*TB 9-6625-1962-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DIGITAL MULTIMETER TEKTRONIX, MODELS 7D13 AND 7D13A

Headquarters, Department of the Army, Washington, DC
19 March 2008

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.

*This bulletin supersedes TB 9-6625-1962-35, dated 16 March 1978, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Digital Multimeter, Tektronix Models 7D13 and 7D13A. 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. Variations among models are described in text and tables.

b. Time and Technique. The time required for this calibration is approximately 1 hour 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
Dc volts	Range: 7D13; 0 to 1000 V 7D13A; 0 to 500 V Accuracy: ±0.1% of reading ±l count
Dc current	Range: 0 to 2 A Accuracy: ±0.5% of reading ±2 counts
Resistance	Range: 0 to 2 MΩ Accuracy: ±0.5% of reading ±l count

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, 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. The following peculiar accessories are also required for this calibration: Indicator oscilloscope, Tektronix 7000 series (must be compatible with TI), and Calibration fixture (extender), Tektronix, model 067-0589-00.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
AUTOTRANSFORMER	Range: 105 to 125 V ac Accuracy: ±1%	Ridge, Model 9020A (9020A)
CALIBRATOR	Dc voltage: Range: 1.997 to 1002 V Accuracy: ± 0.025% Dc current: Range: 1.988 mA to 2.012 A Accuracy: ±0.125% Resistance: Range: 190Ω to 1.9 MΩ Accuracy: ± 0.125%	Fluke, Model 5720A (5720A) (p/o MIS-35947)
FREQUENCY COUNTER	Range: 79.5 to 80.5 kHz Accuracy: ±0.15%	Fluke, Model PM6681/656 (PM6681/656)
MULTIMETER	Range: 4.7 to 15.9 Vdc Accuracy: ±0.025%	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 and item identification number 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.

d. When indications specified in paragraphs **8** through **10** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **8** through **12**. Do not perform power supply check if all other parameters are within tolerance.

e. 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.

a. Remove left side shield from TI and left side panel from indicator oscilloscope for adjustments.

b. Install TI in left vertical plug-in compartment of indicator oscilloscope.

c. Connect indicator oscilloscope to autotransformer. Connect autotransformer to a 115 volt ac (alternating current) source and adjust output to 115 volts.

d. Set indicator oscilloscope to on and allow at least 20 minutes for warm-up and stabilization.

e. Set **MODE/RANGE** switch to **DC VOLTS 2V**.

NOTE

All references to **DC VOLTS** positions of **MOD/ RANGE** switch pertain to those associated with the **INPUT** terminals (orange front-panel tint). Any controls not mentioned for the indicator oscilloscope may be set as desired.

f. Adjust indicator-oscilloscope **INTENSITY** and **READOUT** controls to obtain a usable readout display.

g. Adjust indicator oscilloscope **FOCUS** and **ASTIGMATISM** controls as necessary for well defined characters in oscilloscope display.

NOTE

For model 7D13 perform steps **7 h** and **7 i** only. For 7D13A perform only steps **7 j** only.

h. Set **MODE/RANGE** switch to **DC CURRENT 2mA**. If indicator oscilloscope readout display does not indicate 0.000 ±0.002 mA (milliamperes), position indicator oscilloscope on its right side and remove bottom cover.

i. Adjust R115 ZERO ADJ (fig. 1) to obtain indicator oscilloscope readout display of 0.000. Best adjustment is obtained when readout display just changes from -0.000 to +0.000.

j. Short input terminals. If indicator oscilloscope readout display does not indicate 0.000 ±0.001, perform power supply check.

8. Dc Volts

a. Performance Check

(1) Connect lead between TI **COM INPUT** connector and ground post connector on indicator oscilloscope.

(2) Connect calibrator **OUTPUT VΩA HI** and **LO** to TI **INPUT HIGH** and **COM** terminals.

(3) Set **MODE/RANGE** switch to **DC VOLTS 2V**.

(4) Adjust calibrator output to obtain indicator oscilloscope readout display of 2.000 volts. If calibrator does not indicate between 1.997 and 2.003 volts, perform **b** below.

(5) Adjust calibrator to obtain indicator oscilloscope readout display of -2.000 volts. If calibrator does not indicate between -1.997 and -2.003 volts, perform **b** below.

(7) Repeat technique of (3) through (5) above for **MODE/RANGE** switch positions listed in table 3. Calibrator indications will be within limits specified.

Table 3. Dc Volts

Test instrument MODE/RANGE switch positions	Indicator oscilloscope readout display indications	Calibrator indications (V)	
		Min	Max
DC VOLTS 20V	2.000	1.99	2.01
DC VOLTS 20V	20.00	19.97	20.03
DC VOLTS 200V	20.00	19.9	20.1
DC VOLTS 200V	200.0	199.7	200.3
DC VOLTS 1kV	1000.0	998	1002

b. Adjustments

NOTE

For adjustments on model 7D13A, use calibration fixture (extender) for access to adjustments.

(1) Adjust calibrator for 2.0000 volts.

(2) Connect frequency counter between TP206 (located near center of circuit board assembly) and ground. If frequency counter does not indicate between 79.5 and 80.5 kHz, adjust R203 (located adjacent to TP206) to obtain an indication of 80 kHz. Remove frequency counter connection.

(3) Adjust R148 GAIN ADJ (7D13) R1003 VOLTS (7D13A) (fig. 1) to obtain indicator oscilloscope readout display of 2.000 volts (R).

(4) Adjust calibrator for -2.0000 volts.

(5) Adjust R148 GAIN ADJ (7D13) R1003 VOLTS (7D13A) (fig. 1) to obtain indicator oscilloscope readout display of -2.000 volts.

(6) Repeat (1) and (3) through (5) above for best compromise between positive and negative 2.000 volts.

NOTE

Changing the setting of R1003 will affect the calibration of DC current and resistance measurement modes on 7D13A.

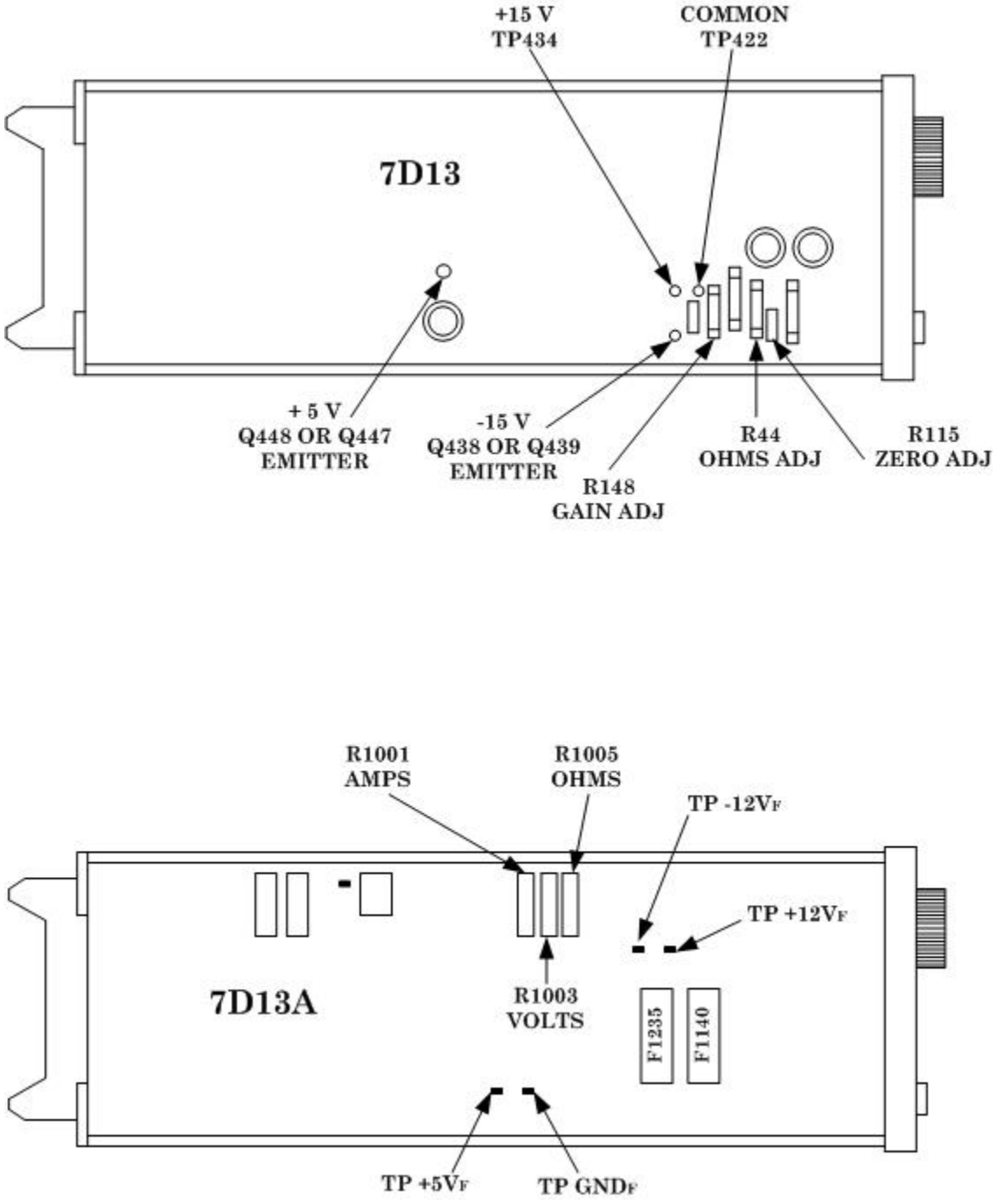

Figure 1. Left side view - adjustments and test points.

9. Dc Current

a. Performance Check

(1) Set **MODE/RANGE** switch to **DC CURRENT 2mA**.

(2) Adjust calibrator to obtain indicator oscilloscope readout display of 2.000 mA. Calibrator will indicate between 1.988 and 2.012 mA for model 7D13. If calibrator does not indicate between 1.988 and 2.012 mA for model 7D13A, perform **b** below.

(3) Repeat technique of (1) and (2) above for **MODE/RANGE** switch and calibrator outputs listed in table 4. Calibrator indications will be within limits specified.

Table 4. Dc Current

Test instrument **MODE/RANGE** switch positions	Indicator oscilloscope readout display indications(mA)	Calibrator indications (mA)	
		Min	Max
DC CURRENT 20mA	20.00	19.88	20.12
DC CURRENT 200mA	200.0	198.8	201.2
DC CURRENT 2A	2000	1988	2012

b. Adjustments

NOTE

No adjustments can be made on model 7D13.

(1) Set calibrator output to 2.00 mA and adjust R1001 AMPS (fig. 1) for a 2.000 mA indication on indicator oscilloscope.

10. Resistance

a. Performance Check

(1) Set **MODE/RANGE** switch to **RESISTANCE 20 kΩ**.

(2) Set calibrator for a 19 kΩ nominal output.

(3) Rotate calibrator knob below **EDIT FIELD** pushbutton to adjust calibrator display indication to equal TI indication. If calibrator **err** display does not indicate within ± 0.0055%, perform **b** below.

(4) Repeat technique of (1) through (3) above, using calibrator outputs and TI indications listed in table 5. Calibrator **err** display will be within limits specified in table 5.

Table 5. Resistance

Test instrument	Indicator oscilloscope	Calibrator	
MODE/RANGE switch positions	Readout display indications (Ω)	Nominal output (Ω)	**err** display indication ±(%)
RESISTANCE 200Ω	190.0	190.0	0.0055
RESISTANCE 2 kΩ	190.0	190.0	0.01
RESISTANCE 2 kΩ	1900	1.900 k	0.0055

Table 5. Resistance - Continued

Test instrument	Indicator oscilloscope	Calibrator	
MODE/RANGE switch positions	Readout display indications (Ω)	Nominal output (Ω)	**err** display indication ±(%)
RESISTANCE 20 kΩ	1900	1.900 k	0.01
RESISTANCE 200 kΩ	19.00 k	19.00 k	0.01
RESISTANCE 200 kΩ	190.0 k	190.0 k	0.0055
RESISTANCE 2 MΩ	190.0 k	190.0 k	0.01
RESISTANCE 2 MΩ	1.900 M	1.900 M	0.0055

b. Adjustments

(1) Set calibrator for 19.000 k ohms.

(2) Adjust R44 OHMS ADJ (7D13) R1005 OHMS (7D13A) (fig. 1) to obtain indicator oscilloscope readout display of 19.00 k ohms (R).

11. Power Supply

a. Performance Check

NOTE

Do not perform power supply check if all other parameters are within tolerance. Perform (1) below for model 7D13 and perform (2) below for model 7D13A.

(1) Connect multimeter between floating power supply COMMON TP422 (fig. 1) and each test point listed in table 6. Multimeter will indicate within limits specified.

Table 6. Power Supply (7D13)

Power supply voltage (V dc)	Test points (fig. 1)	Multimeter indications (V dc)	
		Min	Max
+15	TP434	+14.1	+15.9
-15	TP439[1]	-14.1	-15.9
+5	TP448[2]	+4.7	+5.3

[1]Q438 emitter in early production instruments.
[2]Q447 emitter in early production instruments.

(2) Connect multimeter between floating power supply common, TP GND_F (fig. 1) and each test point listed in table 7. Multimeter will indicate within limits specified.

Table 7. Power Supply (7D13A)

Power supply voltage (V dc)	Test points (fig. 1)	Multimeter indications (V dc)	
		Min	Max
+12	TP+12 V_F	+11.28	+12.72
-12	TP-12 V_F	-12.72	-11.28
+5	TP+5 V_F	+4.7	+5.3

b. Adjustments. No adjustments can be made.

12. 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:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:

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0802821

Distribution:

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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.

PIN: 084626-000