

# FACTORY CALIBRATION PROCEDURE

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## INTRODUCTION:

3B4

This is the guide for calibrating brand-new instruments, it therefore, calls out many procedures and adjustments that are rarely required for subsequent recalibration. *This procedure is company confidential.* In this procedure, all front panel control labels or Tektronix equipment names are in capital letters (VOLTS/DIV, etc.) internal adjustment labels are capitalized only (Gain Adj, etc.).

Tek form number:

0-142  
June 1967

For all serial numbers.

Supersedes  
October 1964



## FACTORY TEST LIMITS:

We initially calibrate the instrument to Factory Test Limits. These limits are often more stringent than advertised performance requirements. This helps insure that the instrument will meet advertised requirements after shipment, allows for inaccuracies of test equipment used, and may allow for changes in environmental conditions.

## QUALIFICATION:

Factory test limits are qualified by the conditions specified in the main body of the calibration procedure. The numbers and letters to the left of the limits correspond to the factory calibration procedure steps where the check or adjustment is made. Instruments may not meet factory test limits if calibration or check-out methods and test equipment differ substantially from those in this procedure.

## ABBREVIATIONS:

Abbreviations in this procedure will be found listed in TEKTRONIX STANDARD A-100.

## CHANGE INFORMATION:

This procedure has been prepared by Product Manufacturing Staff Engineering. For information on changes that have been made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact PMSE, 47-261. (NC)



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## EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

- a. TEKTRONIX Instruments
  - 1 TYPE 561A OSCILLOSCOPE with
  - 1 TYPE 3A1 DUAL TRACE AMPLIFIER (plug-in scope)
  - 1 TYPE 540B series OSCILLOSCOPE with
  - 1 TYPE H PLUG-IN UNIT with
  - 1 TYPE P6006 10X PROBE (test scope)
  - \* 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 50 $\Omega$  coax cables, BNC (012-0057-00)
  - 1 50 $\Omega$  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 20,000 $\Omega$ /VDC Multimeter (VOM)
  - 1 Soldering aid
  - 1 1k $\Omega$ , 1% resistor (309-0115-00)
  - 1 TYPE 76TU LINE VOLTAGE CONTROL UNIT

\* This equipment must be traceable to NBS for instrument certification.

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.

It is assumed that all equipment is provided with BNC connectors; if equipment used has other than BNC connectors, adapters, not listed, may be needed.

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# FACTORY TEST LIMITS

## QUALIFICATION

Factory test limits are qualified by the conditions specified in the main body of the calibration procedure. The numbers and letters to the left of the limits correspond to the factory calibration procedure steps where the check or adjustment is made. Instruments may not meet factory test limits if calibration or checkout methods and test equipment differ substantially from those in this procedure.

### 1. PRELIMINARY INSEPCION

### 2. PRESET CONTROLS

### 3. RESISTANCE CHECKS

### 4. +20 VOLT SUPPLY AND DC FILAMENT

- b. Check +20V supply: 20V  $\pm 10\%$
- c. Check DC filament voltage: -6.1V  $\pm 1V$

### 5. MULTI TRACE OPERATION

Alternate all sweep rates

### 6. LOW FREQUENCY TRIGGERING

- a. Set TRIGGERING LEVEL: 0V
- b. Check TRIGGERING LEVEL range:  
+ & - 15V
- c. Check EXT AC and DC triggering: 0.3V  
P to P
- d. Check EXT  $\div 10$  triggering: 3V  $+10\%$   
at 30' Hz
- e. Check EXT AC LF REJ triggering:  
0.3V at 30 kHz

### 7. HIGH FREQUENCY TRIGGERING

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

### 8. LINE TRIGGERING

Triggers on 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:  $\pm 2\%$
- b. Adjust X50 Mag Gain, R447:  $\pm 4\%$
- c. Adjust Swp Mag Regis, R422:  $\leq 0.1$   
div shift
- d. Check CALIBRATE range:  

CRT horizontal	CALIBRATE range	
<u>deflection factor</u>	<u>max gain</u>	<u>min gain</u>
17.7V/div	+15%	-5%
18.6V/div	+10%	-10%
19.5V/div	+ 5%	-15%
- e. Adjust Length, R173: 10.5 div,  
 $\pm 0.3$  div
- f. Check VARIABLE TIME/DIV ratio:  
 $\geq 2.5:1$

## 12. UNMAGNIFIED TIMING

- \*a. Check slow and medium sweep timing:  
±2%, except 5SEC ±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	4.5-13.5ms
50mSEC-5SEC	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: position 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: -3dB at >425kHz

## 16. TYPE 3L10 CURRENT DRIVE

60 to 70μA/div

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

1. PRELIMINARY 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

*c. TYPE 3B4 internal adjustments*

Set variable capacitors and pots to midr.

*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

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 $\Omega$ to GND	Use
1	75	6.3 VAC
2	75	6.3 VAC
3	$\infty$	---
4	7.5k	multi-trace syne
5	0	gnd
6	20k	+300V unregulated

## 3a. (cont'd)

7	$\infty$	---
8	$\infty$	---
9	0	gnd
10	20k	+300V regulated
11	$\infty$	---
12	$\infty$	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	$\infty$	---

Serial number 739 and below,  $\infty$ , unused.

Check protection diodes; D154, D167 and D411 for opens or shorts.

b. Check EXT  $\div 10$  resistance:

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

Change the positive VOM lead to the center conductor of the EXT TRIG IN connector. Change the COUPLING to DC and check for approx 1M $\Omega$ . Change the SOURCE to EXT  $\div 10$  and check for approx 10.1M $\Omega$ .

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

## 4. (cont'd)

b. Check +20V supply:  $20V \pm 10\%$

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

c. Check DC filament voltage:  
 $-6.1V \pm 1V$

With the VOM polarity reversed, measure the voltage at the top of R464,  $-6.1V \pm 1V$

b. +20 volt test point

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

c. Filament voltage test point R464,  $91\Omega \frac{1}{2}W$  resistor is located at the lower, left, rear corner of the chassis.

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5. MULTI-TRACE OPERATION

Alternate all sweep rates.

Adjust the TYPE 561A 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.

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6. LOW FREQUENCY TRIGGERING

a. Set TRIGGERING LEVEL: 0V

Set the TYPE 3A1 MODE switch to CH 1. Connect the VOM set to read +20V DC 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.

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

a. R12 and R13 junction is on the COUPLING switch.

## 6. (cont'd)

- 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 1 kHz and adjust the amplitude for a 3 div 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. Checks with SLOPE in + and -.

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

Set the TYPE 3A1 CH 1 VOLTS/DIV switch to .1. Change the Sine-wave Generator frequency to 30 Hz and adjust the amplitude for a 3 div 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.

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

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 3 div 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.

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



## 6. (cont'd)

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

Set the TYPE 3B4 TRIGGERING MODE to FREE RUN, SOURCE to EXT and TIME/DIV to 50 $\mu$ SEC. Set the TYPE 3A1 CH 1 VOLTS/DIV to .1. Set the Sine-wave Generator frequency to 30 kHz and adjust the Output for a 3 div 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  $\div$  10 and the TYPE 3A1 VOLTS/DIV to 0.5. Adjust the Sine Wave Generator amplitude for a 6 div display. Check for correct triggering in + and - SLOPE. Return the SOURCE to EXT and the TYPE 3A1 VOLTS/DIV to .05.

Set the TIME/DIV to .2mSEC. Change the Sine Wave Generator frequency to 3 KHz and adjust the amplitude for a 6 div display. Check that the display will not trigger.

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7. HIGH FREQUENCY TRIGGERING

- a. *Check EXT triggering:  
0.3V at 20 MHz,  $\leq$  5ns jitter*

Remove the Sine-wave Generator Output from the BNC "T" connector. Insert a 50 $\Omega$  TERMINATION between the EXT TRIG IN connector and the coax cable. Set the TYPE 3B4 TIME/DIV to .05 $\mu$ SEC, 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 50 kHz and adjust the amplitude for a 3cm display. Change the TYPE 191 frequency to 20 MHz and check triggering in + and - SLOPE, AC, AC LF REJ and DC in NORM TRIGGER MODE. Check for 0.1 div or less trace width.

## 7. (cont'd)

- b. Check EXT  $\div 10$  triggering:  
3V  $\pm 10\%$  at 20 MHz,  $\leq 5\text{ns}$  jitter

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

- c. Check INT triggering: 0.2 div  
at 20 MHz,  $\leq 5\text{ns}$  jitter

Change the TYPE 3B4 SOURCE to INT. Set the TYPE 191 AMPLITUDE and TYPE 3A1 CH 1 VOLTS/DIV for a 0.2 div 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 561A graticule. Jitter must not exceed 5ns.

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

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8. LINE TRIGGERING

Triggers on correct polarity.

Remove the TYPE 191 signal, BNC "T" connector, 50 $\Omega$  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 5 mSEC and SOURCE to LINE. Check triggering polarity in + and - SLOPE. Check that SLOPE, waveform and TRIGGERING LEVEL agree on triggering polarity.

Change the TRIGGER MODE to AUTO and re-check 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 10 $\mu$ S markers from the TYPE 184 to the CH 1 input. Set the TYPE 3B4 TIME/DIV to 10 $\mu$ SEC, 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 3 div of display amplitude.

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.

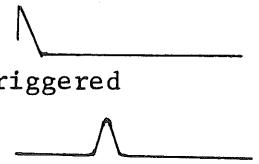
- b. Check bright line AUTO: intensified baseline

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

- a. display

triggered

not triggered



## 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

## 10a. (cont'd)

READY light lights and one sweep 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. Push in the PUSH TO RESET button 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 the 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 remain lit all the time.

## 11. HORIZONTAL AMPLIFIER

a. *Set sweep CALIBRATE:  $\pm 2\%$*

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  $\pm 0.16$  div.

b. *Adjust X50 Mag Gain, R447:  $\pm 4\%$*

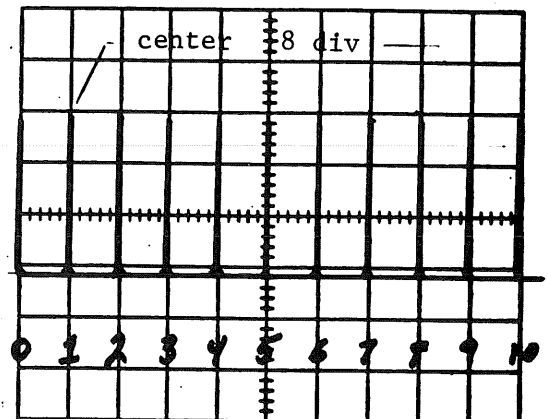
Change the TYPE 184 to 10 $\mu$ S time marks. Pull the MAGNIFIER knob out and turn it to 20 $\mu$ SEC. Check that the TIME/DIV remains at 1mSEC. position time marks to coincide with graticule lines and adjust R447 for 2 time marks/cm.

c. *Adjust Swp Mag Regis, R422:  
 $\leq 0.1$  div 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 8 div. 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'd)

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.

Return the 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		1 time mark/div	
	max gain	min gain	max gain	min gain
17.7 V/div	+15%	-5%	+1.2 div	-0.4 div
18.6 V/div	+10%	-10%	+0.8 div	-0.8 div
19.5 V/div	+5%	-15%	+0.4 div	-1.2 div

Adjust the CALIBRATE control for 1 time mark/div.

e. Adjust Length, R173: 10.5 div,  $\pm 0.3$  div

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

f. Check VARIABLE TIME/DIV ratio:  $\geq 2.5:1$ 

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/2 div at ccw. Return VARIABLE to CALIB.

12. UNMAGNIFIED TIMING

- \*a. Check slow and medium sweep  
timing:  $\pm 2\%$ ; except 5 SEC  $\pm 3\%$*

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 8  
div of sweep. Rise the control settings  
in the following table to check sweep  
accuracy.

<u>TIME/ DIV</u>	<u>TYPE 184</u>	<u>marks/ div</u>	<u>tolerance in div</u>
.1mSEC	.1mS	1	$\pm 0.16$
.2mSEC	.1mS	2	$\pm 0.16$
.5	.5	1	$\pm 0.16$
1	1	1	$\pm 0.16$
2	1	2	$\pm 0.16$
5	5	1	$\pm 0.16$
10	10	1	$\pm 0.16$
20	10	2	$\pm 0.16$
50	50mS	1	$\pm 0.16$

Change TRIGGER MODE to NORM.

100mSEC	.1S	1	$\pm 0.16$
.2 SEC	.1	2	$\pm 0.16$
.5	.5	1	$\pm 0.16$
1	1	1	$\pm 0.16$
2 SEC	1S	2	$\pm 0.16$
5 SEC	5S	1	$\pm 0.24$

- b. Adjust fast sweep rates, C160A &  
C160C:  $\pm 2\%$*

Set the TYPE 3B4 TIME/DIV to 10 $\mu$ SEC and  
TRIGGER MODE to AUTO. Set the TYPE 184  
to 10 $\mu$ S. Adjust C160C for 1 time mark/div.

Change the TYPE 3B4 TIME/DIV to .2 $\mu$ SEC and  
the TYPE 184 to .1 $\mu$ S. Adjust C160A for  
2 time marks/div.

- \*c. Check fast sweep timing:  $\pm 2\%$*

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

<u>TIME/DIV</u>	<u>TYPE 184</u>	<u>marks/ div</u>	<u>tolerance in div</u>
.2 $\mu$ SEC	.1 $\mu$ S	2	$\pm 0.16$
.5 $\mu$ SEC	.5 $\mu$ S	1	$\pm 0.16$
1	1	1	$\pm 0.16$
2	1	2	$\pm 0.16$
5	5	1	$\pm 0.16$

## 12c. (cont'd)

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.

<u>TIME/DIV</u>	<u>MAGNIFIER</u>	<u>TYPE 184</u>	<u>time</u> <u>marks/div</u>	<u>exclude</u> <u>first</u>	<u>tolerance</u> <u>in div</u>
.2μSEC	.05μSEC	50nS	1	2 div	±0.32
.2μSEC	.1 μSEC	.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'd)

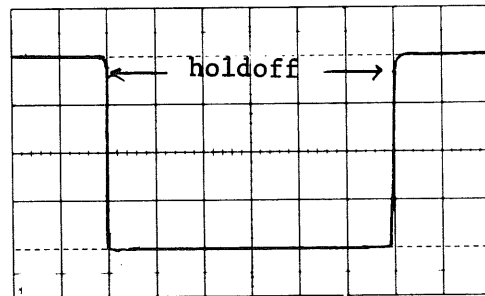
Use the test scope to measure the time between + gate pulses. Use the following table for control settings.

<u>TIME/DIV</u>	<u>holdoff</u>
.2 $\mu$ SEC	4.5 - 8.5 $\mu$ s
.5 $\mu$ SEC	4.5 - 8.5 $\mu$ s
1	4.5 - 8.5
2	4.5 - 8.5
5	9.5 - 13.5
10	9.5 - 13.5
20	9.5 - 13.5
50 $\mu$ SEC	60 - 110
.1mSEC	60 - 110
.2	60 - 110
.5	.45 - .7ms
1	.45 - .7ms
2	.45 - .7ms
5	4.5 - 13.5ms
10	4.5 - 13.5
20	4.5 - 13.5
50	45 - 65
100mSEC	45 - 65
.2S	45 - 65
.5	45 - 65
1	45 - 65
2 SEC	45 - 65ms
5 SEC	45 - 65ms

c. Check holdoff variation: 5 to 10%

Set the TYPE 3B4 TIME/DIV switch to .2 $\mu$ SEC. Set the test scope TIME/CM switch to .5 $\mu$ SEC. 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.



## 15. EXTERNAL HORIZONTAL AMPLIFIER

a. Adjust Ext Horiz Gain, R228:  $\pm 2\%$

Connect a 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.

a. External attenuator

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



## 15. (cont'd)

- \*b. Check HORIZONTAL VOLTS/DIV  
accuracy:  $\pm 2\%$

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	$\pm 0.1$
.5	2 VOLTS	4	$\pm 0.08$
1	5 VOLTS	5	$\pm 0.1$
2	10 VOLTS	5	$\pm 0.1$
5	20 VOLTS	4	$\pm 0.08$

- 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  
1.4 div

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 1.4 div movement.

- e. Check VARIABLE attenuation ratio:  
 $\geq 2.5:1$

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.

- \*f. Check bandwidth:  $-3\text{dB}$  at  $\geq 425\text{ kHz}$

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

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

16. TYPE 3L10 CURRENT DRIVE 60 to 70A/div

Change the TYPE 3B4 TIME/DIV to 1mSEC. Remove the TYPE 191 signal and 50 $\Omega$  TERMINATION from the EXT HORIZ IN. Set the TYPE 3A1 CH 1 VOLTS/DIV to 1. Connect the 1k $\Omega$ , 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 7 div in 10 horizontal div.

THE END

This step does not apply to serial numbers below 740.

