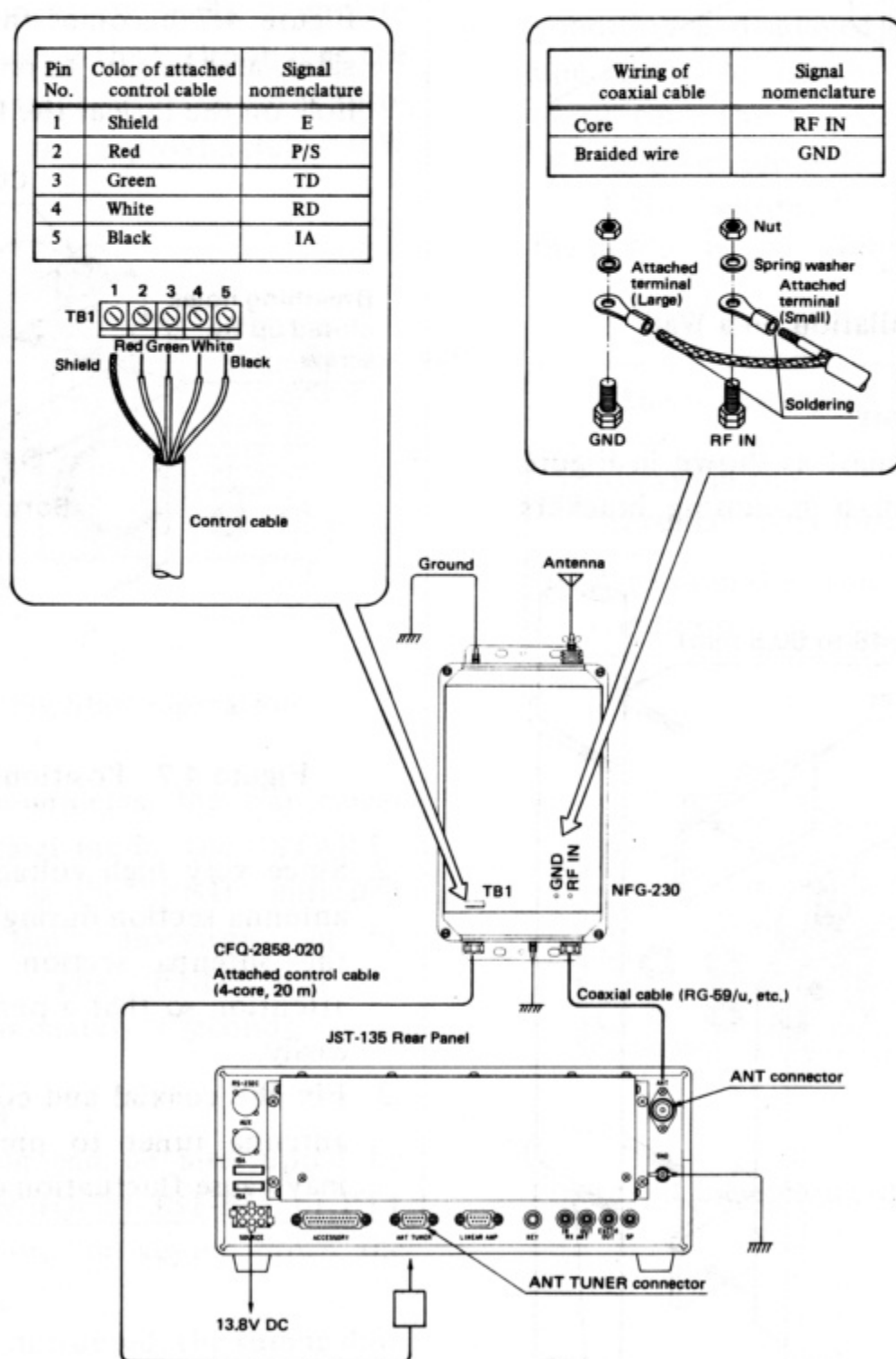


Figure 4.3 Basic Connection of NFG-230

4.3 Installation

The installation examples of NFG-230 are described below.

4.3.1 Installation on a Wall

Install the tuner on a wall with the supplied wood screws through the mounting lugs.

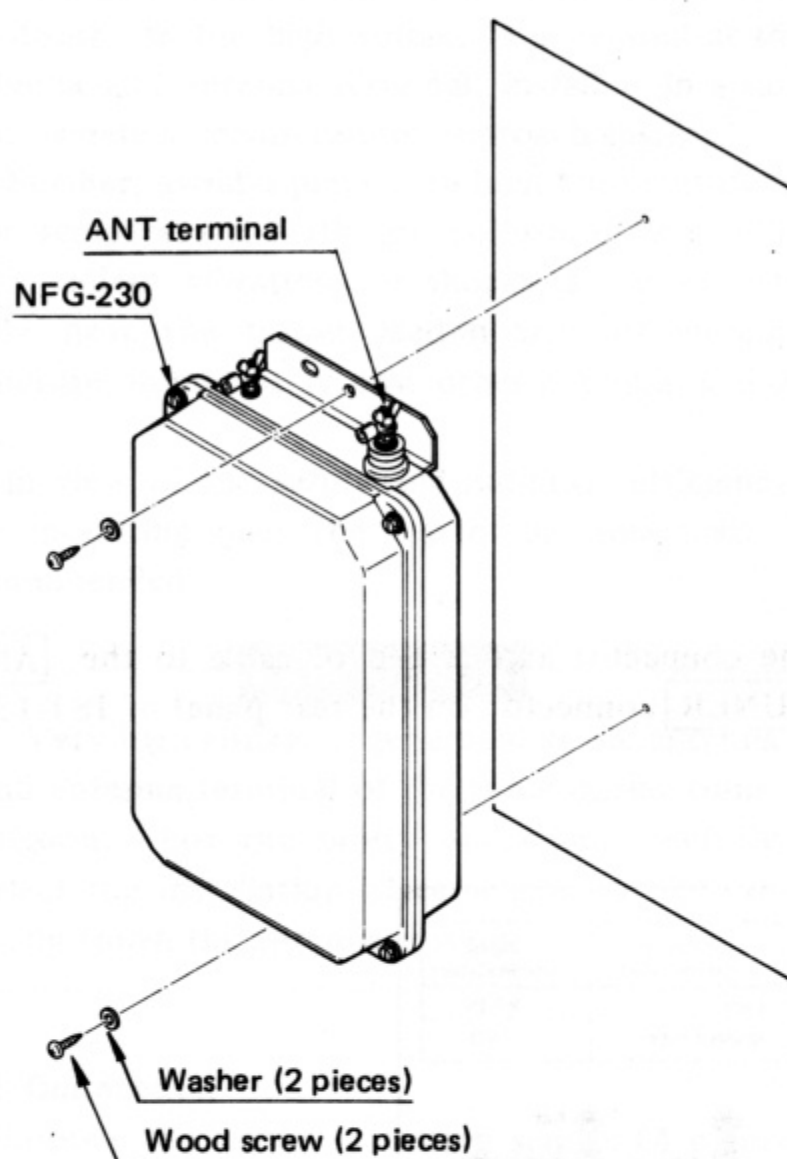


Figure 4.4 Installation on a Wall

4.3.2 Installation to a Mast

Install the tuner to a mast as shown in Figure 4.5, using the supplied mast mounting brackets and U-bolts.

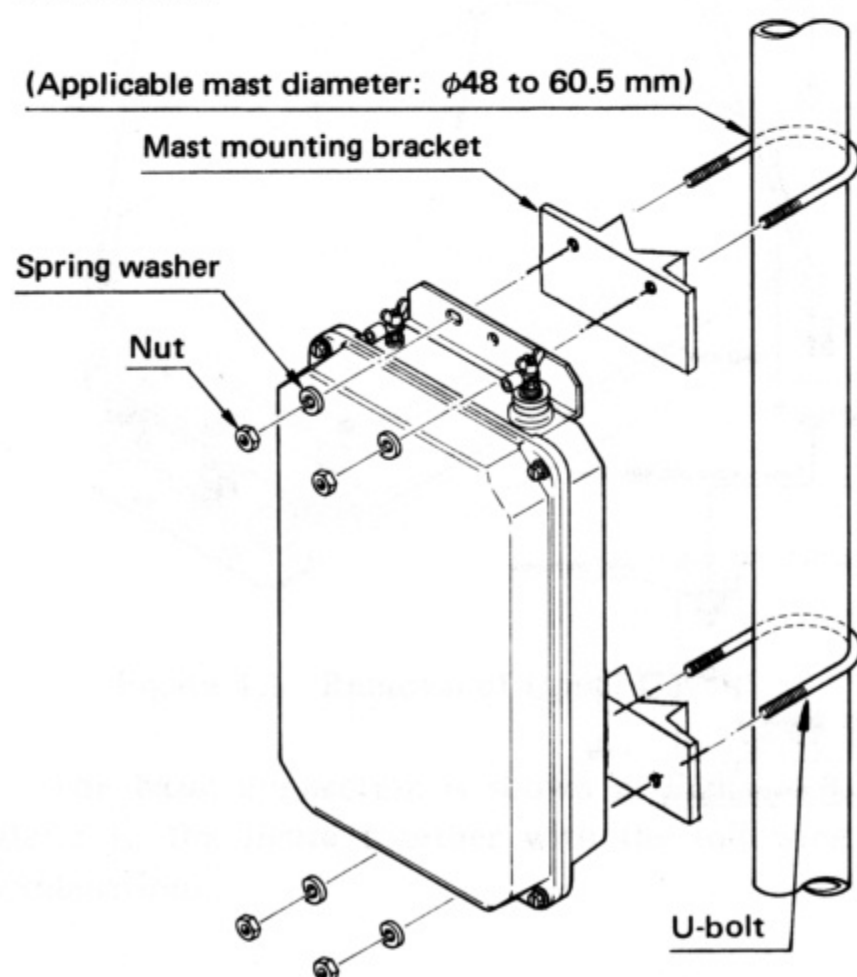


Figure 4.5 Installation to a Mast

4.3.3 Installation in a Mobile Trunk

Install the tuner inside a mobile trunk with screws through the mounting lugs.

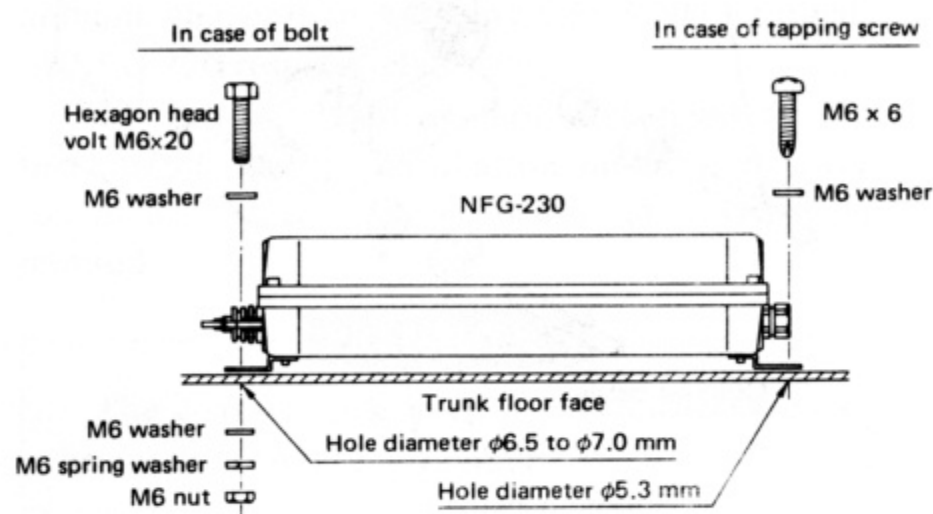


Figure 4.6 Installation in a Mobile Trunk

PRECAUTION

1. For prevention against the dewing by the temperature difference, install the tuner so that either face with breathing hole shown in Figure 4.7 becomes the lower side (ground side), and be sure to remove the screw in the hole on the face at the lower side.

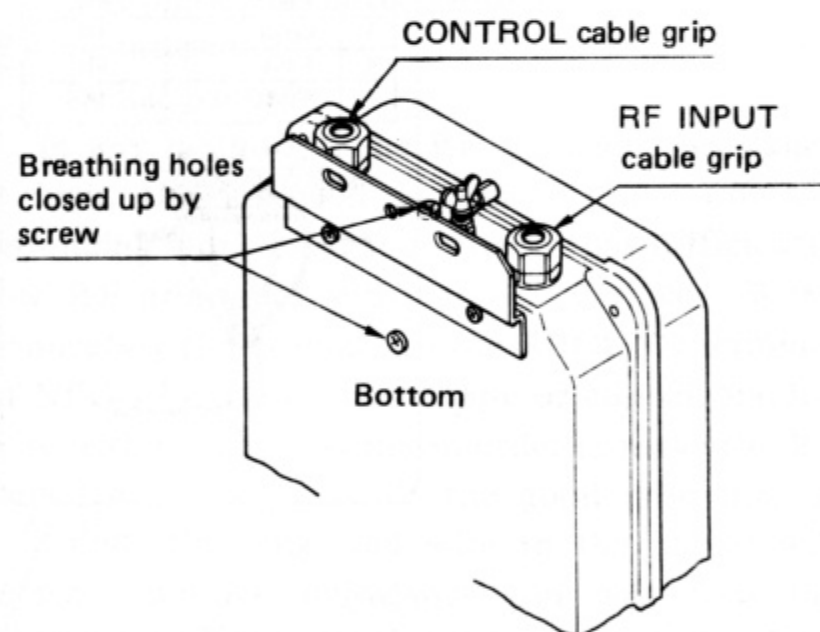


Figure 4.7 Positions of Breathing Holes

2. Since very high voltage is generated at the antenna section during transmission, insulate the antenna section sufficiently and pay attention so that a person does not touch it easily.
3. Fix the coaxial and control cables from the antenna tuner to prevent swinging which may cause fluctuation of SWR.

5. OPERATION

Your NFG-230 combined with the JST-135 provides enjoyable quick tuning through all the HF ham bands by the following simple operation.

5.1 Basic Operation

- 1) Turn the Po knob of JST-135 fully clockwise to obtain the maximum output.
- 2) Set the **FUNC/HAM** switch of JST-135 to ON and press the key **3**, then the transceiver will be in the transmission state, and the tuner starts automatic tuning. When the tuning is erroneously started, press the PTT switch on the microphone, **XMIT** switch of JST-135, or key down the morse key to interrupt the tuning.
- 3) During the automatic tuning, the transceiver operates in the CW mode and the "START" indicator on the display flickers. The typical tuning time is 2 to 4 seconds. However, when the tuning has been performed previously on the same frequency, it will complete instantaneously. Even if the Po knob is at the fully clockwise, the transceiver output is automatically reduced to approximately 10W during tuning.

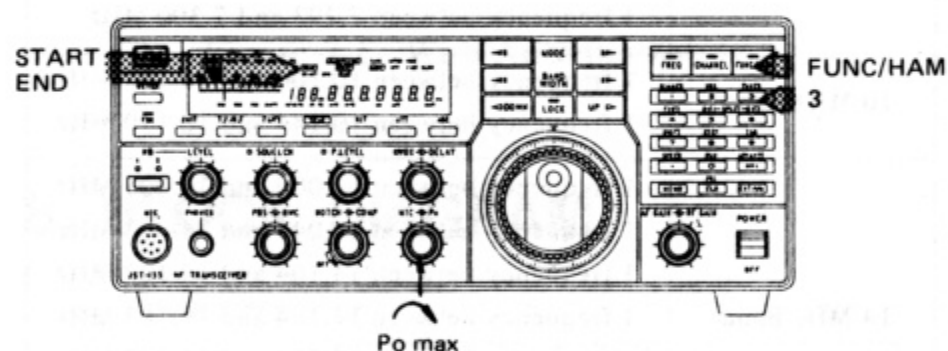


Figure 5.1 Tuning Start Operation

- 4) When the tuning completes, the transceiver returns to the original mode, the "START" indicator goes out, as the "END" indicator comes on, later the transceiver can be operated normally. The "END" indicator goes out after approximately 3 seconds.

5.2 Tuning Interruption

The automatic tuning can be interrupted by pressing the **XMIT** switch of JST-135 or PTT switch on the microphone or keying down the morse key during tuning.

When the tuning is interrupted, the tuning data becomes the data just before starting the tuning operation, so even if the tuning is erroneously started, the tuning data can be protected.

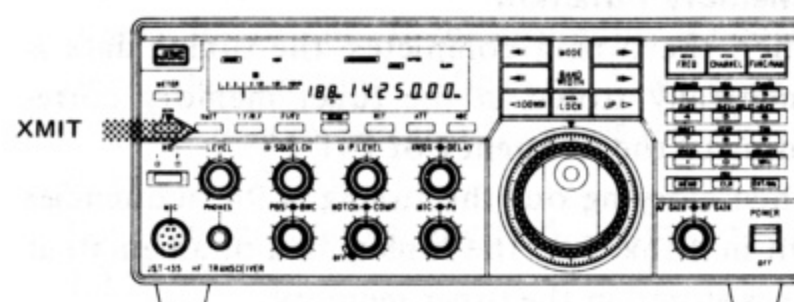


Figure 5.2 Tuning Interruption

5.3 Through Operation

When receiving the frequency largely separated from the transmitting frequency, the tuner can be made as "through" to prevent the sensitivity reduction.

There are 2 kinds of operations as shown below. Select it according to the purpose. The operating condition is displayed on the frequency display of JST-135 by performing the following operation.

When pressing the ten key **3** with the **MEMO** key pressed of JST-135, the tuner condition is displayed on the display. While the tuner condition is displayed on the display, 2 kinds of operation (A) or (B) can be cyclically selected every time the ten key **3** is pressed with the **MEMO** key pressed.

At the factory, the transceiver has been set to the mode (B).

Tuner condition	Display of JST-135
(A) Always in the "through" condition	-- 0 --
(B) Always in the "tuned" condition	-- 1 --

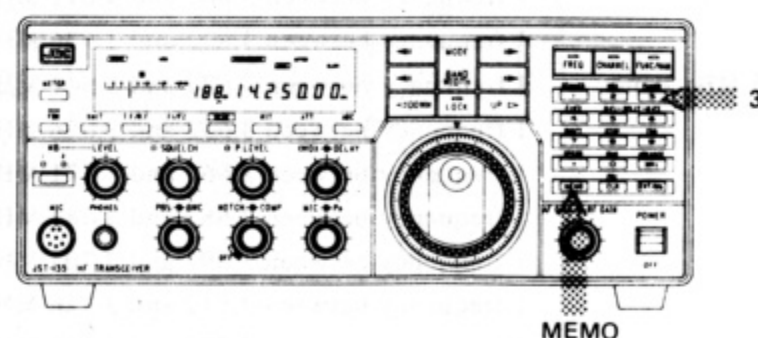


Figure 5.3 Switching of Tuner Through Operation

5.4 Memory Function

When the tuning completes, the tuning data is automatically stored in the tuner memory corresponding to the frequency of JST-135.

When carrying out the tuning at 96 frequencies shown in Table 5.1, the tuning data of all amateur bands is stored in the tuner memory.

Therefore, later there comes no need to carry out the tuning operation from the JST-135, and the speedy QSY can be done.

In case the tuning is not taken at the all frequencies in Table 5.1, carry out the tuning operation at the frequency to use.

PRECAUTION

In case the antenna is replaced, carry out the tuning again.

Table 5.1 Frequency Required for Tuning

Amature Band	Tuning Frequency	Amature Band	Tuning Frequency
1.8 MHz Band	1 frequency between 1.801 and 1.803 MHz	3.5 MHz Band	1 frequency between 3.892 and 3.896 MHz
	1 frequency between 1.810 and 1.812 MHz		1 frequency between 3.907 and 3.911 MHz
	1 frequency between 1.819 and 1.821 MHz		1 frequency between 3.922 and 3.926 MHz
	1 frequency between 1.828 and 1.830 MHz		1 frequency between 3.937 and 3.941 MHz
	1 frequency between 1.837 and 1.839 MHz		1 frequency between 3.952 and 3.956 MHz
	1 frequency between 1.846 and 1.848 MHz		1 frequency between 3.967 and 3.971 MHz
	1 frequency between 1.855 and 1.857 MHz		1 frequency between 3.982 and 3.986 MHz
	1 frequency between 1.864 and 1.866 MHz		1 frequency between 3.997 and 4.000 MHz
	1 frequency between 1.873 and 1.875 MHz	7 MHz Band	1 frequency between 7.000 and 7.002 MHz
	1 frequency between 1.882 and 1.884 MHz		1 frequency between 7.023 and 7.032 MHz
	1 frequency between 1.891 and 1.893 MHz		1 frequency between 7.053 and 7.062 MHz
	1 frequency between 1.900 and 1.902 MHz		1 frequency between 7.083 and 7.092 MHz
	1 frequency between 1.909 and 1.911 MHz		1 frequency between 7.113 and 7.122 MHz
	1 frequency between 1.918 and 1.920 MHz		1 frequency between 7.143 and 7.152 MHz
	1 frequency between 1.927 and 1.929 MHz		1 frequency between 7.173 and 7.182 MHz
	1 frequency between 1.936 and 1.938 MHz		1 frequency between 7.203 and 7.212 MHz
	1 frequency between 1.945 and 1.947 MHz		1 frequency between 7.233 and 7.242 MHz
	1 frequency between 1.954 and 1.956 MHz		1 frequency between 7.263 and 7.272 MHz
	1 frequency between 1.963 and 1.965 MHz		1 frequency between 7.293 and 7.300 MHz
	1 frequency between 1.972 and 1.974 MHz	10 MHz Band	1 frequency between 10.100 and 10.103 MHz
	1 frequency between 1.981 and 1.983 MHz		1 frequency between 10.144 and 10.150 MHz
	1 frequency between 1.990 and 1.992 MHz	14 MHz Band	1 frequency between 14.000 and 14.003 MHz
	1 frequency between 1.999 and 2.000 MHz		1 frequency between 14.044 and 14.063 MHz
3.5 MHz Band	1 frequency between 3.502 and 3.506 MHz		1 frequency between 14.104 and 14.123 MHz
	1 frequency between 3.517 and 3.521 MHz		1 frequency between 14.164 and 14.183 MHz
	1 frequency between 3.532 and 3.536 MHz		1 frequency between 14.224 and 14.243 MHz
	1 frequency between 3.547 and 3.551 MHz		1 frequency between 14.284 and 14.303 MHz
	1 frequency between 3.562 and 3.566 MHz		1 frequency between 14.344 and 14.350 MHz
	1 frequency between 3.577 and 3.581 MHz	18 MHz Band	1 frequency between 18.084 and 18.103 MHz
	1 frequency between 3.592 and 3.596 MHz		1 frequency between 18.144 and 18.163 MHz
	1 frequency between 3.607 and 3.611 MHz	21 MHz Band	1 frequency between 21.005 and 21.054 MHz
	1 frequency between 3.622 and 3.626 MHz		1 frequency between 21.155 and 21.204 MHz
	1 frequency between 3.637 and 3.641 MHz		1 frequency between 21.305 and 21.354 MHz
	1 frequency between 3.652 and 3.656 MHz	24 MHz Band	1 frequency between 21.405 and 21.450 MHz
	1 frequency between 3.667 and 3.671 MHz		1 frequency between 24.905 and 24.954 MHz
	1 frequency between 3.682 and 3.686 MHz	28 MHz Band	1 frequency between 28.000 and 28.004 MHz
	1 frequency between 3.697 and 3.701 MHz		1 frequency between 28.105 and 28.154 MHz
	1 frequency between 3.712 and 3.716 MHz		1 frequency between 28.255 and 28.304 MHz
	1 frequency between 3.727 and 3.731 MHz		1 frequency between 28.405 and 28.454 MHz
	1 frequency between 3.742 and 3.746 MHz		1 frequency between 28.555 and 28.604 MHz
	1 frequency between 3.757 and 3.761 MHz		1 frequency between 28.705 and 28.754 MHz
	1 frequency between 3.772 and 3.776 MHz		1 frequency between 28.855 and 28.904 MHz
	1 frequency between 3.787 and 3.791 MHz		1 frequency between 29.005 and 29.054 MHz
	1 frequency between 3.802 and 3.806 MHz		1 frequency between 29.155 and 29.204 MHz
	1 frequency between 3.817 and 3.821 MHz		1 frequency between 29.305 and 29.354 MHz
	1 frequency between 3.832 and 3.836 MHz		1 frequency between 29.455 and 29.504 MHz
	1 frequency between 3.847 and 3.851 MHz		1 frequency between 29.605 and 29.654 MHz
	1 frequency between 3.862 and 3.866 MHz		
	1 frequency between 3.877 and 3.811 MHz		

6. MAINTENANCE

● Replacement of the backup battery

A lithium battery (manufactured by Sanyo: 3V) is used for memory backup, and normally the backup for approximately 5 years is possible. When the battery life expires and abnormal memory operation appears, replace the battery with new one (type CR-2430FT6, Sanyo).

In case the battery is unavailable or in case you wish to have the battery replaced, contact the dealer you purchased the tuner.

7. OPTIONS

The following options are provided to effectively use the NFG-230.

■ Wire antenna kit (NAW-110)

Long-wire antenna kit, which includes all necessary parts such as insulators, etc..

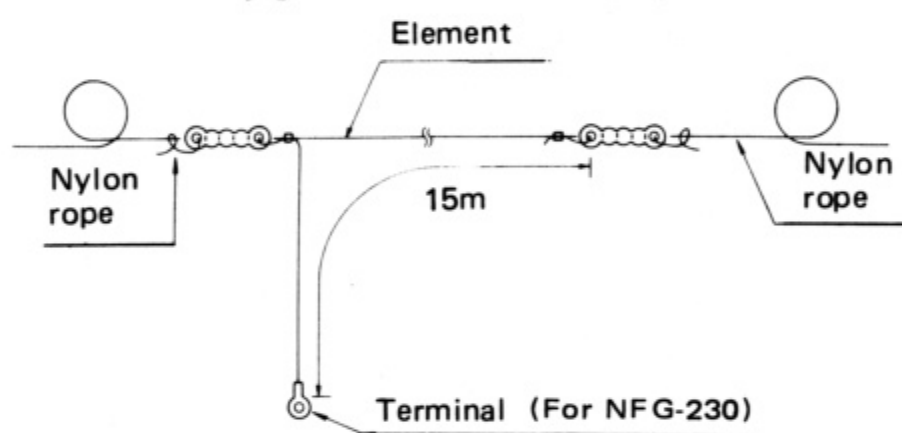


Figure 7.1 Wire Antenna Kit

When using the NAW-110, the grounding work is very important. If the grounding is poor, not only the antenna efficiency lowers to the extreme degree but also it causes the TVI, etc., so be careful of it.

For the grounding method, refer to clause 4.2.2.

■ Dipole antenna kit (NAW-120)

Dipole antenna kit to be mounted to a mast. The mast is not included.

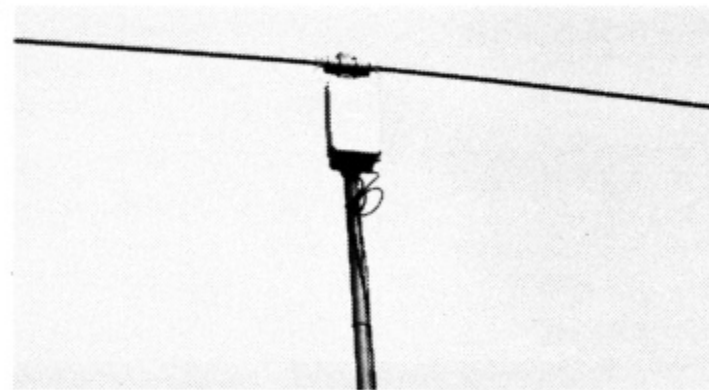


Figure 7.2 Dipole Antenna Kit

■ Mobile antenna kit (NAW-130)

Whip antenna kit for mobile station.

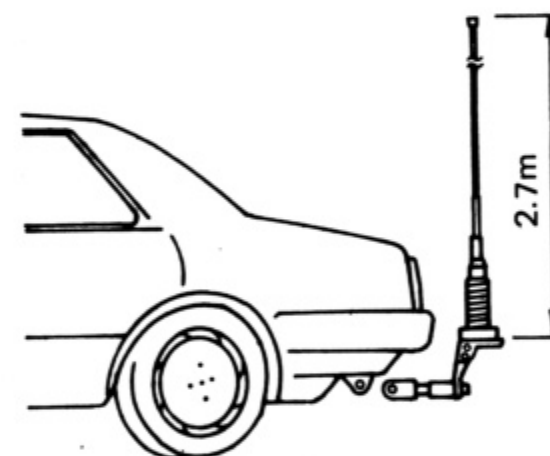


Figure 7.3 Mobile Whipe Antenna Kit

8. BLOCK DIAGRAM

