

SUPERSEDES:

HP 432A POWER METER All Serials

An Alternate Method to Calibrate the 432A

The 432A Power Meter can be calibrated without an 8477A Calibrator using a method similar to the precision power method outlined in the 432A Operating and Service Manual (para. 3-27, page 3-2). The following paragraphs give two different methods for calibrating the 432A without an 8477A Calibrator.

A major difference between the two measurements is that external power need not be applied when calibrating the instrument. Normally, in a stable environment, the V_{comp} output voltage remains constant, not being affected by external RF power; only the V_{rf} output varies during power measurement. Since the power that the meter indicates is proportional to V_{comp} and V_{rf} , we can cause the meter to indicate a power also by holding V_{rf} constant and varying V_{comp} . This is easily done on the 432A by turning the COARSE ZERO control. For a complete discussion of the operation of the instrument, refer to the 432A Operation and Service Manual.

CALIBRATION PROCEDURE (1)

1. Connect thermistor mount to power meter; let instrument warm up for at least 10 minutes.
2. Select range which instrument is to be calibrated on. Note: ranges below 0.1 mW require a precision digital voltmeter with a $1 \mu V$ sensitivity and resolution of 1 part of 1.2×10^6 such as the HP H04-3460A.
3. Connect DVM differentially between the V_{comp} and V_{rf} output jacks on the rear panel. See Figure 1 for location of V_{rf} and V_{comp} outputs.
4. While pressing the FINE ZERO switch, measure and record V_0 . (V_0 is the difference of the bridge voltages with no power applied.)
5. Turn COARSE ZERO control (on front panel) clockwise to a convenient power, e.g., 9 on the zero to 10 scale or two on the 0 to three scale.
6. Differentially measure and record V_1 . V_1 is the difference voltage between V_{comp} and V_{rf} with power applied.
7. Measure and record V_{comp} . Note that the V_{comp} jack is isolated from chassis ground; measure from the center conductor of the BNC to the outer conductor.



Figure 1. Rear Panel of 432A

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 Europe: 54 Route Des Acacias, Geneva, Switzerland, Cable: "HEWPACKSA" Tel. (022) 42.81.50

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8. Calculate the power using the following formula*:

$$P = \frac{1}{4R} [2V_{\text{comp}}(V_1 - V_0) - V_1^2] \quad (1)$$

where R is the resistance of the thermistor mount and should be identical to the setting of the MOUNT RESISTANCE switch.

9. If calculated power is different from the value that was set with the COARSE ZERO control, adjust A2R6 so that the meter reads calculated power. If the range of A2R6 is insufficient to set new power, it will be necessary to change the value of A2R70.

10. Set COARSE ZERO so that meter reads one on the 0 to 1 scale. Set A2R72 for 1.000 V \pm 10 mV at the RECORDER output jack on the rear panel.

There is a simpler form of the equation that was used to calculate power in step 8 above. This form ignores V_0 , the small voltage difference between the two bridges with no power applied. However, V_0 becomes negligible on the higher ranges, that is 1 mW and above, and can be ignored with little decrease in accuracy. The simpler form is as follows:

$$P = \frac{1}{4R} (V_c - V_{\text{rf}}) (V_c + V_{\text{rf}}) \quad (2)$$

*This formula is accurate for on-scale readings; however, with no power applied (i. e., $V_1 = V_0$) it does not solve to $P = 0$ because of a deleted term $+V_0^2$. This term can be neglected for any on-scale reading.

CALIBRATION PROCEDURE (2)

1. Connect thermistor mount to power meter; let instrument warm up for at least 10 minutes.
2. Select 1, 3, or 10 mW range.
3. Turn the COARSE ZERO control clockwise to indicate some convenient on-scale reading.
4. Measure V_{comp} and record. Note that V_{comp} jack is isolated from chassis ground; measure from the center conductor of the BNC to the outer conductor.
5. Measure V_{rf} and record. Follow measurement procedure in step 4.
6. Measure and record $V_{\text{comp}} - V_{\text{rf}}$. This term must be measured differentially, that is, one side of the DVM connected to V_{comp} and the other side connected to V_{rf} . In this way the full resolution of the DVM can be used.
7. Substituting the measured values into the above formula, calculate the power.
8. If calculated power is different from the power set with the COARSE ZERO control, adjust A2R6 so that meter indicates that power. If the range of A2R6 is not great enough to set new power level, the value of A2R70 will have to be changed.
9. Adjust COARSE ZERO so that meter reads one on the 0 to 1 scale. Set A2R72 for 1.000 V \pm 10 mV at the RECORDER output jack on the rear panel.