ADDENDUM E40.672
ADDENDUM A702.589
Issue 1, November, 1958
AT&TCo Standard

VACUUM TUBE VOLTMETER
HEWLETT-PACKARD MODEL 400D

1. GENERAL

1.001 This addendum, Issue 1, supplements Issue 1 of the section.

1.002 This addendum is issued to correct the incomplete last sentence on Page 5 of the instruction manual which is an attachment to this section.

1.003 This addendum should be filed with Section E40.672 also numbered A702.589, Issue 1. The attached Pages 4 and 5 should be inserted in the instruction manual in place of the old Pages 4 and 5.

Attached:

Reissued without change Page 4 dated November, 1958
Revised Page 5 dated November, 1958

range switch is on the .1 volt position and the meter indicates .64 on the 1 volt meter scale, to obtain the value of the voltage being measured:

$$.64 \text{ (meter indication)} \times \frac{.1 \text{ (range switch position)}}{1 \text{ (meter full scale value)}} = .064 \text{ volts}$$

If the range switch is on the 30 volt position and the meter indicates 1.6 on the 3 volt scale:

$$1.6 \text{ (meter indication)} \times \frac{30 \text{ (range switch position)}}{3 \text{ (meter full scale value)}} = 16 \text{ volts}$$

Harmonics - As a precaution in maintaining accuracy of measurement, it must be kept in mind that the instrument is an average reading device but that the meter is calibrated in terms of the RMS voltage of a pure sine wave. If the waveform of the voltage being measured contains appreciable harmonic voltages or other spurious voltages, the meter indication will deviate from the true RMS value on the order indicated by the following table.

EFFECT OF HARMONICS ON MODEL 400D VOLTAGE MEASUREMENTS

Input Voltage Characteristics	True RMS Value	Value Indicated by Model 400D
Fundamental = 100	100	100
Fundamental + 10% 2nd harmonic	100.5	100
Fundamental + 20% 2nd harmonic	102	100 - 102
Fundamental + 50% 2nd harmonic	112	100 - 110
Fundamental + 10% 3rd harmonic	100.5	96 - 104
Fundamental + 20% 3rd harmonic	102	94 - 108
Fundamental + 50% 3rd harmonic	112	90 - 116

DB Measurements - Decibel measurements are made in the same way as voltage measurements except that the indication is read on the db scale. The level in decibels is the algebraic sum of the meter db scale indication and the DB VOLTS (range) switch position. For example, if the indication on the db scale is +1.5 and the range switch is at -40 db, the level in decibels is:

-40. (range switch position)
+ 1.5 (meter db scale indication)
-38.5 (level in db of voltage being measured)

If the indication on the db scale is -5 and the range switch is at +20, the level in db is the algebraic sum of the two, +15 db.

Reissued without change
November, 1958

a. To read the voltage directly in dbm (0 dbm = 1 milliwatt into 600 ohms), the measurement must be made across 600 ohms.

b. Comparative db measurements (without respect to the reference level) may be obtained by direct reading provided each measurement is made across the same value of impedance. Made in this manner, the difference in decibels between two or more voltages may be obtained directly from the DB scale indications.

NOTE: To obtain the level in dbm with respect to impedances other than 600 ohms, the meter correction graph shown in Fig. 2 may be used. The level in dbm of the voltage being measured will be the algebraic sum of the level as indicated on the meter and the correction shown on the graph. For example, if the range switch is at the +30 db position, the voltage being measured is across 90 ohms, and the indication on the DECIBELS scale is +1, the level in dbm is obtained as follows:

+1 (DB scale indication)
+30 (range switch position)
+31 (level in db as indicated by meter)
+8 (correction for 90 ohms impedance)
+39 dbm

For the same conditions, with the voltage being measured across 60,000 ohms:

+1 (DB scale indication)
+30 (range switch position)
+31 (level in db as indicated by meter)
-20 (correction for 60,000 ohms impedance)
+11 dbm

Amplifier - The Model 400D may be used as an amplifier. To obtain maximum gain, proceed as follows:

1. Plug the power cable into a 115/230 volt power line, and turn the toggle switch to ON.

2. Set the DB VOLTS (range) switch at the .001 volt position.

3. Connect the voltage to be amplified to the INPUT binding posts. To obtain optimum amplifier gain and minimum distortion, the load across the output of the amplifier must be at least 10,000 ohms.

With an input of .001 volt and the amplifier working into a 10,000 ohm load, the maximum voltage obtainable at the OUTPUT terminals is .3 volt.

Higher voltages may be applied to the input of the amplifier provided the position of the range switch indicates a full scale voltage equal to or greater than the applied voltage. However, the gain of the amplifier goes down by 10 db for each step that the range switch is advanced toward the high voltage end. At the .03 volt position the amplifier has a gain of 1 and at a higher voltage range switch position the gain is less than unity.