

*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
16 December 2002

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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, 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 provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our FAX number is: DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is: 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual. For the World Wide Web, use: <https://amcom2028.redstone.army.mil>.

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**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 115 V ac power source.

NOTE

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.

CAUTION

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

8. Marker Timing

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 μs (0.9999995 and 1.0000005 μs 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.

Table 3. Marker Timing

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	199.998	ns	200.002	ns	199.9999	ns	200.0001	ns
.5 μ	499.995	ns	500.005	ns	499.99975	ns	500.00025	ns
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	μs	19.99999	μs	20.00001	μs
50 μ	49.9995	μs	50.0005	μs	49.999975	μs	50.000025	μs

Table 3. Marker Timing - Continued

Test instrument MARKER (SEC) switch settings	Frequency counter indications			
	Standard		Option 1	
	Min	Max	Min	Max
.1 m	99.999 μ s	100.001 μ s	99.99995 μ s	100.00005 μ s
.2 m	199.998 μ s	200.002 μ s	199.9999 μ s	200.0001 μ s
.5 m	499.995 μ s	500.005 μ s	499.99975 μ s	500.00025 μ s
1 m	0.99999 ms	1.00001 ms	0.9999995 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	199.998 ms	200.002 ms	199.9999 ms	200.0001 ms
.5	499.995 ms	500.005 ms	499.99975 ms	500.00025 ms
1	0.99999 s	1.00001 s	0.9999995 s	1.0000005 s
2	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

¹Press **5nS** pushbutton.

²Press **2nS** pushbutton.

³Press **1nS** pushbutton and move connection to **1 nS ONLY**.

b. Adjustments. Adjust **TIME REF SET** (fig. 1) until frequency counter indicates 1.00000 μ s, or if required, for best intolerance condition on all ranges (R).

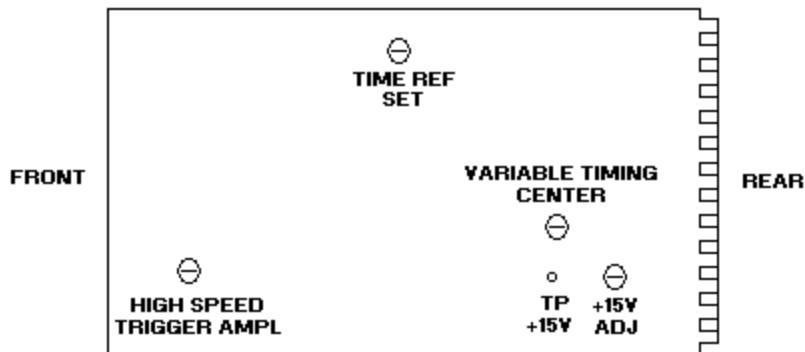


Figure 1. Main circuit board - component locations.

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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 50 Ω 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 50 Ω feedthrough termination.

(2) Connect a 50 Ω 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).

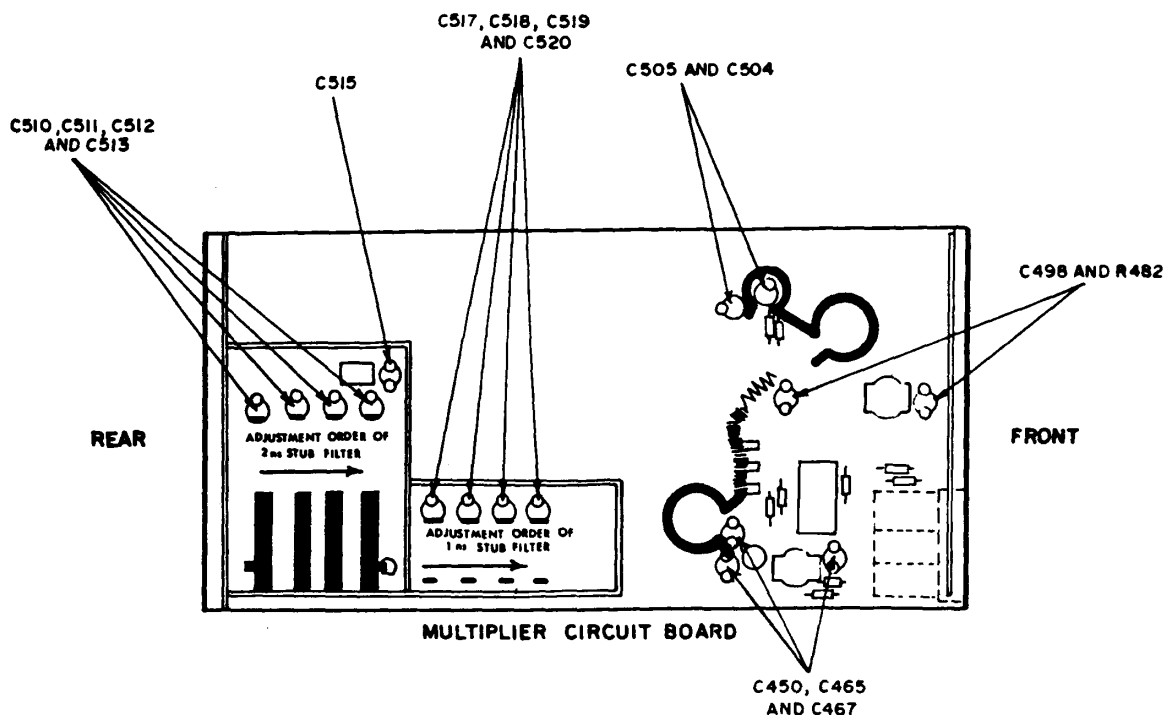


Figure 2. Multiplier circuit board.

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- (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** (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.

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: "Whomever" whomever@avma27.army.mil

To: ls-lp@redstone.army.mil

Subject: DA Form 2028

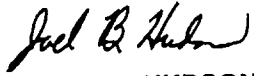
1. **From:** Joe Smith
2. **Unit:** Home
3. **Address:** 4300 Park
4. **City:** Hometown
5. **St:** MO
6. **Zip:** 77777
7. **Date Sent:** 19-Oct-93
8. **Pub No:** TB 9-6625-xxxx-35
9. **Pub Title:** Calibration Procedure for ...
10. **Publication Date:**
11. **Change Number:**
12. **Submitted Rank:** MSG
13. **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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ERIC K. SHINSEKI
General, United States Army
Chief of Staff

OFFICIAL:



JOEL B. HUDSON
Administrative Assistant to the
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