*TB 9-6625-1963-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR UNIVERSAL COUNTER/TIMER TEKTRONIX, MODEL 7D15

Headquarters, Department of the Army, Washington, DC
24 September 2007

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 9-6625-1963-35, dated 19 April 1978, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Universal Counter/Timer, Tektronix Model 7D15. The manufacturer's instruction 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 3 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
Time base	Frequency: 5 MHz Stability: ± 1 part in 10^7/mo[1]
Trigger amplifier compensation	Proper response of trigger amplifier to square wave input
Input compensation	Proper response of input attenuator to square wave
Input sensitivity	Channel A: 100 mV p-p, dc to 100 MHz Channel B: 100 mV p-p, dc to 225 MHz

[1]Verified over 4 hour period as function of time base accuracy (± 0.5 p/m).

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)
FREQUENCY COUNTER	Range: 1 MHz Accuracy: 0.1 part in 10^6	Fluke, Model PM6681/656 (PM6681/656)
FUNCTION GENERATOR	Frequency: 1 kHz Amplitude: 100 mV to 30 V p-p	(SG-1288/G)
OSCILLOSCOPE	Sensitivity: 5 mV to 5V per div Bandwidth: 1 kHz to 3 MHz	Agilent, OS-303/G (OS-303/G)
SIGNAL GENERATOR	Range: 100 MHz to 225 MHz Amplitude: 0 to 53 mV rms	Aeroflex, Model 2023 (2023) or (SG-1207/U)
TEST OSCILLOSCOPE W/VERTICAL AND HORIZONTAL PLUG IN UNITS	Bandwidth: Dc to 225 MHz Sensitivity: 5 mV per div Sweep rate: 0.1 µs div	[1]

[1]Tektronix, Model 7633, w/plug-in units 7B50 and 7A16A or equivalent items. Available with TI.

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 manufacturers' manuals for this TI.

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

7. Equipment Setup

WARNING

HIGH VOLTAGE is used 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.

NOTE

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. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in the manufacturer's manual for this TI.

NOTE

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

a. Remove side panels from TI.

b. Install TI in right vertical compartment of test oscilloscope, using extender.

c. Connect test oscilloscope to 115 volt power source and allow 20 minutes for warm-up.

d. Position controls of test oscilloscope as listed in (1) through (3) below:

(1) **VERTICAL MODE** switch to **LEFT**.

(2) **TRIGGER SOURCE** switch to **VERTICAL MODE**.

(3) **MAIN TRIGGER SOURCE** switch (horizontal plug-in) to **INTERNAL**.

8. Time Base

a. Performance Check

(1) Position TI controls as listed in (a) through (k) below:

(a) **A** and **B SLOPE +** pushbutton switches to **+** (in).
(b) **A** and **B COUPL AC** pushbutton switches to AC (in).
(c) **SOURCE INPUT B** pushbutton switch to input A (out).
(d) **A** and **B P-P SENS** knobs set to **.1V**.
(e) **DISPLAYED WAVEFORM** switch to **PSEUDO GATE**.
(f) **GATE** pushbutton switch to **NORM**.
(g) **MODE** pushbutton switch to **PERIOD A**.
(h) **AVERG** pushbutton switch to **X1**.
(i) **CLOCK** pushbutton switch to **1ms**.
(j) **STORAGE** switch to **ON**.
(k) **INT/EXT CLOCK MODE** switch (fig. 1) to **INT**.

(2) Connect frequency counter input to TI **CLOCK OUT** jack, using termination and cable supplied with TI.

(3) Press **CLOCK 1μs** pushbutton switch.

(4) Adjust CLOCK ADJUSTMENT (fig. 1), for a frequency counter indication of 1.000000 MHz.

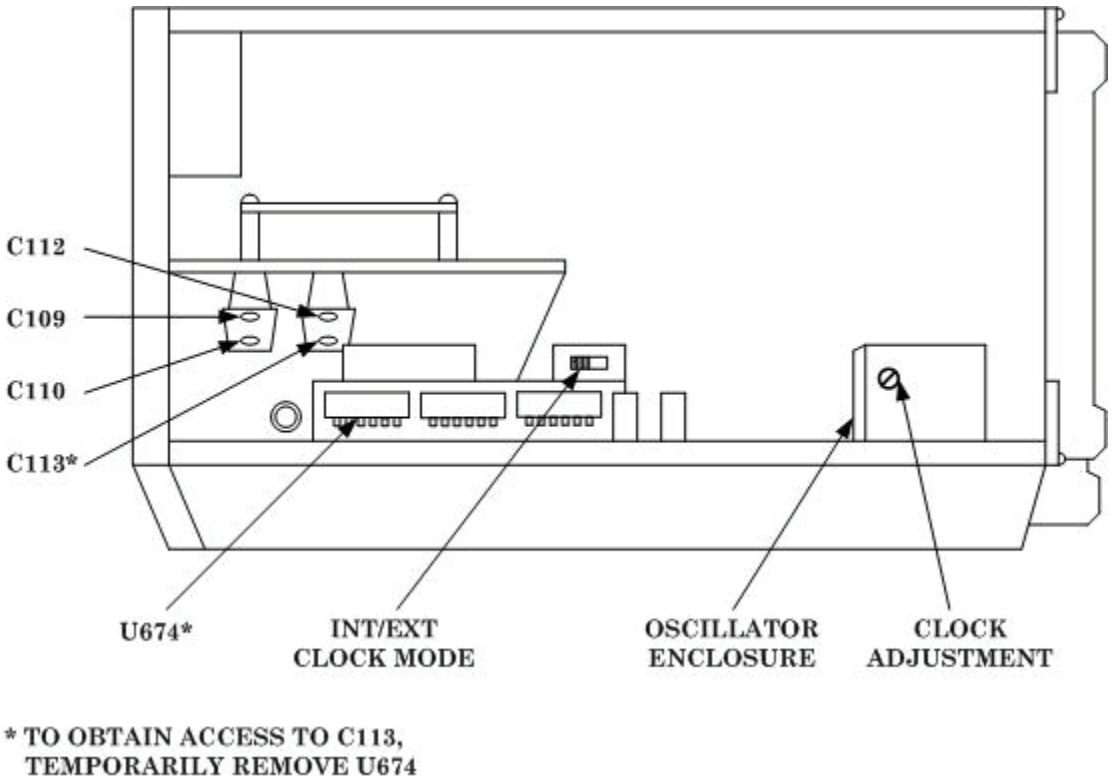

Figure 1. Right side view-component locations.

NOTE

Some oscillators have a metal cover screw which will change the oscillator frequency when replaced. Verify that frequency counter indicates proper CLOCK frequency with cover screw in place.

(5) Allow 4 hours for oscillator stabilization. After 4 hours, oscillator frequency will not have drifted more than 0.6 Hz (hertz).

b. Adjustments. No further adjustments can be made.

9. Trigger Amplifier Compensation

a. Performance Check

(1) Connect function generator to TI A input.

(2) Set TI **A** and **B COUPL AC** switches to DC (out).

(3) Adjust vertical sensitivity of oscilloscope for 20 mV (millivolts) per division.

(4) Connect oscilloscope to test point TP141 (fig. 2), using a X10 probe.

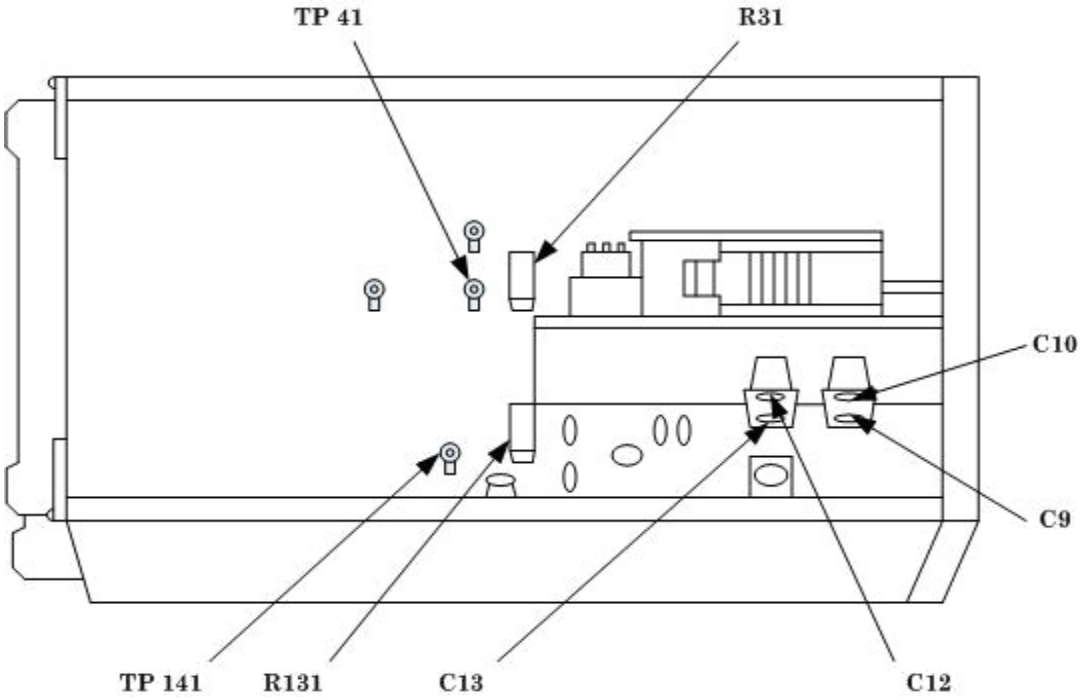

Figure 2. Left side view - component locations.

(5) Adjust frequency of function generator to obtain 1 kHz and amplitude for a 5-division vertical deflection on test oscilloscope.

(6) If oscilloscope does not display square wave with sharp leading corners, perform **b** (1) below.

(7) Connect oscilloscope probe to test point TP41 (fig. 2). If oscilloscope does not display square wave with sharp leading corners, perform **b** (2) below.

b. Adjustments

(1) Adjust R131 (fig. 2) for best leading corner of square wave (R).

(2) Adjust R31 (fig. 2) for best leading corner of square wave (R).

10. Input Compensation

a. Performance Check

(1) Connect function generator to TI A input using a 50 Ω feedthrough termination.

(2) Connect oscilloscope to test point TP41 (fig. 2), using a X10 probe.

(3) Set **A P-P SENS** switch to **1V**.

(4) Adjust function generator amplitude to obtain a 4 division vertical deflection on oscilloscope. If roll off or spikes on square wave exceed ±0.32 major division, perform **b** (1) below.

(5) Set **A P-P SENS** switch to 10 V and repeat technique of (4) above. If roll off or spikes on square wave exceed ±0.32 major division, perform **b** (2) below.

(6) Connect function generator to TI B input, and connect oscilloscope probe to test point TP141 (fig. 2).

(7) Set **TRIGGER SOURCE INPUT B** switch to input B (in) and B **P-P SENS** switch to **1V**.

(8) Adjust function generator amplitude to obtain a 4-division vertical deflection on oscilloscope. If roll off or spikes on square wave exceed ±0.32 major division, perform **b** (3) below.

(9) Set **B P-P SENS** switch to **10V** and repeat technique of (8) above. If roll off or spikes on square wave exceed ±0.32 major division, perform **b** (4) below.

b. Adjustments

(1) Adjust C12 and C13 (fig. 2) for best flatness of square wave (R).

(2) Adjust C9 and C10 (fig. 2) for best flatness of square wave (R).

(3) Adjust C112 and C113 (fig. 1) for best flatness of square wave (R).

(4) Adjust C109 and C110 (fig. 1) for best flatness of square wave (R).

11. Input Sensitivity

a. Performance Check

(1) Connect signal generator to TI **B FREQ IN** jack, using a 50 Ω feedthrough termination.

(2) Adjust signal generator frequency to obtain 225 MHz and amplitude for minimum output.

(3) Position TI controls as listed in (a) through (e) below:

(a) **MODE** pushbutton switch to **FREQ B**.
(b) **TIME** pushbutton switch to **10ms**.
(c) **SOURCE INPUT B** pushbutton switch to B (in).
(d) **A** and **B P-P SENS** switches to **1V**.
(e) **A** and **B LEVEL** controls to **PRESET**.

(4) Slowly increase signal generator amplitude until test oscilloscope displays stable count of applied frequency. Signal generator amplitude will not exceed 53 mV rms.

(5) Reduce signal generator frequency to 100 MHz and amplitude to minimum.

(6) Move signal generator connection to TI **A** input jack.

(7) Position TI controls as listed in (a) through (c) below:

(a) **MODE** pushbutton switch to **PERIOD A**.
(b) **AVERG** pushbutton switch to **X1000**.
(c) **CLOCK** pushbutton switch to **10ns**.

(8) Slowly increase signal generator amplitude until test oscilloscope displays a stable indication of approximately 10 ns. Signal generator amplitude will not exceed 53 mV rms.

b. Adjustments. No adjustments can be made.

12. Final Procedure

a. Deenergize and disconnect all equipment and reinstall TI protective cover.

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:

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0720401

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 343044, requirements for calibration procedure TB 9-6625-1963-24.

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.