INSTRUCTION MANUAL

Serial Number _____

576

ADJUSTMENT and PERFORMANCE CHECK PROCEDURE

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INTRODUCTION

The following procedures are for use in adjusting and checking the Type 576 using the special Type 576 Calibration Fixture (Tektronix part no. 067-0599-00). If this fixture is being used to adjust or check a Type 576, this booklet replaces section 5 of the Type 576 Instruction Manual.

This booklet is made up of 2 sections. Section 1 contains an adjustment procedure which allows all the adjustments in the Type 576 to be made using the calibration fixture. Section 2 contains two procedures: a performance check procedure and a supplementary performance check procedure. The performance check procedure checks the accuracies of the display amplifiers, the step generator and the collector supply with respect to the characteristics given in section 1 of the Type 576 Instruction Manual using the calibration fixture. In addition, this procedure checks each control for proper operation. The supplementary performance check procedure does not use the calibration fixture. This procedure checks characteristics which do not affect the basic accuracy of the instrument, or which can not be checked using the calibration fixture. The performance check procedure provides a good check of the performance of the Type 576 and should be sufficient for most requirements. The addition of the supplementary procedure allows a complete performance check to be made of the instrument.

The Type 576 Calibration Fixture is particularly useful when making adjustments and checks in on-line situations, that is adjusting or checking a Type 576 in the same location in which it is being used.

The Type 576 should be checked and, if necessary, readjusted after each 1000 hours of operation or at least once every six months. To ensure maximum accuracy, it may be desirable to perform the performance check procedure on a shorter cycle.

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Change information, if any, affecting this section will be found at the rear of the manual.

SECTION 1
ADJUSTMENT PROCEDURE

General

The following procedure is arranged to allow a complete or partial adjustment of all the internal controls in the Type 576. Most of the steps require the use of only the calibration fixture and a precision DC voltmeter. After becoming familiar with the procedure, a calibrator can easily adjust the Type 576 in an on-line situation by leaving out some steps such as checking power supply regulation (step 3) and adjusting the horizontal compensation (step 11).

Maintenance

Any maintenance required on the Type 576 should be completed before starting this procedure. If troubles occur in the middle of the procedure, they should be corrected before proceeding. Repair and servicing information is given in the Maintenance section.

Equipment List

The following equipment list gives the equipment required to use the following procedure. The required ranges and tolerances of this equipment along with some suggested instrument types are also provided. To allow accurate measurement, the required tolerances given for each piece of equipment have been chosen to exceed the tolerance to be measured by at least 4 times. For tolerances to be measured to less than 1%, the accuracy of the equipment has been chosen to exceed the tolerance by at least 10 times.

1. Type 576 Calibration Fixture (Tektronix Part No. 067-0599-00).

2. DC Voltmeter (e.g., Fluke Model 801B differential voltmeter or suitable digital voltmeter). Requirements: Voltage range from 0 volts to ±250 volts, basic accuracy within 0.5%, accuracy within 0.05% between 0 and ±75 volts.[1]

3. DC Voltmeter—High Voltage (e.g., Triplett Model 630 NA). Requirements: Measure −4000 volts, accuracy within 3%.

4. Test oscilloscope, Tektronix Type 561B/2A63/2B67, 5100 series, Type 422 or Type 453. Requirements: Bandwidth from DC to 200 kHz, sweep rates from 0.2 ms/cm to 5 μs/cm, vertical deflection factors from 10 mV/div to 2 V/div, accuracy of voltage measurement within 3%, AC vertical input coupling, internal triggering, X1 test probe.

5. Variable autotransformer (e.g., General Radio, Variac Type W10MT3W for 115-volt operation, or Type W20HMT3A for 230-volt operation). Requirements: Output voltage variable from 90 V to 136 V AC RMS for 115-volt operation or from 180 V to 272 V AC RMS for 230-volt operation; maximum power output at least 305 watts. If a monitor voltmeter is not included, a separate AC voltmeter is required.

6. NPN transistor with BV_{CEO} of 50 volts or more.

Record and Index

Table 1-1 at the beginning of this procedure provides a record and index of the procedure. The table may be used as a check list to verify adjustments, an abridged guide for an experienced calibrator, or an index of individual adjustments. Note that each listing of an adjustment also includes a list of related adjustments or checks.

Control Settings

A complete list of initial control settings for the Type 576 and significant control settings for the test instruments precedes step 1 of this procedure. In addition, partial lists of control settings are provided in various places throughout the procedure. Any control setting not listed in a partial list should be set as designated in the initial list of control settings. If adjustments are made without following the procedure, start with the list of control settings preceding the desired adjustment and follow the sequence up to the desired step, making changes in control settings as indicated.

Making Adjustments

When doing a complete adjustment of the instrument, each internal control should be adjusted as near to the specified setting as possible, even if the observed performance is within tolerance. When doing only a partial adjustment, do not readjust any controls unless the observed performance is outside the given tolerance. In either case, do not preset any adjustments unless they are known to be significantly out of adjustment or repairs have been made in the circuit. In these instances, set the particular controls to midrange.

[1] A similar DC voltmeter, but with very high input impedance (500 MΩ) is required for the performance check. Although this high an input impedance is not required for the adjustment procedure, it may be desirable to use the same instrument for both procedures.

TABLE 1-1

ADJUSTMENT PROCEDURE RECORD AND INDEX

Step No.	Title	Adjust	Required Previous Steps	Page
1	Adjust –75 Volt Supply	R721		1-3
2	Check Other Power Supply Voltages			1-4
3	Check Power Supply Regulation			1-4
4	Adjust CRT Controls	R891, R897, R685, R893	1	1-5
5	Adjust Balance of Horizontal Display Amplifier	R681, R650, R645	1, 4	1-7
6	Adjust Balance of Vertical Display Amplifier	R581, R550, R545	1, 4	1-8
7	Adjust Horizontal and Vertical CRT Gain	R692, R592	1, 4, 5, 6	1-8
8	Adjust Horizontal and Vertical Magnifier Gains	R673, R573	1, 4, 5, 6, 7	1-8
9	Adjust Horizontal Display Amplifier Gains	R636, R638, R641	1, 4, 5, 6, 7, 8	1-9
10	Adjust Vertical Display Amplifier Gains	R536, R538, R541	1, 4, 5, 5, 7, 8	1-9
11	Adjust Horizontal Compensation	C433	1	1-10
12	Adjust Zero Crossing and Step Delay	R8, R24	1	1-12
13	Adjust Zero Step Level	R224, R97, R127	1, 12	1-12
14	Adjust Step Amplifier Gain	R113, R86, R85	1, 12, 13	1-13
15	Adjust Current Balance	R243	1, 12, 13, 14	1-13
16	Adjust Looping Compensation	C301, C339, C341, LOOPING COMPENSATION	1	1-14

Preliminary Adjustment Procedure

1. Remove the side panels and the Standard Test Fixture from the Type 576.

2. Set the Line Voltage Selector assembly and the 60 Hz-50 Hz switch on the Type 576 rear panel in accordance with the line voltage source to be used.

3. Connect the autotransformer and other test instruments to a suitable power source. Connect the Type 576 to the autotransformer output.

4. Set the autotransformer for the line voltage and range chosen on the Type 576 Line Voltage Selector assembly.

5. Turn on the autotransformer, Type 576, DC voltmeter and test oscilloscope. Allow at least 5 minutes warmup at an ambient temperature of +25°C ±5°C (+77°F ±9°F) before making any checks or adjustments.

6. Set the instrument controls as shown in the list of Initial Control Settings at the beginning of the procedure and start the procedure with step 1.

Initial Control Settings

Type 576

GRATICULE ILLUM	Graticule Lines Visible
READOUT ILLUM	Readout Visible
INTENSITY	Fully Counterclockwise
FOCUS	Centered
VERTICAL	.5 mA
DISPLAY OFFSET Selector	NORM (OFF)
CENTERLINE VALUE	5

HORIZONTAL	2 V COLLECTOR
POSITION (Vertical and Horizontal)	Control Centered
FINE POSITION (Vertical and Horizontal)	Control Centered
ZERO	Released
CAL	Released
DISPLAY INVERT	Released
MAX PEAK VOLTS	15
PEAK POWER WATTS	220
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
POLARITY	AC
MODE	NORM
LOOPING COMPENSATION	As is
NUMBER OF STEPS	1
CURRENT LIMIT	2 A
STEP GENERATOR AMPLITUDE	2 V
OFFSET	ZERO
OFFSET MULT	10.00 (fully clockwise)
STEPS	Pressed
PULSED STEPS	Released
STEP FAMILY	SINGLE
RATE	.5X
POLARITY INVERT	Released
STEP MULT .1X	Released
LEFT-OFF-RIGHT	OFF
Terminal Selector	BASE TERM STEP GEN

Type 576 Calibration Fixture (067-0599-00)

Function	Step Gen
Calibrator Range	200 mV Cal
Vertical	10 A (fully counterclockwise)
Display Offset Multiplier	0
Horizontal	.5 Collector
Step Generator	.05 μA
Step Generator Loads	Off

Test Oscilloscope

Time/Cm	5 ms
Triggering	Trig, +, AC, Line
Volts/cm	.01
Input Coupling	AC
Position	Display Centered

POWER SUPPLY

1. Adjust –75 Volt Supply

a. Set the Type 576 controls as shown in the list of Initial Control Settings preceding this step.

b. Position the instrument so that the L. V. REGULATOR circuit board (left side of instrument) is visible.

c. Connect the negative lead of the DC voltmeter to ground, pin M on the L. V. REGULATOR board, (See Fig. 1-1). Connect the positive lead to the –75 volt supply, pin K. Be sure the polarity of the DC voltmeter is set for measuring a negative voltage.

d. Check for DC voltmeter reading of –75 volts ±0.375 volt (–75 V ±0.5%).

e. ADJUST–R721, –75-V adjustment (see Fig. 1-1) if the voltage is not correct.

NOTE

The voltage level of the –75-volt supply affects the calibration of the entire instrument. Do not adjust R721 unless the voltage measured in part d is out of tolerance or unless a complete adjustment of the instrument is being performed.

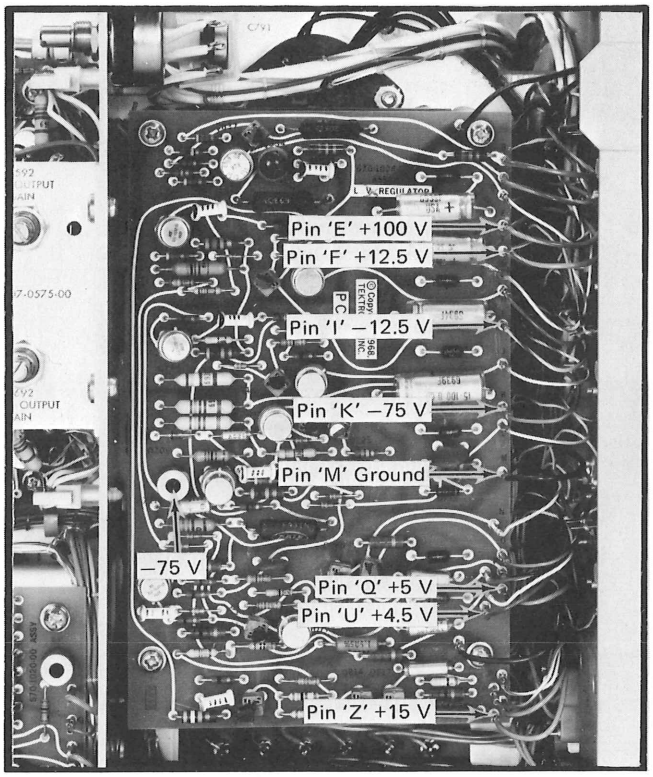

Fig. 1-1. L.V. REGULATOR circuit board: Location of test points and adjustment in steps 1 through 3.

2. Check Other Power Supply Voltages

a. Move the positive lead of the DC voltmeter to the power supply test points (other than −75 volts) listed in Table 1-2. (Change polarity of voltmeter for positive voltages.)

b. CHECK FOR—Meter reading of the power supply voltage within the tolerance given in the accuracy column of Table 1-2.

c. Disconnect the DC voltmeter leads from the Type 576.

d. Connect the negative lead of the High Voltage DC Voltemter to ground (pin M of the L. V. REGULATOR circuit board). Be sure the polarity of the meter is set for measuring a negative voltage.

e. Set the meter for measuring −4 kV. Connect the positive lead of the meter to the arm of the INTENSITY control, R883 (see Fig. 1-2) connected to the white and purple wire.

f. CHECK FOR—High Voltage DC Voltmeter reading of −4000 volts ±160 V ± error of meter (4 kV ±4% ±% error of meter).

g. Disconnect the High Voltage DC Voltmeter leads from the Type 576.

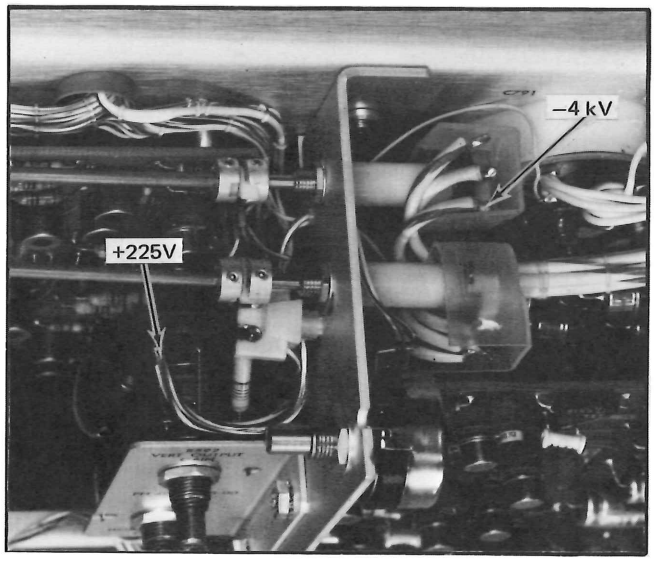

Fig. 1-2. Location of high voltage test points on right side of instrument.

3. Check Power Supply Regulation

a. Trigger the test oscilloscope on the internal line signal.

b. Connect the 1X test probe ground clip to pin M on the L. V. REGULATOR circuit board.

c. Set the autotransformer for the highest voltage within the voltage range selected by the Line Voltage Selector assembly on the rear panel.

TABLE 1-2

POWER SUPPLY VOLTAGE AND REGULATION CHECKS

Voltage	Accuracy	Total Output Noise and Line Frequency Ripple, Peak to Peak	Location of Test Point
−75		5 mV	Pin K
−12.5	±0.31 volt	5 mV	Pin I
Variable +4.5	−0 volts, +0.3 volt (with READOUT ILLUM control fully clockwise)	20 mV	Pin U
+5	±0.25 volt	10 mV	Pin Q
+12.5	±0.31 volt	5 mV	Pin F
+15	±0.75 volt	20 mV	Pin Z
+100	±2.5 volts	20 mV of 28 kHz high voltage oscillator ripple and line frequency ripple	Pin E
+225	±9 volts	80 mV of 28 kHz high voltage oscillator ripple and line frequency ripple	Left arm of R592 VERT OUTPUT GAIN (see Fig. 1-5)

d. Connect the 1X test probe tip to the test points of each of the power supplies given in Table 1-2.

e. CHECK FOR—Test oscilloscope display of power supply ripple with the line frequency ripple peak to peak amplitude not exceeding the maximum value given in Table 1-2. On the +100-volt and the +225-volt supplies, set the test oscilloscope time/cm to 50 μs and check the 20 kHz ripple.

f. Turn off the Type 576. Install the Calibration Fixture. Turn on the Type 576. (Be sure to connect small cable to the CAMERA POWER connector.)

g. Set the autotransformer for the lowest voltage within the voltage range selected by the Line Voltage Selector assembly on the rear panel.

h. Repeat parts d and e.

i. Disconnect the probe from the Type 576.

j. Disconnect the Type 576 from the autotransformer and connect it directly to the power source, or set the autotransformer output votlage to the center of the regulated range selected by the Line Voltage selector assembly. (The camera power cable may also be disconnected from the Type 576.)

CRT AND READOUT

4. Adjust CRT Controls

a. Set the Type 576 and Calibrator Fixture controls as shown in the list of Initial Control Settings at the beginning of the procedure.

b. Turn the Type 576 FOCUS control fully counterclockwise and the INTENSITY control clockwise until a large spot is visible on the CRT.

c. Check for spot having a circular shape.

d. ADJUST—R891, ASTIGMATISM adjustment on the left side of the instrument (see Fig. 1-3), if spot is not circular.

e. Turn the Type 576 FOCUS control clockwise until the spot is the smallest possible.

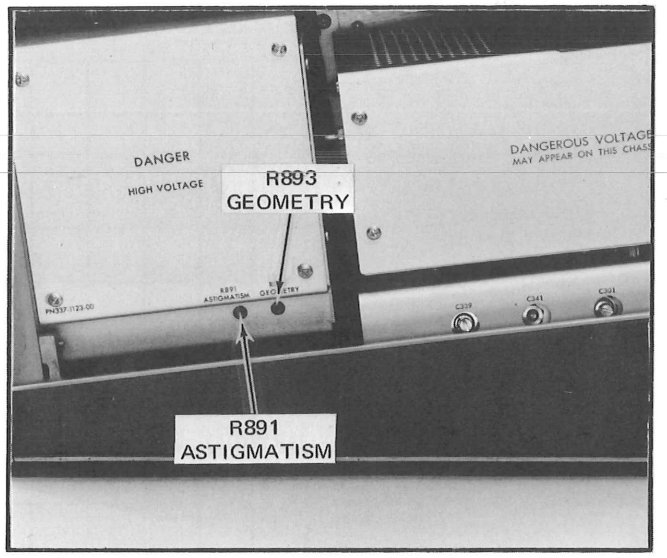

Fig. 1-3. Location of adjustments in step 4.

CAUTION

At various times throughout this procedure, a single spot will be displayed on the CRT. When displaying a single spot reduce the intensity as much as possible, while still maintaining visibility, to prevent burning of the CRT phosphor.

f. Position the spot to the center of the CRT graticule using the Type 576 FINE POSITION controls.

g. Set the Type 576 VARIABLE COLLECTOR SUPPLY control for a trace 10 divisions long.

h. Check for the trace parallel with the horizontal centerline (see Fig. 1-4).

i. ADJUST—R897, TRACE ROTATION adjustment on a chassis bracket on the right of the instrument (see Fig. 1-5) if the trace is not parallel.

j. Set the Calibration Fixture Step Generator Loads switch to 1 K Collector Short.

k. Check for trace parallel with the vertical centerline (see Fig. 1-5).

l. ADJUST—R685, ORTHOGONALITY adjustment, on the DISPLAY AMP circuit board (See Fig. 1-5) if the trace is not parallel.

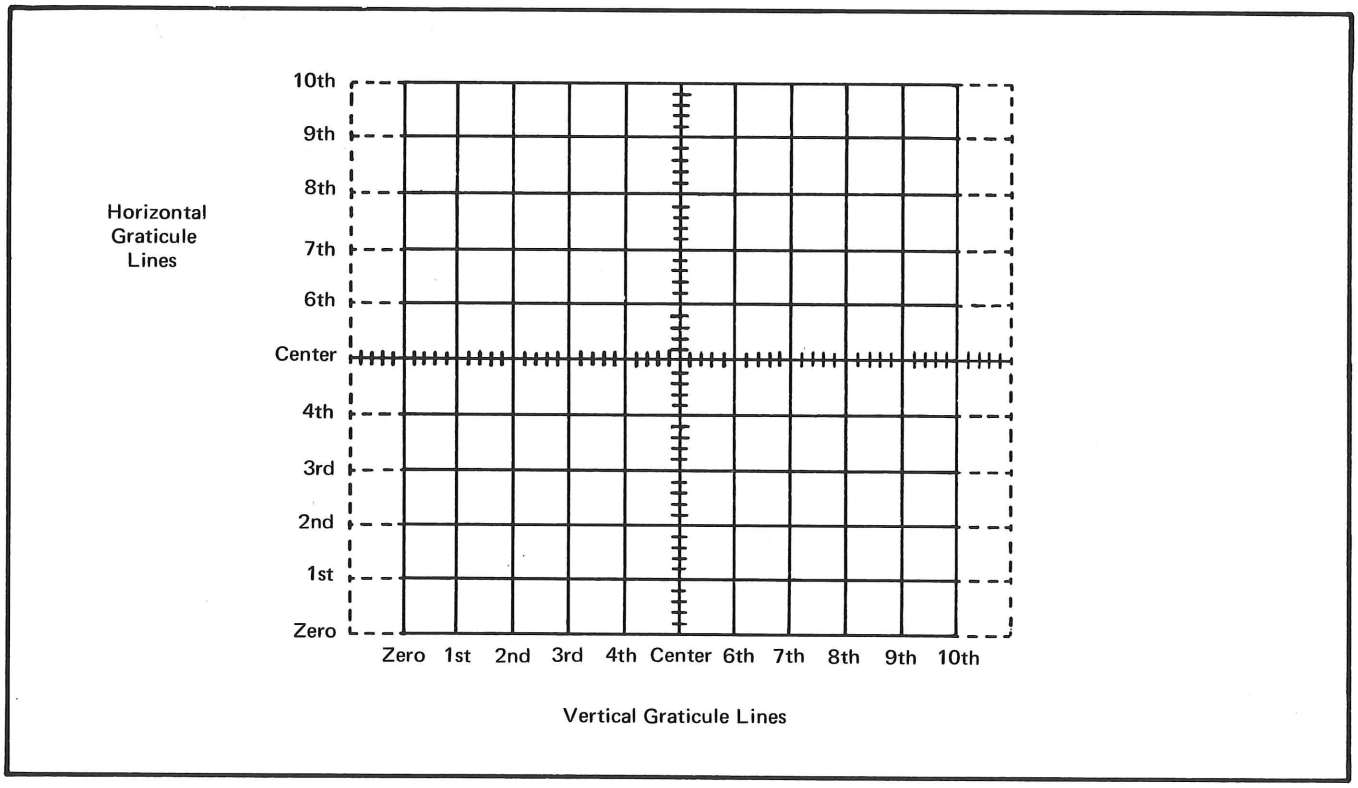

Fig. 1-4. Graticule line labels.

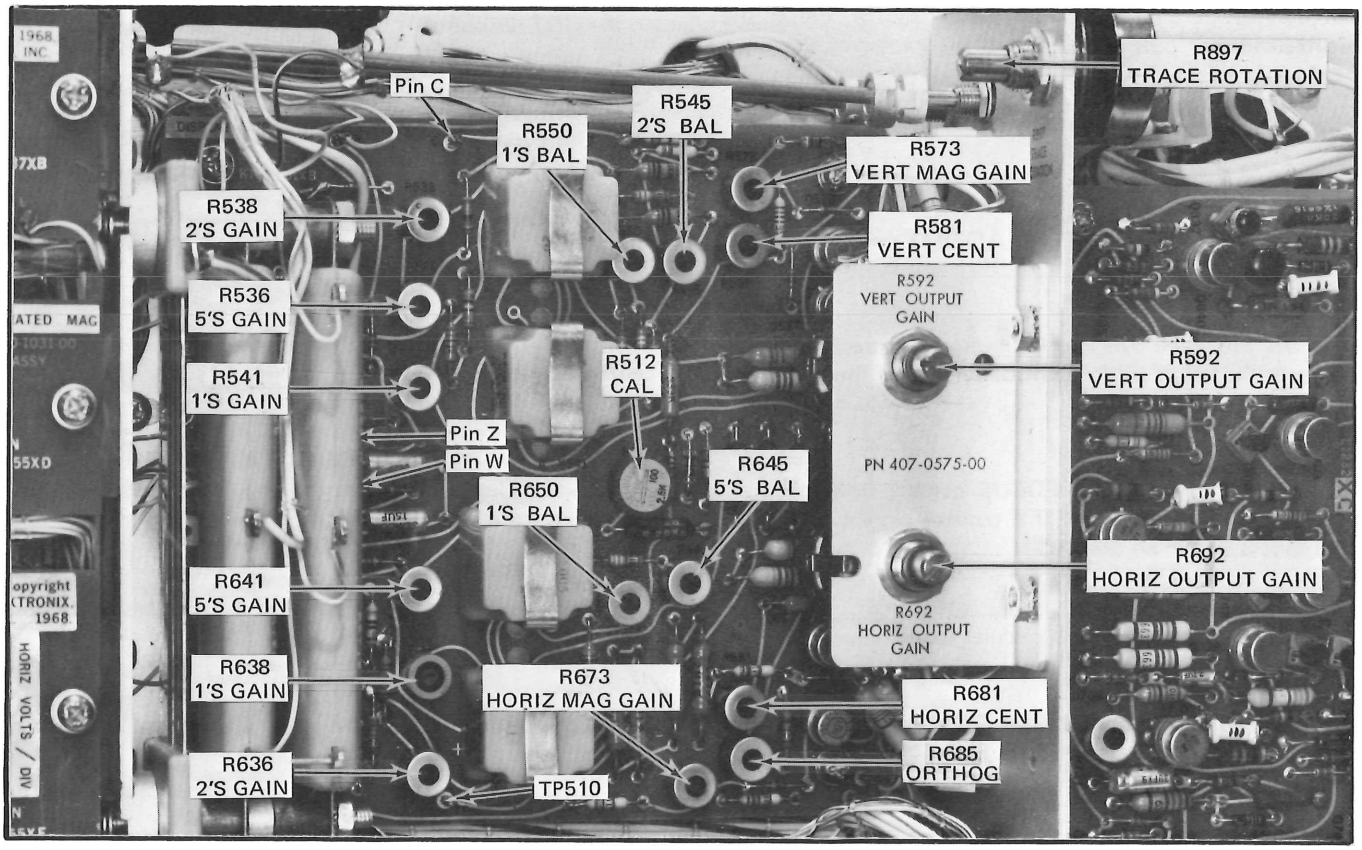

Fig. 1-5. DISPLAY AMP circuit board: Location of voltage checks and adjustments in steps 5 through 10.

m. Using the Type 576 horizontal POSITION switch, position the trace on the zero vertical graticule line of the CRT (see Fig. 1-4).

n. Check the geometry of the trace for minimum bowing.

o. Position the trace to the tenth vertical graticule line (see Fig. 1-4).

p. Repeat part n.

q. Set the horizontal POSITION switch to its center position.

r. Set the Calibration Fixture Step Gen Loads switch to OFF.

s. Using the Type 576 vertical POSITION switch, position the trace to the zero horizontal graticule line (see Fig. 1-4).

t. Repeat part n.

u. Position the trace to the tenth horizontal graticule line.

v. Repeat part n.

w. ADJUST—R893, GEOMETRY adjustment on the left of the instrument (see Fig. 1-3), for minimum bowing of trace.

x. Position the trace to the center horizontal graticule line.

y. Turn the Type 576 FOCUS control and the VARIABLE COLLECTOR SUPPLY control fully counterclockwise and recheck the adjustment of astigmatism and focus as in parts b through f.

Control Settings (Partial List)

INTENSITY	Spot Visible
VERTICAL	.5 A
DISPLAY OFFSET Selector	HORIZ X10

5. Adjust Balance of Horizontal Display Amplifier

a. Set the Type 576 and Calibration Fixture controls as shown in the list of Initial Control Settings at the beginning of the procedure with changes as shown in the preceding partial list.

b. Position the spot to the center of the graticule using the FINE POSITION controls.

c. Set the DISPLAY OFFSET Selector switch to HORIZ X1.

d. Check for the spot on vertical centerline of the CRT graticule.

e. ADJUST—R681, HORIZ CENT adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

f. Set the DISPLAY OFFSET selector switch to HORIZ X10 and repeat parts b through e until no movement of the spot occurs between the two settings of the DISPLAY OFFSET Selector switch.

g. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	HORIZ X10
HORIZONTAL	1 V COLLECTOR

h. Check for the spot horizontally centered on the CRT graticule.

i. ADJUST—R650, 1'S BAL adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

j. Set the HORIZONTAL switch to .5 V COLLECTOR.

k. Check for the spot horizontally centered on the CRT graticule.

l. ADJUST—R645, 5'S BAL adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

m. Set the HORIZONTAL switch to 2 V COLLECTOR and re-check the adjustments made in parts a through l.

6. Adjust Balance of Vertical Display Amplifier

a. Set the DISPLAY OFFSET Selector switch to VERT X10 and position the spot to the center of the graticule using the FINE POSITION controls.

b. Set the DISPLAY OFFSET Selector switch to VERT X1.

c. Check for the spot on the horizontal centerline of the CRT graticule.

d. ADJUST—R581, VERT CENT adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

e. Repeat parts a through d until no movement of the spot occurs between the two settings of the DISPLAY OFFSET Selector switch.

f. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	VERT X10
VERTICAL	1 A

g. Check for the spot vertically centered on the CRT graticule.

h. ADJUST—R550, 1'S BAL adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

i. Set the VERTICAL switch to 2 A.

j. Check for the spot vertically centered on the CRT graticule.

k. ADJUST—R545, 2'S BAL adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

l. Set the VERTICAL switch to .5 A and recheck the adjustments made in parts a through k.

7. Adjust Horizontal and Vertical CRT Gain

a. Set the DISPLAY OFFSET Selector switch to NORM (OFF) and the POLARITY switch to +(NPN).

b. Position the spot to the zero horizontal and vertical CRT graticule lines (see Fig. 1-4) using the FINE POSITION controls.

c. Set the POLARITY switch to —(PNP).

d. Check for the spot on the tenth horizontal and vertical CRT graticule lines ±0.1 division both horizontally and vertically.

e. ADJUST—R692, HORIZ OUTPUT GAIN adjustment, and R592, VERT OUTPUT GAIN adjustment, on a chassis bracket on the right of the instrument (see Fig. 1-5) to remove one half the error noted in part d.

f. Set the POLARITY switch to + (NPN) and repeat steps b through e until 10 divisions of horizontal and vertical deflection are obtained between the +(NPN) and —(PNP) positions of the POLARITY switch.

g. Set the POLARITY switch to AC.

8. Adjust Horizontal and Vertical Magnifier Gains

a. Set the DISPLAY OFFSET Selector switch to HORIZ X10 and position the spot on the center vertical graticule line with the horizontal FINE POSITION control.

b. Switch the CENTERLINE VALUE switch between the 4.5 and the 5.5 positions.

c. Check for the spot deflected 10 divisions horizontally, when the CENTERLINE VALUE switch is switched from 4.5 to 5.5.

d. ADJUST—R673, HORIZ MAG GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot deflection is not correct.

e. Set the DISPLAY OFFSET Selector switch to VERT X10 and the CENTERLINE VALUE switch to 5.

f. Position the spot on the center horizontal graticule line with the vertical FINE POSITION control.

g. Switch the CENTERLINE VALUE switch between the 4.5 and 5.5 positions.

h. Check for the spot deflected 10 divisions vertically when the CENTERLINE VALUE switch is switched from 4.5 to 5.5.

i. ADJUST—R573, VERT MAG GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot deflection is not correct.

9. Adjust Horizontal Display Amplifier Gains

a. Set the following Type 576 controls to:

HORIZONTAL	2 V COLLECTOR
DISPLAY OFFSET Selector	HORIZ X10
CENTERLINE VALUE	10
POLARITY	+(NPN)

b. Set the Calibration Fixture FUNCTION switch to HORIZ AMPL CAL and the Display Offset Multiplier switch to 10.

c. Press the ZERO button and center the spot horizontally on the CRT graticule using the horizontal FINE POSITION control. Release the ZERO button.

NOTE

Before making an adjustment in this step and the following one, always press the ZERO button and be sure the spot is horizontally centered (step 9) or vertically centered (step 10) on the CRT as illustrated in part c of this step.

d. Check for spot centered horizontally on the CRT graticule.

e. ADJUST—R636, 2'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

f. Press the Type 576 CAL button and check for the spot centered horizontally (on the tenth horizontal graticule line).

g. ADJUST—R512, CAL adjustment, (see Fig. 1-5) if the spot is not centered.

h. Release the Type 576 CAL button and set the HORIZONTAL switch to 1 V COLLECTOR.

i. Set the Calibration Fixture Calibrator Range switch to 100 mV.

j. Check for spot horizontally centered on the graticule.

k. ADJUST—R638, 1'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

l. Press the CAL button and check that the spot is still horizontally centered.[2]

m. Release the CAL button and set the HORIZONTAL switch to .5 V COLLECTOR.

n. Set the Calibration Fixture Calibrator Range to 50 mV.

o. Check for spot horizontally centered on the graticule.

p. ADJUST—R641, 5'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

q. Press the CAL button and check that the spot is still horizontally centered.[2]

10. Adjust Vertical Display Amplifier Gains

a. Set the following Type 576 controls to:

VERTICAL	.5 A
DISPLAY OFFSET Selector	VERT X10

b. Set the following Calibration Fixture controls to:

Function	Vert Ampl Cal
Calibration Range	125 mV

c. Press the ZERO button and position the spot vertically onto the center horizontal graticule line using the vertical FINE POSITION control. Release the ZERO button.

d. Check for spot vertically centered on the CRT graticule.

[2] If the spot is not horizontally centered on the CRT graticule, R512 is out of adjustment or the calibrator divider is out of tolerance.

e. ADJUST–R536, 5'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

f. Press the CAL button and check that the spot is still vertically centered on the graticule.[3]

g. Release the CAL button and set the VERTICAL switch to .2 A.

h. Set the Calibration Fixture Calibrator Range switch to 50 mV.

i. Check for spot vertically centered on the CRT graticule.

j. ADJUST–R538, 2'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

k. Press the CAL button and check that the spot is still vertically centered on the graticule.[3]

l. Release the CAL button and set the VERTICAL switch to .1 A.

m. Set the Calibration Fixture Calibration Range switch to 25 mV.

n. Check for spot vertically centered on the graticule.

o. ADJUST–R541, 1'S GAIN adjustment, on the DISPLAY AMP circuit board (see Fig. 1-5) if the spot is not centered.

p. Press the CAL button and check that the spot is still vertically centered on the graticule.

11. Adjust Horizontal Compensation

NOTE

This is a factory adjustment and does not require readjustment when doing a normal maintenance calibration.

[3] If the spot is not vertically centered on the CRT graticule, R512 is out of adjustment or the calibrator divider is out of tolerance.

a. Turn off the Type 576, remove the calibration fixture and install the Standard Test Fixture. Turn on the Type 576.

b. Install the transistor adapter (Tektronix Part No. 013-0098-00) on the Standard Test Fixture.

c. Install a NPN transistor, with a BV_{CEO} of at least 50 volts, in one of the transistor sockets on the right side of the adapter. Install the high voltage protective box on the Standard Test Fixture.

d. Set the following Type 576 controls as listed:

VERTICAL	1 mA
DISPLAY OFFSET Selector	HORIZ X10
CENTERLINE VALUE	.5
HORIZONTAL	50 V COLLECTOR
MAX PEAK VOLTS	75
MAX PEAK POWER WATTS	0.5
STEP GENERATOR AMPLITUDE	.05 μA
PULSED STEPS	300 μs
STEP FAMILY	REP
LEFT-OFF-RIGHT	RIGHT

e. Turn the VARIABLE COLLECTOR SUPPLY control and the AMPLITUDE switch clockwise until a display similar to Fig. 1-6A or B is obtained. Note that the horizontal deflection factor for this setup is 5 V/division.

f. Remove the bottom screw from the high voltage protection shield on the HORIZ VOLTS/DIV circuit board. Carefully swing the shield to the right, exposing C433.

WARNING

High voltage may appear on this capacitor. Use a non-conducting tool to make this adjustment.

g. Turn C433, HORIZ COMP adjustment, on the HORIZ VOLTS/DIV circuit board (see Fig. 1-7) throughout its range.

h. Note the tails on the spots in the display for certain positions of the control (see Fig. 1-6A).

i. ADJUST–C433 for no tails or minimum tail length on the spots (see Fig. 1-6B).

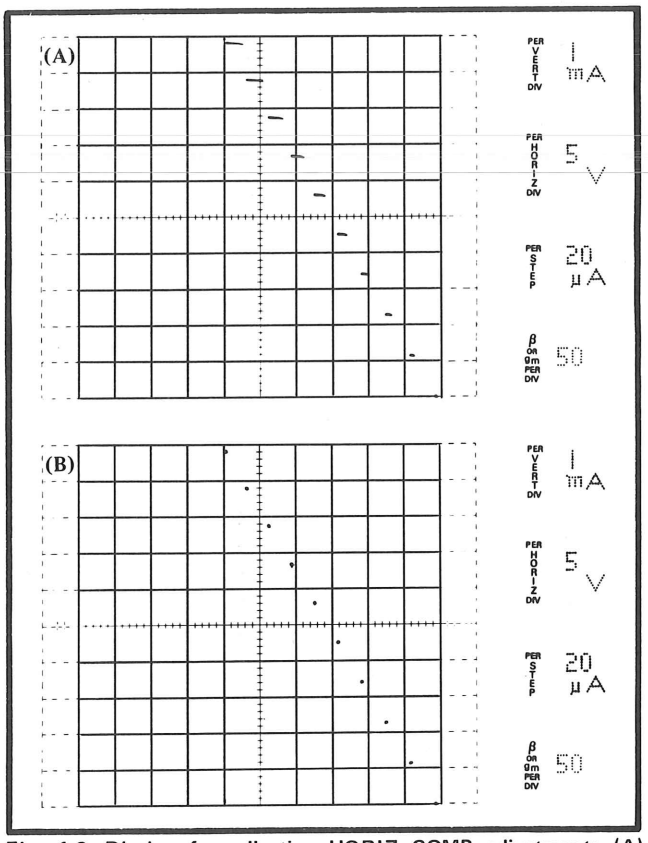

Fig. 1-6. Display for adjusting HORIZ COMP adjustment: (A) Incorrect display; (B) Correct display.

j. Turn off the Type 576 and remove the Standard Test Fixture. Install the Calibration Fixture.

k. Swing the shield back over C433 and replace the screw removed in part f. Turn on the Type 576.

Control Settings (Partial List)

Type 576

INTENSITY	Trace Visible
FOCUS	Well Defined Display
VERTICAL	STEP GEN
HORIZONTAL	.5 V COLLECTOR
VARIABLE COLLECTOR SUPPLY	80
STEP FAMILY	REP

Type 576 Calibration Fixture (067-0599-00)

Step Generator Loads	Step Gen

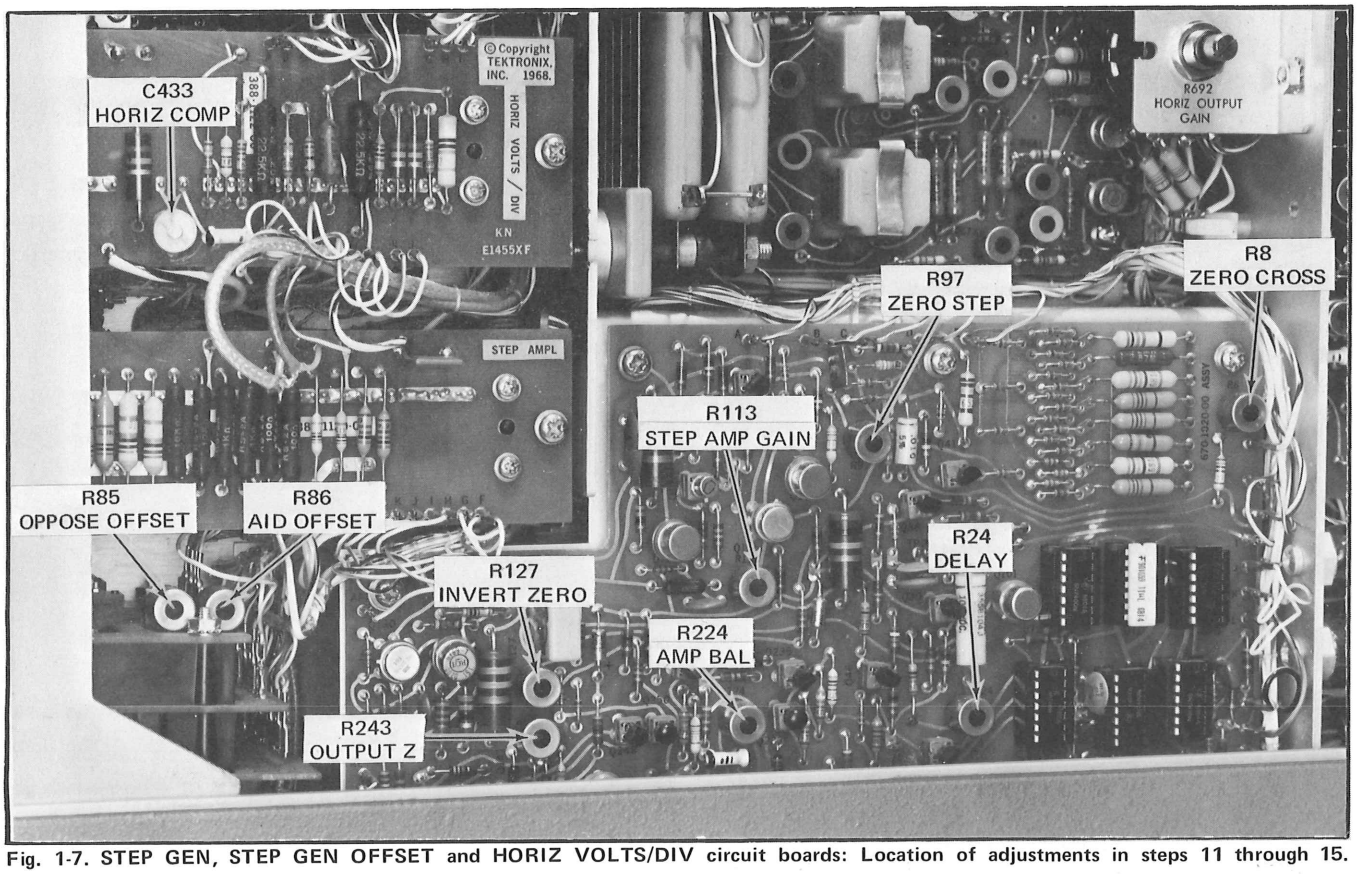

Fig. 1-7. STEP GEN, STEP GEN OFFSET and HORIZ VOLTS/DIV circuit boards: Location of adjustments in steps 11 through 15.

STEP GENERATOR

12. Adjust Zero Crossing and Step Delay

a. Set the Type 576 and Calibration Fixture controls as shown in the list of Initial Control Setting with changes as shown in the preceding partial list.

b. Press the ZERO button and center the spot horizontally using the FINE POSITION controls.

c. Check that the lines crossover at the center vertical graticule line.

d. ADJUST–R8, ZERO CROSS adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the display is not correct.

e. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	HORIZ X10
HORIZONTAL	2 V
POLARITY	+(NPN)
NUMBER OF STEPS	3
RATE	2X

f. Turn the CENTERLINE VALUE switch counterclockwise until the peaks of the Collector Supply output are displayed on the CRT (see Fig. 1-8A).

g. Check that the steps occur exactly at the peak of the Collector Supply output (see Fig. 1-8B).

h. ADJUST–R24, DELAY adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the steps do not occur at the peak of the collector supply output.

13. Adjust Zero Step Level

a. Set the following Type 576 controls to:

CENTERLINE VALUE	0
HORIZONTAL	.05 V BASE
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
STEP GENERATOR AMPLITUDE	.05 V
STEP FAMILY	SINGLE

b. Press the ZERO button and center the spot horizontally on the graticule using the horizontal FINE POSITION control. Release the ZERO button.

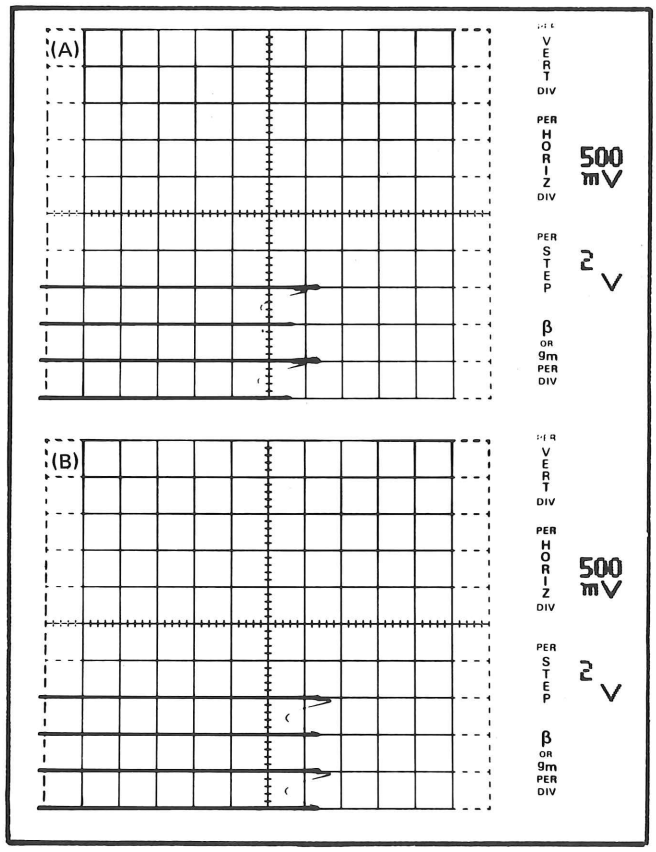

Fig. 1-8. Type 576 display of Collector Supply peaks for adjusting DELAY adjustment R24: (A) incorrect adjustment; (B) correct adjustment.

c. Check for spot horizontally centered on the CRT graticule.

d. ADJUST–R224, AMP BAL adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the spot is not centered.

e. Set the Type 576 AMPLITUDE switch to 2 V.

f. Check for spot horizontally centered on the CRT graticule.

g. ADJUST–R97, ZERO STEP adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the display is not centered.

h. Reset the AMPLITUDE switch to .05 V.

i. Repeat parts b through i until the spot remains centered when the AMPLITUDE switch is switched between the .05 V and the 2 V positions.

j. Set the AMPLITUDE switch to 2 V and press the POLARITY INVERT button.

k. Check for spot centered horizontally on the CRT graticule.

l. ADJUST–R127, INVERT ZERO adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the spot is not centered.

14. Adjust Step Amplifier Gain

a. Set the following Type 576 controls to:

VERTICAL	2 A
CENTERLINE VALUE	10
HORIZONTAL	1 V BASE
NUMBER OF STEPS	10
AMPLITUDE	1 V
STEP FAMILY	REP
POLARITY INVERT	Released

b. Set the Calibration Fixture Step Generator switch to 1 V.

c. Press the Type 576 ZERO button and position the spot to the center vertical graticule line with the FINE POSITION controls. Release the ZERO button.

d. Check for spot on the center vertical graticule line ±2 divisions (±2%).

e. ADJUST–R113, STEP AMP GAIN adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the spot is not centered.

f. Press the AID OFFSET button.

g. Check for spot on the center vertical graticule line ±2 divisions (±2%).

h. ADJUST–R86, AID OFFSET adjustment, on the STEP GEN OFFSET circuit board (see Fig. 1-7) if the spot is not centered.

i. Set the CENTERLINE VALUE switch to 0 and press the OPPOSE OFFSET button.

j. Check for spot on the center vertical graticule line ±2 divisions (±2%).

k. ADJUST–R85, OPPOSE OFFSET adjustment on the STEP GEN circuit board (see Fig. 1-7) if the spot is not centered.

15. Adjust Current Balance

a. Set the following Type 576 controls to:

VERTICAL	STEP GEN
HORIZONTAL	.1 V BASE
DISPLAY OFFSET Selector	HORIZ X1
CENTERLINE VALUE	5
AMPLITUDE	50 μA
OFFSET	ZERO

b. Set the following Calibration Fixture controls to:

Step Generator	50 μA
Step Generator Loads	1 K Collector Short

c. Position the tenth spot to the intersection of the tenth horizontal and center vertical graticule lines.

d. Set the DISPLAY OFFSET Selector switch to HORIZ X10.

e. Reposition the spot to the intersection of the tenth horizontal and center vertical graticule line.

f. Set the Calibration Fixture Step Generator Loads switch to 1 K + 18 K.

g. Check for spot centered horizontally.

h. ADJUST–R243, OUTPUT Z adjustment, on the STEP GEN circuit board (see Fig. 1-7) if the spot is not centered.

i. Turn the Step Generator Loads switch back and forth between the 1 K Collector Short and the 1 K + 18 K positions and check for no movement of the spot between the two positions.

Control Settings (Partial List)

VERTICAL	1 μA
DISPLAY OFFSET Selector	VERT X10
CENTERLINE VALUE	0.0
VARIABLE COLLECTOR SUPPLY	Fully Clockwise
POLARITY	+(NPN)
MODE	DC (ANTI LOOP)

16. Adjust Looping Compensation

a. Turn off the Type 576, remove the Type 576 Calibration Fixture and install the Standard Test Fixture. (Remove the transistor adapter from the Standard Test Fixture.) Turn on the Type 576.

b. Install the protective box on the Standard Test Fixture and close the lid.

c. Set the Type 576 controls as shown in the list of Initial Control Settings with changes as shown in the preceding partial list.

d. Check that the spot has minimum vertical width.

e. ADJUST—C301, LOOPING BALANCE ADJUSTMENT (See Fig. 1-9), and the front panel LOOPING COMPENSATION control for minimum vertical width.

f. Set the following Type 576 controls to:

HORIZONTAL	200 COLLECTOR
DISPLAY OFFSET	VERT X1
Selector	
MAX PEAK VOLTS	1500

g. Check that the spot has minimum vertical width.

h. ADJUST—C339, 350 V and 1500 V LOOPING COMPENSATION adjustment (see Fig. 1-9) for minimum vertical width.

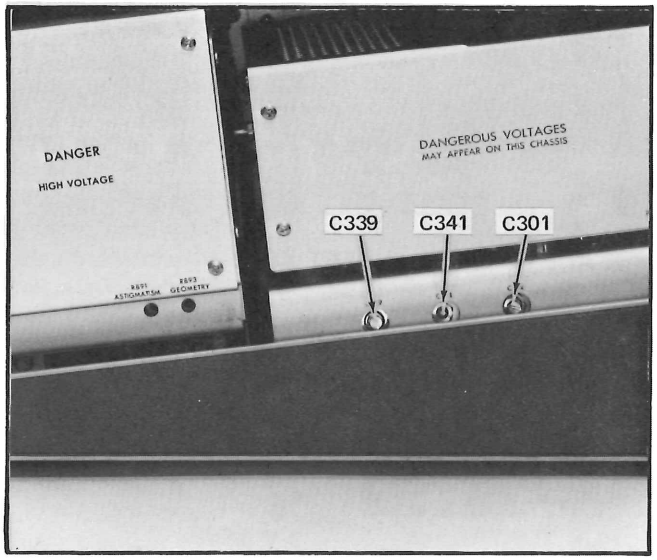

Fig. 1-9. Location of adjustments in step 16.

i. Set MAX PEAK VOLTS switch to 350 and repeat parts g and h. Set C339 for minimum vertical width between the two settings of the MAX PEAK VOLTS switch.

j. Set the MAX PEAK VOLTS switch to 1500 and the MODE switch to NORM.

k. Check for trace with minimum deviation from horizontal line at start of sweep.

l. ADJUST—C341, H. F. NOISE REJECTION adjustment (see Fig. 1-9), for minimum deviation of line. Typical setting of C341 is almost fully counterclockwise. Adjust front-panel LOOPING COMPENSATION control if necessary to get a display.

This concludes the Adjustment procedure.

SECTION 2
PERFORMANCE CHECK PROCEDURE

Change information, if any, affecting this section will be found at the rear of the manual.

General

The following procedures are arranged to allow on-line and incoming inspection performance checks of the Type 576. Using the performance check procedure and the calibration fixture, the accuracies of the display amplifiers, step generator and collector supply are checked with respect to the characteristics given in Section 1 of the Type 576 Instruction Manual. In addition, each control on the Type 576 is checked for proper operation. This performance check does not constitute a complete performance check of the Type 576 since all of the Type 576 performance characteristics are not checked. Those characteristics which do not affect the basic accuracy of the instrument and which are not conveniently checked on an on-line basis are not included in the performance check procedure. These characteristics are checked in the supplementary performance check procedure which follows the performance check procedure.

The performance check procedure provides a high level of confidence in the performance of the Type 576 and should be sufficient for most performance check requirements. The addition of the supplementary performance check procedure allows a complete performance check to be performed.

Record and Index

Table 2-1 and 2-6 at the beginning of these procedures provides a record and index of the procedures. Each table may be used as a check list to verify checks, an abridged guide for an experienced calibrator, or an index of individual checks.

Control Settings

A complete list of initial control settings for the Type 576 and significant control settings for the test instruments precedes step 1 of each procedure. In addition, partial lists of control settings are provided in various places throughout the procedures. Any control setting not listed in a partial list should be set as designated in the initial list of control settings.

PERFORMANCE CHECK PROCEDURE

Equipment List

The following equipment list gives the equipment required to use the following procedure. The required ranges and tolerances of this equipment along with some suggested instrument types are also provided. To allow accurate measurement, the required tolerances given for each piece of equipment have been chosen to exceed the tolerance to be measured by at least 4 times. For tolerances to be measured to less than 1%, the accuracy of the equipment has been chosen to exceed the tolerance by at least 10 times.

TABLE 2-1

Performance Check Record and Index

1. Type 576 Calibration Fixture (Tektronix Part No. 067-0599-00).

2. DC Voltmeter (e.g., Fluke Model 801B differential voltmeter or suitable digital voltmeter). Requirements: Voltage range from 0 volts to ±15 volts, accuracy within 0.5%, input impedance at least 500 MΩ.

3. Two 12 inch patch cords with standard banana plugs.

4. BNC male to dual binding post adapter. Tektronix Part No. 103-0035-00.

Preliminary Performance Check Procedure

1. Set the Line Voltage Selector assembly switches and the 60 Hz-50 Hz switch on the Type 576 rear panel in accordance with the line voltage source to be used.

2. Remove the Standard Test Fixture from the Type 576 and install the Calibration Fixture.

3. Connect the Type 576 to the line voltage source.

4. Turn on the Type 576. Allow at least 5 minutes warm-up at an ambient temperature between 0°C and +50°C (+32°F and +122°F) before making any checks.

5. Set the controls as shown at the beginning of the procedure and start the performance check procedure with step 1.

Initial Control Settings

Type 576

GRATICULE ILLUM	Graticule Lines Visible
READOUT ILLUM	Readout Visible
INTENSITY	Fully Counterclockwise
FOCUS	Centered
VERTICAL	.5 A
DISPLAY OFFSET Selector	NORM (OFF)
CENTERLINE VALUE	0
HORIZONTAL	2 V COLLECTOR
POSITION (Vertical and Horizontal)	Control Centered
FINE POSITION (Vertical and Horizontal)	Control Centered
ZERO	Released
CAL	Released
DISPLAY INVERT	Released
MAX PEAK VOLTS	15
PEAK POWER WATTS	220
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
POLARITY	AC
MODE	NORM
LOOPING COMPENSATION	As is
NUMBER OF STEPS	10
CURRENT LIMIT	2 A
STEP GENERATOR AMPLITUDE	2 V
OFFSET	ZERO
STEPS	Pressed
PULSED STEPS	Released
STEP FAMILY	SINGLE
RATE	NORM
POLARITY INVERT	Released
STEP MULT .1X	Released
LEFT-OFF-RIGHT	OFF
Terminal Selector	BASE TERM STEP GEN

Type 576 Calibration Fixture (067-0599-00)

Function	Step Gen
Calibration Range	200 mV Cal
Vertical	10 A (fully counter-clockwise)
Display Offset Multiplier	0
Horizontal	.5 Collector
Step Generator	.05 μA
Step Generator Loads	Off

CRT AND READOUT

1. Check CRT and Readout Controls

a. Turn the Type 576 GRATICULE ILLUM control throughout its range.

b. CHECK FOR—Continuous increase in graticule illumination when the control is turned from fully counter-clockwise to fully clockwise.

c. Set the GRATICULE ILLUM control for visible graticule lines.

d. Turn the READOUT ILLUM control throughout its range.

e. CHECK FOR—Continuous increase in the readout illumination when the control is turned from fully counter-clockwise to fully clockwise.

f. Set the READOUT ILLUM control for a visible read-out.

g. Turn the INTENSITY control throughout its range. Maintain an overly bright spot only momentarily.

h. CHECK FOR—Continuous increase in the bright-ness of the spot when the control is turned from fully counterclockwise to fully clockwise.

i. Set the INTENSITY control for a visible spot.

CAUTION

At various times throughout this procedure, a single spot will be displayed on the CRT. When displaying a single spot, reduce the intensity as much as possible while still maintaining visibility, to prevent burning of the CRT phosphor.

j. Turn the FOCUS control throughout its range.

k. CHECK FOR—Spot in focus in the center range of the control.

l. Set the FOCUS control for the smallest possible spot.

DISPLAY AMPLIFIERS

2. Check Horizontal and Vertical Positioning and INVERT Button

a. Turn the horizontal FINE POSITION control throughout its range.

b. CHECK FOR—Spot moving at least ±2.5 divisions horizontally about the center vertical graticule line (see Fig. 1-4 in Section 1 of this booklet).

c. Turn the vertical FINE POSITION control throughout its range.

d. CHECK FOR—Spot moving at least ±2.5 divisions vertically about the center horizontal graticule line.

e. Press ZERO button and center the spot on the graticule using the FINE POSITION controls.

f. Set the POLARITY switch to +(NPN).

g. CHECK FOR—Spot located at the intersection of the zero horizontal and vertical graticule lines ±0.1 division.

h. Set the POLARITY switch to −(PNP).

i. CHECK FOR—Spot located at the intersection of the tenth horizontal and vertical graticule lines ±0.1 division.

j. Press the Type 576 DISPLAY INVERT button.

k. CHECK FOR—Spot located at the intersection of the zero horizontal and vertical graticule lines.

l. Release the DISPLAY INVERT button and switch the horizontal POSITION switch to both counterclockwise positions.

m. CHECK FOR—Spot moving 5 divisions to the left ±0.1 division each time the switch is switched one position.

n. Switch the vertical POSITION switch to both counterclockwise positions.

o. CHECK FOR—Spot moving 5 divisions down ±0.1 division each time the switch is switched one position.

p. Set the following Type 576 controls as listed:

POSITION (Horizontal and Vertical)	Centered
POLARITY	+(NPN)

q. Switch the horizontal POSITION switch to both clockwise positions.

r. CHECK FOR—Spot moving 5 divisions to the right ±0.1 division each time the switch is switched one position.

s. Switch the vertical POSITION switch to both clockwise positions.

t. CHECK FOR—Spot moving 5 divisions up ±0.1 division each time the switch is switched one position.

3. Check Display Offset and Cal Button

a. Set the following Type 576 controls as listed:

DISPLAY OFFSET Selector	HORIZ X10
POSITION (Horiz. and Vert.)	Centered

b. Set the Calibration Fixture Function switch to Horiz Ampl Cal.

c. Press the ZERO button and center the spot horizontally on the CRT graticule. Release the ZERO button.

d. Turn the Type 576 CENTERLINE VALUE switch and the Calibration Fixture Display Offset Multiplier switch, together, throughout their ranges.

e. CHECK FOR—Spot centered horizontally for each position of the CENTERLINE VALUE switch ±0.25 division.

f. When the CENTERLINE VALUE switch is set to 10, press the ZERO button and be sure the spot is centered horizontally.

TABLE 2-2

Check CAL Button Accuracy

Type 576		Calibration Fixture
Horizontal	VERTICAL	Calibrator Range
2 V		200 mV
1 V		100 mV
.5 V		50 mV
	.5 A	125 mV
	.2 A	50 mV
	.1 A	25 mV

g. Set the Type 576 HORIZONTAL switch and the Calibration Fixture Calibration Range switch as shown in Table 2-2. For each setting of the HORIZONTAL switch note the position of the spot horizontally, then press the CAL button.

h. CHECK FOR—Spot within ±0.5 division, horizontally, of the position noted in part g.

i. Set the Type 576 DISPLAY OFFSET Selector switch to VERT X10.

j. Set the Calibration Fixture Function switch to Vert Ampl Cal.

k. Press the ZERO button and center the spot vertically.

l. Set the Type 576 VERTICAL switch and the Calibration Fixture Calibrator Range switch as shown in Table 2-2. For each setting of the VERTICAL switch note the position of the spot vertically, then press the CAL button.

m. CHECK FOR—Spot within ±0.5 division, vertically, of the position noted in part l.

4. Check Horizontal Display Accuracy

a. Set the following Type 576 controls to:

HORIZONTAL	.05 COLLECTOR
DISPLAY OFFSET Selector	HORIZ X10
MAX PEAK VOLTS	1500
MODE	DC
STEP FAMILY	REP

b. Set the Calibration Fixture Function switch to Horiz Atten Check.

c. Press the ZERO button and position the spot to the vertical centerline of the CRT graticule. Release the ZERO button.

d. Turn the VARIABLE COLLECTOR SUPPLY control fully clockwise.

e. CHECK FOR—Spot on center vertical graticule line ±2 divisions (±2%).

f. Turn the Type 576 HORIZONTAL switch and the Calibration Fixture Horizontal switch together throughout their ranges.

g. CHECK FOR—Spot on the center vertical graticule line ±2 divisions (±2%) for each position of the HORIZONTAL switch except the STEP GEN position and the 200 COLLECTOR position. In the 200 COLLECTOR position, set the Type 576 CENTERLINE VALUE switch to 5. In the STEP GEN position, set the Type 576 DISPLAY OFFSET Selector switch to NORM (OFF). In this case 11 spots should be displayed horizontally, with the first spot on the zero vertical line and the eleventh spot on the tenth vertical graticule line ±0.4 division (±4%). Note: the horizontal base input impedance is automatically checked by this procedure.

5. Check Vertical Display Accuracy

a. Set the following Type 576 controls as listed:

VERTICAL	2 A
DISPLAY OFFSET Selector	VERT X10
CENTERLINE VALUE	5
HORIZONTAL	200 COLLECTOR
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
MAX PEAK VOLTS	15
PULSED STEPS	300 μs
STEP FAMILY	SINGLE

b. Set the Calibration Fixture Function switch to Vertical Current Check.

c. Press the ZERO button and position the spot on the center horizontal line. Release the ZERO button.

d. Turn the VARIABLE COLLECTOR SUPPLY control fully clockwise.

e. CHECK FOR—Spot on the center horizontal graticule line ±2 divisions (±2%).

f. Set the Type 576 CENTERLINE VALUE switch to 10.

g. Turn the Type 576 VERTICAL switch and the Calibration Fixture Vertical switch, together, throughout their ranges.

h. CHECK FOR—Spot on center horizontal graticule line ±2 divisions (±2%) for all positions of the VERTICAL switch. On high sensitivity positions, adjust the intensity until 2 spots appear. Then, momentarily turn the VARIABLE COLLECTOR SUPPLY control counterclockwise to obtain a single spot.

i. Set the following Type 576 controls as listed:

VERTICAL MODE	5 μA EMITTER LEAKAGE (EMITTER CURRENT)
STEPS	Pressed

j. Set the Calibration Fixture Vertical control to 50 μA.

k. Turn the Type 576 VERTICAL switch and the Calibration Fixture Vertical switch, together clockwise throughout their ranges.

l. CHECK FOR—Spot on center horizontal graticule line ±2 divisions ±1 nA (±2% ±1 nA) for all positions of the Type 576 VERTICAL switch except the 1 nA, 2 nA and 5 nA positions. In these positions set the DISPLAY OFFSET Selector switch to NORM (OFF) and check that the spot is on the tenth horizontal graticule line ±0.5 division ±1 nA (±5% ±1 nA).

m. Set the following Type 576 controls to:

VERTICAL	STEP GEN
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
MODE	NORM
STEP FAMILY	REP

n. CHECK FOR—11 spots displayed vertically with the first spot on the zero horizontal graticule line and the eleventh on the tenth horizontal graticule line ±0.4 division (±4%).

Control Settings (Partial List)

Type 576

INTENSITY	Visible Spot
FOCUS	Smallest Spot Possible
VERTICAL	STEP GEN
POLARITY	+(NPN)
OFFSET MULT	10.0
STEP FAMILY	REP

6. Check Miscellaneous Step Generator Buttons

a. Set the Type 576 and Calibration Fixture controls as shown in the list of Initial Control Settings with changes as shown in the preceding partial list.

b. Turn the NUMBER OF STEPS switch counterclockwise throughout its range.

c. CHECK FOR—Number of spots decreasing by one for each position of the switch. At one step there should be 2 spots.

d. Turn the vertical POSITION switch two positions clockwise and press the POLARITY INVERT button. Turn the NUMBER OF STEPS switch clockwise throughout its range.

e. CHECK FOR—Inverted step generator output with zero step on tenth horizontal graticule line.

f. Set the following Type 576 controls as listed:

Vertical POSITION	Centered
POLARITY INVERT	Released
RATE	.5X

g. Note the rate at which steps are being generated then press the NORM RATE and 2X RATE buttons.

h. CHECK FOR—rate of step generation increasing when the NORM RATE button is pressed then increasing again when the 2X RATE button is pressed.

i. Press the SINGLE STEP FAMILY button. Press it again.

j. CHECK FOR—One Step family generated each time the SINGLE STEP FAMILY button is pressed.

7. Check Step Generator and Offset Multiplier Accuracy

a. Set the following Type 576 controls to:

VERTICAL	2 A
DISPLAY OFFSET Selector	HORIZ X10
HORIZONTAL	1 V BASE
STEP GENERATOR	1 V
STEP FAMILY	REP
RATE	NORM

b. Set the Calibration Fixture Step Generator Loads switch to Step Gen and the Step Generator switch to 1 V.

c. Press the ZERO button and position the spot onto the center horizontal graticule line.

d. Release the ZERO button.

e. CHECK FOR—Spot on the center horizontal graticule line ±0.1 division (1% of 1 volt).

NOTE

The Type 576 vertical, horizontal and display offset must be calibrated to perform the following checks.

f. Turn the CENTERLINE VALUE switch throughout its range, two positions at a time.

g. CHECK FOR—A spot in same position horizontally on the CRT each time the CENTERLINE VALUE switch is switched two positions ±0.5 division (5% of 1 volt).

h. Set the CENTERLINE VALUE switch to 10.

i. CHECK FOR—Spot on the center vertical line ±2 divisions (±2% of total output).

j. Press the AID OFFSET button.

k. CHECK FOR—Spot on the center vertical line ±2 divisions (±2%).

l. Turn the OFFSET MULT control counterclockwise throughout its range. For each complete revolution of the OFFSET MULT control, turn the CENTERLINE VALUE switch clockwise two positions.

m. CHECK FOR—Spot on the center vertical line for each revolution of the OFFSET MULT control.

n. Set the Type 576 OFFSET MULT control to 10.00 and press the OPPOSE OFFSET button.

o. CHECK FOR—Spot on center vertical graticule line ±2 divisions (±2%).

p. Set the following Type 576 controls to:

HORIZONTAL	.1 V BASE
OFFSET	ZERO
STEP MULT .1X	Pressed

q. Repeat parts c through f.

r. CHECK FOR—A spot in the same position horizontally on the CRT each time the CENTERLINE VALUE switch is switched two positions ±1 division (10% of 0.1 volt).

s. Set the CENTERLINE VALUE switch to 10.

t. CHECK FOR—Spot on the center vertical line ±2 divisions (2% of total output).

u. Set the following Type 576 controls to:

HORIZONTAL	200 COLLECTOR
AMPLITUDE	2 V
OFFSET	AID
STEP MULT .1X	Released
STEP FAMILY	SINGLE

v. Set the Calibration Fixture Step Generator switch to 2 V.

w. Set the DC voltmeter to measure 10 volts ±0.2 volt.

x. Connect the male BNC to dual binding post adapter to the Calibration Fixture External Monitor connector.

y. Connect the patch cords between the dual binding posts and the DC voltmeter.

z. CHECK FOR—DC voltmeter reading of 10 volts ±0.2 volts (10 V ±2%).

aa. Turn the Type 576 AMPLITUDE switch and the Calibration Fixture Step Generator switch together throughout their ranges.

bb. CHECK FOR—DC voltmeter reading of 10 volts ±0.2 volts (10 V ±2%) for each setting of the Type 576 AMPLITUDE switch.

cc. Disconnect the DC voltmeter from the calibration fixture.

Control Settings (Partial List)

Type 576

INTENSITY	Visible Spot
FOCUS	Smallest Spot Possible
VERTICAL	20 mA

8. Check Collector Supply Polarity, Peak Voltage and Ripple

a. Set the Type 576 and Calibration Fixture controls as shown in the list of Initial Control Settings at the beginning of the procedure, with changes as shown in the preceding partial list.

b. Press the ZERO button and position the spot to the center of the CRT graticule.

c. Turn the VARIABLE COLLECTOR SUPPLY control clockwise to obtain a 10 division trace.

d. CHECK FOR—Horizontal trace extending out from both sides of the center vertical graticule line.

e. Set the POLARITY switch to −(PNP) and turn the VARIABLE COLLECTOR SUPPLY fully clockwise.

f. CHECK FOR—Horizontal trace extending to the left from the tenth vertical graticule line (along top of the graticule).

g. Set the POLARITY switch to +(NPN).

h. CHECK FOR—Horizontal trace extending to the right from the zero vertical graticule line (along bottom of the graticule).

i. Set the MODE switch to DC.

j. Set the HORIZONTAL switch and MAX PEAK VOLTS as shown in Table 2-3. For each setting of these switches, perform the following procedure:

1. CHECK FOR—Spot displaced from zero vertical graticule line as shown in Table 2-3 under peak volts.

2. Set the DISPLAY OFFSET Selector switch to HORIZ X10.

3. Position the spot onto the CRT with the CENTERLINE VALUE switch.

4. CHECK FOR—Width of spot no greater than shown in Table 2-3 under DC ripple.

TABLE 2-3

Check Collector Supply Peak Voltage and DC Ripple

Switch Settings		Peak Voltages		DC Ripple (Peak-to-Peak)	
HORIZONTAL	MAX PEAK VOLTS	Voltage	Divisions	Voltage	Divisions
2 V	15 V	15 V +35%, −5%	7.5 div +2.6 div, −0.37 div	2% of 15 V	1.5 div
10 V	75 V	75 V +35%, −5%	7.5 div +2.6 div, −0.37 div	2% of 75 V	1.5 div
50 V	350 V	350 V +35%, −5%	7 div +2.4 div, −0.35 div	2% of 350 V	1.4 div
200 V	1500 V	1500 V +35%, −5%	7.5 div +2.6 div, −0.35 div	2% of 1500 V	1.5 div

5. Set DISPLAY OFFSET Selector switch to NORM (OFF) and the HORIZONTAL and the MAX PEAK VOLTS switches to the next positions shown in Table 2-3. (Always set HORIZONTAL switch first to avoid damage to horizontal amplifier.)

6. Repeat parts 1 through 5.

k. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	NORM (OFF)
MODE	NORM
VARIABLE COLLECTOR SUPPLY	Fully counterclockwise

9. Check Collector Supply Minimum Peak Currents

a. Set the Calibration Fixture Step Generator Loads switch to 1 k Collector Short.

b. Press the ZERO button and position the spot on the zero horizontal graticule line. Release the ZERO button.

c. Set the Type 576 VERTICAL and MAX PEAK VOLTS switches as shown in Table 2-4. (Always set the VERTICAL switch first to avoid damage to the vertical amplifer.)

TABLE 2-4

Check Collector Supply Peak Current

VERTICAL	MAX PEAK VOLTS	Minimum Peak Currents
20 mA	1500	10 divisions (200 mA)
.1 A	350	10 divisions (1 A)
.5 A	75	8 divisions (4 A)
2 A	15	10 divisions (20 A)

d. For each setting of the MAX PEAK VOLTS switch, turn the VARIABLE COLLECTOR SUPPLY control clockwise until the minimum peak current shown in Table 2-4 is reached, then return the VARIABLE COLLECTOR SUPPLY control to its fully counterclockwise position.

CAUTION

Do not exceed the rating of the collector supply as shown in Table 2-4. Return the VARIABLE COLLECTOR SUPPLY control to its fully counterclockwise position as soon as the given current has been obtained.

e. CHECK FOR—Minimum peak current values as shown in Table 2-4 under Minimum Peak Current.

10. Check and Adjust LOOPING COMPENSATION Control

a. Turn off the Type 576, remove the Calibration Fixture and install the Standard Test Fixture. Turn on the Type 576. Install the protective box on the Standard Test Fixture and close the lid.

b. Set the VERTICAL switch to 1 μA and the vertical POSITION switch one position clockwise.

c. Set the MAX PEAK VOLTS switch and HORIZONTAL switch as shown in Table 2-5. (Always set MAX PEAK VOLTS switch first to avoid damage to horizontal amplifier.) Turn the VARIABLE COLLECTOR SUPPLY fully clockwise.

TABLE 2-5

Check LOOPING COMPENSATION Control

MAX PEAK VOLTS	HORIZONTAL
1500	200 V COLLECTOR
350	50 V COLLECTOR
75	10 V COLLECTOR
15	2 V COLLECTOR

d. For each setting of the MAX PEAK VOLTS switch, turn the LOOPING COMPENSATION control throughout its range.

e. CHECK FOR—Looping passing through zero for each setting of the MAX PEAK VOLTS switch.

f. Set the MODE switch to DC.

g. ADJUST—LOOPING COMPENSATION control for minimum vertical width.

This concludes the performance check procedure.

SUPPLEMENTARY PERFORMANCE CHECK PROCEDURE

General

This procedure provides a method of checking those electrical characteristics not checked in the Performance Check procedure. It is expected that this procedure will be used when it is desired to perform a complete performance check of the instrument. The procedure may be used as a continuation of the performance check procedure, or as a separate procedure.

Instructions for using the Record and Index, Table 2-6, and for setting controls, are given at the beginning of this section.

Equipment Required

The following equipment and electrical components are required to perform this procedure.

1. Test Oscilloscope—See the description in item 4 of the Equipment Required list for the adjustment procedure (X1 probe not required).

2. 10 MΩ resistor, 1/4 watt, 5%; 1 MΩ resistor, 1/4 watt, 5%.

3. Two 12 inch patch cords with standard banana plugs.

4. BNC male to dual binding post adapter. See item 5 of the Equipment Required list for the performance check procedure.

TABLE 2-6

Supplememtary Performance Check Record and Index

Preliminary Supplementary Performance Check Procedure

1. If this procedure is being performed following the performance check procedure, go to step 5.

2. Set the Line Voltage Selector assembly switches and the 60 Hz-50 Hz switch on the Type 576 rear panel in accordance with the line voltage source to be used.

3. Connect the Type 576 to the line voltage source.

4. Turn on the Type 576 and allow at least 5 minutes warmup at an ambient temperature between 0°C and +50°C (+32°F and +122°F) before making any checks.

5. Set the controls as shown at the beginning of the procedure and start the supplementary performance check procedure with step 1.

Initial Control Settings

	Type 576
GRATICULE ILLUM	Graticule Lines Visible
READOUT ILLUM	Readout Visible
INTENSITY	Spot Visible
FOCUS	Well Defined Spot
VERTICAL	1 μA COLLECTOR
DISPLAY OFFSET Selector	NORM (OFF)
CENTERLINE VALUE	5
HORIZONTAL	.05 V COLLECTOR
POSITION (Vertical and Horizontal	Control Centered
FINE POSITION (Vertical and Horizontal	Control Centered
ZERO	Released
CAL	Released
DISPLAY INVERT	Released
MAX PEAK VOLTS	15
PEAK POWER WATTS	50
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
POLARITY	AC
MODE	NORM
LOOPING COMPENSATION	As is
NUMBER OF STEPS	10
CURRENT LIMIT	2 A
STEP GENERATOR AMPLITUDE	2 V
OFFSET	ZERO
OFFSET MULT	10.00 (fully counterclockwise)
STEPS	Pressed
PULSED STEPS	Released
STEP FAMILY	SINGLE

RATE	NORM
POLARITY INVERT	Released
STEP MULT .1X	Released
LEFT-OFF-RIGHT	OFF
Terminal Selector	BASE TERM STEP GEN

Test Oscilloscope

Time/Div	50 μA/DIV
Triggering	Internally Triggered on + slope
Volts/Div	.5 V/div
Input Coupling	DC
Position	Display Centered

1. Check Readout

a. Turn the Type 576 VERTICAL switch throughout its range.

b. CHECK FOR–PER VERT DIV readout coinciding with the settings of the VERTICAL switch, using COLLECTOR current units. (The readout should always be blank for the STEP GEN position of the switch.)

c. Set the Type 576 DISPLAY OFFSET Selector switch to VERT X10 and turn the VERTICAL switch throughout its range.

d. CHECK FOR–PER VERT DIV readout of 10 times less than the settings of the VERTICAL switch, using COLLECTOR current units.

e. Set the Type 576 MODE switch to LEAKAGE and the DISPLAY OFFSET Selector switch to NORM (OFF).

f. Turn the VERTICAL switch throughout its range.

g. CHECK FOR–PER VERT DIV readout coinciding with settings of the VERTICAL switch, using EMITTER current units.

h. Set the DISPLAY OFFSET Selector switch to VERT X10 and turn the VERTICAL switch throughout its range.

i. CHECK FOR–PER VERT DIV readout of 10 times less than the settings of the VERTICAL switch using EMITTER current units. (Readout should be blank for 1 nA, 2 nA and 5 nA settings of VERTICAL switch.)

j. Set the DISPLAY OFFSET Selector switch to NORM (OFF) and turn the HORIZONTAL switch throughout its range.

k. CHECK FOR–PER HORIZ DIV readout coinciding with the settings of the HORIZONTAL switch. (The readout should be blank for the STEP GEN position of the switch.)

l. Set the DISPLAY OFFSET Selector switch to HORIZ X10 and turn the HORIZONTAL switch throughout its range.

m. CHECK FOR–PER HORIZ DIV readout of 10 times less than the settings of the HORIZONTAL switch.

n. Turn the Type 576 AMPLITUDE switch throughout its range.

o. CHECK FOR–PER STEP readout coinciding with the settings of the AMPLITUDE switch.

p. Press the Type 576 STEP MULT .1X button and turn the AMPLITUDE switch throughout its range.

q. CHECK FOR–PER STEP readout 10 times less than the settings of the AMPLITUDE switch.

r. Set the MODE switch to NORM and release the STEP MULT .1X button.

NOTE

Checking all the positions of the VERTICAL and AMPLITUDE switches which provide a β OR g_m PER DIV readout is a complicated, time-consuming job. The following procedure checks only that all the β OR g_m PER DIV fiber-optics will light up.

s. Set the VERTICAL and AMPLITUDE switches for displayed readout as shown in Table 2-7.

TABLE 2-7

Check β OR g_m PER DIV Readout

PER VERT DIV	PER STEP	β OR g_m PER DIV
200 μA	2 V	100 μ
200 μA	100 mV	2 m
200 μA	50 nA	4 k
500 μA	100 nA	5 k
500 μA	200 nA	2.5 k
500 μA	1 μA	500

t. CHECK FOR—β OR g_m PER DIV readout coinciding with the third column of Table 2-7.

2. Check Horizontal and Vertical Displayed Noise

a. Set the following Type 576 controls as listed:

VERTICAL	1 μA COLLECTOR
HORIZONTAL	.05 V COLLECTOR

b. Install the protective box on the Standard Test Fixture and close the lid.

c. Turn the Type 576 MAX PEAK VOLTS switch throughout its range. (Be sure the CENTERLINE VALUE switch is set to 5.)

d. CHECK FOR—Horizontal width of spot no greater than indicated in Table 2-8 for Horizontal Collector Volts, for each position of the MAX PEAK VOLTS switch.

e. Set the HORIZONTAL switch to .05 BASE. Lift the lid of the protective box and install a 1 MΩ resistor between the base and emitter jacks (right side). Close the lid of the protective box and set the LEFT-OFF-RIGHT switch to RIGHT.

f. Repeat parts c and d, using the Horizontal Base Volts values from Table 2-8.

g. Set the LEFT-OFF-RIGHT switch to off and remove the 1 MΩ resistor.

h. Set the following Type 576 controls to:

HORIZONTAL	200 COLLECTOR
DISPLAY OFFSET Selector	NORM (OFF)
POSITION (Vertical)	1 position clockwise
POLARITY	+(NPN)
VARIABLE COLLECTOR SUPPLY	Fully clockwise

i. Turn the Type 576 MAX PEAK VOLTS switch throughout its range.

NOTE

The LOOPING COMPENSATION control will affect this check. Adjust it for minimum looping.

j. CHECK FOR—Vertical width of display no greater than indicated in Table 2-8 for Vertical Collector Current, for each position of the MAX PEAK VOLTS switch.

k. Set the MODE switch to LEAKAGE (EMITTER CURRENT).

l. Repeat parts i and j using Vertical Emitter Current values from Table 2-8.

m. Remove the protective box.

TABLE 2-8

Check Horizontal and Vertical Displayed Noise

Horizontal or Vertical Range	MAX PEAK VOLTS Switch			
	15	75	350	1500
Horizontal				
Collector Volts	1 div	1 div	4 div	40 div
Base Volts	1 div	1 div	1 div	1 div
Vertical				
Collector Current	1 div	1 div	2 div	5 div
Emitter Current	1 div	1 div	2 div	5 div

3. Step Generator Limits—Current Mode

a. Set the following Type 576 controls as listed:

VERTICAL	1 A COLLECTOR
HORIZONTAL	10 V COLLECTOR
POSITION (Vertical)	Centered
MAX PEAK VOLTS	15
VARIABLE COLLECTOR SUPPLY	Fully Counterclockwise
POLARITY	AC
MODE	NORM
STEP GENERATOR AMPLITUDE	100 mA
OFFSET	AID
STEP FAMILY	REP

b. Connect a patch cord with banana plugs between the base and collector jacks (right side) of the Standard Test Fixture. Set the LEFT-OFF-RIGHT switch to RIGHT.

c. Press the ZERO button and position the spot to the center of the CRT graticule. Release the ZERO button.

d. CHECK FOR—Lowest spot in the display at least 1.5 divisions below the center horizontal graticule line (at least 1.5 A).

e. Press the POLARITY INVERT button.

f. CHECK FOR—Highest spot in the display at least 1 division above the center horizontal graticule line (at least 1.5 A).

g. Release the POLARITY INVERT button.

NOTE

For the remainder of this step and for step 4, make each check with the POLARITY INVERT button both pressed and released. The display with the button pressed in each case will be inverted about the center of the CRT as is illustrated in parts d through g preceding this note.

h. Set the STEP GENERATOR AMPLITUDE switch to 200 mA.

i. CHECK FOR—Lowest spot in the display at least 2 divisions below the center horizontal graticule line (at least 2 A).

j. Set the VERTICAL switch to 10 mA and press the OPPOSE OFFSET button.

k. CHECK FOR—Highest spot in the display between 1 and 2 divisions above the center horizontal graticule line (between 10 mA and 20 mA).

l. Set the following Type 576 controls as listed:

VERTICAL	2 A
SERIES RESISTORS	65 k
STEP GENERATOR AMPLITUDE	50 μA
OFFSET	AID

m. ,CHECK FOR—Spot farthest to the right at least 1 division to the right of the center vertical graticule line (at least 10 V).

n. Set the HORIZONTAL switch to 1 V and press the OPPOSE OFFSET button.

o. CHECK FOR—Spot farthest to the left between 1 and 3 divisions to the left of the center vertical graticule line (between 1 V and 3 V).

4. Check Step Generator Limits—Voltage Mode

a. Set the following Type 576 controls as listed:

HORIZONTAL	10 V COLLECTOR
OFFSET	AID
STEP GENERATOR AMPLITUDE	2 V

b. CHECK FOR—Spot farthest to the right on the fourth vertical graticule line to the right of center (40 V).

c. Set the HORIZONTAL switch to 20 V and press the OPPOSE OFFSET button. Turn the HORIZONTAL switch clockwise and the STEP GENERATOR AMPLITUDE switch clockwise, together, throughout the voltage range of the STEP GENERATOR AMPLITUDE switch.

d. CHECK FOR—Spot farthest to left on the first vertical graticule line to the left of center (10 times AMPLITUDE switch setting).

e. Set the following Type 576 controls as listed:

VERTICAL	10 mA COLLECTOR
HORIZONTAL	10 V COLLECTOR
SERIES RESISTORS	3 k
STEP GENERATOR AMPLITUDE	2 V
OFFSET	AID

f. CHECK FOR—Spot farthest to the right at least 1 division below the center horizontal graticule line (at least 10 mA at 40 V).

g. Set the following Type 576 controls as listed:

VERTICAL	2 A COLLECTOR
SERIES RESISTORS	6.5

h. CHECK FOR—Spot at least 1 division below the center horizontal graticule line (at least 2 A at 10 V).

i. Set the Type 576 controls as shown in Table 2-9.

j. CHECK FOR—Spot is between 1 and 2 divisions below the center horizontal graticule line for each setting of the CURRENT LIMIT switch (between 1 and 1.5 divisions for the 2A setting).

k. Set the following Type 576 controls as listed:

VERTICAL	10 mA COLLECTOR
CURRENT LIMIT	2 A
OFFSET	OPPOSE

l. CHECK FOR—Highest spot of the display between 0.5 and 2 divisions above the center horizontal graticule line (between 5 mA and 20 mA).

TABLE 2-9

Check Short Circuit Current Limit

CURRENT LIMIT	VERTICAL
2 A	2 A
500 mA	.5 A
100 mA	.1 A
20 mA	20 mA

5. Check Pulsed Step Width

a. Set the following Type 576 controls as listed:

NUMBER OF STEPS	1
OFFSET	ZERO
PULSED STEPS	300 μs
LEFT-OFF-RIGHT	OFF

b. Disconnect the patch cord from the Standard Test Fixture. Connect the BNC-to-dual binding post adapter to channel 1 of the test oscilloscope. Connect the + input (red binding post) through a patch cord to the base jack (right side) of the Standard Test Fixture and the ground input to the emitter jack.

NOTE

If the display exhibits noise, shorter patch cords and a shielded cable between the BNC-to-dual binding post adapter and the test oscilloscope may be required.

c. Set the test oscilloscope controls as shown in the list of Initial Control Settings at the beginning of the procedure.

d. Set the LEFT-OFF-RIGHT switch to RIGHT and trigger the test oscilloscope on the positive edge of the pulsed step.

e. CHECK FOR—Pulse width of 300 μs +5%, −15%.

f. Press the 80 μs PULSED STEPS button and set the test oscilloscope Time/div switch to 20 μs.

g. CHECK FOR—Pulse width of 80 μs +20%, −5%.

6. Check Step Generator Ripple

a. Set the following Type 576 controls to:

DISPLAY OFFSET Selector	HORIZ X10
CENTERLINE VALUE	10
HORIZONTAL	.05 BASE
AMPLITUDE	.05 μA
OFFSET	AID
OFFSET MULT	0.00
STEPS	Pressed
STEP FAMILY	SINGLE
POLARITY	+(NPN)
LEFT-OFF-RIGHT	OFF

b. Disconnect the Type 576 from the test oscilloscope.

c. Connect a 10 MΩ, 1/4 watt, 5% resistor between the base and emitter jacks (right) of the Standard Test Fixture. Set the LEFT-OFF-RIGHT switch to RIGHT.

d. Press the ZERO button and position the spot to the horizontal center of the CRT graticule.

e. Turn the OFFSET MULT control clockwise until a spot appears on the CRT.

f. CHECK FOR—Spot with a horizontal width of less than 2 divisions (less than 1 nA peak to peak).

g. Set the following Type 576 controls to:

AMPLITUDE	.05 V
OFFSET MULT	10.00
LEFT-OFF-RIGHT	OFF

h. CHECK FOR—Spot with horizontal width of less than 0.2 division (less than 2 mV peak to peak).

This concludes the Supplementary Performance Check Procedure.

NOTES