

PRECISION SWR·POWER METER

DIAMOND
ANTENNA

Operation Instructions SX-200/SX-400

The SX-200/SX-400 is an insertion type SWR/POWER meter being connected between a transmitter and an antenna. Transmitting power and SWR can be measured with very simple operations.

In addition with those conventional measurement, PEP (peak envelope power) on SSB mode can be measured with a PEP monitor function. With our DIAMOND's wideband and low insertion loss directional coupler those measurements can be performed with minimum effect in transmission line.

Before using the unit

1. Do not intend to open the housing or touch any place inside, since it may invite malfunction of the unit and causes measurement error. Especially directional coupler section is not serviceable without specially prepared measurement tools. Note that warranty will not cover a unit which is modified in any part of the unit by a user.
2. Since the unit displays RF power at input end of the system, if RF power at output end is required, subtract the amount equivalent to the insertion loss from the displayed RF power.
3. When being operated on SSB mode, RF power displayed with PEP MONI function is approximately 70 to 90 percent of peak power at normal talking level. It is because of the time constant in CR circuit, the unit is not able to display 100 percent peak power.

Note on operations

1. Each of the unit has the following band coverage
SX-200: 1.8 - 200MHz
SX-400: 140 - 525MHz
2. Measurable power range of the unit is up to 200W in intermittent mode. If transmitted on FM, CW, RADIO FAX or RTTY mode, do not exceed its continuous maximum power at the following power range. Otherwise pickup unit of the directional coupler section may burn out.

SX-200		
1.8	-	3.5MHz 100W
3.5	-	50MHz 150W
50	-	100MHz 100W
100	-	200MHz 70W
SX-400		
140	-	220MHz 150W
400	-	525MHz 100W

3. Since the unit consists of delicate mechanism, do not drop it or subject it to hard blow.

Description of panel features

1. Meter
Displays forward RF power, reflected RF power and swr.
Uppermost scale is for high (H) and low (L) power swr reading. Low power swr scale is for RF power below 5W.
High power swr scale is for RF power over 5W.
Second and third scales are for RF power measurement which are 5W, 20W and 200W full scales.
2. Range switch
Selects full scale RF power reading between 5W, 20W, and 200W.
3. Function switch
Selects measurement function between RF power and swr.
4. Calibration Knob
Sets RF power to full scale reading depending on transmitting RF power to measure swr. Readings increase as the knob is being turned clockwise in transmission.
5. Power direction switch
Selects RF power measurement between forward RF power and reflected RF power.

6. Average/PEP monitor switch

In ordinary RF power measurement set the switch to the (□) position to display average RF power.

In SSB RF power measurement, set the switch to the (⊔) position to display PEP RF power.

7. Meter zero adjustment screw

Adjusts the meter indicator to zero position with regular screwdriver if the indicator is far from zero position when the unit is not in use.

8. Transceiver

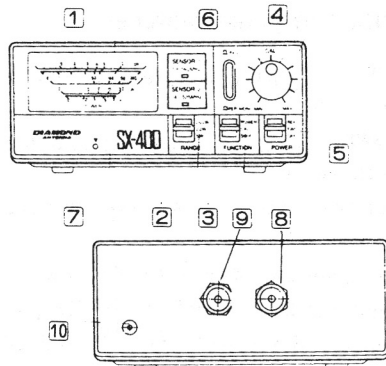
RF power input from a radio equipment which is to be connected by 50 ohm coaxial cable with UHF connector.

9. Antenna

RF power output to an antenna or a dummy load which is to be connected by 50 ohm coaxial cable with UHF connector.

10. 13.8VDC

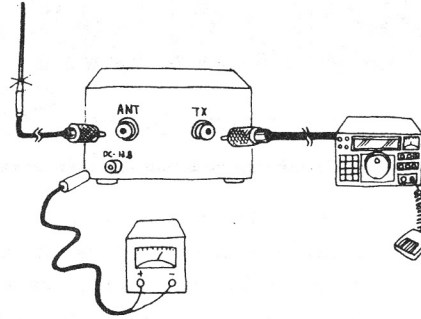
DC power source for meter illumination and LED display. Acceptable DC voltage range is from 11VDC to 15VDC. Connect red line for positive and black line for negative polarities. This power source is not essential for measuring purpose.



Installation

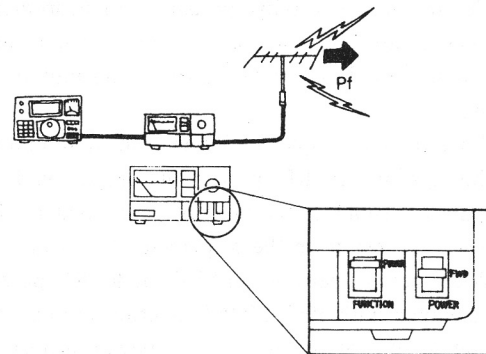
Connection

1. Connect transceiver input of the unit to antenna output of a radio equipment with a coaxial cable with an UHF connector and antenna output of the unit to an antenna feedline or dummy load.
2. If meter illumination are required, connect DC power cable supplied between a power source and DC inlet at the back panel as shown in the below figure. DC power source has to be between 11VDC to 15VDC. Red line has to be connected to positive polarity and black to negative polarity.



Measure forward RF power

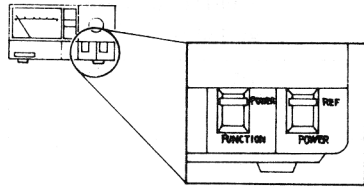
Measure how much RF output power is being applied from a radio equipment to an antenna. In case of forward RF power, the more indicator indicates RF power, the more RF power is applied to the antenna, provided that reflected RF power is minimum.



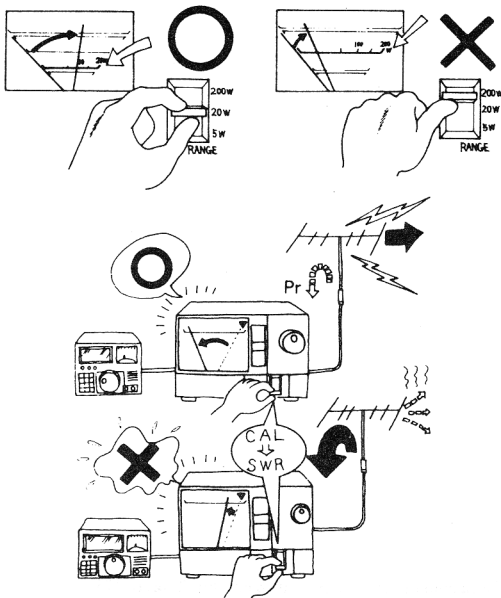
1. Set the FUNCTION switch to the POWER position.
2. Set the POWER switch to the FWD position.
3. Set the RANGE switch to appropriate RF power range. If a radio equipment is 10W RF output power, set the switch to the 20W position. If the equipment is 100W RF output power, then set the switch to 200W position.
4. Confirm to see if antenna output is connected to an antenna or dummy load.
5. Set the radio equipment on transmission, except SSB mode. Then indicator indicates forward RF power proportional to the output RF power of the equipment.
6. In SSB mode, peak envelope power can be monitored by setting the AVG PEP MONI switch to the PEP MONI position and talking to a microphone.

Measure reflected RF power

In case of reflected RF power, the less indicator indicates reflected RF power, the better an antenna connected propagate transmitting power efficiently. Reflected RF power in this case amount of transmitting power which can not be propagated by the antenna due to its problem in propagation efficiency.



1. Set the FUNCTION switch to the POWER position.
2. Set the POWER switch to the REF position.
3. Set the RANGE switch to appropriate RF power range. If a radio equipment is 10W RF output power, set the switch to the 20W position. If the equipment is 100W RF output power, then set the switch to 200W position.
4. Confirm to see if antenna output is connected to an antenna or dummy load.
5. Set the radio equipment on transmission. Then the meter indicates reflected RF power.
6. If the meter does not indicate any power, set the RANGE switch to the lower power range.



Measure swr

1. Set the FUNCTION switch to the CAL position.
2. Turn CAL knob counterclockwise fully to the MIN position.
3. Set the radio equipment on transmission and turn CAL knob clockwise to set the meter indicate "▼" position.
4. While the equipment is kept on transmission, set the FUNCTION switch to the SWR position. Then, the indicator indicates swr of the antenna. Note that there are two scales H and L for swr reading. If transmitting RF power is less than 5W then read L position, and the power is more than 5W then read H position.

※ Relationship between reflected RF power and swr is as follows.

SWR	1.0	1.1	1.2	1.5	2.0	2.5	3.0
Reflected RF power (Pr)	0	0.22	0.8	4.0	11.1	18.4	25.0

5. Calculation of swr value is as follows.

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

Where P_f = forward RF power
 P_r = reflected RF power

Note

If swr reading and calculated swr value differs considerably, calculated swr value is more accurate due to frequency response of pickup diode used in the directional coupler section.

If swr is too high

If swr of the antenna is too high, see if antenna is correctly assembled and soldered or coaxial cable and connector are correctly assembled and soldered. Installation location of the antenna, surrounding buildings and so on, can also be a cause of high swr value.

Specifications

	SX-200	SX-400
Frequency range	1.8—200MHz	140—525MHz
Power measurement range	0~200W (intermittent measurement)	
Power range	5W / 20W / 200W	5W / 20W / 200W
Accuracy of full scale	5W RANGE $\pm 5\%$ 20W RANGE $\pm 7.5\%$ 200W RANGE $\pm 5\%$ Add 15% of full scale at 160 to 200MHz.	5W RANGE $\pm 10\%$ 20W RANGE $\pm 5\%$ 200W RANGE $\pm 5\%$ Subtract 10% of full scale at 220 to 420MHz and add 10% of full scale at 450 to 525MHz.
Minimum power at swr measurement	1W	4W
Measurement range at swr measurement	1.0~ ∞	1.0~ ∞
Insertion loss	0.15dB maximum 1.8—3.5MHz and 150—200MHz 0.2dB maximum	140—250MHz 0.1dB maximum 400—470MHz 0.2dB maximum 470—525MHz 0.3dB maximum
Impedance	50 ohms	50 ohms
Connectors	UHF femle	UHF female
Dimention	155×63×103 mm (W/H/D) (6.1"×2.4"×4.1")	
Weight	540g (1.19lbs.)	540g (1.19lbs.)
Accessories	Operation instructions DC power cable	