*TB 9-6625-2265-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DIGITAL MULTIMETER BALLANTINE, MODEL 3100A

Headquarters, Department of the Army, Washington, DC
18 March 2002

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REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedure, please let us know. Mail your letter or DA Form 2028 to: Commander, U. S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5230. A reply will be furnished to you. You may also send in your comments electronically to our e-mail address: *2028@redstone.army.mil* or by FAX (256) 842-6546/DSN 788-6546.

*This bulletin supersedes TB 9-6625-2265-35, dated 31 October 1991.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Digital Multimeter, Ballantine, Model 3100A. 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 1 hour 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. 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

<table>
<tr><th>Test instrument parameters</th><th colspan="5">Performance specifications (3 1/2 digit display)</th></tr>
<tr><td>Dc voltage</td><td colspan="5">Range: 0 to 1000 V (in 5 ranges)
Accuracy: ± (0.1% of reading + 1 digit)</td></tr>
<tr><td rowspan="5">Ac voltage</td><td colspan="5">Range: 0 to 750 V (in 5 ranges)
Frequency: 40 Hz to 5 kHz
Accuracy: ± (% of reading + digits)</td></tr>
<tr><td colspan="2">Range</td><td colspan="3">Frequency</td></tr>
<tr><td></td><td></td><td>40 Hz to 1 kHz</td><td>1 to 2 kHz</td><td>2 to 5 kHz</td></tr>
<tr><td>200
2
20</td><td>mV
V
V</td><td>.75 + 2</td><td>1.5 + 3</td><td>5.0 + 5</td></tr>
<tr><td>200</td><td>V</td><td></td><td></td><td>N/A</td></tr>
<tr><td></td><td>750</td><td>V</td><td>1.0 + 2</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Resistance</td><td colspan="5">Range: 0 to 20 MΩ (in 6 ranges)
Accuracy: ± (% of reading + digits)

Range:
200Ω ..... 0.2 + 3
2 through 200 kΩ ..... 0.1 + 1
2 MΩ ..... .15 + 1
20 MΩ ..... 2.0 + 1</td></tr>
</table>

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications (3 1/2 digit display)
Dc current	Range: 0 to 10 A (in 6 ranges) Accuracy: ± (% of reading + digits) Range: 200 µA to 2A ..... .75 + 1 10 A ..... 1.5 + 1
Ac current [1]	Range: 0 to 10 A (in 6 ranges) Accuracy: ±(% of reading + digits)

Range	Frequency	
	45 to 450 Hz	450 Hz to 1 kHz
200 µA through 2 A	1.5 + 2	1.5 + 2
10 A	3.0 + 2	5.0 + 3

[1]Ac current verified during dc current check since same shunt resistors are utilized for both functions.

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 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 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	Dc voltage: Range: -190 mV to 1000 V Accuracy: ± (%) 190 mV to 190 V ..... .039 1000 V ..... .050 Ac voltage: Range: 190 mV to 750 V Frequency: 40 Hz to 5 kHz Accuracy: ±(%) Frequency — Voltage 40 Hz and 1.0 kHz — 190 mV through 190 V ..... 0.211 2.0 kHz — 190 mV through 190 V ..... 0.421 5.0 kHz — 190 mV through 19 V ..... 1.316 50 Hz and 1.0 kHz — 750 V 0.333	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)

Table 2. Minimum Specifications of Equipment Required - Continued

Common name	Minimum use specifications	Manufacturer, and model (part number)
CALIBRATOR (continued)	Resistance: Range: 190 Ω to 19 MΩ Accuracy: ± (%) 190Ω ..... .089 1.9 through 190Ω ..... .038 1.9 MΩ ..... .051 19 MΩ ..... .513 Dc current: Range: 190 µA to 10 A	

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 results of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Additional maintenance information is contained in the manufacturer's manual for this TI.

d. 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 bottom cover from TI only to make adjustments and replace upon completion.

b. Set **POWER** switch to **ON**.

c. Set **PEAK HOLD** switch to **OFF**.

8. Dc Voltage

a. Performance Check

(1) Connect calibrator **OUTPUT** terminals to TI **V-**W and **COM** terminals and set TI function/range dial to **DCV 2**.

(2) Set TI function/range dial and calibrator output as specified in table 3. If TI does not indicate within the specified limits, perform **b** below.

b. Adjustments. Set TI function/range dial to **DCV 200m** and calibrator for a 190 mV dc output. Adjust VR1 DC 200 mV (fig. 1) for a TI indication of 190.0 mV (R).

Table 3. Dc Voltage

Test instrument function/range dial (DCV)	Calibrator output (V dc)	Test instrument	
		Min	Max
2	1.9	1.897	1.903
200m	.19	189.7	190.3
200m	-.19	-189.7	-190.3
20	19	18.97	19.03
200	190	189.7	190.3
1000	1000	998	1002

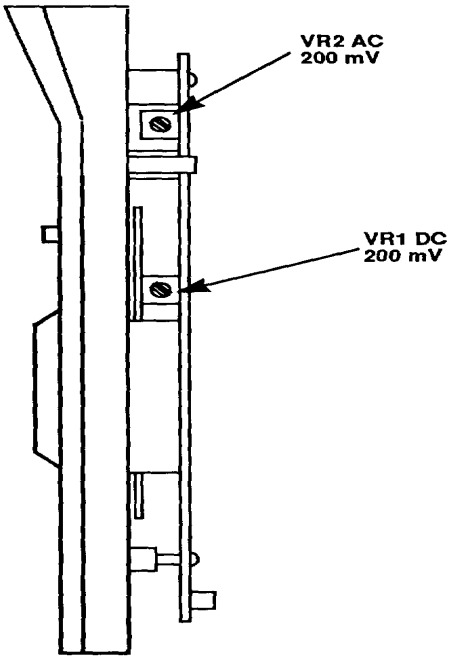

Figure 1. Adjustment locations.

9. Ac Voltage

a. Performance Check

(1) Ensure calibrator **OUTPUT** terminals are connected to TI **V-**W and **COM** terminals and set TI function/range dial to **ACV 2.**

(2) Set TI function/range dial and calibrator for voltages and frequencies listed in table 4. TI will indicate within the specified limits; if not, perform **b** below.

b. Adjustments. Set TI function/range dial to ACV 200m and calibrator for a 190 mV, 400 Hz output. Adjust VR2 AC 200 mV (fig. 1) for a TI indication of 190.0 mV (R).

Table 4. Ac Voltage

Test instrument function/range dial (ACV)	Calibrator output		Test instrument indications	
	Voltage	Frequency	Min	Max
200 M	190 mV	40 Hz	188.4	191.6
200 M	190 mV	1.0 kHz	188.4	191.6
200 M	190 mV	2.0 kHz	186.8	193.2
200 M	190 mV	5.0 Hz	180.0	199.9
2	1.9 V	40 Hz	1.884	1.916
2	1.9 V	1.0 kHz	1.884	1.916
2	1.9 V	2.0 kHz	1.868	1.932
2	1.9 V	5.0 kHz	1.800	1.999
20	19 V	40 Hz	18.84	19.16
20	19 V	1.0 kHz	18.84	19.16
20	19 V	2.0 kHz	18.68	19.32
20	19 V	5.0 kHz	18.00	19.99
200	190 V	40 Hz	188.4	191.6
200	190 V	1.0 kHz	188.4	191.6
200	190 V	2.0 kHz	186.8	193.2
750	750 V	50 Hz	740	760
750	750 V	1.0 kHz	740	760

10. Dc Current

a. Performance Check

(1) Connect calibrator **OUTPUT** terminals to TI **A** and **COM** terminals.

(2) Set TI function/range dial to **DCA 200**m.

(3) Set calibrator **OUTPUT** for 190 μA. Digital multimeter will indicate between 188.5 and 191.5

(4) Repeat technique of steps (2) and (3) above using settings and indications listed in table 5. TI display will indicate within limits specified in table 5.

Table 5. Dc Current

Test instrument function/range dial (DCA) settings	Calibrator initial output	Test instrument display indications	
		Min	Max
2 m	1.9 mA	1.885	1.915
20 m	19 mA	18.85	19.15
200 m	190 mA	188.5	191.5
2	1.9 A	1.885	1.915
10 A[1]	9 A	8.85	9.15

[1]Move TI input lead from A to 10A terminal and move test leads located at calibrator **OUTPUT** terminals to boost amplifier HI and LO terminals.

b. Adjustments. No adjustments can be made.

11. Resistance

a. Performance Check

(1) Connect calibrator **OUTPUT** terminals to TI **V-**Ω and **COM** terminals and set TI function/range dial to Ω **20 M**.

(2) Set TI function/range dial and calibrator to the nominal resistance outputs as listed in table 6. At each resistance output, 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 function/range dial (Ω)	Calibrator output nominal value	Calibrator **ERROR** display indication ±(%)
20 MΩ	19 MΩ	2.05
2 MΩ	1.9 MΩ	.203
200 kΩ	190 kΩ	.153
20 kΩ	19 kΩ	.153
2 kΩ	1.9 kΩ	.153
200 Ω	190 Ω	.358

b. Adjustments. No adjustments can be made.

12. 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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