

# 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.

*This procedure is  
company confidential*

230/R230

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.

March 1969  
For all serial  
numbers.



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).

## 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.

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## EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

### *a. TEKTRONIX Instruments*

- 1 TYPE 547 OSCILLOSCOPE with
- 1 TYPE W PLUG-IN UNIT (Test Scope)
- 1 TYPE 568 OSCILLOSCOPE with
- 1 TYPE 3A2 DUAL-TRACE AMPLIFIER and
- 1 TYPE 3B2 TIME BASE
- 1 TYPE 184 TIME MARK GENERATOR.
- 1 TYPE P6011 1X PASSIVE PROBE
- 1 TYPE 76TU LINE VOLTAGE CONTROL UNIT
- 1 TYPE 3S1 SAMPLING UNIT
- 1 TYPE 3T5 SAMPLING SWEEP

### *b. Test Fixtures and Accessories*

- 1 Test Load Unit for TYPE 230 (Dwg. #1741A)
- 1 External Programmer (Dwg. #1605C)
- 1 Counter Board Check Out Box (Dwg. #1606C)
- 1 LF Sine Wave Generator )067-0542-99)
- 1 Thermometer (BRAUN 12" 0° to 110° Centigrade)
- 1 Cable (TYPE 230 to TYPE 568 012-0119-00)
- 5 Interconnecting cables for External Programmer )012-0106-00)
- 3 50Ω BNC cables (012-0057-01
- 1 BNC T ADAPTER (103-0030-00)
- 1 BNC Female to Female ADAPTER (103-0028-00)
- 3 2" Shorting straps
- 1 Set of checked plug-in cards for TYPE 230
- 1 20,000Ω/volt multimeter (067-0045-00)

### *c. Other equipment*

- \* 1 Voltmeter, John Fluke Model 881A or equivalent

\*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.

## FACTORY TEST LIMITS

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.

### 3. PRESET POWER SUPPLIES

#### e. Regulation and Ripple

Supply	Ripple
+50V	4mV
-50V	4mV
+12V	4mV
+3.8V	3mV
-3.5V	3mV
+1.75V	3mV

### 6. SET POWER SUPPLIES

b, c.	+50V	±125mV
	-50V	±125mV
	-12V	±60mV
	+3.8V	±20mV
	-3.5V	±17mV
	+1.75V	±4% @ 25°C ±2°C
		(see chart 6e)

### 7. CH A [B] MEMORY

- b. 0% Range: 6V ± .5V
- c. 100% Range: -2V ± .5V
- d. 0% Bal: 0.0 ± 6mV
- e. 100% Bal: 0.0 ± 6mV

### 8. START [STOP] COMPARATOR

- \*g. Bal 2: 5V ± 12mV
- h. HORIZ mm FROM SWP START: 5V ± 12mV
- i. mm BELOW 100% ZONE: 0V ± 2mV
- k. Offset Volts: .1% ± 2mV

### 9. A [B] MEMORIES

- b. Memory tracking: 0.00 ± 3 counts
- c. Positive peak charge time: <10μs
- d. Negative peak charge time: <10μs

### 10. BUFFER

- b. 5V (Ramp)' Gain: 5V ± 15mV
- c. 5V (Ramp)' DC Level: 0V ± 10mV
- \*e. X2=+16.00V ± 0.08V  
       ÷1=+08.00V ± 0.04V  
       ÷2=+04.00V ± 0.02V
- \*f. Buffer Amp Gain: ½ ± 0.5%

### 11. ZONE GEN

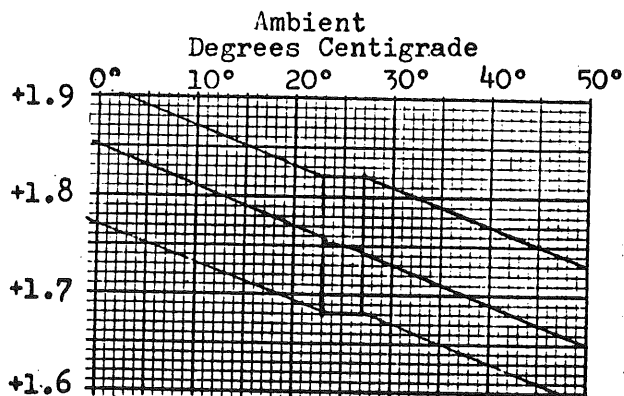
- c. 5V Ramp Gain: ±0.1div
- d. Position Range: 0 through 9.5 div  
       in 0.5 div steps  
       Accuracy: ±.1div
- e. WIDTH: Average; 0.3div ±0.05div  
       2CM; 2div ± 0.2div  
       4CM; 4 div ± 0.4div  
       10CM; to end of sweep

### 22. (TWELVE)' LINES

- b. Memory Leakdown <2counts/10sec

THE END

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



# SHORT FORM PROCEDURE

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 PRESETS

## 2. RESISTANCE

Supply	Resistance	Reverse Resistance
+1.75V	2k	3.5K
+50V	12k	30k
+12V	200k	7k
+3.8V	2k	4k
-3.5V	3.5k	20k
-50V	30k	20k

### Counter Connector

+255V	inf	inf
+12V	20k	5k
+3.8V	800 $\Omega$	1k
-3.5V	15k	3k
+1.75V	15k	10k
D2312	$\approx$ 2k forward	

## 3. PRESET POWER SUPPLIES

- Setup
- Precheck supplies
- Adjust supplies
- Check Counter Board voltage: +185V to +215V
- Regulation and Ripple

Supply	Ripple
+50V	4mV
-50V	4mV
+12V	4mV
+3.8V	3mV
-3.5V	3mV
-1.75V	3mV

## 4. LINE VOLTAGE SELECTOR

- Setup
- Check selector

Line Voltage Selector	Range Selector	Voltage Across R222
115	M	$\approx$ 66V
115	LO	$\approx$ 75V
115	HI	$\approx$ 61V
230	M	$\approx$ 33V

## 5. OPERATIONAL CHECK

- Setup
- Install Clock Card, check operation

## 6. SET POWER SUPPLIES

- Setup
- Adjust power supplies

Test Point	Holder Color Code	Adjust for	
+50V	Brown	+50V $\pm$ 10mV	Interaction
-50V	Red	-50V $\pm$ 10mV	
-12V	Orange	-12V $\pm$ 5mV	
+3.8V	Yellow	+3.8V $\pm$ 1mV	
-3.5V	Blue	-3.5V $\pm$ 1mV	

- Adjust the +1.75V supply:  $\pm$ 4% @ 25°C  $\pm$  2°C (see chart in procedure)

## 7. CH A [B] MEMORY

- Setup
- Adjust 0% Range: +6V
- Adjust 100% Range: -2V
- Adjust 0% Bal: 0.000V $\pm$ 1mV
- Adjust 100% Bal: 0.000V $\pm$ 1mV

## 8. START [STOP] COMPARATOR

- Setup
- Adjust OFF Bal: 0.000V across D1445
- Adjust Bal 1: 0.000V, TP1460 to TP1450

- d. Bal 2: 0.000V, TP1460 to TP1470
- e. Adjust Comp Bal:  $\pm \text{noise} = -\text{noise}$  @ pin 7
- f. Adjust 5V Gain:  $5V \pm 2mV$ , TP1460 to TP1470 with mm ABOVE 0% ZONE
- g. Adjust Bal 2:  $5V \pm 2mV$ , TP1460 to TP1470 with mm BELOW 100% ZONE
- h. Check HORIZ mm FROM SWP START:  $5V \pm 2mV$
- i. Check mm BELOW 100% ZONE:  $0.000V \pm 2mV$
- j. Adjust CAL %: 0V, TP1470 to TP1430
- k. Check offset volts: .1% of voltage  $\pm 2mV$ , TP1460 to TP1470

CH A TIME MEASUREMENT START [STOP] POINT LEVEL	FLUKE 881A	max error
01	50mV	$\pm 2.05mV$
02	100mV	$\pm 2.1mV$
04	200mV	$\pm 2.2mV$
08	400mV	$\pm 2.4mV$
10	500mV	$\pm 2.5mV$
20	1.00V	$\pm 3.0mV$
40	2.00V	$\pm 4.0mV$
80	4.00V	$\pm 6.0mV$

## 9. A [B] MEMORIES

- a. Check Memory Bal: 0V  $\pm 1mV$ , TP1410 to TP1460 (0%), TP1410 to TP1430 (100%)
- b. Check memory tracking:  $0.00 \pm 3$  counts
- c. Check positive peak charge time:  $\leq 10\mu s$
- d. Check negative peak charge time:  $\leq 10\mu s$

## 10. BUFFER

- a. Setup
- b. Adjust 5V (Ramp)' Gain:  $\frac{50V \text{ supply}}{10} \pm 2mV$  TP1460 to TP1410
- c. Adjust 5V (Ramp)' DC Level:  $0V \pm 2mV$ , TP1460 to TP1410
- d. Check  $\div 1$ ,  $\div 2$  and  $\div 5$
- e. Adjust X2,  $\div 1$ ,  $\div 2$ :  $X2 = +16.00V \pm 0.01V$   
 $\div 1 = +08.00V \pm 0.01V$   
 $\div 2 = +04.00V \pm 0.01V$
- f. Check Buffer Amp gain:  $1/2 \pm 0.5\%$

## 11. ZONE GEN

- a. Setup

- b. Adjust Position and Width:  
Position  $\pm 1div$   
Width  $.3div \pm .05div$
- c. Adjust 5V Ramp Gain:  $\pm 1div$
- d. Check Position: Range; 0 through 9.5div in 0.5div steps; step linearity;  $\pm 1div$
- e. Check width:  $2div; \pm .2div$   
 $4div; \pm .4div$   
 $10div; \text{to end of sweep}$

## 12. LIMIT CARD

- a. Setup
- b. Check LIMIT logic and switches

## 13. DECIMAL MEASUREMENT

- a. Check time decimals and measurement nixie
- b. Check volts decimal and measurement nixie

## 14. PRINT COMMAND AND EXT HOLD

## 15. TIME MEASUREMENT

- a. Setup
- b. Check + 1st SLOPE
- c. Check - 1st SLOPE
- d. Check + 2ND SLOPE
- e. Check - 2ND SLOPE
- f. Check + 1ST to -2ND SLOPE
- g. Check + 1ST to - 1ST SLOPE
- h. Check + 1ST to + 2ND SLOPE
- i. Check alternate intensification

## 16. mm ABOVE 0% ZONE

## 17. mm BELOW 100% ZONE

## 18. % BETWEEN ZONES, CH B

## 19. HORIZ mm FROM SWP START

- a. Setup
- b. Check TIME MEASUREMENT START [STOP] POINT LEVEL

## 20. COUNTER BOARD

- a. Setup
- b. Check counter and readout output
- c. Check - indication

## 21. ZONE POSITION & WIDTH

- a. Setup
- b. Check external position
- c. Check external width

## 22. (TWELVE)' LINES

- a. Setup
- b. Check CH A [B] (TWELVE)' and memory;  
leakdown;  $\leq 2$  counts/10sec

## 23. EXT HORIZ mm FROM SWP START

- a. Setup
- b. Check START [STOP] OFFSET

## 24. CHECK EXT LOWER & UPPER LIMITS

## 25. EXT TIME MEASUREMENT

- a. Setup
- b. Check + 1st SLOPE
- c. Check -2nd SLOPE
- d. Check mm ABOVE 0% ZONE
- e. Check mm BELOW 100% ZONE

## 26. EXT DECIMALS & UNITS OF MEASURE

## 27. EXT VOLTS, $\div 2$ AND $\div 5$

## 28. MONITOR DRIVE SIGNALS

- a. Setup
- b. Check (SWP SPEED)' UP
- c. Check (SINGLE)' SWP
- d. Check (A CHOP)' [(B CHOP)']

## 29. EXT HOLD

- a. Setup
- b. Check EXT HOLD WITHIN LIMITS
- c. Check EXT HOLD ABOVE UPPER LIMIT
- d. Check EXT HOLD BELOW LOWER LIMIT

## 30. EXT TRIGGER

## 31. MEASUREMENT AVERAGING

## 32. SYNCHRONIZER

- a. Setup
- b. Check Delay range:  $\approx 1\text{ms}$  to  $\approx 8\text{ms}$
- c. Adjust Delay: 2ms
- d. Check high speed functions
- e. Check for lock up

## 33. SAMPLING

- a. Setup
- b. Check Volts measurement
- c. Check Time measurement

THE END

1. PRESETS

Check that the + lead on capacitors at J1, J4, J6 and J8 are up. Check that the - lead on capacitor at J9 is up.

TYPE 568

CAL	1 kHz
INTENSITY	midr
FOCUS	midr

TYPE 3A2

MODE	CH1
TRIG SOURCE	CH 1
VOLTS/DIV	2
VARIABLE	CALIB
AC-DC-GND	DC

TYPE 3B2

TRIGGER LEVEL	FREE RUN
COUPLING	AC SLOW
SLOPE	+
SOURCE	INT
DELAY TIME	0
DELAY	OUT
TIME/DIV	1mSEC
DIGITAL RESOLUTION	10μSEC

TYPE 230

LINE SELECTOR	115V
RANGE SELECTOR	M
MEASUREMENT	
AVERAGING	1
REF ZONES	BOTH
TIME MEASUREMENT	ON
MEASUREMENT MODE	A VOLTS
CH A REFERENCE ZONES	
0% LEVEL	AVERAGE
100% LEVEL	AVERAGE
CH B REFERENCE ZONES	
0% LEVEL	AVERAGE
100% LEVEL	AVERAGE
TIME MEASUREMENT	
START POINT	CH A, % between zones, 00, +1st
TIME MEASUREMENT	
STOP POINT	CH A, % between zones, 00, +1st
TRIGGERED MEASURE-	
MENT	OFF
DISPLAY TIME	ccw

2. RESISTANCE

Open front panel and remove leads marked 225V, -3.5V, 12V, 3.8V and 1.75V from counter board. Remove the limit lamps. (Front panel)

The 1.75V lead is below the 12V lead. D2312 is next to M2470 (lower left corner of counter).

Set VOM to  $\Omega$  X1K. Measure resistance to ground according to the following table:

<u>Supply</u>	<u>Resistance</u>	<u>Reverse Resistance</u>
+1.75V	2K	3.5K
+50V	12K	30K
+12V	200K	7K
+3.8V	2K	4K
-3.5V	3.5K	20K
-50V	30K	20K

Counter  
Connector

+255V	inf	inf
+12V	20K	5K
+3.8V	800 $\Omega$	1K
-3.5V	15K	3K
+1.75V	15K	10K

D2312  $\approx$  2k forward

Replace limit lamps

3. PRESET POWER SUPPLIES

*a. Setup*

Insert checked CRT Intens /Regulator card in J10. Install test load card in J1. Connect TYPE 230 to TYPE 568 with cable 012-0119-00 (J101 from TYPE 230 to J101 of TYPE 568). Connect TYPE 230 power cord to type 76TU. Connect TYPE 568 power cord to 115 VAC. Switch TYPE 230 and TYPE 568 POWER on. Set TYPE 76TU for 115 VAC.

a. As a precautionary measure against component damage, the TYPE 230 POWER switch should be turned off each time a card is removed or replaced.

No other cards should be installed.

*b. Precheck Supplies*

Connect VOM between gnd and each of the six voltage test points. Check for proper voltage. Replace checked CRT INTENS/REGULATOR with an unchecked card.



## 3. (Cont.)

*c. Adjust supplies:*

Adjust supplies according to the following table:

<u>J10</u> <u>Power Supply</u>	<u>Adjust</u>	<u>Holder</u> <u>Color</u>
+50V	R230	Brown
-50V	R360	Red
+12V	R260	Orange
+3.8V	R290	Yellow
+1.75V	R310	Green
-3.5V	R330	Blue

*d. Check Counter Board voltage*

Check voltages at the counter board at marked leads. Check voltage at top of R 2339 for +185V to +215V (36K between V 2499 and V 2339).

*e. Regulation and Ripple*

Plug the Test Load Unit into J1 of the TYPE 230 and set to Low Load. Set the TYPE 76TU to 126 VAC. Set TYPE W INPUT ATTEN to 1 and MILLIVOLTS/CM to 1. Using an X1 probe check the regulation and ripple of the power supplies hi load and lo load according to the following table:

<u>Supply</u>	<u>Ripple</u>
+50V	4mV
-50V	4mV
+12V	4mV
+3.8V	3mV
-3.5V	3mV
+1.75V	3mV

Repeat at 104 VAC

4. LINE VOLTAGE SELECTOR*a. Setup*

Switch TYPE 230 POWER off. Disconnect the TYPE 230 power cord to TYPE 76TU. Connect VOM across R222. Connect TYPE 230 power cord to TYPE 76TU and turn TYPE 230 POWER on. Set TYPE 76TU for 115V.

*b. Check selector*

Measure the voltage across R222 with each combination of the line voltage and range selector according to the following table:

<u>Line Voltage</u> <u>Selector</u>	<u>Range</u> <u>Selector</u>	<u>Voltage</u> <u>Across R222</u>
115	M	≈66V
115	LO	≈75V
115	HI	≈61V
230	M	≈33V

Return Range Selector to M and Voltage Selector to 115V. Disconnect the VOM. Remove test load from J1. Return line voltage to 115 VAC.

*b.* Turn power off and disconnect power cord between setups.

5. OPERATIONAL CHECK*a. Setup*

Connect the power supplies to the counter board. Install a full set of checked boards. Place a thermometer between Synchronizer card and CRT Intens/Regulator card. Turn TYPE 230 power on. Connect 5V signal from TYPE 568 CALIBRATOR to TYPE 3A2 CH 1 INPUT. Set TYPE 3B2 TIME/DIV to .2mSEC and TRIGGER LEVEL for a triggered display.

*a.* J1 - Zone Generator  
J2 - Zone Generator  
J3 - Memory  
J4 - Memory  
J5 - Buffer  
J6 - Comparator  
J7 - Comparator  
J8 - Clock  
J9 - Synchronizer  
J10- CRT Intens Regulator  
J11- Limit

*b. Install Clock Card, Check Operation*

Adjust the TYPE 230 CH A REFERENCE ZONES 0% POSITION to brighten the bottom part of the squarewave. Adjust 100% POSITION to brighten the top part of the squarewave. Check the TYPE 230 readout for about +05.00V.

Remove the checked clock card from the TYPE 230. Install the unchecked card. Check the TYPE 230 readout for about +05.00V.

*c. Install Synchronizer Card, check operation*

Install the Synchronizer card in J9. Check the TYPE 230 for +0.500V readout.

Disconnect the calibrator.

## 6. SET POWER SUPPLIES

### a. Setup

Connect the Fluke 881A common to the ground test point on the TYPE 230 CRT Intens/Regulator card. Connect the other lead to the +50V test point on the CRT Intens/Regulator card.

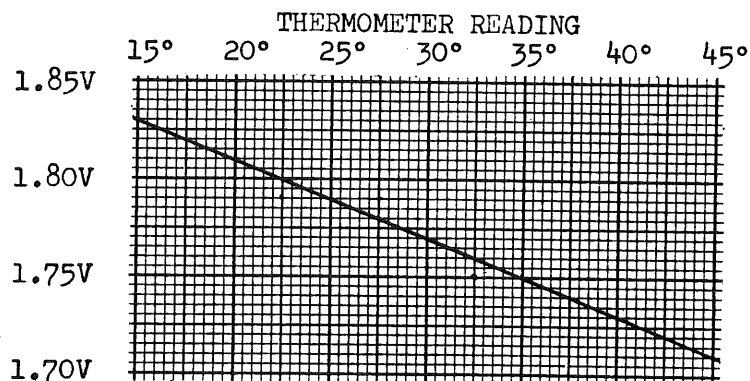
### b. Adjust power supplies

Adjust the power supplies according to the following table:

Test Point	Adjust	Holder Color Code	Adjust For	
+50V	R230	Brown	+50V $\pm$ 10mV	Interaction
-50V	R360	Red	-50V $\pm$ 10mV	
-12V	R260	Orange	+12V $\pm$ 5mV	
+3.8V	R290	Yellow	+3.8V $\pm$ 1mV	
-3.5V	R330	Blue	-3.5V $\pm$ 1mV	

### c. Adjust the +1.75V Supply: $\pm 4\%$ at $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Connect the Fluke 881A to the +1.75V test point. Read the thermometer. Adjust R310 (green holder) according to the following chart:



c. Thermometer reading less  $10^{\circ}$  is considered ambient temperature.

## 7. CH A [B] MEMORY

## a. Setup

Remove the CH A [B] Memory card and place an unchecked Memory card and card extender into J3 [J4]. Connect a X1 probe from TYPE W to pin L on card extender. Set controls according to the following table:

## TYPE 3A2

MODE	CH1 [2]
POSITION	Center Trace

## TYPE 3B2

TIME/DIV	1mSEC
DIGITAL	
RESOLUTION	10 $\mu$ S
TRIGGER LEVEL	Free Run

## TYPE W

ATTENUATOR	100
m V/CM	20
INPUT SELECTOR	DC

## TYPE 547

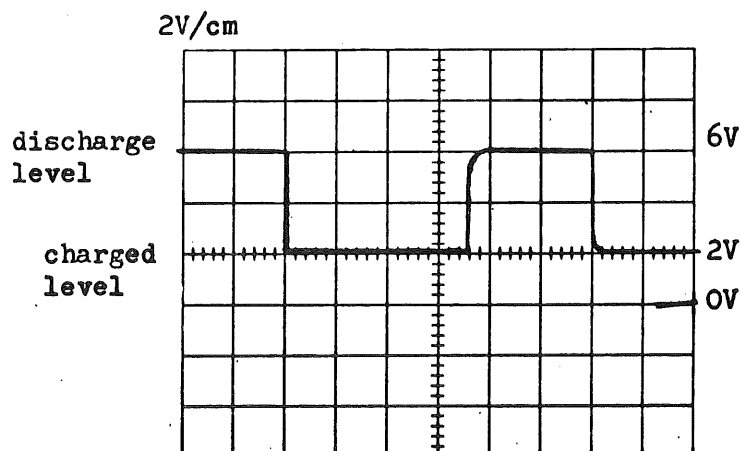
TIME/CM	
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## TYPE 230

CH A B	REFERENCE ZONES POSITION	Superimposed
TIME MEASUREMENT START POINT		CHANNEL A [B]
TIME MEASUREMENT STOP POINT		CHANNEL A [B]

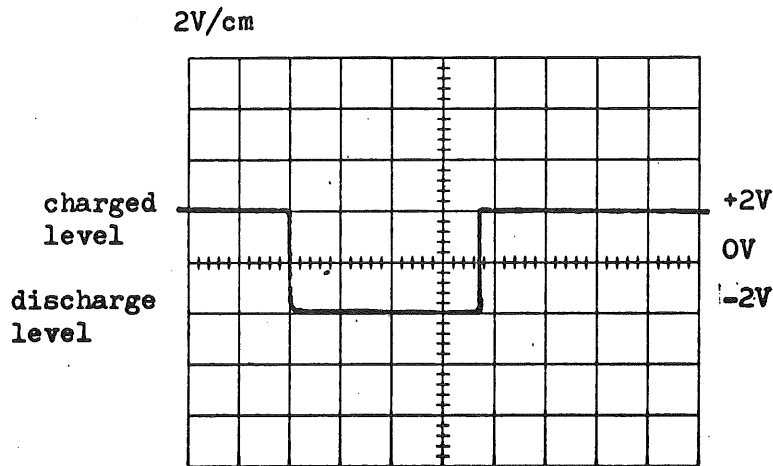
## b. Adjust 0% Range: 6V

Adjust 0% Range (R1064) for a discharge level of +6V. Check for a memory charged level of about +2V as in the following display:



c. *Adjust 100% Range: -2V*

Connect the X1 probe to pin U on the card extender. Adjust 100% Range (R1154) for a discharge level of -2V as in the display below.



Remove the card extender. Install the Memory card in J3 [J4] .

d. *Adjust 0% Bal: 0.000V  $\pm$  1mV*

Change the TYPE 230 MEASUREMENT MODE to TIME.

Connect the 881A between TP1410 and TP1460 on the start comparator card (J6). Center TYPE 568 trace. Adjust 0% Bal (Black) for 0.000 on the voltmeter.

d. Attach Fluke 881A common to underlined TP.

e. *Adjust 100% Bal: 0.000  $\pm$  1mV*

Connect the 881A between TP1410 and TP1430. Adjust the 100% Bal (Brown) for 0.000 on the voltmeter.

Repeat step 7 using the bracketed [ ] instructions.

## 8. START [STOP] COMPARATOR

a. *Setup*

Turn TYPE 230 POWER to OFF. Pull CH A Memory card (J3). Install an unchecked START [STOP] Comparator card and card extender in J6 [J7] . Turn TYPE 230 POWER to ON. Set controls as follows:

8a. (Con't)

TYPE 3A2	
CH 1 & CH 2 VOLTS/DIV	1
MODE	CH 1
POSITION	Center Trace
TYPE 3B2	
TIME/DIV	1mSEC
SWEEP DELAY	OUT
TYPE 230	
MODE	TIME
TRIGGERED MEASUREMENT	OFF
TIME MEASUREMENT START	
POINT	% Between Zones
START CHANNEL	A
TIME MEASUREMENT STOP	
POINT	% Between Zones
STOP CHANNEL	A

Short pins B, J and H together on extender card. Short across D1445 (rear of Q1461).

*b. Adjust Off Bal*

Install a strap across D1445 (to rear of Q1461). Connect the Fluke 881A from D1445 to ground. Adjust Off Bal (orange) for 0.000 reading on the 881A. Remove the strap from D1445.

*c. Adjust Bal 1*

Connect the 881A between TP1460 and TP1450. Adjust Bal 1 (brown) for 0.000 on 881A.

*d. Preset Bal 2*

Connect the 881A between TP1460 and TP1470. Adjust Bal 2 (red) for 0.000V.

*e. Adjust Comp Bal*

Connect a X1 probe to pin 7 on the card extender. Adjust Comp Bal (blue) for + noise equals - noise on the test scope. Remove probe.

*f. Adjust 5V Gain*

Set TIME MEASUREMENT START [STOP] POINT to mm ABOVE 0% ZONE. Position trace to bottom of graticule with TYPE 3A2 POSITION. Switch comparator run-calibrate to calibrate. Connect the 881A between TP1460 and TP1470. Adjust 5V gain for 5.000V on the 881A.

## 8. (Con't)

*g. Adjust Bal 2*

Set the TIME MEASUREMENT START [STOP] POINT to mm BELOW 100% ZONE. Position trace to top of graticule. Note the 881A reading. Adjust Bal 2 so 881A reads halfway between 5.000V and noted reading.

Repeat steps 8f and 8g until 881A reads  $\pm 5.000V \pm 2mV$  in both steps.

*h. Check HORIZ mm FROM SWP START:  $5.000V \pm 2mV$* 

Set the TIME MEASUREMENT START [STOP] POINT to HORIZ mm FROM SWP START. Position trace to graticule center. Check for  $5.000V \pm 2mV$  on the 881A.

*i. Check mm BELOW 100% ZONE:  $0.000V \pm 2mV$* 

Set the TIME MEASUREMENT START [STOP] POINT to mm BELOW 100% ZONE. Switch Run-Calibrate to Run Check for  $0.000V \pm 2mV$  on the 881A.

*j. Adjust CAL %*

Connect the TYPE 568 CALIBRATOR 5V to the TYPE 3A2 CH 2.

## TYPE 3A2

MODE	CH 2
TRIG SOURCE	CH 2

## TYPE 3B2

TIME/DIV	.2mSEC
TRIGGER LEVEL	Stable Display

## TYPE 230

START [STOP] Comparator

Run-Calibrate	Calibrate
---------------	-----------

## TIME MEASUREMENT

START POINT	% BETWEEN ZONES
START CHANNEL	B

## TIME MEASUREMENT

STOP POINT	% BETWEEN ZONES
STOP CHANNEL	B

**CH B REFERENCE ZONES**

## POSITION

100%	Top of squarewave
0%	Bottom of squarewave

## TRIGGERED

MEASUREMENT	ON
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8j. (Con't)

Connect the Fluke 881A between TP1470 and TP1430. Adjust Cal % (green) for 0.000V.

Disconnect CALIBRATOR.

k. Check offset volts: .1% of voltage  $\pm$  2mV

Set TYPE 230 and TYPE 3B2:

START [STOP] Comparator

Run-Calibrate

Run

TIME MEASUREMENT START

[STOP] POINT

mm above 0% ZONE

TRIGGER LEVEL

Free Run

Connect the Fluke 881A between TP1460 and TP1470. Position trace to bottom of graticule. Check the Volts/bit error according to the following table:

CH A TIME MEASUREMENT START [STOP] POINT LEVEL	Fluke 881A	max error
01	50mV	$\pm$ 2.05mV
02	100mV	$\pm$ 2.1 mV
04	200mV	$\pm$ 2.2 mV
08	400mV	$\pm$ 2.4 mV
10	500mV	$\pm$ 2.5 mV
20	1.00V	$\pm$ 3.0 mV
40	2.00V	$\pm$ 4.0 mV
80	4.00V	$\pm$ 6.0 mV

Turn TYPE 230 POWER to OFF. Remove the card extender and insert START [STOP] Comparator into J6 [J7].

Repeat step 8 using the bracketed [ ] instructions. Reinstall CH A Memory and remove shorts from extender.

9. A [B] MEMORIES

a. Check Memory Balance: 0.000V  $\pm$  1mV

Set the TYPE 230 as follows:

POWER

ON

TIME MEASUREMENT START

POINT

% BETWEEN ZONES

START CHANNEL

A [B]

TIME MEASUREMENT STOP

POINT

% BETWEEN ZONES



## 9a. (Con't)

STOP CHANNEL	A [B]
TRIGGERED MEASUREMENT	ON

Center the TYPE 568 trace. Connect Fluke 881A between TP1410 and TP1460 on the Start Comparator card. Check, adjust if necessary, CH A [B] Memory 0% Bal (black) for  $0.000V \pm 1mV$ .

Connect the 881A between TP1410 and TP1430 on the Start Comparator card. Check, adjust if necessary, CH A [B] 100% Bal (brown) for  $0.000V \pm 1mV$ . Disconnect the 881A.

Repeat step 9a using bracketed [ ] instructions.

b. *Check memory tracking:  $0.00 \pm 3$  Counts*

Set controls as follows:

## TYPE 230

MEASUREMENT MODE	A [B] Volts
TRIGGERED MEASUREMENT	OFF
CH A [B] REFERENCE ZONES	
POSITION	SUPERIMPOSED
START CHANNEL	A [B]
STOP CHANNEL	A [B]

## TYPE 3A2

MODE	CH 1 [2]
CH 1 [2] VOLTS/DIV	1
POSITION	Center Trace

## TYPE 3B2

TIME/DIV	1mSEC
----------	-------

Check that the TYPE 230 reads  $00.00 \pm 1$ . Move trace to graticule top. Check that the TYPE 230 reads  $00.00V \pm .03$ . Move trace to graticule bottom. Check for  $00.00V \pm .03$  on the TYPE 230.

c. *Check positive peak charge time:  $<10\mu s$*

Set the TYPE 230 MEASUREMENT MODE to TIME. Position trace to graticule top. Set the test scope TIME/CM to  $5\mu SEC$ , TRIGGERING SLOPE to + and LEVEL for a stable display. Connect the X1 probe to TP1430 on the Start Comparator card. Check chargetime of pos. step for  $<10\mu s$ .

c. Chargetime is equal to time for 0% to 100% of voltage change.

9. (Con't)

d. Check Negative Peak Charge Time:  $\leq 10\mu s$

Position trace to graticule bottom.

Connect X1 probe to TP1460 on the Start Comparator card. Set test scope TRIGGERING SLOPE to - and LEVEL for stable display. Check charge time of the negative step for  $\leq 10\mu s$ .

10. BUFFER

a. Setup

Set the TYPE 230 as follows:

TIME MEASUREMENT START POINT	HORIZ mm FROM SWP START
LEVEL	10
TIME MEASUREMENT STOP POINT	HORIZ mm FROM SWP START
LEVEL	90

Replace the checked buffer card (J5) with an unchecked card.

b. Adjust the 5V (Ramp)' Gain:  $\frac{+50V \text{ Supply}}{10} \pm 2mV$

Measure the +50V supply. Set 5V-Run-0V switch (buffer card) to 5V. Connect the Fluke 881A between TP1410 and TP1460 on the Start Comparator (J6). Adjust 5V (Ramp)' Gain (violet) for  $\frac{+50V \text{ supply}}{10}$ .

c. Adjust 5V (Ramp)' DC Level:  $0.000V \pm 2mV$

Set 5V-Run-0V switch to 0V. Adjust 5V (Ramp)' DC Level (grey) for 0.000V on the 881A.

Repeat steps 10b and c (interaction).

d. Check  $\div 1$ ,  $\div 2$ , and  $\div 5$

Set 5V-Run-0V switch to Run. Check readout for about +08.00 MS (small error in TYPE 3B2).

Set TYPE 3B2 TIME/DIV to 2mSEC. Check readout for about +16.00MS.

Set TYPE 3B2 TIME/DIV to .5mSEC. Check for readout of about +04.00MS.

10. Connect the Fluke 881A common lead to underlined pins.

b. In this procedure

(Ramp)' =  $\overline{\text{Ramp}}$

A' =  $\overline{A}$

etc.

Example: +50V supply = 50.010V  
set 5V (Ramp)' Gain for 5.001V

## 10. (Con't)

e. Adjust X2,  $\div 1$ ,  $\div 2$ :  $X2 = +16.00V \pm 0.01V$   
 $\div 1 = +08.00V \pm 0.01V$   
 $\div 2 = +04.00V \pm 0.01V$

e. Check that the -50V supply is correct for this adjustment.

Set the TYPE 230 controls as follows:

TIME MEASUREMENT START POINT mm ABOVE 0% ZONE  
 LEVEL 00  
 TIME MEASUREMENT STOP POINT mm ABOVE 0% ZONE  
 LEVEL 80  
 Run-Calibrate (Counter Board) Calibrate

Set the TYPE 3A2 VOLTS/DIV to 2. Position trace to graticule bottom. Adjust X2 (green) on the BUFFER card for a readout of +16.00V.

Set the TYPE 3A2 VOLTS/DIV to .1. Adjust  $\div 1$  (brown) for a readout of +08.00V.

Set the TYPE 3A2 VOLTS/DIV to .5. Adjust  $\div 2$  (red) for a readout of +04.00V.

f. Check Buffer Amp Gain:  $1/2 \pm 0.5\%$

Turn off the TYPE 230. Install Buffer card on card extender. Place into J5 and turn TYPE 230 power on.

Connect the Fluke 881A between pins X and FF. Record the voltage ( $\approx +12.000V$ ).

Connect the 881A between pins 22 and FF. Record the voltage ( $\approx +3.800V$ ).

Short pin 22 to pin 21 [27] on the extender. Connect the 881A between pins AA [25] and 23 [CC]. Record the voltage (reads -750mV to 950mV) read on the 881A.

Short pin 21 [27] (remove short to pin 22) to pin X. Record the voltage (opposite polarity to previous reading) read on the 881A.

Use the following format to check gain.

10f. (Con't)

A. Voltage: X to FF = \_\_\_\_\_  
 B. Voltage: 22 to FF = \_\_\_\_\_  
 C. Input: A-B = \_\_\_\_\_  
 Voltage: AA [25] to [23] CC = \_\_\_\_\_  
 E. 22 shorted to 21 [27] = \_\_\_\_\_  
 F. X shorted to 21 [27] = \_\_\_\_\_  
 H. Error: If D>G, D-G=H H= \_\_\_\_\_  
 I. D+2 = \_\_\_\_\_  
 Check that J>H

D. Ideal output: C÷2 = \_\_\_\_\_

G. Output: E+F = \_\_\_\_\_

If G>D, G-D=H H = \_\_\_\_\_

J. Test Limit: 1X10 = \_\_\_\_\_

f. Example:

A=12.020

B= 3.790

C= 8.230

E= 0.814

F= 3.295

I= 2.057

D= 4.115

G= 4.109

H= 0.006

J= 0.0257

Within Test Limit as J>H.

11. ZONE GEN

a. Setup

Connect the TYPE 184 MARKER OUTPUT to the TYPE 3A2 CH 1 and CH 2. Set controls as follows:

TYPE 184

MARKER SELECTOR

Press 1mS and .1mS

TYPE 3A2

MODE

ALTER

CH 1 and CH 2

VOLTS/DIV

1

CH 1 POSITION

Trace Centered

CH 2 POSITION

Trace Graticule Bottom

TYPE 3B2

TIME/DIV

1mSEC

TRIGGER LEVEL

Stable Display

SWEEP CAL

1ms/div

TYPE 230

TIME MEASUREMENT

START POINT

HORIZ mm FROM SWP START

LEVEL

10

TIME MEASUREMENT

STOP POINT

HORIZ mm FROM SWP START

LEVEL

90

CRT INTENSIFICATION

OFF

TIME MEASUREMENT

OFF

## 11. (Con't)

*b. Adjust Position and Width: Position  
± .1 div Width .3 div ± .05 div.*

Replace the checked CH A [B] Zone Gen.  
in J1 [J2] with an unchecked Zone Gen  
card.

Position the 0% zone to the 2nd lms marker  
using CH A [B] REFERENCE ZONES POSITION.  
Adjust 0% Position (black) until the  
leading edge of the reference zone brightens  
the 2nd lms marker. Adjust 0% Width  
(white) until three .lms markers are  
brightened. Position the 0% zone to the  
9th lms marker.

Position the 100% zone to the 2nd lms  
marker. Adjust 100% position (brown)  
for the leading edge to brighten the  
2nd lms marker. Adjust the 100% Width  
(orange) until 3 .lms markers are  
brightened.

Repeat step 11b using the bracketed [ ]  
instructions.

*c. Adjust 50V Ramp Gain: ± .1 div*

Adjust the 50V Ramp Gain (yellow) on the  
Buffer (J5) for zones to start at the  
9th lms marker. Recheck the zone position  
at the 2nd lms marker.

*d. Check POSITION: Range; 0 through 9.5 div  
in 0.5 div steps  
Step Linearity ; ± .1 div*

Position CH A and CH B (0% and 100%)  
Zones and check that each zone marker  
steps .5 div/step.

## 11. (Con't)

- e. Check Width: 2div;  $\pm .2$  div  
4div;  $\pm .4$  div  
10div; to end of sweep

Position all zones to the start of sweep.  
Set CH A [B] 0% LEVEL WIDTH to 2 cm.  
Check for a zone width of 2 div  $\pm .2$  div.  
Set CH A [B] 0% LEVEL WIDTH to 4 cm.  
Check for a zone width of 4 div.  $\pm .4$  div.  
Set CH A [B] 0% LEVEL WIDTH to 10 cm.  
Check that full sweep is brightened.  
Return CH A [B] 0% LEVEL WIDTH to .3 cm.  
Do again using the CH A [B] 100% LEVEL WIDTH.

Repeat step 11 e using the bracketed [ ] instructions.

Disconnect the TYPE 184 from the TYPE 3A2.

---

12. LIMIT CARD AND SWITCHES

## a. Setup

TYPE 230

MEASUREMENT MODE	TIME
CH A REFERENCE ZONES	
0% & 100% LEVEL	AVERAGE
TIME MEASUREMENT START POINT LEVEL 10	

TYPE 3B2

TRIGGER LEVEL	FREE RUN
---------------	----------

Connect Counter Board Check Out Box to TYPE 230 J301.

Connect power cord to Counter Board Check Out Box.

Replace checked Limit card with unchecked Limit card.

## 12. (Con't)

*b. Check Limit logic and switches*

Check the limit card and switches using the following chart. Checkout box uses 8421 BCD Code:

Set Counter Board Checkout Box for	TYPE 230 UPPER LIMIT	TYPE 230 LOWER LIMIT	LIMIT Lamp Indication
-0000	-2000	-2000	ABOVE UPPER
+2000	+0000	-2000	ABOVE UPPER
-2000	+0000	-2000	WITHIN
+0000	+2000	-2000	WITHIN
-0000	+2000	-2000	WITHIN
+2000	+2000	+0000	WITHIN
-2000	+2000	+0000	BELOW LOWER
+0000	+2000	+2000	BELOW LOWER
-0000	-0000	+0000	BELOW LOWER
+0000	-0000	+0000	ABOVE UPPER
-1111	+1111	-1111	WITHIN
+1111	+1111	-1111	WITHIN
+1111	+1110	-1111	ABOVE UPPER
+1111	+1101	-1111	ABOVE UPPER
+1111	+1011	-1111	ABOVE UPPER
+1111	+0111	-1111	ABOVE UPPER
-1111	+0111	-1110	BELOW LOWER
-1111	+0111	-1101	BELOW LOWER
-1111	+0111	-1011	BELOW LOWER
-1111	+0111	-0111	BELOW LOWER
-2222	+2222	-2222	WITHIN
+2222	+2222	-2222	WITHIN
+2222	+2221	-2222	ABOVE UPPER
+2222	+2212	-2222	ABOVE UPPER
+2222	+2122	-2222	ABOVE UPPER
+2222	+1222	-2222	ABOVE UPPER
-3333	+3333	-3333	WITHIN
+3333	+3333	-3333	WITHIN
+0444	+0444	-0444	WITHIN
-0444	+0444	-0444	WITHIN
-0444	+0444	-0443	BELOW LOWER
-0444	+0444	-0434	BELOW LOWER
-0444	+0444	-0344	BELOW LOWER
+0444	+0443	-0344	ABOVE UPPER
+0444	+0434	-0344	ABOVE UPPER
+0444	+0344	-0344	ABOVE UPPER
+0555	+0555	-0555	WITHIN
-0555	+0555	-0555	WITHIN
-0666	+0666	-0666	WITHIN
+0666	+0666	-0666	WITHIN
+0777	+0777	-0777	WITHIN
-0777	+0777	-0777	WITHIN

12b. (Con't)

-0888	+0888	-0888	WITHIN
+0888	+0888	-0888	WITHIN
+0888	+0887	-0888	ABOVE UPPER
+0888	+0878	-0888	ABOVE UPPER
+0888	+0788	-0888	ABOVE UPPER
-0888	+0788	-0887	BELOW LOWER
-0888	+0788	-0878	BELOW LOWER
-0888	+0788	-0788	BELOW LOWER
-0999	+0999	-0999	WITHIN
+0999	+0999	-0999	WITHIN

13. DECIMAL MEASUREMENTa. *Check time decimals and measurement nixie*

Check decimal position and units of measurement readout according to the following chart:

TYPE 3B2 DIGITAL RESOLUTION	TYPE 230 Decimal Neon <u>read from left to right</u>	TYPE 230 Units of <u>measurement nixie</u>
.1 $\mu$ SEC	4th	$\mu$ S
1 $\mu$ SEC	5th	$\mu$ S
10 $\mu$ SEC	3rd	mS
.1mSEC	4th	ms
1mSEC	5th	mS
10mSEC	3rd	S

b. *Check volts decimal and measurement nixie*

Set TYPE 230 MEASUREMENT MODE to A VOLTS.  
Check decimal neons and units of measure nixie according to the following chart:

TYPE 3A2 A (B) VOLTS/DIV	TYPE 230 Decimal Neon <u>read from left to right</u>	TYPE 230 Units of <u>measurement nixie</u>
10	4	V
5	4	V
2	3	V
1	3	V
.5	3	V
.2	2	V
.1	5	MV
.05	5	MV
.02	4	MV
.01	4	MV

Set TYPE 230 MEASUREMENT MODE to B VOLTS.

Repeat Step 13 for CH 2.



14. PRINT COMMAND AND EXT HOLD

Set DISPLAY TIME for a 1 second blink rate on the READY lamp. Check that the PRINT lamp on the Counter Board Checkout Box changes state each time the ready lamp blinks.

Set EXT HOLD on the Counter Board Checkout Box to EXT HOLD. Check that the TYPE 230 EXT HOLD lamp is lit.

Set EXT on the Counter Board Checkout Box to OFF.

15. TIME MEASUREMENT*a. Setup*

Connect the LFSWG to the 3A2 CH 1 & CH 2. Set controls as follows:

## TYPE 3A2

CH 1 VOLTS/DIV	1
CH 2 VOLTS/DIV	1
MODE	CH1

## TYPE 3B2

TIME/ DIV	1mSEC
Digital Resolution	1μs
TRIGGER SLOPE	-
LEVEL	Stable display

## TYPE 230

MEASUREMENT MODE	A VOLTS
CHA REFERENCE ZONES	
0%	10CM
100%	10CM
POSITION	12 o'clock
CRT INTENSIFICATION REF ZONES	OFF

## LFSWG

FREQUENCY	500Hz
AMPLITUDE	+05.00V readout on TYPE 230

15. (Con't)

b. Check + 1st SLOPE

Set controls as follows:

TYPE 230

MEASUREMENT MODE

TIME

TIME MEASUREMENT START

POINT

% BETWEEN ZONES

LEVEL

10

SLOPE

+ 1st

CHANNEL

A

TIME MEASUREMENT STOP

POINT

% BETWEEN ZONES

LEVEL

90

SLOPE

+ 1st

CHANNEL

A

Check for proper sweep intensification and a readout of  $\approx +590\mu\text{s}$ . (See notes)

Change TYPE 3B2 TIME/DIV to .5mSEC, .2mSEC and 1mSEC. Check that the TYPE 230 readout stays at approximately  $+590\mu\text{s}$ .

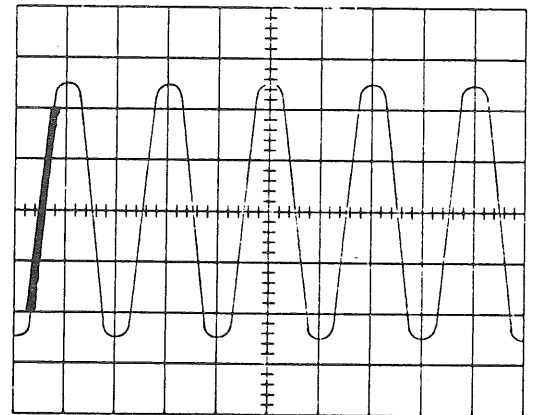
c. Check - 1ST SLOPE

Set TYPE 230 TIME MEASUREMENT START POINT SLOPE to -1st. Set TIME MEASUREMENT STOP POINT SLOPE to -1st. Check for proper display (see notes) and a TYPE 230 readout of approximately  $-590\mu\text{s}$ .

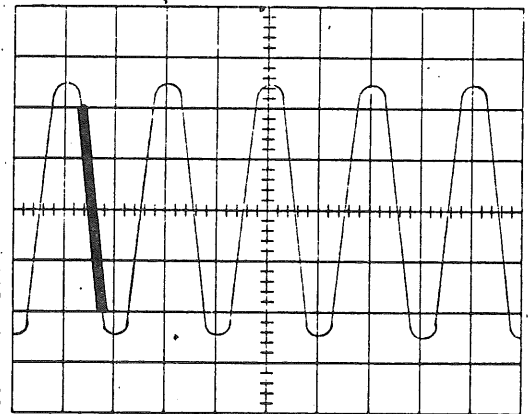
d. Check + 2ND SLOPE

Set TYPE 230 TIME MEASUREMENT START POINT SLOPE to +2nd. Set TIME MEASUREMENT STOP POINT LEVEL SLOPE to +2nd. Check for proper display and readout of approximately  $+590\mu\text{s}$ .

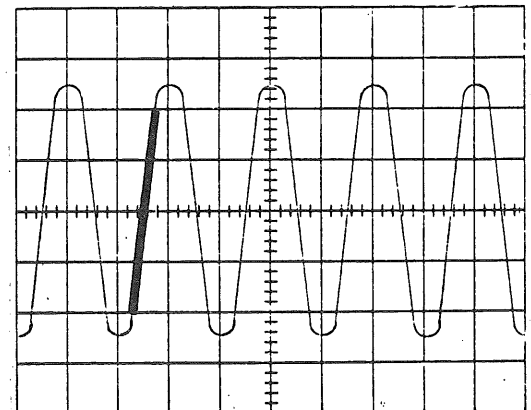
b.



c.



d.

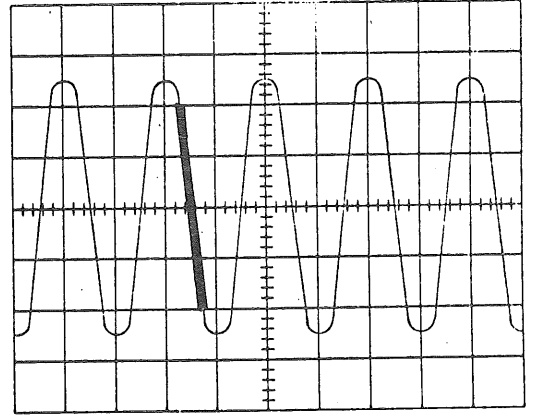


## 15. (Con't)

*e. Check - 2ND SLOPE*

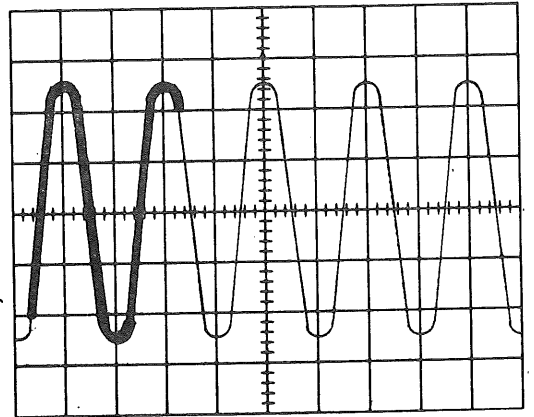
Set TYPE 230 TIME MEASUREMENT START POINT SLOPE to - 2nd and TIME MEASUREMENT STOP POINT SLOPE to -2nd. Check for proper display and readout of approximately  $-590\mu\text{S}$ .

e.

*f. Check + 1ST to - 2ND SLOPE*

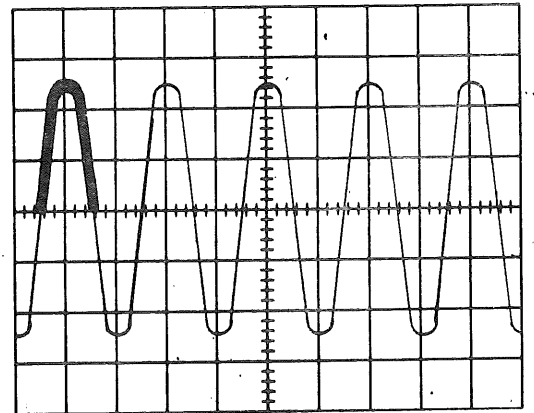
Set TYPE 230 TIME MEASUREMENT START POINT SLOPE to +1st and TIME MEASUREMENT STOP POINT SLOPE to -2nd. Check for proper display.

f.

*g. Check +1ST to -1ST SLOPE*

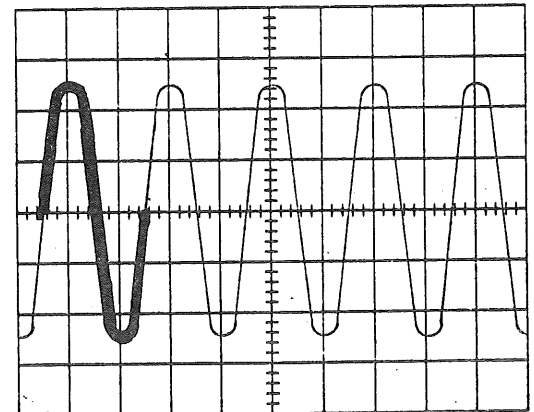
Set TYPE 230 TIME MEASUREMENT STOP POINT to -1st, and both LEVELS to 50. Check for proper display and readout of approximately  $+1000\mu\text{S}$ .

g.

*h. Check +1ST to +2ND SLOPE*

Set TYPE 230 TIME MEASUREMENT STOP +2nd. Check for proper display and readout of approximately  $+2000\mu\text{S}$ .

h.



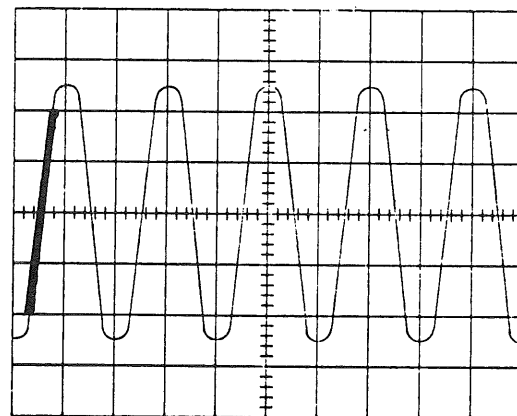
15. (Con't)

i. Check alternate intensification

Decrease LF SINE GENERATOR amplitude to approx 2 volts. Set TYPE 3A2 MODE to ALTER. Set TYPE 230 STOP CHANNEL to B. Increase DISPLAY TIME until READY light blinks. Check for the same intensified portion as in h on both traces. Reverse CHANNEL switches. Observe same display on both traces.

16. mm ABOVE 0% ZONE

Set TYPE 3A2 MODE to CH 1. Set LF SINE WAVE GENERATOR amplitude to 5 volts. Set TYPE 230 START CHANNEL to A. Set TYPE 230 TIME MEASUREMENT START POINT to mm ABOVE 0% ZONE and LEVEL to 05. Set TIME MEASUREMENT STOP POINT to mm ABOVE 0% ZONE, LEVEL to 45 and SLOPE to +1st. Check for proper display and readout of approx +590 $\mu$ S.



16, 17, 18.

17. mm BELOW 100% ZONE

Set TYPE 230 TIME MEASUREMENT START POINT and TIME MEASUREMENT STOP POINT to mm Below 100% ZONE. Check for proper display and observe readout of approx -590 $\mu$ S.

18. % BETWEEN ZONES, CH B

Set controls as follows:

TYPE 230

TIME MEASUREMENT START POINT % BETWEEN ZONES

LEVEL 10

SLOPE +1ST

CHANNEL B

CH B REFERENCE ZONES, 0% & 100% 10cm

TYPE 3A2

MODE CH 2

TRIGGER SOURCE CH 2

Check for proper display.

19. HORIZ mm FROM SWP START*a. Setup*

## TYPE 230

CH A REFERENCE ZONES	AVERAGE
CH B REFERENCE ZONES	AVERAGE
TIME MEASUREMENT START	
POINT	HOR mm FROM SWP START
LEVEL	00 [90]
TIME MEASUREMENT STOP	
POINT	HOR mm FROM SWP START
LEVEL	90 [00]

## TYPE 3A2

Remove signal	
MODE	CH 1
TRIGGER SOURCE	CH 1

## TYPE 3B2

TRIGGER LEVEL	FREE RUN
DIGITAL RESOLUTION	10 $\mu$ S
TIME/DIV	1mSEC

*b. Check TIME MEASUREMENT START [STOP]  
POINT LEVEL*

Set the TIME MEASUREMENT START [STOP]  
POINT LEVEL and check according to  
the following:

START [STOP]	TYPE 230	TYPE 568 visual
POINT LEVEL	Readout	display intensified portion of trace
01	+8.90ms	.1cm to 9th cm
02	+8.8 ms	.2cm to 9th cm
03	+8.7 ms	.3cm to 9th cm
04	+8.6 ms	.4cm to 9th cm
05	+8.5 ms	.5cm to 9th cm
06	+8.4 ms	.6cm to 9th cm
07	+8.3 ms	.7cm to 9th cm
08	+8.2 ms	.8cm to 9th cm
09	+8.1 ms	.9cm to 9th cm
10	+8.0 ms	1st cm to 9th cm
20	+7.0 ms	2nd cm to 9th cm
30	+6.0 ms	3rd cm to 9th cm
40	+5.0 ms	4th cm to 9th cm
50	+4.0 ms	5th cm to 9th cm
60	+3.0 ms	6th cm to 9th cm
70	+2.0 ms	7th cm to 9th cm
80	+1.0 ms	8th cm to 9th cm
90	+0.0 ms	none

Repeat Steps 19 a & b using bracketed [ ]  
instructions. The TYPE 230 readout will  
be negative.

## 19b. (Con't)

Set TYPE 230 TIME MEASUREMENT START POINT LEVEL to 10 and TIME MEASUREMENT STOP POINT LEVEL to 00. Set Run-Cal switch to Stop Comparator to Cal. Check for readout of +9.00mS and trace intensification from 1cm to 10cm.

Return Run-Cal switch to Run.

If measurement does not stop at 10cm, Q671 on Buffer card may not be saturating sufficiently.

20. COUNTER BOARD*a. Setup*

Connect External Programmer to TYPE 230. Set External Programmer 1-2ALT switch to 1, EXT HOLD to OFF, and CH 1 and CH 2 program switches to OFF. Set TYPE 230 MEASUREMENT MODE to EXT PROGRAM.

Set TYPE 3B2 DIGITAL RESOLUTION to .1mS. Adjust TYPE 230 DISPLAY TIME so TYPE 230 READY light blinks at approximately a 1 second rate. Set J202 START HORIZ mm ON and J202 STOP HORIZ mm ON. Set START OFFSET 20 ON and STOP OFFSET 20 and 1 ON. Observe a TYPE 230 readout of +.1mS.

Set EXTERNAL PROGRAM J202 COUNTER RESET INHIBIT to ON.

*b. Check counter and readout output*

Observe both the TYPE 230 and Counter Board Check Out Box nixies. The unit nixie will start to count 1-2-3 etc. up to 9. When the units nixie turns to 0 the next nixie to the left will turn to 1 (tens nixie). When this occurs change the TYPE 3B2 DIGITAL RESOLUTION to 1μS. After the hundred nixie counts from 1 through 9 when it turns to 0 the next nixie to the left (thousands nixie) will turn to 1. When this occurs change the TYPE 3B2 DIGITAL RESOLUTION to .1μSEC. The thousand nixie will count to 3.

a. In order not to be confused with TYPE 230 logic the EXTERNAL PROGRAM switches will be referred to as ON when they are in the UP position.

## 20b. (Con't)

With a count of 3000 displayed on TYPE 230 an E will light on the alphanumeric nixie. Obtain a zero count on the TYPE 230 nixies by switching EXTERNAL PROGRAM J202 STOP OFFSET 1 and COUNTER RESET INHIBIT to OFF, and TYPE 3B2 DIGITAL RESOLUTION to .1mS.

*c. Check - indication*

Set External Programmer J202 OFFSET 1 to ON. Observe a TYPE 230 readout of -.1mS.

21. ZONE POSITION & WIDTH*a. Setup*

Set TYPE 230 as follows:

CRT INTENSIFICATION REF ZONES	BOTH
MEASUREMENT MODE	EXT PROGRAM
CH A AND CH B REFERENCE ZONES	AVERAGE

Set TYPE 3B2 TIME/DIV to 1mSEC. Set TYPE 3A2 MODE to ALTER. Set all External Programmer switches to OFF.

*b. Check external position*

Use the chart below to check position CH A and CH B zones. Set switch ON, check position, then set switch OFF.

External Programmer J201 CH A and B 0% [100%] Zone Position	Position of intensified zone on CRT from Start of trace
.5 POS	.5 div
1 POS	1.0 div
2 POS	2.0 div
4 POS	4.0 div
8 POS	8.0 div

Repeat step 21b using bracketed [ ] instructions.

## 21. (Con't)

*c. Check external width*

Use the following chart to check zone width. Set switch ON, check width, then set switch OFF.

Zone Width	External Programmer	intensified trace from start of trace
	J201	
A 0%	2 WIDTH	2cm
A 0%	4 WIDTH	4cm
A 0%	2 and 4 WIDTH	10cm
A 100%	2 WIDTH	2cm
A 100%	4 WIDTH	4cm
A 100%	2 and 4 WIDTH	10cm
B 0%	2 WIDTH	2cm
B 0%	4 WIDTH	4cm
B 0%	2 and 4 WIDTH	10cm
B 100%	2 WIDTH	2cm
B 100%	4 WIDTH	4cm
B 100%	2 and 4 WIDTH	10cm

Set all External Programmer switches OFF.

## 22. (TWELVE) LINES

*a. Setup*

Connect the TYPE 568 5V 1kHz CALIBRATOR to the TYPE 3A2 CH 1 [2] input and the TYPE 3B2 EXT TRIG IN. Set controls as follows:

TYPE 3A2  
MODE  
AC-DC-GND

CH 1 [2]  
AC

TYPE 3B2  
TIME/DIV  
TRIGGER SOURCE  
LEVEL

.2mSEC  
EXT  
for stable display

External Programmer J201  
J201 A 0% WIDTH 4  
A 100% WIDTH 4  
EXT VOLTS

ON  
ON  
ON

J202 START OFFSET 100%  
START CH B  
STOP CH B

ON  
OFF [ON]  
OFF [ON]



22a. (Con't)

Check that the TYPE 230 reads approx 5.00V.

b. Check CH A [B] (Twelve)' and memory: leak-down; 2 counts/10sec

Set J201 A [B] 0% 8 POS and 4 POS to ON.  
Set A [B] 100% 8 POS and 4 POS to ON.  
Remove the calibrator from TYPE 3A2.  
Check for TYPE 230 readout of  $\approx 5.00V$ .

Set J201 A [B] 0% 8 POS and 4 POS to OFF. Check that TYPE 230 readout is approx 2.50V.

Check that readout does not change over 2 counts in 10 seconds.

Connect the CALIBRATOR to CH 1 [2] again.  
Set A [B] 0% 8 POS and 4 POS to ON.  
Remove CALIBRATOR. Set J201 A [B] 100% 8 POS and 4 POS to OFF. Check that the TYPE 230 readout is approx 2.50V.

Check that readout does not change over 2 counts in 10 seconds.

Set all EXTERNAL PROGRAMMER switches to OFF.

Repeat step 22 using bracketed [ ] instructions.

b. In this procedure

(TWELVE)' =  $\overline{\text{TWELVE}}$

$A' = \overline{A}$

etc.:

23. EXT HORIZ mm FROM SWP START

a. Setup

Set controls as follows:

TYPE 3A2

MODE

CH 1

TYPE 3B2

DIGITAL RESOLUTION

1 $\mu$ S

TRIGGER SOURCE

INT

LEVEL

FREE RUN

External Programmer

J201 A 0% 4 POS

ON

A 0% 2 POS

ON

A 100% 4 POS

ON

A 100% 2 POS

ON

J202 START HORIZ mm

ON

STOP HORIZ mm

ON

## 23. (Con't)

*b. Check START [STOP] OFFSET*

Check offset lines according to the following chart. Use one switch at a time.

<u>J202 START [STOP] ON</u>	<u>Trace intensified except for first</u>
1 OFFSET	1mm
2 OFFSET	2mm
4 OFFSET	4mm
8 OFFSET	8mm
10 OFFSET	1cm
20 OFFSET	2cm
40 OFFSET	4cm
80 OFFSET	8cm

Repeat step 23b using bracketed [ ] instructions.

24. CHECK EXT LOWER & UPPER LIMITS

Set J202 START 20 and STOP 20 to ON.  
Set START HORIZ mm and STOP HORIZ mm to OFF. Set TYPE 230 DISPLAY TIME ccw.

Check input lines according to the following chart:

<u>J203 LOWER</u>	<u>J203 UPPER</u>	<u>Counter Checkout on</u>	<u>Check LIMIT Lamp on</u>
0001	0000	0000	Yellow
0001	0000	0001	Red
0001	0001	0001	Green
0000	0000	0000	Green
0002	0000	0000	Yellow
0002	0000	0002	Red
0002	0002	0002	Green
0004	0000	0000	Yellow
0004	0000	0004	Red
0004	0004	0004	Green
0008	0000	0000	Yellow
0008	0000	0008	Red
0008	0008	0008	Green
0010	0000	0000	Yellow
0010	0000	0010	Red
0010	0010	0010	Green

## 24. (Con't)

0020	0000	0000	Yellow
0020	0000	0020	Red
0020	0020	0020	Green
0040	0000	0000	Yellow
0040	0000	0040	Red
0040	0040	0040	Green
0080	0000	0000	Yellow
0080	0000	0080	Red
0080	0080	0080	Green
0100	0000	0000	Yellow
0100	0000	0100	Red
0100	0100	0100	Green
0200	0000	0000	Yellow
0200	0000	0200	Red
0200	0200	0200	Green
0400	0000	0000	Yellow
0400	0000	0400	Red
0400	0400	0400	Green
0800	0000	0000	Yellow
0800	0000	0800	Red
0800	0800	0800	Green
1000	0000	0000	Yellow
1000	0000	1000	Red
1000	1000	1000	Green
2000	0000	0000	Yellow
2000	0000	2000	Red
2000	2000	2000	Green
0000	0000	+0000	Green
0000	-0000	+0000	Red
0000	-0000	-0000	Yellow
-0000	-0000	-0000	Green

Set all EXT Programmer switches to OFF.

25. EXT TIME MEASUREMENTa. *Setup*

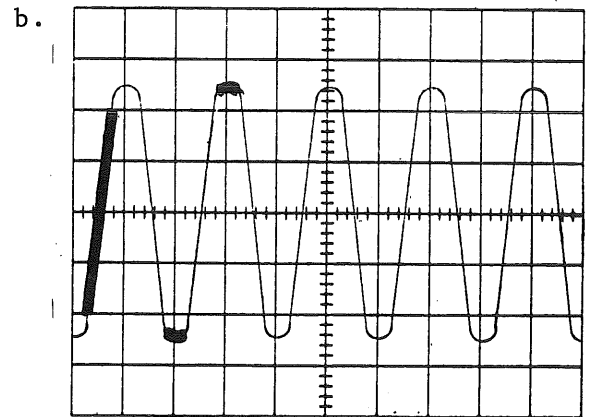
a.

Connect 500Hz signal from LF SINE WAVE GENERATOR to TYPE 3A2 CH 1 input. Set TYPE 3B2 TIME/DIV to 1mSEC. Set TRIGGER LEVEL for a stable display. Set External Programmer J201 A 0% 2 POS to ON. Set A 100% 1 POS and 2 POS to ON.

25. (Con't)

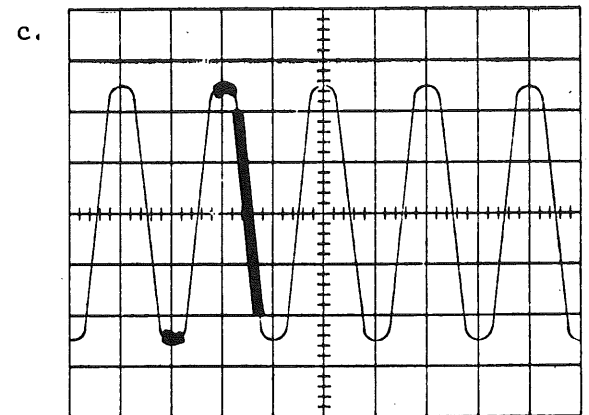
b. *Check + 1st SLOPE*

Set External Programmer J202 START BETWEEN % and OFFSET 10 to ON. Set STOP BETWEEN %, OFFSET 10 and OFFSET 80 to ON. Check for proper display.



c. *Check -2nd SLOPE*

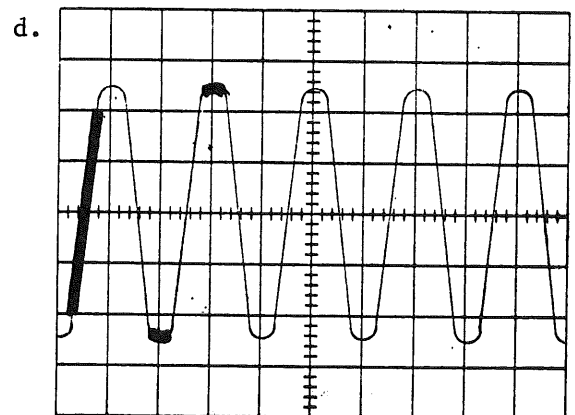
Set External Programmer J202 START MINUS SLOPE and 2nd SLOPE to ON. Set STOP MINUS SLOPE and 2nd SLOPE to ON. Check for proper display. Set all J202 switches to OFF.



d. *Check mm ABOVE 0% ZONE*

Set External Programmer J202 START OFFSET 1 and OFFSET 4 to ON. Set STOP OFFSET 1, OFFSET 4, and OFFSET 40 to ON.

Check for proper display and TYPE 230 readout of +.



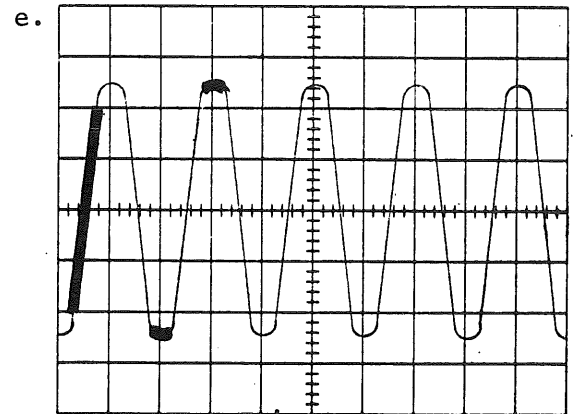
25. (Con't)

e. Check mm BELOW 100% ZONE

Set External Programmer J202 START mm BELOW and OFFSET 100% to ON. Set STOP mm BELOW and OFFSET 100% to ON. Check for proper display and TYPE 230 readout of -.

Remove input from TYPE 3A2 and set TYPE 3B2 TRIGGER LEVEL to FREERUN.

Set all External Programmer switches to OFF.



26. EXT DECIMALS & UNITS OF MEASURE

Set the TYPE 3A2 VOLTS/DIV switches to 1. Set the External Programmer J202 EXT SCALE to ON. Check decimals and units of measure nixies according to the following:

TYPE 230 and Counter Board Checkout

J203	J204	Decimal from left on	Nomenclature nixie on
		5th	None
÷5		4th	None
	DEC 2	2nd	None
÷5	DEC 2	1st	None
	DEC 3	3rd	None
÷5	DEC 3	2nd	None
	DEC 4	4th	None
÷5	DEC 4	3rd	None
	V		V
	S		S
	M		M
	μ		μ
	N		N

Set all External Programmer switches to OFF.

27. EXT VOLTS, ÷2 AND ÷5

Set External Programmer J202 START 20 to ON. Set J201 EXT VOLTS to ON. Check that the TYPE 230 readout is -2.00V.

## 27. (Con't)

Set J203 ÷2 to ON. Check that readout is -1.00V.

Set J203 ÷2 to OFF. Set J203 ÷5 to ON. Check that readout is -0.400V.

Set all External Programmer switches to OFF.

28. MONITOR DRIVE SIGNALS*a. Setup*

Set controls as follows:

TYPE 3B2  
TIME/DIV .1SEC

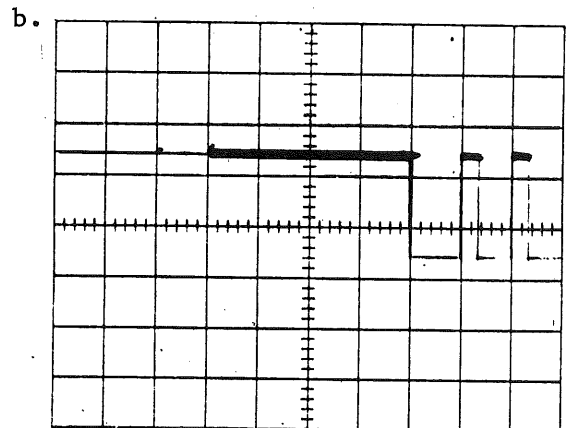
TYPE 3A2  
MODE CH 1  
VOLTS/DIV 5

## External Programmer

J202 START HORIZ mm	ON
OFFSET 40	ON
OFFSET 20	ON
OFFSET 10	ON
STOP HORIZ mm	ON
OFFSET 40	ON
OFFSET 20	ON
OFFSET 10	ON
J201 A 0% POS 8	ON
A 100% POS 8	ON
1	ON

*b. Check (SWP SPEED)' UP*

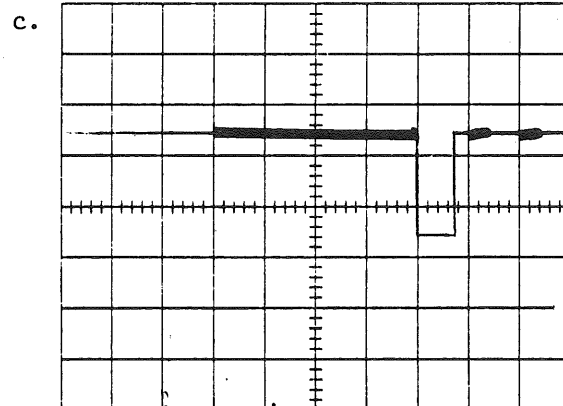
Connect a X1 probe from the SWP SPEED' UP jack on EXT PROG to CH 1 on the TYPE 3A2. Check for proper display.



## 28. (Con't)

## c. Check (SINGLE)' SWP

Connect the X1 probe to the (SINGLE)' SWP jack. Check for the proper display of alternate sweeps.

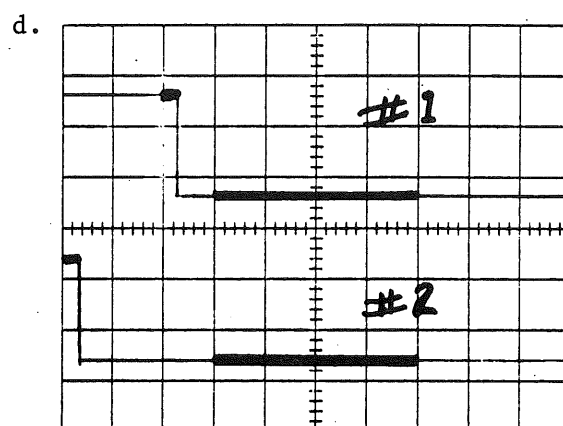


## d. Check (A CHOP)' [(B CHOP)']

Set External Programmer J202 A 0% POS 8 and A 100% POS 8 and POS 1 to OFF. Set all four POS 2 to ON. Set A CHOP and B CHOP to ON. Connect X1 probe to (A CHOP)' [(B CHOP)'] jack. Check for waveform #1.

Set all four POS 2 switches to OFF and back to ON. Check for waveform #2.

Remove Probe. Set External Programmer switches to OFF.



## 29. EXT HOLD

## a. Setup

Set External Programmer CHANNEL 1 program as follows:

J201 A 0% 4 WIDTH and 2 WIDTH	ON
J201 A 100% 4 WIDTH and 2 WIDTH	ON
J201 EXT VOLTS	ON
J202 STOP OFFSET 100%	ON
J203 UPPER LIMIT 400-100-10	ON
J203 LOWER LIMIT 400- 80-10	ON

## 29a. (Con't)

Set CHANNEL 2 program as follows:

J201 A 0% 4 WIDTH and 2 WIDTH	ON
J201 A 100% 4 WIDTH and 2 WIDTH	ON
J202 START OFFSET 20 and 4	ON
J202 STOP OFFSET 80, 10, 4, and 2	ON
J202 START 2nd SLOPE	ON
J202 STOP % BETWEEN	ON
J203 UPPER LIMIT 400, 80, and 10	ON
J203 LOWER LIMIT 400, 100, and 10	ON
J203 UPPER MINUS	ON
J203 LOWER MINUS	ON

Set TYPE 3A2 VOLTS/DIV to 2. Connect the 5 V 20kHz CALIBRATOR to the TYPE 3A2 input. Set the TYPE 3B2 TIME/DIV to 10 $\mu$ SEC and DIGITAL RESOLUTION to .1 $\mu$ S. Set TRIGGER LEVEL for a stable display.

*b. Check EXT HOLD WITHIN LIMITS*

Set External Programmer 1-2-ALT switch to ALT. Press EXT HOLD GREEN and check for lockup of TYPE 230 with EXT HOLD light on.

Set External Programmer RED-YELLOW EXT HOLD switch to EXT HOLD. Check that TYPE 230 does not stop.

*c. Check EXT HOLD ABOVE UPPER LIMIT*

Set External Programmer CHANNEL 1 J203 UPPER LIMIT 400 to OFF. TYPE 230 should lockup with red light on.

*d. Check EXT HOLD BELOW LOWER LIMIT*

Set External Programmer CHANNEL 1 J203 UPPER LIMIT 400 to ON. Set RED-YELLOW EXT HOLD switch to OFF and back to EXT HOLD. Set CHANNEL 1 J203 LOWER LIMIT 200 to ON. TYPE 230 should lockup with yellow light on. Set LOWER LIMIT 200 to OFF.

Set EXT HOLD to OFF.

b. If the TYPE 230 ABOVE UPPER LIMIT light or the BELOW LOWER LIMIT light comes on, the TYPE 230 will stop until manually released.



### 30. EXT TRIGGER

Set External Programmer EXT TRIG +  
-OFF- to OFF. Set TYPE 230 TRIGGERED  
MEASUREMENT to ON. The TYPE 230 should  
stop.

Set External Programmer EXT TRIG to +.  
TYPE 230 should alternate between programs.

Set TYPE 230 TRIGGERED MEASUREMENT to OFF.  
Set External Programmer EXT TRIG to -  
and TYPE 230 TRIGGERED MEASUREMENT to  
ON. The TYPE 230 should continue al-  
ternating between programs. Set External  
Programmer EXT TRIG to OFF. TYPE 230  
should stop.

Set all External Programmer CHANNEL 1  
and 2 PROGRAM switches to OFF.

### 31. MEASUREMENT AVERAGING

#### *a. Check measurement averaging*

Set External Programmer J202 START HORIZ  
mm to ON. Set J202 STOP HORIZ mm to ON.  
Set J202 START OFFSET 10 and 80 ON.  
Set J202 STOP OFFSET 10 and 80 ON. Set  
1-2-ALT switch to 1. Set TYPE 3B2  
TIME/DIV to 1mSEC. Set DIGITAL RESOLUTION  
to 10 $\mu$ S and TRIGGER LEVEL to FREE RUN.  
Remove input from TYPE 3A2.

Set TYPE 230 TRIGGERED MEASUREMENT to  
OFF. Connect a X1 probe to Measure  
test point on Synchronizer card.

Adjust test scope TIME/CM and VARIABLE  
TIME/CM for 8 cycles of signal displayed  
on test scope. Set TRIGGERING MODE  
to TRIG and SLOPE to -. Set External  
Programmer J201 MEASURE AVERAGE to ON.  
1 cycle should now be displayed on test  
scope.

## 31. (Con't)

b. *Check measurement averaging  
internal programming*

Set TYPE 230 MEASUREMENT MODE to TIME.  
Set TYPE 230 MEASUREMENT AVERAGING to  
8 and observe 1 cycle displayed on test  
scope.

Remove test probe from TYPE 230.

Turn TYPE 230 and TYPE 568 POWER off.  
Remove cables from test setup.

32. SYNCHRONIZERa. *Setup*

Connect a X1 probe from the TYPE W  
to the DELAY test point on the syn-  
chronizer. Turn the TYPE 568 POWER  
off. Replace the TYPE 3A2 with a TYPE  
3S1. Replace the TYPE 3B2 with a TYPE  
3T5. Set controls as follows:

TYPE 230	
DISPLAY TIME	ccw
TYPE W	
MILLIVOLTS/CM	50
INPUT ATTEN	100
TYPE 547	
TIME/CM	1mSEC
TRIGGERING SLOPE	+
LEVEL	stable display
TYPE 3T5	
TIME/DIV DECADE	0
MULTIPLIER	2
TRIGGER	free run

## 32. (Con't)

b. *Check Delay range:  $\approx 1\text{ms}$  to  $\approx 8\text{ms}$*

Check the positive duration of the pulse for about 1ms to 8ms at the ccw and cw extremes of the Delay (white) adj. Check that the positive level is about +3.8V

c. *Adjust Delay: 2ms*

Adjust Delay (white) for 2ms positive pulse. Remove probe.

d. *Check high speed functions*

Set controls as follows:

## TYPE 230

TRIGGERED MEASUREMENT	OFF
MEASUREMENT AVERAGING	1
CRT INTENSIFICATION	
REF ZONES	BOTH
TIME MEASUREMENT	ON
MEASUREMENT MODE	TIME
TIME MEASUREMENT START	
POINT	HORIZ mm FROM SWP START
LEVEL	10
TIME MEASUREMENT STOP	
POINT	HORIZ mm FROM SWP START
LEVEL	20

## TYPE 3S1

mVOLTS/DIV	200
POSITION	trace centered
MODE	CH A

## EXTERNAL PROGRAMMER

HIGH SPEED PGM	ON
----------------	----

Check that the dot density during zone times is .00 dots/div and 10 dots/div at other times.

Check that the sweep ends after the last zone time or measure time (whichever is last).

Check that the TYPE 230 readout is about +0.200ns.

## 32. (Con't)

e. *Check for lockup: no lockup*

Turn the TYPE 230 POWER off, then ON. Check that the high speed functions work after the TYPE 230 POWER is turned ON.

33. SAMPLING

a. *Setup*

## TYPE 3T5

SAMPLES/SWEEP	1000
TIME/DIV DECADE	8
MULTIPLIER	2
TRIGGER	free run
PROGRAM SELECTOR	INT

## TYPE 3S1

Selector	DUAL TRACE
A VOLTS/DIV	200mV
B VOLTS/div	200mV
INVERT-NORMAL	NORMAL
INTERNAL TRIGGER	B
Position	traces centered

## TYPE 230

MEASUREMENT AVERAGING	1
CRT INTENSIFICATION REF	
ZONES	BOTH
MEASUREMENT MODE	A VOLTS
CH A REFERENCE ZONES	AVERAGE
CH B REFERENCE ZONES	AVERAGE
TIME MEASUREMENT START POINT	% BETWEEN ZONE
SLOPE	+ 1st
LEVEL	50
TIME MEASUREMENT STOP POINT	% BETWEEN ZONE
SLOPE	- 1st
LEVEL	50

b. *Check VOLTS measurement*

Check that the TYPE 230 reading is about 4 counts.

Change MEASUREMENT MODE to B [A]  
VOLTS. Check for about 4 counts.

## 33b. (Con't)

Connect the 20kHz calibrator to the TYPE 1S1 CHAN B [A] INPUT. Set the TYPE 3T5 TIME/DIV DECADE to 6 and MULTIPLIER to 5. TRIGGER on the 20kHz CALIBRATOR signal. Adjust DELAY to place the rising edge of pulse at the 1cm mark on the graticule. Set the TYPE 230 CH B [A] REFERENCE ZONES 0% to 0cm and the 100% to 2cm. Check that the TYPE 230 reads +0.500V.

Repeat using bracketed [ ] instructions.

*c. Check TIME measurement*

Set the TYPE 230 MEASUREMENT MODE to TIME. Check for a reading of about +25 $\mu$ s.

Remove the 20kHz calibrator from the TYPE 1S1. Set the controls as follows:

## TYPE 230

TIME MEASUREMENT START POINT	HORIZ mm FROM SWP START
LEVEL	50
TIME MEASUREMENT STOP POINT	HORIZ mm FROM SWP START
LEVEL	60

## TYPE 3T5

TRIGGER	free run
---------	----------

Check that the readout is +05.00 $\mu$ s.

Set TYPE 3T5 TIME/DIV DECADE to 6 and MULTIPLIER to 2. Check that readout is +02.00 $\mu$ s.

Set the TYPE 3T5 TIME/DIV MULTIPLIER to 1. Check that the TYPE 230 readout is +01.00 $\mu$ s.

THE END