MFJ

MFJ VersaTuner V

Model MFJ-989D

Requires 9V Battery or 12V DC Source for Meter Operation

INSTRUCTION MANUAL

CAUTION: Read All Instructions Before Operating Equipment

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VERSION 2A

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.

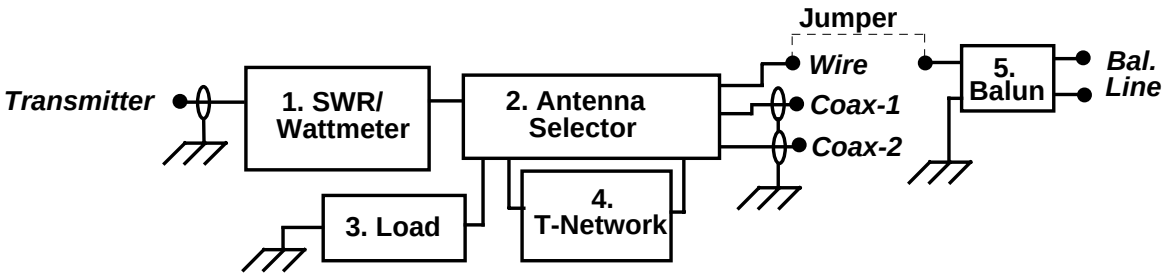
Customers using this manual should report errors or omissions, recommendations for improvements, or other comments to MFJ Enterprises, 300 Industrial Park Road, Starkville, MS 39759. Phone: (662) 323-5869; FAX: (662) 323-6551. Business hours: M-F 8-4:30 CST.

Introduction

Thank you for selecting the MFJ-989D. Over the years, the MFJ-989 has earned an impressive reputation as the world's most popular legal-limit tuner. Now, the "D" model features a number of important upgrades that make it even better. Because of these improvements, you'll enjoy higher efficiency, greater operating convenience, true peak-reading power measurements, extended frequency coverage, plus many more refinements in both design and appearance. Even the cabinet is new, with a nearly indestructible multi-color Lexan front panel and an interior layout that improves component Q and reduces losses. Top to bottom, the Versa Tuner-V has evolved into a truly superior piece of equipment built to deliver years of faithful service.

Circuit Overview

The MFJ-989D Versa-Tuner V incorporates five highly useful stand-alone station accessories into a single package. The block diagram below shows how these five building blocks are organized:



1.) ***SWR / Wattmeter****:* Dual-range (300W/3kW) power meter features precision cross-needle movements with LED illumination, a compensated directional coupler, and dual detectors for measuring average and instantaneous-peak power. Circuit is identical to our MFJ-815C *TrueActive* (TM) stand-alone meter.

2.) ***Antenna Selector Switch****:* Heavy-duty ceramic switch with silver-plated contacts and six positions for routing a variety of loads to your transmitter or amplifier.

3.) ***Dummy Load****:* Precision non-inductive 50-Ohm load resistor, convection cooled and rated for 300 Watts dissipation (same as the MFJ-260C Dummy Load).

4.) ***Legal-Limit Tuner:*** MFJ's proven T-network features 500-pF wide-spaced air-variable capacitors plus our unique 24-uH *AirCore* (TM) rotary inductor for continuous coverage of the HF spectrum. These rugged components allow you to match virtually any antenna load you're likely to encounter.

5.) ***1:1 Balun****:* Features two massive 2.4-inch ferrite cores wound with high-voltage polyethylene wire and terminated to rugged ceramic feed-through posts on the back panel. MFJ's top-of-the-line high-power Guanella current-style balun.

Before attempting to use your MFJ-989D for the first time, we urge you to read through the entire manual. Doing so will help you gain familiarity with all of the MFJ-989D's many functions and features. You'll also find useful technical information applying to all tuners and solutions for difficult-to-match antennas.

MFJ-989D Specifications

Power Rating:	1500-Watts, SSB/CW
Matching Range:	6.5-3200 Ohms at 1500 Watts input
Configuration:	T-Network with rotary inductor
Meter Range:	300 and 3-kW forward, 60 and 600-W reflected
Meter Detection:	Averaged and instantaneous-peak, active-circuit detection
Dummy Load:	50-Ohms non-inductive, 300-W, convection cooled
Antenna Selector:	6-position multi-section heavy-duty ceramic
Balun:	Guanella-style 1:1 current, dual-core 2.4-inch toroid form
External Power	12-vdc, 2.1mm rear-panel jack or internal 9-Volt battery (see text).
Dimensions:	12-7/8" W x 6" High x 11-5/8" D (32.7 x 15.2 x 29.5 cm)
Weight:	9 pounds (4.08 kG)

Power Requirement

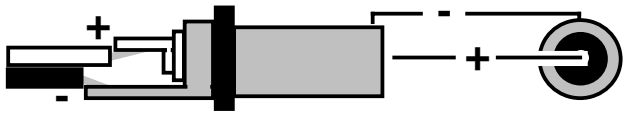
The upgraded MFJ-989D requires a power source to run its *SWR/Wattmeter* circuitry. Power may come from one of two sources:

1.) ***9-Volt Battery****:* To install a 9-volt battery, access the internal holder and snap clip by removing the 12 cabinet screws and lifting off the tuner cover. The holder is mounted on the upper right corner of the front panel. *We strongly recommend installing a battery, even if you intend to use an external power source*. Doing so provides backup voltage to operate the meter and also prevents the battery snap clip from floating loose inside the cabinet where it could contact high RF potentials. If you elect to omit the battery, make sure the snap clip is anchored solidly to the battery holder where it was wedged for shipping.

To extend battery life, the tuner has built-in *RF-sensing* that applies power to the meter electronics only when a transmit signal is applied. After a short period of transmitter inactivity, power is removed automatically.

Important Note: The 9-V battery powers only the meter electronics. It does not power the meter LEDs. You must supply external DC to illuminate the SWR meter.

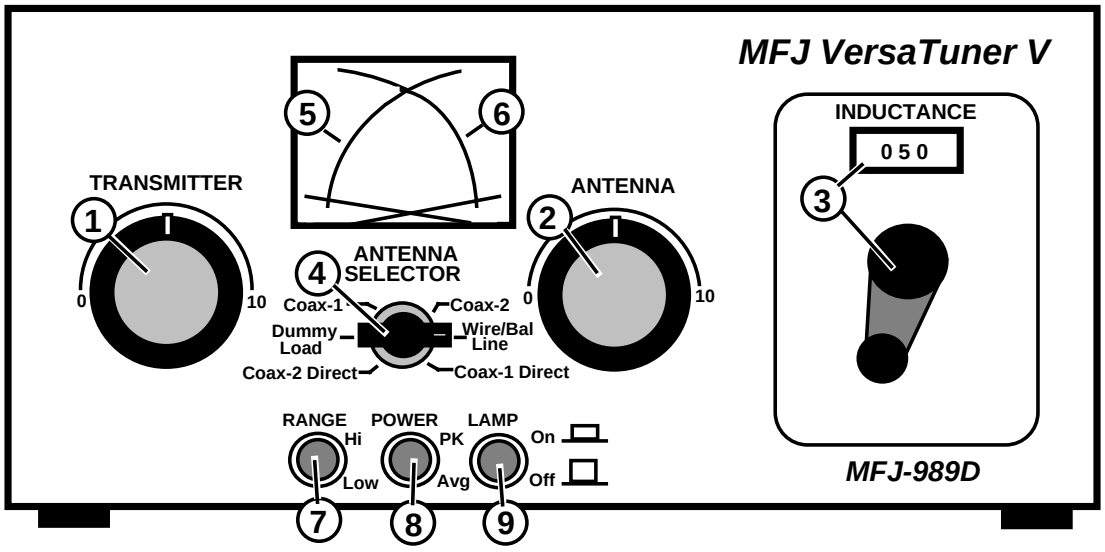
2.) ***12-VDC External Power****:* The *Meter Lamp* power jack is located above the *Transmitter* connector on the rear panel. Apply power from any filtered dc wall adapter (MFJ-1312D or equivalent), or use your station's 13.8-Vdc supply. A cord fitted with a 2.1-mm plug is supplied with the tuner for this purpose. If you make your own supply cord, connect *+12 volts to the center pin and ground the outer sleeve*, as shown below:



Important Note: You don't need to disconnect the battery when using external dc power. It is protected from back-feed and won't be damaged by the other source.

Important Warning: Never connect an ac-voltage or positive-ground source to the Meter Lamp jack or permanent damage may result!

Front Panel Layout



1.) ***Transmitter Tuning Capacitor:*** Series capacitor on the *Transmitter* side of the T-network. Maximum capacity at 0 knob setting and minimum capacity at 10.*

2. ***Antenna Tuning Capacitor****:* Series capacitor on the *Antenna* side of the T-network. Maximum capacity at 0 and minimum capacity at 10.*

3. ***Rotary Inductor****:* Continuously adjustable shunt *Inductor* with maximum inductance at 000 and minimum inductance at 090.*

4. ***Antenna Selector****:* Routes signals inside the tuner and selects *Antenna*.

5. ***Forward Power Scale****:* Displays *Forward Power* (300-W or 3-kW scale).

6. ***Reflected Power Scale****:* Displays *Reflected Power* (60-Watt or 600-Watt scale).

7. ***Range HI/LO****:* Selects the metering circuit power range (x1, x10).

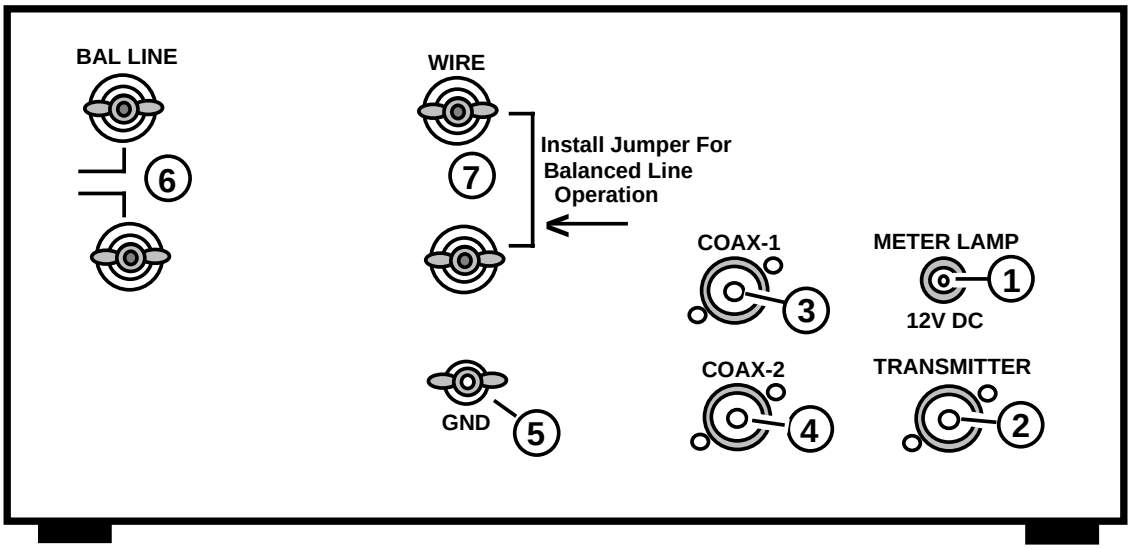
8. ***Power PK/AVG****:* Selects the meter detection (*Peak* or *Average).***

9. ***Lamp On/Off****:* Turns meter's LED lighting on or off.**

NOTE* The control scales track frequency rather than component value. Tuned circuits typically require progressively lower values of L and C as frequency increases.

NOTE** External 12-volt source is required for LED lighting.

Rear Panel Layout



1. ***Meter Lamp****:* 2.1-mm coaxial power jack accepts 12 vdc to operate the LED meter lamps and the metering circuit (see text)

2. ***Transmitter****:* Accepts PL-259, connects transceiver or amplifier to tuner.

3. ***Coax-1****:* Accepts PL-259, connects antenna #1 to tuner routing switch.

4. ***Coax-2****:* Accepts PL-259, connects antenna #2 to tuner routing switch.

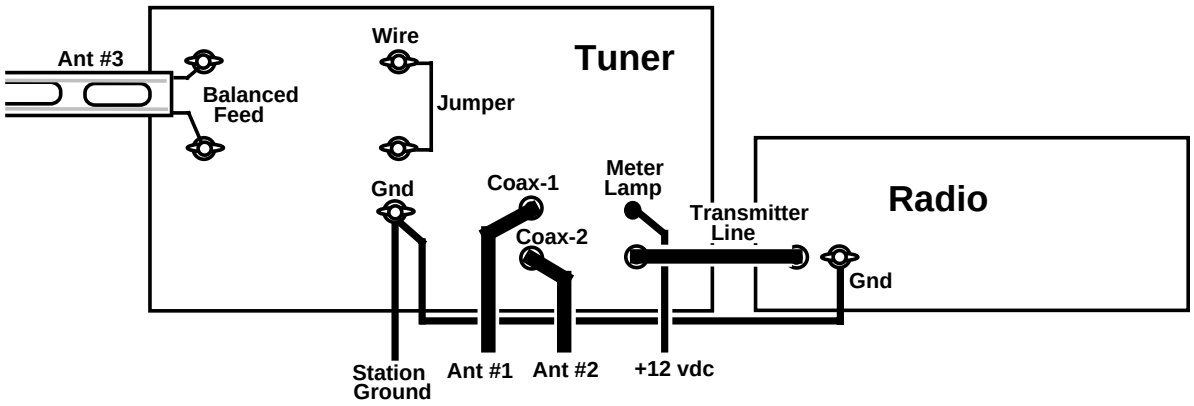
5. ***GND****:* Chassis ground, connects tuner to station's ground system.

6. ***Bal Line****:* Antenna side of the 1:1 balun, accepts balanced feedlines.

7. ***Wire****:* terminal post (*Wire*) accepts single-wire antennas. To feed balanced antennas through the balun, the *Wire* terminal is connected to the terminal post below with a jumper (see text).

Installing the MFJ-989D

The block diagram below shows a typical tuner installation.



Here are some important installation guidelines:

1.) ***Tuner Location****:* Position the tuner for convenient access to all front panel controls. However, make sure you cannot make accidental contact with RF-energized open-wire lines or longwire lead-ins connected to the rear panel (serious RF burns could result). *Also, never operate the tuner with the cover removed!*

2.) ***Transmitter Patch Cable****:* Use a short direct connection between your transmitter and the tuner. The cable should be good-quality 50-Ohm stock that is rated for the full amount of power you intend to run. Also, never install a balun between the tuner and transmitter or string ferrite beads on the cable!

3.) ***Tuner Grounding****:* Connect the tuner chassis directly to your station's ground system. Don't rely on the patch cable to ground the tuner to your radio or amplifier.

4.) ***Lightning Protection****:* Make provisions to disconnect all antennas from your station in the event of violent weather. Lightning arrestors may reduce damage from nearby strikes, but only disconnection can reduce the odds of damage from a direct hit.

Important Warnings: Never install the tuner where you could come in contact with exposed open wire lines connected to the rear panel. Also, never operate with the tuner cover removed. Finally, always disconnect all antennas at the first sign of electrical storm activity!

As previously noted, the MFJ-989D incorporates five very useful station accessories into a single package. Here are operating instructions for each one, beginning with the power meter and SWR bridge.

SWR/Wattmeter

The SWR bridge is configured at the *Transmitter* (or input) side of the tuner and it is always in-line with the transmitter, regardless of the *Antenna Selector* setting. To measure forward and reflected power:

[ ] Select a forward *Power* range (*LO for 300-W or HI for 3-kW*).

[ ] Select *PK* for peak-power readings or *AVG* for average-power readings.

[ ] View the *Forward* scale to read incident power.

[ ] View the *Reflected* scale to read reverse power.

[ ] For SWR, find the red curve closest to where the two meter pointers intersect. The red SWR curves provide a reliable estimate of SWR without the inconvenience of adjusting a sensitivity control to calibrate the meter. Each red line on the meter is marked with a SWR value.

1.) ***Power Readings****:* For continuous carrier (CW or FM) modes, *Peak* and *Average* power readings should measure virtually the same. For SSB voice, *Peak* readings may measure 3 to 5 times higher than the *Average* power, depending on speech characteristics and the amount of speech processing being used. Two-tone-test *Peak* readings should measure twice the *Average* power readings. Readings taken along the upper two-thirds of the meter scale are typically more accurate than those made along the lower third.

2.) ***Measuring Power with SWR****:* When measuring transmitter power into a mismatched load indicating reflected power, remember to subtract the *Reflected Power* reading from the *Forward Power* reading: *(Po = FP - RP).*

3.) ***Precision SWR Readings****:* To obtain *precise* SWR data using the split meters, write down the *Forward* and *Reflected* power measurements (in Watts) and plug them into the formula shown below:

$$SWR = \left[\frac{1 + \sqrt{\frac{Pr}{Pf}}}{1 - \sqrt{\frac{Pr}{Pf}}} \right]$$

Pr = Reflected Power
Pf = Forward Power

Antenna Selector

The *Antenna Selector* is a heavy-duty six-position RF switch that routes the tuner's *Transmitter* input line as described below:

Coax-1 Direct*:* Transmit line passes directly to *Coax-1* output.

Coax-2 Direct*:* Transmit line passes directly to *Coax-2* output.

Dummy Load*:* Transmit line passes directly to the internal *50-Ohm load.*

Coax-1*:* Transmit line goes through the T-network to *Coax-1* output.

Coax-2*:* Transmit line goes through the T-network to *Coax-2* output.

Wire/Bal. Line*:* Transmit line goes through the T-network to the *Wire* terminal post.

Always check the position of the Antenna Selector before applying RF power! If you fail to do so, you may accidentally dump 1500 Watts into the 300-Watt dummy load with catastrophic results or find yourself trying to adjust the tuner's controls while the network is bypassed! Also, never rotate the Antenna Selector when RF power is being applied! "Hot switching" will cause severe arcing and burning of the switch contacts -- and the sudden load interruption could damage your transmitter.

Important Warning: When operating your tuner, always check the position of the Antenna Selector before applying RF power. Also, never change the Antenna Selector when RF power is applied!

Dummy Load

The tuner's internal dummy load features a precision non-inductive power resistor that maintains low SWR across the entire HF spectrum. The load performs two important functions:

1.) Normalizing Transmitters To 50-Ohms: Use the load to pre-tune older transceivers or vintage transmitters with tube-type PA amplifiers to normalize them for 50-Ohm output prior to routing through the T-network.

2.) Accurately Measuring Transmitter Power: Use the load to check any radio running 300 Watts or less for true peak-power power or average power output through the tuner's precision wattmeter.

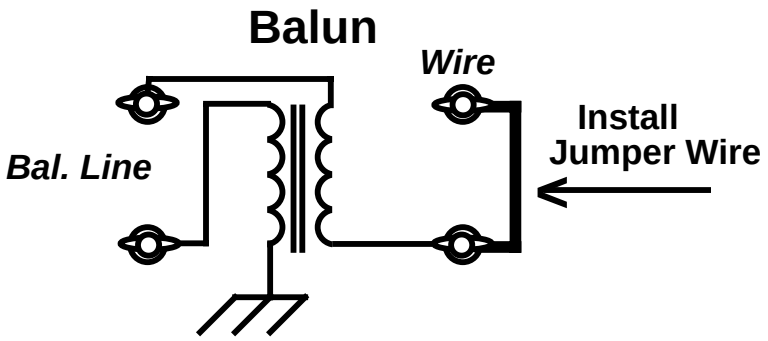
The *Dummy Load* resistor is convection cooled through the bottom of the cabinet and is rated to safely dissipate 300-Watts of applied RF for up to 30-seconds at a time. The minimum cool-down period between power applications is specified at 2-minutes. Longer tune-up durations are possible at lower power levels, but the continuous-duty power rating of the resistor is 25 Watts, so you must adjust the key-down time accordingly.

Never apply power levels exceeding 300-Watts for even short durations. Doing so could permanently alter the resistor's value or catastrophically destroy it. Heat damage to other tuner components could result, as well!

Important Warning: Never tune a high-power linear amplifier into the MFJ-989D Dummy Load or permanent damage will result!

1:1 Balun

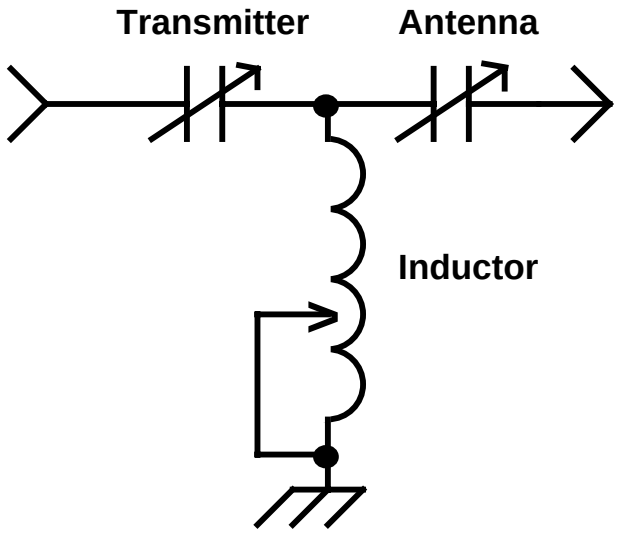
A built-in Guanella-style current balun is used to transition from the tuner's unbalanced *Wire* terminal to the *Bal. Line* output. The balun is wound on two massive 2.4-inch toroid cores with heavy polyethylene-dielectric wire to ensure a high breakdown voltage for handling difficult high-impedance loads. Windings are terminated to ceramic terminal posts mounted on the back panel, with a fourth lead permanently grounded to the chassis (see diagram next page):



To place the balun in line and energize the *Bal. Line* terminals, connect a *Jumper* from the unbalanced *Wire* terminal post to the terminal post directly below it. The jumper-wire path is labeled on back panel for reference. Note that the *T-network* is always in line when the Antenna Selector is switched to the *Wire/Bal. Line* position.

T-Network

1.) The Network Configuration: The T-network gets its name from the distinctive shape of the components making it up (shown below):



This network configuration is especially practical for amateur-radio tuners because it can match an unusually wide range of loads into 50-Ohm equipment. The T-configuration using two series capacitors and a shunt inductor belongs to the high-pass filter family and, as such, it does little to suppress transmitter harmonics. However, modern transceivers and amplifiers must meet stringent harmonic suppression requirements on their own to satisfy FCC requirements, so there's little need for high-frequency suppression in the tuner.

2.) The C-high L-low Rule: With three tunable elements(C-L-C), the *T-Network* is able to provide a low-SWR match into a 50-Ohms system using many different component value combinations. As a rule of thumb, we always look for a combination using the *largest amount of capacitance* (lower knob settings) in combination with the *smallest amount of inductance* (higher counter setting). This ratio ensures the lowest loss and greatest power handling capability -- with less chance of arcing over. When tuning, it may help to recall the phrase: "See (C) high and look (L) low".

3.) Mechanical Considerations: When setting up, always confirm the *Antenna Selector* is on the correct setting and firmly latched in place before applying power. Also, when tuning the rotary inductor, note that its range spans from 000 to approximately 090 on the counter dial. Crank slowly as you approach the end settings to avoid slamming the inductor roller into the stops.

4.) Applying Power During Adjustment: If you normally run a high-power amplifier (greater than 100-W), *leave it out-of-line and tune the antenna for a 1:1 match using only your station transceiver (or an antenna analyzer).*

5.) Tube-Type Output Stages: Always pre-tune transceivers or vintage transmitters with a tube-type PA into a 50-Ohm load prior to routing them through the T-network. Then, leave them set where they are (normalized to 50-Ohms) and let the tuner do the matching!

Important Warning: Never apply high power to the MFJ-989D before it has been fully adjusted for minimum SWR. Always tune unknown antenna loads using the least amount of power needed to obtain a useful SWR reading (25 Watts or less).

6.) Antenna Analyzers: As an alternative to using a transceiver, you may also use an antenna analyzer to tune an unknown load. Connect the analyzer to the tuner's *Transmitter* connector, set if for the desired frequency, and refer to its SWR display as you adjust the tuner's controls. Using an analyzer eliminates QRM to other stations while you are experimenting to find the best L/C settings.

Step-By-Step Tuning Procedure

Important Warning: Never apply high power during the antenna tuning procedure!

[ ] Switch the *Antenna Selector* to the desired antenna.

[ ] Set the SWR Meter's *Range* switch to *AVG* and set the *Power* switch to *LO*.

[ ] Set the *Antenna* and *Transmitter* capacitors to the appropriate value shown below:

160 M:	**0**	**20 M:**	**4**
80 M:	**1**	**17 M:**	**6**
75 M:	**2**	**15 M:**	**7**
40 M:	**3**	**12 M:**	**8**
30 M:	**3-1/2**	**10 M:**	**8-1/2**

[ ] Preset *Inductor* to the highest number (090) (least amount of inductance).

[ ] Apply low power (25-Watts or less)

[ ] Rotate the *Inductor* knob *counter-clockwise* to add progressively more inductance.

[ ] Watching *SWR*, adjust *Inductor* for lowest reflected and highest forward Power.

To bring *Reflected Power* readings lower, continue tuning using the following procedure:

[ ] Readjust *Antenna*, *Inductor*, and *Transmitter* (in that order) for lowest SWR.

[ ] Repeat as needed, until *Reflected Power* falls as close to zero as you can get it.

If you weren't able to achieve zero *Reflected Power* (1:1 *SWR*), try turning the *Inductor* counter-clockwise to a lower number (adding slightly more inductance). Then, repeat the prescribed tuning sequence (*Antenna > Inductor > Transmitter*). Try to find the *lowest front panel capacitor settings* that will allow you to obtain minimum SWR.

The chart below shows sample control settings for a MFJ-989D recorded in our lab using 50-Ohm unbalanced and 600-Ohm balanced loads. Your optimum settings will vary somewhat, depending on the characteristics of your particular antenna.

Frequency (MHz)	Transmitter	Inductor Counter	Antenna	Load (Ω)
1.8	0.5	41	0.5	50
1.8	0	11	0	600
2.0	0.5	48	0.5	50
2.0	1	21	0	600
3.5	.5	70	2	50
3.5	5	49	0	600
3.75	1	70	2.5	50
3.75	5.5	50	0	600
4.0	2	72	3	50
4.0	6	52	3	600
7.15	0.5	80	3.5	50
7.15	7.5	69	0	600
10.1	0	79	4.5	50
10.1	8	75	0	600
14.2	3.5	73	5.5	50

Frequency (MHz)	Transmitter	Inductor Counter	Antenna	Load (Ω)
14.2	9	80	0	600
18.1	7	87	8	50
18.1	10	83	0	600
21.2	8	88	8.5	50
21.2	9	85	0	600
24.9	8	89	9	50
24.9	10	86.5	4	600
28.5	8.5	90	9	50
28.5	10	88.5	5	600

Once you've reduced SWR to a minimum, go ahead and advance transmitter power to 100 Watts. The added power should increase the *Reflected Power* meter-scale deflection enough for a touch-up of the *Antenna* and *Transmitter* controls. With the tuner properly adjusted, it is now safe to bring your amplifier on line.

[ ] Set the meter's *Range* switch to *Hi* (3-kW).

[ ] Set your amplifier's *Band Switch*, *Tune*, and *Load* controls to the desired frequency.

[ ] Apply power, peaking the amplifier's *Tune* and *Load* controls for maximum output.

Follow the amplifier manufacturer's prescribed tuning procedure, paying attention to grid or screen current. Once you've optimized tuner settings and peaked the amplifier for maximum output, don't reset the tuner controls. If arcing or component heating occur because of an extreme load condition, reduce transmitter power and explore taking corrective action for your antenna system.

A Word About BIG Amplifiers

Many linear amplifiers are capable of exceeding the 1500-Watt legal power limit -- some delivering 2800 Watts or more! These BIG amplifiers should always be tuned up for their maximum rated output. *However, don't tune them it through the MFJ-989D, or permanent damage to the routing switch and other internal components may result!*

If it becomes necessary use your MFJ-989D in conjunction with a BIG amplifier, *always pre-tune the amplifier for maximum output into an external 50-Ohm dummy load that is completely isolated from the*

MFJ-989D! Then, reduce *exciter* power to bring output *well below 1500-Watts* before connecting to your tuner. After it is connected, you can readjust the exciter while monitoring amplifier's power on the tuner's wattmeter. When running SSB, be sure to use the *SWR / Wattmeter's PK* (peak power) setting for a true readings on voice peaks!

Never tune up a BIG amplifier using low drive as a strategy to limit its output power (except as an early step in the manufacturer's tune-up procedure to reduce component stress). To maintain linearity and proper loading, these amplifiers should always be tuned to full power following the manual's complete tuning procedure. Then, and only then, is it acceptable to reduce drive to drop output power. And, even this strategy may not be foolproof! Most transceivers use ALC voltage to control drive level, and some radios suffer from severe ALC overshoot. ALC overshoot occurs when the radio's ALC circuit responds to sudden amplitude changes too slowly, allowing high-power transients to slip past. If strong enough, these momentary spikes may cause a flashover in the tuner! The best policy is always to match the power rating of your tuner to the power rating of your amplifier.

Tuner Operating Notes

1.) Tuning Range: The MFJ-989D uses component values carefully chosen to provide the widest possible tuning range. However, there are limits! If an extreme load condition requires more or less capacitance than the network components can provide, SWR may not be reduced to 1:1. Normally, this isn't a problem, but if the residual SWR is higher than the radio's SWR detection circuitry can handle (typically 2:1), you may need to change the length of the antenna radiator or its feedline in order to bring the load impedance back within the tuner's range. Extreme load conditions may also lead to arcing or component heating in the tuner, so they should always be corrected!

2.) Tuner Settings: The "C-high L-low" rule of thumb always applies. Look for the lowest knob settings for the *Transmitter* and *Antenna* controls -- along with the highest *Inductor* counter setting -- when minimizing SWR.

3.) Inductance-Counter Reset: If stressed, the *Inductor* counter could slip out of calibration. To correct the problem, first turn *Inductor* fully counter-clockwise until the inductor roller hits the stop. Then, using a stiff piece of buss wire, a small screw driver, or a pencil, push the reset button which is accessed through a hole located to the right of the counter window. This action resets the counter to 000.

4.) Logging: It pays to log all three tuner settings along with the frequency and antenna in use for each operating setup you make. Use the blank logging chart provided at the rear of the manual and make a copy. Not only does logging reduce future set up time to a minimum, it also notifies you immediately if something has changed out at the antenna site! Commercial stations keep tuner logs, and with good reason!

Warnings

Here's a recap of some important warnings to keep in mind when operating your tuner:

1.) Install so RF-energized terminals and wires are not exposed.

2.) Never operate the tuner with the cover removed!

3.) Never change the Antenna Selector setting while transmitting.

4.) Disconnect all antennas from your building during lightning storms.

5.) Always tune antennas with low power (25 Watts or less for initial adjustments).

6.) Confirm tuner is adjusted for minimum SWR before applying high power.

7.) Never exceed the 1500-Watt legal power limit through your tuner!

In Case Of Difficulty

1.) Tuner Fails To Reduce SWR: Double-check all connections and repeat the tuning procedure again.

2.) Tuner Arcs: If arcing occurs at rated power levels, double-check all connections and repeat the tuning procedure. Confirm you are using the *least inductance* (highest number) and the *most capacitance* (lowest number) possible to match the load. If tuner still arcs (especially on 160 Meters), reduce power and check your antenna system for extreme load conditions.

3.) RFI Problems: Keep radiating wires such as those feeding classic Windoms, long-wires, Ts, or inverted-Ls away from other wiring. To further reduce RFI, run the wire parallel and reasonably close to the station's ground line. Also, use heavily insulated wire wherever possible to prevent arcing!

4.) RF-Grounding: A good RF ground is essential, especially when using a single-wire feed, because the tuner needs a counterpoise to help it force current into the radiating line. Lacking a good ground, RF has a habit of finding its way into power lines (RFI), audio circuits (RF feedback), *and you* (RF burns). Don't rely on water pipes, short copper rods, or "dc" grounds for a antenna counterpoise. RF grounds work better when spread out over a large area with multiple connections to the equipment ground point. A RF-radial system or multi-wire counterpoise is ideal because it provides a large low resistance mat to reinforce the antenna. If installing a good RF ground isn't possible, it's best to avoid using unbalanced monopole designs that depend on ground reinforcement. Regardless of antenna type, always use whatever resource is available (ground rods, pipes, etc) as a *safety ground* for both you and your equipment.

5.) Skin Effect: RF and lightning travel on the *surface* of conductors. Braided or woven conductors have relatively high surface resistance to lightning and RF, so ground leads should always have a smooth metallic high-conductivity outer layer with as much surface area as possible.

Important Warning: For operator safety, always install a good earth ground and connect it directly to the case of the MFJ-989D. A terminal post marked GND is provided on the back panel for a secure connection.

Antenna System Hints

1.) Location: End-fed long-wires should measure at least one quarter-wavelength at their operating frequency. Horizontal dipoles should span at least a half-wavelength and be installed as high and in the clear as possible. Good RF ground systems become especially important when using longwires or other Marconi-style antennas.

2.) The High-Impedance Problem: Most matching problems involve high-Z loads appearing at the tuner end of the feedline. If you feed a low-impedance antenna with an *odd quarter-wavelength* of line, the load will invert to a high impedance at the far end. And, if you feed a high-impedance antenna with an

even half-wave length of line, the load will be repeated at the far end. Either condition can turn a perfectly good radiator into something difficult or impossible to tune. Extreme High-Z loads are "the enemy" because they produce RF-potentials topping several thousand volts to invite insulation breakdown, arcing, and RF heating.

3.) Correcting Problems: The following strategies will help you to prevent most matching problems:

[ ] Never center feed a doublet style multi-band antenna with high-impedance feedline measuring near an odd-multiple of a quarter wave.

[ ] Never center feed a full-wave antenna with *any* feedline measuring near an even multiple of a half-wave.

[ ] If the tuner doesn't match one particular band on your multi-band array, try adding or subtracting 1/8-wave of feedline (as measured on the dysfunctional band).

[ ] Never try to load a G5RV or a center-fed dipole on any band below its half-wave design frequency.

[ ] To operate a 80 meter dipole on 160 meters, it's best to short the feed conductors at the tuner and load it as a long-wire or "T" against the station ground. When fed conventionally, this antenna will be extremely reactive with only a few ohms of feed-point resistance. In other words, it will be nearly impossible to match.

[ ] When feeding any dipole with high-impedance line, use the approximate lengths shown in the table below. Note that the *worst possible* lengths are also shown:

160-meter dipole:	35-60, 170-195, 210-235 feet	[Avoid 130, 260 ft]
80-meter dipole:	34-40, 90-102, 160-172 feet	[Avoid 66, 135, 190 ft]
40-meter dipole:	42-52, 73-83, 112-123, 145-155 feet	[Avoid 32, 64, 96, 128 ft]

*Some slight trimming or adding of length may be necessary to accommodate the higher bands.

Factory Technical Assistance

If you have any problem with your MFJ-989D, first check the appropriate section of this manual. If the manual does not reference the problem or succeed in solving it, call (a.) *MFJ Technical Service* at **662-323-0549** or (b.) the *MFJ Factory* at **662-323-5869**. For best service, have the unit, its manual, and a full description of your station setup handy so you can answer any questions the technician may ask. You may 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 tuner, and a complete description of your station.

Tuner Log

Use the chart below to log tuner settings for your station. You may want to copy this chart and post it by your tuner.

Frequency	Transmitter	Inductor	Antenna
1.8			
1.8			
2.0			
2.0			
3.5			
3.5			
3.5			
3.75			
3.75			
3.75			
4.0			
4.0			
4.0			
7.15			
7.15			
10.1			
10.1			
14.2			
18.1			
18.1			
21.2			
21.2			
24.9			
28.5			

NOTES:

FULL 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 of machine reproduction or 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 **$7.00** covering postage and handling.

3. MFJ Enterprises, Inc. will supply replacement parts free of charge for any MFJ product under warranty upon request. A dated proof of purchase and a **$5.00** personal check, cashiers check, or money order must be provided to cover postage and handling.

4. This warranty is **NOT** void for owners who attempt to repair defective units. Technical consultation is available by calling (601) 323-5869.

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

6. 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.

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

8. **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.

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

10. 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.

11. 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.

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

MFJ ENTERPRISES, INC.
300 Industrial Park Road
Starkville, MS 39759

MFJ-989D Manual
Version 2A
Printed In U.S.A.