VECTRONICS
SWR-66 Dip Meter Adapter

INTRODUCTION

Thank you for purchasing the SWR-66 Dip Meter Adapter. The SWR-66 Dip Meter Adapter works with your Vectronics SWR-584 HF/VHF SWR Analyzer.

The SWR-66 Dip Meter Adapter is a kit consisting of 2 coupling coils and a UHF to RCA female adapter. The larger probe coil covers 1.8 through 50 MHz, and offers maximum sensitivity in the 10 to 20 MHz range. The smaller probe coil covers 20 through 175 MHz, and offers maximum sensitivity in the 100 to 150 MHz range.

DIP METER THEORY OF OPERATION

The SWR-66 Dip Meter adapter is very versatile. When properly used, it can make accurate measurements of many different RF circuits. The following description will help you get maximum accuracy and versatility from the SWR-66.

The SWR-66 is designed to adapt a SWR Analyzer to work as a dip meter. Your SWR analyzer contains an internal bandswitched oscillator circuit. The oscillator is buffered to increase the signal level and prevent the load from affecting the oscillators frequency. The high level RF output covers all Ham bands below 170 MHz and is available on the ANTENNA jack.

The SWR Analyzer also contains a meter used to measure the unbalance in an impedance bridge circuit. As the load on the ANTENNA connector approaches 50 ohms resistive, the meter reads a lower amount (toward 1:1).

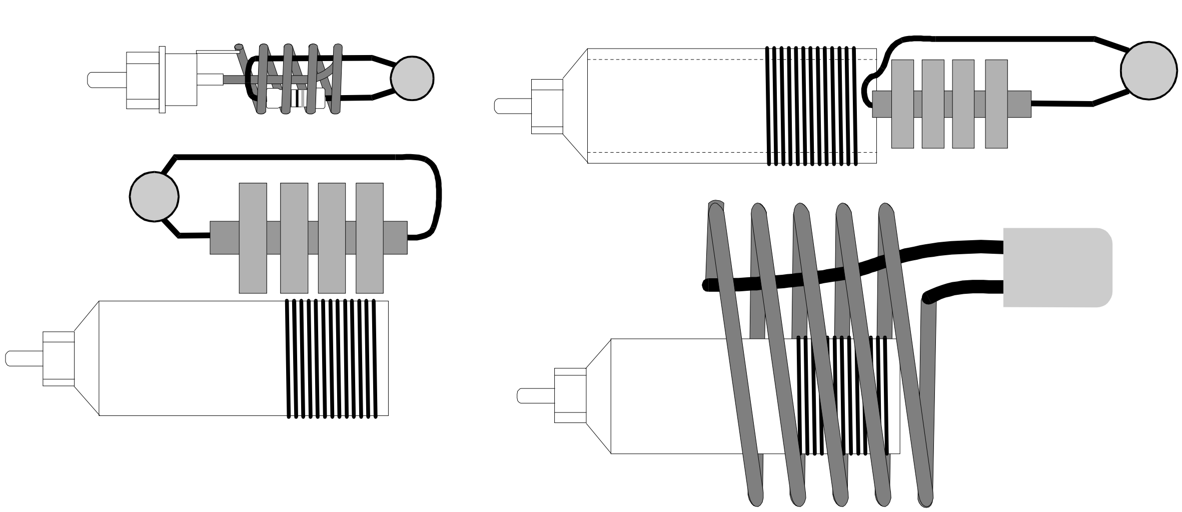
By connecting a small coil through the adapter to the ANTENNA connector, an SWR Analyzer can be used to test external circuits for resonance. The magnetic field surrounding the coupling coil provides the required connection or coupling to the circuit under test. The meter on the SWR Analyzer is then used to measure the amount of RF signal absorbed by the circuit under test. The meter reads lower as resonance is approached.

Any resonant circuit will absorb RF from the coupling coil as long as the circuit is tuned to the same frequency as the oscillator in the SWR Analyzer. As the "Q" of the circuit under test increases, the dip will become sharper and deeper. High "Q" circuits absorb more RF energy in a narrow range of frequencies. If the "Q" of the circuit under test is low or coupling between the coupling coil and the inductor in the circuit under test is inadequate, the dip shown on the meter will be small or perhaps not even visible.

Unlike the tuning coils of a conventional grid dip meter, the SWR-66 coupling coil is ***not*** a part of a resonant tank circuit. This adapter depends on the "Q" of the external circuit to improve the circuit coupling. If the external circuit has a very low "Q", the coupling will have to be increased by placing the inductor of the external circuit very close and in line with the axis of coupling coil.

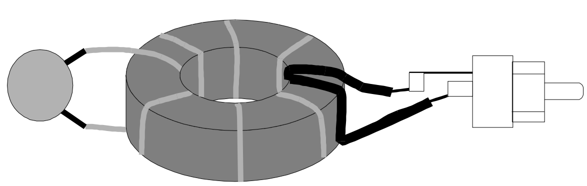
This has the advantage that stray coupling is reduced and frequency pulling of the oscillator is eliminated. Frequency readings can thus be made with more precision.
To insure accurate readings always keep the coupling as loose as possible while still getting a readable dip.

Maximum coupling is obtained when the coupling coil is either placed inside a larger coil under test, placed against a coil of equal size or placed over a coil of small size. When using the smaller coil to couple with a very small coil, such as a molded inductor, the outer plastic sleeve must be removed or cut to allow the molded inductor to be inserted into the small coupling coil. Otherwise coupling may be insufficient to create a dip.



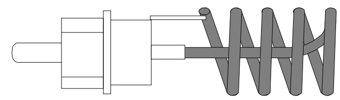
Once a dip is found the coupling coil and the inductor of the circuit under test should be separated until the dip is barely evident. The frequency should be read at this point for maximum accuracy.

The coupling coil can be removed and the coupling coil jack can be used to directly feed a one or two turn link coil on a toroidal inductor. The coupling can be easily varied when testing resonant circuits containing toroids by adding or removing turns from the coupling link. ***Never try to couple with the standard method of using a double link***. The air wound external link acts like a shorted turn on the toroid and lowers the inductance. This "shorted turn affect" will cause inaccurate measurements for many types of toroids.

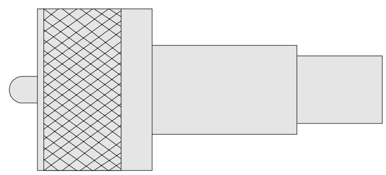


Large Coupling Coil

Small Coupling Coil



VHF to RCA adapter



USING THE SWR-66 DIP METER ADAPTER

Finding the resonant frequency of a tuned circuit.

1. To check the resonant frequency of a tuned circuit, remove all power from the circuit under test.

2. Turn the Band switch to the band you want to test.

3. Place the coupling coil near the circuit to be tuned (see theory of operation). Turn the Tune knob until the needle fluctuates.

4. Slowly turn the Tune knob back and forth very slowly until the needle is at it's minimum deflection.

5. Read the exact frequency from the counter on the SWR-584.

Measure coefficient of coupling of two resonant circuits.

1. Measure the resonant frequency at one coil (refer to the SWR-584 owner's manual) and record it as Fs . This is a measurement of the resonant frequency of both circuits in their coupled state.

2. Make a open in the other tank circuit. Remeasure the resonant frequency and it record as Fo. This is a measurement of the resonant frequency of just one uncoupled tank circuit.

3. Now solve the equation below for the coefficient of coupling, k. The coefficient of coupling is a value between 0 and 100. If two coils are tightly coupled they will have a high k, 100 being perfect. Loosely coupled coils have a low k.

$$k = \sqrt{1 - \frac{Ls}{Lo}}$$

Measure coefficient of coupling of loosely coupled coils.

1. Measure the inductance of one coil (refer to the SWR-584 owner's manual) and record it as L. This is a measurement of the inductance of one inductor coupled to the other coil.

2. Make a short across the other inductor. Remeasure and record the inductance as Ls. This is a measurement of the resonant frequency of just one uncoupled inductor.

3. Now solve the equation below for the coefficient of coupling, k. The coefficient of coupling is a value between 0 and 100. If two coils are tightly coupled they will have a high k, 100 being perfect. Loosely coupled coils have a low k.

$$k = .5\left(1 - \frac{L}{Ls}\right)$$

Measure mutual inductance for two loosely coupled coils.

1. Measure the inductance of both coils in series (refer to the SWR-584 owner's manual). Record this value as L1.

2. Reverse one coil and measure the inductance of both coils in series. Record this value as L2. You have measured the resonance of the coils in and out of phase.

3. Solve this equations with the values you have recorded.

$$M = .5\ k\ L1\ L2$$

Measure the Q of a coil.

To measure the Q of a circuit you must add a detector circuit, see the figure below, and couple it the SWR Analyzer (this may slightly alter the Q of the circuit.) Relative Q can be observed by noting the steepness of the dip as you change frequency. A sharp deep dip at resonance is an indication of high Q. A wide shallow dip at resonance is an indication of a low Q.

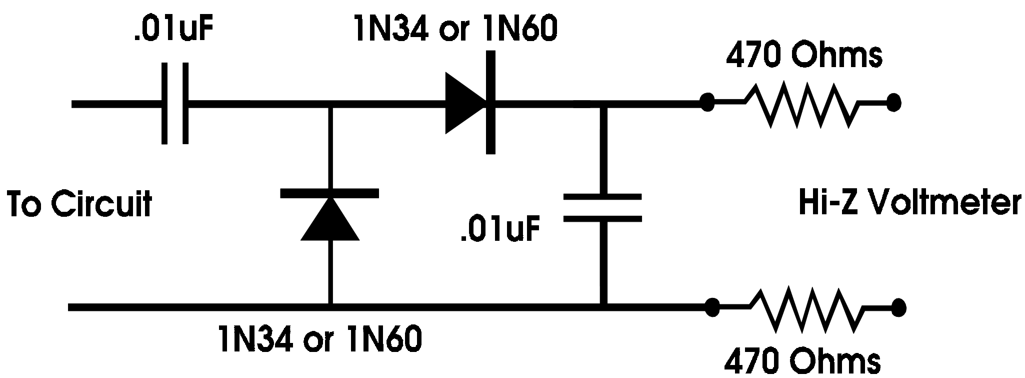
1. Connect a high impedance digital voltmeter across the test circuit in the figure below. Use the lowest range of the voltmeter.

2. Couple the SWR Analyzer to the tank circuit. Adjust the Tune control for a maximum voltage reading on the voltmeter. Do not change the coupling during the rest of the test. Record this frequency as F0.

3. Find a point above and below F1 that the voltage is at 70 % of its max. Record these frequencies as F1 and F2.

4. Divide the positive difference between F1 and F2 by F0 to get Q.

Detection circuit to measure the Q of a coil



TECHNICAL ASSISTANCE

If you have any problem with this unit first check the appropriate section of this manual. If the manual does not reference your problem or your problem is not solved by reading the manual you may call VECTRONICS at 601-323-5800. You will be best helped if you have your unit, manual and all information on your station handy so you can answer any questions the technicians may ask.

You can also send questions by mail to VECTRONICS, 1007 HWY 25 South, Starkville, MS 39759 or by Fax to 601-323-6551. Send a complete description of your problem, an explanation of exactly how you are using your unit, and a complete description of your station.