

## HOW TO READ A CROSS NEEDLE SWR METER

Get a basic understanding of how to read a cross needle SWR meter.

By N4UJW

There are many different SWR meters used in the world of ham radio and one of the more modern types in use now are called cross needle SWR meters.

These newer SWR meters, Fig 2 below, are different from the older style, Fig 1 below, in that there are 2 "needles" that give the SWR reading indication when they "cross" each other rather than the older style 1 needle. The 2 different meter types both perform much the same function to get the end result of your SWR reading. So it is your choice as to which one you use in your shack.

The discussion on this page will be based around the newer cross needle type as seen in the picture below. The picture has been enlarged greatly for best viewing in this article.

It is also assumed that you have the meter hooked to your transceiver and to your antenna system and your mode is set to AM or CW.

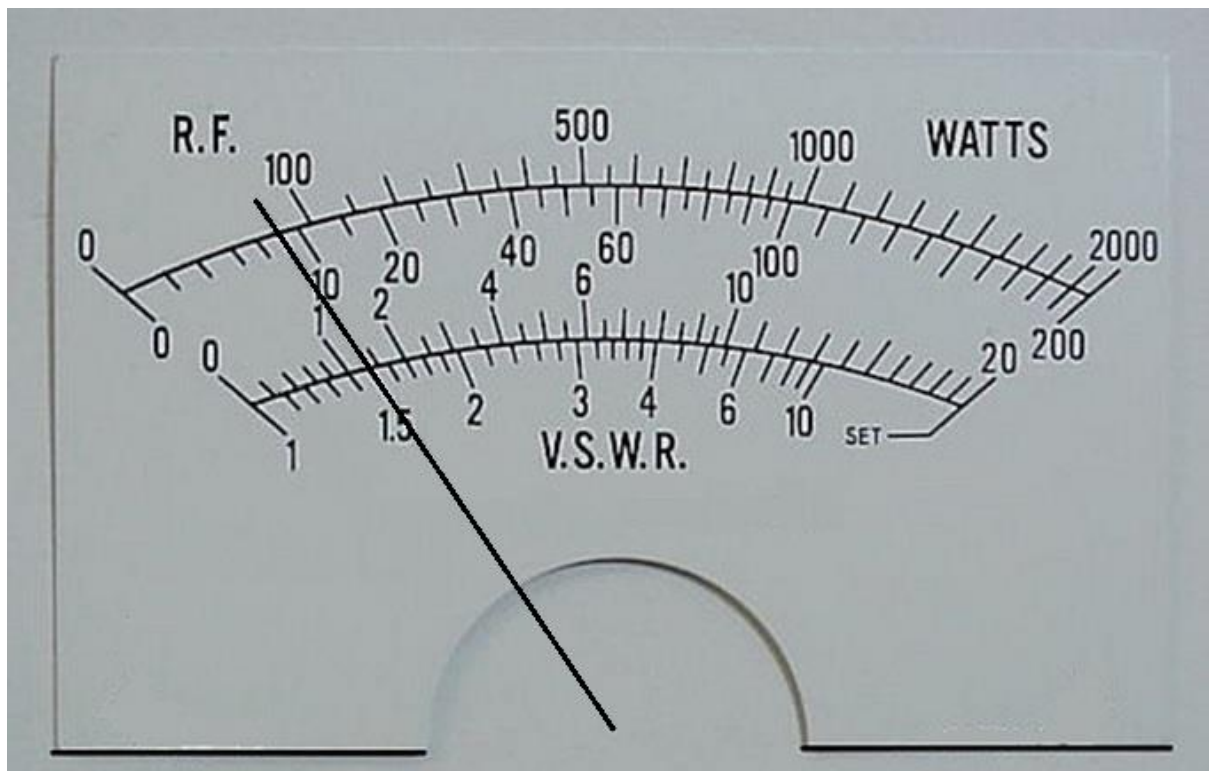
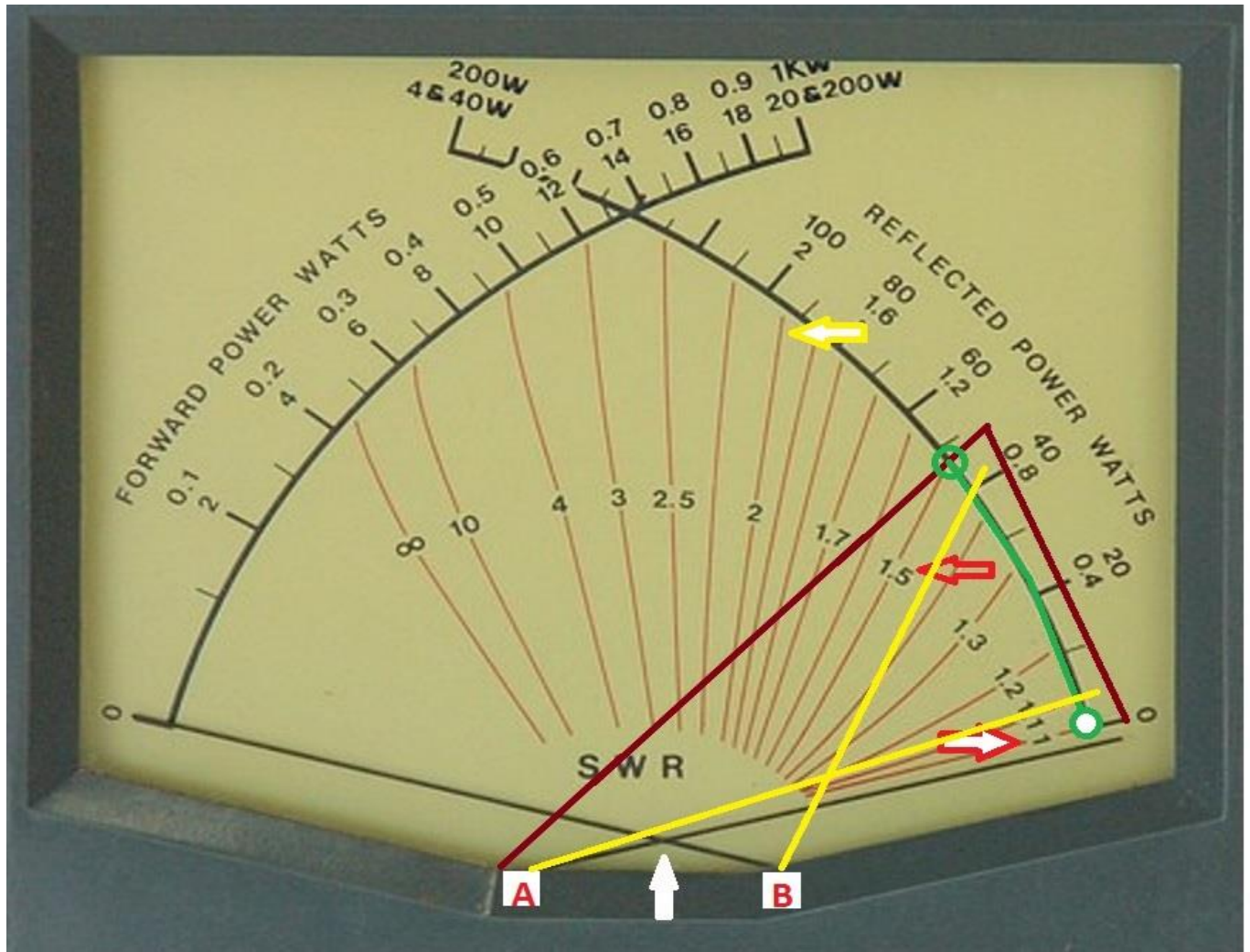


Fig 1. Typical older style single needle SWR meter face enlarged  
The meter above shows about a 1:1.5 SWR.



**Fig 2. Face of a typical new style cross needle SWR meter enlarged.**

**Look closely at it and don't let all of those coloured lines confuse you: they were drawn in for the purpose of explaining how to read the meter face.**

**Reading the SWR is actually very simple when you know how to read it.**

**Refer to Fig 2. for the rest of this article.**

**Now look at the picture above in Fig 2 in approximately the centre of it. You will see some numbers reading from left to right starting with a "lazy 8" (the infinity sign) then 10 to the right of it, and going down to 1:1 to 1. at the bottom right side of the meter face where the red outlined white arrow is pointing.**

Now at that same arrow, you will see a yellow line (drawn in) that "connects" with "A" towards the left bottom of the meter face. This "A" location on the meter is the location of the left meter movement that is out of sight inside the case.

Now imagine that the yellow line (the meter needle) running from "A" towards the red outlined white arrow is the actual meter needle when you are checking your SWR. You will notice that it "points" between the series of (1's) and 1.2 on the meter outer markings scale.

Now let's look at the other yellow "line" (the other needle) running from the letter "B" at the bottom right of the meter face up towards the 1.5 number on the meter face near the red arrow.

Now this is where the "magic" happens on a cross needle SWR meter...

Look **where the yellow "lines" cross each other on the meter face.**

This is the point where you read the SWR! The needles have "crossed" and now you know what your SWR reading is by looking at the markings (lines) directly "behind the crossing point" on the meter face and you can see that the SWR reading is about 1.1:1 to one!

Now look back at the red arrow that is pointing to the 1.5 number for a moment on the meter face.

The 1.5 represents a 1.5 SWR reading "area" and the SWR "numbers" go to 0 in a clockwise fashion from that point on the meter face.

You should see also a green curved line (drawn in) that goes to 0) on the meter face.

This area from 1.5 to 0 is where you want to "see" your SWR reading for best results of your match to the antenna system or other component your transceiver is attached to.

Don't worry about getting that "magic" 1.1:1 SWR reading you may have heard about. It is extremely difficult to get an "antenna system" down to a perfect 50 ohm load.

Anything below about a 2 :1 ratio is fine but lower is a tiny bit better.

At about 2:1 SWR, most modern transceivers start cutting back rf power to help protect it from damage.

For the purposes of this short article, disregard the other markings on the meter and **make absolutely certain you read the instruction manual that came with your SWR meter.**

Don't use the "if all else fails, read the instructions" method that many experienced hams use.

When choosing an SWR meter for your station, don't go overboard. Choose the brand, type and model number that fits your needs and operating parameters.

Have fun! 73 Don, N4UJW

**Tip:**

**Question....How do you know if your SWR meter is accurate?**

Use a known good 50 ohm dummy load instead of any external device connected to it.

**Use caution ....make sure your SWR meter is set for an appropriate power level that you will be using if that is an option. Use only enough power to get a reading.**

Connect the dummy load to the "ant" (antenna) connector of the meter. Connect the meter to the output of the transmitter connector and set to the power level you are using, then using AM or CW, key the transmitter and measure at your desired frequency (as long as the SWR meter and the dummy load is designed for it).

If you get a "perfect" 1:1 SWR reading on your meter, it is calibrated perfectly. Check the SWR across several different bands and frequencies. If the SWR is still very low, then all is fine.

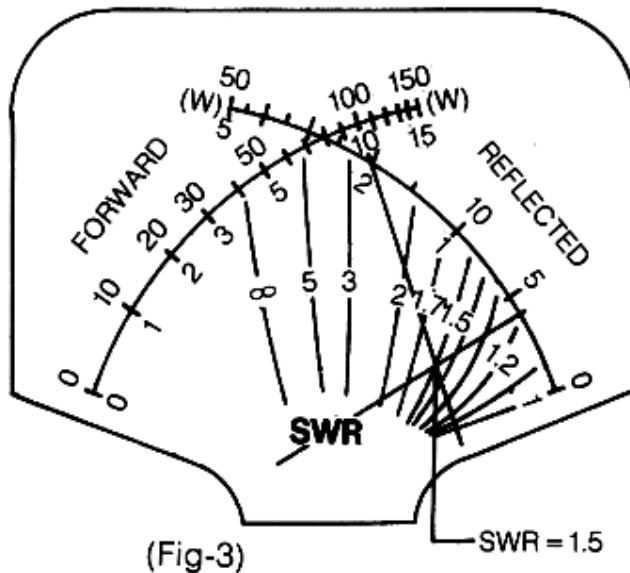
**If there are wide variations in SWR readings on different ham bands, this could indicate trouble with the transceiver, the dummy load or the SWR meter. Check all of your connectors also. Have fun with your cross needle SWR meter!**

**Source:**

**<http://www.hamuniverse.com/readcrossneedleSWRmeter.html>**

## On the Mathematical Front ....

### Verifying SWR measurement with mathematics.



Mathematical verification:

$$SWR = \frac{\sqrt{P_f} + \sqrt{P_r}}{\sqrt{P_f} - \sqrt{P_r}}$$

$$SWR = \frac{\sqrt{100} + \sqrt{4}}{\sqrt{100} - \sqrt{4}} = \frac{10 + 2}{10 - 2} = \frac{12}{8} = 1.5$$

Pf: Forward Power  
Pr: Reflected Power

Source: <https://www.qsl.net/wb4kdi/Daiwa/>