*TB 9-4931-504-40

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DUAL TRACE DELAYED SWEEP SAMPLER, TEKTRONIX TYPE 5S14N

Headquarters, Department of the Army, Washington, DC
7 May 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 9-4931-504-50, dated 31 May 1979, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Dual Trace Delayed Sweep Sampler, Tektronix Type 5S14N. The manufacturers' manual was used as the prime data source in compiling these instructions. The above equipment 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 4 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	Performance specifications
VERTICAL SYSTEM	
Risetime	350 ps or less, 10 to 90% of step pulse signal
Bandwidth (-3 dB)	Dc to 1 GHz
Input resistance	50 Ω within 2%
Deflection factor: Accuracy Variable	2 mV/div to 0.5 V/div in 8 steps of 1, 2, 5 sequence ±3% (with VARIABLE at CAL) At least 2.5:1
Input signal range: Maximum operation	 2 V p-p (dc + peak ac) ±2V
Dc offset range	±2 V or more
Displayed noise(tangential)	2 mV or less, LOW NOISE switch “out”
Low noise operation	Displayed noise reduced by at least 5 times
Vertical signal out	0.2 V/div of deflection, ±3%
Dot slash	Less than 0.1 div at 10 Hz and above
Delta t range	Shifts channel 2 at least ±1 ns with respect to channel 1

Table 1. Calibration Description - Continued

Test instrument	Performance specifications
HORIZONTAL SYSTEM	
Delaying time base:	
Time base range	100 μs/div to 10 ns/div
Time base accuracy	Within ±2%, excluding first 1/2 div of displayed sweep
Delay zero range	0-9 div or more
Delay time multiplier	Each turn equal to 1 crt division
Delay accuracy	Within 1% of full screen when measured between 1st and 10th crt division
Delayed time base:	
Range	100 μs/div to 100 ps/div in 19 steps of 1, 2, 5 sequence
Accuracy	±3%, excluding first 1/2 div of displayed sweep
Variable	At least 2.5:1
Time base display modes:	Conventional display, max lead time, left intensified dot indicates time zero (multiplier zero), right intensified dot indicates point at which delayed sweep starts. Time between dots is read from crt or delay time multiplier dial.
Delayed time base	Delayed sweep starts immediately at end of delay time. Set by delay plus delay time multiplier.
Triggering:	
Amplitude range	
External	10 mV to 2 V p-p
Internal	50 mV to 2 V p-p
Input resistance	51 Ω +10%, ac coupled
Normal triggering modes:	
Sine waves	150 kHz to 100 MHz
Pulse	10 Hz to 100 MHz
Minimum rise rate	10 mV/μs
AUTO TRIG modes:	105 kHz to 100 MHz
Sine waves	10 mV p-p at 100 MHz (ext)
Minimum amplitude	1 kHz to 100 MHz
Pulse	10 ns at 1 kHz
Minimum pulse width	10 mV/μs
Minimum rise rage	100 MHz to 1 GHz
HF SYNC mode:	
Sine waves	
Scan controls:	24-40 Hz repetition rate
Repetitive	1 sweep/single sweep start pushbutton pressed
Single sweep	slightly greater than 10 div
Manual scan range	1 V/div ±5%
Ext scan	150 V
Max sensitivity	
Max input voltage	
Horizontal output signal	1 V/div ±5%
Amplitude	

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 Reference Calibration Standards Set, NSN 4931-00-621-7878. 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. The following peculiar accessory is also required for this calibration: Extender, Tektronix type 067-0645-00 (two required).

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
CALIBRATOR	Range: 3.42 to 911 mV rms at 50 kHz Accuracy: ±0.75%	Fluke, Model 5720A (5720A) (p/o MIS-35947)
MULTIMETER	Range: -30.9 to +30.9 V dc Accuracy: ±0.75%	Hewlett Packard, Model 3458A (3458A)
OSCILLOSCOPE	Must be supplied with TI	Tektronix, Type 5440 (MIS-28706-1)
OSCILLOSCOPE CALIBRATOR	Range: 10 to 500 MHz Range: 2 ns to 10 ms Accuracy: +0.75%	Fluke, Model 5820A-5C-GHZ (5820A-5C-GHZ)
PULSE GENERATOR	Range: 87.5 ps or less	Hewlett-Packard, Model 1105A/ 1106A (MIS-10215)

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 **22** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **8** through **22**. Do not perform power supply check if all other parameters are within tolerance.

e. Unless otherwise specified, all controls are 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 the safety precautions. REDUCE OUTPUT(s) to minimum after each step within the performance check where applicable.

a. Remove TI side panels and connect to oscilloscope center and right hand compartments, using two extenders.

b. Position controls as listed in (1) through (8) below:

(1) **CH1**, **INT CH1**, **REP** pushbuttons pressed and all others released.

(2) **DC OFFSET** controls midrange.

(3) **SCAN** control fully cw.

(4) **TRIGGERING HOLDOFF** control fully ccw.

(5) **DELAYING SWEEP** and **DELAYED SWEEP SEC/DIV** switches to **5 μs** and **DELAYED SWP VAR** control fully ccw.

(6) **DELAY ZERO** and **DELAY TIME MULT** controls ccw.

(7) **CH1** and **CH2 VOLTS/DIV** switches to **.2V**.

(8) Both **VOLTS/DIV CAL** controls fully ccw (to detent).

c. Energize and allow 30 minutes for warm-up.

8. Vertical Deflection

a. Performance Check

(1) Connect calibrator to TI **CH1 INPUT**.

(2) Adjust calibrator output frequency for 50 kHz and amplitude for 0.3535 V rms.

(3) Adjust **TRIGGERING LEVEL** control for stable display. If oscilloscope does not display 5 divisions of vertical deflection, adjust **CH1 GAIN** control for 5 divisions of deflection.

(4) Adjust calibrator for 5 divisions of vertical deflection for settings and indications listed in table 3. Calibrator will indicate within limits specified.

Table 3. Vertical Deflection Check

Test instrument **VOLTS/DIV** switch settings	Calibrator indications (mV rms)	
	Min	Max
0.5 V	857.238	910.263
0.1 V	171.448	182.053
50 mV	85.7238	91.0263
20 mV	34.2895	36.4105
10 mV	17.1448	18.2053

(5) Press **CH2** pushbutton and repeat technique of (1) through (4) above for **CH2**.

b. Adjustments. No adjustments can be made.

9. Triggering

a. Performance Check

(1) Set **CH1 VOLTS/DIV** switch to **50 mV**.

(2) Press **CH1** pushbutton and set **DELAYING SWEEP** and **DELAYED SWEEP** to **1 μS**.

(3) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** to **CH1 INPUT**.

(4) Adjust oscilloscope calibrator level sine output frequency for 1 MHz and amplitude for 2 divisions of vertical deflection.

(5) Adjust **TRIGGERING LEVEL** control for stable display.

(6) Alternately press and release **+SLOPE** pushbutton. If display does not remain stable and white dot on **TRIGGERING LEVEL** control does not indicate between 11 and 1 o'clock positions, perform **b** below.

b. Adjustments. Set **TRIGGERING LEVEL** control to 12 o'clock position and adjust R212 (fig. 1) for stable display while pressing and releasing **+SLOPE** button.

10. Sync Level

a. Performance Check

(1) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** to **CH1 INPUT**.

(2) Press **HF SYNC** and **+SLOPE** pushbuttons.

(3) Set **DELAYING SWEEP** switch to **20 nS** and **DELAYED SWEEP SEC/DIV** switch to **2 nS**.

(4) Adjust oscilloscope calibrator level sine output frequency for 480 MHz and amplitude for 2 divisions of vertical deflection.

(5) Adjust **TRIGGERING LEVEL** control for stable display on oscilloscope. If display will not stabilize, perform **b** below.

b. Adjustments

(1) Connect multimeter negative lead to base of Q201 (fig. 1) and positive lead to base of Q202 (fig. 1).

(2) Adjust R530 (fig. 1) for 0 (zero) voltage indication on multimeter.

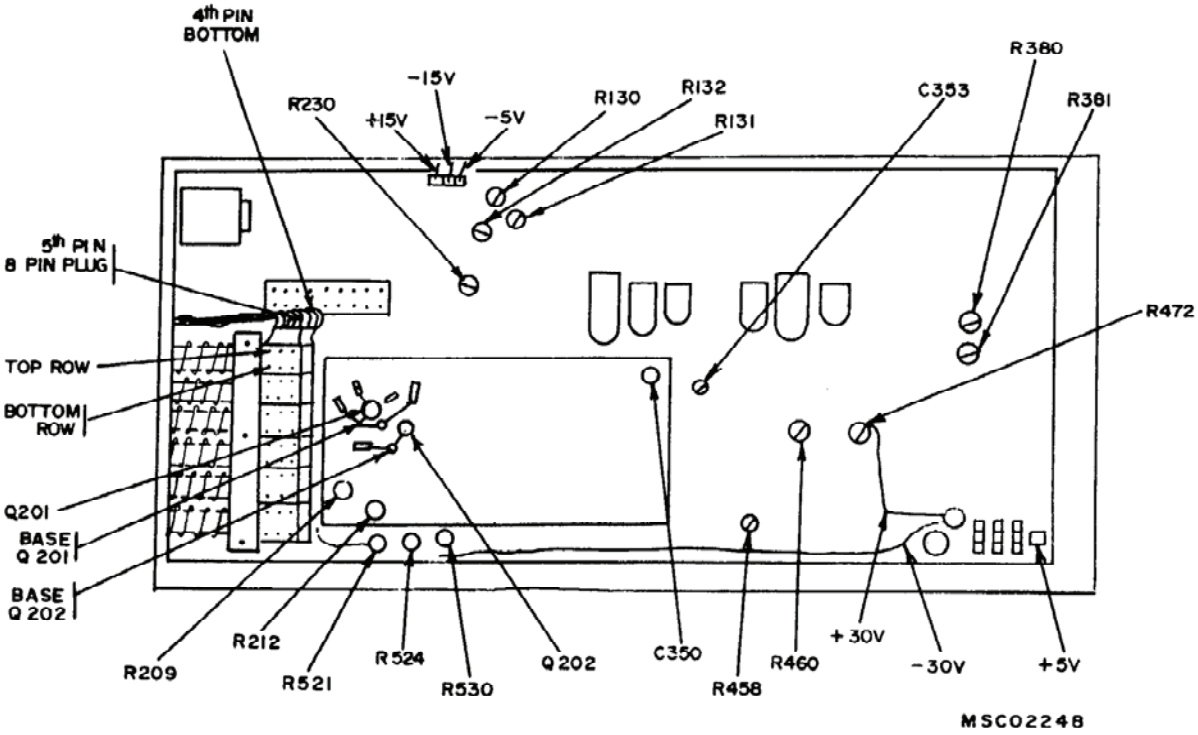

Figure 1. Test instrument - right -side view.

11. Positive and Negative Balance

a. Performance Check

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

(a) **CH2 VOLTS/DIV** switch to **50 mV**.
(b) **DELAYING SWEEP** and **DELAYED SWEEP SEC/DIV** switches to **1 μS**.
(c) **HF SYNC** pushbutton released.
(d) **INT CH1** pushbutton released.
(e) **REP** pushbutton pressed.

(2) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** to **CH1 INPUT** and **EXT INPUT**.

(3) Adjust oscilloscope calibrator level sine output frequency for 1 MHz and amplitude for 2 divisions of vertical deflection on oscilloscope.

(4) Adjust **TRIGGERING LEVEL** control for stable display. If stable display cannot be obtained, perform **b** below.

(5) Press **AUTO TRIG** pushbutton and adjust **TRIGGERING LEVEL CONTROL** for stable display.

(6) Press and release **+SLOPE** pushbutton. Display will remain stable while triggering on positive and negative slope of waveform.

(7) Set **CH1 VOLTS/DIV** switch to **5 mV** and adjust oscilloscope calibrator for 2 divisions of vertical deflection.

(8) Repeat technique of (4) through (6) above.

(9) Set **DELAYING SWEEP** and **DELAYED SWEEP SEC/DIV** switch to 0.1 μS and adjust oscilloscope calibrator frequency to 10 MHz and amplitude for 2 divisions of vertical deflection.

(10) Repeat technique of (4) through (6) above.

(11) Set **DELAYING SWEEP** and **DELAYED SWEEP SEC/DIV** switches to **10 nS** and adjust oscilloscope calibrator frequency to 100 MHz and amplitude for 2 divisions of vertical deflection.

(12) Repeat technique of (4) through (6) above.

b. Adjustments

(1) Remove oscilloscope calibrator from equipment setup.

(2) Press **AUTO TRIG** pushbutton and turn **TRIGGERING LEVEL** control fully cw.

(3) Connect multimeter negative lead to base of Q201 (fig. 1) and positive lead to base of' Q202 (fig. 1).

(4) Adjust R524 (fig. 1) for a +60 mV dc indication on multimeter.

(5) Turn **TRIGGERING LEVEL** control ccw and adjust R521 (fig. 1) for a -60 mV dc indication on multimeter.

NOTE

When adjustments are performed, reconnect equipment as applicable in **a** above.

12. Sync Bias

a. Performance Check

(1) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** to **CH1 INPUT**.

(2) Set TI **CH1 VOLTS/DIV** switch to **50 mV** and press **INT CH1** and **HF SYNC** pushbuttons.

(3) Adjust oscilloscope calibrator frequency for 100 MHz and amplitude for one half division of vertical deflection.

(4) Adjust **LEVEL** control for stable display on oscilloscope. If display does not stabilize with **LEVEL** control, perform **b** below.

b. Adjustments. Preset **TRIGGERING LEVEL** control fully ccw and adjust R209 (fig. 1) fully ccw and then slowly cw until display synchronizes.

13. Timing

a. Performance Check

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

(a) **CH1**, **INT CH1**, **SWP**, **+SLOPE**, and **REP** pushbuttons pressed.
(b) **CH1**, **VOLTS/DIV** switch to **0.5 V**.
(c) **DELAYING SWEEP** and **DELAYED SWEEP SEC/DIV** switches to **1 μS**.
(d) Adjust **DELAY ZERO** fully ccw and **DELAY TIME MULT** dial to **10.00**.
(e) Press and release **HF SYNC**.

(2) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** to **CH1 INPUT**.

(3) Set oscilloscope calibrator to 1 μS marker output.

(4) Adjust **TRIGGERING LEVEL** control for stable display.

(5) Adjust **HORIZ POS** control to align 2^d marker with 2^d vertical graticule line.

(6) Adjust **SWP CAL** control to align 10^{th} marker with 10^{th} vertical graticule line. Readjust **HORIZ POSITION** control as necessary to keep 2^d marker aimed with 2^d vertical graticule line. If one marker per division is not displayed within ±0.1division over center 8 divisions, perform **b** (l) below.

NOTE

It may be necessary to reduce oscilloscope intensity before performing (7) below.

(7) Adjust **HORIZ POS** to align first dot on first graticule line. If 2^d dot is not aligned on 11^{th} graticule line, perform **b** (2) below.

(8) Release **SWP** pushbutton and set **DELAY TIME MULT** fully ccw. Adjust **DELAY ZERO** to align a marker on 2^d vertical graticule line. If 10^{th} marker is not aligned with 10^{th} vertical graticule line, perform **b** (3) below.

b. Adjustments

(1) Adjust R132 (fig. 1) to align one marker per each vertical graticule line (R).

(2) Adjust R130 and R131 (fig. 1) until first dot is aligned on first graticule and 2^d dot is aligned on 11^{th} graticule (R).

NOTE

Due to interaction, R130 (fig. 1) and R131 (fig. 1) must be readjusted for best compromise.

(3) Adjust R460 (fig. 1) to align 1 marker per each vertical graticule line (R).

14. Scan Rate

a. Performance Check

(1) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** to **CH1 INPUT**.

(2) Set oscilloscope calibrator to 10 mS markers output.

(3) Press **HF SYNC** pushbutton and release **INT CH1** pushbutton. Adjust **SCAN** control ccw until time markers stop drifting in one direction. The first point at which time markers stop drifting, oscilloscope will display three time markers. If oscilloscope does not display three time markers, perform **b** below.

b. Adjustments. Adjust R381 (fig. 1) until oscilloscope displays 3 time markers drifting toward right on crt.

15. Lead Time and Register

a. Performance Check

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

(a) **HF SYNC** pushbutton released.
(b) **INT CH1** pushbutton pressed.
(c) **DELAY ZERO** control fully ccw.
(d) **DELAY TIME MULT** dial to **0.00**.
(e) **DELAYING SWEEP** and **DELAYED SWEEP SEC/DIV** switches to **.2 μS**.

(2) Set oscilloscope calibrator markers output to 0.1 μS.

(3) Adjust **TRIGGERING LEVEL** control for a stable crt display and alternately press and release **SWP** pushbutton. If first narrow time marker does not align on 2d vertical graticule line within ±0.l divisions perform **b** below.

b. Adjustments

(1) Release **SWP** pushbutton and adjust R472 (fig. 1) until a marker is aligned on 2d vertical graticule line.

(2) Press **SWP** pushbutton and adjust R230 (fig. 1) until first narrow time mark is aligned on 2d vertical graticule line.

(3) Repeat **a** (3) and **b** (1) and (2) above for best compromise.

16. Delay Timing

a. Performance Check

(1) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** to **CH1 INPUT**.

(2) Release **SWP** pushbutton. Oscilloscope will display two time markers per each major graticule division within ±0.3 division of each graticule line.

(3) Press **SWP** pushbutton for same results in (2) above.

(4) Release **SWP** pushbutton and set **DELAYING SWEEP** and **DELAYED SWEEP SEC/DIV** switches to **1 μS**.

(5) Set oscilloscope calibrator markers output to 1 μS and adjust **TRIGGERING LEVEL** control for stable display.

(6) Set **DELAY TIME MULT** dial to **0.00** and turn **DELAY ZERO** control cw until a time mark is centered on 2d vertical graticule line.

(7) Turn **DELAY TIME MULT** dial to **1.00**. Peak of time mark will remain within ±0.1 division of 2d graticule line.

(8) Repeat technique of (7) above for **DELAY TIME MULT** setting of **2.00** through **9.00** in consecutive order for same results as in (6) above.

(9) Set **DELAY TIME MULT** to **0.00** and press **SWP** pushbutton.

(10) Set dot on first time marker with **DELAY ZERO** control.

NOTE

It may be necessary to reduce intensity on oscilloscope for suitable viewing of dots.

(11) Set **DELAY TIME MULT** control to **1.00** and observe that first intensified dot is within ±0.l division of 2^d time marker. Repeat this technique for **DELAY TIME MULT** settings of **2.00** through **9.00**. Intensified dot will be within 0.1 division of each marker.

(12) Reset dot on first time marker with **DELAY TIME MULT** control.

b. Adjustments. No adjustments can be made.

17. 10 nS/DIV Delay

a. Performance Check

(1) Set **CH1 VOLTS/DIV** switch to **.5 V** and **DELAYING SWEEP** and **DELAYED SWEEP SEC/DIV** switches to **10 nS**. Press **HF SYNC** pushbutton.

(2) Set oscilloscope calibrator to 10 nS markers output.

(3) Adjust **TRIGGERING LEVEL** control for stable display on oscilloscope.

(4) Adjust **HORIZ POS** control to align 2^d cycle on 2^d graticule line. If oscilloscope does not indicate 1 cycle per graticule division over center 8 divisions within ±0.2 divisions, perform **b** (l) below.

(5) Release **SWP** pushbutton. If oscilloscope does not display 1 cycle per graticule division over center 8 divisions within ±0.2 division, perform **b** (2) below.

b. Adjustments

(1) Adjust C350 (fig. 1) until 10^{th} cycle is aligned with 10^{th} vertical graticule line (R).

(2) Adjust **DELAY ZERO** control to set peak of one cycle on 2^d vertical graticule line; then adjust C353 (fig. 1) until 10^{th} cycle is aligned with 10^{th} vertical graticule line (R).

18. 1 nS Linearity

a. Performance Check

(1) Set oscilloscope calibrator to 2 nS markers output.

(2) Set **CH1 VOLTS/DIV** switch to **.5 V**, **DELAYING SWEEP** switch to **10 nS,** and **DELAYED SWEEP SEC/DIV** switch to **1 nS**.

(3) Adjust **TRIGGERING LEVEL** control for stable display and adjust **DELAY ZERO** control to align cycle on 2^d graticule line. If oscilloscope does not indicate 4 cycles over center 8 divisions within ±0.3 division, perform **b** below.

b. Adjustments. Adjust R380 (fig. 1) for 4 cycles of display over center 8 divisions.

19. Risetime

a. Performance Check

(1) Connect pulse generator output to **CH1** and **CH2 INPUTS**, using cable supplied with pulse generator.

(2) Position controls as listed in (a) through (f) below:

(a) Press **CH1**, **INT CH1**, **+SLOPE**, and **REP** pushbuttons and release all others.
(b) **DELAY ZERO** and **DELAY TIME MULT** fully ccw.
(c) **CH1** and **CH2 VOLTS/DIV** switches to **50 mV**.
(d) **DELAYED SWEEP SEC/DIV** switch to **.1 nS**.
(e) **TRIGGERING LEVEL** control for stable display.
(f) **LOW NOISE** pushbutton pressed.

NOTE

It may be necessary to adjust **DELAY TIME MULT** dial, **DC OFFSET**, and **TRIGGERING** controls for proper pulse presentation

(3) Measure risetime, using standard risetime technique. If risetime is not between 300 and 350 ps, perform **b** (l) below.

(4) Press **CH2** pushbutton and repeat technique of (2) (e*)* and (3) above. If risetime is not between 300 and 350 ps, perform **b** (2) below.

b. Adjustments

(1) Adjust channel 1 R20 (fig. 2) for a risetime between 300 and 350 ps.

(2) Adjust channel 2 R20 (fig. 2) for a risetime between 300 and 350 ps.

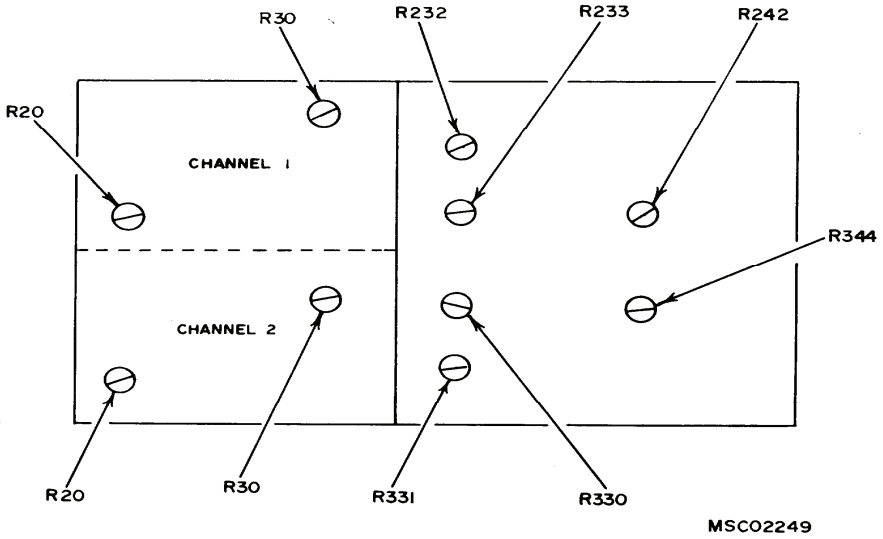

Figure 2. Test instrument - left-side view.

20. Delta t Center

a. Performance Check

(1) Connect pulse generator to CH1 and CH2 inputs, using cable supplied with pulse generator.

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

(a) **CH1** and **CH2** pushbuttons pressed.
(b) **DELAYED SWEEP SEC/DIV** switch to **1 ns**.
(c) **TRIGGERING LEVEL** control for stable display.

(3) Superimpose two displays on oscilloscope, using **CH1** and **CH2 DC OFFSET** controls.

(4) Adjust **CH1 TIME DIFF CH2** control fully cw and then fully ccw. If one display does not lead the other by 1 ns or more, perform **b** below.

(5) Press **ADD** and **CH2 INVERT** pushbuttons and adjust **CH1 TIME DIFF CH2** control for minimum amplitude.

b. Adjustments. Adjust R458 (fig. 1) in conjunction with **CH1 TIME DIFF CH2** control until either adjustment has equal control over leading edge or lagging edges of display.

21. Balance and Loop Gain

a. Performance Check

(1) Connect pulse generator to **CH1** and **CH2 INPUTS**, using cable supplied with pulse generator.

(2) Release **ADD**, **CH2**, and **CH2 INVERT** pushbuttons.

(3) Press **SWP** pushbutton and set **DELAYED SWEEP SEC/DIV** and **DELAYING SWEEP** switches to **2 μS**. If dot displayed on leading edge is not within one-half division of top display, perform **b** (l) through (7) below.

(4) Press **CH2** pushbutton. If dot displayed on leading edge is not within one-half division of top display, perform **b** (8) through (12) below.

b. Adjustments

(1) Remove connection from **CH1** and set both **DELAYED SWEEP SEC/DIV** and **DELAYING SWEEP** switches to **1 μS** and press **HF SYNC** pushbutton.

(2) Adjust R233 (fig. 2) for no vertical movement while simultaneously adjusting R232 (fig. 2) back and forth between fully ccw and 90 degree position. Readjust R232 fully ccw.

(3) Set **CH1 VOLTS/DIV** switch to **10 mV**. Center trace on horizontal graticule with **DC OFFSET** control.

(4) Press **LO NOISE** pushbutton and adjust R242 (fig. 2) for no trace shift while pressing and releasing **NO NOISE** button.

(5) Release **LO NOISE** and **HF SYNC** pushbuttons. Set **CH1 VOLTS/DIV** switch to **50 mV** and **DELAYED SWEEP SEC/DIV** and **DELAYING SWEEP** switches to **2 μS**.

(6) Reconnect pulse generator to **CH1** and release **HF SYNC** pushbutton.

(7) Adjust R232 until first dot is on rise of pulse and level with top lead corner of display.

(8) Repeat (1) above for channel 2.

(9) Adjust R330 (fig. 2) for no vertical shift while simultaneously adjusting R331 (fig. 2) back and forth between fully ccw and 90 degree position. Readjust R331 fully ccw.

(10) Repeat technique of (3) and (4) above for **CH2**, except adjust R344 (fig. 2).

(11) Repeat technique of (5) and (6) above for **CH2**.

(12) Adjust R331 until first dot is on rise of pulse and level with top lead corner of display.

22. Low Frequency Comparator

a. Performance Check

(1) Set **VOLTS/DIV** switch to **10 mV** and **DELAYED SWEEP SEC/DIV** and **DELAYING SWEEP** switches to **1 μS**.

(2) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** to **CH1** and **CH2 INPUTS**.

(3) Adjust oscilloscope calibrator square wave output frequency for 100 kHz and amplitude for 4 divisions of display. If oscilloscope does not display square wave with flat top and level within 0.2 divisions, perform **b** below.

(4) Press **CH1** and release **CH2** pushbuttons.

(5) Repeat technique of (3) above for channel 1.

b. Adjustments. Adjust channel 2, R30 (channel 1, R30) (fig. 2) for optimum square wave display.

23. Power Supply

NOTE

Do not perform power supply check if all other parameters are within tolerance.

a. Performance

(1) Connect multimeter to +30 V test point (fig. 1) and chassis ground. Multimeter will indicate between +29.1 and +30.9 V dc.

(2) Repeat technique of (1) above for test points and multimeter indications listed in table 5. Multimeter will indicate within limits specified.

Table 5. Power Supply Check

Test instrument test points (fig. 1)	Multimeter indications (V dc)	
	Min	Max
+15	+14.55	+15.45
-30	-29.10	-30.90
-15	-14.55	-15.45
-5	-4.85	-5.15
+5	+4.85	+5.15

b. Adjustments. No adjustments can be made.

24. 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:

Official:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army

0807006

Distribution:

To be distributed in accordance with STD IDS No. RLC-1500, 2 January 2003, requirements for calibration procedure TB 9-4931-504-40.

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
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15. **Submitter LName**: Smith
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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: 084698-000