*TB 9-6625-2190-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DIGITAL MULTIMETERS AN/PSM-45A (FLUKE 27/FM) AND FLUKE, MODELS 27 AND 27/AN AND HIGH VOLTAGE PROBE, FLUKE, TYPE 80K-6

Headquarters, Department of the Army, Washington, DC
11 January 2008

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 9-6625-2190-35, dated 13 April 2004.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Digital Multimeters, AN/PSM-45A, (FLUKE 27/FM) and Fluke, Models 27 and 27/AN and High Voltage Probe, Fluke, Type 80K-6. Army Specification No. 3002838, manufacturers' manuals, and TM 11-6625-3199-14 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. Variations among models are described in the text and tables.

b. Time and Technique. The time required for this calibration is approximately 1 hour, using 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
Dc voltage	Range: 0 to 1000 V in 5 ranges (5000 V using high voltage probe) Accuracy: ±(0.1% of reading + 1 digit) ±(1% of reading using high voltage probe)
Dc current	Range: 0 to 10 A in 5 ranges Accuracy: ±(0.75% of reading + 2 digits)[1]
Ac voltage AN/PSM-45A (27/FM)	Range: mV to 1000 V in 5 ranges Accuracy: 20 Hz to 40 Hz; ±(1.5% of reading + 5 digits) 40 Hz to 1 KHz; ±(0.5% of reading + 5 digits) 1 KHz to 5 KHz; ±(5% of reading + 5 digits)
27 and 27AN	Range: mV to 320 V Accuracy: 40 Hz to 2 KHz ±(0.5% of reading + 3 digits) 2 KHz to 10 KHz ±(2% of reading + 3 digits) 10 KHz to 30KHz ±(4% of reading + 10 digits) Range: 1000 V Accuracy: 40 Hz to 2 KHz ±(1% of reading + 3 digits) 2 KHz to 10 KHz ±(3% of reading + 3 digits)
Ac current[2] AN/PSM-45A	Range: 0 to 10 A in 5 ranges Accuracy: 0 - 320mA 40 Hz to 1 kHz ±(1.5% of reading + 5 digits) 10A 40 Hz to 1 KHz ±(2.5% of reading + 5 digits)
27 & 27AN	Accuracy: All ranges 40 Hz to 1 KHz ±(1.5% of reading + 2 digits)
Resistance AN/PSM-45A	Range: 0 Ω to 32 MΩ in 6 ranges Accuracy: 320 Ω range ±(0.3% of reading + 2 digits) 3.2 KΩ to 3.2 MΩ ranges ±(0.25% of reading + 1 digit) 32 MΩ range ±(1% of reading + 1 digit)
27 & 27AN	Accuracy: 320 Ω range ±(0.3% of reading + 3 digits) 3.2 KΩ to 3.2 MΩ ranges ±(0.2% of reading + 1 digit) 32 MΩ range ±(1% of reading + 1 digit)

[1]Specifications for AN/PSM-45A based on Army Specification procurement document.

[2]Ac current verified by dc current check, current measurements of ac and dc are made using same internal shunt resistor.

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 **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: 300 mV to 1000 V Accuracy: ±0.025% Dc current: Range: 300 µA to 5 A Accuracy: ±0.2% Ac voltage: Range: 300 mV to 1000 V Frequency: 20 Hz to 5 kHz Accuracy: ±0.125% Resistance: Range: Accuracy: 190 Ω ±0.01% 190 kΩ to 1.9 MΩ ±0.077% 19 MΩ ±0.262%	Fluke, Model 5720A (5700A/EP) (p/o MIS-35947); w/amplifier, Fluke, Model 5725A/AR (5725A/AR)

SECTION III
CALIBRATION PROCESS FOR MULTIMETERS

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 TM 11-6625-3199-14 for the TI (no calibration adjustments can be made on the High Voltage probe).

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 checks where applicable.

a. Remove protective cover from TI as necessary to gain access to adjustments.

b. For some checks throughout this procedure, it may be necessary to manually set TI range by pressing **RANGE** pushbutton.

8. Dc Voltage

a. Performance Check

(1) Connect calibrator **OUTPUT HI** and **LO** to TI **VΩ⊣►⊢** and **COM**, observing correct polarity.

(2) Set function switch to **⎓mV**. Set calibrator to first setting in table 3. Push calibrator **OPR/STBY** button to **OPR**.

(3) Set TI function switch to **⎓V**. Set TI and calibrator to the remaining settings in table 3.

(4) Set calibrator to **STBY**. If TI did not indicate within limits specified, in table 3, perform **b** below before proceeding.

Table 3. Dc Voltage

Test instrument range settings	Calibrator settings	Test instrument indications	
		Min	Max
320.0 mV	300 mV	299.6 mV	300.4 mV
3.200 V	3 V	2.996 V	3.004 V
32.00 V	30 V	29.96 V	30.04 V
320.0 V	300 V	299.6 V	300.4 V
1000 V	1000 V	998 V	1002 V

NOTE

Model 80K-6 high voltage probe is a component part of the AN/PSM-45A (27/FM) meter set.

(5) If high voltage probe (80K-6) was supplied continue with step (6) below, if not furnished with meter proceed to step (11).

(6) Disconnect connections made in step (1).

(7) Connect the high voltage probe's cable to TI **VΩ⊣►** and **COM**, observing correct polarity. Connect the probe's ground lead to calibrator **OUTPUT LO**. Hold the probe by the black handle and connect the probe tip to calibrator **OUTPUT HI**.

(8) Set TI to 3.200 V range, calibrator set to 1000 V.

(9) Push calibrator **OPR/STBY** button to **OPR**, TI should indicate between .990 and 1.010 V. No calibration adjustments can be made on the probe.

(10) Set calibrator to **STBY**.

(11) Disconnect all connections.

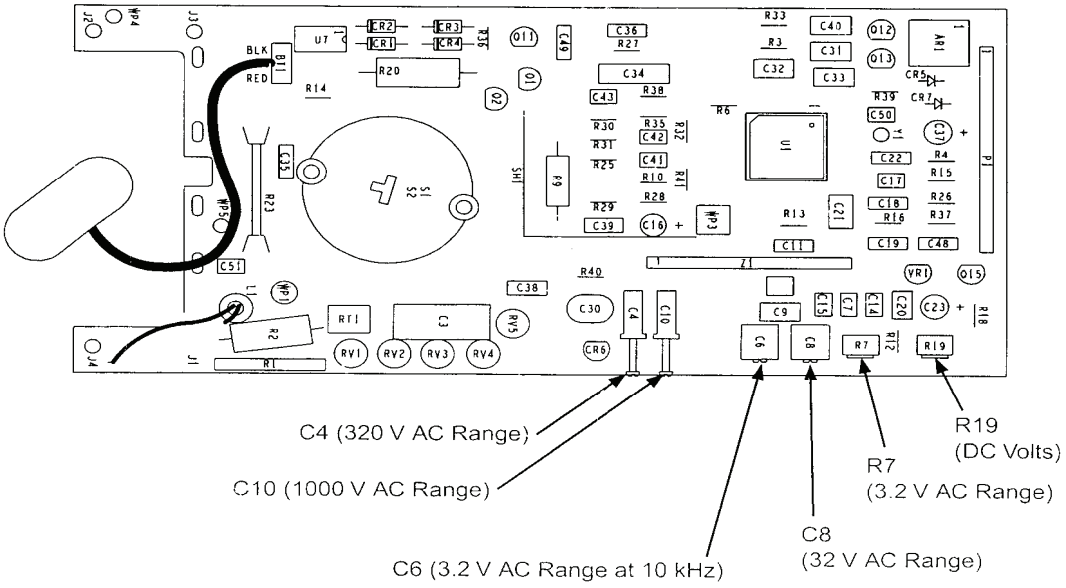

Figure 1. Adjustment locations.

b. Adjustments

(1) With same connection as made in step **8 a** (1) above, and function switch set to **⎓V**, press **RANGE** pushbutton for 3.200 V range.

(2) Set calibrator for a 3 V dc output, push calibrator **OPR/STBY** button to **OPR**.

(3) Adjust R19 (DC Volts) (fig. 1) until TI indicates 3.000 V dc. (R)

(4) After adjustment is made set calibrator to **STBY** and repeat performance check **8 a** (1) through (11) above.

9. Dc Current

a. Performance Check

(1) Connect calibrator **OUTPUT HI** and **LO** to TI **mA/μA** and **COM**.

(2) Set function switch to ⎓**µA**.

(3) Set TI and calibrator for settings listed in table 4. Push calibrator **OPR/STBY** button to **OPR**. TI will indicate within limits specified.

Table 4. Dc Current

Test instrument range settings	Calibrator settings	Test instrument indications	
		Min	Max
320.0 µA	300 µA	297.5 µA	302.5 µA
3200 µA	3000 µA	2975 µA	3025 µA
32.00 mA[1]	30 mA	29.75 mA	30.25 mA
320.0 mA	300 mA	297.5 mA	302.5 mA

[1]Set function switch to ⎓ **mA/A**.

(4) Set calibrator to **STBY**. Move connector from **mA/µA** to **A**.

(5) Move connectors from calibrator **OUTPUT HI** and **LO** to amplifier CURRENT **OUTPUT HI** and **LO**.

(6) Set TI range to 32.00 mA (10 A) calibrator to 5 A and set calibrator to **OPR**. TI should indicate within 4.94 – 5.06 A.

(7) Set calibrator to **STBY** and disconnect connections.

b. Adjustments. No adjustments can be made.

10. Ac Voltage

a. Performance Check

(1) Connect calibrator **OUTPUT HI** and **LO** to TI **VΩ⊣⊢** and **COM**, observing correct polarity.

(2) Set function switch to ⏦**mV**.

(3) Set TI and calibrator to settings listed in table 5 (table 6 for FLUKE 27 & 27AN). Set calibrator to **OPR**. If TI does not indicate within limits specified, set calibrator to **STBY** and perform **b** below.

Table 5. Ac Voltage AN/PSM-45A (Fluke 27/FM)

Test instrument range settings	Calibrator settings		Test instrument indications	
	Voltage	Frequency	Min	Max
320.0 mV	300 mV	20 Hz	295.0 mV	305.0 mV
320.0 mV	300 mV	100 Hz	298.0 mV	302.0 mV
320.0 mV	300 mV	900 Hz	298.0 mV	302.0 mV
320.0 mV	300 mV	5 kHz	284.5 mV	315.5 mV
3.200 V[1]	3 V	20 Hz	2.950 V	3.050 V
3.200 V	3 V	100 Hz	2.980 V	3.020 V
3.200 V	3 V	900 Hz	2.980 V	3.020 V
3.200 V	3 V	5 kHz	2.845 V	3.155 V
32.00 V	30 V	20 Hz	29.50 V	30.50 V

Table 5. Ac Voltage AN/PSM-45A (Fluke 27/FM) - Continued

32.00	V	30	V	100	Hz	29.80	V	30.20	V
32.00	V	30	V	900	Hz	29.80	V	30.20	V
32.00	V	30	V	5	kHz	28.45	V	31.55	V
320.0	V	300	V	40	Hz	295.0	V	305.0	V
320.0	V	300	V	100	Hz	298.0	V	302.0	V
320.0	V	300	V	900	Hz	298.0	V	302.0	V
320.0	V	300	V	5	kHz	284.5	V	315.5	V
1000	V	1000	V	40	Hz	980	V	1020	V
1000	V	1000	V	100	Hz	990	V	1010	V
1000	V	1000	V	900	Hz	990	V	1010	V
1000	V	1000	V	5	kHz	945	V	1055	V

[1]Set function switch to ⏦ **V** and press **RANGE** pushbutton for remaining range settings.

Table 6. Ac Voltage (Fluke 27 & 27AN)

Test instrument range settings		Calibrator settings				Test instrument indications			
		Voltage		Frequency		Min		Max	
320.0	mV	300	mV	40	Hz	298.2	mV	301.8	mV
320.0	mV	300	mV	1.9	KHz	298.2	mV	301.8	mV
320.0	mV	300	mV	9.9	KHz	293.7	mV	306.3	mV
320.0	mV	300	mV	30	KHz	287.0	mV	313.0	mV
3.200	V[1]	3	V	40	Hz	2.982	V	3.018	V
3.200	V	3	V	1.9	KHz	2.982	V	3.018	V
3.200	V	3	V	9.9	KHz	2.937	V	3.063	V
3.200	V	3	V	30	KHz	2.870	V	3.130	V
32.00	V	30	V	40	Hz	29.82	V	30.18	V
32.00	V	30	V	1.9	KHz	29.82	V	30.18	V
32.00	V	30	V	9.9	KHz	29.37	V	30.63	V
32.00	V	30	V	30	KHz	28.70	V	31.30	V
320.0	V	300	V	40	Hz	298.2	V	301.8	V
320.0	V	300	V	1.9	KHz	298.2	V	301.8	V
320.0	V	300	V	9.9	KHz	293.7	V	306.3	V
320.0	V	300	V	30	KHz	287.0	V	313.0	V
1000	V	1000	V	40	Hz	987	V	1013	V
1000	V	1000	V	1.9	KHz	987	V	1013	V
1000	V	1000	V	9.9	KHz	967	V	1033	V

[1]Set function switch to ⏦ **V** and press **RANGE** pushbutton for remaining range settings.

b. Adjustments

(1) Set function switch to ⏦**V**.

(2) Press **RANGE** pushbutton for 3.200 V range.

(3) Set calibrator for a 3 V, 100 Hz output.

(4) Adjust R7 (3.2 V AC Range) (fig. 1) for a 3.000 V ac ±0.001 V ac TI indication. (R)

(5) Press **RANGE** pushbutton for 320.0 V range.

(6) Set calibrator for a 300 V, 5 kHz output.

(7) Adjust C4 (320 V AC Range) (fig. 1) for a 300.0 V ac ±0.1 V ac TI indication. (R)

(8) Press **RANGE** pushbutton for 1000 V range.

(9) Set calibrator for a 1000 V, 5 kHz output.

(10) Adjust C10 (1000 V AC Range) (fig. 1) for a 1000 V ac ±1 V ac TI indication. (R)

(11) Set calibrator to **STBY**.

(12) Press **RANGE** pushbutton for 32.00 V range.

(13) Set calibrator for a 30 V, 5 kHz and **OPR**.

(14) Adjust C8 (32 V AC Range) (fig. 1) for a 30.00 V ac ±0.01 V ac TI indication. (R)

(15) Set calibrator for a 3 V, 5 kHz output.

(16) Press **RANGE** pushbutton for 3.200 V range.

(17) Adjust C6 (3.2 V AC Range at 10 kHz) (fig. 1) for a 3.000 V ac ±0.001 V ac TI indication. (R)

(18) Set calibrator for a 3 V, 100 Hz output. If TI does not indicate between 2.980 and 3.020 V ac, repeat (4) through (17) above as necessary.

(19) Set calibrator to **STBY** and disconnect connections.

11. Resistance

a. Performance Check

NOTE

To subtract test lead resistance from the 320.0 Ω reading, short the test lead tips together between the TI **VΩ⟶⊢** and **COM** and momentarily press the **REL** Δ key.

(1) Connect TI **VΩ⟶⊢** and **COM** to calibrator **OUTPUT HI** and **LO**.

(2) Set function switch to **Ω**.

(3) Set TI and calibrator for settings listed in table 7. At each setting, use calibrator output adjustment controls to set calibrator control display **Reading** equal to TI indication. Calibrator control display **Error** indications will be within limits specified in table 7.

Table 7. Resistance

Test instrument range settings	Calibrator Settings	AN/PSM-45A **Error** indications ±(%)	27 & 27AN **Error** indications ±(%)
320.0 Ω[1]	190 Ω[2]	0.42	0.42
3.200 kΩ	1.9 kΩ	0.31	0.26
32.00 kΩ	19 kΩ	0.31	0.26
320.0 kΩ	190 kΩ[3]	0.31	0.26
3.200 MΩ	1.9 MΩ	0.31	0.26
32.00 MΩ	19 MΩ	1.05	1.05

[1]Use the REL function to compensate for offset at this range.
[2]Set calibrator **2 wire Comp** to **ON**.
[3]Set calibrator **2 wire Comp** to **OFF**.

b. Adjustments. No adjustments can be made.

12. Final Procedure

a. Deenergize and disconnect all equipment.

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

SECTION IV
CALIBRATION PROCESS FOR FLUKE 80K-6 HIGH VOLTAGE PROBE

13. Preliminary Instructions

a. The instructions outlined in paragraphs **13** and **14** 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 the test and, whenever the test requirement is not met, take corrective action. No calibration adjustments can be made on the High Voltage probe.

d. Unless otherwise specified, all controls and control settings refer to the handheld multimeter.

14. 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 checks where applicable.

WARNING

Always hold the TI by its black handle. When making a measurement, do not make body contact with the TI tip or the red portion of TI. TI ground clip lead must be attached to earth ground.

NOTE

To calibrate the high voltage probe when not part of a set, customer must supply a handheld multimeter with input impedance of 10 MΩ ± 10%.

15. Dc Voltage

a. Performance Check

(1) Connect TI cable to the handheld meter **VΩ⊣►** and **COM** observing correct polarity.

(2) Set handheld meter to 3 V range.

(3) Connect the TI ground clip lead to calibrator **OUTPUT LO**. Hold the probe by the black handle and connect the probe tip to calibrator **OUTPUT HI**.

(4) Set calibrator to 1000 V.

(5) Push calibrator **OPR/STBY** button to **OPR**, handheld multimeter should indicate between .990 and 1.010 V. No calibration adjustments can be made on the probe.

(6) Set calibrator to **STBY**.

b. Adjustments. No adjustments can be made.

16. Final Procedure

a. Deenergize and disconnect all equipment.

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

By Order of the Secretary of the Army:

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

Official:

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Administrative Assistant to the
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0732303

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 342275, requirements for calibration procedure TB 9-6625-2190-24.

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.