INTRODUCTION

Congratulations on your choice of the MFJ-9410 Ten-Meter SSB Transceiver. Please read this manual carefully before attempting to operate your new radio. Let's begin with an introduction to some special features we think you'll like!

Easy to Operate: No microprocessor mumbo-jumbo. Just turn on and tune in!

Potent Signal: 20-Watt PEP--plus *Constant Current*™ syllabic speech processing for an added 4 to 6-dB advantage to cut through noise, fading, and QRM.

Low Drain: Operate from a 3-Amp AC supply or 12-Volt battery. All-analog circuitry means highest energy efficiency!

Hot Receiver: Low-noise preamp and active-DBM front end dig deep into the noise to capture weak ones. If the signal is there, you'll hear it.

Excellent Selectivity: Sharp 2.3 KHz SSB ladder filter reduces passband noise, fights QRM, and improves intelligibility.

TVI Protection: Built-in 7-element lowpass filter knocks down TVI--lets you operate day or night, when *you* want to!

Real S-Meter: Steer your beam with pin-point accuracy and give meaningful reports with a full-sized analog S-meter. Also, monitor speech processing level.

Agile Tuning: No unexpected tuning-rate shifts or stair-stepping. Reduction-drive analog VFO lets you scan the band for signals quickly, then zero in smoothly. Best VFO for hunt-and-pounce contest operation!

Loud Audio: Efficient rugged 3-1/2" top-mount speaker delivers robust audio, overcomes ambient noise.

Phone Jack: 1/4" jack accepts standard stereo headphones, cuts off speaker automatically. Attenuated output protects phones and ears, makes gain adjustment easy.

Amplifier Jack: Solid-state FET switch keys external amplifiers.

Built to Last: Conservative design, premium-quality plate through PC board, quality components, handsome brushed-aluminum panel, and tough vinyl-clad case make for years of dependable service.

At home or traveling the world, you'll enjoy superb 10-meter performance with your MFJ-9410. Best of all, it's fully backed by MFJ's exclusive *NO MATTER WHAT*™ one-year guarantee. If it breaks, we'll take care of it.

GENERAL DESCRIPTION

The MFJ-9410 is a 20-Watt PEP USB transceiver designed especially for fixed or portable radio communication in the ten-meter amateur band. Energy-efficient analog circuitry and syllabic speech processing deliver superior on-air performance while conserving valuable power. The MFJ-9410 uses a single-conversion mixing format and a low-noise heterodyne VFO for enhanced weak-signal performance. The transmitter features a built-in 7-element lowpass filter to reduce interference at TV and FM-broadcast entertainment frequencies. Other features include a sharp HF-communication grade crystal, IF bandpass filter, built-in heavy-duty speaker, fully-analog mechanical S-meter, optional semi-break-in CW module, and intuitive "easy-to-operate" controls.

Typical Specifications

Receiver Section:

Frequency Coverage:	28.300-28.600 MHz
Mode:	USB
Receiver Type:	Single-conversion Superhet
Frequency Control:	Crystal mixed heterodyne VFO
IF Frequency:	10 MHz
IF Selectivity:	-6 dB @ 2.3 KHz
AGC:	Audio-derived, 70-dB dynamic range
Sensitivity:	.15 uV for 12-dB S/N
Audio:	500 mW into 8 Ohms at 10% THD
Average RX Current:	60-mA, (S-meter lamp disabled)

Transmitter Section:

RF Power Output:	20-Watts PEP
Mode	USB*
VSWR Tolerance:	3:1 VSWR maximum
Peak TX Current:	3.2 Amps
Speech Enhancement:	RF-compression, syllabic rate
Spurious Attenuation:	-60 dBc
Mic Input:	600-Ohm dynamic

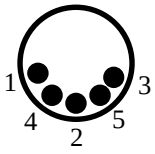
*CW operation is possible within the 28.3-28.6 tuning range with an optional CW adapter board.

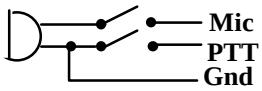
QUICK-START OPERATING INSTRUCTIONS

- **Power Supply:** Use any regulated 13.8-Volt 3-Amp supply or comparably-rated 12-Volt battery. Connect power via a 5.5 OD x 2.1 mm coaxial power plug (Radio Shack 274-1569): **[+] lead must be attached to the connector center pin.**

- **Microphone:** The MFJ-290 dynamic microphone compliments your radio's speech processor, but other 600-ohm PTT microphones may be used with a 5-pin DIN connector installed as shown below (use Radio Shack 274-003). Amplified microphones *should not* be used with the MFJ-9410.

Pin 3 = PTT Line
Pin 4 = Mic Line
Pin 1,2,5 = Ground





- **Antenna Selection:** Use any vertical or horizontal 10-meter antenna exhibiting a VSWR of 2:1 or less. A simple dipole or groundplane is adequate for casual operation, but a 3-element yagi or 2-element quad yields better DX performance.

Important Note: Avoid using antennas with unknown or high VSWR. The MFJ-9410 does not provide automatic high-VSWR shutdown circuitry. Operation into extremely reactive loads may result in out-of-band spurious emissions in violation of FCC rules!

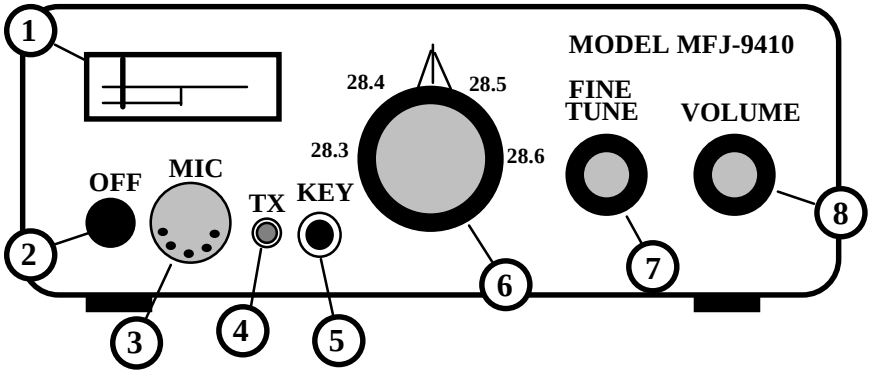
- **Speech Processing:** The MFJ-9410 processor rapidly readjusts transmitter IF gain for each spoken syllable. For best results, hold the Mic about 1" from your lips and speak normally. The S-meter should deflect 1/2 scale as you speak.

Important Note: Transmit meter deflection will be affected by high-VSWR loads. If the meter deflects beyond S9 or holds below S4 with normal speech, check your antenna. A VSWR of 2:1 or less is normally considered acceptable for amateur service.

- **Connecting a Power Amplifier:** The MFJ-9410 provides a built-in FET switch to key an external amplifier. Be sure to follow all manufacturer's instructions carefully when installing an amplifier at your station. The *Ext Amp* jack provides closure to ground during transmit.

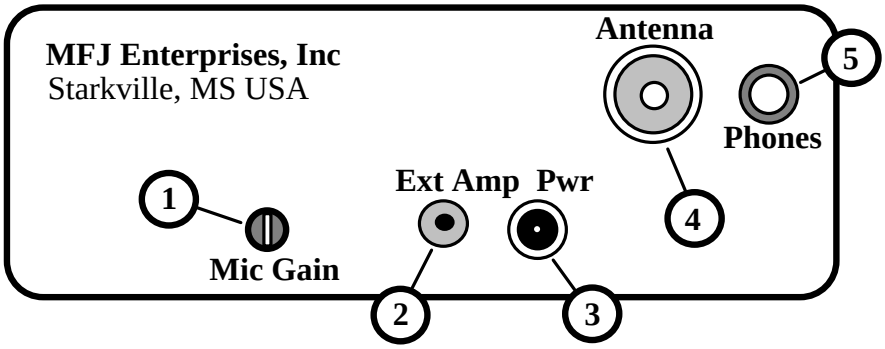
- **Choosing an Operating Location:** Set your station up in a sheltered and dry location. Avoid operating in direct sunlight--the radio's black case may absorb excessive heat that can impair normal operation or damage internal components.

MFJ-9410 CONTROL LOCATIONS AND FUNCTION



Front Panel

1. S-METER: Measures signal strength on receive, ALC on transmit
2. POWER SW: Applies DC power to the radio.
3. MIC JACK: Accepts 5-pin DIN connector for PTT microphone.
4. TX LED: Illuminates when transmitter is keyed.
5. KEY JACK: Accepts telegraph key--only used with CW adapter module.
6. VFO TUNE: Tunes in stations, indicates operating frequency.
7. VFT: Fine tune control for precise SSB tuning.
8. VOLUME: Adjusts listening level.



Rear Panel

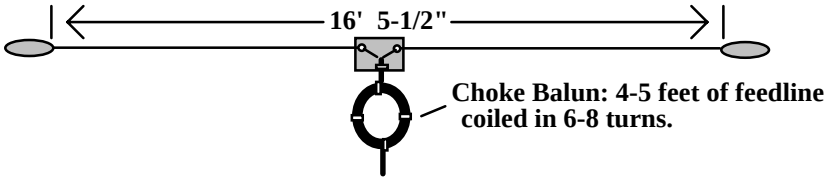
1. MIC GAIN: Adjusts speech-amp gain (normal setting 12:00).
2. EXT AMP: Accepts RCA plug--keys external linear amplifier.
3. POWER JACK: Accepts 5.5mm OD x 2.1mm ID plug, [+] to center pin (+13.8V/3A).
4. ANTENNA: Accepts PL-259 for 50-Ohm coaxial line.
5. PHONES: Accepts 1/4" stereo headphone jack.

TEN-METER ANTENNA SYSTEMS

The better your antenna system works, the more you'll enjoy using the MFJ-9410. Here are some general tips for getting top performance:

- **Antenna Selection:** Dipoles, ground-planes, and converted CB antennas all provide good performance for casual operation. However, for serious DX hunting, a compact 3-element yagi or 2-element quad will yield significantly better results. Many compact directional antennas are small and light enough to roof-mount on a standard TV rotor using readily-available TV hardware. If possible, avoid using low-efficiency "compromise" antennas. Never operate into an antenna with unknown or high VSWR.

- **Making a Dipole:** A simple 10-meter dipole cut for 28.4 MHz will be approximately 16' 5-1/2" long. To prevent feedline radiation and reduce unwanted noise pickup, make a simple choke balun at the center by coiling up a short length of the coax and securing it with electrical tape or tie-wraps.



- **Antenna Location:** Mount your antenna as high and in-the-clear as possible, but remember to factor in feedline loss. A chimney-mounted antenna at 40' with a short low-loss feedline may actually out-perform one mounted 20' higher with a long lossy feed. Be sure to isolate your antenna from other larger antennas or RF-reflective metallic surfaces that may distort its normal radiation pattern.

- **Coax Cable:** For runs to 60', RG8X (or mini-8) works well at 28-MHz. For longer runs, or when running a high-power amplifier, use larger-diameter low-loss cable such as RG8 foam or RG213. Seal all exterior connectors against moisture with silicon grease, rubber tape, or premium-quality electrical tape.

- **Rotor:** Many TV-type rotors will handle a short-boom 10-meter beam or quad. However, long-boom or stacked arrays will require a heavier rotor designed especially for amateur radio use.

- **Safety Tips:** When installing antennas, make sure someone is available to assist you in an emergency. Also, avoid any location where your antenna could fall and contact power wires. For catastrophic lightening protection, permanently ground the mast and coax shield *outside* the building with a good ground rod system. Also, remember to disconnect the feedline from your radio at the first sign of severe weather. Even nearby strikes may damage sensitive receiver components with the antenna connected.

THEORY OF OPERATION

General: The MFJ-9410 is a 20-Watt PEP USB transceiver that tunes from 28.3-28.6 MHz. The radio's single-conversion format uses a high-frequency heterodyne VFO for superior stability, low phase noise, and circuit simplicity. The MFJ-9410 is designed for fixed or portable operation from light-weight power sources and uses all-analog circuitry throughout for reduced power consumption.

Receiver: A four-pole bandpass filter (L1/L2) pre-selects incoming 28 MHz signals and Q1 provides LNA gain ahead of the mixer. Operating frequency is controlled by a 38-MHz heterodyne VFO driving active mixer U1. The mixer then down-converts 28 MHz signals to the radio's 10-MHz IF. A six-crystal SSB ladder filter (Y1-Y6) establishes the radio's 2.3 KHz message-channel bandwidth. Gain of IF amplifier U2 is controlled by audio-derived AGC. Product detector U3 demodulates incoming SSB using a 10-MHz BFO signal generated by the mixer chip's oscillator section. Recovered audio is fed to preamp U4a, which simultaneously drives AGC amp Q3/Q4 and AF-power amp U5. Switch Q2 sets the AGC time constant for TX and RX modes.

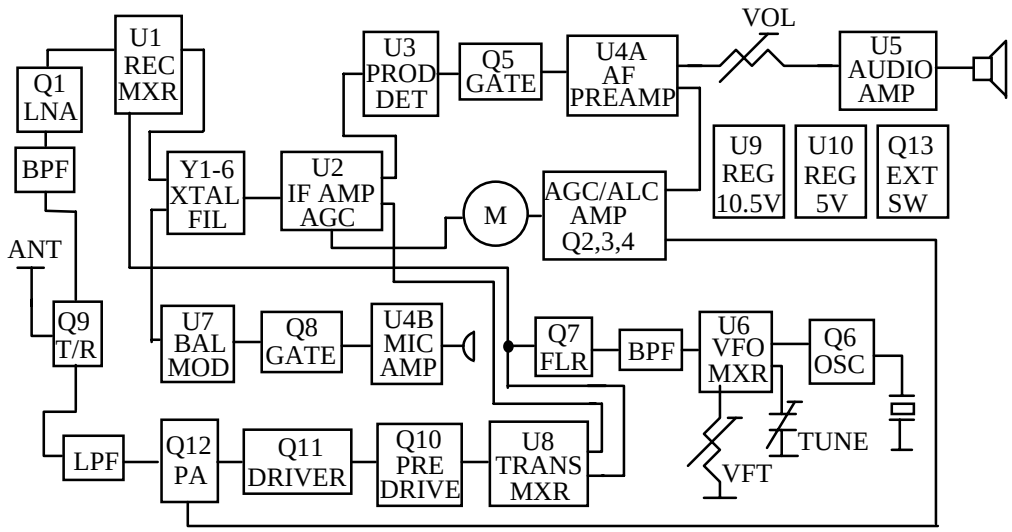
Transmitter: Mic-amp U4b drives balanced modulator U7. Modulator LO is derived from the BFO section of U3. DSB generated by U7 is routed to the IF filter (Y1-Y6) where the lower sideband is removed. IF-amplifier U2 compresses the USB signal at a syllabic rate and routes it to transmit mixer U8. At U8, the 10-MHz IF signal mixes with 38-MHz VFO energy for conversion to 28 MHz. The signal is then amplified by driver stages Q10 and Q11. Interstage matching and 28-MHz passband filtering are provided by tuned-transformers T4-T6. PA-stage Q12 is a self-ballasted emitter-tab device operating in single-ended class AB. Input and output ports are matched by L-networks, and a seven-element low-pass filter reduces harmonic and spur content of the amplified signal. A RF-envelope detector samples signal amplitude and provides feedback to IF-amplifier U2 for speech processing. PTT switch Q9 drives T/R relay K1.

Heterodyne VFO: VFO mixer U6 combines 6.3-6.6 MHz tunable-oscillator energy with a 32-MHz crystal-controlled signal generated by Q6. Bandpass filter L6-L7 admits the 38.3-38.6 MHz mixer product to FET-follower Q7, where it is transformed to a low impedance and distributed to mixers U1 and U8.

Regulation and Protection: Adjustable monolithic voltage regulator U9 provides 10.5 Volts for most low-level stages in the transceiver. Regulator U10 supplies 5 Volts to the mixing VFO. A diode/fuse crowbar circuit protects the radio against accidental reverse-polarity damage.

Amplifier Keying: FET switch Q13 provides a ground-path closure for the purpose of keying an external 28-MHz linear amplifier.

MFJ-9410 BLOCK DIAGRAM



MFJ-9410 INTERNAL ADJUSTMENTS *(see pictorial on next page)*

[1] Voltage Regulator: Adjust V-REG trimpot R78 for 10.5V on tab of U9 [18].
[2] RSSI Threshold: Adjust AGC trimpot R11 for 4.3 V at RSSI test point [16].
[3] Meter Zero: Adjust M-ZERO trimpot R17 for zero meter reading--no signal.
[4] IF Transformers: Peak IF cans T1,T2 for maximum receiver sensitivity.
[5] RF Transformers: Peak RF coils L1, L2 for maximum receiver sensitivity.
[6] BFO: Set BFO trimcap C30 so close-in filter peak corresponds to 600 Hz beat note.*
[7] VFO Cal: Tune signal generator and VFO to 28.4 MHz, set L3 for zero beat.
[8] Mixing VFO: Tune OSC coil L5 and filter coils L6,L7 for maximum RX sensitivity.
[9] Carrier Balance: *Carefully* adjust BAL trimpot R57 for minimum carrier.**
[10] Mic Gain: Set for preference--12:00 position is factory default.
[11] PA Bias: Attach 200-uA meter at [15], Set bias pot for 20-25 uA reading.

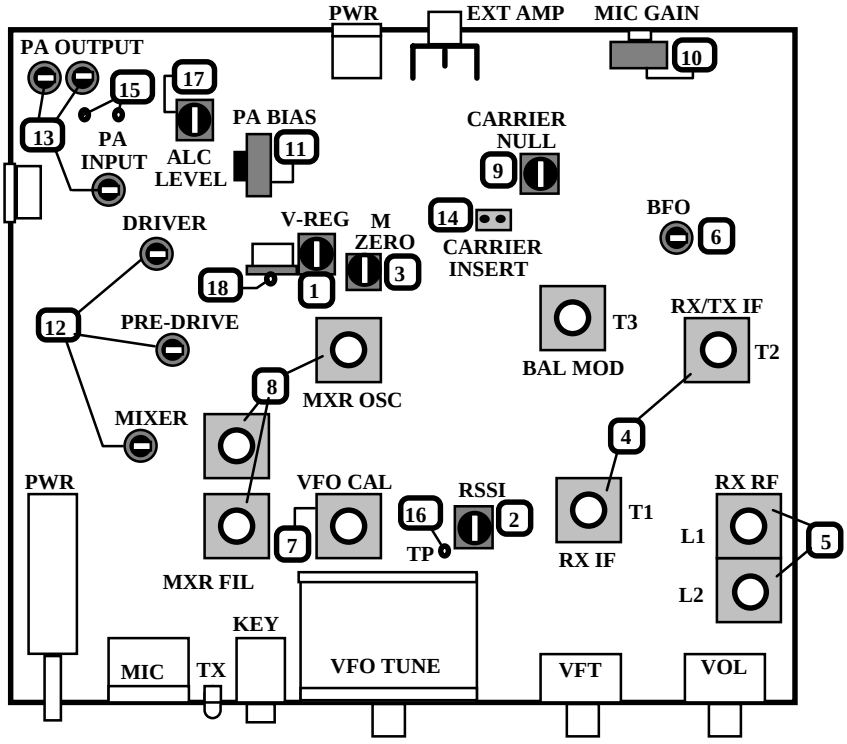
Note: To adjust [12 & 13], install a shorting plug at [14] to insert carrier. Also, turn ALC trimpot (R73) clockwise to disable ALC line (should be no meter deflection on TX).

[12] Exciter tune: Key Mic and peak C89, C96, C99 for maximum RF output.
[13] PA: Key mic and peak C103, C110, C111 for maximum output--then remove plug.
[14] Carrier Insert: Shorting plug location to insert carrier for tuning transmitter.
[15] IC Test Points: Connect 200-uA meter here to set PA idle current (see above).
[16] RSSI Test Point: Used when setting RSSI trimpot [2].
[17] ALC Level: Key Mic and speak, adjust ALC trimpot for 1/2-scale meter deflection.
[18] V-REG Test Point: Set V-REG trimpot [1] for 10.5-V DC reading on regulator tab.

*Caution--may unbalance carrier, step requires special skill and knowledge to perform.
**If R57 alone does not produce deep null, interactively adjust R57 and T3 for best null.

INTERNAL ADJUSTMENT LOCATIONS

WARNING: The tune-up information provided in this manual does not constitute a step-by-step guide for aligning the MFJ-9410. IF YOU LACK THE TEST EQUIPMENT, KNOWLEDGE, AND SKILLS TO ALIGN HF SSB TRANSCEIVERS, DO NOT ATTEMPT TO MAKE THESE ADJUSTMENTS ON YOUR OWN!! Far better to contact the MFJ factory for assistance. Mis-alignment may cause permanent damage to your unit, and may result in interference to other radio services in violation of FCC rules. MFJ cannot be held responsible for the performance of radios that have been improperly tampered with or mis-adjusted by owners and users.



Note: For trimpots, trimcaps, and IF cans (T1-T3), use a non-conductive tuning wand with a metallic tip. For TOKO brand inductors, use a non-conductive wand with a narrow plastic tip. For Coilcraft brand inductors, use a small hex-head non-metallic tuning tool.

IN CASE OF DIFFICULTY

☐ **Radio does not power up:** Check power plug and power supply. Also, reverse-polarity protection fuse may be open (etched on PC board in front of power jack J3). If open, install a 3.0-A pig-tail replacement fuse or short length of #32 wire.
☐ **No signals received:** Check antenna and feedline for breaks or shorts. If okay, you should hear a clearly-audible increase in background noise when the antenna is connected.

☐ **Spurious signals received:** Look for interference from nearby computers, modems, TVs, cordless phones, or other devices that may emit 28-MHz signals.

☐ **Distorted Receiver Audio:** Check for foreign debris in the speaker basket.

☐ **Erratic transmit:** Check antenna VSWR. Also, check battery or power supply voltage. If supply drops below 12-V under load, the radio's regulator will drop out and operation will become erratic. If you operate exclusively from 12-V batteries, reduce V-REG output to 10.0V (measured on tab of U9) for added regulator headroom.

☐ **High meter deflection on transmit, low RF output:** ALC pot R11 may be set too high (or VSWR may be high). Adjust R11 for mid-scale deflection into a 50-Ohm load.

☐ **Splatter, low meter deflection:** ALC pot R11 may be set too low (or there may be a feedline short). Adjust for mid-scale deflection when transmitting into a 50-Ohm load.

☐ **S-meter does not return to zero:** Confirm that V-REG (R78) is set for 10.5V on tab of U9. Confirm that AGC threshold (R11) is set for 4.3V at RSSI test point (no signal). When both readings are set, adjust R17 for zero meter deflection.

☐ **Poor carrier suppression:** Turn Mic gain off (fully CCW) and key the radio while monitoring signal on an external receiver. Adjust R57 for minimum carrier.

☐ **Low or distorted transmit audio:** Check to see if mic gain is set too low. Also, make sure you are using a 600-Ohm low-Z dynamic microphone.

☐ **Excessive background noise on signal, hum:** Mic gain set too high for the ambient noise conditions. Also, is Mic or radio next to a power transformer or electric motor?

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 **601-323-0549** or the *MFJ Factory* at **601-323-5869**. 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 601-323-6551; 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.

MFJ-9410 SCHEMATIC DIAGRAM