INSTRUCTION MANUAL

Serial Number 012152

Shop Copy

TYPE 585A OSCILLOSCOPE

Tektronix, Inc.
S.W. Millikan Way ● P. O. Box 500 ● Beaverton, Oregon 97005 ● Phone 644-0161 ● Cables: Tektronix

070-0391-01

966

WARRANTY

All Tektronix instruments are warranted against defective materials and workmanship for one year. Tektronix transformers, manufactured in our own plant, are warranted for the life of the instrument.

Any questions with respect to the warranty mentioned above should be taken up with your Tektronix Field Engineer.

Tektronix repair and replacement-part service is geared directly to the field, therefore all requests for repairs and replacement parts should be directed to the Tektronix Field Office or representative in your area. This procedure will assure you the fastest possible service. Please include the instrument Type and Serial or Model Number with all requests for parts or service.

Specifications and price change privileges reserved.

CONTENTS

Section 1	Characteristics
Section 2	Operating Instructions
Section 3	Circuit Description
Section 4	Maintenance
Section 5	Performance Check
Section 6	Calibration
	Abbreviations and Symbols
	Parts Ordering Information
Section 7	Electrical Parts List
	Mechanical Parts List Information
Section 8	Mechanical Parts List
Section 9	Diagrams
	Mechanical Parts List Illustrations
	Accessories

Abbrevations and symbols used in this manual are based on or taken directly from IEEE Standard 260 "Standard Symbols for Units", MIL-STD-12B and other standards of the electronics industry. Change information, if any, is located at the rear of this manual.

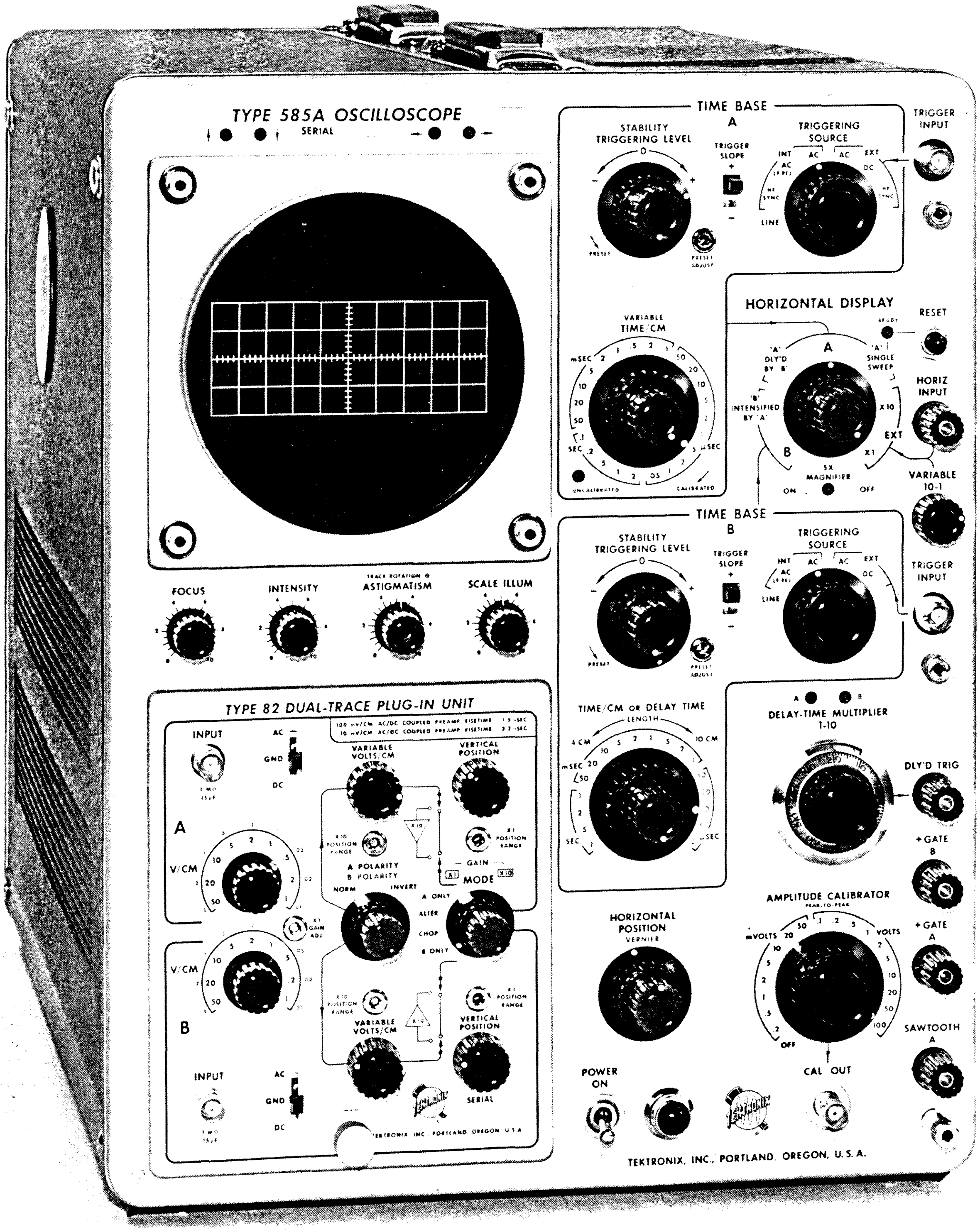


Fig. 1-1. Type 585A Oscilloscope.

SECTION 1
CHARACTERISTICS

Introduction

The Type 585A Oscilloscope is a laboratory instrument designed to operate with the 80 series Plug-In Units. The Type 81 or Type 81A Adapter equips the oscilloscope to accept any Tektronix Letter or 1 Series Plug-In Units.

The instrument will perform to specifications in a laboratory environment with an ambient temperature range between 0° C and 50° C except as indicated. Warm-up time for rated accuracies at +25° C ±5° C is 20 minutes. Adequate ventilation must be maintained and a minimum of two inches clearance around the instrument is recommended.

VERTICAL DEFLECTION SYSTEM

Characteristics	Performance Requirement	Supplemental Information
Frequency Response (Bandwidth)	DC to ≥80 MHz (at —3 dB point) displays at 100 mV/cm.	Equivalent to a risetime of 4.4 ns. Oscilloscope used with the Type 82 or 86 Plug-In Unit.
	DC to ≥75 MHz (at —3 dB point) displays at 10 mV/cm.	Equivalent to a risetime of 4.7 ns. Oscilloscope used with the Type 82 or 86 Plug-In Unit.
Deflection Factor	0.1 V/cm	

HORIZONTAL DEFLECTION SYSTEM

Sweep Rates		
Time Base A	Accuracy within ±3% of the indicated rate for all calibrated front panel positions.	Sweep range from .05 μs/cm to 2 s/cm in 24 calibrated steps.
Variable Range		An uncalibrated control (VARIABLE) provides continuously variable sweep rates from .05 μs/cm to approximately 5 s/cm.
Time Base B	Accuracy within ±3% of the indicated rate.	Sweep range from 2 μs/cm to 1 s/cm in 24 calibrated steps with 1-2-5 sequence.
Length		A front panel control which will vary the sweep length from about 4 cm to 10 cm.
5× Magnifier	Accuracy is within ±2% of the sweep rate accuracy.	Expands the center 2 cm portion of the normal display to 10 cm.

TRIGGERING

Time Base A		
Source		Line; Internal (from trigger pickoff circuit in the vertical amplifier); and External.
Coupling		Internal—AC, AC Low Frequency Reject and High Freq Sync External—AC, DC and High Freq Sync.
Slope		Trigger on positive or negative going slope of the trigger signal.
Level		Adjusts to permit triggering at any selected level on either the rising or falling portion of the waveform and up to ±10 V (external) in amplitude.
Time Base B		
Source		Line; Internal; External.
Coupling		Internal—AC and AC Low Frequency Reject. External—AC and DC.
Slope and Level		Same as Time Base A except triggering level range is up to ±7.5 V (external) in amplitude.

Minimum Triggering Requirements
See Fig. 1-2

	INTERNAL			EXTERNAL	
FREQUENCY	AC	AC LF REJ	HF SYNC	AC/DC	HF SYNC
15 Hz to 15 kHz	4 mm	—	—	0.3 V	—
15 kHz to 5 MHz	4 mm	4 mm	—	0.3 V	—
5 MHz to 10 MHz	4 mm	4 mm	4 mm	0.3 V	0.2 V P to P
10 MHz to 50 MHz	1 cm	1 cm	4 mm	0.5 V	0.2 V P to P
50 MHz to 100 MHz	2 cm	2 cm	4 mm	1.5 V	0.2 V P to P
100 MHz to 150 MHz	3 cm	3 cm	4 mm	2.0 V	0.2 V P to P
150 MHz to 250 MHz	—	—	4 mm	—	0.2 V P to P

TRIGGER REQUIREMENTS
for Time Base B

	INTERNAL		EXTERNAL
FREQUENCY	AC	AC LF REJ	AC/DC
15 Hz to 15 kHz	4 mm	—	0.5 V P to P
15 kHz to 1 MHz	4 mm	4 mm	0.5 V P to P
1 MHz to 5 MHz	2 cm	2 cm	1.5 V P to P

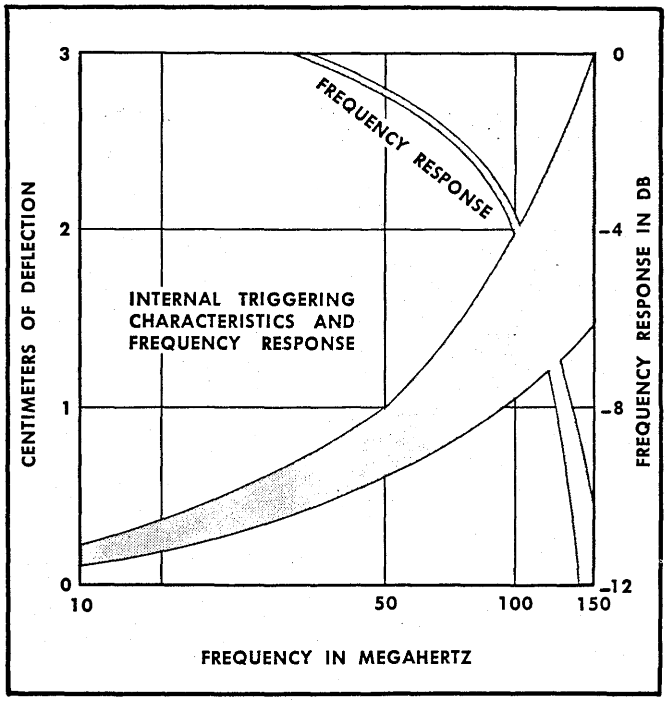


Fig. 1-2. Triggering Characteristics of the 585A.

VARIABLE TIME DELAY

Characteristic	Performance Requirement	Supplemental Information
Delay Time	Accuracy is within ±1% of Time Base B sweep rate accuracy.	Sweep delay continuously variable from 1 μs to 10 s.
Multiplier Incremental Linearity		Incremental delay accuracy is within 0.2% of total range.

EXTERNAL HORIZONTAL AMPLIFIER

Frequency Response	DC to 350 kHz or more, at maximum gain (at —3 dB point).	
Input Characteristics		Approximately 1 MΩ paralleled by 47 pF.
Deflection Factor		
×1	0.2 V/cm maximum (VARIABLE 1-10 control fully clockwise)	VARIABLE 1-10 control provides variable attenuation of the input signal from 0.2 V/cm to over 15 V/cm.
×10	2.0 V/cm maximum	

AMPLITUDE CALIBRATOR

Voltage Output	Peak to peak amplitude accuracy is within ±3% of indicated front panel setting when working into an impedance of 1 MΩ or higher.	
Frequency	1 kHz ±25%, positive-going square wave with zero-volt baseline.	
Risetime	Equal to or less than 2 μs into 15 pF.	

FRONT PANEL OUTPUT SIGNALS

SAWTOOTH A	140 V ±20 V increasing to approximately 180 V ±20 V at the faster sweep rates and having the same time duration as the A sweep. Recommended load ≥100 kΩ.

+ GATE A and + GATE B	Within the range of 20 to 40 volts. Positive-going gate pulse with the baseline at zero volts. Time coincident with the respective sweep. Recommended load ≥5 kΩ.
DLY'D TRIG	A positive-going pulse of approximately 5 V ±2 V into a load ≥10 kΩ. Pulse occurs at the end of the delay period.

EXTERNAL SIGNAL CONNECTORS

Z Axis Modulation

CRT CATHODE	An applied 20 volt peak-to-peak signal from 1.0 kHz to 1 MHz will produce noticeable modulation. Positive portion of the signal blanks CRT beam.

CATHODE-RAY TUBE

Type	T5810-31; P1, P2, P7 and P11 phosphors optional. Other phosphors available on special order.
Accelerating Potential	10 kV.
Usable Viewing Area	4 cm high by 10 cm wide.
Graticule	Internal, adjustable edge lighting. 4 × 10 cm with vertical and horizontal 1-cm divisions with 2-mm markings on the centerlines.

POWER SUPPLY REQUIREMENTS AND FEATURES

Nominal Line Voltage	107, 117, 127, 214, 234, and 254 VAC
Line Voltage Range	105 to 125 volts for nominal line voltage of 117 volts. Proportional limits for other nominal line voltages.
Line Voltage Frequency	50 to 60 Hz.
Input Power (Maximum)	630 watts.
Thermal Protection	Automatic resetting thermal cutout which interrupts instrument power if internal temperature exceeds a safe operating level.

MECHANICAL FEATURES

Construction	Aluminum alloy chassis. Anodized front panel. Blue vinyl painted cabinet.
Overall Dimensions	13 inches wide, 24 inches long and 17 inches high.

ACCESSORIES

Standard accessories supplied with the instrument will be found on the last pull-out page at the back of the manual.

For optional accessories see Tektronix, Inc. catalog.

NOTES

SECTION 2
OPERATING INSTRUCTIONS

Introduction

The Type 585A is a high speed laboratory oscilloscope. Risetime and bandwidth characteristics depend on the plug-in unit and probe used with the oscilloscope. With the Type 82 and 86 Plug-In Unit the bandwidth at 0.1 V/cm is 85 MHz or greater with an equivalent risetime of 4.1 ns or less. See Characteristics section.

Type 81 or Type 81A Adapter equips the oscilloscope to accept any Tektronix Letter Series or 1 Plug-In Unit. Applications include many general purpose laboratory measurements.

This section describes the function of the front panel controls and connectors, power requirements with power transformer wiring diagram for a range of primary input voltages and fan connections for either 110-124 or 220-248 volt operation. The section then describes some oscilloscope basic measurement applications.

POWER CONNECTIONS

Unless otherwise indicated, the Type 585A is shipped with the power transformer and fan wired for 117-volt AC input. A connection diagram on the side of the transformer and Fig. 2-1, show alternative connections for other input voltages to the power transformer. When the transformer is changed from 108-124 volts to a 216-248 volts connection, the fan wiring must be changed. Fig. 2-2 shows the fan connections for each voltage range.

FUNCTIONS OF CONTROLS AND CONNECTORS

Time Base Controls

NOTE

The Time Base A and Time Base B controls serve similar functions with the exception of the LENGTH control.

TRIGGERING LEVEL	Selects the amplitude point on the triggering signal where sweep-triggering occurs.
STABILITY	Can be adjusted to an optimum triggering point or the control can be set to PRESET position to eliminate further adjustments. This position provides adequate triggering stability for most applications.
TRIGGER SLOPE	Selects either the rising (+) or falling (—) portion of the trigger signal and up to ±10 V (external) in amplitude.
TRIGGERING SOURCE	Selects either internal, external or line signal, for trigger.
INT	HF SYNC: Provides stable triggering of displays from 5 MHz to 250 MHz with a fraction of a centimeter of display amplitude.

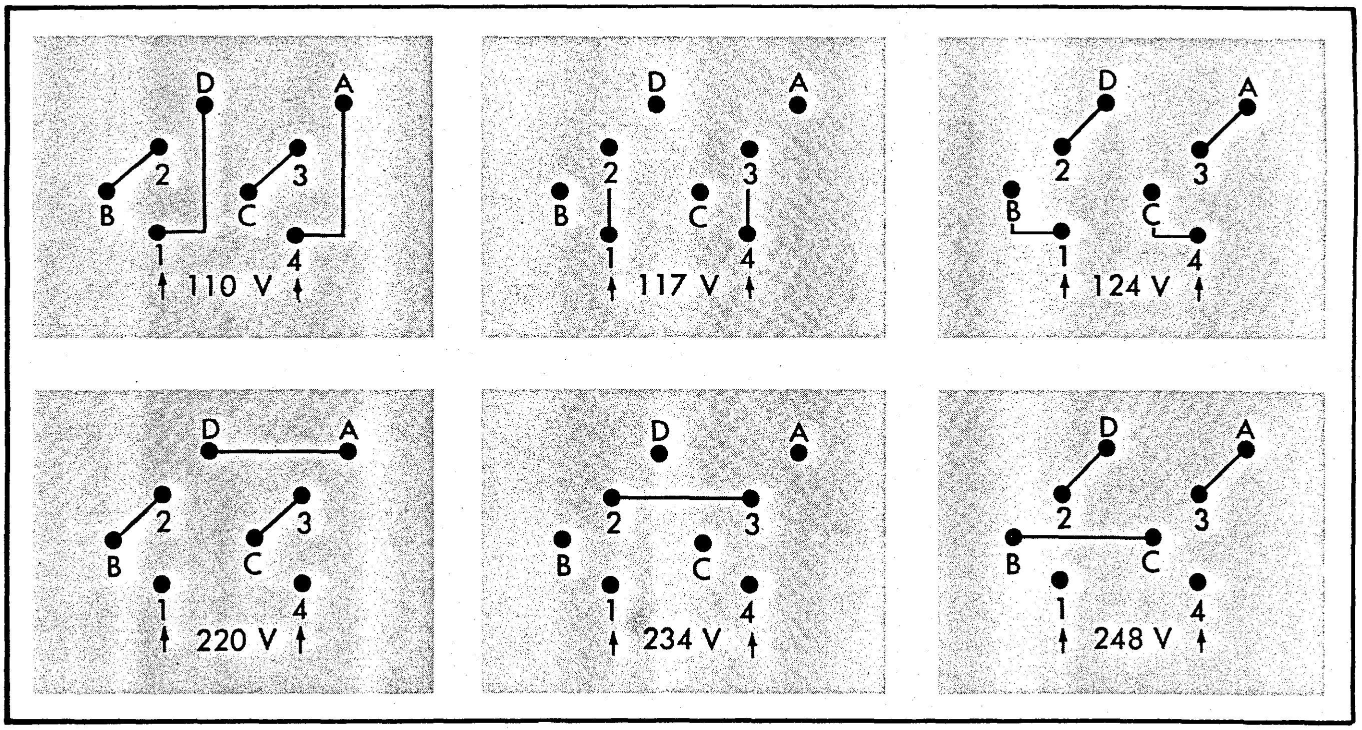


Fig. 2-1. The power transformer has two extra windings permitting nominal primary voltages of 110, 117, 124, 220, 234, 248 volts, 50 to 60 cycle operation.

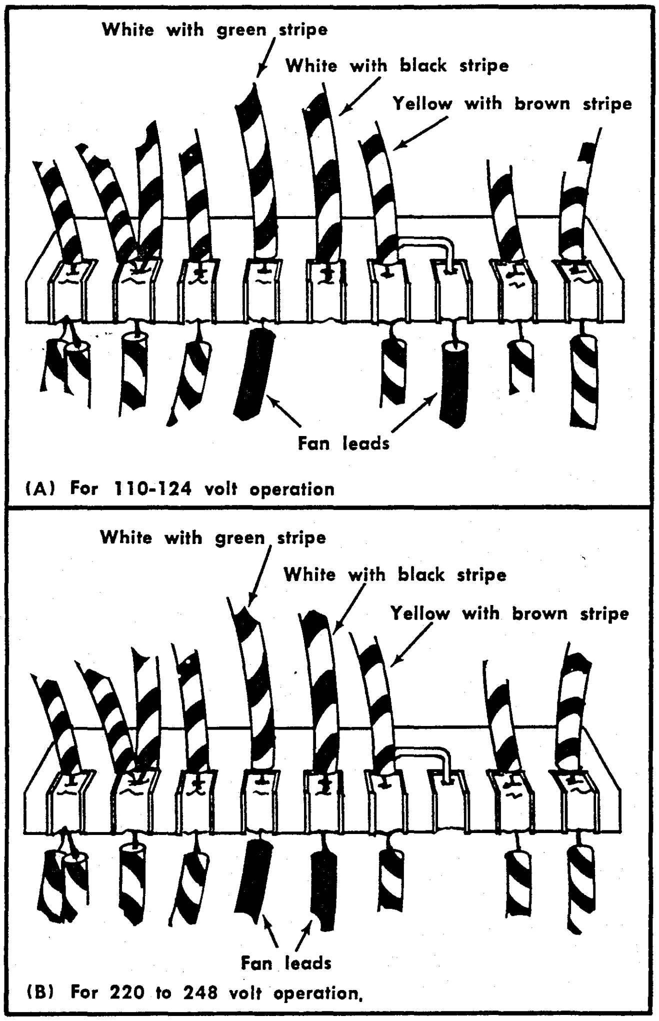


Fig. 2-2. Fan lead connections.

AC LF REJ: Operates above approximately 17 kHz to prevent low-frequency signal components, such as 60 Hz hum, from interfering with stable triggering.

AC: Blocks DC component in the triggering signal so triggering occurs only on the changing portion of the signal. For normal trigger requirements to 150 MHz.

EXT — AC: Same as AC coupling in INT sector. DC: Provides triggering on signals below about 30 Hz.

HF SYNC: Same as coupling in the INT sector of the SOURCE switch.

TIME/CM — Selects the time-base sweep rate.

VARIABLE (Time Base A) — Provides a continuously variable and uncalibrated sweep rate adjustment which will slow the sweep rate to at least 2.5 times the setting of the TIME/CM switch. An UNCALIBRATED lamp lights when the VARIABLE control is not in the CAL position.

TIME/CM or DELAY TIME (Time Base B) — Selects the B Time-Base sweep rate.

LENGTH (Time Base B) — Varies the sweep length from 4 to 10 cm.

HORIZONTAL DISPLAY — Selects sweep mode of operation as follows:

B — Time Base B is displayed.

B INTENSIFIED BY 'A' — One of the delayed functions. In this position a portion of Time Base B is intensified during the interval of Time Base A (delayed sweep) operation.

'A' DLY'D BY B — Another delay sweep function. In this position Time Base A is triggered at the end of each delay period, as determined by the B TIME/CM OR DELAY TIME switch setting and the DELAY TIME MULTIPLIER 1-10 dial reading.

A — Time Base A is displayed.

'A' SINGLE SWEEP — Time Base A will not run until armed by the RESET button and then triggered.

EXT, ×10 and ×1 — Connects an external signal to the horizontal deflection system. Sensitivity is continuously variable with the VARIABLE 1-10 control from approximately .15 V/cm to 15 V/cm.

READY LIGHT — Indicates Time Base A is ready for trigger signal after being reset.

5× MAGNIFIER — Expands the center 2 cm of the display to 10 cm when turned to ON position.

DELAY TIME MULTIPLIER 1-10 — Delays the Time Base B trigger signal to Time Base A and the DLY'D TRIG connector from 0 to 10 times the time indicated by the Time Base B TIME/CM OR DELAY TIME selector switch.

AMPLITUDE CALIBRATOR — Selects the peak-to-peak voltage available at the CAL OUT connector.

POWER — Toggle switch for applying or removing power to the instrument.

INTENSITY — Controls writing gun beam current.

FOCUS — Used in conjunction with the INTENSITY and ASTIGMATISM controls to obtain a well-defined display.

TRACE ROTATION — Permits horizontal alignment of the trace to the horizontal lines of the graticule.

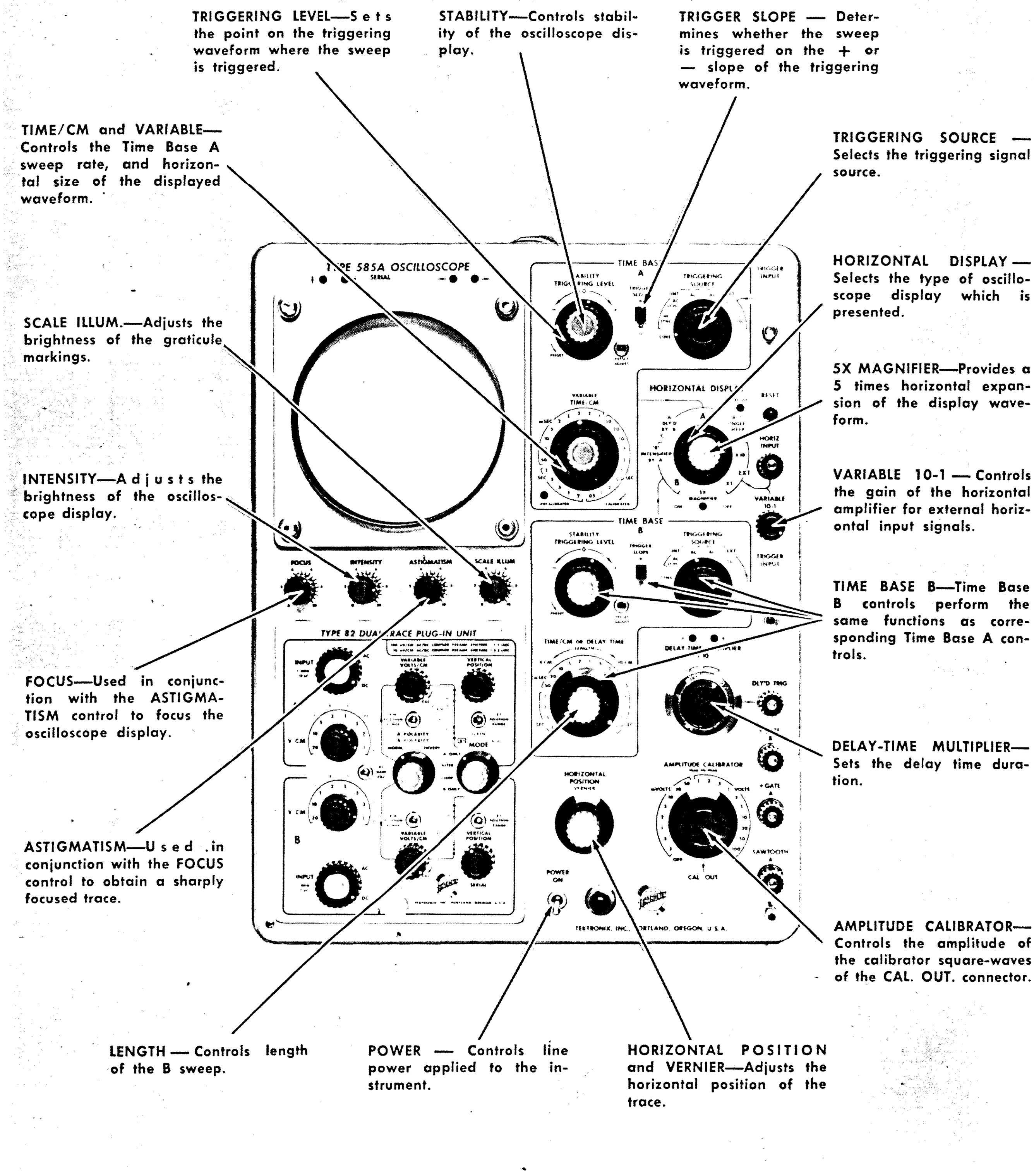


Fig. 2-3. Functions of the front panel controls.

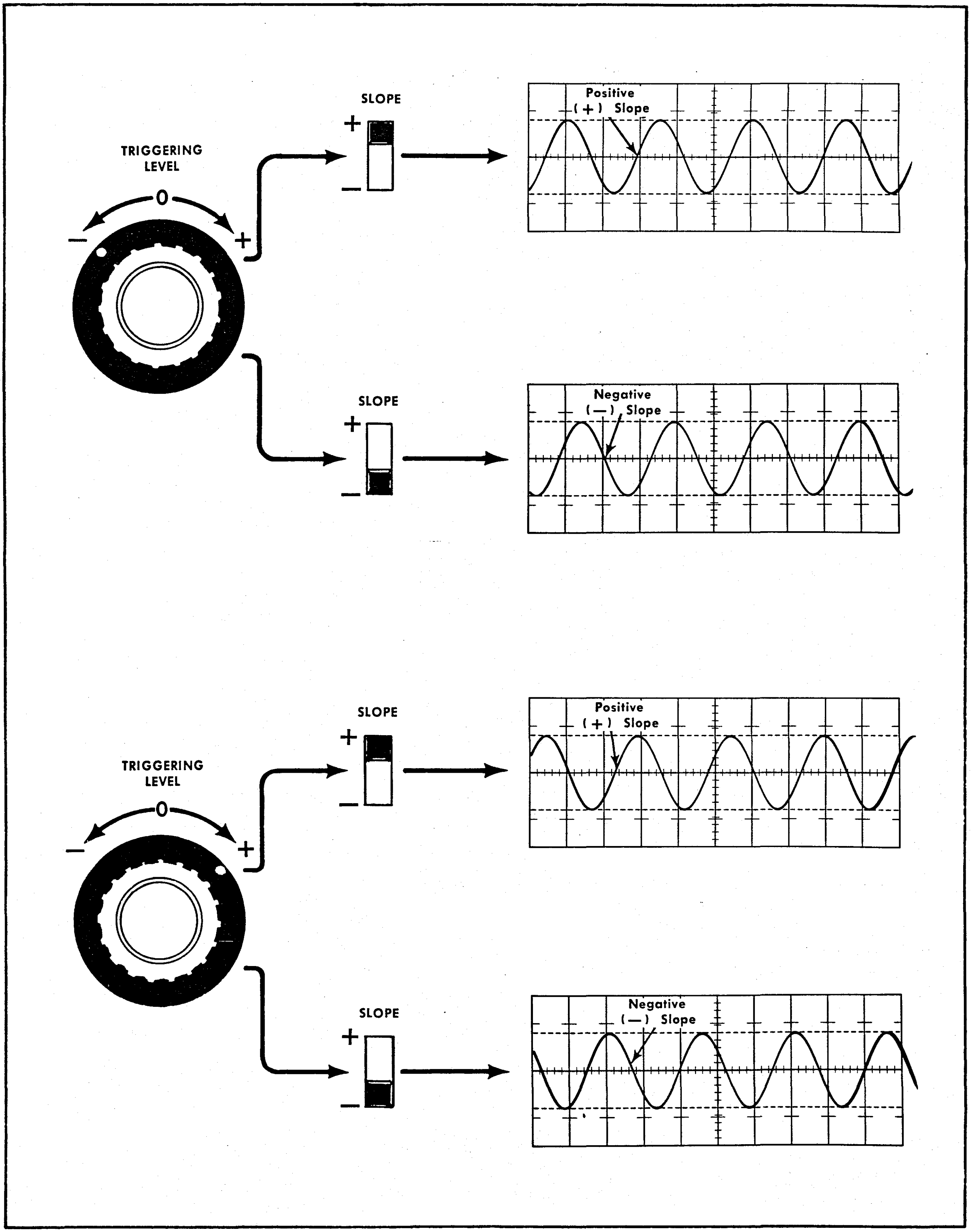


Fig. 2-4. Effects of the TRIGGERING LEVEL and TRIGGER SLOPE controls.

SCALE ILLUM	Varies illumination of the grid lines of the graticule.
TRIGGER INPUT (Time Base A and B)	Connector for applying an external trigger signal to the time base when the respective TRIGGERING SOURCE switch is set to the EXT position.
HORIZ INPUT	Connector to apply external horizontal signal when the HORIZONTAL DISPLAY switch is set to either ×1 or ×10 EXT position.
DLY'D TRIG	Supplies a positive-going trigger output of about 5 volts at the end of the delay period as set by the TIME/CM OR DELAY TIME switch and the DELAY TIME MULTIPLIER 1-10 dial.
+GATE B	Supplies an approximate 20-volt square-wave output pulse when Time Base B is operating. Pulse duration is same as the B sweep length.
+GATE A	Same as +GATE B except that it applies to Time Base A.
SAWTOOTH A	The sweep ramp voltage of Time Base A. Peak amplitude is about +150 volts.
CRT CATHODE	Connector allows Z-axis modulation of the CRT cathode (AC coupled). A grounding strap is provided for normal operation.

OSCILLOSCOPE OPERATION

Preparation for Use

Insert the desired plug-in unit into the plug-in compartment of the Type 585A Oscilloscope. Tighten the locking control to hold the unit securely in place and turn the oscilloscope INTENSITY control fully counterclockwise.

NOTE

When using the Type 81 or Type 81A Plug-In Adapter, insert it into the Type 585A plug-in compartment with a letter series plug-in unit. This permits the thumb tightening screw of the letter series plug-in to secure the Type 81 or Type 81A in place. It is permissible to operate the Type 585A Oscilloscope with the Type 81 or Type 81A Plug-In Adapter in place and a letter series plug-in not installed.

Set the front panel controls of the Type 585A as follows:
CRT Controls

INTENSITY	Fully counterclockwise
FOCUS	Midrange
ASTIGMATISM	Midrange
SCALE ILLUM	As Desired
HORIZONTAL DISPLAY	A
5× MAGNIFIER	OFF
TIME BASE A and B	
TIME/CM	1 mSEC
VARIABLE	CALIBRATED
TRIGGERING SOURCE	INT AC
TRIGGER SLOPE	+
STABILITY	PRESET
TRIGGERING LEVEL	Midrange (0)
DELAY TIME MULTIPLIER 1-10	1.0
AMPLITUDE CALIBRATOR	1 VOLT
HORIZONTAL POSITION and VERNIER	Midrange
Vertical Plug-In Unit	
Volts/Cm	.5
Input Selector	AC

Connect a coaxial cable between the CAL OUT connector and the vertical Input connector.

Connect the Type 585A to a suitable power source and turn the POWER switch to ON. Allow a few minutes for the delay time relays to energize and the instrument to stabilize.

Adjust the INTENSITY control for a display of nominal brightness. Position the display to the center of the graticule area with the HORIZONTAL and Vertical POSITION controls, then adjust TRIGGERING LEVEL control for a stable display.

Re-adjust the INTENSITY, FOCUS and ASTIG controls for a well focused display of nominal brightness. The FOCUS control should be adjusted for the best vertical definition and the ASTIG control should be adjusted for equally focused horizontal and vertical segments of the displayed waveform.

Remove the signal cable between the CAL OUT connector and the vertical Input connector and set both the A TRIGGERING LEVEL and STABILITY controls fully clockwise for a free running trace.

Trace Alignment

If the free running trace is not parallel with the horizontal graticule lines, adjust the TRACE ROTATION control to align the trace with the horizontal graticule lines.

Sweep Triggering

Proper sweep triggering is essential for a stable presentation of an input signal. The sweep must be triggered at the same time relative to the displayed signal. Thus, the sweep must be triggered by the input signal or by some external signal that has a fixed time relationship with the displayed signal. See Fig. 2-4. The external trigger signal must be the same frequency or a sub-mulitple of the input signal.

The SOURCE switch selects one of a variety of possible triggering signals. For most applications the sweep can be triggered internally from the displayed signal. This occurs with the SOURCE switch in the INT positions.

External triggering is often used when signal tracing in amplifiers, phase-shift networks and wave shaping circuits. The signal from a single point in the circuit can be used as the external trigger signal. With this arrangement it is possible to observe the shaping and/or amplification of a signal at various points through the circuit without resetting the triggering controls for each new display.

The LINE position of the switch connects a line-frequency signal to the triggering input. Line triggering is useful whenever the input signal is frequency-related to the line frequency.

Coupling

For most applications AC coupling is recommended. When line-frequency hum is mixed with the triggering signal, use AC LF REJ so that triggering takes place only on the desired signal (if the signal contains frequency components higher than 17 kHz).

On high frequency triggering signals use the HF SYNC position when the signal amplitude is insufficient to provide stable operation.

When trigger signal source is external, DC coupling may be desirable for low frequency ($\leq$15 Hz) signals.

Stability Control

In most triggering applications, satisfactory operation can be obtained with the STABILITY control in the PRESET (fully counterclockwise) position. If triggering becomes difficult, it may be necessary to manually adjust the STABILITY control. To adjust, set the LEVEL and STABILITY control in the fully counterclockwise position, then turn the STABILITY control slowly clockwise until a trace appears on the CRT. The correct setting is obtained by turning the control counterclockwise three to five degrees from the point where the trace appears. This setting is just below a free running sweep. Next, adjust the LEVEL control for a triggered sweep.

Setting Triggering Level

The TRIGGERING LEVEL control determines the amplitude point on the signal where triggering occurs.

The trigger circuit is most sensitive to AC triggering signals with the TRIGGERING LEVEL control set near zero. Moving the TRIGGERING LEVEL control in the + direction causes the trigger circuit to operate at a more positive point on the triggering signal. Moving the TRIGGERING LEVEL control in the — direction causes the trigger circuit to operate at some more negative point on the triggering signal. See Fig. 2-4.

Selecting TIME/CM (Sweep Rate)

The TIME/CM and the 5× MAGNIFIER switches determine sweep rate. The MAGNIFIER expands the time base sweep by a factor of 5.

The TIME/CM switch provides a wide selection of calibrated sweep rates. When making time measurements from the CRT graticule, be certain the VARIABLE control is in the CAL position.

The VARIABLE control provides a continuously variable uncalibrated sweep rate. The UNCAL neon lights when the VARIABLE control is at other than the calibrated (detent) position to indicate that the sweep rate is no longer calibrated.

With the 5× MAGNIFIER switch set to the ON position the setting of the TIME/CM switch must be divided by 5 to determine actual sweep rate. (i.e., if the TIME/CM switch is set to 1 mSEC the sweep rate should be 0.2 mSEC/CM.) See Fig. 2-5. Time measurements from the graticule should be made in the horizontal portion between the 1st and 9th centimeter lines because this is the most linear portion of the sweep. See Fig. 2-6.

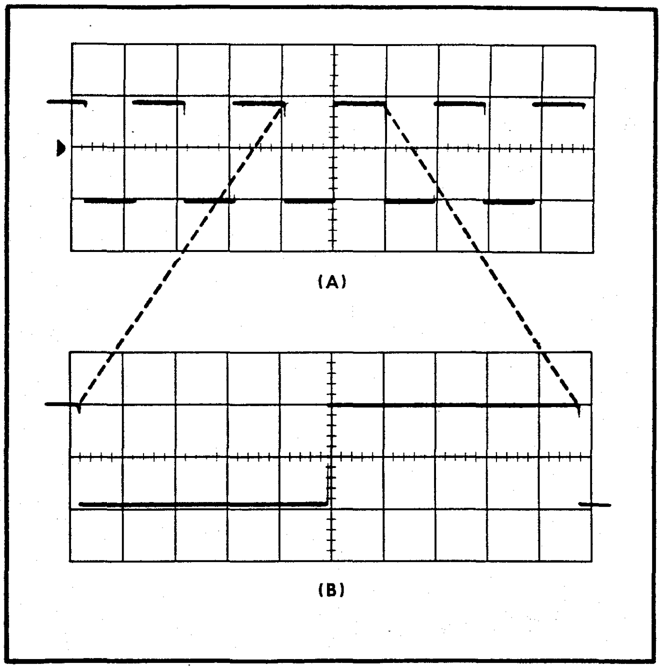


Fig. 2-5. Sweep magnifier operation. (A) Magnifier off. (B) 5× MAGNIFIER switch ON.

Single Sweep Operation

For applications where the displayed signal is not repetitive or varies in amplitude, shape or time, a photograph of the display may be desired. This is most easily accomplished with the single sweep feature.

The single sweep feature is selected with the HORIZONTAL DISPLAY switch in the SINGLE SWEEP position. The RESET button now controls the trigger operation of the time base. With the STABILITY control set fully clockwise, a sweep runs each time the RESET button is depressed.

To prepare the oscilloscope for single sweep operation, set the HORIZONTL DISPLAY switch to A, then adjust the TRIGGERING LEVEL and STABILITY controls for a triggered display. Switch the HORIZONTAL DISPLAY switch to 'A'

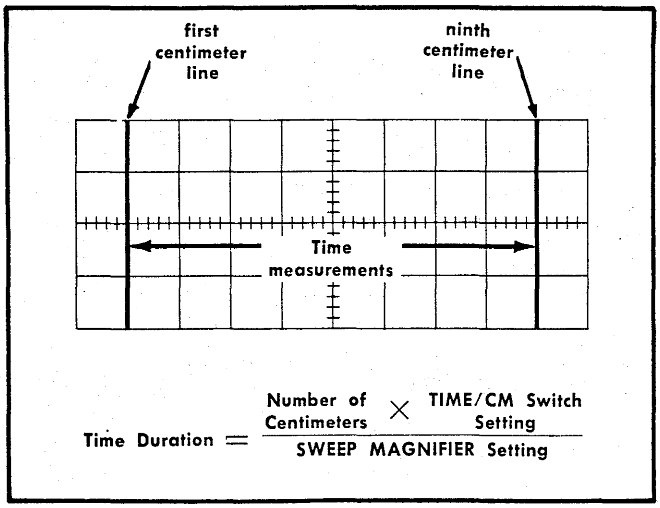


Fig. 2-6. Area of graticule used for accurate time measurements.

©I

SINGLE SWEEP position and push the RESET button. With no input trigger signal the READY lamp should light to indicate that Time Base A is armed and ready to be triggered. With the application of a trigger signal the sweep runs once and the READY light goes out. The procedure repeats each time the RESET button is depressed.

Delayed Sweep Operation

The delayed sweep feature is operable when the HORIZONTL DISPLAY switch is in the 'A' DLY'D by 'B' position. The delay period is indicated by the settings of the B TIME/CM OR DELAY TIME switch multiplied by the setting of the DELAY TIME MULTIPLIER 1-10 vernier dial reading. For example: TIME/CM OR DELAY TIME switch is set to 10 μSEC position and the vernier of the DELAY TIME MULTIPLIER 1-10 dial indicates 6.75. The delay time equals 6.75 $\times$ 10 μSEC or 67.5 microseconds. See Fig. 2-7.

With the HORIZONTAL DISPLAY switch in the 'B' INTENSIFIED BY 'A' position and all controls set for delayed sweep operation, a portion of the Time Base B sweep will be intensified by the Time Base A sweep. The length of the intensified portion is determined by the A TIME/CM switch setting. The position of the intensified portion is dependent on the DELAY TIME MULTIPLIER 1-10 control setting.

To expand a portion of the Time Base B sweep presentation, adjust the DELAY TIME MULTIPLIER 1-10 and the A Time Base TIME/CM controls to include the portion of the waveform to be expanded in the intensified portion, then set the HORIZONTAL DISPLAY switch to the 'A' DLY'D BY 'B' position. This expands the intensified portion to the full 10 cm graticule width, see Fig. 2-8. The amount of magnification is the ratio of Time Base B TIME/CM OR DELAY TIME setting of the Time Base A TIME/CM control setting. For example: Time Base B TIME/CM OR DELAY TIME switch is set to 1 mSEC position, Time Base A TIME/CM switch switch is set at 1 μSEC. The brightened portion is expanded horizontally 1,000 times. Display expansions to approximately 10^4 are attainable.

When using the delayed sweep feature to obtain high magnification, the trace may become very dim because of the low duty cycle. The intensity can often be increased through the use of the Time Base B LENGTH control. Set

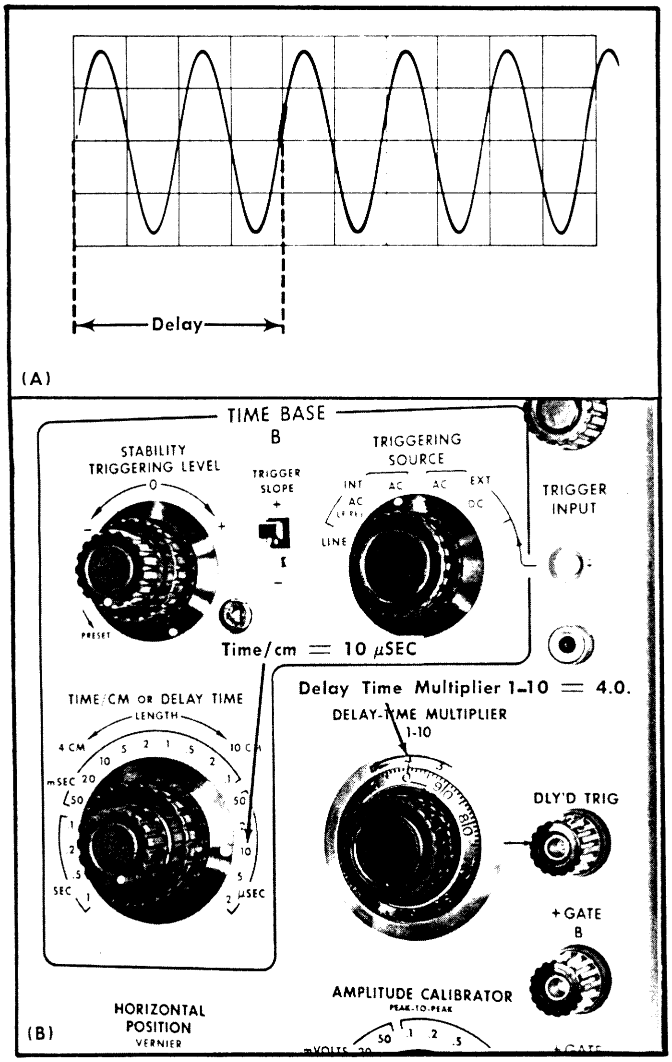


Fig. 2-7. Delay Time = B TIME/CM OR DELAY TIME setting multiplied by DELAY TIME MULTIPLIER 1-10 dial reading. 10 μSEC $\times$ 4 = 40 μs delay time.

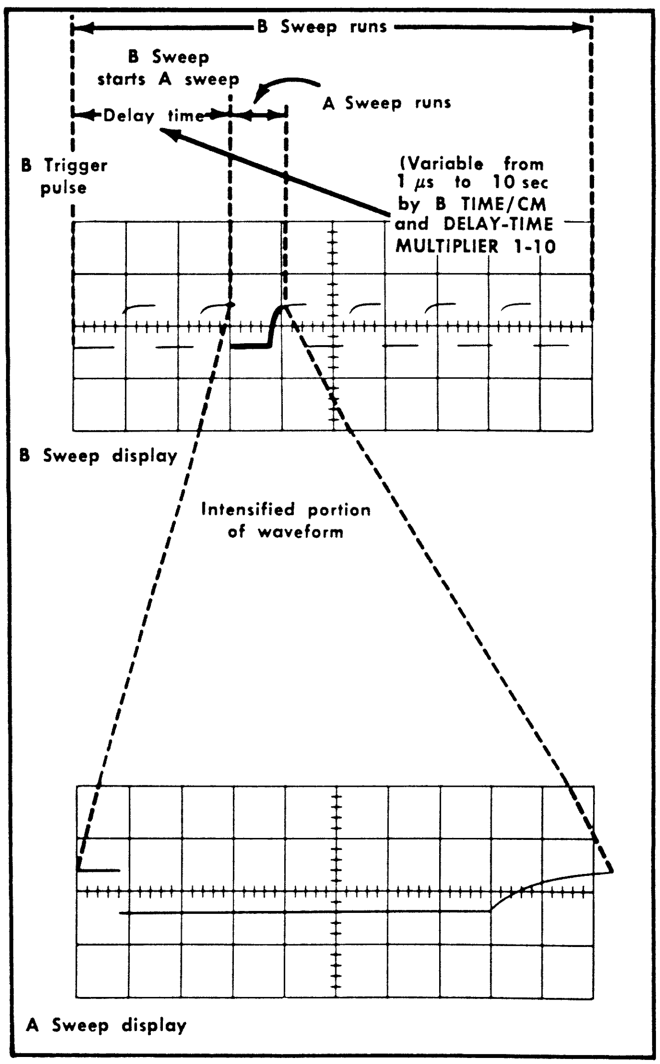


Fig. 2-8. Delayed sweep operation.

the HORIZONTAL DISPLAY switch to the 'B' INTENSIFIED BY 'A' position and adjust the LENGTH control until the sweep stops at a point just past the brightened portion of the trace. Then, return the HORIZONTAL DISPLAY switch to the 'A' DLY'D BY 'B' position. Using this procedure, the maximum delayed sweep repetition rate will be obtained.

Delayed Trigger

A delayed triggering pulse can be obtained from the front panel DLY'D TRIG connector any time from .05 microseconds to 10 seconds after the start of a sweep. When the oscilloscope is set for delayed sweep operation the delayed trigger occurs at the start of the delayed sweep. The delayed triggering pulse can be used to initiate some event after a known time interval, and when used with the delayed sweep, permits observation of the resulting event.

In the Time Base B, 'B' INTENSIFIED BY 'A', 'A' DLY'D BY 'B', EXT ×1 and EXT ×10 positions of the HORIZONTAL DISPLAY switch, the delayed trigger is controlled by Time Base B. In the other two positions of the HORIZONTAL DISPLAY switch, the delayed trigger is controlled by Time Base A.

The lights above the DELAY TIME MULTIPLIER 1-10 control indicate which time base unit is used to produce the delayed trigger with each setting of the HORIZONTAL DISPLAY switch.

External Horizontal Deflection

In some applications, it may be desirable to display one signal versus another (X-Y) rather than against time (internal sweep). The EXT position of the HORIZONTAL DISPLAY switch connects an externally originated signal to the horizontal amplifier to establish this type of display.

To use the External Horizontal Amplifier, connect the external waveform to the HORIZ INPUT connector and place the HORIZONTAL DISPLAY switch in the ×10 or ×1 EXT position. The horizontal deflection factor is continuously variable from approximately 0.15 to approximately 15 volts per centimeter with the VARIABLE 1-10 control and the ×10 or ×1 position of the HORIZONTAL DISPLAY switch. Remember when using this feature the horizontal deflection factor is uncalibrated.

Intensity Modulation

Intensity (Z axis) modulation can be used to relate further information to the displayed waveform, without changing the X-Y information. The intensity modulation can be applied by disconnecting the grounding bar from the EXTERNAL CRT CATHODE connector at the rear of the instrument and applying the external signal to this terminal. A positive signal of approximately 25 volts is required to cut off the beam. Restore the grounding bar to the EXTERNAL CRT CATHODE connector for normal operation.

Oscilloscope Measurement Applications

The following applications describe the procedure and technique for making basic measurements with the Type 585A Oscilloscope. These applications are not described in detail but are designed to provide familiarization with the controls and basic operating technique.

AC Component Voltage Measurements

In oscilloscope measurements, the AC component of a waveform is usually measured in terms of its peak-to-peak or peak-to-trough value. This type of measurement is most conveniently made by using the graticule to measure the vertical distance between peaks and multiplying this distance by the deflection factor of the oscilloscope. The figure obtained is the actual peak-to-peak voltage. In most cases the AC component of a waveform can be measured with the vertical Input Selector switch in either the AC or DC position. It may be necessary to use the AC position, however, in certain applications to prevent the DC components of the waveform from deflecting the trace off the screen. To prevent inaccuracies, the DC position should be used when low-frequency measurements are made.

Peak-to-peak voltage on the AC component of a waveform may be measured as follows:

1. With the aid of the graticule, measure the vertical distance in centimeters from the positive peak to the negative peak.

NOTE

This technique may also be used to make measurements between two points on the waveform rather than peak to peak.

2. Multiply the measured distance by the Volts/Cm switch setting. Include the attenuation factor of the probe.

Example: Assume a peak-to-peak vertical deflection of 3.6 cm (see Fig. 2-9) using a 10× attenuator probe and a Volts/Cm switch setting of 0.5.

Using the formula,

$$\text{Volts peak to peak} = \begin{matrix}\text{Vertical}\\ \text{deflection}\\ \text{(centimeters)}\end{matrix} \times \begin{matrix}\text{Volts/}\\ \text{Cm}\\ \text{setting}\end{matrix} \times \begin{matrix}\text{Probe}\\ \text{attenuation}\\ \text{factor}\end{matrix}$$

Substituting the given values,

Volts peak-to-peak $= 3.6 \times 0.5 \times 10$

The peak-to-peak voltage is 18.

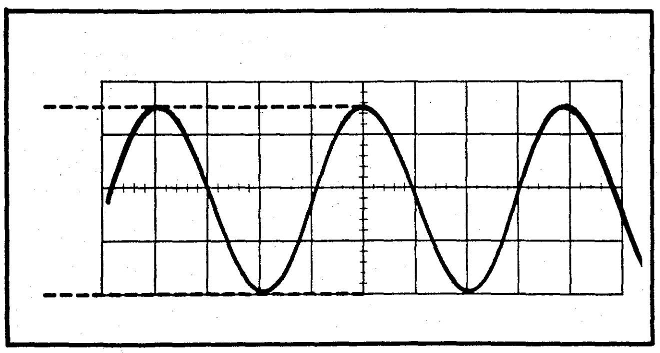


Fig. 2-9. Peak-to-peak voltage measurements.

Instantaneous Voltage Measurements

Instantaneous voltages are measured with respect to some reference voltage (normally ground). This reference level is first established along a graticule line, then the instantaneous voltage is applied and its amplitude measured in much the same way as AC peak-to-peak measurements; however, the measurement is made from the reference graticule line (reference voltage). Voltage measurements are then made with respect to this reference line. In this type of measurement, the Vertical Input Selector switch must be in the DC position. The method used to measure instantaneous voltages may also be used to measure the DC component of a waveform. The average voltage of a waveform is referenced as an instantaneous voltage. The DC component of a waveform can thus be measured once the average voltage has been determined.

Measurement of instantaneous voltages with respect to ground or other reference voltage is performed as follows:

1. Touch the probe tip to an oscilloscope ground terminal or the voltage reference point. Adjust the oscilloscope controls for a free-running sweep. Vertically position the trace to a convenient mark on the graticule. This point depends on the polarity and amplitude of the input signal, but should be chosen so the trace lies along one of the major divisions on the graticule. If the trace is widened by stray interference, ground the probe body near the tip. The trace position will be the voltage reference line and all voltage measurements will be read with respect to this line. (Do not adjust the vertical positioning control after the reference has been established.)

2. Remove the probe tip from the reference voltage and connect it to the signal source. Adjust the triggering controls for a stable display.

3. Use the graticule and measure the vertical distance in centimeters from the voltage reference line to the desired point of the waveform.

4. Multiply the distance measured by the VOLTS/CM setting, and the attenuation factor of the probe.

Example: Assume that the vertical measured distance is 3.2 cm (see Fig. 2-10), the waveform is above the reference line, a 10× probe is used and the Volts/Cm Selector is at 2.0.

Using the formula:

$$\text{Instantaneous voltage} = \begin{matrix}\text{Vertical}\\ \text{distance}\\ \text{(centimeters)}\end{matrix} \times \text{polarity} \times \begin{matrix}\text{Volts/Cm}\\ \text{setting}\end{matrix} \times \begin{matrix}\text{probe}\\ \text{attenuation}\\ \text{factor}\end{matrix}$$

Substituting the given values:

$$\begin{matrix}\text{Instantaneous}\\ \text{Voltage}\end{matrix} = 3.2 \times (+1) \times 2 \times 10 = +64\text{ V}$$

Voltage Comparison Measurements

Some applications may require a set of deflection factors other than those indicated on the Volts/Cm switch. These are useful for comparing signals to some voltage amplitude. Establish a set of deflection factors based upon a specific reference amplitude as follows:

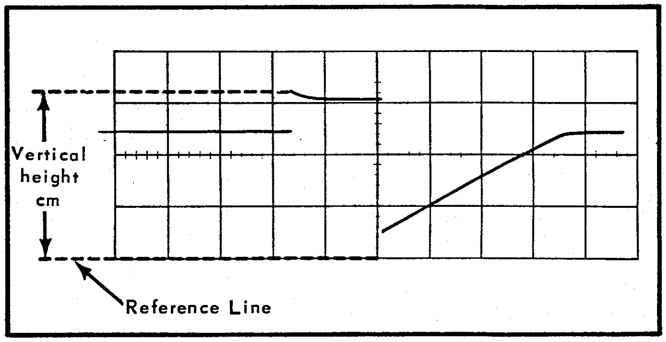


Fig. 2-10. Measuring instantaneous voltage with respect to a reference voltage.

1. Apply the reference signal to the Input connector. Use the Volts/Cm switch and the Variable control to adjust the display amplitude for an exact number of centimeters. Do not move the Variable Volts/Cm control after obtaining the desired deflection.

2. Divide the reference signal potential (volts) by the product of the deflection in centimeters (established in step 1) and the Volts/Cm switch setting. This is the deflection conversion factor.

$$\begin{matrix}\text{Deflection}\\ \text{conversion}\\ \text{factor}\end{matrix} = \frac{\text{Reference signal potential (volts)}}{\text{Deflection amplitude (centimeters)} \times \text{Volts/Cm selector position}}$$

3. To establish an adjusted deflection factor for any setting of the Volts/Cm switch, multiply the Volts/Cm switch setting by the deflection conversion factor.

$$\begin{matrix}\text{Adjusted}\\ \text{deflection}\\ \text{factor}\end{matrix} = \begin{matrix}\text{Volts/Cm}\\ \text{setting}\end{matrix} \times \begin{matrix}\text{Deflection}\\ \text{conversion}\\ \text{factor}\end{matrix}$$

4. To determine the peak-to-peak amplitude of a signal compared to a reference, disconnect the reference and apply the signal to the Input connector.

A. Set the Volts/Cm selector so the signal amplitude is adequate for a measurement, being careful not to readjust the Variable Volts/Cm control.

B. Measure the vertical deflection in centimeters, then determine the amplitude as follows:

$$\begin{matrix}\text{Signal}\\ \text{amplitude}\end{matrix} = \begin{matrix}\text{Adjusted}\\ \text{deflection}\\ \text{factor}\end{matrix} \times \begin{matrix}\text{Deflection}\\ \text{amplitude}\\ \text{(centimeters)}\end{matrix}$$

Time Measurements

The Time Base section is accurately calibrated so that the horizontal distance represents real time. Time intervals between two or more events may therefore be measured directly on the graticule.

The following method is applicable for most applications.

1. Measure the horizontal distance between two displayed events.

2. Multiply the distance measured in centimeters by the setting of the TIME/CM control to obtain the apparent time interval. (The VARIABLE TIME/CM control must be in the CAL position.)

3. Divide the apparent time interval by the MAGNIFIER switch setting to obtain the actual time interval.

Example: Assume that the distance between the time measurement points is 1.0 cm (see Fig. 2-11), the TIME/CM switch is set to .1 μSEC and the 5$\times$ MAGNIFIER switch is on.

$$\text{Time duration} = \frac{\begin{matrix}\text{Horizontal} \\ \text{distance} \\ \text{(centimeters)}\end{matrix} \times \begin{matrix}\text{TIME/CM} \\ \text{selector} \\ \text{setting}\end{matrix}}{\text{magnification factor}}$$

Substituting the given values:

$$\text{Time duration} = \frac{1.0\,\text{cm} \times 0.1\,\mu\text{s/cm}}{5} = 20\,\text{ns}$$

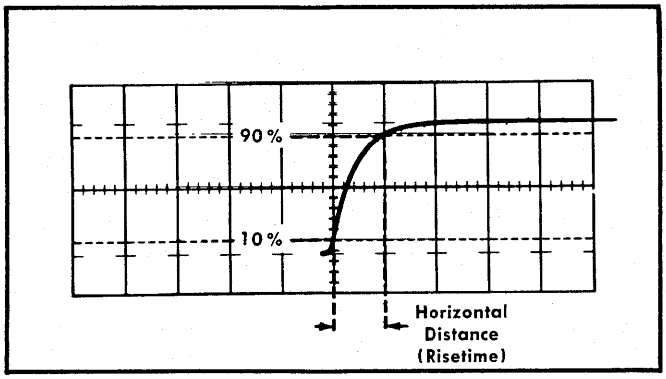


Fig. 2-11. Measuring risetime using the horizontal distance in centimeters.

Increased Accuracy Time Measurements

A second method for measuring time intervals involves the use of the intensified sweep feature of the Type 585A Oscilloscope. In this method the HORIZONTAL DISPLAY switch is placed in the 'B' INTENSIFIED BY 'A' position. The brightened portion of the trace is then used as a continuously variable time marker. The brightened portion of the trace and the DELAY TIME MULTIPLIER 1-10 control are used to make the time measurements. This method provides a high degree of accuracy if care is taken in making the measurements. The method is as follows:

1. Set the HORIZONTAL DISPLAY switch in the 'B' INTENSIFIED BY 'A' position and adjust the B triggering controls for a stable display. Set the A STABILITY control for a free-running operation (fully clockwise).

2. Decrease the intensity until the brightened portion of the trace is easily distinguishable. Set the A TIME/CM switch setting so the brightened portion is a small segment of the trace.

3. With the DELAY TIME MULTIPLIER 1-10 control, position the start of the brightened portion to the start of the interval to be measured. Record the setting of the DELAY TIME MULTIPLIER 1-10 vernier dial.

4. Adjust the DELAY TIME MULTIPLIER 1-10 control to position the start of the brightened portion of the trace to the end of the interval to be measured. Again record the setting of the DELAY TIME MULTIPLIER 1-10 vernier dial.

5. Subtract the first DELAY TIME MULTIPLIER 1-10 dial reading from the second and multiply the difference by the setting of the B TIME/CM OR DELAY TIME switch. The answer obtained is the time interval between the two events.

Maximum Accuracy Time Measurements

The maximum accuracy method of time measurement involves the delayed sweep feature of the Type 585A. This method uses only the DELAY TIME MULTIPLIER 1-10 dial and accuracy to ± 2 minor dial divisions can be achieved. When this accuracy is desired the Time Base B calibration should be checked for the individual TIME/CM ranges to be used.

Establish the accuracy of the Time Base B TIME/CM ranges to be used, then proceed as follows:

1. Complete the time measurement as described in the previous section on Increased Accuracy Time Measurements. The A STABILITY control must be fully clockwise at free-run position.

2. Set the DELAY TIME MULTIPLIER 1-10 control so the intensified spot is at the beginning of the interval to be measured. Set the HORIZONTAL DISPLAY switch to A DLY'D BY 'B'. With the DELAY TIME MULTIPLIER 1-10 control, position the beginning of the interval to be measured to the graticule center vertical line. (The graticule centerline is now the reference point of the CRT display for the following measurements.) Record the DELAY TIME MULTIPLIER 1-10 dial reading.

3. Set the HORIZONTAL DISPLAY switch to 'B' INTENSIFIED BY 'A' and rotate the DELAY TIME MULTIPLIER 1-10 control to position the intensified portion of the sweep to the end of the interval being measured. Set the HORIZONTAL DISPLAY switch to 'A' DLY'D BY 'B'. With the DELAY TIME MULTIPLIER 1-10 control, horizontally position the end of the interval to the graticule center vertical line. Record the DELAY TIME MULTIPLIER 1-10 dial reading.

4. Take the difference of the two DELAY TIME MULTIPLIER 1-10 dial readings and multiply the result by the setting of the Time Base B TIME/CM OR DELAY TIME switch. The accuracy is within 0.2% plus the accuracy of the B sweep.

Example: Assume the first dial reading is 1.31 and the second dial reading is 8.81 with the TIME/CM switch set to 0.2 microsecond (see Fig. 2-12).

Using the formula:

$$\begin{matrix}\text{Time difference} \\ \text{(delayed sweep)}\end{matrix} = \begin{matrix}\text{2nd} \\ \text{reading}\end{matrix} - \begin{matrix}\text{1st} \\ \text{reading}\end{matrix} \times \begin{matrix}\text{B TIME/CM} \\ \text{setting}\end{matrix}$$

Substituting the given values:

$$\text{Time difference} = (8.81 - 1.31) \times 0.2\,\mu\text{s}$$

The time difference is 1.5 microseconds.

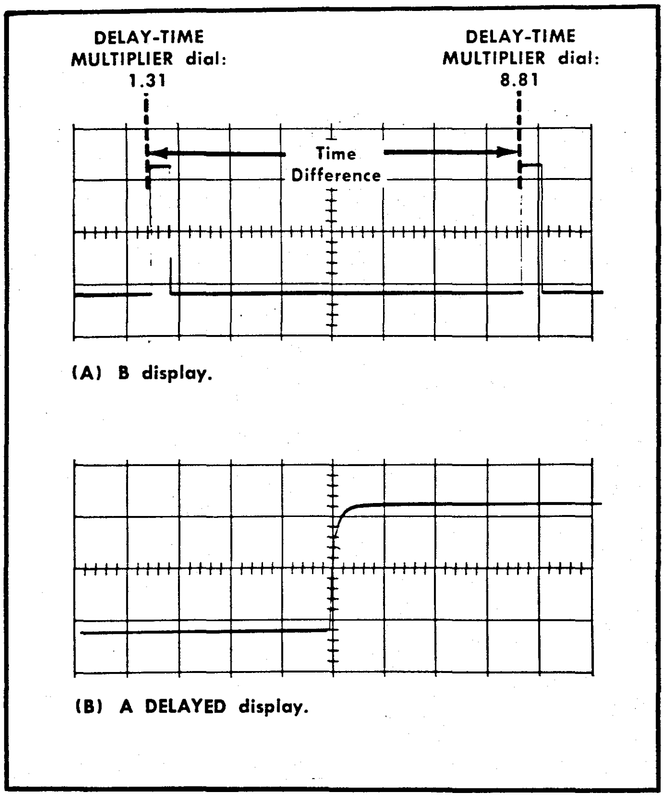


Fig. 2-12. Accurate time measurements using delayed sweep and DELAY TIME MULTIPLIER dial readings.

Frequency Measurements

The frequency can be easily calculated, since frequency is the reciprocal of the time period. For example, if the period of a recurrent waveform is accurately measured and found to be 0.2 μs, the frequency is $\frac{1}{0.2\ \mu s}$ or 5 MHz.

Phase Measurements

Since one complete cycle of a sinusoidal waveform is 360 degrees it is easy to calibrate the graticule in degrees per centimeter. For example if the TIME/CM controls are adjusted so one cycle of the input waveform spans 9 centimeters, (see Fig. 2-13) each centimeter then represents 40 degrees of the complete cycle. The display is then calibrated to 40 degrees per centimeter.

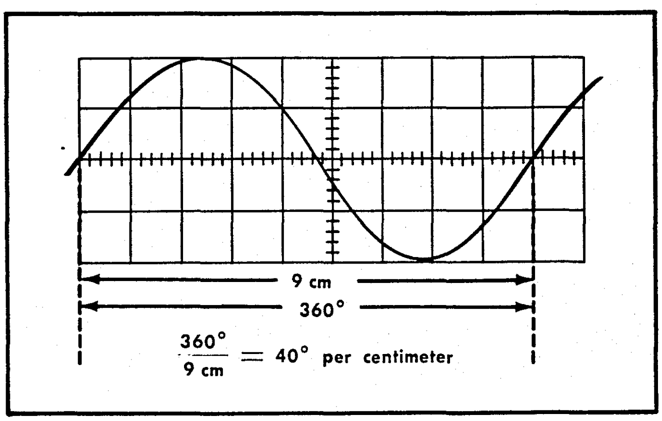


Fig. 2-13. A method of calibrating the displayed waveform in degrees/centimeter.

To measure phase angle: Calibrate the display in degrees per centimeter; measure the displacement between corresponding points on the two phases; and multiply the displacement by the number of degrees per centimeter. See Fig. 2-14. Note that the relative amplitude of the two signals does not affect the phase measurement if the signals are both centered about the graticule center horizontal line. Note that the two waveforms shown in the illustration do not appear simultaneously on the oscilloscope screen. The first waveform is displayed and positioned to a convenient reference point; then the second waveform is displayed and compared to this reference point.

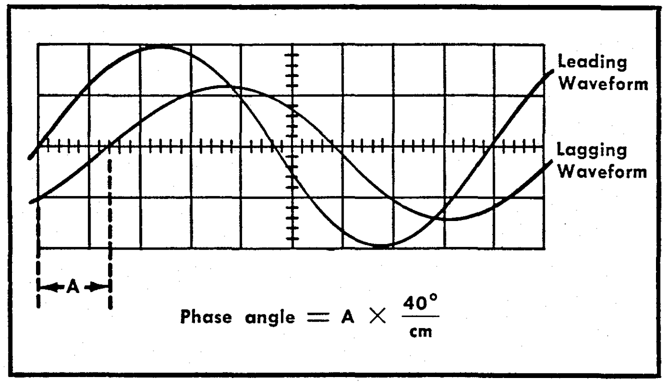


Fig. 2-14. Measurement of the phase angle between two waveforms. NOTE: the two displayed waveforms are not simultaneously on the screen.

When using the Type 585A Oscilloscope for phase measurements, is it necessary to maintain a constant amplitude point on the input triggering signal because the two input signals are compared indirectly to this reference and directly to each other. The trigger signal must have sufficient amplitude to ensure stable triggering. The triggering signal must be related in frequency to the waveforms on which phase measurements are to be made; however the actual phase of the triggering signal is not critical. It is essential that once triggering conditions have been established, there is no change during any phase measurement.

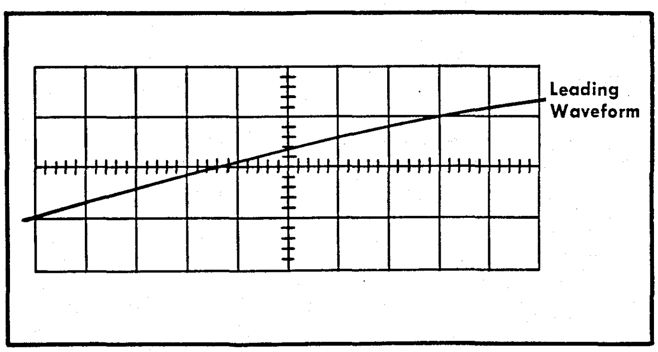


Fig. 2-15. An alternate method for measuring the phase angle between the two signals.

Accuracy of the measurements is improved by keeping the waveforms centered about the graticule center horizontal line (see Fig. 2-15) and maintaining high display amplitude.

NOTES

SECTION 3

CIRCUIT DESCRIPTION

Introduction

This section presents a block diagram and basic circuit analysis of the circuitry used in the Type 585A. The reader should refer to the circuit schematic in the diagram section and the simplified drawings in this section as the circuits are presented.

Block Diagram

This diagram provides a functional representation of the main circuits used in the Type 585A. See Fig. 3-1.

Signals applied to the Input connector of the plug-in unit are amplified and applied to the Vertical Amplifier of the Type 585A. The Vertical Amplifier contains an input amplifier, delay line and output amplifier to drive the vertical deflection plates of the CRT.

A sample of the applied signal is picked off by the Trigger Pickoff circuit in the Vertical Amplifier and applied to the two Time-Base Trigger circuits. These triggering circuits provide the trigger features of the unit. A constant amplitude trigger pulse is generated by the Trigger circuit and applied to the Time-Base Generator.

Three sources of triggering signal may be selected for the Trigger circuit by the front panel TRIGGERING SOURCE switch. These are: Internal (Vertical Trigger Pickoff circuit), External (TRIGGER INPUT connector) and Line frequency. Selection of the triggering signal amplitude and slope are additional features of this circuit.

The Time-Base Generator provides accurately calibrated linear ramp voltages for the horizontal deflection system, unblanking for the CRT and output waveforms to the + GATE OUT and SAWTOOTH OUT front panel connectors.

The Delay Pickoff circuit generates a delayed trigger pulse to arm or trigger Time-Base A when the HORIZONTAL DISPLAY switch is in either the 'A' DLY'D BY 'B' or 'B' INTENSIFIED BY 'A' positions.

With the HORIZONTAL DISPLAY switch in the 'B' INTENSIFIED BY 'A' position, the delayed Time-Base A unblanking gate is applied to the CRT to intensify a segment of the B sweep.

The delayed trigger pulse is also fed to the front panel DLY'D TRIG connector.

The Horizontal Amplifier input signal is selected from either of the two Time-Base Generators or the External Horizontal Amplifier. The selected signal is split in phase and amplified to provide push-pull drive to the horizontal deflection plates of the CRT.

The CRT circuit contains the high voltage power supply for the CRT, intensity modulation circuit to unblank the CRT and an AC coupled external input connection to externally modulate the CRT cathode.

The Calibrator provides a calibrated square-wave output of 18 ranges from 0.2 mVOLTS to 100 VOLTS. Risetime and amplitude accuracy is adequate for most applications in calibrating deflection factors or to compensate probes.

CIRCUIT DESCRIPTION

Reference is made in this description to the circuit schematics in the diagram section (Section 9) of the manual as well as simplified drawings in this section. We suggest the reader pull out the particular circuit page that is applicable when reading this description.

Low-Voltage Power Supply

The Low-Voltage Power Supply in the Type 585A (see Power Supply schematic diagram) consists of seven interrelated supplies that operate together as a system. This system delivers regulated and filtered voltages of +12.6, —150, +100, +225, +350 and +500 volts as well as an unregulated DC voltage of 325 volts. A common power transformer, T601, supplies the input power to each of the supplies, as well as heater power to thermal time-delay relay K600 and the tubes in the oscilloscope. Unless otherwise specified, the Type 585A is shipped with T601 wired for 117-volt AC input. A connection diagram on the side of the transformer shows alternative connections for other input line voltages.

The 117-volt AC input power is applied to T601 through POWER ON switch SW601. Overload protection is provided by fuse F601. Thermal cutout TK601 in the primary circuit of T601 opens the transformer primary circuit if the temperature inside the oscilloscope rises above a safe level. TK601 resets automatically when temperature returns to normal, and to shorten the cooling time, the fan continues to run while TK601 is open (except when T601 is connected for 220-, 234-, or 248-volt operation). Thermal time-delay relay K600 provides a filament warm-up time of approximately 30 seconds before the DC power supplies are activated. The heater of K600 is rated at 18 volts and is connected to 20 V DC from the regulated heater supply winding. During heater warm-up time, contacts 4 and 9 of K600 remain open. At the end of heater warm-up time, contacts 4 and 9 close and apply power to magnetic relay K601. Contacts K601-1 remove the heater power from K600, but before K600 can open, contacts K601-1 lock the holding circuit to the coil of K601. K601 now remains energized until the power to the oscilloscope is switched off or otherwise interrupted. When K601 is energized, contacts K601-2, K601-3, K601-4, K601-5 and K601-6 are also closed and activiate their respective DC supplies.

—150-Volt Supply

The —150-volt supply in the Type 585A is the reference voltage source for the other power supplies; therefore it must be very stable. The supply contains a high-gain electronic voltage regulator designed to provide the required regulation under all operating conditions. This regulator circuit contains three series regulator tubes, a gas voltage regulator tube for the reference source to the comparator, and an error signal amplifier to control the series regulator.

Four silicon diodes D642, A, B, C and D form a bridge rectifier across pins 6 and 11 of transformer T601 and supply the voltage to the —150-volt regulator circuit when contacts of K601-2 close.

Current through the series regulator tubes V627, V637 and V647 is controlled by the output voltage of V634, the error voltage amplifier.

A portion of the —150-volt supply is applied through the DC voltage divider network R617, R616 and R615 to the grid of V624, the voltage comparator. This voltage is compared against the reference voltage established by V609 at the grid and cathode of V624A and applied to the grid of V634 as an error signal.

The —150 Adj control R616 determines the percentage of total output voltage that appears at the grid of V624B, and thus the total voltage across the divider. This control is adjusted so that the output voltage is —150 volts.

The regulator circuit can never completely compensate for changes in output voltage because there must be an error input for the circuit to operate. However, any error in output is reduced by a factor equal to the loop gain of the regulator circuit.

The screen grid of V634 is used as a signal grid for injecting a sample of ripple or transient voltage present in the unregulated side of the —150-volt supply into the regulator circuit. The regulator circuit thereby becomes a dynamic filter for ripple reduction. The ripple signal applied to the screen of V634 is amplified, inverted and applied to the grids of regulator tubes. The amplified and inverted ripple at the grids is of proper amplitude and phase to effectively reduce the ripple appearing at the output.

+100-Volt Supply

Reference for the +100-volt supply is a voltage located at a point near ground potential obtained from the divider R650-R651. V664 essentially compares the reference voltage to ground. Any voltage change at the +100-volt output is amplified and inverted in polarity by V664 then applied to the grid of series regulator V677A correcting the output voltage. Capacitor C650 improves the AC gain of this circuit to reduce any ripple.

Here again the screen grid of V664 is used as a signal grid for injecting a sample of any ripple or transient voltage present in the unregulated side of the +100-volt supply into the regulator circuit. The ripple signal applied to the screen of V664 is amplified, inverted and applied to the grid of V677A.

+225-Volt Supply

The +225-volt supply source is the secondary windings between terminals 5 and 10 and terminals 7 and 14 of T601, part of a two-voltage supply. Diodes D702A and B serve as full-wave rectifiers for the +225-volt supply, with their center lead connected to the +180-volt unregulated supply. Voltage from the full-wave rectifier system adds to the +180-volt unregulated output to provide sufficient voltage for the +325-volt unregulated bus and +225-volt regulated supply.

Reference for the +225-volt supply is a voltage potential near ground, obtained from the divider R680-R681. V684A essentially compares the reference voltage to ground. Any voltage error signal from the comparator side of V684 is cathode-coupled to the amplifier section. The amplified error signal is applied to the grid of V694, which again amplifies and DC couples the inverted error signal as bias to the grids of the series regulator tubes V737A and V737B. The bias of the series regulator tubes sets the current through the power supply and the voltage output. Here again, the screen of the error amplifier is acting as an injection grid for ripple reduction.

+350-Volt Supply

The +350-volt supply source is at the common connection between diodes D732A and B. These diodes are part of a full wave bridge rectifier system.

The negative lead of the +350-volt rectifiers is connected to the +180-volt unregulated bus of the +100-volt power supply. Thus both the +225-volt and +350-volt regulated supplies are elevated to the +180-volt unregulated bus.

Reference for the +350-volt supply is a voltage located near ground potential, which is obtained from the divider R710-R711. V724 compares the reference voltage to ground. The operation of the regulated circuit is the same as the +100-volt supply.

+500-Volt Supply

Rectified voltage from terminals 20 and 21 of T601 is added to the regulated side of the +350-volt bus to furnish power for the +500-volt regulator. Reference for the 500-volt supply is a voltage potential near +350 volts, obtained from the divider R740-R741. V754 compares this voltage to the +350-volt supply. The regulator action of this circuit is the same as that described for the +100-volt supply.

+12.6-Volt Supply

A transistorized +12.6-volt DC regulated voltage is supplied for use within plug-in units and for the heaters of the Vertical Amplifier in the Type 585A Oscilloscope.

Rectified voltage from terminals 33 and 34 of T601 is used both by the time-delay relay K600 with K601, and by the +12.6-volt regulator.

Reference voltage for the +12.6-volt supply is at the center point of five resistors in series-parallel between the +100-volt supply and ground, R781A and B, R782, R783, and R785 (+12.6 V Adj). The reference voltage is directly applied to the base of Q774 to set the forward bias and compare it to the +12.6-volt bus. Emitter follower Q793 provides the current gain to correction signals amplified by Q774, and controls the collector-to-emitter bias of Q797 to maintain a regulated voltage at the +12.6-volt output.

To enable the +12.6-volt supply to sufficiently warm tube heaters before the time-delay relay energizes, a turn-on

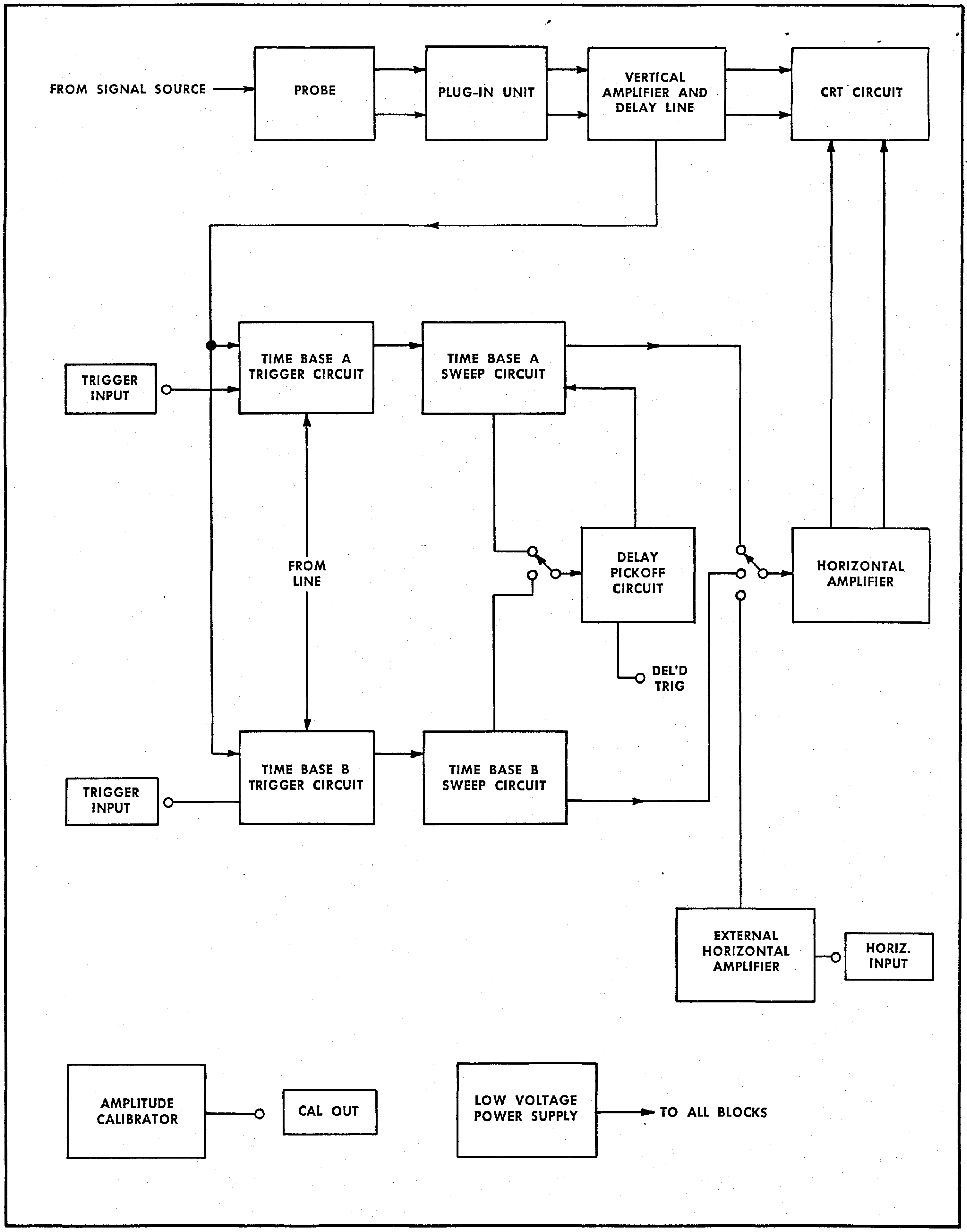


Fig. 3-1. Type 585A Oscilloscope simplified block diagram.

voltage is applied to the base of Q774 via R780 from the +180-volt unregulated supply.

Diode D793 is a protective device for the power transistors in the event Q774 is removed from its socket. Diode D793 clamps the base of Q793 to the +20-volt unregulated supply. Otherwise the base of Q793 would rise toward the +100-volt unregulated bus.

VERTICAL DEFLECTION SYSTEM

The vertical deflection system for the Type 585A contains an input amplifier, delay line driver, a 186-Ω balanced delay line, a trigger pickoff circuit and an output amplifier driving six pairs of distributed vertical deflection plates in the CRT. See Fig. 3-2.

The delay line driver and output amplifier are balanced push-pull stages that provide uniform amplification of the phase inverted signals from the Plug-In amplifier unit.

The input DC level to the vertical circuit is standardized at approximately 50 volts. The bandwidth of the vertical amplifier is from DC to 85 MHz or better when used with a wide band preamplifier such as the Type 82 or 86 units. Any of the 80 series plug-in units can be used to drive the vertical amplifier or by use of the Type 81 Adapter, any Tektronix letter or 1 series plug-in units may be used.

Vertical Amplifier Delay Line Driver

The delay line driver for the vertical amplifier consists of a seven-section push-pull stage connected as a balanced distributed amplifier. Push-pull signals from the preamplifier unit are applied to the distributed amplifier through toroidal transformer T1014, which helps stabilize the amplifier and prevent common mode oscillations.

Both the grid and plate lines are m-derived low pass filter sections with the delay time per section being the same in each line.

Each section of the distributed amplifier is driven progressively, as the input signal travels down the line. When the first section receives a signal from the grid lines, energy from the plate circuits starts a wave front down the plate lines toward the delay line. With the delay times of the plate and grid lines equal, this wave front will reach the plate terminal of the second section simultaneously with the arrival of the signal at the grid terminal of this section. Energy from the plate circuit of the second section is fed into the plate line to add to the wave energy from the first section. Thus the amplitude of the wave front is doubled at this point. This action is continued as grid and plate line wave fronts move down their respective lines, with each plate circuit adding its energy to the wave front on the plate line at the proper time. The wave at the output of the distributed amplifier (plates of V1074), is the result of the addition of the amplification of each of the individual sections of the amplifier stage. This wave then travels down the delay line to the output amplifier and vertical plates of the CRT.

The plate line is a 186-Ω balanced line that is terminated at each end. The reverse termination network R1008-R1011, R1009-R1012 and R1007-C1006 is adjustable so the termination at the output end of the line requires no adjustment.

Current and voltage is supplied to the plate and grid lines at the output end.

DC shift compensation is provided at the input end of the plate line. R1004, C1004 and R1005 comprise the compensating time constant to effectively eliminate most of the DC shift in the amplifier.

Gain of the circuit and the overall gain of the vertical amplifier is controlled by R1015 which controls the cathode bias.

Amplifier stabilization involves many details which are not required for lower bandwidth systems. Toroid transformers T1046 and T1014 in the plate and grid lines provide phase correction and prevent common mode oscilla-

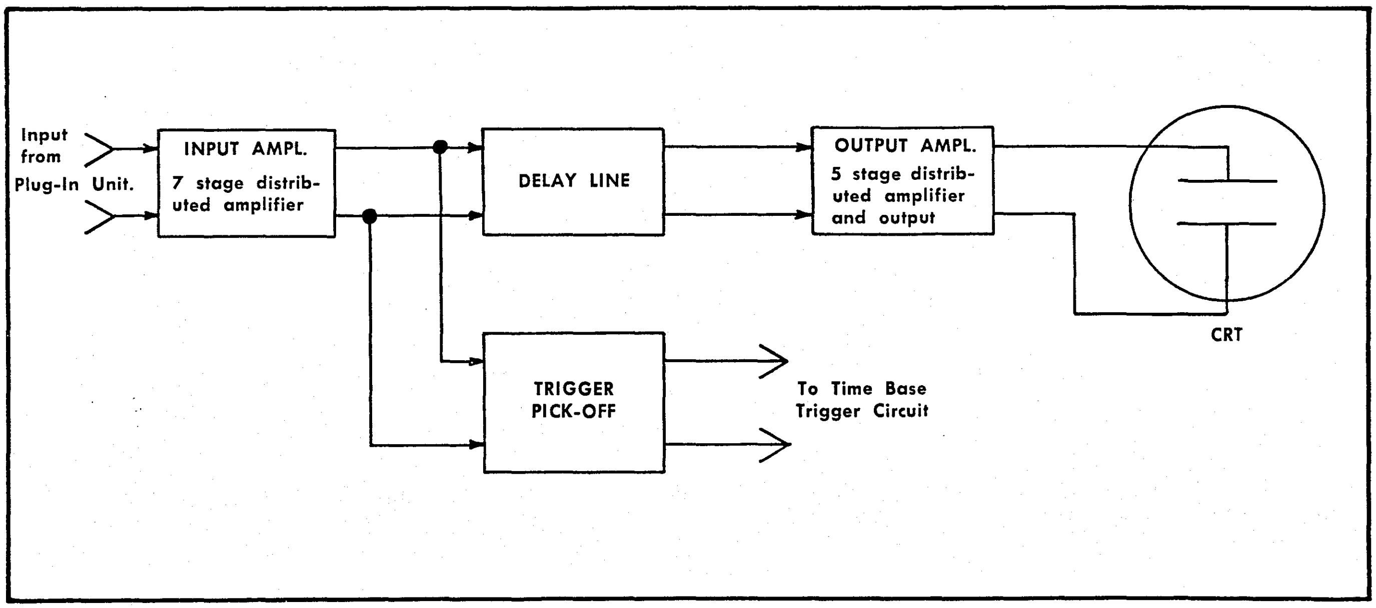


Fig. 3-2. Functional block diagram of the vertical deflection system.

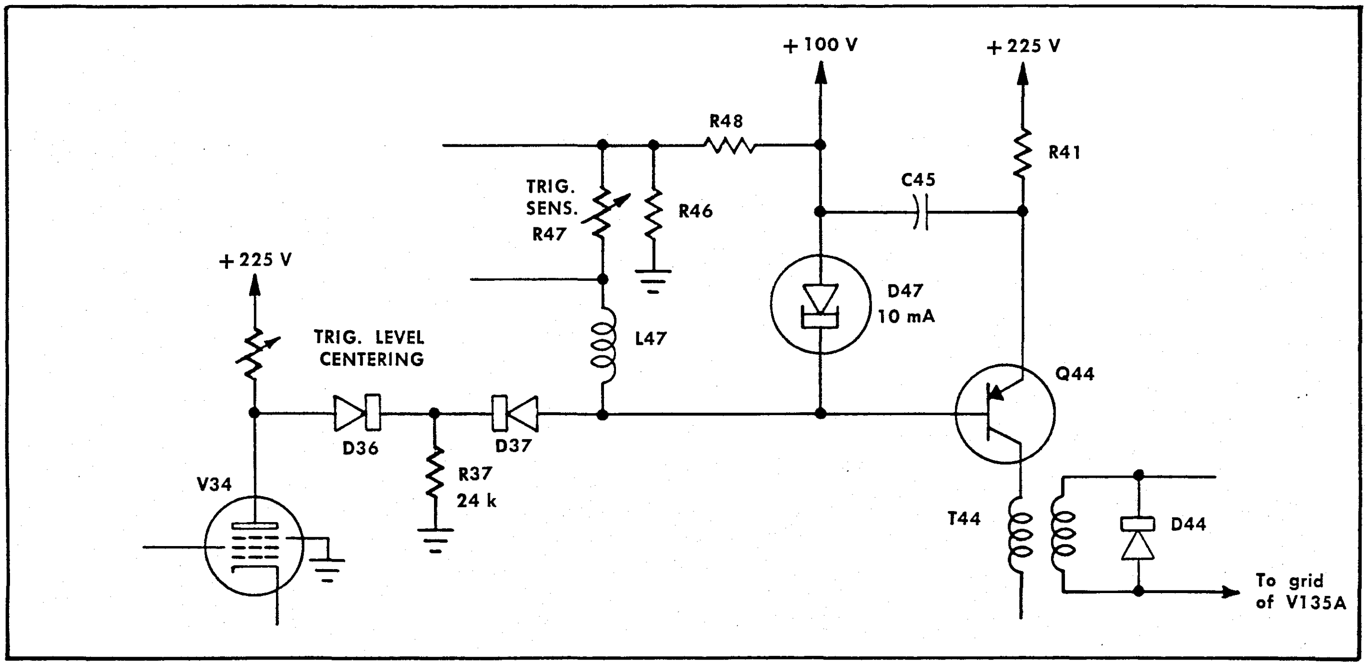


Fig. 3-3. Tunnel diode Trigger Regenerator diagram.

tion. Additional stabilization is provided by neutralizating capacitors in each section with the capacitor for the fourth section adjustable to permit compensation of minor differences in tube and stray capacitance. A ferrite bead placed around one of the cathode coupling capacitor leads (for example L1013) reduces tendency towards oscillation in the cathode lines. The shield between the triode halves of each 6DJ8 is grounded through a 150-Ω resistor to reduce shield Q at high frequencies.

Trigger Pickoff

Output vertical signals from the distributed amplifier are T-coil coupled to the grids of push-pull amplifier V1084-V1094, which drives cathode followers V1083A and V1093A. Output from the cathode followers is fed to the Time-Base Trigger circuit through the SOURCE selector switch SW10 to a differential amplifier V1083B and V1093B. Any DC differential between the output of the cathode followers unbalances the differential amplifier and drives the beam positioning indicators B1088 and B1098 to indicate to the operator the relative vertical position of the beam. Bandwidth for the trigger pickoff circuit is greater than the overall bandwidth of the vertical amplifier system and provides triggering beyond the —3 dB point of the amplifier.

Vertical Amplifier Output Stage

This stage is a distributed amplifier similar to the delay line driver. Each stage has an adjustable compensating capacitor between opposing plates that is adjusted for optimum transient response through the amplifier. Toroidal pulse transformers T1214 and T1284 are phase correction transformers for the grid and plate lines of the distributed amplifier. C1261 is an adjustable compensation capacitor across the input to T1284. The plate line L1214-L1224 is reverse terminated into R1208-R1212, and R1209-R1214. C1209 is adjusted for minimum line reflections.

The output of the distributed amplifier plate line drives a push-pull power amplifier stage V1274-V1284 which supplies the current to drive six pairs of distributed vertical deflection plates in the CRT. This arrangement of distributed deflection plates in the CRT increases the sensitivity and reduces the effective capacitance between plates. The distributed plates are designed so the velocity of the waveform through the line is essentially equal to the velocity of the electrons passing between the plates.

Vertical centering is accomplished by adjusting control R1294 for DC dynamic balance across the two sets of deflection plates. R1293 provides a resistance termination adjustment at the distributed deflection plates of the CRT.

TIME-BASE A CIRCUITS

A Trigger Circuit

The trigger circuit provides a constant amplitude negative going output pulse which switches the sweep-gating multivibrator in the Time Base Generator.

The trigger circuit consists of a difference amplifier driving a tunnel diode trigger generator. By means of complex switching and control adjustment the circuit can be made to function over a wide range of modes and input trigger signals from DC to high frequency AC.

The TRIGGERING SOURCE switch SW10 selects both the method of coupling and the input triggering signals from, an external source, the trigger pickoff in the vertical amplifier or from the power transformer for line triggering.

This selected signal is then applied through the TRIGGER SLOPE switch to the trigger difference amplifier. The posi-

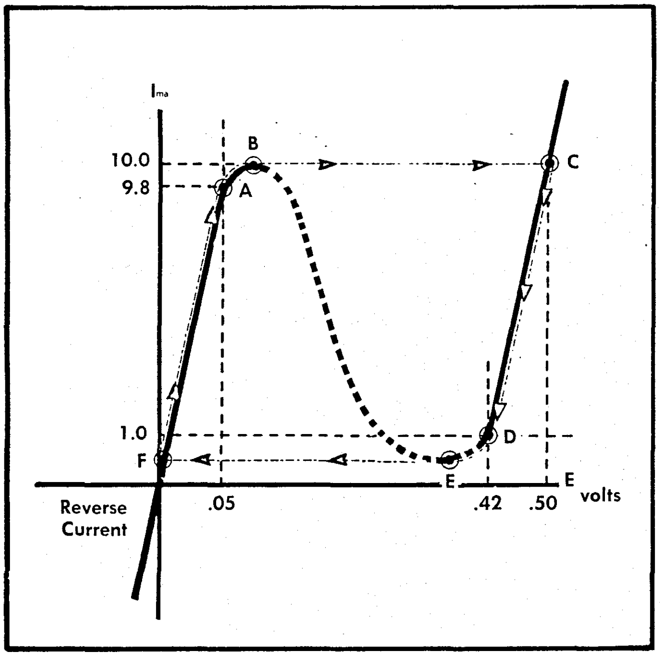


Fig. 3-4. Tunnel diode characteristics curve.

tion of this switch (+ or —) determines which grid of the difference amplifier receives the triggering signal.

TRIGGERING LEVEL control R17 is connected through the TRIGGER SLOPE switch to the opposite grid from the signal section of the difference amplifier V24-V34. The control establishes a DC level on this section that the triggering signal must overcome before the circuit will function. Triggering is therefore a function of signal amplitude and slope.

The trigger difference amplifier operation controls the the current through the tunnel diode D47.

In the quiescent state, tunnel diode D47 is operating somewhere between its low state and threshold. Resting current through the tunnel diode is the summation of the current through R46, R47, L47 and the current through R37 and D37. The current through R46 is 20 mA. With the Trigger Sensitivity control R47 set to midrange, the current through R46, R47 and L47 is approximately 7 mA. The remaining 13 mA is carried by R48 (see Fig. 3-3).

Current through D37 is controlled by the Trigger Difference Amplifier and switching diode D36. With the TRIGGERING LEVEL control R17 adjusted so V34 is cut off, the plate potential of V34 is approximately +100 volts and diode D36 is turned on. Approximately one-half of the 4 mA flowing through R37 is diverted through D36 to the +100-volt line and the plate supply voltage for V34.

If the plate current of V34 is increased by the action of a triggering signal on its grid, or the TRIGGERING LEVEL control is adjusted so current through V34 increases, the plate voltage of V34 will drop sufficiently to disconnect diode D36. All the current through R37 will now flow through D37 and the tunnel diode. This increased current, shifts the TD to its high state and generates a fast-rise negative pulse at the base of transistor Q44.

Operation of the tunnel diode (TD) D47 depends on its dynamic characteristics which are illustrated in Fig. 3-4.

The tunnel diode static operating point is represented by point A and is established when the TRIGGERING LEVEL control is at 0. (The grid voltages of V24 and V34 are both at ground potential.)

If the plate current of V34 is increased by either the application of a signal to the trigger difference amplifier or by rotation of the TRIGGERING LEVEL control, the tunnel diode current can be increased to point B on Fig. 3-4. It will then switch at a very rapid rate to point C. The high impedance to high frequencies of L47 permits the tunnel diode to switch to point C rather than to some lower current portion of the curve between points C and D. As current through L47 changes, the current of the tunnel diode slowly drops to point D.

If the plate current of V34 is held constant, the tunnel diode current will remain at point D. By rotating the TRIGGERING LEVEL control or by the application of a signal, the tunnel diode current can be reduced to point E where it will again switch rapidly to point F. L47 again has a voltage generated across it; however, the L/R time constant soon allows the tunnel diode current to return to point A.

The trigger generator output signal is an almost rectangular waveform of approximately 0.5 volt peak-to-peak. It is DC coupled to the base of the trigger amplifier Q44, where it is inverted and amplified. The amplified signal from Q44 is coupled to the sweep-gating multivibrator through the small toroidal pulse transformer T44. T44 inverts and differentiates the tunnel diode waveform such that negative triggering pulses of about 7 volts are applied to the sweep-gating multivibrator in the Time-Base Generator. Diode D44 reduces the positive voltage excursion of output voltage to prevent triggering jitter. Capacitor C44 provides a low impedance path to ground for the triggering pulse on the DC grid return line.

Time-Base Generator A

The Time-Base A Generator consists of four main circuits: the sweep-gating multivibrator, the Miller runup circuit, the holdoff circuit and the lockout multivibrator. See Fig. 3-5.

Negative-going trigger pulses from the trigger circuit initiate the action of the sweep-gating multivibrator, which generates a positive-going gate to unblank the CRT and a negative gate to cut off the disconnect diodes V152A and B. When the disconnect diodes open, the Miller runup circuit starts to generate a positive-going ramp voltage for the horizontal sweep circuit. A portion of the output ramp voltage is fed back through a Sweep Length control and the hold-off circuit to the grid of the input sweep-gating multivibrator. When the amplitude is sufficient it overcomes the bias of V135A and flips the multivibrator back to its quiescent state which terminates the sweep.

The following circuit description assumes a quiescent state just before the application of an incoming trigger pulse. V135A is conducting.

If the STABILITY control R110 or PRESET ADJUST R111 is advanced, the grid of V135A will become progressively more negative through the cathode follower action of V125,

Ⓓ

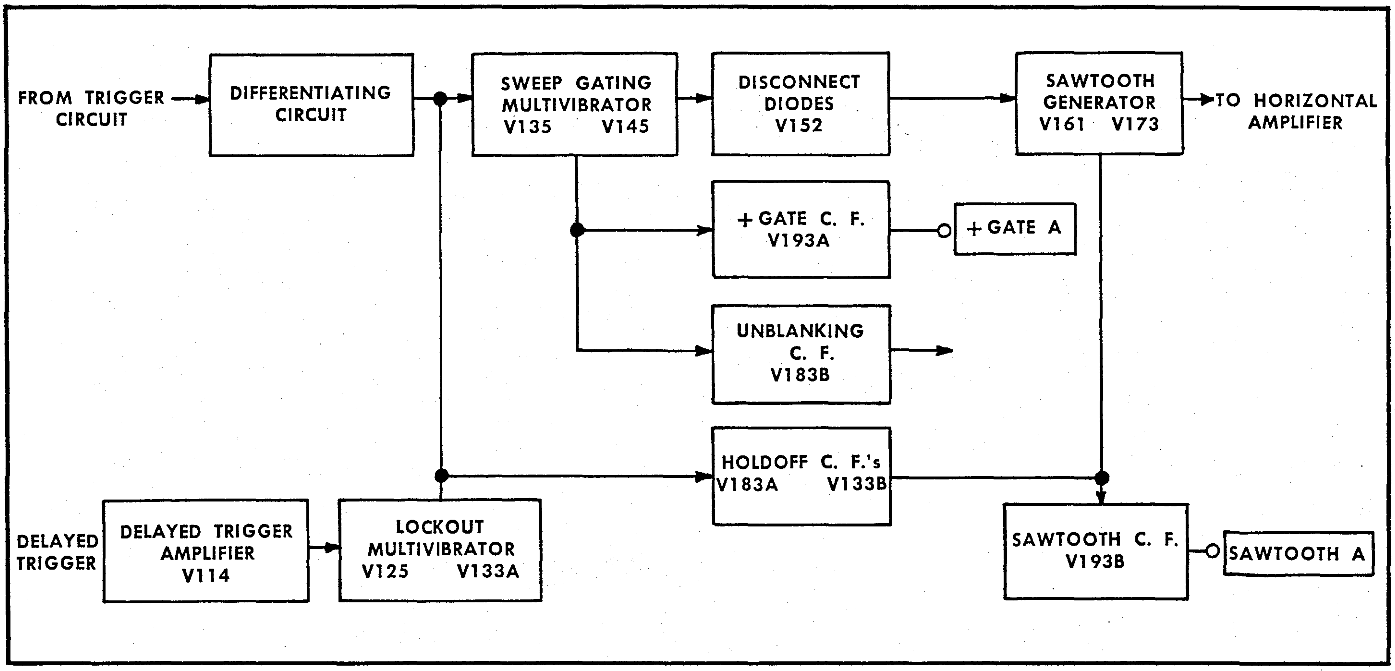


Fig. 3-5. Time Base Generator A block diagram.

until a point is reached at which a negative-going triggering pulse will drive V135A into cutoff.

When V135A is driven to cutoff, its plate voltage rises, carrying with it the grid of cathode-follower V135B. V135B isolates the positive-going plate of V135A from the capacitance of the loads requiring a positive-going pulse. This provides a fast-rise positive-going pulse at the plate of V135A.

The cathode of V135B is long-tailed through R141 and R143 and closely follows the action of the grid. C141 connected in parallel with R141 compensates for the input capacitance of V145 and speeds up the positive step to the grid of V145.

The positive voltage step at the cathode of V135B drives the grid of V145 above cutoff. Its plate voltage drops rapidly and abruptly drops the voltage on the plates of the disconnect diodes. Both diode sections of V152 disconnect and the runup action of the Miller circuit is initiated. Any spiking of the sweep-gate output waveform is attenuated through the series RC filter network C150-R150.

The Miller runup circuit is essentially a class A amplifier employing negative feedback. The positive-going voltage at the plate of the Miller tube is fed back to its grid through runup cathode follower V173 and opposes the negative-going action at the grid. Because the gain of the Miller runup tube is high, (approximately 200) it is possible to maintain an essentially linear rate of charge on the timing capacitor C160.

In the quiescent state, the voltage at the plate of the Miller runup tube is determined by the voltage drop across the DC network formed by neon lamp B167, the runup cathode follower and the disconnect diodes. This DC network establishes a voltage at the plate so the tube operates above the knee, and hence over the linear region, of its characteristic curve.

The grid of Miller runup tube V161 is returned to the —150-volt supply through timing resistor R160. In the quiescent state, the tube is held above cutoff by the current through the disconnect diodes. Current through the A section establishes the plate potential on the B section, which sets the quiescent grid voltage of V161. When the disconnect diodes stop conducting, the grid of the Miller runup tube tends to swing towards —150 V through R160.

The negative shift on the grid causes the plate to become more positive. This positive-going excursion of the plate carries the grids of runup cathode follower V173 with it. The grid voltage of V173 is maintained at a constant difference with respect to the Miller runup tube plate voltage by the voltage drop across neon bulb B167. C167 with R168 connected around B167 improve the risetime characteristics.

A bootstrap capacitor C165 connected between a tap on the Miller runup tube plate load and the cathode of V173 bootstraps the charging rate of the stray circuit capacitance in the tube plate circuit. Its action is most important when generating fast sweep rates.

The cathode output voltage of V173 is a linear voltage ramp that is coupled to the grid of the Miller runup tube through C160 in a phase direction that offsets the tendency of the grid to swing negative.

The timing capacitor C160 charges through timing resistor R160. Since the voltage across the timing resistor is virtually constant, a constant current source is provided to charge the timing capacitor.

Diode D152 in series with the B section of the disconnect diode V152 and the Miller runup tube grid, improves the leakage characteristics of the disconnect diode.

The voltage ramp at the cathode of V173 is applied back to the input of the sweep-gating multivibrator and causes the circuit to revert to its quiescent state. This sawtooth voltage is applied to the grid of V183A through Sweep Length control R176. R176 is adjusted for a sweep length that terminates after it has passed the right-hand limit of the graticule. It adjusts the voltage and the amplitude of signal on the grid of V183A and consequently on the cathode and holdoff capacitor C180. This voltage is then applied through cathode follower action of V133B to the grid of V135A and when the grid becomes positive enough to bring the tube out of cutoff, the multivibrator flips and the sweep is terminated.

The value of C180 is such that its charge will hold the grid of V133B above cutoff long enough to permit circuit capacitances in the Time Base Generator to discharge to their quiescent level.

The positive voltage step at the cathode of V135A is applied through cathode follower V183B to the grid circuit of the CRT. This positive step unblanks the CRT during the sweep time, permitting the left to right motion of the CRT beam to be seen. The end of the unblanking pulse coincides with the sweep duration, so the CRT is blanked during the retrace portion and during quiescent period of the Time Base Generator. Cathode follower V183B isolates the CRT circuit from the sweep-gating multivibrator.

The output sweep from the runup cathode follower V173 is applied through an isolation cathode follower V193B to the SAWTOOTH OUT connector which provides access to a sawtooth waveform at the front panel.

The positive pulse that is applied through V183B for unblanking is also applied through cathode follower V193A to the + GATE OUT front panel connector.

Lockout Multivibrator Operation

The Lockout Multivibrator (V125 and V133A) operates when the HORIZONTAL DISPLAY switch is in one of three positions: A SINGLE SWEEP, 'A' DLY'D BY 'B' and 'B' INTENSIFIED BY 'A'. Operation of the circuit is described for A SINGLE SWEEP mode, the other two positions are variations of this mode.

A Single Sweep. With the HORIZONTAL DISPLAY switch in this position, plate voltage is applied to V133A and it operates in conjunction with V125 as a bistable multivibrator. After the Time-Base Generator has completed a sweep, V125 is cut off and V133A is conducting. In this state the divider between the plate of V125 and the grid of V133A sets the cathode voltage of the Lockout Multivibrator, which in turn sets the grid voltage of V135A. The Lockout Level R125 is adjusted to set the grid of V135A positive enough so the sweep-gating multivibrator cannot be triggered. This locks out the sweep.

Depressing the front panel RESET button grounds the junction of R102 and R101 which generates a positive-going pulse that is coupled through C103 to the grid of V114. The resultant negative pulse at the plate of V114 is applied to grid of V133A and drives the Lockout Multivibrator into its other state, with V125 conducting and V133A cut off. Plate voltage of V133A will rise and light the READY neon and with V125 conducting, the STABILITY control regains control over the grid voltage level of V135A.

Depending on the adjustment of the STABILITY control, a sweep can now be produced in one of two ways. If the STABILITY control is turned fully clockwise, the grid of V135A will be pulled down, causing the sweep-gating multivibrator to switch to its other state and initiate a sweep. Or, if the STABILITY control is adjusted for triggered operation, the sweep will be initiated by the first negative trigger pulse on the grid of V135A.

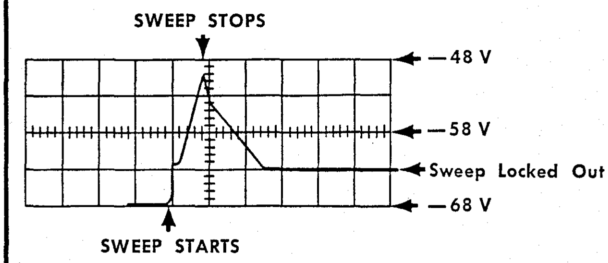


Fig. 3-6. Single sweep waveform showing voltage changes at grid of V135A.

As the sweep begins, the rising sawtooth voltage pulls up the cathode of V133B by the holdoff action previously described. As the cathode of the lockout multivibrator follows the cathode of V133B up, V125 cuts off and V133A conducts. As the cathodes continue to rise (following the rise in the sawtooth sweep voltage) V133A cuts off again. Both tubes are then held cut off for the remainder of the sweep and the READY lamp stays on. When the grid of V135A rises to the point at which the sweep-gating multivibrator reverts, the sweep is terminated.

As holdoff capacitor C180 discharges, the cathode voltage of the lockout multivibrator starts to decrease. V133A conducts before V125 and the READY neon goes out. V125 is held below cutoff by V133A. A new sweep cannot be initiated until another reset pulse resets the circuit.

'A' DLY'D by 'B'. With the HORIZONTAL DISPLAY switch in this position, the Lockout Multivibrator (V125 and V133A) operation is the same as it was in single sweep operation. The reset pulse for the circuit is now applied to the grid of V114 from the delay pickoff circuit. A positive pulse is applied each time the Time-Base B circuit generates a sweep. Time-Base A generator will operate after some period of time set by the B TIME/CM OR DELAY TIME control setting, multiplied by the DELAY-TIME MULTIPLIER 1-10 dial reading. The sweep displayed on the CRT is that of Time-Base A Sweep Generator.

'B' INTENSIFIED BY 'A'. When the HORIZONTAL DISPLAY switch is in this position, the operation of the Lockout Multivibrator is the same as 'A' DLY'D by 'B' mode. The horizontal amplifier, however, receives the Time-Base B sweep. Time-Base A unblanking signal is applied to the CRT and appears as an intensified portion of the display where the delayed Time-Base A sweep occurs. See Fig. 3-7.

Alternate Trace Sync Pulse. Synchronizing pulses for alternate-trace plug-in preamplifiers are supplied via D142 and the differentiating network C154-R154. Only positive pulses are used by the plug-in unit alternate trace switching circuitry.

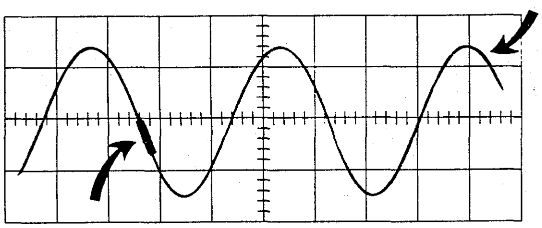


Fig. 3-7. 'B' INTENSIFIED BY 'A' operation.

The quiescent voltage at the junction of D142 and C154 is approximately —3 volts. When the Sweep-Gating Multivibrator switches, V145 plate voltage drops to about —7.5 volts, D142 conducts and charges C154. The charge on C154 stabilizes at about —7.5 volts until the Sweep-Gating Multivibrator terminates the sweep. At this time, the plate of V145 rises very rapidly which opens diode D142 and disconnects the capacitance of the dual trace switching circuitry. The resultant positive output pulse switches the alternate-trace feature of the plug-in unit. (See the instruction manual for the alternate-trace plug-in unit.)

Time Base B Circuits

Triggering signals may be selected from the line voltage source, Trigger Input connector or the vertical amplifier trigger pickoff circuit. The trigger signal is compared by a difference amplifier with an adjustable DC voltage triggering level. The output signal from the difference amplifier is applied to the trigger multivibrator, which is a monostable Schmitt multi that generates a constant amplitude negative output pulse to trigger the B sweep-gating multivibrator and initiate a sweep from the Sweep Generator circuit.

The sweep circuit is basically a Miller run-up circuit that generates a linear voltage ramp for the horizontal deflection system. The Sweep Generator also provides alternate trace sync pulses, unblanking pulses for the CRT and a gate pulse to the front panel + GATE B connector.

Time-Base B Trigger

TRIGGERING SOURCE switch SW60 selects the triggering signal source and the mode of coupling. INT AC position provides triggering capabilities from approximately 15 Hz to 5 MHz. INT AC LF REJ position attenuates the trigger signal below 15 kHz to provide low frequency trigger signal rejection.

Slope or polarity of the triggering signal is set by the TRIGGER SLOPE switch SW70. The level amplifier provides a negative-going pulse to the Schmitt multivibrator. The input amplifier V74 is a cathode coupled comparator that compares the level of voltage set on one of its sections by the TRIGGERING LEVEL control with the level of the selected input trigger signal on its other section.

The TRIGGER SLOPE switch selects the section of V74 that receives the trigger signal or the DC reference voltage set by the TRIGGERING LEVEL control. This input amplifier provides a negative-going pulse, when the plate of V74B swings negative to the grid of V95A. Both sections of V74 share the current through the cathode resistor R79. The Trig Level Centering control is adjusted, with the TRIGGERING LEVEL control centered (0 volts on the grid), so the current through each section of V74 is balanced. The balance point is the only point where the TRIGGER SLOPE switch can be switched from + to — position without changing the current division through the tubes.

The trigger multivibrator V95 is a Schmitt multivibrator that switches when the plate voltage of V74B drops and generates a relatively constant negative gate output pulse to trigger the sweep generator circuit. The multivibrator resets to its quiescent state after the plate voltage of V74B returns to its positive value.

Time-Base B Sweep Generator

Time-Base B sweep linearity tolerance is such that more gain is required from the Miller run-up circuit than that required for the Time-Base A circuit. The increased gain is obtained through the use of a higher-value plate load resistor for V261.

The output sawtooth voltage of Time-Base B Generator is directly coupled to the HORIZONTAL DISPLAY switch. Synchronizing pulses for alternate-trace plug-in preamplifiers are supplied from the screen grid circuit of V245. As the plate current of V245 increases or decreases, the screen voltage also varies across L249. The output pulse is applied through the HORIZONTAL DISPLAY switch only when the switch is in the B or 'B' INTENSIFIED BY 'A' positions to the plug-in unit through the interconnecting plug.

The output sawtooth voltage of Time-Base B Generator is applied directly to the HORIZONTAL DISPLAY switch. The Delay Pickoff circuit receives the B sawtooth ramp in all positions except Time-Base A and 'A' SINGLE SWEEP. The Horizontal Amplifier receives the sawtooth with the display switch in Time-Base B and 'B' INTENSIFIED BY 'A' positions.

The unblanking C. F. V293A output is applied through the HORIZONTAL DISPLAY switch to the CRT circuit in the Time-Base B and 'B' INTENSIFIED BY 'A' positions. The signal rises to about 93 volts to gate the CRT beam on during a sweep. Note that the unblanking pulse amplitude is about 15 volts lower in amplitude than the unblanking pulse of Time-Base A generator. This difference permits the Time-Base A generator unblanking pulse to brighten a portion of the trace to indicate 'B' INTENSIFIED BY 'A' operation.

Horizontal Amplifier

The Horizontal Amplifier converts the single-ended sawtooth output from the Time-Base Generators into a push-pull signal suitable for driving the horizontal deflection plates of the CRT. The gain of the amplifier may be varied by a factor of five with the MAGNIFIER switch. Controls are also provided for horizontal positioning.

The sawtooth waveform from the Time-Base Generator is coupled to the input cathode follower through an RC network which attenuates the input signal and provides adjustable compensation with C330 to the input circuitry to obtain optimum frequency response.

The HORIZONTAL POSITION and VERNIER controls vary the DC level on the grid of V343A. This alters the DC level on the signal path through the amplifier and changes the average DC voltage level applied to the CRT horizontal deflection plates which shifts the horizontal position of the trace.

Signal coupling between the input cathode follower and the driver cathode follower is through the MAGNIFIER switch. With the 5× MAGNIFIER switch in the OFF position, the signal from the input cathode follower is attenuated by a factor of five through the network of C348 in parallel with the series combination of R348 and R349. The Swp Cal R348 adjusts the length of the sweep by varying the amplitude of the sawtooth applied to the grid of V343B and compensation is provided with variable capacitor C348. It is adjusted for optimum linearity of the sweep. To magnify the sweep, the network is removed by switching the 5X MAGNFIER switch to the ON position.

The gain of the Horizontal Amplifier is controlled by negative-feedback. A portion of the signal at the left-hand deflection plate is fed back to the input of the driver cathode follower V343B. Norm/Mag Regis R358 establishes the DC voltage applied to the feedback loop.

By changing the DC voltage level at this point the starting position of the unmagnified sweep can be adjusted so it corresponds with the starting position of the magnified sweep in the center of the graticule.

The cathodes of the output amplifier tubes V364A and V384A are connected through a degenerative network which includes the Mag Gain Adj R375. The Mag Gain R375 is adjusted when the 5× MAGNIFIER switch is in the ON position. C372 in parallel with the Mag Gain is a linearity adjustment for very fast sweep rates.

The output signal from the paraphase amplifier (output amplifier) drives the output cathode followers. Cathode followers are used to provide the current drive for the capacitance of the horizontal deflection plates and stray circuit capacitance. To help apply the high current required at high sweep rates, V398 is connected in a cascode configuration with V364B. Plate current of a pentode remains fairly constant even when the plate voltage decreases. A flat-topped pulse, derived by differentiating the positive going sawtooth from the cathode of V384B through C390 and R390, is applied to the grid of V398 to boost current output during the sweep or trace period. The amplitude of this flat-topped pulse is proportional to the sweep rate; therefore, more current boost is provided as the sweep rate is increased.

Bootstrap capacitors C364 and C384 help supply the charging current for the plate circuits of V364A and V384A respectively at fast sweep rates.

Beam-Position Indicators. The beam-position indicators B397 and B398 located on the front panel above the CRT, indicate the relative horizontal position of the beam. When the beam is centered horizontally, the potential across either neon is insufficient to light it. As the beam is positioned left or right of center on the CRT, the voltage across the neons will change, causing one neon to light. The lighted neon indicates the beam direction.

External Horizontal Amplifier. With the HORIZONTAL DISPLAY switch SW301 in either the EXT ×1 or ×10 position, an external signal can be applied through the HORIZ INPUT connector to an auxiliary amplifier V314. Output from this amplifier is then applied to the Horizontal Amplifier.

External signals are applied to the grid of V314A either directly or through a ×10 attenuator. The signal is then cathode coupled to V314B. The amplifier gain can be varied with VARIABLE 10-1 control R314, which determines the degree of cathode coupling. Cathode DC balance is set by adjusting Ext Horiz Dc Bal R317. This balances cathode potentials on V314A and V314B and prevents a shift in the cathode DC level when the VARIABLE 10-1 control is rotated.

Signal output from V314B is connected to input cathode follower V343A in the Horizontal Amplifier when the HORIZONTAL DISPLAY switch is in either of the EXT positions.

Delay Pickoff Circuit

The delay pickoff circuit compares the ramp-voltage output of the Time Base B Generator with a variable reference voltage and assuming identical characteristics in the two halves of the comparator, generates a trigger pulse when the two voltages are equal. The trigger output of the delay-pickoff circuit is used in the 'A' DLY'D and 'B' INTENSIFIED

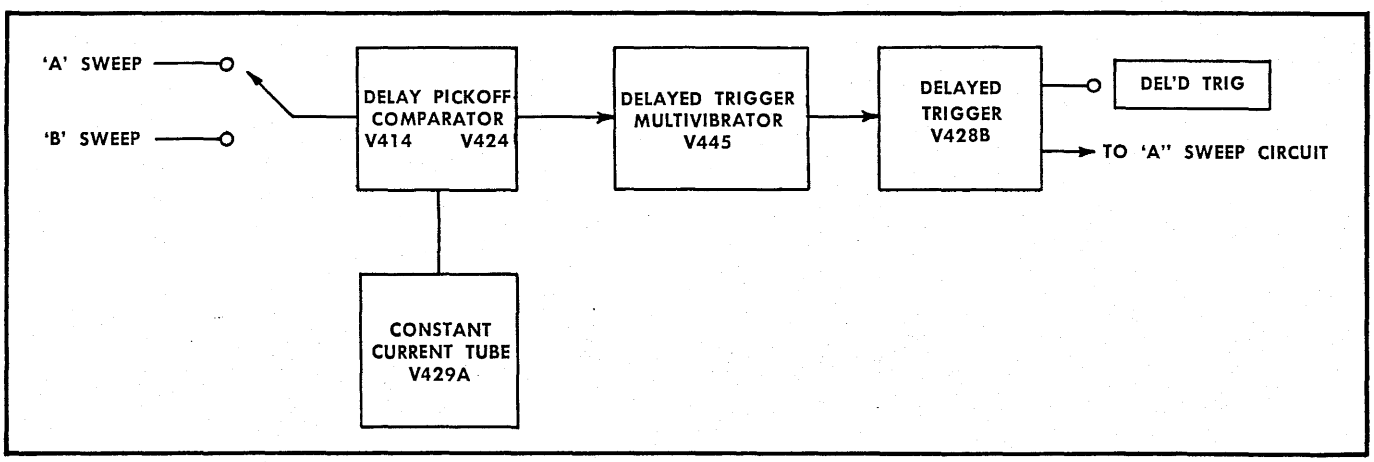


Fig. 3-8. Delay Pickoff circuit block diagram.

by 'A' positions of the HORIZONTAL DISPLAY switch, to arm or trigger Time Base A. The trigger output is also available at a front panel DLY'D TRIG connector.

Difference Amplifier. The difference amplifier provides a time selection on any rate sawtooth voltage. The time selection is based upon the position of the DELAY TIME MULTIPLIER 1-10 dial, which establishes a voltage reference on the grid of V424. A voltage comparison becomes a time selection because the sawtooth voltage is changing at a definite rate. Assume the sawtooth input rate of change is 15 volts per millisecond. If the DELAY TIME MULTIPLIER 1-10 dial were set to 2.0 (2.0 is equal to 30 volts of 140 volt ramp), the delay pickoff would generate a delayed trigger 2 milliseconds after the start of the sawtooth ramp.

Constant Current Tube. To gain a dynamic range of 150 volts grid signal on the difference amplifier, it is necessary to establish a constant cathode current. A constant cathode current also permits the difference amplifier output voltage to vary between the same limits regardless of which portion of the sawtooth is amplified.

V428A grid voltage is stabilized at approximately —100 volts and the cathode is long-tailed to the —150 volt supply. R428 sets the cathode current of V428A at a constant 5 milliamps. Thus, the plate can move over a wide voltage range without appreciable current change in the circuit. The plate resistance changes as the plate-to-cathode voltage changes, thus assuring a constant current cathode circuit for the difference amplifier.

Delayed Trigger Multivibrator. V445A turns on when its grid voltage rises to the upper hysteresis point and the multivibrator flips. The output waveform from the plate of V445B is coupled through a differentiator (C454-R454) and applied to the grid of cathode follower V428B.

V428B is biased at or near cutoff; therefore, only the positive portion of the differentiated multivibrator pulse appears at the output DLY'D TRIG connector and the HORIZONTAL DISPLAY switch. Fig. 3-9 illustrates the waveform sequence of operation for a complete sawtooth input signal.

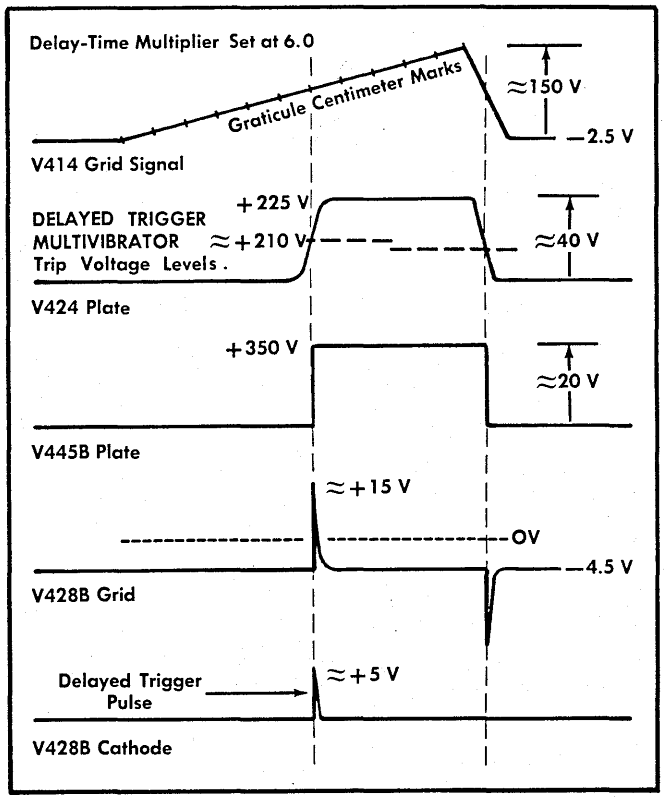


Fig. 3-9. Waveform ladder diagram of the Delay Pickoff circuit operation.

CRT Circuit

The CRT circuit (see CRT schematic diagram) includes the CRT, the high-voltage power supply, and the controls necessary to set the intensity level, focus and astigmatism.

CRT Circuit Controls and Connectors. FOCUS control R846 provides the voltage adjustment for the second anode (focus ring) in the CRT. Proper voltage for the third anode is obtained by adjusting the ASTIGMATISM control R864. Both the FOCUS and ASTIGMATISM controls are adjusted for optimum beam shape and minimum size. Beam intensity is adjusted by means of front-panel INTENSITY control R826 which changes the voltage on the CRT grid, to increase or decrease the beam current. Internal Geometry control R861 adjusts the isolation shield voltage in the CRT, to minimize bowing or tilting of the display. Front-panel TRACE ROTATION control R778 permits minor adjustments of the trace orientation. The Vert Shield Volts Adj R860 permits minor changes of the CRT deflection sensitivities and linearity.

High Voltage. The accelerating potential applied to the electron beam is approximately 10 kV, developed by the —1350 volts applied to the cathode and the +8650 volts on the accelerating anode.

A Hartley oscillator consisting of V800, the primary of T801 and the winding and circuit capacitance, oscillates at approximately 50 kHz. The oscillator provides the energy through the transformer T801 for the high voltage rectifiers.

Half-wave rectifier V862 provides —1350 volts for the CRT cathode. This is the reference supply and is the only one of the three supplies that is regulated. A half-wave voltage tripler circuit, V832, V842 and V852 provides +8650 volts for the post deflection accelerator anode. Both supplies are referenced to the +100-volt regulated supply through the decoupling filter R801-C801.

A floating half-wave rectifier V822 furnishes bias voltage of —1450 volts for the CRT grid. This floating grid supply is independent of the cathode voltage supply and allows DC-coupled unblanking to the CRT grid.

A sample of the —1350-volt regulated supply is fed from the junction of R842-R841 to the grid of the comparator V814B, which compares the sampled portion of the —1350-volt supply with the —150-volt regulated supply on its cathode. The error is DC coupled to the grid of V814A, amplified to the screen of V800 to adjust the screen potential of the Hartley oscillator and regulate the high voltage. R840 is adjusted to set the CRT cathode potential to —1350 volts.

The +8650-volt supply and the negative grid bias supply are indirectly regulated because the output voltage of all three supplies is proportional to the output of the oscillator circuit. To DC couple unblanking signals to the CRT grid, the grid supply is floating (the DC voltage on the components shifts in accordance with the unblanking signals). The positive side of the CRT grid supply is returned to the —150-volt supply through the unblanking cathode-follower load resistor. The negative side of the CRT grid voltage supply is applied through the INTENSITY control to the CRT grid. An isolation network R827, R828, R829 and C827, C828, C829 isolates the grid circuit capacitance from loading the unblanking circuit. The fast rise leading edge of the unblanking pulse is coupled through C827, C828, C829 to the grid of the CRT. For short duration unblanking pulses at the faster sweep rates the power supply is not appreciably affected.

Longer period unblanking pulses at slow sweep rates charge the stray capacitance in the circuit through R827. This pulls the floating supply up and holds the CRT grid at the unblanked potential for the duration of the unblanking pulse.

Amplitude Calibrator

The Amplitude Calibrator is a square-wave generator with an approximate 1 kHz output available at the front-panel CAL OUT connector. The Amplitude Calibrator consists of multivibrator V875 and V885A connected to switch cathode follower V885A between two operating states (cutoff and conduction).

During the negative portion of the multivibrator waveform, the grid of V885A is driven well below cutoff and its cathode rests at ground potential. During the positive portion of the waveform V875 is cut off and its plate rests slightly below +100 volts. The cutoff voltage at the plate of V875 is determined by the setting of the Cal Adj control R879 (part of the divider connected between +100 volts and ground).

Cathode follower V885 has a precision tapped divider for its cathode resistor. With the Cal Adj control properly adjusted, the cathode of V885B is at +100 volts when V875 is cut off. Eighteen output voltages from 0.2 millivolts to 100 volts are available through tapped divider R885 to R893, and 1000/1 divider R896-R897. C885, connected between the cathode of V885B and ground, corrects the output waveform for overshoot.

SECTION 4
MAINTENANCE

Air Filter

Care must be taken to assure adequate ventilation for the Type 585A in order to prevent instrument overheating. To assure free passage of air, the instrument must be placed so the air intake is not blocked, and the filter must be kept clean. Moreover, the side panels and bottom cover must be in place for proper air circulation; do not remove the covers except during maintenance.

The air filter should be visually checked every few weeks and cleaned or replaced if dirty. New filters may be ordered from your local Tektronix Field Office or Representative by Tektronix Part No. 378-0023-00.

The following cleaning procedure is suggested:

1. Flush loose dirt out of filter with a stream of hot water.

2. Prepare a hot water and mild soap or detergent solution. Wash the filter as you would wash a sponge so that the adhesive and dirt is loosened and floated off.

3. Rinse the filter and let it dry.

4. Dip or spray filter with fresh air filter adhesive such as Filter Coat or Handi Coater. These products are available from most air conditioner suppliers, or order Tektronix Part No. 006-0580-00.

Fan Motor

The fan motor bearings should be lubricated every three or four months with a few drops of light machine oil. Failure to lubricate the bearings periodically will cause the fan to slow down or stop, thereby causing the instrument to overheat.

Visual Inspection

You should visually inspect the entire oscilloscope every few months for possible circuit defects. These defects may include such things as loose or broken connections, damaged binding posts, improperly seated tubes, scorched wires or resistors, missing tube shields, or broken terminal strips. For most visual troubles the remedy is apparent; however, particular care must be taken when heat-damaged components are detected. Overheating of parts is often the result of other, less apparent, defects in the circuit. It is essential that you determine the cause of overheating before replacing heat-damaged parts in order to prevent further damage.

Soldering and Ceramic Strips

Many of the components in your Tektronix instrument are mounted on ceramic terminal strips. The notches in these strips are lined with a silver alloy. Repeated use of excessive heat, or use of ordinary tin-lead solder will break down the silver-to-ceramic bond. One application of tin-lead solder will not break the bond if excessive heat is not applied.

If you are responsible for the maintenance of a large number of Tektronix instruments, or if you contemplate frequent part changes, we recommend that you keep on hand a stock of solder containing about 3% silver. This type of solder is used frequently in printed circuitry and should be readily available from radio-supply houses. If you prefer, you can order the solder directly from Tektronix in one pound rolls. Order by Tektronix Part No. 251-0514-00.

Because of the shape of the terminals on the ceramic strips it is advisable to use a wedge-shaped tip on your soldering iron when you are installing or removing parts from the strips. Fig. 4-1 will show you the correct shape for the tip of the soldering iron. Be sure to file smooth all surfaces of the iron tip to be tinned. This prevents solder from building up on rough spots where it will quickly oxidize.

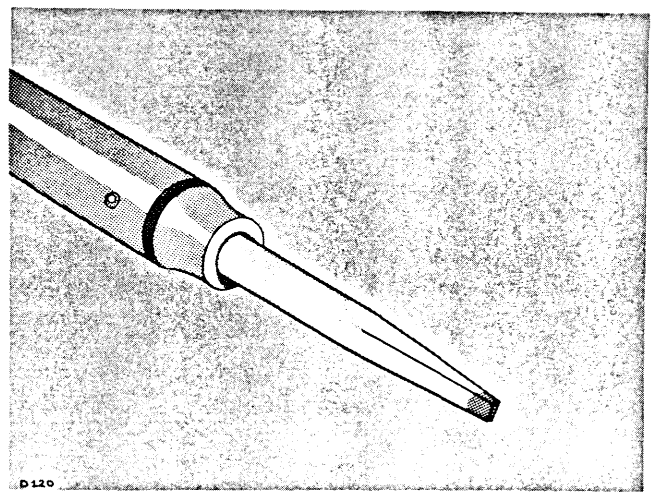


Fig. 4-1. Soldering iron tip properly shaped and tinned.

When removing or replacing components mounted on the ceramic strips you will find that satisfactory results are obtained if you proceed in the manner outlined below.

1. Use a soldering iron of about 75-watt rating.

2. Prepare the tip of the iron as shown in Fig. 4-1.

3. Tin only the first $1/16$ to $1/8$ inch of the tip. For soldering to ceramic terminal strips tin the iron with solder containing about 3% silver.

4. Apply one corner of the tip to the notch where you wish to solder (see Fig. 4-2).

5. Apply only enough heat to make the solder flow freely.

6. Do not attempt to completely fill the notch on the strip with solder; instead, apply only enough solder to cover the wires adequately, and to form a slight fillet on the wire as shown in Fig. 4-3.

In soldering to metal terminals (for example, pins on a tube socket) apply the iron to the part to be soldered as

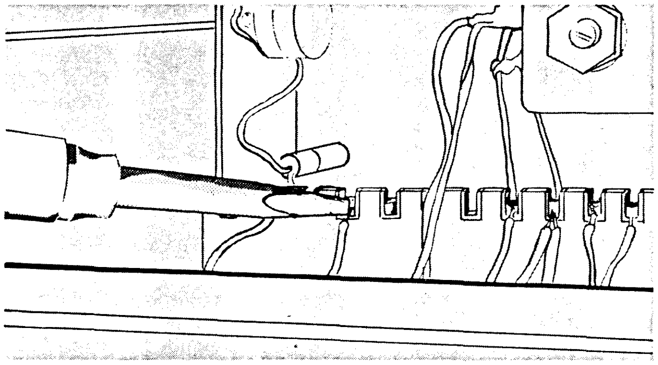


Fig. 4-2. Correct method of applying heat in soldering to a ceramic strip.

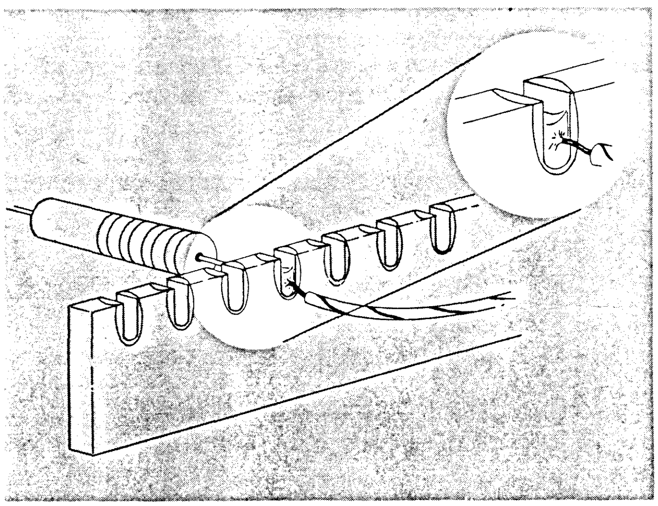


Fig. 4-3. A slight fillet of solder is formed around the wire when heat is applied correctly.

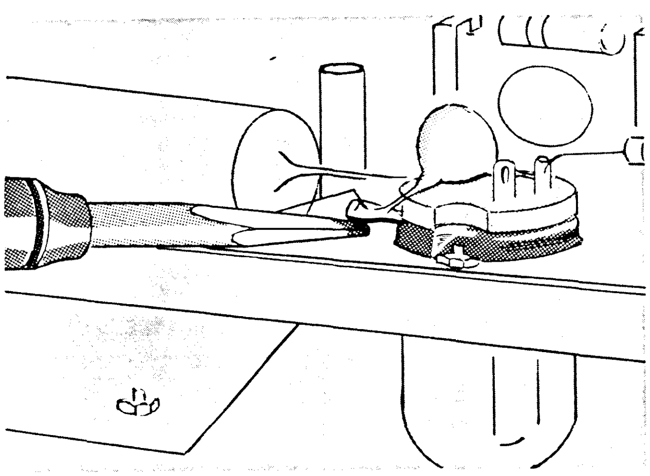


Fig. 4-4. Soldering to a terminal. Note the slight fillet of solder —exaggerated for clarity—formed around the wire.

shown in Fig. 4-4. Use only enough heat to allow the solder to flow freely along the wire so that a slight fillet will be formed.

General Soldering Considerations. When replacing wires in ceramic terminal strip notches, clip the ends neatly as close to the solder joint as possible. In clipping the end of wires, take care the end removed does not stay within the oscilloscope and cause a short circuit.

Occasionally you will wish to hold a bare wire in place as it is being soldered. A handy device for this purpose is a short length of wooden dowel, with one end shaped as shown in Fig. 4-5. In soldering to terminal pins mounted in plastic rods or coil forms it is necessary to use some form of heat sink to avoid melting the plastic. A pair of long-nosed pliers (see Fig. 4-6) makes a convenient tool for this purpose.

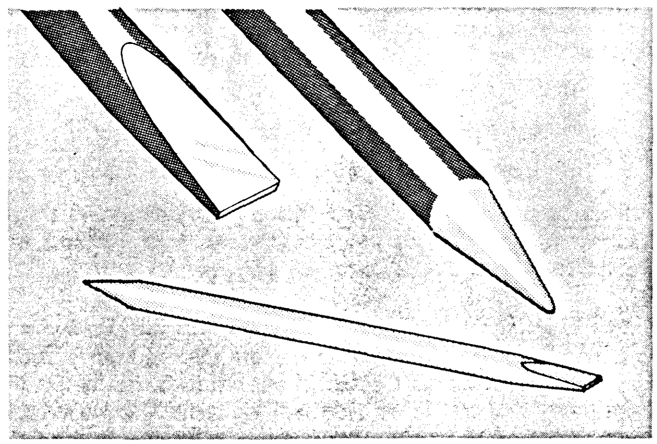


Fig. 4-5. A soldering aid constructed from a ¼ inch wooden dowel.

Ceramic Strips. To replace strips which mount with snap-in plastic mountings, first remove the original fittings from the chassis by simply pulling them directly away from the chassis. Assemble the mounting yoke on the ceramic strip. (It may be already mounted.) Insert the spacer into the mounting holes in the chassis. Carefully force the yoke pin into the spacer. Snip off the portion of the yoke pin which protrudes below the nylon collar on the reverse side of the chassis.

NOTE

Considerable force may be necessary to push the yoke pins into the nylon collars. Be sure that you apply this force to the portion of the ceramic strip directly above the plastic mounting yoke. Take care not to spread the yoke, or the strip may be loose after installation.

REMOVAL AND REPLACEMENT OF PARTS

General Information

Instructions for the removal of certain parts are contained in the following parapgraphs. Because of the nature of the Type 585A replacement of certain parts will require that you recalibrate portions of the oscilloscope in order to insure the proper operation of the instrument. Refer to the Calibra-

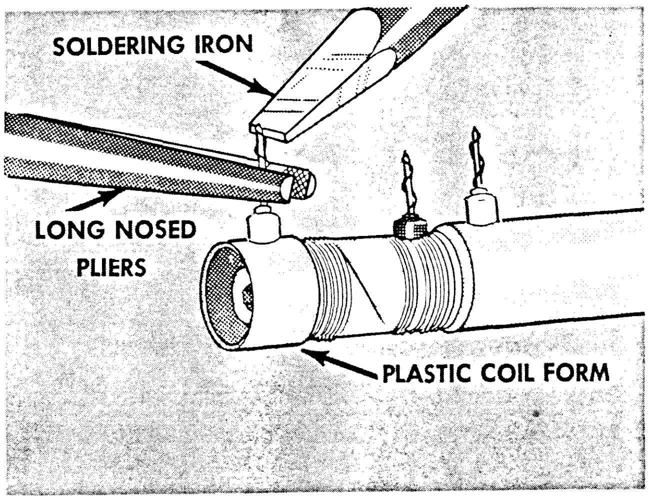


Fig. 4-6. Soldering to a terminal mounted in plastic. Note the use of the long-nosed pliers between the iron and the coil form to absorb the heat.

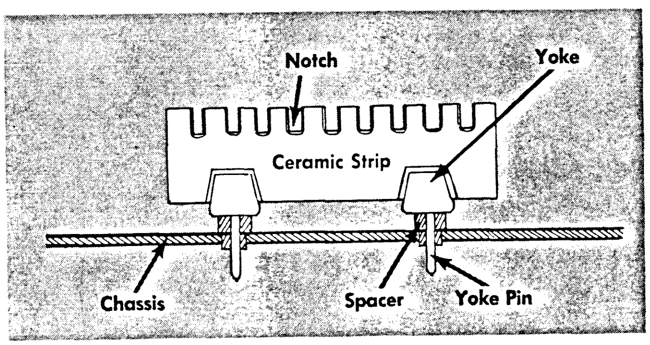


Fig. 4-7. The ceramic strip and its parts.

tion Procedure section of this manual when replacing precision or adjustable parts.

Removal of Panels

The panels of the Type 585A Oscilloscope are held in place by small screwtype fasteners. To remove the side panels, use a screwdriver or coin to rotate the fasteners two or three turns counterclockwise; then pull the upper portion of the panels outward from the carrying handles. To remove the bottom panel, lay the instrument on its side, rotate the fasteners two or three turns counterclockwise, and pull off the panel. Panels are replaced by reversing the order of their removal.

Replacement of the Cathode Ray Tube

CAUTION

When replacing a cathode ray tube, wear both a plastic face guard and leather gloves. These items will protect the operation in case of an implosion and flying glass.

To remove the cathode ray tube, first remove the side panels from the instrument. Disconnect the socket from the base of the CRT, the lead clips from the deflection plate pins at the neck of the CRT and the CRT anode connector. Be careful not to bend the neck pins. (Do not disconnect the beam-rotation coil leads at the top of the CRT shield.) Remove the graticule cover, the scratch shield (or light filter), the eyebrow and the hold-down spring. Loosen the clamp at the neck of the CRT and carefully push the tube forward until it can be removed from the front of the instrument.[1]

Insert the new CRT with the high-voltage anode contact pointing so it will touch the anode contact inside the CRT shield. Temporarily replace the scratch shield and graticule cover, then screw down the knurled retaining nuts. Position the CRT so the graticule lines are parallel to the sides of the oscilloscope and the CRT faceplate is touching the scratch shield. Tighten the neck clamp.

After the CRT is securely in place, connect the base socket, neck pins and CRT anode connector. The color-code information on the CRT shield indicates the order in which the neck-pin leads are to be connected. Remove the graticule cover and scratch shield, install the eyebrow and its hold-down spring, then replace the scratch shield and graticlue cover.

After replacement of the CRT, it will be necessary to calibrate the CRT circuit and check the calibration of the rest of the instrument. Adjust the TRACE ROTATION control before beginning the calibration procedure.

Replacement of Switches

Methods for removal of defective switches are, for the most part, obvious and only a normal amount of care is required. Single wafers are normally not replaced on the switches used in the Type 585A. If one wafer is defective the entire switch should be replaced. Switches can be ordered from Tektronix either wired or unwired as desired.

Tube Replacements

Care should be taken both in preventive and corrective maintenance that tubes are not replaced unless they are actually defective. Many times during routine maintenance it will be necessary for you to remove tubes from their sockets. It is important that these tubes be returned to the same sockets unless they are actually defective. Unnecessary replacement or switching of tubes will many times necessitate recalibration of the instrument. If tubes do require replacement, it is recommended that they be replaced by previously checked high quality tubes. The best way to check is by replacing them in the circuit and checking for proper operation.

REPLACEMENT PARTS

Standard Parts

Replacements for all parts used in the Type 585A Oscilloscope can be purchase directly through your area Tektronix Field Engineer or Field Office. However, since many of

[1]For an instrument with an external graticule CRT (below SN 1000), the procedure is essentially the same as that described, except for the references to the eyebrow, etc. When installing a new CRT of this type, position it so the brush contact inside the CRT shield touches the CRT anode contact, and the face of the CRT is touching the external graticule.

the components are standard electronic parts, they can generally be obtained locally in less time than is required to obtain them from the factory. Before ordering or purchasing parts, be sure to consult the parts list to determine the tolerance and ratings required.

Special Parts

In addition to the standard electronic components mentioned in the previous paragraph special parts are also used in the assembly of the Type 585A Oscilloscope. These parts and most mechanical parts should be ordered directly from Tektronix. They are normally difficult or impossible to obtain from other sources. All parts may be obtained through your area Tektronix Field Engineer or Field Office.

TROUBLESHOOTING

Troubleshooting Procedure

This section of the manual contains information for troubleshooting the Type 585A Oscilloscope. Before attempting to troubleshoot the instrument, make sure that any apparent trouble is actually due to a malfunction within the instrument and not to improper control settings or to a faulty plug-in unit or probe. Instructions for the operation of the Type 585A and general information concerning plug-in operation, are contained in the Operating Instructions section of this manual. Operating Instructions for a specific plug-in unit or probe will be found in the manual for that unit.

When vertical system troubles exist, to determine that the oscilloscope is at fault, the plug-in unit may be replaced with another known to be in good operating condition. If the trouble is still apparent, it is almost a certainty that the oscilloscope is at fault. However, should the trouble appear to have been corrected the plug-in is probably the cause of the trouble.

Tube failure is the most prevalent cause of circuit failure. For this reason, the first step in troubleshooting any circuit in the instrument is to check for defective tubes, first look for dark heaters, and then replace by direct substitution. Do not depend on tube testers to indicate the suitability of a tube for certain positions within the instrument. The criterion for usability of a tube is whether or not it works satisfactorily. Be sure to return all good tubes to their original sockets; if this procedure is followed less recalibration of the instrument will be required upon completion of the servicing.

When replacing any tube in the instrument, check first to see that components through which the tube draws current have not been damaged. Shorted tubes will sometimes overload and damage components. These can generally be located by visual inspection. If no damaged components are apparent, and if tube replacement does not restore operation, it will be necessary to make measurements or other checks within the circuit to locate the trouble.

The component number of each electrical part is shown on the circuit diagrams. The following chart lists the component numbers associated with each circuit.

All numbers less than 100	Time-Base Trigger A and B
All 100 numbers	Time-Base Generator A and Timing Swith A
All 200 numbers	Time-Base Generator B and Timing Switch B
All 300 numbers	Horizontal Amplifier and External Horizontal Amplifier
All 400 numbers	Delay Pickoff
All 600 and 700 numbers	Low-Voltage Power Supply and Regulated Heater Supply
All 800 numbers	CRT Circuit and Calibrator
All 1000 numbers	Vertical Amplifier Delay-Line Driver
All 1100 numbers	Power supply decoupling networks for vertical amplifier and plug-ins
All 1200 numbers	Vertical Amplifier Output Stage

Switch wafers shown on the schematic diagrams are coded to indicate the position of the wafer on the switches. The number portion of the code refers to the wafer number on the switch assembly. Wafers are numbered from the front of the switch to the rear. The letters F and R indicate whether the front or the rear of the wafer is used to perform the particular switching function.

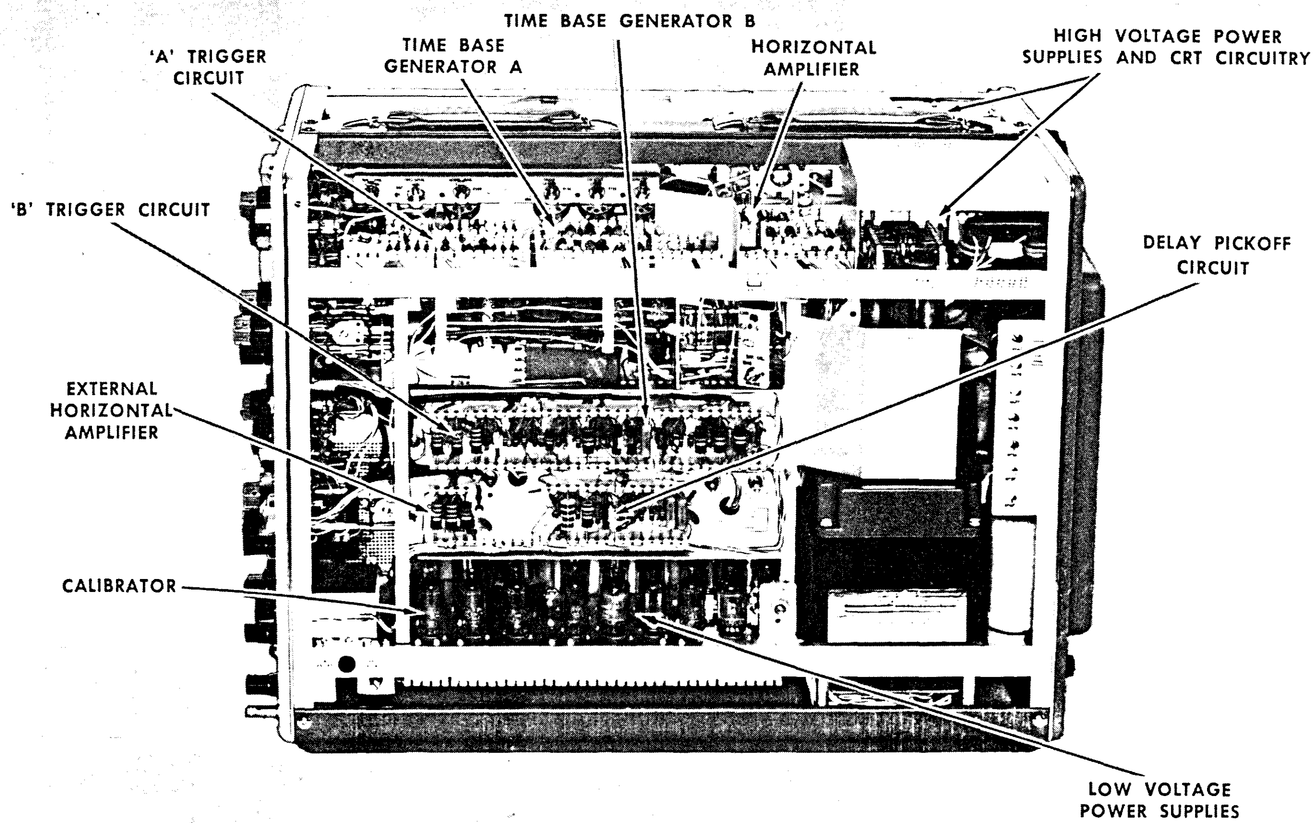
CIRCUIT TROUBLESHOOTING

Although the Type 585A is a complex instrument, it can be itemized into nine main circuits, in addition to the Calibrator circuit. These are the:

1. Low-Voltage Power Supply
2. CRT Circuit
3. Vertical Amplifier and Delay Line
4. Time-Base A Trigger Circuit
5. Time-Base B Trigger Circuit
6. Time-Base A Generator
7. Time-Base B Generator
8. Delay Pickoff
9. Horizontal Amplifier

The first circuit to check is the Low-Voltage Power Supply. Because of the circuit configurations employed, it is possible for an improper power supply voltage to affect one circuit more than the others. For example, if the gain of the Vertical Amplifier should decrease slightly, while the other circuits appear to be functioning normally, this could be due to an improper supply voltage and not to any condition originating in the Vertical Amplifier. In cases of this type, valuable time be be saved by checking the power supply voltages first.

On the other hand, the CRT display can often be used to isolate trouble to one particular circuit when trouble exists in that circuit. If there is no vertical deflection, for example, when the intensity and horizontal deflection appear to be normal, the trouble can be open signal connections, no signal source, the plug-in, the probe, or even loose CRT connections.



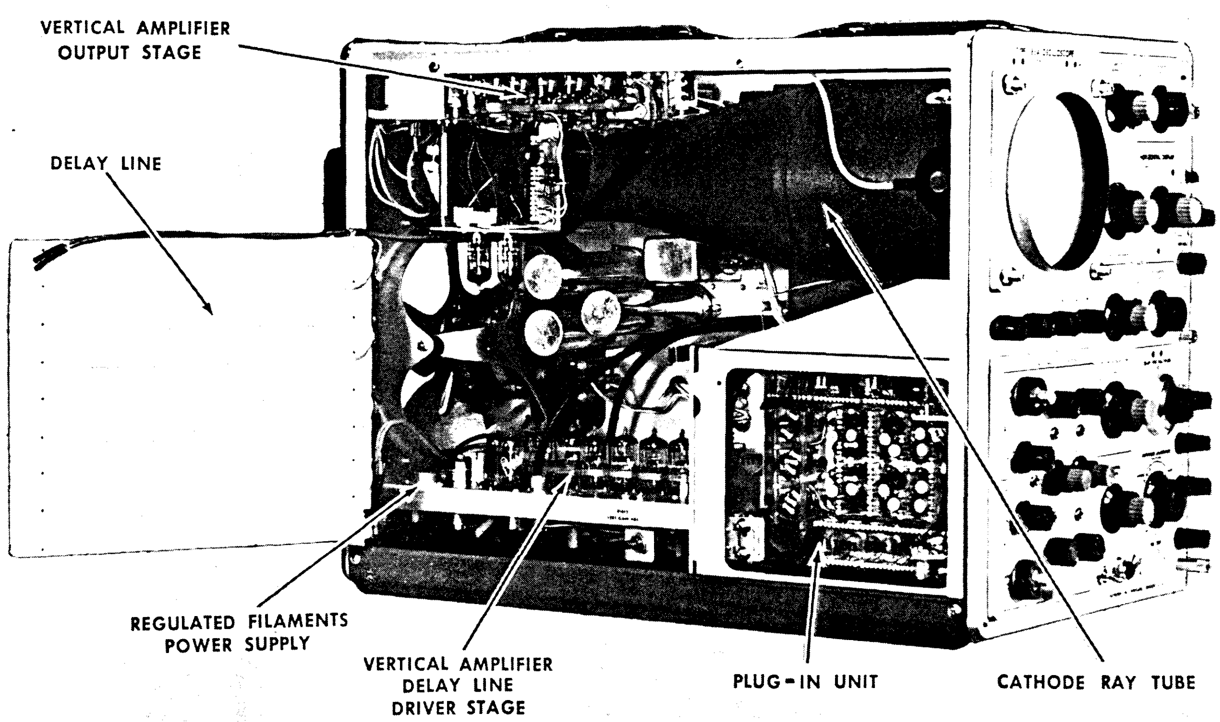


Fig. 4-8. Physical location of circuits which compose the Type 585A Oscilloscope.

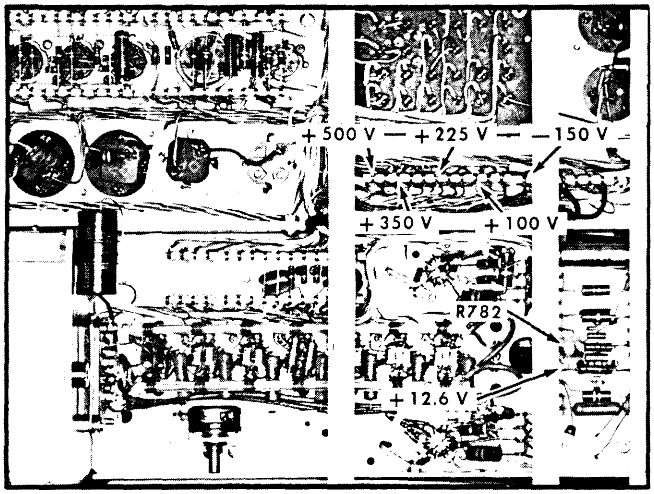


Fig. 4-9. Location of power supply test points underneath the scope.

The material that follows contains information for troubleshooting each circuit for various types of troubles. A method is described, in some instances, for locating the stage in which the trouble may be originating; once the stage at fault is known, the component(s) causing the trouble can be located by voltage and resistance measurements or by substitution. In certain other instances the information is more specific and the trouble can be traced to a particular component.

Front-Panel Checks

The following front-panel checks will help you to isolate the trouble in an instrument to a given circuit. However, the interrelation between circuits is such that it is not always possible to isolate the trouble exactly using these checks. If you are unfamiliar with the instrument, these front-panel checks should prove helpful in looking for the trouble.

Before attempting any of the following front-panel checks make sure that the plug-in installed in the instrument is operating correctly. If the pilot lamp fails to light when the POWER switch is turned to the ON position, and if the fan fails to operate, turn to the section on troubleshooting the Low-Voltage Power Supply. If the pilot light and fan operate but the time-delay relay fails to operate with an audible "click" in less than one minute, you should also consult the section on troubleshooting the Low-Voltage Power Supply.

With a Calibration Fixture 067-0523-00 installed, and the pilot light and fan both operating, allow the oscilloscope to run for several minutes.

Set the front-panel controls as follows:

A STABILITY	fully clockwise
A TRIGGERING LEVEL	0
A TRIGGERING SOURCE	INT AC
A TRIGGER SLOPE	+
A TIME/CM	5 mSEC
A VARIABLE TIME/CM	fully clockwise
HORIZONTAL DISPLAY	A
B STABILITY	counterclockwise, but not PRESET
FOCUS	midrange
INTENSITY	midrange
ASTIGMATISM	midrange
SCALE ILLUM	midrange
HORIZONTAL POSITION	midrange
HORIZONTAL POSITION VERNIER	midrange

Other controls may be left at any setting.

Set the test unit front-panel controls as follows:

Load	Norm
Display Selector	Cal (2 cm And Alt Sync
Vertical Position	midrange

Other controls may be left at any setting.

With the test unit controls as above, there should be two traces, two centimeters apart on the CRT. It may be necessary to readjust the Vertical Position control to bring both traces in view.

A second check is to set the test unit Display Selector switch to Ext Input and patch into the Ext Input connector .2 VOLTS of Calibrator signal. It will be necessary to turn the Type 585A STABILITY control into the triggerable region and adjust the TRIGGERING LEVEL control for a stable display.

If either of the tests do not produce a display as described, turn to the section on troubleshooting the Vertical Amplifier. If the first test above does not produce two traces, (but the second test permits a proper display of the Calibrator waveform), check the Time-Base Generator dual-trace sync pulse source. If no Calibrator waveform appears in the second test, turn to troubleshooting the Amplitude Calibrator.

Additional troubles are discussed below in relation to use of a Type 82 or 86 Plug-In Unit for this initial trouble test. If a Type 82 or 86 is used, set the appropriate plug-in Input switch to DC and the oscilloscope AMPLITUDE CALIBRATOR switch to 2 VOLTS. Use a patch cord which produces no attenuation, connect the CAL OUT connector to the plug-in Input connector.

If no spot is evident check the Beam-Position Indicator lamps. If the spot is off the screen vertically turn the Vertical Position control from one extreme position to the other. If the spot does not appear, and operating of the Vertical Position control has no effect on the Beam-Position Indicator lamps, turn to the section on Troubleshooting the Vertical Amplifier.

If the display which appears consists only of a horizontal line, you may check the operation of the calibrator by disconnecting the end of the patch cord from the CAL OUT connector and grasping the end between your fingers. A series of sloping vertical lines (power line pickup) appearing

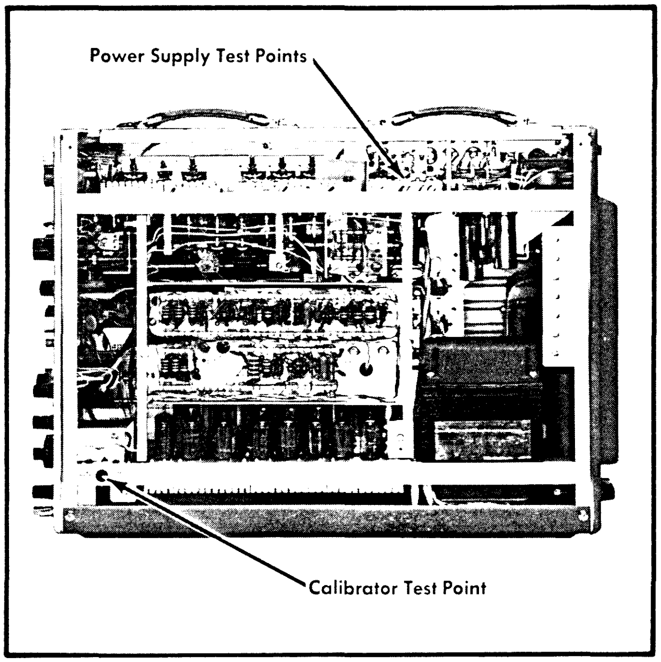


Fig. 4-10. Calibrator and power supply test points.

on the CRT indicates that the Vertical Amplifier is operating and that the Amplitude Calibrator is probably inoperative. See the section on Troubleshooting the Amplitude Calibrator for the remedy.

If the operation of the VERTICAL POSITION control causes the vertical Beam-Position Indicator lamps to indicate the display is centered vertically, rotate the HORIZONTAL POSITION control from one extreme position to the other. If the horizontal Beam-Position Indicator lamps indicate the display remains off screen refer to the section on Troubleshooting the Horizontal Amplifier.

If both sets of Beam-Position lamps indicate that the display is centered, but no display is observed, CAUTIOUSLY advance the INTENSITY control. If no display is seen or if the display is of low intensity or defocused but otherwise normal, refer to the section on Troubleshooting the CRT circuit.

TROUBLESHOOTING THE VERTICAL AMPLIFIER

No Spot or Trace Visible on CRT

If all power supply voltages are normal, and the CRT is known to be good, failure to obtain a spot or trace on the screen will be due to improper deflection-plate voltages. This condition is caused by a DC unbalance in either or both of the deflection amplifier circuits or by a loose CRT lead.

To determine which circuit is at fault, adjust the Time-Base A controls for a free-running sweep at 1 mSEC/CM (STABILITY control fully clockwise) and set the INTENSITY control to midrange. Using a screwdriver with an insulated handle, CAREFULLY short the vertical deflection plates together at the neck pins on the CRT. These are the pins marked BLUE (UPPER) and BROWN (LOWER). Be careful not to short either pin to the metal shield around the CRT. If the DC unbalance is in the vertical deflection circuit the trace will appear at or near the center of the CRT when the vertical deflection plates are shorted together. If the trace does not appear, the trouble does not lie in the vertical circuit. The DC balance of the horizontal circuit can be checked in a like manner after first stopping the sweep.

If the vertical deflection circuit is unbalanced, the next step is to further check the system. This is accomplished in a manner similar to the shorting procedure used to find the CRT electrical center. It is best to guard against common-mode oscillations by performing the shorting operation using a 27 Ω 1-watt resistor. Figure 4-11 illustrates a satisfactory method of holding the shorting resistor for use in the following procedure.

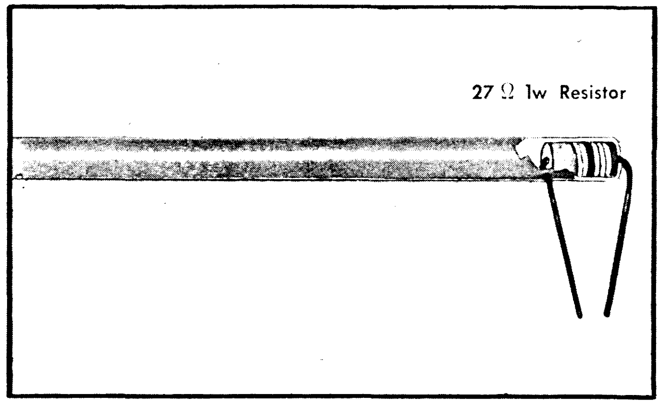


Fig. 4-11. 27-ohm shorting resistor. Tektronix Part Number 003-0002-00.

1. Use the shorting resistor to short across C1261. If the trace appears, V1274, V1284 and circuit is good.

2. Connect the shorting resistor between the grid lines of the Output Stage near V1214. If the trace appears, all tubes and circuitry from this point to the CRT are good.

3. Connect the shorting resistor between the plate lines of the Vertical Amplifier Delay-Line Driver stage. If the trace appears, the Delay Line is not open.

4. Connect the shorting resistor between the grid lines of the Vertical Amplifier Delay-Line Driver stage. If the trace appears, the vertical amplifier is good and the trouble lies within either the plug-in unit or the probe. If available, another plug-in unit or probe should be substituted for the suspected unit.

During the shorting procedure, if one of the distributed amplifiers is proven at fault, it is unlikely that just one non-conducting tube could be responsible. Each tube draws only a small portion of the total plate current. If a tube has shorted, excessive current may damage resistors or other parts. A visual inspection will probably reveal the damaged part(s).

Insufficient or No Vertical Deflection

Insufficient deflection indicates a change in the gain characteristics of the Vertical Amplifier. If only a slight change in deflection is apparent, the circuit can normally be recalibrated for gain.

If the change in deflection is more pronounced, or if there is no deflection at all, the tubes should first be checked by subsitiution. Then check for components which can affect the gain of the circuit but not the DC balance. Such components are the common cathode resistors; the VERT GAIN control; common screen resistors and common plate-load resistors.

Waveform Distortion

If compression is severe, refer to step 12 of the Calibration Procedure to make the necessary corrections.

With the Plug-In Test Unit in place, turn its Display Selector to Pulser, operate the Type 585A 'A' sweep at .05 μSEC/CM, (use a viewing hood in a lighted room) adjust the Test Unit Pulser Amplitude for +2 cm of display, permitting a view of the oscilloscope's transient response. If other than a clean step-function is presented on the CRT, calibration of the vertical amplifier is indicated. Calibration can require tube balancing, replacement, and/or high-frequency adjustments. See the Calibration Procedure including steps 8 through 9 and step 46.

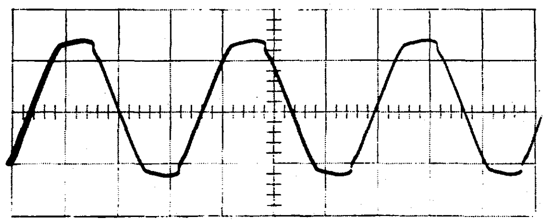
TROUBLESHOOTING THE TIME-BASE A TRIGGER CIRCUIT

Unstable Triggering

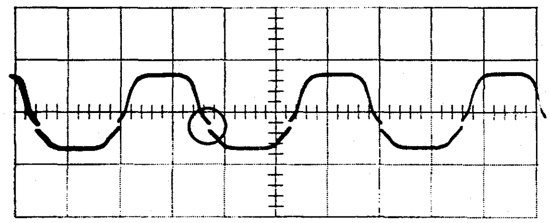
If the display of a repetitive waveform cannot be made stable, the sweep generator may not be receiving proper triggering signals. If the trace can be turned off and on with STABILITY control, the sweep generator is capable of being triggered. This indicates the trigger circuitry is not functioning properly.

Trouble can be anywhere from the Trigger Pickoff circuit on the Vertical Amplifier Delay-Line Driver chassis to the grid circuit of the Sweep Gating Multivibrator.

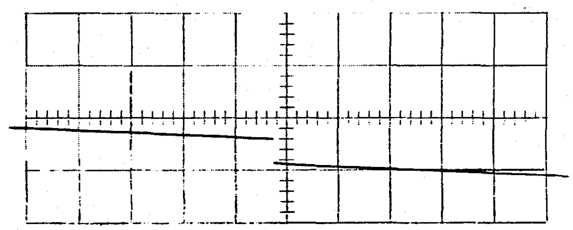
To determine if the trouble is within the Time-Base A Trigger circuit, and not the trigger pickoff circuit, the LINE triggering signal can be used. Figure 4-12 illustrates three waveforms within the Time-Base A Trigger circuit when the triggering signal is 60 cycles.



A. 60 cycles as measured at TRIGGER SLOPE switch side of R27. 1 V/CM, 5 MILLISEC/CM.



B. 60 cycles, including switching of tunnel diode D47. Measured at pin 5, V34. 5 V/CM, 5 MILLISEC/CM.



C. Circled portion of waveform B expanded. .5V/CM 1 μSEC/CM.

Fig. 4-12. Trigger circuit waveforms when using LINE triggering. TRIGGER SLOPE switch set to +.

Should the Time-Base A Trigger circuit not be functioning properly, the trouble probably lies within the Trigger Pickoff amplifier and cathode follower system. Tube substitution should be tried first if no burned parts are evident. A possible cause of unstable triggering is heater-cathode leakage in a Trigger Pickoff tube. Also voltage measurements can aid in finding the problem. Voltages or important points in the Trigger Pickoff circuit are shown in the Vertical Amplifier Delay-Line Drive stage diagram.

TROUBLESHOOTING THE TIME-BASE A GENERATOR

No Horizontal Sweep

If the Time-Base 'A' Generator is not producing a sawtooth sweep voltage when the STABILITY control is adjusted for a free-running sweep, some defect in the generator is holding the Miller runup circuit. Depending on the on-off states of the disconnect diodes V152, the Miller runup circuit may be held at either the high or the low end of the sawtooth. The manner in which it is held may be determined by measuring the voltage at the SAWTOOTH A binding post. If the Miller runup circuit is held at the high end of the sawtooth the voltage at the front-panel binding post may measure about +300 volts; if held at the low end, the voltage at this point will measure anywhere between ground and —20 volts. If it rests at —20 volts, the trouble probably is non-conduction of V152.

If the Miller runup circuit is held at the high voltage end of the sawtooth, replace V152 as it can mean both heaters can be open or its cathode can have low emission and give the same effect. Usually if V161 is not conducting, B167 will be glowing brightly.

If the front panel SAWTOOTH A connector voltage reads +350, there is probably a grid to plate short within V173; replace it. When this occurs, B167 glows brightly at the electrode attached to pin 6 of V161. If this reverse conduction condition is permitted to continue for longer than about 15 minutes it may be necessary to replace B167 with a new neon glow tube because B167 may be unstable thereafter.

If the heater of V173 is open, both neon glow tubes will be glowing brightly and there will be no sweep.

If all tubes have been checked, then check for open plate and cathode resistors in the Sweep Gating Multivibrator circuit, the Hold-Off circuit and the runup CF circuit. Also check that the STABILITY control varies the voltage at the grid of V135A.

Nonlinear Sweep

A nonlinear sweep voltage will be generated if the current charging the Timing Capacitor C160 does not remain constant. If the nonlinearity occurs at all sweep rates a defective Miller runup tube is the probable cause. If the nonlinearity occurs only at certain sweep rates a Timing Capacitor is the probable cause but the Miller runup tube should not be overlooked. A defective bootstrap capacitor C165 can cause the sweep to be nonlinear at the faster sweep rates. If the sweep appears linear in all but the 1 and 2 SEC/CM rates, or if the spot moves to a point near the center of the CRT and stops there, there is likely heater-cathode leakage in V152B and it should be replaced.

Insufficient Horizontal Deflection

If the trace cannot be expanded to the full width of the graticule with the SWEEP LENGTH control R176, check the resistance value in the cathode circuit of V173.

TROUBLESHOOTING TIME-BASE B TRIGGER AND SWEEP CIRCUITS

By following the circuit description of various Time-Base A and Time-Base B circuits, you will note a similarity. Therefore the preceding troubleshooting procedures for Time-Base A trigger and sweep circuits is a guide when problems exist with the Time-Base B system. The exception, is that the HORIZONTAL DISPLAY switch must be in the B position.

TROUBLESHOOTING THE HORIZONTAL AMPLIFIER

No Spot or Trace Visible on Crt

To determine whether the Horizontal Amplifier is in a state of DC unbalance, short the horizontal deflection plates together at the neck pins of the CRT in the manner explained for troubleshooting the Vertical Amplifier. The horizontal deflection plates are marked RED (LEFT) and GREEN (RIGHT). The INTENSITY control should be set to midrange. If a spot appears when the horizontal deflection plates are shorted together (it may be necessary to adjust the VERTICAL POSITION control), the trouble lies in the Horizontal Amplifier.

CAUTION

Do not permit the spot to remain on the CRT at this setting of the INTENSITY control. Either reduce the intensity until the spot is just visible, or remove the short from the horizontal deflection plates.

The procedure for troubleshooting the Horizontal Amplifier is similar to that explained for troubleshooting the Vertical Amplifier for unbalance. The shorting strap can be moved from deflection plates back toward the Input Amplifier stage, until a point is reached where the trace does not appear. When the defective stage is determined, check for defective tubes and components associated with that stage.

Insufficient or No Horizontal Deflection

If the gain of the Horizontal Amplifier decreases from normal, the trace will not extend from the left to the right side of the graticule. In addition, the timing will no longer correspond to the calibrated value indicated by the TIME/CM switch. (This is to distinguish insufficient sweep caused by a trouble in the Time-Base Generator; e.g., an improper adjustment of the SWEEP LENGTH control. In the latter case the trace will be shortened but the timing will not be affected.)

If the change in gain is slight, as indicated by improper timing and a slightly decreased sweep, the amplifier can usually be recalibrated. Since the gain of the Horizontal Amplifier affects the timing of the sweep, care must be taken to insure that the gain adjustments are accurately made. Be sure to refer to the Calibration Procedure if it is necessary to adjust the gain of the Horizontal Amplifier.

If the decrease in gain of the Horizontal Amplfier is more pronounced, or if there is no sweep at all, check for defective components which can affect the gain but not the DC balance. In addition to the tubes, such components are the common cathode resistors and controls.

TROUBLESHOOTING THE DELAY PICKOFF CIRCUIT

When no delay trigger is present at the DLY'D TRIG connector, the Delay Pickoff circuit has probably failed. However, before attempting to repair the Delay Pickoff circuit, be sure that the 'A' or 'B' sweep circuits are working correctly and that a sawtooth voltage is being presented to the Delay Pickoff system. Also, turn the DELAY-TIME MULTIPLIER 1-10 dial away from zero. A properly calibrated Delay Pickoff circuit may not deliver any output pulse during the first minor division of rotation from the zero end of the dial.

Check to see that the two grids of the Difference Amplifier can be made to be at the same voltage, either by sweep sawtooth application or by rotating the DELAY-TIME MULTIPLITER 1-10 dial. With the two grids at the same voltage value, the plate of V424 should read near +200 volts.

If the difference amplifier is functioning correctly check to see if the multivibrator is functioning. It should switch from conduction of V445B to conduction of V445A when the grid of V445A rises above +210 volts. It should switch back when the grid of V445A drops to about +205 volts.

Another possible trouble, the output cathode follower can be held either in cutoff or heavy conduction by a component failure in its grid or cathode circuit.

TROUBLESHOOTING THE LOW-VOLTAGE POWER SUPPLY

Proper operation of every circuit in the Type 585A including the plug-in unit, depends on proper operation of the Low-Voltage Power Supply. The regulated DC voltages must remain within their specified tolerances for the instrument and plug-in unit to retain their calibration.

WARNING

Exercise care in checking the power supply. Because of their high current capabilities and low impedance, the Low-Voltage supplies can produce more harmful shocks than the High-voltage supply in the CRT Circuit.

Open Primary Circuit (Dead Circuit)

If the pilot lamp and the fan do not come on when the power is turned on, check the source of power and the power cord connections. Check the fuse at the rear of the instrument. If the fuse is blown replace it with one of the proper value and turn the instrument on again. If the new fuse blows immediately, check the power transformer for shorted primary or secondary windings. Also check for a shorted rectifier. If the new fuse does not blow until the time-delay relay has activiated (a "click" can be heard), check for a shorted condition in the regulator circuits and the loading on the supply.

If the fuse is good, check for an open primary winding in the power transformer. If your instrument is wired for 200-, 234- or 248-volt operation, check for an open Thermal Cutout Switch, the resistance of this switch is about 0.1 Ω. (If your instrument is wired for 110-, 117- or 124-volt operation, the fan will come on even though the Thermal Cutout Switch is open.)

If both the fan and pilot lamp come on, the power transformer is operating normally.

Incorrect Output Voltage

Test points for checking the Low-Voltage Power Supply, including the +12.6-volt supply, are located on the bottom chassis (see Fig. 4-9). The voltage for each test point (except the +12.6-volt supply) is also silk-screened on the lip of the chassis adjacent to the ceramic strip on the right side in front of the shield covering the high voltage transformer (see Fig. 4-10).

If any of the supplies fail to regulate, the first thing to check is the line voltage. The supplies are designed to regulate at a line voltage between 105 and 125 volts with the design center at 117 volts, or between 210 and 250 volts with the design center at 234 volts, rms, 50-60 cycle single phase AC. The other design center voltages have similar line voltage ranges.

If the line voltage is the correct value, the next step is to remove the plug-in unit and measure the resistance between each regulated bus and ground. The following resistance values are approximate minimum readings.

REGULATED BUS	APPROX. MINIMUM RESIST. TO GROUND
—150 V	3 kΩ
+100 V	2.2 kΩ
+225 V	6.5 kΩ
+350 V	25 kΩ
+500 V	33 kΩ
+12.6 V	0.7 Ω

If the resistance values between the regulated buses and ground check out, check the series regulator tubes. Then make sure that the line voltage is set near the design center for your instrument and check the rms voltage across the secondary winding for each supply. If the secondary voltages are all correct, check the operation of the bridge rectifiers. This can be done by measuring the rectified voltage at the input to each regulator. Then check for off-value resistors, especially in the reference dividers, and for faulty capacitors.

The material that follows may be used as a quick index for troubleshooting the regulator circuits:

If the output voltage is high with excessive ripple, check:

a. For high line voltage.

b. For open voltage-regulator tube, V609.

c. The amplifier tubes in the regulator circuits, V664, etc.

d. For insufficient loading.

If the output voltage is high with normal ripple, check for proper resistance values in the dividers, refer to the diagram to determine the location of the resistors involved. Since these are generally precision resistors (±1% tolerance) the use of a good bridge is recommended in checking the value.

If the output is low with excessive ripple, check:

a. For low line voltage.

b. For shorted voltage-regulator tube, V609.

c. The series tubes in the regulator circuits, V667A, etc.

d. For excessive loading.

e. Faulty filter capacitors.

f. Defective rectifiers.

If the output is low with normal ripple, check:

a. The resistance values in the dividers.

b. The capacitors across the divider.

IMPORTANT

If any components in the —150-volt supply are changed, or if the setting of the —150 control is changed, it will be necessary to check the calibration of the instrument.

TROUBLESHOOTING THE AMPLITUDE CALIBRATOR

If the output square-wave is not symmetrical (the positive portion has a duration considerably different from that of the negative portion or vice versa), the two tubes in the Calibrator Multivibrator circuit are not being held cutoff for equal periods. This will normally be caused by a defective tube. If tube replacement does not correct the waveform, the circuit components must be checked. The pentode in the Multivibrator is held cutoff for an interval determined by the discharge of C871 and the triode is held cutoff for an interval determined by the discharge of C874. A change in the value of either capacitor or in the value of the resistors through which they discharge, could produce an asymmetrical waveform.

In addition, the time needed for these capacitors to discharge a given amount is affected by the potential toward which they discharge; this would be the voltage at the plate of the triode in the case of C871, and the voltage at the screen of the pentode in the case of C874. Since these voltages are affected by the value of R870 and R875, these resistors should be checked. The resistors in the plate circuit of the pentode should also be checked, since they will affect the plate-to-screen ratio of the pentode.

Incorrect Output Voltage

The amplitude of the output square wave is determined almost entirely by the plate circuit of V875. The accuracy of square-wave voltages less than 100 volts is determined by the resistance values in the divider in the cathode-follower stage. A quick check of the +100-volt maximum output value can be made by turning off the AMPLITUDE CALIBRATOR and measuring the voltage at the CAL TEST PT (see Fig. 4-10). If the test point does not measure exactly +100 volts, the CAL OUT voltages will not be correct.

The CAL control R879 will vary the voltage at the test point over about a 5-volt range. If this voltage cannot be set to exactly +100 volts, and if the tubes have been replaced, then check to be sure V875 is completely cut off.

TROUBLESHOOTING THE CRT CIRCUIT

The intensity, focus, geometry and calibration of the CRT display depend on proper operation of the three high-voltage supplies in the CRT circuit.

No Spot or Trace

If the low-voltage power supply is operating normally, but no spot or trace is visible on the CRT, the trouble could be a defective CRT, a defect in the CRT cathode circuit including the —1350-volt supply, or an unbalanced DC condition in either or both of the deflection amplifiers. In the latter case the DC unbalance is producing improper positioning voltages and the beam is deflected off the screen.

To determine which circuit is at fault, turn the ASTIGMATISM control clockwise. If a flare is observed on the CRT, one of the deflection amplifiers is probably at fault. If no flare is observed with the INTENSITY control turned fully clockwise, the trouble will either be due to a defective CRT or to an inoperative cathode supply circuit. The cathode supply can be checked by measuring the voltage at the HV test point. The voltage at this point should be —1350 volts, although it will vary with the setting of the HV control. If a voltage reading near —1350 volts is obtained, turn the instrument off. Measure the resistance of R847, the 27 kΩ resistor connected to the test point. If this resistor is not open a defective CRT is indicated.

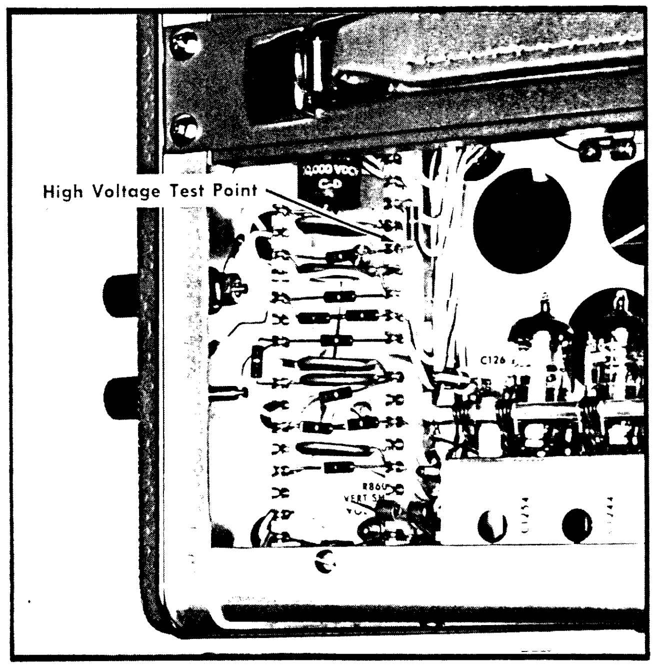


Fig. 4-13. Location of the high voltage test point.

If the voltage at the HV test point is zero or abnormally low; replace the oscillator tube V800 and the error-signal amplifier tube V814. If this does not restore operation the oscillator circuit should be checked.

A quick check on the operation of the oscillator circuit can be made by observing the heater glow in the rectifier tubes, located under the shield at the upper right side of the instrument. If no heater glow is visible the oscillator circuit is inoperative. This could be due to an open transformer T801, or to a defective component in the circuit of V800 or V814.

If heater glow is visible in the rectifier tubes, the oscillator circuit is operating. If the heater glow appears to be dim, the output of the oscillator may be insufficient for proper operation. A more accurate check on the oscillator may be made by removing the shield covering the high-voltage transformer and measuring the bias at the grid of V800. This can be measured at the junction of R806 and C806. The voltage at this point should measure about —65 volts.

WARNING

Do not let your hand or body touch the chassis when making this check.

If the oscillator circuit is operating properly, but the voltage of the HV test point does not measure in the vicinity of —1350 volts, V862 is most likely defective.

Abnormal Intensity

If a trace is visible on the CRT, the intensity of the trace may be used to identify trouble in either the negative bias supply or the positive anode supply.

If the trace is excessively bright, and does not change as the INTENSITY control is adjusted, check the negative bias supply including the lead to the grid of the CRT. Check for a defective rectifier tube V822, an open supply winding or a filament winding, an open resistor including the INTENSITY control, or a shorted or leaky capacitor. If trouble is not found in any of these components, a defective CRT is indicated.

If the intensity of the trace is extremely low, check for an inoperative positive supply. Also check the anode connection to the CRT, including R836 and C836.

If the accelerating potentials appear to be too high, as evidenced by decreased deflection sensitivity, check the error-signal amplifier circuit.

If a badly distorted trace or spot is visible on the CRT, check the Geom control R861 and its connection to the neck pin on the CRT. Also check the ASTIGMATISM control R864 and its connection to the CRT base socket. If the FOCUS control has no effect on the trace, check this control (R856) and its connection to the CRT base socket.

IMPORTANT

If any components in the oscillator, error-signal amplifier or —1350-volt cathode supply circuit are changed, or if the setting of the HV control is changed, it will be necessary to check the calibration of the instrument.

SECTION 5
PERFORMANCE CHECK

Introduction

This section of the manual provides a means of rapidly checking the performance of the Type 585A. It is intended to check the calibration of the instrument without the need for performing the complete Calibration Procedure. The Performance Check does not provide for the adjustment of any internal controls. Failure to meet the requirements given in this procedure indicates the need for internal checks or adjustments, and the user should refer to the Calibration Procedure in this manual.

Recommended Equipment

The following equipment is recommended for a complete performance check. Specifications given are the minimum necessary to perform this procedure. All equipment is assumed to be calibrated and operating within the original specifications. If equipment is substituted, it must meet or exceed the specifications of the recommended equipment.

For accuracy and convenience, special calibration fixtures are used in this procedure. These calibration fixtures are available from Tektronix, Inc. Order by part number through your local Tektronix Field Office or representative.

1. Test oscilloscope. Risetime 20 ns or less, minimum deflection factor .05 volts/cm. Tektronix 540-series with a Type B Plug-In Unit or equivalent.

2. 10× attenuator probe. Tektronix P6006, or equivalent.

3. High gain DC Differential Amplifier plug-in unit. Sensitivity 1 mV/cm to 50 V/cm, frequency response DC to 2 MHz. Tektronix Type 1A6 or equivalent.

4. Test Load/Pulser Plug-In Unit. Tektronix Calibration Fixture 067-0523-00.

5. Tektronix 80-Series Plug-In Unit. Sensitivity .1 V/cm or higher. (Type 82 or 86)

6. Time-Mark Generator. Marker Outputs 5 s to .1 μs, sine-wave output of 50 MHz (20 ns), accuracy 0.001%. Tektronix Type 184 Time-Mark Generator.

7. Standard Amplitude Calibrator. Amplitude accuracy within 0.25%, signal amplitude range 100 mV to 100 volts, frequency output 1 kHz, —DC and +DC with mixed display feature. Tektronix Calibration Fixture 067-0502-00.

8. Constant Amplitude Signal Generator with 5 ns cable. Frequency range 350 kHz to 100 MHz with 50 kHz reference. Tektronix Type 191 Constant Amplitude Signal Generator.

9. Sine Wave Oscillator 15 Hz to 350 kHz. General Radio Type 1310-A.

10. Termination, 50 ohm, GR to BNC connectors. Tektronix Part No. 017-0083-00.

11. Three 50-ohm coaxial cables. Length 42 inches, with BNC connectors. Tektronix Part No. 012-0057-00.

12. T connector, BNC. Tektronix Part No. 013-0030-00.

13. Two patch cords. About 18 inches long; BNC to banana plug. Tektronix Part No. 012-0090-00.

14. Patch cord. About 18 inches long. BNC to BNC. Tektronix Part No. 012-0086-00.

15. Adapter BNC to clip lead. Tektronix Part No. 013-0076-00.

16. Viewing Hood. Round viewer. Tektronix Part No. 016-0053-00.

NOTE

For oscilloscopes equipped with UHF connectors, coaxial cables and adapters must be ordered with UHF fittings. See Tektronix catalog or your local Field Office.

PERFORMANCE CHECK PROCEDURE

General

In the following procedure, test equipment connections or control settings should not be changed except as noted. If only a partial check is desired, refer to the preceding step(s) for setup information.

The following procedure uses the equipment listed under Recommended Equipment. If substitute equipment is used, control settings or setup must be altered to meet the requirements of the equipment used.

Preliminary Procedure

1. Install a test plug-in load/pulser unit (Calibration Fixture 067-0523-00) in the vertical compartment of the Type 585A, then connect the Type 585A to a power supply source within the regulating range of its power supplies.

2. Set the front panel controls as follows:

Type 585A

CRT Controls	
FOCUS	Midrange
INTENSITY	CCW
ASTIGMATISM	Midrange
Time Base Controls (A and B)	
TIME/CM	1 mSEC
VARIABLE	CALIBRATED
LENGTH	10 CM
STABILITY	CW
TRIGGERING LEVEL	CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
HORIZONTAL DISPLAY	A
5× MAGNIFIER	OFF

DELAY TIME MULTIPLIER 1-10	1.00
HORIZONTAL POSITION	Midrange or centered display
AMPLITUDE CALIBRATOR	OFF

Calibration Fixture 067-0523-00

+12.6 Load (Internal switch behind front panel)	Switch towards panel
Load	Norm
Vertical Position	Midrange
Display Selector	Ext Input
Pulser Amplitude	0
Pulser Frequency	Midrange

Test Oscilloscope

Time/Cm	1 ms
Volts/Cm	.05

3. Set the POWER switch to ON. The pilot light should light and the delay relay for the power supply should operate with an audible click within a period of 15 seconds to 1 minute. Allow a minimum 20 minute warm-up period at an ambient temperature of +25°C, ±5°C for stabilizing, before checking the instrument to any given accuracy.

1. Check Graticule Scale Illumination

a. Requirement—Graticule scale illumination should vary as the SCALE ILLUM control is rotated through its range.

b. Rotate the SCALE ILLUM control clockwise and counterclockwise.

c. Check—Maximum brightness with the control fully clockwise and minimum or no illumination with the control fully counterclockwise.

2. Trace Alignment and Rotation

a. Requirement—Trace must align within ±1 mm of the center horizontal graticule line.

b. In the later production instruments (Serial number 9000 and subsequent) the trace should rotate clockwise with a clockwise rotation of the TRACE ROTATION control and counterclockwise when the control is rotated counterclockwise.

c. Adjust the INTENSITY, FOCUS and ASTIGMATISM controls for a well defined trace of nominal brightness. Adjust the Vertical and Horizontal Position controls to center the trace in the graticule area.

d. Rotate the TRACE ROTATION control and note the direction of trace rotation. Must rotate in the same direction as the control is adjusted.

e. Adjust the TRACE ROTATION control to align the trace with the horizontal graticule lines.

3. Check Graticule Alignment (SN 5969-8999)

a. Requirement—The graticule should be centered within the vertical scan area.

b. Position a free running trace upward until the trace dims then downward until the trace dims.

c. Check—The graticule center horizontal line should be located within ±1 mm of the center of the vertical window.

4. Position Neons

a. Requirement—The position neons indicate the relative beam position. The vertical position neons should indicate when the trace is no more than 2 cm from the center graticule line. The horizontal neons should indicate when the spot is no more than 4.5 cm from the center.

b. Check the ↑ position neon and the ↓ position neon as the free running trace is positioned from top to bottom of the graticule.

c. Decrease the intensity level with the INTENSITY control then switch the HORIZONTAL DISPLAY switch to EXT ×10 position.

d. Check the → position neon and the ← position neon as the beam spot is moved from left to right of the center, with the HORIZONTAL POSITION control. The position neons should indicate before the spot is 4.5 cm from the center graticule line.

e. Return the HORIZONTAL DISPLAY switch to A position and center the sweep with the POSITION controls.

5. Check Voltage Regulation

a. Low and high voltage regulator circuits must compensate for line voltage changes from 105 to 125 VAC (210 to 250 VAC) and for load changes. To perform this check a variable line voltage control unit must be connected between the power source and the Type 585A power input.

b. Apply the output from the Amplitude Calibrator to the Ext Input connector. Set the calibrator to .2 VOLTS and adjust the STABILITY and TRIGGERING LEVEL controls for a stable display.

c. Turn the FOCUS control fully clockwise or counterclockwise to defocus the display. Increase the INTENSITY control fully clockwise (maximum intensity level).

d. Adjust the variable autotransformer control to decrease the Type 585A line voltage to 105 (210) VAC.

e. Check—The display for no jitter, drift or blooming.

f. Change the variable autotransformer control to increase the line voltage to 125 (250) VAC.

g. Check—The display for no jitter, drift or blooming.

h. Return the line voltage to 117 (234) VAC. Remove the test plug-in unit and install a Type 80 plug-in unit.

i. Readjust the INTENSITY, FOCUS and ASTIGMATISM controls for a well focused trace of nominal brightness.

6. Check Geometry and Resolution

a. Requirement—Geometry is a measure of the display linearity in both the vertical and horizontal plane and is most noticeable at the graticule edge. Geometry must be within ±1 mm relative to the graticule line.

Resolution is the display definition and is within ±1 mm.

b. Rotate the STABILITY control fully clockwise for a free running trace. Position the trace, with the Vertical Position control, to the top line of the graticule then to the bottom line. Check for trace bowing or tilt. Must not exceed ±1 mm. See Fig. 5-1.

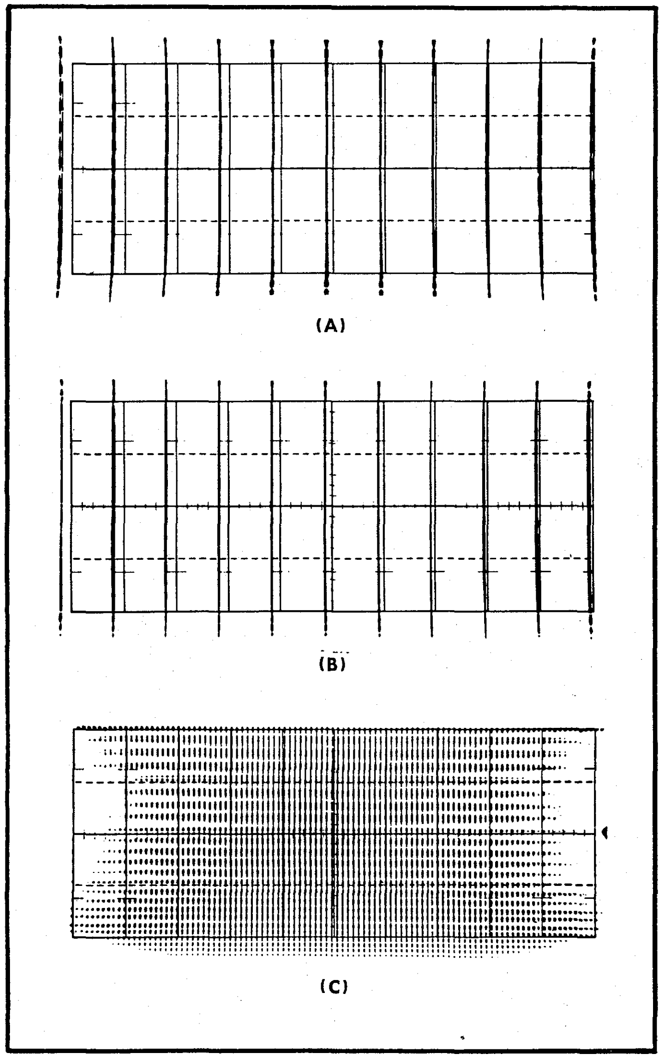


Fig. 5-1. Checking geometry and resolution. (A) Incorrect geometry, (B) typical display showing correct geometry and (C) checking horizontal resolution 1 marker/mm.

c. Apply 0.1 ms markers from the Time Mark Generator to the Input connector of the Vertical Plug-In unit (Type 86 or 82) through a 50-Ω termination.

d. Position the baseline of the display below the graticule area and adjust the Volts/Cm control so the markers overscan the entire vertical area of the graticule.

e. Set the Type 585A STABILITY control to PRESET and adjust the TRIGGERING LEVEL control for a stable triggered display.

f. Set the TIME/CM selector to .1 mSEC and adjust the INTENSITY, FOCUS and ASTIGMATISM controls for a low intensity, optimum focused display.

g. Check the amount of bowing or tilt of the time markers. Must be within ±1 mm.

h. Change the TIME/CM switch to 1 mSEC position and again adjust the FOCUS and ASTIGMATISM controls for optimum focus.

i. Check—The display resolution. Must distinguish one time-marker/mm within the center 8 cm of the horizontal plane.

j. Remove the Time Mark Generator signal and apply the signal from the AMPLITUDE CALIBRATOR to the vertical Input.

k. Set the AMPLITUDE CALIBRATOR switch to .1 VOLTS and the Volts/Cm switch of the Vertical plug-in unit to .1.

l. Set the STABILITY control fully clockwise for a free running display and the TIME/CM switch to 10 μSEC. Display amplitude should be 1 cm.

m. Set the AMPLITUDE CALIBRATOR to 10 mVOLTS. (Display amplitude should now be 1 mm.)

n. Check—Resolution of the display. There should be no overlapping of the two traces as the display is positioned to the top and bottom of the graticule area.

o. Remove the Amplitude Calibrator signal from the Input and replace the vertical plug-in unit with the test Calibration Fixture 067-0523-00.

7. Check Alternate Trace Operation

a. Requirement—Alternate trace operation at all settings of the A TIME/CM switch and the B TIME/CM OR DELAY TIME switch.

b. Set the Test Unit Display Selector switch to Cal and Alt Sync position, then turn both A and B STABILITY controls fully clockwise for a free running sweep.

c. Check—Alternate trace operation at all settings of the A TIME/CM switch. (At the slow sweep rates, alternate traces will consist of a single spot for one sweep, then two spots vertically separated in amplitude proportional to the amplitude of the input signal from the amplitude calibrator.)

d. Set the HORIZONTAL DISPLAY switch to B.

e. Check—Alternate trace operation at all settings of the B TIME/CM OR DELAY TIME switch.

f. Set the test plug-in unit, Display Selector switch to Ext Input position and both TIME/CM selector switches to 1 mSEC position.

8. Check A and B Sweep Length

a. Requirement—The A sweep length must be equal to or more than 10 cm; the B sweep length must vary between 4 cm or less and 10 cm or more.

b. Apply 1 mS and 0.1 mS markers from the Time-Mark Generator to the Ext Input connector of the Calibration Fixture test unit.

c. Set the HORIZONTAL DISPLAY switch to B and adjust the STABILITY and LEVEL controls for a stable display.

d. Check—B sweep length must be 10 cm or more.

e. Rotate the LENGTH control fully counterclockwise.

f. Check—Smoothness of electrical operation of the LENGTH control and sweep length should decrease to 4 cm or less.

g. Return the B LENGTH control to full clockwise position then change the HORIZONTAL DISPLAY switch to A position.

h. Adjust the A STABILITY and LEVEL controls for a stable display.

i. Check—A sweep length is 10 cm or more.

TIMING CHECKS

9. Check Sweep Magnifier Registration

a. Requirement—Normal to magnified sweep registration must be equal to or less than 0.5 cm.

b. Turn the 5X MAGNIFIER to ON and check that the MAGNIFIER neon lights.

c. Position the start of the trace (0 time marker) to the center vertical graticule line with the HORIZONTAL POSITION control.

d. Turn the 5X MAGNIFIER switch to OFF and note the horizontal displacement in the start of the trace.

e. Check—Horizontal trace shift should be $\leq$ 0.5 cm in either direction.

f. Set the A TIME/CM switch to .1 μSEC and position the start of the trace to the left graticule marker.

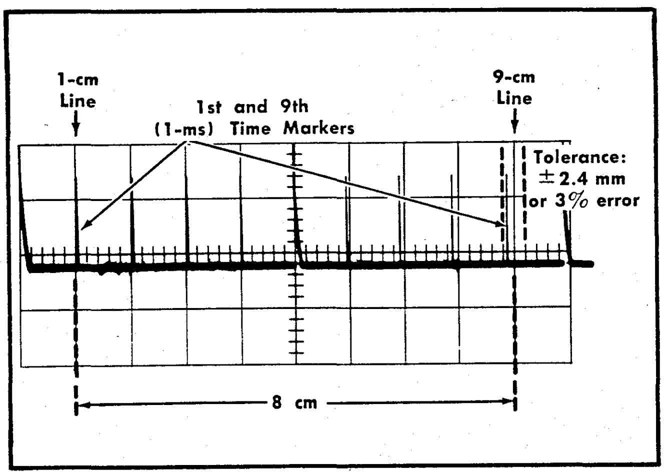


Fig. 5-2. Determining sweep rate accuracy.

10. Check A Sweep Timing

a. Requirement—Sweep timing accuracy within 3% of TIME/CM indicated position.

b. Check—A sweep timing as indicated in Table 5-1. Timing checked within the center 8 cm of the graticule area and must be within 3%. See Fig. 5-2.

TABLE 5-1

A TIME/CM Switch Setting	Time-Mark Generator Marker Selector	CRT Display Markers/Cm
.05 μSEC	20 nS	1
.1 μSEC	.1 μS	1
.2 μSEC	.1 μS	2
.5 μSEC	.5 μS	1
1 μSEC	1 μS	1
2 μSEC	1 μS	2
5 μSEC	5 μS	1
10 μSEC	10 μS	1
20 μSEC	10 μS	2
50 μSEC	50 μS	1
.1 mSEC	.1 mS	1
.2 mSEC	.1 mS	2
.5 mSEC	.5 mS	1
1 mSEC	1 mS	1
2 mSEC	1 mS	2
5 mSEC	5 mS	1
10 mSEC	10 mS	1
20 mSEC	10 mS	2
50 mSEC	50 mS	1
.1 SEC	.1 S	1
.2 SEC	.1 S	2
.5 SEC	.5 S	1
1 SEC	1 S	1
2 SEC	1 S	2

11. Check Magnifier Timing Accuracy

a. Requirement—Within ±5% of magnified sweep rate.

b. Set the A TIME/CM switch to .1 μSEC position.

c. Set the 5X MAGNIFIER to ON position.

d. Set the Time-Mark Generator marker selector to 20 ns (50 MHz). Slowly adjust the A TRIGGERING LEVEL control to the point at which the display stabilizes.

e. Check—1 cycle/cm within 4 mm (5%) between the first and ninth vertical graticule lines.

f. Turn the 5X MAGNIFIER switch to OFF and set the A TIME/CM switch to 1 mSEC position.

12. Check A Time Base Variable Control Range

a. Requirement—Sweep rate is continuously variable from .05 μSEC/cm to 5 SEC/cm.

b. Set the Time-Mark Generator marker selector to 1 mS.

c. Rotate the VARIABLE control fully counterclockwise.

d. Check—5 or more time-marks per 2 cm of display (2.5:1 range). Displayed sweep rate varies smoothly with control rotation. UNCALIBRATED neon light when the VARIABLE control is out of the CALIBRATED switch position.

e. Return the VARIABLE control to the CALIBRATED position.

13. Check B Sweep Timing Accuracy

a. Requirement—Sweep timing accuracy within $\pm 3\%$ of the indicated sweep rate.

b. Check—B sweep timing as indicated in Table 5-2. Timing checked within center 8 cm of graticule area and must check within 3%.

TABLE 5-2

B TIME/CM OR DELAY TIME Switch Setting	Time-Mark Generator Marker Selector	CRT Display Markers/Cm
2 μSEC	1 μS	2
5 μSEC	5 μS	1
10 μSEC	10 μS	1
20 μSEC	10 μS	2
50 μSEC	50 μS	1
.1 mSEC	.1 mS	1
.2 mSEC	.1 mS	2
.5 mSEC	.5 mS	1
1 mSEC	1 mS	1
2 mSEC	1 mS	2
5 mSEC	5 mS	1
10 mSEC	10 mS	1
20 mSEC	10 mS	2
50 mSEC	50 mS	1
.1 SEC	.1 S	1
.2 SEC	.1 S	2
.5 SEC	.5 S	1
1 SEC	1 S	1

CHECK DELAY TIME MULTIPLIER

14. Check Linearity and Range Accuracy

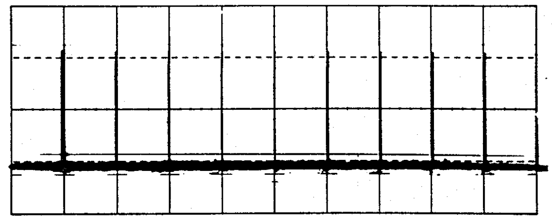
a. Requirement—Delay time multiplier range accuracy is within 1% with an incremental linearity error of no more than $\pm 0.2\%$.

b. Set the HORIZONTAL DISPLAY switch to 'B' INTENSIFIED BY 'A' position.

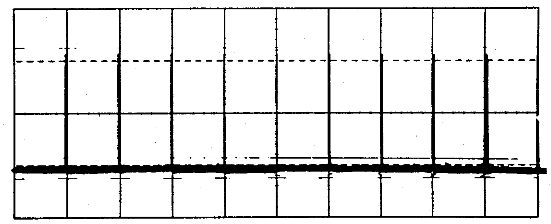
c. Set the A TIME/CM switch to 5 μSEC and the B TIME/CM or DELAY TIME switch to 1 mSEC.

d. Set the Time-Mark Generator selector switch for 1 mS markers.

e. Adjust the display intensity level with the INTENSITY control so the intensified portion of the display is visible, then by means of the DELAY-TIME MULTIPLIER 1-10 dial position the intensified portion of the display to the first time mark (see Fig. 5-3).



(A) 'B' INTENSIFIED BY 'A' showing the 1st timemark intensified. DELAY-TIME MULTIPLIER approximately at 1.00.



(B) 9th Time marker intensified. DELAY-TIME MULTIPLIER approximately at 9.00.

Fig. 5-3. Delay linearity measurement showing intensified markers.

f. Set the HORIZONTAL DISPLAY switch to 'A' DLY'D position.

g. Adjust the HORIZONTAL POSITION control to align the start of the trace with the extreme left graticule line.

h. Adjust the DELAY-TIME MULTIPLIER 1-10 dial to position the beginning or rising portion of the first time marker to the left graticule line.

i. Record the dial reading (it should be very close to 1.00).

j. Turn the DELAY-TIME MULTIPLIER 1-10 dial to position the second time marker to the left graticule line and record this reading.

k. Continue taking readings of each time mark through the ninth time marker.

l. Check—Difference between dial readings at the first time mark and the ninth time mark must be between 7.92 and 8.08 ($\pm 1\%$). Difference between each recorded interval must be one major dial division ± 1.6 minor divisions.

CHECK AMPLITUDE CALIBRATOR

15. Check Amplitude Calibrator Voltage Accuracy

a. Requirement—Voltage accuracy within $\pm 3\%$ of indicated setting.

b. Install a Differential Amplifier plug-in unit (Type 1A6 or equivalent) in the test oscilloscope and set the front panel controls as follows:

Test Oscilloscope

Triggering controls, for a free running trace.

Level	Clockwise
Stability	Clockwise
Time/cm	10 μSEC

Differential Amplifier (Type 1A6)

Millivolts/cm	1000
Variable	Calibrated
Input Selectors	DC
Position	Centered

c. Connect the output signal of a Standard Amplitude Calibrator to one of the Inputs of the Differential Amplifier.

d. Connect a 50-Ω coaxial cable between the Type 585A CAL OUT connector and the other Input of the Differential Amplifier.

e. Set both the Standard Amplitude Calibrator and the Type 585A AMPLITUDE CALIBRATOR output to 2 volts.

f. Check—There should be 3 or 4 parallel lines on the test oscilloscope with the center line or lines showing the difference in amplitude of the two signals that are applied to the two inputs of the Differential Amplifier. See Fig. 5-4.

g. Set both the Standard Amplitude Calibrator and the Type 585A AMPLITUDE CALIBRATOR to 100 volts.

h. Check—Amplitude error tolerance of the Type 585A AMPLITUDE CALIBRATOR as specified in Table 5-3. A single line indicates no difference of voltage, two lines indicate a potential difference which is proportional to the separation between the two displayed traces.

TABLE 5-3

STANDARD and TYPE 585A AMPLITUDE CALIBRATORS	Differential Amplifier MILLIVOLTS/CM	Allowable Error in CM
100 volts	1000	3
50 volts	1000	1.5
20 volts	1000	0.6
10 volts	100	3
5 volts	100	1.5
2 volts	100	0.6
1 volt	10	3
.5 volt	10	1.5
.2 volt	10	0.6
.1 volt	1	3
50 mvolt	1	1.5

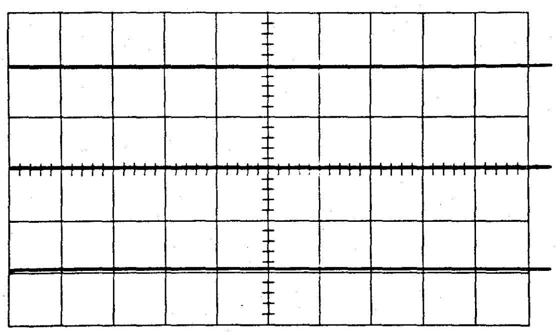
i. Remove the Standard Amplitude Calibrator signal.

16. Check Amplitude Calibrator Repetition Rate

a. Requirement—Repetition rate 1 kHz $\pm 25\%$.

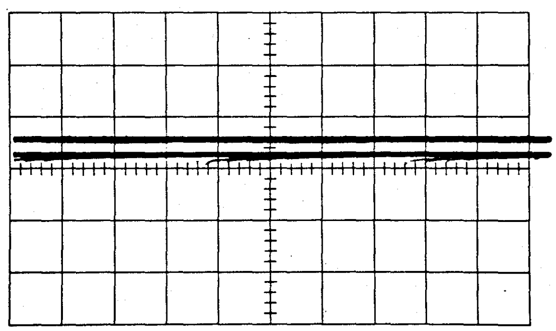
b. Change the test oscilloscope and the differential amplifier controls to the following settings:

Time/cm	1 mSEC
Triggering controls	
Slope	+ INT
Differential Amplifier	
Millivolts/cm	100
Input Selector	DC



(A)

Display of the three parallel traces with the center trace actually two lines combined.



(B)

Typical display of the center two lines separated by an amplitude proportional to the difference of the inputs to the Differential Amplifier.

Fig. 5-4. Checking the AMPLITUDE CALIBRATOR accuracy.

c. Adjust test oscilloscope triggering controls for a stable display.

d. Check—Test oscilloscope display is between 7.5 and 12.5 cycles in 10 centimeters (repetition rate of 1 kHz ±25%).

17. Check Amplitude Calibrator Symmetry and Risetime

a. Requirement—Symmetry within ±10% (duty cycle); risetime approximately 2 μs.

b. Change the test oscillscope Time/Cm switch and Variable Time/Cm control to display one complete cycle in 10 cm.

c. Check—First half cycle duration is between 4 and 6 cm.

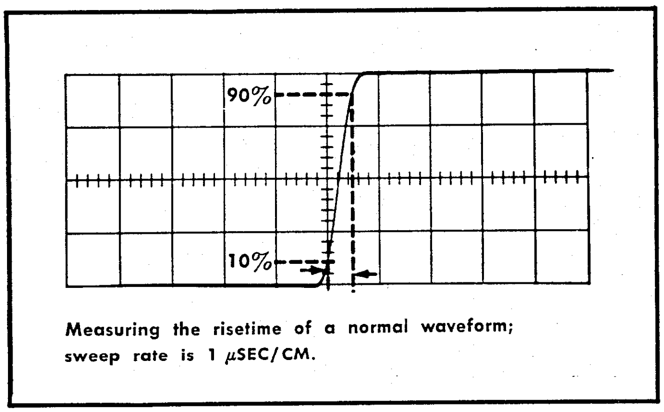
d. Set the test oscilloscope Time/Cm switch to 1 μs and set the Variable to the Calibrated position.

e. Adjust the Triggering Level control so the leading edge of the signal is displayed, then adjust the Volts/Cm selector and Variable for a 4-cm display amplitude.

f. Use the Horizontal Position control to center the display, then measure the risetime from the 10% to 90% amplitude points.

g. Check—Risetime is typically 2 μs or less. See Fig. 5-5.

h. Disconnect all test equipment.



Measuring the risetime of a normal waveform; sweep rate is 1 μSEC/CM.

Fig. 5-5. Measuring the risetime of a normal waveform; sweep rate is 1 μSEC/CM.

CHECK FRONT PANEL OUTPUT WAVEFORM AND HOLDOFF TIME

18. Check Sawtooth A

a. Requirement—Sawtooth waveform with an amplitude of approximately 140 volts ±20 volts increasing to approximately 170 volts ±20 volts at the faster sweep rates.

b. Connect the 10× probe from the test oscilloscope and the plug-in unit to the SAWTOOTH A connector on the Type 585A.

c. Set the controls as follows:

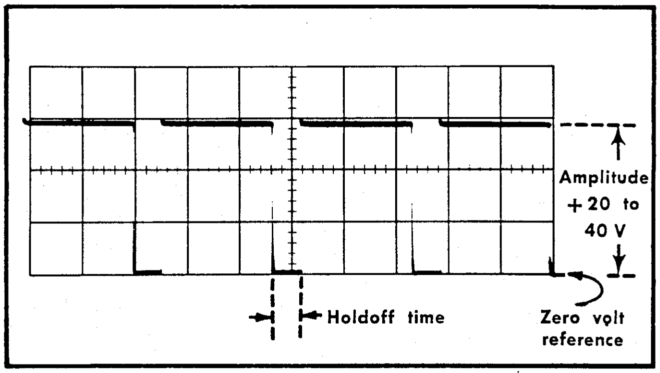


Fig. 5-6. Typical test oscilloscope display of the +GATE output signal. Time/cm = 10 μSEC.

Type 585A

HORIZONTAL DISPLAY	A
A TIME/CM	.1 mSEC
TRIGGERING SOURCE	INT AC
STABILITY and TRIGGERING LEVEL	Fully clockwise for a free running A sweep

Test Oscilloscope

Volts/Cm	5
Time/Cm	1 mSEC

d. Adjust test oscilloscope triggering controls for a stable display.

e. Check—Type 585A SAWTOOTH A output amplitude, should be within 130 to 180 volts.

19. Check +Gate A and Time Base A Holdoff Time

a. Requirement—Gate amplitude within 20 to 40 volts, holdoff time within the item specified in Table 5-4.

b. Connect the 10× probe from the test oscilloscope to the +GATE A connector.

c. Change the test oscilloscope Volts/Cm switch to 1 and the Time/Cm switch to 1 μSEC.

d. Check—Waveform amplitude of 20 to 40 volts and holdoff time (lower portion of the square-wave display) as specified in Table 5-4. See Fig. 5-6.

TABLE 5-4

TYPE 585A TIME/CM Setting	Test Oscilloscope Time/Cm Setting	Holdoff Time
.05 to .5 μSEC	1 μSEC	3-9 μs
1 to 50 μSEC	5 μSEC	15-40 μs
.1 to .5 mSEC	50 μSEC	150-400 μs
1 to 5 mSEC	.5 mSEC	1.5-4 ms
10 to 50 mSEC	5 mSEC	15-40 ms
.1 to 5 SEC	50 mSEC	150-400 ms

20. Check +Gate B and Time Base B Holdoff Time

a. Requirement—Gate amplitude is within 20 to 40 volts, holdoff time within the time specified in Table 5-5.

b. Connect the 10× probe from the test oscilloscope to the +GATE B connector.

c. Set HORIZONTAL DISPLAY switch to B and B TIME/CM OR DELAY TIME selector to 2 μSEC position.

d. Check—Waveform amplitude and holdoff time. See Fig. 5-6.

TYPE 585A B TIME/CM OR DELAY TIME	Test Oscilloscope Time/Cm Setting	Holdoff Time
2 to 10 μSEC	5 μSEC	5-15 μs
20 μSEC to .1 mSEC	50 μSEC	50-150 μs
.2 to 1 mSEC	.5 mSEC	.5-1.5 ms
2 to 10 mSEC	5 mSEC	5-15 μs
20 mSEC to 1 SEC	50 mSEC	50-150 ms

21. Check Dly'd Trig

a. Requirement—Delayed trigger amplitude approximately equal to +5 V ±3 volts.

b. Connect the 10× probe to the DLY'D TRIG connector.

c. Set the front panel controls as follows:

Type 585A

HORIZONTAL DISPLAY	'B' INTENSIFIED BY 'A'
A TIME/CM	.5 mSEC
B TIME/CM OR DELAY TIME	1 mSEC

Test Oscilloscope

Volts/Cm	.2
Time/Cm	2 μSEC
Trigger Slope	+ INT

d. Check—Delayed trigger pulse. Positive going pulse with an amplitude of +5 V ±3 volts.

EXTERNAL HORIZONTAL AMPLIFIER

22. Check External Horizontal Amplifier DC Balance

a. Requirement—DC trace shift when the VARIABLE control is rotated through its range must be no more than 5 cm.

b. Turn the INTENSITY control counterclockwise then set the HORIZONTAL DISPLAY selector to the EXT ×1 position.

c. Adjust the INTENSITY control for a visible beam spot then position the spot to the graticute center with the Position controls.

d. Vary the VARIABLE 10-1 control through its range and note the amount of trace or spot movement.

e. Check—Movement must not exceed 5 cm.

23. Check External Horizontal Amplifier Deflection Factor

a. Requirement— ×1 position ≤.2 V/cm, ×10 position ≤2 V/cm. VARIABLE 10-1 control attenuates the deflection factor by a ratio of 10:1 or more.

b. Connect a BNC to banana plug patch cord between the SAWTOOTH A connector and the vertical Input connector. Connect the output of the CAL OUT connector through two patch cords to the A TRIGGER INPUT and the HORIZ INPUT connectors.

c. Set the Type 585A front panel controls as follows:

A TIME/CM	.5 mSEC
STABILITY	PRESET
TRIGGERING SOURCE	EXT AC
AMPLITUDE CALIBRATOR	1 VOLT
HORIZONTAL DISPLAY	EXT X1
VARIABLE 10-1	Fully clockwise

Vertical Plug-In Unit

Volts/Cm	20
Input	AC

d. Check—Display horizontal amplitude must equal or exceed 5 cm. (0.2 V/cm)

e. Switch the HORIZONTAL DISPLAY switch to X10 position and change the AMPLITUDE CALIBRATOR selector to 10 VOLTS.

f. Check—Display amplitude must equal the amplitude noted in step d, ±3%. (≤2 V/cm)

g. Change the HORIZONTAL DISPLAY switch to X1 position and turn the VARIABLE 10-1 control fully counterclockwise.

h. Check—Display horizontal amplitude must be equal to or less than the amplitude noted in step f. (10:1 attenuation ratio)

i. Set the AMPLITUDE CALIBRATOR selector to 1 VOLT, the VARIABLE 10-1 control fully clockwise and adjust the TRIGGERING LEVEL control for a triggered display.

j. Note the waveform amplitude and shape.

k. Switch the HORIZONTAL DISPLAY switch to X10 position and the AMPLITUDE CALIBRATOR selector to 10 VOLTS.

l. Compare the display waveshape with the display noted in step j. Amplitude must be within ±3% and aberrations for both ×1 and ×10 positions must be less than 5%.

m. Remove the patch cords from the CAL OUT connector to the HORIZ INPUT and A TRIGGER INPUT connectors. Set the A TRIGGERING SOURCE switch to INT AC position and turn the STABILITY control fully clockwise.

24. Check External Horizontal Amplifier Bandwidth

a. Requirement—Bandwidth $\geq$350 kHz (at the —3 dB point with maximum gain).

b. Set the HORIZONTAL DISPLAY switch to X1 position and the VARIABLE 10-1 control fully clockwise.

c. Apply the output signal from a Constant Amplitude Signal Generator (Type 191) through the 5-ns cable, a 50-Ω GR to BNC termination and a BNC to clip lead adapter to the HORIZ INPUT jack. Make certain the ground path between the signal generator and the Type 585A is complete.

d. Set the frequency of the signal generator to 50 kHz and adjust the output for a horizontal display amplitude of 6 cm.

e. Increase the Constant Amplitude Signal Generator frequency to 350 kHz.

f. Check—Horizontal amplitude of the display must equal or exceed 4.2 cm. (—3 dB point) See Fig. 5-7.

g. Remove the Constant Amplitude Signal Generator signal and the SAWTOOTH A patch cords to the vertical Input connector. Set the HORIZONTAL DISPLAY switch to A position and center the trace with the Position controls.

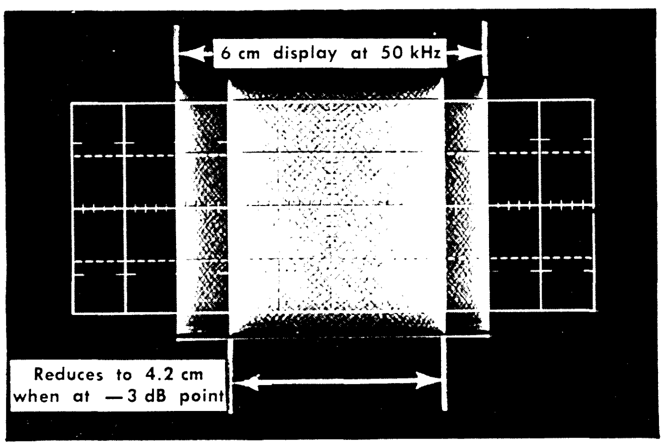


Fig. 5-7. Typical CRT display when checking horizontal amplifier response. Picture is a double exposure to show the two amplitude points.

25. Check Z Axis Cathode Modulation

a. Requirement—A 20-volt signal (1 kHz to 1 MHz) applied to the cathode of the CRT will produce noticeable modulation.

b. Apply the output signal from the CAL OUT connector through a BNC T connector to both the vertical Input connector and the CRT CATHODE connector on the rear panel of the Type 585A. This can be done by connecting a 50-Ω cable between the vertical Input and the T connector plus a 50-Ω cable and a BNC to clip lead adapter between the T connector and the CRT CATHODE jack.

c. Remove the ground strap from the CRT CATHODE jack, set the A TIME/CM selector to .5 mSEC and set the STABILITY control to PRESET position.

d. Set the AMPLITUDE CALIBRATOR selector to 20 VOLTS and the vertical unit Volts/Cm switch to 10. Adjust the TRIGGERING LEVEL control for a stable display.

e. Check—Z axis modulation on the display. The positive portion of the Calibrator signal should show a decrease in intensity level. (The INTENSITY control may require adjustment to observe this modulation.)

f. Remove the cables, T connector and adapter and replace the ground strap to the CRT CATHODE jack.

VERTICAL AMPLIFIER CHECKS

26. Check Vertical Amplifier DC Balance

a. Requirement—With the input to the vertical amplifier shorted the CRT trace position must be within 1 cm above or below the graticule vertical center.

b. Remove the vertical plug-in unit and install the Calibration Fixture 067-0523-00 into the vertical compartment.

c. Turn the A STABILITY control fully clockwise and adjust the Position controls to position the trace to the center of the graticule.

d. Depress the Scope Ampl. Balance Check button on the test plug-in unit.

e. Check—Trace position must be within 1 cm of the center horizontal graticule line.

27. Check Vertical Amplifier Sensitivity and Linearity

a. Requirement—Vertical amplifier sensitivity must be within $\pm$3% of gain indicated.

b. Set the Display Selector switch of the test plug-in unit to Cal (2 cm) position.

c. Check—Vertical separation of the two traces must be 2 cm $\pm$0.6 mm.

d. Position the display to the top and then the bottom of the graticule area and note the amplitude of the display. Variations in amplitude at these extremes from the amplitude of the display at the graticule center indicate the amount of compression or expansion.

e. Check—Expansion or compression of the display must be less than 0.5 mm or 1.0 mm total.

28. Check Vertical Amplifier Transient Response and Risetime

a. Requirement—Maximum overshoot, rounding, ringing or tilt of a square wave is 5% (1 mm/2 cm of display amplitude). Risetime $\leq$ 4.2 ns.

b. Set the front panel controls as follows:

Type 585A

A STABILITY	PRESET
A TRIGGERING SOURCE	INT AC LF REJ
A TIME/CM	.05 μSEC

VARIABLE	CALIBRATED
5X MAGNIFIER	ON
HORIZONTAL DISPLAY	A

Calibration Fixture

Load	Normal
Display Selector	Pulser
Pulser Frequency	Clockwise

c. Adjust the TRIGGERING LEVEL control for a triggered display then adjust the Pulser Amplitude control for a display amplitude of exactly 2 cm. Adjust the HORIZONTAL POSITION controls and the TRIGGERING LEVEL to display a triggered pulse at the center of the graticule. See Fig. 5-8.

d. Measure the risetime of the square wave from the 10% to 90% amplitude points. Sweep rate is 10 ns/cm.

e. Check—Risetime equal or less than 4.2 ns for an equivalent bandwidth of 90 MHz. This is indicated by a horizontal spread of not more than 2 mm or divisions between the 10% and 90% points on the waveform when measuring as in Fig. 5-8.

f. Turn the Display Selector switch to Ext Input, 5X MAGNIFIER switch to OFF and the TIME/CM to .2 mSEC position.

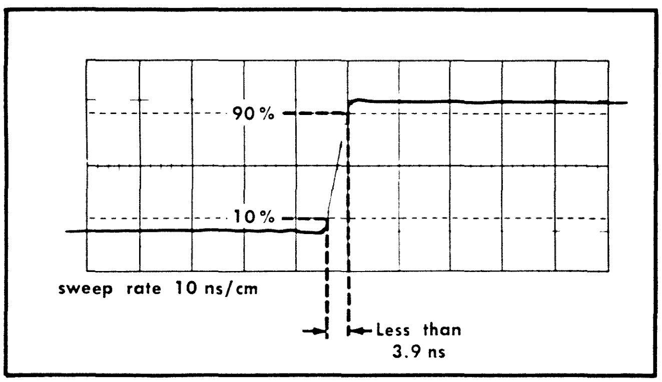


Fig. 5-8. Measuring response time of the vertical amplifier.

29. Check the Vertical Amplifier Frequency Response

a. Requirement—Frequency response with the Type 82 or Type 86 Plug-In Unit in the 100 mV/cm sensitivity position at the —3 dB point, is approximately 80 MHz (equivalent to a risetime of 4.4 ns).

b. Remove the Calibration Fixture and install an 80 series Plug-In Unit.

c. Set the front panel controls as follows:

Type 585A

A STABILITY	Fully clockwise
A TIME/CM	.2 mSEC

Type 80 Series Plug-In Unit

Volts/Cm	.05
Input Selector	DC

d. Apply the output of the Constant Amplitude Signal Generator through a 5-ns cable and a 50-Ω GR to BNC termination to the vertical Input connector.

e. Set the frequency of the signal generator to 50 kHz and adjust the OUTPUT control for a display amplitude of 4 cm.

f. Change the signal generator frequency to 80 MHz.

g. Check—Amplitude of the display must equal or exceed 2.8 cm (—3 dB point). See Fig. 5-9.

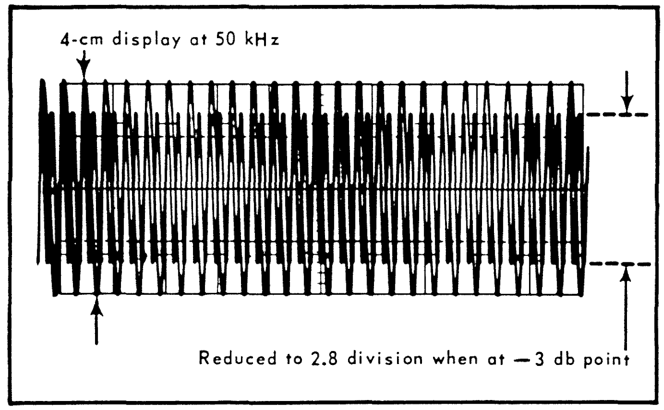


Fig. 5-9. Double exposure showing both amplitude levels when measuring amplifier frequency response.

TRIGGERING CHECK

30. Check Triggering Sensitivity of Time Base A

a. Requirement—Stable triggering with source, coupling, frequency and amplitude of trigger signals as specified in Table 5-6.

b. Apply the output signal of the constant Amplitude Signal Generator or an audio signal generator (depending upon the trigger signal frequency listed in Table 5-6) through the 5-ns cable, a GR to BNC 50-Ω termination and a BNC T connector to the Input connector of the vertical plug-in unit.

c. Connect a coaxial cable from the open end of the T connector to the A TRIGGER INPUT connector of the Type 585A.

d. Check—The triggering must be stable with the SLOPE switch in either + or — position in accordance with the sensitivity specifications listed in Table 5-6.

With the STABILITY control out of the PRESET position the STABILITY and TRIGGERING LEVEL controls must be adjusted as follows:

(1) Adjust the STABILITY control 2 to 3 degrees past the position at which the trace does not free run.

(2) Adjust the TRIGGERING LEVEL control for a stable triggered display. The LEVEL control may need readjusting when the SLOPE switch position is changed.

(3) When the TRIGGERING SOURCE switch is in the EXT positions the trigger signal amplitude may be monitored by the vertical plug-in unit for the Type 585A as follows:

Set the Volts/Cm switch to .2 and the Variable control to Cal position.

Adjust the output amplitude control of the signal generator for the specified trigger signal amplitude listed in Table 5-6. For example, .5 V = 2.5 cm signal amplitude with a vertical sensitivity of .2 V/cm.

Adjust the TIME/CM switch and the Triggering controls for a stable triggered display.

e. Check—Stable triggering with the SLOPE switch in either + or — position in accordance with the sensitivity specifications listed in Table 5-6.

f. Check—Maximum trigger voltage characteristic.

(1) Connect a coaxial cable from the CAL OUT connector of the Type 585A to the vertical Input connector of the test oscillscope, then apply the Vert Sig Output of the test oscilloscope through a T connector and two cables to both the Type 585A A TRIGGER INPUT and the vertical Input connector.

(2) Set the front panel controls as follows:

Type 585A

HORIZONTAL DISPLAY	A
Time Base A	
TRIGGERING SOURCE	EXT AC
STABILITY	PRESET
TIME/CM	.5 mSEC
AMPLITUDE CALIBRATOR	20 VOLTS

Vertical Plug-In Unit

Input Selector	DC
Volts/Cm	5
Variable	Calibrated

TABLE 5-6

Triggering Controls	Input Trigger Signal		Other Conditions
A TRIGGERING SOURCE	Frequency	Amplitude	
INT AC	15 Hz	4 mm	
INT AC LF REJ	15 Hz	4 mm	Must not trigger in this state
INT AC	15 kHz	4 mm	
INT AC LF REJ	15 kHz	4 mm	
EXT AC	15 kHz	0.3 V	
EXT DC	15 kHz	0.3 V	
EXT DC	15 Hz	0.3 V	
EXT AC	15 Hz	0.3 V	
EXT AC	1 MHz	0.3 V	
EXT DC	1 MHz	0.3 V	
INT AC	1 MHz	4 mm	
INT AC LF REJ	1 MHz	4 mm	
INT AC LF REJ	5 MHz	4 mm	
INT AC	5 MHz	4 mm	
EXT AC	5 MHz	0.3 V	
EXT DC	5 MHz	0.3 V	
EXT HF SYNC	50 MHz	0.2 V	
EXT DC	50 MHz	0.5 V	
EXT AC	50 MHz	0.5 V	
INT AC	50 MHz	1 cm	
INT AC LF REJ	50 MHz	1 cm	
INT HF SYNC	50 MHz	4 mm	
INT HF SYNC	100 MHz	4 mm	
INT AC LF REJ	100 MHz	2 cm	
INT AC	100 MHz	2 cm	
EXT AC	100 MHz	1.5 V	
EXT DC	100 MHz	1.5 V	
EXT HF SYNC	100 MHz	0.2 V	

Test Oscilloscope

Input Selector	AC
Volts/Cm	1
Position	Adjusted for a centered trace with input signal removed.

(3) Adjust the Variable control on the test oscilloscope vertical plug-in unit for a display amplitude of 2.0 cm on the Type 585A (10-volt signal).

(4) Rotate the Type 585A TRIGGERING LEVEL control to both extremes. Check—Display must not trigger at the extreme positions of the TRIGGERING LEVEL control.

(5) Remove all cables connected to the Type 585A and test oscilloscope.

32. Check Time Base B Triggering Sensitivity

a. Requirement—Stable triggering under the conditions specified in Table 5-7.

TABLE 5-7

B Triggering Sensitivity

Triggering Controls	Input Trigger Signal		Other Conditions
B TRIGGERING SOURCE	Frequency	Amplitude	
INT AC	15 Hz	4 mm	
INT AC LF REJ	15 Hz	4 mm	Must not trigger in this state
INT AC	15 kHz	4 mm	
INT AC LF REJ	15 kHz	4 mm	
EXT AC	15 kHz	0.5 V	
EXT DC	15 kHz	0.5 V	
EXT DC	15 Hz	0.5 V	
EXT AC	15 Hz	0.5 V	
EXT AC	1 MHz	0.5 V	
EXT DC	1 MHz	0.5 V	
INT AC	1 MHz	4 mm	
INT AC LF REJ	1 MHz	4 mm	
INT AC LF REJ	5 MHz	2 cm	
INT AC	5 MHz	2 cm	
EXT AC	5 MHz	1.5 V	
EXT DC	5 MHz	1.5 V	

b. Disconnect the cable from the vertical Input connector to the A TRIGGER INPUT and reconnect to the B TRIGGER INPUT connector.

c. Change the HORIZONTAL DISPLAY selector to the B position.

d. Check—Triggering sensitivity. Must be stable with either + or — position of the SLOPE selector. Adjust the B STABILITY and TRIGGERING LEVEL controls as directed in step 30.

e. Disconnect and remove test equipment and cables. Return the HORIZONTAL DISPLAY switch to the A position.

31. Check Line Triggering

a. Requirement—Line triggering must produce stable triggering and trigger on the correct slope of the waveform.

b. Set the 585A front panel controls for both Time Base A and B to the following settings:

TIME/CM	5 mSEC
TRIGGERING SOURCE	LINE
STABILITY	Fully clockwise

c. Set the vertical plug-in unit Input selector to AC and the Volts/Cm switch to 10, then apply the high side of the line voltage source through a 10× probe to the Input connector.

d. Adjust the STABILITY and TRIGGERING LEVEL control for a stable triggered display.

e. Change the SLOPE switch from + to — position and check the slope of the display for each position of the SLOPE switch.

f. Check—Slope of the display must correspond with the settings of the TRIGGER SLOPE switch. See Fig. 5-10.

g. Set the STABILITY control to PRESET and again adjust the TRIGGERING LEVEL control for a stable display.

h. Check—Correct slope of the display with each position of the TRIGGER SLOPE switch.

33. Check Single Sweep Operation

a. Requirement—Triggering signal must trigger a sweep each time the RESET button is depressed. The READY neon

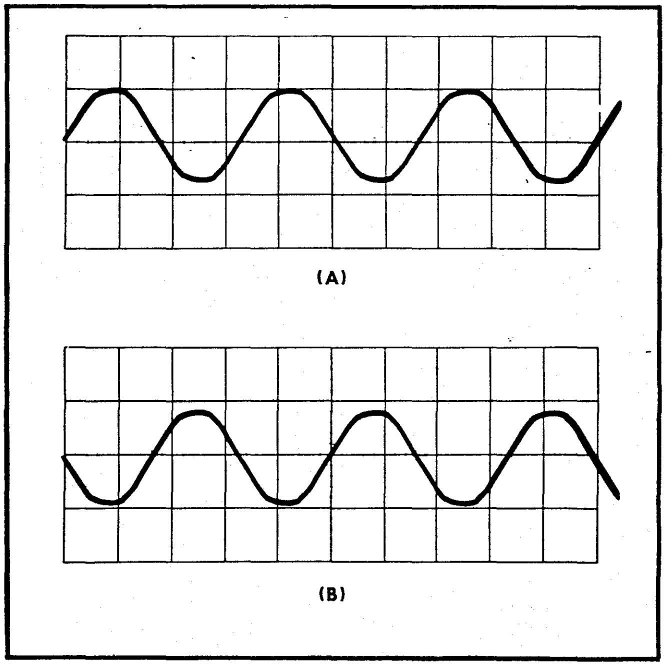


Fig. 5-10. Line Triggering. (A) Positive slope triggering. (B) Negative slope triggering.

must light when the circuit is armed and stay lit until the sweep has run.

b. Set the front panel controls as follows:

HORIZONTAL DISPLAY	A
TIME BASE A	
TIME/CM	1 mSEC
TRIGGERING SOURCE	INT AC
STABILITY	PRESET
TRIGGERING LEVEL	Clockwise
AMPLITUDE CALIBRATOR	20 mVOLTS

Vertical Plug-In Unit

Volts/Cm	.1 Volt

c. Apply the signal from the CAL OUT connector to the Input connector of the vertical plug-in unit.

d. Adjust the Volts/Cm and Variable control for a display amplitude of 4 mm.

e. Adjust the TRIGGERING LEVEL control for a stable display.

f. Change the HORIZONTAL DISPLAY switch to SINGLE SWEEP position and remove the signal cable to the Input connector of the vertical plug-in unit.

g. Depress the RESET button. Check—The READY neon lights.

h. Reconnect the signal cable to the vertical Input connector.

i. Check—A single sweep should run and the READY neon must extinguish.

j. Remove the coaxial cable between the CAL OUT connector and the Input of the vertical unit.

NOTES

SECTION 6
CALIBRATION

Introduction

This calibration procedure can be used for complete calibration of the Type 585A to return it to original performance, or as an operational check of instrument performance. Completion of every step in this procedure returns the Type 585A to original factory performance standards. To touch up the calibration, perform only those steps entitled Adjust.

NOTE

The Adjust steps provide a check of instrument performance before the adjustment is made. To prevent recalibration of other circuits when performing a partial calibration, readjust only if the listed tolerance is not met.

General Information

Any needed maintenance should be performed before proceeding with calibration. Troubles which become apparent during calibration should be corrected using the techniques given in the Maintenance section of the Instruction Manual.

This procedure is arranged in a sequence which allows this instrument to be calibrated with the least interaction of adjustments and reconnection of equipment. If desired, the steps may be performed out of sequence or a step may be done individually. However, some adjustments affect the calibration of other circuits within the instrument. In this case, it will be necessary to check the operation of other parts of the instrument. When a step interacts with others, the steps which need to be checked will be noted.

The location of test points and adjustments is shown in each step. Waveforms which are helpful in determining the correct adjustments or operation are also shown.

EQUIPMENT REQUIRED

(See Figs. 6-1 and 6-2)

General

The following equipment or its equivalent is required for complete calibration of the Type 585A. Specifications given are the minimum necessary for accurate calibration of this instrument. All test equipment is assumed to be correctly calibrated and operating within the original specifications. If equipment is substituted, it must meet or exceed the specifications of the recommended equipment.

Special Calibration Fixtures

For the quickest and most accurate calibration, special calibration fixtures are used where necessary. All calibration fixtures listed under Equipment Required can be obtained from Tektronix, Inc. Order by part number through your local Tektronix Field Office or representative.

1. Test oscilloscope. Bandwidth, DC to 30 MHz; minimum deflection factor, 0.005 volts/cm. Tektronix 540-series Oscilloscope with Type B Plug-In Unit and Tektronix P6006 Probe recommended.

2. 1× probe. Tektronix P6028 Probe recommended. Part No. 010-0074-00.

3. Calibration Fixture Plug-In Unit for the 580-series Oscilloscope. Tektronix Calibration Fixture 067-0523-00.

4. Plug-In Unit for the Type 585A: Bandwidth, DC to 85 MHz. Tektronix 80-series plug-in units (Type 82-86).

5. Variable autotransformer. Must be capable of supplying at least 700 watts over a voltage range of 105 to 125 volts (210 to 250 volts for 230-volt nominal line). If autotransformer does not have an AC voltmeter to indicate output voltage, monitor output with an AC voltmeter (RMS) with a range to ate least 137 (or 274) volts. For example, General Radio W10MT3W Metered Variac Autotransformer.

6. Time-mark generator. Marker outputs, 5 seconds to .1 microsecond; sine-wave output, 20 MHz to 100 MHz (10 ns); accuracy 0.001%. Tektronix Type 184 Time-Mark Generator recommended.

7. Standard amplitude calibrator. Amplitude accuracy within 0.25%; signal amplitude, range 100 millivolts to 100 volts in calibrated steps with a frequency of approximately 1 kHz. Tektronix Calibration Fixture 067-0502-00 recommended.

8. Constant amplitude signal generator. Frequency range 50 kHz and 350 kHz to 100 MHz. Variable Output amplitude with an amplitude accuracy within ±3% from 50 kHz to 100 MHz. Tektronix Type 191 Constant Amplitude Signal Generator with a 5-ns cable.

9. Audio Oscillator. Frequency 15 Hz to 350 kHz. General Radio Oscillator Type 1310-A.

10. DC voltmeter. Minimum sensitivity rating, 20,000 ohms/volt; range at least 2000 volts full scale, with an accuracy checked to within 1% at 12.6, 100, 150, 225, 350, 500 volts and at least 3% at 1350 volts.

11. Termination. Impedance, 50 ohm; accuracy ±3%; GR to BNC type connectors. Tektronix Part No. 017-0083-00.

12. Termination. Impedance, 50 ohm; accuracy ±3%; BNC to BNC type connectors. Tektronix Part No. 011-0049-00.

13. Two (2) T connectors, BNC. Tektronix Part No. 103-0030-00.

14. Coaxial cables (three). Impedance, 50 ohm; length 42 inches; connectors, BNC. Tektronix Part No. 012-0057-00.

15. Viewing Hood. Tektronix Part No. 016-0053-00. (To reduce glare under high ambient light conditions.)

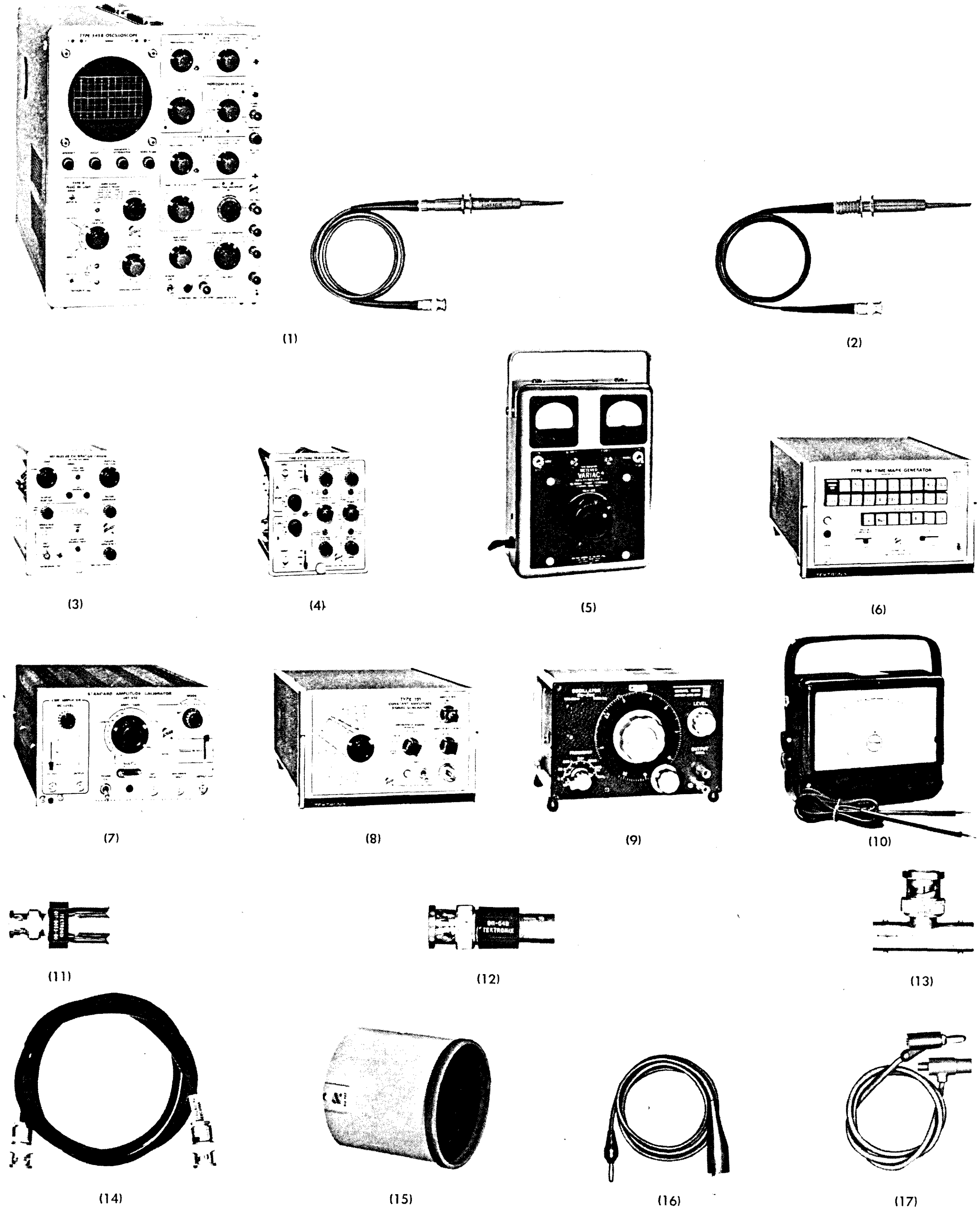


Fig. 6-1. Equipment required to calibrate the Type 585A.

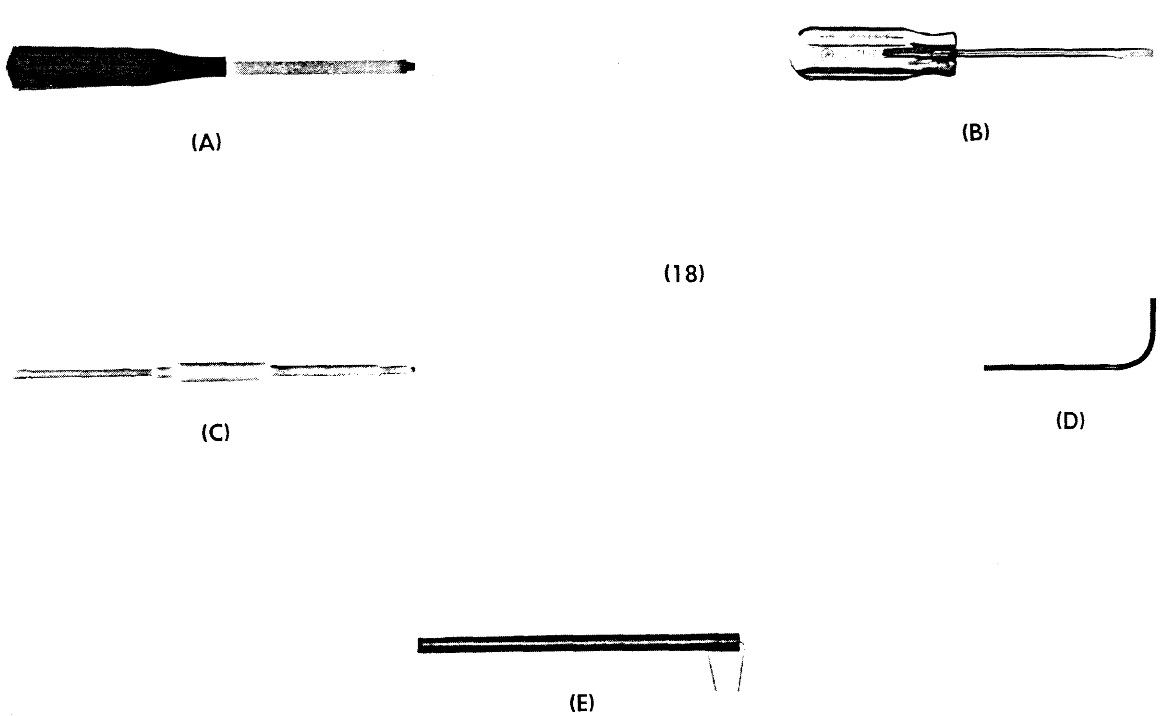


Fig. 6-2. Tools for calibration of the Type 585A.

16. Patch cord, about 30 inches long. Banana plug to alligator clips. Part No. 012-0014-00.

17. Two (2) patch cords, about 18 inches long, BNC to banana plug. Part No. 012-0088-00 or 012-0089-00.

18. Adjustment tools:

Description	Tektronix Part No.
a. Insulated screwdriver, 3 inch shaft, non-metallic	003-0047-00
b. Screwdriver, $^3/_{32}$ inch bit	003-0192-00
c. Tuning rod, 5 inches	003-0301-00
d. Hexagonal Key wrench, $^1/_{16}$ inch	003-0106-00
e. Shorting tool (with 27 Ω resistor)	003-0002-00

CALIBRATION RECORD AND INDEX

This Abridged Calibration Procedure is provided to aid in checking the operation of the Type 585A. It may be used as a calibration guide by the experienced calibrator, or it may be used as a calibration record. Since the step numbers and titles used here correspond to those in the complete Calibration Procedure, the following procedure serves as an index to locate a step in the complete Calibration Procedure. Characteristics are those listed in the Characteristics section of the Instruction Manual.

Type 585A, Serial No. ____________________

Calibration Date ____________________

☐ 1. Adjust —150 Volt Power Supply. Page 6-6.

☐ 2. Adjust +12.6 Volt Power Supply. Page 6-6.

☐ 3. Check Low Voltage Power Supply Regulation and Ripple. Page 6-7.

☐ 4. Adjust High Voltage Power Supply. Page 6-8.
—1350 V

☐ 5. Adjust Amplitude Calibrator. Page 6-8.
Adjust R879 for +100 V, check duty cycle, 45 to 55%.

☐ 6. Check High Voltage Regulation. Page 6-9.
—1350 V, through the line voltage range, 105 to 125, at full intensity.

☐ 7. CRT trace and Graticule Alignment. Page 6-9.

☐ 8. Adjust Vertical Shield Voltage. Page 6-10.
(Normally required only after CRT replacement.)

☐ 9. Adjust Geometry. Page 6-11.
Vertical geometry: 1 mm maximum bowing in 4 cm.
Horizontal geometry: 1 mm maximum bowing in 10 cm.

☐ 10. Check Amplitude Calibrator Accuracy. Page 6-12.
Error in all ranges equal to or less than ±3%.

☐ 11. Check Amplitude Calibrator Repetition Rate. Page 6-13.
1 kHz ±25%.

☐ 12. Check Vertical Amplifier Balance. Page 6-14.
From the CRT electrical center or the pervious stage; Delay Line Driver, 0.5 cm maximum unbalance; Output Amplifier, 0.5 cm maximum unbalance; overall less than 0.5 cm.

☐ 13. Adjust Vertical Amplifier Gain. Page 6-15.
With the Display Selector switch of the test plug-in unit in the Cal (2 cm) and Alt Sync position, adjust R1015 for a display amplitude of 2 cm.

☐ 14A. Adjust Vertical Output Centering Control (SN 10460-up). Page 6-15.
Balance the degree of compression and/or expansion of the upper and lower halves of the graticule area.

☐ 14B. Check Vertical Compression and/or Expansion (SN 5969-10459) Page 6-16.
Compression or expansion must not exceed 0,5 mm at the top or bottom of the graticule. Total compression and/or expansion must not exceed 1 mm.

☐ 15. Check Alternate Sweep Operation. Page 6-16.

☐ 16. Check DC Shift. Page 6-16.
Trace drift after trace returns to electrical center must not exceed 1 mm.

☐ 17. Check Vertical Drift. Page 6-16.
Vertical drift through the line voltage range of 105 to 125, 2 mm maximum.

☐ 18. Adjust A Trigger Sensitivity and Trigger Level Centering. Page 6-18.
Adjusted to trigger on the + or — slope of a 1 mm signal, but not on a 0.5 mm signal.

☐ 19. Check Trigger Level Control Position. Page 6-19.

☐ 20. Adjust PRESET ADJUST. Page 6-19.

☐ 21. Check Time Base A Triggering. Page 6-20.
Must trigger properly under conditions listed in Table 6-3.

☐ 22. Check Line Triggering. Page 6-22.
±Line, fixed level.

☐ 23. Adjust Lockout Level. Page 6-22.
Sawtooth to gate ratio between 1:1 and 2:3 with a gate amplitude of 9 V minimum.
Table 6-1.

☐ 24. Check Time Base A Single Sweep Operation. Page 6-22.

☐ 25. Adjust 'B' Trigger Level Centering and Triggering Level Control position. Page 6-23.
Adjusted to trigger on the + and — slope of a 2 mm signal.

☐ 26. Check 'B' Triggering Level Control Position. Page 6-24.

☐ 27. Adjust B Preset. Page 6-24.

☐ 28. Check Time Base B Triggering. Page 6-25.
Must trigger properly under the conditions listed in Table 6-4.

☐ 29. Adjust Magnifier Gain. Page 6-27.
Adjust Mag Gain R372.

☐ 30. Adjust Sweep Calibration. Page 6-28.
Adjust Swp Cal R348 for one 1 ms marker/cm.

☐ 31. Adjust Time Base A to Time Base B. Page 6-28.
Adjust timing potentiometer R160Z.

☐ 32. Adjust 'A' Sweep Length and Check Variable Control Range. Page 6-28.
Adjust R176 for a 10.5 cm sweep length. Check range of VARIABLE control for a sweep rate reduction equal to or greater than 2.5 times the TIME/CM selector indication.

☐ 33. Adjust Sweep Magnifier Registration. Page 6-28.
Adjust Norm/Mag Regis R358.

☐ 34. Check Time Base A Sweep Timing Accuracy (.1 mSEC/CM to 2 SEC/CM). Page 6-29.
Check timing accuracy as per Table 6-5.

☐ 35. Adjust and Check Time Base A Sweep Rates (50 μSEC/CM through .01 μSEC/CM). Page 6-29.
Adjust and check as per Table 6-6.

☐ 36. Adjust Delay Start and Stop. Page 6-32.

☐ 37. Check Delay Time Multiplier Incremental Linearity. Page 6-32.
Accuracy over total range is ±2%.

☐ 38. Adjust Time Base B Sweep Rate. Page 6-33.
Adjust C260A.

☐ 39. Check Time Base B Sweep Timing Accuracy. Page 6-33.
Check as per Table 6-7. Timing accuracy over the center 8 cm is within ±3%.

☐ 40. Check A Sweep Holdoff Time. Page 6-34.

☐ 41. Check B Sweep Holdoff Time. Page 6-35.

☐ 42. Adjust External Horizontal Amplifier DC Balance. Page 6-36.
Adjust Ext Horiz DC Bal R317.

☐ 43. Adjust External Horizontal Amplifier Input Compensation. Page 6-37.
Adjust C301C.

☐ 44. Check External Horizontal Input Deflection Factor. Page 6-37.
×1 with 0.2 V applied, 1.1 cm deflection, minimum.
×10 deflection factor error, ±3% maximum.
VARIABLE ATTENUATOR 10-1 control ratio, 10:1 minimum.

- [ ] 45. Check External Horizontal Amplifier Bandwidth. Page 6-38.
  Bandwidth $\geq$350 kHz.
- [ ] 46. Adjust Vertical System High Frequency Compensation. Page 6-39.
  Aberrations on pulse from test plug-in unit, $\leq \pm 5\%$.
- [ ] 47. Check Risetime. Page 6-42.
  Delay 40 ns, minimum; risetime, 3.9 ns maximum.

CALIBRATION PROCEDURE

General

In the following procedure, a test equipment setup is shown for each major setup change. Complete control settings are listed beneath the illustration. To aid in locating individual controls which have been changed during the complete calibration, the control names are printed in bold type. If only a partial calibration is performed, start with the setup preceding the desired portion of the procedure.

NOTE

When performing a complete recalibration, best performance will be provided if each adjustment is made to the exact setting, even if the Check is within the allowable tolerance. The following procedure uses the equipment listed under Equipment Required. If substitute equipment is used, control settings or setup must be altered to meet the requirements of the equipment used.

Preliminary

1. Remove the side and bottom covers from the Type 585A and install the calibration fixture plug-in unit for the Type 580 series.

2. Connect the autotransformer to a suitable power source.

3. Connect the Type 585A power cord to the autotransformer output.

4. Set the Autotransformer to 117 (234) volts.

5. Turn POWER switch ON.

6. Check—Delay time of the relay. The relay armature should pull in with an audible click within 15 to 60 seconds.

7. Allow at least 20 minutes warm up at ambient temperature of 25°C, ±5°C, for stabilizing before checking the instrument to given accuracy.

NOTES

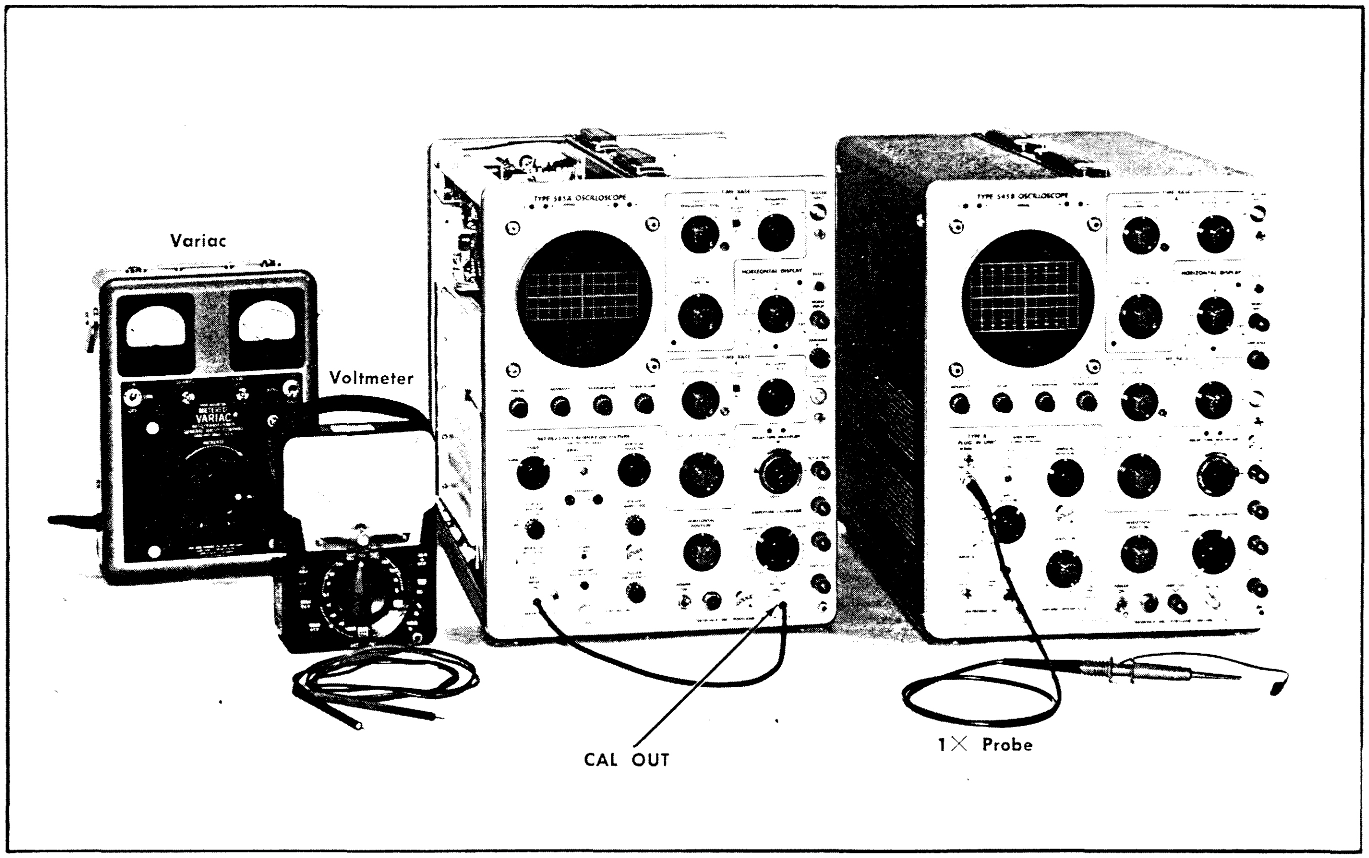


Fig. 6-3. Equipment setup for steps 1 through 7.

Type 585A

CRT Controls	
FOCUS and ASTIGMATISM	Well focused display
INTENSITY	Adjusted for nominal brightness
HORIZONTAL DISPLAY	A
5X MAGNIFIER	OFF
Time Base A Controls	
TIME/CM	.5 mSEC
VARIABLE	CALIBRATED
STABILITY	Fully CW
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
Time Base B Controls	
TIME/CM	1 mSEC
LENGTH	10 CM
STABILITY	Fully CW
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
DELAY-TIME MULTIPLIER 1-10	1.00
AMPLITUDE CALIBRATOR	OFF
HORIZONTAL POSITION	Midrange or centered display

Calibration Fixture 067-0523-00

+12.6 Load	Switch toward panel
Load	Norm
Vertical Position	Midrange or centered display
Display Selector	Ext Input
Pulser Amplitude	0
Pulser Frequency	Midrange

Test Oscilloscope

Time/Cm	1 mSEC
Volts/Cm	.5

1. Adjust—150-Volt Power Supply ⓘ

a. Equipment setup is shown in Fig. 6-3.

b. Connect the DC voltmeter between the —150-volt check point and ground (see Fig. 6-4B).

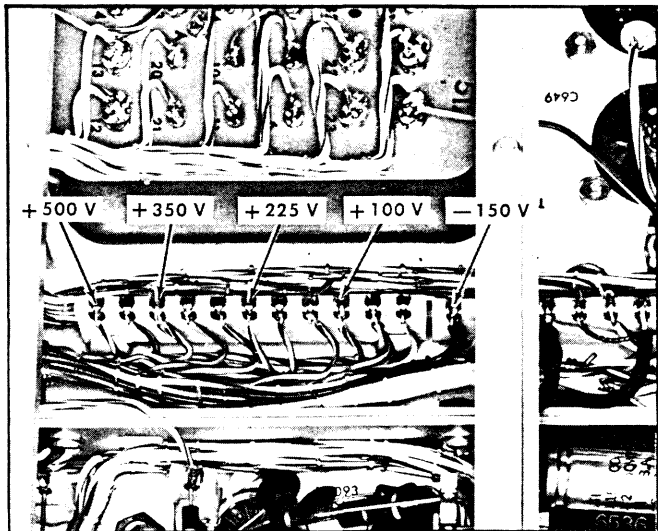
c. Adjust —150 Adj R616 for a —150-volt reading. Fig. 6-4C.

d. Interaction—Operation of most circuits within the Type 585A are affected by —150-volt supply.

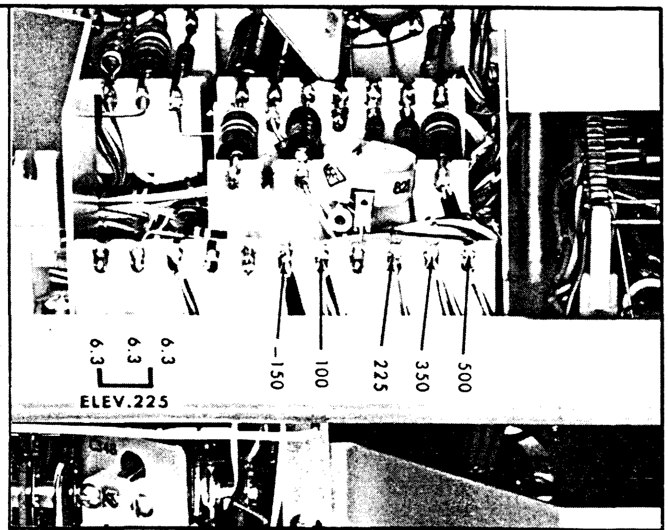
2. Adjust +12.6 Volt Power Supply ⓘ

a. Equipment setup is given for step 1.

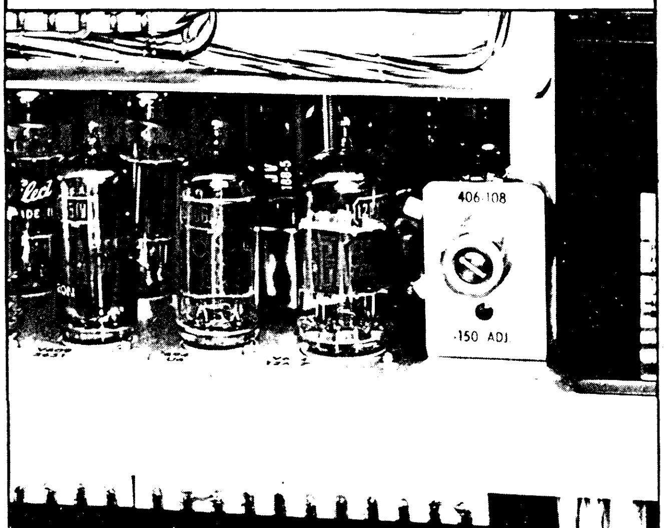
b. Connect the voltmeter between the +12.6-volt check point and ground (see Fig. 6-4D).



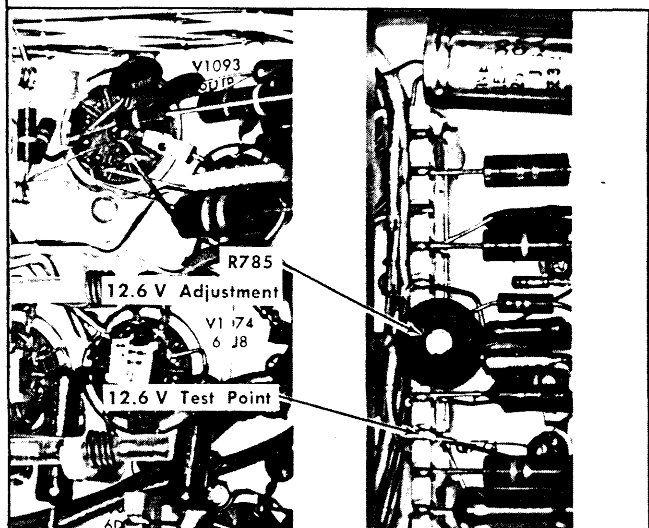
A. Terminal strips on the bottom chassis. Check ripple amplitude at these test points.



B. Voltage calibration check points on the upper chassis.



C. −150 V adjustment.



D. +12.6 V adjustment R785 and 12.6 V test point.

Fig. 6-4. Low voltage power supply check points.

c. Adjust R785 (Fig. 6-4D) for +12.6-volt reading. (Vertical amplifier heater circuit and plug-in units utilize the +12.6-volt supply.)

3. Check Low Voltage Power Supply Regulation and Ripple

a. Equipment setup is shown in Fig. 6-3.

b. Connect the DC voltmeter between each low voltage check point and chassis ground to check the regulation. Connect the 1× probe from the test oscilloscope to each point to check ripple. See Fig. 6-4A.

c. Check each voltage and ripple amplitude against tolerances listed in Table 6-1.

NOTE

Ripple should be checked at the check points illustrated in Fig. 6-4A.

Set the calibration fixture Load selector switch first to Low position, autotransformer at 125 VAC (250 VAC), then set the switch to High Load position, autotransformer at 105 VAC (210 VAC) and repeat the check for regulation and ripple tolerance.

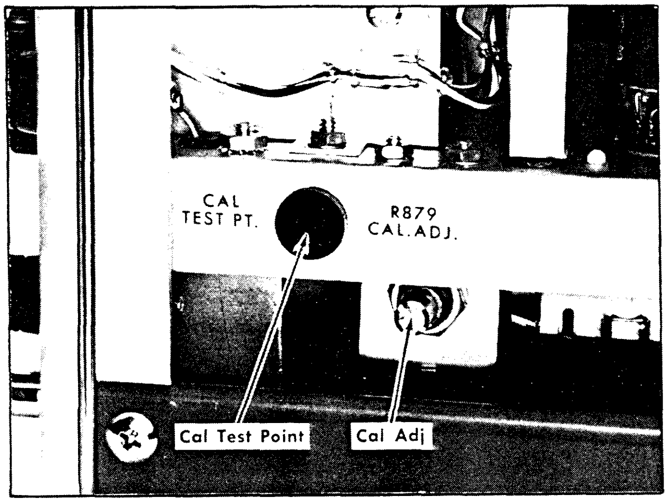


Fig. 6-5. Amplitude Calibrator test point and Cal. Adj. location.

TABLE 6-1

Supply	Tolerance[1]	Typical Ripple
—150 V	±3 V	5 mV
+12.6 V	±0.6 V	15 mV
+100 V	±2 V	15 mV
+225 V	±5 V	5 mV
+350 V	±7 V	30 mV
+500 V	±10 V	30 mV

[1]Applicable when line contains 2% or less harmonic distortion.

f. Set the test plug-in unit Load selector to Norm position and the autotransformer for 117 VAC (234 VAC) output.

g. Disconnect the test oscilloscope probe and the DC voltmeter.

4. Adjust High Voltage Power Supply

a. Equipment setup is shown in Fig. 6-3.

b. Connect the DC voltmeter between the —1350-volt supply and ground. See Fig. 6-6A.

c. Adjust the High Voltage adjustment R840 (see Fig. 6-6B) for —1350 volts.

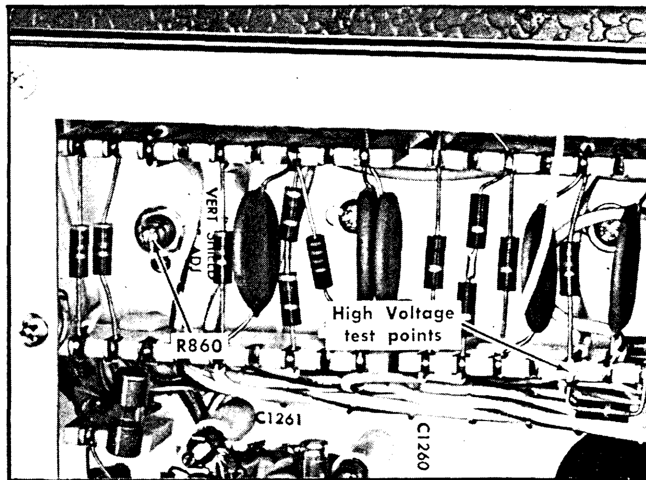
d. Interaction—Operation of the CRT circuits within the Type 585A depend on this adjustment.

5. Adjust Amplitude Calibrator

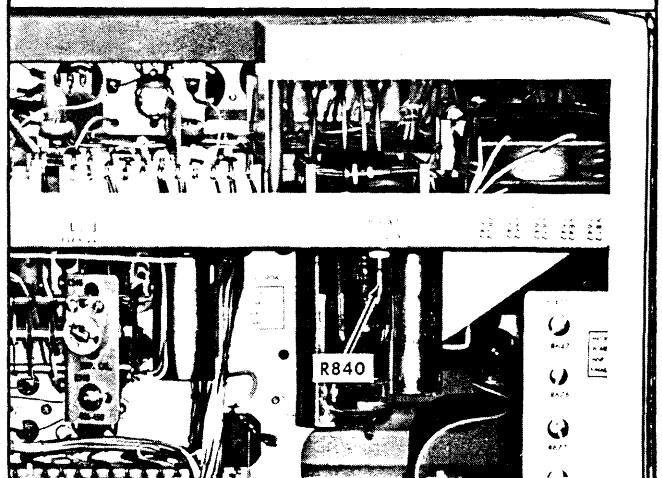
a. Equipment setup is given in step 4.

b. With the AMPLITUDE CALIBRATOR switch in the OFF position connect a voltmeter between the Cal Test Pt and chassis ground (see Fig. 6-5).

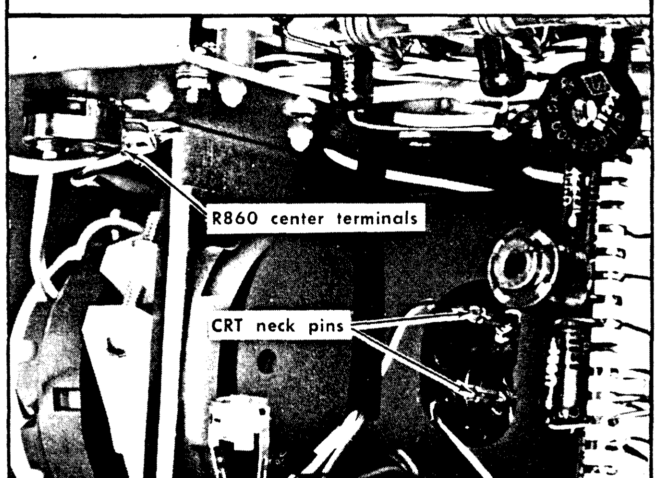
c. Adjust Cal Adj R879 for 100 V.



A. High voltage check point and Vert. Shield. Adjust R860.



B. High Voltage Adj: R840 location.



C. Test points to adjust adjust Vert Shield Voltage.

Fig. 6-6. High voltage check points.

d. Turn the AMPLITUDE CALIBRATOR switch to any mVOLTS setting and check for meter reading of 45 to 55 volts which indicates 45 to 55% duty cycle.

e. Remove the voltmeter.

6. Check High Voltage Regulation

a. Equipment setup is given in step 5.

b. Connect a voltmeter between the —1350 V check point and chassis ground. See Fig. 6-6A.

c. Connect a coaxial cable between the CAL OUT connector and the Ext Input of the test plug-in vertical unit. Set the AMPLITUDE CALIBRATOR switch to .5 VOLTS.

d. Adjust Triggering controls for a stable display then set the FOCUS and ASTIGMATISM controls so display is completely defocused.

e. Set the INTENSITY control fully clockwise and set the line voltage to 105 volts.

f. Check display for blooming (expanding vertically or horizontally) and check meter reading for any change greater than ±20 volts in the —1350-volt supply. Both are indications of insufficient high voltage regulation.

g. Turn the INTENSITY control fully counterclockwise and set the line voltage to 125 volts.

h. Check —1350 V variation. Should not exceed ±20 V.

i. Remove the meter and set the autotransformer for an output of 117 VAC (234 VAC).

7. Adjust CRT Trace and Graticule Alignment

SN 9000-up

a. Remove the Amplitude Calibrator signal to the Ext Input connector of the test plug-in unit and set the STABILITY control fully clockwise for a free running trace.

b. Center the free running trace on the graticule with the POSITION controls.

c. Adjust the TRACE ROTATION control R865 to align the trace with the horizontal graticule lines.

SN 5969 to 8999

a. Obtain a free running trace in the same manner as above.

b. Turn the red knob near the CRT base to align the trace with the graticule line.

All Serial Numbers

Adjust the FOCUS, INTENSITY and ASTIGMATISM controls for a sharp, clearly defined trace. Position the trace alternately to the upper and lower vertical scan limits. The trace should remain visible the same distance above the graticule as below.

NOTE

The graticule may be positioned anywhere within the scan area if necessary for optimum geometry, compression and focus which are checked in the following steps.

NOTES

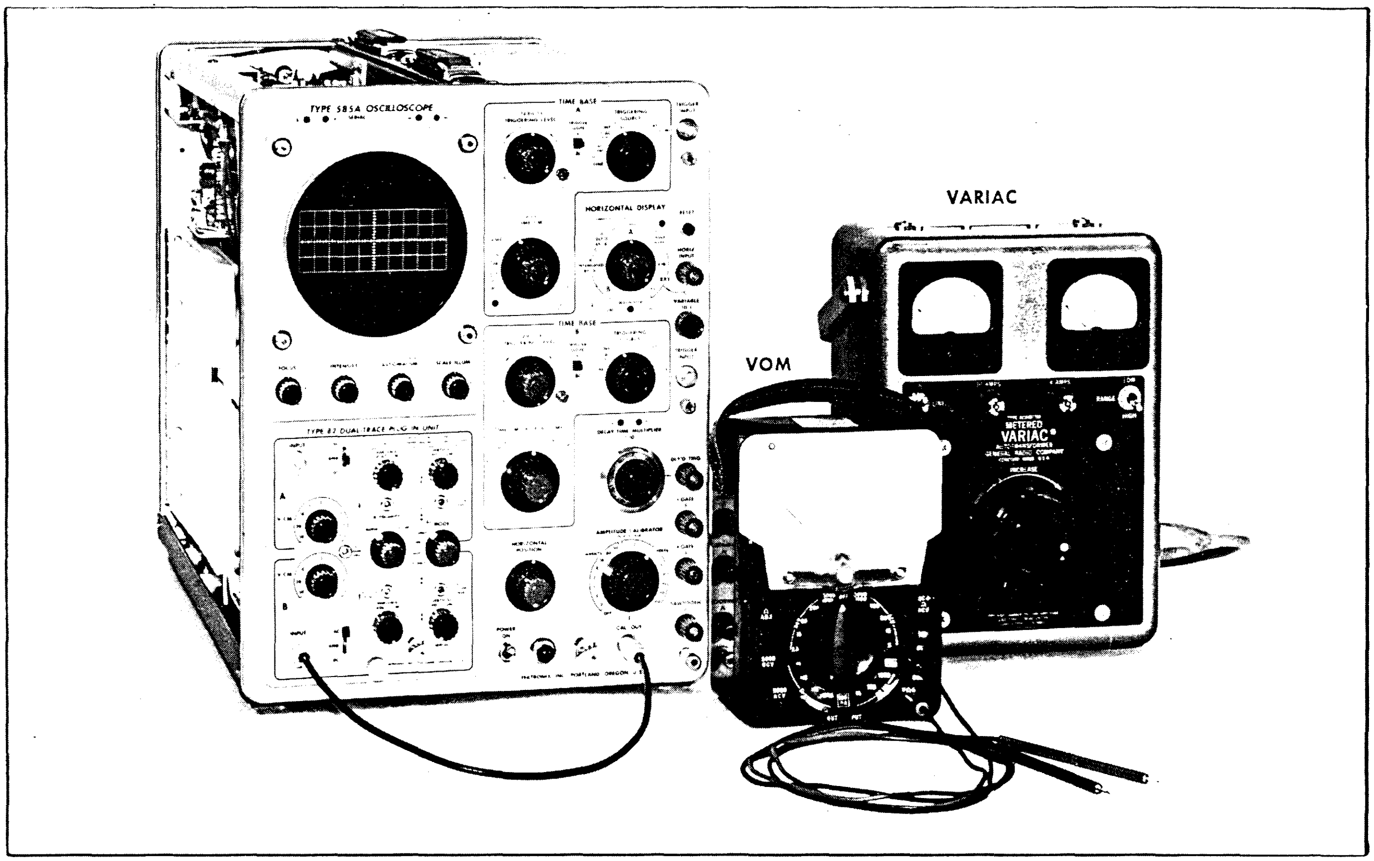


Fig. 6-7. Equipment setup for steps 8 and 9.

Type 585A

CRT Controls	
FOCUS and ASTIGMATISM	Well focused display
INTENSITY	Adjusted for nominal brightness
HORIZONTAL DISPLAY	A
5X MAGNIFIER	OFF
Time Base A Controls	
TIME/CM	**1 mSEC**
VARIABLE	CALIBRATED
STABILITY	Fully CW
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
Time Base B Controls	
TIME/CM	1 mSEC
LENGTH	10 CM
STABILITY	Fully CW
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
DELAY-TIME MULTIPLIER 1-10	1.00
AMPLITUDE CALIBRATOR	OFF
HORIZONTAL POSITION	Midrange or centered display

Vertical Plug-In Unit (Type 82 or 86)

Volts/Cm	.5
Input Selector	AC
Variable Volts/Cm	Cal

8. Adjust Vertical Shield Voltage

USE FOR NEW TUBE ONLY

NOTE

This adjustment usually is only required after replacing the CRT.

a. Equipment setup is shown in Fig. 6-7.

b. Connect a voltmeter between the center terminal of the Vert Shield Adj R860 and the rear CRT vertical deflection plate neck pin. See Fig. 6-6C. Position the trace to the graticule center.

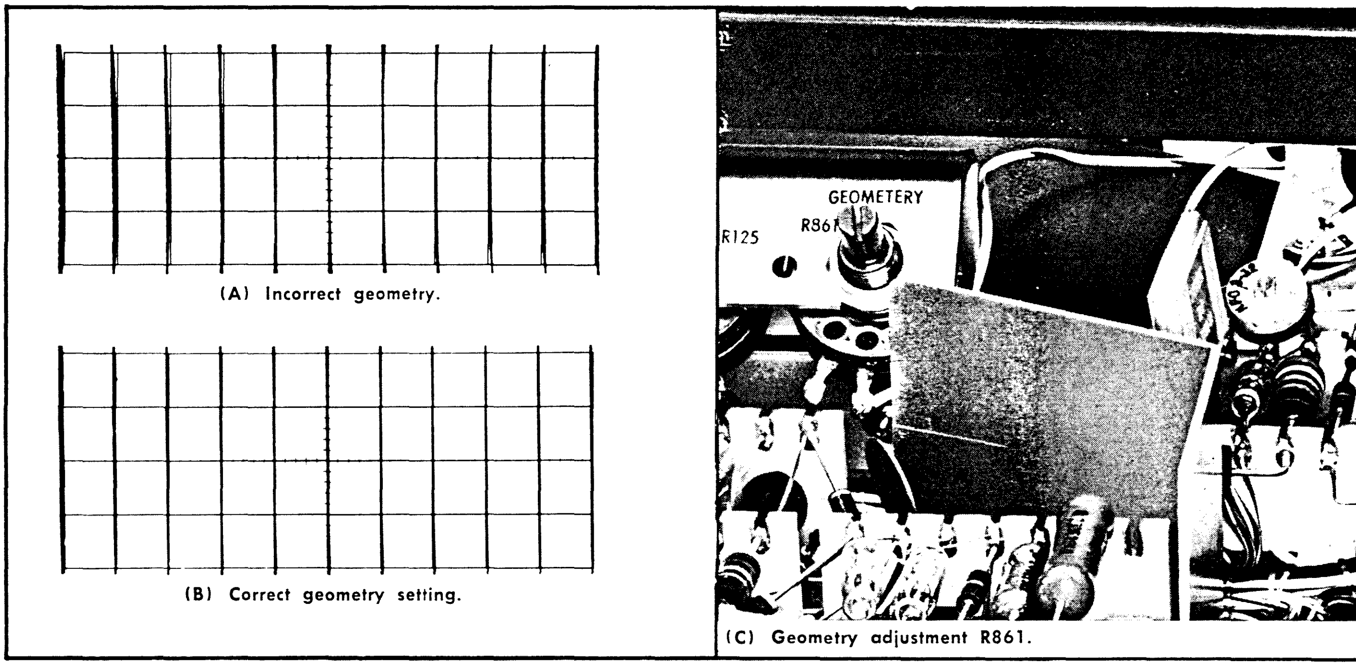
c. Adjust R860 for a meter reading of 0 volts.

d. Perform step 9 (Adjust Geometry).

e. Reconnect the AMPLITUDE CALIBRATOR signal to the vertical Input connector. Set the vertical Plug-In unit, Input selector to DC, then adjust the Volts/Cm switch and Variable control for a display amplitude of 1 cm with the display centered in the graticule area.

f. Adjust the INTENSITY FOCUS and ASTIGMATISM controls for optimum display focus.

©



(A) Incorrect geometry.

(B) Correct geometry setting.

(C) Geometry adjustment R861.

Fig. 6-8. Geometry Adjustments. (A) Display of incorrect geometry. (B) Correct geometry. (C) Geometry adjustment R861.

g. Position the display to the upper 1 cm of the graticule, then to the lower portion of the graticule and note the display amplitude expansion and/or compression. Expansion or compression should not exceed 0.5 mm from the center of the 2 cm display.

h. Check the focus.

i. The Vertical Shield voltage affects both the focus and compression or expansion of the display; therefore, a compromise setting must be made for optimum setting. It is best not to exceed ±15 volts from the 0 volt condition.

9. Adjust Geometry

a. Equipment setup is given in step 8.

b. With AMPLITUDE CALIBRATOR output signal applied to the vertical Input connector, set the CALIBRATOR switch to 1 VOLT position.

c. Set the STABILITY control to PRESET and adjust the TRIGGERING LEVEL control for a stable display.

d. Adjust the display vertical position and the Volts/Cm Variable control so the square wave display overscans the graticule area.

e. Adjust the Geometry R861 control (Fig. 6-8C) for optimum vertical geometry (Fig. 6-8B).

f. Remove the signal from the AMPLITUDE CALIBRATOR and set the STABILITY control fully clockwise to free run the trace.

g. Position the trace to the top then the bottom graticule line and check for bowing of the horizontal trace. Bowing should not exceed 1 mm. Adjust Geometry control if necessary to compromise between the vertical and horizontal geometry.

NOTES

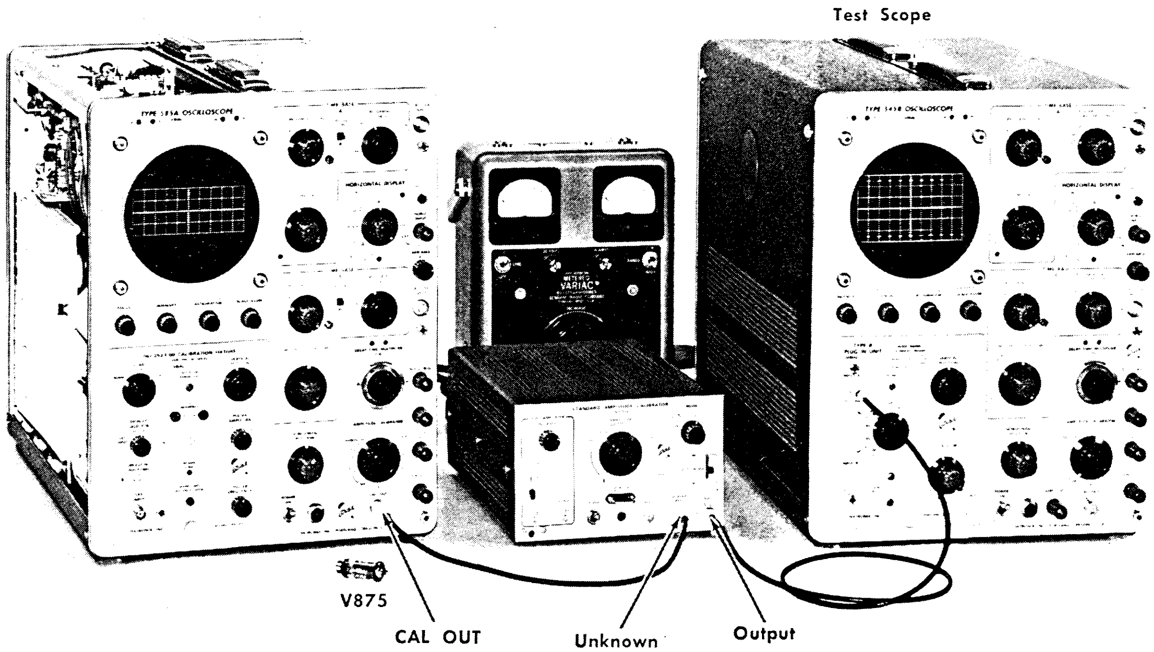


Fig. 6-9. Equipment setup for steps 10 and 11.

Type 585A

CRT Controls	
FOCUS and ASTIGMATISM	Well focused display
INTENSITY	Adjusted for nominal brightness
HORIZONTAL DISPLAY	A
5× MAGNIFIER	OFF
Time Base A Controls	
TIME/CM	1 mSEC
VARIABLE	CALIBRATED
STABILITY	Fully CW
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
Time Base B Controls	
TIME/CM	1 mSCEC
LENGTH	10 CM
STABILITY	Fully CW
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
DELAY-TIME MULTIPLIER 1-10	1.00
AMPLITUDE CALIBRATOR	**100 VOLTS**
HORIZONTAL POSITION	Midrange or centered display

Calibration Fixture 067-0523-00

+12.6 Load	Switch towards panel
Load	Norm
Vertical Position	Midrange or centered display
Display Selector	Ext Input
Pulser Amplitude	0
Pulser Frequency	Midrange

Test Oscilloscope

Time/Cm	**2 mSEC**
Volts/Cm	.5
Triggering Source	**Line**
Input Coupling	**AC**

10. Adjust and Check Amplitude Calibrator Accuracy

a. Equipment setup is shown in Fig. 6-9.

b. Remove V875 from the Type 585A Amplitude Calibrator circuit.

c. Set the Standard Amplitude Calibrator to 100 V and its Mode selector to +DC Mixed.

d. Adjust the Cal Adj R879 (Fig. 6-5) for a null on the test oscilloscope display. (Display will appear as a straight line.)

TABLE 6-2

Standard Amplitude Calibrator & Type 585A AMPLITUDE CALIBRATOR	Test Oscilloscope Volts/Cm	Max Error[2] Allowed ±3%
100	.5	0 Adjusted
50	.5	3 cm
20	.2	3 cm
10	.1	3 cm
5	.05	3 cm
2	.02	3 cm
1	.01	3 cm
.5	.005	3 cm
.2	.005	1 cm
.1	.005	6 mm

[2]The test oscilloscope display is a square wave; one half of each cycle is the standard calibrator (accurate) DC reference; the other half cycle is the Type 585A Calibrator DC reference (unknown accuracy). If the amplitude of the display is the voltage difference between the accurate DC reference and the unknown accuracy of the Type 585A Calibrator the Type 585A Cal per cent of error =

$$\frac{\text{voltage difference}}{\text{Type 585 Calibrator setting}} \times 100$$

e. Check the error at each AMPLITUDE CALIBRATOR output voltage setting as listed in Table 6-2. Error is listed as trace separation amplitude.

f. Add the error (in %) found in the 0.1 volt position to the worst error in the same direction (+ or —) found in previous positions. Total error should be less than ±3%.

g. Replace V875.

11. Check Amplitude Calibrator Repetition Rate

a. Equipment setup is shown in Fig. 6-9.

b. Set the AMPLITUDE CALIBRATOR selector to 0.2 VOLTS, the Standard Amplitude Calibrator output selector to Unknown position.

c. Set the test oscilloscope Trigger Slope to + Int, Time/cm to 1 mSEC, and Volts/cm to .1 volts position. Adjust Triggering controls for a triggered display.

d. Check—Test oscilloscope display contains 7.5 to 12.5 cycles in 10 divisions (repetition rate is 1 kHz ±25%).

e. Disconnect all test equipment from the Type 585A.

NOTES

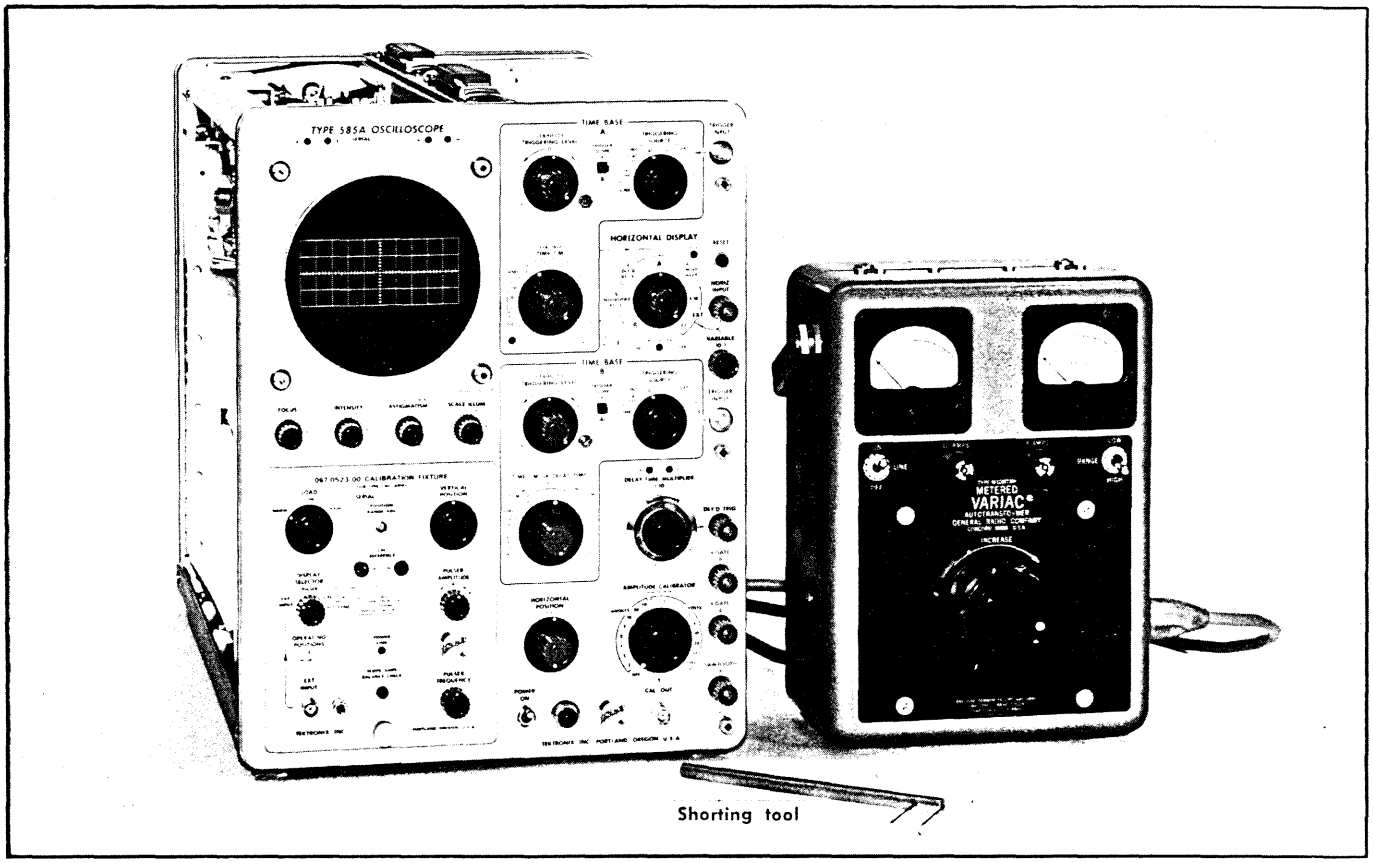


Fig. 6-10. Equipment setup for steps 12 through 17.

Type 585A

CRT Controls	
FOCUS and ASTIGMATISM	Well focused display
INTENSITY	Adjusted for nominal brightness
HORIZONTAL DISPLAY	A
5× MAGNIFIER	OFF
Time Base A Controls	
TIME/CM	1 mSEC
VARIABLE	CALIBRATED
STABILITY	Fully CW
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
Time Base B Controls	
TIME/CM	1 mSEC
LENGTH	10 CM
STABILITY	Fully CW
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
DELAY-TIME MULTIPLIER 1-10	1.00
AMPLITUDE CALIBRATOR	**OFF**
HORIZONTAL POSITION	Midrange or centered display

Calibration Fixture 067-0523-00

+12.6 Load	Switch towards panel
Load	Norm
Vertical Position	Midrange or centered display
Display Selector	Ext Input
Pulser Amplitude	0
Pulser Frequency	Midrange

12. Check Vertical Amplifier Balance

a. Equipment setup is given in Fig. 6-10.

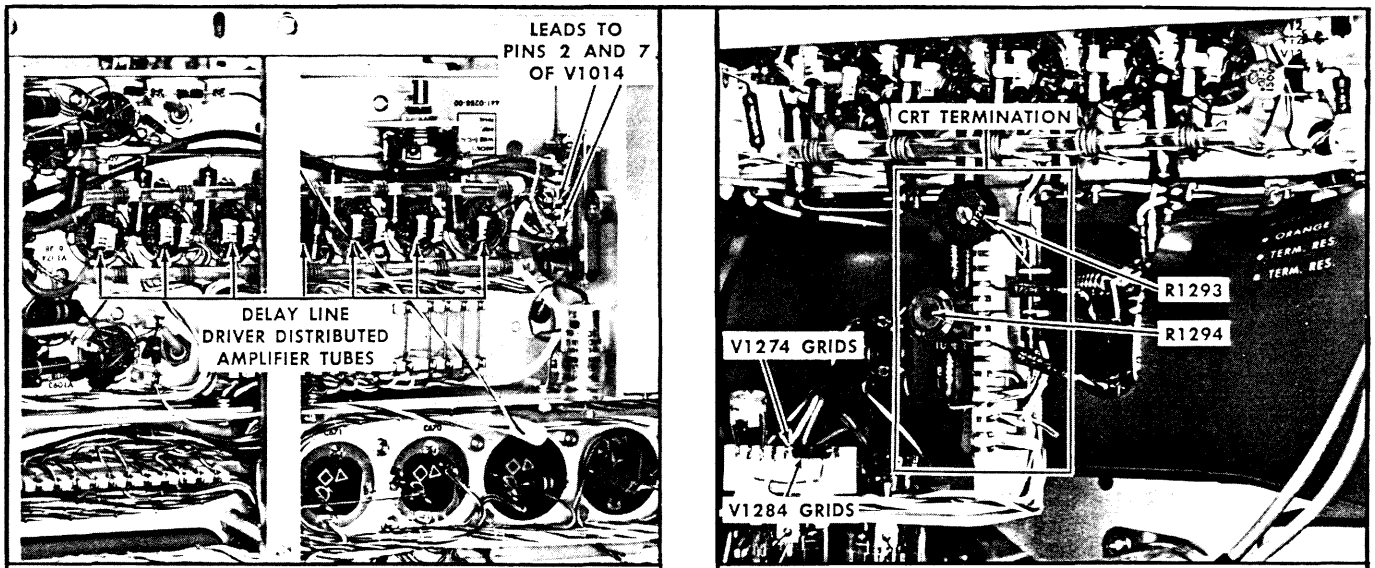
b. With no signal input, adjust the STABILITY control fully clockwise for a free running trace.

c. Short the front vertical deflection plates together with the shorting tool, Part No. 003-0002-00 (Fig. 6-10). Note the position of the trace. This is the electrical center of the CRT.

d. Remove the short and position the trace to the CRT electrical center.

e. Connect the shorting tool between pin 2 of V1274 and pin 2 of V1284 (Fig. 6-11B).

f. Adjust R1294 to position the trace to the electrical center.



A. Bottom view of Vertical Amplifier. Delay Line driver.

B. Left side view showing Vertical Output Amplifier.

Fig. 6-11. Location of Vertical calibration adjustments and test points.

g. Short pin 2 to pin 7 of V1214 and note the amplitude of trace shift. Trace shift should not exceed 0.5 cm.

h. Depress the Scope Ampl Balance Check button on the Calibration Test Unit. (This shorts pins 2 and 7 of V1014.) Trace shift should not exceed 0.5 cm.

NOTE

When vertical system imbalance results in a trace shift of more than 0.5 cm, it will be necessary to locate the tube or tubes responsible for the condition. Steps (1) and (2) below describe the procedure.

(1) To isolate an unbalanced condition in the Delay Line Driver stage, attach a clip lead between the +100-volt supply, and to a small screwdriver shaft. Then, starting with V1014 and progressing through V1074, touch the screwdriver tip to pins 3 and 8 (cathodes) of each tube, see Fig. 6-12. Note the amount and direction of trace shift at each tube. This cuts off the tube as the positive voltage is applied to its cathode, and shows the effect on system balance of each tube. Replace any tubes that cause excessive trace shift, and recheck the stage.

(2) In the Output Amplifier stage, (V1214 through V1254) attach the clip lead to the +225-volt supply and again touch the screwdriver tip to pins 3 and 8 of each successive tube in the stage, see Fig. 6-13. Follow the procedure described in (1).

13. Adjust Vertical Amplifier Gain

a. Equipment setup is shown in Fig. 6-10.

b. Set the Display Selector switch on the test plug-in unit to Cal (2 Cm) and Alt Sync position. Set the STABILITY control fully clockwise to free run the sweep, and center the display.

c. Adjust Vert Gain R1015 (see Fig. 6-11A) for an exact 2-cm vertical amplitude between the two traces.

d. Return the Display Selector switch to the Ext Input position.

14A. Adjust Vertical Output Centering Control R1294 (SN 10460-up)

a. Equipment setup is given in step 13.

b. Set the Display Selector switch to Cal (2 Cm), then position the top of the display to the top graticule line. Note the display amplitude.

c. Position the bottom of the display to the bottom graticule line and note the amplitude of the display.

d. Position the display to the center of the graticule, then adjust the Vert Output Centering control R1294 (see Fig. 6-11B) to shift the display a slight amount towards the direction with the most compression.

e. Recheck the compression at the lower and upper limits of the graticule and readjust R1294 if necessary until the two halves are balanced. Compression or expansion should not exceed 1 mm at either graticule extreme.

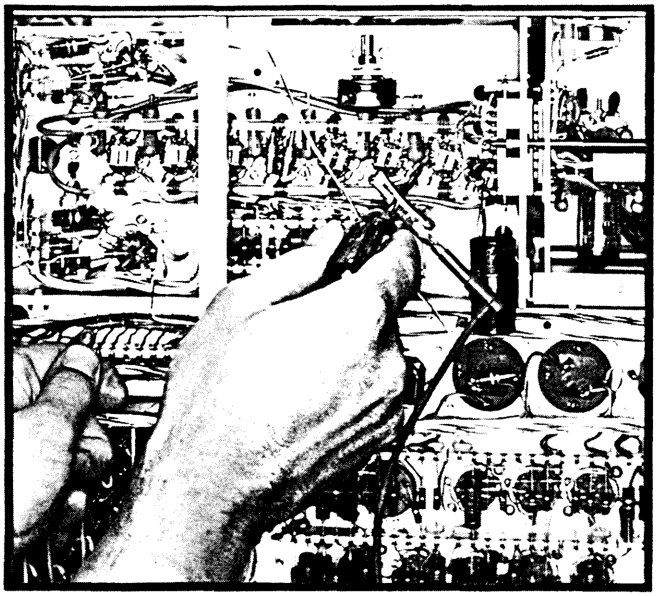


Fig. 6-12. Elevating cathodes of V1014 by supplying +100 V to R1013. Be very careful to avoid grounding +100 V supply.

14B. Check Vertical Compression and/or Expansion (SN 5969-10459)

a. Equipment setup is given in step 13.

b. Switch the test plug-in unit Display Selector switch to Cal position. Position the display to the upper graticule line, then to the bottom graticule line and note the compression and/or expansion of the 2 cm display.

c. Expansion or compression should not exceed .5 mm at the graticule extremes with a total expansion or compression $\leq$1 mm.

NOTE

If total expansion or compression is excessive, the Vert Shield voltage and the geometry may be adjusted to establish a balanced condition. When the shield voltage or geometry is changed, recheck beam focus.

15. Check Alternate Sweep Operation

a. Equipment setup is given in step 13.

b. Set the Display Selector switch to Alt Sync position and the STABILITY control fully clockwise for a free running trace.

c. Rotate the TIME/CM selector to all sweep rate settings and check for two traces.

d. Return the Display Selector switch to Ext Input position and the Type 585A A TIME/CM switch to .5 mSEC position.

16. Check DC Shift

a. Equipment setup is given in step 15.

b. Position the free running trace in either vertical direction, so it is just off the screen.

c. Push the Scope Ampl Balance Check button on the test plug-in unit. Note the amount of trace drift after the trace returns to about the CRT center. (The trace will move to the electrical center, then may drift a slight amount.)

d. If trace drift exceeds 1 mm, one or more of the 6DJ8 tubes in the vertical system should be replaced.

e. Release the Balance Check button and position the trace to the graticule center.

17. Check Vertical Drift

a. Equipment setup is given in step 16.

b. Vary the line voltage from 105/210 to 125/250 VAC. Note the amount of trace drift.

c. From the stable position at low voltage to the stable position at high voltage the trace drift should not exceed 2 mm. If trace drift is excessive, check +12.6 V supply regulation and vertical output tubes for low emission.

d. Return the line voltage to 117 VAC. The Type 585A may now be connected directly to the power source for the remainder of the procedure.

NOTES

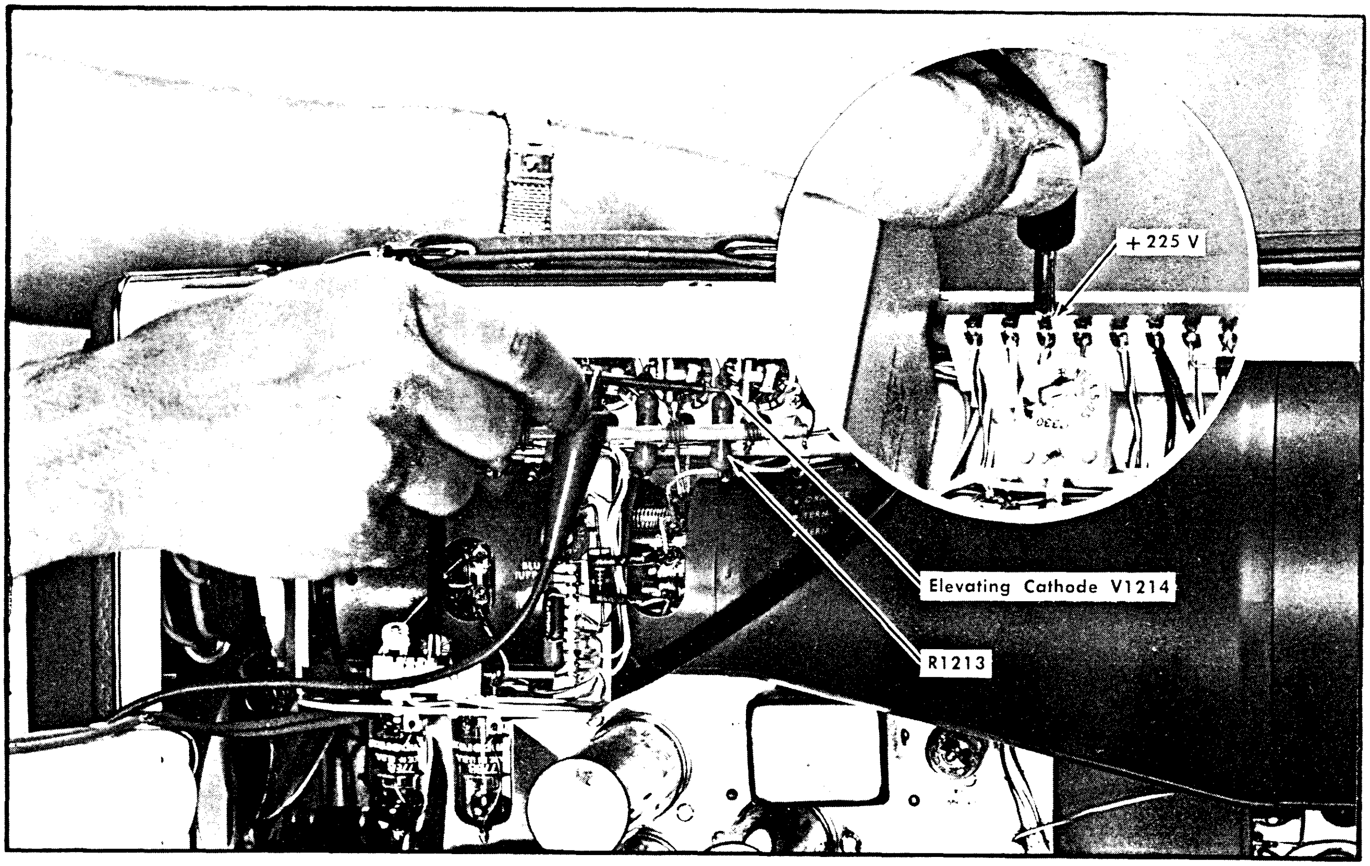


Fig. 6-13. Elevating cathodes of V1214 by applying +225 V to R1213. Be very careful to avoid grounding +225 V supply.

NOTES

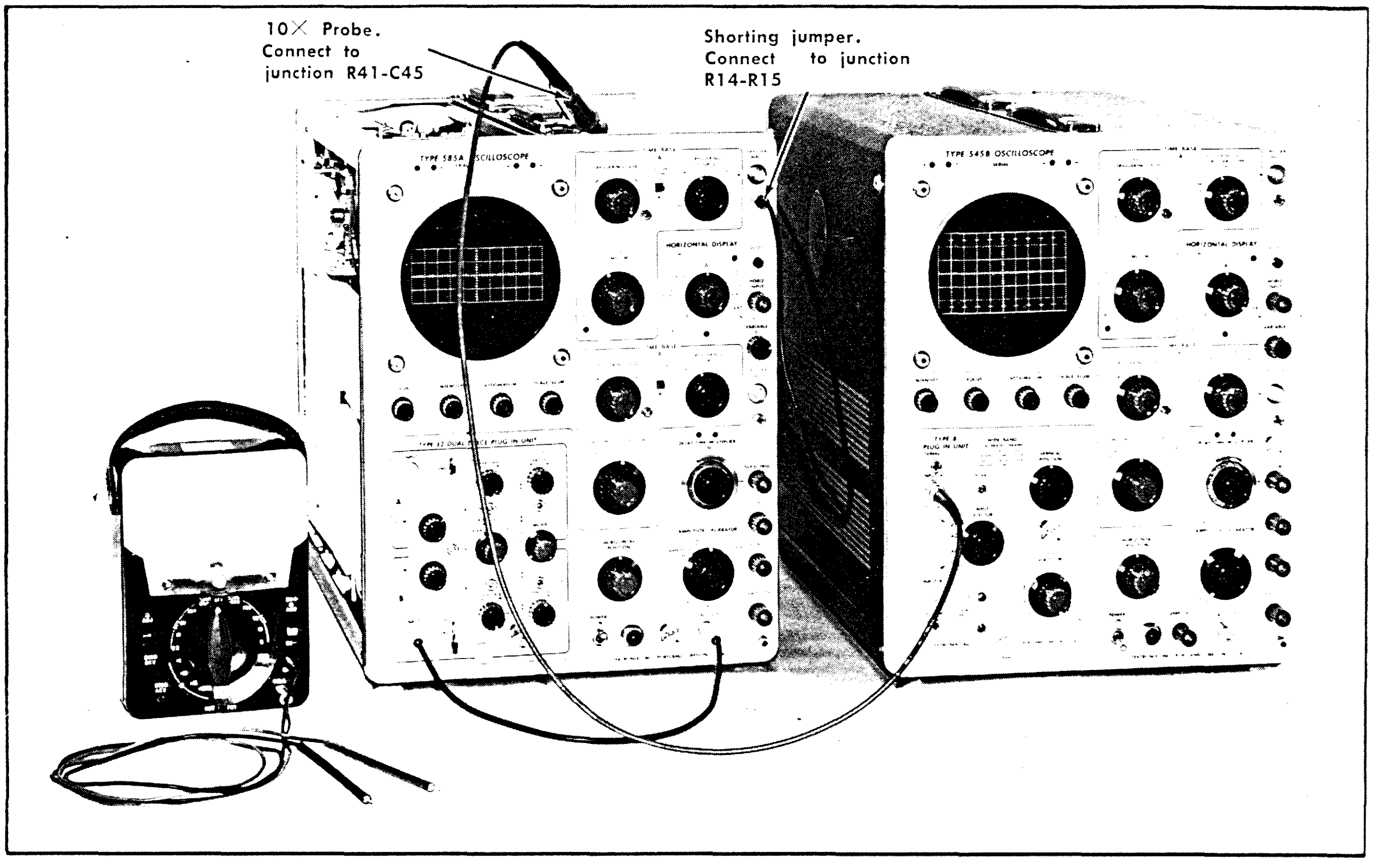


Fig. 6-14. Test setup for steps 18 through 20.

Type 585A

CRT Controls	
FOCUS and ASTIGMATISM	Well focused display
INTENSITY	Adjusted for nominal brightness
HORIZONTAL DISPLAY	A
5× MAGNIFIER	OFF
Time Base A Controls	
TIME/CM	1 mSEC
VARIABLE	CALIBRATED
STABILITY	Fully CW
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
Time Base B Controls	
TIME/CM	1 mSEC
LENGTH	10 CM
STABILITY	Fully CW
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
DELAY-TIME MULTIPLIER 1-10	1.00
AMPLITUDE CALIBRATOR	**.2 VOLTS**
HORIZONTAL POSITION	Adjusted for a centered sweep

Vertical Plug-In Unit (Type 86 or 82)

Volts/Cm	**.1**
Input Selector	**DC**
Variable	Cal
Gain	×1
Vertical Position	Adjusted for a centered display

Test Oscilloscope

Time/Cm	**1 mSEC**
Volts/Cm	**.1**
Input Coupling	AC

TIME BASE A TRIGGERING

18. Adjust A Trigger Sensitivity and Trigger Level Centering

a. Equipment setup is shown in Fig. 6-14.

b. Connect a jumper lead between chassis ground and the junction of R14-R15. See Fig. 6-15.
R14 - 82K to GND - R15 470K to R12 - 1 meg.

c. Connect a 10× probe from the test oscilloscope to the junction of R41-C45. See Fig. 6-15.

R41 - 68K to C45 - .001

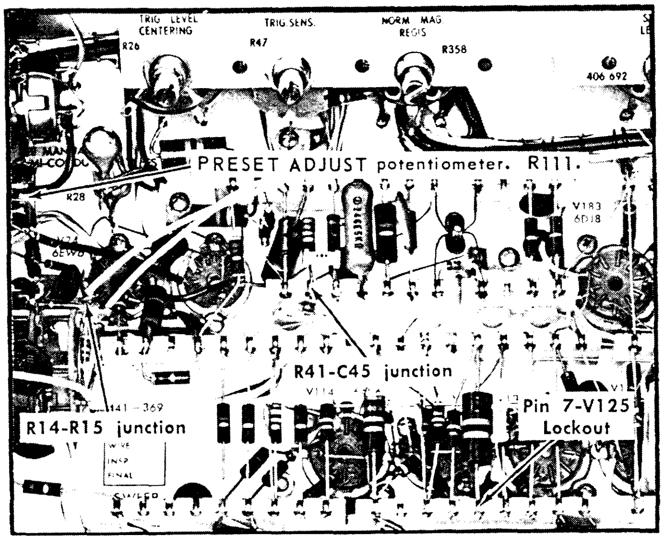


Fig. 6-15. Time Base A trigger adjustment and test points.

d. Connect a coaxial cable between the CAL OUT connector and the Input connector of the vertical plug-in unit, and set the AMPLITUDE CALIBRATOR to .2 VOLTS.

e. Adjust the Volts/Cm and Variable control of the plug-in unit for a signal amplitude of 2 cm, then switch the AMPLITUDE CALIBRATOR to 10 mVOLTS (this provides a 1-mm signal amplitude).

f. Vertically position the display to the center graticule line.

g. Preset the Trig Sens R47 approximately 1/4 turn from the fully clockwise position. Adjust the Trig Level Centering R26 and Trig Sens R47 for a stable square wave display on the test oscilloscope, while the TRIGGER SLOPE switch is switched between the + and — positions.
ADJUST BOTH AT SAME TIME

h. Switch the AMPLITUDE CALIBRATOR selector to 5 mVOLT position. If stable triggering occurs with a 1/2-mm signal, the Trig Sens R47 setting must be reduced. Recheck with a 1-mm signal for correct triggering.

i. Turn the STABILITY control slowly counterclockwise to a position where the display triggering is stable on the Type 585A, or to a position which is slightly clockwise from the non-triggered position.

j. Check—Stable display triggering, of proper polarity (slope) with the AMPLITUDE CALIBRATOR switch at the 10 mVOLTS position, TRIGGERING SOURCE switch in either the INT AC LF REJ or INT AC position and the SLOPE switch in either + or — position.

k. Remove the jumper lead between ground and the junction of R14-R15.

19. Check Triggering Level Control Position

a. Equipment setup is given in step 18.

b. With the STABILITY control adjusted as in step 18 turn the TRIGGERING LEVEL control until the display is again triggered.

c. Check—White dot on the TRIGGERING LEVEL control should point to the 0 between the + and — arrows. If necessary, loosen the knob set screw and position the knob to the correct setting, then tighten the set screw.

d. Remove the cable between the CAL OUT connector and the Input connector on the plug-in unit.

20. Adjust PRESET ADJUST

a. Equipment setup is given in step 19.

b. Set the STABILITY control to PRESET position, TRIGGERING SOURCE switch to LINE and the A TIME/CM selector to .1 mSEC.

c. Connect a voltmeter between the center tap of the PRESET ADJUST potentiometer (Fig. 6-15) and chassis ground.

d. Slowly turn the PRESET ADJUST control clockwise from a fully counterclockwise position until the trace appears. Note the meter reading.

e. Continue to turn the PRESET ADJUST control further clockwise until the trace brightens. Note the meter voltage reading.

f. Set the PRESET ADJUST control to a voltage reading halfway between the two noted readings.

NOTE

Meter reading difference should equal or exceed 15 V.

g. Disconnect and remove the voltmeter leads.

Minimum Triggering Requirements
See Fig. 1-2

FREQUENCY	INTERNAL AC	INTERNAL AC LF REJ	INTERNAL HF SYNC	EXTERNAL AC/DC	EXTERNAL HF SYNC
15 Hz to 15 kHz	4 mm	—	—	0.3 V	—
15 kHz to 5 MHz	4 mm	4 mm	—	0.3 V	—
5 MHz to 10 MHz	4 mm	4 mm	4 mm	0.3 V	0.2 V P to P
10 MHz to 50 MHz	1 cm	1 cm	4 mm	0.5 V	0.2 V P to P
50 MHz to 100 MHz	2 cm	2 cm	4 mm	1.5 V	0.2 V P to P
100 MHz to 150 MHz	3 cm	3 cm	4 mm	2.0 V	0.2 V P to P
150 MHz to	—	—	4 mm	—	0.2 V P to P

TRIGGER REQUIREMENTS
for Time Base B

FREQUENCY	INTERNAL AC	INTERNAL AC LF REJ	EXTERNAL AC/DC
15 Hz to 15 kHz	4 mm	—	0.5 V P to P
15 kHz to 1 MHz	4 mm	4 mm	0.5 V P to P
1 MHz to 5 MHz	2 cm	2 cm	1.5 V P to P

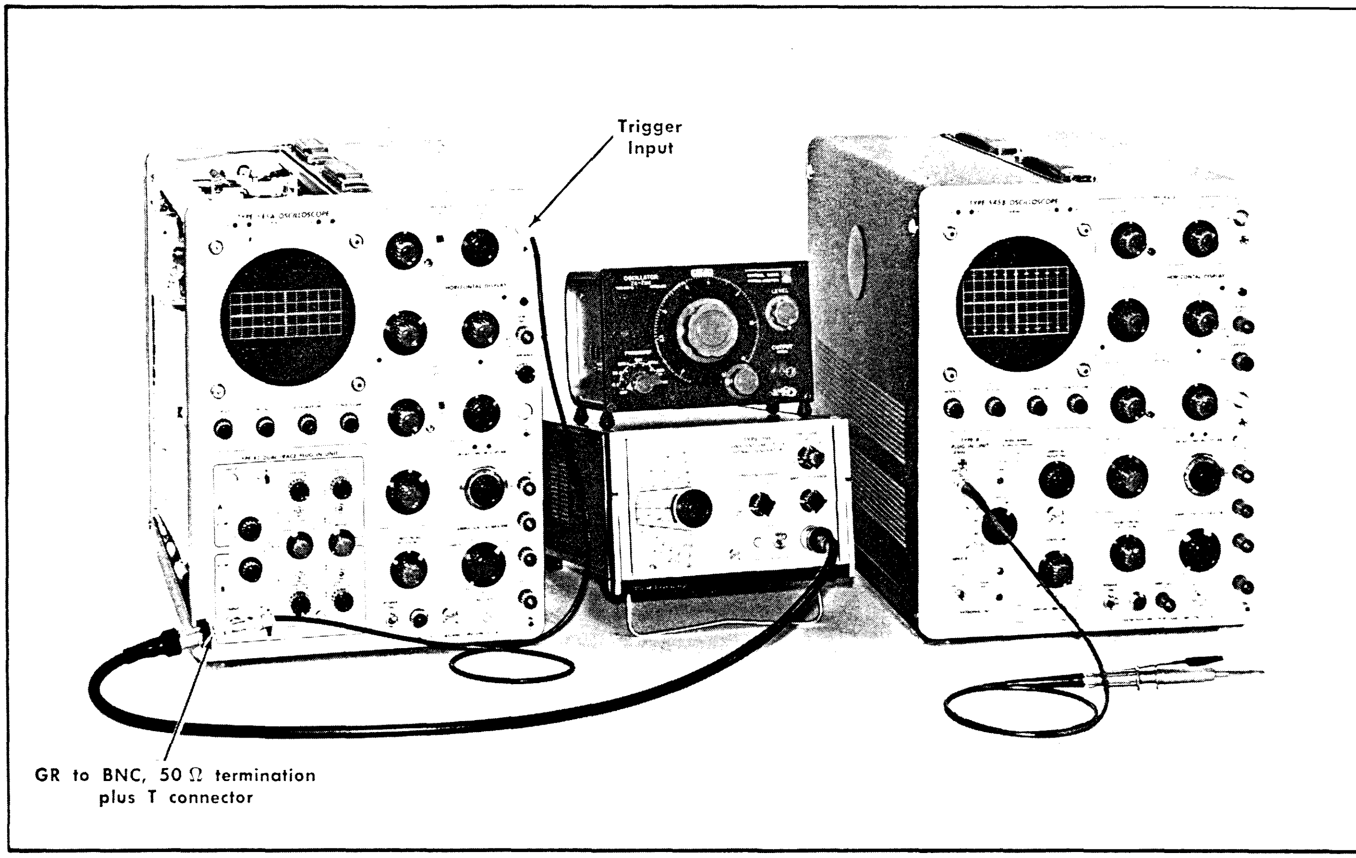


Fig. 6-16. Equipment setup for steps 21 through 24.

Type 585A

CRT Controls	
FOCUS and ASTIGMATISM	Well focused display
INTENSITY	Adjusted for nominal brightness
HORIZONTAL DISPLAY	A
5× MAGNIFIER	OFF
Time Base A Controls	
TIME/CM	1 mSEC
VARIABLE	CALIBRATED
STABILITY	**PRESET**
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
Time Base B Controls	
TIME/CM	1 mSEC
LENGTH	10 CM
STABILITY	Fully CW
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
DELAY-TIME MULTIPLIER 1-10	1.00
AMPLITUDE CALIBRATOR	**OFF**
HORIZONTAL POSITION	Midrange or centered display

Vertical Plug-In Unit (Type 86 or 82)

Volts/Cm	**.5**
Input Selector	**AC**
Vertical Position	Midrange or centered display
Gain	×1
Variable	Cal

Test Oscilloscope

Time/Cm	1 mSEC
Volts/Cm	**.5**
Input Coupling	**DC**

21. Check Time Base A Triggering

a. Equipment setup is given in Fig. 6-16.

b. Connect the output of a Constant Amplitude Signal Generator or an audio signal generator (depending on the trigger signal frequency listed in Table 6-3) through a 50 Ω termination, a T connector and two coaxial cables to the Input connector of the vertical plug-in unit (Type 86 or 82) and the A TRIGGER INPUT connector of the Type 585A.

c. Check—Stable triggering with the TRIGGER SLOPE switch in either + or — position with the TRIGGERING SOURCE switch and the signal amplitude set in accordance with the specifications listed in Tablle 6-3.

With the STABILITY control out of the PRESET position, the STABILITY and TRIGGERING LEVEL controls must be adjusted as follows:

(1) Adjust the STABILITY control 2 to 3 degrees CCW past the position at which the trace no longer free runs.

(2) Adjust the TRIGGERING LEVEL control for a stable triggered display. The TRIGGERING LEVEL control may need readjustment when the TRIGGER SLOPE switch setting is changed.

With the TRIGGERING SOURCE switch in the EXT positions, monitor the external trigger signal amplitude with a test oscilloscope. If the frequency of the trigger signal is above the capabilities of the test oscilloscope, adjust the Constant Amplitude Signal Generator output for the specified signal amplitude at a lower frequency, then increase the signal generator frequency to the specified frequency.

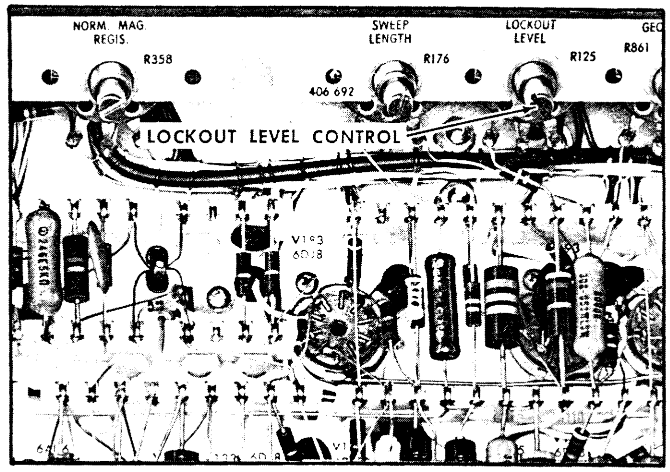


Fig. 6-17. LOCKOUT LEVEL control location.

d. Disconnect test equipment and cables.

TABLE 6-3

A Time Base

Triggering Sensitivity

Triggering Frequency	A TRIGGERING SOURCE Internal			Other Conditions
	AC	AC LF REJ	HF SYNC	
15 Hz to 15 kHz	4 mm	—	—	Check also with STABILITY in PRESET position. Will trigger on any 4-cm signal up to 150 MHz.
5 MHz	4 mm	4 mm	4 mm	
10 MHz	4 mm	4 mm	4 mm	
30 MHz	1 cm	1 cm	4 mm	
50 MHz	1 cm	1 cm	4 mm	
100 MHz	2 cm	2.5 cm	4 mm	

Triggering Frequency	A TRIGGERING SOURCE External		Other Conditions
	AC/DC	HF SYNC	
15 Hz to 15 kHz	0.3 V	—	
5 MHz	0.3 V	—	
10 MHz	0.3 V	0.2 V	
30 MHz	0.5 V	0.2 V	
50 MHz	0.5 V	0.2 V	
100 MHz	1.5 V	0.2 V	
150 MHz	2.0 V	0.2 V	

22. Check A Line Triggering

a. Equipment setup is given in step 21.

b. Change the A TIME/CM setting to 5 mSEC position and the TRIGGERING SOURCE switch to LINE.

c. Connect a 10× probe from the Input connector of the vertical plug-in unit to the AC voltage supply for the graticule illumination lamps.

d. Adjust the vertical sensitivity and SCALE ILLUM control for a display amplitude of about 2 cm, then adjust the A STABILITY and TRIGGERING LEVEL controls for a stable display.

e. Change the TRIGGER SLOPE switch from + to — position. Check that triggering occurs on the correct slope of the waveform as indicated by the SLOPE switch position.

f. Disconnect the 10× probe and set the Type 585A TRIGGERING SOURCE switch to INT AC position.

23. Adjust Lockout Level

a. Equipment setup is given in Fig. 6-16.

b. Connect the 10× probe from the test oscilloscope to pin 7 of V125 (See Fig. 6-15) and position the trace on the test scope to the graticule center.

c. Adjust the STABILITY control from a fully counterclockwise position slowly clockwise to a position where the trace just free runs. Note the display reference trace level on the test oscilloscope.

d. Change the HORIZONTAL DISPLAY of the Type 585A to 'A' SINGLE SWEEP position. Note the new position of the trace on the test scope.

e. Adjust the Lockout Level R125 (See Fig. 6-17) for a 10 to 11 volt difference between the display reference with the HORIZONTAL DISPLAY switch in the A position and the display reference with the switch in the 'A' SINGLE SWEEP position.

f. Remove the 10× probe from pin 7 of V125, and return the HORIZONTAL DISPLAY switch to A position.

24. Check Time Base A Single Sweep Operation

a. Equipment setup is given in Fig. 6-16.

b. Connect a coaxial cable between the CAL OUT connector and the Input connector of the vertical plug-in unit. Set the AMPLITUDE CALIBRATOR switch to .2 VOLTS position.

c. Adjust the TRIGGERING LEVEL control for a triggered display.

d. Disconnect the Calibrator signal and switch the HORIZONTAL DISPLAY switch to 'A' SINGLE SWEEP.

e. Push the RESET button and note that the READY lamp is lit.

f. Reconnect the Calibrator signal to the vertical Input connector.

g. Check—A single sweep should run and the READY neon indicator should extinguish.

NOTES

If Single Sweep has Shortened Trace (6 cm) Readjust lockout.

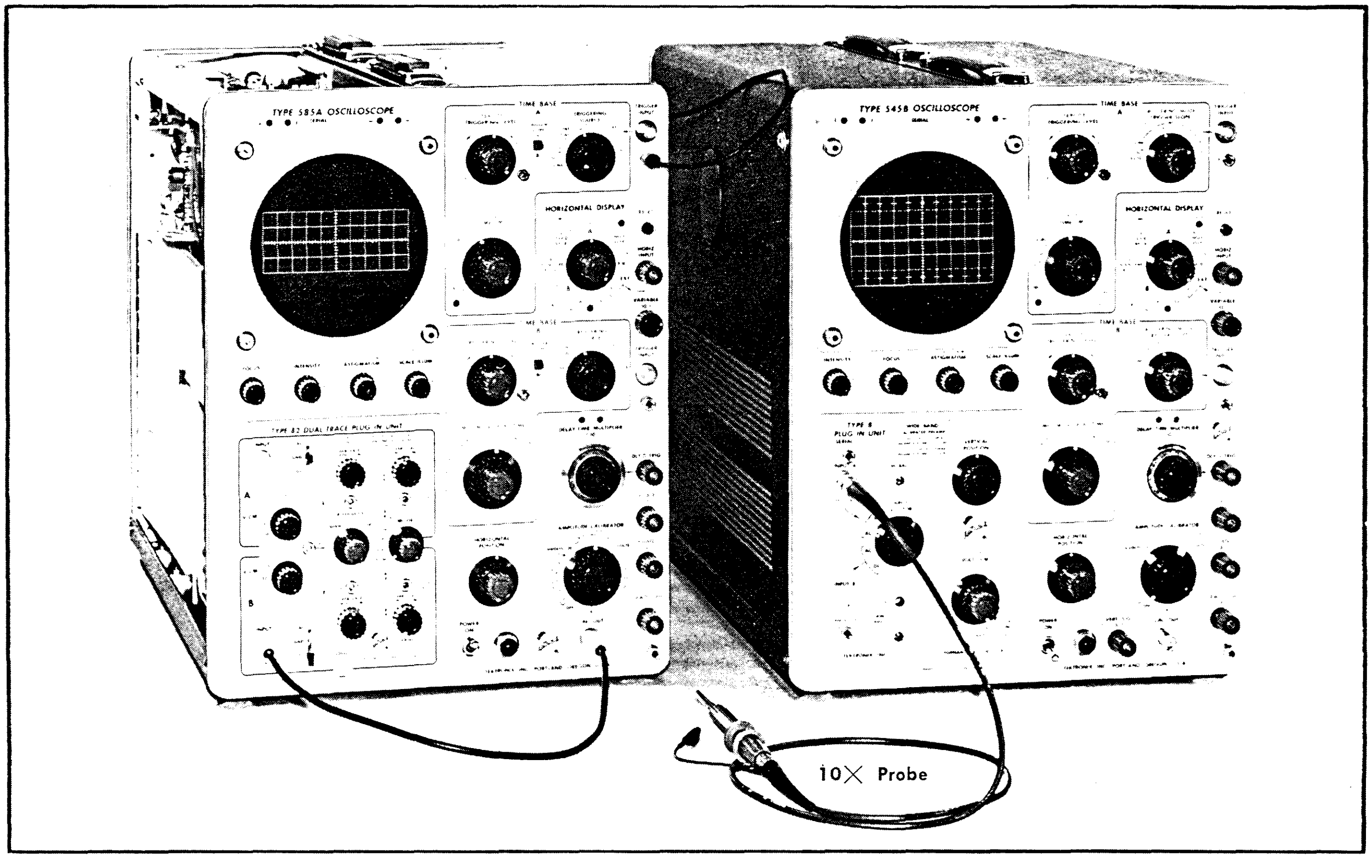


Fig. 6-18. Equipment setup for steps 25 through 27.

Type 585A

CRT Controls	
FOCUS and ASTIGMATISM	Well focused display
INTENSITY	Adjusted for nominal brightness
HORIZONTAL DISPLAY	A
5× MAGNIFIER	OFF
Time Base A Controls	
TIME/CM	1 mSEC
VARIABLE	CALIBRATED
STABILITY	**Fully CW**
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
Time Base B Controls	
TIME/CM	1 mSEC
LENGTH	10 CM
STABILITY	Fully CW
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
DELAY-TIME MULTIPLIER 1-10	1.00
AMPLITUDE CALIBRATOR	**.2 VOLTS**
HORIZONTAL DISPLAY	Midrange or a centered display

Vertical Plug-In Unit

Volts/Cm	**.1**
Input Selector	**DC**
Variable	Cal
Gain	×1
Vertical Position	Adjusted for a centered display

Test Oscilloscope

Time/Cm	1 mSEC
Volts/Cm	**1**
Input Coupling	**AC**

TIME BASE B TRIGGERING

25. Adjust 'B' Trigger Level Centering and Triggering Level Control Position

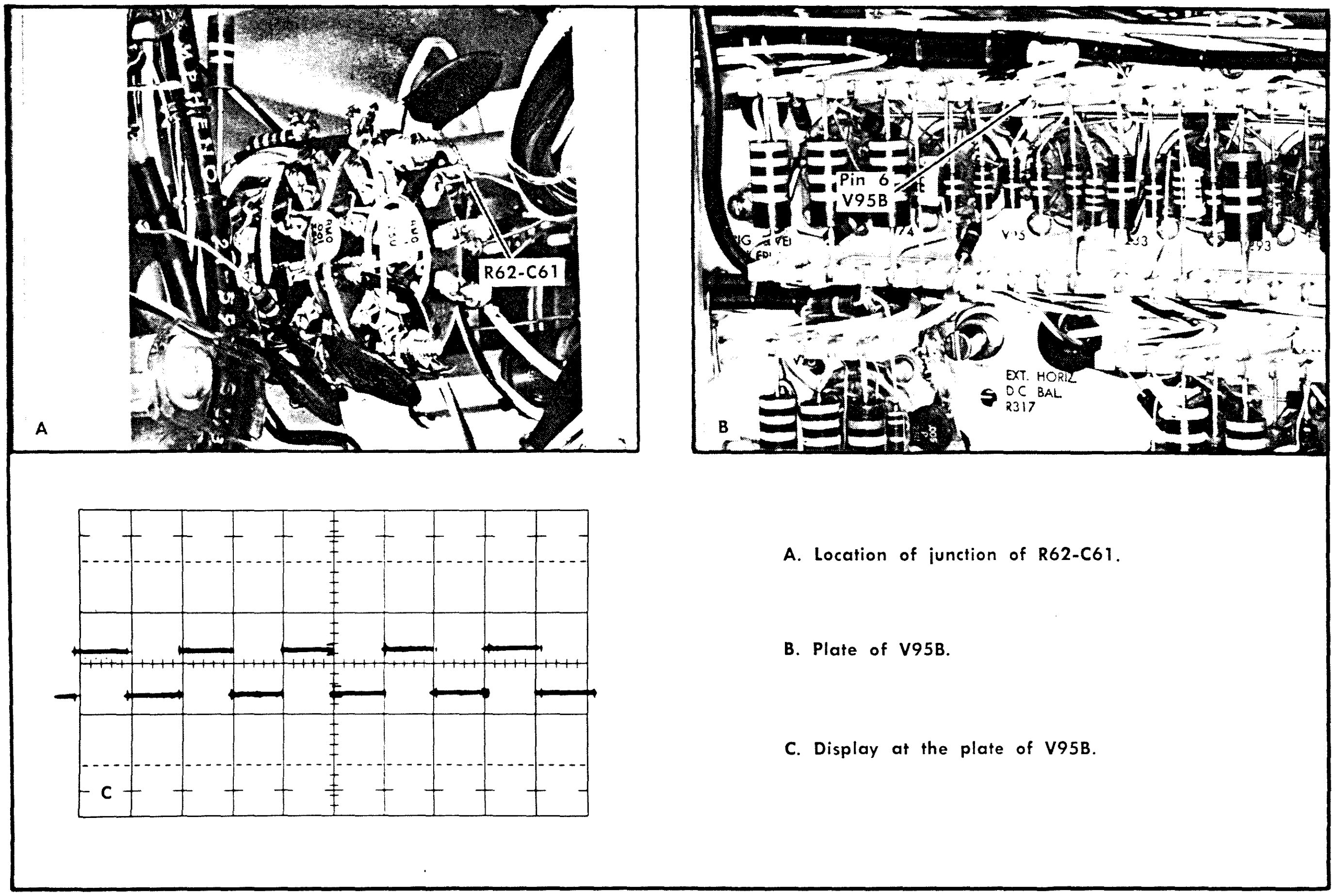
a. Equipment setup is shown in Fig. 6-18.

b. Connect a jumper lead between chassis ground and the junction of R62-C61. See Fig. 6-19.

c. Connect a coaxial cable between the CAL OUT connector and the Input connector of the vertical plug-in unit. Set up as in step 18e for a 2 mm display amplitude.

d. Vertically center the display at the graticule center.

R62 - 470K
C61 .01 uF



A. Location of junction of R62-C61.

B. Plate of V95B.

C. Display at the plate of V95B.

Fig. 6-19. Adjusting B Trigger Level Centering.

e. Connect the 10× probe from the test oscilloscope to the plate of V95B. See Fig. 6-19.

f. Adjust the Trig Level Centering R78 for a stable square wave display on the test oscilloscope, with the TRIGGER SLOPE switch in either the + or — position (Fig. 6-19).

g. Turn the STABILITY control counterclockwise until a stable triggered display is observed on the Type 585A.

h. Check—Stable triggering and proper trigger polarity with the TRIGGERING SOURCE switch in both AC and AC LF REJ positions and the TRIGGER SLOPE switch in both the + and — position.

i. Remove the 10× probe from the plate of V95B and the jumper from the junction of R62-C61.

26. Check B Triggering Level Control Position

a. Equipment setup is shown in step 25.

b. With the STABILITY control adjusted as in step 25g, turn the TRIGGERING LEVEL control until a display is again triggered.

c. Check—White dot on the TRIGGERING LEVEL control should point to the 0 between the + and — arrows. Loosen the knob set-screw and position if necessary.

d. Remove the coaxial cable from the CAL OUT connector and the vertical Input connector.

27. Adjust B Preset

a. Equipment setup is given in step 26.

b. Turn the STABILITY control to the PRESET position. Set the 'B' TRIGGERING SOURCE switch to LINE and SLOPE to +.

c. Connect a voltmeter between the center tap of the B Preset Adjust potentiometer and ground.

d. Slowly turn the PRESET ADJ from a full counter-clockwise position, clockwise until the trace appears. Note the voltage reading.

e. Continue turning the PRESET ADJ control clockwise until the trace brightens and again note the voltage reading.

f. Set the PRESET ADJUST to a voltage reading halfway between the two noted readings.

g. Remove the voltmeter.

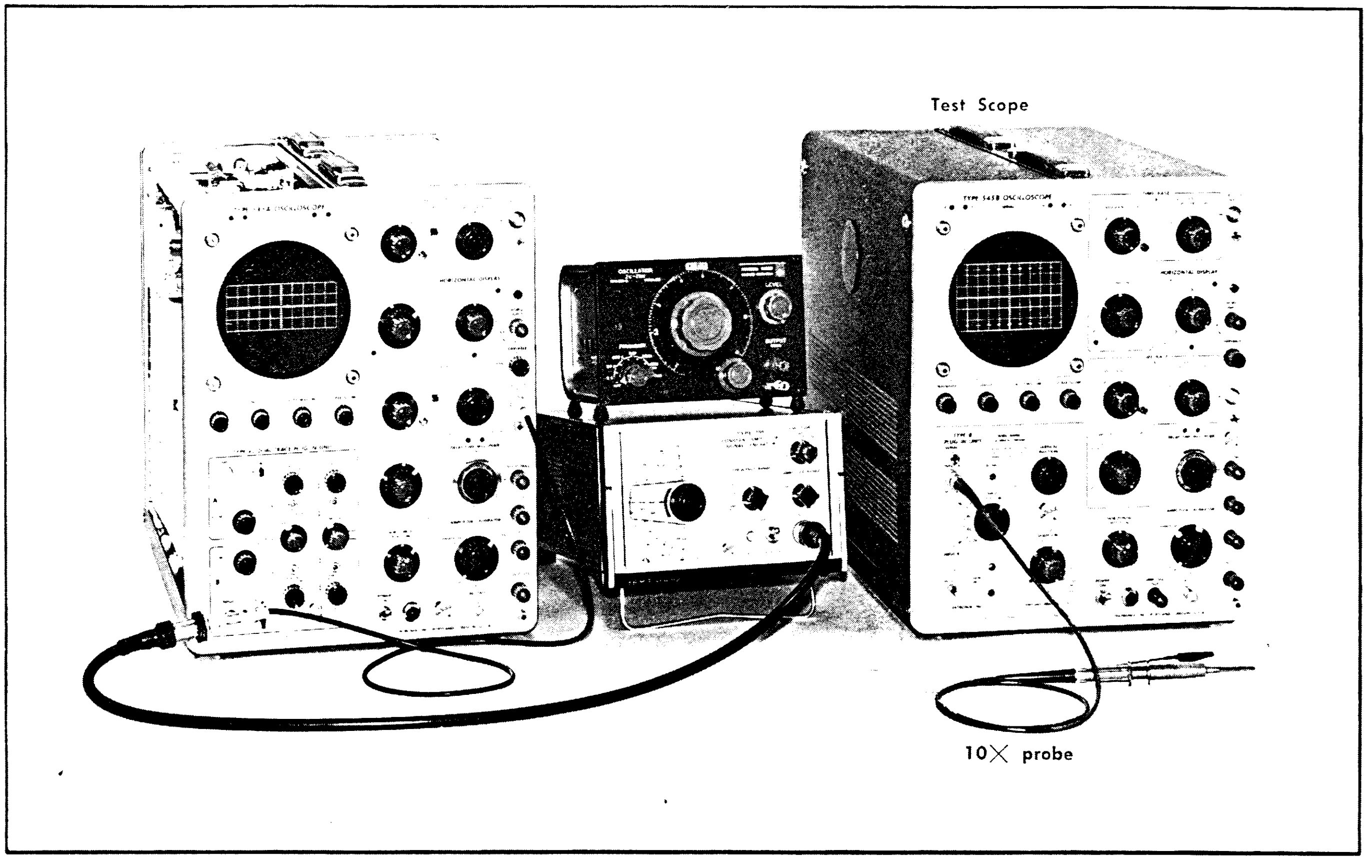


Fig. 6-20. Equipment setup for step 28.

Type 585A

CRT Controls

FOCUS and ASTIGMATISM	Well focused display
INTENSITY	Adjusted for nominal brightness
HORIZONTAL DISPLAY	A
5× MAGNIFIER	OFF

Time Base A Controls

TIME/CM	1 mSEC
VARIABLE	CALIBRATED
STABILITY	**PRESET**
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC

Time Base B Controls

TIME/CM	1 mSEC
LENGTH	10 CM
STABILITY	Fully CW
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
DELAY-TIME MULTIPLIER 1-10	1.00
AMPLITUDE CALIBRATOR	**OFF**
HORIZONTAL POSITION	Adjusted for a centered sweep

Vertical Plug-In Unit (Type 82 or 86)

Volts/Cm	.1
Input Selector	DC
Gain	×1
Variable	Cal
Vertical Position	Adjusted for a centered display

Test Oscilloscope

Time/Cm	1 mSEC
Volts/Cm	**.2**
Input Coupling	AC

28. Check Time Base B Triggering

a. Equipment setup is shown in Fig. 6-20.

b. Connect the output signal of a Constant Amplitude Signal Generator or Audio Signal Generator (depending on the trigger signal frequency listed in Table 6-4) through a 50 Ω termination and a T connector to the Input connector of the vertical plug-in unit.

c. Now connect a cable from the T connector on the vertical Input to the B TRIGGER INPUT through another T connector. The test oscilloscope may now be connected to monitor the triggering signal amplitude.

d. Check—The B Time Base triggering in accordance with the control settings and specifications listed in Table 6-4.
With the STABILITY control out of the PRESET position, the STABILITY and TRIGGERING LEVEL must be adjusted as follows:

(1) Adjust the STABILITY control 2 to 3 degrees past the position at which the trace no longer free runs.

(2) Adjust the TRIGGERING LEVEL control for a stable triggered display. The LEVEL control may need readjustment when the TRIGGER SLOPE switch setting is changed.

With the TRIGGERING SOURCE switch in the EXT positions the amplitude of the external trigger signal is monitored with the test oscilloscope. When the frequency of the trigger signal is above the bandwidth of the test oscilloscope, set the specified amplitude at a lower frequency then increase the Constant Amplitude Signal Generator frequency to the specified setting.

e. Remove the test equipment and connecting cables, then connect a jumper between the hot lead of one of the graticule illumination lights and the Input connector of the vertical plug-in unit.

f. Set the B TRIGGERING SOURCE switch to LINE.

g. Adjust the SCALE ILLUM control and the Volts/CM selector for a display amplitude of about 3 cm.

h. Check—Stable triggering and the slope of the display must correspond to the position of the TRIGGER SLOPE switch.

TABLE 6-4

B Triggering Sensitivity

Triggering Frequency	Internal		External AC/DC
	AC	AC LF REJ	
15 Hz - 15 kHz	4 mm	—	.5 V peak to peak
15 kHz - 1 MHz	4 mm	4 mm	.5 V peak to peak
1 MHz - 5 MHz	1 cm	1 cm	1.5 V peak to peak

i. Turn the SCALE ILLUM control to minimum and remove the jumper between the Input selector and the graticule light.

SWEEP TIMING

Timing adjustments interact; therefore, these adjustments should be made in sequence. All adjustments are made between the 1-cm and 9-cm graticule vertical lines.

NOTES

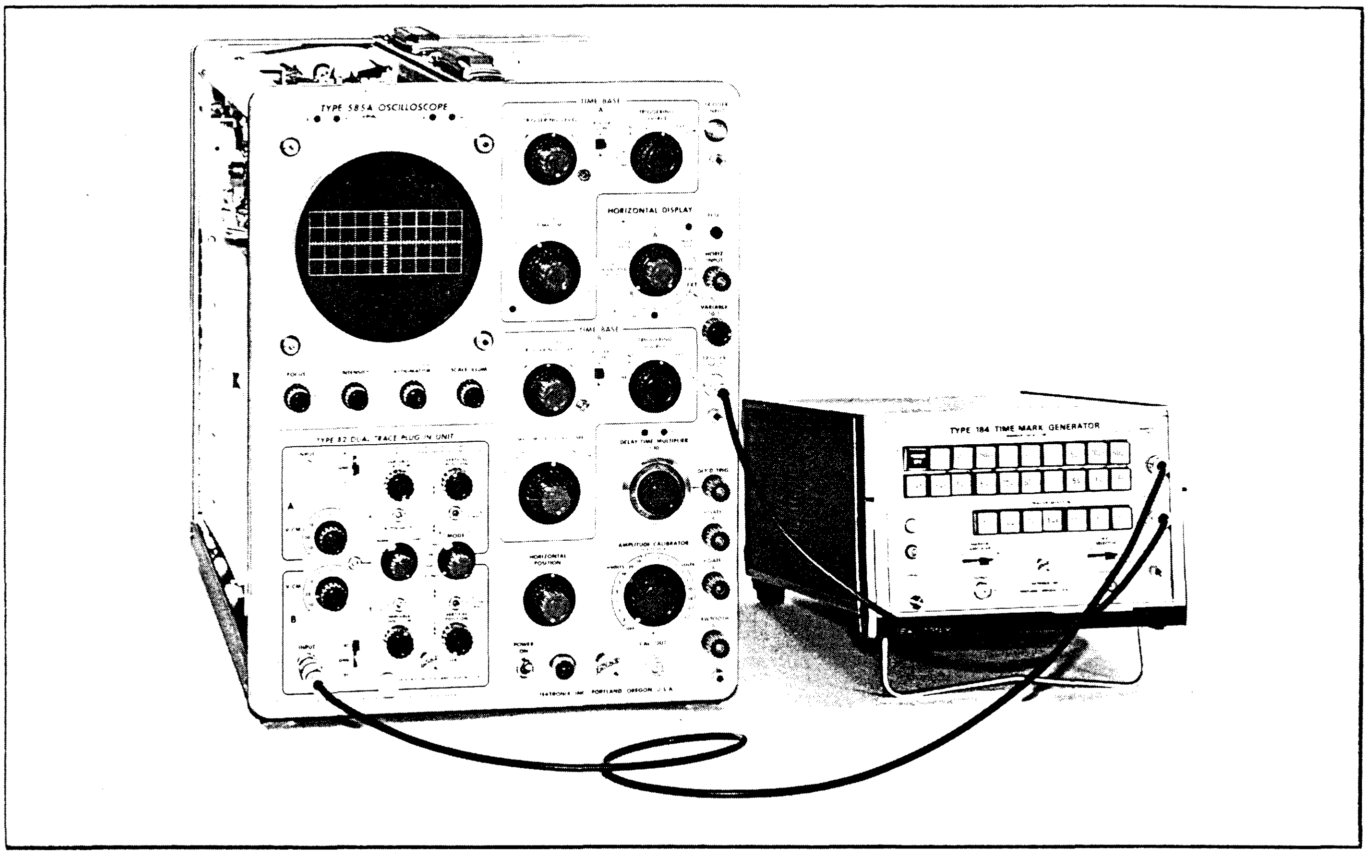


Fig. 21. Equipment setup for steps 29 through 39.

Type 585A

CRT Controls

FOCUS and ASTIGMATISM	Well focused display
INTENSITY	Adjusted for nominal Brightness
HORIZONTAL DISPLAY	**B**
5× MAGNIFIER	**ON**

Time Base A Controls

TIME/CM	1 mSEC
VARIABLE	CALIBRATED
STABILITY	PRESET
TRIGGERING LEVEL	**0**
TRIGGER SLOPE	+
TRIGGERING SOURCE	**EX AC**

Time Base B Controls

TIME/CM	1 mSEC
LENGTH	10 CM
STABILITY	**PRESET**
TRIGGERING LEVEL	**0**
TRIGGER SLOPE	+
TRIGGERING SOURCE	**EXT AC**
DELAY TIME MULTIPLIER 1-10	1.00
AMPLITUDE CALIBRATOR	OFF
HORIZONTAL POSITION	Midrange or centered display

Vertical Plug-In Unit (Type 82 or 86)

Volts/Cm	**.5**
Input Selector	DC
Gain	×1
Variable	Cal
Vertical Position	Adjusted for a centered display

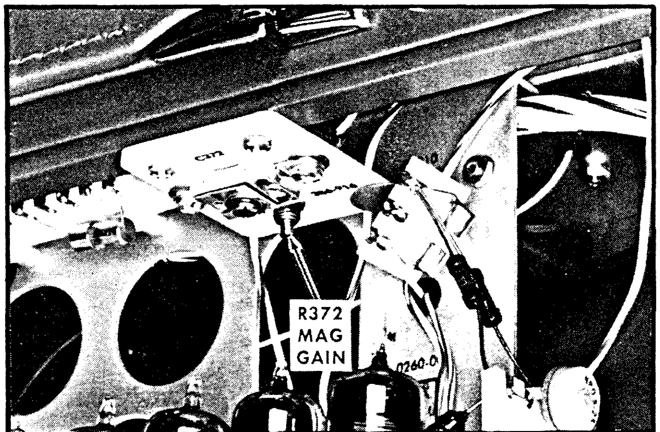
29. Adjust Magnifier Gain

a. Equipment setup is given in Fig. 6-21.

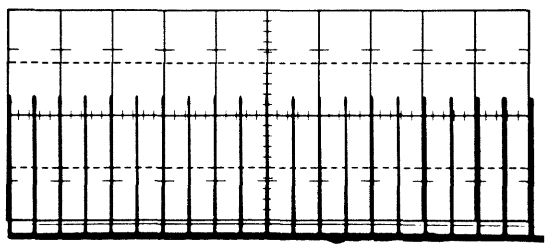
b. Apply .1 ms and 1 ms time-markers from the Time-Mark Generator through a 50 Ω termination to the Input connector of the vertical plug-in unit and apply 1 ms trigger signal to the B TRIGGER INPUT connector.

c. Adjust the B STABILITY and TRIGGERING LEVEL control for a triggered display and turn the 5× MAGNIFIER switch on.

d. Adjust the Mag Gain R372 (Fig. 6-22A) for two .1 ms markers/cm. See Fig. 6-22B.



(A) Location of Mag Gain Adj R372.



(B) Two .1 ms markers per centimeter.

Fig. 6-22. Adjusting Magnifier Gain.

e. Check—Magnifier neon indicator is lit, then turn the 5X MAGNIFIER switch to OFF.

30. Adjust Sweep Calibration

a. Equipment setup is given in step 29.

b. Adjust the Swp Cal R348 (Fig. 6-23) for one 1 ms marker/cm.

31. Adjust Time Base A to Time Base B

a. Equipment setup is given in step 30.

b. Set the A TIME/CM switch to 1 mSEC position, the HORIZONTAL DISPLAY switch to A and change the Time-Mark Generator trigger signal from the B TRIGGER INPUT to the A TRIGGER INPUT connector.

c. Adjust A Triggering controls for a triggered display, then adjust timing potentiometer R160Z for 1 ms marker/cm. Fig. 6-24.

32. Adjust 'A' Sweep Length and Check Variable Control Range

a. Equipment setup is given in step 30.

b. Adjust Sweep Length R176 (Fig. 6-25) for a sweep length of 10.5 cm.

c. Rotate the VARIABLE control fully counterclockwise.

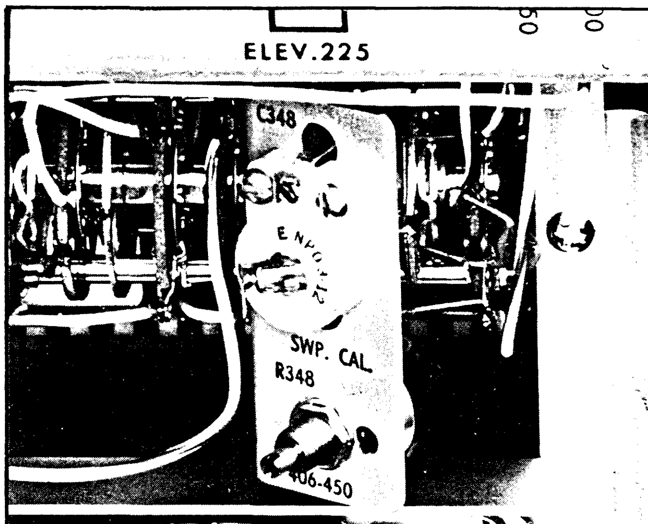
d. Check—Display for 5 or more 1 ms markers/2 cm or a Time/Cm equal to or greater than 2.5 times the TIME/CM switch setting. The UNCALIBRATED neon indicator must be lit with the VARIABLE control out of the detent CALIBRATED switch position.

33. Adjust Sweep Magnifier Registration

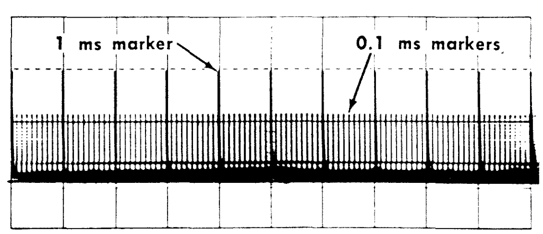
a. Equipment setup is given in step 31.

b. Turn the 5X MAGNIFIER switch to the ON position, then position the display so that the zero time marker is directly behind the graticule center vertical line. See Fig. 6-26.

c. Turn the 5X MAGNIFIER switch to OFF position and adjust the Norm/Mag Regis R358 (Fig. 6-25) to position the zero time-marker directly behind the graticule center vertical line. See Fig. 6-26.



(A) Location of R348.



(B) 1 ms and 0.1 ms marker display.

Fig. 6-23. Sweep Calibration adjustments.

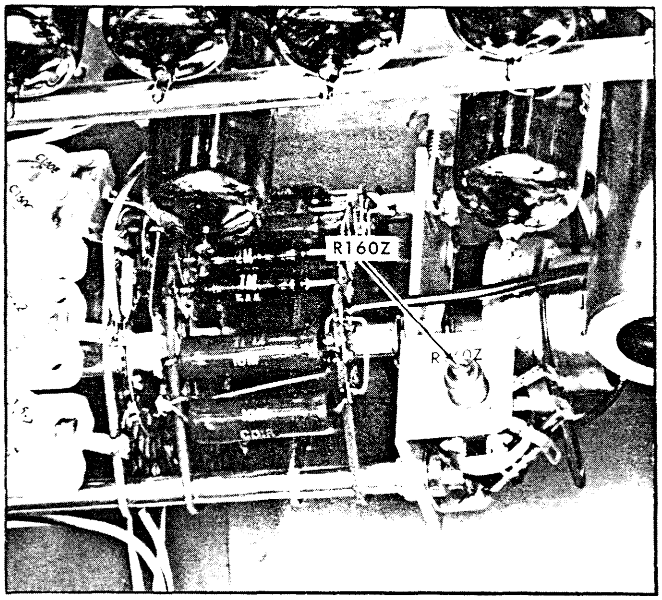


Fig. 6-24. Location of R160Z timing potentiometer.

34. Check Time Base A Sweep Timing Accuracy (.1 mSEC/CM to 2 SEC/CM)

a. Equipment setup is given in step 33.

b. Set the A TIME/CM selector switch, the Time-Mark Generator marker selector and trigger selector as per Table 6-5 and check the Time Base A timing accuracy from .1 mSEC/CM through 2 SEC/CM.

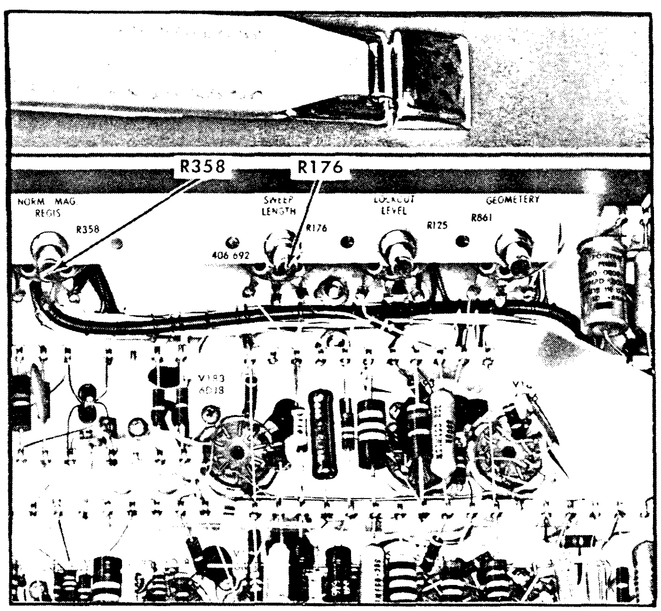


Fig. 6-25. Location of Sweep Length and Norm Mag Regis adjustments.

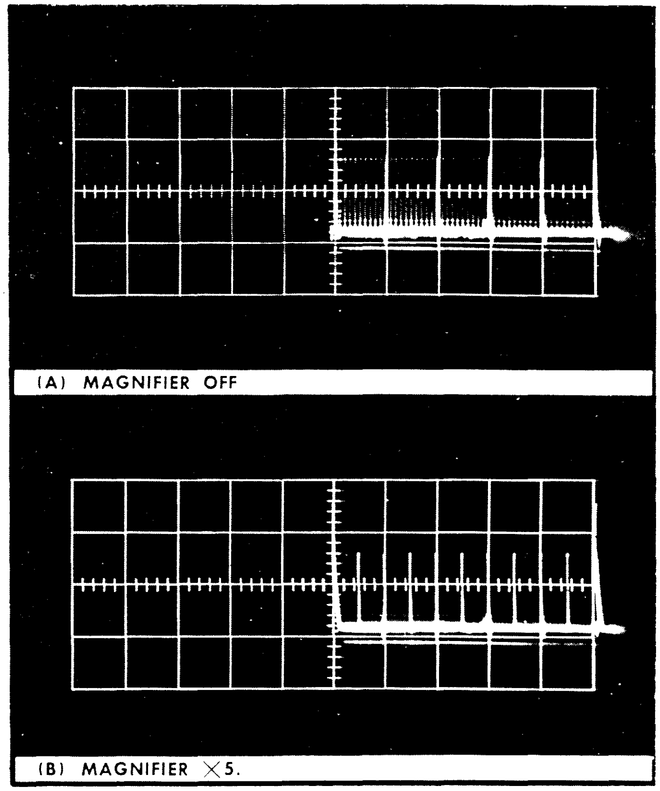


Fig. 6-26. Correct adjustment of Norm Mag Regis R358.

NOTE

Check the timing accuracy over the center 8 cm (See Fig. 6-27). Position the baseline of the display below the graticule area to avoid phosphor burns at the slower sweep rates.

c. Return the A TIME/CM switch to .1 mSEC/CM position.

35. Adjust and Check Time Base A Sweep Rates (50 μSEC/CM through .01 μSEC/CM)

a. Equipment setup is given in step 34.

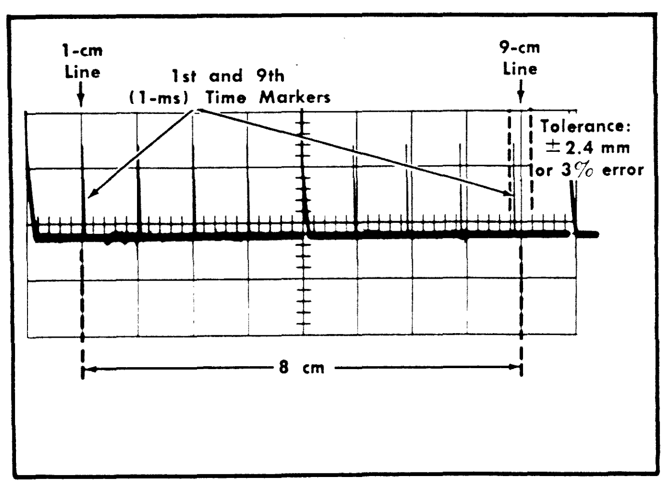
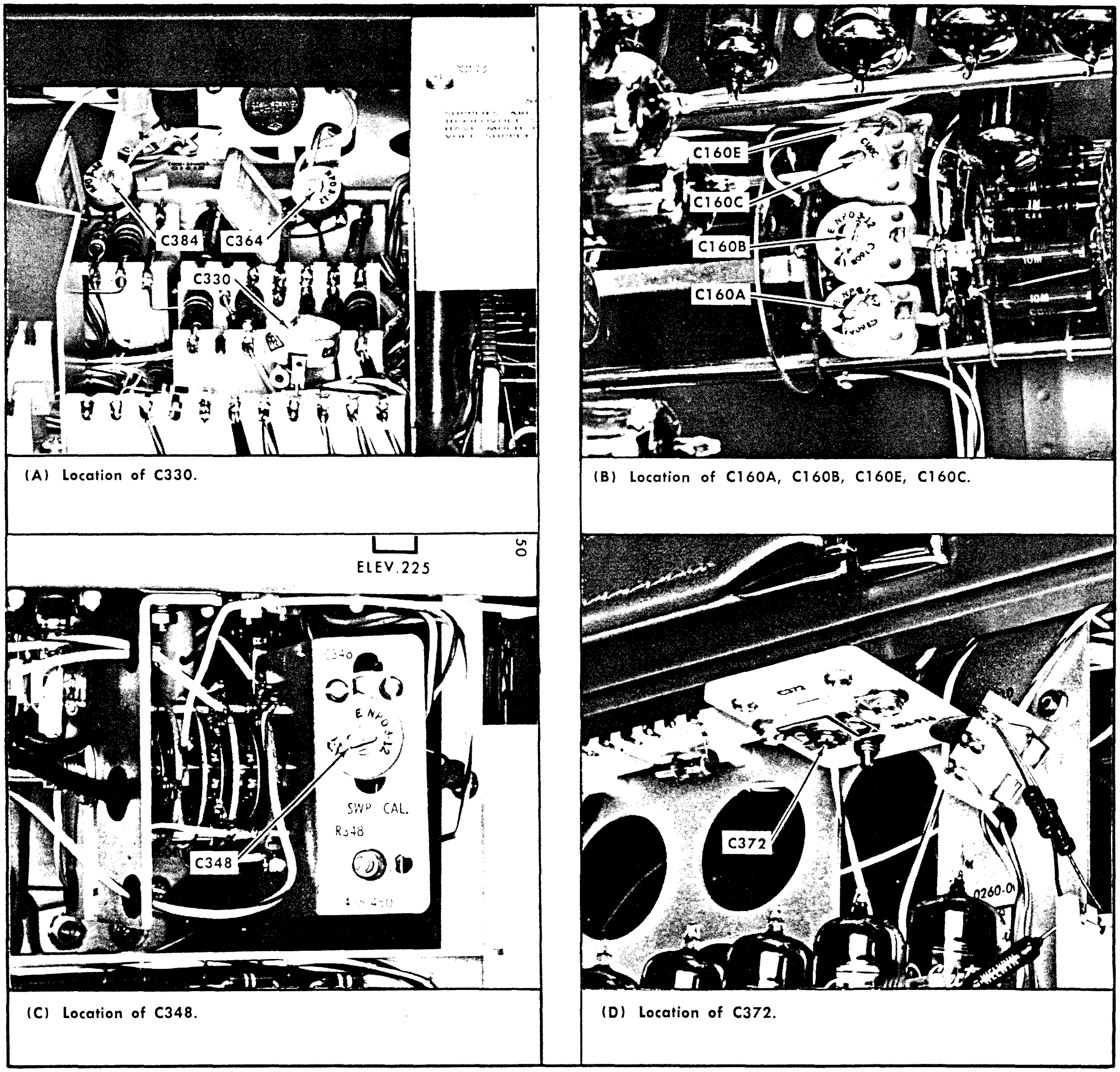


Fig. 6-27. Determining sweep rate accuracy.



(A) Location of C330.

(B) Location of C160A, C160B, C160E, C160C.

(C) Location of C348.

(D) Location of C372.

Fig. 6-28. Time Base A Timing adjustments.

b. Set the A TIME/CM switch to 50 μSEC position and turn the 5× MAGNIFIER switch ON.

c. Apply 10 μs markers and trigger signals from the Time-Mark Generator to the Input of the vertical plug-in unit and the A TRIGGER INPUT connector.

d. Position the display so the zero time marker is aligned with the graticule center vertical line.

e. Switch the TIME/CM selector between 50 μSEC and .1 mSEC positions while adjusting C330 (Fig. 6-28A) so the zero time marker for both sweep rates coincides.

f. Turn the 5× MAGNIFIER switch to OFF, TIME/CM selector to 10 μSEC and proceed with the adjustments and checks listed in Table 6-6.

TABLE 6-5

A TIME/CM	Time Marker Selector	Trigger Selector	Markers/ cm	Maximum Error
.1 mSEC	.1 ms	1 ms	1	±2.4 mm
.2 mSEC			2	±2.4 mm
.5 mSEC	.5 ms	10 ms	1	±2.4 mm
1 mSEC	1 ms		1	±2.4 mm
2 mSEC			2	±2.4 mm
5 mSEC	5 ms	.1 s	1	±2.4 mm
10 mSEC	10 ms		1	±2.4 mm
20 mSEC			2	±2.4 mm
50 mSEC	50 ms		1	±2.4 mm
.1 SEC	.1 s	1 s	1	±2.4 mm
.2 SEC			2	±2.4 mm
.5 SEC	.5 s		1	±2.4 mm
1 SEC	1 s		1	±2.4 mm
2 SEC			2	±2.4 mm

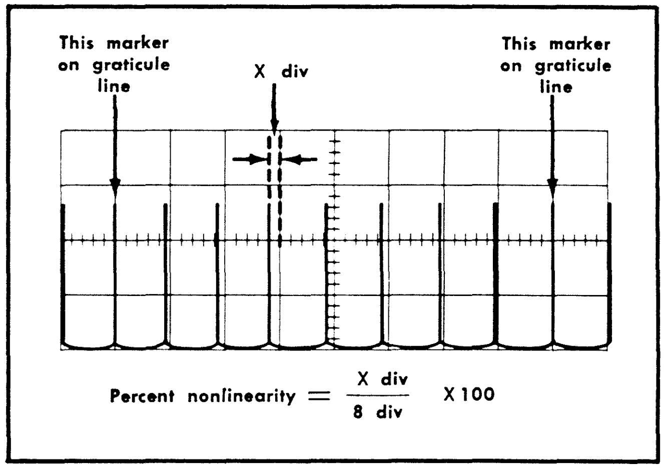


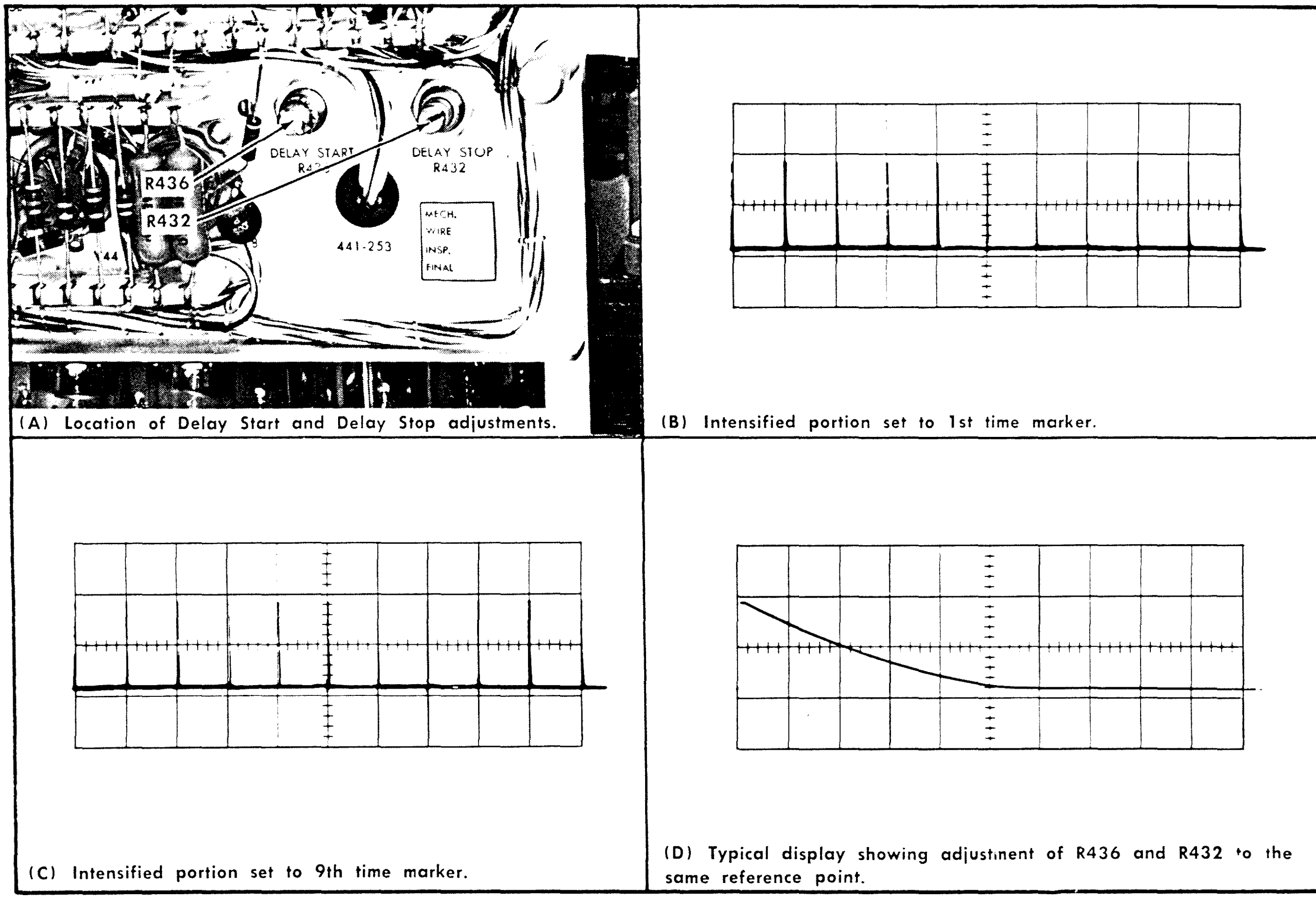
Fig. 6-29. Linearity measurement.

TABLE 6-6

TIME/CM	Time-Marker Selector	Adjust[3]	Observe	Maximum error in mm (±3%)
		5× MAGNIFIER ON		
.1 μSEC	20 ns	C384	Min sweep length	
.1 μSEC	20 ns	C364	Max sweep length	
.05 μSEC	10 ns	C372 and C160A	Preset C372 one turn from fully closed position, then adjust C160A for 1 cycle/cm. Position the start of the magnified display near the first graticule line and adjust C372 for optimum linearity (1 cycle/cm) on the center (4-5-6) graticule vertical lines. Center the display and readjust C160A for 1 cycle/cm. Repeat the adjustment of C372 and C160A for optimum timing and display linearity. Check the display linearity (exclude the first 6 or 8 cycles).	
		5× MAGNIFIER OFF		
.05 μSEC	50 ns	C348	1 cycle/cm	±2.4
.1 μSEC	.1 μs	C160B[4]	1 marker/cm	±2.4
1 μSEC	1 μs	C160C	1 marker/cm	±2.4
10 μSEC	10 μs	C160E	1 marker/cm	±2.4
.2 μSEC	.1 μs	Check	2 markers/cm	±2.4
.5 μSEC	.5 μs	Check	1 marker/cm	±2.4
2 μSEC	1 μs	Check	2 markers/cm	±2.4
5 μSEC	5 μs	Check	1 marker/cm	±2.4
20 μSEC	10 μs	Check	2 markers/cm	±2.4
50 μSEC	50 μs	Check	1 marker/cm	±2.4

[3]The linearity error of the sweep on any TIME/CM selector setting with the 5× MAGNIFIER on or off must not exceed 2 mm. See Fig. 6-29.

[4]Due to interaction between C160B and C348 these adjustments should be repeated.



(A) Location of Delay Start and Delay Stop adjustments.

(B) Intensified portion set to 1st time marker.

(C) Intensified portion set to 9th time marker.

(D) Typical display showing adjustment of R436 and R432 to the same reference point.

Fig. 6-30. Delay Start and Stop adjustment.

36. Adjust Delay Start and Stop

a. Equipment setup is given in step 35.

b. Remove the triggering signal from the A TRIGGER INPUT and apply the Time-Mark Generator triggering signal to the B TRIGGER INPUT connector. Change the front panel controls as follows:

HORIZONTAL DISPLAY	'B' INTENSIFIED BY 'A'
B TRIGGERING SOURCE	EXT AC
A STABILITY	Fully clockwise
A TIME/CM	5 μSEC
B TIME/CM	1 mSEC

c. Set the Time-Mark Generator marker selector for 1 ms markers and the trigger selector for 1 ms trigger signals. Adjust B TRIGGERING LEVEL control for a stable display.

d. With the DELAY TIME MULTIPLIER 1-10 dial set at 1.00, adjust the Delay Start R436 (Fig. 6-30A) to position the intensified segment to the first time-marker (1 cm from the sweep start).

e. Rotate the DELAY-TIME MULTIPLIER 1-10 dial clockwise to 9.00, then adjust the Delay Stop R432 so the intensified portion starts at the ninth time mark (9 cm from the start of the trace).

f. Repeat the Delay Start and Delay Stop adjustments because of interaction.

g. Set the DELAY TIME MULTIPLIER 1-10 control for a dial reading of 1.00 and switch the HORIZONTAL DISPLAY switch to 'A' DLY'D BY 'B'.

h. Adjust the Delay Start R436 so that the leading edge of the time mark is at the start of the trace (see Fig. 6-30D).

i. Set the DELAY TIME MULTIPLIER 1-10 control for a dial reading of 9.00 and adjust the Delay Stop R432, until the leading edge of the time mark is at the start of the trace.

37. Check Delay Time Multiplier Incremental Linearity

a. Equipment setup is given in step 36.

b. With the HORIZONTAL DISPLAY switch first in the 'B' INTENSIFIED BY 'A' position for rough setting and then in the 'A' DLY'D BY 'B' position, adjust the DELAY TIME MULTIPLIER dial so the sweep starts on the leading edge of the second (2 cm from the graticule edge) 1 ms time mark.

c. Check—The DELAY TIME MULTIPLIER dial must read 2.00 $\pm$2 minor dial divisions ($\pm$0.2%).

TABLE 6-7

Time Base B TIME/CM	Time-Mark Generator Marker Output	Trigger Output	CRT Display Markers/ Centimeter
2 μSEC	1 μS	10 μS	2
5 μSEC	5 μS		1
10 μSEC	10 μS		1
20 μSEC	10 μS		2
50 μSEC	50 μS	.1 mS	1
.1 mSEC	.1 mS		1
.2 mSEC	.1 mS		2
.5 mSEC	.5 mS	1 mS	1
1 mSEC	1 mS		1
2 mSEC	1 mS		2
5 mSEC	5 mS	.1 S	1
10 mSEC	10 mS		1
20 mSEC	10 mS		2
50 mSEC	50 mS		1
.1 SEC	.1 S		1
.2 SEC	.1 S		2
.5 SEC	.5 S	1 S	1
1 SEC	1 S		1

d. Repeat this accuracy check between each major dial division up to 9.00. Incremental accuracy is ±0.2%.

38. Adjust Time Base B Sweep Rate **0**

a. Equipment setup is given in step 37.

b. Set Time Base B TIME/CM switch to 5 μSEC and Time Base A TIME/CM switch to .1 μSEC.

c. Set the Time-Mark Generator marker selector for 5 μS time markers.

d. With the HORIZONTAL DISPLAY switch first in the 'B' INTENSIFIED BY 'A' position for a rough setting and then in the 'A' DLY'D BY 'B' position adjust the DELAY TIME MULTIPLIER 1-10 dial so the sweep starts at the leading edge of the first time marker and note the dial reading (approximately 1.00).

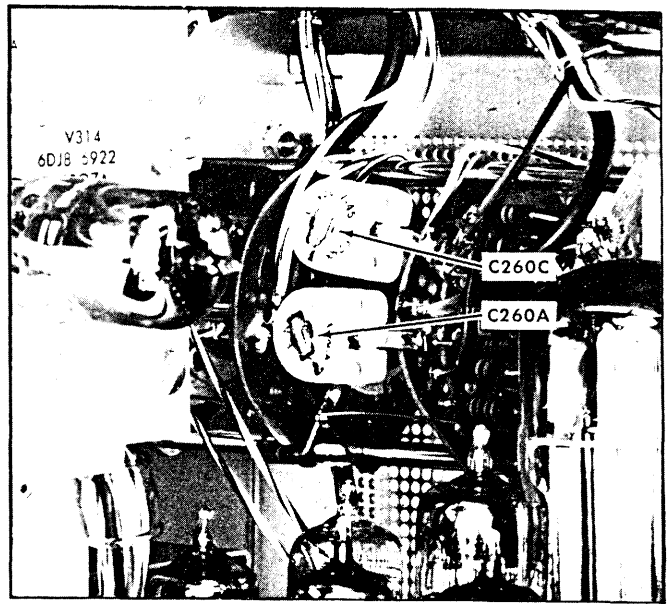


Fig. 6-31. Adjusting Time Base B sweep rate.

e. Rotate the DELAY TIME MULTIPLIER exactly 8.00 divisions above the setting for step d (approximate setting 9.00).

f. Adjust C260A (see Fig. 6-31) so the sweep starts at the leading edge of the ninth time marker.

g. Repeat the procdure to compensate for circuit interaction.

h. Set the A TIME/CM selector to 1 μSEC and the B TIME/CM OR DELAY TIME selector to 50 μSEC postion.

i. Adjust C260C as C260A was adjusted in step f.

39. Check Time Base B Sweep Timing Accuracy

a. Equipment setup is given in step 38.

b. Set the HORIZONTAL DISPLAY to B and adjust B LEVEL control if necessary for a triggered display.

c. Check—Set the B TIME/CM switch and the Time-Mark Generator as in Table 6-7, checking the timing accuracy over the center 8 cm. Accuracy must be within ±3% (2.4 mm).

d. Remove the Time-Mark Generator, marker and trigger signals from the Type 585A.

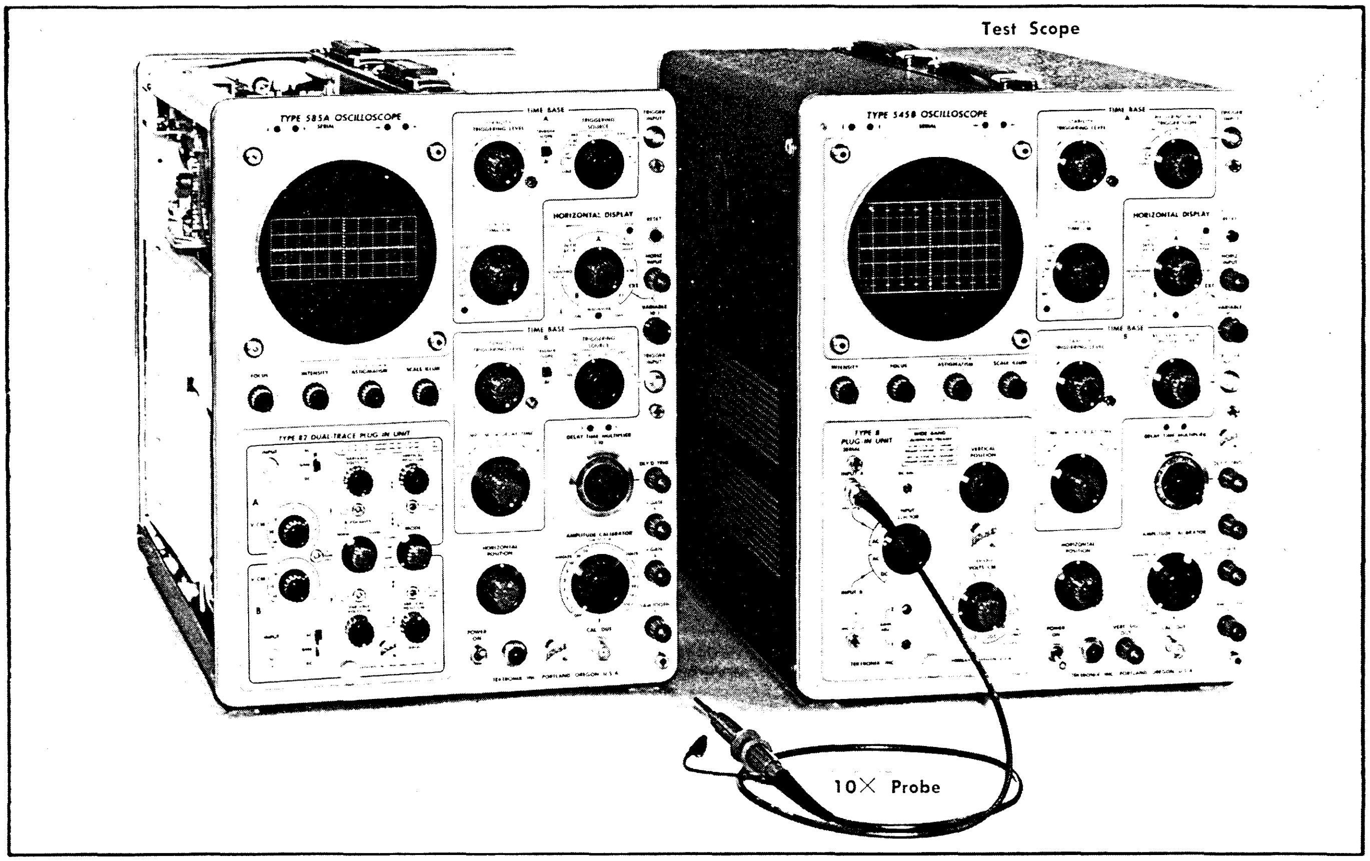


Fig. 6-32. Equipment setup for steps 40 and 41.

Type 585A

CRT Controls

FOCUS and ASTIGMATISM	Well focused display
INTENSITY	Adjusted for nominal brightness
HORIZONTAL DISPLAY	**A**
5× MAGNIFIER	**OFF**

Time Base A Controls

TIME/CM	**.1 μSEC**
VARIABLE	CALIBRATED
STABILITY	PRESET
TRIGGERING LEVEL	**CW**
TRIGGER SLOPE	+
TRIGGERING SOURCE	**INT AC**

Time Base B Controls

TIME/CM	**2 μSEC**
LENGTH	10 CM
STABILITY	PRESET
TRIGGERING LEVEL	**CW**
TRIGGER SLOPE	+
TRIGGERING SOURCE	**INT AC**
DELAY-TIME MULTIPLIER 1-10	1.00
AMPLITUDE CALIBRATOR	OFF
HORIZONTAL POSITION	Midrange or centered sweep

Vertical Plug-In Unit (Type 86 or 82)

Volts/Cm	**.5**
Input Selector	**AC**
Gain	×1
Variable	Cal
Vertical Position	Adjusted for a centered display

Test Oscilloscope

Time/Cm	**2 μSEC**
Volts/Cm	**5.0**
Coupling	AC

40. Check A Sweep Holdoff Time

a. Test equipment setup is shown in Fig. 6-32.

b. Connect a 10× probe from the test oscilloscope to the junction of R330-C330 (see Fig. 6-33A) and adjust test oscilloscope controls for a stable display.

c. Check Time Base A for the following holdoff times. See Fig. 6-33B.

A TIME/CM	HOLDOFF TIME
.05 μSEC to .5 μSEC	3 μs to 9 μs
1 μSEC to 50 μSEC	15 μs to 40 μs
.1 μSEC to .5 mSEC	150 μs to 400 μs
1 mSEC to 5 mSEC	1.5 ms to 4 ms
10 mSEC to 50 mSEC	15 ms to 40 ms
.1 SEC to 2 SEC	150 ms to 400 ms

41. Check B Sweep Holdoff Time

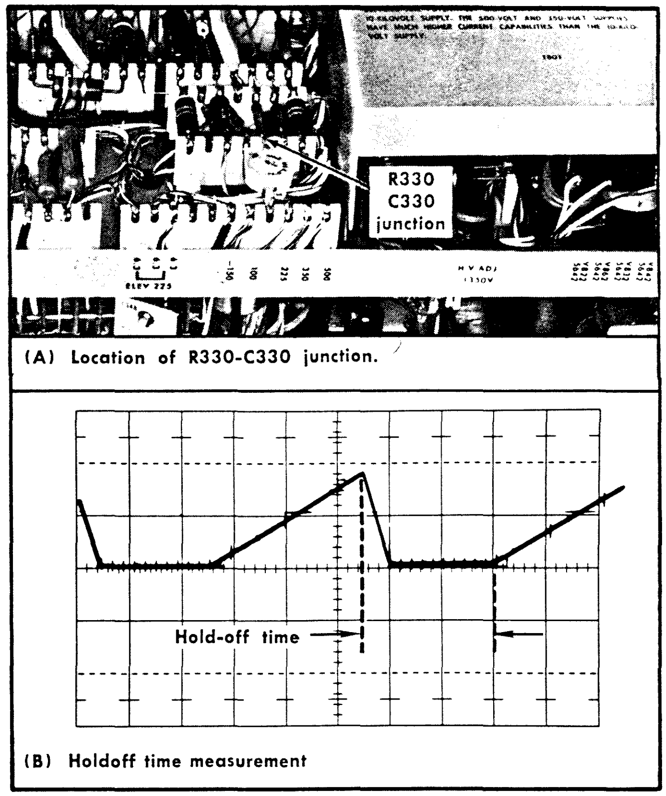
a. Equipment setup is given in step 40.

b. Set HORIZONTAL DISPLAY switch to B position.

c. Check—B Sweep for the following holdoff times:

A TIME/CM	HOLDOFF TIME
.05 μSEC to .5 μSEC	5 μs to 15 μs
1 μSEC to 50 μSEC	50 μs to 150 μs
.1 mSEC to .5 mSEC	0.5 ms to 1.5 ms
1 mSEC to 5 mSEC	5 ms to 15 ms
10 mSEC to 50 mSEC	50 ms to 150 ms
.1 SEC to 2 SEC	50 ms to 150 ms

d. Disconnect the 10X probe from the junction of R330 and C330.



(A) Location of R330-C330 junction.

(B) Holdoff time measurement

Fig. 6-33. Checking holdoff time.

NOTES

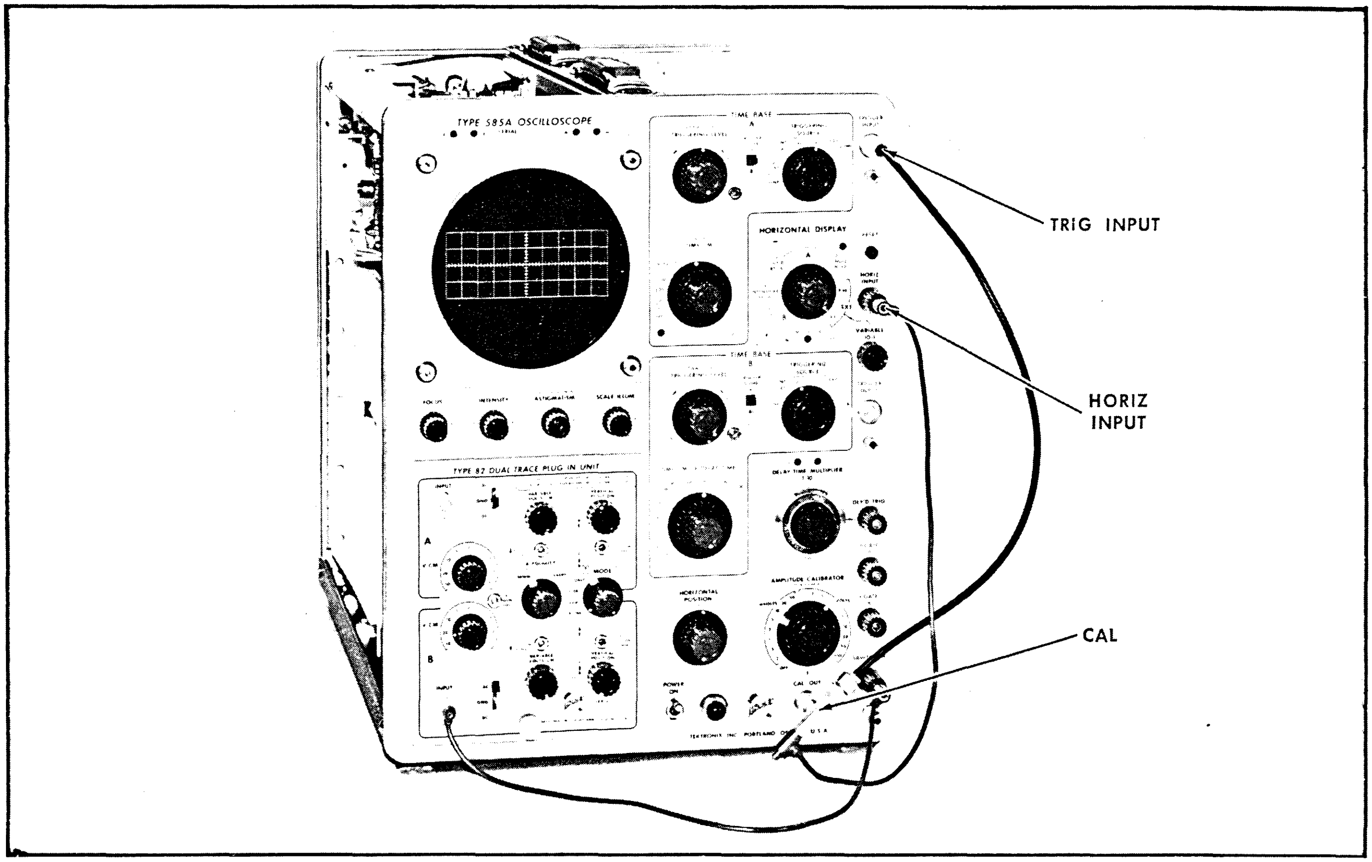


Fig. 6-34. Equipment setup for steps 42 through 44.

Type 585A

CRT Controls

FOCUS and ASTIGMATISM	Well focused display
INTENSITY	Adjusted for nominal brightness
HORIZONTAL DISPLAY	**EXT ×1**
5× MAGNIFIER	OFF

Time Base A Controls

TIME/CM	**.5 mSEC**
VARIABLE	CALIBRATED
STABILITY	PRESET
TRIGGERING LEVEL	CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	**EXT AC**

Time Base B Controls

TIME/CM	1 mSEC
LENGTH	10 CM
STABILITY	**Fully CW**
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
DELAY-TIME MULTIPLIER 1-10	1.00
AMPLITUDE CALIBRATOR	**1 VOLT**
HORIZONTAL POSITION	Midrange or centered sweep

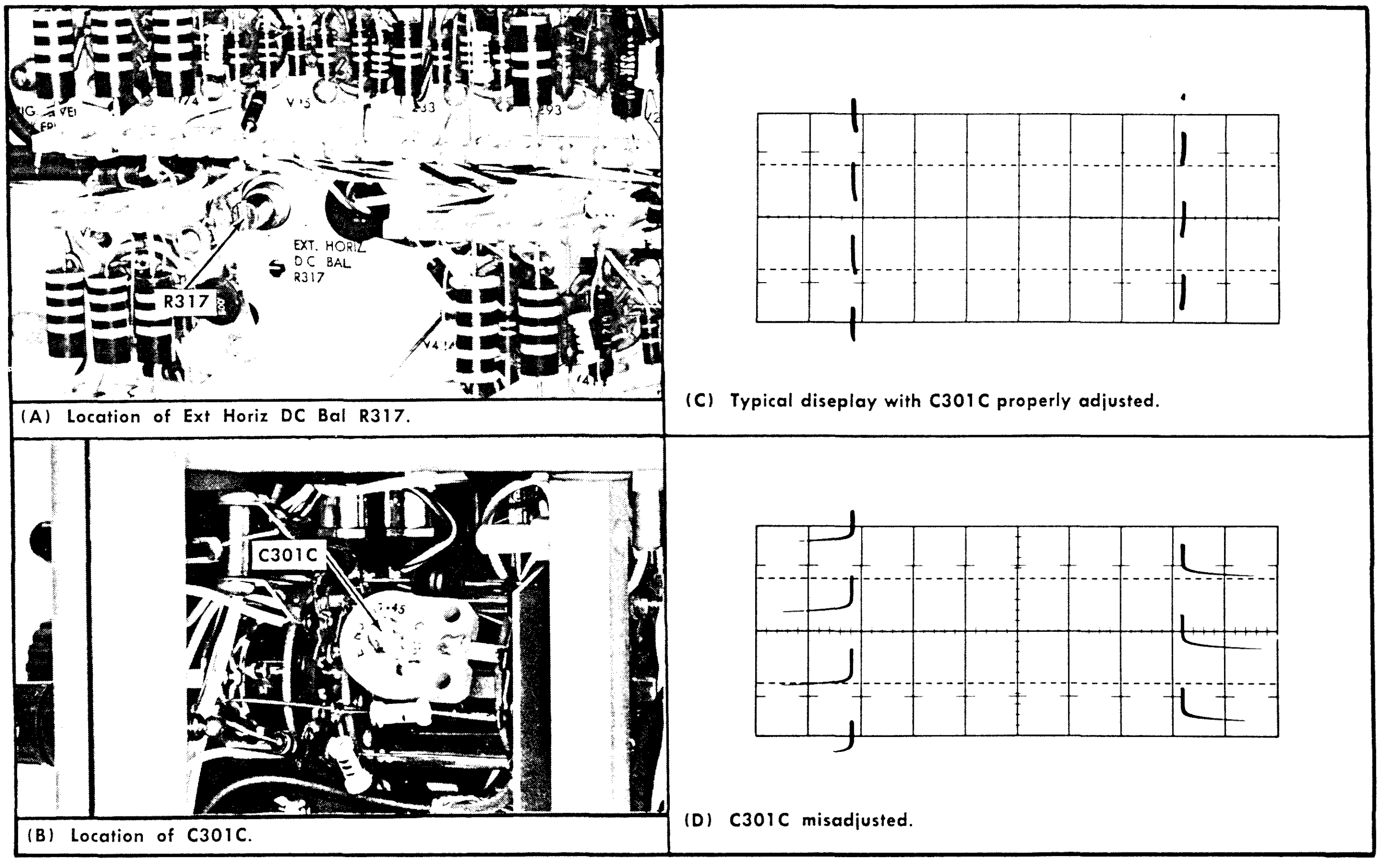
Vertical Plug-In Unit (Type 86 or 82)

Volts/Cm	**20**
Input Selector	AC
Gain	×1
Variable	Cal
Vertical Position	Adjusted for a centered display

42. Adjust External Horizontal Amplifier DC Balance

a. Equipment setup is shown in Fig. 6-34.

b. Connect a BNC to banana plug patch cord between the SAWTOOTH A connector and the Input connector for the vertical plug-in unit. Connect the output from the CAL



(A) Location of Ext Horiz DC Bal R317.

(B) Location of C301C.

(C) Typical diseplay with C301C properly adjusted.

(D) C301C misadjusted.

Fig. 6-35. External horizontal adjustments.

OUT connector through two patch cords (BNC to BNC and BNC to banana plug) to the A TRIGGER INPUT connector and the HORIZ INPUT jack.

c. Adjust the A TRIGGERING LEVEL control for a stable display. See Fig. 6-35C and 6-35D.

d. Adjust the Ext Horiz DC Bal R317 (see Fig. 6-35A) for minimum horizontal shift of the left side of the waveform as the VARIABLE 10-1 control is rotated through its range.

e. Switch the HORIZONTAL DISPLAY switch to EXT ×10 position.

f. Check—The waveform baseline should not shift more than 2 mm as the VARIABLE 10-1 control is rotated through its range.

43. Adjust External Horizontal Amplifier Input Compensation

a. Equipment setup is given in step 42.

b. Set the VARIABLE 10-1 control fully clockwise, then set the AMPLITUDE CALIBRATOR selector to 10 VOLTS.

c. Adjust C301C for same display as noted in ×1 display. Aberrations should not exceed ±5%. Fig. 6-35B.

44. Check External Horizontal Amplifier Input Deflection Factor

a. Equipment setup is given in step 43.

b. Set the VARIABLE 10-1 control fully clockwise, the AMPLITUDE CALIBRATOR selector to 1.0 VOLT and the HORIZONTAL DISPLAY switch to EXT ×1 position.

c. Check—Horizontal deflection $\geq$5 cm.

d. Change the HORIZONTAL DISPLAY switch to ×10 position and the AMPLITUDE CALIBRATOR to 10 VOLTS.

e. Check—Horizontal deflection should be within ±3% of the amplitude noted in step c.

f. Change the VARIABLE 10-1 control to the full counterclockwise position and the HORIZONTAL DISPLAY switch to ×1. Note the amplitude of the horizontal deflection.

g. Change the HORIZONTAL DISPLAY switch to the ×10 position and rotate the VARIABLE 10-1 control fully clockwise.

h. Check—The horizontal deflection amplitude must be equal to or greater than the deflection in step f.

i. Set the AMPLITUDE CALIBRATOR to the 1 VOLT position, the VARIABLE 10-1 control fully clockwise and the HORIZONTAL DISPLAY switch to ×1 position. Note the display signal amplitude and aberrations.

j. Change the HORIZONTAL DISPLAY switch to ×10 position and the AMPLITUDE CALIBRATOR to 10 VOLTS.

k. Check and compare the display amplitude and waveshape with the display noted in step i. Amplitude must be within ±3% and aberrations in both ×1 and ×10 positions must be less than 5%.

45. Check External Horizontal Amplifier Bandwidth

a. Equipment setup is given in step 44.

b. Remove the AMPLITUDE CALIBRATOR signal and apply a 50-kHz signal from the Constant Amplitude Signal Generator (Type 191) through a 50-Ω termination to the HORIZ INPUT connector.

c. Set the HORIZONTAL DISPLAY selector to ×1 position and the VARIABLE 10-1 control fully clockwise.

d. Adjust the Constant Amplitude Signal Generator Output control for a 6-cm horizontal deflection.

e. Increase the frequency of the Constant Amplitude Signal Generator until the display amplitude decreases to 4.2 cm.

f. Check—Frequency of the Constant Amplitude Signal Generator must be ≥350 kHz.

g. Remove all cables and patch cords to the Type 585A.

NOTES

Fig. 6-36. Equipment setup for steps 46 and 47.

Type 585A

CRT Controls	
FOCUS and ASTIGMATISM	Well focused display
INTENSITY	Adjusted for nominal brightness
HORIZONTAL DISPLAY	**A**
5× MAGNIFIER	OFF
Time Base A Controls	
TIME/CM	**.5 μSEC**
VARIABLE	CALIBRATED
STABILITY	PRESET
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	**INT AC**
Time Base B Controls	
TIME/CM	1 mSEC
LENGTH	10 CM
STABILITY	**PRESET**
TRIGGERING LEVEL	Fully CW
TRIGGER SLOPE	+
TRIGGERING SOURCE	INT AC
DELAY-TIME MULTIPLIER 1-10	1.00
AMPLITUDE CALIBRATOR	**OFF**
HORIZONTAL POSITION	Midrange or centered display

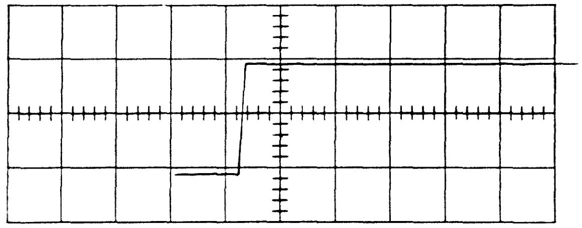
Calibration Fixture 067-0523-00

+12.6 Load	Switch towards panel
Load	Norm
Vertical Position	Midrange or centered display
Display Selector	**Pulser**
Pulser Amplitude	**3 o'clock**
Pulser Frequency	Midrange or adjusted for optimum display intensity

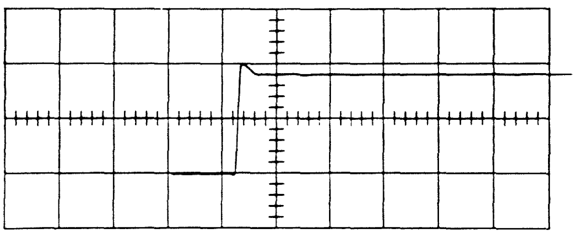
46. Adjust Vertical System High Frequency Compensation **0**

a. Equipment setup is shown in Fig. 6-36.

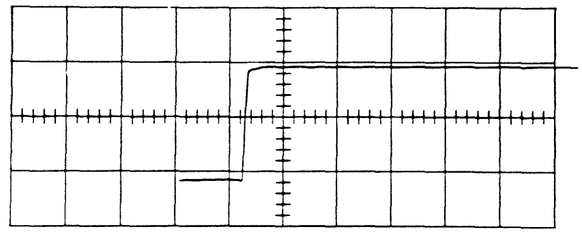
b. Adjust the Pulser Amplitude control on the test plug-in unit for a 2 cm signal, then adjust the Type 585A triggering controls for a stable triggered display. Increase the A TIME/CM selector to .1 μSEC position and adjust the FOCUS, ASTIGMATISM and INTENSITY controls for optimum focus of the waveform. See Fig. 6-37A.



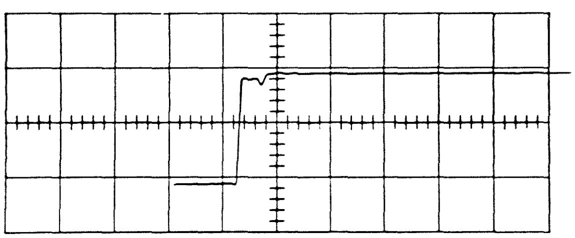
A. Correct response.



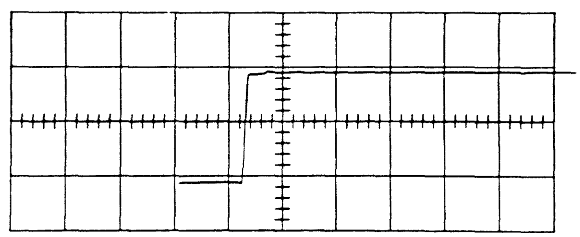
B. Peak response C1276 maladjusted.



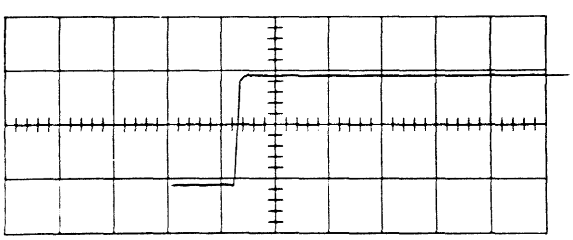
C. Rolloff, R1293 maladjusted.



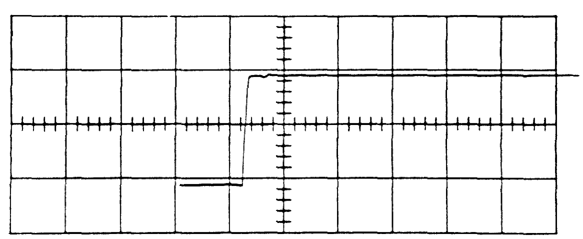
D. C1209 maladjusted.



E. C1006 maladjusted.



F. C1260 maladjusted.



G. C1214 maladjusted.

Fig. 6-37. Vertical amplifier transient response waveforms. All taken at sweep rate of .05 μSEC/CM, using a 067-0523-00 Calibration Fixture.

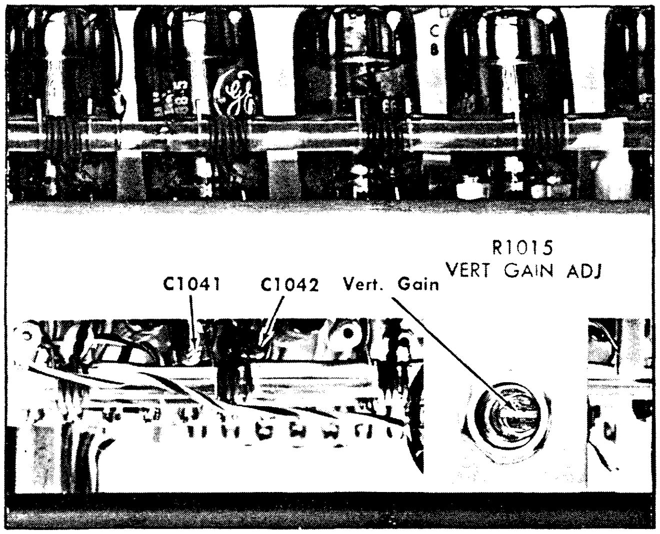


Fig. 6-38. Location of C1041 and C1042.

Position the pulse to the center of the graticule and adjust the test plug-in unit Pulser Frequency control for optimum intensity.

NOTE

The adjustments that follow are actually impedance matching adjustments. If the impedance of one section of a distributed amplifier is different than the impedance of the previous or following section, there will be an instantaneous change in the gain as the signal passes the mismatched section and appears as a bump or dip on the CRT pulse display.

Begin the vertical amplifier check of the transient response by comparing the presentation with the waveform of Fig. 6-37A. The seven pictures demonstrate the affect the various adjustments have on the waveshape. Any variations in amplitude beyond 25 ns from the leading edge are not adjustable. All adjustments interact to some degree and should be made in the following sequence.

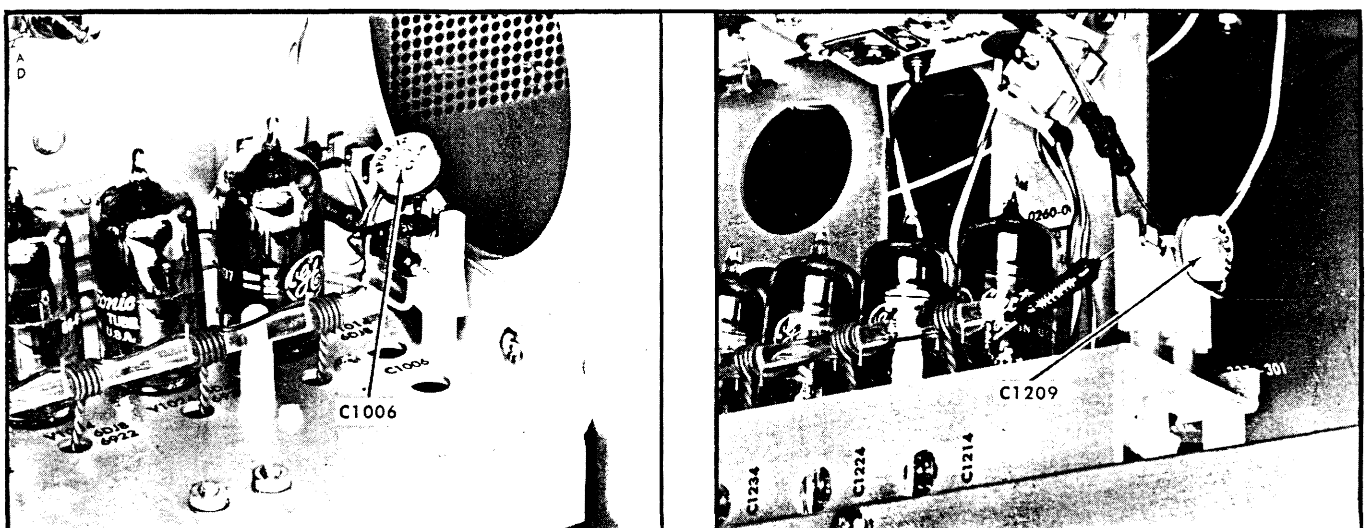
c. Recheck the vertical amplifier gain by setting the test plug-in unit Display Selector to Cal and Alt Sync position and adjust as in step 13. Return the Display Selector switch to the Pulser position.

d. C1042 and C1041 (see Fig. 6-38) are oscillation suppressors. Misadjustment appears as a wide trace. Adjust if necessary by adjusting both equal increments in the same direction.

e. With the TIME/CM selector at .1 μSEC position and the 5× MAGNIFIER turned ON, adjust C1209 (near V1214) and C1006 (Fig. 6-39) for optimum flat top and minimum aberrations. Check overall level by periodically switching from fast to slower sweep rates (5 to 10 μSEC).

f. Starting with C1214, adjust C1214 through C1254 (Fig. 6-40) for optimum waveform flat top and minimum aberration.

g. Adjust C1260 and C1261 (Fig. 6-40) for optimum front corner and minimum aberration. Ringing may occur if these capacitors are not adjusted near capacity.



A. Location of C1006.

B. Location of C1209.

Fig. 6-39. Location of C1209 and C1006.

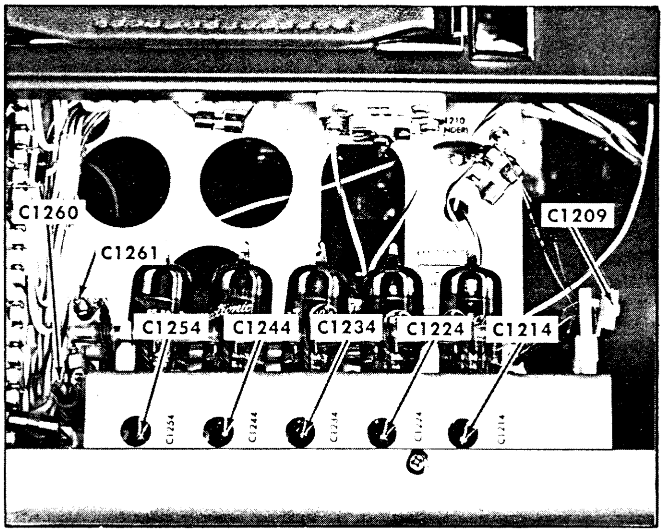


Fig. 6-40. Location of C1214 through C1254.

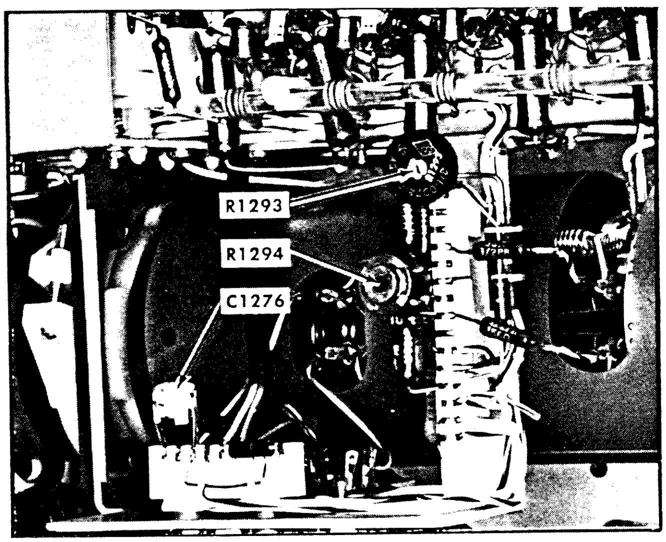


Fig. 6-41. CRT Termination network.

h. Change the A TIME/CM selector to 1 or 2 μSEC, then adjust R1293 and C1276 (Fig. 6-41) for optimum overall level or minimum tilt. Waveform should be flat top through TIME/CM ranges from 1 mSEC to .05 μSEC. Adjustment of R1293 will affect the vertical system gain; therefore, Vert Gain Adj R1015 must be rechecked (step c).

Most of the HF adjustments interact, so the above procedure should be repeated until optimum response is obtained.

i. Check the transient response with the Type 585A side panels in place. It may be necessary to slightly readjust R1293.

This completes the transient response adjustments.

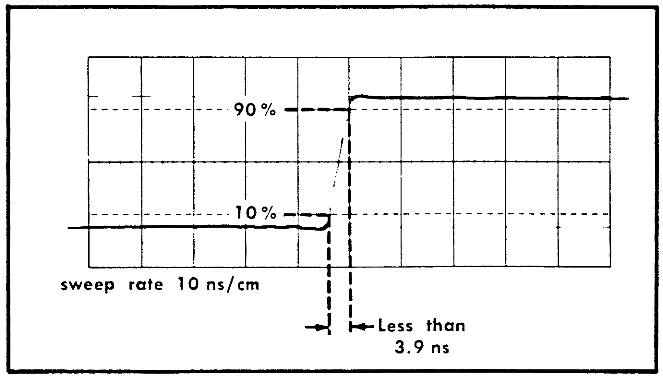


Fig. 6-42. Measuring risetime. Sweep rate 10 ns/cm.

47. Check Risetime

a. Equipment setup is given in step 46.

b. Set the TIME/CM switch to .05 μSEC and turn the 5$\times$ MAGNIFIER to ON. The sweep rate is now 10 ns/cm.

c. Position the start of the trace to the 0 graticule line, then adjust the TRIGGERING LEVEL control for a stable triggered display with the pulse leading edge on the graticule center vertical line.

d. Adjust the test plug-in unit Pulser Amplitude control for a pulse amplitude of 2.4 cm.

e. Measure the risetime. See Fig. 6-42. Risetime is $\leq$4.2 ns.

This completes the calibration procedure for the Type 585A. Replace the side and bottom covers. If the instrument has been completely calibrated to the tolerances given in this procedure, it will perform to the limits given in the Characteristics section of the manual.

PARTS LIST ABBREVIATIONS

BHB	binding head brass
BHS	binding head steel
cap.	capacitor
cer	ceramic
comp	composition
conn	connector
CRT	cathode-ray tube
csk	countersunk
DE	double end
dia	diameter
div	division
elect.	electrolytic
EMC	electrolytic, metal cased
EMT	electrolytic, metal tubular
ext	external
F & I	focus and intensity
FHB	flat head brass
FHS	flat head steel
Fil HB	fillister head brass
Fil HS	fillister head steel
h	height or high
hex.	hexagonal
HHB	hex head brass
HHS	hex head steel
HSB	hex socket brass
HSS	hex socket steel
ID	inside diameter
inc	incandescent
int	internal
lg	length or long
met.	metal
mtg hdw	mounting hardware
OD	outside diameter
OHB	oval head brass
OHS	oval head steel
P/O	part of
PHB	pan head brass
PHS	pan head steel
plstc	plastic
PMC	paper, metal cased
poly	polystyrene
prec	precision
PT	paper, tubular
PTM	paper or plastic, tubular, molded
RHB	round head brass
RHS	round head steel
SE	single end
SN or S/N	serial number
S or SW	switch
TC	temperature compensated
THB	truss head brass
thk	thick
THS	truss head steel
tub.	tubular
var	variable
w	wide or width
WW	wire-wound

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial or model number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

SPECIAL NOTES AND SYMBOLS

×000	Part first added at this serial number
00×	Part removed after this serial number
*000-0000-00	Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, Inc., or reworked or checked components.
Use 000-0000-00	Part number indicated is direct replacement.

SECTION 7
ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Description			S/N Range

Bulbs

Ckt. No.	Tektronix Part No.	Description			S/N Range
B129	Use 150-027	Neon, NE-23		READY	5969-11419
B129	150-0030-00	Neon, NE-2V		READY	11420-up
B160W	Use 150-027	Neon, NE-23		UNCALIBRATED	5969-11419
B160W	150-0030-00	Neon, NE-2V		UNCALIBRATED	11420-up
B167	Use 150-027	Neon, NE-23			
B171	Use 150-027	Neon, NE-23			
B267	Use 150-027	Neon, NE-23			
B271	Use 150-027	Neon, NE-23			
B347	Use 150-027	Neon, NE-23			5969-11419
B347	150-0030-00	Neon, NE-2V			11420-up
B386	Use 150-027	Neon, NE-23			
B397	Use 150-027	Neon, NE-23			5969-11419
B397	150-0030-00	Neon, NE-2V			11420-up
B398	Use 150-027	Neon, NE-23			5969-11419
B398	150-0030-00	Neon, NE-2V			11420-up
B434A	Use 150-027	Neon, NE-23			5969-11419
B434A	150-0030-00	Neon, NE-2V			11420-up
B434B	Use 150-027	Neon, NE-23			5969-11419
B434B	150-0030-00	Neon, NE-2V			11420-up
B601	150-001	Incandescent, #47	Graticule Light		5969-8999
B601	150-031	Incandescent, #44	Graticule Light		9000-up
B602	150-001	Incandescent, #47	Graticule Light		5969-8999
B602	150-031	Incandescent, #44	Graticule Light		9000-up
B603	150-001	Incandescent, #47	Pilot Light		
B1088	Use 150-027	Neon, NE-23			5969-11419
B1088	150-0030-00	Neon, NE-2V			11420-up
B1098	Use 150-027	Neon, NE-23			5969-11419
B1098	150-0030-00	Neon, NE-2V			11420-up

Capacitors

Tolerance ±20% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Description				S/N Range
C1	283-002	.01 μf	Disc Type	500 v		
C2	283-002	.01 μf	Disc Type	500 v		
C3	281-523	100 pf	Cer.	350 v		
C4	283-000	.001 μf	Disc Type	500 v		
C5	281-550	120 pf	Cer.	500 v	10%	
C6	283-002	.01 μf	Disc Type	500 v		
C7	283-002	.01 μf	Disc Type	500 v		
C8	281-523	100 pf	Cer.	350 v		
C21	283-001	.005 μf	Disc Type	500 v		
C22	283-000	.001 μf	Disc Type	500 v		
C40	283-001	.005 μf	Disc Type	500 v		
C43	283-013	.01 μf	Disc Type	1000 v		
C44	281-524	150 pf	Cer.	500 v		
C45	281-536	1000 pf	Cer.	500 v	10%	
C51	283-002	.01 μf	Disc Type	500 v		
C52	283-002	.01 μf	Disc Type	500 v		
C53	283-000	.001 μf	Disc Type	500 v		

Capacitors *(Cont)*

Ckt. No.	Tektronix Part No.	Description					S/N Range
C54	283-000	.001 μf	Disc Type		500 v		
C56	283-000	.001 μf	Disc Type		500 v		
C61	283-002	.01 μf	Disc Type		500 v		
C74	283-001	.005 μf	Disc Type		500 v		
C76	283-001	.005 μf	Disc Type		500 v		
C78	283-000	.001 μf	Disc Type		500 v		
C87	281-510	22 pf	Cer.		500 v		
C103	283-002	.01 μf	Disc Type		500 v		
C105	283-000	.001 μf	Disc Type		500 v		
C109	Use 283-002	.01 μf	Disc Type		500 v		
C116	283-000	.001 μf	Disc Type		500 v		
C120	283-001	.005 μf	Disc Type		500 v		
C123	281-541	6.8 pf	Cer.		500 v	10%	
C129	283-002	.01 μf	Disc Type		500 v		
C134	281-504	10 pf	Cer.		500 v	10%	
C138	283-002	.01 μf	Disc Type		500 v		
C141	281-544	5.6 pf	Cer.		500 v	10%	
C150	281-528	82 pf	Cer.		500 v	10%	
C151	281-543	270 pf	Cer.		500 v	10%	
C154	281-543	270 pf	Cer.		500 v	10%	
C160A	281-005	1.5-7 pf	Cer.	Var.			
C160B	281-007	3-12 pf	Cer.	Var.			
C160C	281-010	4.5-25 pf	Cer.	Var.			
C160D	283-534	82 pf	Mica		500 v	5%	
C160E	281-010	4.5-25 pf	Cer.	Var.			
C160F	283-534	82 pf	Mica		500 v	5%	
C160G	*291-008	.001 μf				±½%	5969-12499
C160H C160J C160K	*291-007	.01 μf .1 μf 1 μf		Timing Series		±½%	5969-12499
C160G † C160H C160J C160K	*295-0102-00	.001 μf .01 μf .1 μf 1 μf	Timing Capacitor Assembly				12500-up
C160L	281-543	270 pf	Cer.		500 v	10%	
C160M	281-513	27 pf	Cer.		500 v		X6310-up
C161	281-500	2.2 pf	Cer.		500 v	±.5 pf	
C163	283-006	.02 μf	Disc Type		600 v		
C165	281-523	100 pf	Cer.		350 v		
C167	283-000	.001 μf	Disc Type		500 v		
C170	283-001	.005 μf	Disc Type		500 v		
C180A	283-509	180 pf	Mica		500 v	10%	
C180B	285-543	.0022 μf	MT		400 v		
C180C	285-515	.022 μf	MT		400 v		
C180D	285-526	.1 μf	MT		400 v		
C180E	285-526	.1 μf	MT		400 v		
C181	281-516	39 pf	Cer.		500 v	10%	
C187	283-001	.005 μf	Disc Type		500 v		
C190	281-508	12 pf	Cer.		500 v	±.6 pf	
C193	283-002	.01 μf	Disc Type		500 v		
C196	283-000	.001 μf	Disc Type		500 v		
C197	283-001	.005 μf	Disc Type		500 v		

†C160 G, H, J, K and C260 D, E, F, G (S/N 12500-up) furnished as a unit.

Capacitors *(Cont)*

Ckt. No.	Tektronix Part No.	Description					S/N Range
C221	281-518	47 pf	Cer.		500 v		
C234	281-504	10 pf	Cer.		500 v	10%	
C241	281-534	3.3 pf	Cer.		500 v	±.25 pf	
C250	281-516	39 pf	Cer.		500 v	10%	
C254	283-002	.01 μf	Disc Type		500 v		
C260A	281-007	3-12 pf	Cer.	Var.			
C260B	283-533	39 pf	Mica		500 v	5%	
C260C	281-012	7-45 pf	Cer.	Var.			
C260D		480 pf					
C260E	*291-026	.005 μf		Timing Series		±½%	5969-12499
C260F		.05 μf					
C260G		.5 μf					
C260D †		480 pf					
C260E	*295-0102-00	.005 μf	Timing Capacitor Assembly				12500-up
C260F		.05 μf					
C260G		.5 μf					
C267	283-000	.001 μf	Disc Type		500 v		
C280A	281-510	22 pf	Cer.		500 v		
C280B	281-525	470 pf	Cer.		500 v		
C280C	285-506	.0047 μf	MT		400 v		
C280D	285-519	.047 μf	MT		400 v		
C280E	285-519	.047 μf	MT		400 v		
C295	281-509	15 pf	Cer.		500 v	10%	
C301C	281-012	7-45 pf	Cer.	Var.			
C301E	281-546	330 pf	Cer.		500 v	10%	
C301H	281-506	12 pf	Cer.		500 v	10%	
C320	283-001	.005 μf	Disc Type		500 v		
C330	281-010	4.5-25 pf	Cer.	Var.			
C331	281-504	10 pf	Cer.		500 v	10%	
C336	283-001	.005 μf	Disc Type		500 v		
C340	281-504	10 pf	Cer.		500 v	10%	
C343	283-001	.005 μf	Disc Type		500 v		
C347	283-000	.001 μf	Disc Type		500 v		
C348	281-007	3-12 pf	Cer.	Var.			
C355	281-526	1.5 pf	Cer.		500 v	±.5 pf	
C356	283-001	.005 μf	Disc Type		500 v		
C364	281-036	3-12 pf	Cer.	Var.			
C372	281-023	9-180 pf	Mica	Var.			
C380	290-000	6.25 μf	EMT		300 v		5969-13649
C380	290-0405-00	10 μf	EMT		150 v		13650-up
C384	281-036	3-12 pf	Cer.	Var.			
C390	281-501	4.7 pf	Cer.		500 v	±1 pf	
C393	285-519	.047 μf	MT		400 v		
C397	283-001	.005 μf	Disc Type		500 v		
C421	283-002	.01 μf	Disc Type		500 v		
C426	283-001	.005 μf	Disc Type		500 v		
C444	281-510	22 pf	Cer.		500 v		
C454	281-518	47 pf	Cer.		500 v		
C457	283-001	.005 μf	Disc Type		500 v		
C601	283-004	.02 μf	Disc Type		150 v		
C610	285-510	.01 μf	MT		400 v		
C617	285-510	.01 μf	MT		400 v		

†C260 D, E, F, G and C160 G, H, J, K (S/N 12500-up) furnished as a unit.

Capacitors *(Cont)*

Ckt. No.	Tektronix Part No.	Description				S/N Range
C628	285-510	.01 μf	MT	400 v		
C640	Use 290-016	125 μf	EMC	350 v		
C648	283-002	.01 μf	Disc Type	500 v		
C649	Use 290-012	2 x 40 μf	EMC	250 v		
C650	285-510	.01 μf	MT	400 v		
C670	Use 290-130	2 x 125 μf	EMC	350 v		
C671	Use 290-173	200 μf	EMC	250 v		
C679A,B,C	Use 290-005	3 x 10 μf	EMC	450 v		
C680	285-510	.01 μf	MT	400 v		
C688	285-510	.01 μf	MT	400 v		
C700	Use 290-017	125 μf	EMC	450 v		
C710	285-511	.01 μf	PTM	600 v		
C730	Use 290-016	125 μf	EMC	350 v		
C740	285-510	.01 μf	MT	400 v		
C760A,B	Use 290-013	2 x 40 μf	EMC	450 v		
C770	283-001	.005 μf	Disc Type	500 v		
C771	283-001	.005 μf	Disc Type	500 v		
C782	283-003	.01 μf	Disc Type	150 v		
C783	290-135	15 μf	EMT	20 v		
C786	290-015	100 μf	EMT	25 v		
C790	Use 290-174	4500 μf	EMC	25 v		
C791	Use 290-174	4500 μf	EMC	25 v		
C792	Use 290-174	4500 μf	EMC	25 v		
C793	Use 283-057	.1 μf	Disc Type	200 v		
C801	285-519	.047 μf	MT	400 v		
C802	Use 290-010	2 x 20 μf	EMC	450 v		
C803	285-501	.001 μf	MT	600 v		
C806	285-510	.01 μf	MT	400 v		
C808	285-501	.001 μf	MT	600 v		
C819	Use 283-057	.1 μf	Disc Type	200 v		
C820	283-011	.01 μf	Disc Type	2000 v		
C821	283-011	.01 μf	Disc Type	2000 v		
C827	283-011	.01 μf	Disc Type	2000 v		
C828	283-011	.01 μf	Disc Type	2000 v		
C829	283-000	.001 μf	Disc Type	500 v		
C831	283-011	.01 μf	Disc Type	2000 v		
C832	283-034	.005 μf	Disc Type	4000 v		
C833	281-556	500 pf	Cer.	10,000 v		
C834	281-556	500 pf	Cer.	10,000 v		
C836	281-556	500 pf	Cer.	10,000 v		
C841	283-006	.02 μf	Disc Type	600 v		
C842	283-011	.01 μf	Disc Type	2000 v		
C845	283-011	.01 μf	Disc Type	2000 v		
C848	283-011	.01 μf	Disc Type	2000 v		
C871	283-518	330 pf	Mica	500 v	10%	
C874	283-518	330 pf	Mica	500 v	10%	
C885	281-513	27 pf	Cer.	500 v		
C897	283-000	.001 μf	Disc Type	500 v		
C1004	290-111	250 μf	EMT	6 v		
C1006	Use 281-036	3-12 pf	Cer.	Var.		

Capacitors *(Cont)*

Ckt. No.	Tektronix Part No.	Description					S/N Range
C1011	281-557	1.8 pf	Cer.		500 v		
C1012	281-557	1.8 pf	Cer.		500 v		
C1013	283-000	.001 μf	Disc Type		500 v		
C1014	281-537	.68 pf	Cer.		500 v	±.136 pf	
C1021	281-557	1.8 pf	Cer.		500 v		
C1022	281-557	1.8 pf	Cer.		500 v		
C1023	283-000	.001 μf	Disc Type		500 v		
C1024	281-537	.68 pf	Cer.		500 v	±.136 pf	
C1031	281-557	1.8 pf	Cer.		500 v		
C1032	281-557	1.8 pf	Cer.		500 v		
C1033	283-000	.001 μf	Disc Type		500 v		
C1034	281-538	1 pf	Cer.		500 v		
C1041	281-027	.7-3 pf	Tub.	Var.			
C1042	281-027	.7-3 pf	Tub.	Var.			
C1043	283-000	.001 μf	Disc Type		500 v		
C1044	281-538	1 pf	Cer.		500 v		
C1051	281-557	1.8 pf	Cer.		500 v		
C1052	281-557	1.8 pf	Cer.		500 v		
C1053	283-000	.001 μf	Disc Type		500 v		
C1054	281-529	1.5 pf	Cer.		500 v	±.25 pf	
C1061	281-557	1.8 pf	Cer.		500 v		
C1062	281-557	1.8 pf	Cer.		500 v		
C1063	283-000	.001 μf	Disc Type		500 v		
C1064	281-529	1.5 pf	Cer.		500 v	±.25 pf	
C1071	281-557	1.8 pf	Cer.		500 v		
C1072	281-557	1.8 pf	Cer.		500 v		
C1074	281-557	1.8 pf	Cer.		500 v		
C1080	283-000	.001 μf	Disc Type		500 v		
C1082	283-000	.001 μf	Disc Type		500 v		
C1084	283-001	.005 μf	Disc Type		500 v		
C1088	283-001	.005 μf	Disc Type		500 v		
C1090	283-000	.001 μf	Disc Type		500 v		
C1092	283-000	.001 μf	Disc Type		500 v		
C1094	283-001	.005 μf	Disc Type		500 v		
C1098	283-001	.005 μf	Disc Type		500 v		
C1101	283-006	.02 μf	Disc Type		600 v		
C1102	290-002	8 μf	EMT		450 v		
C1103	283-006	.02 μf	Disc Type		600 v		
C1105	283 006	.02 μf	Disc Type		600 v		
C1106	285-537	.5 μf	MPT		400 v		
C1107	283 006	.02 μf	Disc Type		600 v		
C1204	283 003	.01 μf	(nominal value)		Selected		
C1205	283 003	.01 μf	(nominal value)		Selected		
C1209	281 011	5-25 pf	Cer.	Var.			
C1210	283-006	.02 μf	Disc Type		600 v		

Capacitors *(Cont)*

Ckt. No.	Tektronix Part No.	Description				S/N Range
C1211	281-557	1.8 pf	Cer.		500 v	
C1212	281-557	1.8 pf	Cer.		500 v	
C1213	283-000	.001 μf	Disc Type		500 v	
C1214	Use 281-053	.35-1.37 pf	Poly.	Var.		
C1221	281-557	1.8 pf	Cer.		500 v	
C1222	281-557	1.8 pf	Cer.		500 v	
C1223	283-000	.001 μf	Disc Type		500 v	
C1224	281-027	.7-3 pf	Tub.	Var.		
C1231	281-557	1.8 pf	Cer.		500 v	
C1232	281-557	1.8 pf	Cer.		500 v	
C1233	283-000	.001 μf	Disc Type		500 v	
C1234	281-027	.7-3 pf	Tub.	Var.		
C1241	281-557	1.8 pf	Cer.		500 v	
C1242	281-557	1.8 pf	Cer.		500 v	
C1243	283-000	.001 μf	Disc Type		500 v	
C1244	281-027	.7-3 pf	Tub.	Var.		
C1251	281-557	1.8 pf	Cer.		500 v	
C1252	281-557	1.8 pf	Cer.		500 v	
C1253	283-000	.001 μf	Disc Type		500 v	5969-13631X
C1254	281-027	.7-3 pf	Tub.	Var.		
C1255	281-557	1.8 pf	Cer.		500 v	
C1258	283-001	.005 μf	Disc Type		500 v	
C1260	281-027	.7-3 pf	Tub.	Var.		
C1261	281-027	.7-3 pf	Tub.	Var.		
C1276	281-060	2-8 pf	Cer.	Var.		

Diodes

Ckt. No.	Tektronix Part No.	Description			S/N Range
D36	*152-138	Point contact with axial lead			5969-14409
D36	*152-0425-00	Silicon Schotkey Barrier			14410-up
D37	*152-138	Point contact with axial lead			5969-14409
D37	*152-0425-00	Silicon Schotkey Barrier			14410-up
D44	152-008	Germanium			
D47	152-140	Tunnel 1N3848 10 MA			5969-13929
D47	152-0140-01	Tunnel 1N3848 10 MA			13930-up
D122	152-008	Germanium			
D134	152-025	Germanium 1N634			
D142	152-008	Germanium			
D152	152-0246-00	Silicon Low Leakage	0.25 w	40 V	X12000-up
D252	152-0246-00	Silicon Low Leakage	0.25 w	40 V	X12000-up
D642A,B,C,D	*152-047	Silicon Replaceable by 1N2862			5969-11999
D642A,B,C,D	152-0066-00	Silicon 1N3194			12000-up
D672A,B,C,D	*152-047	Silicon Replaceable by 1N2862			5969-11999
D672A,B,C,D	152-0066-00	Silicon 1N3194			12000-up
D702A,B	*152-047	Silicon Replaceable by 1N2862			5969-11999
D702A,B	152-0066-00	Silicon 1N3194			12000-up
D732A,B	*152-047	Silicon Replaceable by 1N2862			5969-11999
D732A,B	152-0066-00	Silicon 1N3194			12000-up
D762A,B,C,D	*152-047	Silicon Replaceable by 1N2862			5969-11999
D762A,B,C,D	152-0066-00	Silicon 1N3194			12000-up
D792A,B,C,D	152-113	Silicon RCA 40108			5969-13649
D792A,B,C,D	*152-0274-00	Silicon Replaceable by 1N1200			13650-up
D793	152-008	Germanium			
D1284	*152-075	Germanium Tek Spec			X9000-up

Fuses

Ckt. No.	Tektronix Part No.	Description	S/N Range
F601	159-036	7 AMP 3AG Slo-Blo 117 v oper. (50 & 60 cycle)	
F601	159-027	4 Amp 3AG Slo-Blo 234 v oper. (50 & 60 cycle)	
F790	159-038	15 Amp 3AG Fast-Blo	X6850-up

Fuses *(Cont)*

Ckt. No.	Tektronix Part No.	Description	S/N Range
F1210	159-049	.15 Fast-Blo w/pig tail	
F1260	159-049	.15 Fast-Blo w/pig tail	
F1285	159-049	.15 Fast-Blo w/pig tail	

Relays

Ckt. No.	Tektronix Part No.	Description	S/N Range
K600	148-002	6 v 45 Sec. Delay	5969-9179
K600	148-023	18 v 30 Sec. Delay	9180-up
K601	148-012	18 v DC 150 Ω	

Inductors

Ckt. No.	Tektronix Part No.	Description	S/N Range
L4	*108-220	.15 μh	
L12	*108-220	.15 μh	
L47	*108-057	8.8 μh	
L249	*108-174	245 μh	
L424	*108-015	255 μh	
L865	*108-296	Beam Rotator	X9000-up
L914	Use *108-267	Delay Line	
L1013	276-528	Core, Ferramic Suppressor	
L1014	*108-196	Plate Line, 8 Section	
L1015	*108-197	Grid Line, 7 Section	
L1023	276-528	Core, Ferramic Suppressor	
L1024	*108-196	Plate Line, 8 Section	
L1025	*108-197	Grid Line, 7 Section	
L1033	276-528	Core, Ferramic Suppressor	
L1043	276-528	Core, Ferramic Suppressor	
L1053	276-528	Core, Ferramic Suppressor	
L1063	276-528	Core, Ferramic Suppressor	
LR1083	*108-221	.45 μh (wound on a 1 k resistor)	
LR1093	*108-221	.45 μh (wound on a 1 k resistor)	
L1213	276-0528-00	Core, Ferramic Suppressor	X13632-up
L1214	*108-198	Plate Line, 6 Section	
L1215	*108-199	Grid Line, 5 Section	
L1223	276-0528-00	Core, Ferramic Suppressor	X13632-up
L1224	*108-198	Plate Line, 6 Section	
L1225	*108-199	Grid Line, 5 Section	
L1233	276-0528-00	Core, Ferramic Suppressor	X13632-up
L1243	276-0528-00	Core, Ferramic Suppressor	X13632-up
L1282	*108-181	.2 μh	5969-14539
L1282	*108-0181-01	.2 μh	14540-up
L1283	*108-181	.2 μh	5969-14539
L1283	*108-0181-01	.2 μh	14540-up
L1286	*108-181	.2 μh	5969-14539
L1286	*108-0181-01	.2 μh	14540-up
L1287	*108-181	.2 μh	5969-14539
L1287	*108-0181-01	.2 μh	14540-up

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

Ckt. No.	Tektronix Part No.	Description		S/N Range
R1	302-185	1.8 meg	½ w	
R2	316-101	100 Ω	¼ w	
R3	316-105	1 meg	¼ w	
R4	316-104	100 k	¼ w	
R6	316-104	100 k	¼ w	

Resistors *(Cont)*

Ckt. No.	Tektronix Part No.	Description					S/N Range
R7	316-470	47 Ω	1/4 w				
R8	316-104	100 k	1/4 w				
R12	316-105	1 meg	1/4 w				
R13	301-223	22 k	1/2 w			5%	
R14	316-823	82 k	1/4 w				
R15	316-474	470 k	1/4 w				
R16	302-475	4.7 meg	1/2 w				
R17[1]	311-096	2 x 100 k		Var.		TRIGGERING LEVEL	
R20	316-470	47 Ω	1/4 w				
R21	302-470	47 Ω	1/2 w				
R24	304-822	8.2 k	1 w				
R25	306-822	8.2 k	2 w				
R26	311-353	25 k	3 w	Var.		TRIG. LEVEL CENT.	
R27	316-470	47 Ω	1/4 w				
R28	308-069	12 k	8 w		WW	5%	
R34	Use 306-103	10 k	2 w				
R36	302-471	470 Ω	1/2 w				
R37	303-243	24 k	1 w			5%	
R40	302-470	47 Ω	1/2 w				
R41	302-683	68 k	1/2 w				
R43	302-682	6.8 k	1/2 w				
R44	304-223	22 k	1 w				
R46	308-135	5 k	5 w		WW	5%	
R47	311-238	30 Ω		Var.		TRIG. SENS.	
R48	301-180	18Ω	1/2 w			5%	
R52	316-101	100 Ω	1/4 w				
R53	316-474	470 k	1/4 w				
R54	316-104	100 k	1/4 w				
R55	316-103	10 k	1/4 w				
R59	316-103	10 k	1/4 w				
R62	301-434	430 k	1/2 w			5%	
R63	316-394	390 k	1/4 w				
R64	316-473	47 k	1/4 w				
R65	316-274	270 k	1/4 w				
R67[2]	311-096	2 x 100 k		Var.		TRIGGERING LEVEL	
R72	302-101	100 Ω	1/2 w				
R73	302-101	100 Ω	1/2 w				
R74	302-470	47 Ω	1/2 w				
R75	306-333	33 k	2 w				
R76	302-470	47 Ω	1/2 w				
R78	311-066	500 Ω	.2 w	Var.		TRIG. LEVEL CENT.	
R79	306-333	33 k	2 w				
R83	302-101	100 Ω	1/2 w				
R85	301-182	1.8 k	1/2 w			5%	
R87	302-104	100 k	1/2 w				

[1]R17 concentric with R110 and SW110. Furnished as a unit.

[2]R67 concentric with R210 and SW210. Furnished as a unit.

Resistors *(Cont)*

Ckt. No.	Tektronix Part No.	Description				S/N Range
R88	302-274	270 k	½ w			
R91	302-101	100 Ω	½ w			
R93	302-122	1.2 k	½ w			
R96	306-333	33 k	2 w			
R101	302-226	22 meg	½ w			
R103	302-155	1.5 meg	½ w			
R104	302-470	47 Ω	½ w			
R105	302-394	390 k	½ w			
R106	302-105	1 meg	½ w			
R107	302-101	100 Ω	½ w			
R108	302-102	1 k	½ w			
R109	302-224	220 k	½ w			
R110[3]	311-096	100 k		Var.	STABILITY	
R111	311-219	200 k	.2 w	Var.	PRESET ADJUST	
R114	301-564	560 k	½ w		5%	
R115	301-154	150 k	½ w		5%	
R116	301-224	220 k	½ w		5%	
R119	302-101	100 Ω	½ w			
R120	302-470	47 Ω	½ w			
R122	304-683	68 k	1 w			
R123	302-334	330 k	½ w			
R124	302-334	330 k	½ w			
R125	311-023	50 k		Var.	LOCKOUT LEVEL	
R126	302-104	100 k	½ w			
R127	302-101	100 Ω	½ w			
R128	302-123	12 k	½ w			
R129	302-103	10 k	½ w			
R130	306-223	22 k	2 w			
R133	302-104	100 k	½ w			
R134	*310-555	6 k	3 w	Mica Plate (3 k Tap)		
R137	302-470	47 Ω	½ w			
R138	302-101	100 Ω	½ w			
R141	310-093	45 k	1 w	Prec.	1%	
R143	310-070	33 k	1 w	Prec.	1%	
R144	308-053	8 k	5 w	WW	5%	
R146	302-470	47 Ω	½ w			
R147	302-103	10 k	½ w			
R148	304-183	18 k	1 w			
R149	302-470	47 Ω	½ w			
R150	302-271	270 Ω	½ w			
R151	302-102	1 k	½ w			
R152	302-681	680 Ω	½ w			
R153	306-333	33 k	2 w			
R154	302-102	1 k	½ w			
R155	302-0685-00	6.8 meg	½ w			X12260-up
R160A	309-045	100 k	½ w	Prec.	1%	5969-14479
R160A	323-0385-01	100 k	½ w	Prec.	½%	14480-up
R160B	309-051	200 k	½ w	Prec.	1%	5969-14479
R160B	323-0414-01	200 k	½ w	Prec.	½%	14480-up
R160C	309-003	500 k	½ w	Prec.	1%	5969-14479
R160C	323-0740-01	500 k	½ w	Prec.	½%	14480-up
R160D	309-014	1 meg	½ w	Prec.	1%	5969-14479

[3]Concentric with R17 and ganged with SW110. Furnished as a unit.

Resistors *(Cont)*

Ckt. No.	Tektronix Part No.	Description					S/N Range
R160D	323-0481-01	1 meg	½ w		Prec.	½%	14480-up
R160E	309-023	2 meg	½ w		Prec.	1%	5969-14479
R160E	323-0510-00	2 meg	½ w		Prec.	1%	14480-up
R160F	309-087	5 meg	½ w		Prec.	1%	5969-14479
R160F	325-0056-00	5 meg	½ w		Prec.	1%	14480-up
R160G	310-107	10 meg	1 w		Prec.	1%	5969-14479
R160G	323-0577-00	10 meg	½ w		Prec.	1%	14480-14509
R160G	325-0072-00	10 meg	1 w		Prec.	1%	14510-up
R160H	310-107	10 meg	1 w		Prec.	1%	5969-14479
R160H	323-0577-00	10 meg	½ w		Prec.	1%	14480-14509
R160H	325-0072-00	10 meg	1 w		Prec.	1%	14510-up
R160L	315-0180-00	18 Ω	¼ w			5%	X12230-up
R160T	304-563	56 k	1 w				
R160V	302-105	1 meg	½ w				
R160W	302-104	100 k	½ w				
R160X	302-103	10 k	½ w				
R160Y[4]	311-108	20 k		Var.	WW	VARIABLE	
R160Z	311-066	500 Ω	.2 w	Var.			
R163	302-470	47 Ω	½ w				
R165	308-081	20 k	8 w		WW	5%	
R166	308-108	15 k	5 w		WW	5%	
R167	302-155	1.5 meg	½ w				
R168	302-473	47 k	½ w				
R170	302-470	47 Ω	½ w				
R171	302-470	47 Ω	½ w				
R172	302-470	47 Ω	½ w				
R173	302-471	470 Ω	½ w				
R174	308-053	8 k	5 w		WW	5%	
R176	311-008	2 k		Var.		SWEEP LENGTH	
R178	308-062	3 k	5 w		WW	5%	
R180A	302-474	470 k	½ w				
R180B	302-475	4.7 meg	½ w				
R181	302-475	4.7 meg	½ w				
R183	302-101	100 Ω	½ w				
R186	302-101	100 Ω	½ w				
R187	302-470	47 Ω	½ w				
R189	306-563	56 k	2 w				
R190	302-473	47 k	½ w				
R191	302-104	100 k	½ w				
R192	302-101	100 Ω	½ w				
R193	302-101	100 Ω	½ w				
R194	304-472	4.7 k	1 w				
R196	302-104	100 k	½ w				
R197	302-470	47 Ω	½ w				
R199	304-104	100 k	1 w				
R210[5]	311-096	100 k		Var.		STABILITY	
R211	311-110	100 k		Var.		PRESET ADJUST	
R214	302-104	100 k	½ w				
R215	301-273	27 k	½ w			5%	
R216	302-393	39 k	½ w				

[4]Concentric with SW160, and SW160Y.

[5]Concentric with R67 and ganged SW210. Furnished as a unit.

Resistors *(Cont)*

Ckt. No.	Tektronix Part No.		Description				S/N Range
R221	302-101	100 Ω	½ w				
R230	304-223	22 k	1 w				
R232	302-101	100 Ω	½ w				
R233	309-132	5.6 k	½ w		Prec.	1%	
R234	309-159	5 k	½ w		Prec.	1%	5969-14729
R234	322-0677-00	5 k	¼ w		Prec.	1%	14730-up
R235	302-274	270 k	½ w				
R237	302-101	100 Ω	½ w				
R241	310-070	33 k	1 w		Prec.	1%	
R243	310-072	30 k	1 w		Prec.	1%	
R244	308-108	15 k	5 w		WW	5%	
R246	302-101	100 Ω	½ w				
R247	302-222	2.2 k	½ w				
R248	302-473	47 k	½ w				
R250	302-272	2.7 k	½ w				
R254	302-102	1 k	½ w				
R255	316-0106-00	10 meg	¼ w				X12260-up
R260A	*312-567	404 k	½ w		Prec.	¼%	5969-14479
R260A	323-0776-03	404 k	½ w		Prec.	¼%	14480-up
R260B	*312-568	606 k	½ w		Prec.	¼%	5969-14479
R260B	323-0777-03	606 k	½ w		Prec.	¼%	14480-up
R260C	*312-571	1.01 meg	½ w		Prec.	¼%	5969-14479
R260C	323-1481-03	1.01 meg	½ w		Prec.	¼%	14480-up
R260D	*312-575	4.04 meg	½ w		Prec.	¼%	5969-14479
R260D	*312-0658-00	4.04 meg	½ w		Prec.	¼%	14480-up
R260E	*312-576	6.06 meg	½ w		Prec.	¼%	5969-14479
R260E	*312-0659-00	6.06 meg	½ w		Prec.	¼%	14480-up
R260F	*312-577	10.1 meg	½ w		Prec.	¼%	5969-14479
R260F	*312-0660-00	10.1 meg	½ w		Prec.	¼%	14480-up
R264	306-224	220 k	2 w				
R267	302-155	1.5 meg	½ w				
R268	302-104	100 k	½ w				
R271	302-101	100 Ω	½ w				
R274	306-153	15 k	2 w				
R276	311-016	10 k		Var.		LENGTH	
R277[6]	Selected						
R278[6]	Selected						
R279	306-123	12 k	2 w				
R280	302-125	1.2 meg	½ w				
R281	302-475	4.7 meg	½ w				
R282	302-102	1 k	½ w				
R283	302-102	1 k	½ w				
R291	302-101	100 Ω	½ w				
R293	306-823	82 k	2 w				
R295	302-393	39 k	½ w				
R296	302-104	100 k	½ w				
R297	302-101	100 Ω	½ w				
R299	302-103	10 k	½ w				
R300	302-470	47 Ω	½ w				
R301C	309-111	900 k	½ w		Prec.	1%	
R301E	309-046	111 k	½ w		Prec.	1%	

[6]Selected to provide correct sweep length.

Resistors *(Cont)*

Ckt. No.	Tektronix Part No.	Description					S/N Range
R303	302-105	1 meg	½ w				
R311	302-102	1 k	½ w				
R313	306-333	33 k	2 w				
R314	Use 311-571	15 k		Var.		VARIABLE 10-1	
R315	306-333	33 k	2 w				
R317	311-026	100 k		Var.		EXT. HORIZ. DC BAL.	
R319	302-224	220 k	½ w				
R320	302-332	3.3 k	½ w				
R321	302-101	100 Ω	½ w				
R324	306-273	27 k	2 w				
R330	309-017	1.5 meg	½ w		Prec.	1%	
R332	309-086	3.5 meg	½ w		Prec.	1%	
R333[T]	311-149	100 k		Var.		HORIZONTAL POSITION	
R336	309-268	12.1 meg	½ w		Prec.	1%	5969-12189
R336	310-0069-00	13 meg	1 w		Prec.	2%	12190-14239
R336	301-0625-00	6.2 meg	½ w			5%	14240-up
R337	301-0685-00	6.8 meg	½ w			5%	X14240-up
R338[T]	311-0149-00	200 k		Var.		VERNIER	
R340	302-272	2.7 k	½ w				
R341	302-101	100 Ω	½ w				
R343	302-470	47 Ω	½ w				
R345	306-473	47 k	2 w				
R347	302-104	100 k	½ w				
R348	311-125	50 k	.2 w	Var.		SWP. CAL.	
R349	309-151	174 k	½ w		Prec.	1%	5969-9299
R349	323-414	200 k	½ w		Prec.	1%	9300-up
R351	302-101	100 Ω	½ w				
R353	306-473	47 k	2 w				
R355	310-094	400 k	1 w		Prec.	1%	
R356	310-094	400 k	1 w		Prec.	1%	
R357	302-223	22 k	½ w				
R358	311-018	20 k		Var.		NORM. MAG. REGIS.	
R361	302-470	47 Ω	½ w				
R364	*310-558	15 k	7 w	Mica Plate (3 k Tap)			
R366	302-470	47 Ω	½ w				
R372	311-120	2.5 k	.2 w	Var.		MAG. GAIN	5969-9299
R372	311-323	1.5 k		Var.	WW	MAG GAIN	9300-up
R373	323-633	801 Ω	½ w		Prec.	1%	X9300-up
R374	308-053	8 k	5 w		WW	5%	5969-9299
R374	308-302	20 k	5 w		WW	1%	9300-up
R375	308-053	8 k	5 w		WW	5%	
R376	308-077	1 k	3 w		WW	20%	X9300-up
R380	302-101	100 Ω	½ w				
R381	302-470	47 Ω	½ w				
R384	*310-558	15 k	7 w	Mica Plate (3 k Tap)			5969-9299
R384	*310-600	18 k/4.5 k	8 w		Prec.	1%	9300-up
R386	302-470	47 Ω	½ w				
R387	306-393	39 k	2 w				
R388	306-393	39 k	2 w				
R390	302-222	2.2 k	½ w				
R391	302-470	47 Ω	½ w				
R393	Use 302-271	270 Ω	½ w				

[T]R333 and R338 are concentric. Furnished as a unit.

Ⓟ

Resistors *(Cont)*

Ckt. No.	Tektronix Part No.	Description						S/N Range
R396	302-474	470 k	½ w					
R397	302-155	1.5 meg	½ w					
R398	302-155	1.5 meg	½ w					
R399	302-474	470 k	½ w					
R410	302-105	1 meg	½ w					
R411	302-101	100 Ω	½ w					
R415	302-473	47 k	½ w					
R416	302-123	12 k	½ w					
R421	302-101	100 Ω	½ w					
R424	302-103	10 k	½ w					
R425	302-104	100 k	½ w					
R426	302-473	47 k	½ w					
R427	302-101	100 Ω	½ w					
R428	302-103	10 k	½ w					
R431	308-054	10 k	5 w		WW	5%		
R432	311-015	10 k		Var.	WW	DELAY STOP		
R433	311-022	30 k		Var.		DELAY TIME MULTIPLIER 1-10		
R434	302-104	100 k	½ w					
R436	311-141	2 k		Var.	WW	DELAY START		
R437	308-108	15 k	5 w		WW	5%		
R441	302-101	100 Ω	½ w					
R443	302-272	2.7 k	½ w					
R444	309-044	95 k	½ w		Prec.	1%		
R446	309-049	150 k	½ w		Prec.	1%		
R447	306-393	39 k	2 w					
R451	302-101	100 Ω	½ w					
R453	302-332	3.3 k	½ w					
R454	302-103	10 k	½ w					
R455	302-274	270 k	½ w					
R456	302-101	100 Ω	½ w					
R457	302-470	47 Ω	½ w					
R458	302-102	1 k	½ w					
R600	306-330	33 Ω	2 w					5969-9179X
R601	308-142	30 Ω	3 w		WW	5%		5969-8999X
R602	311-055	50 Ω		Var.	WW	SCALE ILLUM.		5969-8999
	311-377	25 Ω		Var.	WW	SCALE ILLUM.		9000-up
R608	302-333	33 k	½ w					
R610	302-104	100 k	½ w					
R615	310-054	68 k	1 w		Prec.	1%		
R616	311-015	10 k		Var.	WW	—150 V		
R617	310-086	50 k	1 w		Prec.	1%		
R618	302-104	100 k	½ w					
R621	302-102	1 k	½ w					
R623	302-474	470 k	½ w					
R625	302-104	100 k	½ w					
R628	302-275	2.7 meg	½ w					

Resistors *(Cont)*

Ckt. No.	Tektronix Part No.	Description				S/N Range
R629	302-275	2.7 meg	½ w			
R633	302-105	1 meg	½ w			
R635	304-153	15 k	1 w			
R636	304-153	15 k	1 w			
R637	302-154	150 k	½ w			
R638	302-273	27 k	½ w			
R639	302-683	68 k	½ w			
R640	304-100	10 Ω	1 w			
R641	304-100	10 Ω	1 w			
R642	Use 306-563	56 k	2 w			
R643	302-102	1 k	½ w			
R644	302-102	1 k	½ w			
R646	308-053	8 k	5 w	WW	5%	5969-9299X
R647	308-037	1 k	25 w	WW	5%	5969-9299
R647	308-155	800 Ω	25 w	WW		9300-up
R648	302-100	10 Ω	½ w			
R650	310-056	333 k	1 w	Prec.	1%	
R651	310-057	490 k	1 w	Prec.	1%	
R663	302-155	1.5 meg	½ w			
R667	302-684	680 k	½ w			
R668	302-473	47 k	½ w			
R669	302-393	39 k	½ w			
R670	306-100	10 Ω	2 w			
R676	308-065	2 k	25 w	WW	5%	
R677	308-029	400 Ω	20 w	WW	5%	
R678	308-029	400 Ω	20 w	WW	5%	
R680	310-056	333 k	1 w	Prec.	1%	
R681	310-055	220 k	1 w	Prec.	1%	
R682	302-124	120 k	½ w			
R683	302-102	1 k	½ w			
R685	304-823	82 k	1 w			
R686	302-184	180 k	½ w			
R688	302-155	1.5 meg	½ w			
R689	302-225	2.2 meg	½ w			
R692	302-102	1 k	½ w			
R693	302-155	1.5 meg	½ w			
R697	302-105	1 meg	½ w			
R698	302-274	270 k	½ w			
R699	302-563	56 k	½ w			
R700	306-100	10 Ω	2 w			
R702	306-104	100 k	2 w			
R710	310-124	237 k	1 w	Prec.	1%	
R711	Use 323-385	100 k	½ w	Prec.	1%	
R712	302-154	150 k	½ w			
R723	302-155	1.5 meg	½ w			
R727	302-105	1 meg	½ w			

Resistors *(Cont)*

Ckt. No.	Tektronix Part No.	Description					S/N Range
R728	302-564	560 k	½ w				
R729	302-473	47 k	½ w				
R730	304-100	10 Ω	1 w				
R731	304-100	10 Ω	1 w				
R732	304-104	100 k	1 w				
R734	302-102	1 k	½ w				
R736	308-065	2 k	25 w		WW	5%	
R737	308-041	2.4 k	25 w		WW	5%	
R740	310-055	220 k	1 w		Prec.	1%	
R741	310-059	720 k	1 w		Prec.	1%	
R753	302-105	1 meg	½ w				
R757	302-154	150 k	½ w				
R758	302-124	120 k	½ w				
R759	302-273	27 k	½ w				
R760	302-100	10 Ω	½ w				
R767	308-113	3 k	8 w		WW	5%	
R770	302-104	100 k	½ w				
R772	302-104	100 k	½ w				
R773	302-104	100 k	½ w				
R780	303-303	30 k	1 w			5%	
R781A	309-154	30 k	½ w		Prec.	1%	
R781B	309-154	30 k	½ w		Prec.	1%	
R782	309-181	2.5 k	½ w		Prec.	1%	
R783	301-163	16 k	½ w			5%	5969-13419
R783	301-0512-00	5.1 k	½ w			5%	13420-up
R784	304-104	100 k	1 w				
R785	311-017	10 k	.1 w	Var.		+12.6 V	5969-13419
R785	311-0497-00	50 k		Var.			13420-up
R786	304-271	270 Ω	1 w				5969-8999
R786	304-102	1 k	1 w				9000-up
R791A	308-123	20 Ω	5 w		WW	5%	
R791B	308-175	10 Ω	10 w		WW	5%	
R791C	308-175	10 Ω	10 w		WW	5%	
R791D	308-123	20 Ω	5 w		WW	5%	
R793	308-054	10 k	5 w		WW	5%	
R794	302-330	33 Ω	½ w				
R801	302-102	1 k	½ w				
R802	306-391	390 Ω	2 w				
R803	306-563	56 k	2 w				
R806	302-104	100 k	½ w				
R807	302-102	1 k	½ w				
R814	302-474	470 k	½ w				
R818	302-185	1.8 meg	½ w				
R819	302-185	1.8 meg	½ w				
R820	302-473	47 k	½ w				
R824	302-475	4.7 meg	½ w				
R825	302-475	4.7 meg	½ w				
R826	311-041	1 meg		Var.		INTENSITY	5969-13479
R826	311-0041-02	1 meg		Var.		INTENSITY	13480-up

Resistors *(Cont)*

Ckt. No.	Tektronix Part No.	Description					S/N Range
R827	302-333	33 k	½ w				
R828	302-105	1 meg	½ w				
R829	302-183	18 k	½ w				
R836	302-105	1 meg	½ w				
R840	311-042	2 meg		Var.		H.V.	
R841	302-225	2.2 meg	½ w				
R842	302-475	4.7 meg	½ w				
R843	302-475	4.7 meg	½ w				
R844	302-475	4.7 meg	½ w				
R845	302-103	10 k	½ w				
R847	302-273	27 k	½ w				
R848	302-105	1 meg	½ w				
R853	302-225	2.2 meg	½ w				
R854	302-225	2.2 meg	½ w				
R856	311-043	2 meg		Var.		FOCUS	5969-13479
R856	311-0043-02	2 meg		Var.		FOCUS	13480-up
R857	302-105	1 meg	½ w				
R860	311-088	100 k	.2 w	Var.		VERT. SHIELD VOLTS	
R861	311-026	100 k		Var.		GEOM.	
R862	302-473	47 k	½ w				
R863	302-473	47 k	½ w				
R864	311-023	50 k		Var.		ASTIGMATISM	5969-8999
R864 }	Use 311-507	100 k		Var.		ASTIGMATISM	9000-up
R865 }		2 x 500 Ω				TRACE ROTATION	
R866	301-0563-00	56 k	½ w			5%	X12500-up
R870	302-154	150 k	½ w				
R871	302-275	2.7 meg	½ w				
R872	302-102	1 k	½ w				
R874	302-395	3.9 meg	½ w				
R875	302-683	68 k	½ w				
R876	302-102	1 k	½ w				
R878	304-333	33 k	1 w				
R879	311-016	10 k		Var.		CAL.	
R880	302-104	100 k	½ w				
R883	302-101	100 Ω	½ w				
R885	309-121	9.5 k	½ w		Prec.	1%	
R886	309-119	6.375 k	½ w		Prec.	1%	
R887	309-117	2.1 k	½ w		Prec.	1%	
R888	309-116	1.025 k	½ w		Prec.	1%	
R889	309-113	610 Ω	½ w		Prec.	1%	
R890	309-073	200 Ω	½ w		Prec.	1%	
R891	309-112	100 Ω	½ w		Prec.	1%	
R892	309-067	60 Ω	½ w		Prec.	1%	
R893	309-066	40 Ω	½ w		Prec.	1%	
R896	309-045	100 k	½ w		Prec.	1%	
R897	309-112	100 Ω	½ w		Prec.	1%	
R898	302-101	100 Ω	½ w				
R899	*308-090	¼ Ω	1 w		WW		
R1004	319-060	1.25 k	¼ w		Prec.	1%	
R1005	319-060	1.25 k	¼ w		Prec.	1%	

Resistors *(Cont)*

Ckt. No.	Tektronix Part No.	Description					S/N Range
R1007	302-150	15 Ω	½ w				
R1008	309-128	50 Ω	½ w		Prec.	1%	5969-13779
R1008	322-0618-00	50 Ω	¼ w		Prec.	1%	13780-up
R1009	309-128	50 Ω	½ w		Prec.	1%	5969-13779
R1009	322-0618-00	50 Ω	¼ w		Prec.	1%	13780-up
R1011	309-067	60 Ω	½ w		Prec.	1%	
R1012	309-067	60 Ω	½ w		Prec.	1%	
R1013	308-062	3 k	5 w		WW	5%	
R1014		Selected					X10870-up
R1015	311-005	500 Ω		Var.		VERT. GAIN	
R1017	316-151	150 Ω	¼ w				
R1023	308-062	3 k	5 w		WW	5%	
R1027	316-151	150 Ω	¼ w				
R1033	308-062	3 k	5 w		WW	5%	
R1037	316-151	150 Ω	¼ w				
R1043	308-062	3 k	5 w		WW	5%	
R1047	316-151	150 Ω	¼ w				
R1053	308-062	3 k	5 w		WW	5%	
R1057	316-151	150 Ω	¼ w				
R1063	308-062	3 k	5 w		WW	5%	
R1066	302-101	100 Ω	½ w				
R1067	316-151	150 Ω	¼ w				
R1073	308-062	3 k	5 w		WW	5%	
R1076	302-101	100 Ω	½ w				
R1077	316-151	150 Ω	¼ w				
R1079	306-822	8.2 k	2 w				
R1080	302-153	15 k	½ w				
R1081	*310-533	1.8 k	2 w	Mica Plate		1%	
R1082	302-101	100 Ω	½ w				
R1084	304-472	4.7 k	1 w				
R1085	306-123	12 k	2 w				
R1086	302-102	1 k	½ w				
R1087	302-224	220 k	½ w				
R1088A	302-105	1 meg	½ w				
R1088B	316-333	33 k	¼ w				
R1089	302-474	470 k	½ w				
R1090	302-473	47 k	½ w				
R1091	*310-533	1.8 k	2 w		Prec.	1%	
R1092	302-101	100 Ω	½ w				
R1094	304-472	4.7 k	1 w				
R1095	306-123	12 k	2 w				
R1096	302-102	1 k	½ w				
R1097	302-224	220 k	½ w				
R1098A	302-105	1 meg	½ w				
R1098B	316-333	33 k	¼ w				
R1101	302-100	10 Ω	½ w				
R1103	302-100	10 Ω	½ w				
R1105	302-100	10 Ω	½ w				
R1107	302-100	10 Ω	½ w				
R1202	302-101	100 Ω	½ w				
R1203	302-101	100 Ω	½ w				
R1204	309-060	4 Ω	(nominal value)		Selected		5969-13429
R1204	309-0127-00	5 Ω	(nominal value)		Selected		13430-up

Resistors *(Cont)*

Ckt. No.	Tektronix Part No.	Description					S/N Range
R1205	309-060	4 Ω	(nominal value)		Selected		5969-13429
R1205	309-0127-00	5 Ω	(nominal value)		Selected		13430-up
R1207	309-360	170 Ω	½ w		Prec.	1%	
R1208	309-067	60 Ω	½ w		Prec.	1%	
R1209	309-067	60 Ω	½ w		Prec.	1%	
R1210	308-096	500 Ω	20 w		WW	5%	
R1212	309-128	50 Ω	½ w		Prec.	1%	5969-13779
R1212	322-0618-00	50 Ω	¼ w		Prec.	1%	13780-up
R1213	308-051	4 k	5 w		WW	5%	
R1214	309-128	50 Ω	½ w		Prec.	1%	5969-13779
R1214	322-0618-00	50 Ω	¼ w		Prec.	1%	13780-up
R1215	317-0047-00	4.7 Ω	⅛ w			5%	X13632-up
R1217	316-151	150 Ω	¼ w				
R1223	308-051	4 k	5 w		WW	5%	
R1225	317-0047-00	4.7 Ω	⅛ w			5%	X13632-up
R1227	316-151	150 Ω	¼ w				
R1233	308-051	4 k	5 w		WW	5%	
R1235	317-0047-00	4.7 Ω	⅛ w			5%	X13632-up
R1237	316-151	150 Ω	¼ w				
R1243	308-051	4 k	5 w		WW	5%	
R1245	317-0047-00	4.7 Ω	⅛ w			5%	X13632-up
R1247	316-151	150 Ω	¼ w				
R1253	308-051	4 k	5 w		WW	5%	
R1255	317-0047-00	4.7 Ω	⅛ w			5%	X13632-up
R1256	309-266	93.1 Ω	½ w		Prec.	1%	
R1257	316-151	150 Ω	¼ w				
R1258	302-100	10 Ω	½ w				
R1259	309-266	93.1 Ω	½ w		Prec.	1%	
R1271	302-181	180 Ω	½ w				
R1274	316-473	47 k	¼ w				
R1276	309-069	70 Ω	½ w		Prec.	1%	5969-14359
R1276	323-0082-00	69.8 Ω	½ w		Prec.	1%	14360-up
R1278	309-069	70 Ω	½ w		Prec.	1%	5969-14359
R1278	323-0082-00	69.8 Ω	½ w		Prec.	1%	14360-up
R1280	316-473	47 k	¼ w				
R1281	302-181	180 Ω	½ w				
R1282	308-072	1 k	5 w		WW	1%	
R1283	301-822	8.2 k	½ w			5%	
R1285	306-471	470 Ω	2 w				
R1286	309-175	156 Ω	½ w		Prec.	1%	
R1287	309-175	156 Ω	½ w		Prec.	1%	
R1288	309-175	156 Ω	½ w		Prec.	1%	
R1289	309-175	156 Ω	½ w		Prec.	1%	
R1290	309-072	180 Ω	½ w		Prec.		5969-10459
R1290	323-0108-00	130 Ω	½ w		Prec.	1%	10460-up
R1291	309-072	180 Ω	½ w		Prec.		5969-10459
R1291	323-0108-00	130 Ω	½ w		Prec.	1%	10460-up
R1292	301-471	470 Ω	½ w			5%	
R1293	311-074	5 k	.1 w	Var.			
R1294	311-0433-00	100 Ω		Var.	VERT AMP CENTERING		X10460-up

Switches

Ckt. No.	Tektronix Part No. Unwired	Wired	Description		S/N Range
SW10	260-554	*262-570	Rotary	TRIGGERING SOURCE A	
SW20	260-212		Slide	TRIGGER SLOPE A	5969-10619
SW20	260-0447-00		Slide	TRIGGER SLOPE A	10620-up
SW60	260-555	*262-571	Rotary	TRIGGERING SOURCE B	
SW70	260-212		Slide	TRIGGER SLOPE B	5969-10619
SW70	260-0447-00			TRIGGER SLOPE B	10620-up
SW101	260-017		Push-Button	RESET	
SW110[8]	311-096			PRESET	
SW160[9]	260-268	Use *262-588	Rotary	TIME/CM A	5969-12229
SW160[9]	260-0268-01	*262-0588-02	Rotary	TIME/CM A	12230-12499
SW160[9]	260-0268-01	*262-0588-01	Rotary	TIME/CM A	12500-14479
SW160[9]	260-0268-01	*262-0588-03	Rotary	TIME/CM A	14480-up
SW160Y	311-108				
SW210[10]	311-096			PRESET	
SW260	260-260	*262-208	Rotary	TIME/CM B	5969-12499
SW260	260-0260-00	*262-0208-01	Rotary	TIME/CM B	12500-14479
SW260	260-0260-00	*262-0208-02	Rotary	TIME/CM B	14480-up
SW301	Use 260-502	Use *262-533	Rotary	HORIZ. DISPLAY FRONT	
SW347A SW347B	Use *050-078	*050-080	Rotary	HORIZ. DISPLAY REAR 5X MAGNIFIER	5969-6169
	260-503	*262-532	Rotary	HORIZ. DISPLAY REAR 5X MAGNIFIER	6170-9299
SW347A SW347B	260-503	*262-691	Rotary	HORIZ. DISPLAY REAR 5X MAGNIFIER	9300-up
SW601	260-134		Toggle	POWER ON	
SW870	260-253	*262-207	Rotary	AMPLITUDE CALIBRATOR	

Thermal Cutout

TK601	260-246	Thermal Cutout, 123°F ±5°

Transformers

T44	*120-198	Toroid, 4T TD29
T601	*120-141	Power
T801	*120-036	CRT Supply
T1014	*120-132	Toroid, on form 276-512
T1046	*120-148	Toroid, on form 276-507
T1214	*120-132	Toroid, on form 276-512
T1284	*120-132	Toroid, on form 276-512

Transistors

Q44	151-076	2N2048
Q774	Use 151-040	2N1302
Q793	Use 151-137	2N2148
Q797	151-002	2N277

[8]Concentric with R17 and ganged with R110. Furnished as a unit.

[9]Concentric with R160Y and SW160Y.

[10]Concentric with R67 and ganged with R210. Furnished as a unit.

Electron Tubes

Ckt. No.	Tektronix Part No.		Description	S/N Range
V24	154-212	6EW6		
V34	154-212	6EW6		
V74	154-187	6DJ8		
V95	154-187	6DJ8		
V114	154-022	6AU6		
V125	154-022	6AU6		
V133	154-187	6DJ8		
V135	154-187	6DJ8		
V145	154-187	6DJ8		
V152	Use *157-0104-02	6AL5	selected	5969-11999
V152	154-0016-00	6AL5		12000-up
V161	154-031	6CL6		
V173	154-187	6DJ8		
V183	154-187	6DJ8		
V193	154-187	6DJ8		
V233	154-187	6DJ8		
V235	154-187	6DJ8		
V245	154-022	6AU6		
V252	*157-075	12AL5	checked	5969-6849
V252	154-038	12AL5		6850-up
V261	Use 154-0040-05	8426		
V283	154-187	6DJ8		
V293	154-187	6DJ8		
V314	154-187	6DJ8		
V343	154-187	6DJ8		
V364	154-187	6DJ8		
V384	154-187	6DJ8		
V398	154-031	6CL6		
V414	154-022	6AU6		
V424	154-022	6AU6		
V428	154-187	6DJ8		
V445	154-187	6DJ8		
V609	154-052	5651		
V624	154-043	12AX7		
V627	154-044	12B4		
V634	154-022	6AU6		
V637	154-044	12B4		
V647	154-044	12B4		
V664	154-022	6AU6		
V677	154-056	6080		
V684	154-043	12AX7		
V694	154-022	6AU6		
V724	154-022	6AU6		
V737	154-056	6080		
V754	154-022	6AU6		
V767	154-044	12B4		
V800	154-021	6AU5		

Electron Tubes *(Cont)*

Ckt. No.	Tektronix Part No.	Description	S/N Range
V814	154-041	12AU7	
V822	154-051	5642	
V832	154-051	5642	
V842	154-051	5642	
V852	154-051	5642	
V859	*154-354	CRT T5810-31 Standard Phosphor	5969-8999
V859[11]	Use 154-0479-00	CRT T5810-31-1 Standard Phosphor	9000-10204
V859	*154-0479-00	CRT T5810-31-1 Standard Phosphor	10205-up
V862	154-051	5642	
V875	154-022	6AU6	
V885	154-041	12AU7	
V1014	154-187	6DJ8	
V1024	154-187	6DJ8	
V1034	154-187	6DJ8	
V1044	154-187	6DJ8	
V1054	154-187	6DJ8	
V1064	154-187	6DJ8	
V1074	154-187	6DJ8	
V1083	154-187	6DJ8	
V1084	154-207	6CY5	
V1093	154-187	6DJ8	
V1094	154-207	6CY5	
V1214	154-187	6DJ8	
V1224	154-187	6DJ8	
V1234	154-187	6DJ8	
V1244	154-187	6DJ8	
V1254	154-187	6DJ8	
V1274	154-420	7788	
V1284	154-420	7788	

[11]S/N 9000-10204 add *050-0246-00 kit.

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations which appear either on the back of the diagrams or on pullout pages immediately following the diagrams of the instruction manual.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the Description column.

Assembly and/or Component
  Detail Part of Assembly and/or Component
  mounting hardware for Detail Part
    Parts of Detail Part
    mounting hardware for Parts of Detail Part
mounting hardware for Assembly and/or Component

Mounting hardware always appears in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation.

Mounting hardware must be purchased separately, unless otherwise specified.

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial or model number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

ABBREVIATIONS AND SYMBOLS

For an explanation of the abbreviations and symbols used in this section, please refer to the page immediately preceding the Electrical Parts List in this instruction manual.

INDEX OF MECHANICAL PARTS LIST ILLUSTRATIONS

(Located behind diagrams)

FIG. 1	FRONT
FIG. 2	REAR
FIG. 3	PLUG-IN HOUSING & VERTICAL AMPLIFIER
FIG. 4	SWEEP & POWER
FIG. 5	RECTIFIER
FIG. 6	FOCUS & INTENSITY
FIG. 7	CRT SHIELD & VERTICAL OUTPUT BRACKET
FIG. 8	DELAY SWEEP
FIG. 9	CABLE HARNESS & CERAMIC STRIPS
FIG. 10	CABINET & RAILS
FIG. 11	ACCESSORIES

SECTION 8
MECHANICAL PARTS LIST

FIG. 1 FRONT

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
1-1	366-0039-00			1	KNOB, red—STABILITY
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
-2	366-0046-00	5969	10619	1	KNOB, black—TRIGGERING LEVEL
	366-0159-00	10620		1	KNOB, charcoal—TRIGGERING LEVEL
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
-3	- - - - - -			3	RESISTOR, variable
	- - - - - -			-	mounting hardware for each: (not included w/resistor)
-4	210-0013-00			1	LOCKWASHER, internal, 3/8 ID x 11/16 inch OD
-5	210-0413-00			1	NUT, hex., 3/8-32 x 1/2 inch
-6	366-0042-00	5969	10619	1	KNOB, black—TRIGGERING SOURCE
	366-0117-00	10620		1	KNOB, charcoal—TRIGGERING SOURCE
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
-7	262-0570-00			1	SWITCH, wired—TRIGGERING SOURCE
	- - - - - -			-	switch includes:
	260-0554-00			1	SWITCH, unwired—TRIGGERING SOURCE
	- - - - - -			-	mounting hardware: (not included w/switch)
-8	210-0013-00			1	LOCKWASHER, internal, 3/8 ID x 11/16 inch OD
-9	210-0413-00			1	NUT, hex., 3/8-32 x 1/2 inch
	262-0588-02	12230	12499	1	SWITCH, wired—TIME/CM
-10	366-0038-00			1	KNOB, red—VARIABLE
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
-11	366-0058-00	5969	10619	1	KNOB, black—TIME/CM
	366-0144-00	10620		1	KNOB, charcoal—TIME/CM
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
-12	262-0226-00	5969	6309	1	SWITCH, wired—TIME/CM
	262-0588-00	6310	12229	1	SWITCH, wired—TIME/CM
	262-0588-02	12230	14479	1	SWITCH, wired—TIME/CM
	262-0588-03	14480		1	SWITCH, wired—TIME/CM
	- - - - - -			-	switch includes:
	260-0268-00	5969	12229	1	SWITCH, unwired—TIME/CM
	260-0268-01	12230		1	SWITCH, unwired—TIME/CM
-13	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
-14	210-0413-00			2	NUT, hex., 3/8-32 x 1/2 inch
-15	210-0012-00			1	LOCKWASHER, internal, 3/8 ID x 1/2 inch OD
-16	406-0449-00			1	BRACKET, switch mounting
	- - - - - -			-	mounting hardware: (not included w/bracket)
-17	210-0017-00			1	LOCKWASHER, spring, #5
-18	210-0449-00			2	NUT, hex., 5-40 x 1/4 inch
-19	210-0202-00			1	LUG, solder, SE #6
-20	376-0014-00			1	COUPLING, wire
	361-0233-00	X14460		1	RESTRAINT, coupling
	361-0234-00	X14460		1	RESTRAINT, coupling

FIG. 1 FRONT *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
1-21	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
-22	210-0046-00			1	LOCKWASHER, internal, 1/4 ID x 0.400 inch OD
-23	210-0583-00			1	NUT, hex., 1/4-32 x 5/16 inch
-24	384-0162-00			1	ROD, extension
	- - - - - -			-	mounting hardware: (not included w/switch)
-25	210-0012-00			1	LOCKWASHER, internal, 3/8 ID x 1/2 inch OD
-26	210-0413-00			1	NUT, hex., 3/8-32 x 1/2 inch
-27	210-0407-00			2	NUT, hex., 6-32 x 1/4 inch
	210-0457-00			2	NUT, keps, 6-32 x 5/16 inch (not shown)
-28	210-0803-00			4	WASHER, flat, 0.150 ID x 3/8 inch OD
-29	366-0033-00	5969	6389	1	KNOB, black—FOCUS
	366-0224-00	6390	10619	1	KNOB, black—FOCUS
	366-0220-00	10620		1	KNOB, charcoal—FOCUS
	- - - - - -			-	knob includes:
	213-0004-00	5969	6389	1	SCREW, set, 6-32 x 3/16 inch, HSS
	213-0020-00	6390		1	SCREW, set, 6-32 x 1/8 inch, HSS
-30	- - - - - -			3	RESISTOR, variable
	- - - - - -			-	mounting hardware for each: (not included w/resistor)
-31	210-0013-00	5969		1	LOCKWASHER, internal, 3/8 ID x 11/16 inch OD
-32	210-0840-00	5969		1	WASHER, flat, 0.390 ID x 9/16 inch OD
-33	210-0413-00	5969	6389	1	NUT, hex., 3/8-32 x 1/2 inch
	210-0590-00	6390		1	NUT, hex., 3/8-32 x 7/16 inch
-34	366-0033-00	5969	6389	1	KNOB, black—INTENSITY
	366-0224-00	6390	10619	1	KNOB, black—INTENSITY
	366-0220-00	10620		1	KNOB, charcoal—INTENSITY
	- - - - - -			-	knob includes:
	213-0004-00	5969	6389	1	SCREW, set, 6-32 x 3/16 inch, HSS
	213-0020-00	6390		1	SCREW, set, 6-32 x 1/8 inch, HSS
-35	366-0033-00	5969	6389	1	KNOB, black—ASTIGMATISM
	366-0224-00	6390	8999	1	KNOB, black—ASTIGMATISM
	366-0277-00	9000	10619	1	KNOB, black—ASTIGMATISM
	366-0254-00	10620		1	KNOB, charcoal—ASTIGMATISM
	- - - - - -			-	knob includes:
	213-0004-00	5969	6389	1	SCREW, set, 6-32 x 3/16 inch, HSS
	213-0020-00	6390		1	SCREW, set, 6-32 x 1/8 inch, HSS
-36	366-0033-00	5969	6389	1	KNOB, black—SCALE ILLUM
	366-0224-00	6390	10619	1	KNOB, black—SCALE ILLUM
	366-0220-00	10620		1	KNOB, charcoal—SCALE ILLUM
	- - - - - -			-	knob includes:
	213-0004-00	5969	6389	1	SCREW, set, 6-32 x 3/16 inch, HSS
	213-0020-00	6390		1	SCREW, set, 6-32 x 1/8 inch, HSS
-37	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
-38	210-0590-00	5969		1	NUT, hex., 3/8-32 x 7/16 inch
-39	210-0207-00	5969		1	LUG, solder, 3/8 ID x 5/8 inch OD, SE
-40	210-0840-00	5969		1	WASHER, flat, 0.390 ID x 9/16 inch OD
-41	210-0413-00	5969	6389	1	NUT, hex., 3/8-32 x 1/2 inch
	210-0590-00	6390		1	NUT, hex., 3/8-32 x 7/16 inch

FIG. 1 FRONT *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
1-42	366-0038-00			1	KNOB, red—VERNIER
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x $^3/_{16}$ inch, HSS
-43	366-0040-00	5969	10619	1	KNOB, black—HORIZONTAL POSITION
	366-0160-00	10620		1	KNOB, charcoal—HORIZONTAL POSITION
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x $^3/_{16}$ inch, HSS
-44	366-0060-00	5969	10619	1	KNOB, black—AMPLITUDE CALIBRATOR
	366-0115-00	10620		1	KNOB, charcoal—AMPLITUDE CALIBRATOR
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x $^3/_{16}$ inch, HSS
-45	262-0207-00			1	SWITCH, wired—AMPLITUDE CALIBRATOR
	- - - - - -			-	switch includes:
	260-0253-00			1	SWITCH, unwired—AMPLITUDE CALIBRATOR
-46	210-0207-00			1	LUG, solder, $^3/_8$ ID x $^5/_8$ inch OD, SE
	- - - - - -			-	mounting hardware: (not included w/switch)
-47	210-0012-00			1	LOCKWASHER, internal, $^3/_8$ ID x $^1/_2$ inch OD
-48	210-0413-00			1	NUT, hex., $^3/_8$-32 x $^1/_2$ inch
-49	366-0038-00			1	KNOB, red—5X MAGNIFIER
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x $^3/_{16}$ inch, HSS
-50	366-0040-00	5969	10619	1	KNOB, black—HORIZONTAL DISPLAY
	366-0160-00	10620		1	KNOB, charcoal—HORIZONTAL DISPLAY
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x $^3/_{16}$ inch, HSS
-51	262-0235-00	5969	6029	1	SWITCH, wired—HORIZONTAL DISPLAY (front)
	262-0533-00	6030		1	SWITCH, wired—HORIZONTAL DISPLAY (front)
	- - - - - -			-	switch includes:
	260-0262-00	9569	6169	1	SWITCH, unwired—HORIZONTAL DISPLAY (front)
	260-0502-00	6170		1	SWITCH, unwired—HORIZONTAL DISPLAY (front)
-52	337-0279-00			1	SHIELD
	- - - - - -			-	mounting hardware: (not included w/shield)
-53	211-0007-00			2	SCREW, 4-40 x $^3/_{16}$ inch, PHS
-54	210-0004-00			1	LOCKWASHER, internal, #4
-55	210-0201-00			1	LUG, solder, SE #4
-56	210-0406-00			2	NUT, hex., 4-40 x $^3/_{16}$ inch
	- - - - - -			-	mounting hardware: (not included w/switch)
-57	210-0013-00			1	LOCKWASHER, internal, $^3/_8$ ID x $^{11}/_{16}$ inch OD
-58	210-0413-00			1	NUT, hex., $^3/_8$-32 x $^1/_2$ inch
-59	262-0225-00	5969	6169	1	SWITCH, wired—HORIZONTAL DISPLAY (rear)
	262-0532-00	6170	9299	1	SWITCH, wired—HORIZONTAL DISPLAY (rear)
	262-0691-00	9300		1	SWITCH, wired—HORIZONTAL DISPLAY (rear)
	- - - - - -			-	switch includes:
	260-0263-00	5969	6169	1	SWITCH, unwired—HORIZONTAL DISPLAY (rear)
	260-0503-00	6170		1	SWITCH, unwired—HORIZONTAL DISPLAY (rear)
-60	- - - - - -			1	CAPACITOR
	- - - - - -			-	mounting hardware: (not included w/capacitor)
	211-0013-00			2	SCREW, 4-40 x $^3/_8$ inch, RHS

FIG. 1 FRONT *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
1-61	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
	210-0046-00			1	LOCKWASHER, internal, 1/4 ID x 0.400 inch OD
	210-0583-00			1	NUT, hex., 1/4-32 x 5/16 inch
-62	406-0450-00			1	BRACKET
	- - - - - -			-	mounting hardware: (not included w/bracket)
-63	211-0008-00			2	SCREW, 4-40 x 1/4 inch, PHS
-64	210-0004-00			2	LOCKWASHER, internal, #4
-65	210-0406-00			2	NUT, hex., 4-40 x 3/16 inch
	- - - - - -			-	mounting hardware: (not included w/switch)
-66	210-0012-00			1	LOCKWASHER, internal, 3/8 ID x 1/2 inch OD
-67	210-0840-00			1	WASHER, flat, 0.390 ID x 9/16 inch OD
-68	210-0413-00			1	NUT, hex., 3/8-32 x 1/2 inch
-69	406-0451-00			1	BRACKET, switch
	- - - - - -			-	mounting hardware: (not included w/switch)
	211-0507-00			2	SCREW, 6-32 x 5/16 inch, PHS (not shown)
	210-0803-00			2	WASHER, flat, 0.150 ID x 3/8 inch OD (not shown)
-70	210-0006-00			2	LOCKWASHER, internal, #6
-71	210-0407-00			1	NUT, hex., 6-32 x 1/4 inch
-72	348-0003-00			1	GROMMET, rubber, 5/16 inch
-73	348-0002-00			3	GROMMET, rubber, 1/4 inch
-74	376-0007-00			1	COUPLING, 1 inch long
	- - - - - -			-	coupling includes:
	213-0005-00			2	SCREW, set, 8-32 x 1/8 inch, HSS
-75	366-0039-00			1	KNOB, red—STABILITY
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
-76	366-0046-00	5969	10619	1	KNOB, black, TRIGGERING LEVEL
	366-0159-00	10620		1	KNOB, charcoal—TRIGGERING LEVEL
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
-77	366-0042-00	5969	10619	1	KNOB, black—TRIGGERING SOURCE
	366-0117-00	10620		1	KNOB, charcoal—TRIGGERING SOURCE
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
78	262-0571-00			1	SWITCH, wired—TRIGGERING SOURCE
	- - - - - -			-	switch includes:
	260-0555-00			1	SWITCH, unwired—TRIGGERING SOURCE
	- - - - - -			-	mounting hardware: (not included w/switch)
-79	210-0013-00			1	LOCKWASHER, internal, 3/8 ID x 11/16 inch OD
-80	210-0413-00			1	NUT, hex., 3/8-32 x 1/2 inch

FIG. 1 FRONT *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
1-81	366-0038-00			1	KNOB, red—LENGTH
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x $^{3}/_{16}$ inch, HSS
-82	366-0058-00	5969	10619	1	KNOB, black—TIME/CM or DELAY TIME
	366-0144-00	10620		1	KNOB, charcoal—TIME/CM or DELAY TIME
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x $^{3}/_{16}$ inch, HSS
-83	262-0208-00	5969	12499	1	SWITCH, wired—TIME/CM or DELAY TIME
	262-0208-01	12500		1	SWITCH, wired—TIME/CM or DELAY TIME
	- - - - - -			-	switch includes:
	260-0260-00			1	SWITCH, unwired—TIME/CM or DELAY TIME
-84	406-0497-00			1	BRACKET
	- - - - - -			-	mounting hardware: (not included w/bracket)
-85	210-0017-00			2	LOCKWASHER, spring #5
-86	210-0449-00			2	NUT, hex., 5-40 x $^{1}/_{4}$ inch
-87	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
-88	210-0012-00			1	LOCKWASHER, internal, $^{3}/_{8}$ ID x $^{1}/_{2}$ inch OD
-89	210-0413-00			2	NUT, hex., $^{3}/_{8}$-32 x $^{1}/_{2}$ inch
-90	384-0180-00			1	ROD, extension
-91	376-0014-00			1	COUPLING, wire
	361-0234-00	X14460		1	RESTRAINT, coupling
	361-0233-00	X14460		1	RESTRAINT, coupling
	- - - - - -			-	mounting hardware: (not included w/switch)
-92	210-0803-00			4	WASHER, flat, 0.150 ID x $^{3}/_{8}$ inch OD
-93	210-0407-00			2	NUT, hex., 6-32 x $^{1}/_{4}$ inch
	210-0457-00			2	NUT, keps, 6-32 x $^{5}/_{16}$ inch (not shown)
-94	210-0013-00			1	LOCKWASHER, internal, $^{3}/_{8}$ ID x $^{11}/_{16}$ inch OD
-95	210-0413-00			1	NUT, hex., $^{3}/_{8}$-32 x $^{1}/_{2}$ inch
-96	260-0212-00	5969	10619	2	SWITCH, slide—TRIGGER SLOPE
	260-0447-00	10620		2	SWITCH, slide—TRIGGER SLOPE
	- - - - - -			-	mounting hardware for each: (not included w/switch)
-97	211-0101-00			2	SCREW, 4-40 x $^{1}/_{4}$ inch, 100° csk, FHS
-98	210-0406-00			2	NUT, hex., 4-40 x $^{3}/_{16}$ inch
-99	210-0202-00			2	LUG, solder, SE #6
-100	211-0503-00			2	SCREW, 6-32 x $^{3}/_{16}$ inch, PHS
-101	260-0017-00			1	SWITCH, pushbutton—RESET
	- - - - - -			-	mounting hardware: (not included w/switch)
-102	210-0207-00			1	LUG, solder, $^{3}/_{8}$ ID x $^{5}/_{8}$ inch OD, SE
-103	210-0012-00			1	LOCKWASHER, internal, $^{3}/_{8}$ ID x $^{1}/_{2}$ inch OD
-104	210-0840-00			1	WASHER, flat, 0.390 ID x $^{9}/_{16}$ inch OD
-105	210-0413-00	5969	13519	1	NUT, hex., $^{3}/_{8}$-32 x $^{1}/_{2}$ inch
	210-0590-00	13520		1	NUT, hex., $^{3}/_{8}$-32 x $^{7}/_{16}$ inch

FIG. 1 FRONT *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
1-106	352-0006-00	5969	11419	3	HOLDER, plastic, neon bulb, double, black
	352-0064-00	11420		3	HOLDER, plastic, neon bulb, double, gray
	- - - - - -			-	mounting hardware for each: (not included w/holder)
-107	211-0031-00	5969	11419	1	SCREW, 4-40 x 1 inch, 100° csk, FHS
	211-0109-00	11420		1	SCREW, 4-40 x 7/8 inch, 100° csk, FHS
-108	210-0406-00			2	NUT, hex., 4-40 x 3/16 inch
-109	352-0008-00	5969	11419	3	HOLDER, plastic, neon bulb, single, black
	352-0067-00	11420		3	HOLDER, plastic, neon bulb, single, gray
	- - - - - -			-	mounting hardware for each: (not included w/holder)
	211-0031-00	5969	11419	1	SCREW, 4-40 x 1 inch, 100° csk, FHS
	211-0109-00	11420		1	SCREW, 4-40 x 7/8 inch, 100° csk, FHS
	210-0406-00			2	NUT, hex., 4-40 x 3/16 inch
-110	260-0134-00			1	SWITCH, toggle—POWER ON
	- - - - - -			-	switch includes:
-111	210-0414-00			1	NUT, hex., 15/32-32 x 9/16 inch
	- - - - - -			-	mounting hardware: (not included w/switch)
-112	354-0055-00			1	RING, locking
-113	210-0902-00			1	WASHER, flat, 0.470 ID x 21/32 inch OD
-114	210-0473-00			1	NUT, 12 sided, 15/32-32 x 0.634 inch
-115	136-0025-00			1	SOCKET, light, w/hardware
-116	378-0518-00	5969	13389	1	JEWEL, light, red
	378-0513-00	13390		1	JEWEL, light, green
-117	129-0051-00			1	ASSEMBLY, binding post
	- - - - - -			-	assembly includes:
	355-0507-00			1	STEM
	200-0182-00			1	CAP
	- - - - - -			-	mounting hardware: (not included w/assembly)
-118	210-0223-00			1	LUG, solder, 1/4 ID x 7/16 inch OD, SE
-119	210-0455-00			1	NUT, hex., 1/4-28 x 3/8 inch
-120	129-0053-00			1	ASSEMBLY, binding post
	- - - - - -			-	assembly includes:
	355-0507-00			1	STEM
	200-0103-00			1	CAP
	- - - - - -			-	mounting hardware: (not included w/assembly)
	210-0046-00			1	LOCKWASHER, internal, 1/4 ID x 0.400 inch OD
	210-0455-00			1	NUT, hex., 1/4-28 x 3/8 inch
-121	129-0053-00			1	ASSEMBLY, binding post
	- - - - - -			-	assembly includes:
	355-0507-00			1	STEM
	200-0103-00			1	CAP
	- - - - - -			-	mounting hardware: (not included w/assembly)
-122	210-0223-00			1	LUG, solder, 1/4 ID x 7/16 inch OD, SE
-123	385-0142-00			1	ROD, hex., 3/8 x 5/8 inch

FIG. 1 FRONT *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
1-124	129-0036-00	5969	10619	5	POST, binding, black
	129-0063-00	10620		5	POST, binding, charcoal
	- - - - - -			-	mounting hardware for each: (not included w/post)
-125	358-0036-00	5969	10619	1	BUSHING, plastic, black
	358-0169-00	10620		1	BUSHING, plastic, charcoal
	210-0206-00	5969	6709	1	LUG, solder, SE #10, long
	210-0010-00	5969	6709	1	LOCKWASHER, internal, #10
	210-0445-00	5969	6709	2	NUT, hex., 10-32 x 3/8 inch
-126	220-0410-00	6710		1	NUT, keps, 10-32 x 3/8 inch
-127	131-0126-00			2	CONNECTOR, coaxial, 1 contact, BNC w/hardware
-128	131-0279-00			1	CONNECTOR, coaxial, 1 contact, BNC
	- - - - - -			-	mounting hardware: (not included w/connector)
-129	211-0025-00			2	SCREW, 4-40 x 3/8 inch, FHS
-130	406-0244-00			1	BRACKET, coaxial, insulator
	210-0224-00			2	LUG, solder, #10, non-locking, 7/8 inch long
	210-0812-00			2	WASHER, fiber, 0.190 ID x 0.380 inch OD
	210-0004-00			2	LOCKWASHER, internal, #4
	210-0406-00			2	NUT, hex., 4-40 x 3/16 inch
-131	333-0764-00	5969	8999	1	PANEL, front
	333-0857-00	9000		1	PANEL, front
	- - - - - -			-	mounting hardware: (not included w/panel)
-132	213-0088-00			1	SCREW, thread forming, 4-40 x 1/4 inch, PHS
-133	386-0888-00			1	PLATE, subpanel front
	- - - - - -			-	plate includes:
-134	355-0043-00			4	STUD, graticule (replacement)
	- - - - - -			-	each stud includes:
	210-0010-00			1	LOCKWASHER, internal, #10 (not shown)
	212-0507-00			1	SCREW, 10-32 x 3/8 inch, PHS (not shown)
-135	354-0056-00			1	RING, ornamental, 12 5/8 x 15 7/8 x 1/8 inches
-136	- - - - - -			2	RESISTOR, variable
	- - - - - -			-	mounting hardware for each: (not included w/resistor)
	210-0046-00			1	LOCKWASHER, internal, 1/4 ID x 0.400 inch OD
	210-0471-00			1	NUT, hex., 1/4-32 x 5/16 x 19/32 inch long
-137	210-0223-00			1	LUG, solder, 1/4 ID x 7/16 inch OD, SE
-138	358-0054-00			1	BUSHING, 1/4-32 x 13/32 inch
-139	200-0382-00			1	COVER, graticule
	- - - - - -			-	cover includes:
	354-0116-00			1	RING, ornamental, 5 inches, black
	- - - - - -			-	mounting hardware: (not included w/cover)
-140	210-0424-00			4	NUT, knurled, 3/8-24 x 9/16 x 3/16 inch
-141	210-0816-00			4	WASHER, rubber, 0.200 ID x 0.620 inch OD
-142	337-0187-00	5969	8999X	1	SHIELD, graticule light

FIG. 1 FRONT *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
1-143	331-0034-00	5969	8999X	1	GRATICULE, 5 inches, 4 CM vertical, 10 CM horizontal
-144	401-0004-00	5969	8999X	1	CAM, plastic, 3/8 inch OD
	- - - - - -			-	mounting hardware: (not included w/cam)
-145	213-0012-00	5969	8999X	1	SCREW, thread forming, 4-40 x 3/8 inch, 100° csk, FHS
-146	214-0433-00	X9000	10204	1	SPRING, light reflector
	354-0262-00	10205		1	RING, light plate reflector
-147	387-0917-00	X9000	10204	1	PLATE, light reflector
	386-0212-00	10205		1	PLATE, light reflector
-148	- - - - - -			1	FILTER, light (see standard accessories page)
-149	378-0541-00	X11420		9	FILTER, lens, neon
-150	343-0006-00			1	CLAMP, cable, plastic, 1/2 inch
	- - - - - -			-	mounting hardware: (not included w/clamp)
-151	211-0507-00			1	SCREW, 6-32 x 5/16 inch, PHS
-152	210-0803-00			1	WASHER, flat, 0.150 ID x 3/8 inch OD
-153	385-0072-00			1	ROD, round, 3/8 x 2 inches
	- - - - - -			-	mounting hardware: (not included w/rod)
	210-0007-00			1	LOCKWASHER, external, #8
	212-0040-00			1	SCREW, 8-32 x 3/8 inch, 100° csk, FHS
-154	343-0004-00			1	CLAMP, cable, plastic, 5/16 inch
	- - - - - -			-	mounting hardware: (not included w/clamp)
	210-0804-00			1	WASHER, flat, 0.170 ID x 3/8 inch OD
	212-0004-00			1	SCREW, 8-32 x 5/16 inch, PHS
-155	385-0135-00			1	ROD, plastic, 5/16 x 15/16 inch
	- - - - - -			-	mounting hardware: (not included w/rod)
	213-0068-00			1	SCREW, thread cutting, 6-32 x 5/16 inch, FHS
-156	331-0022-00	5969	10619	1	DIAL, black—DELAY TIME MULTIPLIER
	331-0091-00	10620		1	DIAL, charcoal—DELAY TIME MULTIPLIER
-157	366-0033-00	5969	10619	1	KNOB, black—VARIABLE 10-1
	366-0148-00	10620		1	KNOB, charcoal—VARIABLE 10-1
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS

FIG. 2 REAR

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5 Description
2-1	636-0420-00	5969	9009	1	ASSEMBLY, delay line
	636-0422-00	9010		1	ASSEMBLY, delay line
	- - - - - -			-	assembly includes:
-2	343-0089-00			2	CLAMP, cable, plastic
-3	214-0003-00			1	HINGE, w/pins
	- - - - - -			-	mounting hardware: (not included w/hinge)
-4	211-0097-00			4	SCREW, 4-40 x $\frac{5}{16}$ inch, PHS
-5	210-0823-00			4	WASHER, fiber, $\frac{1}{8}$ ID x $\frac{1}{4}$ inch OD
-6	210-0004-00			2	LOCKWASHER, internal, #4
-7	210-0201-00			2	LUG, solder, SE #4
-8	210-0406-00			4	NUT, hex., 4-40 x $\frac{3}{16}$ inch
-9	343-0002-00			1	CLAMP, cable, plastic, $\frac{3}{16}$ inch
	- - - - - -			-	mounting hardware: (not included w/clamp)
-10	211-0014-00			1	SCREW, 4-40 x $\frac{1}{2}$ inch, PHS
-11	210-0823-00			1	WASHER, fiber, $\frac{1}{8}$ ID x $\frac{1}{4}$ inch OD
-12	210-0851-00			1	WASHER, flat, 0.119 ID x $\frac{3}{8}$ inch OD
-13	210-0004-00			1	LOCKWASHER, internal, #4
-14	210-0406-00			1	NUT, hex., 4-40 x $\frac{3}{16}$ inch
	- - - - - -			-	mounting hardware: (not included w/assembly)
-15	211-0101-00			5	SCREW, 4-40 x $\frac{1}{4}$ inch, 100° csk, FHS
-16	210-0201-00			1	LUG, solder, SE #4
-17	210-0586-00			5	NUT, keps, 4-40 x $\frac{1}{4}$ inch
-18	- - - - - -			1	RESISTOR
	- - - - - -			-	mounting hardware: (not included w/resistor)
-19	212-0037-00			1	SCREW, 8-32 x $1\frac{3}{4}$ inches, FIL HS
-20	210-0008-00			1	LOCKWASHER, internal, #8
-21	210-0809-00	5969	14159	1	WASHER, centering, 0.173 ID x $\frac{5}{8}$ inch OD
	210-0808-00	14160		1	WASHER, centering, 0.173 ID x $\frac{9}{16}$ inch OD
-22	210-0462-00			1	NUT, hex., $\frac{1}{2}$ x $\frac{23}{64}$ inch
-23	210-0228-00			1	LUG, solder, SE #8 long
-24	212-0004-00			1	SCREW, 8-32 x $\frac{5}{16}$ inch, PHS
-25	- - - - - -			2	RESISTOR
	- - - - - -			-	mounting hardware: (not included w/resistor)
-26	212-0037-00			1	SCREW, 8-32 x $1\frac{3}{4}$ inches, FIL HS
-27	210-0008-00			1	LOCKWASHER, internal, #8
-28	210-0808-00			1	WASHER, centering, 0.173 ID x $\frac{9}{16}$ inch OD
-29	210-0462-00			1	NUT, hex., $\frac{1}{2}$ x $\frac{23}{64}$ inch
-30	212-0004-00			1	SCREW, 8-32 x $\frac{5}{16}$ inch, PHS

FIG. 2 REAR *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description
2-31	- - - - - -			3	RESISTOR
	- - - - - -			-	mounting hardware for each: (not included w/resistor)
-32	212-0037-00			1	SCREW, 8-32 x 1 3/4 inches, FIL HS
-33	210-0008-00			1	LOCKWASHER, internal, #8
-34	210-0809-00	5969	14159	1	WASHER, centering, 0.173 ID x 5/8 inch OD
	210-0808-00	14160		1	WASHER, centering, 0.173 ID x 9/16 inch OD
-35	210-0462-00			1	NUT, hex., 1/2 x 23/64 inch
-36	212-0004-00			1	SCREW, 8-32 x 5/16 inch, PHS
	131-0102-00	5969	12429	1	ASSEMBLY, connector, 3 wire, male
	131-0102-01	12430	13429	1	ASSEMBLY, connector, 3 wire, male
	131-0102-02	13430		1	ASSEMBLY, connector, 3 wire, male
	- - - - - -			-	assembly includes:
-37	129-0041-00	5969	12429	1	POST, ground
	129-0041-01	12430	13429	1	POST, ground
-38	200-0185-00	5969	12429	1	COVER, plastic
	200-0185-01	12430	13429	1	COVER, plastic
	204-0335-00	13430		1	BODY-CONTACT ASSEMBLY
-39	211-0015-00	5969	12429	1	SCREW, 4-40 x 1/2 inch, RHS
	213-0088-00	12430	13429	1	SCREW, thread forming, 4-40 x 1/4 inch, PHS
	213-0146-00	13430		1	SCREW, thread forming, #6 x 0.313 inch, PHS
-40	214-0078-00			2	PIN, connecting
-41	377-0041-00	5969	12429	1	INSERT, plastic
	377-0051-00	12430	13429	1	INSERT, plastic
	214-1016-00	13430		1	INSULATOR, connector
-42	386-0933-00	5969	13429	1	PLATE, mounting
	386-1356-01	13430		1	PLATE, mounting
-43	210-0003-00	5969	12429X	2	LOCKWASHER, external, #4
-44	210-0551-00	5969	12429X	2	NUT, hex., 4-40 x 1/4 inch
	211-0132-00	X12430	13429	1	SCREW, 4-40 x 1/2 inch, PHS
	211-0534-00	13430	14409	1	SCREW, sems, 6-32 x 5/16 inch, PHS
	211-0614-00	14410		1	SCREW, sems, 6-32 x 1/4 inch, PHS
	- - - - - -			-	mounting hardware: (not included w/assembly)
-45	211-0537-00			2	SCREW, 6-32 x 3/8 inch, THS
-46	210-0457-00			2	NUT, keps, 6-32 x 5/16 inch
	635-0419-00			1	ASSEMBLY, fan
	- - - - - -			-	assembly includes:
-47	147-0001-00			1	MOTOR, 1500 RPM, 115 V
	- - - - - -			-	mounting hardware: (not included w/motor)
-48	210-0010-00			6	LOCKWASHER, internal, #10
-49	355-0044-00			2	STUD, 10-32 x 2 7/16 inches
-50	210-0410-00			4	NUT, hex., 10-32 x 5/16 inch
-51	426-0047-00			1	MOUNT, fan motor
	- - - - - -			-	mounting hardware: (not included w/mount)
-52	348-0008-00			3	SHOCKMOUNT, rubber, 1/2 diameter x 1/2 inch high
-53	210-0008-00			6	LOCKWASHER, internal, #8
-54	210-0409-00			6	NUT, hex., 8-32 x 5/16 inch
-55	369-0007-00			1	BLADE, fan
-56	354-0074-00			1	RING, fan
	- - - - - -			-	mounting hardware: (not included w/assembly)
-57	213-0104-00			6	SCREW, thread forming, #6 x 3/8 inch, THS

Ⓔ I

FIG. 2 REAR *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
2-58	386-0374-00			1	PLATE, connecting
-59	378-0023-00			1	FILTER, air, charcoal
-60	380-0018-00			1	HOUSING, air filter, blue vinyl
	- - - - - -			-	mounting hardware: (not included w/housing)
-61	212-0031-00			2	SCREW, 8-32 x $1\frac{1}{4}$ inches, RHS
-62	210-0458-00			2	NUT, keps, 8-32 x $\frac{11}{32}$ inch
-63	210-0894-00			2	WASHER, flat, plastic, 0.190 ID x $\frac{7}{16}$ inch OD
-64	210-0402-00			2	NUT, cap, hex., 8-32 x $\frac{5}{16}$ inch
-65	406-0477-00			1	BRACKET, shunt resistors
	- - - - - -			-	mounting hardware: (not included w/bracket)
-66	211-0507-00			2	SCREW, 6-32 x $\frac{5}{16}$ inch, PHS
-67	- - - - - -			1	RESISTOR
	- - - - - -			-	mounting hardware: (not included w/resistor)
-68	211-0516-00			1	SCREW, 6-32 x $\frac{7}{8}$ inch, PHS
-69	210-0886-00			1	WASHER, centering, 0.170 ID x 0.380 inch OD
-70	210-0805-00			1	WASHER, flat, 0.204 ID x 0.438 inch OD
-71	210-0478-00			1	NUT, hex., $\frac{5}{16}$ x $\frac{21}{32}$ inch long
-72	211-0507-00			1	SCREW, 6-32 x $\frac{5}{16}$ inch, PHS
-73	129-0036-00	5969	10619	1	POST, binding, black
	129-0063-00	10620		1	POST, binding, charcoal
	- - - - - -			-	mounting hardware: (not included w/post)
	210-0206-00	5969	6709	1	LUG, solder, SE #10, long
	210-0445-00	5969	6709	1	NUT, hex., 10-32 x $\frac{3}{8}$ inch
-74	220-0410-00	6710		1	NUT, keps, 10-32 x $\frac{3}{8}$ inch
-75	129-0036-00	5969	10619	1	POST, binding, black
	129-0063-00	10620		1	POST, binding, charcoal
	- - - - - -			-	mounting hardware: (not included w/post)
-76	358-0036-00	5969	10619	1	BUSHING, plastic, black
	358-0169-00	10620		1	BUSHING, plastic, charcoal
	210-0206-00	2969	6709	1	LUG, solder, SE #10 long
	210-0010-00	5969	6709	1	LOCKWASHER, internal, #10
	210-0445-00	5969	6709	2	NUT, hex., 10-32 x $\frac{3}{8}$ inch
-77	220-0410-00	6710		1	NUT, keps, 10-32 x $\frac{3}{8}$ inch
	352-0002-00			1	ASSEMBLY, fuse holder
	- - - - - -			-	assembly includes:
-78	352-0010-00			1	HOLDER, fuse
-79	200-0582-00			1	CAP, fuse
-80	210-0873-00			1	WASHER, rubber, $\frac{1}{2}$ ID x $\frac{11}{16}$ inch OD
-81	- - - - - -			1	NUT
-82	386-0912-00			1	PLATE, subpanel, rear
	- - - - - -			-	plate includes:
-83	354-0056-00			1	RING, ornamental, $12\frac{5}{8}$ x $15\frac{7}{8}$ x $\frac{1}{8}$ inches
-84	387-0752-00			1	PLATE, rear overlay, blue vinyl
	- - - - - -			-	mounting hardware: (not included w/plate)
-85	213-0104-00			4	SCREW, thread forming, #6 x $\frac{3}{8}$ inch, THS
-86	378-0762-00			1	SCREEN, filter
-87	334-0649-00			1	TAG, voltage rating
	- - - - - -			-	mounting hardware: (not included w/tag)
-88	213-0088-00			2	SCREW, thread forming, 4-40 x $\frac{1}{4}$ inch, PHS

FIG. 3 PLUG-IN HOUSING & VERTICAL AMPLIFIER

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
3-1	337-0066-00			1	SHIELD, plug in housing top
	- - - - - -			-	mounting hardware: (not included w/shield)
-2	211-0101-00			2	SCREW, 4-40 x $\frac{1}{4}$ inch, 100°, csk, FHS
-3	210-0851-00			2	WASHER, flat, 0.119 ID x $\frac{3}{8}$ inch OD
-4	210-0004-00			2	LOCKWASHER, internal, #4
-5	210-0406-00			2	NUT, hex., 4-40 x $\frac{3}{16}$ inch
-6	386-0566-00	5969	6259	2	PLATE, plug-in housing side
	386-0680-00	6260		2	PLATE, plug-in housing side
	- - - - - -			-	mounting hardware for each: (not included w/plate)
	211-0559-00			2	SCREW, 6-32 x $\frac{3}{8}$ inch, 100° csk, FHS (not shown)
-7	210-0457-00			2	NUT, keps, 6-32 x $\frac{5}{16}$ inch
-8	337-0091-00			1	SHIELD, plug-in housing
	- - - - - -			-	mounting hardware: (not included w/shield)
-9	211-0101-00			2	SCREW, 4-40 x $\frac{1}{4}$ inch, 100° csk, FHS
-10	210-0851-00			2	WASHER, flat, 0.119 ID x $\frac{3}{8}$ inch OD
-11	210-0004-00			2	LOCKWASHER, internal, #4
-12	210-0406-00			2	NUT, hex., 4-40 x $\frac{3}{16}$ inch
-13	406-0245-00			2	BRACKET, ground clip
-14	386-0355-00			1	PLATE, plug-in housing rear
	- - - - - -			-	mounting hardware: (not included w/plate)
-15	211-0507-00			3	SCREW, 6-32 x $\frac{5}{16}$ inch, PHS
-16	211-0538-00			1	SCREW, 6-32 x $\frac{5}{16}$ inch, 100° csk, FHS
-17	210-0006-00			4	LOCKWASHER, internal, #6
-18	210-0407-00			4	NUT, hex., 6-32 x $\frac{1}{4}$ inch
-19	211-0513-00			1	SCREW, 6-32 x $\frac{5}{8}$ inch, PHS
-20	210-0206-00			1	LUG, solder, SE 10 long
-21	343-0008-00			1	CLAMP, cable, plastic, $\frac{3}{4}$ inch
-22	210-0863-00			1	WASHER, "D" shape, 0.191 x $\frac{33}{64}$ x $\frac{33}{64}$ inch
-23	210-0457-00			1	NUT, keps, 6-32 x $\frac{5}{16}$ inch
-24	212-0023-00			2	SCREW, 8-32 x $\frac{3}{8}$ inch, PHS
-25	210-0804-00			2	WASHER, flat, 0.170 ID x $\frac{3}{8}$ inch OD
	210-0458-00			2	NUT, keps, 8-32 x $\frac{11}{32}$ inch (not shown)
-26	343-0042-00			2	CLAMP, cable, plastic, $\frac{5}{16}$ inch
	- - - - - -			-	mounting hardware for each: (not included w/clamp)
-27	211-0507-00			2	SCREW, 6-32 x $\frac{5}{16}$ inch, PHS
-28	210-0803-00			2	WASHER, flat, 0.150 ID x $\frac{3}{8}$ inch OD
-29	210-0006-00			2	LOCKWASHER, internal, #6
-30	210-0407-00			2	NUT, hex., 6-32 x $\frac{1}{4}$ inch
-31	344-0025-00			1	CLIP, retaining, delay line
	- - - - - -			-	mounting hardware: (not included w/clip)
-32	211-0510-00			1	SCREW, 6-32 x $\frac{3}{8}$ inch, PHS
-33	210-0803-00			1	WASHER, flat, 0.150 ID x $\frac{3}{8}$ inch OD
-34	210-0457-00			1	NUT, keps, 6-32 x $\frac{5}{16}$ inch

FIG. 3 PLUG-IN HOUSING & VERTICAL AMPLIFIER *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
3-35	131-0018-00			1	CONNECTOR, 16 contact
	- - - - - -			-	mounting hardware: (not included w/connector)
-36	211-0016-00			2	SCREW, 4-40 x $^5/_8$ inch, RHS
-37	166-0107-00	5969	7859	2	TUBE, spacing, 0.180 ID x $^1/_4$ OD x $^7/_{32}$ inch
	166-0030-00	7860		2	TUBE, spacing, 0.180 ID x $^1/_4$ OD x $^3/_{16}$ inch
-38	210-0586-00			2	NUT, keps, 4-40 x $^1/_4$ inch
-39	175-0059-00			2	ASSEMBLY, cable, coaxial
	- - - - - -			-	each assembly includes:
	131-0007-00			2	CONNECTOR, cable end
-40	136-0071-00			2	SOCKET, tube, 7 pin miniature
	- - - - - -			-	mounting hardware for each: (not included w/socket)
-41	213-0044-00			2	SCREW, thread forming, 5-32 x $^3/_{16}$ inch, PHS
-42	136-0072-00			9	SOCKET, tube, 9 pin miniature
	- - - - - -			-	mounting hardware for each: (not included w/socket)
-43	213-0044-00			2	SCREW, thread forming, 5-32 x $^3/_{16}$ inch, PHS
-44	406-0018-00			1	BRACKET, variable resistor
	- - - - - -			-	mounting hardware: (not included w/bracket)
-45	211-0507-00			2	SCREW, 6-32 x $^5/_{16}$ inch, PHS
-46	210-0006-00			2	LOCKWASHER, internal, #6
-47	210-0407-00			2	NUT, hex., 6-32 x $^1/_4$ inch
-48	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
-49	210-0207-00			1	LUG, solder, $^3/_8$ ID x $^5/_8$ inch OD, SE
-50	210-0012-00			1	LOCKWASHER, internal, $^3/_8$ ID x $^1/_2$ inch OD
-51	210-0840-00			1	WASHER, flat, 0.390 ID x $^9/_{16}$ inch OD
-52	210-0413-00			1	NUT, hex., $^3/_8$-32 x $^1/_2$ inch
-53	385-0013-00			1	ROD, plastic, $^5/_{16}$ x $^3/_4$ inch
	- - - - - -			-	mounting hardware: (not included w/rod)
	211-0507-00			1	SCREW, 6-32 x $^5/_{16}$ inch, PHS
-54	348-0002-00			1	GROMMET, rubber, $^1/_4$ inch
-55	352-0020-00			4	HOLDER, plastic, $^1/_4$ x 1$^1/_8$ inches long
	- - - - - -			-	mounting hardware for each: (not included w/holder)
-56	213-0045-00			1	SCREW, thread forming, 4-40 x $^5/_{16}$ inch, PHS
-57	352-0021-00			4	HOLDER, plastic, $^1/_4$ x $^{11}/_{16}$ inch
	- - - - - -			-	mounting hardware for each: (not included w/holder)
-58	213-0045-00			1	SCREW, thread forming, 4-40 x $^5/_{16}$ inch, PHS

FIG. 3 PLUG-IN HOUSING & VERTICAL AMPLIFIER *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
3-59	------			1	TRANSISTOR
	------			-	mounting hardware: (not included w/transistor)
-60	386-0689-00			1	PLATE, mica
-61	210-0813-00			1	WASHER, fiber, #10, shouldered
-62	210-0206-00			1	LUG, solder, SE 10 long
-63	210-0410-00			1	NUT, hex., 10-32 x 5/16 inch
-64	------			1	TRANSISTOR
	------			-	mounting hardware: (not included w/transistor)
-65	211-0507-00			2	SCREW, 6-32 x 5/16 inch, PHS
-66	386-0786-00			1	PLATE, mica
-67	210-0811-00			2	WASHER, fiber, #6, shouldered
-68	210-0202-00			1	LUG, solder, SE #6
-69	210-0006-00			1	LOCKWASHER, internal, #6
-70	210-0407-00			2	NUT, hex., 6-32 x 1/4 inch
-71	210-0201-00			4	LUG, solder, SE #4
	------			-	mounting hardware for each: (not included w/lug)
-72	213-0044-00			1	SCREW, thread forming, 5-32 x 3/16 inch, PHS
-73	210-0204-00			2	LUG, solder, DE #6
	------			-	mounting hardware for each: (not included w/lug)
-74	213-0044-00			1	SCREW, thread forming, 5-32 x 3/16 inch, PHS
-75	210-0203-00			1	LUG, solder, SE 6 long
-76	441-0288-00			1	CHASSIS, vertical amplifier
	------			-	mounting hardware: (not included w/chassis)
	212-0040-00			6	SCREW, 8-32 x 3/8 inch, 100° csk, FHS (not shown)
-77	210-0458-00			5	NUT, keps, 8-32 x 11/32 inch
-78	211-0507-00			3	SCREW, 6-32 x 5/16 inch, PHS
-79	210-0803-00			3	WASHER, flat, 0.150 ID x 3/8 inch OD
-80	210-0457-00			1	NUT, keps, 6-32 x 5/16 inch
-81	343-0002-00			1	CLAMP, cable, plastic, 3/16 inch
	------			-	mounting hardware: (not included w/clamp)
-82	211-0507-00			1	SCREW, 6-32 x 5/16 inch, PHS
-83	210-0803-00			1	WASHER, flat, 0.150 ID x 3/8 inch OD

FIG. 4 SWEEP & POWER

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
4-1	136-0015-00			2	SOCKET, tube, 9-pin, w/ground lugs
	- - - - - -			-	mounting hardware for each: (not included w/socket)
-2	211-0033-00			2	SCREW, sems, 4-40 x $^5/_{16}$ inch, PHS
-3	337-0005-00			1	SHIELD, socket, $^{29}/_{32}$ inch ID
-4	210-0004-00			2	LOCKWASHER, internal, #4
-5	210-0406-00			2	NUT, hex., 4-40 x $^3/_{16}$ inch
-6	136-0011-00			1	SOCKET, tube, 8 pin, w/ground lugs
	- - - - - -			-	mounting hardware: (not included w/socket)
-7	213-0044-00			2	SCREW, thread forming, 5-32 x $^3/_{16}$ inch, PHS
-8	136-0015-00			16	SOCKET, tube, 9 pin, w/ground lugs
	- - - - - -			-	mounting hardware for each: (not included w/socket)
-9	213-0044-00			2	SCREW, thread forming, 5-32 x $^3/_{16}$ inch, PHS
-10	136-0071-00			2	SOCKET, tube, 7 pin, miniature
	- - - - - -			-	mounting hardware for each: (not included w/socket)
-11	213-0044-00			2	SCREW, thread forming, 5-32 x $^3/_{16}$ inch, PHS
-12	136-0127-00			1	SOCKET, diode
-13	136-0095-00	5969	9659	1	SOCKET, transistor, 4 pin
	136-0181-00	9660		1	SOCKET, transistor, 3 pin
	- - - - - -			-	mounting hardware: (not included w/socket)
-14	213-0113-00	5969	9659	2	SCREW, thread forming, 2-32 x $^5/_{16}$ inch, RHS
	354-0234-00	9660		1	RING, socket mounting
-15	348-0002-00			6	GROMMET, rubber, $^1/_4$ inch
-16	348-0003-00			4	GROMMET, rubber, $^5/_{16}$ inch
-17	348-0005-00			3	GROMMET, rubber, $^1/_2$ inch
-18	348-0006-00			1	GROMMET, rubber, $^3/_4$ inch
-19	348-0012-00			1	GROMMET, rubber, $^5/_8$ inch
-20	385-0129-00			2	ROD, plastic, $^5/_{16}$ x $^5/_8$ inch
	- - - - - -			-	mounting hardware for each: (not included w/rod)
-21	211-0507-00			1	SCREW, 6-32 x $^5/_{16}$ inch, PHS
-22	385-0135-00			2	ROD, plastic, $^5/_{16}$ x $^{15}/_{16}$ inch
	- - - - - -			-	mounting hardware for each: (not included w/rod)
-23	213-0041-00			1	SCREW, thread cutting, 6-32 x $^3/_8$ inch, THS
-24	- - - - - -			1	CAPACITOR
	- - - - - -			-	mounting hardware: (not included w/capacitor)
-25	211-0534-00			2	SCREW, sems, 6-32 x $^5/_{16}$ inch, PHS
-26	386-0253-00			1	PLATE, metal, small
-27	210-0006-00			2	LOCKWASHER, internal, #6
-28	210-0407-00			2	NUT, hex., 6-32 x $^1/_4$ inch

FIG. 4 SWEEP & POWER *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
4-29	406-0692-00			1	BRACKET, variable resistor mounting
	- - - - - -			-	mounting hardware: (not included w/bracket)
-30	212-0004-00			2	SCREW, 8-32 x $^5/_{16}$ inch, PHS
-31	210-0804-00			2	WASHER, flat, 0.170 ID x $^3/_8$ inch OD
-32	- - - - - -			1	CAPACITOR
	- - - - - -			-	mounting hardware: (not included w/capacitor)
-33	211-0534-00			2	SCREW, sems, 6-32 x $^5/_{16}$ inch, PHS
-34	386-0253-00			1	PLATE, metal, small
-35	210-0202-00			1	LUG, solder, SE #6
-36	210-0006-00			2	LOCKWASHER, internal, #6
-37	210-0407-00			2	NUT, hex., 6-32 x $^1/_4$ inch
-38	210-0201-00			4	LUG, solder, SE #4
	- - - - - -			-	mounting hardware for each: (not included w/lug)
-39	213-0044-00			1	SCREW, thread forming, 5-32 x $^3/_{16}$ inch, PHS
-40	- - - - - -			7	RESISTOR, variable
	- - - - - -			-	mounting hardware for each: (not included w/resistor)
-41	210-0840-00			1	WASHER, flat, 0.390 ID x $^9/_{16}$ inch OD
-42	210-0413-00			1	NUT, hex., $^3/_8$-32 x $^1/_2$ inch
-43	- - - - - -			1	RESISTOR
	- - - - - -			-	mounting hardware: (not included w/resistor)
-44	211-0545-00			1	SCREW, 6-32 x 1$^1/_4$ inches, THS
	210-0601-00			1	EYELET, (not shown)
-45	210-0478-00			1	NUT, hex., $^5/_{16}$ x $^{21}/_{32}$ inch long
-46	211-0507-00			1	SCREW, 6-32 x $^5/_{16}$ inch, PHS
	621-0411-00			1	ASSEMBLY, high voltage
	- - - - - -			-	assembly includes:
-47	124-0086-00			4	STRIP, ceramic, $^3/_4$ inch h, w/2 notches
	- - - - - -			-	each strip includes:
	355-0046-00			1	STUD, plastic
	- - - - - -			-	mounting hardware for each: (not included w/strip)
-48	361-0009-00			1	SPACER, plastic, 0.406 inch long
-49	124-0088-00			1	STRIP, ceramic, $^3/_4$ inch h, w/4 notches
	- - - - - -			-	strip includes:
	355-0046-00			2	STUD, plastic
	- - - - - -			-	mounting hardware: (not included w/strip)
-50	361-0009-00			2	SPACER, plastic, 0.406 inch long
-51	124-0100-00			1	STRIP, ceramic, $^3/_4$ inch h, w/1 notch
	- - - - - -			-	strip includes:
	355-0046-00			1	STUD, plastic
	- - - - - -			-	mounting hardware: (not included w/strip)
-52	361-0009-00			1	SPACER, plastic, 0.406 inch long

FIG. 4 SWEEP & POWER *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
4-53	210-0205-00			3	LUG, solder, SE #8
-54	- - - - - -			1	TRANSFORMER
	- - - - - -			-	mounting hardware: (not included w/transformer)
-55	346-0001-00			1	STRAP, mounting
-56	210-0004-00			2	LOCKWASHER, internal, #4
-57	210-0406-00			2	NUT, hex., 4-40 x $^3/_{16}$ inch
-58	386-0358-00			1	PLATE, bakelite
	- - - - - -			-	mounting hardware: (not included w/assembly)
-59	211-0507-00			3	SCREW, 6-32 x $^5/_{16}$ inch, PHS
-60	385-0080-00			3	ROD, hex., $^1/_4$ x $^7/_{16}$ inch
-61	210-0006-00			3	LOCKWASHER, internal, #6
-62	211-0504-00			3	SCREW, 6-32 x $^1/_4$ inch, PHS
-63	337-0008-00			1	SHIELD, w/spring, 1$^1/_{32}$ ID x 1$^{15}/_{16}$ inches high
-64	337-0009-00			1	SHIELD, w/spring, 1$^1/_{32}$ ID x 2$^{13}/_{32}$ inches high
-65	384-0135-00			1	ROD, spacing
	- - - - - -			-	mounting hardware: (not included w/rod)
-66	211-0507-00			1	SCREW, 6-32 x $^5/_{16}$ inch, PHS
-67	337-0287-00	5969	10499	1	SHIELD, high voltage
	337-0149-01	10500		1	SHIELD, high voltage
	- - - - - -			-	mounting hardware: (not included w/shield)
-68	211-0503-00			1	SCREW, 6-32 x $^3/_{16}$ inch, PHS
	211-0541-00			2	SCREW, 6-32 x $^1/_4$ inch, 100°, csk, FHS (not shown)
-69	441-0369-00			1	CHASSIS, sweep
	- - - - - -			-	mounting hardware: (not included w/sweep)
	212-0040-00			4	SCREW, 8-32 x $^3/_8$ inch, 100°, csk, FHS (not shown)
-70	136-0044-00			1	SOCKET, tube, 7 pin
	- - - - - -			-	mounting hardware: (not included w/socket)
-71	213-0044-00			2	SCREW, thread forming, 5-32 x $^3/_{16}$ inch, PHS
-72	214-0210-00	X10500		1	ASSEMBLY, solder spool
	- - - - - -			-	assembly includes:
	214-0209-00			1	SPOOL, solder
	- - - - - -			-	mounting hardware: (not included w/assembly)
-73	361-0007-00			1	SPACER, plastic, 0.188 inch long (not shown)
-74	337-0289-00			1	SHIELD
	- - - - - -			-	mounting hardware: (not included w/shield)
-75	211-0507-00			2	SCREW, 6-32 x $^5/_{16}$ inch, PHS
-76	210-0457-00			2	NUT, keps, 6-32 x $^5/_{16}$ inch

FIG. 4 SWEEP & POWER *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5 Description
4-77	105-0014-00			1	STOP, hex., 1/4 x 3/4 inch
	- - - - - -			-	mounting hardware: (not included w/stop)
-78	210-0006-00			1	LOCKWASHER, internal, #6
-79	210-0407-00			1	NUT, hex., 6-32 x 1/4 inch
-80	136-0008-00			9	SOCKET, tube, 7 pin, w/ground lugs
	- - - - - -			-	mounting hardware for each: (not included w/socket)
-81	213-0044-00			2	SCREW, thread forming, 5-32 x 3/16 inch, PHS
-82	136-0011-00			2	SOCKET, tube, 8 pin, w/ground lugs
	- - - - - -			-	mounting hardware for each: (not included w/socket)
-83	211-0538-00			2	SCREW, 6-32 x 5/16 inch, 100°, csk, FHS
-84	210-0006-00			2	LOCKWASHER, internal, #6
-85	210-0407-00			2	NUT, hex., 6-32 x 1/4 inch
-86	136-0037-00			1	SOCKET, tip jack
	- - - - - -			-	mounting hardware: (not included w/socket)
-87	210-0840-00			1	WASHER, flat, 0.390 ID x 9/16 inch OD
-88	210-0413-00			1	NUT, hex., 3/8-32 x 1/2 inch
-89	252-0564-00	X10880		FT.	CHANNEL, extruded plastic (2 inches)
-90	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
-91	210-0840-00			1	WASHER, flat, 0.390 ID x 9/16 inch OD
-92	210-0444-00			1	NUT, hex., 3/8-32 x 1/2 x 5/8 inch
-93	348-0004-00			3	GROMMET, rubber, 3/8 inch
-94	406-0108-00			1	BRACKET, variable resistor
	- - - - - -			-	mounting hardware: (not included w/bracket)
-95	211-0507-00			2	SCREW, 6-32 x 5/16 inch, PHS
-96	210-0006-00			2	LOCKWASHER, internal, #6
-97	210-0407-00			2	NUT, hex., 6-32 x 1/4 inch
-98	210-0204-00			1	LUG, solder, DE #6
	- - - - - -			-	mounting hardware: (not included w/lug)
-99	211-0507-00			1	SCREW, 6-32 x 5/16 inch, PHS
-100	210-0407-00			1	NUT, hex., 6-32 x 1/4 inch
-101	- - - - - -			3	CAPACITOR
	- - - - - -			-	mounting hardware for each: (not included w/capacitor)
-102	211-0543-00			2	SCREW, 6-32 x 5/16 inch, RHS
-103	386-0254-00			1	PLATE, fiber, large
-104	210-0006-00			2	LOCKWASHER, internal, #6
-105	210-0407-0			2	NUT, hex., 6-32 x 1/4 inch

FIG. 4 SWEEP & POWER *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
4-106	- - - - - -			1	CAPACITOR
	- - - - - -			-	mounting hardware: (not included w/capacitor)
-107	211-0534-00			2	SCREW, sems, 6-32 x 5/16 inch, PHS
-108	386-0252-00			1	PLATE, fiber, small
-109	210-0006-00			2	LOCKWASHER, internal, #6
-110	210-0407-00			2	NUT, hex., 6-32 x 1/4 inch
-111	- - - - - -			2	CAPACITOR
	- - - - - -			-	mounting hardware for each: (not included w/capacitor)
-112	211-0534-00			2	SCREW, sems, 6-32 x 5/16 inch, PHS
-113	386-0255-00			1	PLATE, metal, large
-114	210-0006-00			2	LOCKWASHER, internal, #6
-115	210-0407-00			2	NUT, hex., 6-32 x 1/4 inch
-116	- - - - - -			1	CAPACITOR
	- - - - - -				mounting hardware: (not included w/capacitor)
	166-0038-00	5969	10649X	2	TUBE, spacer, 0.180 ID x 1/4 OD x 3/4 inch long (not shown)
-117	211-0517-00	5969	6679	2	SCREW, 6-32 x 1 inch, PHS
	211-0529-00	6680	10649	2	SCREW, 6-32 x 1 1/4 inches, PHS
	211-0534-00	10650		2	SCREW, sems, 6-32 x 5/16 inch, PHS
-118	210-0006-00	5969	6679	2	LOCKWASHER, internal, #6
	210-0006-00	6680	10649	4	LOCKWASHER, internal, #6
	210-0006-00	10650		2	LOCKWASHER, internal, #6
-119	210-0407-00	5969	6679	2	NUT, hex., 6-32 x 1/4 inch
	210-0407-00	6680	10649	4	NUT, hex., 6-32 x 1/4 inch
	210-0407-00	10650		2	NUT, hex., 6-32 x 1/4 inch
-120	386-0255-00			2	PLATE, metal, large
-121	- - - - - -			1	TRANSFORMER
	- - - - - -			-	transformer includes:
-122	212-0543-00			4	SCREW, 10-32 x 3 3/4 inches, HHS
-123	210-0812-00			4	WASHER, fiber, 0.190 ID x 0.380 inch OD
	- - - - - -			-	mounting hardware: (not included w/transformer)
-124	211-0531-00			2	SCREW, 6-32 x 3/8 inch, Fil HS
-125	384-0599-00			4	ROD, transformer support
	210-0010-00			4	LOCKWASHER, internal, #10
-126	381-0212-00			2	BAR, transformer support
	211-0544-00			4	SCREW, 6-32 x 3/4 inch, THS (not shown)
	210-0803-00			4	WASHER, flat, 0.150 ID x 3/8 inch OD (not shown)
	210-0457-00			2	NUT, keps, 6-32 x 5/16 inch (not shown)
-127	441-0238-00	5969	13887	1	CHASSIS, power
	441-0238-02	13888		1	CHASSIS, power
	- - - - - -			-	mounting hardware: (not included w/chassis)
	212-0040-00			5	SCREW, 8-32 x 3/8 inch, 100° csk, FHS
	210-0458-00			5	NUT, keps, 8-32 x 11/32 inch
-128	200-0256-00			1	COVER, plastic, 1 diameter x 2 1/32 inches
-129	200-0258-00			2	COVER, plastic, 1.365 diameter x 3 1/32 inches
-130	200-0293-00			1	COVER, plastic, 1.365 diameter x 2 9/16 inches

FIG. 4 SWEEP & POWER *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
4-131	337-0291-00			1	SHIELD, calibrator switch
	- - - - - -			-	mounting hardware: (not included w/shield)
-132	211-0507-00			2	SCREW, 6-32 x 5/16 inch, PHS
-133	210-0006-00			2	LOCKWASHER, internal, #6
-134	210-0407-00			2	NUT, hex., 6-32 x 1/4 inch
-135	337-0290-00	5969	11629X	1	SHIELD, calibrator switch
	- - - - - -			-	mounting hardware: (not included w/shield)
-136	211-0507-00	5969	11629X	1	SCREW, 6-32 x 5/16 inch, PHS
-137	210-0457-00	5969	11629X	1	NUT, keps, 6-32 x 5/16 inch
-138	406-0022-00	5969	11629	1	BRACKET, variable resistor
	407-0258-00	11630		1	BRACKET, variable resistor
	- - - - - -			-	mounting hardware: (not included w/bracket)
-139	211-0507-00			2	SCREW, 6-32 x 5/16 inch, PHS
-140	210-0006-00	5969	11629X	2	LOCKWASHER, internal, #6
-141	210-0407-00	5969	11629X	2	NUT, hex., 6-32 x 1/4 inch
-142	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
-143	210-0013-00	X11630		1	LOCKWASHER, internal, 3/8 ID x 11/16 inch OD
-144	210-0840-00			1	WASHER, flat, 0.390 ID x 9/16 inch OD
-145	210-0413-00	5969	11629	1	NUT, hex., 3/8-32 x 1/2 inch
	210-0444-00	11630		1	NUT, hex., 3/8-32 x 1/2 x 5/8 inch long
-146	343-0001-00			1	CLAMP, cable, 1/8 inch, plastic
	- - - - - -			-	mounting hardware: (not included w/clamp)
-147	211-0507-00			1	SCREW, 6-32 x 5/16 inch, PHS
-148	210-0803-00			1	WASHER, flat, 0.150 ID x 3/8 inch OD
-149	210-0457-00			1	NUT, keps, 6-32 x 5/16 inch
-150	385-0138-00			2	ROD, plastic, 5/16 x 1 9/16 inches
	- - - - - -			-	mounting hardware for each: (not included w/rod)
	213-0041-00			1	SCREW, thread cutting, 6-32 x 3/8 inch, THS

FIG. 5 RECTIFIER

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
5-1	386-0906-00	5969	7797	1	PLATE, rectifier mounting
	387-0828-00	7798		1	PLATE, rectifier mounting
	- - - - - -			-	mounting hardware: (not included w/plate)
-2	212-0023-00			8	SCREW, 8-32 x $^3/_8$ inch, PHS
-3	210-0804-00			8	WASHER, flat, 0.170 ID x $^3/_8$ inch OD
-4	210-0458-00			7	NUT, keps, 8-32 x $^{11}/_{32}$ inch
-5	136-0015-00			1	SOCKET, tube, 9 pin, w/ground lugs
	- - - - - -			-	mounting hardware: (not included w/socket)
-6	211-0033-00			2	SCREW, sems, 4-40 x $^5/_{16}$ inch, PHS
-7	210-0004-00			2	LOCKWASHER, internal, #4
-8	210-0406-00			2	NUT, hex., 4-40 x $^3/_{16}$ inch
-9	- - - - - -			1	RELAY
	- - - - - -			-	mounting hardware: (not included w/relay)
-10	211-0503-00			2	SCREW, 6-32 x $^3/_{16}$ inch, PHS
-11	348-0002-00			2	GROMMET, rubber, $^1/_4$ inch
-12	348-0004-00			1	GROMMET, rubber, $^3/_8$ inch
-13	202-0012-00			1	CAN
	- - - - - -			-	mounting hardware: (not included w/can)
-14	210-0457-00			2	NUT, keps, 6-32 x $^5/_{16}$ inch
-15	352-0031-00	X6850		1	HOLDER, fuse
	- - - - - -			-	mounting hardware: (not included w/holder)
-16	211-0510-00			1	SCREW, 6-32 x $^3/_8$ inch, PHS
-17	210-0457-00			1	NUT, keps, 6-32 x $^5/_{16}$ inch
-18	385-0138-00			1	ROD, plastic, $^5/_{16}$ x 1$^9/_{16}$ inches
	- - - - - -			-	mounting hardware: (not included w/rod)
-19	213-0041-00			1	SCREW, thread cutting, 6-32 x $^3/_8$ inch, THS
-20	- - - - - -			1	THERMAL CUTOUT
	- - - - - -			-	mounting hardware: (not included w/thermal cutout)
-21	211-0504-00			2	SCREW, 6-32 x $^1/_4$ inch, PHS
-22	210-0006-00			2	LOCKWASHER, internal, #6
-23	210-0407-00			2	NUT, hex., 6-32 x $^1/_4$ inch
-24	- - - - - -			3	CAPACITOR
	- - - - - -			-	mounting hardware (not included w/capacitor)
-25	211-0534-00			2	SCREW, sems, 6-32 x $^5/_{16}$ inch, PHS
-26	386-0255-00			1	PLATE, metal, large
-27	210-0006-00			2	LOCKWASHER, internal, #6
-28	210-0407-00			2	NUT, hex., 6-32 x $^1/_4$ inch

FIG. 5 RECTIFIER *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description (1 2 3 4 5)
5-29	- - - - - -			2	RESISTOR
	- - - - - -			-	mounting hardware for each: (not included w/resistor)
-30	211-0553-00			1	SCREW, 6-32 x $1\frac{1}{2}$ inches, RHS
-31	210-0601-00			1	EYELET, 0.183 ID x 0.323 inch OD
-32	210-0478-00			1	NUT, hex., $\frac{5}{16}$ x $\frac{21}{32}$ inch long
-33	211-0507-00			1	SCREW, 6-32 x $\frac{5}{16}$ inch, PHS
-34	166-0099-00			2	TUBE, spacing, $\frac{1}{4}$ x $1\frac{23}{32}$ inches
	- - - - - -			-	mounting hardware for each: (not included w/tube)
-35	211-0507-00			1	SCREW, 6-32 x $\frac{5}{16}$ inch, PHS
-36	337-0288-00			1	SHIELD, plexiglass, 5 x $2\frac{1}{2}$ x $\frac{1}{16}$ inches
	- - - - - -			-	mounting hardware: (not included w/shield)
-37	211-0507-00			2	SCREW, 6-32 x $\frac{5}{16}$ inch, PHS
-38	- - - - - -			1	CAPACITOR
	- - - - - -			-	capacitor includes:
	407-0277-00	X12500		1	BRACKET, capacitor
	124-0187-00	X12500	14389	1	STRIP, ceramic, $\frac{7}{16}$ inch h, w/5 notches
	124-0208-01	14390		1	STRIP, ceramic, $\frac{7}{16}$ inch h, w/6 notches
	- - - - - -			-	strip includes:
	355-0046-00			2	STUD, plastic
	124-0187-01	X12500	14389	1	STRIP, ceramic, $\frac{7}{16}$ inch h, w/5 notches & silver band
	124-0208-02	14390		1	STRIP, ceramic, $\frac{7}{16}$ inch h, w/6 notches & silver band
	- - - - - -			-	strip includes:
	355-0046-00			2	STUD, plastic
	361-0007-00	X12500		4	SPACER, plastic, 0.188 inch long
	- - - - - -			-	mounting hardware: (not included w/capacitor)
-39	210-0457-00			2	NUT, keps, 6-32 x $\frac{5}{16}$ inch, PHS
-40	- - - - - -			4	DIODE, w/hardware

FIG. 6 FOCUS & INTENSITY

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
6-1	136-0072-00			5	SOCKET, tube, 9 pin, miniature
	- - - - - -			-	mounting hardware for each: (not included w/socket)
-2	213-0044-00			2	SCREW, thread forming, 5-32 x $\frac{3}{16}$ inch, PHS
-3	348-0002-00			4	GROMMET, rubber, $\frac{1}{4}$ inch
-4	348-0004-00			1	GROMMET, rubber, $\frac{3}{8}$ inch
-5	348-0005-00			1	GROMMET, rubber, $\frac{1}{2}$ inch
-6	348-0012-00			1	GROMMET, rubber, $\frac{3}{4}$ inch
-7	352-0021-00			4	HOLDER, plastic, $\frac{1}{4}$ x $\frac{11}{16}$ inch long
	- - - - - -			-	mounting hardware for each: (not included w/holder)
-8	213-0045-00			1	SCREW, thread forming, 4-40 x $\frac{5}{16}$ inch, PHS
-9	352-0020-00			4	HOLDER, plastic, $\frac{1}{4}$ x 1$\frac{1}{8}$ inches long
	- - - - - -			-	mounting hardware for each: (not included w/holder)
-10	213-0045-00			1	SCREW, thread forming, 4-40 x $\frac{5}{16}$ inch, PHS
-11	352-0022-00			5	HOLDER, plastic
	- - - - - -			-	mounting hardware for each: (not included w/holder)
-12	211-0040-00			1	SCREW, 4-40 x $\frac{1}{4}$ inch, BH plastic
-13	384-0542-00			2	ROD, capacitor mounting, plastic, $\frac{5}{16}$ x 1 inch
	- - - - - -			-	mounting hardware for each: (not included w/rod)
-14	211-0507-00			1	SCREW, 6-32 x $\frac{5}{16}$ inch, PHS
-15	385-0071-00			1	ROD, plastic, $\frac{5}{16}$ diameter x $\frac{15}{16}$ inch, w/pin
	- - - - - -			-	mounting hardware: (not included w/rod)
-16	211-0507-00			1	SCREW, 6-32 x $\frac{5}{16}$ inch, PHS
-17	343-0042-00			1	CLAMP, cable, plastic, $\frac{5}{16}$ inch
	- - - - - -			-	mounting hardware: (not included w/clamp)
-18	211-0507-00			1	SCREW, 6-32 x $\frac{5}{16}$ inch, PHS
-19	210-0803-00			1	WASHER, flat, 0.150 ID x $\frac{3}{8}$ inch OD
-20	210-0006-00			1	LOCKWASHER, internal, #6
-21	210-0407-00			1	NUT, hex., 6-32 x $\frac{1}{4}$ inch
-22	- - - - - -			1	RESISTOR
	- - - - - -			-	mounting hardware: (not included w/resistor)
-23	212-0037-00			1	SCREW, 8-32 x 1$\frac{3}{4}$ inches, Fil HS
-24	210-0808-00			1	WASHER, centering, 0.173 ID x $\frac{9}{16}$ inch OD
-25	210-0462-00			1	NUT, hex., $\frac{1}{2}$ x $\frac{23}{64}$ inch
-26	210-0205-00			1	LUG, solder, SE #8
-27	212-0004-00			1	SCREW, 8-32 x $\frac{5}{16}$ inch, PHS

FIG. 6 FOCUS & INTENSITY *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
6-28	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
-29	210-0046-00			1	LOCKWASHER internal, 1/4 ID x 0.400 inch OD
-30	210-0583-00			1	NUT, hex., 1/4-32 x 5/16 inch
-31	210-0201-00			5	LUG, solder, SE #4
	- - - - - -			-	mounting hardware for each: (not included w/lug)
-32	211-0033-00			1	SCREW, sems, 4-40 x 5/16 inch, PHS
-33	210-0406-00			1	NUT, hex., 4-40 x 3/16 inch
-34	210-0201-00			1	LUG, solder, SE #4
	- - - - - -			-	mounting hardware: (not included w/lug)
-35	211-0033-00			1	SCREW, sems, 4-40 x 5/16 inch, PHS
-36	210-0004-00			1	LOCKWASHER, internal, #4
-37	210-0406-00			1	NUT, hex., 4-40 x 3/16 inch
-38	343-0003-00			1	CLAMP, cable, plastic, 1/4 inch
	- - - - - -			-	mounting hardware: (not included w/clamp)
-39	211-0507-00			1	SCREW, 6-32 x 5/16 inch, PHS
-40	210-0803-00			1	WASHER, flat, 0.150 ID x 3/8 inch OD
-41	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
-42	210-0046-00			1	LOCKWASHER, internal, 1/4 ID x 0.400 inch OD
-43	210-0583-00			1	NUT, hex., 1/4-32 x 5/16 inch
-44	- - - - - -			1	CAPACITOR
	- - - - - -			-	mounting hardware: (not included w/capacitor)
-45	211-0510-00			2	SCREW, 6-32 x 3/8 inch, PHS
-46	210-0802-00			2	WASHER, flat, 0.150 ID x 5/16 inch OD
-47	210-0803-00			2	WASHER, flat, 0.150 ID x 3/8 inch OD
-48	210-0202-00			2	LUG, solder, SE #6
-49	210-0407-00			2	NUT, hex., 6-32 x 1/4 inch
-50	441-0260-00			1	CHASSIS
	- - - - - -			-	mounting hardware: (not included w/chassis)
	210-0804-00			1	WASHER, flat, 0.170 ID x 3/8 inch OD (not shown)
	212-0004-00			1	SCREW, 8-32 x 5/16 inch, PHS (not shown)
	211-0537-00			2	SCREW, 6-32 x 3/8 inch, THS (not shown)
-51	386-0916-00			1	PLATE, plastic, 1 15/16 x 1 5/8 inches
	- - - - - -			-	mounting hardware: (not included w/plate)
-52	211-0507-00			2	SCREW, 6-32 x 5/16 inch, PHS

FIG. 7 CRT SHIELD & VERTICAL OUTPUT BRACKET

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
7-1	337-0301-00			1	SHIELD, CRT, blue vinyl
	- - - - - -			-	mounting hardware: (not included w/shield)
	211-0559-00			6	SCREW, 6-32 x 3/8 inch, 100°, csk, FHS (not shown)
-2	210-0457-00			7	NUT, keps, 6-32 x 5/16 inch
-3	211-0513-00			1	SCREW, 6-32 x 5/8 inch, PHS
-4	210-0006-00			1	LOCKWASHER, internal, #6
-5	361-0060-00			1	SPACER, hex., 1/4 inch
-6	210-0935-00			2	WASHER, fiber, shouldered, 0.140 ID x 0.375 inch
-7	210-0803-00			1	WASHER, flat, 0.150 ID x 3/8 inch OD
	406-0239-00	5969	8999X	2	BRACKET, CRT spring ground (not shown)
-8	441-0512-00			1	CHASSIS, vertical output bracket
	- - - - - -			-	mounting hardware: (not included w/chassis)
	211-0507-00			3	SCREW, 6-32 x 5/16 inch, PHS
	210-0803-00			3	WASHER, flat, 0.150 ID x 3/8 inch OD
-9	124-0068-00	5969	8999	1	STRIP, felt, 1/8 x 5 3/4 inches
	124-0166-00	9000	12149	1	STRIP, CRT shield
	348-0070-01	12150		4	CUSHION, CRT sponge
-10	200-0112-00			1	COVER, CRT anode & plate
	- - - - - -			-	cover includes:
	200-0111-00			1	COVER, plastic, black
	386-0647-00			1	PLATE, plastic, black
-11	131-0086-00			1	ASSEMBLY, anode connector
	- - - - - -			-	assembly includes:
	131-0073-00			1	CONNECTOR, anode
	200-0110-00			1	CAP, CRT anode
-12	136-0001-00			2	SOCKET, graticule lamp
	- - - - - -			-	mounting hardware for each: (not included w/socket)
-13	211-0534-00			1	SCREW, sems, 6-32 x 5/16 inch, PHS
-14	210-0803-00			1	WASHER, flat, 0.150 ID x 3/8 inch OD
-15	210-0457-00			1	NUT, keps, 6-32 x 5/16 inch
-16	343-0001-00			2	CLAMP, cable, plastic, 1/8 inch
	- - - - - -			-	mounting hardware for each: (not included w/clamp)
	211-0507-00			1	SCREW, 6-32 x 5/16 inch, PHS (not shown)
-17	210-0803-00			1	WASHER, flat, 0.150 ID x 3/8 inch OD
-18	210-0457-00			1	NUT, keps, 6-32 x 5/16 inch
-19	- - - - - -			1	COIL
	- - - - - -			-	mounting hardware: (not included w/coil)
-20	214-0490-00			1	FASTENER, snap
-21	136-0076-00			1	SOCKET, CRT, 14 pin
	- - - - - -			-	socket includes:
-22	136-0117-00			1	SOCKET, CRT
	131-0178-00			8	CONNECTOR, CRT pin
-23	387-0393-00			1	PLATE, back
-24	213-0087-00			2	SCREW, thread cutting, 2-32 x 1/2 inch, RHS
-25	136-0072-00			2	SOCKET, tube, 9 pin, miniature
	- - - - - -			-	mounting hardware for each: (not included w/socket)
-26	214-0034-00			2	BOLT, spade, 4-40 x 5/16 inch
-27	210-0801-00			2	WASHER, flat, 9/64 ID x 9/32 inch OD
-28	210-0004-00			4	LOCKWASHER, internal, #4
-29	210-0406-00			2	NUT, hex., 4-40 x 3/16 inch

FIG. 7 CRT SHIELD & VERTICAL OUTPUT BRACKET *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
7-30	344-0013-00			2	CLIP, spring tube
-31	354-0103-00			1	ASSEMBLY, ring clamping
	- - - - - -			-	assembly includes:
-32	210-0502-00			1	NUT, round, 10-32 internal thread
-33	211-0560-00			1	SCREW, 6-32 x 1 inch, RHS
-34	210-0407-00			1	NUT, hex., 6-32 x 1/4 inch
-35	432-0022-00	5969	14149	1	BASE, rotator
	432-0022-02	14150		1	BASE, rotator
	- - - - - -			-	mounting hardware: (not included w/base)
-36	211-0561-00			2	SCREW, 6-32 x 3/8 inch, hex. socket FH cap
-37	210-0503-00			1	NUT, 21/32 x 2 1/2 inches
	386-1485-00	X14150		1	PLATE, retaining
	- - - - - -			-	mounting hardware: (not included w/plate)
	211-0022-00			1	SCREW, 2-56 x 3/16 inch, PHS
-38	354-0178-00			1	RING, securing
-39	355-0049-00			1	STUD, 10-32 x 3 1/4 x 3/16 inches
-40	366-0032-00			1	KNOB, red
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
-41	131-0049-00			4	CONNECTOR, cable end, CRT
-42	175-0587-00			1	WIRE, CRT lead, red stripe
	- - - - - -			-	wire includes:
	131-0049-00			1	CONNECTOR, cable end, CRT
	175-0588-00			1	WIRE, CRT lead, orange stripe
	- - - - - -			-	wire includes:
	131-0049-00			1	CONNECTOR, cable end, CRT
	175-0591-00			1	WIRE, CRT lead, green stripe
	- - - - - -			-	wire includes:
	131-0049-00			1	CONNECTOR, cable end, CRT
-43	134-0031-00			1	PLUG, CRT contact
-44	210-0914-00			1	WASHER, wavy, 0.320 ID x 0.492 inch OD

FIG. 8 DELAY SWEEP

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
8-1	136-0010-00			1	SOCKET, tube, 7 pin, w/shield
	- - - - - -			-	mounting hardware: (not included w/socket)
-2	211-0033-00			2	SCREW, sems, 4-40 x $^5/_{16}$ inch, PHS
-3	210-0004-00			1	LOCKWASHER, internal, #4
-4	210-0201-00			1	LUG, solder, SE #4
-5	210-0406-00			2	NUT, hex., 4-40 x $^3/_{16}$ inch
-6	136-0015-00			9	SOCKET, tube, 9 pin, w/ground lugs
	- - - - - -			-	mounting hardware for each: (not included w/socket)
-7	213-0044-00			2	SCREW, thread forming, 5-32 x $^3/_{16}$ inch, PHS
-8	136-0044-00			1	SOCKET, tube, 7 pin, w/ground lugs
	- - - - - -			-	mounting hardware: (not included w/socket)
-9	213-0044-00			2	SCREW, thread forming, 5-32 x $^3/_{16}$ inch, PHS
-10	136-0008-00			3	SOCKET, tube, 7 pin, w/ground lugs
	- - - - - -			-	mounting hardware for each: (not included w/socket)
-11	213-0044-00			2	SCREW, thread forming, 5-32 x $^3/_{16}$ inch, PHS
-12	214-0008-00			1	BOLT, captive, $^3/_8$ OD x 1$^{13}/_{32}$ inch
	- - - - - -			-	mounting hardware: (not included w/bolt)
-13	210-0812-00			1	WASHER, fiber, 0.190 ID x 0.380 inch OD
-14	354-0048-00			1	RING, securing
-15	343-0001-00			3	CLAMP, cable, plastic, $^1/_8$ inch
	- - - - - -			-	mounting hardware for each: (not included w/clamp)
-16	211-0510-00			1	SCREW, 6-32 x $^3/_8$ inch, PHS
-17	210-0803-00			1	WASHER, flat, 0.150 ID x $^3/_8$ inch OD
-18	210-0006-00			1	LOCKWASHER, internal, #6
-19	210-0407-00			1	NUT, hex., 6-32 x $^1/_4$ inch
-20	- - - - - -			3	RESISTOR, variable
	- - - - - -			-	mounting hardware for each: (not included w/resistor)
-21	210-0840-00			1	WASHER, flat, 0.390 ID x $^9/_{16}$ inch OD
-22	210-0413-00			1	NUT, hex., $^3/_8$-32 x $^1/_2$ inch
-23	210-0201-00			1	LUG, solder, SE #4
	- - - - - -			-	mounting hardware: (not included w/lug)
-24	213-0044-00			1	SCREW, thread forming, 5-32 x $^3/_{16}$ inch, PHS
-25	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
-26	210-0046-00			1	LOCKWASHER, internal, $^1/_4$ ID x 0.400 inch OD
-27	210-0583-00			1	NUT, hex., $^1/_4$-32 x $^5/_{16}$ inch

FIG. 8 DELAY SWEEP *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
8-28	210-0203-00			1	LUG, solder, SE #6 long
	- - - - - -			-	mounting hardware: (not included w/lug)
-29	211-0504-00			1	SCREW, 6-32 x 1/4 inch, PHS
-30	210-0407-00			1	NUT, hex., 6-32 x 1/4 inch
-31	348-0002-00			1	GROMMET, rubber, 1/4 inch
-32	348-0003-00			1	GROMMET, rubber, 5/16 inch
-33	348-0004-00			2	GROMMET, rubber, 3/8 inch
-34	337-0006-00			1	SHIELD, 7/8 ID x 1 3/8 inch, w/spring
-35	441-0253-00			1	CHASSIS, delay sweep
	- - - - - -			-	mounting hardware: (not included w/chassis)
-36	211-0529-00			2	SCREW, 6-32 x 1 1/4 inches, PHS
-37	166-0143-00			2	TUBE, spacer, 3/8 OD x 13/16 inch long
-38	381-0063-00			1	BAR, support
	- - - - - -			-	mounting hardware: (not included w/bar)
-39	210-0821-00			2	WASHER, 0.250 ID x 0.500 inch OD
-40	381-0064-00			1	BAR, support
	- - - - - -			-	mounting hardware: (not included w/bar)
	212-0008-00	5969	10099	2	SCREW, 8-32 x 1/2 inch, PHS (not shown)
	212-0008-00	10100		1	SCREW, 8-32 x 1/2 inch, PHS
	212-0023-00	10100		1	SCREW, 8-32 x 3/8 inch, PHS
-41	386-0921-00			1	PLATE, air deflection
	- - - - - -			-	mounting hardware: (not included w/plate)
-42	211-0511-00			1	SCREW, 6-32 x 1/2 inch, PHS
-43	211-0512-00			1	SCREW, 6-32 x 1/2 inch, 100° csk, FHS
-44	343-0005-00			2	CLAMP, cable, plastic, 7/16 inch
	- - - - - -			-	mounting hardware for each: (not included w/clamp)
-45	211-0511-00			1	SCREW, 6-32 x 1/2 inch, PHS
-46	210-0803-00			1	WASHER, flat, 0.150 ID x 3/8 inch OD
-47	105-0014-00			1	STOP, hex., 1/4 diameter x 3/4 inch long

FIG. 9 CABLE HARNESS & CERAMIC STRIPS

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
9-1	179-0734-00	5969	12499	1	CABLE HARNESS, sweep
	179-0734-01	12500	13479	1	CABLE HARNESS, sweep
	179-0734-02	13480		1	CABLE HARNESS, sweep
-2	124-0088-00			12	STRIP, ceramic, $\frac{3}{4}$ inch h, w/4 notches
	- - - - - -			-	each strip includes:
	355-0046-00			2	STUD, plastic
	- - - - - -			-	mounting hardware for each: (not included w/strip)
	361-0009-00			2	SPACER, plastic, 0.406 inch long
-3	124-0089-00			15	STRIP, ceramic, $\frac{3}{4}$ inch h, w/7 notches
	- - - - - -			-	each strip includes:
	355-0046-00			2	STUD, plastic
	- - - - - -			-	mounting hardware for each: (not included w/strip)
	361-0009-00			2	SPACER, plastic, 0.406 inch long
-4	124-0090-00			15	STRIP, ceramic, $\frac{3}{4}$ inch h, w/9 notches
	- - - - - -			-	each strip includes:
	355-0046-00			2	STUD, plastic
	- - - - - -			-	mounting hardware: (not included w/strip)
	361-0009-00			2	SPACER, plastic, 0.406 inch long
-5	124-0091-00			28	STRIP, ceramic, $\frac{3}{4}$ inch h, w/11 notches
	- - - - - -			-	each strip includes:
	355-0046-00			2	STUD, plastic
	- - - - - -			-	mounting hardware for each: (not included w/strip)
	361-0009-00			2	SPACER, plastic, 0.406 inch long
-6	124-0100-00			11	STRIP, ceramic, $\frac{3}{4}$ inch h, w/1 notch
	- - - - - -			-	each strip includes:
	355-0046-00			1	STUD, plastic
	- - - - - -			-	mounting hardware for each: (not included w/strip)
	361-0007-00			1	SPACER, plastic, 0.188 inch long
-7	179-0731-00			1	CABLE HARNESS, vertical amplifier
-8	124-0146-00			1	STRIP, ceramic, $\frac{7}{16}$ inch h, w/16 notches
	- - - - - -			-	strip includes:
	355-0046-00			2	STUD, plastic
	- - - - - -			-	mounting hardware: (not included w/strip)
	361-0009-00			2	SPACER, plastic, 0.406 inch long
-9	124-0148-00			1	STRIP, ceramic, $\frac{7}{16}$ inch h, w/9 notches
	- - - - - -			-	strip includes:
	355-0046-00			2	STUD, plastic
	- - - - - -			-	mounting hardware: (not included w/strip)
	361-0007-00			2	SPACER, plastic, 0.188 inch long

FIG. 9 CABLE HARNESS & CERAMIC STRIPS *(cont)*

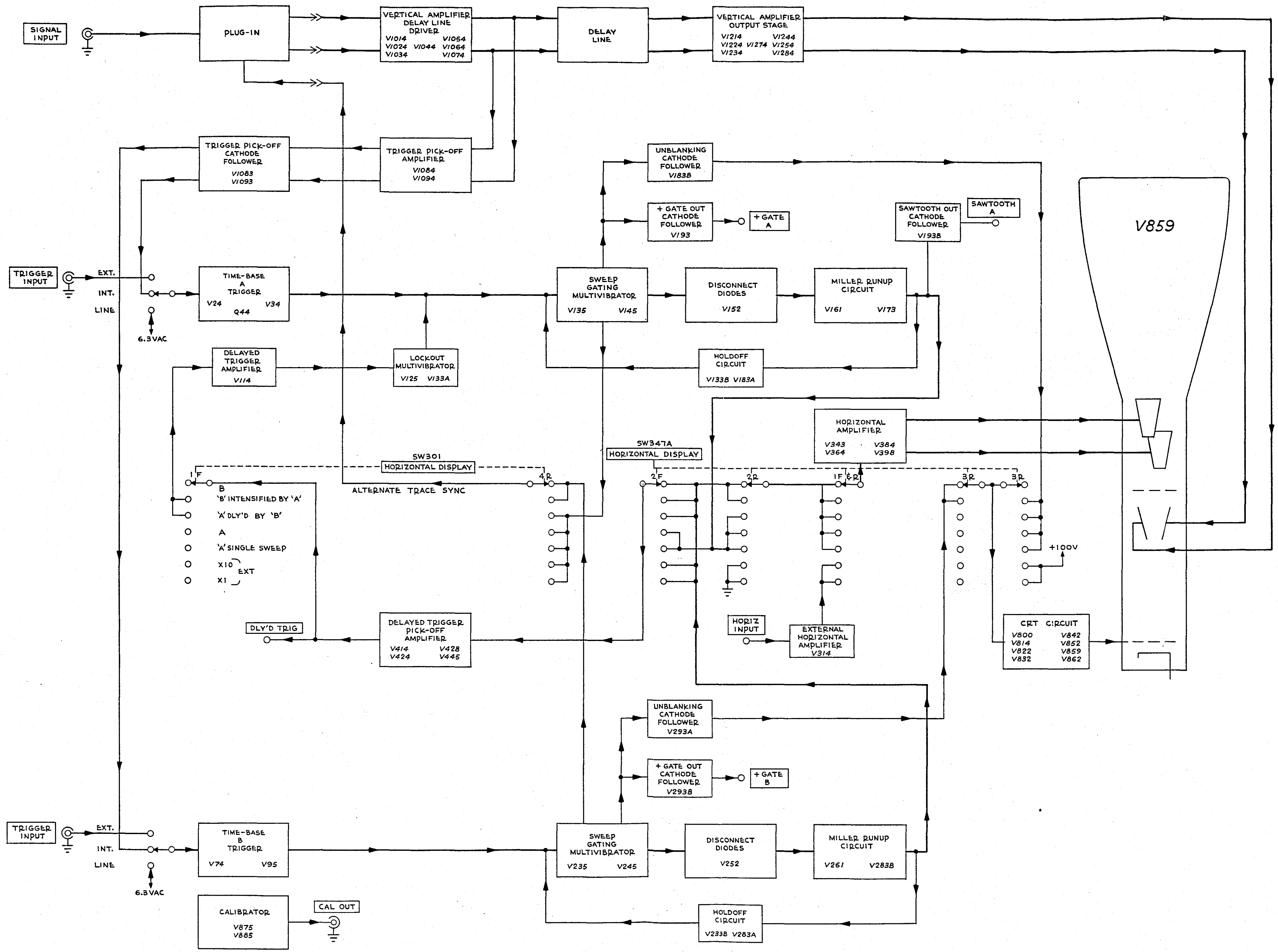
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
9-10	124-0086-00			1	STRIP, ceramic, 3/4 inch h, w/2 notches
	- - - - - -			-	strip includes:
	355-0046-00			1	STUD, plastic
	- - - - - -			-	mounting hardware: (not included w/strip)
	361-0009-00			1	SPACER, plastic, 0.406 inch long
-11	124-0087-00			1	STRIP, ceramic, 3/4 inch h, w/3 notches
	- - - - - -			-	strip includes:
	355-0046-00			1	STUD, plastic
	- - - - - -			-	mounting hardware: (not included w/strip)
	361-0009-00			1	SPACER, plastic, 0.406 inch long
-12	179-0729-00			1	CABLE HARNESS, focus & intensity, #1
-13	179-0730-00			1	CABLE HARNESS, focus & intensity, #2
-14	179-0728-00	5969	9249	1	CABLE HARNESS, rectifier
	179-0946-00	9250		1	CABLE HARNESS, rectifier
	- - - - - -			-	cable harness includes:
	348-0006-00	5969	10879X	1	GROMMET, rubber, 3/4 inch (not shown)
-15	179-0305-00			1	CABLE HARNESS, 110 volt
-16	179-0315-00	5969	13779	1	CABLE HARNESS, power #1
	179-0315-01	13780		1	CABLE HARNESS, power #1
-17	179-0324-00			1	CABLE HARNESS, power #2
-18	179-0306-00			1	CABLE HARNESS, 110 volt
-19	179-0434-00			1	CABLE HARNESS, delay sweep

FIG. 10 CABINET & RAILS

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
10-1	387-0077-00			1	PLATE, cabinet side, left, blue vinyl
	- - - - - -			-	plate includes:
	214-0057-00			2	ASSEMBLY, fastener, cabinet latch
-2	134-0028-00			1	PLUG
-3	387-0076-00			1	PLATE, cabinet side, right, blue vinyl
	- - - - - -			-	plate includes:
	214-0057-00			2	ASSEMBLY, fastener, cabinet latch
-4	200-0216-00			1	COVER, blue vinyl
	- - - - - -			-	mounting hardware: (not included w/cover)
-5	384-0538-00			1	ROD, hinge, $^3/_{32} \times 4^7/_8$ inches
-6	214-0061-00			1	SPRING
-7	354-0165-00			1	RING, retaining
-8	214-0234-00			1	SPRING, clip
	- - - - - -			-	mounting hardware: (not included w/spring)
-9	211-0008-00			1	SCREW, 4-40 x $^1/_4$ inch, PHS
-10	210-0004-00			1	LOCKWASHER, internal, #4
-11	210-0406-00			1	NUT, hex., 4-40 x $^3/_{16}$ inch
-12	387-0478-00			1	PLATE, cabinet bottom, blue vinyl
	- - - - - -			-	plate includes:
-13	214-0057-00			4	ASSEMBLY, fastener, cabinet latch
	- - - - - -			-	each assembly includes:
-14	213-0033-00			1	SCREW, fastening, 8-32 x $^1/_2$ inch
-15	210-0847-00			1	WASHER, plastic, 0.164 ID x 0.500 inch OD
-16	105-0007-00			1	STOP
-17	210-0480-00			1	NUT, latch, plastic
-18	381-0208-00			1	BAR, extruded, $20^7/_{16}$ inch
	- - - - - -			-	bar includes:
-19	367-0011-00			2	HANDLE, $5^1/_2$ inches, blue vinyl
-20	343-0073-00			4	CLAMP, cover, chrome
	- - - - - -			-	mounting hardware: (not included w/bar)
	381-0073-00			1	BAR, $^3/_{16} \times ^1/_2 \times 1^3/_4$ inches (not shown)
-21	212-0039-00			4	SCREW, 8-32 x $^3/_8$ inch, THS
-22	122-0059-00			1	ANGLE, frame, top left, $20^7/_{16}$ inches
	- - - - - -			-	mounting hardware: (not included w/angle)
-23	211-0559-00			4	SCREW, 6-32 x $^3/_8$ inch, 100° csk, FHS
	210-0457-00			4	NUT, keps, 6-32 x $^5/_{16}$ inch (not shown)

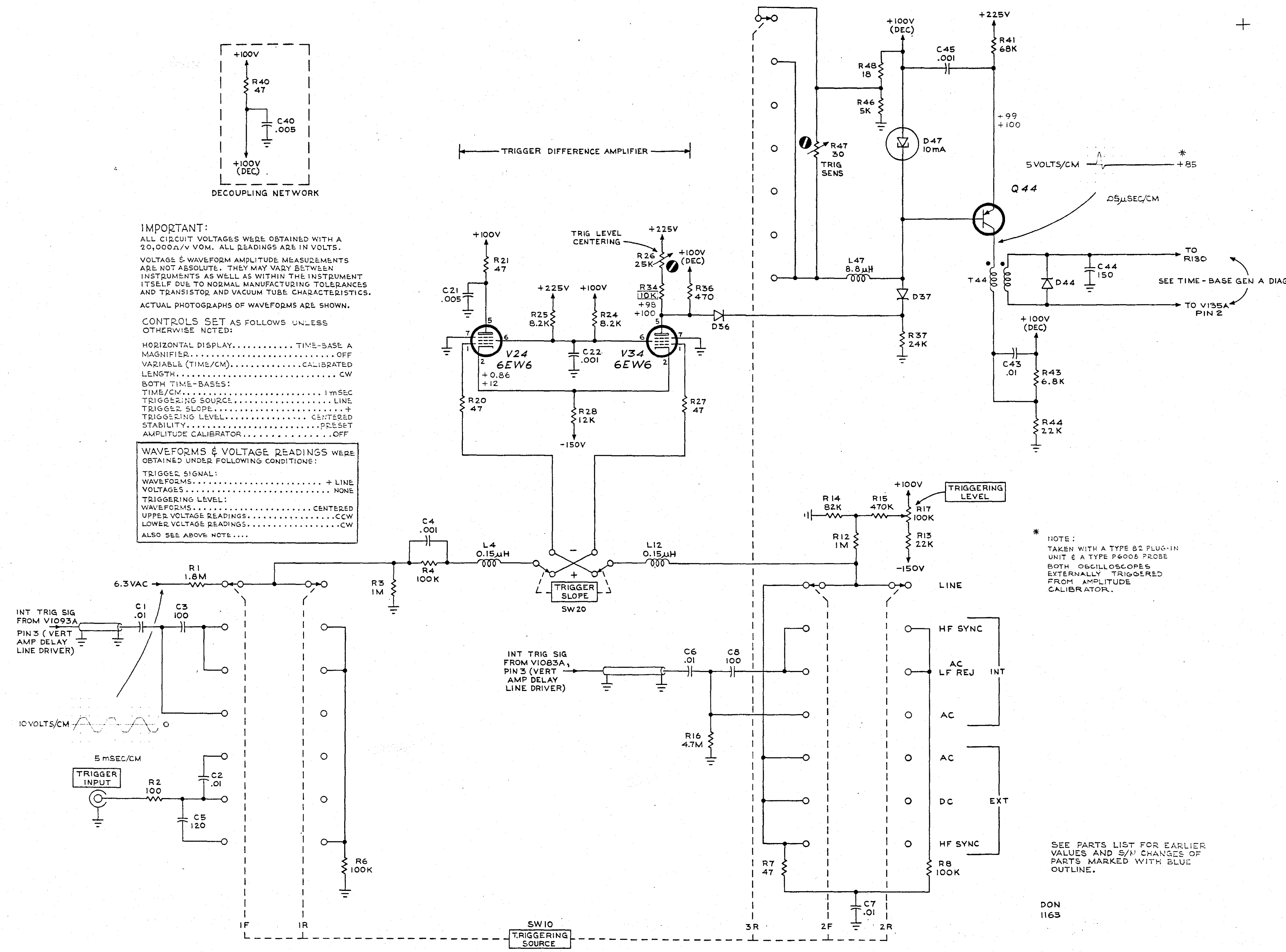
FIG. 10 CABINET & RAILS *(cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
10-24	122-0104-00	5969	11939	1	ANGLE, frame, bottom right, 20 7/16 inches, blue vinyl
	122-0138-00	11940		1	ANGLE, frame, bottom
	- - - - - -			-	mounting hardware: (not included w/angle)
-25	212-0039-00			4	SCREW, 8-32 x 3/8 inch, THS
	210-0458-00			4	NUT, keps, 8-32 x 11/32 inch (not shown)
-26	122-0105-00	5969	11939	1	ANGLE, frame, bottom left, 20 7/16 inches, blue vinyl
	122-0138-00	11940		1	ANGLE, frame, bottom
	- - - - - -			-	mounting hardware: (not included w/angle)
-27	212-0039-00			4	SCREW, 8-32 x 3/8 inch, THS
	210-0458-00			4	NUT, keps, 8-32 x 11/32 inch (not shown)



A

TR
663
BLOCK DIAGRAM



IMPORTANT:
ALL CIRCUIT VOLTAGES WERE OBTAINED WITH A 20,000Ω/V VOM. ALL READINGS ARE IN VOLTS.

VOLTAGE & WAVEFORM AMPLITUDE MEASUREMENTS ARE NOT ABSOLUTE. THEY MAY VARY BETWEEN INSTRUMENTS AS WELL AS WITHIN THE INSTRUMENT ITSELF DUE TO NORMAL MANUFACTURING TOLERANCES AND TRANSISTOR AND VACUUM TUBE CHARACTERISTICS.

ACTUAL PHOTOGRAPHS OF WAVEFORMS ARE SHOWN.

CONTROLS SET AS FOLLOWS UNLESS OTHERWISE NOTED:

HORIZONTAL DISPLAY............TIME-BASE A
MAGNIFIER..............................OFF
VARIABLE (TIME/CM)..............CALIBRATED
LENGTH....................................CW
BOTH TIME-BASES:
TIME/CM...............................1mSEC
TRIGGERING SOURCE.......................LINE
TRIGGER SLOPE.................................+
TRIGGERING LEVEL..................CENTERED
STABILITY..................................PRESET
AMPLITUDE CALIBRATOR...................OFF

WAVEFORMS & VOLTAGE READINGS WERE OBTAINED UNDER FOLLOWING CONDITIONS:

TRIGGER SIGNAL:
WAVEFORMS................................+ LINE
VOLTAGES......................................NONE
TRIGGERING LEVEL:
WAVEFORMS..............................CENTERED
UPPER VOLTAGE READINGS..................CCW
LOWER VOLTAGE READINGS....................CW
ALSO SEE ABOVE NOTE....

* NOTE:
TAKEN WITH A TYPE 82 PLUG-IN UNIT & A TYPE P6006 PROBE
BOTH OSCILLOSCOPES EXTERNALLY TRIGGERED FROM AMPLITUDE CALIBRATOR.

SEE PARTS LIST FOR EARLIER VALUES AND S/N CHANGES OF PARTS MARKED WITH BLUE OUTLINE.

DON
1163

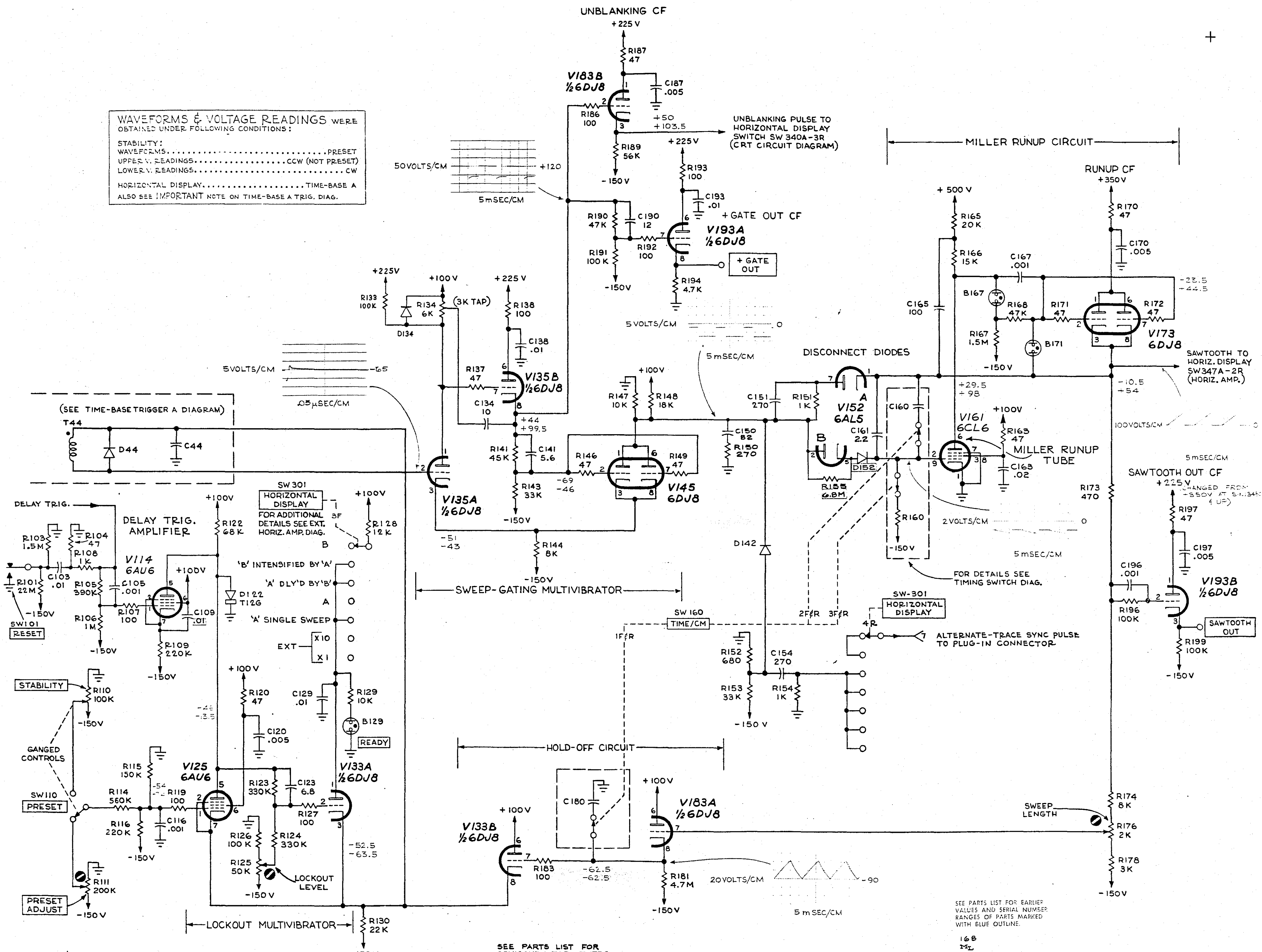
TYPE 585A OSCILLOSCOPE

B1

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

TIME BASE A TRIGGER

CIRCUIT NUMBERS
1 THRU 49



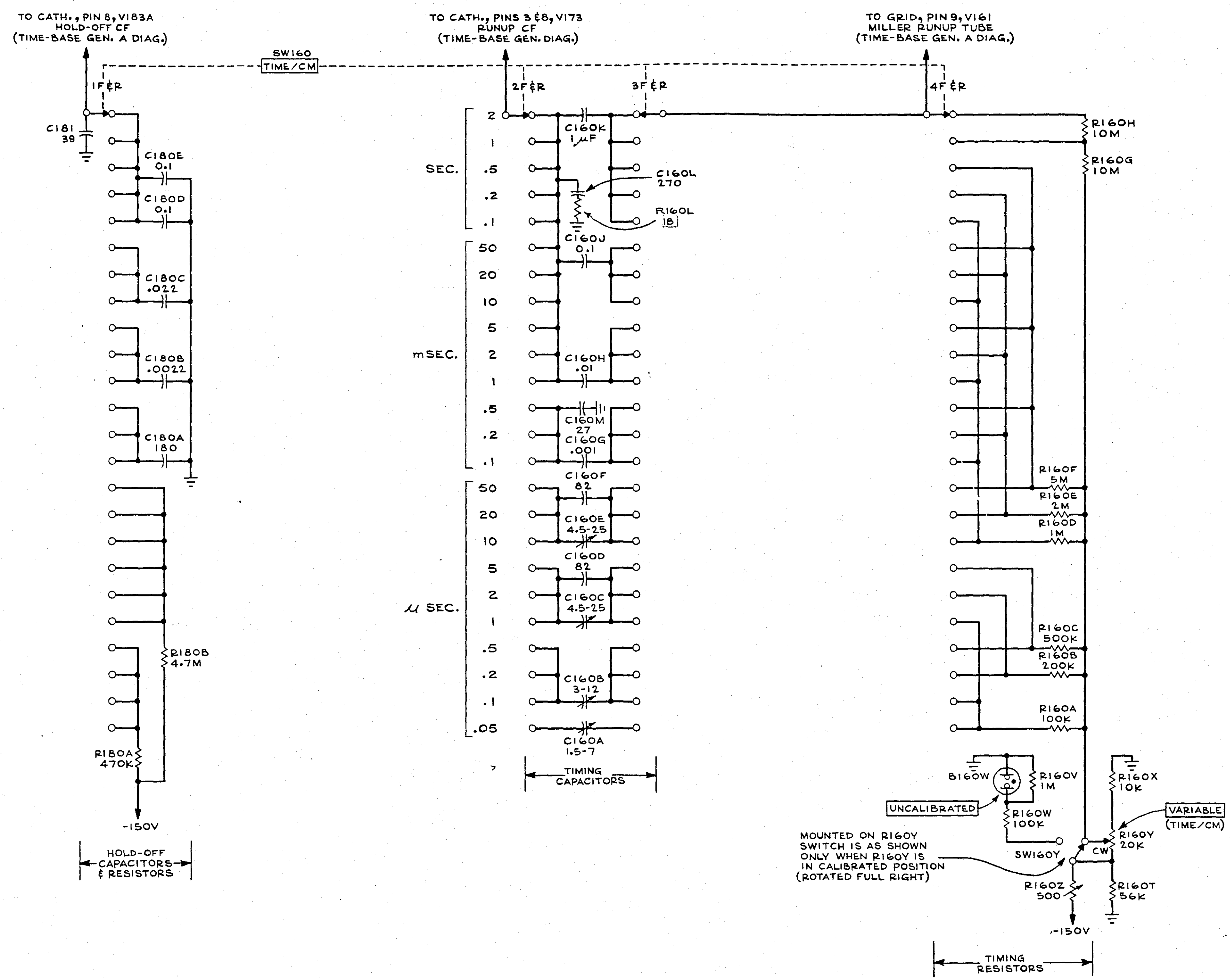
TYPE 585A OSCILLOSCOPE

E

TIME-BASE GENERATOR A

CIRCUIT NUMBERS 100 THRU 199

TIME-BASE GENERATOR A



TYPE 585A OSCILLOSCOPE

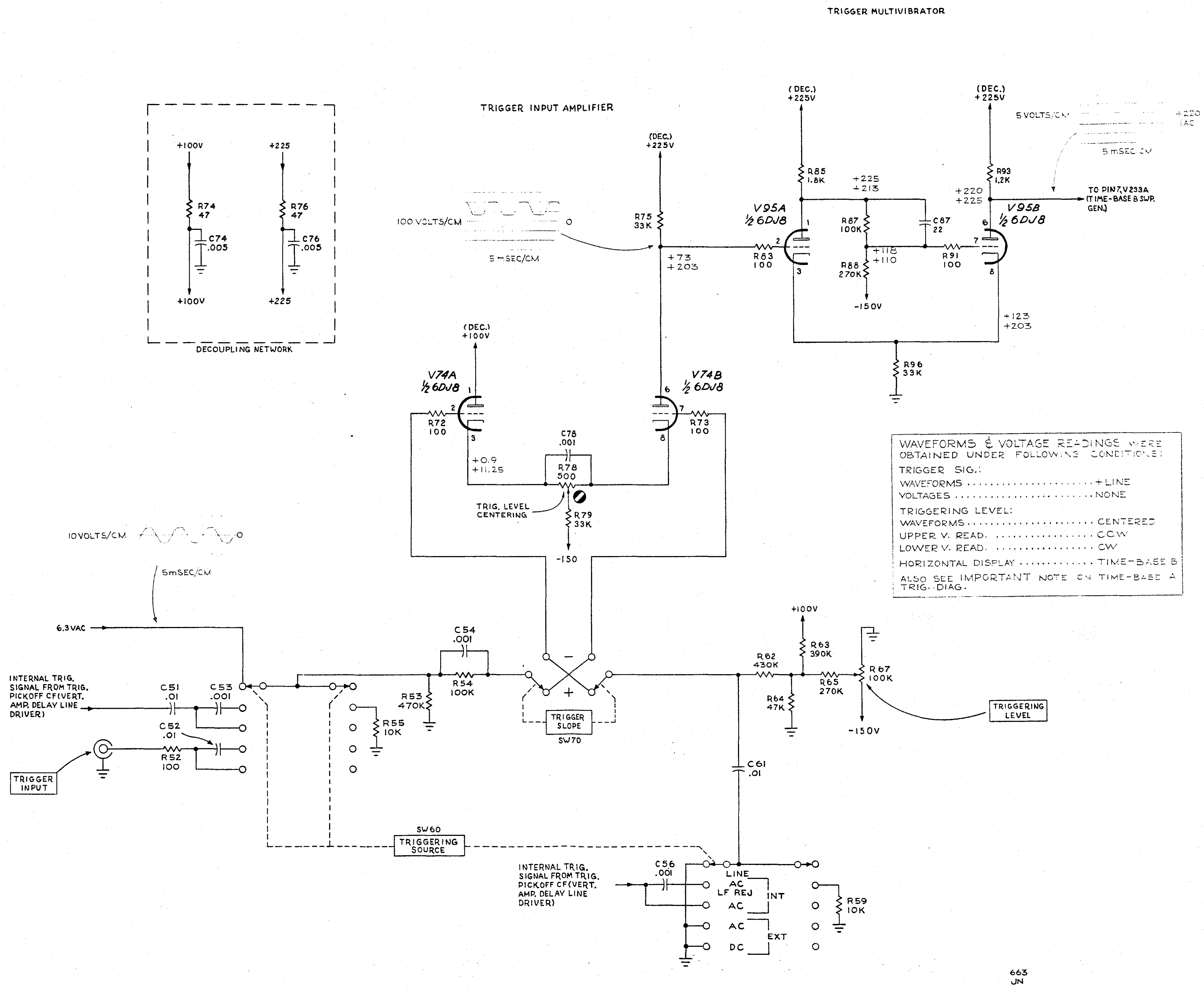
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE.

TIME-BASE A TIMING SWITCH

1166
TP

B

TIME-BASE A TIMING SWITCH



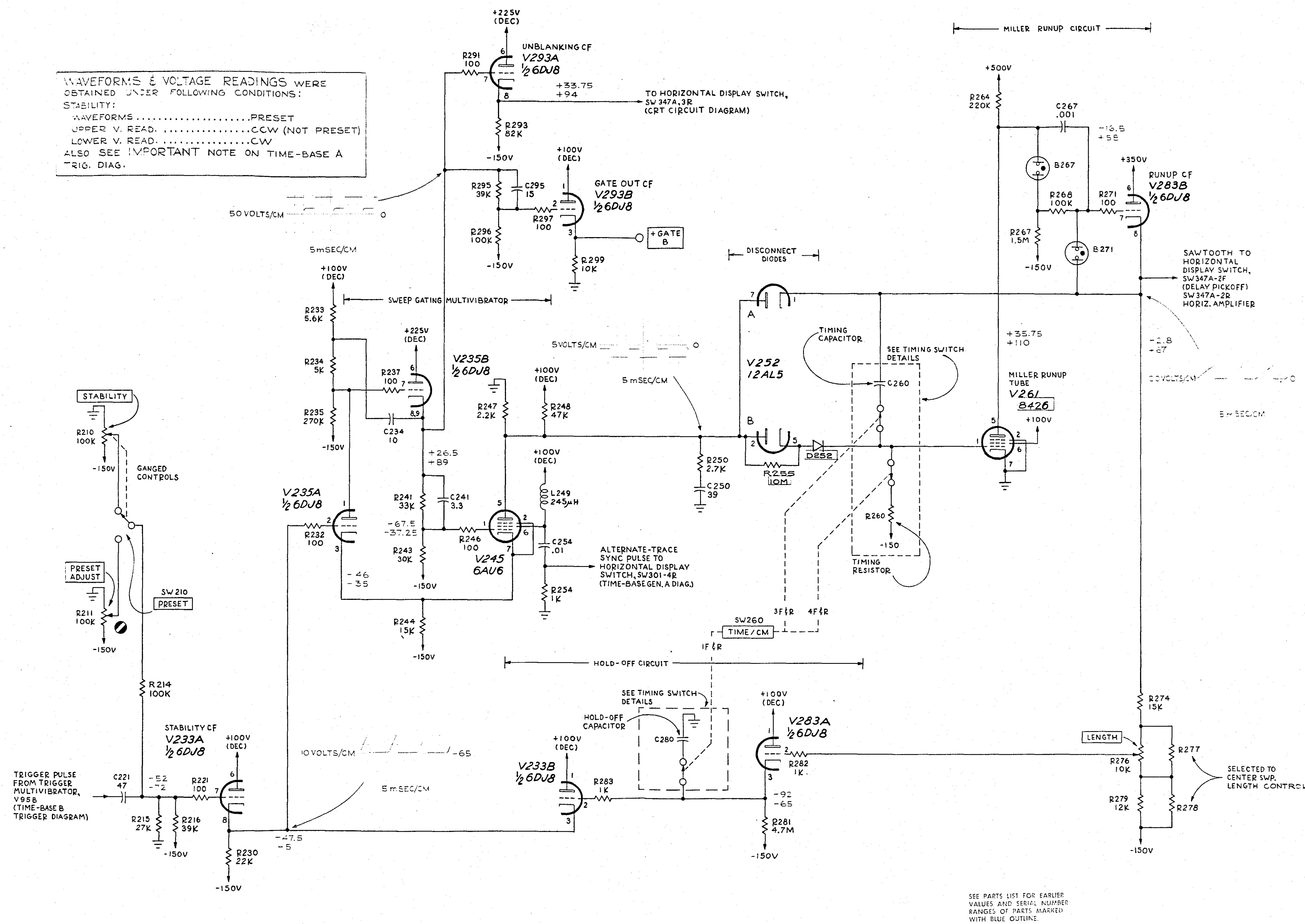
663
JN

TYPE 585A OSCILLOSCOPE

A

TIME-BASE B TRIGGER

CIRCUIT NUMBERS 50 THRU 99



JN 1266

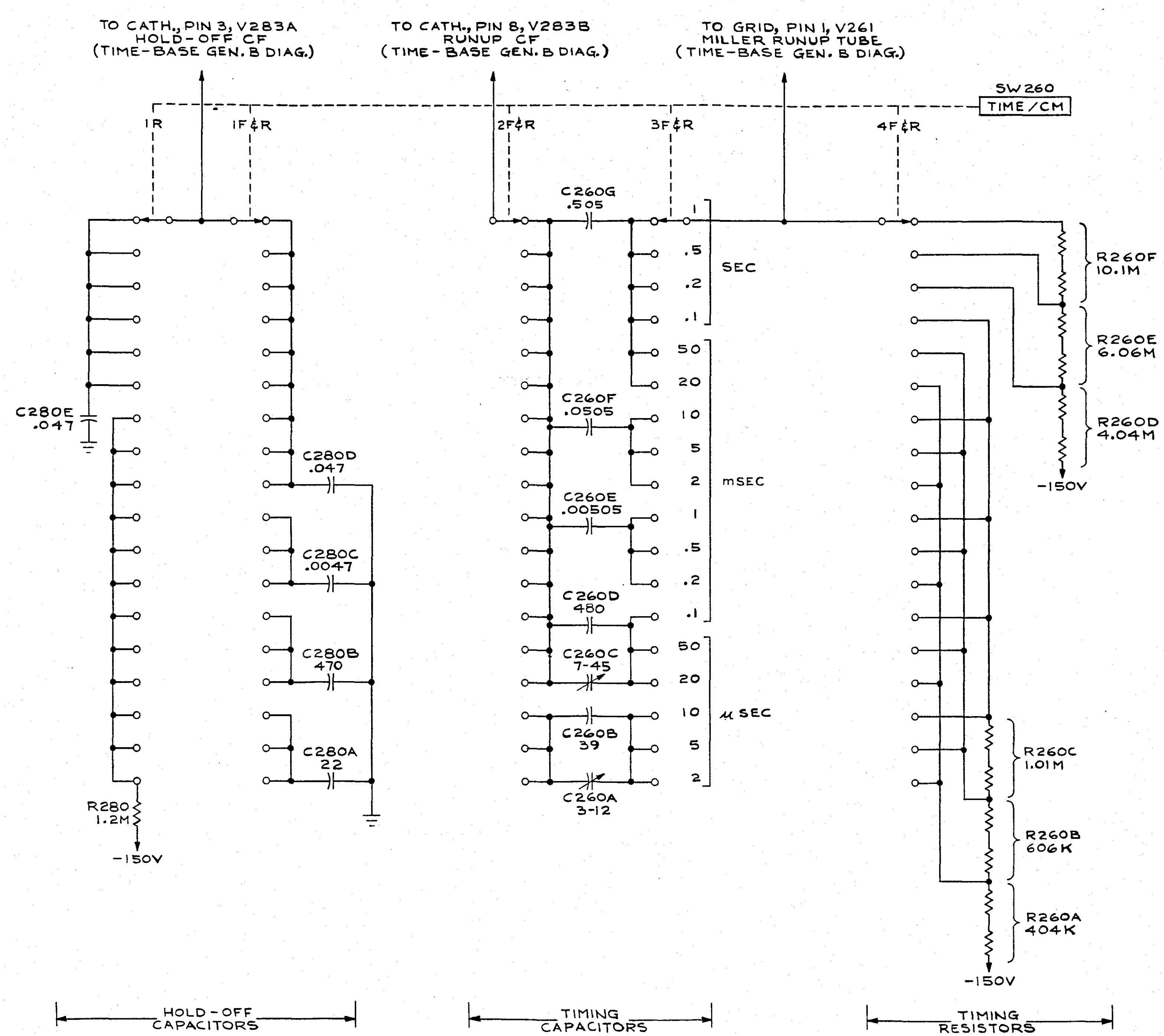
TIME-BASE B GENERATOR

CIRCUIT NUMBERS 210 THRU 299

TYPE 585A OSCILLOSCOPE

C

TIME-BASE GENERATOR B



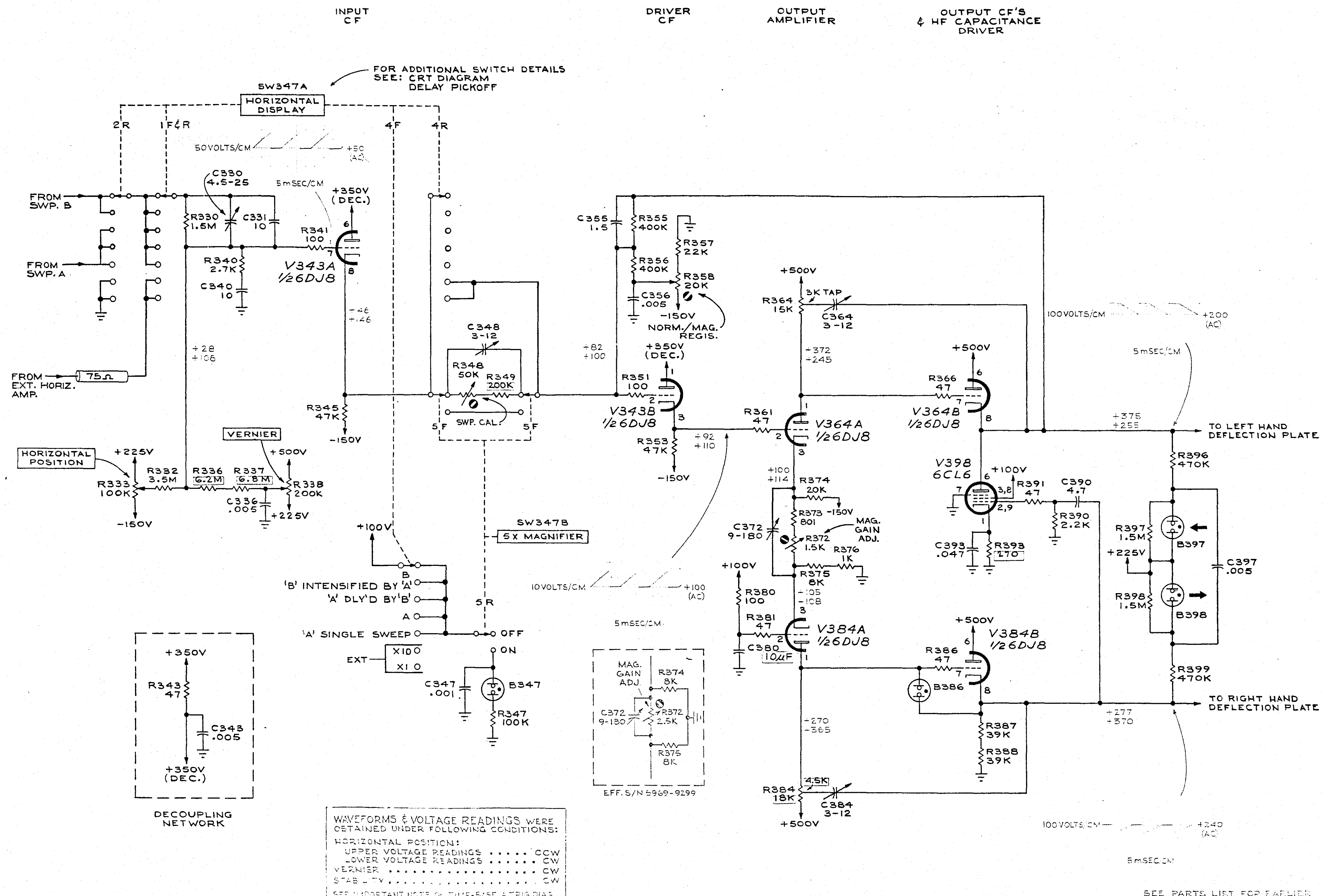
MRH
663

TYPE 585A OSCILLOSCOPE

TIME-BASE B TIMING SWITCH

A

TIME-BASE B TIMING SWITCH



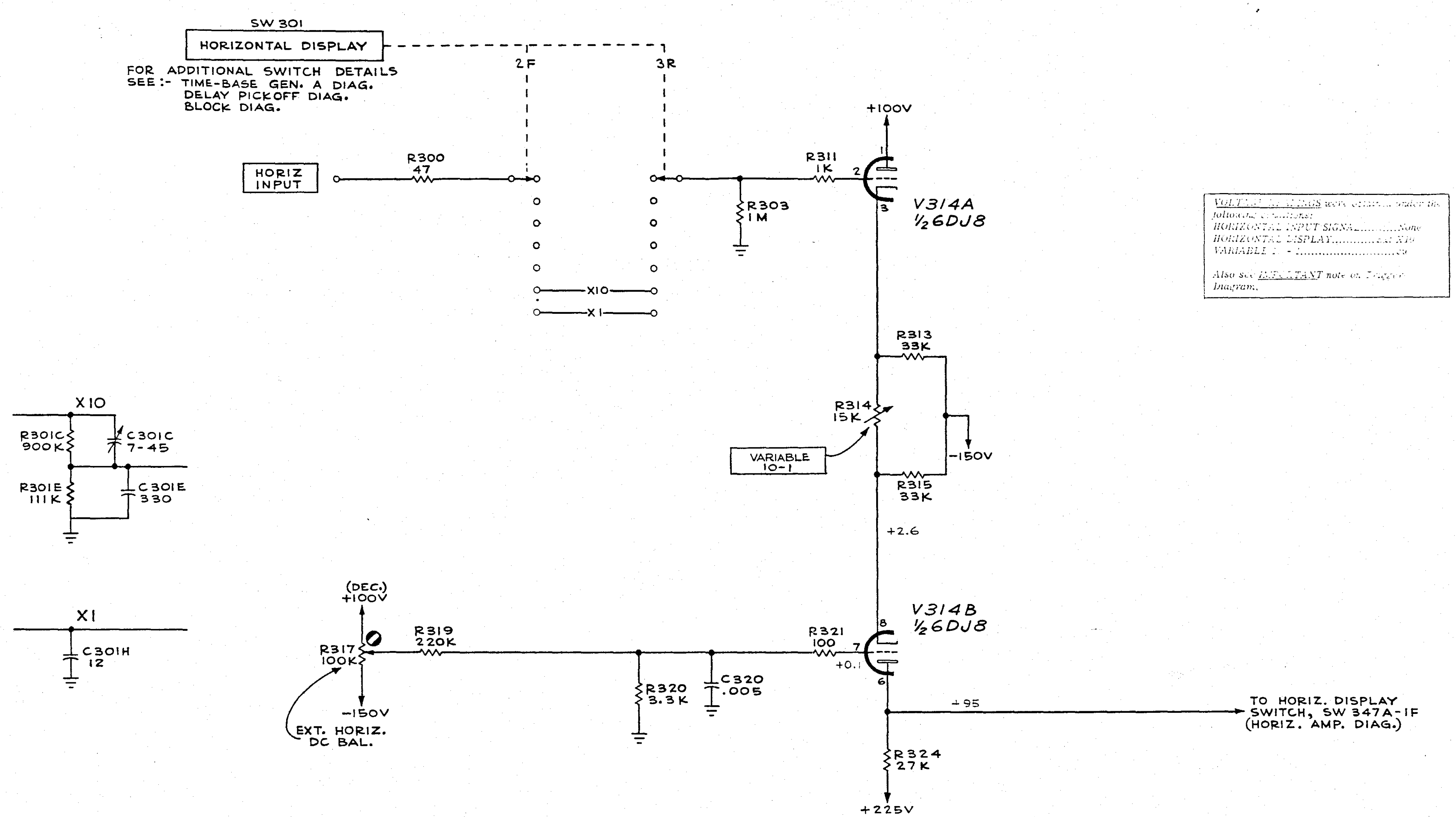
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE.

TYPE 585A OSCILLOSCOPE

469

HORIZONTAL AMPLIFIER

CIRCUIT NUMBERS 330 THRU 399



TYPE 585A OSCILLOSCOPE

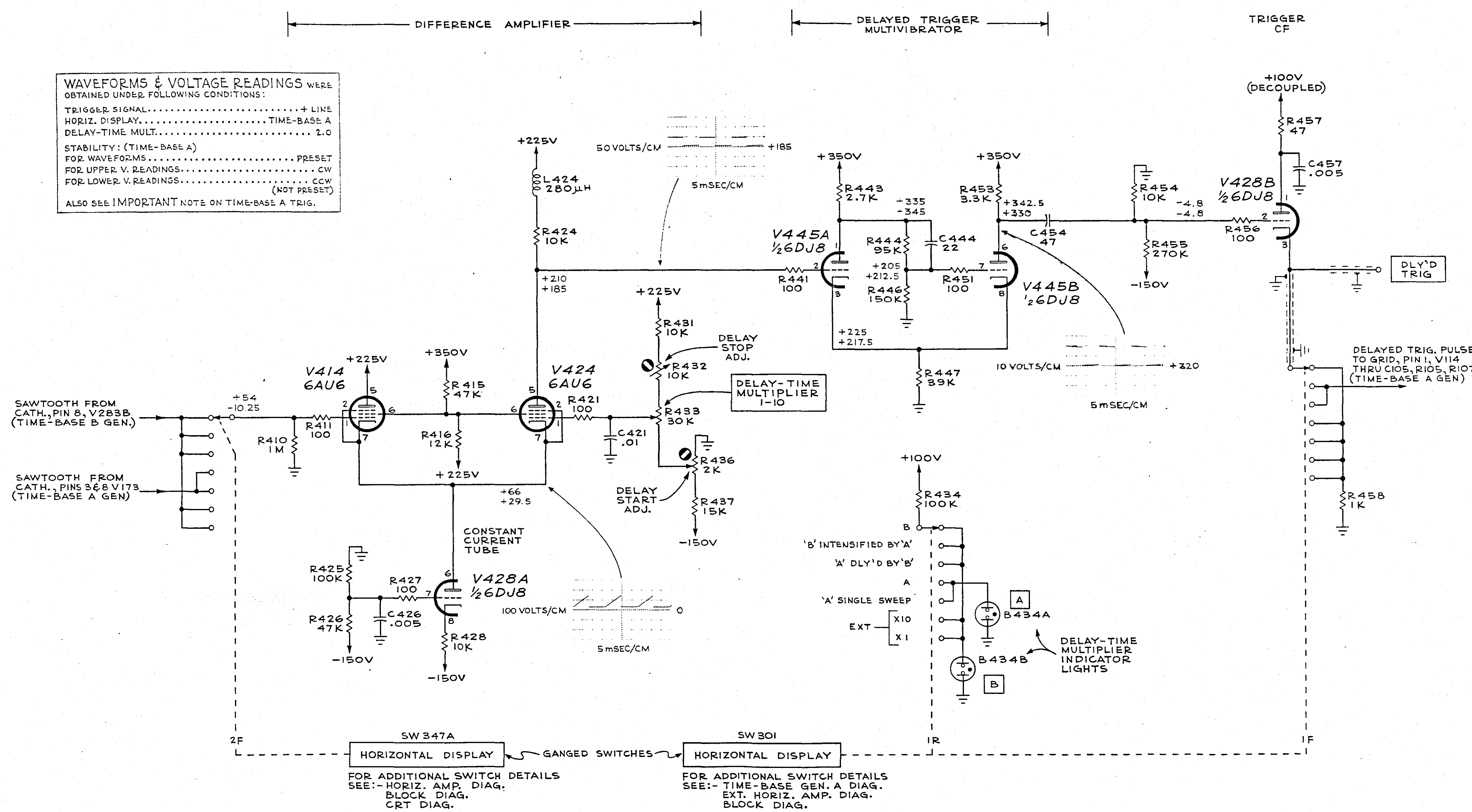
A1

EXTERNAL HORIZONTAL AMPLIFIER

CIRCUIT NUMBERS
300 THRU 325

GAB
663

EXT. HORIZ. AMP.



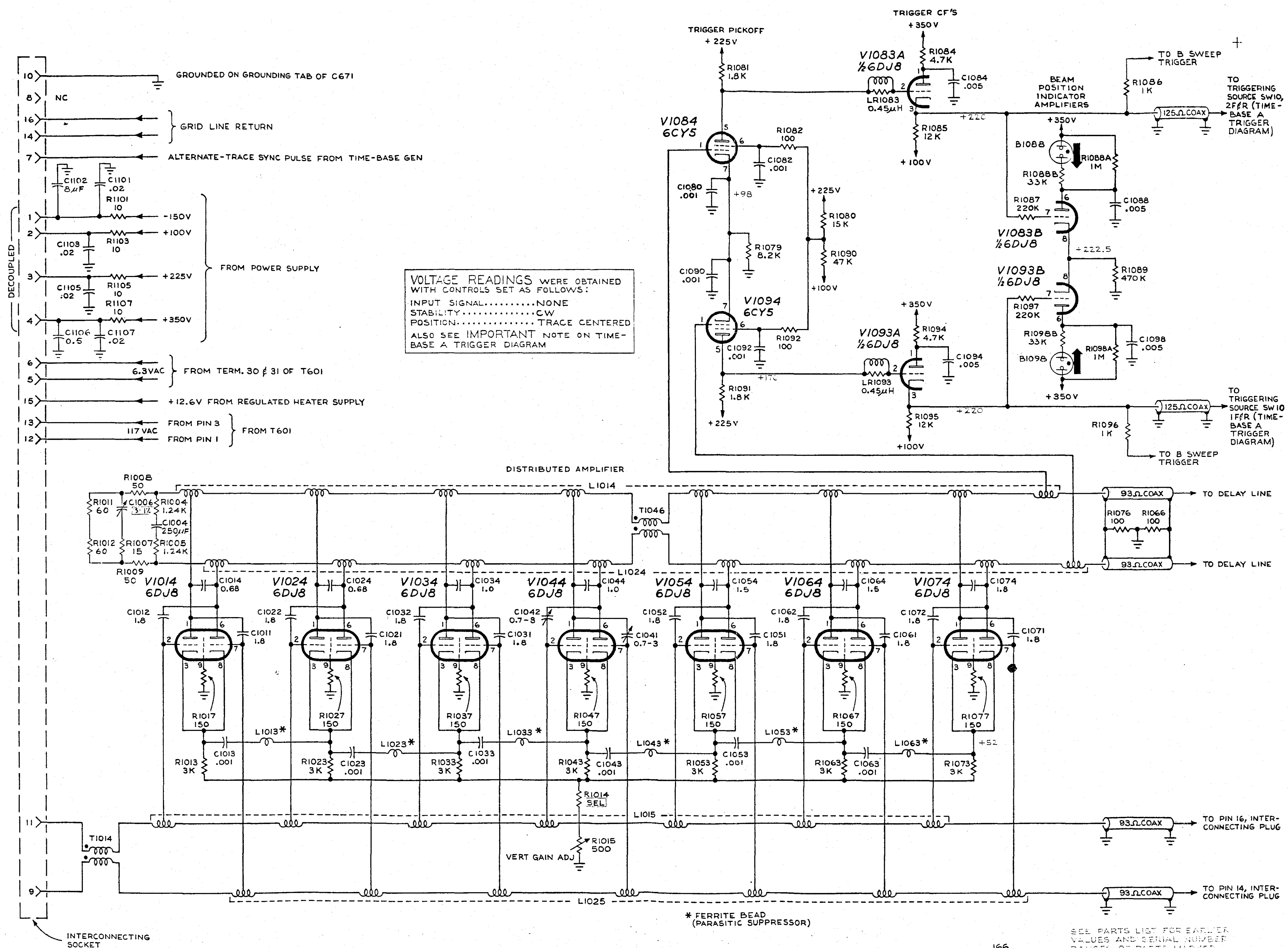
GAB
663

TYPE 585A OSCILLOSCOPE

A1

DELAY PICKOFF

CIRCUIT NUMBERS 410 THRU 459



SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE.

166

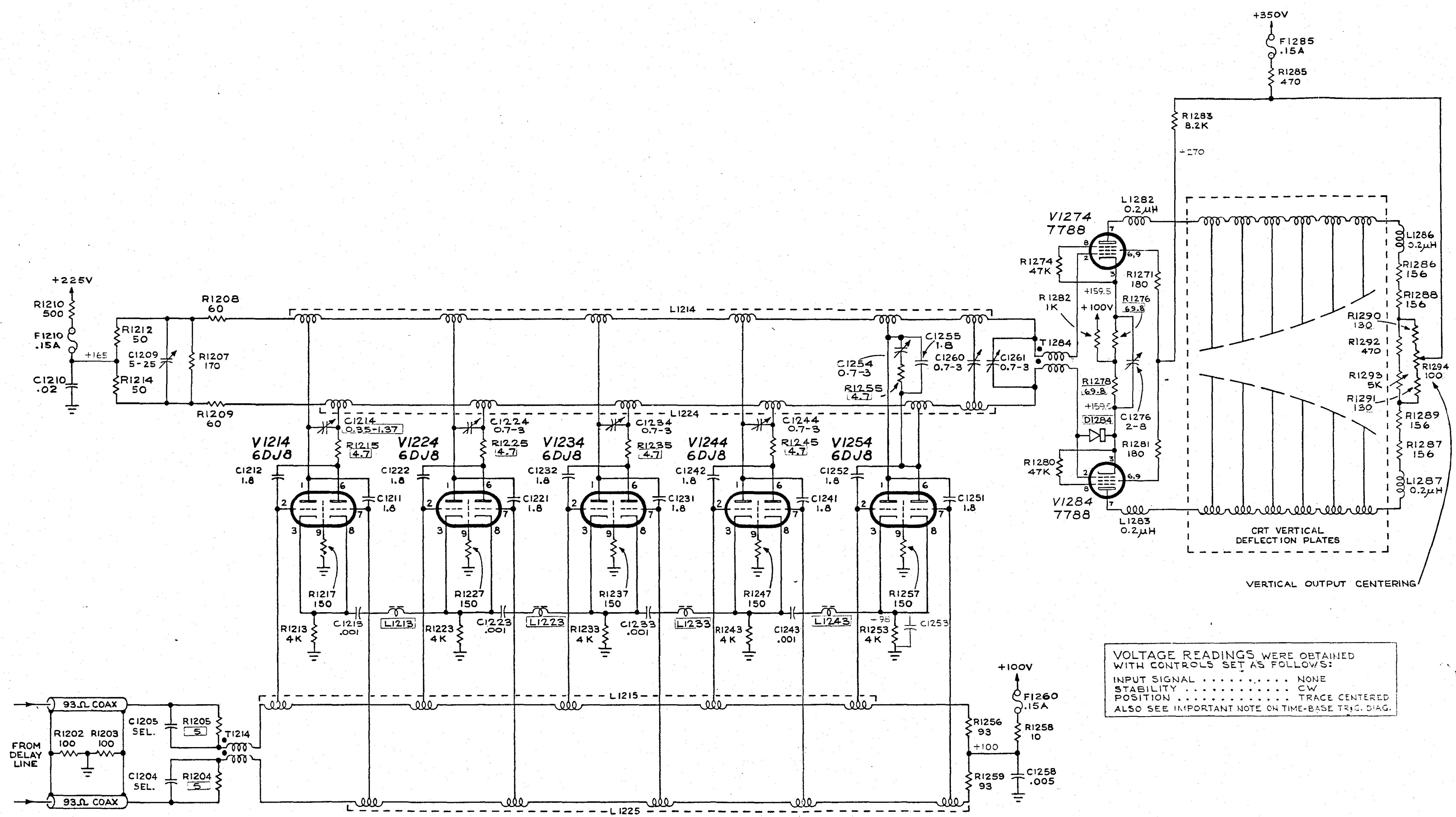
TYPE 585A OSCILLOSCOPE

VERTICAL AMPLIFIER DELAY LINE DRIVER

CIRCUIT NUMBERS 1000 THRU 1189

C2

VERT. AMP. DELAY LINE DRIVER



VOLTAGE READINGS WERE OBTAINED WITH CONTROLS SET AS FOLLOWS:

INPUT SIGNAL	NONE
STABILITY	CW
POSITION	TRACE CENTERED

ALSO SEE IMPORTANT NOTE ON TIME-BASE TRIG. DIAG.

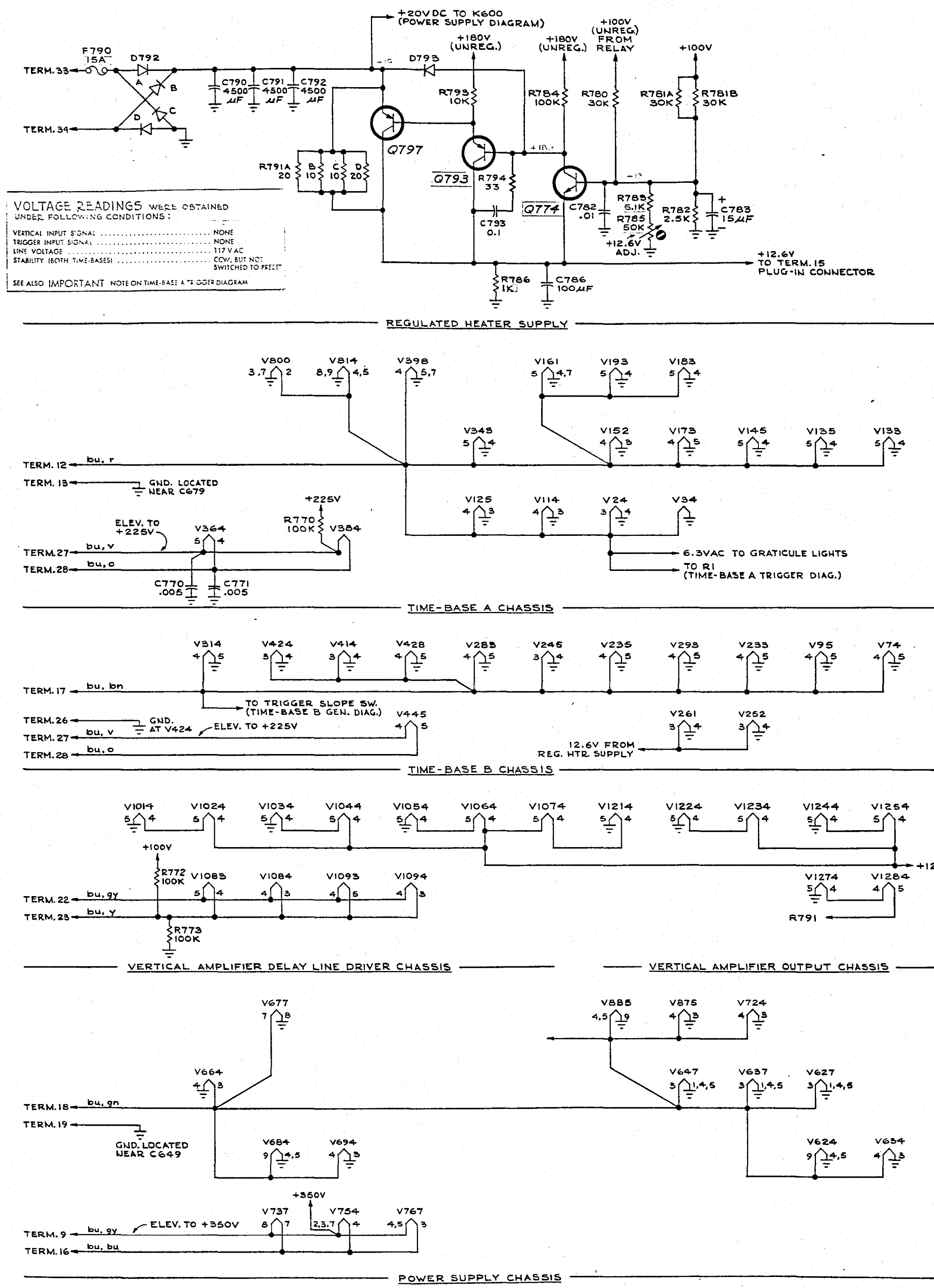
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE.

669

TYPE 585A OSCILLOSCOPE

VERTICAL AMPLIFIER OUTPUT STAGE

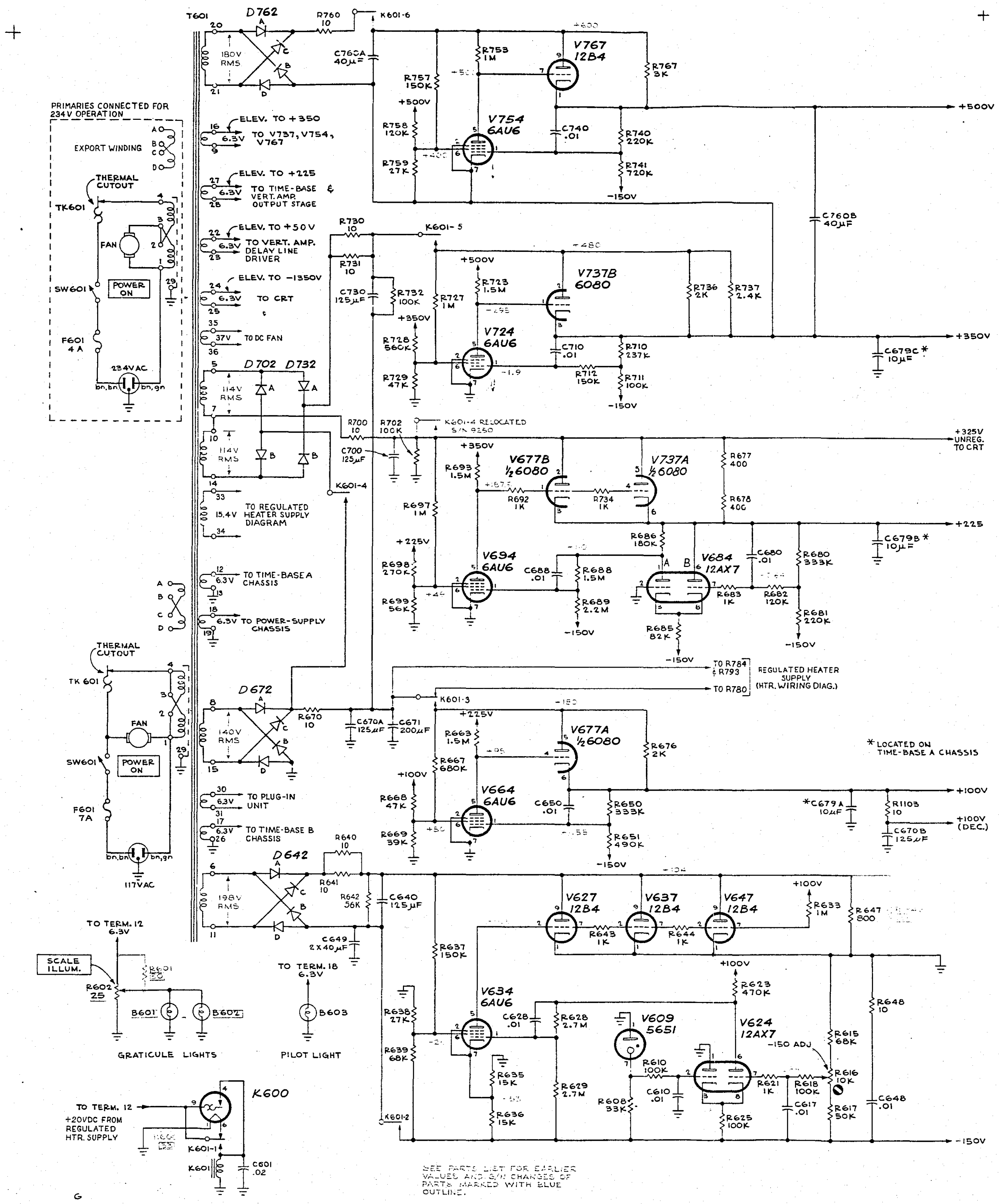
CIRCUIT NUMBERS 1200 THRU 1299



TYPE 585A OSCILLOSCOPE

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

HEATER WIRING DIAGRAM

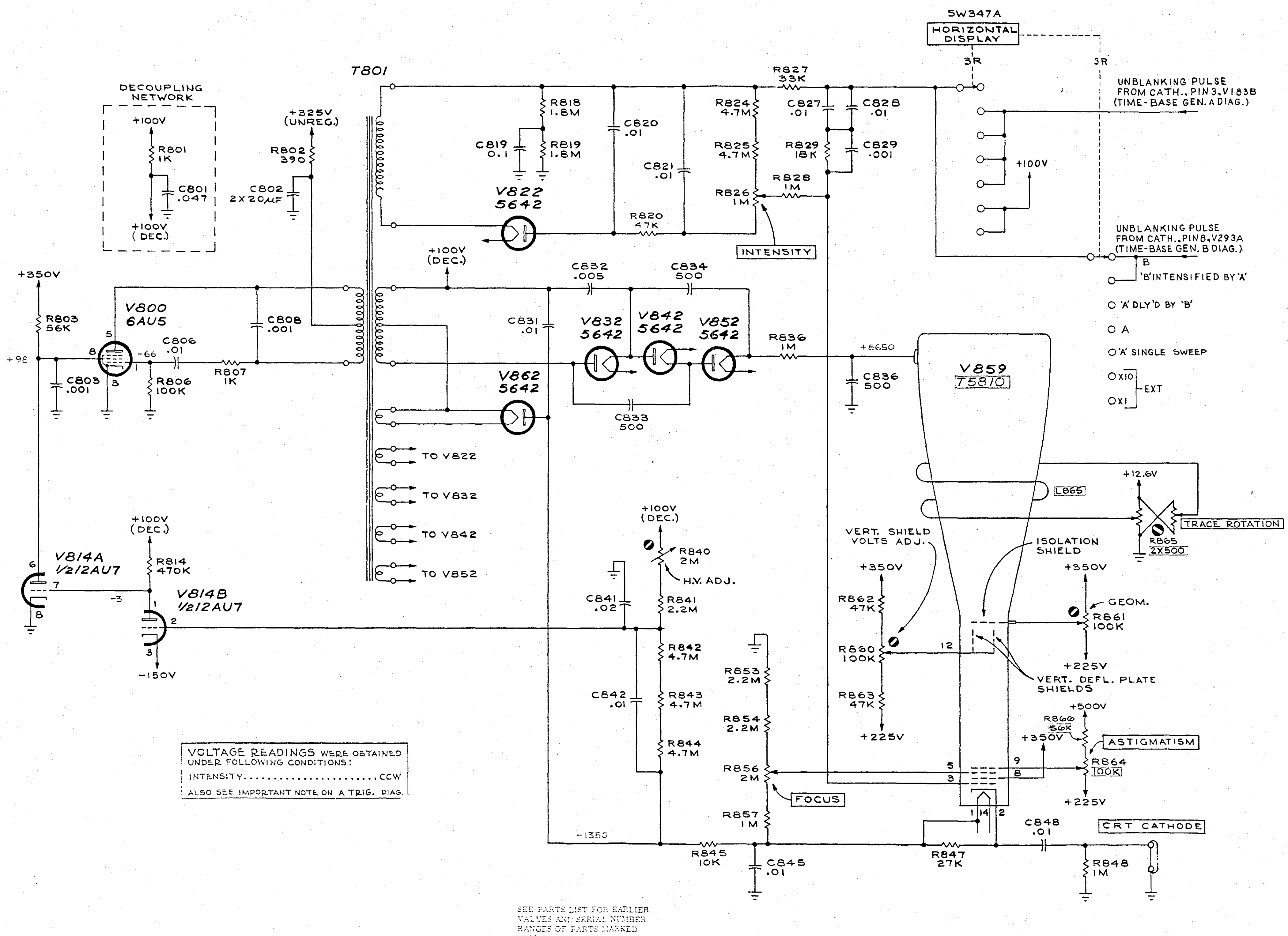


SEE PARTS LIST FOR EARLIER VALUES AND S/N CHANGES OF PARTS MARKED WITH BLUE OUTLINE.

POWER SUPPLY

CIRCUIT NUMBERS 600 THRU 799

GAB 1267



CRT CIRCUIT

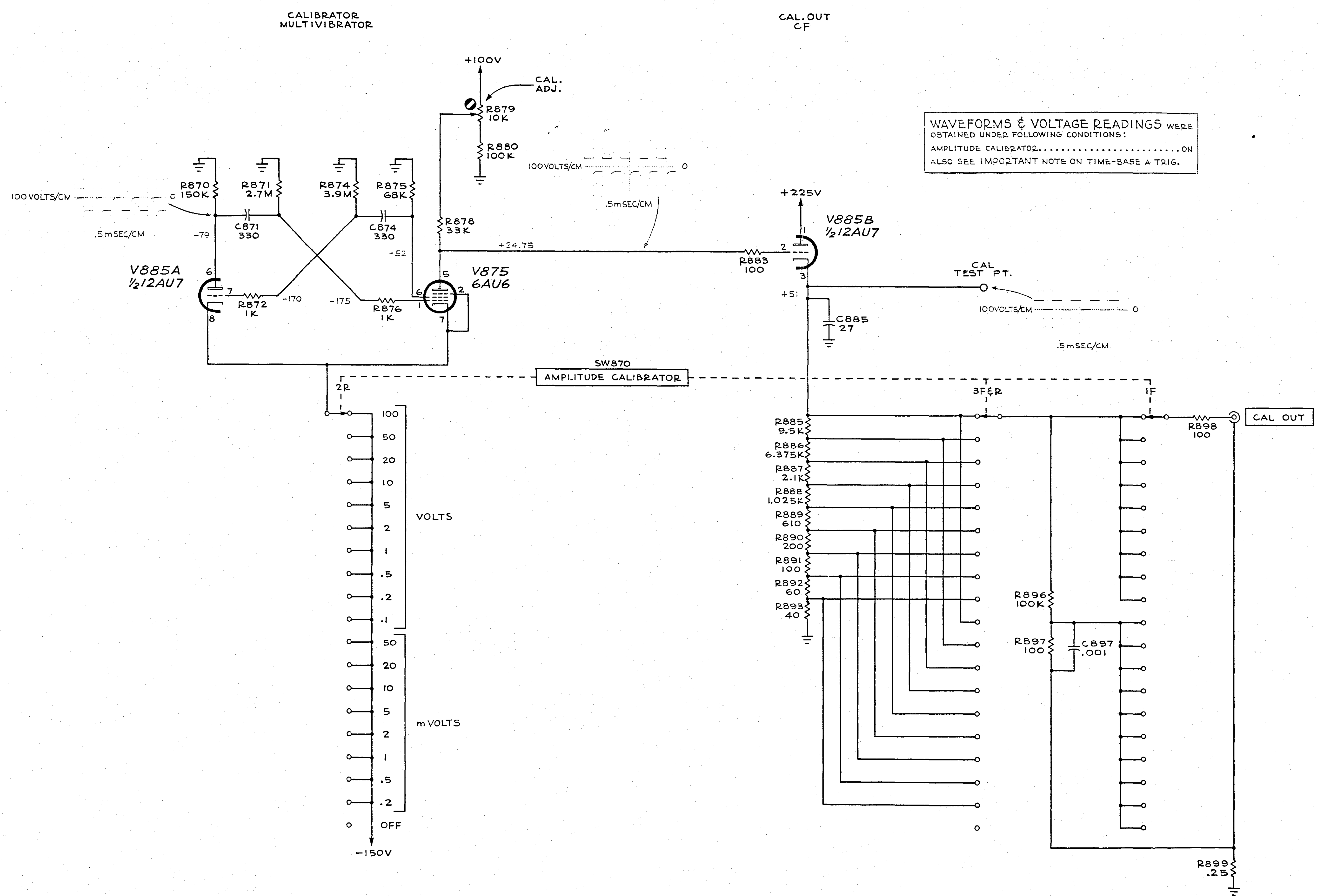
TYPE 585A OSCILLOSCOPE

D

MRH
167

CRT CIRCUIT

CIRCUIT NUMBERS
800 THRU 869
ALSO SW347A



GAB 663

TYPE 585A OSCILLOSCOPE

CALIBRATOR

CIRCUIT NUMBERS 870 THRU 899

A

CALIBRATOR

FIG. 1 FRONT

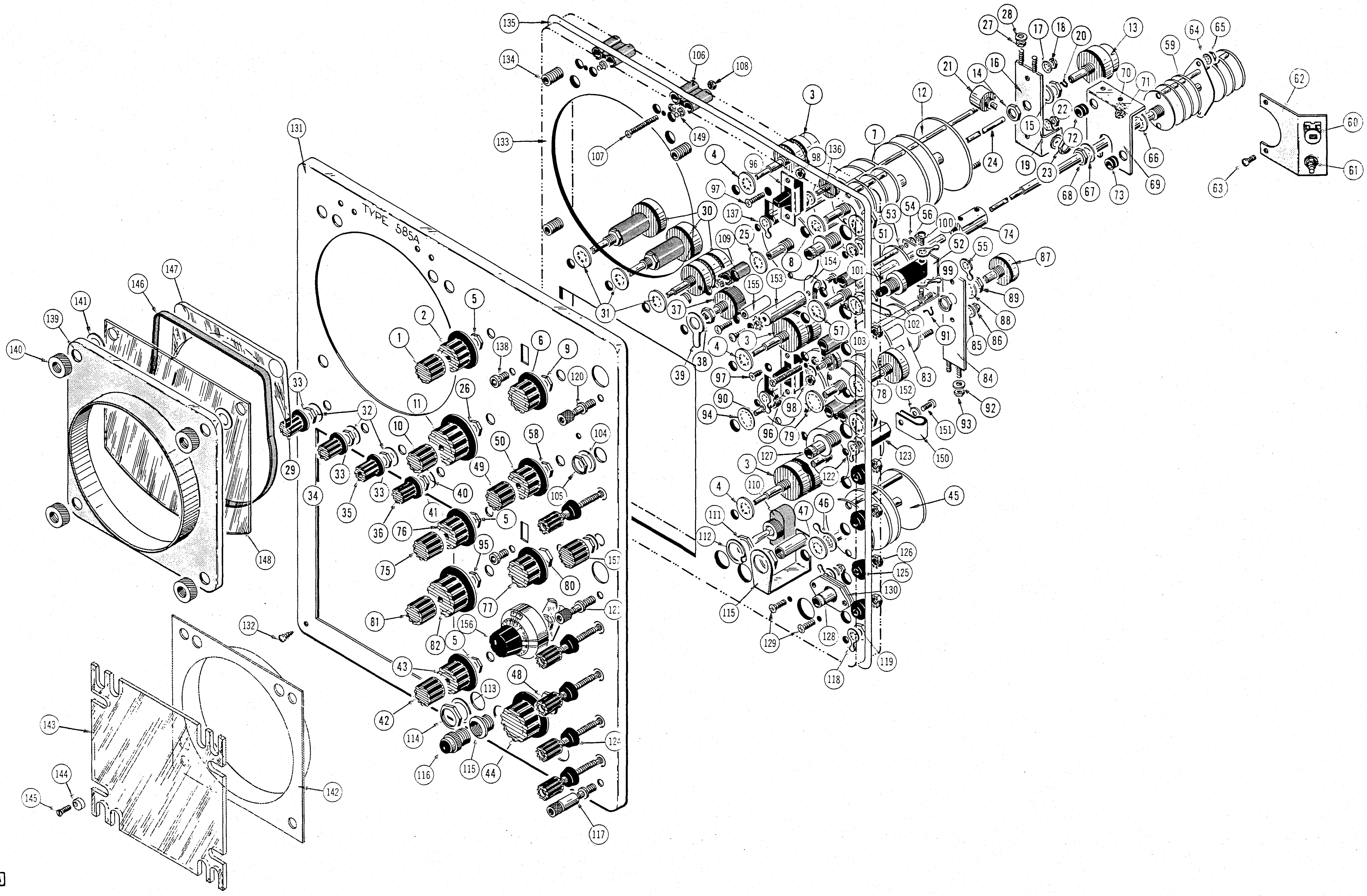


FIG. 1

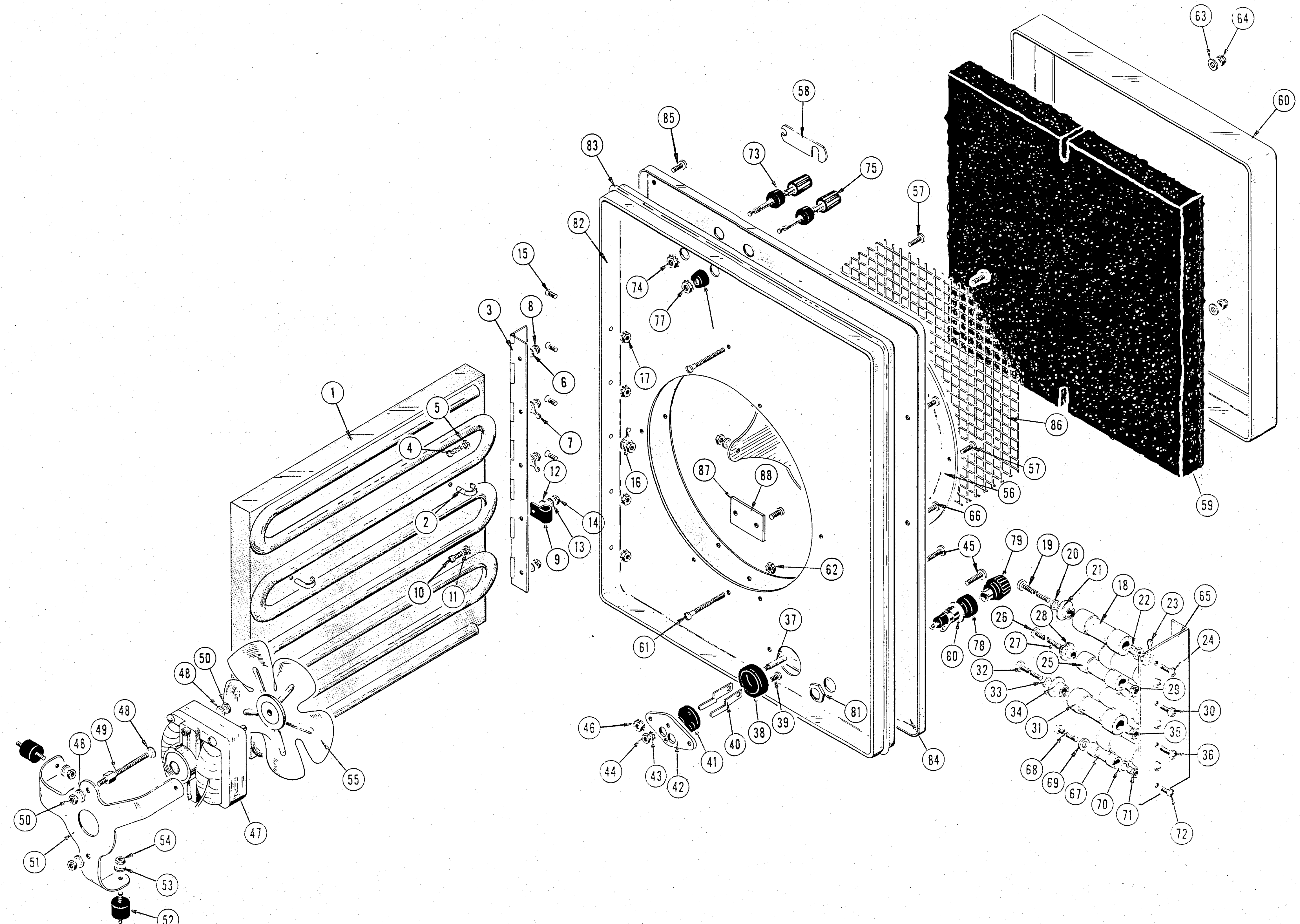

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
77
78
79
80
81
82
83
84
85
86
87
88

FIG. 3 PLUG-IN HOUSING & VERTICAL AMPLIFIER

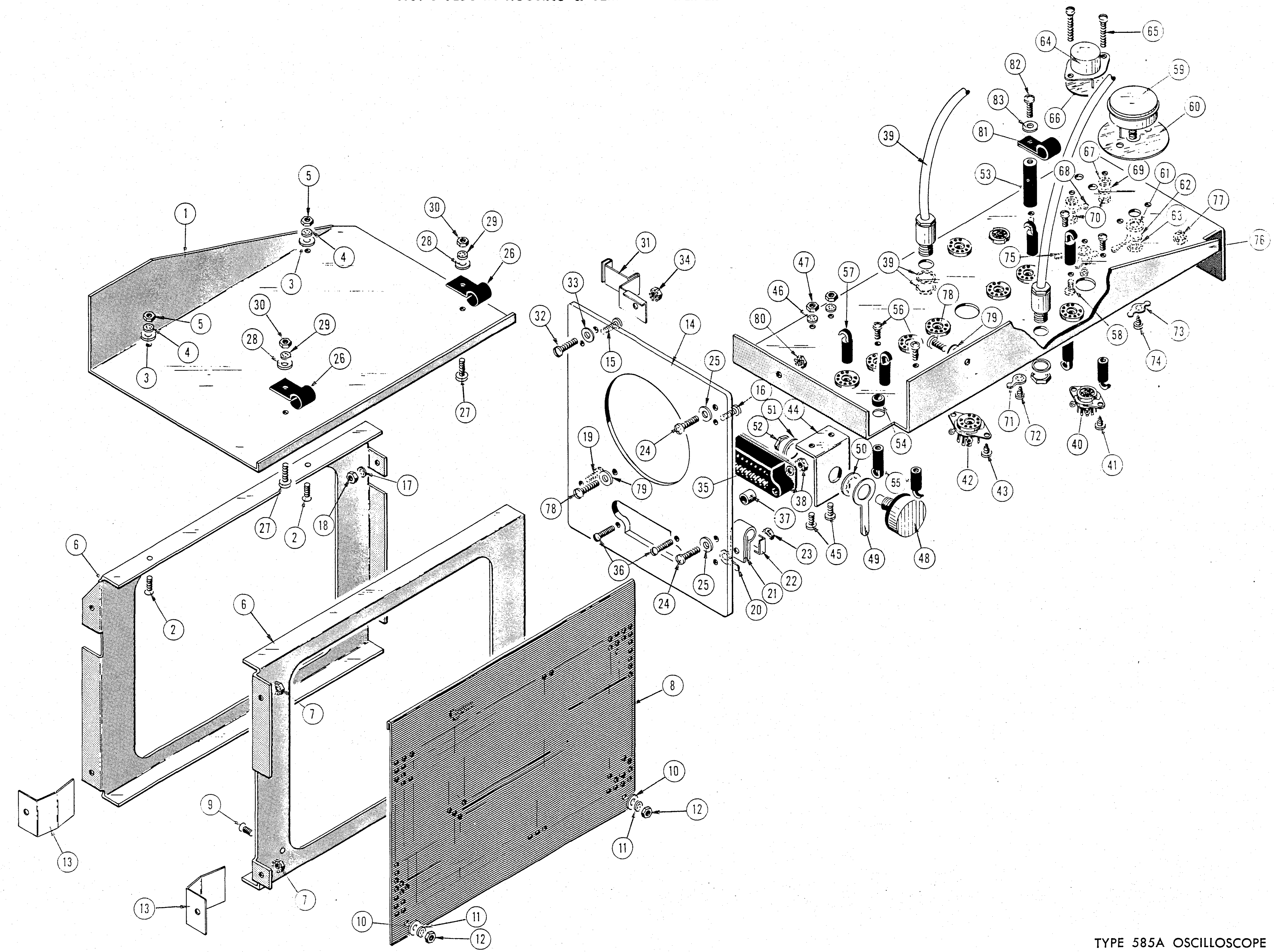


FIG. 3

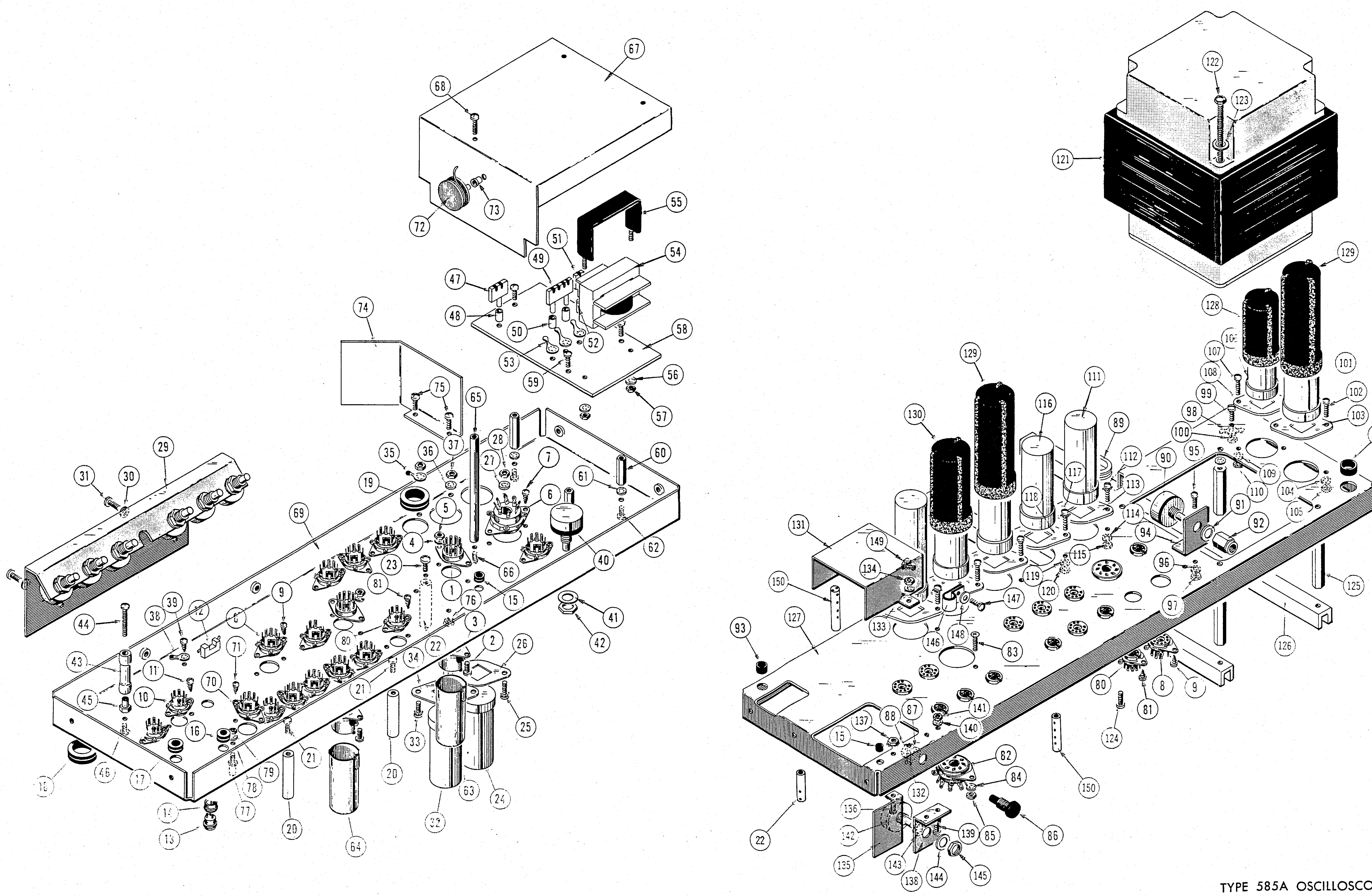
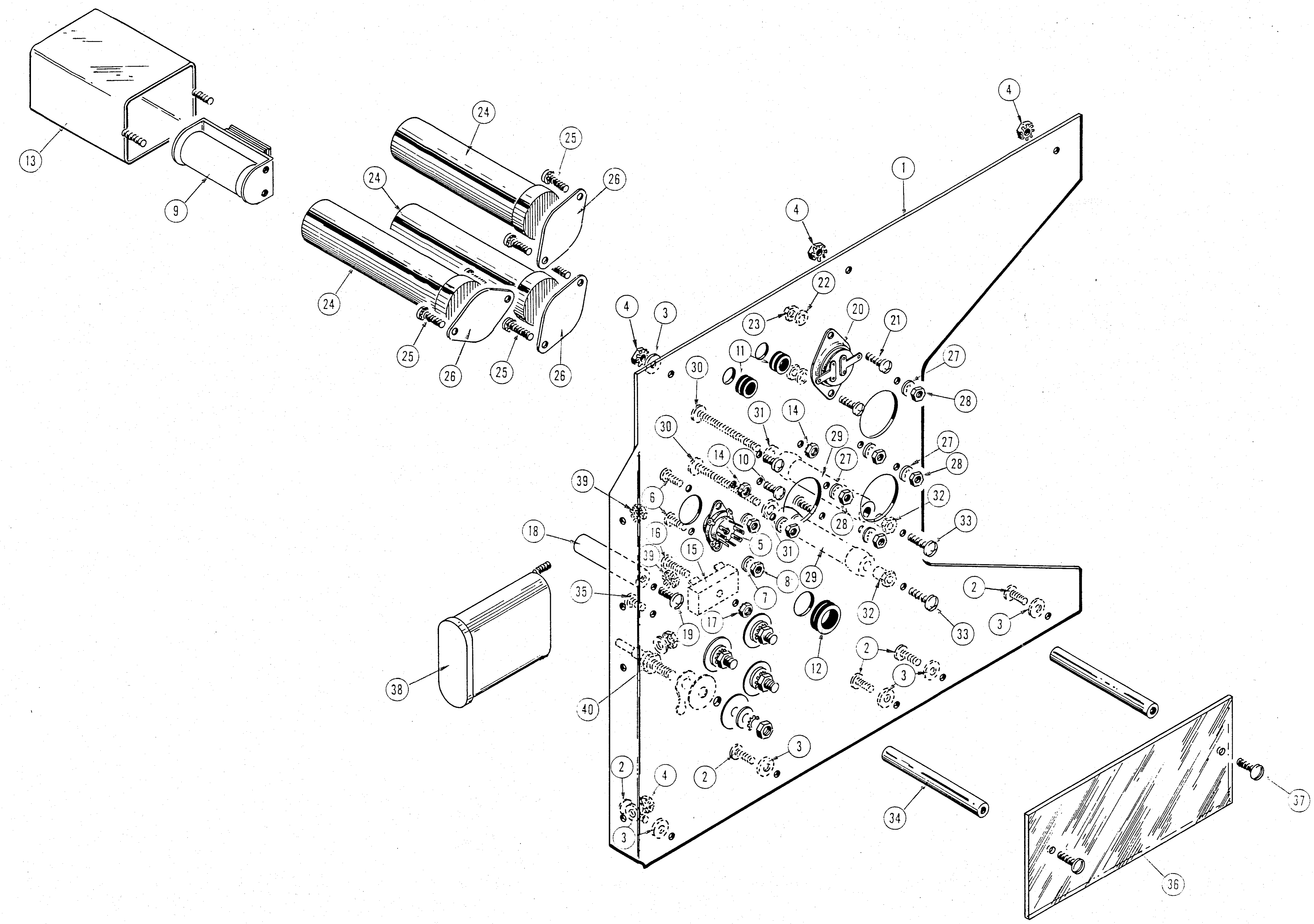


FIG. 5 RECTIFIER



A

FIG. 6 FOCUS & INTENSITY

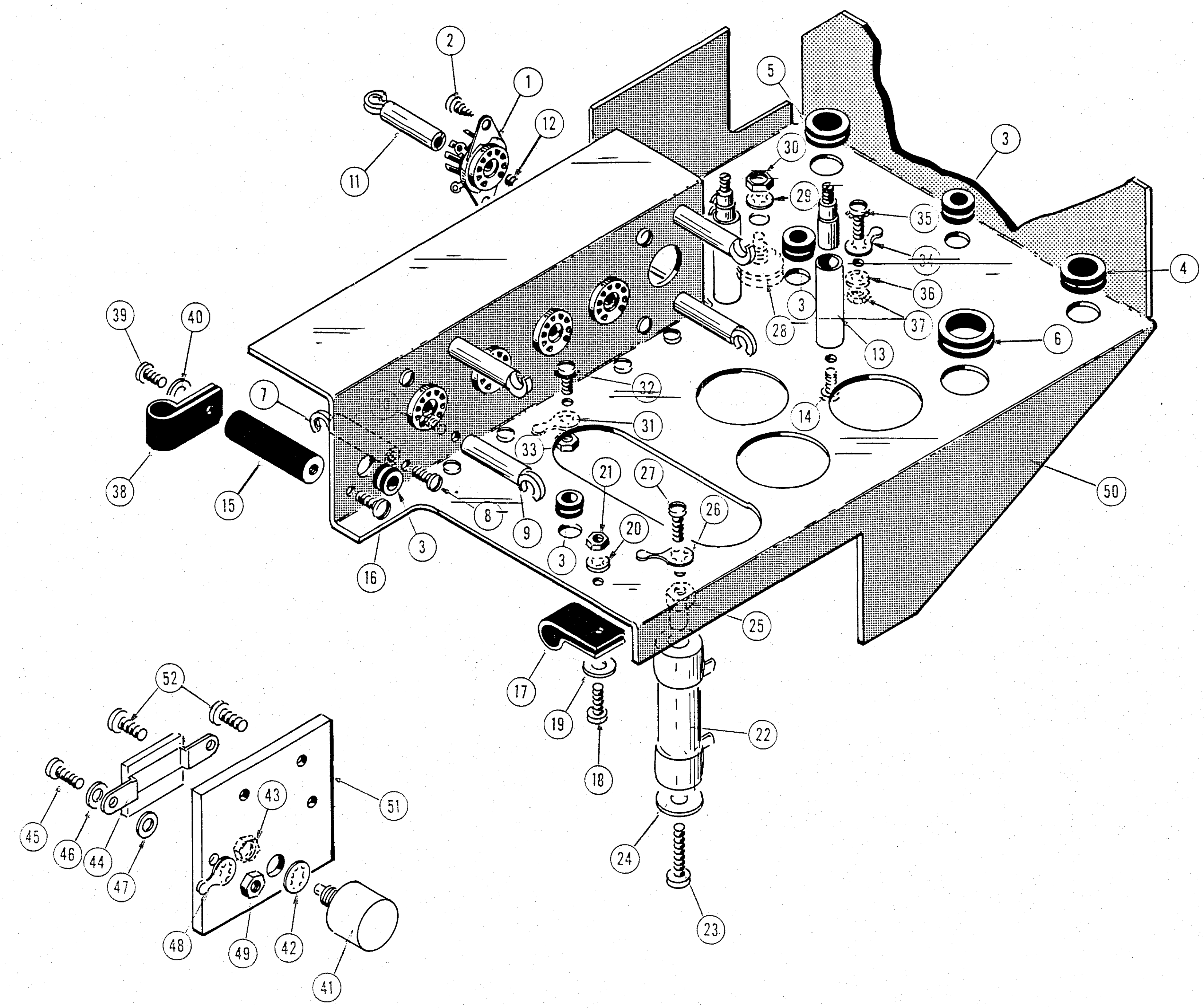


FIG. 7 CRT SHIELD & VERTICAL OUTPUT BRACKET

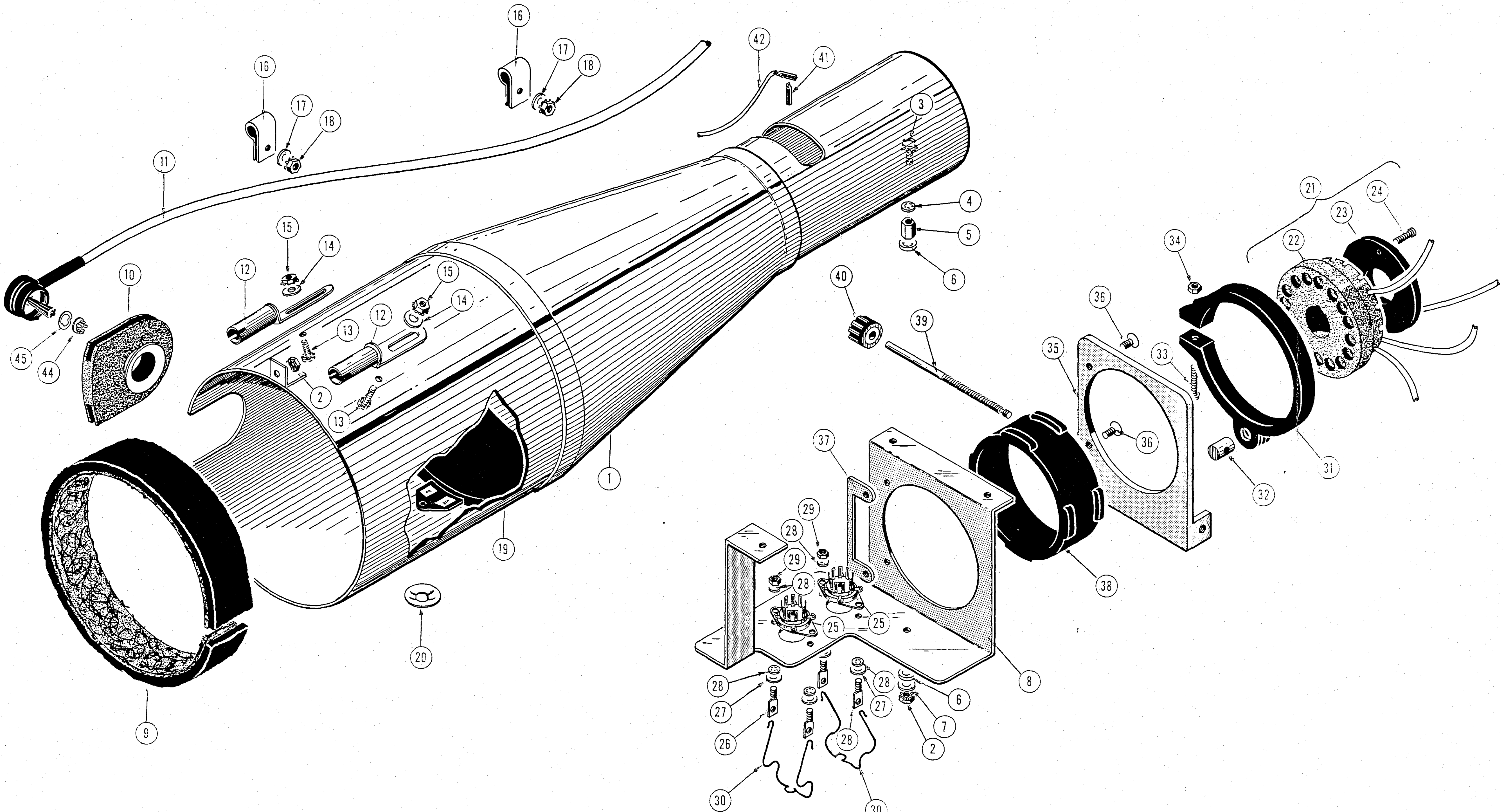


FIG. 7

FIG. 8 DELAY SWEEP

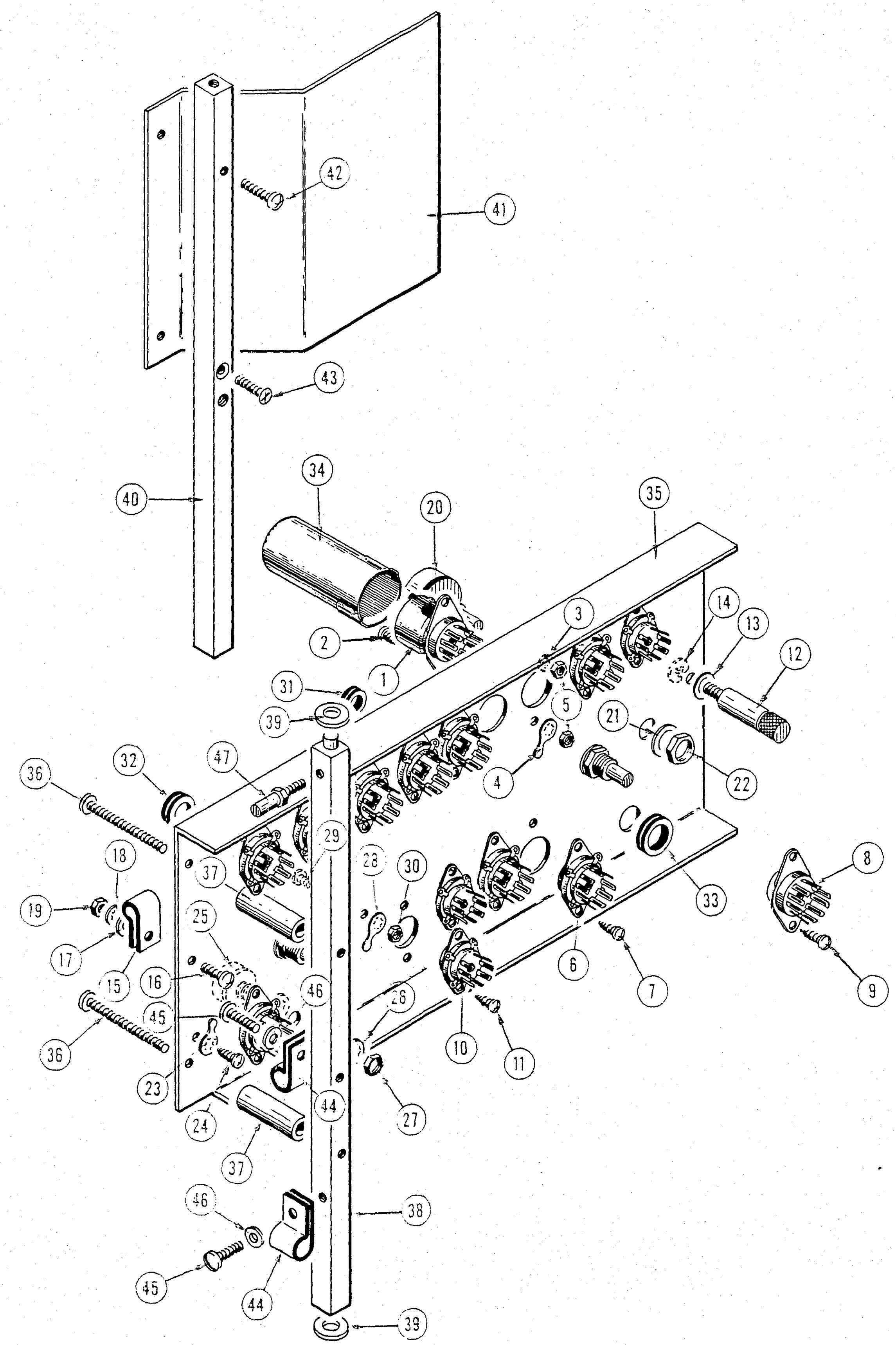


FIG. 9 CABLE HARNESS & CERAMIC STRIP

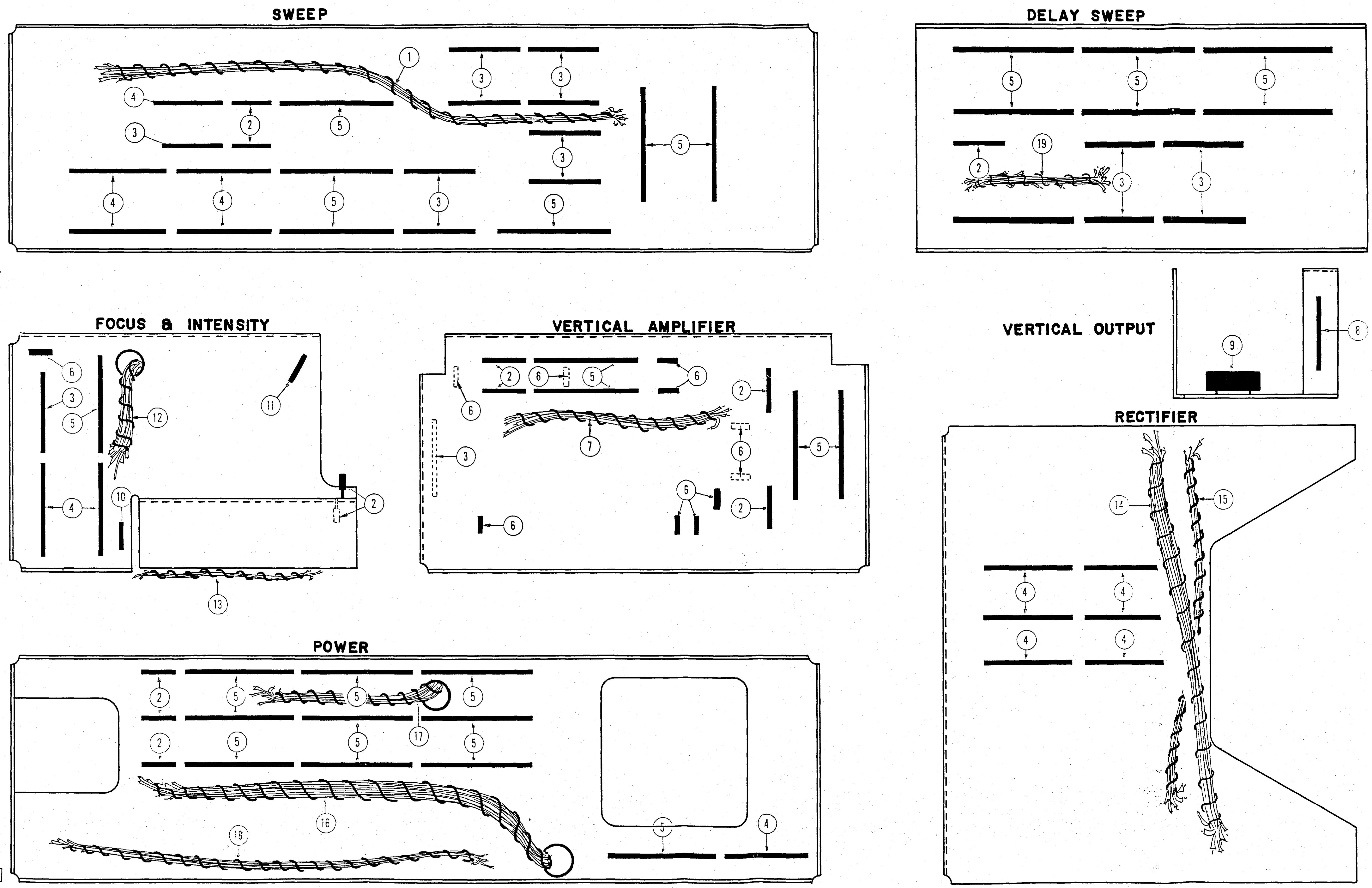
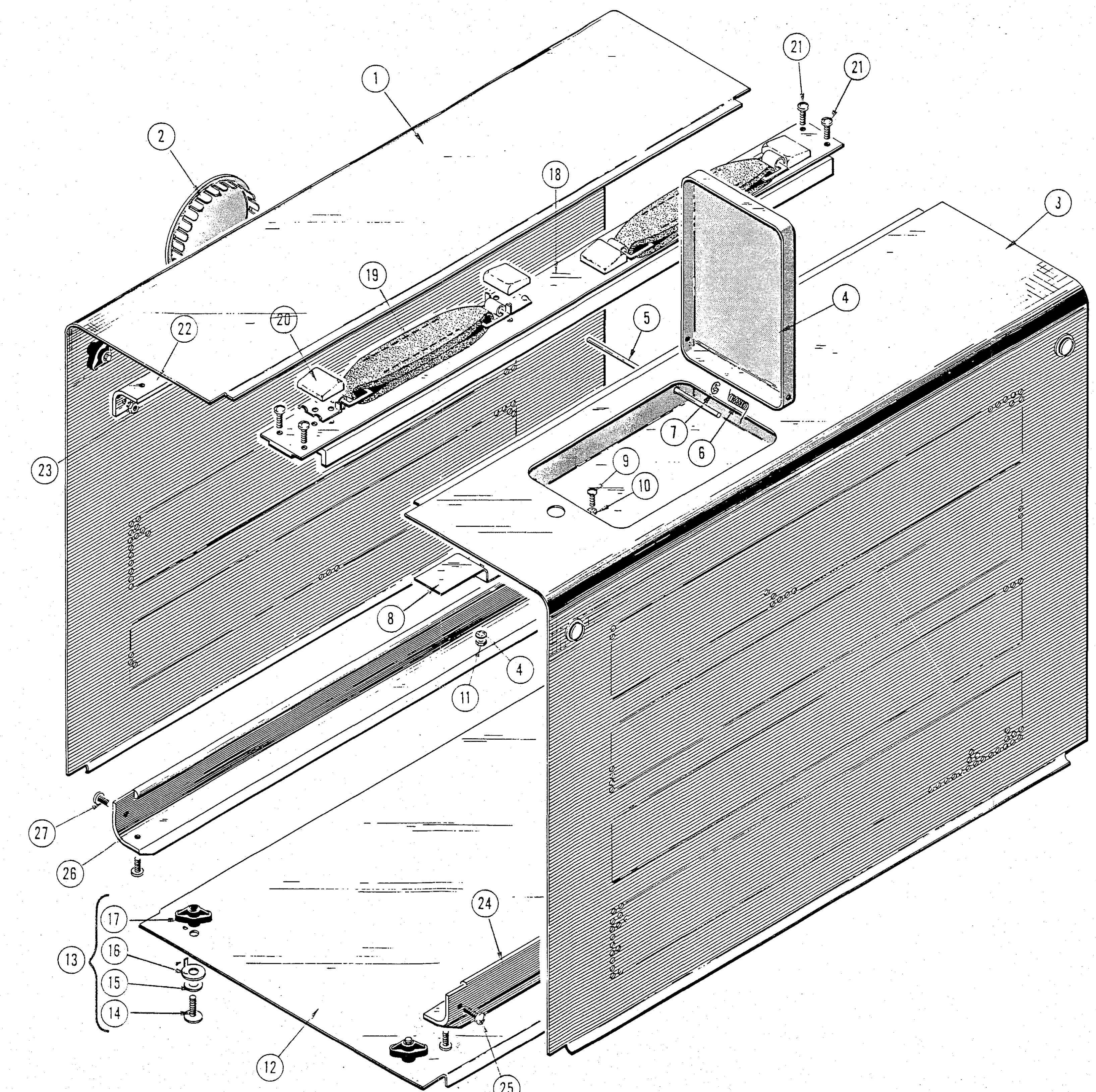


FIG. 9

FIG. 10 CABINET & RAILS



Ⓐ

581A EFF SN 6360-up

585A EFF SN 14,776-up

RM585A EFF SN 14,778-up

ELECTRICAL PARTS LIST CORRECTION

CHANGE TO:

R1286	322-1115-00	156 Ω	1/4 W	1%
R1287	322-1115-00	156 Ω	1/4 W	1%
R1288	322-1115-00	156 Ω	1/4 W	1%
R1289	322-1115-00	156 Ω	1/4 W	1%

FIG. 11 STANDARD ACCESSORIES

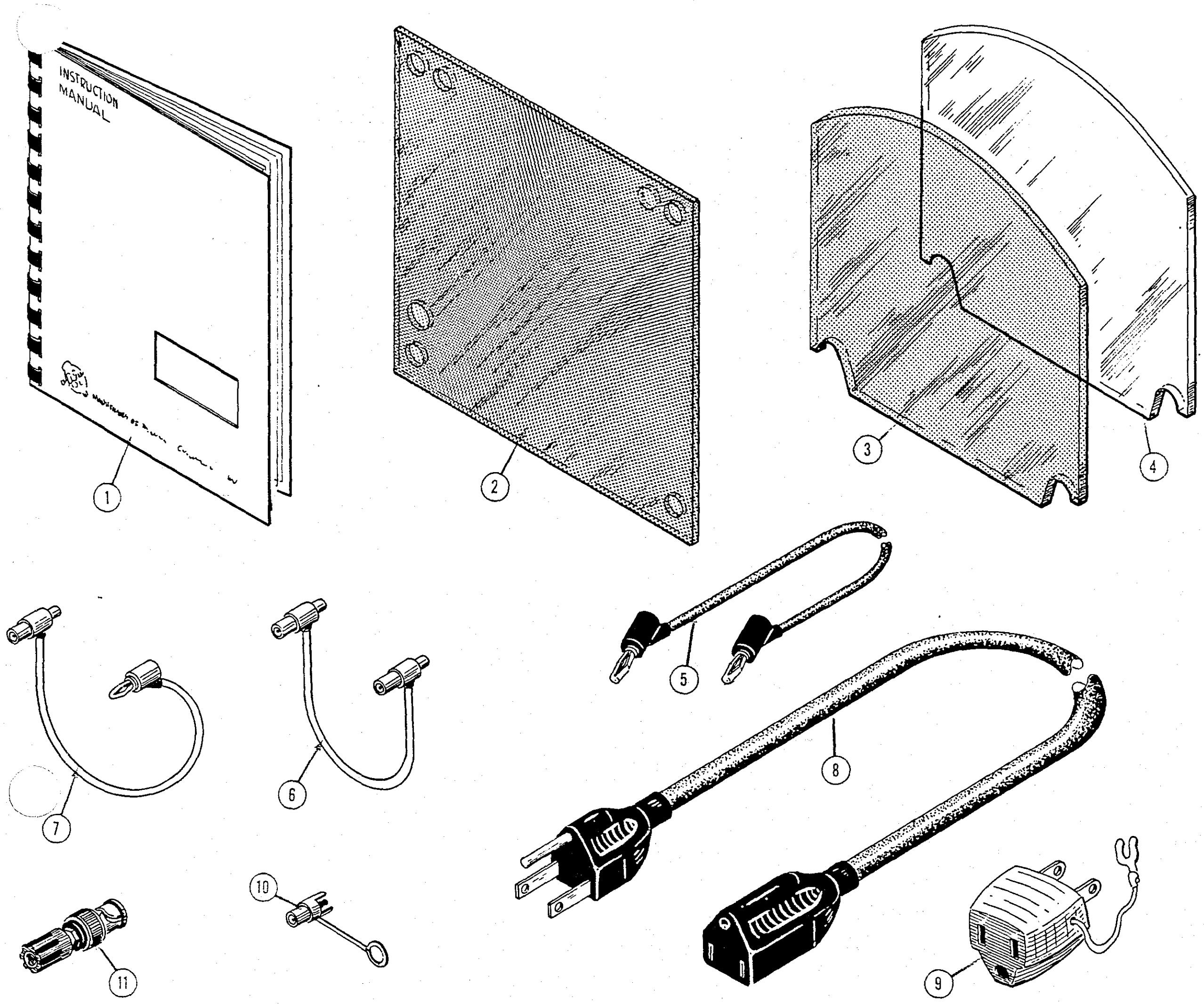


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
11-1	070-0391-01			2	MANUAL, instruction
-2	378-0514-00	5969	8999	1	FILTER, light, plexiglas, 5 inch, green, w/cam hole
-3	378-0546-00	9000	10599	1	FILTER, light, smoke grey, 5 inch (installed)
	378-0567-00	10600		1	FILTER light grey, (installed)
-4	378-0918-00	X9000		1	PLATE, CRT face protector
-5	012-0031-00	5969	9874	1	CORD, patch—banana, 18 inches long
-6	012-0087-00	9875		1	CORD, patch, BNC to BNC, red, 18 inches long
-7	012-0091-00	X9875		1	CORD, patch, BNC to banana, red, 18 inches long
-8	161-0010-00	5969	13029	1	CORD, power, 16 gauge, 8 feet, 3 wire
	161-0010-03	13030		1	CORD, power, 16 gauge, 8 feet, 3 wire
-9	103-0013-00			1	ADAPTER, power cord, 3 wire
-10	012-0092-00	X9875		1	JACK, BNC—post
-11	103-0033-00	5969	9874X	2	ADAPTER, BNC to binding post

PROBLEM: CAN NOT obtain preset adjust. When checking & adjusting
Trace doesn't brighten Be sure to use proper procedure!

Check Q44 → 2N2048

if still not correct. Check D47 (tunnel diode)

proper settings for check

1) STABILITY → IN preset
2) Time/cm → .1 m Sec
3) Trig Source → LINE
4) HORIZONTAL DISPLAY → A
5) trigger level → zero