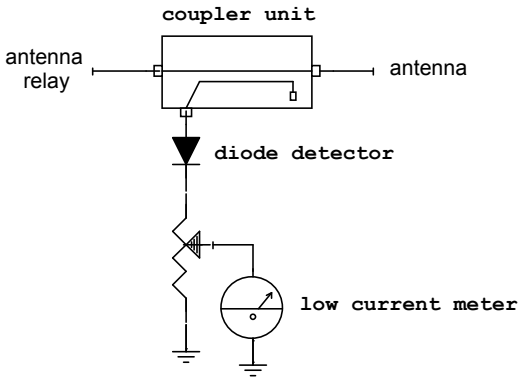
Relative power monitors W3KM

We all need a way to see at a glance that the transmitter is putting out power. Normally the output meter in HF transceivers is adequate. What if you operate on several VHF/UHF bands, or have 10 bands above 30 MHz? The use of many Bird watt meters and laboratory power meters with RF couplers and attenuators would be expensive.

How about using simple relative power monitors. You measure your transmitter with a real power meter, then adjust the relative meter to a full scale reading.

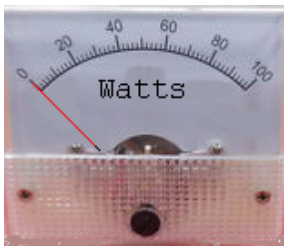
Basically, a relative power monitor is a coupler that samples RF and drives a current meter. Some couplers have internal diodes and produce a small dc voltage. Units without detector diodes require a diode in the meter circuit. A small pot is used to set the meter reading.

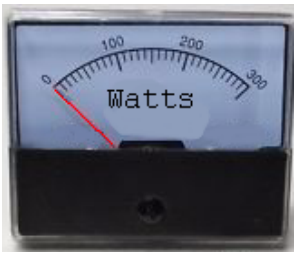


Most meters are 30uA to 1mA full scale and are useable for relative power measurements. The F.S. meter reading depends on the available output voltage from your detector circuit. Set the pots to minimum, then adjust to get the desired reading. Current meters labeled 1-10mA F.S. and volt meters are usually suitable for monitor meters. If you apply mV from a your diode detector to the meter and it doesn't indicate, open it up and see if there are resistors.

Lots of meters are available at flea markets, in club member basements and on eBay. See next page below. Many meters have a scale that is perfect for relative power monitoring. First, use some paint to cover the unwanted text, then add your own text.

If all your relative meter circuits work with a 1mA meter for example, you could connect them to that meter using reed relays selected by your band switching system. Instead of full scale settings, you can set the levels in watts. If all your rigs are 60-100W for example, you will get decent meter deflections on a meter that indicates 100W. My equipment is in the attic, and I use a single meter to monitor my station.





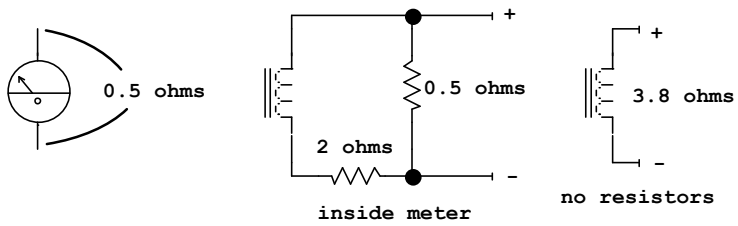
The above were volt meters with 1mA movements and I removed the internal resistors.

A good source of information about meters is at:
http://meterbuilder.com/mb1/evaluating-analog-meters.html

See http://ve6atv.sbszoo.com/dir_coupler/dir_cplr.htm for a homebrew 1.2GHz directional coupler from the ARRL handbook. Nice work and nice photography as well!

Another type of relative monitor can be a DC current meter connected in series with the power supply feeding a solid state amplifier. Note: Many meters marked Amps may not have the required high current shunt built into the meter.

Checking current meters for use as power monitor meters

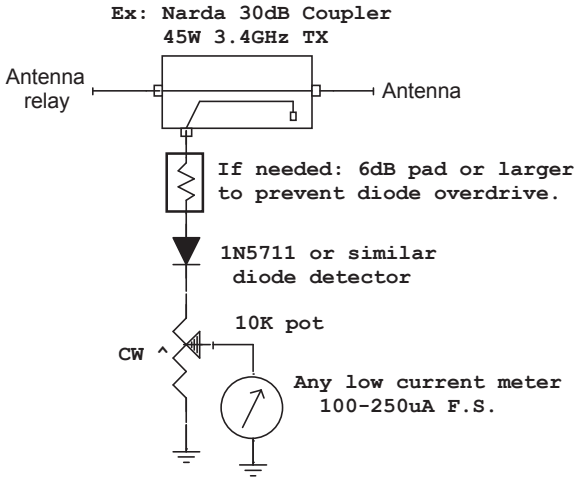


Many newer 100-500 mA meters in plastic housings from eBay (China) are cheap, but are actually configured as indicated for current and not useable for 1mA F.S. monitors. Some meters have the meter resistance marked on the front panel.

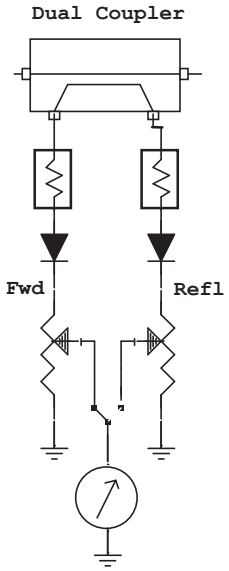
If a low voltage (mV) across the terminals shows no deflection, measuring the meter will probably show a very low reading, 0.5 ohms for example. Opening the meter shows shunt and calibration resistors. If removing them does not increase the resistance significantly, then the meter movement is configured for current, in the range indicated on the meter face.

Use these meters as-is to measure the indicated current. By connecting a shunt of lower resistance (a short piece of copper wire) across the meter terminals, you can easily change the F.S. meter reading by 10X.

Relative power monitor
WA3JUF 1985



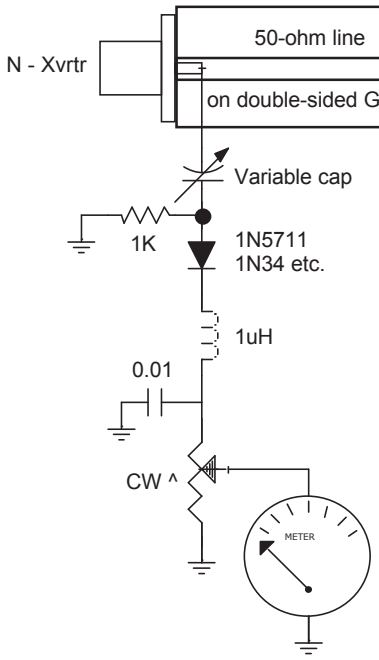
Set the pot CCW, turn on the TX and adjust for full scale reading.



Connect the coupler in reverse and set the Refl reading to F.S. Then connect normally and set Fwd to full scale.

20 Watt Relative Power Monitor

WA3JUF 1982

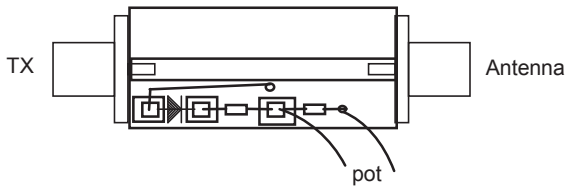


Silver plated N-connectors are soldered to the PCB ground plane. Warming the N-conn with a small torch makes soldering easier.

Pot: 10K 10-turn
Cap: 1-10pf
My example: 20uA F.S. = 20W F.S. Other values are OK. If meter adjust is too sensitive, put a low value resistor across the meter terminals.

Read the power output on a calibrated power meter and adjust the pot and capacitor for desired reading. Keeping the cap at the lowest capacitance value will insure minimum thru insertion loss. Increase the cap value if the pot runs out of range.

Used on my 6M 20W transverter. At higher frequencies and high power levels, try using a sniffer wire placed near the stripline.

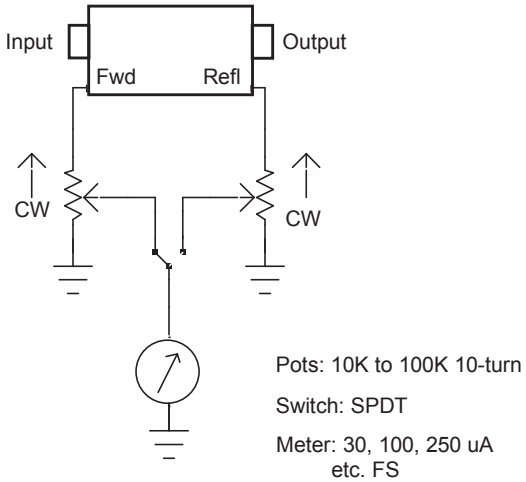


The CB and HF SWR/Field strength meters are good to convert to higher frequency monitors. The Lafayette 99-2537 works on 6M. Above 6M the insertion loss is higher. The connectors, meter and adjustment pot are already there for your use.

Relative Power Monitor

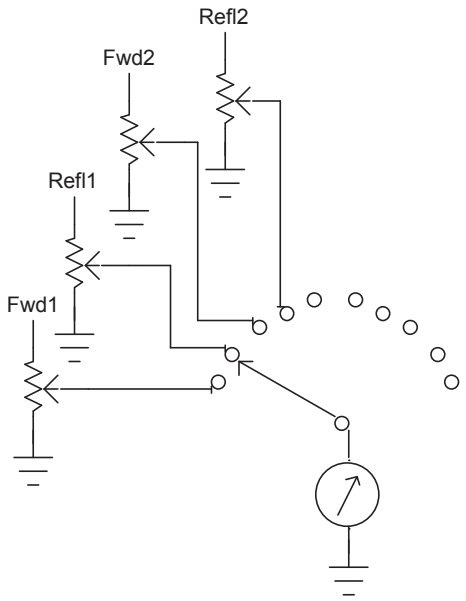
Example: Microwave Devices 263.51 Dual Coupler
WA3JUF 1982

Use any similar surplus coupler unit connected in the feedline of your station to measure the relative power output and reflected power. These units have detector diodes that supply a small voltage. You can initially measure the power output with a calibrated power meter, then use this monitor to free up the meter. The unit is set to read full scale, so you can see the FWD or REFL power while operating.



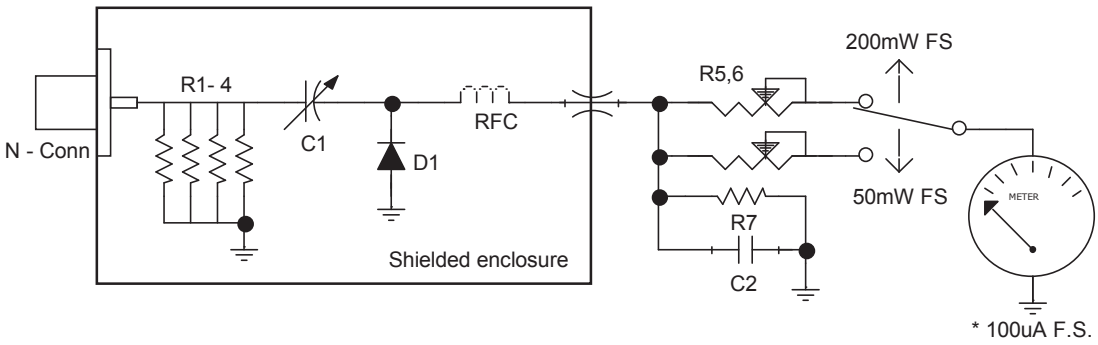
Calibration:
- Set pots fully CCW to start.
- Reflected: Install the sensor in the reverse direction and set to full scale in the Refl switch position.
- Forward: Insert sensor in the normal direction and set to full scale in the Fwd switch position.

Options:
- For multi-band systems, use reed relays (or a multi-pole wafer switch) to select the different couplers and calibration circuits.
- A forward power only measurement is also useful if a dual directional unit is not available.

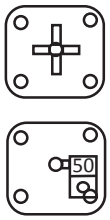


In lue of power monitoring, an analog meter displaying the DC current of a SS amplifier can be a simple and useful indicator. As long as the current reads the same, the TX is putting out power.

Rover Power Meter WA3JUF 1987



Silver plated
N-Conn



R1- 4 220-ohm 1/4W mounted on N-conn
with very short leads
Input RTL @3456-MHz >17dB
or
R1-4 220-ohm 1206 SMT mounted on conn
Input RTL @3456-MHz >20dB
or
Single 50-ohm Microstrip flanged load
Input RTL @3456-MHz >24dB

R5,6 500K-ohm pots
R7 100K-ohm
C1 3.3pf Johanson adjusted for linearity
C2 .01ufd
D1 BAR11, 2N5711, HP2811, etc.
RFC 4t, #28, close spaced

Notes:
* Meter had 2 scales, 50 and 200 FS

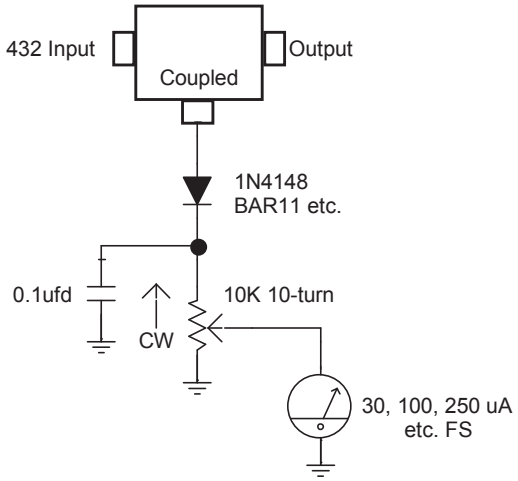
Warming the N-conn with a small torch will make it easier to solder with a pencil iron.

Add a 10dB N-attenuator on the input to measure 2W and 500mW F.S.

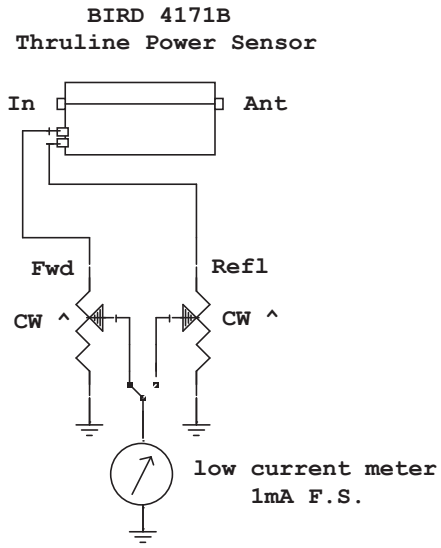
Add a 20dB N-attenuator on the input to measure 20W and 5W F.S.

Unit can be calibrated for one band to 10GHz.

Relative Power Meter
Werlatone C2222 Coupler



903-1296 MHz
Relative power monitor
WA3JUF 1990



Option: Use 2 meters without a switch.

Adjust the FWD pot for full scale. With a properly matched antenna adjust the REFL pot for a low reading just off of zero.

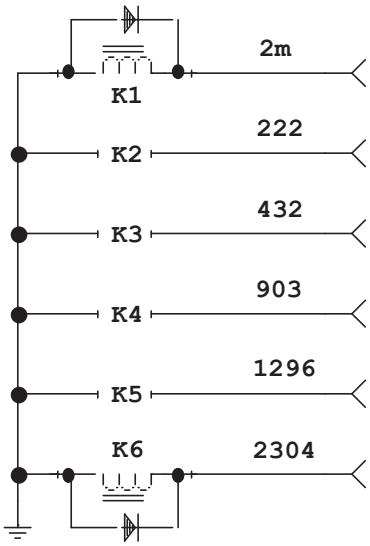
You can quickly see that the Pout and VSWR are the same each time.

If meter circuit is too sensitive or pins the meter, a 1K resistor can be added across the meter terminals.

This Bird coupler has been used at 100W on 903 and 60W on 1296 MHz.

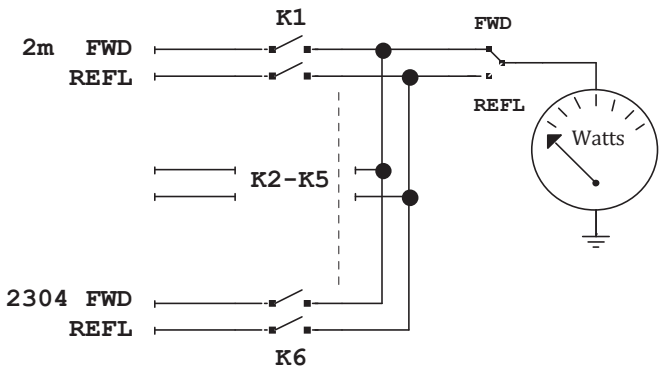
Relative output meter switching
WA3JUF 1986

6m and 3456 had their own relative meter circuits.

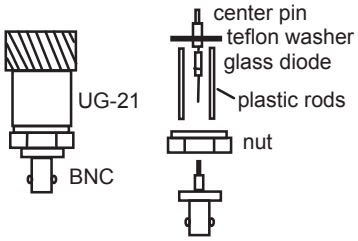


+5V or +12V from each transverter on TX.

K1-K6 DPST reed relay 5V or 12VDC



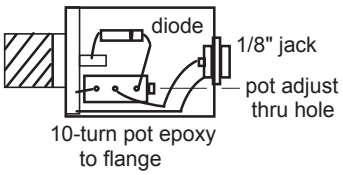
UG-21 detector



Solder the BNC to the UG-21 nut.
Solder diode to the center pins.
Slide the teflon spacer on the center pin.

Epoxy 2 or 3 plastic stiffener pieces
to the center pins and along the diode
to hold the unit from collapsing when you
insert the assembly into the UG-21 body
and tighten the nut.

Meter circuit on N-conn



Use a pill bottle and
epoxy to N-conn