OPERATOR'S MANUAL

TYPE 585A

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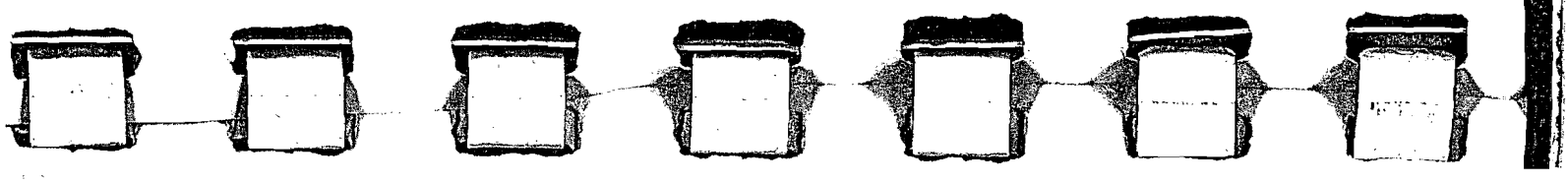
CONTENTS



CONTROLS AND CONNECTORS

Time-Base Controls

TRIGGERING LEVEL (A and B)

Determines the point on the triggering waveform at which the sweep will start.

STABILITY (A and B)

Adjusts the sweep for triggered or free running operation. Can generally be turned full left to PRESET for triggered operation, except for a few extremely difficult triggering applications. For free-running operation, STABILITY control is turned full right.

TRIGGER SLOPE (A and B)

Determines whether triggering occurs during the rise of the triggering waveform (+) or during the fall of the triggering waveform (—).

TRIGGERING SOURCE (Time-Base A)

Selects the triggering signal source — signal being displayed (INT AC, INT AC LF REJECT, or INT HF SYNC), power line signal (LINE), or signal coupled to TRIGGER INPUT connector (EXT AC, EXT DC, or EXT HF SYNC).

TRIGGERING SOURCE (Time-Base B)

Selects the triggering signal source — signal being displayed (INT AC, or INT AC LF REJECT), power line signal (LINE), or the signal coupled to TRIGGER INPUT connector (EXT AC, or EXT DC).

TIME/CM (Time-Base A)

Determines sweep rate and horizontal size of displayed waveform. Calibrated sweep rates are obtained only when VARIABLE control is fully clockwise.

VARIABLE (TIME/CM—Time-Base A)

Provides continuous uncalibrated sweep rates between ranges of TIME/CM switch. UNCALIBRATED indicator lamp lights when the VARIABLE control is turned away from CALIBRATED position.

TIME/CM OR DELAY TIME (Time-Base B)

TIME/CM OR DELAY TIME switch has two functions. When the HORIZONTAL DISPLAY switch is in the B or the 'B' INTENSIFIED BY 'A' position, the switch determines sweep rate and horizontal size of the displayed waveform. When the HORIZONTAL DISPLAY switch is in the 'A' DLY'D BY 'B' position, the switch determines delay time along with DELAY TIME MULTIPLIER control.

LENGTH

Adjusts sweep length of TIME BASE B between approximately 4 and 10 centimeters. Turning control counterclockwise reduces length of sweep, increases duty cycle, and brightens display. Normally LENGTH control is set fully clockwise.

Horizontal Controls

HORIZONTAL DISPLAY

Determines the time base used and the type of display presented. In three TIME BASE A positions, A sweep is connected to horizontal amplifier input. In two TIME BASE B positions, B sweep is connected to horizontal amplifier input. In the two EXT positions, an externally derived sweep (applied to the HORIZ INPUT connector) is connected to horizontal amplifier input. In X10 position of HORIZONTAL DISPLAY switch, input signal to external horizontal amplifier is attenuated 10 times.

In 'B' INTENSIFIED BY 'A' position, TIME BASE A is used to brighten a portion of TIME BASE B. In the 'A' DLY'D BY 'B' position, brightened portion, as seen in the 'B' INTENSIFIED BY 'A' position, is expanded the full width of the screen. In 'A' position only TIME BASE A is used. In 'B' position only TIME BASE B is used. In 'A' SINGLE SWEEP position, the RESET button controls the start of a single sweep.

In all positions of the HORIZONTAL DISPLAY switch, except 'A' and 'A' SINGLE SWEEP, the delayed trigger is controlled by TIME BASE B. The time base selected by the HORIZONTAL DISPLAY switch is indicated by the lights above the DELAY-TIME MULTIPLIER control.

5X MAGNIFIER

Expands center two-centimeter portion of displayed waveform to full ten-centimeter width of graticule. Expanded portion is determined by setting of HORIZONTAL POSITION switch. Indicator lamp is lit when the 5X MAGNIFIER is ON.

RESET

Prepares sweep circuits for reception of triggering pulse when HORIZONTAL DISPLAY switch is in 'A' SINGLE SWEEP position.

EXTERNAL HORIZ ATTENUATOR 10-1

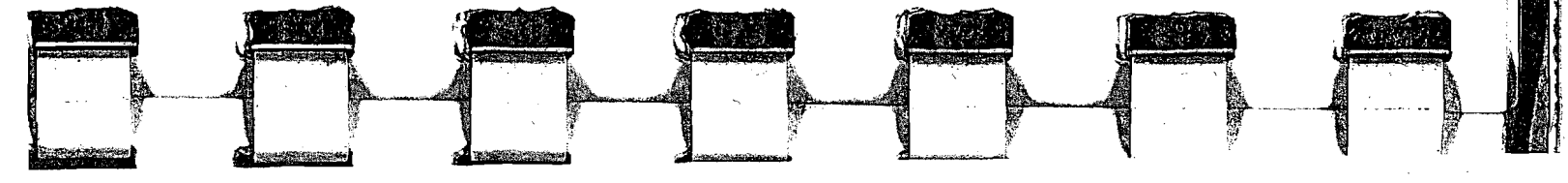
Controls gain of external horizontal amplifier in conjunction with HORIZONTAL DISPLAY switch.

DELAY-TIME MULTIPLIER 1-10

Ten-turn control multiplies setting of either TIME/CM switch of TIME BASE A, or TIME/CM OR DELAY TIME switch of TIME BASE B. This determines delay time. An indicator lamp, located above the DELAY-TIME MULTIPLIER, will light designating the time base used, according to the setting of the HORIZONTAL DISPLAY switch.

HORIZONTAL POSITION And VERNIER

Adjusts horizontal position of trace.



Checking-Signal Source

AMPLITUDE CALIBRATOR

Selects any one of eighteen square-wave output amplitudes, from .2 MILLIVOLTS to 100 VOLTS.

Crt Controls

SCALE ILLUM

Controls brightness of graticule markings.

ASTIGMATISM

Used in conjunction with FOCUS control to obtain sharply focused trace.

INTENSITY

Adjusts brightness of crt display.

FOCUS

Used in conjunction with ASTIGMATISM control to focus crt display. FOCUS and ASTIGMATISM controls are adjusted together for best trace definition.

Front-Panel Connectors

TRIGGER INPUT (A and B)

Connects external triggering signal to trigger circuitry. TRIGGERING SOURCE switch must be placed in one of EXT positions.

HORIZ INPUT

Connects external signal to external horizontal amplifier. HORIZONTAL DISPLAY switch must be placed in one of EXT positions to connect external horizontal amplifier to horizontal amplifier in oscilloscope.

DLY'D TRIG

Connector supplies a positive-going delayed trigger output.

+GATE OUT (A and B)

Supplies positive-going waveform with peak value of approximately +30 volts. Start and duration of +GATE A corresponds to start and duration of positive-going sawtooth waveform available from SAWTOOTH A binding post.

SAWTOOTH A

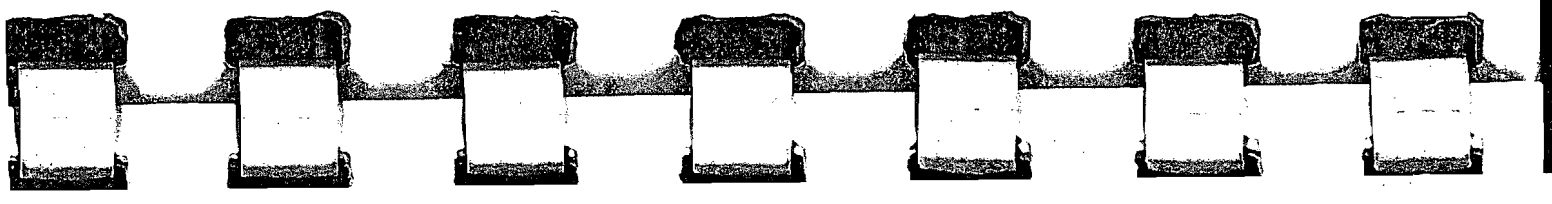
Supplies a positive-going waveform with peak value of approximately +150 volts. Start of waveform coincides with start of 'A' sweep. Rate at which sawtooth rises is determined by setting of Time-Base A TIME/CM switch.

CAL OUT

Supplies 1-kc square-wave output. Peak-to-peak value of square-wave signal is controlled by AMPLITUDE CALIBRATOR switch.

POWER ON

Applies power to the instrument.



Position Indicators

BEAM-POSITION INDICATORS

If beam is positioned horizontally or vertically away from center of graticule, either on or off screen, appropriate beam-position indicator lamp lights.

Rear-Panel Connectors

EXTERNAL CRT CATHODE

EXTERNAL CRT CATHODE binding post should remain jumpered to the GND binding post unless external signal is being fed in for beam-intensity modulation.

OSCILLOSCOPE/PLUG-IN COMBINATIONS

Compatible Plug-Ins

Any 80-Series numbered plug-in will fit the 580A-Series oscilloscope directly. If it is desired to use one of the Letter-Series or One-Series plug-ins, the Type 81 Adapter Plug-in must also be used to adapt the selected plug-in to the oscilloscope.

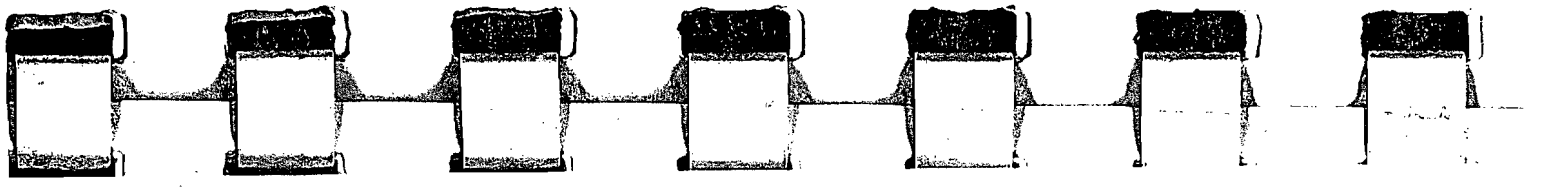
Oscilloscope/Plug-In Characteristics

Plug-In Type	Bandpass	Rise Time
B	dc to 20 mc	18 nsec
CA	dc to 24 mc	15 nsec
G	dc to 20 mc	18 nsec
H	dc to 15 mc	23 nsec
K	dc to 30 mc	12 nsec
L	dc to 30 mc	12 nsec
M	dc to 20 mc	17 nsec
O	dc to 25 mc	14 nsec
80	dc to 95 mc	3.9 nsec
82	dc to 85 mc	4 nsec
86	dc to 85 mc	4 nsec

PROBE INFORMATION

Probe Compensation

The following brief procedure describes probe compensation for the P80, P6006, and P6008 probes. For more detailed compensating procedures refer to the manual accompanying the probe.



P80 (CF probe—used with Type 80 Plug-In only)

1. Terminate the OUTPUT of a Type 105 in 50 ohms. Set the Frequency of the Type 105 at 25 kc. Adjust the compensation of the Type P80 for a flat-topped square wave.

2. To adjust the X10 or X100 standards for the P80 Probe, carry out step 1 of this procedure. Next, put the 2:1 Attenuator Head on the probe. Reconnect to the Type 105 as in step 1. Adjust the attenuator head compensation for best response to the square wave.

Remove the 2:1 Attenuator Head. Put on the Standardized Head to be calibrated. Connect the 2:1 Attenuator Head in front of the Standardized Head. Reconnect to the Type 105 without the 50 Ω termination.

Adjust both compensations in the Standardized Head for the best response to the square wave.

P6006 and P6008 (Passive probes)

1. Set the oscilloscope calibrator for an output of suitable amplitude.

2. Hold the probe body and tip assembly and loosen the locking sleeve several turns.

3. Touch the probe tip to the oscilloscope calibrator output connector.

4. Set the sweep rate to display several cycles of the calibrator output signal.

5. Hold the base bushing and turn the probe body and tip assembly to obtain an undistorted presentation of the calibrator output signal.

6. Hold the probe body and tip assembly and carefully hand-tighten the locking sleeve.

NOTE

To obtain accurate displays it is necessary to check the compensation of the probe before each use.

Probe Input Capacitance

P80 (All attenuators are external)

Attenuation	Input Capacitance	Input DC Resistance
X1	10 pf	
X2	7.8 pf	200 k
X5	3.3 pf	500 k
X10	2 pf	1 Megohm
X20	1.4 pf	2 Megohms
X50	3.7 pf	5 Megohms
X100	1.4 pf	10 Megohms

P6006 and P6008 (Build-in attenuation)

Probe	Attenu-ation	Input Capacitance	Input DC Resistance
P6006	X10	7 pf with 20 pf plug-in	10 Megohms
		9.5 pf with 47 pf plug-in	
P6008	X10	7 pf with 15 pf plug-in	10 Megohms

TRIGGERING INFORMATION

NOTE

The triggering of Time Base B is the same as that for Time Base A. The number of triggering modes and the amount of display amplitude needed are the only differences.

Triggering Requirements for Time-Base B

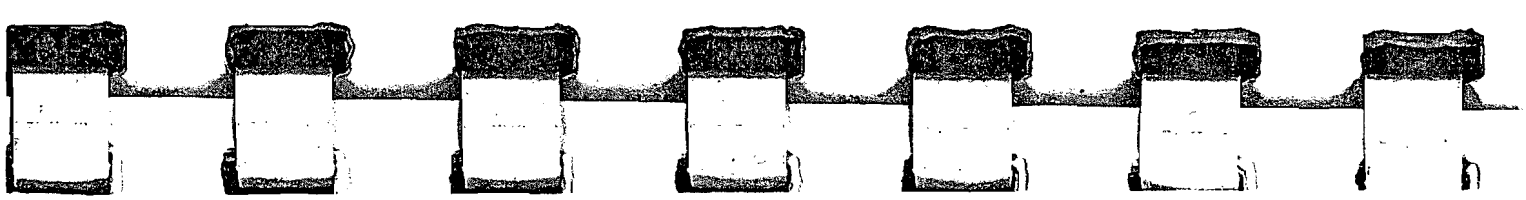
Frequency	Internal		External
	AC	AC LF REJECT	AC and DC
15 cps to 15 kc	4 mm		.2 v
15 kc to 1 mc	4 mm	4 mm	.5 v
1 mc to 5 mc	1 cm	1 cm	1.5 v

Internal Triggering

The three INT positions of the TRIGGERING SOURCE switch allow triggering from the displayed waveform. This is the most convenient mode of operation since no external triggering connections are required.

To trigger a displayed waveform using one of the INT positions of the TRIGGERING SOURCE switch, set the oscilloscope controls as follows:

STABILITY	PRESET
TRIGGERING LEVEL	Full left or right
TRIGGER SLOPE	+ or —
TRIGGERING SOURCE	INT — AC for normal triggering requirements to 150 mc.
	AC LF REJECT to suppress low-frequency components that may cause jitter or otherwise mistrigger the desired waveform.
	HF SYNC for waveforms above 5 mc of insufficient amplitude for normal jitter-free triging. Minimum deflection needed: 4 mm.



For internal triggering in INT AC or AC LF REJECT, certain minimum crt deflection requirements must be met by the displayed signal. These are: frequencies up to 5 mc, 2 mm; 5 to 10 mc, 4 mm; 10 to 50 mc, 1 cm; 50 to 100 mc, 2 cm; and 100 to 150 mc, 3 cm.

HORIZONTAL DISPLAY	INTERNAL SWEEP
TIME/CM	Desired sweep rate
VARIABLE (TIME/CM)	CALIBRATED

Turn the TRIGGERING LEVEL toward the 0 mark until a stable display is obtained.

Line Triggering

The LINE position allows the displayed waveform to be triggered from the power line frequency (as in the case when observing a waveform which has a time relationship to the power-line frequency). Set the controls as follows:

STABILITY	PRESET
TRIGGERING LEVEL	Full left or right
TRIGGER SLOPE	+ or —
TRIGGERING SOURCE	LINE
HORIZONTAL DISPLAY	INTERNAL SWEEP
TIME/CM	Desired sweep rate
VARIABLE (TIME/CM)	CALIBRATED

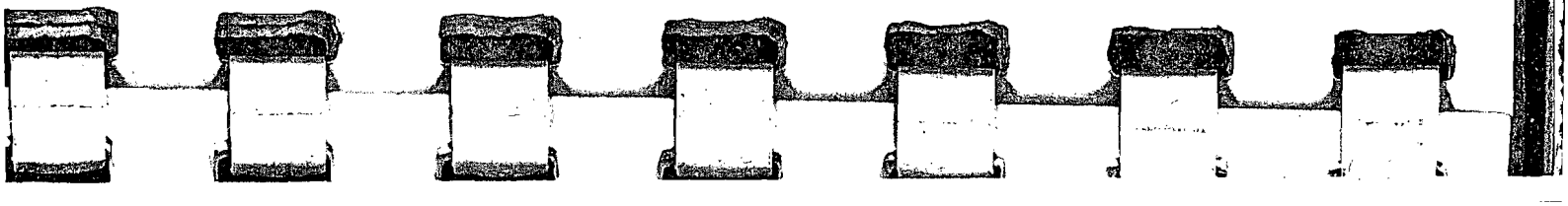
Turn the TRIGGERING LEVEL toward the 0 mark until a stable display is obtained.

External Triggering

This mode is convenient for observing the shaping and amplification of a signal by each stage of a circuit without resetting the triggering controls for each observation. The external triggering waveform used to trigger the sweep must bear a time relationship to the displayed waveform.

To trigger a displayed waveform using one of the EXT positions of the TRIGGERING SOURCE switch, set the oscilloscope controls as follows:

STABILITY	PRESET
TRIGGERING LEVEL	Full left or right
TRIGGER SLOPE	+ or —
TRIGGERING SOURCE	EXT — AC for normal triggering requirements to 150 mc.
	DC if the triggering waveform frequency is below 15 cycles. Minimum amplitude needed: DC to 15 kc—.2 v, 15 kc to 10 mc—.3 v, 10 mc to 50 mc—.5 v, 50 mc to 100 mc—1.5 v, 100 mc to 150 mc—2 v.



	HF SYNC for waveforms above 5 mc of insufficient amplitude for normal jitter-free triggering. Minimum amplitude needed: 15 kc to 150 mc—.1 v.
HORIZONTAL DISPLAY	INTERNAL SWEEP
TIME/CM	Desired sweep rate
VARIABLE (TIME/CM)	CALIBRATED

Connect the external triggering waveform to the TRIGGER INPUT connector, and turn the TRIGGERING LEVEL control toward the 0 mark until a stable display is obtained.

Selection of the Triggering Slope

The horizontal sweep can be triggered on either the rising (+ slope) or falling (— slope) portion of the triggering waveform. This is determined by the position of the TRIGGER SLOPE switch. When the switch is in the + position, the sweep is triggered on the rising portion of the triggering waveform; when the TRIGGER SLOPE switch is in the — position, the sweep is triggered on the falling portion of the waveform (see Figure 1).

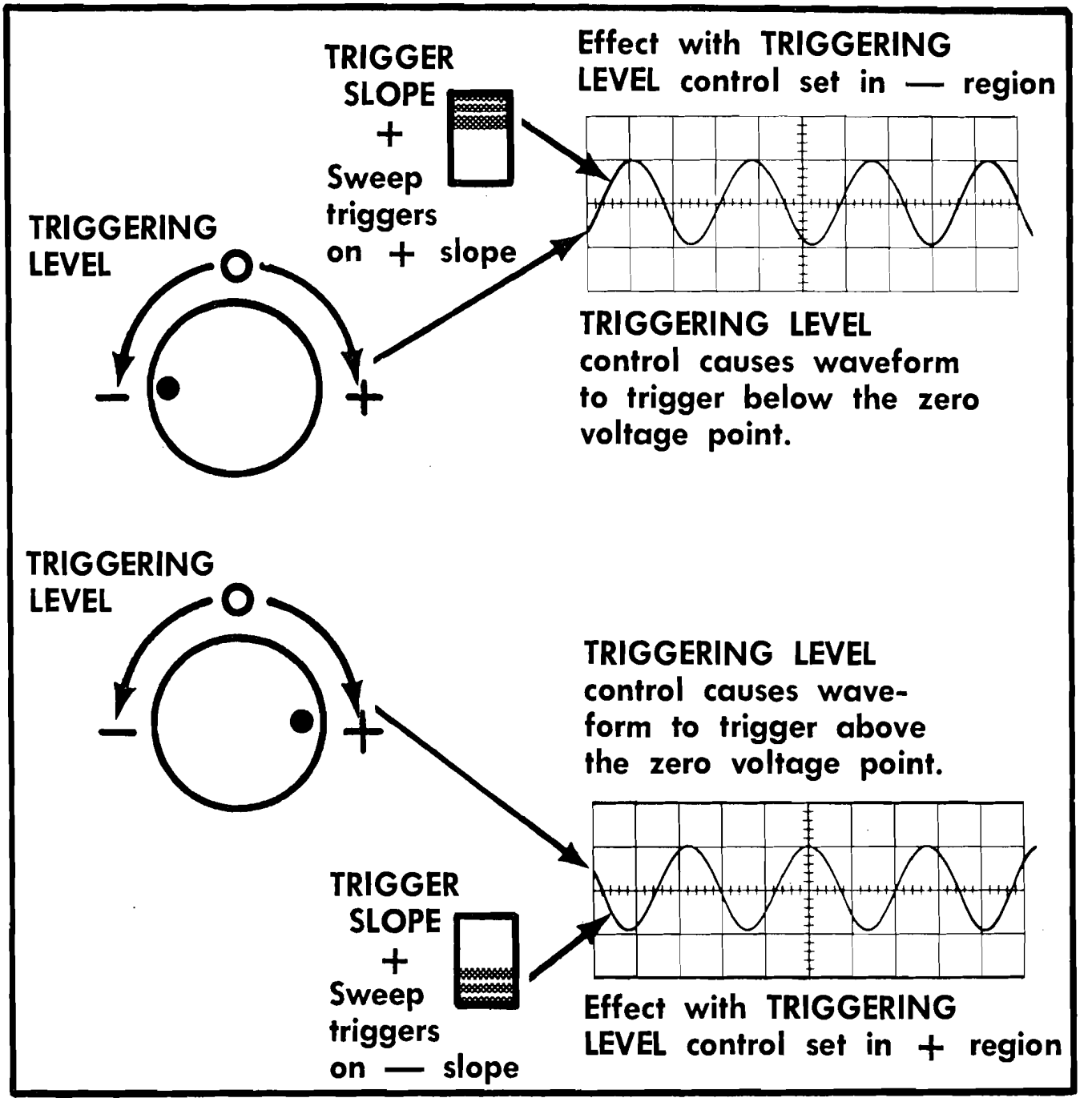
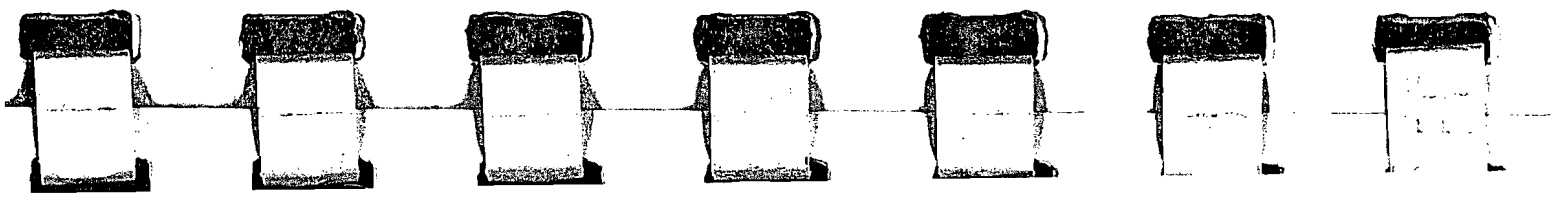


Fig. 1. Effects of the TRIGGERING LEVEL and TRIGGER SLOPE controls.



NOTE

When displaying waveforms above 50 mc, the trigger circuit may produce a stable display on only one slope. Be sure to try both + and — positions of the TRIGGER SLOPE switch for best triggering.

Using the STABILITY and TRIGGERING LEVEL Controls

In virtually every triggering application, satisfactory operation can be obtained with the STABILITY control in the fully counterclockwise, PRESET, position. This setting has the advantage that no further adjustment of the STABILITY control is required when you are switching from one triggering signal to another. However, if it becomes difficult for you to obtain stable triggering with the STABILITY control at PRESET, it will be necessary for you to adjust the control for proper triggering.

To adjust the STABILITY control, place the TRIGGERING LEVEL control in the fully counterclockwise position. Then rotate the STABILITY control slowly clockwise until a trace appears on the screen. The correct setting is obtained by rotating the control counterclockwise three to five degrees past the point where the trace disappears.

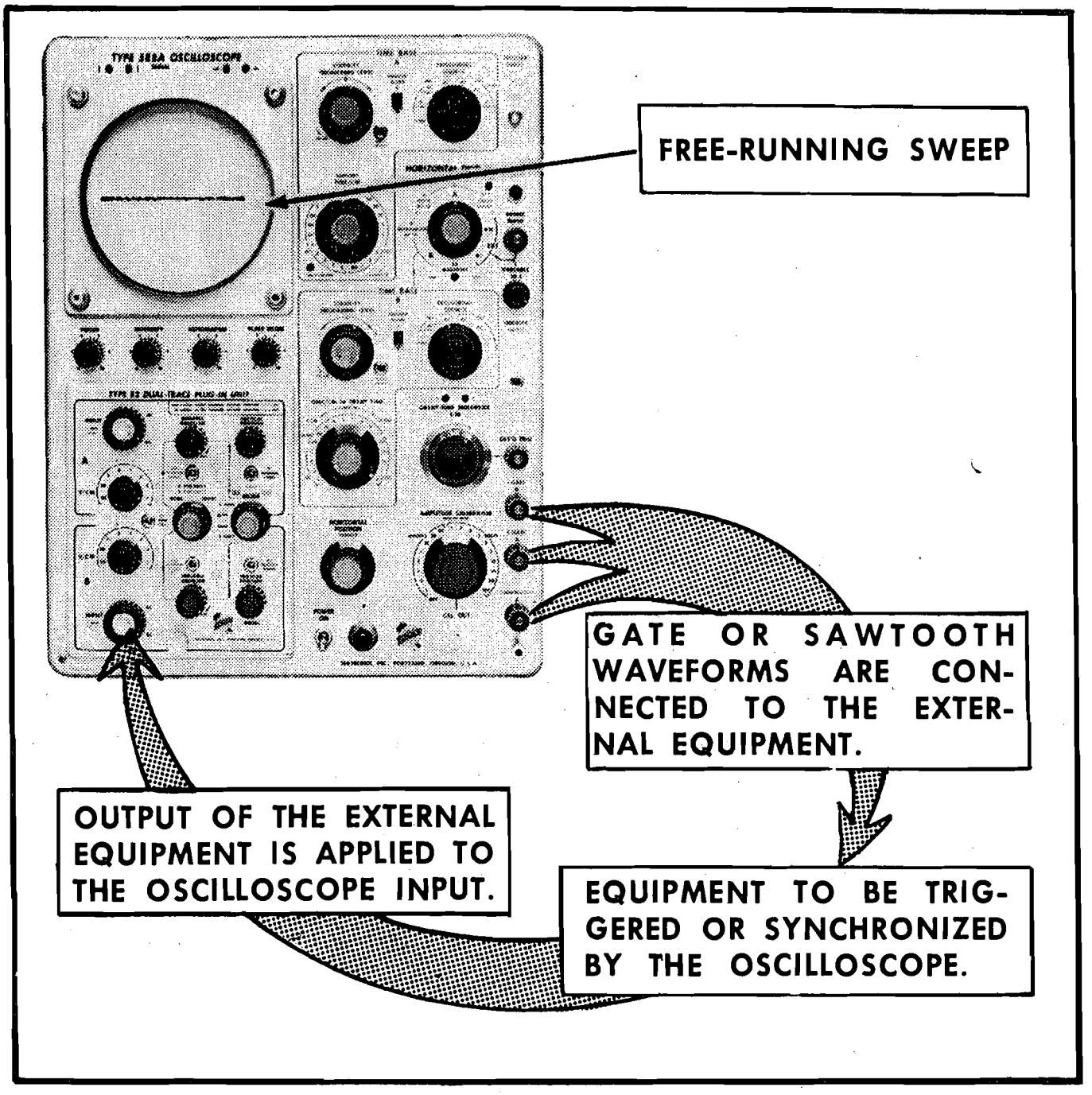
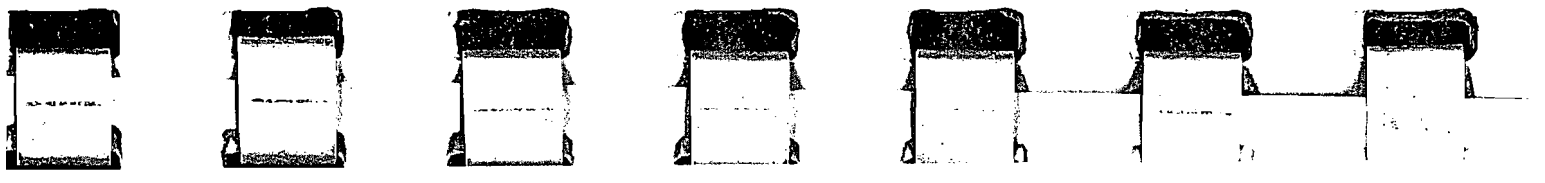
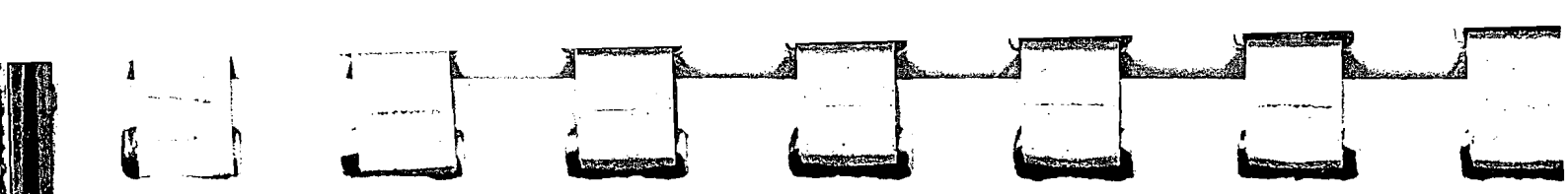


Fig. 2. Using the Gate or Sawtooth output waveforms to synchronize or trigger external equipment.





The TRIGGERING LEVEL control determines the point on the triggering waveform where triggering occurs. Rotating the control clockwise causes the sweep to trigger at more positive points on the waveform while rotating the control counterclockwise causes the sweep to trigger at more negative points. Setting the TRIGGERING LEVEL at 0 will cause the sweep to start at approximately the average-voltage point of the waveform.

Free-Running Sweep

In the usual oscilloscope application, the sweep is triggered or synchronized by the input waveform. However, in some applications it may be more desirable to reverse the process and initiate the input waveform through use of a periodically recurrent waveform from the oscilloscope. In this type of application the sweep is caused to free-run and an output from either the +GATE OUT (A and B) or SAWTOOTH A (Time-Base A only) connectors is used to trigger or synchronize the input waveform.

The sweep can be made to free run by rotaing the STABILITY control fully clockwise. Under these condtions the sweep runs at a rate determined by the setting of the TIME/CM controls.

In this application it is advisable to place the TRIGGERING SOURCE switch in its EXT-AC position to prevent the vertical signal from producing any possible interference or jitter.

SINGLE SWEEP OPERATION

General

The usual oscilloscope display formed by a repetitive sweep is best for most applications. However, in applications where the displayed waveform is not repetitive or varies in amplitude, slope, or time interval, a repetitive sweep produces a jumbled display. When observing a waveform of this type, it is usually advantageous to use a single sweep presentation.

The single sweep feature is selected by placing the HORIZONTAL DISPLAY switch in the 'A' SINGLE SWEEP position. The RESET button controls the operation of the single sweep.

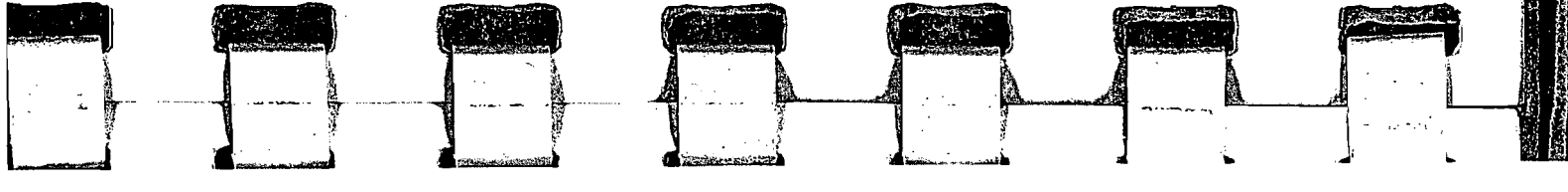
Manual Operation

This type of operation is best used when photographing waveforms which are repetitive but contain too much jitter.

Set the Time-Base A oscilloscope controls to:

STABILITY	Full right
TRIGGERING LEVEL	Full right
TRIGGER SLOPE	+
TRIGGERING SOURCE	EXT-AC
HORIZONTAL DISPLAY	'A' SINGLE-SWEEP
TIME/CM	Desired sweep rate
VARIABLE (TIME/CM)	CALIBRATED

Each time a sweep is desired, the RESET button must be pressed.



Triggered Operation

This type of operation is used to photograph non-repetitive waveforms.

Set the Time-Base A oscilloscope controls to:

TRIGGERING SOURCE	INT—AC For normal triggering requirements to 150 mc. AC LF REJECT to suppress low-frequency components that may cause jitter or otherwise mistrigger the desired waveform.
HORIZONTAL DISPLAY	A
TIME/CM	Desired sweep rate
VARIABLE (TIME/CM)	CALIBRATED

Obtain a waveform of about the same amplitude and frequency as that of the expected waveform. Adjust the Time-Base A STABILITY TRIGGERING LEVEL and TRIGGER SLOPE controls for a stable display of the substitute waveform. Disconnect the substitute waveform and connect the expected waveform to the oscilloscope. Set the HORIZONTAL DISPLAY to 'A' SINGLE SWEEP. Reset the single sweep circuitry of the oscilloscope by pressing the RESET button.

The oscilloscope will now sweep once when the expected waveform arrives. It will then not sweep again until the RESET button is once again pressed.

DELAYED OPERATION

Delayed Sweep Time Calculation

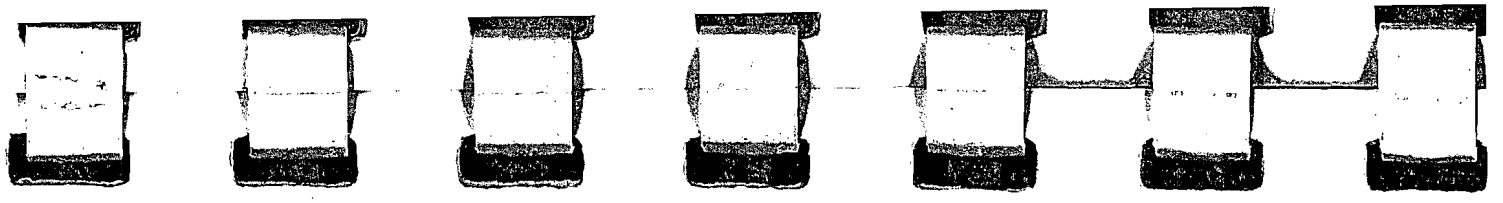
The amount of delay occurring after the application of the triggering waveform until the sweep is permitted to run, is indicated directly by the settings of the TIME/CM OR DELAY TIME control and the DELAY-TIME MULTIPLIER 1-10 control. The settings of the two controls are multiplied together to obtain the actual delay time. For example, if the TIME/CM OR DELAY TIME switch is set at 1 mSEC and the vernier dial of the DELAY-TIME MULTIPLIER 1-10 control indicates 6.75, the delay time is 6.75 milliseconds. When this time delay has elapsed, one of two events will occur depending upon the setting of the Time Base A STABILITY control.

1. Non-Triggered Operation

If the STABILITY control is fully clockwise, the horizontal sweep will occur immediately at the end of the delay period. This is the mode of operation most commonly used because it allows obtaining calibrated, continuously variable delay times.

2. Triggered Operation

If the Time Base is adjusted for normal triggered operation, the horizontal sweep does not start at the end of the delay period but waits until a triggering signal is received by the Time-Base A Trigger Circuit. In this mode of operation, the delay in presentation of the horizontal sweep is



not continuously variable but is dependent on both the setting of the delay time controls and the occurrence of the triggering signal.

Determining Delayed Portion

When the HORIZONTAL DISPLAY switch is placed in the 'B' INTENSIFIED BY 'A' position, you can obtain a normal sweep presentation using Time Base B. If all other controls are set for delayed sweep operation and the Time Base A TIME/CM switch is set for a faster sweep rate than the Time Base B TIME/CM OR DELAY TIME control, a portion of the sweep will be brightened. The start of the brightened portion indicates the start of the delayed sweep duration. The start of the brightened portion can be positioned left or right with the DELAY-TIME MULTIPLIER 1-10 control. The length of the brightened portion can be adjusted with the Time Base A TIME/CM control.

Expanding Delayed Portion

Place the HORIZONTAL DISPLAY switch in the 'A' DLY'D BY 'B' position to expand the brightened portion to the full width of the crt. The amount of magnification is the ratio of the Time Base B TIME/CM OR DELAY TIME control setting to the Time Base A TIME/CM control setting. For example, if the Time Base B TIME/CM OR DELAY TIME switch is set at 1 mSEC and the Time Base A TIME/CM

switch is set at 1 μSEC, the brightened portion of the sweep is magnified horizontally 1,000 times. Using this method, practical sweep magnifications up to approximately 10,000 times are attainable.

At times when using the delayed sweep to obtain high magnification, the trace may appear very dim because of low duty cycle.

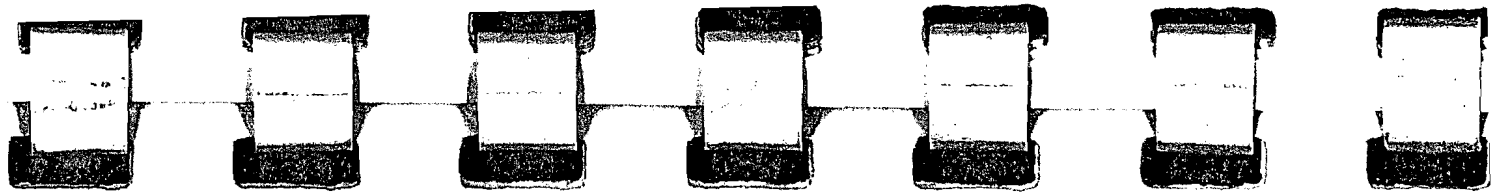
Delayed Trigger

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.

MISCELLANEOUS OPERATIONS

External Horizontal Input

For special applications you can deflect the spot horizontally with some externally derived waveform. This allows you to use the oscilloscope to plot one function versus another.



To use an external horizontal input, connect the externally derived waveform to the HORIZ INPUT connector and place the HORIZONTAL DISPLAY switch in either X1 or X10 EXT position. The horizontal deflection factor is continuously variable from approximately .2 to approximately 15 volts per centimeter with external horizontal VARIABLE 10-1 control and the HORIZONTAL DISPLAY switch.

Intensity Modulation

The crt display of the Type 585A Oscilloscope can be intensity modulated by an external signal to display additional information. This is done by disconnecting the grounding bar from the EXTERNAL CRT CATHODE connector at the rear of the instrument and connecting the external signal to this terminal.

When you wish to make very accurate time measurements from the crt display, you can intensity modulate the beam with time markers and make your measurements directly from the time markers presented on the screen. A positive signal of approximately 25 volts is required to cut off the beam from normal intensity. Restore the grounding bar to the EXTERNAL CRT CATHODE connector during normal operation to avoid uneven trace intensity at high sweep rates.