

INTRODUCTION

The MFJ-616 *Speech Intelligibility Enhancer*[™] is a powerful communication tool that surrounds your operating position with crystal-clear electronically-enhanced audio. It also puts the fun back into ham radio! Here are some of the high-tech features we think you'll enjoy:

Studio Quality: The *Speech Intelligibility Enhancer*[™] is designed to drive two identical high quality speakers installed three or more feet apart. This configuration improves intelligibility, enhances frequency response, and dramatically increases spatial presence. Once your system is set up, you'll think you're in a broadcast studio!

***Speech Intelligibility Enhancer*[™]:** Every radio has different audio characteristics--and everyone's hearing response changes over time. Our exclusive *Speech Intelligibility Enhancer*[™] tailors the sound of your radio especially for your ears. Young or old, you'll hear more clearly than ever before!

Dual Amplifiers: Two powerful monolithic IC amplifiers deliver deep, rich, undistorted audio to high quality, hi-fidelity speakers (not supplied).

Adjustable Balance: A front-panel *Balance* control aligns speakers for dead-center positioning regardless of speaker placement or differences in ear sensitivity.

Easy-to-Operate: Large knobs, easy-to-access switches, and a wide-open panel layout make the MFJ-616 very easy to set up and use.

Dual Input: Switch between radios with the push of a button--no messing with patch cables behind the desk.

By-Pass Function: Switch *Speech Intelligibility Enhancer*[™] in or out without cutting off the speakers. This feature is especially helpful for sound comparisons during the frequency set-up.

Multiple Outputs: Choose individual 3.5mm monaural jacks or a stereo jack wired for computer-style speakers. Also, a front panel switch turns off your speakers, the stereo headset stays active. Front panel phone jack is attenuated to headset levels (deactivated with internal jumpers).

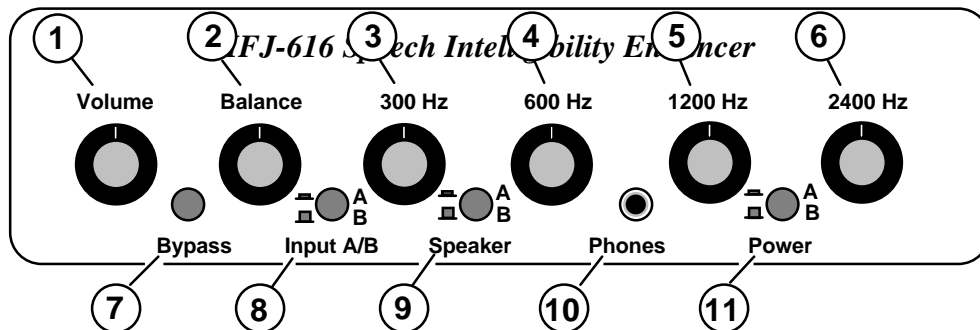
Multiple Power Sources: Use transceiver's 13.8-volt supply, wall adapter, dedicated supply, or 12-volt battery to power your unit.

Rugged Construction: Attractive all-metal cabinet, conservative component selection, and space-age SMD circuitry ensure solid performance for years to come. Fully covered by MFJ's "No Matter What" one year limited warranty.

Before attempting to operate your MFJ-616, please read this manual thoroughly. It contains important details you'll need to know to obtain the best performance from your unit.

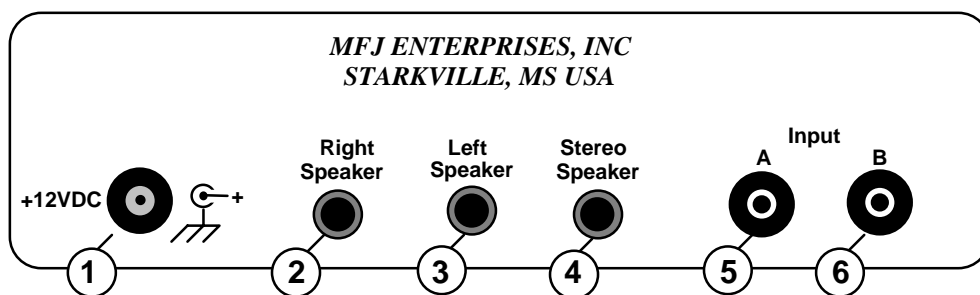
JACKS AND CONTROLS

Front View:



1. **Volume:** Adjusts overall loudness of both channels.
2. **Balance:** Establishes central balance between right and left speakers.
3. **300 Hz:** Cuts or emphasizes lowest speech frequencies.
4. **600 Hz:** Cuts or emphasizes mid-range speech frequencies.
5. **1200 Hz:** Cuts or emphasizes upper-range speech frequencies.
6. **2400 Hz:** Cuts or emphasizes syllabant sounds and adjacent channel "chatter".
7. **Bypass:** Turns *Speech Intelligibility Enhancer*™ function on and off for comparative listening.
8. **Input A/B:** Selects between two sources.
9. **Speaker:** Disables speakers--used when monitoring with headphones.
10. **Phones:** Accepts 1/4" stereo headphone plug, normally attenuated for phones (attenuation deactivated internally).
11. **Power:** Selects between unamplified and amplified signals.

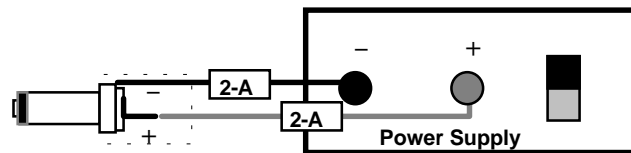
Rear View:



1. **Power:** Accepts 2.1-mm power plug to supply 12-15 Vdc to the unit.
2. **Right Speaker:** Accepts 3.5mm mono phone plug for right-hand monitor speaker.
3. **Left Speaker:** Accepts 3.5-mm mono phone plug for left-hand monitor speaker.
4. **Stereo Speaker:** Accepts 3.5-mm stereo plug for computer-style speaker pairs.
5. **Input A:** Accepts RCA plug from first radio (auxiliary audio or speaker line).
6. **Input B:** Accept RCA plug from second radio (auxiliary audio or speaker line).

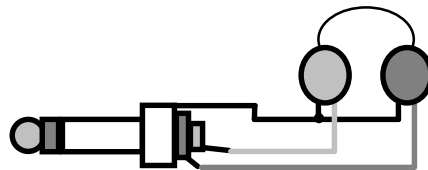
SET-UP INSTRUCTIONS

Power Sources: Power your unit from any stable 12-15 Vdc source capable of delivering 1.5 Amps--including 13.8-volt high-current transceiver supplies, smaller dedicated power sources, properly rated wall adapters, and 12-volt batteries. The MFJ-616 features supplemental internal filtering, but hum and noise may still occur if your source is under-rated or very poorly regulated. Protect both power leads with 2-Amp fuses when using a high-current source such as a station supply. The controller's external power jack accepts a 5.5-mm x 2.1-mm coaxial plug. You may obtain extra plugs from RadioShack (274-1567 or equivalent). Wire (+) voltage to center terminal, and (-) to common, as shown:

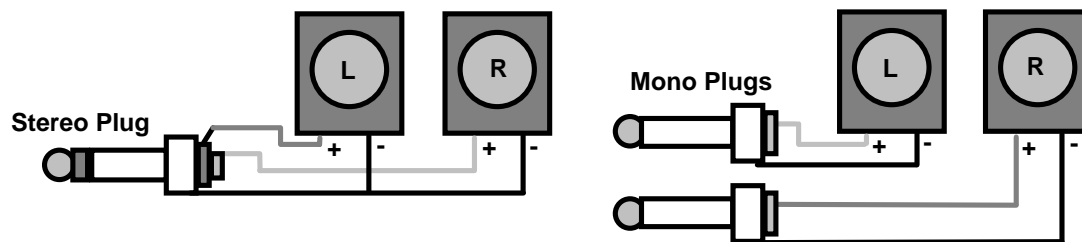


Important Note: *Unregulated DC sources (simple wall cubes, solar panels, etc.) may damage your unit. Never apply more than 15 volts.*

Headphones: Use stereo headphones rated at 8-40 Ohms impedance. The front-panel headphone jack accepts a standard 1/4" stereo plug. If stereo phones are unavailable, you may use monaural phones with a mono plug if JMP4 and JMP5 are removed (factory default). JMP4 and JMP5 are located on the main PC board directly behind the headphone jack.



Speakers: For best results, use a matched pair of high quality speakers housed in properly-designed cabinets. Acoustic suspension or ported drivers in the 4-to-6 inch range work especially well for speech. Any voice-coil impedance between 4 and 16 ohms is acceptable. Tweeters should be disconnected in extended-range monitors to reduce high-frequency noise contribution. Use monaural or stereo patching, as shown below:



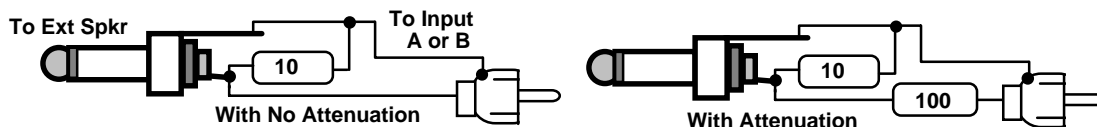
When preparing speaker cables, it's important to ***maintain proper lead phasing***. If speakers are cross-phased, frequency response and efficiency suffer due to acoustic cancellation.

Radio Connections: The *Speech Intelligibility Enhancer™* accepts signals in the "line-level" range from any of the following sources:

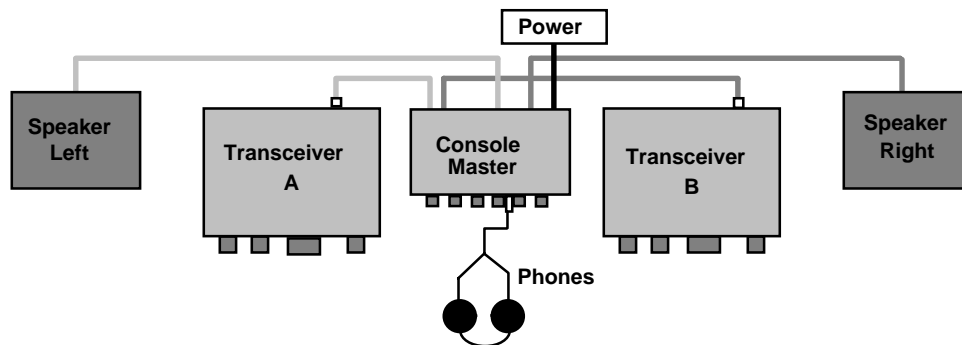
1. Auxiliary Jack: Many larger transceivers provide an *Auxiliary Audio* output jack on the back panel. This source may or may not be tied to the radio's volume control. Before using the auxiliary line, be sure to check your transceiver manual for specifications. The *Speech Intelligibility Enhancer™* input jacks are terminated at 500 Ohms. If your radio's auxiliary output line has a significantly higher driving impedance (10K for example), use the external speaker jack or headphone jack instead.

2. Headphone Jack: Many transceivers provide a *Headphone Jack* which disables the radio's internal speaker. This line is generally tied to the radio's output amplifier and often provides attenuation to prevent overdriving headsets. Due to attenuation, a higher setting of the radio's volume control may be necessary to drive the Station Master. In many cases, this condition is desirable--the higher setting may over-ride residual amplifier noise and provide better signal-to-noise performance.

3. External Speaker Line: Virtually all transceivers provide an *External Speaker Jack* that disables the internal speaker and routes audio directly to an external load. This line may be connected to either input A or B, but a 10-Ohm termination resistor should be installed at the speaker plug to replace the load normally provided by the speaker. If drive from the external speaker line seems excessive, you may add attenuation in the form of a series resistor to reduce the level (see below):



SPEECH INTELLIGIBILITY ENHANCER OPERATION



Connect your *Speech Intelligibility Enhancer™* as shown. Monitor speakers should be separated by at least three feet (preferably more) for best results. They may be wall mounted or placed at desk level. If possible, position each speaker equidistant from the "center" operating position and at equal height above the desk.

1. Initial Set-Up Levels: Begin by setting the *Speech Intelligibility Enhancer*™ controls as follows:

- Volume:** 10:00 position (about 1/3 up).
- Balance:** 12:00 position (mid-scale).
- Frequency Controls:** Set all four for 12:00 position (mid-scale).
- Bypass:** *Speech Intelligibility Enhancer*™ On (switch in)
- Input A/B:** A (out)
- Speaker:** On (in)
- Power:** On (in)

2. Radio Levels: Adjust the volume control on the *A-Input* radio for a comfortable listening level in the monitor speakers. Next, press the *Input* switch to select the *B-Input* Radio. Set the *B-Input* radio's volume control for a comfortable listening level.

3. Set Balance: Sitting at the microphone location, adjust the *Balance* control so sound appears to come from the center of the console in front of you.

4. Set *Speech Intelligibility Enhancer*™: Adjust all four frequency settings (300, 600, 1200, 2400) to preference. Use the *Bypass* switch to gauge the effectiveness of each control as you adjust it.

5. Headphones: Plug in a stereo headset and turn the *Speaker* switch off (out). The speakers should silence and the phones should work normally.

Some Results of Research on Speech Intelligibility in hearing English Words:

- The frequencies important for speech intelligibility are the consonant sounds from 500 to 4000 Hz. They contribute 83 % of word intelligibility.
- Frequencies from 500 to 1000 Hz contributes 35% of word intelligibility and 35 % of sound energy.
- Frequencies from 1000 to 4000 Hz contribute 48% of intelligibility but has only 4% of sound energy.
- In contrast, frequencies from 125 to 500 Hz contributes 55 % of sound energy but only 4 % to word intelligibility.
- In other words, nearly half the speech intelligibility is contained in 1000 to 4000 Hz frequency range with only 4 % of the speech sound energy.
- On the other hand, the low frequencies 125 to 500 Hz have most of the speech energy but contribute very little to intelligibility.

How to adjust your *Speech Intelligibility Enhancer*™ for Maximum Speech Intelligibility

There are four-frequency boost (increase in amplitude) and cut (decrease in amplitude) knobs spaced an octave apart in frequency. The center frequencies are approximately 300, 600, 1200 and 2400 Hz. With a knob set at 12 o'clock, there is no boost or cut. Turning the knob clockwise boosts an octave of frequencies by up to 12 dB while counterclockwise rotation gives more than 12 dB of cut.

Adjusting your *Speech Intelligibility Enhancer*™ is based on the following three principles.

First, drastically *reduce* the speech energy below 500 Hz. These frequencies contribute only 4 % of intelligibility but has 55 % of the speech energy. Do this by turning the 300 and 600 Hz knobs fully counterclockwise. This will drastically reduce the speech in those two octaves. You may want to increase the amplitude in this range a little by rotating the 600 Hz knob to 9 to 12 o'clock. Use the bypass switch to compare.

Second, drastically *increase* the speech energy above 1000 Hz. These frequencies contribute 48 % of intelligibility but has only 4 % of speech energy. Do this by turning the 1200 and 2400 knobs fully clockwise. You may want to experiment with less levels of boost with the knobs set 12 o'clock to fully clockwise. Use the bypass switch to compare.

Third, your hearing characteristics are unique. People's voices are different. Experiment by boosting and cutting each frequency range based on the two principles above until you find a combination that gives *you* best speech clarity.

For example, you may have frequency response "holes" in your hearing that you can "fill in" by boosting those ranges of frequencies. You may be having a QSO with a YL or XYL with a high pitched voice or someone with a booming low voice or poor microphone. By adjusting the knobs based on their voice characteristics, you can optimize speech clarity.

Remember -- 12 o'clock is flat (no boost or cut), clockwise is boost and counterclockwise is cut.

Don't forget to use the bypass switch often to make comparisons.

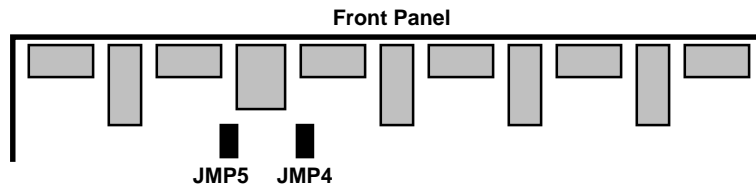
Be sure to adjust the balance control so the sound appears to be equally loud in each ear.

If you use a hearing aid, try removing them and use the *Speech Intelligibility Enhancer*™ with headphones. Also try speakers.

For best results, use a pair of high quality bookshelf speakers designed for high-end stereo systems.

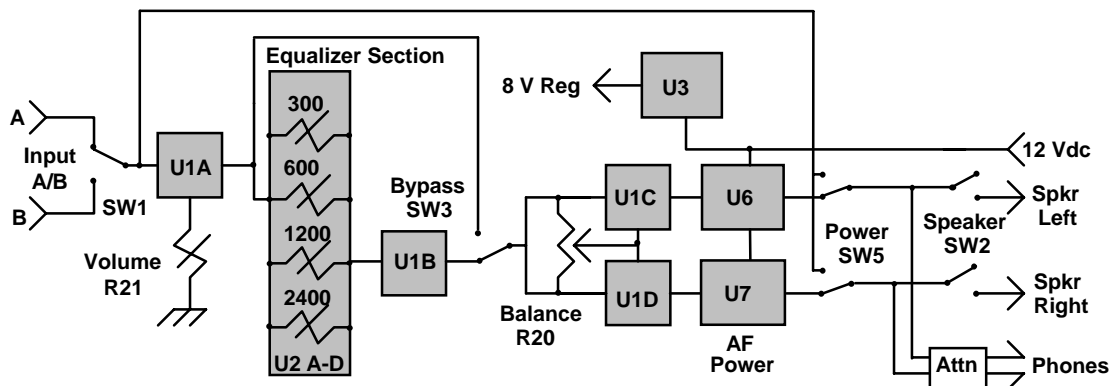
INTERNAL SETTINGS

The *Speech Intelligibility Enhancer*™ headphone circuit is normally attenuated to protect you against hearing injury due to an accidental high volume setting. If the sensitivity of your phones is unusually low, you may bypass the attenuators by removing the cabinet cover and installing shorting plugs on JMP4 and JMP5. JMP4 and JMP5 are located on the main PC board directly behind the headphone jack (see below).



*Note that these jumpers are not pre-installed at the factory, and most headphones do not require installation. **Install them only as needed!***

THEORY OF OPERATION



Transceiver sources are fed to inputs A and B at line level. SW1 (*Input A/B*) selects a source and routes it through *Volume* control R21 to pre-amp U1B. Following U1B, active filters U2A-U2D provide four octaves of adjustable audio conditioning at the input of summing amplifier U1A. Alternatively, audio is routed around speech enhancer circuitry via *Bypass* switch SW3. A bridge-type *Balance* control at R20 splits the AF signal and sets a drive ratio for pre-amplifiers U1C and U1D. Monolithic AF-power amplifiers U6 and U7 then boost the divided signal to speaker level. *Speaker On/Off* switch SW2 provides the option to disconnect speakers for headphone listening. *Power On/Off* is an audio routing switch that bypasses all amplification circuitry when off. DC power remains connected to the unit at all times.

TYPICAL SPECIFICATIONS

Input Sources.....	2, switched
Source Level.....	Line
Input Load	500 Ohms resistive
Frequency Range.....	300, 600, 1200, 2400 Hz center
Overall Response.....	100-5000 Hz
Channels Out.....	2, bridged balance control
Power Output.....	3 watts per channel into 4 Ohms
Power Requirement.....	12-15 Vdc @ 1.5Amp

IN CASE OF DIFFICULTY

- [] **Won't Power Up:** Check power source and power supply connections.
- [] **No Audio on One Channel:** Check associated input and output patch cables.
- [] **No Audio on Both Channels:** Check *Speaker* switch and power connections.
- [] **Noisy Audio, Hum:** Check for low transceiver AF output or open ground line.
- [] **Distorted Audio:** Check for high receiver AF output. Check speaker condition.
- [] **Insufficient Gain:** Check for low receiver AF output, check impedance of source.
- [] **Controls Don't Function:** Check *Power* switch--should be *On*.

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.

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