

# **\*TB 9-6625-022-50**

**DEPARTMENT OF THE ARMY TECHNICAL BULLETIN**

## **CALIBRATION PROCEDURE FOR ELECTRONIC COUNTER, HEWLETT-PACKARD, MODEL 3734A**

Headquarters, Department of the Army, Washington, DC  
17 March 1971

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**SECTION 1  
GENERAL**

**1. Purpose and Scope.** This bulletin provides information for the periodic calibration of Electronic Counter, Hewlett-Packard Model 3734A. It is to be used by personnel trained and qualified in the use of calibration equipment.

**2. Descriptive Data**

**a. Identification**

Nomenclature.....	ELECTRONIC COUNTER.
Manufacturer.....	Hewlett-Packard
Model number.....	3734A
Reference.....	Manufacturer's instruction manual.

**b. Specifications**

Power requirements	115 or 230 v rms $\pm 10\%$ , 50 to 1000 Hz, 30 w
General:	
Maximum counting rate.....	2.5 MHz
Registration:	
Number of digits.....	5
Display.....	Numerical indicator tubes with display storage
Input sensitivity.....	100 mv rms sine wave, or 1 v pulse, 0.2 $\mu$ SEC width.
Mode of operation.....	Sine wave or negative pulse operation (adjustment required for optimum pulse operation)
Overload <sup>1</sup> .....	Input voltage limited to 5 v rms for accurate operation; 50 v rms to prevent damage (maximum sensitivity setting). At minimum sensitivity setting, voltage must not exceed 500 v peak
Input impedance <sup>1</sup> .....	Approximately 1 megohm shunted by 15 pF
Operating temperature.....	-10° to +50°C
Storage Temperature.....	Minimum: -20° C Maximum: +65° C
Time base:	
Frequency.....	100 kHz
Stability <sup>1</sup> .....	Aging rate $\pm 2$ ppm/wk
Temperature drift <sup>1</sup> .....	$\pm 20$ ppm between + 15° C and 35° C
Time base (rear panel):	
Internal output.....	1 v p-p (open circuit) from 1000-ohm source
External input.....	1 v rms into 1000 ohms, 100 Hz to 300 kHz
Frequency measurement:	
Range.....	2 Hz to 2. MHz
Accuracy.....	$\pm$ count $\pm$ time-base accuracy

(Specifications - continued)

Frequency ratio and multiplier ratio:	
Reads.....	f1/f2 x period multiplier
Range .....	f1: 100 Hz to 300 kHz, 1 v rms into 1,000 ohms via rear panel std jack f2: 2 Hz to 300 kHz via front panel INPUT jack. ±1 count of f1, ± (trigger error <sup>2</sup> of f2 period multiplier)
Accuracy .....	
Time interval:	
Gate operation	
Manual .....	Start and stop pushbuttons, front panel
Electrical .....	Separate start and stop channels (BNC connectors-rear panel)
Pulse amplitude.....	12 to 25 v positive
Pulse width.....	1 µsec or greater
Input impedance.....	110 pF in series with approx. 200 ohms
Frequency counted:	
Internal mode (INT) .....	100 kHz internal time-base
External mode .....	2 Hz to 2 MHz
Range (INT) .....	999,999 ms max with 10 µsec resolution
Accuracy.....	±1 count ± accuracy of counted frequency
Check (EXT).....	Totalizes at 10-Hz rate
Period and multiple period average measurements:	
Range .....	2 Hz to 10 kHz in single period. 2 Hz to 300 kHz in multiple-period average
Average .....	±1 count ± time base accuracy ± (trigger error <sup>2</sup> periods averaged.)
Reads.....	ms and µsec with positioned decimal
Periods averaged .....	1, 10, 10 <sup>2</sup> , 10 <sup>3</sup> , 10 <sup>4</sup> , and 10 <sup>5</sup>
Self check .....	Period of 100 kHz
Frequency counted	100 kHz or external time-based frequency

**c. Calibration**

Time required.....	2 hours (approx.)
Technique.....	Dc and low frequency

<sup>1</sup>This specification is for information only and is not necessarily verified in this bulletin.

<sup>2</sup>Trigger error for 0.1-v rms sine wave input is 0.3% for signals with 40 db signal-to-noise ratio. Trigger error decreases with increasing signal amplitude and slope.

**3. General Instructions**

**a. DA Form 2416 (Calibration Data Card).** During the use of this bulletin, annotate DA Form 2416 in accordance with TM 38-750.

**b. Unit Under Test.** Electronic Counter, Hewlett-Packard Model 3734A, will be referred to as the UUT (unit under test) throughout this bulletin.

**c. Equipment and Accessory Identification.** The equipment and accessories referred to throughout this bulletin are identified in tables 1 and 2 and section III.

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**d. Equipment Setup.** Disconnect instructions are not contained in this bulletin.

**e. Power Supply.** When indications specified in paragraphs 7 and 8 are not within tolerance, perform the power supply checks prior to making adjustments. After power supply adjustments are made, repeat paragraphs 7 and 8. Do not perform the power supply checks if all other parameters are within tolerance.

**SECTION II  
CALIBRATION**

**4. Equipment and Accessories Required.** Table 1 lists minimum use specifications of equipment required for calibration performance checks and adjustments. Table 2 lists required accessories. Tables 1 and 2 are provided to assist in the selection of required equipment and accessories. For specific item identification refer to section III.

Table 1. Minimum Specifications of Equipment Required

Item number	Common name	Minimum use specifications
A1	FREQUENCY COUNTER	RANGE: 10 Hz to 2.5 MHz ACCURACY: $\pm 1$ count $\pm 1 \times 10^{-8}$
A2	OSCILLATOR	FREQUENCY: 10 Hz to 2.5 MHz OUTPUT: 0 to 100 mv rms ACCURACY: $\pm 3\%$
A3	OSCILLOSCOPE	RANGE: 10 mv to 50 v p-p ACCURACY: $\pm 3\%$
A4	DC VOLTMETER	RANGE: 0 to -36 vdc ACCURACY: $\pm 1\%$
A5	AUTOTRANSFORMER	RANGE: 105 to 125 vac ACCURACY: $\pm 1\%$

Table 2. Accessories Required

Item number	Common name	Description
B1	ADAPTER	BNC T type, 2 jacks, 1 plug
B2	CABLE	30-in.. RG-58 / U with BNC plug terminations
B3	TERMINATION	50-ohm feed-through, with BNC plug and BNC jack terminations
B4	PROBE	X10 passive probe

**5. Preliminary Procedure**

**NOTE**

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

**a.** Remove top and bottom protective covers from UUT as necessary for access to adjustments.

**b.** Connect UUT to autotransformer (A5, table 1).

**c.** Connect autotransformer to 115-volt ac source and adjust for 115 volts ac.

**d.** Energize equipment and allow at least 30 minutes for equipment to warm up and stabilize.

Note. When the UUT is not within tolerance, perform the specified adjustment and continue the performance check. When the UUT is not within tolerance and no adjustment is specified, the deficiency must be corrected before continuing with the procedure.

**WARNING**

HIGH VOLTAGE is used during the performance of this procedure. DEATH ON CONTACT may result if personnel fail to observe safety precautions.

**6. Stability and Self-check**

**a. Performance Check**

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

- (a) SENSITIVITY control to CHECK.
- (b) DISPLAY control fully counterclockwise (power on).
- (c) Function switch to 1 MILLISEC.
- (d) RESET DISABLE/NORMAL switch (rear panel) to NORMAL.
- (e) INT/EXT switch (rear panel) to INT.

(2) UUT will indicate 000.01.

(3) Vary output of autotransformer (A5. table 1) between 105 and 125 volts. UUT indication will remain at 000.01.

(4) Adjust autotransformer output to 115 volts.

(5) Turn UUT function switch to positions listed in table 3 and repeat (3) above. UUT indications will be as specified.

Table 3. Self-check Display

Unit under test function switch position		Unit under test display (Sec)
10	MILLISEC	00.010
100	MILLISEC	0.0100
1	K MICROSEC	010.00
10	K MICROSEC	10.000
100	K MICROSEC	0.0000
.01	KC	0010.0
.1	KC	010.00
1	KC	10.000
10	(OPT) KC	0.0000

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**b. Adjustments.** No adjustments can be made.

**7. Frequency Response and Input Sensitivity**

**a. Performance Check**

(1) Connect 50-ohm output of oscillator (A2, table 1). with termination (B3, table 2), to UUT INPUT jack, using cable and adapter (B2 and B1 table 2). (T connector plug at UUT INPUT).

(2) Connect other cable (B2) from C INPUT of counter (A1) to remaining jack, on adapter (B1).

(3) Turn SENSITIVITY control of UUT to MAX and FREQUENCY KC control to 1.

(4) Adjust oscillator for 10-Hz indication on counter (A1, table 1) and 100-mv rms output. Maintain this level throughout the procedure. UUT will display frequency and period of frequency to within  $\pm 1$  count.

(5) Repeat technique of (3) and (4) above, substituting values listed in (a) through (e) below.

(a) 100 Hz

(b) 1 kHz

(c) 100 kHz (set frequency KC control to .01)

(d) 1 MHz

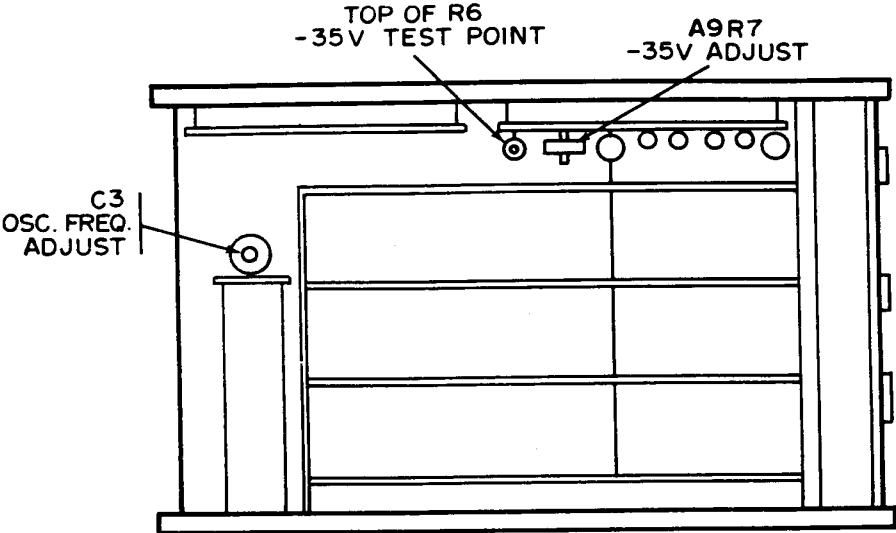
(e) 2.5 MHz

(6) Remove cable assembly connected in (2) above and connect oscilloscope (A3) to test point A1 (fig. 1) using probe (B4). A stable rectangular wave shape will be displayed on oscilloscope.

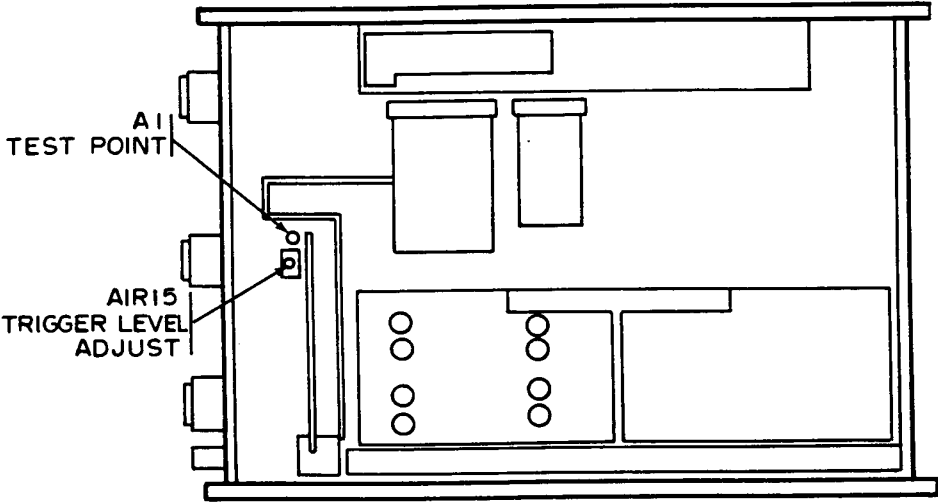
(7) Adjust oscillator frequency to 400, 1000 and 1500 Hz. Oscilloscope will display uniform waveform jitter-free, and with rectangular shape. If observed display is not as specified, perform **b(1)** below.

(8) Adjust oscillator for 1-MHz, 100-mv output. Observe display as specified in (7) above. If necessary, repeat *b* below until desired pattern is obtained.

(9) Connect STD jack (rear panel) of UUT to C INPUT of frequency counter using cable assembly (B2). Frequency counter will indicate 100 kHz  $\pm 1$  count. If not, perform **b(2)** below.



TOP VIEW



BOTTOM VIEW

Figure 1. Electronic counter-bottom view.

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### **b. Adjustments**

(1) Adjust A1R15 (fig. 1) fully clockwise. Slowly adjust counterclockwise until pattern on oscilloscope remains uniform and jitter-free for 400-, 1000-, and 1500-Hz input frequencies.

(2) Adjust C3 (fig. 1) until frequency counter indicates 100 kHz  $\pm$ 1 count.

## **8. Power Supply**

### **a. Performance Check**

#### **NOTE**

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

(1) Connect dc voltmeter (A4, table 1) to 35 V TESTPOINT (fig. 1) Dc voltmeter will indicate between -34 and -36 vdc. If not, perform **b**(1) below. Note dc voltmeter indication.

(2) Vary line voltage from 105 to 125 vac. Dc voltmeter indication will be within  $\pm$ 0.5 vdc of indication noted in (1) above.

### **b. Adjustments**

(1) Adjust A9R7 (fig. 1) for -35 volt indication on dc voltmeter.

## **9. Final Procedure**

**a.** Deenergize and disconnect all equipment.

**b.** In accordance with TM 38-750, annotate and affix DA Label 80 (U.S. Army Calibration System). When the UUT cannot be adjusted within tolerance, annotate and affix DA Form 2417 (Unserviceable Test Instrument or Standard) (red tag 1).

## **SECTION III SPECIFIC ITEM IDENTIFICATION**

**10. Identification.** This section identifies specific equipment and accessories as issued with specific calibration standards sets or specific maintenance equipment groups.

## **11. Secondary Transfer Calibration Standards Set**

**a. Equipment Identification.** The equipment listed in table 4 is issued with secondary transfer calibration standards set 4931-621-7877 and is to be used in performing this procedure. When any equipment listed in table 4 is not available,



equivalent items may be substituted provided that they meet the minimum use specifications listed in table 1.

**b. Accessory Identification.** The accessories listed in table 5 are issued with secondary transfer calibration standards set 4931-621-7877 and are to be used in performing this procedure. These accessories may be substituted unless specifically prohibited.

Table 4. Equipment Identification

Item Number	Nomenclature	Identifying Number	Manufacturer and Model Number
A1	COUNTER, ELECTRICAL DIGITAL	7910823	Systron-Donner, Model 1037M.
A2	OSCILLATOR, AUDIO-RADIO FREQUENCY	MIS-10224	Preston, Model 134A
A3	OSCILLOSCOPE w / AMPLIFIER, PLUG-IN, DUAL TRACE TIME BASE UNIT, PLUG-IN	7910655-2 7911441-1 7912040-1	Tektronix, Type RM561A. Tektronix, Type 3A6 Tektronix, Type 3B4
A4	VOLTMETER, DIGITAL	7912606	Dana, Model 5703-S-2127
A5	TRANSFORMER, VARIABLE, POWER.	7910809	General Radio, Model W10MT3AS3.

Table 5. Accessory Identification

Item Number	Nomenclature	Identifying Number.	Description
B1	ADAPTER, CONNECTOR	MS35173-274	BNC T; two jacks, one plug.
B2	CABLE ASSEMBLY, RADIO FREQUENCY <sup>1</sup>	7907467	30-in., RG-58/U with BNC terminations.
B3	DUMMY LOAD, ELECTRIC	7911587	Hewlett-Packard, Model 11048B.
B4	LEAD, TEST PROBE, STANDARD	7911545	Tektronix, Type P6006 (010-127).

<sup>1</sup>Two required.

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By Order of the Secretary of the Army:

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*General, United States Army*  
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Distribution:

TAG (1)	UMAD (2)	USA Aberdeen R&D Cen (4)
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USARJ (7)	SVAD )7_	USAMERDC (2)
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USATOPOCOM (2)	Cornhusker AAP (1)	USAGETA (2)
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USARADB (2)	Sunflower AAP (2)	Norfolk Naval Air Sta (1)
Armies (3) except	Longhorn AAP (1)	Nav Air Tech Svc Fac (1)
Eighth USA (1)	Milan AAP (1)	NAVPRO MEC Library (2)
138th Ord Co (2)	Newport AAP (1)	USAMCI&SA (3)
Ft Hood (5)	138th Ord Co (2)	USN Air Dev Cen (2)
Ft Detrick (2)	Louisiana AAP (1)	USA Mat & Mech Rsch Cen (2)
USAOC&S (21)	Rocky Mountain Arsenal (2)	Comdt of Marine Corps (3)
USAMMC (1)	Picatinny Arsenal (5)	USAMC Taiwan Mat Agcy (1)
APG (2)	Edgewood Arsenal (4)	LBAD (20)
ANAD (20)	Frankford Arsenal (5)	USMACV (3)
LEAD (37)	Pine Bluff Arsenal (2)	NCAD (4)
SIAD (2)	Rock Island Arsenal (2)	
ARNG: None		
USAR: None		
For explanation of abbreviations used, see AR 310-50		

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