

## MFJ-836 SWR/Wattmeter and RF Ammeter

### Introduction

The MFJ-836 is an all-in-one true peak reading SWR/Wattmeter with a built in RF Ammeter designed to operate on 1.8-30 MHz. The SWR/Wattmeter uses our *TrueActive*™ peak reading circuit to read true peak/average forward and reflected power and SWR simultaneously. It has 3000/300 Watts forward and 600/60 Watts reflected power scales. The SWR/Wattmeter utilizes a large illuminated three-inch Cross-Needle meter to read the SWR from 1:1 to  $\infty$ . The RF Ammeter measures RF feedline current in three calibrated ranges: 0.3 Amperes, 1 Ampere, and 3 Amperes.

#### **IMPORTANT:**

**Please read entire manual before attempting to operate this equipment. This unit does not provide a dc or low frequency earth ground. A separate wire should be connected from the station ground bus to an electric ground. Do not place any non-coaxial feed wires near metallic or RF sensitive devices.**

### Installation

1. Connect your transmitter to the connector on the back of the unit labeled TRANSMITTER and your antenna to the connector labeled ANTENNA. It is important that you use good quality coax and properly installed connectors.
2. The MFJ-836 has a *TrueActive*™ peak reading circuit included the SWR/Wattmeter that requires a DC power supply such as the MFJ-1312B in order to function. A 9 VDC may also be installed inside the meter with a battery clip that is included. The rear panel accepts a 2.1 mm coaxial plug with the center conductor positive (+) and the sleeve negative (-). The negative lead is grounded inside the meter. There is no need to disconnect the battery when using external power. The RF Ammeter does not require power to operate.
3. An internal lamp backlights the SWR/Wattmeter scale. The lamp circuit requires 12 VDC and will not illuminate with the 9 VDC battery alone.
4. To measure the power output capability of a transmitter/amplifier you should connect a quality 50-ohm dummy load to the ANTENNA connector of the MFJ-836.

#### **NOTE:**

**The SWR/Wattmeter must have a power source in order to function. A nine-volt battery may be installed in the compartment on the rear panel, or an external 12 VDC source, such as the optional MFJ-1312D power supply, may be used.**

## Operation

1. With the DC power supply or 9 VDC battery installed, push the **ON/OFF** button **in** to turn the unit ON. If 12 VDC is used, the SWR/Wattmeter backlight will also be turned ON.
2. The SWR/Wattmeter's full-scale forward and reflected power range is controlled by the **3000/300-Watt** button. When the button is pushed **in**, the forward power scale is on 3000 Watts and the reflected power scale is on 600 Watts. When the button is pushed **out**, the forward power scale is on 300 Watts and the reflected power scale is on 60 Watts. If your transmitter/amplifier runs more than 300 Watts of output power, push the button **in** for 3000 Watts. If your transmitter runs less than 300 Watts of output power, push the button **out** for 300 Watts.
3. Average power is measured when the **PEAK/AVG** button is pushed **out**. Peak envelope power (PEP) is measured when the **PEAK/AVG** button is pushed **in**. Peak and average power values are equal with steady unmodulated carriers, FSK, or FM. The meter reading on these modes will be the same whether the **PEAK/AVG** button is pushed **in** or **out**. On SSB, the PEP meter reading should be twice the average power with two-tone test modulation. On SSB, the ratio of PEP to average power varies with different voice characteristics. With most voices, the PEP reading is three to five times higher than the average voice power reading. The most accurate PEP readings are obtained only with sustained carrier, voice or two-tone test modulation. During normal voice modulation, the wattmeter will typically indicate only 70% of the true Peak Envelope Power.
4. Forward power is displayed on the left-hand FORWARD meter scale. This scale is calibrated from 0 to 300 Watts and is read directly in the **300W (out)** position. Each picket (scale mark) represents 5 Watts below 10 Watts, 10 Watts between 10 and 100 Watts, and 25 Watts between 100 and 300 Watts. In the **3000W (in)** position, the forward power scale must be multiplied by 10. Each picket represents 50 Watts below 100 Watts, 100 Watts from 100 to 1000 Watts, and 250 Watts from 1000 to 3000 Watts.
5. The reflected power is read on the right-hand REFLECTED meter scale. Reflected power is 60-Watts full scale when the **300W (out)** power scale is selected, and 600-Watts full scale when the **3000W (in)** power scale is selected.
6. The most accurate power readings occur in the upper half of the meter scales. When trying to measure power with a less than perfect match, the reflected power should be subtracted from the forward power reading in order to find the true power.
7. The SWR is read directly from nine red SWR curves that range from 1:1 to  $\infty$ . SWR is measured by observing the point where the forward and reflected power

needles cross. The SWR is indicated by the red curve closest to the needle crossing point.

8. The RF Ammeter measures RF current in three calibrated ranges: 0.3 Amperes, 1 Ampere, and 3 Amperes. Simply turn the Current Range knob to the desired range.
9. The meter is scaled from 0 to 100. On the 100-mA range, readout is direct (100 = 100 mA). On the 1-A range, move the decimal point 2 places to the left (100 = 1.00 A). To convert meter readings made on the 30 mA, 300 mA, and 3-A ranges, multiply accordingly. For example, a reading of 85 on the 300-mA range equals 300 x .85, or 255 mA. See Table 1 below to estimate readings quickly.
10. To prevent meter pegging, begin checks on a high range and work down. To estimate unknown current levels, use the formula below (I = Unknown Current in Amps, P = Applied Power in Watts, and R = Load Resistance in Ohms).

$$I = \sqrt{\frac{P}{R}}$$

Meter	Range		
	300 mA	1 A	3 A
10	30	0.1	0.3
20	60	0.2	0.6
30	90	0.3	0.9
40	120	0.4	1.2
50	150	0.5	1.5
60	180	0.6	1.8
70	210	0.7	2.1
80	240	0.8	2.4
90	270	0.9	2.7
100	300	1.0	3.0

*Table 1: Actual Current Value*

**RF Hazard--Important Warnings:**

1. RF-current measurements must be conducted with extreme caution. Physical contact with conductors carrying even moderate RF-energy levels can result in severe RF burns, or injury.
2. Avoid measuring RF currents on conductors where high RF voltages may be present (>500 Volts). Damage to your meter may result.

## Calibration

Both the MFJ-836 SWR/Wattmeter section and RF Ammeter sections have been calibrated at the factory. If the SWR/Wattmeter or RF Ammeter should ever need to be recalibrated, then follow this procedure:

### Equipment Needed

1. Transmitter capable of supplying enough power to obtain ½ to full-scale reading at 14 or 21 MHz.
2. 50-ohm dummy load that is capable of handling full transmitter output power and has better than a 1.15:1 SWR.
3. Power meter of known accuracy. The calibration will only be as good as the standard reference meter.
4. 50-ohm cables capable of handling the power. RG-58/u is recommended. DO NOT USE RG-59 or RG-11.

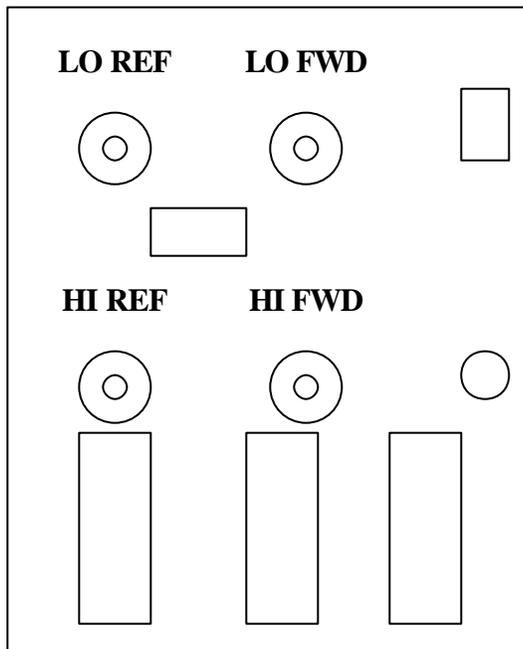
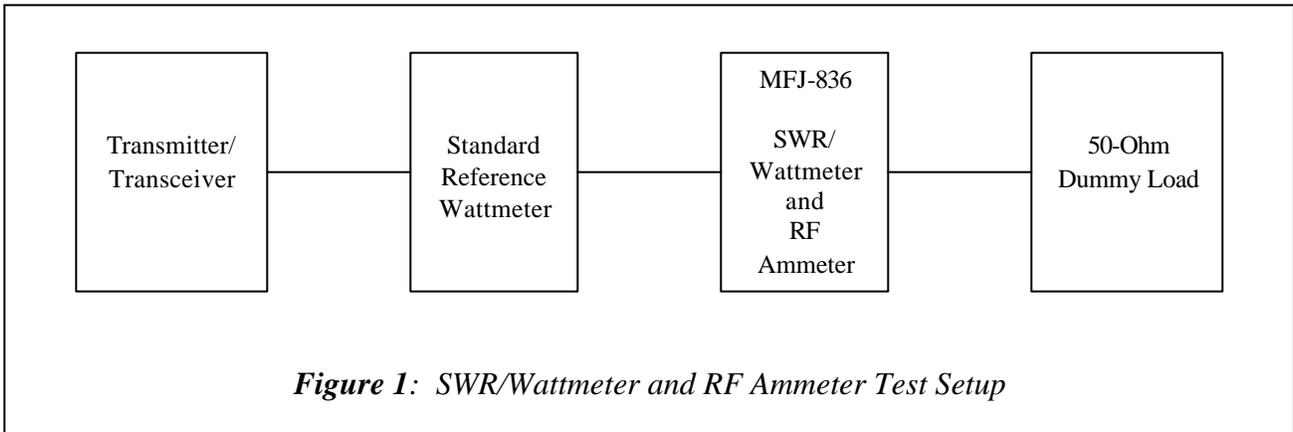
### SWR/Wattmeter Calibration

1. Refer to *Figure 1* for the Test Setup and refer to the PCB layout in *Figure 2* for trim pot location.
2. Remove the top of the MFJ-836.
3. Connect the Test Setup equipment as shown in *Figure 1*. Use a 50-ohm dummy load for the antenna. Set the Transmitter to the 14 MHz in the 20-meter band.
4. With the **3000/300-Watts** button pushed **out** for the 300-Watt scale, Transmit 100 Watts as indicated on the reference meter. Adjust the LO FWD trim pot to set the forward power scale to 100 Watts.
5. With the **3000/300-Watts** button pushed **in** for the 3000-Watt scale, Transmit 1000 Watts as indicated on the reference meter. Adjust the HI FWD trim pot to set the forward power scale to 1000 Watts.
6. To set the reflected power, interchange the TRANSMITTER and ANTENNA coax cables so that the transmitter is connected to the ANTENNA connector and the dummy load is connected to the TRANSMITTER connector.

7. With the **3000/300-Watts** button pushed **out** for the 60 Watt reflected scale, Transmit 10 Watts as indicated on the reference meter. Adjust the LO REF trim pot to set the reflected power scale to 10 Watts.

**SWR/Wattmeter Calibration (cont.)**

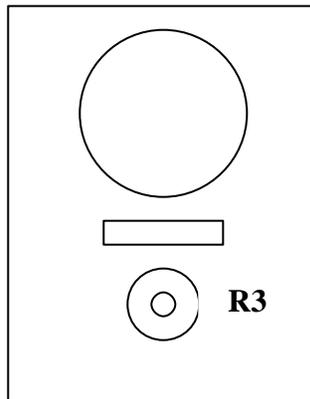
8. With the **3000/300-Watts** button pushed **in** for the 600 Watt reflected scale, Transmit 100 Watts as indicated on the reference meter. Adjust the HI REF trim pot to set the reflected power scale to 100 Watts.
9. SWR requires no calibration.



*Figure 2: SWR/Wattmeter PCB Layout and Trim Pot Location*

### RF Ammeter Calibration

1. Refer to *Figure 1* for the Test Setup and refer to the PCB layout in *Figure 3* for trim pot location.
2. Remove the top of the MFJ-836.
3. Connect the Test Setup equipment as shown in *Figure 1*. Use a 50-ohm dummy load for the antenna. Set the Transmitter to the 14 MHz in the 20-meter band.
4. Set the Current Range selector to 1A. For meaningful results, *your wattmeter must be accurate and the 50-ohm load free of significant reactance*. To test, apply a 50-watt CW signal to the 50-ohm dummy load. You should observe a full-scale reading of 1A (100 on the scale). If results vary significantly from this reading, adjust trim pot R3 for the correct indication. Trim pot R3 is located on the pc board below the sense coil.



*Figure 3: RF Ammeter PCB Layout and Trim Pot Location*

**IMPORTANT WARNING: Avoid direct physical contact with this device when making measurements with power sources of over 5 Watts. RF burns or permanent injury may result from contact with high RF voltages.**

If your meter is out of calibration and you lack the equipment or skills to perform the calibration procedure, you may return it to the MFJ factory for service.

## **Schematic**

## 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 reading the manual does not solve your problem, 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.