

MFJ-66 Dip Meter Adapter

Thank you for purchasing the MFJ-66 Dip Meter Adapter. The MFJ-66 Dip Meter Adapter works with your MFJ-209/249/259 SWR Analyzer.

The MFJ-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 MFJ-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 MFJ-66.

The MFJ-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.

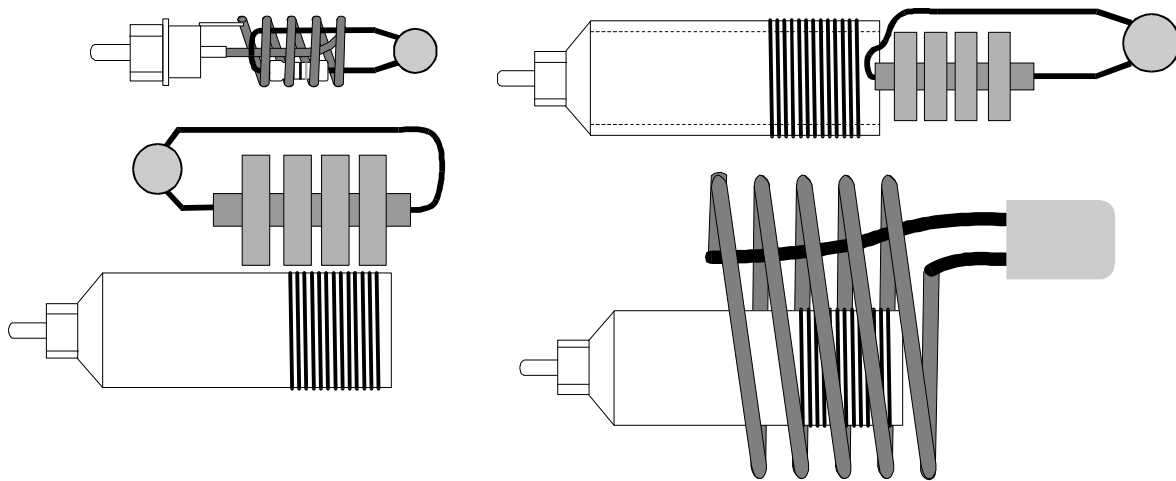
Any resonant circuit will absorb RF from the coupling coil as long as the circuit is tuned to the same frequency as the oscillator in the SWR Analyzer. As the "Q" of the circuit under test increases, the dip will become sharper and deeper. High "Q" circuits absorb more RF energy in a narrow range of 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 MFJ-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.

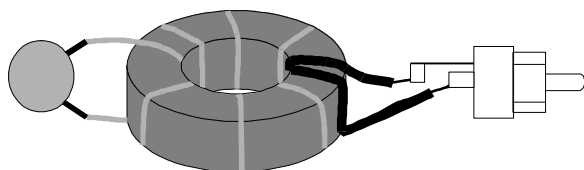
To insure accurate readings always keep the coupling as loose as possible while still getting a readable dip.

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.

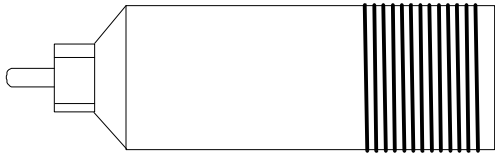


Once a dip is found the coupling coil and the inductor of the circuit under test should be separated until the dip is barely evident. The frequency should be read at this point for maximum accuracy.

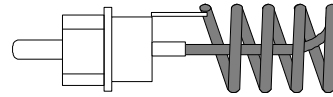
The coupling coil can be removed and the coupling coil jack can be used to directly feed a one or two turn link coil on a toroidal inductor. The coupling can be easily varied when testing resonant circuits containing toroids by adding or removing turns from the coupling link. **Never try to couple with 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.



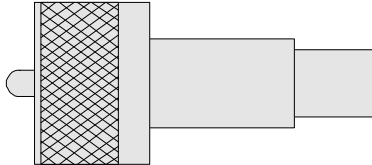
Large Coupling Coil



Small Coupling Coil



VHF to RCA adapter



Using The MFJ-66 Dip Meter Adapter

Caution If you have an MFJ-209 the frequency tolerance of the front panel markings and the accuracy of all measurements can vary up to 20% unless an external frequency measurement device is used to calibrate frequency readings. Refer to your MFJ-209 manual to find how to accurately measure frequency readings. If you have an MFJ-249 or MFJ-259 read the frequency from the counter display.

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 (MFJ-249/259) or read the approximate frequency from the Tune scale (MFJ-209).

Measure coefficient of coupling of two resonant circuits.

1. Measure the resonant frequency at one coil (refer to the MFJ-209/249/259 manual) and record it as F_s . 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 F_o . 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 .

$$k = \sqrt{1 - \frac{L_s}{L_o}}$$

Measure coefficient of coupling of loosely coupled coils.

1. Measure the inductance of one coil (refer to the MFJ-209/249/259 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 L_s . 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 .

$$k = .5 \sqrt{\frac{L}{L_s}}$$

Measure mutual inductance for two loosely coupled coils.

1. Measure the inductance of both coils in series (refer to the MFJ-209/249/259 manual). Record this value as L_1 .
2. Reverse one coil and measure the inductance of both coils in series. Record this value as L_2 . You have measured the resonance of the coils in and out of phase.
3. Solve this equations with the values you have recorded.

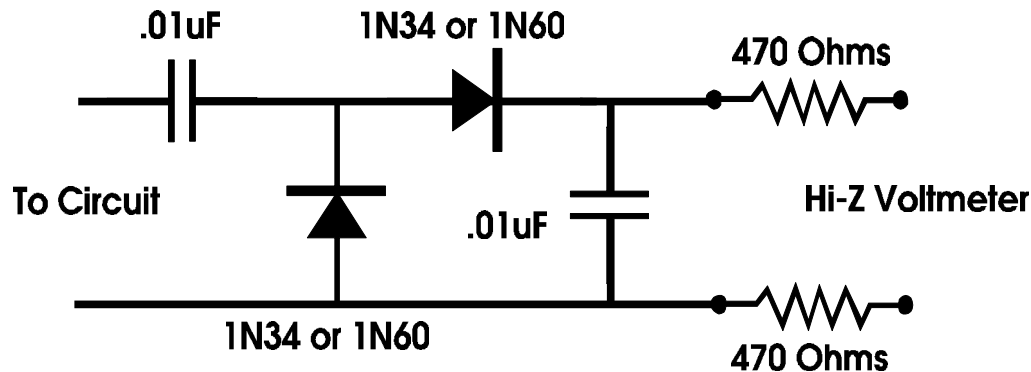
$$M = .5 k L_1 L_2$$

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 Analyser (this may slightly alter the Q of the circuit.) Relative Q can be observed by noting the stepness 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



FULL 12 MONTH WARRANTY

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1. The purchaser must retain the dated proof-of-purchase (bill of sale, canceled check, credit card or money order receipt, etc.) describing the product to establish the validity of the warranty claim and submit the original of machine reproduction or such proof of purchase to MFJ Enterprises, Inc. at the time of warranty service. MFJ Enterprises, Inc. shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, or forgery shall be cause to void any and all warranty terms immediately.
2. MFJ Enterprises, Inc. agrees to repair or replace at MFJ's option without charge to the original owner any defective product provided the product is returned postage prepaid to MFJ Enterprises, Inc. with a personal check, cashiers check, or money order for **\$7.00** covering postage and handling.
3. MFJ Enterprises, Inc. will supply replacement charges free of charge for any MFJ product under warranty upon request. A dated proof of purchase and a **\$5.00** personal check, cashiers check, or money order must be provided to cover postage and handling.
4. This warranty is **NOT** void for owners who attempt to repair defective units. Technical consultation is available by calling (601) 323-5869.
5. This warranty does not apply to kits sold by or manufactured by MFJ Enterprises, Inc.
6. Wired and tested PC board products are covered by this warranty provided **only the wired and tested PC board product is returned**. Wired and tested PC boards installed in the owner's cabinet or connected to switches, jacks, or cables, etc. sent to MFJ Enterprises, Inc. will be returned at the owner's expense unrepai red.
7. Under no circumstances is MFJ Enterprises, Inc. liable for consequential damages to person or property by the use of any MFJ products.
8. **Out-of-Warranty Service:** MFJ Enterprises, Inc. will repair any out-of-warranty product provided the unit is shipped prepaid. All charges will be shipped COD to the owner.
9. This warranty is given in lieu of any other warranty expressed or implied.
10. MFJ Enterprises, Inc. reserves the right to make changes or improvements in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.
11. All MFJ products to be serviced in-warranty or out-of-warranty should be addressed to **MFJ Enterprises, Inc., 921A Louisville Road, Starkville, Mississippi 39759, USA** and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase.
12. This warranty gives you specific rights, and you may also have other rights which vary from state to state.