*TB 9-6625-011-35

SUPERSEDED COPY DATED 30 AUGUST 1982

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
29 May 1992

Approved for public release; distribution is unlimited.

♦REPORTING OF ERRORS♦

You can help improve this publication by calling attention to errors and by recommending improvements and stating your reasons for the recommendations. Your letter or DA Form 2028, Recommended Changes to Publications, should be mailed directly to Commander, U. S. Army Aviation and Missile Command, ATTN: AMSAM-TMD-EP, Redstone Arsenal, AL 35898-5000. FAX to DSN 788-2313 (commercial 256-842-2313). A reply will be furnished directly to you.

			Paragraph	Page
SECTION	I	INDENTIFICATION 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	4
		Equipment setup	7	5
		Voltage accuracy	8	5
		Final procedure	9	10

*This bulletin supersedes TB 9-6625-011-35, dated 30 August 1982, including all changes.

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). The manufacturer's 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.

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 I.

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 10 Hz 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-286. 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: 10 mV to 300 V Frequency: 400 Hz and 1 kHz Accuracy: ±.25% Wideband voltage: Voltage: 900 µV to 0.9 V Frequency: 20 Hz to 10 MHz (1 kHz reference) Amplitude flatness: ±(%) 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 5700A/CT w/option 003 (p/o MIS-35947) w/Power Amplifier, John Fluke, Model 5215A/CT (5215A/CT), w/Ac Divider, John Fluke, Model 7405A-4207 (7405A-4207)
DIGITAL MULTIMETER	Range: -1.0 V dc Accuracy: ±.25%	John Fluke, Model 8506A/CT (p/o MIS-35947)

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. Additional maintenance information is contained in the manufacturers' manuals 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. 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 warmup.

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 (±.01) V, perform **b** (1) and (2) below.

(3) Connect calibrator **OUTPUT** to TI **INPUT** terminal.

(4) Set calibrator for a 10 mV, 400 Hz output, then adjust calibrator for a TI indication of 1 on the 0-to-1 scale. Calibrator **Error** display will be $\leq$ ±1.0%; if not, perform **b**(3) through (7) below.

(5) 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 $\leq$ ±1.0%; if not, perform **b**(8) below.

(6) Reset calibrator.

(7) Connect ac divider **INPUT** (p/o calibrator) to calibrator **OUTPUT** terminals and ac divider **OUTPUT** to TI **INPUT** terminal.

(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.

(9) Connect TI **INPUT** to calibrator **WIDEBAND** output and press calibrator **W BND** 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 (.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%.

(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 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]
.003	---	3	3.0 V	1.0 kHz	1.0
Reset calibrator and remove ac divider from setup					
.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

[1]After performing this check, set calibrator for a .9 V, 1 kHz output and record TI indication (.0009 V) for use in **b**(9) below.
[2]After performing this check, set calibrator for a 0.3 V. 1 kHz output and record TI indication (on the 0-to-1 scale) for used in **b**(15) below.
[3]After performing this check, set calibrator for a .9 V, 1 kHz output and record TI indication for use in **b**(l2) below.

Table 4. Frequency Response

Test instrument **RANGE** switch settings	Calibrator				
	Output				Error display limits ±(%)
	Initial voltage	Frequency			
.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**.

(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 μV 1 kHz wideband output, then adjust for the TI indication record for table 3 (.0009 V).

(10) Press calibrator **NEW REF** pushbutton, then set frequency to 10 MHz. Adjust C405 (fig. 1) for the 1 kHz reference established **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 intolerance 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**(l5) above (R).

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

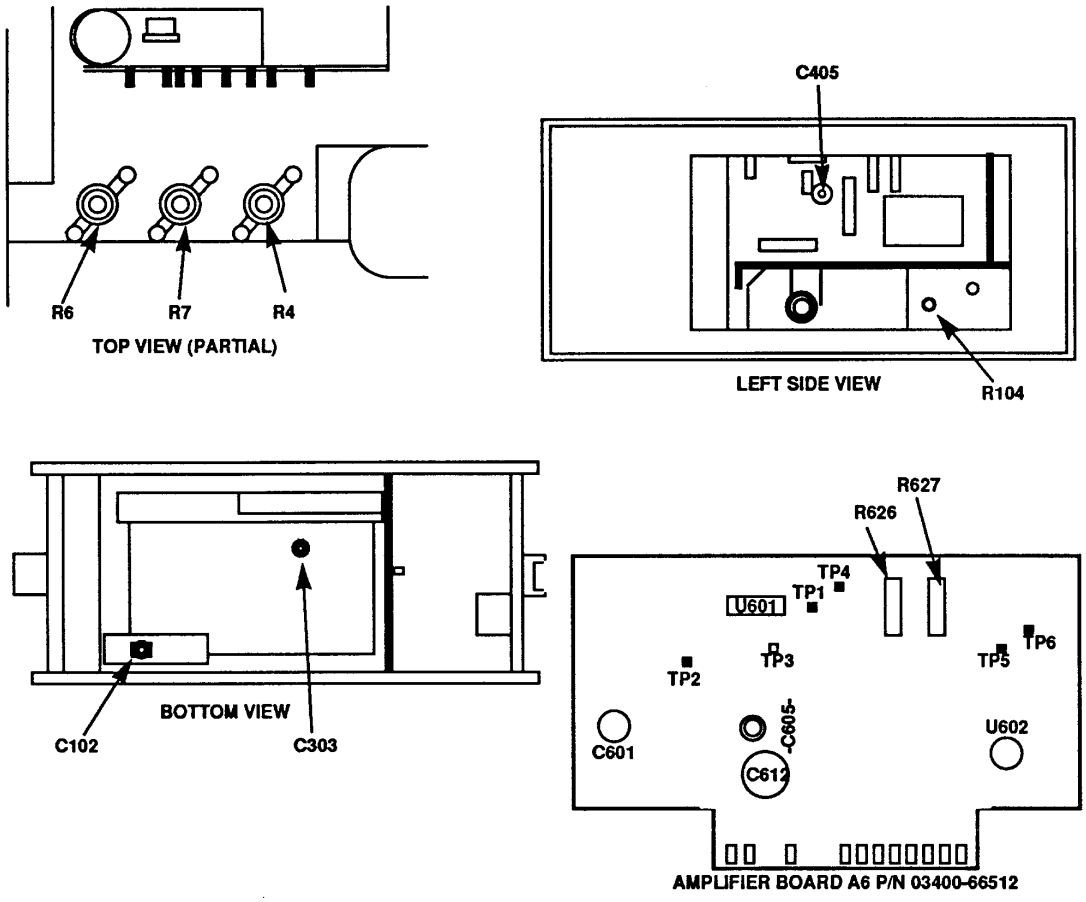

Figure 1. Test instrument - top, left side, bottom view, and A6 board, P/N 03400-66512.

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:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the Secretary of the Army

01527

Distribution:

To be distributed in accordance with DA Form 12-34-E, Block No. 2091, requirements for calibration procedure TB 9-6625-011-35.

US GOVERNMENT PRINTING OFFICE: 1992 - 631-006/60238

PIN NO: 015188-000