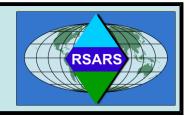
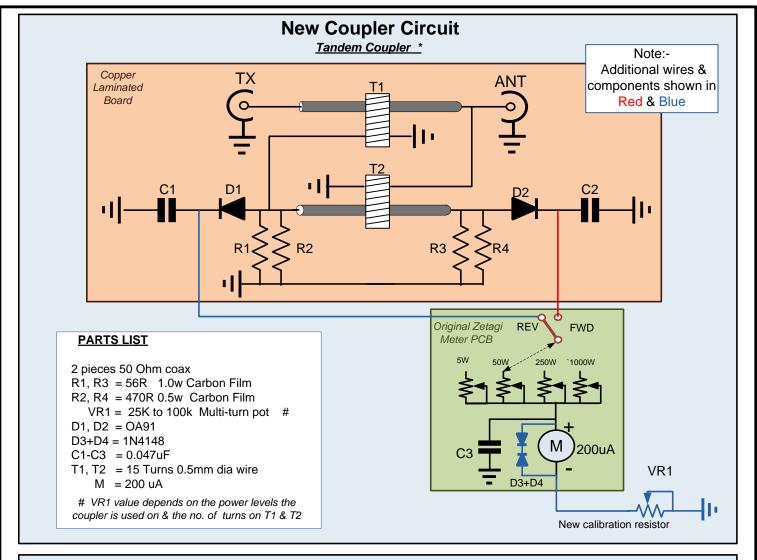
Conversion of ZETAGI HP201 SWR Wattmeter for HF Amateur Bands





Modification for the CB ZETAGI HP201 SWR Wattmeter (0-1000watts)

This modification replaces the original CB SWR sensing circuit with the Tandem Coupler based on the Sontheimer & Fredrick Directional Coupler – 1969 Patent

The meter wiring is left connected to the FWD/REV switch and new forward and reverse voltage feeds are taken from the S&F coupler. The negative of the meter is disconnected from the earth connection and is reconnected via a new variable scaling resistor to earth.

This is because the S&F circuit is more sensitive and produces a greater output than the original CB SWR sensing circuit.

The circuit uses two Murata cores 18mm OD11mm and ID 8 mm thick. These are wound with 15 turns of 0.5mm PVC insulated wire, but enamelled wire can be used if the cores don't have any sharp edges. The cores were supplied by UK Surplus Components Supplier www.surplectronics.com.

N.B. Not all types of toroids work with this circuit. Some provide accurate results at 80m but produce ever increasing errors at 20m and above. The accuracy also depends on the 50ohm line being correctly terminated R1 // R2 and R3//R4 =50ohms if available a single carbon 50Ohm resitor can be used instead.

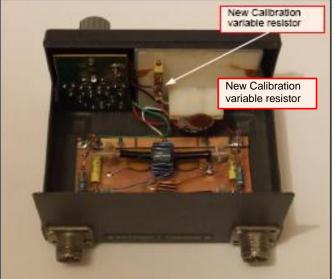
Using the correct iron core toroids and calibrating the meter on 20m, linear results of +/- 2% are obtained between 160-10m even with 5 watts of RF. The modified Zetagi meter unit has been tested with 500 watts from a linear amplifer into a dummy load.

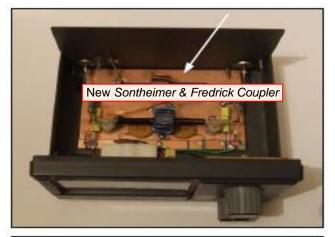
Mario G80DE

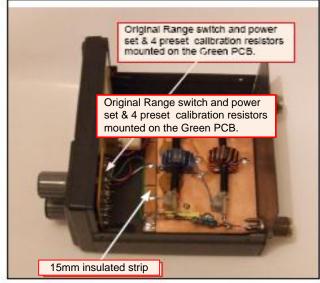
Conversion of ZETAGI HP201 SWR Wattmeter for HF Amateur Bands











Notes

Copper Laminate Board Details.

The coupler is built on single sided glass-fibre copper laminate board that forms the ground plane. A 15mm wide strip of the board is glued on top on the main board to create an insulated strip. The strip is scored with a hacksaw to create three separate copper sections. These are used to solder the two diodes and filter capacitors to and for the 0V connection to the meter.

Additional Scaling Resistor.

The new scaling resistor is a 1.25inch 20 turn variable resistor and is glued to the rear of the meter. To protect the meter movement two back to back 1N4148 diodes were fitted across the meter terminals. These can be seen in the photo underneath the meter's 0.047uF RF decoupling capacitor. During calibration this was used to set the output voltage from the coupler to a level that enabled the four originals calibration resistors to be set approximately mid-range.

Transmission Lines. .

The <u>important and essential</u> part of this circuit are the two short lengths of 50 ohm coax. The coupler circuit's accuracy depends on a correctly terminated 50 ohm line. Four nylon stand off pillars are used support the coaxes above the copper ground plane.

Calibration.

The Zetagi HP201 SWR Wattmeter was recalibrated using an ex-RAF 200w absorption power meter. With the transmitter set to 5 watts, the new scaling resistor was adjusted so that the reading was full scale – this assumed that the original scaling resistor was set correctly. The 50 watt range was similarly checked. The 250 & 1000w ranges were checked using the linear amplifier. The original range switch & 4 scale presets that are mounted on green coloured PCB seen in the photos . The 1000w range could only be calibrated accurately at 200 watts the limit of the RAF power meter. A final check was made for mid scale reading by using a "Vectronics Vector 500" linear amplifier to provide 500 watts for a few moments into a dummy load.

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Conversion of ZETAGI HP201 SWR Wattmeter for HF Amateur Bands



Acknowledgment to Larry Phipps N8LP for his article on this subject

The Theory of Operation of the TANDEM MATCH COUPLER based on a Patent by Sontheimer and Fredrick in 1969

Design Fundamentals:-

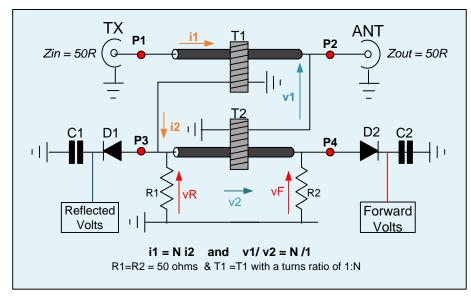
- 1. The Tandem Match Coupler has two transmission lines provided by two equal lengths of 50 Ohm coaxial cable.
- 2. T1 and T2 use toroid cores with a secondary of N turns. The 50 ohm coax forms the one turn primary winding.
- 3. T1 & T2 secondary of windings have a relatively high reactance that prevents excessive loading of the main transmission line.
- 4. T1 is a voltage transformer and T2 acts as a current transformer.

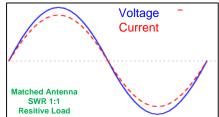
Operation:-

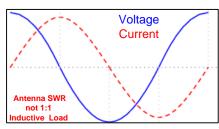
The circuit comprises of 4 ports (P1-P4). The Main transmission has ports P1 & P2, and connects the transmitter to the antenna. The second transmission line is used for measuring and uses ports P3 and P4 that are terminated with 50 ohm non-inductive resistors.

The transformers are used to transfer scaled down samples (N:1) of the voltage & current to the second transmission line. The samples produce a scaled version of the forward and reflected voltages in the main line, and thus enables the VSWR to be measured more readily at much lower power levels.

For a detailed analysis refer to http://michaelgellis.tripod.com/direct.html







As with all good ideas when it comes to saving money some can sort of backfire. Let me explain. Quite some time ago I was at a Radio Rally and saw this "bargain" Zetagi SWR Wattmeter. I thought "meter and ranges look useful and I reckon it will be a simple matter to modify this by gutting the CB circuit and adding my own". A couple of months later I had some spare time and decided to build a new sensing element. I soon realised that there is more to an SWR sensing element than I had bargained for. The word bargain was to haunt me for some while. I tried a variety of circuits published in the RSGB and ARRL, and finally my friend Ian G8OFZ pointed me to this tandem coupler circuit in an article published in RADCOM. But even that did not work correctly with the specified cores. So what you have here is my "bargain" attempt no.14 that finally worked when I discovered the Murata cores that were a "bargain price of £1". That word again! But in reality I had already spent some £30 buying special cores and components for circuits that did not work. I have better clarify that statement. I found that if I got the SWR correct at 80m, the errors got progressively worse above 20m. If I got 10m correct then at 80m the SWR would show 3:1!. Even if I split the difference and calibrated initially at 20m there were huge errors at 80m and 10m. The finally this circuit worked. Can it be replicated – YES -- See my ALTAI SWR METER MOD in the RSARS e-Library

My special thanks go to Ian G8OFZ and Peter G0RGB for supplying me parts for some the earlier circuits, and for the interest and encouragement I received to get this project to work.

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Conversion of ZETAGI HP201 SWR Wattmeter for HF Amateur Bands



Appendix 1 Derivation of the Tandem Coupler

EXTRACT FROM PATENT

Feb. 4, 1969

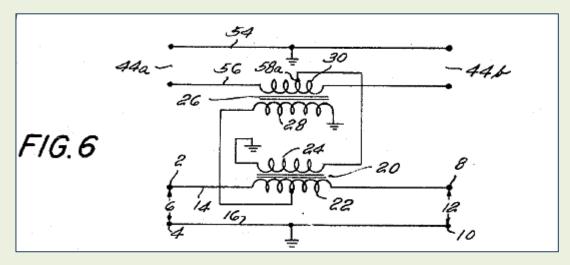
C. G. SONTHEIMER ET AL

3,426,298

BROADBAND DIRECTIONAL COUPLER

Filed April 19, 1966

Sheet _2 of 3



You can view the entire US Patent on this link http://www.g3ynh.info/zdocs/refs/Sontheimer/us3426298.html

THE PRACTICAL SIMPLIFIED CIRCUIT

