TYPE 6R1A
AND SYSTEM CALIBRATION

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6R1A AND SYSTEM TRAINING CALIBRATION PROCEDURE

The following calibration procedure is step-by-step training device. The specifications listed are customer performance requirements. Each instrument must meet or exceed these specifications.

This procedure has been divided into sections to further clarify the "things" that must be done to insure accurate calibration of the 567 system. Each section has been set up as a major part of the calibration procedure. Thus, Section 1 is designed to "get things off the ground". In Section 1, we check the power supplies, both main frame and plug-in, the trigger circuits of the time base units, and so on. In Section II, we set up the memory and comparators of the 6R1A. In Section III, we set up the gain of the vertical plug-ins and the voltage read out of the 6R1A, and so on. Again, the individual sections have been set up to represent a major part or idea of the calibration procedure.

Many of the things in the 567 system can be made traceable to NBS. The methods of calibration outlined in this procedure will yield results that are traceable if the proper test equipment is used . For example: the 50Ω Amplitude Calibrator is used to adjust the gain and check the MV/DIV (V/DIV) accuracy. To be traceable, the 50Ω Amplitude Calibrator must be calibrated periodically as shown on the traceable to NBS sticker which is attached to the 50Ω Amplitude Calibrator. Another example: The timing is set using a Type 180A and a GR oscillator. For the GR oscillator to be traceable, it must be checked immediately before it is used as a test device. It is imperative that the test equipment be properly calibrated and that it is recalibrated within the time limitations indicated to provide calibration which can be certified.

A variety of plug-ins can be used in this system. The 3S76 or 3S3 can be used for sampling with the 3T77 time base. Or the 3A2 and 3B2 can be used for real time measurements. This procedure includes the calibration of each of these plug-ins. Since the system is most commonly found with the 3S76 and 3T77 as the vertical and horizontal plug-ins, most of the procedure is outlined with these plug-ins. If the procedure radically changes when other plug-ins are used, then alternate methods will be outlined. If not, the front panel controls mentioned will have to be interpreted and applied to your particular arrangement.

If you desire to calibrate an individual plug-in then the appropriate sections can be used. Since the procedure is primarily designed to calibrate the main frame and plug-ins as a system, the plug-ins must be used with the main frame. Other procedures have been written that outline the procedure for calibrating the plug-ins for use in other scopes.

A short form procedure is also provided. It is intended as a quick check of the system's calibration and as an aid in trouble shooting.

Other equipment may be substitutued for many of the devices listed under equipment required. The specifications of the substituted devices must meet or exceed the specifications of the equipment we have used.

A complete outline of adjustments with specifications is provided at the beginning of the calibration procedure. This outline can be used as a short form procedure by those familar with the complete procedure.

An abridged outline of adjustments (no specs) is provided at the beginning of each section. An equipment required list is also provided at the beginning of each section. There is no complete equipment required list at the beginning of the procedure.

HOW TO USE THIS THING

The following calibration procedure is a long and completed device. As an aid to the operator, colored inserts are used as markers throughout the procedure. A BLUE insert indicates the start of a section. A YELLOW insert indicates that part of a section outlined for the 3S3 and a PINK insert indicates that part of a section outlined for the 3A2 and/or 3B2.

Sections II and VII are concerned with the calibration of the 6R1A only. Since the 3S76, 3T77, 6R1A combination is the most popular, these sections were written around these 2 plug-ins. When calibrating the 567 system with other plug-ins, the front panel controls will have to be interpreted and applied according to your particular set up.

When calibrating any combination of plug-ins in the 567 system, it is only necessary to pick the part of each section that applies to your particular arrangement.

OUTLINE OF ADJUSTMENTS

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SECTION I

I. 567 LOW VOLTAGE SUPPLIES 1-10

Adjustable supply tolerance = ±1%
Non-adjustable supply tolerance = ±3%

All supplies must regulate within ±3% as the line voltage is varied from 105 to 125.

SUPPLY	TYPICAL RIPPLE VOLTAGE
-100	4 mv
-12.2	5 mv
+20	4 mv
+125	20 mv
+300	70 mv

II. HIGH VOLTAGE SUPPLY 1-18

High voltage supply must be within ±3%. It must regulate within ±3% as the line voltage is varied from 105 to 125.

III. CRT BEAM ROTATOR and CALIBRATOR 1-21

CRT Beam Rotator must align trace with graticule center.
Calibrator must be accurate to ±2%.

IV. 3S76 +20v SUPPLY 1-23

+20v supply must be within ±3%.
+20v supply must regulate within ±3% as the line voltage is varied from 105 to 125.
Maximum allowable ripple is 3 mv.

V. 3T77 POWER SUPPLIES 1-25

Supplies must be within ±3%.
Supplies must regulate to ±3% as line voltage is varied from 105 to 125.

SUPPLY	MAXIMUM ALLOWABLE RIPPLE
+19.5	1 mv
-20	1 mv

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VI. 3T77 TRIGGER 1-27

Adjust the TRIG SENS RANGE so the sweep free runs when the TRIGGER SENSITIVITY is set to within 10° of midrange and so the sweep disappears when the control is set CCW from midrange.
Adjust the 2nd TRIG REGEN SENS so the signal at the TRIG OUT jack has a rep rate from 75 to 100 kc as the RECOVERY TIME control is set from full CCW to full CW.
Adjust the D25 CURRENT RANGE for 8 to 12 pulses as monitored at the junction of L14, R18, and D18 with the PULL FOR SYNC control pulled out. Test scope sweep speed is 1 μsec.

VII. 3S3 +20 SUPPLY (corresponds to IV) 1-33

The +20v supply is specified as +20v ±2v.

VIII. 3A2 POWER SUPPLIES (corresponds to IV) 1-35

The +20v supply is specified as +20v ±2v. The +43v supply is specified as +43v ±2.15v.

IX. 3B2 +15v SUPPLY (corresponds to V) 1-36

The +15v supply is specified as +15v ±0.75v.

X. 3B2 TRIGGER THRESHOLD (corresponds to VI) 1-37

Adjust the TRIGGER THRESHOLD so sweep free runs when the TRIGGER LEVEL is set full CW (in detent). Sweep must disappear when the TRIGGER LEVEL is set CCW from the free run position.

SECTION II

I. A MEMORY ZONES 2-4

The ZONE POSITION control must be able to position the zone over at least 8.5 div. of the graticule.
The ZONE WIDTH adjustment must be able to adjust the zone to cover 10.5 divisions of trace.
Nominal ZONE WIDTH adjustment is .5 div.

II. B MEMORY ZONES 2-9

Same specifications as A MEMORY ZONES

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III. MEMORY and COMPARATOR BALANCE 2-13

When the START and STOP COMPARATOR BALANCE, and the 0% and 100% MEMORY BALANCE are properly adjusted:
The 3S76 (3S3), 3T77, 6R1A combination must recognize these programs with 1 m.d. of a 1 mc signal from the Type 105.
STOP or START, 10% or 90%, plus (+) or minus (-), normal or inverted (plug-in). The 3A2, 3B2, 6R1A combination must recognize these programs with 0.5 (1/2) m.d. of signal from the 567 calibrator.
STOP or START, 10% or 90%, plus (+) or minus (-), normal or inverted (plug-in).

IV. START and STOP COMPARATOR 3-DOT DELAY 2-25

START and STOP COMPARATOR 3-DOT DELAY adjusted to delay the start and stop of the measurement by 3 dots.

V. MEMORY DRIFT 2-30

The drift of the memory circuits is specified as:
In slow response: 4v or less in 10 seconds.
In fast response: The nature of this check is such that a specification would not be realistic.

SECTION III

3S76, 3T77, 6R1A combination 3-3

I. INPUT IMPEDANCE 3-5
The CH A and CH B input impedance is specified as 50Ω ±0.9%.

II. PROBE POWER 3-9
The probe power is specified as +100v ±3% and -12.2v ±3%.

III. MILLER DC LEVEL 3-10

Adjust the MILLER DC LEVEL for less than 0.5 div. of trace shift as the SMOOTH-NORMAL control is switched.

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IV. CH B VOLTAGE RESPONSE 3-12

Attenuator accuracy from 200 to 10 mv/div is specified as ±3%.
Attenuator accuracy from 5 to 2 mv/div is specified as ±6%.
The NORM-INV gain match at 200 mv/div is specified as ±1.5%.
The NORM-INV gain match in the 5 and 2 mv/div positions is specified as ±8%.
The VARIABLE attenuator range is specified as 2.5:1 ±2.5%.
The 6R1A voltage response is specified as: 600 ±2 counts with 6cm of vertical deflection, in FAST and SLOW response, AVE and PEAK Modes.
150 ±3 counts with 1.5 cm of deflection as the display is positioned over the graticule.

V. CH A VOLTAGE RESPONSE 3-21

Same specifications as CH B.

VI. START and STOP VOLTAGE CAL 3-26

The START and STOP VOLTAGE TRACKING specifications are:
The normal tracking is specified as ±4 md.
The inverted tracking is specified as ±8 md.

3S3, 3T77, 6R1A combination 3-31

I. VERTICAL CENTERING and SMOOTHING BALANCE 3-33

VERTICAL CENTERING adjusted to align trace with electrical.
Adjust SMOOTHING BALANCE for less than 1 cm of trace shift as the SMOOTHING control is rotated.

II. PRELIMINARY GAIN ADJUST 3-35

Adjust the 6R1A A and B voltage response for 600 ±2 counts in FAST and SLOW response, AVE and PEAK Modes.

III. START and STOP VOLTAGE CAL 3-41

The Start and Stop Voltage tracking specifications are:
The normal tracking is specified as ±4 md.
The inverted tracking is specified as ±8 md.

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3A2, 3B2, 6R1A combination 3-47

I. DC BALANCE 3-49

Adjust the DC Balance for no trace shift as the VARIABLE VOLTS/DIV control is rotated.

II. GAIN 3-50

The GAIN and VOLTS/DIV accuracy is specified as ±3%.

III. START and STOP VOLTAGE CAL 3-59

The Start and Stop Voltage tracking specifications are:
The normal tracking is specified as ±4 md.
The inverted tracking is specified as ±8 md.

SECTION IV

3T77 4-1

I. PRELIMINARY SWEEP ADJUSTMENTS 4-3

The Gain is specified as ±3%. The Staircase DC Level is specified as 0v ±100 mv.
Adjust the MAG REGIS for no horizontal trace shift as the HORIZ MAG is switched. Adjust the SWEEP LENGTH for 10.5 ±.3 cm of sweep length.
The Horizontal Position control must be able to position the beginning and end of the sweep past graticule center.

II. TIMING 4-11

The Timing is specified as ±3%.
With the HORIZ MAG set to X10, the timing is specified as ±6%.
The VARIABLE TIME/DIV is specified 2.7:1 minimum.

III. DOTS PER DIV 4-20

With the DOTS PER DIV control set to 100, there must be 800 dots between the 2nd and 10th graticule lines.
With the DOTS PER DIV control set to 10, there must be 80 dots between the 2nd and 10th graticule lines.

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IV. DELAY 4-24

The Inverter Input Zero is specified as 0v ±100 mv.
Adjust the Delay Zero so the fast rise portion of the 111 pulse just disappears. Adjust the Comp Regen Sens so the fast rise portion of the 111 pulse just disappears. The Delay Range is specified as 100 nsecs ±12%.
The Ramp Linearity is specified as ±7.5% in the first 5 nsecs and as ±3% after the first 5 nsecs.

3B2 4-31

I. TIMING 4-32

The Timing from .5 sec to 2 μsec is specified as ±3%.
The Timing at 1 sec is specified as ±4%.
The Sweep Length is specified as 10.5 ±3 cm.
The POSITION control must be able to position the start and end of the trace past graticule center.

II. DELAY TIMING 4-35

The Delay Timing is specified as ±1%.

III. SIGNAL TO THE 6R1A 4-39

The Sweep Take-off DC Level from .2 sec to 20 μsec is specified as no greater than 150 mv.
The Sweep Take-off DC Level for .5 and 1 sec is specified as no greater than 250 mv.
The + Gate to the 6R1A must be from 6 to 10v.
The 1 mc clock must be within 0.01%.

SECTION V

3S76, 3T77, 6R1A combination 5-3

I. BRIDGE BALANCE 5-5

Adjust OFFSET MONITOR for 0v at the X1000 OFFSET MONITOR jack.
Adjust the Bridge Balance for minimum trace shift as the MV/DIV control is rotated.

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II. RISETIME 5-7

The Risetime is specified as ≤ 0.4 nsecs. The voltage at each end of the sampling bridge must be greater than 1.6v (ignore polarity) and must match within 0.2v.

III. DOT TRANSIENT RESPONSE 5-17

Memory Gate pulse length must be from 250 to 400 nsec.
Adjust the Preamp Sens so the false baseline is aligned with the true baseline (loop gain of 1).
Pulse aberrations must be less than ±3%.
A + B Rejection Ratio must be greater than 50:1.

IV. NOISE 5-23

Noise in NORMAL must be less than 2 mv and in SMOOTH less than 1 mv.
Microphonics must be less than 4 mv.
Check for less than 4 mv of trace shift as TIME/DIV control is rotated from 10 µsec to .2 nsec.

V. DC OFFSET 5-24

The DC OFFSET control must be able to position the trace over 9 cm of total travel.

VI. MEMORY SLASH and LISSAJOUS CHECK 5-25

Less than 2 mm of memory slash with a 30 cps input signal.
With 10 mc from the 180A applied to CH A and CH B, set the MODE to A VERT B HORIZ and check for a 45° line.

3S3, 3T77, 6R1A combination 5-27

I. RISETIME 5-29

The Risetime is specified as 340 psec ±5 psec.
Adjust the Bridge Balance for no trace shift as the MV/DIV control is rotated. Adjust the Risetime Balance for no trace shift as the FAST RT-LOW NOISE switch is thrown.

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II. GAIN — 5-37

The MV/DIV accuracy is specified as ±3%.
The NORM-INV error is specified as ±3%.
The VARIABLE range is specified as 3:1 or greater.
The Rejection Ratio is specified as 20:1.
The DC OFFSET control must be able to position the trace over 9 cm of travel.

III. DOT TRANSIENT RESPONSE — 5-43

Adjust the Memory Gate Width for maximum loop gain.
Adjust the Loop Gain adj. for a loop gain of 1 (unity).
Check for less 0.5 cm of memory slash with 10 cps input signal.
Check for less than 1 cm of trace shift as input frequency is varied from 50 cps to 100 kc.

3A2, 3B2, 6R1A combination — 5-49

I. INPUT CAPACITANCE and VOLTS/DIV COMPENSATIONS — 5-50

Adjust the Input Capacitance and Volts/Div compensation for a flat response to 4 cm of a 1 kc signal from a Type 105.

II. TRIGGER TAKE-OFF — 5-53

Adjust the Trig Out DC Level for 0v.
Adjust the Trig Out DC Level CRT SIG for 0v.

III. SQUARE-WAVE RESPONSE — 5-55

Check each VOLTS/DIV switch setting for a flat response to 4 cm of 105 signal from 100 cps to 10 kc.
With 80v of 100 kc 105 signal applied to CH 1, check CH 2 for less than 1 mm of deflection.

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SECTION VI

3T77 6-1

I. TRIGGER 6-3

The trigger is specified as follows:
Internal + and - : Must trigger on 40 mv signal. Jitter less than 50 psec with 111 signal and less than 300 psec with GR oscillator signal.
External + and - : Must trigger on 8 mv signal. Jitter less than 50 psec with 111 signal and less than 300 psec with GR oscillator signal.

II. MISCELLANEOUS 6-5

Less than 2% change in DOTS PER DIV as input frequency is varied from 10 cps to 100 kc.
Check SINGLE SWEEP and MANUAL SCAN for proper operation.

3B2 6-7

I. TRIGGER 6-7

Internal Trigger: Must trigger on 5 cm of signal without an adjustment of the TRIGGER LEVEL control.
Must trigger on 2 cm of signal with a slight adjustment of the TRIGGER LEVEL control.
EXTERNAL Trigger: Must trigger on 1v signal without an adjustment of the TRIGGER LEVEL control.
Must trigger on 0.5v signal with a slight adjustment of the TRIGGER LEVEL control.
High Frequency: Must trigger on 5 mm of 200 kc sine wave.
Must trigger on 1 cm of 500 kc sine wave.

SECTION VII

I. A TIME READOUT 7-4

A Risetime readout is specified as 145 ±3 counts with 10 mc input signal. A Norm + Slope readout is specified as 500 ±7 counts.
A inverted - Slope readout is specified as 500 ±7 counts.

II. B TIME READOUT 7-5

Same specification as A Time Readout.

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III. START TO STOP INTENSIFIED ZONE and MANUAL OPERATION — 7-6

Check for proper start to stop zone operation. Manual Start control must be able to position the start of the zone to within 4 mm of the last graticule line. Manual Stop control must be able to position the end of the zone to within 2 mm of the 2nd graticule line and to within 2 mm of the last graticule line.
Check for proper operation of the ÷ 1, 2, 5 board.

IV. NIXIE TUBES — 7-10

Check that each NIXIE TUBE counts properly.

V. GO, NO-GO INDICATORS — 7-11

Check GO, MID-ZONE, and NO-GO INDICATORS for proper operation.

SECTION I

Section I is designed to get things off the ground. In this section, the power supplies, both main frame and plug-in, the trigger circuits of the time base units, the main frame calibrator, etc., are checked and adjusted.

The methods of setting up the main frame are pretty much the same regardless of which plug-ins are used. Therefore, no alternate procedures are given. The procedure is arranged so the methods for calibration of the 3S76 and 3T77 are in logical sequence following the calibration of the main frame. Methods for calibrating the other plug-ins are then given. If the 3S3 is used, then Part IV, which is the power supply check for the 3S76, would be omitted and Part VII, which is the corresponding part for the 3S3, would be performed.

OUTLINE OF ADJUSTMENTS

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VII.	3S3 +20v SUPPLY (corresponds to IV)	1-33
VIII.	3A2 POWER SUPPLIES (corresponds to IV)	1-35
IX.	3B2 +15v SUPPLY (corresponds to V)	1-36
X.	3B2 TRIGGER THRESHOLD (corresponds to V)	1-37

<u>EQUIPMENT REQUIRED</u>:

540 series oscilloscope or equivalent (530 series, 580 series with an 81 adaptor, etc.).

Vertical preamp with at least 5mv sensitivity (L, D, H, W, etc.).

TU-76 Variac or equivalent

X1 Probe

X10 Probe

<u>EQUIPMENT REQUIRED</u>: (Con't)

VOM 20,000Ω/V

Fluke Differential Voltmeter, Model 801 or equivalent

Type 180A or equivalent

Male BNC to GR Adaptor (017-064)

24 pin plug-in extender (013-034)

Preset the front panel controls as follows:

3S76

MODE	DUAL-TRACE
SMOOTH-NORMAL	NORMAL
Gain Adj.	---
CH A and B	
POSITION	midrange
MV/DIV	200
2-200 VAR	CALIB (CCW)
DC OFFSET	midrange
NORM-INV	NORM

3T77

TIME/DIV	.1 μsec
VARIABLE	CALIB (CCW)
HORIZ MAG	X1
DOTS PER DIV	100
SWEEP MODE	NORMAL
MANUAL SCAN OR EXT. ATTEN.	midrange
DELAY	CCW (Minimum)
TRIGGER	
SENSITIVITY	CCW
SELECTOR	INT +
RECOVERY TIME	CW (not pulled)
Gain Adj.	---

567

FOCUS	CCW
ASTIGMATISM	CCW
INTENSITY	CCW
SCALE ILLUM	CCW

Figure 1 shows the proper set up for the 3S76, 3T77 and 567.

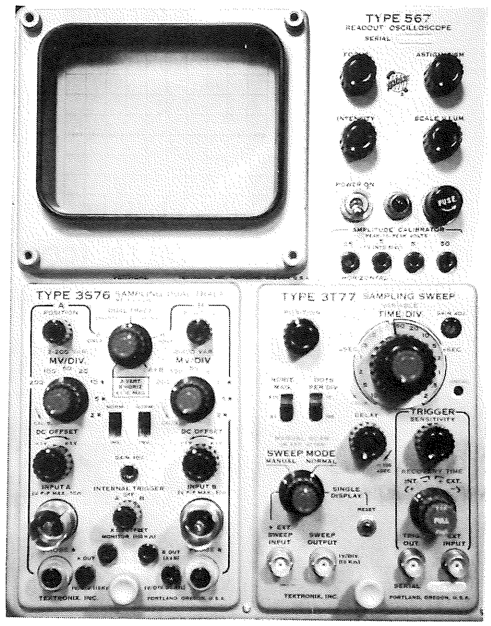
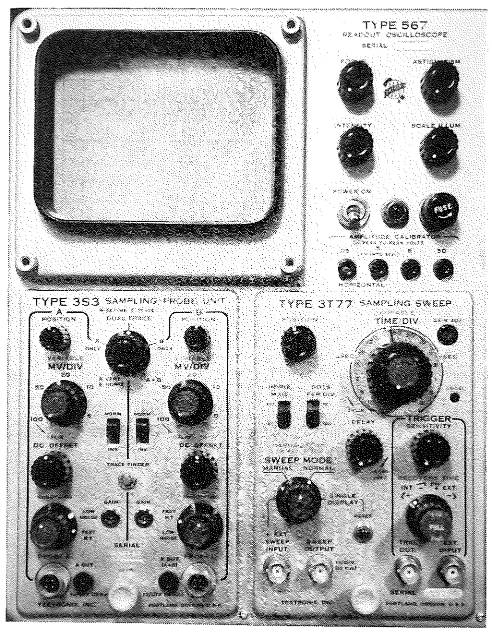


Figure 1

<u>3S3</u>

MODE	DUAL-TRACE
CH A and B	
POSITION	midrange
MV/DIV	100
VARIABLE	CALIB (CCW)
NORM-INV	NORM
DC OFFSET	midrange
FAST RT-LOW NOISE	FAST RT
Gain	---

Figure 2 shows the proper set up for the 3S3, 3T77 and 567.



<u>Figure 2</u>

Before power is applied to the 567, connect the proper P6038 probe to the CH A and CH B probe connectors.

<u>3A2</u>

MODE	ALTER
TRIG SOURCE	CH 1
Gain Adj.	---
CH 1 and 2	
INPUT COUPLING	GND
VOLTS/DIV	.01
VARIABLE	CALIB
POSITION	midrange
POLARITY	NORM
DC Bal	---

<u>3B2</u>

TRIGGER	
LEVEL	CCW
COUPLING	AC SLOW
SLOPE	+
SOURCE	INT
DELAY	
SWEEP DELAY	OUT
DELAY TIME	1 ms
VERNIER	5.00
SWEEP	
POSITION	midrange
TIME/DIV	1 msec
DIGITAL RESOLUTION	.1 msec
SWEEP Cal	---

Figure 3 shows the proper set up for the 3A2, 3B2 and 567.

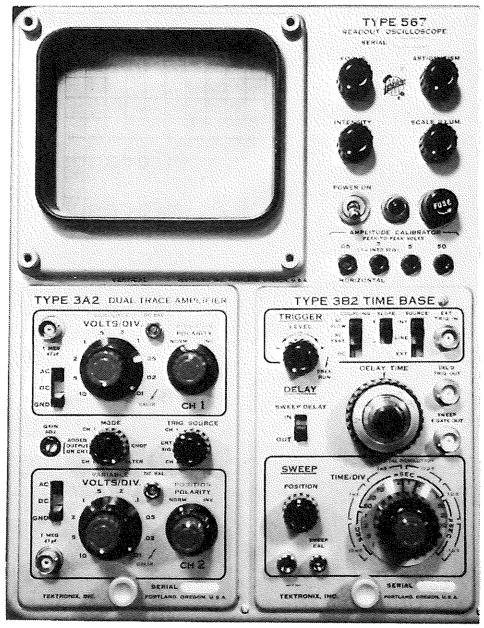


Figure 3

6R1A

LOWER LIMIT SET	0000
UPPER LIMIT SET	9999
MODE	EXT PROGRAM
B VOLTAGE	UP
A VOLTAGE	UP
RESOLUTION	ONE SWEEP UNSCALED (MAX)
DISPLAY TIME	midrange
ZONE POSITION	
A 100%	midrange
A 0%	midrange
B 100%	midrange
B 0%	midrange
CRT INTENSIFICATION	
MEMORY ZONES	UP (on)
START TO STOP	UP (on)
START and STOP CONTROLS	
SLOPE	FIRST +
TIMING START (STOP)	MANUAL (CCW)
MANUAL	midrange
START (STOP) VOLTAGE	+
CRT DIVISIONS FROM 0% ZONE (DUODIAL)	5.00

Figure 4 shows the proper set up for the 6R1A.

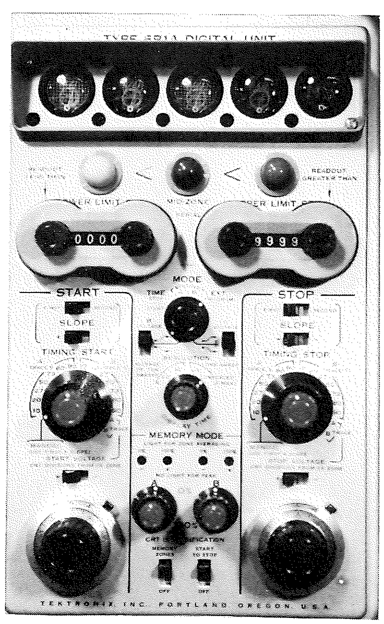


Figure 4

Preset the internal controls as follows:

<u>6R1A</u>

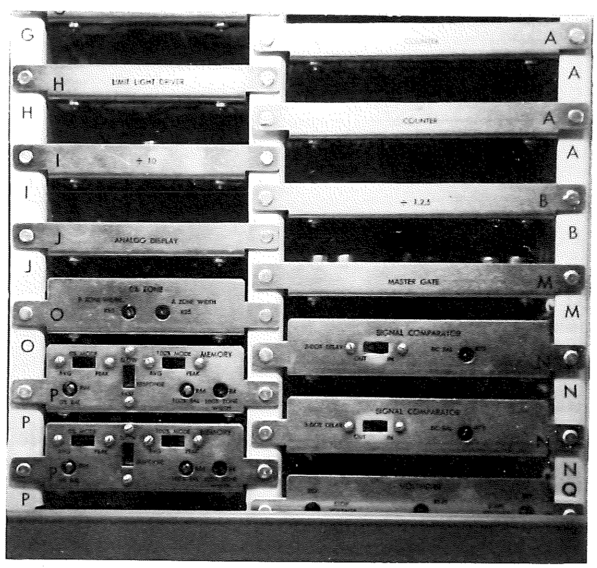
A and B MEMORY

0% MODE	AVG
100% MODE	AVG
RESPONSE	SLOW

START and STOP SIGNAL COMPARATOR

3-DOT DELAY	IN

Figure 5 shows the proper set up for the 6R1A internal controls.



<u>Figure 5</u>

I. 567 LOW VOLTAGE SUPPLIES

The low voltage supplies of the 567 are specified as follows:

With the line voltage set to 115v, the adjustable supplies should be within ±1% of their indicated value. The non-adjustable supply (+20) should be within ±3% of its indicated value. As the line voltage is varied from 105 to 125v and high and low load conditions are simulated, the adjustable supplies should remain within ±3% of its indicated value.

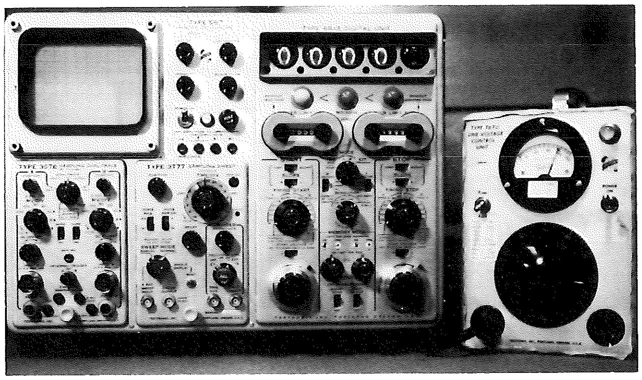
In earlier 567 main frames only the -100v supply was adjustable. When these scopes are calibrated, the -100v supply is adjusted so that all the low voltage supplies are within ±3% of their indicated value under the conditions stated in the preceeding paragraph.

The typical ripple voltage is the same for each supply in the earlier and later model 567 main frames.

Supply	Typical ripple voltage
-100	4mv
-12.2	5mv
+20	4mv
+125	20mv
+300	70mv

A. PRELIMINARY SET UP

1. Remove the side panels and the top panel from the 567. Insert the 6R1A and the vertical and horizontal plug-ins into their proper receptacle.
2. Connect the 567 to a Type 76 TU line-voltage control unit. Connect the Type 76 TU to a line voltage source. Apply power to the Type 76 TU. Set the output voltage on the Type 76 TU to Eout and turn on the 567. Set the output voltage on the Type 76 TU to 115v and allow 20 minutes for warm up. See Figure 1-1.



Type 76 TU line voltage control unit set for 115v output.

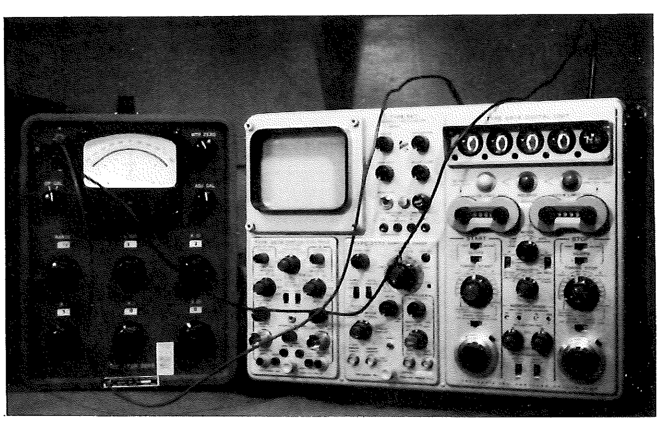
Figure 1-1

3. Insert a lettered series plug-in with a 5mv deflection factor (L, D, H, W, 1A1, etc.) into a 540 series scope, or use an equivalent set up. Apply power to the test scope.
4. Apply power to a differential voltmeter which has an accuracy of 0.1%. (For early model 567s with ±3% supplies, a 20,000Ω/v meter may be used).

B. LOW VOLTAGE SUPPLIES CHECK and ADJUSTMENT

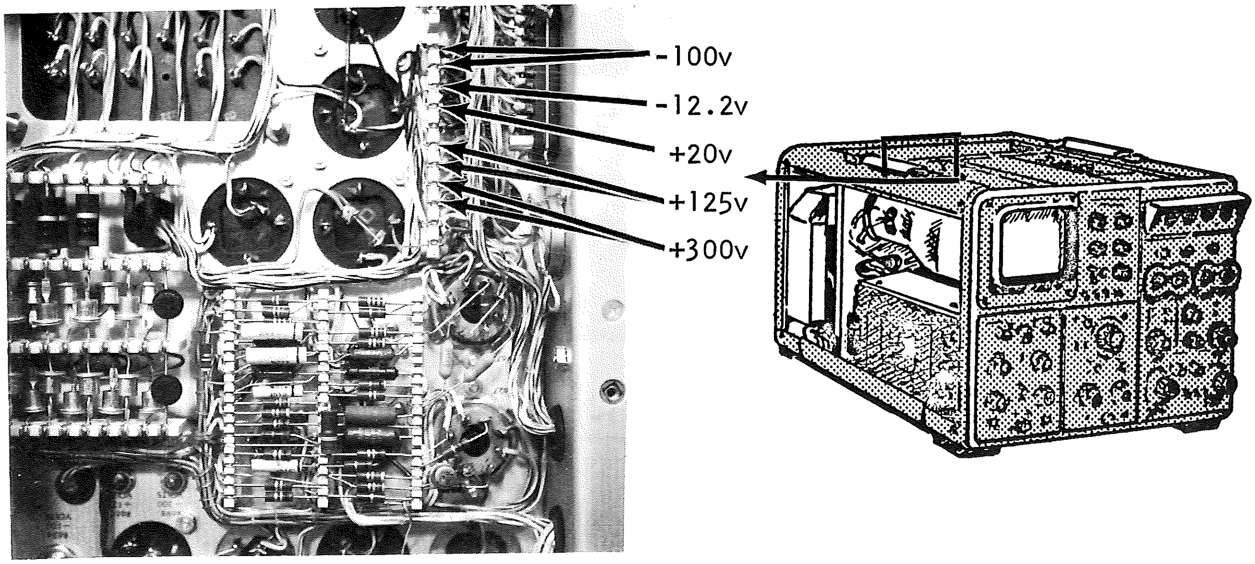
1. Check the low voltage supplies against the following chart. See Figure 1-2, A and B.

Supply	Meter Reading
-100	99 v - 101 v
+125	123.75v - 126.25v
+300	297 v - 303 v
- 12.2	12.08v - 12.32v
+ 20	19.4 v - 20.6 v(19.8v-20.2v)



Differential voltmeter set up to read +125v supply.

Figure 1-2A

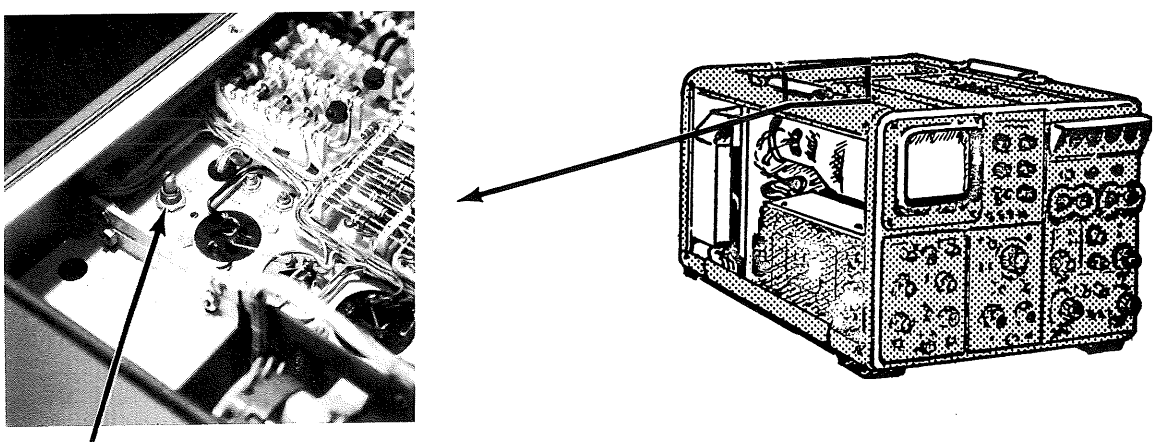


Low voltage supply test points

Figure 1-2B

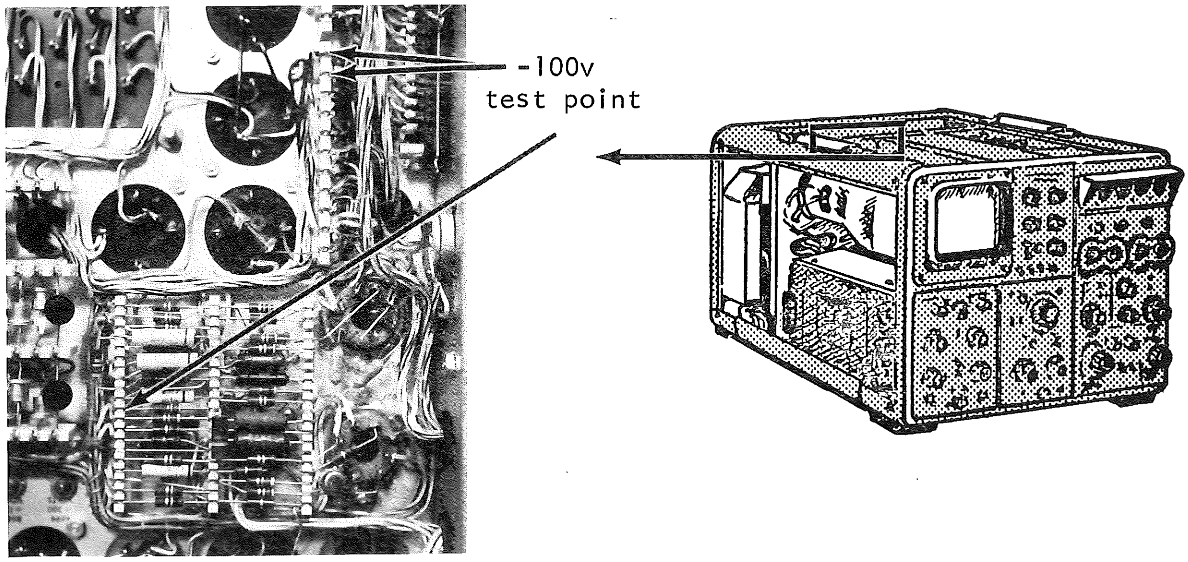
If the low voltage supplies are within the values stated above, adjustment should not be necessary and you may proceed to #C. If the supplies are not within the values stated above, continue #B.

2. Adjust R624, See Figure 1-3, A and B for exactly -100v.



R624
-100v adjustment

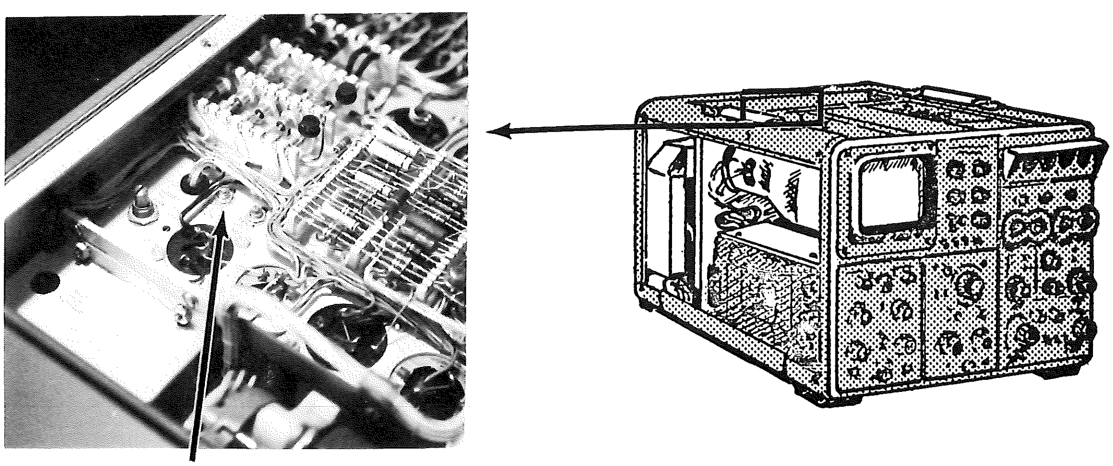
Figure 1-3A



-100v test points

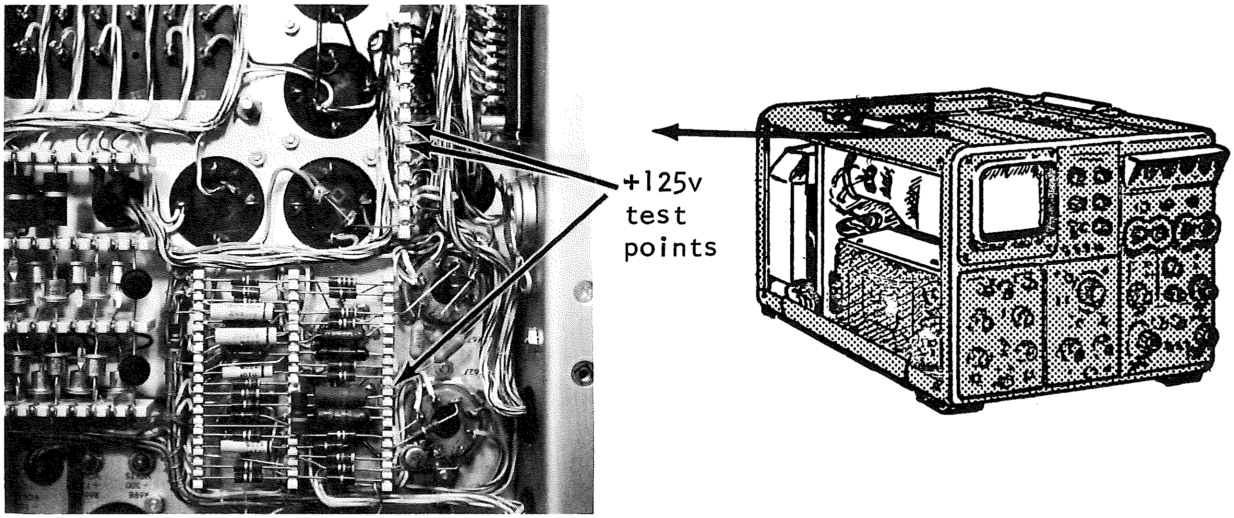
<u>Figure 1-3B</u>

3. Adjust R668, See Figure 1-4, A and B for exactly +125v.



R668 +125v adj.

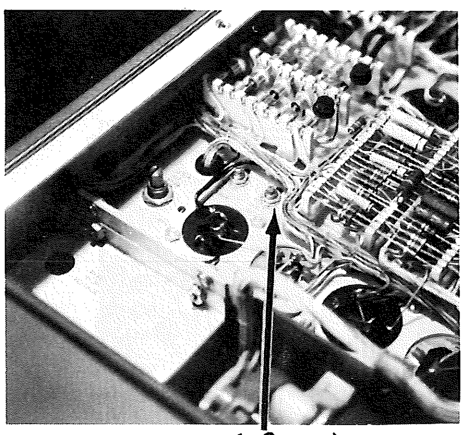
<u>Figure 1-4A</u>



+125v test points

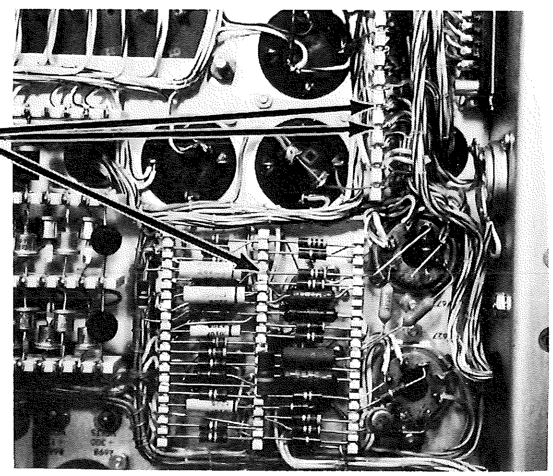
Figure 1-4B

4. The -100v and +125v adjustments interact. Repeat steps 2 and 3 until R624 and R668 are properly adjusted.
5. Adjust R698, See Figure 1-5, A and B for exactly +300v.



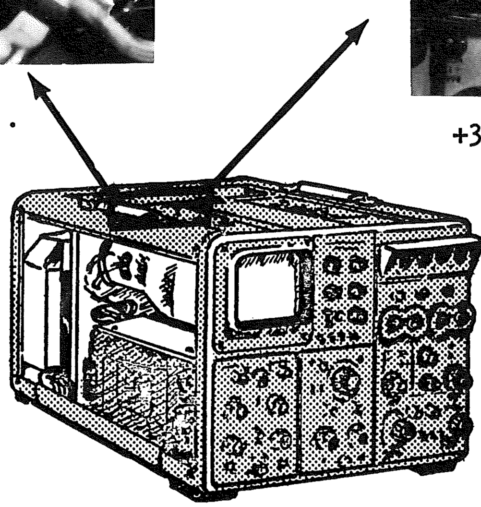
R698
+300v adj.

Figure 1-5A

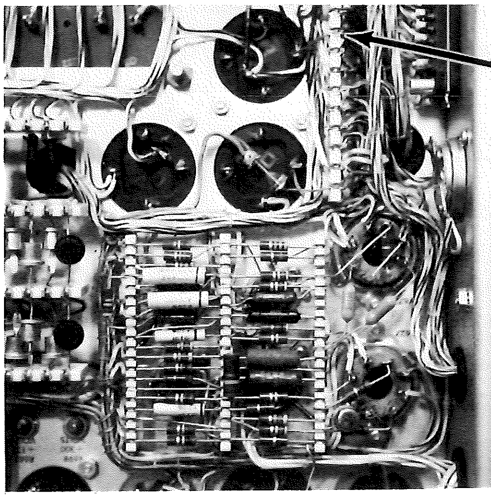


+300v test points

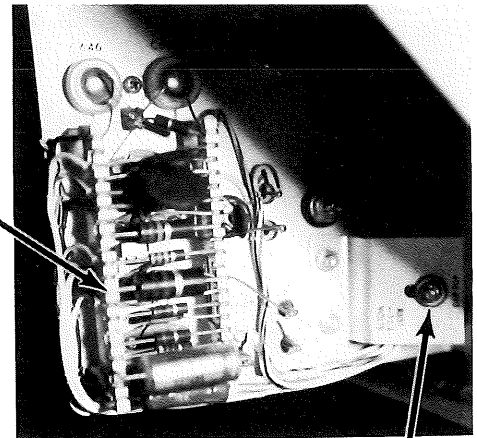
Figure 1-5B



6. Adjust R631, See Figure 1-6, A and B for exactly -12.2v.



-12.2v
test point

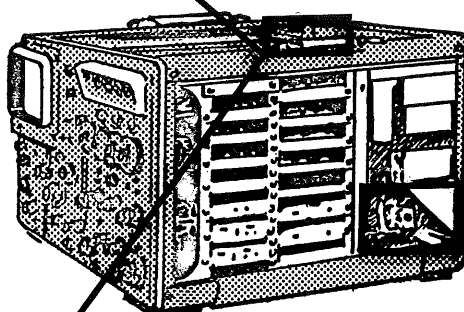


-12.2v test points

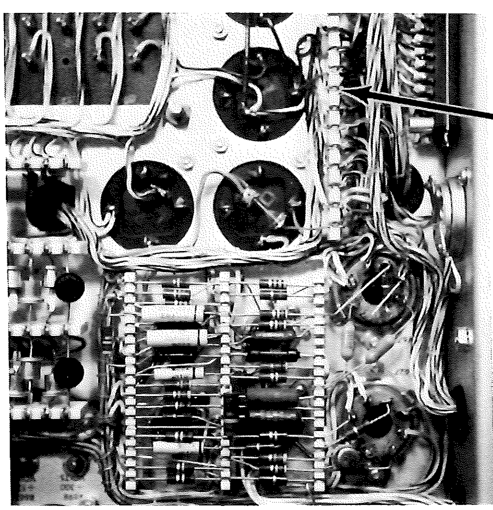
Figure 1-6A

-12.2v adj. R631

Figure 1-6B



7. Check the +20v supply as indicated in step 1. See Figure 1-7.



+20v
test points

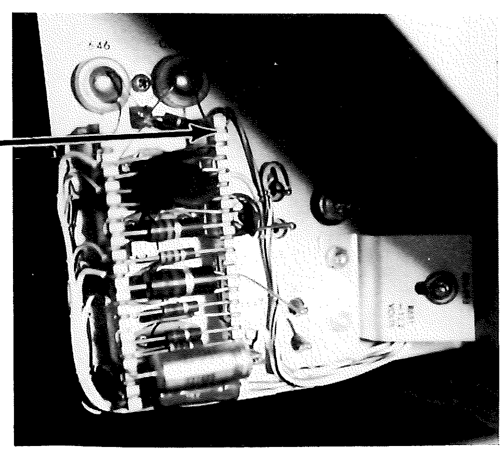


Figure 1-7

C. REGULATION

1. Set the voltage control on the Type 76 TU to 125v and check each supply for regulation against the following chart.

Supply	Meter Reading
-100	98 v - 102 v
+125	122.5 v - 127.5 v
+300	294 v - 306 v
- 12.2	11.96v - 12.44v
+ 20	19.4 v - 20.6 v(19.6v-20.4v)

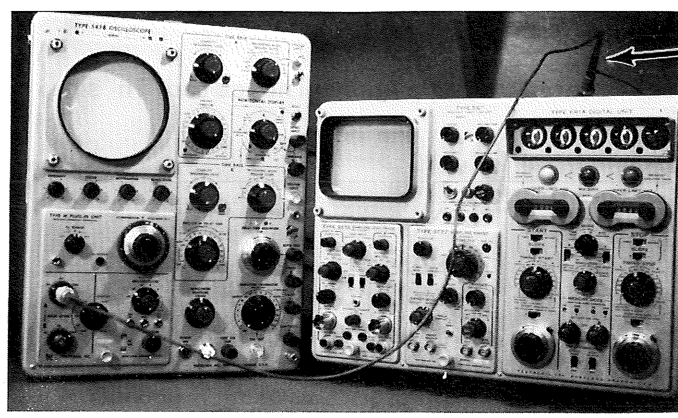
2. Set the voltage control on the Type 76 TU to 105v. On the 3T77, set the TRIGGER SENSITIVITY fully CW. On the 6R1A, set the MODE to TIME START (-) STOP. Check each supply for regulation against the chart in step 1.

D. RIPPLE

1. Set the line voltage control to 115v. On the 3T77, set the TRIGGER SENSITIVITY fully CCW and on the 6R1A, set the MODE to EXT. PROGRAM.

2. On the test scope, set the TIME/CM to 5 msec, free running or triggered. On the test scope vertical, set the input sensitivity to 5 mv, AC coupled. See Figure 1-8. (If a lower vertical sensitivity is available, it should be used).

Sweep Rate
5 msec



X1 probe

1 mv/cm
AC coupled

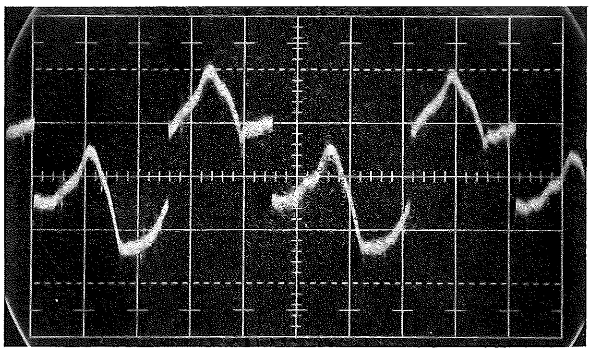
If the Type W is used as the vertical preamp, set the INPUT COUPLING to AC before the probe is connected to the supply output.

Figure 1-8

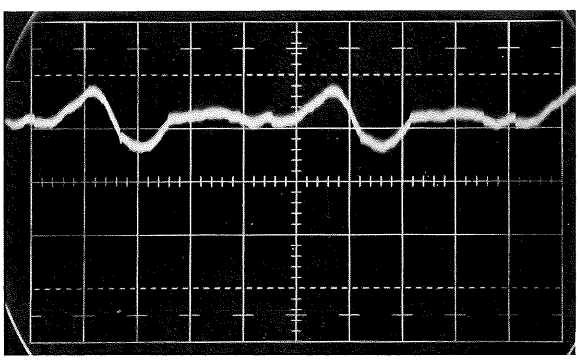
3. Check the ripple of the low voltage supplies against the following chart.

Supply	Typical Ripple
-100	4mv
-12.2	5mv
+125	20mv
+300	70mv
+20	4mv

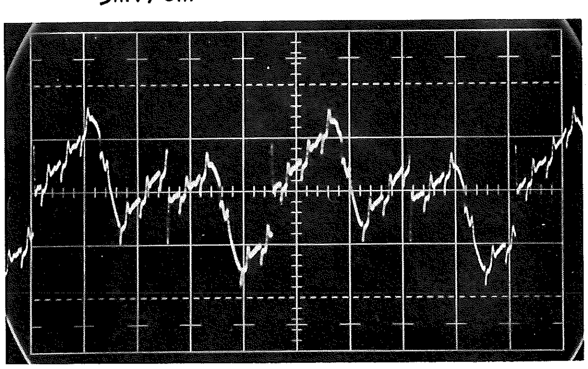
Figure 1-9 shows the ripple of each supply.



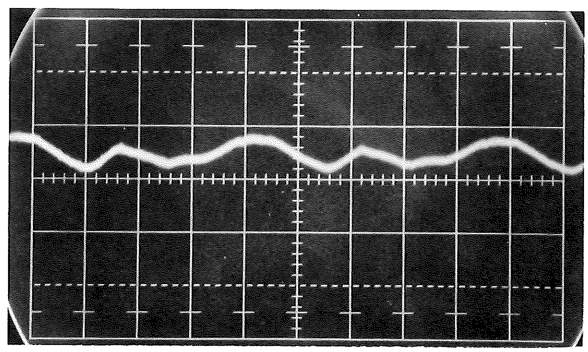
(a) -100v ripple
vertical sensitivity
1mv/cm



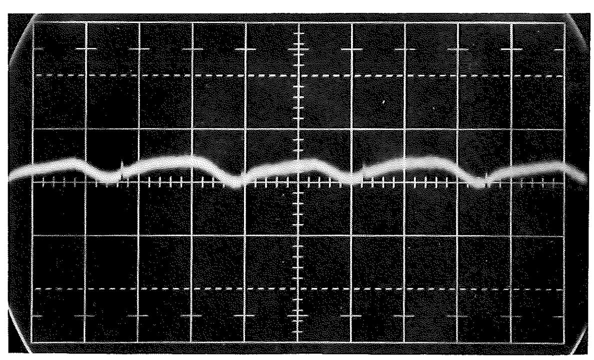
(b) +125v ripple
vertical sensitivity
5mv/cm



(c) +300v ripple
vertical sensitivity
5mv/cm



(d) +20v ripple
vertical sensitivity
1mv/cm



(e) -12.2v ripple
vertical sensitivity
1mv/cm

Figure 1-9

II. HIGH VOLTAGE SUPPLY

The high voltage supply is specified as 3.3 KV ±3%. The high voltage supply must regulate as the line voltage is varied between 105v to 125v.

A. HIGH VOLTAGE SUPPLY CHECK and ADJUSTMENT

1. Turn off the 567. Connect a 20,000 Ω/v DC meter from the high voltage test point to ground. See Figure 1-10.

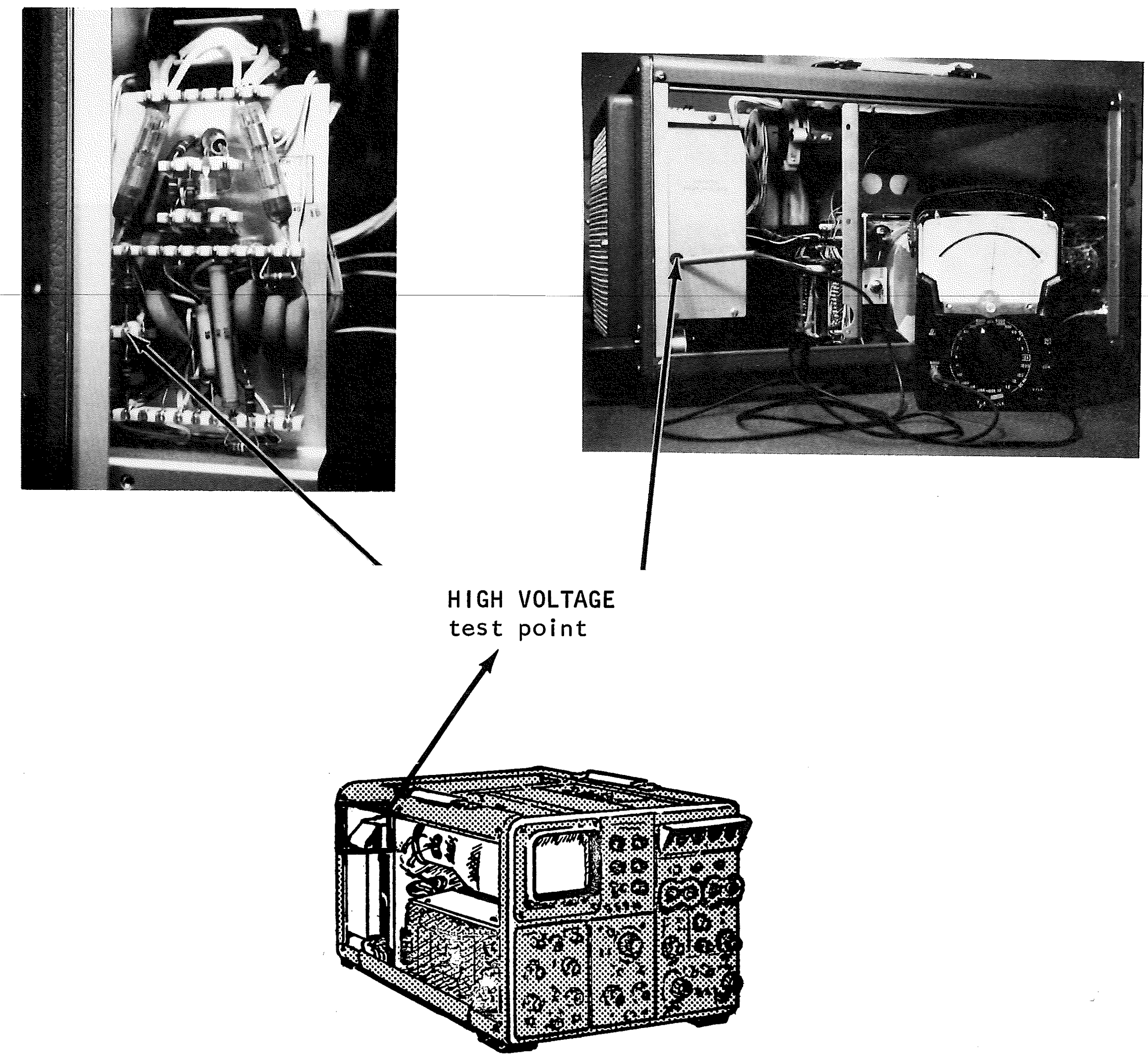
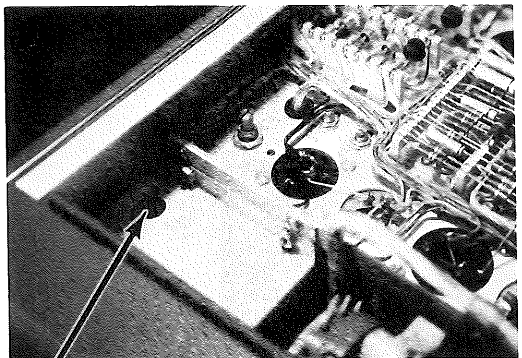
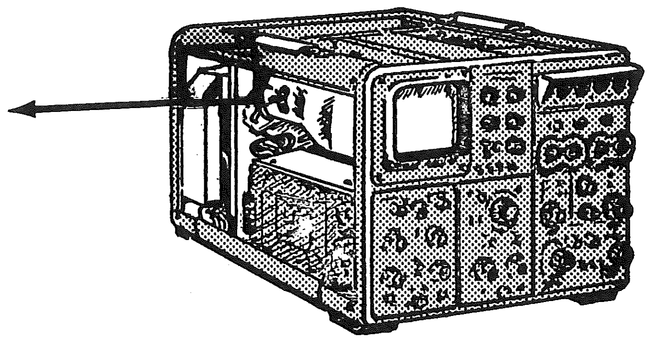


Figure 1-10

2. Turn on the 567. Check the high voltage supply for 3.3 KV ±3%, 3,201v to 3,399v. If the supply is within ±3%, do not adjust the supply. If the supply is not within ±3%, adjust R841, See Figure 1-11, for exactly 3.3 KV.





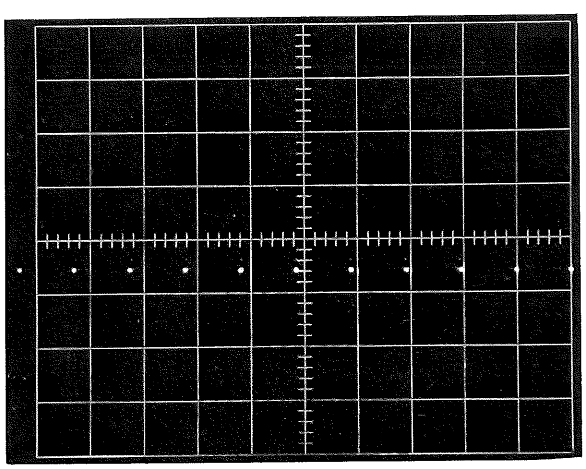
R841
HIGH VOLTAGE adjustment

Figure 1-11

B. REGULATION

1. On the 3T77, turn the TRIGGER SENSITIVITY fully CW. On the 567, turn the INTENSITY control CW until a trace is visible. On the 3S76, set the MODE to A ONLY.
2. On the 3T77, set the HORIZ MAG to X10 and the DOTS PER DIV to 10. On the 567, adjust the FOCUS and ASTIGMATISM controls for sharply defined dots. Adjust the INTENSITY and SCALE ILLUM for an easily discernible trace. See Figure 1-12.

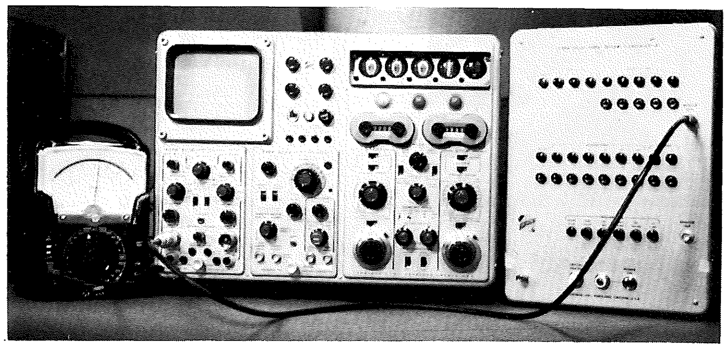
Focus and Astigmation adjusted for sharply defined dots.



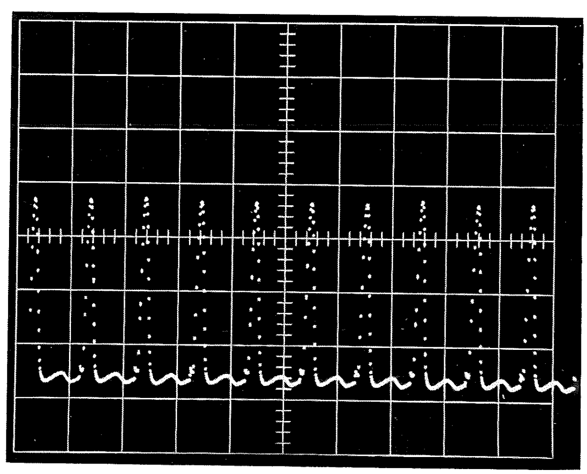
Scale ILLUM and INTENSITY adjusted for an easily discernible trace.

Figure 1-12

3. On the 3T77, return the **HORIZ MAG** to X1 and the **DOTS PER DIV** to 100. Set the **TIME/DIV** to 1 µsec.
4. Connect the output of a Type 180A to the **CH A** input on the 3S76. Set the output of a Type 180A for 1 µsec markers. With the **TRIGGER SENSITIVITY** control on the 3T77, obtain a stable display. See Figure 1-13.



1 µsec markers from 180A applied to the CH A input.



Trigger Sensitivity adjusted for a stable display.

Figure 1-13

5. While the line voltage is varied from 105v to 125v, the supply voltage must remain within ±3% of 3.3 KV and the trace must not bloom or defocus.
6. Return the line voltage to 115v. Disconnect the signal from the 180A. Turn off the 567 and disconnect the DC meter. Turn on the 567.

III. CRT BEAM ROTATION and CALIBRATOR

A. CRT BEAM ROTATION

1. On the 3T77, set the TRIGGER SENSITIVITY fully CW and the TIME/DIV to .1 μsec. With the horizontal POSITION control, set the start of the sweep to the left of the graticule. With the vertical POSITION control on the 3S76, set the trace to graticule center.
2. Adjust the CRT BEAM ROTATOR, R860 - See Figure 1-14, so the trace is aligned with graticule center. See Figure 1-15.

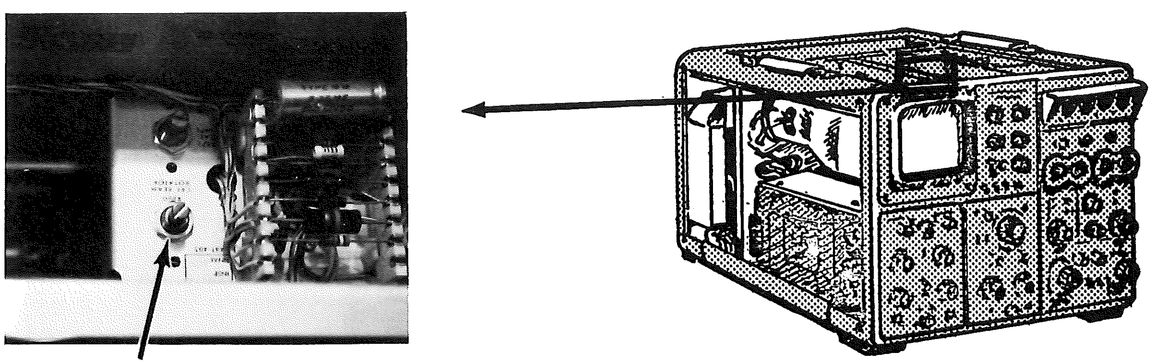
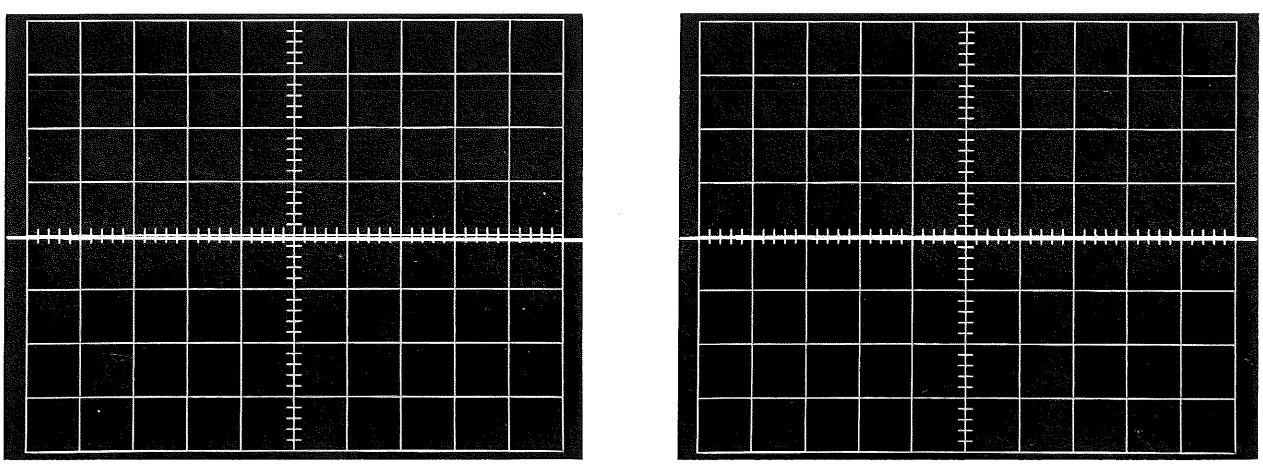


Figure 1-14



Improper Adjustment

Proper Adjustment

Figure 1-15

B. CALIBRATOR

The accuracy of the CALIBRATOR is specified as ±2%.

1. Connect a jumper lead from the cathode of V884A (pin 8) to ground. See Figure 1-16.

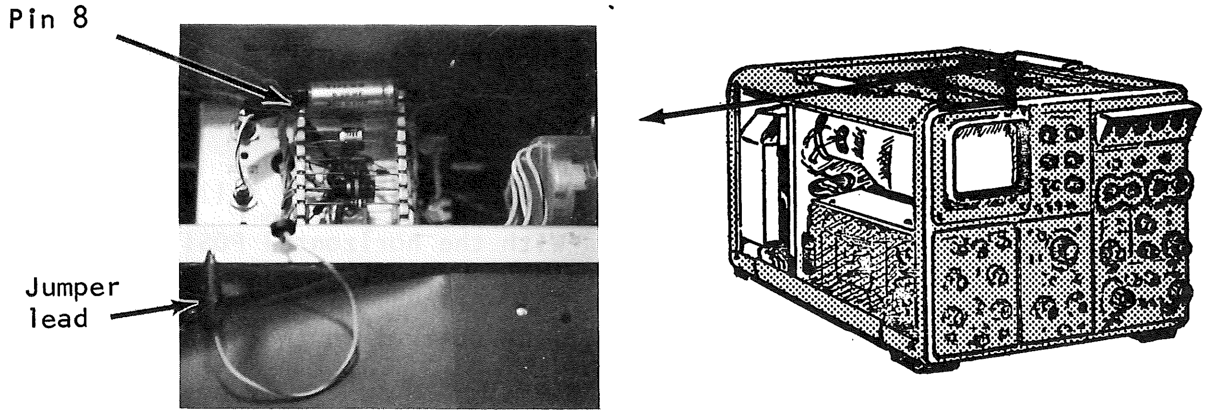


Figure 1-16

2. Connect the Differential volt meter from the cathode of V884B (pin 7) to ground, See Figure 1-17. Adjust the CAL AMPL, R871, See Figure 1-18, for exactly 100v.

Pin 7

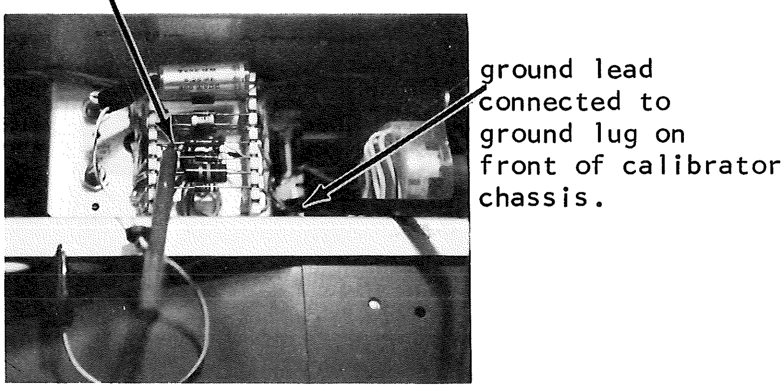
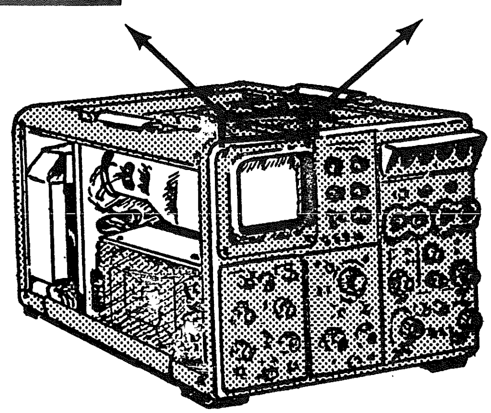


Figure 1-17

Figure 1-18



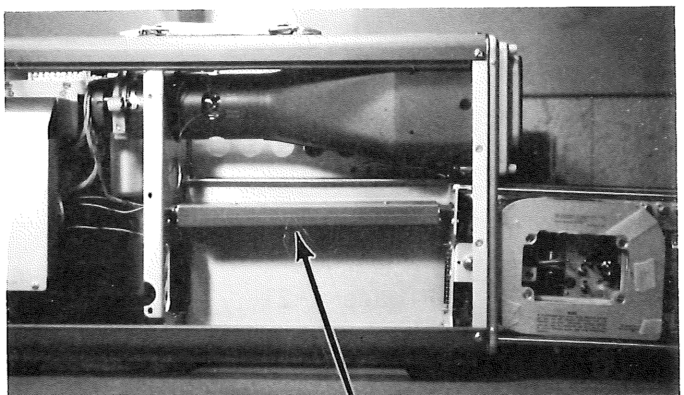
3. Disconnect the DC meter and the jumper lead.

IV. 3S76 +20v SUPPLY

The +20v supply is specified as 20v ±3%. It must regulate as the line voltage is varied from 105v to 125v. The maximum allowable ripple voltage is 3mv.

A. PRELIMINARY SET UP

1. Turn off the 567. Remove the 3S76 from the vertical plug-in receptacle. Connect P11, the horizontal plug on the back panel, to a 24 pin plug-in extension and connect the plug-in extension to J11 on the 567 main frame. Turn on the 567. See Figure 1-19.



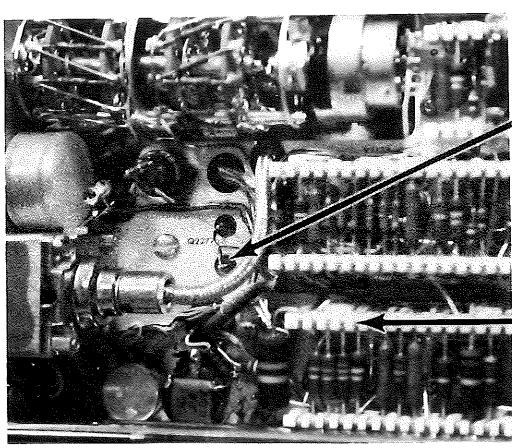
Plug-in extension

Figure 1-19

2. On the 3T77, turn the TRIGGER SENSITIVITY fully CCW.

B. +20v CHECK and REGULATION

1. Connect the DC meter from the emitter of Q2277 to ground. Check for a meter reading of +20v ±3%. See Figure 1-20.



Emitter of Q2277

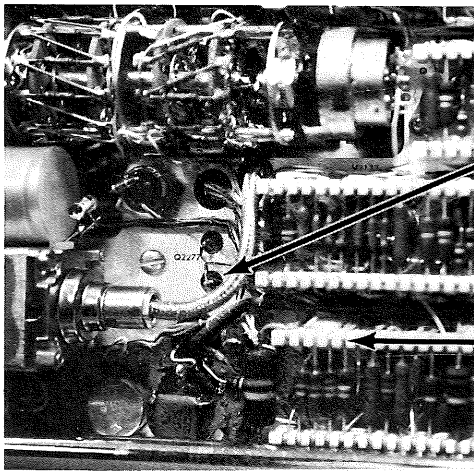
Alternate +20v
test point

Figure 1-20

2. Set the line voltage to 105v and check for +20v ±3%. Set the line voltage to 125v and check for +20v ±3%.

C. RIPPLE

1. Disconnect the DC meter and connect a X1 probe from the test scope to the emitter of Q2277. See Figure 1-21.

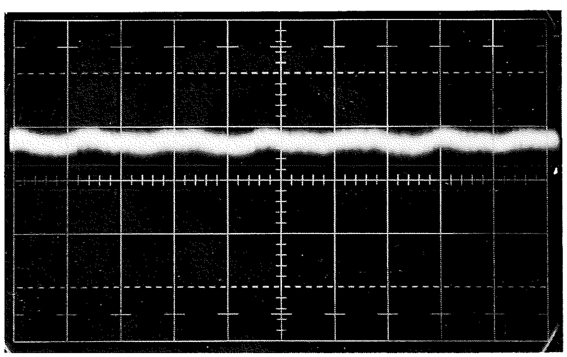


Emitter of Q2277

Alternate +20v test point

Figure 1-21

2. As the line voltage is varied from 105v to 125v the ripple voltage must not exceed 3mv. See Figure 1-22.



+20v ripple line voltage at 115v. Test scope AC coupled, 1 mv/cm, 5 msec triggered sweep.

Figure 1-22

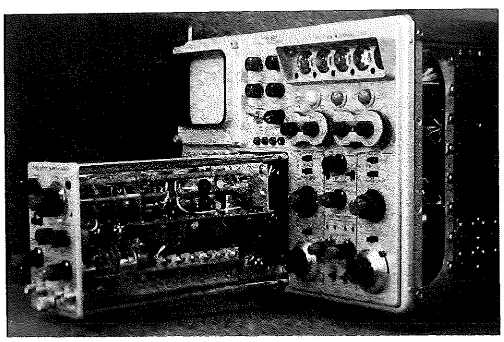
3. Disconnect the test scope.

V. 3T77 POWER SUPPLIES

The 3T77 power supplies are specified as +19.5v ±3% and -20v ±3%. They must regulate as the line voltage is varied from 105v to 125v. Maximum allowable ripple voltage for both supplies is 1mv.

A. PRELIMINARY SET UP

1. Turn off the 567. Remove the plug-in extension from the 3S76 and set the 3S76 in the vertical plug-in receptacle. Remove the 3T77 from the horizontal plug-in receptacle. Connect P21, the horizontal plug on the back panel, to a 24 pin plug-in extension and connect the plug-in extension to J21 on the 567 main frame. Turn on the 567. See Figure 1-23.



3T77 connected to 24 pin plug-in extension.

Figure 1-23

B. POWER SUPPLIES CHECK and REGULATION

1. Connect a DC meter to the emitter of Q724 and check for 19.5v ±3%. Set the line voltage to 105v and check for 19.5v ±3%. Set the line voltage to 125v and check for 19.5v ±3%. See Figure 1-24.

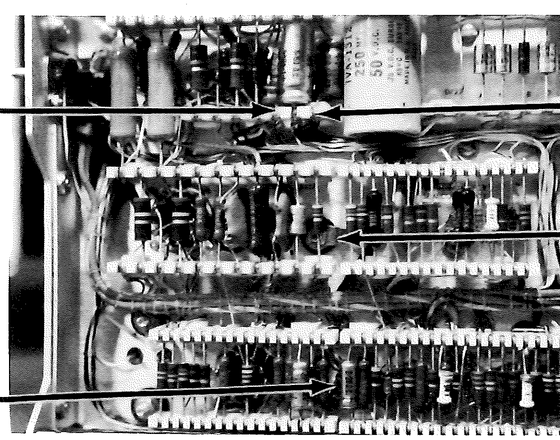


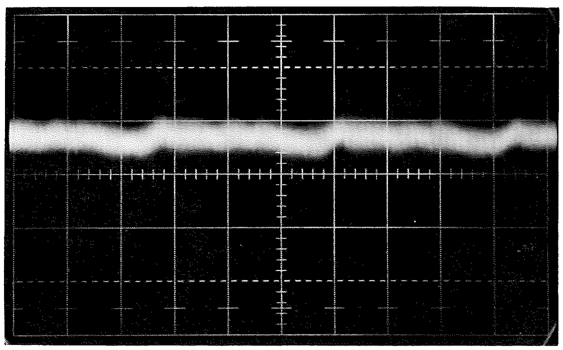
Figure 1-24

2. Connect the DC meter to the emitter of Q734 (or the collector of Q737) and check for -20v ±3%. Set the line voltage to 105v and check for -20v ±3%. Set the line voltage to 125v and check for -20v ±3%. See Figure 1-24.

C. RIPPLE

1. Connect a X1 probe from the test scope to the emitter of Q724.

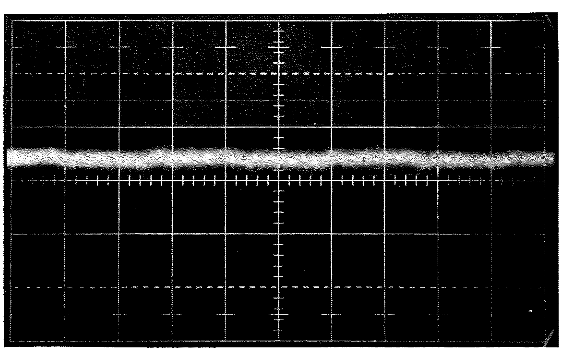
2. As the line voltage is varied from 105v to 125v the ripple voltage must not exceed lmv. See Figure 1-25.



+19.5v ripple line voltage at 115v. Test scope AC coupled, 1 mv/cm, 5 msec/cm, triggered sweep.

Figure 1-25

3. Connect the X1 probe to the emitter of Q734 (or collector of Q737). Repeat step 2. See Figure 1-26.



-20v ripple test scope same as step 2.

Figure 1-26

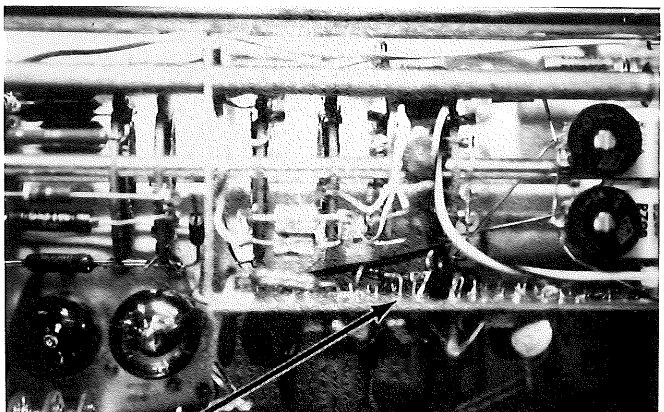
4. Set the line voltage to 115v. Disconnect the X1 probe.

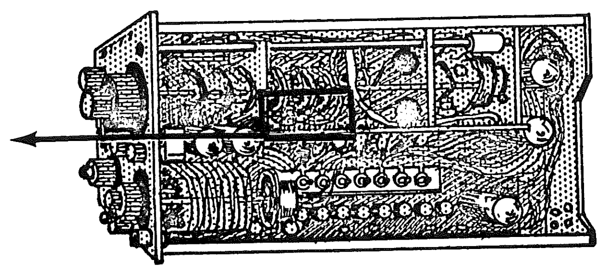
VI. 3T77 TRIGGER

A. TRIG SENS RANGE

With no signal applied, the sweep must free run when the TRIGGER SENSITIVITY control is set to within 10° of midrange. The sweep must disappear when the control is set CCW from the midrange position.

1. Set the TRIGGER SENSITIVITY control to midrange.
2. Connect a X10 probe to the junction of L14, R18, and D18. See Figure 1-27.

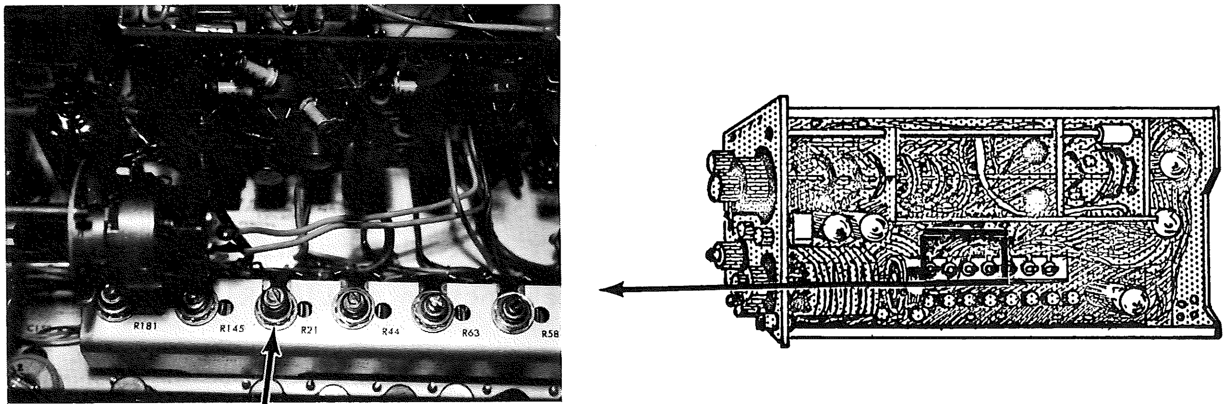




Junction of L14, R18, & D18

Figure 1-27

3. Set the test scope for a .2 μsec, internally triggered sweep. Vertical sensitivity is .2v (includes probe), AC coupled.
4. Adjust the Trig Sens Range, R21 - See Figure 1-28, so a positive pulse appears on the test scope. See Figure 1-29. The pulse must disappear when the TRIGGER SENSITIVITY is set about 10° CCW. A trace may appear on the 567 when the positive pulse is visible on the test scope. This will depend on the adjustment of the 2nd Trig Regen Sens, R44.

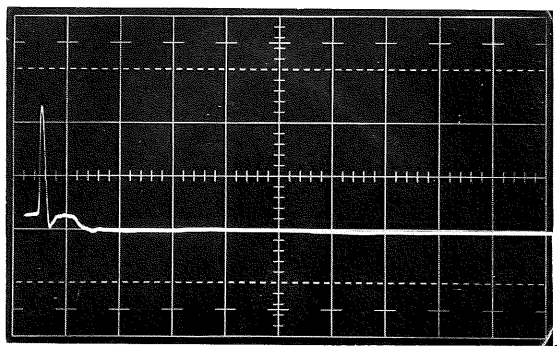


Trig Sens Range, R21

Figure 1-28

.2 μsec internally triggered sweep.

Vertical sensitivity .2v (includes probe), AC coupled.

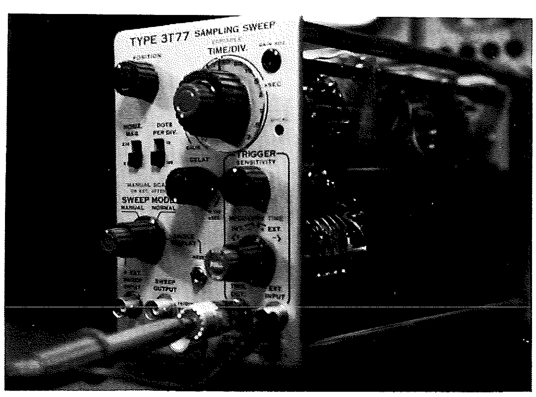


R21 adjusted so a positive pulse appears on the test scope.

Figure 1-29

B. 2nd TRIG REGEN SENS

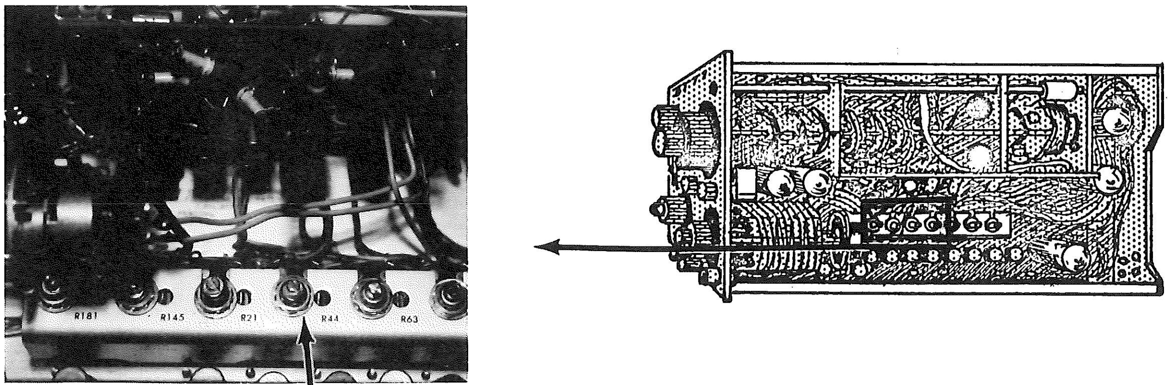
1. Set the TRIGGER SENSITIVITY control to midrange.
2. Connect the X10 probe to the Trig Out jack on the front panel of the 3T77. See Figure 1-30.



X10 probe connected to Trig Out jack.

Figure 1-30

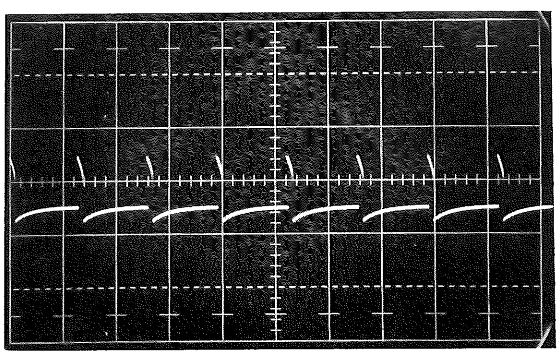
3. On the test scope, set the sweep speed to 10 μsec.
4. Adjust the 2nd Trig Regen Sens, R44 - See Figure 1-31, for a display of approximately a pulse per division. See Figure 1-32A and B. When the RECOVERY TIME control is set fully CW, the rep rate is usually between 75 and 80 KC. When the RECOVERY TIME control is set fully CCW, the rep rate is usually between 90 and 100 KC.



2nd Trig Regen Sens, R44

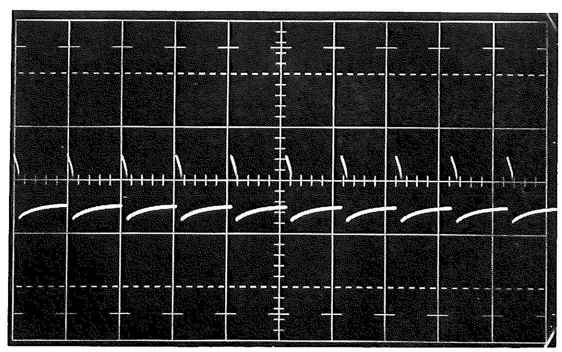
Figure 1-31

Sweep Speed 10 μsec



RECOVERY TIME set full CW

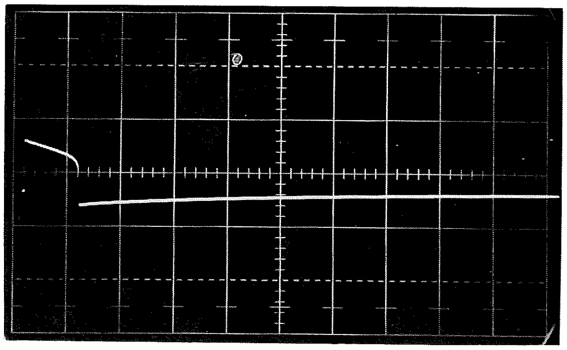
Figure 1-32A



RECOVERY TIME full CCW

Figure 1-32B

5. On the test scope, set the sweep speed to 1 μsec. Rotate the RECOVERY TIME control from full CW to full CCW, and check the display on the test scope for no jitter on the Trig Out waveform. See Figure 1-33.



test scope sweep speed 1 μsec

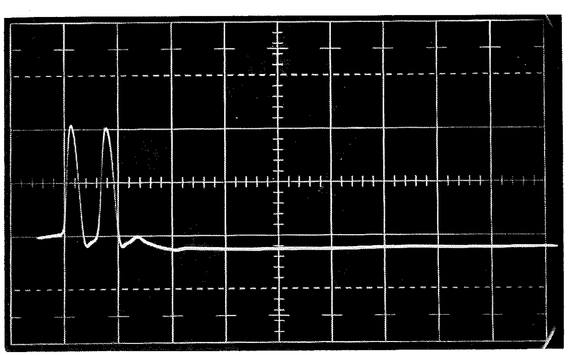
Check for no jitter as RECOVERY TIME control is set full CCW and full CW. Pulse width is normally from 1 μsec to 1.8 μsec.

Figure 1-33

6. A trace will now be visible on the 567. When the Trig Sens Range and the 2nd Trig Regen Sens are properly adjusted, the sweep will free run when the TRIGGER SENSITIVITY is set to midrange and the trace will disappear when the TRIGGER SENSITIVITY is set slightly CCW (about 10°).

C. HF SYNC

1. Again connect the X10 probe to the junction of L14, R18, and D18. On the test scope, set the sweep speed to .1 μsec.
2. Turn the TRIGGER SENSITIVITY control fully CW and turn the RECOVERY TIME control fully CW. Two (2) positive pulses should be displayed on the test scope. See Figure 1-34.

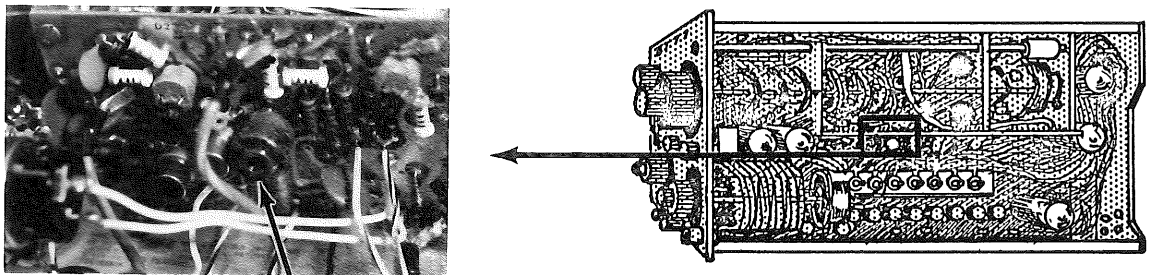


test scope sweep speed at .1 μsec

TRIGGER SENSITIVITY and RECOVERY TIME controls set full CW.

Figure 1-34

3. Pull out the PULL FOR SYNC control (RECOVERY TIME control). Adjust the D25 Current Range, R24 - See Figure 1-35, for 10 pulses (nominal setting is from 8 to 12 pulses). See Figure 1-36.

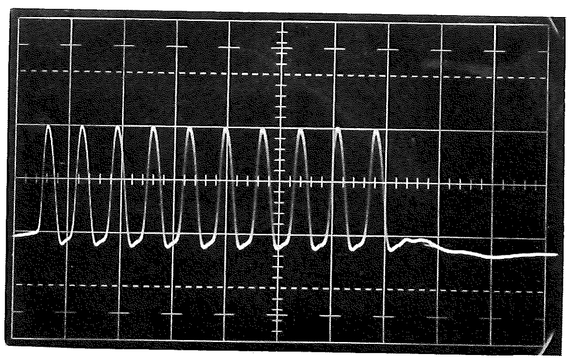


D25 Current Range, R24

R24 is located on the underside of the p.c. board.

Figure 1-35

Test scope sweep speed .1 μsec

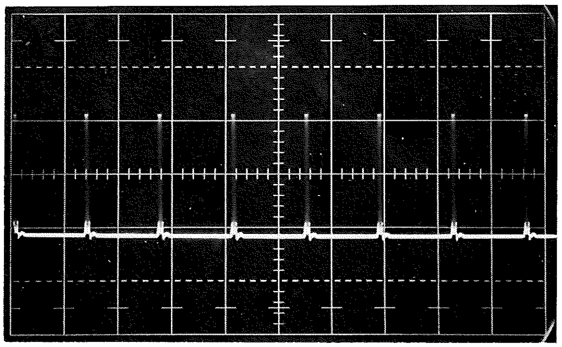


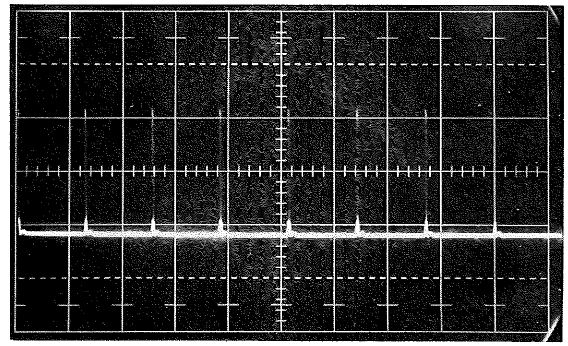
R24 adjusted for 10 pulses (11th pulse almost visible).

Figure 1-36

4. On the test scope, set the sweep speed to 10 μsec. Note the difference in waveform and rep rate as the PULL FOR SYNC control is pushed in. See Figure 1-37.

Test scope sweep speed 10 μsec





PULL FOR SYNC pulled

PULL FOR SYNC not pulled

RECOVERY TIME control set full CW for these pictures.

Figure 1-37

5. When the Trig Sens Range, the 2nd Regen Sens, and the D25 Current Range are properly adjusted, the sweep (567) must free run as the TRIGGER SENSITIVITY is set to midrange or further CW and the sweep must disappear as the TRIGGER SENSITIVITY control is set slightly CCW from midrange (approximately 10°).
6. Remove the X10 probe. Turn off the 567. Remove the 3T77 from the plug-in extension and place the 3T77 in the horizontal plug-in receptacle. Turn on 567.

VII. 3S3 +20v SUPPLY (corresponds to IV)

The +20v supply is specified as +20v ±2v.

A. PRELIMINARY SET UP (See Presets, Page 1-5)

1. Turn off the 567. Remove the 3S3 from the vertical plug-in receptacle. Connect P11, the horizontal plug on the back panel, to a 24 pin plug-in extension and connect the plug-in extension to J11 on the 567 main frame. Turn on the 567. See Figure 1-38.

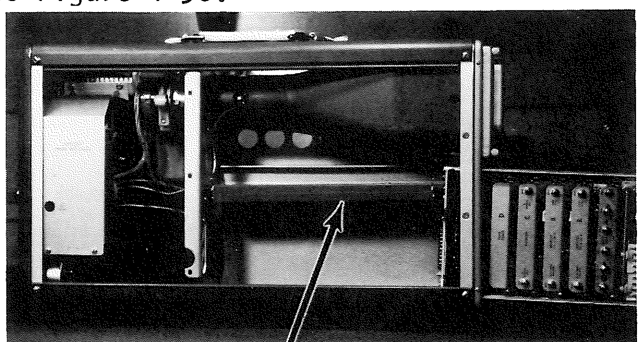


Figure 1-38

2. On the 3T77, turn the TRIGGER SENSITIVITY full CCW.

B. +20v CHECK

1. Connect the DC meter to pin M of each 3S3 plug-in board and check for +20v. See Figure 1-39.

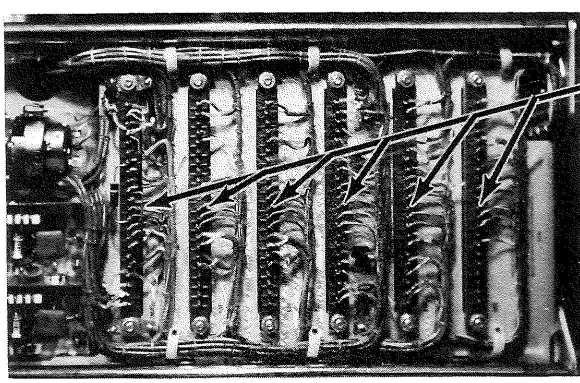


Figure 1-39

2. Disconnect the DC meter and turn off the 567. Remove the 3S3 from the plug-in extension and set the 3S3 into the vertical plug-in receptacle.

VIII. 3A2 POWER SUPPLIES (corresponds to IV)

The +20v supply is specified as +20v ±2v. The +43v supply is specified as +43v ±2.15v.

A. PRELIMINARY SET UP

1. Turn off the 567. Remove the 3A2 from the vertical plug-in receptacle. Connect P11, the horizontal plug on the back panel, to a 24 pin plug-in extension and connect the plug-in extension to J11 on the 567 main frame. Turn on the 567. See Figure 1-40.

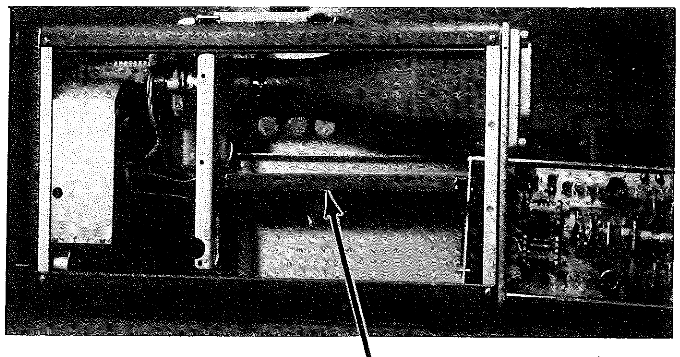


Figure 1-40

2. On the 3B2, turn the TRIGGER LEVEL full CCW.

B. +20v CHECK

1. Connect the DC meter across D326 (cathode to ground). Check for +20v ±2v. See Figure 1-41.

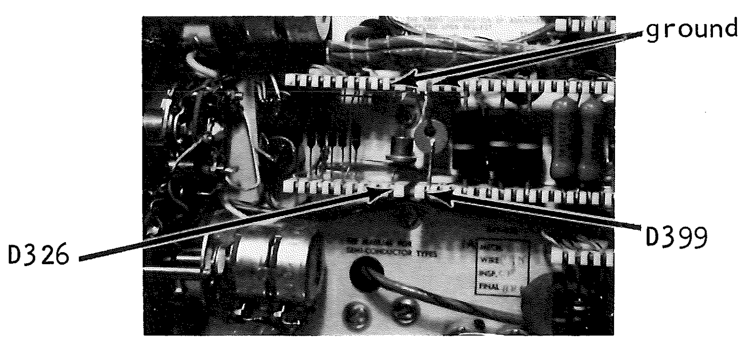


Figure 1-41

2. Connect the DC meter across D399 (cathode to ground). Check for +43v ±2.15v. See Figure 1-42.
3. Disconnect the DC meter and turn off the 567. Remove the 3A2 from the plug-in extension and set the 3A2 into the vertical plug-in receptacle.

IX. 3B2 +15v SUPPLY (corresponds to V)

The +15v supply is specified as +15v ±0.75v.

A. PRELIMINARY SET UP

1. Turn off the 567. Remove the plug-in extension from the 3A2 and set the 3A2 into the vertical plug-in receptacle. Remove the 3B2 from the horizontal plug-in receptacle. Connect P21, the horizontal plug on the back panel, to a 24 pin plug-in extension and connect the plug-in extension to J21 on the 567 main frame. Turn on the 567. See Figure 1-42.

3B2 connected to 24 pin plug-in extension.

Figure 1-42

B. +15v CHECK

1. Connect the DC meter to pin 13 of any plug-in connector in the 3B2 (J1, J2, J3, or J4). Check for +15v ±0.75v. See Figure 1-43.

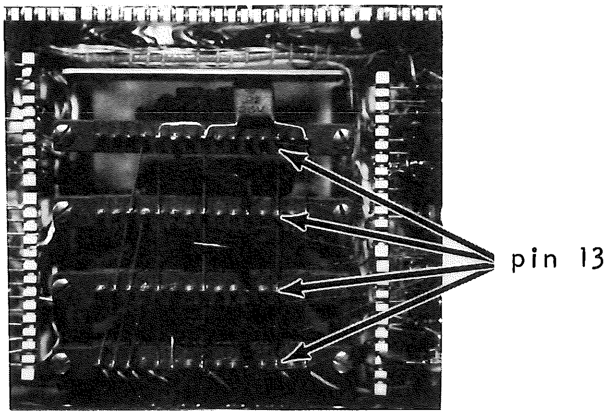


Figure 1-43

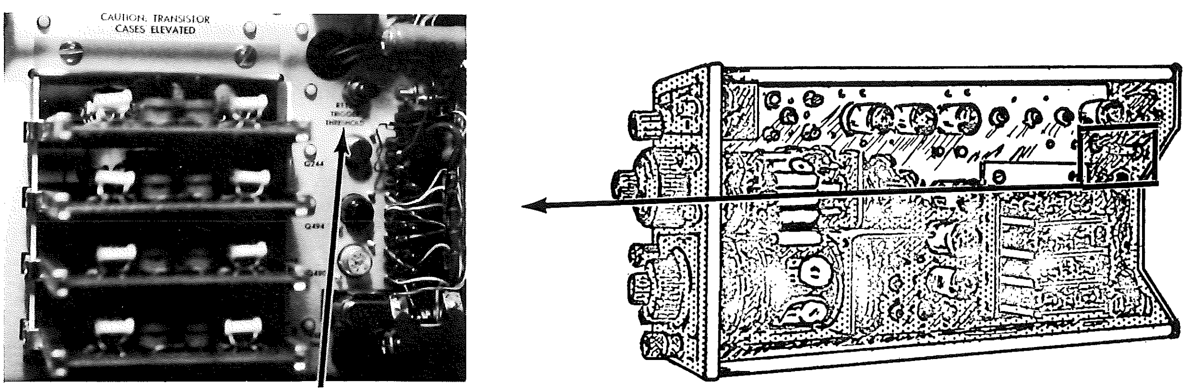
2. Disconnect the DC meter.

X. 3B2 TRIGGER THRESHOLD (corresponds to VI)

With no signal applied, the Trigger Threshold is adjusted so the trace free runs when the TRIGGER LEVEL is set to FREE RUN (full CW - in detent). The trace must disappear when the TRIGGER LEVEL is switched out of FREE RUN.

A. TRIGGER THRESHOLD

1. Set the TRIGGER LEVEL to FREE RUN (full CW - in detent).
2. Adjust the Trigger Threshold, R110 - See Figure 1-44, so the trace free runs.



Trigger Threshold R110

Figure 1-44

3. Set the TRIGGER LEVEL out of FREE RUN. The trace must disappear.

4. Turn off the 567. Remove the 3B2 from the plug-in extension and set the 3B2 into the horizontal plug-in receptacle. Turn on the 567.

SECTION II

Section II is the calibration of the Memory and Comparator circuits in the 6R1A. Part III of this section, which is the balancing of the memory and comparator circuits, departs from methods outlined in earlier calibration procedures. A special introduction is given for Part III. The other things in this section follow methods similar to those outlined in earlier procedures.

The 3S76 and 3T77 are used exclusively in this section. If other plug-ins are used, the procedure must be modified accordingly.

OUTLINE OF ADJUSTMENTS

		Page No.
I.	A MEMORY ZONES	2-4
II.	B MEMORY ZONES	2-9
III.	MEMORY and COMPARATOR BALANCE	2-13
IV.	START and STOP COMPARATOR 3-DOT DELAY	2-25
V.	MEMORY DRIFT	2-30

<u>EQUIPMENT REQUIRED</u>:

540 series oscilloscope or equivalent
Vertical preamp, comparison voltage type (W or Z)
Type 105 or equivalent
Two (2) 5X 50Ω GR attenuators (017-045)
Male BNC to GR adaptor (017-064)
Male UHF to female BNC adaptor (103-015)
Banana lead adaptor (012-059) <u>OR</u>: Clip lead adaptor (013-003)

Preset the front panel controls:

<u>567</u>

FOCUS	
ASTIGMATISM	
INTENSITY	Adjust for a sharply defined,
SCALE ILLUM	easily discernible trace.

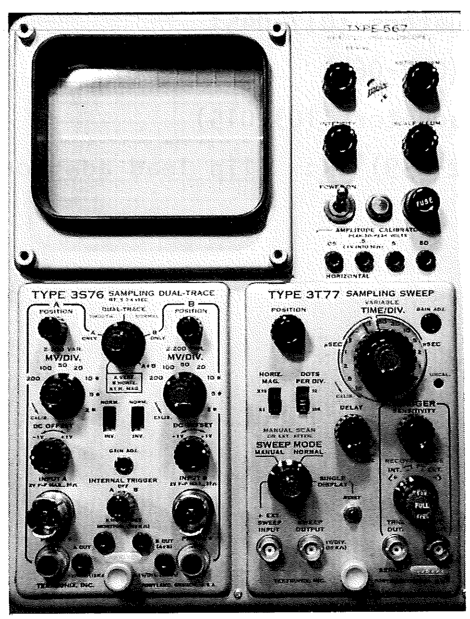
<u>3S76</u>

MODE	A only
SMOOTH-NORMAL	NORMAL
INTERNAL TRIGGER	OFF
CH A and CH B	
POSITION	midrange
MV/DIV	200
NORM-INV	NORM

<u>3T77</u>

TIME/DIV	.1 µsec
POSITION	midrange
HORIZ MAG	X1
DOTS PER DIV	100
TRIGGER SENSITIVITY	CW
SWEEP MODE	NORMAL

Figure 2-1 shows the proper set up.

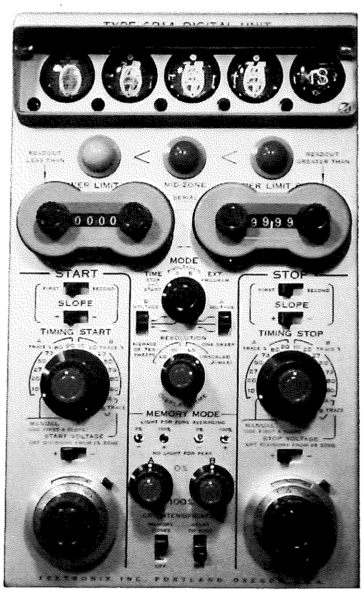


<u>Figure 2-1</u>

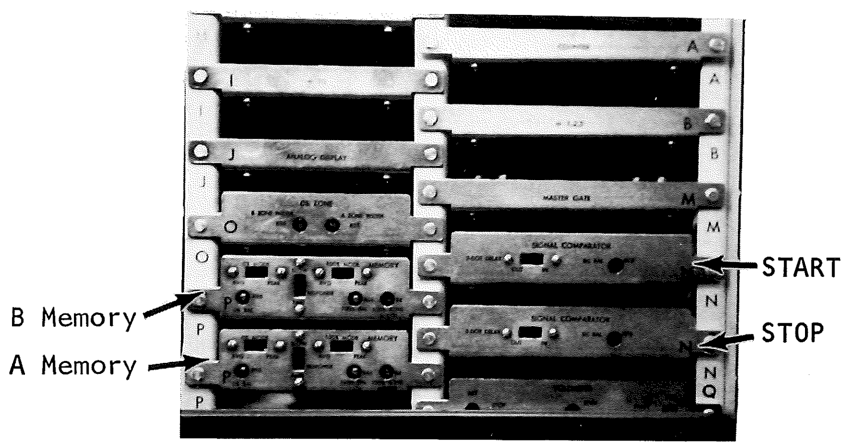
6R1A

MODE	TIME STOP (-) START
RESOLUTION	ONE SWEEP UNSCALED (max)
ZONE POSITION	
A 100%	midrange
A 0%	midrange
B 100%	midrange
B 0%	midrange
CRT INTENSIFICATION	
MEMORY ZONES	UP (on)
START TO STOP	DOWN (off)
START and STOP CONTROLS	
SLOPE	FIRST +
TIMING START (STOP)	MANUAL (CCW)
INTERNAL CONTROLS	
A and B MEMORY	
0% MODE	AVG
100% MODE	AVG
RESPONSE	SLOW
START and STOP SIGNAL COMPARATOR	
3-DOT DELAY	IN

Figure 2-2A and B show the proper set up.



A



B

Figure 2-2

I. A MEMORY ZONES

The ZONE POSITION controls must be able to position the zone over at least 8.5 divisions of the graticule.

The Zone Width controls must be able to adjust the zone to cover 10.5 divisions of trace.

A. 0% ZONE WIDTH

1. On the 3S76, adjust the CH A POSITION and DC OFFSET controls to position the trace on the CRT.
2. Switch the NORM-INV control from NORM to INV and adjust the DC OFFSET control for no vertical trace shift. With the POSITION control, keep the trace on the CRT.
3. On the 3T77, adjust the POSITION control so the trace starts at the 1st graticule line.
4. On the 6R1A, set the A 100% ZONE POSITION control full CCW. Set the A 0% ZONE POSITION control so the 0% zone is out of the dead zone. See Figure 2-3.

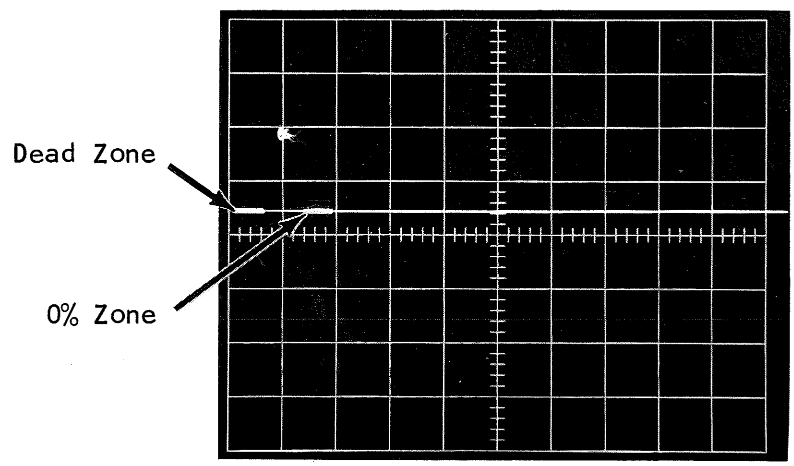
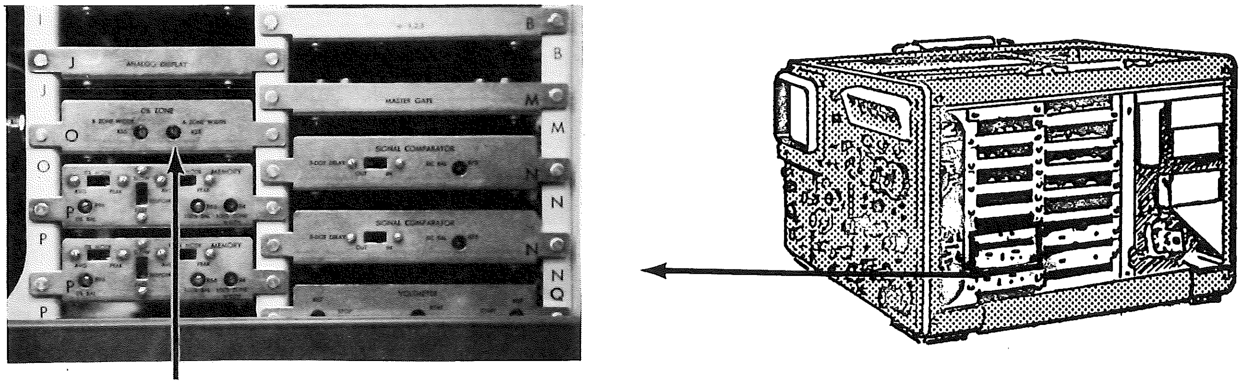


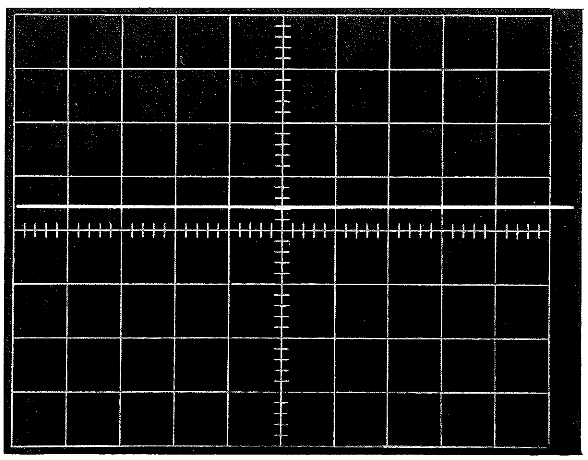
Figure 2-3

5. Set the A 0% Zone Width, R25 - See Figure 2-4, full CW. The 0% zone must cover the trace. (The 0% ZONE POSITION control may have to be set CCW to set the left end of the 0% zone into the dead zone). See Figure 2-5.



A 0% Zone Width R25

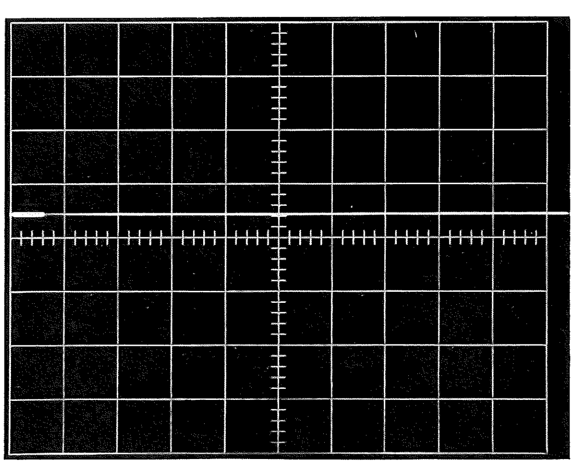
Figure 2-4



When R25 is set full CW, the entire trace must be intensified.

Figure 2-5

6. Position the left end of the 0% zone out of the dead zone. Set the A 0% Zone Width, R25, full CCW. The 0% zone must disappear. See Figure 2-6.



When R25 is set full CCW, the 0% zone must disappear.

Figure 2-6

7. Adjust the A 0% Zone Width so the 0% zone is roughly 0.5 divisions wide. See Figure 2-7.

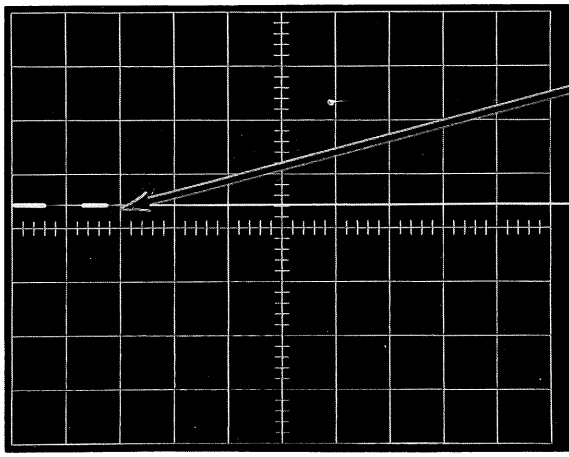


Figure 2-7

NOTE: The Zone Width is a convenience adjustment. The Zone Width should be wide enough to allow the 0% memory circuit time to change to the proper DC level.

B. 0% ZONE POSITION RANGE

1. Set the A 0% ZONE POSITION control full CCW. The 0% zone must disappear into the dead zone.
2. Set the A 0% ZONE POSITION control full CW. The 0% zone must go 8.5 divisions from the start of the trace. See Figure 2-8.

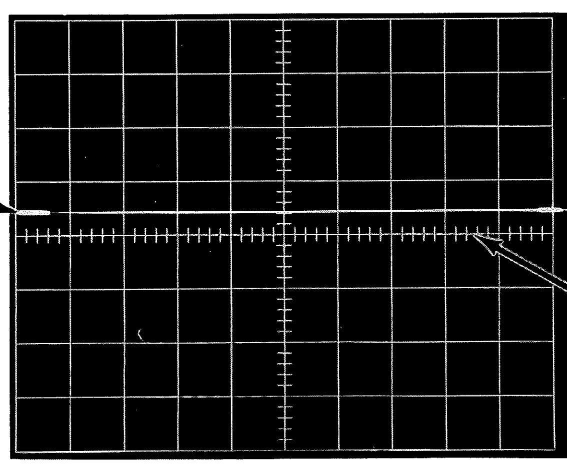
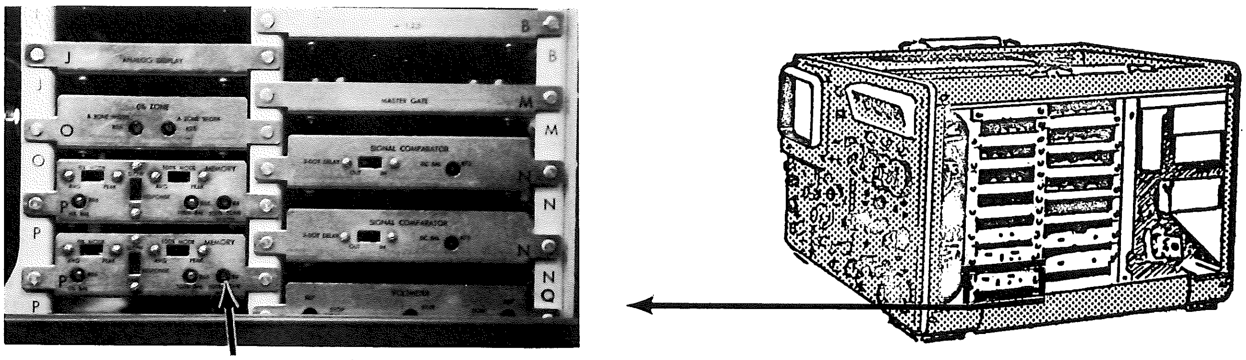


Figure 2-8

3. Set the A 0% ZONE POSITION control full CCW.

C. 100% ZONE WIDTH

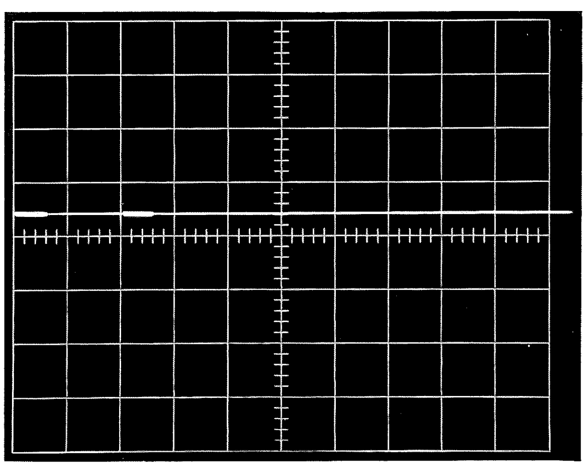
1. Set the A 100% ZONE POSITION control so the 100% zone is out of the dead zone.
2. Set the A 100% Zone Width, R4 - See Figure 2-9, full CW. The 100% zone must cover the trace.



A 100% Zone Width, R4

Figure 2-9

3. Position the left end of the 100% zone out of the dead zone. Set the A 100% Zone Width, R4, full CCW. The 100% zone must disappear.
4. Adjust the A 100% Zone Width so the 100% zone is roughly 0.5 divisions wide. See Figure 2-10.



A 100% Zone Width, R4, adjusted for roughly 0.5 divisions.

Figure 2-10

D. 100% ZONE POSITION RANGE

1. Set the A 100% ZONE POSITION control full CCW. The 100% zone must disappear into the dead zone.
2. Set the A 100% ZONE POSITION control full CW. The 100% zone must go 8.5 divisions from the start of the trace. See Figure 2-11.

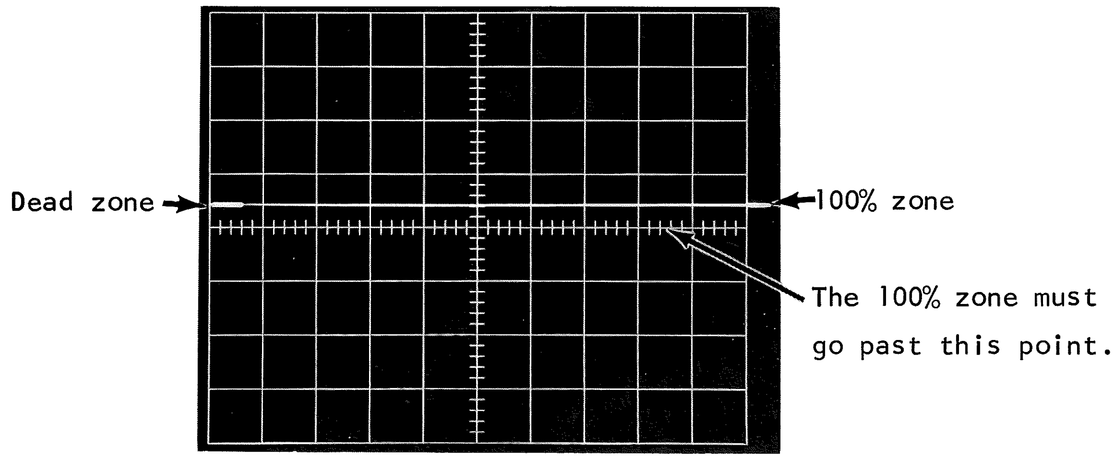


Figure 2-11

3. Set the A 0% and 100% ZONE POSITION controls so both the 0% and 100% zones are out of the dead zone and visible on the CRT. See Figure 2-12.

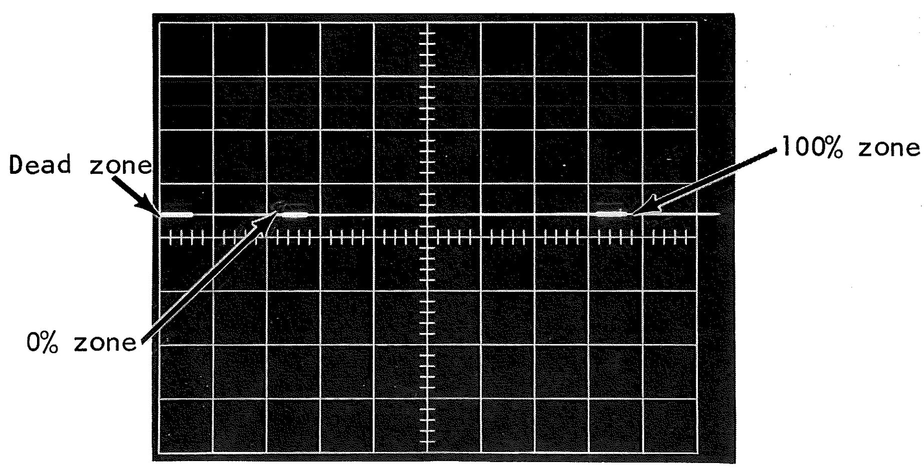


Figure 2-12

II. B MEMORY ZONES

The ZONE POSITION controls must be able to position the zone over at least 8.5 divisions of the graticule.

The Zone Width controls must be able to adjust the zone to cover 10.5 divisions of trace.

A. 0% ZONE WIDTH

1. On the 3S76, set the MODE to B ONLY. Adjust the CH B POSITION and DC OFFSET controls to position the trace on the CRT.
2. Switch the NORM-INV control from NORM to INV and adjust the DC OFFSET control for no vertical trace shift. With the POSITION control, keep the trace on the CRT.
3. On the 6R1A, set the B 100% ZONE POSITION control full CCW. Set the B 0% ZONE POSITION control so the 0% zone is out of the dead zone. See Figure 2-13.

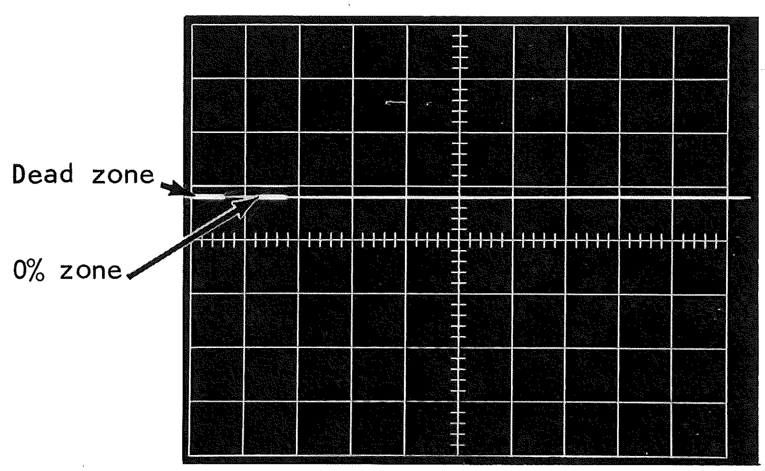
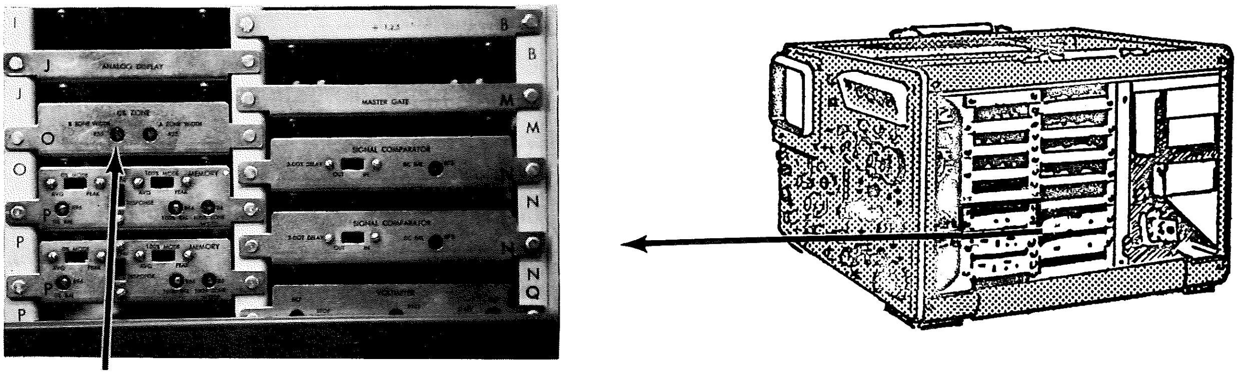


Figure 2-13

4. Set the B 0% Zone Width, R25 - See Figure 2-14, full CW. The 0% zone must cover the trace. (The 0% ZONE POSITION control may have to be set CCW to set the left end of the 0% zone into the dead zone).



B 0% Zone Width, R55

Figure 2-14

5. Position the left end of the 0% zone out of the dead zone. Set the B 0% Zone Width, R55, full CCW. The 0% zone must disappear.
6. Adjust the B 0% Zone Width so the 0% zone is roughly 0.5 divisions wide. See Figure 2-15.

R25 adjusted so the B 0% zone is roughly 0.5 divisions wide.

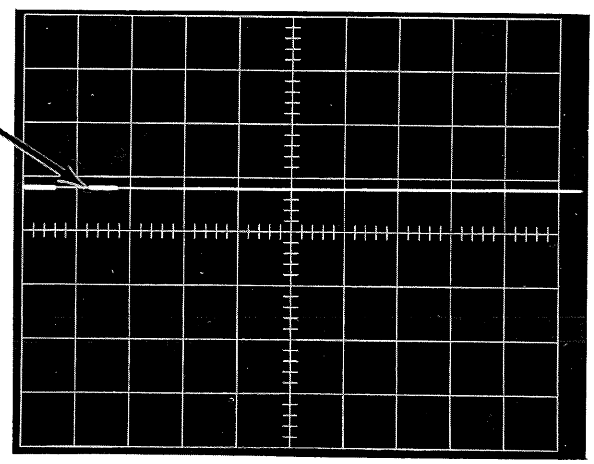


Figure 2-15

B. 0% ZONE POSITION RANGE

1. Set the B 0% ZONE POSITION control full CCW. The 0% zone must disappear into the dead zone.
2. Set the B 0% ZONE POSITION control full CW. The 0% zone must go 8.5 divisions from the start of the trace. See Figure 2-16.

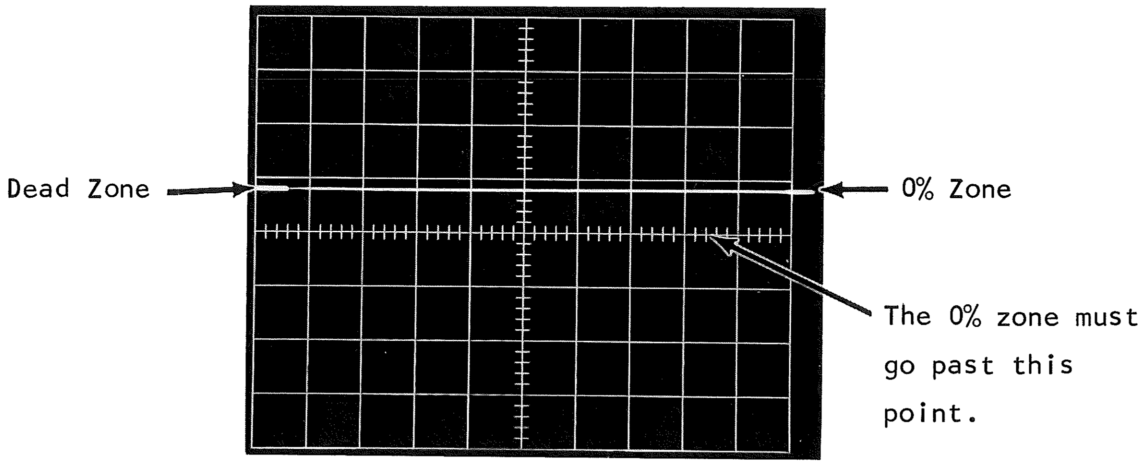


Figure 2-16

3. Set the B 0% ZONE POSITION control full CCW.

C. 100% ZONE WIDTH

1. Set the B 100% ZONE POSITION control so the 100% zone is out of the dead zone.
2. Set the B 100% Zone Width, R4 - See Figure 2-17, full CW. The 100% zone must cover the trace.

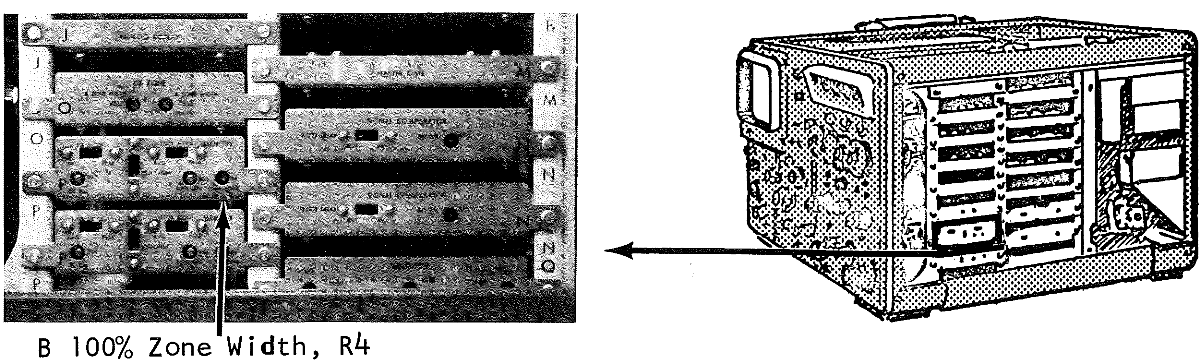


Figure 2-17

3. Position the left end of the 100% zone out of the dead zone. Set the B 100% Zone Width, R4, full CCW. The 100% zone must disappear.
4. Adjust the B 100% Zone Width so the 100% zone is roughly 0.5 divisions wide.

D. 100% ZONE POSITION RANGE

1. Set the B 100% ZONE POSITION control full CCW. The 100% zone must disappear into the dead zone.
2. Set the B 100% ZONE POSITION control full CW. The 100% zone must go 8.5 divisions from the start of the trace. See Figure 2-18.

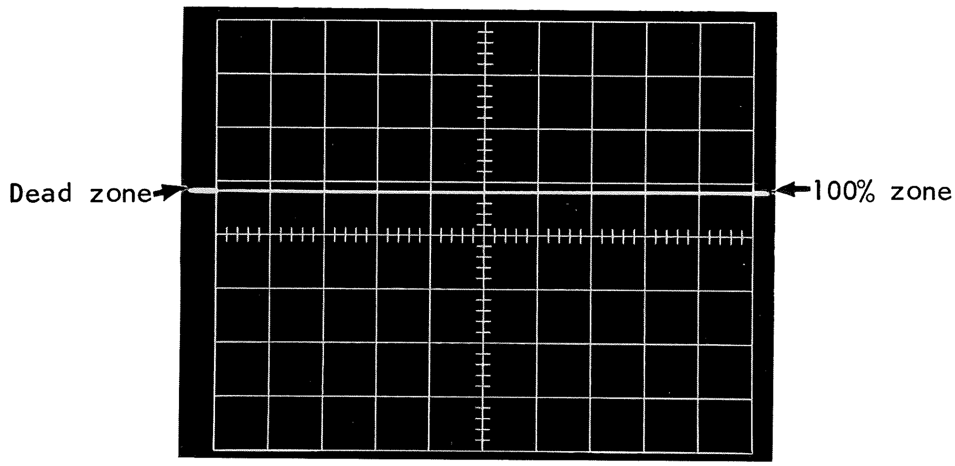


Figure 2-18

3. Set the B 0% and 100% ZONE POSITION controls so both the 0% and 100% zones are out of the dead zone and visible on the CRT. See Figure 2-19.

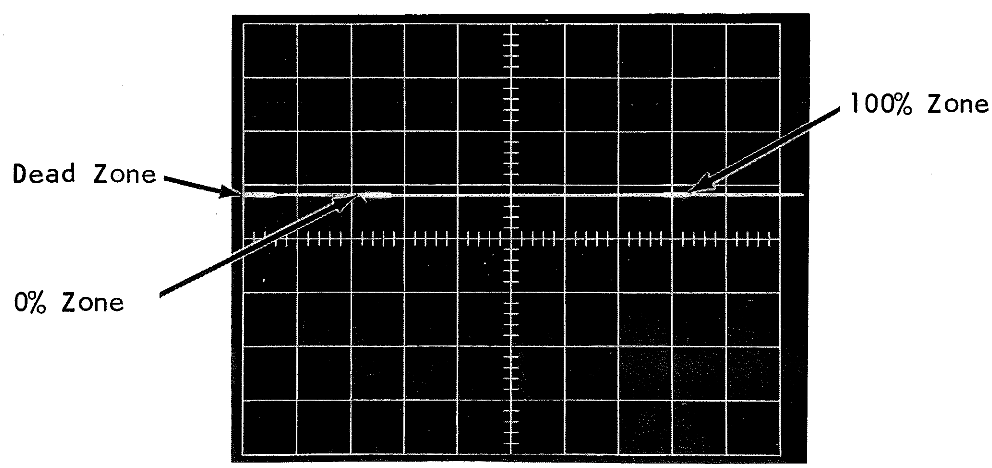


Figure 2-19

III. MEMORY and COMPARATOR BALANCE

The comparator circuits traditionally have been adjusted under dynamic operating conditions while the memory circuits have been adjusted under static conditions. In this procedure, both the comparator and memory circuits will be adjusted under dynamic operating conditions. Dynamic balancing is the better method as it is performed under normal circuit operating conditions with all signal noise present.

Unbalance in these circuits can be determined by observing the behavior of the start-to-stop intensified zone under various measurement programs. Continuing in this vein, if unbalance can be observed, it can also be adjusted to zero. Our ability to discern unbalance is limited by the noise present in the system. The inherent noise of a sampling system is greater than a real time system. Therefore, our ability to discern and adjust out unbalance is better with real time units than with sampling units.

Another factor limiting our ability to discern and adjust out unbalance is the type of waveform displayed. It is easier to discern unbalance in a rectangular waveform than in a sine wave or sawtooth waveform.

Comparator unbalance is a pick-off error voltage which appears to invert as the START or STOP SLOPE is switched from plus (+) to minus (-). Memory versus signal unbalance appears as a pick-off error voltage which appears to invert if the NORM-INV switch on the vertical plug-in is thrown.

Memory and comparator balance will be accomplished by applying a pulse of a rectangular nature to the vertical plug-in. While the amplitude of the pulse is decreased, the start-to-stop intensified zone is observed under the conditions stated in the preceeding paragraph. The pulse amplitude will eventually be reduced to the point where the circuits will no longer be able to recognize the various measurement programs. We will then have balanced the circuits within the limitations of the system.

The comparators and memories are specified as follows:
The 6R1A, 3S76 (3S3), 3T77 combination must recognize these programs with 1 minor division of a 1 MC signal from the Type 105 displayed on the CRT.

> STOP or START, 10% or 90%, plus (+) or minus (-), normal or inverted.

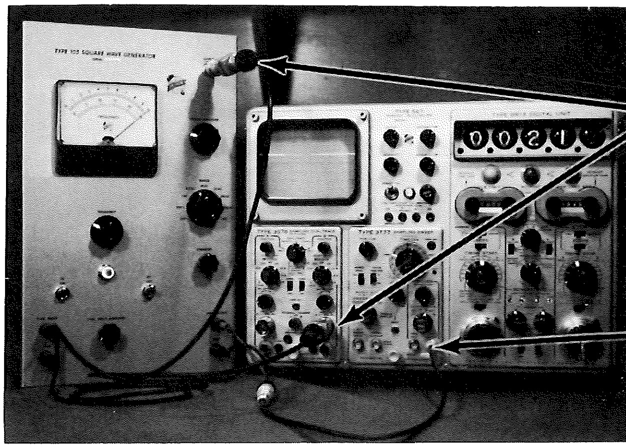
The 6R1A, 3A2, 3B2 combination must recognize these programs with 0.5 (1/2) minor divisions of signal from the 567 calibrator displayed on the CRT.

> STOP or START, 10% or 90%, plus (+) or minus (-), normal or inverted.

Those things that limit our ability to discern unbalance also limit the accuracy of the measurements made by the 6R1A. As can be seen by the specifications stated above, the 6R1A can make measurements far more accurately than an operator viewing the analog display on the CRT.

A. START COMPARATOR BALANCE

1. Apply power to a Type 105. Set output frequency of the 105 to 1 MC. Set the output amplitude to minimum (control full CCW). Connect the output of the 105 to the CH B input connector through two (2) 5X attenuators. Connect the sync output on the 105 to the EXT. IN (TRIGGER) on the 3T77. See Figure 2-20.

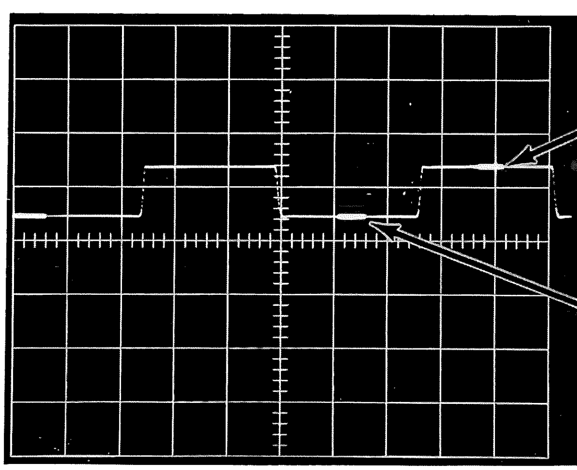


5X Attenuators

EXT. IN (TRIGGER)

Figure 2-20

2. On the 3T77, set the TRIGGER SELECTOR to EXT. - (minus). Set the TIME/DIV to .2 μsec.
3. On the 105, adjust the output amplitude control for approximately 1 division of vertical deflection on the 567. Obtain a stable display with the TRIGGER SENSITIVITY control on the 3T77. Position the 0% and 100% zones appropriately on the waveform. See Figure 2-21.



100% Zone

The DELAY & RECOVERY TIME controls may require adjustment to insure that the portion of the display in the dead zone is the negative part of the signal.

0% Zone

Figure 2-21

4. On the 6R1A, set the CRT INTENSIFICATION START TO STOP control up (on). Set the MANUAL START control so the intensified zone starts before the first positive slope. Set the MANUAL STOP control so the intensified zone stops after the first negative slope. See Figure 2-22.

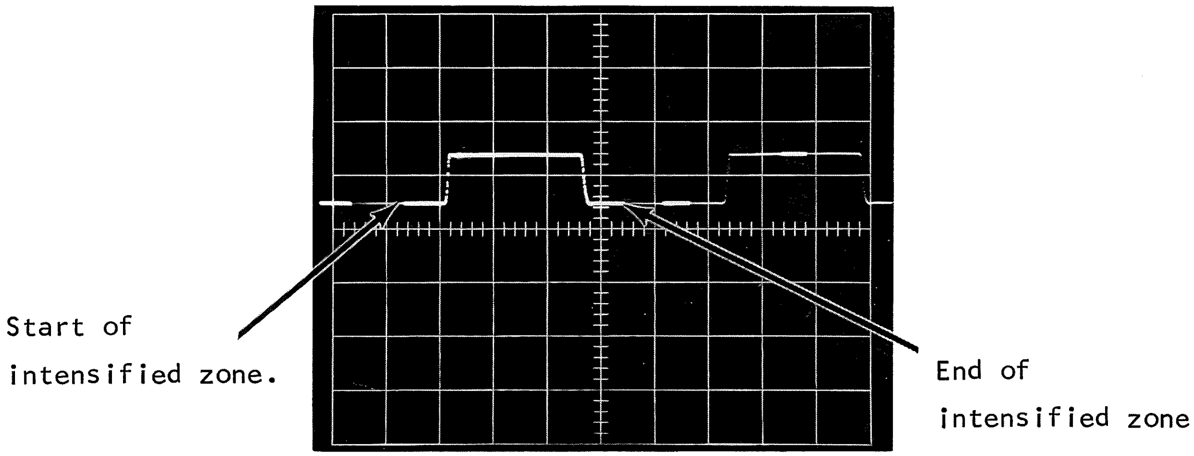


Figure 2-22

5. Set the TIMING START control to B TRACE 50%.
6. Switch the START SLOPE control from + to - while reducing the signal amplitude. Adjust the DC Bal, R75 - See Figure 2-23, so the comparator will switch on the positive and negative slopes of the waveform. See Figure 2-24.

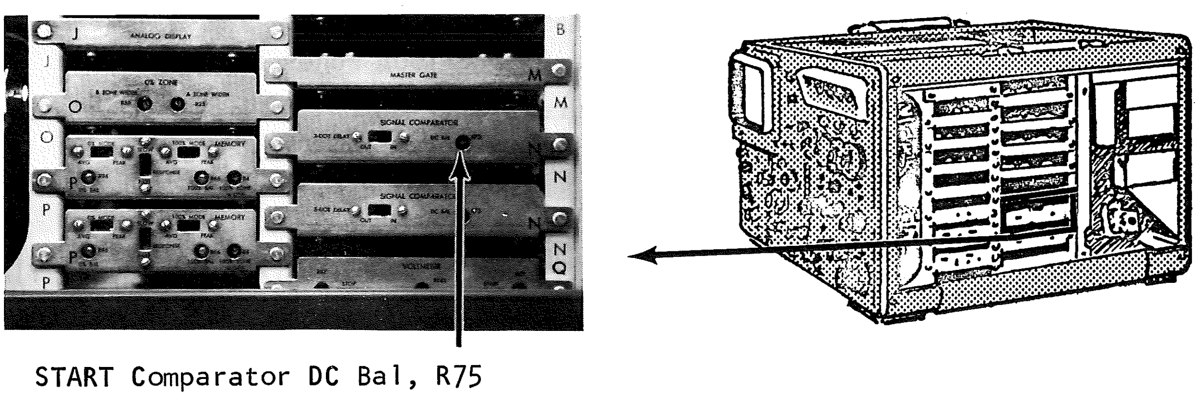
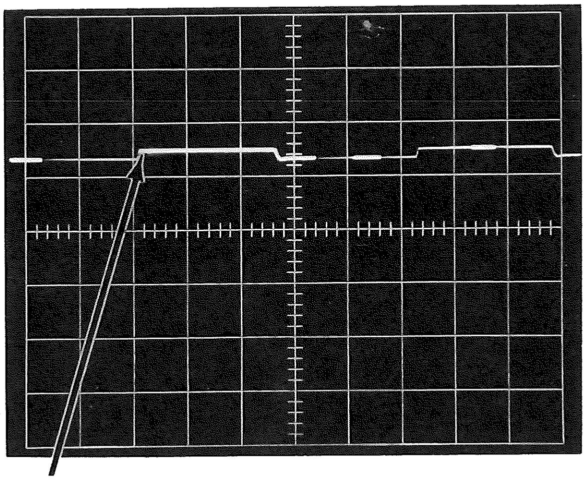
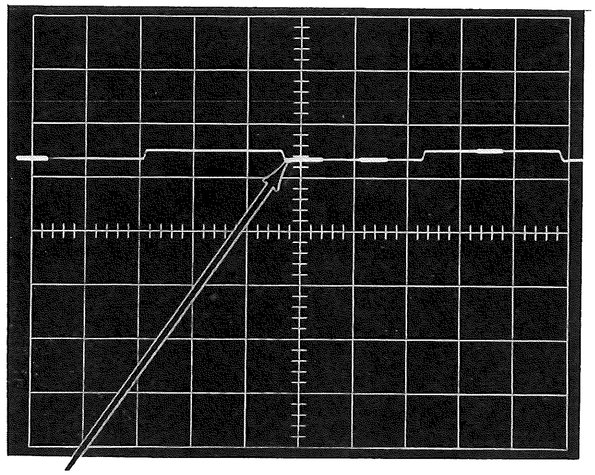


Figure 2-23



Start Comparator recognizing 50%
point of the 1st positive slope.



Start Comparator recognizing 50%
point of the 1st negative slope.

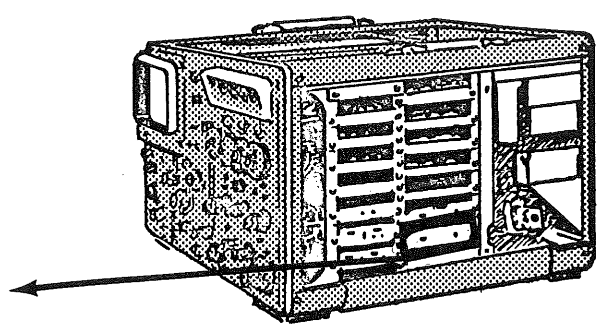
NOTE: The 3-dot delay is switched in on both comparators.

Figure 2-24

7. A signal amplitude will be found where the comparator will not switch on either the positive or negative slope, and where a small increase in amplitude will allow it to switch on either the signal or noise.

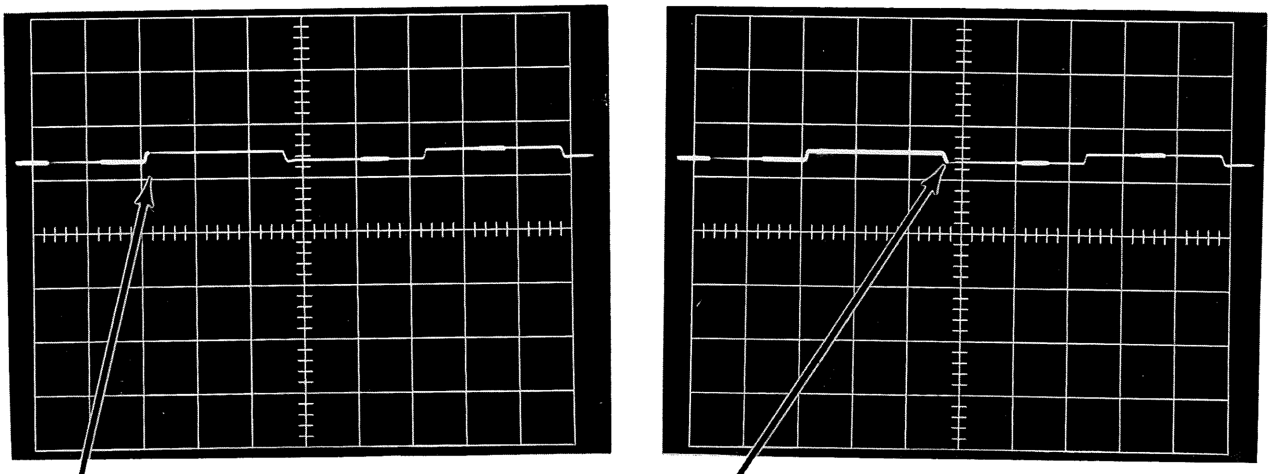
B. STOP COMPARATOR BALANCE

1. Adjust the output amplitude control on the 105 for approximately 1 division of vertical deflection on the 567.
2. Set the TIMING START control to MANUAL, (START SLOPE control must be at +) and the TIMING STOP control to B TRACE 50%.
3. Switch the STOP SLOPE control from + to - while reducing the signal amplitude. Adjust the DC BAL, R75 - See Figure 2-25, so the comparator will switch on the positive and negative slopes of the waveform. See Figure 2-26.



Stop Comparator DC Bal, R75

Figure 2-25



Stop Comparator recognizing 50% point of the 1st positive slope.

Stop Comparator recognizing 50% point of the 1st negative slope.

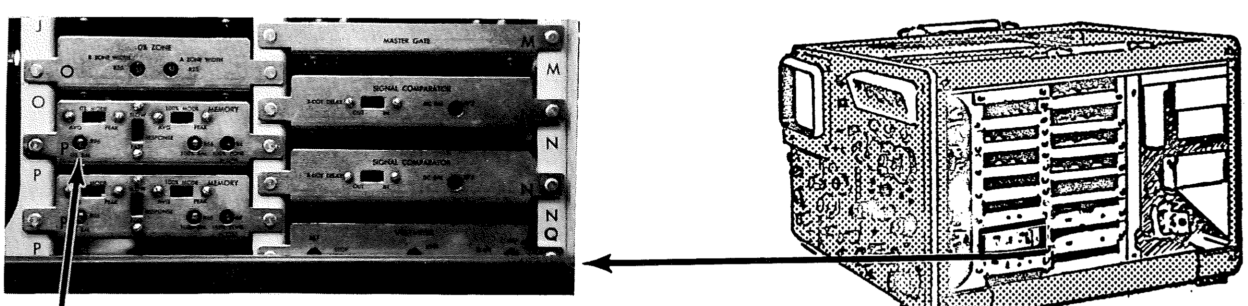
Figure 2-26

4. A signal amplitude will be found where the comparator will not switch on either the positive or negative slope, and where a small increase in amplitude will allow it to switch on either the signal or noise.

C. B 0% MEMORY BALANCE

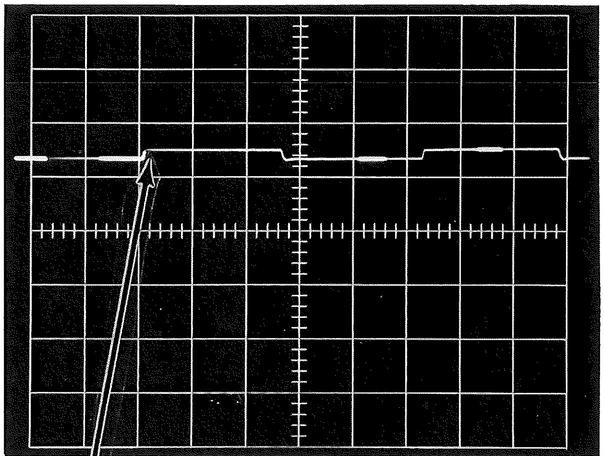
1. On the 105, set the output amplitude for approximately 1 division of vertical deflection on the 567. On the 6R1A, set the TIMING STOP control to B TRACE 10%. Set the STOP SLOPE control to +.

2. Reduce the signal amplitude while throwing the NORM-INV control on the vertical plug-in. Adjust the 0% Bal, R96 - See Figure 2-27, so the comparator will switch on the normal or inverted waveform. See Figure 2-28.

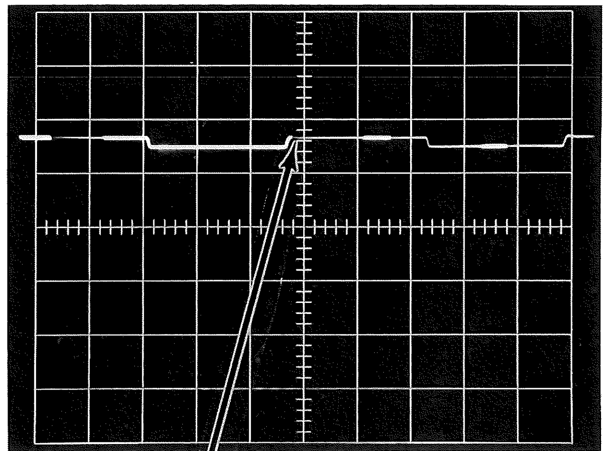


B Memory 0% Bal, R96

Figure 2-27



Stop Comparator recognizing 10% point of the 1st positive slope on normal waveform.



Stop Comparator recognizing 10% point of the positive pulse on inverted waveform.

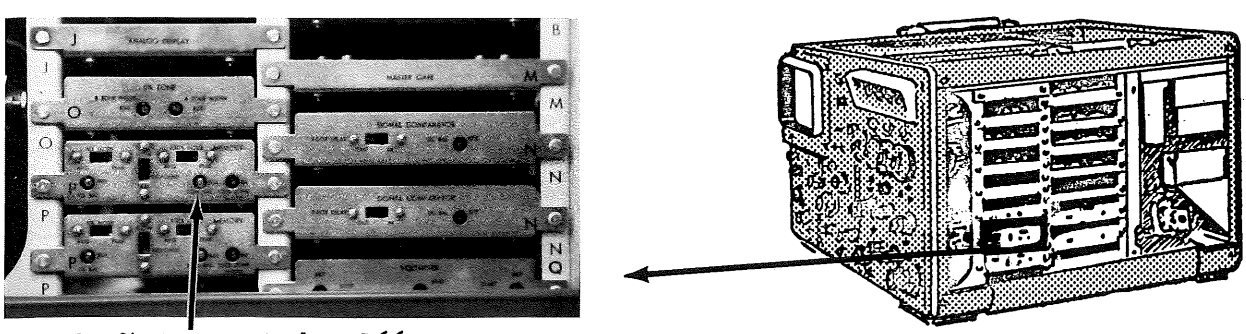
Figure 2-28

3. A signal amplitude will be found where the comparator will not switch with either polarity signal, and where a small increase in amplitude will allow it to switch on either the signal or noise.

D. B 100% MEMORY BALANCE

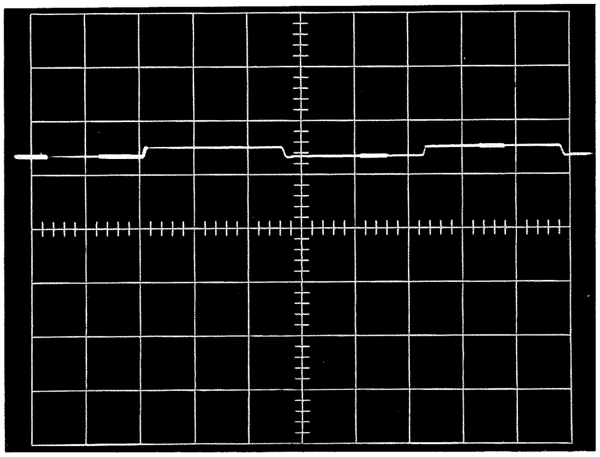
1. On the 105, set the output amplitude for approximately 1 division of vertical deflection on the 567. On the 6R1A, set the TIMING STOP control to B TRACE 90%.

2. Reduce the signal amplitude while throwing the NORM-INV control on the vertical plug-in. Adjust the 100% Bal, R66 - See Figure 2-29, so the comparator will switch on the normal or inverted waveform. See Figure 2-30.

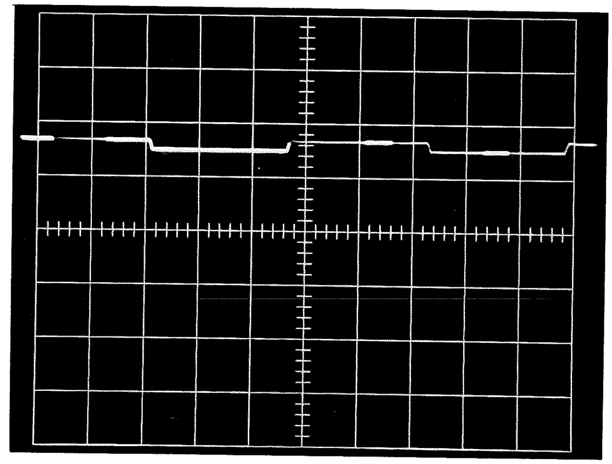


B 100% Memory Bal., R66

Figure 2-29



Stop Comparator recognizing 90% point of 1st positive slope of normal waveform.



Stop Comparator recognizing 90% point of the 1st positive slope of inverted waveform.

Figure 2-30

3. A signal amplitude will be found where the comparator will not switch on either polarity signal, and where a small increase in amplitude will allow it to switch on either the signal or noise.
4. The 0% and 100% balance adjustments interact. Repeat C and D until the memory circuits are properly balanced.
5. The Memory balance may (or may not) affect the Comparator balance. Repeat A through D until the memory and comparator circuits are properly balanced. (This is one of those things where it is impossible to say when the memories will affect the comparators and when they will not. It appears that about "1%" is gained by redoing the procedure).

E. B MEMORY and COMPARATOR FINAL CHECK and B MEMORY TRACKING

1. The start comparator must recognize the 10% and 90% points with 1 minor division of vertical deflection on the 567, when the START SLOPE control is set to + or -, and when the NORM-INV control on the vertical plug-in is thrown. Check for proper operation when the trace is positioned to the top, in the center, and to the bottom of the graticule.

a. START SLOPE at +, NORM-INV at NORM

b. START SLOPE at +, NORM-INV at INV

c. START SLOPE at -, NORM-INV at NORM

d. START SLOPE at -, NORM-INV at INV

2. The stop comparator must recognize the 10% and 90% points with 1 minor division of vertical deflection on the 567, when the STOP SLOPE control is set + or -, and when the NORM-INV control on the vertical plug-in is thrown. Check for proper operation when the trace is positioned to the top, in the center, and to the bottom of the graticule.

F. A 0% MEMORY BALANCE

1. On the 6R1A, set the TIMING START and STOP controls to MANUAL. Set the START and STOP SLOPE controls to +.

2. On the 3S76, set the MODE to A ONLY. Connect the output of the 105 to the CH A input connector. On the 105, set the output amplitude for 1 division of vertical deflection on the 567.

3. On the 6R1A, set the CRT INTENSIFICATION START TO STOP control down (off). Position the A 0% and 100% zones appropriately on the waveform. See Figure 2-31.

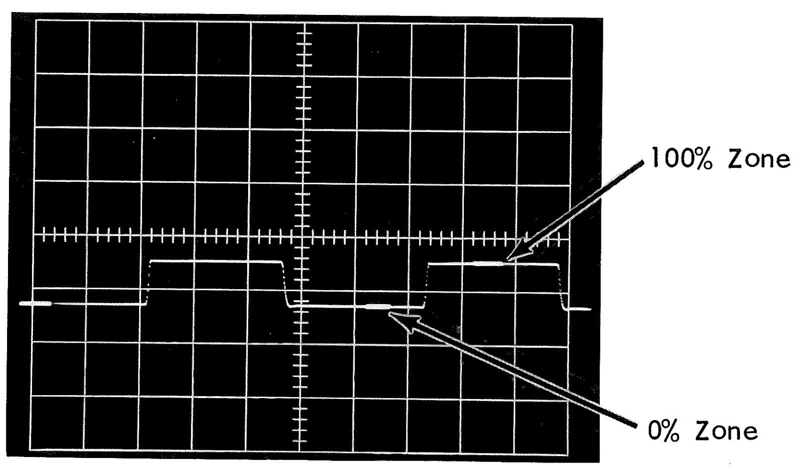
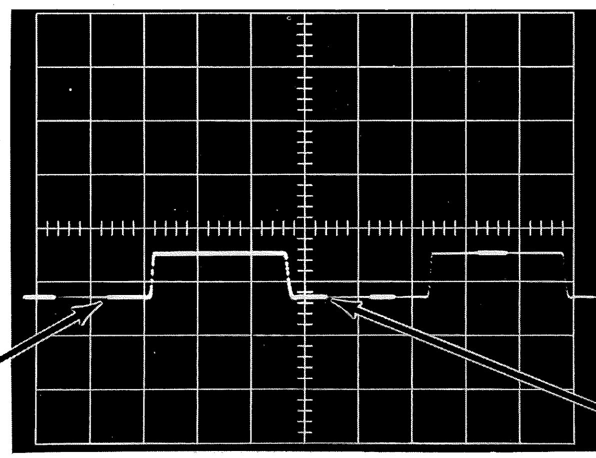


Figure 2-31

4. On the 6R1A, set the CRT INTENSIFICATION START TO STOP control up (on). Set the MANUAL START control so the intensified zone starts before the first positive slope. Set the MANUAL STOP control so the intensified zone stops after the first negative slope. See Figure 2-32.

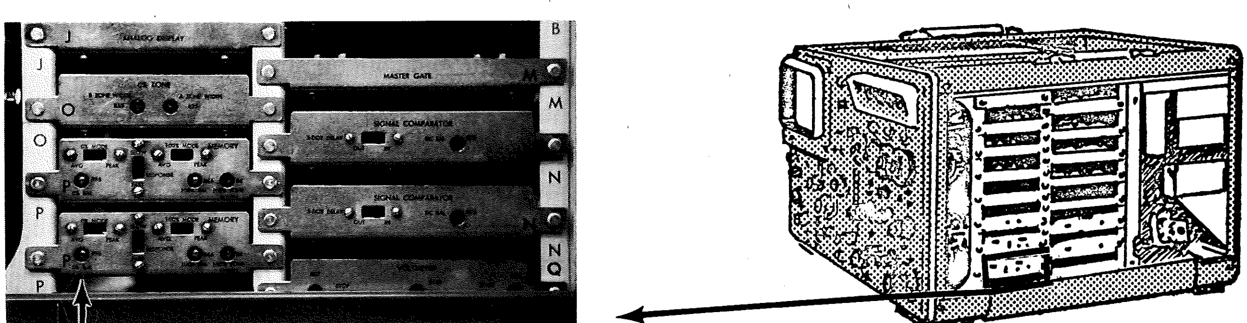


Start of intensified zone.

End of intensified zone.

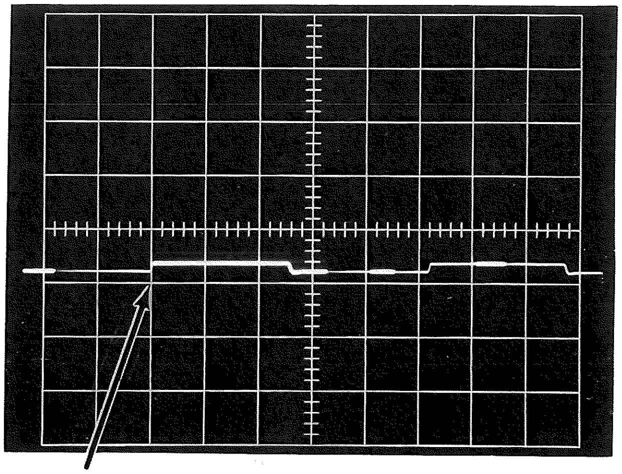
Figure 2-32

5. Set the TIMING START control to A TRACE 10%.
6. Reduce the signal amplitude while throwing the NORM-INV control on the vertical plug-in. Adjust the 0% DC Bal, R96 - See Figure 2-33, so the comparator will switch on the normal or inverted waveform. See Figure 2-34.

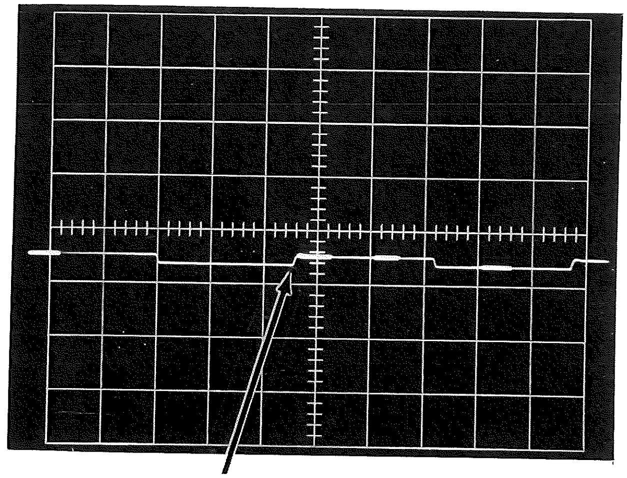


A 0% DC Bal, R96

Figure 2-33



Start Comparator recognizing 10% point of 1st positive slope on normal waveform.



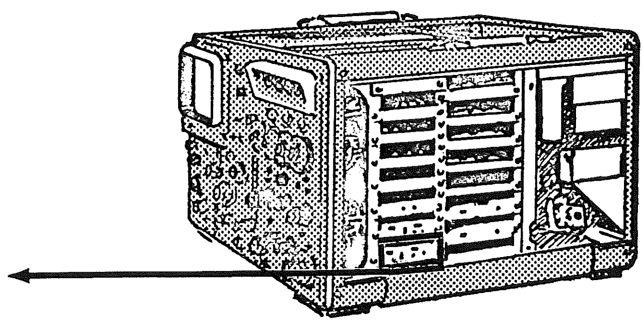
Start Comparator recognizing 10% point of the 1st positive slope on inverted waveform.

Figure 2-34

7. A signal amplitude will be found where the comparator will not switch on either polarity signal, and where a small increase in amplitude will allow it to switch on either the signal or noise.

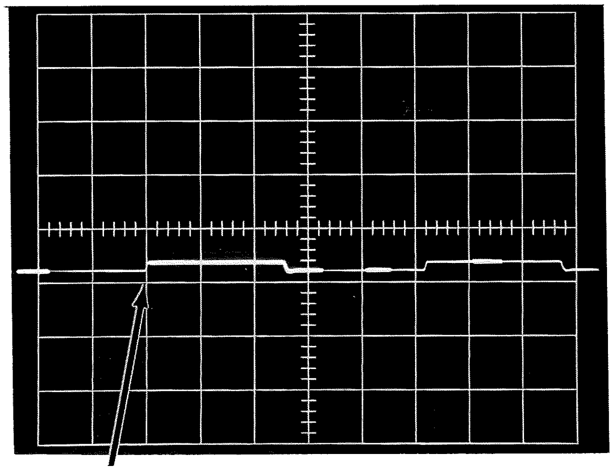
G. A 100% MEMORY BALANCE

1. On the 105, set the output amplitude for approximately 1 division of vertical deflection on the 567. On the 6R1A, set the TIMING START control to A TRACE 90%.
2. Reduce the signal amplitude while throwing the NORM-INV control on the vertical plug-in. Adjust the 100% Bal, R66 - See Figure 2-35, so the comparator will switch on the normal or inverted waveform. See Figure 2-36.

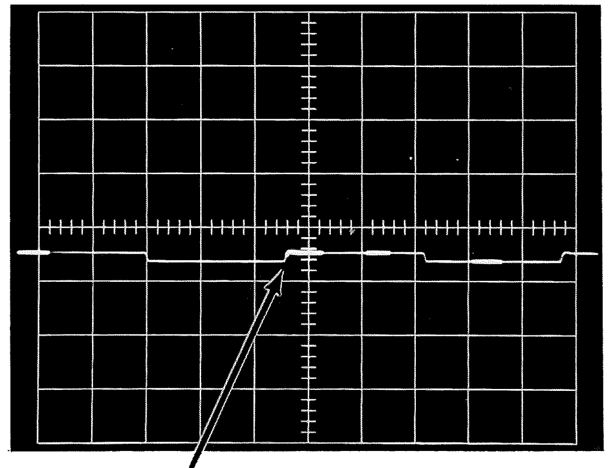


A Memory 100% Bal, R66

Figure 2-35



Start Comparator recognizing 90% point of the 1st positive slope on normal waveform.



Start Comparator recognizing 90% point of the 1st positive slope on inverted waveform.

Figure 2-36

3. A signal amplitude will be found where the comparator will not switch on either polarity signal, and where a small increase in amplitude will allow it to switch on either the signal or noise.
4. The 0% and 100% balance adjustments interact. Repeat F and G until the memory circuits are properly balanced.

H. A MEMORY and COMPARATOR FINAL CHECK and A MEMORY TRACKING

1. The start comparator must recognize the 10% and 90% points with 1 minor division of vertical deflection on the 567, when the START SLOPE control is set to + or -, and when the NORM-INV control on the vertical plug-in is thrown.
   Check for proper operation when the trace is positioned to the top, in the center, and to the bottom of the graticule.
   a. START SLOPE at +, NORM-INV at NORM
   b. START SLOPE at +, NORM-INV at INV
   c. START SLOPE at -, NORM-INV at NORM
   d. START SLOPE at -, NORM-INV at INV

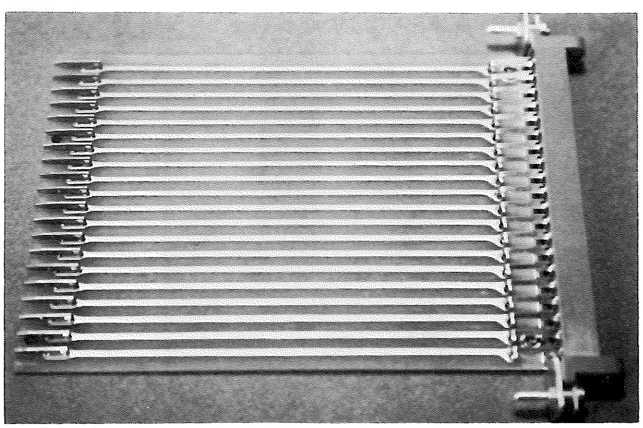
2. The stop comparator must recognize the 10% and 90% points with 1 minor division of vertical deflection on the 567, when the STOP SLOPE control is set to + or -, and when the NORM-INV control on the vertical plug-in is thrown. Check for proper operation when the trace is positioned to the top, in the center, and to the bottom of the graticule.

NOTE: If the real time plug-ins are used when calibrating the comparator and memory circuits, the procedure remains the same. The input signal will be from the 567 calibrator and vertical deflection on the 567 can be controlled by the VOLTS/DIV and VARIABLE controls on the vertical plug-in. The memory and comparator final checks (E and H) are the same but the amount of vertical deflection on the 567 is 0.5 (1/2) minor division.

IV. START and STOP COMPARATOR 3-DOT DELAY

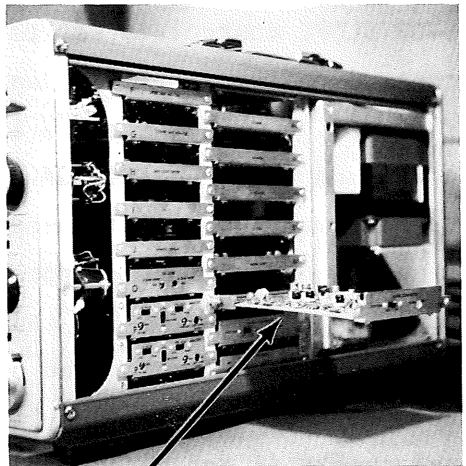
A. START COMPARATOR 3-DOT DELAY

1. Remove the 105 signal from the CH A input on the 3S76 and the EXT INPUT (TRIGGER) on the 3T77. Turn off the 567.
2. Remove the start comparator board (upper) and insert a 20 pin extender board, See Figure 2-37, into the start comparator receptacle. Connect the start comparator card to the 20 pin extender board. See Figure 2-38.



20 pin extender board

Figure 2-37



Start comparator board connected
to 20 pin extender board.

Figure 2-38

3. Turn on the 567. On the 3T77, set the TRIGGER SENSITIVITY control full CW. On the 6R1A, set the TIMING START and STOP controls to MANUAL. The START and STOP SLOPE controls must be set to first +. Adjust the START and STOP MANUAL controls for an intensified zone that is about 3 divisions wide. The memory zones and the start to stop zone should not overlap. On the 3T77, set the DOTS PER DIV to 10. See Figure 2-39.

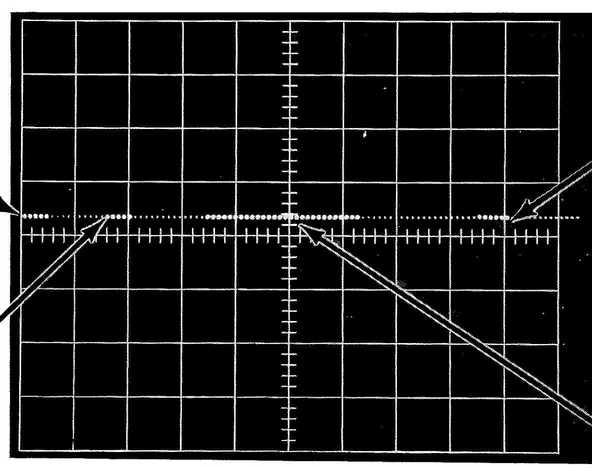


Figure 2-39

4. As the 3-DOT DELAY control on the start comparator board is set to OUT, 3 dots must become visible at the start of the intensified zone. When the 3-DOT DELAY control is set to IN, the 3 dots must disappear. Adjust C24, See Figure 2-40, for proper operation of the 3-DOT DELAY control. See Figure 2-41.

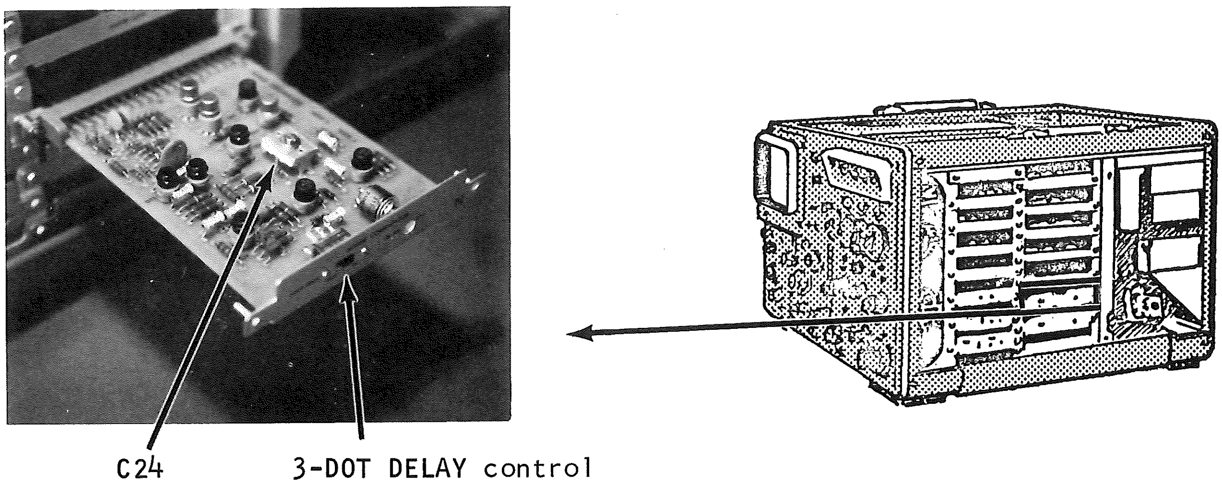
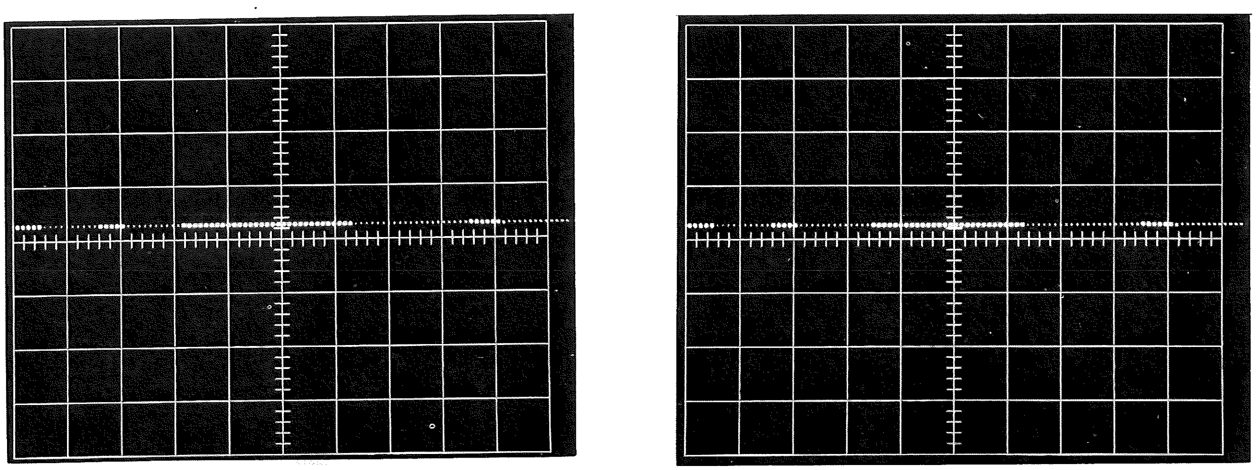


Figure 2-40



3-DOT DELAY switched OUT

3-DOT DELAY switched IN

Figure 2-41

B. STOP COMPARATOR 3-DOT DELAY

1. Turn off the 567. Remove the 20 pin extender board and the stop comparator board. Insert the start comparator board into the 6R1A. Insert the extender board into the stop comparator receptacle and connect the stop comparator board to the extender board. Turn on the 567.
2. As the 3-DOT DELAY control on the stop comparator board is set to OUT, 3 dots must disappear at the end of the intensified zone. When the 3-DOT DELAY control is set to IN, the 3 dots must become visible at the end of the intensified zone. Adjust C24, See Figure 2-42, for proper operation of the 3-DOT DELAY control. See Figure 2-43.

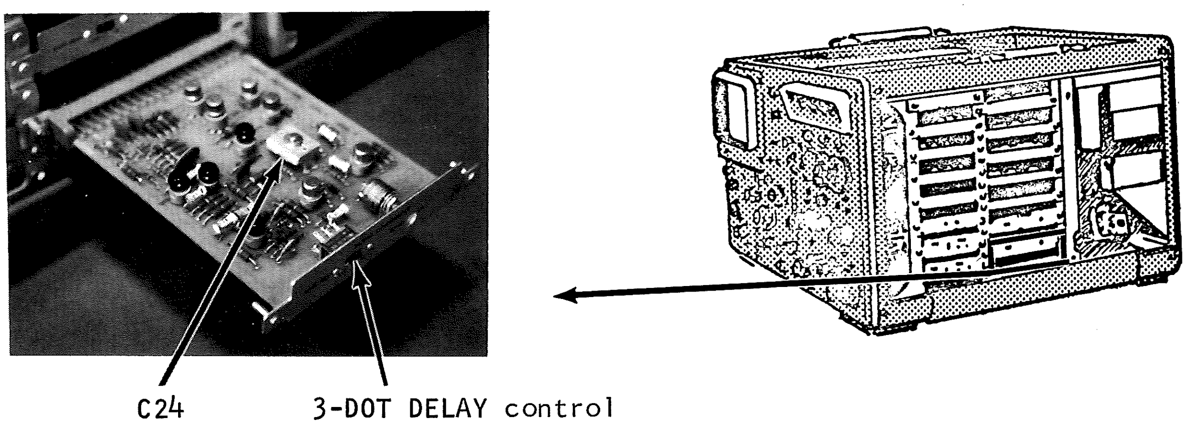
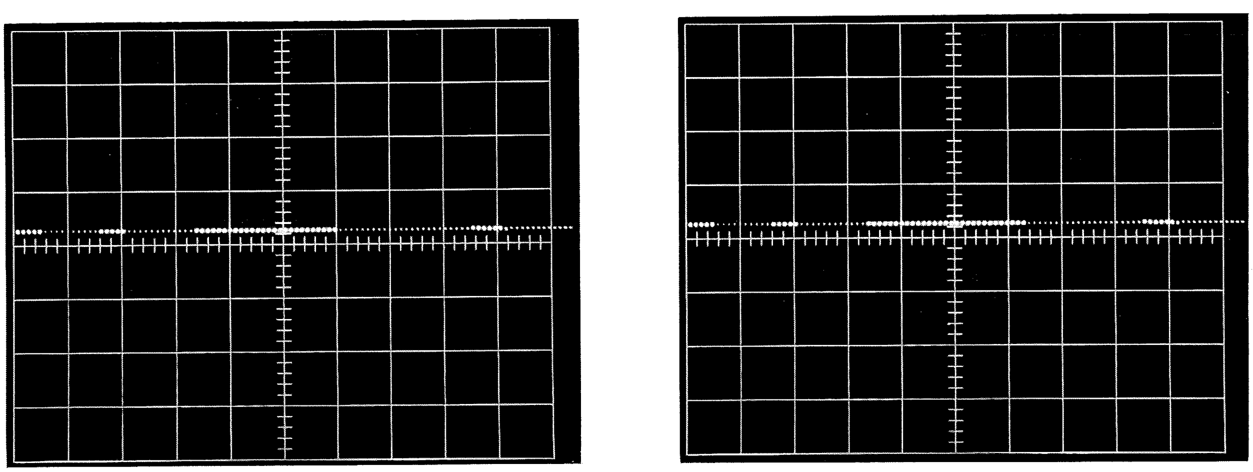


Figure 2-42

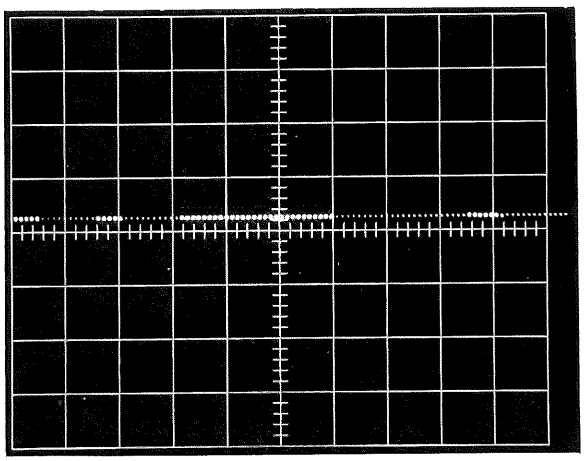


3-DOT DELAY switched OUT

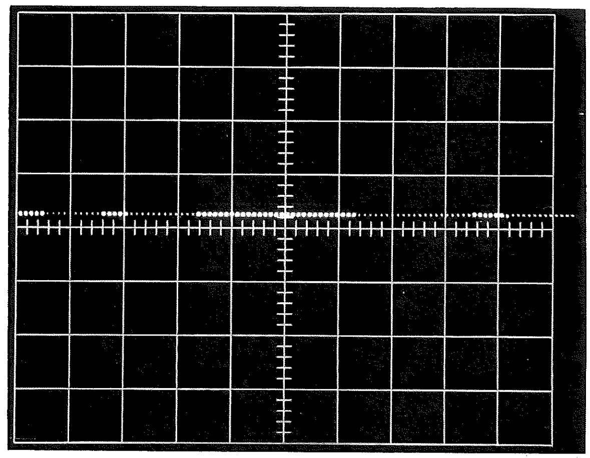
3-DOT DELAY switched IN

Figure 2-43

3. Turn off the 567. Remove the extender board and reinsert the stop comparator board into the 6R1A. Turn on the 567.
4. When C24 of both comparators is properly adjusted, setting the 3-DOT DELAY controls to OUT or setting the 3-DOT DELAY controls to in, will not change the number of dots in the start to stop intensified zone. See Figure 2-44.



3-DOT DELAY on both comparators switched OUT.



3-DOT DELAY on both comparators switched IN.

The number of dots in the start zone does not change when the 3-DOT DELAY on both comparators is switched OUT or IN.

Figure 2-44

5. Insure that the 3-DOT DELAY control on each comparator is set to IN.

V. MEMORY DRIFT

This part of the calibration procedure checks the ability of the memory circuits to hold a charge. After the memory circuit has charged to its input voltage, the input will be removed and the output of the memory will be monitored.

The drift of the memory circuits is specified as:

In slow response: 4v or less in 10 seconds

In fast response: The nature of this check is such that a specification for the fast response would not be realistic.

A. A 0% MEMORY DRIFT

1. Turn off the 567. Remove the A memory board from the 6R1A. Insert a 15 pin extender board, See Figure 2-45, into the A memory receptacle and connect the A memory board to the 15 pin extender board. Turn on the 567. See Figure 2-46.

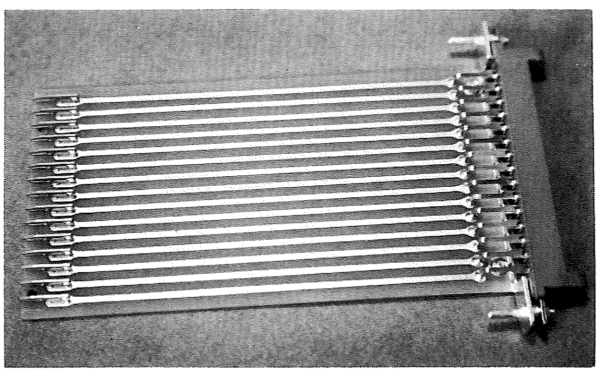


Figure 2-45

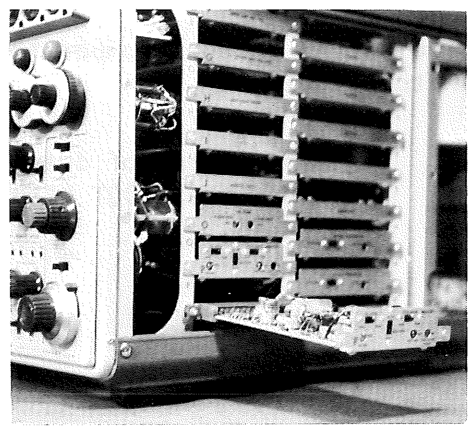
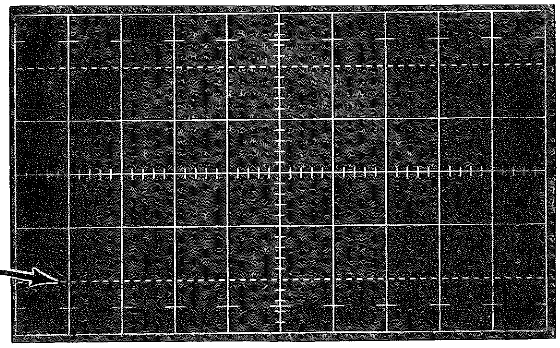


Figure 2-46

2. On the 3T77, set the DOTS PER DIV control to 100 and the TRIGGER SENSITIVITY control full CW. With the POSITION control on the 3S76, set the trace to graticule center.

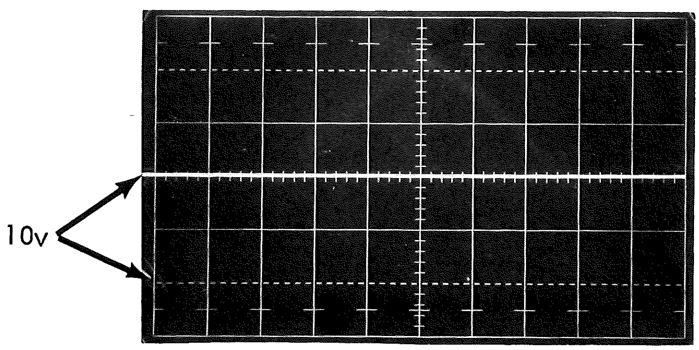
3. Set the test scope for a free running sweep with a sweep speed of 1 msec. Set the comparison voltage type vertical for a deflection factor of 5v/div, DC coupled. Position the trace to a reference point on the graticule. See Figure 2-47.



The first dotted line from the bottom of the graticule is used as the reference point.

Figure 2-47

4. Connect a probe to pin 7, 0% memory output, on the A memory board. On the test scope, check for a 10v signal from the 0% memory output. See Figure 2-48.

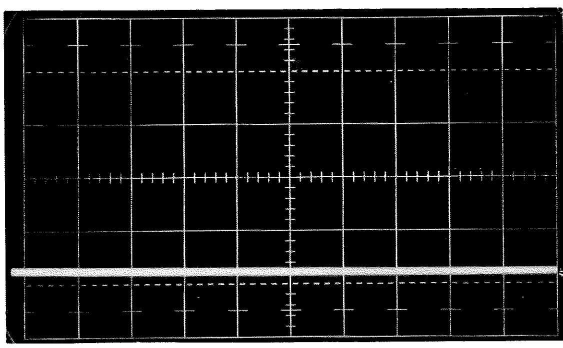


DC level of memory output when trace is centered on graticule.

This 10v DC level is not critical. If this voltage is between 9v and 11v, we know the system is operating around design center.

Figure 2-48

5. Disconnect the 0% memory signal from the test scope.
   a. Type W: Set the vertical deflection factor to 100mv/div (including probe), DC coupled.
   b. Type Z: Set the vertical deflection factor to 1v/div (including probe), DC coupled.
6. Reconnect the 0% memory signal to the test scope. With the COMPARISON VOLTAGE controls, position the trace to a reference point on the graticule. (We used the same reference point as we did in step 3).
7. On the 3T77, set the TRIGGER SENSITIVITY control full CCW. (Sweep is shut down and no input signal is applied to the memory circuit). Check for 4 divisions or less of trace shift in 10 seconds. See Figure 2-49.



Trace shifted about 1 minor division.

This is the type of thing that is either well within specs or way out of specs. Usually the trace shift is between 1 to 2 minor divisions (0.2 to 0.4v of memory drift).

Figure 2-49

8. On the 3T77, set the TRIGGER SENSITIVITY control full CW. On the A memory board, set the RESPONSE to FAST.
9. On the 3T77, set the TRIGGER SENSITIVITY control full CCW. The trace on the test scope will go off screen.

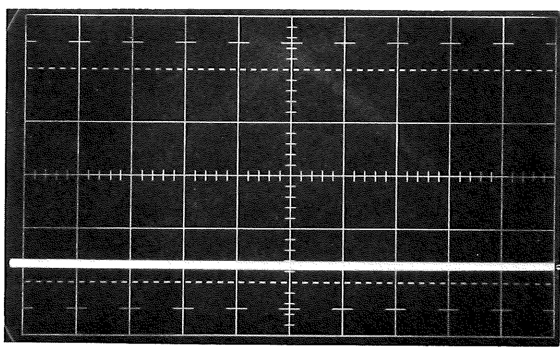
a. The rule of thumb spec is that if the movement of the trace is slow enough to be seen, the circuit is operating properly.

b. Past experience has shown that if the FAST RESPONSE does not operate properly, the SLOW RESPONSE will be out of specs.

10. On the 3T77, set the TRIGGER SENSITIVITY control full CW. On the A memory board, set the RESPONSE to SLOW.

11. Connect the probe to pin 8, 100% memory output, on the memory board. It may be necessary to reposition the trace to the reference point with the COMPARISON VOLTAGE controls.

12. On the 3T77, set the TRIGGER SENSITIVITY control full CCW. Check for 4 divisions or less of trace shift in 10 seconds. See Figure 2-50.



Trace shift is about 1.5 minor division.

Figure 2-50

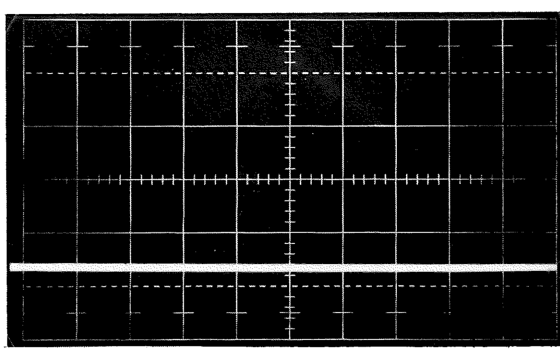
13. On the 3T77, set the TRIGGER SENSITIVITY control full CW. On the memory board set the RESPONSE to FAST.

14. On the 3T77, set the TRIGGER SENSITIVITY control full CCW. The trace on the test ccope will go off screen. (Same conditions as outlined in step 9).

15. On the 3T77, set the TRIGGER SENSITIVITY control full CW and on the memory board, set the RESPONSE to SLOW.

B. B MEMORY DRIFT

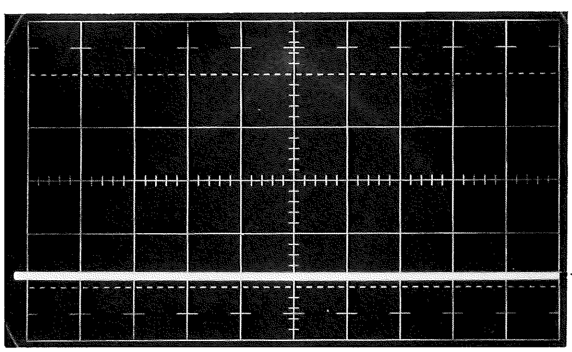
1. Turn off the 567. Remove the extender board from the A memory board into the 6R1A. Remove the B memory board and plug the extender board in the B memory board receptacle. Connect the B memory board to the extender board. Turn on the 567.
2. Set the vertical plug-in for a deflection sensitivity of 5 V/div. Position the trace to the reference point.
3. Connect a probe to pin 7, 0% memory output, on the B memory board. On the test scope, check for a 10v signal from the 0% memory output.
4. Disconnect the 0% memory signal from the test scope.
   a. Type W: Set the vertical deflection factor to 100 mv/div (including probe), DC coupled.
   b. Type Z: Set the vertical deflection factor to 1 v/div (including probe), DC coupled.
5. Reconnect the 0% memory signal to the test scope. With the COMPARISON VOLTAGE controls, position the trace to a reference point on the graticule. (We used the same reference point as we did in step 3).
6. On the 3T77, set the TRIGGER SENSITIVITY control full CCW. (Sweep is shut down and no input signal is applied to the memory circuit). Check for 4 divisions or less of trace shift in 10 seconds. See Figure 2-51.



Trace shifted almost 2 minor divisions.

Figure 2-51

7. On the 3T77, set the TRIGGER SENSITIVITY control full CW. On the B memory board, set the RESPONSE to FAST.
8. On the 3T77, set the TRIGGER SENSITIVITY control full CCW. The trace on the test scope will go off screen.
   a. The rule of thumb spec is that if the movement of the trace is slow enough to be seen, the circuit is operating properly.
   b. Past experience has shown that if the FAST RESPONSE does not operate properly, the SLOW RESPONSE will be out of specs.
9. On the 3T77, set the TRIGGER SENSITIVITY control full CW. On the B memory board, set the RESPONSE to SLOW.
10. Connect the probe to pin 8, 100% memory output, on the memory board. It may be necessary to reposition the trace to the reference point with the COMPARISON VOLTAGE controls.
11. On the 3T77, set the TRIGGER SENSITIVITY control full CCW. Check for 4 divisions or less of trace shift in 10 seconds. See Figure 2-52.



Trace shifted about 1 minor division.

Figure 2-52

12. On the 3T77, set the TRIGGER SENSITIVITY control full CW. On the memory board set the RESPONSE to FAST.
13. On the 3T77, set the TRIGGER SENSITIVITY control full CCW. The trace on the test scope will go off screen. (Same conditions as outlined in step 9).

14. On the 3T77, set the TRIGGER SENSITIVITY control full CW and on the memory board, set the RESPONSE to SLOW.
15. Turn off the 567. Remove the extender board and plug the B memory board into the 6R1A. Turn on the 567.

SECTION III

In this section, we will calibrate the gain of the 567. We will apply a known input signal to the system and adjust for the proper 6R1A response and for the proper amount of vertical deflection on the CRT.

When the system is operating at design center, the vertical signal to the 6R1A is equal to 1v per centimeter of deflection on the CRT. When the MODE switch on the 3S76 is set to A VERT B HORIZ X1 MAG, this signal from the CH B amplifier is sent to the 3T77. (The A VERT B HORIZ mode of operation is also available with the 3S3). If the vertical will be used to make Lissajous measurements, then the signal should be accurately calibrated for 1 v/cm of deflection. Otherwise, the voltage/cm is not critical as long as the 6R1A voltage measurements are accurate.

The general method for adjusting the gain of the system is similar for the various plug-in combinations. The changes in procedure are primarily dependent on the differences in the various units. The procedure will be written for each plug-in combination.

OUTLINE OF ADJUSTMENTS

		Page No.
3S76, 3T77, 6R1A combination		
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II.	PROBE POWER	3-9
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IV.	CH B VOLTAGE RESPONSE	3-12
V.	CH A VOLTAGE RESPONSE	3-21
VI.	START and STOP VOLTAGE CAL	3-26
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EQUIPMENT REQUIRED:

3S76, 3T77, 6R1A combination

540 series oscilloscope or equivalent (530 series, 580 series with an 81 adaptor, etc.).
Vertical preamp with at least 5mv sensitivity (L, D, H, W, etc.)
Vertical preamp comparison voltage type (W or Z)
Type 105 or equivalent
50Ω Amplitude Calibrator
Female BNC to Male UHF
GR to BNC plug adaptor (017-025)

3S3, 3T77, 6R1A combination

540 series oscilloscope or equivalent (530 series, 580 series with an 81 adaptor, etc.).
Vertical preamp with at least 5mv sensitivity (L, D, H, W, etc.)
Vertical preamp comparison voltage type (W or Z)
Type 105 or equivalent
50Ω Amplitude Calibrator
GR to BNC plug adaptor (017-025)
GR to P6038 probe adaptor (017-076)
GR to BNC jack adaptor (017-024)
50Ω BNC terminator (011-049)
Female BNC to Male UHF (103-015)

3A2, 3B2, 6R1A combination

540 series oscilloscope or equivalent (530 series, 580 series with an 81 adaptor, etc.).
Vertical preamp differential type (D or W)
Standard Amplitude Calibrator (067-502)

Preset the front panel controls for the 3S76, 3T77, 6R1A combination as follows:

<u>567</u>	
FOCUS	Adjust for an easily discernible sharply defined trace.
ASTIGMATISM	
INTENSITY	
SCALE ILLUM	
<u>3S76</u>	
MODE	A ONLY
SMOOTH-NORMAL	NORMAL
INTERNAL TRIGGER	OFF
CH A and CH B	
POSITION	midrange
MV/DIV	200
NORM-INV	NORM
VARIABLE	CALIB (CCW)
<u>3T77</u>	
TIME/DIV	.1 μsec
POSITION	midrange
HORIZ MAG	X1
DOTS PER DIV	X100
SWEEP MODE	NORMAL
TRIGGER	
SENSITIVITY	CW
SELECTOR	EXT -

Figure 3-1 shows the proper set up.

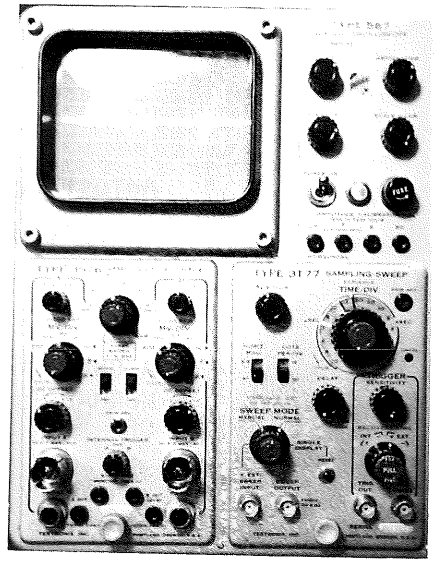


Figure 3-1

6R1A	
MODE	VOLTAGE B
RESOLUTION	ONE SWEEP UNSCALED (Max)
CRT INTENSIFICATION	
MEMORY ZONES	UP (on)
INTERNAL CONTROLS	
A and B MEMORY	
0% MODE	AVG
100% MODE	AVG
RESPONSE	SLOW
START and STOP COMPARATOR	
3-DOT DELAY	IN

Figure 3-2A and B show the proper set up.

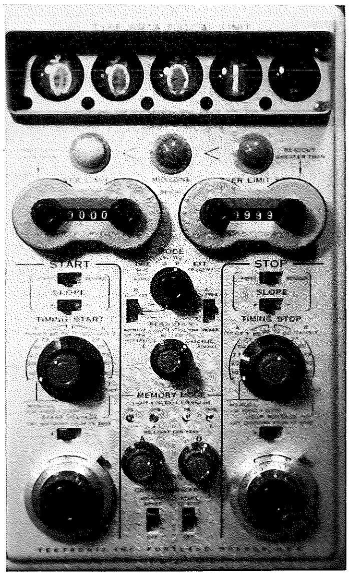


Figure 3-2A

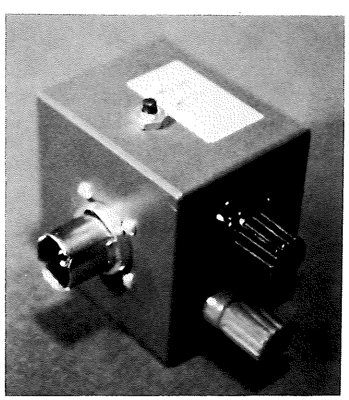
Figure 3-2B

I. INPUT IMPEDANCE

The CH A and CH B input impedance specifications are identical. The input impedance is specified as 50Ω ±0.9%.

A. CH A

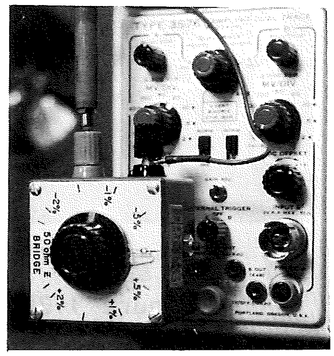
1. Turn off the 567.
2. Connect a 50Ω impedance bridge, See Figure 3-3, to the CH A input connector.



50Ω Impedance bridge

Figure 3-3

3. Insert a high gain plug-in, at least 5mv sensitivity, into the test scope. Set the sweep to 1 msec, free running and the vertical to the most sensitive position, **DC** coupled.
4. Connect a X1 probe from the plug-in to the 50Ω impedance bridge. The probe tip is connected to the red terminal and the ground strap to the black terminal. See Figure 3-4.

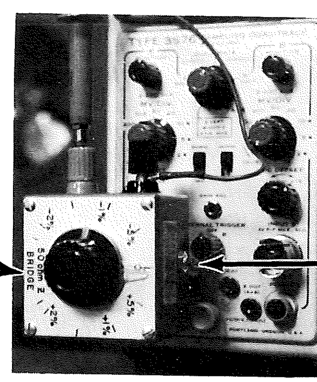


X1 probe connected to 50Ω bridge.

Figure 3-4

5. While alternating depressing and releasing the red button on the 50Ω bridge, adjust the % indicator for no vertical trace shift on the test scope. See Figure 3-5.

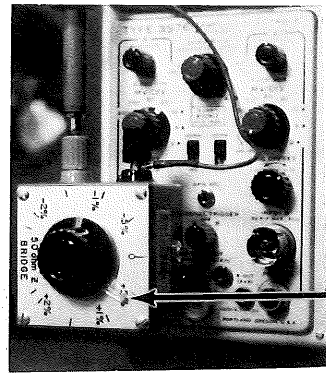
% Indicator



Red button

Figure 3-5

6. When the % indicator has been adjusted for no trace shift in the test scope, the % of error (deviation from 50Ω) can be read directly from the % indicator on the 50Ω impedance bridge. See Figure 3-6.

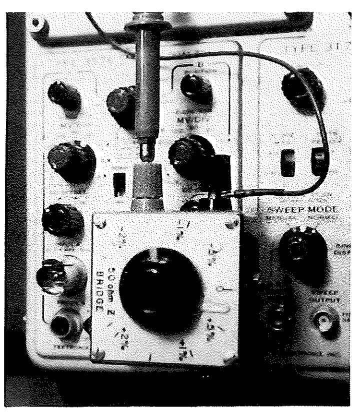


CH A in our box is about 0.6% high

Figure 3-6

B. CH B

1. Remove the 50Ω bridge from the CH A input connector and connect it to the CH B input connector. See Figure 3-7.



50Ω impedance bridge connected to the CH B input connector.

Figure 3-7

2. While alternating depressing and releasing the red button on the 50Ω bridge, adjust the % indicator for no vertical trace shift on the test scope. See Figure 3-8.

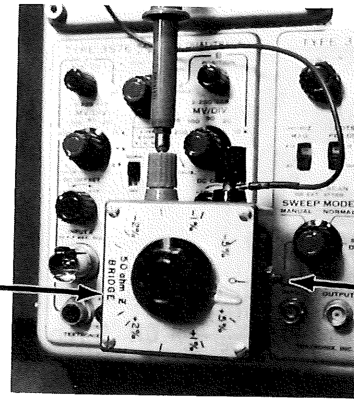
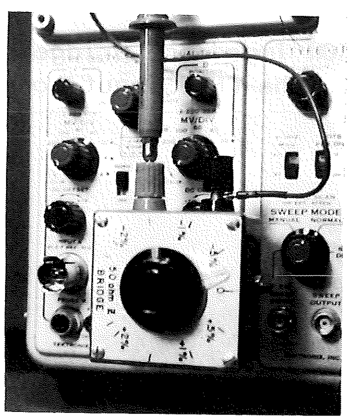


Figure 3-8

3. When the % indicator has been adjusted for no trace shift in the test scope, the % of error (deviation from 50Ω) can be read directly from the % indicator on the 50Ω impedance bridge. See Figure 3-9.



CH B in our box is about 0.25% low.

Figure 3-9

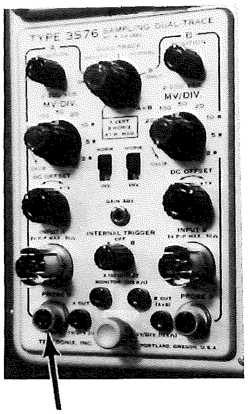
4. Disconnect the 50Ω impedance bridge.

II. PROBE POWER

The probe power is specified as +100v ±3% and -12.2v ±3%.

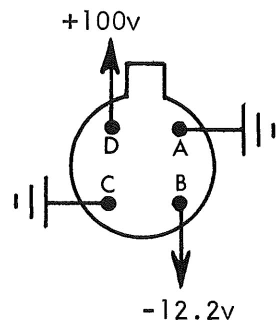
A. CH A

1. Turn on the 567. Connect a 20,000Ω/v DC meter from pin D of the CH A probe power jack to ground. See Figure 3-10 A and B.



CH A probe power jack

(A)



Schematic of probe power jack

(B)

Figure 3-10

2. Check for +100v ±3%.

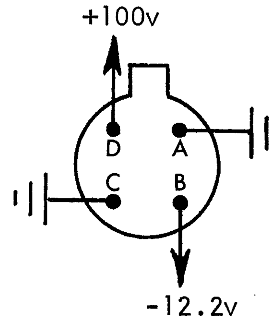
3. Connect the DC meter to pin B and check for -12.2v ±3% (approximately -11.8v to 12.6v).

B. CH B

1. Connect the DC meter to pin B of the CH B probe power jack. See Figure 3-11 A and B.

CH B probe power jack

(A)



Schematic of probe power jack

(B)

Figure 3-11

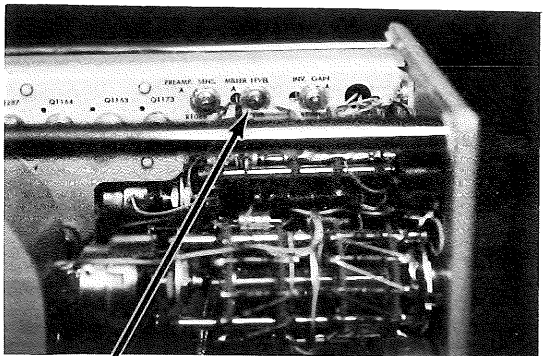
2. Check for -12.2v ±3% (approximately -11.8v to -12.6v).
3. Connect the DC meter to pin D and check for +100v ±3%.
4. Disconnect the DC meter.

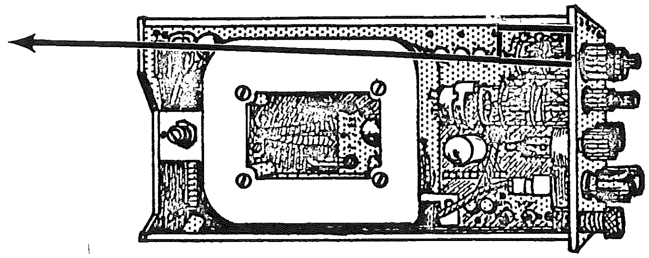
III. MILLER DC LEVEL

When the Miller DC level is properly adjusted there should be less than 0.5 divisions of trace shift as the SMOOTH-NORMAL control is switched.

A. CH A

1. With the CH A POSITION and DC OFFSET controls, position the trace on the graticule.
2. While switching the NORM-INV control, adjust the DC OFFSET for no trace shift. Keep the trace on screen with the POSITION control.
3. Adjust the CH A Miller DC Level, R1136 - See Figure 3-12, for less than .5 divisions of trace shift as the SMOOTH-NORMAL control is switched. When R1136 is properly adjusted, set the SMOOTH-NORMAL control to NORMAL.
   a. The Miller DC Level can usually be adjusted for no trace shift.





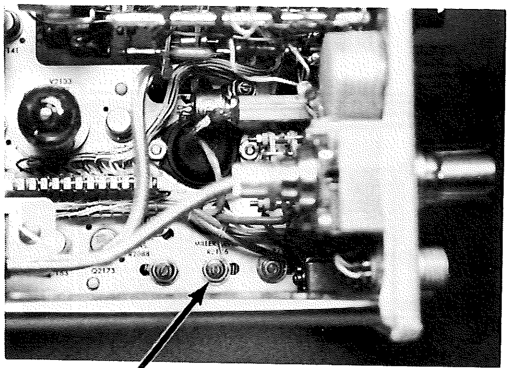
R1136 A Miller DC Level

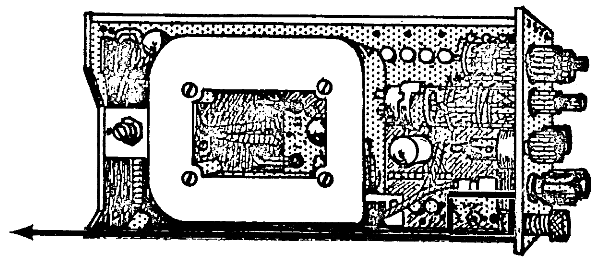
Adjust the A Miller DC Level, R1136, for less than 0.5 division of trace shift, as the SMOOTH-NORMAL control is switched.

Figure 3-12

B. CH B

1. Set the MODE to B only. With the CH B POSITION and DC OFFSET controls, position the trace on the graticule.
2. While switching the NORM-INV control, adjust the DC OFFSET for no trace shift. Keep the trace on screen with the POSITION control.
3. Adjust the CH B Miller DC Level, R2136 - See Figure 3-13, for no trace shift as the SMOOTH-NORMAL control is switched. When R2136 is properly adjusted, set the SMOOTH-NORMAL control to NORMAL.





R2136 B Miller DC Level

Adjust the B Miller DC Level, R2136, for less than 0.5 divisions trace shift as the SMOOTH-NORMAL control is rotated.

Figure 3-13

IV. CH B VOLTAGE RESPONSE

The gain specifications for CH A and CH B are identical.

The Attenuator accuracy from 200 to 10mv/div is specified as ±3%.

The Attenuator accuracy from 5 to 2mv/div is specified as ±6%.

The NORM-INV gain match at 200mv/div is specified as ±1.5%.

The NORM-INV gain match in the 5 and 2mv/div positions is specified as ±8%.

The VARIABLE attenuator range is specified as 2.5:1 ±2.5%.

The 6R1A A and B voltage response specifications are identical.

With the MV/DIV control set to 200 and 1.2v applied from the 50Ω Amplitude Calibrator, the 6R1A response is specified as 600 ±2 counts with the 0% Mode and 100% Mode (MEMORY) set to FAST and SLOW. With the MV/DIV set to 200 and .3v applied from the 50Ω Amplitude Calibrator, the 6R1A response is specified as 150 ±3 counts as the display is positioned to the top, in the center, and to the bottom of the graticule.

We will first adjust the CH B Normal gain and the 6R1A Voltmeter Ramp, then we will adjust the front panel gain and last, we will adjust the CH B INV gain.

The CH A gain will then be adjusted in a similar manner.

A. NORM and INV GAIN

1. On the 3T77, set the TIME/DIV control to 10 μsec and the DOTS PER DIV to 10.
2. Apply power to a Type 105. Set the 105's output frequency at 10 KC. Connect the 105 to a 50Ω Amplitude Calibrator. Set the VOLTS control to 1.2 and adjust the AMPLITUDE control on the 105 for a Dull Red Glow as displayed on neon in the 50Ω Amplitude Calibrator.
3. Connect the output of the calibrator to the CH B input connector. Connect the trigger source on the calibrator to the EXT INPUT (TRIGGER) on the 3T77. Adjust the TRIGGER SENSITIVITY and RECOVERY TIME controls for a stable display on the 567. With the POSITION control on the 3S76, center the display on the graticule. See Figures 3-14 A and B.

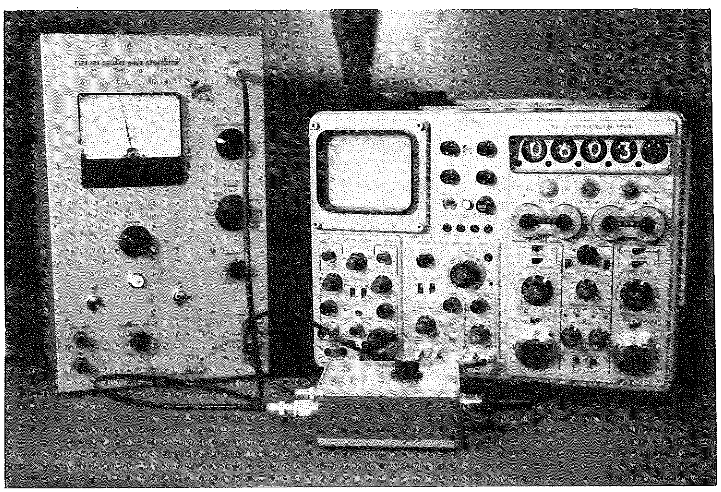


Figure 3-14-A

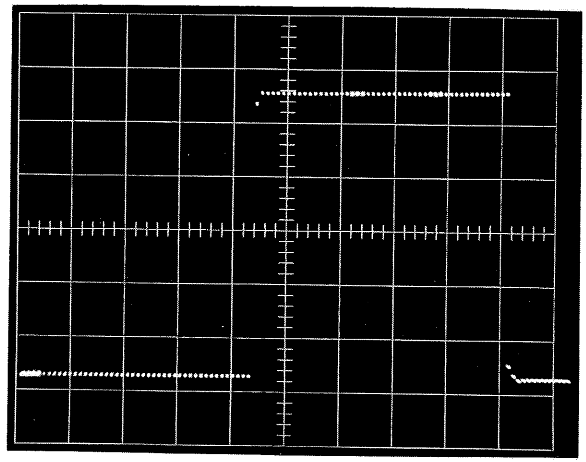


Figure 3-14-B

4. Monitor the signal from the 3S76 to the 6R1A.
   a. If Lissajous measurements will be made with the 3S76, then this signal must be accurately calibrated for 1v per centimeter of deflection on the 567. Insert a comparison voltage plug-in into the test scope. Set the vertical for a .2v deflection sensitivity, AC coupled. Set the sweep for 5 msec, triggered.
   b. To insure a linear response when measuring voltage, the signal to the 6R1A should be from 0.9v/cm of deflection to 1.1v/cm of deflection. This can be adequately measured with any lettered series plug-in. Set the vertical for .2v deflection sensitivity, AC coupled. Set the sweep for 5 msec, triggered.
5. Connect a X10 probe from the test scope to the B OUT (A+B) jack on the front panel of the 3S76. See Figure 3-15 and 3-16.

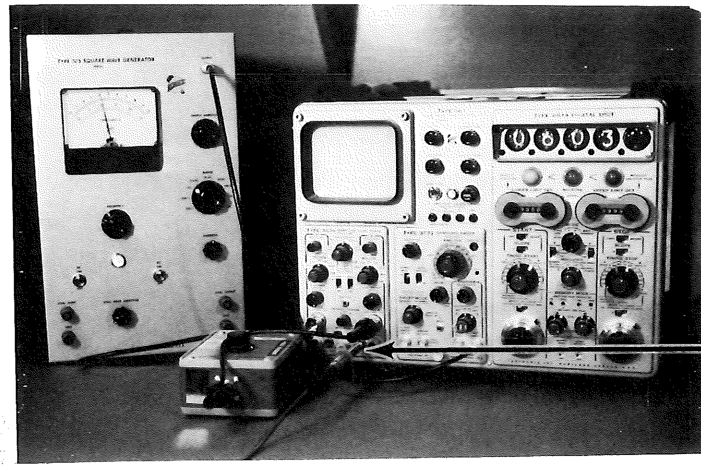


Figure 3-15

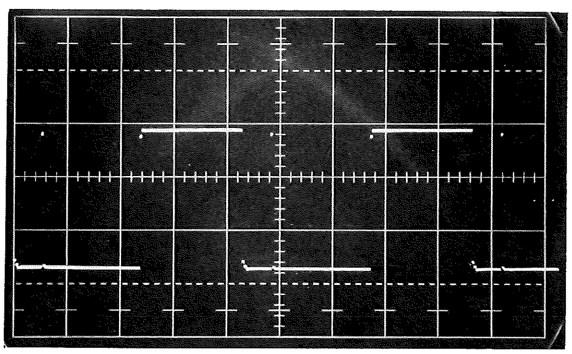


Figure 3-16

6. On the 3S76, set the CH B NORM-INV control to INV. Position the display so the base line is 1 centimeter up from the bottom of the graticule. See Figure 3-17.

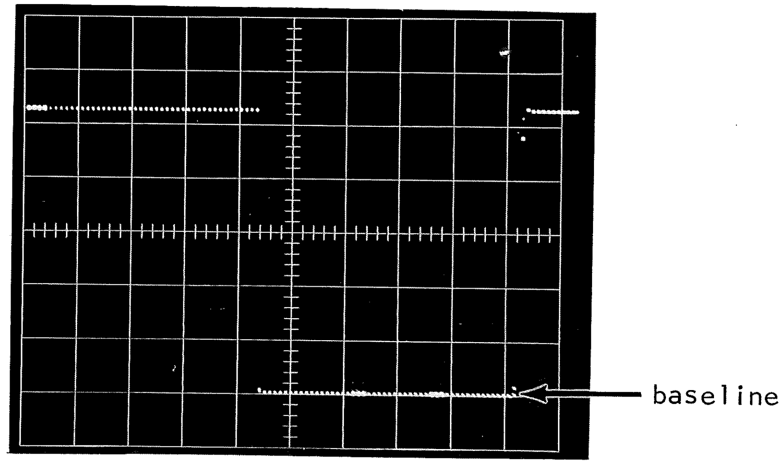
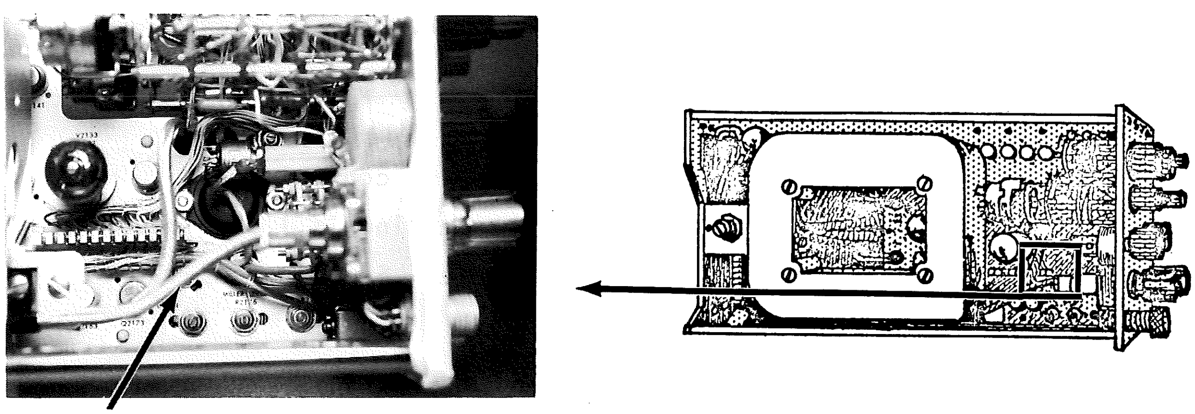


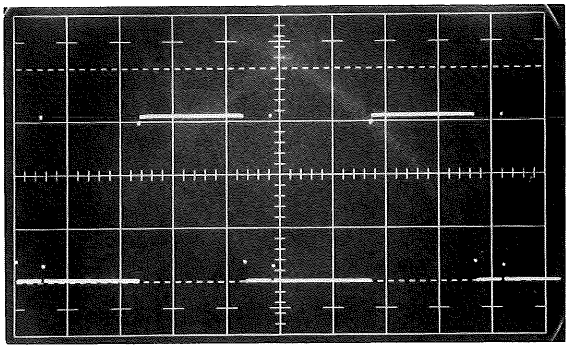
Figure 3-17

7. On the 6R1A, set the MODE to B VOLTAGE and the B VOLTAGE control down (inverted position).
8. Position the 0% zone to the top of the waveform and the 100% zone to the bottom (waveform is inverted).
9. Adjust the B Normal Gain, R2172 - See Figure 3-18, for 3 divisions of vertical deflection on the test scope. See Figure 3-19.



R2172 (located immediately behind the lower cable) B Normal Gain

Figure 3-18

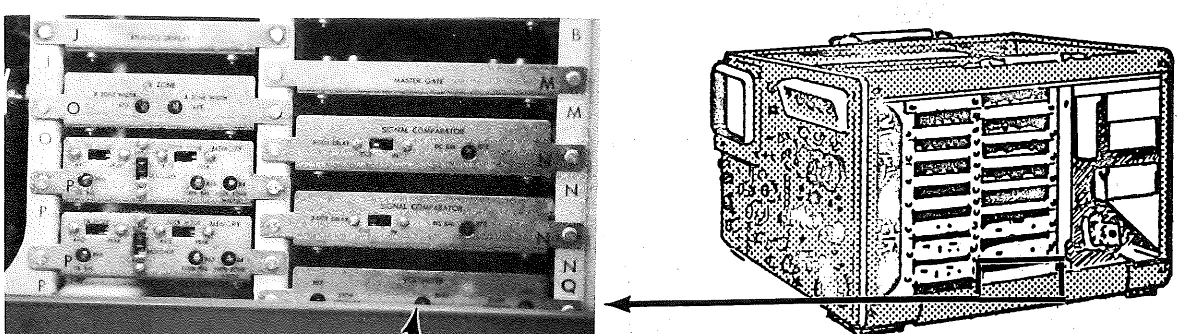


Test scope display

We first measured the signal with the Comparison Voltage Source of the Type W. After the B Normal Gain was adjusted right on, we then measured the signal with the W operating as a standard plug-in. (If a signal equal to 1v per cm of 567 deflection is desired, then a Comparison Voltage measurement should be used).

Figure 3-19

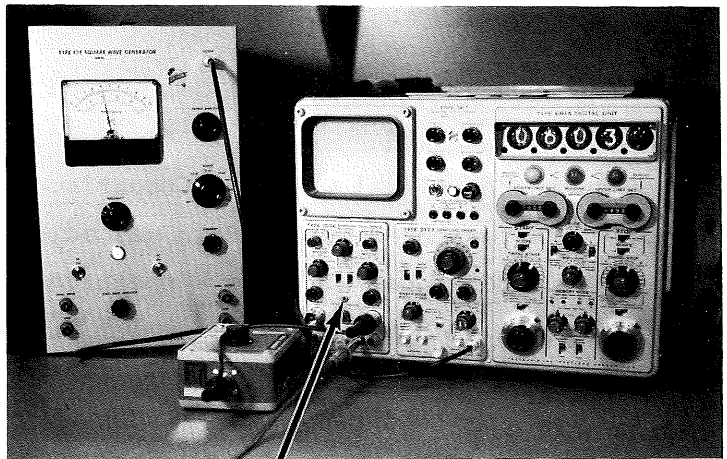
10. If necessary, reposition the baseline 1 centimeter from the bottom of the graticule. Adjust the Ramp Slope, R141 - See Figure 3-20, for a digital count of 600.



R141, Ramp Slope

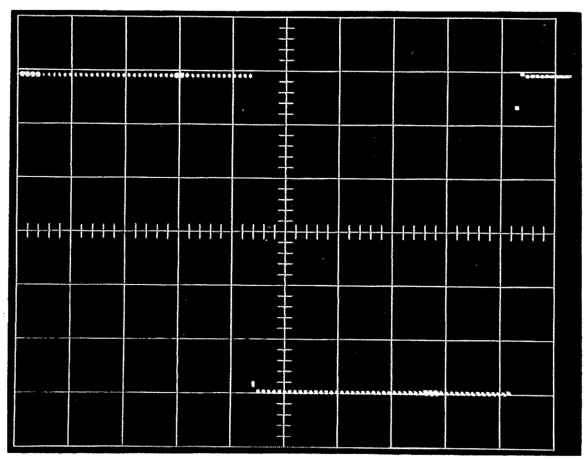
Figure 3-20

11. With the baseline positioned 1 centimeter from the bottom of the graticule, adjust the Gain Adjust, R1209 - See Figure 3-21, for exactly 6 cm of vertical deflection on the 567. See Figure 3-22.



R1209, Gain Adj.

Figure 3-21



Adjust R1209 for 6cm of vertical deflection on the 567.

Figure 3-22

12. Set the B 0% Mode and 100% Mode (Memory) to Peak. Lights for ZONE Averaging must go out. Set the B Memory Response to FAST.
13. Check 6R1A for a readout of 600 ±2 counts.
14. Return the 0% MODE and 100% MODE to Average and the RESPONSE to SLOW.
15. Set the Volts on the 50Ω Calibrator to .3v. Check for 1.5 cm of deflection on the 567.
16. Position the display on the 567 to the bottom of the graticule, in the center, and to the top of the graticule.
    a. Check the display on the test scope. (Change the vertical sensitivity to .5v including probe). There should be no discernible change in the display. No discernible compression or expansion of the signal sent to the 6R1A.
    b. Check the digital count for 150 ±3 counts. The total variation in count must not be greater than 3 counts. The limits are 147-150, 148-159, 149-152 or 151-153. (This checks the linearity of the voltmeter Ramp and digital count. The check is not valid unless the conditions in step a have been met).
    c. Check the display on the 567. The compression or expansion must not exceed 1/2 mm.
17. Set the Volts on the 50Ω Calibrator to 1.2v and set the test scope for a 2v vertical sensitivity.
18. On the 3S76, set the CH B NORM-INV to NORM and position the baseline of the display 1 cm from the top of the graticule.
19. On the 6R1A, set the B VOLTAGE control to UP.
20. Adjust the B Inv. Gain, R2161 - See Figure 3-23, for exactly 600 counts on the 6R1A. There should be 6 cm of vertical deflection on the 567 and the test scope display should match the display seen in step 9. See Figure 3-24.

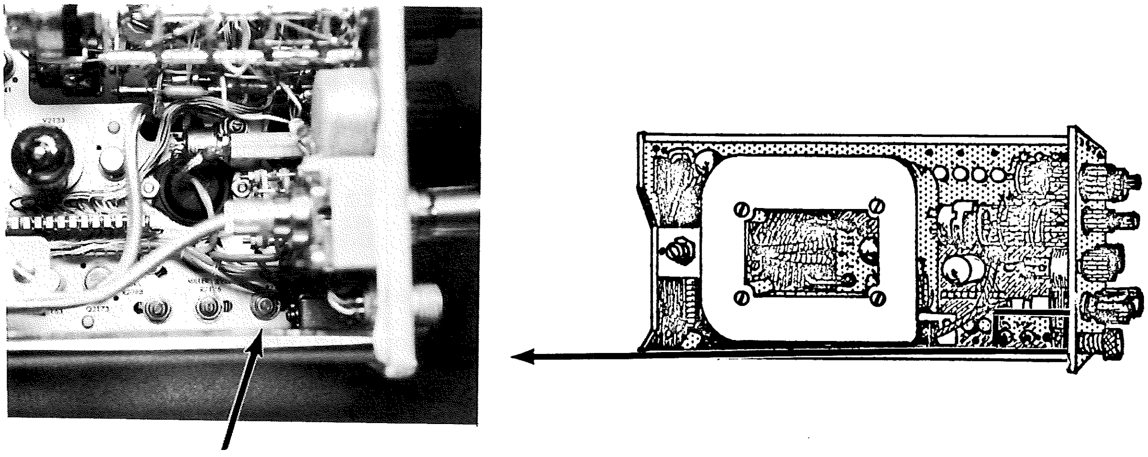
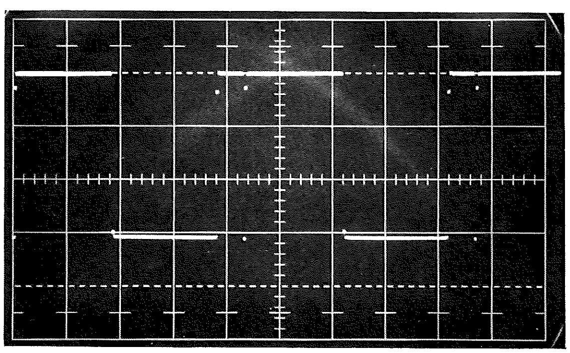
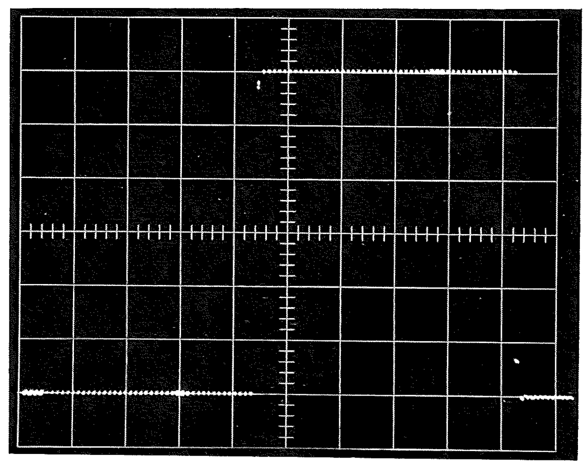


Figure 3-23



Vertical deflection on test scope same as step 9.



6 cm of deflection on 567

Figure 3-24

B. MV/DIV ACCURACY

1. Check the CH B MV/DIV control accuracy against the following chart. Check the MV/DIV accuracy in the NORM and INV modes.

MV/DIV	50Ω CAL	6R1A COUNT	VERT. DEFL.	NORM-INV MATCH
200**	1.2 v	600 ±3	6 cm	±1.5%
100	.6 v	600 ±18	6 cm ±1.8mm	
50	.3 v	600 ±18	6 cm ±1.8mm	
20	.12v	600 ±18	6 cm ±1.8mm	
10	.06v	600 ±18	6 cm ±1.8mm	
5	.03v	600 ±36	6 cm ±3.6mm	±8%
2	.012v	600 ±36	6 cm ±3.6mm	±8%

**Previously Adjusted

C. VARIABLE

1. Set the MV/DIV control to 200 and the NORM-INV control to NORM.
2. Set the 50Ω Cal. output to .3v.
3. Set the VARIABLE control full CW. The display on the 567 must be 3.75 cm ±1 mm.

D. SPECIAL PURPOSE NIXIE and DECIMAL NEONS

1. Remove the 50Ω Cal. signal from the CH B input connector.
2. On the 6R1A, set the RESOLUTION control to ONE SWEEP LO.
3. Check the 6R1A readout against the following chart.

MV/DIV	6R1A READOUT
200	00.00 v
100	0000. mv
50	0000. mv
20	0000. mv
10	000.0 mv
5	000.0 mv
2	000.0 mv

Noise on the 3S76 signal may be measured as a voltage input when the MV/DIV control is set in the more sensitive positions. The trace should be set at approximately graticule center.

4. Return the MV/DIV control to 200. Switch the VARIABLE CW (out of the detent). The special purpose nixie and the decimal neon should go out. Return the VARIABLE to the full CCW position (in the detent).

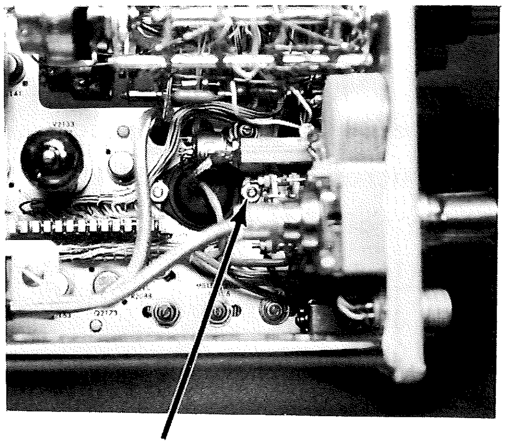
V. CH A VOLTAGE RESPONSE

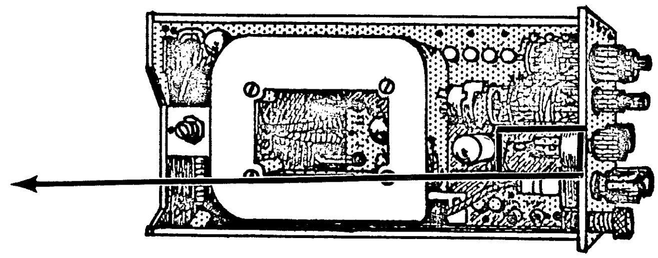
The CH A gain specifications are identical to the CH B specifications.

A. NORM and INV GAIN

1. On the 3S76, set the MODE to A ONLY. Connect the 50Ω Cal. output to the CH A input connector. Set the 50Ω Cal. output to 1.2v. Connect the X10 probe to the A OUT jack.
2. On the 3S76, set the CH A NORM-INV to the INV position. Position the display so the base line is 1 centimeter up from the bottom of the graticule.
3. On the 6R1A, set the MODE to A VOLTAGE and the A VOLTAGE control down (inverted position). Set the RESOLUTION to ONE SWEEP UNSCALED (Max).
4. Position the 0% zone to the top of the waveform and the 100% zone to the bottom (waveform is inverted).

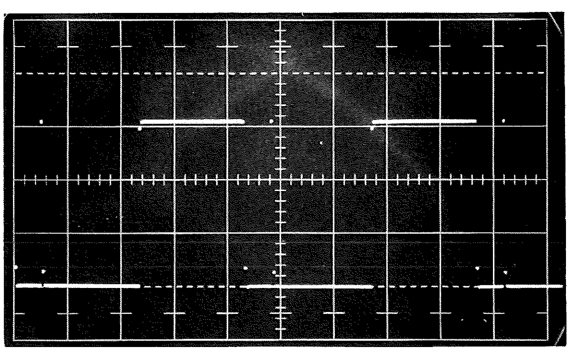
5. Adjust the A Normal Gain, R1172 - See Figure 3-25, for 3 divisions of vertical deflection on the test scope and 6 cm of vertical deflection on the 567. The 6R1A count should be 600 ±2 counts. See Figure 3-26.



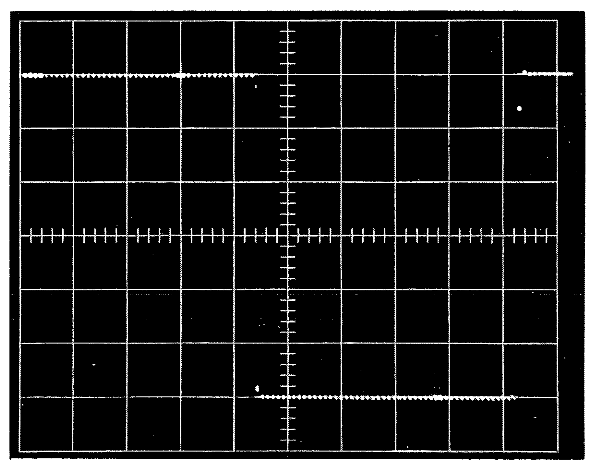


R1172 A Normal Gain

Figure 3-25



Test scope display same as Part IV, step 9.



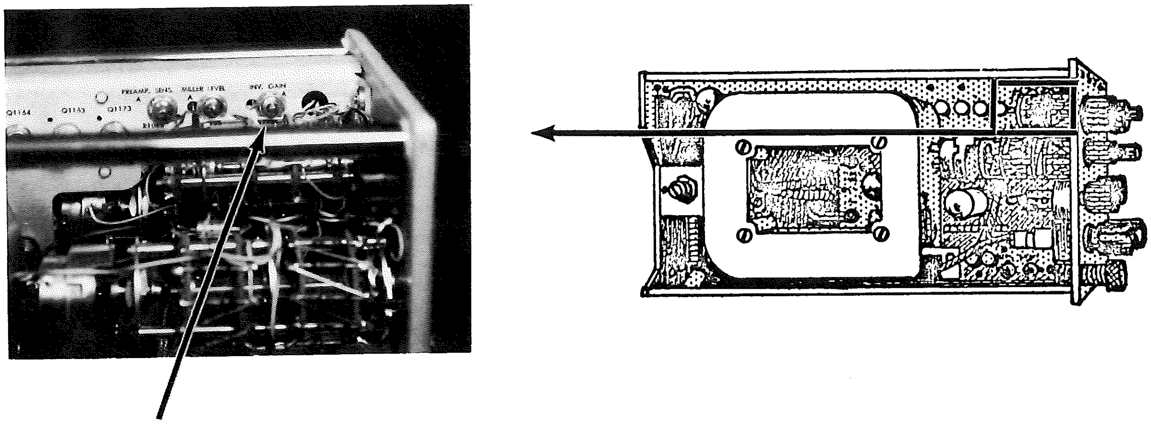
6 cm of vertical deflection on the 567.

6R1A count remains 600 ±2 counts.

Figure 3-26

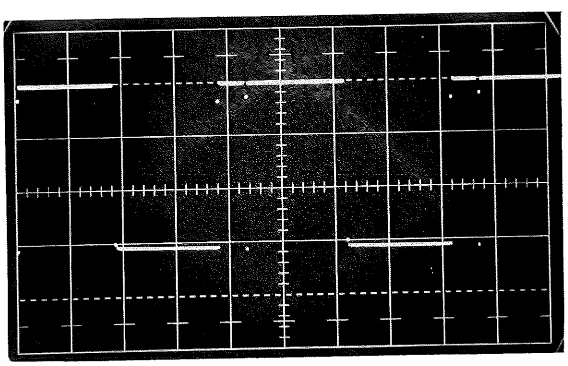
6. On the 3S76, set the CH A NORM-INV to NORM and position the baseline of the display 1 cm from the top of the graticule.
7. On the 6R1A, set the A VOLTAGE control to UP.

8. Adjust the A Inv. Gain, R1161 - See Figure 3-27, for exactly 600 counts on the 6R1A. There should be 6 cm of vertical deflection on the 567 and the test scope display should match the display seen in step 5. The 6R1A count should be 600 ±2 counts. See Figure 3-28.

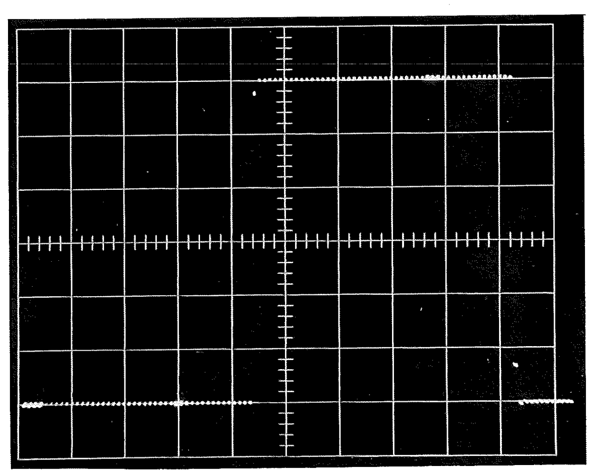


R1161 A Inv Gain

Figure 3-27



Same amount of vertical deflection as in step 5.



6 cm of deflection on 567.

The 6R1A count should be 600 ±2 counts.

Figure 3-28

9. Set the A Memory 0% Mode and 100% Mode to Peak. Lights for ZONE AVERAGING must go out. Set the A Memory Response to FAST.
10. Check 6R1A for a readout of 600 ±2 counts.
11. Return the 0% Mode and 100% Mode to AVE and the Response to SLOW.
12. Set the Volts on the 50Ω Calibrator to .3 and check for 1.5 cm of deflection on the 567.
13. Position the display on the 567 to the bottom of the graticule, in the center, and to the top of the graticule.
    a. Check the display on the test scope. (Change the vertical sensitivity to .5v including probe). There should be no discernible change in the display. No discernible compression or expansion of the signal sent to the 6R1A.
    b. Check the digital count for 150 ±3 counts. The total variation in count must not be greater than 3 counts. The limits are 147-150, 148-159, 149-152 or 151-153. (This checks the linearity of the voltmeter Ramp and digital count. The check is not valid unless the conditions in step a have been met).
    c. Check the display on the 567. The compression or expansion must not exceed 1/2 mm.
14. Set the Volts on the 50Ω Calibrator to 1.2.

B. MV/DIV ACCURACY

1. Check the CH A MV/DIV control accuracy against the following chart. Check the MV/DIV accuracy in the NORM and INV modes.

MV/DIV	50Ω CAL.	6R1A COUNT	VERT.DEFL.	NORM-INV MATCH
200**	1.2 v	600 ±2	6 cm	±1.5%
100	.6 v	600 ±18	6 cm ±1.8 mm	
50	.3 v	600 ±18	6 cm ±1.8 mm	
20	.12v	600 ±18	6 cm ±1.8 mm	
10	.06v	600 ±18	6 cm ±1.8 mm	
5	.03v	600 ±36	6 cm ±3.6 mm	±8%
2	.012v	600 ±36	6 cm ±3.6 mm	±8%

**Previously adjusted

C. VARIABLE

1. Set the MV/DIV control to 200 and the NORM-INV control to NORM. Set the SMOOTH-NORMAL control to NORMAL.
2. Set the 50Ω Cal. output to .3v.
3. Set the VARIABLE control full CW. The display on the 567 must be 3.75 cm ±1 mm.

D. SPECIAL PURPOSE NIXIE and DECIMAL NEONS

1. Remove the 50Ω Cal. signal from the CH A input connector.
2. On the 6R1A, set the RESOLUTION control to ONE SWEEP LO.
3. Check the 6R1A readout against the following chart.

MV/DIV	6R1A READOUT
200	00.00 v
100	0000. mv
50	0000. mv
20	0000. mv
10	000.0 mv
5	000.0 mv
2	000.0 mv

Noise on the 3S76 signal may be measured as a voltage input when the MV/DIV control is set in the more sensitive positions. The trace should be set at approximately graticule center.

4. Return the MV/DIV control to 200. Switch the VARIABLE CW (out of the detent). The special purpose nixie and the decimal neon should go out. Return the VARIABLE to the full CCW position (in the detent).

VI. START and STOP VOLTAGE CAL

The Start and Stop Voltage tracking specifications are identical.

The normal tracking is specified as ±4 minor divisions.

The inverted tracking is specified as ±8 minor divisions.

A. START VOLTAGE NORMAL

1. On the 3S76, set the MV/DIV to 200. Set the VOLTS control on the 50Ω Amplitude Calibrator to the CH A input connector.
2. On the 3T77, set the TRIGGER SELECTOR to EXT + and obtain a stable display with the TRIGGER SENSITIVITY control.
3. On the 6R1A, position the 0% and 100% zones appropriately on the display. Set the START and STOP to FIRST + SLOPE. Set the TIMING START and TIMING STOP controls to MANUAL. Set the MODE to TIME STOP (-) START. Set the MANUAL controls so the intensified zone starts before the first positive (+) slope and so the intensified zone stops after the first positive (+) slope. See Figure 3-29.

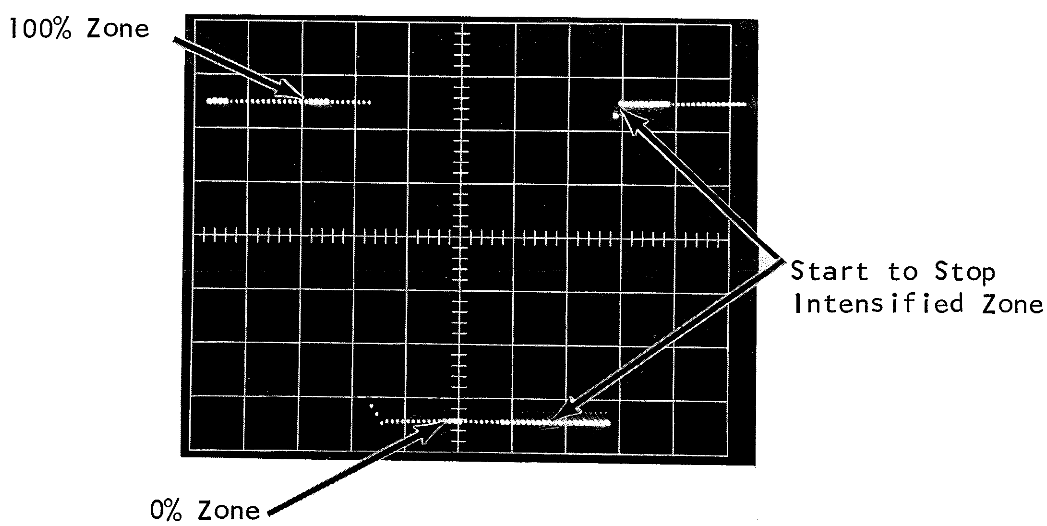
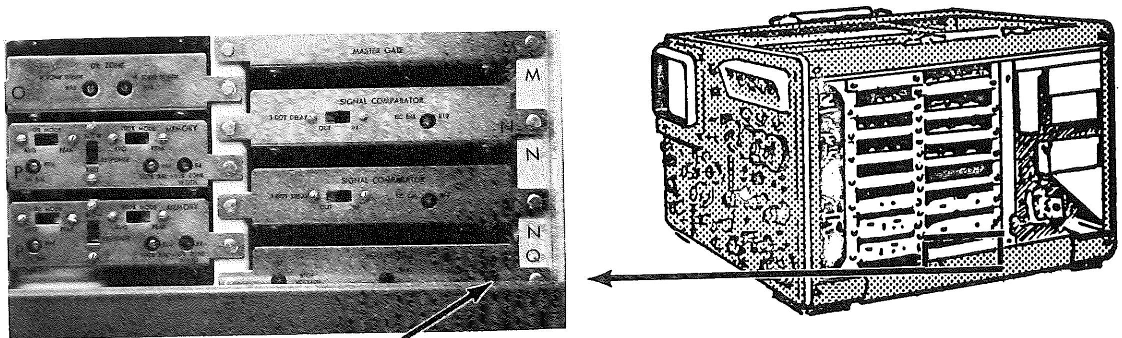


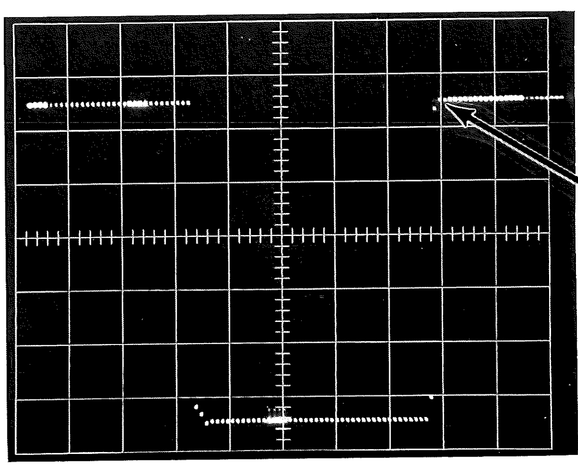
Figure 3-29

4. Set the START and STOP VOLTAGE to + and both helidials to 6.00.
5. Set the TIMING START to A TRACE. Adjust the Start Voltage Cal, R67 - See Figure 3-30, so the intensified zone just starts to jitter at the top of the first + slope. See Figure 3-31.



R67 Start Voltage Cal

Figure 3-30



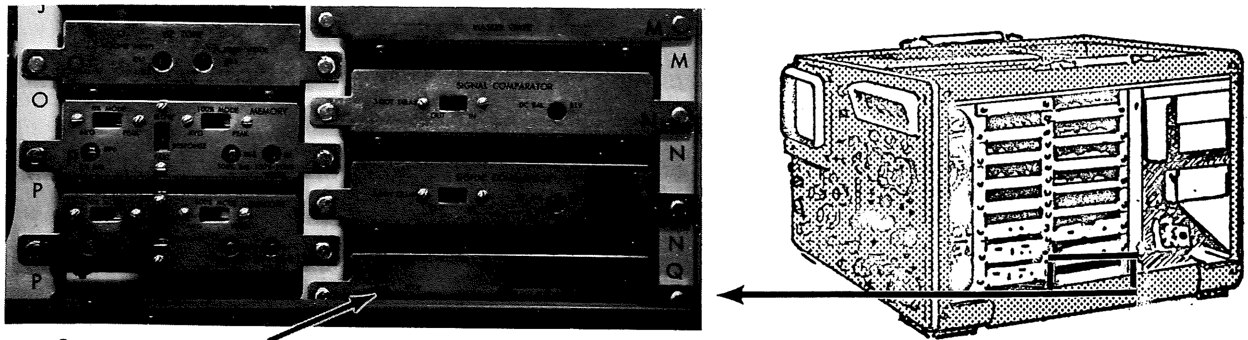
Start Voltage Cal adjusted so the intensified zone starts to jitter at the top of the first + slope.

Figure 3-31

6. The intensified zone should completely disappear when the helidial is set to 6.04 or higher.
7. Return the Start helidial to 6.00 and the TIMING START control to MANUAL.

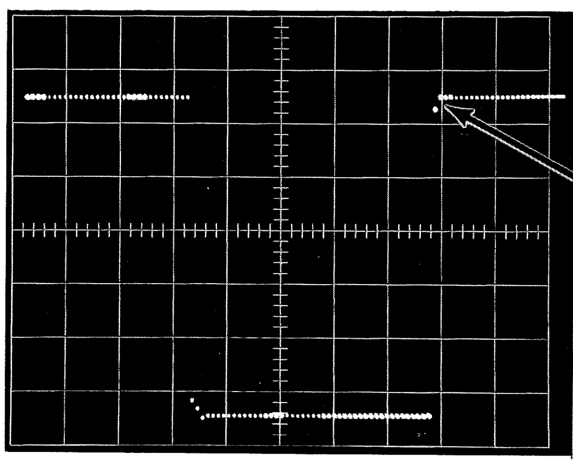
B. STOP VOLTAGE NORMAL

1. Set the TIMING STOP to A TRACE. Adjust the Stop Voltage Cal, R87 - See Figure 3-32, so the intensified zone just starts to jitter at the top of the first + slope. See Figure 3-33.



R89 Stop Voltage Cal

Figure 3-32



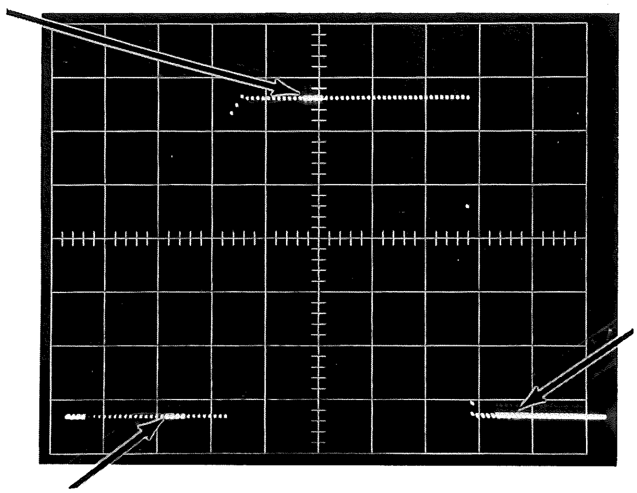
Stop Voltage Cal adjusted so the intensified zone starts to jitter at the top of the first + slope.

Figure 3-33

2. The intensified zone must "break over" if the helidial is set to 6.04 or higher. The jitter must cease when the helidial is set to 5.96 or lower.
3. Set the Stop helidial to 6.00.

C. START and STOP VOLTAGE INVERTED

1. Set the TIMING START to A TRACE.
2. On the 3S76, set the CH A NORMAL-INV to INV. On the 6R1A, set the START and STOP SLOPE control to FIRST -. Set the START and STOP VOLTAGE to -.
3. Set the Stop helidial to 6.08 or higher. There will be a jittery intensified zone after the first - slope. See Figure 3-34.



0% Zone

Intensified Zone

100% Zone

Figure 3-34

4. Set the Stop helidial below 6.08. The intensified zone will disappear. Return the Stop helidial to 6.08 or higher.
5. Set the Start helidial to 6.08 or higher. The intensified zone must disappear.

Preset the front panel controls for the 3S3, 3T77, 6R1A combination as follows:

<u>567</u>

FOCUS ASTIGMATISM INTENSITY SCALE ILLUM	Adjust for an easily discernible, sharply defined trace.

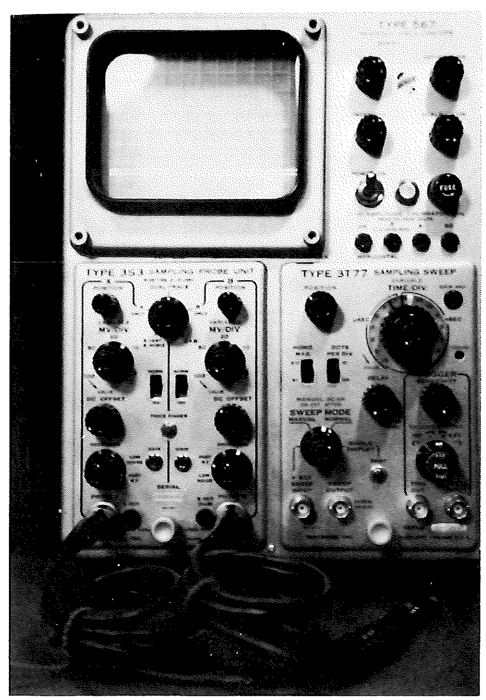
<u>3S3</u>

MODE	DUAL-TRACE
CH A and CH B	
POSITION	midrange
MV/DIV	100
VARIABLE	CALIB (CCW)
DC OFFSET	midrange
FAST RT - LOW NOISE	FAST RT
SMOOTHING	midrange
NORM-INV	NORM

<u>3T77</u>

TIME/DIV	.1 μsec
POSITION	midrange
HORIZ MAG	X1
DOTS PER DIV	100
SWEEP MODE	NORMAL
TRIGGER	
SENSITIVITY	CW
SELECTOR	EXT +

Figure 3-35 shows the proper set-up.

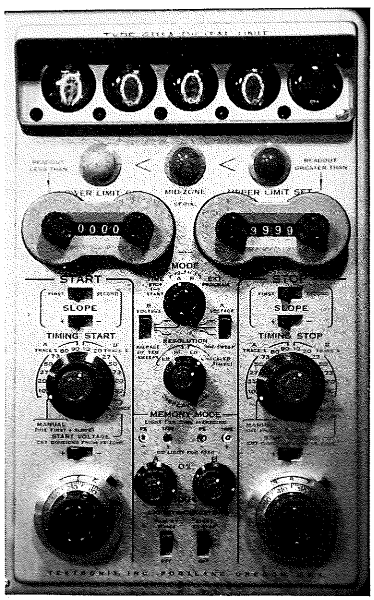


<u>Figure 3-35</u>

6R1A

MODE	VOLTAGE A
RESOLUTION	ONE SWEEP UNSCALED (max)
CRT INTENSIFICATION	
MEMORY ZONES	UP (on)
INTERNAL CONTROLS	
A and B MEMORY	
0% MODE	AVG
100% MODE	AVG
RESPONSE	SLOW
START and STOP COMPARATOR	
3-DOT DELAY	IN

Figure 3-36 A and B show the proper set up.



(A)

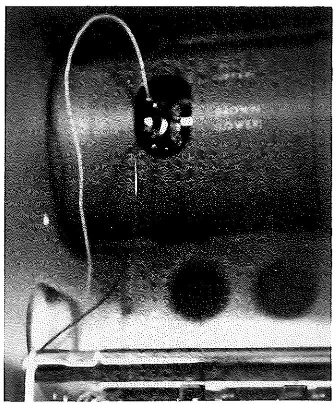
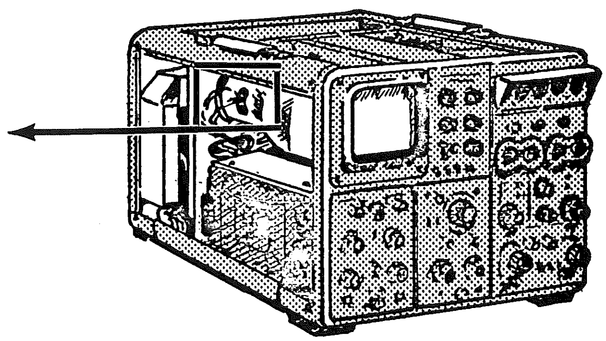
(B)

Figure 3-36

I. VERTICAL CENTERING and SMOOTHING BALANCE

A. VERTICAL CENTERING

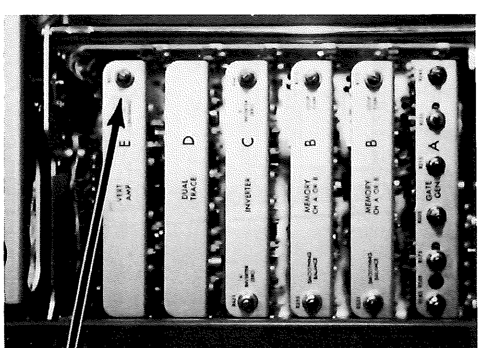
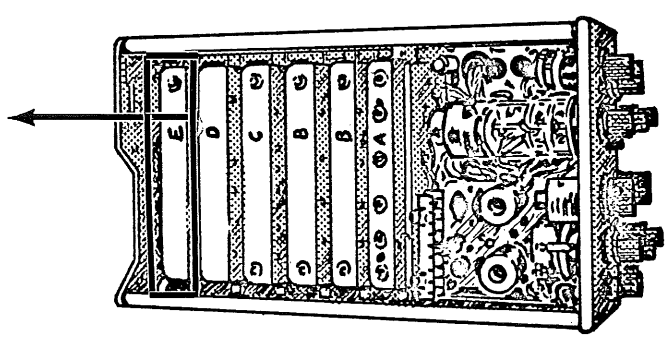
1. Terminate both probes in 50Ω.
2. Set both NORM-INV controls halfway between NORM and INV.
3. Momentarily short the vertical deflection plates together. (Be careful not to short the plates to ground). See Figure 3-37.

When shorting the deflection plates together, be careful not to short the plates to the CRT shield.

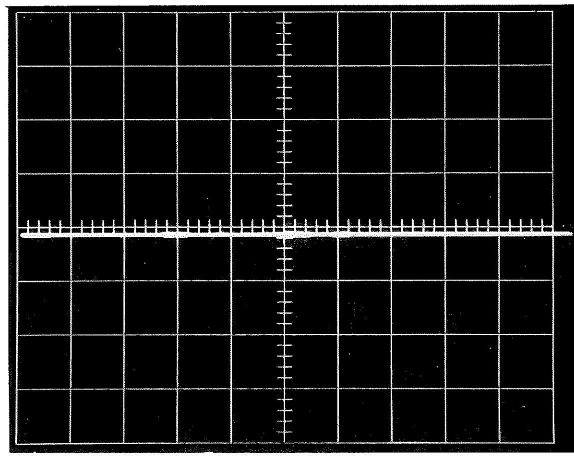
Figure 3-37

4. Push the TRACE FINDER button in halfway (so only 1 trace is visible). Adjust the Vert. Centering, R611 - See Figure 3-38, so the trace is aligned with electrical center. (The trace must be aligned with the position of the trace when the vertical deflection plates were shorted). See Figure 3-39.

R611 Vert. Centering

Figure 3-38



Electrical center

With the TRACE FINDER in halfway (only one trace on screen) adjust the Vert. Centering, so the trace is aligned with electrical center.

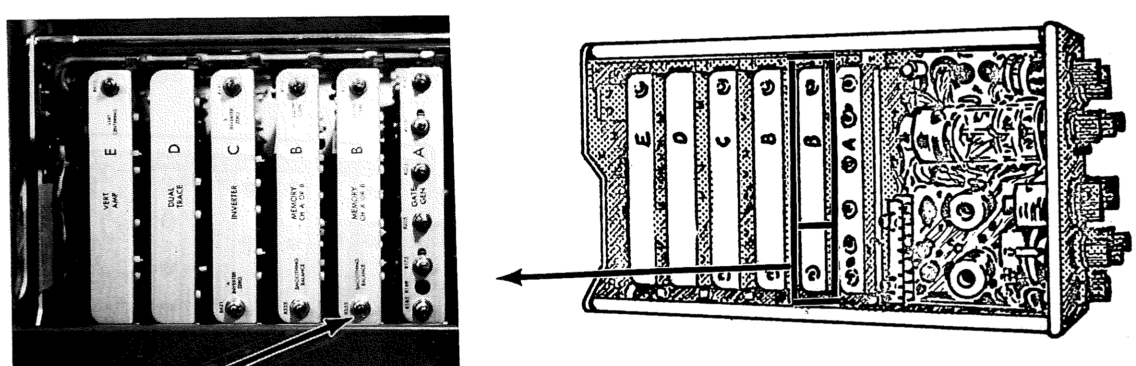
Figure 3-39

5. Release the TRACE FINDER and set both NORM-INV controls to NORM.

B. SMOOTHING BALANCE

The smoothing balance is specified as less than 1 cm of trace shift as the SMOOTHING control is rotated.

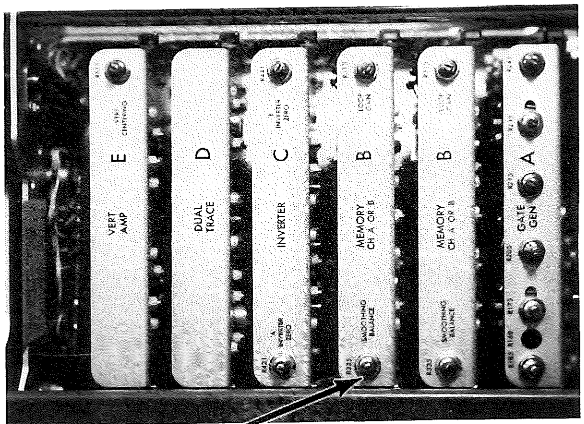
1. While rotating the CH A SMOOTHING control, adjust the Smoothing Balance, R335 - See Figure 3-40, for less than 1 cm of trace shift.

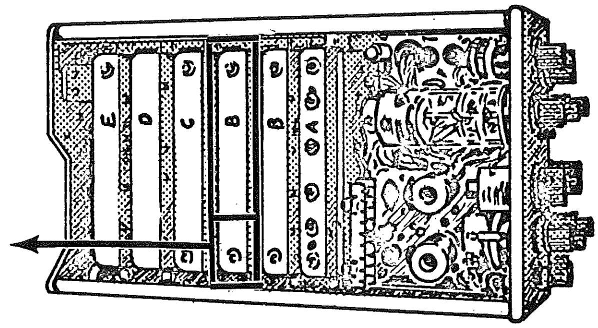


R335 A Smoothing Balance

Figure 3-40

2. While rotating the CH B SMOOTHING control, adjust the Smoothing Balance, R335 - See Figure 3-41, for less than 1 cm of trace shift.





R335 B Smoothing Balance

Figure 3-41

II. PRELIMINARY GAIN ADJUST

The nature of the 3S3 is such that the gain can not be adjusted until the risetime has been adjusted. In this part we will adjust the voltmeter ramp of the 6R1A.

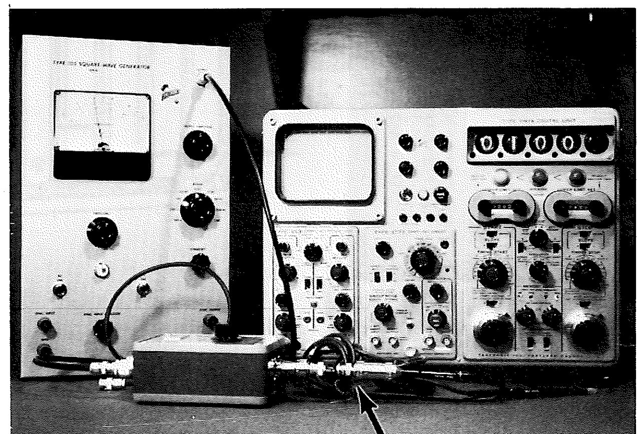
The A and B voltage response specifications are identical.

With the MV/DIV control set to 100 and 0.6v applied from the 50Ω Amplitude Calibrator, the 6R1A response is specified as 600 ±2 counts in slow and fast response.

A. CH A GAIN

1. On the 3T77, set the TIME/DIV to 10 μsec and the DOTS PER DIV to 10. On the 3S3, set the Mode to A only.
2. Apply power to a Type 105. Set the 105's output frequency to 10 KC. Connect the 105 to a 50Ω Amplitude Calibrator. Set the VOLTS control to 0.6v and adjust the Amplitude control on the 105 for a Dull Red glow as displayed on the neon in the 50Ω Amplitude Calibrator.

3. Connect the CH A probe to a GR to P6038 probe adaptor. Connect the probe adaptor to a GR to BNC adaptor and connect the GR to BNC adaptor to a 50Ω terminator. Connect the 50Ω terminator to another GR to BNC adaptor. Connect the last GR to BNC adaptor to the output of the 50Ω Amplitude Calibrator. See Figure 3-42.



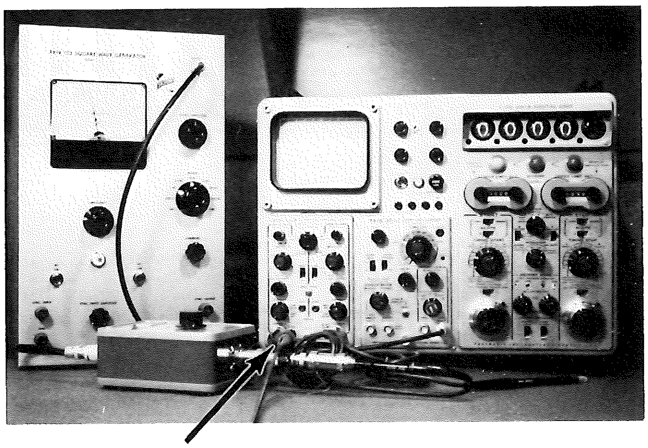
50Ω Amplitude Calibrator--
GR to BNC - 50Ω Terminator--
GR to BNC - GR to P6038 probe--
P6038 Probe

Figure 3-42

4. Connect the trigger source on the calibrator to the EXT INPUT (TRIGGER) on the 3T77. Adjust the TRIGGER SENSITIVITY and RECOVERY TIME controls for a stable display. On the 3S3, adjust the SMOOTHING control for a rectangular display.
5. Monitor the signal from the 3S3 to the 6R1A.
   a. If Lissajous measurments will be made with the 3S3, then this signal must be accurately calibrated for 1v per centimeter of deflection on the 567. Insert a comparison voltage plug-in into the test scope. Set the vertical for a .2v deflection sensitivity, AC coupled. Set the sweep for 5 msec, triggered.

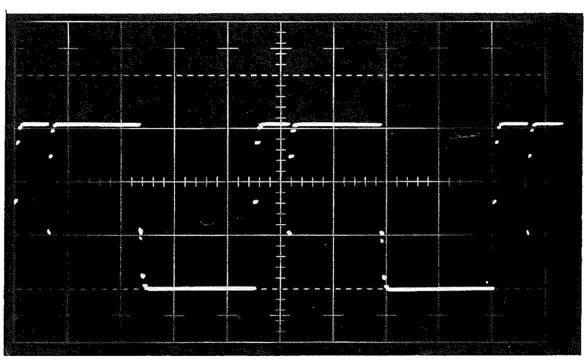
b. To insure a linear response when measuring voltage, the signal to the 6R1A should be from 0.9v/cm of deflection to 1.1v/cm of deflection. This can be adequately measured with any lettered series plug-in. Set the vertical for .2v deflection sensitivity, AC coupled. Set the sweep for 5 msec, triggered.

6. Connect a X10 probe from the test scope to the A OUT jack on the front panel of the 3S3. See Figure 3-43, 3-44, and 3-45.



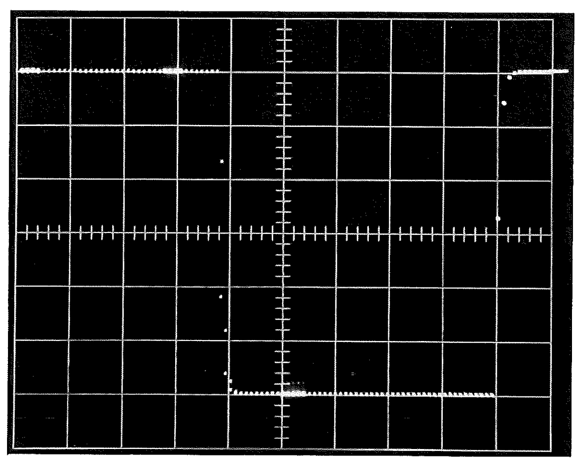
X10 probe from test scope

Figure 3-43



Test Scope Display

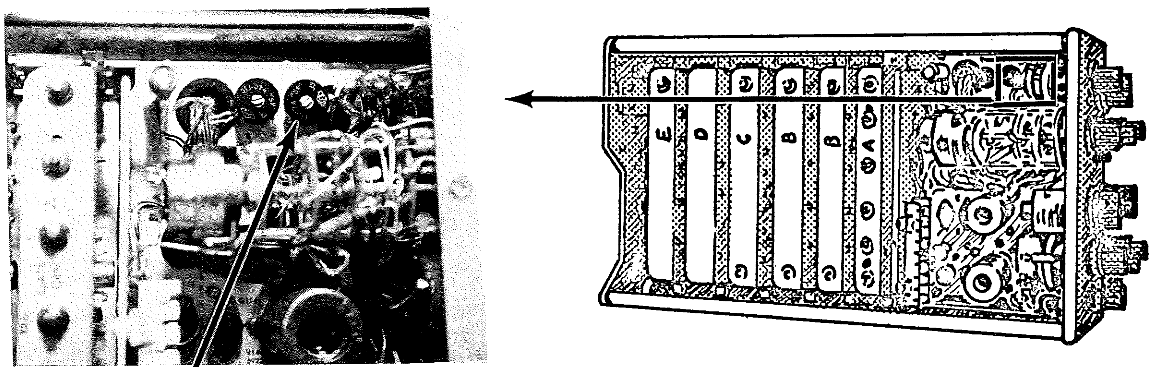
Figure 3-44



567 Display

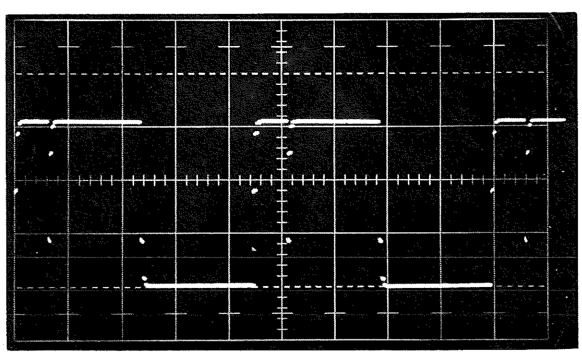
Figure 3-45

7. Vertically center the display on the 567. Position the 0% zone to the bottom of the display and the 100% zone to the top of the display.
8. Adjust the A Digital Gain, R354 - See Figure 3-46, for 3 divisions of vertical deflection on the test scope. See Figure 3-47.



R354 A Digital Gain

Figure 3-46

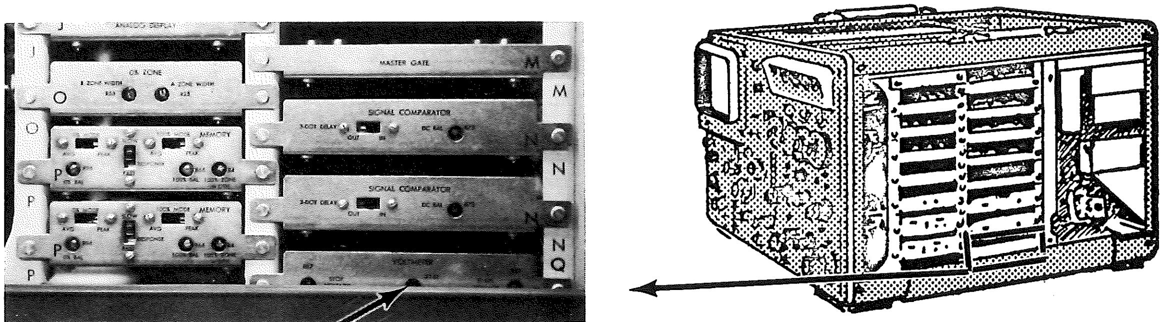


Adjust A Digital Gain for 3 divisions of vertical deflection on the test scope.

If Lissajous measurements will be made with the 3S3, the signal on the test scope should be accurately calibrated with a comparison voltage type plug-in.

Figure 3-47

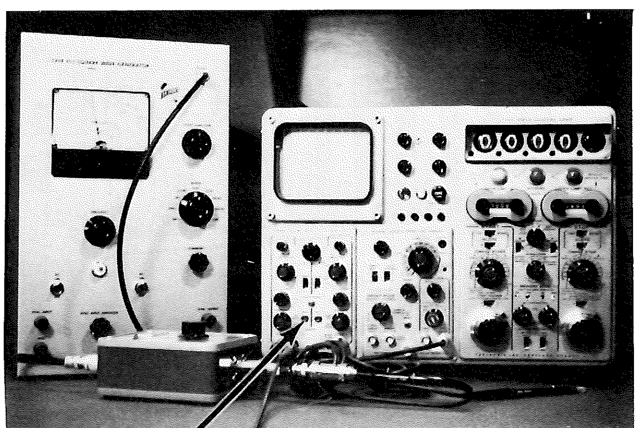
9. With the display still centered on the 567, adjust the Ramp Slope R141 - See Figure 3-28, for 600 counts.



R141 Ramp Slope

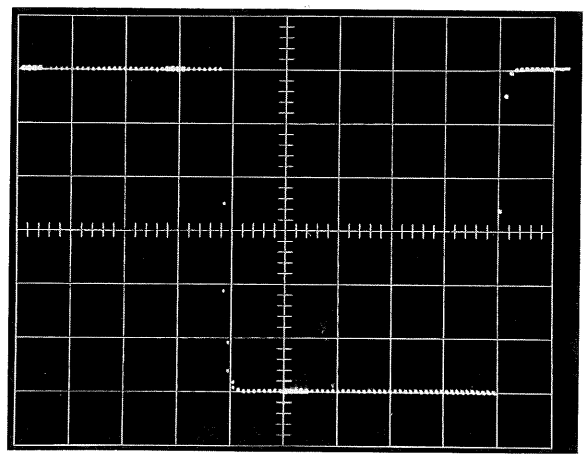
Figure 3-48

10. Adjust the CH A Gain, R439 - See Figure 3-49, for 6 cm of vertical deflection on the 567. See Figure 3-50.
11. Set the A Memory 0% Mode and 100% Mode to Peak. Light for Averaging must go out. Set the A Memory Response to Fast.



R439 CH A Gain

Figure 3-49



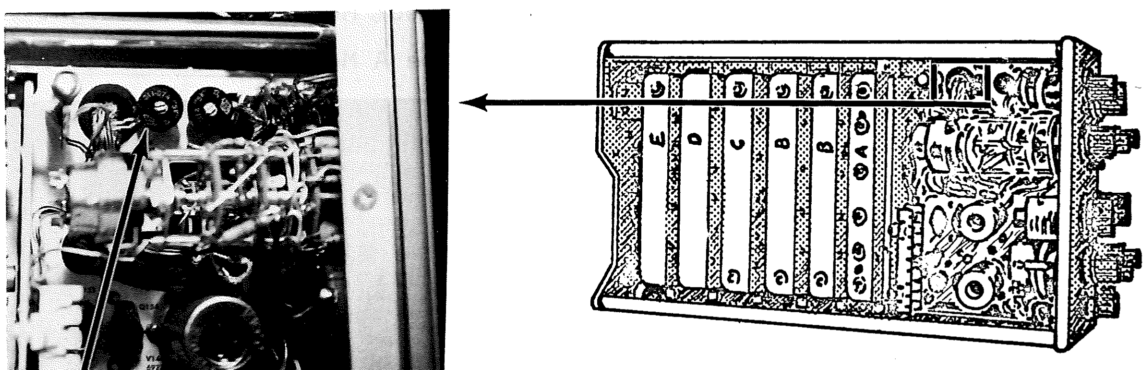
6 cm of vertical deflection

Figure 3-50

12. The 6R1A count must remain 600 ±2 counts.
13. Return the 0% and 100% Mode to AVG and the RESPONSE to SLOW.

B. CH B GAIN

1. On the 3S3, set the MODE to B ONLY. Disconnect the CH A probe from the GR to P6038 probe adaptor. Terminate the CH A probe in 50Ω.
2. Connect the CH B probe to the GR to P6038 probe adaptor. Connect the X10 probe from the test scope to the B OUT jack.
3. Center the display on the 567. Adjust the SMOOTHING control for a rectangular display.
4. Position the 0% zone to the bottom of the display and the 100% zone to the top of the display. Set the 6R1A MODE to B VOLTAGE and the B VOLTAGE switch to UP.
5. Adjust the B Digital Gain, R414 - See Figure 3-51, for 3 cm of vertical deflection on the test scope. There should be 600 counts on the 6R1A. See Figure 3-52.



R414 B Digital Gain

Figure 3-51

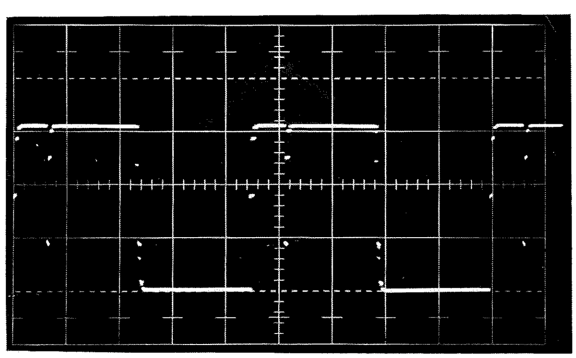
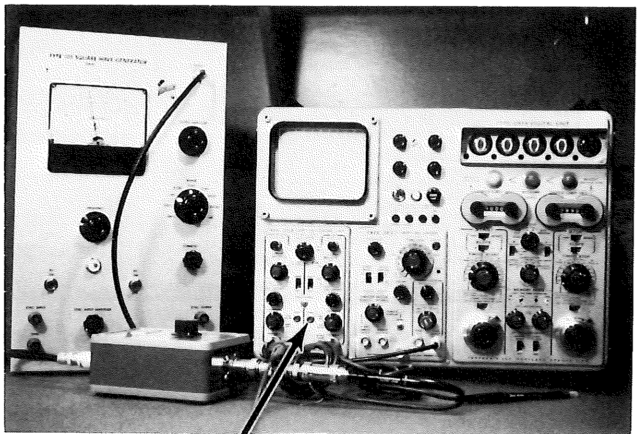


Figure 3-52

6. With the display still centered on the 567, adjust the CH B Gain, R459 - See Figure 3-53, for 6 cm of vertical deflection on the 567.



R459 B Gain

Figure 3-53

7. On the B Memory, set the 0% Mode and 100% Mode to PEAK. Lights for Zone Averaging must go out. Set the B Memory Response to FAST.
8. Check for a 6R1A count of 600 ±2 counts.
9. Return the 0% and 100% Mode to AVE and the Response to SLOW.

III. START and STOP VOLTAGE CAL

The Start and Stop Voltage tracking specifications are identical.

The normal tracking is specified as ±4 minor divisions.

The inverted tracking is specified as ±8 minor divisions.

A. START VOLTAGE NORMAL

1. On the 3T77, insure the TRIGGER SELECTOR is set to EXT +.
2. On the 6R1A, set the TIMING START and TIMING STOP controls to MANUAL and the START and STOP control to FIRST + SLOPE. Set the MODE to TIME STOP (-) START. Set the MANUAL controls so the intensified zone starts before the first positive (+) slope and so the intensified zone stops after the first positive (+) slope. See Figure 3-54.

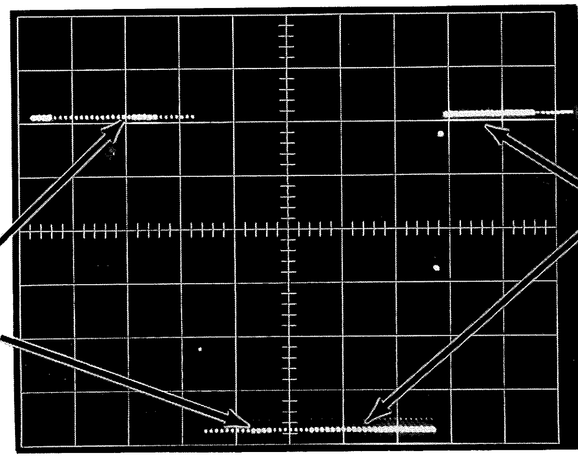


Figure 3-54

3. Set the START and STOP SLOPE controls to FIRST +. Set the START and STOP VOLTAGE to + and both helidials to 6.00.
4. Set the TIMING START to B TRACE. Adjust the Start Voltage Cal, R67 - See Figure 3-55, so the intensified zone just starts to jitter at the top of the first + slope. See Figure 3-56.

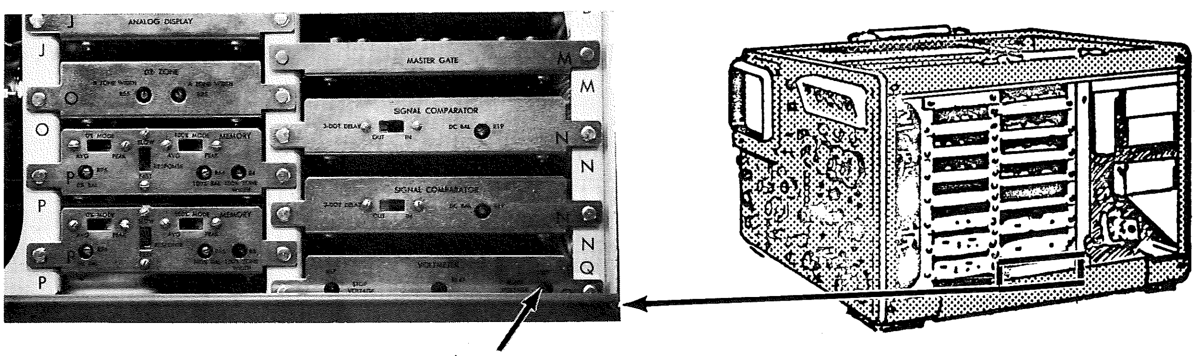
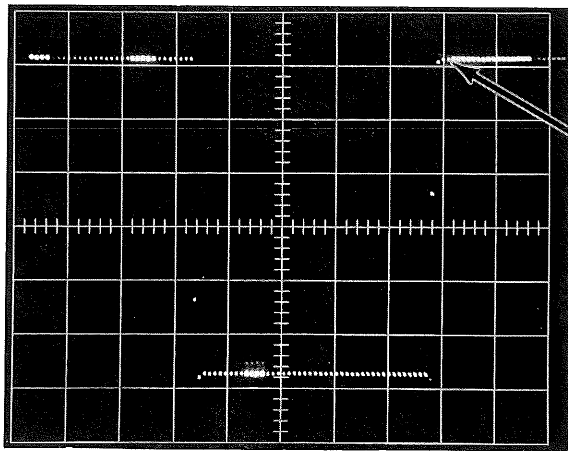


Figure 3-55



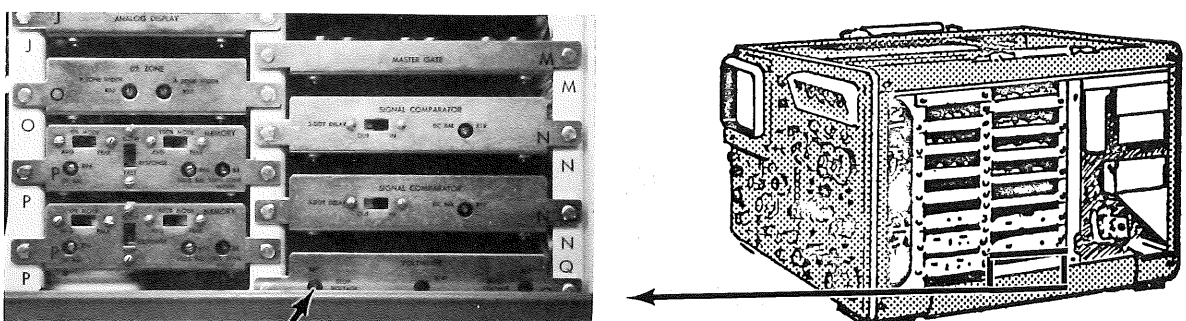
Start Voltage Cal adjusted so the intensified zone starts to jitter at the top of the first + slope.

Figure 3-56

5. The intensified zone must completely disappear when the helidial is set to 6.04 or higher.
6. Return the Start helidial to 6.00 and the TIMING START control to MANUAL.

B. STOP VOLTAGE NORMAL

1. Set the TIMING STOP to B TRACE. Adjust the Stop Voltage Cal, R87 - See Figure 3-57, so the intensified zone just starts to jitter at the top of the first + slope. See Figure 3-58.



R87 Stop Voltage Cal

Figure 3-57

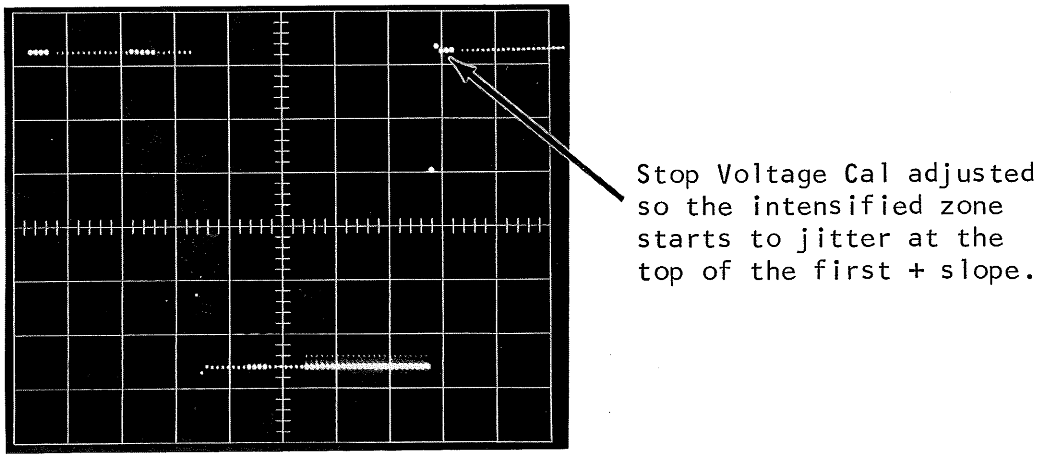


Figure 3-58

2. The intensified zone must "break over" if the helidial is set to 6.04 or higher. The jitter must cease when the helidial is set to 5.96 or lower.
3. Set the Stop helidial to 6.00.

C. START and STOP VOLTAGE INVERTED

1. Set the TIMING START to B TRACE.
2. On the 3S3, set the CH B NORMAL-INV to INV. On the 6R1A, set the START and STOP SLOPE controls to FIRST -. Set the START and STOP VOLTAGE to 0.
3. Set the Stop helidial to 6.08 or higher. There will be a jittery intensified zone after the first - slope. See Figure 3-59.

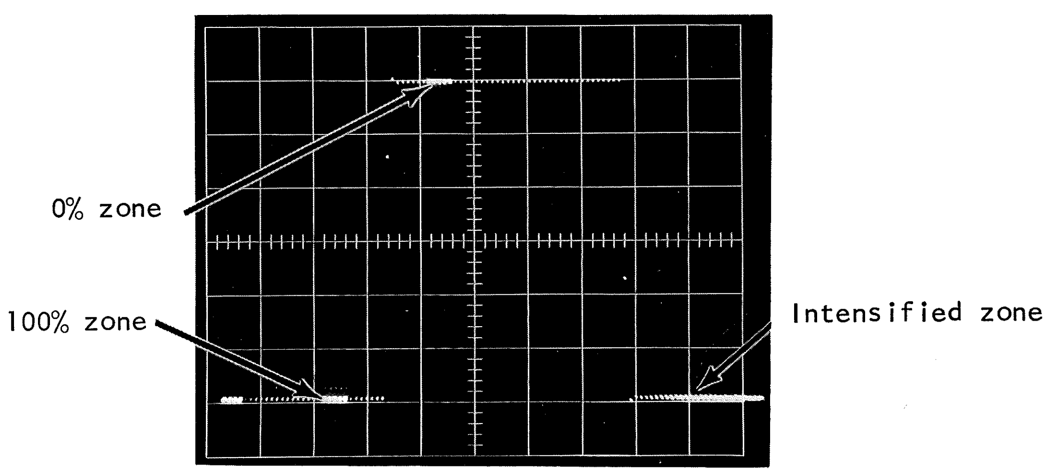


Figure 3-59

4. Set the Stop helidial below 6.08. The intensified zone will disappear. Return the Stop helidial to 6.08 or higher.
5. Set the Start helidial to 6.08 or higher. The intensified zone must disappear.
6. Disconnect the 50Ω Amplitude Calibrator and terminate the CH B probe in 50Ω.

Preset the front panel controls for the 3A2, 3B2, 6R1A combination as follows:

567

FOCUS ASTIGMATISM INTENSITY SCALE ILLUM	Adjust for an easily discernible sharply defined trace.

3A2

MODE	ALTER
TRIG SOURCE	CRT SIG
CH 1 and CH 2	
POSITION	midrange
INPUT COUPLING	GND
VOLTS/DIV	.01
VARIABLE	CALIB (in detent)
POLARITY	NORM

3B2

TRIGGER	
LEVEL	FREE RUN (CW)
COUPLING	AC SLOW
SLOPE	+
SOURCE	INT
SWEEP	
SWEEP DELAY	OUT
TIME/DIV	.5 msec
POSITION	midrange

Figure 3-59 shows the proper set up.

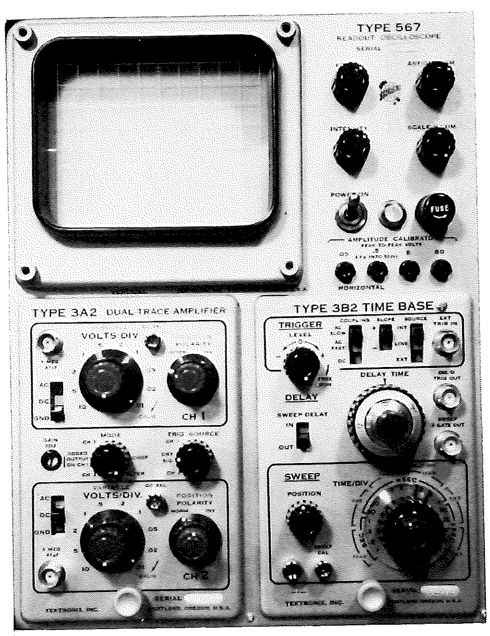
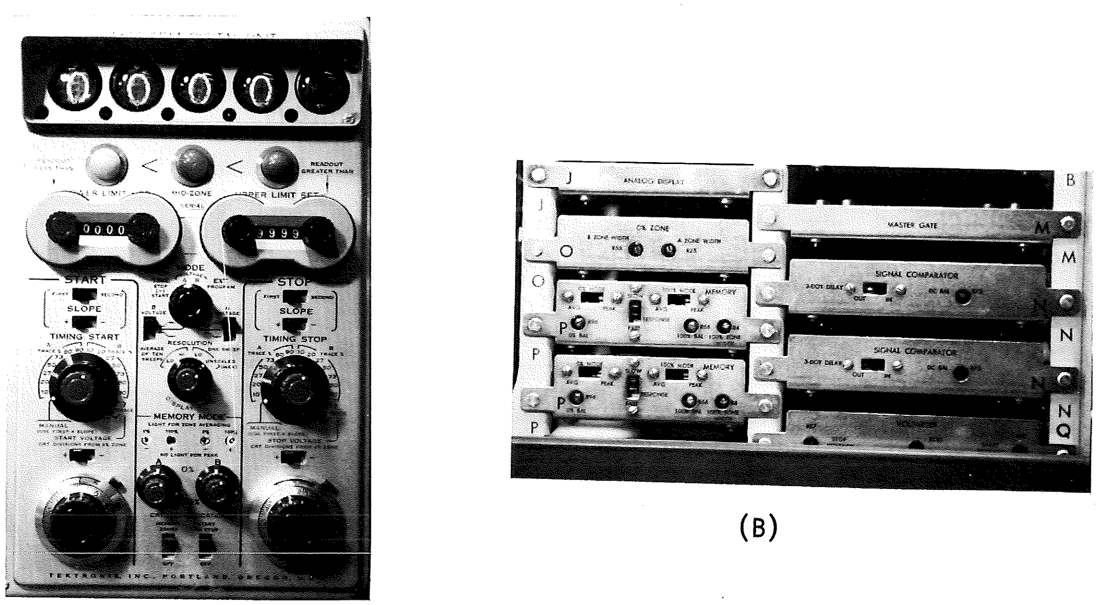


Figure 3-59

6R1A

MODE	VOLTAGE A
RESOLUTION	ONE SWEEP UNSCALED (max)
CRT INTENSIFICATION	
MEMORY ZONES	UP (on)
INTERNAL CONTROLS	
A and B MEMORY	
0% MODE	AVG
100% MODE	AVG
RESPONSE	SLOW
START and STOP COMPARATOR	
3-DOT DELAY	IN

Figure 3-60 A and B show the proper set up.



(A) (B)

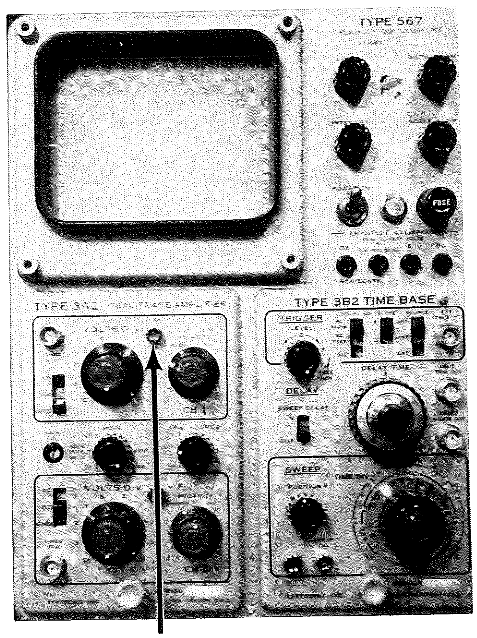
Figure 3-60

I. DC BALANCE

The DC Balance is specified as no trace shift when the VARIABLE VOLTS/DIV control is rotated.

A. CH 1 DC BALANCE

1. While rotating the CH 1 VARIABLE, adjust the DC Balance, R119 - See Figure 3-61, for no vertical trace shift.

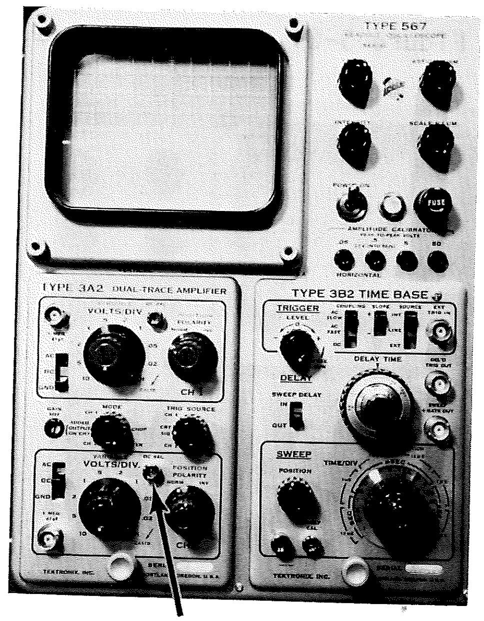


R119 CH 1 DC Balance

Figure 3-61

B. CH 2 DC BALANCE

1. While rotating the CH 2 VARIABLE, adjust the DC Balance, R219 - See Figure 3-62, for no vertical trace shift.



R219 CH 2 DC Balance

Figure 3-62

II. GAIN

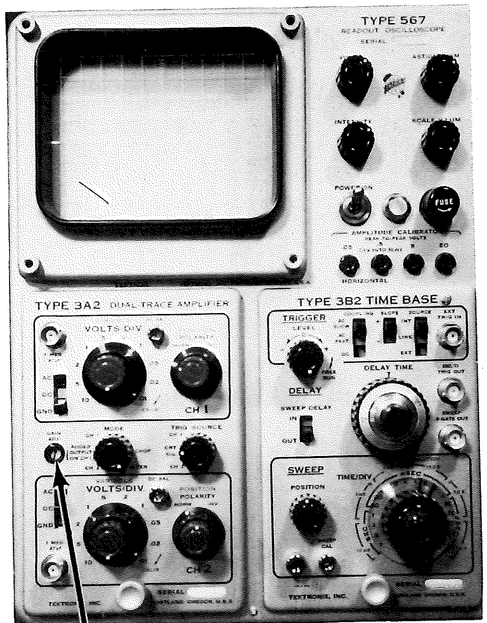
The GAIN and VOLTS/DIV accuracy is specified as ±3%.

A. PRELIMINARY GAIN ADJUSTMENT

1. Connect the output of a Standard Amplitude Calibrator to the CH 2 input connector. Set the output of the Standard Amplitude Calibrator to 50 mv.

2. Set the CH 2 INPUT Coupling to DC. Set the MODE switch to CH 2. On the 3B2, adjust the TRIGGER LEVEL for a stable display.

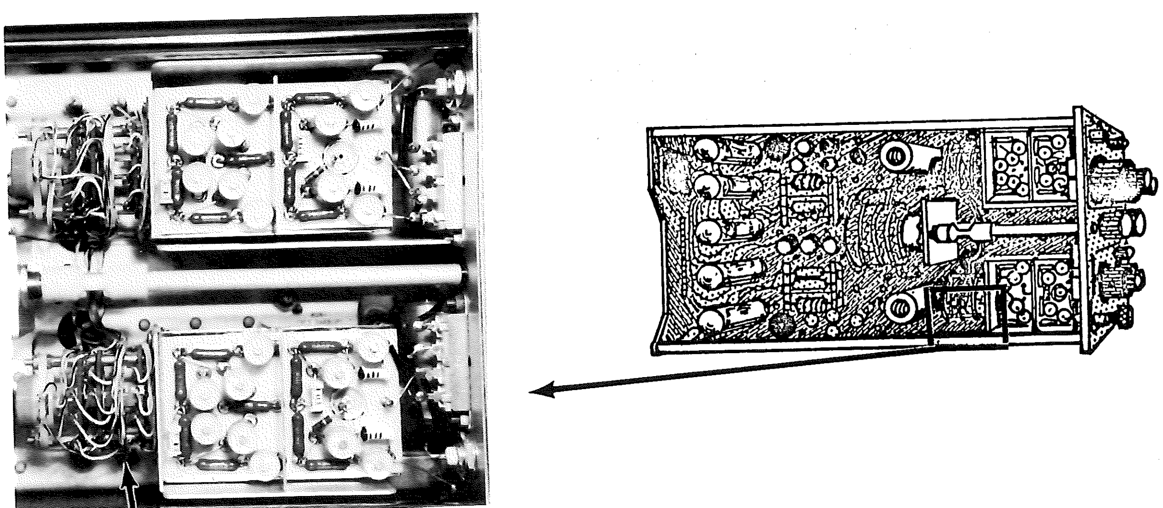
3. Set the Gain Adj., R327 - See Figure 3-63, full CW. (Maximum gain).



R327 Gain Adj.

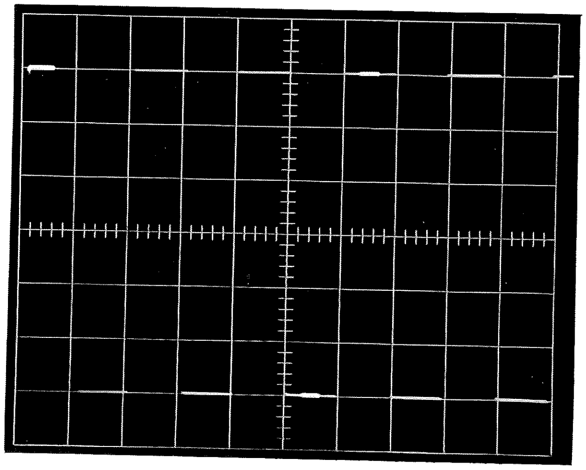
Figure 3-63

4. Adjust the CH 2 10mv Gain, R249 - See Figure 3-64, for 6 cm of vertical deflection. See Figure 3-65.



R249 CH 2 10mv Gain

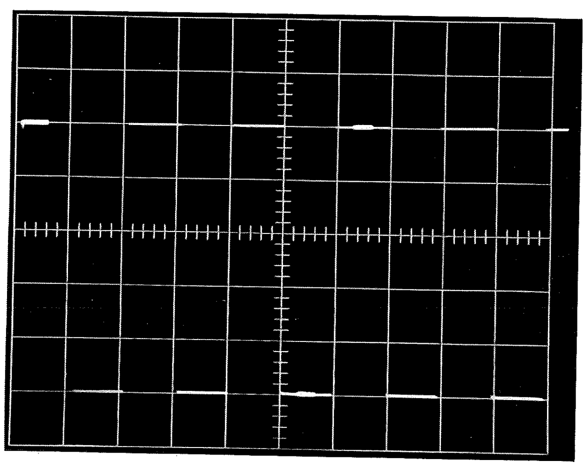
Figure 3-64



CH 2 10mv Gain adjusted for 6 cm of deflection

Figure 3-65

5. Readjust the Gain Adj., R327, for 5 cm of deflection. See Figure 3-66.



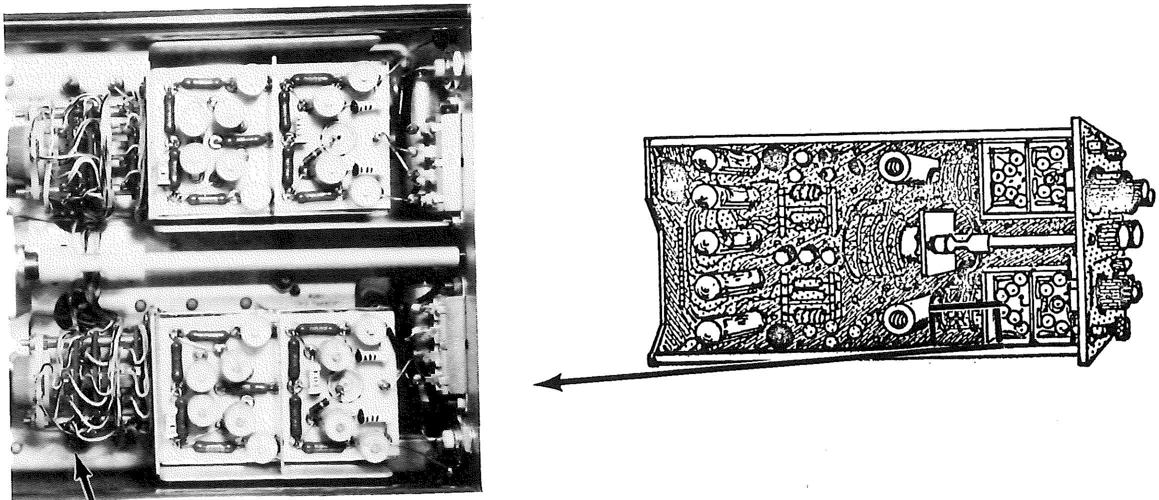
R327 Gain Adj. set for 5 cm of vertical deflection.

Figure 3-66

B. CH 2 20mv GAIN

1. Set the CH 2 VOLTS/DIV control to .02 and the output of the Standard Amplitude Calibrator to 100 mv.

2. Adjust the CH 2 20mv Gain, R247 - See Figure 3-67, for 5 cm of deflection.

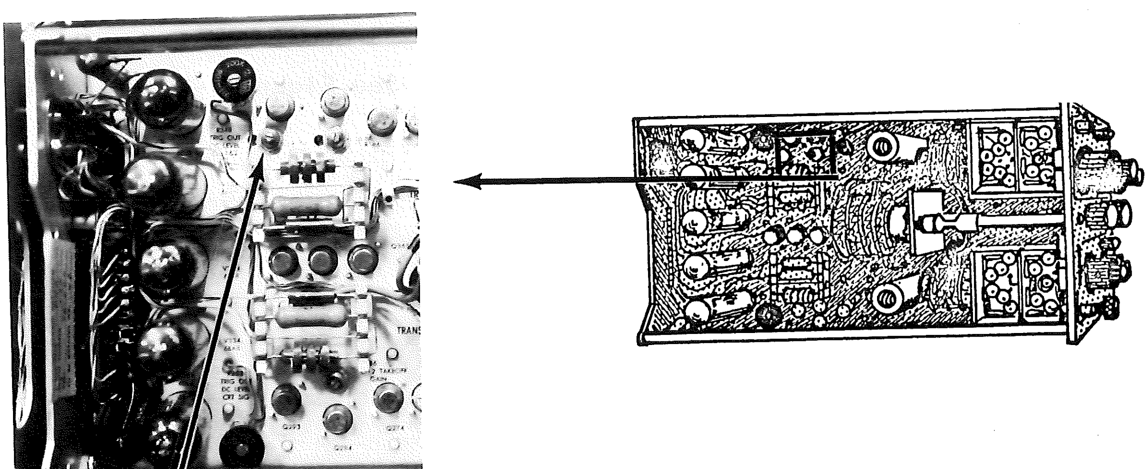


R247 CH 2 20mv Gain

Figure 3-67

C. ADDED GAIN BALANCE

1. Set the MODE switch to ADDED (Output on CH 1). (CH 1 POSITION control positions trace).
2. Adjust the Added Gain Balance, R163 - See Figure 3-68, for 5 cm of deflection.

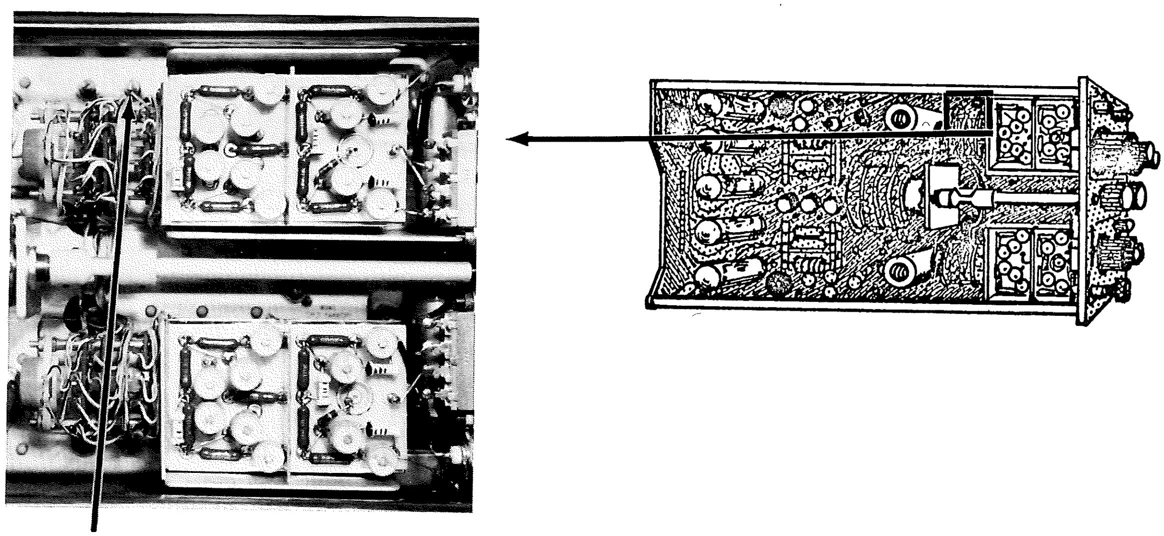


R163 Added Gain Balance

Figure 3-68

D. CH 1 GAIN

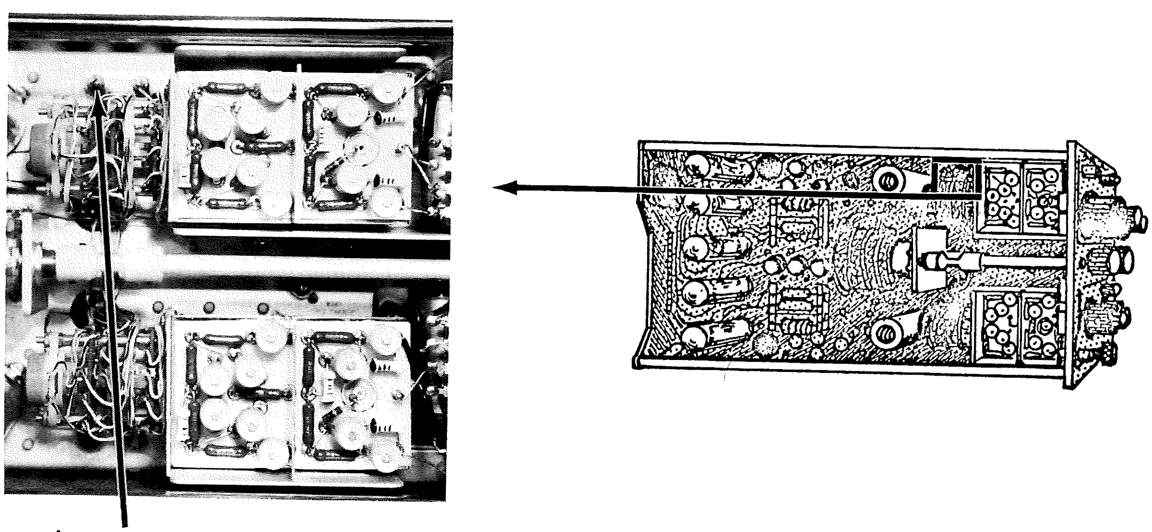
1. Set the MODE switch to CH 1. Set the Standard Amplitude Calibrator to 50 mv and connect it to the CH 1 input connector. Set the CH 1 INPUT COUPLING to DC and the CH 2 INPUT COUPLING to GND.
2. Adjust the CH 1 10mv Gain, R149 - See Figure 3-69, for 5 cm of deflection.



R149 CH 1 10mv Gain

Figure 3-69

3. Set the CH 1 VOLTS/DIV control to .02 and set the Standard Amplitude Calibrator to 100 mv.
4. Adjust the CH 1 20mv Gain, R147 - See Figure 3-70, for 5 cm of deflection.

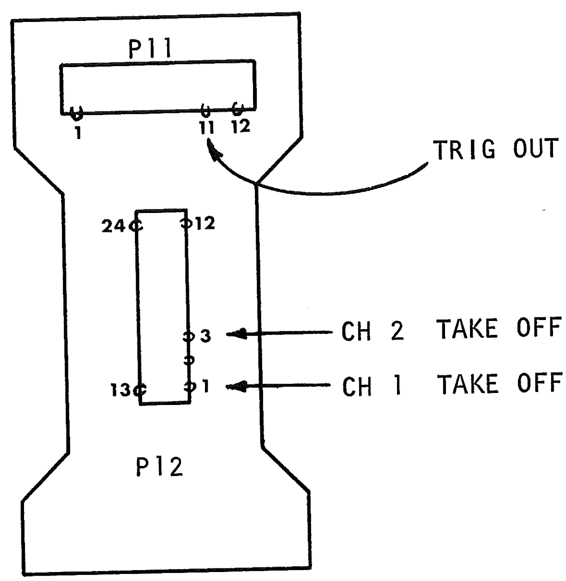


R147 CH 1 20mv Gain

Figure 3-70

E. TAKE-OFF DC LEVELS

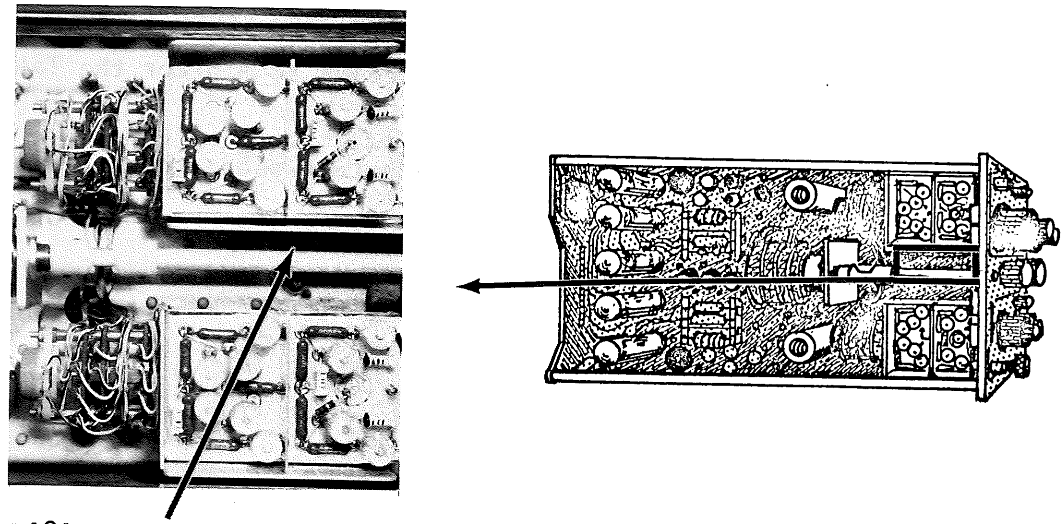
1. Set the MODE to ALTER and both VOLTS/DIV controls to .01. Set both INPUT COUPLINGS to GND. Position both traces to graticule center on the 3B2, set the TRIGGER LEVEL to FREE RUN.
2. Use a Comparison Voltage Preamp to monitor the Take-off DC Levels.
3. Connect a X1 probe from the test scope to pin 1 of P12, See Figure 3-71.



Pins 1 and 3 of P12 are located immediately behind V264.

Figure 3-71

4. Adjust the CH 1 Take-off DC Level, R181 - See Figure 3-72, for +10v ±0.25v.

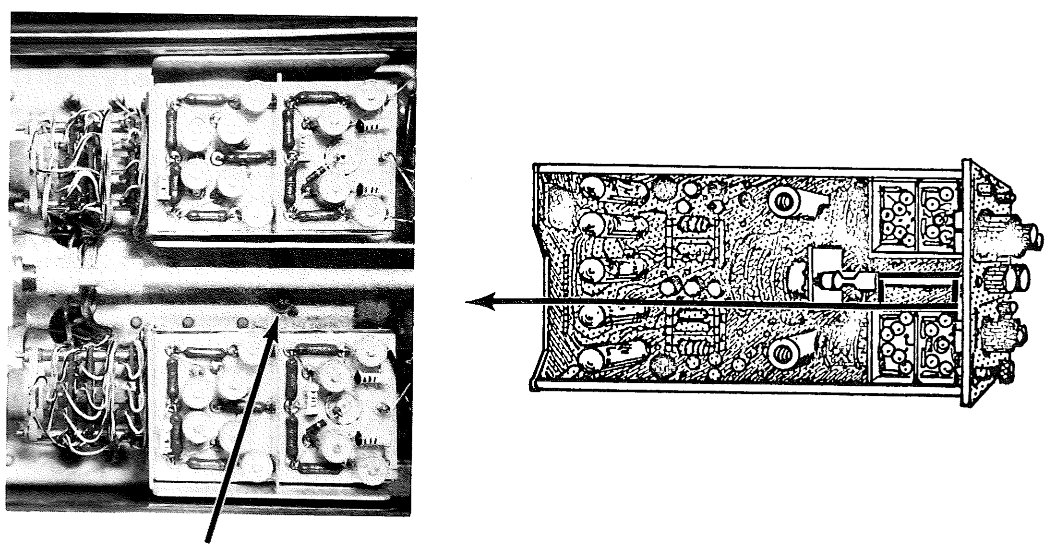


R181 CH 1 Take-off DC Level

Figure 3-72

5. Connect the X1 probe to pin 3 of P12, See Figure 3-71 (previous page).

6. Adjust the CH 2 Take-off DC Level, R281 - See Figure 3-73, for +10v ±0.25v.

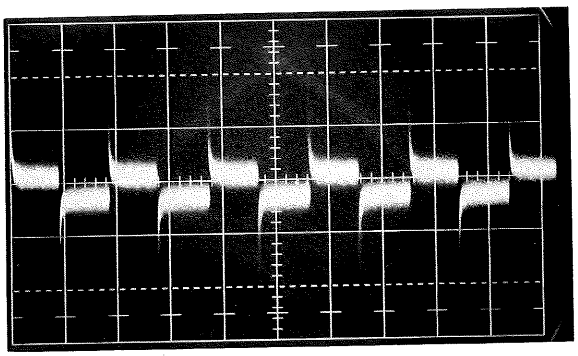


R281 CH 2 Take-off DC Level

Figure 3-73

F. CH 1 and CH 2 TAKE-OFF GAIN and LINEARITY

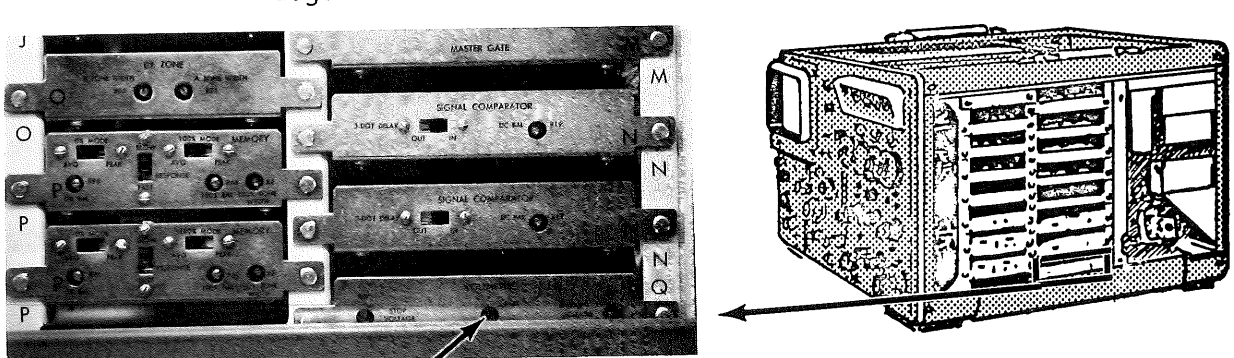
1. Set the MODE switch to CH 1. Set the CH 1 VOLTS/DIV to 1. Apply 5v from the Standard Amplitude Calibrator.
2. With a High Gain Differential Preamp (Type W or D), monitor the CH 1 input and pin 1 of P12.
3. Set the test scope for a deflection sensitivity of 10mv (includes probe), AC coupled, A-B mode.
4. Adjust the CH 1 VARIABLE control for a null indication on the test scope. See Figure 3-74.



CH 1 VARIABLE adjusted for null indication on test scope.

Figure 3-74

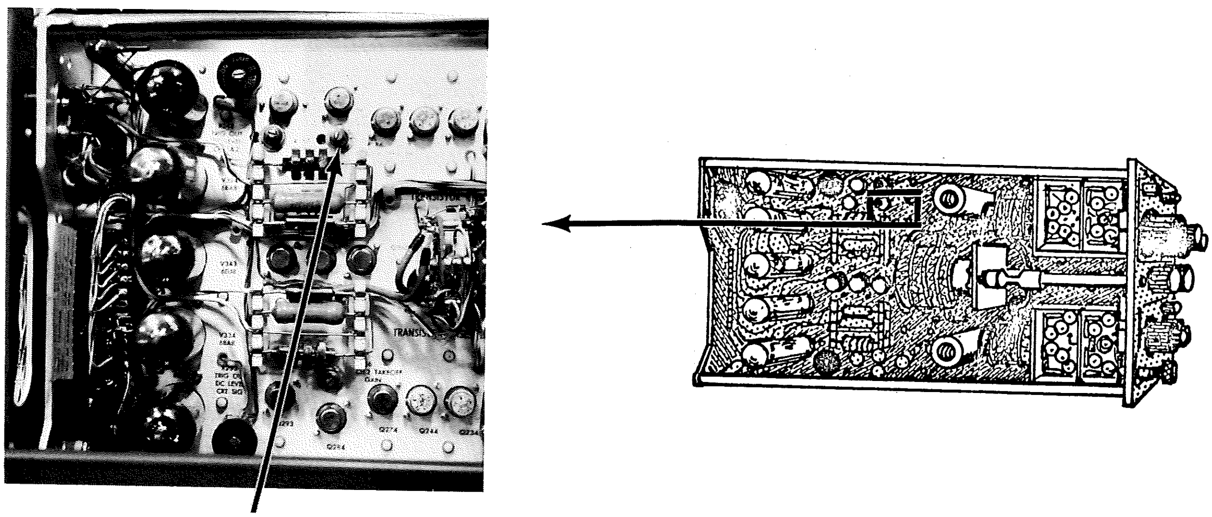
5. Adjust the TRIGGER LEVEL (3B2) for a stable display. Position the 0% and 100% zones appropriately on the 567 display.
6. Adjust the Ramp Slope, R141 - See Figure 3-75, for a digital count of 500.



R141 Ramp Slope

Figure 3-75

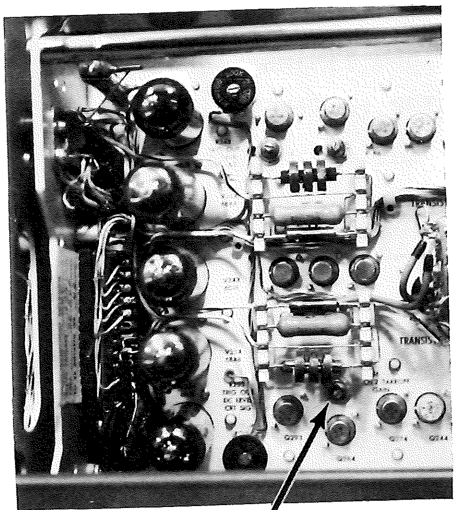
7. Set the Amplitude Calibrator to 1v. While positioning the display on the 567 from the top to the bottom of the graticule, check the test scope for an amplitude spread no greater than ±10 mv.
8. Set the output of the Standard Amplitude Calibrator to 50 mv, the CH 1 VOLTS/DIV control to .01 and the VARIABLE to CALIB (in detent).
9. Adjust the CH 1 Take-off Gain, R186 - See Figure 3-76, for a digital count of 500.

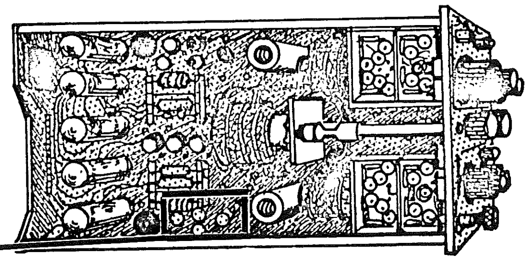


R186 CH 1 Take-off Gain

Figure 3-76

10. On the A Memory, set the 0% Mode and 100% Mode to PEAK. The lights for Zone Averaging must go out. Set the B Memory Response to FAST.
11. The 6R1A readout must remain 500 ±2 counts.
12. Return the 0% and 100%, Mode to AVE and the Response to SLOW.
13. Set the CH 1 INPUT COUPLING to GND. Connect the output of the Standard Amplitude Calibrator to the CH 2 input connector. Set the MODE switch to CH 2 and the CH 2 INPUT COUPLING to DC.
14. On the 6R1A, set the MODE to VOLTAGE B and position the 0% and 100% zones appropriately on the waveform.
15. Adjust the CH 2 Take-off Gain, R286 - See Figure 3-77, for a digital count of 500.





R286 CH 2 Take-off Gain

Figure 3-77

16. Set the CH 2 VOLTS/DIV to .1 and the Amplitude Calibrator to 1v. With the test scope set up as in step 3, monitor the CH 2 input and pin 3 of P12.
17. With the CH 2 VARIABLE, adjust the display on the test scope for a null indication.
18. Position the display on the 567 to the top and to the bottom of the graticule. Check the test scope for an amplitude spread no greater than ±10 mv.
19. Set the B Memory 0% Mode and 100% Mode to PEAK. Light for Zone Averaging must go out. Set the B Memory Response to FAST.
20. The 6R1A Readout must remain 500 ±2 counts.
21. Return the 0% and 100% Mode to AVE and the Response to SLOW.
22. Disconnect the probes.

III. START and STOP VOLTAGE CAL

The Start and Stop Voltage tracking specifications are identical.

The normal tracking is specified as ±4 minor divisions.

The inverted tracking is specified as ±8 minor divisions.

A. START VOLTAGE NORMAL

1. On the 3A2, set the VOLTS/DIV to .01 and the VARIABLE to CALIB (in detent). Set the output of the Standard Amplitude Calibrator to 50 mv.

2. On the 3B2, set the TIME/DIV to .2 msec. Insure the TRIGGER SLOPE is set to + and the TRIGGER SOURCE to INT.
3. On the 6R1A, set the TIMING START and TIMING STOP controls to MANUAL and set the START and STOP to FIRST + SLOPE. Set the MODE to TIME STOP (-) START. Set the MANUAL controls so the intensified zone starts before the first positive (+) slope and so the intensified zone stops after the first positive (+) slope, See Figure 3-78.

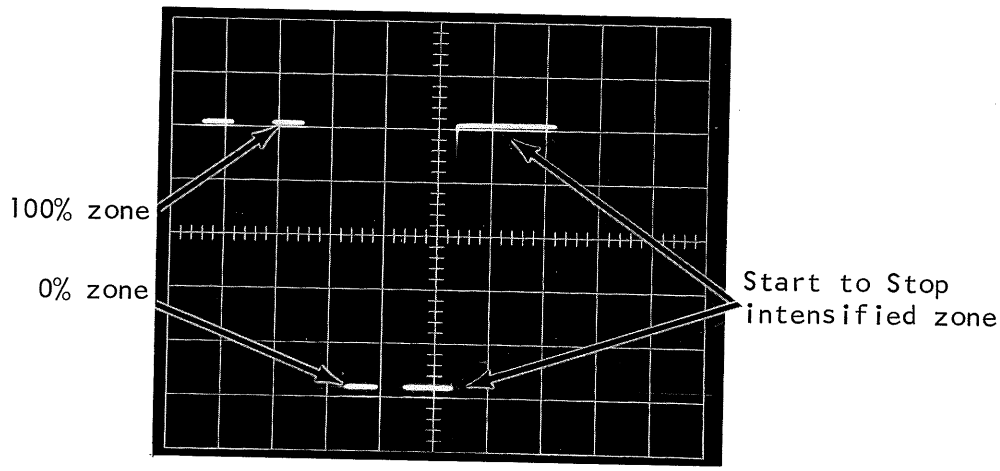


Figure 3-78

4. Set the START and STOP VOLTAGE to + and both helidials to 5.00.
5. Set the TIMING START to B TRACE. Adjust the Start Voltage Cal, R67 - See Figure 79, so the intensified zone just starts to jitter at the top of the first + slope. See Figure 3-80.

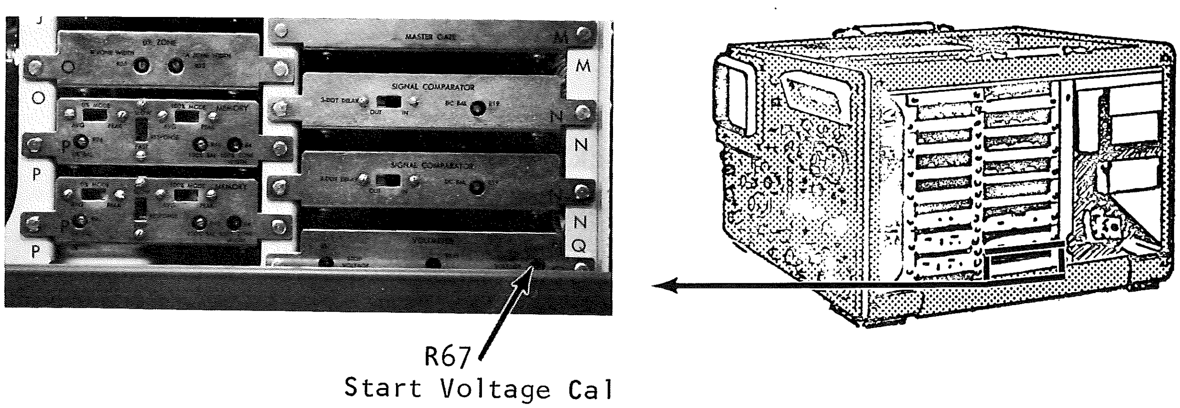


Figure 3-79

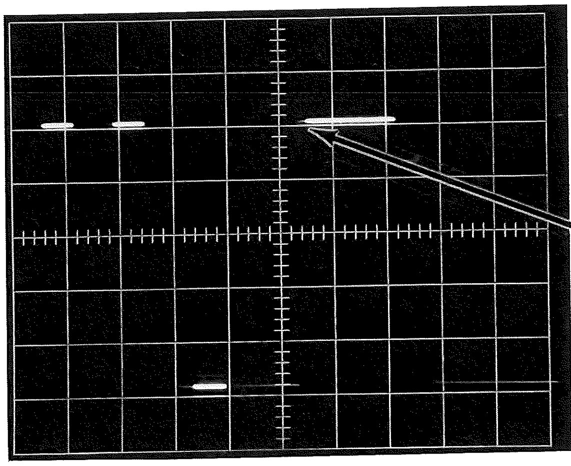


Figure 3-80

6. The intensified zone should completely disappear when the helidial is set to 5.04 or higher.
7. Return the Start helidial to 5.00 and the TIMING START to MANUAL.

B. STOP VOLTAGE NORMAL

1. Set the TIMING STOP to B TRACE. Adjust the Stop Voltage Cal, R87 - See Figure 3-81, so the intensified zone just starts to jitter at the top of the first + slope. See Figure 3-82.

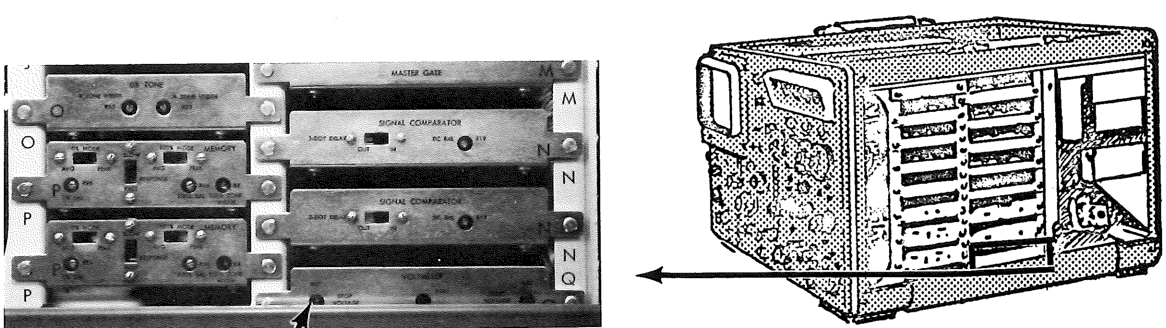


Figure 3-81

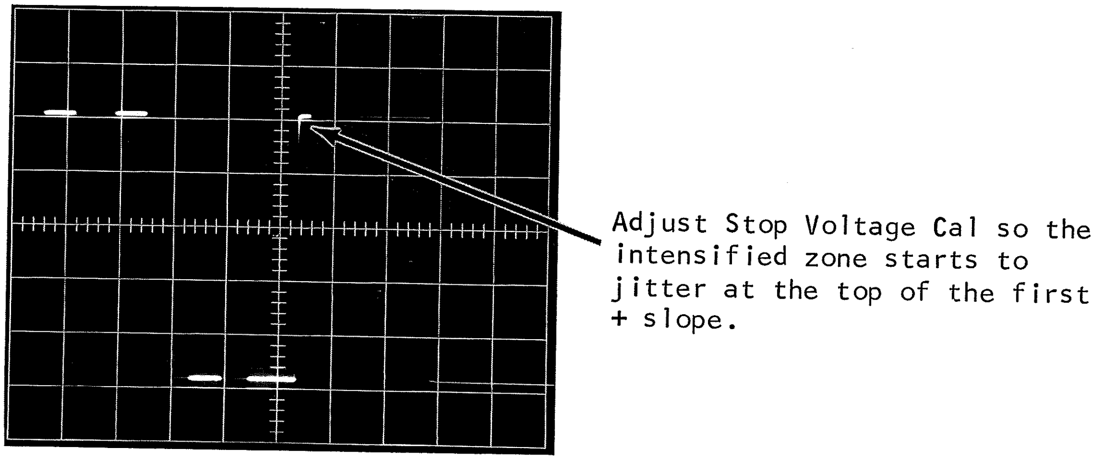


Figure 3-82

2. The intensified zone must "break over" if the helidial is set to 5.04 or higher. The jitter must cease when the helidial is set to 4.96 or lower.
3. Set the Stop helidial to 5.00.

C. START and STOP VOLTAGE INVERTED

1. Set the TIMING START to B TRACE.
2. On the 3A2, set the CH 1 POLARITY control to INV. On the 6R1A, set the START and STOP SLOPE controls to FIRST -. Set the START and STOP VOLTAGE to -.
3. Set the Stop helidial to 5.08 or higher. There will be a jittery intensified zone after the first - slope. See Figure 3-83.

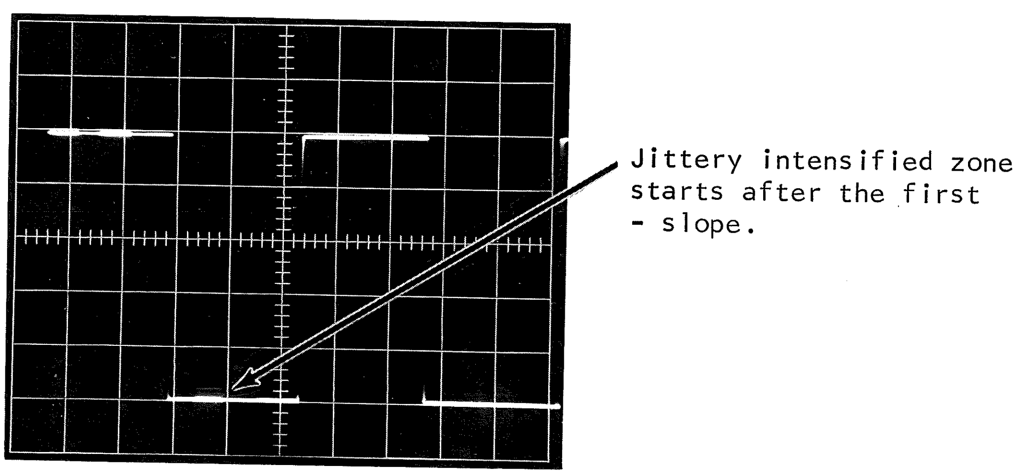


Figure 3-83

4. Set the Stop helidial below 5.08. The intensified zone will disappear. Return the Stop helidial to 5.08 or higher.
5. Set the Start helidial to 5.08 or higher. The intensified zone must disappear.

SECTION IV

This section covers the timing of the time base units. The 3T77 will have the 3S76 as the vertical unit in this section. If the 3S3 is used, some of the attenuators may need to be changed. Otherwise the procedure is the same.

The Trigger circuits will not be checked until the risetime of the vertical has been calibrated. The time readout capabilities of the 6R1A will also be checked after the vertical risetime has been set.

OUTLINE OF ADJUSTMENTS

		Page No.
3T77		
I.	PRELIMINARY SWEEP ADJUSTMENTS	4-3
II.	TIMING	4-11
III.	DOTS PER DIV	4-20
IV.	DELAY	4-24
3B2		4-31
I.	TIMING	4-32
II.	DELAY TIMING	4-35
III.	SIGNAL TO THE 6R1A	4-39

EQUIPMENT REQUIRED:

540 series oscilloscope or equivalent
Vertical preamp Type W (or Type Z and D)
Type 105 Square Wave Generator
50Ω Amplitude Calibrator
GR Oscillator Type 1209 (067-039)
GR Power Supply (068-040)
Mixer Rectifier (067-081)
Type 111
5X GR attenuator (017-045)
Male UHF to Female BNC (103-015)
10X GR Attenuator (017-044)
GR to UHF Adaptor
Type 180A or equivalent

3A2, 3B2, etc.

540 series oscilloscope or equivalent
Vertical Preamp differential input (CA, D, W, etc.)
Type 180A or equivalent

Preset the front panel controls for the 3S76, 3T77, 6R1A combination as follows:

567

FOCUS ASTIGMATISM INTENSITY SCALE ILLUM	Adjust for an easily discernible sharply defined trace.

3S76

MODE	B ONLY
SMOOTH-NORMAL	NORMAL
INTERNAL TRIGGER	B
CH A and B	
MV/DIV	200
POSITION	midrange
NORM-INV	NORM

3T77

POSITION	midrange
TIME/DIV	.1 μsec
VARIABLE	CALIB (fully CCW)
HORIZ MAG	X1
DOTS PER DIV	100
DELAY	CCW
SWEEP MODE	NORMAL
TRIGGER	
SENSITIVITY	CW
SELECTOR	INT +

6R1A

Presets for the 6R1A are not given at this time. It is only used toward the end of the section.

Figure 4-1 shows the proper set up.

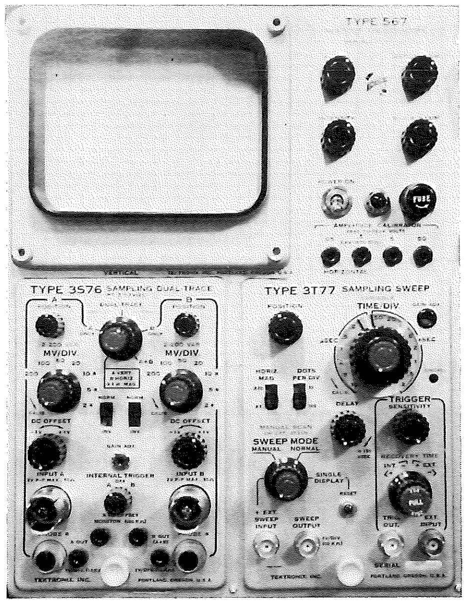


Figure 4-1

Turn off the 567 and remove the 3T77 from the horizontal plug-in receptacle. Connect P21 and P22, the horizontal plugs on the back panel of the mainframe, to a 24 pin plug-in extension. Connect the 3T77 to both 24 pin extenders. Turn on the 567.

I. PRELIMINARY SWEEP ADJUSTMENTS

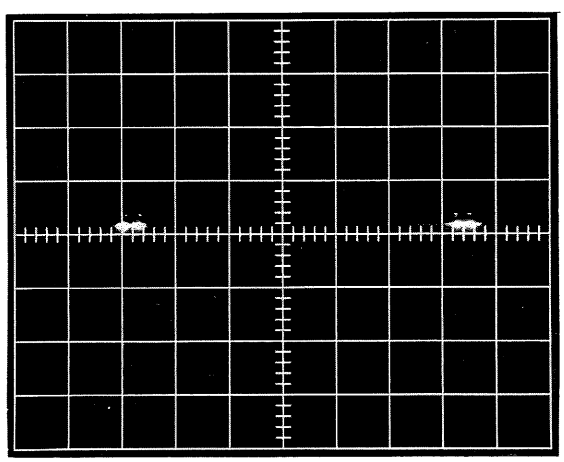
A. GAIN

Two methods are given for setting the gain. Method I utilizes the A VERT B HORIZ MODE of the vertical plug-in. Method I should be used only if the 3S76 vertical has been accurately calibrated to send a lv/cm of vertical deflection signal to the 6R1A. Method II utilizes the EXT SWEEP MODE of the horizontal.

The results obtained from the two methods are slightly different. The Gain Adj. sets the gain of the final stage in the horizontal amplifier. The signal from the vertical is sent to one side of a paraphase in the final stage. The signal from the horizontal is sent to the other side of the same paraphase. Resistance tolerances in the different input networks will cause the slight difference in results.

METHOD I

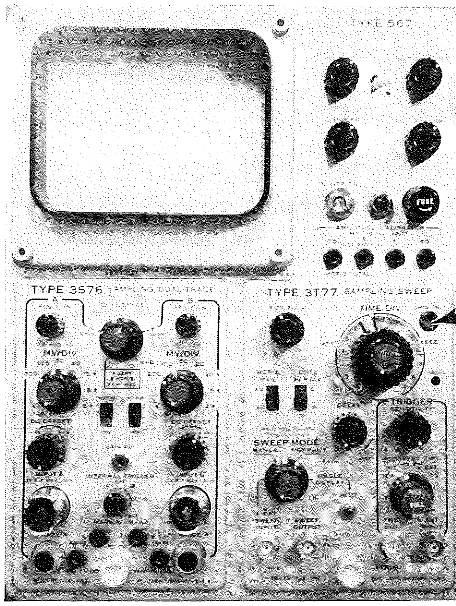
1. On the 3T77, set the TIME/DIV to 10 μsec and the DOTS PER DIV to 10.
2. Connect the output of a Type 105 to a 50Ω Amplitude Calibrator. Connect the 50Ω Calibrator to the CH B input connector. Set the output frequency of the 105 to 10 kc and adjust the amplitude for a dull red glow on the neon in the 50Ω Amplitude Calibrator. Set the 50Ω Calibrator for a 1.2v output. This is the same set up as used to adjust the vertical gain.
3. With the TRIGGER SENSITIVITY control on the 3T77, obtain a stable display. Check for 6 cm of vertical deflection on the 567 (adjusted in Section III).
4. Set the MODE control on the 3S76 to A VERT B HORIZ. With the CH A and B POSITION controls, center the display on the CRT. See Figure 4-2.



Display centered on the graticule.

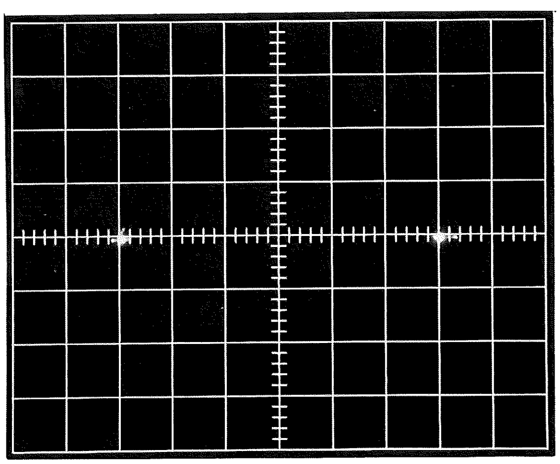
Figure 4-2

5. Adjust the Gain Adj., R356 - See Figure 4-3, for 6 cm of horizontal deflection. See Figure 4-4.



R356
Gain Adj.

Figure 4-3



R356 adjusted for 6 cm of horizontal deflection.

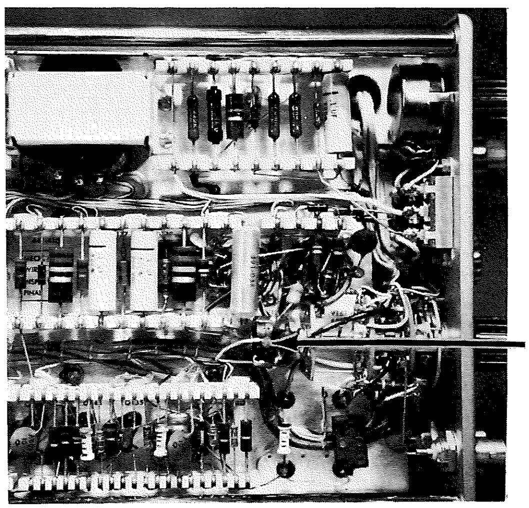
The DOTS PER DIV was set to 10 for this picture.

Figure 4-4

6. On the 3S76, set the MODE to A ONLY and the INTERNAL TRIGGER to A. Disconnect the 50Ω Amplitude Calibrator. On the 3T77, set the TIME/DIV to .1 μsec and the TRIGGER SENSITIVITY CW and the DOTS PER DIV to 100.

METHOD II

1. On the 3T77, set the SWEEP MODE to EXT SWEEP. Connect the output of a Standard Amplitude Calibrator to the EXT SWEEP INPUT. Set the output of the Standard Amplitude Calibrator to 50v.
2. With a Comparison voltage type preamp, monitor the center tap of the EXT ATTEN. See Figure 4-5.



Center tap of the
EXT. ATTEN.

Figure 4-5

3. Adjust the EXT ATTEN, See Figure 4-6, for 30v as measured at the center tap.

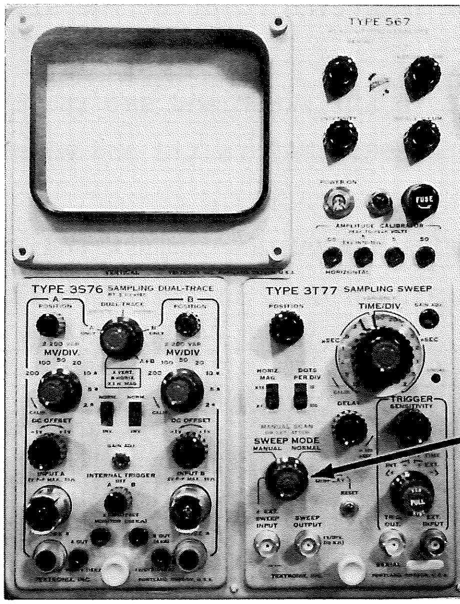


Figure 4-6

4. Adjust the Gain Adj., R356 - See Figure 4-7, for 6 cm of horizontal deflection.

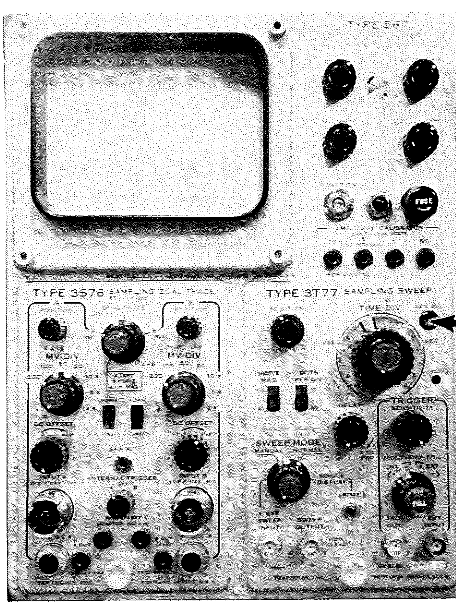


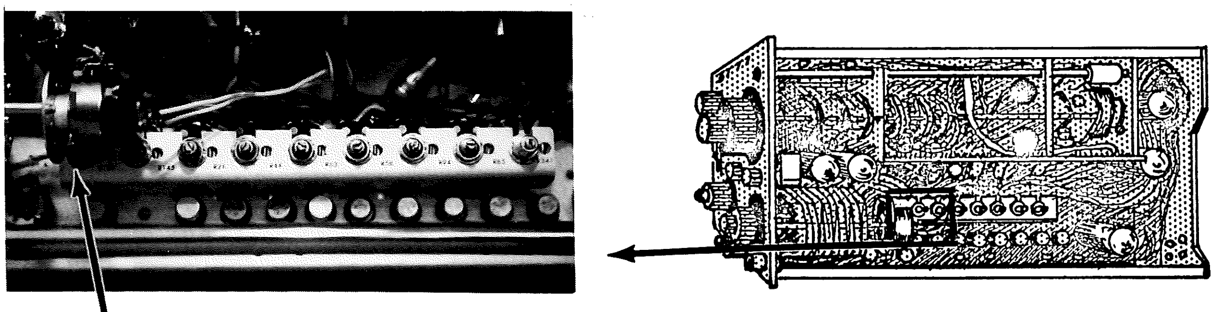
Figure 4-7

5. Disconnect the Standard Amplitude Calibrator.

B. STAIRCASE DC LEVEL

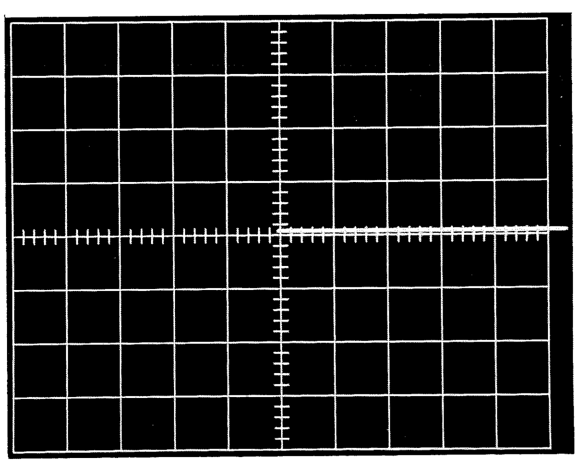
The Staircase DC Level (starting point of the staircase) is specified as 0v ± 100 mv.

1. Set the SWEEP MODE to EXT SWEEP and set the EXT ATTEN fully CCW. Set the HORIZ MAG to X10 and with the POSITION control, set the dot to graticule center.
2. Set the SWEEP MODE to NORMAL and adjust the Staircase DC Level, R181 - See Figure 4-8, so the sweep starts at graticule center. See Figure 4-9.



R181 Staircase DC Level

Figure 4-8

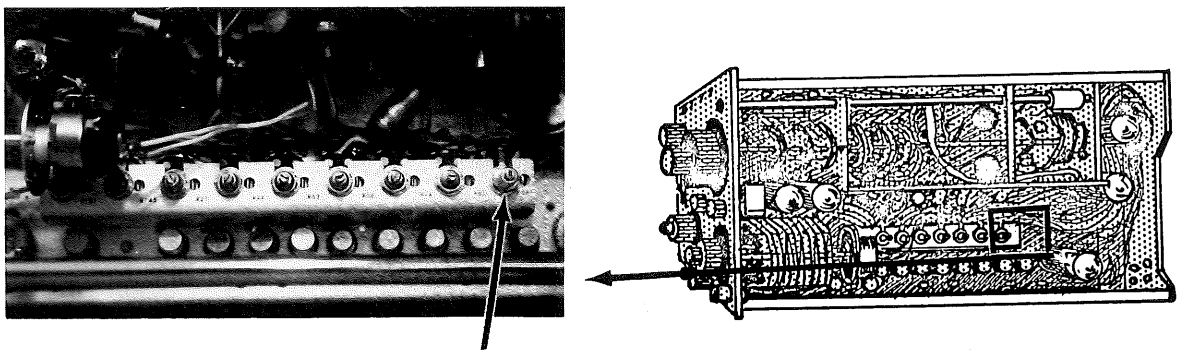


Staircase DC Level adjusted so the Sweep starts at graticule center.

Figure 4-9

C. MAG REGIS

1. With the SWEEP MODE set to NORMAL, set the HORIZ MAG to X10 and position the start of the trace to graticule center.
2. Set the HORIZ MAG to X1 and adjust the Mag Regis, R341 - See Figure 4-10, so the trace starts at graticule center.



R341
Mag Regis

Adjust R341 so the Sweep starts at graticule center.

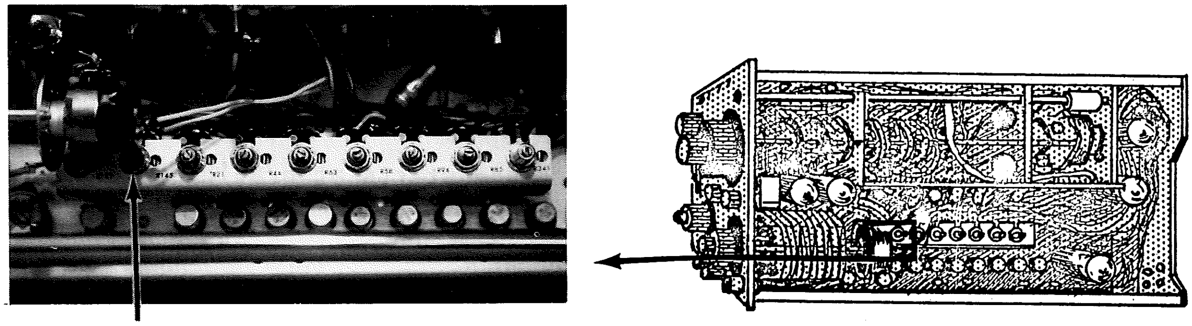
Figure 4-10

3. The adjustment of R341 causing an interaction between the X1 and X10 positions. Repeat steps 1 and 2 until the interaction is at a minimum. (There is no specific spec on the trace shift as the HORIZ MAG is switched between X1 and X10. Typically the trace shift should be less than 2 mm).

D. SWEEP LENGTH

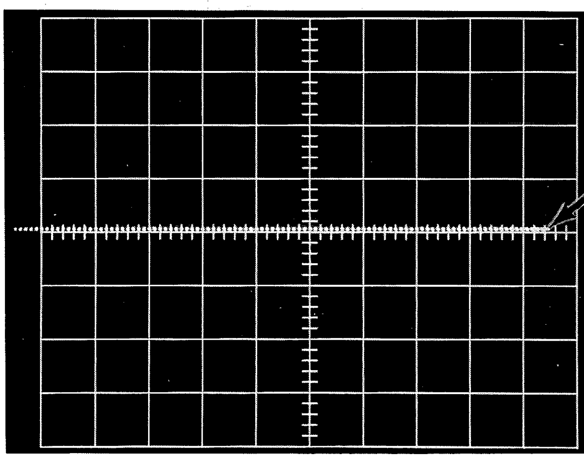
The Sweep Length is specified as 10.5 cm ±0.3 cm.

1. Set the HORIZ MAG to X1 and position the start of the trace to the first graticule line.
2. Adjust the Sweep Length, R145 - See Figure 4-11, for a sweep length of 10.5 cm. (We think the easiest way to adjust the Sweep Length is to set the DOTS PER DIV to 10 and adjust for a sweep length of 10 cm. Then position the trace to the left and adjust for 5 more dots at the end of the trace. See Figure 4-12).



R145 Sweep Length

Figure 4-11



With the 3T77 set to 10 dots, we first adjusted for a 10 cm sweep. We then adjusted for 5 more dots at the end of the sweep.

Figure 4-12

E. HORIZ POSITION RANGE

The HORIZ POSITION RANGE is specified as follows:

With a 10 cm sweep, the beginning and end of the sweep must pass the center graticule line as the POSITION control is set full CW and CCW.

1. Set the POSITION control full CW. The start of the trace must be to the right of graticule center.
2. Set the POSITION control full CCW. The end of the trace must be to the left of graticule center.
3. Position the start of the trace to the first graticule line.

II. TIMING

The Timing is specified as ±3%, with the HORIZ MAG set to X1. With the HORIZ MAG set to X10, the Timing is specified as ±6%.

A. BASIC TIMING

1. On the 3S76, set the MV/DIV to 50, the MODE to A ONLY, and the Internal Trigger to A.
2. On the 3T77, set the TIME/DIV to 5 μsec, and the DELAY control to midrange.
3. Connect the output of a Type 180A through a female BNC to GR adaptor and a 10X GR Attenuator to the CH A input connector. Apply 5 μsec markers from the 180A. Obtain a stable display, with the TRIGGER SENSITIVITY. (If the 3S3 is used, an external trigger will be needed).
4. Adjust the Sweep Cal, R85 - See Figure 4-13, for 1 marker/cm. See Figure 4-14.
   a. Timing is checked and adjusted in the middle 8 horizontal centimeters unless otherwise noted.

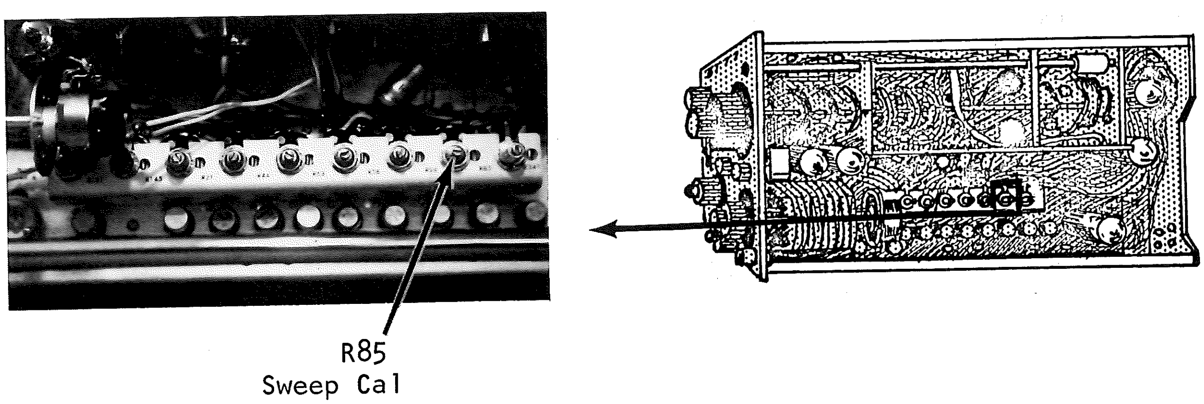
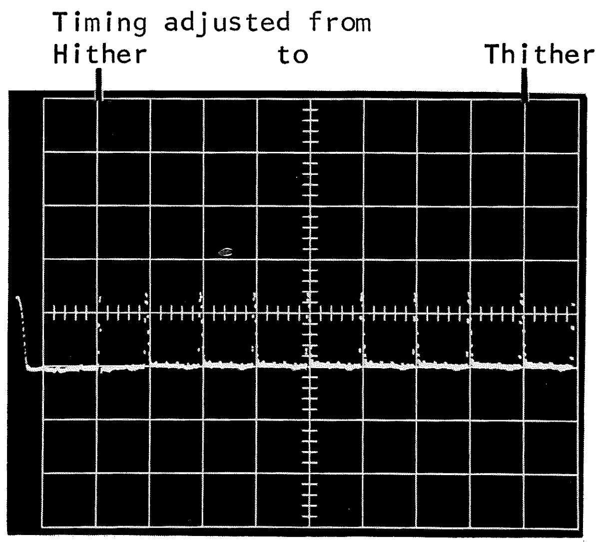


Figure 4-13



R85 adjusted for 1 marker/cm

Figure 4-14

5. Set the TIME/DIV to 1 μsec and apply 1 μsec markers from the 180. Adjust R79A, See Figure 4-15, for 1 marker/cm.

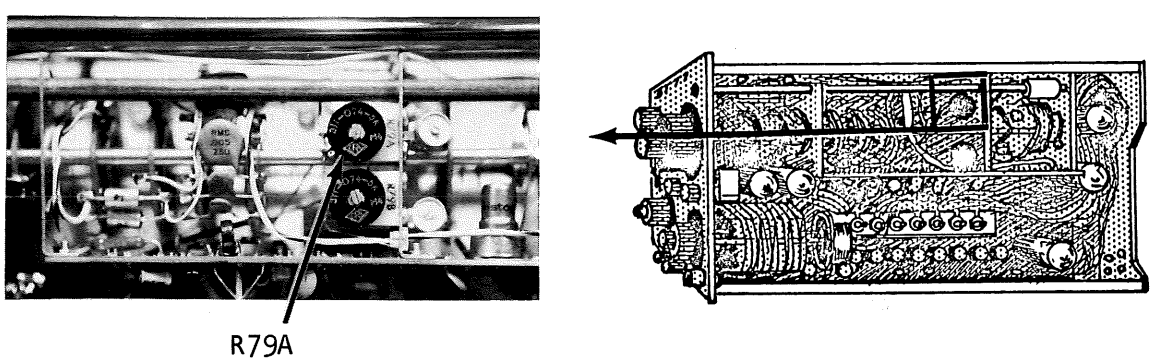


Figure 4-15

6. Set the TIME/DIV to .1 µsec and apply 10 mc from the 180. Adjust R79B, See Figure 4-16, for 1 cycle/cm.

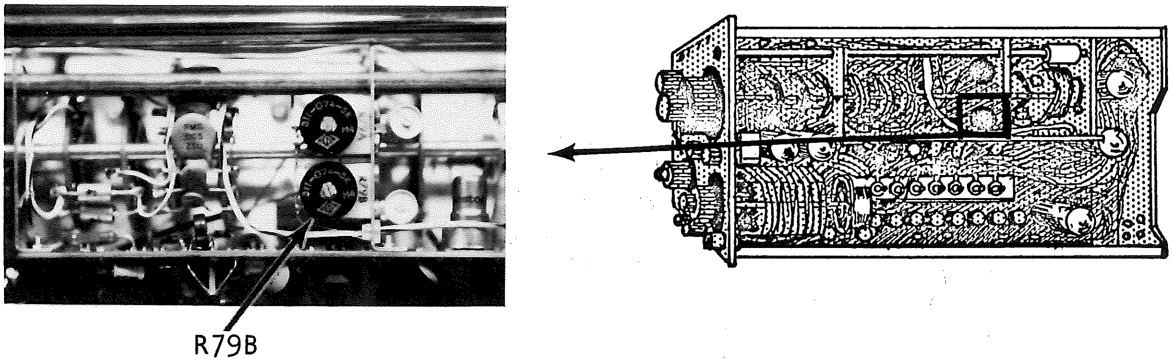
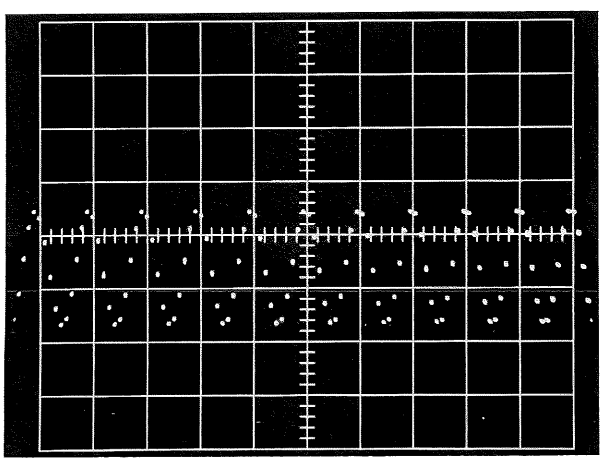


Figure 4-16

B. MAGNIFIER ACCURACY and LINEARITY

1. Set the TIME/DIV to 1 µsec and the HORIZ MAG to X10. 180 signal is still 10 mc.
2. Note timing accuracy and linearity over the complete display. The total error must not exceed ±3%. See Figure 4-17.



TIME/DIV at 1 µsec and
HORIZ MAG at X10.
10 mc applied from 180A.

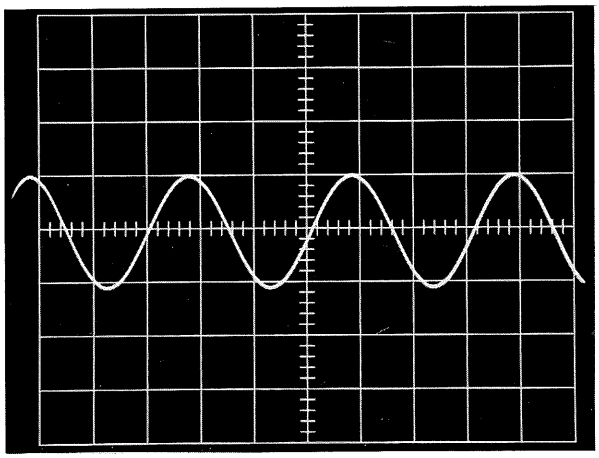
Check timing and linearity over the complete display.
Figure 4-17

3. Set the HORIZ MAG to X1 and the TIME/DIV to .1 µsec.

C. VARIABLE TIME/DIV

The Variable range is specified as 2.7:1, minimum.

1. Set the VARIABLE TIME/DIV control fully CW.
2. There must be at least 2.7 cm between successive cycles. See Figure 4-18.



With the VARIABLE set full CW, there must be at least 2.7 cm between successive cycles.

Figure 4-18

3. Return the VARIABLE to the CALIB position (fully CCW - in detent).

D. TIMING CHECKS with 180A

1. Check the Timing from 10 μsec to 20 nsec against the following chart.

TIME/DIV	180A	DISPLAY	TOLERANCE
10 μsec	10 μsec	1 marker/cm	±2.4 mm
5 μsec*	5 μsec	"	"
2 μsec	1 μsec	2 marker/cm	"
1 μsec*	1 μsec	1 marker/cm	"
.5 μsec	1 μsec	1 marker/2 cm	"
.2 μsec	5 mc**	1 cycle/cm	"
.1 μsec*	10 mc	1 cycle/cm	"
50 nsec	10 mc	1 cycle/2 cm	"
20 nsec	50 mc	1 cycle/cm	"

*Previously adjusted

**On 3S76, set MV/DIV to 200

E. 500 MC OSCILLATOR CERTIFICATION

This portion of the procedure provides a method of certifying the accuracy of the 500 mc source. This part must be performed to certify the 3T77's timing from .2 nsec to 10 nsec as traceable to NBS.

1. Connect the output of a GR oscillator Type 1209-B (or equivalent) to the UNKNOWN input connector on a MIXER RECTIFIER through a 10X GR attenuator. See Figure 4-19.

Connect 180A signal

Connect GR signal

Connect to scope input

Mixer Rectifier (067-081)

Figure 4-19

2. Connect the output of a Type 180A to the KNOWN input connector of the Mixer Rectifier. Set the output frequency of the 180A to 50 mc.
3. Connect the OUTPUT connector of the Mixer Rectifier to the input of a test scope with at least 50 mv deflection sensitivity. See Figure 4-20.

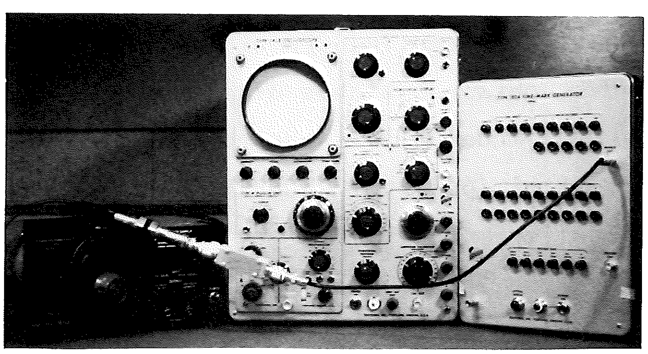
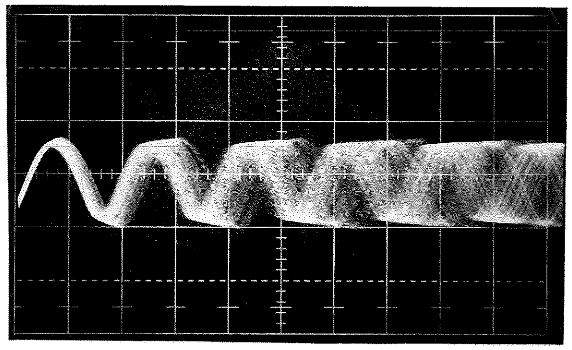


Figure 4-20

4. On the test scope, set the sweep speed to .1 msec, free running or triggered. AC couple the input signal.
5. On the GR oscillator, set the output frequency to approximately 500 mc as read on the frequency indicator.
6. Slowly twirl the GR frequency control about 500 mc while monitoring the display on the test scope. When the GR's frequency is a multiple of 50 mc (180A signal), an audio difference signal will be seen on test scope. See Figure 4-21.



With the test scope sweep rate set to .1 msec and the beat frequency's period is greater than 1 division, the accuracy of the GR at 500 mc is greater than 0.4%.

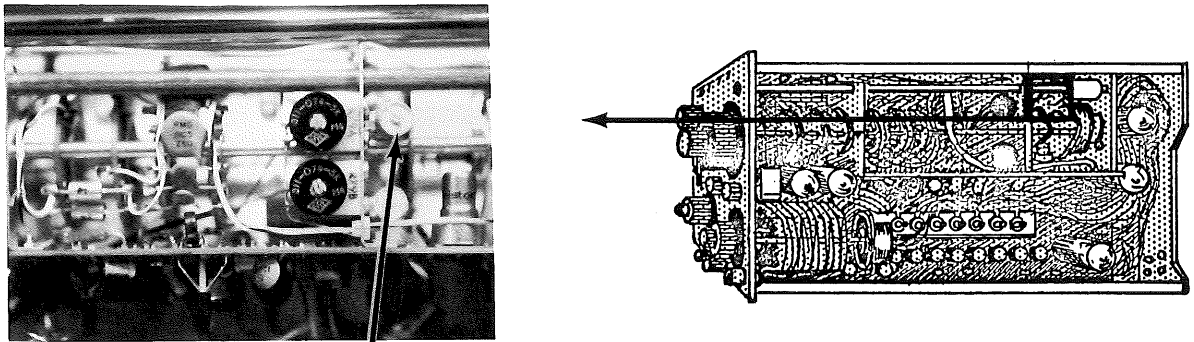
Figure 4-21

NOTE: An audio amplifier and a headset can be substituted for the test scope. With this arrangement tune for maximum screech as heard with ear drums. Then tweak for a low frequency audio tone.

F. TIMING CHECKS and ADJUSTMENTS WITH 500 MC OSCILLATOR

1. Disconnect the output of the GR oscillator from the Mixer Rectifier and connect it to the CH A input connector of the 3S76.
2. With the 2-200 VARIABLE and, if necessary, by selecting GR attenuators, obtain about 6 cm of vertical deflection on the 567. With the TRIGGER SENSITIVITY and RECOVERY TIME controls, obtain a stable display.
   a) Later model 3T77's are equipped with a PULL FOR SYNC control (pull out RECOVERY TIME control).
   b) Earlier model 3T77's may require External Trigger or Type 280 Trigger Countdown unit to obtain a stable display.

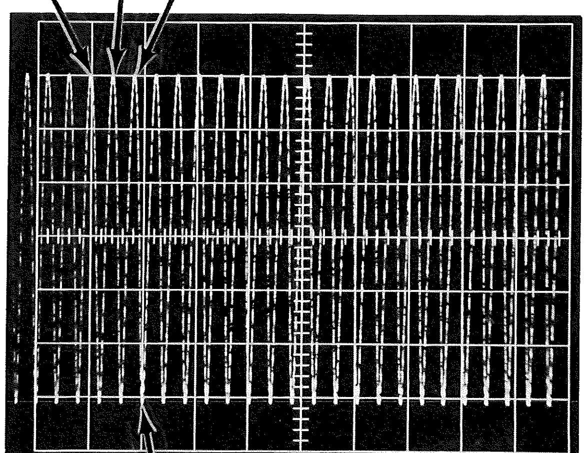
3. On the 3T77, set the TIME/DIV to 5 nsec. Adjust C88E, See Figure 4-22, for 2.5 cycles/cm. See Figure 4-23.



C88E

Figure 4-22

Start 1 2

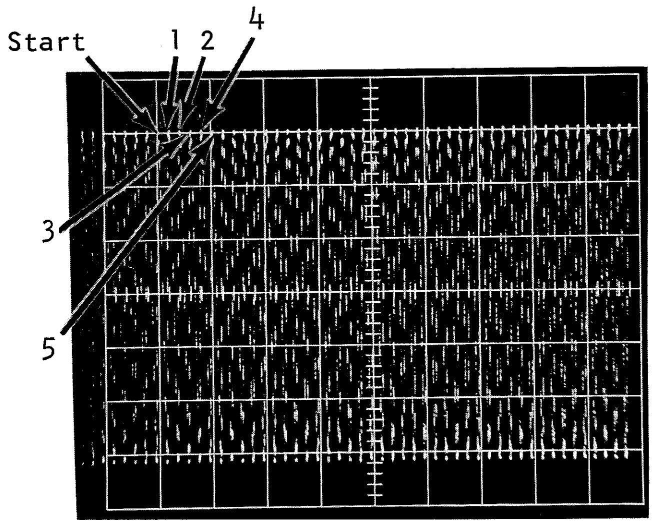


1/2

Adjust C88E for 2 1/2 cycles/cm

Figure 4-23

4. Set the TIME/DIV to 10 nsec and check for 5 cycles/cm. See Figure 4-24.



TIME/DIV set to 10 nsec

Figure 4-24

We ain't guaranteeing nothing, but you could get cross-eyed on this one.

5. Set the TIME/DIV to 1 nsec and adjust C88G, See Figure 4-25, for 1 cycle/2 cm.

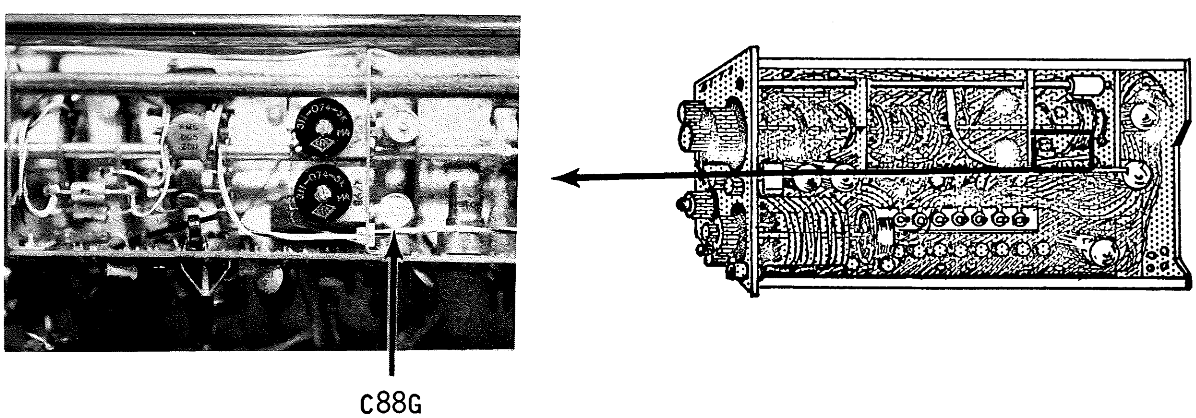


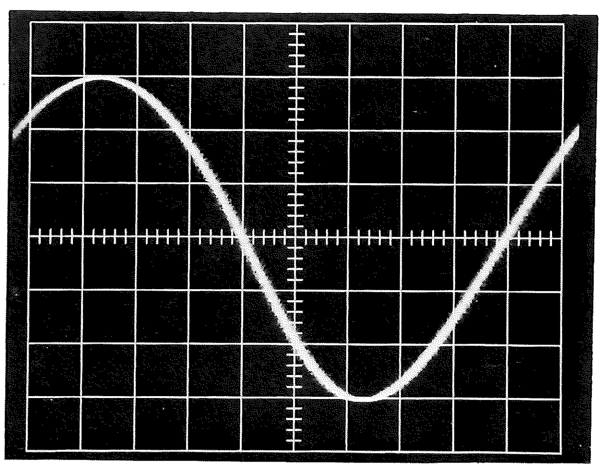
Figure 4-25

6. Check the Timing from 10 nsec to .2 nsec against the following chart.

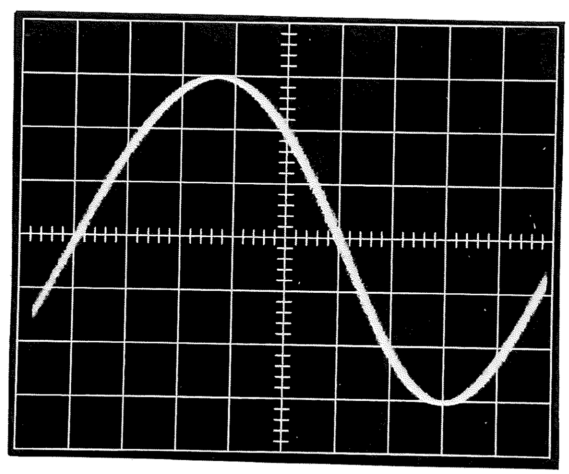
TIME/DIV	GR	DISPLAY	TOLERANCE
10 nsec	500 mc	5 cycles/cm	±2.4 mm
5 nsec*	"	2.5 cycles/cm	±2.4 mm
2 nsec	"	1 cycle/cm	±2.4 mm
1 nsec*	"	1 cycle/2 cm	±2.4 mm
.5 nsec	"	1 cycle/4 cm	±2.4 mm
.2 nsec**	"	1/2 cycle/5 cm	±2.4 mm

*Previously adjusted

**Check by positioning a positive or negative peak at the 2nd graticule line and check for the opposite peak at the 7th graticule line. Then position a positive or negative peak at the 10th graticule line and check for the positive peak at the 5th graticule line. See Figure 4-26A and B.



A



B

Figure 4-26

7. Disconnect the GR oscillator.

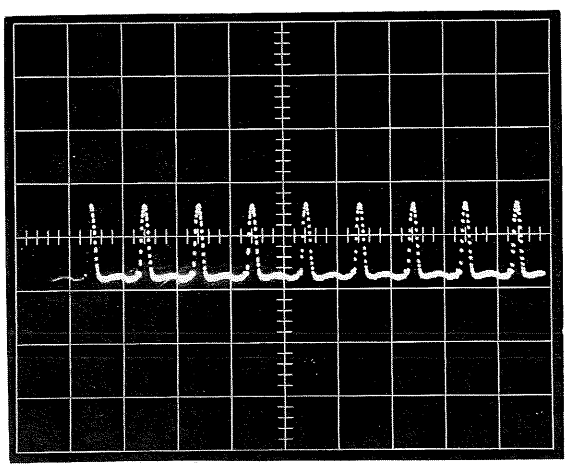
III. DOTS PER DIV ACCURACY

With the DOTS PER DIV control set at 100, there must be 800 dots between the 2nd and 10th graticule lines. With the DOTS PER DIV control set at 10, there must be 80 dots between the 2nd and 10th graticule lines.

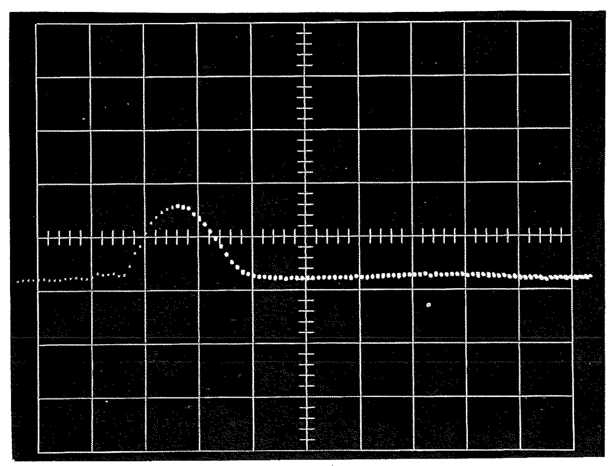
A. 100 DOTS PER DIV

1. On the 3T77, set the TIME/DIV to 1 μsec. Apply 1 μsec markers from a 180A through a 10X GR attenuator to the CH A input connector on the 3S76. Obtain a stable display.

2. On the 6R1A, set the MODE to TIME STOP (-) START. Set the CRT INTENSIFICATION MEMORY ZONES to down (off) and the START TO STOP to up (on). Set the TIMING START to MANUAL and adjust the MANUAL control so the intensified zone starts at the peak of the second (2) 1 μsec marker. See Figure 4-27A and B.



A

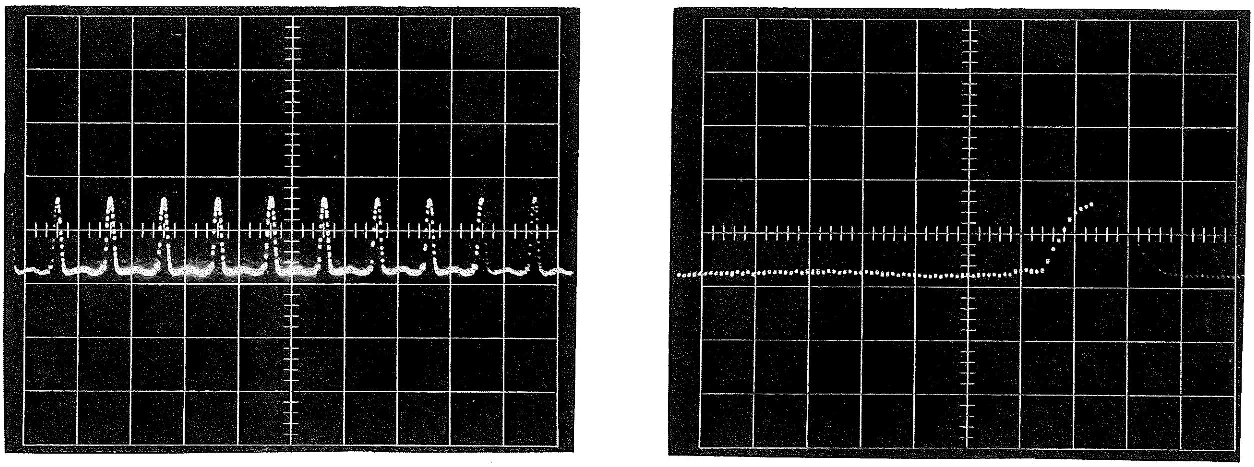


B

Set the HORIZ MAG to X10 for fine adjustment of manual start control.

Figure 4-27

3. Set the TIMING STOP to MANUAL and adjust the MANUAL control so the intensified zone stops one dot before the peak of the ninth (9) 1 μsec marker. See Figure 4-28A and B.



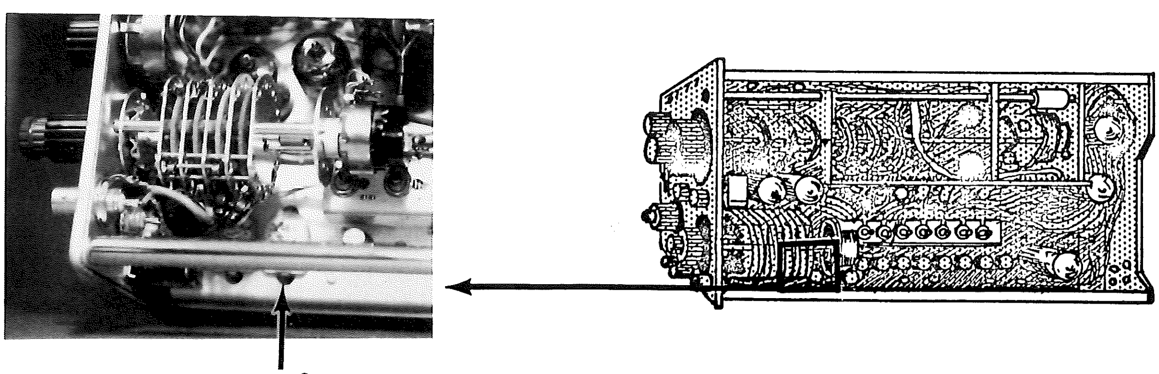
A

B

Set HORIZ MAG to X10 for fine adjustment of the MANUAL STOP CONTROL.

Figure 4-28

4. Adjust the 100 Dots Per Div adj. C158A - See Figure 4-29, for a digital count of 800.

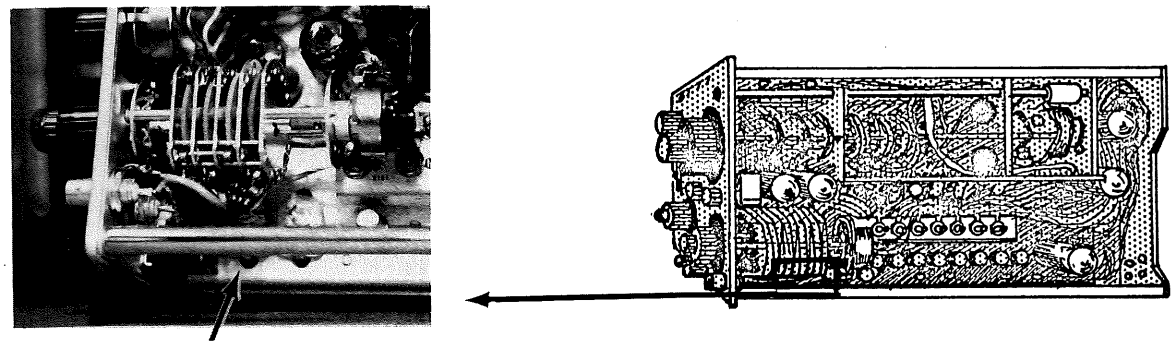


C158A 100 DOTS PER DIV

Figure 4-29

B. 10 DOTS PER DIV

1. On the 3T77, set the DOTS PER DIV to 10.
2. Adjust the 10 Dots Per Div adj., C156 - See Figure 4-30, for a digital count of 80.



C156 10 DOTS PER DIV

Figure 4-30

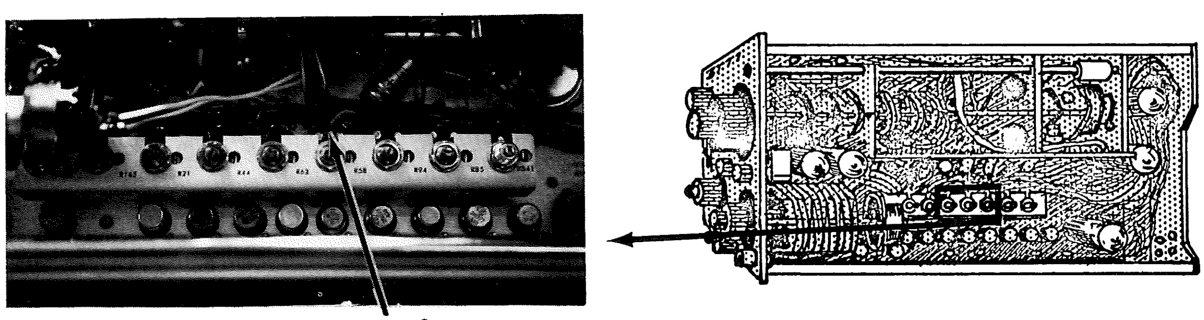
3. Remove the signal from the 180A.

IV. DELAY

A. INVERTER ZERO

The Inverter Input Zero is specified as 0v ± 100 mv.

1. On the 3T77, set the DOTS PER DIV to 100, the TIME/DIV to .2 μsec, and obtain a free running trace with the TRIGGER SENSITIVITY.
2. Set the test scope for a free running trace, 1 msec. Set the vertical for 50 mv deflection sensitivity, DC coupled.
3. Connect a X10 probe from the test scope to the center tap of the Delay Zero adj., R58 - See Figure 4-31.

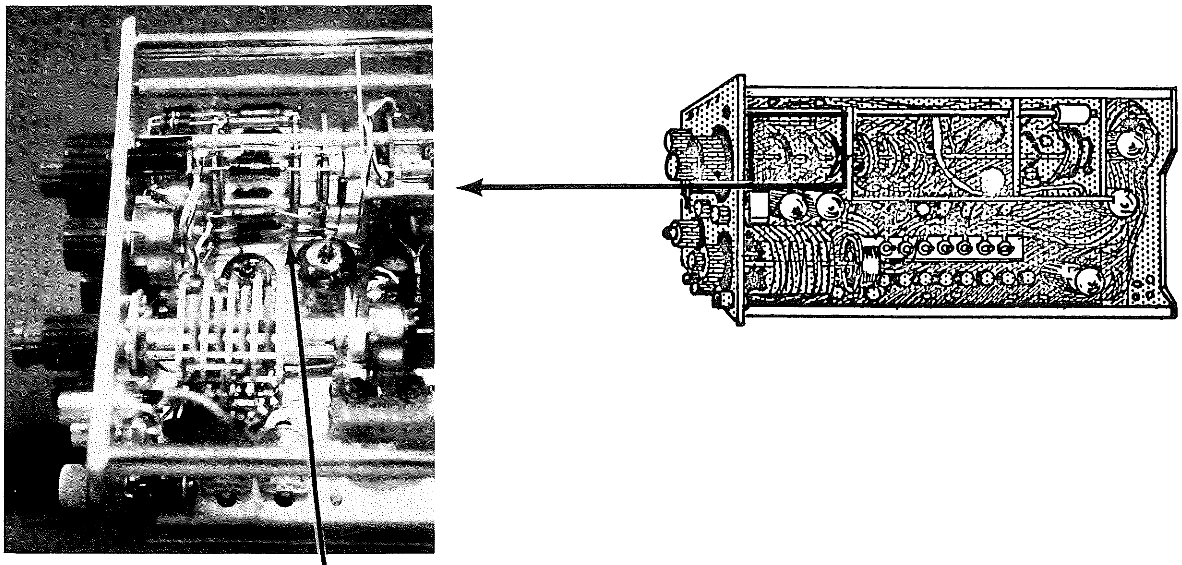


DELAY ZERO R58

Figure 4-31

4. Adjust the Delay Zero, R58, for 0v at the center tap.

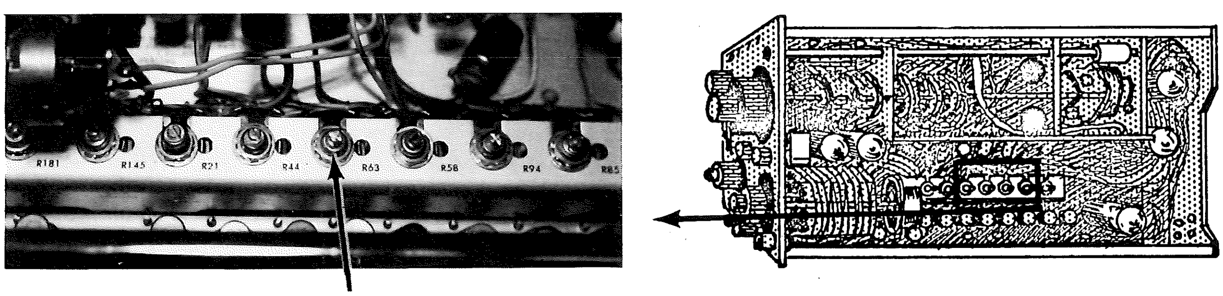
5. Connect the X10 probe to the TIME/DIV control at W2-18F (junction of 220K resistor and coax with green tracer (base of Q63). See Figure 4-32.



W2-18F (Junction of 220K resistor and coax with green tracer)

Figure 4-32

6. Adjust the Inverter Input Zero, R63 - See Figure 4-33, for 0v at the base of Q63.



Inverter Input Zero R63

Figure 4-33

B. DELAY TIME

1. Turn off the 567. Remove the 24 pin plug-in extensions and install the 3T77 in the horizontal plug-in receptacle. Turn on the 567. (The Delay can be adjusted with the 3T77 on an extension, but the Delay will change when the 3T77 is set in the scope).
2. On the 3T77, set the DOTS PER DIV to 100 and the TIME/DIV to .2 µsec and the DELAY to minimum (CCW).
3. Apply power to a Type 111 and connect a 5 nsec charge line to the 111. (A charge line greater than 5 nsec but no greater than 9 nsec can be used).
4. Connect the output of the 111 to the CH A input connector through a 10X GR attenuator and a 2X GR attenuator. See Figure 4-34.

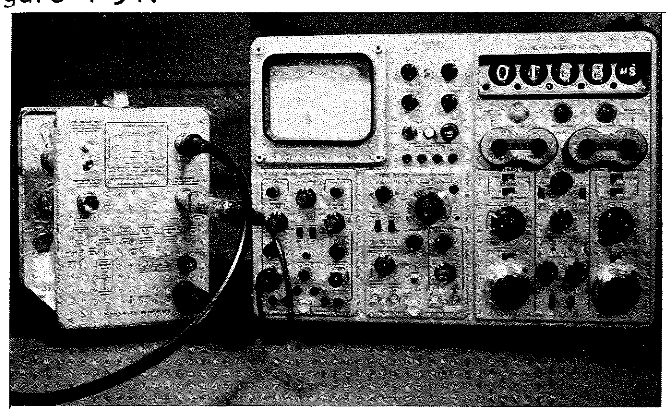
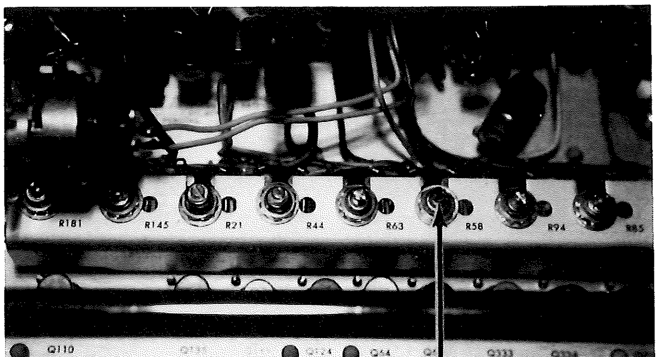
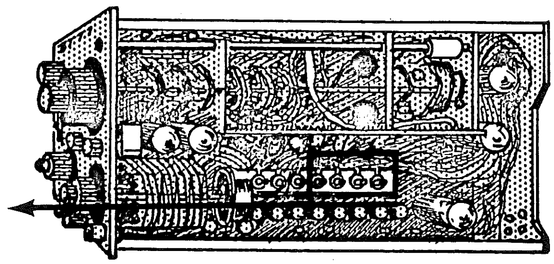


Figure 4-34

5. Set the 111 rep rate to 100 kc and obtain a stable display with the TRIGGER SENSITIVITY and REC VERY TIME controls.

6. Adjust the DELAY ZERO, R58 - See Figure 4-35, so the fast rise portion of the 111 pulse is not visible on the 567. See Figure 4-36.

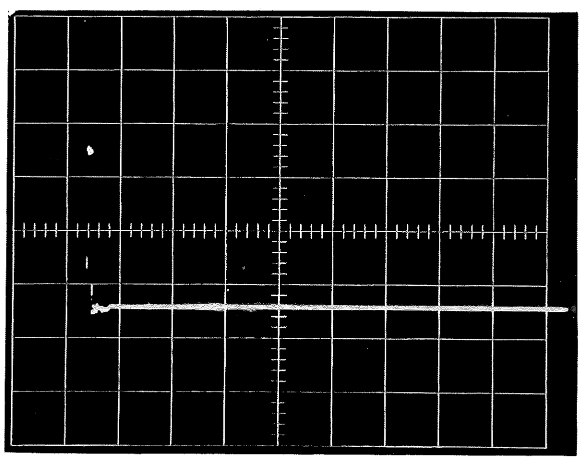




DELAY ZERO R58

If the 3T77 is in the scope, you will have to set the scope on its side and go in from the bottom of the scope to reach the adjustments.

Figure 4-35

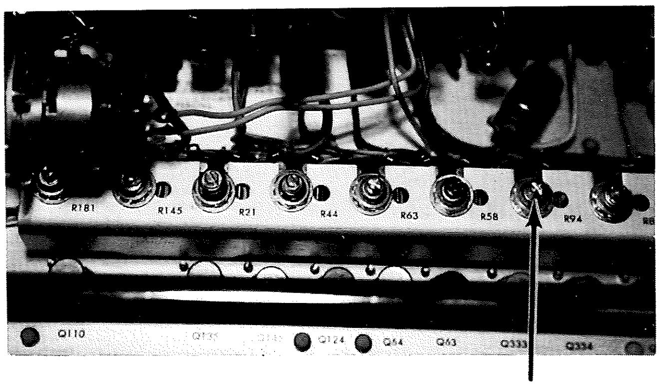


Adjust the Delay Zero so the fast rise portion of the display just disappears.

Figure 4-36

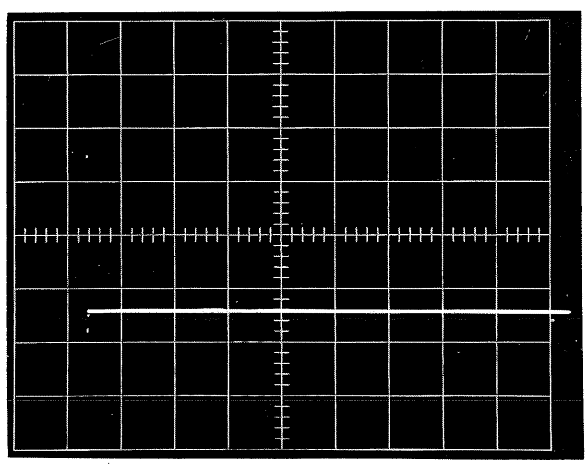
NOTE: If the Delay is grossly misadjusted, you may have to use a faster sweep speed to see the fast rise portion.

7. Set the TIME/DIV to 2 μsec. Adjust the 1st Comp. Regen. Sens., R94 - See Figure 4-37, so the fast rise portion of the 111 pulse is not visible on the 567. See Figure 4-38.



Comp Regen Sens R94

Figure 4-37



Adjust the 1st Comp Regen Sens so the fast rise portion will just disappear.

Figure 4-38

8. The adjustments of R94 and R58 interact. Set the TIME/DIV to .2 μsec and repeat steps 6 through 8 until the Delay Zero and 1st Comp. Regen. Sens. are properly adjusted.
9. Switch the TIME/DIV from 10 μsec to .2 nsec. From 10 μsec to .2 μsec the leading edge of the 111 pulse must not be visible on the 567. From .1 μsec to .2 nsec the leading edge of the 111 pulse must be visible on the 567. The DELAY control on the front panel must be adjusted to see the leading edge at the 3 fastest sweep speeds.

C. DELAY RANGE

1. Set the TIME/DIV to 20 nsec and the DELAY full CCW.
2. Pick a reference on the display and a reference on the graticule. See Figure 4-39.

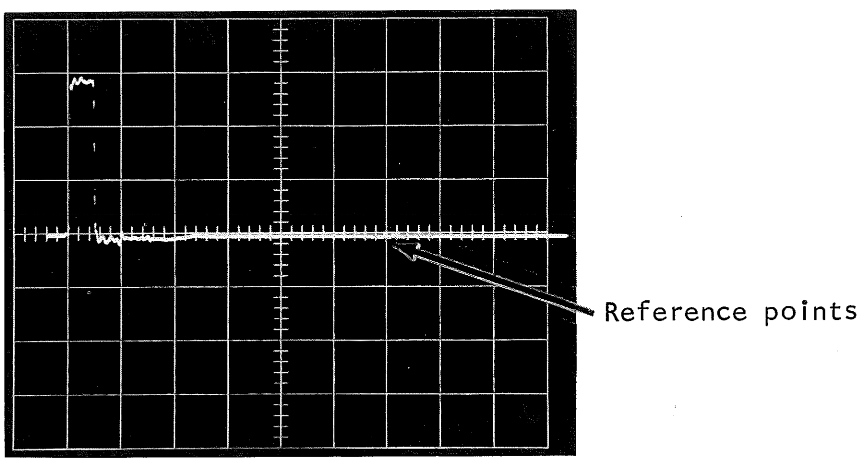


Figure 4-39

3. Set the DELAY full CW and check for 100 nsecs of delay ±12% (5 cms ±3 mm). See Figure 4-40.

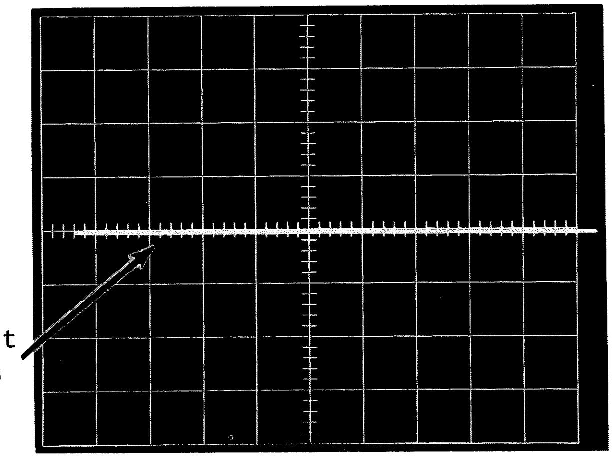


Figure 4-40

4. Disconnect the 111.

D. RAMP LINEARITY

The Ramp Linearity is specified as ±7.5% in the first 5 nsecs and as ±3% after the first 5 nsecs.

1. Set the TIME/DIV to 2 nsecs and the DELAY to midrange.
2. Connect the output of a GR oscillator, Type 1209B, through a 10X GR attenuator to the CH A input connector.
3. Set the GR oscillator's output frequency to 500 mc (1 cycle/cm). With the TRIGGER SENSITIVITY control, obtain a stable display.
4. Check and record timing accuracy.
5. Rotate the DELAY full CCW (minimum). Then rotate the DELAY CW until the first 5 nsecs are to the left of the 2nd graticule line. Now check timing accuracy. It must be within ±3% of the results of step 4.
6. Rotate the DELAY full CW and check timing accuracy. It must be within ±3% of the results obtained in steps 4 and 5.

7. Set the DELAY to midrange and the TIME/DIV to 1 nsec. Repeat steps 4 through 6.
8. Set the DELAY to midrange and the TIME/DIV to .5 nsecs. Adjust the output frequency of the GR oscillator to obtain 3 cycles in the middle 8 cms (about 745 mc).
9. Set the DELAY full CCW. Note 3 cycles in the middle 8 cms, ±5%. Disregard the first cm of horizontal deflection.
10. Disconnect the GR oscillator.

V. DIGITAL READOUT

A. SPECIAL PURPOSE NIXIE and DECIMAL NEONS

1. Set the TRIGGER SENSITIVITY control CW.
2. Set the RESOLUTION control, 6R1A, to ONE SWEEP LO.
3. Check the special purpose nixie and decimal neons against the following chart.

TIME/DIV	6R1A READOUT
10 μsec	000.0 μs
5 μsec	000.0 μs
2 μsec	000.0 μs
1 μsec	00.00 μs
.5 μsec	00.00 μs
.2 μsec	00.00 μs
.1 μsec	0.000 μs
50 nsec	0.000 μs
20 nsec	0.000 μs
10 nsec	000.0 ns
5 nsec	000.0 ns
2 nsec	000.0 ns
1 nsec	00.00 ns
.5 nsec	00.00 ns
.2 nsec	00.00 ns

4. Set the VARIABLE TIME/DIV CW (out of its detent). The special purpose nixie and the decimal neon must go out.
5. Return the VARIABLE TIME/DIV control CCW, the CALIB position.

Preset the front panel controls for the 3A2, 3B2, 6R1A combination as follows:

<u>3A2</u>

MODE	CH 1
TRIG SOURCE	CRT SIG
CH 1	
VOLTS/DIV	2
VOLTS/DIV VARIABLE	---
INPUT COUPLING	DC
POLARITY	NORM
POSITION	midrange
CH 2	---

<u>3B2</u>

TRIGGER	
LEVEL	CW (FREE RUN)
COUPLING	AC SLOW
SLOPE	+
SOURCE	INT
TIME/DIV	1 msec
DELAY	
SWEEP DELAY	OUT
DELAY TIME	1 msec
DELAY TIME VERNIER	1.00
DIGITAL RESOLUTION	1 μsec
POSITION	midrange

<u>6R1A</u>

Presets for the 6R1A are not given at this time. It is only used at the end of the section.

Figure 4-41 shows the proper set up.

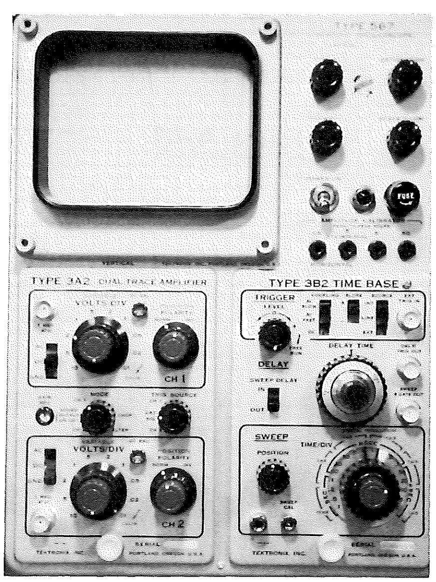


Figure 4-41

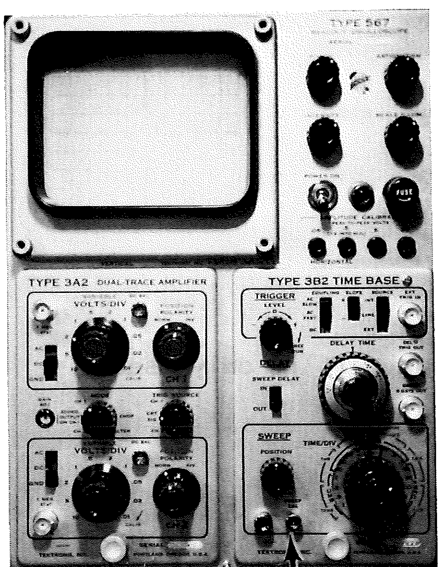
Turn off the 567 and remove the 3B2 from the horizontal plug-in receptacle. Connect P21, the horizontal plug on the back panel of the mainframe, to a 24 pin plug-in extension. Connect the 3B2 to the 24 pin extension. Turn on the 567.

I. TIMING

The Timing from .5 sec to 2 μsec is specified as ±3%. The 1 sec Timing is specified as ±4%.

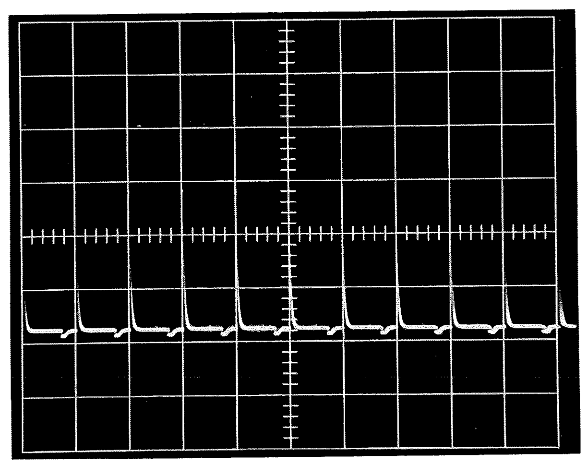
A. SWEEP CAL

1. DC Balance CH 1 of the 3A2.
2. Connect the output of a Type 180A to the CH 1 input connector. Set the output of the 180 for 1 msec markers. Obtain a stable display with the TRIGGER LEVEL control.
3. Adjust the Sweep Cal, R303 - See Figure 4-42, for 1 marker/cm. See Figure 4-43.



R303
SWEEP CAL

Figure 4-42



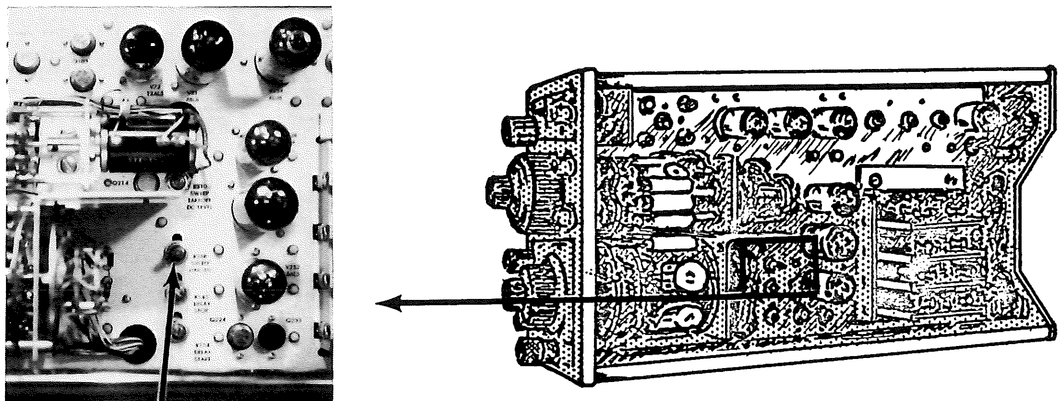
R303 adjusted for 1 marker/cm

Figure 4-43

B. SWEEP LENGTH and HORIZONTAL POSITION RANGE

The Sweep Length is specified as 10.5 cm ±.3 cm. The POSITION control must position the sweep to the left and to the right of graticule center.

1. Adjust the Sweep Length, R268 - See Figure 4-44, for a sweep length of 10.5 cm.



R268
SWEEP LENGTH

Figure 4-44

2. Rotate the POSITION control fully CW. The start of the sweep must be to the right of graticule center.
3. Rotate the POSITION control fully CCW. The end of the sweep must be to the left of graticule center.
4. Set the POSITION control to midrange.

C. SWEEP RATE ADJUSTMENTS

1. Set the TIME/DIV to 20 μsec and apply 10 μsec markers from the 180A.

2. Adjust C260C, See Figure 4-45, for 2 markers/cm.

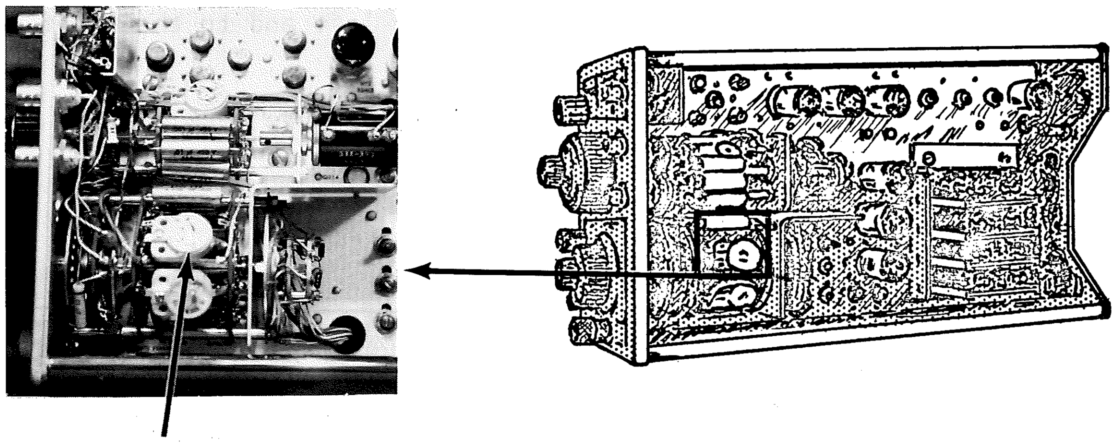


Figure 4-45

3. Set the TIME/DIV to 2 μsec and apply 1 μsec markers from the 180.
4. Adjust C260A, See Figure 4-46 for 2 markers/cm.

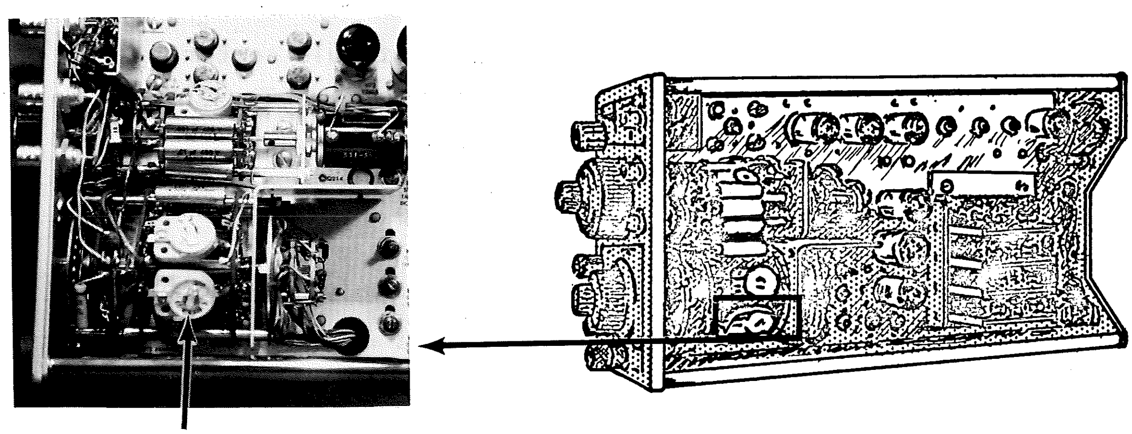


Figure 4-46

D. SWEEP RATES CHECK

1. Check the 3B2 sweep rates against the following chart.

TIME/DIV	180A	MARKERS/CM	TOLERANCE
2 µsec*	1 µsec	2	± 2.4 mm
5 µsec	5 µsec	1	"
10 µsec	10 µsec	1	"
20 µsec*	10 µsec	2	"
50 µsec	50 µsec	1	"
.1 msec	100 µsec	1	"
.2 msec	100 µsec	2	"
.5 msec	500 µsec	1	"
1 msec	1 msec	1	"
2 msec	1 msec	2	"
5 msec	5 msec	1	"
10 msec	10 msec	1	"
20 msec	10 msec	2	"
50 msec	50 msec	1	"
.1 sec	100 msec	1	"
.2 sec	100 msec	2	"
.5 sec	500 msec	1	"
1 sec	1 sec	1	± 3.2 mm

*Previously Adjusted

II. DELAY TIMING

The Delay Timing is specified as ±1%.

A. DELAY START and STOP

1. Set the TIME/DIV to .2 msec.

2. Apply 1 msec markers from the 180A and obtain a stable display.

3. Align the 2nd marker with the center graticule line. See Figure 4-47.

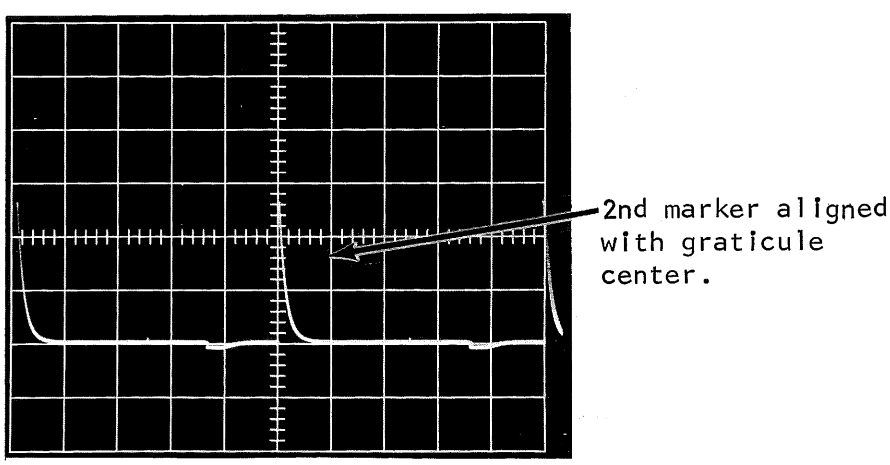
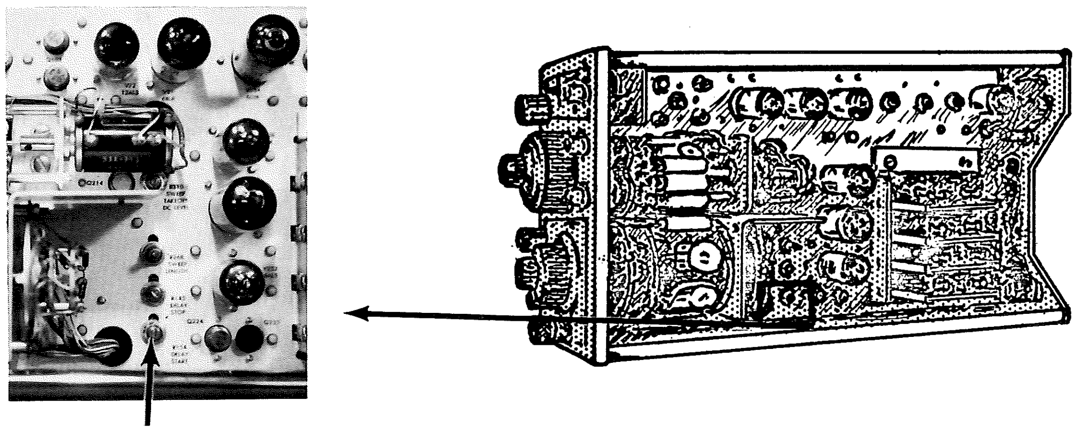


Figure 4-47

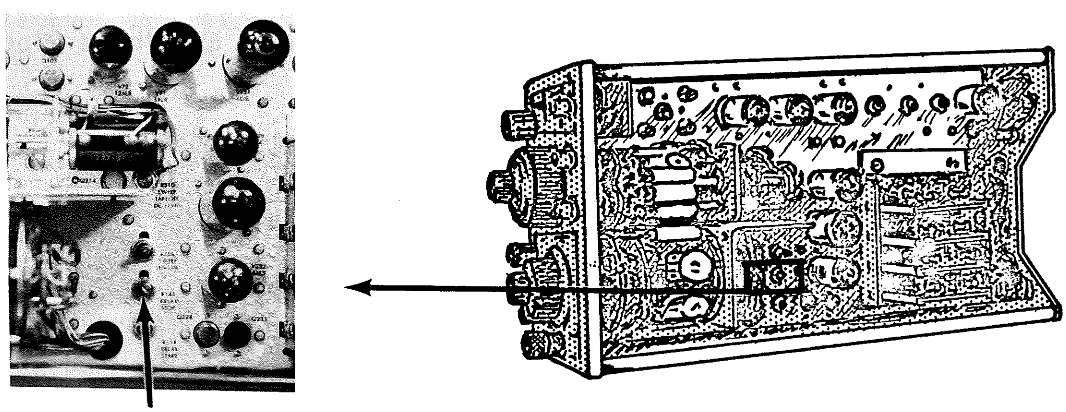
4. Switch the SWEEP DELAY to IN. Adjust the Delay Start, R154 - See Figure 4-48, so the 2nd marker is aligned with the center graticule line. Same display as seen in step 3.



R154
Delay Start

Figure 4-48

5. Set the DELAY TIME VERNIER to 9.00. Adjust Delay Stop, R145 - See Figure 4-49, so the 9th marker is aligned with the center graticule line.



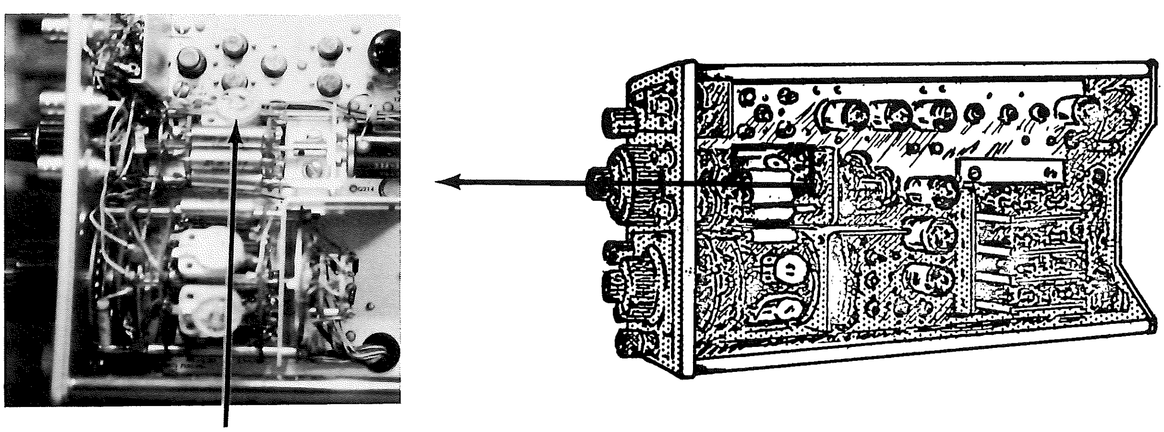
R145
Delay Stop

Figure 4-49

6. The Delay Start and Delay Stop adjustments interact. Set the DELAY TIME VERNIER to 1.00. Repeat steps 4 through 6 until R154 and R145 are properly adjusted.
7. Set the DELAY TIME VERNIER to 1.00. With the DELAY TIME VERNIER, position the marker at the right of the graticule to the center graticule line. The DELAY TIME VERNIER must read 2.00 ± 4 minor divisions.
8. Check Delay Timing Linearity from 1.00 to 9.00 using the procedure described in step 7.

B. 10 μsec DELAY SWEEP RATE

1. Set the TIME/DIV to 2 μsec, the DELAY TIME to 10 μsec, the DELAY TIME VERNIER to 1.00, and the SWEEP DELAY to IN.
2. Apply 10 μsec markers from the 180A and obtain a stable display.
3. With the POSITION control, align the middle marker with the center graticule line.
4. Set the DELAY TIME VERNIER to 9.00. Adjust C80F, See Figure 4-50, so the 9th marker is aligned with the center graticule line.



C80F

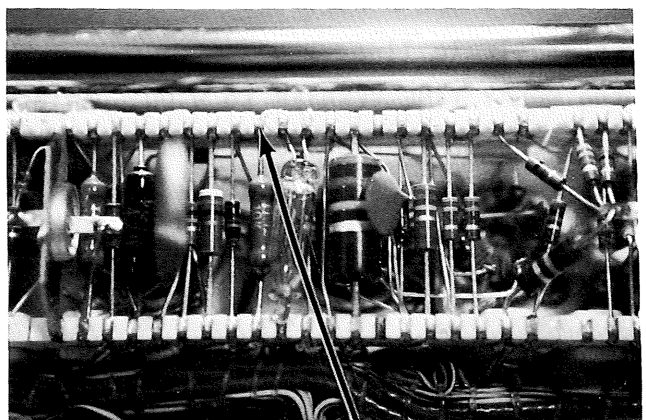
Figure 4-50

5. Set the DELAY TIME VERNIER to 1.00. Check the position of the middle marker. If necessary, reposition the middle marker to the graticule line with the POSITION control and repeat step 4.
6. Repeat steps 4 and 5 until C80F is properly adjusted.
7. Check the 10 μsec DELAY TIMING LINEARITY as described in steps 7 and 8 of Part A.

C. DELAY TIME SWEEP LENGTH

The Delay Time Sweep Length is specified as 75v ±10v.

1. Set the test scope for 20v/div (includes probe), AC coupled. Set the sweep to 1 msec, free running.
2. Connect a probe (preferably X10) to pin 8 of V91B. See Figure 4-51.



Pin 8 of V91B (10k 1%R)

Figure 4-51

3. Check for a sawtooth whose amplitude is 75v ±10v.
4. Disconnect the probe.

D. DELAY TIME SWEEP RATES

1. Set the TIME/DIV to 20 μsec, the DELAY TIME to .1 msec, the DELAY TIME VERNIER to 1.00, and apply 100 μsec markers from the 180A. Obtain a stable display.

2. With the POSITION control, align the middle marker with the center graticule line.
3. With the DELAY TIME VERNIER, position the 9th marker so it is aligned with the center graticule line. The DELAY TIME VERNIER reading must be 9.00 ± 4 md.
4. Check the other Delay Time Sweep Rates in the manner described in steps 2 and 3 against the following chart.

TIME/DIV	DELAY TIME	180	TOLERANCE
2 msec	10 msec	10 msec	9.00 ±4 md
20 msec	.1 sec	100 msec	9.00 ±4 md
.2 sec	1 sec	1 sec	9.00 ±4 md

E. CHECK TIME DELAY JITTER

The Time Delay Jitter is specified as less than 1 part in 20,000.

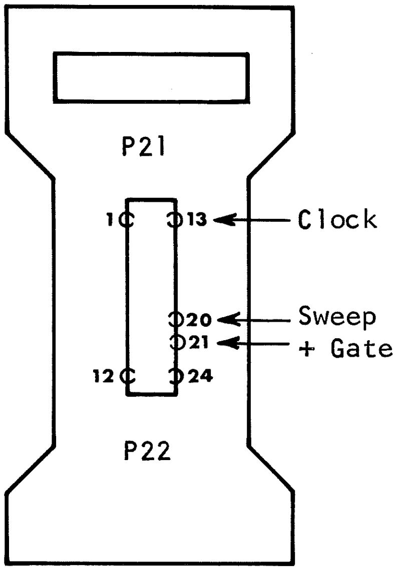
1. Set the TIME/DIV to 10 μsec, the DELAY TIME to 10 msec, and the DELAY TIME VERNIER to 0.50. Apply 10 msec markers from the 180A and obtain a stable display.
2. Set the DELAY TIME VERNIER at 5.00 and check the 5th marker for less than 5 mm of jitter.
3. Disconnect the 180A signal.

III. SIGNAL TO THE 6R1A

A. SWEEP TAKE-OFF DC LEVEL

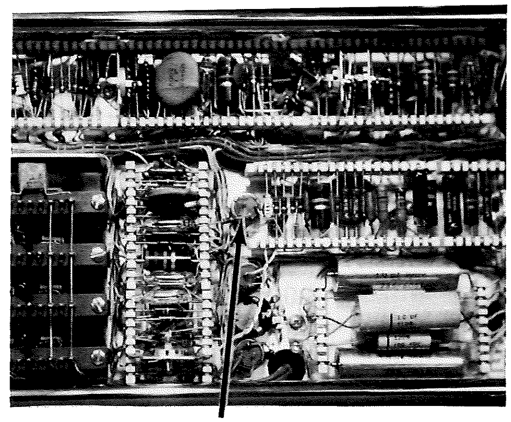
The Sweep Take-off DC Level from .2 sec to 20 μsec is specified as no greater than 150 mv. The Sweep Take-off DC Level for .5 sec and 1 sec is specified as no greater than 250 mv.

1. Set the TIME/DIV to 1 msec and the TRIGGER LEVEL full CCW. Set the SWEEP DELAY to OUT.
2. Set the test scope for a free running sweep and the vertical for 50 mv sensitivity, DC coupled.
3. Connect a X10 probe to pin 20 of P22 or to the center tap of R310, the Sweep Take-off DC Level. See Figures 4-52 A and B.



Pin 20

A

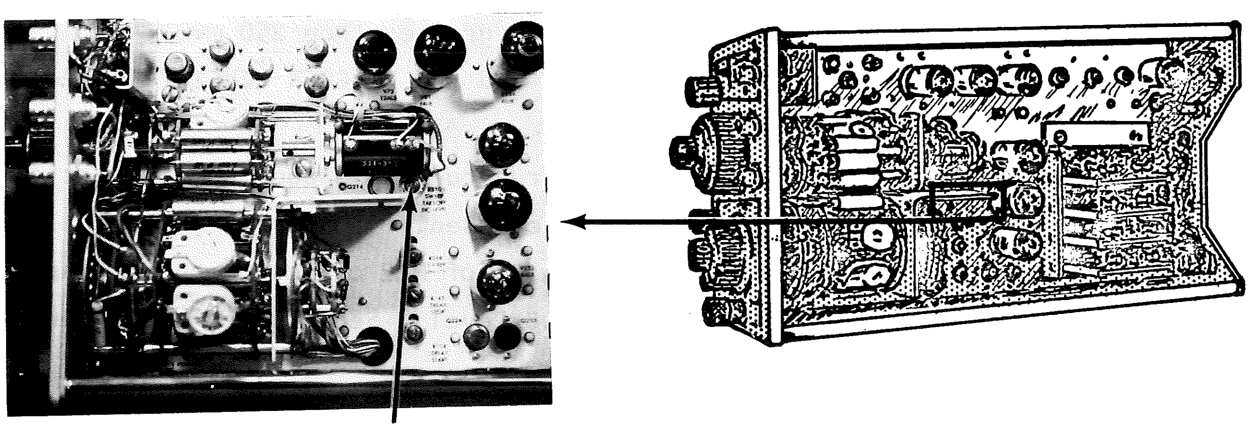


Center of R310

B

Figure 4-52

4. Adjust the Sweep Take-off DC Level, R310 - See Figure 4-53, for 0 volts as read on the test scope.



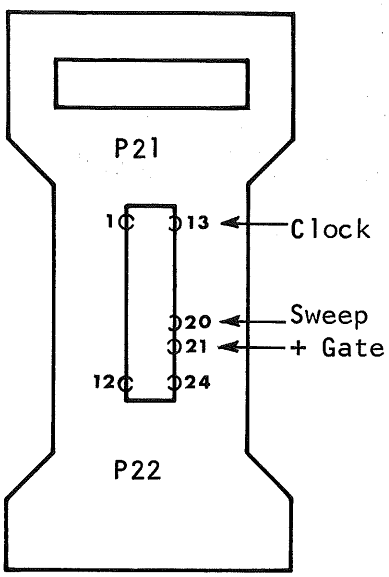
R310
Sweep Take-off DC Level

Figure 4-53

5. Switch the TIME/DIV control from 20 μsec to .2 sec, the DC Level at the center tap of R310 (pin 20) must be less than 150 mv.
6. Switch the TIME/DIV control to .5 sec and 1 sec. The DC Level must be less than 250 mv.

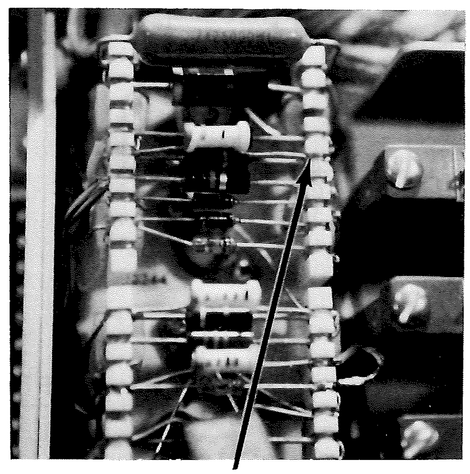
B. + GATE to 6R1A

1. Connect the X10 probe to pin 21 of P22 or to the junction of C248, R248, and R249. See Figures 4-54 A and B.



P21

A



Junction of C248, R248 & R249

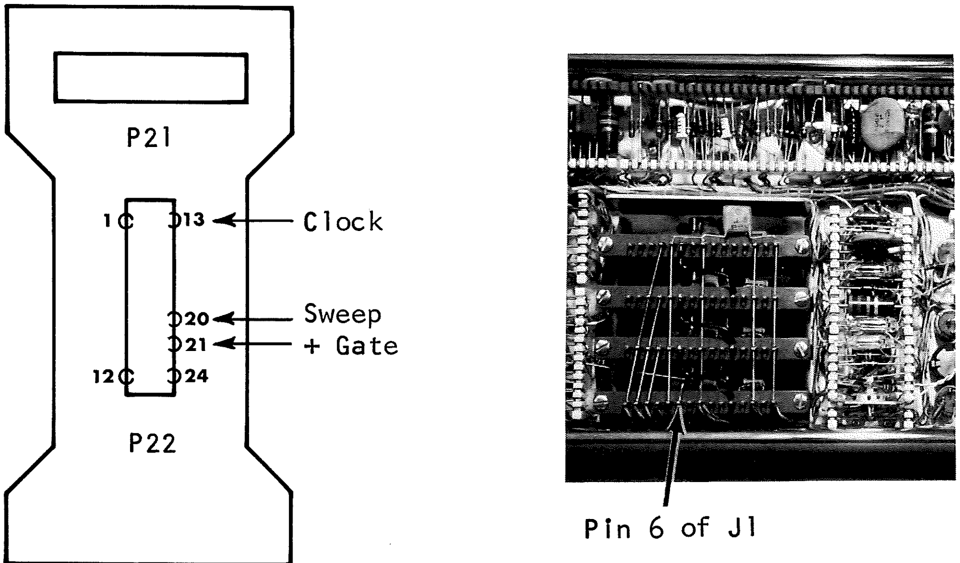
B

Figure 4-54

2. Set the vertical sensitivity to 2v/div (includes probe).
3. Check on all sweep rates from 1 sec to 20 μsec for a 6-10v signal.

C. 1 MC CLOCK ACCURACY

1. On the 3B2, set the RESOLUTION to 1 μsec.
2. Connect a probe (preferably X10) from a differential plug-in to pin 13 of P22 or to pin 6 of J1. See Figure 4-55 A and B.



Pin 6 of J1

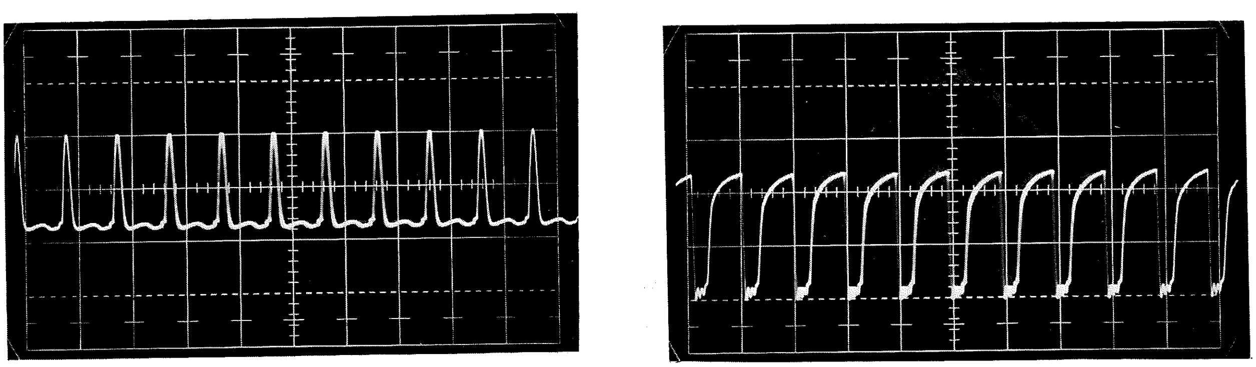
B

Pin 13

A

Figure 4-55

3. Connect the output of a 180A to the other differential input. Set the 180A output for 1 μsec markers.
4. Adjust the two (2) input signals so the variation in voltage is no greater than 2:1. See Figure 4-56.

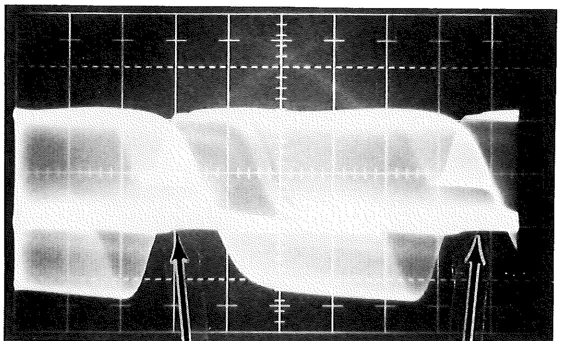


180A signal
(applied to A input)

1 mc clock from 3B2
(applied to -B input)

Figure 4-56

5. Set the vertical to the A-B mode (added algebraically) and set the sweep rate so two (2) modes appear on the display.
6. The time between the 2 modes is the period of the beat frequency. The period must be greater than 10 msecs.



period between modes

Sweep rate for this picture is .1 msec. (When display is viewed by the operator, the mode will appear as minimum amplitude points.

Figure 4-57

D. SPECIAL PURPOSE NIXIE and DECIMAL NEONS

1. Turn off the 567 and remove the plug-in extension. Set the 3B2 into the horizontal plug-in receptacle. Turn on the 567.
2. On the 6R1A, set the MODE to TIME STOP (-) START and the RESOLUTION control to ONE SWEEP LO.
3. On the 3B2, rotate the RESOLUTION control and check the special purpose nixie and decimal neons against the following chart.

3B2 RESOLUTION	6R1A READOUT
.1 μsec	000.0 μs
1 μsec	0000. μs
10 μsec	00.00 ms
.1 msec	000.0 ms
1 msec	0000. ms
10 msec	00.00 s

SECTION V

In this section we will complete the calibration of the vertical plug-ins. In the sampling plug-ins, we will adjust the risetime, check dot transient response, check the CMR, etc. In the real time plug-in, we will check bandpass, adjust the attenuator compensations, etc.

OUTLINE OF ADJUSTMENTS

	Page No.
<u>3S76, 3T77, 6R1A combination</u>	5-3
I. BRIDGE BALANCE	5-5
II. RISETIME	5-7
III. DOT TRANSIENT RESPONSE	5-17
IV. NOISE	5-23
V. DC OFFSET	5-24
VI. MEMORY SLASH and LISSAJOUS CHECK	5-25
<u>3S3, 3T77, 6R1A combination</u>	5-27
I. RISETIME	5-29
II. GAIN	5-37
III. DOT TRANSIENT RESPONSE	5-43
<u>3A2, 3B2, 6R1A combination</u>	5-49
I. INPUT CAPACITANCE and VOLTS/DIV COMPENSATIONS	5-50
II. TRIGGER TAKE-OFF	5-53
III. SQUARE-WAVE RESPONSE	5-55

<u>EQUIPMENT REQUIRED</u>:

<u>3S76, 3T77, 6R1A combination</u>

540 series scope or equivalent
Vertical preamp with at least 50 mv sensitivity
Type 109
30 psec Pulser
5 nsec cable
24 pin plug-in extender
Type 105 or Type 111 or equivalent
5X GR Attenuator (017-045)
GR to BNC Jack adaptor (017-024)
Type 180A or equivalent

<u>EQUIPMENT REQUIRED</u>: (Con't)

<u>3S3, 3T77, 6R1A combination</u>

30 psec Pulser
2X GR Attenuator (017-046)
GR to BNC Jack Adaptor (017-024)
Type 105
50Ω Amplitude Calibrator
Female BNC to Male UHF (103-015)
GR Tee connector
Type 111
10X GR Attenuator (017-044)
5 (or 9) nsec Cable

<u>3A2, 3B2, 6R1A combination</u>

Type 105
5X BNC Attenuator (011-060)
47 pf Standardizer (011-068)
50Ω BNC Terminator (011-049)
Type 190 with piggyback

Preset the front panel controls for the 3S76, 3T77, 6R1A combination as follows:

3S76

MODE	DUAL-TRACE
INTERNAL TRIGGER	A
SMOOTH NORMAL	NORMAL
CH A and CH B	
MV/DIV	200
NORM-INV	NORM
POSITION	midrange

3T77

POSITION	midrange
TIME/DIV	10 Nsec
VARIABLE TIME/DIV	CALIB (CCW)
HORIZ MAG	X1
DOTS PER DIV	100
SWEEP MODE	NORMAL
DELAY	CCW
TRIGGER	
SENSITIVITY	CW
SELECTOR	INT -

Figure 5-1 shows the proper set up.

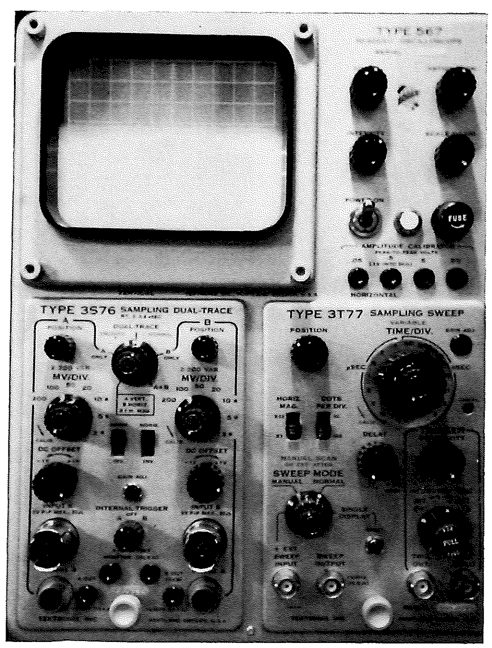
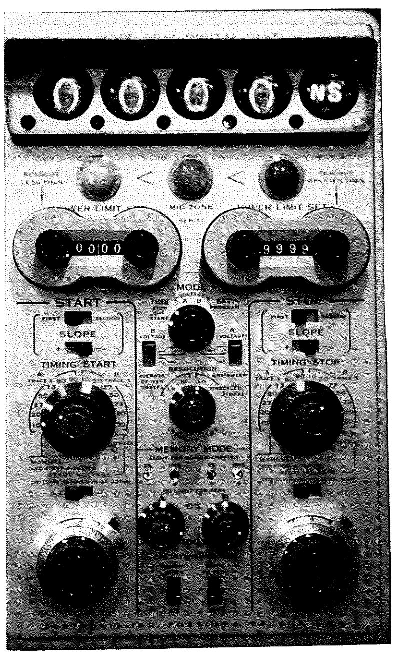


Figure 5-1

6R1A

MODE	TIME STOP (-) START
RESOLUTION	ONE SWEEP LO
CRT INTENSIFICATION	
MEMORY ZONES	DOWN (off)
START TO STOP	DOWN (off)
START	
SLOPE	FIRST -
TIMING START	A TRACE 10%
STOP	
SLOPE	FIRST -
TIMING STOP	A TRACE 90%
INTERNAL CONTROLS	
A and B MEMORY	
0% MODE	AVG
100% MODE	AVG
RESPONSE	SLOW
START and STOP COMPARATOR	
3-DOT DELAY	IN

Figure 5-2 A and B shows the proper set up.



(A)

(B)

Figure 5-2

I. BRIDGE BALANCE

A. CH A

1. Connect a X10 probe to the CH A X100 OFFSET MONITOR jack. (A multimeter can also be used for this check). See Figure 5-3.

CH A X100
OFFSET
MONITOR

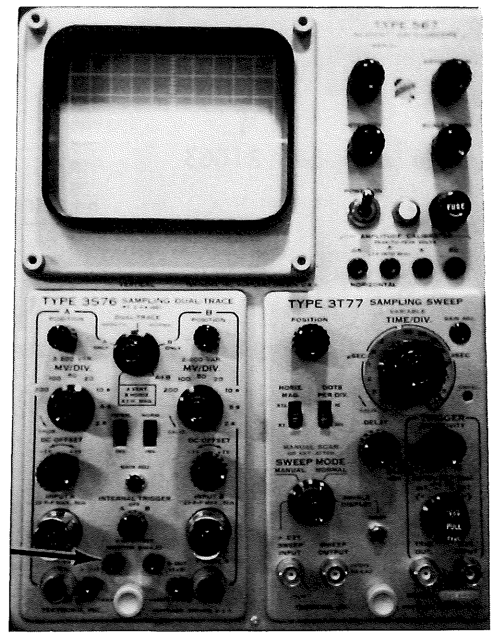
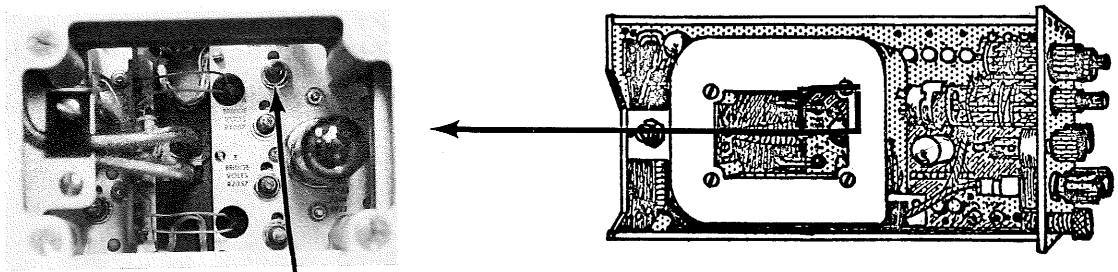


Figure 5-3

2. Adjust the CH A DC OFFSET for 0 volts as read on the test scope.
3. Set the test scope for a free running sweep. Set the vertical for a 50 mv deflection factor, DC coupled.
4. Adjust the CH A DC OFFSET for 0 volts as read on the test scope (or Multimeter).
5. With the CH A POSITION control, position the trace on screen.
6. While switching the CH A MV/DIV control from 200 to 5, adjust the A BRIDGE BALANCE, R1063 - See Figure 5-4, for minimum trace shift.

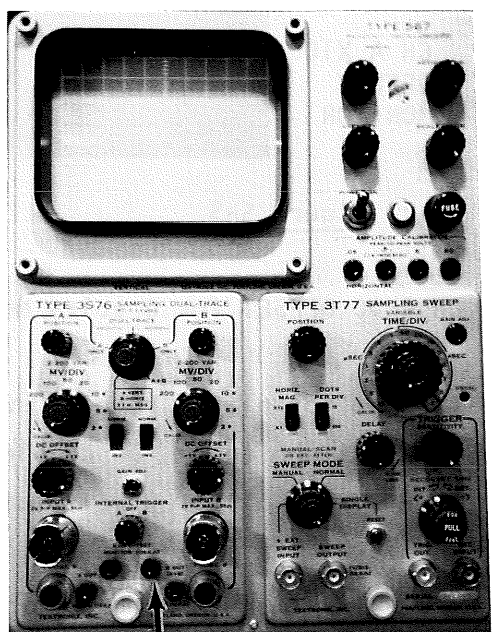


A Bridge Bal R1063

Figure 5-4

B. CH B

1. Connect a X10 probe to the CH B X100 OFFSET MONITOR jack. (A Multimeter can also be used for this check). See Figure 5-5.

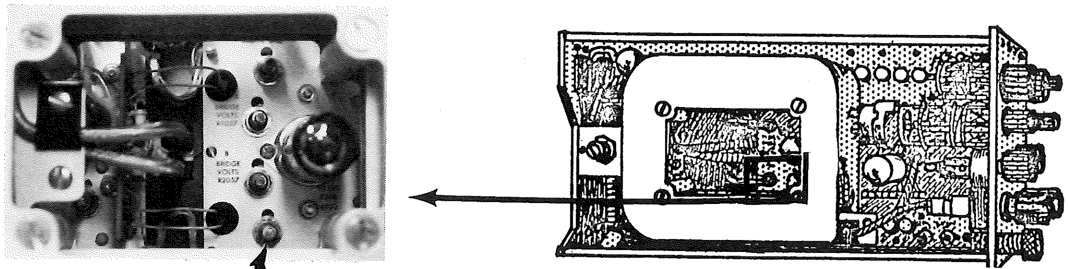


CH B X100 OFFSET MONITOR

Figure 5-5

2. Adjust the CH B DC OFFSET for 0 volts as read on the test scope (or Multimeter).
3. With the CH B POSITION control, position the trace on screen.

4. While switching the CH B MV/DIV control from 200 to 5, adjust the B BRIDGE BALANCE, R2063 - See Figure 5-6, for minimum trace shift.



A BRIDGE BAL R2063

Figure 5-6

II. RISETIME

The Risetime is specified as ≤0.4 nsec.

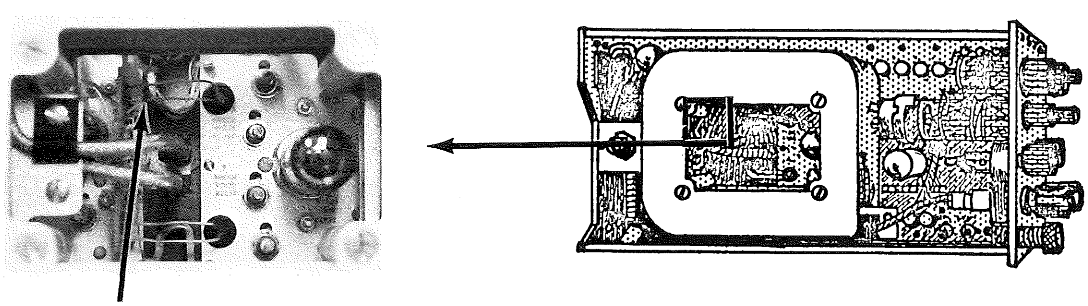
If a Type 109 is used as the fast rise source, the risetime is adjusted for 0.42 to 0.44 nsec.

If a 30 psec pulser is used as the fast rise source, the risetime is adjusted for 0.4 nsec.

When the risetime is properly adjusted, the voltage (in reference to ground) at each end of the sampling bridge (CH A & CH B) must be greater than 1.6v and the individual voltages (ignore polarity) must match within 0.2v. (The X100 OFFSET MONITOR must be set to 0v).

A. CH A BRIDGE VOLTS

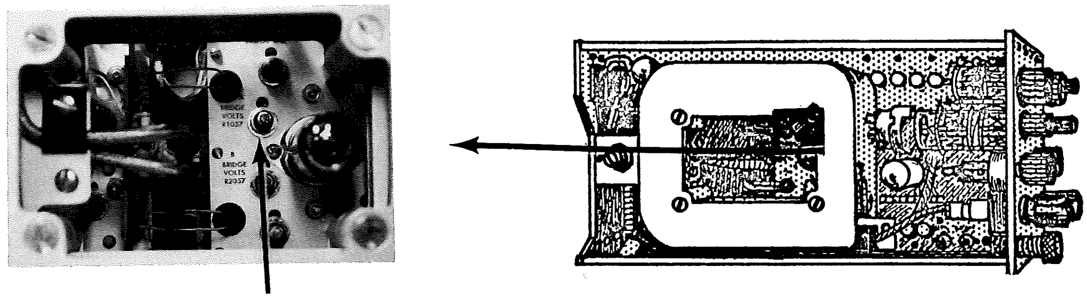
1. Set the test scope for a 0.1v deflection sensitivity, DC coupled.
2. With a X10 probe, monitor either end of R1057. See Figure 5-7.



Connect the probe to the yellow-white or to the red-white wire to monitor R1057.

Figure 5-7

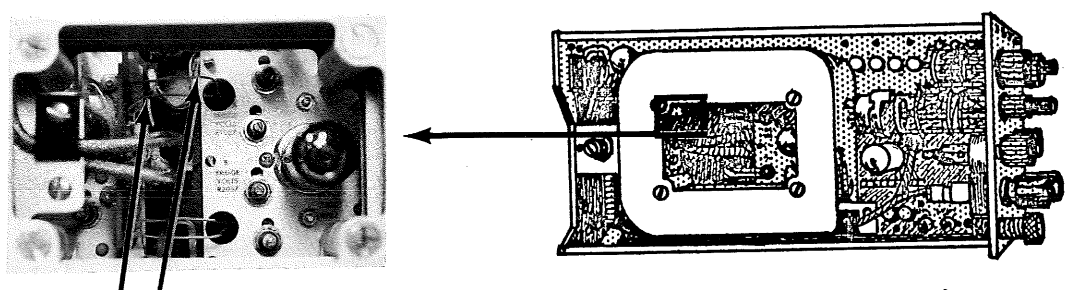
3. Adjust the CH A Bridge Volts, R1057 - See Figure 5-8, for 2v as read on the test scope. (Disregard polarity).



A Bridge Volts R1057

Figure 5-8

4. Connect the X10 probe to the other end of R1057. See Figure 5-9. The voltage at this end must be withing 0.2v of the voltage obtained in step 3.
   a) When the Bridge Volts is properly adjusted, the total voltage drop across R1057 will be 4v ±0.2v. The voltage at one end of the pot will be approximately +2v and the voltage at the opposite end of the pot will approximately -2v.



Connect the probe to the yellow-white or to the red-white wire to monitor R1057.

Figure 5-9

B. SNAP-OFF CURRENT

1. On the 3S76, set the MODE to A ONLY.
2. Connect a 30 psec pulser to the CH A Input connector. Turn on the pulser and set the DRIVE to midrange. See Figure 5-10.

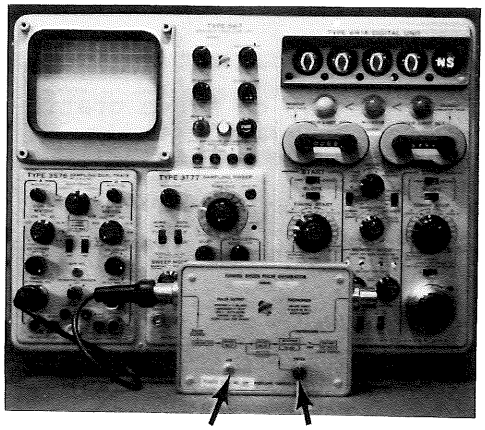


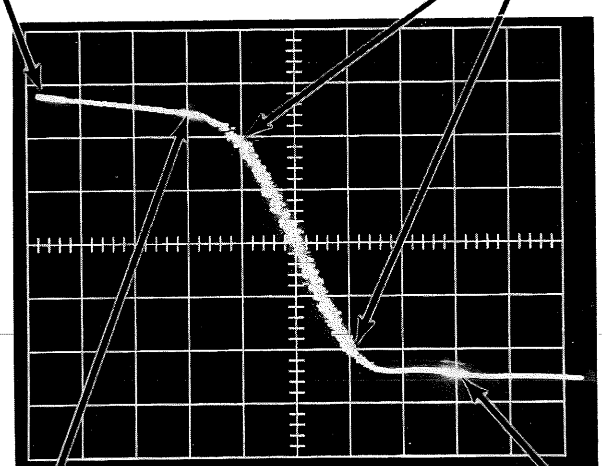
Figure 5-10

3. On the 3T77, adjust the TRIGGER SENSITIVITY to obtain a stable display. On the 30 psec pulser, rotate the DRIVE CCW until the fast rise portion of the display disappears. Then, rotate the DRIVE CW so the fast rise portion of display just appears.
   a) There is a point at which the DRIVE can be set where the TD in the pulser is not firing every time. The resultant waveform is a mixture of the display with the fast rise portion and without the fast rise portion.
   b) After the DRIVE is properly adjusted, the TRIGGER SENSITIVITY may require a slight readjustment.
4. On the 3T77, set the TIME/DIV to .2 nsec. Keep the fast rise portion of the display near graticule center with the DELAY control.
5. On the 3S76, rotate the VARIABLE CCW to obtain approximately 5 cm of vertical deflection.
6. On the 6R1A, set the MEMORY ZONES to UP (on). The dead zone must be at a relatively flat portion of the display.
7. With the DELAY, TRIGGER SENSITIVITY, and/or the POSITION controls, set the fast rise portion of display at graticule center.
8. Position the 0% zone 2 cm to the left of graticule center and the 100% zone 3 cm to the right of graticule center.

9. On the 3S76, adjust the VARIABLE for exactly 5 cm of vertical deflection.
   a) When the vertical deflection is exactly 5 cm, the 0% zone should be 2.5 cm above graticule center and the 100% zone should be 2.5 cm below graticule center.
   b) Repeat step 7. The fast rise portion of the display is now centered. Risetime is measured from 2 cm above and 1 cm to the left of graticule center to 2 cm below and 1 cm to the right of graticule center. See Figure 5-11.

Dead zone set at relatively flat portion of display.

Risetime measured from 2 cm above and 1 cm to the left of graticule center to 2 cm below and 1 cm to the right of graticule center.

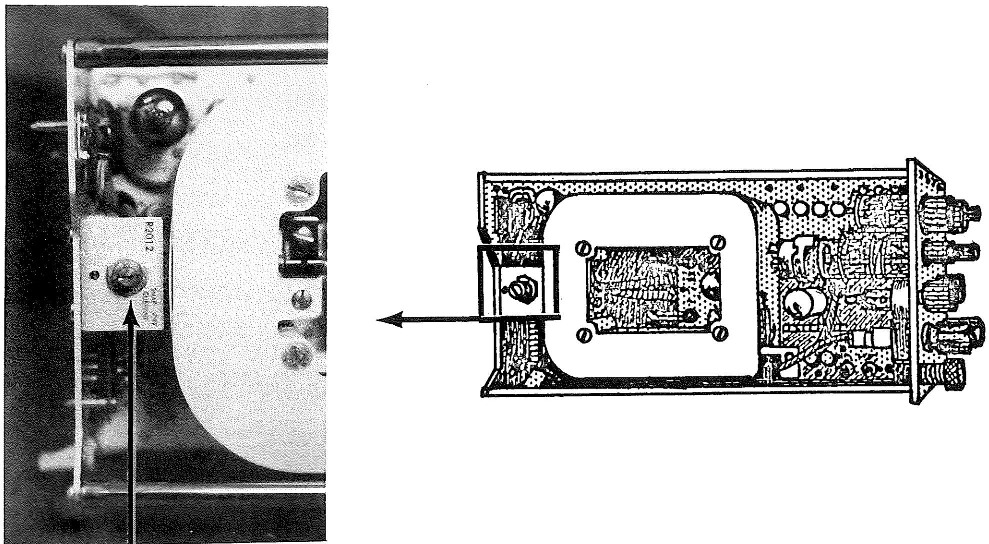


0% zone 2.5 cm above and 2 cm to the left of graticule center.

100% zone 2.5 cm below and 3 cm to the right of graticule center.

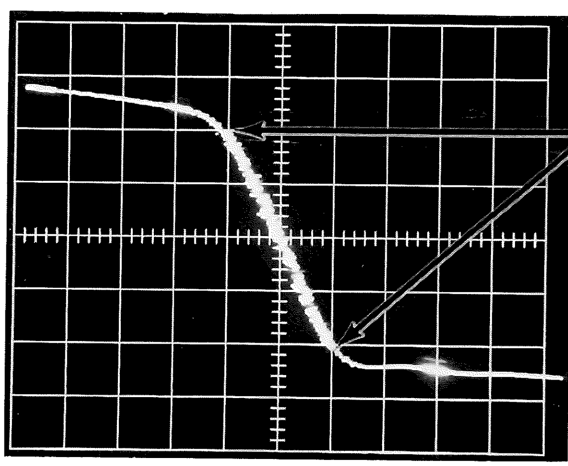
Figure 5-11

10. Adjust the Snap-off Current, R2012 - See Figure 5-12, for a 0.4 nsec risetime as seen on the graticule and as read out on the 6R1A. See Figure 5-13.



Snap-off Current
R2012

Figure 5-12



Measure
Risetime

Figure 5-13

a) The display may need to be reset to meet the conditions outlined in Step 9 as the Snap-off Current is adjusted.

b) The risetime as read on the graticule and as read on the 6R1A may not agree with each other. There should be a very close correlation of the 2 results. The 6R1A reading will be the more exact, although the 6R1A readout will jump around. This is the nature of the beast and the nature of the measurement. The various totals should average out to 0.4 nsec.

c) The procedure we have outlined requires more muss and fuss than the usual calibration procedure. We have used this rather elaborate method to provide a standard form of risetime measurement with the 567. This same procedure will be used to check the risetime of the 3S3. This procedure can also be used to check the risetime of the vertical plug-ins in the 661 mainframe, although we will not have the luxury of 0%, 100%, and Start to Stop intensified zones to zones to aid our measurement.

C. B BRIDGE VOLTS

1. On the 3S76, set the MODE to B ONLY and the INTERNAL TRIGGER to B. Connect the output of the 30 psec pulser to the CH B input connector.

2. This step is a summary of step 5 through 9 of the Snap-off Current adjustment.

   a) Adjust the CH B VARIABLE for 5 cm of vertical deflection.

   b) With the fast rise portion of the display vertically and horizontally centered on the graticule, position the 0% zone 2 cm to the left of graticule center and the 100% zone 3 cm to the right of graticule center.

3. On the 6R1A, set the TIMING START to B TRACE 10% and the TIMING STOP to B TRACE 90%.

a) The display should be that obtained in Step 9. The 0% zone will be 2.5 cm above and 2 cm to the left of graticule center. The 100% zone will be 2.5 cm below and 3 cm to the right of graticule center. The middle of the fast rise portion of the display (start to stop intensified zone) will pass through graticule center. See Figure 5-14.

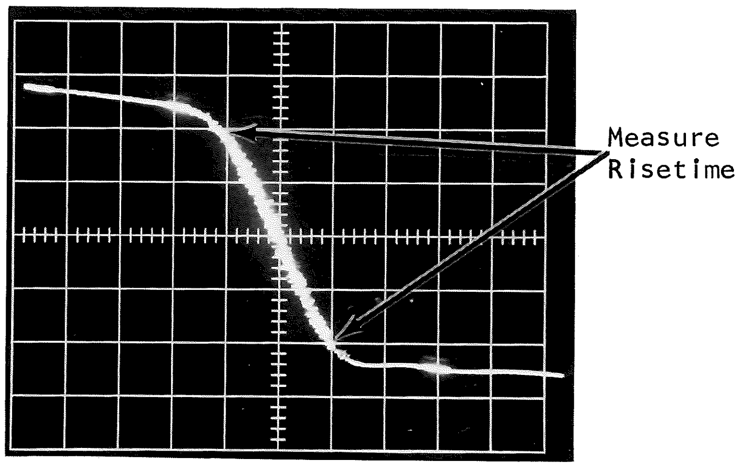


Figure 5-14

4. Adjust the CH B Bridge Volts, R2057 - See Figure 5-15, for a risetime of 0.4 nsec as read on the graticule and the 6R1A.

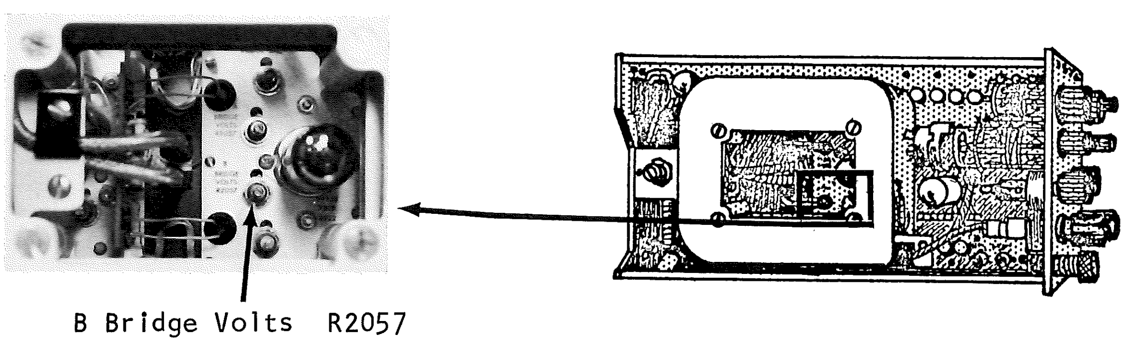
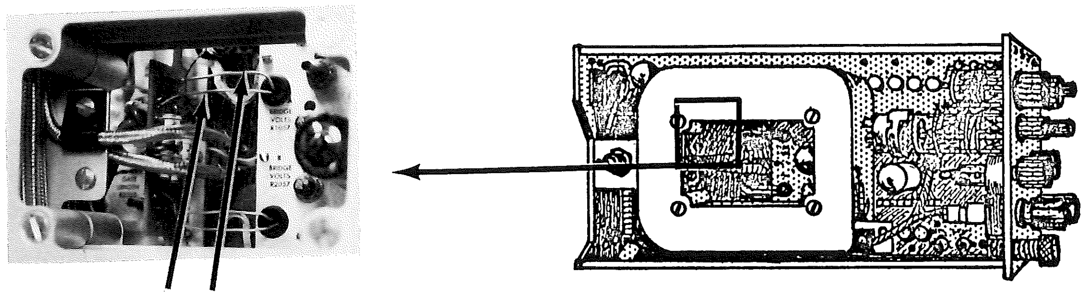


Figure 5-15

D. FINAL BRIDGE VOLTS CHECKS

1. Turn off the 30 psec pulser and disconnect it from the 3S76.
2. On the 3T77, set the TRIGGER SENSITIVITY CW. (Sweep free runs).
3. On the 3S76, set the MODE to DUAL-TRACE, the CH A and CH B VARIABLE controls full CCW to the CALIB position, and set the POSITION controls to midrange.
4. Insure the CH A and CH B DC OFFSET controls are set to 0 volts by monitoring the X100 OFFSET MONITOR jacks as outlined previously.
5. With the test scope and a X10 probe, measure the voltage across the CH A sampling bridge. The voltage at each end of the bridge should be greater than 1.6v (disregard polarity) and within 0.2 volts of each other. (This was measured previously in Part A, Step 4, when the CH A Bridge volts was adjusted). See Figure 5-16 A and B.



Monitor "A" sampling bridge
at yellow-white wire and
red-white wire.

Figure 5-16 A

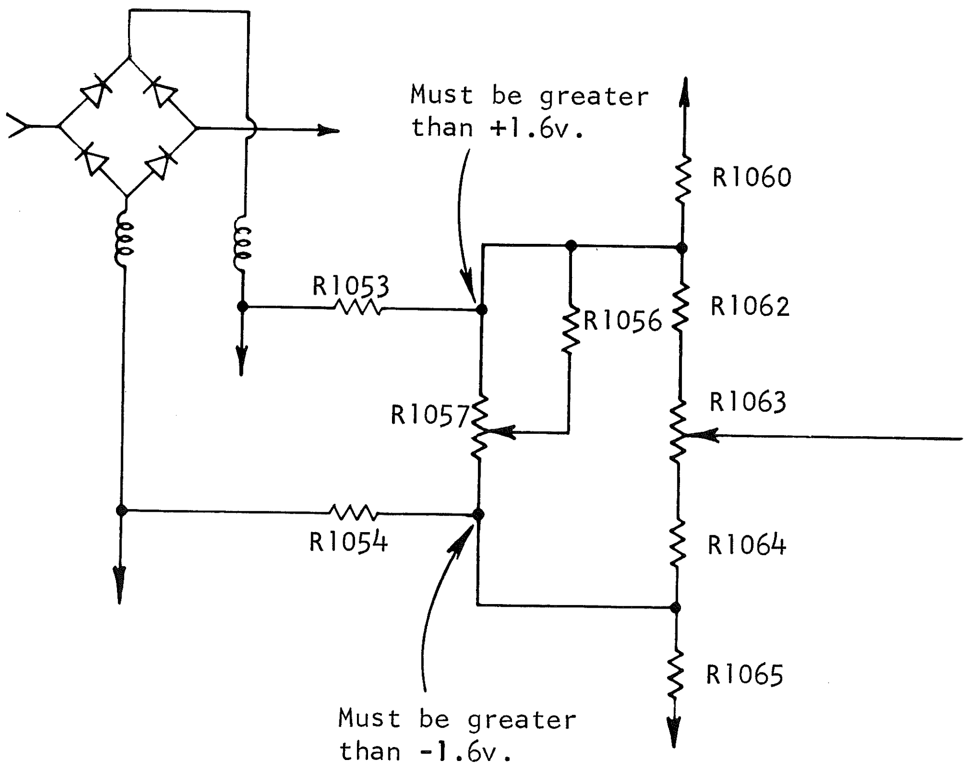
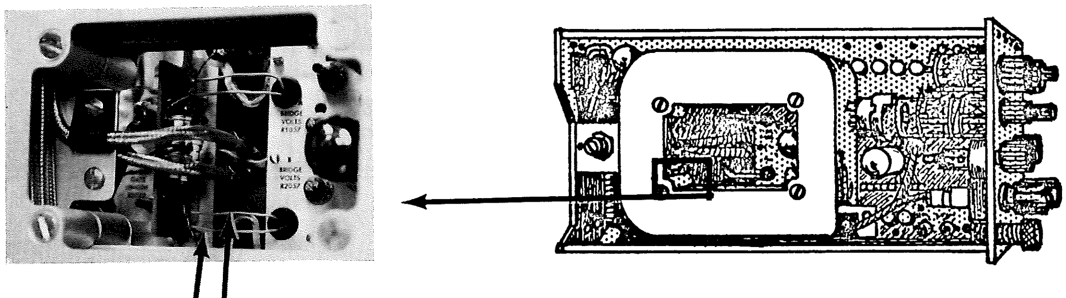


Figure 5-16 B

6. With the test scope and a X10 probe, measure the voltage across the CH B sampling bridge. The voltage at each end of the bridge must be greater than 1.6v (disregard polarity) and within 0.2 volts of each other. See Figure 5-17 A and B.



Monitor B sampling bridge
at yellow-white wire and
red-white wire.

Figure 5-17 A

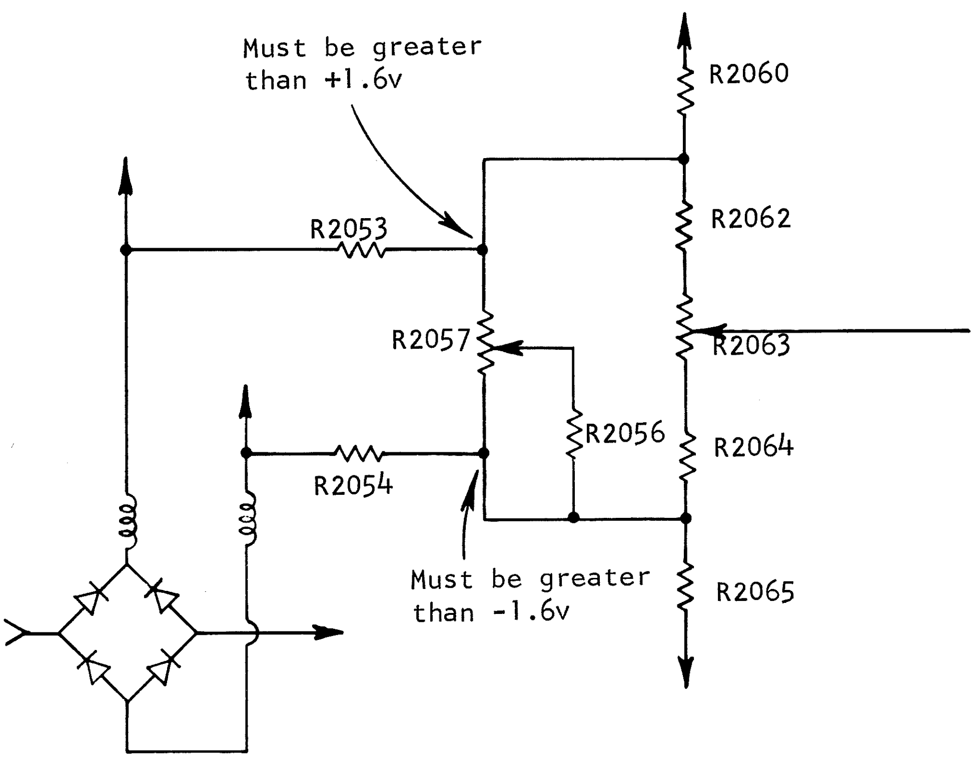


Figure 5-17 B

NOTE: If the Type 109 is used to check risetime, the same basic procedure is used. The major differences will be that (1) the trigger must be set for a + slope and (2) the 6R1A must be set up to read risetime on a positive going signal.

Things like setting the vertical deflection for 5 cm and the position of the 0% and 100% zones are roughly the same. The 0% zone will be set 2 cm to the left of graticule center and the 100% zone 3 cm to the right of graticule center.

The CH A and B Bridge Volts specs remain the same. The risetime is adjusted for 0.42 nsec to 0.44 nsec. This is due to the slower risetime of the 109 when compared to the risetime of the 30 psec pulser.

III. DOT TRANSIENT RESPONSE

A. MEMORY GATE LENGTH

1. Turn off the 567. Pull out the 3S76 and connect a 24 pin extender to P11. Connect the 3S76 to the 24 pin extender. Turn on the 567.
2. On the 3S76, set the MODE to A ONLY and the INTERNAL TRIGGER to A.
3. On the 3T77, set the TIME/DIV to 2 nsec, the TRIGGER SELECTOR to INT +, and the DOTS PER DIV to 10.
4. Apply power to a Type 109. Connect a 5 nsec cable to Charge Line 1. Do not connect the cable to Charge Line 2. Connect the output of the 109 to the CH A input connector. (The input signal must not be greater than 2v or it may harm the 3S76). See Figure 5-18.

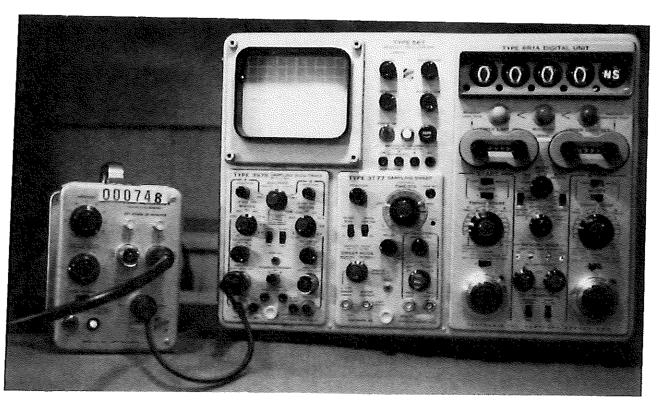
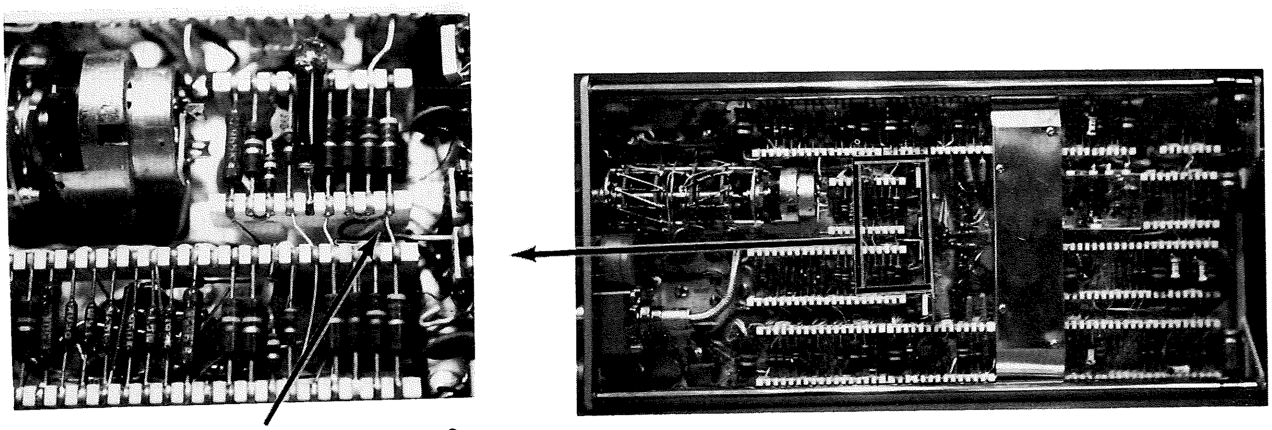


Figure 5-18

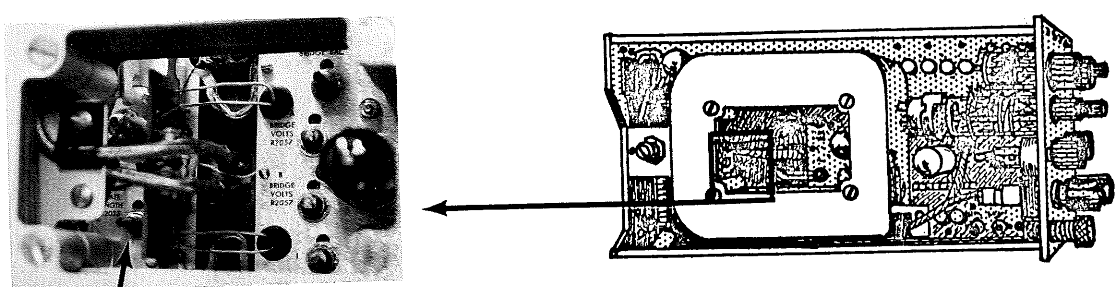
5. Adjust the **TRIGGER SENSITIVITY** to obtain a stable display and adjust the **DELAY** so the fast rise portion of the 109 pulse is on screen.
6. Adjust the **AMPLITUDE** controls on the 109, to obtain from 4 to 6 cm of vertical deflection.
7. Set the test scope for a 0.5v deflection sensitivity, AC coupled and set the sweep rate to 0.1 μsec. Connect a X10 probe from the test scope to the collector of Q2024 (the junction of R2027 and R2028). See Figure 5-19. Obtain a stable display on the test scope.



Junction of R2027 & R2028

Figure 5-19

8. While observing the 567 display, adjust the Memory Gate Length, R2023 - See Figure 5-20, for maximum distance of the horizontal lines (maximum loop gain). See Figure 5-21.



Memory Gate Length R2023

Figure 5-20

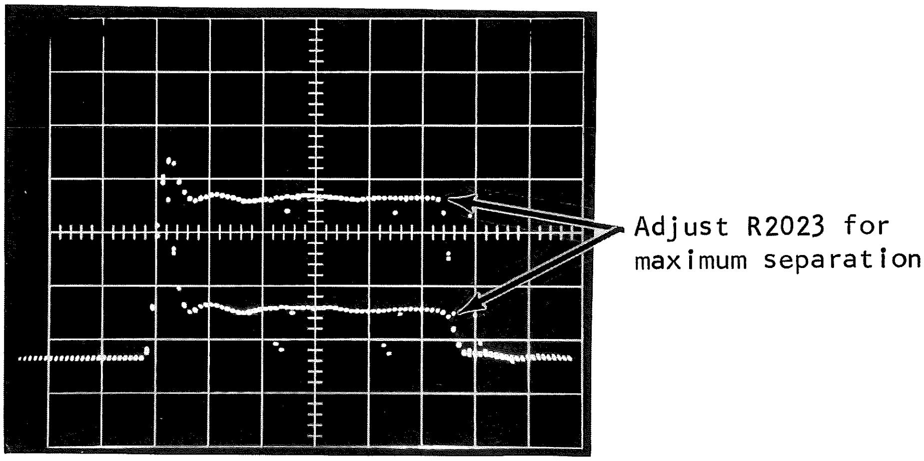
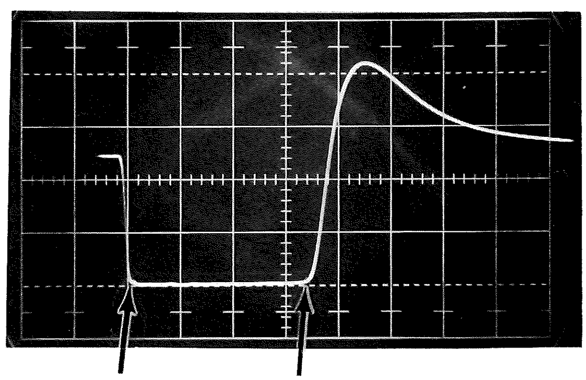


Figure 5-21

9. When R2023 is properly adjusted, the most negative portion of the test scope display is typically 350 to 380 nsec. Do not adjust beyond 400 nsec. If no maximum is observed, adjust for 350 nsec. The minimum allowable pulse length is 250 nsec. See Figure 5-22.



Pulse length must be from 250 nsec to 400 nsec, typically 350 - 380 nsec.

Figure 5-22

10. Disconnect the X10 probe. Readjust the 109 signal amplitude for 4 to 6 cm of vertical deflection.

B. A PREAMP SENSITIVITY

1. Adjust the A Preamp Sens, R1088 - See Figure 5-23, so the false baseline under the pulse is aligned with the true baseline which precedes and follows the pulse. See Figure 5-24.

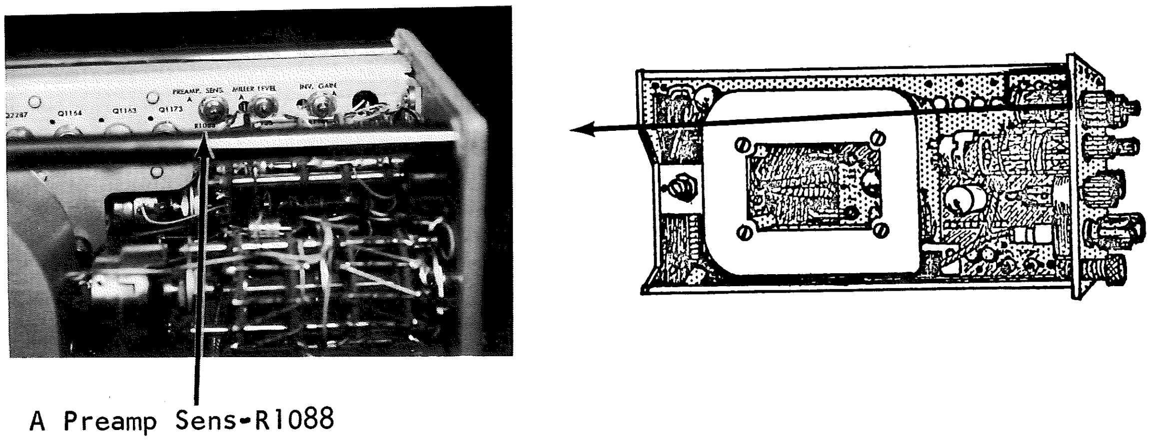


Figure 5-23

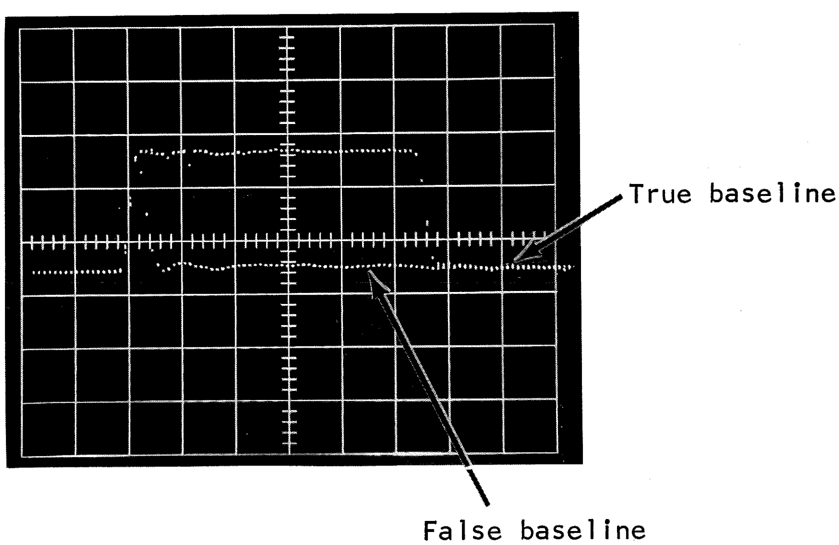
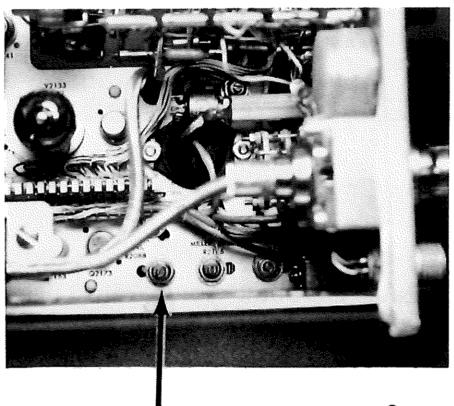


Figure 5-24

2. Vary the output of the 109 from 2 to 8 cm of vertical deflection on the 567. The false baseline should not move more than 10% of the displayed amplitude.

C. B PREAMP SENSITIVITY

1. Set the MODE to B ONLY, the INTERNAL TRIGGER to B, and connect the output of the 109 to the CH B input connector.
2. Adjust the B Preamp Sens, R2058 - See Figure 5-25, so the false baseline under the pulse is aligned with the true baseline which precedes and follows the pulse. See Figure 5-24.



B Preamp Sens-R2058

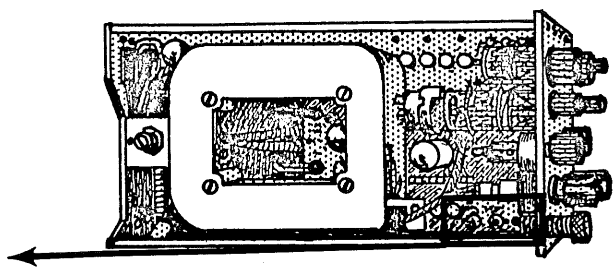


Figure 5-25

3. Vary the output of the 109 from 2 to 8 cm of vertical deflection on the 567. The false baseline should not move more than 10% of displayed pulse amplitude.
4. Set the NORM-INV control to INV and set the pulse polarity control on the 109 to -. Repeat step 3.
5. Set the NORM-INV to NORM and the pulse polarity to +.

D. SMOOTH-NORMAL CHECK

1. Short the center conductor of CHARGE LINE 2 to ground. Set the 109 amplitude for 8 cm of vertical deflection. (No double display).
2. Adjust the DELAY so there are no dots on the leading edge.

3. Set the SMOOTH-NORMAL control to SMOOTH. The first dot must fall between 2 and 2.4 cm from the baseline. See Figure 5-26.

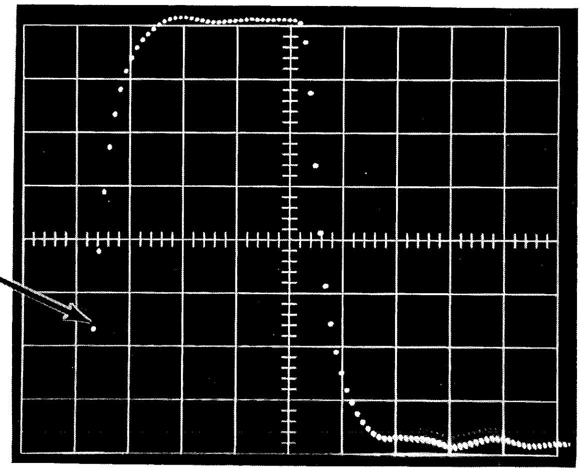


Figure 5-26

4. Set the MODE to A ONLY, the INTERNAL TRIGGER to A, and connect the output of the 109 to the CH A input connector.
5. Set the SMOOTH-NORMAL to NORMAL and adjust the output of the 109 for 8 cm of display. Repeat steps 2 and 3. Return the SMOOTH-NORMAL control to NORMAL.

F. PULSE ABERRATION

1. Remove the 5 nsec cable and the shorting strap from the 109 and connect the 50Ω charge network to the 109.
2. Set the TIME/DIV to 5 nsec and adjust the amplitude for 8 cm of vertical deflection.
3. With the DELAY and TRIGGER SENSITIVITY, obtain a stable display and position the pulse so it is displayed on the graticule.
4. Check the front of the pulse for less than ±3% aberrations.
5. Set the MODE to B ONLY, the INTERNAL TRIGGER to B, and connect the output of the 109 to the CH B input connector.
6. Repeat steps 3 and 4.

E. A + B REJECTION RATIO

1. Disconnect the input of the 109 from CH B. Connect the output of the 109 to a GR Tee connector. Connect the CH A and CH B input connectors to the GR Tee connector. (Use equal length GR cables from the GR Tee to each input connector).
2. Adjust the output amplitude for 8 cm of vertical deflection. Set the MODE to DUAL-TRACE and position both the CH A and CH B baselines to graticule center.
3. Set the MODE to A + B and the CH B NORM-INV control to INV.
4. Check for not more than 0.16 cm of vertical deflection (excluding spikes). This equals a rejection ratio of 50:1.
5. Set the MODE to A ONLY and the CH B NORM-INV control to NORM.
6. Disconnect 109 signal.

IV. NOISE

A. NOISE

1. Turn off the 567. Remove the plug-in extensions and set the 3S76 into the vertical plug-in receptacle. Turn on the 567.
2. Set the MODE to DUAL-TRACE and set both MV/DIV controls to 2. Set the INTERNAL TRIGGER to OFF.
3. Set the DOTS PER DIV control to 100 and check for less than 10% of the dots outside of 2 mv.
4. Set the SMOOTH-NORMAL control to SMOOTH and check for less than 1 mv of noise.

B. MICROPHONICS

1. Set the SMOOTH-NORMAL control to NORMAL.
2. Rap lightly on the front panel and check for less than 4 mv of microphonics.

C. TRACE SHIFT

1. Switch the TIME/DIV control from 10 µsec to .2 nsec. Check for less than 4 mv of trace shift.

V. DC OFFSET

A. CH A

1. Set the MV/DIV control to 200, the Mode to A only, the Internal Trigger to A, and rotate the DC OFFSET fully CW.
2. With the POSITION control, set the trace to the bottom of the graticule.
3. Rotate the DC OFFSET control CCW, until the trace is aligned with the top of the graticule. Reposition the trace to the bottom of the graticule.
4. Now rotate the DC OFFSET fully CCW. The trace must move at least 1 cm (total travel of 9 cm). The DC OFFSET control will typically position the trace 11 cm.

   NOTE: The rest of the DC OFFSET check is only valid if the signal from the 3S76 to the 6R1A has been adjusted for 1 v/cm of vertical deflection.
5. Connect the output of a Type 105 to the input of a 50Ω Amplitude Calibrator. Set the output of the 50Ω Calibrator to 1.2v. Set the 105 frequency to 10 kc and adjust the 105 amplitude for a dull red glow on the neon in the 50Ω Amplitude Calibrator. Same setup as used to adjust the gain.
6. Set the TIME/DIV to 10 μsec and the DOTS PER DIV to 10. With the TRIGGER SENSITIVITY control, obtain a stable display.
7. Insert a comparison voltage type preamp in the test scope. Set the sweep to 5 msec, free running. Set the vertical deflection sensitivity to 5v/div, DC coupled.
8. Connect a X10 probe from the test scope to the CH A X100 OFFSET MONITOR.
9. Adjust the DC OFFSET control to -60v as read on the test scope.
10. With the POSITION control, align the top of the waveform with graticule center.
11. With the DC OFFSET control, align the bottom of the waveform with graticule center. Check test scope for a change in voltage of 120v ±3%. (Circuit tolerance is 2% plus 1% for the probe).

B. CH B

1. Set the MV/DIV control to 200, the Mode to B only, and rotate the DC OFFSET fully CW.
2. With the POSITION control, set the trace to the bottom of the graticule.
3. Rotate the DC OFFSET control CCW until the trace is aligned with the top of the graticule. Then reposition the trace to the bottom of the graticule.
4. Now rotate the DC OFFSET fully CCW, the trace must move at least 1 cm (total travel of 9 cm). The DC OFFSET control will typically position the trace 11 cm.

   NOTE: The rest of the DC OFFSET check is only valid if the signal from the 3S76 to the 6R1A has been adjusted for 1 v/cm of vertical deflection.
5. Connect the 50Ω Amplitude Calibrator to the CH B input connector.
6. Set the INTERNAL TRIGGER to B.
7. Connect the X10 probe from the test scope to the CH B X100 OFFSET MONITOR.
8. Adjust the DC OFFSET control to -60v as read on the test scope.
9. With the POSITION control, align the top of the waveform with graticule center.
10. With the DC OFFSET control, align the bottom of the waveform with graticule center. Check the test scope for a change in voltage of 120v ±3%. (Circuit tolerance is 2% plus 1% for the probe).
11. Disconnect the X10 probe and the 50Ω Amplitude Calibrator.

VI. MEMORY SLASH and LISSAJOUS CHECK

A. MEMORY SLASH

1. Set the MODE to A ONLY and the INTERNAL TRIGGER to A.
2. Connect the output of a 105 to the CH A input connector through a 5X GR attenuator.
3. Obtain a stable display with the TRIGGER SENSITIVITY control. Adjust the 105 amplitude for approximately 6 cm of deflection.

4. Set the output frequency of the 105 to 30 cps and check for less than 2 mm of memory slash.
5. Set the MODE to B ONLY and the INTERNAL TRIGGER to B. Connect the output of the 105 to the CH B input connector.
6. Check for less than 2 mm of Memory Slash.
7. Disconnect the 105 signal.

B. LISSAJOUS CHECK

1. Apply power to a Type 180A. Set the output frequency of the 180A to 10 mc.
2. Connect the output of the 180A to the CH A and CH B input connectors through a 5X attenuator. (Use equal length cables from the 180A to each input connector).
3. With the TRIGGER SENSITIVITY and PULL FOR SYNC controls, obtain a stable display.
4. Set the MODE to A VERT B HORIZ and check for a 45 degree line.
5. Disconnect the 180A.

Preset the front panel controls for the 3S3, 3T77, 6R1A combination as follows:

3S3

MODE	B ONLY
CH A and CH B	
POSITION	midrange
MV/DIV	100
VARIABLE	---
DC OFFSET	midrange (5 turns from either end)
FAST RT-LOW NOISE	FAST RT
SMOOTHING	midrange

3T77

TIME/DIV	.2 nsec
VARIABLE	CALIB (full CCW)
HORIZ MAG	X1
DOTS PER DIV	100
SWEEP MODE	NORMAL
DELAY	CCW
TRIGGER	
SENSITIVITY	CW
SELECTOR	EXT +

Figure 5-27 shows the proper set up.

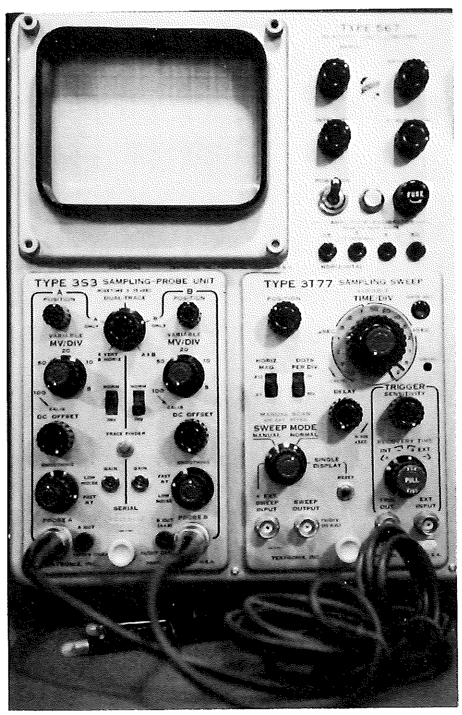
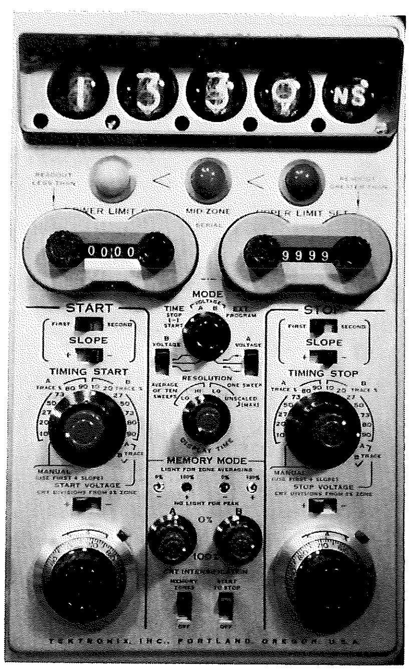


Figure 5-27

<u>6R1A</u>

MODE	TIME STOP (-) START
RESOLUTION	AVERAGE OF TEN SWEEP HI
CRT INTENSIFICATION	
MEMORY ZONES	UP (on)
START TO STOP	UP (on)
START	
SLOPE	FIRST -
TIMING START	B TRACE 10%
STOP	
SLOPE	FIRST -
TIMING STOP	B TRACE 90%
INTERNAL CONTROLS	
A and B MEMORY	
0% MODE	AVG
100% MODE	AVG
RESPONSE	SLOW
START and STOP COMPARATOR	
3-DOT DELAY	IN

Figure 5-28 A and B shows the proper set up.



(A)

(B)

<u>Figure 5-28</u>

I. RISETIME

The Risetime is specified as 340 psec ±5 psec.

A. CH B

1. Connect the output of a 30 psec pulser to the CH B probe (red band) through a 2X GR attenuator. Connect the Pretrigger output to the EXT INPUT (TRIGGER) on the 3T77. On the pulser, set the DRIVE to midrange and turn the pulser on. See Figure 5-29.

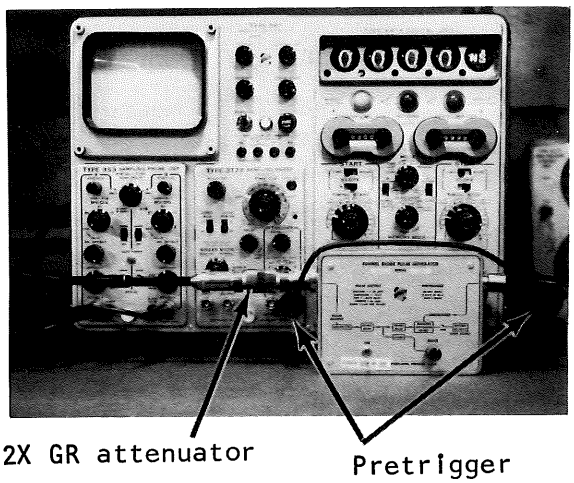


Figure 5-29

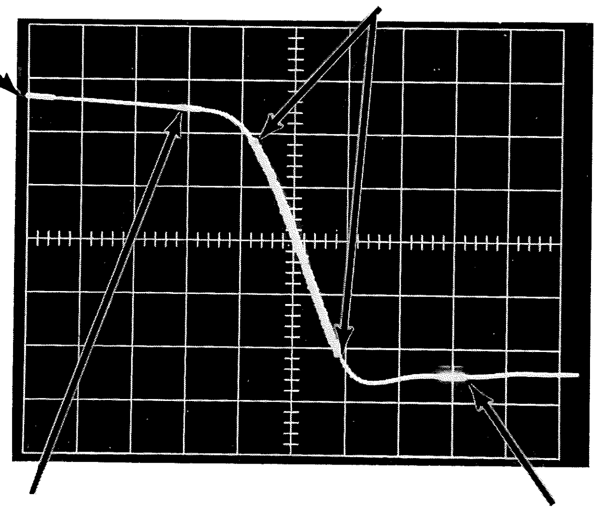
2. Obtain a stable display with the TRIGGER SENSITIVITY control. Adjust the DELAY so the fast rise portion of the display is on the graticule. Vertically position the display to approximately graticule center. (Use both the POSITION and DC OFFSET controls).

3. Adjust the DRIVE control and the DELAY control so the fast rise portion of the display is approximately in the center of the graticule and the Dead zone is at a relatively flat portion of the waveform.

4. With the VARIABLE MV/DIV control, adjust for 5 cm of vertical deflection. Position the 0% zone 2 cm to the left and 2.5 cm above graticule center. Position the 100% zone 3 cm to the right and 2.5 cm below graticule center. See Figure 5-30.

Dead zone set to relatively flat portion of display.

T_r measured from 2 cm above and 1 cm to the left of graticule center to 2 cm below and 1 cm to the right of graticule center.



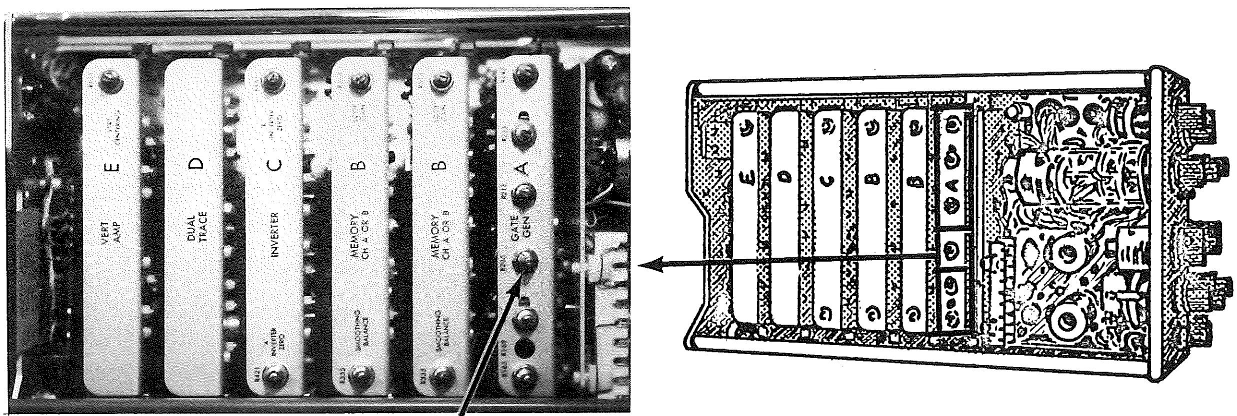
0% zone 2.5 cm above and 2 cm to the left of graticule center.

100% zone set 2.5 cm below and 3 cm to the right of graticule center.

Figure 5-30

5. Adjust the Snap-off Current, R205 - See Figure 5-31, for 340 psec risetime as read on the CRT and on the 6R1A. Keep the display set up as outlined in Step 4.

   a. There will be some difference in risetime as read on the CRT and on the 6R1A. The readings should be close and the 6R1A is the more accurate.



Snap-off Current R205

Figure 5-31

B. CH A

1. Disconnect the 30 psec pulser from CH B. Terminate the CH B probe in 50Ω. Remove the 50Ω termination from the CH A probe and connect it to the 30 psec pulser through a 2X GR attenuator.

2. Set the MODE to A ONLY and vertically position the display so it is centered on the graticule. (Use the POSITION and DC OFFSET controls).

3. On the 6R1A, set the TIMING START to A TRACE 10% and the TIMING STOP to A TRACE 90%.

4. With the VARIABLE MV/DIV control, obtain 5 cm of deflection. Position the 0% zone 2 cm to the left and 2.5 cm above graticule center. Position the 100% zone 3 cm to the right and 2.5 cm below graticule center. Same as Step 4 part A. See Figure 5-32.

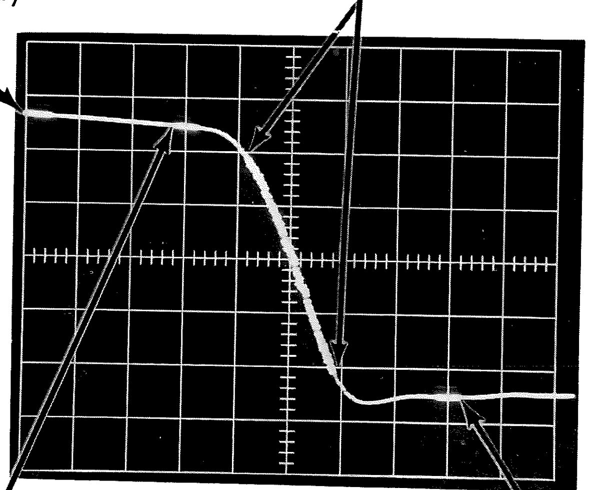


Figure 5-32

5. Adjust the A Bridge Volts, R169 - See Figure 5-33, for a risetime of 340 psec ±5 psec. Keep the display set up as outlined in Step 4.

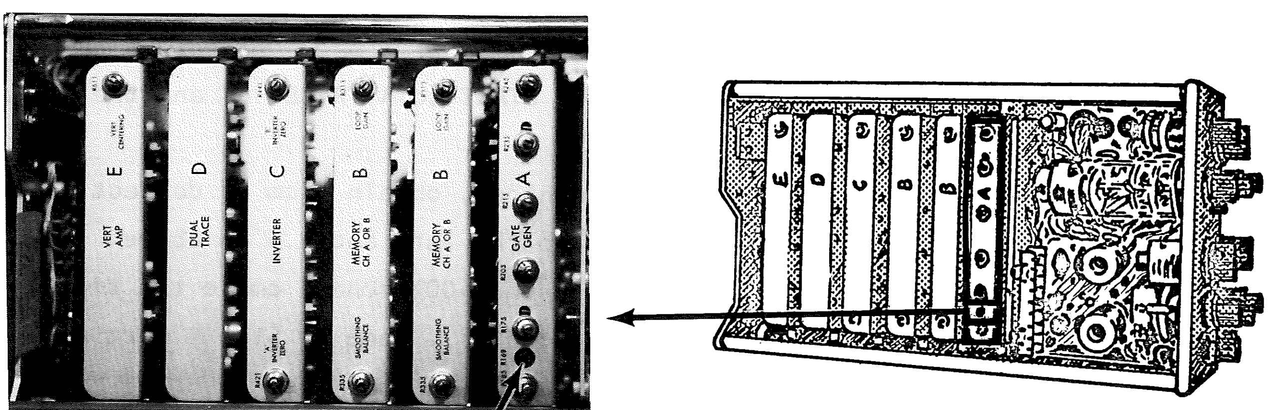
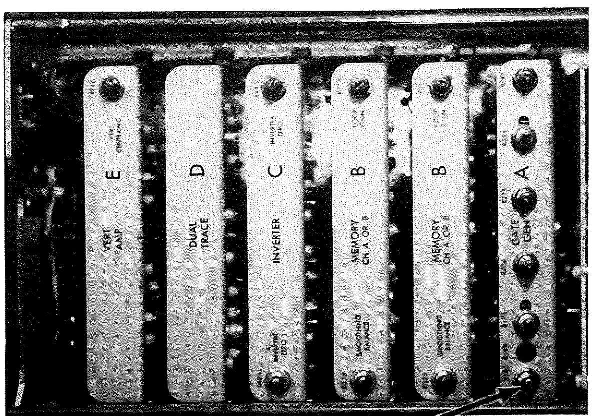
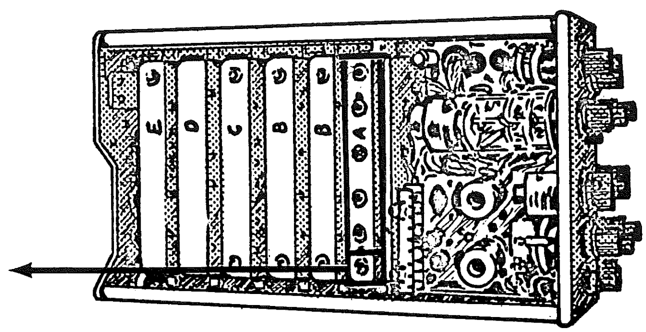


Figure 5-33

C. CH A BALANCE

1. Disconnect the 30 psec pulser from the CH A probe and terminate the probe in 50Ω.
2. Turn off the pulser and set the TRIGGER SENSITIVITY CW.
3. Set the VARIABLE to the CALIB position (full CCW) and set the DC OFFSET to midrange. (5 turns from either end).
4. Set the FAST RT-LO NOISE control to LOW NOISE and align the trace to graticule center with the POSITION control.
5. Set the MV/DIV control to 5 and return the trace to graticule center with the A Bridge Bal, R185 - See Figure 5-34.

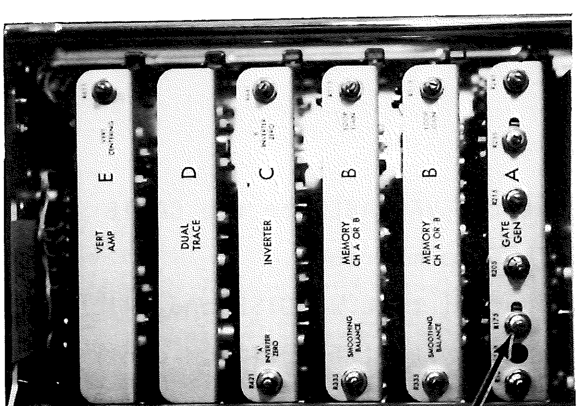


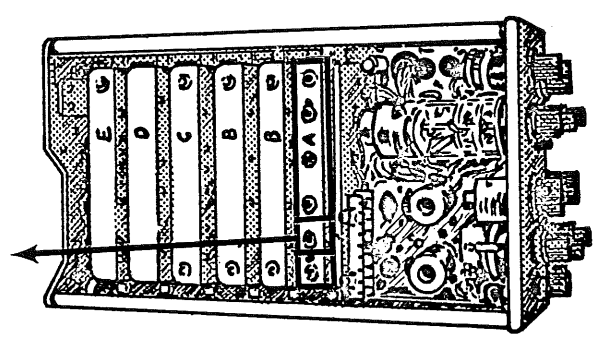


A Bridge Bal R185

Figure 5-34

6. Leave the MV/DIV control at 5. Set the FAST RT-LOW NOISE control to FAST RT. Return the trace to graticule center with the A Risetime Bal, R175 - See Figure 5-35.

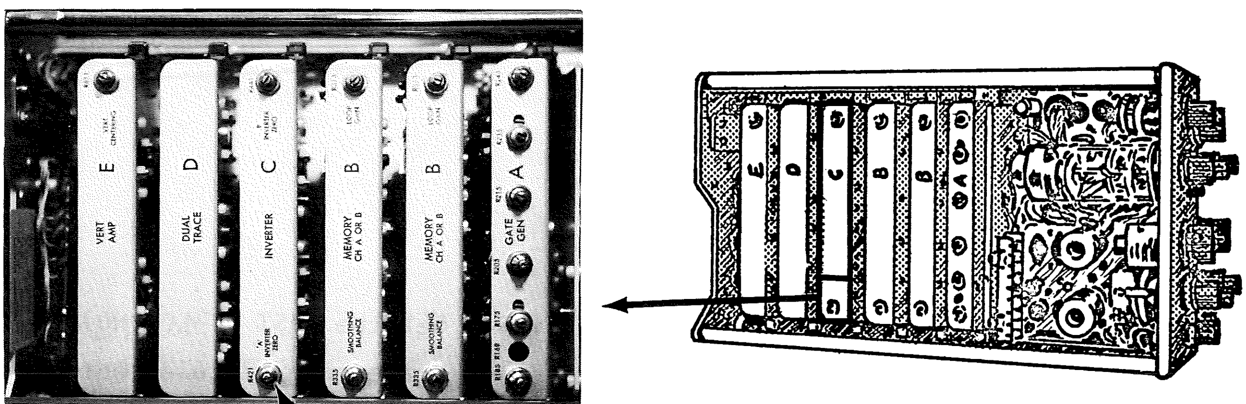




A Risetime Bal R175

Figure 3-35

7. Adjust the A Risetime Bal for no trace shift as the FAST RT-LOW NOISE switch is thrown. Keep the trace on screen with the A Bridge Bal.
8. Adjust the A Bridge Bal for no trace shift as the MV/DIV control is rotated.
9. The adjustment of R185 and R175 interact. Repeat Steps 7 and 8 until the Bridge Bal and Risetime Bal are properly adjusted.
   a. The FAST RT-LOW NOISE control must be set to LOW NOISE when the A Bridge Bal is adjusted.
10. Set the MV/DIV control to 100 and the FAST RT-LOW NOISE control to LOW NOISE. Adjust the DC OFFSET for no trace shift as the VARIABLE MV/DIV control is rotated. Return the VARIABLE to the CALIB position.
11. Adjust the A Inverter Zero, R421 - See Figure 5-36, for no trace shift as the NORM-INV switch is thrown.

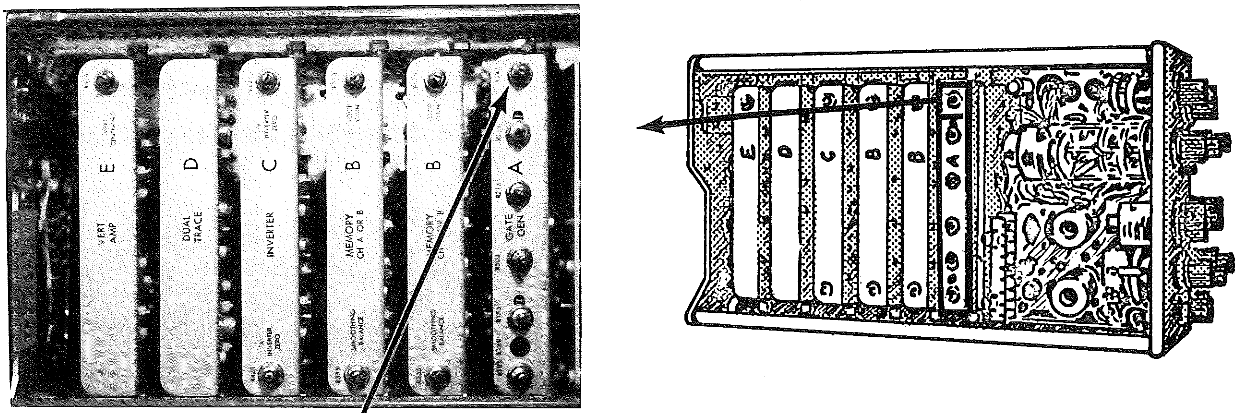


A Inverter Zero - R421

Figure 5-36

D. CH B. BALANCE
1. Set the MODE to B ONLY. Set the VARIABLE to the CALIB position and set the DC OFFSET to midrange.
2. Set the FAST RT-LOW NOISE control to LOW NOISE and align the trace with graticule center with the POSITION control.

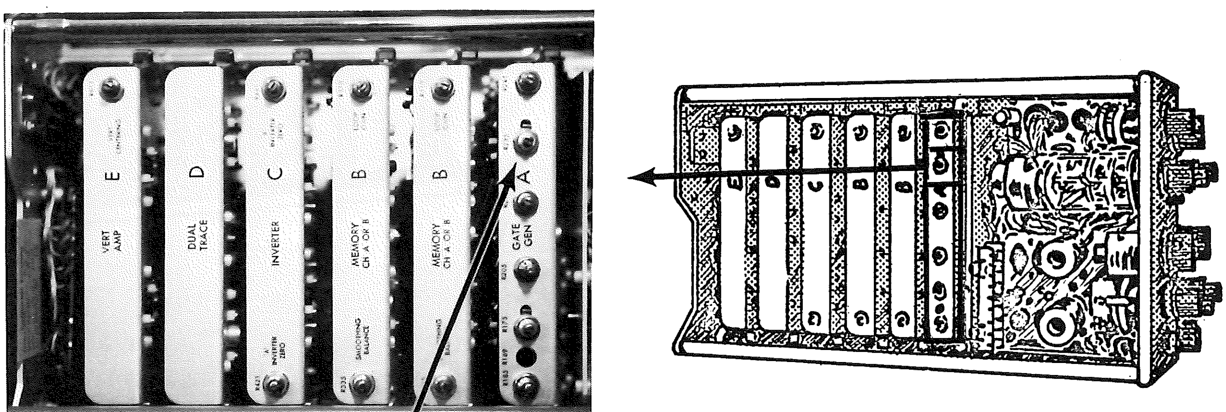
3. Set the MV/DIV control to 5 and return the trace to graticule center with the B Bridge Bal, R245 - See Figure 5-37.



B Bridge Bal R245

Figure 5-37

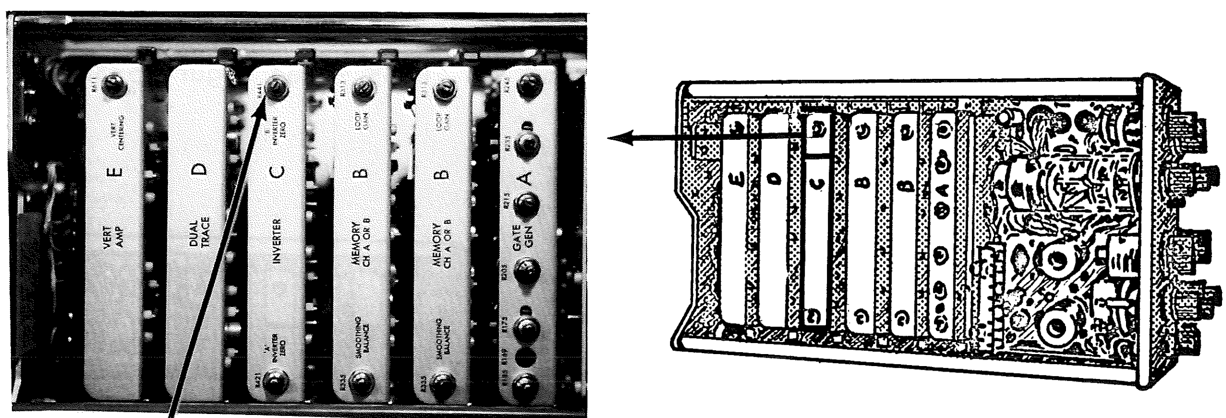
4. Leave the MV/DIV control at 5. Set the FAST RT-LOW NOISE control to FAST RT and return the trace to graticule center with the B Risetime Bal, R235 - See Figure 5-38.



B Risetime Bal R235

Figure 5-38

5. Adjust the B Risetime Bal for no trace shift as the FAST RT-LOW NOISE switch is thrown. Keep the trace on screen with the B Bridge Bal.
6. Adjust the B Bridge Bal for no trace shift as the MV/DIV control is rotated.
7. The adjustment of R235 and R245 interact. Repeat steps 5 and 6 until the Bridge Bal and Risetime Bal are properly adjusted.
   a. The FAST RT-LOW NOISE control must be set to LOW NOISE when the B Bridge Bal is adjusted.
8. Set the MV/DIV control to 100 and the FAST RT-LOW NOISE control to LOW NOISE. Adjust the DC OFFSET for no trace shift as the VARIABLE MV/DIV control is rotated. Return the VARIABLE to the CALIB position.
9. Adjust the B Inverter Zero, R441 - See Figure 5-39, for no trace shift as the NORM-INV switch is thrown.



B Inverter Zero R441

Figure 5-39

10. On the 6R1A, set the TIMING START to B TRACE 10% and the TIMING STOP to B TRACE 90%.
11. Remove the 50Ω termination from the CH B probe and connect the output of the 30 psec pulser to CH B.
12. Set the FAST RT-LOW NOISE control to FAST RT. Check and/or adjust the CH B Risetime as described in Part A.

13. Check and/or adjust the CH A Risetime as described in part B.
    a. If either the CH A or CH B risetime is readjusted the balance adjustments must be rechecked. You may "have to play the game 2 or 3 times before the risetime and balance are properly adjusted.
    b. Before rechecking the balance adjustments, adjust the DC OFFSET for no trace shift as the VARIABLE is rotated (FAST RT-LOW NOISE in LOW NOISE position).
14. Disconnect the 30 psec pulser.

II. GAIN

The MV/DIV accuracy is specified as ±3%. The NORM-INV error is specified as ±3%. The VARIABLE range is specified as 3:1 or greater.

A. CH A

1. On the 3T77, set the TIME/DIV to 10 μsec and the DOTS PER DIV to 10.
2. On the 6R1A, set the MODE to A VOLTAGE and the resolution to ONE SWEEP UNSCALED (max). Set the A VOLTAGE control to UP.
3. On the 3S3, set the MODE to A ONLY, the MV/DIV control to 100, and the FAST RT-LOW NOISE control to LOW NOISE.
4. Connect the output of a Type 105 to the input of the 50Ω Amplitude Calibrator. Connect the pretrigger on the 50Ω Calibrator to the EXT INPUT (TRIGGER) on the 3T77. Connect the output of the 50Ω Calibrator to a 50Ω BNC terminator through a GR to BNC adaptor. Connect the 50Ω terminator to a GR Tee connector through a GR to BNC adaptor. Connect the CH A and B probes to the GR Tee connector. See Figure 5-40.

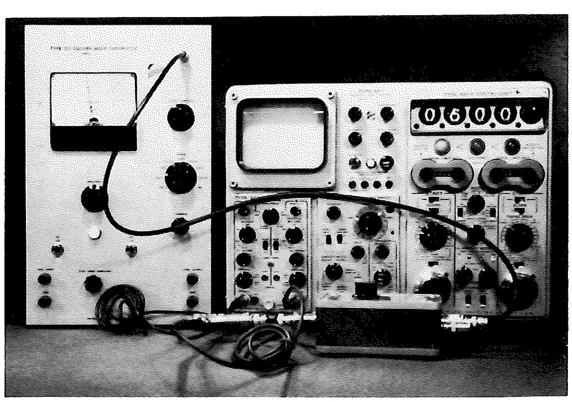
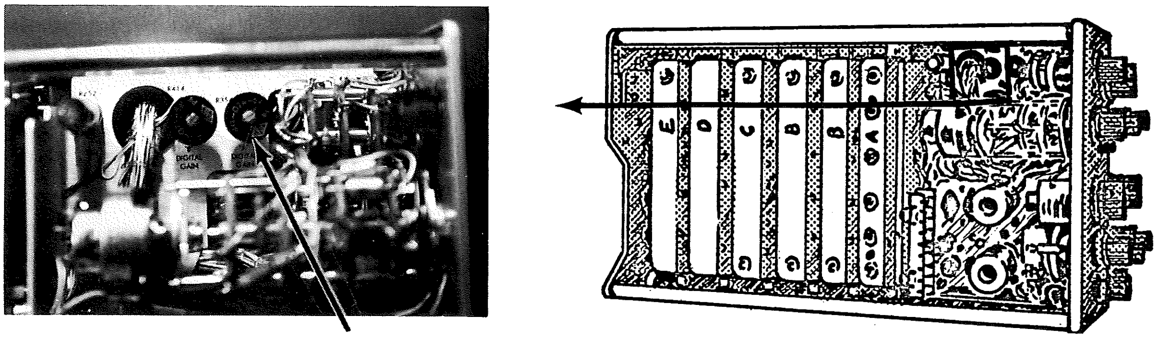


Figure 5-40

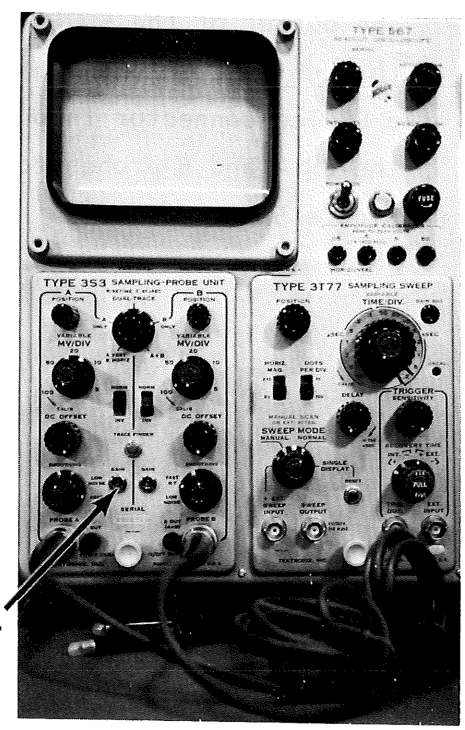
5. Adjust the output frequency of the 105 to 10 kc and adjust the amplitude for a dull red glow as seen on the neon in the 50Ω Calibrator.
6. Set the VOLTS control on the calibrator to .6 and adjust the TRIGGER SENSITIVITY for a stable display. Position the 0% zone to the bottom of the display and the 100% zone to the top of the display. Adjust SMOOTHING control for best front corner.
7. Adjust the A Digital Gain, R354 - See Figure 5-41, for a digital count of 600.



A Digital Gain R354

Figure 5-41

8. Adjust the CH A Gain Adj., R439 - See Figure 5-42, for 6 cm of vertical deflection.



CH A Gain Adj.
R439

Figure 5-42

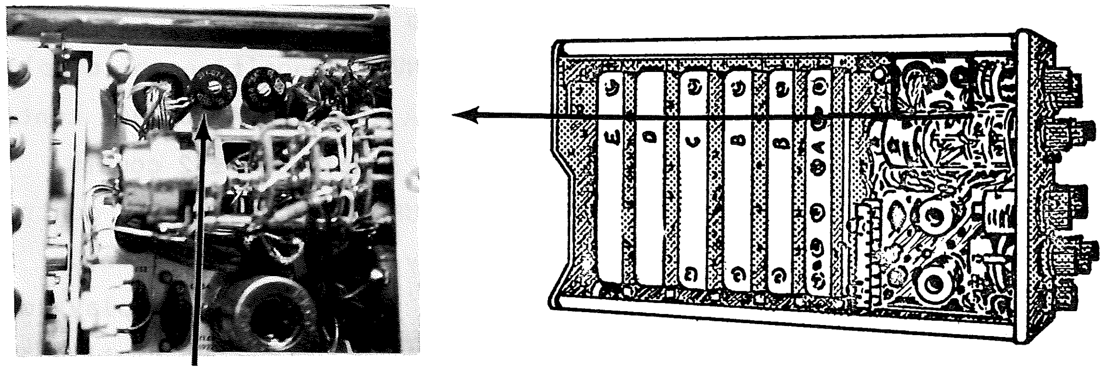
9. On the A Memory board, set the 0% and 100% MODE to FAST. The digital count must remain within ±2 counts of 600. Return the 0% and 100% MODE to SLOW.
10. Set the NORM-INV control to INV and position the display to graticule center. On the 6R1A, set the A VOLTAGE control to DOWN. The digital count must remain 600 ±12 counts.
11. Set the A VOLTAGE control to UP and the NORM-INV control to NORM. Position the display to graticule center.
12. Set the VOLTS control to .12. Position the display to the top, at the center, and to the bottom of the graticule. There must be 1.2 cm ±1 mm of deflection and the digital count must be 120 ±2 counts.
13. Set the VARIABLE full CW. There must be 3.6 cm or more of vertical deflection and the digital count must be 360 or greater.
14. Return the VARIABLE to the CALIB position.
15. Check the MV/DIV accuracy against the following chart.

MV/DIV	50Ω CALIBRATOR	VERT. DEFL.	DIGITAL COUNT	TOLERANCE
100	.6	6 cm	600	±3%
50	.3	"	"	"
20	.12	"	"	"
10	.06	"	"	"
5	.03	"	"	±5%

16. Set the MV/DIV control to 100 and the VOLTS to .6.

B. CH B

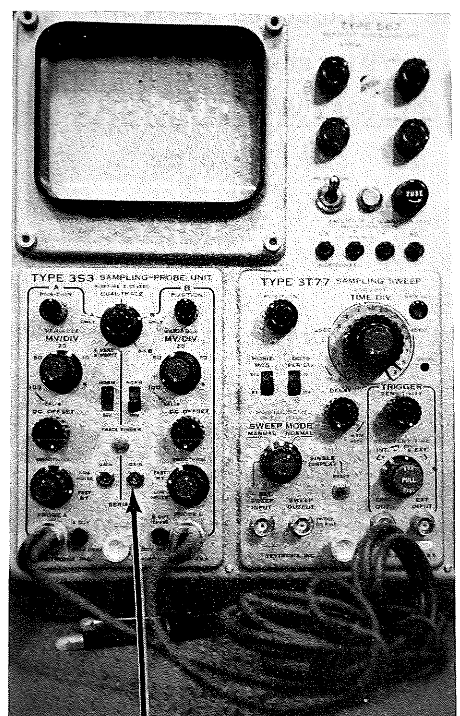
1. On the 3S3, set the MODE to B ONLY. On the 6R1A, set the MODE to B VOLTAGE and the B VOLTAGE control to UP. Position the 0% zone to the bottom of the display and the 100% zone to the top.
2. Set the MV/DIV control to 100 and the FAST RT-LOW NOISE to LOW NOISE. Adjust the SMOOTHING control for best front corner.
3. Adjust B Digital Gain, R414 - See Figure 5-43, for a digital count of 600.



B Digital Gain R414

Figure 5-43

4. Adjust the CH B Gain, R459 - See Figure 5-44, for 6 cm of vertical deflection.



CH B Gain Adj. R459

Figure 5-44

5. On the B Memory board, set the 0% and 100% MODES to FAST. The digital count must remain with ±2 counts of 600. Return the 0% and 100% MODES to SLOW.
6. Set the NORM-INV control to INV and position the display to graticule center. Set the B VOLTAGE control to DOWN. The digital count must remain 600 ±12 counts.
7. Set the B VOLTAGE control to Up and the NORM-INV control to NORM. Position the display to graticule center.
8. Set the VOLTS control to .12. Set the VARIABLE full CW. There must be 3.6 cm or more of vertical deflection and the digital count must be 360 or greater.
9. Return the VARIABLE to the CALIB position.
10. Check the MV/DIV accuracy against the following chart.

MV/DIV	50Ω CALIBRATOR	VERT. DEFL.	DIGITAL COUNT	TOLERANCE
100	.6	6 cm	600	±3%
50	.3	"	"	"
20	.12	"	"	"
10	.06	"	"	"
5	.03	"	"	±5%

11. Set the MV/DIV control to 100 and the VOLTS control to .3.

C. A + B and REJECTION RATIO

1. On the 3S3, set the MODE to A + B.
2. With both NORM-INV controls set to NORM, the digital count must be 600 ±2 counts.
3. Set the CH B NORM-INV control to INV. The digital count must be 15 or less (rejection ratio or 20:1).
4. Set the CH B NORM-INV control to NORM and the CH A NORM-INV control to INV. Set the B VOLTAGE control to DOWN. The digital count must be 15 or less.
5. Set the CH A NORM-INV control to NORM and the B VOLTAGE control to UP.

D. A VERT B HORIZ

1. On the 50Ω Amplitude Calibrator, set the VOLTS control to .6.
2. Remove the CH A probe from the GR Tee connector and terminate it in 50Ω.

3. Set the MODE to A VERT B HORIZ and check for 6 cm of horizontal deflection.
4. Disconnect the CH B probe from the GR Tee connector and terminate it in 50Ω.

E. DC OFFSET RANGE

1. On the 3T77, set the TRIGGER SENSITIVITY control full CW, the DOTS PER DIV to 100, and the TIME/DIV to .1 μsec.
2. On the 3S3, set the MODE to DUAL-TRACE. Set both FAST RT-LOW NOISE controls to LOW NOISE.
3. Adjust both DC OFFSET controls for no trace shift as the MV/DIV controls are rotated.
4. With the CH A POSITION control, set the A trace 1 cm below graticule center.
5. Rotate the CH A DC OFFSET fully CW. The trace must travel at least 4.5 cm toward the top of the graticule.
6. With the DC OFFSET control, return the trace to 1 cm below graticule center. Then with the POSITION control, set the A trace 1 cm above graticule center.
7. Rotate the CH A DC OFFSET control fully CCW. The trace must travel at least 4.5 cm toward the bottom of the graticule.
8. Position the B trace 1 cm below graticule center, with the CH B POSITION control.
9. Rotate the CH B DC OFFSET control fully CW. The trace must travel at least 4.5 cm toward the top of the graticule.
10. With the DC OFFSET control, return the trace to 1 cm below graticule center. Then with the POSITION control, set the B trace 1 cm above graticule center.
11. Rotate the CH B DC OFFSET control fully CCW. The trace must travel at least 4.5 cm toward the bottom of the graticule.
12. Adjust both DC OFFSET controls for no trace shift as the MV/DIV controls are rotated.

III. DOT TRANSIENT RESPONSE

A. MEMORY GATE WIDTH

1. Apply power to a Type 111 and connect a 5 nsec charge line to the CHARGE LINE connection on the back panel. Connect the output of the 111 to the CH A probe through 100 times attenuation. Connect the pretrigger output to the EXT INPUT (TRIGGER) through a 10X GR attenuator.
2. On the 3S3, set the MODE to A ONLY and on the 3T77, set the TIME/DIV to 5 nsec. See Figure 5-45.

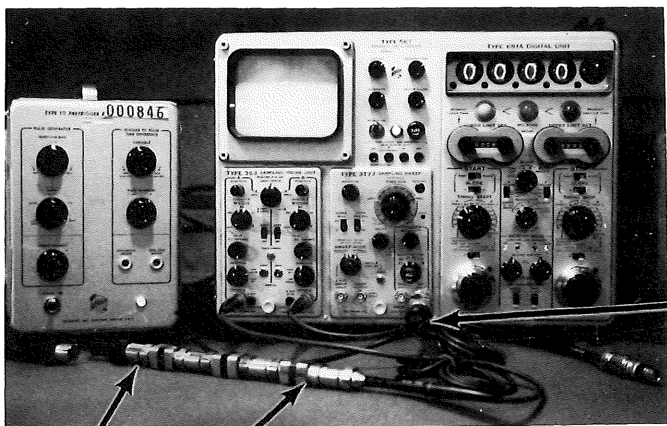
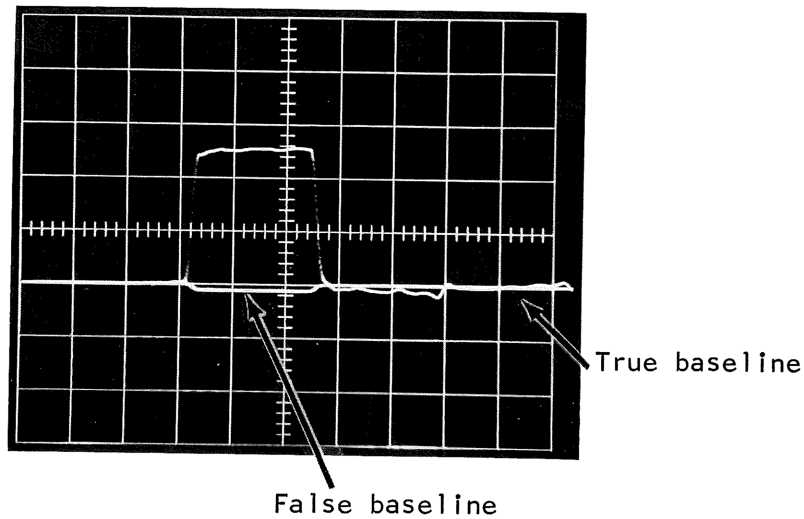


Figure 5-45

3. On the 111, set the output polarity to +, the rep rate to approximately 100 kc, and the trigger to pulse time difference variable to approximately 60 nsec.
4. With the TRIGGER SENSITIVITY and DELAY controls, obtain a stable display with the pulse at approximately graticule center. Adjust the TRIGGER SENSITIVITY so a multiple display is seen. See Figure 5-46.



Display has 2 baselines.

Figure 5-46

5. Connect the CH A probe to the 111 signal through a Response Normalizer. Set the SMOOTHING control full CCW.
6. Adjust the Memory Gate Width, R215 - See Figure 5-47, for maximum separation between the two pulses. If two maximum separation points are observed, set the Memory Gate Width to the one which is closest to full CCW.

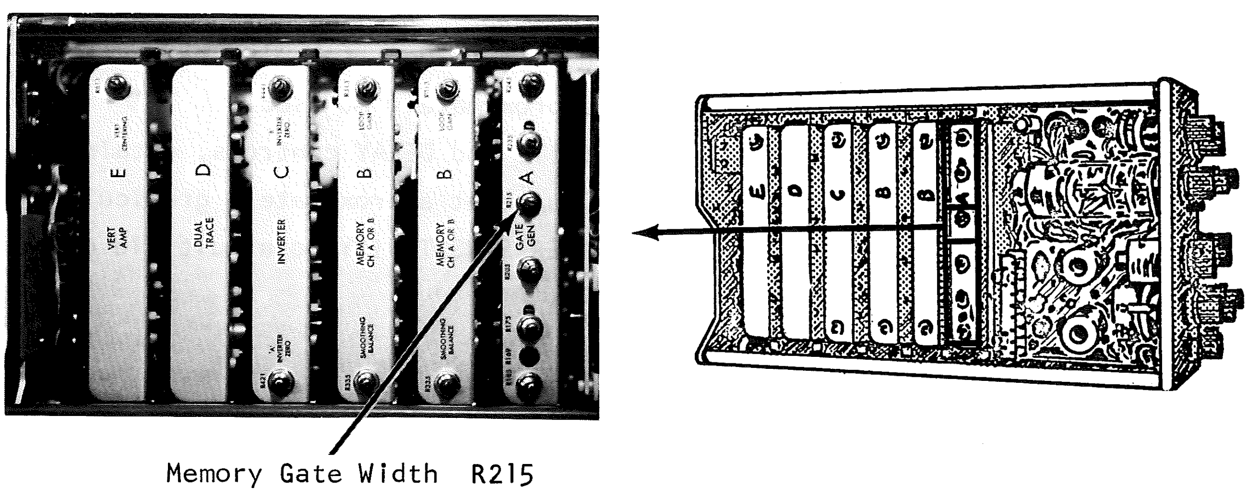
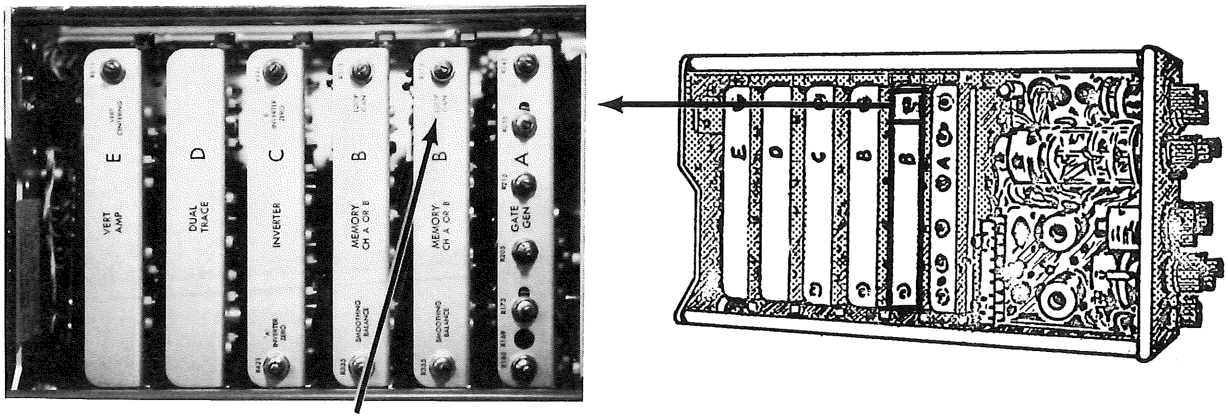


Figure 5-47

B. CH A LOOP GAIN

1. Adjust the Loop Gain, R313 - See Figure 5-48, so the false baseline is aligned with the real baseline.



Loop Gain R313

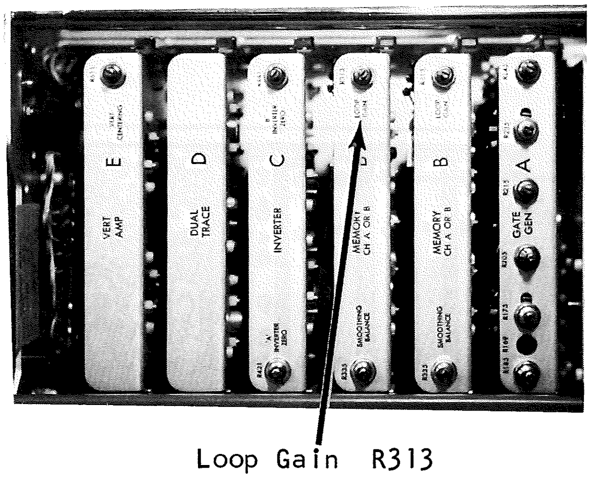
Figure 5-48

2. Remove the Response Normalizer and connect the CH A probe to the 111 signal.
3. Rotate the SMOOTHING control to align the false baseline with the real baseline (loop gain of 1). The SMOOTHING control must be able to adjust the loop gain to within 10% of Unity (1). (Position of false baseline must correspond to less than 10% of pulse amplitude).
4. Set the FAST RT-LOW NOISE control to FAST RT and rotate the SMOOTHING control to obtain a loop gain of 1.
5. Set the FAST RT-LOW NOISE control to LOW NOISE and the NORM/INV control to INV. Set the 111 output polarity to - .
6. Repeat steps 4 and 5. The SMOOTHING control must be able to adjust the loop gain to within 25% of Unity (1).
7. Set the 111's output polarity to + and the NORM-INV control to NORM.

C. CH B LOOP GAIN

1. Disconnect the CH A probe from the 111 and terminate it in 50Ω. Connect the CH B probe through a Response Normalizer to the 111 signal.
2. Set the MODE to B ONLY and the SMOOTHING control full CCW.

3. Adjust the Loop Gain, R313 - See Figure 5-49, for a loop gain of 1.



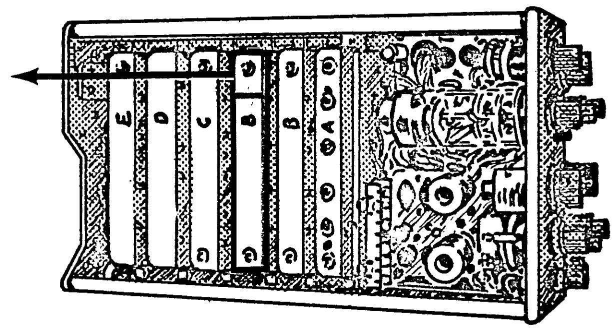


Figure 5-49

4. Remove the Response Normalizer and connect the CH B probe to the 111 signal.
5. Rotate the SMOOTHING control to obtain a loop gain of 1. The SMOOTHING control must be able to adjust the loop gain to within 10% of Unity.
6. Set the FAST RT-LOW NOISE control to FAST RT and rotate the SMOOTHING control to obtain a loop gain of 1.
7. Set the FAST RT-LOW NOISE control to LOW NOISE and the NORM-INV control to INV. Set the 111's output polarity to -.
8. Repeat steps 5 and 6. The SMOOTHING control must adjust the loop gain to within 25% of Unity.
9. Return the NORM-INV control to NORM and disconnect the CH B probe from the 111 signal. Terminate the CH B probe in 50Ω.

D. MEMORY SLASH

1. Set the MV/DIV to 10 and the FAST RT-LOW NOISE control to FAST RT.
2. Set the TIME/DIV to 10 nsec and the DOTS PER DIV to 10.
3. Set the 111 rep rate to 10 and check for less than 0.5 cm of memory slash.
4. Vary 111 rep rate from 50 pps to 100 kc and check for less than 1 cm of trace shift.

5. Set the MODE to A ONLY and the FAST RT-LOW NOISE control to FAST RT.
6. Repeat steps 3 and 4 for CH A.
7. Disconnect the 111 pretrigger signal.

Preset the front panel controls for the 3A2, 3B2, 6R1A combination as follows:

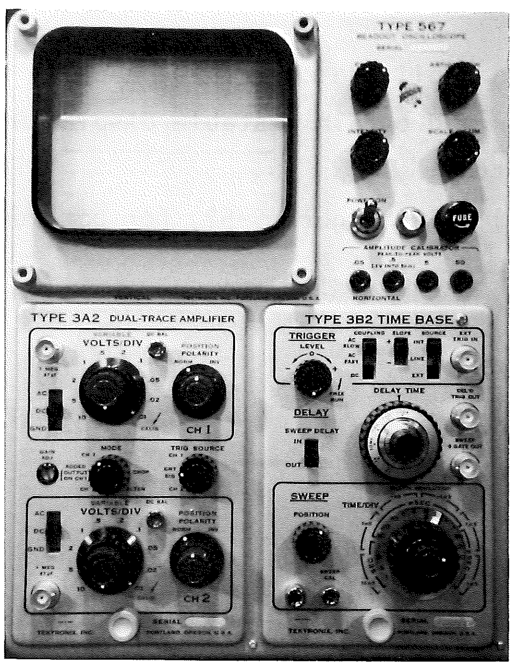
<u>3A2</u>

MODE	CH 1
TRIG SOURCE	CRT SIG
CH 1 and CH 2	
VOLTS/DIV	.01
VARIABLE	CALIB (in detent)
POLARITY	NORM
POSITION	midrange
INPUT COUPLING	DC

<u>3B2</u>

TRIGGER	
LEVEL	CW
COUPLING	AC SLOW
SLOPE	+
SOURCE	INT
SWEEP	
TIME/DIV	.5 msec
POSITION	midrange
DELAY	
SWEEP DELAY	OUT

The 6R1A is not used in this section. Figure 5-50 shows the proper set up.

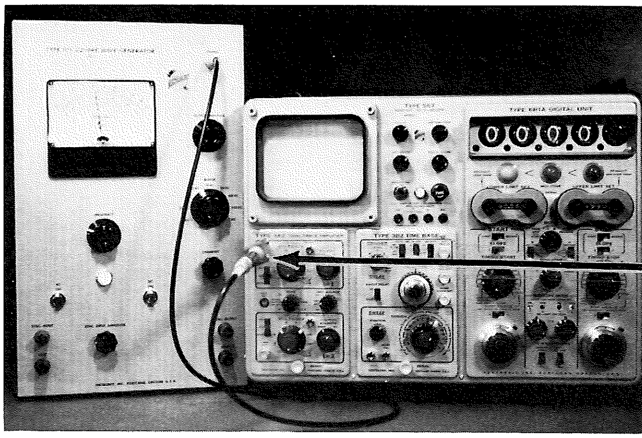


<u>Figure 5-50</u>

I. INPUT CAPACITANCE and VOLTS/DIV COMPENSATIONS

A. CH 1

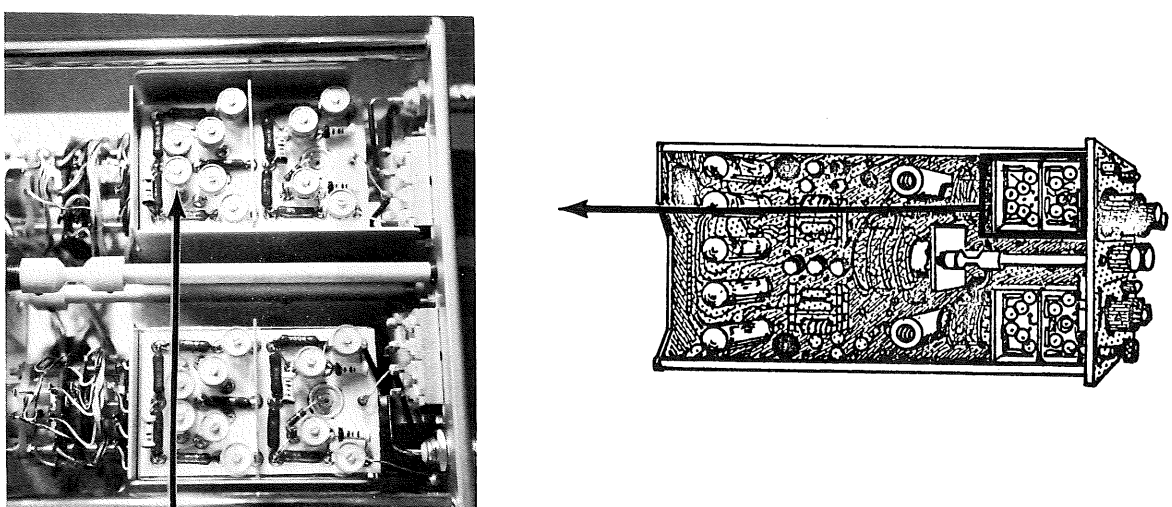
1. Apply power to a Type 105 and set the 105's output frequency to 1 kc.
2. Connect the output of the 105 to the CH 1 input connector through a 5X BNC attenuator and a 47 pf standardizer. See Figure 5-51.



47 pf standardizer
5X BNC attenuator

Figure 5-51

3. Adjust the amplitude control on the 105 for 4 cm of deflection and obtain a stable display with the TRIGGER LEVEL control.
4. Adjust C111, See Figure 5-52, for optimum flat-topped waveform.



C111

Figure 5-52

5. Set the VOLTS/DIV control to .02 and adjust C112, see Figure 5-53, for optimum flat-topped waveform. Readjust 105 for 4 cm of vertical deflection.

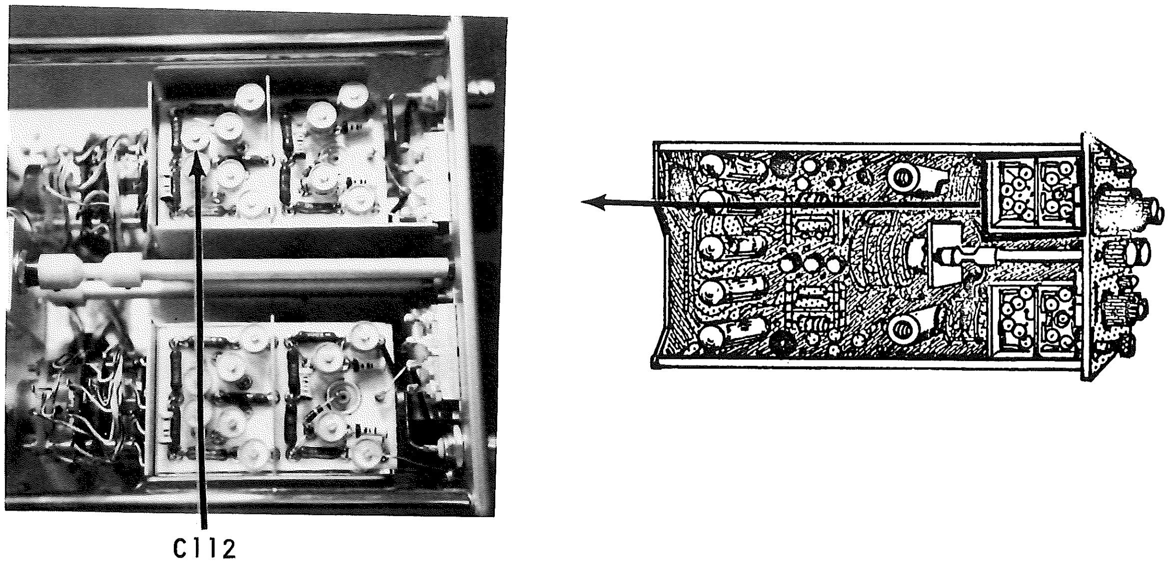


Figure 5-53

6. Adjust or check the other VOLTS/DIV settings for optimum flat-top and best front corner against the following chart.

VOLTS/DIV	FRONT CORNER	FLAT TOP	105 SIGNAL
.05	C103C	C103B	4 cm
.1	C105C	C105B	"
.2	C107C	C107B	"
.5	Check	Check	"
1**	Check	Check	"
2	C109C	C109B	"
5	Check	Check	"
10	Check	Check	"

**Remove the 5X BNC attenuator. See Figure 5-54.

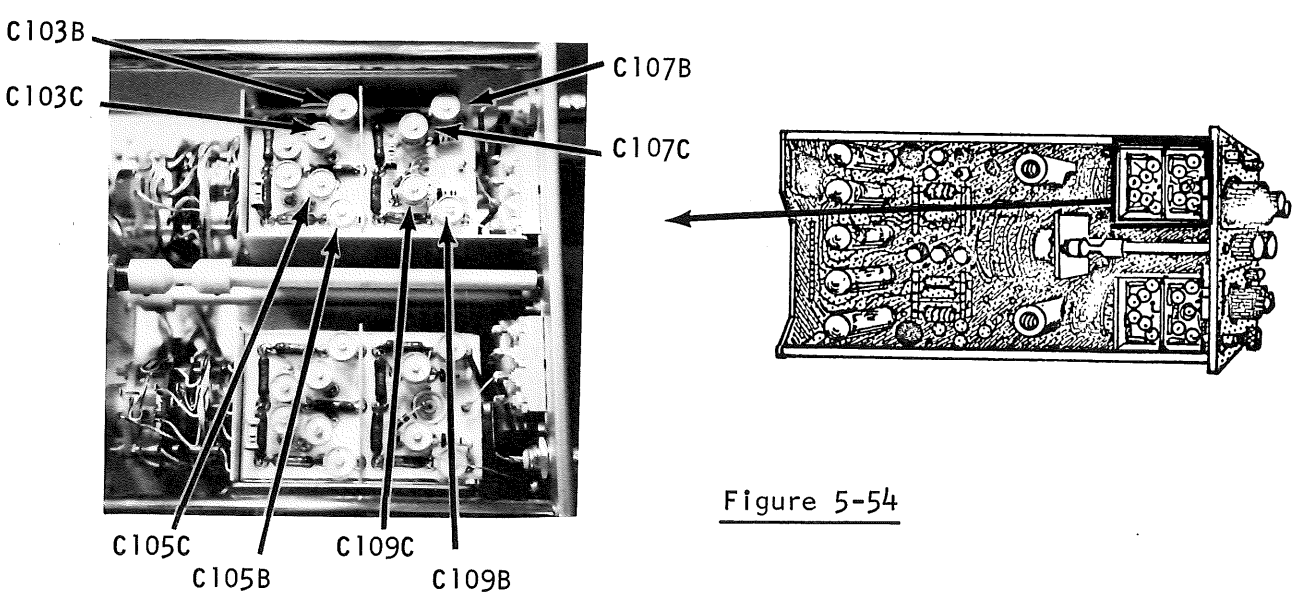
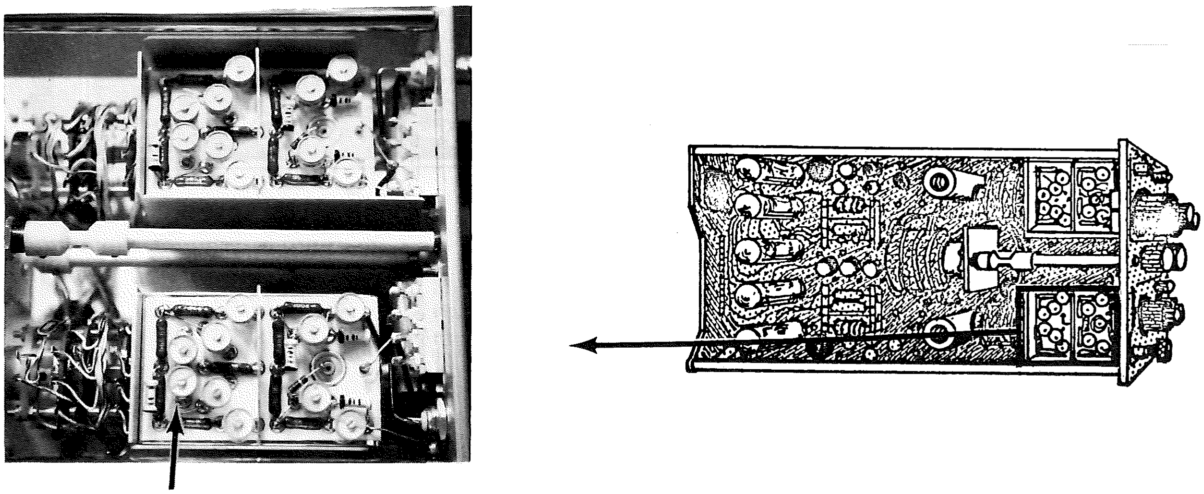


Figure 5-54

B. CH 2

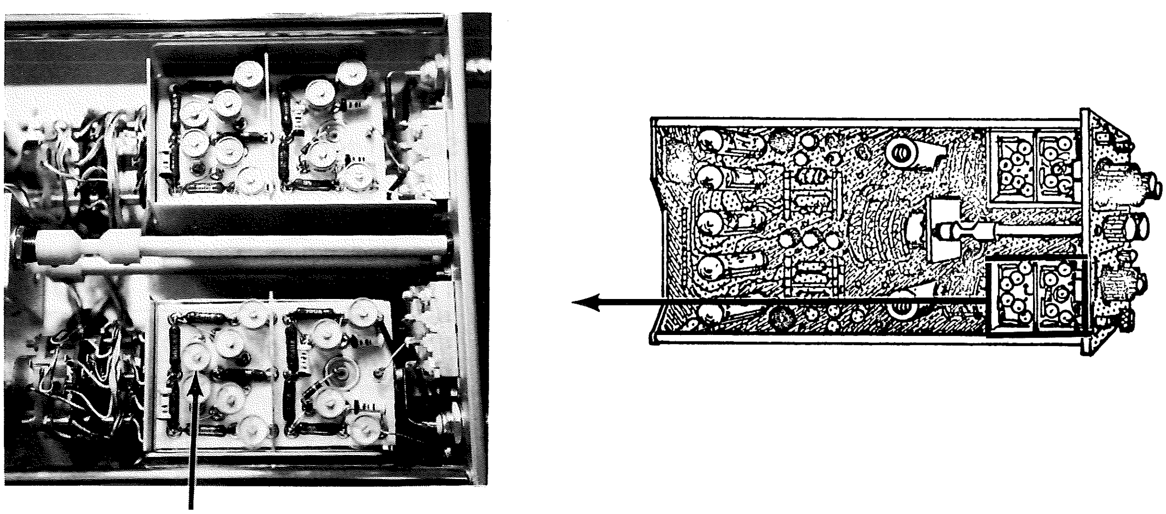
1. Connect the output of the 105 to the CH 2 input connector and set the MODE to CH 2. Insert the 5X BNC attenuator into the network.
2. Adjust the amplitude control on the 105 for 4 cm of deflection.
3. Adjust C211, See Figure 5-55, for optimum flat-topped waveform.



C211

Figure 5-55

4. Set the VOLTS/DIV control to .02 and adjust C212, see Figure 5-56, for optimum flat-topped waveform. Adjust 105 amplitude for 4 cm of deflection.



C212

Figure 5-56

5. Adjust or check the other VOLTS/DIV settings for optimum flat-top and best front corner against the following chart.

VOLTS/DIV	FRONT CORNER	FLAT TOP	105 SIGNAL
.05	C203C	C205B	4 cm
.1	C205C	C205B	"
.2	C207C	C207B	"
.5	Check	Check	"
1**	Check	Check	"
2	C209C	C209B	"
5	Check	Check	"
10	Check	Check	"

**Remove the 5X BNC attenuator. See Figure 5-57.

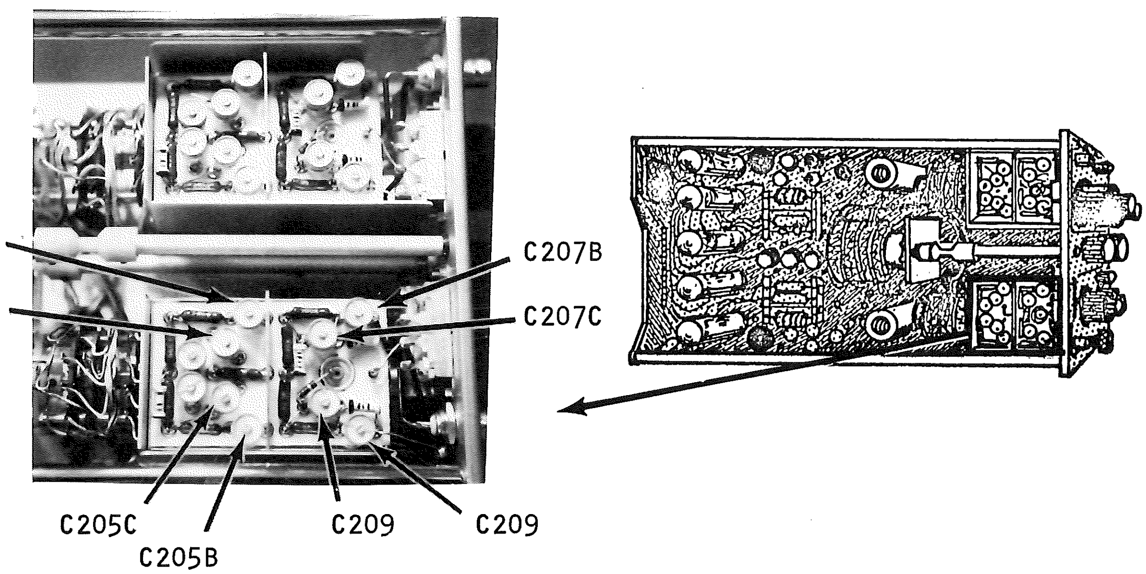


Figure 5-57

6. Remove the 105 signal, 50Ω terminator, and the 47 pf standardizer.

II. TRIGGER TAKE-OFF

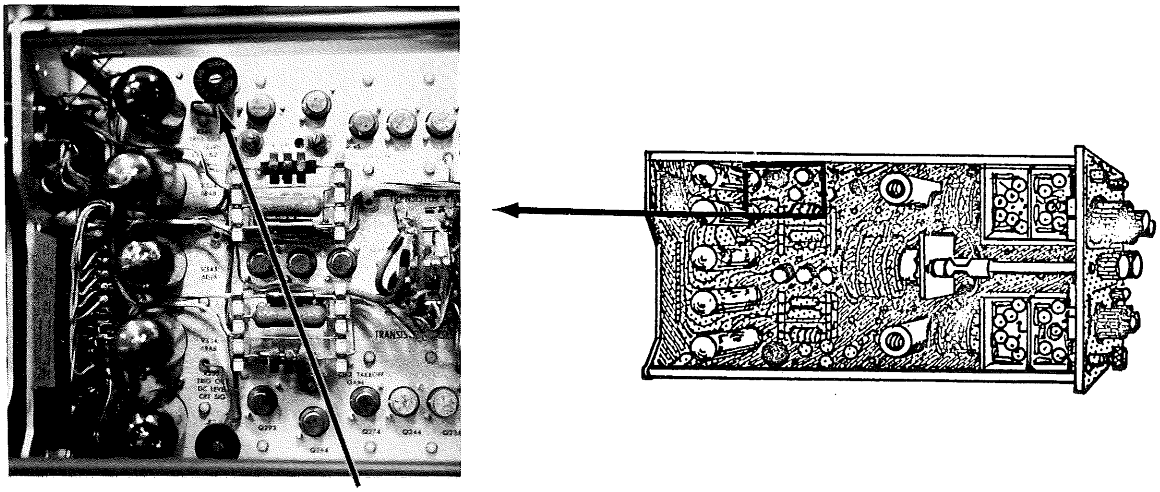
A. DC LEVEL

1. Set both VOLTS/DIV controls to .01 and both INPUT COUPLINGS to GND. On the 3B2, set the Trigger Level full CW (free running).

2. Position the CH 2 trace to graticule center and set the MODE to CH 1. Position the CH 1 trace to graticule center.

3. With a X10 probe from the test scope, monitor pin 11 of P11. Set the Trig Source to CH 1.

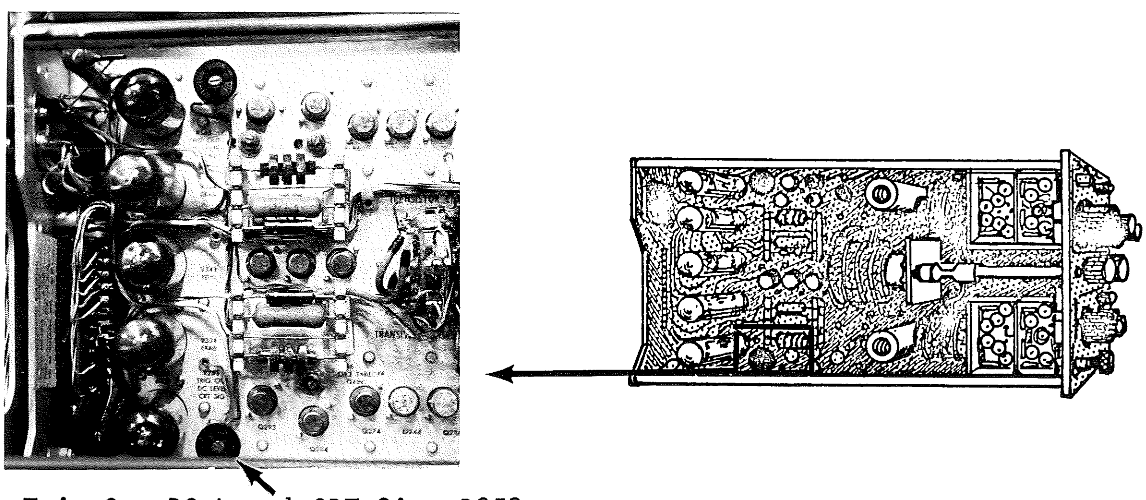
4. Adjust the Trig Out DC Level, R348 - See Figure 5-58, for 0 volts as read on the test scope.



Trig Out DC Level R348

Figure 5-58

5. Set the MODE and TRIG SOURCE to CH 2 and check for 0v ±2v.
6. Set the TRIG SOURCE to CRT SIG and adjust the TRIG OUT DC LEVEL CRT SIG, R353 - See Figure 5-59, for 0 volts as read on the test scope.



Trig Out DC Level CRT Sig R353

Figure 5-59

B OUTPUT

1. Set the MODE and TRIG SOURCE to CH 1. Apply a 10 kc signal from the 105 through a 5X BNC attenuator to the CH 1 input connector.
2. Set the INPUT COUPLING to AC and AC couple the input of the test scope.
3. Adjust the amplitude control on the 105 for 2 cm of deflection. Check for a 3v signal with less than 5% overshoot and a risetime less than 1.5 μsec on the test scope.
4. Change amplitude to 3 cm of deflection and check for at least 6v of undistorted signal on test scope.
5. Set the INPUT COUPLING to DC and change amplitude for 8 cm of deflection. Check for at least 9v of signal.
6. Set the MODE and TRIG SOURCE to CH 2 and set the INPUT COUPLING to AC. Connect the 105 signal to the CH 2 input connector and obtain 2 cm of deflection.
7. Repeat steps 3 through 5 for CH 2.
8. Set the INPUT COUPLING to AC and the TRIGGER SOURCE to CRT SIG. Obtain 2 cm of deflection.
9. Check for at least 6v of signal with less than 5% overshoot and a risetime of less than 1.4 μsec.
10. Change amplitude to 3 cm and check for at least 9v of signal on test scope. Disconnect probe.

III. SQUARE-WAVE RESPONSE

A. CH 2

1. Set the INPUT COUPLING to DC.
2. Obtain 4 cm of deflection.
3. Check each VOLTS/DIV setting from 100 cps to 10 kc for a flat-topped waveform. (Replace 5X attenuator with a 50Ω terminator at 2v/DIV.)

B. CH 1

1. Set the MODE to CH 1 and connect the 105 signal to CH 1.
2. Set the INPUT COUPLING to DC.
3. Check each VOLTS/DIV setting from 100 cps to 10 kc for a flat-topped waveform. (Replace the 5X attenuator with a 50Ω terminator at 2v/DIV.).

C. CROSSTALK

1. Set the CH 2 VOLTS/DIV control to .01 and the INPUT COUPLING to GND.
2. Remove the 50Ω terminator and set the amplitude for 6 cm of deflection. The CH 1 VOLTS/DIV control remains at 20. Set the 105 frequency to 100 kc.
3. Set the MODE to CH 2 and check for less than 1 mm of deflection.

IV. HIGH FREQUENCY RESPONSE

A. CH 1

1. Connect the output of 190 with piggyback to the CH 2 input connector. Set the INPUT COUPLING to DC, the MODE to CH 1, and the VOLTS/DIV to .01.
2. Set the output frequency to 1 kc and adjust for 4 cm of deflection.
3. Set the output frequency to 500 kc and check for at least 2.8 cm of deflection (30% down).

B. CH 2

1. Set the MODE to CH 2 and the INPUT COUPLING to DC. Connect the output of the 190 to the CH 2 input connector.
2. Set the 190 frequency to 1 kc and obtain 4 cm of deflection.
3. Set the frequency to 500 kc and check for at least 2.8 cm of deflection (30% down).

C. TAKE-OFF GAIN FREQUENCY RESPONSE

1. Set the TRIG SOURCE to CH 2 and monitor pin 3 of P12 with a X10 probe.
2. Set the 190's frequency to 1 kc and obtain 4 cm of deflection on the test scope. (Do not overdrive the 3A2).

3. Set the frequency to 500 kc and check for at least 2.8 cm on the test scope.
4. Set the MODE and TRIG SOURCE to CH 1 and apply the 190 signal to the CH 1 input connector.
5. Set the frequency to 1 kc and obtain 4 cm of deflection on the test scope. (Do not overdrive the 3A2).
6. Set the frequency to 500 kc and check for at least 2.8 cm of deflection on the test scope.
7. Disconnect the probe and the 190.

SECTION VI

In Section VI, the calibration of the time base units is completed. For the most part this section is a check of the trigger circuits.

OUTLINE OF ADJUSTMENTS

	Page No.
3T77	6-2
I. TRIGGER	6-3
II. MISCELLANEOUS	6-5
3B2	6-7
I. TRIGGER	6-8

EQUIPMENT REQUIRED:

3S76, 3T77, 6R1A combination

Type 111
GR Tee connector
5X GR Attenuator (017-045)
GR Oscillator Type 1209 (067-039)
GR Power Supply (067-040)
10X GR Attenuator (017-044)

3A2, 3B2, 6R1A combination

Type 190 with piggyback

Preset the front panel controls for the 3S76, 3T77, 6R1A combination as follows:

<u>3S76</u>

MODE	A ONLY
INTERNAL TRIGGER	A
CH A and CH B	
MV/DIV	5
VARIABLE	CALIB
NORM-INV	NORM

<u>3T77</u>

TIME/DIV	1 nsec
VARIABLE	CALIB
SWEEP MODE	NORMAL
HORIZ MAG	X1
DOTS PER DIV	100
DELAY	CCW
TRIGGER	
SENSITIVITY	CW
SELECTOR	INT +

The 6R1A is not used in this section. Figure 6-1 shows the proper set up.

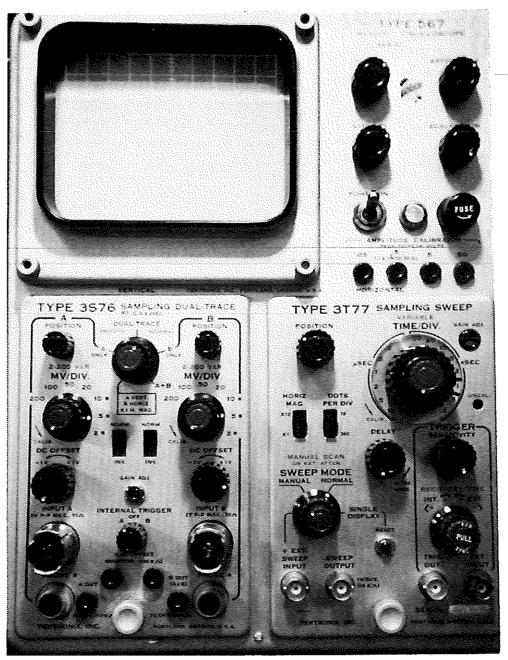


Figure 6-1

I. TRIGGER

A. TRIGGER SENSITIVITY and JITTER

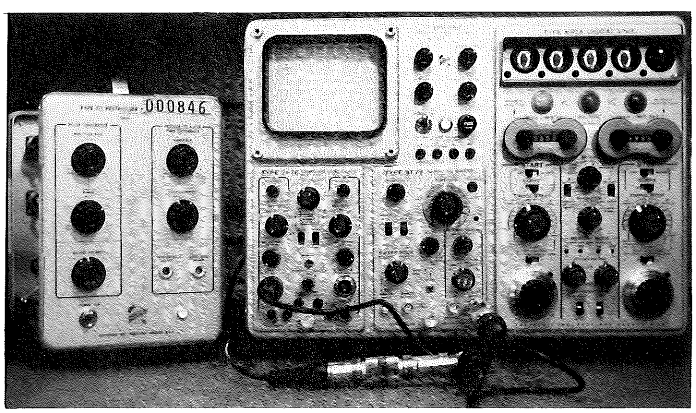
The trigger is specified as follows:

Internal + and - : Must trigger on 40 mv signal. Jitter less than 50 psec with 111 signal and jitter less than 300 psec with GR oscillator signal.

External + and - : Must trigger on 8 mv signal. Jitter less than 50 psec with 111 signal and jitter less than 300 psec with GR oscillator signal.

Display must be stable as 111 rep rate is varied from 10 cps to 100 kc.

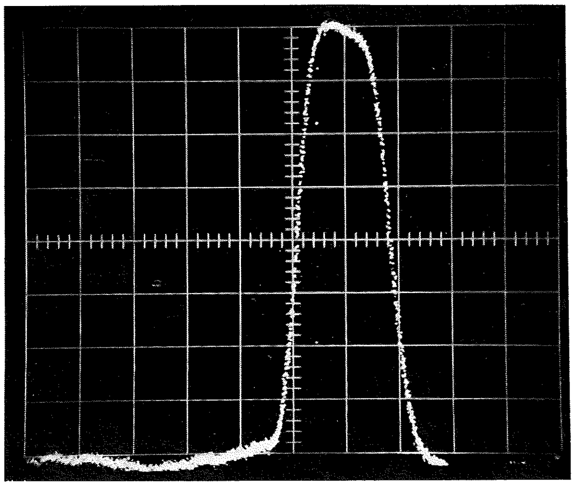
1. Apply power to a 111. Set the rep rate to 10 kc and the pulse width to 2 nsec (no charge line).
2. On the 3T77, connect the EXT INPUT (TRIGGER) to a GR Tee connector through a 5X GR attenuator. Connect the CH A input connector directly to the GR Tee connector. Connect the output of the 111 to the GR Tee connector through a 50Ω terminator. Select attenuators to provide a 40 mv input to the 3S76. See Figure 6-2.



The amount of attenuation needed will vary from one 111 to the next.

Figure 6-2

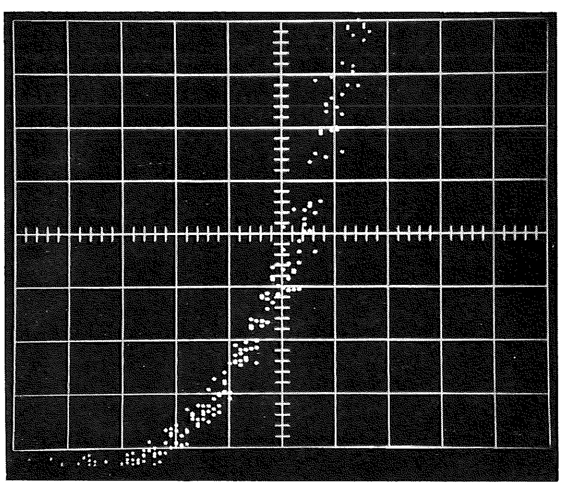
3. With the TRIGGER SENSITIVITY and DELAY CONTROLS, obtain a stable display with the fast rise portion of the display set to graticule center. See Figure 6-3.



It may not be possible to get exactly 40 mv. Signal should be at least 30 mv (6 cm). Home made variable attenuators are legal here.

Figure 6-3

4. Set the MV/DIV control to 2 and position the 50% point to graticule center.
5. Set the HORIZ MAG to X10 and check for less than .5 cm of trace width at the 50% point. See Figure 6-4.



This display may be a bit hard to see if a lower rep rate pulse generator is used.

Figure 6-4

6. Set the TRIGGER SELECTOR to INT - and the output polarity on the 111 to -. Reposition the 50% point to graticule center. Check for a trace width less than .5 cm.
7. Set the TRIGGER SELECTOR to EXT - and repeat Step 6.
8. Set the TRIGGER SELECTOR to EXT + and the output polarity to + and check for a trace width less than .5 cm at the 50% point.
9. Set the MV/DIV control to 5 and Horiz Mag to X1. Vary 111 rep rate from 10 pps to 100 kc and check for a stable display.
10. Disconnect the 111 signal and set the TRIGGER SELECTOR to INT +.
11. Apply power to a Type 1209B GR oscillator and connect its output to the CH A input connector. Set the output frequency to 325 mc and select attenuators to obtain a 40 mv signal.
12. With the TRIGGER SENSITIVITY and/or PULL FOR SYNC controls, obtain a triggered or synced display.
13. Set the MV/DIV control to 200 and obtain 8 cm of display (1.6v).
14. Set the HORIZ MAG to X10 and check for less than 300 psec of jitter.
15. Disconnect the GR oscillator.

B. TRIGGER TAKE-OFF TERMINATIONS

1. Set the HORIZ MAG to X1 and the TRIGGER SELECTOR to EXT +.
2. Connect the output of a 111 to a GR Tee connector through a 10X GR attenuator. Connect the CH A input connector to one side of the GR Tee and the EXT INPUT (TRIGGER) to the other side.
3. Obtain a stable display.
4. Set the INTERNAL TRIGGER to A, OFF, and B. The display must not change.

II. MISCELLANEOUS

A. DOTS PER DIV VS. REP RATE

1. Connect the output of the 111 to the EXT INPUT through two (2) 10X attenuators.
2. Adjust the TRIGGER SENSITIVITY so the display is triggered. (If the signal is removed from the trigger, the display must disappear).

3. Set the DOTS PER DIV to 10 and the HORIZ MAG to X10. Vary the 111 rep rate from 10 cps to 100 kc. Check for less than 2% change in the number of dots per div.

B. MANUAL SCAN and SINGLE SWEEP

1. Set the DOTS PER DIV to 100 and the HORIZ MAG to X1. Set the TRIGGER SELECTOR to INT +.
2. Connect the output of a 111 to the CH A input connector through a 10X attenuator. Connect a 5 nsec charge line to the 111.
3. Set the TIME/DIV to 5 nsec and obtain a stable display.
4. Set the SWEEP MODE to MANUAL and rotate MANUAL SCAN (EXT. ATTEN). Check for proper operation.
5. Set SWEEP MODE to SINGLE DISPLAY. A single display must be obtained each time the reset button is pushed.
6. Set the SWEEP MODE to NORMAL and disconnect the 111 signal.

Preset the front panel controls for the 3A2, 3B2, 6R1A combination as follows:

<u>3A2</u>

MODE	CH 1
TRIG SOURCE	CRT SIG
CH 1	
VOLTS/DIV	.01
VARIABLE	CALIB
INPUT COUPLING	DC
POLARITY	NORM

<u>3B2</u>

TIME/DIV	.5 msec
SWEEP DELAY	OUT

The 6R1A is not used in this section. Figure 6-5 shows the proper set up.

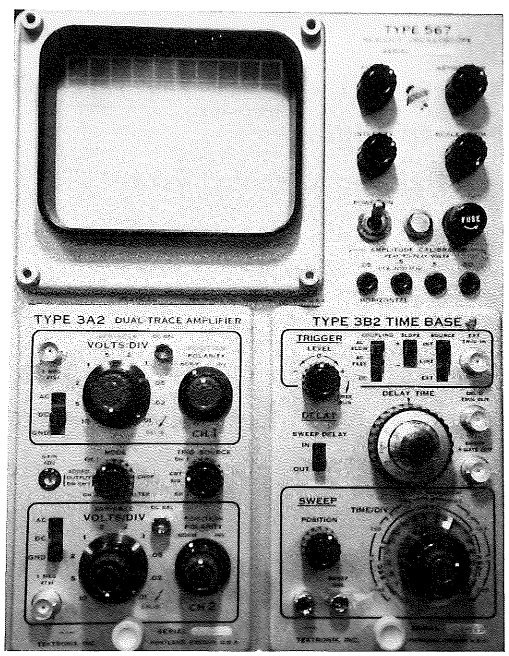


Figure 6-5

I. TRIGGER

A. INTERNAL TRIGGER

1. Set the 3B2 TRIGGER controls as follows: COUPLING to SLOW; SLOPE to +; SOURCE to INT; and the LEVEL to approximately 0.
2. Apply 5 mv from the 567 calibrator or the Standard Amplitude Calibrator to the CH 1 input connector.
3. Adjust the TRIGGER LEVEL for a stable display.
4. While switching the SLOPE between + and -, a stable display must be obtained without an adjustment of the TRIGGER LEVEL control.
5. Repeat Step 4 with the COUPLING set to AC FAST and to DC.
6. Apply 2 mv from the calibrator. Check for proper triggering with an adjustment of the LEVEL control in AC SLOW, AC FAST, and DC while the SLOPE control is switched.

B. LINE

1. Remove the cal signal and set the INPUT COUPLING to GND. Set the SOURCE to LINE.
2. Check for a triggered display (straight line) without an adjustment of the LEVEL control as the SLOPE is switched in AC SLOW, AC FAST, and DC.

C. EXTERNAL

1. Connect the cal signal to the EXT TRIG IN jack.
2. Set the CALIBRATOR for 1 volt and the SOURCE to EXT.
3. Adjust the TRIGGER LEVEL control for a stable display.
4. Check for a triggered display without an adjustment of the LEVEL control while the SLOPE is switched in AC FAST, AC SLOW, and DC.
5. Set the CALIBRATOR to .5v.
6. Check for a triggered display with an adjustment of the LEVEL control while the SLOPE is switched in the AC SLOW, AC FAST, and DC.

D. HIGH FREQUENCY TRIGGERING

1. Set the 3B2 TRIGGER controls as follows: COUPLING to AC SLOW; SLOPE to +; and SOURCE to INT.

2. Disconnect the cal signal and apply 200 kc from a 190 with piggyback.
3. Set the INPUT COUPLING to DC and obtain 5 mm of vertical deflection.
4. With the LEVEL control, obtain a stable display in AC SLOW, AC FAST, and DC.
5. Set the 190 frequency to 500 kc and obtain 1 cm of vertical deflection.
6. Repeat Step 4.
7. Disconnect the 190 signal.

SECTION VII

Section VII finishes the calibration of the 6R1A. There are no adjustments in this section. All the checks in this section can be made from the front panel.

OUTLINE OF ADJUSTMENTS

		Page No.
I.	A TIME READOUT	7-4
II.	B TIME READOUT	7-5
III.	START TO STOP INTENSIFIED ZONE and MANUAL OPERATION	7-6
IV.	NIXIE TUBES	7-10
V.	GO, NO-GO INDICATORS	7-11

<u>EQUIPMENT REQUIRED</u>:

Type 180A or equivalent
5X GR Attenuator (017-045)
5X BNC Attenuator (017-060)
GR to BNC Jack Adaptor (017-024)

Preset the front panel controls for the 3S76, 3T77, 6R1A combination as follows:

<u>3S76</u>

MODE	A ONLY
SMOOTH-NORMAL	NORMAL
INTERNAL TRIGGER	A
CH A and CH B	
MV/DIV	200
NORM-INV	NORM

<u>3T77</u>

TIME/DIV	20 nsec
VARIABLE	CALIB
SWEEP MODE	NORMAL
HORIZ MAG	X1
DOTS PER DIV	100
TRIGGER SELECTOR	INT +

Figure 7-1 shows the proper set up.

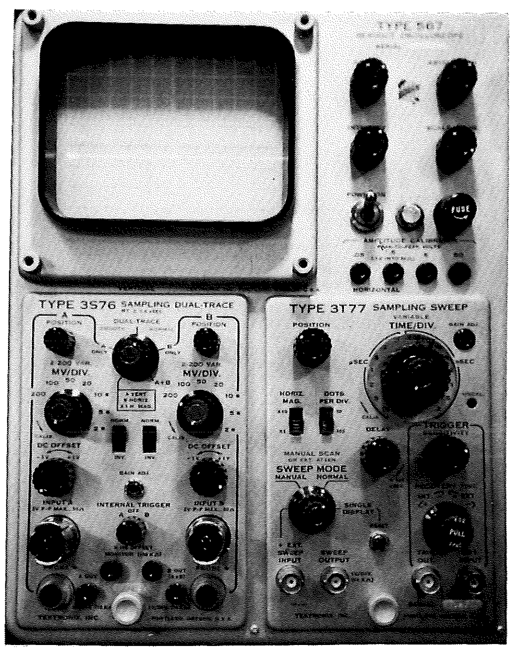
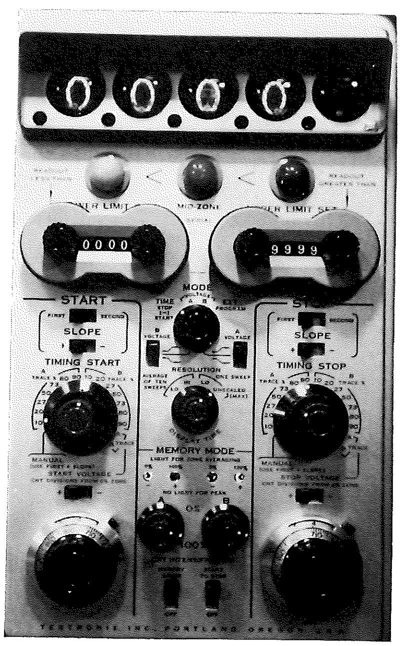


Figure 7-1

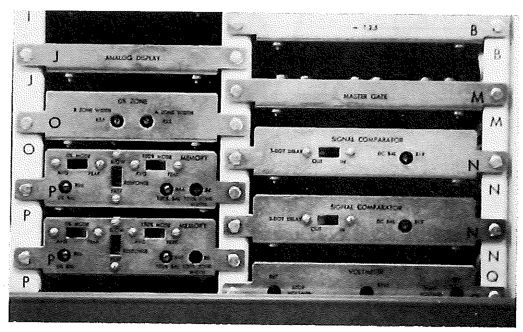
6R1A

MODE	TIME STOP (-) START
RESOLUTION	ONE SWEEP UNSCALED
CRT INTENSIFICATION	
MEMORY ZONES	UP
START TO STOP	UP
START	
SLOPE	FIRST +
TIMING START	A TRACE 10%
STOP	
SLOPE	FIRST +
TIMING STOP	A TRACE 90%
INTERNAL CONTROLS	
A and B MEMORY	
0% and 100% MODE	AVG
RESPONSE	SLOW
START and STOP COMPARATOR	
3-DOT DELAY	IN

Figure 7-2 A and B shows the proper set up.



(A)



(B)

Figure 7-2

I. A TIME READOUT

A. RISETIME READOUT

1. Connect the output of a Type 180A to the CH A input connector through a 5X GR attenuator and a Male BNC to GR adaptor.
2. Set the 180 output to 10 mc and obtain a stable display with the TRIGGER SENSITIVITY, RECOVERY TIME, and PULL FOR SYNC controls.
3. Adjust the CH A VARIABLE MV/DIV control for 8 cm of deflection. (Some 180A's may require more attenuation to obtain an 8 cm display).
4. Adjust the DELAY control so the dead zone is at the bottom of the display. Position the 0% zone to the bottom of the display and the 100% zone to the top of the display. Adjust the appropriate Zone Width adjustments so the zones are quite narrow. See Figure 7-3.

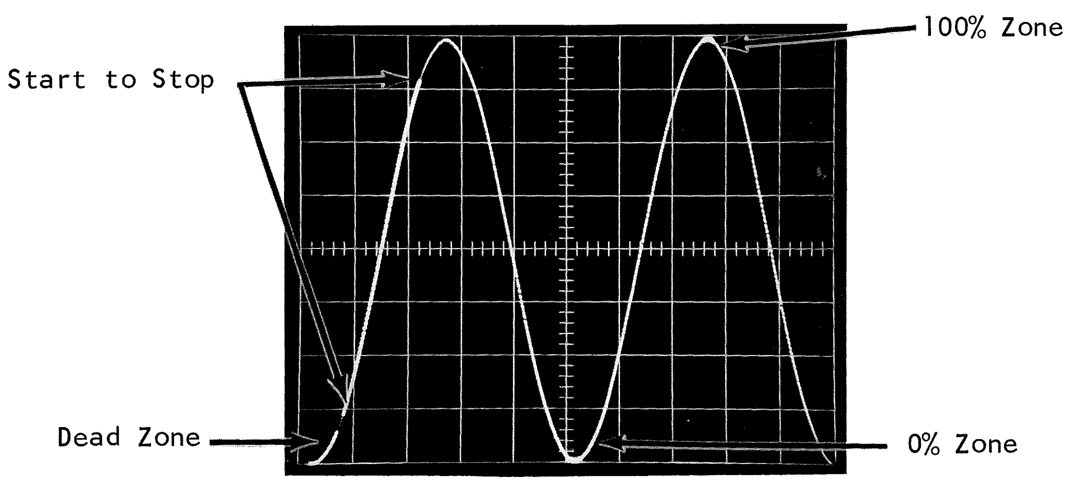


Figure 7-3

5. Check the NIXIE tubes for a readout of 145 ±3 counts.

B. A NORM + SLOPE READOUT

1. Set the STOP to SECOND SLOPE + and the TIMING STOP to A TRACE 10%.
2. Check the NIXIE tubes for a readout of 500 ±7 counts.
3. Check the remaining A TRACE position on the TIMING START and STOP controls against the following chart.

TIMING START	TIMING STOP	READOUT
20%	20%	500 ± 7 counts
27%	27%	"
50%	50%	"
73%	73%	"
80%	80%	"
90%	90%	"

C. A INVERTED - SLOPE READOUT

1. On the 3S76, set the CH A NORM-INV control to INV. With the POSITION control, recenter the display on the graticule.
2. Set the START to FIRST SLOPE - and the STOP to SECOND SLOPE -
3. Check the A TRACE TIMING START and STOP controls against the following chart.

TIMING START	TIMING STOP	READOUT
90%	90%	500 ± 7 counts
80%	80%	"
73%	73%	"
50%	50%	"
27%	27%	"
20%	20%	"
10%	10%	"

II. B TIME READOUT

A. RISETIME READOUT

1. Connect the 180A signal to the CH B input connector. Set the MODE to B ONLY and the INTERNAL TRIGGER to B. With the CH B VARIABLE MV/DIV control, obtain 8 cm of deflection.
2. Set the START and STOP to FIRST SLOPE +. Set the TIMING START to B TRACE 10% and the TIMING STOP to B TRACE 90%. With the DELAY control set so the dead zone is at the bottom of the display, position the 0% zone to the bottom of the display and the 100% zone to the top. Adjust the appropriate Zone Width adjustments so the zones are quite narrow.

3. Check the NIXIE tubes for a readout of 145 ±3 counts.

B. B NORM + SLOPE READOUT

1. Set the STOP to SECOND SLOPE + and the TIMING STOP to B TRACE 10%.
2. Check the NIXIE tubes for a readout of 500 ±7 counts.
3. Check the remaining B TRACE positions on the TIMING START and STOP controls against the following chart.

TIMING START	TIMING STOP	READOUT
20%	20%	500 ± 7 counts
27%	27%	"
50%	50%	"
73%	73%	"
80%	80%	"
90%	90%	"

C. B INVERTED - SLOPE READOUT

1. On the 3S76, set the CH B NORM-INV control to INV. With the POSITION control, recenter the display on the graticule.
2. Set the START to FIRST SLOPE - and the STOP to SECOND SLOPE -.
3. Check the B TRACE TIMING START and STOP controls against the following chart.

TIMING START	TIMING STOP	READOUT
90%	90%	500 ± 7 counts
80%	80%	"
73%	73%	"
50%	50%	"
27%	27%	"
20%	20%	"
10%	10%	"

III. START TO STOP INTENSIFIED ZONE and MANUAL OPERATION

A. START TO STOP INTENSIFIED ZONE

1. On the 3S76, set the CH B NORM-INV control to NORM and with the POSITION control, recenter the display on the graticule.
2. Set the START and STOP to FIRST + SLOPE and set the TIMING STOP to B TRACE 90%.

3. Set the START and STOP to SECOND + SLOPE and check for proper CRT display. See Figure 7-4.

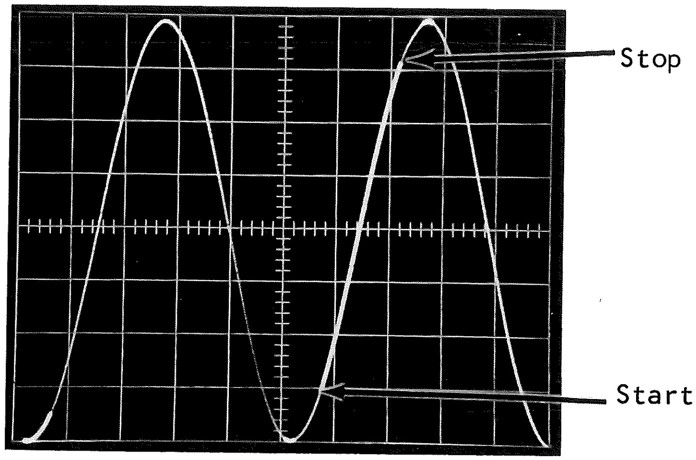


Figure 7-4

4. Set START to FIRST + SLOPE and check for proper display. See Figure 7-5.

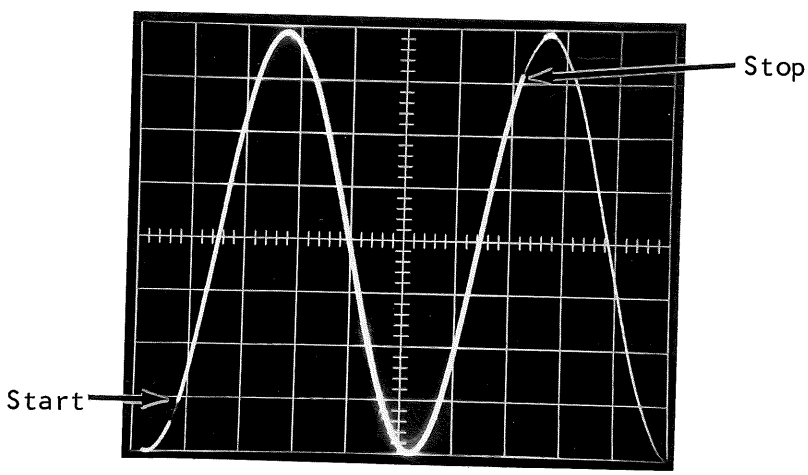


Figure 7-5

5. Set START to FIRST - SLOPE and check for proper display. See Figure 7-6.

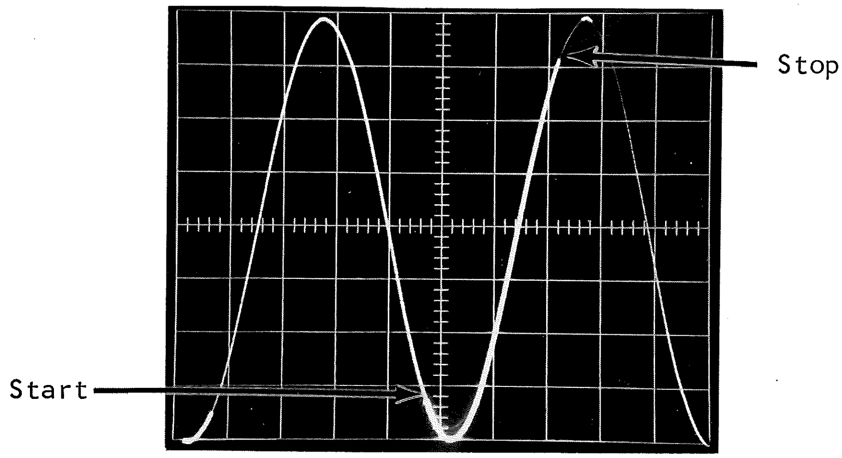


Figure 7-6

6. Set STOP to SECOND - SLOPE and check for proper display. See Figure 7-7.

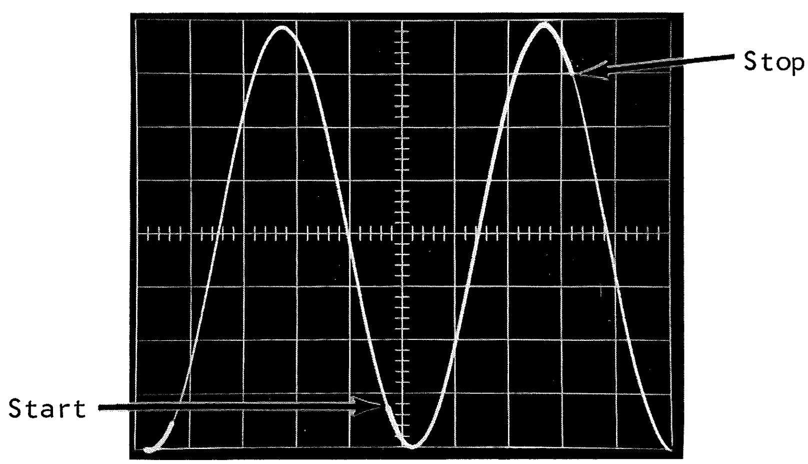


Figure 7-7

7. Remove the 180A signal from the 3S76.

B. MANUAL OPERATION

1. Set the TRIGGER SENSITIVITY full CW.
2. Set the START and STOP to FIRST + SLOPE and the TIMING START and STOP to MANUAL.
3. Adjust the START MANUAL control so the Start to Stop zone starts 1 cm to the left of the first graticule line. See Figure 7-8.

Manual START adjusted so the beginning of the start to stop zone is 1 cm from the first graticule line.

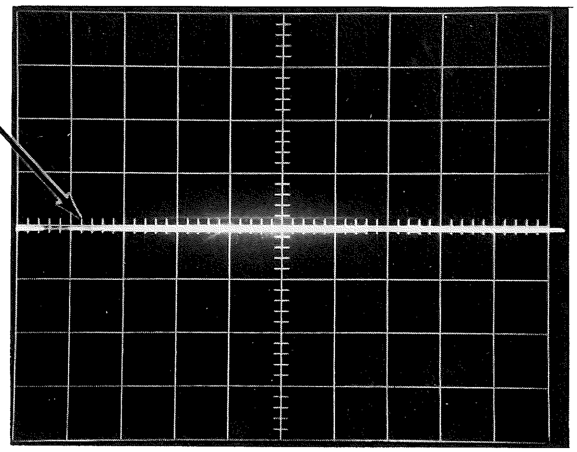


Figure 7-8

4. Check the STOP MANUAL control is capable of moving the end of the start to stop zone within 2 mm of the beginning of the intensified zone and to within 2 mm of the last graticule line.
5. Set the STOP MANUAL control so the intensified zone is within 2 mm of the last graticule line.
6. Check that the START MANUAL control is capable of moving the beginning of the intensified zone to within 2 mm of the end of the intensified zone (within 4 mm of the last graticule line).

C. ÷ 1, 2, 5 Check

1. Set the TIME/DIV to 10 nsec and adjust the START and STOP MANUAL controls for a digital reading of 030.0. (This takes a little patience, but it is well worth the effort).
2. Set the TIME/DIV control to 20 nsec and check for a readout of 0.060.
3. Set TIME/DIV to 50 nsec and check for a readout of 0.150.

IV. NIXIE TUBES

A. UNITS

1. Connect the output of the 180A to the EXT INPUT (TRIGGER) on the 3T77. Set the TRIGGER SELECTOR to EXT. +.
2. Set the START MANUAL control so the beginning of the intensified zone is just to the right of the dead zone. Set the STOP MANUAL control so the end of the intensified zone is within 2 mm of the last graticule line.
3. Set the RESOLUTION to ONE SWEEP LO.
4. Apply 100 msec markers from the 180A and with the TRIGGER SENSITIVITY control, obtain a triggered display. (The trace will slowly hop across the screen).
5. Check that the units NIXIE is counting in sequence from 0 to 9.

B. TENS

1. Set the 180A output to 50 msec markers.
2. Check that the tens NIXIE is counting in sequence from 0 to 9.

C. HUNDREDS

1. Set the 180A output to 5 msec markers and the TIME/DIV to .1 μsec.
2. Check that the hundreds NIXIE is counting in sequence from 0 to 9.

D. THOUSANDS

1. Set the 180A output to 500 μsec markers and set the RESOLUTION to AVERAGE OF TEN SWEEPS HI.
2. Check that the thousands NIXIE is counting in sequence from 0 to 9.

V. GO, NO-GO INDICATORS

A. INDICATOR LIGHTS

1. Remove the 180A signal and set the TRIGGER SENSITIVITY full CW.
2. Set the DISPLAY TIME full CCW.
3. By positioning the MANUAL STOP control CCW, select a readout that does not contrain a 0 or 9. When this readout is obtained, set the TRIGGER SENSITIVITY full CCW.
   a. Readout now will not change until sweep starts to run.
   b. Example readout: 6718
4. The MID-ZONE (GREEN) LIGHT must be on.
5. Set the LOWER LIMIT SET thousands number 1 digit higher than the number on the thousands NIXIE.

   EXAMPLE: If readout is 6718; then set LOWER LIMIT to 7000.

   a. MID-ZONE light must go out and READOUT LESS THAN (YELLOW) light must come on.
6. Set the LOWER LIMIT SET thousands number to same digit that is displayed on the thousands NIXIE.

   EXAMPLE: If readout is 6718; then set LOWER LIMIT to 6000.

   a. READOUT LESS THAN light must go out and MID-ZONE light must come on.
7. Repeat sequence outlined in steps 5 and 6 for hundreds, tens, and units of the LOWER LIMIT SET.
8. Set LOWER LIMIT SET to same digits as displayed on NIXIE tubes. MID-ZONE light must come on.
9. Set UPPER LIMIT SET to same digits as displayed on NIXIE tubes. MID-ZONE light must remain on.
10. Set UPPER LIMIT SET to read one digit lower than number displayed on NIXIE tubes.

    EXAMPLE: If readout is 6718; then set UPPER LIMIT SET to 6717.

    a. READOUT GREATER THAN (RED) light must come on.
11. Set LOWER LIMIT SET to read one digit higher than number displayed on NIXIE tubes.

EXAMPLE: If readout is 6718; then set LOWER LIMIT SET to 6719.

a. READOUT LESS THAN light must come on.

12. Set LOWER LIMIT SET to 0000 and UPPER LIMIT SET to 9999. MID-ZONE light must come on.

13. Set the UPPER LIMIT SET thousands number 1 digit lower than the number on the thousands NIXIE.

EXAMPLE: If readout is 6718; then set UPPER LIMIT to 5999.

a. MID-ZONE light must go out and READOUT GREATER THAN light must come on.

14. Set the UPPER LIMIT SET thousands number to same digit that is displayed on the thousands NIXIE.

EXAMPLE: If readout is 6718; then set UPPER LIMIT to 6999.

a. READOUT GREATER THAN light must go out and MID-ZONE light must come on.

15. Repeat the sequence outlined in steps 13 and 14 for the hundreds, tens, and units of the UPPER LIMIT SET.

16. Set UPPER LIMIT SET to 9999.

The End