*TB 9-6625-1966-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR FUNCTION GENERATOR HEWLETT-PACKARD, MODEL 3300A WITH AUX UNIT PLUG-IN, MODEL 3301A; TRIGGER/PHASE PLUG-IN, MODEL 3302A; SWEEP/OFFSET PLUG-IN, MODEL 3304A; AND SWEEP PLUG-IN MODEL 3305A

Headquarters Department of the Army, Washington, DC
4 March 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 technical bulletin supersedes TB 9-6625-1966-35, dated 12 May 2004.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Function Generator, Hewlett-Packard, Model 3300A with Aux Unit Plug-in, Model 3301A; Trigger/Phase Plug-in, Model 3302A; Sweep/Offset Plug-in, Model 3304A; and Sweep Plug-in, Model 3305A. The manufacturers' manuals 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. Section III applies to TI's with SN prefix 630. Designators enclosed in parenthesis pertain to SN prefix 519, 533, 609, 616, 622, and above.

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
Hewlett-Packard, Models 3300A with 3301A	
Power input requirements	115 V ac ± 10%
Square wave	Rise and falltime: <250 ns Symmetry error: <1% Sag: <1% Overshoot: <5%
Frequency	Range: 0.01 Hz to 100 kHz Accuracy: ±1% maximum dial setting 0.01 Hz to 10 kHz ±2% maximum dial setting on 10K range (10 to 100 kHz)
Distortion	<1%, 0.01 Hz to 10 kHz[1] <3%, on X10K range
Dc output level	<200 mV
Maximum output voltage	>35 V p-p open circuit >15 V p-p into 600 Ω >2 V p-p into 50 Ω

Footnotes at the end of table.

Table 1. Calibration Description Continued

Test instrument parameters	Performance specifications
Sine wave response[2]	± 1%, 0.01 Hz to 10 kHz ± 3%, 10 to 100 kHz
Model 3302A	
Single and multiple cycle	Single: Starts on positive or minus phase and changes from 90 to +90 Multiple: Oscillates on positive or negative portion of voltage
Trigger amplitude	Starts and stops oscillations between 0 and 500 mV
Phase lock	Requires at least 10 V p-p to lock with sine wave input
Phase dial	± 10°, 10 Hz to 10 kHz ± 20°, 10 to 100 kHz on X10K range
Introduced distortion	<1%, 10 Hz to 10 kHz <3%, 10 to 100 kHz on X10K range
Model 3304A	
Dc offset	Fine: Adjustable from -1 to +1 V Coarse: Adjustable from -16 to +16 V
Offset square wave	>15 V p-p into open circuit
Square wave	<400 ns <5% overshoot <1% sag
Sawtooth	Range: 0.01 Hz to 100 kHz Accuracy: ± 1% FS, 0.01 to 1 Hz <± 5% FS, 1 Hz to 100 kHz Output: >15 V p-p into open circuit Response: <2%, 0.01 Hz to 10 kHz <5%, 10 to 100 kHz
Flyback time	≤5% = 250 ns
Model 3305A	
Sweep width and start stop dial	Range: 0.1 Hz to 100 kHz Accuracy: ± 10%
Sweep mode	Automatic: Sweeps between start and stop frequency settings repetitively Manual: Adjustable to start and stop between settings Trigger: Sweeps between start and stop frequency settings on application of an external trigger or front panel pushbutton Sensitivity: 6 V/decade
Sweep voltage	>15 V p-p into open circuit
Sweep time	Risetime: ≤10 ms Falltime: <3 ms
External frequency	Within ± 5% of final frequency

[1]Not calibrated below 1 kHz.
[2]Not calibrated below 20 Hz.

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 297; or AN/GSM-705. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. 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.

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 accessories are also required for this calibration: Decade Resistor, Winslow 336 (7907234) and Probe, X10 passive (P6106).

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
AUDIO ANALYZER	Range: 1 kHz to 100 kHz Accuracy: ± 0.25% distortion	Boonton, Model 1121 (1121)
AUTOTRANSFORMER	Range: 105 to 125 V Accuracy: ± 1%	Ridge, Model 9020A (9020A)
CALIBRATOR	Range: 3.535 to 4.242 Vac at 100 Hz and 10 kHz Accuracy: ± 0.25% Range: 0 to 6 Vdc Accuracy: ± 0.125%	Fluke, Model 5720A (5700EP) (p/o MIS-35947)
FREQUENCY COUNTER	Range: 0.01 Hz to 105 kHz Accuracy: ± 0.06%	Fluke, Model PM6681/656 (PM6681/656)
MULTIMETER	Range: 4.85 to 5.15 V ac to 100 kHz Accuracy: ± 1.25% Range: -26.48 to +26.52 V dc Accuracy: ± 0.25%	Agilent, Model 3458A (3458A)
OSCILLOSCOPE	Range: 200 mV to 35 V Accuracy: ±3% Risetime: <62 ns	Agilent, OS-303/G (OS-303/G)

SECTION III
CALIBRATION PROCESS FOR HEWLETT-PACKARD MODEL 3300A WITH MODEL 3301A

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 **16** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **8** through **16**. 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 checks where applicable.

NOTE

The function generator, model 3300A and aux unit plug-in, model 3301A are calibrated as a unit. If required, install model 3301A into front panel of model 3300A. Only model 3300A will be referred to as the TI.

a. Connect **PWR LINE GND**, **SHIELD GND**, and **OUTPUT GND** terminals (rear) together.

b. Remove shorting strap between **FREQ DIAL** and **FREQ CONTROL** terminals (rear).

c. Connect TI to autotransformer.

d. Connect autotransformer to a 115 V ac source and adjust for a 115 V output.

e. Set **POWER** switch to on and allow at least 30 minutes for equipment to reach operating temperature.

8. Symmetry

a. Performance Check

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

(a) **RANGE** switch to **X.1**.
(b) **CHANNEL A** function switch to **SQUARE**.
(c) **CHANNEL AMPLITUDE** control to midrange.
(d) **FREQUENCY** dial to **10**.

(2) Connect calibrator to **FREQUENCY CONTROL** (rear panel).

CAUTION

Voltage must be limited to between +0.3 and -15 V. Voltage outside this range will damage TI. Do not use standby/reset position of calibrator.

(3) Adjust calibrator output to 0.3 V.

(4) Connect frequency counter to TI **CHANNEL A OUTPUT**.

NOTE

For convenience (because of long time interval of TI signal), obtain initial settings for start and stop channels with TI **RANGE** switch turned to **X100**; then, set **RANGE** switch to **X.1** and continue with performance check.

(5) Measure T_1 and T_2 (fig. 1). If T_1 does not equal T_2 within 1 percent, perform **b** below.

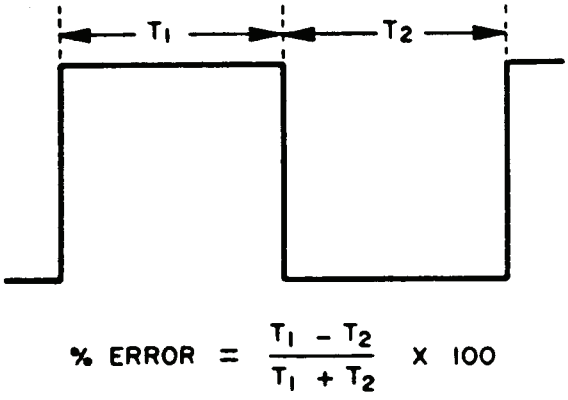

Figure 1. Symmetry waveform.

NOTE

To measure TI, set start **CHANNEL A** slope switch to positive and stop **CHANNEL B** slope switch to negative. Reverse slope switches to measure T_2.

(6) Set **RANGE** switch to **X100**.

(7) Measure T_1 and T_2 (fig. 1). If T_1 does not equal T_2 within 1 percent, perform **b** below.

b. Adjustments

NOTE

Due to interaction, if any adjustment is required all adjustments must be completed.

NOTE

When TI SN prefix is 630 or higher, perform (1) through (10) below. When TI SN prefix is 519, 533, 609, 616, or 622, perform (11) through (15) below:

(1) Turn A13R24 (fig. 2) fully ccw.

(2) Set **RANGE** switch to **X.1**.

(3) Measure T_1 and record value.

(4) Measure T_2 while adjusting A13R22 (fig. 2) until T_2 equals TI (R).

(5) Set **RANGE** switch to **X100**.

(6) Measure T_1 and T_2 and record both values.

(7) Adjust A13R23 (fig. 2) until T_2 is midway between both values recorded in (6) above (R).

(8) Measure T_1 and T_2 and record both values.

(9) Adjust A13R24 (fig. 2) until T_2 is midway between both values recorded in (8) above (R).

(10) Repeat (2) through (9) above for best in-tolerance condition.

(11) Set **RANGE** switch to **X.1**.

(12) Adjust R8 (fig. 2) until T_2 equals T_1 (R).

(13) Set **RANGE** switch to **X100**.

(14) Adjust R7 (fig. 2) until T_2 equals T_1 (R).

(15) Repeat (11) through (14) above for best in-tolerance condition.

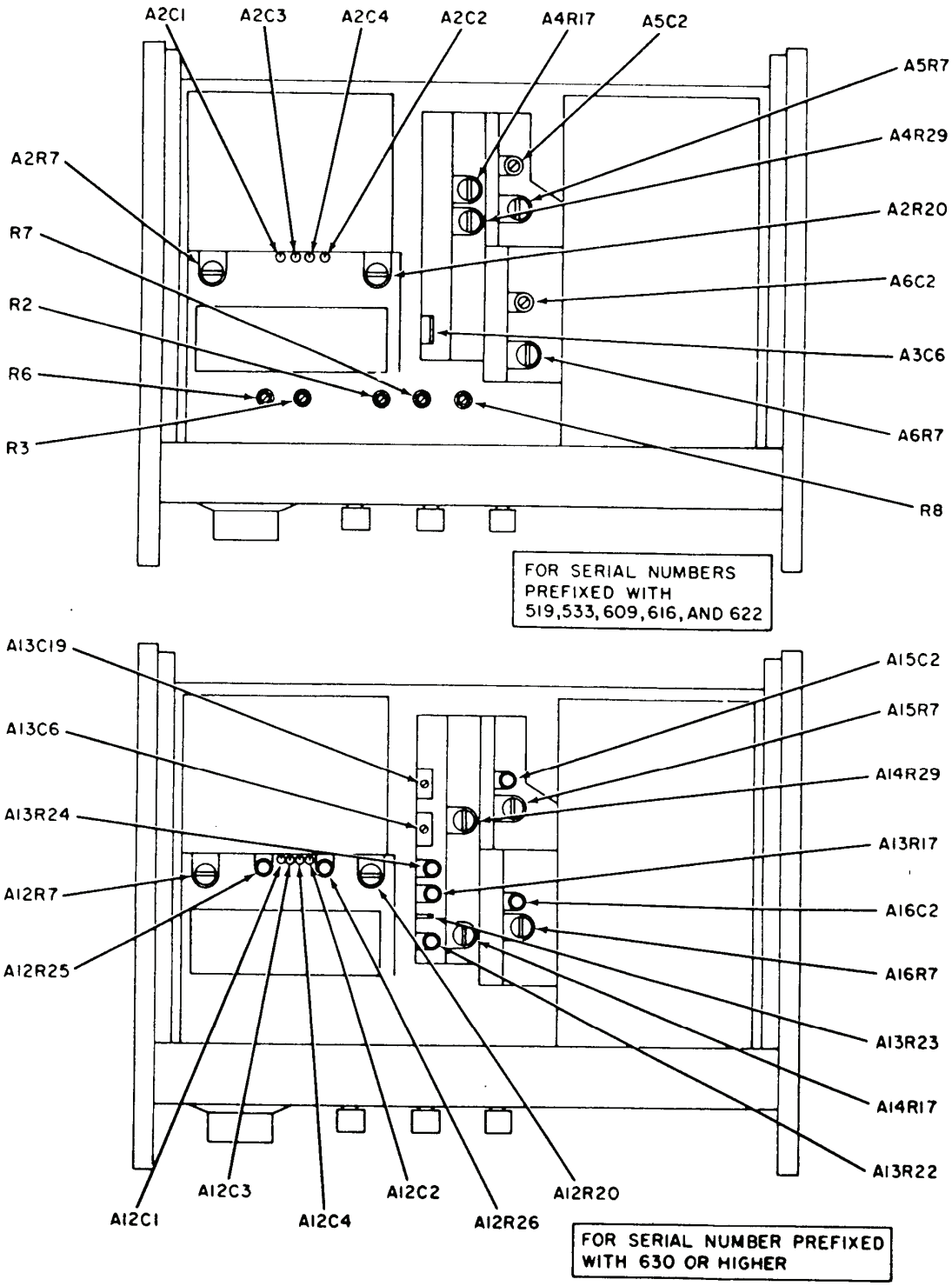

Figure 2. Model 3300A - top view.

9. Dial Accuracy and Stability

a. Performance Check

(1) Disconnect calibrator from equipment setup.

(2) Connect shorting strap between **FREQ DIAL** and **FREQ CONTROL** (rear panel).

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

(a) **FREQUENCY** dial to **1**.
(b) **RANGE** switch to **X100**.
(c) **CHANNEL A** function switch to **SINE**.

(4) Measure frequency. If frequency counter does not indicate between 9.090 and 11.111 ms, perform **b** below.

(5) Repeat (4) above at autotransformer settings of 105 and 125 V.

(6) Adjust autotransformer for 115 V output.

(7) Repeat technique of (4) above at **RANGE** and **FREQUENCY** settings listed in table 3. If frequency counter does not indicate within limits specified, perform **b** below.

b. Adjustments

(1) Set **FREQUENCY** dial to **1** and **RANGE** switch to **X100**.

(2) Loosen **FREQUENCY** dial from shaft.

(3) Rotate shaft until frequency counter indicates 10 ms (R).

(4) Set **FREQUENCY** dial to indicate 1 and tighten **FREQUENCY** dial to shaft.

(5) Set **FREQUENCY** dial to **10**.

(6) Adjust A13R17 or R6 (fig. 2) until frequency counter indicates 1 ms (R).

(7) Repeat (1) through (6) above for best in-tolerance condition.

(8) Set **RANGE** switch to **X1K** and **FREQUENCY** dial to **10**.

(9) Adjust A13C19 (fig. 2) until frequency counter indicates 10 kHz (R).

Table 3. Dial Accuracy

Test instrument		Frequency counter indications	
RANGE switch settings	**FREQUENCY** dial settings	Min	Max
X100	5	1.96 ms	2.04 ms
X100	10	0.99 ms	1.01 ms
X0.01	10	9.90 s	10.10 ms
X0.01	5	19.6 s	20.4 s
X0.01	1	90.90 s	111.11
X0.1	1	9.09 s	11.11 s
X0.1	5	1.96 s	2.04 s
X0.1	10	0.99 s	1.01 s
X1	10	99 ms	101 ms

Table 3. Dial Accuracy - Continued

Test instrument		Frequency counter indications	
RANGE switch settings	**FREQUENCY** dial settings	Min	Max
X1	5	196 ms	204 ms
X1	1	0.909 s	1.111 s
X10	1	90.9 ms	111.1 ms
X10	5	19.6 ms	20.4 ms
X10	10	9.90 ms	10.1 ms
X1K	10	9900 Hz	10,100 Hz
X1K	5	4900 Hz	5100 Hz
X1K	1	900 Hz	1100 Hz
X10K	1	8000 Hz	12,000 Hz
X10K	5	48,000 Hz	52,000 Hz
X10K	10	98,000 Hz	102,000 Hz

NOTE

No adjustments can be made in (8) and (9) above for TIs with SN prefixed with 519, 533, 609, and 616.

(10) Set **RANGE** switch to **X10K**.

(11) Adjust A13C6 or A3C6 (fig. 2) until frequency counter indicates 100,000 Hz (R).

10. Distortion

a. Performance Check

(1) Connect audio analyzer to **CHANNEL A OUTPUT**.

(2) Set **RANGE** switch to **X1K** and **FREQUENCY** dial to **1**.

(3) Measure distortion at 1 kHz. If audio analyzer does not indicate less than 1 percent distortion, perform **b** below.

(4) Set **FREQUENCY** dial to **10**. Measure distortion at 10 kHz. If audio analyzer does not indicate less than 1 percent distortion, perform (2) above and **b** below.

(5) Set **RANGE** switch to **X10K**. Measure distortion at 100 kHz. If audio analyzer does not indicate less than 3 percent distortion, perform (2) above and **b** below.

b. Adjustments. Adjust A14R17 or A4R17 (fig. 2) and A14R29 or A4R29 (fig. 2) for minimum distortion less than 1 percent (R).

11. Dc Output Level

a. Performance Check

(1) Connect **CHANNEL A OUTPUT** to oscilloscope vertical input.

(2) Set **RANGE** switch to **X100** and **FREQUENCY** dial to **10**.

(3) Set oscilloscope **VOLTS/DIV** switch to **1**. Adjust **CHANNEL A AMPLITUDE** control for 7 major divisions of vertical deflection on oscilloscope.

(4) Set oscilloscope coupling switch to **GND** and vertically center the baseline of waveform on oscilloscope screen. Set coupling switch to **DC**. If oscilloscope display is not vertically centered on graticule centerline within ± 200 mV, perform **b** (1) below.

(5) Repeat technique of (4) above with **CHANNEL A** function switch set to **TRIANGLE** and then to **SQUARE**.

(6) Remove connection from **CHANNEL A OUTPUT** and connect to **CHANNEL B OUTPUT**.

(7) Repeat (3) and (4) above for **CHANNEL B AMPLITUDE**. If oscilloscope display is not vertically centered on graticule centerline within ± 200 mV, perform **b** (2) below.

(8) Repeat (4) and (7) above with **CHANNEL B** function switch set to **TRIANGLE,** and then to **SQUARE**.

b. Adjustments

(1) Adjust A15R7 or A5R7 (fig. 2) for optimum centering of waveform on screen in **SQUARE, TRIANGLE,** and **SINE** positions of **CHANNEL A** function switch (R).

(2) Adjust A16R7 or A6R7 (fig. 2) for optimum centering of waveform on screen in **SQUARE**, **TRIANGLE**, and **SINE** positions of **CHANNEL B** function switch (R).

12. Maximum Output Voltage

a. Performance Check

(1) Connect oscilloscope to **CHANNEL OUTPUT**.

NOTE

If a substitute oscilloscope is used, it must have an input impedance of 1 MΩ or greater.

(2) Adjust **CHANNEL A AMPLITUDE** control fully ccw.

(3) Set **CHANNEL A** function switch to positions listed in table 4. Oscilloscope will indicate within limits specified.

Table 4. Output Voltage

Test instrument function switch	Oscilloscope indications (V p-p)
SINE	>35
TRIANGLE	>35
SQUARE	>35
SQUARE[1]	>2
TRIANGLE	>2
SINE	>2
SINE[2]	>15
TRIANGLE	>15
SQUARE	>15

[1]Connect 50 Ω load to TI **OUTPUT**, using decade resistor.

[2]Adjust decade resistor to 600 Ω.

(4) Adjust **CHANNEL A AMPLITUDE** control to midrange and repeat (1) through (3) above for **CHANNEL B**.

(5) Adjust **CHANNEL B AMPLITUDE** control to midrange.

b. Adjustments. No adjustments can be made.

13. Square Wave Response

a. Performance Check

(1) Connect oscilloscope to **CHANNEL A OUTPUT,** using probe.

(2) Set **RANGE** switch to **X10K** and function switch to **SQUARE.**

(3) Measure rise and fall times and sag. If rise and fall times are not less than 250 ns and sag is not less than 1 percent, perform **b** below.

(4) Adjust **CHANNEL A AMPLITUDE** control fully ccw. If overshoot is not less than 5 percent, perform **b** below.

(5) Repeat (1) through (4) above for **CHANNEL B**.

b. Adjustments

(1) For **CHANNEL A,** adjust A15C2 or A5C2 (fig. 2) for best intolerance square wave (R).

(2) For **CHANNEL B,** adjust A16C2 or A6C2 (fig. 2) for best intolerance square wave (R).

14. Sine Wave Response

a. Performance Check

(1) Connect multimeter to **CHANNEL A OUTPUT**.

(2) Set **RANGE** switch to **X100** and function switch to **SINE**.

(3) Adjust **CHANNEL A AMPLITUDE** control for a 5 V indication on multimeter.

(4) Adjust **FREQUENCY** dial in turn to 1, 5, and 10. Multimeter will indicate between 4.95 and 5.05 V at each setting.

(5) Repeat technique of (4) above at **RANGE** and **FREQUENCY** settings listed in table 5. Multimeter will indicate within limits specified.

Table 5. Sine Wave Response

Test instrument		Multimeter indications (V Ac)	
RANGE switch settings	**FREQUENCY** dial settings	Min	Max
X10	2	4.95	5.05
X10	5	4.95	5.05
X10	10	4.95	5.05
X1K	1	4.95	5.05

Table 5. Sine Wave Response Continued

Test instrument		Multimeter indications (V Ac)	
RANGE switch settings	**FREQUENCY** dial settings	Min	Max
X1K	5	4.95	5.05
X1K	10	4.95	5.05
X10K	1	4.85	5.15
X10K	5	4.85	5.15
X10K	10	4.85	5.15

b. Adjustments. No adjustments can be made.

15. Power Supply

NOTE

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

a. Performance Check. Connect multimeter between test points and chassis ground as listed in table 6 and shown in figure 2. If multimeter does not indicate within limits specified, perform appropriate adjustments listed in table 6.

Table 6. Power Supply

Test instrument test points (fig. 2)	Multimeter indications (V dc)		Adjustments (fig. 2)[1]	
	Min	Max	Adjustments	Indications
A12C2 (A2C2)	-26.48	-26.52	A12R20 (A2R20)	-26.5
A12C1 (A2C1)	+26.48	+26.52	A12R7 (A2R7)	+26.5
A12C4 (A2C4)	-19.99	-20.01	A12R26 (R3)	-20.0
A12C3 (A2C3)	+19.99	+20.01	A12R25 (R2)	+20.0

[1]All power supply adjustments interact; readjust as necessary for best compromise.

b. Adjustments. No further adjustments can be made.

16. Final Procedure

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

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

SECTION IV
CALIBRATION PROCESS FOR MODEL 3302A

17. Preliminary Instructions

a. The instructions outlined in paragraphs **17** and **18** 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. Unless otherwise specified, all controls and control settings refer to the TI.

18. 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 checks where applicable.

a. Insert TI into function generator and connect function generator to autotransformer.

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

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

d. Set function generator **FREQUENCY** dial to **10**, **RANGE** switch to **X10K**, and function switches to **SINE**.

e. Connect function generator **CHANNEL B OUTPUT** to oscilloscope **CH2** input.

f. Set TI **MODE** switch to **FREE RUN**.

g. Adjust function generator **B AMPLITUDE** control for a 30 V p-p output on oscilloscope.

19. Single and Multiple Cycle

a. Performance Check

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

(a) **EXTERNAL MANUAL** switch to **EXTERNAL**.

(b) **START/STOP PHASE** control to center.

(c) **MODE** switch to **SINGLE**.

(d) **FREQUENCY** switch to **>50KC**.

(e) **+INPUT PHASE -** switch to **+** (positive).

(2) Connect equipment as shown in figure 3.

(3) Set oscilloscope **VERTICAL MODE** switch to **ALTERNATE** and horizontal **TRIGGER SOURCE** switch to **EXTERNAL**.

(4) Adjust calibrator frequency for 10 kHz and amplitude for 4.242 V rms.

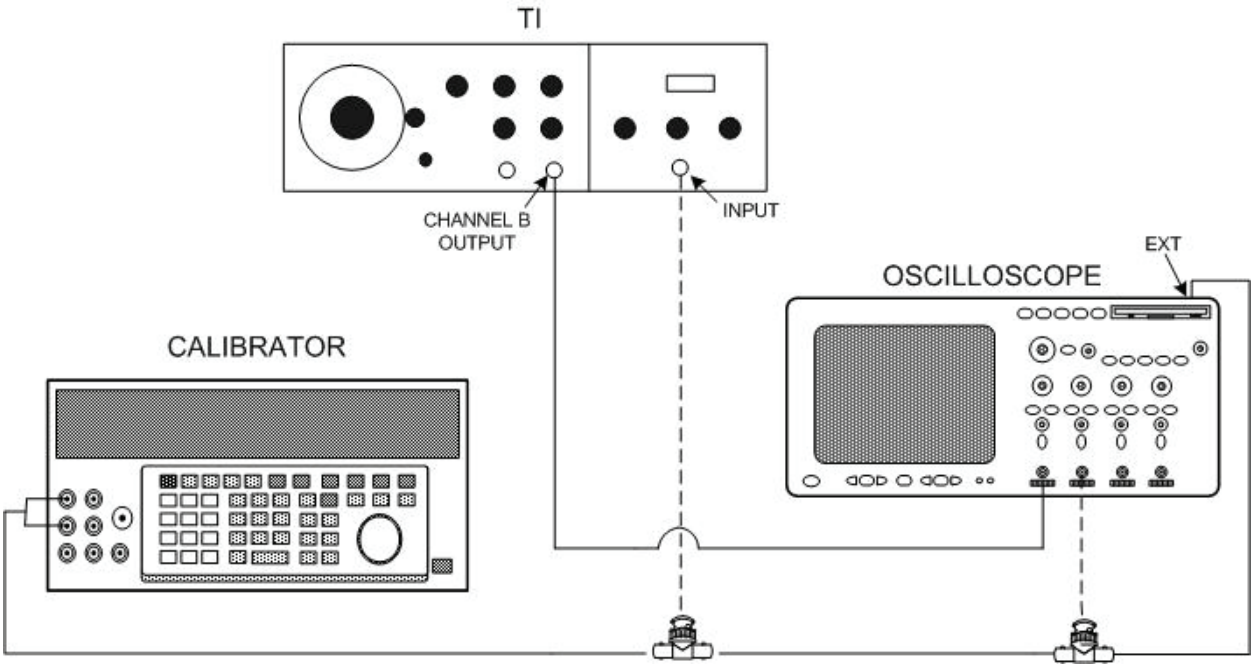

Figure 3. Single and multiple cycle - equipment setup.

(5) Adjust function generator frequency for 100 kHz.

(6) Adjust oscilloscope horizontal **TIME/DIV** switch for a convenient viewing display.

(7) Adjust TI **START/STOP PHASE** control until function generator output cycle begins at zero-degree phase on positive slope of calibrator waveform, as shown in figure 4.

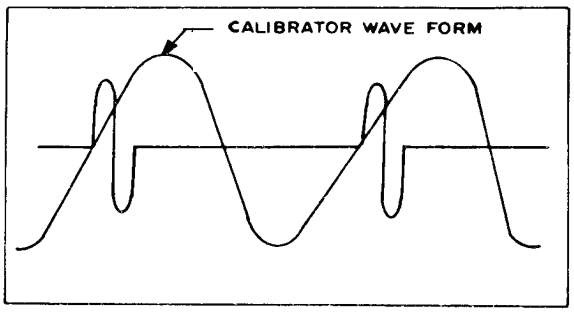

Figure 4. Single cycle phase relationship.

(8) Set TI + **INPUT PHASE** switch to **-** (negative). Function generator output cycle will begin on negative slope of calibrator waveform.

(9) Vary TI **START/STOP PHASE** dial between -90 and +90 and observe that function generator output changes from -90 to +90.

(10) Set TI **MODE** switch to **MULTIPLE**. The function generator output will appear on oscilloscope only during negative portion of the calibrator output. The last cycle of function generator output will be completed during positive portion of calibrator output.

(11) Set TI + **INPUT PHASE** -switch to **+** (positive). Oscilloscope presentation will be as in (10) above except in reverse polarity.

(12) Disconnect calibrator from TI and set oscilloscope **MODE** switch to **CH 1**.

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

(a) **EXTERNAL MANUAL** switch to **MANUAL**.
(b) **MODE** switch to **SINGLE**.
(c) **START/STOP PHASE** control centered.

(14) Set oscilloscope coupling switch to **DC**.

(15) Set function generator **RANGE** switch to **X.1** and **FREQUENCY** dial to **10**.

(16) Press TI **MANUAL TRIGGER** pushbutton and observe that oscilloscope trace moves in vertical axis, starting and stopping at the same place.

(17) Set TI **MODE** switch to **MULTIPLE** and press **MANUAL TRIGGER** pushbutton. Observe that trace moves in a vertical axis until **MANUAL TRIGGER** pushbutton is released.

b. Adjustments. No adjustments can be made.

20. Trigger Amplitude

a. Performance Check

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

(2) Connect function generator **CHANNEL B OUTPUT** to oscilloscope vertical **CH 1**.

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

(a) **MODE** switch to **MULTIPLE**.
(b) **+ INPUT PHASE -** switch to **+** (positive).
(c) **EXTERNAL MANUAL** switch to **EXTERNAL**.

(4) Adjust function generator **FREQUENCY** for **100 kHz** output.

(5) Adjust calibrator from 0 to 500 mV and observe that function generator frequency output starts and stops oscillations on oscilloscope between 0 and 500 mV.

(6) Set TI **+ INPUT PHASE** switch to **-** (negative) and reverse cable on calibrator for negative output.

(7) Repeat (5) above.

b. Adjustments. No adjustments can be made.

21. Phase Lock

a. Performance Check

(1) Connect equipment as shown in figure 3.

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

(a) **MODE** switch to **PHASE LOCK**.

(b) **FREQUENCY** switch to **>50 kHz**.

(c) **+ INPUT PHASE -** switch to **+** (positive).

(d) **CAL UNCAL** switch to B.

(e) **START/STOP PHASE** control to center.

(3) Position function generator **FREQUENCY** dial to **1** and **RANGE** switch to **X100**.

(4) Adjust calibrator frequency to 100 Hz and output for 3.535 V rms.

(5) Set oscilloscope vertical **MODE** switch to **ALTERNATE** and horizontal **TIME/DIV** switch for 4 or 5 cycles of display.

(6) Obtain phase lock by slowly rotating TI **PHASE** control. If the two displays on oscilloscope are not in phase, and if TI **LOCK RANGE** pointer is not centered, perform **b** (1) below.

NOTE

To quicken phase lock, set TI **MODE** switch to **FREE RUN** until meter pointer indicates left of lock range; then set **MODE** switch to **PHASE LOCK** for lock-in conditions.

(7) Adjust both function generator and calibrator frequencies for 1 kHz and function generator **FREQUENCY** dial to **10**.

(8) Repeat (6) above. If meter pointer is not centered and displays on oscilloscope are not in phase, perform **b** (2) below.

b. Adjustments

(1) Repeat **a** (3) and (4) above and adjust R5 (fig. 5) until meter pointer is centered and the two displays on oscilloscope are in phase (R).

(2) Repeat **a** (7) above and adjust R6 (fig. 5) for indication in **b** (1) above (R).

22. Phase Dial and Distortion

a. Performance Check

(1) Adjust function generator **FREQUENCY** for **1 kHz** and set function switch to **SINE**.

(2) Set TI + **INPUT PHASE** -switch to **+** (positive).

(3) Adjust calibrator frequency to 1 kHz and for a 3.535 V output.

(4) Set oscilloscope vertical **MODE** switch to **ALTERNATE**, adjust horizontal **TIME/DIV** switch for several cycles of display, and set **TRIGGER SOURCE** switch to **EXT**.

(5) While observing oscilloscope, obtain phase lock by adjusting TI **PHASE** control until two displays on oscilloscope are in phase. If TI **PHASE** dial does not indicate 0 ±20 degrees, perform **b** (1) below.

(6) Set TI **+ INPUT PHASE -** switch to **-** (negative). Repeat (5) above. If TI **PHASE** dial does not indicate 180 ± 10 degrees, perform **b** (2) below.

(7) Repeat (2) through (6) above for frequencies of 100 Hz and 10 kHz, respectively.

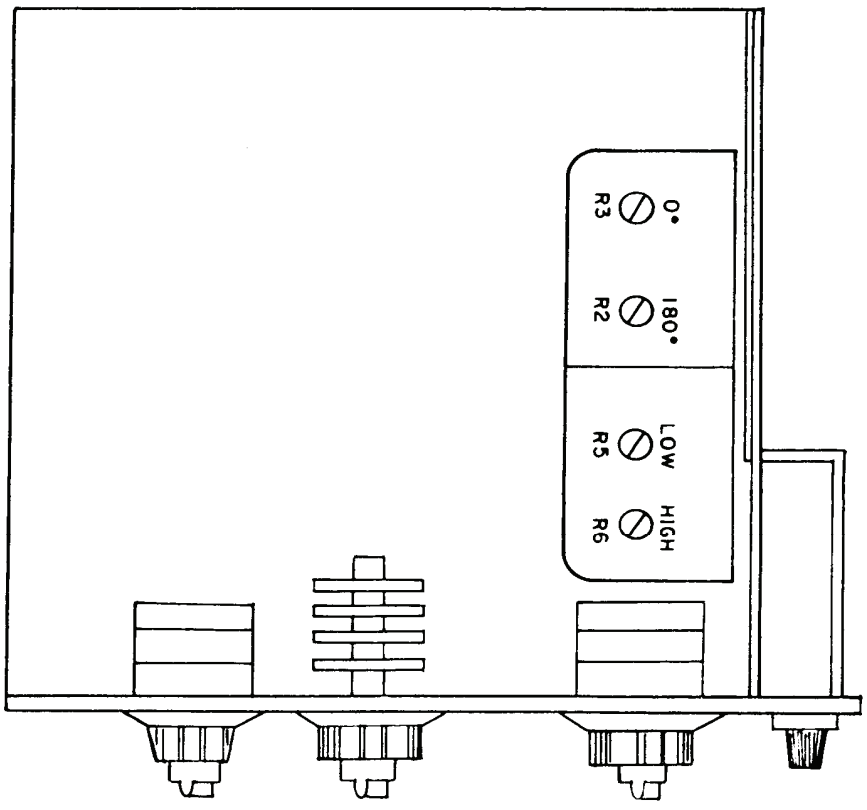

Figure 5. Model 3302A - top view.

(8) Set TI **FREQUENCY** switch to <50KC and repeat technique of (2) through (6) above for frequencies of 50 and 10 kHz.

(9) Connect audio analyzer to function generator **CHANNEL A OUTPUT**.

(10) Set TI function **MODE** switch to **FREE RUN**.

(11) Measure and record distortion.

(12) Set TI **MODE** switch to **PHASE LOCK** and insure that phase lock is obtained as indicated on oscilloscope.

(13) Repeat (11) above. Difference between recordings will be 3 percent or less.

(14) Repeat (10) through (13) above for frequency 50 kHz.

(15) Set TI **FREQUENCY** switch to **>50KC**.

(16) Repeat technique of (1), (3), and (10) through (13) above for frequencies of 10 kHz and 100 Hz. The difference between recordings will be 1 percent or less.

b. **Adjustments**

(1) Obtain phase lock and adjust **PHASE** dial to 0 degree. Adjust R3 (fig. 5) until the two displays are in phase (R).

(2) Obtain phase lock and adjust **PHASE** dial to 180 degrees and adjust R2 (fig. 5) until the two displays are in phase (R).

23. Final Procedure

a. Deenergize and disconnect all equipment.

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

SECTION V
CALIBRATION PROCESS FOR MODEL 3304A

24. Preliminary Instructions

a. The instructions outlined in **24** and **25** are preparatory to this 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. Unless otherwise specified, all controls and control settings refer to the TI.

25. 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 checks where applicable.

a. Insert TI into function generator.

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

c. Energize equipment and allow 30 minutes for equipment to reach operating temperature.

NOTE

Top cover of function generator must be removed when performing adjustments.

d. Set TI **DC OFFSET** selector switch to **+** (positive), **COARSE** control to **0V** (fully ccw), and **SWEEP WIDTH** control to **OFF**.

e. Adjust function generator controls to positions listed in (1) through (4) below:

(1) **FREQUENCY** dial to **10**.

(2) **RANGE** selector switch to **X10K**.

(3) **CHANNEL A** function switch to **SINE**.

(4) **CHANNEL A AMPLITUDE** control fully ccw.

26. Dc Offset Controls

a. Performance Check

(1) Remove **CKT-GND-to-OUTPUT GND** shorting bar on rear of function generator.

(2) Connect multimeter to function generator **CHANNEL A OUTPUT**.

(3) Rotate TI **DC OFFSET FINE** control from fully ccw to fully cw. If multimeter does not indicate between +1 V and -1 V, perform **b** below.

(4) Adjust TI **DC OFFSET COARSE** control fully cw. Multimeter will indicate greater than +16 V with **DC OFFSET COARSE** to **+** (positive) and greater than -16 V with **DC OFFSET COARSE** to **-** (negative).

(5) Set **DC OFFSET** to **-** (negative) and repeat (3) and (4) above. Multimeter will indicate reverse polarity.

(6) Replace shorting bar removed in (1) above.

b. Adjustments. Set function generator **CHANNEL A** function switch to **SQUARE** and adjust A2R24 (fig. 6) until multimeter indicates same voltage reading at both ends of **FINE** control rotation (R).

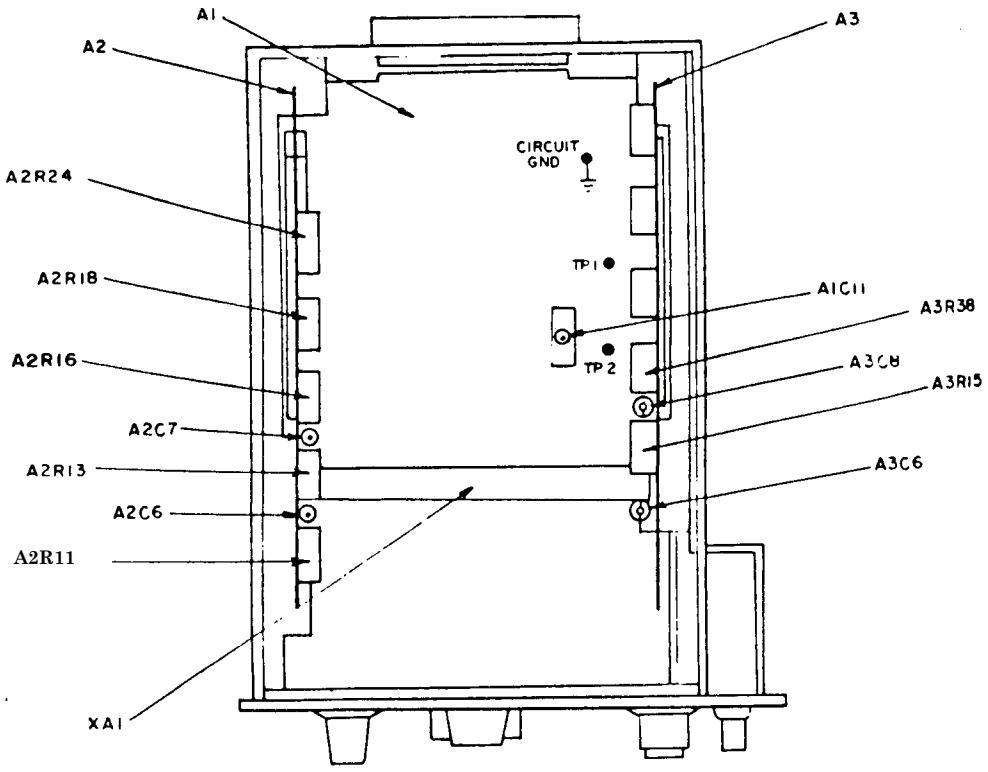

Figure 6. Model 3304A - to view.

27. Offset Square Wave

a. Performance Check

(1) Position function generator controls as listed in (a) through (d) below:

(a) **FREQUENCY** dial to **10**.
(b) **RANGE** selector switch to **X10K**.
(c) **CHANNEL A** function switch to **PLUG-IN**.
(d) **CHANNEL A AMPLITUDE** control fully cw.

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

(a) **DC OFFSET** selector switch to **0**.
(b) **SWEEP WIDTH** control to **OFF**.
(c) **CHANNEL A** and **B** slide switches to **OFFSET SQUARE**.
(d) **OFFSET SQUARE** slide switch to **+** (positive).

(3) Connect oscilloscope to function generator **CHANNEL A OUTPUT**. If oscilloscope does not display square wave with amplitude of 15 V or greater, perform **b** (1) through (3) below.

(4) Set TI **OFFSET SQUARE** slide switch to **-** (negative) and repeat (3) above. If square wave on oscilloscope is not 15 V or greater in amplitude, perform **b** (1), (2), and (4) below.

(5) Remove connection from **CHANNEL A** and connect to **CHANNEL B OUTPUT**.

(6) Repeat (1) through (3) above for **CHANNEL B**. If indications are not as specified, perform **b** (1), (2), and (5) below.

(7) Repeat (4) above. If indications are not as specified, perform **b** (1), (2), and (6) below.

(8) Turn **CHANNEL A** and **B AMPLITUDE** controls fully ccw.

b. Adjustments

(1) Adjust function generator **FREQUENCY** dial to **1** and **RANGE** selector switch to **X1**.

NOTE

Function generator frequency is set so that multimeter will read top of square wave for 5 seconds and bottom for 5 seconds.

(2) Connect multimeter positive lead between bottom center contact on **CHANNEL A** slide switch XA1 pin F (fig. 6) and negative lead to circuit ground.

(3) Adjust A2R11 (fig. 6) until top of square wave indicates 10 V on multimeter and bottom of square wave indicates between +1.5 and 2.5 V (R).

(4) Adjust A2R13 (fig. 6) until bottom of square wave indicates 10 V on multimeter and top of square wave indicates between +17.5 and +18.5 V (R).

(5) Adjust A2R16 (fig. 6) until top of square wave indicates 10 V on multimeter and bottom of square wave indicates between +1.5 and 2.5 V (R).

(6) Adjust A2R18 (fig. 6) until bottom of square wave indicates 10 V on multimeter and top of square wave indicates between +17.5 and +18.5 V (R).

28. Square Wave Pulse Response

a. Performance Check

(1) Connect oscilloscope to function generator **CHANNEL A OUTPUT**.

(2) Adjust function generator **CHANNEL A AMPLITUDE** control fully cw.

(3) Set TI **OFFSET SQUARE** slide switch to + (positive).

(4) Measure. risetime, using standard risetime technique. If risetime is not 400 ns or less, with overshoot less than 5 percent and sag less than 1 percent, perform **b** (1) below.

(5) Set TI **OFFSET SQUARE** slide switch to - (negative) and repeat (4) above.

(6) Remove connection from **CHANNEL A OUTPUT** and connect to **CHANNEL B OUTPUT**.

(7) Repeat (2) through (5) above for **CHANNEL B OUTPUT**.

(8) Adjust **CHANNEL A** and **B AMPLITUDE** controls fully ccw.

b. Adjustments

(1) While switching **OFFSET SQUARE** slide switch back and forth between + and -, adjust A2C6 (fig. 6) for optimum flat top square wave (R).

(2) While switching **OFFSET SQUARE** slide switch back and forth between + and -, adjust A2C7 (fig. 6) for optimum flat top square wave (R).

29. Sawtooth Generator Dial

a. Performance Check

(1) Connect frequency counter to function generator **CHANNEL A OUTPUT**.

(2) Adjust function generator **FREQUENCY** dial to **1** and **RANGE** switch to **X.01**.

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

(a) **FREQUENCY** dial to **10**.

(b) **CHANNEL A** slide switch to **SAWTOOTH**.

(c) **SAWTOOTH** slide switch to **+** (positive).

(d) **RANGE** selector switch to **X100**.

(4) Measure frequency. If frequency counter does not indicate between 950 and 1050 Hz, perform **b** (2) through (5) below.

(5) Repeat technique of (4) above at settings listed in table 7. Frequency counter will indicate within limits specified.

Table 7. Sawtooth Dial Accuracy

Test instrument		Frequency counter indications	
RANGE switch settings	**FREQUENCY** dial settings	Min	Max
X.01	10	11.1 s	9.09 s
X.1	10	1.11 s	909 ms
X1	10	105 ms	95.3 ms
X10	10	10.5 ms	9.53 ms
X1K	10	9.5 kHz	10.5 kHz
X10K	10	95 kHz	105 kHz

b. Adjustments

(1) Set **RANGE** switch to **X100**.

(2) Adjust A1C11 (fig. 6) for 1000 Hz on frequency counter (R).

(3) Set **RANGE** switch to **X10K.**

(4) Readjust A1C11 (fig. 6) for 100 kHz on frequency counter.

(5) Repeat (1) through (4) above for best in-tolerance condition.

30. Sawtooth Output

a. Performance Check

(1) Connect oscilloscope to function generator **CHANNEL A OUTPUT**.

(2) Adjust function generator **FREQUENCY** dial to **1** and **RANGE** selector switch to **X.01**. If oscilloscope does not display sawtooth waveform with amplitude of 15 V or greater over entire frequency range of TI, perform **b** (1) through (3) and (5) below.

NOTE

Adjust **AMPLITUDE** control fully cw. Return to ccw position after check.

(3) Set TI **SAWTOOTH** slide switch to - (negative) and repeat (2) above.

(4) Remove connection from **CHANNEL A** and connect to **CHANNEL B OUTPUT**.

NOTE

TI **CHANNEL B** slide switch must be in **SAWTOOTH** position.

(5) Repeat technique of (2) and (3) above for **CHANNEL B OUTPUT**. If oscilloscope does not display sawtooth with amplitude of 15 V or greater, perform **b** (1), (2), (4), and (5) below.

b. Adjustments

(1) Connect jumper between TP2 and CIRCUIT GND (fig. 6).

(2) Connect multimeter between TI upper center terminal of **SAWTOOTH** slide switch and circuit ground.

(3) Adjust A3R15 (fig. 6) until multimeter indicates +10 V (R).

(4) Adjust A3R38 (fig. 6) until multimeter indicates +10 V (R).

(5) Remove jumper connected in (1) above.

31. Frequency Response

a. Performance Check

(1) Connect oscilloscope to function generator **CHANNEL A OUTPUT**.

(2) Adjust function generator **FREQUENCY** dial to 1 and **RANGE** switch to **X.01**. Set **AMPLITUDE** control fully cw.

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

(a) **RANGE** selector switch to **X100**.

(b) **FREQUENCY** dial to **1**.

(c) **SAWTOOTH** control to **+** (positive).

(4) Adjust oscilloscope sensitivity controls for exactly 5 cm p-p display.

(5) Set TI **RANGE** selector switch and adjust **FREQUENCY** dial from .01 Hz to 10 kHz. If oscilloscope does not display same amplitude as in (4) above ±0.5 minor division, perform **b** below.

(6) Set TI **SAWTOOTH** slide switch to **-** (negative) and repeat technique of (3) through (5) above.

(7) Remove connection from **CHANNEL A OUTPUT** and connect to **CHANNEL B OUTPUT**.

(8) Repeat technique of (2) through (6) above for **CHANNEL B OUTPUT**.

b. Adjustments. Adjust, A3C6 (fig. 6) for optimum indication without introducing nonlinearity (R).

32. Flyback Time

a. Performance Check

(1) Connect oscilloscope to function generator **CHANNEL A OUTPUT**.

(2) Adjust function **FREQUENCY** dial to **1** and **RANGE** selector switch to **X.01**.

(3) Position controls as in (a) through (c) below:

(a) **RANGE** selector to **X1**.

(b) **FREQUENCY** dial to **1**.

(c) **SAWTOOTH** slide switch to **+** (positive).

(4) If oscilloscope does not display sawtooth waveform with flyback time of 5 ms or less, perform **b** below.

(5) Set TI **RANGE** selector switch to positions listed in table 8. At each position, flyback time will be equal to or less than that indicated in table 8.

Table 8. Flyback Time

Test instrument **RANGE** selector switch	Oscilloscope indications
X1	5 ms
X.1	500 µs
X10	500 µs
X1K	5.25 µs
X100	750 ns
X10K	750 ns

b. Adjustments

(1) Set TI **RANGE** selector switch to **X10K** and **FREQUENCY** dial to **10**.

(2) Connect oscilloscope between TI 11th terminal (white-green wire to XA1 pin 15) on rear of C wafer of **RANGE** selector switch and circuit ground, using probe.

(3) Adjust A3C8 (fig. 6) for minimum flatness on sawtooth waveform (R).

33. Final Procedure

a. Deenergize and disconnect all equipment.

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

SECTION VI
CALIBRATION PROCESS FOR MODEL 3305A

34. Preliminary Instructions

a. The instructions outlined in paragraphs **34** and **35** 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 t h e manufacturer's manual for this TI.

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

35. 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 checks where applicable.

a. Insert TI into function generator.

b. Set function generator **CHANNEL A** function switch to **SINE** and **CHANNEL A AMPLITUDE** control to midrange.

c. Position controls as listed in (1) through (6) below:

(1) **SWEEP MODE** switch to **MANUAL**.

(2) **START** control fully ccw.

(3) **STOP** control fully ccw.

(4) **MAN. START/MAN. STOP** control fully ccw.

(5) **FREQUENCY RANGE** switch to **X10** to **X10K**.

(6) **SWEEP TIME** switch to **100-10** and **VERNIER** control fully ccw.

d. Connect function generator to autotransformer and connect autotransformer to a 115 V ac source.

e. Adjust autotransformer for 115 V output and energize equipment. Allow 1 hour for warm-up.

NOTE

Do not remove top cover from function generator during warm-up.

36. Model 3305A Calibration

NOTE

When any parameter specified in paragraph **36** is not within tolerance, proceed to paragraph **38** and perform all the adjustments for model 3305A before continuing with the calibration.

a. Performance Check

(1) Connect frequency counter to function generator **CHANNEL B OUTPUT**.

(2) Set function generator **CHANNEL B** function switch to **SQUARE WAVE** and **AMPLITUDE** control to midrange.

(3) Rotate TI **MAN. START/MAN. STOP** control fully cw. Frequency counter will indicate between 90 and 110 kHz.

(4) Set TI **FREQUENCY RANGE** switch to **X1** to **X1K**. Frequency counter will indicate between 9 and 11 kHz.

(5) Rotate TI **MAN. START/MAN. STOP** control fully ccw. Frequency counter will indicate between 909 and 1111 ms.

(6) Set TI **FREQUENCY RANGE** switch to **X.1** to **X100**. Frequency counter will indicate between 9.1 and 11.1 seconds.

(7) Rotate TI **MAN. START/MAN. STOP** control fully ccw. Frequency counter will indicate between 900 and 1100 Hz.

(8) Adjust TI **MAN. START/MAN. STOP** control fully ccw and set **FREQUENCY RANGE** switch to **X1** to **X1K**.

(9) Adjust TI **START** dial to **1 Hz.** Frequency counter will indicate frequency between 0.9 and 1.1 Hz and output period between 909 and 1111 ms.

(10) Repeat technique of (9) above for TI **START** control settings listed in table 9. At each setting, frequency counter will indicate as specified.

Table 9. Dial Accuracy

Test instrument **FREQUENCY START/STOP** control settings	Frequency counter indications	
	Min	Max
5 Hz	182 ms	222 ms
10 Hz	91 ms	111 ms
50 Hz	18 ms	22 ms
100 Hz	9.1 ms	11.1 ms
500 Hz	1.82 ms	2.22 ms
1 kHz	900 Hz	1100 Hz
5 kHz	4.5 kHz	5.5 kHz
10 kHz	9.0 kHz	11.0 kHz
100 kHz[1]	90 kHz	110 kHz
50 kHz[1]	45 kHz	55 kHz

[1]Set **FREQUENCY RANGE** switch to **X10** to **X10K**.

(11) Adjust TI **MAN. START/MAN. STOP** control fully cw frequency range switch to **X1** to **X1K,** and set **STOP** dial to **1 Hz.** Frequency counter will indicate as in (9) above.

(12) Repeat technique of (9) above for TI **STOP** control settings listed in table 9. Frequency counter will indicate as specified.

(13) Connect oscilloscope to function generator **CHANNEL B OUTPUT**.

(14) Set function generator **CHANNEL B** function switch to **SINE** and **AMPLITUDE** control fully cw.

(15) Position controls as listed in (a) through (d) below:

(a) **SWEEP TIME** switch to **10-1** and **VERNIER** control to midrange.
(b) **FREQUENCY RANGE** switch to **X10** to **X10K**.
(c) **START** and **STOP** controls fully ccw.
(d) **SWEEP MODE** switch to **AUTO**.

(16) Adjust oscilloscope sweep time controls for suitable viewing. Oscilloscope will indicate sine wave sweeping from 10 Hz to 100 kHz and blanking to 0 during retrace.

(17) Set TI **SWEEP MODE** switch to **TRIG** and press **TRIG** pushbutton. Oscilloscope will sweep from 10 Hz to 100 kHz, blank for 4 seconds, and return to start frequency of 10 Hz.

(18) Set TI **SWEEP MODE** switch to **MANUAL**.

(19) Rotate **MANUAL** control from **MAN. START** to **MAN. STOP** while observing oscilloscope. Frequency will vary between 10 Hz and 100 kHz during rotation.

(20) Set function generator **CHANNEL B** function switch to **PLUG-IN** and **AMPLITUDE** control fully cw.

(21) Connect oscilloscope to function generator **CHANNEL B OUTPUT**.

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

(a) **SWEEP TIME** switch to **.1 - .01**.

(b) **SWEEP TIME VERNIER** control fully cw.

(c) **SWEEP MODE** switch to **AUTO**.

(23) Measure risetime, using standard risetime techniques. Risetime will be 10 ms or less and falltime less than 3 ms, with amplitude greater than 15 V p-p.

(24) Connect frequency counter to function generator **CHANNEL B OUTPUT.**

(25) Set function generator **CHANNEL B** function switch to **SQUARE WAVE** and **AMPLITUDE** control to midrange.

(26) Set TI **SWEEP MODE** switch to **EXT**. **FREQ CONTROL** and **FREQUENCY RANGE** switch to **X10 to X10K**.

(27) Adjust TI start control until frequency counter indicates 100 Hz.

(28) Connect calibrator to TI **INPUT TRIG/FREQ CONTROL**.

(29) Adjust calibrator for a 6 V output. Frequency counter will indicate between 950 and 1050 Hz.

(30) Connect oscilloscope to function generator **CHANNEL A OUTPUT**. Set function generator function switch to **SQUARE**.

(31) Set TI **FREQUENCY RANGE** switch to **X1** to **X1K**.

(32) Adjust **START** control to **90 Hz** and **STOP** control to **110 Hz.**

(33) Rotate **MAN. START/MAN. STOP** control from **START** to **STOP** positions while adjusting oscilloscope controls for a 1 cycle square wave display on oscilloscope.

(34) Rotate **MAN. START/MAN. STOP** control from **START** to **STOP** positions, while observing waveform. If variation occurs at midway point of rotation, perform **b** below.

b. Adjustments

NOTE

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

(1) Adjust A5R5 (fig. 7) for minimum variation of waveform at midway point of rotation (R).

(2) Set TI **FREQUENCY RANGE** switch to **X10 TO 10K** and adjust A1C19 (fig. 7) for minimum variation at midway point of rotation (R).

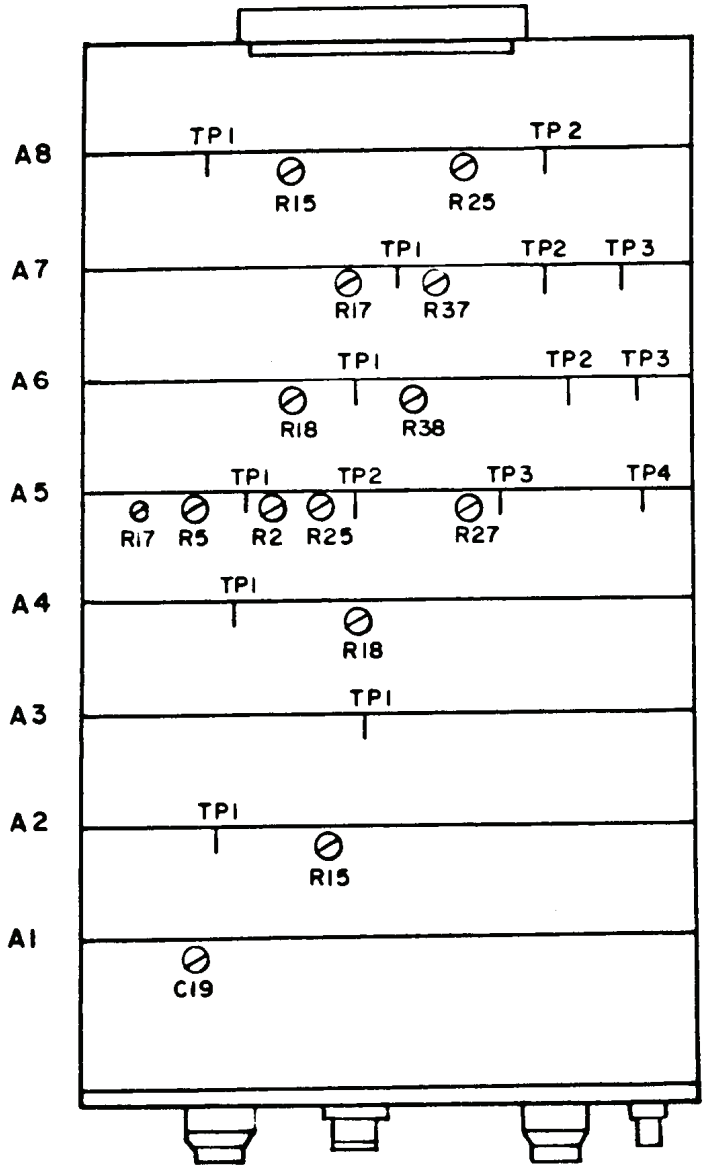

Figure 7. Model 3305A - top view.

37. Model 3305A Adjustments

a. Performance Check

(1) Connect multimeter between test points and circuit ground as listed in table 10. If multimeter does not indicate within limits specified, perform corresponding adjustment.

Table 10. Model 3305A Adjustments

Test instrument		Multimeter adjustment limits(V)	
Test points (fig. 7)	Adjustment (fig. 7)	Min	Max
A8TP1	A8R15	23.999	24.001
A8TP2	A8R25	-23.999	-24.001
A2TP1[1]	A2R15	-0.005	+0.005
A4TP1	A4R18	-0.005	+0.005
A5TP1[2]	A5R17	-0.005	+0.005
A5TP4[3]	A5R2	19.990	20.010
A5TP3[4]	A5R27	-0.490	-0.500
A5TP4	A5R25	0.1966	0.1986
A6TP1	A6R18	-4.1755	-4.1765
A6TP2	A6R38	-3.9995	-4.0005
A5TP1[5]	A7R17	4.1755	4.1765

[1]Set **SWEEP MODE** switch to **MANUAL** and turn **MAN. START/MAN.STOP** control fully ccw.
[2]Set **FREQUENCY RANGE** switch to **X1** to **X1K**.
[3]Adjust **MAN. START/MAN.STOP** control to midrange switch point.
[4]Turn **START** control fully ccw and **MAN. START/MAN.STOP** control fully ccw.
[5]Set **FREQUENCY RANGE** switch to **X10** to **X10K**.

(2) Connect frequency counter time interval unit to **CHANNEL A OUTPUT**.

(3) Set function generator function switch to **SQUARE**.

(4) Measure symmetry of square wave as illustrated in figure 1. Adjust A7R37 (fig. 7) until T_1 is equal to T_2 (R).

b. Adjustments. No further adjustments can be made.

38. 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
0800714

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 342160, requirements for calibration procedure TB 9-6625-1966-24.

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.