

***TB 9-6625-2227-35**

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DIGITAL MULTIMETER HEWLETT-PACKARD MODELS 3435A AND 3438A

Headquarters, Department of the Army, Washington, DC
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REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

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		Paragraph	Page
SECTION	I. IDENTIFICATION AND DESCRIPTION		
	Test instrument identification	1	2
	Forms, records, and reports.....	2	2
	Calibration description.....	3	2
	II. EQUIPMENT REQUIREMENT		
	Equipment required.....	4	3
	Accessories required.....	5	3
	III. CALIBRATION PROCESS		
	Preliminary instructions.....	6	4
	Equipment setup	7	4
	Dc voltage	8	5
	Dc current.....	9	6
	Ac voltage.....	10	6
	Resistance	11	7
	Power supply.....	12	8
	Final procedure	13	8

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**SECTION I
IDENTIFICATION AND DESCRIPTION**

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Digital Multimeter, Hewlett-Packard, Models 3435A and 3438A. The manufacturer's manual was 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. None.

b. Time and Technique. The time required for this calibration is approximately 2 hours, using the dc and low frequency technique.

2. Forms, Records, and Reports.

a. Forms, records and reports required for calibration personnel at all levels are prescribed by TB 750-25.

b. Adjustments to be reported 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 applications which pertain to this calibration are in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Dc voltage	Range: 0 to 1200 V in 5 ranges Accuracy: 200 mV range: $\pm(0.1\%$ of reading + 2 digits) 2 V to 1200 V range: $\pm(0.1\%$ of reading + 1 digit)
Ac voltage	Range: 0 to 1200 V in 5 ranges Accuracy: 0 to 50 Hz : $\pm(1.5\%$ of reading + 3 digits) 50 to 20 kHz: $\pm(0.3\%$ of reading + 3 digits) 20 to 100 kHz: $\pm(1.5\%$ of reading + 10 digits)
Dc current	Range: 0 μ A to 2000 mA in 5 ranges Accuracy: 200 μ A to 200 mA range: $\pm(0.3\%$ of reading + 2 digits) 200 mA range: $\pm(0.6\%$ of reading + 2 digits)
Ac current ¹	Range: 0 μ A to 2000 mA in 5 ranges Accuracy: 200 μ A to 200 mA: 30 to 50 Hz: $\pm(1.7\%$ of reading + 4 digits) 50 Hz to 10 kHz: $\pm(0.9\%$ of reading + 4 digits) 200 mA: 30 to 50 Hz: $\pm(2\%$ of reading + 4 digits) 50 to 10 kHz: $\pm(1.2\%$ of reading + 4 digits)
Resistance	Range: 0 Ω to 20 M Ω in 7 ranges Accuracy: 20 Ω range: $\pm(0.5\%$ of reading + 10 digits) 200 Ω to 2 M Ω range: $\pm(0.2\%$ of reading + 2 digits) 20 M Ω range: $\pm(0.8\%$ of reading + 2 digits)

¹Actual parameters not tested; checked in dc current mode.

**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 Set AN/GSM-286. Alternate items may be used by the calibrating activity. The item 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 required for this calibration are common usage accessories, issued as indicated in paragraph 4 above, and are not listed in this calibration procedure.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
CALIBRATOR	<u>Ac voltage:</u> Range: 190.0 mV to 1000 V ac Frequency: 30 Hz to 100 kHz Accuracy: ± .118% <u>Dc voltage:</u> Range: 190.0 mV to 1100 V dc Accuracy: ± .039% <u>Dc current:</u> Range: 190 µA to 1900 mA Accuracy: ± .1% <u>Resistance:</u> Range: 10.01Ω to 1000 MΩ Accuracy: ± .1% Range: 1.000 MΩ to 10 MΩ Accuracy: ± .25%	John Fluke, Model 5700A/CT (p/o MIS-35947); w/power amplifier John Fluke, Model 5725A (5725A); W/ac divider, John Fluke, Model 7405A-2407 (7405A-4207)
MULTIMETER	Range: 7.00 V dc Accuracy: ± .036% Frequency: Range: 9980 to 10020 Hz Accuracy: ±0.05%	Hewlett-Packard, Model 3458A (3458A)

**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 as listed in table 2.

c. Unless otherwise specified, verify the result 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.

d. When indications specified in paragraphs **8** through **11** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **8** through **11**. Do not perform power supply check if all other parameters are within tolerance.

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

7. Equipment Setup


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. REDUCE OUTPUT(S) to minimum after each step within the performance check where applicable.

a. Remove covers from TI as required to make adjustments.

b. Connect TI to 115 V ac source.

c. Press **POWER** pushbutton to **ON** and allow at least 15 minutes for warmup and stabilization.

d. Press **FUNCTION**  **V** and **20 V RANGE** pushbuttons.

8. Dc Voltage

a. Performance Check

- (1) Connect calibrator output to TI **VW** and **COM** terminals.
- (2) Set calibrator output to 19.00 V dc. If TI does not indicate between 18.97 and 19.03 V dc, perform **b** below.
- (3) Repeat technique of (2) above, using settings and indications listed in table 3.

b. Adjustments. Adjust DC GAIN ADJ R403 (fig. 1) for an indication of 19.00 V dc on TI (R).

Table 3. Dc Voltage

Calibrator output (dc)	Test instrument RANGE pushbutton settings	Test instrument indications	
		Min	Max
190.0 mV	200 mV	189.6 mV	190.4 mV
1.900 V	2 V	1.897 V	1.903 V
190.0 V	200 V	189.7 V	190.3 V
1100 V	1200 V	1098 V	1102 V

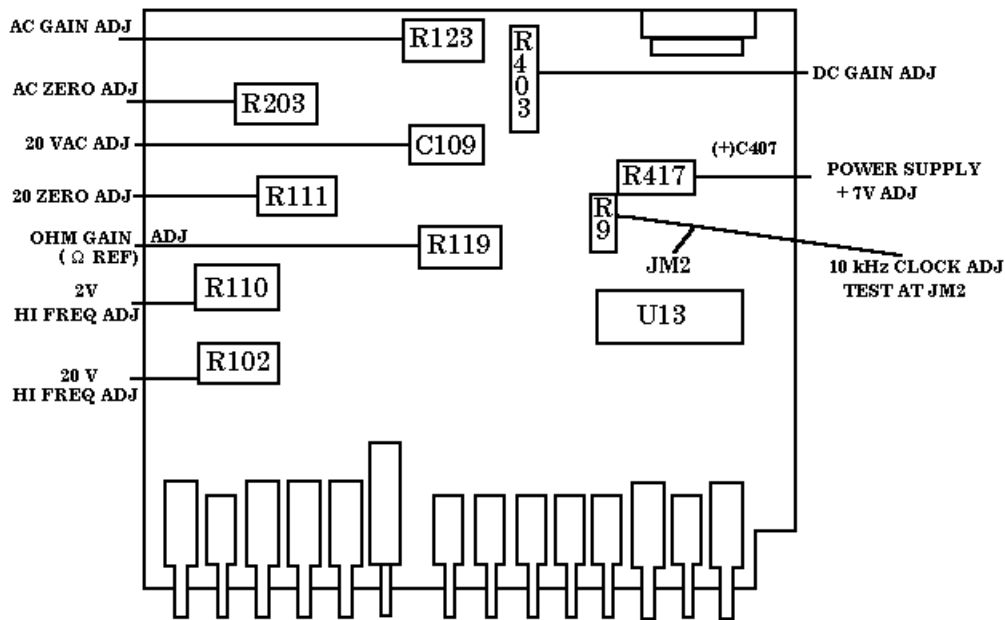


Figure 1. Adjustments locations - models 3435A and 3438A.

9. Dc Current

a. Performance Check

- (1) Connect calibrator **OUTPUT** to TI **A** and **COM** terminals.
- (2) Press **FUNCTION** **----- mA** and **200 mA RANGE** pushbuttons.
- (3) Set calibrator output to 190 μ A.
- (4) TI will indicate between 189.2 μ A and 190.7 μ A.
- (5) Repeat technique of (2) and (3) above, using settings and indications listed in table 4. TI will indicate within specified limits.

b. Adjustments. No adjustments can be made.

Table 4. Dc Current

Calibrator output (mA)	Test instrument		
	RANGE pushbutton settings (mA)	Indications (mA)	
		Min	Max
1.9	2	1.892	1.907
19	20	18.92	19.07
190	200	189.2	190.77
1900	2000	1886	1913

10. Ac Voltage

a. Performance Check

- (1) Press **FUNCTION** **~ V** (ac volts) and **20 V RANGE** pushbuttons.
- (2) Connect a short between the **VW** and **COM** jacks. If TI does not indicate 0.00 V ac, perform **b(1)** below.
- (3) Remove the short and connect **VW** and **COM** jacks to calibrator.
- (4) Set calibrator output to 19 V and frequency to 200 Hz. If TI does not indicate between 18.91 and 19.09 V, perform **b(2)** below.
- (5) Set calibrator frequency to 20 kHz. If TI does not indicate between 18.91 and 19.09 V, perform **b(3)** below.
- (6) Set calibrator frequency to 100 kHz. If TI does not indicate between 18.61 and 19.39 V, perform **b(4)** below.
- (7) Set calibrator output to 1.9 V and frequency to 20 kHz.
- (8) Press **2V RANGE** pushbutton. If TI does not indicate between 1.891 and 1.909 V ac, perform **b(5)** below.
- (9) Repeat technique of (4) through (8) above, using settings and indications listed in table 5.

Table 5. Ac Voltage

Test instrument RANGE pushbutton settings	Calibrator output		Test instrument indications	
	Frequency	Voltage	Min	Max
200 mV	30 Hz	190 mV	186.9 mV	193.1 mV
	100 Hz	190 mV	189.1 mV	190.9 mV
	10 kHz	190 mV	189.1 mV	190.9 mV
	100 kHz	190 mV	186.1 mV	193.9 mV
2 V	30 Hz	1.9 V	1.869 V	1.931 V
	100 Hz	1.9 V	1.891 V	1.909 V
	10 kHz	1.9 V	1.891 V	1.909 V
	100 kHz	1.9 V	1.861 V	1.939 V
200 V	30 Hz	190 V	186.9 V	193.1 V
	100 Hz	190 V	189.1 V	190.9 V
	10 kHz	190 V	189.1 V	190.9 V
	100 kHz	190 V	186.1 V	193.9 V
1200 V	40 Hz	1000 V	982 V	1018 V
	100 Hz	1000 V	994 V	1006 V
	10 kHz	1000 V	994 V	1006 V

b. Adjustments

- (1) Adjust AC ZERO ADJ R203 (fig. 1) for a TI indication of 0.00 V ac (R).
- (2) Adjust AC GAIN ADJ R123 (fig. 1) for a TI indication of 19.00 V ac (R).
- (3) Adjust 20 V HI FREQ ADJ R102 (fig. 1) for a TI indication of 19.00 V ac (R).
- (4) Adjust 20 VAC ADJ C109 (fig. 1) for a TI indication of 19.00 V ac (R).
- (5) Adjust 2 V HI FREQ ADJ R110 (fig. 1) for a TI indication of 1.900 V ac (R).

11. Resistance

a. Performance Check

- (1) Press **FUNCTION kW** and **20W RANGE** pushbuttons.
- (2) Short **VW** and **COM** jacks. If TI does not indicate **0.00W**, perform **b(1)** below, then remove short.
- (3) Connect calibrator output terminals to TI **INPUT VW** and **COM** terminals.
- (4) Press **20 kW RANGE** pushbutton and set calibrator to nominal 19 kΩ. Adjust the calibrator output adjustment control knob for a calibrator control display reading equal to the TI indication. The calibrator control display **ERROR** indication will be within ±.3000%; if not, perform **b(2)** below.
- (5) Set TI range and calibrator to the nominal resistance outputs listed in table 6. At each resistance input, adjust the calibrator output adjustment control knob for a calibrator control display reading equal to the TI indication. The calibrator control display **ERROR** indication will be within the specified limits of table 6.

Table 6. Resistance

Test instrument RANGE pushbutton settings	Calibrator nominal output	ERROR display indications ±(%)
20 Ω	10 Ω	1.5000
200 Ω	100 Ω	.4000
2 kΩ	1 kΩ	.4000
200 kΩ	100 kΩ	.4000
2000 kΩ	1 MΩ	.4000
20 MΩ	10 MΩ	1.0000

b. Adjustments

(1) Adjust 20 ZERO ADJ R111 (fig. 1) for a TI indication of 0.00 kΩ.

(2) Set calibrator to 19 kΩ. Adjust OHM GAIN ADJ (Ω REF) R119 (fig. 1) for TI indication of actual calibrator resistance.

12. Power Supply

a. Performance Check

NOTE

Do not perform power supply check if all other parameters are within tolerance.

(1) Connect multimeter to positive side of capacitor (+) C407 (fig. 1) and ground. If digital multimeter does not indicate between 6.99 and 7.01 V dc, perform **b(1)** below.

(2) Set multimeter to measure frequency and connect frequency counter input to JM2 (fig. 1). If multimeter does not indicate frequency between 9980 and 10020 Hz, perform **b(2)** below.

b. Adjustments

(1) Adjust POWER SUPPLY + 7 V ADJ R417 (fig. 1) for 7.00 (R).

(2) Adjust 10 kHz CLOCK ADJ TEST AT JM2 R9 (fig. 1) for 9980 to 10020 Hz (R).

13. Final Procedure

a. Deenergize and disconnect all equipment.

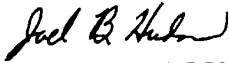
b. Annotate and affix DA label/form in accordance with TB 750-25.

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By Order of the Secretary of the Army:

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