*TB 9-6625-146-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DC MICROVOLT-AMMETER HEWLETT-PACKARD, MODELS 425A AND 425AR

Headquarters, Department of the Army, Washington, DC
10 December 1980

REPORTING OF ERRORS

You can help improve this publication by calling attention to errors and by recommending improvements and stating your reasons for the recommendations. Your letter or DA Form 2028, Recommended Changes to Publications, should be mailed directly to Commander, U. S. Army Aviation and Missile Command, ATTN: AMSAM-TMD-EP, Redstone Arsenal, AL 35898-5000. FAX to DSN 788-2313 (commercial 256-842-2313). A reply will be mailed directly to you.

*This bulletin supersedes TB 9-6625-146-35, 8 December 1969.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Dc Microvolt-Ammeter, Hewlett-Packard Models 425A and 425AR. The manufacturer's manuals were used as the prime data source in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Model 425AR is rack-mounted and is electrically the same as Model 425A.

b. Time and Technique. The time required for this calibration is approximately 1 hour, using the dc and low frequency technique.

2. DA Form 2416 (Calibration Data Card)

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25-1, DA Form 2416 must be annotated in accordance with TB 750-25-1 for each calibration performed.

b. Adjustments to be reported on DA Form 2416 are designated (R) at the end of the sentence in which they appear. When adjustments are in tables, the (R) follows the designated adjustment. Report only those adjustments made and designated with (R).

3. Calibration Description. TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test Instrument Parameters	Performance Specifications
Power input requirements	Range: 115 V, 60 Hz. 40 W Accuracy: ±10%
Voltmeter	Range: 10 μV to 1 V FS in 11 ranges Accuracy: ±3% FS
Microammeter	Range: 10 pA to 3 mA FS in 18 ranges Accuracy: ±3% FS

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Sets AN/GSM-256 and AN/GSM-286. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications

listed in table 2. The accuracies listed in table 2 provide a four-to-one ratio between the standard and TI.

5. Accessories Required. The accessories listed in table 3 are issued as indicated in paragraph 4 above and are used in this calibration procedure. When necessary, these items may be substituted by equivalent items, unless specifically prohibited.

Table 2. Minimum Specifications of Equipment Required

Item	Common name and/or (official nomenclature)	Minimum use specifications	Manufacturer, model, and (part number)	
			AN/GSM-286	AN/GSM-256
A1	AUTOTRANSFORMER	Range: 105 to 125 V ac Accuracy: ±0.75%	General Radio, Model W10MT3AS3 (7910809)	Same
A2	DC VOLTAGE STANDARD	Range: 0.097 to 30.9 V dc Accuracy: ±0.75%	John Fluke, Model 332BAF (7911393)	John Fluke, Model 760A (760A)
A3	DECADE RESISTOR[1]	Range: 10 to 999,990 Ω Accuracy: [2 3]	Biddle-Gray Model 71-631 (7910328)	Same
A4	RESISTANCE STANDARD	Range: 1 to 10 MΩ Accuracy: [3]	Industrial Instruments, Model CR10M (8598965)	General Radio, Model 1433-9719 (1433-9719)
A5	RESISTANCE STANDARD	Range: 100 to 1000 MΩ Accuracy: [3]	Industrial Instruments, Model CR1000M (8579478)	Same

[1]Two required.
[2]Combined accuracy of A2 and two A3's must be at least ±0.75%.
[3]Combined accuracy of A2 and A3, or A4, or A5 must be at least ±0.75%.

Table 3. Accessories Required

Item	Common name and/or (official nomenclature)	Description and (part number)
B1	TEST LEAD[1]	24-in., No. 18; single banana plug terminations (red) (7907497)

[1]Three required.

SECTION III
CALIBRATION PROCESS

6. Preliminary Instructions

a. The instructions outlined in paragraphs **6** and **7** are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name and item identification number as listed in tables 2 and 3. For the identification of equipment referenced by item numbers prefixed with A, see table 2, and for prefix B, see table 3.

WARNING

HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions.

NOTE

Unless otherwise specified, verify the results of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in the manufacturer's manual for this TI.

NOTE

Unless otherwise specified, all controls and control settings refer to the TI.

7. Equipment Setup

a. Remove protective cover from TI only if necessary to make adjustments.

b. Connect TI to autotransformer (A1).

c. Connect autotransformer to a 115-V ac source and adjust for 115 V output.

d. Set TI POWER switch to ON and allow 15 minutes for warmup.

e. Set TI POWER switch to off (down) position and wait approximately 30 seconds.

f. If necessary, rotate TI mechanical zero adjustment screw cw to bring meter pointer below zero and ccw until meter pointer begins to move upscale toward zero.

g. Continue to rotate ccw until meter pointer is centered near zero.

h. Rotate mechanical zero adjustment screw cw approximately 5 degrees to free adjustment screw from meter suspension. If meter pointer moves during this adjustment, repeat steps f through h.

i. Set POWER switch to ON and FUNCTION switch to VOLTAGE.

j. Short TI probe to ground lead and adjust ZERO control for zero indication on meter.

8. Electrical Zero

a. Performance Check. Set RANGE switch to .003 MILLIAMPERES. If meter pointer does not indicate 0 (zero) within ±1.5 divisions, perform **b** below.

b. Adjustments. Adjust BIAS R47 (fig. 1) for 0 (zero) indication on TI.

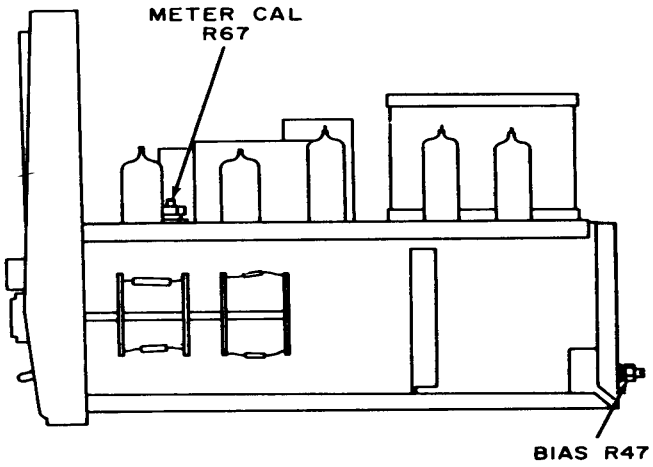

Figure 1. Microvolt-ammeter - right side view.

9. Dc Voltage Ranges and Stability

a. Performance Check

CAUTION

Adjust controls of dc voltage standard (A2) for minimum output before changing ranges; otherwise, damage to TI may result.

(1) Connect equipment as shown in figure 2.

(2) Adjust decade resistor (A3) No. 1 for 999,990 ohms and decade resistor No. 2 for 10 ohms.

(3) Set RANGE switch to 10 MICROVOLTS.

(4) Adjust dc voltage standard (A2) for a full-scale indication on TI meter. If dc voltage standard does not indicate between 0.97 and 1.03 V, perform **b** below.

(5) Vary output of autotransformer (A1) from 105 to 125 V while maintaining full-scale indication on TI meter with dc voltage standard. Dc voltage standard indication will remain between 0.97 and 1.03 V.

(6) Adjust autotransformer for 115 V output.

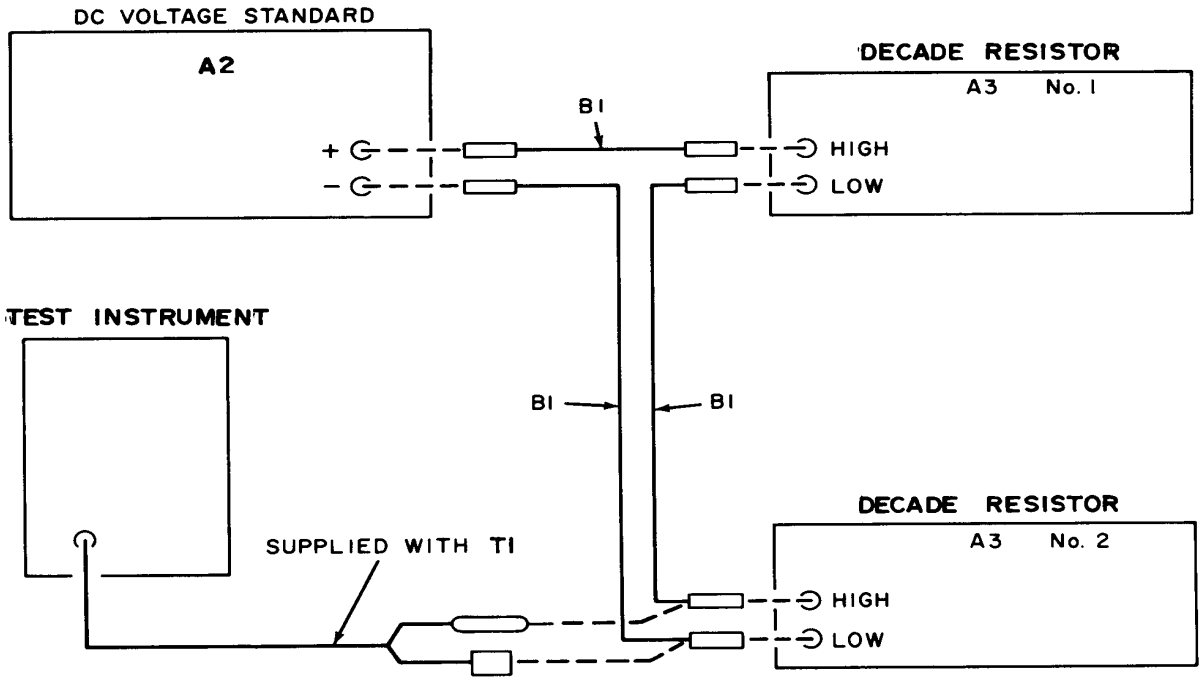

Figure 2. Dc voltage - equipment setup.

(7) Repeat technique of (2) through (4) above for TI switch settings and dc voltage standard indications listed in table 4. If dc voltage standard does not indicate within limits specified, and if **b** was not performed in (4) above, perform **b** below.

Table 4. Dc Voltage Range Check

Decade resistor settings (Ω)		Test instrument RANGE switch	Dc voltage standard indications (V dc)	
No. 1	No. 2	Settings	Min	Max
999,990	10	30 MICROVOLTS	2.91	3.09
999,990	10	100 MICROVOLTS	9.7	10.3
999,990	10	.3 MILLIVOLTS	29.1	30.9
999,000	1000	1 MILLIVOLTS	0.97	1.03
999,000	1000	3 MILLIVOLTS	2.91	3.09
999,000	1000	10 MILLIVOLTS	9.7	10.3
999,000	1000	30 MILLIVOLTS	29.1	30.9

(8) Connect TI probe and ground lead to dc voltage standard, observing polarity.

(9) Set RANGE switch to .1 VOLTS and adjust dc voltage standard output until TI meter indicates .1 V. If dc voltage standard does not indicate between 0.097 and 0.103 V dc, and if **b** was not performed in (4) or (7) above, perform **b** below.

(10) Repeat technique of (9) above for TI switch settings and indications listed in table 5. If dc voltage standard does not indicate within limits specified, and if **b** was not performed in (4), (7), or (9) above, perform **b** below.

Table 5. Voltage Tracking Check

Test instrument		Dc voltage standard indications (V dc)	
Meter indications	RANGE switch settings	Min	Max
.3	.3 VOLTS	0.291	0.309
1	1 VOLTS	0.97	1.03
.8	1 VOLTS	0.77	0.83
.6	1 VOLTS	0.57	0.63
.4	1 VOLTS	0.37	0.43
.2	1 VOLTS	0.17	0.23
- .2[1]	1 VOLTS	0.17	0.23
- .4	1 VOLTS	0.37	0.43
- .6	1 VOLTS	0.57	0.63
- .8	1 VOLTS	0.77	0.83
-1	1 VOLTS	0.97	1.03

[1]Reverse TI leads at dc voltage standard.

b. Adjustments

(1) Set RANGE switch to 10 MILLIVOLTS.

(2) Adjust decade resistor No. 1 for 999,000 ohms.

(3) Adjust decade resistor No. 2 for 1000 ohms.

(4) Adjust dc voltage standard for 10.00 V output.

(5) Adjust METER CAL R67 (fig. 1) for full-scale indication on TI (R).

10. Dc Current Ranges

a. Performance Check

(1) Connect equipment as shown in figure 3.

(2) Set FUNCTION switch to CURRENT and RANGE switch to .3 MILLI-MICROAMPERES.

(3) With resistance standard (A5) connected for 1000 megohms, adjust dc voltage standard (A2) for a full-scale indication on TI. Dc voltage standard will indicate between 0.291 and 0.309 V.

(4) Repeat technique of (2) and (3) above for TI switch settings and indications listed in table 6. Dc voltage standard will indicate within limits specified.

b. Adjustments. No adjustments can be made.

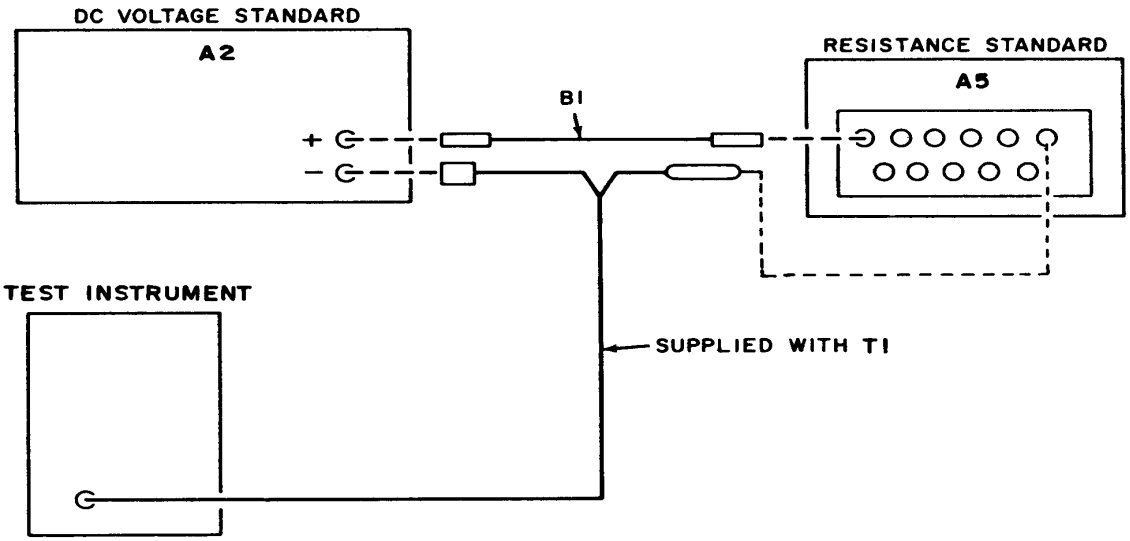

Figure 3. DC current range check - equipment setup.

Table 6. Dc Current Range Check

Test instrument RANGE switch settings	Resistance standard settings	Dc voltage standard indications (V dc)	
		Min	Max
1 MILLI-MICROAMPERES	1000 megohm	.97	1.03
3 MILLI-MICROAMPERES	1000 megohm	2.91	3.09
10 MILLI-MICROAMPERES	100 megohm	.97	1.03
30 MILLI-MICROAMPERES	100 megohm	2.91	3.09
.1 MICROAMPERES	10 megohm[1]	.97	1.03
.3 MICROAMPERES	10 megohm	2.91	3.09
1 MICROAMPERES	1 megohm	.97	1.03
.003 MILLIAMPERES	1 megohm	2.91	3.09
.01 MILLIAMPERES	100 kilohm[2]	.97	1.03
.03 MILLIAMPERES	100 kilohm	2.91	3.09
.1 MILLIAMPERES	10 kilohm	.97	1.03
.3 MILLIAMPERES	10 kilohm	2.91	3.09
1 MILLIAMPERES	1 kilohm	.97	1.03
3 MILLIAMPERES	1 kilohm	2.91	3.09

[1]Substitute resistance standard (A4) for (A5).
[2]Substitute decade resistor (A3) for resistance standard (A4).

11. Final Procedure

a. Deenergize and disconnect all equipment and reinstall protective cover on TI.

b. When all parameters are within tolerance, annotate and affix DA Label 80 (US Army Calibrated Instrument). When the TI receives limited or special calibration, annotate and affix DA Label 163 (US Army Limited or Special Calibration). When the TI cannot be adjusted within tolerance, repair the TI in accordance with the maintenance manual. When repair is delayed for any reason or the TI cannot be repaired with local resources, annotate and affix DA Form 2417 (US Army Calibration System Rejected Instrument) and inform the owner/user accordingly in accordance with TB 750-25-1.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief Of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-34A (qty rqr block No. 75), requirements for calibration procedures publications.

U.S. GOVERNMENT PRINTING OFFICE: 1981 740-031/2024

PIN: 047771-000