The NOGA SWR – Wattmeter | The NoGaWaTT

Introduction

The need for a simple SWR/Wattmeter that will go down to 200 mw seems to be great. Experiments with the Stockton bridge have resulted in modifications that will allow QRPp levels on 80 thru 10 meters but with some loss (about 10%) on 160 meters. To get better efficiency on 160 meters the toroid turns can be upped to 12 turns as used in the W1FB model but then you loose the QRPp feature (12 turns on both will work at the 6 watt level)

The NOGA version uses 7 turns on each toroid and the 160 meter loss is in the lower impedance in the 2nd toroid (it will heat). Also omitted were the Faraday shields because at QRP power levels no difference was noted. Of course with two small pieces of RG-174U coax you could add this feature. You will need to use your own cabinet and coax fittings. The PC board is designed to be installed into an Altoids tin and a second tin can be used to house the meters. The two tins can be joined with double sided tape or solder.

We used Silver BNC fittings soldered on one end of the tin on 7/8 inch centers and the board is soldered to the BNC center pins. You can also use phono or TV or whatever fittings you normally use. There are meter scales provided on sticky paper. They are 10 watt max, and SWR. Note that the SWR scale is only meaningful when the power scale reading is full. The meter face is removed by removing the clear tape and be sure to do this in a surgically clean area and be sure to not bend the needle.

Cut the 4 sides just outside the lines so you can trim them exactly before peeling the protective covering off the back. Be sure that nothing is touching the meter needle. Considerable care will be needed to place the labels after the protective covering is removed.

Some History

We have been calling this the Stockton (GM4ZNX from W1FB info and G4ZNQ from Sprat) bridge because he is the one who introduced it to QRPers. However if you were to open your 1996 copy of the ARRL handbook you will see this same "Directional Coupler" (P22.36) that has a US patent in 1969 by Sontheimer and Fredrick. What NOGA is doing is making it fun, cheap and available not to mention Altoids friendly.

Prepare the Altoids tin by installing BNC connectors on one end at 7/8 Inch centers. Some find it easier punching the holes with a sharp awl then enlarging them screwdrivers or any other tool that tapers then to try drilling. Some may also find it convenient to use a 2 circuit stereo 1/8 inch jack to run the meter wiring but others simply punch a hole to run wires to the meter.

Assembly Instructions

This is a surface mount project using wire lead parts. It is very similar to Manhattan style construction. This makes it very easy to change any parts in the event you want to make any changes in the future. First closely examine the PC board to make sure that there are no mystery traces especially along the edges.

Tin all wire leads prior to attaching to the PC board leaving a small droplet of solder on the lead. Tin all pads on the PC board prior to attaching a component and do it as you go along. Then to attach a component simply touch the two together and touch the iron to the junction. Bend about a 1/16 inch foot on each component lead prior to tinning. Each component should be mounted about ¼ inch above the board. Solder the diodes in last to prevent heat damage. For the 0.047uf disc capacitors leave them installed in the cardboard strips but straighten the kinked leads just below the disc. Then tin the same area. Cut them out as you need them at about 3/16 inch lead length and bend the foot.

CONSTRUCTION

Install the components in the following order:

[ ] 1. Prepare the Altoids tin with the coax fittings (BNC are the QRP standard)

[ ] 2. The 4 100 ohm resistors should be wired to the PC board first.

[ ] 3. Next install the 4 .047 disc ceramic capacitors.

[ ] 4. The 25K trimmers are soldered off the edge of the board and check that the board can still be installed into the Altoids tin and that the coax fittings will be able to be soldered to the board

[[5. The chokes are marked with the value or colored bands like: silver, brown, black, red and gold.

[ ] 6. For the two toroids wind 7 turns on each core being sure that both are wound in the same direction (they should both look identical) and remember that one turn means once thru the hole. Start with 7 inches of wire with one inch of wire free. Strip and trim them as you solder them in. These will be the easiest toroids you ever wound because the plastic wire is easily stripped. The primary will be simply one wire passed thru the center of the wound toroid and it will be added after the other winding (7 turns) ends are soldered to the board. Part of the toroid will pass thru the hole in the PC board.

[ ] 7. Diodes may be of glass or ceramic with a single band on one end. The diode bands go to the sides of the PC board. The arrow part of the diode symbol is left off the diode but it points to the + side of the meter (thru the trim pot).

[ ] 8. Prior to installing the completed PC board into the Altoids tin solder one of the resistor leads (a clipped lead from one of the previously installed resistors) to the bottom of the tin at the top middle of the board and another resistor lead to the bottom of the tin at the bottom middle of the board. When you install the board first solder the coax center terminals to the board then the wires bend over the ground plane and are soldered. Two additional resistor leads (from installed resistors) are soldered from the sides of the tin to the board ground plane per the sketch. You may need to prop the board up with foam or something while soldering to the coax fittings then remove after soldering.

[ ] 9. Do not install the meters until the new scales (if desired) are installed. They can be installed in a second Altoids tin (held in with double sided tape) or just stuck on top of the original tin with double sided tape.

[ ] 10. To wire up the meters first jumper both meter (-) terminals.

[ ] 11. Then connect a wire from the meter (-) terminals to the Altoids tin (ground).

[ ] 12. Then a wire from a meter (+) terminal is soldered to a middle trimmer terminal (wiper) and is continued to the end (either) of the same trimmer.

[ ] 13. Now wire the second meter to the second trimmer as above.

[ ] 14. A dummy load is provided in the form of 2 watt resistors. You will find either 4 200 ohm resistors (red, black, brown) or 6 300 ohm resistors (orange, black, brown) in this kit. We are sure that you have already figured that when paralleled either nets 50 ohms for the dummy load. A simple way to parallel them is to take two pieces of tin can cut to 1" X 1¼" and punch 4 or 6 small holes for the resistor leads. Space the tin 1/8" from the resistor bodies prior to soldering. Clip off the excess leads. Measure from tin to tin and you should see 50 ohms then either run a short wire from each to a coax fitting or go to your scrap bin and pull out a piece of coax with a fitting, cut it about 4", strip the end and solder to the tin plates. Some folks drill holes in two pennies and others use a couple of PC scraps. The idea is to leave air space between the resistors for cooling. You will also find this dummy handy for aligning the RX front end too as the tuning will be correct for 50 ohms.

Now that you have your dummy load you can make some tests. Note that one terminal is marked Antenna and the other is marked Transmitter.

There is a reason for this as if they are reversed the indicated SWR may be greater than it really is.

Testing basically starts with a couple of watts into the Transmitter terminal with the dummy connected to the Antenna terminal. One meter will indicate and the other will show little or nothing. Adjust the indicating meter trimmer for max scale. Reverse the T & A terminals and perform the same operation. OK now return the T & A to the proper connections. You are now set up to read SWR.

Calibration for power is made by the use of an accurate watt meter.

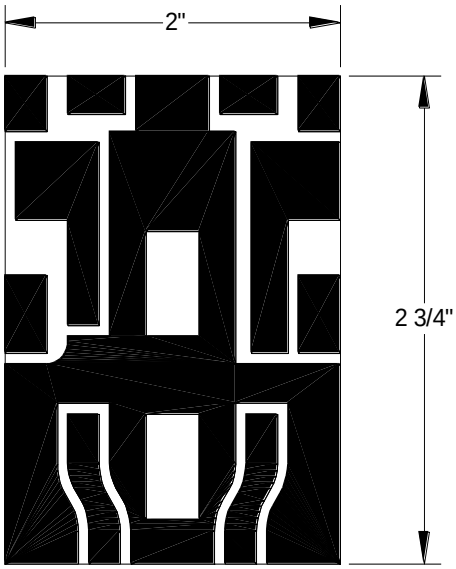
Parts List for the NOGAWATT meter

Quantity	Description
2	200-300 ua meters 2 Stick on meter labels for “FORWARD” and “REVERSE”
1	baggie full of parts
2	diodes either germanium or schotky, glass or ceramic with a single band on one end: both should be of the same type (identical)
4	0.047 uf disc ceramic capacitors marked 472
2	25 K trim pots
2	1 mh molded chokes (silver, brown, black, red, gold)
4	100 ohm resistors, (brown, black, brown)
1	50 ohm dummy load consisting of either:
6	300 ohm resistors (orange, black, brown) OR
4	200 ohm resistors (red, black, brown)
1	etched PC board 2" X 2 3/4"'
2	FT50-43 ferrite torroid cores
1	2 foot length of 24 ga insulated wire
1	shipping box

ERRATA

We have found that some of the circuit boards have a thin piece of foil down one of the long edges that causes a short circuit. Check your boards for this foil and scrape it off before beginning assembly.

4/10/2012



NOGA SWR-WATT METER
6-1-00 W3IRZ