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

3B4

January 1969

For all serial numbers.

CHANGE INFORMATION:

This procedure has been prepared by Test-Final Staff Engineering. For information on changes made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact T-FSE, 39-307.

EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

a. TEKTRONIX Instruments

1	TYPE 561B OSCILLOSCOPE (plug-in scope)
1	TYPE 3A1 DUAL TRACE AMPLIFIER
1	TYPE 546 or 547 OSCILLOSCOPE (test scope)
1	TYPE 1A1 DUAL TRACE PLUG-IN
1	TYPE P6006 10X PROBE
*1	TYPE 184 TIME MARK GENERATOR
*1	TYPE 191 CONSTANT AMPLITUDE SIGNAL GENERATOR

b. Test Fixtures and Accessories

*1	STANDARD AMPLITUDE CALIBRATOR (SAC) (067-0502-00)
3	50Ω coax cables, BNC (012-0057-01)
1	50Ω TERMINATION, BNC (011-0049-00)
1	BNC "T" connector (103-0015-00)
1	Plug-in extension, for TYPE 560 series Oscilloscope (013-0034-00)
1	Sine-Wave Generator (067-0542-99)

c. Other Equipment

1	20,000Ω/VDC Multimeter (VOM)

*This equipment must be traceable to NBS for certification of measurement characteristics.

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.

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 (setups, 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. +20 VOLT SUPPLY AND DC FILAMENT

b. +20V supply: 20V ±10%
c. DC filament voltage: -6.1 ±1V

5. MULTI TRACE OPERATION

Must alternate at all sweep rates

6. LOW FREQUENCY TRIGGERING

b. TRIGGERING LEVEL range: + & - 15V
c. EXT AC and DC triggering: 0.3V @30Hz
d. EXT ÷ 10 triggering: 3V +10% @30Hz
e. EXT AC LF REJ triggering: 0.3V @30kHz

7. HIGH FREQUENCY TRIGGERING

a. EXT triggering: 0.3V @20MHz, ≤5ns jitter
b. EXT ÷ 10 triggering: 3V +10% at 20MHz, ≤5ns jitter
c. INT triggering: 0.2div at 20MHz, ≤5ns jitter

9. AUTO TRIGGERING MODE

a. AUTO repetition rate: between 50 and 500ms

10. SINGLE SWEEP

a. SINGLE SWEEP: must operate at same TRIGGERING LEVEL as NORM
b. SWEEP TRIG'D light: on with triggered pulses

11. HORIZONTAL AMPLIFIER

*a. CALIBRATE accuracy: ±2%
*b. X50 Mag Gain: ±4%
c. Sweep Mag Regis: ≤0.1div shift
d. CALIBRATE range:

CRT horizontal deflection factor	CALIBRATE range max gain	min gain
17.7V/div	+15%	-5%
18.6V/div	+10%	-10%
19.5V/div	+5%	-15%

e. Sweep Length: 10.5div, ±0.3div
f. VARIABLE TIME/DIV ratio: ≥2.5:1

12. UNMAGNIFIED TIMING

*a. Slow and medium sweep timing: ±2%; except 5SEC, ±3%
*b. Fast sweep rates: ±2%
*c. Fast sweep timing: ±2%

*13. MAGNIFIED TIMING

Accuracy: ±4%

14. + GATE OUT

a. + GATE OUT amplitude: 20V ±10%
b. Holdoff:

TIME/DIV	holdoff
.2-2μ SEC	4.5-8.5μs
5-20μ SEC	9.5-13.5μs
50 SEC-.2mSEC	60-110μs
.5-2mSEC	.45-.7ms
5-20mSEC	8-20ms
50mSEC-5SEC	45-65ms

c. Holdoff variation: 5 to 10%

15. EXTERNAL HORIZONTAL AMPLIFIER

*a. Ext Horiz Gain: ±2%
*b. HORIZONTAL VOLTS/DIV accuracy: ±2%
c. POSITION range: positions 20V display off graticule
d. FINE POSITION range: 0.8 to 1.4div
e. VARIABLE attenuation ratio: ≥2.5:1
*f. Bandwidth: ≥425kHz @-3dB

16. CURRENT DRIVE

60 to 70μA/div

*Indicates measurement characteristic; test equipment must be traceable to NBS for instrument certification.

THE END

This instrument must meet Factory Test Limits 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, this procedure may require that some checks and adjustments be made so that performance is better than that required by Factory Test Limits.

1. PRELIMINARY INSPECTION

a. Install current modifications
b. General inspection

2. PRESET CONTROLS

a. Preset TYPE 3A1 (CH 1 & 2)
b. Preset TYPE 3B4 ext controls
c. Preset TYPE 3B4 int adjustments to midr

3. RESISTANCE CHECKS

a. Check plug-in connector resistances
b. Check COUPLING and EXT ÷ 10 resistances

4. +20 VOLT SUPPLY AND DC FILAMENT

a. Install TYPE 3B4
b. Check +20V supply: 20V ±10%
c. Check DC filament voltage: -6.1V ±1V

5. MULTI TRACE OPERATION

Check for alternate at all sweep rates

6. LOW FREQUENCY TRIGGERING

a. Set TRIGGERING LEVEL for 0V and index
b. Check TRIGGERING LEVEL range: + & -15V
c. Check EXT AC and DC triggering: 0.3V @30Hz
d. Check EXT ÷ 10 triggering: 3V ±10% at 30Hz
e. Check EXT AC LF REJ triggering: 0.3V at 30kHz

7. HIGH FREQUENCY TRIGGERING

a. Check EXT triggering: 0.3V at 20MHz, $\leq$5ns jitter
b. Check EXT ÷ 10 triggering: 3V +10% at 20MHz, $\leq$5ns jitter
c. Check INT triggering: 0.2div at 20MHz, $\leq$5ns jitter

8. LINE TRIGGERING

Check TRIGGER MODE, TRIGGER LEVEL and SLOPE for correct polarity

9. AUTO TRIGGERING MODE

a. Check AUTO repetition rate: between 50 and 500ms
b. Check bright line AUTO: intensified baseline

10. SINGLE SWEEP

a. Check SINGLE SWEEP: operates at same TRIGGERING LEVEL as NORM
b. Check SWEEP TRIG'D light: on with trigger pulses

11. HORIZONTAL AMPLIFIER

a. Set sweep CALIBRATE: ±2%
b. Adjust X50 Mag Gain, R447: ±4%
c. Adjust Sweep Mag Regis, R422: ≤0.1 div shift
d. Check CALIBRATE range:

deflection factor	Range of 1st-9th mkr max gain - min gain	
17.7V/div	≥9.2div	≤7.6div
18.6V/div	≥8.8div	≤7.2div
19.5V/div	≥8.4div	≤6.8div

e. Adjust Length, R173: 10.5div, ±0.3div
f. Check VARIABLE TIME/DIV ratio: ≥2.5:1

12. UNMAGNIFIED TIMING

a. Check slow and medium sweep timing: ±2%; except 5 SEC ±3%
b. Adjust fast sweep rates, C160A & C160C: ±2%
c. Check fast sweep timing: ±2%

13. MAGNIFIED TIMING

Accuracy ±4%

14. + GATE OUT

a. Check + GATE OUT amplitude: 20V ±10%
b. Check holdoff:

TIME/DIV	holdoff
.2-2μSEC	4.5-8.5μs
5-20μSEC	9.5-13.5μs
50μSEC-.2mSEC	60-110μs
.5-2mSEC	.45-.7ms
5-20mSEC	8-20ms
50mSEC-5 SEC	45-65ms

c. Check holdoff variation: 5 to 10%

15. EXTERNAL HORIZONTAL AMPLIFIER

a. Adjust Ext Horiz Gain, R228: ±2%
b. Check HORIZONTAL VOLTS/DIV accuracy: ±2%
c. Check POSITION range: positions 20V display off graticule
d. Check FINE POSITION range: 0.8 to 1.4 div
e. Check VARIABLE attenuation ratio: ≥2.5:1
f. Check bandwidth: ≥425 kHz @ -3dB

16. CURRENT DRIVE

60 to 70μA/div

THE END

1. PRELIMINARY INSPECTION

a. Install current modifications

b. General inspection

Check for unsoldered joints, rosin joints, improper lead dress, loose hardware, foreign material and long ends. Check controls and switches for smooth mechanical operation and proper indexing. Correct all defects found.

2. PRESET CONTROLS

a. TYPE 3A1 (both CHANNELS)

POSITION	midr
VOLTS/DIV	.05
VARIABLE	CALIB
AC-DC-GND	GND
MODE	ALTER

b. TYPE 3B4 external controls

POSITION	midr
FINE	midr
TIME/DIV or HORIZONTAL	
VOLTS/DIV	1mSEC
MAGNIFIER	dot at 1mSEC
VARIABLE	CALIB
TRIGGER MODE	FREE RUN
SLOPE	+
COUPLING	AC
SOURCE	INT
TRIGGERING LEVEL	cw

b. TIME/DIV OR HORIZONTAL VOLTS/DIV

To simplify control settings this switch will be referred to by the function it is performing.

Sweep rates---TIME/DIV
External Horizontal deflection---VOLTS/DIV

c. TYPE 3B4 internal adjustments

Set variable capacitors and pots to midr.

Leave controls and adjustments, for any step as they were in the step preceding unless otherwise noted.

3. RESISTANCE CHECKS

a. Check plug-in connector resistance

Check the approx resistance to gnd of each plug-in connector terminal with the VOM.

Terminal	Approx Ω to GND	Use
1	75	6.3 VAC
2	75	6.3 VAC
3	∞	---
4	7.5k	multi-trace sync
5	0	gnd
6	20k	+300V unregulated
7	∞	---
8	∞	---
9	0	gnd
10	20k	+300V regulated
11	∞	---
12	∞	trigger pickoff lead
13	10k	unblanking
14	5k	+125V regulated
15	5k	+125V regulated
16	3	-12.2V regulated
17	30k	output
18	120k	sawtooth
19	0	gnd
20	7k	+125 unregulated
21	30k	output
22	0	gnd
23	7.5k	-100V regulated
24	∞	---

Serial number 739 and below, pin 18 is unused.

Check protection diodes; D123, D124, D154, D167 and D234 for opens or shorts.

b. Check EXT ÷ 10 resistance

Set the TYPE 3B4 COUPLING to DC and SOURCE to EXT. Use the VOM to check the resistance from the R7 (1MΩ)-R10 (220kΩ) junction (COUPLING switch) to gnd. Approx 1MΩ. Change the COUPLING to AC LF REJ and check for approx 91kΩ.

Change the positive VOM lead to the center conductor of the EXT TRIG IN connector. Change the COUPLING to DC and check for approx 1MΩ. Change the SOURCE to EXT ÷ 10 and check for approx 10.1MΩ.

Remove the VOM leads, set the SOURCE to INT and COUPLING to AC.

4. +20 VOLT SUPPLY AND DC FILAMENT

a. Setup

Install the TYPE 3A1 in the TYPE 561B left plug-in compartment. Using the plug-in extension install the TYPE 3B4 in the right plug-in compartment. Plug the TYPE 561B power cord into the TYPE 76TU and set the TYPE 76TU for 117V, read on its meter. Set the TYPE 561B FOCUS and INTENSITY ccw. Turn POWER ON.

b. Check +20V supply: 20V ±10%

Set the VOM to read 20V. Connect the leads between gnd and the junction of D462 and R462. Check for +20V ±2V.

b. +20 volts test point

D462, 20V zener diode and R462, 8.2k 2W 5% resistor, are located at the top, left, center of the chassis.

c. Check DC filament voltage: -6.1V ±1V

With the VOM polarity reversed, measure the voltage at the top of R464, -6.1V ±1V.

c. Filament voltage test point

R464, 91Ω ½W resistor is located at the lower, left, rear corner of the chassis.

5. MULTI-TRACE OPERATION

Check for alternate at all sweep rates.

Adjust the TYPE 561B FOCUS and INTENSITY for 2 traces of optimum focus. Position the traces 2 div apart and rotate the TYPE 3B4 TIME/DIV switch through all sweep rates. Check for alternate traces at all sweep rates. Return TIME/DIV switch to 1mSEC.

6. LOW FREQUENCY TRIGGERING

a. Set TRIGGERING LEVEL: 0V

Set the TYPE 3A1 MODE switch to CH 1. Connect the VOM set to read +20VDC between the junction of R12-R13 and gnd. Set the TRIGGERING LEVEL for a VOM reading of 0V. Loosen the TRIGGERING LEVEL knob set screw and position the index dot to front panel 0. Tighten the TRIGGERING LEVEL knob set screw and check that the VOM still reads 0V, with the index dot at front panel 0.

a. The 9-3 wire on SLOPE switch is a convenient place to contact the R12-R13 junction.

6a. (cont'd)

Install the TYPE 3B4 in the TYPE 561B plug-in compartment.

b. Check TRIGGERING LEVEL range: + & -15V

Connect a BNC T connector to the TYPE 3A1 CH 1 input. Connect a coax cable from the "T" to the TYPE 3B4 EXT TRIG IN. Set the TYPE 3A1 CH 1 VOLTS/DIV switch to 10. Connect the Output of the Sine-wave Generator to the "T" connector. Set the Sine-wave Generator frequency to 1kHz and adjust the amplitude for a 3div display. Set the TYPE 3B4 TRIGGER MODE to NORM, COUPLING to DC and SOURCE to EXT.

Rotate the TRIGGERING LEVEL through its range. The display must not trigger at extreme cw and ccw settings of the TRIGGERING LEVEL control. Check with SLOPE in + and -.

c. Check EXT AC and DC Triggering: 0.3V at 30Hz.

Set the TYPE 3A1 CH 1 VOLTS/DIV switch to .1. Change the Sine-wave Generator frequency to 30Hz and adjust the amplitude for a 3div display. Change the TYPE 3B4 TIME/DIV to 10mSEC. Check triggering in + and - SLOPE, AC and DC COUPLING in AUTO and NORM TRIGGER MODE. Check that the SLOPE, waveform and TRIGGERING LEVEL agree on triggering polarity. Check AC LF REJ for no triggering on 0.3V.

c. The TYPE 3B4 will not trigger in both + and - SLOPE without adjusting the TRIGGERING LEVEL.

d. Check EXT ÷ 10 triggering: 3V +10% at 30Hz

Set the TYPE 3B4 TRIGGERING MODE to FREE RUN, SOURCE to EXT ÷ 10 and TIME/DIV to 1mSEC. Set the TYPE 3A1 CH 1 VOLTS/DIV to 1. Adjust the Sine-wave Generator amplitude for 3div of display.

Change the TYPE 3B4 TIME/DIV to 10mSEC and check triggering in + and - SLOPE, AC and DC COUPLING in both NORM and AUTO TRIGGERING MODE. Check that SLOPE, waveform and TRIGGERING LEVEL agree on triggering polarity.

6. (CONT)

e. Check EXT AC LF REJ triggering: 0.3V at 30kHz

Set the TYPE 3B4 TRIGGERING MODE to FREE RUN, SOURCE to EXT and TIME/DIV to 50μSEC. Set the TYPE 3A1 CH 1 VOLTS/DIV to .1. Set the Sine-wave Generator frequency to 30kHz and adjust the Output for a 3div display. Set the TYPE 3B4 COUPLING to AC LF REJ. Check triggering in both + and - SLOPE in NORM and AUTO TRIGGERING MODE. Check that SLOPE waveform and TRIGGERING LEVEL agree on triggering polarity.

Change the SOURCE to EXT ÷ 10 and the TYPE 3A1 VOLTS/DIV 1. Adjust the Sine-wave Generator amplitude for a 3div display. Check for correct triggering in + and - SLOPE. Return the SOURCE to EXT and the TYPE 3A1 VOLTS/DIV to .1.

Set the TIME/DIV to .2mSEC. Change the Sine-wave Generator frequency to 3kHz and adjust the amplitude for a 3div display. Check that the display will not trigger.

7. HIGH FREQUENCY TRIGGERING

a. Check EXT triggering: 0.3V at 20MHz, ≤5ns jitter

Remove the Sine-wave Generator Output from the BNC "T" connector. Insert a 50Ω TERMINATION between the EXT TRIG IN connector and the coax cable. Set the TYPE 3B4 TIME/DIV to .05μSEC, MAG ONLY. Set the TRIGGER MODE to FREE RUN.

Connect the output of the TYPE 191 to the BNC "T" connector. Set the TYPE 191 to 50kHz and adjust the amplitude for a 3cm display. Change the TYPE 191 frequency to 20MHz and check triggering in + and - SLOPE, AC, AC LF REJ and DC in NORM TRIGGER MODE. Check for 0.1div or less trace width.

7. (CONT)

b. Check EXT ÷ 10 triggering 3V +10% at 20MHz, ≤5ns jitter

Change TRIGGER MODE to FREE RUN and set the TYPE 3A1 VOLTS/DIV to 1. Change the TYPE 191 frequency to 50kHz and adjust the amplitude for 3div of display. Change the TYPE 191 frequency to 20MHz, set the TYPE 3B4 SOURCE to EXT ÷ 10 and TRIGGER MODE to NORM. Check triggering in AC, AC LF REJ and DC in both + and - SLOPE. Check for 0.1div or less trace width.

c. Check INT triggering: 0.2div at 20MHz, ≤5ns jitter

Change the TYPE 3B4 SOURCE to INT. Set the TYPE 191 AMPLITUDE and TYPE 3A1 CH 1 VOLTS/DIV for a 0.2div display. Check triggering in AC and AC LF REJ in both + and - SLOPE. Jitter must not exceed 5ns.

Change COUPLING to DC and check triggering in both + and - SLOPE with the display at the top and the bottom of the TYPE 561B graticule. Jitter must not exceed 5ns.

Change the TRIGGER MODE to AUTO. Check that stable triggering can be obtained by adjusting the TRIGGERING LEVEL.

8. LINE TRIGGERING

Triggers on correct polarity.

Remove the TYPE 191 signal, BNC "T" connector, 50Ω TERMINATION and coax cable from the TYPE 3A1 and TYPE 3B4. Connect the 10X PROBE to the TYPE 3A1 CH 1 input. Hook the probe tip to the TYPE 561A fuse holder.

Set the TYPE 3A1 CH 1 VOLTS/DIV to 10. Set the TYPE 3B4 TIME/DIV to 5mSEC and SOURCE to LINE. Check triggering polarity in + and - SLOPE. Check that SLOPE, waveform and TRIGGERING LEVEL agree on triggering polarity.

8. (CONT)

Change the TRIGGER MODE to AUTO and recheck the display for correct triggering in + and - slope.

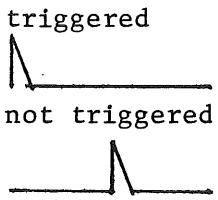
If line triggering does not work properly in AUTO mode check T38 for correct wiring.

9. AUTO TRIGGERING MODE

a. Check AUTO repetition rate: between 50 & 500ms

Remove the 10X PROBE from the fuse holder and TYPE 3A1 CH 1 input. Connect the 10μS markers from the TYPE 184 to the CH 1 input. Set the TYPE 3B4 TIME/DIV to 10μSEC, SLOPE to +, COUPLING to AC and SOURCE to INT. Change the TRIGGER MODE to AUTO. Set the TYPE 3A1 CH 1 VOLTS/DIV and VARIABLE for 3div of display amplitude.

a. Display



Change the TYPE 184 to 50mS and adjust the TYPE 3B4 TRIGGERING LEVEL for a stable display, triggered on the leading edge of the time mark. Change the TYPE 184 to .5S and check to see that the sweep will not trigger on the time mark leading edge.

b. Check bright line AUTO: intensified baseline

Rotate the TRIGGERING LEVEL and check for an intensified baseline, except at one point near 0 where the SWEEP TRIG'D light is lit.

10. SINGLE SWEEP

a. Check SINGLE SWEEP: Operates at same TRIGGERING LEVEL as NORM

Set the TYPE 184 to .1S. Set the TYPE 3B4 TIME/DIV to 100mSEC, TRIGGER MODE to NORM and adjust the TRIGGERING LEVEL for a stable display. Observe the display for several sweeps to insure correct triggering.

Change the TRIGGER MODE to SINGLE SWEEP, wait for READY Light to go out. Check for no display and the SWEEP TRIG'D light lit. Push in the PUSH TO RESET button. Check that the SWEEP TRIG'D light goes out, the READY light lights and one sweep

10a. (CONT)

starts. Hold down on the PUSH TO RESET button during sweep time and check that a second sweep does not start after the first one ends. Check that the SWEEP TRIG'D light comes on when the READY light goes off.

Set the TYPE 3A1 CH 1 AC-DC-GND switch to GND. Change TRIGGER MODE to NORM then back to SINGLE SWEEP and check that the READY light comes on. SWEEP TRIG'D goes out. Change the TYPE 3A1 AC-DC-GND switch to DC. Check for one sweep, READY light goes off, then SWEEP TRIG'D light on.

b. Check SWEEP TRIG'D light: on with trigger pulses

Change TYPE 184 to .5S, TYPE 3B4 TRIGGER MODE to NORM and check that the SWEEP TRIG'D light flashes as each time mark is displayed. Change the TYPE 184 to 1mS. Set the TYPE 3B4 TIME/DIV switch to 1mSEC and check that the SWEEP TRIG'D light remains on all the time.

11. HORIZONTAL AMPLIFIER

a. Set sweep CALIBRATE: ±2%

Set the TYPE 3B4 TRIGGER MODE to AUTO. Set the TYPE 184 for 1mS time marks. Position the time marks to align the number 1 time mark with the number 1 graticule line. Adjust the TYPE 3B4 CALIBRATE for 1 time mark/div ±0.16div.

b. Adjust X50 Mag Gain, R447: ±4%

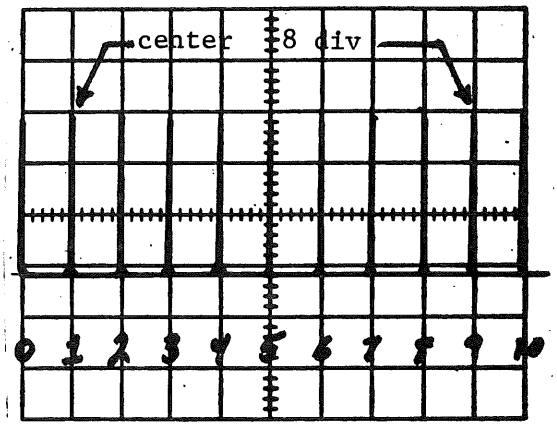
Change the TYPE 184 to 10µS time marks. Pull the MAGNIFIER knob out and turn it to 20µSEC. Check that the TIME/DIV remains at 1mSEC. Position time marks to coincide with graticule lines and adjust R447 for 2 time marks/cm.

c. Adjust Sweep Mag Regis, R422: ≤0.1div shift

Use a non-magnetic soldering aid to short the CRT horizontal deflection plates together. Check the position of the spot on the graticule; this is the CRT electrical center.

a. 1. Leave MAGNIFIER and TIME/DIV locked together unless otherwise instructed.

2. Sweep accuracy



Sweep accuracy is checked over the center 8div. Tolerances are distance between 9th time mark and number 9 graticule line, when the 1st time mark is aligned with the number 1 graticule line.

11c. (CONT)

Position the start of the display to CRT electrical center. Change the MAGNIFIER to 1mSEC and adjust R422 to return the start of the display to the CRT electrical center.

Repeat steps 11a, b and c until interaction is eliminated.

d. Check CALIBRATE range:

Change the TYPE 3B4 TIME/DIV to EXT HORIZ IN and position the spot to the left side of the graticule. Measure the voltage between CRT deflection plate leads with the VOM. Position the spot to the right side of the graticule, reverse the VOM polarity and measure the voltage between deflection plates. Add the voltages together, divide by 10 and the result is the horizontal deflection factor of the CRT.

Change TYPE 184 to 1mS and TYPE 3B4 TIME/DIV switch to 1mSEC. Rotate the CALIBRATE control ccw, check minimum range. Rotate the CALIBRATE cw and check the maximum range. Use the horizontal deflection factors in the following table to determine CALIBRATE range.

CRT horizontal deflection factor	CALIBRATE range max gain	CALIBRATE range min gain	Range of 1st-9th marker max gain	Range of 1st-9th marker min gain
17.7V/div	+15%	-5%	≥9.2div	≤7.6div
18.6V/div	+10%	-10%	≥8.8div	≤7.2div
19.5V/div	+5%	-15%	≥8.4div	≤6.8div

Adjust the CALIBRATE control for 1 time mark/div.

e. Adjust Length, R173: 10.5div, ±0.3div

Add .1mS marks to 1mS marks from the TYPE 184. Adjust R173 for 10.5div. Each small time mark equals 0.1div.

f. Check VARIABLE TIME/DIV ratio: ≥2.5:1

Change the TYPE 184 to 1mS. Rotate the TYPE 3B4 VARIABLE TIME/DIV ccw. Check that UNCAL is lit when the VARIABLE is out of CALIB. Check for 5 time marks or more/2div at ccw. Return VARIABLE to CALIB.

12. UNMAGNIFIED TIMING

a. Check slow and medium sweep timing: ±2%; except 5 SEC ±3%

Set the TYPE 3B4 TIME/DIV to .1mSEC. Change the TYPE 184 to .1mS. Align the time marks with the graticule lines and check sweep accuracy over the center 8div of sweep. Use the control settings in the following table to check sweep accuracy.

TIME/ DIV	TYPE 184	marks/ div	tolerance in div
.1mSEC	.1mS	1	±0.16
.2mSEC	.1mS	2	±0.16
.5	.5	1	±0.16
1	1	1	±0.16
2	1	2	±0.16
5	5	1	±0.16
10	10	1	±0.16
20	10	2	±0.16
50	50mS	1	±0.16

Change TRIGGER MODE to NORM.

100mSEC	.1S	1	±0.16
.2 SEC	.1	2	±0.16
.5	.5	1	±0.16
1	1	1	±0.16
2 SEC	1S	2	±0.16
5 SEC	5S	1	±0.24

b. Adjust fast sweep rates, C160A & C160C: ±2%

Set the TYPE 3B4 TIME/DIV to 10µSEC and TRIGGER MODE to AUTO. Set the TYPE 184 to 10µS. Adjust C160C for 1 time mark/div.

Change the TYPE 3B4 TIME/DIV to .2µSEC and the TYPE 184 to .1µS. Adjust C160A for 2 time marks/div.

c. Check fast sweep timing: ±2%

Use the control settings in the following table to check fast sweep accuracy.

TIME/DIV	TYPE 184	marks/ div	tolerance in div
.2µSEC	.1µS	2	±0.16
.5µSEC	.5µS	1	±0.16
1	1	1	±0.16
2	1	2	±0.16
5	5	1	±0.16
10	10	1	±0.16
20µSEC	10µS	2	±0.16
50µSEC	50µS	1	±0.16

13. MAGNIFIED TIMING Accuracy ±4%

Set the TYPE 3B4 TIME/DIV switch to .2μSEC. Pull the MAGNIFIER knob out and set to .05μSEC. Set the TYPE 184 to 50nS. Use the control settings in the following table and check magnified timing accuracy at the start, middle and prior to the 9th unmagnified division. When checking the start of sweep, exclude the specified portion.

TIME/DIV	MAGNIFIER	TYPE 184	time marks/div	exclude first	tolerance in div
.2μSEC	.05μSEC	50nS	1	2 div	±0.32
.2μSEC	.1μSEC	.1μS	1	2 div	±0.32
.5μSEC	.05μSEC	50nS	1	5 div	±0.32
.5μSEC	.1μSEC	.1μS	1	2 div	±0.32
.5μSEC	.2μSEC	.1μS	2	2 div	±0.32
1μSEC	.05μSEC	50nS	1	5 div	±0.32
1μSEC	.1μSEC	.1μS	1	2 div	±0.32
1μSEC	.2μSEC	.1μS	2	2 div	±0.32
1μSEC	.5μSEC	.5μS	1	2 div	±0.32
2μSEC	.05μSEC	50nS	1	5 div	±0.32
2μSEC	.1μSEC	.1μS	1	2 div	±0.32
2μSEC	.2μSEC	.1μS	2	2 div	±0.32
2μSEC	.5μSEC	.5μS	1	2 div	±0.32
2μSEC	1μSEC	1μS	1	2 div	±0.32
5μSEC	.1μSEC	.1μS	1	2 div	±0.32
5μSEC	.2μSEC	.1μS	2	2 div	±0.32
5μSEC	.5μSEC	.5μS	1	2 div	±0.32
5μSEC	1μSEC	1μS	1	2 div	±0.32
5μSEC	2μSEC	1μS	2	2 div	±0.32

14. + GATE OUT

a. Check +GATE OUT amplitude: 20V ±10%

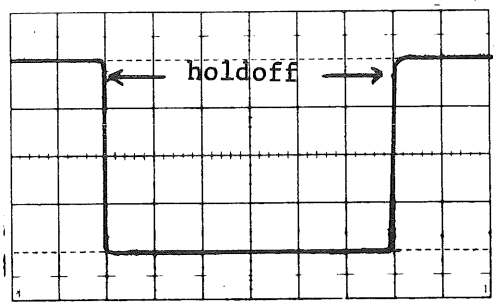
Remove the cable from the TYPE 3A1 CH 1 input. Set the TYPE 3B4 TIME/DIV and MAGNIFIER to .1mSEC. Set the TRIGGER MODE to FREE RUN. Check the amplitude of the + GATE OUT signal with the test scope 10X PROBE, 18 to 22V.

b. Check holdoff

Set the TYPE 3B4 TRIGGERING LEVEL to 0.

14b. (CONT)

Use the test scope to measure the time between + gate pulses. Use the following table for control settings.



TIME/DIV	holdoff
.2μSEC	4.5 - 8.5μs
.5μSEC	4.5 - 8.5μs
1μSEC	4.5 - 8.5μs
2μSEC	4.5 - 8.5μs
5μSEC	9.5 - 13.5μs
10μSEC	9.5 - 13.5μs
20μSEC	9.5 - 13.5μs
50μSEC	60 - 110μs
.1mSEC	60 - 110μs
.2mSEC	60 - 110μs
.5mSEC	.45 - .7ms
1mSEC	.45 - .5ms
2mSEC	.45 - .7ms
5mSEC	8 - 20ms
10mSEC	8 - 20ms
20mSEC	8 - 20ms
50mSEC	45 - 65ms
100mSEC	45 - 65ms
.2SEC	45 - 65ms
.5SEC	45 - 65ms
1 SEC	45 - 65ms
2 SEC	45 - 65ms
5 SEC	45 - 65ms

c. Check holdoff variation: 5 to 10%

Set the TYPE 3B4 TIME/DIV switch to .2μSEC. Set the test scope TIME/CM switch to .5μSEC. Rotate the TYPE 3B4 TRIGGERING LEVEL cw and adjust the test scope VARIABLE TIME/CM for a pulse duration of 10cm.

Rotate the TYPE 3B4 TRIGGERING LEVEL ccw. Check the duration of the pulse, 9.5 to 9.0cm.

Remove the PROBE from + GATE OUT.

15. EXTERNAL HORIZONTAL AMPLIFIER

a. Adjust Ext Horiz Gain, R228: ±2%

Apply 1 VOLT from the SAC to the TYPE 3B4 EXT HORIZ IN. Set the TYPE 3B4 TIME/DIV to EXT HORIZ IN, pull the MAGNIFIER knob out and set it to .2 EXT VOLTS. Position the display to the center 6 horizontal div. Adjust R228 for 5 major div.

b. Check HORIZONTAL VOLTS/DIV accuracy: ±2%

Use the control settings in the following table to check the EXT VOLTS positions of the TIME/DIV switch.

TYPE 3B4 HORIZONTAL VOLTS/DIV	SAC	deflection in div	tolerance in div
.2	1 VOLT	5	±0.1
.5	2 VOLTS	4	±0.08
1	5 VOLTS	5	±0.1
2	10 VOLTS	5	±0.1
5	20 VOLTS	4	±0.08

c. Check POSITION range: positions 20V display off graticule

Rotate the TYPE 3B4 POSITION control and check that the display can be positioned off of the graticule in both directions.

d. Check FINE POSITION range: 0.8 to 1.4div

Set the FINE ccw. Position the display to the graticule center line with the POSITION control. Rotate the FINE control cw and check for 0.8 to 1.4div movement.

e. Check VARIABLE attenuation ratio: ≥2.5:1

Set the SAC to 10 VOLTS and the TYPE 3B4 HORIZONTAL VOLTS/DIV to 2 EXT VOLTS. Rotate the VARIABLE TIME/DIV control ccw and check for 2cm or less display. Return VARIABLE to CALIB.

a. External attenuator

The TIME/DIV switch is used for the EXT HORIZ attenuator. The MAGNIFIER knob controls the attenuator setting.

15. (CONT)

f. Check bandwidth: ≥425kHz at -3dB

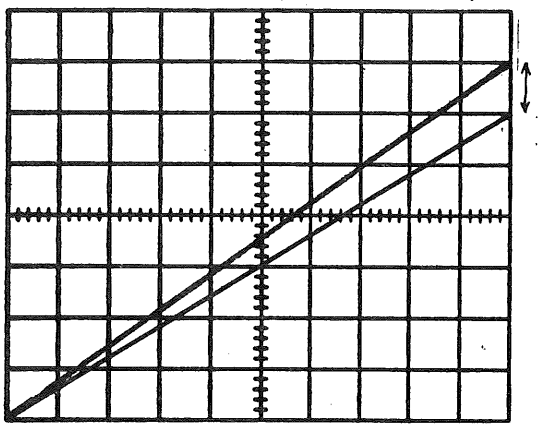
Remove the SAC cable and connect the output of the TYPE 191 through a 50Ω TERMINATION to the EXT HORIZ IN. Set the TYPE 3B4 HORIZONTAL VOLTS/DIV to .2 EXT VOLTS. Set the TYPE 191 FREQUENCY RANGE to 50kHz and adjust the AMPLITUDE for 8div of deflection.

Change the frequency of the TYPE 191 to 425kHz and check for 5.6div or more of display.

16. CURRENT DRIVE 60 to 70μA/Div

Change the TYPE 3B4 TIME/DIV to 1mSEC. Remove the TYPE 191 signal and 50Ω TERMINATION from the EXT HORIZ IN. Set the TYPE 3A1 CH 1 VOLTS/DIV to .1. Connect the 1kΩ, 1% resistor from pin 18 of the TYPE 3B4 plug-in connector to gnd. Connect a meter lead from pin 18 to the TYPE 3A1 CH 1 input. Position the start of the display to the lower left corner of the graticule. The waveform must rise 6 to 7div in 10 horizontal div.

This step does not apply to serial numbers below 740.



THE END