*TB 9-6625-1958-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR TIME MARK GENERATOR, TEKTRONIX TYPES TG 501 AND TG 501 OPTION 1

Headquarters, Department of the Army, Washington, DC

6 July 2001

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REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedure, please let us know. Mail your letter or DA Form 2028 to: Commander, U. S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5230. 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.

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*This bulletin supersedes TB 9-6625-1958-35, 1 June 1984.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Time Mark Generator, Tektronix, Types TG 501 and TG 501 Option 1. 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. Variations among models are described in the text.

    b. Time and Technique. The time required for this calibration is approximately 2 hours, using the dc and low frequency technique.

2. Forms, Records, and Reports. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

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	
Markers	Range:	1 ns to 5 s
	Accuracy:	1 part in 10^5 (±0.001%)
		5 parts in 10^7 (±0.00005%) (Option 1)
	Amplitude:	≥1 V peak into 50Ω, 5 s to 10 ns
		≥750 mV p-p into 50Ω, 5 ns and 2 ns
		≥200 mV p-p into 50Ω, 1 ns
Variable error readout	Range: +7.5 to -7.5%	
	Accuracy: ± one least significant digit	

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. 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.

5. Accessories Required. The accessories required are issued as indicated in paragraph 4 above and are used in this calibration procedure. The following peculiar accessories are required: Extender, Tektronix 067-0645-02, and Power Module, Tektronix TM 500 series.

Table 2. Minimum Specifications of Equipment Required

Common Name	Minimum Use Specifications	Manufacturer and Model (Part Number)
FREQUENCY COUNTER	Range: 1 GHz to 5 s Accuracy: 1 part in 10^7	Hewlett-Packard, Model 5345A (MIS-28754/1 Type 1) w/frequency converter, Hewlett-Packard, Model 5355A (5355A)
MEASURING RECEIVER	Range: ≥265.1 mV, 200 and 500 MHz ≥70.7 mV, 1000 MHz	Hewlett-Packard, Model 8902A (8902A) w/sensor module, Hewlett-Packard, Model 11722A (11722A)
MULTIMETER	Range: 14.75 to 15.25 V dc Accuracy: ±0.4%	John Fluke, Model 8840A/AF (AN/GSM-64D)
OSCILLOSCOPE	Measurement: .1μs and 50 ns marker amplitudes	Tektronix, Type 2465BOPT46 (2465BOPT46)

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. Additional maintenance information is contained in the manufacturer's manual for this TI.

d. For TIs with serial numbers B0131770 and up, when indications specified in paragraphs **8** through **11** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **8** through **11**. 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. Connect TI to power module.

    b. Connect power module to a 115V ac power source**.**

<div align="center">

NOTE
</div>

        Do not remove TI covers unless required to gain access to adjustments. Replace covers upon completion of adjustments. Covers removed for extended periods of time will degrade timing accuracy.

    c. Energize equipment and allow at least 1 hour for equipment to stabilize.

<div align="center">

CAUTION
</div>

        Always deenergize power module before removing TI. Damage to TI may result.

8. Marker Frequency

    a. Performance Check

        (1) Position controls as listed in (a) through (c) below:

            (a) **MARKER (SEC)** switch to **1m**

            (b) **VARIABLE TIMING (OUT)** control pushed in.

            (c) **NOT VARIABLE** pushbuttons released.

        (2) Connect frequency counter input to TI **MARKER OUT** using 50Ω feedthrough termination. If frequency counter does not indicate between 0.99999 and 1.00001 MHz (0.9999995 and 1.0000005 MHz for option 1), perform **b** below.

        (3) Repeat technique of (2) above for TI **MARKER (SEC)** switch settings listed in table 3. Frequency counter will indicate within limits specified.

<div align="center">Table 3. Marker Frequency</div>

Test instrument **MARKER (SEC)** switch settings	Frequency counter indications			
	Standard		Option 1	
	Min	Max	Min	Max
10 n	9.9999 ns	10.0001 ns	9.999995 ns	10.000005 ns
20 n	19.9998 ns	20.0002 ns	19.99999 ns	20.00001 ns
50 n	49.9995 ns	50.0005 ns	49.999975 ns	50.000025 ns
.1 μ	99.999 ns	100.001 ns	99.99995 ns	100.00005 ns
.2 μ	.199998 μs	.200002 μs	199.9999 ns	200.0001 ns
.5 μ	.499995 μs	.500005 μs	499.99975 ns	500.00025 ns

Table 3. Marker Frequency - Continued

Test instrument **MARKER (SEC)** switch settings	Frequency counter indications			
	Standard		Option 1	
	Min	Max	Min	Max
2 μ	1.99998 μs	2.00002 μs	1.999999 μs	2.000001 μs
5 μ	4.99995 μs	5.00005 μs	4.9999975 μs	5.0000025 μs
10 μ	9.9999 μs	10.0001 μs	9.999995 μs	10.000005 μs
20 μ	19.9998 μs	20.0002 ms	19.99999 μs	20.00001 μs
50 μ	49.9995 μs	50.0005 ms	49.999975 μs	50.000025 μs
.1 m	99.999 μs	100.001 ms	99.99995 μs	100.00005 μs
.2 m	.199998 ms	.200002 ms	199.9999 μs	200.0001 μs
.5 m	.499995 ms	.500005 ms	499.99975 μs	500.00025 μs
1 m	.99999 ms	1.00001 ms	.9999995 ms	1.0000005 ms
2 m	1.99992 ms	2.00002 ms	1.999999 ms	2.000001 ms
5 m	4.99995 ms	5.00005 ms	4.9999975 ms	5.0000025 ms
10 m	9.9999 ms	10.0001 ms	9.999995 ms	10.000005 ms
20 m	19.9998 ms	20.0002 ms	19.99999 ms	20.00001 ms
50 m	49.9995 ms	50.0005 ms	49.999975 ms	50.000025 ms
.1	99.999 ms	100.001 ms	99.99995 ms	100.00005 ms
.2	.199998 s	.200002 s	199.9999 ms	200.0001 ms
.5	.499995 s	.500005 s	499.99975 ms	500.00025 ms
1	.99999 s	1.00001 s	.9999995 s	1.0000005 s
	1.99998 s	2.00002 s	1.999999 s	2.000001 s
5	4.99995 s	5.00005 s	4.9999975 s	5.0000025 s
521 n[1]	4.99995 ns	5.00005 ns	4.9999975 ns	5.0000025 ns
521 n[2]	499.995 MHz	500.005 MHz	499.999750 MHz	500.000250 MHz
521 n[3]	999.990 MHz	1000.010 MHz	999.9995 MHz	1000.0005 MHz

[1]Press **5nS** pushbutton.
[2]Press **2nS** pushbutton.
[3]Press **1nS** pushbutton and move connection to **1 nS ONLY**.

b. Adjustments. Adjust TIME REF SET (fig. 1) until frequency counter indicates 1.00000 MHz, or if required, for best intolerance condition on all ranges (R).
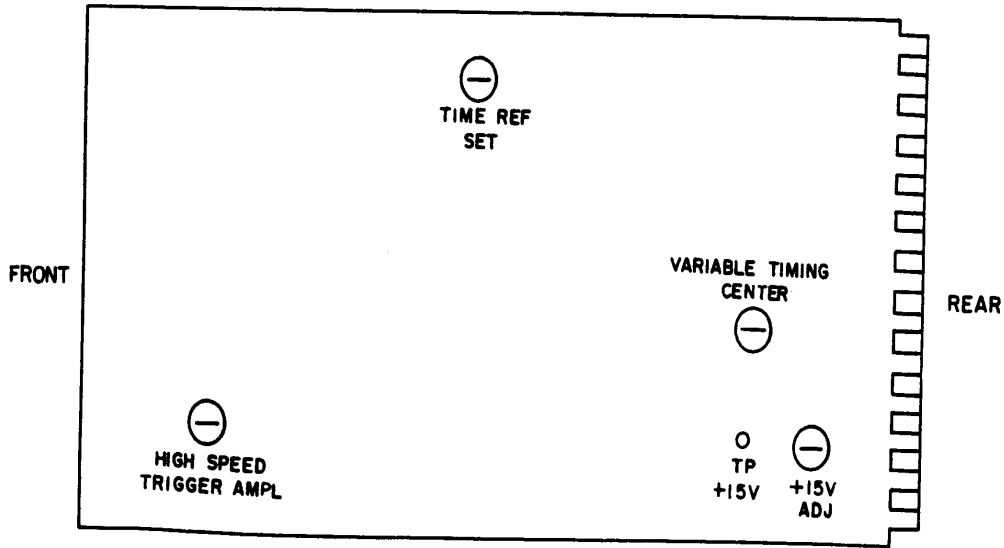
Figure 1. Main circuit board - component locations.

9. Error Readout

a. Performance Check

(1) Set **MARKER (SEC)** switch to **1m** and pull out **VARIABLE TIMING (OUT)** control.

(2) Adjust **VARIABLE TIMING (OUT)** control fully cw, then fully ccw while noting **VARIABLE TIMING** indication at each limit. If **VARIABLE TIMING** indication at each limit is not at least 7.5, perform **b** below.

(3) Connect frequency counter input to TI **MARKER OUT** using 50Ω feedthrough termination.

(4) Set **MARKER (SEC)** switch to **.1m**.

(5) Adjust **VARIABLE TIMING (OUT)** control for a 0.0% **VARIABLE TIMING** indication. Frequency counter will indicate between 9.99 and 10.01 kHz.

(6) Adjust **VARIABLE TIMING (OUT)** control for a 5.0% **FAST VARIABLE TIMING** indication. Frequency counter will indicate between 10.49 and 10.51 kHz.

(7) Adjust **VARIABLE TIMING (OUT)** control for a 5.0% **SLOW VARIABLE TIMING** indication. Frequency counter will indicate between 9.49 and 9.51 kHz.

(8) Push in **VARIABLE TIMING (OUT)** control.

b. Adjustments. Adjust VARIABLE TIMING CENTER (fig. 1) until VARIABLE TIMING indication at each limit is at least 7.5 (R).

10. High Speed Trigger Amplitude

a. Performance Check

(1) Connect oscilloscope **CH 1** input to TI **+TRIGGER OUT** using 50Ω feedthrough termination.

(2) Connect a 50Ω feedthrough termination to TI **MARKER OUT**.

(3) Rotate **MARKER (SEC)** switch back and forth between **.1m** and **50n** noting amplitude at each position. If amplitudes are not within 0.1 V of each other, perform **b** below.

b. Adjustments

(1) Adjust **HIGH SPEED TRIGGER AMPL** (fig. 1) until amplitudes are within 0.1 V of each other (R).

11. Marker Amplitude

a. Performance Check

(1) Connect measuring receiver sensor module to TI **MARKER OUT**.

(2) Set **MARKER (SEC)** switch to **521n** and press **5nS** pushbutton.

(3) Set measuring receiver to measure volts at 200 MHz. If measuring receiver indication is less than 265.1 mV, perform **b**(1).

(4) Press **2nS** pushbutton.

(5) Set measuring receiver to measure volts at 500 MHz. If measuring receiver indication is less than 265.1 mV, perform **b**(2) through (14) below.

(6) Disconnect sensor module from TI **MARKER OUT** and connect to TI **1nS ONLY**.

(7) Press **1nS** pushbutton.

(8) Set measuring receiver to measure volts at 1000 MHz. If measuring receiver indication is less than 70.7 mV, perform **b**(8) through (14) below.

b. Adjustments

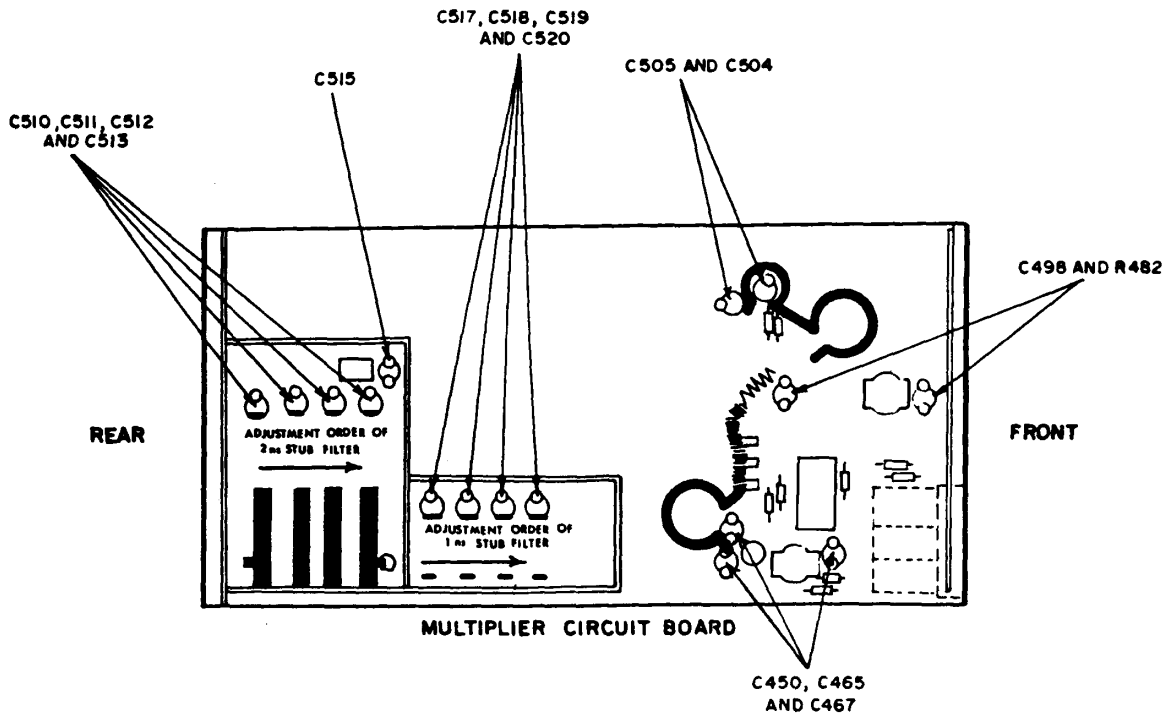(1) Adjust C450, C465, and C467 (fig. 2) for maximum measuring receiver indication (R).

Figure 2. Multiplier circuit board.

(2) Adjust C498 and R482 (fig. 2) for maximum measuring receiver indication (R).

(3) Adjust C504 and C505 (fig. 2) for maximum measuring receiver indication (R).

(4) Adjust C510, C511, C512, and C513 (fig. 2) (order of adjustments as shown by arrow) for maximum measuring receiver indication (R).

(5) Disconnect sensor module from TI **MARKER OUT** and connect to TI **1nS ONLY**.

(6) Press **1nS** pushbutton.

(7) Set measuring receiver to measure volts at 1000 MHz.

(8) Adjust C517, C518, C519, and C520 (fig. 2) (order of adjustment as shown by arrow) for maximum measuring receiver indication (R).

(9) Adjust C515 (fig. 2) for a measuring receiver indication > 70.7 mV (R).

(10) Disconnect sensor module from TI **1nS ONLY** and connect to TI **MARKER OUT**.

(11) Press **2nS** pushbutton.

(12) Set measuring receiver to measure volts at 500 MHz.

(13) Adjust C515 (fig. 2) for a measuring receiver indication > 265.1 mV (R).

(14) 1ns and 2ns adjustments interact; repeat (2) through (13) above as necessary.

12. Power Supply

NOTE

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

    a. Performance Check. Connect multimeter **INPUT HI** to TI TP +15V (fig. 1) and **INPUT LO** to ground. If multimeter indication is not between 14.75 and 15.25 V, perform **b** below.

    b. Adjustments. Adjust +15V ADJ (R606) (fig. 1) for a multimeter indication of 15.0 V (R).
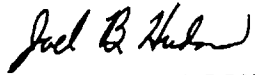
13. Final Procedure

    a. Deenergize and disconnect all equipment and reinstall TI protective covers.

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

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Distribution:
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From: "Whomever" 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**
7. **Date Sent:** 19-Oct-93
8. **Pub No:** TB 9-6625-xxxx-35
9. **Pub Title: Calibration Procedure for ...**
10. **Publication Date:**
11. **Change Number:**
12. **Submitted Rank:** MSG
13. **Sumitter 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.