*TB 9-6625-1973-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR FREQUENCY COUNTER AGILENT, MODELS 5326A, 5326B, AND 5326C

Headquarters, Department of the Army, Washington, DC
18 March 2008

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 9-6625-1973-35, dated 5 December 1980, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Frequency Counter, Agilent Models 5326A, 5326B, and 5326C. 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 per instrument, 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
Time base Frequency Aging Rate Stability	 10 MHz < 3 parts in 10^7/month (5 parts in 10^{10}/day for Model 5326A with Option 011) ≤ 1 part in 10^7 (5 parts in 10^9 for Model 5326A with Option 011) for 10% line voltage change
Frequency A and B Sensitivity	 0 to 50 MHz 100 mV
Input zero	Less than + 1 mV dc at A and B INPUT jacks for X10 and X100 positions of attenuator (Option 004 only)
Frequency C[1] Range Sensitivity	 0 to 50 MHz 5 mV[2]
Dc voltage[3] Ranges Accuracy	 10, 100, and 1000 V dc 10 and 100 V ranges, ± (0.04% of reading + 0.02% of range) ± 1 count; 1000V range, ± (0.08% of reading + 0.02% of range) ± 1 count

[1]Not available on Model 5326C.

[2]Test instruments with serial number prefix 1128A and below, 0 to 30 MHz, 50 mV; 30 MHz to 50 MHz, 100 mV.

[3]Available on Model 5326B only.

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 Sets 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 and/or (official nomenclature)	Minimum use specifications	Manufacturer, model, and (part number)
AUTOTRANSFORMER	Range: 105 to 125 V ac Accuracy: ± 1%	Ridge, Model 9020A (9020A)
CALIBRATOR	Range: 1 to 1000 V dc Accuracy: ± 0.15% Range: 100 kHz @ 100 mV rms Accuracy: ± 3%	Fluke, Model 5720A (5720A) (p/o MIS-35947)
FREQUENCY DIFFERENCE METER	Range: 5 parts in 10^{10} Resolution: 1 part in 10^{11}	Tracor, Model 527E (527E)
FUNCTION GENERATOR	Frequency: 20 Hz to 50 MHz Amplitude: 0 to 20 mV rms Accuracy: ± 3%	Agilent, Model 33250A (33250A)
MULTIMETER	Range: 0 to ± 17 V dc Accuracy: ± 1%	Agilent, Model 3458A (3458A)
OSCILLOSCOPE	Sensitivity: 100 mV/cm at 1000 Hz	Agilent, OS-303/G (OS-303/G)
TIME/FREQUENCY WORKSTATION	Frequency: 1 MHz Accuracy: ± 1 part in 10^{9}	Datum, Model ET6000-75 (13589305)

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 results 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 **13** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **8** through **13**. 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.

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.

7. Equipment Setup

a. Remove protective cover from TI only for access to adjustments or test points. Reinstall upon completion of adjustments.

b. Connect TI to autotransformer.

c. Connect autotransformer to a 115 V ac source and adjust for a 115 V output.

d. Turn **SAMPLE RATE** control to midrange and allow 1 hour for equipment to warm-up and stabilize.

8. Time Base Stability

a. Performance Check

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

(a) **FAST/NORM/HOLD** switch to **NORM**.
(b) **FUNCTION** switch to **FREQ A** (**FREQ**).
(c) **TIME BASE/MULTIPLIER** switch to **10s**.
(d) **SLOPE** switch(es) to **+** (plus).
(e) **AC/DC** switch(es) to **AC**.
(f) **ATTEN** switch(es) to **X1**.
(g) **CHK/SEP/COM** (**CHK/NORM**) switch to **SEP** (**NORM**).
(h) **LEVEL** control(s) to **PRESET**.
(i) **STORAGE** switch (rear panel) to **OFF**.
(j) **OSC** switch (rear panel) to **INT**.

(2) Connect a 1 MHz output signal from time/frequency workstation to **REF INPUT** of frequency difference meter.

(3) Connect TI **OSC** jack (rear panel) to **TEST INPUT** of frequency difference meter.

(4) Adjust A4C3 (fig. 1) for minimum difference indication on frequency difference meter.

NOTE

On model 5326A with option 011, frequency adjustment is located on oscillator enclosure.

NOTE

Replace protective cover after oscillator adjustment and wait 1 hour for TI indication to stabilize. Readjust, if necessary, until frequency difference meter indication remains at minimum with cover installed.

NOTE

On some models this adjustment is accessible through hole in protective cover.

(5) Adjust autotransformer to 105 V and wait 1 minute. Frequency difference meter indication will not change more than 1 part in 10^7 (5 parts in 10^9 for model 5326A with option 011).

(6) Repeat (5) above with autotransformer adjusted to 125 V.

(7) Adjust autotransformer to 115 V.

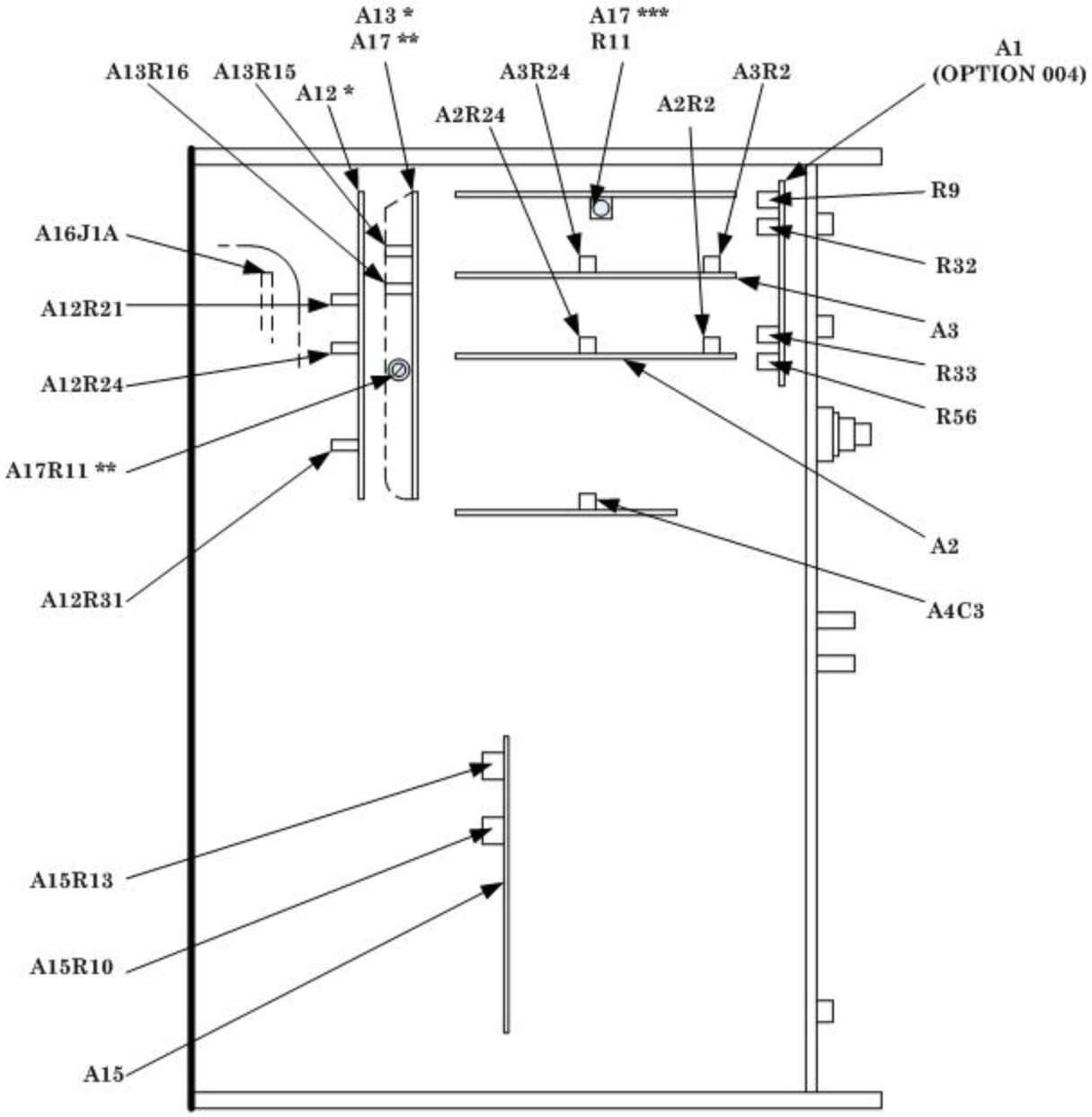
(8) Allow 24 hours for stabilization. After 24 hours, frequency difference meter indication will be less than 1 part in 10^8 (5 parts in 10^{10} for model 5326A with option 011).

b. Adjustments. No further adjustments can be made.

9. Self Check

a. Performance Check

(1) Turn **CHK/SEP/COM** (**CHK/NORM**) switch to **CHK** and **TIME BASE/MULTIPLIER** switch to **.1 μs**. TI will indicate 0.01 GHz (±1 count).



* A12 and A13 circuit boards used only on model 5326B.

** A13 circuit boards location is used for A17 circuit board on model 5326A.

*** A17 circuit board and R11 component location for model 5326B.

Figure 1. Top view - component locations.

(2) Turn **TIME BASE/MULTIPLIER** switch to positions listed in table 3. TI indication will be as specified.

Table 3. Self Check

TIME/BASE MULTIPLIER switch positions	Test instrument indications (+ 1 count)
1 μs	10 MHz
10 μs	10.0 MHz
0.1 ms	10.00 MHz
1 ms	10.000 MHz
10 ms	10000.0 kHz
0.1 s	10000.00 kHz
1 s	0000.00 kHz OF (10000.000 kHz) [1]
10 s	000.0000 kHz OF (0000.0000 kHz OF)[1]

[1]Models with option 001.

b. Adjustments. No adjustments can be made.

10. Sensitivity and Offset

a. Performance Check

(1) Connect function generator output to **INPUT A**, using 50 Ω feedthrough termination.

(2) Position **CHK-SEP-COM** (**CHK-NORM**) switch to **SEP** (**NORM**) and **TIME BASE/MULTIPLIER** switch to **1s**.

(3) Set function generator frequency to 20 Hz and amplitude to minimum.

(4) Slowly increase function generator output amplitude until TI indicates stable count. If output amplitude of function generator exceeds 100 mV rms, perform **b** (1) through (6) below.

(5) Alternately set **SLOPE** switch to **+** and **-** positions. If TI does not display stable count in both positions of **SLOPE** switch and, if not previously performed, perform **b** (1) through (6) below.

(6) Repeat technique of (3) through (5) above at frequencies of 2 kHz, 2 MHz, and 10 MHz.

NOTE

Change setting of **TIME BASE/MULTIPLIER** switch as required.

(7) Turn **TIME BASE/MULTIPLIER** switch to **.1s**.

(8) Set function generator frequency to 50 MHz, and amplitude to minimum.

(9) Increase function generator amplitude until TI indicates a stable display. If signal output exceeds 100 mV rms and, if not previously performed, perform **b** (1) through (6) below.

NOTE

Omit (10) through (16) below when calibrating model 5326C.

(10) Connect function generator to **INPUT B** jack.

(11) Position controls as listed in (a) through (f) below.

(a) **FUNCTION** switch to **T.I. A to B**.
(b) **CHK-SEP-COM** switch to **SEP**.
(c) **A SLOPE** switch to **+** (positive).
(d) **B SLOPE** switch to **-** (negative).
(e) **TIME BASE/MULTIPLIER** switch to **.1μs**.
(f) **A** and **B LEVEL** controls to midrange.

(12) Set function generator frequency to 50 MHz and minimum amplitude; slowly increase amplitude while adjusting **B LEVEL** control until channel B trigger light illuminates. If function generator output amplitude exceeds 100 mV rms, perform **b** (1) through (6) below, using adjustments on (A3) circuit board.

(13) Connect signal generator to **INPUT C** jack.

(14) Turn **FUNCTION** switch to **FREQ C** and **TIME BASE** switch to **1 ms**.

(15) Set function generator frequency to 50 MHz and amplitude to minimum.

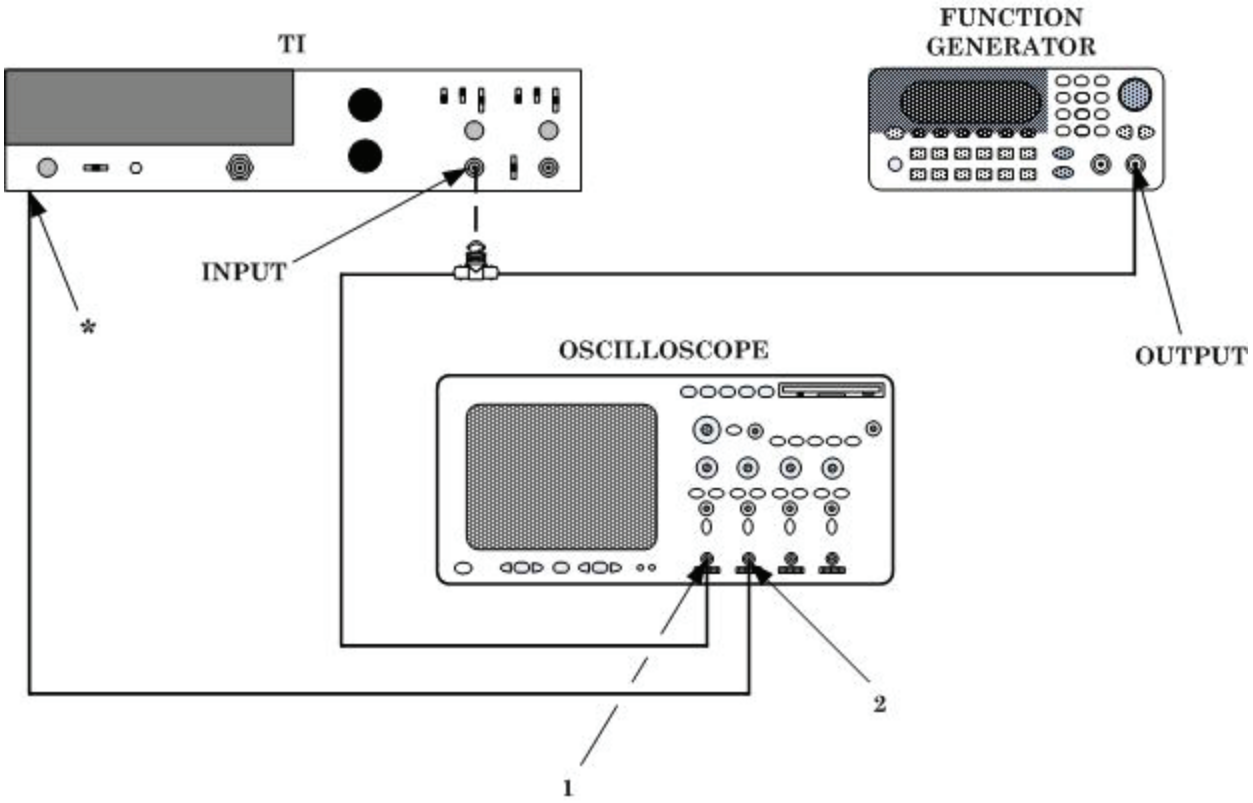
(16) Slowly increase function generator amplitude until TI displays stable indication of applied frequency. If function generator amplitude exceeds 5 mV rms (100 mV rms for TI's with SN prefix 1128A and below), perform **b** (7) below.

b. Adjustments

NOTE

If calibrating **INPUT B**, set **FUNCTION** switch to **FREQ A** and **LEVEL B** control to **PRESET**. Perform adjustments on A3 circuit board.

(1) Connect equipment as shown in figure 2.



* FOR MODELS 5326A AND 5326B CONNECT TO MARKER A JACK FOR CHANNEL A, MARKER B JACK FOR CHANNEL B. FOR MODEL 5326C, CONNECT TO A16J1A(8) (FIG. 1 AND FIG. 3).

Figure 2. Sensitivity-equipment setup.

(2) Set function generator frequency to 1000 Hz and amplitude to 100 mV rms.

(3) Alternately set **SLOPE** switch to **+** and **-** positions while adjusting A2R2 (fig. 1) until markers displayed on oscilloscope have equal offset about zero volt axis of waveform for both positions of **SLOPE** switch (R).

NOTE

Steps (4) through (7) below do not apply to model 5326C.

(4) Increase function generator amplitude to 200 mV rms.

(5) Turn **FUNCTION** switch to **T.I. A to B**.

(6) Alternately set **SLOPE** switch to **+** and **-** positions while adjusting A2R24 (fig. 1) to align markers with zero volt axis of oscilloscope waveform for both positions of **SLOPE** switch (R).

NOTE

If calibrating channel A, return **FUNCTION** switch to **FREQ A**.

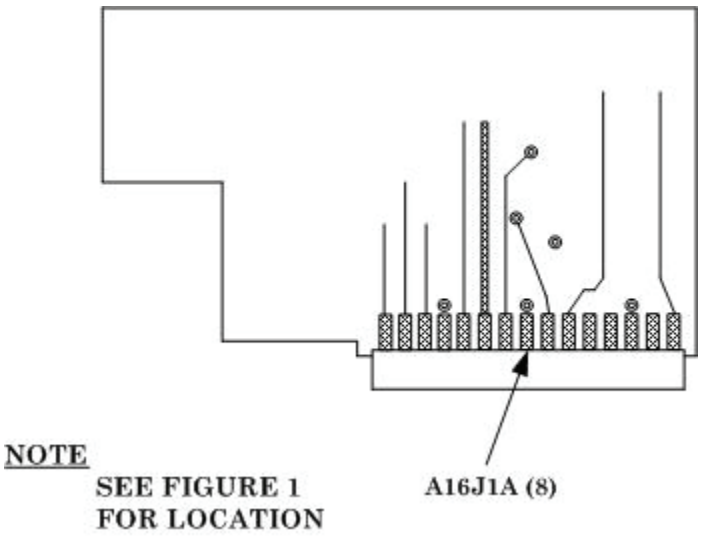


Figure 3. Model 5326C marker test point.

(7) Adjust A17R11 (fig. 1) (no adjustment can be made for TI's with SN prefix 1128A and below) while reducing function generator amplitude until TI displays applied frequency with less than 5 mV rms input (R).

11. Input Zero

NOTE

This check is applicable only on those models having option 004 programmable attenuator assembly.

a. Performance Check

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

(a) **TIME BASE** switch to **0.1 sec**.
(b) **AC/DC** switch to **DC**.
(c) **SEP/COM** switch to **SEP**.
(d) **ATTEN A** and **B** switches to **X10**.

(2) Connect multimeter to **CHANNEL A** connector.

(3) If multimeter indicates more than ±1 mV, perform **b** (1) below.

(4) Move multimeter connection to **CHANNEL B** connector. If multimeter indicates more than ±1 mV, perform **b** (2) below.

(5) Set **A** and **B ATTEN** switches to **X100**. If multimeter indicates more than ±1 mV, perform **b** (3) below.

(6) Move multimeter connection to **CHANNEL A** connector. If multimeter indicates more than ±1 mV, perform **b** (4) below.

b. Adjustments (fig. 1)

(1) Adjust R56 for minimum indication (less than 1 mV) on multimeter (R).

(2) Adjust R9 for minimum indication (less than 1 mV) on multimeter (R).

(3) Adjust R32 for minimum indication (less than 1 mV) on multimeter (R).

(4) Adjust R33 for minimum indication (less than 1 mV) on multimeter (R).

12. Ratio

a. Performance Check

(1) Position switches as listed in (a) through (h) below:

(a) **FUNCTION** to **FREQ A** (**FREQ**).
(b) **MULTIPLIER** (**TIME BASE/MULTIPLIER**) to **1 ms**.
(c) **SLOPE A** (**SLOPE**) to **+** (plus).
(d) **AC/DC** to **AC**.
(e) **ATTEN** to **X1**.
(f) **CHK-SEP-COM** (**CHK-NORM**) to **SEP** (**NORM**).
(g) **OSC** (located on rear panel) to **EXT**.
(h) **LEVEL A** (**LEVEL**) to **PRESET**.

(2) Connect function generator to **OSC** jack, using 50 Ω feedthrough termination.

(3) Connect calibrator to **INPUT A** (**CHANNEL A**) jack.

(4) Adjust function generator for 10 MHz at 1 V rms, and calibrator for 100 kHz at 100 mV rms. TI will indicate a ratio of 0.100 (disregarding units digit and decimal point).

b. Adjustments. No adjustments can be made.

13. DVM Accuracy and Tracking (Model 5326B)

a. Performance Check

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

(a) **FAST/NORM/HOLD** switch to **NORM**.
(b) **FUNCTION** switch to **DVM**.
(c) **TIME BASE** switch to **1s**.
(d) **RANGE** switch to **10 V**.
(e) **OSC** (rear panel) to **INT**.

(2) Connect a lead between **DVM INPUT** terminals. If indication on TI is not ±0.0000 V (±1 count), perform **b** (1) below.

(3) Remove lead from **DVM INPUT** terminals.

(4) Connect calibrator to **DVM INPUT** terminals.

(5) Adjust calibrator output for a 1.0000 V indication on TI. If calibrator does not indicate between 0.9975 and 1.0025 V, perform **b** (2) through (5) below.

(6) Repeat technique of (5) above using values in table 4. If calibrator indications are not within limits specified, perform indicated adjustment, using the technique of **b** (2) through (5) below.

Table 4. DVM Accuracy and Tracking

Test instrument		Calibrator indications (V dc)		Adjustments (fig. 1)
RANGE switch	Indication	Min	Max	
10	2.0000	1.9971	2.0029	
	3.0000	2.9967	3.0033	
	4.0000	3.9963	4.0037	
	5.0000	4.9959	5.0041	
	6.0000	5.9955	6.0045	
	7.0000	6.9951	7.0049	
	8.0000	7.9947	8.0053	
	9.0000	8.9943	9.0057	
	10.0000	9.9939	10.0061	
	- 10.0000	- 9.9939	-10.0061	A13R15 (R)
100	- 100.0000	- 99.939	-100.061	A12R21 (R)[1]
100	+100.0000	99.939	100.061	A12R21 (R)[1]
CAUTION Do not reverse polarity of 1000 V input.				
1000	+1000.00	998.99	1001.01	A12R24 (R)

[1]Adjust for best in-tolerance between + 100 and -100 V indication.

b. Adjustments

(1) Adjust A12R31 (fig. 1) for a ±.0000 V indication on TI (R).

(2) Adjust calibrator output for +10.0000 V.

(3) Adjust A13Rl6 (fig. 1) for a +10.0000 V (±2 counts) indication on TI (R).

(4) Reverse polarity of input signal to TI.

(5) Adjust A13R15 (fig. 1) for a -10.0000 (±2 counts) indication on TI (R).

14. Power Supply

NOTE

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

a. Performance Check

(1) Connect multimeter (A3) to pin 7 of A15 (fig. 1). If multimeter does not indicate between 16 and 17 V, perform **b** (1) below.

(2) Connect multimeter to pin 6 of A15 (fig. 1). If multimeter does not indicate between -16 and -17 V, perform **b** (2) below.

b. Adjustments

(1) Adjust A15R10 (fig. 1) for a +16.5 V indication on multimeter (R).

(2) Adjust A15Rl3 (fig. 1) for a -16.5 V indication on multimeter (R).

15. Final Procedure

a. Deenergize and disconnect all equipment and replace TI within protective cover.

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

0802822

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

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 343045, requirements for calibration procedure TB 9-6625-1973-24.

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.