*TB 9-6625-2277-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DIGITAL MULTIMETER FLUKE, MODELS 8010A, 8010A-01, 8010M, AND 8012A

Headquarters, Department of the Army, Washington, DC
27 November 2007

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.

*This bulletin supersedes TB 9-6625-2277-35, dated 19 May 2004.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Digital Multimeter, Fluke, Models 8010A, 8010A-01, 8010M, and 8012A. The manufacturers' manuals and/or technical 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. Variations among models are described in text and tables.

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 in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications ±(% of reading + digits) (3 1/2 digit display)
Dc voltage	Range: ±200 mV, ±2V, ±20V, ±200V, ±1000V (±1200V)[1] Accuracy: (0.1 + 1)
Ac Voltage	Range: 200 mV, 2 V, 20 V Accuracy: 45 Hz to l0 kHz (0.5 + 2) 10 to 20 kHz (1.0 + 2) 20 to 50 kHz (5.0 + 3) Range: 200 V Accuracy: 45 Hz to 10 kHz (0.5 + 2) 10 to 20 kHz (1.0 + 2) 20 to 50 kHz[1] (5.0 + 3) Range: 750 V Accuracy: 45 Hz to 1 kHz (0.5 + 2) Range: 1200 V[1] Accuracy: 45 Hz to 10 kHz (0.5 + 2) 10 to 20 kHz (1.0 + 2)

See footnotes at end of table.

Table 1. Calibration Description Continued

Test instrument parameters	Performance specifications ±(% of reading + digits) (3 1/2 digit display)
Dc current	Range: 200 μA, 2 mA, 20 mA, 200 mA, 2000 mA Accuracy: (0.3 +1)
High current[2]	Range: 10 A Accuracy: (0.5 + 1)
Ac current[3]	Range: 200 μA, 2 mA, 20 mA, 200 mA Accuracy: 45Hz to l0 kHz (1.0 + 2) 10 to 20 kHz (2.0 + 2) Range: 2000 mA Accuracy: 45 Hz to 2 kHz (1.0 + 2) 45 Hz to 3kHz (1.0 + 2)[1]
High current[2, 3]	Range: 10 A Accuracy: 45 Hz to 2 kHz (1.0 + 2)
Resistance	Range: 200 Ω, 2 kΩ, 20 kΩ, 200 Ω Accuracy: (0.2 + 1) Range: 2000 Ω and 20 MΩ Accuracy: (0.5 + 1) Range: 2000 kΩ[1] Accuracy: (0.2 + 1)
Low resistance[4]	Range: 2 Ω Accuracy: (1 + 2) Range: 20 Ω Accuracy: (0.5 + 2)
Conductance	Range: 2 mS and 20 μS Accuracy: (0.2 + 1) Range: 200 nS Accuracy: (1 + 10)

[1]Model 8010M only.
[2]Models 8010A and 8010A-01.
[3]Ac current and high current are verified during dc current checks since same shunts are utilized for both ac and dc current functions.
[4]Model 8012A only.

SECTION II
REQUIPMENT 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. 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	Dc voltage: Range: -1.9 to 190 V dc Accuracy: ±0.0395% Range: 1000 V dc Accuracy: ±0.05% Ac Voltage: Range: 190 mV to 1000 V ac Frequency: Accuracy: 45 Hz to 10 kHz ±0.157% 20 kHz ±0.273% 50 kHz ±1.23% Dc current: Range: 190 µA to 10 A Accuracy: ±0.092% Resistance: Range: 1.9 Ω to 10 MΩ Accuracy: ±0.075%	Fluke, Model 5720A (5720A) (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 manufacturers' manuals and/or technical manuals for the 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 TI protective cover from TI only to make adjustments and replace upon completion.

b. Connect TI to a 115 V ac source.

c. Press TI **POWER** switch to **ON** and allow at least 15 minutes for warm-up and stabilization.

8. Dc Voltage

a. Performance Check

(1) Connect calibrator **OUTPUT HI** to TI **V/kΩ/S** (**V/kΩ** on model 8010M) and calibrator **OUTPUT LO** to TI **COMMON**.

(2) Press **AC/DC** pushbutton to **DC**.

(3) Press **V** function and **2** range pushbuttons.

(4) Set calibrator output to 1.9 V dc. If TI does not indicate between 1.897 and 1.903, perform **b** below.

(5) Set calibrator output to -1.9 V dc. If TI does not indicate between -1.897 and -1.903, perform **b** below.

(6) Press TI range pushbutton and set calibrator output for settings listed in table 3. TI will indicate within limits specified in table 3.

Table 3. Dc Voltage

Test instrument range pushbuttons	Calibrator settings	Test instrument indications	
		Min	Max
200 mV	190 mV	189.7	190.3
20 V	19 V	18.97	19.03
200 V	190 V	189.7	190.3
1000 V DC (1200 V DC) [1]	1000 V	998	1002

[1]Model 8010M.

b. Adjustments

(1) Set calibrator output to 1.9 V dc. Adjust R4 (fig. 1) for a TI indication between 1.899 and 1.901 (R).

(2) Set calibrator output to -1.9 V dc. If TI does not indicate between -1.899 and -1.901, adjust R4 (fig. 1) (R).

(3) Repeat (1) and (2) above until both indications are within limits specified.

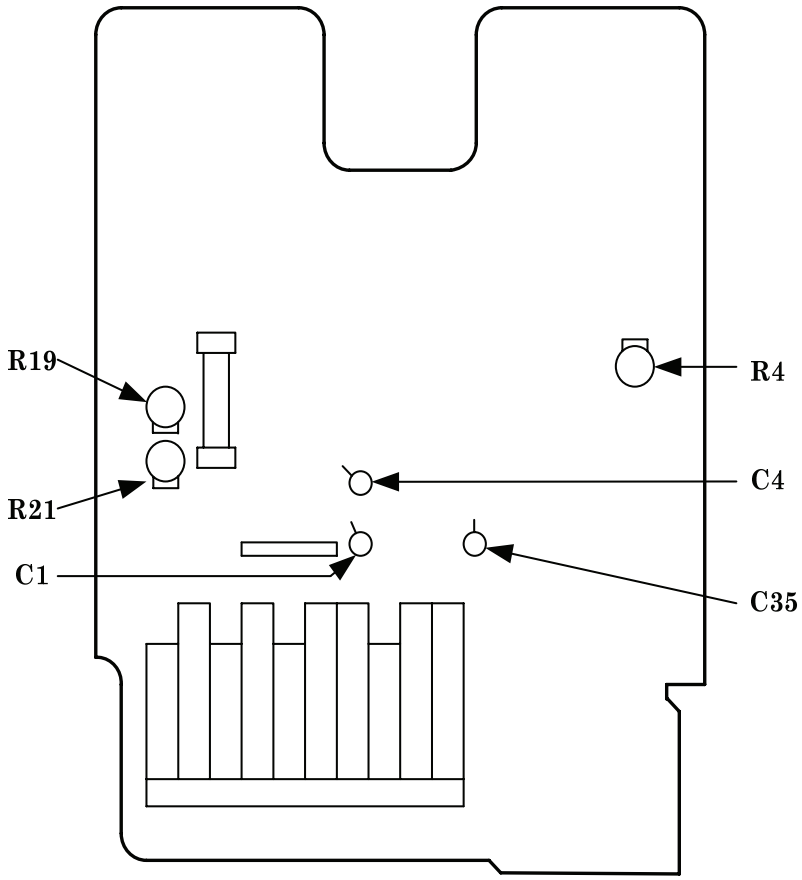

Figure 1. Adjustment locations.

9. Ac Voltage

a. Performance Check

(1) Connect calibrator **OUTPUT HI** to TI **V/kΩS** (**V/kΩ** on model 8010M) and calibrator **OUTPUT LO** to TI **COMMON**.

(2) Press **V** function pushbutton and **AC/DC** pushbutton to **AC**.

(3) Press TI range pushbutton and set calibrator output for settings listed in table 4. If TI does not indicate within limits specified in table 4, perform **b** below.

Table 4. Ac Voltage

Test instrument range pushbuttons	Calibrator settings		Test instrument indications	
	Voltage	Frequency	Min	Max
200 mV	190 mV	45 Hz	188.8	191.2
200 mV	190 mV	1 kHz	188.8	191.2
200 mV	190 mV	10 kHz	188.8	191.2
200 mV	190 mV	20 kHz	187.9	192.1

Table 4. Ac Voltage -Continued

Test instrument Range pushbuttons	Calibrator settings		Test instrument indications	
	Voltage	Frequency	Min	Max
200 mV	190 mV	50 kHz	180.2	199.8
2	1.9 V	50 kHz	1.802	1.998
2	1.9 V	20 kHz	1.879	1.921
2	1.9 V	10 kHz	1.888	1.912
2	1.9 V	1 kHz	1.888	1.912
2	1.9 V	45 Hz	1.888	1.912
20	19 V	45 Hz	18.88	19.12
20	19 V	1 kHz	18.88	19.12
20	19 V	10 kHz	18.88	19.12
20	19 V	20 kHz	18.79	19.21
20	19 V	50 kHz	18.02	19.98
200[1]	190 V	50 kHz	180.2	199.8
200	190 V	20 kHz	187.9	192.1
200	190 V	10 kHz	188.8	191.2
200	190 V	1 kHz	188.8	191.2
200	190 V	45 Hz	188.8	191.2
750 V AC (1200 V AC)[1]	750 V (1000 V)	50 Hz	744 (993)	756 (1007)
750 V AC (1200 V AC)[1]	750 V (1000 V)	1 kHz	744 (993)	756 (1007)
1200 V AC[1]	1000 V	20 kHz	988	1012

[1]Model 8010M.

b. Adjustments

(1) Set calibrator output to standby and press TI **2** range pushbutton.

(2) Adjust R21 (fig. 1) to center of range.

(3) Set calibrator output to 1.9 V at 100Hz. Adjust R19 (fig. 1) for a TI indication between 1.899 and 1.901 (R).

(4) Set calibrator output to 190 mV at 100 Hz. Adjust R21 (fig. 1) for a TI indication between .189 and .191 (R).

(5) Set calibrator output to 1.9 V at 100 Hz. If TI does not indicate between 1.899 and 1.901, repeat (2) through (4) above.

(6) Press TI **20** pushbutton and set calibrator output to 19 V at 10 kHz. Adjust C1 (fig. 1) for a TI indication of exactly 19.00 (R).

(7) Press TI **200** pushbutton and set calibrator output to 110 V at 10 kHz. Adjust C4 (fig. 1) for a TI indication of exactly 110.0 (R).

(8) Repeat (1) and (3) through (7) above until no further adjustments are required.

NOTE

Perform (9) and (10) below for model 8010M only.

(9) Press TI **1200V AC** pushbutton and set calibrator output to 1000 V at 10 kHz. Adjust C35 (fig. 1) for a TI indication of exactly 1000 (R).

(10) Repeat (1) and (3) through (9) above until no further adjustments are required.

10. Dc Current Accuracy

a. Performance Check

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

(2) Press **mA/A** (**mA** on models 8012A and 8010M) function and **AC/DC** pushbutton to **DC**.

(3) Press TI range pushbutton and set calibrator output for settings listed in table 5. TI will indicate within limits specified in table 5.

Table 5. Dc Current

Test instrument range pushbuttons	Calibrator settings	Test instrument indications	
		Min	Max
200 µA	190 µA	189.3	190.7
2 mA	1.9 mA	1.893	1.907
20 mA	19 mA	18.93	19.07
200 mA	190 mA	189.3	190.7
2000 mA	1.9 A	1893	1907
10 A[1]	10 A	9.94	10.06

[1] For models 8010A and 8010A-01 only, connect amplifier output to TI **10A** and **COMMON**.

b. Adjustments. No adjustments can be made.

11. Resistance

a. Performance Check

(1) Connect calibrator **OUTPUT HI** to TI **V/kΩ/S** (**V/kΩ** on model 8010M) and calibrator **OUTPUT LO** to TI **COMMON**.

(2) Press **kΩ/S** function pushbutton.

(3) Press TI range pushbutton and set calibrator to the nominal resistance outputs as listed in table 6. At each resistance output, rotate calibrator knob below **EDIT FIELD** pushbutton to adjust calibrator display indication to equal TI indication. The calibrator **err** display indication will be within limits specified in table 6.

Table 6. Resistance

Test instrument range pushbuttons	Calibrator output nominal value	Calibrator **err** display indications ±(%)
200 Ω	100 Ω	0.3
2	1 kΩ	0.3
20	10 kΩ	0.3
200	100 kΩ	0.3
2000	1 MΩ	0.6 (0.3)[1]
20 MΩ	10 MΩ	0.6

[1]Model 8010M.

NOTE

Perform (4) through (9) below for models 8010A and 8010A-01.

(4) Simultaneously press **200Ω** and **2** range pushbuttons to select **2 mS** range.

(5) Set calibrator for 1000 Ω nominal output with **2 wire comp ON**. TI will indicate between 0.997 and 1.003.

(6) Simultaneously press **20** and **200** range pushbuttons to select **20 μS** range.

(7) Set calibrator for 100 kΩ nominal output. TI will indicate between 9.97 and 10.03.

(8) Simultaneously press **2000** and **20MΩ** range pushbuttons to select **200 nS** range.

(9) Set calibrator for 10 MΩ nominal output. TI will indicate between 98.0 and 102.0.

b. Adjustments. No adjustments can be made.

12. Resistance (Model 8012A only)

a. Performance Check

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

(2) Simultaneously press **V** and **mA** function pushbuttons to select **LO RANGE Ω** function and press **2** range pushbutton.

NOTE

Calibrator **2 wire Comp** must be set to **ON** in (3) through (6) below.

(3) Set calibrator output for 0 ohm. Adjust TI **ZERO** control for a .000 to .001 TI indication.

(4) Set calibrator for a nominal 1.9 ohm output. Rotate calibrator knob below **EDIT FIELD** pushbutton to adjust calibrator display indication to equal TI indication. If calibrator **err** display does not indicate within ±1.105%, perform **b** below.

(5) Press **20** range pushbutton.

(6) Set calibrator for a nominal 19 Ω output. Rotate calibrator knob below **EDIT FIELD** pushbutton to adjust calibrator display indication to equal TI indication. If calibrator **err** display does not indicate within ±0.632%, perform **b** below.

(7) Connect calibrator output to TI **V/kΩ/S** and **COMMON**. Press **kΩ/S** function pushbutton.

(8) Press TI range pushbutton and set calibrator to the nominal resistance outputs as listed in table 7. At each resistance output, rotate calibrator knob below **EDIT FIELD** pushbutton to adjust calibrator display indication to equal TI indication. Calibrator **err** display indication will be within limits specified in table 7.

Table 7. Resistance

Test instrument range pushbuttons	Calibrator output nominal value	Calibrator **err** display indication ± (%)
200 Ω	100 Ω	.3
2	1 kΩ	.3
20	10 kΩ	.3
200	100 kΩ	.3
2000	1 MΩ	.6
20 MΩ	10 MΩ	.6

(9) Simultaneously press **200Ω** and **2** range pushbuttons to select **2 mS** range.

(10) Set calibrator for 1000 Ω nominal output (**2 wire comp ON**). TI will indicate between 0.997 and 1.003.

(11) Simultaneously press **20** and **200** range pushbuttons to select **20 μS** range.

(12) Set calibrator for 100 kΩ nominal output (**2 wire comp OFF**). TI will indicate between 9.97 and 10.03.

(13) Simultaneously press **2000** and **20MΩ** range pushbuttons to select **200 nS** range.

(14) Set calibrator for 10 MΩ nominal output. TI will indicate between 98.0 and 102.0.

b. Adjustments. Press **20** range pushbutton and set calibrator for a nominal 19 ohm output and adjust R57 for a TI indication equal to value displayed on calibrator to two decimal places (R).

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:

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

Official:

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

0726812

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 343482, requirements for calibration procedure TB 9-6625-2277-24.

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.