

*TB 9-6695-281-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR PYROMETER AND THERMOCOUPLE TESTER, TYPE N-3A (MIL-T-58082)

Headquarters, Department of the Army, Washington, DC
28 November 2008

Distribution Statement A: 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 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 9-6695-281-35, dated 24 September 1986.

SECTION I IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Pyrometer and Thermocouple Tester, Type N-3A (MIL-T-58082). The manufacturers' manuals and MIL-T-58082 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 hour, using the physical, and 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

Circuit resistance:	Accuracy $\pm 0.04 \Omega$
Voltage check	Accuracy ± 0.5 Vdc
Thermocouple thermometer	Range 0 to 20 mV Accuracy ± 0.04 mV Range 20 mV to 49 mV Accuracy ± 0.06 mV
Thermocouple thermometer lead resistance	Accuracy $\pm 0.04 \Omega$
Resistance type thermometer	Accuracy $\pm 0.05 \Omega$

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 and 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 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 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)
MULTIMETER	Range: 3.61 mV dc to 29 V dc Accuracy: $\pm 0.03\%$ Range: 0 to 242.75 Ω Accuracy: $\pm 0.18\%$	Fluke, Model 8840A/AF05 (AN/GSM-64D)
RESISTANCE STANDARD	Range: 0 to 500 Ω Accuracy: $\pm 0.03\%$	Biddle-Gray, Model 71-631 (7910328)

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 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 control 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. Zero TI voltmeter, using mechanical zero located below meter.
- b. Position controls as listed in (1) through (5) below:
 - (1) Temperature selector switch to **OFF**.
 - (2) **OHMS** selector switch (lead resistance on some models) to 2 Ω .
 - (3) **ADJUSTOR INDICATOR** control to **0.2 LOW**.
 - (4) **RESISTANCE** and **VOLTAGE** selector switch to **LEAD RES CHECK**.
 - (5) **LEFT** and **RIGHT** switch to **LEFT** and **SINGLE**.

8. Circuit Resistance

a. Performance Check

(1) Connect multimeter to resistance standard. Measure and record the zero resistance of resistance standard.

(2) Connect TI to resistance standard high and low terminals, using thermocouple thermometer (red and black) leads.

(3) Adjust resistance standard for 2 ohms.

NOTE

Do not press TI **PUSH FOR OHMS** pushbutton until resistance standard is adjusted for the same resistance indication as TI **OHMS** selector switch indication.

(4) Press and hold TI **PUSH FOR OHMS** pushbutton while adjusting resistance standard X1, X.1, and X.01 controls until TI voltmeter indicates a null (zero).

(5) Release **PUSH FOR OHMS** pushbutton. Resistance standard indication, plus value recorded in (1) above will be between 1.76 and 1.84 ohms. If not, perform **b** below.

(6) Repeat technique of (3) through (5) above for settings listed in table 3. If resistance standard does not indicate within limits specified, perform **b** below.

Table 3. Resistance Measuring – Circuit

Test instrument		Resistance standard indication	
OHMS selector switch settings	ADJUST INDICATOR control settings	Min	Max
2	0.4 LOW	1.56	1.64
2	0.6 LOW	1.36	1.44
2	0.8 LOW	1.16	1.24
8	0.5 LOW	7.46	7.54
22	0.2 LOW	21.76	21.84
22	0.8 HIGH	22.76	22.84
8	0.5 HIGH	8.46	8.54
2	0.5 HIGH	2.46	2.54

b. Adjustments

(1) Set TI **OHMS** selector switch to 8 ohms and adjust resistance standard for 7.50 ohms.

(2) Press **PUSH FOR OHMS** pushbutton and adjust **ADJUST INDICATOR** control for zero indication on TI voltmeter.

(3) Maintain zero indication on TI voltmeter; loosen knob on **ADJUST INDICATOR** control, turn knob to 0.5 LOW and secure knob.

(4) Adjust resistance standard for 8.50 ohms.

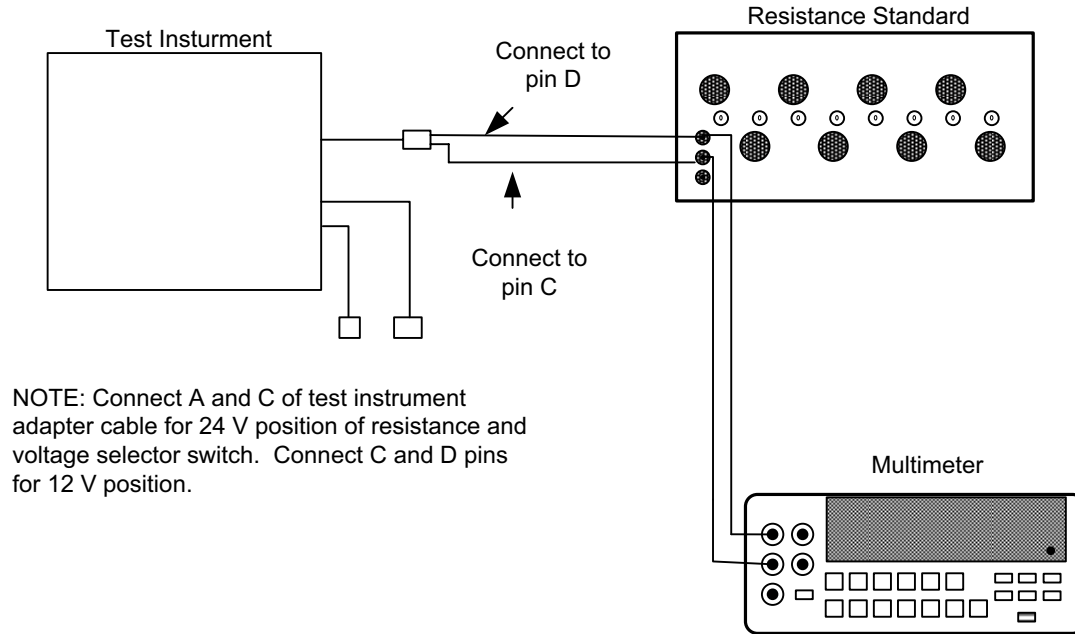
(5) Repeat (2) above.

(6) Maintain zero indication on TI voltmeter; loosen knob on adjust indicator control, turn knob half way between its position at completion of (5) above and 0.5 HIGH and secure knob.

9. Voltage

a. Performance Check

(1) Connect equipment as shown in figure 1.



NOTE: Connect A and C of test instrument adapter cable for 24 V position of resistance and voltage selector switch. Connect C and D pins for 12 V position.

Figure 1. Voltage test-equipment setup.

- (2) Set TI **RESISTANCE** and **VOLTAGE** selector switch to 12 V.
- (3) Adjust resistance standard for 500.00 ohms.
- (4) Adjust **COURSE** rheostat for full- scale (red line) indication on TI voltmeter. If multimeter does not indicate between 13.750 and 14.750 V, perform **b** below.
- (5) Repeat technique of (3) and (4) above for resistance and voltage selector switch positions listed in table 4. Multimeter will indicate within limits specified.

Table 4. Voltage Check

Test instrument		Multimeter (V)	
OHMS selector switch settings	TI voltmeter indication (V)	Min	Max
12 V	11.25	10.750	11.750
24 V ¹	Full scale (red line)	28.000	29.000
24 V	22.50	22.000	23.000

¹Remove connection from pin D and connect to pin A.

(6) Set TI **RESISTANCE** and **VOLTAGE** selector switch to **OFF**.

b. Adjustments. Set TI **COURSE** rheostat for a 14.25 V indication on multimeter and adjust magnetic shunt (located on back of meter on some models) or R10 (located on circuit board behind meter on other models) for red line indication on TI meter.

10. Thermocouple Thermometer

a. Performance Check

NOTE

A full-scale (red line) indication is required for all measurements.

- (1) Remove TI **TESTER STANDARDIZING ONLY** cover.
- (2) Connect equipment as shown in figure 2.
- (3) Set TI **RESISTANCE** and **VOLTAGE** selector switch to **THERMOCOUPLE BENCH TEST 8 OHMS**.
- (4) Adjust resistance standard for 17 ohms.
- (5) Adjust TI **COURSE** and **FINE** rheostats for full-scale (red line) indication on TI voltmeter.

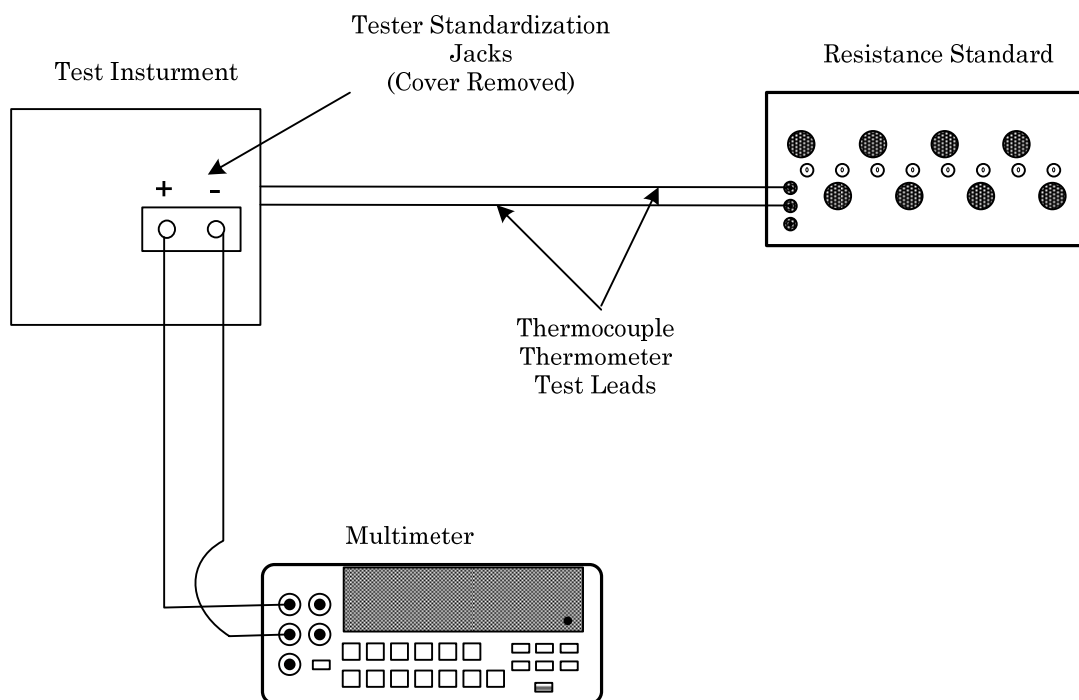


Figure 2. Thermocouple thermometer- equipment setup.

(6) Set **TEMPERATURE** selector switch to -50 on **IRON-CONSTANTAN °C**, outer scale. If multimeter does not indicate between -3.53 and -3.61 mV dc, perform **b** below.

(7) Repeat technique of (4) through (6) above for switch positions listed in table 5. Multimeter will indicate within limits specified.

Table 5. Thermocouple Thermometer

Resistance standard settings (ohms)	Test instrument TEMPERATURE selector switch positions (outer scale)	Multimeter indications	
		Min	Max
	IRON CONSTANTAN °C		
17.00	0	-1.01	-1.09
17.00	+20	-0.04	+0.04
17.00	+50	+1.57	+1.65
17.00	+100	+4.31	+4.39
17.00	+150	+7.10	+7.18
17.00	+200	+9.90	+9.98
17.00	+250	+12.70	+12.78
17.00	+300	+15.47	+15.55
17.00	+350	+18.23	+18.31
	COPPER CONSTANTAN °C		
17.00	-50	-2.55	-2.63
17.00	0	-0.75	-0.83
17.00	+20	-0.04	+0.04
17.00	+50	+1.21	+1.29
17.00	+100	+3.45	+3.53
17.00	+150	+5.87	+5.95
17.00	+200	+8.46	+8.54
17.00	+250	+11.18	+11.26
17.00	+300	+14.03	+14.11
17.00	+350	+16.99	+17.07
	CHROMEL ALUMEL °C		
42.00	0	-0.04	+0.04
42.00	+200	+8.09	+8.17
42.00	+400	+16.35	+16.43
42.00	+500	+20.58	+20.70
42.00	+600	+24.84	+24.96
42.00	+700	+29.08	+29.20
42.00	+800	+33.25	+33.37
42.00	+1000	+41.25	+41.37
42.00	+1200	+48.83	+48.95

b. Adjustments

(1) Adjust magnetic shunt or R10 (see **9 b** above) to bring multimeter indication within the limits specified.

(2) Repeat **9 a** above.

NOTE

The thermocouple thermometer check and the voltage check interact.

11. Thermocouple Thermometer Lead Resistance

a. Performance Check

(1) Short multimeter positive (+) and negative (-) terminals. Select 2 wire ohm function. Press the offset button. The multimeter should now read zero.

(2) Disconnect TI batteries and connect TI thermocouple leads (red and black) to multimeter positive (+) and negative (-) terminals.

(3) Set TI **TEMPERATURE** selector switch to **0 REF** on **CHROMEL-ALUMEL** °C, outer scale and **RESISTANCE** and **VOLTAGE** selector switch to 2. Multimeter indication will be between 1.96 and 2.04 ohms.

(4) Repeat technique of (3) above for 8 and 22 ohm switch positions. Multimeter will indicate between 7.96 and 8.04 and 21.96 and 22.04 respectively.

b. Adjustments. No adjustments can be made.

12. Resistance Type Thermometer

a. Performance Check

NOTE

TI batteries should be disconnected for this check.

(1) Connect leads to multimeter positive (+) and negative (-) and short leads. Press the offset button. The multimeter should now read zero.

(2) Connect multimeter to TI thermometer test cable pins B and C.

(3) Set TI **TEMPERATURE** selector switch to -70 on **90.38 OHMS RES** inner scale. Multimeter will indicate between 68.22 and 68.32 ohms.

(4) Repeat technique of (3) above for **TEMPERATURE** selector switch positions listed in table 6. Multimeter will indicate within limits specified.

Table 6. Resistance Type Thermometer Check

Test instrument TEMPERATURE selector switch positions (inner scale)	Multimeter indications (ohms)	
	Min	Max
90.38 (OHMS) RES.		
-50	74.19	74.29
-30	80.51	80.61
-10	86.99	87.09
0	90.33	90.43
+10	93.75	93.85
+30	100.86	100.96
+50	108.34	108.44
+80	120.31	120.41
+100	128.80	128.90
+120	137.73	137.83
+150	151.86	151.96
+200	177.90	178.00
+250	207.95	208.05

Table 6. Resistance Type Thermometer Check – Continued

Test instrument TEMPERATURE selector switch positions (inner scale)	Multimeter indications (ohms)	
	Min	Max
50.00 (OHMS) RES.		
+300	242.65	242.75
+300	164.45	164.55
+250	138.95	139.05
+200	116.45	116.55
+150	96.45	96.55
+100	78.95	79.05
+50	63.50	63.60
0	49.95	50.05
-50	37.90	38.00

(5) Set TI **LEFT** and **RIGHT** switch to **RIGHT**.

(6) Connect multimeter to TI thermometer test cable pins E and C Repeat technique of (1) through (4) above.

b. Adjustments. No adjustments can be made.

13. 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:



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Secretary of the Army*

0827403

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Chief of Staff*

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 342316, requirements for calibration procedure TB 9-6695-281-24.

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.

