INSTRUCTION MANUAL
CROSS NEEDLE SWR & POWER METER

CN-901 Series  HP TYPE  HP3 TYPE  V TYPE

The CN-901 Series is a high-quality instrument with unique features which make tedious measurement of SWR and Power during antenna tests, matching and tuning of transmitters a very easy task. SWR and Power indicators are installed in one meter unit. One scale will indicate Forward Power. Another scale, reflected Power and SWR is indicated at the crossing point of the two needles. This unique feature makes it possible to read Forward Power, Reflected Power and SWR all at the same time. HP Type. HP3 Type can also check P.E.P. (Peak Power in SSB operation.)

### SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
<th>HP TYPE</th>
<th>HP3 TYPE</th>
<th>V TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>1.8 ~ 200MHz</td>
<td>1.8 ~ 200MHz</td>
<td>140 ~ 525MHz</td>
</tr>
<tr>
<td>Power range: Forward</td>
<td>20/200/2KW</td>
<td>30/300/3KW</td>
<td>20/200W</td>
</tr>
<tr>
<td>Tolerance</td>
<td>±10% at full scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SWR measurement</td>
<td>1:1 ~ 1:∞</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SWR detection sensitivity</td>
<td>5W min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input / Output impedance</td>
<td>50 ohms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input / Output connectors</td>
<td>M Type (so 239)</td>
<td>M or N Type</td>
<td></td>
</tr>
<tr>
<td>DC Power supply</td>
<td>DC13.8V (70mA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions and Weight</td>
<td>157 (W) x 117 (H) x 117 (D) mm</td>
<td>1 Kg</td>
<td></td>
</tr>
</tbody>
</table>

※ Add 15% of full scale at 160-200MHz. Power Rating MAX 1kw (144MHz)
※ HP type, HP3 type: DC Power(13.8V) is necessary to operate.
※ The suitable DC plug size: Diameter (Inside/Outside) 2.5mm/5.5mm Length 9.0mm
※ Meter light: ON/OFF Can be switched by light switch.

### CONTROLS AND FUNCTIONS

![Diagram of CN-901 Series Front Panel]

HP TYPE  FRONT PANEL

- Forward Power
- Reflected Power
- Power measuring range switch.
- Mode switch
- Indicates SWR

![Diagram of CN-901 Series Rear Panel]

HP TYPE  REAR PANEL

- Connect with 50 ohms coaxial cable to antenna system.
- Connect with 50 ohms coaxial cable to transmitter or transceiver.
- DC Power socket for meter light & P.E.P. function
- P.E.P. HOLD switch
- Light switch

### OPERATION

1. Use only 50 ohms coaxial line for connections. This will maintain the accuracy of the meter.

2. For accurate power measurements, use 50 ohms pure resistance dummy load (Fig. 1)

※ HP type, HP3 type:
DC Power(13.8V) is necessary to operate.
3. Effective Radiated Power & SWR.

Select the Mode switch to 「AVG」position.
To measure effective radiated power, subtract reflected power from Forward Power. (Apparent loss is only produced by impedance mismatch and does not include cable losses.)

See Fig.2. The meter indicates Forward power 10W and Reflected power 0.4W. At the crossing point of the 2 needles the indication is SWR1.5.

4. P.E.P power (Turn Mode switch to 「P.E.P」position.)

HP, HP3 type
can also check P.E.P Peak Power in SSB operation.
(can not measure Reflected Power range.)

V type
When the transmitter is operated and the switch is in the 「P.E.P」 position the meter needle Monitor P.E.P of the SSB signal. This function can not hold peak envelope power.

Mathematical verification

\[
\text{SWR} = \frac{\sqrt{\text{Pf}} + \sqrt{\text{Pr}}}{\sqrt{\text{Pf}} - \sqrt{\text{Pr}}} = \frac{\sqrt{10} + \sqrt{0.4}}{\sqrt{10} - \sqrt{0.4}} = 1.5
\]

\text{Pf : Forward Power Pr : Reflected Power}

■ RF POWER FOR VARIOUS MODULATION MODES

(VOLTAGES SHOWN VARIOUS VOLTAGES FOR 50 OHMS DUMMY LOAD)

<table>
<thead>
<tr>
<th>MODULATION MODE</th>
<th>Carrier Power (W)</th>
<th>Average Power (W)</th>
<th>P.E.P (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM/FM CARRIER</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>AM Single Tone (100% modulation)</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>SSB Single Tone Modulation</td>
<td>100</td>
<td>150</td>
<td>400</td>
</tr>
<tr>
<td>SSB Two Tone Modulation</td>
<td>100</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>SSB Voice Modulation</td>
<td>100</td>
<td>20-50</td>
<td>100</td>
</tr>
</tbody>
</table>

During the various SSB transmission modes, as shown in the table left, the meter reading of AVG and P.E.P will differ. Therefore, when in the SSB transmit mode, after switching the mode switch from AVG to P.E.P, make certain that the meter power setting is correct. Otherwise, the meter needle will go off-scale, resulting in damage to the instrument.

■ CAUTION

1. As the meter movements has high sensitivity, it should be handled with utmost attention. Prevent mechanical shock and vibration.

2. Measuring power with a poorly matched antenna or disconnecting the output of the bridge while operating may damage the meter.

3. In low humidity conditions, the needles may stop on its way or may behave as though it caught on thermometer face due to static electricity. In such case, apply commercially available static cream or spray for plastics or clothes on the meter face. The needles return to the original position.

4. Use only 50 ohms coaxial cable for connections. This will maintain the accuracy of the meter.