*TB 9-6625-1188-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR CLIP-ON DC MILLIAMMETER, HEWLETT-PACKARD MODEL 428A AND 428B

Headquarters, Department of the Army, Washington, DC
17 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.

			Paragraph	Page
SECTION	I.	IDENTIFICATION AND DESCRIPTION		
		Test instrument identification	1	2
		Forms, records, and reports	2	2
		Calibration description	3	2
	II.	EQUIPMENT REQUIREMENTS		
		Equipment required	4	2
		Accessories required	5	3
	III.	CALIBRATION PROCESS		
		Preliminary instructions	6	3
		Equipment setup	7	3
		Electrical zero and stability	8	4
		Range and linearity	9	5
		Power supply	10	7
		Final procedure	11	8

*This bulletin supersedes TB 9-6625-1188-35, dated 21 September 1979, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Clip-On Dc Milliammeter, Hewlett-Packard Models 428A and 428B. The manufacturers' manuals were used as the prime data sources in compiling these instructions. The above equipment will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Model 428A has a current range from 3 to 1000 mA full scale, and model 428B from 0.1 mA to 10 A full scale. Only model 428B has the +12 and -7 Vdc power supply.

b. Time and Technique. The time required for each instrument 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
Power input requirements	115 or 230 V ± 10%, 60 Hz, 70W
Current ranges: 428A 428B	 3 to 1000 mA full scale 1 mA to 10 A full scale
Accuracy	± (3% FS + 0.1 mA)

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Sets AN/GSM-287 or AN/GSM-705. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. 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 four-to-one 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)
AUTOTRANSFORMER	Range: 105 to 125 V ac Accuracy: ± 0.75%	Ridge, Model 9020A (9020A)
CALIBRATOR	Range: 1 mA to 10.3 A Accuracy: ± 0.75%	Fluke, Model 5720A (5700A) (p/o MIS-35947); w amplifier, Fluke, Model 5725A/AR (5725A/AR)
MULTIMETER	Range: - 8 to + 286 V dc Accuracy: ± 0.75%	Agilent, Model 3458A (3458A)

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 and item identification number as listed in tables 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. Additional maintenance information is contained in the manufacturers' manuals.

d. Unless otherwise specified all controls and controls 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.

b. Connect TI to autotransformer.

c. Connect autotransformer to a 115 Vac source and adjust controls for a 115 V output.

d. Set **POWER** switch to **ON** and allow 20 minutes for equipment to warm-up.

e. Set **POWER** switch to **OFF** and wait one minute. If meter does not indicate zero, adjust meter zero screw cw until pointer moves up-scale and then starts to move down-scale toward zero. Continue adjusting cw until pointer is directly over zero mark.

NOTE

Numerical values, control settings, and adjustments pertaining to model 428B are shown in parenthesis when they differ from model 428A.

NOTE

When indications specified in paragraphs **8** and **9** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **8** and **9**. Do not perform power supply check if all other parameters are within tolerance.

8. Electrical Zero and Stability

a. Performance Check

(1) Set **POWER** switch to **ON** and **RANGE** switch to **3 MA** (**1 MA**).

(2) Adjust TI meter to 2.7 (0.9), using **ZERO** (**ZERO** and **VERNIER**) control.

(3) Vary autotransformer between 105 and 125 V ac and then back to 115 V. If meter drift does not remain within ±0.5 mA of value set in (2) above, perform **b** (1) through (4) below, and if necessary, **b** (5) through (9) below.

(4) Adjust **ZERO** (**ZERO** and **VERNIER**) control until meter indicates zero.

b. Adjustments

(1) Set **POWER** switch to **OFF**.

(2) Squeeze probe head flanges together and clean mating surfaces with brush furnished with TI. Repeat **a** (1) through (3) above. If this method is insufficient, probe will have to be disassembled as in (3) and (4) below.

CAUTION

Do not twist cable during disassembly and reassembly.

(3) Unscrew probe center section and clean surfaces with pencil eraser.

(4) Reassemble probe so that polarity arrow points toward side of terminal strip with heavy red lead of probe cable. Repeat **a** (1) through (4) above.

NOTE

If zeroing difficulties still remain after cleaning, demagnetize probe head as outlined in (5) through (8) below.

(5) Set **POWER** switch to **ON**.

(6) Insert probe head into degausser at rear of TI (front of TI if rack-mounted) with arrow on probe pointing in same direction as arrow on chassis.

(7) Press pushbutton S3 (fig. 1) to energize degausser.

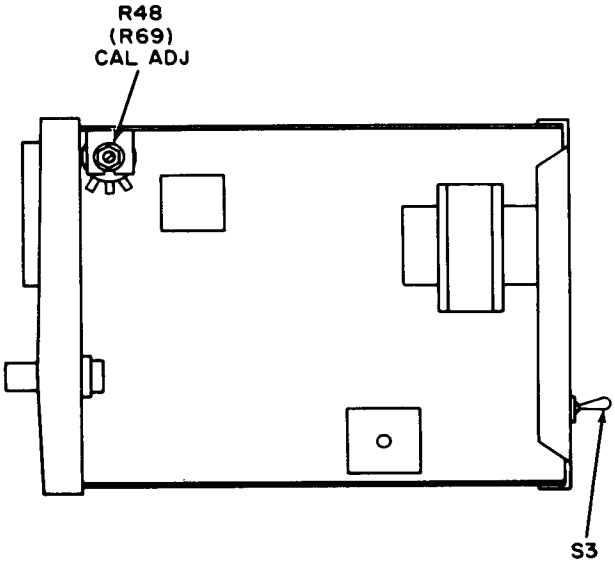

Figure 1. Dc milliammeter - right-side view.

(8) While pressing degausser pushbutton, withdraw probe slowly from degausser for first few inches and then normally until probe is withdrawn about 1 foot.

(9) Repeat **a** (1) through (4) above.

9. Range and Linearity

a. Performance Check

(1) Connect equipment as shown in fig. 2, Connection A.

NOTE

Zero meter after changing ranges. Probe jaws must be completely closed when performing checks.

(2) Set **RANGE** switch to **3 MA**.

(3) Adjust calibrator controls until meter indicates 3. If calibrator does not indicate between 2.81 and 3.19 mA dc, perform **b** below.

(4) Repeat technique of (2) and (3) above, using values and indications listed in table 4.

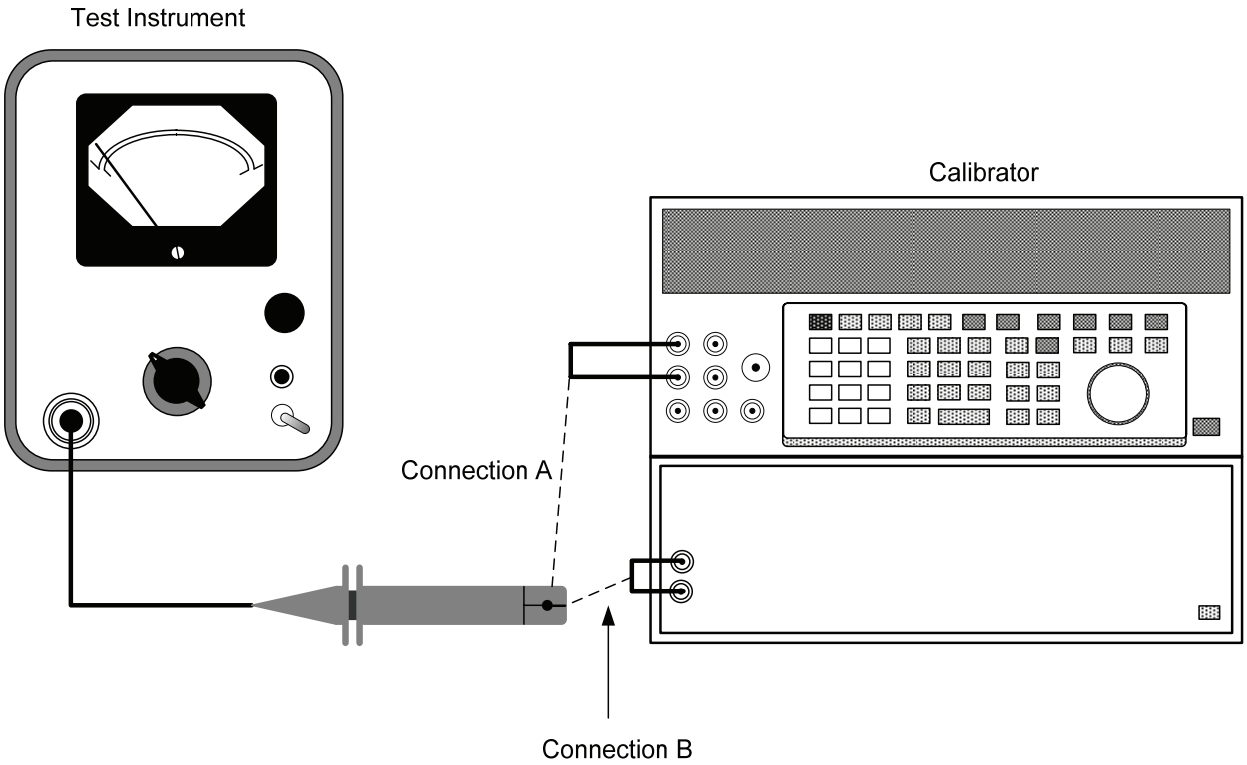

Figure 2. Range and linearity - equipment setup.

Table 4. Range and Linearity Check

Test instrument		Calibrator indication	
RANGE switch setting	Meter indication	Min	Max
1 MA[1]	1	0.87 mA	1.13 mA
10 MA	1	9.6 mA	10.4 mA
30 MA	3	29 mA	31 mA
100 MA	0.2	16.9 mA	23.1 mA
100 MA	0.4	36.9 mA	43.1 mA
100 MA	0.6	56.9 mA	63.1 mA
100 MA	0.8	76.9 mA	83.1 mA
100 MA	1	96.9 mA	103.1 mA
300 MA	3	290.9 mA	309.1 mA
1000 MA[2]	1	969.9 mA	1.0301 A
1 A[1]	1	969.9 mA	1.0301 A
3 A[13]	3	2.9099 A	3.0901 A
10 A[1]	1	9.6999 A	10.3001 A

[1]Model 428B.
[2]Model 428A.
[3]Switch to Connection B.

b. Adjustments

(1) Set **RANGE** switch to **100 MA**.

(2) Set calibrator for a 100 mA dc output.

(3) Adjust R48 CAL ADJ (R69 CAL ADJ) (fig. 1) until meter indicates 100 mA dc (R).

10. Power Supply

NOTE

Do not perform power supply check if all other parameters are within tolerance.

a. Performance Check

(1) Connect multimeter positive lead to any red lead on TERMINAL BOARD C (F) (fig. 3) and negative lead to chassis ground. If multimeter does not indicate between +274.4 and +285.6 (+266 and +278) V dc, perform **b** below.

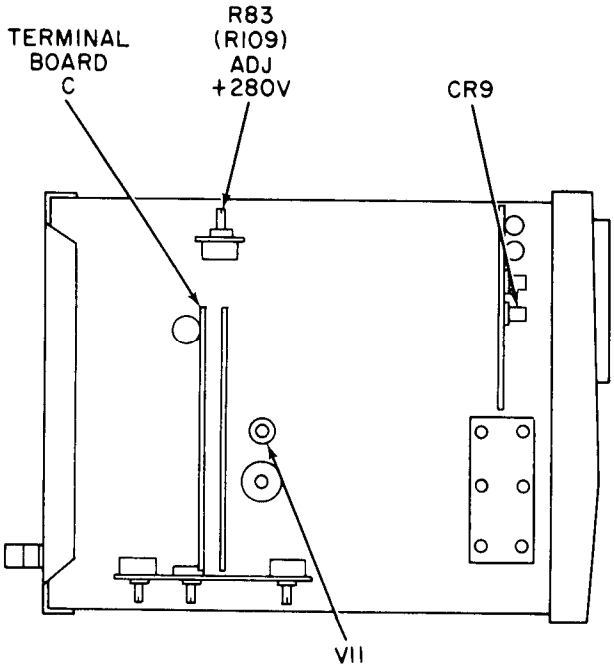

Figure 3. Dc milliammeter - left-side view.

NOTE

Steps (2) and (3) below are for model 428B only.

(2) Connect multimeter positive lead to pin 2 of V11 (fig. 3) and negative lead to chassis ground. Multimeter will indicate between +11 and +13 Vdc.

(3) Move positive lead to anode of CR9 (fig. 3). Multimeter will indicate between -6.0 and -8.0 V dc.

b. Adjustments. Adjust ADJ +280V, R83 (ADJ +272V, R109) (fig. 3) for +280 (+272) Vdc indication on multimeter (R).

11. Final Procedure

a. Deenergize and disconnect all equipment and replace TI protective cover.

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:

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0733201

Distribution:

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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.