

*TB 9-6625-781-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR ELECTRONIC COUNTER

HEWLETT-PACKARD, MODELS 5245L AND 5245M, AND INTERNAL TIMER, HEWLETT-PACKARD, MODEL 5262A

Headquarters, Department of the Army, Washington, DC
31 October 2007

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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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*This bulletin supersedes TB 9-6625-781-35, 8 September 1988, including all changes.

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SECTION I IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Electronic Counter, Hewlett-Packard Models 5245L and 5245M, and Interval Timer, Hewlett-Packard, Model 5262A. The manufacturers' manuals were used as the prime data sources in compiling these instructions. The electronic counter and interval timer being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. The instructions outlined in this bulletin are for the most common models of Hewlett-Packard, Model 5245. Refer to manufacturer's manual for model variations.

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

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
Models 5245L and 5245M	
Input requirement ¹	Range: 115/230 V ± 10%, 50 to 60 Hz
Input frequency ¹ Maximum sensitivity: Dc input Ac input	Range: 0 to 50 MHz 50 Hz to 50 MHz Accuracy: ± 1 count ± time base accuracy
Self check	Counts 10 MHz for gate time indicated by time base selector switch
Input sensitivity	100 mV rms
Ration input sensitivity	100 mV rms

See footnote at end of table.

Table 1. Calibration Description– Continued

Test instrument parameters	Performance specifications
Time base: Model 5245L Model 5245M	Frequency: 1 MHz 5 MHz
Model 5245L Model 5245M	Aging rate stability: < ± 3 parts in 10^9 / 24 hrs < ± 5 parts in 10^{10} / 24 hrs
Model 5262A	
Range	1 μ s to 10^8 s
Accuracy	± 1 period of standard frequency counted \pm time base accuracy
Sensitivity	0.3 V p-p minimum, direct coupled input

¹This specification is for information only and is not verified in this bulletin.

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-287 and AN/GSM-705. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. 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.

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 accessory is also required for this calibration: extender cable, Hewlett-Packard, model 10506 (7913217).

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: $\pm 1\%$	Ridge, Model 9020A (9020A)
ELECTRONIC COUNTER	Accuracy: ± 1 count \pm time base accuracy	Hewlett-Packard, Model 5245L or 5245M
FREQUENCY DIFFERENCE METER	Range: 1 to 5 MHz Accuracy: $\pm 5\%$ Resolution: ± 5 parts in 10^{10}	Tracor, Model 527E (527E)
FUNCTION/ARBITRARY GENERATOR	Range: 10 Hz to 10 MHz	Agilent, Model 33250A (33250A)
MULTIMETER	Range: 0 mV to 187 V Accuracy: $\pm 1\%$	Agilent, Model 3458A (3458A)
OSCILLOSCOPE	Range: 150 to 300 mV p-p Accuracy: $\pm 3\%$	Agilent, OS-303/G (OS-303/G)

Table 2. Minimum Specifications of Equipment Required – Continued

Common name	Minimum use specifications	Manufacturer and model (part number)
OSCILLOSCOPE CALIBRATOR	Range: 100 kHz Output: 100 to 300 mV p-p	Fluke, Model 5820A-5C-GHZ (5820A-5C-GHZ)
SIGNAL GENERATOR	Range: 10 to 350 MHz Output: 0 to 100 mV rms	(SG-1207/U)
TIME/FREQUENCY WORKSTATION	Range: 1 and 5 MHz Accuracy: ± 1 part in 10^9	Datum, Model ET6000-75 (13589305)

**SECTION III
CALIBRATION PROCESS FOR ELECTRONIC COUNTER
HEWLETT-PACKARD, MODELS 5245L AND 5245M**

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. 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 controls 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 top and bottom protective covers from TI as necessary to gain access to adjustments.
- b. Connect TI to 115 V, 50 to 60 Hz source.
- c. Allow 72 hours for crystal oscillator stabilization.

- d. After 72 hour warm-up period, connect autotransformer between TI and 115 V power source.
- e. Adjust output of autotransformer to 115 V.
- f. Turn **SAMPLE RATE** control to midrange and allow 1 hour for restabilization of crystal oscillator.

8. Oscillator Stability

a. Performance Check

- (1) Connect equipment as shown in figure 1.
- (2) Position controls as listed in (a) through (d) below:
 - (a) **MODE** switch (rear panel) to **INT STD FREQ.**
 - (b) **OUTPUT** switch (rear panel) to **1 MC.**
 - (c) **FUNCTION** switch to **FREQUENCY.**
 - (d) **STORAGE** switch (rear panel) to **OFF.**

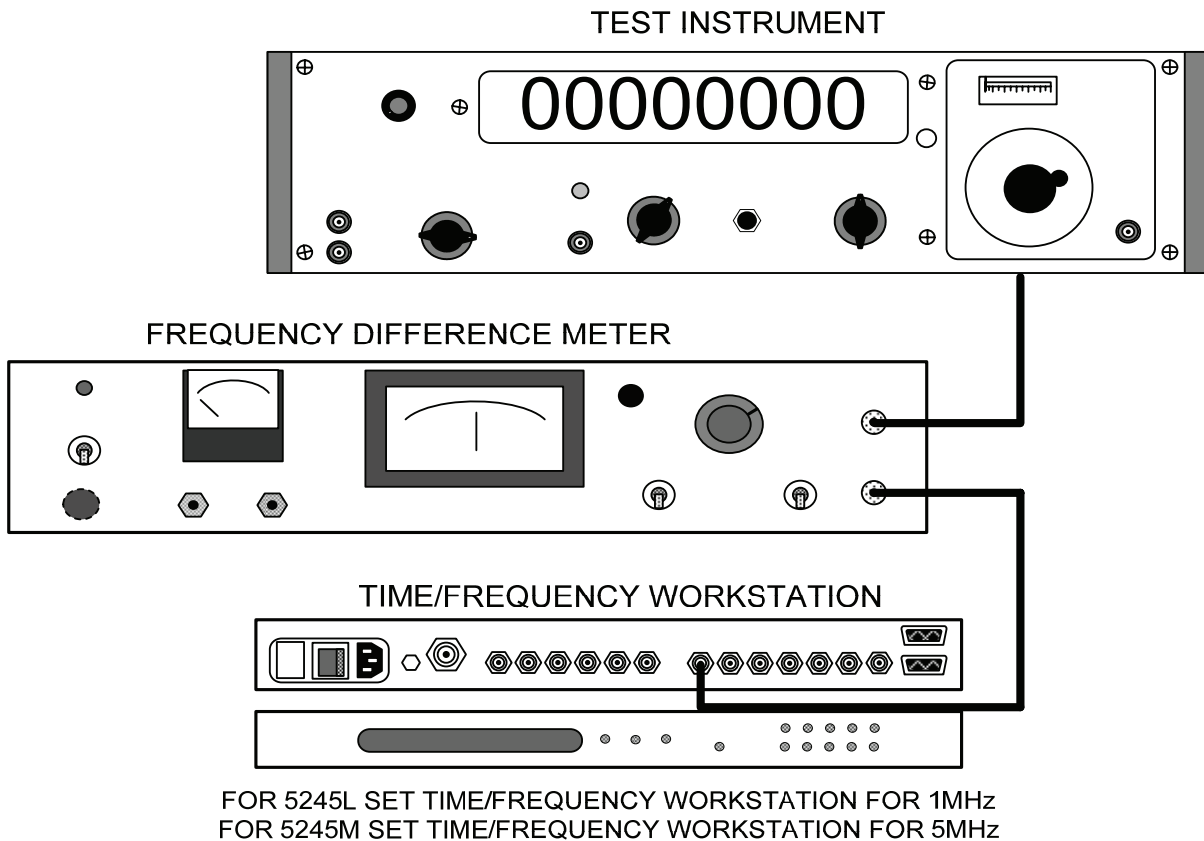


Figure 1. Oscillator stability - equipment setup.

(3) Adjust **COARSE FREQ ADJ** (rear panel) until frequency difference meter indicates minimum frequency difference.

(4) Remove plug-in unit from TI plug-in compartment and adjust **MED FREQ ADJ** and **FINE FREQ ADJ** until frequency difference meter indicates 0 frequency difference.

NOTE

Model 5245M has no **MED FREQ ADJ** adjustment.

(5) Replace plug-in unit.

(6) Allow 24 hours for TI oscillator stabilization. After 24 hours, if frequency difference meter does not indicate between ± 3 parts in 10^9 (± 5 parts in 10^{10} for model 5245M) repeat (3) through (6) above.

b. Adjustments. No further adjustments can be made.

9. Self Check

a. Performance Check

(1) Set **SENSITIVITY** switch to **CHECK**. Indications observed on TI will be as listed in table 3 for respective settings of **TIME BASE** switch.

(2) Set **FUNCTION** switch to **MANUAL START** and **TIME BASE** switch to **.1** second setting. TI will count continuously.

Table 3. Frequency Self Check

TIME BASE switch settings	Indications (± 1 count)
1 μ S	00000010
10 μ S	0000010.0
0.1 ms	000010.00
1 ms	00010000
10 ms	0010000.0
0.1 s	010000.00
1 s	10000.000
10 s ¹	0000.0000

¹Vary autotransformer output from 105 to 125V ac. Wait at least 1 minute at each autotransformer setting (105 and 125 V ac) and then adjust autotransformer for 115 V ac.

(3) Set **FUNCTION** switch to **PERIOD AVERAGE 1**. Indications observed on TI will be as listed in table 4 for respective settings of **FUNCTION** switch.

Table 4. Period Average Self Check

FUNCTION switch settings (period average)	Indications (± 1 count)
1	00000001
10	00000010
100	00000100
1 K	00001000
10 K	00010000
100 K	00100000

b. Adjustments. No adjustments can be made.

10. Input Amplifier Sensitivity

a. Performance Check

- (1) Position controls as listed in (a) through (c) below:
 - (a) **SENSITIVITY** switch to **.1 (50V MAX)** or **.1** for model 5245M.
 - (b) **FUNCTION** switch to **FREQUENCY**.
 - (c) **TIME BASE** switch to **10 ms**.

NOTE

On models 5245L with SN prefix 628 and above, turn **-LEVEL+** control to **PRESET**.

- (2) Connect signal generator to **TI AC SIGNAL INPUT**, using a 50 Ω termination.
- (3) Set **TIME BASE** switch to **1 ms**, **SENSITIVITY** switch to **.1 (50V MAX)** and **FUNCTION** switch to **FREQUENCY** if not performed in (1) above.
- (4) Adjust signal generator frequency to 50 MHz and output amplitude to minimum.
- (5) Slowly increase signal generator amplitude output until a stable count is obtained on TI. If signal generator output level indication is greater than 100 mV, perform **b** below.
- (6) Repeat (4) and (5) above at 10 MHz.

b. Adjustments

- (1) Adjust signal generator amplitude output to 100 mV.
- (2) Adjust A19R20 or A19R7 (fig. 2) until a stable count is obtained on TI (R).

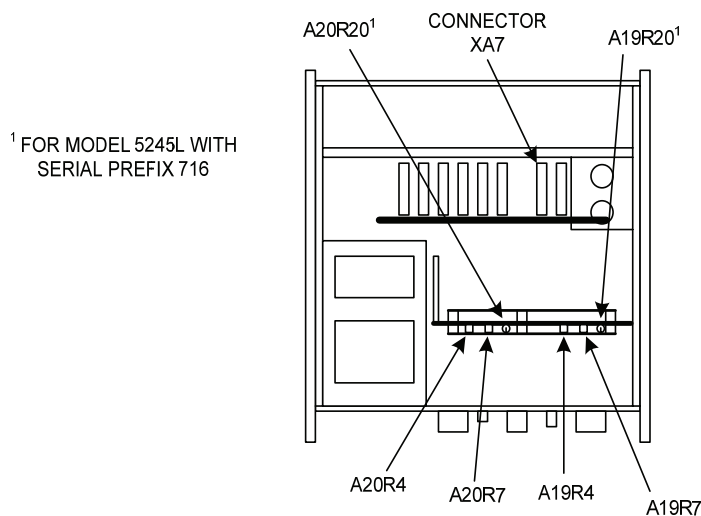


Figure 2. Electronic counter - bottom view.

NOTE

On some models, these resistors are not adjustable and no adjustments can be made.

(3) Alternately decrease signal generator output while adjusting A19R20 or A19R7 until maximum sensitivity is obtained.

11. Ratio Input Amplifier Sensitivity

a. Performance Check

- (1) Position controls as listed in (a) through (c) below:
 - (a) **SENSITIVITY (VOLTS RMS)** switch to **1**.
 - (b) **TIME BASE** switch to **EXT**.
 - (c) **FUNCTION** switch to **PERIOD AVERAGE 1**.
- (2) Connect multimeter to **EXT TIME BASE (50V MAX)** connector.
- (3) Adjust A20R4 (fig. 2) until multimeter indicates 0 ± 15 mV dc.
- (4) Set **OUTPUT** switch (located on rear panel) to **100 CPS**.
- (5) Connect **OUTPUT jack (rear panel)** to **SIGNAL INPUT AC** jack.
- (6) Connect signal generator output to **EXT TIME BASE (50V MAX)** jack, using a 50 Ω termination.
- (7) Adjust frequency of signal generator to 50 MHz and amplitude to minimum.
- (8) Slowly increase signal generator output until stable indication is obtained on TI. If signal generator output amplitude is greater than 100 mV, perform **b** below.
- (9) Repeat (7) and (8) above at signal generator frequency of 10 MHz.

b. Adjustments

- (1) Adjust signal generator amplitude output to 100 mV.
- (2) Adjust A20R20 or A20R7 (fig. 2) until a stable count is obtained on TI (R).

NOTE

On some models, these resistors are not adjustable and no adjustments can be made.

(3) Alternately decrease signal generator output while adjusting A20R20 or A20R7 until maximum sensitivity is obtained.

12. Power Supply

NOTE

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

a. Performance Check. Connect multimeter between test points listed in table 5 and chassis ground. If multimeter does not indicate within limits specified, perform corresponding adjustments listed in table 5.

Table 5. Power Supply Check

Test instrument test points XA7 correction (fig. 2)	Multimeter indications (V)		Adjustments (fig. 3) (R)
	Min	Max	
A7-1	+19.5	+20.5	A7R17
A7-13	-14.5	-15.5	A7R5
A7-4	+12.5	+13.5	A7R12

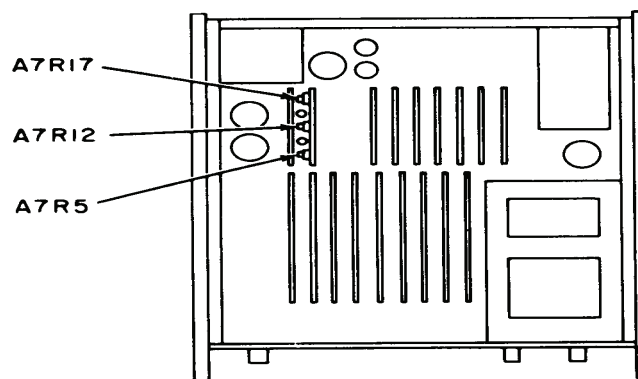


Figure 3. Electronic counter - top view.

b. Adjustments. No further adjustments can be made.

13. Final Procedure

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

**SECTION IV
CALIBRATION PROCESS FOR INTERVAL TIMER, MODEL 5262A**

14. Preliminary Instructions

a. The instructions outlined in paragraphs 14 and 15 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 controls and controls settings refer to the TI.

15. 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 electronic counter, using extender cable.

NOTE

Electronic counter must remain connected to TI for all performance checks.

- b.** Connect electronic counter to a 115 V, 60 Hz power source.

- c.** Position controls as listed in (1) through (4) below:

- (1) **TRIGGER LEVEL** controls (**START** and **STOP**) to **0**.
- (2) **MULTIPLIER** switches (**START** and **STOP**) to **.1**.
- (3) **SLOPE** switches (**START** and **STOP**) to **+** (positive).
- (4) **COM-REMOTE-SEP** switch to **SEP**.

- d.** Position electronic counter controls as listed in (1) through (4) below:

- (1) **FUNCTION** switch to **REMOTE OR TIME INT**.
- (2) **SENSITIVITY** switch to **PLUG IN**.
- (3) **TIME BASE** switch to **.1 ms**.
- (4) **SAMPLE RATE** control to mid position.

- e.** Allow sufficient time for equipment to warm up and stabilize.

16. Input Zero Set

a. Performance Check

- (1) Connect multimeter to **STOP** input.
- (2) Adjust A4R6 (fig. 4) on stop channel board for zero (± 10 mV) indication on multimeter.

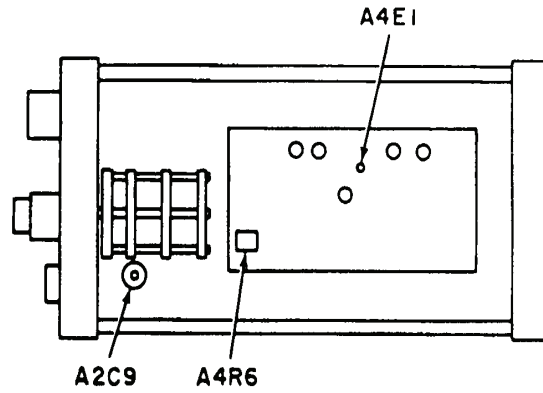


Figure 4. Interval timer - right view.

(3) Disconnect multimeter from **STOP** input and connect **START** input.

(4) Adjust A3R6 (fig. 5) on start channel board for zero (± 10 mV) indication on multimeter.

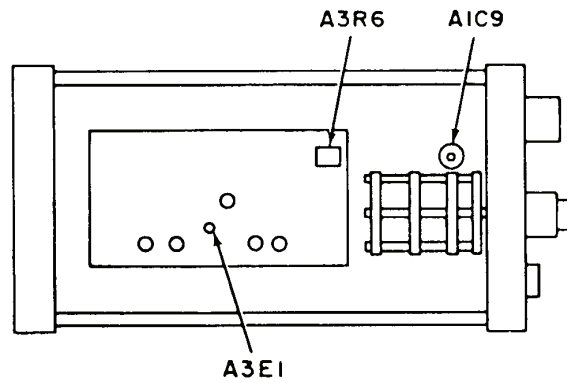


Figure 5. Interval timer - left view.

b. Adjustments. No further adjustments can be made.

17. Attenuator Compensation

a. Performance Check

(1) Connect equipment as shown in figure 6.

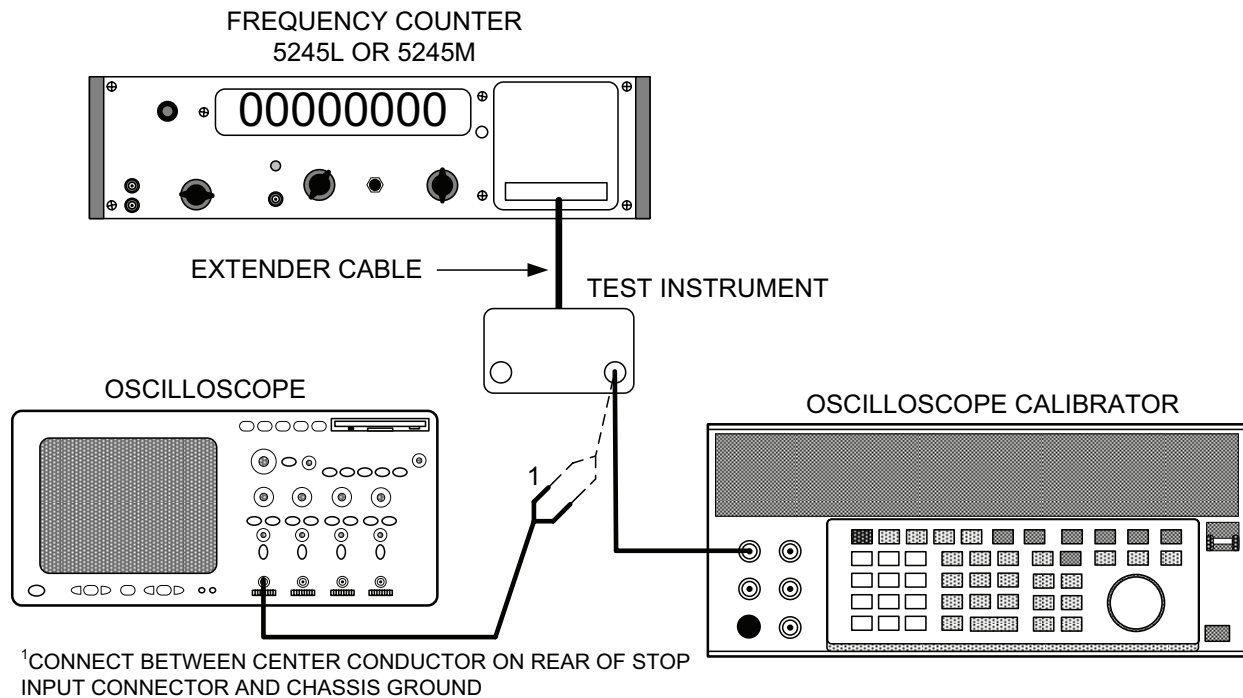


Figure 6. Attenuator compensation - equipment setup.

(2) Adjust oscilloscope calibrator frequency to 10 kHz and output to 300 mV p-p as indicated on oscilloscope.

(3) Disconnect cable from **STOP** connector and connect it to test point A4E1 (fig. 4). Note waveforms displayed on oscilloscope.

(4) Set **STOP MULTIPLIER** switch to **.2**. If waveform observed on oscilloscope is not as noted in (3) above, except reduced in amplitude by one-half, perform **b** (1) below.

(5) Disconnect cable from test point A4E1, and connect it to center conductor of **START** connector and chassis ground.

(6) Connect oscilloscope calibrator to **START** connector and repeat (2) above.

(7) Disconnect cable from **START** connector, and connect it between test point A3E1 (fig. 5) on start channel board and chassis ground. Note waveform displayed on oscilloscope.

(8) Set **START MULTIPLIER** switch to **.2**. If waveform observed on oscilloscope is not as noted in (7) above, except reduced in amplitude by one-half, perform **b** (2) below.

b. Adjustments

(1) Adjust A2C9 (fig. 4) to meet requirements of **a** (4) above (R).

(2) Adjust A1C9 (fig. 5) to meet requirements of **a** (8) above (R).

18. Minimum Time Interval and Sensitivity

a. Performance Check

- (1) Position controls as listed in (a) through (e) below:
 - (a) **COM-REMOTE-SEP** switch to **COM**.
 - (b) **MULTIPLIER** switches (**START** and **STOP**) to **.1**.
 - (c) **TRIGGER LEVEL** controls (**START** and **STOP**) to **0**.
 - (d) **STOP SLOPE** switch to - (negative).
 - (e) **START SLOPE** switch to + (positive).
- (2) Set electronic counter **TIME BASE** switch to **.1 μ s**.
- (3) Connect function/arbitrary generator 50 Ω output to **START** connector, using a 50 Ω termination.
- (4) Adjust function/arbitrary generator frequency to 500 kHz and output to 100 mV.
- (5) Slowly adjust **START** and **STOP TRIGGER LEVEL** controls, and verify that a stable count of 1 μ s or less can be obtained on electronic counter.
- (6) Adjust test oscillator frequency to 2 MHz and output to 100 mV.
- (7) Adjust **START** and **STOP TRIGGER LEVEL** controls, and verify that a stable count can be obtained on electronic counter.

b. Adjustments. No adjustments can be made.

19. 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:

Official:



JOYCE E. MORROW

*Administrative Assistant to the
Secretary of the Army*

0724702

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

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 342808, requirements for calibration procedure TB 9-6625-781-24.

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.

