

The Transmission Line 1..30 MHz (SWR meter)

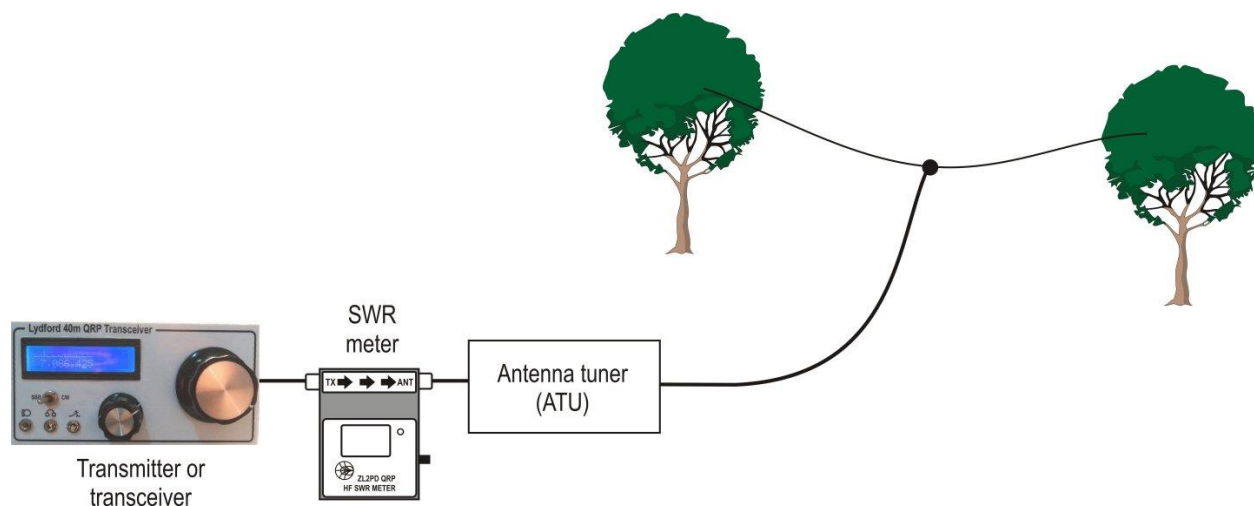
Main features:

- Range: 1-30 MHz
- Max RF power: up to 100W

Introduction

SWR meters measure the impedance match between a transmitter and the output load. If the load differs from the reference impedance then 'standing waves', i.e. peaks and drops in RF voltages, will be present in the transmission line between the transmitter and the antenna. The ratio of the peak to minimum RF voltage is displayed on the SWR meter, referenced to the transmission line's characteristic impedance, usually 50 ohms.

Figure 1 : The SWR meter is located between the transmitter and the antenna tuner



Transmitter-antenna matching is a complex and controversial subject. However, most accept that transmitters operate best when the power output is connected to a load which presents an SWR below 2:1. For example, 100 ohms, 25 ohms, or a reactive load such as $35+j25$ ohms.

In some cases, severe mismatching the output can result in damage to the transmitter output stage. Antenna tuners (one is described elsewhere on my website) are used to match an antenna's impedance, sometimes outside of this notionally safe 2:1 SWR range, to a more suitable value. SWR meters allow antenna matching to be measured, and so are often used to adjust an antenna tuning unit or matching network to the correct setting.

Circuit Description

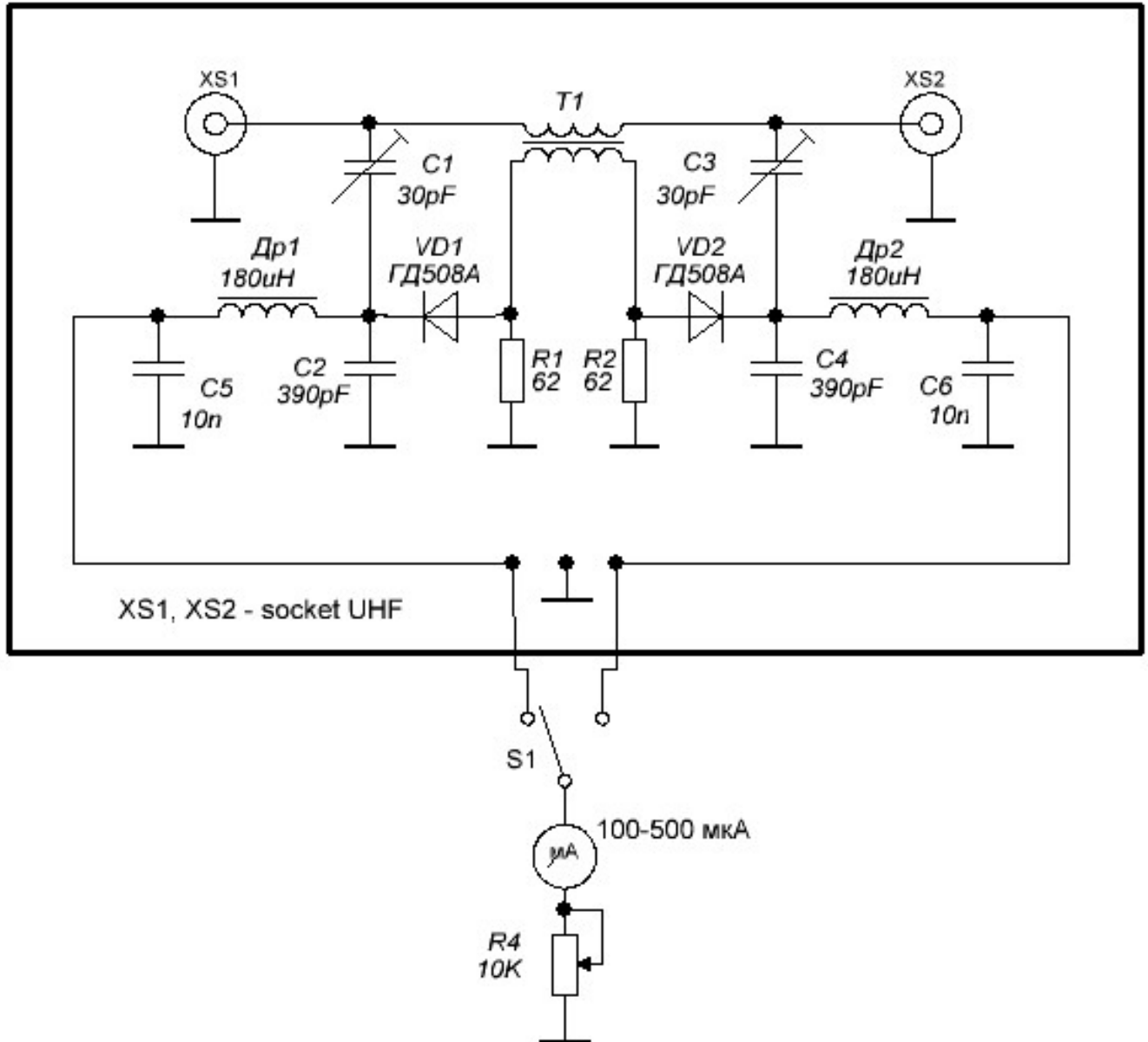
The schematic is shown in Figure 2.

The directional coupler consists of the toroid T1, which samples the current in the transmission line, and capacitors C2 and C3 which sample the voltage on the line. The current sampling transformer produces two anti-phase outputs at each end of R1. Along

with the voltage from the C2/C3 voltage sampling, this arrangement allows 'forward' and 'reverse' power to be detected by the germanium diodes (D1 and D2).

The detected forward and reverse voltages pass to analog indicator or digital converters inside the microprocessor. The firmware in the processor then calculates the resulting SWR.

Schematic Diagram



Construction

Now a few words about the design of the device and applied details. Diodes it is desirable to use germanium as they begin to open at a lower applied voltage compared to silicon. The design uses a current transformer, performed on the RF toroid size 12x6x4,5 or 16x8x6.

The primary winding consists of a segment of the Central conductor of a coaxial cable with insulated threaded through the toroid.

The secondary winding is 30 turns of 0.2mm wire. The ends of the primary winding sealed coaxial connectors XS1 and XS2.

Strengthen the PCB inside the case, which is made of sheet aluminum or brass. On the front wall of the housing is installed a toggle switch S1, a variable resistor Sensitivity, and an indicator μA or digital power meter. Coaxial connectors XS1 and XS2 of the type UHF installed on the Board.

Adjustment

- Connect the resistor 50 or 75 Ohms to XS2. Its value depends on the wave impedance of the used coaxial cable in the feeder of the antenna, and the power from the transmitter power output.
- The transmitter is connected to the connector XS1. Switch S1 is set to the reflected wave.
- Tuning the capacitance of the capacitor C1 changes the division ratio of the capacitive divider C1C2 so that the amplitude of the voltage on the capacitor C2 and the resistor R1 is equal. Since this voltage relative to the diode VD1 counter is enabled, the current through the diode must be equal to zero. If, however, adjusting C1, you cannot set the arrow of the indicator on the zero division of the scale, you should swap the terminals of winding II of the transformer T1. XS1 then connected to the load, and to XS2 transmitter. Change the position of the switch S1 and adjusting C3, the arrow was again set on zero division. At the end of the adjustment should pay attention to match the arrows marked on the panel of the switch S1, the direction of the incident wave. If the switch is set to arrows pointing to the left, the device needs to register the incident wave when the transmitter is connected to the left and load - right. In case you need to restore this correspondence is possible by swapping the wires soldered to the fixed contacts of the switch.

