

***TB 9-6625-011-35**

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR TRUE RMS VOLTMETER ME-318/U (HEWLETT-PACKARD, MODEL 3400A)

Headquarters, Department of the Army, Washington, DC
30 July 2003

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 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 provide DA Form 2028 information to AMCOM via email, 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 manual. For the World Wide Web, use <https://amcom2028.redstone.army.mil>.

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*This bulletin supersedes TB 9-6625-011-35, dated 29 May 1992.

**SECTION I
IDENTIFICATION AND DESCRIPTION**

1. Test Instrument Identification. This bulletin provides instructions for the calibration of True RMS Voltmeter ME-318/U (Hewlett-Packard, Model 3400A). TM11-6625-1541-15 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. Variations among models are described in text.

b. Time and Technique. The time required for this calibration is approximately 1.5 hours, using the dc and low frequency technique.

2. Forms, Records, and Reports. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

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																									
Ac voltage	Range: 1.0 mV to 300 V rms in 12 ranges Frequency: 10 Hz to 10 MHz Accuracy: ±(%) FS Frequency: <table style="margin-left: 40px; border: none;"> <tr> <td style="padding-right: 10px;">10</td> <td style="padding-right: 10px;">to</td> <td style="padding-right: 10px;">50</td> <td style="padding-right: 10px;">Hz.....</td> <td style="padding-right: 10px;">5.0</td> </tr> <tr> <td style="padding-right: 10px;">50</td> <td style="padding-right: 10px;">Hz to</td> <td style="padding-right: 10px;">1.0</td> <td style="padding-right: 10px;">MHz.....</td> <td style="padding-right: 10px;">1.0</td> </tr> <tr> <td style="padding-right: 10px;">1.0</td> <td style="padding-right: 10px;">to</td> <td style="padding-right: 10px;">2.0</td> <td style="padding-right: 10px;">MHz.....</td> <td style="padding-right: 10px;">2.0</td> </tr> <tr> <td style="padding-right: 10px;">2.0</td> <td style="padding-right: 10px;">to</td> <td style="padding-right: 10px;">3.0</td> <td style="padding-right: 10px;">MHz.....</td> <td style="padding-right: 10px;">3.0</td> </tr> <tr> <td style="padding-right: 10px;">3.0</td> <td style="padding-right: 10px;">to</td> <td style="padding-right: 10px;">10</td> <td style="padding-right: 10px;">MHz.....</td> <td style="padding-right: 10px;">5.0</td> </tr> </table>	10	to	50	Hz.....	5.0	50	Hz to	1.0	MHz.....	1.0	1.0	to	2.0	MHz.....	2.0	2.0	to	3.0	MHz.....	3.0	3.0	to	10	MHz.....	5.0
10	to	50	Hz.....	5.0																						
50	Hz to	1.0	MHz.....	1.0																						
1.0	to	2.0	MHz.....	2.0																						
2.0	to	3.0	MHz.....	3.0																						
3.0	to	10	MHz.....	5.0																						

**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-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.

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: 3 mV to 300 V Frequency: 400 Hz and 1 kHz Accuracy: $\pm 0.25\%$ ¹ Wideband voltage: Voltage: 900 μ V to 0.9 V Frequency: 20 Hz to 10 MHz (1 kHz reference) Amplitude flatness: \pm (%) Frequency: 20 Hz 1.25 400 Hz to 1 MHz 0.25 2 MHz 0.50 3 MHz 0.75 10 MHz 1.25	John Fluke, Model 5720A (p/o MIS-35947)
DIGITAL MULTIMETER	Range: -1.0 V dc Accuracy: $\pm 0.25\%$	Hewlett-Packard, Model 3458A/E02 (MIS35947/1)
RATIO TRANSFORMER	Range: 0.0010000 Accuracy: ¹	DT72A (7915908)

¹ For TI range 1 mV @ 1 kHz, combined accuracy is $\pm 0.25\%$.

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. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in TM 11-6625-1541-15

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 when necessary to make adjustments. Replace cover after completing the adjustments; then repeat the check.
- b. Zero meter using front panel adjustment and set **RANGE** switch to **300 VOLTS**.
- c. Connect to an appropriate ac voltage source and press **LINE** switch to **ON**. Allow at least 30 minutes for warm-up.

8. Voltage Accuracy

a. Performance Check

- (1) Connect calibrator **OUTPUT** to TI **INPUT** terminal and connect digital multimeter to TI rear panel **DC OUT** terminal.
- (2) Set TI **RANGE** switch to **.01 VOLTS** and set calibrator for a 10 mV, 400 Hz output. If digital multimeter does not indicate -1.0 ($\pm .01$) V, perform **b(1)** and (2) below.
- (3) Adjust calibrator for a TI indication of 1 on the 0-to-1 scale. Calibrator **Error** display will be $\leq \pm 1.0\%$; if not, perform **b(3)** through (7) below.
- (4) Set TI **RANGE** switch to **1 VOLTS** and set calibrator for a 1.0 V, 400 Hz output, then adjust calibrator for a TI indication of 1 on the 0-to-1 scale. Calibrator **Error** display will be $\leq \pm 1.0\%$; if not, perform **b(8)** below.
- (5) Reset calibrator.
- (6) Connect ratio transformer **INPUT** to calibrator **OUTPUT** terminals and ratio transformer **OUTPUT** to TI **INPUT** terminal.
- (7) Set ratio transformer dial settings to 0.0010000.
- (8) Set TI **RANGE** switch and calibrator initial output as indicated in table 3. Adjust calibrator for the TI meter indication specified. Calibrator **Error** display will indicate within the specified limits.

Table 3. Range Accuracy

Test instrument			Calibrator		
RANGE switch settings (VOLTS)	Meter indication scale		Initial output		ERROR display indications ≤ ± (%)
	0-to-1	0-to-3	Voltage	Frequency	
.001	1	---	1.0 V	1.0 kHz	1.0 ¹
Reset calibrator and remove ratio transformer from setup.					
.003	---	3	3 mV	1.0 kHz	1.0
.03	---	3	30 mV	1.0 kHz	1.0
.1	1	---	100 mV	1.0 kHz	1.0
.3	---	3	0.3 V	1.0 kHz	1.0 ²
1	1	---	1.0 V	1.0 kHz	1.0 ³
1	.8	---	0.8 V	1.0 kHz	1.25
1	.6	---	0.6 V	1.0 kHz	1.7
1	.4	---	0.4 V	1.0 kHz	2.5
1	.2	---	200 mV	1.0 kHz	5.0
3	---	3	3.0 V	1.0 kHz	1.0
10	1	---	10 V	1.0 kHz	1.0
30	---	3	30 V	1.0 kHz	1.0
100	1	---	100 V	1.0 kHz	1.0
300	---	3	300 V	1.0 kHz	1.0

¹After performing this check, set calibrator for a 0.9 V, 1 kHz output and record TI indication (0.0009 V) for use in **b(9)** below.

²After performing this check, set calibrator for a 0.3 V, 1 kHz output and record TI indication (on the 0-to-1 scale) for use in **b(15)** below.

³After performing this check, set calibrator for a .9 V, 1 kHz output and record TI indication for use in **b(12)** below.

(9) Connect TI **INPUT** to calibrator **WIDEBAND** output and press calibrator **WBND** pushbutton.

(10) Set TI **RANGE** switch to **.001 VOLTS**.

(11) Set calibrator for an initial 900 μV, 1 kHz, wideband output. Adjust calibrator for a TI indication equal to value recorded in table 3 (0.0009 V) to establish a 1 kHz reference. Press calibrator **NEW REF** pushbutton.

(12) Set calibrator frequency to 20 Hz, then readjust amplitude for TI reference established in (11) above. Calibrator **Error** display indication will be < ± 5.6 percent.

(13) Repeat technique of (12) above for remaining frequencies listed for the **.001 VOLTS RANGE** switch settings in table 4. Calibrator **Error** display will be within specified limits; if not, perform **b(9)** through (11) below.

(14) Repeat technique of (10) through (13) above for TI **RANGE** switch settings and calibrator initial voltage listed in table 4. Calibrator **Error** display indication will be within the limits specified; if not, perform **b(12)** through (14) below for **1 VOLTS RANGE** switch setting and (15) through (17) for **.3 VOLTS RANGE** switch setting.

Table 4. Frequency Response

Test instrument RANGE switch settings	Calibrator			Error display limits ±(%)
	Output		Frequency	
	Initial voltage			
.001	---	400	Hz	1.1
.001	---	10	kHz	1.1
.001	---	50	kHz	1.1
.001	---	100	kHz	1.1
.001	---	500	kHz	1.1
.001	---	1.0	MHz	1.1
.001	---	2.0	MHz	2.2
.001	---	3.0	MHz	3.3
.001	---	10	MHz	5.6
1	0.9 V	1.0	kHz	N/A
1	---	20	Hz	5.6
1	---	10	kHz	1.1
1	---	50	kHz	1.1
1	---	100	kHz	1.1
1	---	500	kHz	1.1
1	---	1.0	MHz	1.1
1	---	2.0	MHz	2.2
1	---	3.0	MHz	3.3
1	---	10	MHz	5.6
.3	0.3 V	1.0	kHz	N/A
.3	---	20	Hz	5.0
.3	---	400	Hz	1.0
.3	---	10	kHz	1.0
.3	---	50	kHz	1.0
.3	---	100	kHz	1.0
.3	---	500	kHz	1.0
.3	---	1.0	MHz	1.0
.3	---	2.0	MHz	2.0
.3	---	3.0	MHz	3.0
.3	---	10	MHz	5.0

b. Adjustments

- (1) Adjust R4 (R627 for TIs with amplifier board A6, P/N 03400-66512) (fig.1) until digital multimeter indicates -1.00 V.
- (2) If necessary, adjust R6 (fig. 1) for full-scale indication on TI.
- (3) Set calibrator for a 10 mV, 400 Hz output. Adjust R6 (fig.1) until TI indicates full scale (R).
- (4) Set **RANGE** switch to **.1 VOLTS**.

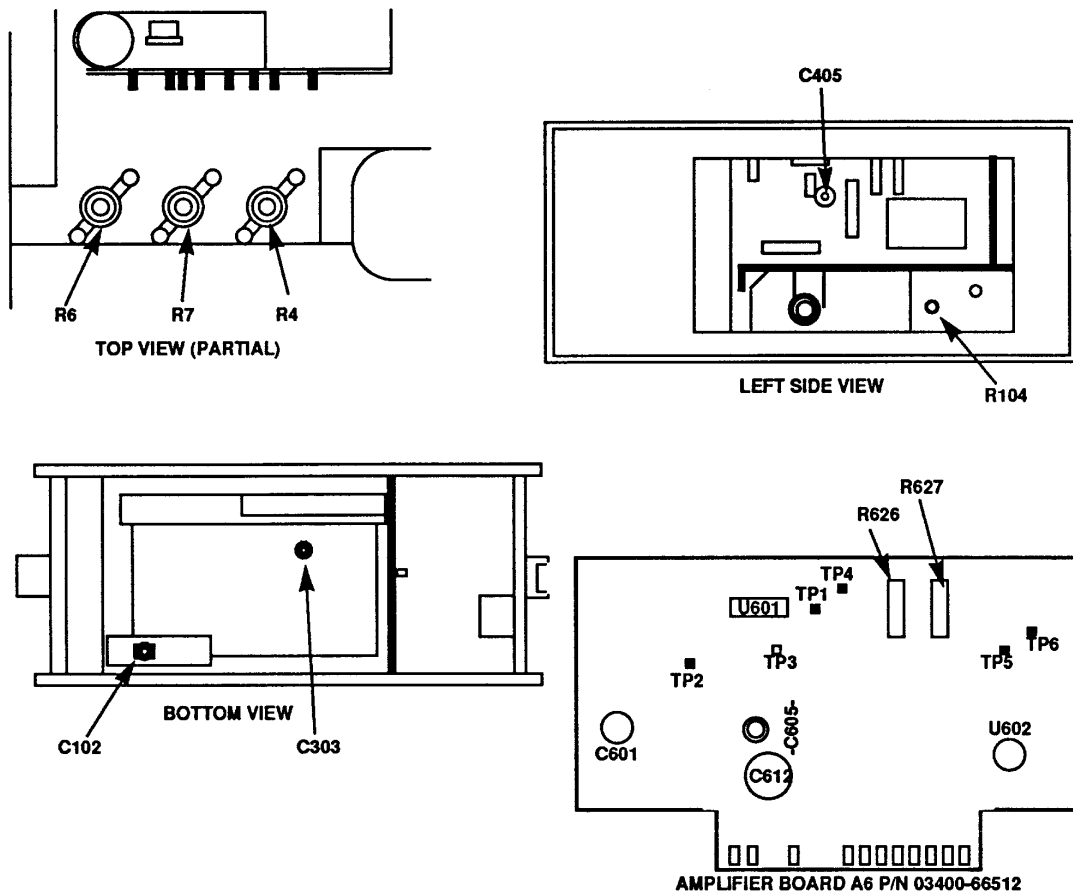


Figure 1. Test instrument - top, left side, bottom view, and A6 board, P/N 03400-66512.

- (5) Adjust R7 (R626 for TIs with amplifier board A6, P/N 03400-66512) (fig. 1) until TI indicates 0.01 V (1 /10 scale) (R).
- (6) Set **RANGE** switch to **.01 VOLTS**.
- (7) Repeat (3) through (6) above until no further adjustment is necessary.
- (8) Set calibrator for a 1.0 V, 400 Hz output. Adjust R104 (fig. 1) until TI indicates 1 (R).
- (9) Set calibrator for an initial 900 μ V, 1 kHz wideband output, then adjust for the TI indication record for table 3 (0.0009 V).

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(10) Press calibrator **NEW REF** pushbutton, then set frequency to 10 MHz. Adjust C405 (fig. 1) for the 1 kHz reference established in **b(9)** above (R).

(11) Vary calibrator frequency between 3 and 10 MHz and if required, readjust C405 (fig. 1) for best in-tolerance condition.

(12) Set calibrator for an initial 0.9 V, 1 kHz wideband output, then adjust for the TI indication recorded for table 3 (0.9 V).

(13) Press calibrator **NEW REF** pushbutton, then set frequency to 100 kHz. Adjust C102 (fig. 1) for the 1 kHz reference established in **b(12)** above (R).

(14) Vary calibrator frequency between 100 kHz and 10 MHz and, if required, readjust C102 (fig. 1) for best in-tolerance condition.

(15) Set calibrator for an initial 0.3 V, 1 kHz wideband output, then adjust for the TI indication recorded for table 3 (0.3 V).

(16) Press calibrator **NEW REF** pushbutton, then set frequency to 3.0 MHz. Adjust C303 (fig. 1) for the 1 kHz reference established in **b(15)** above (R).

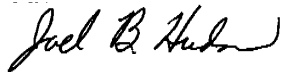
(17) Vary calibrator frequency between 3 and 10 MHz and, if required, readjust C303 (fig. 1) for best in-tolerance condition.

9. 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:



JOEL B. HUDSON

*Administrative Assistant to the
Secretary of the Army*

0314901

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*General, United States Army
Acting Chief of Staff*

Distribution:

To be distributed in accordance with IDN 342901, requirements for calibration procedure TB 9-6625-011-35.

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.

PIN: 015188-000