

# MFJ

## *Compact Artificial Ground*

*Model MFJ-9231*



### INSTRUCTION MANUAL

CAUTION: Read All Instructions Before Operating Equipment

## MFJ ENTERPRISES, INC.

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## DISCLAIMER

Information in this manual is designed for **user purposes only** and is *not* intended to supersede information contained in customer regulations, technical manuals/documents, positional handbooks, or other official publications. The copy of this manual provided to the customer will *not* be updated to reflect current data.

Customers using this manual should report errors or omissions, recommendations for improvements, or other comments to MFJ Enterprises, 300 Industrial Park Road, Starkville, MS 39759. Phone: (662) 323-5869; FAX: (662) 323-6551. Business hours: M-F 8-4:30 CST.

## MFJ COMPACT ARTIFICIAL GROUND

**IMPORTANT:** Please read entire manual before attempting to operate this equipment. This unit does not provide a DC electric ground. A separate wire will need to be run from the transmitter to an electric ground if it is not already available.

Thank you for purchasing the MFJ-9231 COMPACT ARTIFICIAL GROUND. The MFJ-9231 creates an artificial ground with a random length of wire thrown on the floor. This produces a tuned counterpoise. Also, the MFJ-9231 will electrically place a far away RF ground directly at our rig.

### INSTALLATION AND OPERATION

#### Creating Artificial Ground

1. Install the ground from your transmitter or antenna tuner to the black binding post labeled "TRANSMITTER GROUND" on the front of the MFJ-9231.

**Note:** This wire needs to be as short as possible, preferably with the ground posts as close as possible i.e., the units side by side or one on top of the other.

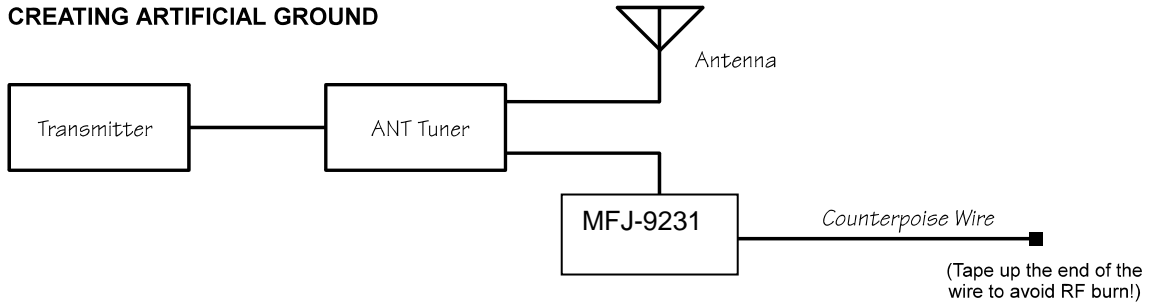
2. Attach a length of random wire to the red binding post labeled "COUNTERPOISE WIRE" on front of the MFJ-9231. **Be sure not to reverse these wires.** The random wire should be a quarter-wave length or less at the operating frequency. Be sure to throw the random wire along the floor and to tape up the open end of the wire to avoid RF burn.

**DANGER: Touching the wire while keying can cause RF burn and is potentially fatal. Watch out for children and pets.**

3. To obtain maximum RF ground current for a low impedance RF ground, adjust the Slide Switch and Rotary Switch controls on the front panel labeled "INDUCTANCE".
  - a. Select a base inductance value using the INDUCTANCE Slide Switch. Then use the INDUCTANCE rotary knob to vary the inductance.
    - i. L1 is the minimum inductance value (approx. 1 - 13  $\mu$ H).
    - ii. L2 has twice the inductance of L1 (approx. 13-26  $\mu$ H)
    - iii. L3 has 3 times the inductance of L1. (approx. 27-39  $\mu$ H)
  - b. Turn the INDUCTANCE control until the lowest SWR is achieved on your SWR Wattmeter. Try several inductance settings for best results. .

You may need to retune both the MFJ-9231 and your antenna tuner several times to achieve best results.

**CREATING ARTIFICIAL GROUND**

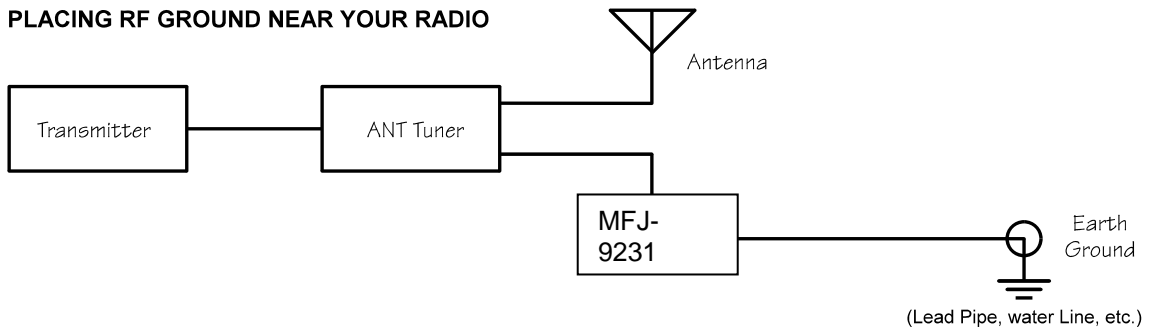


**Electrically Placing Your Far Away RF Ground at Your Radio**

Connect your transmitter or antenna tuner ground to the black binding post labeled "TRANSMITTER GROUND" on the front of the MFJ-9231 with the shortest possible wire(s). If necessary, place the MFJ-9231 and your transmitter or antenna tuner side by side or one on top of the other to insure the ground of each are as close to each other as possible. Connect your existing ground wire to the red binding post labeled "COUNTERPOISE WIRE" on the front of the MFJ-9231. **Do not reverse these wires.** After making these connections, follow the same procedure for maximizing RF ground current as described in the Creating Artificial Ground section. After maximum RF current is reached, retune your antenna tuner for minimum SWR. You may need to retune both your antenna tuner and the MFJ-9231 several times to achieve best results.

**WARNING: This unit does not provide a DC electric ground. A separate wire will need to be run from the transmitter to an electric ground if it is not already available.**

**PLACING RF GROUND NEAR YOUR RADIO**



**Failure to Obtain a Ground Reading**

If a ground current reading cannot be obtained at full transmitting power, the counterpoise or ground may not generate sufficient current at the operating frequency. If no RFI problems exist, set the INDUCTANCE control to "A" and operate. If you experience RF in the shack or other problems, alter the counterpoise or add a different length of wire. The wire for a counterpoise should be a quarter wavelength at the lowest frequency used. Additional short lengths may be placed for other bands if needed. More radials will give a stronger current reading.

You should be aware of typical antenna current behavior at different wavelengths. An antenna which is a half wavelength will not show any ground current at exactly the resonant frequency. An antenna which is a quarter wavelength at the resonant frequency will show maximum ground current. The amount of current through the ground wire depends entirely on the antenna system. The odd wavelengths give maximum current reading, and the even wavelengths are minimum or zero. Zero current draw shows a zero meter reading. This does not mean that the meter is not working. Try the same antenna on at least an eighth of a wavelength difference in frequency, which should show some ground current.

In the case of a halfwave antenna, the meter is not usable for measuring ground current, so it is very difficult to tune the artificial ground. You may use a field strength meter, such as the MFJ-812B, to tune the ground for maximum radiated signal. This also means that the receiving station S-units will go to maximum for this antenna system. You would also use the field strength meter when tuning a counterpoise system.

Using the artificial ground to tune the ground may not be obvious if you are a new user. You must visualize and account for all sources of ground current. If the artificial ground is connected into the ground lead of the transmitter, and a ground wire is also connected to the ground lead of the amplifier or tuner, then the artificial ground is effectively shorted out, and no ground current will show on the meter. You must install the MFJ-9231 in series with the ground system.

**Visual tool:** A station is positioned a mile higher than the ground rod. A ground wire runs from the ground rod to the station. The ground wire will show very high resistance and radiation instead of conducting current to the ground rod. The MFJ-9231 tunes the wire for low resistance at the antenna system resonant frequency so that the antenna system may develop maximum current. This in turn provides maximum radiated power from the antenna system. Without the MFJ-9231, the wire makes a better antenna than a ground wire.

## Using a Counterpoise

If you are unable to connect the station to any type of ground wire, then you may still use the counterpoise to increase your signal. As more and more wire is installed underneath an antenna, the signal strength will increase. This will continue until a maximum occurs. Only one wire installed along the floor is enough to make a very noticeable improvement in signal strength. The counterpoise reflects radiated energy, which would normally be absorbed by the ground as heat, back above the ground plane. This redirection of energy combines with the primary radiated signal as usable field strength. Received energy bounces off of the counterpoise into the antenna along the reverse path.

**Visual tool:** A lighted candle on a table in a dark room emits a given amount of energy in all directions. Light which reaches the walls will have a given brightness. You could say that this would be signal strength. Energy is broadcast in all directions around the candle, up and down. If a mirror is inserted underneath the candle, energy previously absorbed by the table (ground) is radiated upward. The result is that the amount of light on the walls increases. The transmitted energy is not changed, simply redirected. The amount of signal increase will depend on the area of reflection. Beyond a certain area, no further increase will be noticed. A sliver of mirror placed on only one side of the candle would give an increase only in that direction. A ground plane underneath a HT rubber ducky will tremendously increase radiated field strength from the radio.

## Radio Frequency Interference

In many cases, providing an adequate ground to the antenna system will reduce or stop unwanted radiation outside the operating frequency. Harmonics can be directed to ground, or simply become part of the main radiated energy. This gives the appearance of a cleaner signal on the air.

RFI can also increase by use of a grounded antenna system. A common belief, which is not true, is that an artificial ground will remove all RFI from the station. RFI suppression is a side effect of a clean signal, not a universal solution.

The most common type of RFI is commonly called front-end overload. This results whenever a semiconductor junction comes into contact with an AC (RF) signal and rectifies it. Any diode, transistor, or IC can rectify RF and mix it internally with any other signal present. More signal present raises the level of mixing in the semiconductor junction. The higher signal present can be a result of the increased field strength of the antenna. The only way to remove this type of RFI is by shielding and filtering of the received RF in the receiving device. Grounding of the receiving device case can help. If the case is non-metallic, then RF energy is free to invade the internal circuitry. Any wires attached to the device may act as antennas. Installing an RF suppression kit, such as the MFJ-701, can greatly reduce the interference traveling up these lines.

Installing a ground in the wrong fashion, such as mistuning and bad connections, can also generate additional RFI. Harmonics and loss of signal strength can be the result. Energy outside the band may become great enough to radiate into the commercial radio and TV bands. Installing a low pass filter, such as the MFJ-704, will provide additional suppression of the out-of-band signal.

### **TECHNICAL ASSISTANCE**

If you have any problem with this unit first check the appropriate section of this manual. If the manual does not reference your problem or your problem is not solved by reading the manual, you may call *MFJ Technical Service* at **662-323-0549** or the *MFJ Factory* at **662-323-5869**. You will be best helped if you have your unit, manual and all information on your station handy so you can answer any questions the technicians may ask.

You can also send questions by mail to MFJ Enterprises, Inc., 300 Industrial Park Road, Starkville, MS 39759; by Facsimile (FAX) to 662-323-6551; or by email to [techinfo@mfjenterprises.com](mailto:techinfo@mfjenterprises.com). Send a complete description of your problem, an explanation of exactly how you are using your unit, and a complete description of your station.

## LIMITED 12 MONTH WARRANTY

MFJ Enterprises, Inc. warrants to the original owner of this product, if manufactured by MFJ Enterprises, Inc. and purchased from an authorized dealer or directly from MFJ Enterprises, Inc. to be free from

defects in material and workmanship for a period of 12 months from date of purchase provided the following terms of this warranty are satisfied.

**1.** The purchaser must retain the dated proof-of-purchase (bill of sale, canceled check, credit card or money order receipt, etc.) describing the product to establish the validity of the warranty claim and submit the original or machine reproduction of such proof of purchase to MFJ Enterprises, Inc. at the time of warranty service. MFJ Enterprises, Inc. shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, or forgery shall be cause to void any and all warranty terms immediately.

**2.** MFJ Enterprises, Inc. agrees to repair or replace at MFJ's option without charge to the original owner any defective product under warrantee provided the product is returned postage prepaid to MFJ Enterprises, Inc. with a personal check, cashiers check, or money order for **\$10.00** covering postage and handling.

**3.** This warranty is **NOT** void for owners who attempt to repair defective units. Technicalconsultation is available by calling the Service Department at 662-323-0549 or the MFJ Factory at 662-323-5869.

**4.** This warranty does not apply to kits sold by or manufactured by MFJ Enterprises, Inc.

**5.** Wired and tested PC board products are covered by this warranty provided **only the wired and tested PC board product is returned.** Wired and tested PC boards installed in the owner's cabinet or connected to switches, jacks, or cables, etc. sent to MFJ Enterprises, Inc. will be returned at the owner's expense unrepaired.

**6.** Under no circumstances is MFJ Enterprises, Inc. liable for consequential damages to person or property by the use of any MFJ products.

**7. Out-of-Warranty Service:** MFJ Enterprises, Inc. will repair any out-of-warranty product provided the unit is shipped prepaid. All repaired units will be shipped COD to the owner. Repair charges will be added to the COD fee unless other arrangements are made.

**8.** This warranty is given in lieu of any other warranty expressed or implied.

**9.** MFJ Enterprises, Inc. reserves the right to make changes or improvements in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.

**10.** All MFJ products to be serviced in-warranty or out-of-warranty should be addressed to:

**MFJ Enterprises, Inc.**

**300 Industrial Park Road**

**Starkville, Mississippi 39759 USA**

and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase.

**11.** This warranty gives you specific rights, and you may also have other rights which vary from state to state.