



Power and SWR Meter Instruction Manual



Connecting the Power + SWR Meter

DC Power connection

The power lead supplied with the meter mates with the black DC jack on the rear panel of the meter. The other end of the cable ends in tinned wires marked red and black. These need to be connected to the station 12 Volt supply, or indeed any DC power supply in the range 6 to 16 Volts. Some transceivers have a switched 12 Volt outlet for accessories. This would also be a good place to connect the meter supply. The red wire must go to the positive and the black to negative. If a mistake is made, an internal series diode will prevent damage to the meter. Note the negative supply is grounded in the meter.

RF connections

The SO239 co-ax socket marked "RF IN" should be connected to your transceiver or linear amplifier. This is the input to the meter. The other SO239 socket marked "RF OUT" is the output of the meter and should be connected to your antenna matching unit, which in turn is connected to the antenna. If there is no matching unit, connect the antenna directly to the "RF OUT" SO239 socket.



Operating the Power + SWR Meter

As soon as power is applied to the meter, it will be in the “on” state and the display screen will be as below:

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Power    0.00 Watts
SWR      _._ : 1
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The top line of the display gives the true output power in watts being supplied to the antenna. This is a value dependent on both the forward and reverse power flows through the meter. In the extreme incidence of an open circuit or short circuit load, the meter will read 0.00 Watts. This is the true value reaching the load. It does not mean that the transmitter is not producing power. It means that any power being produced is totally reflected back to the transmitter, where it may be doing harm.

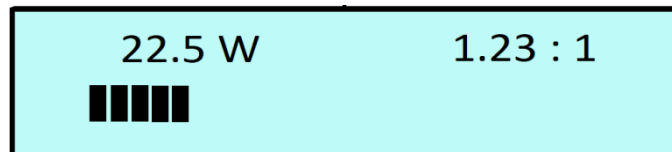
The second line of the display indicates the standing wave ratio. This value is also dependent on the forward and reverse power flows through the meter. When the numbers are replaced with dashes, it means there is insufficient power to calculate the SWR. A perfect match would produce a value of 1.00:1, which would be seldom seen in practice. However a value of less than 1.50:1 is considered satisfactory. The backlight color of the display is normally a light blue and it remains this way while the SWR is in the safe range below 1.50:1. When the SWR rises above 1.50:1 the display starts to turn slightly pink. It becomes pinker as the SWR rises. By the time the SWR reaches 3.00:1 it will be bright red.

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Power  88.6 Watts
SWR    3.24 : 1    20m
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This is a warning that the transmitter may be stressed. Most modern transceivers and linear amplifiers have built-in high SWR protection. For those that do not, the meter provides alarm contacts. To the right of the SWR reading is an indication of the band in use.

Using the meter to adjust an antenna matching unit

The normal display screen could be used to adjust a matching unit while observing the SWR reading. However this display is rather slow to respond, so a special tuning screen is provided. To toggle between the normal screen and the tuning screen, briefly push the button located on the front panel to the right of the display. An example of the tuning screen is shown below.



Power and SWR can still be read on the upper line, but the second line is a bar graph representing the SWR. The matching unit should be adjusted to shrink the bar towards the left hand side of the display. At a perfect 1.00:1 the bar will completely disappear. When the best match has been found, another momentary push of the button will restore the normal screen. The alarm function is suspended while the tuning screen is in use.

Operating using CW, AM, Data, and SSB

The meter will automatically recognise CW, AM, Data and SSB signals. It will read the carrier level of a tune signal, data signal or CW signal. It will read the PEP power of an SSB signal. It will read the carrier power of an AM signal when unmodulated and the PEP power of a modulated AM signal. When a PEP measurement is being made, an asterisk is inserted after the word "Power" in the first line. The meter makes measurements at the rate of two thousand readings per second. It finds and displays the highest peaks. Do not be surprised if your 100 watt transceiver produces a reading of 120 W PEP or more, especially at the beginning of a transmission when the ALC is adjusting.

Operating with QRP rigs

The meter will read power down to 10 mW. It will start to measure SWR at power levels as low as 50mW. As such, it is ideal to use with the many QRP rigs and kits available.

Operating on MF and LF

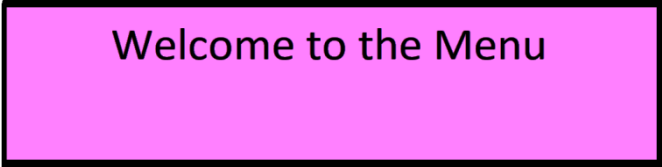
The meter covers the 630m and 2200m bands with accuracy. Note that the power limitation on the 2200m band is reduced to 100 Watts maximum and 500 Watts on 630m. Operating at higher power levels may cause the voltage transformer to overheat. The meter can be safely operated at 2000 watts on the HF bands

Turning the meter off and on

If the meter is powered by your transceiver power supply, it will simply go off when the transceiver goes off and come on again when the transceiver comes on. No power switching of the meter is needed. If however you are powering the meter from a source that is always on, you may wish to switch the meter off and on independently. The meter allows you to do this. To switch off, hold the button until the menu screen appears, then keep the button pressed until the “goodbye” screen appears, then release. To restart the meter, momentarily press the button. Interrupting the power supply will also restart the meter.

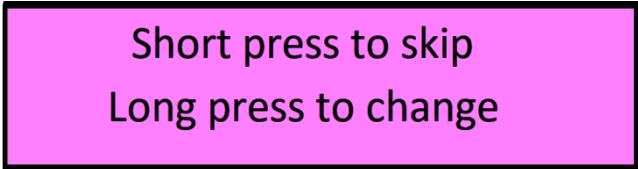
Using the Menu

The menu enables the operator to adjust the brightness of the display and to set-up the alarm parameters. To enter the menu, hold the button until the menu screen appears and then release immediately. Holding the button for longer causes the meter to turn off.



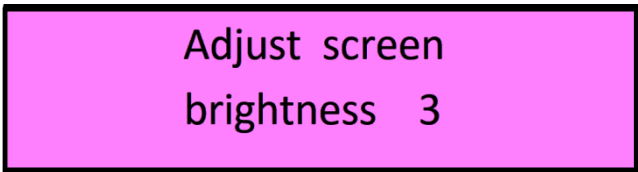
Welcome to the Menu

This is followed by the help screen. It reminds you how the menu works. A quick press will move to the next item. A long press will change the displayed item. Note that the help screen is only shown once in each session.



Short press to skip
Long press to change

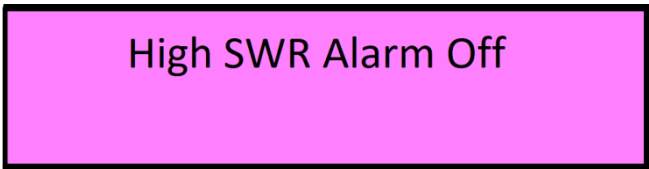
The first menu item allows you to adjust the screen brightness in four stages to suit the ambient lighting in your shack. Brightness 1 is quite dim, rising to brightness 4, the brightest.



Adjust screen
brightness 3

The high SWR warning and alarm screens are at full brightness and independent of the brightness setting. When the brightness number is at the desired level, a short press will skip to the next item.

The second menu item turns on or off the high SWR alarm. When the meter leaves the factory, the alarm is turned off. If the alarm is not to be used, there are no further menu items and a short press will leave the menu.



High SWR Alarm Off

Setting up the high SWR alarm

The high SWR alarm provides an alarm contact which could be used to turn off a transmitter or linear amplifier in the event of a high SWR. The contact is available at the two pin green socket on the rear of the meter. A mating plug is supplied with the meter. The contact can handle a maximum of 50 Volts and up to 500mA of current. The contact is optically isolated from the rest of the circuit and is not polarity conscious.

Alarm contact is
normally open

This menu item allows the user to select the contact to be either normally open or normally closed. A simple method of connection would be to put the contact in series with the key line to the transmitter and set the contact to be normally closed.

Auto reset is Off

This item decides whether the alarm will be manually reset or auto reset. In manual reset, when the SWR alarm threshold is exceeded the relay changes state. This will normally cause the transmitter to be cut off, depending on the external wiring to the alarm contact. The relay will remain in this condition until the button is pressed. If auto reset is selected, the meter resets the alarm after 3 minutes and again after 6 minutes. If the fault has cleared the transmitter will operate normally. If the fault persists the alarm is locked on until manually reset.

Threshold level is
2.00 : 1

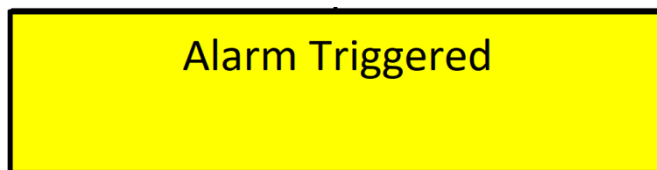
The final item in the alarm setting menu is the SWR alarm threshold value. There are four choices. 1.50:1, 1.70:1, 2.00:1 and 3.00:1. Long presses of the button will cycle through these options. When the desired value is displayed, a short press of the button will exit the menu.

The final menu display will indicate if any changes have been made. Changes are stored in non-volatile memory. If no changes were made, the second line is omitted.

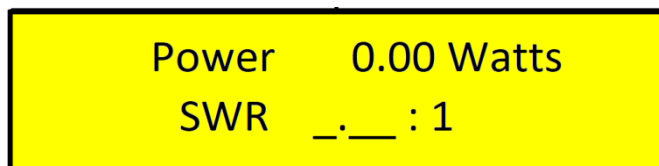
Leaving the Menu
Saving changes

Operating the meter with the Alarm activated.

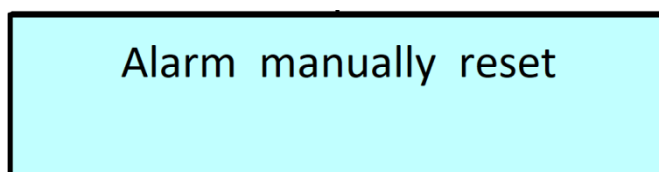
When the SWR rises above the alarm threshold, the alarm relay is operated. The contact will close if “normally open” operation has been selected. It will open if “normally closed” operation has been selected. This screen is displayed briefly.



The display then reverts to the normal measurement screen, but the yellow color persists.



In the above example, the alarm contacts have been wired to cut off the transmitter. Zero power is correctly indicated and if manual reset has been selected, it will remain in this condition until reset by pressing the button.



If the high SWR condition remains, the alarm will be immediately re-triggered. To investigate the cause of the high SWR, it will be necessary to reduce transmitter power and turn off the alarm through the meter menu.

If auto-reset has been selected, the meter will apply transmitter power to the load after approximately three minutes. If the fault condition still exists, the alarm will be re-triggered and the transmitter turned off. The meter will try again in a further 3 minutes. If both retries are failures, the alarm is locked on until manually reset by pressing the button. If the fault condition has cleared, the transmitter will continue normal operation and the screen color will revert to normal.

Additional notes

If the screen becomes blue, it means the power rating of the meter is being exceeded. Reduce power immediately to prevent damage to the meter.

If the screen flashes red during receive, it means the antenna is picking up strong signals. This normally only occurs with very large and high antennas and when a thunderstorm is near-by. The meter detects the lightning. Shut down the station and earth the antennas.

Some unexpected high SWR readings may occur when large RF currents are passing along the braid of the co-ax cables, depending on where the cables are earthed. This doesn't occur when the antenna is fed via a balun. It is also possible for DC currents to flow through the meter if there is, for example, a poor negative supply connection to the transmitter. These currents may upset the bridge balance especially if the centre conductor of the co-ax is involved.

Specifications

Power ranges:

0.00 to 19.99 Watts, resolution 0.01 Watt

20.0 to 999.9 Watts, resolution 0.1 Watt

1000 to 2000 Watts, resolution 1 Watt

The correct power range is auto selected.

SWR range:

1.00 : 1 to 99.9 : 1. Above 99.9 : 1, the meter reads "infinity".

Frequency range:

130 kHz to 30 MHz

Amateur bands, 2200m, 630m, 160, 75m, 60m, 40m, 30m, 20m, 17m, 15m, 12m, 10m.

There are individual calibration factors for every Amateur band, which are auto selected.

Accuracy:

This is a precision instrument with 48 calibration points and each instrument is individually calibrated at the factory. Expect Power measurements to be better than 5% over most of the power and frequency range. SWR readings are calculations based on the same input data and have similar accuracy.

Modulation modes:

CW, SSB, AM, FM, RTTY, Data modes: WSPR, FST4, JT9 etc. SSB is auto detected and PEP measurements are applied where necessary.

Max Power handling:

2000 Watts for the HF bands

500 Watts for 630m

100 Watts for 2200m

Alarm contact:

Solid state, opto-isolated, 50 Volts max, 500mA max, not polarity conscious.

Open resistance > 2 MOhm, closed resistance < 0.01 Ohm

Power Supply: 6 to 16 V DC, at 42mA (typical)

Connectors: Two SO239 panel mount sockets

Size: 105 mm wide, 58 mm high, 140 mm deep.

Weight: 410 gm

Warranty

Monitor Sensors products are covered by a warranty which warrants "that all equipment supplied is free from defects in material and workmanship for a period of **one year** from the date of delivery from the works, providing there is no evidence of abnormal use. The obligation under the warranty is limited to replacing or repairing, at our option, any of the items so determined to be defective. The warranty shall not apply to any item that has been repaired or altered by others or which has been subjected to misuse." Customers should contact our service department before returning goods.

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