*TB 9-6625-2331-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR ELECTRONIC COUNTER FLUKE, MODEL PM6681/656

Headquarters, Department of the Army, Washington, DC
18 December 2008

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 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 9-6625-2331-35, dated 21 September 2007, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Electronic Counter, 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. Report adjustments made to bring TI in tolerance.

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 Aging rate (after 48 hour warm-up): $< 5 \times 10^{-10}$ per day Aging rate (after 24 hour warm-up): $< 1 \times 10^{-8}$ per month Aging rate (after 24 hour warm-up): $< 7.5 \times 10^{-8}$ per year Line voltage variation (for 10% variation): $<5 \times 10^{-10}$ Total uncertainty @ 2σ: $<1 \times 10^{-7}$ per year
Channel A and B sensitivity	20 mV rms (-21 dBm), <100 MHz 30 mV rms (-17 dBm), 100 to 200 MHz 40 mV rms (-15 dBm), 200 to 250 MHz 60 mV rms (-11 dBm), >250 MHz
Channel C sensitivity	20 mV rms (-21 dBm), 150 to 300 MHz 10 mV rms (-27 dBm), 300 to 2500 MHz 20 mV rms (-21 dBm), 2500 to 2700 MHz
Volt max/min	Range: -50 to +50 V dc 100 mV to 100 V pp (1 Hz to 100 MHz) Accuracy: 5 V dc (1X) ±(1% + 4 mV) 50 V dc (10X) ±(2% + 40 mV) 5 V pp (1X) <30 MHz ±(6% + 4 mV) 5 V pp (1X) >30 MHz ±(25% + 4 mV) 50 V pp (10X) ±(10% + 40 mV)
Trig level outputs	±(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. 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)
AUTOTRANSFORMER	Range: 105 to 125 V ac 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 DCV: 4 to 40 V dc Accuracy: ±.275%	Fluke, Model 5720A (5720A) (p/o MIS-35947)
FREQUENCY COUNTER	Range: 10 Mhz Resolution: ≥10 digits Accuracy: N/A	(AN/USM459B)
FREQUENCY DIFFERENCE METER	Range: 10 MHz Resolution: 1 part in 10^{-10} per day	Tracor, Model 527E
MULTIMETER	Range: -5.15 to +12.1 V dc Accuracy: ±0.2%	Fluke, Model 8840A/AF05 (AN/GSM-64D)
SIGNAL GENERATOR	Range: 1 MHz to 2 GHz Amplitude: -27 to -11 dBm Accuracy: ±3%	Aeroflex, Model 2023B (2023B)
TIME/FREQUENCY WORKSTATION	Frequency: 10 MHz Accuracy: 1.25 parts in 10^{-10} per day	Datum, Model ET6000-75 (13589305)
TUNABLE ACTIVE FILTER	50 kHz low pass 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.

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 **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.

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. 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 warm-up 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 10 MHz output to frequency counter 10 MHz reference input connector and set frequency counter external reference on.

(2) Connect TI **FREQ STD OUT 10 MHz** output jack (rear panel) to frequency counter **Channel A** input.

(3) Verify frequency counter indicates between 9.999999000 and 10.00000100 MHz; annotate calibration condition, and continue with procedure.

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

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

NOTE

The following time base adjustment is performed during each calibration to correct for aging (drift) and should only be reported as an out-of-tolerance condition if the TI is not within the limits in step (3) above.

(6) Adjust R4 (fig. 1) for a minimum indication on frequency difference meter 10^{10} range or better. Record frequency difference meter indication.

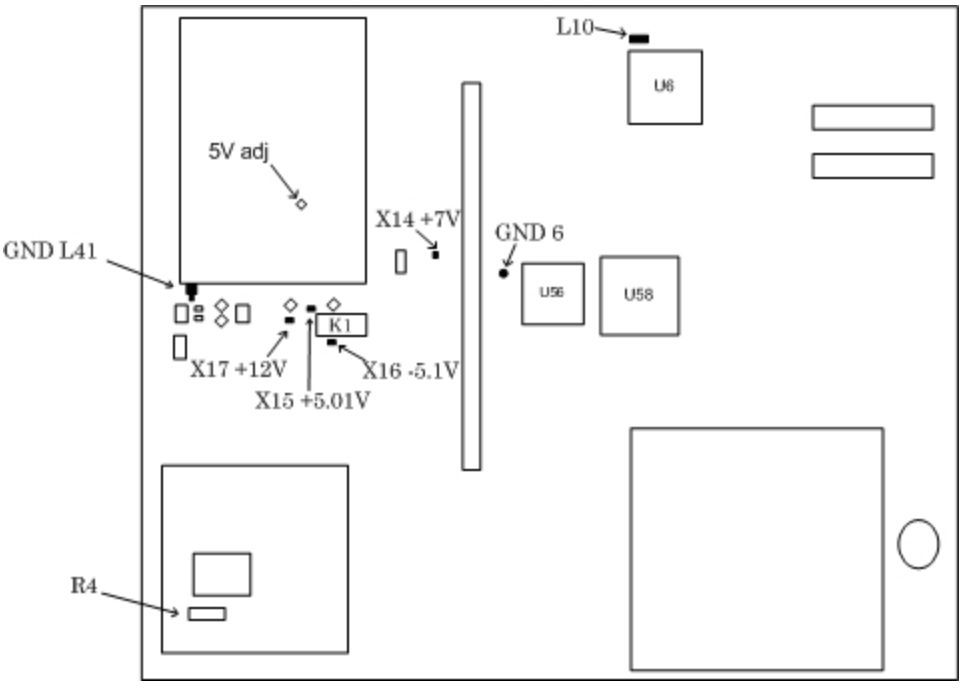


Figure 1. Top view.

(7) Allow at least 24 hours for stabilization. Frequency difference meter indication will remain within 5 parts in 10^{-10} of indication recorded in step (6) above.

(8) 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}.

(9) 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}.

(10) Adjust autotransformer output to 115 V.

b. Adjustments. No further adjustments can be made.

9. Sensitivity

a. Performance Check

(1) Press TI **LOCAL/PRESET** key.

(2) Press both **INPUT A 50Ω/1MΩ** and **INPUT B 50Ω/1MΩ** key to select **50Ω**.

(3) Connect signal generator RF output to TI **INPUT A**.

(4) Set signal generator to settings in first row of table 3 with RF output off.

(5) Set the signal generator RF output to on. If TI does not indicate a stable display of the applied frequency as listed in table 3, perform **b** below.

(6) Repeat steps (4) and (5) above for remaining settings listed in table 3.

Table 3. Input A and B Sensitivity

Signal generator settings	
Frequency (MHz)	Amplitude (dBm)
1	-21
50	-21
100	-21
200	-17
250	-15
300	-11
1[1]	-21
50	-21
100	-21

[1]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 50Ω/1MΩ** to **INPUT C**.

(8) Connect 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 frequency and amplitude to the first settings in table 4 with RF output off.

(11) Set the signal generator RF output to on. If TI does not display a stable indication of the applied frequency as listed in table 4, perform **b** below.

(12) Repeat steps (10) and (11) above for remaining settings listed in table 4.

Table 4. Input C Sensitivity.

Signal generator settings	
Frequency (MHz)	Amplitude (dBm)
150	-21
200	-21
500	-27
1000	-27
2000	-27

(13) Disconnect all equipment and cables from TI.

b. Adjustments

(1) Press **FUNCTION** ◄ ►, as needed, to select **DUTY FA**.

(2) Press TI keys on both **INPUT A** and **INPUT B** as listed in (a) through (c) below:

(a) **50Ω/1MΩ** key to select **50Ω**.

(b) **AC/DC** to select **AC**.

(c) **AUTO** to select **Manual X1**.

(3) Press **SET A** and use ▼ ▲ keys, as needed, to set trigger level to **0.000V**.

(4) Press **ENTER**.

(5) Press **SET B** and use ▼ ▲ keys, as needed, to set trigger level to **0.000V**.

(6) Press **ENTER**.

(7) Connect signal generator to TI **INPUT A 50Ω/1MΩ.**

(8) Set signal generator for a 1 kHz, -16dBm output.

(9) Adjust Offset A (R18) (fig. 2.) until TI indicates 0.500 ± 0.001.

(10) Move signal generator connection to TI **INPUT B 50Ω/1MΩ**.

(11) Press **SWAP**.

(12) Adjust Offset B (R44) (fig 2.) until TI indicates 0.500 ± 0.001.

(13) Disconnect equipment from TI.

(14) Connect calibrator to TI **INPUT A 50Ω/1MΩ** using a tee-connector.

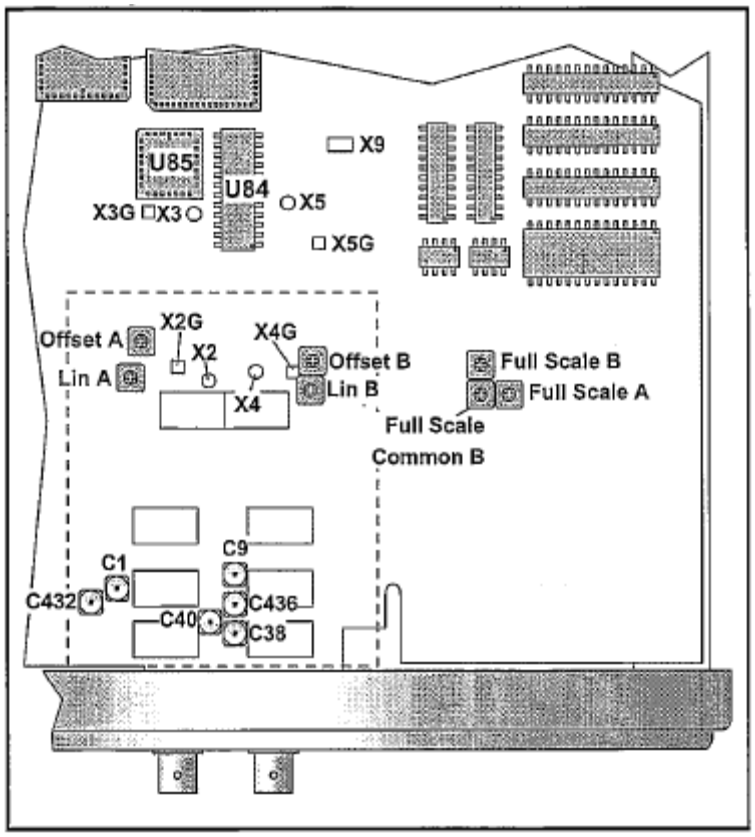
(15) Press TI keys as listed in (a) through (g) below:

(a) **AUX MENU**.

(b) **FUNCTION** ◄ ►keys, as needed, to select **AU. COdES** and **ENTER**.

(c) **DATA ENTRY** keys to type 23.1 and **ENTER**.

(d) **TIME** and ▼ ▲ keys, as needed, to set time to 80 ns.



Front

Figure 2. Top view.

(e) **STAT** and ▼▲ keys, as needed, to select **MEAN**.

(f) **DATA ENTRY** keys to type 10 and **ENTER**.

(g) **1X/10X** to select **X1**.

NOTE

If **1X** cannot be selected, adjust R308 first.

(16) Adjust Full Scale A (R308) (fig. 2) until TI indicates the same multimeter value ± 1 mV.

(17) Select **COMMON**.

(18) Press **SWAP**.

(19) Adjust Full Scale Common B (R311) (fig. 2) until TI indicates the same as multimeter value ± 1 mV.

(20) Move calibrator connection to TI **INPUT B 50Ω/1MΩ.**

(21) Deselect **COMMON** and **SWAP**.

(22)Adjust Full Scale B (R331) (fig. 2) until TI indicates the same as multimeter value ± 1 mV.

10. Volts Maximum/Minimum

a. Performance Check

NOTE
Ensure all cables are disconnected from TI.

(1) Press TI keys as listed in (a) through (f) below:

(a) **LOCAL/PRESET**.
(b) **INPUT A AC/DC** to **DC**.
(c) **INPUT A 50Ω/1MΩ** to select **1MΩ.**
(d) **FUNCTION ◄ ►**keys to select the **VOLT A MAX/MIN** function.
(e) **AUX MENU**.
(f) **FUNCTION ◄ ►**keys to select the **CAL HYST** function and **ENTER**.

(2) Verify that the TI indicates within the limits listed in first row of table 5.

(3) Connect calibrator **OUTPUT HI** and **LO** connectors to the tunable active filter **INPUT CH1** and connect the tunable active filter **OUTPUT CH1** to **INPUT A 50Ω/1MΩ** and **INPUT B 50Ω/1MΩ**.

(4) Set up the tunable active filter as a 50 kHz low pass filter.

(5) Set calibrator frequency and amplitude to first setting listed in table 5. TI should indicate within the limits listed in table 5.

(6) Repeat (5) above for remaining settings listed in table 5.

Table 5. Volt Max/Min

Calibrator		Test instrument			
Frequency	Amplitude	Input	Function	Min	Max
----------	----------	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[1]	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[1]	-4.00 V	A	VMax	-4.044	-3.956
DC	-4.00 V	A	VMin	-4.044	-3.956
DC[2]	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[1]	-40.0 V	B	VMax	-40.84	-39.16
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[3]	1.414 Vrms (4 Vpp)	B	VMax/Min	3.756	4.244
100 kHz[1]	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[1]	6.372 Vrms (18 Vpp)	B	VMax/Min	16.16	19.84

[1] Press **SWAP A↔B** key.
[2] Remove the tunable active filter from the connection.
[3] 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 (b) below:

(a) **LOCAL/PRESET**.

(b) **TRIGGER LEVEL SET A**.

(3) Press **DATA ENTRY** keys to set TI to first setting listed in table 6.

(4) Press **ENTER** and verify multimeter indicates within limits listed in table 6.

(5) Repeat steps (3) and (4) above for remaining settings in table 6.

Table 6. Trigger Level A&B

Test instrument	Multimeter indication	
Trigger Level Output	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
+5.00 V[1]	4.720	5.280
-5.00 V	-5.280	-4.720
0.00 V	-0.030	+0.030

[1]Press **TRIGGER LEVEL SET B** and move multimeter connection from **TRIG LEVEL A OUT** to **TRIG LEVEL B OUT** (rear panel).

(6) 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.

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

TI test point locations (fig. 1)	Dc voltage limits	
	Min	Max
X15 +5.01V[1]	+4.98	+5.04
X16 -5.1V	-5.05	-5.15
X14 +7V	+6.90	+7.10
X17+12V	11.90	12.10

[1]If the +5V voltage is out-of -tolerance, then all other levels will be out, since they are based on the +5V level.

b. Adjustments

(1) Connect multimeter negative lead to TI GND6 and connect the positive lead to L10 (fig. 1).

(2) Adjust 5V adj (fig. 1) for 5.000 ± 0.001 V indication on multimeters.

13. 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
0719038

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 344740, requirements for calibration procedure TB 9-6625-2331-24.

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.

PIN: 085116-000