

The Knight-Kit P-2 SWR/Power Meter

BY WILFRED M. SCHERER*, W2AEF

A **STANDING-wave-ratio** and relative-power meter provides a means for determining the adjustment of the antenna system which results in the lowest s.w.r.; indicates the relative loss of power due to a particular s.w.r., and indicates relative transmitter output-power into the line for tune-up purposes. It will thereby serve as a useful tool toward the attainment of the best overall efficiency. Once the system has been tuned up, the instrument may be left in the line and used as an r.f. output monitor, an indicator that the transmitter is being modulated and will provide an instant check of any changes in the s.w.r. due to any malfunction in the antenna system.

The Knight-Kit® Model P-2 SWR/Power Meter is one such device which is available in kit-form at a price just under \$15.00.

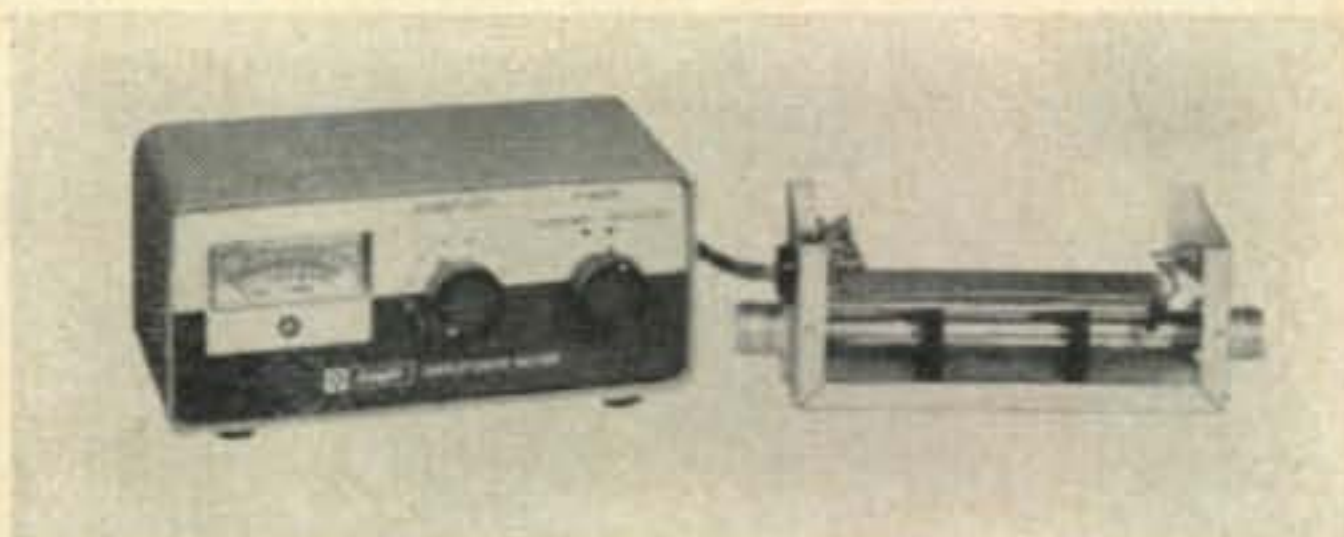
It consists of two small boxes, one of which is the "sampling" or pickup unit, the other is the metering unit. The pick-up unit is a reflectometer which contains the equivalent of a short section of transmission line with two separate pick-up elements inductively and capacitively coupled to the hot side of the transmission-line section. One element is for the forward wave, the other is for the reflected wave. A crystal diode is connected to each pick-up element to rectify the r.f. potential induced therein, producing a reading on a 0-100 μ a d.c. meter which may be switched from one diode to the other.

Dual Arrangement

The meter, a SENSITIVITY control and the FORWARD-REFLECTED-POWER switch are mounted in the second box which is connected to the pick-up box with a four-foot length of cable. This dual-unit arrangement, a feature not found in many other similar devices, is a convenience which permits the meter to be placed at a suitable location near the operating position for viewing and monitoring, while the pick-up unit is inserted in the transmission line at the rear of the transmitter.

The pick-up unit also contains terminating resistors for each coupling element to provide a proper match with the transmission line. Two sets of resistors are furnished so that the unit may be constructed for use with either 52- or 72- ohm lines.

The frequency range of the instrument is 1.8 to 432 mc and the minimum power required for full-scale deflection of the meter (FORWARD direction) is 45 watts at 1.8 mc, dropping off to



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$\frac{1}{2}$ watt at 432 mc. At 27 mc the power requirement is about 1 watt, making it suitable for Citizen-Band use. The maximum r.f. power handling capability is 1 kw. The unit may be left connected in the line at all times. The meter has two scales; one calibrated in terms of standing-wave-ratio from 1:1 up to 20:1, the other in terms of relative power from 0.1 to 10.

Construction

Assembly of the Model P-2 is quite simple and will consume from 1½ to 2 hours of time when the step-by-step procedure, described in the Assembly Manual, is used.

A few suggestions regarding the assembly instructions are as follows: In fig. 1, page 5, the direction of the flange at the bottom of the meter sub-panel may not appear quite clearly. This flange is "going away" from the reader.

In the last step on page 8, the two 4" lengths of the large bare wire should be made as straight as possible before they are mounted.

The connecting and soldering of the crystal diodes, as indicated on page 12, will be better left until last. First solder all the points to which the diodes eventually will be connected. Then "spot" solder each diode lead while it is held with a pair of long-nose pliers. This provides a heat sink which will minimize the possibility of damage to the crystals due to overheating.

Alignment, operating and trouble-shooting instructions are also included in the Manual.

Operation

Ordinarily no special adjustment is needed for use at frequencies below 30 mc, but a slight adjustment on the pick-up elements may be needed at higher frequencies. In our case, no difficulties were encountered in this respect and a correct 1:1 s.w.r. null was obtainable well up into the higher-frequency range.

The following points regarding the operating instructions should be noted: In the first paragraph on page 14 regarding the placement of the

[Continued on page 90]

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date and time as the REF. We have no other information except that ON stations will use the usual serial numbers and also give their province for the WABP award.

The list of claimed c.w. scores were taken from some of the early received logs. Don't get disturbed if yours is not listed. I have a feeling that some of the bigger scores are yet to be received.

73 for now, Frank, WIWY

Knight-Kit SWR Meter [from page 31]

pick-up unit between the transmitter and a low-pass TVI filter, it will be found that more accurate indications of the s.w.r. and power will be obtained with the unit connected between the filter and the transmission line due to the resulting attenuation of harmonics from the transmitter.

In connection with the first step under "measuring s.w.r." on page 14, the transmitter, or input-end of the pick-up unit is the one with J_1 which is located next to the meter-cord bushing. J_2 , the transmission line- or output-connector, is at the opposite end of the box.

Also on page 14, the SWR/Reflected-Useful-Power chart contains several errors. The corrections are as follows (these have been included in later production models):

SWR	% Reflected Power	% Useful Power
5	44.4	55.6
6	51.0	49.0
8	60.5	39.5
1.5 (add) ...	4.0	96.0

A feature of the meter scale, not mentioned in the Manual, is that by adding a "zero" to the figures on the relative-power scale, the percentage of reflected power for the indicated s.w.r. may be read directly.

Another point to note is that an s.w.r. meter of this type will not indicate the true s.w.r. due to load mismatch unless the transmission-line is a multiple of an electrical half wave¹. An example of this was clearly demonstrated by readings made with a 2:1 mismatched load. With the load connected directly at the instrument, or by a half-wave line, the s.w.r. read correctly at 2:1, but at intermediate line lengths it read different values, even as low as 1:1.1.

The instrument also may be used for modulation monitoring. With a constant-carrier 100% amplitude modulated transmitter, the meter will rise about 5% with full voice modulation. During controlled-carrier a.m. or s.s.b. transmissions, the meter should kick up $\frac{1}{4}$ to $\frac{1}{2}$ the amount indicated during tune-up at maximum output. Also for s.s.b., the meter may be used as a null indicator when the carrier is balanced out.

Once the Model P-2 has been used, it will be found hard to get along without it, making it a worthwhile low-cost investment. ■

¹Length in feet = $\frac{492 \times V}{\text{freq. mc}}$

Where: V = velocity constant of coax line
(0.65 for most coax).