product modification

050-0493-00

Type P6038

P6038 SAMPLING PROBE (WITH BLUE DOT DIODES) REPLACEMENT

For Tektronix Type P6038 Sampling Probe

Code date 65-09 and above*

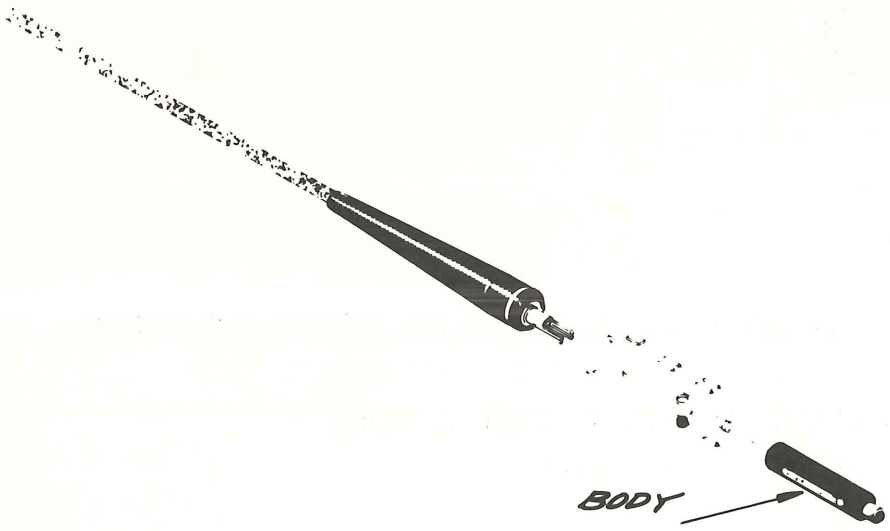
010-0157-01 with purple dot sampling diodes replaces 010-0157-00 with blue dot sampling diodes that are no longer available.

Type 3S3 and Type 4S3 DUAL TRACE SAMPLING UNITS should not be used with only one probe.

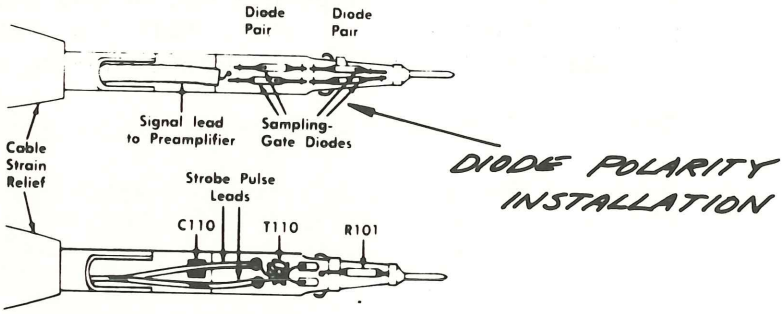
Because of characteristic differences in forward voltage drop between GaAs sampling diodes and silicon sampling diodes both probes used with either a Type 3S3 or a Type 4S3 must use the same type of diode. This kit contains a set of purple dot diodes and an 010-0157-01 with purple dot diodes. It also contains a probe body with the new part number to indicate the change to the new diodes.

*For location of code date see Fig. 1C.

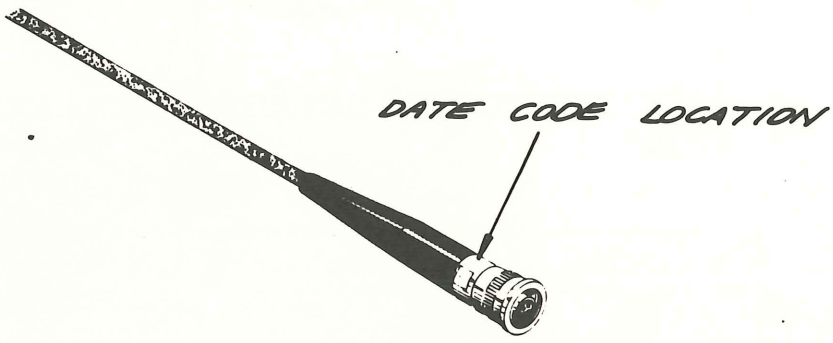
A.


BODY

B.


Diode Pair
Diode Pair
Signal lead to Preamplifier
Sampling-Gate Diodes
DIODE POLARITY INSTALLATION
Cable Strain Relief
Strobe Pulse Leads
C110
T110
R101

C.


DATE CODE LOCATION

PARTS INCLUDED IN PARTS REPLACEMENT KIT:

Ckt.No.	Quantity	Part Number	Description
D110 D111 D112 D113	1 ea	152-0441-00	Quad, diode silicon
	1 ea	010-0157-01	P6038, probe, sampling
	1 ea	204-0207-01	body, probe
3S3 ONLY			
R168	1 ea	315-0273-00	27k 1/4W 5%
R200	1 ea	321-0137-00	261Ω 1/8W 1%
	1 ea		Calibration Procedure

INSTRUCTIONS

( ) 1. Unscrew probe body from probe, and discard probe body. (Fig. 1A)

( ) 2. Replace Sampling Bridge diodes D110, D111, D112, and D113 with silicon diodes from the kit. Install the diodes with the dots (cathode) as shown in Fig. 1B.

( ) 3. Reassemble probe, using the new probe body, from the kit.

TYPE 3S3 ONLY

( ) Replace R168, 33k with 27k 1/4W from kit. (Fig. 2)

( ) Add R200, 261Ω 1/8W 1% from kit across clipping line. (Fig. 2)

( ) Refer to the Manual Insert and check "Vertical Balance:, "Set Channel 'B' Risetime" and "Set Channel 'A' Risetime".

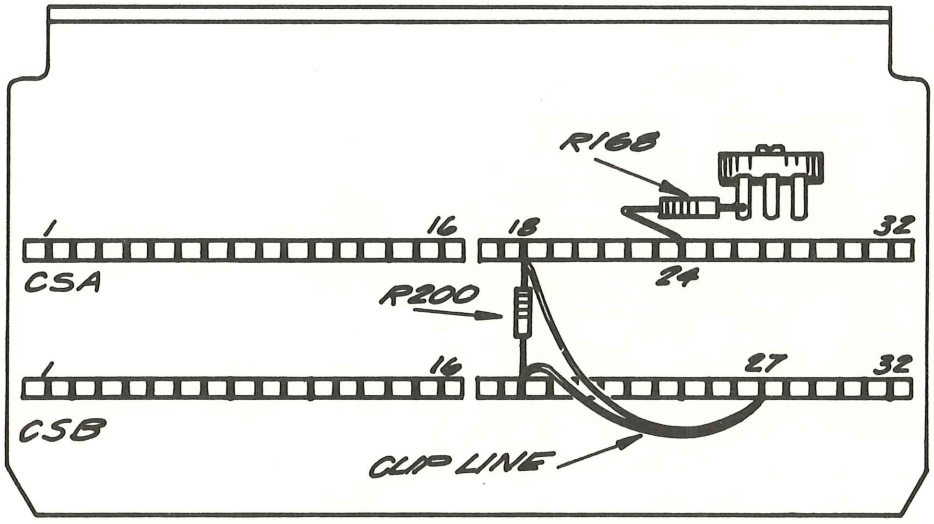


FIGURE 2

TYPE 4S3 ONLY

( ) Refer to your Instruction Manual and check "Risetime" and "Bridge Voltage Balance Adj".

JT:ls

INSTRUCTION MANUAL

MODIFICATION INSERT

P6038 SAMPLING PROBE (WITH BLUE DOT DIODES) REPLACEMENT

Type 3S3 Plug-in Unit

Installed in Type 3S3 SN_____Date_____

This insert has been written to supplement the Instruction Manual for this instrument. The information given in this insert will supersede that given in the manual.

GENERAL INFORMATION

010-0157-01 with purple dot sampling diodes replaces 010-0157-00 with blue dot sampling diodes that are no longer available.

Type 3S3 and Type 4S3 DUAL TRACE SAMPLING UNITS should not be used with only one probe.

Because of characteristic differences in forward voltage drop between GaAs sampling diodes and silicon sampling diodes both probes used with either a Type 3S3 or a Type 4S3 must use the same type of diode. This kit contains a set of purple dot diodes and an 010-0157-01 with purple dot diodes. It also contains a probe body with the new part number to indicate the change to the new diodes.

TYPE 3S3 ONLY

ELECTRICAL PARTS LIST:

Ckt.No.	Part Number	Description		
		RESISTORS		
R168	315-0273-00	27k	1/4W	5%
R200	321-0137-00	261Ω	1/8W	1%

SECTION 5
CALIBRATION

Introduction

The following paragraphs outline a procedure for calibrating the Type 3S3. The instrument should not require frequent recalibration, but occasional adjustments will be necessary when tubes and other components are changed. Also, a periodic recalibration is desirable from the standpoint of preventive maintenance.

Apparent troubles in the instrument are occasionally the result of improper calibration of one or more circuits. Consequently, calibration checks should be an integral part of any troubleshooting procedure. Abnormal indications occurring during calibration checks will often aid in isolating troubles to a definite circuit or stage.

In the instructions that follow, the steps are arranged in the proper sequence for a complete calibration of the instrument. Each numbered step contains the information required to make one check or adjustment or a series of related checks or adjustments. The steps are arranged to avoid unnecessary repetition.

EQUIPMENT REQUIRED

The equipment listed in Fig. 5-1, or its equivalent, is required for calibrating or checking the performance of the Type 3S3. To assure accuracy, all test equipment must be calibrated. If other equipment is substituted, it must meet or exceed the limits stated below.

1. A calibrated oscilloscope, preferably a Type 568 with a calibrated Type 230 Digital Unit. A Type 567/6R1A combination may be used. A calibrated 3T-series sampling sweep unit, Type 3T77A or Type 3T2 is recommended.

2. A square wave and pulse generator that produces 1 μs period square waves with 1.0 $\pm$0.5% and 0.1 $\pm$1.0% volt peak amplitude into 50 ohms. Also required is a pulse of approximately 0.2 volt with $\leq$70 ps risetime. A separate trigger signal is required with at least a 75 ns leadtime in advance of the fast pulse. The Tektronix Type 284 meets the above requirements. For a Type 284 with a 5-50 ns trigger lead time, add Field Modification kit, Part No. 040-0487-00.

3. A square wave generator to check Memory Slash. Specific frequencies used are 50 and 150 Hz. Tektronix Type 106 Square Wave Generator.

4. A precision DC voltmeter. Accuracy within $\pm$0.05% capable of measuring 20 volts. For example, Fluke Model 825A differential DC Voltmeter. This meter is used in step 10, Check Signal Outputs, but is not required if the outputs are not used.

5. A 50 Ω Amplitude Calibrator. Output impedance 50 Ω; voltage range 0.012 to 1.2 volts square wave; accuracy within $\pm$0.25%. Tektronix Calibration Fixture 067-0508-00.

6. Two special flexible interconnecting cables to go between the Type 3S3 and the oscilloscope power connectors. Tektronix Part No. 012-0066-00.

7. A 50 Ω coaxial cable, RG-58/U, approximately 42" with BNC connectors. Tektronix Part No. 012-0057-01.

8. A 20 cm 50 Ω GR air line, GR 874-L20. Tektronix Part No. 017-0084-00.

9. A 50 Ω coaxial tee, GR 874T. Tektronix Part No. 017-0069-00.

10. A special Variable Attenuator with GR 874 connectors. It consists of a 100 Ω potentiometer across the 50 Ω line and does not have a guaranteed response. Tektronix Part No. 067-0511-00.

11. A Tektronix Type VP-2 50 Ω Voltage Pickoff Tee. Tektronix Part No. 017-0077-00.

12. A 50 Ω 2X GR attenuator, GR 874-G6. Tektronix Part No. 017-0080-00.

13. A 50 Ω 5X attenuator, GR 874-G14. Tektronix Part No. 017-0079-00.

14. A 50 Ω GR end-line termination, GR 874-W50B. Tektronix Part No. 017-0081-00.

15. Two special Tektronix probe tip-to-GR adapters. Tektronix Part No. 017-0076-00.

16. A test oscilloscope with vertical risetime of 16 ns or less and a minimum deflection factor of 5 mV/cm. For example, Tektronix Type 545B with Type 1A1 Dual-trace Plug-in Unit and a P6006 Probe, not shown.

PRELIMINARY PROCEDURE

Remove the top cover of the Type 568 Oscilloscope and correctly connect the flexible interconnecting cables between the Type 3S3 and the jacks in the left compartment of the oscilloscope. These cables may not be needed if all of the adjustments can be reached from the left side of the oscilloscope used.

Install the Type 3T77A or other sampling sweep unit into the right compartment of the oscilloscope.

Connect the 50 Ω coaxial cable with BNC connectors between the Trigger Output of the Type 284 Pulse Generator and the External Trigger Input of the Type 3T77A.

Install the proper cable from J101 of the Type 230 Digital Unit to J101 of the Type 568 Oscilloscope.

Connect in this order to the Type 284 Pulse Output Terminal: a 20 cm air line, a VP-2 and a 50 Ω termination. See Fig. 5-2.

Make all power connections including those to the Type 284 Pulse and Square Wave Generator and the 50 Ω Amplitude Calibrator fixture.

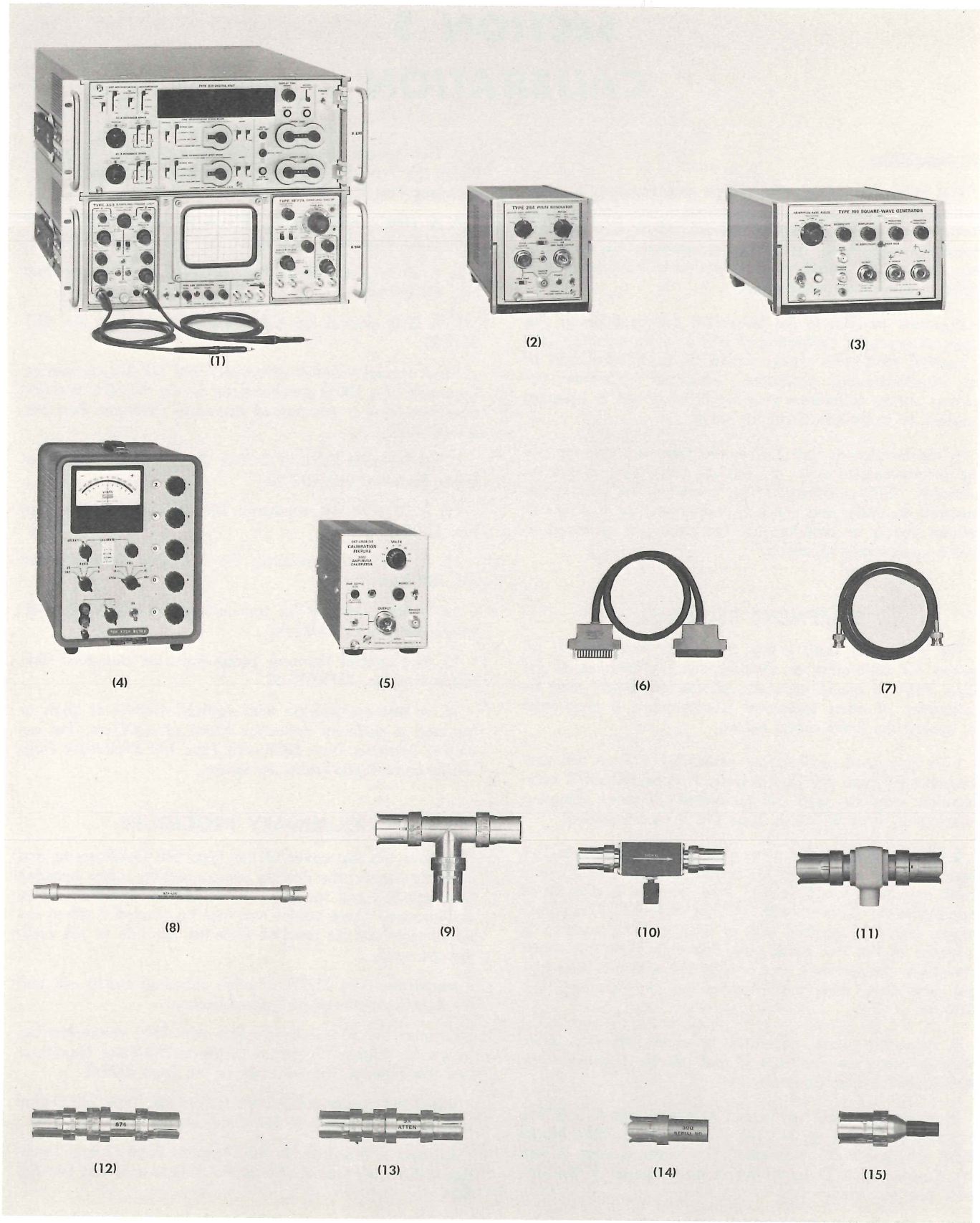


Fig. 5-1. Equipment required for calibration of the Type 3S3.

Turn on all equipment except the Type 284 and allow a 20 minute warmup.

Check all of the Type 3S3 knobs for correct orientation on the front panel and set the VARIABLE mV/DIV control to CALIB.

Set all of the controls as instructed in the Control Settings Chart following Fig. 5-2.

Since the adjustments for Risetime and Gate Width interact with the Vertical Balance, the calibration sequence must be a follows: Initial Vertical Balance, Risetime, Gate Width and Loop Gain adjustments, Vertical Re-balancing, Digital and Vertical Gain adjustment and checks.

While doing any vertical balancing keep the DC OFFSET control at mid-position, which is 5 turns from either end. Since the control is easy to disturb, keep a check on its position.

The calibration procedure should be performed while using the sampling sweep unit normally used with the Type 3S3. The sampling sweep unit is always externally triggered.

CONTROL SETTINGS

Type 3S3 (Both Channels)

POSITION	Centered
MV/DIV	100
VARIABLE	CALIB (detent)
DC OFFSET	5 turns from either end
NORM-INV	B: halfway between end positions A: NORM
Mode	B ONLY
SMOOTHING	Fully clockwise
LOW NOISE-FAST RT	FAST RT
GAIN	As set

Type 3T77A

Horizontal Position	Center trace
Dots/Div	100
Time Expander	X1
Time/Div	5 ns
Variable	Calib
Time Position	Fully counterclockwise
Trigger Sensitivity	Clockwise to free run
Recovery Time	Fully counterclockwise, pushed in
Sweep Mode	Normal
Trigger Source	+ Ext

Type 284

Mode	Pulse Output
Period	1 μs
Square Wave Amplitude	1.0 v
Lead Time	75 ns
Power	Off

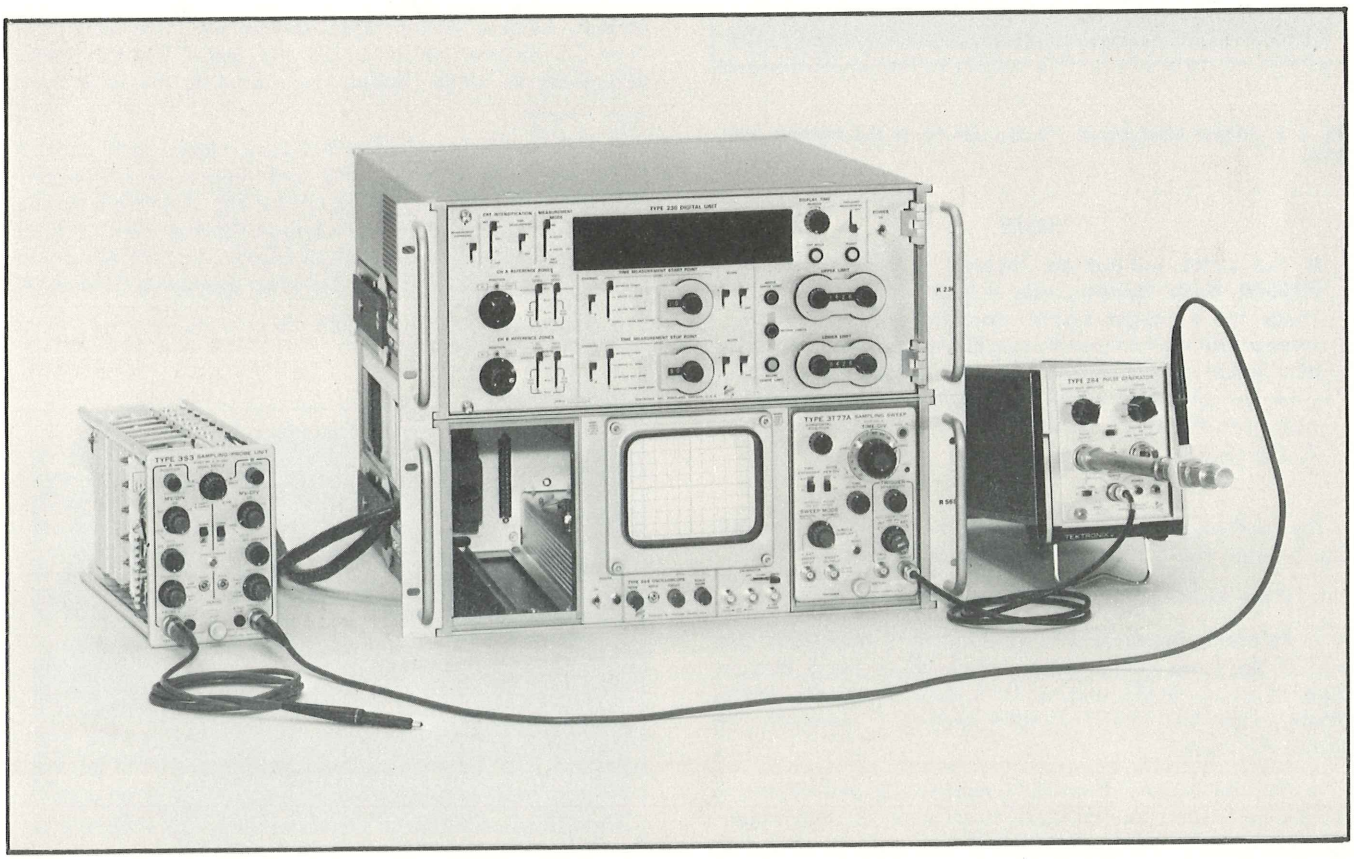


Fig. 5-2. Equipment set-up for the Preliminary Procedure.

MAIN PROCEDURE

1. Adjust Initial Vertical Balance

a. Make all connections and control settings as instructed in the Preliminary Procedure. See Fig. 5-2.

b. Insert the Channel B P6038 Probe tip into the VP-2. (The probe is now properly terminated and is receiving no signal.)

c. Turn the Snap-Off Current control (R205) fully clockwise and the Memory Gate Width control (R215) 5° from the fully counterclockwise position.

d. Center the Channel B POSITION control.

e. Center the trace with the Vertical Centering control (R611).

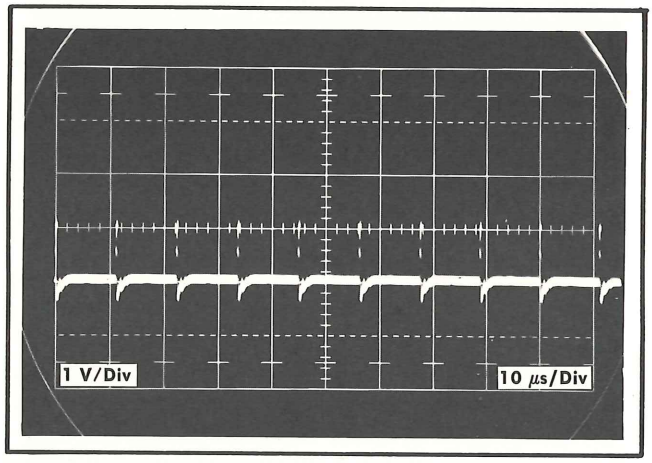


Fig. 5-3. Trigger input signal (at P21 pin R) to the blocking oscillator.

NOTE

If the trace cannot be located with the TRACE FINDER push button, use a test oscilloscope to check for a trigger signal input from the sampling sweep unit at P21 pin R, see Fig. 5-3. Next, check the signal at pin J (which is the amplified signal from the blocking oscillator to turn on the memory gate, see Fig. 5-4). Check for a strobe pulse at pin Z, Fig. 5-5.

The oscilloscope used when taking the pictures of Fig. 5-3, Fig. 5-4 and Fig. 5-5 had a bandpass of 22 MHz.

f. Place both of the NORM-INV switches to NORM.

g. Re-center the trace with the Channel B POSITION control. If the trace cannot be centered, adjust the B Risetime Balance control (R235) and/or the B Memory Balance control (R365). Use the TRACE FINDER button, if necessary, to locate the trace.

h. Set the Channel B mV/DIV switch to 5, and adjust the B Risetime Balance control (R235) to re-center the trace again.

i. Set the Channel B LOW NOISE-FAST RT switch to LOW NOISE and adjust the B Bridge Balance control (R245) to re-center the trace. Return the switch to FAST RT.

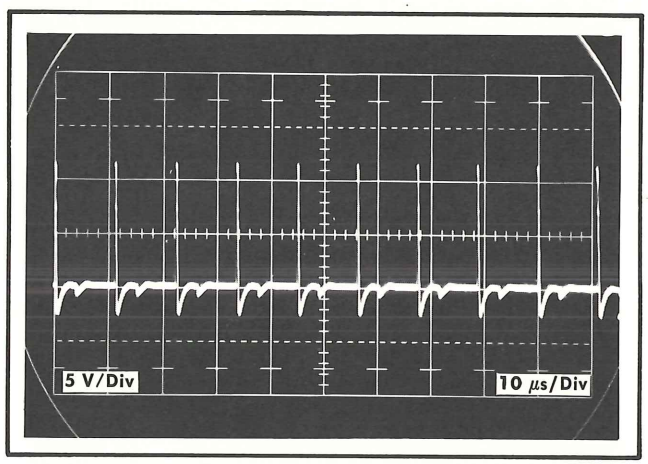


Fig. 5-4. Blocking oscillator signal (at P21 pin J) to the memory gate.

j. Repeat parts (h) and (i) as needed to eliminate the trace shift when operating back and forth between the two positions of the LOW NOISE-FAST RT switch. Then return the switch to FAST-RT.

k. Set the mV/DIV switch to 100. If the trace shifts, re-center it with the POSITION control and repeat the balance sequence starting at part (h) with the LOW NOISE-FAST RT switch in the FAST RT position.

l. Set the mV/DIV switch to 100 and adjust Channel B Memory Balance control (R365) so that the trace moves less than 0.3 division while turning the SMOOTHING control throughout its range. Return the control to the fully clockwise position.

m. Set the Mode switch to A ONLY, place the Channel A P6038 Probe tip into the VP-2 and repeat the above procedure for Channel A starting at part (g). Adjust the A Risetime Balance control (R175), A Bridge Balance Control (R185) and A Memory Balance control (R365). Do not adjust the Vertical Centering control (R611) when displaying Channel A.

n. Place the Channel B probe tip into the VP12 and place the Mode switch to B ONLY.

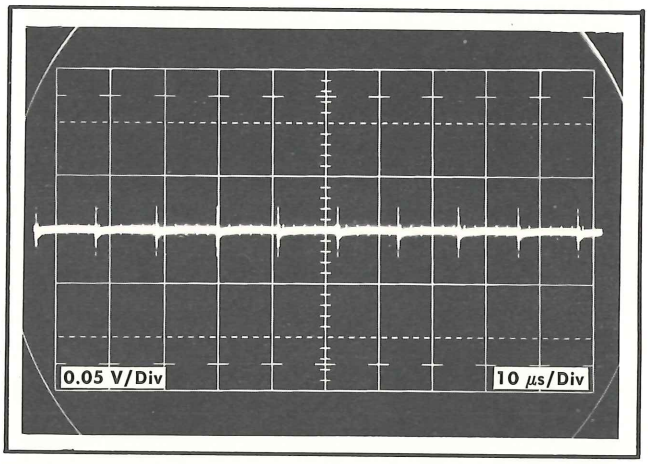


Fig. 5-5. Strobe pulse (at P21 pin Z) to the diode bridge in probe B.

2. Adjust Inverter Zero (Series C only)

a. Step 1 must be completed before doing this step.

b. Set Channel B NORM-INV switch to NORM and adjust the B INVERTER ZERO control (R441) so the trace is at the same position as when the NORM-INV switch is at INV. Operate the NORM-INV switch back and forth to be certain the B INVERTER ZERO control is properly adjusted.

c. Repeat this procedure for Channel A.

d. Place Channel B probe tip into the VP-2.

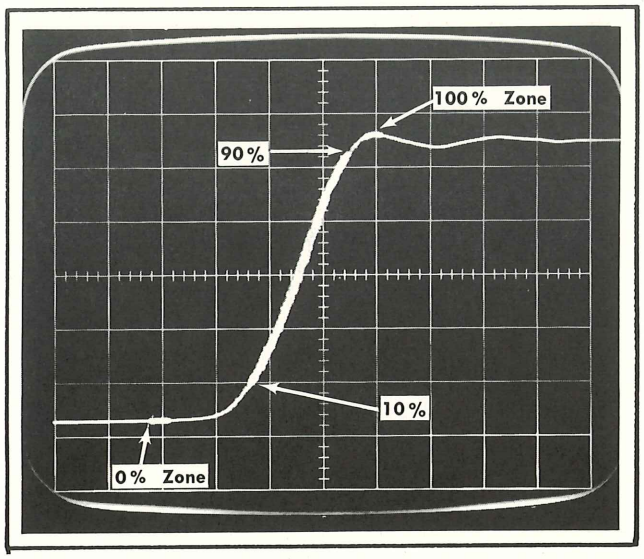


Fig. 5-6. Risetime measurement using a Type 230 Digital Unit.

3A. Adjust Channel B Risetime—With a Digital Unit

a. Set the Type 284 Pulse Generator controls as instructed in the Preliminary Procedure chart and turn the Power switch to On.

b. Set the Type 3S3 controls to B ONLY, FAST RT, 50 mV/DIV and turn the SMOOTHING control fully clockwise.

c. Set the Type 3T77A for a sweep rate of 0.2 ns/Div and adjust the Time Position and the Trigger Sensitivity controls to place the leading edge of the pulse as shown in Fig. 5-6.

d. Set the Type 230 Digital Unit controls to read Channel B 10% to 90% risetime. Refer to the Type 230 manual for control settings.

e. Adjust the Type 3S3 Snap-Off Current control (R205) for a risetime of 0.350 ns. Turning R205 counterclockwise increases the rate of rise, giving a faster risetime.

3B. Adjust Channel B Risetime—Without a Digital Unit

a. Set the Type 284 Pulse Generator controls as instructed in the Preliminary Procedure Chart and turn the Power switch to On.

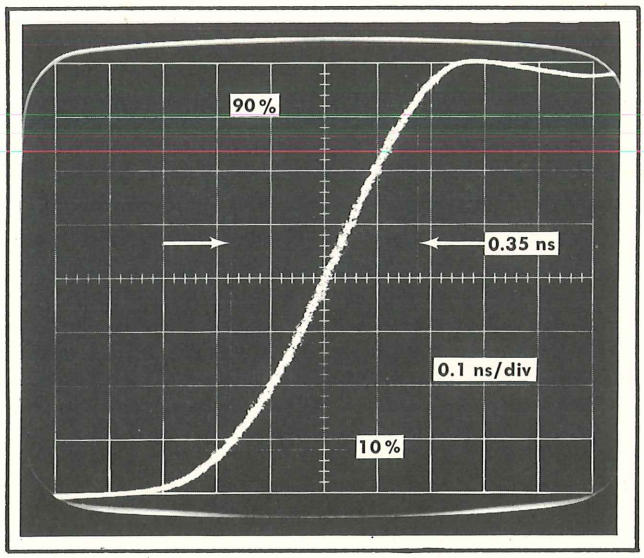


Fig. 5-7. Risetime measurement without a Digital Unit.

b. Set the Type 3S3 controls to B ONLY, FAST RT, 50 mV/DIV and the SMOOTHING control fully clockwise.

c. Set the Type 3T77A for a sweep rate of 0.1 ns/Div by setting the Time/Div switch to 1 ns/Div and the Time Expander to X10.

d. Adjust the Type 3S3 mV/DIV VARIABLE control until the display amplitude is 8 vertical divisions between the 0% and the 100% points as shown in Fig. 5-7. Use either the trace top or bottom so that the trace width is excluded from the measurement.

e. Adjust the Type 3S3 Snap-Off Current control (R205) until the displayed risetime is 0.35 ns from the 10% amplitude to the 90% amplitude points of the pulse rise. See Fig. 5-7. Turning the control counterclockwise increases the rate of rise, giving a faster risetime.

f. Place the VARIABLE control to its CALIB position.

g. Set the Type 3T77A Time Expander switch back to the X1 position.

4. Adjust Memory Gate Width and Loop Gain

a. Connect to the Type 284 Square Wave Output connector (in the following order): a 2X attenuator, a VP-2 and a 50 Ω termination. Install the Normalizer onto the Channel B P6038 Probe tip and insert it into the VP-2.

NOTE

The Type 3S3 controls permit the operator to adjust the internal loop gain to suit the measurement. Page 2-2 of the manual describes the probe source impedance sensitivity and how the Response Normalizer cancels that sensitivity. Because the probe tip is sensitive to source impedance, the variable SMOOTHING control and the LOW NOISE-FAST RT switch are provided. These controls permit the

internal loop gain to be adjusted over a wide range. However, the two most commonly used source resistances are 50 Ω and 300 Ω. If the instrument being calibrated is used to test from numerous values of source resistance, use the Response Normalizer and perform this step as written. If the instrument is used with the probe in a 50 Ω environment at all times, do not use the Response Normalizer in this step. Instead, place the probe tip into a 50 Ω environment and perform the step.

In both situations, 300 Ω or 50 Ω, the variable SMOOTHING control is set fully counterclockwise and the LOW NOISE-FAST RT switch is set to FAST RT. Before continuing, it is important to decide how the instrument will be used because if the Type 3S3 is calibrated without the Normalizer, unity loop gain cannot be obtained from 300 Ω signal source resistances.

The option offered thus allows the calibrator to adjust internal controls so that unity loop gain is automatically obtained from 50 Ω signal sources with fixed front panel controls. This special option should not be followed on instruments used for general testing.

b. Set the Type 284 controls as follows:

Mode	Square Wave Output
Period	1 μs
Square Wave Amplitude	1 V

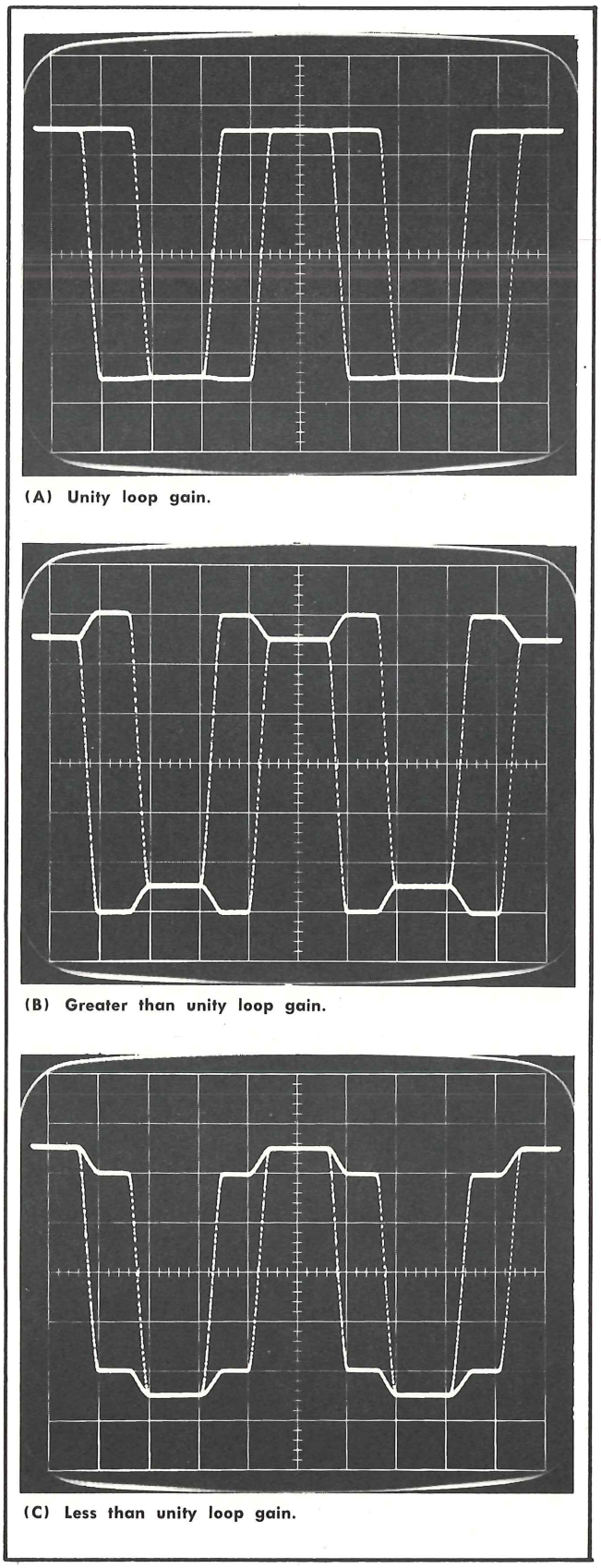
c. Set the Type 3S3 Channel B controls to 100 mV/DIV, FAST RT and SMOOTHING fully counterclockwise.

d. Set the Type 3T77A for a sweep rate of 0.2 μs/div, advance the Trigger Sensitivity control clockwise for a free-run trace and adjust the Recover Time control to obtain a double triggered display similar to that shown in Fig. 5-8. Should the vertical amplitude of the display exceed the graticule area, temporarily adjust C387 in the B Memory to reduce the display. Use an insulated tip screwdriver.

e. Maximize the loop gain (referring to Fig. 5-8A, B and C) by adjusting the Memory Gate Width control (R215). If two maxima occur, set the control at the maximum that occurs nearest the counterclockwise end of rotation. This places the maximum charge on the Memory feed-back capacitor (C387).

f. Turn the SMOOTHING control fully counterclockwise and adjust C387 in the Channel B memory circuit for unity loop gain. See Fig. 5-8A for this display. Unity loop gain must be obtained at both the top and the bottom of the square wave display. If there is any difference, adjust for unity loop gain on one side and let the loop gain be equal to or greater than unity for the other side.

g. Check the remaining mV/DIV ranges in like manner by using the DC OFFSET control to look at the top or the bottom of the waveform. The amplitude of the square wave signal can be decreased to check the lower ranges. Adjust C387 if necessary so that all ranges make unity loop gain when the SMOOTHING control is fully counterclockwise. Remove the Response Normalizer after this check and turn the SMOOTHING control fully clockwise.



(A) Unity loop gain.

(B) Greater than unity loop gain.

(C) Less than unity loop gain.

Fig. 5-8. Typical double-triggered display for adjusting loop gain to unity.

h. Place a Response Normalizer on the Channel A probe and insert it into the VP-2.

i. Place the Mode switch at A ONLY and repeat parts (f) and (g) for Channel A, adjusting C387 of Channel A.

j. Turn the SMOOTHING control fully clockwise and remove the Response Normalizer for the next step.

5. Adjust Channel A Risetime

a. Use the equipment and control setup of step 3A, parts (a) through (c) or 3B, parts (a) through (d) for Channel A.

b. Place the Type 3S3 Mode switch in A ONLY and insert the Channel A probe tip into the VP-2 (62.5 Ω signal source resistance).

c. Adjust the A Bridge Volts control (R169) so that the Channel A risetime is the same as that of Channel B. Turning the control clockwise increases the rate of rise. (It may be convenient to change to Channel B and verify Channel B risetime.)

d. If the risetime cannot be made the same, reverse the position of the two P6038 Probes to the two channels and repeat the whole calibration procedure. If the probes are reversed, change the red and blue color bands which are semi-elastic. Also do a time coincidence check (found later in this section under Calibration With A New P6038 Probe).

e. Set the Type 3T77A Time Expander switch back to the X1 position if you set the Channel A risetime using step 3B.

6. Adjust Final Vertical Balance

a. Set the controls as listed before step 1, the Initial Vertical Balance.

b. Repeat all the parts of the Initial Vertical Balance adjustment starting at (f).

c. Re-check the risetime of both channels and correct if necessary. If a correction is made, repeat the Final Vertical Balance adjustment.

7A. Adjust Digital and Vertical Gain—With Digital Unit

a. Connect a GR-to-probe adapter to the 50 Ω Amplitude Calibrator and insert the Channel A probe tip into the adapter.

b. Connect the 50 Ω Amplitude Calibrator Trigger Output to the External Trigger Input of the Type 3T77A using a 50 Ω coaxial cable with BNC connectors.

c. Set the 50 Ω Amplitude Calibrator switch at 0.3 V output and the Test-Operate switch to Operate. Read the NOTE preceding Table 5-1.

d. Set the Type 3S3 controls to A ONLY, 100 mV/DIV, FAST RT and SMOOTHING fully clockwise.

e. Set the Type 3T77A for a sweep rate of 2 μs/div and adjust the Trigger Sensitivity to display less than one cycle of calibrator square wave. See Fig. 5-9.

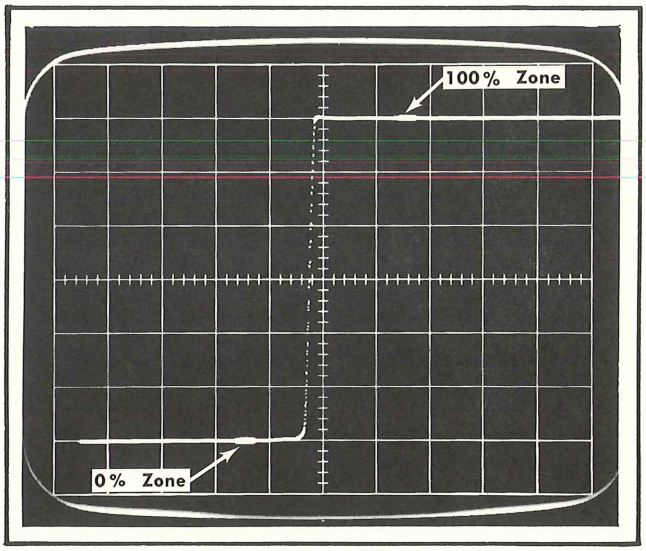


Fig. 5-9. Square wave voltage measurement to set Digital Gain.

f. Adjust Channel A Digital Gain control (R354) until the Type 230 Digital Unit readout is 600 mV. R354 is located behind the front panel.

g. Adjust the front panel A GAIN control for exactly 6 divisions of CRT square wave display.

h. Insert the Channel B probe tip into the VP-2 and place the Mode switch at B ONLY.

i. Repeat part (f) for Channel B Digital Gain control (R414) which is located behind the front panel.

j. Repeat part (g) for the front panel Channel B GAIN control.

k. Check both channels for a 6 division display at all positions of the mV/DIV switch as listed in Table 5-1. The display amplitude tolerance is ±3% with the NORM-INV switch at NORM, and ±5% with the NORM-INV switch at INV. Record the deflections in each case. If only one range is above tolerance, it may be possible to adjust the front panel GAIN control to bring all ranges within tolerance without need for checking the Feedback Attenuator resistor values.

NOTE

The 50 Ω Amplitude Calibrator is a zero-ohm voltage source which is connected in series with a 50 Ω resistor. An external 50 Ω load resistor, therefore, causes the output voltage to be ½ of the no-load output voltage. The voltages marked on the front panel are valid only when a 50 Ω load is connected to the 50 Ω Amplitude Calibrator Output connector. Use of a 1% 50 Ω termination changes the 0.25% tolerance of the voltage source to ±1.25%. If no termination is used, the 2X Output voltage accuracy is 0.25% as measured by the P6038 Probe.

Table 5-1

Type 3S3 mV/DIV	50 Ω Amplitude Calibrator Volts switch position	NORMAL Signal Deflection Limits (divisions)	INV Signal Deflection Limits (divisions)
100	0.3	6.0 ±0.18	6.0 ±0.3
50	0.12	4.8 ±0.144	4.8 ±0.24
20	0.06	6.0 ±0.18	6.0 ±0.3
10	0.03	6.0 ±0.18	6.0 ±0.3
5	0.012	4.8 ±0.144	4.8 ±0.24

7B. Adjust Digital and Vertical Gain—Without Digital Unit

a. Leave both Type 3S3 Digital Gain controls (R354 and R414) as adjusted at the factory.

b. Do step 7A procedure but omit part (f).

c. Repeat the procedure for the other channel.

8. Check DC OFFSET

Requirement: The trace will move ≥±5 divisions from midposition of the DC OFFSET control when the mV/DIV control is at 100. The dc component of a signal may be offset up to ±0.5 V to reposition the trace.

a. Repeat step 1 parts (a) and (b) setting both NORM-INV switches to NORM and the mV/DIV switches to 100.

b. Place the free-running trace one major division above the graticule center using the POSITION control.

c. Turn the DC OFFSET control fully counterclockwise. Check that the trace moved down ≥5 divisions (—0.5 V).

d. Turn the DC OFFSET control 5 turns to mid-position and use the POSITION control to place the trace one major division below the graticule center.

e. Turn the DC OFFSET control fully clockwise. Check that the trace moved up ≥5 divisions (+0.5 V).

f. Repeat this check for the other channel.

9. Check Co-channel Time Coincidence

Requirement: Dual-trace display of a time coincident fast rise pulse will produce two displays whose midpoints differ in time by no more than 60 ps.

Procedure: Do the time coincidence check found later in this section under Calibration With New P6038 Probe.

10. Check Signal Outputs

NOTE

This check is not required if the signal outputs are not used.

Requirement: A OUT and B OUT signals are each 1 V/div, ±3%, riding on a dc level of about +10 V when the trace is centered vertically.

a. Place the mV/div switch at 100.

b. Measure the voltage at the B OUT jack with an infinite impedance voltmeter. With the centered free-running trace the voltage will be about +10 V. The voltage must change 1 V, ±3%, for each division of vertical displacement of the trace.

c. Repeat the check for Channel A OUT.

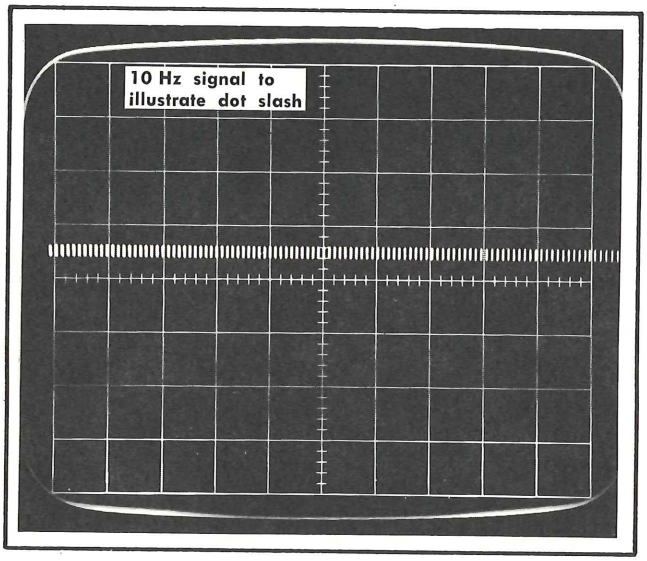


Fig. 5-10. Dot slash check.

11. Check Dot Slash

Requirement: No visible slash with a trigger rate above approximately 150 Hz and the slash shall be no greater than 0.2 division for a 50 Hz trigger rate.

a. Set the Type 3S3 controls:

Mode	B ONLY
DC OFFSET	Midrange
mV/DIV	100
LOW NOISE-FAST RT	FAST RT
SMOOTHING	Fully clockwise

b. Set the Type 3T77A controls:

Time/Div	0.5 μs
Time Position	Fully clockwise
Trigger Sensitivity	Fully clockwise
Dots/Div	10

c. Connect a coaxial cable with BNC connectors from the Type 106 Trigger Output to the Type 3T77A External Trigger Input.

d. With the probe unterminated, turn the Trigger Sensitivity fully counterclockwise. Each dot should have a vertical slash $\leq$0.2 division at 50 Hz. If no slash is evident, reduce the frequency of the input signal to 10 Hz. Fig. 5-10 shows the typical 10 Hz dot slash. Check for no dot slash at about 150 Hz. See Fig. 5-10.

e. Place the Mode switch at A ONLY and repeat the check.

f. Set the Dots/Div switch at 100 after the check.

NOTE

In troubleshooting for excessive dot slash, look in the Memory circuit. A possible source of trouble is the 4 gate diodes in the Series H Memory (2 diodes in the Series B). Series B Memories should have $\leq$0.2 division of dot slash at 50 Hz. If yours does not, change V353 and after 10 hours of operation (aging to stabilize grid current) repeat the slash check.

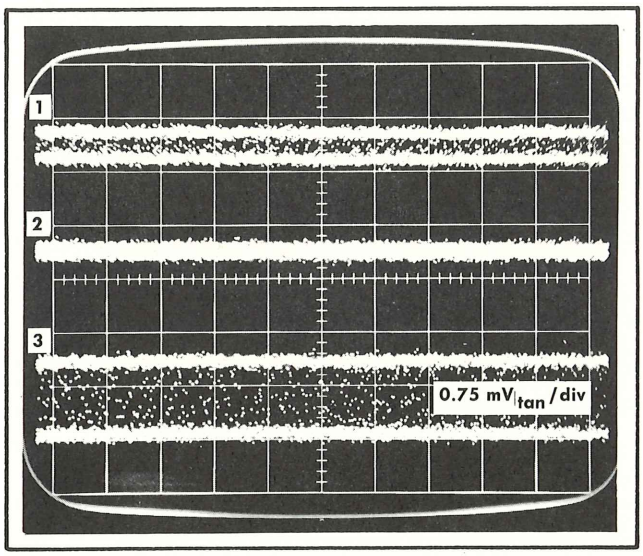


Fig. 5-11. Tangential noise check.

12. Check Tangential Noise

Requirement with probe only: FAST RISETIME, $\leq$2 mV; LOW NOISE, $\leq$0.5 mV. The specifications of Table 1-1 will be met when the above limits are met.

a. To the Type 284 Square Wave Output connect in the following order: a 5X 50 Ω attenuator, a special variable attenuator (Equipment Required item No. 10), a 20 cm air line and a GR-to-probe adapter. Insert Channel B probe into the adapter.

b. Set the Type 284 controls:

Period	1 μs
Square Wave Amplitude	100 mV
Lead Time	Optional

c. Set the Type 3T77A controls:

Trigger Sensitivity	Clockwise to free-run
Sweep Rate	0.5 μs/div

Remove external trigger cable.

d. Set the Type 3S3 controls:

Mode	B ONLY
mV/DIV	5 (both channels)
DC OFFSET	Midrange
LOW NOISE-FAST RT	FAST RT
SMOOTHING	Adjust for unity loop gain

NOTE

To adjust for unity loop gain, temporarily use an external trigger and double trigger the display (described in part (d) of step 4). Adjust for unity loop gain and then remove the coaxial cable. Once you become familiar with the appearance of the free-running trace adjusted to unity loop gain you will be able to adjust for unity loop gain without the need for a double-triggered sweep.

e. Obtain a free-run display of two traces. See part 1 of Fig. 5-11. Adjust the variable attenuator until the two traces start to blend together and the dark space between the traces first becomes imperceptible; see part 2 of Fig. 5-11. At this point the two traces form one extra-wide trace.

f. Set the Type 284 Square Wave Amplitude control to 1.0 V (10 times the original signal amplitude). The display should be similar to that of part 3 of Fig. 5-11 and should not exceed 2.67 divisions (equivalent to 2.0 mV). The display (3) has a tangential deflection factor of 0.75 mV/div

$$(E_{tangential}/div = \frac{5\ mV/div}{2}\ (.3) = 0.75\ mV/div).$$

Fig. 5-11 part 3 shows $\approx$1.05 mV tangential noise. Use the bottom edges as reference for measuring. (Though the special variable attenuator may present an impedance other than 50 Ω to the air line, the air line presents an impedance of 50 Ω to the probe during the probe conduction time.)

NOTE

When making a visual noise reading from a sampling display, the eye interprets a noise value which is neither the RMS nor the peak to peak value. Since most observers agree that the displayed noise value is approximately 3 times the RMS value, the tangential noise here defined is 3 times the RMS value. (The measurement technique given produces acceptable agreement between various operators as to the instrument's noise value.)

The noise display (part 3 of Fig. 5-11) has a noise deflection factor based upon the signal amplitude, the Type 3S3 Units/Div switch setting, the fact that the final trace separation is twice the RMS noise, and that the tangential noise is then 3 times the RMS noise. The square wave signal amplitude that makes two traces appear as one sets the trace

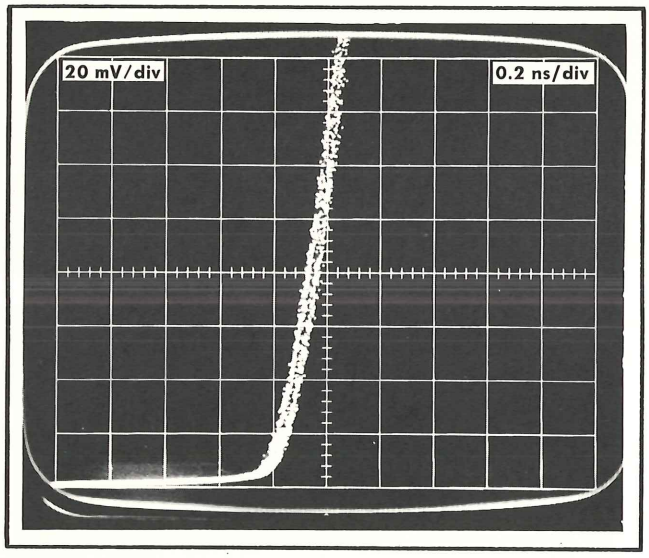


Fig. 5-12. Co-channel time coincidence check.

separation to twice the RMS noise. The procedure used here then permits a noise deflection factor to be determined by dividing the input mV/div deflection factor by 2 (trace separation is 2 X the RMS noise), multiplying by 3 (tangential noise is 3 X the RMS noise) and then divided by 10 (the signal amplitude change complement).

g. Repeat the complete check procedure for the LOW NOISE position of the switch. The tangential noise should be 0.5 mV or less, which corresponds to 0.66 divisions or less on the graticule.

h. Place the Mode switch at A ONLY and insert Channel A probe into the adapter. Repeat the Tangential Noise Check.

NOTE

If the tangential noise is significantly higher than the stated limits, look for one or more of the following possible causes.

Possible Noise Causes

1. High-energy radio-frequency radiation in the vicinity of the sampling system.
2. Imbalance between the SNAP-OFF CURRENT and the BRIDGE VOLTS controls. This is usually due to insufficient bridge voltage.
3. A high degree of bridge volts imbalance, such as a ratio of 5 to 1 or greater between + and — volts to one of the probes. This indicates defective sampling diodes or incorrect adjustment. If you are certain the adjustment procedure was performed correctly, new diodes are required. The diode location and part numbers are in the Maintenance section of this manual.

CALIBRATION WITH NEW P6038 PROBE

A new P6038 Probe is either a currently used probe with a new set of sampling diodes, or a new probe never before used on your Type 3S3. If installing a new probe, place the correct color band on the probe body for operating convenience.

1. Install the new probe and perform all of the previous procedure starting at the Initial Vertical Balance.

2. Time Coincidence Check

a. Set the Type 284 controls:

Mode	Pulse Output
Lead Time	75 ns

b. Set the Type 3S3 controls:

mV/DIV	20
Mode	DUAL-TRACE
LOW NOISE-FAST RT	FAST RT
SMOOTHING	Clockwise
NORM-INV	NORM

c. Set the Type 3T77A controls:

Time/Div	0.2 ns
Dots/Div	100
Time Expander	X1
Trigger Source	+Ext
Sweep Mode	Normal

d. Connect a coaxial cable with BNC connectors to the Type 284 Trigger Output and the Type 3T77A External Trigger Input.

e. Connect two GR-to-probe adapters to a GR tee and connect the tee to the Pulse Output of the Type 284. Insert a probe into each adapter.

f. Adjust the Type 3T77A Trigger Sensitivity for a triggered display and position the traces so that the portion preceding the pulse rise intersects the lower left-hand corner of the graticule. See Fig. 5-12.

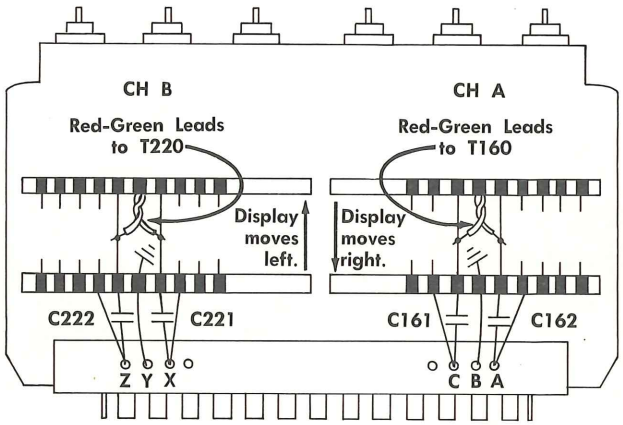


Fig. 5-13. Gate Generator parts location for adjusting co-channel time coincidence.

g. Use one side of the traces and measure the trace separation of the pulse rise as the traces cross the center of the horizontal graticule line. Each minor horizontal division is 40 ps. If the two pulse-rise positions are more than 60 ps apart, record the difference and determine which rise is Channel A and which rise is Channel B.

h. Fig. 5-13 shows the location of an adjustable time system on the Gate Generator subchassis. For example, if Channel A display should need to be moved to the right 30 ps, move the red and green leads to T160 exactly one centimeter closer to the 22-pin connector. Use a small soldering iron and move both leads equally so they are parallel when moved. A total range of about 100 ps adjustment is available by moving the red and green leads of both channels in opposite directions.

i. If it is necessary to move the leads just described, be careful not to change the twist as you move them. (Take care not to alter the turns-per-inch of the red-green leads located at D200, the snap-off diode.)

NOTES