FACTORY CALIBRATION PROCEDURE

CONTENTS:

This is the guide for calibrating new instruments in Product Manufacturing. The procedure consists of 4 sections:

Equipment Required

Factory Test Limits - Factory Test Limits are limits an instrument must meet before leaving Manufacturing. These limits are often more stringent than advertised performance requirements. This is to insure that the instrument will meet advertised requirements after shipment, allows for individual differences in test equipment used, and (or) allows for changes in environmental conditions.

Short Form Procedure - The Short Form Procedure has the same sequence of steps and the same limits on checks or adjustments as the Main Procedure.

Main Procedure - The Main Procedure gives more detailed instructions for the calibration of the instrument. This procedure may require that some checks and adjustments be made so that performance is better than that required by the Factory Test Limits. This insures the Factory Test Limits will be met when side panels are added, permits some normal variation in test equipment and plug-in scopes, etc.

Abbreviations in this procedure will be found listed in TEKTRONIX STANDARD A-100. Definitions of terms used in this procedure may be found in TEKTRONIX STANDARD A-101.

In this procedure, all front panel control labels and Tektronix instrument names are in capital letters (VOLT/DIV, etc). Internal adjustment labels are capitalized only (Gain Adj, etc).

This procedure is company confidential

611

March 1968

For all serial numbers.

CHANGE INFORMATION:

This procedure has been prepared by Product Manufacturing Staff Engineering. For information on changes made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact PMSE, 39-307. (DH)

EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

a. TEKTRONIX Instruments

1 TYPE 547 OSCILLOSCOPE
1 TYPE 1A1 PLUG-IN UNIT
1 TYPE 114 PULSE GENERATOR
1 TYPE 76TU LINE-VOLTAGE CONTROL UNIT
1 TYPE 184 TIME-MARK GENERATOR
1 TYPE P6006 10X PASSIVE PROBE

b. Test Fixtures and Accessories

1 DC Voltage Bridge (067-0543-99)
1 Standard Amplitude Calibrator (SAC) (067-0502-00)
2 50Ω Terminations, BNC (011-0049-00)
3 50Ω Cables, BNC (012-0057-00)
1 Test Display Generator (067-0561-00)

c. Other Equipment

1 20,000Ω/V Multimeter
1 Test Graticule (067-0573-00)
1 Remote Programmer (PMPE Dwg #1808-B)
1 Sweep Attenuator Test Unit (PMPE Dwg #1832-A)
1 Microscope with minimum 20X magnification, and Field of view of .325"
1 20V PS External Load (PMPE Dwg #1992-B, 1766-C & 1765-C)
1 Z Axis .75V Divider (PMPE Dwg #1979-A)

Substitute test equipment may be used. The Plant Staff Engineer must approve any substitutions. All equipment listed must perform within its manufacturer's specifications, unless otherwise stated.

QUALIFICATION

Factory Test Limits are qualified by the conditions specified in the main body of the Factory Calibration Procedure. The numbers and letters to the left of the limits correspond to the procedure steps where the check or adjustment is made. Steps without Factory Test Limits (set-ups, presets, etc.) are not listed. Instruments may not meet Factory Test Limits if calibration or checkout methods and test equipment differ substantially from those in this procedure.

4. POWER SUPPLIES

a. -100V Supply: -100V ±0.5%

b. Power Supplies Accuracy, Regulation and Ripple:

Supply	Accuracy	Regulation	Ripple
-100V	±0.5% (500mV)	±0.1% (0.1V)	4mV, max
+100V	±2.5% (2.5V)	±0.1% (0.1V)	4mV, max
-20V	±2.5% (500mV)	±1% (200mV)	5mV, max
+20V	±2.5% (500mV)	±1% (200mV)	5mV, max
+275V			20V, max
+420V			20V, max

c. +20V Current Limiting: ≥2.5A, ≤3.5A

d. Line Voltage Selector Switch

Line Voltage Selector	Approximate Voltage
115V	
LO	115
M	100
HI	90
230V	
LO	57
M	50
HI	45

e. High Voltage and Regulation:
Voltage: 3800V ±2%
Regulation: ±1%

f. Flood Gun Anode Range: 102 - 150V, min

5. Z AXIS OPERATION

a. Z Axis Threshold: Turn-on Level: 1V
Shut-off Level: 0.5V

b. Maximum Input Volts: + and - 50V

d. Risetime and Falltime: ≤0.15µs

7. STORAGE ADJUSTMENTS

b. Operating Level Range: ≤125V to ≥335V

d. Erase Pulse and Erase Interval: 450ms ±50ms

8. X AND Y AMPLIFIERS

b. Position Range: + and - 0.1V min

c. Vert Gain Range and Set Gain:
Range: + and - 5%
Gain: ±2%

d. Vert Input X10 Attenuation: ±2%

e. Horiz Gain Range and Set Gain:
Range: + and - 5%
Gain: ±2%

f. Horiz Input X10 Attenuation: ±2%

9. LINE STRAIGHTNESS AND CORNER FOCUS

b. Vertical Line Straightness: 1% P-P max

c. Horizontal Line Straightness: 1% P-P max

10. DOT WRITING TIME AND DOT RESOLUTION

a. Dot Writing Time and Dot Resolution:
Writing Time: ≤5µs
Resolution: ≤15% bridging
≤5% drop out

11. LINEARITY

a. Linearity: Full Scale: 1%
Incremental: 10%

12. REMOTE PROGRAMMER

a. View Mode: must override Holding Mode
b. View Multi Turn-on Rate: ≤10V/ms
c. Write Thru: must form non storing small diameter eliptical pattern

13. SETTLING TIME

c. Vertical Amplifier Settling Time: ≤3.5µs/cm +5µs
e. Horizontal Amplifier Settling Time: ≤3.5µs/cm +5µs
f. Horiz & Vert Amp Oscillations: none allowed

14. POSITION SWITCHES

a. Spot must be within ±5% of position selected

15. ORIGIN SHIFTER

b. Dot Shift: Upward and to the right 8 positions

16. TEST SPIRAL

a. Nonstored ccw spiral
b. Stored ccw spiral

THE END

Factory TEST LIMITS are limits an instrument must meet before it leaves Manufacturing; therefore, it must be possible to inspect to these limits. Because of normal variations in test equipment and plug-in scopes, addition of side panels, etc, it is necessary to set up some circuits so their performance is better than required by Factory Test Limits. Therefore, the instructions given in the Factory Calibration Procedure may call for checks or adjustments which result in less error than that allowed by the Factory Test Limits.

1. PRELIMINARY INSPECTION

a. General
b. CRT Inspection

2. PRESETS

3. RESISTANCE CHECKS

a. Check power supply resistances to ground:

Supply	Test Point	Approximate Resistance
-100V	AC	4kΩ
+100V	X	2.5kΩ
+20V	AM	63Ω
-20V	AZ	32Ω
+430V	Q	50kΩ
+280V	S	40kΩ

b. Check Remote Program connector pins to ground:

Pin	Approximate Resistance	Use	Meter Range
1*	5kΩ	X Input	X10k
2*	0	X Ground	X1
3*	0	Y Ground	X1
4*	10kΩ	Z Input	X10k
5*	0	Z Ground	X1
6	∞	Non-Store	X100k
7	2kΩ	Erase Interval	X1k
8	10kΩ	Write Through	X10k

3b. (cont'd)

Pin	Approx Resistance	Use	Meter Range
9-13	∞	Not used	X100k
14*	0	X Ground	X1
15*	5kΩ	Y Input	X10k
16*	0	Y Ground	X1
17*	0	Z Ground	X1
18	∞	Remote Erase	X100k
19	0	Program Ground	X1
20	∞	View	X100k
21-25	∞	Not used	X100k

4. POWER SUPPLIES

a. Adjust -100V Supply
b. Check Power Supplies For Accuracy, Regulation and Ripple:

Supply	Accuracy	Regulation	Ripple
-100V	±0.5% (500mV)	±0.1% (0.1V)	4mV, max
+100V	±2.5% (2.5V)	±0.1% (0.1V)	4mV, max
-20V	±2.5% (500mV)	±1% (200mV)	5mV, max
+20V	±2.5% (500mV)	±1% (200mV)	5mV, max
+275V			20V, max
+420V			20V, max

c. Check +20V Current Limiting: $\geq$2.5A, $\leq$3.5A
d. Check Line Voltage Selector Switch:

Line Voltage Selector	Approximate voltage
115V	
LO	115
M	100
HI	90
230V	
LO	57
M	50
HI	45

e. Adjust High Voltage (R450) and check Regulation: Voltage: -3800V
Regulation: ±1%
f. Check Flood Gun Anode (R667) Range: 102 - 150V min

5. Z AXIS OPERATION

a. Adjust Z Axis Threshold (R428):
   Turn-on Level: 1V
   Shut-off Level: 0.5V
b. Check Maximum Input Volts: + and - 50V
c. Adjust Writing Gun Grid Bias (R486)
d. Check Risetime and Falltime: $\leq$0.15µs

6. YOKE ALIGNMENT

a. Align the yoke

7. STORAGE ADJUSTMENTS

a. Setup
b. Check Operating Level Range: $\leq$125V to $\geq$335V
c. Set CE-2 (R540), CE-1 (R554) and Erase Collimation (R538) to that voltage specified with the tube.
d. Adjust Erase Pulse and check Erase Interval: 450ms ±50ms

8. X AND Y AMPLIFIERS

a. Set Beam Position using Horiz Beam Centering (R72) and Vert Beam Centering (R172) with pins T and Z set to zero volts with R44 and R144.
b. Check Horiz and Vert Position Range (R44) and (R144): + and - 0.1V min
c. Check Vert Gain Range (R145) and Set Gain: Range + and - 5%
   Gain: 21cm of deflection
d. Check Vert Input X10 Attenuation: ±3%
e. Check Horiz Gain Range (R45) and Set Gain: Range: + and - 5%
   Gain: 16.2cm of deflection
f. Check Horiz Input X10 Attenuation: ±3%

9. LINE STRAIGHTNESS AND CORNER FOCUS

a. Setup
b. Adjust Vertical Line Straightness using Horiz Geom (R238) and Horiz Geom Bal (R227)
c. Adjust Horizontal Line Straightness using vert Geom (R278) & Vert Geom Bal (R267)
d. Adjust Focus Correction Symmetry (R288) and Corner Focus (R292)

10. DOT WRITING TIME AND DOT RESOLUTION

a. Check Dot Writing Time and Dot Resolution: Writing Time: $\leq$5µs
   Resolution: $\leq$15% bridging
   $\leq$5% drop out

11. LINEARITY

a. Check Linearity: Full Scale 1%
   Incremental 10%

12. REMOTE PROGRAMMER

a. Check View Mode: must overide Holding Mode
b. Check View Multi Turn-On Rate: $\leq$10V/ms
c. Adjust Write Thru: must form non storing small diameter eliptical pattern

13. SETTLING TIME

a. Setup
b. Adjust Vertical Amplifier High Frequency Compensations (C112, C145, C153, & C132)
c. Check Vertical Amplifier Settling Time: $\leq$3.5µs/cm +5µs
d. Adjust Horizontal Amplifier High Frequency Compensations (C12, C45, C53, & C62)
e. Check Horizontal Amplifier Settling Time: $\leq$3.5µs/cm +5µs
f. Check Horiz Amp (pin P) & Vert Amp (pin A) for Oscillations: none allowed

14. POSITION SWITCHES

a. Spot must be within 5% of position selected

15. ORIGIN SHIFTER

a. Setup
b. Check dot shift: upward and to the right 8 positions

16. TEST SPIRAL

a. Check for nonstored ccw spiral
b. Check for stored ccw spiral

THE END

1. PRELIMINARY INSPECTION

a. General

Check fuses for proper value.

b. CRT Inspection

Inspect the CRT for physical defects: phosphor defects, scratches, chips or cracks. Check that front CRT bracket is firmly in place.

b. Do not reject a CRT without consulting a CRT checker.

2. PRESETS

Set the TYPE 611 controls:

WRITE THRU INT	ccw
INTENSITY	ccw
FOCUS	ccw
OPERATING LEVEL	ccw
TEST SPIRAL	centered
Line Voltage Selector (on rear panel)	M - 115
Writing Gun Grid Bias (R488)	ccw
Flood Gun Anode (R667)	cw
C E 1 (R554)	cw
Erase Collimation (R538)	ccw
Z Axis Threshold (R428)	cw
All other internal adjustments	centered
SW 202	centered
SW 204	centered

Set the TRIG 547 with TYPE 1A1 installed.

HORIZONTAL DISPLAY	B
MAIN TIME BASE (B)	
TRIGGERING LEVEL	0
TRIGGERING MODE	AUTO
TRIGGERING SLOPE	+
TRIGGERING COUPLING	AC
TRIGGERING SOURCE	NORM
TIME/CM	1mSEC

Set the TYPE 1A1 controls:

MODE	CH 1
CHANNEL 1 VOLTS/CM	.05
CHANNEL 1 POSITION	midr
CHANNEL 1 VARIABLE VOLTS/CM	CALIB
CHANNEL 1 PULL FOR INVERT	Pushed In
CHANNEL 1 INPUT SELECTOR	DC

3. RESISTANCE CHECKS

a. Check power supply resistances to ground. (- polarity meter lead grounded) Resistance values may vary depending on range and meter type. The type used is Triplett, Model 630-NA

Supply	Test Point	Approximate Resistance
-100V	AC	4kΩ
+100V	X	2.5kΩ
+20V	AM	63Ω
-20V	AZ	32Ω
+430V	Q	50kΩ
+280V	S	40kΩ

b. Check the Remote Program connector pins to ground

Pin	Approx Resistance	Use	Meter Range
1*	5kΩ	X Input	X10k
2*	0	X Ground	X1
3*	0	Y Ground	X1
4*	10kΩ	Z Input	X10k
5*	0	Z Ground	X1
6	∞	Non-Store	X100k
7	2	Erase Interval	X1k
8	10kΩ	Write Through	X10k
9-13	∞	Not used	X100k
14*	0	X Ground	X1
15*	5kΩ	Y Input	X10k
16*	0	Y Ground	X1
17*	0	Z Ground	X1
18	∞	Remote Erase	X100k
19	0	Program Ground	X1
20	∞	View	X100k
21-25	∞	Not used	X100k

b. Pin numbers with an asterisk are optional and need be checked when wired in.

Set the Remote Programmer NON STORE - OFF switch to NON STORE, VIEW-OFF to VIEW, WRITE THRU-OFF to OFF and VOLTS SELECTOR to +1. Connect it to the REMOTE PROGRAMMER connector on the rear panel of the TYPE 611.

4. POWER SUPPLIES

a. Adjust -100V Supply: -100V ±0.5%

Connect the TYPE 611 to the TYPE 76TU set for 115VAC and turn power ON. Connect the DC Voltage Bridge between gnd and -100V supply (pin AC on power supply board). Adjust R817 for -100V.

b. Check Power Supplies for Accuracy Regulation and Ripple:

Using the DC Voltage Bridge and test scope at appropriate settings, check accuracy, regulation and ripple of supplies as indicated below while varing the TYPE TU from 104VAC to 126VAC.

Supply	Accuracy	Regulation	Ripple
-100V	±0.5% (500mV)	±0.1% (0.1V)	4mV, max
+100V	±2.5% (2.5V)	±0.1% (0.1V)	4mV, max
-20V	±2.5% (500mV)	±1% (200mV)	5mV, max
+20V	±2.5% (500mV)	±1% (200mV)	5mV, max
+275V			20 V, max
+420V			20 V, max

c. Check +20V Current Limiting: $\geq$2.5A, $\leq$3.5A

Set the TYPE 611 POWER switch to OFF. Remove the lead going to pin AP on the low voltage power supply board. Set the multimeter to an appropriate current setting and connect the - polarity lead to pin AP. Connect the + polarity lead to lifted lead. Connect the + lead to the TYPE 611 +20V External Load to pin AM and the - lead to gnd. Set the TYPE 611 POWER switch to ON and while observing the multimeter, press the +20V External Load PUSH TO TEST button and rotate the INCREASE LOAD control ccw. Note that the current increases to a point where it will increase no more. This current must be equal to or greater than 2.5A and equal to or less than 3.5A. If necessary to obtain the proper load set the +20V External Load, MAX MIN LOAD switch to MAX.

Set the TYPE 611 POWER switch to OFF, remove the multimeter leads and +20V External Load leads and reconnect the lead to pin AP. Set the TYPE 611 POWER switch to ON.

4. (cont'd)

d. Check Line Voltage Selector Switch

Connect a multimeter across pins 14 and 15 of the power transformer and adjust the TYPE 76TU for 100VAC (indicated on the multimeter). While changing the Line Voltage Selector, check for voltages as indicated in the table below.

Line Voltage Selector	Approximate voltage
115V	
LO	115
M	100
HI	90
230V	
LO	57
M	50
HI	45

Remove the multimeter and return the Line Voltage Selector to 115V, M. Set the TYPE 76TU for 115VAC.

e. Adjust High Voltage and check regulation: Voltage: 3800V ±2%
Regulation: ±1%

Connect the DC Voltage Bridge between ground and the High Voltage Test Point. Adjust 4kV set (R450) for -3800V. Check regulation from 104VAC to 126VAC. Must regulate within ±1% (38V).

f. Check Flood Gun Anode Range: 102 - 150V min

Connect a multimeter from the emitter of Q670 to gnd on the storage EC board. The meter should read 102V. Rotate the Flood Gun Anode (R667) full cw. The voltage must be 150V min. Set R667 to 150V.

5. Z AXIS OPERATION

a. Adjust Z Axis Threshold:
Turn-on Level: 1V
Shut-Off Level: 0.5V

Set the Standard Amplitude Calibrator (SAC) AMPLITUDE control to 1 VOLTS and connect the TYPE 611 Z Axis 0.75V Divider to its OUTPUT connecter. Connect a 50Ω cable from the 0.75V Divider to the TYPE 611 Z INPUT. Set the TYPE 611 INTENSITY control to midrange and connect a X10 probe from the TYPE 1A1 CHANNEL 1 INPUT to TP440 on the Z Axis H.V. Power Supply EC board. Set the test scope B TIME/CM to .5mSEC and the TYPE 1A1 CHANNEL 1 VOLTS/CM to 1. While observing the test scope display, rotate the Z Axis Thresold (R428) ccw until a square wave display appears.

Remove the Z Axis 0.75V Divider from the SAC and reconnect the 50Ω cable. Set the SAC AMPLIUTUDE control to .5 VOLTS. The display should disappear. Set the SAC AMPLITUDE control to 1 VOLTS. The display should again appear.

b. Check Maximum Input Volts: + and -50V

While observing the test scope display, set the SAC AMPLITUDE control to 50 VOLTS. There should be no change in the display. Set MODE to + DC and -DC. There should be no display signal. Return MODE to the square wave position and note that display returns. Set the SAC AMPLITUDE to .5 VOLTS. There should again be no display. Set the SAC AMPLITUDE control to 1 VOLTS. The display should return. Remove the SAC signal from the Z INPUT.

5. (cont'd)

c. Adjust Writing Gun Grid Bias

Set the Storage Display Test Unit as follows:

DISPLAY control

CONT-READY-SINGLE	- CONT
HORIZ-VERT-CROSS HATCH	- VERT
RASTER-SINGLE DOT	- RASTER
DOTS 100/80-LINES 100	- LINES 100
DENSITY	- X1
VARIABLE DENSITY	- ccw
Z AXIS PULSE	- 9
HORIZ-POSITIONING-VERT	- ON
TIME/LINE mSEC	- ccw Pulled Out
AMPLITUDE	- cw

Connect a 50Ω cable from the TYPE 611 Y and Z INPUT's to the Y and Z connectors on the Storage Display Test Unit. Set the test scope B TIME/CM to .1μSEC and the TYPE 1A1 CHANNEL 1 VOLTS/CM to 1. Set the TYPE 611 INTENSITY control full ccw and rotate the Writing Gun Grid Bias (R486) cw until a vertical trace is just visible on the CRT. Rotate (R486) a few degrees ccw to turn the display off. Rotate the INTENSITY control full cw and note that the display appears. Check the test scope display for an approximate amplitude of 50V. Rotate the INTENSITY control full ccw to turn the TYPE 611 display off. Note the test scope display amplitude to be approximately 10V.

d. Check Risetime and Falltime: $\leq$0.15μs

Rotate the INTENSITY full cw. Set the test scope B TIME/CM to .1μSEC and check risetime to be equal to or less than 0.15μs. Rotate the INTENSITY full ccw. Set the TYPE 1A1 CHANNEL 1 VOLTS/CM to an appropriate setting and the B TRIGGERING SLOPE to -. Check fall time to be equal to or less than 0.15μs. Remove the probe from TP440.

6. YOKE ALIGNMENT

a. Align the yoke

Set SW 204 on the TYPE 611 to its forward position and install the test graticule. Increase the INTENSITY as necessary and adjust FOCUS to obtain a well defined trace. Set the trace to the center graticule line with the Horiz Position (R44).

Loosen the retaining screw and raise the storage chassis. Loosen the CRT Shield Clamp and with a pair of CRT pliers, rotate the rear CRT shield to align the vertical trace, parallel with the center graticule line (see notes). Tighten the shield clamp, lower and secure the storage chassis.

It may be necessary to adjust Horiz Geom Bal (R227) for a straight line at graticule center.

7. STORAGE ADJUSTMENTS

a. Setup

Set the Storage Display Test Unit CONT-READY-SINGLE switch to READY. Set the Remote Programmer NON STORE-OFF switch to OFF.

b. Check Operating Level Range: ≤125V to ≥335V

Connect a multimeter set at appropriate volts range from gnd to the emitter of Q526. Check that voltage is equal to or less than 125V. Rotate OPERATING LEVEL full cw and check voltage to be equal to or greater than 335V. Set the OPERATING LEVEL to that specified for the tube. Connect the multimeter to OL TP on the Front sub panel and check for the same voltage.

c. Set CE-2 (R540), CE-1 (R554) and Erase Collimation (R538)

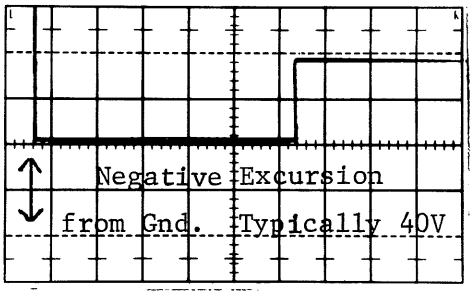
Connect the multimeter set at appropriate volts range to pin CE-2 on the storage board and set CE-2 (R540) to that voltage specified with the tube. Connect

7c. (cont'd)

the multimeter to pin CE-1 and adjust CE-1 (R554) to that specified.

Connect a X10 probe from the TYPE 1A1 CHANNEL 1 INPUT to pin CE-2. Set the TYPE 1A1 CHANNEL 1 VOLTS/CM to 2. Set the test scope B TIME/CM to .1 SEC and TRIGGERING MODE to AUTO. Set the TYPE 1A1 INPUT SELECTOR to GND and using the POSITION control, set the trace 1cm from the bottom graticule line. Set the AC-DC-GND switch to DC and note a positive trace shift to the voltage level set by CE-2 (R540) above. Push the TYPE 611 ERASE switch and note the negative excursion of the test scope display. Adjust the Erase Collimation (R538) so that the negative excursion from ground is that called out by the CRT specifications (see figure 1 in notes column).

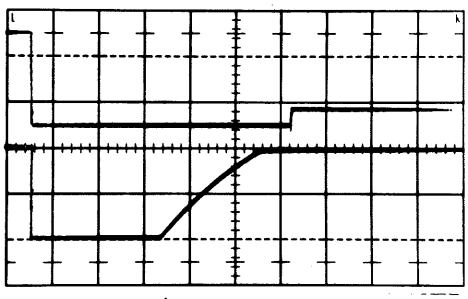
Fig. 1



d. Adjust Erase Pulse and check Erase Interval: 450ms ±50ms

Set the TYPE 1A1 CHANNEL 1 and 2 INPUT SELECTORS to GND and MODE to CHOP. Set the test scope CRT CATHODE SELECTOR to CHOPPED BLANKING. Connect a 10X probe from the CHANNEL 2 INPUT to pin STB on the storage board. Set the CHANNEL 1 and 2 VOLTS/CM switches to 10. Using the POSITION controls, place the CHANNEL 1 trace to the center graticule line and the CHANNEL 2 trace 1cm from the bottom graticule line. Set both INPUT SELECTOR's to DC. While pushing the ERASE switch adjust the test scope TRIGGERING LEVEL control to obtain a display similar to figure 2.

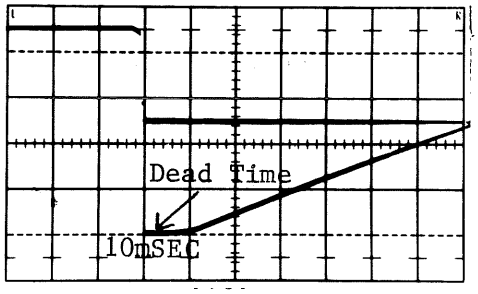
Fig. 2



TIME/CM .2SEC

Set the TYPE 1A1 CHANNEL 2 VOLTS/CM to 2 and the test scope B TIME/CM to 10mSEC. While repeatedly pushing the ERASE switch adjust Fade Neg Amp (R510) for a dead time of approximately 10ms as shown in figure 3. Set the CHANNEL 2 VOLTS/CM to

Fig. 3

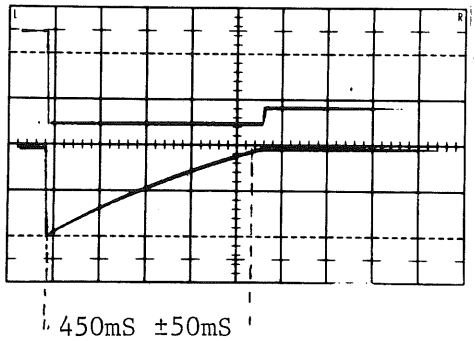


TIME/CM 10mSEC

7d. (cont'd)

10 and B TIME/CM to .1 SEC. While pushing the ERASE switch adjust Backplate Recovery (R511) so that the recovery time of the lower display (Erase Pulse) conincides with the upper (Erase Interval) 450ms ±50ms. See figure 4. The adjustments of Fade Neg Amp (R510) and Backplate Recovery (R511) must be repeated due to interaction.

Fig. 4



Remove the probes and set the Remote Programmer NON-STORE-OFF switch to NON-STORE.

8. X AND Y AMPLIFIERS

a. Set Beam Position

Remove the 50Ω cable from the TYPE 611 Y INPUT. Connect a 50Ω termination to the X and Y INPUT. Set SW 204 to its center position the INTENSITY full ccw and set the Storage Display Test Unit CONT-READY-SINGLE switch to CONT. Rotate the INTENSITY control cw to obtain a dim spot which should be near the center of the screen.

Set the TYPE 1A1 MODE switch to CH 1 and connect the X10 probe from the CHANNEL 1 INPUT to pin T. Set the CHANNEL 1 VOLTS/CM to .05 and free run the test scope sweep. Adjust Horiz position (R44) for zero volts as indicated on the test scope. Connect the X10 probe to pin Z and adjust Vert Position (R144) for zero volts. Remove the X10 probe. Place the spot to the graticule center using Horiz Beam centering (R72) and Vert Beam centering (R172).

8. (cont'd)

b. Check Position Range: + and - 0.1V min

Remove the 50Ω termination from the X and Y INPUT's. Set the SAC AMPLITUDE control to OFF, set MODE to + DC and connect a 50Ω cable from the OUTPUT to the TYPE 611 X INPUT. Note the position of the spot and set the SAC AMPLITUDE control to .1 VOLTS. It must be possible to return the spot to its former position with the Horiz Position (R44). Set the SAC MODE to -DC and again return the spot to its original position. Set the SAC AMPLITUDE control to OFF and set the spot to its original position.

Remove the 50Ω cable from the X INPUT and connect it to the Y INPUT. Repeat the above procedure using the Vert Position (R144).

c. Check Vert Gain Range and Set Gain:
Range: + and -5%
Gain: ±2%

Connect a 50Ω cable from the X INPUT to the X connector on the Storage Display Test Unit and set the HORIZ VERT-CROSS HATCH switch to HORIZ. Set SW 202 to its forward position and set the Remote Programmer NON STORE-OFF switch to OFF. Set the SAC AMPLITUDE control to .2 VOLTS and the MODE switch to the square wave position. Rotate Vert Gain (R145) full cw. The display amplitude must be 4.4cm, min. Rotate R145 full ccw. The display amplitude must be 3.1cm, max.

Set SW 204 to its forward position and set the SAC AMPLITUDE control to 1 VOLTS. Using the Vert Position (R144) control to center the display, adjust R145 for 21cm of deflection Set the SAC AMPLITUDE control to 50 VOLTS and the MODE switch to +DC and then to -DC. Return the MODE switch to the square wave position and the AMPLITUDE to 1 VOLTS. The display amplitude must be 21cm of deflection.

8. (cont'd)

d. Check Vert Input X10 Attenuation: ±3%

Lift the lead from pin I on the vertical attenuator board and connect it to pin H. Lift the lead from pin J and connect it to pin K. Set the SAC AMPLITUDE control to 10 VOLTS and check that the display amplitude is 21cm, ±2%. Return the leads to pins I and J.

e. Check Horiz Gain Range and Set Gain:
Range: + and - 5%
Gain : ±2%

Remove the 50Ω cables from the TYPE 611 X and Y INPUT's and set SW 202 to its center position. Connect a 50Ω cable from the Y INPUT to the Storage Display Test Unit Y connector and set the HORIZ-VERT-CROSS HATCH switch to VERT. Connect a 50Ω cable from the X INPUT to the SAC and set the SAC AMPLITUDE control to .2 VOLTS. Rotate Horiz Gain (R45) full cw. The display amplitude must be 3.4cm, min. Rotate R45 full ccw. The display amplitude must be 3.1cm, max.

Set SW 202 to its forward position and set the SAC AMPLITUDE control to 1 VOLTS. Using the Horiz Position (R44) to center the display, adjust R45 for 16.2cm of deflection. Set the SAC AMPLITUDE control to 50 VOLTS and the MODE switch to +DC and then to -DC. Return the MODE switch to the square wave position and the AMPLITUDE to 1 VOLTS. The display amplitude must be 16.2cm of deflection.

f. Check Horiz Input X10 Attenuation: ±3%

Lift the lead from pin D on the horizontal attenuator board and connect it to pin E. Lift the lead from pin C and connect it to pin B. Set the SAC AMPLITUDE control to 10 VOLTS and check that the display amplitude is 16.2cm, ±2%. Return the leads to pins D and C. Set the Remote Programmer NON STORE-OFF switch to NON STORE and remove the 50Ω cable from the X INPUT.

9. LINE STRAIGHTNESS AND CORNER FOCUS

a. Setup

Connect a 50Ω cable from the TYPE 611 X INPUT to the X connector on the Storage Display Test Unit. Center the display with HORIZ-POSITIONING-VERT controls. Adjust the TYPE 611 FOCUS control for optimum focus.

b. Adjust Vertical Line Straightness: 1% P-P max

Adjust Horiz Geom (R238) and Horiz Geom Bal (R227) for optimum straightness of the vertical lines. The deviation from a straight line must not exceed 1% P-P (2.1mm) from top to bottom of the test graticule.

It may be necessary at this time to make a slight readjustment of the yoke.

c. Adjust Horizontal Line Straightness 1% P-P max

Set the Storage Display Test Unit HORIZ-VERT-CROSS HATCH switch to HORIZ and center the display if necessary using HORIZ-POSITIONING-VERT controls. Adjust Vert Geom (R278) and Vert Geom Bal (R267) for optimum straightness of the horizontal lines. The deviation from a straight line must not exceed 1% P-P (1.63mm) from left to right side of the test graticule.

d. Adjust Focus Correction Symmetry and Corner Focus

Set the Storage Display Test Unit DOTS 100/80 - LINES 100 to DOTS 100/80. Adjust Corner Focus (R292) for optimum focus of the dots in the corner areas of the graticule. Adjust Focus Correction Symmetry (R288) and front panel FOCUS control for best overall focus of the display.

10. DOT WRITING TIME AND DOT RESOLUTION

a. Check Dot Writing Time and Dot Resolution: Writing Time: ≤5μs
Resolution: ≤15% bridging
≤5% drop out

Set the Storage Display Test Unit CONT-READY-SINGLE switch to READY, DENSITY to X5 , VARIABLE DENSITY full cw and Z AXIS PULSE to 5μs. Set the Remote Programmer NON-STORE-OFF switch to OFF. Depress the Storage Display Test Unit CONT-READY-SINGLE to the SINGLE position and write the entire screen. Check the stored dots throughout the graticule area for any indication of bridging (dots touching) or drop out (dots missing). Inspect any questionable area with a microscope adjusted to observe a 10 X 10 dot area. Check for a maximum of 15% bridging (15 dots touching) and/or a maximum of 5 drop outs (5 dots with less the 3 raised collectors).

11. LINEARITY

a. Check Linearity: Full Scale: 1%
Incremental: 10%

Set the Storage Display Test Unit DOTS 100/80- LINE 100 Switch to LINES 100, the CONT-READY-SINGLE switch to CONT and DENSITY to X1. Adjust the VARIABLE DENSITY control to obtain 21 horizontal lines placing the first line at the bottom graticule line and the twenty first at the top graticule line. Check that all lines within the graticule area coincide with their corresponding 1cm graticule lines within 1% (2mm) along the center axis.

Check the entire graticule area for the lines spaced 2 divisions apart that are the closest together and the lines spaced 2 divisions apart that are the greatest distance apart. The difference between the two sets of lines must not exceed 10% (1mm).

Set the Storage Display Test Unit HORIZ-VERT-CROSS HATCH to VERT and adjust the VARIABLE DENSITY for 16 vertical lines. Repeat the above checks for horizontal linearity.

12. REMOTE PROGRAMMER

a. Check View Mode: must override Holding Mode

Push the Storage Display Test Unit TIME/LINE mSEC in and set the CONT-READY-SINGLE switch to READY. Press the ERASE switch. Set the VIEW-OFF switch to OFF and wait until the TYPE 611 PUSH to VIEW (HOLDING) switch lights. Depress the Storage Display Test Unit CONT-READY-SINGLE to the SINGLE position. The TYPE 611 PUSH TO VIEW (HOLDING) switch light should go out and vertical lines should be displayed.

The display should go to the hold mode in 60 to 90 seconds and the PUSH TO VIEW (HOLDING) switch should light. Push the PUSH TO VIEW (HOLDING) switch. The light should go OFF and the display should return. The display should again go to the hold mode in 60 to 90 seconds. Return the Remote Programmer VIEW-OFF to VIEW and push the ERASE switch.

b. Check View Multi Turn-On Rate: ≤10V/ms

Connect the Sweep Attenuator Test Unit to the test scope (see example in figure 1 at end of procedure). Set the test scope as follows: HORIZONTAL DISPLAY to B, NORMAL-SINGLE SWEEP to NORMAL. Set the A TIME BASE TRIGGERING MODE to AUTO and TIME/CM to 50μSEC. Set the B TIME BASE TRIGGERING MODE to AUTO, SLOPE to -, COUPLING to AC, SOURCE TO NORM and TIME/CM to .1mSEC. Set the TYPE 1A1 MODE to CH 1 and the CHANNEL 1 VOLTS/CM to 5. Set the Sweep Attenuator Test Unit to VERT and connect a 50Ω cable from its X connector to the TYPE 1A1 CHANNEL 1 INPUT. Adjust the B TRIGGERING LEVEL control for a stable display. Adjust the A TIME/CM VARIABLE control and the Sweep Attenuator Test Unit SWEEP ATTEN for a ramp 10cm long and 2cm high.

12b. (cont'd)

Set the NORMAL-SINGLE SWEEP switch to SINGLE SWEEP and remove the 50Ω cable from the TYPE 1A1 CHANNEL 1 INPUT. Remove the Storage Display Test Unit 50Ω cable from the TYPE 611 Z INPUT and connect the 50Ω cable from the Sweep Attenuator Test Unit. Depress the test scope NORMAL-SINGLE SWEEP switch to RESET. The PUSH TO VIEW (HOLDING) switch light should go out and the display should return. Remove the 50Ω cable from the Z INPUT and reconnect the 50Ω cable from the Storage Display Test Unit. Return the Remote Programmer VIEW-OFF to VIEW and push the ERASE switch.

c. Adjust Write Thru: must form non storing small diameter circular pattern

Set the TYPE 611 SW202 and SW204 to their center positions. Set the INTENSITY control full ccw. Set the Storage Display Test Unit RASTER-SINGLE DOT switch to SINGLE DOT and CONT-READY-SINGLE to CONT. Rotate the INTENSITY control cw until a low intensity spot appears. Set the Remote Programmer WRITE THRU-OFF switch to WRITE THRU. Rotate the WRITE THRU control cw to obtain a dim circle. Adjust WRITE THRU for a visible circle which will not store when positioned anywhere on screen using the Storage Display Test Unit HORIZ-POSITIONING-VERT controls.

Repeat steps a, b and c (without adjusting WRITE THRU) with the Remote Programmer VOLTS SELECTOR switch at -10.

Set the WRITE THRU-OFF switch to OFF and NON STORE-OFF to NON STORE. Remove the 50Ω cables from the TYPE 611 X, Y, and Z INPUT's. Set the INTENSITY control to midrange.

13. SETTLING TIME

a. Setup

Interchange the leads from pins T & S on the Horiz Amp and Y & Z on the Vert Amp of the TYPE 611. Setup equipment as shown in firure 1 at end of procedure. Set the TYPE 114 PERIOD control to EXTERNAL TRIGGER. Set the WIDTH to 10μs and VARIABLE WIDTH to midrange. Set the AMPLITUDE control to 1 to 3V +. Set the TYPE 184 MARKER SELECTOR to 1μs and 5μs. Set the TRIGGER SELECTOR to 10μs. Set the test scope TIME BASE A TRIGGERING LEVEL to 0, TRIGGERING MODE to TRIG, SLOPE to +, COUPLING to AC and SOURCE to EXT. Set the A TIME/CM to 20μSEC. Set the Sweep Attenuator Test Unit to VERT and adjust the SWEEP ATTEN for an 8cm display width. A display similar to that shown in figure 1 of the notes column should be obtained.

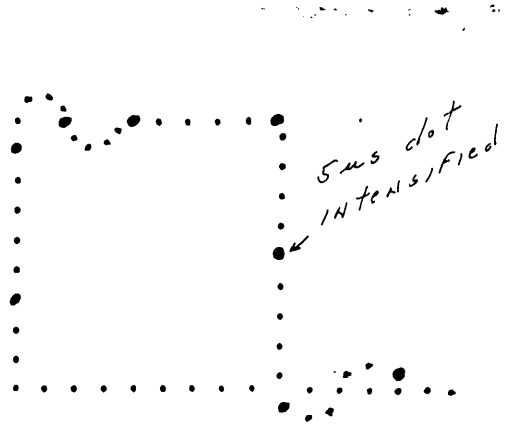


Figure 1

b. Adjust Vertical Amplifier High Frequency Compensations

Adjust the TYPE 114 VARIABLE WIDTH for a pulse width of 3cm and the VARIABLE AMPLITUDE for a pulse amplitude of 1cm (add additional attenuation to TYPE 114 OUTPUT if necessary). Adjust the TYPE 611 Vert Amp High Frequency Compensations C112, C145, C153 and C132 for optimum response of the displayed waveform.

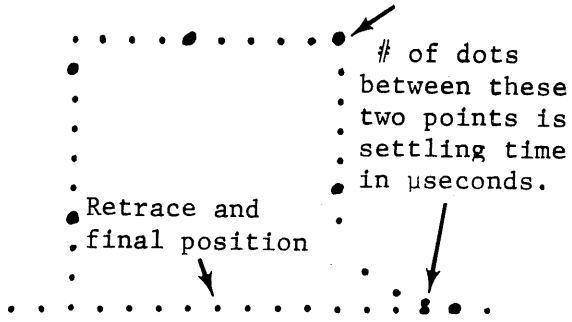


Figure 2

c. Check Vertical Amplifier Settling Time: ≤3.5μs/cm + 5μs

Adjust the TYPE 114 VARIABLE WIDTH control so that a 5μs dot is positioned at the start of the settling deflection. Count the number of dots as shown in figure 2 of the notes column. The settling time must be equal to or less than 8.5μs. Using the TYPE 611 SW202, SW204, the Vert Position (R144) and Horiz Position (R44), position the 1cm display in various areas of the graticule and repeat. Set the TYPE 114 AMPLITUDE control to 1 to 3V - and repeat.

13c. (cont'd)

Adjust the TYPE 114 AMPLITUDE control for a 4cm display and check settling time to be equal to or less than 19μs throughout the graticule area. Set the TYPE 114 AMPLITUDE control to 1 to 3V + and repeat.

Set the TYPE 114 AMPLITUDE control to 3 to 10V + and adjust the VARIABLE AMPLITUDE for 21cm of deflection. Settling time must be equal to or less than 78.5μs. Set the TYPE 114 AMPLITUDE control to 3 to 10V - and repeat.

d. Adjust Horizontal Amplifier High Frequency Compensations

Set the TYPE 611 SW202, SW204, Vert Position (R144) and Horiz Position (R44) to their centered positions. Set the Sweep Attenuator Test Unit to HORIZ. Set the TYPE 114 AMPLITUDE control to 1 to 3V + and adjust the VARIABLE AMPLITUDE control for a 1cm display. Adjust the Horiz Amplifier High Frequency Compensations C12, C45, C53 and C62 for optimum response of the displayed wave form.

e. Check Horizontal Amplifier Settling Time: ≤3.5μs/cm +5μs

Position the 1cm display anywhere in the graticule area and check settling time to be equal to or less than 8.5μs. Set the TYPE 114 AMPLITUDE control to 1 to 3V + and repeat.

Adjust the TYPE 114 AMPLITUDE control for a 4cm display and check settling time to be equal to or less than 19μs anywhere in graticule area. Set the TYPE 114 AMPLITUDE control to 1 to 3V + and repeat.

Set the TYPE 114 AMPLITUDE control to 3 to 10V + and adjust the VARIABLE AMPLITUDE for 16.3cm of delfection. Check settling time to be equal to or less than 62μs. Set the TYPE 114 AMPLITUDE control to 3 to 10V - and repeat.

13e. (cont'd)

Remove the 50Ω cables from the TYPE 611 X, Y and Z INPUT's. Return the leads on the Horiz and Vert Amps to their original pins and SW202 & SW204 to their centered positions.

f. Check Horiz & Vert Amp Oscillations: none allowed

Connect 50Ω terminations to the X & Y INPUT's. Connect a 50Ω cable from the Storage Display Test Unit to the Z INPUT. Set the spot to the graticule center using Horiz and Vert Positioning (R44 and R144). Remove the 50Ω terminations from the X & Y INPUT's and connect the 50Ω cables from the X and Y connectors of the Storage Display Test Unit. Set the TYPE 1A1 CHANNEL 1 VOLTS/CM to .005 and the test scope B TIME/CM to 1μSEC. Connect the X10 probe from the CHANNEL 1 INPUT to pin P on Horiz Amp board. Set SW202 & SW204 to their forward positions. While observing the test scope and Type 611, position the spot to various extremes of the graticule using the Storage Display Test Unit HORIZ-POSITIONS-VERT control. Check that no oscillations occur while moving the spot. Connect the X10 probe to pin A on the Vert Amp board and repeat. Return SW202 & SW204 to their centered positions and remove the 50Ω cables from the X and Y INPUT's. Remove the X10 probe.

14. POSITION SWITCHES

a. Spot must be within ±5% of position selected

Using SW202 & SW204, select positions as shown in figure 2 at end of procedure. The spot must be within plus or minus 5% of the position selected. Return the switches to their center position.

15. ORIGIN SHIFTER

a. Setup

Connect the origin shifter to the X and Y amplifier board.

b. Check dot shift: Upward and to the right 8 positions

Push the ERASE switch eight times noting that the dot shifts upward and to the right for seven steps and then returns to point of origin.

Remove the SAC signal from the TYPE 611 Z INPUT and the 50Ω terminations from the X and Y INPUT's.

16. TEST SPIRAL

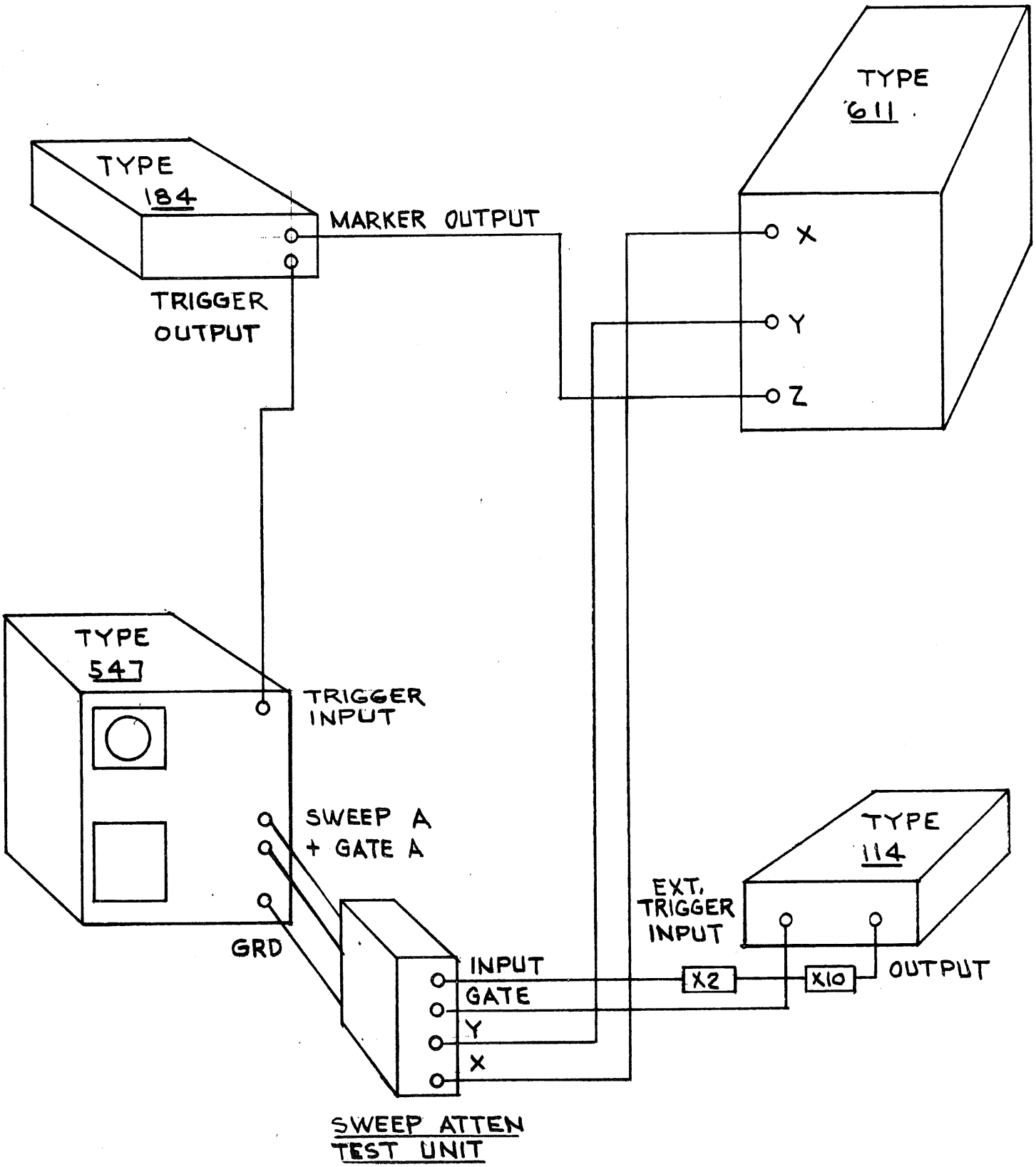
a. Check for nonstored ccw spiral

Pull the TEST SPIRAL knob out. A nonstored ccw spiral (starting from the outside and spiraling inward) display should be observed. Return TEST SPRIAL to its center position.

b. Check for stored ccw sprial

Set the Remote Programmer NON STORE-OFF switch to OFF. Push the TEST SPRIAL knob in, hold for approximately 1 second and release. A stored spiral display should be observed (the INTENSITY may have to be increased). Push the SPIRAL knob in again and note that the stored spiral is erased before another spiral is written.

THE END


TYPE
611
TYPE
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X
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TYPE
547
TRIGGER
INPUT
SWEEP A
+ GATE A
GRD
TYPE
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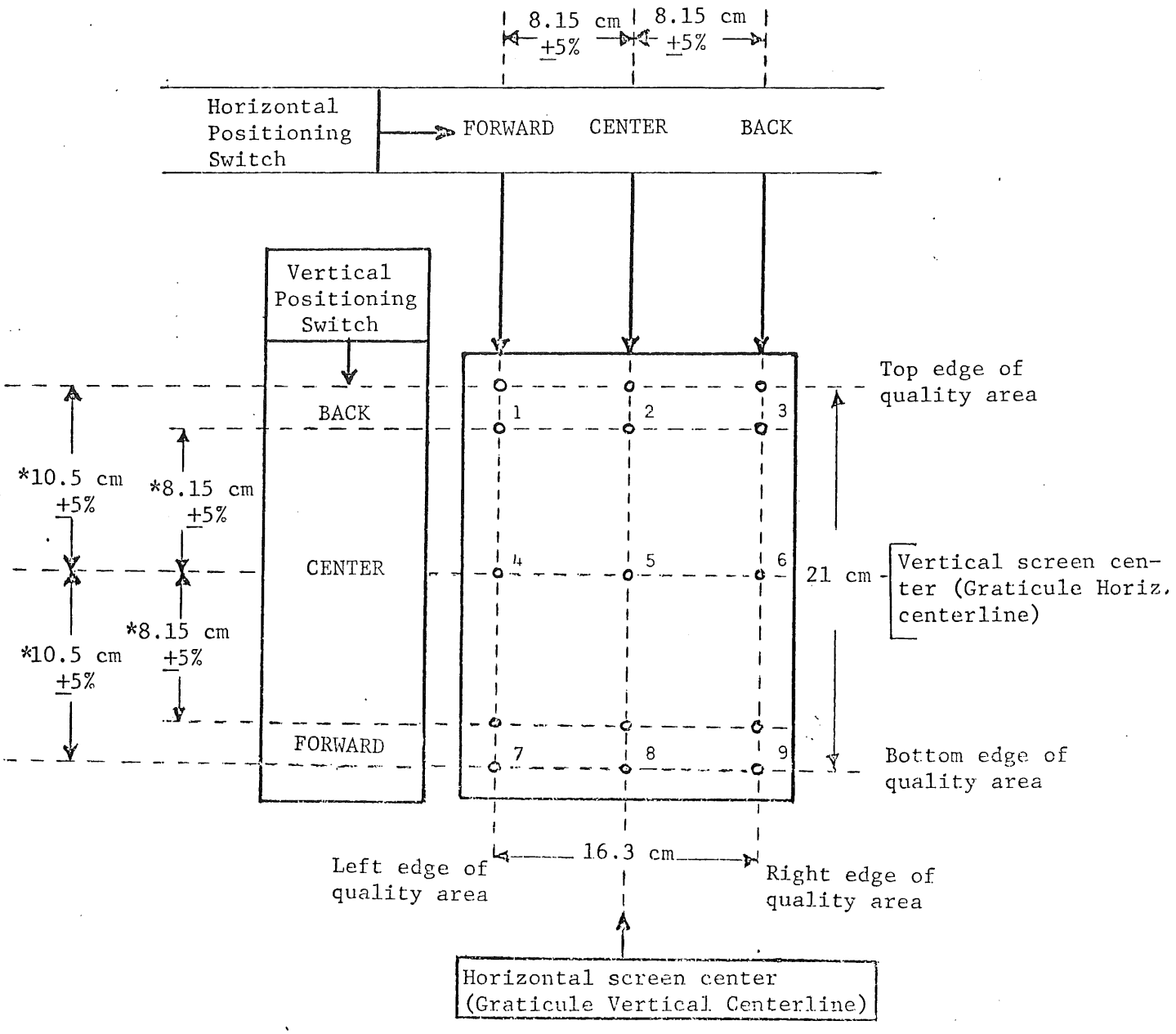
EXT.
TRIGGER
INPUT
INPUT
GATE
Y
X
X2
X10
OUTPUT
SWEEP ATTEN
TEST UNIT

Figure 1



Conditions:

1. X and Y Inputs terminated in 50 Ω.
2. X and Y Amplifier gains properly adjusted.
3. Horizontal and Vertical Positioning adjustments properly set.

*8.15 cm with gain set for square format and 10.5 cm for rectangular format.

Positions selected by internal switches

Figure 2