

FACTORY CALIBRATION PROCEDURE

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INTRODUCTION:

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:

0-443
September 1967

For all serial numbers.



R230

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. (JT)



EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

a. *TEKTRONIX Instruments*

- 1 TYPE 547 OSCILLOSCOPE
- 1 TYPE W PLUG-IN UNIT
- 1 TYPE 568 OSCILLOSCOPE
- 1 TYPE 3A2 DUAL-TRACE AMPLIFIER
- 1 TYPE 3B2 TIME BASE
- 1 TYPE 184 TIME MARK GENERATOR
- 1 TYPE P6011 1X PASSIVE PROBE
- 1 TYPE 76TU LINE VOLTAGE CONTROL UNIT

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 821A 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.

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 INSPECTION

2. PRESETS

3. POWER SUPPLY RESISTANCE

4. COUNTER BOARD RESISTANCE

5. INITIAL POWER SUPPLY ADJUSTMENT

6. COUNTER BOARD SUPPLIES

7. REGULATION AND RIPPLE

Regulation: 104 to 126V Ripple: $\leq 3\text{mV}$

8. LINE VOLTAGE SELECTOR

9. OPERATIONAL CHECK

10. POWER SUPPLIES

- b. Adjust +50V $\pm 10\text{mV}$
- c. Adjust -50V $\pm 10\text{mV}$
- d. Adjust +12V $\pm 5\text{mV}$
- e. Adjust +3.8V $\pm 1\text{mV}$
- f. Adjust -3.5V $\pm 1\text{mV}$
- g. Adjust +1.75V temp/volts chart

11. MEMORY RANGE AND BAL

- b. Adjust 0% Range 6V $\pm .5\text{V}$
- c. Adjust 100% Range -2V $\pm .5\text{V}$
- d. Adjust 0% Bal 0.0 $\pm 1\text{mV}$
- e. Adjust 100% Bal 0.0 $\pm 1\text{mV}$

12. START AND STOP COMPARATORS

- * g. Adjust Bal 2 5.000V $\pm 2\text{mV}$
- h. Check HORIZmm FROM SWP START
5.000 $\pm 2\text{mV}$
- i. Check mm BELOW 100% ZONE
0.000 $\pm 2\text{mV}$
- k. Check Offset volts
.1% of voltage $\pm 2\text{mV}$

13. CH A AND B MEMORIES

- a. Check Memory tracking
0.00 ± 3 counts
- b. Check Memory leak down
 ± 2 counts change
- c. Check positive peak charge time
 $< 10\mu\text{SEC}$
- d. Check negative peak charge time
 $< 10\mu\text{SEC}$

14. ZONE GENERATOR

- b. Adjust POSITION and WIDTH
Position: ± 1 div
Width: .3cm $\pm .05\text{cm}$
- c. Adjust Inv Ramp Gain ± 1 div
- d. Check POSITION
Range: 0 through 9.5 div in
.5 div steps
Accuracy: ± 1 div at the .5,
1, 2, 4 and 8 div steps

- e. Check WIDTH
 - 2cm $\pm .2$ cm
 - 4cm $\pm .4$ cm
 - 10cm intensified to end of sweep
- 15. BUFFER
 - b. Adjust 5V Ramp Gain 5.00V ± 2 mV
 - c. Adjust 5V Ramp DC Level 0.00V ± 2 mV
 - * e. Adjust X2, $\div 1$, and $\div 2$ Voltmeter Ramp
 - X2 = 16.00V $\pm .05$ V
 - $\div 1$ = 8.00V $\pm .03$ V
 - $\div 2$ = 4.00V $\pm .02$ V
- 16. SYNCHRONIZER
- 17. COUNTER BOARD AND LIMIT CARD
- 18. DECIMALS
- 19. PRINT COMMAND AND EXT HOLD
- 20. TIME MEASUREMENT
- 21. mm ABOVE 0% ZONE
- 22. mm BELOW 100% ZONE
- 23. % BETWEEN ZONES B CHANNEL
- 24. HORIZ mm FROM SWP START
- 25. COUNTER BOARD
- 26. ZONE POSITION AND WIDTH
 - b. Check position $\pm .1$ div
 - c. Check width 2 div $\leq \pm .2$ div
 - 4 div $\leq \pm .4$ div
 - 10 div - intensified to end of sweep
- 27. TWELVE LINES
- 28. HORIZ mm FROM SWP START
- 29. LOWER AND UPPER LIMITS
- 30. UPPER AND LOWER MINUS
- 31. TIME MEASUREMENT
- 32. DECIMALS AND UNITS OF MEASURE
- 33. EXT VOLTS
- 34. $\div 2$ AND $\div 5$
- 35. MONITOR DRIVE SIGNALS
- 36. EXT HOLD
- 37. EXT TRIGGER
- 38. MEASUREMENT AVERAGING

THE FOLLOWING CHECK IS NOT MADE ON 100% OF THE INSTRUMENTS BUT IS DONE ON A SAMPLING BASIS ONLY.

14.

- f. Check buffer amp DC level CHA 50mVolts to 250mVolts
- g. Check buffer amp gain CHA 4 Volts $\pm 0.5\%$
- h. Check buffer amp DC level CHB 50mVolts to 250mVolts
- i. Check buffer amp gain CHB 4 Volts $\pm 0.5\%$

THE END

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

1. PRELIMINARY INSPECTION

Check the component assembly of the instrument; unsoldered joints, rosin joints, lead dress and unclipped wire ends. Check for loose hardware and protruding parts. Check controls for smooth mechanical operation, proper indexing and spacing. Check polarity of capacitors on J₁, J₄, J₆, J₈, and J₉.

Check line voltage selector for MED 115V operation.

Correct all defects found.

2. PRESETSTYPE 568

CAL	1 kHz
INTENSITY	midr
FOCUS	midr

TYPE 3A2

MODE	CH 1
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	10 μ SEC

TYPE 230

MEASUREMENT	
AVERAGING	1
REF ZONES	BOTH
TIME MEASUREMENT	ON
MEASUREMENT MODE	A VOLTS

2. (cont'd)

TYPE 230

CHA REFERENCE ZONES	
0% LEVEL	AVERAGE
100% LEVEL	AVERAGE
CHB 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

3. POWER SUPPLY RESISTANCE

Disconnect power supply voltages to counter board. Set VOM to X1K Scale. Remove limit lights from the front panel.

Supply	Approx Resistance Neg lead to GND	Approx Resistance Pos lead to GND
+1.75V	2K	3.5K
+50V	12K	30K
+12V	200K	7K
+3.8V	2K	4K
-3.5V	3.5K	20K
-50V	30K	20K Ω

4. COUNTER BOARD RESISTANCE

Supply	Approx Resistance Neg lead to GND	Approx Resistance Pos lead to GND
+255V	inf	inf
+12V	20K	5K
+3.8V	800 Ω	1K Ω
-3.5V	15K	3K
+1.75V	15K	10K Ω

Note: D2312 is located in the lower left hand corner nearest M2470.

Check the forward resistance of D2312 for \approx 2 K Ω . Replace the limit lights.

5. INITIAL POWER SUPPLY ADJUST*a. Setup*

Insert checked CRT Intens /Regulator card in J10. Install test load card in J1 or J2. Set test load unit to LOW LOAD. 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.

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.

c. Adjust + and - 50 volt supplies

Connect VOM between +50V test point and gnd. Adjust R230 (brown) for an indicated 50V on VOM. Connect VOM between -50V test point and gnd. Adjust R360 (red) for an indicated -50V on VOM. These two adjustments (R230 and R360) interact. Repeat until both supplies read their proper voltage.

d. Adjust +12 volt supply

Connect VOM between 12V test point and gnd. Adjust R260 (orange) for an indicated +12 on VOM.

e. Adjust +3.8 volt supply

Connect a VOM between 3.8V test point and gnd. Adjust R290 (yellow) for an indicated +3.8 volts on VOM.

f. Adjust +1.75 volt supply

Connect the VOM between +1.75V test point and gnd. Adjust R310 (green) for an indicated +1.75 volts on VOM.

g. Adjust -3.5 volt supply

Connect the VOM between -3.5 volt test point and gnd. Adjust R330 (blue) for an indicated -3.5 volt on VOM.

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.

c. Most adjustments are color coded by the color of the component holder.

6. COUNTER BOARD SUPPLIES

Check the +255V, +12V, +3.8V, +1.75V and -3.5V supplies to the counter board for correct voltages.

R2339 is a .5 watt 36k Ω located between V2499 and V2339.

Check for +200V \pm 15V at the top of R2339.

7. REGULATION AND RIPPLE

Regulation:
104 VAC to 126 VAC
Ripple: \leq 3mV

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, using the chart below.

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

Set the Test Load Unit to Hi and the TYPE 76TU to 104V AC and using the chart above check regulation and ripple.

8. 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 line voltage selector MED 115V

The VOM should read \approx 66V. Turn TYPE 230 POWER off and disconnect the TYPE 230 power cord from the TYPE 76TU.

8. (cont'd)

c. Check line voltage selector LOW 115V

Change the TYPE 230 line voltage selector to LOW 115V. Connect the TYPE 230 power cord to the TYPE 76TU and turn the TYPE 230 POWER on. The VOM should read $\approx 75V$. Turn the TYPE 230 POWER off and disconnect the TYPE 230 power cord from the TYPE 76TU.

d. Check line voltage selector HI 115V

Change the TYPE 230 line voltage selector to HI 115V. Connect the TYPE 230 power cord to the TYPE 76TU and turn the TYPE 230 POWER on. The VOM should read $\approx 61V$ across R222. Turn the TYPE 230 POWER off and disconnect the TYPE 230 power cord from the TYPE 76TU.

e. Check line voltage selector MED 230V

Change the TYPE 230 line voltage selector to MED 230V. Connect the TYPE 230 power cord to the TYPE 76TU and turn the TYPE 230 POWER on. The VOM should read $\approx 33V$. Turn the TYPE 230 POWER off and disconnect the TYPE 230 power cord from the TYPE 76TU. Change the line voltage selector to MED 115V.

9. OPERATIONAL CHECK*a. Setup*

Disconnect the VOM from across R222. Disconnect the Test Load Unit from the TYPE 230. Connect the power supplies to the counter board. Install a full set of checked boards in their proper jacks. Place a thermometer between Synchronizer card and CRT Intens/Regulator card. Connect TYPE 230 power cord to TYPE 76TU. Turn TYPE 230 power on. Set TYPE 76TU for 115V. 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.

9. (cont'd)

b. Check TYPE 230 for proper operation

Set the TYPE 230 CH A REFERENCE ZONES so the intensified portion of the waveform controlled by 0% POSITION is set at the negative portion of the square-wave and the intensified portion of the waveform controlled by the 100% POSITION is set on the positive portion of the waveform. The TYPE 230 read-out should be approx 5V. Set the VOM to X1K. Measure the forward resistance of D2011 on the unchecked Clock card to be $\approx 2K\Omega$. Replace the checked Clock card with the unchecked Clock card and observe TYPE 230 read-out of $\approx 5V$. Disconnect the CALIBRATOR from the TYPE 3A2.

b. D2011 is located one-half inch to the rear of M2128.

10. POWER SUPPLIES*a. Setup*

Connect the differential voltmeter -terminal to the ground test point on the TYPE 230 CRT Intens/Regulator card. Connect the positive lead to the +50V test point on the CRT Intens/Regulator card.

b. Adjust +50V +50V, $\pm 10mV$, max

Adjust R230 (brown) for exactly +50V indicated on the differential voltmeter.

c. Adjust -50V supply -50V, $\pm 10mV$, max

Connect the differential voltmeter to the -50V test point. Adjust R360 (red) for exactly -50V indicated on the differential voltmeter. The +50V adjust and the -50V adjust interact so it will be necessary to repeat adjustment of R230 and R360.

d. Adjust +12V supply +12V, $\pm 5mV$, max

Connect the differential voltmeter to the +12V test point. Adjust R260 (orange) for exactly +12V indicated on the differential voltmeter.

e. Adjust +3.8V supply +3.8V, $\pm 1mV$, max

Connect the differential voltmeter to the +3.8V test point. Adjust R290 (yellow) for exactly +3.8V indicated on the differential voltmeter.

10. (cont'd)

f. Adjust -3.5V supply -3.5V, $\pm 1mV$, max

Connect the differential voltmeter to the -3.5 V test point and adjust R330 (blue) for exactly -3.5V indicated on the differential voltmeter.

g. Adjust +1.75V supply $\pm 4\%$ at $25^{\circ}C$, $\pm 2^{\circ}C$

Connect the differential voltmeter to the +1.75V test point. Read the temperature on the thermometer and subtract 10 degrees. Read this temperature on Fig. 1 chart on the horizontal axis and find the voltage on the vertical axis. Adjust R310 (green) for this voltage on the differential voltmeter. Disconnect the differential voltmeter from the test points.

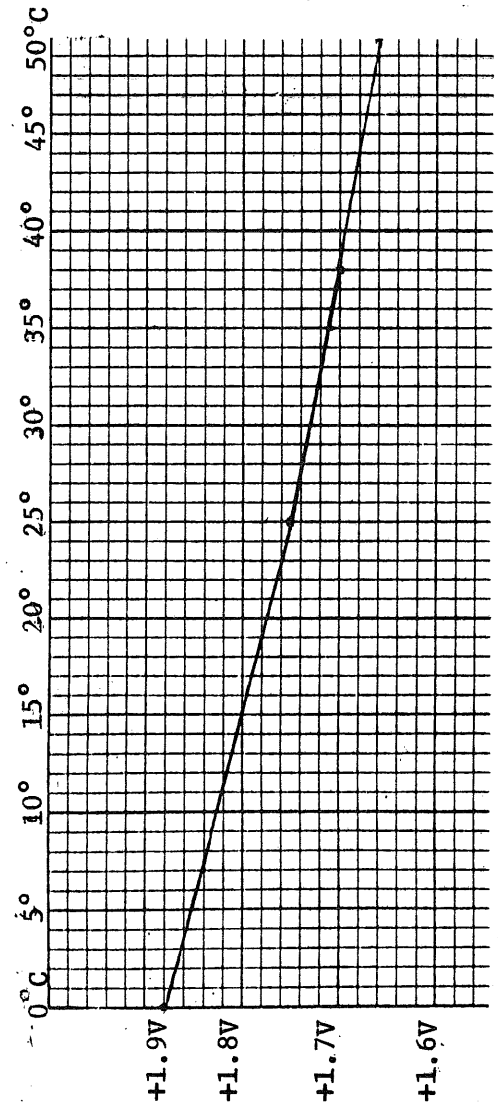


Fig. 1

11. CH A & B MEMORY RANGE AND BAL

a. Setup

Remove the CH A (CH B) Memory Card and place an unchecked Memory card on the Card Extender. Set the TYPE 3A2 MODE to 1 (2) Set the TYPE 3B2 TRIGGER LEVEL to FREE RUN, TIME/DIV to 1mSEC, and DIGITAL RESOLUTION to 10 μ SEC. Set W INPUT ATTEN to 100 and MILLIVOLTS/CM to 20. Connect an X1 probe to Pin L of CH A (CH B) MEMORY card in the TYPE 230. Center trace on TYPE 568 CRT with TYPE 3A2 POSITION control. Set TYPE 230 CHANNEL switches to A (B) with the TYPE 230 REFERENCE ZONES POSITION, position the 0% and +100% zones over each other.

b. Adjust 0% Range 6V $\pm .5V$

Adjust R1064 for a discharge level of +6V. The memory charged level should be at approx +2V. See Fig. 2. Disconnect probe from Pin L.

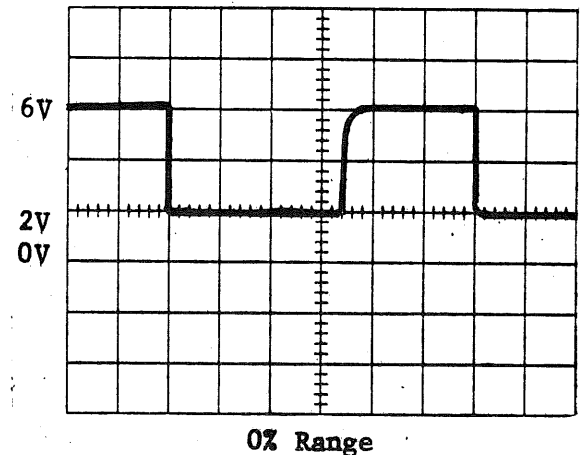


Fig. 2

11. (cont'd)

c. *Adjust 100% Range* $-2V \pm .5V$

Connect X1 probe to Pin U of CH A (CH B) Memory Card. Adjust R1154 for a discharge level of $-2V$. The charged level should be approx $+2V$. See Fig. 3. Disconnect probe from Pin U. Remove card extender and place Memory card inside of TYPE 230.

d. *Adjust 0% BAL* $0.000 \pm 1mV$

Set the TYPE 230 TIME MEASUREMENT START POINT and TIME MEASUREMENT STOP POINT to % BETWEEN ZONES. Set TRIGGERED MEASUREMENT to ON and MEASUREMENT MODE to TIME. Connect the differential voltmeter between test point 1410 and 1460 on the Start Comparator card. Check to see that the traces on the TYPE 568 CRT are still centered. Adjust R1077 (black) for 0.000.

e. *Adjust 100% BAL* $0.000, \pm 1mV$

Connect differential voltmeter between test point 1410 and 1430 on the Start Comparator card. Adjust R1147 (brown) for 0.000. Set TYPE 230 TRIGGERED MEASUREMENT to OFF.

Repeat Step 11a through e for CH B Memory. Remove differential voltmeter leads.

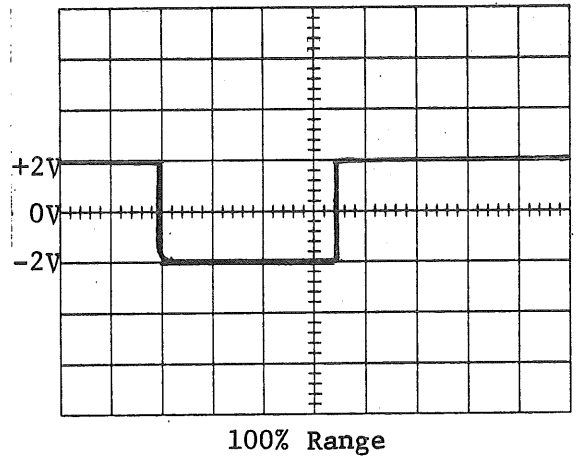


Fig. 3

12. START AND STOP COMPARATORS

a. *Setup*

Remove CH A Memory. Install an unchecked Start (Stop) Comparator card on the Card Extender. Set the TYPE 3A2 VOLTS/DIV to 1 and MODE to CH 1. Set the TYPE 3B2 TIME/DIV to 1mSEC, SWEEP DELAY to OUT. Set the TYPE 230 as follows: TRIGGERED MEASUREMENT to OFF, MEASUREMENT MODE to TIME, TIME MEASUREMENT START POINT and TIME MEASUREMENT STOP POINT to % BETWEEN ZONES. Both CHANNEL switches to A.

With the TYPE 3A2 POSITION control position the trace to graticule center. Short Pins B, J and H together on the Start (Stop) Comparator jack.

12. (cont'd)

b. Adjust Off Bal

Install a shorting strap across D1445. Connect the differential voltmeter from D1445 to gnd. Adjust R1445 (orange) for an 0.000 reading on differential voltmeter. Remove differential voltmeter and shorting strap from D1445.

c. Adjust Bal 1

Connect the differential voltmeter between test point 1460 and test point 1450. Adjust R1425 (brown) for an 0.000 reading on the differential voltmeter.

d. Adjust Bal 2

Connect the differential voltmeter between test points 1460 and test point 1470. Adjust R1465 (red) for an 0.000 reading on the differential voltmeter.

e. Adjust Comp Bal

Connect an X1 probe to Pin 7 of the Start Comparator (Stop Comparator). Adjust R1475 (blue) so test scope display of noise is equally positive and negative. See Fig. 4. Remove probe.

f. Adjust 5V Gain

Set the TYPE 230 TIME MEASUREMENT START POINT (TIME MEASUREMENT STOP POINT) to mm ABOVE 0% ZONE. Position trace to bottom graticule with TYPE 3A2 POSITION control. Switch the Run Cal switch on the Comparator card to Cal. Connect the differential voltmeter between test point 1460 and test point 1470. Adjust R1455 (yellow) for a reading on the differential voltmeter of 5.000 volts.

g. Adjust Bal 2 5.000 $\pm 2mV$

Set the TYPE 230 TIME MEASUREMENT START POINT (TIME MEASUREMENT STOP POINT) to mm BELOW 100% ZONE. Position trace to top of graticule with TYPE 3A2 POSITION control. Note reading on the differential voltmeter. Subtract this voltage from 5V. Adjust R1465 (red) so reading on differential voltmeter is halfway between 5V and previous reading. Do steps f and g over until 5 volts $\pm 2mV$ is read on the differential voltmeter in the two positions of the TIME MEASUREMENT START POINT (TIME MEASUREMENT STOP POINT) switch.

b. D1445 is a IN3497 located to to the rear of Q1461 and Q1464.

This voltage may drift several millivolts but should be set as close as possible to 0.000 on the differential voltmeter.

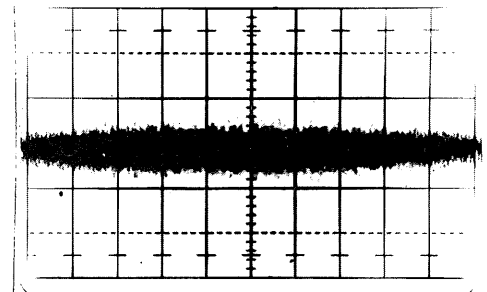


Fig. 4

f. R1456 is previously selected and matched with D1445 to center the adjustment of R1455. If R1455 adjusts to one extreme, R1456 should be selected in the following manner: Connect a differential voltmeter across D1445 and measure the voltage. Subtract 5.87 from this reading. The difference X1K will be the value of R1456.

12. (cont'd)

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

Set the TYPE 230 TIME MEASUREMENT START POINT (TIME MEASUREMENT STOP POINT) to HORIZ mm FROM SWP START. Position trace to center of graticule with TYPE 3A2 POSITION control. Check the reading on the differential voltmeter for 5V $\pm 2mV$.

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

Set the TYPE 230 TIME MEASUREMENT START POINT (TIME MEASUREMENT STOP POINT) to mm BELOW 100% ZONE. Switch Run-Cal switch on Comparator card to Run. Check reading on differential voltmeter for .000V $\pm 2mV$.

- j. Adjust Cal %*

Remove shorts from B, J and H on the Comparator card and install Memory card in TYPE 230. Connect the TYPE 568 CALIBRATOR signal to the TYPE 3A2 input. Set TYPE 3B2 TIME/DIV and TRIGGER LEVEL for a triggered display of 2 cycles on TYPE 568 CRT.

Set TYPE 230 TRIGGERED MEASUREMENT to ON. Set the TIME MEASUREMENT START POINT and TIME MEASUREMENT STOP POINT to % BETWEEN ZONES. With the CH A REFERENCE ZONE POSITION control position the 0% zone to the bottom of the square-wave and the 100% zone to the top of the square-wave. Connect the differential voltmeter between test point 1470 and test point 1430. Switch Run-Cal switch on Comparator card to Cal. Adjust R1435 (green) for 0.000V. Disconnect CALIBRATOR from TYPE 3A2 input.

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

Set TYPE 230 Run-Cal switch on Comparator card to Run. Set the TIME MEASUREMENT START POINT (TIME MEASUREMENT STOP POINT) to mm ABOVE 0% ZONE.

j. R1434 is previously selected and matched with D1445 to center the adjustment of R1435. If R1435 adjusts to one extreme, R1434 should be selected in the following manner: Connect a differential voltmeter across D1445 and measure the voltage. Subtract 5.87 from this reading. The difference X1K will be the value of R1434.

12k. (cont'd)

Set TYPE 3B2 TRIGGER LEVEL to FREE RUN. Connect the differential voltmeter between test point 1460 and test point 1470. Position the trace to the bottom of the graticule. Using the following chart, check the volts/bit error.

<u>CH A TIME MEASUREMENT START POINT LEVEL</u>	<u>differential voltmeter</u>	<u>max error</u>
01	50mV	±2.05mV
02	100mV	±2.1 mV
04	200mV	±2.2 mV
08	400mV	±2.4 mV
10	500mV	±2.5 mV
20	1.00V	±3.0 mV
40	2.00V	±4.0 mV
80	4.00V	±6.0 mV

Disconnect differential voltmeter. Turn TYPE 230 POWER to OFF. Remove Start Comparator card from Card Extender and install in TYPE 230. Remove Stop Comparator card from TYPE 230 and install Card Extender. Turn POWER to ON and repeat step 12 for Stop Comparator. After both Comparators have been calibrated, recheck Memory balance as follows:

Set TYPE 230 TIME MEASUREMENT START POINT and TIME MEASUREMENT STOP POINT to % BETWEEN ZONES. Set TRIGGERED MEASUREMENT to ON. Connect differential voltmeter to test points 1410 and 1460 on the Start Comparator card. Check to see that the trace is centered on the TYPE 568 CRT. Check and adjust, if necessary, R1077 (black) on the CH A Memory for 0.000V ±1mV. Connect differential voltmeter to test points 1410 and 1430 on the Start Comparator.

Check and adjust, if necessary, R1147 (brown) for 0.000V ±1mV. Set CHANNEL switches to B. Adjust, if necessary, R1147 (brown) on CH B Memory for 0.000V ±1mV. Connect differential voltmeter to test points 1410 and 1460 on Start Comparator. Adjust, if necessary, R1077 (black) on CH B Memory for 0.000 ±1mV.

Remove differential voltmeter.

13. CHA & B MEMORIES

a. *Check Memory tracking: 0.00 ±3 counts*

Set TYPE 3A2 MODE to CH 1 (CH 2). Set TYPE 230 MEASUREMENT MODE to A VOLTS (B VOLTS) and TRIGGERED MEASUREMENT to OFF. Superimpose CH A (CH B) 0% and 100% zones. Set CHANNEL switches to A (B).

With the TYPE 3A2 POSITION control, position the trace to graticule center. The TYPE 230 readout should be 0.00 ±1 count. Position the trace to graticule top and to graticule bottom. The readout at the top and at the bottom should be 0.00 ±3 counts.

Return Trace to graticule center.

b. *Check Memory leak down not more than ±2 counts change*

Set TYPE 230 CH A (CH B) REFERENCE ZONES to .3cm AVERAGE. Set the TYPE 3A2 VOLTS/DIV to 2. Set the TYPE 3B2 TIME/DIV to 1mSEC and DELAY TIME to 10s. TYPE 230 readout should be 0.00 ±1 count.

Set TYPE 3B2 DELAY to IN and let sweep run at least three times. TYPE 230 readout must not change more than ±2 counts from previous reading.

Set TYPE 3B2 to OUT.

c. *Check Positive peak charge time ≤10μSEC*

Set TYPE 230 MEASUREMENT MODE to TIME. Set the TIME MEASUREMENT START POINT and TIME MEASUREMENT STOP POINT to % BETWEEN ZONES. Position trace to top of graticule with TYPE 3A2 POSITION control. Set test scope TIME/cm to 5μSEC. Connect X1 probe to TP1430 on the Comparator card. Set test scope TRIGGERING SLOPE to + and LEVEL for a stable display. Check risetime to be ≤10μSEC.

13. (cont'd)

d. Check Negative peak charge time $\leq 10\mu\text{SEC}$

Position trace to bottom of graticule with the TYPE 3A2 POSITION control. Connect test scope probe to TP1460 on the Comparator card. Set TRIGGERING SLOPE to - and LEVEL for a stable display. Check falltime to be $\leq 10\mu\text{SEC}$.

Repeat Step 13a, b, c, and d for CH B. Remove probe.

14. ZONE GEN

a. Setup

Set TYPE 3A2 MODE to ALTER. Position A trace to center of graticule and B trace to bottom of graticule. Set both VOLTS/DIV switches to 1. Connect 1mS and .1mS markers from the TYPE 184 to CH 1 and CH 2 inputs.

Set TYPE 3B2 TIME/DIV to 1mSEC and TRIGGER LEVEL for a stable display. Set SWEEP CAL for exactly one 1mS marker per div.

Set TYPE 330 TIME MEASUREMENT START POINT to HORIZ mm FROM SWP START and LEVEL to 10. Set TIME MEASUREMENT STOP POINT to HORIZ mm FROM SWP START and LEVEL to 90. Adjust R670 (violet) on the Buffer card for 8.00 mS on the readout. Adjust R675 (gray) on the Buffer card for the 2nd and the 10th 1mS marker to be intensified. Set CRT INTENSIFICATION TIME MEASUREMENT to OFF.

b. Adjust Position and Width

Position: ± 1 div

Width: $.3\text{cm} \pm .05\text{cm}$

Replace the checked CH A (CH B) Zone Gen card with an unchecked Zone Gen card.

With the TYPE 230 CH A (CH B) REFERENCE ZONES POSITION controls, position the 0% zone to start at the second 1mS marker and adjust R805 (black) until that marker is intensified. Adjust R879 (white) until three .1mS markers are intensified. Position the 0% zone to the ninth 1mS marker. Position the 100% zone to start at the second 1mS marker

14b. (cont'd)

and adjust R905 (brown) until that marker is intensified. Adjust R979 (orange) until three .1mS markers are intensified.

Repeat Step 14b for CHB Zone Gen.

c. *Adjust Inv. Ramp Gain ± 1 div*

Adjust R680 (yellow) on the Buffer card for zones to start at the ninth 1mS marker. Recheck the zone position at the second 1mS marker.

d. *Check Position*

*Range: 0 through 9.5 div
in .5 div steps.*

*Accuracy: ± 1 div at the 0,
5, 1, 2, 4, and 8 div steps*

With CH A and CH B REFERENCE ZONES POSITION set all zones to start of trace. Each position on the POSITION control switch is equal to .5 div. Check all positions on all switches from 0 div to 9.5 div.

e. *Check WIDTH*

2cm $\pm .2$ cm

4cm $\pm .4$ cm

10cm intensified to end of sweep

With TYPE 230 CH A and CH B REFERENCE ZONES POSITION, position all zones to start of trace. With CH A (CH B) zone WIDTH set the 0% (100%) zone to 2cm. Check for intensification of first 2cm of trace. Set 0% (100%) WIDTH to 10cm and check for intensification of entire trace.

Return 0% WIDTH to .3cm.

Repeat for 100% WIDTH.

Repeat for CH B WIDTH.

Remove time marks.

Set TYPE 3B2 TRIGGER LEVEL to FREERUN.

15. BUFFER*a. Setup*

Set TYPE 3A2 MODE to CH 1. Replace the checked Buffer card with an unchecked Buffer card. Set TYPE 230 CRT INTENSIFICATION TIME MEASUREMENT to ON.

b. Adjust 5V Ramp Gain 5.00V ±2mV

Set switch on Buffer card to 5V. Connect differential voltmeter between TP 1410 and TP 1460 on the Start Comparator card and adjust R670 (violet) for 5.00V

c. Adjust 5V Ramp DC Level 0.00V ±2mV

Set switch on Buffer card to 0V and adjust R675 (gray) for 0.00V on the differential voltmeter. Repeat Step 14b and 14c for adjustment interaction. Set switch on Buffer card to Run.

d. Check ÷1, ÷2, and ÷5

Check the TYPE 230 readout to be approx 8.00mS. Set the TYPE 3B2 TIME/DIV to .5mSEC and check for a readout of approx 4.00mS. Set the TYPE 3B2 TIME/DIV to 2mSEC and check for a readout of approx 16.00mS.

Any small deviation from the 4.00mS, 8.00mS, and 16.00mS readouts will typically be error in the timebase unit.

*e. Adjust X2, ÷ 1, X2 = 16.00V ±0.01V
and ÷ 2. ÷ 1 = 8.00V ±0.01V
÷ 2 = 4.00V ±0.01V*

Set the Run-Cal switch on the counter board to Cal. Position the trace to the bottom of the graticule with the TYPE 3A2 POSITION control. Set the TYPE 230 TIME MEASUREMENT START POINT to mm ABOVE 0% ZONE and LEVEL to 00. Set the TIME MEASUREMENT STOP POINT to mm ABOVE 0% ZONE and LEVEL to 80.

Set the TYPE 3A2 VOLTS/DIV to 2. Adjust R660 (green) for a TYPE 230 readout of 16.00V. Set the TYPE 3A2 VOLTS/DIV to 1. Adjust R645 (brown) for a TYPE 230 readout of 8.00V. Set the TYPE 3A2 VOLTS/DIV to .5. Adjust R635 (red) for a TYPE 230 readout of 4.00V.

Set TYPE 3A2 CH 1 and CH 2 VOLTS/DIV to 1. Set Run Cal switch to Run.

15. (cont'd)

- f. *Check buffer amp DC level CH A 50mV to 250mV*

Turn TYPE 230 POWER OFF and place Buffer card on Card Extender. Turn TYPE 230 POWER ON.

Connect the differential voltmeter between pins Y and 21 of the Buffer card connector. Using the TYPE 3A2 CH 1 POSITION control position the trace so the differential voltmeter reads 6 volts. Connect the differential voltmeter between pins Y and 23 of the Buffer card connector. The reading on the differential voltmeter will be 50mv to 250mv. Record this reading.

- g. *Check buffer amp gain CH A 4 volts ±.3% (3.988V to 4.012V)*

Connect the differential voltmeter between pins Y and 21 of the Buffer card connector. Rotate the TYPE 3A2 CH 1 POSITION control until the differential voltmeter reads 14 volts. Connect the differential voltmeter between pins Y and 23 of the Buffer card connector. Take the reading on the differential voltmeter minus the reading in step f. This figure should be from 3.980V to 4.020V.

Example: reading in step f 175mV
 reading in step g 4.185V

$$\begin{array}{r} 4.185V \\ \underline{.175mV} \\ 4.010V \end{array}$$

- h. *Check buffer amp DC level CH B 50mv to 250mv*

Set the TYPE 230 CHANNEL switches to B. Set the TYPE 3A2 MODE to CH 2. Connect the differential voltmeter between pins 27 and EE of the Buffer card connector. Using the TYPE 3A2 CH 2 POSITION control position the trace so the differential voltmeter reads 6 volts. Connect the differential voltmeter between pins 27 and CC of the Buffer card connector. The reading on the differential voltmeter will be 50mV to 250mV. Record this reading.

f., g., h., i. THESE ARE SAMPLE CHECKS AND ARE NOT MADE ON 100% OF THE INSTRUMENTS, BUT ARE DONE ON A SAMPLING BASIS.

These checks should be performed as fast as possible minimizing error caused by TYPE 3A2 drift.

15. (cont'd)

- i. *Check buffer amp gain CH B 4 volts \pm .3% (3.988V to 4.012V)*

Connect the differential voltmeter between pins 27 and EE of the Buffer card connector. Rotate the TYPE 3A2 CH 2 POSITION control until the differential voltmeter reads 14 volts. Connect the differential voltmeter between pins 27 and CC. Take this reading minus the reading in step i. This figure should be between 3.980 volts and 4.020 volts. Turn TYPE 230 POWER OFF and place Buffer card in TYPE 230. Turn TYPE 230 POWER ON.

16. SYNCHRONIZER

- a. *Setup*

Set TYPE 230 DISPLAY TIME ccw. Connect a X1 probe to the center tap (V/wh wire) of the DISPLAY TIME control. Set TYPE W MILLIVOLTS/CM to 50 and INPUT ATTEN to 100. Set test scope TIME/CM to 1mSEC, TRIGGERING SLOPE to + and LEVEL for a stable display. Replace checked Synchronizer card with unchecked Synchronizer card. Set TYPE 3A2 MODE to CH 1. Set TYPE 3B2 TRIGGER LEVEL to FREE RUN.

- b. *Check Delay range*

Check delay time when R1780 (White) is at its two extremes. It should be approximately 1ms to 8ms. The delay range is the width of the positive going portion of the waveform.

- c. *Adjust Delay*

Adjust R1780 (White) for 2mSEC delay.

Remove probe.

17. COUNTER BOARD AND LIMIT CARD

a. Setup

TYPE 230

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

Connect Counter Board Check Out Box to
 TYPE 230 J301.

Connect power cord to Counter Board
 Check Out Box.

Replace checked Limit card with un-
 checked Limit card.

b. Check counter board & Limit card

Using chart below check counter board and
 Limit card.

<u>Counter Board Check Out Box Bit Switches</u>	<u>TYPE 230 UPPER LIMIT</u>	<u>TYPE 230 LOWER LIMIT</u>	<u>TYPE 230 and Counter Board Check Out Box Limit Indication</u>
1000-100-10-1	+1111 thru +3999	-3999 thru +1111	WITHIN LIMITS
	+1111 thru +3999	+1112 thru +3999	BELOW LOWER LIMIT
	-3999 thru +1110	+1112 thru +3999	both UPPER & LOWER LIMIT
	-3999 thru +1110	-3999 thru +1111	ABOVE UPPER LIMIT
2000-200-20-2	+2222 thru +3999	-3999 thru +2222	WITHIN LIMITS
	+2222 thru +3999	+2223 thru +3999	BELOW LOWER LIMIT
	-3999 thru +2221	+2223 thru +3999	both UPPER & LOWER LIMIT
	-3999 thru +2221	-3999 thru +2222	ABOVE UPPER LIMIT
400-40-4	+0444 thru +2221	-3999 thru 0444	WITHIN LIMITS
	+0444 thru +3999	+0445 thru +3999	BELOW LOWER LIMITS
	-3999 thru +0443	+0445 thru +3999	both UPPER & LOWER LIMIT
	-3999 thru +0443	-3999 thru +0444	ABOVE UPPER LIMITS
800-80-8	+0888 thru +3999	-3999 thru +0888	WITHIN LIMITS
	+0888 thru +3999	+0889 thru +3999	BELOW LIMITS
	-3999 thru +0887	+0889 thru +3999	both UPPER & LOWER LIMIT
	-3999 thru +0887	-3999 thru 0888	ABOVE UPPER LIMITS
1000-100-10-1	-1111 thru +3999	-1111 thru -3999	WITHIN LIMITS
	-1112 thru -3999	-1111 thru -3999	ABOVE UPPER LIMITS
	-1111 thru +3999	-1110 thru +3999	BELOW LOWER LIMITS
	-1111 thru -3999	-1110 thru +3999	both UPPER & LOWER LIMIT

17b. (cont'd)

2000-200-20-2	-2222 thru +3999	-2222 thru -3999	WITHIN LIMITS
	-2223 thru -3999	-2222 thru -3999	ABOVE UPPER LIMITS
	-2222 thru +3999	-2221 thru +3999	BELOW LOWER LIMITS
	-2223 thru +3999	-2221 thru +3999	both UPPER & LOWER LIMIT
400-40-4	-0444 thru +3999	-0444 thru -3999	WITHIN LIMITS
	-0445 thru -3999	-0444 thru -3999	ABOVE UPPER LIMITS
	-0444 thru +3999	-0443 thru +3999	BELOW LOWER LIMITS
	-0445 thru -3999	-0443 thru +3999	both UPPER & LOWER LIMIT
800-80-8	-0888 thru +3999	-0888 thru -3999	WITHIN LIMITS
	-0889 thru -3999	-0888 thru -3999	ABOVE UPPER LIMITS
	-0888 thru +3999	-0887 thru +3999	BELOW LOWER LIMITS
	-0889 thru -3999	-0887 thru +3999	both UPPER & LOWER LIMIT

18. DECIMAL

a. *Check time decimal*

Switch TYPE 3B2 DIGITAL RESOLUTION to .1μSEC.

Using the chart below check decimal neon and units of measure nixie.

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

b. *Check volts decimal*

Set TYPE 230 MEASUREMENT MODE to A VOLTS.
Using the chart below check decimal neons and units of measure nixie.

18b. (cont'd)

TYPE 3A2 A (B) VOLTS/DIV	TYPE 230 Decimal Neon read from left to right	TYPE 230 Units of measurement nixie
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 18b for CH 2

Return TYPE 3A2 CH 1 and CH 2 VOLTS/DIV to 1

19. PRINT COMMAND AND EXT HOLD

Rotate TYPE 230 DISPLAY TIME cw until READY light blinks at approximately a 1 second rate. Check the PRINT light on the Counter Board Check Out Box. It should change state every time the READY light on the TYPE 230 blinks.

Set the EXT HOLD switch on the Counter Board Check Out Box to EXT HOLD. The TYPE 230 EXT HOLD Light should be on.

Set EXT HOLD on the Counter Board Check Out Box to OFF.

20. TIME MEASUREMENT

a. Setup

Connect a 500Hz signal from LF SINE WAVE GENERATOR to the TYPE 3A2 CH 1 and CH 2 inputs. Set the TYPE 230 MEASUREMENT MODE to A VOLTS, DISPLAY TIME ccw, and CH A REFERENCE ZONES 0% and 100% WIDTH to 10cm. Adjust LF SINE WAVE GENERATOR for a 5.00V indication on TYPE 230. Set TYPE 3B2 TIME/DIV to 1mSEC and DIGITAL RESOLUTION to 1µs. Set TRIGGER SLOPE to - and LEVEL for a stable display.

20. (cont'd)

Set CRT INTENSIFICATION REF ZONES to OFF.

b. Check + 1st slope

Set TYPE 230 MEASUREMENT MODE to TIME.
Set TIME MEASUREMENT START POINT to %
BETWEEN ZONES, LEVEL to 10, and SLOPE to
+ 1st.

Set CHANNEL switch to A.

Set TIME MEASUREMENT STOP POINT to %
BETWEEN ZONES, LEVEL to 90, and SLOPE to
+ 1st. See Fig. 5 for proper intensi-
fication and check TYPE 230 readout of
approx +590 μ S. Change TYPE 3B2 TIME/DIV
to .5mSEC and .2mSEC and check TYPE 230
readout for approx same as 1mSEC.

Set TYPE 3B2 TIME/DIV to 1mSEC.

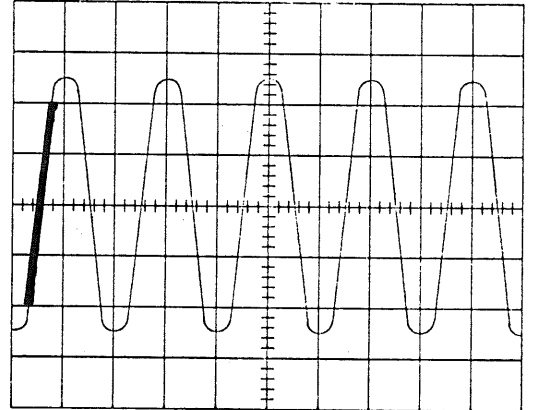


Fig. 5

c. Check - 1st slope

Set TYPE 230 TIME MEASUREMENT START
POINT SLOPE TO -1st. Set TIME MEASURE-
MENT STOP POINT SLOPE to -1st. See
Fig. 6 for proper display and observe
readout of approx -590 μ S.

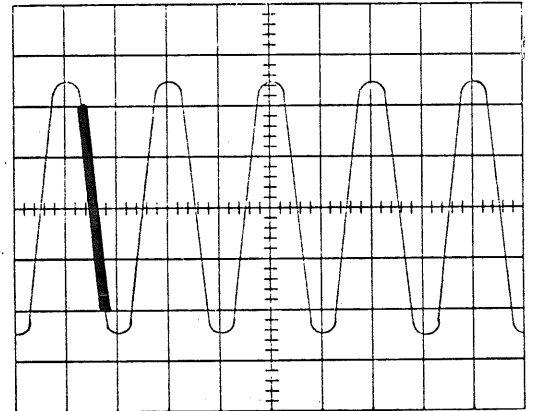


Fig. 6

d. Check + 2nd slope

Set TYPE 230 TIME MEASUREMENT START
POINT SLOPE to +2nd. Set TIME MEASURE-
MENT STOP POINT LEVEL SLOPE to +2nd. See
Fig. 7 for proper display and observe
readout of approx +590 μ S.

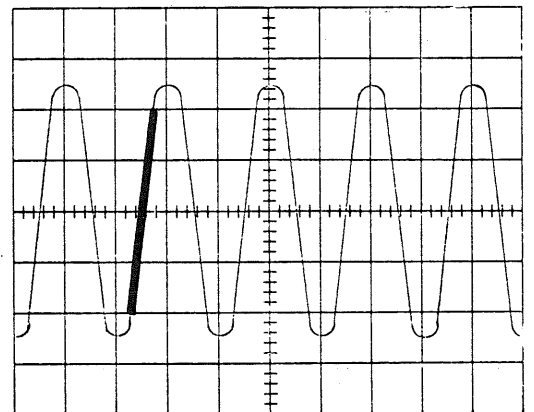


Fig. 7

20. (cont'd)

e. *Check - 2nd slope*

Set TYPE 230 TIME MEASUREMENT START POINT SLOPE to - 2nd and TIME MEASUREMENT STOP POINT SLOPE to -2nd. See Fig. 8 for proper display and observe readout of approx -590 μ S.

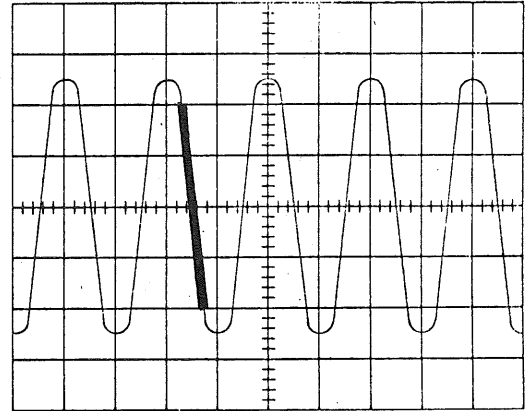


Fig. 8

f. *Check + 1st to - 2nd slope*

Set TYPE 230 TIME MEASUREMENT START POINT SLOPE to + 1st and TIME MEASUREMENT STOP POINT SLOPE to -2nd. See Fig. 9 for proper display.

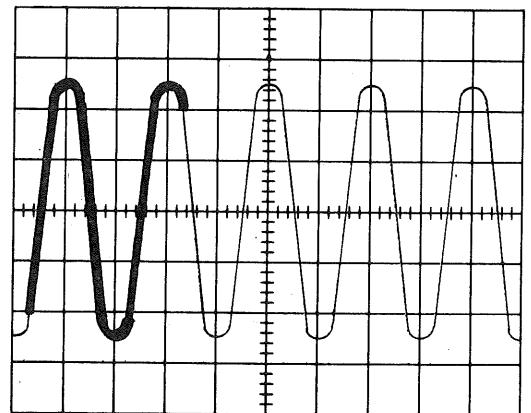


Fig. 9

g. *Check + 1st to - 1st slope*

Set TYPE 230 TIME MEASUREMENT STOP POINT to -1st, and both LEVELS to 50. See Fig. 10 for proper display and observe readout of approx +1000 μ S.

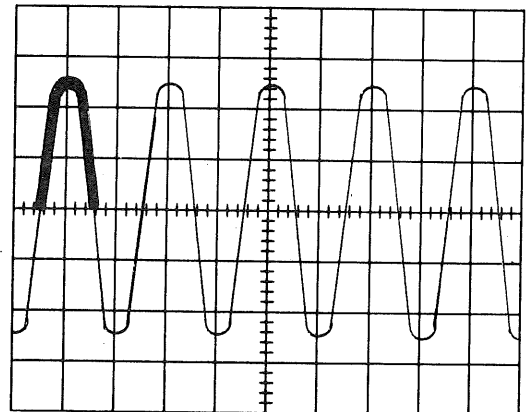


Fig. 10

h. *Check + 1st + 2nd slope*

Set TYPE 230 TIME MEASUREMENT STOP + 2nd. See Fig. 11 for proper display and observe readout of approx +2000 μ S.

20. (cont'd)

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 Fig. 11 on both traces. Reverse CHANNEL switches. Observe same display on both traces. Set TYPE 3A2 MODE to CH 1. Set LF SINE WAVE GENERATOR amplitude to 5 volts. Set TYPE 230 START CHANNEL to A.

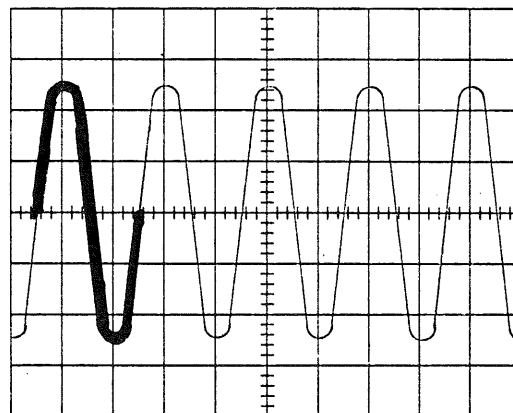


Fig. 11

21. mm ABOVE 0% ZONE

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. See Fig. 5 for proper display and observe readout of approx +590 μ S.

22. mm BELOW 100% ZONE

Set TYPE 230 TIME MEASUREMENT START POINT and TIME MEASUREMENT STOP POINT to mm Below 100% ZONE. See Fig. 5 for proper display and observe readout of approx -590 μ S.

23. % BETWEEN ZONES B CH*a. Setup*

Set TYPE 230 CHANNEL switches to B.

23a. (cont'd)

Set TIME MEASUREMENT START POINT to % BETWEEN ZONES and LEVEL to 10. Set TIME MEASUREMENT STOP POINT to % BETWEEN ZONES and LEVEL to 90. Set CH B REFERENCE ZONES 0% and 100% to 10cm. Disconnect signal from TYPE 3A2 CH 1 and connect it to CH 2. Set MODE to CH 2, TRIGGER SOURCE to CH 2.

b. *Check B CHANNEL*

See Fig. 5 for proper display.

Remove signal from TYPE 3A2. Set MODE to CH 1 and TRIG SOURCE to CH 1. Set TYPE 3B2 TRIGGER LEVEL to FREERUN.

24. HORIZ mm FROM SWP START

a. *Setup*

Set TYPE 230 as follows: CH A REFERENCE ZONES and CH B REFERENCE ZONES to AVERAGE, TIME MEASUREMENT START POINT to HORIZ mm from SWP START, and LEVEL to 00. TIME MEASUREMENT STOP POINT to HORIZ mm from SWP START, and LEVEL to 90. Set TYPE 3B2 DIGITAL RESOLUTION to 10µS.

b. *Check TIME MEASUREMENT START and STOP POINT LEVELS*

Using the chart below check TIME MEASUREMENT START POINT LEVEL:

TYPE 230 TIME MEASUREMENT (START) (STOP) POINT LEVEL	TYPE 230 Readout	TYPE 568 visual 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

24b. (cont'd)

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

Set TIME MEASUREMENT START POINT LEVEL TO 00. Use preceding check for TIME MEASUREMENT STOP POINT LEVEL. The TYPE 230 readout will be negative.

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

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

Return Run-Cal switch to Run.

25. COUNTER BOARD

a. Setup

Connect External Programmer to TYPE 230. Set External Programmer 1-2-ALT 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.

Note: 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.

Set the 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.

25. (cont'd)

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 10 μ SEC. When the tens nixie counts from 1 through 9 it will turn to 0 and the next nixie (hundred nixie) to the left will turn to 1. When this occurs change TYPE 3B2 DIGITAL RESOLUTION to 1 μ S. After the hundred nixie counts from 1 through 9 when it turns to 0 the next nixie to the left (thousand nixie) will turn to 1. When this occurs change the TYPE 3B2 DIGITAL RESOLUTION to .1 μ SEC. The thousands nixie will count to 3.

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.

26. ZONE POSITION AND 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.

26. (cont'd)

b. Check position

Using the chart below check position of CH A and CH B zones. Set switch ON, check position, 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

Using chart above check position of A 100% and B 100% zones.

c. Check width

Using the following chart check zone width. Set switch ON, check width, and set switch OFF.

Zone Width	External Programmer J201	intensified trace from start of trace
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.

27. TWELVE LINES*a. Setup*

Connect TYPE 568 5V 1KHz CALIBRATOR signal to TYPE 3A2, CH 1 input, set MODE to CH 1 (CH 2) and AC-DC-GND to AC. Connect the same signal through a BNC T connector to TYPE 3B2 EXT TRIG IN.

Set TIME/DIV to .2mSEC. Set TRIGGER SOURCE to EXT and LEVEL for a stable display.

Set External Programmer J201 as follows: A 0% WIDTH 4 ON, A 100% WIDTH 4 ON and EXT VOLTS ON. Set J202 START OFFSET 100% on.

b. Check CH A twelve

Observe approx 5.00V readout on TYPE 230.

Set J201 A 0% 8 POS and 4 POS ON. Set J201 A 100% 8 POS and 4 POS ON. Remove calibrator signal from TYPE 3A2 input and observe readout on TYPE 230 of approx 5.0V.

Set J201 A 0% 8 POS and 4 POS to OFF and observe a readout on the TYPE 230 of approx 2.5V.

Set J201 A 100% 8 POS and 4 POS to OFF and observe readout on TYPE 230 of approx 0.00V.

c. Check CH B twelve

Set J202 START CH B and STOP CH B to ON. Repeat Step 27a and 27b for B Channel.

Set all switches on External Programmer to OFF.

Set TYPE 3A2 MODE to CH 1. Set TYPE 3B2 DIGITAL RESOLUTION to 1 μ S. Set TRIGGER SOURCE to INT and LEVEL to FREE RUN.

29. (cont'd)

<u>J203 LOWER</u>	<u>J203 UPPER</u>	<u>Counter check- out box switch</u>	<u>TYPE 230 Limit Indication Light</u>
1 ON			yellow
1 ON		1 ON	red
1 ON	1 ON	1 ON	green
OFF	OFF	OFF	-----
2 ON			yellow
2 ON		2 ON	red
2 ON	2 ON	2 ON	green
OFF	OFF	OFF	-----
4 ON			yellow
4 ON		4 ON	red
4 ON	4 ON	4 ON	green
OFF	OFF	OFF	-----
8 ON			yellow
8 ON		8 ON	red
8 ON	8 ON	8 ON	green
OFF	OFF	OFF	-----
10 ON			yellow
10 ON		10 ON	red
10 ON	10 ON	10 ON	green
OFF	OFF	OFF	-----
20 ON			yellow
20 ON		20 ON	red
20 ON	20 ON	20 ON	green
OFF	OFF	OFF	-----
40 ON			yellow
40 ON		40 ON	red
40 ON	40 ON	40 ON	green
OFF	OFF	OFF	-----
80 ON			yellow
80 ON		80 ON	red
80 ON	80 ON	80 ON	green
OFF	OFF	OFF	-----
100 ON			yellow
100 ON		100 ON	red
100 ON	100 ON	100 ON	green
OFF	OFF	OFF	-----
200 ON			yellow
200 ON		200 ON	red
200 ON	200 ON	200 ON	green
OFF	OFF	OFF	-----
400 ON			yellow
400 ON		400 ON	red
400 ON	400 ON	400 ON	green
OFF	OFF	OFF	-----
800 ON			yellow
800 ON		800 ON	red
800 ON	800 ON	800 ON	green
OFF	OFF	OFF	-----

29. (cont'd)

1000 ON			yellow
1000 ON		1000 ON	red
1000 ON	1000 ON	1000 ON	green
OFF	OFF	OFF	-----
2000 ON			yellow
2000 ON		2000 ON	red
2000 ON	2000 ON	2000 ON	green
OFF	OFF	OFF	-----

30. UPPER AND LOWER MINUS

Set Counter Board Check Out Box +- switch to +. The green limit light should be ON. Set External Programmer J203 UPPER MINUS switch to ON. Red limit light should now be on and the green limit light off. Set Counter Board Check Out Box +- switch to -. The yellow limit light should now be on and red limit light off. Set External Programmer J203 LOWER MINUS switch ON. The green limit light should now be on and yellow limit light off.

Set all External Programmer switches to OFF.

31. TIME MEASUREMENT

a. Setup

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.

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 display as shown in Fig. 12.

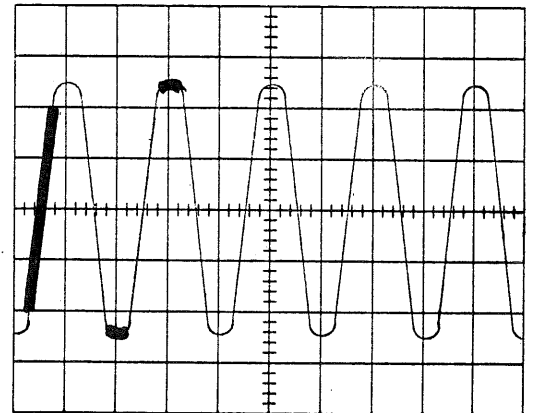


Fig. 12

31. (cont'd)

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 display as shown in Fig. 13. 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 same display as in Fig. 12 and TYPE 230 readout is +.

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 some display as in Fig. 12 and TYPE 230 readout is -.

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

Set all External Programmer switches to OFF.

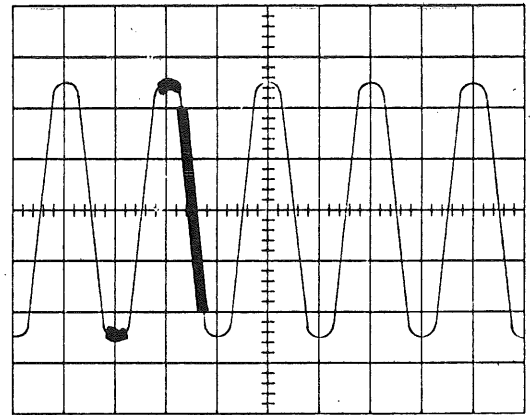


Fig. 13

Note: To obtain the desired display, slight adjustment of the TYPE 3B2 TRIGGER LEVEL may be necessary.

32. DECIMALS AND UNITS OF MEASURE

Set External Programmer J202 EXT SCALE to ON. The 5th decimal from left on TYPE 230 and the Counter Board Check Out Box should be ON. The units of measure nixies should not have an indication. Using the chart below check ext program decimals and units of measure nixies on the TYPE 230 and the Counter Board Check Out Box.

Note: The TYPE 3A2 "divide by" lines will effect the external programmed logic. The 3A2 VOLTS/DIV switch must be in a ÷ 1 condition (any "1" attenuator position).

EXT PROGRAMMER SWITCHES ON		TYPE 230	TYPE 230
J203	J204	decimal from the left	nomeclature nixie
÷5		4th decimal	none
	DEC 2	2nd decimal	none
÷5	DEC 2	1st decimal	none
	DEC 3	3rd decimal	none
÷5	DEC 3	2nd decimal	none
	DEC 4	4th decimal	none
÷5	DEC 4	3rd decimal	none
	V		V
	S		S
	M		M
	μ		μ
	N		N

32. (cont'd)

Set all External Programmer switches to Off.

33. EXT VOLTS

Set External Programmer J202 START 20 to ON. Set J201 EXT VOLTS to ON. TYPE 230 readout should be -2.00V.

34. ÷2 AND ÷5

Set External Programmer J203 ÷2 to ON. TYPE 230 readout should be -1.00V.

Set J203 2 to OFF. Set J203 ÷5 ON. The TYPE 230 readout should be -.400V.

Set all External Programmer switches to OFF.

35. MONITOR DRIVE SIGNALS

a. Setup

Set TYPE 3B2 TIME/DIV to .1 SEC. Set TYPE 3A2 MODE to CH 1 and VOLTS/DIV to 5. Connect X1 probe from CH 1 input to SWP SPEED UP Jack on EXT PROG. Set External Programmer J202 START HORIZ mm, OFFSET 20 and 10 to ON. Set STOP HORIZ mm, OFFSET 40, 20, and 10 to ON. Set J201 A 0% POS 8 to ON. Set A 100% POS 8 and 1 to ON. Set J204 HI SPEED PROG to ON.

b. Check SWP SPEED UP

Check for display on alternate sweeps to be same as shown in Fig. 14.

c. Check SINGLE SWP

Set TYPE 3B2 TIME/DIV to 2mSEC. Connect X1 probe to SINGLE SWP Jack. Check for display on alternate sweeps to be same as shown in Fig. 15.

Set all position switches to OFF.

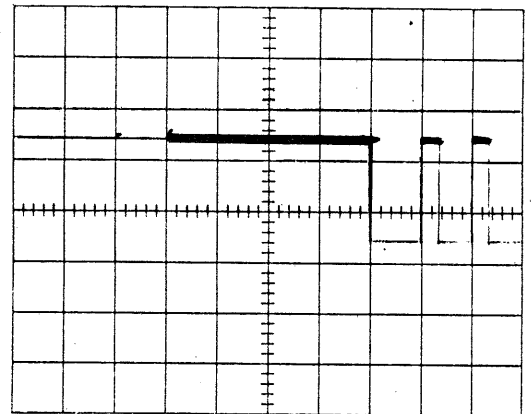


Fig. 14

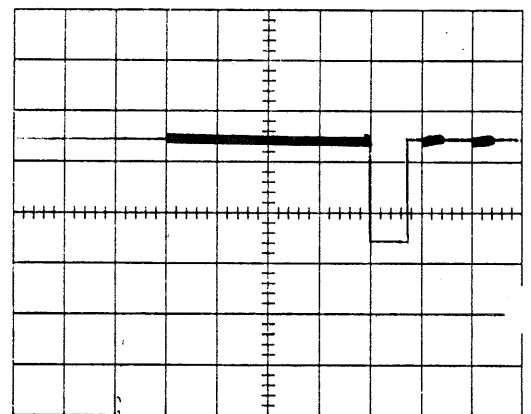


Fig. 15

35. (cont'd)

d. Check A CHOP

Set External Programmer J202 A 0% POS 8 and A 100% POS 8 and POS 1 to OFF.

Set all four POS 2 switches to ON. Set A CHOP and B CHOP to ON. Connect X1 probe to A CHOP Jack. *Observe Waveform #1 in Fig. 16. Set each (four) POS 2 switch to OFF and back to ON. Observe Waveform #2 in Fig. 16.

e. Check B CHOP

Connect X1 probe to B CHOP Jack. Repeat Step 35d from *.

Remove X1 probe.

Set all External Programmer switches to OFF.

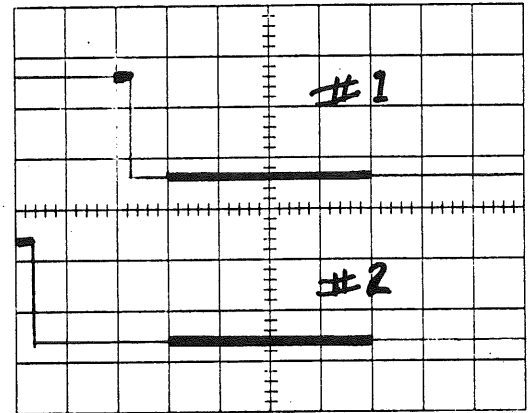


Fig. 16

36. 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

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

36a. (cont'd)

Set TYPE 3A2 VOLTS/DIV to 2. Connect 5V at 20KHz from TYPE 568 CALIBRATOR to 3A2 input. Set TYPE 3B2 TIME/DIV to 10 μ SEC, DIGITAL RESOLUTION to .1 μ S, and 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 for no TYPE 230 lockup.

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.

Note: If the TYPE 230 ABOVE UPPER LIMIT light or the BELOW LOWER LIMIT light comes on, the TYPE 230 will lockup until manually released.

37. EXT TRIGGER

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

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 alternating between programs. Set External Programmer EXT TRIG to OFF. TYPE 230 should lock up.

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

38. 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 μ 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.

*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.

THE END.

