*TB 9-6625-1924-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR MULTIMETER, AGILENT MODELS 427A AND 427A OPT 01

Headquarters, Department of the Army, Washington, DC
26 March 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	4
		Amplifier balance and zero offset	8	4
		Regulator	9	6
		Dc volts	10	6
		Ac volts and frequency response	11	7
		Ac rejection	12	8
		Resistance	13	9
		Final procedure	14	9

*This bulletin supersedes TB 9-6625-1924-50, dated 10 January 1975, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Multimeter, Agilent Models 427A and 427A Opt 01. The manufacturer's manual was used as the prime data source in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Model 427A option 01 contains battery operation and ac line operation. Model 427A is battery operated. Other variations are described in text.

b. Time and Technique. The time required for this calibration is approximately 4 hours, 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
Dc voltage	Range: 100 mV to 1000 v Accuracy: ±2 % full scale
Ac voltage	Range: 10 mV to 300 V Accuracy: ±2 % FS
Frequency response	Range: 10 Hz to 1 MHz (10 mV to 30 V) 10 Hz to 100 kHz (100 V to 300 V) Accuracy: ± 2 % FS
Resistance	Range: 10 ohms to 10 megohms Accuracy: ±5% of reading at midscale
Ac rejection	Superimposed peak ac voltages (60 Hz and above) 100 times greater than FS affects reading less than 1 %. Max 450 v peak.

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment used in this calibration procedure. This equipment is issued with the 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 four-to-one ratio 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	AC Voltage: Range: 9.8 mV to 306 V Accuracy: ±0.5 % DC Voltage: Range: 0.098 to 1020 V Accuracy: ±0.5 % Resistance: Range: 9.5 ohms to 10.5 megohms Accuracy: ±l.25%	Fluke, Model 5720A (5720A) (p/o MIS-35947); w amplifier, Fluke 5725A/AR (5725A/AR)
MULTIMETER	Range: 0.01 to 3 V Accuracy: ±0.5 %	Agilent, Model 3458A (3458A)
FUNCTION GENERATOR	Range: 10 Hz to 1 MHz Flatness: ±0.5 %	Agilent, Model 33250A (33250A)

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 text 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. Turn TI **FUNCTION** switch to **OFF**.

b. After 1 minute, observe meter needle. If meter needle is not on zero, adjust mechanical zero adjustment, located below meter face until needle is exactly on zero.

c. Set **BATT/LINE** slide switch (option 01 only) located on rear panel to **BATT**.

d. Turn **FUNCTION** switch to **BATT/1.5V MIN**. If TI meter does not indicate 1.5 or more on 0 to 3 scale, replace batteries.

8. Amplifier Balance and Zero Offset

a. Performance Check

(1) Set **FUNCTION** switch to **+DCV** and **RANGE** switch to **.1**.

(2) Short TI **VOLTS** terminal to **COM** terminal.

(3) Adjust TI **DC ZERO/Ω∞** control until TI meter indicates zero on top scale.

(4) Remove short connected in (2) above. If TI meter does not indicate zero, perform **b** (1) and (2) below.

(5) Turn **DC ZERO/Ω∞** control fully to the right and record meter indication.

(6) Turn **FUNCTION** switch to **-DCV** and turn **DC ZERO/Ω∞** fully to the left. If meter indication is not the same as recorded in (5) above, perform **b** (3) below.

NOTE

FUNCTION switch must be in **+DCV** position for **a** (5) above and in **-DCV** position for **a** (6) above.

b. Adjustments

(1) Adjust A2R7 DC OFFSET ADJ (fig. 1) until TI meter indicates zero (R).

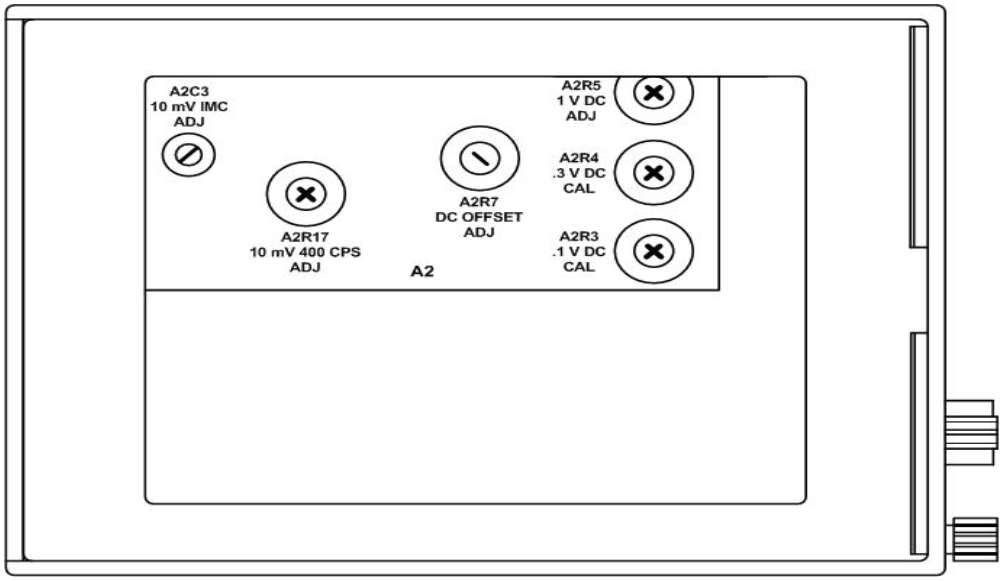

Figure 1. Voltmeter - left view.

(2) Repeat **a** (2) through (4) above.

(3) Adjust A1R15 AMP BAL (fig. 2) while repeating **a** (5) and (6) above until meter indication is the same in both steps (R).

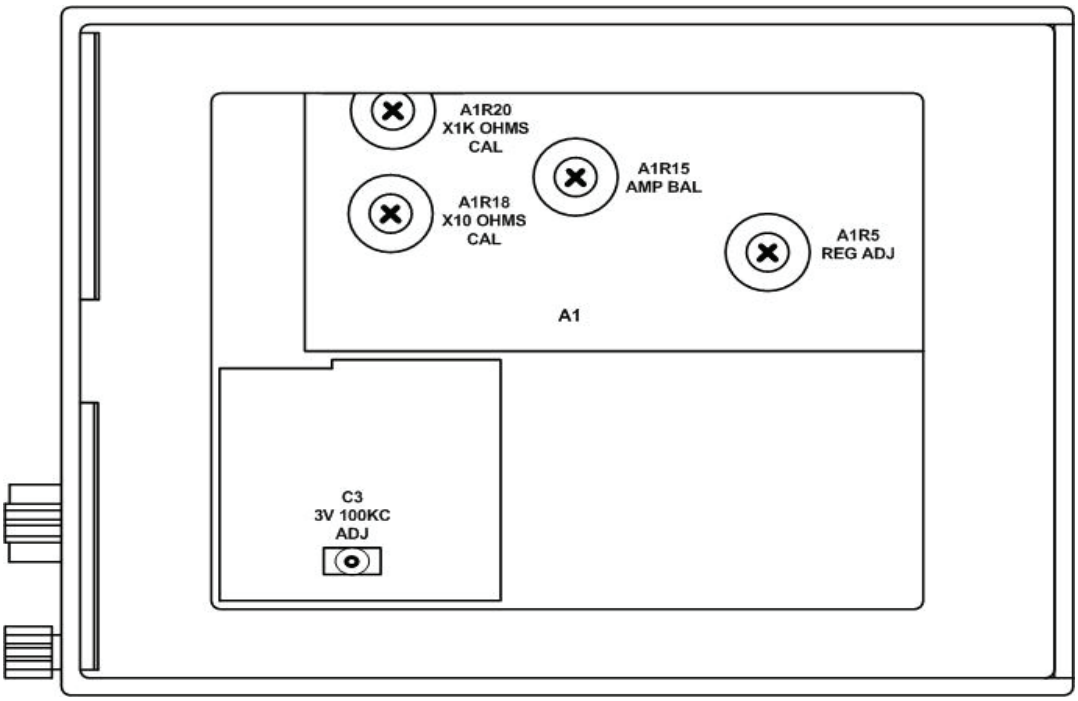

Figure 2. Voltmeter - right view.

9. Regulator

a. Performance Check

(1) Turn **FUNCTION** switch to **+DCV**.

(2) Short **VOLTS** terminal to **COM** terminal, and **OHMS** terminal to **COM** terminal, using two leads (B2).

(3) Adjust **DC ZERO/Ω∞** control for zero indication on top scale.

(4) Turn **FUNCTION** switch to **OHMS**. If meter does not indicate zero, perform **b** below.

(5) Remove shorts connected in (2) above.

b. Adjustments. Adjust A1R5 REG ADJ (fig. 2) while turning **FUNCTION** switch between **OHMS** and **+DCV** until meter indication is the same in both **OHMS** and **+DCV** positions (R).

10. Dc Volts

a. Performance Check

(1) Connect calibrator to TI **VOLTS** and **COM** terminals.

(2) Turn TI **FUNCTION** switch to **+DCV**.

(3) Adjust calibrator output for an indication of 1 on TI meter 0 to 1 scale. If calibrator does not indicate between 0.098 and 0.102 volt, perform **b** (1) and (2) below.

(4) Repeat technique of (3) above at TI **RANGE** switch settings and meter indications listed in table 3. Calibrator will indicate within limits specified.

Table 3. Dc Volts.

Test instrument			Calibrator indication (V)	
RANGE switch setting	Meter indication			
	0-1 Scale	0 - 3 Scale	Min	Max
.3	---	3	0.294	0.306[1]
1	1	---	0.98	1.02[2]
3	---	3	2.94	3.06
10	1	---	9.8	10.2
10	.8	---	7.8	8.2
10	.6	---	5.8	6.2
10	.4	---	3.8	4.2
10	.2	---	1.8	2.2
30	---	3	29.4	30.6
100	1	---	98	102
300	---	3	294	306
1000	1	---	980	1020

[1]If indication is out of tolerance, perform **b** (3) and (4).
[2]If indication is out of tolerance, perform **b** (5) and (6).

(5) Reduce calibrator output to minimum.

(6) Reverse leads on calibrator.

(7) Turn TI **FUNCTION** switch to **-DCV** and **RANGE** switch to **1**.

(8) Adjust calibrator output until TI meter indicates 1 on 0 to 1 scale. Calibrator will indicate between 0.98 and 1.02 volts.

b. Adjustments

(1) Adjust calibrator to 0.100 volt.

(2) Adjust A2R3 .1V DC CAL (fig. 1) until TI meter indicates 1 on 0 to 1 scale (R).

(3) Adjust calibrator to 0.300 volt.

(4) Adjust A2R4 .3V DC CAL (fig. 1) until TI meter indicates 3 on 0 to 3 scale (R).

(5) Adjust calibrator to 1.00 volt.

(6) Adjust A2R5 1VDC ADJ (fig. 1) until TI meter indicates 1 on 0 to 1 scale (R).

11. Ac Volts and Frequency Response

a. Performance Check

(1) Connect calibrator to TI **VOLTS** and **COM** terminals.

(2) Turn TI **FUNCTION** switch to **ACV** and **RANGE** switch to **.01**.

(3) Adjust calibrator frequency to 400 Hz and output until TI meter indicates 1 on 0 to 1 scale. If calibrator does not indicate between 9.8 and 10.2 millivolts, perform **b** (1) and (2) below.

(4) Repeat technique of (3) above at TI **RANGE** switch settings and meter indications listed in table 4. Calibrator will indicate within limits specified.

Table 4 Ac Volts.

Test instrument			Calibrator indication (V)	
RANGE switch setting	Meter indication			
	0 - 1 Scale	0 - 3 Scale	Min	Max
0.03	---	3	0.0294	0.0306
0.1	1	---	0.098	0.102
0.3	---	3	0.294	0.306
1	1	---	0.98	1.02
3	---	3	2.94	3.06
10	1	---	9.8	10.2
30	---	3	29.4	30.6
100	1	---	98	102
300	---	3	294	306

(5) Turn TI **RANGE** switch to **.01**.

(6) Connect function generator and multimeter to TI **VOLTS** and **COM** terminals.

(7) Adjust function generator frequency to 400 Hz and output to 0.010 volt as indicated on multimeter.

(8) Adjust function generator for zero reference.

(9) Disconnect multimeter from test setup.

(10) Vary function generator frequency from 10 Hz to 1 MHz, while maintaining an indication of 1 on TI meter 0 to 1 scale. If function generator does not indicate within ±2 percent, perform **b** (3) and (4) below.

(11) Repeat technique of **a** (6) through (10) above for TI **RANGE** switch settings of **.03**, **.1**, **.3**, **1**, and **3**. If function generator does not indicate within ±2 percent on 3 volt range, perform **b** (5) and (6) below.

b. Adjustments

(1) Adjust calibrator to 10.000 millivolts.

(2) Adjust A2R17 10mV 400 CPS ADJ (fig. 1) until TI meter indicates 1 on 0 to 1 scale (R).

(3) Adjust function generator frequency to 1 MHz and output for zero reference on expand scale.

(4) Adjust A2C3 10mV IMC ADJ (fig. 1) until TI meter indicates 1 on 0 to 1 scale or best in-tolerance condition (R).

(5) Adjust function generator frequency to 100 kHz and output for zero reference.

(6) Adjust C3 3V 100KC ADJ (fig. 2) until TI meter indicates 3 on 0 to 3 scale (R).

12. Ac Rejection

a. Performance Check

(1) Turn TI **FUNCTION** switch to **+DCV** and **RANGE** switch to **.1**.

(2) Short **VOLTS** to **COM** terminal and adjust **DC ZERO/Ω∞** for zero indication. Remove short.

(3) Connect calibrator to TI **VOLTS** and **COM** terminals.

(4) Adjust calibrator frequency to 400 Hz and output to 7.07 volts. TI meter will indicate 0 on 0 to 1 scale ±1 minor scale division.

(5) Turn TI **RANGE** switch to **1**.

(6) Adjust calibrator output to 70.7 volts. TI meter will indicate 0 on 0 to 1 scale ±1 minor scale division.

b. Adjustments. No adjustments can be made.

13. Resistance

a. Performance Check

(1) Turn TI **FUNCTION** switch to **OHMS** and **RANGE** switch to **X10**. Adjust **DC ZERO/Ω∞** control until TI meter indicates infinity on ohms scale.

(2) Connect calibrator to TI **OHMS** and **COM** terminals.

(3) Adjust calibrator until TI meter indicates 1 on ohms scale. If calibrator does not indicate between 9.5 and 10.5 ohms, perform **b** (1) through (4) below.

(4) Repeat (1) through (3) above except turn **RANGE** switch to **X1K**. If calibrator does not indicate between 950 and 1050 ohms, perform **b** (1), (2), (5), and (6) below.

(5) Repeat technique of **a** (1) through (3) above at TI **RANGE** switch positions listed in table 5. Calibrator will indicate within limits specified.

Table 5. Resistance.

Test instrument RANGE switch position	Calibrator indication (Ohms)	
	Min	Max
X100	95	105
X10K	9500	10500
X100K	95 K	105 K
X1M	0.95 M	1.05 M
X10M	9.5 M	10.5 M

b. Adjustments

(1) Short **OHMS** to **COM** terminals.

(2) Adjust **DC ZERO/Ω∞** control until TI meter indicates zero on ohms scale.

(3) Remove short and adjust A1R18 X10 OHMS CAL (fig. 2) until TI meter indicates infinity on ohms scale (R).

(4) Repeat **a** (2) and (3) above.

(5) Remove short and adjust A1R20 X1K OHMS CAL (fig. 2) until TI meter indicates infinity on ohms scale (R).

(6) Repeat **a** (4) above.

14. 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:

Official:

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

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

0802802

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 343036, requirements for calibration procedure TB 9-6625-1924-24.

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.