

# \*TB 9-6625-2217-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

## CALIBRATION PROCEDURE FOR DIGITAL ELECTRONIC COUNTER AN/USM-459A, (RACAL DANA, MODEL 1992, OPTIONS 04E AND 55)

Headquarters, Department of the Army, Washington, DC  
25 March 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](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.

SECTION		Paragraph	Page
I.	IDENTIFICATION AND DESCRIPTION		
	Test instrument identification.....	1	2
	Forms, records, and reports .....	2	2
	Calibration description .....	3	2
II.	EQUIPMENT REQUIREMENTS		
	Equipment required .....	4	3
	Accessories required.....	5	3
III.	CALIBRATION PROCESS		
	Preliminary instructions.....	6	4
	Equipment setup .....	7	4
	Time base stability .....	8	5
	Channel A sensitivity .....	9	5
	Channel B sensitivity .....	10	7
	Channel C sensitivity .....	11	8
	Trigger levels .....	12	9
	Final procedure.....	13	10

\*This bulletin supersedes TB 9-6625-2117-35, dated 14 September 1998.

**SECTION I  
IDENTIFICATION AND DESCRIPTION**

**1. Test Instrument Identification.** This bulletin provides instructions for the calibration of Digital Electronic Counter, AN/USM-459A (Racal Dana, Model 1992, Options 04E and 55). The manufacturer's manual and TM 11-6625-3232-40 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.** Model 1992, option 04E, is the high stability ovened oscillator and option 55 is the GPIB interface.

**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 specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Timebase	Frequency: 10 MHz Aging rate: $<\pm 1 \times 10^{-9}$ per day after 48 hours operation Aging rate: $<\pm 5 \times 10^{-10}$ per day (10 day average) Line variation: $<\pm 5 \times 10^{-10}$ for 10% line variation
Channel A sensitivity	25 mV rms: Dc to 100 MHz (dc coupled) 10 Hz to 100 MHz (ac coupled) 50 mV rms: 100 to 160 MHz
Channel B sensitivity	25 mV rms: Dc to 100 MHz (dc coupled) 10 Hz to 100 MHz (ac coupled)
Channel C sensitivity	$<15$ mV rms: 40 MHz to 1 GHz $<75$ mV rms: 1 to 1.3 GHz
Trigger level outputs	Range: -5.1 to +5.1 V Accuracy: $\pm 1\%$ V output $\pm 10$ 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 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	General Radio W10MT3AS3 (7910809) or Ridge, Model 9020A (9020A), or Ridge, Model 9020F (9020F)
FREQUENCY COUNTER	Range: 10 Mhz Accuracy: <2 parts in 10 <sup>8</sup>	Fluke, Model PM6681/656 (PM6681/656)
FREQUENCY DIFFERENCE METER	Accuracy: <±1.25 parts in 10 <sup>10</sup>	Tracor, Model 527E (527E)
FUNCTION GENERATOR	Function: Sine wave, 50Ω Frequency: 10 Hz to 100 kHz Amplitude: 1 to 71 mVp-p	Agilent, Model 33250A (33250A)
MULTIMETER	Range: -14.95 to +15.05 V dc Accuracy: ±0.08%	Fluke, Model 8840A/AF05 (AN/GSM-64D)
SIGNAL GENERATOR	Frequency: 10 to 1300 MHz Amplitude: 1 to 75 mVrms	Wiltron, Model 68347M
TIME/FREQUENCY WORKSTATION	Frequency: 1 and 10 MHz Accuracy: <± 1.25 parts in 10 <sup>10</sup>	Datum, Model ET6000-75 (13589305)

### 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. Additional maintenance information is contained in the manufacturer's manual and TM 11-6625-3232-40 for this TI.

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

a. Remove protective covers as needed to make adjustments.

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

c. Press **POWER ON OFF** pushbutton to **ON** and allow at least 72 hours for stabilization.

d. TI will assume the following states:

(1) Display **00000000**.

(2) **Hz, RESOLUTION, FREQ A, INPUT A** and **INPUT B** LEDs ON.

(3) **INPUT A** and **INPUT B TRIG** LEDs may be ON or OFF.

## 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 **10MHz STD. OUTPUT** to frequency counter **Channel A** input.
- (3) Adjust frequency counter for a stable indication. Frequency counter should indicate between 9.999999819 and 10.00000019 MHz.

#### NOTE

The limits in step (3) above are based on a one year interval + LSD of frequency counter. To determine time base drift limits for TI with other intervals: multiply aging rate per day by the interval (days).

- (4) Connect time/frequency workstation 1 MHz output to frequency difference meter **REF INPUT**.
- (5) Connect TI **10MHz STD. OUTPUT** to frequency difference meter **SIG INPUT**.

#### NOTE

The time base is adjusted during each calibration in order to correct for drift and improve reliability of the TI throughout the interval. If TI is within the limits in step (3) above, then the following time base adjustment will not be annotated as an out-of-tolerance condition.

- (6) Adjust TI rear panel **FREQ STD ADJUST FINE** and **COARSE** for a minimum indication on frequency difference meter  $10^{10}$  range. Record frequency difference meter indication.
- (7) Allow at least 24 hours for oscillator stabilization. Frequency difference meter indication will remain within 1 part in  $10^9$  of indication recorded in (6) above.
- (8) Adjust autotransformer output to 105 V and allow 2 minutes for stabilization. Frequency difference meter will indicate a drift of less than 5 parts in  $10^{10}$ .
- (9) Adjust autotransformer output to 125 V and allow 2 minutes for stabilization. Frequency difference meter will indicate a drift of less than 5 parts in  $10^{10}$ .
- (10) Adjust autotransformer output to 115 V.
- (11) Disconnect frequency difference meter from TI.

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

## 9. Channel A Sensitivity

### a. Performance Check

- (1) Press TI **INPUT A 50Ω/1MΩ** key to select **50Ω (LED ON)**.

- (2) Connect signal generator **OUTPUT RF** to TI **INPUT A**.
- (3) Set signal generator frequency to 160 MHz and amplitude to 1 mV. Slowly increase signal generator amplitude until TI displays a stable indication at approximately 160 MHz. If signal generator amplitude exceeds 50 mV, perform **b** below.
- (4) Repeat technique of step (3) above at 100 MHz and 10 MHz; if signal generator amplitude exceeds 25 mV, perform **b** below.
- (5) Disconnect TI from signal generator.
- (6) Connect TI **INPUT A** to function generator **Function Outputs Unbalanced**.
- (7) Press TI **RESET/CONTINUE** key.
- (8) Set function generator for a sine wave, 100 kHz, 1 mVp-p, 50Ω output. Slowly increase function generator amplitude until TI displays a stable indication at approximately 100 kHz. If function generator amplitude exceeds 71 mVp-p; perform **b** below.
- (9) Repeat step (8) above at 5 kHz and 10 Hz.
- (10) Disconnect function generator from TI.

**b. Adjustments**

- (1) Disconnect signal or function generator from TI **INPUT A** and press TI **RESET/CONTINUE** key.
- (2) Adjust R149 (fig. 1) fully ccw.
- (3) Adjust R192 (fig. 1) to its mid-point.
- (4) Press TI **RESOLUTION** ↓ key until display indicates **000**.
- (5) Connect signal generator rear panel **EXT REF INPUT** to TI rear panel **10MHz STD. OUTPUT**.
- (6) Connect signal generator **OUTPUT RF** to TI **INPUT A**.
- (7) Set signal generator frequency to 100 MHz and amplitude to 3 mV.

**NOTE**

Adjustment of R192 in (8) below will cause random displays to occur on both sides of the correct setting.

- (8) Adjust R192 (fig. 1) to obtain a stable  $100.0 \pm 0.1 E^{-6}$  TI indication with **GATE** and **INPUT A TRIG** LEDs flashing.
- (9) Disconnect signal generator from TI **INPUT A**.
- (10) If TI does not indicate  $100.0 \pm 0.1 E^{-6}$  without **GATE** LED flashing; repeat step (6) above through step (10).
- (11) Press TI **RESET/CONTINUE** key.
- (12) Press TI **RESOLUTION** ↑ key until display indicates **00000000**.
- (13) Reconnect signal generator **OUTPUT RF** to TI **INPUT A**.
- (14) Set signal generator amplitude to 13 mV.

- (15) Slowly adjust R149 (fig. 1) cw until TI display just becomes unstable.

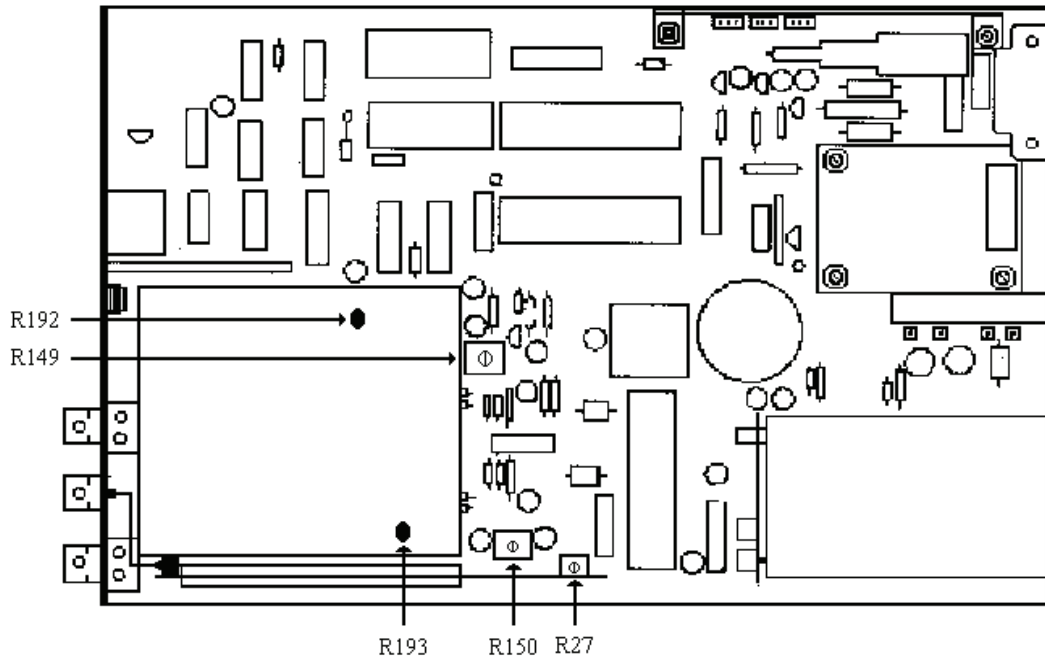


Figure 1. Adjustment locations, test instrument top view.

- (16) Slowly adjust R149 (fig. 1) ccw until TI display stabilizes and indicates  $100.000000 \pm 0.000001$ .
- (17) Set signal generator amplitude to 7 mV.
- (18) If TI GATE LED is flashing; repeat (14) above through (18).

## 10. Channel B Sensitivity

### a. Performance Check

- (1) Press TI **INPUT B 50Ω/1MΩ** key to select **50Ω** (LED ON).
- (2) Press TI keys **2, 1, SHIFT, STORE, SF, SHIFT, SF**.
- (3) Connect signal generator **OUTPUT RF** to TI **INPUT B**.
- (4) Set signal generator frequency to 100 MHz and amplitude to 1 mV. Slowly increase signal generator amplitude until TI displays a stable indication at approximately 100 MHz. If signal generator amplitude exceeds 25 mV, perform **b** below.
- (5) Repeat step (4) above at 10 MHz.
- (6) Disconnect TI from signal generator.
- (7) Connect TI **INPUT B** to function generator **Function Outputs Unbalanced**.
- (8) Press TI **RESET/CONTINUE** key.

(9) Set function generator for a sine wave, 100 kHz, 1 mVp-p, 50  $\Omega$  output. Slowly increase function generator amplitude until TI displays a stable indication at approximately 100 kHz. If function generator amplitude exceeds 71 mVp-p; perform **b** below.

(10) Repeat step (9) above at 5 kHz and 10 Hz.

(11) Press TI keys **2, 0, SHIFT, STORE, SF, SHIFT, SF**.

(12) Disconnect function generator from TI.

### **b. Adjustments**

(1) Disconnect signal or function generator from TI **INPUT B** and press TI **RESET/CONTINUE** key.

(2) Adjust R150 (fig. 1) fully ccw.

(3) Adjust R193 (fig. 1) to its mid-point.

(4) Press TI **RESOLUTION**  $\downarrow$  key until TI displays **000**.

(5) Connect signal generator rear panel **EXT REF INPUT** to TI rear panel **10MHz STD. OUTPUT**.

(6) Connect signal generator **OUTPUT RF** to TI **INPUT B**.

(7) Set signal generator output to 100 MHz and output level to 3 mV rms.

### **NOTE**

Adjustment of R193 in (8) below will cause random displays to occur on both sides of the correct setting.

(8) Adjust R193 (fig. 1) to obtain a stable  $100.0 \pm 0.1 E6$  TI indication with **GATE** and **INPUT B TRIG** LEDs flashing.

(9) Disconnect signal generator from TI **INPUT B**.

(10) If TI does not indicate  $100.0 \pm 0.1 E^{-6}$  without **GATE** LED flashing, repeat step (6) above through (10).

(11) Press TI **RESET/CONTINUE** key.

(12) Press TI **RESOLUTION**  $\uparrow$  key until display indicates **00000000**.

(13) Reconnect signal generator **OUTPUT RF** to TI **INPUT B**.

(14) Set signal generator amplitude to 13 mV.

(15) Slowly adjust R150 (fig. 1) cw until TI display just becomes unstable.

(16) Slowly adjust R150 (fig. 1) ccw until TI display stabilizes and indicates  $100.000000 \pm .000001$ .

(17) Set signal generator amplitude to 7 mV.

(18) If TI **GATE** LED is flashing; repeat step (14) above through (18).

## **11. Channel C Sensitivity**

### **a. Performance Check**



- (1) Press TI **RESET/CONTINUE** key.
- (2) Connect signal generator **OUTPUT RF** to TI **INPUT C 50Ω**.
- (3) Press **FUNCTION**  $\uparrow$  or  $\downarrow$  key to select **INPUT C**.
- (4) Set signal generator frequency to 1300 MHz and amplitude to 1 mV. Slowly increase signal generator amplitude until TI displays a stable indication at approximately 1300 MHz. If signal generator amplitude is not less than 75 mV; perform **b** below.
- (5) Repeat technique of step (4) above at 1000 MHz, 500 MHz, 100 MHz and 40 MHz. If signal generator amplitude is not less than 15 mV; perform **b** below.
- (6) Disconnect signal generator from TI.

### **b. Adjustments**

- (1) Connect signal generator rear panel **EXT REF INPUT** to TI rear panel **10MHz STD. OUTPUT**.
- (2) Adjust R27 (fig. 1) fully cw.
- (3) Set signal generator frequency to 1000 MHz and amplitude to 8 mV.
- (4) Slowly adjust R27 (fig. 1) ccw to obtain a stable TI indication of 1000.00000  $\pm$ 0.00001 with **GATE LED** flashing.
- (5) Set signal generator amplitude to 7 mV.
- (6) If TI **GATE LED** is flashing; repeat (3) above through (6).

## **12. Trigger Levels**

### **a. Performance Check**

- (1) Cycle **POWER ON/OFF** pushbutton from **OFF** to **ON**.
- (2) Connect multimeter **INPUT HI** to TI rear panel **A TRIGGER LEVEL OUTPUTS** and **INPUT LO** to TI chassis ground.
- (3) Press TI keys **INPUT A TRIG LEVEL, 5, INPUT A TRIG LEVEL**.
- (4) Multimeter will indicate between +4.94 and +5.06 V dc.
- (5) Press TI keys **INPUT A TRIG LEVEL, 5, SHIFT, +/-, INPUT A TRIG LEVEL**.
- (6) Multimeter will indicate between -5.06 and -4.94 V dc.
- (7) Press TI keys **INPUT A TRIG LEVEL, 0, INPUT A TRIG LEVEL**.
- (8) Multimeter will indicate between -0.010 and +0.010 V dc.
- (9) Connect multimeter **INPUT HI** to TI rear panel **B TRIGGER LEVEL OUTPUTS**.
- (10) Press TI keys **INPUT B TRIG LEVEL, 5, INPUT B TRIG LEVEL**.
- (11) Multimeter will indicate between +4.94 and +5.06 V dc.
- (12) Press TI keys **INPUT B TRIG LEVEL, 5, SHIFT, +/-, INPUT B TRIG LEVEL**.
- (13) Multimeter will indicate between -5.06 and -4.94 V dc.
- (14) Press TI keys **INPUT B TRIG LEVEL, 0, INPUT B TRIG LEVEL**.

(15) Multimeter will indicate between -0.010 and +0.010 V dc.

(16) Disconnect multimeter from TI.

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

**13. Final Procedure**

**a.** Deenergize and disconnect all equipment and reinstall protective covers on TI.

**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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*Administrative Assistant to the  
Secretary of the Army*

0802810

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Distribution:

To be distributed in accordance with the initial distribution number (IDN) 343075, requirements for calibration procedure TB 9-6625-2217-24.



### 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](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.





