*TB 9-6625-2119-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR MULTIMETER, AN/USM-451 (BALLANTINE, MODEL 9632M)

Headquarters, Department of the Army, Washington, DC
21 May 2004

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, US Army Aviation and Missile Command, AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our fax number is DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual. For the World Wide Web, use https://amcom2028.redstone.army.mil.

*This bulletin supersedes TB 9-6625-2119-35, dated 8 June 1988, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Multimeter, AN/USM-451 (Ballantine, Model 9632M). The manufacturer's manual and TM 11-6625-2953-14 were used as the prime data sources in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Some of the earlier models have a twist wire capacitor instead of a screw type for the 200 V ac frequency compensation adjustment C52 and the 2 V ac frequency compensation adjustment C50.

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

Test instrument parameters	Performance specifications
Dc voltage	Range: 0 to +1000 V in 5 ranges Accuracy: ±(0.2% of reading +1 LSD)
Ac voltage	Range: 0 to 1000 V in 5 ranges Accuracy: 200 mV, 2, 20, and 200 V ranges, 40 to 420 Hz ± (0.5% of reading +5 LSD); 200 mV, 2, 20, and 200 V ranges, 420 Hz to 1 kHz ±(2% of reading +5 LSD); 200 mV, 2, 20, and 200 V ranges, 420 Hz to 10 kHz ±(1% of reading +5 LSD); 1000 V range, 40 to 420 Hz ± (2% of reading +5 LSD), 420 Hz to 1 kHz; ± (3.75% of reading +5 LSD)
Dc current	Range: 0 to 10 A in 6 ranges Accuracy: 200 μA range, ±(1% of reading +1 LSD); 2, 20, 200, 2000 mA and 10 A ranges, ±(0.75% of reading +1 LSD)
Ac current[1]	Range: 0 to 10 A in 6 ranges Accuracy: 200 μA range, 40 to 420 Hz +(3.5% of reading +5 LSD), 420 Hz to 1 kHz ±(5% of reading +5 LSD); 2,20, 200, 2000 mA and 10 A ranges, 40 to 420 Hz ±(1.5% of reading +5 LSD), 420 Hz to 1 kHz ±(4% of reading +5 LSC)
Resistance	Range: 0 to 20 MΩ in 6 ranges Accuracy: 200 Ω, 2 Ω, 20 Ω, 200 Ω, and 2000 kΩ ranges ± (0.5% of reading +1 LSD); 20 MΩ range, ± (1% of reading +2 LSD)

[1]Ac current verified when dc current and ac voltage checks are performed.

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; AN/GSM-287; and AN/GSM-705. 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: ±0.066% Ac voltage: Range: 190 mV to 1000 V Frequency: 40 Hz to 10 kHz Accuracy: ±0.196% Dc current: Range: 190 μA to 10 A Accuracy: ±0.196% Resistance: Range: 190 Ω to 10 MΩ Accuracy: ± .144%	Fluke, Model 5720A (5700A/EP) (p/o MIS-35947), w/amplifier, Fluke, 5725A/AR (5725A/AR)

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 and TM 11-6625 2953-14 for this TI.

d. When indications specified in paragraphs **8** through **11** are not within tolerance, perform the battery zero check prior to making adjustments. After adjustments are made, repeat paragraphs **8** through **11**. Do not perform battery zero 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. Position controls as listed in (1) through (4) below:

(1) **POWER ON/OFF** pushbutton pressed to **ON**.

(2) **AC/DC** mode pushbutton released to **DC**.

(3) **V** mode pushbutton pressed.

(4) Range **200 m** pushbutton pressed.

b. Short TI **V-Ω** and **COMMON** inputs. Display will indicate 00.0 ±2 counts.

c. Remove short.

8. Dc Voltage

a. Performance Check

(1) Connect TI **V-Ω** to calibrator **OUTPUT HI** and TI **COMMON** to calibrator **OUTPUT LO**.

(2) Set calibrator for an output amplitude of 190 mV dc. If TI does not indicate within limits specified in first row of table 3, perform **b** below.

(3) Repeat technique of (2) above, using calibrator outputs and TI range settings listed in table 3. TI will indicate within limits specified in table 3.

Table 3. Dc Voltage

Calibrator	Test instrument		
	Range	Indication limits (V dc)	
Output	setting	Min	Max
190 mV	200 m	189.5	190.5
1.9 V	2	1.895	1.905
19 V	20	18.95	19.05
190 V	200	189.5	190.5
1000 V	1000	997	1003

(4) Set calibrator output to minimum.

b. Adjustments. Set calibrator for an output of 0.1900 V and adjust 190 mV DC CAL ADJ R10 (fig. 1) until TI indicates 190.0 (R).

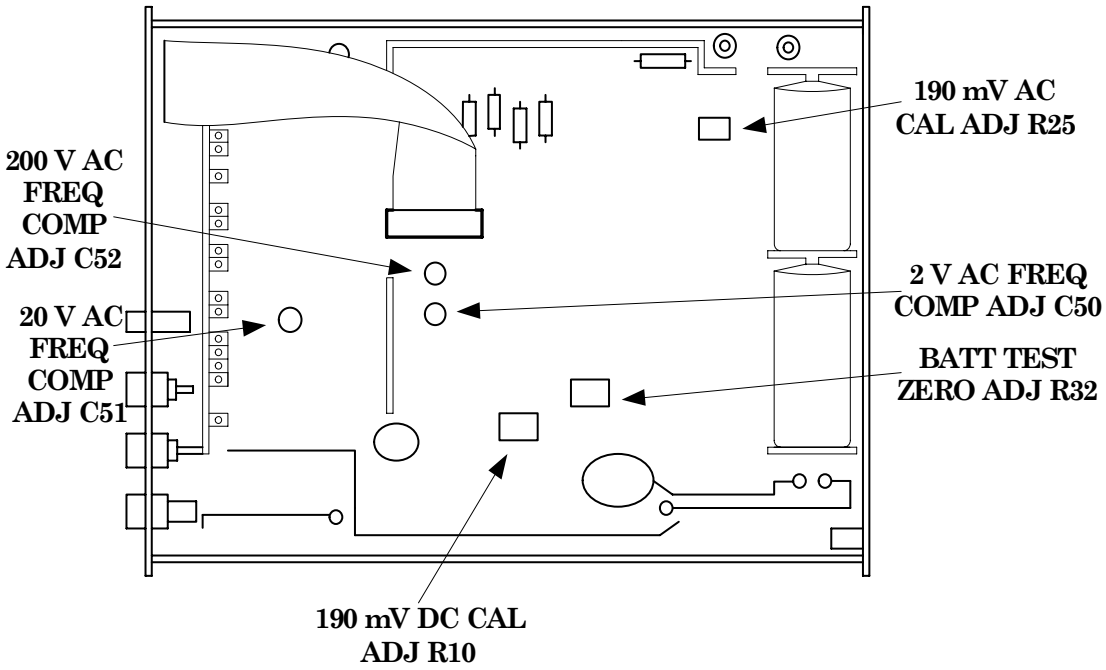

Figure 1. Test instrument - top view.

9. Ac Voltage

a. Performance Check

(1) Press **AC/DC** mode pushbutton to **AC** (in) and range **200 m** pushbutton (in).

(2) Set calibrator for an output amplitude of 190 mV at an output frequency of 40 Hz. If TI does not indicate within limits specified in first row of table 4, perform corresponding adjustment in table 4.

(3) Repeat technique of (1) and (2) above, for calibrator outputs, TI settings and indications listed in table 4. If TI does not indicate within limits specified in table 4, perform corresponding adjustments in table 4.

Table 4. Ac Voltage

Calibrator		Test instrument			Adjustments
Output amplitude	Output frequency	Range	Indication limits Min	Indication limits Max	
190 mV	40 Hz	200 m	188.5 mV	191.5 mV	**b** (1) and (2)
190 mV	1 kHz	200 m	185.7 mV	194.3 mV	– – – – –
190 mV	10 kHz	200 m	187.6 mV	192.4 mV	– – – – –
1.9 V	40 Hz	2	1.885 V	1.915 V	– – – – –
1.9 V	10 kHz	2	1.876 V	1.924 V	**b** (3) and (4)
19 V	40 Hz	20	18.85 V	19.15 V	– – – – –

Table 4. Ac Voltage - Continued

Calibrator		Test instrument			Adjustments
Output amplitude	Output frequency	Range	Indication limits Min	Indication limits Max	
19 V	10 kHz	20	18.76 V	19.24 V	**b** (5) and (6)
190 V	40 Hz	200	188.5 V	191.5 V	– – – – –
190 V	10 kHz	200	187.6 V	192.4 V	**b** (7) and (8)
1000 V	40 Hz	1000	975 V	1025 V	– – – – –
1000 V	1 kHz	1000	957 V	1043 V	– – – – –

(4) Set calibrator output to minimum.

b. Adjustments

(1) Set calibrator for an output amplitude of 190.00 mV and an output frequency of 94 Hz.

(2) Adjust 190 mV AC CAL ADJ R25 (fig. 1) until TI indicates 190.0 (R).

(3) Set calibrator for an output amplitude of 1.9 V and an output frequency of 5 kHz.

(4) Adjust 2 V AC FREQ COMP ADJ C50 (fig. 1) until TI indicates 1.900 (twist the Teflon pair tighter to increase capacitance or incrementally cut twisted pair to reduce capacitance (R).

(5) Set calibrator for an output amplitude of 19 V and an output frequency of 5 kHz.

(6) Adjust 20 V AC FREQ COMP ADJ C51 (fig. 1) until TI indicates 19.00 (R).

(7) Set calibrator for an output amplitude of 190 V and an output frequency of 5 kHz.

(8) Adjust 200 V AC FREQ COMP ADJ C52 (fig. 1) (twist the Teflon pair tighter to increase capacitance or incrementally cut the twisted pair to reduce the capacitance) until TI indicates 190.0 (R).

10. Dc Current

a. Performance Check

(1) Connect TI **A** to calibrator **OUTPUT HI** and TI **COMMON** to calibrator **OUTPUT LO**.

(2) Position controls as listed in (a) through (c) below:

(a) **AC/DC** mode pushbutton released to **DC**.
(b) Range **200 μ** pushbutton pressed.
(c) **A** mode pushbutton pressed.

(3) Set calibrator for an output of 190 mA. TI will indicate within limits specified in first row of table 5.

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

Table 5. Dc Current

Calibrator	Test instrument		
	Range	Indication limits	
Output	setting (MA)	Min	Max
190 μA	200 μ	188.5	191.5
1.9 mA	2 m	1.885	1.915
19 mA	20 m	18.85	19.15
190 mA	200 m	188.5	191.5
1.9 A	2000 m	1885	1915
10 A	10 A[1]	9.991	10.09

[1] Reduce calibrator output to minimum, disconnect leads from TI **A** and **COMMON** and connect to TI **10 A** and **10 A LO** respectively.

(5) Set calibrator output to minimum.

b. Adjustments. No adjustments can be made.

11. Resistance

a. Performance Check

(1) Connect TI **V-Ω** to calibrator **OUTPUT HI** and TI **COMMON** to calibrator **OUTPUT LO**.

(2) Press **Ω** mode pushbutton and range **200** pushbutton.

(3) Set calibrator for a 190 Ω nominal output.

(4) Rotate calibrator knob below **EDIT FIELD** pushbutton to adjust calibrator display indication to equal TI indication. Calibrator **err** display will indicate within limits specified in first row of table 6.

(5) Repeat technique of (2) through (4) above, using outputs and settings listed in table 6. Calibrator **err** display will indicate within limits specified in table 6.

Table 6. Resistance

Test instrument	Calibrator	
Range pushbutton settings	Nominal output (Ω)	**err** display Indication ±(%)
200	190	.576
2 k	1.9 k	.576
20 k	19 k	.576
200 k	190 k	.576
2000 k	1.9 M	.576
20 M	19 M	1.186

b. Adjustments. No adjustments can be made.

12. Battery Zero

a. Performance Check

(1) Remove batteries from TI.

(2) Connect calibrator **OUTPUT HI** to (+) terminal of battery compartment and calibrator **OUTPUT LO** to (–) terminal of battery compartment.

(3) Set calibrator for a 2.2 V output.

(4) Position controls as listed in (a) through (c) below:

(a) **POWER ON/OFF** pushbutton pressed to **ON**.

(b) **AC/DC** mode pushbutton released to **DC**.

(c) **A** and **V** mode pushbuttons pressed to **BAT** (**A** and **V** pressed simultaneously). If TI does not indicate 0.000 ±3 LSD, perform **b** (1) below.

(5) Disconnect calibrator and reinstall batteries. If TI display indicates negative, perform **b** (2) below.

(6) Release **POWER ON/OFF** pushbutton to **OFF**.

b. Adjustments

(1) Adjust BATT TEST ZERO ADJ R32 (fig. 1) for a 0.000 indication on TI display.

(2) Install new batteries.

13. Final Procedure

a. Deenergize and disconnect all equipment.

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

By Order of the Secretary of the Army:

Official:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

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Administrative Assistant to the
Secretary of the Army

0408902

Distribution:
To be distributed in accordance with the initial distribution number (IDN) 343064, requirements for calibration procedure TB 9-6625-2119-35.

Instructions for Submitting an Electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" whomever@redstone.army.mil
To: <2028@redstone.army.mil

Subject: DA Form 2028

1. **From**: Joe Smith
2. Unit: home
3. **Address**: 4300 Park
4. **City**: Hometown
5. **St**: MO
6. **Zip**: 77777
7. **Date Sent**: 19-OCT –93
8. **Pub no:** 55-2840-229-23
9. **Pub Title**: TM
10. **Publication Date**: 04-JUL-85
11. Change Number: 7
12. Submitter Rank: MSG
13. **Submitter FName**: Joe
14. Submitter MName: T
15. **Submitter LName**: Smith
16. **Submitter Phone**: 123-123-1234
17. **Problem**: 1
18. Page: 2
19. Paragraph: 3
20. Line: 4
21. NSN: 5
22. Reference: 6
23. Figure: 7
24. Table: 8
25. Item: 9
26. Total: 123
27. **Text**

This is the text for the problem below line 27.