

Soup-Up the MFJ-932 QRP Loop Tuner
By Phil Salas AD5X

Introduction

I've been using the MFJ-935B 150-watt manual loop tuner for some of my portable QRO operation, and I've been pleased with its performance. However, I also operate QRP portable with my IC-703, and the MFJ-935B is larger than my radio! Since MFJ has now introduced their compact MFJ-932 QRP Loop Tuner, I obtained one for my QRP portable operation. I quickly found that the performance of the MFJ-932 is essentially similar to the MFJ-935B. However, it lacks in ease-of-use when compared to the larger MFJ-935B, in that tuning is much "trickier", and there is no internal metering.

The MFJ-932 QRP Loop Tuner basic information

With dimensions of just 3"x4"x1.5", the MFJ-932 QRP Loop Tuner is the perfect size for portable operation. Since it has a power handling capability of 50 watts, you can easily use it with your higher power portable radios by turning down the power 3 dB. Actually, I have used this loop tuner at the full 100-watt output capability of my IC-706MKIIG, but it is probably not wise to exceed the specified 50 watt limit.

Improving the MFJ-932: Adding an internal SWR indicator

I don't like to rely on my rig's SWR metering when tuning up the MFJ-932, as this requires changing menu settings in my IC-703 (I normally monitor output power). Also, since the MFJ-932 (like most antenna tuners) presents a high SWR to your radio during the tuning process, I used a resistive SWR bridge which limits the SWR to about 2:1 maximum. The SWR circuit shown in Figure 1 is an updated version of my Tenna-Tune resistive SWR bridge (see QST November 2004 Hints & Kinks). This design employs an ultra-bright red LED as both the RF detector and the SWR indicator. Table 1 shows the required components and component sources.

TABLE 1 – Resistive SWR Bridge Parts

<u>Qty</u>	<u>Description</u>	<u>Source</u>	<u>Cost</u>
3	50 Ω 15-watt resistor	Mouser 684-MP915-50	\$2.78 ea
1	DPDT Slide Switch	Mouser 629-GF11261110	\$1.08
1	0.01 uf 500V capacitor	Mouser 75-5HKSS10	\$0.26 ea
1	5.6K ¼-watt resistor	AllElectronics 5.6K	10/\$0.50
1	6000mcd red LED	AllElectronics LED-94	\$0.75
1	Heat sink grease	Radio Shack 276-1372	\$1.99
3	#2 screws	Radio Shack 64-3010	\$1.49/pk
3	#2 nuts	Radio Shack 64-3017	\$1.49/pk
1	0.040 thick sheet aluminum	ACE Hardware	
2	#6 x 1" nylon screws	ACE Hardware	
2	#6 x 1" nylon nuts	ACE Hardware	
2	#4 x 5/16" screws	ACE Hardware	
2	#4 nuts/lockwashers	ACE Hardware	

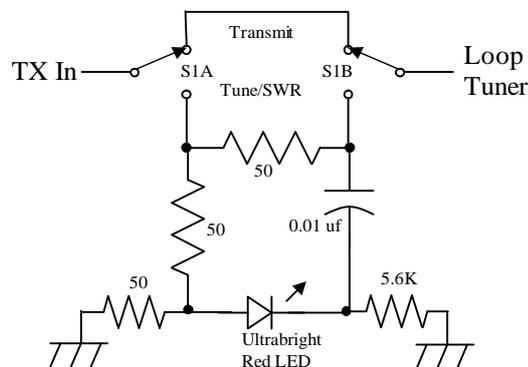


Figure 1 – Resistive SWR Bridge

The photos below show mechanical details of the added resistive SWR bridge. All parts are mounted on a 1"x1.3"x0.040" piece of sheet aluminum. The two 50-ohm series resistors to ground are located on the bottom left of the plate, the LED is mounted in the lower center (protruding through the case), and the input/output series resistor is on the lower right of the plate. The complete assembly is held to the case with the #4 switch mounting screws. Make sure you connect a ground wire between the aluminum plate and the SO-239 connector ground.



Internal SWR bridge mounting



Top view: Switch & LED indicator

Improving the MFJ-932: Adding a vernier drive

Now I began to wonder if I could solve the biggest problem with the MFJ-932: the lack of a vernier drive on the tuning capacitor. Because a small loop antenna system has very high Q, tuning is extremely sharp and so the lack of a vernier makes tuning very touchy. The larger, higher powered MFJ loop tuners do include vernier drives. But the tiny size of the MFJ-932 precludes the ability to include a vernier drive – or does it?

I found a very small 10:1 Jackson Brothers vernier drive on the Surplus Sales of Nebraska website (www.surplussales.com), part number SHW-5870, for \$10. This appeared to be promising, so I ordered one. When the unit arrived, I was very pleased to find that it would fit on the MFJ-932 - with a little bit of work of course!

First, remove the butterfly tuning capacitor. Using a hacksaw, cut the shaft length to ¼” beyond the bushing. Next, cut the shaft length of the vernier drive to 3/8”. Now position the vernier drive on the box with the mounting tabs oriented vertically, and mark positions for the mounting holes. Drill #4 clearance holes for the #4 screws that will be used to mount the vernier. Finally, drill #6 clearance holes, oriented horizontally, positioned 0.4 inches to each side of the center of the hole. I used #6 x 1” long nylon screws through these holes to keep the butterfly capacitor from rotating. The photos below show more details.



Modified shafts



Vernier mounted

Before re-mounting the butterfly capacitor, replace the loop antenna interface wires with braid, as the amount of room for running the antenna interface wires is now much more restricted. The photo below shows details of the capacitor and vernier final mounting.



Capacitor & vernier mounted

You’re not finished yet! You also need a pointer for the vernier drive. I built a pointer by soldering a thin piece of brass to the modified cable-clamp parts of a microphone connector. I cut off part of the shoulder from the main microphone connector housing, and then filed both shoulder pieces as narrow as possible. To solder the brass pointer to the aluminum cable-clamp parts, I used aluminum solder paste and a butane torch from the Solder-It Company (www.solder-it.com). The photos below show more details.



Mic connector & modified parts



Brass pointer soldered to modified part

The photos below show the new front and top of the MFJ932 after all the modifications. All labeling was done using a Casio labeler with “white-on-clear” tape.



New front of MFJ-932



New top of MFJ-932

The addition of the vernier REALLY improves tuning. Originally, only 1/4th turn of the knob would tune the butterfly capacitor over its full range. Now, 3-1/2 turns of the tuning knob are required to tune the butterfly capacitor over its full range!

MFJ-932 Efficiency, Frequency Coverage and Support considerations

Even at IC-703 10-watt output level, up to 10-amperes of RF current can flow in the antenna loop. So attention must be paid to minimize losses in the antenna conductor and the tuning circuit itself, or significant efficiency penalties will occur. Just as in their higher power loop tuners, the MFJ-932 uses only high-Q air variable capacitors for tuning and matching. A good discussion of loop tuners, losses and trade-offs can be found on the MFJ website (www.mfjenterprises.com) in their Antenna Talk article #6.

The MFJ-932 can achieve about a 2-to-1 frequency range due to its tuning capacitor range. Exact frequency coverage depends on each individual installation configuration involving choice of loop length, shape of the loop, height above ground level, and operating environment. For portable operation, I use 1/4" flexible copper tubing for the antenna loop. This tubing is inexpensive and can be relatively tightly coiled for transport, and then unrolled for installation. It is also easily shaped into the more efficient circular shape. And a single 10-foot copper loop can cover 20-10 meters, though this violates the “small loop” definition as the length is greater than $\lambda/4$ on 12 and 10 meters. Details on constructing these loops and a support structure can be found in the MFJ Antenna Talk article referenced above.

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Support & coiled 10-ft loop



Unassembled QRP Station



MFJ-932 antenna connections



QRP station in operation

Loop Tuner Use

As pointed out in the MFJ-932 manual, you need to be aware of RF exposure due to the near-field RF power intensity of any small loop antenna system. At QRP levels, though, this is really not as much of a problem. Also, maximum radiation is along the plane of the loop, with sharp nulls perpendicular to the plane of the loop. So sitting where you face the plane of the loop is best for minimal exposure. However, staying a few feet away from the loop during operation is a prudent thing to do.

Before operating, make sure the loop antenna connections are clean and tight. Actual tuning is not difficult, especially now with the vernier drive on the tuning capacitor. I found that I could achieve a 1.5:1 or less SWR with very little effort. If you built-in the resistive SWR bridge, you should be able to tune such that the LED goes completely out.

Conclusion

Small loop antennas can be very effective portable antennas, and the little MFJ-932 Loop Tuner enables you to make a particularly compact and efficient loop antenna system. This article has described some modifications to the MFJ-932 QRP Loop Tuner that overcome some of the deficiencies associated with this compact loop antenna tuner, significantly improving its ease of use.