MFJ

HF Automatic Remote Antenna Tuner

Model MFJ-926B

INSTRUCTION MANUAL

CAUTION: Read All Instructions Before Operating Equipment

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The Basics

Introduction

The MFJ-926B HF Automatic Remote Antenna Tuner, the *IntelliTuner*™, lets you rapidly tune any antenna automatically: unbalanced or single-wire. MFJ's exclusive *InstantRecall*™, *IntelliTune*™ and *AdaptiveSearch*™ algorithms give you fast automatic tuning with more than 2500 non-volatile *VirtualAntenna*™ memories. .

The tuner includes a highly efficient switching L-network with wide matching capability, 1.8 to 30 MHz coverage, a radio interface port, and heavy-duty 10 amp/1000 volt relays. It is rated at 200 watts SSB/CW.

A maximum of 256 values of inductance and 256 values of capacitance are available. With the capacitance switched between the input and output side, this provides a total of 131,072 L/C tuning combinations. The nominal tuning ranges are 0 to 24 μH and 0 to 3900 pF.

The MFJ-926B *IntelliTuner*™ learns and remembers. When you transmit, it automatically adjusts for minimum SWR and remembers the frequency and tuner settings, safely stored in non-volatile memory. The next time you operate on that frequency (or close to it), the MFJ-926B tuner settings are instantly restored and you're ready to operate in milliseconds.

When you key your transmitter, MFJ's *InstantRecall*™ checks its memory to see if you have operated on that frequency before. If so, tuning is instantaneous and you're ready to operate. If not, MFJ's *IntelliTune*™ algorithm (based on MFJ's famous SWR Analyzer technology) kicks in. It measures the complex impedance of your antenna. Next, it calculates the components it needs and instantly snaps them in. Finally, it fine-tunes to minimize SWR, and you're ready to operate--all in a fraction of a second.

If the antenna impedance is not within the tuner's measurement range, MFJ's *AdaptiveSearch*™ algorithm goes into action. Frequency is measured and relevant components values are determined. Only those values are searched for fast tuning. If it still cannot find a match, the search is performed again using a different search pattern.

The tuners enter a "sleep" mode when idle and when no transmit signal is present, turning off the microprocessor clock to avoid the generation of spurious signals.

Features

- Automatically matches antennas from 6 to 1600 ohms impedance (SWR up to 32:1)
- Handles 200 watts SSB/CW
- Tune in less than 15 seconds, usually less than 5 seconds
- Over 2500 non-volatile memories for tuner settings
- Highly efficient switching L-network matching circuit
- 1.8 to 30 MHz continuous frequency coverage
- Powered by DC voltage impressed on coax using built-in bias tee
- SO-239 coax fed antenna connector
- Connector for random wire or single wire antennas
- Included external bias tee for impressing DC voltage on the input coax

Specifications

- Impedance matching range: 6 to 1600 ohms
- SWR matching range: up to 8:1 for < 50 ohms and up to 32:1 for > 50 ohms
- Minimum power for tuning: 2 watts
- Maximum power while tuning: 100 watts with foldback, 20 watts without foldback
- RF power limit: 200 watts SSB/CW
- Frequency range: 1.8 to 30 MHz continuous coverage
- Capacitance range: 0 to 3961 pF nominal (256 values)
- Inductance range: 0 to 24.86 µH nominal (256 values)
- Relay rating: 10 amp 1000 volts
- Relay electrical life: 100,000 operations
- Relay mechanical life: 10 million operations
- Memory endurance: 1 million erase/write cycles
- Memory data retention: > 200 years
- Power requirements: 12 - 15 volts DC
- External bias tee DC interface: 2.1 × 5.5 mm coaxial plug, center pin positive
- Current consumption: 750 milli-amp or less
- Dimensions (approx.): 10.5 × 2.5 × 14.0 in. (width/height/depth)
- Weight (approx.): 1.0lb

† Specifications and design are subject to change without notice.

Fast Start

WARNING

- ***Never* operate the tuner with its cover removed. Contact with the components inside the tuner while transmitting will result in painful RF burns.**
- **Locate the tuner so that the terminals are *not accessible* during operation. The single wire connection may have high voltage while transmitting.**
- ***Disconnect* all antennas from the tuner during lightning storms.**
- ***Always* tune with low power (2-10 watts). Apply maximum power only after tuning up.**
- ***Never* exceed tuner specifications.**
- **Do *not* transmit with a high SWR for extended periods of time.**

1. Connect the transmitter to the **"RF IN/OUT"** coaxial connector on the **MFJ-4117 Bias-Tee** using a 50-ohm coaxial cable. (See Figure 1) This is the RF signal input connector.

2. Connect a 12-15 VDC voltage source capable of supplying at least 750 milli-amps to the "**DC IN\OUT"** jack on the **MFJ-4117 Bias-Tee.** This is your DC voltage input connector.

3. Connect the **"RF/DC OUT/IN"** coaxial connector on the **MFJ-4117 Bias-Tee** to the **TRANSMITTER** connector on the **MFJ-926B Intellituner** using 50-ohm coaxial cable. The **MFJ-926B Intellituner** will recover the RF and DC signals.

4. Connect your coax-fed antenna to the **ANTENNA** connector using a 50-ohm coaxial cable, or connect your random wire to the **WIRE** binding post.

5. Connect your ground connection to the **GROUND** post.

6. Key your transmitter to output a carrier of 2-10 watts CW, FM or AM. The SWR should be auto-tuned to less than 1.5:1. This can be verified with an external SWR meter if desired.

7. You are now ready to transmit at full power.

Note: *During the automatic tuning process, the tuner will make some noise. These are the relays switching at a very high rate and is normal. Do not be alarmed.*

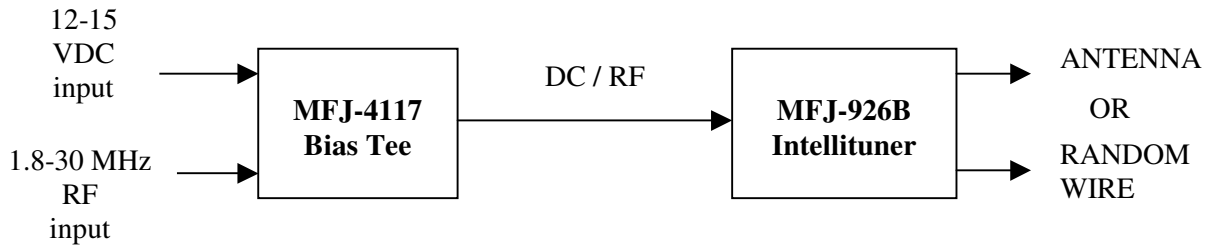

Figure 1: MFJ-926B and MFJ-4117 Installation Block Diagram

Note: To use the Random WIRE binding post, make sure to remove the antenna, if any, from the ANTENNA connector.

Internal Components

The MFJ-926B was designed for remote operation with no manual operation required. The tuning process starts automatically when the transmitter is keyed with at least two watts of power when the SWR is greater than 2:1. The MFJ-926B has been pre-set with default settings at the MFJ Factory. However, if you remove the unit from the box, you can change the default settings as well as verify proper operation of the unit. The following will guide you through the process.

- **SWR LED:** A green LED that illuminates when the SWR is 1.5 or less.

- **TUNE LED:** A red LED that illuminates when automatic tuning is in progress.

- **TUNE Button:** Has three different functions based on the length of time you press and hold it before releasing. Press and release [TUNE] quickly (less than 0.5 second) to bypass the tuner. One flash indicates bypass mode, where RF from the transmitter goes directly to the antenna with no matching. A second quick press toggles the tuner back to its last L/C setting, and the tuner responds with two flashes.

  Press and hold [TUNE] for 0.5 to 2 seconds to start the automatic tuning process. Tuning starts after the [TUNE] button is released during the 0.5-2 second time frame. The transmitter must be keyed first with at least two watts of power. When the SWR is already below the target SWR of 1.5, pressing [TUNE] will fine-tune the match for a lower SWR, if possible. When the automatic tuning is completed, a series of flashes indicates the tuned SWR where one flash indicates an SWR of 1.5 or less, two flashes indicate an SWR of 1.6 to 2.0, three flashes indicate an SWR of 2.1 to 2.5, and four flashes indicate an SWR of 2.6 to 3.0. For SWR above 3.0, "SWR" (di-di-dit di-dah-dah di-dah-dit) will be sent on CW and indicated on the green LED.

  "*StickyTune*" enables the tuning process automatically when the transmitter is keyed with at least two watts regardless of the SWR. To toggle the *StickyTune* mode on and off, press and hold the [TUNE] button for two seconds. One Flash indicates "on" and two Flashes indicate "off". The default is "off"..

  Automatic/Semi-Automatic Tuning Mode
  The Automatic tuning mode should always be left on (default is "on". In automatic mode, the tuning routine is automatically started when at least two watts of power is applied and the SWR is greater than 2.0. In semi-automatic mode, the tuning routine starts only when the [TUNE] button is pressed for 0.5 to 2 seconds. Since the [TUNE] button is only available when the unit is opened up, the Semi-Automatic mode should NOT be selected. Simulataneously pressing [TUNE] and [ANT] toggles between automatic and semi-automatic tuning modes. One Flash indicates automatic mode and two Flashes indicate semi-automatic mode.

Note: *During the tuning process, the tuner will make some noise. These are the relays switching at a very high rate and is normal. Do not be alarmed.*

- **ANT Button:** Used in conjunction with other buttons for changing functions in the MFJ-926B.

- **POWER Button:** Used to turn the power on and off. When the power is off, the tuner is placed in bypass mode and Antenna is selected. When turning on the power, the tuner powers up in the bypass mode, but will resort to a previously stored setting upon application of RF power. The POWER button should always be left on. Power is turned on and off externally.

> ***WARNING:*** **Do not turn the power on and off rapidly, otherwise the tuning setting memory can be corrupted and the unit will have to be reset to factory defaults.**

> ***Note:*** *When the tuner power is OFF, the tuner is in bypass mode and RF from the transmitter goes directly to the antenna with no matching.*

Connections

- **Transmitter:** SO-239 connector for coax cable from transmitter or transceiver. A MFJ-4117 bias tee is connected in-line between the transmitter output and this connector. This provides 12 volts DC on the coax to power the tuner. The MFJ-4117 is included with the MFJ-926B.

- **Antenna:** SO-239 connector for coax cable from antenna, or binding post for wire antennas. The **ANTENNA** connector is internally connected to the **WIRE** binding post.

> ***Note:*** *When using the ANTENNA connector, make sure to remove the wire antenna, if any, from the WIRE binding post.*

- **Ground:** Wing-nut terminal for RF ground wire connection.

- **Wire:** Binding post for connecting single wire antennas. Notice the **WIRE** binding post is internally connected to the **ANTENNA** connector.

> ***Note:*** ***When*** *using the WIRE binding post, make sure to remove the antenna, if any, from the ANTENNA connector.*

Installation

WARNING

- ***Never* operate the tuner with its cover removed. Contact with the components inside the tuner while transmitting will result in painful RF burns.**
- **Locate the tuner so that the terminals are *not accessible* during operation. The single wire connection may have high voltage while transmitting.**
- ***Disconnect* all antennas from the tuner during lightning storms.**
- ***Always* tune with low power (2-10 watts). Apply maximum power only after tuning up.**
- ***Never* exceed tuner specifications.**
- **Do *not* transmit with a high SWR for extended periods of time.**

1. Place the tuner in a convenient location at the operating position using the mounting holes provided. With a random wire, the WIRE terminal may have high RF voltages present. These voltages can cause serious RF burns if the terminal is touched when transmitting. **Be sure to locate the tuner so this terminal cannot accidentally be contacted during operation.**
2. Install the MFJ-4117 Bias-Tee between the transmitter and the antenna. Use a 50-ohm coaxial cable (such as RG-58) to connect the transmitter. See Figure 1.
3. Connect the transmitter to the **"RF IN/OUT"** coaxial connector on the **MFJ-4117 Bias-Tee** using a 50-ohm coaxial cable. (See Figure 1) This is the RF signal input connector.
4. Connect a 12-15 VDC voltage source capable of supplying at least 750 milli-amps to the "**DC IN\OUT"** jack on the **MFJ-4117 Bias-Tee.** This is your DC voltage input connector.
5. Connect the **"RF/DC OUT/IN"** coaxial connector on the **MFJ-4117 Bias-Tee** to the **TRANSMITTER** connector on the **MFJ-926B Intellituner** using 50-ohm coaxial cable. The **MFJ-926B Intellituner** will recover the RF and DC signals.
6. Connect your coax-fed antenna to the **ANTENNA** connector using a 50-ohm coaxial cable, or connect your random wire to the **WIRE** binding post.
7. Connect your ground connection to the **GROUND** post.
8. Key your transmitter to output a carrier of 2-10 watts CW, FM or AM. If desired, an external SWR/Wattmeter can be used to verify a tuned SWR of 1.5 or less before increasing RF power.
9. You are ready to transmit.
    - If too much power is applied when tuning, tuning will cease and the tuner will go into the bypass mode. This occurs when the forward power exceeds 75 watts and the SWR is greater than 3.0, or when the forward power exceeds 125 watts regardless of the SWR.
    - If more than 200 watts is applied to the tuner, the tuner will go into bypass mode.
    - Random wire and coax antennas must not be connected simultaneously to the WIRE and coax connectors on the tuner.

Note: Route all random wire antennas safely to prevent RF burn hazard.

Miscellaneous

Antenna Memory

The "memory resolution" is the width of frequency spectrum that the tuner recognizes as being the same as a tuned frequency already in memory. The memory resolution is approximately 0.1 percent of the lower frequency of each amateur band. For example, the memory resolution on the 40-meter band (7000 to 7300 kHz) is 7 kHz; if the tuner has memorized a setting for 7050 kHz, it will automatically call up this setting for any frequency from 7047 to 7053 kHz. Memory resolution is smaller at lower frequency to accommodate the higher antenna Q and larger at higher frequency where the antenna Q is lower. The memory resolutions for the HF amateur bands 160 through 10 meters are:

Meter	Frequency Range (kHz)	Memory Resolution (kHz)
160	1800 – 2000	2
75/80	3500 – 4000	4
60	5330.5, 5346.5, 5366.5, 5371.5 and 5403.5	5 memory locations
40	7000 – 7300	7
30	10100 – 10150	10
20	14000 – 14350	14
17	18068 – 18168	18
15	21000 – 21450	21
12	24890 – 24990	25
10	28000 – 29700	28

Table 1. Memory Resolution.

The memory resolution for non-amateur frequency bands between 160 and 10 meters is approximately 0.2 percent of the lower frequency of each band. There are over 2500 memory locations.

IntelliTune™ Algorithm

When the tuner cannot find an appropriate setting in its memory, it begins its calculation function. It measures the complex impedance of the antenna (load) at the transmitting frequency, then it calculates the LC components needed for a match. Then it fine-tunes the components for minimum SWR. If the tuner cannot calculate the load impedance, it proceeds to an adaptive search algorythm for tuning.

LC Limits

The upper limits of inductance (L) and capacitance (C) are factory-limited according to frequency and maximum power rating; i.e., higher frequencies need less inductance and less capacitance when the L-network is properly tuned. These limits are built into the MFJ-926B to prevent matching of extreme load impedance outside the tuner's specification, which may result in excess voltage and/or current across the tuner's components.

Morse Code and Flashes (Only available when the MFJ-926B cover is removed)

If not enough power is applied for tuning (less than two watts); "QRO" (dah-dah-di-dah di-dah-dit dah-dah-dah) will be sent on CW as indicated on the green LED. Increasing the input power above two watts ends this message.

When input power is too high, the tuner enters a self-protection mode by bypassing the tuner. The tuner will not allow any of its relays to change. This feature prevents damage to your tuner.

If too much power is applied when tuning, the tuner will cease the tuning routine and send "QRP" (dah-dah-di-dah di-dah-dit di-dah-dah-dit) on CW. This occurs when the forward power exceeds 75 watts and the SWR is greater than 3.0, or when the forward power exceeds 125 watts regardless of the SWR.

If more than 200 watts is applied to the tuner, the tuner will go into bypass mode and send "QRT" (dah-dah-di-dah di-dah-dit dah) on CW.

If the tuning process is activated under these conditions, the tuner will not start the tuning. It will send the appropriate code on CW.

The following table shows the various tuner Flashes:

Function	Indicates By One Flash		Indicates By Two Flashes			By Pressing
Antenna	1		2*			[ANT] < 1 second
Memory Bank	Bank A (1 Flash)	Bank B* (2 Flashes)	Bank C* (3 Flashes)	Bank D* (4 Flashes)	Off (5 Flashes)	[ANT] > 1 second
Bypass Toggle	Bypass Mode (L = 0 and C = 0)		Restore Last L/C Setting			[TUNE] < 0.5 sec.
Tuned SWR	SWR ≤1.5 (1 Flash)	SWR ≤2.0 (2 Flashes)	SWR ≤2.5 (3 Flashes)	SWR ≤3.0 (4 Flashes)	SWR >3.0 ("SWR")	[TUNE] for 0.5 to 2 seconds
StickyTune	On		Off			[TUNE] > 2 seconds
Tuning Mode	Automatic		Semi-Automatic			[TUNE] + [ANT]

* Not available on the MFJ-926B Table 2. Tuner Flashes.

Foldback Circuit

Modern transceivers with solid-state finals usually have a foldback circuit to protect the final transistors from high SWR. A foldback circuit detects the SWR during transmit and reduces the output power as the SWR rises above a preset threshold, usually 2:1. The higher the SWR the lower the power is set to prevent damage.

If your transceiver has a foldback circuit, you can simply key down and tune at any power level from 2 to 100 watts. If your transceiver does not have a foldback circuit, you must manually set the power level to 20 watts or less for tuning (2-10 watts recommended). At higher power levels, the reflected power occurring during tuning can damage your transceiver and causes component arcing which can damage the relays in the tuner.

Check your transceiver owner's manual to see if your transceiver has a foldback circuit.

Grounding Hints

To minimize RFI, single wire feedlines (such as used with Windom or longwire antennas) should be kept away from other wiring. Radiation will be minimized if the single wire feeder runs parallel and reasonably close to the wire that connects the tuner to the outdoor ground. The antenna feed wire should be adequately insulated to prevent arcing or accidental contact.

CAUTION

For operator safety, a good outside earth ground or water pipe ground should always be installed and connected to the case of the MFJ-926B. Make certain the safety ground also connects to the transmitter and other station accessories. A wing-nut post marked GROUND is provided for ground connections.

For safety, please use good DC and RF grounds. It is particularly important to have a good RF ground when using a single wire feeder. When using a single wire feeder, the tuner needs something to "push" against in order to force current into the single wire feedline. If a good RF ground is not available, RF will usually find its way back into the power line (RFI), transmitter audio circuits (RF feedback), or the operator (RF burns).

Metal water pipes and ground rods provide good DC and AC safety grounds, but they are often inadequate for RF grounding. Ground rods by themselves are almost useless for dependable RF grounding.

RF grounds work much better when "spread out" over a large area, especially when they employ multiple connections directly to the equipment ground point. Metal water pipes, heating ducts, and fences may work (especially if they are connected together with multiple wires), but the best RF grounds are radial systems or multi-wire counterpoises. Radials and counterpoises provide large, low resistance surfaces for RF energy.

RF and lightning travel on the surface of conductors. Braided or woven conductors have high surface resistance to lightning and RF. Ground leads for RF and lightning should have wide smooth surfaces. Avoid the use of woven or braided conductors in RF and lightning grounds unless the lead needs to be flexible.

Antenna System Hints

Location

For the best performance, an end-fed longwire wire antenna should be at least one quarter-wavelength long at the operating frequency. Horizontal dipole antennas should be at least a half-wavelength long and located as high and clear as possible. While good RF grounds help the signal in almost any transmitting installation, it is extremely important to have good RF grounds with long wire or other Marconi-style antennas.

Matching Problems

Most matching problems occur when the antenna system presents an extremely high impedance to the tuner. When the antenna impedance is much lower than the feedline impedance, an *odd quarter-*

wavelength feedline converts the low antenna impedance to a very high impedance at the tuner. A similar problem occurs if the antenna has an extremely high impedance and the transmission line is a multiple of a half-wavelength. The half-wavelength line *repeats* the very high antenna impedance at the tuner. Incorrect feedline and antenna lengths can make an otherwise perfect antenna system very difficult or impossible to tune.

One example where this problem occurs is on 80 meters when an odd quarter-wave (60 to 70 feet) open wire line is used to feed a half-wave (100 to 140 feet) dipole. The odd quarter-wave line transforms the dipole's low impedance to over three thousand ohms at the tuner. This is because the mismatched feedline is an *odd multiple* of 1/4 wavelength long. The line *inverts* (or teeter-totters) the antenna impedance.

A problem also occurs on 40 meters with this same antenna example. The feedline is now a multiple of a half-wave (60 to 70 feet) and connects to a full-wave high impedance antenna (100 to 140 feet). The half-wave line repeats the high antenna impedance at the tuner. The antenna system looks like several thousand ohms at the tuner on 40 meters.

This places enormous strain on the tuner components, since voltages can reach several thousand volts. This can cause component arcing and heating.

The following suggestions will reduce the difficulty in matching an antenna with a tuner:

- Never center feed a half-wave multi-band antenna with a high impedance feedline that is close to an odd multiple of a quarter-wave long.
- Never center feed a full-wave antenna with a feedline close to a multiple of a half-wave long.
- If this tuner will not "tune" a multi-band antenna, add or subtract 1/8 wave of feedline (for the band that won't tune) and try again.
- Never try to load a G5RV or center fed dipole on a band below the half-wave design frequency. If you want to operate an 80-meter antenna on 160 meters, feed either or both conductors as a longwire against the station ground.

To avoid problems matching or feeding any dipole antenna with high impedance open wire lines, avoid the following lengths.

160 meters dipole:	Avoid 130, 260 ft
80 meters dipole:	Avoid 66, 135, 190 ft
40 meters dipole:	Avoid 32, 64, 96, 128 ft

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

WARNING

To avoid problems, a dipole antenna should be a full half-wave on the lowest band. On 160 meters, an 80 or 40 meters antenna fed the normal way will be extremely reactive, with only a few ohms of feedpoint resistance. Trying to load an 80 meters half-wave dipole (or shorter) antenna on 160 meters can be a disaster for both your signal and the tuner. The best way to operate 160 meters with an 80 or 40 meters antenna is to load either or both feedline wires (in parallel) as a longwire. The antenna will act like a "T" antenna worked against station ground.

Appendices

POWER-ON OPERATIONS

(Press and hold buttons while turning on the power.)

Press and hold	TUNE		+	POWER			to start the self test.
Press and hold	TUNE	+ ANT	+	POWER			to delete current antenna memory.
Press and hold	ANT	+ POWER			then press	TUNE	1 time to reset factory defaults.
Press and hold	ANT	+ POWER			then press	TUNE	2 times to delete current memory bank.
Press and hold	ANT	+ POWER			then press	TUNE	3 times to perform total reset.
Press and hold	ANT	+ POWER			then press	TUNE	4 times to test the power-down circuitry.
Press and hold	ANT	+ POWER			then press	TUNE	5 times to test the relays.
Press and hold	ANT	+ POWER			then press	TUNE	6 times to calibrate the frequency counter.
Press and hold	ANT	+ POWER			then press	TUNE	7 times to calibrate the SWR bridge.

For the ANT + POWER operations, not pressing TUNE or pressing it more than seven times will cancel the operation after idling four seconds, beep two times and then resume normal operation.

Figure 2. Power-On Operations.

Resetting the Tuner

Each time the tuner is powered off, the microprocessor saves all memories and configurations to non-volatile memory. If the tuner is not working properly, even on initial power on, try resetting to the factory defaults.

Factory Defaults

The unit is shipped with the following default settings:

- Inductance 0 μH
- Capacitance 0 pF on antenna side
- Memory Bank 1A
- Tuning Mode Automatic
- Sticky-Tune Off

Note: *Resetting to factory defaults does not erase the antenna memories.*

To reset the tuner to these defaults:

1. Turn off the power to the tuner.
2. Press and hold *only* the [ANT] button while turning the power on. Both LEDs will blink until the button is released.
3. Within four seconds of releasing [ANT], press the [TUNE] button once.
4. After releasing [TUNE] for four seconds, Flash three times and resume normal operation.

WARNING:	**If the MFJ-926B is not behaving normally or acting erratic, try resetting the tuner to factory defaults.**

Delete Entire Antenna Memory

To delete the entire antenna memory:

1. Turn off the power to the tuner.
2. Press and hold *both* the [TUNE] and [ANT] buttons while turning the power on. It takes approximately three seconds to delete the memory bank.
3. Flash three times and release the buttons to resume normal operation. Remember that the antenna memory will be lost!

Total Reset

To erase antenna memories and reset to factory defaults:

1. Turn off the power to the tuner.
2. Press and hold *only* the [ANT] button while turning the power on. Both LEDs will blink until the button is released.
3. Within four seconds of releasing [ANT], press the [TUNE] button three times.
4. After releasing [TUNE] for four seconds, both antenna memories are deleted and factory defaults are reset. The total reset takes approximately six seconds.
5. Flash three times and resume normal operation.

Self Test

A self-test routine will check the functions of the MFJ-926B. This routine checks the LEDs, the internal buttons, the internal memory, and the power-down circuitry. During the self-test, you may stop the test by turning off the unit; however, this should NOT be done during the memory test or the memory could be corrupted. The self-test can be completed in approximately 10 seconds.

Note:	*Performing the self-test will reset the unit to its factory default settings.*

Here is the self-test procedure:

1. Turn off the power to the tuner.
2. Press and hold *only* the [TUNE] button while turning the power on.
3. The test begins by blinking the firmware version number via the two front panel LEDs. The green LED blinks first, followed by the red LED. The version number X.Y is represented by the number of times the green LED blinks for X and the number of times the red LED blinks for Y. For example, green LED blinks one time and red LED blinks two times represent firmware version number 1.2. This also tests the two LEDs.

4. Release the [TUNE] button. The unit then checks for short circuits, power-down detection level, and wakeup circuitry.
5. Press [ANT] button and the green LED should blink once.
6. Press [TUNE] button and the green LED should blink once.
7. The unit then tests its non-volatile memory. Notice this step will reset the unit to its factory default settings.
8. If the unit is okay, a repetitive message "PASS" will be sent in Morse code (di-dah-dah-dit di-dah di-di-dit di-di-dit) by blinking the green LED. If there is a problem, a failure message will be sent repetitively and the red LED will blink.
9. Turn the unit off, wait one second and turn the unit on again to test the power-down detection circuitry.
10. If the power-down detection circuitry is okay, a repetitive message "PASS" will be sent in Morse code (di-dah-dah-dit di-dah di-di-dit di-di-dit) by blinking the green LED. If there is a problem, message "PD FAIL" will be sent as Morse code repetitively and the red LED will blink.
11. Turn the power off.

Failure Message	Indicates
ANT FAIL	[ANT] button is shorted or improperly connected.
TUNE FAIL	[TUNE] button is shorted or improperly connected.
MEMORY FAIL	Non-volatile memory circuitry is improperly connected.
WAKEUP FAIL	Microprocessor wakeup circuitry problem.
PD FAIL	Power-down circuitry problem.

Table 3. Failure Messages.

Power-Down Circuit Test

When the 12 VDC power to the tuner is turned off, the tuner saves all settings to non-volatile memory. The Power-Down Circuit Test checks the power-down detection circuitry. It is recommended that this test be done immediately after the regular self-test described above.

Note: *The tuner must be reset to factory defaults before performing this test.*

Here is the test procedure:

1. Make sure power to the tuner is off.
2. If the tuner has been reset to factory defaults, skip to step 6; otherwise continue with step 3.
3. Press and hold *only* the [ANT] button while turning the power on. Both LEDs will blink until the button is released.
4. Within four seconds of releasing [ANT], press the [TUNE] button once.
5. After releasing [TUNE] for four seconds, Flash three times and turn the power off.
6. Press and hold *only* the [ANT] button while turning the power on. Both LEDs will blink until the button is released.
7. Within four seconds of releasing [ANT], press the [TUNE] button four times.

8. After releasing [TUNE] for four seconds and if the power-down detection circuitry is okay, a repetitive message "PASS" will be sent in Morse code (di-dah-dah-dit di-dah di-di-dit di-di-dit) by blinking the green LED. If there is a problem, message "PD FAIL" will be sent in Morse code repetitively and the red LED will blink.
9. Turn the power off.

Relay Test

WARNING:	**Turn off the transmitter power or disconnect the transmitter before performing this test; otherwise, damage to the tuner can result.**

To test the relays and their control circuitry;

1. Turn off the power to the tuner.
2. Press and hold *only* the [ANT] button while turning the power on. Both LEDs will blink until the button is released.
3. Within four seconds of releasing [ANT], press the [TUNE] button five times.
4. After releasing [TUNE] for four seconds, Flash once and the Relay Test routine is initiated.
5. Press the [TUNE] button to engage the relay and the red LED will turn on. Release the [TUNE] button to disengage the relay and the red LED will turn off. Listen for relay clicks.
6. There are 19 relays in the tuner. Press the [ANT] button to test the next relay. The green LED will illuminate until the [ANT] button is released.
7. Repeat Steps 5 and 6 to test all 19 relays (in the order of relay K1 to K19).
8. After releasing [ANT] on the 19th relay, Flash three times and resume normal operation.

Frequency Counter Calibration

To calibrate the frequency counter, you will need a transmitter, a 50-ohm dummy load, two 50-ohm SO-239 coax cables, a Phillips screwdriver, and a tuning tool or small flat blade screwdriver.

WARNING:	**Do not touch anything inside the tuner during operation! Serious, painful RF burns can result.**

WARNING:	**Never operate the MFJ-926B with its cover removed; dangerous voltages and currents can be present during operation. Never exceed tuner specifications.**

1. Turn off the power to the transmitter and the tuner.
2. Remove the cover from the tuner (6 screws) with a Phillips screwdriver.
3. Connect the transmitter to the **"RF IN/OUT"** coaxial connector on the **MFJ-4117 Bias-Tee** using a 50-ohm coaxial cable. (See Figure 1) This is the RF signal input connector.
4. Connect a 12-15 VDC voltage source capable of supplying at least 750 milli-amps to the "**DC IN\OUT"** jack on the **MFJ-4117 Bias-Tee.** This is your DC voltage input connector.
5. Connect the **"RF/DC OUT/IN"** coaxial connector on the **MFJ-4117 Bias-Tee** to the **TRANSMITTER** connector on the **MFJ-926B Intellituner** using 50-ohm coaxial cable. The **MFJ-926B Intellituner** will recover the RF and DC signals.
6. Connect a 50-ohm dummy load to the **ANTENNA** connector using a 50-ohm coaxial cable.

7. Turn on the power to the transmitter. Set and lock the frequency to *exactly* 29.000 MHz.
8. Press and hold *only* the [ANT] button while turning the power on. Both LEDs will blink until the button is released.
9. Within four seconds of releasing [ANT], press the [TUNE] button six times.
10. After releasing [TUNE] for four seconds, the green LED lights up and the Frequency Counter Calibration is initiated.
11. Key the transmitter to output about 10 watts and adjust trimmer capacitor VC3 (located next to the big integrated circuit on the front side of the front panel circuit board) until both LEDs are lighted up. The green LED lights when the calibration is below 29 MHz, the red LED lights when the calibration is above 29 MHz and both LEDs light up when the calibration equals to 29 MHz.
12. Unkey the transmitter. Turn off the power to the transmitter and the tuner.
13. Secure the cover back onto the tuner.

SWR Bridge Calibration

This is a factory calibration procedure only

In Case of Difficulty

If the tuner acts erratic, reset the tuner to factory defaults.

If the tuner fails to tune, please **double check** all connections and follow the tuning procedures again.

If the tuner arcs at the rated power levels, please **double check** all connections and follow the tuning procedures again. Ensure you are not exceeding the tuner's rated power handling capability.

> ***Note:*** *If the tuner arcs when operating on the 160-meter band, it may be necessary to reduce transmitter output power.*

If you are still unsuccessful, but the tuner does adjust and operate when used with a dummy load or another antenna, please read "Grounding Hints" and "Antenna System Hints" on page 13.

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. Send a complete description of your problem, an explanation of exactly how you are using your unit, and a complete description of your station. Also include the firmware version number of your unit.

List of Accessories

- **MFJ-1312D**: 12 VDC 500mA power supply
- **MFJ-4117**: BiasTee DC power injector with on/off switch (included with the MFJ-926B)
- **MFJ-5803**: 3 feet long RG-58 A/U 50-ohm coax cable with a PL-259 connector on each end
- **MFJ-5806**: 6 feet long RG-58 A/U 50-ohm coax cable with a PL-259 connector on each end
- **MFJ-5818**: 18 feet long RG-58 A/U 50-ohm coax cable with a PL-259 connector on each end

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 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, of 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 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. 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 **$8.00** 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 (662) 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 Rd, 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 and a telephone number.

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