

*TB 9-6625-2267-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DIGITAL MULTIMETER, ME-518/U (FLUKE, MODEL 8600A-01) AND FLUKE, MODEL 8600A

Headquarters, Department of the Army, Washington, DC
12 December 2007

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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, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. 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. For the World Wide Web use: <https://amcom2028.redstone.army.mil>. Instructions for sending an electronic 2028 can be found at the back of this manual.

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*This bulletin supersedes TB 9-6625-2267-35, dated 27 September 2002.

**SECTION I
IDENTIFICATION AND DESCRIPTION**

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Digital Multimeter, ME-518/U (Fluke, Model 8600A-01) and Fluke, Model 8600A. The manufacturers' manuals 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. Model ME-518/U (Fluke, Model 8600A-01) has rechargeable batteries; otherwise, models are the same.

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. 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 Accuracy: \pm (% of reading + % of range) 4 1/2 digits (1999.9 maximum display)																																									
Dc voltage	Range: 0 to 1200 V (in 5 ranges) Accuracy: <table border="1" style="margin-left: 40px;"> <thead> <tr> <th style="text-align: center;">Range</th> <th style="text-align: center;">Accuracy</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">200 mV</td> <td style="text-align: center;">0.04 + 0.010</td> </tr> <tr> <td style="text-align: center;">2, 20, and 200 V</td> <td style="text-align: center;">0.02 + 0.005</td> </tr> <tr> <td style="text-align: center;">1200</td> <td style="text-align: center;">0.02 + 0.008</td> </tr> </tbody> </table>	Range	Accuracy	200 mV	0.04 + 0.010	2, 20, and 200 V	0.02 + 0.005	1200	0.02 + 0.008																																	
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See footnotes at end of table.

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications Accuracy: ± (% of reading + % of range) 4 1/2 digits (1999.9 maximum display)																				
Ac current ²	Range: 0 to 2000 mA (in 5 ranges) Frequency: 30 Hz to 10 kHz Accuracy: <table border="1" data-bbox="492 443 1252 598"> <thead> <tr> <th data-bbox="492 443 703 506">Range</th> <th colspan="4" data-bbox="703 443 1252 478">Frequency</th> </tr> <tr> <th data-bbox="492 478 703 506"></th> <th data-bbox="703 478 833 506">30 Hz</th> <th data-bbox="833 478 881 506">50 Hz</th> <th data-bbox="881 478 1011 506">5 kHz</th> <th data-bbox="1011 478 1252 506">10 kHz</th> </tr> </thead> <tbody> <tr> <td data-bbox="492 506 703 562">200 µA through 200 mA</td> <td data-bbox="703 506 833 562">0.6 + 0.1</td> <td colspan="3" data-bbox="881 506 1252 562">0.3 + .08</td> </tr> <tr> <td data-bbox="492 562 703 598">2000 mA</td> <td colspan="3" data-bbox="703 562 1011 598"></td> <td data-bbox="1011 562 1252 598">N/A</td> </tr> </tbody> </table>	Range	Frequency					30 Hz	50 Hz	5 kHz	10 kHz	200 µA through 200 mA	0.6 + 0.1	0.3 + .08			2000 mA				N/A
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Resistance	Range: 0 to 20 MΩ (in 6 ranges) Accuracy: Range: <table data-bbox="621 835 1138 951"> <tbody> <tr> <td data-bbox="621 835 946 863">200 Ω</td> <td data-bbox="987 835 1138 863">0.1 + 0.015</td> </tr> <tr> <td data-bbox="621 863 946 890">2 kΩ</td> <td data-bbox="987 863 1138 890">0.1 + 0.005</td> </tr> <tr> <td data-bbox="621 890 946 917">20, 200, and 2000 kΩ</td> <td data-bbox="987 890 1138 917">0.05 + 0.005</td> </tr> <tr> <td data-bbox="621 917 946 945">20 MΩ</td> <td data-bbox="987 917 1138 945">0.2 + 0.005</td> </tr> </tbody> </table>	200 Ω	0.1 + 0.015	2 kΩ	0.1 + 0.005	20, 200, and 2000 kΩ	0.05 + 0.005	20 MΩ	0.2 + 0.005												
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¹Volts/hertz product not to exceed 2 x 10⁷.

²Ac current verified during dc current check since same shunt resistors are utilized for both checks.

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; or 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. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

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	<p>Dc voltage range: -190 mV to 1000 V</p> <p>Voltage: Accuracy: ± (%)</p> <table border="0"> <tr> <td>±190 mV</td> <td>0.013</td> </tr> <tr> <td>-1.9 to 190 V</td> <td>0.0066</td> </tr> <tr> <td>1000 V</td> <td>0.0075</td> </tr> </table> <p>Ac voltage:</p> <p>Range: 190 mV to 1000 V</p> <p>Frequency: 30 Hz to 100 kHz</p> <p>Accuracy: ± (%)</p> <table border="1"> <thead> <tr> <th data-bbox="397 619 576 672">Voltage</th> <th colspan="5" data-bbox="576 619 1104 651">Frequency (kHz)</th> </tr> <tr> <td></td> <th data-bbox="576 651 682 672">0.030</th> <th data-bbox="682 651 787 672">5.0</th> <th data-bbox="787 651 893 672">0.040/20</th> <th data-bbox="893 651 998 672">50</th> <th data-bbox="998 651 1104 672">100</th> </tr> </thead> <tbody> <tr> <td data-bbox="397 672 576 703">190 mV</td> <td data-bbox="576 672 682 703">0.151</td> <td data-bbox="682 672 787 703">0.071</td> <td data-bbox="787 672 893 703">N/A</td> <td data-bbox="893 672 998 703">0.151</td> <td data-bbox="998 672 1104 703">0.257</td> </tr> <tr> <td data-bbox="397 703 576 766">1.9 V through 190 V</td> <td data-bbox="576 703 682 766">0.132</td> <td data-bbox="682 703 787 766">0.0541</td> <td data-bbox="787 703 893 766">N/A</td> <td data-bbox="893 703 998 766">0.132</td> <td data-bbox="998 703 1104 766">0.263</td> </tr> <tr> <td data-bbox="397 766 576 798">400 V</td> <td data-bbox="576 766 682 798">N/A</td> <td data-bbox="682 766 787 798">0.075</td> <td data-bbox="787 766 893 798">N/A</td> <td data-bbox="893 766 998 798">N/A</td> <td data-bbox="998 766 1104 798">N/A</td> </tr> <tr> <td data-bbox="397 798 576 829">1000 V</td> <td data-bbox="576 798 682 829">N/A</td> <td data-bbox="682 798 787 829">0.102</td> <td data-bbox="787 798 893 829">0.150</td> <td data-bbox="893 798 998 829">N/A</td> <td data-bbox="998 798 1104 829">N/A</td> </tr> </tbody> </table> <p>Dc current range: 190 µA to 1.9 A</p> <p>Current: Accuracy: ± (%)</p> <table border="0"> <tr> <td>190 µA to 190 mA</td> <td>0.028</td> </tr> <tr> <td>1.9 A</td> <td>0.053</td> </tr> </table> <p>Resistance range: 100 Ω to 10 MΩ</p> <p>Resistance: Accuracy: ± (%)</p> <table border="0"> <tr> <td>100 Ω</td> <td>0.0325</td> </tr> <tr> <td>1.0 kΩ</td> <td>0.0275</td> </tr> <tr> <td>10, 100, and 1000 kΩ</td> <td>0.0150</td> </tr> <tr> <td>10 MΩ</td> <td>0.0525</td> </tr> </table>	±190 mV	0.013	-1.9 to 190 V	0.0066	1000 V	0.0075	Voltage	Frequency (kHz)						0.030	5.0	0.040/20	50	100	190 mV	0.151	0.071	N/A	0.151	0.257	1.9 V through 190 V	0.132	0.0541	N/A	0.132	0.263	400 V	N/A	0.075	N/A	N/A	N/A	1000 V	N/A	0.102	0.150	N/A	N/A	190 µA to 190 mA	0.028	1.9 A	0.053	100 Ω	0.0325	1.0 kΩ	0.0275	10, 100, and 1000 kΩ	0.0150	10 MΩ	0.0525	Fluke, Model 5720A (5720A) (p/o MIS-35947); w amplifier, Fluke 5725A/AR (5725A/AR)
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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. 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. 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 protective cover from TI only to make adjustments and replace upon completion.
- b. Connect TI to a 115 V ac source.
- c. Press **POWER ON/OFF** pushbutton to **ON** and allow at least 15 minutes for stabilization.

8. Dc Voltage

a. Performance Check

- (1) Connect calibrator **OUTPUT HI** and **LO** to TI **INPUT V-Ω** and **LO**.
- (2) Press TI **FUNCTION DCV** pushbutton.
- (3) Press TI **RANGE** pushbuttons and set calibrator output for settings listed in table 3. If TI indications are not within limits specified, perform **b** below.

Table 3. Dc Voltage

Test instrument RANGE pushbuttons	Calibrator output settings	Test instrument indications	
		Min	Max
200 mV	190 mV	+189.90 mV	+190.10 mV
200 mV	-190 mV	-189.90 mV	-190.10 mV
2 V	1.9 V	+1.8995 V	+1.9005 V
2 V	-1.9 V	-1.8995 V	-1.9005 V
20 V	19 V	+18.995 V	+19.005 V
20 V	-19 V	-18.995 V	-19.005 V
200 V	190 V	+189.95 V	+190.05 V
1200 V	1000 V	+999.7 V	+1000.3 V

b. Adjustments

- (1) Set calibrator for a 1 MΩ output.
- (2) Press TI **RANGE 200mV** pushbutton.
- (3) Adjust C24 (fig. 1) until TI indicates between -00.01 and +00.01.
- (4) Set calibrator for a 190 mV dc output. Record TI indication.
- (5) Set calibrator for a -190 mV dc output. Adjust C30 (fig. 1) until TI indication is within ± 1 digit of indication recorded in (4) above. (R)
- (6) Repeat (1) through (5) above until no further adjustments are required.

- (7) Press **RANGE 2** pushbutton.
- (8) Set calibrator for a 1.9 V dc output. Adjust R57 (fig. 1) until TI indicates $+1.9000 \pm 1$ digit. (R)
- (9) Set calibrator for a -1.9 V dc output. Adjust R57 (fig. 1) until TI indicates -1.9000 ± 1 digit.
- (10) Repeat (8) and (9) above until no further adjustments are required.
- (11) Press **RANGE 20** pushbutton.
- (12) Set calibrator for a 19 V dc output. Adjust R4 (fig. 1) until TI indicates $+19.000 \pm 1$ digit. (R)
- (13) Set calibrator for a -19 V dc output. Adjust R4 (fig. 1) until TI indicates -19.000 ± 1 digit.
- (14) Repeat (12) and (13) above until no further adjustments are required.
- (15) Press **RANGE 200** pushbutton.
- (16) Set calibrator for a 190 V dc output. Adjust R6 (fig. 1) until TI indicates $+190.00 \pm 1$ digit. (R)
- (17) Press **RANGE 1200V** pushbutton.
- (18) Set calibrator for a 1000 V dc output. Adjust R8 (fig. 1) until TI indicates $+1000.0 \pm 1$ digit. (R)

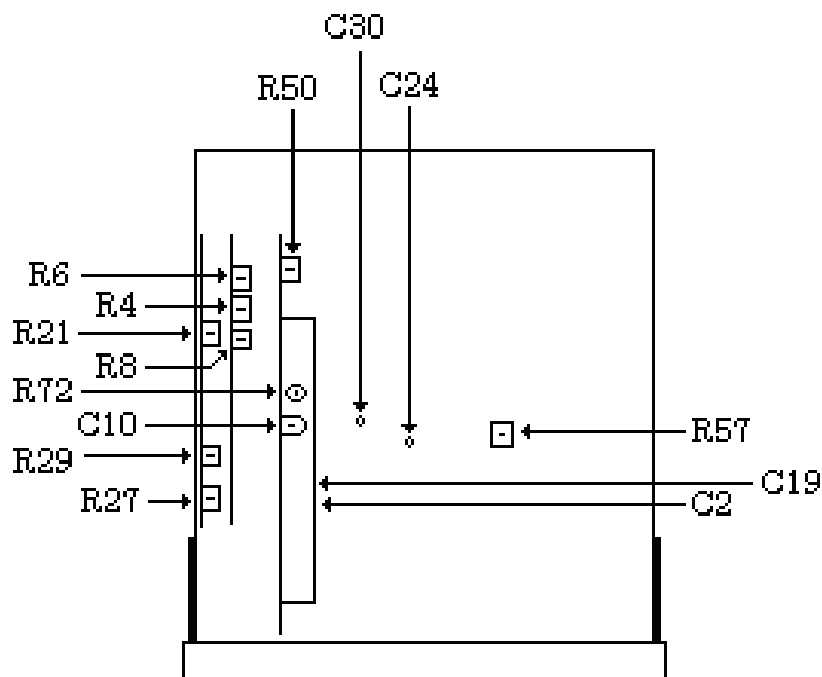


Figure 1. Test instrument – top view.

9. Resistance

a. Performance Check

- (1) Connect calibrator **OUTPUT HI** and **SENSE HI** to **TI INPUT V-Ω**.
- (2) Connect calibrator **OUTPUT LO** and **SENSE LO** to **TI INPUT LO**.
- (3) Press **TI FUNCTION kΩ** and **RANGE AUTO** pushbuttons.
- (4) Set calibrator for a 0 Ω output, **EX SNS** on and **2 wire Comp** on. If TI does not indicate between 00.00 and 00.03, perform **b** below.
- (5) Set calibrator output for settings listed in table 4. At each output setting, use calibrator output adjustment controls to set calibrator control display **Reading** equal to TI indication. If calibrator control display **Error** indications are not within limits specified, perform **b** below.

Table 4. Resistance

Calibrator		Control display Error indications ±(%)
Output settings ¹		
100	Ω	0.13
1	kΩ	0.11
10	kΩ	0.06
100	kΩ	0.06
1	MΩ	0.06
10	MΩ	0.21

¹Set calibrator **EX SNS** off and **2 wire Comp** off above 10 kΩ.

b. Adjustments

- (1) Press **TI RANGE 2000kΩ** pushbutton.
- (2) Set calibrator **EX SNS** off, **2 wire Comp** off and output to 1 MΩ. Adjust R21 (fig. 1) until TI indication is within ±1 digit of calibrator output display indication rounded to TI digits of resolution. (R)
- (3) Press **TI RANGE 2** pushbutton.
- (4) Set calibrator for a 1 kΩ output, **EX SNS** on and **2 wire Comp** on. Adjust R27 (fig. 1) until TI indication is within ±1 digit of calibrator output display indication rounded to TI digits of resolution. (R)
- (5) Press **TI RANGE 20MΩ** pushbutton.
- (6) Set calibrator **EX SNS** off, **2 wire Comp** off and output to 10 MΩ. Adjust R29 (fig. 1) until TI indication is within ±1 digit of calibrator output display indication rounded to TI digits of resolution. (R)

10. AC Voltage

a. Performance Check

- (1) Connect calibrator **OUTPUT HI** and **LO** to **TI INPUT V-Ω** and **LO**.
- (2) Press **FUNCTION ACV** pushbutton.
- (3) Press **TI RANGE** pushbuttons and set calibrator output for settings listed in table 5. If TI indications are not within limits specified, perform **b** below.

Table 5. Ac Voltage

Test instrument RANGE pushbuttons	Calibrator output settings		Test instrument indications	
	Voltage	Frequency	Min	Max
200 mV	190 mV	30 Hz	188.85 mV	191.15 mV
200 mV	190 mV	5 kHz	189.46 mV	190.54 mV
200 mV	190 mV	50 kHz	188.85 mV	191.15 mV
200 mV	190 mV	100 kHz	188.05 mV	191.95 mV
2	1.9 V	30 Hz	1.8900 V	1.9100 V
2	1.9 V	500 Hz	1.8959 V	1.9041 V
2	1.9 V	5 kHz	1.8959 V	1.9041 V
2	1.9 V	50 kHz	1.8900 V	1.9100 V
2	1.9 V	100 kHz	1.8800 V	1.9200 V
20	19 V	30 Hz	18.900 V	19.100 V
20	19 V	5 kHz	18.959 V	19.041 V
20	19 V	50 kHz	18.900 V	19.100 V
20	19 V	100 kHz	18.800 V	19.200 V
200	190 V	30 Hz	189.00 V	191.00 V
200	190 V	5 kHz	189.59 V	190.41 V
200	190 V	50 kHz	189.00 V	191.00 V
200	190 V	100 kHz	188.00 V	192.00 V
1200 V	400 V	5 kHz	398.8 V	401.2 V
1200 V	1000 V	40 Hz	994.0 V	1006.0 V
1200 V	1000 V	5 kHz	995.9 V	1004.1 V
1200 V	1000 V	20 kHz	994.0 V	1006.0 V

b. Adjustments

- (1) Set calibrator to **STANDBY**.
- (2) Press **RANGE 1200V** pushbutton.
- (3) Simultaneously press **FUNCTION AC MA** and **DCV** pushbuttons. Adjust R72 (fig. 1) until TI indicates between -20 and -30.
- (4) Press **FUNCTION ACV** and **RANGE 2** pushbuttons.
- (5) Set calibrator for a 1.9 V, 500 Hz output. Adjust R50 (fig. 1) until TI indicates 1.9000 ±5 digits (R).
- (6) Press **RANGE 200** pushbutton.
- (7) Set calibrator for a 190 V, 50 kHz output. Adjust C2 (fig. 1) until TI indicates 190.00 ±5 digits (R).

- (8) Set calibrator for a 1.9 V, 50 kHz output.
- (9) Press **RANGE 2** pushbutton. Adjust C19 (fig. 1) until TI indicates 1.9000 ±5 digits. (R)
- (10) Repeat (6) through (9) above until no further adjustments are required.
- (11) Press **RANGE 20** pushbutton.
- (12) Set calibrator for a 19 V, 50 kHz output. Adjust C10 (fig. 1) until TI indicates 19.000 ±10 digits. (R)

11. Dc Current

a. Performance Check

- (1) Connect calibrator **OUTPUT HI** and **LO** to **TI INPUT MA** and **LO**.
- (2) Press **TI FUNCTION DC MA**.
- (3) Press **TI RANGE** pushbuttons and set calibrator output for settings listed in table 6. TI will indicate within limits specified.

Table 6. Dc Current

Test instrument RANGE pushbuttons	Calibrator output settings	Test instrument indications	
		Min	Max
200 μA	190 μA	189.79 μA	190.21 μA
2	1.9 mA	1.8979 mA	1.9021 mA
20	19 mA	18.979 mA	19.021 mA
200	190 mA	189.79 mA	190.21 mA
2000 mA	1.9 A	1896 mA	1904 mA

- 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.

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:



JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army

0728904

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 344418, requirements for calibration procedure TB 9-6625-2267-24.

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.

