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DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR ELECTRONIC COUNTER, HEWLETT · PACKARD MODEL 5223L AND C10-5223L

Headquarters, Department of the Army, Washington, DC
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SECTION I

INTRODUCTION AND DESCRIPTION

1. Purpose and Scope. This bulletin provides instructions for the calibration of Electronic Counter, Hewlett-Packard Model 8222L and C10-8222L. It is to be used by personnel that are trained and qualified in the usage of calibration standards and equipment. Electronic Counter, Hewlett-Packard Model 8222L and C10-8222L will be referred to as the "test instrument" throughout this bulletin.

a. Model Variations. Variations among models are described in text.

b. Time and Technique. The time required for this calibration is approximately 8 hours, using the dc and low frequency technique.

2. Calibration Data Card (DA Form 2410). Maintenance forms, records, and reports

which are to be used by calibration personnel at all calibration levels are listed in and prescribed by TM 38-750. Reparable adjustments are followed by (R).

3. Reporting of Errors. The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2400 (Recommended Change to Publications and Blank Forms) and forwarded direct to Commander, US Army Electronic Center, ATTN: AMSEL-MA-DS, Fort Monmouth, NJ 07708.

4. Calibration Description. Test instrument parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameter	Performance specifications
Power input requirements	115 or 230 v $\pm 10\%$, 60 to 63 Hz, 50 w
Frequency	Range: 0 to 200 kHz Accuracy: ± 1 count \pm time base accuracy
Time base	Internal frequency 100 kHz Aging rate: Less than ± 2 parts in 10^6 /year
Input sensitivity and frequency response	Range: DC coupled, 0 to 200 kHz; or coupled, 10 Hz to 200 kHz. Sensitivity: 0.1 v rms sine wave, 1 v pulse, 1 μ sec min pulse width.

SECTION II

EQUIPMENT REQUIREMENTS

(A AND C LEVEL)

5. Equipment Required. Tables 2 and 4 identify the specific equipment used in the calibration procedure in sections IV and VI, respectively. The equipment in tables 2 and 4 are issued with accom-

pany transfer calibration standards and 4821-221-7877 and AN/TSM55A(v) Transportable Maintenance Calibration Facility, respectively, and is to be used in performing this procedure. Alternates

Items may be used by the calibrating activity when the equipment listed in table 2 or 4 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 or 4. The Accuracy listed in table 2 provide a four-to-one accuracy ratio between the standard and test instrument. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

6. Accessories Required. The accessories listed in tables 3 and 5 are issued with secondary transfer calibration standards ret 4981-821-7877 and AN/TSM36A(v) Transportable Maintenance Calibration Facility, respectively, and are to be used in this calibration procedure. When necessary, these items may be substituted by equivalent items unless specifically prohibited.

Table 2. Minimum Specifications of Equipment Required (A Low-)

Item	Equipment name	Minimum use specifications	Manufacturer, model and part no.
A1	AUTOTRANSFORMER	Range: 105 to 125 vac Accuracy: $\pm 1\%$	General Radio Co. Model W10MT3AS3 (7912000)
A2	DC VOLTMETER	Range: -36 to +36 vdc Accuracy: $\pm 1\%$	Dana Labr. Model 5700-S-2127 (7912000)
A3	FREQUENCY DIFFERENCE METER	Range: 100 kHz Resolution: ± 1 parts in 10^4	Hitech Inst. Co. FDM 2100 (MIS 10010)
A4	OSCILLOSCOPE W TIME BASE PLUG-IN AND VERTICAL PLUG-IN	Range: 100 Hz to 100 kHz Accuracy: $\pm 3\%$	Tektronix, Model 561A/W(7910000), Model 3A4(7911441), and Model 3B4 (7912000)
A5	OSCILLATOR, FREQUENCY STANDARD	Range: 100 kHz Accuracy: ± 5 parts in 10^4	Vertron Model FS 323 (MIS 10022)
A6	TEST OSCILLATOR	Frequency Range: 10 Hz to 300 kHz $0 + 1$ VRMS Accuracy: $\pm 2\%$	Precision Model 134A or Hewlett-Packard Model 602A (MIS 10024)

Table 3.

Item	Equipment name	Description and part number
B1	ADAPTER CONNECTOR	BNC plug to double banana jack (7909401)
B2	CABLE ASSEMBLY, RADIO FREQUENCY	36-in. RG-58-U, BNC plug terminations (7907467)
B3	PROBE STANDARDS	Tektronix, Type P0005 (7911545)
B4	TERMINAL	Hewlett-Packard, Model 12930B (7911567)

Two required

Table 4. Minimum Specifications of Equipment Required (C Level)

Item	Common name	Minimum test specifications	Manufacturer, model, or part No.
A1	AUTOTRANSFORMER	100 to 125 var. $\pm 3\%$	Variable Power Transformer TP-410/U (General Radio, Model W100T2A)
A2	DIFFERENTIAL VOLTMETER	0 to 35 vdc ± 0.01 volt	Voltmeter TS-2042/U (Fluke, Model 002A2)
A3	METER CALIBRATOR	50 to 100 var. ± 2 var. 400 Hz	Meter Calibrator TS-2704/U (Fluke, Model 700A)
A4	OSCILLOSCOPE	2 Hz to 300 kHz $\pm 3\%$	Oscilloscope AN/USM-270 (Tektronix, Model 465) with X10 Probe (Tektronix, Model 010-0100-00)
A5	ELECTRONIC COUNTER	2 Hz to 300 kHz 1 vdc, Time Base 5 parts in $10^6/24$ hours	Electronic Digital Random Counter AN/USM-257A (Synova Danner, Model 100204-F-10) with Frequency Converter CV-2349/U (Synova Danner, Model 1002A)
A6	OSCILLATOR	2 Hz to 300 kHz	Signal Generator AN/USM-280 (General Radio, Model 1300A)

Table 5. Accessories Required (C Level)

Item	Common name	Description and part number
B1	ADAPTER	BNC Jack to Clip Leads or Test Lead Assembly GX-12049/U (Tektronix Model 013-0076-00)
B2	ADAPTER	Ter. BNC Plug to 2 BNC Jacks or Connector Adapter UG-274B/U (Amphenol, Model UG-274B/U)
B3	CABLE ASSEMBLY (2 REQUIRED)	36 inch. RG-303/U, BNC Plug to BNC Plug or Cable Assembly, Perma Electronics, Model BNC-C-36
B4	CABLE ASSEMBLY (2 REQUIRED)	BNC Plug to Black and Red Banana Plugs or Radio Frequency Cable Assembly CG-3572/U (Perma Electronics, Model 2241-C-30)
B5	VOLTAGE DIVIDER	600 Ω or 100:1 divider or Voltage Divider TS-2109/U (Hewlett-Packard, Model 11007A)

SECTION III

PRELIMINARY OPERATIONS (A LEVEL)

7. Preliminary Instructions. a. The instructions outlined in this section 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 and item identification number as listed in tables 2 and 3. For the identification of equipment referenced by item

numbers prefixed with A, see table 2, for prefix B, see table 3.

WARNING

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

8. Equipment Setup. a. Set test instrument

SECTION IV

CALIBRATION PROCESS (A LEVEL)

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met before continuing with the calibration.

9. Time Base and Stability. a. Performance Check.
- (1) Position test instrument controls as listed in (a) through (f) below:
 - (a) FUNCTION switch to FREQUENCY A.
 - (b) TIME BASE MULTIPLIER switch to $10s-10^7$.
 - (c) COM SEP CHECK switch to COM.

- (d) Channel A and B DC VOLTS-AC VOLTS switch to AC VOLTS X1.
 - (e) Both SLOPE switches to \pm (positive).
 - (f) LEVEL A and B controls to +0.
- (2) Connect STD. FREQ. OUTPUT jack of test instrument to TEST INPUT jack of frequency difference meter (A3), using cable (B2).
- (3) Connect REF INPUT jack of frequency difference meter to 100 kHz jack of frequency standard (A4), using cable (B2).
- (4) Adjust C5 (Fig. 1) for no frequency difference (null) on frequency difference meter.

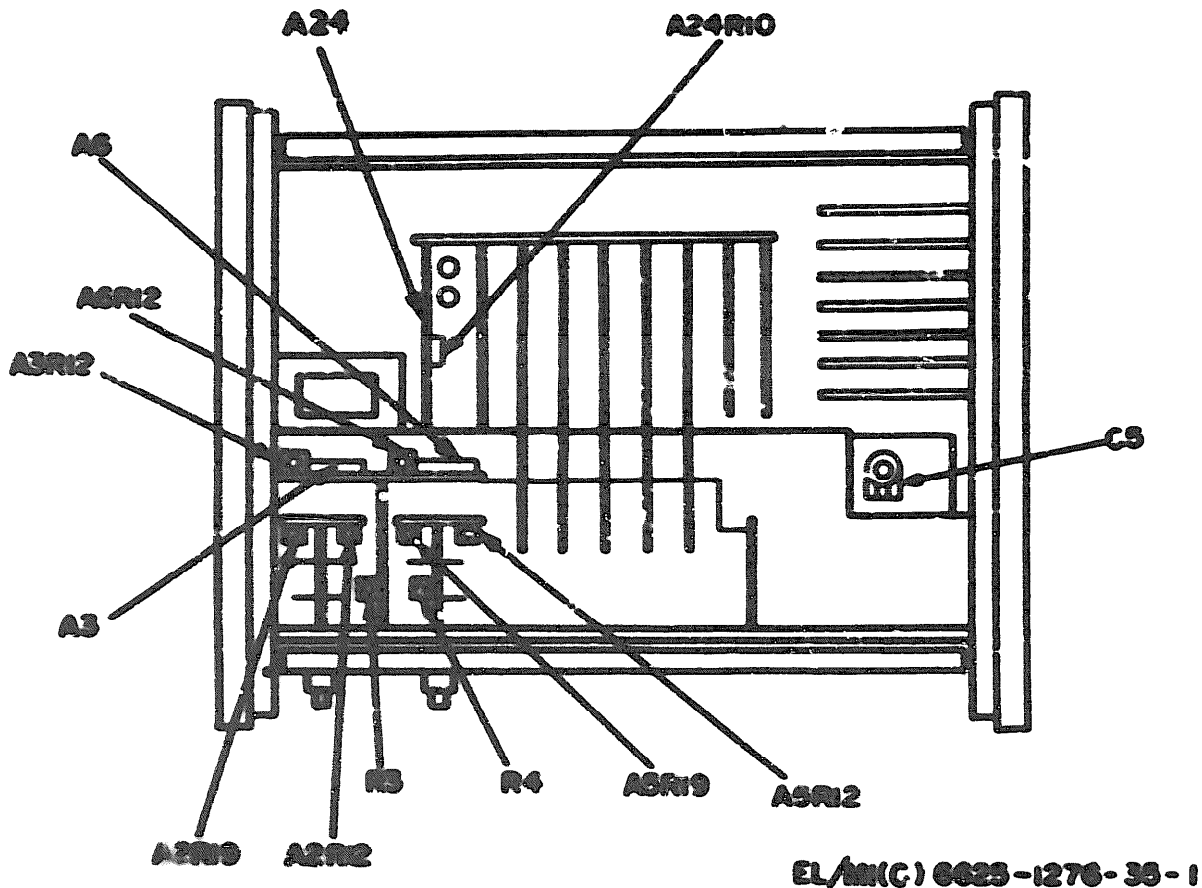


Figure 1. Electric counter, top view

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(6) Vary autotransformer output (A1) between 105 and 125 volts. Wait at least 1 minute at 105 and 125 volts for stabilization. Frequency difference meter indication will remain within ± 1 part of 10^5 .

(6) Adjust autotransformer output to 115 volts.

(7) Monitor test instrument time base for 4 hours. Frequency difference meter indication will remain within ± 5 parts in 10^5 .

b. Adjustments. No adjustments can be made.

10. Self-Check. a. Performance Check.

(1) Set COM-SEP-CHECK switch to CHECK.

(2) Set TIME BASE-MULTIPLIER switch to settings listed in table 6 at each setting of TIME BASE-MULTIPLIER switch, set FUNCTION switch to settings listed. Test instrument will indicate within specified limits.

b. Adjustments. No adjustments can be made.

Table 6. Self-Check

TIME BASE-MULTIPLIER Setting	FUNCTION Switch Setting	Indication
50 μ S	FREQUENCY A	0000.0 to 0000.2 MHz
10 μ S	PERIOD A	000.00 to 000.01 μ S
10 μ S	PERIOD AVG A	000.00 to 000.02 μ S
1 MS	PERIOD AVG A	00.000 to 00.001 mS
1 mS	PERIOD A	0000.0 to 1000.1 μ S
1 mS	FREQUENCY A	000.00 to 000.10 MHz
1 mS	FREQUENCY A	00.000 to 00.100 MHz
10 MS	PERIOD A	00000 to 01000 μ S
10 MS	PERIOD A	000.00 to 001.01 S
1 S	FREQUENCY A	0000.0 to 0100.1 KHz
1 S	FREQUENCY A	000.00 to 100.01 KHz
1 S	PERIOD A	0000.0 to 0001.0 μ S
1 S	PERIOD AVG A	00.000 to 10.001 μ S
1 S	RATIO A/B	0.0000 to 1.0001 μ S
1 S	PERIOD AVG A	0.0000 to 0.0001 μ S
1 S	FREQUENCY A	00.000 to 00.001 KHz
10 S	FREQUENCY A	0.0000 to 0.0001 KHz
10 S	PERIOD AVG A	00000 to 00001 μ S

11. Input Amplifier. a. Performance Check.

(1) Position test instrument controls as listed in (a) through (b) below:

(a) DC VOLTS-AC VOLTS switches to DC VOLTS XI (channels A and B).

(b) COM-SEP-CHECK switch to SEP.

(2) Connect dc voltmeter (A2) to channel A input connector, using adapter (B1). Dc voltmeter indication will be between -0.1 and $+0.1$ volt dc. If not, perform b (1) below.

(3) Repeat technique of (2) above for channel B. If dc voltmeter does not indicate between -0.1 and $+0.1$ volt dc, perform b (2) below.

(4) Turn channel A and B LEVEL controls to +1.

(5) Connect test oscillator (A6) to channel A input connector, using cable and termination (B2 and B4).

(6) Adjust test oscillator for 1 kHz and minimum output.

(7) Connect oscilloscope (A4) vertical input to center pin of channel A SLOPE switch and chassis ground, using probe (B3).

(8) Slowly increase test oscillator amplitude until stable trigger pulses appear on oscilloscope. Amplitude of test oscillator will not exceed 0.7 volt rms. If amplitude exceeds 0.7 volt, perform b (3) and (4) below.

(9) Turn channel A LEVEL control to -1 and repeat technique of (8) above. If amplitude exceeds 0.7 volt rms, perform b (3) and (5) below.

(10) Connect oscilloscope probe to center terminal of channel B SLOPE switch, and test oscillator to channel B input connector.

(11) Repeat (8) above for channel B. If amplitude exceeds 0.7 volt, perform b (3) and (6) below.

(12) Turn B level control to -1 and repeat technique of (8) above for channel B. If amplitude exceeds 0.7 volt, perform b (3) and (7) below.

b. Adjustments.

(1) Adjust R3 (fig. 1) for dc voltmeter indication of zero, ± 0.01 volt. (R)

(2) Adjust R4 (fig. 1) for dc voltmeter indication of zero, ± 0.01 volt. (R)

(3) Adjust test oscillator amplitude to 0.7 volt rms.

(4) Turn A2R12 (fig. 1) fully counterclockwise and then clockwise until stable trigger pulses appear on oscilloscope. (R)

(5) Turn A2R10 (fig. 1) fully clockwise and then counterclockwise until stable trigger pulses appear on oscilloscope. (R)

(6) Turn A2R12 (fig. 1) fully counterclockwise and then clockwise until stable trigger pulses appear on oscilloscope.

(3) Turn AST10 (fig. 1) fully clockwise and then counterclockwise until stable trigger points appear on oscilloscope.

12. Sensitivity. a. Performance Check.

(1) Connect test oscillator (AO) to channel A connector, using cable and termination (B3 and B4).

(2) Turn FUNCTION SWITCH to FREQUENCY A, and turn TIME BASE MULTIPLIER switch to $1s - 10^4$.

(3) Adjust test oscillator frequency to 1 kHz and output level to 0.1 volt.

(4) Adjust LEVEL A control to display stable count.

(5) Adjust test oscillator frequency from 10 Hz to 300 kHz, while maintaining output level of 0.1 volt. Test instrument will display stable count over entire frequency range. For 300 kHz turn TIME BASE MULTIPLIER switch to $.1s - 10^4$.

NOTE

If test instrument fails to count, or counts erratically, adjust LEVEL A control to obtain stable count.

(6) Turn channel A DC VOLTS-AC VOLTS switch to AC VOLTS X1.

(7) Repeat technique of (3) through (5) above.

(8) Position test instrument controls as listed in (a) through (c) below:

(a) Channel A DC VOLTS-AC VOLTS switch to DC VOLTS X1.

(b) FUNCTION switch to RATIO A/B.

(c) TIME BASE MULTIPLIER to 1-10 μ sec.

(9) Move connection from channel A to channel B connector.

(10) Repeat (3) above and adjust B LEVEL control until gate indicator flickers.

(11) Repeat technique of (5) above. Test instrument gate indicator will flicker over entire frequency range.

NOTE

Readjust B LEVEL control if necessary.

(12) Turn TIME BASE MULTIPLIER switch to $10 - .1$ ms.

(13) Adjust test oscillator frequency from 10 Hz to 100 kHz while maintaining output level at 0.1 volt. Test instrument gate indicator will flicker over entire frequency range.

(14) Turn LEVEL B DC VOLTS-AC VOLTS switch to AC VOLTS X1.

b. Adjustments. No adjustments can be made.

13. Trigger Level. a. Performance Check.

(1) Turn FUNCTION switch to FREQUENCY A.

(2) Connect test oscillator (AO) to channel A connector, using cable and termination (B3 and B4).

(3) Connect oscilloscope (AO) to MARKER A connector (rear panel of test instrument) using cable (B2).

(4) Turn channel A DC VOLTS-AC VOLTS switch to AC VOLTS X1 and LEVEL A control to +1.

(5) Adjust test oscillator frequency to 1 kHz and output for 1 volt rms.

(6) While observing oscilloscope, reduce amplitude of input to test instrument until marker disappears. Marker will disappear when input signal level is between 0.5 and 0.9 volt rms.

(7) Turn LEVEL A control to -1.

(8) Repeat technique of (6) and (7) above.

(9) Repeat (2) through (8) above for test instrument channel B with FUNCTION switch turned to RATIO A/B.

b. Adjustments. No adjustments can be made.

14. Power Supply

NOTE

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

a. Performance Check.

(1) Connect dc voltmeter (A2) between pin 15 of A24 (fig. 1) and ground. Dc voltmeter indication will be between -34 and -36 volts. If not, perform b below. Record dc voltmeter indication.

(2) Vary autotransformer (A1) output from 105 to 125 volts and back to 115 volts. Dc voltmeter indication will remain within ± 0.2 volt of value recorded in (1) above.

b. Adjustments. Adjust A24R10 (fig. 1) for indication of -35 volts on dc voltmeter. (R).

15. Final Procedure. a. Demarginate and disconnect all equipment and replace test instrument within protective cover.

b. In accordance with TM 38-700, annotate and affix DA Label 80 (U.S. Army Calibration System). When the test instrument cannot be adjusted within tolerance, annotate and affix DA Form 2617 (Unserviceable Test Instrument or Limited Use).

SECTION V

PRELIMINARY OPERATIONS (C LEVEL)

16. **Preliminary Instructions.** a. The instructions outlined in this section are preparatory to the calibration process. Personnel should become familiar with the entire section before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name and item identification number as listed in tables 4 and 5. For the identification of equipment referenced by item numbers prefixed with A, see table 4, and for prefix B, see table 5.

WARNING

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

17. **Equipment Setup.** a. Set test instrument **STORAGE** switch (rear panel) to **OFF** and **EXT INT** switch to **INT** (rear panel).

NOTE

Verify that slide switch on rear panel is set to 115 volts ac.

b. Remove protective cover. Join test instrument only if required to perform adjustments.

c. Connect test instrument to autotransformer (A1).

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

e. Turn test instrument **SAMPLE RATE** switch to midrange, and allow sufficient time for equipment to warm up and stabilize.

SECTION VI

CALIBRATION PROCESS (C LEVEL)

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met before continuing with the calibration.

18. **Time Base Stability.** a. **Performance Check.**

(1) Connect test instrument **FREQ STD** connector (rear panel) to electronic counter (A6) input using cable assembly (B3).

(2) Position test instrument controls as follows:

(a) **STORAGE** switch (rear panel) to **OFF**.

(b) **FREQ STD** switch (rear panel) to **INT**.

(3) Set electronic counter **TIME BASE** switch to 10.

(4) Adjust C6 (fig. 1) for electronic counter indication of 0100.0000 kHz.

(5) Allow a minimum of 24 hours warmup. Do not remove electrical power from test instrument or

electronic counter. Electronic counter indicates between 0000.9999 and 0100.0000 kHz.

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

19. **Input Sensitivity.** a. **Performance Check.**

(1) Position test instrument controls as follows:

(a) - **LEVEL A** +control to 0.

(b) - **LEVEL B** +control to 0.

(c) A channel **DC VOLTS/AC** switch to **AC VOLTS X1**.

(d) B channel **DC VOLTS/AC** switch to **AC VOLTS X1**.

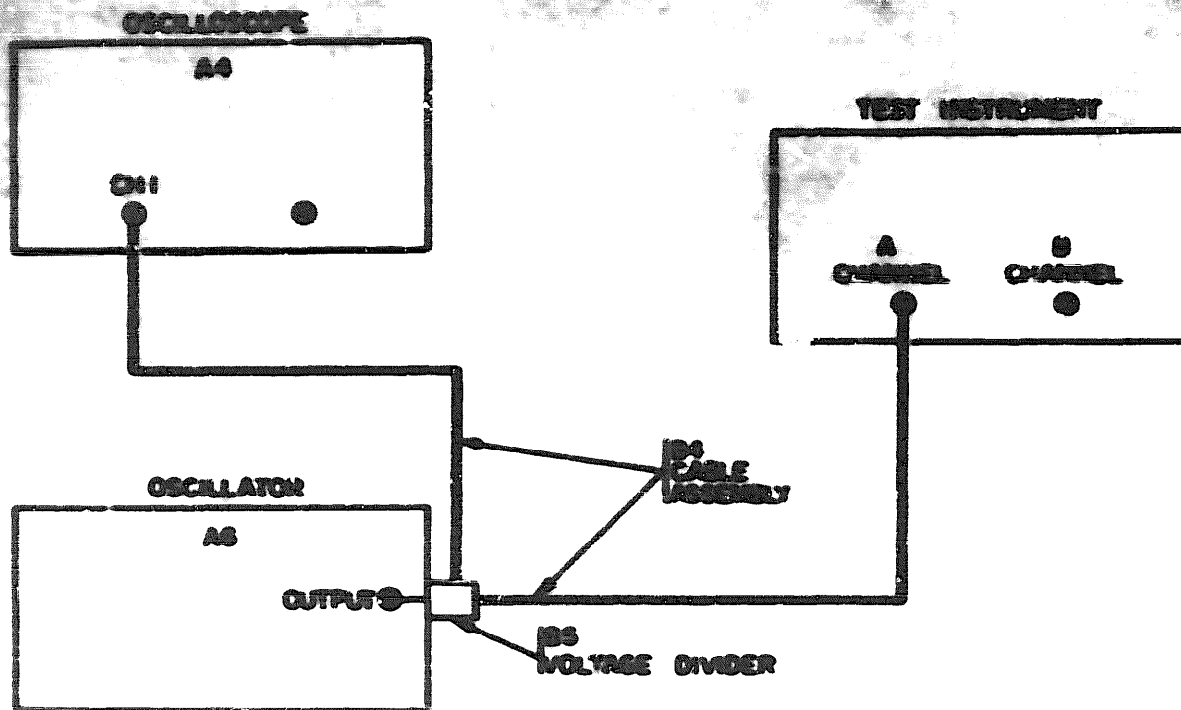
(e) **COM-SEP-CHECK** switch to **SEP**.

(f) A channel - **SLOPE** +switch to + (positive).

(g) B channel - **SLOPE** +switch to + (positive).

(h) **FUNCTION** switch to **FREQUENCY A**.

(2) Connect equipment as shown in figure 2.



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Figure 2. Input Sensitivity Setup (C Level).

(3) Set oscillator (A8) frequency controls to settings listed in table 7. At each setting perform the following:

(a) Adjust oscillator OUTPUT LEVEL control for oscilloscope display of 0.20 volt peak to peak.

(b) Set FUNCTION switch to setting listed.

(c) Set TIME BASE-MULTIPLIER switch to setting listed.

(d) Set - LEVEL A + control for stable test instrument indication within specified limits.

NOTE

The test instrument indications listed in table 7 reflect oscillator (A8) frequency accuracy and test instrument \pm count error.

(4) Set A channel DC VOLTS/AC VOLTS switch to AC VOLTS X10.

(5) Adjust oscillator level control for oscilloscope display 2.0 volts peak to peak.

(6) Adjust - LEVEL A + control for stable test instrument indication between 6029.9 and 6030.1 kHz.

(7) Position test instrument controls as follows:

(a) A channel DC VOLTS/AC VOLTS switch to DC VOLTS X1.

(b) TIME BASE-MULTIPLIER switch to 1 S.

(8) Adjust oscillator controls for 2 Hz and oscilloscope display 0.20 volt peak to peak.

Table 7. Input Sensitivity

Oscillator Output Setting	Test Instrument		
	FUNCTION Switch Setting	TIME BASE-MULTIPLIER Switch Setting	Indication
10 Hz	FREQUENCY A	1 S	60.299 to 60.301 kHz
10 Hz	PERIOD A	1mS	6029.9 to 6030.1 ms
1 kHz	FREQUENCY A	1 S	60.299 to 60.301 kHz
100 kHz	FREQUENCY A	10 mS	6029.9 to 6030.1 kHz
100 kHz	FREQUENCY A	10 mS	6029.9 to 6030.1 kHz

(9) Adjust - LEVEL A + control for stable test instrument indication between 99.991 and 99.993 kHz.

(10) Set A channel DC VOLTS/AC VOLTS switch to DC VOLTS X10.

(11) Adjust oscillator level control for oscilloscope display 2.5 v peak to peak.

(12) Adjust - LEVEL A + control for stable test instrument indication between 99.991 and 99.993 kHz.

(13) Relocate cable assembly (B4) from A channel input connector to B channel input connector.

(14) Connect cable assembly (B3) between FREQ STD connector (rear panel) and A channel input connector.

(15) Position test instrument controls as follows:

(a) A channel DC VOLTS/AC VOLTS switch to AC VOLTS X1.

(b) TIME BASE-MULTIPLIER switch to 10 us.

(c) FUNCTION switch to RATIO A/B.

(16) Adjust oscillator controls for 10 Hz and oscilloscope display 0.25 peak to peak.

(17) Adjust - LEVEL B + control for stable test instrument indication between 10001. and 09799.

(18) Adjust oscillator controls for 100 kHz and oscilloscope display 0.25 volt peak to peak.

(19) Set TIME BASE-MULTIPLIER switch to 1 us.

(20) Adjust - LEVEL B + control for stable test instrument indication between 0.9799 and 1.0201.

A. Adjustments.

(1) Disconnect equipment.

(2) Connect cable assembly (B4) between differential voltmeter (A3) and test instrument A channel input connector.

(3) Position test instrument controls as follows:

(a) - LEVEL A + control to 0.

(b) - LEVEL B + control to 0.

(c) A channel DC VOLTS/AC VOLTS switch to DC VOLTS X1.

(4) Adjust B4 (fig. 1) for differential voltmeter indication between -0.01 and +0.01 vdc. (R)

(5) Relocate cable assembly (B4) from A channel input connector to B channel input connector.

(6) Adjust B4 (fig. 1) for differential voltmeter indication between -0.01 and +0.01 vdc. (R)

(7) Repeat performance check.

20. Trigger Level. a. Performance Check.

(1) Connect equipment as shown in figure 2.

(2) Connect cable assembly (B3) between oscilloscope CH2 input connector and test instrument MARKER A connector (rear panel).

(3) Set FUNCTION switch to FREQUENCY A.

(4) Adjust oscillator (A-4) controls for 1 kHz and oscilloscope CH1 display of 2.5 vts peak to peak.

(5) Turn - LEVEL A + control clockwise (positive) to 1.

(6) Oscilloscope CH2 displays negative going marker pulse.

(7) Adjust oscillator OUTPUT LEVEL control to reduce amplitude of 1 kHz test signal until oscilloscope CH2 pulse display disappears.

(8) Oscilloscope CH1 displays 1 kHz test signal amplitude between 1.5 and 2.5 volts peak to peak.

(9) Turn - LEVEL A + control counter-clockwise (negative) to 1.

(10) Repeat steps (7) and (8).

(11) Relocate cable assembly (B4) from A channel input connector to B channel input connector.

(12) Relocate cable assembly (B3) from MARKER A connector to MARKER B connector (rear panel).

(13) Turn - LEVEL B + control clockwise (positive) to 1.

(14) Repeat steps (7) and (8).

(15) Turn - LEVEL B + control counter-clockwise (negative) to 1.

(16) Repeat steps (7) and (8).

(17) Disconnect cable assembly (B-4) connected between B channel input connector and voltage divider (B5).

(18) Connect B channel input connector to meter calibrator (A-3) output terminals with cable assembly (B4).

(19) Position test instrument controls as follows:

(a) A channel DC VOLTS/AC VOLTS switch to AC VOLTS X100.

(b) B channel DC VOLTS/AC VOLTS switch to AC VOLTS X100.

(20) Adjust meter calibrator controls for 400 Hz and 100 volts.

(21) Adjust meter calibrator controls until oscilloscope CH2 pulse display disappears.

(22) Meter calibrator indicates between 50 and 90 vdc.

(23) Adjust meter calibrator for zero output.

(24) Relocate cable assembly (B4) from B channel input connector to A channel input connector.

(25) Relocate cable assembly (B3) from MARKER B connector (rear panel) to MARKER A connector (rear panel).

(26) Repeat steps (20) through (23).

(27) Disconnect equipment.

b. Adjustments.

(1) Connect equipment as shown in figure 2.

(3) Connect cable (B3) between oscilloscope CH2 input connector and adapter (B1).

(4) Connect adapter (B1) red lead between A channel - SLOPE + switch center terminal (B4) and adapter black lead to test instrument chassis.

(5) Adjust oscilloscope controls for 1 kHz and oscilloscope CH1 display of 2 volts peak to peak.

(6) Set A channel and B channel controls as follows:

(a) - LEVEL A + control clockwise to + (positive) 1.

(b) DC VOLTS/AC VOLTS switch to AC VOLTS X1.

(c) Adjust AGR12 (fig. 1) fully counterclockwise then clockwise for oscilloscope CH2 display of trigger pulses. (R)

(7) Turn - LEVEL A + control counterclockwise (negative) to 1.

(8) Adjust AGR10 (fig. 1) fully clockwise, then counterclockwise for oscilloscope CH2 display of trigger pulses. (S)

(9) Relocate cable assembly (B4) from A channel input connector to B channel input connector.

(10) Relocate adapter (B1) from A channel - SLOPE + switch terminal to B channel - SLOPE + switch center terminal.

(11) Turn - LEVEL B + control counterclockwise (negative) to 1.

(12) Adjust AGR12 (fig. 1) fully counterclockwise then clockwise for oscilloscope CH2 display of trigger pulses. (R)

(13) Turn - LEVEL B + control counterclockwise (negative) to 1.

(14) Adjust AGR10 (fig. 1) fully clockwise then counterclockwise for oscilloscope CH2 display of trigger pulses. (R)

(15) Disconnect adapter (B1) and cable assembly (B4).

(16) Connect oscilloscope CH2 input to pin A of A6 connector (fig. 1) and ground with oscilloscope X10 probe.

(17) Insure that oscilloscope controls are set for 1 kHz and oscilloscope CH1 displays 2 volts peak to peak.

(18) Adjust AGR12 adjustment (fig. 1) fully counterclockwise then clockwise for oscilloscope CH2 display of symmetrical square wave and note setting. (R)

(19) Adjust AGR12 fully clockwise then counterclockwise for oscilloscope CH2 display of symmetrical square wave and note setting. (R)

(20) Readjust AGR12 halfway between settings noted in steps (18) and (19). (R)

(21) Relocate cable assembly (B4) from B channel input connector to A channel input connector.

(22) Relocate oscilloscope X10 probe from pin A of A6 connector to pin A of A3 connector (fig. 1).

(23) Repeat steps (17) through (20) using AGR12 (fig. 1). (R)

(24) Repeat performance check

21. External Standard Input Sensitivity. a. Performance Check.

(1) Connect equipment as shown in figure 3.

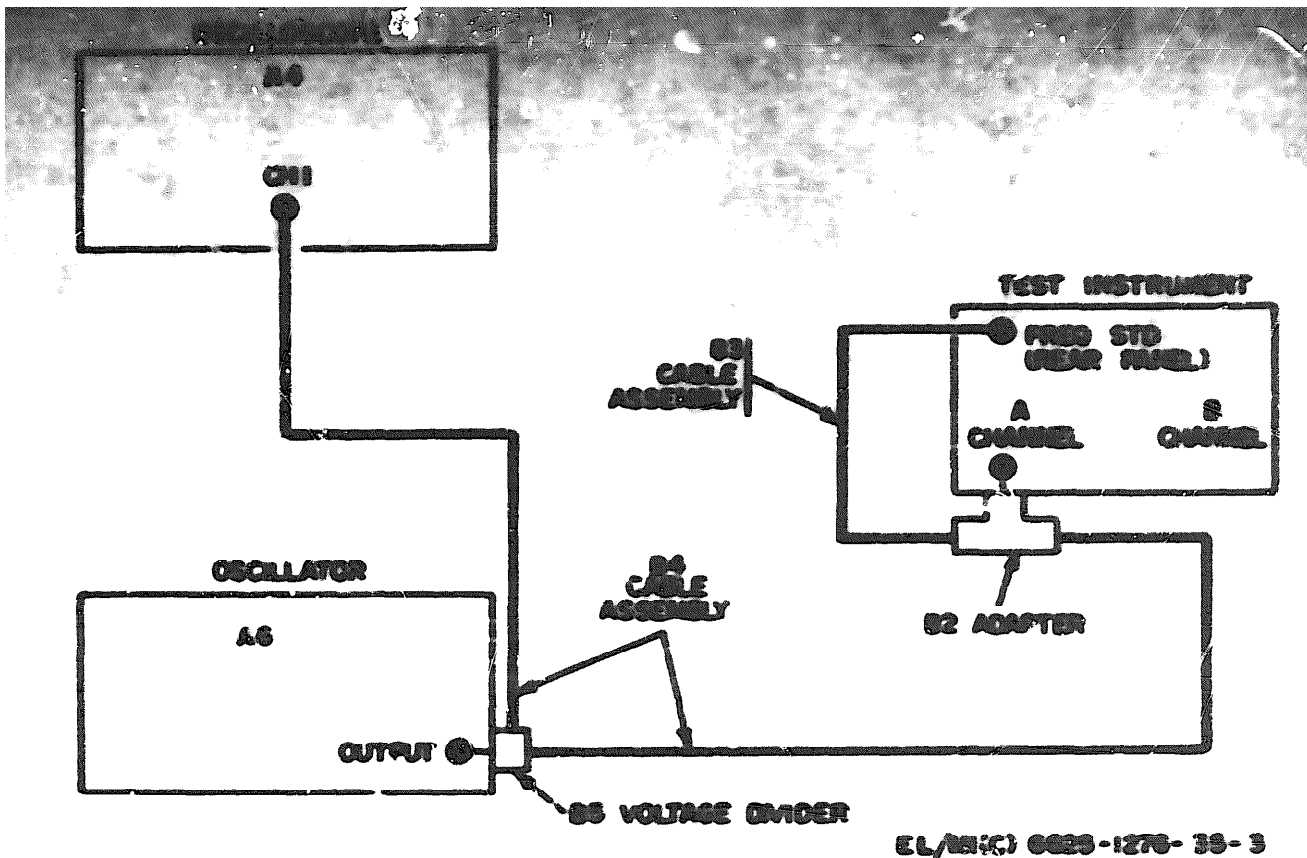


Figure 3. External Standard Input Sensitivity, equipment setup (C Level).

- (2) Position test instrument controls as follows:
 - (a) FUNCTION switch to FREQUENCY A.
 - (b) A channel DC VOLTS/AC VOLTS switch to AC VOLTS X1.

(c) TIME BASE-MULTIPLIER switch to .1 s.

(d) FREQ STD switch (rear panel) to EXT.

(3) Adjust oscillator controls for 100 Hz and oscilloscope display of 2.5 volts peak to peak.

(4) Test instrument indicates between 99.99 and 100.01.

(5) Slowly adjust oscillator frequency controls between 100 and 300 kHz and maintain oscilloscope display amplitude of 2.5 volts peak to peak.

(6) Test instrument indicates between 99.99 and 100.01 at any oscillator frequency between 100 and 300 kHz.

(7) Disconnect equipment.

b. Adjustments. No adjustments can be made.

22. Time Base Output: Performance Check.

(1) Connect oscilloscope (A-4) CH1 input connector to test instrument TIME BASE connector (rear panel) with cable assembly (B3).

(2) Position test instrument controls as follows:

(a) Function switch to MANUAL START A.

(b) COM-SWP-CHECK switch to CHECK.

(c) FREQ STD switch (rear panel) to INT.

(3) Set TIME BASE-MULTIPLIER switch to each setting between 10 μ s and 10 s. At each setting oscilloscope displays waveform with amplitude greater than 5 volts peak to peak.

(4) Disconnect equipment.

b. Adjustments. No adjustments can be made.

23. Self-Check. a. Performance Check.

(1) Position test instrument controls as follows:

(a) - LEVEL A control to 0.

(b) - LEVEL B control to 0.

(c) Channel A - SLOPE switch to (positive).

(d) Channel B - SLOPE switch to (positive).

(e) SAMPLE RATE control counter-clockwise (maximum rate).

(2) Set TIME BASE-MULTIPLIER switch to settings listed in table 8. At each setting of TIME BASE-MULTIPLIER switch, set FUNCTION switch to settings listed. Test instrument indicates within specified limits.

b. Adjustments. No adjustments can be made.

Table 8. ~~247-104~~

The following		
TEST CHARACTERISTICS	FUNCTIONS (with setting)	Indication
10 μ S	FREQUENCY A	000.0 to 000.2 KC
10 μ S	PERIOD A	000.00 to 000.01 mS
10 μ S	PERIOD AVG A	000.00 to 000.02 mS
100	PERIOD AVG A	00.000 to 00.011 mS
100	PERIOD A	0000.0 to 1000.7 mS
1mS	FREQUENCY A	000.00 to 000.11 KC
1mS	FREQUENCY A	00.000 to 00.101 KC
1mS	PERIOD A	0000. to 01001. mS
1000	PERIOD A	000.00 to 001.01 S
1000	FREQUENCY A	0000.0 to 0000.1 KC
1S	FREQUENCY A	000.00 to 100.01 KC
1S	PERIOD A	0000.0 to 0001.1 SEC
1S	PERIOD AVG A	00.000 to 00.001 S
1S	RATIO A/B	0.0000 to 1.0001 μ S
1S	PERIOD AVG A	0.0000 to 0.0001 μ S
1S	FREQUENCY A	00.000 to 01.001 KC
10S	FREQUENCY A	0.0000 to 0.0001 KC
10S	PERIOD AVG A	0000. to 00001. μ S

24. Final Procedure. a. Deenergize and disconnect all equipment and replace test instrument within protective cover.

b. In accordance with TM 28-750, annotate and

affix DA Label 80 (U.S. Army Calibration System). When the test instrument cannot be adjusted within tolerance, annotate and affix DA Form 2417 (Unserviceable or Limited Use).

Officer:

VERNE L. BOWERS

Major General, United States Army.

The Adjutant General

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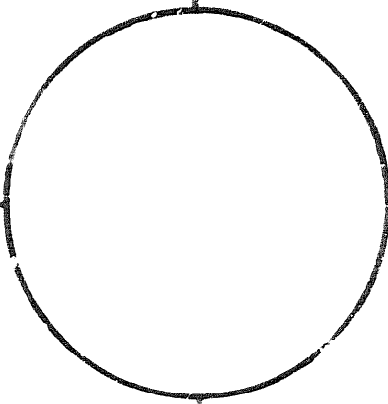
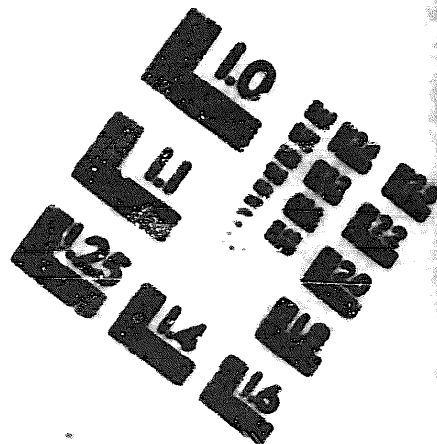
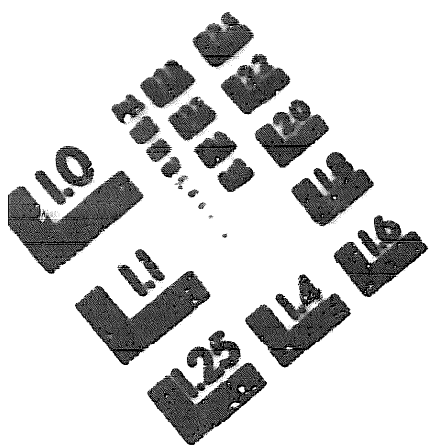
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DEPARTMENT OF THE ARMY

MICROFORM
TEST TARGET



150 MM



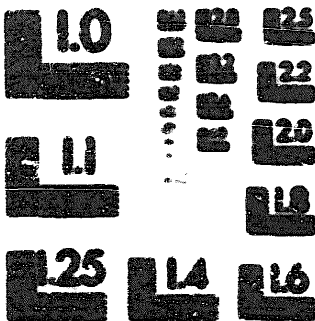
1.0 mm (approx 1.00 mm)



2.0 mm (approx 1.57 mm)



2.5 mm (approx 1.77 mm)



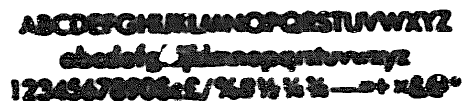
1.0 mm (approx 1.00 mm)



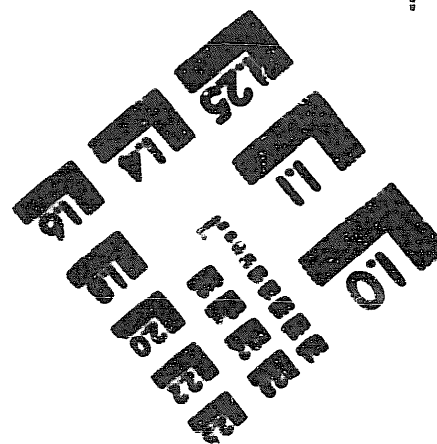
2.0 mm (approx 1.57 mm)



2.5 mm (approx 1.77 mm)



200 MM



250 MM

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR COUNTER ELECTRONIC DIGITAL READOUT, CP-1033/U

(HEWLETT-PACKARD MODEL 5223L) (NSN 6625-00-407-0762) AND HEWLETT-PACKARD MODEL C10-5223L (NSN 6625-00-946-6061)

Headquarters, Department of the Army, Washington, DC
3 January 1978

TB 11-6625-2672-35, 12 July 1974, is changed as follows:

The title of the bulletin is changed as shown above.

Page 2, paragraph 1, line 2 "Hewlett-Packard Model 5223L" is changed to read: "Digital Readout, CP-1033 U (Hewlett-Packard, Model 5223L)."

Line 6 "Hewlett-Packard Model 5223L" is changed to read: "Digital Readout, CP-1033 U (Hewlett-Packard, Model 5223L)."

Paragraph 3 line 7 "AMSEL-MA Q'S" is changed to read: "DR/EI-MA-Q."

Paragraph 5, line 5 "4931-621-7877" is changed

to read: "6695-00-621-7877."

Page 5, paragraph 6, line 3 "4931-621-7877" is changed to read: "6695-00-621-7877."

Page 5, paragraph 9a(1) (e) "±(positive)" is changed to read: "±(positive)."

Page 6, paragraph 9a(7) line 3 "5 parts in 10⁶" is changed to read: "2 parts in 10⁶."

Paragraph 11b(1), line 2 "±0.01 volt" is deleted.

Paragraph 11b(2), line 2 "±0.01 volt" is deleted.

By Order of the Secretary of the Army:

Official:

J. C. PENNINGTON

Brigadier General, United States Army
The Adjutant General

BERNARD W. ROGERS
General, United States Army
Chief of Staff

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