

MFJ

***MFJ Compact
SWR/Wattmeter
Model MFJ-9213***

INSTRUCTION MANUAL

CAUTION: Read All Instructions Before Operating Equipment

MFJ ENTERPRISES, INC.

300 Industrial Park Road
Starkville, MS 39759 USA
Tel: 662-323-5869 Fax: 662-323-6551

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-9213 Compact SWR/Wattmeter

INTRODUCTION

The MFJ-9213 is a specialized SWR/Wattmeter that measures *SWR* and indicates *relative power* for any low-power HF transmitter running between 100 mW and 100 Watts. The MFJ-9213's exceptionally wide measurement range makes it an especially valuable tool for experimenters, kit builders, and serious QRP operators. To ensure accuracy, the MFJ-9213 features a Bruene-style SWR bridge circuit that sums RF-current and RF-voltage levels to ensure more uniform accuracy across a wide range of load impedances, operating frequencies, and power levels.

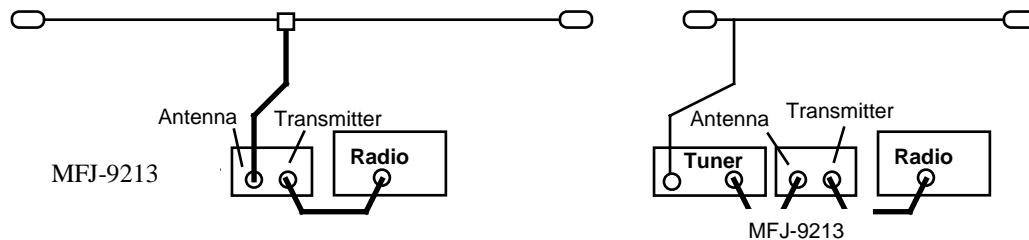
Important Note: The MFJ-9213 is a sensitive electronic device that could be damaged by incorrect setup and operation. Please read this manual thoroughly before attempting to use it!

MFJ-9213 Controls:

1. **SWR/POWER:** Pot sets power sensitivity, calibrates meter for SWR measurements.
2. **FWD/SET and REF/SWR Switch:** Switches meter between forward and reverse power detectors. Also switches between SWR Set and SWR Read functions.
3. **5-W / 30-W / 100-W Marker:** 5/30/100 Watt power scale is calibrated when SWR/POWER control is set here.
4. **SWR Scale:** Displays SWR in REV when meter is set to full-scale deflection in FWD.

INSTALLATION

Using a RF patch cable, connect your radio to the meter's *TRANSMITTER* jack. Connect the antenna or the input line to a tuner to the *ANTENNA* jack.



Reading Absolute Power (5/30/100-Watt Scale): Adjust the *SWR/POWER* knob to the *5/30/100-W* calibration marker on the panel. To read forward power in Watts, select *FWD/SET* with the meter switch. For reflected power in Watts, select *REF/SWR*.

Reading Relative Power: The MFJ-9213 is continuously adjustable for displaying relative power from a maximum rating of 100 Watts down to 100 mW or less. The meter's exceptional sensitivity is especially useful for testing and tuning low-power QRP transmitters. To measure relative power, first set the *SWR/POWER* control *fully counter-clockwise* for minimum meter sensitivity. Once power is applied, gradually increase the *SWR/POWER* control until you obtain a useful range of meter deflection.

Important Warning: Always begin relative power measurements by setting the *SWR/POWER* control for minimum sensitivity (fully counterclockwise). Applying excessive power with the control adjusted to a high-sensitivity setting could permanently damage the meter movement!

OPERATION

Measuring SWR:

The MFJ-9213 measures SWR from 100-Watts input down to 100-mW or below. To measure SWR:

1. Select *FWD/SET* and turn the *SWR/POWER* control *fully counter-clockwise*.
2. Apply RF power and carefully adjust *SWR/POWER* for a full-scale meter deflection*
3. Select *REV/SWR* and read SWR directly from the meter scale.

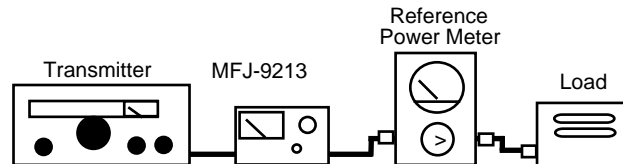
Note: Adjusting for "*full-scale meter deflection*" means carefully setting the meter pointer exactly over the last right-hand marking on the meter scale (the 5-watt mark or infinite SWR). Full-scale deflection should not be confused with "*maximum deflection*" which implies pinning the meter!

Important Note: For QRP SWR measurements, you must apply sufficient RF power to obtain full-scale meter deflection with the meter switch in *FWD/SET*.

QRP SWR Accuracy: Meter scale accuracy for reflected power normally decreases at very low power settings because of detector-diode characteristics. Note that this condition does not alter the *frequency* where minimum SWR occurs, nor should it limit your ability to make practical tuner and antenna adjustments for lowest SWR.

Adding Calibrated Power Ranges: The MFJ-9213 comes from the factory with a 5/30/100-Watt calibrated power scale, but it is possible to add customized power ranges if you wish. For example, if your radio runs 100 Watts, a 100-Watt scale might be desirable. By the same token, a 5 Watt scale could be useful for calculating QRP miles-per-watt scores. To add one or more ranges, follow the steps outlined below. You'll need a 20 or 40-Meter transmitter with adjustable output power, a dummy load, and an in-line wattmeter of known accuracy to complete the procedure:

1. Connect the transmitter to the dummy load through the two power meters, as shown.



2. Key the transmitter. Viewing the reference power meter, set transmitter output to the maximum level you want to measure on the new MFJ-9213 scale (5-W, 30-W, etc.)
3. Set the meter switch to FWD/SET and adjust the SWR/POWER sensitivity control on the MFJ-9213 until the meter reads full scale (confirm that the pointer is positioned *exactly* over the last division printed on the meter scale).
4. Carefully apply a marker to the panel that shows the location of the SWR/POWER knob pointer. Accuracy matters, you must be able to reset the sensitivity control to this spot again without ambiguity.

Interpreting SSB Power Readings: The MFJ-9213 is an averaging wattmeter. As such, SSB power readings will represent an average compilation of the speech waveform rather than the maximum output on voice peaks. The exact difference between average and peak power readings can vary, depending on factors like voice pattern, Mic-Gain setting, and AGC compression. During conversational speech, average readings are typically 20 to 30 percent of peak power for properly adjusted transmitters.

Power Handling: The MFJ-9213 is especially designed for HF applications and carries a suggested maximum power rating of 100 Watts.

Important Warning: Never apply over 100 Watts of power to your meter or permanent damage to the meter movement and other sensitive components may result! Also, never operate your meter without a load connected to the Antenna port.

Frequency Range: The MFJ-9213 has been tested and found to perform reliably from 1.8 to 54 MHz.

Circuit Description: The MFJ-9213 uses a Bruene-style SWR bridge circuit, a design commonly found in higher-priced commercial-grade meters. Originally developed by Collins Radio, it sums both RF-current and RF-voltage levels to ensure better accuracy across a wide range of load impedances, operating frequencies, and power levels. The RF-voltage component is sampled across C1/C2/R1 and combined via the center tap of T1. The RF-current component is sampled via T1. The output of each DC level detector (forward and reverse) is filtered and routed through the *FWD/REV* switch (SW1). *SWR/POWER* potentiometer (R5) sets the power sensitivity level of meter M1.

Meter Calibration Procedure: Your MFJ-9213 was calibrated at the factory and should deliver years of accurate service without further attention. However, you may replicate the factory alignment procedure by following the procedure outlined below:

1. Setting the Null Trimcap: This adjustment requires an insulated tuning wand, a HF transmitter with adjustable power output, and an accurate 50-Ohm HF dummy load. Remove the box cover and locate the null-trimmer at the rear of the PC board (C1). Switch the meter to *REF/SWR* (S1) and set *SWR/POWER* (R5) to the 5-Watt calibration mark. Connect the dummy load, set radio to 14-MHz, and apply a 5-W carrier. Using the insulated wand, adjust C1 for *minimum meter indication*. Meter deflection should approach zero when C1 is properly adjusted.

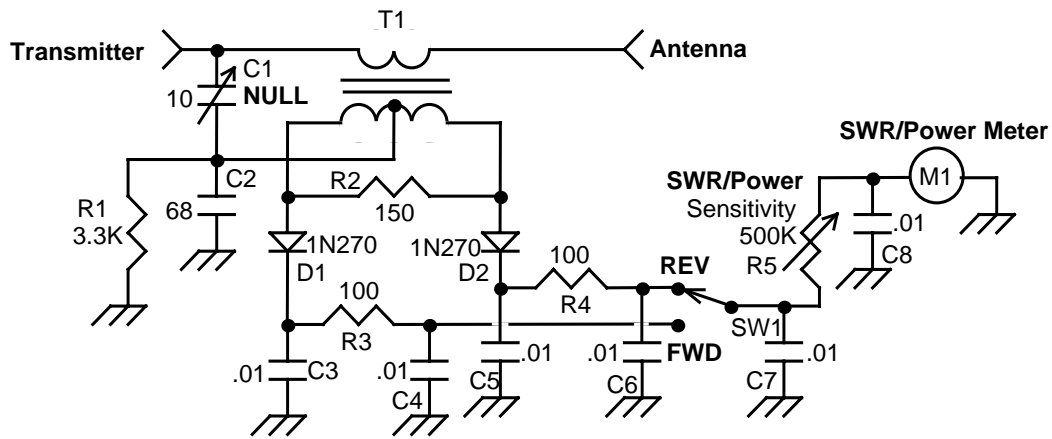
2. Check Power Calibration: The 30-Watt calibration adjustment requires an accurate 30-W signal source, a 1/16" Allen wrench, and a 50-Ohm dummy load. Switch meter to *FWD/SET* (S1), apply a 14-MHz 5-Watt carrier, and carefully adjust the meter sensitivity knob (R5) for a full-scale (30-W) reading. When this is done, the knob pointer should fall in exactly alignment with the 30-Watt calibration marker. If it doesn't, loosen the knob with the Allen wrench and reposition for exact alignment. Tighten firmly in place. This completes the MFJ-9213 alignment procedure.

TECHNICAL ASSISTANCE

If you have any problem with this unit first check the appropriate section of this manual. If this manual does not reference your problem or your problem is not solved by reading this 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. Send a complete description of your problem, an explanation of exactly how you are using your unit, and a complete description of your station.

SCHEMATIC



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. Technical consultation 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.