

TB 9-6625-2409-24

CHANGE 1

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR OSCILLOSCOPE, AGILENT MODELS DSO3062A AND DSO3202A

Headquarters, Department of the Army, Washington, DC
27 July 2010

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TB 9-6625-2409-24, 17 February 2010, is changed as follows:

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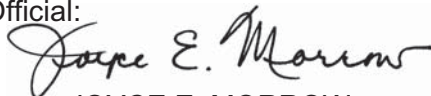
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2. File this change sheet in front of the publication for reference purposes.

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17 February 2010

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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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SECTION I IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Oscilloscope, Agilent Models DSO3062A and DSO3202A. The manufacturer's user/service 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. Model DSO3062A has a bandwidth of 60 MHz and model DSO3202A has a bandwidth of 200 MHz.

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 Vertical gain	2 mV/div to 5 mV/div: $\pm 4\%$ 10 mV/div to 5 V/div $\pm 3\%$
Bandwidth	DSO3062A: 60 MHz DSO3202A: 200 MHz

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 four-to-one 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)
OSCILLOSCOPE CALIBRATOR	Voltage output: Range: -15 to +15 V Accuracy: ±0.75% Leveled sine wave: Range: 10 mV to 600 mV p-p Frequency: 50 kHz to 200 MHz	Fluke, Model 5820A-5C-GHZ (5820A-5C-GHZ)

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.
- 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 OUPUT(S) to minimum after each step within the performance check where applicable.

NOTE

Throughout this procedure “soft keys” are identified by the use of brackets [] around the key.

- a. Connect TI to appropriate power source.
- b. Press TI  button and allow 30 minute warm-up time.
- c. Press TI **Utility** button.
- d. From displayed menu select [**Self-Test**].
- e. From displayed menu select [**Screen Test**].
- f. Follow TI on-screen message.

NOTE

The screen of the TI turns black, white, red, green, and blue, in sequence, when pressing the **Run/Stop** button. Check for screen display failures.

- g. Press TI **Run/Stop** button to exit screen test.
- h. From displayed menu select [**Key Test**].


NOTE

The on screen rectangles represent the front panel keys. The rectangles with two arrows beside them represent the front panel knobs. The squares represent the knob presses for knobs like the Scale knobs.

- i. Test all keys and knobs and verify all of the controls turn green.
- j. Press TI **Run/Stop** button three times to exit key test.

8. DC Gain Accuracy

a. Performance Check

- (1) With all TI inputs open, press TI **Save/Recall** button.
- (2) From displayed menu press [**Storage**] key until “Setups” appears.
- (3) Press [**Default Setup**] key.
- (4) Press **Acquire** button.
- (5) From displayed menu press [**Mode**] key until “Average” appears.
- (6) Press [**Averages**] until “256” appears.
- (7) Use TI channel 1  knob to set TI vertical sensitivity to 2 mV/div.
- (8) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** output to TI **1** input and oscilloscope calibrator **SOURCE/MEASURE CHAN 2** output to TI **2** input.
- (9) Set oscilloscope calibrator for a channel 1 dc voltage output of +6 mV with 1 MΩ impedance.
- (10) Press TI **Measure** button.
- (11) From displayed menu select [**Voltage**].
- (12) From displayed menu select [**Vavg**].
- (13) Record TI indicated Vavg value in appropriate block of table 3 below.
- (14) Set oscilloscope output for -6 mV and record TI indicated Vavg value in appropriate block of table 3 below.
- (15) Calculate DC gain ratio using the following formula:


$$\text{DC gain ratio} = (\text{Vavg}_+ - \text{Vavg}_-) \div (\text{Output}_+ - \text{Output}_-)$$

(16) If calculated DC gain ratio is not within limits specified in table 3, perform Section IV below.

(17) Repeat technique of (7), (9) and (13) through (15) above using TI vertical sensitivity settings and calibrator outputs specified in table 3. If calculated DC gain ratio is not within limits specified in table 3, perform Section IV below.

Table 3. DC Gain-Channel 1

Oscilloscope calibrator	Test instrument		Calculated ratio limit	
	Output voltage (Dc)	Vertical sensitivity (/div)	Vavg indication	Min
+6 mV	2 mV		0.96	1.04
-6 mV	2 mV			
+15 mV	5 mV		0.96	1.04
-15 mV	5 mV			
+30 mV	10 mV		0.97	1.03
-30 mV	10 mV			
+60 mV	20 mV		0.97	1.03
-60 mV	20 mV			
+150 mV	50 mV		0.97	1.03
-150 mV	50 mV			
+300 mV	100 mV		0.97	1.03
-300 mV	100 mV			
+600 mV	200 mV		0.97	1.03
-600 mV	200 mV			
+1.5 V	500 mV		0.97	1.03
-1.5 V	500 mV			
+2.4 V	1 V		0.97	1.03
-2.4 V	1 V			
+ 6.0 V	2 V		0.97	1.03
-6.0 V	2 V			
+15 V	5 V		0.97	1.03
-15.0 V	5 V			

- (18) Set oscilloscope calibrator to standby.
- (19) Press TI **Save/Recall** button.
- (20) From displayed menu press [**Storage**] key until “Setups” appears.
- (21) Press [**Default Setup**] key.
- (22) Use TI channel 2  knob to set TI vertical sensitivity to 2 mV/div.
- (23) Set oscilloscope calibrator for a channel 2 dc voltage output of +6 mV with 1 MΩ impedance.
- (24) Press TI **Measure** button.
- (25) From displayed menu select [**Voltage**].
- (26) From displayed menu select [**Vavg**].
- (27) Record TI indicated Vavg value in appropriate block of table 3 below.

(28) Set oscilloscope output for -6 mV and record TI indicated Vavg value in appropriate block of table 3 below.

(29) Calculate DC gain ratio using formula given in (15) above.

(30) If calculated DC gain ratio is not within limits specified in table 4, perform Section IV below.

(31) Repeat technique of (22), (23) and (27) through (29) above using TI vertical sensitivity settings and calibrator outputs specified in table 3. If calculated DC gain ratio is not within limits specified in table 3, perform Section IV below.

Table 4. DC Gain-Channel 2

Oscilloscope calibrator	Test instrument		Calculated ratio limit	
	Vertical sensitivity (/div)	Vavg indication	Min	Max
+6 mV	2 mV		0.96	1.04
-6 mV	2 mV			
+15 mV	5 mV		0.96	1.04
-15 mV	5 mV			
+30 mV	10 mV		0.97	1.03
-30 mV	10 mV			
+60 mV	20 mV		0.97	1.03
-60 mV	20 mV			
+150 mV	50 mV		0.97	1.03
-150 mV	50 mV			
+300 mV	100 mV		0.97	1.03
-300 mV	100 mV			
+600 mV	200 mV		0.97	1.03
-600 mV	200 mV			
+1.5 V	500 mV		0.97	1.03
-1.5 V	500 mV			
+2.4 V	1 V		0.97	1.03
-2.4 V	1 V			
+ 6.0 V	2 V		0.97	1.03
-6.0 V	2 V			
+15 V	5 V		0.97	1.03
-15.0 V	5 V			

(32) Set oscilloscope to standby.





b. Adjustments. None

9. Bandwidth

a. Performance Check

(1) Press TI **Save/Recall** button.

(2) From displayed menu press [**Storage**] key until “Setups” appears.

- (3) Press **[Default Setup]** key.
- (4) Press TI **Auto-Scale** button.
- (5) Use TI channel 1  knob to set TI vertical sensitivity to 200 mV/div.
- (6) Use TI **Horizontal**  knob to set TI horizontal scale to 1 μ s/div.
- (7) Press **Acquire** button.
- (8) From displayed menu press **[Mode]** key until “Average” appears.
- (9) Press **[Averages]** until “8” appears.
- (10) Press TI **Measure** button.
- (11) From displayed menu select **[Voltage]**.
- (12) From displayed menu select **[Vpp]**.
- (13) Connect oscilloscope calibrator SOURCE/MEASURE CHAN 1 and SOURCE/MEASURE CHAN 2 TO TI 1 and 2 inputs respectively through 50 ohm feedthrough terminations and set oscilloscope calibrator for a channel 1 level sine output frequency of 50 kHz at a level of 1.2 V.
- (14) Use oscilloscope calibrator rotary knob to adjust oscilloscope calibrator output until TI displays 6 divisions of vertical deflection.
- (15) Sweep oscilloscope calibrator output frequency up to 60 MHz for model DSO3062A or 200 MHz for model DSO3202A while adjusting TI sweep speed to 10 ns/div for model DSO3062A or 2 ns/div for model DSO3202A.
- (16) If TI does not display ≥ 4.2 divisions of vertical deflection throughout sweep perform section IV below.
- (17) Set oscilloscope to standby.
- (18) Press TI **Save/Recall** button.
- (19) From displayed menu press **[Storage]** key until “Setups” appears.
- (20) Press **[Default Setup]** key.
- (21) Press TI **Auto-Scale** button.
- (22) Use TI channel 2  knob to set TI vertical sensitivity to 200 mV/div.
- (23) Use TI **Horizontal**  knob to set TI horizontal scale to 1 μ s/div.
- (24) Press **Acquire** button.
- (25) From displayed menu press **[Mode]** key until “Average” appears.
- (26) Press **[Averages]** until “8” appears.
- (27) Press TI **Measure** button.
- (28) From displayed menu select **[Voltage]**.
- (29) From displayed menu select **[Vpp]**.
- (30) Set oscilloscope calibrator for a channel 2 level sine output frequency of 50 kHz at a level of 1.2 V.

(31) Use oscilloscope calibrator rotary knob to adjust oscilloscope calibrator output until TI displays 6 divisions of vertical deflection.

(32) Sweep oscilloscope calibrator output frequency up to 60 MHz for model DSO3062A or 200 MHz for model DSO3202A while adjusting TI sweep speed to 10 ns/div for model DSO3062A or 2 ns/div for model DSO3202A.

(33) If TI does not display ≥ 4.2 divisions of vertical deflection throughout sweep perform section IV below.

(34) Set oscilloscope to standby.

b. Adjustments. None

10. Final Procedure

- a. Deenergize and disconnect all equipment.
- b. Annotate and affix DA label/form in accordance with TB 750-25.

SECTION IV ALIGNMENT PROCESS

11. Self-Calibration

NOTE

Self-calibration should be performed if TI fails any parameter.

- a. Press **TI Utility** button.
- b. From displayed menu select **[Self-Cal]**.
- c. Follow all prompts and instructions displayed.

12. Final Procedure

- a. Deenergize and disconnect all equipment.
- b. Perform paragraphs **6** through **10** above.

By Order of the Secretary of the Army:

Official:



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Secretary of the Army*

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

Distribution:

To be distributed in accordance with IDN 345024 requirements for calibration procedure
TB 9-6625-2409-24.

THESE ARE THE INSTRUCTIONS FOR SENDING 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: "Whoever" whomever@avma27.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
- Date Sent:** 19-Oct-93
- Pub No:** TB 9-6625-xxxx-35
- Pub Title:** Calibration Procedure for ...
10. **Publication Date:**
11. **Change Number:**
12. **Submitted 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.

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