

TB 9-6625-2405-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DECADE RESISTOR IET, MODEL HARS-LX-9-0.001

Headquarters, Department of the Army, Washington, DC

27 January 2010

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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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SECTION I IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Decade Resistor, IET, Model HARS-LX-9-0.001. 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 45 minutes, 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. 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
Resistance	Range: 10 mΩ to 1,211,111.11 Ω Accuracy: + (100 ppm + 0.5 mΩ)

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, and Secondary Reference Calibration Standards Set, NSN 4931-00-621-7878. 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 paragraph 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: 10 mΩ to 1.1MΩ Accuracy: ± 25 ppm	Agilent, Model 3458A (3458A)

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.
- 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 check where applicable.

NOTE

Minimum resistance 10 mΩ ± 0.5 mΩ limited by the lowest settable position, "1", of the 10 mΩ/step decade. If the TI lowest three decades are not within limits specified the TI will be evacuated to the ACL for calibration support.

- a. Exercise each decade dial throughout its entire range ten times in each direction.
- b. Allow the switch to stabilize for 15 minutes.
- c. Set multimeter as listed in (1) through (3) below:
 - (1) OHMF.
 - (2) OCOMP ON.
 - (3) NPLC 100.
- d. Connect multimeter to TI front panel connectors.

8. Resistance Decade Dial Accuracy

a. Performance Check

(1) Set TI decade dial to obtain first value listed in table 1. TI will indicate within limits listed in table 3.

(2) Repeat technique of (1) above for remaining TI settings listed in table 3.

(3) Set TI output to minimum.

(4) Repeat technique of (1) through (3) above for remaining TI decade values listed in tables 3 through 11. If TI does not indicate within limits listed in tables 6 through 11, perform **b** below.

Table 3. Resistance Accuracy 0.001 Ω /Step

TI	Min (Ω)	Max (Ω)
Zero ¹	0.00950	0.01050
1	0.01050	0.01150
2	0.01150	0.01250
3	0.01250	0.01350
4	0.01350	0.01450
5	0.01450	0.01550
6	0.01550	0.01650
7	0.01650	0.01750
8	0.01750	0.01850
9	0.01850	0.01950
10	0.01950	0.02050

¹Minimum (zero) resistance check (0.01 is minimum setting) for TI.

Table 4. Resistance Accuracy 0.01 Ω /Step

TI	Min (Ω)	Max (Ω)
2	0.01950	0.02050
3	0.02950	0.03050
4	0.03950	0.04050
5	0.04950	0.05051
6	0.05949	0.06051
7	0.06949	0.07051
8	0.07949	0.08051
9	0.08949	0.09051
10	0.09949	0.10051

Table 5. Resistance Accuracy 0.1 Ω /Step

TI	Min (Ω)	Max (Ω)
1	0.10949	0.11051
2	0.20948	0.21052
3	0.30947	0.31053
4	0.40946	0.41054
5	0.50945	0.51055
6	0.60944	0.61056
7	0.70943	0.71057
8	0.80942	0.81058
9	0.90941	0.91059
10	1.00940	1.01060

Table 6. Resistance Accuracy 1 Ω /Step

TI	Min (Ω)	Max (Ω)
1	1.00940	1.01060
2	2.00930	2.01070
3	3.00920	3.01080
4	4.00910	4.01090
5	5.00900	5.01100
6	6.00890	6.01110
7	7.00880	7.01120
8	8.00870	8.01130
9	9.00860	9.01140
10	10.00850	10.01150

Table 7. Resistance Accuracy 10 Ω /Step

TI	Min (Ω)	Max (Ω)
1	10.00850	10.01150
2	20.00750	20.01250
3	30.00650	30.01350
4	40.00550	40.01450
5	50.00450	50.01550
6	60.00350	60.01650
7	70.00250	70.01750
8	80.00150	80.01850
9	90.00050	90.01950
10	99.99950	100.02050

Table 8. Resistance Accuracy 100 Ω /Step

TI	Min (k Ω)	Max (k Ω)
1	0.0999995	0.1000205
2	0.1999895	0.2000305
3	0.2999795	0.3000405
4	0.3999695	0.4000505
5	0.4999595	0.5000605
6	0.5999495	0.6000705
7	0.6999395	0.7000805
8	0.7999295	0.8000905
9	0.8999195	0.9001005
10	0.9999095	1.0001105

Table 9. Resistance Accuracy 1 k Ω /Step

TI	Min (k Ω)	Max (k Ω)
1	0.9999095	1.000111
2	1.999810	2.000211
3	2.999710	3.000311
4	3.999601	4.000411
5	4.999510	5.000511
6	5.999410	6.000611
7	6.999310	7.000711
8	7.999210	8.000811
9	8.999110	9.000911
10	9.999010	10.001011

Table 10. Resistance Accuracy 10 kΩ/Step

TI	Min (kΩ)	Max (kΩ)
1	9.999010	10.00101
2	19.99801	20.00201
3	29.99701	30.00301
4	39.99601	40.00401
5	49.99501	50.00501
6	59.99401	60.00601
7	69.99301	70.00701
8	79.99201	80.00801
9	89.99101	90.00901
10	99.99001	100.01001

Table 11. Resistance Accuracy 100 kΩ/Step

TI	Min (MΩ)	Max (MΩ)
1	0.0999900	0.1000100
2	0.1999800	0.2000200
3	0.2999700	0.3000300
4	0.3999600	0.4000400
5	0.4999500	0.5000500
6	0.5999400	0.6000600
7	0.6999300	0.7000700
8	0.7999200	0.8000800
9	0.8999100	0.9000900
10	0.9999000	1.0001000
11	1.09989001	1.1001100

- (5) Set TI to minimum and disconnect equipment.

b. Adjustments

NOTE

Adjusting any one resistance decade, note that the nth step of the decade is the sum of resistance 1 through nth, so that errors are cumulative. It is recommended when any resistance of a particular decade is adjusted, all resistance of that decade be tested and adjusted as required.

- (1) Exercise each decade dial throughout its entire range ten times in each direction.
- (2) Allow the switch to stabilize for 15 minutes.
- (3) Set multimeter as listed in (a) through (c) below:
 - (a) **OHMF.**
 - (b) **OCOMP ON.**
 - (c) **NPLC 100.**
- (4) Connect multimeter to TI front panel connectors.
- (5) For ranges 1 Ω -100 kΩ start with the lowest setting, adjust the associated trim pots listed in table 12.

Table 12. TI Trimmer Board Designation

Switch Position	Potentiometer Designation (Fig 1)
1	T0
2	T1
3	T2
4	T3
5	T4
6	T5
7	T6
8	T7
9	T8
10	T9
11	T10 ¹

¹ 100 k decade only.

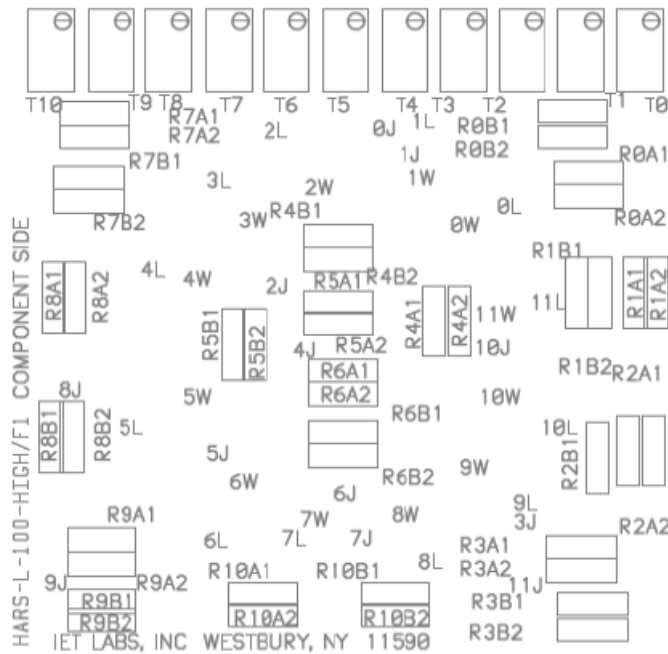


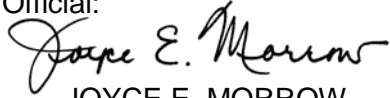
Figure 1. Typical trimmer board.

9. Final Procedure

- a. De-energize 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*

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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**

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