

*TB 9-6625-2400-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR TPI MODEL 275 DIGITAL AMP METER

Headquarters, Department of the Army, Washington, DC
9 June 2010

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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.

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*This bulletin supersedes TB 9-6625-2400-24, dated 21 January 2010, including all changes.

**SECTION I
IDENTIFICATION AND DESCRIPTION**

1. Test Instrument Identification. This bulletin provides instructions for the calibration of TPI Model 275, Digital Amp Meter. The manufacturers' 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. None

b. Time and Technique. The time required for this calibration is approximately 2 hour for each item, 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. Report only those adjustments made and designated (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 600 V (in 5 ranges) Range: Accuracy: ¹ 110 mV to 600 V 0.5 + 2
Dc Current	Range: 0 to 400 A (in 4 ranges) Range: Accuracy: ¹ 110 μ and 1100 μA 0.8 + 2 110A 3.0 + 10 400A 3.0 + 5
Ac Voltage	Range: 0 to 600 V (in 5 ranges) Frequency: 45 Hz to 450 Hz ² Range: Accuracy: ¹ 110 mV 1.2 + 5 1V and 11V 1.2 + 3 110 V and 600V 1.5 + 3
Ac current	Range: 0 to 400 A (in 2 ranges) Frequency: 45 Hz to 450 Hz ³ Range: Accuracy: ¹ 110 and 400 A 3.0 + 5
Resistance	Range: 0 to 11 MΩ (in 6 ranges) Range: Accuracy: ¹ 110 Ω 1.0 + 5 1 KΩ through 110 kΩ 1.0 + 2 1 MΩ 3.0 + 5 11 MΩ 3.0 + 10 110 MΩ 3.0 + 20
Capacitance	Range: 11 nF to 110 mF (in 8 ranges) ⁴ Range: Accuracy: ¹ 0 to 11mF 3.0 + 5 110 mF 7.0 + 5

See footnotes at end of table.

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications
Temperature	Range: -40 to 1000 °F Range: 32 °F to 120 °F Accuracy: ± 2 °F -3 °F to 749 °F ± 1.0%+ 2.0 °F 750 °F to 1000 °F ± 2.0% + 1.5 °F -40 °F to -4 °F ± 2% + 4 °F
Frequency	Range: 1111.0 Hz to 110 MHz (in 6 ranges) Range: 1111.0 Hz to 110 MHz Accuracy: ¹ ± 1 + 2

¹Accuracy: ± (% of reading + digits).

²45 Hz to 10 0Hz frequency response 400 mV range. 45 Hz to 450 Hz frequency response all other ranges.

³45 Hz to 100 Hz frequency response 200 A to 400 A. 45 Hz to 450 Hz frequency response below 200 A.

⁴Capacitance only checked to 1 µf.

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; 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 actual 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. The following peculiar accessories are also required for this calibration: cool/heat source, Thermalcal Inc., model M28 and Fluke 5500A calibration coil.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
CALIBRATOR	Dc voltage: Range: 0 to 600 V Accuracy: ±0.0125% Ac voltage Range: 0 to 600 V Frequency: 45 Hz to 450 Hz Accuracy: ±0.3% Resistance Range: 0 to 100 MΩ Accuracy: ±0.25% Dc current: Range: 0 to 11A Accuracy: ±0. 2% Ac current Range: 0 to 11A Frequency: 45 Hz to 450 Hz Accuracy: ±0.75%	Fluke, Model 5720A (5720A) (p/o MIS-35947); w amplifier, Fluke 5725A/AR (5725A/AR)
CAPACITANCE STANDARD	Range: 5 nF to 1 µF Accuracy: ±0.75%	Arco Electronic, Model SS-32 (7907233)

Table 2. Minimum Specifications of Equipment Required – Continued

Common name	Minimum use specifications	Manufacturer and model (part number)
FUNCTION GENERATOR	Range: 1 kHz to 11 MHz Accuracy: $\pm 0.25\%$	Agilent, Model 33250A (33250A)
SIGNAL GENERATOR	Range: 11 MHz to 100 MHz Accuracy: $\pm 0.25\%$	SG-1207/U)
THERMOMETER	Range: -25°C to 250°C Accuracy: $\pm 0.25\%$	Azonix, Model A1012 (MIS 38958) w/Temperature Probe Instrulab, Model 4101-10X

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 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 checks where applicable.

a. Remove protective cover from TI only to make adjustments and replace upon completion.

b. Turn TI rotary switch to --- V (volts DC).

c. Allow at least 10 minutes for stabilization.

d. Press **R-H** push button to activate the manual ranging mode. Pressing the **R-H** button cycles through the available ranges. Set the range to 110 mV range.

8. Dc Voltage

a. Performance Check

(1) Connect calibrator OUTPUT HI and LO to TI **V/ Ω / μA** and **COM**.

(2) Adjust calibrator for a 100 mV dc output. If TI does not indicate between 99.3 mV and 100.7 mV, perform **b** below.

(3) Adjust the TI range and calibrator output for the remaining settings listed in table 3. TI will indicate within limits specified.

(4) Reduce calibrator output to minimum. Set operate/standby switch to standby.

Table 3. Dc Voltage

Test instrument ranges	Calibrator output		Test instrument indications			
			Min		Max	
110 mV	100	mV	99.3	mV	100.7	mV
1 V	1.00	V	0.993	V	1.007	V
11 V	10.00	V	9.93	V	10.07	V
110 V	100.00	V	99.3	V	100.7	V
600 V	600.00	V	595	V	605	V

b. Adjustments

(1) Set the range to 110 mV range.

(2) Adjust calibrator output for 100mVdc output.

(3) Press the operate/standby switch to operate.

(4) Adjust VR3 for a TI indication of 100.00 mV. (R)

(5) Repeat steps **8 a** (2) and (3) above. If any other values are not within tolerance adjust VR3. If VR3 is adjusted, repeat all voltage checks to insure they are within tolerance.

9. Ac Voltage

a. Performance Check

(1) Turn TI rotary switch to \sim V (volts AC). Set range to 110 mV.

(2) Adjust calibrator for a 100 mV at 45Hz ac output. If TI does not indicate between 98.3 mV and 101.7 mV, perform **b** below.

(3) Adjust the TI ranges and calibrator outputs for the remaining settings listed in table 4. TI will indicate within limits specified.

(4) Reduce calibrator output to minimum. Set operate/standby switch to standby. Disconnect meter leads from the meter.

Table 4. Ac Voltage

Test instrument ranges	Calibrator output settings		Test instrument indications			
	Voltage	Frequency	Min		Max	
110 mV	100 mV	45 Hz	98.3	mV	101.7	mV
110 mV	100 mV	100 Hz	98.3	mV	101.7	mV
1 V	1 V	45 Hz	985	mV	1.015	V
1 V	1 V	450 Hz	985	mV	1.015	V
11 V	10 V	45 Hz	9.85	V	10.15	V
11 V	10 V	450 Hz	9.85	V	10.15	V
110 V	100 V	45 Hz	98.2	V	101.8	V
110 V	100 V	450 Hz	98.2	V	101.8	V
600 V	600 V	45 Hz	588	V	612	V
600 V	600 V	450 Hz	588	V	612	V

b. Adjustments

- (1) Short the input; turn VR2, and adjust the Zero point.
- (2) Set calibrator output for 1 Vac at 60Hz output.
- (3) Press the operate/standby switch to operate.
- (4) Adjust VR1 for a TI indication of 1.00 Vac. (R)
- (5) Repeat steps **9 a** (1) thru (4).

10. Ac Current

a. Performance Check

- (1) Turn TI rotary switch to **~A** (Amps AC). Set the TI range to 110 A.
- (2) Connect the calibrator output to the calibration coil. Clamp TI around the coil.
- (3) Set the calibrator output for 0.4 amps at 60Hz.
- (4) TI will indicate within limits specified in table 5 for the 110A range. If TI does not indicate within the limits of table 5, perform **b** (1), (2) and 5 below.
- (5) Set TI range to 400 A. Disconnect the calibrator output and connect the amplifier output to the coil.
- (6) Set the calibrator output for 4.0 amps at 60Hz.
- (7) TI will indicate within limits specified in table 5 for the 400A range. If TI does not indicate within the limits of table 5, perform **b** (3) thru (5) below.
- (8) Reduce calibrator output to minimum. Set operate/standby switch to standby.

Table 5. Ac Current

Test instrument rotary switch	Calibrator output	Test instrument indications	
		Min	Max
110 A	0.4 A	19.35 A	20.65 A
400 A ¹	4.0 A	193.5 A	206.5 A

¹Move connection to the amplifier output.

b. Adjustments

- (1) Set TI range to 110 A. Set the calibrator output for 0.4 amps at 60Hz.
- (2) Adjust VR1 for a 20.00 A indication. (R)
- (3) Set TI range to 400 A. Set the calibrator output for 4.0 amps at 60Hz.
- (4) Adjust VR7 for a 200.0 A indication. (R)
- (5) Repeat step **10 a** above.

11. Dc Current

a. Performance Check

- (1) Connect calibrator OUTPUT HI and LO to TI **V/Ω/μA**.
- (2) Turn TI rotary switch to **μA ==** (micro amps DC).

(3) Adjust calibrator for a 100 μA output. TI will indicate within limits specified in table 6.

(4) Repeat (3) for the 1100 μA range using calibrator output for range and limits in table 6. Disconnect meter leads from the meter.

(5) Turn TI range switch to **110 A** DC (Amps DC). Press DC A zero button and adjust for a zero reading. Connect the calibrator output to the calibration coil. Set the calibrator output for 0.4 amps. Clamp TI around the coil. TI will indicate within limits specified in table 6 for 110 A range.

(6) Turn TI rotary switch to **400 A** DC (Amps DC). Press DC amp zero button and adjust for a zero reading. Set the calibrator output for 4.0 amps. TI will indicate within limits specified in table 6 for 400 A range.

(7) Reduce calibrator output to minimum. Set operate/standby switch to standby.

Table 6. Dc Current

Test instrument ranges	Calibrator output	Test instrument indications	
		Min	Max
110 μA	100 μA	99.18 μA	100.82 μA
1100 μA	1.1 mA	1091 μA	1109 μA
110 A	0.4 A	19.30 A	20.70 A
400 A ¹	4.0 A	193.5 A	206.5 A

¹Move connection to the amplifier output.

b. Adjustments. No adjustments can be made.

12. Resistance

a. Performance Check

(1) Connect calibrator OUTPUT HI and LO to TI **V/ Ω / μA** and **COM**.

(2) Turn TI rotary switch to **Ω** (ohms) and press **R-H** (range) button to **110 Ω** range.

(3) Set calibrator for a 100 Ω output and 2 wire Comp on.

(4) Rotate calibrator knob below EDIT FIELD pushbutton to adjust calibrator display indication to equal TI indication. Calibrator err display will indicate within limits specified in first row of table 7.

(5) Repeat technique of (2) through (4) above, using calibrator outputs and TI indications listed in table 7. Calibrator err display will indicate within limits specified in table 7.

Table 7. Resistance

Test instrument RANGE	Calibrator	
	Output	ERROR display indication $\pm(\%)$
110 Ω	100 Ω	1.50
1 K Ω	1 k Ω	1.20
11 K Ω	10 k Ω	1.20
110 K Ω ¹	100 k Ω ¹	1.20
1 M Ω	1 M Ω	3.50
11 M Ω	10 M Ω	4.00
110 M	100 M Ω	5.00

¹Set calibrator 2 wire Comp off before setting output.

b. Adjustments. No adjustments can be made.

13. Frequency

a. Performance Check

- (1) Connect function generator to TI **V/Ω/μA** and **COM** inputs.
- (2) Set TI rotary switch to **Hz**.
- (3) Set function generator to 1 kHz. Adjust function generator amplitude as necessary to achieve stable frequency reading. TI will indicate within limits specified in first row of table 8.
- (4) Repeat technique of (3) above for ranges, settings and indications listed in table 8 up to 11 MHz. TI will indicate within limits specified in table 8.
- (5) Set the TI range switch to 110 MHz. Connect the signal generator to TI **V/Ω/μA** and **COM** inputs. Adjust the signal generator frequency to 100 MHz. TI will indicate within limits specified in table 8 for the 110 MHz range.

Table 8. Frequency Accuracy

Function generator output frequency	Test instrument range	Test instrument indication (Hz)	
		Min	Max
1000.0 Hz	1111.0 Hz	989.8 Hz	1010.2 Hz
10 kHz	11.000 kHz	9.898 kHz	10.102 kHz
100 kHz	110.00 kHz	98.98 kHz	101.02 kHz
1 MHz	1.1000 MHz	.9898 MHz	1.0102 MHz
10 MHz	11.000 MHz	9.898 MHz	10.102 MHz
100 MHz	110.00 MHz	98.98 MHz	101.02 MHz

- (6) Set function generator output to minimum and disconnect equipment setup.

b. Adjustments. No adjustments can be made.

14. Capacitance

a. Performance Check

- (1) Connect leads to TI **V/Ω/μA** and **COM** inputs.
- (2) Set function switch to —|< (capacitance). Set range to first range in table 9, and push **REL** pushbutton.
- (3) Connect open end of leads to 10.0 nF capacitance standard. TI will indicate within limits specified in first row of table 9.
- (4) Repeat technique of (2) and (3) above, using settings and indications listed in table 9. TI will indicate within limits specified table 9.

Table 9. Capacitance Accuracy

Capacitance standard Value ¹	Range	Test instrument	
		Min	Max
10.0 nF	11.0 nF	9.695 nF	10.305 nF
100 nF	110 nF	96.95 nF	103.05 nF
1.1 μF	1.0 μF	0.9695 μF	1.0305 μF

¹Capacitance values are nominal; actual values are derived from Test Report. Min and Max values are different from actual values.

(5) Disconnect capacitance standard.

b. Adjustments. No adjustments can be made.

15. Temperature

a. Performance Check

NOTE

A type k thermocouple probe must accompany TI in order to perform this check. Ensure that TI temperature probe and thermometer probe are inserted into cool/heat source wells to the same depth.

(1) Remove test leads. Connect temperature probe to TI **V/Ω/μA** and **COM** inputs.

(2) Insert TI temperature probe and thermometer probe into cool/heat source.

(3) Set TI rotary switch to **TEMP**.

(4) Adjust cool/heat source for a thermometer reading of 32°F (0° C). Allow sufficient time for temperature stabilization prior to making measurement. TI will indicate within limits specified in first row of table 10. If TI does not indicate within the limits of table 10, perform **b** below.

(5) Repeat technique of (4) above, using settings and indications listed in table 10. TI will indicate within limits specified in table 10.

Table 10. Temperature Accuracy

Thermometer reading	Test instrument	
	Min	Max
32 ° F (0 ° C)	30 °F	34 °F
120 ° F (37.77 °C)	118 °F	122 °F
212 ° F (100.00 °C)	208 °F	216 °F
325 ° F (176.66 ° C)	320 °F	330 °F

b. Adjustments

(1) Set the cool/heat source to 32° F (0°C). Adjust VR5 within 2.7° F. Adjust VR6 to read 32° F on the TI. (R)

(2) Set the cool/heat source to 120° F. Insure that the TI reads between 118 ° F and 122° F.

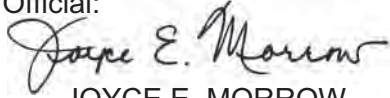
16. Final Procedure

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:



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

1014608

GEORGE W. CASEY, JR.
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7. **Date Sent:** 19-OCT-93
8. **Pub no:** 55-2840-229-23
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12. **Submitter Rank:** MSG
13. **Submitter FName:** Joe
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16. **Submitter Phone:** 123-123-1234
17. **Problem:** 1
18. **Page:** 2
19. **Paragraph:** 3
20. **Line:** 4
21. **NSN:** 5
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