

***TB 9-6625-2267-35**

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

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

Headquarters, Department of the Army, Washington, DC
27 September 2002

Approved for public release; distribution is unlimited

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, 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 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 bulletin. For the World Wide Web, use: <https://amcom2028.redstone.army.mil>.

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**SECTION I
IDENTIFICATION AND DESCRIPTION**

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Digital Multimeter, ME-518/U (John Fluke, Model 8600A-01) and John Fluke, Model 8600A. The manufacturer’s 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 (John 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. 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: ± (% 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; border-collapse: collapse; width: 60%;"> <thead> <tr> <th style="width: 50%;">Range</th> <th style="width: 50%;">Accuracy</th> </tr> </thead> <tbody> <tr> <td>200 mV</td> <td>.04 + .010</td> </tr> <tr> <td>2, 20, and 200 V</td> <td>.02 + .005</td> </tr> <tr> <td>1200</td> <td>.02 + .008</td> </tr> </tbody> </table>	Range	Accuracy	200 mV	.04 + .010	2, 20, and 200 V	.02 + .005	1200	.02 + .008																																	
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200 mV	.04 + .010																																									
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Ac voltage	Range: 0 to 1200 V (in 5 ranges) Frequency: 30 Hz to 100 kHz ¹ Accuracy: <table border="1" style="margin-left: 40px; border-collapse: collapse; width: 80%;"> <thead> <tr> <th rowspan="2" style="width: 20%;">Range</th> <th colspan="6" style="text-align: center;">Frequency</th> </tr> <tr> <th style="width: 10%;">30 Hz</th> <th style="width: 10%;">50 Hz</th> <th style="width: 10%;">10 kHz</th> <th style="width: 10%;">20 kHz</th> <th style="width: 10%;">50 kHz</th> <th style="width: 10%;">100 Hz</th> </tr> </thead> <tbody> <tr> <td>200 mV</td> <td>.5 + .1</td> <td>.2 + .08</td> <td colspan="2" style="text-align: center;">.5 + .1</td> <td colspan="2" style="text-align: center;">.5 + .5</td> </tr> <tr> <td>2 V through 200 V</td> <td>.5 + .025</td> <td>.2 + .015</td> <td colspan="2" style="text-align: center;">.5 + .025</td> <td colspan="2" style="text-align: center;">1 + .05</td> </tr> <tr> <td>1200 V: 10 to 500 V</td> <td>.5 + .08</td> <td>.2 + .03</td> <td>.5 + .08</td> <td colspan="3" style="text-align: center;">Not specified</td> </tr> <tr> <td>500 to 1200 V</td> <td>.5 + .08</td> <td>.37 + .03</td> <td>.5 + .08</td> <td colspan="3" style="text-align: center;">Not specified</td> </tr> </tbody> </table>	Range	Frequency						30 Hz	50 Hz	10 kHz	20 kHz	50 kHz	100 Hz	200 mV	.5 + .1	.2 + .08	.5 + .1		.5 + .5		2 V through 200 V	.5 + .025	.2 + .015	.5 + .025		1 + .05		1200 V: 10 to 500 V	.5 + .08	.2 + .03	.5 + .08	Not specified			500 to 1200 V	.5 + .08	.37 + .03	.5 + .08	Not specified		
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500 to 1200 V	.5 + .08	.37 + .03	.5 + .08	Not specified																																						

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="490 451 1247 611"> <thead> <tr> <th data-bbox="490 451 701 514">Range</th> <th colspan="4" data-bbox="701 451 1247 483">Frequency</th> </tr> <tr> <td data-bbox="490 514 701 577">200 μA through 200 mA</td> <td data-bbox="701 514 880 577">30 Hz</td> <td data-bbox="880 514 1010 577">50 Hz</td> <td data-bbox="1010 514 1156 577">5 kHz</td> <td data-bbox="1156 514 1247 577">10 kHz</td> </tr> <tr> <td data-bbox="490 577 701 611">2000 mA</td> <td colspan="2" data-bbox="701 577 880 611">.6 + .1</td> <td colspan="2" data-bbox="880 577 1247 611">.3 + .08</td> </tr> <tr> <td></td> <td colspan="4" data-bbox="1010 577 1247 611">N/A</td> </tr> </thead> </table>	Range	Frequency				200 μA through 200 mA	30 Hz	50 Hz	5 kHz	10 kHz	2000 mA	.6 + .1		.3 + .08			N/A			
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Resistance	Range: 0 to 20 MΩ (in 6 ranges) Accuracy: Range: <table data-bbox="625 856 1123 972"> <tr> <td>200Ω</td> <td>.1</td> <td>+ .015</td> </tr> <tr> <td>2 kΩ.....</td> <td>.1</td> <td>+ .005</td> </tr> <tr> <td>20, 200, and 2000 kΩ.....</td> <td>.05</td> <td>+ .005</td> </tr> <tr> <td>20 MΩ</td> <td>.2</td> <td>+ .005</td> </tr> </table>	200Ω1	+ .015	2 kΩ.....	.1	+ .005	20, 200, and 2000 kΩ.....	.05	+ .005	20 MΩ2	+ .005								
200Ω1	+ .015																			
2 kΩ.....	.1	+ .005																			
20, 200, and 2000 kΩ.....	.05	+ .005																			
20 MΩ2	+ .005																			

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. 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.

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> <p>±190 mV013</p> <p>-1.9 to 190 V0066</p> <p>1000 V0075</p> <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" data-bbox="440 632 1089 852"> <thead> <tr> <th rowspan="2">Voltage</th> <th colspan="5">Frequency (kHz)</th> </tr> <tr> <th>.030</th> <th>5.0</th> <th>.040/20</th> <th>50</th> <th>100</th> </tr> </thead> <tbody> <tr> <td>190 mV</td> <td>.151</td> <td>.071</td> <td>N/A</td> <td>.151</td> <td>.257</td> </tr> <tr> <td>1.9 V through 190V</td> <td>.132</td> <td>.0541</td> <td>N/A</td> <td>.132</td> <td>.263</td> </tr> <tr> <td>400 V</td> <td>N/A</td> <td>.075</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> </tr> <tr> <td>1000 V</td> <td>N/A</td> <td>.102</td> <td>.150</td> <td>N/A</td> <td>N/A</td> </tr> </tbody> </table> <p>Dc current range: 190 µA to 1.9 A</p> <p>Current: Accuracy: ±(%)</p> <p>190 µA to 190 mA028</p> <p>1.9 A053</p> <p>Resistance range: 100Ω to 10 MΩ</p> <p>Resistance: Accuracy: ±(%)</p> <p>100Ω0325</p> <p>1.0 kΩ0275</p> <p>10, 100, and 1000 kΩ0150</p> <p>10 MΩ0525</p>	Voltage	Frequency (kHz)					.030	5.0	.040/20	50	100	190 mV	.151	.071	N/A	.151	.257	1.9 V through 190V	.132	.0541	N/A	.132	.263	400 V	N/A	.075	N/A	N/A	N/A	1000 V	N/A	.102	.150	N/A	N/A	John Fluke, Model 5700A/CT (p/o MIS-35947), w/power amplifier, John Fluke, Model 5725A (5725A)
Voltage	Frequency (kHz)																																				
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1000 V	N/A	.102	.150	N/A	N/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 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-W** 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	+190.10
200 mV	-190 mV	-189.90	-190.10
2	1.9 V	+1.8995	+1.9005
2	-1.9 V	-1.8995	-1.9005
20	19 V	+18.995	+19.005
20	-19 V	-18.995	-19.005
200	190 V	+189.95	+190.05
1200 V	1000 V	+999.7	+1000.3

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).

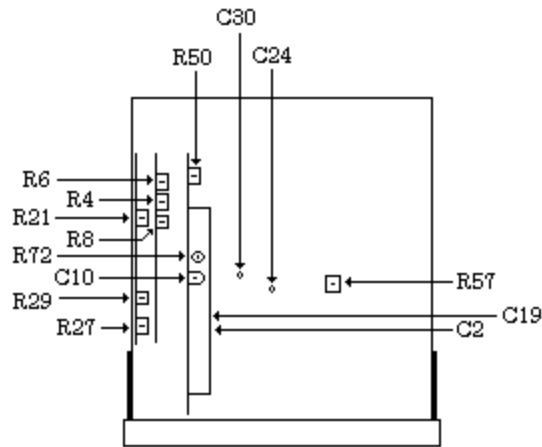


Figure 1. test instrument – top view.

9. Resistance

a. Performance Check

- (1) Connect calibrator **OUTPUT HI** and **SENSE HI** to TI **INPUT V-W**.
- (2) Connect calibrator **OUTPUT LO** and **SENSE LO** to TI **INPUT LO**.
- (3) Press TI **FUNCTION kW** 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
1kΩ		0.11
10kΩ		0.06
100 kΩ		0.06
1MΩ		0.06
10MΩ		0.21

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

b. Adjustments

- (1) Press TI **RANGE 2000kW** 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 20MW** 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-W** 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	191.15
200 mV	190 mV	5 kHz	189.46	190.54
200 mV	190 mV	50 kHz	188.85	191.15
200 mV	190 mV	100 kHz	188.05	191.95
2	1.9 V	30 Hz	1.8900	1.9100
2	1.9 V	500 Hz	1.8959	1.9041
2	1.9 V	5 kHz	1.8959	1.9041
2	1.9 V	50 kHz	1.8900	1.9100
2	1.9 V	100 kHz	1.8800	1.9200
20	19 V	30 Hz	18.900	19.100
20	19 V	5 kHz	18.959	19.041
20	19 V	50 kHz	18.900	19.100
20	19 V	100 kHz	18.800	19.200
200	190 V	30 Hz	189.00	191.00
200	190 V	5 kHz	189.59	190.41
200	190 V	50 kHz	189.00	191.00
200	190 V	100 kHz	188.00	192.00
1200 V	400 V	5 kHz	398.8	401.2
1200 V	1000 V	40 Hz	994.0	1006.0
1200 V	1000 V	5 kHz	995.9	1004.1
1200 V	1000 V	20 kHz	994.0	1006.0

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	190.21
2	1.9 mA	1.8979	1.9021
20	19 mA	18.979	19.021
200	190 mA	189.79	190.21
2000 mA	1.9 A	1896	1904

- 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.

THESE ARE THE INSTRUCTIONS FOR SENDING 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@avma27.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:** TB 9-6625-xxxx-35
9. **Pub Title:** Calibration Procedure for ...
10. **Publication Date:**
11. **Change Number:**
12. **Submitted 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

By Order of the Secretary of the Army:

Official:



JOEL B. HUDSON
*Administrative Assistant to the
Secretary of the Army*
0222106

ERIC K. SHINSEKI
*General, United States Army
Chief of Staff*

Distribution:

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TB 9-6625-2267-35

PIN: 069035-000