

# \*TB 9-4935-367-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

## CALIBRATION PROCEDURE FOR DIGITAL OSCILLATOR HEWLETT-PACKARD MODEL 4204A

Headquarters, Department of the Army, Washington, DC

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*Distribution Statement A: Approved for public release; distribution is unlimited.*

### 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](mailto: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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**SECTION I  
IDENTIFICATION AND DESCRIPTION**

**1. Test Instrument Identification.** This bulletin provides instructions for the calibration of Digital Oscillator, Hewlett-Packard Model 4204A. 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.** None.

**b. Time and Technique.** The time required for this calibration is approximately 3 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
Line voltage	115 V ac, $\pm 10\%$ , 60 Hz
Frequency	Range: 10 Hz to 1 MHz Accuracy: $\pm 0.2\%$ or $\pm 0.1$ Hz, whichever is greater Stability: $< \pm 0.01\%$ at $\pm 10\%$ line voltage variation
Frequency response	$\pm 3\%$ (referenced at 9.999 kHz)
Output	10 V into 600 $\Omega$ 20 V open circuit
Distortion	$< 0.3\%$ 30 Hz to 100 kHz $< 1.0\%$ 100 kHz to 600 kHz $< 1.2\%$ 600 kHz to 1 MHz (not checked)
Output meter	Range: 0 to 20 V Accuracy: $\pm 2\%$ FS
Output attenuator	Range: -60 to +20 dB Accuracy: $\pm 0.5$ dB

## 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 the calibration procedure. The following peculiar accessory is also required for this calibration: voltage divider, 600  $\Omega$  double banana plug to triple banana jack, Hewlett-Packard Model 11047A (7911560).

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
AUDIO ANALYZER	Range: 40 Hz to 600 kHz Capability: < 0.3%	Boonton, Model 1121 (1121)
AUTOTRANSFORMER	Range: 105 to 125 V ac Accuracy: $\pm 1\%$	Ridge, Model 9020A (9020A),
FREQUENCY COUNTER	Range: 49.75 mS to 1,001,900 Hz Accuracy: 0.05%	Fluke, Model PM6681/656 (PM6681/656)
MULTIMETER	Range: -35.5 to -36.5 V dc Accuracy: $\pm 0.35\%$	Fluke, Model 8840A/AF05 (AN/GSM-64D)
TRUE RMS VOLTMETER	Range: 1.80 to 20.6 V ac Accuracy: $\pm 0.5\%$	Fluke, Model 8922A/AA (8922A/AA)

## 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 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 12 are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made,

repeat paragraphs 8 through 12. 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.

## **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. If necessary, zero-set meter by turning slotted disk below meter face until meter pointer indicates zero.
- b. Remove TI protective cover as required for adjustment.
- c. Connect TI to autotransformer.
- d. Connect autotransformer to a 115 V ac source and adjust for a 115 V output.
- e. Set **POWER** switch to **ON** and allow at least 15 minutes for equipment to warm-up and stabilize.
- f. Disconnect output level guard strap.

## **8. Frequency Accuracy and Stability**

### **a. Performance Check**

- (1) Connect **OUTPUT** to frequency counter using voltage divider.
- (2) Position controls as listed in (a) through (d) below.
  - (a) **OUTPUT ATTENUATOR** switch to **3 V**.
  - (b) Frequency dials to indicate 999.9 kHz.
  - (c) **VERNIER** control to centerline.
  - (d) **AMPLITUDE** control for **3 V** indication on output meter.
- (3) Measure frequency. Frequency counter will indicate between 997.900 and 1,001,900 Hz.
- (4) Set frequency dials to settings listed in table 3. Frequency counter will indicate within limits specified.

Table 3. Frequency Accuracy

Frequency dial settings	Frequency counter indications			
	Min		Max	
500.0 kHz	499,000	Hz	501,000	Hz
100.0 kHz	99,800	Hz	100,200	Hz
10.00 kHz	9980	Hz	10,020	Hz
9.900 kHz	9880.2	Hz	9919.8	Hz
8.800 kHz	8782.4	Hz	8817.6	Hz
7.700 kHz	7684.6	Hz	7715.4	Hz
6.600 kHz	6586.8	Hz	6613.2	Hz
5.500 kHz	5489	Hz	5511	Hz
4.400 kHz	4391.2	Hz	4408.8	Hz
3.300 kHz	3293.4	Hz	3306.6	Hz
2.200 kHz	2195.6	Hz	2204.4	Hz
1.100 kHz	1097.8	Hz	1102.2	Hz
020.0 Hz	49.75	ms	50.25	ms
010.0 Hz	99.01	ms	101.01	ms

(5) Set frequency dials and **VERNIER** control for a 1,000,000 Hz indication on frequency counter.

(6) Vary autotransformer between 105 and 125 V ac. Frequency counter indication will remain between 999,900 and 1,000,100 Hz.

(7) Adjust autotransformer to 115 V.

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

**9. Output Voltage and Meter Accuracy**

**a. Performance Check**

(1) Connect **OUTPUT** to true rms voltmeter using voltage divider.

(2) Set **OUTPUT ATTENUATOR** switch to **10 V**, frequency dials to indicate 400.0 Hz and **VERNIER** control to centerline.

(3) Adjust **AMPLITUDE** control for an indication of 10 V on output meter. If true rms voltmeter does not indicate between 9.8 and 10.2 V, perform **b** (1) and (2) below.

(4) Repeat technique of (3) above using output meter indications listed in table 4. True rms voltmeter will indicate within limits specified.

Table 4. Output Voltage Accuracy

Output meter indications (V ac)	True rms voltmeter indications	
	Min	Max
8	7.80	8.20
6	5.80	6.20
4	3.80	4.20
2	1.80	2.20

(5) Set frequency dials to indicate 999.9 kHz. Adjust **AMPLITUDE** control for an indication of 10.0 V on output meter. If true rms voltmeter does not indicate between 9.8 and 10.2 V ac, perform **b** (1) and (3) below. Adjust **AMPLITUDE** control to minimum output.

(6) Remove voltage divider and connect cable to **OUTPUT**.

(7) Set frequency dials to indicate 400.0 Hz.

(8) Set **OUTPUT ATTENUATOR** switch to **30 V** and adjust **AMPLITUDE** control for **20 V** on output meter. If true rms voltmeter does not indicate between 19.4 and 20.6 V ac, perform **b** (4) and (5) below. Adjust **AMPLITUDE** control for minimum output.

**b. Adjustments**

- (1) Adjust **AMPLITUDE** control for an indication of 10.0 V on true rms voltmeter.
- (2) Adjust A3R15 (fig. 1) for an indication of 10.0 V on output meter (R).
- (3) Adjust A3C7 (fig. 1) for an indication of 10.0 V on output meter (R).
- (4) Adjust **AMPLITUDE** control for an indication of 20.0 V on true rms voltmeter.

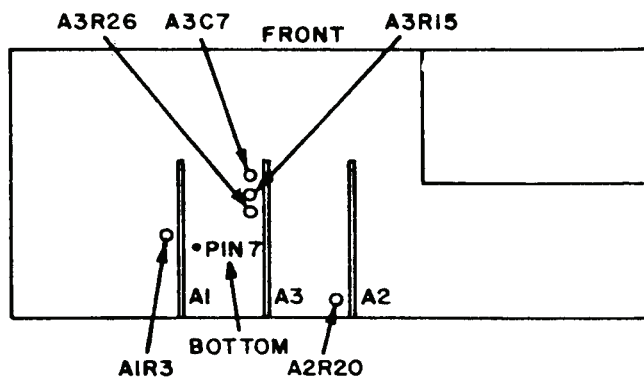


Figure 1. Test oscillator top view adjustments.

(5) Adjust A3R26 (fig. 1) for an indication of 20.0 V on output meter (R).

**10. Frequency Response**

**a. Performance Check**

- (1) Connect **OUTPUT** to true rms voltmeter using voltage divider.
- (2) Set frequency dials to indicate 9.999 kHz (reference). Adjust **AMPLITUDE** control for an indication of 8.00 V on true rms voltmeter. Record output meter indication.
- (3) While maintaining output meter indication in (2) above, set frequency dials to settings listed in table 5. True RMS voltmeter will indicate between 7.76 and 8.24 V ac.

Table 5. Frequency Response Accuracy

Frequency dial settings	
999.9	kHz
100.0	kHz
99.99	kHz
10.00	kHz
1.000	kHz
999.9	Hz
010.0	Hz

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

## 11. Distortion

### a. Performance Check

- (1) Connect **OUTPUT** to audio analyzer using voltage divider.
- (2) Position controls as listed in (a) through (d) below:
  - (a) **OUTPUT ATTENUATOR** switch to **10 V**.
  - (b) Frequency dials for 040.0 Hz indication.
  - (c) **AMPLITUDE** control for a 10 V ac indication on output meter.
  - (d) **VERNIER** control to centerline.
- (3) If audio analyzer does not indicate less than 0.3 percent distortion, perform **b** below.
- (4) Set frequency dials to settings listed in table 6. Audio analyzer will indicate within limits specified.

Table 6. Distortion Accuracy

Frequency dial indications	Audio analyzer indications
1.000 kHz	<0.3%
10.00 kHz	<0.3%
100.0 kHz	<1.0%
600.0 kHz	< 1.2%

**b. Adjustments.** Set frequency dials to indicate 10.00 kHz. Adjust A2R20 (fig. 1) for minimum distortion on audio analyzer.

## 12. Output Attenuator

### a. Performance Check

- (1) Adjust **AMPLITUDE** control for minimum output.
- (2) Connect **OUTPUT** to true rms voltmeter using voltage divider.
- (3) Set frequency dials to indicate 1.000 kHz and **OUTPUT ATTENUATOR** switch to **+20 DBM**. Adjust **AMPLITUDE** control for a 9.0 V indication on output meter.
- (4) Adjust true rms voltmeter to measure relative dBm by performing (a) through (f) below.
  - (a) Select autorange mode (**AUTO**).

- (b) Release **REL/dBm** pushbutton (out).
- (c) Set dBm **REFERENCE  $\Omega$**  switch to 600.
- (d) Press **dB/VOLTS** pushbutton (in).
- (e) Press **REL** pushbutton (in).
- (f) The display should indicate 0 dB and **RELATIVE REFERENCE** light should be lit.
- (5) Set **OUTPUT ATTENUATOR** switch to **+10 dBm**.
- (6) True rms voltmeter will indicate between -9.5 to -10.5 dBm.
- (7) Repeat technique of (5) and (6) above using settings listed in table 7. True rms voltmeter will indicate within limits specified.

Table 7. Output Attenuation Accuracy

OUTPUT ATTENUATOR switch settings (dBm)	True rms voltmeter indications (dB)	
	Min	Max
0	-19.5	-20.5
-10	-29.5	-30.5
-20	-39.5	-40.5
-30	-49.5	-50.5
-40	-59.5	-60.5
-50	-69.5	-70.5
-60	-79.5	-80.5

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

**13. Power Supply**

**a. Performance Check**

- (1) Connect multimeter between A1 PIN 7 (fig. 1) and signal ground.
- (2) If multimeter does not indicate between -35.5 V dc and -36.5 V dc, perform **b** below.

**a. Adjustments.** Adjust A1R3 (fig. 1) for a -36.0 V dc indication on multimeter (R).

**14. 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:



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### 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](mailto: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.





