

***TB 9-6625-137-50**

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR ELECTRONIC COUNTER HEWLETT-PACKARD, MODEL 521 SERIES

Headquarters, Department of the Army, Washington, DC
9 October 1967

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Appendix A

*This bulletin supersedes TB 9-6625-137-50, 17 October 1966.

**SECTION I
GENERAL**

1. Purpose and Scope. This bulletin provides information for the periodic calibration of electronic counter, Hewlett-Packard Model 521 series and is to be used by calibration personnel trained and qualified in the use of calibration equipment.

2. Descriptive Data

a. Identification Data

Nomenclature	ELECTRONIC COUNTER
Manufacturer	Hewlett-Packard
Manufacturer's model number	521 series
Size	9 3/4 x 15 1/4 x 14 1/2 in.
Weight	521A/D 27 lbs and 521C/E/G 28 lbs
Reference	Manufacturer's instruction manual

b. Specifications Data

Power input requirement ¹	115 or 230 volts \pm 10%, 50 to 60 cps
Maximum counting rate	521A/C/D/E 120 kHz 521G 1 MHz
Input sensitivity	0.2 v rms sine wave
Accuracy:	
With crystal time base	\pm 1 count, \pm 0.1%
Without crystal time base	\pm count, \pm 0.1%
Gate time	521A/D/G 1/10, and 1 sec 521C/E 1/10, 1, and 10 sec

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

c. Program Data

Time required for calibration	2 hours (approx)
Calibration technique	Dc and low frequency

3. General Instructions

a. Calibration Data Card. During the performance of this procedure, annotate DA Form 2416 in accordance with TM 38-750.

b. Test Instrument. Electronic counter, Hewlett Packard, Model 521 Series will be referred to as "test instrument."

c. Equipment Identification. The equipments cited throughout this bulletin are listed in Appendix "A" and are not necessarily the same as may be listed in any subsequent published appendices.

d. Equipment Setup. Disconnect instructions are not contained in this procedure since it is understood that equipment in one setup must be disconnected, in its entirety or in part, to arrange it for the next setup in the procedure.

e. Power Supply. If any parameter specified in paragraph 8 is not within tolerance, perform the power supply check, paragraph 9, prior to making corresponding adjustments. If power supply adjustment is required, repeat paragraphs 7 and 8. Do not perform the power supply check if all parameters are within tolerances.

4. Difference Among Models

Model	Type	Readout	Gate selector (sec)	Range
521A	Number column	4 Places (9999)	1/10, 1	120 kc
521C*	Number column	5 Places (99,999)	1/10, 1, 10	120 kc
521D	Digital display tube	4 Places (9999)	1/10, 1	120 kc
521E*	Digital display tube	5 Places (99,999)	1, 10, 1, 10	120 kc
521G	Number column	5 Places (99,999)	1/10, 1	1.2 mc

*Crystal time base plug-in unit is a standard part of 521C and 521E.

**SECTION II
CALIBRATION**

5. Equipment Required. Minimum use specifications of equipment required for calibration performance checks and adjustments are listed in table 1. Minimum use specifications are standard specifications necessary for this calibration and are listed to assist in the selection of alternate equipment. Refer to appendix A for specific item identification.

Table 1. Minimum Specifications of Equipment Required for Calibration

Item number	Common name	Minimum use specifications	Procedure limitations
A1	AUTOTRANSFORMER	RANGE: 105 to 125 v ac ACCURACY: ±3%	
A2	DC VOLTMETER	RANGE: 0 to ±225 v dc ACCURACY: ±1%	
A3	FREQUENCY COUNTER	RANGE: 100 Hz to 1.2 MHz ACCURACY: ±0.003	
A4	TEST OSCILLATOR	RANGE: 100 Hz to 1.2 MHz ACCURACY: ±10% (amplitude)	

6. Preliminary Procedure

NOTE

Personnel should familiarize themselves with the entire procedure prior to performing calibration.

- a. Remove test instrument from protective cover.
- b. Connect test instrument to autotransformer (A1).
- c. Connect autotransformer to 115 v ac source and adjust controls of autotransformer for 115 volts ac.

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d. Energize equipment and allow sufficient time for equipment to warm up and stabilize.

NOTE

When the test instrument is within tolerance, do not perform the corresponding adjustment. When the test instrument is not within tolerance, perform the corresponding adjustment before continuing with the calibration procedure. When the test instrument is not within tolerance and no adjustment is specified, the deficiency must be corrected before continuing with the procedure.

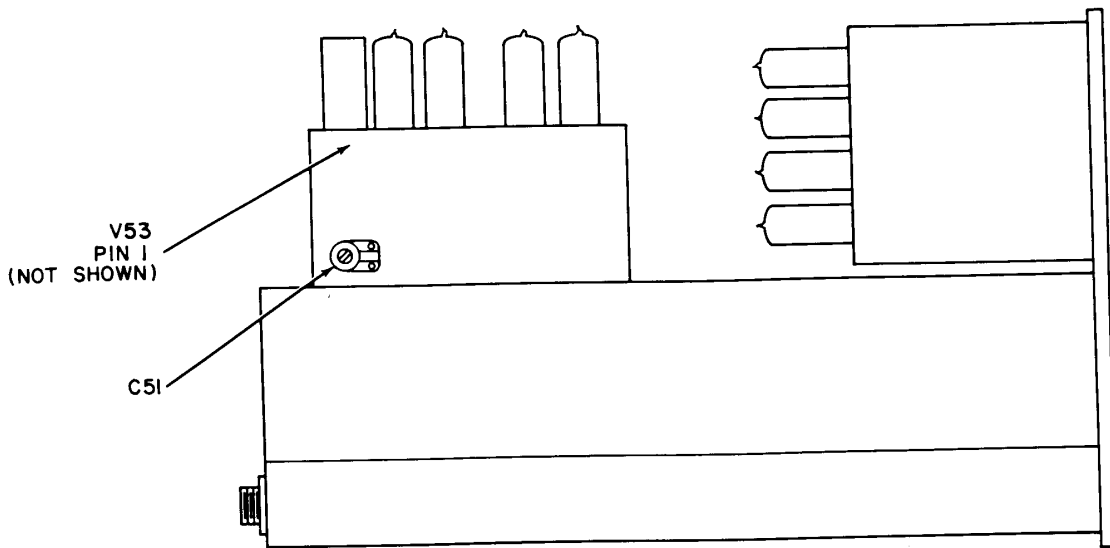
7. Frequency Standard

a. Performance Check

NOTE

This check applicable only to test instrument having a crystal time base.

- (1) Set frequency counter (A3) AC-DC switch to AC.
- (2) Connect frequency counter to V53 pin 1 (fig. 1) on test instrument using cable assembly (B1).



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Figure 1. Electronic counters - left side view

- (3) Position controls on test instrument as listed in (a) through (c) below.

- (a) GATE SELECTOR switch to 1 SEC.
- (b) DISPLAY TIME control to mid-range.
- (c) INPUT SENSITIVITY control fully clockwise.
- (4) Frequency counter shall indicate between 99.990 kc and 100.010 kHz.
- (5) Annotate FREQUENCY on DA Form 2416.

b. Adjustments. Adjust C51 (fig. 1) for frequency counter indication of 100.00 kHz.

8. Sensitivity and Regulation

a. Performance Check

- (1) Connect equipment as shown in figure 2.

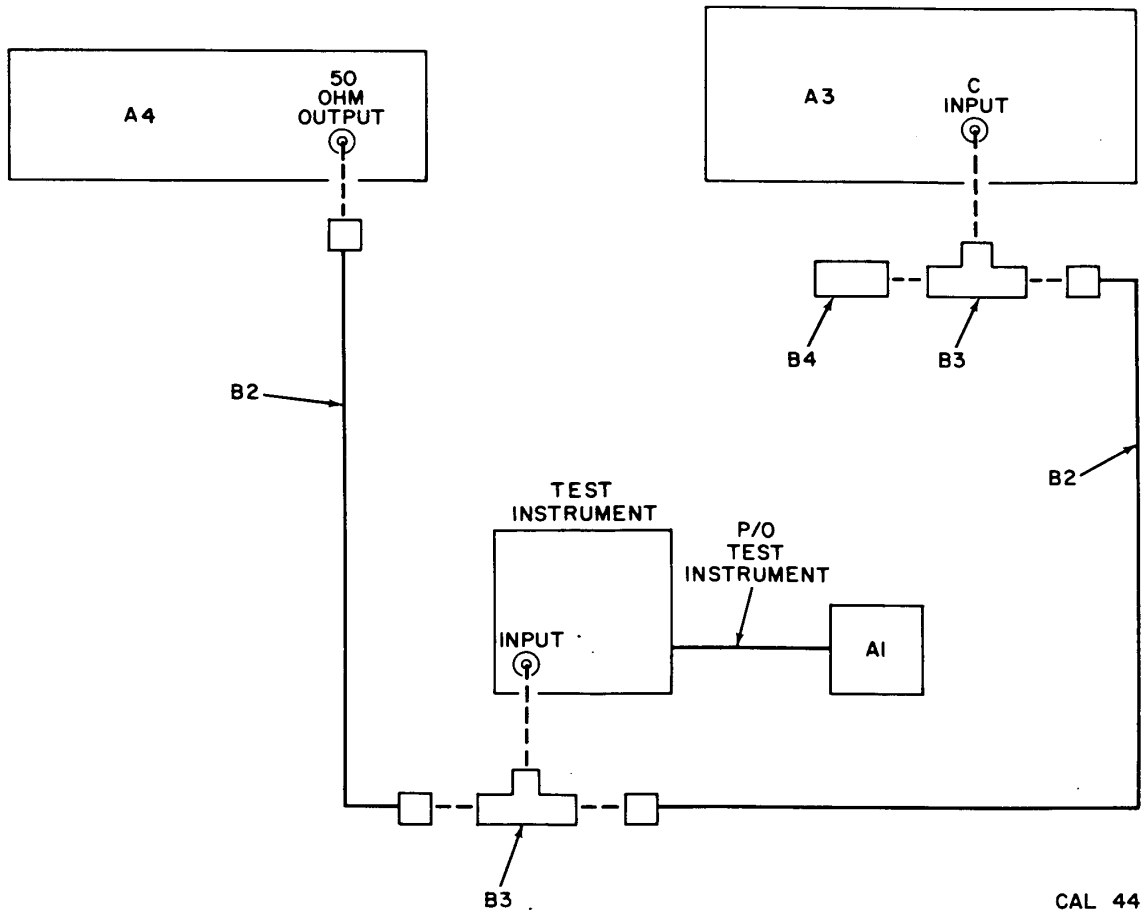


Figure 2. Sensitivity and Regulation - equipment setup

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- (2) Turn GATE SELECTOR switch to 1 SEC.
- (3) Adjust test oscillator (A4) output AMPLITUDE to 0.3 volt rms and FREQUENCY for 100 Hz indication on test instrument.
- (4) Frequency counter indication shall be between 99.5 and 100.5 Hz.
- (5) Decrease test oscillator output AMPLITUDE until test instrument stops counting. Slowly increase test oscillator AMPLITUDE until test instrument again indicates 100 Hz. Test oscillator RMS-VOLTS indication shall be between 0.1 and 0.2 volt rms.
- (6) Vary autotransformer output between 105 and 125 volts ac and verify that test instrument indication does not change. Set autotransformer to 115 volts ac.
- (7) Repeat (2) through (5) using test instrument settings and frequency counter indications listed in table 2.

Table 2. Sensitivity and Regulation Check

Test instrument		Frequency counter indication (Hz)	
GATE SELECTOR switch setting	Indication ¹	Min	Max
² 10 SEC	10000	³ 999.0	1000.1
		9999.0	10001.0
1 SEC	10000	³ 9990.0	10010.0
		119.9880 kHz	120.0120 kHz
1/10 SEC	12000	³ 119.8800 kHz	120.120 kHz
		1,199.880 kHz	1200.120 kHz
⁴ 1/10 SEC	20000	³ 1,198.800 kHz	1201.200 kHz

¹Indication listed for Models C/E/G only. For Models A/D first digit will not be displayed.

²Models C/E only.

³Limits for test instruments without a crystal time base.

⁴Model G only.

- (8) Annotate SENSITIVITY and REGULATION on DA Form 2416.

b. Adjustments

- (1) Adjust model A/C/D/E as listed in (a) through (e) below.
 - (a) Turn test instrument GATE SELECTOR switch to 1/10 SEC.
 - (b) Adjust test oscillator output to 1 kHz at 3 volts rms.
 - (c) Turn DISC BIAS ADJUST R606 (fig. 3) fully counterclockwise and adjust AMPLIFIER BALANCE R2 (fig. 3) for stable indication on test instrument.

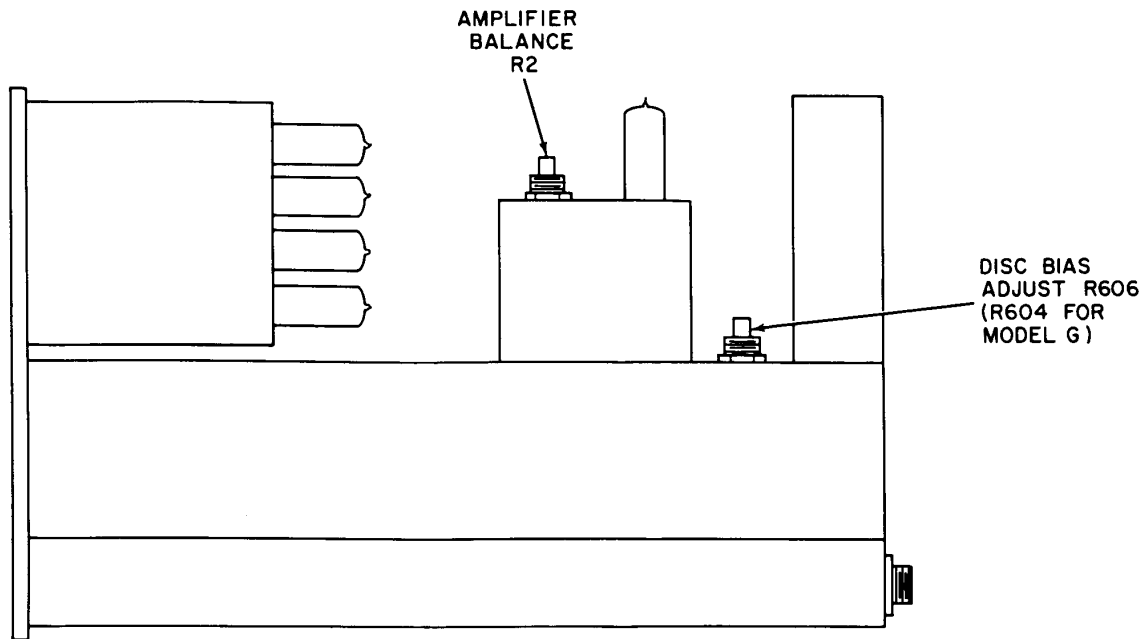


Figure 3. Electronic counter - right side view

(d) Adjust test oscillator output AMPLITUDE to 0.6 volt rms and adjust R606 for stable indication on test instrument.

(e) Adjust test oscillator output AMPLITUDE to 0.15 volt rms and adjust R2 and R606 for stable indication on test instrument.

(2) Adjust model G as listed in (a) through (c) below.

(a) Turn test instrument GATE SELECTOR switch to 1/10 SEC.

(b) Adjust test oscillator output to 1 kHz at 0.15 volt rms.

(c) Adjust DISC BIAS ADJUST potentiometer R604 (fig. 3) for stable indication on test instrument.

9. Power Supply

a. Performance Check

(1) Adjust dc voltmeter (A2) to measure -105 and connect between V508 pin 2 (fig. 4) and chassis ground on test instrument.

(2) Dc voltmeter indication shall vary less than 2.1 volts dc as autotransformer is adjusted between 105 and 125 volts ac.

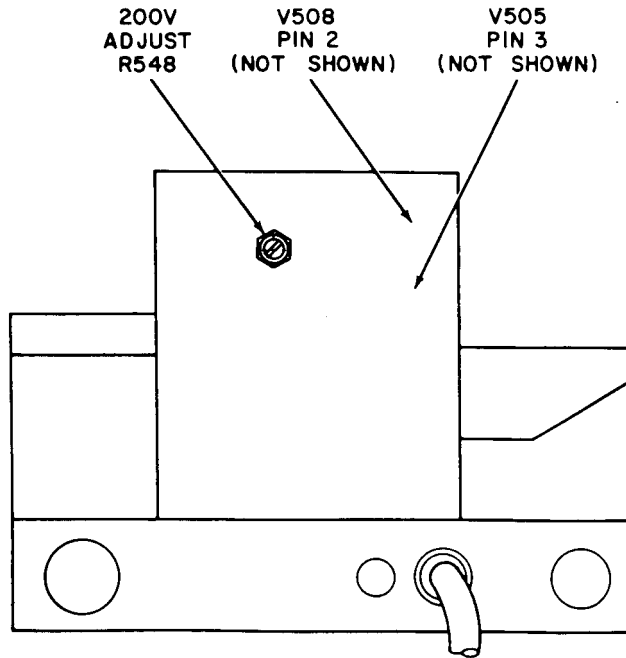


Figure 4. Electronic counter - rear view

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- (3) Adjust autotransformer to 115 volts ac.
- (4) Connect dc voltmeter between V505 pin 3 (fig. 4) and chassis ground on test instrument.
- (5) Dc voltmeter indication shall be between +194 and +206 volts dc. Record indication.
- (6) Dc voltmeter indication shall vary less than 4 volts from the indication recorded in (5) above and be within tolerance given in (5) above as the autotransformer is adjusted between 105 and 125 volts.
- (7) Adjust autotransformer to 115 volts ac.
- (8) Annotate VOLTAGE DC on DA Form 2416.

b. Adjustments

- (1) Repeat **a**(4) above.
- (2) Adjust 200 v ADJUST R548 (fig. 4) for +200 volt dc indication on dc voltmeter.

10. Final Procedure

a. Deenergize and disconnect all equipment and replace protective covers of test instrument.

b. In accordance with TM 38-750, annotate and affix calibration DA Label 80 (U.S. Army Calibration System). When the test instrument cannot be adjusted within tolerance, annotate and affix DA Form 2417 (red tag) (Unserviceable Test Instrument or Standard)

APPENDIX A

APPENDIX A identifies each item listed in table 1 with Nomenclature, Identifying number, Manufacturer and model number as issued with secondary transfer calibration standards set 4931-621-7877. When any of the standards prefixed with "A" are not available, equivalent calibrated items may be substituted provided they meet the minimum use specifications listed in table 1. Any items prefixed with "B" may be substituted.

A - Standards			
Item No.	Nomenclature	Identifying No.	Manufacturer and Model No.
A1	TRANSFORMER, POWER VARIABLE	4931-921-7408	General Radio, Model W10MT3A
A2	VOLTMETER/RATIOMETER AC/DC DIGITAL	4931-913-3069	CIMRON, Model 7500A-162 & 6710A-163 (MOD)
A3	COUNTER, ELECTRONIC DIGITAL w/UNIT, TIMER INTERVAL	4931-964-0088 4931-964-0169	Systron Donner, Model 1037M Systron-Donner, Model 1926A
A4	OSCILLATOR TEST	4931-921-7401	Hewlett-Packard, Model 651AR (MOD)

B - Accessories			
Item No.	Nomenclature	Identifying No.	Description
B1	CABLE ASSEMBLY, RADIO FREQUENCY	4931-072-0780	36-IN. RG-58c/u, BNC plug with alligator clips
B2	CABLE ASSEMBLY, RADIO FREQUENCY ¹	4931-843-2792	30-in. RG-58/U, BNC plug terminations
B3	ADAPTER, CONNECTOR ¹	5935-683-7892	BNC "T" type, 2 jacks, 1 plug
B4	CONNECTOR	4931-546-6347	51 ohm load on BNC plug

¹Two required.

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USAARMC (1)	9-107 (12)
NG: None	
USAR: None	

For explanation of abbreviations used, see AR 320-50.