

TB 9-6625-2356-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR THERMOCOUPLE SOURCE, ALTEK MODEL 22K

Headquarters, Department of the Army, Washington, DC
20 October 2004

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REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

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SECTION		Paragraph	Page
	I. IDENTIFICATION 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	3
	Equipment setup	7	3
	Scale accuracy.....	8	4
	Final procedure	9	9

**SECTION I
IDENTIFICATION AND DESCRIPTION**

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Thermocouple Source, Altek Model 22K. 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. The type, degree and range of thermocouple sources are determined by the front panel markings.

b. Time and Technique. The time required for this calibration is approximately 1 hour, using the physical 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

Test instrument parameters	Performance specifications
Scale accuracy	Range: 500°, 1000° or 2100° Accuracy: ($\pm 0.1\%$ of span $\pm 1^\circ$) ¹

¹For negative temperatures: $\pm 0.1\%$ of span $\pm 3^\circ$.

**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 Sets AN/GSM-286; 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. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
THERMOMETER	Range: 0°C, 32°F Accuracy: ± 0.2°C, ±0.36°F	Azonix, Model A1012, (MIS 38958) with Temperature Probe, Instrulab, Model 4101-10X
ICE BATH	Range: 32 °F; 0.0 °C Accuracy: ±0.018 °F; ±0.01 °C	As available
MULTIMETER NO.1	Range: -1 to 1 V dc, 5.5 digits Accuracy: ± 0.05%	Hewlett-Packard, Model 3458A (3458A)
MULTIMETER NO.2	Range: -1 to 1 V dc, 5.5 digits Accuracy: ± 0.05%	Fluke, Model 8840A/AF05 (AN/GSM-64D)

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 the calibration procedure. The following peculiar accessory is also required for this calibration: laboratory beaker.

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 manufacturer's manual for this TI.

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

7. Equipment Setup

a. Determine and record ambient temperature in degrees Celsius using thermometer.

b. Prepare and maintain an ice bath for an ice-point temperature of zero degrees Celsius or 32 degrees Fahrenheit as monitored with thermometer.

c. Connect equipment as shown in figure 1.

d. Energize TI by moving the slide switch to the right black **ON** position while observing the green LED for a flash to indicate batteries are good. If no flash, replace batteries and repeat.

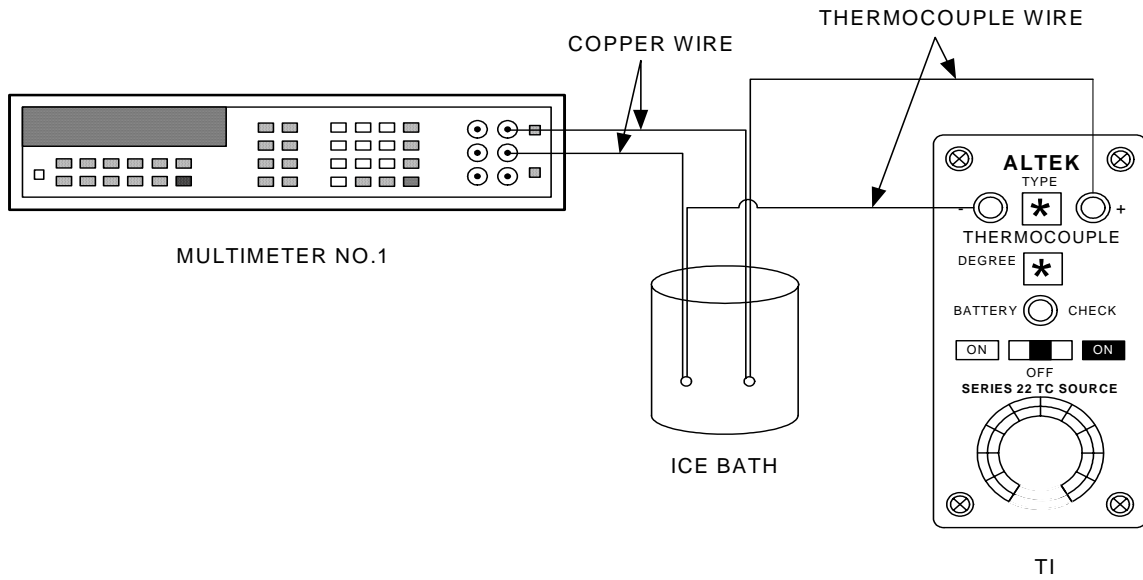


Figure 1. Equipment setup.

8. Scale Accuracy

a. Performance Check

- (1) Set multimeter to measure dc millivolts.
- (2) Energize TI by moving the slide switch to the right black **ON** position while observing the green LED for a flash.
- (3) Set TI temperature selector switch to the first value in tables 3 or 4 for Celsius thermocouple sources or tables 5, 6, or 7 for Fahrenheit thermocouple sources.
- (4) Multimeter will indicate within the limits specified. If not, perform paragraph **b** below.
- (5) Repeat steps (3) and (4) above for the remaining values listed in the table. If not within the limits specified, perform paragraph **b** below.

Table 3. Scale Accuracy – 500 Degrees Centigrade Full Scale

TI outer scale dial setting (Black °C)	Multimeter reading (mV)			Adjustment
	Min	Actual	Max	
0	-0.0601	0	0.0602	R18 ¹
50	1.9602	2.023	2.0860	N/A
100	4.0331	4.096	4.1593	N/A
150	6.0769	6.138	6.1997	N/A
200	8.0775	8.138	8.1994	N/A
250	10.0913	10.153	10.2155	N/A
300	12.1454	12.209	12.2718	N/A
350	14.2293	14.293	14.3571	N/A
400	16.3327	16.397	16.4616	N/A
450	18.4510	18.516	18.5806	N/A
500	20.5793	20.644	20.7093	R8 ²

See footnotes at end of table.

Table 3. Scale Accuracy – 500 Degrees Centigrade Full Scale - Continued

TI inner scale dial setting (White °C) ³	Multimeter reading (mV)			
	Min	Actual	Max	Adjustment
-25	-1.1008	-0.968	-0.8338	N/A
25	0.9385	1.000	1.0621	R6⁴
75	2.9956	3.059	3.1223	N/A
125	5.0621	5.124	5.1867	N/A
175	7.0795	7.140	7.2013	N/A
225	9.0797	9.141	9.2025	N/A
275	11.1137	11.176	11.2391	N/A
325	13.1844	13.248	13.3116	N/A
375	15.2789	15.343	15.4072	N/A
425	17.3903	17.455	17.5195	N/A
475	19.5143	19.579	19.6441	N/A

¹ Perform paragraphs b (1) through (11) below.

² Perform paragraphs b (1) through (8) below.

³ Set slide switch to the left white **ON** position.

⁴ Perform paragraphs b (1) through (16) below.

Table 4. Scale Accuracy – 1000 Degrees Centigrade Full Scale

TI outer scale dial setting (Black °C)	Multimeter reading (mV)			
	Min	Actual	Max	Adjustment
0	-0.0808	0	0.0810	R18¹
100	4.0114	4.096	4.1810	N/A
200	8.0566	8.138	8.2204	N/A
300	12.1236	12.209	12.2936	N/A
400	16.3106	16.397	16.4837	N/A
500	20.5569	20.644	20.7317	N/A
600	24.8183	24.905	24.9926	N/A
700	29.0431	29.129	29.2148	N/A
800	33.1913	33.275	33.3594	N/A
900	37.2439	37.326	37.4079	N/A
1000	41.1957	41.276	41.3555	R8²
TI inner scale dial setting (White °C) ³	Multimeter reading (mV)			
	Min	Actual	Max	Adjustment
-50	-2.0336	-1.889	-1.7436	N/A
50	1.9386	2.023	2.1077	R6⁴
150	6.0557	6.138	6.2209	N/A
250	10.0700	10.153	10.2369	N/A
350	14.2073	14.293	14.3791	N/A
450	18.4287	18.516	18.6029	N/A
550	22.6890	22.776	22.8638	N/A
650	26.9382	27.025	27.1115	N/A
750	31.1284	31.213	31.2985	N/A
850	35.2300	35.313	35.3961	N/A
950	39.2325	39.314	39.3945	N/A

¹ Perform paragraphs b (1) through (11) below.

² Perform paragraphs b(1) through (8) below.

³ Set slide switch to the left white **ON** position.

⁴ Perform paragraphs b (1) through (16) below.

TB 9-6625-2356-35

Table 5. Scale Accuracy – 500 Degrees Fahrenheit Full Scale

TI outer scale dial setting (Black °F)	Multimeter reading (mV)			
	Min	Actual	Max	Adjustment
0	-0.7249	-0.692	-0.6599	R18 ¹
50	0.3631	0.397	0.4307	N/A
100	1.4861	1.521	1.5554	N/A
150	2.6316	2.667	2.7019	N/A
200	3.7850	3.820	3.8552	N/A
250	4.9307	4.965	5.0001	N/A
300	6.0594	6.094	6.1277	N/A
350	7.163	7.207	7.251	N/A
400	8.2823	8.316	8.3501	N/A
450	9.3982	9.432	9.4667	N/A
500	10.5267	10.561	10.5960	R8 ²
TI inner scale dial setting (White °F) ³	Multimeter reading (mV)			
	Min	Actual	Max	Adjustment
-25	-1.2915	-1.218	-1.1452	N/A
25	-0.1863	-0.153	-0.1198	R6 ⁴
75	0.9210	0.955	0.9896	N/A
125	2.0569	2.092	2.1268	N/A
175	3.2084	3.244	3.2788	N/A
225	4.3596	4.395	4.4295	N/A
275	5.4973	5.532	5.5661	N/A
325	6.6176	6.652	6.6855	N/A
375	7.7275	7.761	7.7951	N/A
425	8.8389	8.873	8.9070	N/A
475	9.960	9.995	10.0296	N/A

¹ Perform paragraphs b (1) through (11) below.

² Perform paragraphs b (1) through (8) below.

³ Set slide switch to the left white **ON** position.

⁴ Perform paragraphs b (1) through (16) below.

Table 6. Scale Accuracy – 1000 Degrees Fahrenheit Full Scale

TI outer scale dial setting (Black °F)	Multimeter reading (mV)			
	Min	Actual	Max	Adjustment
0	-0.7361	-0.692	-0.6487	R18 ¹
100	1.4741	1.521	1.5674	N/A
200	3.7729	3.820	3.8673	N/A
300	6.0477	6.094	6.1395	N/A
400	8.2706	8.316	8.3617	N/A
500	10.5148	10.561	10.6079	N/A
600	12.8072	12.855	12.9020	N/A
700	15.1316	15.179	15.2274	N/A
800	17.4773	17.526	17.5738	N/A
900	19.8382	19.887	19.9352	N/A
1000	22.2067	22.255	22.3038	R8 ²

See footnotes at end of table.

Table 6. Scale Accuracy – 1000 Degrees Fahrenheit Full Scale - Continued

TI inner scale dial setting (White °F) ³	Multimeter reading (mV)			
	Min	Actual	Max	Adjustment
-50	-1.8106	-1.729	-1.6477	N/A
50	0.3514	0.397	0.4423	R6 ⁴
150	2.6195	2.667	2.7140	N/A
250	4.9187	4.965	5.0120	N/A
350	7.1615	7.207	7.2524	N/A
450	9.3864	9.432	9.4784	N/A
550	11.6559	11.703	11.7499	N/A
650	13.9663	14.014	14.0616	N/A
750	16.3021	16.350	16.3983	N/A
850	18.6563	18.705	18.7531	N/A
950	21.0221	21.071	21.1192	N/A

¹ Perform paragraphs b (1) through (11) below.

² Perform paragraphs b (1) through (8) below.

³ Set slide switch to the left white **ON** position.

⁴ Perform paragraphs b (1) through (16) below.

Table 7. Scale Accuracy – 2100 Degrees Fahrenheit Full Scale

TI outer scale dial setting (Black °F)	Multimeter reading (mV)			
	Min	Actual	Max	Adjustment
100	1.4503	1.521	1.5913	R18 ¹
300	6.0241	6.094	6.1630	N/A
500	10.4909	10.561	10.6318	N/A
700	15.1070	15.179	15.2519	N/A
900	19.8134	19.887	19.9601	N/A
1100	24.5488	24.622	24.6953	N/A
1300	29.2430	29.315	29.3872	N/A
1500	33.8416	33.912	33.9823	N/A
1700	38.3207	38.389	38.4575	N/A
1900	42.6742	42.741	42.8070	N/A
2100	46.8900	46.954	47.0182	R8 ²
TI inner scale dial setting (White °F) ³	Multimeter reading (mV)			
	Min	Actual	Max	Adjustment
0	-0.7584	-0.692	-0.6262	N/A
200	6.0241	3.820	3.8915	R6 ⁴
400	8.2473	8.316	8.3851	N/A
600	12.7829	12.855	12.9263	N/A
800	17.4526	17.526	17.5986	N/A
1000	22.1818	22.255	22.3287	N/A
1200	26.9051	26.978	27.0507	N/A
1400	31.5564	31.628	31.6990	N/A
1600	36.0966	36.166	36.2354	N/A
1800	40.5135	4.0581	40.6484	N/A
2000	44.8008	44.866	44.9314	N/A

¹ Perform paragraphs b (1) through (11) below.

² Perform paragraphs b (1) through (8) below.

³ Set slide switch to the left white **ON** position.

⁴ Perform paragraphs b (1) through (16) below.

TB 9-6625-2356-35

b. Adjustment

- (1) Remove the four front panel screws and case.
- (2) Connect multimeter no.2 as indicated in figure 2.

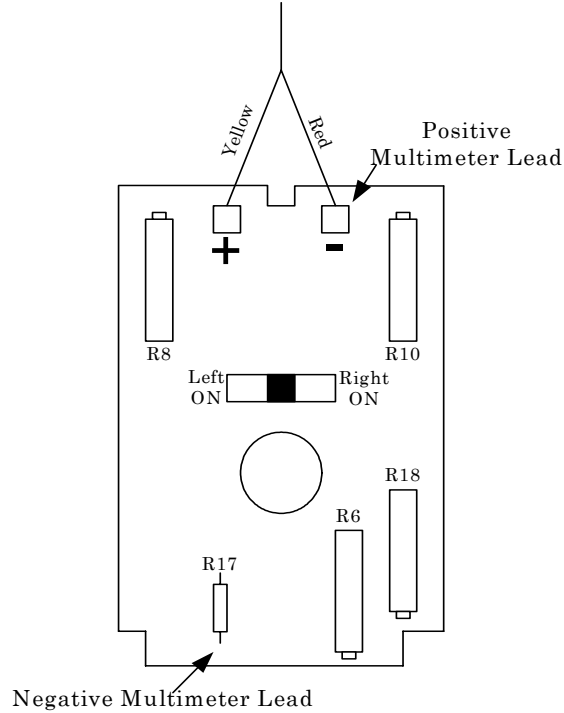


Figure 2. Motherboard – component side

- (3) Set multimeter no. 2 to measure dc millivolts.
- (4) Energize TI by moving the slide switch to the right black **ON** position.
- (5) Move temperature selector to the highest output position.
- (6) Adjust **R10** (fig. 2) for multimeter no. 2 reading in table 8; corresponding to the ambient temperature recorded in paragraph **7 a** above (R).

Table 8. Cold Junction Compensator Set Points

Ambient temperature (degrees C)	Multimeter no. 2 reading (mV)
20	12.071
21	12.111
22	12.152
23	12.192
24	12.233
25	12.273
26	12.314
27	12.354
28	12.395
29	12.435
30	12.476

- (7) Adjust **R8** (fig. 2) for in tolerance reading on multimeter no. 1 (R).
- (8) Repeat steps (6) and (7) until readings are in tolerance.
- (9) Move temperature selector to the lowest output position.
- (10) Adjust **R18** (fig. 2) for in tolerance reading on multimeter no. 1 (R).
- (11) Repeat steps (6) through (10) until readings are in tolerance.
- (12) Move temperature selector to the second lowest output position.
- (13) Energize TI by moving the slide switch to the left white **ON** position.
- (14) Adjust **R6** (fig. 2) for in tolerance reading on multimeter no. 1 (R).
- (15) Repeat steps (4) through (14) above until readings are in tolerance.
- (16) Repeat paragraph 8 a.

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:



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*Administrative Assistant to the
Secretary of the Army*

0423606

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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.

