# *TB 9-6625-2107-24

**DEPARTMENT OF THE ARMY TECHNICAL BULLETIN**

# CALIBRATION PROCEDURE FOR AC VOLTMETER, ME-30F/U AND HEWLETT-PACKARD, MODELS 400F AND 400FL

Headquarters, Department of the Army, Washington, DC
25 March 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 9-6625-2107-35, dated 2 February 1993.

## SECTION I
## IDENTIFICATION AND DESCRIPTION

**1. Test Instrument Identification.** This bulletin provides instructions for the calibration of Ac Voltmeter, ME-30F/U and Hewlett-Packard, Models 400F and 400FL. 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**. Variations among models are described in text.

**b. Time and Technique**. The time required for this calibration is approximately 1 hour, 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 | | | |
|---|---|---|---|---|
| ME-30F/U | | | | |
| Power input requirements | 115 or 230 V ac, 50 to 400 Hz | | | |
| Ac voltage ranges (12) | 1 mV to 300 V | | | |
| Accuracy | ±% FS | | | |
| Frequency response | (3 mV to 300 V ranges) | | | |
| | 10 to 40Hz ±5% | 40 Hz to 2 MHz ±1% | 2 to 4 MHz ±3% | 4 to 10 MHz ±5% |

Table 1. Calibration Description - Continued

| Test instrument parameters | Performance specifications | | | | |
|---|---|---|---|---|---|
| ME-30F/U - continued | | | | | |
| Frequency response | (1 mV range) | | | | |
| | 10 Hz to 40 Hz<br>±5% | | 40 Hz to 500 kHz<br>±1% | | 500 kHz to 4 MHz<br>±5% |
| Model 400F | | | | | |
| Power input requirements | 115 or 230 V ac, 50 to 400 Hz | | | | |
| Ac voltage ranges (14) | 100 μV to 300 V | | | | |
| Accuracy | ± (% FS + % reading) | | | | |
| Frequency response | (300 μV to 300 V ranges) | | | | |
| | 20-40Hz<br>(2 + 2) | 40-100Hz<br>(1 + 1) | 100Hz-1MHz<br>(0.5 + 0.5) | 1-2MHz<br>(1 + 1) | 2-4MHz<br>(2 + 2) |
| Frequency response | (100 μV range) | | | | |
| | 30 Hz – 60 Hz<br>(2 + 2) | | 60 Hz – 100 kHz<br>(1 + 1) | | 100 kHz – 500 kHz<br>(1 +(+0,-7) |
| Model 400FL | | | | | |
| Power input requirements | 115 or 230 V ac, 50 to 400 Hz | | | | |
| Ac voltage ranges (14) | 100 μV to 300 V | | | | |
| Accuracy: | ±% reading | | | | |
| Frequency response | (300 μV to 300 V ranges) | | | | |
| | 20-40Hz<br>±4 | 40-100Hz<br>±2 | 100Hz-1MHz<br>±1 | 1-2MHz<br>±2 | 2-4MHz<br>±4 |
| Frequency response | (100 μV range) | | | | |
| | 30 Hz – 60 Hz<br>±4 | | 60 Hz – 100 kHz<br>±2 | | 100 kHz – 500 kHz<br>+1, -8 |

## 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 this calibration procedure.

Table 2. Minimum Specifications of Equipment Required

| Common name | Minimum use specifications | Manufacturer and model (part number) |
|---|---|---|
| CALIBRATOR | Ac voltage:<br>Range: 96 μV to 303 V<br>Frequency: 10 Hz to 10 MHz<br>Accuracy:[1] | Fluke, Model 5720A (5720A) (p/o MIS-35947); w/ac divider, Fluke, Model 7405A-4207 (7405A-4207) |

[1]Combined accuracy of calibrator (ac voltage) and voltage divider (ac voltage) is 0.25% for TI needed accuracy of 1%, while noting required TI accuracies of 2%, 3%, 4%, and 5% allow the use of a calibrator with 0.5%, 0.75%, 1%, and 1.25% accuracies accordingly.

## SECTION III
## CALIBRATION PROCESS FOR ME-30F/U

### 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 the procedure. Additional maintenance information is contained in the manufacturer's manual for this TI.

**d.** 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.** Remove protective cover from TI only when necessary to make adjustments. Replace cover after completing the adjustments.

**b.** Adjust front panel mechanical zero adjustment for a 0 indication.

**c.** Assure **115/230** slide switch (rear panel) is set for **115 V ac**.

**d.** Connect TI to 115 V ac source.

**e.** Set **RANGE** switch to **300 V** and power switch to **ON** and allow at least 30 minutes for warm-up and stabilization.

**8. Range Accuracy and Stability**

**a. Performance Check**

(1) Connect calibrator **OUTPUT** terminal to TI **INPUT** terminal.

(2) Set **RANGE** switch to **1 VOLT**.

(3) Adjust calibrator frequency for 1 kHz and **OUTPUT** for indication of 1 on TI 0 to 1 scale. Calibrator will indicate 0.99 to 1.01 V ac; if not, set calibrator **OUTPUT** to **1 V ac** and adjust A2R38 (fig. 1) for indication of 1 on TI (R).

(4) Connect ac voltage divider **INPUT** (p/o calibrator) to calibrator **OUTPUT** terminals and ac divider **OUTPUT** to TI **INPUT** terminal.

(5) Set **RANGE** switch to **.001 VOLTS**.

(6) Adjust calibrator **OUTPUT** for indication of 1 on TI 0 to 1 scale. Calibrator will indicate 0.99 to 1.01 V ac; if not, set calibrator **OUTPUT** to **1 V ac** and adjust A2R44 (fig. 1) for a 1 indication on TI (R).

(7) Set TI **RANGE** and calibrator initial **OUTPUT** as indicated in table 3. Adjust calibrator for the TI meter indication specified. Final calibrator **Error** display indication will be within the specified limits.

**NOTE**

In table 3 below where '- -' appears in "Meter indications" column and 'N/A' appears in "**Error** display" column, a reference point is being established on the TI to be used in paragraph **9** below. TI accuracy is not being verified at these points.

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

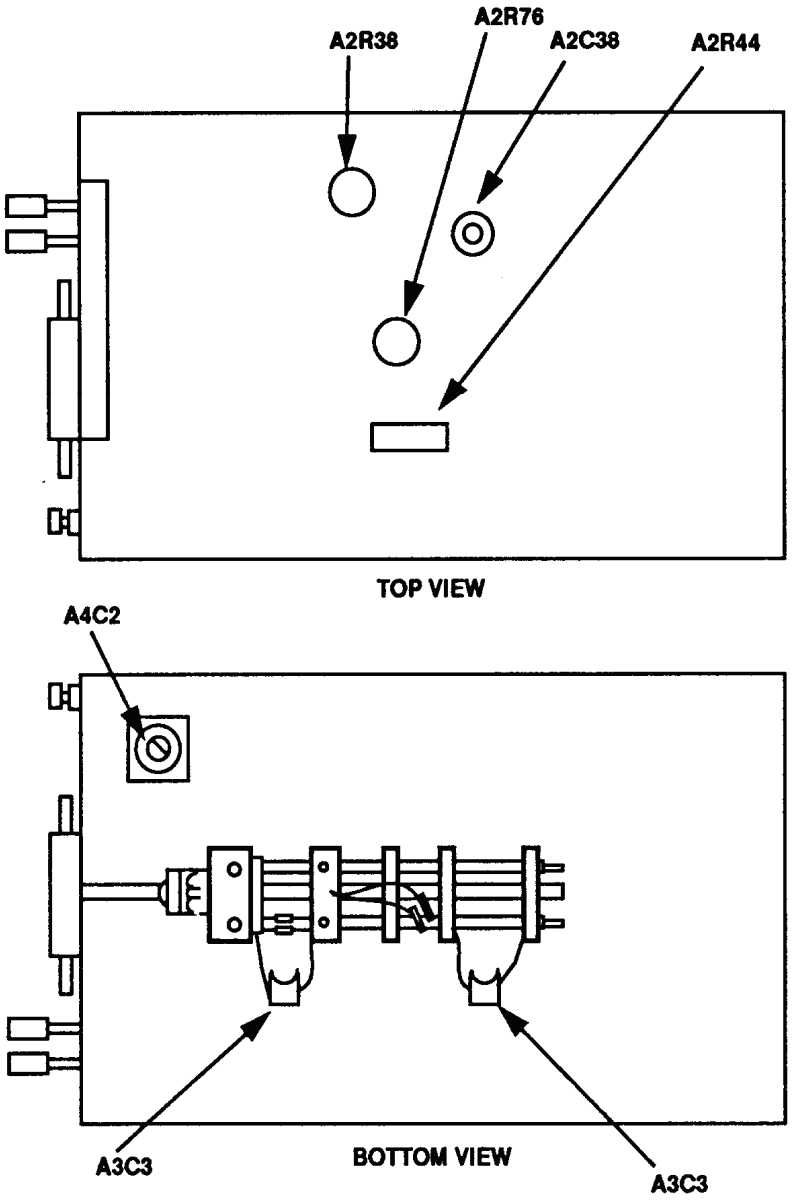


Figure 1. ME-30F/U - adjustment locations.

Table 3. Range Accuracy

| Test instrument | | Calibrator | | |
|---|---|---|---|---|
| **RANGE (VOLTS)** switch settings | Meter indications | Initial output | | Error display indications (±%) |
| | | Voltage | Frequency | |
| 0.001 | - - - | 0.9 V | 1.0 kHz | N/A[1] |
| 0.003 | 3 | 3.0 V | 1.0 kHz | 1.0 |
| 0.003 | - - - | 3.0 V | 1.0 kHz | N/A[1] |
| 0.01 | 1 | 10 V | 1.0 kHz | 1.0 |
| 0.01 | - - - | 9.0 V | 1.0 kHz | N/A[1] |
| Set calibrator to **STANDBY** and remove ac divider from setup | | | | |
| 0.03 | 3 | 30 mV | 1.0 kHz | 1.0 |
| 0.1 | 1 | 100 mV | 1.0 kHz | 1.0 |
| 0.3 | 3 | 0.3 V | 1.0 kHz | 1.0 |
| 1 | 1 | 1.0 V | 1.0 kHz | 1.0 |
| 1 | - - - | 0.9 V | 1.0 kHz | N/A[1] |
| 1 | .8 | 0.8 V | 1.0 kHz | 1.0 |
| 1 | .6 | 0.6 V | 1.0 kHz | 1.0 |
| 1 | .4 | 0.4 V | 1.0 kHz | 1.0 |
| 1 | .2 | 0.2 V | 1.0 kHz | 1.0 |
| 3 | 3 | 3 V | 1.0 kHz | 1.0 |
| 3 | - - - | 3 V | 1.0 kHz | N/A[1] |
| 10 | 1 | 10 V | 1.0 kHz | 1.0 |
| 30 | 3 | 30 V | 1.0 kHz | 1.0 |
| 100 | 1 | 100 V | 1.0 kHz | 1.0 |
| 300 | 3 | 300 V | 1.0 kHz | 1.0 |

[1]Record resulting TI indication for use in paragraph **9** below.

## 9. Frequency Response

### a. Performance Check

(1) Connect TI **INPUT** to calibrator **WIDEBAND OUTPUT** and press calibrator **W BND** pushbutton.

(2) Set TI **RANGE** switch to **.01 VOLTS**.

(3) Set calibrator **FREQUENCY** to **1 kHz** and **AMPLITUDE** for an initial 9.0 mV output. Adjust calibrator output **AMPLITUDE** for a TI indication equal to value recorded in table 3 for **.01 VOLTS** (1 kHz) to establish a 1 kHz reference. Press calibrator **NEW REF** pushbutton.

(4) Set calibrator **FREQUENCY** to **10 MHz** and output **AMPLITUDE** for a TI meter indication of 9 mV. Calibrator **Error** will be within ±5.0 percent; if not, adjust calibrator output **AMPLITUDE** for ERROR = 0% and adjust A2R76 (fig. 1) for a TI indication of 9 (R).

**NOTE**

Adjustments interact, repeat as necessary to achieve in-tolerance condition if adjustments are made.

(5) Repeat technique of (2) through (4) above, using settings listed in table 4. Calibrator **Error** display indication will be within limits specified.

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

Table 4. Frequency Response

| Test instrument **RANGE (VOLTS)** switch settings | Calibrator | | | | Error display indications (±%) | Adjustments/ frequency (fig. 1) (R) |
|---|---|---|---|---|---|---|
| | Initial output | | | | | |
| | Voltage | | Frequency | | | |
| 0.01 | 9.0 | mV | 1.0 | MHz | 1.0 | - - - |
| 0.01 | - - - | | 10 | Hz | 5.0 | - - - |
| 0.001[1] | 0.9 | mV | 1 | kHz | - - - | - - - |
| 0.001 | - - - | | 10 | Hz | 5.0 | - - - |
| 0.001 | - - - | | 500 | kHz | 1.0 | - - - |
| 0.001 | - - - | | 3 | MHz | 5.0 | - - - |
| 0.003[1] | 3.0 | mV | 1.0 | kHz | - - - | - - - |
| 0.003 | - - - | | 8.0 | MHz | 5.0 | A3C3 (R) |
| 0.003 | - - - | | 3.0 | MHz | 3.0 | - - - |
| 0.003 | - - - | | 1.0 | MHz | 1.0 | - - - |
| 0.003 | - - - | | 10 | Hz | 5.0 | - - - |
| 1[1] | 0.9 | V | 1.0 | kHz | - - - | - - - |
| 1 | - - - | | 3 | MHz | 3.0 | A2C28 (R) |
| 1 | - - - | | 8.0 | MHz | 5.0 | A3C4 (R) |
| 1 | - - - | | 1.0 | MHz | 1.0 | - - - |
| 1 | - - - | | 10 | Hz | 5.0 | - - - |
| 3[1] | 3.0 | V | 1.0 | kHz | - - - | - - - |
| 3 | - - - | | 500 | kHz | 1.0 | A4C2 (R) |
| 3 | - - - | | 3.0 | MHz | 3.0 | - - - |
| 3 | - - - | | 10 | MHz | 5.0 | - - - |

[1]Reference point established in table 3.

## 10. 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
## HEWLETT-PACKARD, MODELS 400F AND 400FL

## 11. Preliminary Instructions

**a.** The instructions outlined in paragraphs **11** and **12** 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 results of each test and, whenever the test requirement is not met take corrective action before continuing with the calibration. Additional maintenance information is contained in the manufacturer's manual for this TI.

**d.** Unless otherwise specified, all controls and control settings refer to the TI.

**12. 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.** Remove protective cover from TI only when necessary to make adjustments. Replace cover after completing the adjustments.

**b.** Adjust front panel mechanical zero adjustment (model 400F only) for a 0 indication.

**c.** Assure **115/230** slide switch (rear panel) is set for **115 V ac**.

**d.** Set **100 kHz L. P. FILTER** to **OUT**.

**e.** Set **RANGE** switch to **300 VOLTS** and power switch to **ON** and allow at least 30 minutes for warm-up and stabilization.

**13. Range Accuracy and Stability**

**a. Performance Check**

(1) Connect calibrator **OUTPUT** to TI **INPUT** terminal.

(2) Set **RANGE** switch to **30 MV**.

(3) Set calibrator **FREQUENCY** for **400 Hz** and output **AMPLITUDE** for indication of **3** on TI 0 to 3 scale. If calibrator does not indicate 30 mV ±1 percent, set calibrator output **AMPLITUDE** to **30 MV** and adjust A2R62 (400 HZ 30MV CAL) (fig. 2) for TI indication of 3 (R).

(4) Repeat technique of (1) through (3) above for remaining calibrator frequencies listed in table 5. Calibrator **Error** display will be within specified limits; if not, perform indicated adjustments.

**NOTE**

In table 5 below where '- - -' appears in "Meter indication" column and 'N/A' appears in "**Error** display" column, a reference point is being established on the TI to be used in paragraph **14** below. TI accuracy is not being verified at these points.

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

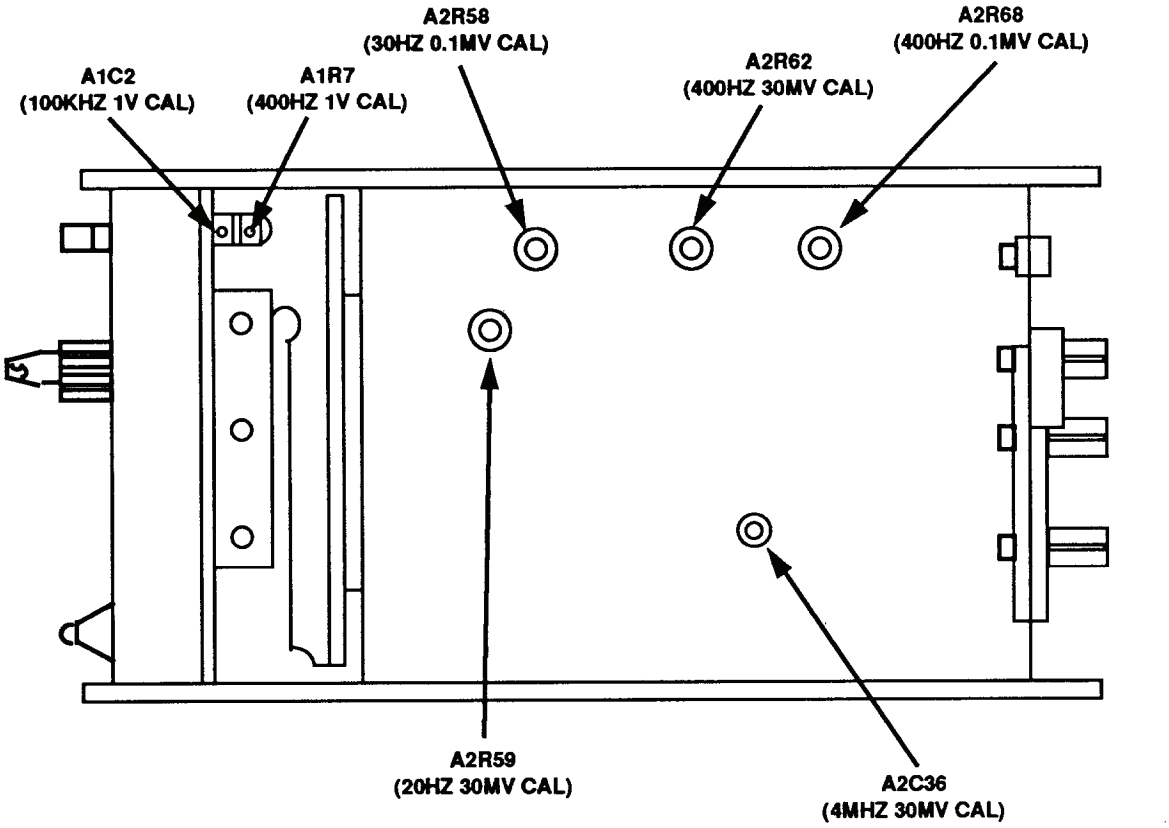


Figure 2. Models 400F and 400FL - top view.

Table 5. Range Accuracy

| Test instrument | | | Calibrator | | | | | | Adjustments (fig. 2) (R) |
|---|---|---|---|---|---|---|---|---|---|
| **RANGE (VOLTS)** switch settings | | Meter indications | Initial output | | | | Error display indications (±%) | | |
| | | | Voltage | | Frequency | | | | |
| 30 | mV | 3 | 30 | mV | 20 | Hz | 4.0 | | A2R59 (R) |
| 30 | mV | 3 | 30 | mV | 80 | Hz | 2.0 | | - - - |
| 30 | mV[1] | - - - | 30 | mV | 1.0 | kHz | N/A | | - - - |
| 30 | mV | 3 | 30 | mV | 800 | kHz | 1.0 | | - - - |
| Set calibrator to **STANDBY** and connect ac divider in setup[2] | | | | | | | | | |
| 0.1 | mV | 1 | 100 | mV | 400 | Hz | 2.0 | | A2R68 (R) |
| 0.1 | mV | 1 | 100 | mV | 30 | Hz | 4.0 | | A2R58 (R) |
| 0.1 | mV | 1 | 100 | mV | 80 | Hz | 2.0 | | - - - |
| 0.1 | mV | 1 | 100 | mV | 1.0 | kHz | 2.0 | | - - - |
| 0.3 | mV | 3 | .3 | V | 1.0 | kHz | 1.0 | | - - - |
| 1 | mV | 1 | 1.0 | V | 1.0 | kHz | 1.0 | | - - - |
| 3 | mV | 3 | 3.0 | V | 1.0 | kHz | 1.0 | | - - - |
| 10 | mV | 1 | 10 | V | 1.0 | kHz | 1.0 | | - - - |
| 100 | mV | 1 | 100 | V | 1.0 | kHz | 1.0 | | - - - |
| 300 | mV | 3 | 300 | V | 1.0 | kHz | 1.0 | | - - - |

Table 5. Range Accuracy

| Test instrument | | | Calibrator | | | | | Adjustments (fig. 2) (R) |
|---|---|---|---|---|---|---|---|---|
| **RANGE (VOLTS)** switch settings | | Meter indications | Initial output | | | | Error display indications (±%) | |
| | | | Voltage | | Frequency | | | |
| 30 | mV | 3 | 30 | mV | 20 | Hz | 4.0 | A2R59 (R) |
| 30 | mV | 3 | 30 | mV | 80 | Hz | 2.0 | - - - |
| 30 | mV[1] | - - - | 30 | mV | 1.0 | kHz | N/A | - - - |
| 30 | mV | 3 | 30 | mV | 800 | kHz | 1.0 | - - - |
| Set calibrator to **STANDBY** and remove ac divider from setup[3] | | | | | | | | |
| 1 | | 1 | 1.0 | V | 400 | Hz | 1.0 | A1R7 (R) |
| 1[1] | | - - - | 1.0 | V | 1 | kHz | N/A | - - - |
| 1 | | 1 | 1.0 | V | 100 | kHz | 1.0 | A1C2 (R) |
| 3 | | 3 | 3 | V | 1.0 | kHz | 1.0 | - - - |
| 10 | | 1 | 10 | V | 1.0 | kHz | 1.0 | - - - |
| 30 | | 3 | 30 | V | 1.0 | kHz | 1.0 | - - - |
| 100 | | 1 | 100 | V | 1.0 | kHz | 1.0 | - - - |
| 300 | | 3 | 300 | V | 1.0 | kHz | 1.0 | - - - |

[1]Record resulting TI indication for use in paragraph **14** below.
[2]Connect ac divider **INPUT** (p/o calibrator) to calibrator **OUTPUT** terminal and ac divider **OUTPUT** to TI **INPUT** terminal.
[3]Connect calibrator **OUTPUT** terminal to TI **INPUT** terminal.

## 14. Frequency Response

### a. Performance Check

(1) Connect TI **INPUT** to calibrator **WIDEBAND OUTPUT** and press calibrator **W BND** pushbutton.

(2) Set TI **RANGE** switch to **30 MV**.

(3) Set calibrator **FREQUENCY** to **1 kHz** and **AMPLITUDE** for an initial 30 mV output. Adjust calibrator output **AMPLITUDE** for a TI indication equal to value recorded in table 5 for 30 mV (1 kHz) to establish a reference. Press calibrator **NEW REF** pushbutton.

(4) Set calibrator **FREQUENCY** to **4 MHz** and output **AMPLITUDE** for a TI meter indication of 30 mV. Calibrator **Error** display indication will be within ±4.0 percent, if not, set calibrator output amplitude to reference set in (3) above and adjust A2C36 (4 MHZ 30 MV CAL) (fig. 2) for TI indication of 30 mV (R).

(5) Repeat technique of (4) above using calibrator frequency of 1 MHz. Calibrator **Error** display indication will be within ±1 percent.

(6) Set TI **RANGE** switch to **1 VOLT**, adjust calibrator output **AMPLITUDE** for **1 V**, and repeat technique of (3) and (4) above. Calibrator **Error** display indication with be within ±4%.

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

## 15. 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*

0800703

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 342234, requirements for calibration procedure TB 9-6625-2107-24.

## 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.