*TB 9-5855-1892-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR THERMAL SIGHT COLLIMATOR, SM-D-969722 (12951545)

Headquarters, Department of the Army, Washington, DC
22 July 2008

REPORTING OF ERRORS AND RECOMMDENDING 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.

*This bulletin supersedes TB 9-5855-1892-35, dated 2 November 1998, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Thermal Sight Collimator, SM-D-969722 (12951545). The manufacturer's manual 6004651, dated 01 July 1996, Revision B, 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 3 hours, 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
Temperature differential	Temperature: 4.5 °C (ambient to heater) Deviation: ±0.45 °C

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. 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

Common name	Minimum use specifications	Manufacturer and model (part number)
DIFFERENTIAL THERMOCOUPLE SET	Range: 0 to 5 °C differential Accuracy: ±0.11 °C	Omega Engineering 0.020 Type K (7917040)[1]
MULTIMETER	Range: 0 to 15 V Accuracy:[2]	Hewlett Packard, Model 3458A (3458A)

[1]Part of calibration kit 7917034, limited deployed.
[2] Combined accuracy of thermocouples and multimeter is ± 4.5 μV.

Table 3. Accessories Required

Common name	Description (part number)
COTTON TIP APPLICATOR[1]	Swab with cotton tip on one end
HOLDING CLAMP[2]	Mounting post clamp (7917039) [3]
LABORATORY CLAMP[2]	Laboratory clamp (MS-36012-1) [3]
PASTE REMOVAL SOLVENT[1]	WD40 or equivalent
THERMOCOUPLE MOUNTING POST[2]	Mounting post with base (7917037)[3]
THERMALLY CONDUCTIVE PASTE[1]	Omegatherm 201 or equivalent

[1]Additional equipment required.
[2]Two required.
[3]Component part of calibration kit 7917034, limited deployed.

SECTION III
CALIBRATION PROCESS

6. Preliminary Instructions

a. The instructions outlined in paragraphs **6**, **7** and **8** 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 tables 2 and 3.

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 TM 9-4931-586-30&P for this TI.

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

7. Preliminary Checks

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.

NOTE

TI should be placed away from direct sunlight and air currents.

a. Remove top cover of transit case and shroud from TI as shown in figure 1.

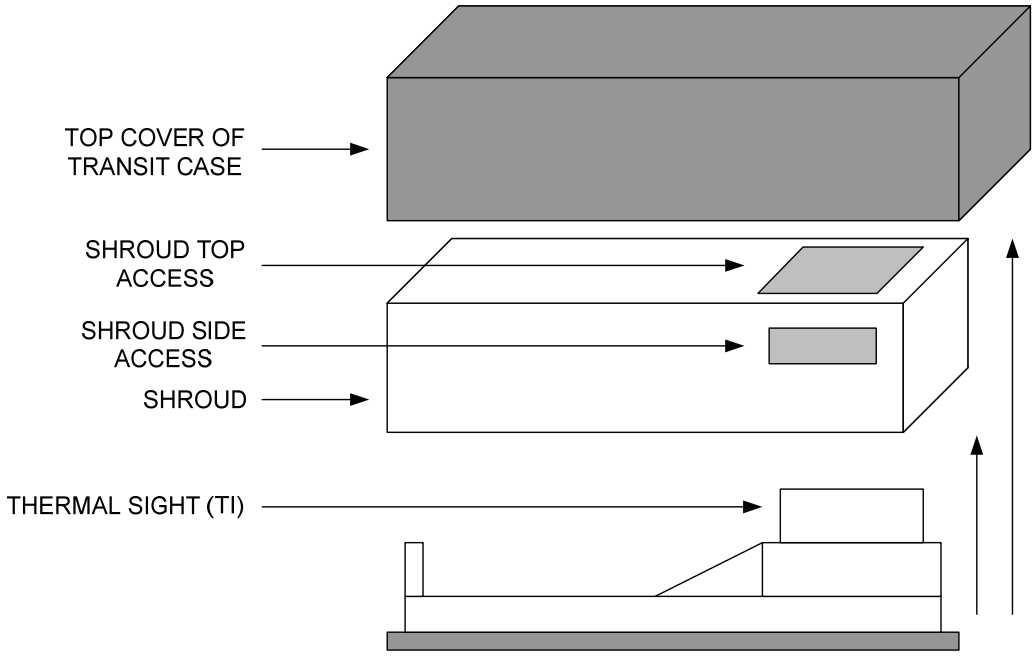

Figure 1. Thermal sight (TI) with top cover of case and shroud removed.

b. Remove cables from transit case and rotate target select knob to **BAR** position (fig. 2).

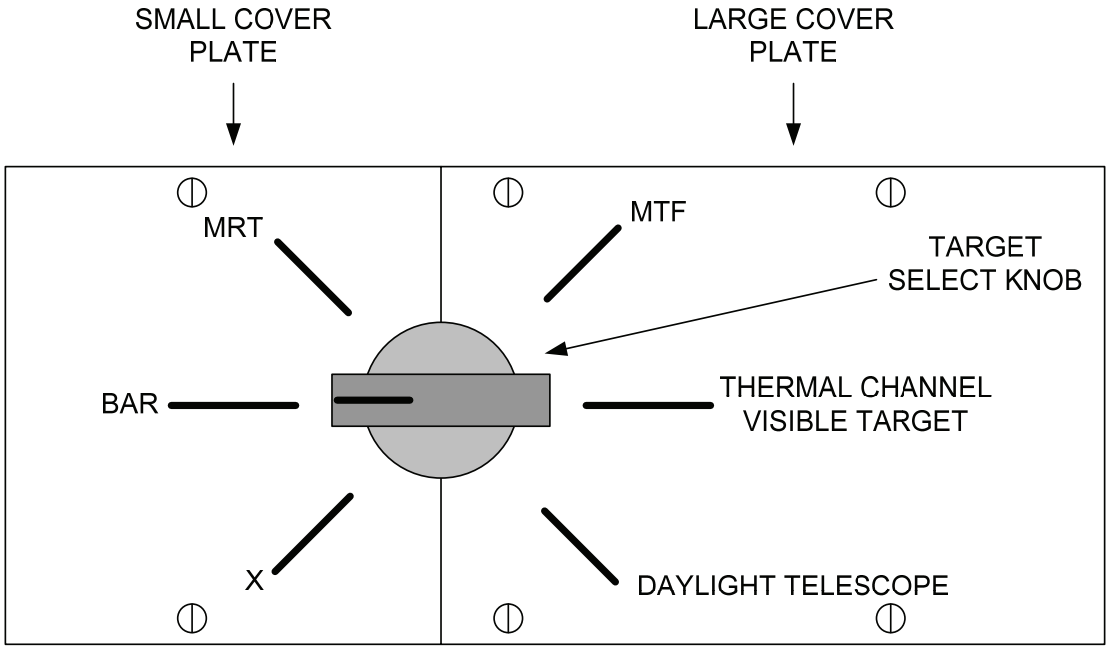

Figure 2. TI top view.

c. Remove four screws from large cover plate and remove large cover plate (fig. 2).

d. Set **ON/ALIGN** switch to **ALIGN** (fig. 3).

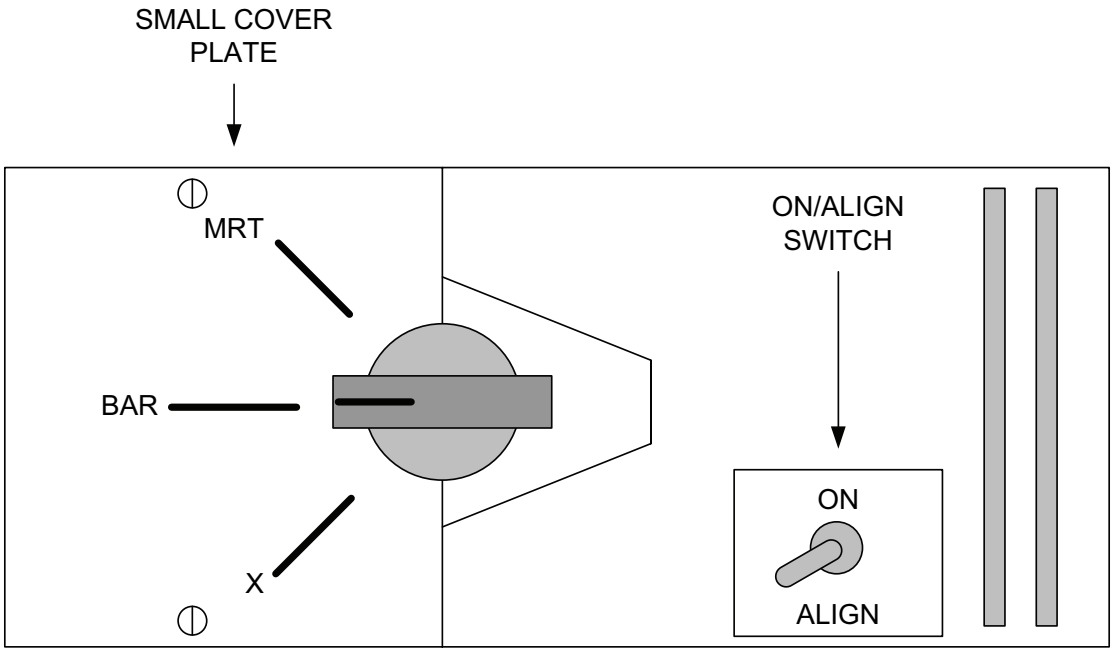

Figure 3. Large cover plate removed (top view).

e. Loosely replace large cover plate (fig. 2).

f. Perform steps (1) through (6) below:

(1) Ensure TI **ON/OFF** switch is in **OFF** position.

(2) Position TI **1°C/4.5°C/10°C** switch to **4.5°C**.

(3) Connect ac power cable supplied to J1 (fig. 4).

NOTE

TI should be allowed to stabilize in calibration environment for a minimum of 1 hour.

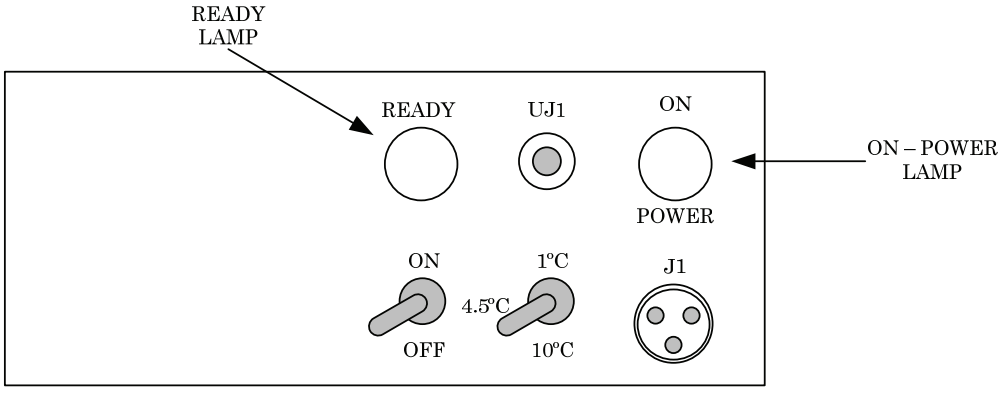

Figure 4. TI side view.

(4) Connect remaining end of ac power cable to 115 V ac source.

(5) Set **ON/OFF** switch to **ON**.

NOTE

READY lamp will initially illuminate then extinguish for approximately 10 seconds. **READY** lamp will then blink once a second.

(6) Verify **READY** lamp blinks approximately once a second and **POWER** lamp illuminates; if not, perform **8 b**(1) below.

g. Set **ON/OFF** switch to **OFF**.

h. Perform steps (1) through (7) below:

(1) Rotate target select knob to **MRT**.

(2) Set **ON/OFF** switch to **ON**.

NOTE

READY lamp will initially illuminate, then extinguish for approximately 10 seconds. **READY** lamp will then blink once a second.

(3) Verify **READY** lamp blinks approximately once a second; if not, perform **8 b** (1) below.

(4) Set TI **ON/OFF** switch to **OFF**.

(5) Remove large cover plate (fig. 2).

(6) Set **ON/ALIGN** switch to **ON** (fig. 3).

(7) Loosely replace large cover plate (fig. 2).

8. Equipment Setup

a. Set target select knob to **BAR**.

b. Connect equipment as shown in figure 5 and as described in (1) through (5) below:

NOTE

Equipment used to mount thermocouples to TI may vary at each lab. The following instructions describe the most common equipment in use.

(1) Install thermocouple mounting post (pair) (fig. 5) on base of TI (approximately center of second slot pair from exit port).

(2) Install thermocouple harness wire to thermocouples (connectors are keyed and labeled).

(3) Clamp differential thermocouple set (pair) in laboratory clamps and install on thermocouple mounting posts, using mounting post clamps (fig. 5).

(4) Using the wood end of a cotton tip applicator, daub a small amount of thermal conducive paste on bottom of **HEATER PLATE** behind BAR TARGET (fig. 6).

(5) Place tip of thermocouple No. 1 (TC1) in thermal conductive paste against bottom of **HEATER PLATE** (INSIDE) **BAR TARGET AMBIENT PLATE** (fig. 6).

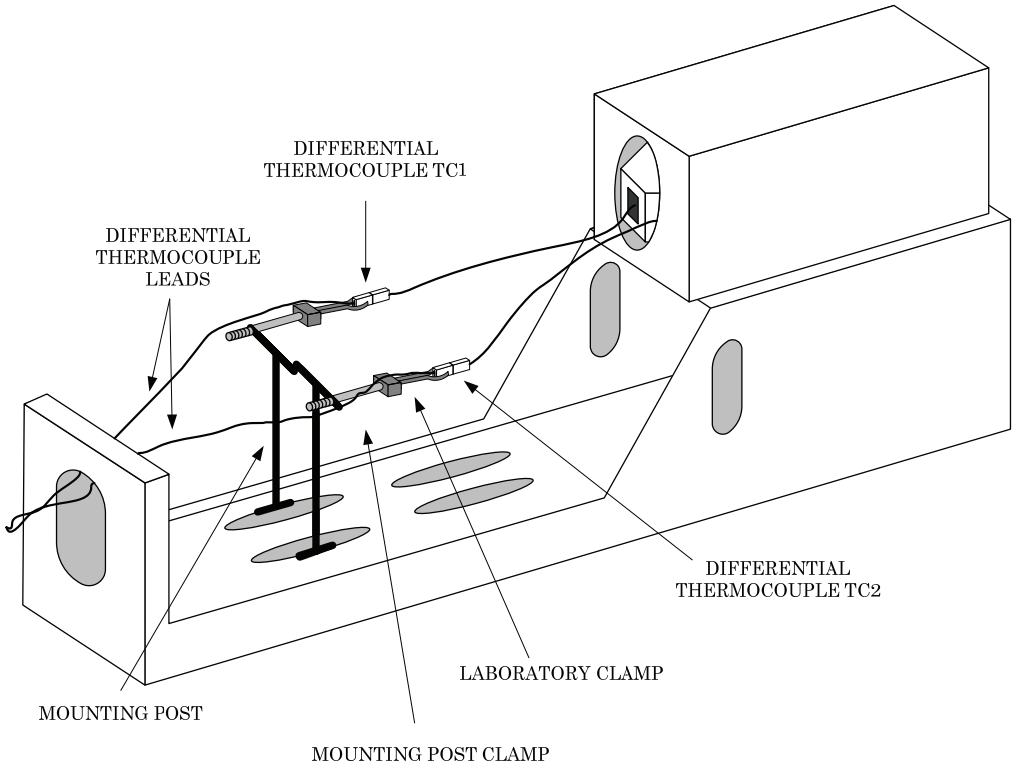

Figure 5. Equipment setup.

CAUTION

Avoid scratching internal edges of **BAR TARGET** (fig. 6) during application and removal of thermal conductive paste.

c. Perform steps (1) through (4) below:

(1) Loosen mounting post clamp (fig. 5) which holds laboratory clamp (fig. 6).

(2) Increase tension on thermocouple No. 1 (TC1) to produce a moderate bow in thermocouple wire by sliding laboratory clamp (fig. 6) forward (toward temperature controller) in mounting post clamps; then tighten mounting post clamps (fig. 5).

(3) If necessary, physically position thermocouple TC1 on **HEATER PLATE** to the position shown in figure 6.

(4) Daub a small amount of thermally conductive paste on exterior of TI BAR TARGET adjacent to placement of TC1 and place tip of thermocouple No. 2 (TC2) in the thermally conductive paste (fig. 6).

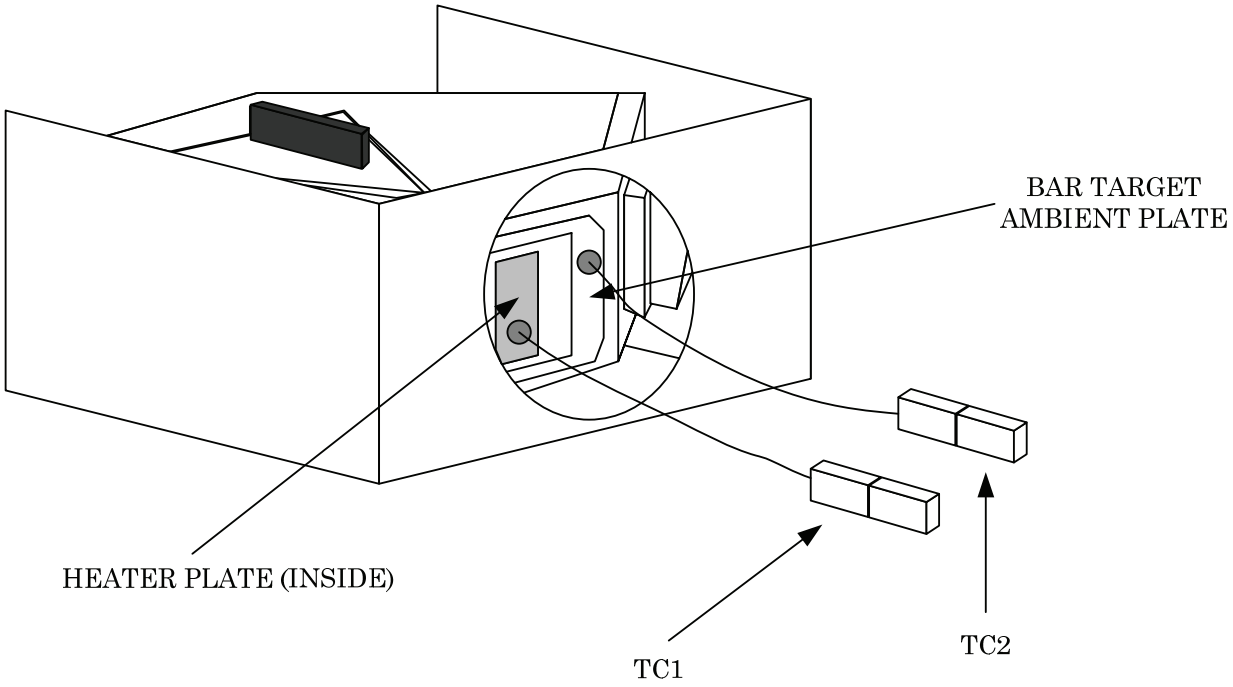

Figure 6. Thermocouple to heater plate setup.

d. Repeat technique of **c** (1) through (3) above for thermocouple TC2 (fig. 6).

e. Connect thermocouple wires to multimeter input **HI** (TC1) and input **LO** (TC2) terminals.

NOTE
TC1 is labeled with a **+** sign.

NOTE
Verify thermocouple leads have not moved and are still located in thermally conductive paste and are not touching sides of BAR TARGET window.

f. Ensure TI **ON/OFF** switch is in **OFF** position.

g. Connect multimeter to 115 V ac power source, turn power on, and allow time for multimeter to warm-up and stabilize.

9. Temperature Check

a. Performance Check

(1) Set TI **ON/OFF** switch to **ON** (green **READY** lamp will momentarily illuminate).

(2) Wait for **READY** lamp to illuminate and remain illuminated for a minimum of 8 minutes.

(3) Perform steps (a) through (g) below:

(a) Monitor multimeter indications for a minimum of 2 minutes.

(b) Record multimeter maximum and minimum indications on BAR Target Temperature Worksheet (appendix A). Make copies of BAR Target Temperature Worksheet as required.

(c) Use formula provided on BAR Target Temperature Worksheet to compute temperature equivalent values for T max and T min.

(d) Average T max and T min values to determine current temperature and record on BAR Target Temperature Worksheet.

(e) Use formula provided on BAR Target Temperature Worksheet to calculate temperature error.

(f) Temperature error will be between –0.45 °C and +0.45 °C; if not, perform **b** (2) below and repeat steps in paragraphs **9 a** through **f**.

(g) Set TI **ON/OFF** switch to **OFF**.

(4) Loosen mounting post clamp (fig. 5) on thermocouple No. 2 (TC2) and slide laboratory clamp (fig. 6) back (away from TI) in mounting post clamp until thermocouple is outside TI, then tighten mounting post clamp (fig. 5).

NOTE

Apply cotton tip applicator gently to blackened painted surfaces to prevent rubbing off black paint.

(5) Use cotton-tip applicator soaked in paste removal solvent to remove thermally conductive paste from exterior surface of **BAR TARGET AMBIENT PLATE** (fig. 6), then remove solvent residue using a dry cotton-tip applicator.

(6) Remove large cover plate (fig. 2) from TI.

(7) Loosen **TARGET SELECTOR SWITCH** screws and move **TARGET SELECTOR SWITCH** back to disengage contacts (fig. 7).

NOTE

MRT is now selected internally while target select knob shows **BAR** target is selected.

(8) Loosely replace large cover plate (fig. 2).

(9) Daub a small amount of thermally conductive paste on left side (flat surface) of **MRT** target housing and place tip of thermocouple No. 2 (TC2) (fig. 8) in thermally conductive paste.

NOTE

You may need to remove small cover plate (fig. 2).

(10) Loosen holding clamp (fig. 5) slightly.

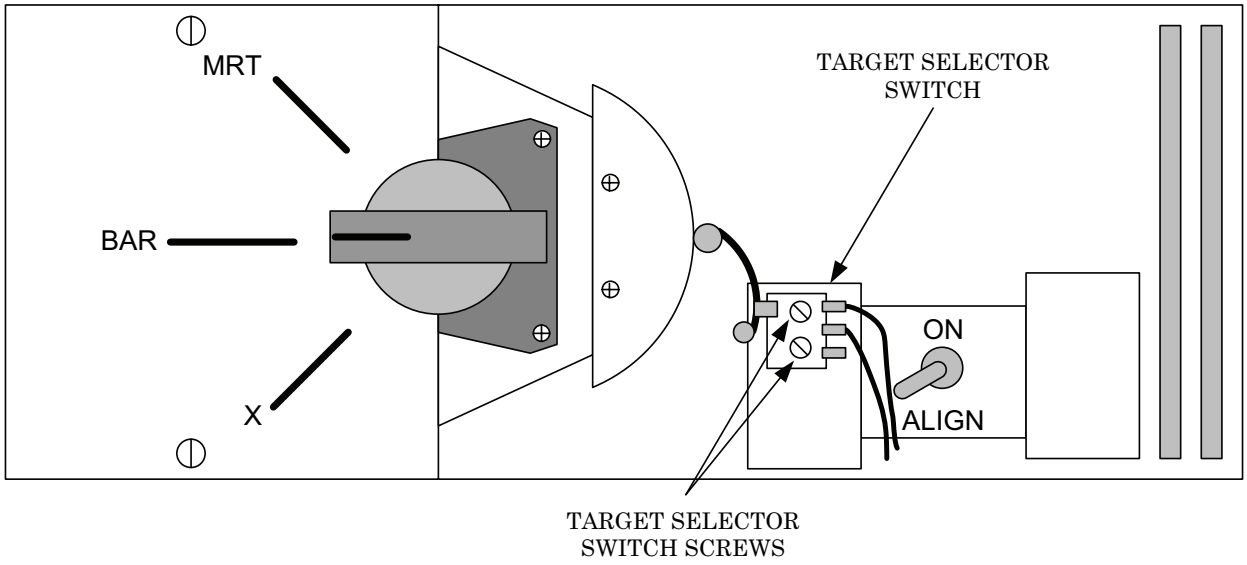

Figure 7. Loosening target selector switch mount. (**ON/ALIGN** switch is shown for clarity only).

(11) Increase pressure on thermocouple No. 2 to produce a slight bow in thermocouple wire by sliding laboratory clamp forward (toward TI) in holding clamp, then tighten holding clamp (fig. 5).

(12) Repeat technique of steps **9 a** (1) through **9 a** (3) (e) and record values on "MRT Target Temperature Worksheet". Temperature error will be between –0.45 and +0.45 °C; if not, perform **b** (2) below and repeat this step.

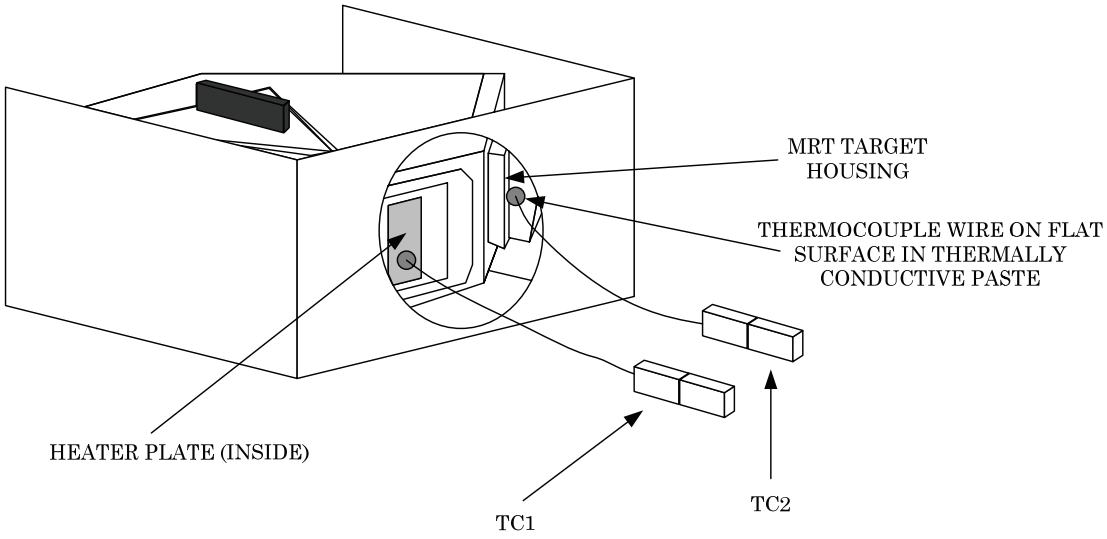

Figure 8. Repositioning TC2 thermocouple wire to MRT target housing.

(10) Loosen holding clamp (fig. 5) slightly.

(11) Increase pressure on thermocouple No. 2 to produce a slight bow in thermocouple wire by sliding laboratory clamp forward (toward TI) in holding clamp, then tighten holding clamp (fig. 5).

(12) Repeat technique of steps **9 a** (1) through **9 a** (3) (e) and record values on "MRT Target Temperature Worksheet". Temperature error will be between –0.45 and +0.45 °C; if not, perform **b** (2) below and repeat this step.

(13) Deenergize and disconnect all leads.

(14) Perform steps in paragraph **10** for final procedure.

b. Adjustments

(1) Perform steps (a) through (f) below:

(a) Set multimeter power to **ON**.

(b) Set multimeter to measure dc volts and auto range.

(c) Connect multimeter to UJ1 (fig. 4).

(d) Verify multimeter indications vary between 0 ± 2 V dc and 15 ± 2 V dc.

(e) Wait for **READY** lamp to stop blinking and remain illuminated.

(f) Verify multimeter indication is 15 ± 2 V dc.

(2) Perform steps in (2) (a) through (f) below:

(a) Set TI **ON/OFF** switch to **OFF** position.

(b) Remove large cover plate (fig. 2).

(c) Ensure **ON/ALIGN** switch is set to **ON**.

CAUTION

Disconnect ac power cable from TI before changing dip switch settings and reconnect TI to ac power cable after changing dip switch settings.

NOTE

Ensure dip switch 1, **A** and **B** are set to **ON**. Ensure dip switch 2**, C** and **D** are set to **ON**. Refer to figure 9 for example of settings.

(d) Refer to calculated temperature error for **BAR** target recorded on BAR Target Temperature Worksheet or for **MRT** target recorded on MRT Target Temperature Worksheet and set dip switch 1 and dip switch 2 (example in figure 9) to indicate temperature error °C as indicated in table 4 (R).

NOTE

A temperature correction greater than limits specified in table 4 is possible. A temperature correction is added or removed each time technique of **9 b** (2) is performed depending on dip switch settings. Repeating technique of **9 b** (2) will cause additional temperature corrections each time the step is performed.

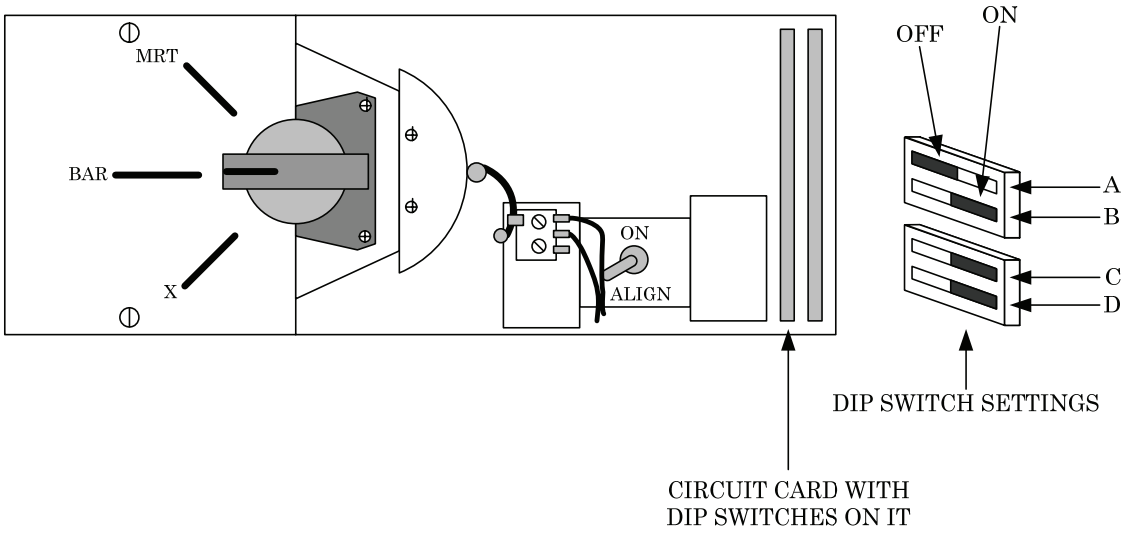

Figure 9. Example of Dip Switch correction setting for – 0.025 to – 0.075 °C.

(e) Perform steps 1 through 3 below:

1 Set TI **ON/OFF** switch to **ON**, and wait until **READY** lamp illuminates and remains illuminated.

2 Set **ON/ALIGN** switch to **ALIGN**, wait 10 seconds and set **ON/ ALIGN** switch to **ON**.

3 Verify temperature error correction has been stored by observing **READY** lamp blinking at 2 Hz rate.

Table 4. Temperature Correction Settings

Temperature error °C	Dip switch 1		Dip switch 2	
	A	B	C	D
+0.375 and greater	On	On	On	Off
+0.325 to +0.375	Off	On	On	Off
+0.275 to +0.325	On	Off	On	Off
+0.225 to +0.275	Off	Off	On	Off
+0.175 to +0.225	On	On	Off	Off
+0.125 to +0.175	Off	On	Off	Off
+0.075 to +0.125	On	Off	Off	Off

Table 4. Temperature Correction Settings - Continued

Temperature error °C	Dip switch 1		Dip switch 2	
	A	B	C	D
+0.025 to +0.075	Off	Off	Off	Off
–0.025 to –0.075	Off	On	On	On
–0.075 to –0.125	On	Off	On	On
–0.125 to –0.175	Off	Off	On	On
–0.175 to –0.225	On	On	Off	On
–0.225 to –0.275	Off	On	Off	On
–0.275 to –0.325	On	Off	Off	On
–0.325 and less	Off	Off	Off	On

(f) Perform steps 1 and 2 below:

1 Set TI **ON/OFF** switch to **OFF**.

CAUTION

Disconnect ac power cable from TI before changing dip switch settings and reconnect TI ac power cable after changing dip switch settings.

2 Set dip switch **1**, **A** and **B** to on and dip switch **2**, **C** and **D** to on, then loosely replace large cover plate (fig. 2).

10. Final Procedure

a. Deenergize and disconnect all equipment.

b. Remove TI large cover plate (fig. 2), place **TARGET SELECTOR SWITCH** back in original position and tighten **TARGET SELECTOR SWITCH** screws (fig. 7).

c. Install TI large cover plate (fig. 2) and four screws.

d. Using cotton tip applicator soaked with paste removal solvent, clean thermal conductive paste from TI heater plate surface, **MRT** target housing, and thermocouple wires. Remove solvent residue using dry cotton tip applicator.

NOTE

If residue is severe, a cotton tip applicator soaked in contact cleaner (Krylon No. 1333) may be used, then remove solvent residue with a dry cotton tip applicator.

e. Stow all cables in straps provided, reinstall shroud and reinstall TI in transit case.

f. Annotate and affix DA label/form in accordance with TB 750-25.

APPENDIX A

BAR Target Temperature Worksheet

Digital Multimeter Indications mV dc	
Max:	Min:
Temperature Equivalent (Voltage Thermocouple) Find (T max) and (T min) = $V_{thermocouple}$ ÷ Test report value [Sensitivity (mV/°C)]	
T max:	T min:
Find Current Temperature: (T max + T min) ÷ 2 =	
Find Temperature Error: (4.5 °C - Current Temperature) =	

MRT Target Temperature Worksheet

Digital Multimeter Indications mV dc	
Max:	Min:
Temperature Equivalent (Voltage Thermocouple) Find (T max) and (T min) = $V_{thermocouple}$ ÷ Test Report value [Sensitivity (mV/°C)]	
T max:	T min:
Find Current Temperature: (T max + T min) ÷ 2 =	
Find Temperature Error: (4.5 °C - Current Temperature) =	

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
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0814803

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 344620, requirements for calibration procedure TB 9-5855-1892-35.

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.