*TB 9-6625-2344-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR OSCILLOSCOPE OS-303/G

Headquarters, Department of the Army, Washington, DC
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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.

*This bulletin supersedes TB 9-6625-2344-35, dated 1 July 2003, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Oscilloscope, OS-303/G. The manufacturer's manual and TM 43-6625-915-40 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. None.

b. Time and Technique. The time required for this calibration is approximately 3 hours, 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
Vertical gain	Dual cursor measurement: ±(gain accuracy + resolution) Resolution: 0.4% full scale without averaging, 0.024% full scale with 32 averages Accuracy: ±1.00% of full scale at full resolution channel scale
Vertical offset	Accuracy: ±1.25% of channel offset + 2% of full scale
Bandwidth	Dc to ≥600 MHz
Time measurements	Equivalent time: (≥16 averages) ±[(0.005% x Δt) + (full scale/(2 x memory depth)) + 60ps] Real time: ±[(0.005% x Δt) + (0.2 x sample period)]
Trigger sensitivity	Internal: dc to 100 MHz; 0.5 div 100 MHz to 500 MHz; 1.0 div >500 MHz; 1.5 div Auxiliary: dc to 500 MHz; 300 mV p-p
Dc calibrator	Amplitude: −2.4 V to +2.4 V Accuracy: ±0.2% of ΔV output

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 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)
FUNCTION/ARBITRARY GENERATOR	Square wave: Range: 0 to 2.5 V Frequency: 1 MHz to 40 MHz Accuracy: ±0.014%	Agilent, Model 33250A (33250A)
MULTIMETER	Range: 2.4V to -2.4V Accuracy: ±0.05%	Fluke, Model 8840A/AF05 (AN/GSM-64D)
OSCILLOSCOPE CALIBRATOR	Voltage output: Range: 49 mV to 35 V Accuracy: ±0.25% Leveled sine wave: Range: 10 mV to 600 mV p-p Frequency: 50 kHz to 600 MHz Accuracy: ±0.25%	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. Additional maintenance information is contained in the manufacturer's manual for this TI.

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 bulletin, the term "button" denotes a front panel pushbutton which must be physically pressed. The term "key" denotes a button which must be activated by using the TI mouse.

a. Connect TI mouse to mouse input port on TI rear panel.

b. Connect TI keyboard to keyboard input port on TI rear panel.

c. Connect TI to appropriate power source.

d. Press TI ⏻ button and allow 30 minute warm-up time.

NOTE

Warm-up must be preceded by a 2 hour non-operating temperature stabilization period (if applicable).

e. Using TI mouse, click key to enable graphical interface.

f. Click **UTILITIES** menu on top of TI display.

g. From displayed roll down menu, click **SELF TEST**.

h. In **SELF TEST WINDOW**, click **SELF TEST** ∇ key.

i. Click **SCOPE SELF TESTS** from **SELF TEST** drop-down list box.

j. Click **START TEST** key.

NOTE

If one or more self-tests fail, refer to TM 43-6625-915-40 Chapter 2, Troubleshooting Procedures.

k. Once TI has passed self-tests, in **SELF TEST** window, click **CLOSE** key.

NOTE

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

8. Vertical Gain Accuracy

a. Performance Check

(1) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1-4** outputs to TI channels **1-4** input connectors respectively.

(2) Press TI **DEFAULT SETUP** button.

(3) Click **SETUP** menu on top of TI display.

(4) From displayed drop-down menu, click **ACQUISITION**.

(5) In **ACQUISITION SETUP** window, click **SAMPLING MODE EQUIVALENT TIME** and **AVERAGING ENABLED** box.

(6) Place cursor over **# OF AVERAGES** box and left click mouse to activate percent.

(7) Using either TI keyboard or mouse, enter **32** and click **OK** key.

(8) In **ACQUISITION SETUP** window, click **CLOSE** key.

(9) Click **MEASURE** menu on top of TI display.

(10) From displayed drop-down menu, select **VOLTAGE**.

(11) From **VOLTAGE** submenu, click **V AVG**.

(12) In **ENTER MEASUREMENT INFO** window, ensure **CHANNEL 1** is selected in **SOURCE** box and click **OK** key.

(13) Click **SETUP** menu on top of TI display.

(14) From displayed drop-down menu, click **CHANNEL 1**.

(15) In displayed **CHANNEL SETUP** window, place cursor over **SCALE** box and left click mouse to activate percent.

(16) Using either TI keyboard or mouse, enter **5** and click **OK** key.

(17) In displayed **CHANNEL SETUP** window, place cursor over **OFFSET** box and left click mouse to activate percent.

(18) Using either TI keyboard or mouse, enter **17.5** and click **OK** key.

(19) In displayed **CHANNEL SETUP** window, click **CLOSE** key.

(20) With oscilloscope calibrator in standby mode, press TI **CLEAR DISPLAY** button and allow TI displayed readings to settle.

(21) Record TI displayed **V AVG MEAN** indication as V avg. 1.

(22) Set oscilloscope calibrator for a channel 1 output of 35 V dc.

(23) Press TI **CLEAR DISPLAY** button and allow TI displayed readings to settle.

(24) Record TI displayed **V AVG MEAN** indication as V avg. 2.

(25) Calculate vertical gain using formula below. Calculated result will be within limits specified in first row of table 1 below.

V avg. 2 – V avg. 1 = vertical gain

(26) Repeat technique used in (13) through (25) above for remaining TI settings and calibrator outputs listed in table 3. Calculated results will be within limits specified in table 3 below.

Table 3. Vertical Gain

Oscilloscope calibrator	Test instrument			
Output (dc)	Scale (/div)	Offset	Calculated gain limit	
			Min	Max
35 V	5 V	17.5 V	34.490 V	35.510 V
14 V	2 V	7.0 V	13.796 V	14.204 V
8.75 V	1.25 V	4.375 V	8.623 V	8.887 V
3.5 V	500 mV	1.75 V	3.449 V	3.551 V
1.75 V	250 mV	875 m V	1.724 V	1.77548 V
700 mV	100 mV	350 m V	689.808 mV	710.19 mV
350 mV	50 mV	175 m V	344.904 mV	355.096 mV
140 mV	20 mV	70 m V	137.962 mV	142.038 mV
70 mV	10 mV	35 mV	68.981 mV	71.019 mV
49 mV	7 mV[1]	24.5 mV	48.287 mV	49.713 mV

[1]Ranges from 1 mV to 6 mV/div are handled in firmware and will be within tolerance when the 7 mV/div range is within tolerance.

(27) Set oscilloscope calibrator to standby.

(28) Press TI buttons as listed in (a) and (b) below:

(a) **VERTICAL 1** (not illuminated).
(b) **VERTICAL 2** (illuminated).

(29) Change oscilloscope calibrator output from channel 1 to channel 2.

(30) Repeat technique of (9) through (29) above for remaining TI channels.

(31) Set oscilloscope calibrator to standby.

b. Adjustments. None.

9. Vertical Offset

a. Performance Check

(1) Press TI **DEFAULT SETUP** button.

(2) Click **SETUP** menu on top of TI display.

(3) From displayed drop-down menu, click **ACQUISITION**.

(4) In **ACQUISITION SETUP** window, click **SAMPLING MODE EQUIVALENT TIME** and **AVERAGING ENABLED** box.

(5) Place cursor over **# OF AVERAGES** box and left click mouse to activate percent.

(6) Using either TI keyboard or mouse, enter **32** and click **OK** key.

(7) In **ACQUISITION SETUP** window, click **CLOSE** key.

(8) Click **SETUP** menu on top of TI display.

(9) From displayed drop-down menu, click **CHANNEL 1**.

(10) In displayed **CHANNEL SETUP** window, place cursor over **SCALE** box and left click mouse to activate percent.

(11) Using either TI keyboard or mouse, enter **200 m**.

(12) In displayed **CHANNEL SETUP** window, place cursor over **OFFSET** box and left click mouse to activate percent.

(13) Using either TI keyboard or mouse, enter **2.000** and click **OK** key.

(14) In displayed **CHANNEL SETUP** window, click **CLOSE** key.

(15) Set oscilloscope calibrator for a channel 1 output of 2.00 Vdc.

(16) Press TI **CLEAR DISPLAY** button.

(17) After display settles, if necessary, use TI **VERTICAL** ⇳ knob to adjust the displayed trace as close as possible to center horizontal grid line.

(18) Click **SETUP** menu on top of TI display.

(19) From displayed drop-down menu, click **CHANNEL 1**.

(20) In **CHANNEL SETUP** window, the value displayed in **OFFSET** box will be within limits specified in first row of table 2.

(21) In displayed **CHANNEL SETUP** window, click **CLOSE** key.

(22) Repeat technique used in (8) through (21) above for remaining TI settings and calibrator outputs listed in table 4. Offset indications will be within limits specified in table 4 below.

Table 4. Vertical Offset

Oscilloscope calibrator	Test instrument			
Output (dc)	Scale (/div)	Offset	Offset indication	
			Min	Max
2.00 V	200 mV	2.000 V	1.943 V	2.057 V
1.00 V	100 mV	1.000 V	0.9715 V	1.0285 V
500 mV	50 mV	500.000 mV	485.75 mV	514.25 mV

(23) Set oscilloscope calibrator to standby.

(24) Press TI buttons as listed in (a) and (b) below:

(a) **VERTICAL 1** (not illuminated).
(b) **VERTICAL 2** (illuminated).

(25) Change oscilloscope calibrator output from channel 1 to channel 2.

(26) Repeat technique of (8) through (25) above for remaining TI channels.

(27) Set oscilloscope calibrator to standby.

b. Adjustments. None.

10. Bandwidth Accuracy

a. Performance Check

(1) Press TI **DEFAULT SETUP** button.

(2) Click **SETUP** menu on top of TI display.

(3) From displayed drop-down menu, click **ACQUISITION**.

(4) In **ACQUISITION SETUP** window, click **SAMPLING MODE EQUIVALENT TIME** and **AVERAGING ENABLED** box.

(5) Place cursor over **# OF AVERAGES** box and left click mouse to activate percent.

(6) Using either TI keyboard or mouse, enter **32** and click **OK** key.

(7) In **ACQUISITION SETUP** window, click **CLOSE** key.

(8) Using TI channel 1 **VERTICAL** ∿∿ knob, set vertical scale to 100 mV/div.

(9) Press TI channel 1 **VERTICAL INPUT** button to illuminate **50Ω** indicator.

(10) Place cursor over horizontal scale box at bottom of TI display and left click mouse to activate percent.

(11) Using either TI keyboard or mouse, enter **1.5µ**.

(12) Set oscilloscope calibrator for a channel 1 level sine output frequency of 50 kHz at a level of 600 mV.

(13) Click **MEASURE** menu on top of TI display.

(14) From displayed drop-down menu, select **VOLTAGE**.

(15) From displayed **VOLTAGE** submenu, click **V AMPTD**.

(16) Adjust oscilloscope calibrator output for a TI **V AMPTD CURRENT** indication as close to 600 mV as possible.

(17) Sweep oscilloscope calibrator output frequency up to 600 MHz while adjusting TI sweep speed to 1 ns/div.

(18) TI **V AMPTD CURRENT** indication will be ≥420 mV throughout.

(19) Set oscilloscope calibrator to standby.

(20) Press TI buttons as listed in (a) through (c) below:

(a) **VERTICAL 1** (not illuminated).
(b) **VERTICAL 2** (illuminated).
(c) **TRIGGER SOURCE** (**1** not illuminated, **2** illuminated).

(21) Change oscilloscope calibrator output from channel 1 to channel 2.

(22) Repeat technique of (8), (9) and (12) through (21) above for remaining TI channels.

(23) Set oscilloscope calibrator to standby.

(24) Press TI **DEFAULT SETUP** button.

(25) Repeat technique of (8) through (22) above for TI real time sampling.

(26) Set oscilloscope calibrator to standby and disconnect equipment setup.

b. Adjustments. None.

11. Equivalent Time Measurement

a. Performance Check

(1) Connect function/arbitrary generator output to TI channel **1** input connector.

(2) Set function/arbitrary generator output for a square wave with a period of 25.0 ns, a duty cycle of 50 percent and an amplitude of 2.5 Vp-p.

(3) Press TI buttons as listed in (a) and (b) below.

(a) **DEFAULT SETUP**.
(b) **INPUT** (to select **50Ω**).

(4) Using TI channel 1 **VERTICAL** ∿∿ knob, set vertical scale to 500 mV/div.

(5) Click **SETUP** menu on top of TI display.

(6) From displayed drop-down menu, click **HORIZONTAL**.

(7) In **HORIZONTAL SETUP** window, place cursor over **SCALE** box and left click mouse to activate percent.

(8) Using either TI keyboard or mouse, enter **5 n**.

(9) In **HORIZONTAL SETUP** window, place cursor over **POSITION** box and left click mouse to activate percent.

(10) Using either TI keyboard or mouse, enter **–5.0 n**.

(11) In **HORIZONTAL SETUP** window, click **REFERENCE** key until **LEFT** ↑ is highlighted.

(12) In **HORIZONTAL SETUP** window, click **CLOSE** key.

(13) Click **SETUP** menu on top of TI display.

(14) From displayed drop-down menu, click **AQUISITION**.

(15) In **ACQUISITION SETUP** window, click **SAMPLING MODE EQUIVALENT TIME** and **AVERAGING ENABLED** box.

(16) Click **MEMORY DEPTH MANUAL**.

(17) In **ACQUISITION SETUP** window, place cursor over **MEMORY DEPTH** box and left click mouse to activate percent.

(18) Using either TI keyboard or mouse, enter **2004** and click **OK** key.

(19) In **ACQUISITION SETUP** window, click **CLOSE** key.

(20) Click **MEASURE** menu on top of TI display.

(21) From displayed drop-down menu, select **TIME**.

(22) From **TIME** submenu, click **DELTA TIME**.

(23) In **ENTER MEASUREMENT INFO** window, select **CHANNEL 1** in both **SOURCE 1** and **SOURCE 2** boxes.

(24) In **ENTER MEASUREMENT INFO** window, click **OK** key.

(25) Click **MEASURE** menu on top of TI display.

(26) From displayed drop-down menu, click **MEASUREMENT DEFINITIONS**.

(27) In **MEASUREMENT DEFINITIONS** window, click **DELTA TIME** tab.

(28) In **MEASUREMENT DEFINITIONS** window, place cursor over **FROM EDGE #** box and left click mouse to activate percent.

(29) Using either TI keyboard or mouse, enter **+1** and click **OK** key.

(30) In **MEASUREMENT DEFINITIONS** window, click ∇ key of **FROM EDGE DIRECTION** box and select **RISING**.

(31) In **MEASUREMENT DEFINITIONS** window, click ∇ key of **FROM EDGE THRESHOLD** box and select **MIDDLE LEVEL**.

(32) In **MEASUREMENT DEFINITIONS** window, place cursor over **TO EDGE #** box and left click mouse to activate percent.

(33) Using either TI keyboard or mouse, enter **+2**.

(34) In **MEASUREMENT DEFINITIONS** window, click ∇ key of **TO EDGE DIRECTION** box and select **RISING**.

(35) In **MEASUREMENT DEFINITIONS** window, click ∇ key of **TO EDGE THRESHOLD** box and select **MIDDLE LEVEL**.

(36) In **MEASUREMENT DEFINITIONS** window, click **CLOSE** key.

(37) TI **Δ TIME** minimum and maximum indications will be within limits specified in table 5.

Table 5. Δ Time @ 25 ns

Test instrument Δ time indications (ns)	
Min (≥)	Max (≤)
24.926	25.074

(38) Change function/arbitrary generator output period to 50 ns.

(39) Click **SETUP** menu on top of TI display.

(40) From displayed drop-down menu, click **HORIZONTAL**.

(41) In **HORIZONTAL SETUP** window, place cursor over **SCALE** box and left click mouse to activate percent.

(42) Using either TI keyboard or mouse, enter **100 n**.

(43) In **HORIZONTAL SETUP** window, place cursor over **POSITION** box and left click mouse to activate percent.

(44) Using either TI keyboard or mouse, enter **–11.0 n.**

(45) In **HORIZONTAL SETUP** window, click **CLOSE** key.

(46) Click TI **CLEAR ALL** key in lower left corner of screen.

(47) Click **MEASURE** menu on top of TI display.

(48) From displayed drop-down menu, select **TIME**.

(49) From **TIME** submenu, click **DELTA TIME**.

(50) In **ENTER MEASUREMENT INFO** window, select **CHANNEL 1** in both **SOURCE 1** and **SOURCE 2** boxes.

(51) In **ENTER MEASUREMENT INFO** window, click **OK** key.

(52) TI **Δ TIME** minimum and maximum indications will be within limits specified in table 6.

Table 6. Δ Time @ 50 ns

Test instrument Δ time indications (ns)	
Min (≥)	Max (≤)
49.69	50.31

(53) Change function arbitrary generator output period to 1 µs.

(54) Click **SETUP** menu on top of TI display.

(55) From displayed drop-down menu, click **HORIZONTAL**.

(56) In **HORIZONTAL SETUP** window, place cursor over **SCALE** box and left click mouse to activate percent.

(57) Using either TI keyboard or mouse, enter **1 µ**.

(58) In **HORIZONTAL SETUP** window, click **CLOSE** key.

(59) Click TI **CLEAR ALL** key in lower left corner of screen.

(60) Click **MEASURE** menu on top of TI display.

(61) From displayed drop-down menu, select **TIME**.

(62) From **TIME** submenu, click **DELTA TIME**.

(63) In **ENTER MEASUREMENT INFO** window, select **CHANNEL 1** in both **SOURCE 1** and **SOURCE 2** boxes.

(64) In **ENTER MEASUREMENT INFO** window, click **OK** key.

(65) TI **Δ TIME** minimum and maximum indications will be within limits specified in table 7.

Table 7. Δ Time @ 1 µs

Test instrument Δ time indications	
Min (≥)	Max (≤)
997.4 ns	1.0026 µs

(66) Click **MEASURE** menu on top of TI display.

(67) From displayed drop-down menu, click **MEASUREMENT DEFINITIONS**.

(68) In **MEASUREMENT DEFINITIONS** window, place cursor over **TO EDGE #** box and left click mouse to activate percent.

(69) Using either TI keyboard or mouse, enter **6** and click **OK** key.

(70) In **MEASUREMENT DEFINITIONS** window, click **CLOSE** key.

(71) Click TI **CLEAR ALL** key in lower left corner of screen.

(72) Click **MEASURE** menu on top of TI display.

(73) From displayed drop-down menu, select **TIME**.

(74) From **TIME** submenu, click **DELTA TIME**.

(75) In **ENTER MEASUREMENT INFO** window, select **CHANNEL 1** in both **SOURCE 1** and **SOURCE 2** boxes.

(76) In **ENTER MEASUREMENT INFO** window, click **OK** key.

(77) TI **Δ TIME** minimum and maximum indications will be within limits specified in table 8.

Table 8. Δ Time @ 1 µs, 6th Edge

Test instrument indications (µs)	
Min (≥)	Max (≤)
4.9972	5.0028

(78) Set function arbitrary generator output to minimum.

b. Adjustments. None.

12. Real Time Measurement

a. Performance Check

(1) Set function/arbitrary generator output for a square wave with a period of 39.5 ns, a duty cycle of 50 percent and an amplitude of 2.5 V pp.

(2) Click **SETUP** menu on top of TI display.

(3) From displayed drop-down menu, click **ACQUISITION**.

(4) In **ACQUISITION SETUP** window, click **REAL TIME** and uncheck **AVERAGING ENABLED** box.

(5) In **ACQUISITION SETUP** window, click **MEMORY DEPTH AUTOMATIC**.

(6) In **ACQUISITION SETUP** window, click **SAMPLING RATE MANUAL**.

(7) In **ACQUISITION SETUP** window, click ∇ key of **SAMPLING RATE** box until sampling rate is **1.00 GSa/s**.

(8) In **ACQUISITION SETUP** window, click **CLOSE** key.

(9) Click **SETUP** menu on top of TI display.

(10) From displayed drop-down menu, click **HORIZONTAL**.

(11) In **HORIZONTAL SETUP** window, place cursor over **SCALE** box and left click mouse to activate percent.

(12) Using either TI keyboard or mouse, enter **50 n**.

(13) In **HORIZONTAL SETUP** window, place cursor over **POSITION** box and left click mouse to activate percent.

(14) Using either TI keyboard or mouse, enter **0** and click **OK** key.

(15) In **HORIZONTAL SETUP** window, click **CLOSE** key.

(16) Click **MEASURE** menu on top of TI display.

(17) From displayed drop-down menu, click **MEASUREMENT DEFINITIONS**.

(18) In **MEASUREMENT DEFINITIONS** window, place cursor over **TO EDGE #** box and left click mouse to activate percent.

(19) Using either TI keyboard or mouse, enter **11** and click **OK** key.

(20) In **MEASUREMENT DEFINITIONS** window, click **CLOSE** key.

(21) Click TI **CLEAR ALL** key in lower left corner of screen.

(22) Click **MEASURE** menu on top of TI display.

(23) From displayed drop-down menu, select **TIME**.

(24) From **TIME** submenu, click **PERIOD**.

(25) TI **PERIOD** minimum and maximum indications will be within limits specified in table 9.

Table 9. Period @ 39.5 ns

Test instrument indications (ns)	
Min (≥)	Max (≤)
39.298	39.702

(26) Click **MEASURE** menu on top of TI display.

(27) From displayed drop-down menu, select **TIME**.

(28) From **TIME** submenu, click **DELTA TIME**.

(29) In **ENTER MEASUREMENT INFO** window, select **CHANNEL 1** in both **SOURCE 1** and **SOURCE 2** boxes.

(30) In **ENTER MEASUREMENT INFO** window, click **OK** key.

(31) TI **Δ TIME MIN** and **MAX** indications will be within limits specified in table 10.

Table 10. Δ Time @ 39.5 ns

Test instrument indications (ns)	
MIN (≥)	MAX (≤)
394.780	395.220

(32) Press TI **STOP** button.

(33) Press TI **TRIGGER SWEEP** button until **TRIGGER SINGLE** indicator is illuminated.

(34) Press TI **CLEAR DISPLAY** button.

(35) Click **SETUP** menu on top of TI display.

(36) From displayed drop-down menu, click **HORIZONTAL**.

(37) In **HORIZONTAL SETUP** window, place cursor over **SCALE** box and left click mouse to activate percent.

(38) Using either TI keyboard or mouse, enter **1 µ**.

(39) In **HORIZONTAL SETUP** window, click **CLOSE** key.

(40) Press TI **RUN** button once.

(41) Click **MEASURE** menu on top of TI display.

(42) From displayed drop-down menu, click **MEASUREMENT DEFINITIONS**.

(43) In **MEASUREMENT DEFINITIONS** window, place cursor over **TO EDGE #** box and left click mouse to activate percent.

(44) Using either TI keyboard or mouse, enter **101** and click **OK** key.

(45) In **MEASUREMENT DEFINITIONS** window, click **CLOSE** key.

(46) TI **Δ TIME MEAN** indication will be within limits specified in table 11.

Table 11. Δ Time @ 39.5 ns, Edge 101

Test instrument Δ time mean indication (μs)	
Min	Max
3.94960	3.95040

(47) Click **MEASURE** menu on top of TI display.

(48) From displayed drop-down menu, click **MEASUREMENT DEFINITIONS**.

(49) In **MEASUREMENT DEFINITIONS** window, place cursor over **TO EDGE #** box and left click mouse to activate keypad.

(50) Using either TI keyboard or mouse, enter **201** and click **OK** key.

(51) In **MEASUREMENT DEFINITIONS** window, click **CLOSE** key.

(52) TI **Δ TIME MEAN** indication will be within limits specified in table 12.

Table 12. Δ Time @ 39.5 ns, Edge 201

Test instrument Δ time mean indication (μs)	
Min	Max
7.8992	7.9008

(53) Set function/arbitrary generator output to minimum and disconnect equipment setup.

b. Adjustments. None.

13. Trigger Sensitivity

a. Performance Check

(1) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1-4** outputs to TI channels **1-4** input connectors respectively.

(2) Press TI **DEFAULT SETUP** button.

(3) Click **SETUP** menu on top of TI display.

(4) From displayed drop-down menu, click **ACQUISITION**.

(5) In **ACQUISITION SETUP** window, click **SAMPLING MODE EQUIVALENT TIME** and **AVERAGING ENABLED** box.

(6) In **ACQUISITION SETUP** window, place cursor over **# OF AVERAGES** box and left click mouse to activate percent.

(7) Using either TI keyboard or mouse, enter **16** and click **OK** key.

(8) In **ACQUISITION SETUP** window, click **CLOSE** key.

(9) Click **SETUP** menu on top of TI display.

(10) From displayed drop-down menu, click **HORIZONTAL**.

(11) In **HORIZONTAL SETUP** window, place cursor over **SCALE** box and left click mouse to activate percent.

(12) Using either TI keyboard or mouse, enter **5 n**.

(13) In **HORIZONTAL SETUP** window, click **CLOSE** key.

(14) Press TI channel 1 **VERTICAL INPUT** button to highlight **50Ω** indicator.

(15) Ensure **DC** coupling indicator is illuminated.

(16) Using TI channel 1 **VERTICAL** ∿∿ knob, set vertical scale to 200 mV.

(17) Set oscilloscope calibrator for a level sine output frequency of 100 MHz at a level of 100 mV.

(18) Click **MEASURE** menu on top of TI display.

(19) From displayed drop-down menu, click **MARKERS**.

(20) In **MARKERS SETUP** window, click **MODE MANUAL PLACEMENT**.

(21) In **MARKERS SETUP** window, place cursor over **MARKER A Y** box and left click mouse to activate keypad.

(22) Using either TI keyboard or mouse, enter **50 m**.

(23) In **MARKERS SETUP** window, place cursor over **MARKER B Y** box and left click mouse to activate percent.

(24) Using either TI keyboard or mouse, enter –**50 m**.

(25) In **MARKERS SETUP** window, ensure channel 1 is selected for both **MARKER A** and **MARKER B**.

(26) In **MARKERS SETUP** window, click **CLOSE** key.

(27) Markers should be present on TI screen.

(28) Press TI **TRIGGER SWEEP** button to illuminate **TRIG 'D** indicator.

(29) If necessary, adjust TI **TRIGGER LEVEL** ⇳ knob for a stable display and TI **HORIZONTAL TRIG 'D** indicator illumination.

(30) Repeat technique of (9) through (29) above for oscilloscope calibrator outputs and TI settings listed in table 13 below. TI will trigger at all settings.

Table 13. Triggering Level

Oscilloscope calibrator level sine output		Test instrument settings		
Frequency (MHz)	Level (mV)	Horizontal scale (ns)	Marker A Y (mV)	Marker B Y (mV)
500	100	1	100	–100
600	100	1	150	–150

(31) Set oscilloscope calibrator to standby.

(32) Press TI buttons as listed in (a) through (c) below:

(a) **VERTICAL 1** (not illuminated).
(b) **VERTICAL 2** (illuminated).
(c) **TRIGGER SOURCE** (**1** not illuminated, **2** illuminated).

(33) Change oscilloscope calibrator output from channel 1 to channel 2.

(34) Repeat technique of (9) through (32) above for remaining TI channels.

(35) Set oscilloscope calibrator to standby and disconnect equipment setup.

(36) Using a tee, connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** to TI **AUX TRIG IN** (rear panel) through 50 Ω feed through termination and to TI channel 1 input.

(37) Press TI buttons as listed in (a) through (c) below:

(a) **VERTICAL 1** (illuminated).
(b) **VERTICAL 2-4** (not illuminated).
(c) **TRIGGER SOURCE** (**1** illuminated, **2-4** not illuminated).

(38) Set oscilloscope calibrator for a level sine output frequency of 500 MHz at a level of 600 mV.

(39) Press TI channel 1 **VERTICAL INPUT** button to illuminate **50Ω** indicator.

(40) Press TI **AUTOSCALE** button.

(41) Using TI channel 1 **VERTICAL** ~ ∿ knob, set vertical scale to 50 mV/div.

(42) Adjust oscilloscope calibrator output level for six divisions of amplitude on TI screen.

(43) Press TI **TRIGGER SOURCE** button until **TRIGGER AUX** is illuminated.

(44) Place cursor over **TRIGGER LEVEL** box and left click mouse to activate keypad.

(45) Using either TI keyboard or mouse, enter **0** and click **OK** key.

(46) Slowly adjust TI **TRIGGER LEVEL** ⬍ knob around the 0 V setting.

(47) TI will display a stable signal and TI **HORIZONTAL TRIG 'D** indicator will illuminate.

(48) Set oscilloscope calibrator to standby and disconnect equipment setup.

b. Adjustments. None.

14. DC Calibrator

a. Performance Check

(1) Connect multimeter to TI **AUX OUT** on back panel.

(2) Press TI **DEFAULT SETUP** button.

(3) Click **UTILITIES** menu on top of TI display.

(4) From displayed drop-down menu, click **CALIBRATION**.

(5) Click ∇ key of **AUX OUTPUT** box.

(6) Click **DC** from roll down menu.

(7) Place cursor over **LEVEL** box and left click mouse to activate percent.

(8) Using either TI keyboard or mouse, enter **2.400** and click **OK** key.

(9) Record multimeter reading (to four significant digits) as V1.

(10) Place cursor over **LEVEL** box and left click mouse to activate percent.

(11) Using either TI keyboard or mouse, enter –**2.400** and click **OK** key.

(12) Record multimeter reading (to four significant digits) as V2.

(13) Using formula below, calculate calibrator voltage.

$$(V1 - V2) \div 4.8 = \text{voltage}$$

(14) Calculated result will be within limits specified in table 14 below.

Table 14. Calibrator Output

Calculated result	
Min	Max
0.998	1.002

(15) Click TI **CALIBRATION CLOSE** key.

(16) Press TI **DEFAULT SETUP** button.

(17) Disconnect equipment setup.

b. Adjustments. None.

15. Power Supply

WARNING

HIGH VOLTAGE is used or exposed during the performance of this check. 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

Do not perform power supply check if all other parameters are within tolerance.

a. Performance Check

(1) Press TI ⏻ button to power down TI.

(2) Disconnect power cord and remove TI cover.

(3) Reconnect power cord and press TI ⏻ button to power up TI.

(4) Connect multimeter common lead to TI ground.

(5) Connect multimeter positive lead to TI +5.1 V test point (fig.1).

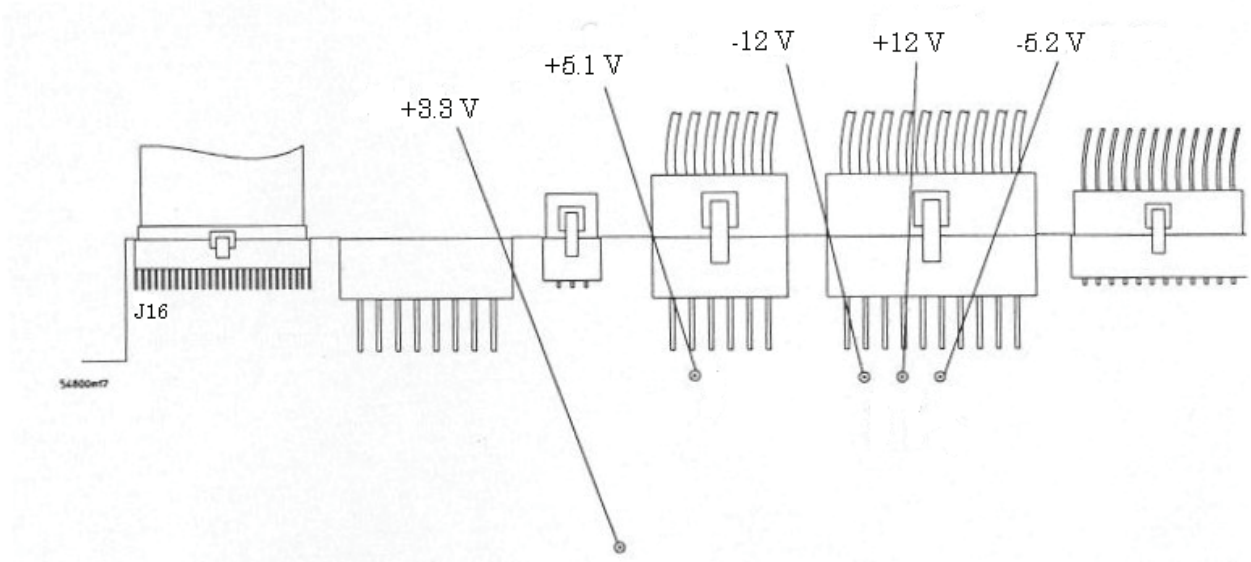

Figure 1. Power supply test points

(6) Multimeter indication will be within limits specified in first row of table 15.

(7) Repeat technique of (4) and (5) above for remaining test points listed in table 14 below. Multimeter indications will be within limits specified.

Table 15. Power Supply Voltages

Test instrument	Multimeter	
Test point (V)	Indications (V)	
	Min	Max
+5.1	5.0	5.2
–5.2	–5.3	–5.1
+12.2	11.9	12.5
–12.2	–12.5	–11.9
+3.3	2.8	3.5

(8) Disconnect equipment setup and reinstall TI cover.

b. Adjustments. None.

16. 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

17. Self-Calibration

NOTE

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

a. Using TI mouse, click key to enable graphical interface.

b. Click **UTILITIES** menu on top of TI display.

c. From displayed drop-down menu, click **CALIBRATION**.

d. Click TI **CAL MEMORY PROTECT** box to uncheck it.

NOTE

Clear **CAL MEMORY PROTECT** to perform self calibration. You cannot perform self calibration if this box is checked.

e. Click **START** key and follow instructions displayed in text box.

NOTE

Throughout the self-calibration process you will be asked to perform various cable connections. After performing these connections, click **OK** key in displayed dialog box to continue self-calibration process.

NOTE

After each portion of the self-calibration process is completed, the TI will display a **PASSED / FAILED** message.

f. When self-calibration is complete, click **CALIBRATION COMPLETE** window **OK** key.

g. Click **CALIBRATION CLOSE** key and disconnect connection.

18. Final Procedure

a. Deenergize and disconnect all equipment.

b. Perform paragraphs **6** through **16** above.

By Order of the Secretary of the Army:

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

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army

0722003

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 344782, requirements for calibration procedure TB 9-6625-2344-24.

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.