

XCOM SWR Meter



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XCOM Avionics SWR & Power Meter Operating Instructions

The XCOM Voltage Standing Wave Ratio (VSWR or SWR) and Power meter is a piece of equipment which is used to measure the quality and match between the antenna and transmission line and the transmitter. The XCOM SWR and Power meter can also be used to measure the forward power (power from the transmitter), reflected power (from the antenna and line), and peak envelope power (PEP) of your radio installation.

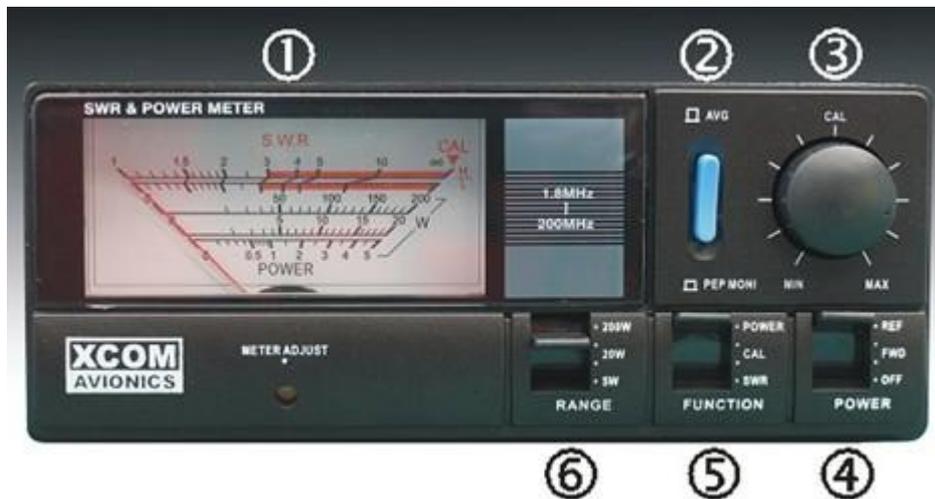
These instructions are specifically directed toward the VHF aircraft band of 118 MHz through to 136 MHz although they can generally be applied to the entire frequency range capability of the equipment. The XCOM SWR meter has the capability to be utilised in the range 1.8 MHz to 200 MHz.

The XCOM SWR meter may be used on transceivers emitting up to 200 W but generally aircraft transceivers operate in the 5 W to 10 W power range.

Matching the antenna to the transceiver and transmission line is crucial. It not only ensures that your system works most efficiently and gives you the maximum range possible, but it also ensures that reflected power does not damage damage your radio. All aircraft radios have a warranty but this does not cover damage to the output amplifier section which can easily be damaged from a poorly matched antenna and transmission line. During installation it is the radio owner's responsibility to ensure that tuning of the antenna and transmission line is performed. Using a SWR meter allows you to check the installation and make any adjustments that are necessary.

There are several controls on the front of the SWR Meter as shown below.

Front View



1. Meter gauge
2. Average or PEP (Peak Envelope Power) switch
3. Calibration knob
4. Power switch. Off, FWD - forward reading and REF - reflected reading
5. Function switch. SWR, CAL - Calibration and Power
6. Transmit Power Range switch. 5W, 20W and 200W

Rear View



1. Power connector. Note the XCOM SWR meter will operate without power; this only supplies a backlight to the front panel meter gauge
2. Antenna connector
3. Transmitter connector

What is a SWR meter ?

When a radio transmits a signal we want that signal to be emitted cleanly from the antenna to provide as much range as possible. Picture a round swimming pool, when a person dives into the centre of the pool waves are created. The waves will cause water to go to the edges of the pool but some waves will also be reflected by the edges and return to the centre of the pool.

When a radio transmits a signal, this same phenomenon is encountered. Some power is radiated by the antenna and some is reflected back to the transmitter. A SWR meter is used to measure this reflection effect of the antenna and transmission line, a high reflection means you are not transmitting efficiently and a high reflection also means you can damage your transmitter.

How to take SWR readings

NOTE: While performing the following steps, do not transmit for long periods as we do not yet know whether the antenna is correctly matched to the radio. Short transmissions are better and are less likely to cause damage to the radio if the antenna is not correctly matched.

It is important to note that when using the SWR meter we are measuring emitted power and comparing this to reflected power. Reflections can be generated from any conductive source so it is important that SWR readings are taken when the aircraft is well away from objects such as hangars, other aircraft, cars, fuel bowsers, etc and that any other metallic objects are kept clear. This includes ensuring that metallic or conductive canopies or other control surfaces near the antenna are closed or in the 'flying' configuration.

Before we do anything we need to connect the XCOM SWR meter into the aircraft system. On the rear of the SWR meter are 2 connectors labelled TRANS (for transceiver) and ANT for Antenna.

Connect the aircraft radio via a short patch lead to the TRANS plug on the rear of the SWR meter. The patch lead should be as short as possible so that we are measuring from as close to the radio as possible. This will ensure maximum accuracy.

Connect the aircraft antenna to the ANT plug on the SWR meter. You may need to use an adapter to convert from the PL-259 socket on the back of the SWR meter to a BNC socket which is used on most aircraft installations.

Locate the function switch ⑤ and the calibration control knob ③ on the front of the SWR meter. Also locate the **CAL ▼** mark on the meter scale ①. Set the function switch to CAL and the calibration knob to a low setting.

Set the aircraft radio to a central frequency within the operating band. For the aircraft band of 118.000 MHz to 136.000 MHz, the central frequency is 127.000 MHz.

While transmitting on the radio, adjust the calibration knob ③ to set the needle ① on the red **CAL ▼** mark on the meter scale.



Switch the function switch ⑤ to SWR and note the reading on the top scale of the meter ①.



NOTE: If the needle ① shows in the red portion of the scale - STOP transmitting immediately. There is a problem with the connections, cables or antenna matching and this could cause damage to the radio.

Repeat the entire procedure above for frequencies of 118.000 MHz and 136.000 MHz, remembering to calibrate the meter for each frequency. Note down the SWR readings.

Frequency (MHz)	SWR Reading
118.000	
127.000	
136.975	

A reading of below 1.5 is ideal, a reading of under 2 is ok, but a reading in the red part of the SWR meter scale (above 3) means that the SWR is high enough to damage the aircraft radio.

Tuning your antenna

If you're SWR readings are LOWER on frequency 118.000 than they are on 136.975 then your aerial needs to be shortened.

If you're SWR readings are LOWER on frequency 136.975 than they are on 118.000 then your aerial needs to be lengthened.

NOTE: *When tuning your antenna make very small adjustments. It is easy to over adjust and this may result in requiring a replacement antenna.*

How to check the transmitter power output

The XCOM SWR and Power meter allows you to measure the power being emitted from the transmitter (PEP), the power being transmitted by the antenna (FWD) and the power being reflected by the antenna (REF). The following procedure measures the overall power emitted from the transmitter.

NOTE: *The accuracy of the XCOM SWR and Power meter is $\pm 10\%$. Power readings may vary with modulation settings and with losses in cables and connections. Power readings in a field test such as this are indicative only and may not accurately indicate the actual power being emitted from the radio.*

Connect the aircraft radio via a short patch lead to the TRANS plug on the rear of the SWR meter. The patch lead should be as short as possible to minimise losses in the cable. This will ensure maximum accuracy.

Fit the supplied 50 ohm dummy load to the ANT socket on the back of the SWR meter.



Locate the AVG/PEP switch ②, range switch ③, function switch ④ and the power switch ⑤ on the front of the SWR meter.

Set the range switch ③ to PEP (depressed).

Set the range switch ③ to one setting higher than the rated radio output power. For example, if your transmitter is rated at 5W, then set the range switch to 20W. If your transmitter is rated to 2W, then set the range switch to 5W. If in doubt, set a higher range, test the power output and then adjust if necessary. This will avoid damaging the SWR meter.

Select POWER on the function switch ④ and FWD on the power switch ⑤.



Transmit on the radio and note the reading on the appropriate power scale.

The needle will swing up to display the power output (carrier wave) that the aircraft radio is transmitting, if you speak into the headset microphone the needle will move showing the varying out power due to your voice modulation.