

TB 9-6625-2023-35

CHANGE 4

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DIGITAL VOLTMETER HEWLETT-PACKARD, MODEL 3455A

Headquarters, Department of the Army, Washington, DC
8 March 1990

TB 9-6625-2023-35, 1 June 1981, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page.

Remove pages
9 and 10

Insert pages
9 and 10

2. File this change sheet in front of the publication for reference purposes. **This change incorporates DA Form(s) 2028 dated 6 October 1989.**

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CHANGE 3

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DIGITAL VOLTMETER HEWLETT-PACKARD, MODEL 3455A

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5 and 6
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DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DIGITAL VOLTMETER HEWLETT-PACKARD MODEL 3455A

Headquarters, Department of the Army, Washington, DC
1 June 1981

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.

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**SECTION I
IDENTIFICATION AND DESCRIPTION**

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Digital Voltmeter, Hewlett-Packard Model 3455A. 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. None.

b. Time and Technique. The time required for this calibration is approximately 5 hours, using the dc and low frequency technique.

2. DA Form 2416 (Calibration Data Card)

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25. DA Form 2416 must be annotated in accordance with TB 750-25 for each calibration performed.

b. Adjustments to be reported on DA Form 2416 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 Accuracy (high resolution off): 0.1 V range: $\pm(0.010\%$ of reading + 5 digits) 1 V range: $\pm(0.009\%$ of reading + 1 digit) 10 V range: $\pm(0.008\%$ of reading + 1 digit) 100 and 1000 V range: $\pm(0.010\%$ of reading + 1 digit) Accuracy (high resolution on): 1 V range: $\pm(0.009\%$ of reading + 5 digits) 10 V range: $\pm(0.008\%$ of reading + 3 digits) 100 and 1000 V range: $\pm(0.010\%$ of reading + 3 digits)
Ac voltage	Range: 0 to 1000 V in 4 ranges Accuracy: 30 Hz ¹ to 20 kHz $\pm (0.06\%$ of reading + 60 digits) 20 to 100 kHz $\pm (0. \%$ of reading + 130 digits) 100 to 250 kHz ² $\pm (2.1 \%$ of reading + 300 digits) 250 to 500 kHz ² $\pm (5.1 \%$ of reading + 600 digits) 500 kHz to 1 MHz ² $\pm (6.3 \%$ of reading + 3500 digits) Inputs above 500 V multiply tolerance by $\frac{(1500 + 1 \text{ V in } 1)}{1000}$

See footnotes at end of table.

Table 1. Calibration Description - Continued.

Test instrument parameters	Performance specifications
Ohms	<p>Range: 0 to 10,000 kΩ in 6 ranges³</p> <p>Accuracy (high resolution off):</p> <ul style="list-style-type: none"> 0.1 kΩ range: ± (0.005% of reading + 6 digits) 1 kΩ range: ± (0.005% of reading + 1 digit) 10 kΩ range: ± (0.007% of reading + 2 digits) 100 kΩ range: ± (0.004% of reading + 3 digits) 1000 kΩ range: ± (0.014% of reading + 5 digits) 10,000 kΩ range: ± (0.100% of reading + 5 digits) <p>Accuracy (high resolution on):</p> <ul style="list-style-type: none"> 1 kΩ range: ±(0.0040% of reading + 6 digits) 10 kΩ range: ±(0.0065% of reading + 6 digits) 100 kΩ range: ±(0.0040% of reading + 7 digits) 1000 kΩ range: ±(0.0140% of reading + 6 digits) 10,000 kΩ range: ±(0.1000% of reading + 6 digits)

¹Not calibrated below 50 Hz.

²Frequencies greater than 100 kHz specified on 1 and 10 V ranges only.

³Accuracies specified are for the 4-wire kΩ function: Accuracy specifications are the for the 2-wire kΩ function except add 0.0004 kΩ to all readings.

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. 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 actual accuracy of the equipment selected is shown in parenthesis.

5. Accessories Required. The accessories listed in table 3 are issued as indicated in paragraph 4 above and are used in this calibration procedure. When necessary, these items may be substituted by equivalent items, unless specifically prohibited.

Table 2. Minimum Specifications of Equipment Required

Item	Common name and/or (official nomenclature)	Minimum use specifications	Manufacturer and model (part number)
A1	AC VOLTAGE STANDARD (STANDARD CALIBRATOR)	<p>Range: 0 to 1001.2 V</p> <p>Accuracy:</p> <ul style="list-style-type: none"> 50 Hz to 20 kHz: ±0.03% (0.034%) 20 to 100 kHz: ±0.1825% 100 to 250 kHz: ±0.6% 250 to 500 kHz: ±1.425% 500 kHz to 1 MHz: ±2.45% 	Hewlett-Packard, Model 745AOPTION C93 with C90-746A (C90-746A)

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Table 2. Minimum Specifications of Equipment Required - Continued.

Item	Common name and/or (official nomenclature)	Minimum use specifications	Manufacturer, model, and (part number)
A2	AUTOTRANSFORMER (VARIABLE POWER TRANSFORMER)	Range: 105 to 125 V ac Accuracy: $\pm 1\%$	General Radio, Model W10MT3AS3 (7910809)
A3	DC TRANSFER STANDARD (DC VOLTAGE REFERENCE BANK)	Range: 1 to 40 V dc Accuracy: ¹	John Fluke, Model 730A (MIS-10358TYPE2)
A4	DC VOLTAGE DIVIDER	Range: 0 to 1.000000 Accuracy: ¹	Electro Scientific Industries, Model RV722 (7911092)
A5	DC VOLTAGE STANDARD(VOLTAGE CALIBRATOR)	Range: 0 to 1000 V Accuracy: 0.003%	John Fluke Model 332B/AF (7911393)
A6	DECADE RESISTOR	Range: 100 Ω to 1000 k Ω Accuracy (high resolution of: 0.1 k Ω range: $\pm 0.00275\%$ 1 k Ω range: $\pm 0.0015\%$ ($\pm 0.0025\%$) 10 and 100 k Ω range: $\pm 0.00225\%$ ($\pm 0.0025\%$) 1000 k Ω range: $\pm 0.00275\%$ Accuracy (high resolution on): 1 k Ω range: $\pm 0.00115\%$ ($\pm 0.0025\%$) 10 and 100 k Ω range: $\pm 0.01775\%$ ($\pm 0.0025\%$) 1000 k Ω range: $\pm 0.00365\%$	Biddle-Gray, Model 71-650 (MIS-10264)
A7	DIGITAL VOLTMETER	Resolution: 50 μ V	Hewlett-Packard, Model 3490AOPTION060 (3490AOPTION060)
A8	GALVANOMETER (VOLTMETER NULL-DETECTOR)	Resolution: 1 μ V	John Fluke, Model 845AR(7915945)
A9	OSCILLATOR	Range: 250 kHz to 1 MHz Amplitude: 6 V	Hewlett-Packard, Model 652A (MIS-10224)
A10	RESISTANCE STANDARD	Range: 1 to 10 M Ω Accuracy: $\pm 0.025\%$	IIC CR10M (8598965)

¹Combined accuracy of A3 and A4 $\pm 0.0011\%$

Table 3. Accessories Required

Item	Common name and/or (official nomenclature)	Description and (part number)
B1	ADAPTER	BNC jack to double banana plug (7907592)
B2	CABLE	30-in., RG -58/U, double banana plug terminations (7907470)
B3	CABLE	30-in., BNC plug terminations (7907467)
B4	LEAD	4-in., No. 18, single banana plug terminations (7907492)
B5	LEAD ¹	24-in., No. 18 (black), single banana plug terminations (7907498)
B6	LEAD ²	24-in., No. 18 (red), single banana plug terminations (7907497)
B7	PROBE ³	Test hook probe (SKC4850-14)
B8	TERMINATION	50 Ω feed-through HP 11048B (11048B)

¹Six required.

²Three required.

³Two required.

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 and 3. For the identification of equipment referenced by item numbers prefixed with A, see table 2, and for prefix B, see table 3.

c. Most controls on the TI are of the light emitting diode (LED) type and are generally referred to as keys. The center of each key contains an LED which illuminates to indicate the control has been selected. The keys will be referred to as controls because they do not function like pushbuttons (press and release). In addition, some of the controls will be duplicated in a following check because there are cases when the controls are automatically voided during operation.

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. The possibility of electrical fire or shock hazard exists if the TI is exposed to rain or excessive moisture.

NOTE

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 manufacturer's manual for this TI.

NOTE

Unless otherwise specified, all controls and control settings refer to the TI.

7. Equipment Setup

a. Set line frequency switch (rear panel) to 60 Hz and VOLTAGE SELECT switch (rear panel) to 120 V.

CAUTION

If 60 Hz line frequency is not available refer to manufacturer's manual for proper line frequency selection.

b. Connect TI to autotransformer (A2) and connect autotransformer to a 115 V ac (volt alternating current) source and adjust for a 120 V output.

c. Press TI line pushbutton and allow at least 1 hour for warm up and stabilization.

d. Set TEST control to on. All front panel indicators will light except REAR TERMINAL indicator and TI will indicate +8888888 with all decimal points lit.

e. Set TEST control to off by pressing any other FUNCTION control.

f. Set controls as listed in (1) through (7) below:

(1) FUNCTION to = V.

(2) RANGE to 10.

(3) HIGH RESOLUTION to on.

(4) AUTO CAL to off.

(5) GUARD to on.

(6) TRIGGER to INTERNAL.

(7) MATH to OFF.

g. Set RANGE to 100 and AUTO CAL to on. If TI does not indicate .0000 V ± 1 count, perform (1) through (8) below.

(1) Remove top outer cover and top inner cover to gain access to circuit board A10.

(2) Set RANGE to 10 and AUTO CAL to off.

(3) Adjust digital voltmeter (A7) to measure dc volts.

(4) Connect low input of digital voltmeter to TI LO INPUT terminal (inguard chassis) and high input to A10 TP1 (fig. 1), using leads and probes (B5 and B7).

(5) Adjust A10 R66 (fig. 1) until digital voltmeter indicates 0 (zero) V ± 50 μ V.

(6) Disconnect digital voltmeter.

(7) Set RANGE to 100 and AUTO CAL to on. TI will indicate 0.0000 V ± 1 count.

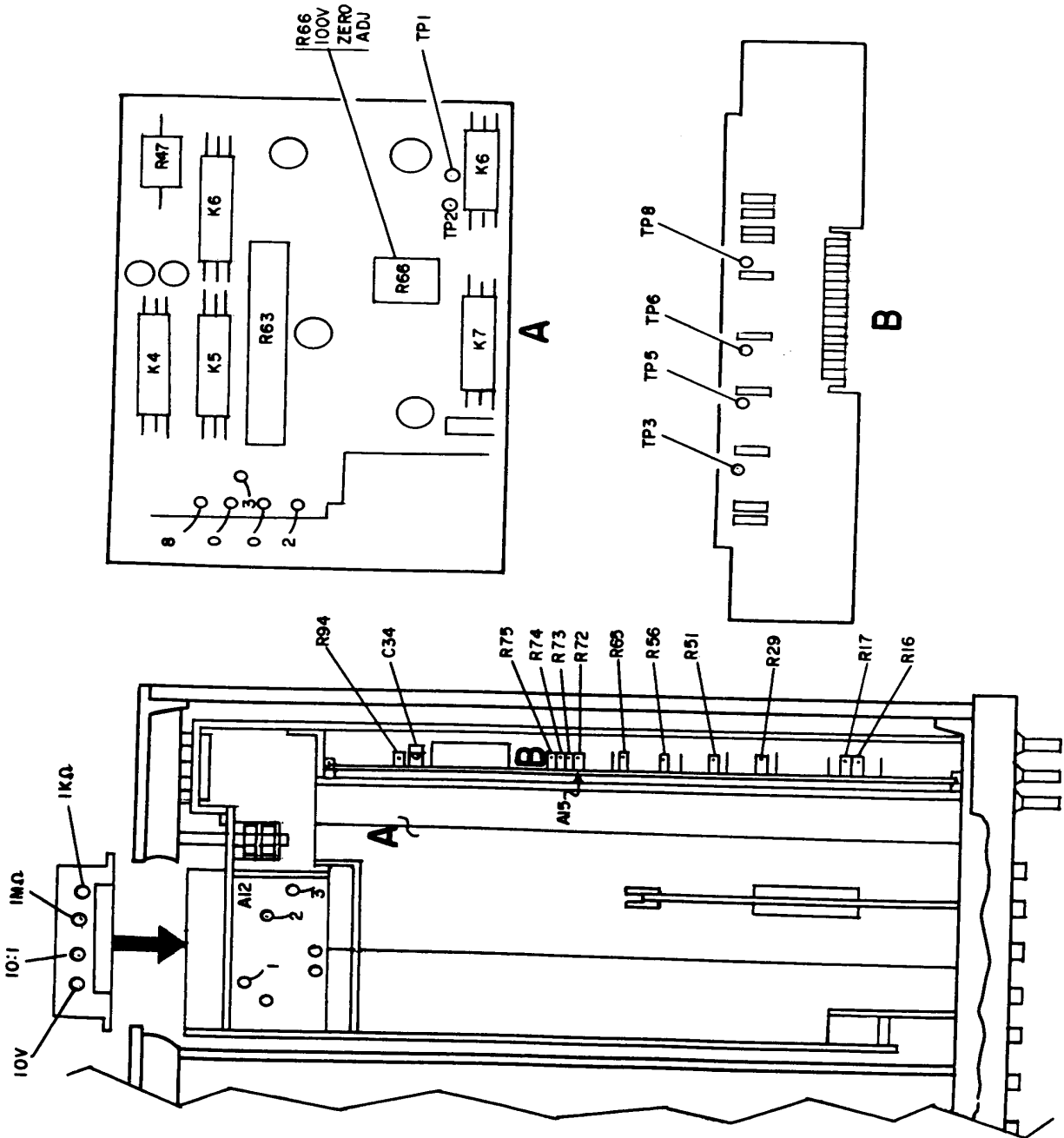


Figure 1. Test instrument - top view.

- (8) Replace TI protective covers.
- h.** Set RANGE to 1.
- i.** Short INPUT terminals, using lead (B4). TI will indicate $0.000000 \text{ V} \pm 4$ counts. Remove short.

8. Dc Voltage

a. Performance Check

CAUTION

Always reduce input voltage to TI to minimum before changing RANGE settings.

(1) Connect equipment as shown in figure 2.

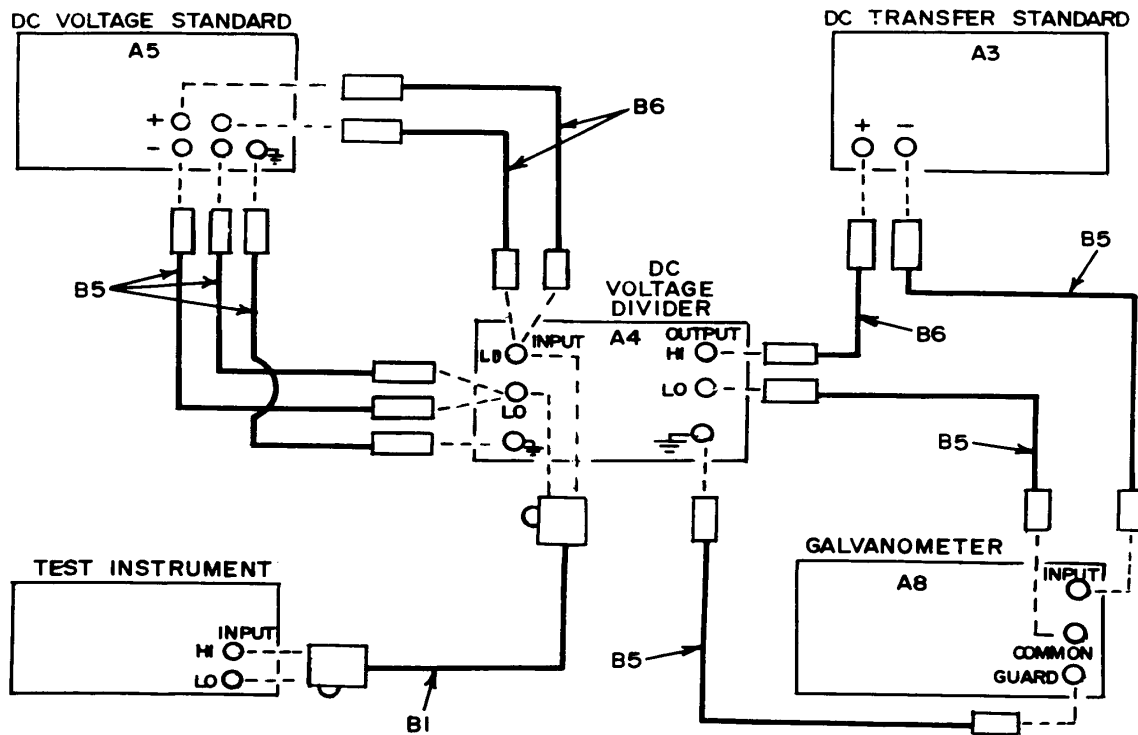


Figure 2. Dc voltage - equipment setup.

(2) Set controls as listed in (a) through (f) below.

- (a) FUNCTION to = V.
- (b) AUTO CAL to on.
- (c) GUARD to on.
- (d) TRIGGER to INTERNAL.
- (e) Set RANGE to 10.

- (f) HIGH RESOLUTION to on.
- (3) Set dc voltage divider (A4) dials to .1000000.
- (4) Preset dc voltage standard (A5) dials to 9.999999. Do not set STANDBY/RESET to OPR.
- (5) Set dc transfer standard (A3) for a 1 V output (mean).
- (6) Set dc voltage standard STANDBY/RESET to OPR and readjust dc voltage standard as required to obtain a null on galvanometer (A8). If TI does not indicate between 9.99917 and 10.00083 V, perform **b(1)** below.

NOTE

This establishes a 10.000000 V reference output from dc voltage standard. Do not readjust voltage dials until directed.

- (7) Vary autotransformer (A2) between 108 and 126 volts and back again to 120 V while performing (6) above.
- (8) Set HIGH RESOLUTION to off. TI will indicate between 9.9991 and 10.0009 V.
- (9) Set RANGE to 100 and HIGH RESOLUTION to on. TI will indicate between 9.9987 and 10.0013 V.
- (10) Set dc voltage standard STANDBY/RESET to STANDBY and disconnect galvanometer and dc transfer standard from dc voltage divider output terminals.
- (11) Connect dc voltage standard to dc voltage divider (A4) 1.0 and LO INPUT terminals, using leads (B5 and B6).

NOTE

If excess fluctuations (noise) occur, set GUARD to OFF and connect lead (B5) from TI GUARD to dc voltage divider, or isolate TI power core.

- (12) Connect dc voltage divider HIGH and LO OUTPUT terminals to TI, using cable (B2).
- (13) Set dc voltage divider dials to .1000000.
- (14) Set TI RANGE to 1 and HIGH RESOLUTION to on.
- (15) Set dc voltage standard STANDBY/RESET to OPR. If TI does not indicate between 0.999905 and 1.000095 V, perform **b(2)** below.

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- (16) Set HIGH RESOLUTION to off. TI will indicate between 0.99990 and 1.00010 V.
- (17) Set dc voltage standard STANDBY/RESET to STANDBY.
- (18) Set GUARD to off. Connect GUARD terminal to HI INPUT terminal, using lead (B4).
- (19) Reverse leads at TI INPUT terminals and repeat (14) through (16) above for negative (-) indications on TI.
- (20) Set dc voltage standard STANDBY/RESET to STANDBY and reconnect leads for positive measurements. Disconnect GUARD terminal from HI INPUT terminal and set GUARD to on.
- (21) Repeat technique of (13) through (15) above, using settings and indications in table 4.

Table 4. Dc Accuracy

Voltage divider settings	Test instrument indications (V)			
	RANGE settings	HIGH RESOLUTION	Min	Max
.500000	10	on	4.99957	5.00043
.100000	10	on	0.99989	1.00011
.010000	1	on	0.099986	0.100014
.010000	.1	off	0.099985	0.100015
.050000	1	on	0.499950	0.500050

- (22) Set dc voltage standard STANDBY/RESET to STANDBY and disconnect TI from dc voltage divider OUTPUT terminals.
- (23) Connect equipment as shown in figure 2.
- (24) Set RANGE to 100 and HIGH RESOLUTION to off.
- (25) Set dc voltage divider dials to .1000000.
- (26) Preset dc voltage standard dials to 99.999 V. Do not set STANDBY/RESET to OPR.
- (27) Set dc transfer standard for a 10 V output (mean).
- (28) Set dc voltage standard STANDBY/RESET to OPR and readjust dc voltage standard as required to obtain a null on galvanometer. TI will indicate between 99.989 and 100.011 V.

- (29) Set HIGH RESOLUTION to on. TI will indicate between 99.9897 and 100.0103 V.
- (30) Set RANGE to 1 k. TI will indicate between 99.987 and 100.013 V.
- (31) Set dc voltage standard STANDBY/RESET to STANDBY.
- (32) Set RANGE to 100 and HIGH RESOLUTION to on.
- (33) Preset dc voltage standard dials to 49.999 V. Do not turn STANDBY/RESET switch to OPR.
- (34) Set dc voltage divider dials to .2000000.
- (35) Set dc voltage standard STANDBY/RESET to OPR and readjust dc voltage standard as required to obtain a null on galvanometer. TI will indicate between 49.9947 and 50.0053 V.
- (36) Set dc voltage standard STANDBY/RESET to STANDBY.
- (37) Set RANGE to 1 k and HIGH RESOLUTION to on.
- (38) Set dc voltage divider dials to .1000000.
- (39) Preset dc voltage standard dials to 399.99. Do not turn STANDBY/RESET to OPR.
- (40) Set dc transfer standard for a 40 V output (series).
- (41) Set dc voltage standard STANDBY/RESET to OPR and readjust dc voltage standard as required to obtain a null on galvanometer. TI will indicate between 399.957 and 400.043 V.
- (42) Set HIGH RESOLUTION to off. TI will indicate between 399.95 and 400.05 V.
- (43) Set dc voltage standard STANDBY/RESET to STANDBY and disconnect equipment setup.
- (44) Connect dc voltage standard to TI INPUT HI LO terminals, using cable (B2).
- (45) Set dc voltage standard STAND-BY/RESET to OPR and adjust output voltage to obtain an indication of 1000.00 V on TI. Dc voltage standard will indicate between 999.89 and 1000.11 V.
- (46) Set HIGH RESOLUTION to on. Dc voltage standard will indicate between 999.897 and 1000.103V.

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(47) Set dc voltage standard STANDBY/RESET to STANDBY and disconnect from TI.

b. Adjustments (fig. 1)

NOTE

The following adjustments are accessible through holes in rear panel of TI. Adjustment designators are marked on panel.

(1) Adjust 10 V potentiometer A11R9 to obtain TI indication of +10.00000 V (R).

(2) Adjust 10:1 potentiometer A11R6 to obtain TI indication of +1.000000 V (± 1 count) (R).

9. Ohms

a. Performance Check

(1) Connect decade resistor (A6) to TI INPUT and OHMS SIGNAL terminals in a four-wire measurement configuration, using leads (B5 and B6).

NOTE

A four-wire measurement connection is made using 4 leads. Connect leads from INPUT (2-wire) HI and LO terminals to decade resistor P2 HIGH and P1 LOW terminals. Connect leads from SIGNAL (4-WIRE) HI and LO terminals to decade resistor C2 HIGH and C1 LOW terminals.

(2) Set controls as listed in (a) through (c) below:

(a) FUNCTION to 4 WIRE k Ω

(b) RANGE to 1.

(c) HIGH RESOLUTION to on.

(3) Set decade resistor to 1 k Ω . If TI does not indicate between 0.999954 and 1.000046 k Ω , perform **b(1)** below.

(4) Set RANGE to 100.

(5) Set decade resistor to 100 k Ω . If TI does not indicate between 99.9953 and 100.0047 k Ω perform **b(2)** below.

(6) Repeat technique of (2) and (3) above, using settings and indications in table 5.

Table 5. Four Wire Ohms Accuracy

Test instrument		Decade resistor settings (Ω)	Test instrument indications (k Ω)	
RANGE settings	HIGH RESOLUTION settings		Min	Max
1	off	1 k	.99994	1.00006
0.1	off	100	0.099989	0.100011
10	on	10 k	9.99929	10.00071
10	off	10 k	9.9991	10.0009
100	off	100 k	99.993	100.007
1 k	off	1 M	999.81	1000.19
1 k	on	1 M	999.854	1000.146

(7) Remove leads (B5 and B6) from Ω SIGNAL terminals and decade resistor. Leave leads between INPUT terminals and resistance standard connected.

(8) Set FUNCTION to 2 WIRE kΩ and repeat technique of (2) and (3) above, using settings and indications in table 6.

Table 6. Two-Wire Ohms Accuracy

Test Instrument		Decade resistor settings (Ω)	Test instrument indications (kΩ)	
RANGE settings	HIGH RESOLUTION settings		Min	Max
.1	off	100	0.099578	0.100422
1	off	1 k	0.99954	1.00046
1	on	1 k	0.999554	1.000446
10	off	10 k	9.9987	10.0013
10	on	10 k	9.99889	10.00115
100	off	100 k	99.993	100.007
100	on	100 k	99.9949	100.0051
1 k	on	1 M	999.859	1000.146
1 k	off	1 M	999.81	1000.19

(9) Disconnect decade resistor.

(10) Set controls as listed in (a) through (c) below:

(a) FUNCTION to 4 WIRE kΩ.

(b) RANGE to 10 k.

(c) HIGH RESOLUTION to on.

(11) Connect resistance standard (A10) to TI INPUT terminals and OHMS SIGNAL terminals in a four-wire measurement configuration, using leads (B5 and B6). TI will indicate between 9989.94 and 10010.06 kΩ.

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(12) Set HIGH RESOLUTION to off. TI will indicate between 9989.5 and 10010.5 k Ω .

(13) Repeat (7) above.

(14) Set FUNCTION to 2 WIRE k Ω . TI will indicate between 9989.5 and 10010.5 k Ω .

(15) Set HIGH RESOLUTION to on. TI will indicate between 9989.94 and 10010.06 k Ω .

b. Adjustments (fig. 1)

NOTE

The following adjustments are accessible through holes in rear panel of TI. Adjustment designators are marked on panel.

(1) Adjust 1 kilohm potentiometer until TI indicates 1.000000 K (R).

(2) Adjust 1 megohm potentiometer until TI indicates 100.0000 K (R).

10. Ac Voltage

a. Performance Check

(1) Set controls as listed in (a) through (d) below:

(a) FUNCTION to ~ V.

(b) RANGE to 10.

(c) AUTO CAL to on.

(d) AC-AC/DC (rear panel) to AC.

(2) Connect ac voltage standard (A1) to INPUT terminals, using cable (B2).

(3) Adjust ac voltage standard for 100 Hz frequency and output for 100.0000 mV. If TI does not indicate between 0.0998 and 0.1002 V, perform **b(1)** through (12) below.

(4) Set rear panel AC-AC/DC switch to AC/DC.

(5) Connect dc voltage standard (A5) to INPUT terminals, using leads (B5 and B6) for a negative measurement.

- (6) Adjust dc voltage standard for a 10.0000 V output. Record TI indication.
- (7) Reverse leads at TI INPUT terminals for a positive measurement. If TI indication is not within ± 0.0005 V of indication recorded in (6) above, perform **b(13)** below.
- (8) Disconnect dc voltage standard.
- (9) Set rear panel AC-AC/DC switch to AC.
- (10) Connect ac voltage standard (A1) to INPUT terminals using cable (B2).
- (11) Set RANGE to 1.
- (12) Adjust ac voltage standard for 100 Hz frequency and output for a 1.00000 V indication on TI. If ac voltage standard does not indicate between 0.998800 and 1.00120 V, reduce output of ac voltage standard to minimum and perform **b(14)** through (18) below.
- (13) Adjust ac voltage standard for 10 kHz frequency and 1.000000 V output. Record TI indication in \sim V and PAST \sim V function for subsequent use. Leave FUNCTION switch in \sim V.
- (14) Adjust ac voltage standard for 40 kHz frequency and output for a 1.00000 V indication on TI. If ac voltage standard does not indicate between 0.992700 and 1.007300 V, perform **b(19)** and (20) below.
- (15) Set RANGE to 10.
- (16) Adjust ac voltage standard for 100 Hz frequency and output for a 10.0000 V indication on TI. If ac voltage standard does not indicate between 9.98800 and 10.01200 V, perform **b(21)** and (22) below.
- (17) Adjust ac voltage standard for 10 kHz frequency and 6.00000 V output. Record TI indication in \sim V and FAST \sim V function for subsequent use. Leave FUNCTION switch in \sim V.
- (18) Adjust ac voltage standard for 40 kHz frequency and output for a 10.0000 V indication on TI. If ac voltage standard does not indicate between 9.92700 and 10.0730 V, perform **b(23)** and (24) below.
- (19) Set RANGE to 100.
- (20) Adjust ac voltage standard for 100 Hz frequency and output for a 100.000 V indication on TI. If ac voltage standard does not indicate between 99.880 and 100.120 V, perform **b(25)** and (26) below.

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(21) Adjust ac voltage standard for 40 kHz frequency and output for a 100.000 V indication on TI. If ac voltage standard does not indicate between 99.2700 and 100.7300 V, perform **b**(27) and (28) below.

(22) Repeat technique of (21) above, using settings and indications in table 7.

Table 7. Ac voltage Accuracy

Test instrument			Ac voltage standard		
RANGE settings	FUNCTION settings ¹	Indications (V)	Frequency (Hz)	Indications (V)	
				Min	Max
1	ACV	1.00000	50	0.998000	1.001200
1	ACV and FAST ACV	1.00000	300	0.998000	1.001200
1	ACV and FAST ACV	1.00000	10K	0.998000	1.001200
1	ACV and FAST ACV	1.00000	20K	0.998000	1.001200
1	ACV	1.00000	40K	0.992700	1.007300
1	ACV and FAST ACV	1.00000	50K	0.992700	1.007300
1	ACV and FAST ACV	1.00000	100K	0.992700	1.007300
10	ACV	5.0000	50	4.99100	5.00900
10	ACV and FAST ACV	5.0000	300	4.99100	5.00900
10	ACV and FAST ACV	5.0000	20K	4.99100	5.009000
10	ACV and FAST ACV	5.0000	100K	4.95700	5.04300
10	ACV	10.0000	50	9.98800	10.01200
10	ACV	10.0000	100	9.98800	10.01200
10	ACV and FAST ACV	10.0000	500	9.98800	10.01200
10	ACV and FAST ACV	10.0000	1 K	9.98800	10.01200
10	ACV and FAST ACV	10.0000	5 K	9.98800	10.01200
10	ACV and FAST ACV	10.0000	10K	9.98800	10.01200
10	ACV and FAST ACV	10.0000	20K	9.98800	10.01200
10	ACV	10.0000	40K	9.92700	10.0730
10	ACV and FAST ACV	10.0000	50K	9.92700	10.0730
10	ACV and FAST ACV	10.0000	100K	9.92700	10.0730
100	ACV	100.000	50	99.8800	100.1200
100	ACV	100.000	100	99.8800	100.1200
100	ACV and FAST ACV	100.000	300	99.8800	100.1200
100	ACV and FAST ACV	100.000	10K	99.8800	100.1200
100	ACV and FAST ACV	100.000	20K	99.8800	100.1200
100	ACV	100.000	40K	99.2700	100.7300
100	ACV and FAST ACV	100.000	100K	99.2700	100.7300
1000	ACV	1000.00	50	997.000	1003.000
1000	ACV and FAST ACV	1000.00	300	997.00	1003.000
1000	ACV and FAST ACV	1000.00	10K	997.000	1003.000

¹ ACV is equal to ~ V and FAST ACV is equal to FAST ~ V.

(23) Reduce output of ac voltage standard to minimum and disconnect from TI.

(24) Connect oscillator (A9) to front panel INPUT terminals, using cable, termination, and adapter (B3, B8, and B1).

(25) Set FUNCTION to ~ V and RANGE to 1 V.

(26) Adjust oscillator frequency to 10 kHz and output for TI indication recorded in (13) above for ~ V function.

(27) Adjust oscillator for 0 (zero) reference in expanded mode.

(28) Adjust oscillator frequency to 250 kHz and maintain 0 (zero) reference established in (27) above. TI will indicate between 0.97600 and 1.02400 V.

(29) Repeat (28) above for frequencies of 500 kHz and 1 MHz. At 500 kHz TI will indicate between, 0.94300 and 1.05700 V and at 1 MHz TI will indicate between 0.90200 and 1.09800.

(30) Set FUNCTION to FAST ~ V.

(31) Adjust oscillator frequency to 10 kHz and output for TI indication recorded in (13) above for FAST ~ V function.

(32) Adjust oscillator for 0 (zero) reference in expanded mode.

(33) Adjust oscillator frequency to 250 kHz and maintain zero reference established in (32) above. TI will indicate between 0.97600 and 1.02400.

(34) Repeat (33) above for frequencies of 500 kHz and 1 MHz. At 500 kHz TI will indicate between 0.94300 and 1.05700 V and at 1 MHz, TI will indicate between 0.90200 and 1.09800 V.

(35) Reduce oscillator output to minimum and remove termination (B8).

(36) Connect oscillator to front panel INPUT terminals, using cable (B3).

(37) Set FUNCTION to ~ V and RANGE to 10.

(38) Adjust oscillator frequency to 10 kHz and output for TI indication recorded in (17) above for ~ V function.

(39) Adjust oscillator for 0 (zero) reference in expanded mode.

(40) Adjust oscillator frequency to 250 kHz and maintain zero reference established in (39) above. TI will indicate between 5.8440 and 6.1560 V.

(41) Repeat (40) above for frequencies of 500 kHz and 1 MHz. AT 500 kHz TI will indicate between 5.6340 and 6.3660 V, and at 1 MHz, TI will indicate between 5.2720 and 6.7280 V.

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(42) Set FUNCTION to FAST ~ V.

(43) Adjust oscillator frequency to 10 kHz and output for TI indication recorded in (17) above for FAST ~ V function.

(44) Adjust oscillator for 0 (zero) reference in expanded mode.

(45) Adjust oscillator frequency to 250 kHz and maintain 0 (zero) reference established in (44) above. TI will indicate between 5.8440 and 6.1560 V.

(46) Repeat (45) above for frequencies of 500 kHz and 1 MHz. At 500 kHz TI will indicate between 5.6340 and 6.3660 V. and at 1 MHz. TI will indicate between 5.2720 and 6.7280 V.

b. Adjustments (fig. 1)

NOTE

Adjustments are labeled on top inner cover. Top inner cover must be removed to gain access to test points on circuit boards.

(1) Short INPUT terminals, using lead (B4). Set digital voltmeter (A7) to measure dc volts and connect to A15TP6 (-) and A15TP8 (+), using probes (B7).

(2) Adjust R65 PREAMP OFFSET ADJ until digital voltmeter indicates 0 (zero) V dc (R).

(3) Connect digital voltmeter to A15TP6 (-) and to A15TP5 (+), using probes (B7).

(4) Adjust R56 ABS AMP OFFSET ADJ until digital voltmeter indicates 0 (zero) V dc (R).

(5) Disconnect digital voltmeter.

(6) Connect A15TP3 and A15TP6 together, using probes (B7).

(7) Adjust R16 INT AMP OFFSET until TI indicates 0 (zero) V (R).

(8) Disconnect probes (B7) from A15TP3 and A15TP6.

(9) Remove short from INPUT terminals.

(10) Connect ac voltage standard (A1) to INPUT terminals, using cable (B2).

(11) Adjust ac voltage standard for 100 Hz frequency and output to 100.0000 mV.

- (12) Adjust R29 LOGGER AMP OFFSET until TI indicates 0.1000 (R).
- (13) Adjust R51 AC-DC TURNOVER ADJ for equal indications (R).
- (14) Adjust digital voltmeter (A7) to measure ac volts and connect to TP6 (-) and TP8 (+), using probes (B7).
- (15) Adjust ac voltage standard for 100 Hz frequency and output for 1.00000 V.
- (16) Adjust R74 1 V, 100 Hz ADJ until digital voltmeter indicates 1.00000 V (R).
- (17) Disconnect digital voltmeter.
- (18) Adjust R17 GAIN until TI indicates 1.00000 V (R).
- (19) Adjust ac voltage standard for 1.000000 V.
- (20) Adjust R75 1 V, 40 kHz ADJ until TI indicates 1.00000 V (R).
- (21) Adjust ac voltage standard for 10.00000 V.
- (22) Adjust R73 10 V, 100 Hz ADJ until TI indicates 10.0000 V (R).
- (23) Adjust ac voltage standard for 10.00000 V.
- (24) Adjust A72 10 V, 40 kHz ADJ until TI indicates 10.0000 V (R).
- (25) Adjust ac voltage standard for 100.0000 V.
- (26) Adjust R94 100 V, 100 Hz ADJ until TI indicates 100.000 V (R).
- (27) Adjust ac voltage standard for 100.000 V.
- (28) Adjust C34 100 V, 40 kHz ADJ until TI indicates 100.000 V (R).

11. Final Procedure

- a.** Deenergize and disconnect all equipment and reinstall protective cover on TI.
- b.** When all parameters are within tolerance, annotate and affix DA Label 80 (US Army Calibrated Instrument). When the TI receives limited or special calibration, annotate and affix DA Label 163 (US Army Limited or Special Calibration). When the TI cannot be adjusted within tolerance, repair the TI in accordance with the maintenance manual. When repair is delayed for any reason or the TI cannot be repaired with local resources, annotate and affix DA Form 2417 (US Army Calibration System Rejected Instrument) and inform the owner/user accordingly in accordance with TB 750-25- 1.

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