*TB 9-6625-1213-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR AC AMPLIFIER AM-1881/U (HEWLETT-PACKARD MODEL 450A) AND HEWLETT-PACKARD MODEL 465A

Headquarters, Department of the Army, Washington, DC
20 February 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 9-6625-1213-35; dated 5 March 1982, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Ac Amplifier AM-1881/U (Hewlett-Packard Model 450A), and Hewlett-Packard Model 465A. The manufacturers' manuals were used as the prime data sources in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Differences among models are described within the text.

b. Time and Technique. The time required for this calibration is approximately 1 hour 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
Models AM-1881/U and 450A	
Power input requirements	115 V ± 10%, 50 to 1000 Hz
Gain	
AM-1881/U	20 or 40 dB ± 0.13 dB at 1 kHz
450A	20 or 40 dB ± 0.125 dB at 1 kHz

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications
Models AM-1881/U and 450A - Continued	
Frequency response (open circuit) 20-dB gain 40 dB gain	 Range: 5 Hz to 1 MHz Accuracy: ±0.5 dB Range: 2 Hz to 1.2 MHz Accuracy: ±1 dB Range: 10 Hz to 1 MHz Accuracy: ±0.5 dB Range: 5 Hz to 2 MHz Accuracy: ±1 dB
Stability	± 2% with ± 10% change in line voltage
Distortion	<1% from 2 Hz to 100 kHz <2% above 100 kHz
Noise level	40-dB gain, less than 40 μV 20-dB gain less than 250 μV (referred to input)
Model 465A	
Power input requirements	115 V ± 10%, 50 to 400 Hz
Voltage gain	20 or 40 dB ±1%
Frequency response	Range: 100 Hz to 50 kHz Accuracy: ±0.1 dB Range: 5 Hz to 1 MHz Accuracy: Less than 2 dB down
Output	>10 V open circuit and >5 V into 50 ohms
Distortion	Range: 10 Hz to 100 kHz Accuracy: Less than 1% Range: 5 to 10 Hz and 100 kHz to 1 MHz Accuracy: Less than 2%

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 Set 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 four-to-one 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	Minimum use specifications	Manufacturer and model (part number)
AUTOTRANSFORMER	Range: 105 to 125 V ac Accuracy: ±1%	Ridge, Model 9020A (9020A)
AUDIO ANALYZER	Range: 50 mV to 1 V ac Frequency: 10 Hz to 100 kHz Distortion: < 1%	Boonton, Model 1121 (1121)
FUNCTION/ARBITRARY GENERATOR	Range: 20 Hz to 2 MHz Flatness: ±0.25%	Agilent, Model 33250A (33250A)
MULTIMETER	Range: 8 mV to 10.15 V ac 100 Hz to 50 kHz Accuracy: ±0.25% ac Range: 6.24 to 46 V dc Accuracy: ±0.1% dc	Agilent, Model 3458A (3458A)
TRUE RMS VOLTMETER	Range: 10 mV to 10 V at 20 Hz to 1 MHz Accuracy: ±1.5% Range: 10 V at 1.2 to 2 MHz Accuracy: ±3%	Fluke, Model 8922A/AA (8922A/AA)

SECTION III
CALIBRATION PROCESS FOR AC AMPLIFIER AM-1881/U (HEWLETT-PACKARD MODEL 450A)

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.

d. Unless otherwise specified, all control 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 OUPUT(S) to minimum after each step within the performance check where applicable.

WARNING

Selenium rectifiers are contained in this TI. When selenium rectifiers burn out, poisonous fumes are released. Do not inhale fumes or handle rectifiers until they have cooled.

NOTE

When indications specified in paragraphs **8** through **11** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **8** through **11**. Do not perform power supply check if all other parameters are within tolerance.

7. Equipment Setup

a. Remove protective cover from TI only to make adjustments. Replace immediately upon completion of adjustments.

b. Connect TI to autotransformer.

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

d. Set TI power switch to **ON** and allow 10 minutes for warm-up.

8. Gain and Stability

a. Performance Check

(1) Connect function/arbitrary generator and multimeter to TI **INPUT**.

CAUTION

Do not set **GAIN** switch to **40 dB** until instructed. Damage to equipment may result.

(2) Set **GAIN** switch to **20 dB**.

(3) Adjust function/arbitrary generator frequency for 1000 Hz and amplitude for a 1 V indication on multimeter.

(4) Connect multimeter to TI **OUTPUT**. If multimeter does not indicate between 9.85 and 10.15 V, perform **b** (1) below.

(5) Record multimeter indication.

(6) Vary autotransformer from 105 to 125 V ac and back to 115 V. Multimeter will indicate within ± 2 percent of indication recorded in (5) above.

(7) Connect multimeter to TI **INPUT** and adjust function/arbitrary generator output for a 100 mV indication on multimeter.

(8) Set **GAIN** switch to **40 dB** and connect multimeter to TI **OUTPUT**. If multimeter does not indicate between 9.85 and 10.15 V, perform **b** (1) and (2) below.

b. Adjustments

(1) Adjust R6 (fig. 1) for a 10-V indication on multimeter (R).

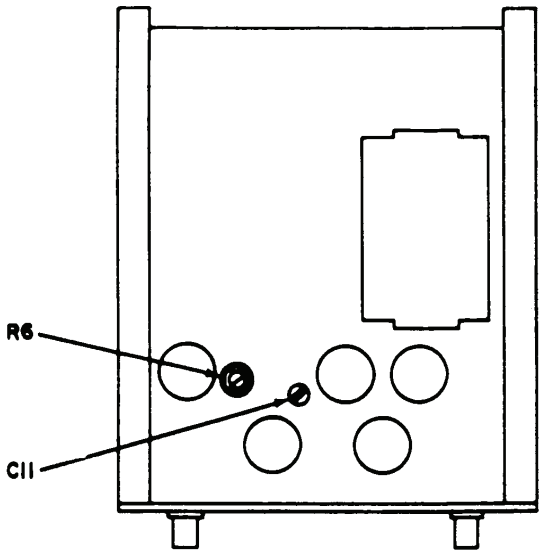

Figure 1. Model 450A.

(2) Repeat **a** (1) through (4) above and if required, adjust R6 for best in-tolerance indication.

9. Frequency Response

a. Performance Check

(1) Connect function/arbitrary generator to TI **INPUT**.

(2) Connect true rms voltmeter to TI **OUTPUT** and set **GAIN** switch to **40 dB**.

(3) Adjust function/arbitrary generator frequency for 1000 Hz and, -20.0 dB output. Record TI output voltage as indicated on voltmeter.

(4) Adjust function/arbitrary generator frequency for 20 Hz, 10 kHz, 100 kHz, 500 kHz, and 1 MHz in succession while adjusting output level as necessary to maintain true rms voltmeter indication recorded in (3) above. If function/arbitrary generator output indication is not within ±0.5 dB of reference level indication for each frequency, perform **b** (1) below.

(5) Adjust function/arbitrary generator frequency for 2 MHz. If function/arbitrary generator output indication is not within ±1 dB of reference-level indication, perform **b** (1) below while repeating (4) and (5) above for best compromise.

(6) Repeat technique of (3) and (4) above with function/arbitrary generator output set to 0 dB and TI **GAIN** switch set to **20 dB**.

(7) Adjust function/arbitrary generator frequency for 1.2 MHz. If indication on function/arbitrary generator is not within ±1 dB of reference level indication, perform **b** (1) and (2) below.

b. Adjustments

(1) Adjust C11 (fig. 1) for an in-tolerance indication (R).

(2) Adjust function/arbitrary generator output to minimum and repeat **a** (2) through (7) above.

10. Distortion

a. Performance Check

(1) Connect equipment as shown in figure 2.

(2) Adjust function/arbitrary generator frequency for 10 Hz and output for an 8 V indication on audio analyzer.

(3) Measure and record distortion. Distortion will be less than 1 percent.

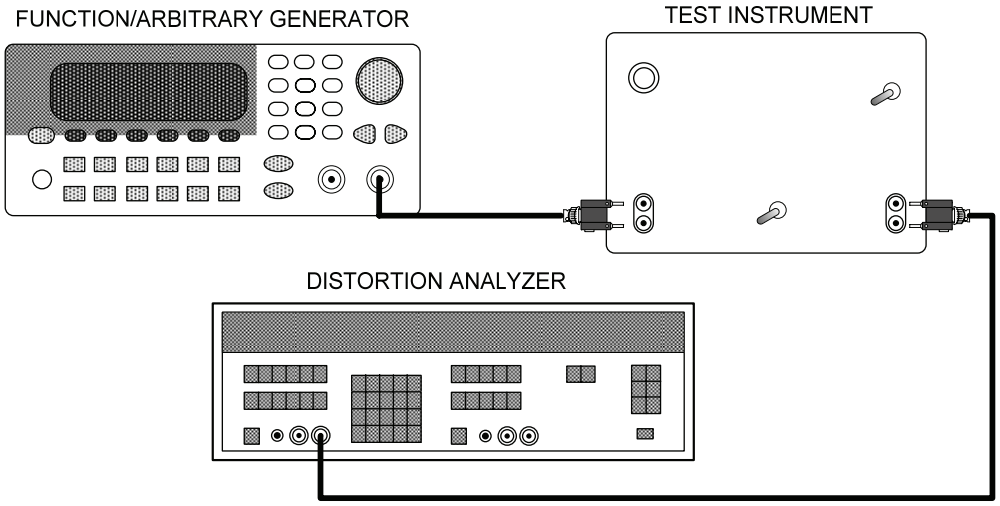

Figure 2. Distortion Check - equipment setup.

(4) Repeat (2) and (3) above far frequencies of 50 Hz, 1 kHz, and 100 kHz.

b. Adjustments. No adjustments can be made.

11. Noise

a. Performance Check

(1) Disconnect function/arbitrary generator from TI **INPUT**.

(2) Short TI **INPUT**. Set **GAIN** switch to **40 dB**.

(3) Measure TI **OUTPUT** noise level with audio analyzer voltmeter function. Audio analyzer will indicate less than 4 mV (40 μV referred to input).

(4) Set **GAIN** switch to **20 dB**. Audio analyzer will indicate less than 2.5 mV (250 μV referred to input).

b. Adjustments. No adjustments can be made.

12. Power Supply

NOTE

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

a. Performance Check. Connect multimeter to junction of R27 and C7 (fig. 3) and chassis ground. If multimeter does not indicate between 6.24 and 6.36 Vdc, perform **b** below.

b. Adjustments. Adjust R27 (fig. 3) for a 6.30 V indication on multimeter (R).

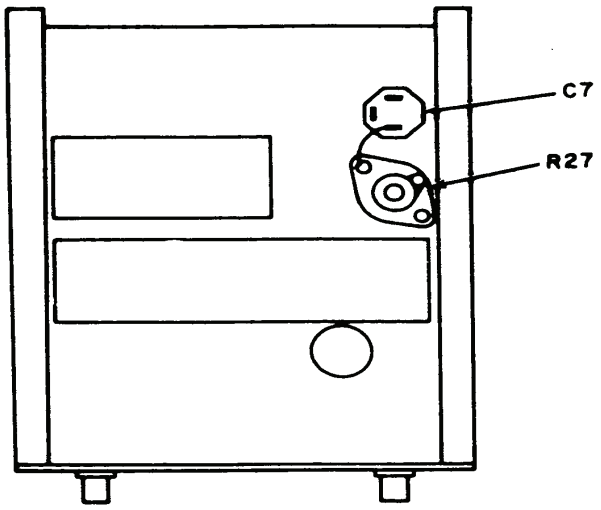

Figure 3. Model 450A.

13. Final Procedure

a. Deenergize and disconnect all equipment.

b. Annotate and affix DA label/form in accordance with TB 750-25.

SECTION IV
CALIBRATION PROCESS FOR AC AMPLIFIER HEWLETT-PACKARD MODEL 465A

14. Preliminary Instructions

a. The instructions outlined in paragraphs **14** and **15** 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.

d. Unless otherwise specified, all control 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 OUPUT(S) to minimum after each step within the performance check where applicable.

WARNING

Selenium rectifiers are contained in this TI. When selenium rectifiers burn out, poisonous fumes are released. Do not inhale fumes or handle rectifiers until they have cooled.

NOTE

When indications specified in paragraphs **16** and **17** are not within tolerance perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **16** and **17**. Do not perform power supply check if all other parameters are within tolerance.

15. Equipment Setup

a. Remove protective cover from TI only to make adjustments and replace immediately upon completion.

b. Connect TI to autotransformer.

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

d. Set **GAIN** switch to **20 dB** and **LINE** switch to **ON** and allow 15 minutes for warm-up.

16. Gain, Stability, and Frequency Response

a. Performance Check

(1) Connect function/arbitrary generator and multimeter to TI **INPUT**.

(2) Adjust function/arbitrary generator frequency for 1 kHz and output for a 1 V indication on multimeter.

(3) Connect multimeter to TI **OUTPUT**. Multimeter will indicate between 9.9 and 10.1 V ac.

(4) Vary autotransformer from 105 to 125 V ac and back to 115 V while observing multimeter. Multimeter will indicate within limits of (3) above.

(5) Adjust function/arbitrary generator amplitude for a 1 V indication on multimeter.

(6) Set **GAIN** switch to **40 dB**. Multimeter will indicate between 9.9 and 10.1 V ac.

(7) Adjust function/arbitrary generator frequency to 1 kHz and output amplitude for a 9-V indication on multimeter. Record multimeter indication.

(8) Vary function/arbitrary generator frequency, from 100 Hz to 50 kHz while maintaining indication recorded in (7) above. Function/arbitrary generator will indicate between 8.9 and 9.1 V.

(9) Set **GAIN** switch to **20 dB**.

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

(12) Substitute true rms voltmeter for multimeter.

(13) Repeat (7) and (8) above, while varying function/arbitrary generator frequency from 10 Hz to 1 MHz. If true rms voltmeter does not indicate between 7.2 and 10.8 V, perform **b** below.

(14) Set **GAIN** switch to **40 dB** and repeat (13) above. If out-of-tolerance conditions exist, set **GAIN** switch to **20 dB** and perform **b** below.

b. Adjustments

(1) Set function/arbitrary generator frequency for 1 MHz and output for 1 V (verify with true rms voltmeter).

(2) Adjust C5 $1MH_Z$ ADJ(fig. 5) until true rms voltmeter indicates 8.5 V (R).

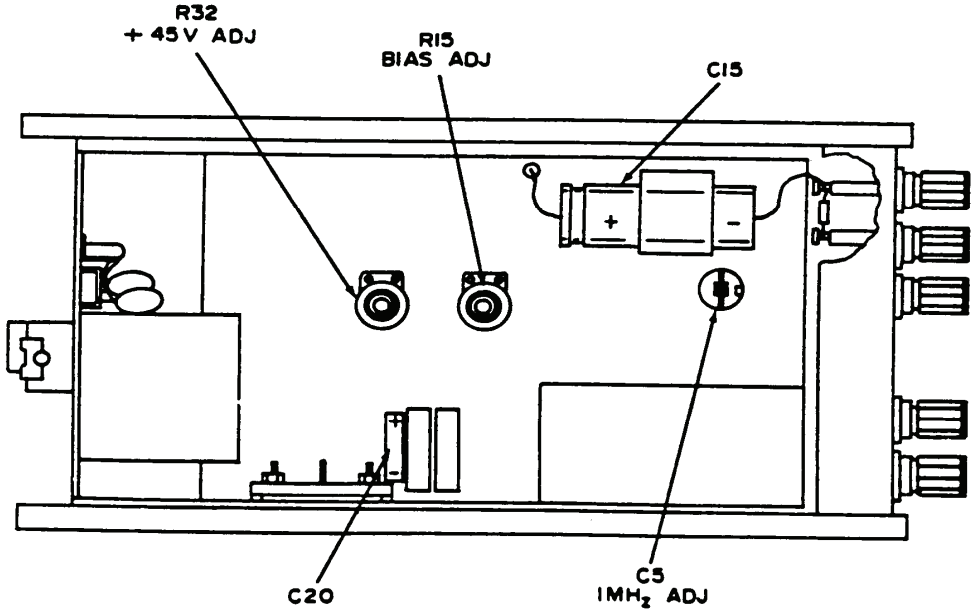

Figure 5. Hewlett-Packard Model 465A - top view.

17. Distortion

a. Performance Check

(1) Connect function/arbitrary generator to audio analyzer.

(2) Adjust function/arbitrary generator frequency for 10 Hz and amplitude for 1 V.

(3) Measure and record function/arbitrary generator distortion.

NOTE

Do not change function/arbitrary generator frequency or output.

(4) Set **GAIN** switch to **20 dB** and connect function/arbitrary generator to TI **INPUT**.

(5) Connect audio analyzer to TI **OUTPUT**. Audio analyzer will indicate less than 1 percent distortion after subtracting distortion recorded in 3 above.

(6) Repeat technique (1) through (5) above at values listed in table 3. Audio analyzer will indicate within limits specified.

Table 3. Distortion Check

Test instrument **GAIN** switch settings	Function/arbitrary generator		Audio analyzer indications (less function/arbitrary generator distortion)
	Frequency	Output amplitude (V)	
20	1 kHz	1	Less than 1%
20	100 kHz	1	Less than 1%
20	600 kHz	1	Less than 2%
40	10 Hz	0.1	Less than 1%
40	1 kHz	0.1	Less than 1%
40	100 kHz	0.1	Less than 1%
40	600 kHz	0.1	Less than 2%

b. Adjustments. No adjustments can be made.

18. Power Supply

NOTE

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

a. Performance Check

(1) Connect multimeter between positive side of C20 (fig. 5) and chassis ground. If multimeter does not indicate between 44 and 46 V, perform **b** (1) below.

(2) Move positive lead to positive side of C15 (fig. 5). If multimeter does not indicate between 22.5 and 23.5 V dc, perform **b** (2) below.

b. Adjustments

(1) Adjust R32 +45 V ADJ (fig. 5) until multimeter indicates 45 V dc (R).

(2) Adjust R15 BIAS ADJ (fig. 5) until multimeter indicates 23 V dc (R).

19. 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:

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

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army

0802806

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 342122, requirements for calibration procedure TB 9-6625-1213-24.

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.