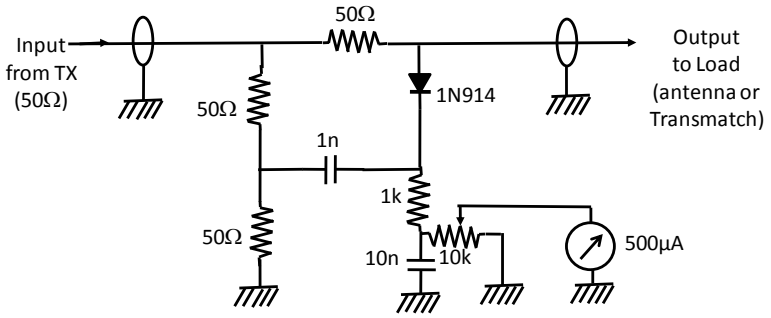
Investigation of the performance of a resistive bridge type QRP SWR indicator using an LED in place of an analogue meter

The basic circuit diagram of a conventional resistive bridge type SWR indicator, as used in ZS6AZP's shack for many years, is shown in figure 1.

Figure 1

Basic circuit of a Conventional resistor SWR Bridge

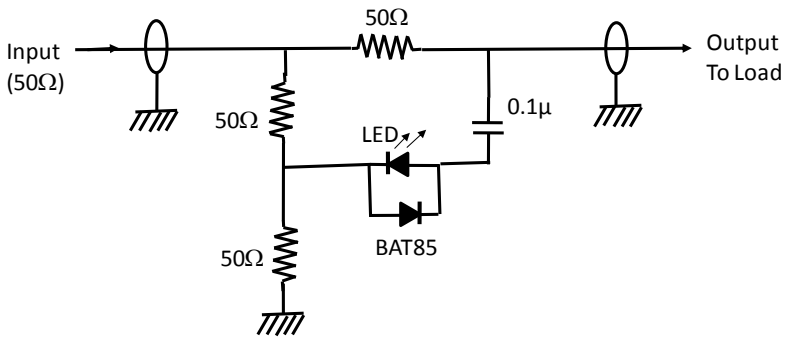


As can be observed, the circuit is just a variation of the Wheatstone Bridge, much loved by your high-school science teacher ("Educator"?). When the load presents an impedance of a pure 50 ohm resistance, ie no reactance present, the bridge is balanced and the meter will indicate zero. This bridge has the very attractive feature that, irrespective of the load presented by the antenna, the SWR seen by the transmitter will never be more than 2:1, a big advantage to the output stage transistor(s)! There is one big disadvantage however in that the bridge cannot be permanently left in circuit as it introduces a 6dB attenuation and must thus be switched completely out of circuit during normal transmission and only used when adjusting your antenna or Transmatch for a 1:1 SWR.

Another perceived disadvantage is in the use of a rather sensitive micro-ampere meter-not an ideal application for field day type use where "drop-tests" can often occur. A solution to this was offered by GM3OXX (Reference 1) who advocated the use of a ultra-bright, white LED as a indicator in place of the meter, ie, –the idea is that the circuit is configured so that an LED, used as an indicator in place of the meter, extinguishes when the bridge is in balance and the SWR 1:1. Figure 2 is the circuit diagram of GM3OXX's design.

Figure 2.

Basic Circuit of an resistor SWR Bridge using an LED indicator



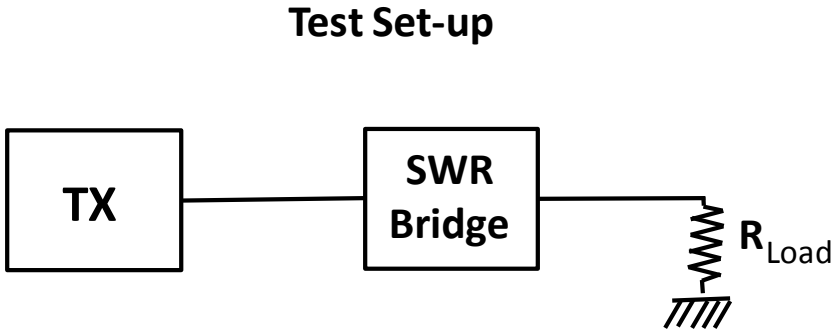
What could be simpler – definitely worth a try. I built my version using parallel 100 ohm, 1 watt resistors for the resistive components, an OA81 germanium diode in place of the BAT85

Schottky diode and a white LED salvaged from a string of LEDs incorporated in a battery operated table/Christmas tree decoration.

I had my doubts about the sensitivity of the LED type indicator as used in this version of SWR bridge for QRP applications, and measured the “switch on” voltage of the LED I used before doing any evaluation of the circuit. The minimum voltage required to cause the LED to just illuminate was 2.65 volts.

I then ran a series of tests with different values of load resistance (producing a range of defined SWRs) using the arrangement shown in Figure 3.

Figure 3.



The results obtained were quite interesting:

With a TX output of 1 watt, the LED totally extinguished at SWRs of less than 1.6:1, while with a 6 watt transmitter output, SWRs lower than 1.3:1 caused the LED to be extinguished. (Using a 1N4148 silicon signal diode in place of the OA81 only resulted in a slight loss in measurement sensitivity)

Basically the conclusion was that this type of circuit is not exactly for the purist who insists on adjusting his/her antenna or Transmatch for an SWR of exactly 1:1 when using QRP output power levels, but as the input power of the transmitter is increased, one can get closer to an indication of the ideal matching condition (providing of course that the resistors used can cope with the load!).

On the plus side, however, there is no doubt however that the LED indicator is considerably more robust than the sensitive micro-ampere meter generally used in this form of SWR bridge.

Reference 1 : “A simple SWR bridge”, GM3OXX, Sprat No. 124, G-QRP Club

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