

# TB 9-6625-2331-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

## CALIBRATION PROCEDURE FOR ELECTRONIC COUNTER JOHN FLUKE, MODEL PM6681/656

Headquarters, Department of the Army, Washington, DC  
25 April 2002

*Approved for public release; distribution is unlimited*

### REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedure, please let us know. Mail your letter or DA Form 2028 to: Commander, U. S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5230. 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 FAX 256-882-6546/DSN 788-6546.

| SECTION |                                     | Paragraph | Page |
|---------|-------------------------------------|-----------|------|
| I.      | IDENTIFICATION AND DESCRIPTION      |           |      |
|         | Test instrument identification..... | 1         | 2    |
|         | Forms, records, and reports.....    | 2         | 2    |
|         | Calibration description.....        | 3         | 2    |
| II.     | EQUIPMENT IDENTIFICATION            |           |      |
|         | Equipment required.....             | 4         | 3    |
|         | Accessories required.....           | 5         | 3    |
| III.    | CALIBRATION PROCESS                 |           |      |
|         | Preliminary instructions.....       | 6         | 3    |
|         | Equipment setup.....                | 7         | 4    |
|         | Time base stability.....            | 8         | 4    |
|         | Sensitivity.....                    | 9         | 5    |
|         | Volts maximum/minimum.....          | 10        | 7    |
|         | Trig level A&B outputs.....         | 11        | 8    |
|         | Power supply.....                   | 12        | 9    |
|         | Final procedure.....                | 13        | 9    |

**SECTION I  
IDENTIFICATION AND DESCRIPTION**

**1. Test Instrument Identification.** This bulletin provides instructions for the calibration of Electronic Counter, John Fluke, Model PM6681/656. 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 2 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 applications which pertain to this calibration are in table 1.

Table 1. Calibration Description

| Test instrument parameters   | Performance specifications   |
|------------------------------|--|
| Time base:                   | Frequency: 10 MHz<br>Aging rate (after 48 hour warmup): $< 5 \times 10^{-10}$ per day<br>Aging rate (after 24 hour warmup): $< 1 \times 10^{-8}$ per month<br>Aging rate (after 24 hour warmup): $< 7.5 \times 10^{-8}$ per year<br><br>Line voltage variation (for 10% variation): $< 5 \times 10^{-10}$  |
| Channel A and B sensitivity: | 20 mV rms (-21 dBm), $< 100$ MHz<br>30 mV rms (-21 dBm), 100 to 200 MHz<br>40 mV rms (-17 dBm), 200 to 250 MHz<br>60 mV rms (-11 dBm), $> 250$ MHz   |
| Channel C sensitivity:       | 20 mV rms (-21 dBm), 150 to 300 MHz<br>10 mV rms (-27 dBm), 300 to 2500 MHz<br>20 mV rms (-21 dBm), 2500 to 2700 MHz   |
| Volt max/min                 | Range: -50 to +50 V dc<br>100 mV to 100 V pp (1 Hz to 100 MHz)<br>Accuracy:<br>5 V dc (1X) <span style="float:right"><math>\pm(1\% + 4 \text{ mV})</math></span><br>50 V dc (10X) <span style="float:right"><math>\pm(2\% + 40 \text{ mV})</math></span><br>5 V pp (1X) $< 30$ MHz <span style="float:right"><math>\pm(6\% + 4 \text{ mV})</math></span><br>5 V pp (1X) $> 30$ MHz <span style="float:right"><math>\pm(25\% + 4 \text{ mV})</math></span><br>50 V pp (10X) <span style="float:right"><math>\pm(10\% + 40 \text{ mV})</math></span> |
| Trig level outputs           | $\pm(5\%$ of output level + 30 mV)   |

**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-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.

**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<br>Accuracy: ±1%                                     | General Radio, Type W10MT3AS3 (7910809) or Ridge, Model 9020A (9020A) or Ridge, Model 9020F (9020F) |
| CALIBRATOR                 | ACV: 1.416 to 6.372 Vrms @ 100 kHz<br>DCV: 4 to 40 V dc<br>Accuracy: ±.275% | John Fluke, Model 5700A/CT (p/o MIS-35947)  |
| FREQUENCY DIFFERENCE METER | Range: 10 MHz<br>Resolution: 1 part in 10 <sup>-10</sup> per day            | Tracor, Model 527E (MIS-10318)  |
| MULTIMETER                 | Range: -5.15 to +12.1 V dc<br>Accuracy: ±0.2%                               | John Fluke, Model 8840A/AF-05/09 (AN/GSM-64D)   |
| SIGNAL GENERATOR           | Range: 1 MHz to 2 GHz<br>Amplitude: -27 to -11 dBm<br>Accuracy: ±3%         | (SG-1207/U)   |
| TIME/FREQUENCY WORKSTATION | Frequency: 10 MHz<br>Accuracy: 1.25 parts in 10 <sup>-10</sup> per day      | Autek Systems Corp. Model 620 (MIS-38946)   |
| TUNABLE ACTIVE FILTER      | 50 kHz low pass<br>Cutoff frequency accuracy ±2%                            | Krohn-Hite, Model 3940 (3940)   |

**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.

**TB 9-6625-2331-35**

**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.** 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.** Connect TI to autotransformer, connect autotransformer to a 115 V ac source and adjust for 115 V ac output.

**c.** Set **POWER** switch to **ON** and allow at least 1 hour for stabilization. If TI has been disconnected from line power for more than 48 hours, allow at least 48 hours for warmup before beginning calibration.

**d.** Disconnect any connections from inputs A and B.

**e.** Press keys as listed in (1) through (3) below:

(1) **AUX MENU.**

(2) **SELECT/SET ? ?** to select **CAL HYSE.**

(3) **ENTER.**

**8. Time Base Stability**

**a. Performance Check**

(1) Connect time/frequency workstation **OUTPUT 1 MHz** to frequency difference meter **REF INPUT.**

(2) Connect TI **10 MHz OUT** (rear panel) to frequency difference meter **SIG INPUT.**

(3) Adjust R4 (fig. 1) reference adjust for minimum difference indication on frequency difference meter.

(4) Allow at least 24 hours for stabilization. Frequency difference meter indication will remain within 5 parts in  $10^{-10}$ .

(5) Adjust autotransformer output to 105 V and allow 15 minutes for stabilization. Verify that TI oscillator drift is less than 5 parts in  $10^{-10}$ .

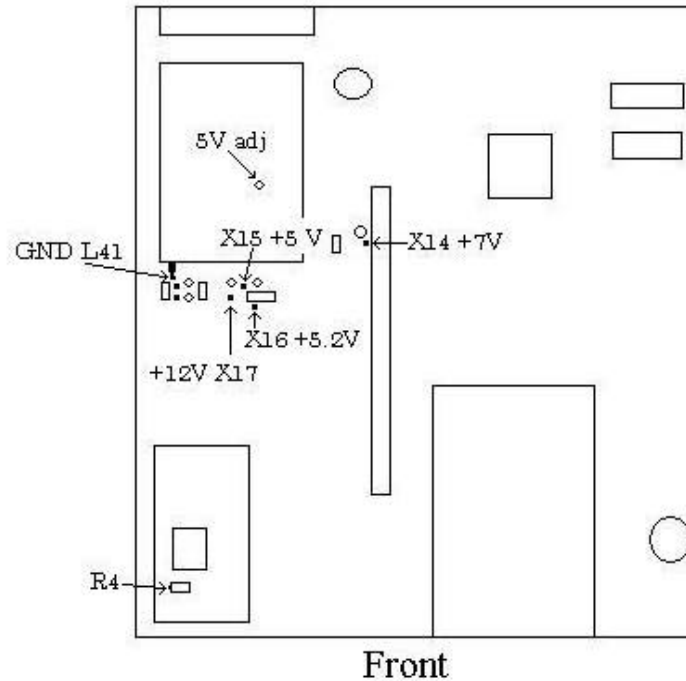


Figure 1. Top view.

(6) Adjust autotransformer output to 125 V and allow 15 minutes for stabilization. Verify that TI oscillator drift is less than 5 parts in  $10^{-10}$ .

(7) Adjust autotransformer output to 115 V.

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

## 9. Sensitivity

### a. Performance Check

(1) Set signal generator for a 1 MHz -21 dBm output with RF output off.

(2) Press TI keys as listed in (a) and (b) below:

(a) **LOCAL/PRESET.**

(b) **INPUT A** and **INPUT B 50W/1MW** to select **50W.**

**TB 9-6625-2331-35**

- (3) Connect signal generator **RF OUT** to TI **A** input.
- (4) Set the signal generator **RF OUT** to on.
- (5) Verify that the TI indicates a stable display of the signal generator frequency as listed in table 3.
- (6) Repeat technique of (1), (4) and (5) above for remaining settings listed in table 3.

Table 3. Sensitivity.

| Test instrument input | Signal generator |                 |
|-----------------------|------------------|-----------------|
|                       | Amplitude (dBm)  | Frequency (MHz) |
| Input A               | -21              | 1               |
| Input A               | -21              | 50              |
| Input A               | -21              | 100             |
| Input A               | -17              | 200             |
| Input A               | -15              | 250             |
| Input A               | -11              | 300             |
| Input B <sup>1</sup>  | -21              | 1               |
| Input B               | -21              | 50              |
| Input B               | -21              | 100             |

<sup>1</sup>Move the signal generator connection from TI input **A** to input **B**, and press **SWAP A**« **B** key.

- (7) Move connection from TI input **B** to input **C**.
- (8) Connect the signal generator **10 MHz Ref Out** to TI **REFERENCE IN** (rear panel).
- (9) Press TI keys as listed in (a) through (c) below:
  - (a) **LOCAL/PRESET**.
  - (b) **FUNCTION** ? ? to select **FREQ C**.
  - (c) **EXT REF**.
- (10) Set signal generator for a 150 MHz -21 dBm output.
- (11) Verify that the TI indicates a stable display of the signal generator frequency as listed in table 4.
- (12) Repeat technique of (10) and (11) above for remaining settings listed in table 4.

Table 4. Input C Sensitivity.

| Test instrument input | Signal generator |                 |
|-----------------------|------------------|-----------------|
|                       | Amplitude (dBm)  | Frequency (MHz) |
| Input C               | -21              | 150             |
| Input C               | -21              | 200             |
| Input C               | -27              | 500             |
| Input C               | -27              | 1000            |
| Input C               | -27              | 2000            |

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

**10. Volts Maximum/Minimum**

**a. Performance Check**

- (1) Make sure all cables are disconnected from inputs **A** and **B**.
- (2) Press TI keys as listed in (a) through g) below:
  - (a) **LOCAL/PRESET**.
  - (b) **INPUT A AC/DC** to **DC**.
  - (c) **INPUT A 50W/1MW** to select **1MW**.
  - (d) **FUNCTION** ? ? keys to select the **VOLT A MAX/MIN** function.
  - (e) **AUX MENU**.
  - (f) **FUNCTION** ? ? keys to select the **CAL HYST** function.
  - (g) **ENTER**.
- (3) Verify that the TI indicates within limits listed in table 5 row 1.
- (4) Connect calibrator **OUTPUT HI** and **LO** connectors to the variable filter **INPUT CH1** and the variable filter **OUTPUT CH1** to TI input **A** and input **B**.
- (5) Set the tunable active filter as a 50 kHz low pass filter.
- (6) Set calibrator to frequency and amplitude listed in table 5.
- (7) Verify that the TI indicated within limits listed in table 5.
- (8) Repeat (6) above for remaining settings listed in table 5. TI will indicate within limits listed.

Table 5. Volt Max/Min

| Calibrator      |           | Test instrument |          |        |        |
|-----------------|-----------|-----------------|----------|--------|--------|
| Frequency       | Amplitude | Input           | Function | Min    | Max    |
| -----           | -----     | A               | VMax     | -0.004 | +0.004 |
| -----           | -----     | A               | VMin     | -0.004 | +0.004 |
| DC              | 4.00 V    | A               | VMax     | 3.956  | 4.044  |
| DC              | 4.00 V    | A               | VMin     | 3.956  | 4.044  |
| DC <sup>1</sup> | 4.00 V    | B               | VMax     | 3.956  | 4.044  |
| DC              | 4.00 V    | B               | VMin     | 3.956  | 4.044  |
| DC              | -4.00 V   | B               | VMax     | -4.044 | -3.956 |
| DC              | -4.00 V   | B               | VMin     | -4.044 | -3.956 |
| DC <sup>1</sup> | -4.00 V   | A               | VMax     | -4.044 | -3.956 |
| DC              | -4.00 V   | A               | VMin     | -4.044 | -3.956 |
| DC <sup>2</sup> | 40.0 V    | A               | VMax     | 39.16  | 40.84  |
| DC              | 40.0 V    | A               | VMin     | 39.16  | 40.84  |
| DC              | -40.0 V   | A               | VMax     | -40.84 | -39.16 |
| DC              | -40.0 V   | A               | VMin     | -40.84 | -39.16 |
| DC <sup>1</sup> | -40.0 V   | B               | VMax     | -40.84 | -39.16 |

See footnotes at end of table.

**TB 9-6625-2331-35**

Table 5. Volt Max/Min - Continued

| Calibrator           |                     | Test instrument |          |        |        |
|----------------------|---------------------|-----------------|----------|--------|--------|
| Frequency            | Amplitude           | Input           | Function | Min    | Max    |
| DC                   | -40.0 V             | B               | VMin     | -40.84 | -39.16 |
| DC                   | 40.0 V              | B               | VMax     | 39.16  | 40.84  |
| DC                   | 40.0 V              | B               | VMin     | 39.16  | 40.84  |
| 100 kHz <sup>3</sup> | 1.414 Vrms (4 Vpp)  | B               | VMax/Min | 3.756  | 4.244  |
| 100 kHz <sup>1</sup> | 1.414 Vrms (4 Vpp)  | A               | VMax/Min | 3.756  | 4.244  |
| 100 kHz              | 6.372 Vrms (18 Vpp) | A               | VMax/Min | 16.16  | 19.84  |
| 100 kHz <sup>1</sup> | 6.372 Vrms (18 Vpp) | B               | VMax/Min | 16.16  | 19.84  |

<sup>1</sup> Press **SWAP A** < **B** key.

<sup>2</sup> Remove the tunable active filter from the connection.

<sup>3</sup> Press **MATH** key, **FUNCTION** ? ? keys to select **(K\*X+L)/M**, and **ENTER**.

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

**11. Trig Level A&B Outputs**

**a. Performance Check**

- (1) Connect the TI **TRIG LEVEL A OUT** (rear panel) to the multimeter inputs.
- (2) Press TI keys as listed in (a) through (d) below:
  - (a) **LOCAL/PRESET**.
  - (b) **TRIGGER LEVEL SET A**.
  - (c) Use the **DATA ENTRY** keys to enter SET A levels listed in table 6 below.
  - (d) **ENTER**.
- (3) Verify that the multimeter indicates within limits listed in table 6 below.
- (4) Repeat technique of (2)(b), (c), (d) and (3) above for remaining rows in table 6

Table 6. Trigger Level A&B

| Test instrument    |         | Multimeter indication |           |
|--------------------|---------|-----------------------|-----------|
| SET A              | SET B   | Min (Vdc)             | Max (Vdc) |
| +5.00 V            | -----   | 4.720                 | 5.280     |
| -5.00 V            | -----   | -5.280                | -4.720    |
| 0.00 V             | -----   | -0.030                | +0.030    |
| ----- <sup>1</sup> | +5.00 V | 4.720                 | 5.280     |
| -----              | -5.00 V | -5.280                | -4.720    |
| -----              | 0.00 V  | -0.030                | +0.030    |

<sup>1</sup>Move multimeter connection from **TRIG LEVEL A OUT** to **TRIG LEVEL B OUT** (rear panel)

- (5) Disconnect equipment setup.

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



**12. Power Supply**

**NOTE**

Do not perform power supply check if all other parameters are within tolerance. If any of the power supply checks are out of tolerance perform the entire calibration adjustment procedures in the manufacturer’s service manual for this instrument.

**a. Performance Check**

(1) Connect multimeter negative lead to TI GND L41 (fig. 1), and connect the positive lead to the appropriate test point listed in table 7.

(2) Verify that the multimeter indicates within limits listed in table 7 for each of the test points. If multimeter does not indicate within limits specified in table 7, perform adjustments listed.

Table 7. Power Supply Check

| Test instrument test point locations (fig. 1) | Dc voltage limits |       |
|---|-------------------|-------|
|   | Min               | Max   |
| X15 +5V                                       | +4.70             | +5.30 |
| X16 +5.2V                                     | -5.05             | -5.15 |
| X14 +7V                                       | +6.90             | +7.10 |
| +12V X17                                      | 11.90             | 12.10 |

**b. Adjustments**

(1) Adjust 5V ADJ (fig. 1) for 5.00 V indication on multimeter (R).

(2) Repeat paragraph **11a** above and perform the entire calibration adjustment procedures in the manufacturer’s service manual for this instrument.

**13. Final Procedure**

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

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

**THESE ARE THE INSTRUCTIONS FOR SENDING 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@avma27.army.mil](mailto:whomever@avma27.army.mil)

To: [2028@redstone.army.mil](mailto: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:** TB 9-6625-xxxx-35
9. **Pub Title:** Calibration Procedure for ...
10. **Publication Date:**
11. Change Number:
12. **Submitted Rank:** MSG
13. **Sumitter 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:**

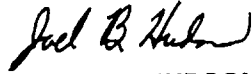
This is the text for the problem below line 27.

**TB 9-6625-2331-35**

By Order of the Secretary of the Army:

**ERIC K. SHINSEKI**  
*General, United States Army*  
*Chief of Staff*

**OFFICIAL:**



**JOEL B. HUDSON**  
*Administrative Assistant to the*  
*Secretary of the Army*

0207309

Distribution:

To be distributed in accordance with IDN 344740, requirements for calibration procedure TB 9-6625-2331-35.

