



**PLEASE CHECK FOR CHANGE INFORMATION  
AT THE REAR OF THIS MANUAL.**

**7B85  
DELAYING TIME BASE  
WITH OPTIONS**


**INSTRUCTION MANUAL**

**Tektronix, Inc.**  
**P.O. Box 500**  
**Beaverton, Oregon 97077**  
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Each instrument has a serial number on a panel insert, tag,  
or stamped on the chassis. The first number or letter  
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United States have six unique digits. The country of  
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# SAFETY SUMMARY

This manual contains safety information the user must follow to ensure safe operation of this instrument. WARNING information is intended to protect the operator; CAUTION information is intended to protect the instrument. The following are general safety precautions that must be observed during all phases of operation and maintenance.

## WARNING

### Ground the Instrument

*To reduce electrical-shock hazard, the mainframe (oscilloscope) chassis must be properly grounded. Refer to the mainframe manual for grounding information.*

### Do Not Operate in Explosive Atmospheres

*Do not operate this instrument in an area where flammable gases or fumes are present. Such operation could cause an explosion.*

### Avoid Live Circuits

*Electrical-shock hazards are present in this instrument. The protective instrument covers must not be removed by operating personnel. Component replacement and internal adjustments must be referred to qualified service personnel.*

### Do Not Service or Adjust Alone

*Do not service or make internal adjustments to this instrument unless another person, capable of giving first aid and resuscitation, is present.*

## WARNING

### Warning Statements

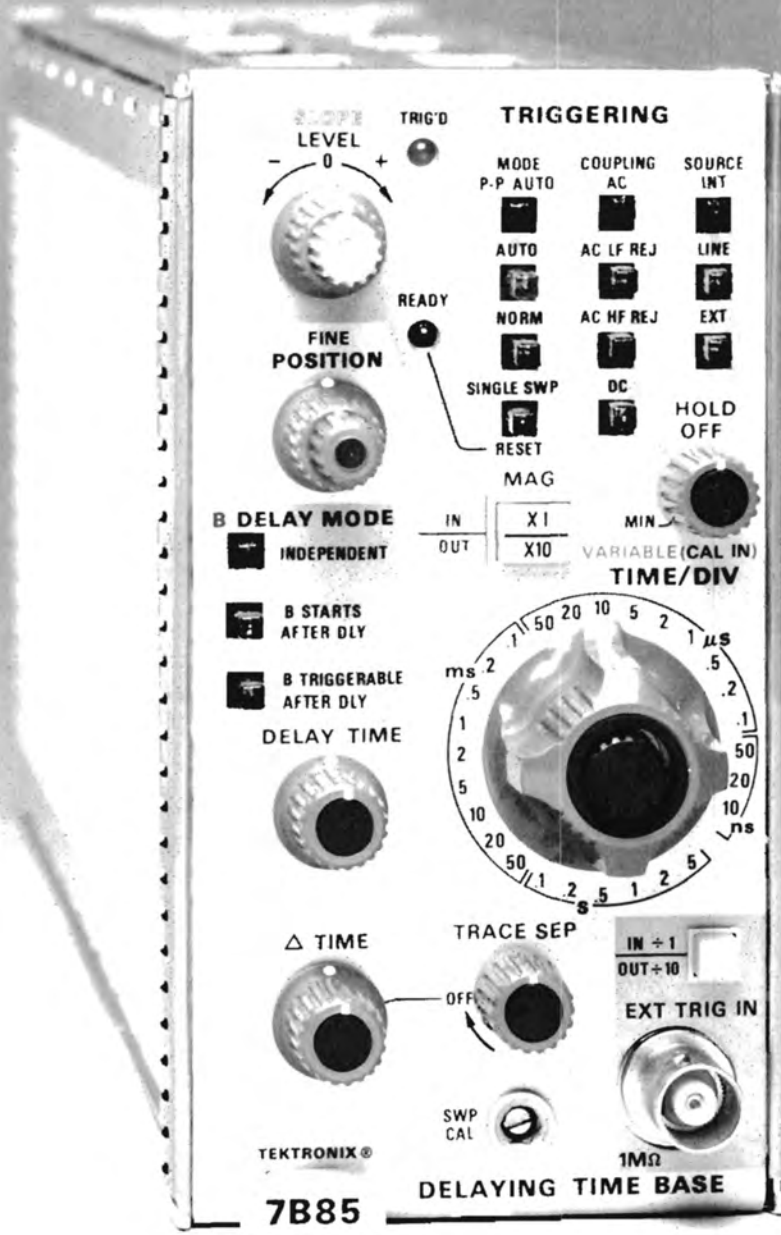
*Warning statements accompany potentially dangerous procedures in this manual. The following warnings appear in this manual and are listed here for additional emphasis.*

*To avoid electrical shock, disconnect the instrument from the power source before soldering.*

*To avoid electrical shock, disconnect the instrument from the power source before replacing components.*

*Handle silicone grease with care. Avoid getting silicone grease in eyes. Wash hands thoroughly after use.*





1961-80A

7B85 Delaying Time Base

# OPERATING INSTRUCTIONS

The 7B85 Delaying Time Base unit operates with a TEKTRONIX 7700-, 7800-, or 7900-Series oscilloscope mainframe and a 7A-Series amplifier unit to form a complete oscilloscope system. This section describes the operation of the front-panel controls and connectors, provides general operating information, a functional check procedure, and basic applications for this instrument.

## FEATURES

The 7B85 Delaying Time Base unit provides calibrated sweep rates from 5 s to 10 ns and triggering to 400 MHz for 7700-, 7800-, and 7900-Series oscilloscopes. The X10 Magnifier increases each sweep rate by a factor of 10 and the VARIABLE control allows continuously variable sweep rates between calibrated steps. Variable hold off and alphanumeric readout are provided. Also, when operating in the AUTO TRIGGERING MODE, a bright baseline trace is displayed in the absence of a trigger signal.

## INSTALLATION

The time-base unit is designed to operate in the horizontal plug-in compartment of the mainframe. This instrument can also be installed in a vertical plug-in compartment to provide a vertical sweep on the crt. However, when used in this manner, there are no internal triggering or retrace blanking provisions, and the unit may not meet the specifications given in Section 2.

To install the unit in a plug-in compartment, push it in until it fits firmly into the compartment. The front panel of the unit should be flush with the front panel of the mainframe. Even though the gain of the mainframe is standardized, the sweep calibration of the unit should be checked when installed. The procedure for checking the unit is given under Sweep Functions in the Functional Check procedure in this section.

To remove the unit, pull the release latch (see Fig. 1-1) and pull it out of the plug-in compartment.

## CONTROLS, CONNECTORS, AND INDICATORS

All controls, connectors, and indicators required for the operation of the time-base unit are located on the front panel.

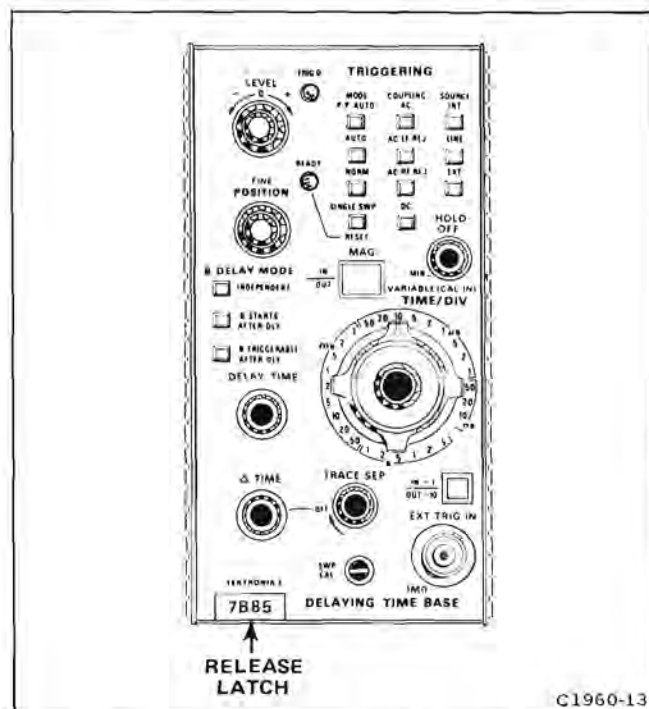


Fig. 1-1. Location of release latch.

el. Figure 1-2 provides a brief description of all front-panel controls, connectors, and indicators. More detailed information is given in the General Operating Instructions.

## FUNCTIONAL CHECK

The following procedures are provided for checking basic instrument functions. Refer to the description of the controls, connectors, and indicators while performing this procedure. If performing the functional check procedure reveals a malfunction or possible improper adjustment, first check the operation of the associated plug-in units, then refer to the instruction manual for maintenance and adjustment procedures.

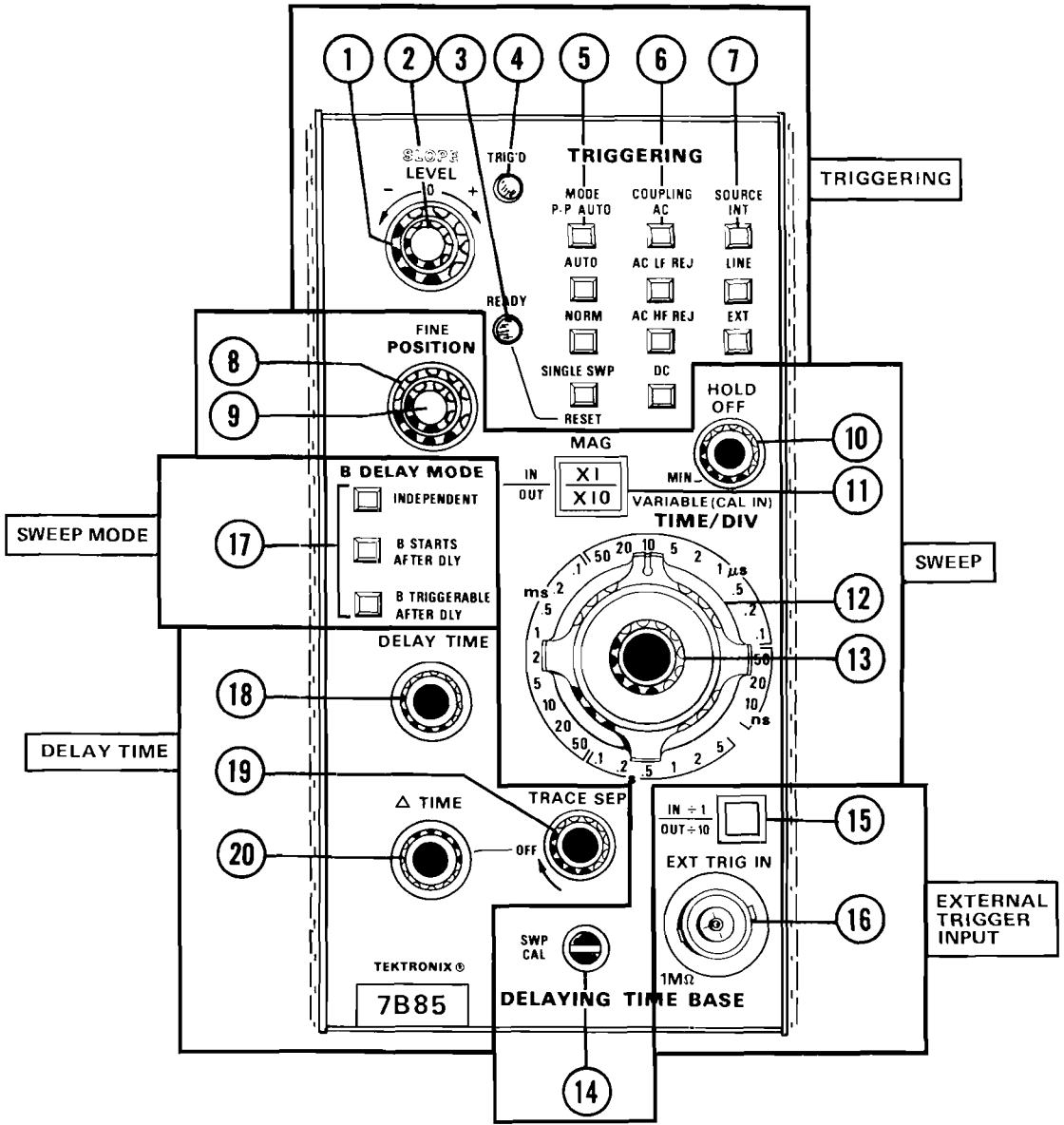


Fig. 1-2. Front-panel controls, connectors, and indicators.

## TRIGGERING

- ① LEVEL Control—Selects a point on the trigger signal where triggering occurs.
- ② SLOPE Switch—Permits sweep to be triggered on negative- or positive-going portions of the trigger signal.
- ③ READY Indicator—Illuminates when sweep circuit is armed (SINGLE SWEEP Mode).
- ④ TRIG'D Indicator—Illuminates when the display is triggered.
- ⑤ MODE Pushbuttons—Selects the operating mode of the triggering circuits.
- ⑥ COUPLING Pushbuttons—Selects the method of coupling the trigger signal to triggering circuit.
- ⑦ SOURCE Pushbuttons—Selects source of the trigger signal.

## SWEEP

- ⑧ POSITION Control—Provides horizontal positioning.
- ⑨ FINE Control—Provides precise horizontal positioning.
- ⑩ HOLD OFF Control—Permits hold off period to be varied to improve triggering stability of repetitive complex waveforms.
- ⑪ MAG Pushbutton—Selects X10 magnified or unmagnified sweep.
- ⑫ TIME/DIV Switch—Selects the sweep rate of the sweep generator.
- ⑬ VARIABLE Control and CAL Switch—Selects calibrated or uncalibrated sweep rates. Uncalibrated sweep rates can be continuously reduced to at least the sweep rate of the next slower position.
- ⑭ SWP CAL Adjustment—Compensates for basic timing changes due to the differences in sensitivity of mainframes in which the 7B85 may be used.

## EXTERNAL TRIGGER INPUT

- ⑮ EXT TRIG ATTENUATOR—Selects attenuation factor for external trigger signals.
- ⑯ EXT TRIG IN Connector—Connector (BNC type) provides input for external trigger signals.

## SWEEP MODE

- ⑰ B DELAY MODE Pushbuttons—Selects independent or delaying sweep operation. In the B STARTS AFTER DLY and B TRIGGERABLE AFTER DLY delaying sweep modes, the DELAY TIME and  $\Delta$  TIME functions are activated. There will be a 2 division vertical shift of the trace when switching from INDEPENDENT to B STARTS AFTER DELAY.

## DELAY TIME

- ⑱ DELAY TIME Control—Provides variable delay time before the start of the delayed sweep produced by companion time-base unit.
- ⑲ TRACE SEP Control and Switch—Enables  $\Delta$  TIME functions and provides vertical separation of the delayed sweep traces ( $\Delta$  TIME operation).
- ⑳  $\Delta$  TIME Control—Provides differential time measurements between 2 selected intensified zones on the delaying sweep trace. Two delayed sweep traces corresponding to the intensified zones are displayed by the companion time-base unit. Differential time is displayed on the crt readout.

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Fig. 1-2. Front-panel controls, connectors, and indicators (cont.).

## Operating Instructions—7B85

### Setup Procedure

1. Install the 7B85 in the A horizontal compartment of the mainframe.

2. Install an amplifier plug-in unit in a vertical compartment.

3. Set the 7B85 controls as follows:

SLOPE	(+)
MODE	P-P AUTO
COUPLING	AC
SOURCE	INT
B DELAY MODE	INDEPENDENT
TRACE SEP	OFF (fully clockwise)
POSITION	Midrange
TIME/DIV	1 ms
VARIABLE (CAL IN)	Calibrated (Pushed in)
HOLD OFF	MIN (fully counter-clockwise)
MAG	X1 (pushed in)

4. Turn on the oscilloscope and allow at least 20 minutes warmup.

5. Set the mainframe vertical and horizontal modes to display the plug-in units used and adjust the intensity and focus for a well-defined display. See the oscilloscope mainframe and amplifier unit instruction manuals for detailed operating instructions.

### Sweep Functions

**Normal Sweep.** Perform the following procedure to obtain a normal sweep and to demonstrate the function of the related controls.

1. Perform the preceding Setup Procedure.

2. Connect a 0.4 V, 1 kHz signal from the mainframe calibrator to the amplifier unit input.

3. Set the amplifier unit deflection factor for 4 divisions of display.

4. Adjust the LEVEL control for a stable display.

5. Turn the POSITION control and note that the trace moves horizontally.

6. Turn the FINE control and note that the display can be precisely positioned horizontally.

7. Check the display for one complete cycle per division. If necessary, adjust the front-panel SWP CAL screwdriver adjustment for one complete cycle per division over the center 8 graticule divisions. Be sure that the timing of the mainframe calibrator signal is accurate to within 0.25% (+20 to +30°C).

8. Press to release the VARIABLE (CAL IN) control. Turn the VARIABLE (CAL IN) control fully counterclockwise and note that the displayed sweep rate changes to at least the next slower TIME/DIV switch setting (i.e., 2 ms/div). Press the VARIABLE (CAL IN) knob in to the calibrated position.

**Magnified Sweep.** Perform the following procedure to obtain a X10 magnified display and to demonstrate the function of the related controls.

1. Obtain a one cycle per division display as described in the preceding Normal Sweep procedure.

2. Press to release the MAG button (X10). Note that the unmagnified display within the center division of the graticule is magnified to about 10 divisions.

3. Press the MAG button (X1).

**Delaying and Delayed Sweep.** Perform the following procedure to obtain delaying- and delayed-sweep displays and to demonstrate the function of the related controls. To obtain a delayed-sweep display, a companion time-base unit must be installed in the B horizontal compartment of the mainframe.

1. Obtain a display as described in the preceding Normal Sweep procedure.

2. Press the B STARTS AFTER DLY button.

3. Set the mainframe horizontal mode for chopped operation.

4. Set the companion time-base unit sweep rate for 0.1 ms/div, and triggering for p-p auto mode, ac coupling, internal source, and + slope.

5. Adjust the mainframe B sweep intensity and check for an intensified zone about 1 division wide on the delaying (A) sweep display. Also note that the delayed (B) sweep provides an expanded display of the intensified portion of the delaying (A) sweep.

6. Position the start of the delaying (A) sweep to the left edge of the graticule.

7. Adjust the DELAY TIME control for a crt readout (bottom division of crt graticule) of 5.000 ms. Check that the left edge of the intensified zone is at the graticule center line.

8. Set the 7B85 TIME/DIV switch to .5 ms and the delayed (B) sweep unit sweep rate to 20  $\mu\text{s}/\text{div}$ .

9. Turn the DELAY TIME control fully counterclockwise to position the intensified zone near the front corner of the first square-wave cycle. Press the B TRIGGERABLE AFTER DLY button and check that the intensified zone moves to the front corner of the next displayed square wave.

**$\Delta$  (Differential) TIME.** Perform the following procedure to obtain a  $\Delta$  (differential) time display and to demonstrate the function of the related controls.

1. Obtain a delaying (A) and delayed (B) sweep display as described in steps 1 through 4 of the preceding Delaying and Delayed Sweep procedure.

2. Turn the TRACE SEP control counterclockwise out of the OFF (detent) position.

3. Set the DELAY TIME and  $\Delta$  TIME controls to the fully counterclockwise position. Check for two delayed (B) sweeps and note that the crt readout (bottom right of crt) is 0.000 ms.

4. Slowly turn the  $\Delta$  TIME control clockwise and note that a second intensified zone moves across the delaying (A) sweep display, and the crt readout indicates the differential time between the left edge of the stationary intensified zone and the left edge of the second intensified zone. Also note that the lower delayed (B) sweep is an expanded display of the second intensified zone.

### Triggering Functions

Perform the following procedure to obtain a triggered sweep and to demonstrate the functions of the related controls.

1. Obtain a display as described in the preceding Normal Sweep procedure.

2. Press the AUTO MODE button and turn the LEVEL control fully counterclockwise to obtain a free-running sweep.

3. Slowly turn the HOLD OFF control clockwise and note that a stable display can be obtained at several positions of the HOLD OFF control. Return the HOLD OFF control to the fully counterclockwise (MIN) position.

### NOTE

*The HOLD OFF control varies the sweep holdoff time, which effectively changes the repetition rate of the horizontal sweep signal. However, its primary function is to obtain a stable display of complex waveforms that are otherwise difficult to trigger.*

4. Press the AC, AC HF REJ, and DC COUPLING buttons for both the + and - positions of the SLOPE switch and check for a stable display (LEVEL control may be adjusted, if necessary, to obtain a stable display).

5. Apply the 0.4 V, 1 kHz signal from the mainframe calibrator to the amplifier unit and to the EXT TRIG IN connector.

6. Press the EXT SOURCE button and set the amplifier unit deflection factor for a 4-division display.

7. Press the AC, AC HF REJ, and DC COUPLING buttons for both the + and - positions of the SLOPE switch and check for a stable display (LEVEL control may be adjusted, if necessary, for a stable display).

8. Press the AC COUPLING, INT SOURCE, and NORM MODE buttons. Adjust the LEVEL control for a stable display.

9. Press the AUTO MODE button and adjust the LEVEL control for a free-running display.

10. Press the NORM MODE button and check for no display.

11. Adjust the LEVEL control for a stable display and press the SINGLE SWP MODE button.

12. Note that one trace occurs when the RESET MODE button is pressed.

13. Disconnect the mainframe calibrator signal from the amplifier unit input and press the RESET MODE button. Check for no display and note that the READY indicator is lit.

14. Note that one trace occurs and that the READY indicator extinguishes when the mainframe calibrator signal is connected to the amplifier unit input.

## **GENERAL OPERATING INFORMATION**

### **Triggering Switch Logic**

The MODE, COUPLING, and SOURCE push buttons of the TRIGGERING switches are arranged in a sequence that places the most-often used position at the top of each series of push buttons. With this arrangement, a stable display can usually be obtained by pressing the top push buttons: P-P AUTO, AC, INT. When an adequate trigger signal is applied and the LEVEL control is correctly set, the unit is triggered as indicated by the illuminated TRIG'D light. If the TRIG'D light is not on, the LEVEL control is either at a setting outside the range of the trigger signal applied to this unit from the vertical unit, the trigger signal amplitude is inadequate, or its frequency is below the lower frequency limit of the AC COUPLING switch position. If the desired display is not obtained with these buttons pushed in, other selections must be made. Refer to the following discussions or the instruction manuals for the associated oscilloscope mainframe and vertical unit(s) for more information.

### **Triggering Modes**

The MODE push-button switches select the mode in which the sweep is triggered.

#### **P-P AUTO**

The P-P AUTO MODE provides a triggered display at any setting of the LEVEL control whenever an adequate trigger signal is applied. The range of the LEVEL control in the P-P AUTO MODE is between approximately 10% and 90% of the peak-to-peak amplitude of the trigger signal. The LEVEL control can be set so that the displayed waveform starts at any point within this range on either slope. The trigger circuits automatically compensate for a change in trigger signal amplitude. Therefore, if the LEVEL control is set to start the waveform display at a certain percentage point on the leading edge of a low-amplitude signal, it triggers at the same percentage point on the leading edge of a high-amplitude signal if the LEVEL control is not changed.

When the trigger repetition rate is outside the parameter given in the Specification section, or when the trigger signal is inadequate, the sweep free runs at the rate indicated by the TIME/DIV switch to produce a bright baseline, reference trace (TRIG'D light off). When an adequate trigger signal is again applied, the free-running condition ends and a triggered display is presented.

The P-P AUTO MODE is particularly useful when observing a series of waveforms, since it is not necessary to reset the LEVEL control for each observation. The P-P AUTO MODE is used for most applications because of the ease of obtaining a triggered display. The AUTO, NORM, and SINGLE SWP MODE settings may be used for special applications.

#### **AUTO**

The AUTO MODE provides a triggered display with the correct setting of the LEVEL control whenever an adequate trigger signal is applied (see Trigger Level discussions). The TRIG'D light indicates when the display is triggered.

When the trigger repetition rate is outside the frequency range selected by the COUPLING switch or the trigger signal is inadequate, the sweep free runs at the rate indicated by the TIME/DIV switch (TRIG'D indicator off). An adequate trigger signal ends the free-running condition and a triggered display is presented. The sweep also free runs at the rate indicated by the TIME/DIV switch when the LEVEL control is at a setting outside the amplitude range of the trigger signal. This type of free-running display is useful when it is desired to measure only the peak-to-peak amplitude of a signal without observing the waveshape (such as bandwidth measurements).

#### **NORMAL**

The NORM MODE provides a triggered display with the correct setting of the LEVEL control whenever an adequate trigger signal is applied. The TRIG'D light indicates when the display is triggered.

The normal trigger mode must be used to produce triggered displays with trigger repetition rates below approximately 30 Hz. When the TRIG'D light is off, no trace is displayed.

#### **SINGLE SWEEP**

When the signal to be displayed is not repetitive or varies in amplitude, waveshape, or repetition rate, a conventional repetitive type display may produce an unstable presentation. Under these circumstances, a stable display can often be obtained by using the single-sweep feature of this unit.

The single-sweep mode is also useful to photograph non-repetitive or unstable displays.

To obtain a single-sweep display of a repetitive signal, first obtain the best possible display in the NORM MODE. Then, without changing the other TRIGGERING controls, press the SINGLE SWP RESET button. A single trace is presented each time this button is pressed. Further sweeps cannot be presented until the SINGLE SWP RESET button is pressed again. If the displayed signal is a complex waveform composed of varying amplitude pulses, successive single-sweep displays may not start at the same point on the waveform. To avoid confusion due to the crt persistence, allow the display to disappear before pressing the SINGLE SWP RESET button again. At fast sweep rates, it may be difficult to view the single-sweep display. The apparent trace intensity can be increased by reducing the ambient light level or by using a viewing hood as recommended in the mainframe instruction manual.

When using the single-sweep mode to photograph waveforms, the graticule may have to be photographed separately, in the normal manner, to prevent over-exposing the film. Be sure the camera system is well protected against stray light, or operate the system in a darkened room. For repetitive waveforms, press the SINGLE SWP RESET button only once for each waveform unless the signal is completely symmetrical. Otherwise, multiple waveforms may appear on the film. For random signals, the lens can be left open until the signal triggers the unit. Further information on photographic techniques is given in the appropriate camera instruction manual.

### Trigger Coupling

The TRIGGER COUPLING push buttons select the method in which the trigger signal is connected to the trigger circuits. Each position permits selection or rejection of some frequency components of the signal that triggers the sweep.

**AC.** AC COUPLING blocks the dc component of the trigger signal. Signals with low-frequency components below approximately 30 Hz are attenuated. In general, AC COUPLING can be used for most applications. However, if the signal contains unwanted frequency components or if the sweep is to be triggered at a low repetition rate or dc level, one of the other COUPLING switch positions will provide a better display.

**AC LF REJ.** AC LF REJ COUPLING rejects dc, and attenuates low-frequency trigger signals below approximately 30 kHz. Therefore, the sweep is triggered only by the higher-frequency components of the trigger signal. This position is particularly useful for providing stable triggering if the trigger signal contains line-frequency components. Also, the AC

LF REJ position provides the best alternate-mode vertical displays at fast sweep rates when comparing two or more unrelated signals.

**AC HF REJ.** AC HF REJ COUPLING passes all low-frequency signals between approximately 30 Hz and 50 kHz. Dc is rejected, and signals outside the above range are attenuated. When triggering from complex waveforms, this position is useful to provide a stable display of the low-frequency components.

**DC.** DC COUPLING can be used to provide stable triggering from low-frequency signals that would be attenuated in other COUPLING switch positions. DC COUPLING can be used to trigger the sweep when the trigger signal reaches a dc level set by the LEVEL control. When using internal triggering, the setting of the vertical unit position control affects the triggering point.

### Trigger Source

The TRIGGERING SOURCE push buttons select the source of the trigger signal connected to the trigger circuits.

**INTernal.** The INT position connects the trigger signal from the vertical plug-in unit. Further selection of the internal trigger signal may be provided by the vertical plug-in unit or by the mainframe; see the instruction manuals for these instruments for more information. For most applications, the internal source can be used. However, some applications require special triggering that cannot be obtained in the INT position. In such cases, the LINE or EXT positions of the SOURCE switches must be used.

**LINE.** The LINE position connects a sample of the power-line voltage from the mainframe to the trigger circuit. Line triggering is useful when the input signal is time-related (multiple or submultiple) to the line frequency. It is also useful for providing a stable display of a line-frequency component in a complex waveform.

**EXTernal.** The EXT position connects the signal from the EXT TRIG IN connector to the trigger circuit. The external signal must be time-related to the displayed waveform for a stable display. An external trigger signal can be used to provide a triggered display when the internal signal is either too low in amplitude for correct triggering or contains signal components on which triggering is not desired. It is also useful when signal tracing in amplifiers, phase-shift networks, wave-shaping circuits, etc. The signal from a single point in the circuit can be connected to the EXT TRIG IN connector through a probe or cable. The sweep is then triggered by the same signal at all times and allows amplitude, time relationship, or waveshape changes of signals at var-



## Operating Instructions—7B85

ious points in the circuit to be examined without resetting the TRIGGERING controls.

The  $\div 10$  push buttons attenuates the external trigger signal by a factor of 10. Attenuation of high amplitude external trigger signals is desirable to increase the effective range of the LEVEL control.

### Trigger Slope

The TRIGGERING SLOPE switch (concentric with the TRIGGERING LEVEL control) determines whether the trigger circuit responds on the positive- or negative-going portion of the trigger signal. When the SLOPE switch is in the (+) (positive-going) position, the display starts on the positive-going portion of the waveform (see Fig. 1-3). When several cycles of a signal appear in the display, the setting of the SLOPE switch is often unimportant. However, if only a certain portion of a cycle is to be displayed, correct setting of the SLOPE switch is important to provide a display that starts on the desired slope of the input switch.

### Trigger Level

The TRIGGERING LEVEL control determines the voltage level on the trigger signal at which the sweep is triggered. When the LEVEL control is set in the + region, the trigger circuit responds at a more positive point on the trigger signal. When the LEVEL control is set in the - region, the trigger circuit responds at a more negative point on the trigger signal. Figure 1-3 illustrates this effect with different settings of the SLOPE switch.

To set the LEVEL control, first select the TRIGGERING MODE, COUPLING, SOURCE, and SLOPE. Then set the LEVEL control fully counterclockwise and rotate it clockwise until the display starts at the desired point. Less selection of the triggering level is available as the trigger signal frequency exceeds 150 MHz.

### Horizontal Sweep Rates

The TIME/DIV switch provides calibrated sweep rates from 5 s/div to 10 ns/div in a 1-2-5 sequence. The VARIABLE TIME/DIV control must be in the calibrated position and the MAG switch set to X1 to obtain the sweep rate indicated by the TIME/DIV switch. However, the mainframe crt readout will display the appropriate sweep rate.

The VARIABLE TIME/DIV control includes a two-position switch to determine if the sweep rate is calibrated, or uncalibrated. When the VARIABLE control is pressed in, it is inoperative and the sweep rate is calibrated. When pressed and released outward, the VARIABLE control is activated for uncalibrated sweep rates, to at least the sweep rate of the next slower position.

A calibrated sweep rate can be obtained in any position of the VARIABLE control by pressing in the VARIABLE control. This feature is particularly useful when a specific uncalibrated sweep rate has been obtained and it is desired to switch between calibrated and uncalibrated displays.

### Time Measurements

When making time measurements from the graticule, the area between the second and tenth vertical lines of the graticule provides the most linear time measurements (see Fig. 1-4). Position the start of the timing area to the second vertical line and adjust the TIME/DIV switch so the end of the timing area falls between the second and tenth vertical lines.

### Sweep Magnification

The sweep magnifier can be used to expand the display by a factor of 10. The center division of the unmagnified display is the portion visible on the crt in the magnified form (see Fig. 1-5). The equivalent length of the magnified sweep is more than 100 div; any 10-div portion can be viewed by adjusting the POSITION and FINE POSITION controls to bring the desired portion into the viewing area.

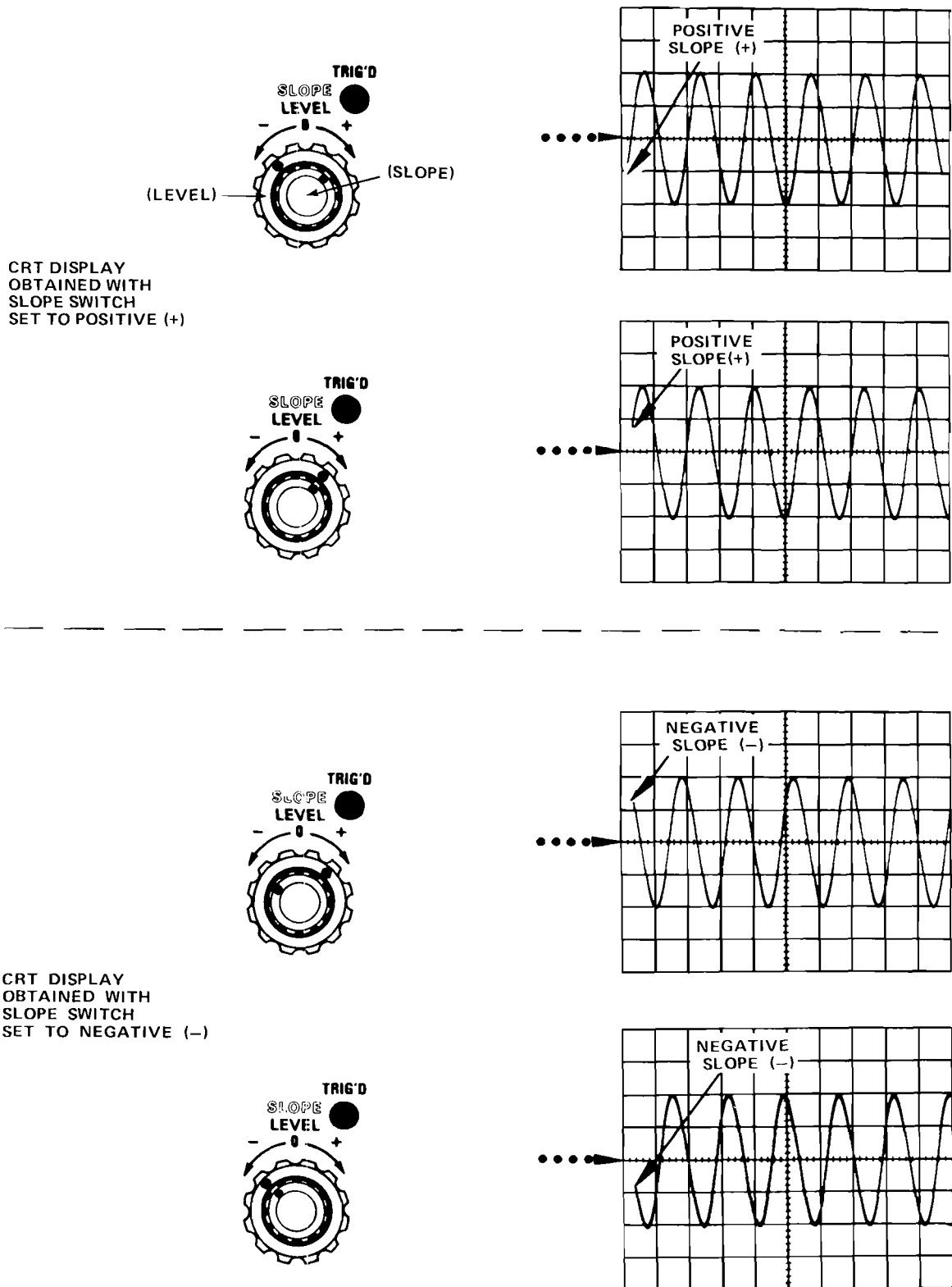
When the MAG switch is set to X10 (OUT), the equivalent magnified sweep rate can be determined by dividing the TIME/DIV setting by 10; the equivalent magnified sweep rate is displayed on the crt readout.

### Variable Hold Off

The HOLD OFF control improves triggering stability on repetitive complex waveforms by effectively changing the repetition rate of the horizontal sweep signal. The HOLD OFF control should normally be set to its minimum setting. When a stable display cannot be obtained with the TRIGGERING LEVEL control, the HOLD OFF control can be varied for an improved display. If a stable display cannot be obtained at any setting of the LEVEL and HOLD OFF controls, check the TRIGGERING COUPLING and SOURCE switch settings.

### Delay-Time Operation

A 7B85 installed in the mainframe A horizontal compartment can delay a companion time-base unit installed in the B horizontal compartment. When operating the 7B85 in a delaying mode (B DELAY MODE switch set to B STARTS AFTER DLY or B TRIGGERABLE AFTER DLY), an intensified zone is provided on the delaying sweep display during the time that the companion time-base unit runs (see Fig. 1-6). A delayed-sweep trace is provided by the companion time-base unit, corresponding to the intensified zone on the delaying trace, at the sweep rate set by the TIME/DIV



CRT DISPLAY  
OBTAINED WITH  
SLOPE SWITCH  
SET TO POSITIVE (+)

CRT DISPLAY  
OBTAINED WITH  
SLOPE SWITCH  
SET TO NEGATIVE (-)

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Fig. 1-3. Effects of LEVEL control and SLOPE switch on crt display.

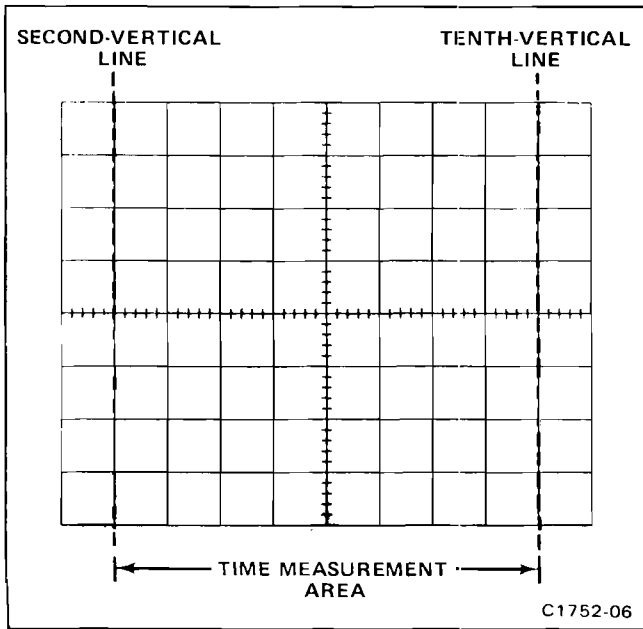


Fig. 1-4. Area of graticule used for most accurate time measurements.

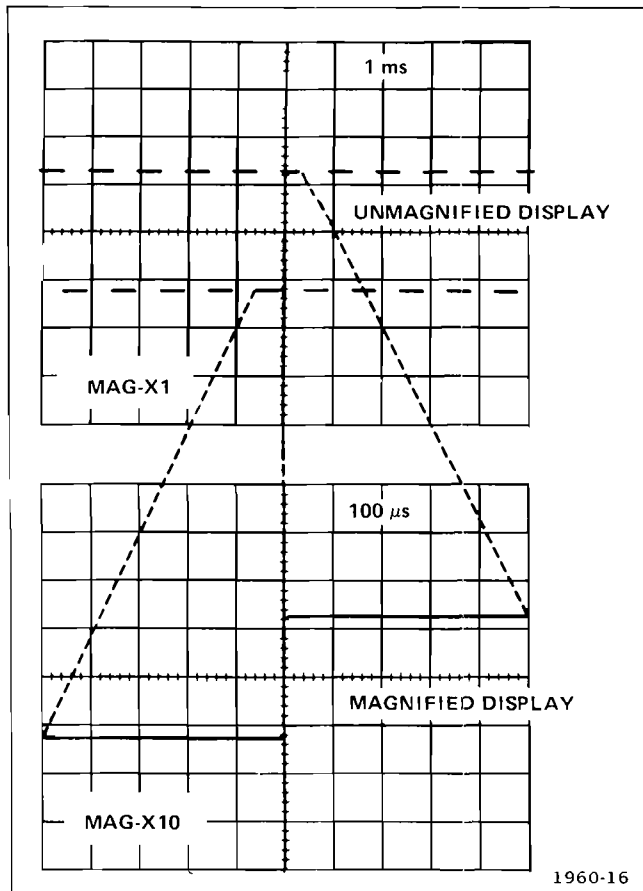


Fig. 1-5. Effect of sweep magnifier on crt display.

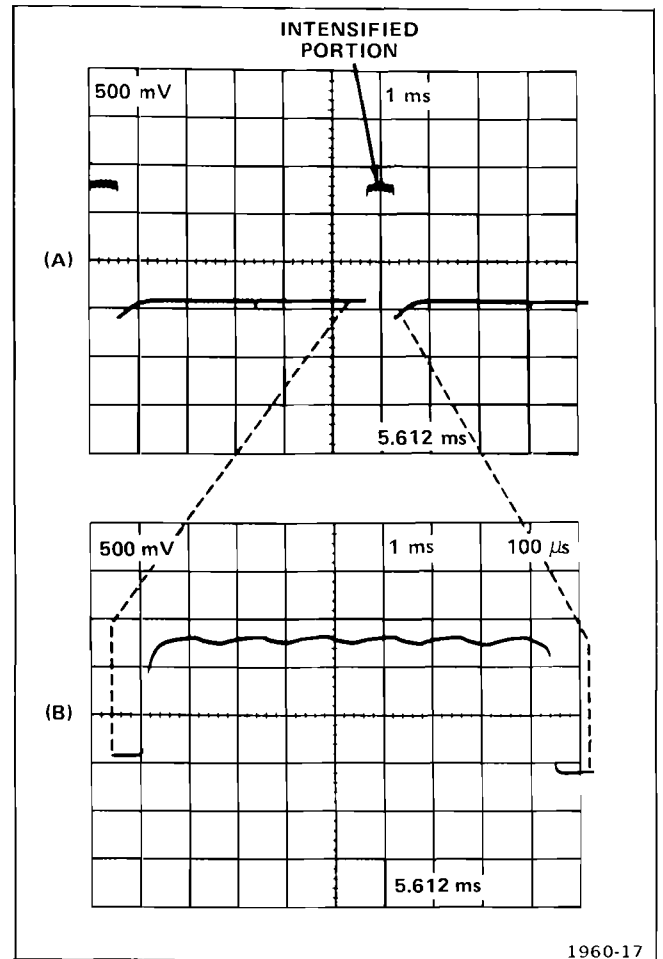


Fig. 1-6. (A) Delaying-sweep display produced by 7B85 in the A horizontal compartment. (B) Delayed-sweep display produced by companion time-base unit in the B horizontal compartment.

switch of the companion time-base unit (see Fig. 1-6). The delay time between the triggering event that starts the delaying-sweep trace and the start of the intensified zone (and corresponding delayed sweep), is determined by the 7B85 TIME/DIV switch and DELAY TIME control. The amount of calibrated delay time is displayed on the crt readout.

To view the delaying-sweep trace (intensified display), set the mainframe horizontal mode switch to A; to view the corresponding delayed-sweep trace, set the mainframe horizontal mode switch to B. To view the delaying trace (intensified) and the corresponding delayed-sweep trace on the same display, set the mainframe horizontal mode switch to alternate or chop.

Triggering for the delaying-sweep trace is controlled by the 7B85 TRIGGERING controls. Triggering for the intensified zone on the delaying-sweep trace and the correspond-

ing delayed-sweep trace is controlled by the triggering controls of the companion time-base unit when the 7B85 is in the B TRIGGERABLE AFTER DLY mode.

Delay-time measurements must be made with the B DELAY MODE switch set to B STARTS AFTER DLY. When the B DELAY MODE switch is set to B TRIGGERABLE AFTER DLY, the delayed sweep starts with the first trigger pulse after the delay time shown on the crt readout. Therefore, precision time measurements cannot be made in this mode because the time delay is only partially dependent on the DELAY TIME control. The crt readout displays the greater-than symbol (>) preceding the delay time when operating in the B TRIGGERABLE AFTER DLY mode to indicate that the delay time is uncalibrated. However, the B TRIGGERABLE AFTER DLY mode is useful for triggering on waveforms with excessive jitter.

### **Δ TIME Operation**

The Δ TIME delaying mode provides the best means of making differential time measurements. The 7B85 can delay a companion time-base unit at two separate delay times. At the end of the first delay time (determined by the 7B85 DELAY TIME control and TIME/DIV switch) an intensified zone is provided on the delaying-sweep trace. Further, a separate delayed-sweep trace corresponding to the first intensified zone is provided. At the end of the second delay time (determined by the 7B85 TIME/DIV switch, the DELAY TIME, and Δ TIME controls) a second intensified zone and corresponding second delayed-sweep trace are displayed (see Fig. 1-7). The 7B85 must be installed in the A horizontal compartment. The companion time-base unit must be installed in the B horizontal compartment. The TRACE SEP control must be rotated counterclockwise out of the switch detent position for Δ TIME operation. The sweep rate for the delaying-sweep trace is determined by the 7B85 TIME/DIV switch, and the sweep rate of the intensified zones and corresponding delayed-sweep display is determined by the sweep rate setting of the companion time-base unit.

The differential time between the start of the first intensified zone and the start of the second intensified zone is displayed on the crt readout (see Fig. 1-7). A Δ symbol preceding the delay-time readout indicates a differential measurement. The > (greater-than) symbol following the Δ

symbol indicates that the TIME/DIV VARIABLE control is activated or that the B DELAY MODE switch is set to B TRIGGERABLE AFTER DLY and, therefore, the differential time is uncalibrated.

The TRACE SEP control vertically positions the second delayed-sweep trace with respect to the first delayed-sweep trace. Vertical positioning of the delayed-sweep traces with respect to the delaying-sweep trace is provided by the vertical separation control on the oscilloscope mainframe.

**Δ TIME Operation in a Dual-Beam Oscilloscope Mainframe.** The 7B85 Δ TIME function is compatible with 7000-series dual-beam mainframes and operation is basically the same as given for Δ Time Operation. The 7B85 must be installed in the A horizontal compartment and the companion time-base unit must be installed in the B horizontal compartment, as with conventional four plug-in compartment mainframes. Set the horizontal mode switch so that the 7B85 provides horizontal deflection for one beam and the companion time-base unit provides horizontal deflection for the other beam. Apply the input signal to the desired vertical plug-in unit and select that unit for vertical deflection of both beams.

Operation of the Δ TIME mode in dual-beam mainframes with a dedicated vertical system differs slightly from conventional dual-beam mainframes with vertical-mode switches. The plug-in unit in the left vertical compartment provides vertical deflection of beam 1, and the plug-in unit in the right vertical compartment provides vertical deflection for beam 2. Therefore, the input signal must be applied to the units in both the left and right vertical compartments for Δ TIME operation.

### **Mainframe Operating Modes**

The 7B85 can also be operated either as an independent time base in any TEKTRONIX 7700-, 7800-, and 7900-Series mainframes, or as a delayed-sweep unit (B DELAY MODE switch set to INDEPENDENT) in those mainframes that have two horizontal compartments. A companion delaying time-base unit (e.g., another 7B85) is required for delayed-sweep operation. Refer to Applications in this section for additional information.

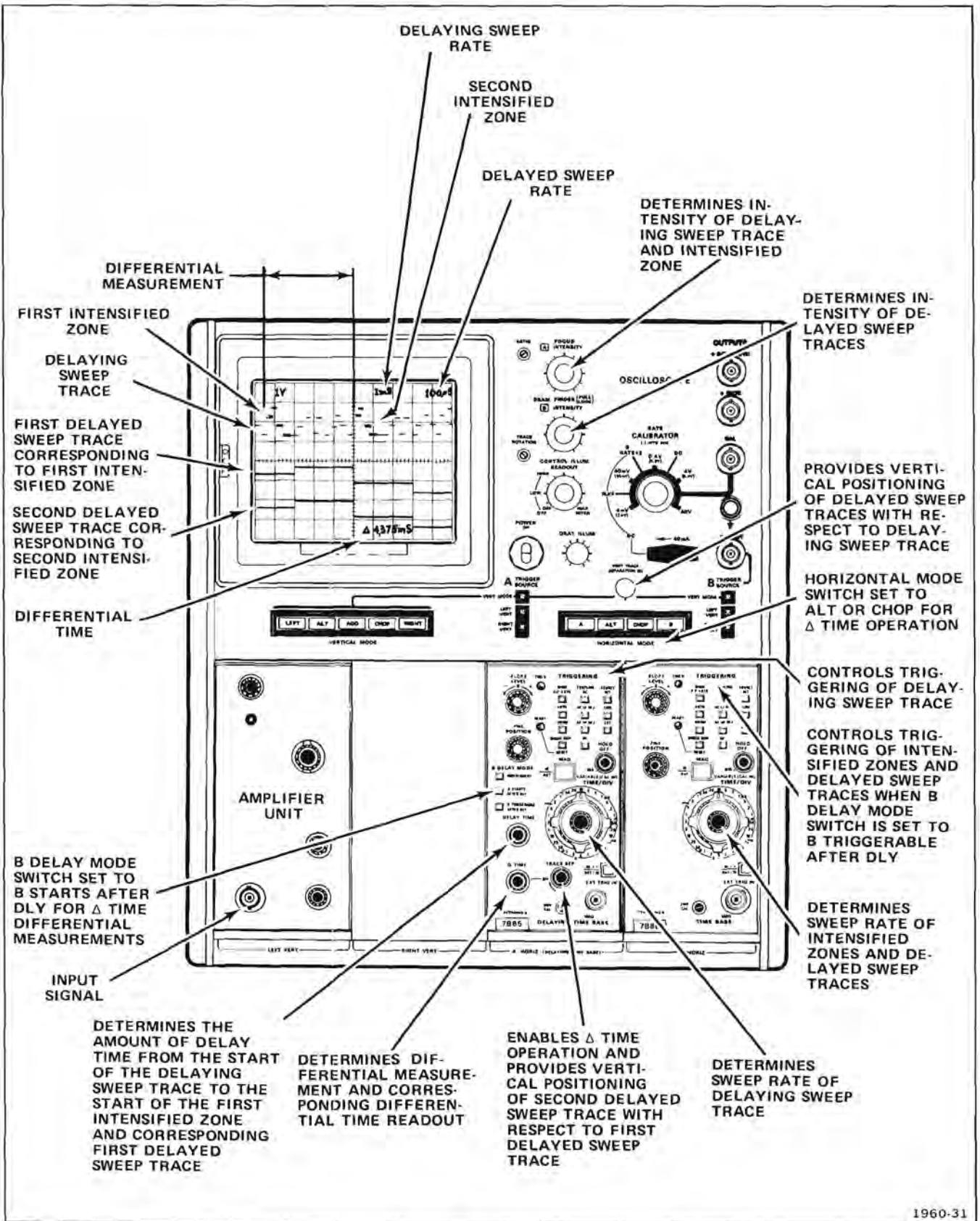


Fig. 1-7. Typical Δ (differential) time operation.

## APPLICATIONS

The 7B85 is designed primarily for use with a companion time-base unit in a readout-equipped mainframe to make delayed-sweep time-interval measurements. The 7B85 can also be used as an independent non-delaying time base. The following procedures provide instructions for making several delayed-sweep time-interval measurements using the delay-time and  $\Delta$  (differential) time modes. These procedures provide enough detail to enable the operator to adapt them to other related time-interval measurements. Contact your Tektronix Field Office or representative for assistance in making measurements not described in this manual.

### DELAYED-SWEEP MEASUREMENTS

Complex signals often consist of a number of individual events of differing amplitudes. Since the trigger circuits are sensitive only to changes in signal amplitude, a stable display can normally be obtained only when the sweep is triggered by the event(s) having the greatest amplitude. However, this may not produce the desired display of a lower-amplitude portion following the triggering event. The delayed-sweep feature provides a means of delaying the start of the delayed sweep by a selected amount following the event that triggers the sweep generator. Then, the part of the waveform containing the information of interest can be displayed at the delayed-sweep rate with a higher apparent magnification than is provided by the MAG switch.

The delayed-sweep feature can also be used to provide rapid and accurate time-interval measurements from a triggering event (i.e., the start of the delaying sweep) to a selected point or between two selected points on a displayed waveform. See General Operating Information in this section for a further discussion of delay-time operation.

In the delay-time mode, the delayed (B) sweep runs for a selected interval after the delaying (A) sweep as indicated by an intensified zone superimposed on the delaying (A) sweep trace. The length of the intensified zone indicates the time that the delayed sweep runs and is determined by the delayed (B) sweep plug-in unit sweep rate (TIME/DIV setting). The time from the start of the delaying (A) sweep to the start of the intensified zone (i.e., the start of the delayed sweep) can be read directly on the crt readout.

In the  $\Delta$  (differential) time mode, the delayed (B) sweep runs for a second selected interval indicated by a second intensified zone superimposed on the delaying (A) sweep trace. The two intensified zones can be positioned with the DELAY TIME and  $\Delta$  TIME controls. The crt readout then indicates the differential ( $\Delta$ ) time from the start of the first to the start of the second intensified zones.

By selecting the mainframe alternate or chopped horizontal operation, the delaying (A) sweep and either the first delayed (B) sweep interval (delay-time mode) or both delayed (B) sweep intervals ( $\Delta$  time mode) can be displayed

simultaneously. Since the delayed (B) sweep(s) can be displayed at a higher magnification than is available with the MAG switch, more precise selection of time intervals is possible.

The following procedures provide instructions for making several types of time-interval measurements in the delay-time and  $\Delta$  (differential) time modes.

### Time-Interval Measurements (Delay-Time Mode)

Perform the following procedure to measure the time from a triggering event (start of sweep) to any point on a displayed waveform.

1. Install the 7B85 in the mainframe A horizontal compartment and a companion time-base unit in the B horizontal compartment.

2. Set the 7B85 controls as follows:

B DELAY MODE	B STARTS AFTER DLY (button in)
MAG	X1 (button in)
HOLD OFF	MIN (fully counter-clockwise)
TRACE SEP	OFF (fully clockwise)
VARIABLE TIME/DIV	Calibrated (knob in)

3. Connect the signal to be measured to the vertical unit input.

4. Set the mainframe for the A horizontal mode to display the 7B85, and the vertical mode to display the vertical unit.

5. Set the TRIGGERING controls for a stable display (see General Operating Information in this section to select proper triggering).

6. Set the vertical deflection factor and 7B85 sweep rate for the desired display. See the example in Fig. 1-8.

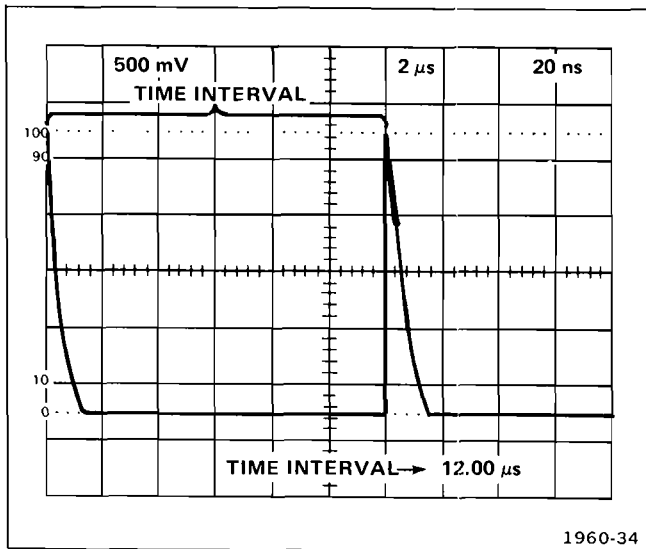


Fig. 1-8. Measuring time intervals from a triggering event (start of sweep) to any point on a waveform.

7. Set the delayed (B) unit sweep rate for about a 0.5 div intensified zone.

8. Rotate the DELAY TIME control to position the leading edge of the intensified zone at the point on the displayed waveform where the desired time interval ends.

9. Read the time interval from the start of the sweep to the leading edge of the intensified zone directly on the crt readout (see Fig. 1-8).

### Differential Time-Interval Measurements ( $\Delta$ Time Mode)

Perform the following procedure to measure the time interval between any two selected points on a waveform. This procedure can be used to measure the rise time, fall time, period, frequency, or pulse width of a displayed waveform.

1. Install the 7B85 in the mainframe A horizontal compartment and a companion time-base unit in the B horizontal compartment.

2. Set the 7B85 controls as follows:

B DELAY MODE	B STARTS AFTER DLY (button in)
MAG	X1 (button in)
HOLD OFF	MIN (fully counter-clockwise)
TRACE SEP	OFF (fully clockwise)
VARIABLE TIME/DIV	Calibrated (knob in)

3. Connect the signal to be measured to the vertical unit input.

4. Set the mainframe for the A horizontal mode to display the 7B85 and the vertical mode to display the vertical unit.

5. Set the TRIGGERING controls for a stable display (see General Operating Information in this section to select proper triggering).

6. Set the appropriate triggering, position, deflection-factor, and sweep-rate controls to obtain the desired display. See the example in Fig. 1-9.

7. Adjust the DELAY TIME control to position the leading edge of the first intensified zone to the beginning of the time interval to be measured (see Fig. 1-9, point A).

8. Turn the TRACE SEP control counterclockwise just out of the OFF (detent) position to obtain a second intensified zone ( $\Delta$  time mode) on the display.

9. Adjust the  $\Delta$  TIME control to position the leading edge of the second intensified zone to the end of the time interval to be measured (see Fig. 1-9, point B).

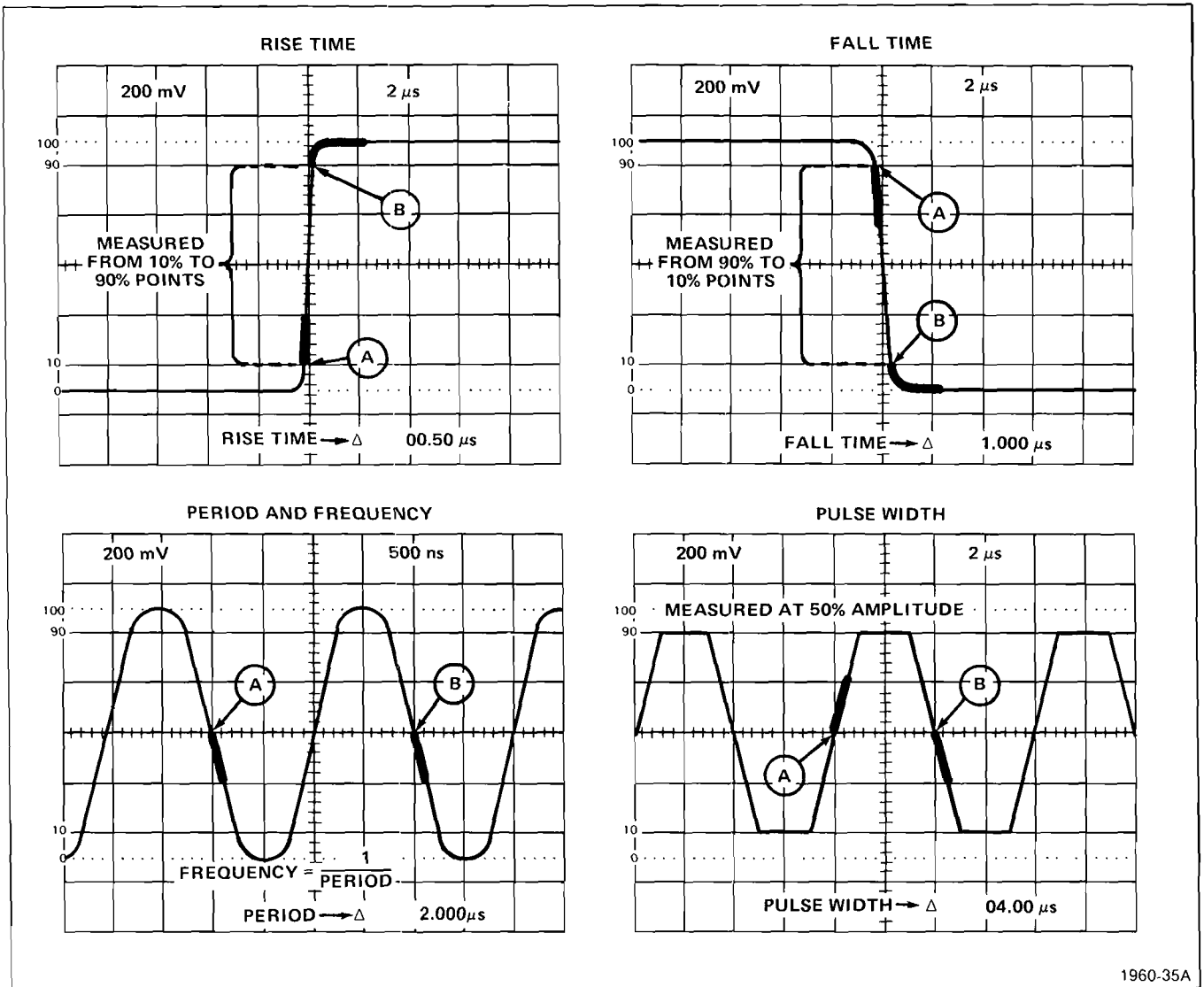
10. Read the time interval between the intensified zones directly from the crt readout.

### NOTE

*For more accurate time-interval measurements with a dual-trace magnified display, refer to the Delayed-Sweep Magnification procedure.*

### Delayed-Sweep Magnification

By selecting the mainframe alternate or chopped horizontal mode, a dual-trace display of both the delaying (A) sweep and the delayed (B) sweep can be obtained. In the delay-time mode (i.e., TRACE SEP control in the OFF position), the delayed (B) sweep appears as a magnified display of the single intensified portion on the delaying (A) sweep trace. In the  $\Delta$  (differential) time mode (i.e., TRACE SEP control rotated counterclockwise out of the OFF position), the delayed (B) sweep appears as a dual magnified display of both intensified portions of the delaying (A) sweep trace. The dual-delayed (B) sweep displays can be superimposed or separated by rotating the TRACE SEP control.



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Fig. 1-9. Measuring rise time, fall time, period, frequency, or pulse width in the Δ (differential) time mode.

The following procedures use alternate or chopped horizontal (dual-trace) operation to: (1) magnify a selected segment of the delaying (A) sweep and determine apparent magnification in the delay-time mode; (2) make more accurate time-interval measurements in the delay-time and Δ (differential) time modes; and (3) examine an event that occurs within a selected time interval after a known delay time in the delay-time mode.

1. Install the 7B85 in the mainframe A horizontal compartment and a companion time-base unit in the B horizontal compartment.

2. Set the 7B85 controls as follows:

- |                   |                                   |
|-------------------|-----------------------------------|
| B DELAY MODE      | B STARTS AFTER DLY<br>(button in) |
| MAG               | X1 (button in)                    |
| HOLD OFF          | MIN (fully counter-clockwise)     |
| VARIABLE TIME/DIV | Calibrated (knob in)              |
| TRACE SEP         | OFF (fully clockwise)             |

3. Connect the signal to be measured to the vertical unit input.



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4. Set the mainframe horizontal mode for alternate or chopped operation (see oscilloscope mainframe instruction manual for discussion of alternate or chopped operation).

5. Use the following procedure to magnify a selected segment of the delaying (A) sweep waveform and determine apparent magnification in the delay-time mode.

- a. Perform the procedures in step 1 through 4.
- b. Set the appropriate triggering, position, deflection-factor, and sweep-rate controls for the desired dual-trace display. See the example in Fig. 1-10.

### NOTE

*If there is excessive jitter in the delayed (B) sweep display, refer to the Triggered Delayed Sweep Magnification discussion.*

c. Turn the DELAY TIME control to position the intensified zone to the portion of the delaying (A) sweep waveform to be magnified.

d. Set the delayed (B) sweep unit sweep rate to select the desired duration of the magnified display as indicated by the length of the intensified zone.

e. Observe the magnified display on the delayed (B) sweep. See Fig. 1-10.

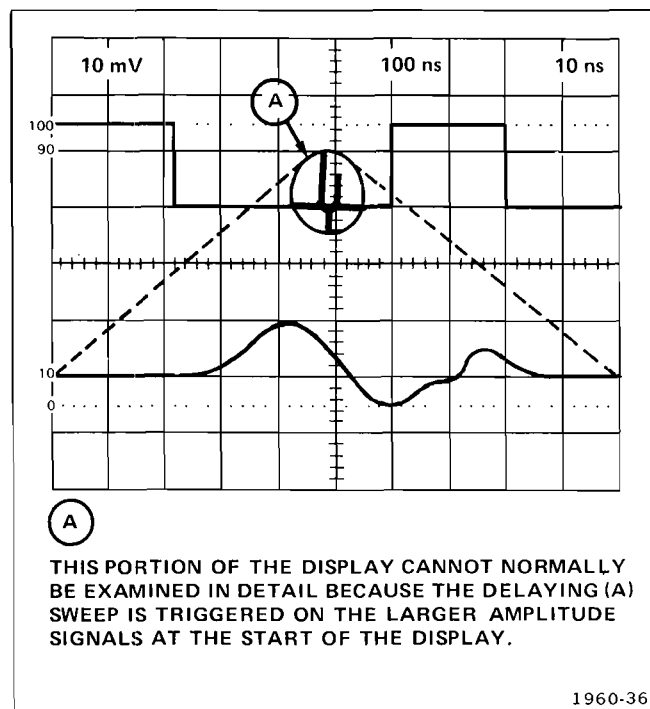
### NOTE

*For a better look at the delayed (B) sweep waveform, set the mainframe to the B horizontal mode and the amplifier-unit deflection factor to increase the display amplitude. Do not change the 7B85 TIME/DIV setting.*

f. Determine apparent magnification by dividing the 7B85 TIME/DIV setting by the delayed (B) sweep unit sweep-rate setting.

Example: The apparent magnification of the delayed (B) sweep shown in Fig. 1-10 with a 7B85 TIME/DIV setting of .1 ms and a delayed (B) sweep unit sweep-rate setting of 1  $\mu$ s is:

$$\text{Apparent Magnification} = \frac{7B85 \text{ TIME/DIV setting}}{\text{Delayed (B) Sweep Time/Div setting}}$$



**Fig. 1-10. Magnifying a selected segment of the delaying (A) sweep in the delay-time mode with mainframe alternate or chopped horizontal operation.**

Substituting values:

$$\text{Apparent Magnification} = \frac{1 \times 10^{-4}}{1 \times 10^{-6}} = 100$$

The apparent magnification of the delayed (B) sweep display is 100 times the delaying (A) sweep display.

6. Use the following procedure to make more accurate time interval measurements in the delay-time or  $\Delta$  (differential) time mode.

- a. Perform the procedures in steps 1 through 4.

### NOTE

*The remaining steps of this procedure apply for both delay-time and  $\Delta$  (differential) time measurements. For  $\Delta$  (differential) time operation, the 7B85 TRACE SEP control must be turned counterclockwise out of the OFF (detent) position. The  $\Delta$  TIME control then positions the second intensified zone and the DELAY TIME control positions the first intensified zone. Parentheses are used to indicate the instructions that apply only to  $\Delta$  (differential) time operation.*

b. Set the appropriate triggering, position, deflection factor, and sweep-rate controls for the desired dual-trace display. See the examples in Fig. 1-11.

**NOTE**

If there is excessive jitter in the delayed (B) sweep display, refer to the Triggered Delayed-Sweep Magnification discussion.

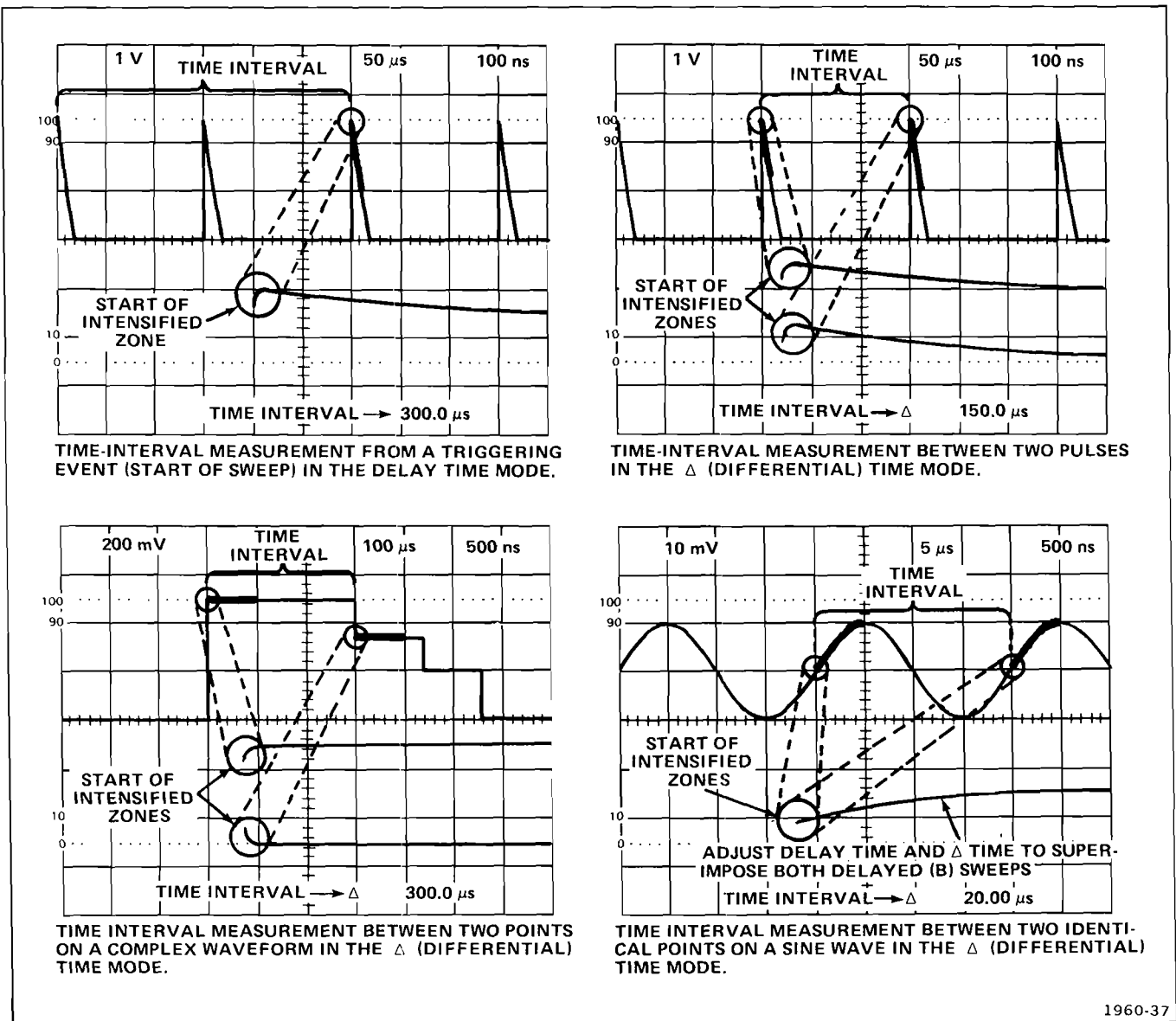
c. Turn the DELAY TIME (and  $\Delta$  TIME) control(s) to position the intensified zone(s) for the precise time interval to be measured using the magnified delayed (B) sweep waveform(s). See the examples in Fig. 1-11.

**NOTE**

For a better look at the delayed (B) sweep waveform, set the mainframe to the B horizontal mode and the amplifier-unit deflection-factor to increase the display amplitude. Do not change the 7B85 TIME/DIV setting.

d. Read the desired time interval directly on the crt readout.

7. Use the following procedure to examine an event that occurs within a selected time interval after a known delay time in the delay-time mode.



1960-37

Fig. 1-11. Time-interval measurements in the delay-time and  $\Delta$  (differential) time mode with mainframe alternate or chopped operation.

## Operating Instructions—7B85

- a. Perform the procedures in steps 1 through 4.
- b. Set the appropriate triggering, position, deflection-factor, and sweep-rate controls for the desired dual-trace display. See the example in Fig. 1-12.

### NOTE

If there is excessive jitter in the delayed (B) sweep display, refer to the Triggered Delayed-Sweep Magnification discussion.

- c. Adjust the DELAY TIME control for the known delay time as indicated on the crt readout.
- d. Set the delayed (B) sweep rate (i.e., the intensified zone length) for the desired time interval after the delay time selected in part c. Multiply the delayed (B) sweep rate by 10 to determine the actual displayed delayed (B) sweep time interval. See the example in Fig. 1-12.

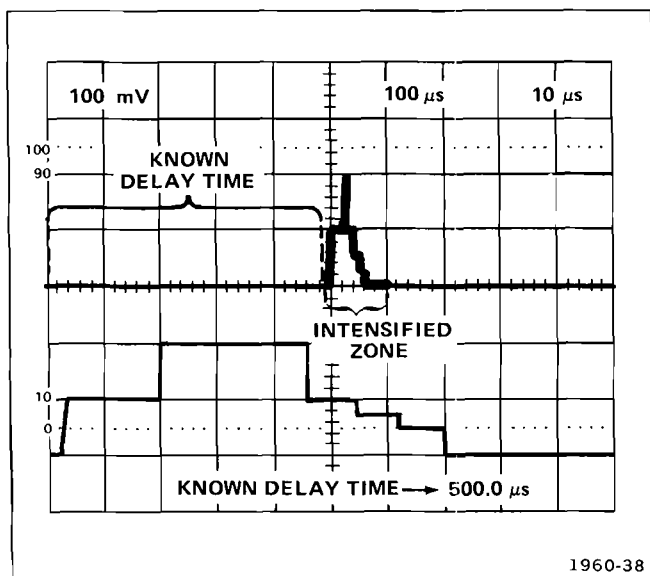


Fig. 1-12. Examining an event that occurs within a selected time interval after a known delay time in the delay-time mode.

- e. Observe the magnified event to be examined on the delayed (B) sweep.

### NOTE

For a better look at the delayed (B) sweep waveform, set the mainframe to the B horizontal mode and the amplifier-unit deflection-factor to increase the display amplitude. Do not change the 7B85 TIME/DIV setting.

## Triggered Delayed-Sweep Magnification

The displayed waveform may have excessive jitter at the faster delayed (B) sweep-rate settings. The B TRIGGERABLE AFTER DLY position (button in) of the B DELAY MODE switch provides a more stable display, since the delayed (B) sweep display is then triggered at the same point each time. The crt readout is uncalibrated in this mode as indicated by the > symbol.

Inability to obtain the intensified zone(s) on the delaying (A) sweep display indicates that the delayed (B) sweep triggering controls are incorrectly set, or that the input signal does not meet triggering requirements. If the condition cannot be corrected with the triggering controls, or by increasing the display amplitude, externally trigger the delayed (B) sweep.

## INDEPENDENT TIME-INTERVAL MEASUREMENTS

The 7B85 is designed primarily for use with a companion time-base unit in 7700-, 7800-, or 7900-Series oscilloscope mainframes with two horizontal compartments and crt readout. However, the 7B85 can also be used as an independent non-delaying time base (e.g., in a compatible mainframe with one horizontal compartment). To operate the 7B85 as an independent time base for time-interval measurements, press the INDEPENDENT button and obtain the desired display as described in steps 2 through 6 of the Time-Interval Measurements (Delay-Time Mode) procedure. Measure time intervals by multiplying the horizontal distance, in divisions, between the desired measurement points times the TIME/DIV switch setting.

# SPECIFICATION

This instrument will meet the electrical characteristics listed in Table 2-1, following complete adjustment. The following electrical characteristics apply over an ambient temperature range of 0° to +50°C, except as otherwise indicated. Warmup time for given accuracy is 20 minutes.

**Table 2-1**  
**ELECTRICAL CHARACTERISTICS**

Characteristic	Performance Requirement	Supplemental Information																				
<b>SWEEP GENERATOR</b>																						
Sweep Rates																						
Calibrated Range	5 s/div to 10 ns/div in 27 steps. X10 Magnifier extends fastest calibrated sweep rate to 1 ns/div.																					
Variable Range	Continuously variable uncalibrated sweep rate to at least 2.5 times the calibrated sweep rate setting.	Extends the slowest uncalibrated sweep rate to at least 12.5 s/div.																				
Sweep Accuracy <sup>a</sup> (With 7700, 7800, or 7900-Series Mainframes)	With SWP CAL adjusted at 1 ms/div within the temperature range of +20° to +30°C to a timing reference of 0.25% or better.																					
Over Center 8 Div	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th colspan="2">+ 15° to + 35° C</th> <th colspan="2">0° to + 50° C</th> </tr> <tr> <th>Unmag</th> <th>Mag</th> <th>Unmag</th> <th>Mag</th> </tr> </thead> <tbody> <tr> <td>5 s/Div to 1 s/Div</td> <td>4.0%</td> <td>5.0%</td> <td>6.0%</td> </tr> <tr> <td>0.5 s/Div to 0.1 μs/Div</td> <td>1.5%</td> <td>2.5%</td> <td>3.5%</td> </tr> <tr> <td>50 ns/Div to 10 ns/Div</td> <td>2.5%</td> <td>4.0%</td> <td>5.0%</td> </tr> </tbody> </table>	+ 15° to + 35° C		0° to + 50° C		Unmag	Mag	Unmag	Mag	5 s/Div to 1 s/Div	4.0%	5.0%	6.0%	0.5 s/Div to 0.1 μs/Div	1.5%	2.5%	3.5%	50 ns/Div to 10 ns/Div	2.5%	4.0%	5.0%	
+ 15° to + 35° C		0° to + 50° C																				
Unmag	Mag	Unmag	Mag																			
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0.5 s/Div to 0.1 μs/Div	1.5%	2.5%	3.5%																			
50 ns/Div to 10 ns/Div	2.5%	4.0%	5.0%																			
Excluded Portions of Sweep																						
Start of Sweep	First 10 ns in 7800, 7900-Series mainframes. First 20 ns in 7700-Series mainframes. First 50 ns in all other 7000-Series mainframes.																					
End of Sweep	Beyond 10th div unmagnified. Beyond 100th div magnified.																					
Sweep Length (Unmagnified)	At least 10.2 div at all sweep rates.																					
MAG Registration	0.5 div or less from graticule center when changing from MAG X10 to MAG X1.																					

Table 2-1 (cont)

Characteristic	Performance Requirement	Supplemental Information
SWEEP GENERATOR (cont)		
Position Range		
POSITION Controls Fully Clockwise	Start of sweep must be to the right of graticule center at 1 ms/div.	
POSITION Controls Fully Counter-clockwise	End of sweep must be to the left of graticule center at 1 ms/div.	
Trigger Holdoff Time		
Minimum Holdoff Setting 5 s/Div to 1 $\mu$ s/Div 0.5 $\mu$ s/Div to 10 ns/Div	2 times TIME/DIV setting or less. 2.0 $\mu$ s or less.	
Variable Holdoff Range	Extends holdoff time through at least two sweep lengths for sweep rates of 20 ms/div or faster.	
VARIABLE TIME DELAY		
$\Delta$ TIME		
Range	0.0 to at least 9.0 TIME/DIV setting.	
Accuracy (+15° to +35°C) 0.5 s/Div to 50 ms/Div 20 ms/Div to 100 ns/Div	Within (0.5% measurement +0.1% full scale +1 least significant digit). <sup>b</sup> Within (0.5% measurement +0.03% full scale +1 least significant digit). <sup>b</sup>	
TRACE SEPARATION Range	Functional only in the $\Delta$ TIME mode when alternating or chopping between time-base units. The second delayed sweep display can be vertically positioned at least 3 div below the first delayed sweep display with mainframe Vertical Separation control centered.	
DELAY TIME		
Range	0.2 or less to at least 9.0 times TIME/DIV setting.	
Jitter	(0.002% of full scale +0.1 ns) or less. (0.002% equals 1/50,000.)	
Differential Measurement Accuracy (Measurement is made by subtracting 2 delay times from the crt readout) (+15° to +35°C) 05 s/Div to 100 ns/Div	Derate $\Delta$ TIME specification by one additional least significant digit.	

Table 2-1 (cont)

Characteristic	Performance Requirement	Supplemental Information	
VARIABLE TIME DELAY (cont)			
Start of Delayed Sweep Display (With respect to start of delaying sweep display)  0.5 s/Div to 10 $\mu$ s/Div	Within (0.5% of measurement + 0.5% full scale). <sup>b</sup>		
TRIGGERING			
Triggering Sensitivity from Repetitive Signal (Auto, Norm and Single Sweep Modes)  Coupling	Triggering Frequency Range <sup>c</sup>	Minimum Triggering Signal Required	
		Internal	External
AC	30 Hz to 50 MHz 50 MHz to 400 MHz	0.3 div 1.5 div	50 mV 250 mV
AC LF REJ <sup>d</sup>	30 kHz to 50 MHz 50 MHz to 400 MHz	0.3 div 1.5 div	50 mV 250 mV
AC HF REJ	30 Hz to 50 kHz	0.3 div	50 mV
DC <sup>e</sup>	Dc to 50 MHz 50 MHz to 400 MHz	0.3 div 1.5 div	50 mV 250 mV
Internal Trigger Jitter	0.1 ns or less at 400 MHz.		
External Trigger Input			
Maximum Input Voltage	250 V (dc plus peak ac).		
Input R and C	1 M $\Omega$ within 5%, 20 pF within 10%.		
Level Range (Excluding P-P AUTO)	(Checked on 1 kHz sine wave.)		
EXT $\div$ 1	At least + and - 1.5 volts.		
EXT $\div$ 10	At least + and - 15 volts.		
P-P AUTO Operation Sensitivity (Ac or Dc Coupling)	Triggering Frequency Range	Minimum Triggering Signal Required	
		Internal	External
	200 Hz to 50 MHz 50 MHz to 400 MHz	0.5 div 1.5 div	125 mV 375 mV
Low Frequency Response	At least 50 Hz	2.0 div	500 mV

<sup>a</sup>The fastest calibrated sweep rate is limited by some mainframes (oscilloscopes).

<sup>b</sup>Full scale equals 10 times the TIME/DIV switch setting.

<sup>c</sup>The triggering frequency ranges given here are limited to the -3 dB frequency of the oscilloscope vertical system (mainframe and amplifier unit) when operating from an internal source.

<sup>d</sup>Will not trigger on sine waves at or below 60 Hz when amplitudes are less than 8 div internal or 3 V external.

<sup>e</sup>The Triggering Frequency Range for DC COUPLING applies to frequencies above 30 Hz when operating in the AUTO TRIGGERING MODE.

**Table 2-2  
ENVIRONMENTAL CHARACTERISTICS**

Refer to the Specification section of the associated mainframe manual.

**Table 2-3  
PHYSICAL CHARACTERISTICS**

Characteristic	Description
Net Weight	Approximately 2.6 pounds (1.2 kilogram).
Dimensions	See Fig. 2-1, dimensional drawing.

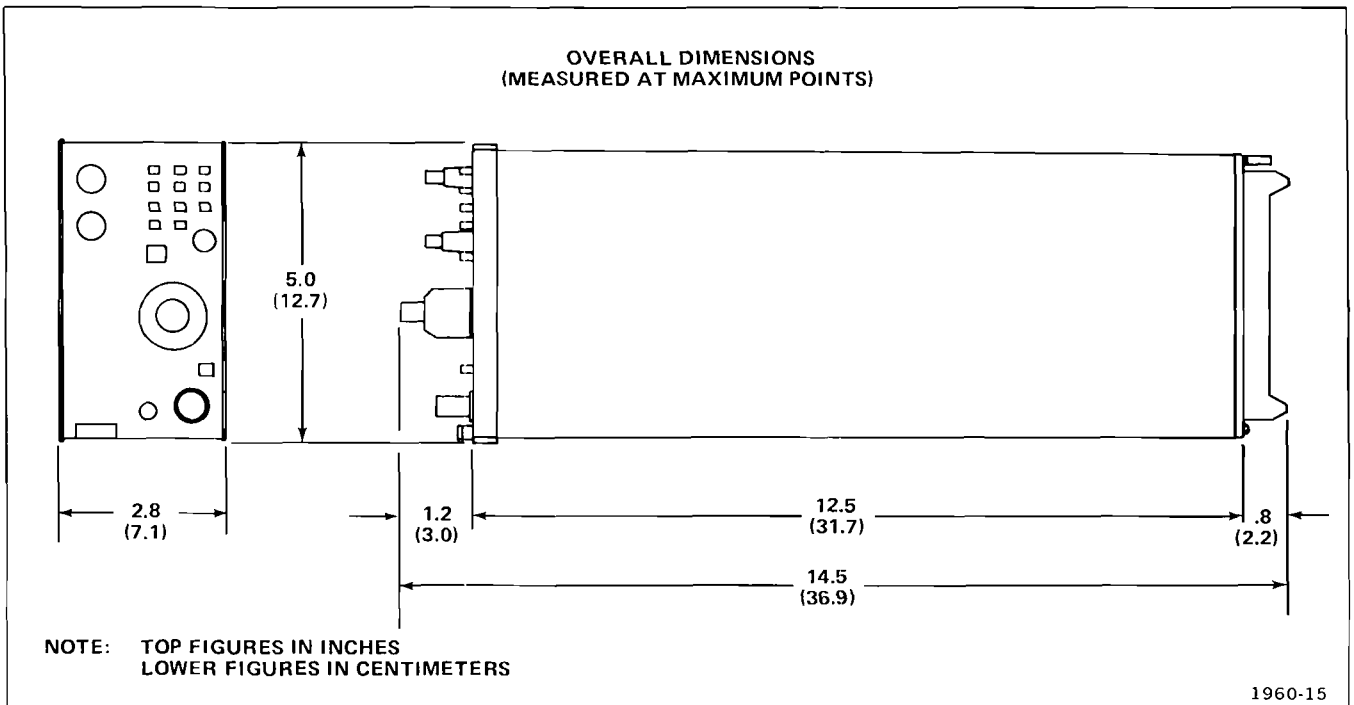


Fig. 2-1. 7B85 dimensional drawing.

**STANDARD ACCESSORIES**

- 1 ea ..... Operators Manual
- 1 ea ..... Instruction Manual

# THEORY OF OPERATION

This section of the manual describes the circuitry used in the 7B85 Delaying Time-Base unit. The description begins with a discussion of the instrument, using the block diagram shown in Fig. 3-1. Next, each circuit is described in detail with a block diagram provided to show the major interconnections between circuits, and the relationship of the front-panel controls to each circuit. Detailed schematic diagrams of each circuit are located in the diagrams foldout section at the back of this manual. Refer to these diagrams throughout the following discussions for specific electrical values and relationships.

## BLOCK DIAGRAM DESCRIPTION

The following discussion is provided to aid in understanding the overall concept of the 7B85 before the individual circuits are discussed in detail. A basic block diagram is shown in Fig. 3-1. The numbered diamond in each block refers to the corresponding circuit diagram at the rear of this manual.

### TRIGGER GENERATOR

The Trigger Generator ensures a stable crt display by starting each sweep at the same point on the waveform. Circuitry is included for selection of trigger mode, coupling, and source. The output of the Trigger Generator is a fast-rise gate that enables the Sweep Generator.

### SWEEP GENERATOR

The sweep sawtooth signal is initiated when the Trigger Generator output is applied to the Sweep Generator. The rate of change (slope) of the sawtooth signal is determined by the TIME/DIV switch setting. The sawtooth signal provides horizontal deflection for the mainframe (oscilloscope) and is used by the Pickoff Amplifiers and the Delay Gate Generator in the 7B85. The Sweep Generator also generates a Sweep Gate pulse that unblanks the crt in the mainframe.

### PICKOFF AMPLIFIERS AND DELAY GATE GENERATOR

The Pickoff Amplifiers and Delay Gate Generator circuits produce a delay gate when the sawtooth signal from the sweep generator reaches the level set by the DELAY TIME

and  $\Delta$  TIME controls. The DELAY TIME control determines the pickoff point for the first intensified zone and the  $\Delta$  TIME control determines the pickoff point for the second intensified zone. The Delay Gate signal enables the companion delayed time-base unit.

### LOGIC

The Logic circuit determines the sweep mode (B DELAY MODE) of the 7B85. The 7B85 can operate either independently or delay a companion delayed sweep time-base unit. The Logic circuit also determines the trigger mode and generates control signals for use by the mainframe (e.g., hold off, auxiliary, Y-axis, etc.).

### DIGITAL VOLTMETER

The Digital Voltmeter circuit converts the selected dc pickoff levels (from the Pickoff Amplifier) to a calibrated delay-time readout on the crt. When operating in the DELAY TIME mode, the time before the start of the first intensified zone is displayed on the crt readout; when operating in the  $\Delta$  TIME mode, the differential time between the start of the first intensified zone and the second intensified zone is displayed.



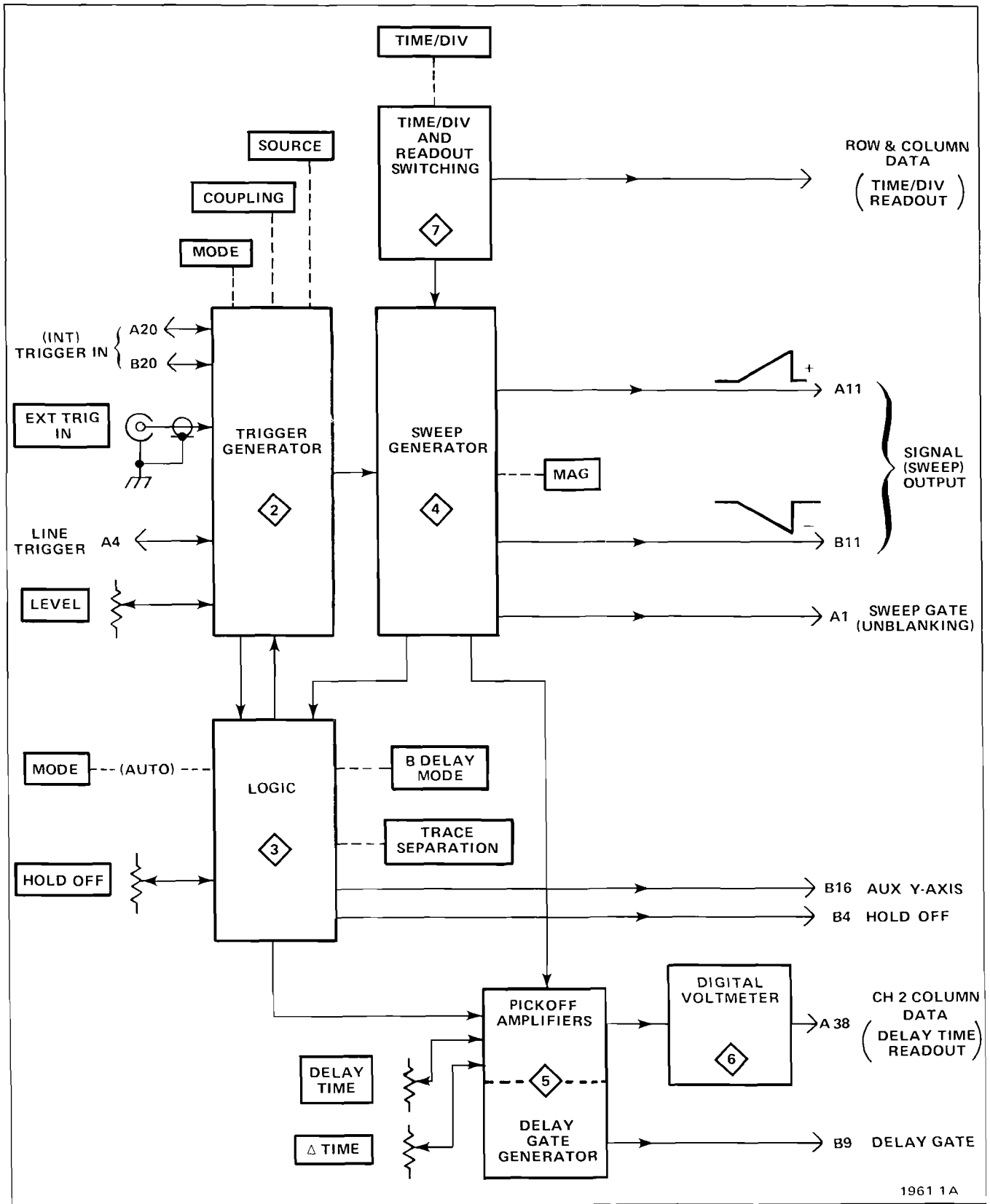


Fig. 3-1. Basic block diagram of the 7B85 Delaying Time-Base unit.

## DETAILED CIRCUIT DESCRIPTION

The operation of circuits unique to this instrument is described in detail in this discussion. Circuits commonly used in the electronics industry are not described in detail.

The following circuit analysis, with supporting illustrations, gives the names of individual stages, and shows how they are connected to form major circuits. These illustrations show the inputs and outputs for each circuit and the relationship of the front-panel controls to the individual stages. The detailed circuit diagrams from which the illustrations are derived are shown in the diagrams foldout section.

### LOGIC FUNDAMENTALS

Digital logic techniques are used to perform many functions within this instrument. The function and operation of the logic circuits are described using logic symbology and terminology. This portion of the manual is provided to be an aid in the understanding of these symbols and logic concepts, not a comprehensive discussion of the subject.

#### Symbols

The symbols used to describe digital circuits in this instrument are based on ANSI standard Y32.14-1973. Table 3-1 provides a basic reference for the logic devices used within this instrument. Any deviations from the standard symbology, or devices not defined by the standard, are described in the circuit description for the applicable device.

#### NOTE

*Logic symbols used on the diagrams depict the logic function as used in this instrument, and may differ from the manufacturer's data.*

#### Logic Polarity

All logic functions are described using the positive logic convention. Positive logic is a system of notation where the more positive of two levels (HI) is called the true or 1-state; the more negative level (LO) is called the false or 0-state. The HI-LO method of notation is used in this description. The specific voltages that constitute a HI or LO state may vary between individual devices. Wherever possible, the input and output lines are named to indicate the function performed when at the HI (true) state.

#### Input/Output Tables

Input/Output (truth) tables are used to show the input combinations important to a particular function, along with the resultant output conditions. This table may be given either for an individual device or for a complete logic stage. For examples of input/output tables for individual devices, see Table 3-1.

### NON-DIGITAL DEVICES

Not all of the integrated circuits in this instrument are digital logic devices. The function of non-digital devices is described individually, using operating waveforms or other techniques to illustrate the function.

**Table 3-1**  
**BASIC LOGIC REFERENCE**





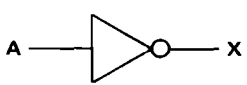


Device	Symbol	Description	Input/Output Table																		
AND gate		A device with two or more inputs and one output. The output of the AND gate is HI if and only if all of the inputs are at the HI state.	<table border="1"> <thead> <tr> <th colspan="2">Input</th> <th>Output</th> </tr> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>LO</td> <td>LO</td> <td>LO</td> </tr> <tr> <td>LO</td> <td>HI</td> <td>LO</td> </tr> <tr> <td>HI</td> <td>LO</td> <td>LO</td> </tr> <tr> <td>HI</td> <td>HI</td> <td>HI</td> </tr> </tbody> </table>	Input		Output	A	B	X	LO	LO	LO	LO	HI	LO	HI	LO	LO	HI	HI	HI
Input		Output																			
A	B	X																			
LO	LO	LO																			
LO	HI	LO																			
HI	LO	LO																			
HI	HI	HI																			
NAND gate		A device with two or more inputs and one output. The output of the NAND gate is LO if and only if all of the inputs are at the HI state.	<table border="1"> <thead> <tr> <th colspan="2">Input</th> <th>Output</th> </tr> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>LO</td> <td>LO</td> <td>HI</td> </tr> <tr> <td>LO</td> <td>HI</td> <td>HI</td> </tr> <tr> <td>HI</td> <td>LO</td> <td>HI</td> </tr> <tr> <td>HI</td> <td>HI</td> <td>LO</td> </tr> </tbody> </table>	Input		Output	A	B	X	LO	LO	HI	LO	HI	HI	HI	LO	HI	HI	HI	LO
Input		Output																			
A	B	X																			
LO	LO	HI																			
LO	HI	HI																			
HI	LO	HI																			
HI	HI	LO																			
OR gate OR gate		A device with two or more inputs and one output. The output of the OR gate is HI if one or more of the inputs are at the HI state.	<table border="1"> <thead> <tr> <th colspan="2">Input</th> <th>Output</th> </tr> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>LO</td> <td>LO</td> <td>LO</td> </tr> <tr> <td>LO</td> <td>HI</td> <td>HI</td> </tr> <tr> <td>HI</td> <td>LO</td> <td>HI</td> </tr> <tr> <td>HI</td> <td>HI</td> <td>HI</td> </tr> </tbody> </table>	Input		Output	A	B	X	LO	LO	LO	LO	HI	HI	HI	LO	HI	HI	HI	HI
Input		Output																			
A	B	X																			
LO	LO	LO																			
LO	HI	HI																			
HI	LO	HI																			
HI	HI	HI																			
NOR gate		A device with two or more inputs and one output. The output of the NOR gate is LO if one or more of the inputs are at the HI state.	<table border="1"> <thead> <tr> <th colspan="2">Input</th> <th>Output</th> </tr> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>LO</td> <td>LO</td> <td>HI</td> </tr> <tr> <td>LO</td> <td>HI</td> <td>LO</td> </tr> <tr> <td>HI</td> <td>LO</td> <td>LO</td> </tr> <tr> <td>HI</td> <td>HI</td> <td>LO</td> </tr> </tbody> </table>	Input		Output	A	B	X	LO	LO	HI	LO	HI	LO	HI	LO	LO	HI	HI	LO
Input		Output																			
A	B	X																			
LO	LO	HI																			
LO	HI	LO																			
HI	LO	LO																			
HI	HI	LO																			
Inverter		A device with one input and one output. The output state is always opposite to the input state.	<table border="1"> <thead> <tr> <th>Input</th> <th>Output</th> </tr> <tr> <th>A</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>LO</td> <td>HI</td> </tr> <tr> <td>HI</td> <td>LO</td> </tr> </tbody> </table>	Input	Output	A	X	LO	HI	HI	LO										
Input	Output																				
A	X																				
LO	HI																				
HI	LO																				
LO-state indicator		A small circle at the input or output of a symbol indicates that the LO state is the significant state. Absence of the circle indicates that the HI state is the significant state. Two examples follow:																			
		AND gate with LO-state indicator at the A input.  The output of this gate is HI if, and only if, the A input is LO and the B input is HI.	<table border="1"> <thead> <tr> <th colspan="2">Input</th> <th>Output</th> </tr> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>LO</td> <td>LO</td> <td>LO</td> </tr> <tr> <td>LO</td> <td>HI</td> <td>HI</td> </tr> <tr> <td>HI</td> <td>LO</td> <td>LO</td> </tr> <tr> <td>HI</td> <td>HI</td> <td>LO</td> </tr> </tbody> </table>	Input		Output	A	B	X	LO	LO	LO	LO	HI	HI	HI	LO	LO	HI	HI	LO
Input		Output																			
A	B	X																			
LO	LO	LO																			
LO	HI	HI																			
HI	LO	LO																			
HI	HI	LO																			

Table 3-1 (cont)

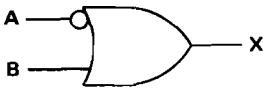

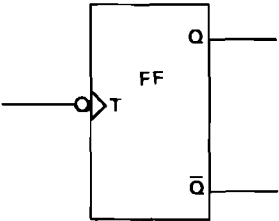
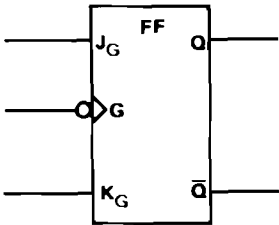
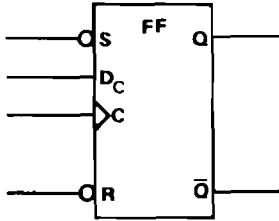
Device	Symbol	Description	Input/Output Table																								
		<p>OR gate with LO-state indicator at the A input:</p> <p>The output of this gate is HI if either the A input is LO or the B input is HI.</p>	<table border="1"> <thead> <tr> <th colspan="2">Input</th> <th>Output</th> </tr> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>LO</td> <td>LO</td> <td>HI</td> </tr> <tr> <td>LO</td> <td>HI</td> <td>HI</td> </tr> <tr> <td>HI</td> <td>LO</td> <td>LO</td> </tr> <tr> <td>HI</td> <td>HI</td> <td>HI</td> </tr> </tbody> </table>	Input		Output	A	B	X	LO	LO	HI	LO	HI	HI	HI	LO	LO	HI	HI	HI						
Input		Output																									
A	B	X																									
LO	LO	HI																									
LO	HI	HI																									
HI	LO	LO																									
HI	HI	HI																									
Dynamic Indicator		<p>Indicates that this input (usually the trigger input of a flip-flop) responds to the indicated transition of the applied signal.</p>																									
Triggered (toggle) Flip-Flop		<p>A bistable device with one input and two outputs (either or both outputs may be used). When triggered, the outputs change from one stable state to the other stable state with each trigger. The outputs are complementary (i.e., when one output is HI the other is LO). The dynamic indicator on the trigger (T) input may be of either polarity depending on the device.</p>	<table border="1"> <thead> <tr> <th colspan="2">Input</th> <th colspan="2">Output</th> </tr> <tr> <th>Condition before trigger pulse</th> <th>Condition after trigger pulse</th> <th>Q</th> <th><math>\bar{Q}</math></th> </tr> </thead> <tbody> <tr> <td>Q</td> <td><math>\bar{Q}</math></td> <td>Q</td> <td><math>\bar{Q}</math></td> </tr> <tr> <td>LO</td> <td>HI</td> <td>HI</td> <td>LO</td> </tr> <tr> <td>HI</td> <td>LO</td> <td>LO</td> <td>HI</td> </tr> </tbody> </table>	Input		Output		Condition before trigger pulse	Condition after trigger pulse	Q	$\bar{Q}$	Q	$\bar{Q}$	Q	$\bar{Q}$	LO	HI	HI	LO	HI	LO	LO	HI				
Input		Output																									
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Q	$\bar{Q}$	Q	$\bar{Q}$																								
LO	HI	HI	LO																								
HI	LO	LO	HI																								
Triggered Set-Clear (J-K) Flip-Flop		<p>A bistable device with three or more inputs and two outputs (either or both outputs may be used). When gated, the outputs change state in response to the states at the inputs prior to the trigger. The outputs are complementary (i.e., when one output is HI the other is LO). The dynamic indicator on the gate (G) input may be of either polarity depending on the device.</p>	<table border="1"> <thead> <tr> <th colspan="2">Input</th> <th colspan="2">Output</th> </tr> <tr> <th>J</th> <th>K</th> <th>Q</th> <th><math>\bar{Q}</math></th> </tr> </thead> <tbody> <tr> <td>LO</td> <td>LO</td> <td>No change</td> <td></td> </tr> <tr> <td>LO</td> <td>HI</td> <td>LO</td> <td>HI</td> </tr> <tr> <td>HI</td> <td>LO</td> <td>HI</td> <td>LO</td> </tr> <tr> <td>HI</td> <td>HI</td> <td>Changes state</td> <td></td> </tr> </tbody> </table> <p><b>Output conditions shown after gate pulse.</b></p>	Input		Output		J	K	Q	$\bar{Q}$	LO	LO	No change		LO	HI	LO	HI	HI	LO	HI	LO	HI	HI	Changes state	
Input		Output																									
J	K	Q	$\bar{Q}$																								
LO	LO	No change																									
LO	HI	LO	HI																								
HI	LO	HI	LO																								
HI	HI	Changes state																									
D (data) Type Flip-Flop with Direct Inputs  (Direct Inputs may be applied to all triggered flip-flops)		<p>A bistable device with two inputs and two outputs (either or both outputs may be used). When clocked, the state of the Q output changes to the state at the data (D) input. The outputs are complementary (e.g., when one output is HI the other is LO). The dynamic indicator on the clock input may be of either polarity, depending upon the device.</p>	<p>Set (S) and reset (R) inputs override data (D) and clock (C) inputs.</p> <table border="1"> <thead> <tr> <th colspan="2">Input</th> <th colspan="2">Output</th> </tr> <tr> <th>S</th> <th>R</th> <th>Q</th> <th><math>\bar{Q}</math></th> </tr> </thead> <tbody> <tr> <td>HI</td> <td>LO</td> <td>LO</td> <td>HI</td> </tr> <tr> <td>LO</td> <td>LO</td> <td>Undefined</td> <td></td> </tr> <tr> <td>HI</td> <td>HI</td> <td>No Effect</td> <td></td> </tr> <tr> <td>LO</td> <td>HI</td> <td>HI</td> <td>LO</td> </tr> </tbody> </table>	Input		Output		S	R	Q	$\bar{Q}$	HI	LO	LO	HI	LO	LO	Undefined		HI	HI	No Effect		LO	HI	HI	LO
Input		Output																									
S	R	Q	$\bar{Q}$																								
HI	LO	LO	HI																								
LO	LO	Undefined																									
HI	HI	No Effect																									
LO	HI	HI	LO																								

Table 3-1 (cont)

Device	Symbol	Description	Input/Output Table												
		For devices with set (S) or reset (R) inputs, the indicated state at either of these inputs overrides all other inputs to the states shown in the Input/Output Table.	Set (S) and Reset (R) inputs both high. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Input</th> <th colspan="2">Output</th> </tr> <tr> <th>Condition before clock pulse</th> <th>Q</th> <th><math>\bar{Q}</math></th> </tr> </thead> <tbody> <tr> <td>HI</td> <td>HI</td> <td>LO</td> </tr> <tr> <td>LO</td> <td>LO</td> <td>HI</td> </tr> </tbody> </table>	Input	Output		Condition before clock pulse	Q	$\bar{Q}$	HI	HI	LO	LO	LO	HI
Input	Output														
Condition before clock pulse	Q	$\bar{Q}$													
HI	HI	LO													
LO	LO	HI													

## FRONT-PANEL DISTRIBUTION 1

The Front-Panel Distribution diagram shows the interconnections between front-panel functions (controls, connectors, and indicators) and circuit boards within this instrument.

## TRIGGER GENERATOR 2

The Trigger Generator provides a stable display by starting the Sweep Generator (diagram 4) at a selected point on the input waveform. The triggering point can be varied by the LEVEL control and may be on either the positive or negative slope of the waveform. The triggering signal source may be from either the signal being displayed (INT), a signal from an external source (EXT), or a sample of the power-line voltage (LINE). A block diagram of the Trigger Generator is shown in Fig. 3-2.

### External Source

The external trigger signal is connected to the Trigger Generator through EXT TRIG IN connector J12. Push-button switch S10 provides 10 times attenuation of the external trigger input signal.

When SOURCE switch S50 is set to EXT, external signals below approximately 16 kHz are coupled through R15 and R20 to External Trigger Amplifier Q22. Ac coupling is provided by C15. Triggering signals above 16 kHz are coupled through C20 to the gate of Q22A.

Field-effect transistors Q22A and Q22B form a unity-gain source follower, which couples the external trigger signal to the Trigger Source Selector and Amplifier stage (U65, pin 4). Diodes CR23 and CR24 provide input protection by clamp-

ing the input within a diode drop of ground (approximately 0.7 volt).

### Internal and Line Source

The internal trigger signal from the vertical channel of the mainframe is connected to the Internal Trigger Amplifier stage (U35) differentially via interface connector pins A20 and B20.

Internal trigger signals with frequencies above 16 kHz are coupled through C37 directly into the Trigger Source Selector and Amplifier stage (U65, pin 8). Internal trigger signals with frequencies below 16 kHz are coupled differentially through R31 and R33 to U35, pins 2 and 3. The single-ended output at U35, pin 6 is coupled, along with the offset from LEVEL control R60, to U65, pin 10. Ac coupling is provided by C43.

A sample of the line voltage is connected to the trigger circuits via interface connector pin A4. The line signal is connected to the Trigger Source Selector and Amplifier stage at U65, pin 2.

### Trigger Source Selector and Amplifier

The Trigger Source Selector and Amplifier stage (partial U65) determines whether the triggering signal source is from the signal being displayed (INT), a signal from an external source (EXT), or a sample of the power line voltage (LINE).

The trigger source is selected by SOURCE switch S50 by connecting the most positive voltage to the source input of U65 (refer to Fig. 3-3). The voltage offset from LEVEL control R60 is coupled to U65, pin 10. The differential trigger output signal from U65, pins 16 and 17 is coupled to the Slope Selector and Trigger Generator stage (U85).

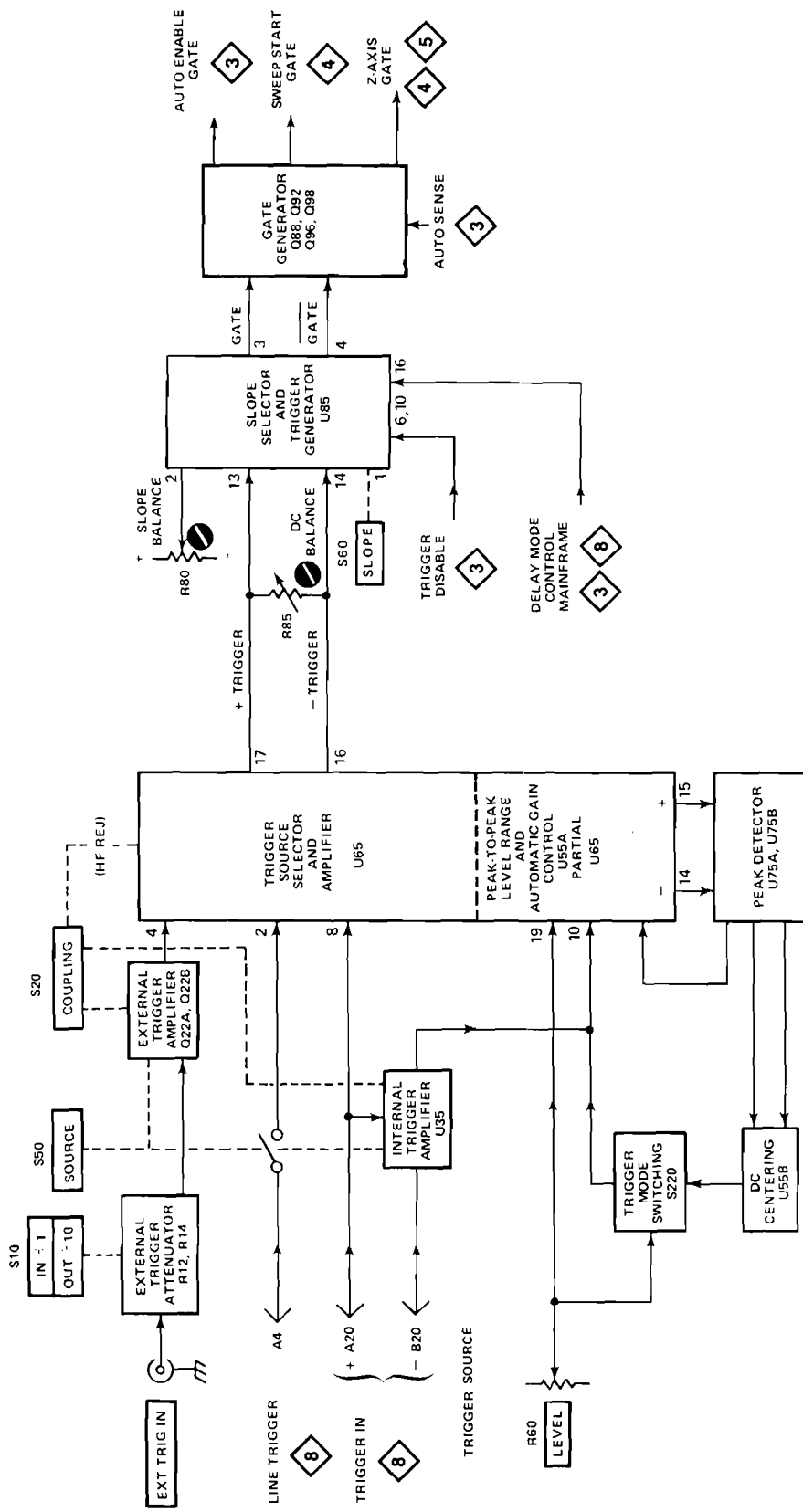


Fig. 3-2. Detailed block diagram of Trigger Generator.

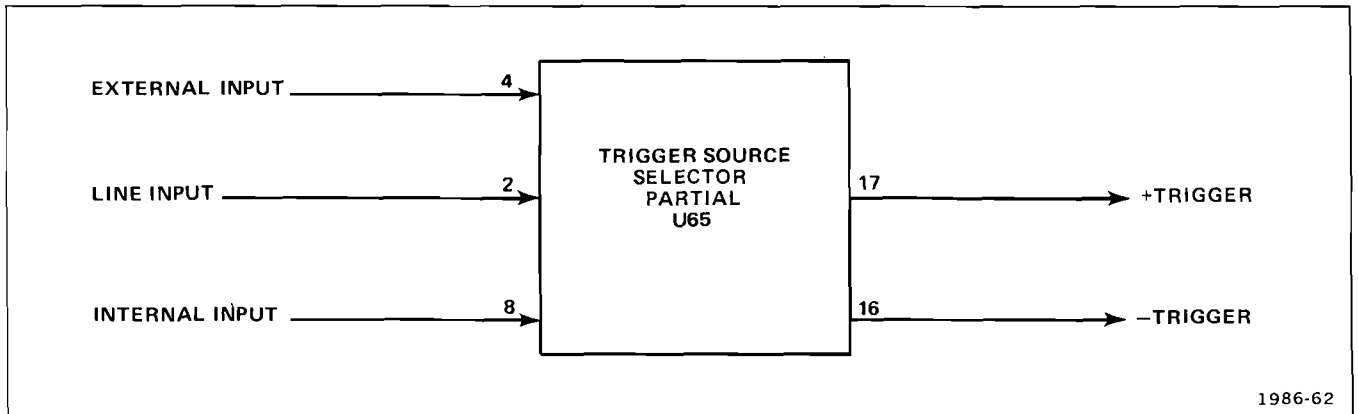


Fig. 3-3. Functional diagram of Trigger Source Selector.

High-frequency reject coupling is provided in the Trigger Source Selector stage. When the AC HF REJ pushbutton is pressed, C68 and components internal to U65, pin 9 form a high-frequency rejection filter. Only low-frequency ac triggering signals are accepted.

**Peak-to-Peak Auto**

The Peak-to-Peak Auto function can be divided into three distinct blocks. First, the Peak Detector determines signal size and dc positioning. Second, a DC Centering loop centers the peak-detected output regardless of the dc input and offset voltages. Third, the Peak-to-Peak Level Range output voltage is automatically adjusted until the trigger output reaches the clamp level set by the Automatic Gain Control to achieve full level range (refer to the Specification section in this manual for level range parameters).

**Peak Detector.** The peak detector outputs from U65, pins 14 and 15, rectified within U65, are externally filtered by C73 and C74. Secondary stages of peak detection for the positive and negative detector signals are provided by U75A-CR71-C72 and U75B-CR75-C76. Outputs from the Peak Detector stage are coupled to the Peak-to-Peak Level Range and DC Centering stages.

**DC Centering.** Operational amplifier U55B adjusts the input level at U65, pin 10 to null the dc input voltage and accumulated dc offsets. This allows the trigger outputs at U65, pins 16 and 17 to balance when LEVEL control R60 is set to zero. DC Balance adjustment R85 provides centering for offset voltages due to circuitry external to U65, pins 16 and 17 (e.g., U85).

**Peak-to-Peak Level Range.** The Peak-to-Peak Level Range stage amplifies the peak Detector signals to provide constant amplitude trigger signals and to determine the range of the front-panel LEVEL control. Peak Detector sig-

nal amplitude is dependent on triggering (input) signal amplitude.

Peak Detector signals from R58-R59 are coupled to U55A, pin 3 of the Peak-to-Peak Level Range stage. The gain of the feedback amplifier (consisting of U55A and pins 1 and 20 of U65) increases as the Peak Detector signal amplitude is reduced, thereby producing a constant trigger signal level at U65, pins 16 and 17.

The range of the front-panel LEVEL control is zero at minimum triggering signal amplitude. The LEVEL range increase as triggering signal amplitude increases, until it reaches maximum level range at the Automatic Gain Control threshold. Refer to the Specification section in this manual for triggering sensitivity and triggering LEVEL range parameters.

**Automatic Gain Control.** The Automatic Gain Control stage limits the trigger signal amplitude to approximately 450 mV peak to peak (at U65, pins 16 and 17) regardless of the trigger input signal amplitude. The level of the peak detected signal from R58-R59 is sensed by a feedback amplifier stage (U55A and pins 1 and 20 of U54). When the peak detected signal is above the Automatic Gain Control threshold (resulting from approximately 50 mV external trigger signal), the Automatic Gain Control stage limits the output trigger signal amplitude at U65, pins 16 and 17. Current into U65, pin 3 (established by R51) determines the current reference that sets the Automatic Gain Control threshold.

**Slope Selector and Trigger Generator**

Integrated circuit U85 converts the differential trigger signal from the Trigger Source Selector and Amplifier block to a differential gate waveform for use by the Gate Generator stage.

SLOPE switch S60 is connected to U85, pin 1 to determine whether the display is triggered on the positive-going or negative-going slope. When the SLOPE switch is set to +, a positive-going signal on pin 13 produces a positive-going gate on pin 3 and a negative-going gate on pin 4. When the SLOPE switch is set to -, a negative-going signal on pin 13 produces a positive-going gate on pin 3 and a negative-going gate on pin 4. Slope Balance adjustment R80 provides optimum input balance for both + and - SLOPE operation.

The delay mode control signal into U85, pin 16 is functional only when the unit is operating as a delayed sweep unit in the B Horizontal compartment of a mainframe with two horizontal compartments. When the unit is operating in the independent or triggerable after delay time modes (as determined by the delaying sweep time-base unit in the A horizontal compartment), there is no affect on the Trigger Generator circuits. However, when the unit is operating in the B starts after delay time mode, a HI level at U85 pin 16 supplies a trigger gate pulse to U85, pins 3 and 4 in the absence of a trigger disable pulse at pin 10 of U85.

At the end of each sweep, the Logic circuits (diagram 3) supply a trigger disable pulse through Q242 to U85, pins 6 and 10. A HI level disables the Trigger Generator to allow enough time for the sweep generator to stabilize before another trigger pulse starts the next sweep.

### Gate Generator

The Gate Generator stage provides an auto enable gate to the Logic circuits (diagram 3), and a sweep start gate and Z-axis gate (unblanking) to the Sweep Generator circuit (diagram 4). Refer to Fig. 3-4 for a timing diagram of the Gate Generator functions.

When an adequate trigger signal is applied to U85, pins 13 and 14, a HI level is produced at U85, pin 3 and a LO level is produced at U85, pin 4.

The HI level from U85, pin3 is coupled through emitter follower Q88 and J200-2 into the Logic circuit (diagram 3) to indicate that a triggering signal has been received. The Log-

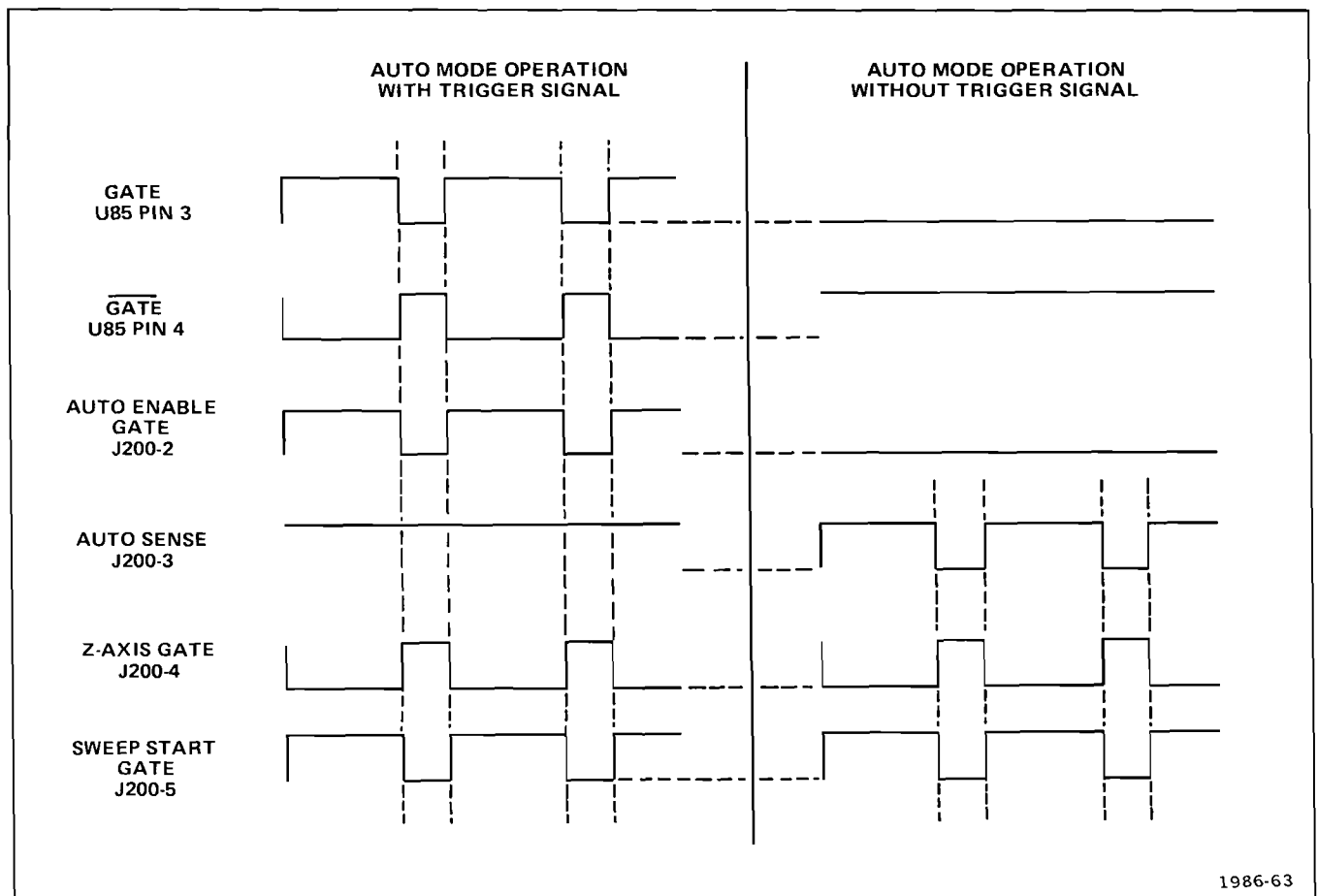


Fig. 3-4. Timing diagram for Gate Generator stage (Q92, Q96, Q98).



**LOGIC 3**

ic circuit (diagram 3) sets the auto sense at J200-3 HI, turning off Q98. Simultaneously, the LO level at U85, pin 4 gates comparator Q96-Q92. The collector of Q92 rises HI to provide a sweep start gate at J200-5 and the collector of Q96 falls LO to provide a Z-axis gate (unblanking) at J200-4.

The Logic circuit controls the sweep modes and associated functions of the time-base unit (e.g., sweep display, hold off, auto sweep, single sweep, etc.). The Logic circuit also generates control signals for the mainframe. A block diagram for the Logic circuit is shown in Fig. 3-5.

In the absence of a trigger output at U85, pins 13 and 14, pin 3 is set LO and pin 4 is set HI. The LO level from U85, pin 3 is coupled through J200-2 to the Logic circuit (diagram 3) to indicate the lack of a triggering signal. The Logic circuit provides a LO-level auto sense pulse through J200-3 to the base of Q98. This LO level gates the comparator (Q98 and Q96). The collector of Q98 rises high to provide a sweep start gate, and the collector of Q96 falls LO to provide a Z-axis gate (unblanking) at J200-4.

**Sweep Modes**

Integrated circuit U220 controls the NORM, AUTO, and SINGLE SWEEP MODES and also generates control signals used in the 7B85. P-P AUTO operation is described in the Trigger Generator circuit description (diagram 2).

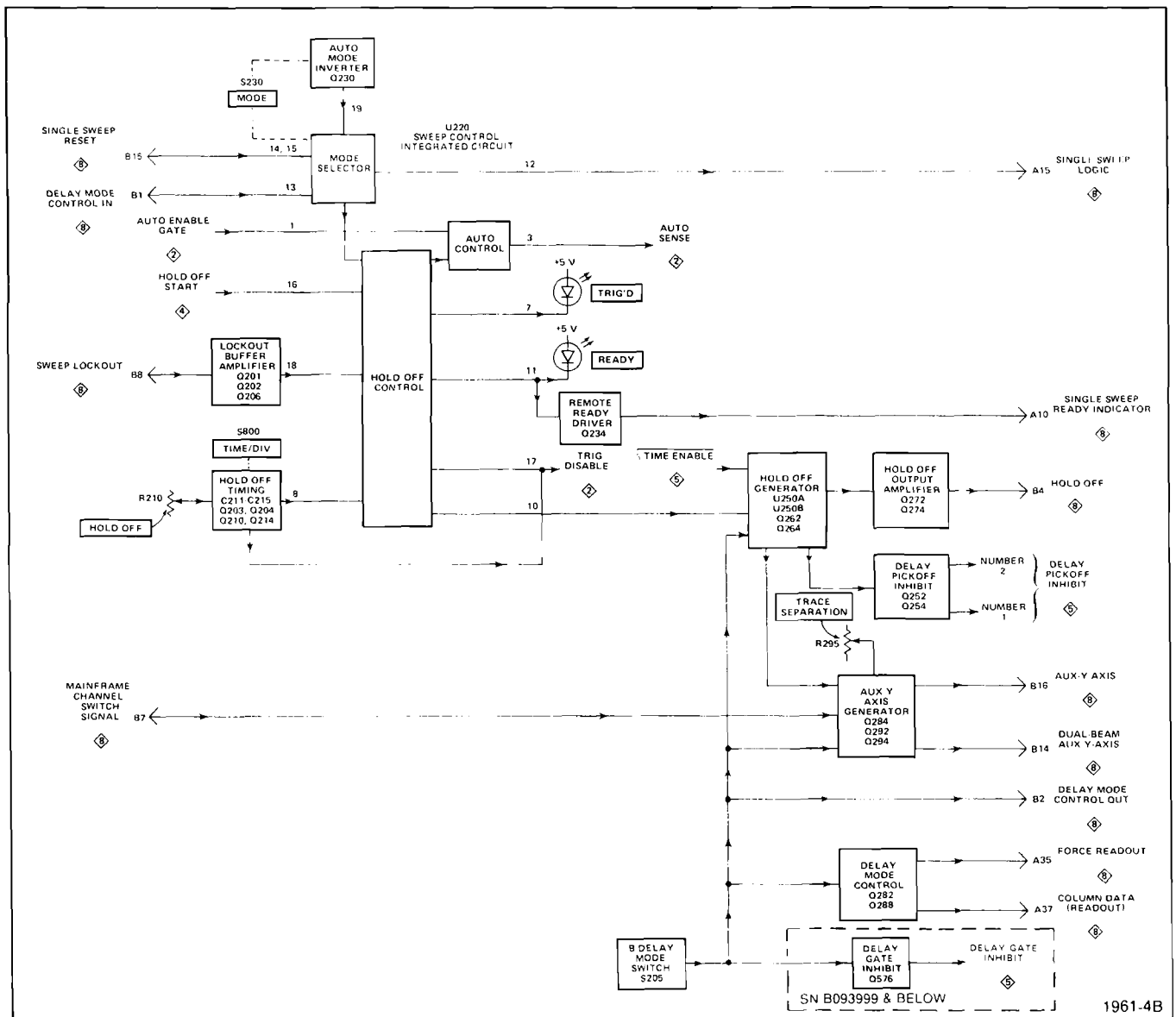


Fig. 3-5. Detailed block diagram of Logic circuit.

**NORMal MODE.** The NORM MODE is provided when U220, pin 12 is LO. In the NORM MODE, only an appropriate trigger signal can initiate a sweep gate to the Sweep Generator (diagram 4). Sweep Control integrated circuit U220 controls sweep lockout and hold off functions.

**AUTO MODE.** The Auto Control stage produces a free-running reference trace (bright base line) in the absence of a trigger signal.

A HI level from MODE switch S230 is inverted by Q230 to set U220, pin 19 LO, which selects AUTO MODE operation. In the presence of a trigger pulse from the Trigger Generator (diagram 2), a HI level at U220, pin 1 discharges the auto stage, which inhibits the auto sense signal from U220, pin 3. In the absence of a trigger pulse, the LO level at U220, pin 1 enables the Auto Control stage. After a time delay determined by R228, C228, and circuitry internal to U220, pin 6, an auto sense signal is initiated from U220, pin 3 to the Trigger Generator (diagram 2).

**SINGLE SWEEP MODE.** Single sweep operation provides display of only one sweep. After one sweep has run, all other sweeps are inhibited until the SINGLE SWP PRESET push button is pressed. The READY light indicates when the sweep is ready to accept a trigger.

After completion of one sweep, the hold off start pulse at U220, pin 16 causes the sweep disable out at pin 17 to rise HI. A HI level at U220, pin 12 initiates single-sweep operation and holds the sweep disable out at U220, pin 17 HI after completion of the sweep. Momentary contact of the RESET push button places a LO at U220, pins 14 and 15, which removes the sweep disable out from pin 17 and allows the Sweep Generator (diagram 4) to accept a trigger. Interface connector B15 provides a remote single-sweep reset input from compatible mainframes.

### Hold Off Timing

The hold off stages prevent the Sweep Generator (diagram 4) from being retriggered until the sweep timing capacitors are discharged.

At the end of each sawtooth waveform from the Sweep Generator (diagram 4), a sweep stop comparator pulse (HI) is coupled to U220, pin 16. This pulse enables the hold off timing circuits at U220, pin 8, which sets the sweep disable out at U220, pin 8, which sets the sweep disable out at U220, pin 17 HI and the  $\overline{\text{hold off}}$  signal at pin 10 LO for the duration of the hold off cycle. Hold off timing (U220, pin 8) is provided by capacitors C212 through C215, and resistors R212 through R214. Transistors Q203 and Q204 prevent

the sweep disable out pulse at U220, pin 17 from falling LO until the timing capacitors have discharged. Transistors Q210 and Q214 and front-panel HOLD OFF control R210 provide variable current to the timing components to change the hold off time period.

### Lockout Buffer Amplifier

A lockout pulse (HI) may be initiated at interface connector pin B8 by mainframe switching functions. A HI level, coupled from interface connector B8 through the Lockout Buffer Amplifier (Q201, Q202, and Q206) to the lockout input at U220, pin 18, initiates a sweep disable pulse at U220, pin 17, thereby disabling the sweep. The lockout pulse (HI) is also applied through Q358 (diagram 4) to the hold off start input at U220, pin 16 to enable the hold off cycle.

### Hold Off Generator

The Hold Off Generator provides an appropriate hold off pulse to the Hold Off Output Amplifier, depending upon the sweep mode.

In the  $\Delta$  Time (delta time) mode, a HI level from Q546 (diagram 5) reverse biases CR248; this sets U250, pins 3 and 10 HI and removes the set input from pin 10. Since the J and K inputs of U250A (pins 2 and 3) are both HI, the outputs at pins 5 and 6 switch with every negative-going  $\overline{\text{hold off}}$  pulse. The divide-by-2 output from U250B is coupled to Hold Off Output Amplifier Q272 and Q274. A HI level saturates Q272 and blocks the  $\overline{\text{hold off}}$  signal from buffer Q262-Q264; a LO level allows the  $\overline{\text{hold off}}$  signal to pass to the Hold Off Output Amplifier. Therefore, a hold off pulse is generated on every other  $\overline{\text{hold off}}$  pulse from U220, pin 10.

When operating in the Independent or Delay Time modes, the LO level from Q546 (diagram 5) forward biases CR248, which switches the set input (pin 10) of U250B LO. As a result, pin 7 switches LO and releases the hold off thorough buffer Q262-Q264 to the Hold Off Output Amplifier. Then, a hold off pulse is generated with every hold off pulse.

### Hold Off Output Amplifier

The Hold Off Output Amplifier inverts and amplifies the  $\overline{\text{hold off}}$  signal from the Hold Off Generator for use by the mainframe.

Transistor Q272 inverts the  $\overline{\text{hold off}}$  signal from Q264 to provide a HI level when hold off is present. The inverted signal is coupled through emitter follower Q274 to interface connector B4.

**Delay Pickoff Inhibit**

The Delay Pickoff Inhibit stage provides an inhibit level to disable the delay pickoff comparator (diagram 5) of the delayed sweep not being displayed (two delayed sweep traces are produced by a delayed companion time base when operating in the  $\Delta$  Time mode). When the 7B85 is set to INDEPENDENT, both delay pickoff comparators are inhibited. When the 7B85 is set for Delay Time operation (TRACE SEP control set to OFF detent), the Second Delay Pickoff Comparator (diagram 5) is inhibited. During  $\Delta$  Time operation, the First and Second Delay Pickoff Comparators (diagram 5) are alternately inhibited.

A HI level from the Hold Off Generator turns on Q252 and turns off Q254, which results in a LO level at P33, pin 3 and a HI level at P33, pin 2. A LO level turns off Q252 and turns on Q254, which results in a HI level at P33, pin 3 and a LO level at P33, pin 2. A LO pickoff-inhibit level (P33, pins 2 and 3) disables the appropriate delay time comparator (diagram 5). Refer to the timing diagram in Fig. 3-6.

**Delay Mode Control**

The Delay Mode Control stage determines whether delayed companion time-base unit operates in the B Starts After Delay or Triggerable After Delay modes. The delay mode information is coupled from S205 to the delayed companion time-base unit through interface connector B2.

In either delay mode, Q282 is turned on to provide a force readout level to the mainframe through interface connector A35. Force readout enables display in the A Horizontal compartment of a mainframe with two horizontal compartments even though the A Horizontal compartment has not been selected for display. This provides delay-time readout in the delaying sweep applications where only the B Horizontal unit is displayed.

When Q282 is on, Q288 is turned off to provide a HI level through CR288 to interface connector A37. The HI level disables the channel 1 readout in the A Horizontal compartment (top of graticule) when only the B Horizontal compartment has been selected for display.

**Auxiliary Y-Axis Generator**

The Auxiliary Y-Axis Generator provides vertical trace separation to the mainframe when operating in the  $\Delta$  Time mode (3 trace display). Information from interface connector B7 indicates which trace (delaying or delayed sweep trace) is displayed by the mainframe. Information from U250, pin 6 of the Hold Off Generator stage indicates which delayed sweep trace is displayed. The Auxiliary Y-Axis Generator processes the sweep mode information and supplies the appropriate positioning current to interface connector B16. Also, Auxiliary Y-Axis information for dual-beam mainframes is supplied at interface connector B14.

During the delaying sweep trace (intensified trace), Q292 turns off, Q294 turns on, and CR293 is reverse biased. As a result, a fixed positioning current is provided to interface connector B16 by R292 and the  $\pm 15$  V supply.

During the delayed sweep traces, Q292 is saturated and Q294 is turned off. Diode CR292 is reverse biased to block positioning current from R292 and the  $\pm 15$  V supply. Therefore, positioning is determined by U250A, pin 6 of the Hold Off Generator stage. The first delayed sweep trace is the reference trace and does not require vertical positioning. Therefore, the HI level from U250A, pin 6 reverse biases CR293 and block positioning current. However, during the second delayed sweep trace, the LO level from U250A reverse biases CR295 and opens the variable positioning current path from TRACE SEP control R295, through R294 and CR293 to interface connector B16.

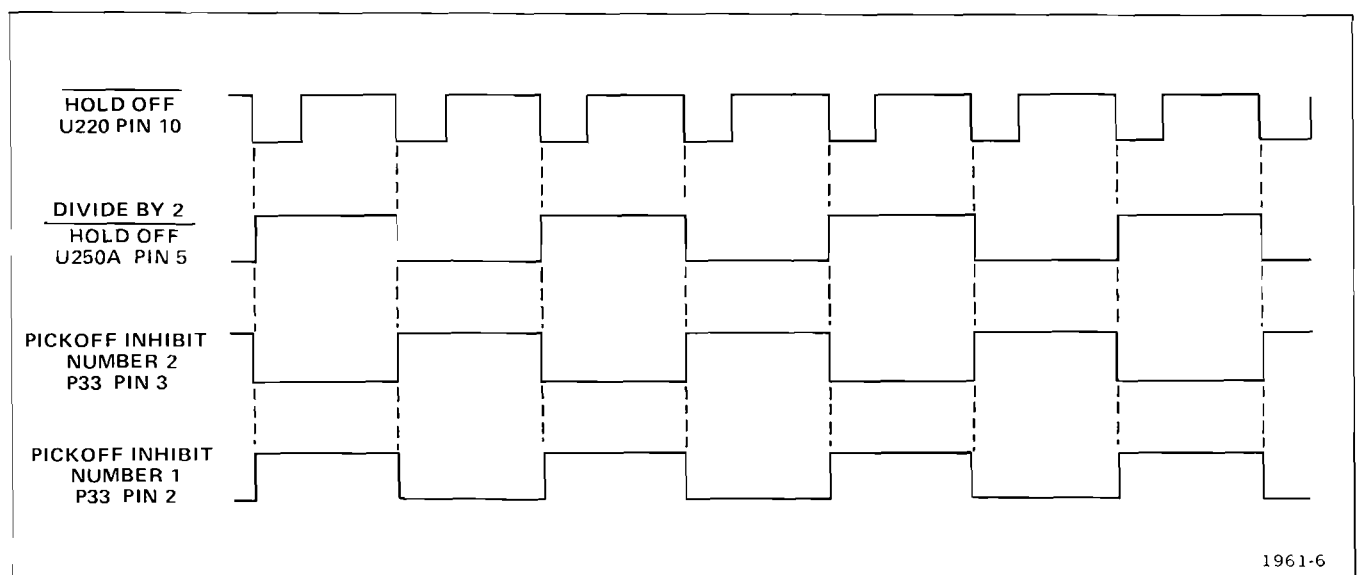


Fig. 3-6. Timing diagram for Delay Pickoff Inhibit stage.

## SWEEP GENERATOR

The Sweep Generator produces a linear ramp waveform for the mainframe when gated by the Trigger Generator. The sweep trace is displayed either independently or as the intensified sweep (when used with a companion delayed time-base unit) of an alternate display. The sweep ramp is also used as a time reference for the delay pickoff comparators (diagram 5). A sweep gate (unblanking) is also generated in this circuit block.

The linear sweep ramp waveform is produced by charging a capacitor from a constant current source. The slope of the ramp determines the sweep rate of the displayed trace. A block diagram of the Sweep Generator is shown in Fig. 3-7.

### Timing Current Source

The Timing Current Source stages generate a constant current for the Ramp Generator stages (see Fig. 3-7).

A Reference Voltage Source is established by the +50 volt supply and R710, R711, R717, and R705 (front-panel SWP CAL adjustment).

The reference voltage is applied to the Source Current Generator stage. Operational amplifier U722 provides unity voltage gain and low output impedance. The output of U722 is connected through the base-emitter junction of Q732 to the Timing Resistors (R741 through R749). Timing current is the result of the voltage drop across the Timing Resistors and flows through the collector of Q732 to the Ramp Generator stages.

### Ramp Generator

The Ramp Generator stages produce a linear positive-going ramp for the Output Preamp and Sweep Gate Generator stages, and for delay pickoff in the Logic circuit (diagram 5). Refer to Fig. 3-7.

Upon the arrival of a HI-level sweep start gate at the Current Switch stage, Q322 turns on and Q324 turns off. The source current from Q732 charges the Timing Capacitors (C332, C334, C336) in a positive ramp. Field effect transistors Q334A, Q334B, and transistor Q338 form a unity-gain Ramp Voltage Follower for the sweep ramp. The output of Q338 is connected to the Horizontal Preamp, Sweep Stop Comparator, and Baseline Stabilizer stages.

When the sweep start is LO, Q322 turns off and Q324 turns on causing the Timing Capacitors (C332, C334, and C336) to discharge. The Baseline Stabilizer stage (Q304, Q314) maintains a constant level from which the ramp begins. The output of Q338 is compared (by way of Q304A) with the reference level at the base of Q304B. If the output of Q338 is less than the reference, Q314 will charge the timing capacitors through CR323 until the output and reference voltages are equal. If the output of Q338 is greater than the reference, Q314 conducts more and CR323 conducts more and CR323 conducts less, causing the Timing

Capacitors to discharge through Q324 and R322. When the output and reference voltages are equal, the current through CR323 and Q732 equal the current through Q324.

### Output Preamp

The Output Preamp stages connect the differential sweep signal to the mainframe and provide an offset voltage for trace positioning. Provisions are made in these stages for sweep magnification, and a negative-going sawtooth signal is supplied to the mainframe for sawtooth output and special plug-in unit functions. Refer to Fig. 3-7.

Q424 and Q434 form a single-ended to push-pull converter with Q428 and Q438 as current follower stages for the push-pull signal. Output drivers Q448 and Q458 provide final amp simplification and connect the sweep signal to the mainframe.

The MAG switch, S435, increases the Horizontal Preamp gain ten times by connecting R431 and R430 in parallel with R442.

The Position Voltage Source stage combines the dc voltages of the FINE and POSITION controls for a position voltage level at the output of operational amplifier U416. This voltage level on the base of Q434 provides a ramp waveform offset voltage to horizontally position the displayed trace.

The Auxiliary Sweep Preamp stage provides a negative-going sweep ramp to the mainframe (via interface connector pins A3 and B3) for sawtooth output and special plug-in unit functions. Transistor Q344 and Q346 form a unity-gain inverting amplifier for the sawtooth signal from the Ramp Voltage Follower stage. Diode CR344 provides emitter-base compensation.

### Sweep Gate Generator

The Sweep Gate Generator produces an unblanking gate for the Z-axis system of the mainframe. When the sweep is displayed, the crt is unblanked (gate level LO). The sweep is blanked (gate level HI) between sweeps. Refer to Fig. 3-7.

The sweep ramp is applied to the Sweep Stop Comparator stage. A comparison voltage is set at the base of Q356. When the ramp voltage exceeds the comparison voltage, Q352 turns off and Q356 couples a HI level through common-base transistor Q358. The Sweep Stop Comparator output is coupled to the Sweep Gate Generator stage and to the Logic circuit (diagram 3) to initiate hold-off.

The Z-axis gate from the Trigger Generator circuit (diagram 2) is LO at the start of the sweep. This LO level turns off Q372. The resultant HI-level sweep gate pulse at the collector of Q372 is coupled through emitter follower Q382 to the mainframe for sweep unblanking. At the end of the sweep, the HI level from the Sweep Stop Comparator stage turns Q362 off and Q372 on. The resultant LO is coupled through emitter follower Q382 to the mainframe for sweep blanking.

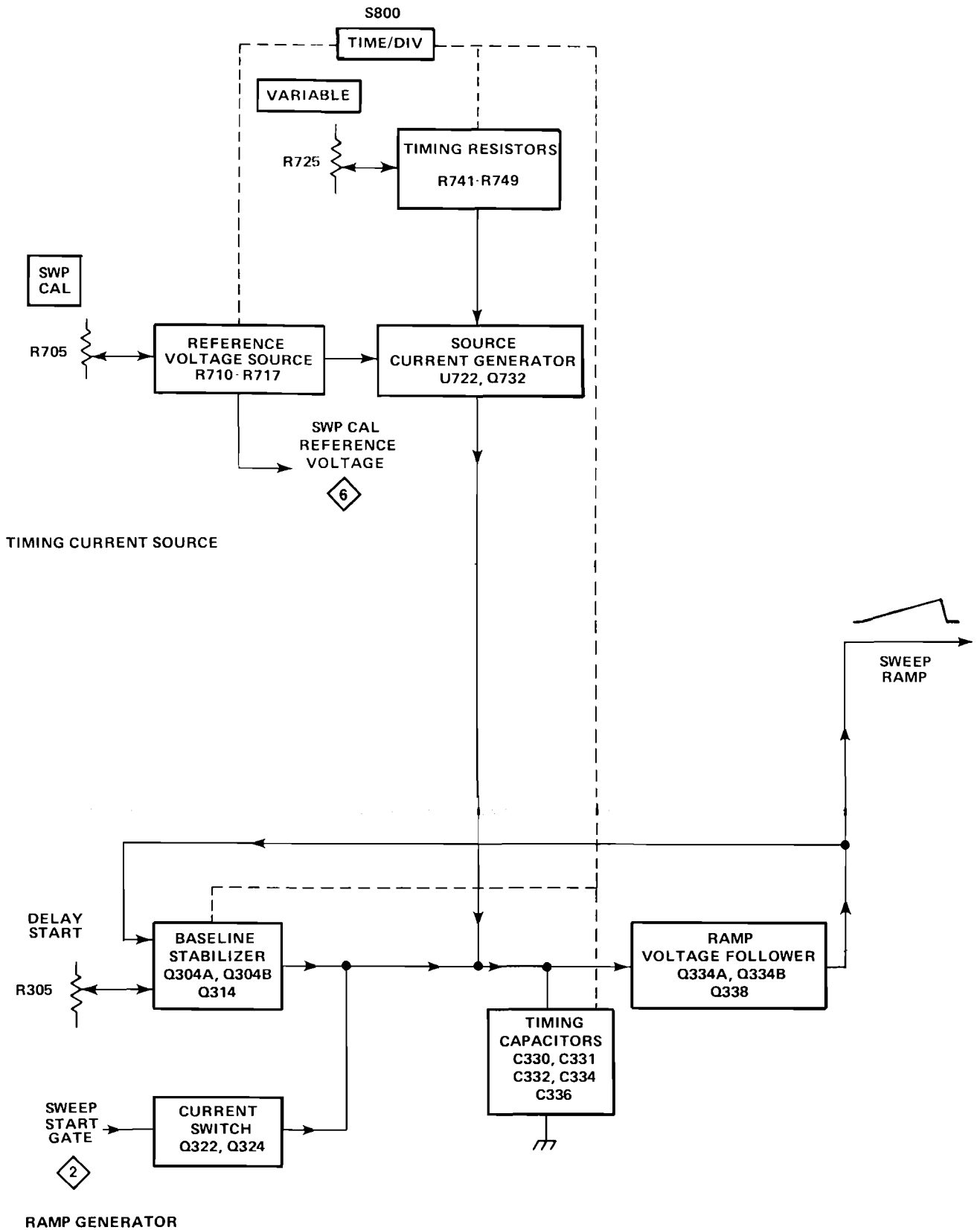
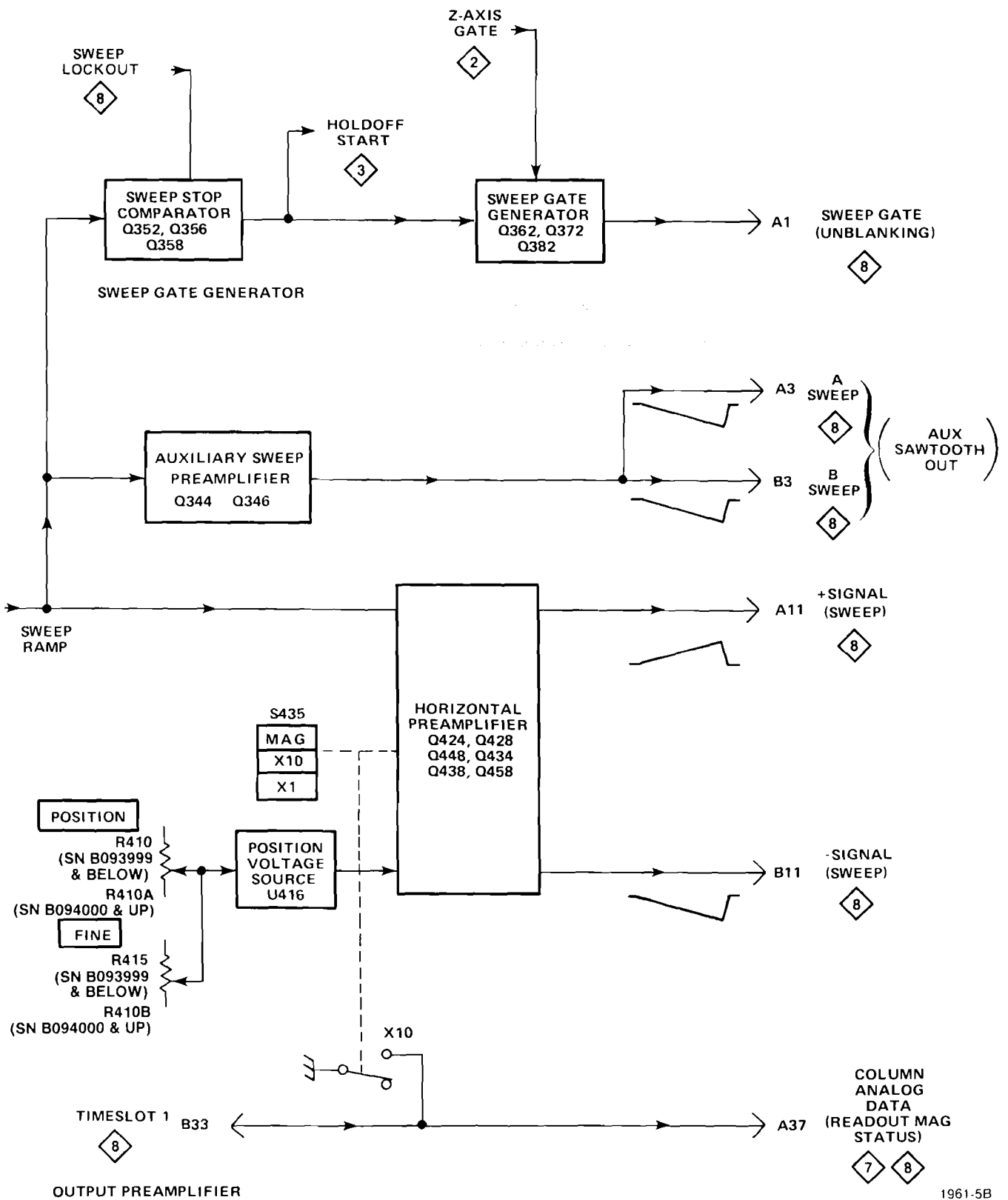


Fig. 3-7. Detailed block diagram of Sweep Generator.



1961-5B

Fig. 3-7. Detailed block diagram of Sweep Generator (cont.).

## PICKOFF AMPLIFIERS AND DELAY GATE GENERATOR 5

The Pickoff Amplifiers and Delay Gate Generator circuits determines the first and second delay times and generate the delay gate that allows the delayed sweep of the companion time-base unit to run. Calibrated dc voltages are supplied to the Digital Voltmeter circuit (diagram 6) to provide delay time and  $\Delta$  time crt readout. A block diagram of the Pick-off Amplifiers and Delay Gate Generator circuits is shown in Fig. 3-8.

### Delay Time Comparison (SN B094000 & Up)

DELAY TIME control R520 determines the delay time before the start of the first delayed sweep trace and the associated intensified zone. The delay-time voltage, selected by R520, is coupled through unity gain buffer amplifier U530B to the delay comparison voltage switch stage (Q592) and to the delay time pickoff comparator Q512B and Q522A.

When the sweep ramp voltage at the base of Q522A exceeds the delay-time voltage at the base of Q512B, the comparator switches (Q522A turns off and Q512B turns on). The resultant LO level at the base of Q562 initiates the delay gate, which allows the delayed sweep of the companion time-base unit to run (refer to Delay Gate Generator discussion).

Transistor Q572 disables the Delay Gate Generator until the Z-axis circuits are ready for the sweep to run. A HI level at the base of Q572 turns on the transistor and diverts current from Q574, which inhibits the companion time-base unit sweep (delay gate HI).

When B DELAY MODE switch S280 is set to INDEPENDENT, a LO level at the base of Q578 holds the delay gate LO and allows the companion time base to run independently.

The current source for the delay time pickoff comparator (Q512B and Q522A) is provided by Q518. A LO level from the Logic circuits (diagram 3) at P3-3 turns off Q518 and disables the comparator. The delay time pickoff comparator (Q512B and Q522A) is then inhibited during the time that the second delayed sweep trace ( $\Delta$  Time mode) is displayed.

### Delay Time Comparison (SN B088750 to B093999)

DELAY TIME control R520 determines the delay time before the start of the first delayed sweep trace and the associated intensified zone. The delay-time voltage, selected by R520, is coupled through unity gain buffer amplifier U530B to the delay comparison voltage switch stage (Q592) and to the delay time pickoff comparator (Q512B and Q522B).

When the sweep ramp voltage at the base of Q522B exceeds the delay-time voltage at the base of Q512B, the comparator switches (Q522B turns off and Q512B turns on). The resultant LO level at the base of Q562 initiates the delay gate, which allows the delayed sweep of the companion time-base unit to run (refer to Delay Gate Generator discussion).

The current source for the delay time pickoff comparator (Q512B and Q522B) is provided by Q518. A LO level from the Logic circuits (diagram 3) at P3-3 turns off Q518 and disables the comparator. The delay time pickoff comparator (Q512B and Q522B) is then inhibited during the time that the second delayed sweep trace ( $\Delta$  Time mode) is displayed.

### Delay Time Comparison (SN B088749 & Below)

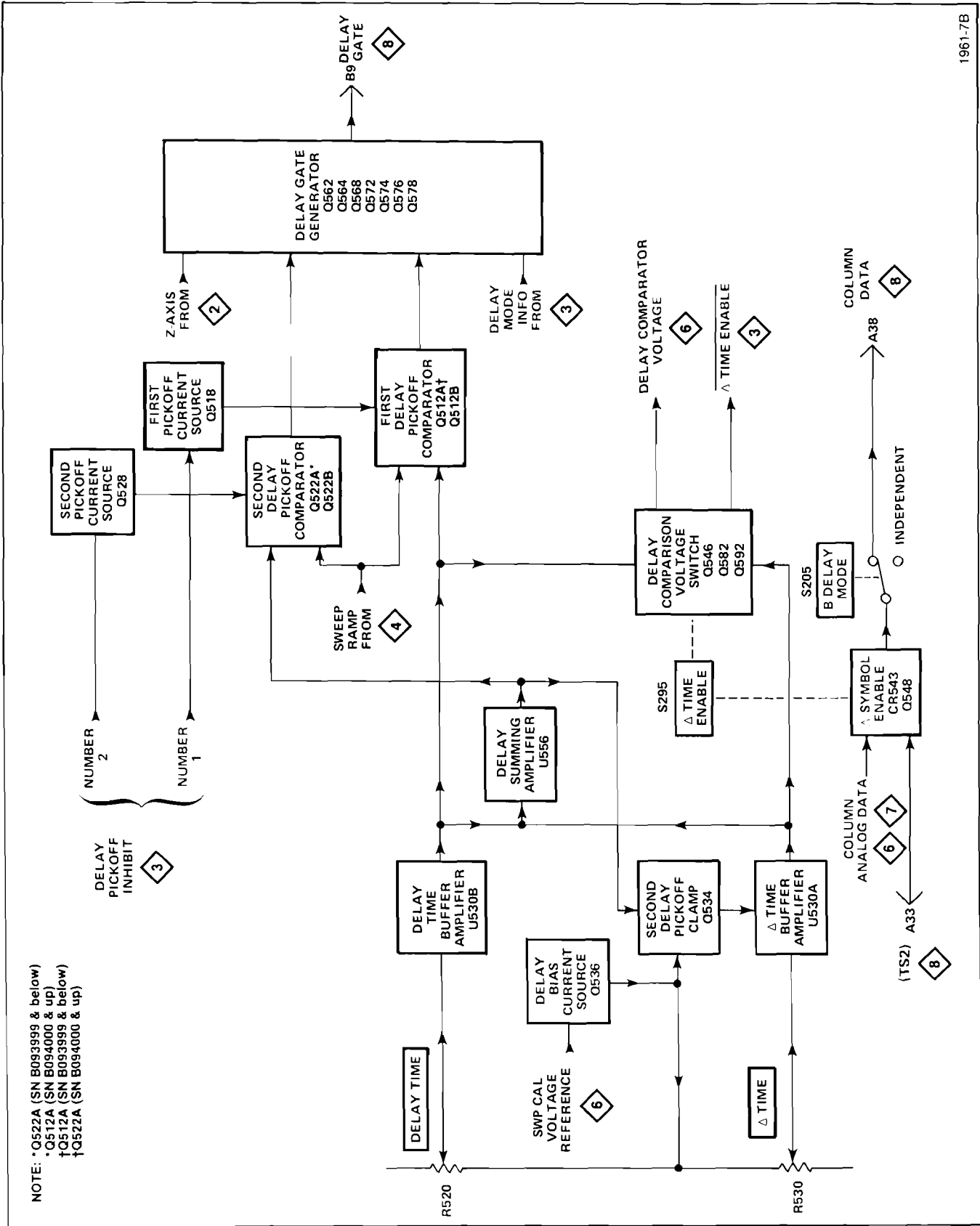
DELAY TIME control R520 determines the delay time before the start of the first delayed sweep trace and the associated intensified zone. The delay-time voltage, selected by R520, is coupled through unity gain buffer amplifier U530B to the Delay Comparison Voltage Switch stage (Q592) and to the First Delay Pickoff Comparator (Q512).

When the sweep ramp voltage at the base of Q512A exceeds the delay time voltage at the base of Q512B, the comparator switches (Q512A turns off and Q512B turns on). The resultant LO level at the base of Q562 initiates the delay gate, which allows the delayed sweep of the companion time-base unit to run (refer to Delay Gate Generator discussion).

The current source for the First Delay Pickoff Comparator (Q512) is provided by Q518. A LO level from the Logic circuits (diagram 3) at P3-3 turns off Q518 and disables comparator Q512. The First Delay Pickoff Comparator (Q512) is then inhibited during the time that the second delayed sweep trace ( $\Delta$  Time mode) is displayed.

### $\Delta$ Time Comparison (SN B094000 & Up)

$\Delta$  Time control R530 determines the amount of delay time from the start of the first intensified zone and corresponding delayed sweep display, to start the second intensified zone and corresponding delayed sweep display ( $\Delta$  Time operation only). The  $\Delta$  TIME control also supplies a dc level, which corresponds to the differential time from the



NOTE: \*Q522A (SN B093999 & below)  
 †Q512A (SN B094000 & up)  
 ‡Q512A (SN B093999 & below)  
 †Q522A (SN B094000 & up)

Fig. 3-8. Detailed block diagram of Pickoff Amplifiers and Delay Gate Generator.



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start of the first intensified zone to the start of the second intensified zone, through Q592 to the Digital Voltmeter circuit (diagram 6). Refer to the Delay Time and  $\Delta$  Time Reference Voltage Sources discussion.

The voltage levels from the DELAY TIME control R520 and  $\Delta$  TIME control R530 are added in the delay summing amplifier U556. The summed voltage levels are coupled to the  $\Delta$  time pickoff comparator stage, Q512A and Q522A, to determine the delay time before the start of the second delayed sweep trace.

When the sweep ramp at the base of Q522B exceeds the  $\Delta$  time voltage at the base of Q512A, the comparator switches (Q522B turns off and Q512A turns on). The collectors of Q522B falls LO and initiates the delay gate, which allows the second delayed sweep of the comparator time-base unit to run (refer to Delay Gate Generator discussion).

The current source for the  $\Delta$  time pickoff comparator (Q512A and Q522B) is provided by Q528. A LO level from the Logic circuits at P3-2 turns off Q528 and disables this comparator. The  $\Delta$  time pickoff comparator (Q512A and Q522B) is inhibited during the time that the first delayed sweep trace is displayed ( $\Delta$  Time mode).

### $\Delta$ Time Comparison (SN B088750 To B093999)

$\Delta$  Time control R530 determines the amount of delay time from the start of the first intensified zone and corresponding delayed sweep display, to start the second intensified zone and corresponding delayed sweep display ( $\Delta$  Time operation only). The  $\Delta$  TIME control also supplies a dc level, which corresponds to the differential time from the start of the first intensified zone to the start of the second intensified zone, through Q592 to the Digital Voltmeter circuit (diagram 6). Refer to the Delay Time and  $\Delta$  Time Reference Voltage Sources discussion.

The voltage levels from the DELAY TIME control R520 and  $\Delta$  TIME control R530 are added in the delay summing amplifier U556. The summed voltage levels are coupled to the  $\Delta$  time pickoff comparator stage, Q522, to determine the delay time before the start of the second delayed sweep trace.

When the sweep ramp at the base of Q522A exceeds the  $\Delta$  time voltage at the base of Q522B, the comparator switches (Q522A turns off and Q522B turns on). The collectors of Q522A falls LO and initiates the delay gate, which allows the second delayed sweep of the comparator time-base unit to run (refer to delay Gate Generator discussion).

The current source for the  $\Delta$  time pickoff comparator (Q512A and Q522A) is provided by Q528. A LO level from the Logic circuits at P3-2 turns off Q528 and disables this comparator. The  $\Delta$  time pickoff comparator (Q512A and Q522A) is inhibited during the time that the first delayed sweep trace is displayed ( $\Delta$  Time mode).

### $\Delta$ Time Comparison (SN B088749 & Below)

$\Delta$  TIME control R530 determines the amount of delay time from the start of the first intensified zone and corresponding delayed sweep display, to the start of the sec-

ond intensified zone and corresponding delayed sweep display ( $\Delta$  Time operation only). The  $\Delta$  TIME control also supplies a dc level, which corresponds to the differential time from the start of the first intensified zone to the start of the second intensified zone, through Q592 to the Digital Voltmeter circuit (diagram 6). Refer to the Delay Comparison Voltage Switch discussion.

The voltage levels from DELAY TIME control R520 and  $\Delta$  TIME control R530 are added in the Delay Summing Amplifier U556. The summed voltage levels are coupled to the Second delay Pickoff Comparator Stage Q522 to determine the delay time before the start of the second delayed sweep trace.

When the sweep ramp at the base of Q522A exceeds the  $\Delta$  time voltage at the base of Q522B, the comparator switches (Q522A turns off and Q522B turns on). The collector of Q522A falls LO and initiates the delay gate, which allows the second delayed sweep of the companion time-base unit to run (refer to delay Gate Generator discussion).

The current source for the Second Delay Pickoff Comparator (Q522) is provided by Q528. A LO level from the Logic circuits at P3-2 turns off Q528 and disables comparator Q522. The Second Delay Pickoff Comparator (Q522) is inhibited during the time that the first delayed sweep trace is displayed ( $\Delta$  Time mode).

### Delay Bias and Second Delay Pickoff Clamp

Bias for delay-time controls R520 and R530 is provided by Q536 and associated circuitry. Base current into Q536, and consequently delay-time bias at the junction of R537 and R533, changes with respect to the front-panel SWP CAL adjustment. The SWP CAL reference voltage is also coupled to the Reference Current Source stage (Digital Voltmeter circuit, diagram 6) in an amount proportional to the change in delay bias and the resultant delay comparison voltage. As a result, a change in the SWP CAL adjustment does not affect the delay time readout.

Transistor Q534 senses the output of Delay Summing Amplifier U556 and limits the comparison voltage at Q512A, SN B094000 & up (Q522B, SN B088750 & below) to a level equivalent to approximately 10 div of delay time. Transistor Q534 turns on and reduces the  $\Delta$  time voltage output from U530A and thereby limits the second delay pickoff to approximately 10 div. The voltage at which Q534 turns on can be varied by Second Pickoff Bias adjustment R535.

### Delay Comparison Voltage Switch

Delay Time or  $\Delta$  Time voltage is coupled through the Delay Comparison Voltage Switch to the Digital Voltmeter circuit (diagram 6), where voltage is converted for delay time readout.

When operating in the DELAY TIME mode, S295 couples a HI level to the base of Q546 and to the gate of Q592. Transistor Q546 turns on; the resultant LO at its collector turns off Q582. Field-effect transistor Q592 then turns on and couples the delay time comparison voltage to the Digital Voltmeter circuit (diagram 6).

In  $\Delta$  time operation, S295 is open, and a LO level is coupled to the base of Q546 and to the gate of Q592. Field-effect transistor Q592 and transistor Q546 turn off. The resultant HI at the collector of Q546 turns on Q582 and couples the  $\Delta$  Time comparison voltage to the Digital Voltmeter circuit (diagram 6).

**Delay Gate Generator (SN B094000 & Up)**

The Delay Gate Generator produces a square-wave delay gate signal on command of the First and Second Delay Pickoff Comparators. The delay signal controls the delayed sweep of the delayed companion time-base unit.

At the time of delay pickoff of either the First (Q522A and Q512B) or Second (Q512A and Q522B) Delay Pickoff Comparator, Q522A or Q522B turns off and Q512A or Q512B turns on. The base of emitter follower Q562 then falls LO, as does the input to Schmitt trigger Q564, Q568 (base of Q564). Transistor Q564 turns off and Q568 turns on, thereby increasing the current through R572, Q574, and R574. The collector of Q574 falls and the LO level is coupled through emitter follower Q578 to interface connector B9. The LO level enables the sweep of the delayed companion time-base unit.

**Delay Gate Generator (SN B093999 & Below)**

The Delay Gate Generator produces a square-wave delay gate signal on command of the First and Second Delay Pickoff Comparators. The delay gate signal controls the delayed sweep of the delayed companion time-base unit.

At the time of delay pickoff of either the First (Q512) or Second (Q522) Delay Pickoff Comparator, transistor A turns off and transistor B turns on. The base of emitter follower Q562 then falls LO, as does the input to Schmitt trigger Q564, Q568 (base of Q564). Transistor Q564 turns off and Q568 turns on, thereby increasing the current through R572, Q574, and R574. The collector of Q574 falls and the LO level is coupled through emitter follower Q578 to interface connector B9. The LO level enables the sweep of the delayed companion time-base unit.

Transistor Q572 disables the Delay Gate Generator until the Z-axis circuits are ready for the sweep to run. A HI level at the base of Q572 turns on the transistor and diverts current from Q574, which inhibits the companion time-base unit (delay gate HI).

When B DELAY MODE switch S280 is set to INDEPENDENT, a LO level at the base of Q578 holds the delay gate

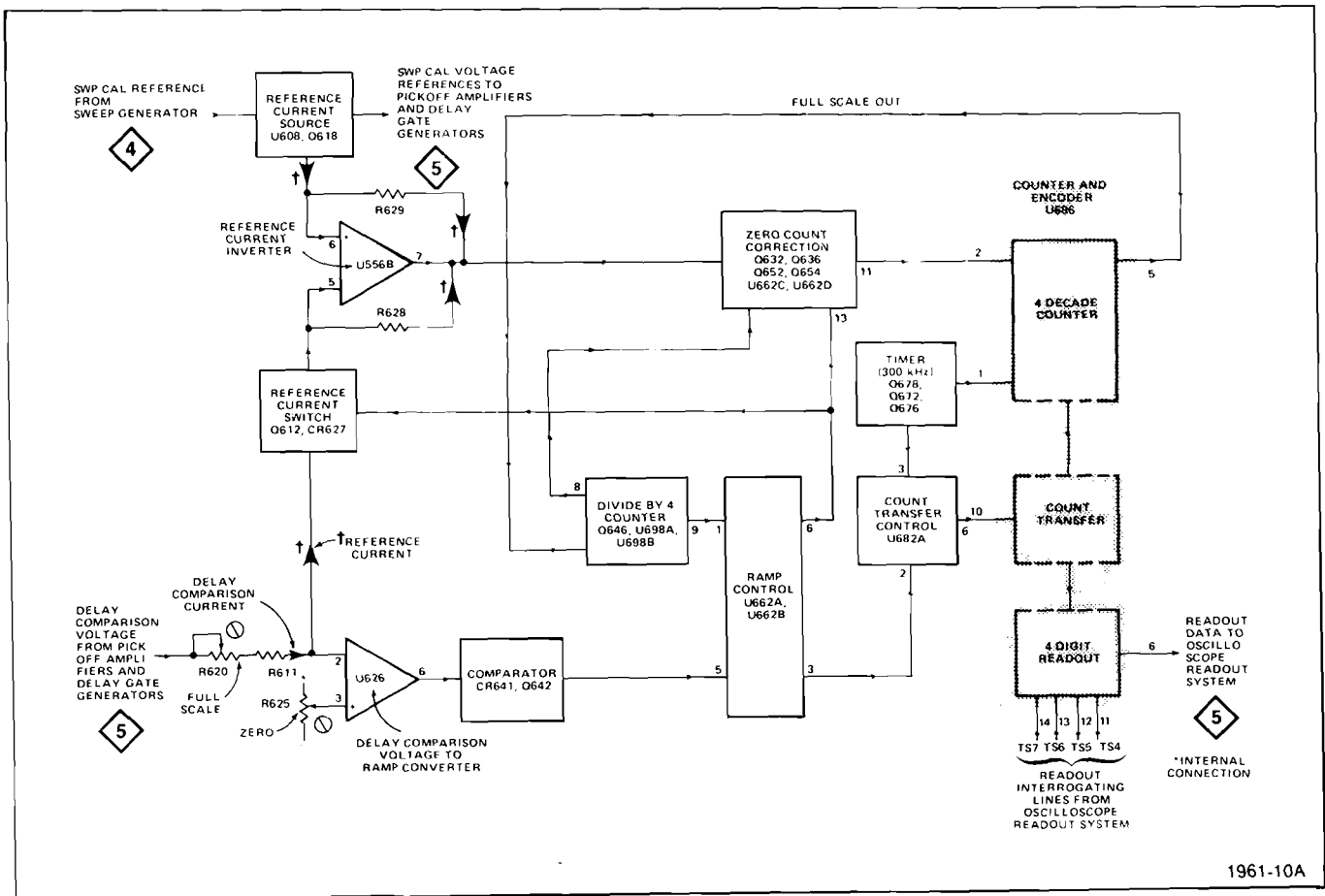


Fig. 3-9. Digital Voltmeter detailed block diagram (SN B088749 & below).

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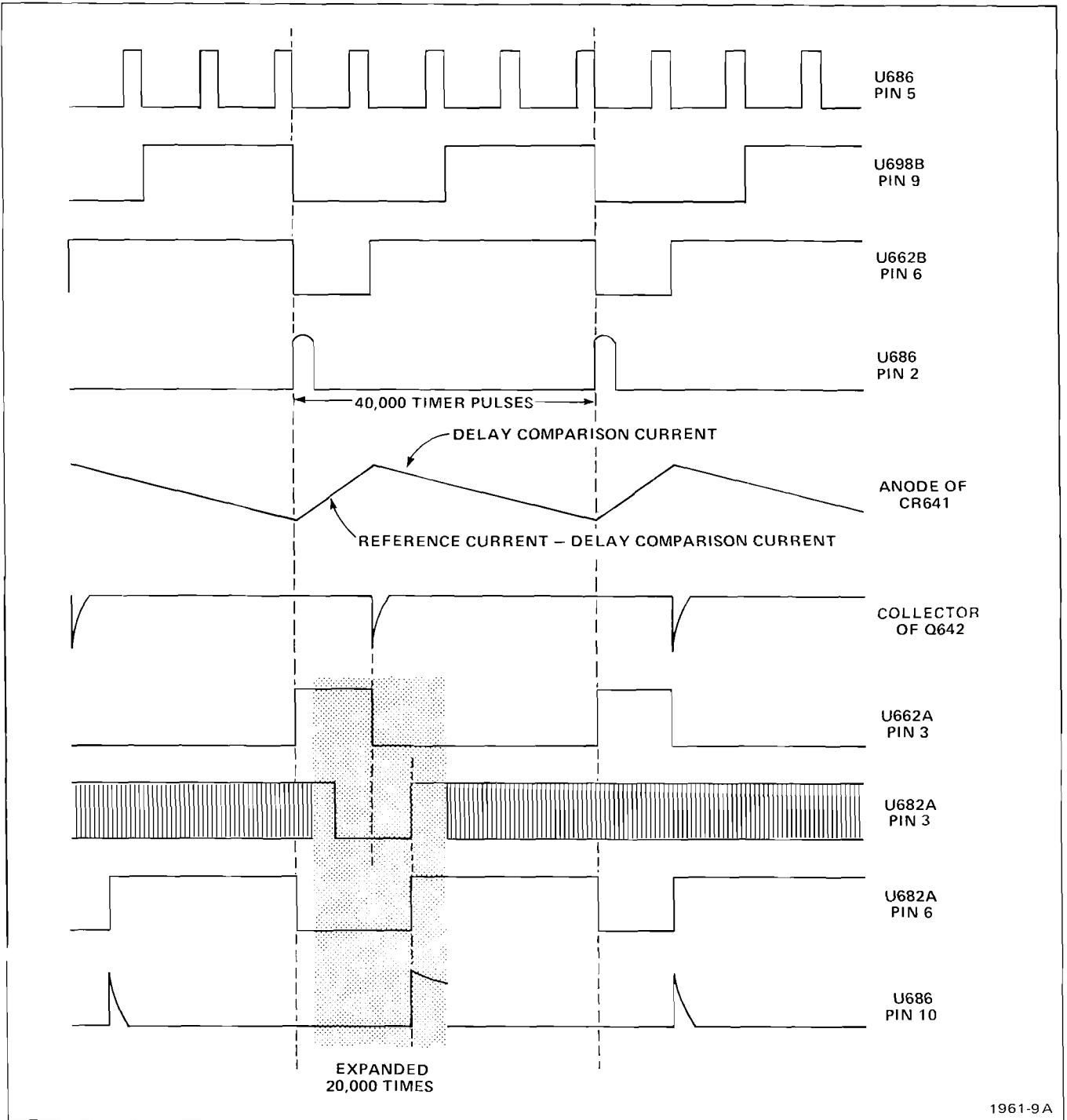
LO and allows the companion time base to run independently.

**Δ Symbol Enable**

The Δ Symbol Enable stage senses Δ time operation and sets the readout row and column output current necessary to enable the Δ symbol.

During Delay Time operation, the HI level from S295 turns Q548 on; its emitter rises and reverse biases CR543. Column current is thus blocked from interface connector A38, thereby disabling the Δ symbol.

During Δ time operation, S295 is open and the LO level through R547 holds Q548 off. A -15 V pulse, during time-slot 2, at interface connector A33 provides approximately 0.9 mA column current through R543 and approximately



**Fig. 3-10. Digital Voltmeter timing diagram.**

0.1 mA row current through R542. This enables the  $\Delta$  symbol via interface connectors A38 and B38. At time slots other than time-slot 2, the  $-15$  V pulse is not present at interface connector A33.

## DIGITAL VOLTMETER

The Digital Voltmeter circuit converts the Delay Comparison Voltage, determined by the DELAY TIME and  $\Delta$  TIME front-panel controls, to an accurate time measurement that is displayed on the crt by the mainframe readout system. The schematic for the Digital Voltmeter circuit is given in the diagrams section of this manual. A detailed block diagram of the Digital Voltmeter circuit is shown in Fig. 3-9.

### Delay Comparison Voltage to Ramp Converter (SN B088750 & Up)

The Delay Comparison Voltage to Ramp Converter stage develops a positive- and negative-going ramp (see Fig. 3-10, anode of CR641 waveform). Integrated circuit U626 is connected as a Miller integrator. The current that flows through R621 and R622 (delay comparison current, determined by the DELAY TIME and  $\Delta$  TIME front-panel controls) causes the voltage at pin 6 of U626 to go negative. The rate at which this can occur is limited by the charging of C627. The result is a negative-going ramp with a slope proportional to the delay comparison voltage. Consequently, the more positive the delay comparison voltage, the more negative the ramp will run.

After a period of time (determined by U686), diode CR632 turns on and adds reference current to the delay comparison current. This reference current polarity is opposite to the delay comparison current and is always at least 10 times greater. Therefore, the output of U626 becomes a positive-going ramp. When the positive-going ramp reaches approximately 7 V, the Comparator stage switches and the Ramp control turns off CR632. The output of U626 becomes a negative-going ramp, completing the cycle.

The DVM Zero adjustment, R625, provides a dc offset current to set the quiescent operating level of the Delay Comparison Voltage to Ramp Converter. DVM Gain adjustment R620 allows for calibration of the delay comparison current.

### Delay Comparison Voltage to Ramp Converter (SN B088749 & Below)

The Delay Comparison Voltage to Ramp Converter stage develops a positive- and negative-going ramp (see Fig. 3-10, anode of CR631 waveform). Integrated circuit U626 is connected as a Miller integrator. The current that flows through R620 and R621 (delay comparison current, determined by the DELAY TIME and  $\Delta$  TIME front-panel controls) causes the voltage at pin 6 of U626 to go negative. The rate at which this can occur is limited by the charging of C627. The result is a negative-going ramp with a slope proportional to the delay comparison voltage. Consequently, the more positive the delay comparison voltage, the more negative the ramp will run.

After a period of time (determined by the Ramp Control stage), the Reference Current Switch turns on and adds reference current to the delay comparison current. The reference current polarity is opposite to the delay comparison current and is always at least four times greater. Therefore, the output of U626 becomes a positive-going ramp. When the positive-going ramp reaches approximately 1.2 volts, the Comparator stage switches and the Ramp Control turns off the Reference Current Switch. Now that the reference current no longer overrides the delay comparison current, the ramp output of U626 goes negative, completing the cycle.

DVM Zero adjustment R625 provides a dc offset current to set the quiescent operating level of the Delay Comparison Voltage to Ramp Converter. DVM Gain adjustment R620 allows for calibration of the delay comparison current.

### Comparator (SN B088750 & Up)

The Comparator circuitry drives the comparator input of U686. When the output of U626 rises to approximately 7 V, CR643 becomes forward biased, which turns on Q644. Components U654B, U654D, and R654 provide rapid latchup of the positive-going signal from Q644. Integrated circuit U654C inverts this signal, which causes pin 8 of U686 to go low. A low is then generated at pin 16; the ramp control output of U686. This ramp control signal is used for reference current switching.

### Comparator (SN B088749 & Below)

The Comparator stage provides one of two inputs to the Ramp Control stage (see Fig. 3-10, collector of Q642 waveform). The Comparator switches when the positive-going ramp from U626 reaches approximately 1.2 volts. The collector of Q642 goes LO, which sets pin 6 of U662B HI and turns Q612 of the Reference Current Switch on. When Q612 turns on, CR627 turns on and causes the ramp at pin 6 of U626 to run positive.

### Ramp Control

The Ramp Control stage operates as an RS flip-flop. This stage controls the Zero Count Correction, Count Transfer Control, and Delay Comparison Voltage to Ramp Converter stages by way of the Reference Current Switch.

When the output of the Comparator goes negative (see Fig. 3-10, collector of Q641 waveform), pin 6 of U662B goes HI. This turns off the Reference Current Switch stage and actuates the Zero Count Correction stage. When the Reference Current Switch turns off, the Delay Comparison Voltage to Ramp Converter output begins to run negative, and continues to do so until the output of the Ramp Control goes LO. At this time, the ramp output of the Delay Comparison Voltage to Ramp Converter will go positive until the output of the Ramp Control again goes HI. The period of a positive-going and a negative-going waveform at pin 6 of U626 is determined by the output of the Divide by 4 Counter stage. The output of the Divide by 4 Counter is applied to the Ramp Control stage and switches the output at pin 6 of U662B to the LO state.

### Divide by 4 Counter

Integrated circuit U698 is connected as a Divide by 4 Counter. Transistor Q646 operates as a buffer for the Divide by 4 Counter. Dc blocking capacitor C645 couples the full scale out pulses from pin 5 of U686 to Q646. Each full scale out pulse represents 10,000 Timer stage output pulses. Therefore, the output of the Divide by 4 Counter changes states once for every 20,000 Timer pulses.

### Timer

The Timer stage produces a 300 kHz signal. Transistors Q672 and Q676 are connected as a multivibrator. Buffer Q678 provides drive to the Count Transfer Control stage. The collector of Q672 delivers Timer pulses to the 4 Decade Counter stage (pin 1 of U686).

### Reference Current Source (SN B088750 & Up)

The Reference Current Source determines the amount of current to be used for comparison with the delay comparison current. The front-panel SWP CAL control determines the absolute value of reference current. The swp cal reference input, on pin 1 of J100, changes the reference current value to compensate for different front-panel SWP CAL settings.

### Reference Current Source (SN B088749 & Below)

The Reference Current Source determines the amount of current to be used for comparison with the delay comparison current. The front-panel TIME/DIV switch and SWP CAL control determine the absolute value of reference current. The setting of R605, in series with R606, determines the reference current when the TIME/DIV switch is set to a sweep rate where the numeral 1 is the scaling factor (such as 0.1, 1, or 10). Parallel combinations of R605, R606, R618, and R607 determine the reference current value for numerals 2 and 5. The swp cal reference input, on pin 1 of J100, changes the reference current value to compensate for different front-panel SWP CAL settings.

### Reference Current Inverter (SN B088750 & Up)

The Reference Current Inverter acts as a current "mirror" to produce an equivalent current in opposite polarity. Thus, current flowing through R631 is reversed in direction as it flows through R632. Reversing current flow direction allows U626 to sum the reference current with the delay comparison current.

Reference current switching is controlled by the ramp control output of U686. A high on pin 16 of U686 causes a low at U654's output, which reverse biases CR634. This forward biases CR632 allowing reference current to flow into the summing node at pin 2 of U626. A low at pin 16 of U686 causes CR634 to forward bias turning off CR632, which routes the reference current away from the summing node at U626.

### Reference Current Inverter (SN B088749 & Below)

The Reference Current Inverter changes the direction of current flow through R628, 180° from the direction of the current through R629. Reversing current flow direction allows the Delay Comparison Voltage to Ramp Converter stage to sum the reference current with the delay comparison current.

### Reference Current Switch

The Reference Current Switch is controlled by the Ramp Control stage. A HI on pin 6 of U662B causes Q612 to conduct, routing the reference current to ground. A LO on pin 6 of U662B causes Q612 to turn off, routing the reference current through CR627 to the negative input of U626.

### Counter and Encoder (SN B088750 & Up)

The Counter and Encoder integrated circuit consists basically of a 4 Decade Counter with multiplexer and associated circuitry.

An integration cycle of 100,000 counts begins with the ramp control (pin 16) going high and the start of a short internal delay. During the delay, the counters are cleared and set to their initial state. After the delay, the counters are enabled and count until a transition occurs on the comparison input (pin 8) signaling that the counters contain the desired digital output that is a direct function of the unknown input current. At this point clock pulses to the counters are disabled, the ramp control is set low, and the contents of the counter are latched. The counter then resumes operation.

Each decade counter counts synchronously with data read out by sequentially strobing the four column-select lines, pins 3, 4, 5, and 6. The output appears at pin 18 as a current that varies from 0 mA to 1 mA in 100  $\mu$ A steps.

Integrated circuit U686 uses S800 cam switch control voltages at pins 10 and 11 for accurate 1, 2, and 5 sweep speed scaling. The presence of voltages at pins 10 and/or 11 allows the IC to determine if it should be dividing by 2 or 5. An absence of voltage at both pins is interpreted as divide by one.

### Counter and Encoder (SN B088749 & Below)

The Counter and Encoder integrated circuit consists of 3 logic stages. The 4 Decade Counter, Count Transfer and 4 Digit Readout stages are discussed in the following paragraphs.

**4 Decade Counter.** The 4 Decade Counter counts the pulses from the Timer stage on a continuing basis, starting at 0000 and running through 9,999. Each time the count reaches 9,999, a full scale out pulse occurs at pin 5 of U686. After 4 of these pulses occur, the Divide by 4 Counter sets pin 6 of U662B LO (Ramp Control stage). Then, the Delay Comparison Voltage to Ramp Converter output goes positive until the positive-going ramp reaches 1.2 V. At this time, the count reached in the 4 Decade Counter is transferred to the 4 Digit Readout stage (within U686).

**Count Transfer.** The Count Transfer stage transfers the count reached in the 4 Decade Counter (during the time the Delay Comparison Voltage to Ramp Converter output runs positive) to the 4 Digit Readout stage. The Count Transfer Control stage actuates the Count Transfer stage (through pin 10 of U686) when the Comparator switches and a Timer pulse occurs.

**4 Digit Readout.** After the count from the 4 Decade Counter is transferred to the 4 Digit Readout stage, the 4 Digit Readout stage formats the information. With the data properly formatted, the mainframe readout system can retrieve the information and display the measurement, made by the Digital Voltmeter circuit, on the crt.

### Count Transfer Control

The Count Transfer Control stage provides a count transfer pulse to pin 10 of U686. When pin 2 of U682A is LO, the positive transition of the clock pulse at pin 3, produces a HI output at pin 6 of U682A. The transition to the HI state actuates the Count Transfer stage, within U686, to transfer the count from the 4 Decade Counter stage to the 4 Digit Readout stage.

### Zero Count Correction

The Zero Count Correction stage delays the start of the 4 Decade Counter stage, within U686, by a fixed amount of time. This allows small offsets in the Digital Voltmeter circuit to be compensated during adjustment.

When pin 6 of U662B goes LO, C662 couples the negative transition to pin 13 of U662D to set pin 11 of U662D HI. This HI is then coupled to pin 2 of U686 by C683 to inhibit the 4 Decade Counter stage, until pin 2 goes LO again.

At the same time that pin 6 of U662B went LO, pin 8 of U698B went HI to turn Q636 off and allow C652 to discharge through Q632. Capacitor C652 discharges until the comparator, consisting of Q652 and U662D, goes LO on pin 11 of U662D and pulls pin 2 of U686 LO, which allows the 4 Decade Counter stage to continue counting.

## TIME/DIVISION AND READOUT SWITCHING

The Readout Switching circuits provide sweep rate and delay time information to the mainframe readout system. Readout circuitry is shown on the Time/Division and Readout Switching diagram (7) at the rear of this manual.

### Basic Readout System

The readout system in 7000-series mainframes provides alphanumeric display of information encoded by the plug-in units. This display is presented on the crt, and is written by the crt beam on a time-shared basis with the analog waveform display.

The readout system produces a pulse train consisting of ten negative-going pulses called time slots. Each pulse represents a possible character in a readout word, and is assigned a time-slot number corresponding to its position in the word. Each time-slot pulse is directed to one of ten output lines, labeled TS 1 through TS 10 (time slots one through ten), which are connected to the vertical and horizontal plug-in compartments. Two output lines, row and column, are connected from each channel (two channels per plug-in compartment) back to the readout system.

Data is encoded on these output lines either by connecting resistors between them and the time-slot input lines or by generating equivalent currents. The resultant output is a sequence of analog current levels on the row and column output lines. The row and column current levels are decoded by the readout system to address a character matrix during each time slot, thus selecting a character to be displayed or a special instruction to be followed.

### Time/Division Readout

Time/Division readout is displayed on channel 1 (top of the graticule) corresponding to the plug-in compartment in which the time-base unit is installed. The sweep rate is selected by TIME/DIV switch S800, which also selects the resistors that determine the various readout characters shown in Table 3-2.

### Delay Time Readout

Both delay-time readout (delay time before the start of the first intensified zone) and  $\Delta$  time readout (differential delay time between the start of the first intensified zone and the start of the second intensified zone) are displayed on channel 2 (bottom of the graticule) corresponding to the plug-in compartment in which the 7B85 is operating. Delay time is selected by DELAY TIME control R520 and differential delay time is selected by  $\Delta$  TIME control R530, as explained in the Pickoff Amplifiers and delay Gate Generator description (diagram 5).



The resistors that control the various delay time readout functions are shown in the channel 2 portions of Table 3-2. Numerical scaling for delay time readout (0, 1, 2, 3, etc.) is explained in the Digital Voltmeter description (diagram 6). Origin of the  $\Delta$  readout symbol is explained in the Logic discussion (diagram 3).

## INTERFACE CONNECTORS AND POWER SUPPLY

The Interface Connectors provide interconnection for control signals and power supply voltages between the mainframe and the time-base unit.

The Power Supply derives supply voltages from the mainframe supplies for power requirements unique to this instrument. Additional voltage regulation is also provided.

**Table 3-2  
READOUT CHARACTER SELECTION**

Characters	Time Slot	Description	Encoded By	
			Channel 1 (Time/Division)	Channel 2 (Delay Time)
Decimal	TS-1	Determines decimal magnitude (number of zeros displayed or prefix change information).	R751,R752 R756	R753,R754 R755,R757
Uncalibrated (>)	TS-3	Indicates calibrated or uncalibrated sweep rates and delay times.	R761,R764	S280 R762,R763
1,2,5	TS-4	Scaling (TIME/DIV).	R771 R772,R773	
0 through 9	TS-4, TS-5, TS-6, TS-7	Scaling (Delay Time).		U686 
m, $\mu$ ,n	TS-8	Defines the prefix that modifies the units of measurement.	R781,R782 R783,R784	R785,R786 R787
s(seconds)	TS-9	Defines the unit of measurement.	R793,R794	R791,R792
$\Delta$	TS-2	Indicates differential delay-time measurement.		R542, R543 

# MAINTENANCE

This section of the manual contains information for performing preventive maintenance, troubleshooting, and corrective maintenance for this instrument.

## PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, visual inspection, lubrication, etc. Preventive maintenance performed on a regular basis may prevent instrument breakdown and will improve the reliability of the instrument. The severity of the environment to which this instrument is subjected determines the frequency of maintenance. A convenient time to perform preventive maintenance is preceding adjustment of the instrument.

### CLEANING

This instrument should be cleaned as often as operating conditions require. Accumulation of dirt on components acts as an insulating blanket and prevents efficient heat dissipation, which can cause overheating and component breakdown.



Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. In particular, avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

#### Exterior

Loose dust accumulated on the front panel can be removed with a soft cloth or small brush. Dirt that remains can be removed with a soft cloth dampened with a mild detergent and water solution. Abrasive cleaners should not be used.

#### Interior

Dust in the interior of the instrument should be removed occasionally due to its electrical conductivity under high-humidity conditions. The best way to clean the interior is to blow off the accumulated dust with dry, low-pressure air. Remove any remaining dirt with a soft brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces.

### Switch Contacts

Switch contacts and pads are designed to operate dry for the life of the switch. However, as the switches are not sealed, dust attracted to the contact area may cause switch contacts to become electrically noisy. Cleaning may be accomplished by flushing the contact area with isopropyl alcohol or kelite (one part kelite to 20 parts water). Do not use chemical cleaning agents that leave a film or that might damage plastic parts. Do not use cotton swabs or similar applicators to apply cleaning agents, as they tend to snag and leave strands of cotton on switch contacts. Should it become necessary to remove a switch for replacement or cleaning, refer to Component Removal and Replacement in this section.

## VISUAL INSPECTION

This instrument should be inspected occasionally for such defects as broken connections, improperly seated semiconductors, damaged circuit boards, and heat-damaged parts.

The corrective procedure for most visible defects is obvious; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, it is important that the cause of overheating be corrected to prevent recurrence of the damage.



## LUBRICATION

Generally, there are no components in this instrument that require a regular lubrication program during the life of the instrument.

### Cam Switch Lubrication

In most cases, factory lubrication should be adequate for the life of the instrument. However, if the switch has been disassembled for replacement of switch sub-parts, a lubrication kit containing the necessary lubricating materials and instructions is available through any Tektronix Field Office. Order Tektronix Part No. 003-0342-02. General Electric Versi-lube® silicone grease should be applied sparingly so that the lubricant does not get on the contacts. Refer to Fig. 4-1 for lubrication instructions.

## SEMICONDUCTOR CHECKS

Periodic checks of the semiconductory in this instrument are not recommended. The best check of semiconductor performance is actual operation in the instrument. More details on checking semiconductor operation are given under Troubleshooting.

## ADJUSTMENT AFTER REPAIR

After any electrical component has been replaced, the adjustment of that particular circuit should be checked, as well as the adjustment of other closely related circuits. The Performance Check and Adjustment procedure in this manual provides a quick and convenient means of checking instrument operation. In some cases, minor troubles may be revealed or corrected by adjustment.

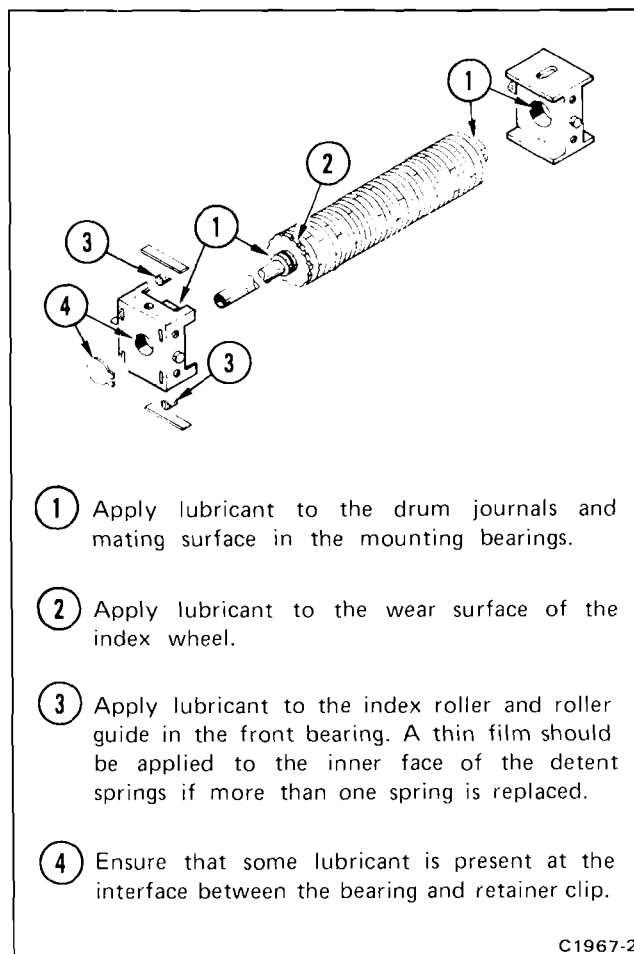


Fig. 4-1. Lubrication procedure for a typical cam switch.

## TROUBLESHOOTING

The following information is provided to help troubleshoot this instrument. Information contained in other sections of this manual should be used along with the following information to aid in locating the defective component. An understanding of the circuit operation is very helpful in locating troubles, particularly where integrated circuits are used.

### TROUBLESHOOTING AIDS

#### Diagrams

Circuit diagrams are given on foldout pages in Section 8. The component number and electrical value of each component in this instrument are shown on the diagrams. Components that are mounted on circuit boards are out-lined on the diagrams with a heavy black line.

#### Voltages and Waveforms

Typical operating voltages are shown on the diagrams. Voltage Conditions given on the diagram page indicate the test equipment used and the front-panel control status necessary to obtain the given voltages.

Typical operating waveforms are shown next to the diagram where they were measured. Each waveform is numbered to locate on the diagram the point where the waveform was taken. Waveform Conditions given on the diagram page list the test equipment used and the front-panel control status necessary to obtain the given waveform.

#### Circuit-Board Illustrations

Circuit-board illustrations are shown on the foldout page preceding the associated diagram. Each board-mounted electrical component is identified by its circuit number, as are interconnecting wires and connectors.

Figure 8-2, in the front of the diagrams section, shows the location and assembly number of each circuit board in this instrument.

#### Switch Cam Identification

Switch cam numbers shown on diagrams indicate the position of each cam in the complete switch assembly. The switch cams are numbered from front to rear.

#### Diode Color Code

The cathode end of each glass-encased diode is indicated by a stripe, a series of stripes, or a dot. The cathode and anode ends of metal-encased diodes are identified by the

diode symbol marked on the case. For most silicon or germanium diodes with a series of stripes, the color code identifies the four significant digits of the JEDEC or vendor number using the resistor color-code system (e.g., a diode color-coded yellow-brown-green-red indicates a 1N-4152 diode).

#### Wiring Color Code

Insulated wire and cable used in this instrument is color-coded to facilitate circuit tracing.

#### Semiconductor Basing

Figure 4-2 illustrates the basing configurations for all semiconductors used in this instrument. Some plastic-case transistors have lead configurations that do not agree with those shown here. If a replacement transistor is made by a different manufacturer than the original, check the manufacturer's basing diagram. All transistor sockets in this instrument are wired for the standard basing used for metal-case transistors.

#### Inter-Board Pin Connector Identification

The inter-board pin connector sockets are installed on circuit boards, in groups of five sockets (as in Fig. 4-3). Socket number 1 is indexed on the circuit board with either a triangular mark or the number 1. Each group of sockets is identified by its J (jack) number etched on the circuit board. The J numbers correlate to the J (jack) and P (plug) circuit numbers on the schematic diagrams.

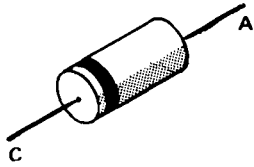
#### Multi-Pin Connector Identification

Multi-pin connectors mate with groups of pins soldered to circuit boards. Pin number 1 is indexed with a triangular mark on the circuit board and molded on the holder of the multi-pin connector, as shown in Fig. 4-4. Each group of pins is identified by its corresponding J number etched on the circuit board. The J numbers on the circuit boards correlate to the J and P component numbers on the schematic diagrams.

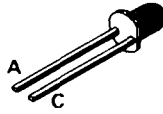
#### Interface Connector Pin Locations

The Interface circuit board couples the plug-in unit to the associated mainframe (oscilloscope). Figure 4-5 identifies the pins on the interface connector as shown on Power

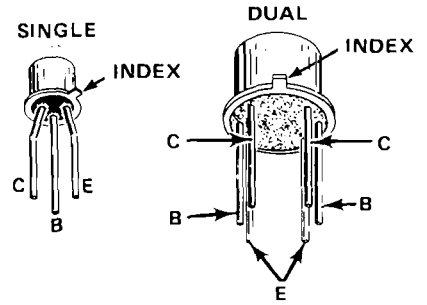
NOTE  
LEAD CONFIGURATIONS AND CASE STYLES ARE TYPICAL, BUT MAY VARY DUE TO VENDOR CHANGES OR INSTRUMENT MODIFICATIONS.



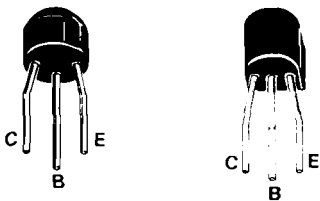
SIGNAL DIODE



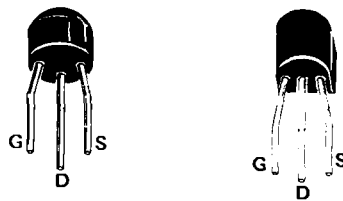
LIGHT EMITTING DIODE (L.E.D.)



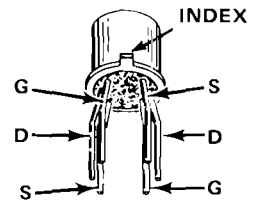
METAL CASE TRANSISTORS



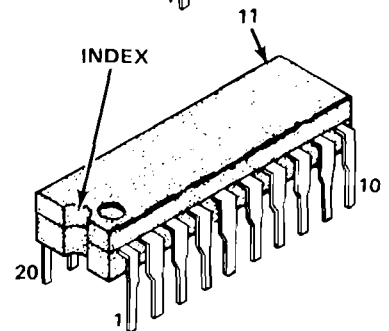
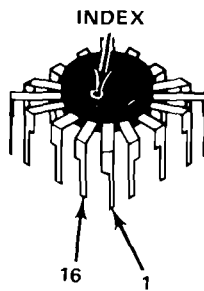
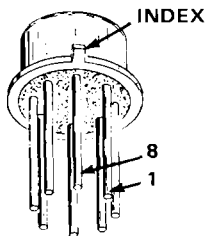
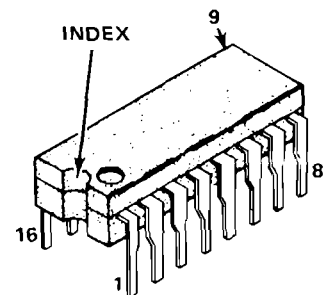
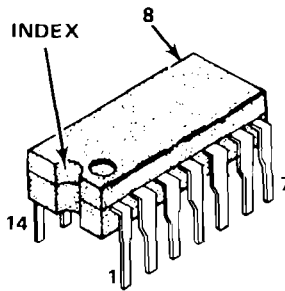
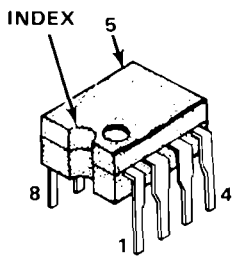
PLASTIC CASE TRANSISTORS



PLASTIC CASE FETS



DUAL METAL CASE FET



INTEGRATED CIRCUITS

(1986-66)1961-72

Fig. 4-2. Semiconductor lead configuration.

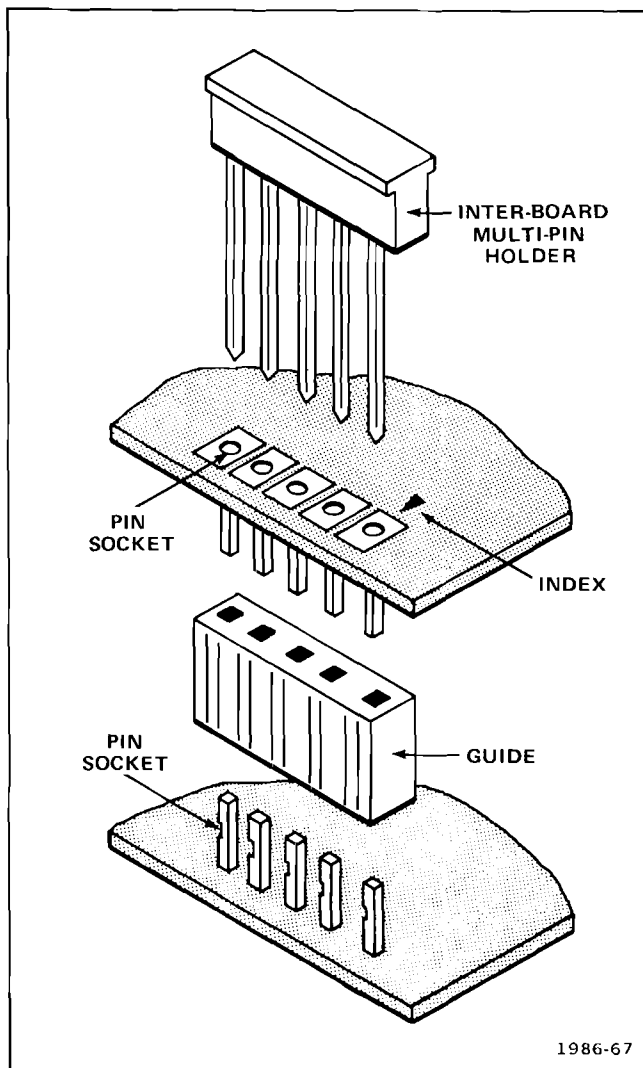


Fig. 4-3. Inter-board multi-pin connector assembly.

Supply, and Interface Connectors diagram 8 in the Diagrams section.

**Performance Check and Adjustment**

The Performance Check and Adjustment procedure, given in Section 5 of this manual, provides a quick and convenient means of checking instrument operation. In some cases, minor troubles may be revealed or corrected by adjustment.

**TROUBLESHOOTING EQUIPMENT**

The following equipment, in addition to that listed in the Performance Check and Adjustment section, is useful for troubleshooting.

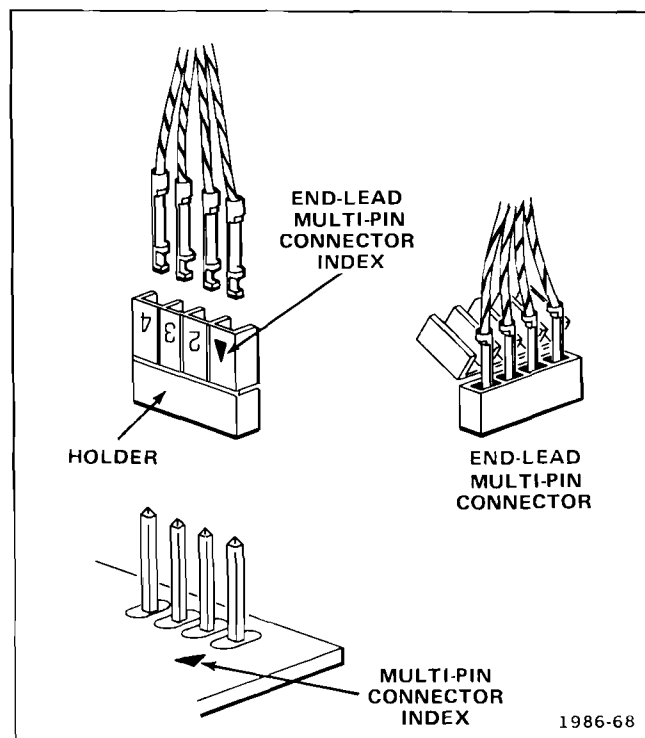


Fig. 4-4. End-lead multi-pin connector assembly.

**Transistor Tester**

Description: Dynamic-type tester.

Purpose: Test semiconductors.

Recommended Tektronix types: 576 Curve Tracer, 577/177 Curve Tracer system, 7CTIN Curve Tracer unit and a 7000-Series oscilloscope system, or a 5CTIN Curve Tracer unit and a 5000-Series oscilloscope.

**Multimeter**

Description: Voltmeter, 10 MΩ input impedance and a range from 0 to at least 50 Vdc; accuracy, within 0.1% Ohmmeter, 0 to 20 MΩ. Test probes should be insulated to prevent accidental shorting.

Purpose: Check voltage and resistance.

**Test Oscilloscope**

Description: Frequency response, dc to 100 MHz minimum; deflection factor, 5 mV to 5 V/div. A 10×, 10 MΩ voltage probe should be used to reduce circuit loading.

Purpose: Check operating waveforms.

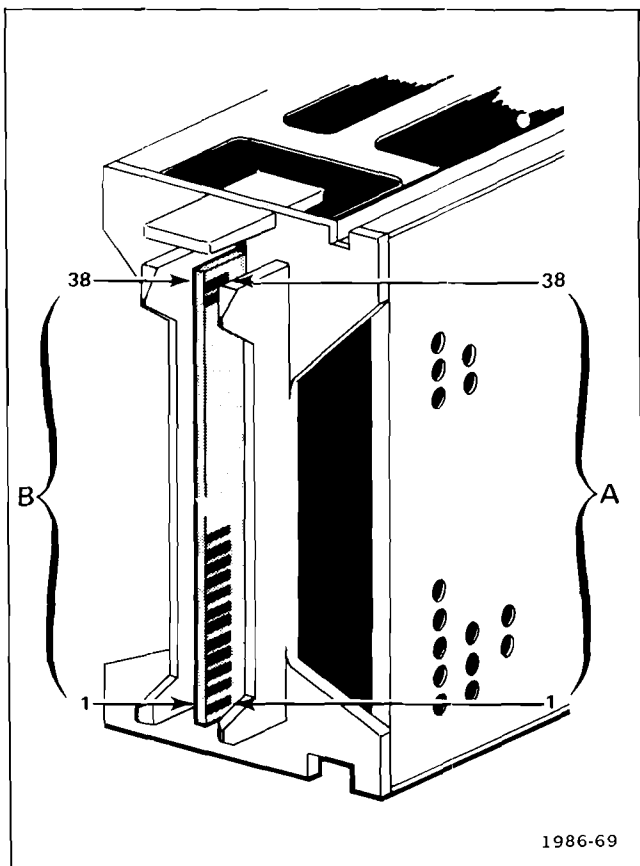


Fig. 4-5. Location of pin numbers on Interface connector.

## TROUBLESHOOTING TECHNIQUES

The following troubleshooting procedure is arranged to check the simple trouble possibilities before proceeding with extensive troubleshooting. The first few checks ensure proper connection, operation, and adjustment. If the trouble is not located by these checks, the remaining steps aid in locating the defective component. When the defective component is located, it should be replaced using the replacement procedure given under Corrective Maintenance.

### Troubleshooting Procedure

#### 1. Check Control Settings

Incorrect control settings can indicate a trouble that does not exist. If there is any question about the correct function or operation of any control, see the Operating Instruction Section 2.

#### 2. Check Associated Equipment

Before troubleshooting, check that the equipment used with this instrument is operating correctly. Check that the

signal is properly connected and that the interconnecting cables are not defective. Also, check the power source. If the trouble persists, the time-base unit is probably at fault.

#### 3. Visual Check

Visually check the portion of the instrument in which the trouble is located. Many troubles can be located by visible indications such as unsoldered connections, broken wires, damaged circuit boards, damaged components, etc.

#### 4. Check Instrument Adjustment

Check the adjustment of this instrument, or the affected circuit if the trouble appears in one circuit. The apparent trouble may be the result of misadjustment. Complete adjustment instructions are given in the Performance Check and Adjustment, Section 5.

#### 5. Isolate Trouble To a Circuit

To isolate trouble to a circuit, note the trouble symptom. The symptom often identifies the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check the affected circuits by taking voltage and waveform readings. Incorrect operation of all circuits often indicates trouble in the power supply. Check first for correct voltages of the individual supplies. However, a defective component elsewhere in the instrument can appear as a power-supply trouble and may also affect the operation of other circuits.

Figure 4-6 provides a guide for locating a defective circuit. Start at the top of the chart and perform the checks given on the left side of the page until a step is found that does not produce the indicated results. Further checks, or the circuit in which the trouble is probably located, are listed to the right of the step. The shaded blocks on the Troubleshooting Chart indicate circuit(s) listed in shaded blocks are discussed in detail in the Theory of Operation section of this manual. This chart does not include checks for all possible defects; use steps 6 and 7 in such cases.

After the defective circuit has been located, proceed with steps 6 and 7 to locate the defective component(s).

#### 6. Check Voltages and Waveforms

Often the defective component can be located by checking for the correct voltages and waveforms in the circuit. Refer to the diagram section at the rear of this manual for typical voltages and waveforms.

**NOTE**

*Voltages and waveforms given on the diagrams are not absolute and may vary slightly between instruments. To obtain operating conditions similar to those used to take these readings, see the voltage and waveforms page adjacent to each schematic diagram. Note the recommended test equipment, front-panel control settings, voltage and waveform conditions, and test equipment cable connection instructions.*

**7. Check Individual Components**

The following procedures describe methods for checking individual components. Two-lead components that are soldered in place are best checked by first disconnecting one end. This isolates the measurement from the effects of surrounding circuitry.



*To avoid component damage, disconnect the power source before removing or replacing semiconductors.*

**Transistor.** The best check of transistor operation is actual performance under operating conditions. A transistor can be most effectively checked by substituting a new component or one that has been checked previously. However, be sure that circuit conditions are such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester. Static-type testers are not recommended, since they do not check operation under simulated operating conditions.

**Integrated Circuits.** IC's can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of circuit operation is desirable when troubleshooting circuits using IC's. Use care when checking voltages and waveforms around the IC's so that adjacent leads are not shorted together. A convenient means of clipping a test probe to the 14- and 16-pin IC's is with an IC clip. This device also serves as an extraction tool. The lead configuration for the semiconductors used in this instrument are shown on a pullout page in the front of the diagrams section.



*Do not use an ohmmeter scale that has a high internal current. High currents may damage the diode.*

**Diodes.** A diode can be checked for an open or shorted condition by measuring the resistance between terminals with an ohmmeter scale having a low internal source current, such as the R $\times$ 1K scale. The resistance should be very high in one direction and very low when the meter leads are reversed.

The cathode end of each glass-encased diode is indicated by a stripe, a series of stripes, or a dot. The cathode and anode ends of metal-encased diodes are identified by the diode symbol marked on the case. For most silicon or germanium diodes with a series of stripes, the color code identifies the four significant digits of the JEDC or vendor number using the resistor color-code system (e.g., a diode color coded yellow-brown-green-red indicates a 1N-4152 diode).

**Resistors.** Check resistors with an ohmmeter. See the Replaceable Electrical Parts list for the tolerance of the resistors used in this instrument. Resistors normally do not need to be replaced unless the measured value varies widely from that specified.

**Inductors.** Check for open inductors by checking continuity with an ohmmeter. Shorted or partially shorted inductors can usually be found by checking the waveform response when high-frequency signals are passed through the circuit. Partial shorting often reduces high-frequency response.

**Capacitors.** A leaky or shorted capacitor can usually be detected by checking resistance with an ohmmeter on the highest scale. Do not exceed the voltage rating of the capacitor. The resistance reading should be high after initial charge of the capacitor. An open capacitor can best be detected with a capacitance meter or by checking that the capacitor passes ac signals.

**8. Repair and Adjustment.**

If any defective parts are located, follow the replacement procedures given in Corrective Maintenance. Be sure to check the performance of any circuit that has been repaired or had any electrical components replaced.

**TROUBLESHOOTING CHART INSTRUCTIONS:**

1. Proceed down the left side of chart until the instrument does not perform as indicated. Then proceed to the right as the symptom(s) indicates.
2. Follow the path(s) of symptoms until a shaded block is reached. The shaded block indicates the circuit(s) that may cause instrument malfunction. Refer to the Theory of Operation section for a detailed discussion of the circuit(s).

**NOTE**

The upper case titles in shaded blocks are the same titles as used in the Theory of Operation section and on tabs in the diagrams section.

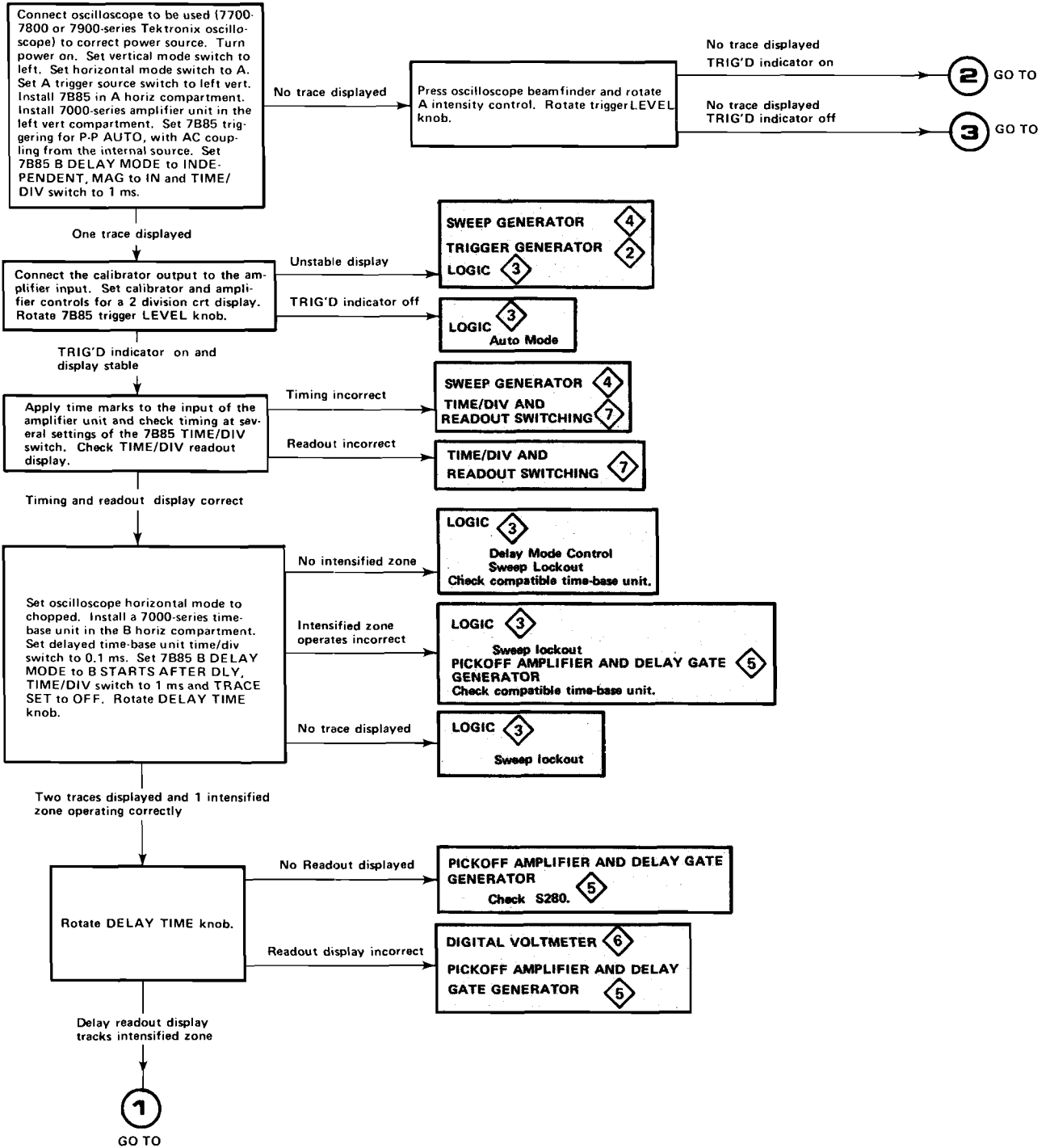
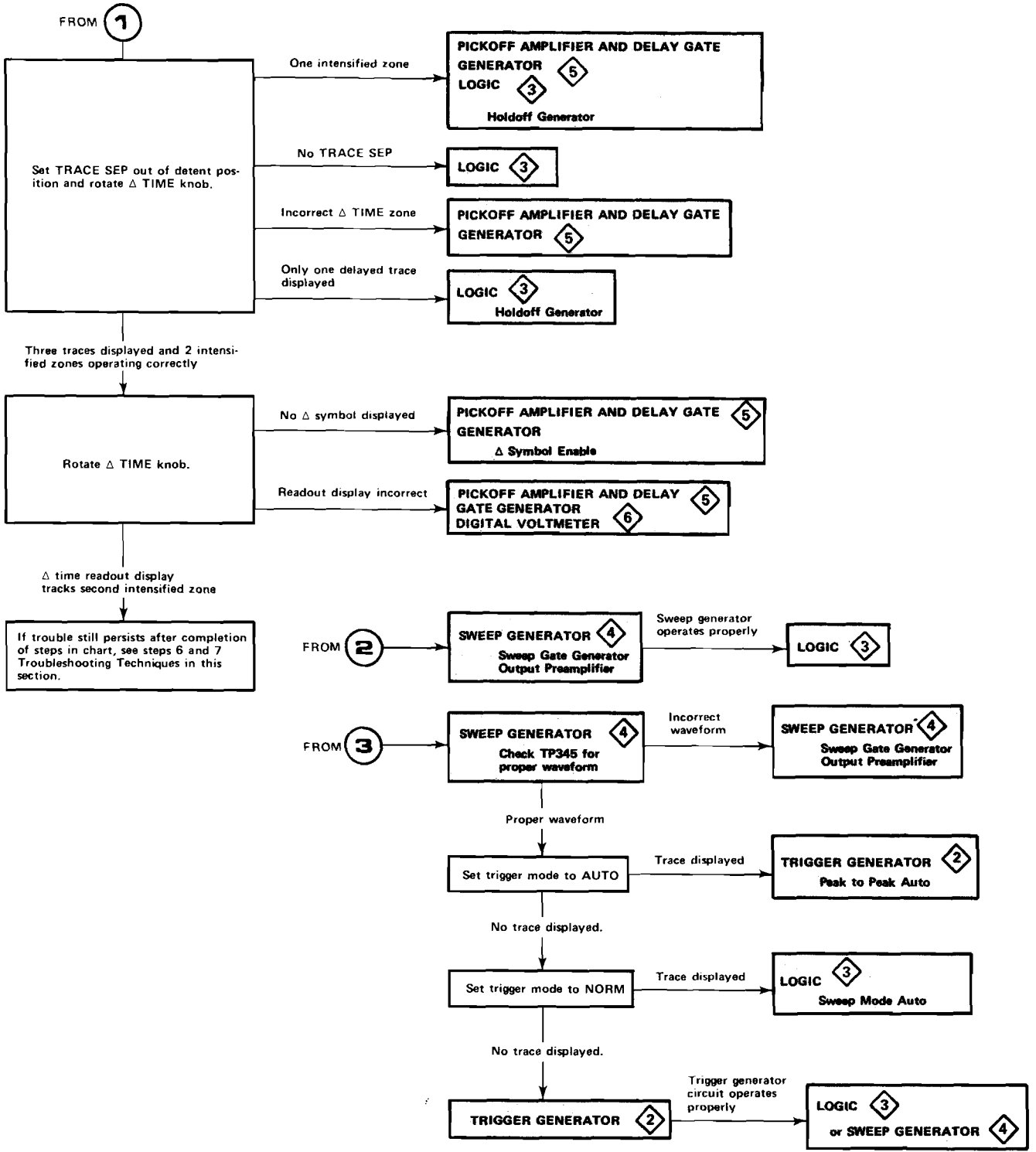


Fig. 4-6. 7B85 troubleshooting chart.



1961-2

Fig. 4-6. 7B85 troubleshooting chart (cont.).



## CORRECTIVE MAINTENANCE

Corrective maintenance consists of component replacement and instrument repair. Special techniques required to replace components in this instrument are given here.

### OBTAINING REPLACEMENT PARTS

All electrical and mechanical part replacements can be obtained through your Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating and description.

#### NOTE

*When selecting replacement parts, remember that the physical size and shape of a component may affect the performance of the instrument, particularly at high frequencies. All parts should be direct replacements unless a different component will not adversely affect instrument performance.*

Some parts are manufactured or selected by Tektronix, Inc, to satisfy particular requirements, or are manufactured to specifications for Tektronix, Inc. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. To determine the manufacturer of parts, refer to parts list, Cross Index Mfr. Code Number to Manufacturer.

When ordering replacement parts from Tektronix, Inc, include the following information:

1. Instrument type.
2. Instrument serial number.
3. A description of the part (if electrical, include circuit number).
4. Tektronix part number.

### SOLDERING TECHNIQUES

#### WARNING

*To avoid electrical shock, disconnect the instrument from the power source before soldering.*

The reliability and accuracy of this instrument can be maintained only if proper soldering techniques are used when repairing or replacing parts. General soldering techniques, which apply to maintenance of any precision electronic equipment, should be used when working on this instrument. Use only 60/40 rosin-core, electronic-grade solder. The choice of soldering iron is determined by the repair to be made. When soldering on circuit boards, use a 15 to 40 W pencil-type soldering iron with a 1/8-inch wide, wedge-shaped tip. Keep the tip properly tinned for best heat transfer to the solder joint. A higher wattage soldering iron may separate the wiring from the base material. Avoid excessive heat; apply only enough heat to remove the component or to make a good solder joint. Also, apply only enough solder to make a firm solder joint; do not apply too much solder.

#### CAUTION

*All circuit boards, except the readout circuit board, in this instrument are multilayer type boards with a conductive path(s) laminated between the top and bottom board layers. All soldering on these boards should be done with extreme care to prevent breaking the connections to the center conductor(s); only experienced maintenance personnel should attempt repair of these boards.*

For metal terminals (e.g., switch terminals, potentiometers, etc.), a higher wattage-rating soldering iron may be required. Match the soldering iron to the work being done. For example, if the component is connected to the chassis or other large heat-radiating surface, it will require a 75 W or larger soldering iron.

The following techniques should be used to replace a component on a circuit board.

1. Grip the component lead with long-nose pliers. Touch the soldering iron to the lead at the solder connection. Do not lay the iron directly on the board, as it may damage the board.

2. When the solder begins to melt, gently pull the lead out. If unable to pull out the lead without using force, try removing the other end of the component as it may be more easily removed.

#### NOTE

*The reason some component leads are troublesome to remove is due to a bend placed on each lead during the manufacturing process. The bent leads hold components in place during a process that solders many components at one time.*

If a component lead is extremely difficult to remove, it may be helpful to straighten the leads on the back side of the board with a small screwdriver or pliers while heating the soldered connection.

Use only enough heat to remove the component lead without removing the solder from the board. If it is desired to remove solder from a circuit-board hole for easier installation of a new component, a solder-removing wick should be used.

3. Bend the leads of the new component to fit the holes in the board. If the component is replaced while the board is mounted in the instrument, cut the leads so they will just protrude through the board. Insert the leads into the holes so the component is firmly seated against the board (or as positioned originally). If it does not seat properly, heat the solder and gently press the component into place.

4. Touch the iron to the connection and apply a small amount of solder to make a firm solder joint. To protect heat-sensitive components, hold the lead between the component body and the solder joint with a pair of long-nose pliers or other heat sink.

5. Clip any excess lead protruding through the board (if not clipped in step 3).

6. Clean the area around the solder connection with a flux-removing solvent. Be careful not to remove information printed on the board.

## COMPONENT REMOVAL AND REPLACEMENT

### WARNING

*To avoid electrical shock, disconnect the instrument from the power source before replacing components.*

The exploded-view drawing associated with the Replaceable Mechanical Parts list may be helpful in the removal or disassembly of individual components or subassemblies. Component locations and circuit board locations are shown in the Diagrams section.

### Circuit Boards

If a circuit board is damaged beyond repair, replace the entire board assembly. Part numbers for completely wired boards are given in the Replaceable Electrical Parts list.

#### A4-Digital Voltmeter Circuit Board.

To remove the circuit board; perform the following steps.

1. Remove two inter-board multi-pin connectors (see Fig. 4-3 for identification).

2. Note the color of the other multi-pin connectors and J number to which each is attached (see Fig. 4-4 for identification).

3. Disconnect all cables that terminate on the Digital Voltmeter board.

4. Remove three securing screws from circuit board; do not remove the three screws securing the metal shield to the bottom of the board.

5. Lift the rear of the circuit board away from the frame and slide it toward the rear until the board clears the B DELAY MODE switch.

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To replace the circuit board, reverse the order of removal.

### A3-Readout Circuit Board.

To remove the circuit board, follow the procedure given in Figure 4-7.

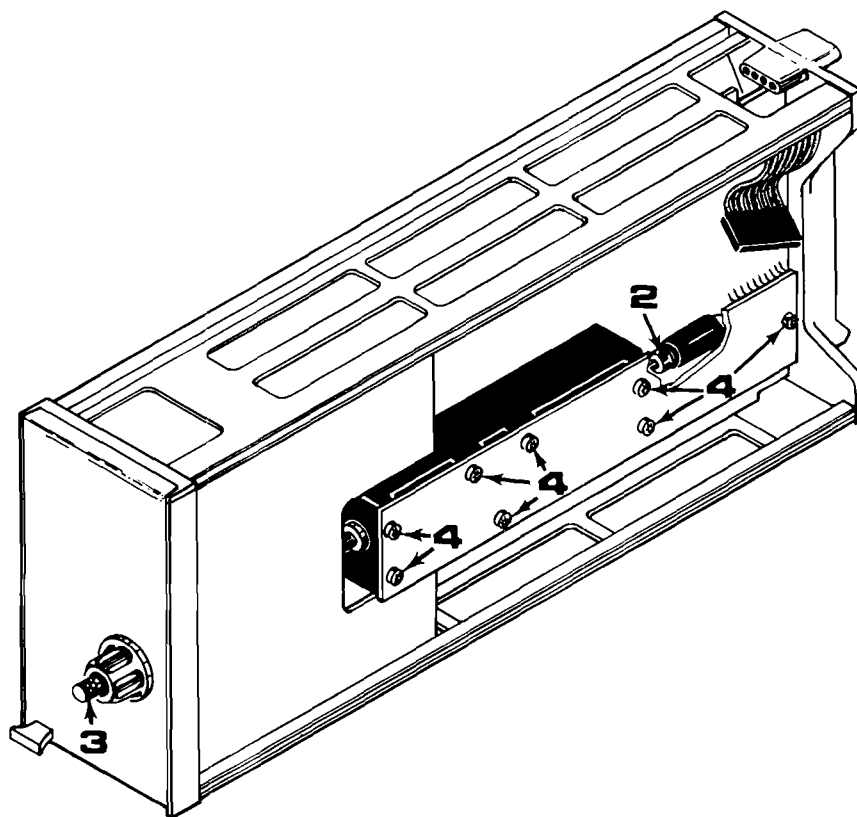
### A2-Trigger Circuit Board.

Remove the circuit board; perform the following steps.

1. Remove three inner-board multi-pin connectors (see Fig. 4-3 for identification).

2. Remove the two screws from the circuit board.

3. Lift the rear of the circuit board away from the frame and slide the board to the rear until push-button switches are clear of the front panel.



#### REMOVE READOUT BOARD AS FOLLOWS:

1. Note index of multi-pin connector attached to board and disconnect cable.
2. Loosen set screw on variable switch assembly.
3. Remove VARIABLE (CAL IN) TIME/DIV knob and attached shaft out the front of the instrument.
4. Remove the 8 securing screws from board.
5. Lift board away from cam switch assembly.

TO REPLACE READOUT BOARD, REVERSE THE ORDER OF REMOVAL.

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Fig. 4-7. Readout board removal procedure.

4. Note the wire color on the single-conductor shielded cables (see Fig. 4-8 for identification) and the connector to which each is attached.

5. Disconnect the cables from the back of the circuit board.

To replace the circuit board, reverse the order of removal.

#### A1-Interface Circuit Board.

To remove the circuit board; perform the following steps.

1. Remove the trigger and digital Voltmeter circuit boards using procedure given previously.

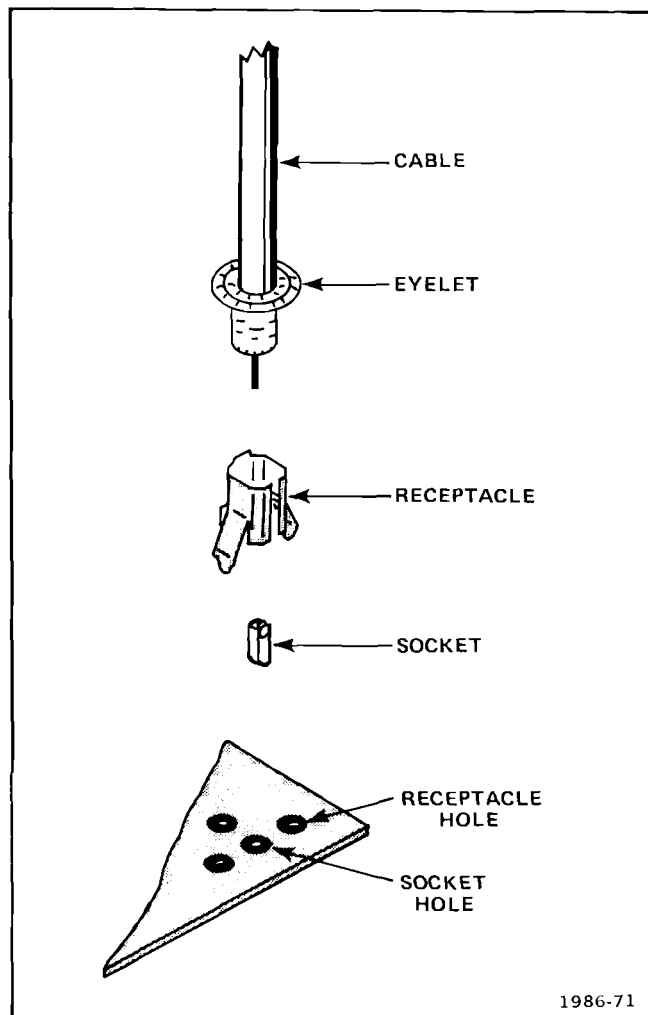


Fig. 4-8. Coaxial end-lead connector assembly.

2. Set the TIME/DIV knob to the 2 ms position and the VARIABLE TIME/DIV knob to expose the set screw.

3. With hex-key wrench, loosen the set screws in both knobs. Remove the knobs from the shafts.

4. Note the color of the multi-pin connectors (see Fig. 4-4 for identification) and P numbers to which each connected. Disconnect all multi-pin connectors from the board.

5. Remove the four screws that secure the gray plastic rear panel to the instrument frame.

6. Remove the six screws that secure the perimeter of the board to the instrument frame.

7. Remove the Interface circuit board through the rear of the instrument.

To install the Interface circuit board; perform the following steps.

1. Guide the TIME/DIV switch shaft through the hole in the front panel.

2. Install the six screws that secure the perimeter of the board to the instrument frame.

3. Install the gray plastic rear panel with the four securing screws.

4. Replace the TIME/DIV knob on the shaft. Align the knob index with the 2 ms position; then, tighten the two set screws on the knob.

5. Replace the VARIABLE knob and tighten the set screw.

6. Replace all cables as noted during the removal procedure.

7. Replace the Trigger and Digital Voltmeter circuit boards.

## Switches

Two types of switches are used in this instrument. Contact alignment and spacing are critical to the operation of the push button and cam switches. Therefore, defective switches should either be replaced as a unit or repaired only by personnel experienced with these types of switches. Your local Tektronix Field Office or representative can provide additional repair information. The following special maintenance information is provided for switch replacement.

**Cam Switches.** Cam switches consist of a rotating cam that mates with contacts on the adjacent circuit board. These contacts are activated by lobes on the cam as the switch is rotated. A cam switch can be disassembled for inspection, cleaning, repair, or replacement; however, it is recommended that the switch be removed and replaced as a unit. Refer to Fig. 4-9 for special instruction on cam switch removal.

### CAUTION

*Repair of a cam switch should be undertaken only by experienced maintenance personnel. Switch alignment and contact spacing must be carefully maintained for proper operation. A cam switch repair kit is available (Tektronix part No. 040-0541-00) that contains special alignment tools for use in repairing or replacing the switch contacts. For information or assistance on maintenance of cam switches, contact your local Tektronix Field Office or representative.*

**Push-Button Switches.** Removal and replacement instructions for push button switches are shown in Fig. 4-10.

## Semiconductors

### CAUTION

*To avoid component damage, power must be turned off before removing or replacing semiconductors.*

Semiconductors should not be replaced unless actually defective. If semiconductors are removed during routine maintenance, return them to their original sockets. Unnecessary replacement of semiconductors may affect the adjustment of this instrument. When semiconductors are replaced, check the operation of the part of the instrument that may be affected.

### WARNING

*Handle silicone grease with care. Avoid getting silicone grease in eyes. Wash hands thoroughly after use.*

Replacement devices should be of the original type or a direct replacement. Figure 4-2 shows the lead configurations of the semiconductor devices used in this instrument. Some plastic-case transistors have lead configurations that do not agree with those shown here. When replacing, check the manufacture's basing diagram for correct basing. All transistor sockets in this instrument are wired for the standard basing used for metal-case transistor. Semiconductors that have heat radiators use silicone grease to increase heat transfer. Replace the silicone grease when replacing these semiconductors.

An extraction tool should be used to remove the 14- and 16-pin integrated circuits to prevent damage to the pins. This tool is available from Tektronix, Inc. Order Tektronix Part No. 003-0619-00. If an extraction tool is not available when removing one of these integrated circuits, pull slowly and evenly on both ends of the device. Try to avoid having one end of the integrated circuit disengage from the socket before the other, as the pins may be damaged.

## Interconnecting Pins

Three methods of interconnection are used to connect the circuit boards with other boards and components. When the interconnection is made with a coaxial cable, a special end-lead connector plugs into a socket on the board (Fig. 4-8). When the interconnection is made with a wire lead, an end-lead connector is used that mates with the interconnecting pin soldered into the board (Fig. 4-4). When the interconnection is made between adjacent boards, an interboard multi-pin connector is used (Fig. 4-3). The following information provides the removal and replacement procedure for the various types of interconnection methods.

**Coaxial End-Lead Connectors.** Replacement of the coaxial-type end-lead connectors requires special tools and techniques; only experienced maintenance personnel should attempt to remove and replace these connectors. It is recommended that the cable be replaced as a unit. For cable part numbers, see the Replaceable Mechanical Parts list. An alternative solution is to refer the replacement of the defective connector to your local Tektronix Field Office or representative.

**End-Lead Pin Connectors.** The pin connectors used to connect the wires to the interconnecting pins are clamped to the ends of the associated leads. To remove and replace

damaged end-lead pin connectors, remove the old pin connector from the end of the lead and clamp the replacement connector to the lead.

Some of the pin connectors are grouped together and mounted in a plastic holder; the overall result is that these connectors are removed and installed as a multi-pin connector (see Fig. 4-4). To provide correct orientation of this multi-pin connector when it is replaced, an arrow is marked on the circuit board and a matching arrow is molded into the plastic holder of the multi-pin connector. Be sure these arrows are aligned as the multi-pin connector is replaced. If the individual end-lead pin connectors are removed from the plastic holder, note the color of the individual wires for replacement.

**Inter-Board Multi-Pin Connector.** The inter-board multi-pin connector pin-holder is not repairable and should be replaced as a unit (see Fig. 4-3). Refer to the Replaceable Mechanical Parts list for part number. Inter-board multi-pin connector pin-sockets are soldered to circuit boards (see Fig. 4-3). To replace a socket, first remove the guide. Then, remove the old socket using soldering techniques previously described. Solder the new socket in place, making sure it will align properly with the inter-board connector pins.

#### Circuit-Board Pins



*All circuit boards in this instrument, except the Readout circuit board, are multi-layer type boards with a conductive path(s) laminated between the top and bottom board layers. All soldering on these boards should be done with extreme care to prevent breaking the connection to the center conductor(s); only experienced maintenance personnel should attempt repair of these boards.*

A circuit-board pin replacement kit including the necessary tools, instructions, and replacement pins is available from Tektronix, Inc. Order Tektronix Part No. 040-0542-00. Replacement of circuit-board pins on multi-layer boards is not recommended; refer such repairs to your local Tektronix Field Office or representative.

To replace a damaged pin mounted on a single-layer circuit board, first disconnect any pin connectors. Then (using Soldering Techniques given earlier in this section), unsolder the damaged pin and pull it from the board with a pair of pliers, leaving the ferrule (see Fig. 4-11) in the hole, if possible. If the ferrule remains in the circuit board, remove the spare ferrule from the replacement pin and press the new pin into the hole in the circuit board. If the ferrule is removed

with the damaged pin, clean out the hole using a solder-removing wick and a scribe. Then, press the replacement pin with attached spare ferrule into the hole. Position the replacement pin in the same manner as the damaged pin. Solder the pin to the circuit board on each side of the board. If the old pin was bent at an angle to mate with a connector, carefully bend the new pin to the same angle. Replace the pin connector.

#### Front-Panel Lights

This instrument uses LED's (light-emitting diodes) and incandescent lamps for front-panel lights.

LED's are used to illuminate the TRIG'D and SINGLE SWP READY lights. To replace LED's, remove the cap from the sleeve as in Fig. 4-12. Note the lead wire color coding and the LED lead configuration. Unsolder the wire leads and remove the LED from the cap. Solder the replacement LED and lead wires to the socket cap as noted previously. Install the cap in the sleeve.

Incandescent lamps are used to illuminate the transparent pushbutton switches. To replace incandescent lamps, unsolder the lead wires from the rear of the cap (see Fig. 4-12) and pull the cap and bulb out of the sleeve. Solder the replacement lamp and lead wires to the cap. Install the assembly in the sub-panel sleeve.

### ADJUSTMENT AFTER REPAIR

After any electrical component has been replaced, the adjustment of that particular circuit should be checked, as well as other closely related circuits. See Section 5 for a complete adjustment procedure.

### INSTRUMENT REPACKAGING

If the Tektronix instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address) and the name of an individual at your firm that can be contacted, complete instrument serial number, and a description of the service required.

Save and re-use the package in which your instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows.

1. Obtain a carton of corrugated cardboard having inside dimensions of no less than six inches more than the instrument dimensions; this will allow for cushioning. Refer to Table 4-1 for carton test strength requirements.

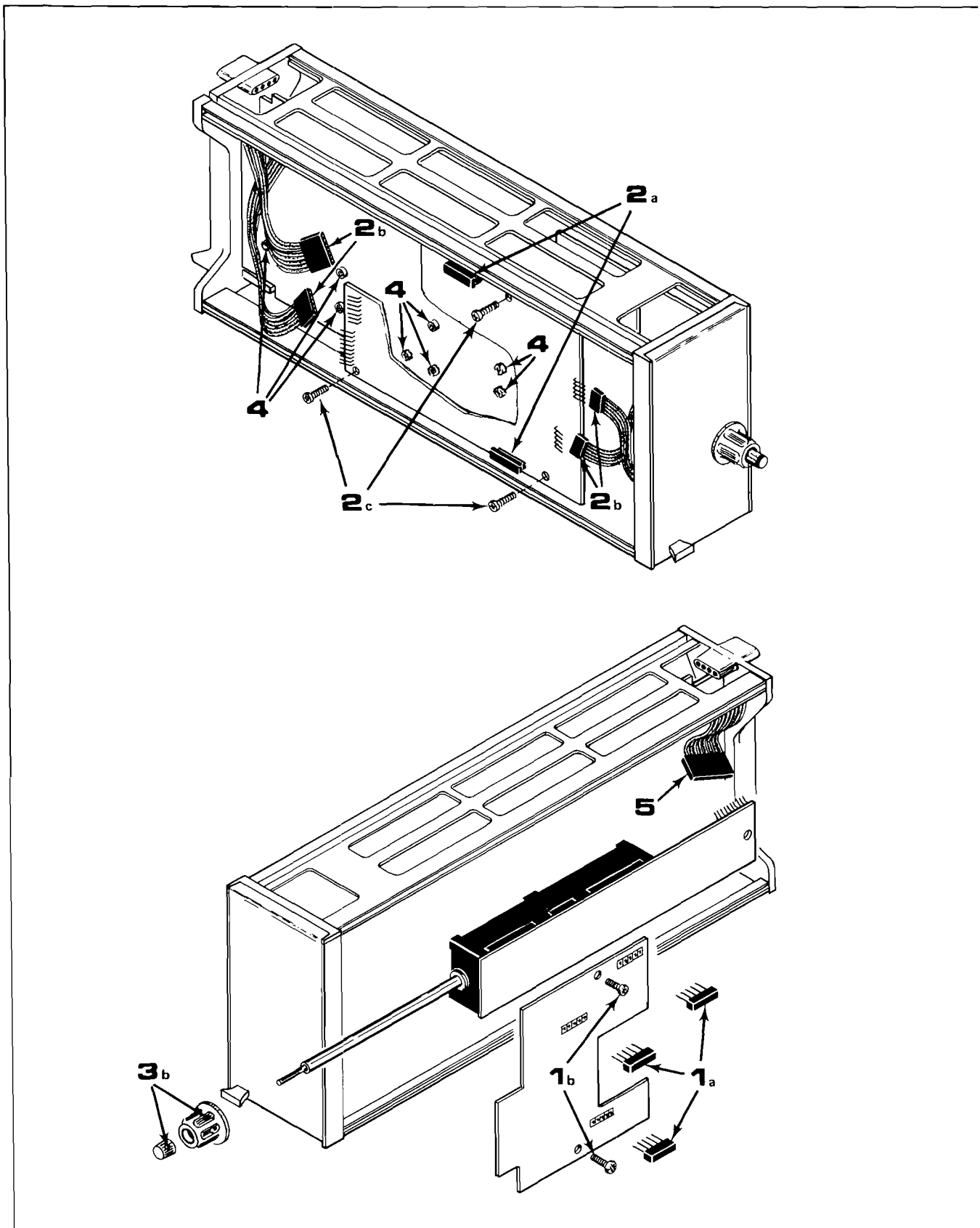


Fig. 4-9. Cam switch removal procedure.

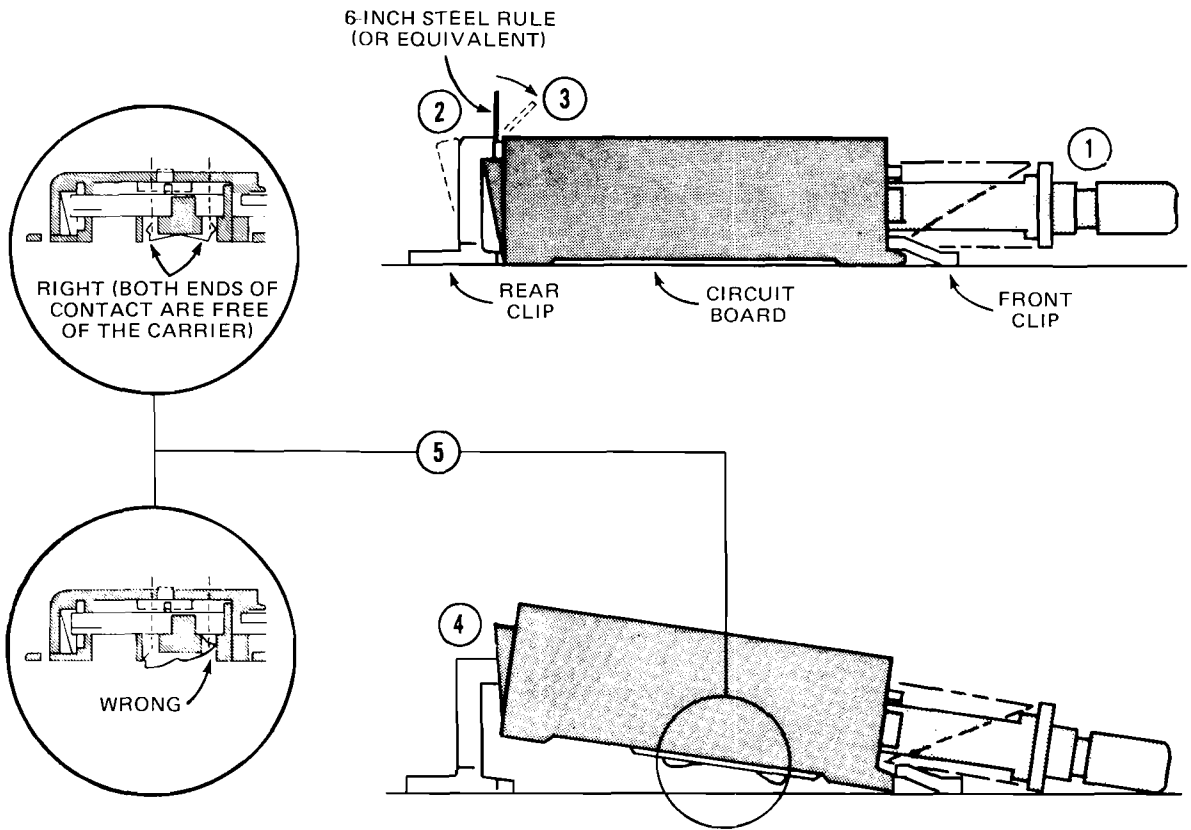
**REMOVE CAM-TYPE SWITCH ASSEMBLY AS FOLLOWS:**

1. Remove Trigger circuit board as follows:
  - a. Remove the 3 inter-board multi-pin connectors.
  - b. Remove 2 screws from circuit board.
  - c. Lift rear of board away from frame and slide toward rear of instrument.
  - d. Note wire color of single-conductor shielded cables and connector to which each attach. Then, disconnect cables.
  
2. Remove Digital Voltmeter circuit board as follows:
  - a. Remove the 2 inter-board multi-pin connectors.
  - b. Note color of multi-pin connectors and J numbers to which each attach. Then, disconnect 4 multi-pin connectors.
  - c. Remove the 3 securing screws from circuit board.
  - d. Lift rear of board and slide toward rear of instrument until board clears the B DELAY MODE switch.
  
3. Remove the TIME/DIV and VARIABLE (CAL IN) knobs as follows:
  - a. Set the TIME/DIV switch to the 2 ms position and the VARIABLE (CAL IN) knob out to expose set screw.
  - b. With a hex key wrench loosen the set screws in both knobs. Remove knobs from shaft.
  
4. Remove 8 screws securing cam-type switch to the Interface circuit board.
  
5. Disconnect multi-pin connector from Readout circuit board.

To replace the cam-type switch, reverse the order of removal.

Fig. 4-9. Cam switch removal procedure (cont.).





- ① Make sure that all switch shafts are in the OUT position to clear the rear clip.
- ② Place the long edge of a six-inch rule or similar thin straight edge between the top edge of the rear clip and the switch body.
- ③ Carefully pry the rear clip back just far enough to push the steel rule down between the clip and switch body.

**CAUTION**

*When the switch is removed, the contacts may drop free and be damaged or lost. Body salts or acids can contaminate the switch contacts. Wear cotton gloves to prevent touching the contacts in the switch or on the board with bare hands.*

- ④ Pull the rear of the switch up, remove the steel rule, and pull the switch out of the front clip.
- ⑤ To replace the switch, first check that the slide contacts are properly installed in the carrier. Then, place the front of the switch into the front clip and push the rear of the switch down until the rear clip catches and holds the switch in place.

1967-3

**Fig. 4-10. Removal procedure for typical push-button switch.**

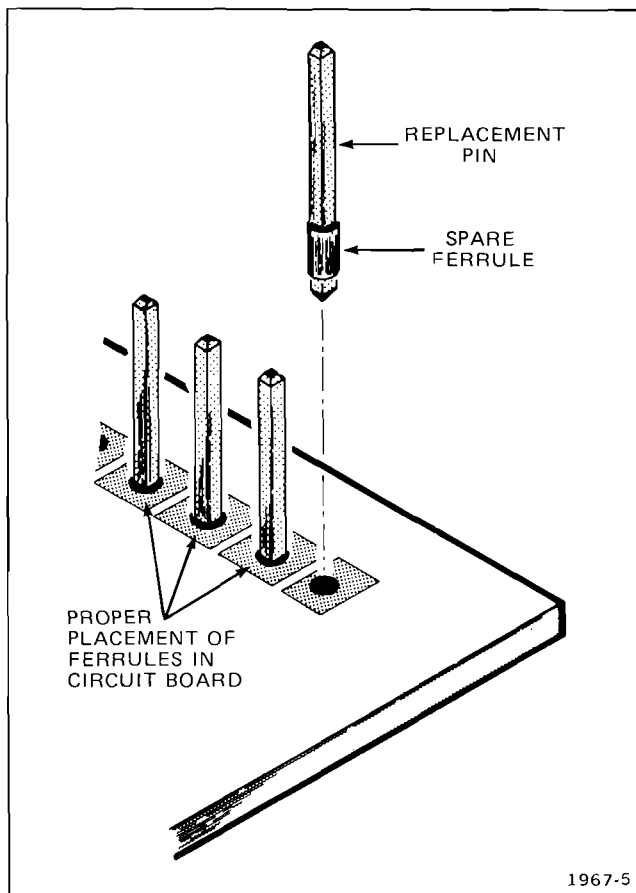


Fig. 4-11. Exploded view of circuit-board pin and ferrule.

2. Surround the instrument with polyethylene sheeting to protect the finish of the instrument.

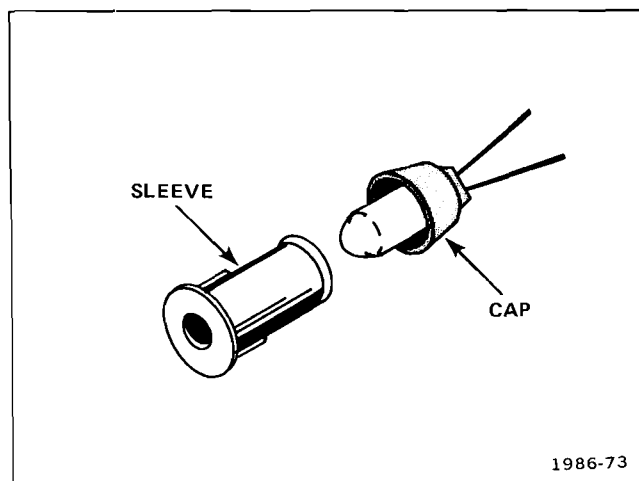


Fig. 4-12. Front-panel light socket assembly.

3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between the carton and the instrument, allowing three inches on all sides.

4. Seal the carton with shipping tape or an industrial stapler.

Table 4-1  
SHIPPING CARTON TEST STRENGTH

Gross Weight (lb)	Carton Test Strength (lb)
0-10	200
10-30	275
30-120	375
120-140	500
140-160	600

# PERFORMANCE CHECK AND ADJUSTMENT

This section contains information necessary to perform a complete instrument performance check and adjustment. The information in this section describes procedures to verify that the instrument is performing properly and meets the specifications listed in the Performance Requirement column of Table 2-1 in Section 2, Specifications.

## PRELIMINARY INFORMATION

### Adjustment Interval

To maintain instrument accuracy, check the performance of the 7B85 every 1000 hours of operation, or every six months if used infrequently. Before complete adjustment, thoroughly clean and inspect this instrument as outlined in Section 4, Maintenance.

### Tektronix Field Service

Tektronix Field Service Centers and the Factory Service Center provide instrument repair and adjustment services. Contact your Tektronix Field Office or representative for further information.

### Using This Procedure

This Performance Check and Adjustment procedure can be used either for complete adjustment or as a check of instrument performance. Completion of each step in the procedure ensures that the instrument is correctly adjusted and operating within specified limits. Refer to the following discussion for instructions on a complete or partial check and adjustment.

**Index.** An index precedes the procedure to aid in locating Performance Check and Adjustment steps.

**Performance Check.** Instrument performance can be checked by performing the complete Performance Check and Adjustment procedure and omitting only the ADJUST parts of the steps.

**Adjustment.** Completion of each step in the Performance Check and Adjustment procedure ensures that the

instrument is correctly adjusted and performing within specified limits. Where possible, instrument performance is checked before an adjustment is made. For best overall performance when performing the complete adjustment procedure, make each adjustment to the exact setting indicated.

**Partial Procedures.** The following procedure is written to completely check and adjust the instrument to the Performance Requirements listed in Section 2, Specification. If the applications for which the instrument is used do not require the full available performance, the procedures and the required equipment list can be shortened accordingly.

A partial performance check and adjustment may be desirable after replacing components, or to touch up the adjustment of a portion of the instrument. To check or adjust only part of the instrument, refer to the Equipment Required list preceding that portion of the procedure to be performed. To avoid unnecessary adjustment of other parts, adjust only if the tolerance given in each CHECK is not met.

## TEST EQUIPMENT REQUIRED

The test equipment listed in Table 5-1 is required for a complete performance check and adjustment of this instrument. The specifications given in Table 5-1 for test equipment are the minimum required to meet the Performance Requirements listed in Section 2, Specification. Detailed operating instructions for test equipment are omitted in this procedure. Refer to the test equipment instruction manual if more information is needed.

### Special Fixtures

Special fixtures are used only where they facilitate instrument adjustment. These fixtures are available from Tektronix, Inc. Order by part number from Tektronix Field Offices or representatives.

### Test Equipment Alternatives

The test equipment listed in the Examples of Applicable Test Equipment column, Table 5-1, is required to check and adjust this instrument. The Performance Check and Adjustment procedure is based on the first item of equipment given as an example. If other equipment is substituted, control

**Performance Check and Adjustment—7B85**

settings or setups may need to be altered. If the exact item of equipment given as an example is not available, refer to the Minimum Specifications column to determine if other equipment may be substituted. Then check the Purpose col-

umn. If you determine that your measurement requirements will not be affected, the item and corresponding step(s) can be deleted.

**Table 5-1  
TEST EQUIPMENT**

Description	Minimum Specifications	Purpose	Examples of Applicable Test Equipment
Oscilloscope mainframe	TEKTRONIX 7000-Series with 2 horizontal plug-in compartments; bandwidth, 400 MHz.	Provides a display for unit under test.	TEKTRONIX 7904 Oscilloscope.
Amplifier plug-in unit	TEKTRONIX 7A-Series. Bandwidth, 400 MHz; deflection factor, 10 mV to 0.5 V/div.	Provides vertical input to oscilloscope system.	TEKTRONIX 7A19 Amplifier plug-in unit.
Time-base unit	TEKTRONIX 7B-Series delayed sweep unit.	Companion delayed sweep unit for delay time checks and adjustments.	a. TEKTRONIX 7B80 Time-Base unit.  b. TEKTRONIX 7B85 Time-Base unit.
High-frequency signal generator <sup>a</sup>	Frequency, 50 MHz to 400 MHz; output amplitude, variable from 50 mV to 0.5 V into 50 Ω.	High-frequency triggering checks.	a. TEKTRONIX SG 504 Leveled Sine Wave Generator with power module.  b. Wavetek 1002 Sweep/ Signal Generator.
Time-mark generator	Marker outputs, 2 ns to 5 s; accuracy, within 0.1%.	Sweep timing checks and adjustments. Sweep delay checks and adjustments.	a. TEKTRONIX TG 501 Time-Mark generator with power module.  b. TEKTRONIX 2901 Time-Mark Generator.  c. TEKTRONIX 184 Time-Mark Generator.
Digital voltmeter (with test leads) <sup>b</sup>	Range, 5 mV to 105 mV; accuracy, within 0.1%. Digital Voltmeter must have at least 4 1/2 digit readout.	Readout bias checks and adjustments.	a. TEKTRONIX DM 501A Digital Multimeter with power module.  b. TEKTRONIX 7D12 A/D Converter with M1 Multi-function Module.

Table 5-1 (Cont.)

Description	Minimum Specifications	Purpose	Examples of Applicable Test Equipment
Low-frequency sine-wave generator	Frequency, 30 Hz to 50 kHz; output amplitude, variable from 50 mV to 3 V into 50 $\Omega$ .	Low-frequency triggering checks and adjustments.	a. TEKTRONIX FG 503 Function Generator with power module.  b. General Radio 1310-B Oscillator.
Plug-in extender <sup>b</sup>	TEKTRONIX 7000-Series extender.	Provides access to internal adjustments and test points.	TEKTRONIX 067-0589-00 Calibration Fixture.
Coaxial cables (2 required)	Impedance, 50 $\Omega$ ; type RG 58/U; length, 42 and 18 inches; connectors, bnc.	Provides signal interconnections.	Tektronix Part No. 012-0057-01 (42 inches) and 012-0076-00 (18 inches).
T connector	Connectors, bnc.	External trigger checks and adjustments.	Tektronix Part No. 103-0030-00.
Impedance, 50 $\Omega$ ; accuracy, within 2%; connectors, bnc.	Magnified sweep timing check.	Tektronix Part No. 011-0049-01.	Termination <sup>a</sup>  Screwdriver <sup>b</sup>
3-inch shaft, 3/32-inch bit.	Adjustments.	Xcelite R3323.	

<sup>a</sup>Used for performance check only; NOT used for adjustment.

<sup>b</sup>Used for adjustment only; NOT used for performance check.

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### PRELIMINARY PROCEDURE

1. Install an amplifier unit into the left vertical compartment of the mainframe.
  
2. Install the 067-0589-00 plug-in extender into the A horizontal compartment of the mainframe. Remove the side covers and install the 7B85 in the plug-in extender.
  
3. Install the delayed sweep time-base unit into the B horizontal compartment of the mainframe.
  
4. Set the mainframe vertical mode switch to display the left vertical unit and the horizontal mode switch to display the A horizontal unit. Set the mainframe intensity controls fully counterclockwise, and set the trigger source switches to vertical mode.
  
5. Turn on the mainframe and allow at least 20 minutes warmup before beginning the procedure.

#### NOTE

*The performance of this instrument can be checked at any ambient temperature within the 0° to +50° C range unless stated otherwise. This instrument must be adjusted at an ambient temperature of +20° to +30° C for quoted accuracy.*

## A. TRIGGERING SYSTEM

### Equipment Required

Oscilloscope mainframe	Plug-in extender
Amplifier plug-in unit	50 $\Omega$ cables (2)
Low-frequency sine-wave generator	Bnc T connector
High-frequency signal generator	

BEFORE YOU BEGIN, see

TEST POINT AND  
ADJUSTMENT LOCATIONS

in the Diagrams section.

### Control Settings

Set the 7B85 controls as follows:

#### TRIGGERING

MODE	P-P AUTO
COUPLING	AC
SOURCE	INT

#### SWEEP MODE

B DELAY MODE	INDEPENDENT
--------------	-------------

#### DELAY TIME

TRACE SEP ( $\Delta$ TIME enable)	OFF
--------------------------------------	-----

#### SWEEP

POSITION	Midrange
TIME/DIV	20 $\mu$ S/DIV
VARIABLE	IN (calibrated)
MAG	X1
HOLD OFF	MIN

e. Check for a stable display with TRIG'D light on.

f. ADJUST—R85 (DC Balance) for a stable crt display.

g. Set the SLOPE switch to (–) and check for a stable display.

h. ADJUST—R80 (Slope Balance) for a stable display.

i. Check for a stable display when the SLOPE switch is set to (+) and (–).

j. INTERACTION—Repeat the adjustment of R85 (DC Balance) and R80 (Slope Balance) until a stable display is obtained while changing TRIGGERING SLOPE.

#### NOTE

*If any of the CHECK parts in the following steps cannot be met, repeat step A1.*

### A1. Adjust DC Balance and Slope Balance (R85, R80)

a. Connect the low-frequency sine-wave generator to the amplifier unit input with a 50  $\Omega$  cable.

b. Set the oscilloscope mainframe intensity and focus controls for the desired display.

c. Set the low-frequency sine-wave generator and the amplifier unit deflection factor for a 0.3-div display at 50 kHz. Center the display vertically.

d. Set the TRIGGERING LEVEL control to approximately 0 (midrange) and TRIGGERING SLOPE to (+).

### A2. Check Triggering Modes

a. Remove the 7B85 and plug-in extender; then, install the 7B85 directly into the A horizontal compartment.

b. Set the low-frequency sine-wave generator and the amplifier unit deflection factor for approximately a 2-division display.

c. CHECK—for a stable display at all LEVEL control settings (P-P AUTO MODE).

d. Set TRIGGERING MODE to AUTO.

## Performance Check and Adjustment—7B85

e. CHECK—Set the TRIGGERING LEVEL control for a stable display (TRIG'D light on).

f. CHECK—For a free-running display with the TRIG'D light off when the TRIGGERING LEVEL control is set fully clockwise and fully counterclockwise.

g. Set TRIGGERING MODE to NORM.

h. CHECK—Set the TRIGGERING LEVEL control for a stable display (TRIG'D light on).

i. CHECK—For no display (TRIG'D light off) when the TRIGGERING LEVEL control is set fully clockwise and fully counterclockwise.

j. Set the TRIGGERING LEVEL control for a stable display (TRIG'D light on).

k. Set TRIGGERING MODE to SINGLE SWP and the SOURCE to EXT.

l. CHECK—Press the SINGLE SWP RESET push button and check that the READY light is on.

m. CHECK—for one sweep and that the READY light is out after completion of that sweep when the INT SOURCE push button is pressed (oscilloscope intensity may need to be increased to view the single-sweep display).

n. Remove signal connection.

### A3. Check External Level Range

a. Connect the low-frequency sine-wave generator to the EXT TRIG IN connector with a 42-inch 50  $\Omega$  cable and T connector. Connect the output of the T connector to the amplifier unit input with an 18-inch 50  $\Omega$  cable.

b. Set TRIGGERING MODE to AUTO, SLOPE to (+), and SOURCE to EXT. Set the TIME/DIV switch to 0.5 ms and the EXT TRIG IN attenuator to IN  $\div$  1.

c. Set the amplifier unit deflection factor for 0.5 V/div. Set the low-frequency sine-wave generator for a 6-division display (3 V) at 1 kHz.

d. CHECK—That all levels of the positive slope may be selected for the sweep starting point as the TRIGGERING LEVEL control is rotated throughout its range (indicates an external level range of at least plus and minus 1.5 V). Check that the display is not triggered at either end of the LEVEL control rotation.

e. CHECK—Change TRIGGERING SLOPE to (–) and repeat part d for the negative slope of the waveform.

### A4. Adjust Triggering Sensitivity (R49)

a. Set the TRIGGERING LEVEL control to 0. Set the TRIGGERING MODE to NORM, SOURCE to INT.

b. Set the amplifier unit deflection factor to 50 mV/div. Set the low-frequency sine-wave generator for a 5-division display (250 mV) at 1 kHz.

c. Set the amplifier unit deflection factor to 1 V/div (0.25 div). Set the TRIGGERING LEVEL control for a stable display.

d. ADJUST—R49, Trigger Sensitivity, for a stable crt display.

### A5. Check External Triggering Sensitivity

a. Set the amplifier unit deflection factor for 10 mV/div. Set the low-frequency sine-wave generator for a 5-division display (50 mV) at 30 Hz.



b. Set the TRIGGERING SLOPE to (+), MODE to NORM, SOURCE to EXT, TIME/DIV to 20 ms, and set the LEVEL control for a stable display.

c. CHECK—Set TRIGGERING MODE to AUTO and check for a stable display (TRIG'D light on) with the COUPLING push button set to:

1. AC
2. AC HF REJ
3. DC

(Set the TRIGGERING LEVEL control as necessary.)

d. CHECK—Change TRIGGERING SLOPE to (–) and repeat part c.

e. Set TRIGGERING MODE to P-P AUTO and COUPLING to AC.

f. Set the amplifier unit deflection factor for 0.1 V/div and the low-frequency sine-wave generator for a 5-division display (500 mV) at 50 Hz.

g. CHECK—for a stable display (TRIG'D light on) at all settings of the LEVEL control with COUPLING set to:

1. AC
2. DC

h. CHECK—Set the SLOPE to (+) and repeat part g.

i. Set the amplifier unit deflection factor for 50 mV/div and the low-frequency sine-wave generator for a 2.5-division display (125 mV) at 200 Hz. Set the TIME/DIV switch to 5 ms.

j. CHECK—Repeat part g for both the (+) and (–) SLOPE.

k. Disconnect the low-frequency sine-wave generator from the T connector and connect the high-frequency signal generator to the T connector.

l. Set TRIGGERING MODE to AUTO and the SLOPE to (+). Set the TIME/DIV switch to 20 ns.

m. Set the amplifier unit deflection factor to 10 mV/div and the high-frequency signal generator for a 5-division display (50 mV) at 50 MHz.

n. CHECK—for a stable display (TRIG'D light on) with the COUPLING switch set to:

1. AC
2. AC LF REJ
3. DC

(Set the LEVEL control as necessary.)

o. CHECK—Set the SLOPE switch to (–) and repeat part n.

p. Set the amplifier unit deflection factor to 50 mV/div and set the high-frequency signal generator for a 2.5-division display (125 mV).

q. CHECK—Set TRIGGERING MODE to P-P AUTO and check for a stable display (TRIG'D light on) at all settings of the LEVEL control with COUPLING set to:

1. AC
2. DC

r. CHECK—Set the SLOPE switch to (+) and repeat part q.

s. Set the high-frequency signal generator for a 7.5-division display (375 mV) at 400 MHz. Set the TIME/DIV switch to 10 ns and the MAG switch to X10.

t. CHECK—Set TRIGGERING MODE to P-P AUTO and check for a stable display (TRIG'D light on) when the LEVEL control setting is within the ends of the arrows on the front panel. Repeat for both the (+) and (–) SLOPE.

u. Set the high-frequency signal generator for a 5-division display (250 mV) at 400 MHz. Set TRIGGERING MODE to AUTO and the SLOPE to (+).

v. CHECK—for a stable display (TRIG'D light on) with COUPLING set to:

1. AC
2. AC LF REJ
3. DC

(Set the LEVEL control as necessary.)

w. CHECK—Set the SLOPE switch to (–) and repeat part v.

### A6. Check Internal Triggering Sensitivity

a. Remove all signal connections; then, connect the low-frequency sine-wave generator to the amplifier unit input.

b. Set the TIME/DIV switch to 20 ms and the MAG switch to X1.

c. Set the low-frequency sine-wave generator and the amplifier unit deflection factor for a 0.3-division display at 30 Hz.

d. Set TRIGGERING for (+) SLOPE, NORM MODE, AC COUPLING, and INT SOURCE, and set the LEVEL control for a stable display (TRIG'D light on).

e. CHECK—Set TRIGGERING MODE to AUTO and check for a stable display (TRIG'D light on) with COUPLING set to:

1. AC
2. AC HF REJ
3. DC

(Set the TRIGGERING LEVEL control as necessary.)

f. Change the TRIGGERING SLOPE to (–) and repeat part e.

g. Set TRIGGERING MODE to P-P AUTO and COUPLING to AC.

h. Set the low-frequency sine-wave generator and the amplifier unit deflection factor for a 2-division display at 50 Hz.

i. CHECK—for a stable display (TRIG'D light on) at all settings of the LEVEL control with COUPLING set to:

1. AC
2. DC

j. Set the SLOPE switch to (+) and repeat part i.

k. Set the low-frequency sine-wave generator and the amplifier unit deflection factor for a 0.5-division display at 200 Hz. Set the TIME/DIV switch to 5 ms.

l. CHECK—Repeat part i for both the (+) and (–) SLOPE.

m. Disconnect the low-frequency sine-wave generator and connect the high-frequency signal generator to the amplifier unit input.

n. Set TRIGGERING MODE to AUTO and the SLOPE switch to (+). Set the TIME/DIV switch to 20 ns.

o. Set the high-frequency signal generator and the amplifier unit deflection factor for a 0.3-division display at 50 MHz.

p. CHECK—for a stable display (TRIG'D light on) with COUPLING set to:

1. AC
2. AC LF REJ
3. DC

(Set the LEVEL control as necessary.)

q. CHECK—Set the SLOPE switch to (–) and repeat part p.

r. Set the high-frequency signal generator and the amplifier unit deflection factor for a 0.5-division display.

s. CHECK—Set TRIGGERING MODE to P-P AUTO and check for a stable display at all settings of the LEVEL control (TRIG'D light on) with COUPLING set to:

1. AC
2. DC

t. CHECK—Set the SLOPE switch to (+) and repeat part s.

u. Set the high-frequency signal generator and the amplifier unit deflection factor for a 1.5-division display at 400 MHz. Set the TIME/DIV switch to 10 ns and the MAG switch to X10.

v. CHECK—Set TRIGGERING MODE to P-P AUTO and check for a stable display (TRIG'D light on) when the LEVEL control setting is within the ends of the arrows on the front panel. Repeat for both the (+) and (–) SLOPE.

w. Set TRIGGERING MODE to AUTO and SLOPE to (+).

x. CHECK—for a stable display (TRIG'D light on) with COUPLING set to:

1. AC
2. AC LF REJ
3. DC

(Set the LEVEL control as necessary.)

y. CHECK—Set the SLOPE to (–) and repeat part x.

#### **A7. Check Internal Trigger Jitter**

a. Set TRIGGERING COUPLING to AC and set the LEVEL control for a stable display (TRIG'D light on).

b. CHECK—for a stable display with no more than 0.1 division (0.1 ns) of jitter.

#### **A8. Check Line Triggering**

a. Remove all signal connections.

b. Set TRIGGERING SOURCE to LINE, the TIME/DIV switch to 1 ms, and the MAG switch to X1.

c. CHECK—Set TRIGGERING LEVEL to approximately midrange and check that the TRIG'D light is on.

d. CHECK—that the display is not triggered (TRIG'D light off) at either end of the LEVEL control rotation.

## B. HORIZONTAL SYSTEM

### Equipment Required

Oscilloscope mainframe	Plug-in extender
Amplifier plug-in unit	50 $\Omega$ cable (1)
Time-base unit	50 $\Omega$ termination
Digital voltmeter with test leads	
Time-mark generator	

### Control Settings

Set the 7B85 controls as follows:

#### TRIGGERING

MODE	AUTO
COUPLING	AC
SOURCE	INT

#### SWEEP MODE

B DELAY MODE	INDEPENDENT
--------------	-------------

#### DELAY TIME

TRACE SEP	OFF
DELAY TIME	Fully counterclockwise
$\Delta$ TIME	Fully clockwise

#### SWEEP

POSITION	Midrange
TIME/DIV	1 ms
VARIABLE	IN (calibrated)
MAG	X1
HOLD OFF	MIN

### B1. Set Basic Sweep Calibration

a. Set the companion time-base unit triggering for auto mode, ac coupling, and internal source. Set the companion unit for a 1 ms/div sweep rate.

b. Remove the 7B85 from the oscilloscope mainframe and install the plug-in extender in the A horizontal compartment. Then, install the 7B85 in the plug-in extender.

c. Connect the time-mark generator to the amplifier unit input with a 50  $\Omega$  cable. Set the time-mark generator for 1 ms markers, and set the mainframe horizontal mode to alternate. Set the mainframe intensity and focus for the desired display.

d. Set both time-base unit LEVEL controls for a stable display (TRIG'D lights on). Set the amplifier unit for approxi-

mately a 2-division display of each trace. Center the 7B85 trace in the upper half of the graticule and the companion unit trace in the lower half.

e. Set the 7B85 front-panel SWP CAL adjustment for exactly 1 marker/div (upper trace) over the center 8 divisions (position as necessary).

f. Set the front-panel sweep calibration adjustment of the companion time-base unit for exactly 1 marker/div (lower trace) over the center 8 divisions (position as necessary).

### B2. Check Sweep Length and Positioning Range

a. Set the mainframe horizontal mode to display the A horizontal compartment. Center the display vertically.

b. Horizontally position the display to place the second time marker to the first graticule line.

c. CHECK—that the end of the sweep extends to at least 9.2 graticule divisions (indicates sweep length of at least 10.2 div).

d. Set the POSITION and FINE controls fully clockwise.

e. CHECK—the start of the sweep must be to the right of graticule center.

f. Set the POSITION and FINE controls fully counterclockwise.

g. CHECK—the end of the sweep must be to the left of graticule center.

**B3. Check/Adjust Magnifier Gain and Registration (R430, R445)**

- a. Set the time-mark generator for 0.1 ms markers.
- b. Set the MAG switch to X10 and set the POSITION controls to midrange. Set the mainframe intensity controls for the desired display.
- c. Check for 1 marker/div over the center 8 divisions of the display (position as necessary).
- d. ADJUST—R430 (Mag Gain) for 1 marker/div over the center 8 divisions of the display.
- e. Set the time-mark generator for 5 ms markers. Align the center time marker with graticule center.
- f. CHECK—Set the MAG switch to X1 and check that the center time marker is at graticule center within 0.5 div.
- g. ADJUST—R445 (Mag Reg) to align the center time marker with graticule center.
- h. INTERACTION—Set the MAG switch to X10 and repeat parts e, f, and g as necessary.

**B4. Check Variable Time/Division and Variable Hold Off**

- a. Press and release the VARIABLE TIME/DIV control for uncalibrated sweep rates. Set the VARIABLE control fully clockwise and note 3 time markers in 10 graticule divisions.
- b. CHECK—Set the VARIABLE control fully counterclockwise and check for 2 divisions or less between 5 ms markers.
- c. Press in the VARIABLE control for calibrated sweep rates.
- d. Set the LEVEL control for a free-running display (TRIG'D light off).
- e. Set the HOLD OFF control fully counterclockwise.

f. CHECK—Rotate the HOLD OFF control slowly clockwise throughout its range and check that the display (3 time markers in 10 divisions) will stabilize at least three times throughout the range of the HOLD OFF control (disregard any slow drift).

g. Set the HOLD OFF control counterclockwise to MIN and set the LEVEL control for a stable display.

**B5. Adjust Sweep Timing (C330, R710, R715)**

- a. Set the TIME/DIV switch to 50 ns and set the time-mark generator for 50 ns markers.
- b. Check for 1 marker/div over the center 8 divisions of the display (position as necessary).
- c. ADJUST—C330 (50 ns Timing) for 1 marker/div over the center 8 divisions of the display (position as necessary).
- d. Set the TIME/DIV switch to 10  $\mu$ s and set the time-mark generator for 10  $\mu$ s markers.
- e. Check for 1 marker/div over the center 8 divisions of the display (position as necessary).
- f. ADJUST—R710 (10  $\mu$ s Timing) for 1 marker/div over the center 8 divisions of the display (position as necessary).
- g. Set the TIME/DIV switch to 10 ms and set the time-mark generator for 10 ms markers.
- h. Check for 1 marker/div over the center 8 divisions of the display (position as necessary).
- i. ADJUST—R715 (10 ms Timing) for 1 marker/div over the center 8 divisions of the display (position as necessary).

**NOTE**

*Final adjustment of R710 and R715 is made in step B13.*

**B6. Check Delay Modes**

- a. Set the TIME/DIV switch to 1 ms and set the time-mark generator for 1 ms markers.

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b. CHECK—Rotate the DELAY TIME control and note that it has no effect on the independent sweep display.

c. CHECK—Rotate the TRACE SEP control counterclockwise out of switch detent to enable the  $\Delta$  TIME mode. Rotate the  $\Delta$  TIME control and check for no effect on the independent sweep display.

d. Rotate the TRACE SEP control into the switch detent to disable the  $\Delta$  TIME operation. Set the B DELAY MODE switch to B STARTS AFTER DLY.

e. Set the mainframe horizontal mode to alternate. Set the companion time-base sweep rate to 0.1 ms/div and set the level control for a triggered display (TRIG'D light on).

f. Set the mainframe intensity control for optimum brightness of the intensified- and delayed-sweep traces. Center the delaying-sweep trace in the upper half of the graticule and the delayed-sweep trace in the lower half of the graticule.

g. CHECK—Rotate the DELAY TIME control throughout its range and note that the delay before the start of the intensified zone is continuously variable.

h. Set the B DELAY MODE switch to B TRIGGERABLE AFTER DLY.

i. CHECK—Rotate the DELAY TIME control throughout its range and note that the intensified zone jumps from time marker to time marker. This indicates that the intensified zone does not start at the completion of delay time, but waits for the next trigger pulse.

j. CHECK—That the greater-than symbol (>) precedes the delay-time readout, thereby indicating that the delay-time readout is uncalibrated.

### NOTE

*The 7B85 may be operated as a delayed-sweep unit (B horizontal compartment) with a companion delaying-sweep unit (A horizontal compartment). To check 7B85 delayed-sweep operation, install the 7B85 in the B horizontal compartment and a companion delaying-sweep unit into the A horizontal compartment. Set the 7B85 B DELAY MODE to INDEPENDENT and the TIME/DIV switch to 0.1 ms. Set the delaying-sweep unit for a 1 ms/div sweep rate and apply 1 ms time markers to the amplifier unit input. Check delayed-sweep operation as outlined in step B6, parts d through i.*

## B7. Adjust Delay Time Readout Bias (R685) (SN B088749 & Below)

a. Rotate the DELAY TIME control fully counterclockwise and rotate the TRACE SEP control counterclockwise out of the switch detent.

b. Disconnect multi-pin connector P32 from the Digital Voltmeter circuit board (A4). Disconnect the two-pin jumper (P34) from pins 1 and 2 and place it on P32 pin 9 and P34 pin 1. Place P32 pin 1 to pin 1 only on the circuit board.

c. Set the digital voltmeter to the 2 V dc-voltage range.

d. Connect the digital voltmeter test leads across R541.

e. Rotate the  $\Delta$  TIME control to display symbols and nines (.>>99.99RE9) on the delay-time readout.

f. Check the digital voltmeter readout for 0.100 V within 0.001 V.

g. ADJUST—R685 (Readout Bias) for 0.100 V within 0.001 V.

h. ADJUST—Set the  $\Delta$  TIME control for the readout numerals given in Table 5-2 (various symbols will also appear in the readout display), and check for the corresponding digital voltmeter readings. If necessary, adjust R685 and recheck.

**Table 5-2**  
**DELAY TIME READOUT BIAS**

Readout Numeral	Digital Voltmeter Reading
(9)s	.100 V (Within .001 V)
(8)s	.090 V (Within .001 V)
(7)s	.080 V (Within .001 V)
(6)s	.070 V (Within .001 V)
(5)s	.060 V (Within .001 V)
(4)s	.050 V (Within .001 V)
(3)s	.040 V (Within .001 V)
(2)s	.030 V (Within .001 V)
(1)s	.020 V (Within .001 V)
(0)s	.010 V (Within .001 V)

j. Disconnect the digital voltmeter test leads from R541. Disconnect the two-pin jumper (from P32 pin 9 and P34 pin 1) and place it on P34 pins 1 and 2. Disconnect multi-pin connector P32 from pin 1 and replace it on pins 1 through 9.

### **B8. Adjust Delay Offset and Delay Gain (R555, R510)**

a. Set the B DELAY MODE switch to B STARTS AFTER DLY.

b. Set the companion delayed-sweep time-base unit for a 10  $\mu\text{s}/\text{div}$  sweep rate.

c. Rotate the  $\Delta$  TIME control fully counterclockwise. Rotate the DELAY TIME control to start the intensified zone approximately 1 div from the start of the delaying-sweep trace (upper trace). Rotate the DELAY TIME control to further position the time markers on the delayed-sweep traces to graticule center.

#### *NOTE*

*Do not disturb the setting of the  $\Delta$  TIME control (fully counterclockwise) during the remainder of step B8.*

d. Check that the time markers of both the first and second delayed-sweep traces are horizontally aligned with 0.1 div. It may be necessary to rotate the TRACE SEP control to distinguish between the two delayed-sweep traces.

e. ADJUST—R555 (Delay Offset) to horizontally align the time markers of the first and second delayed-sweep traces.

f. Rotate the DELAY TIME control to start the intensified zone approximately 8 divisions from the start of the trace. Further rotate the DELAY TIME control to position the time markers of the delayed-sweep traces near graticule center.

g. Check that the time-markers of both delayed-sweep traces are horizontally aligned within 0.1 div.

h. ADJUST—R510 (Delay Gain) to horizontally align the time markers of the delayed-sweep traces.

i. INTERACTION—Repeat step B8 until there is no change in the adjustment.

### **B9. Adjust DVM Zero (R625) (SN B088750 & up)**

a. Rotate the  $\Delta$  TIME control fully counterclockwise and TRACE SEP counterclockwise out of the switch detent.

b. Set the DELAY TIME control to position the intensified zones near the second graticule line so that the time markers in the delayed-sweep display are on the center graticule line.

c. Advance the  $\Delta$  TIME control until the first and second delayed time markers are 2.0 div (20  $\mu\text{s}$ ) apart (1 horizontal division equals 10  $\mu\text{s}$  of delayed sweep).

#### *NOTE*

*If it is difficult to set the  $\Delta$  TIME control for exactly 2 divisions (20  $\mu\text{s}$ ) between delayed-sweep time markers, note the actual time separation displayed. Then, follow the procedure outlined in part d and adjust R625 so that the  $\Delta$  TIME readout corresponds to the actual time separation displayed between the delayed-sweep time markers.*

**EXAMPLE:** A 2.2 div time delay corresponds to a 0.022 ms  $\Delta$  time readout. Adjust R625 for a  $\Delta$  TIME readout of 0.021 ms. Then, adjust R625 until the  $\Delta$  TIME readout just changes to 0.022 ms.

d. ADJUST—R625 (DVM Zero) for a  $\Delta$  TIME readout of 0.019 ms. Then, adjust R625 until the  $\Delta$  TIME readout just changes to 0.020 ms.

e. Rotate the  $\Delta$  TIME control fully counterclockwise.

f. Check for a  $\Delta$  time readout of exactly 0.000 ms and for horizontal alignment of the delayed sweep time markers within 0.1 div. Disregard an occasional  $\Delta$  TIME readout of 0.001 ms.

### **B9. Adjust Scaling and DVM Zero (R605, R625) (SN B088749 & Below)**

a. Set the DELAY TIME control fully counterclockwise and set the  $\Delta$  TIME control for a  $\Delta$  time readout of 8.000 ms.

b. Set the TIME/DIV switch to 2 ms and check for a  $\Delta$  TIME readout of 16.02 ms.

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- c. Note the difference in readout from 16.02 ms.
- d. ADJUST—Set the TIME/DIV switch to 1 ms and adjust R605 (Scaling) for a  $\Delta$  TIME readout of 8.000 ms plus one-half the difference in the readout noted in part c.  

EXAMPLE: If the reading in part c was 16.21 ms, the difference would be  $(16.21 - 16.02) = 0.19$  ms. Adjust R605 for a  $\Delta$  time readout of  $[8.000 \text{ ms} + 0.5 (0.19 \text{ ms})] = 8.095$  ms.
- e. INTERACTION—Set the  $\Delta$  TIME control for a  $\Delta$  TIME readout of 8.000 ms. Repeat parts b, c, and d as necessary.
- f. Set the TIME/DIV switch to 5 ms and check for a  $\Delta$  TIME readout between 39.97 and 40.07 ms.
- g. Set the TIME/DIV switch to 1 ms and rotate the  $\Delta$  TIME control fully counterclockwise.
- h. Set the DELAY TIME control to position the intensified zones near the second graticule line so that the time markers in the delayed-sweep display are on the center graticule line.
- i. Advance the  $\Delta$  TIME control until the first and second delayed time markers are 2.0 div ( $20 \mu\text{s}$ ) apart (1 horizontal division equals  $10 \mu\text{s}$  of delayed sweep).

### NOTE

*If it is difficult to set the  $\Delta$  TIME control for exactly 2 div ( $20 \mu\text{s}$ ) between delayed-sweep time markers, note the actual time separation displayed. Then, follow the procedure outlined in part j and adjust R625 so that the  $\Delta$  TIME readout corresponds to the actual time separation displayed between the delayed-sweep time markers.*

EXAMPLE: A 2.2 div time delay corresponds to a 0.022 ms  $\Delta$  TIME readout. Adjust R625 for a  $\Delta$  time readout of 0.021 ms. Then, adjust R625 until the  $\Delta$  time readout just changes to 0.022 ms.

- j. ADJUST—R625 (DVM Zero) for  $\Delta$  time readout of 0.019 ms. Then, adjust R625 until the  $\Delta$  TIME readout just changes to 0.020 ms.
- k. Rotate the  $\Delta$  TIME control fully counterclockwise.

- l. Check for a  $\Delta$  TIME readout of exactly 0.000 ms and for horizontal alignment of the delayed sweep time markers within 0.1 div.

## B10. Adjust DVM Gain (R620)

- a. Set the DELAY TIME control to start the first intensified zone on the second time marker and set the  $\Delta$  TIME control to start the second intensified zone on the tenth time marker. Further rotate the  $\Delta$  TIME control to horizontally align the delayed-sweep traces (it may be necessary to rotate the TRACE SEP control to view the two delayed-sweep traces).

### NOTE

*If the  $\Delta$  TIME control cannot be set to obtain 8 divisions between intensified zones, preset R535 (Second Pickoff Bias) fully clockwise. Final adjustment of R535 is made in step B12.*

- b. Check for a  $\Delta$  TIME readout of 8.000 ms.
- c. ADJUST—R620 (DVM Gain) for a  $\Delta$  TIME readout of 8.000 ms.

## B11. Adjust Delay Start and Second Pickoff Bias (R305, R535)

- a. Set the TRACE SEP control fully clockwise into the switch detent to disable  $\Delta$  TIME operation.
- b. Position both traces horizontally (7B85 trace and companion time-base trace) to start on the first graticule line.
- c. Set the DELAY TIME control for 0.950 ms of delay-time readout.
- d. Check for a delayed-sweep time marker (lower trace) at graticule center, within 1.0 div.
- e. ADJUST—R305 (Delay Start) to position the delayed time marker, corresponding to the intensified delaying-sweep time marker, to graticule center.
- f. Rotate the TRACE SEP control counterclockwise, just out of switch detent, to enable the  $\Delta$  TIME mode. Set the DELAY TIME control fully counterclockwise and the  $\Delta$  TIME control fully clockwise.



g. Check for a time readout of 9.200 ms, within 0.100 ms.

h. ADJUST—R535 (Second Pickoff Bias) for a  $\Delta$  TIME readout of 9.200 ms.

### B12. Check Delay Time, $\Delta$ Time, and Trace Separation Ranges

a. CHECK—Set the TRACE SEP control clockwise into the OFF detent to disable  $\Delta$  TIME operation. Check that the  $\Delta$  symbol disappears from the delay-time readout.

b. CHECK—Set the DELAY TIME control fully clockwise and check for a delay-time readout of 9.000 ms or greater.

c. CHECK—Set the DELAY TIME control fully counterclockwise and check for a delay-time readout of 0.200 ms or less.

d. Set the TRACE SEP control counterclockwise, out of the switch detent, to enable  $\Delta$  TIME operation.

e. CHECK—Set the  $\Delta$  TIME control fully clockwise and check for a  $\Delta$  TIME reading of 9.000 ms or greater.

f. CHECK—Set the  $\Delta$  TIME control fully counterclockwise and check for a  $\Delta$  TIME readout of 0.000 ms. Check that the  $\Delta$  symbol precedes the readout display.

g. Set the TRACE SEP control fully clockwise. Set the mainframe vertical trace separation control to midrange. Position the delayed-sweep trace, with the amplifier unit position control, to the center graticule line.

h. CHECK—Set the TRACE SEP control fully counterclockwise and check that the second delayed-sweep trace is at least 3 divisions below graticule center.

### B13. Adjust 10 $\mu$ s and 10 ms Delay Timing (R710, R715)

a. Set the 7B85 TIME/DIV switch to 10  $\mu$ s and set the companion time-base unit for a 0.2  $\mu$ s/div sweep rate.

b. Set the time-mark generator for 10  $\mu$ s markers.

c. Set the amplifier unit position control to center the intensified trace in the upper half of the graticule. Set the TRACE SEP control clockwise to position the delayed-sweep traces together.

d. Set the DELAY TIME control to start the first intensified zone on the second time marker and set the  $\Delta$  TIME control to start the second intensified zone on the tenth time marker. Rotate the  $\Delta$  TIME control for a  $\Delta$  TIME readout of exactly 80.00  $\mu$ s.

e. Check that the time markers of both the first and second delayed-sweep traces are horizontally aligned within 1.0 div.

f. ADJUST—R710 (10  $\mu$ s Timing) to horizontally align the delayed-sweep time markers.

g. Set the 7B85 TIME/DIV switch to 10 ms and set the companion time-base unit for a 0.2 ms/div sweep rate.

h. Set the time-mark generator for 10 ms markers.

i. Set the DELAY TIME control to start the first intensified zone on the second time marker, and set the  $\Delta$  TIME control to start the second intensified zone on the tenth marker. Rotate the  $\Delta$  TIME control for a  $\Delta$  TIME readout of exactly 80.00 ms.

j. Check that the time markers of both the first and second delayed-sweep traces are horizontally aligned within 1.0 div.

k. ADJUST—R715 (10 ms Timing) to horizontally align the delayed-sweep time markers.

### B14. Check $\Delta$ Time Accuracy

a. Remove the 7B85 and plug-in extender from the A horizontal compartment. Then, install the 7B85 directly into the A horizontal compartment.

b. Set the TRACE SEP control to position the second delayed-sweep trace approximately 0.2 div below the first delayed-sweep trace.

c. Set the time-mark generator for 0.2  $\mu$ s markers. Set the TIME/DIV switch to 0.1  $\mu$ s and the companion time-base unit for a 10 ns/div sweep rate (unmagnified).

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d. Position the display for 1 marker/div over the center 8 divisions of intensified display.

e. Set the DELAY TIME control to start the first intensified zone on the time marker that is nearest the second graticule line. Set the Δ TIME control to start the second intensified zone on the time marker that is nearest the tenth graticule line.

f. Further adjust the Δ TIME control to horizontally align the time markers of the first and second delayed-sweep traces.

g. CHECK—for a Δ TIME readout between 795.6 ns and 804.4 ns.

**NOTE**

*The limits in part g and Table 5-3 are derived from the Performance Requirement in the Specification section.*

*EXAMPLE: The Performance Requirement for Δ TIME accuracy at 0.1 μs/DIV is:*

*Within (0.5% measurement + 0.03% full scale + 1 least significant digit).*

*For an 8 division measurement (80 ns), the accuracy is:*

$$\pm(0.5\% \text{ of } 800 \text{ ns} + 0.03\% \text{ of } 1000 \text{ ns} + 0.1 \text{ ns}) = \pm(4.0 \text{ ns} + 0.3 \text{ ns} + 0.1 \text{ ns}) = \pm 4.4 \text{ ns}$$

*Therefore, the specified limits for a measurement interval of 800 ns are:*

$$800 \text{ ns} \pm 4.4 \text{ ns} = 795.6 \text{ ns to } 804.4 \text{ ns.}$$

h. CHECK—Follow the procedure outlined in parts c through g and check for Δ TIME accuracy as given in Table 5-3.

**B15. Check Δ TIME Linearity**

a. Set the TIME/DIV switch to 1 ms.

b. Set the time-mark generator for 0.5 ms markers and set the companion time-base unit for a 10 μs/div sweep rate.

**Table 5-3  
Δ TIME ACCURACY**

<b>7B85 TIME/DIV</b>	<b>Companion Time Base Sweep Rate</b>	<b>Time Markers</b>	<b>Δ Time Readout Range</b>
.1 μs	10 ns	.1 μs	795.6 ns to 804.4 ns
.2 μs	20 ns	.2 μs	1.591 μs to 1.609 μs
.5 μs	50 ns	.5 μs	3.977 μs to 4.023 μs
1 μs	.1 μs	1 μs	7.956 μs to 8.044 μs
2 μs	.2 μs	2 μs	15.91 μs to 16.09 μs
5 μs	.5 μs	5 μs	39.77 μs to 40.23 μs
10 μs	1 μs	10 μs	79.56 μs to 80.44 μs
20 μs	2 μs	20 μs	159.1 μs to 160.9 μs
50 μs	5 μs	50 μs	397.7 μs to 402.3 μs
.1 ms	10 μs	.1 ms	795.6 μs to 804.4 μs
.2 ms	20 μs	.2 ms	1.591 ms to 1.609 ms
.5 ms	50 μs	.5 ms	3.977 ms to 4.023 ms
1 ms	.1 ms	1 ms	7.956 ms to 8.044 ms
2 ms	.2 ms	2 ms	15.91 ms to 16.09 ms
5 ms	.5 ms	5 ms	39.77 ms to 40.23 ms
10 ms	1 ms	10 ms	79.56 ms to 80.44 ms
20 ms	2 ms	20 ms	159.1 ms to 160.9 ms
50 ms	5ms	50 ms	397.4 ms to 402.6 ms
.1 s	10 ms	.1 s	794.9 ms to 805.1 ms
.2 s	20 ms	.2 s	1.589 s to 1.611 s
.5 s	50 ms	.5 s	3.974 s to 4.026 s

c. Position the delaying- and delayed-sweep traces horizontally to start on the first graticule line.

d. Set the DELAY TIME control to place the first intensified zone on the time marker that is between the first and second graticule lines (second time marker).

e. Set the Δ TIME control to place the second intensified zone to the time marker that is 0.5 division from the first intensified time marker (third time marker).

f. Set the Δ TIME control to precisely align the delayed-sweep traces.

g. CHECK— $\Delta$  TIME readout for 0.496 ms to 0.504 ms.

h. Set the DELAY TIME control to position the first intensified zone to the next 0.5 ms time marker (third time marker). Then, rotate the  $\Delta$  TIME control to precisely align the delayed-sweep traces.

i. CHECK— $\Delta$  TIME readout for 0.496 ms to 0.504 ms.

j. Set the DELAY TIME control to position the first intensified zone to the next 0.5 ms time marker (fourth time marker). Then, rotate the  $\Delta$  TIME control to precisely align the delayed sweep traces.

k. CHECK— $\Delta$  TIME readout for 0.496 ms to 0.504 ms.

l. CHECK—Use the procedure outlined in parts h through k and check  $\Delta$  TIME linearity at each 0.5 div point until the first intensified zone is beyond the tenth graticule line.

### B16. Check Delay Time Accuracy (Start of Delayed Sweep Display with Respect to Delaying Sweep Display)

a. Set the TRACE SEP control into the OFF detent to disable the  $\Delta$  TIME operation.

b. Set the time-mark generator for 1 ms markers.

c. Position the delaying- and delayed-sweep traces to start on the first graticule line.

d. Set the DELAY TIME control to place the intensified zone on the second time marker.

e. Set the DELAY TIME control to precisely position the leading edge of the delayed-time marker to the first graticule line.

f. CHECK—delay-time readout for 0.945 ms to 1.055 ms.

g. Set the DELAY TIME control to place the intensified zone on the sixth time marker.

h. Set the DELAY TIME control to precisely position the leading edge of the delayed time marker to the first graticule line.

i. CHECK—delay-time readout for 4.925 ms to 5.075 ms.

j. Set the DELAY TIME control to place the intensified zone on the tenth time marker.

k. Set the DELAY TIME control to precisely position the leading edge of the delayed time marker to the first graticule line.

l. CHECK—delay time readout for 8.905 ms to 9.095 ms.

### B17. Check Delay Time Jitter

a. Set the companion time-base unit sweep rate to  $2 \mu\text{s}/\text{div}$ . Set the time-mark generator for  $10 \mu\text{s}$  markers.

b. Set the DELAY TIME control for a delay-time readout of approximately 1.000 ms

c. Set the DELAY TIME control further to position a delayed-sweep time marker near the display center.

d. Magnify the companion time-base unit sweep rate to  $200 \text{ ns}/\text{div}$  (MAG X10) and position the delayed-sweep time marker near the graticule center.

e. CHECK—for 1 division or less jitter.

f. Set the companion time-base unit for X1 sweep magnification ( $2 \mu\text{s}/\text{div}$ ). Set the DELAY TIME control for a delay-time readout of approximately 9.000 ms.

g. CHECK—Repeat parts c through e.

h. Set the companion time-base unit sweep rate to  $20 \text{ ns}/\text{div}$  and magnification to X1. Set the time-mark generator for  $0.1 \mu\text{s}$  markers.

i. Set the 7B85 TIME/DIV switch to  $10 \mu\text{s}$ .

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j. Set the DELAY TIME control for a delay-time readout of approximately 10.00  $\mu$ s.

k. Set the DELAY TIME control further to position a delayed-sweep time marker near the display center.

l. Magnify the companion time-base unit sweep rate to 2 ns/div (MAG X10) and position the delayed-sweep time marker near the graticule center.

m. CHECK—for 1 division or less jitter.

n. Set the companion time-base unit sweep magnification to X1 (20 ns/div). Set the DELAY TIME control for a delay-time readout of approximately 90.00  $\mu$ s.

o. CHECK—Repeat parts k through m.

**B18. Check Sweep Timing**

**NOTE**

*The tolerances given in Table 5-4 are for an ambient temperature range of +15° to +35° C. If outside this range, see the Specification section for applicable tolerances.*

a. Set the POSITION controls to midrange and TRIGGERING MODE to NORM. Set the mainframe horizontal mode to A.

b. CHECK—Using the TIME/DIV setting and time-mark generator settings from Table 5-4, check sweep accuracy for 1 time mark/div over the center 8 divisions within the tolerance given in Table 5-4. Set the POSITION controls and TRIGGERING LEVEL control as necessary for a stable display aligned with the vertical graticule lines.

**NOTE**

*If the time-mark generator used does not have 1-2-5 sequence markers, apply 1 unit markers in place of 2 unit markers and check for 2 markers/div over the center 8 divisions of display, to the tolerances given in Tables 5-4 and 5-5.*

**Table 5-4  
SWEEP TIMING**

TIME/DIV	Time Markers	Tolerance (+ 15° to +35° C)
10 ns	10 ns	Within 0.2 div
20 ns	20 ns	Within 0.2 div
50 ns	50 ns	Within 0.2 div
.1 $\mu$ s	.1 $\mu$ s	Within 0.12 div
.2 $\mu$ s	.2 $\mu$ s	Within 0.12 div
.5 $\mu$ s	.5 $\mu$ s	Within 0.12 div
1 $\mu$ s	1 $\mu$ s	Within 0.12 div
2 $\mu$ s	2 $\mu$ s	Within 0.12 div
5 $\mu$ s	5 $\mu$ s	Within 0.12 div
10 $\mu$ s	10 $\mu$ s	Within 0.12 div
20 $\mu$ s	20 $\mu$ s	Within 0.12 div
50 $\mu$ s	50 $\mu$ s	Within 0.12 div
.1 ms	.1 ms	Within 0.12 div
.2 ms	.2 ms	Within 0.12 div
.5 ms	.5 ms	Within 0.12 div
1 ms	1 ms	Within 0.12 div
2 ms	2 ms	Within 0.12 div
5 ms	5 ms	Within 0.12 div
10 ms	10 ms	Within 0.12 div
20 ms	20 ms	Within 0.12 div
50 ms	50 ms	Within 0.12 div
.1 s	.1 s	Within 0.12 div
.2 s	.2 s	Within 0.12 div
.5 s	.5 s	Within 0.12 div
1 s	1 s	Within 0.32 div
2 s	2 s	Within 0.32 div
5 s	5 s	Within 0.32 div

**B19. Check Magnified Sweep Timing**

**NOTE**

*The tolerances in Table 5-5 are for an ambient temperature range of +15° to +35° C. If outside this range, see the Specification section for applicable tolerances.*

a. Set the POSITION controls to midrange. Set the MAG switch to X10 and the SOURCE switch to EXT.

b. Connect the time-mark generator trigger output to the EXT TRIG IN connector with a 50  $\Omega$  cable and 50  $\Omega$  termination.

c. CHECK—Using the TIME/DIV settings and time-mark generator settings in Table 5-5, check magnified sweep accuracy for 1 time mark/div, over the center 8 divisions, within the tolerance given in Table 5-5. Set the POSITION controls and TRIGGERING LEVEL control as necessary for a stable display aligned with the vertical graticule lines.

This completes the Performance Check and Adjustment procedure.

**Table 5-5**  
**MAGNIFIED SWEEP TIMING**

TIME/DIV	Time Markers	Tolerance (+ 15° to +35°C)
10 ns	2 ns	<sup>a</sup> Within 0.32 div
20 ns	2 ns	Within 0.32 div
50 ns	5 ns	Within 0.32 div
.1 $\mu$ s	10 ns	Within 0.2 div
.2 $\mu$ s	20 ns	Within 0.2 div
.5 $\mu$ s	50 ns	Within 0.2 div
1 $\mu$ s	.1 $\mu$ s	Within 0.2 div
2 $\mu$ s	.2 $\mu$ s	Within 0.2 div
5 $\mu$ s	.5 $\mu$ s	Within 0.2 div
10 $\mu$ s	1 $\mu$ s	Within 0.2 div
20 $\mu$ s	2 $\mu$ s	Within 0.2 div
50 $\mu$ s	5 $\mu$ s	Within 0.2 div
.1 ms	10 $\mu$ s	Within 0.2 div
.2 ms	20 $\mu$ s	Within 0.2 div
.5 ms	50 $\mu$ s	Within 0.2 div
1 ms	.1 ms	Within 0.2 div
2 ms	.2 ms	Within 0.2 div
5 ms	.5 ms	Within 0.2 div
10 ms	1 ms	Within 0.2 div
20 ms	2 ms	Within 0.2 div
50 ms	5 ms	Within 0.2 div
.1 s	10 ms	Within 0.2 div
.2 s	20 ms	Within 0.2 div
.5 s	50 ms	Within 0.2 div
1 s	.1 s	Within 0.4 div
2 s	.2 s	Within 0.4 div
5 s	.5 s	Within 0.4 div

<sup>a</sup>Check for 1 time-marker in 2 div over the center 8 div.

# INSTRUMENT OPTIONS

No options were available for this instrument at the time of this printing.

Information on any subsequent options may be found in the CHANGE INFORMATION section in the back of this manual.

# REPLACEABLE ELECTRICAL PARTS

## 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 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.

## SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number

00X Part removed after this serial number

## ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

## ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

## CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00853	SANGAMO WESTON INC COMPONENTS DIV	SANGAMO RD PO BOX 128	PICKENS SC 29671-9716
01121	ALLEN-BRADLEY CO	1201 S 2ND ST	MILWAUKEE WI 53204-2410
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPY PO BOX 655012	DALLAS TX 75265
02111	HAMILTON STANDARD CONTROLS INC SPECTROL DIV	17070 E GALE AVE P O BOX 1220	CITY OF INDUSTRY CA 91749
02114	AMPEREX ELECTRONIC CORP FERROXCUBE DIV	5083 KINGS HWY	SAUGERTIES NY 12477
02735	RCA CORP SOLID STATE DIVISION	ROUTE 202	SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT	W GENESEE ST	AUBURN NY 13021
04222	AVX CERAMICS DIV OF AVX CORP	19TH AVE SOUTH P O BOX 867	MYRTLE BEACH SC 29577
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS SECTOR	5005 E MCDOWELL RD	PHOENIX AZ 85008-4229
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIV	11901 MADISON AVE	CLEVELAND OH 44101
07263	FAIRCHILD SEMICONDUCTOR CORP NORTH AMERICAN SALES	10400 RIDGEVIEW CT	CUPERTINO CA 95014
07716	SUB OF SCHLUMBERGER LTD MS 118 TRW INC	2850 MT PLEASANT AVE	BURLINGTON IA 52601
12697	TRW IRC FIXED RESISTORS/BURLINGTON CLAROSTAT MFG CO INC	LOWER WASHINGTON ST	DOVER NH 03820
14433	ITT SEMICONDUCTORS DIV		WEST PALM BEACH FL
14552	MICROSEMI CORP	2830 S FAIRVIEW ST	SANTA ANA CA 92704-5948
14752	ELECTRO CUBE INC	1710 S DEL MAR AVE	SAN GABRIEL CA 91776-3825
18324	SIGNETICS CORP MILITARY PRODUCTS DIV	4130 S MARKET COURT	SACRAMENTO CA 95834-1222
19396	ILLINOIS TOOL WORKS INC PAKTRON DIV	1205 MCCONVILLE RD PO BOX 4539	LYNCHBURG VA 24502-4535
19701	MEPCO/CENTRALAB A NORTH AMERICAN PHILIPS CO	PO BOX 760	MINERAL WELLS TX 76067-0760
20932	MINERAL WELLS AIRPORT KYOCERA INTERNATIONAL INC	11620 SORRENTO VALLEY RD PO BOX 81543 PLANT NO 1	SAN DIEGO CA 92121
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701-3737
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA CA 95051-0606
31918	ITT SCHADOW INC	8081 WALLACE RD	EDEN PRAIRIE MN 55344-2224
32293	INTERSIL INC SUB OF GENERAL ELECTRIC CO	10600 RIDGEVIEW COURT	CUPERTINO CA 95014-0704
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507-2114
50434	HEWLETT-PACKARD CO OPTOELECTRONICS DIV	370 W TRIMBLE RD	SAN JOSE CA 95131
51984	NEC AMERICA INC	2741 PROSPERITY AVE	FAIRFAX VA 22031-4308
52763	STETCO INC	3344 SCHIERHORN	FRANKLIN PARK IL 60131
54473	MATSUSHITA ELECTRIC CORP OF AMERICA	ONE PANASONIC WAY PO BOX 1501	SECAUCUS NJ 07094-2917
56289	SPRAGUE ELECTRIC CO WORLD HEADQUARTERS	92 HAYDEN AVE	LEXINGTON MA 02173-7929
57668	ROHM CORP	8 WHATNEY PO BOX 19515	IRVINE CA 92713
58361	QUALITY TECHNOLOGIES CORP	3400 HILLVIEW AVE	PALO ALTO CA 94304-1319
58854	GTE PRODUCTS CORP LIGHTING PRODUCTS GROUP	60 BOSTON ST	SALEM MA 01970-2147
59660	TUSONIX INC	7741 N BUSINESS PARK DR PO BOX 37144	TUCSON AZ 85740-7144
59821	MEPCO/CENTRALAB A NORTH AMERICAN PHILIPS CO	7158 MERCHANT AVE	EL PASO TX 79915-1207
74970	JOHNSON E F CO	299 10TH AVE S W	WASECA MN 56093-2539
75042	IRC ELECTRONIC COMPONENTS PHILADELPHIA DIV TRW FIXED RESISTORS	401 N BROAD ST	PHILADELPHIA PA 19108-1001



## CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

<u>Mfr. Code</u>	<u>Manufacturer</u>	<u>Address</u>	<u>City, State, Zip Code</u>
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
91637	DALE ELECTRONICS INC	2064 12TH AVE PO BOX 609	COLUMBUS NE 68601-3632
TK1345	ZMAN AND ASSOCIATES	7633 S 180TH	KENT WA 98032

Replaceable Electrical Parts - 7B85

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Discort	Name & Description	Mfr. Code	Mfr. Part No.
A1	-----			(CKT BOARD ASSY:INTERFACE) (REPLACEABLE UNDER 672-0540-XX ONLY)		
A2	670-4181-00	B010100	B069999	CIRCUIT BD ASSY:TRIGGER	80009	670-4181-00
A2	670-4181-01	B070000		CIRCUIT BD ASSY:TRIGGER	80009	670-4181-01
A3	670-4183-00			CIRCUIT BD ASSY:READOUT	80009	670-4183-00
A4	670-4184-00	B010100	B088749	CIRCUIT BD ASSY:DVM	80009	670-4184-00
A4	670-4184-01	B088750		CIRCUIT BD ASSY:DVM	80009	670-4184-01
C3	290-0748-00			CAP, FXD, ELCTLT:10UF, +50-20%, 25WVDC	54473	ECE-BIEV100S
C5	290-0748-00			CAP, FXD, ELCTLT:10UF, +50-20%, 25WVDC	54473	ECE-BIEV100S
C7	290-0748-00			CAP, FXD, ELCTLT:10UF, +50-20%, 25WVDC	54473	ECE-BIEV100S
C9	290-0534-00			CAP, FXD, ELCTLT:1UF, 20%, 35V	05397	T368A105M035AZ
C12	281-0661-00			CAP, FXD, CER DI:0.8PF, +/-0.1PF, 500V	52763	2RDPLZ007 0P80BC
C14	281-0503-00			CAP, FXD, CER DI:8PF, +/-0.5PF, 500V	52763	2RDPLZ007 8P00DC
C15	283-0005-00			CAP, FXD, CER DI:0.01UF, +100-0%, 250V	04222	SR303E103ZAA
C20	281-0505-00			CAP, FXD, CER DI:12PF, 10%, 500V	59660	301-000C0G0-120K
C21	283-0299-00			CAP, FXD, CER DI:51PF, 5%, 500V	04222	SR157A51QJAA
C22	283-0299-00			CAP, FXD, CER DI:51PF, 5%, 500V	04222	SR157A51QJAA
C23	281-0812-00	B070000		CAP, FXD, CER DI:1000PF, 10%, 100V	04222	MA101C102KAA
C30	281-0773-00	B010100	B069999	CAP, FXD, CER DI:0.01UF, 10%, 100V	04222	MA201C103KAA
C30	281-0813-00	B070000		CAP, FXD, CER DI:0.047UF, 20%, 50V	05397	C412C473M5V2CA
C34	281-0525-00			CAP, FXD, CER DI:470PF, +/-94PF, 500V	52763	2RDPLZ007 470PMO
C35	281-0551-00			CAP, FXD, CER DI:390PF, 10%, 500V	52763	2RDPLZ007 390PMO
C37	281-0773-00			CAP, FXD, CER DI:0.01UF, 10%, 100V	04222	MA201C103KAA
C43	283-0203-00			CAP, FXD, CER DI:0.47UF, 20%, 50V	04222	SR305SC474MAA
C46	281-0792-00			CAP, FXD, CER DI:82PF, 10%, 100V	04222	SA102A820KAA
C51	283-0111-00			CAP, FXD, CER DI:0.1UF, 20%, 50V	04222	SR305C104MAA
C52	283-0111-00			CAP, FXD, CER DI:0.1UF, 20%, 50V	04222	SR305C104MAA
C53	281-0773-00			CAP, FXD, CER DI:0.01UF, 10%, 100V	04222	MA201C103KAA
C56	283-0010-00	B010100	B039999	CAP, FXD, CER DI:0.05UF, +80-20%, 50V	04222	SR305E503ZAA
C56	283-0341-00	B040000		CAP, FXD, CER DI:0.047UF, 10%, 100V	04222	SR301C473KAA
C57	283-0203-00			CAP, FXD, CER DI:0.47UF, 20%, 50V	04222	SR305SC474MAA
C66	283-0111-00			CAP, FXD, CER DI:0.1UF, 20%, 50V	04222	SR305C104MAA
C67	281-0773-00			CAP, FXD, CER DI:0.01UF, 10%, 100V	04222	MA201C103KAA
C68	283-0195-00			CAP, FXD, CER DI:680PF, 5%, 50V	04222	SR205A681JAA
C69	281-0773-00			CAP, FXD, CER DI:0.01UF, 10%, 100V	04222	MA201C103KAA
C71	281-0773-00			CAP, FXD, CER DI:0.01UF, 10%, 100V	04222	MA201C103KAA
C72	290-0580-00			CAP, FXD, ELCTLT:0.27UF, 20%, 50V	05397	T368A274M050AZ
C73	283-0114-00			CAP, FXD, CER DI:1500PF, 5%, 200V	59660	805-534-Y5D0152J
C74	283-0114-00			CAP, FXD, CER DI:1500PF, 5%, 200V	59660	805-534-Y5D0152J
C75	281-0773-00			CAP, FXD, CER DI:0.01UF, 10%, 100V	04222	MA201C103KAA
C76	290-0580-00			CAP, FXD, ELCTLT:0.27UF, 20%, 50V	05397	T368A274M050AZ
C84	281-0773-00			CAP, FXD, CER DI:0.01UF, 10%, 100V	04222	MA201C103KAA
C85	283-0111-00			CAP, FXD, CER DI:0.1UF, 20%, 50V	04222	SR305C104MAA
C88	281-0773-00			CAP, FXD, CER DI:0.01UF, 10%, 100V	04222	MA201C103KAA
C89	281-0786-00			CAP, FXD, CER DI:150PF, 10%, 100V	04222	MA101A151KAA
C92	281-0773-00			CAP, FXD, CER DI:0.01UF, 10%, 100V	04222	MA201C103KAA
C99	281-0786-00	B050000		CAP, FXD, CER DI:150PF, 10%, 100V	04222	MA101A151KAA
C204	283-0000-00	B010100	B093999	CAP, FXD, CER DI:0.001UF, +100-0%, 500V	59660	831-610-Y5U0102P
C204	281-0772-00	B094000		CAP, FXD, CER DI:4700PF, 10%, 100V	04222	MA201C472KAA
C211	283-0672-00			CAP, FXD, MICA DI:200PF, 1%, 500V	00853	D155F2010FO
C212	283-0555-00			CAP, FXD, MICA DI:2000PF, 1%, 500V	00853	D195F202FO
C213	285-0683-00			CAP, FXD, PLASTIC:0.022UF, 5%, 100V	19396	223J01PT485
C214	290-0269-00			CAP, FXD, ELCTLT:0.22UF, 5%, 35V	05397	T320A224J035AS
C215	290-0523-00			CAP, FXD, ELCTLT:2.2UF, 20%, 20V	05397	T368A225M020AS
C221	283-0111-00	B010100	B093999	CAP, FXD, CER DI:0.1UF, 20%, 50V	04222	SR305C104MAA
C221	281-0775-00	B094000		CAP, FXD, CER DI:0.1UF, 20%, 50V	04222	MA205E104MAA
C222	283-0110-00	B010100	B093999	CAP, FXD, CER DI:0.005UF, +80-20%, 150V	59660	855-547-E-502Z

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
C222	281-0772-00	B094000		CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
C225	290-0536-00			CAP,FXD,ELCTLT:10UF,20%,25V TANTALUM	05397	T368B106M025AS
C228	290-0534-00			CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
C255	283-0028-00			CAP,FXD,CER DI:0.0022UF,20%,50V	59660	0805585Y5S0222M
C263	281-0782-00	B010100	B088749	CAP,FXD,CER DI:33 PF,10%,500V	52763	2RDPLZ007 33POKE
C263	281-0629-00	B088750		CAP,FXD,CER DI:33PF,5%,600V	52763	2RDPLZ007 33POJC
C273	281-0815-00	B094000		CAP,FXD,CER DI:0.027UF,20%,50V	04222	MA205C273MAA
C312	283-0691-00			CAP,FXD,MICA DI:650PF,1%,300V	00853	D153F651FO
C324	283-0111-00	B010100	B093999	CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
C324	281-0775-00	B094000		CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
C330	281-0166-00			CAP,VAR,AIR DI:1.9-15.7 PF,250V	74970	187-0109-055
C331	283-0633-00			CAP,FXD,MICA DI:77PF,1%,100V	00853	D155E770FO
C332	295-0172-00			CAP SET,MATCHED:0.1UF,10UF,898PF,MATCHED	80009	295-0172-00
C333	283-0111-00	B010100	B093999	CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
C333	281-0775-00	B094000		CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
C334	295-0172-00			CAP SET,MATCHED:0.1UF,10UF,898PF,MATCHED	80009	295-0172-00
C335	283-0111-00	B010100	B093999	CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
C335	281-0775-00	B094000		CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
C336	295-0172-00			CAP SET,MATCHED:0.1UF,10UF,898PF,MATCHED	80009	295-0172-00
C353	281-0763-00	B094000		CAP,FXD,CER DI:47PF,10%,100V	04222	MA101A470KAA
C353	281-0772-00	B094000		CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
C356	283-0616-00			CAP,FXD,MICA DI:75PF,5%,500V	00853	D155E750J0
C416	283-0003-00	B010100	B093999	CAP,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCSX
C416	290-0534-00	B094000		CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
C432	283-0111-00	B010100	B093999	CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
C432	281-0775-00	B094000		CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
C440	281-0616-00	B010100	B093999	CAP,FXD,CER DI:6.8PF,+/-0.5PF,200V	52763	2RDPLZ007 6P80DC
C441	281-0592-00			CAP,FXD,CER DI:4.7PF,+/-0.5PF,500V	52763	2RDPLZ007 4P70DC
C515	283-0004-00	B010100	B039999	CAP,FXD,CER DI:0.02UF,+80-20%,150V	59660	855-558Z5V0203Z
C515	283-0111-00	B040000	B093999	CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
C520	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
C522	283-0119-00			CAP,FXD,CER DI:2200PF,5%,200V	59660	855-XXX5E0222J
C523	290-0527-00			CAP,FXD,ELCTLT:15UF,20%,20V	05397	T368B156M020AS
C526	290-0527-00			CAP,FXD,ELCTLT:15UF,20%,20V	05397	T368B156M020AS
C530	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
C532	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
C556	281-0826-00	B092075		CAP,FXD,CER DI:2200PF,10%,100V	20932	401EM100AD222K
C573	290-0527-00			CAP,FXD,ELCTLT:15UF,20%,20V	05397	T368B156M020AS
C576	283-0111-00	B050000	B093999	CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
C576	281-0775-00	B094000		CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
C608	281-0791-00	B010100	B088749	CAP,FXD,CER DI:270PF,10%,100V	04222	MA101C271KAA
C626	281-0762-00	B088750		CAP,FXD,CER DI:27PF,20%,100V	04222	MA101A270MAA
C627	285-0809-00	B010100	B092054	CAP,FXD,PLASTIC:1UF,10%,50V	56289	LP66A1A105K
C627	285-1056-00	B092055		CAP,FXD,PLASTIC:1UF,2%,50V	14752	650B1A105G
C645	281-0786-00	B010100	B088749	CAP,FXD,CER DI:150PF,10%,100V	04222	MA101A151KAA
C652	285-0627-00	B010100	B088749	CAP,FXD,PLASTIC:0.0033UF,5%,100V	07716	TEK44-33251
C654	283-0032-00	B010100	B088749	CAP,FXD,CER DI:470PF,5%,500V	59660	831-000-Z5E0471J
C662	281-0786-00	B010100	B088749	CAP,FXD,CER DI:150PF,10%,100V	04222	MA101A151KAA
C676	283-0673-00	B010100	B088749	CAP,FXD,MICA DI:455PF,1%,500V	00853	D155F4550F0
C679	283-0198-00	B010100	B088749	CAP,FXD,CER DI:0.22UF,20%,50V	05397	C330C224M5U1CA
C683	290-0512-00	B010100	B088749	CAP,FXD,ELCTLT:22UF,20%,15V	05397	T368B226M015AS
C684	283-0000-00	B010100	B088749	CAP,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-610-Y5U0102P
C686	281-0791-00	B010100	B088749	CAP,FXD,CER DI:270PF,10%,100V	04222	MA101C271KAA
C686	283-0691-00	B088750		CAP,FXD,MICA DI:650PF,1%,300V	00853	D153F651FO
C687	281-0773-00	B088750		CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
C690	290-0531-00	B010100	B059999	CAP,FXD,ELCTLT:100UF,20%,10V	05397	T368C107M010AS
C691	290-0748-00			CAP,FXD,ELCTLT:10UF,+50-20%,25WVDC	54473	ECE-BIEV100S
C692	290-0748-00			CAP,FXD,ELCTLT:10UF,+50-20%,25WVDC	54473	ECE-BIEV100S

Replaceable Electrical Parts - 7B85

Component No.	Tektronix	Serial/Assembly No.		Name & Description	Mfr.	Mfr. Part No.
	Part No.	Effective	Discont		Code	
C693	281-0775-00	B088750		CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
C694	290-0748-00	B088750		CAP,FXD,ELCTLT:10UF,+50-20%,25WVDC	54473	ECE-B1EV100S
C695	283-0111-00	B010100	B088794	CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
C696	290-0535-00	B010100	B059999	CAP,FXD,ELCTLT:33UF,20%,10V TANTALUM	56289	196D336X0010KA1
C697	290-0748-00	B010100	B088749	CAP,FXD,ELCTLT:10UF,+50-20%,25WVDC	54473	ECE-B1EV100S
C699	281-0786-00	B010100	B088749	CAP,FXD,CER DI:150PF,10%,100V	04222	MA101A151KAA
C712	290-0420-00			CAP,FXD,ELCTLT:0.68UF,20%,75V	05397	T110A684M075AS
C722	283-0054-00	B010100	B093999	CAP,FXD,CER DI:150PF,5%,200V	59660	855-535 U2J0151J
C730	283-0110-00	B010100	B093999	CAP,FXD,CER DI:0.005UF,+80-20%,150V	59660	855-547-E-502Z
C730	281-0772-00	B094000		CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
C731	283-0204-00	B010100	B093999	CAP,FXD,CER DI:0.01UF,20%,50V	04222	SR155E103MAA
C731	281-0772-00	B094000		CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
C810	283-0178-00	B010100	B093999	CAP,FXD,CER DI:0.1UF,20%,100V	05397	C330C104Z1U1CA
C810	281-0775-00	B094000	B094870	CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
C810	283-0167-00	B094871		CAP,FXD,CER DI:0.1UF,10%,100V	04222	SR301C104KAA
C820	290-0745-00			CAP,FXD,ELCTLT:22UF,+50-20%,25WVDC	54473	ECE-A25V22L
C822	283-0004-00	B010100	B093999	CAP,FXD,CER DI:0.02UF,+80-20%,150V	59660	855-558Z5V0203Z
C830	290-0745-00			CAP,FXD,ELCTLT:22UF,+50-20%,25WVDC	54473	ECE-A25V22L
C840	290-0745-00			CAP,FXD,ELCTLT:22UF,+50-20%,25WVDC	54473	ECE-A25V22L
C844	283-0004-00	B010100	B093999	CAP,FXD,CER DI:0.02UF,+80-20%,150V	59660	855-558Z5V0203Z
CR23	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR24	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR53	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR55	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR71	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR75	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR201	152-0153-00	B010100	B093999	SEMICON DVC,DI:SW,SI,10V,50MA,.DO-7	07263	F07003
CR202	152-0153-00	B094000		SEMICON DVC,DI:SW,SI,10V,50MA,.DO-7	07263	F07003
CR206	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR208	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR224	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR225	152-0141-02	B010100	B093999	SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR226	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR248	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR250	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR252	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR254	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR255	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR256	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR264	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR273	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR286	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR288	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR291	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR292	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR293	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR294	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR295	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR296	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR301	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR302	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR314	152-0141-02	B040000		SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR323	152-0322-00			SEMICON DVC,DI:SCHOTTKY,SI,15V,1.2PF,DO-35	50434	5082-2672
CR324	152-0242-00	B040000		SEMICON DVC,DI:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
CR334	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR344	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR356	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR362	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
CR372	152-0322-00			SEMICON DVC,DI: SCHOTTKY,SI,15V,1.2PF,DO-35	50434	5082-2672
CR382	152-0141-02	B010100	B093999	SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR423	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR433	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR435	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR526	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR543	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR548	152-0141-02	B088750		SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR567	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR574	152-0141-02	B010100	B093999	SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR578	152-0141-02	B094000		SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR579	152-0141-02	B094000		SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR627	152-0246-00	B010100	B088749	SEMICON DVC,DI:SW,SI,40V,200MA,DO-7	14433	WG1537TK
CR632	152-0141-02	B088750		SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR634	152-0141-02	B088750		SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR635	152-0141-02	B088750		SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR641	152-0141-02	B010100	B088794	SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR642	152-0141-02	B010100	B088794	SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR643	152-0141-02	B088750		SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR683	152-0141-02	B010100	B088749	SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR684	152-0322-00	B010100	B088794	SEMICON DVC,DI: SCHOTTKY,SI,15V,1.2PF,DO-35	50434	5082-2672
CR717	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR718	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR723	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR724	152-0141-02	B010100	B093999	SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR725	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR751	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR752	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR753	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR754	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR763	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR772	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR773	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR782	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR783	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR785	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR786	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
CR844	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
DS220	150-1029-00	B010100	B095373	LT EMITTING DIO:GREEN,565NM,35MA	58361	Q6480/MV5274C
DS220	150-1078-00	B095374		LT EMITTING DIO:GREEN,565NM,20MA	50434	HLMP-1503
DS232	150-1033-00			LT EMITTING DIO:AMBER,585NM,40MA MAX	50434	HLMP-1401
DS810	150-0048-01			LAMP, INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
DS820	150-0048-01			LAMP, INCAND:5V,0.06A,#683,AGED & SEL	58854	683AS15
E578	276-0507-00			SHLD BEAD, ELEK:FERRITE	02114	56-590-65B/3B
L274	276-0507-00			SHLD BEAD, ELEK:FERRITE	02114	56-590-65B/3B
L382	276-0507-00	B010100	B093999	SHLD BEAD, ELEK:FERRITE	02114	56-590-65B/3B
L691	108-0543-00			COIL, RF:FIXED, 1.1UH	TK1345	108-0543-00
L692	108-0543-00	B010100	B088749	COIL, RF:FIXED, 1.1UH	TK1345	108-0543-00
L694	108-0543-00	B088750		COIL, RF:FIXED, 1.1UH	TK1345	108-0543-00
L697	108-0543-00	B010100	B088749	COIL, RF:FIXED, 1.1UH	TK1345	108-0543-00
LR3	108-0543-00			COIL, RF:FIXED, 1.1UH	TK1345	108-0543-00
LR5	108-0537-00			COIL, RF:FIXED, 200UH	80009	108-0537-00
LR7	108-0543-00			COIL, RF:FIXED, 1.1UH	TK1345	108-0543-00
LR70	108-0328-00			COIL, RF:FIXED, 275UH	TK1345	108-0328-00
LR75	108-0328-00			COIL, RF:FIXED, 275UH	TK1345	108-0328-00
LR326	108-0271-00			COIL, RF:FIXED, 245NH	80009	108-0271-00
LR810	108-0537-00			COIL, RF:FIXED, 200UH	80009	108-0537-00
LR820	108-0537-00			COIL, RF:FIXED, 200UH	80009	108-0537-00

Replaceable Electrical Parts - 7885

Component No.	Tektronix	Serial/Assembly No.		Name & Description	Mfr.	Mfr. Part No.
	Part No.	Effective	Discont		Code	
LR830	108-0537-00			COIL, RF: FIXED, 200UH	80009	108-0537-00
LR840	108-0537-00			COIL, RF: FIXED, 200UH	80009	108-0537-00
Q22	151-1042-00			SEMICON DVC SE:FET, SI, TO-92	80009	151-1042-00
Q48	151-0190-00	B070000		TRANSISTOR: NPN, SI, TO-92	80009	151-0190-00
Q88	151-0223-00			TRANSISTOR: NPN, SI, 625MW, TO-92	80009	151-0223-00
Q92	151-0271-00	B010100	B088450	TRANSISTOR: PNP, SI, TO-92	04713	SPS8236
Q92	151-0221-00	B088451		TRANSISTOR: PNP, SI, TO-92	80009	151-0221-00
Q96	151-0271-00	B010100	B088450	TRANSISTOR: PNP, SI, TO-92	04713	SPS8236
Q96	151-0221-00	B088451		TRANSISTOR: PNP, SI, TO-92	80009	151-0221-00
Q98	151-0325-00	B010100	B083999	TRANSISTOR: PNP, SI, TO-92, SEL	80009	151-0325-00
Q98	151-0342-00	B084000		TRANSISTOR: PNP, SI, TO-92	07263	S035928
Q201	151-0325-00	B010100	B083999	TRANSISTOR: PNP, SI, TO-92, SEL	80009	151-0325-00
Q201	151-0221-00	B084000		TRANSISTOR: PNP, SI, TO-92	80009	151-0221-00
Q202	151-0325-00			TRANSISTOR: PNP, SI, TO-92, SEL	80009	151-0325-00
Q203	151-0220-00	B010100	B029999	TRANSISTOR: PNP, SI, TO-92	80009	151-0220-00
Q203	151-0216-00	B030000		TRANSISTOR: PNP, SI, TO-92	04713	SPS8803
Q204	151-0223-00			TRANSISTOR: NPN, SI, 625MW, TO-92	80009	151-0223-00
Q206	151-0223-00			TRANSISTOR: NPN, SI, 625MW, TO-92	80009	151-0223-00
Q210	151-0273-00			TRANSISTOR: SELECTED	03508	X16E3616
Q214	151-0220-00			TRANSISTOR: PNP, SI, TO-92	80009	151-0220-00
Q230	151-0302-00			TRANSISTOR: NPN, SI, TO-18	04713	ST899
Q234	151-0301-00			TRANSISTOR: PNP, SI, TO-18	80009	151-0301-00
Q242	151-0223-00			TRANSISTOR: NPN, SI, 625MW, TO-92	80009	151-0223-00
Q252	151-0190-00			TRANSISTOR: NPN, SI, TO-92	80009	151-0190-00
Q254	151-0190-00			TRANSISTOR: NPN, SI, TO-92	80009	151-0190-00
Q262	151-0223-00			TRANSISTOR: NPN, SI, 625MW, TO-92	80009	151-0223-00
Q264	151-0223-00			TRANSISTOR: NPN, SI, 625MW, TO-92	80009	151-0223-00
Q272	151-0223-00			TRANSISTOR: NPN, SI, 625MW, TO-92	80009	151-0223-00
Q274	151-0223-00			TRANSISTOR: NPN, SI, 625MW, TO-92	80009	151-0223-00
Q282	151-0190-00			TRANSISTOR: NPN, SI, TO-92	80009	151-0190-00
Q284	151-0223-00			TRANSISTOR: NPN, SI, 625MW, TO-92	80009	151-0223-00
Q288	151-0190-00			TRANSISTOR: NPN, SI, TO-92	80009	151-0190-00
Q292	151-0190-00	B010100	B088749	TRANSISTOR: NPN, SI, TO-92	80009	151-0190-00
Q292	151-0192-00	B088750		TRANSISTOR: NPN, SI, TO-92	04713	SPS8801
Q294	151-0221-00	B010100	B088749	TRANSISTOR: NPN, SI, TO-92	80009	151-0221-00
Q294	151-0220-00	B088750		TRANSISTOR: PNP, SI, TO-92	80009	151-0220-00
Q304	151-0354-00			TRANSISTOR: PNP, SI, TO-78	32293	ITS-1200-A
Q314	151-0220-00			TRANSISTOR: PNP, SI, TO-92	80009	151-0220-00
Q322	151-0367-00			TRANSISTOR: NPN, SI, TO-92	04713	SPS 8811
Q324	151-0367-00			TRANSISTOR: NPN, SI, TO-92	04713	SPS 8811
Q334	151-1036-00			TRANSISTOR: FET, N-CHAN, SI, TO-71	80009	151-1036-00
Q338	151-0437-00	B010100	B083449	TRANSISTOR: SELECTED	80009	151-0437-00
Q338	151-0127-00	B083450	B096834	TRANSISTOR: NPN, SI, TO-18	04713	SL6073A
Q338	151-0427-00	B096835		TRANSISTOR: NPN, SI, TO-92	07263	S39287
Q344	151-0220-00			TRANSISTOR: PNP, SI, TO-92	80009	151-0220-00
Q346	151-0220-00			TRANSISTOR: PNP, SI, TO-92	80009	151-0220-00
Q352	151-0325-00	B010100	B083999	TRANSISTOR: PNP, SI, TO-92, SEL	80009	151-0325-00
Q352	151-0221-00	B084000		TRANSISTOR: PNP, SI, TO-92	80009	151-0221-00
Q356	151-0325-00	B010100	B083999	TRANSISTOR: PNP, SI, TO-92, SEL	80009	151-0325-00
Q356	151-0221-00	B084000		TRANSISTOR: PNP, SI, TO-92	80009	151-0221-00
Q358	151-0223-00			TRANSISTOR: NPN, SI, 625MW, TO-92	80009	151-0223-00
Q362	151-0325-00	B010100	B083999	TRANSISTOR: PNP, SI, TO-92, SEL	80009	151-0325-00
Q362	151-0221-00	B084000		TRANSISTOR: PNP, SI, TO-92	80009	151-0221-00
Q372	151-0223-00			TRANSISTOR: NPN, SI, 625MW, TO-92	80009	151-0223-00
Q382	151-0367-00			TRANSISTOR: NPN, SI, TO-92	04713	SPS 8811
Q424	151-0220-00			TRANSISTOR: PNP, SI, TO-92	80009	151-0220-00
Q428	151-0325-00			TRANSISTOR: PNP, SI, TO-92, SEL	80009	151-0325-00
Q434	151-0220-00			TRANSISTOR: PNP, SI, TO-92	80009	151-0220-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Discnt	Name & Description	Mfr. Code	Mfr. Part No.
Q438	151-0325-00			TRANSISTOR:PNP,SI,TO-92,SEL	80009	151-0325-00
Q448	151-0472-00			TRANSISTOR:NPN,SI,TO-92	51984	NE41632B
Q458	151-0472-00			TRANSISTOR:NPN,SI,TO-92	51984	NE41632B
Q512	151-0354-00			TRANSISTOR:PNP,SI,TO-78	32293	ITS-1200-A
Q518	151-0410-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS6765
Q522	151-0354-00			TRANSISTOR:PNP,SI,TO-78	32293	ITS-1200-A
Q528	151-0410-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS6765
Q534	151-0220-00	B010100	B088749	TRANSISTOR:PNP,SI,TO-92	80009	151-0220-00
Q534	151-0216-00	B088750		TRANSISTOR:PNP,SI,TO-92	04713	SPS8803
Q536	151-0410-00	B010100	B088749	TRANSISTOR:PNP,SI,TO-92	04713	SPS6765
Q536	151-0216-00	B088750		TRANSISTOR:PNP,SI,TO-92	04713	SPS8803
Q546	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
Q548	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q562	151-0223-00			TRANSISTOR:NPN,SI,625MW,TO-92	80009	151-0223-00
Q564	151-0223-00			TRANSISTOR:NPN,SI,625MW,TO-92	80009	151-0223-00
Q568	151-0223-00			TRANSISTOR:NPN,SI,625MW,TO-92	80009	151-0223-00
Q572	151-0223-00			TRANSISTOR:NPN,SI,625MW,TO-92	80009	151-0223-00
Q574	151-0223-00			TRANSISTOR:NPN,SI,625MW,TO-92	80009	151-0223-00
Q576	151-0223-00			TRANSISTOR:NPN,SI,625MW,TO-92	80009	151-0223-00
Q578	151-0223-00			TRANSISTOR:NPN,SI,625MW,TO-92	80009	151-0223-00
Q582	151-1059-00			TRANSISTOR:FET,N-CHAN,30MW,TO-92 CASE	04713	ORDER BY DESCR
Q592	151-1059-00			TRANSISTOR:FET,N-CHAN,30MW,TO-92 CASE	04713	ORDER BY DESCR
Q612	151-0192-00	B010100	B088794	TRANSISTOR:NPN,SI,TO-92	04713	SPS8801
Q618	151-0410-00	B010100	B088749	TRANSISTOR:PNP,SI,TO-92	04713	SPS6765
Q618	151-0216-00	B088750		TRANSISTOR:PNP,SI,TO-92	04713	SPS8803
Q632	151-0192-00	B010100	B088794	TRANSISTOR:NPN,SI,TO-92	04713	SPS8801
Q636	151-0220-00	B010100	B088794	TRANSISTOR:PNP,SI,TO-92	80009	151-0220-00
Q642	151-0192-00	B010100	B088794	TRANSISTOR:NPN,SI,TO-92	04713	SPS8801
Q642	151-0301-00	B088750		TRANSISTOR:PNP,SI,TO-18	80009	151-0301-00
Q646	151-0190-00	B010100	B088794	TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q652	151-0192-00	B010100	B088794	TRANSISTOR:NPN,SI,TO-92	04713	SPS8801
Q654	151-0192-00	B010100	B088794	TRANSISTOR:NPN,SI,TO-92	04713	SPS8801
Q672	151-0220-00	B010100	B088749	TRANSISTOR:PNP,SI,TO-92	80009	151-0220-00
Q676	151-0220-00	B010100	B088749	TRANSISTOR:PNP,SI,TO-92	80009	151-0220-00
Q678	151-0190-00	B010100	B088749	TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
Q696	151-0350-00	B010100	B088749	TRANSISTOR:PNP,SI,TO-92	04713	SPS6700
Q732	151-0410-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS6765
Q844	151-0301-00			TRANSISTOR:PNP,SI,TO-18	80009	151-0301-00
R8	315-0512-00	B010100	B069999	RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R8	315-0622-00	B070000		RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
R9	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R12	315-0915-00			RES,FXD,FILM:9.1M OHM,5%,0.25W	01121	CB9155
R13	317-0470-00	B070000		RES,FXD,CMPSN:47 OHM,5%,0.125W	01121	BB4705
R14	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
R15	315-0824-00			RES,FXD,FILM:820K OHM,5%,0.25W	19701	5043CX820K0J
R16	315-0274-00			RES,FXD,FILM:270K OHM,5%,0.25W	57668	NTR25J-E270K
R19	315-0274-00			RES,FXD,FILM:270K OHM,5%,0.25W	57668	NTR25J-E270K
R20	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R21	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
R22	315-0272-00			RES,FXD,FILM:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
R23	315-0751-00	B070000		RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
R28	315-0822-00			RES,FXD,FILM:8.2K OHM,5%,0.25W	19701	5043CX8K200J
R29	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
R30	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
R31	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
R32	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
R33	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
R34	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K

Replaceable Electrical Parts - 7885

Component No.	Tektronix	Serial/Assembly No.		Name & Description	Mfr.	Mfr. Part No.
	Part No.	Effective	Discont		Code	
R35	315-0203-00			RES, FXD, FILM: 20K OHM, 5%, 0.25W	57668	NTR25J-E 20K
R36	315-0203-00			RES, FXD, FILM: 20K OHM, 5%, 0.25W	57668	NTR25J-E 20K
R37	315-0560-00			RES, FXD, FILM: 56 OHM, 5%, 0.25W	57668	NTR25J-E56E0
R38	317-0101-00	B085317		RES, FXD, CMPSN: 100 OHM, 5%, 0.125W	01121	BB1015
R41	315-0102-00			RES, FXD, FILM: 1K OHM, 5%, 0.25W	57668	NTR25JE01K0
R42	315-0473-00			RES, FXD, FILM: 47K OHM, 5%, 0.25W	57668	NTR25J-E47K0
R43	315-0752-00			RES, FXD, FILM: 7.5K OHM, 5%, 0.25W	57668	NTR25J-E07K5
R44	315-0103-00			RES, FXD, FILM: 10K OHM, 5%, 0.25W	19701	5043CX10K00J
R45	315-0102-00			RES, FXD, FILM: 1K OHM, 5%, 0.25W	57668	NTR25JE01K0
R47	315-0101-00			RES, FXD, FILM: 100 OHM, 5%, 0.25W	57668	NTR25J-E 100E
R48	315-0682-00	B070000		RES, FXD, FILM: 6.8K OHM, 5%, 0.25W	57668	NTR25J-E06K8
R49	311-1564-00	B070000		RES, VAR, NONNW: TRMR, 500 OHM, 0.5W	32997	3352T-CK5501
R50	315-0133-00			RES, FXD, FILM: 13K OHM, 5%, 0.25W	19701	5043CX13K00J
R51	321-0274-00			RES, FXD, FILM: 6.98K OHM, 1%, 0.125W, TC=TO	19701	5043ED6K980F
R52	321-0431-01			RES, FXD, FILM: 301K OHM, 0.5%, 0.125W, TC=TO	07716	CEAD30102D
R53	315-0124-00			RES, FXD, FILM: 120K OHM, 5%, 0.25W	19701	5043CX120K0J
R54	315-0622-00			RES, FXD, FILM: 6.2K OHM, 5%, 0.25W	19701	5043CX6K200J
R55	315-0202-00			RES, FXD, FILM: 2K OHM, 5%, 0.25W	57668	NTR25J-E 2K
R56	315-0104-00			RES, FXD, FILM: 100K OHM, 5%, 0.25W	57668	NTR25J-E100K
R57	315-0104-00			RES, FXD, FILM: 100K OHM, 5%, 0.25W	57668	NTR25J-E100K
R58	321-0443-00			RES, FXD, FILM: 402K OHM, 1%, 0.125W, TC=TO	19701	5043ED402K0F
R59	321-0443-00			RES, FXD, FILM: 402K OHM, 1%, 0.125W, TC=TO	19701	5043ED402K0F
R60	311-1192-00	B010100	B095250	RES, VAR, NONNW: PNL, 10K OHM, 1W, W/SW	12697	381-CM39695
R60	311-2303-00	B095251		RES, VAR, NONNW: PNL, 10K OHM, 10%, LINEAR, 0.25W	12697	CM45205
R61	315-0203-00			RES, FXD, FILM: 20K OHM, 5%, 0.25W	57668	NTR25J-E 20K
R62	315-0512-00			RES, FXD, FILM: 5.1K OHM, 5%, 0.25W	57668	NTR25J-E05K1
R63	315-0152-00			RES, FXD, FILM: 1.5K OHM, 5%, 0.25W	57668	NTR25J-E01K5
R64	315-0123-00			RES, FXD, FILM: 12K OHM, 5%, 0.25W	57668	NTR25J-E12K0
R65	315-0511-00			RES, FXD, FILM: 510 OHM, 5%, 0.25W	19701	5043CX510R0J
R67	323-0155-00			RES, FXD, FILM: 402 OHM, 1%, 0.5W, TC=TO	75042	CECT0-4020F
R68	315-0162-00			RES, FXD, FILM: 1.6K OHM, 5%, 0.25W	19701	5043CX1K600J
R69	315-0131-00	B010100	B069999	RES, FXD, FILM: 130 OHM, 5%, 0.25W	19701	5043CX130R0J
R69	315-0820-00	B070000		RES, FXD, FILM: 82 OHM, 5%, 0.25W	57668	NTR25J-E82E0
R72	315-0205-00			RES, FXD, FILM: 2M OHM, 5%, 0.25W	01121	CB2055
R73	315-0514-00			RES, FXD, FILM: 510K OHM, 5%, 0.25W	19701	5043CX510K0J
R74	315-0514-00			RES, FXD, FILM: 510K OHM, 5%, 0.25W	19701	5043CX510K0J
R76	315-0205-00			RES, FXD, FILM: 2M OHM, 5%, 0.25W	01121	CB2055
R80	311-1228-00			RES, VAR, NONNW: TRMR, 10K OHM, 0.5W	32997	3386F-T04-103
R83	315-0470-00			RES, FXD, FILM: 47 OHM, 5%, 0.25W	57668	NTR25J-E47E0
R84	315-0680-00			RES, FXD, FILM: 68 OHM, 5%, 0.25W	57668	NTR25J-E68E0
R85	311-1594-00			RES, VAR, NONNW: TRMR, 10 OHM, 0.5W	32997	3352T-1-100
R86	315-0470-00			RES, FXD, FILM: 47 OHM, 5%, 0.25W	57668	NTR25J-E47E0
R88	315-0100-00	B082252		RES, FXD, FILM: 10 OHM, 5%, 0.25W	19701	5043CX10RR00J
R89	315-0103-00			RES, FXD, FILM: 10K OHM, 5%, 0.25W	19701	5043CX10K00J
R90	315-0102-00			RES, FXD, FILM: 1K OHM, 5%, 0.25W	57668	NTR25JE01K0
R91	315-0470-00			RES, FXD, FILM: 47 OHM, 5%, 0.25W	57668	NTR25J-E47E0
R92	315-0102-00			RES, FXD, FILM: 1K OHM, 5%, 0.25W	57668	NTR25JE01K0
R93	321-0260-00			RES, FXD, FILM: 4.99K OHM, 1%, 0.125W, TC=TO	19701	5033ED4K990F
R94	321-0202-00			RES, FXD, FILM: 1.24K OHM, 1%, 0.125W, TC=TO	24546	NA55D1241F
R95	315-0470-00			RES, FXD, FILM: 47 OHM, 5%, 0.25W	57668	NTR25J-E47E0
R96	315-0470-00			RES, FXD, FILM: 47 OHM, 5%, 0.25W	57668	NTR25J-E47E0
R97	315-0221-00			RES, FXD, FILM: 220 OHM, 5%, 0.25W	57668	NTR25J-E220E
R98	315-0470-00			RES, FXD, FILM: 47 OHM, 5%, 0.25W	57668	NTR25J-E47E0
R99	315-0911-00			RES, FXD, FILM: 910 OHM, 5%, 0.25W	57668	NTR25J-E910E
R200	315-0201-00	B010100	B052214	RES, FXD, FILM: 200 OHM, 5%, 0.25W	57668	NTR25J-E200E
R201	315-0223-00			RES, FXD, FILM: 22K OHM, 5%, 0.25W	19701	5043CX22K00J92U
R202	315-0202-00			RES, FXD, FILM: 2K OHM, 5%, 0.25W	57668	NTR25J-E 2K
R203	315-0391-00			RES, FXD, FILM: 390 OHM, 5%, 0.25W	57668	NTR25J-E390E



Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Discnt	Name & Description	Mfr. Code	Mfr. Part No.
R204	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
R205	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
R206	321-0219-00			RES,FXD,FILM:1.87K OHM,1%,0.125W,TC=TO	07716	CEAD18700F
R207	321-0173-00			RES,FXD,FILM:619 OHM,1%,0.125W,TC=TO	07716	CEAD61900F
R208	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R209	321-0274-00			RES,FXD,FILM:6.98K OHM,1%,0.125W,TC=TO	19701	5043ED6K980F
R210	311-0467-00	B010100	B095250	RES,VAR,NONW:PNL,100K OHM,0.5W	01121	W7705B
R210	311-2306-00	B095251		RES,VAR,NONW:PNL,100K OHM,20%,0.5W	12697	CM43489
R211	301-0752-00			RES,FXD,FILM:7.5K OHM,5%,0.5W	19701	5053CX7K500J
R212	321-0373-00			RES,FXD,FILM:75.0K OHM,1%,0.125W,TC=TO	19701	5033ED75K00F
R213	321-0373-00			RES,FXD,FILM:75.0K OHM,1%,0.125W,TC=TO	19701	5033ED75K00F
R214	321-0327-00	B010100	B093999	RES,FXD,FILM:24.9K OHM,1%,0.125W,TC=TO	07716	CEAD24901F
R215	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R216	321-0327-00	B010100	B093999	RES,FXD,FILM:24.9K OHM,1%,0.125W,TC=TO	07716	CEAD24901F
R217	321-0288-00	B010100	B029999	RES,FXD,FILM:9.76K OHM,1%,0.125W,TC=TO	19701	5033ED9K760F
R217	321-0291-00	B030000		RES,FXD,FILM:10.5K OHM,1%,0.125W,TC=TO	19701	5033ED10K50F
R218	321-0274-00	B010100	B029999	RES,FXD,FILM:6.98K OHM,1%,0.125W,TC=TO	19701	5043ED6K980F
R218	321-0267-00	B030000		RES,FXD,FILM:5.90K OHM,1%,0.125W,TC=TO	19701	5033ED5K900F
R222	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R224	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
R225	315-0103-00	B094000		RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R226	315-0393-00			RES,FXD,FILM:39K OHM,5%,0.25W	57668	NTR25J-E39K0
R227	315-0121-00	B010100	B095373	RES,FXD,FILM:120 OHM,5%,0.25W	19701	5043CX120R0J
R227	315-0201-00	B095374		RES,FXD,FILM:200 OHM,5%,0.25W	57668	NTR25J-E200E
R228	315-0184-00			RES,FXD,FILM:180K OHM,5%,0.25W	19701	5043CX180K0J
R231	315-0432-00			RES,FXD,FILM:4.3K OHM,5%,0.25W	57668	NTR25J-E04K3
R232	315-0121-00			RES,FXD,FILM:120 OHM,5%,0.25W	19701	5043CX120R0J
R233	315-0561-00			RES,FXD,FILM:560 OHM,5%,0.25W	19701	5043CX560R0J
R234	315-0430-00			RES,FXD,FILM:43 OHM,5%,0.25W	19701	5043CX43R00J
R240	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
R241	315-0241-00			RES,FXD,FILM:240 OHM,5%,0.25W	19701	5043CX240R0J
R242	315-0332-00			RES,FXD,FILM:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
R243	315-0821-00			RES,FXD,FILM:820 OHM,5%,0.25W	19701	5043CX820R0J
R244	315-0432-00			RES,FXD,FILM:4.3K OHM,5%,0.25W	57668	NTR25J-E04K3
R248	315-0163-00			RES,FXD,FILM:16K OHM,5%,0.25W	57668	NTR25J-E 16K
R249	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
R250	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R251	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
R253	315-0912-00	B010100	B088749	RES,FXD,FILM:9.1K OHM,5%,0.25W	57668	NTR25J-E09K1
R253	315-0113-00	B088750		RES,FXD,FILM:11K OHM,5%,0.25W	19701	5043CX11K00J
R254	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R255	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
R256	315-0102-00	B010100	B088749	RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R257	315-0133-00	B010100	B088749	RES,FXD,FILM:13K OHM,5%,0.25W	19701	5043CX13K00J
R261	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R262	315-0472-00	B010100	B049999	RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R263	315-0122-00			RES,FXD,FILM:1.2K OHM,5%,0.25W	57668	NTR25J-E01K2
R264	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R271	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
R272	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R274	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
R275	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
R280	315-0820-00			RES,FXD,FILM:82 OHM,5%,0.25W	57668	NTR25J-E82E0
R281	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
R282	315-0624-00			RES,FXD,FILM:620K OHM,5%,0.25W	19701	5043CX620K0J
R283	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R284	315-0511-00	B010100	B088749	RES,FXD,FILM:510 OHM,5%,0.25W	19701	5043CX510R0J
R284	315-0471-00	B088750		RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E

Replaceable Electrical Parts - 7885

Component No.	Tektronix	Serial/Assembly No.		Name & Description	Mfr.	Mfr. Part No.
	Part No.	Effective	Discort		Code	
R285	315-0201-00			RES,FXD,FILM:200 OHM,5%,0.25W	57668	NTR25J-E200E
R286	315-0563-00			RES,FXD,FILM:56K OHM,5%,0.25W	19701	5043CX56K00J
R287	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
R288	315-0182-00			RES,FXD,FILM:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
R291	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
R292	315-0752-00			RES,FXD,FILM:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
R293	315-0303-00			RES,FXD,FILM:30K OHM,5%,0.25W	19701	5043CX30K00J
R294	315-0432-00			RES,FXD,FILM:4.3K OHM,5%,0.25W	57668	NTR25J-E04K3
R295	311-1322-00	B010100	B095250	RES,VAR,NONNW:PNL,5K OHM,1W,W/SW	12697	381-CM39701
R295	311-2304-00	B095251		RES,VAR,NONNW:PNL,5K OHM,10%,LINEAR	12697	CM45204
R296	315-0512-00	B010100	B088749	RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R296	315-0432-00	B088750		RES,FXD,FILM:4.3K OHM,5%,0.25W	57668	NTR25J-E04K3
R297	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
R301	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
R303	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R304	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R305	311-1228-00			RES,VAR,NONNW:TRMR,10K OHM,0.5W	32997	3386F-T04-103
R307	321-0301-00			RES,FXD,FILM:13.3K OHM,1%,0.125W,TC=TO	07716	CEAD13301F
R308	321-0275-00			RES,FXD,FILM:7.15K OHM,1%,0.125W,TC=TO	07716	CEAD71500F
R312	315-0201-00			RES,FXD,FILM:200 OHM,5%,0.25W	57668	NTR25J-E200E
R313	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R314	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R315	315-0112-00			RES,FXD,FILM:1.1K OHM,5%,0.25W	19701	5043CX1K100J
R321	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R322	323-0175-00			RES,FXD,FILM:649 OHM,1%,0.5W,TC=TO	75042	CECT0-6490F
R323	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R324	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
R325	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
R326	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
R330	315-0330-00			RES,FXD,FILM:33 OHM,5%,0.25W	19701	5043CX33R00J
R331	315-0330-00			RES,FXD,FILM:33 OHM,5%,0.25W	19701	5043CX33R00J
R332	315-0560-00			RES,FXD,FILM:56 OHM,5%,0.25W	57668	NTR25J-E56E0
R333	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R334	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R335	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R336	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R337	315-0272-00			RES,FXD,FILM:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
R338	315-0120-00			RES,FXD,FILM:12 OHM,5%,0.25W	57668	NTR25J-R12
R339	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R340	315-0474-00	B094000		RES,FXD,FILM:470K OHM,5%,0.25W	19701	5043CX470K0J92U
R341	321-0260-00			RES,FXD,FILM:4.99K OHM,1%,0.125W,TC=TO	19701	5033ED4K990F
R342	315-0474-00	B010100	B093999	RES,FXD,FILM:470K OHM,5%,0.25W	19701	5043CX470K0J92U
R343	321-0263-00			RES,FXD,FILM:5.36K OHM,1%,0.125W,TC=TO	07716	CEAD53600F
R344	315-0431-00			RES,FXD,FILM:430 OHM,5%,0.25W	19701	5043CX430R0J
R345	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
R346	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
R347	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
R350	315-0751-00	B094000		RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
R351	315-0101-00	B010100	B091399	RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R351	315-0161-00	B091400		RES,FXD,FILM:160 OHM,5%,0.25W	57668	NTR25J-E 160E
R352	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
R353	321-0222-07			RES,FXD,FILM:2.0K OHM,0.1%,0.125W,TC=T9	19701	5033RE2K000B
R354	321-0196-00			RES,FXD,FILM:1.07K OHM,1%,0.125W,TC=TO	07716	CEAD10700F
R355	315-0162-00			RES,FXD,FILM:1.6K OHM,5%,0.25W	19701	5043CX1K600J
R356	321-0229-00			RES,FXD,FILM:2.37K OHM,1%,0.125W,TC=TO	19701	5043ED2K37F
R358	321-0185-00			RES,FXD,FILM:825 OHM,1%,0.125W,TC=TO	07716	CEAD825R0F
R362	315-0122-00			RES,FXD,FILM:1.2K OHM,5%,0.25W	57668	NTR25J-E01K2
R371	315-0121-00			RES,FXD,FILM:120 OHM,5%,0.25W	19701	5043CX120R0J

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Discont	Name & Description	Mfr. Code	Mfr. Part No.
R372	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
R373	321-0173-00	B094000		RES,FXD,FILM:619 OHM,1%,0.125W,TC=TO	07716	CEAD619ROF
R381	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
R382	315-0270-00	B010100	B093999	RES,FXD,FILM:27 OHM,5%,0.25W	19701	5043CX27R00J
R382	315-0270-00	B094000		RES,FXD,FILM:27 OHM,5%,0.25W	19701	5043CX27R00J
R383	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
R410	311-1781-00	B010100	B095250	RES,VAR,NONWW:PNL,10K OHM,10%,0.5W	12697	388CM40913
R410	311-2305-00	B095251		RES,VAR,NONWW:PNL,10K OHM X 10K OHM	12697	CM43490
R412	315-0513-00			RES,FXD,FILM:51K OHM,5%,0.25W	57668	NTR25J-E51K0
R413	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
R414	321-0362-00			RES,FXD,FILM:57.6K OHM,1%,0.125W,TC=TO	19701	5043ED57K60F
R415	-----			(PART OF R410)		
R416	321-0289-00	B010100	B093999	RES,FXD,FILM:10.0K OHM,1%,0.125W,TC=TO	19701	5033ED10K0F
R416	321-0289-03	B094000		RES,FXD,FILM:10.0K OHM,0.25%,0.125W,TC=T2	07716	CEAC10001C
R422	315-0101-00	B010100	B029999	RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R422	315-0680-00	B030000		RES,FXD,FILM:68 OHM,5%,0.25W	57668	NTR25J-E68E0
R424	323-0285-00			RES,FXD,FILM:9.09K OHM,1%,0.5W,TC=TO	19701	5053RD9K090F
R426	315-0180-00			RES,FXD,FILM:18 OHM,5%,0.25W	19701	5043CX18R00J
R427	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R428	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
R430	311-1423-00			RES,VAR,NONWW:TRMR,20 OHM,0.5W	32997	3386F-T04-200
R431	321-0122-00			RES,FXD,FILM:182 OHM,1%,0.125W,TC=TO	19701	5033ED182ROF
R432	315-0180-00			RES,FXD,FILM:18 OHM,5%,0.25W	19701	5043CX18R00J
R433	315-0820-00			RES,FXD,FILM:82 OHM,5%,0.25W	57668	NTR25J-E82E0
R434	323-0285-00			RES,FXD,FILM:9.09K OHM,1%,0.5W,TC=TO	19701	5053RD9K090F
R435	321-0400-00			RES,FXD,FILM:143K OHM,1%,0.125W,TC=TO	19701	5043ED143K0F
R436	315-0180-00			RES,FXD,FILM:18 OHM,5%,0.25W	19701	5043CX18R00J
R437	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
R438	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
R439	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	57668	NTR25J-E150E
R440	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R441	315-0682-00			RES,FXD,FILM:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
R442	321-0225-00			RES,FXD,FILM:2.15K OHM,0.25%,0.125W,T=T9	07716	CEAE21500C
R444	322-0210-00			RES,FXD,FILM:1.50K OHM,1%,0.25W,TC=TO	75042	CEBT0-1501F
R445	311-1226-00			RES,VAR,NONWW:TRMR,2.5K OHM,0.5W	32997	3386F-T04-252
R446	315-0682-00			RES,FXD,FILM:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
R447	321-0928-03			RES,FXD,FILM:250 OHM,0.25%,0.125W,TC=T2	19701	5033RC250ROC
R448	322-0218-00			RES,FXD,FILM:1.82K OHM,1%,0.25W,TC=TO	75042	CEBT0-1821F
R449	322-0224-00			RES,FXD,FILM:2.10K OHM,1%,0.25W,TC=TO	19701	5043RD2K100F
R454	322-0210-00			RES,FXD,FILM:1.50K OHM,1%,0.25W,TC=TO	75042	CEBT0-1501F
R455	321-0124-00			RES,FXD,FILM:191 OHM,1%,0.125W,TC=TO	07716	CEAD191ROF
R456	315-0682-00			RES,FXD,FILM:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
R457	321-0928-03			RES,FXD,FILM:250 OHM,0.25%,0.125W,TC=T2	19701	5033RC250ROC
R458	322-0218-00			RES,FXD,FILM:1.82K OHM,1%,0.25W,TC=TO	75042	CEBT0-1821F
R459	322-0224-00			RES,FXD,FILM:2.10K OHM,1%,0.25W,TC=TO	19701	5043RD2K100F
R509	321-0222-07			RES,FXD,FILM:2.0K OHM,0.1%,0.125W,TC=T9	19701	5033RE2K000B
R510	311-1594-00			RES,VAR,NONWW:TRMR,10 OHM,0.5W	32997	3352T-1-100
R513	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R514	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
R515	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W,TC=TO	19701	5033ED1K00F
R518	321-0260-00			RES,FXD,FILM:4.99K OHM,1%,0.125W,TC=TO	19701	5033ED4K990F
R520	311-0946-00	B010100	B039999	RES,VAR,WW:TRMR,50K OHM,2W	02111	534-0070
R520	311-1889-00	B040000		RES,VAR,WW:PNL,50K OHM,2W	32997	3541S-458-503
R521	315-0331-00	B010100	B088794	RES,FXD,FILM:330 OHM,5%,0.25W	57668	NTR25J-E330E
R521	321-0222-07	B088750		RES,FXD,FILM:2.0K OHM,0.1%,0.125W,TC=T9	19701	5033RE2K000B
R522	315-0331-00			RES,FXD,FILM:330 OHM,5%,0.25W	57668	NTR25J-E330E
R523	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R524	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E

Replaceable Electrical Parts - 7885

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Discort	Name & Description	Mfr. Code	Mfr. Part No.
R526	321-0260-00			RES, FXD, FILM: 4.99K OHM, 1%, 0.125W, TC=TO	19701	5033ED4K990F
R527	321-0285-00			RES, FXD, FILM: 9.09K OHM, 1%, 0.125W, TC=TO	07716	CEAD90900F
R528	321-0260-00			RES, FXD, FILM: 4.99K OHM, 1%, 0.125W, TC=TO	19701	5033ED4K990F
R530	311-0946-00	B010100	B039999	RES, VAR, WW: TRMR, 50K OHM, 2W	02111	534-0070
R530	311-1889-00	B040000		RES, VAR, WW: PNL, 50K OHM, 2W	32997	3541S-458-503
R531	321-0222-07			RES, FXD, FILM: 2.0K OHM, 0.1%, 0.125W, TC=T9	19701	5033RE2K000B
R532	315-0202-00			RES, FXD, FILM: 2K OHM, 5%, 0.25W	57668	NTR25J-E 2K
R533	321-0161-00			RES, FXD, FILM: 464 OHM, 1%, 0.125W, TC=TO	07716	CEAD464R0F
R534	321-0257-09	B010100	B088749	RES, FXD, FILM: 4.64K OHM, 1%, 0.125W, TC=T9	07716	CEAE46400F
R534	321-0257-00	B088750		RES, FXD, FILM: 4.64K OHM, 1%, 0.125W, TC=TO	19701	5043ED4K640F
R535	311-1560-00			RES, VAR, NONWW: TRMR, 5K OHM, 0.5W	32997	3352T-1-502
R536	321-0342-00	B010100	B088749	RES, FXD, FILM: 35.7K OHM, 1%, 0.125W, TC=TO	07716	CEAD35701F
R536	321-0340-00	B088750		RES, FXD, FILM: 34.0K OHM, 1%, 0.125W, TC=TO	19701	5043ED34K00F
R537	315-0511-00			RES, FXD, FILM: 510 OHM, 5%, 0.25W	19701	5043CX510R0J
R541	321-0097-00	B010100	B088749	RES, FXD, FILM: 100 OHM, 1%, 0.125W, TC=TO	91637	CMF55116G100R0F
R541	315-0101-00	B088750		RES, FXD, FILM: 100 OHM, 5%, 0.25W	57668	NTR25J-E 100E
R542	315-0154-00	B010100	B093999	RES, FXD, FILM: 150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R543	321-0308-00	B010100	B093999	RES, FXD, FILM: 15.8K OHM, 1%, 0.125W, TC=TO	07716	CEAD 15801F
R544	315-0204-00			RES, FXD, FILM: 200K OHM, 5%, 0.25W	19701	5043CX200K0J
R545	315-0433-00	B010100	B088749	RES, FXD, FILM: 43K OHM, 5%, 0.25W	19701	5043CX43K00J
R546	315-0513-00			RES, FXD, FILM: 51K OHM, 5%, 0.25W	57668	NTR25J-E51K0
R547	315-0303-00			RES, FXD, FILM: 30K OHM, 5%, 0.25W	19701	5043CX30K00J
R548	315-0204-00			RES, FXD, FILM: 200K OHM, 5%, 0.25W	19701	5043CX200K0J
R549	315-0104-00	B010100	B088749	RES, FXD, FILM: 100K OHM, 5%, 0.25W	57668	NTR25J-E100K
R552	321-0222-07			RES, FXD, FILM: 2.0K OHM, 0.1%, 0.125W, TC=T9	19701	5033RE2K000B
R554	315-0205-00			RES, FXD, FILM: 2M OHM, 5%, 0.25W	01121	CB2055
R555	311-1230-00			RES, VAR, NONWW: TRMR, 20K OHM, 0.5W	32997	3386F-T04-203
R560	321-0196-00			RES, FXD, FILM: 1.07K OHM, 1%, 0.125W, TC=TO	07716	CEAD10700F
R561	321-0302-00			RES, FXD, FILM: 13.7K OHM, 1%, 0.125W, TC=TO	07716	CEAD 13701F
R562	315-0242-00			RES, FXD, FILM: 2.4K OHM, 5%, 0.25W	57668	NTR25J-E02K4
R563	315-0162-00			RES, FXD, FILM: 1.6K OHM, 5%, 0.25W	19701	5043CX1K600J
R564	315-0510-00			RES, FXD, FILM: 51 OHM, 5%, 0.25W	19701	5043CX51R00J
R567	315-0242-00			RES, FXD, FILM: 2.4K OHM, 5%, 0.25W	57668	NTR25J-E02K4
R569	315-0223-00	B094000		RES, FXD, FILM: 22K OHM, 5%, 0.25W	19701	5043CX22K00J92U
R570	315-0511-00			RES, FXD, FILM: 510 OHM, 5%, 0.25W	19701	5043CX510R0J
R571	315-0153-00			RES, FXD, FILM: 15K OHM, 5%, 0.25W	19701	5043CX15K00J
R572	315-0270-00			RES, FXD, FILM: 27 OHM, 5%, 0.25W	19701	5043CX27R00J
R573	315-0153-00			RES, FXD, FILM: 15K OHM, 5%, 0.25W	19701	5043CX15K00J
R574	315-0362-00	B010100	B093999	RES, FXD, FILM: 3.6K OHM, 5%, 0.25W	19701	5043CX3K600J
R574	315-0242-00	B094000		RES, FXD, FILM: 2.4K OHM, 5%, 0.25W	57668	NTR25J-E02K4
R575	315-0392-00			RES, FXD, FILM: 3.9K OHM, 5%, 0.25W	57668	NTR25J-E03K9
R576	315-0112-00			RES, FXD, FILM: 1.1K OHM, 5%, 0.25W	19701	5043CX1K100J
R577	315-0821-00			RES, FXD, FILM: 820 OHM, 5%, 0.25W	19701	5043CX820R0J
R578	315-0510-00			RES, FXD, FILM: 51 OHM, 5%, 0.25W	19701	5043CX51R00J
R579	315-0122-00	B094000		RES, FXD, FILM: 1.2K OHM, 5%, 0.25W	57668	NTR25J-E01K2
R582	315-0275-00			RES, FXD, FILM: 2.7M OHM, 5%, 0.25W	01121	CB2755
R592	315-0275-00			RES, FXD, FILM: 2.7M OHM, 5%, 0.25W	01121	CB2755
R605	311-1466-00	B010100	B088749	RES, VAR, NONWW: TRMR, 2K OHM, 0.5W	32997	3386F-T04-202
R606	321-0963-07	B010100	B088749	RES, FXD, FILM: 98.73K OHM, 0.1%, 0.125W, TC=T9	07716	CEA 98.73K0HM 1%
R607	321-0986-07	B010100	B088749	RES, FXD, FILM: 25K OHM, 0.1%, 0.125W, TC=T9	19701	5033RE25K00B
R613	315-0333-00	B010100	B088749	RES, FXD, FILM: 33K OHM, 5%, 0.25W	57668	NTR25J-E33K0
R614	315-0272-00	B010100	B088749	RES, FXD, FILM: 2.7K OHM, 5%, 0.25W	57668	NTR25J-E02K7
R615	315-0132-00	B010100	B088749	RES, FXD, FILM: 1.3K OHM, 5%, 0.25W	57668	NTR25J-E01K3
R616	321-0346-00	B010100	B088749	RES, FXD, FILM: 39.2K OHM, 1%, 0.125W, TC=TO	19701	5043ED39K20F
R616	321-0820-06	B088750		RES, FXD, FILM: 42K OHM, 0.25%, 0.125W, TC=T9	19701	5033RE42K00C
R617	321-0243-00	B010100	B088749	RES, FXD, FILM: 3.32K OHM, 1%, 0.125W, TC=TO	19701	5033ED3K32F
R617	321-0259-00	B088750		RES, FXD, FILM: 4.87K OHM, 1%, 0.125W, TC=TO	07716	CEAD48700F
R618	321-0385-07	B010100	B088749	RES, FXD, FILM: 100K OHM, 0.1%, 0.125W, TC=T9	19701	5033RE100K0B

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
R620	311-1339-00	B010100	B088749	RES, VAR, NONNW: TRMR, 5K OHM, 0.75W	02111	43P502T672
R620	311-1336-00	B088750		RES, VAR, NONNW: TRMR, 100K OHM, 0.75W	02111	43P104T672
R621	321-0820-06	B010100	B088749	RES, FXD, FILM: 42K OHM, 0.25%, 0.125W, TC=T9	19701	5033RE42K00C
R621	321-0967-03	B088750		RES, FXD, FILM: 55K OHM, 0.25%, 0.125W, TC=T2	07716	CEAC55001C
R622	321-0995-00	B088750		RES, FXD, FILM: 549K OHM, 1%, 0.125W, TC=T0	24546	NA55D5493F
R623	315-0433-00	B010100	B088749	RES, FXD, FILM: 43K OHM, 5%, 0.25W	19701	5043CX43K00J
R623	315-0513-00	B088750		RES, FXD, FILM: 51K OHM, 5%, 0.25W	57668	NTR25J-E51K0
R624	315-0101-00			RES, FXD, FILM: 100 OHM, 5%, 0.25W	57668	NTR25J-E 100E
R625	311-1230-00			RES, VAR, NONNW: TRMR, 20K OHM, 0.5W	32997	3386F-T04-203
R626	315-0104-00			RES, FXD, FILM: 100K OHM, 5%, 0.25W	57668	NTR25J-E100K
R627	315-0152-00	B010100	B088749	RES, FXD, FILM: 1.5K OHM, 5%, 0.25W	57668	NTR25J-E01K5
R628	321-0257-09	B010100	B088749	RES, FXD, FILM: 4.64K OHM, 1%, 0.125W, TC=T9	07716	CEAE46400F
R629	321-0257-09	B010100	B088749	RES, FXD, FILM: 4.64K OHM, 1%, 0.125W, TC=T9	07716	CEAE46400F
R631	321-0289-06	B088750		RES, FXD, FILM: 10.0K OHM, 0.25%, 0.125W, TC=T9	19701	5033RE10K00C
R632	315-0432-00	B010100	B088749	RES, FXD, FILM: 4.3K OHM, 5%, 0.25W	57668	NTR25J-E04K3
R632	321-0289-06	B088750		RES, FXD, FILM: 10.0K OHM, 0.25%, 0.125W, TC=T9	19701	5033RE10K00C
R634	315-0202-00	B010100	B088749	RES, FXD, FILM: 2K OHM, 5%, 0.25W	57668	NTR25J-E 2K
R635	315-0392-00	B010100	B088749	RES, FXD, FILM: 3.9K OHM, 5%, 0.25W	57668	NTR25J-E03K9
R636	315-0563-00	B088750		RES, FXD, FILM: 56K OHM, 5%, 0.25W	19701	5043CX56K00J
R637	315-0222-00	B088750		RES, FXD, FILM: 2.2K OHM, 5%, 0.25W	57668	NTR25J-E02K2
R641	315-0202-00	B010100	B088749	RES, FXD, FILM: 2K OHM, 5%, 0.25W	57668	NTR25J-E 2K
R642	315-0512-00	B010100	B088749	RES, FXD, FILM: 5.1K OHM, 5%, 0.25W	57668	NTR25J-E05K1
R644	315-0182-00	B088750		RES, FXD, FILM: 1.8K OHM, 5%, 0.25W	57668	NTR25J-E1K8
R645	315-0333-00	B010100	B088749	RES, FXD, FILM: 33K OHM, 5%, 0.25W	57668	NTR25J-E33K0
R646	315-0332-00	B010100	B088749	RES, FXD, FILM: 3.3K OHM, 5%, 0.25W	57668	NTR25J-E03K3
R653	315-0243-00	B010100	B088749	RES, FXD, FILM: 24K OHM, 5%, 0.25W	57668	NTR25J-E24K0
R653	315-0103-00	B088750		RES, FXD, FILM: 10K OHM, 5%, 0.25W	19701	5043CX10K00J
R654	315-0183-00	B010100	B088749	RES, FXD, FILM: 18K OHM, 5%, 0.25W	19701	5043CX18K00J
R654	315-0392-00	B088750		RES, FXD, FILM: 3.9K OHM, 5%, 0.25W	57668	NTR25J-E03K9
R655	315-0391-00	B088750		RES, FXD, FILM: 390 OHM, 5%, 0.25W	57668	NTR25J-E390E
R661	315-0203-00	B010100	B088749	RES, FXD, FILM: 20K OHM, 5%, 0.25W	57668	NTR25J-E 20K
R662	315-0273-00	B010100	B088749	RES, FXD, FILM: 27K OHM, 5%, 0.25W	57668	NTR25J-E27K0
R671	315-0202-00	B010100	B088749	RES, FXD, FILM: 2K OHM, 5%, 0.25W	57668	NTR25J-E 2K
R672	315-0133-00	B010100	B088749	RES, FXD, FILM: 13K OHM, 5%, 0.25W	19701	5043CX13K00J
R672	315-0473-00	B088750		RES, FXD, FILM: 47K OHM, 5%, 0.25W	57668	NTR25J-E47K0
R673	315-0153-00	B010100	B088749	RES, FXD, FILM: 15K OHM, 5%, 0.25W	19701	5043CX15K00J
R674	315-0103-00	B010100	B088749	RES, FXD, FILM: 10K OHM, 5%, 0.25W	19701	5043CX10K00J
R674	315-0472-00	B088750		RES, FXD, FILM: 4.7K OHM, 5%, 0.25W	57668	NTR25J-E04K7
R675	321-0241-00	B010100	B039999	RES, FXD, FILM: 3.16K OHM, 1%, 0.125W, TC=T0	07716	CEAD31600F
R675	321-0225-00	B040000	B088749	RES, FXD, FILM: 2.15K OHM, 1%, 0.125W, TC=T0	19701	5033ED2K15F
R676	315-0133-00	B010100	B088749	RES, FXD, FILM: 13K OHM, 5%, 0.25W	19701	5043CX13K00J
R676	315-0473-00	B088750		RES, FXD, FILM: 47K OHM, 5%, 0.25W	57668	NTR25J-E47K0
R677	315-0822-00	B010100	B088749	RES, FXD, FILM: 8.2K OHM, 5%, 0.25W	19701	5043CX8K200J
R678	315-0103-00	B010100	B039999	RES, FXD, FILM: 10K OHM, 5%, 0.25W	19701	5043CX10K00J
R678	315-0362-00	B040000	B088749	RES, FXD, FILM: 3.6K OHM, 5%, 0.25W	19701	5043CX3K600J
R678	315-0472-00	B088750		RES, FXD, FILM: 4.7K OHM, 5%, 0.25W	57668	NTR25J-E04K7
R679	315-0152-00	B010100	B088749	RES, FXD, FILM: 1.5K OHM, 5%, 0.25W	57668	NTR25J-E01K5
R681	315-0512-00	B010100	B088749	RES, FXD, FILM: 5.1K OHM, 5%, 0.25W	57668	NTR25J-E05K1
R681	315-0202-00	B088750		RES, FXD, FILM: 2.4K OHM, 5%, 0.25W	57668	NTR25J-E 2K
R682	315-0102-00	B010100	B088749	RES, FXD, FILM: 1K OHM, 5%, 0.25W	57668	NTR25JE01K0
R682	315-0332-00	B088750		RES, FXD, FILM: 3.3K OHM, 5%, 0.25W	57668	NTR25J-E03K3
R683	315-0103-00	B010100	B088749	RES, FXD, FILM: 10K OHM, 5%, 0.25W	19701	5043CX10K00J
R683	315-0331-00	B088750		RES, FXD, FILM: 330 OHM, 5%, 0.25W	57668	NTR25J-E330E
R684	321-0302-00	B010100	B088749	RES, FXD, FILM: 13.7K OHM, 1%, 0.125W, TC=T0	07716	CEAD 13701F
R685	311-1560-00	B010100	B088749	RES, VAR, NONNW: TRMR, 5K OHM, 0.5W	32997	3352T-1-502
R686	315-0242-00			RES, FXD, FILM: 2.4K OHM, 5%, 0.25W	57668	NTR25J-E02K4
R687	321-1651-04	B088750		RES, FXD, FILM: 37.5K OHM, 0.1%, 0.125W, TC=T2	19701	5033RC37K50B
R690	315-0432-00	B010100	B059999	RES, FXD, FILM: 4.3K OHM, 5%, 0.25W	57668	NTR25J-E04K3
R693	321-0217-00	B010100	B088749	RES, FXD, FILM: 1.78K OHM, 1%, 0.125W, TC=T0	19701	5043D1K780F

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Component No.	Tektronix	Serial/Assembly No.		Name & Description	Mfr.	Mfr. Part No.
	Part No.	Effective	Discnt		Code	
R694	321-0202-00	B010100	B088749	RES, FXD, FILM: 1.24K OHM, 1%, 0.125W, TC=TO	24546	NA55D1241F
R695	315-0100-00	B010100	B088749	RES, FXD, FILM: 10 OHM, 5%, 0.25W	19701	5043CX10RR00J
R696	315-0131-00	B010100	B088749	RES, FXD, FILM: 130 OHM, 5%, 0.25W	19701	5043CX130R0J
R697	315-0203-00	B010100	B088749	RES, FXD, FILM: 20K OHM, 5%, 0.25W	57668	NTR25J-E 20K
R698	315-0102-00	B010100	B088749	RES, FXD, FILM: 1K OHM, 5%, 0.25W	57668	NTR25JE01K0
R699	315-0273-00	B010100	B088749	RES, FXD, FILM: 27K OHM, 5%, 0.25W	57668	NTR25J-E27K0
R705	311-0467-00	B010100	B095250	RES, VAR, NONNW: PNL, 100K OHM, 0.5W	01121	W7705B
R705	311-2306-00	B095251		RES, VAR, NONNW: PNL, 100K OHM, 20%, 0.5W	12697	CM43489
R706	321-0438-00			RES, FXD, FILM: 357K OHM, 1%, 0.125W, TC=TO	07716	CEAD35702F
R710	311-1232-00			RES, VAR, NONNW: TRMR, 50K OHM, 0.5W	32997	3386F-T04-503
R711	321-0458-00			RES, FXD, FILM: 576K OHM, 1%, 0.125W, TC=TO	07716	CEAD57602F
R712	315-0273-00			RES, FXD, FILM: 27K OHM, 5%, 0.25W	57668	NTR25J-E27K0
R713	315-0273-00			RES, FXD, FILM: 27K OHM, 5%, 0.25W	57668	NTR25J-E27K0
R714	321-0363-00			RES, FXD, FILM: 59.0K OHM, 1%, 0.125W, TC=TO	07716	CEAD59001F
R715	311-1232-00			RES, VAR, NONNW: TRMR, 50K OHM, 0.5W	32997	3386F-T04-503
R717	321-0360-00			RES, FXD, FILM: 54.9K OHM, 1%, 0.125W, TC=TO	19701	5033ED54K90F
R721	315-0121-00			RES, FXD, FILM: 120 OHM, 5%, 0.25W	19701	5043CX120R0J
R722	321-0225-06			RES, FXD, FILM: 2.15K OHM, 0.25%, 0.125W, T=T9	07716	CEAE21500C
R723	321-0642-00			RES, FXD, FILM: 20.3K OHM, 0.25%, 0.125W, T=T9	19701	5033RE20K30C
R724	315-0682-00			RES, FXD, FILM: 6.8K OHM, 5%, 0.25W	57668	NTR25J-E06K8
R725	311-1590-00	B010100	B095931	RES, VAR, NONNW: PNL, 10K OHM, 1W, COMPOSITION OR CERMET	12697	CM40256
R725	311-2371-00	B095932		RES, VAR, NONNW: PNL, 10K OHM, 0.5W	12697	CM45236
R728	301-0302-00	B010100	B093999	RES, FXD, FILM: 3K OHM, 5%, 0.5W	19701	5053CX3K000J
R729	315-0101-00			RES, FXD, FILM: 100 OHM, 5%, 0.25W	57668	NTR25J-E 100E
R731	315-0221-00			RES, FXD, FILM: 220 OHM, 5%, 0.25W	57668	NTR25J-E220E
R732	315-0104-00			RES, FXD, FILM: 100K OHM, 5%, 0.25W	57668	NTR25J-E100K
R741	323-0810-07			RES, FXD, FILM: 4 MEG OHM, 0.1%, 0.5W, TC=T9	24546	NE65E4004B
R742	323-0809-07			RES, FXD, FILM: 2.667MEG OHM, 0.1%, 0.5W, TC=T9	19701	5053RE2M667B
R743	323-1500-07			RES, FXD, FILM: 1.6MEG OHM, 0.1%, 0.5W, TC=T2	24546	NE65E1604B
R744	323-0620-07			RES, FXD, FILM: 800K OHM, 0.1%, 0.5W, TC=T9	24546	NE65E8003B
R745	323-0806-07			RES, FXD, FILM: 266.7K OHM, 0.1%, 0.5W, TC=T9	91637	MFF1226C26672B
R746	323-1404-07			RES, FXD, FILM: 160K OHM, 0.1%, 0.5W, TC=T9	24546	NE65E1603B
R747	323-0805-07			RES, FXD, FILM: 80.0K OHM, 0.1%, 0.5W, TC=T9	24546	NE65E8002B
R748	323-0802-07			RES, FXD, FILM: 26.67K OHM, 0.1%, 0.5W, TC=T9	07716	CECE26671B
R749	323-1308-07			RES, FXD, FILM: 16.0K OHM, 0.1%, 0.5W, TC=T9	24546	NE65E1602B
R751	315-0154-00			RES, FXD, FILM: 150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R752	315-0154-00			RES, FXD, FILM: 150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R753	315-0154-00			RES, FXD, FILM: 150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R754	315-0154-00			RES, FXD, FILM: 150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R755	321-0344-00			RES, FXD, FILM: 37.4K OHM, 1%, 0.125W, TC=TO	19701	5033ED 37K40F
R756	315-0753-00			RES, FXD, FILM: 75K OHM, 5%, 0.25W	57668	NTR25J-E75K0
R757	321-0327-00			RES, FXD, FILM: 24.9K OHM, 1%, 0.125W, TC=TO	07716	CEAD24901F
R761	315-0154-00			RES, FXD, FILM: 150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R762	315-0154-00			RES, FXD, FILM: 150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R763	315-0133-00			RES, FXD, FILM: 13K OHM, 5%, 0.25W	19701	5043CX13K00J
R764	315-0133-00			RES, FXD, FILM: 13K OHM, 5%, 0.25W	19701	5043CX13K00J
R771	315-0753-00			RES, FXD, FILM: 75K OHM, 5%, 0.25W	57668	NTR25J-E75K0
R772	321-0356-00			RES, FXD, FILM: 49.9K OHM, 1%, 0.125W, TC=TO	19701	5033ED49K90F
R773	315-0154-00			RES, FXD, FILM: 150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R779	315-0151-00			RES, FXD, FILM: 150 OHM, 5%, 0.25W	57668	NTR25J-E150E
R781	315-0154-00			RES, FXD, FILM: 150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R782	315-0753-00			RES, FXD, FILM: 75K OHM, 5%, 0.25W	57668	NTR25J-E75K0
R783	315-0154-00			RES, FXD, FILM: 150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R784	321-0356-00			RES, FXD, FILM: 49.9K OHM, 1%, 0.125W, TC=TO	19701	5033ED49K90F
R785	315-0154-00			RES, FXD, FILM: 150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R786	315-0753-00			RES, FXD, FILM: 75K OHM, 5%, 0.25W	57668	NTR25J-E75K0
R787	321-0356-00			RES, FXD, FILM: 49.9K OHM, 1%, 0.125W, TC=TO	19701	5033ED49K90F

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Discnt	Name & Description	Mfr. Code	Mfr. Part No.
R791	321-0344-00			RES, FXD, FILM:37.4K OHM, 1%, 0.125W, TC=T0	19701	5033ED 37K40F
R792	315-0154-00			RES, FXD, FILM:150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R793	321-0344-00			RES, FXD, FILM:37.4K OHM, 1%, 0.125W, TC=T0	19701	5033ED 37K40F
R794	315-0154-00			RES, FXD, FILM:150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R803	321-0308-00	B094000		RES, FXD, FILM:15.8K OHM, 1%, 0.125W, TC=T0	07716	CEAD 15801F
R806	315-0154-00	B094000		RES, FXD, FILM:150K OHM, 5%, 0.25W	57668	NTR25J-E150K
R821	315-0510-00			RES, FXD, FILM:51 OHM, 5%, 0.25W	19701	5043CX51R00J
R832	315-0150-00			RES, FXD, FILM:15 OHM, 5%, 0.25W	19701	5043CX15R00J
R841	321-0260-00			RES, FXD, FILM:4.99K OHM, 1%, 0.125W, TC=T0	19701	5033ED4K990F
R842	321-0289-00	B010100	B093999	RES, FXD, FILM:10.0K OHM, 1%, 0.125W, TC=T0	19701	5033ED10K0F
R842	321-0289-03	B094000		RES, FXD, FILM:10.0K OHM, 0.25%, 0.125W, TC=T2	07716	CEAC10001C
R844	315-0101-00	B010100	B093999	RES, FXD, FILM:100 OHM, 5%, 0.25W	57668	NTR25J-E 100E
R844	315-0241-00	B094000		RES, FXD, FILM:240 OHM, 5%, 0.25W	19701	5043CX240R0J
S10	263-0010-01			SWITCH PB ASSY:1 PUSH, 7.5 MM, 1 CONTACT	80009	263-0010-01
S20	263-0016-00			SWITCH PB ASSY:4 LATCHING, 7.5 MM, 5 CONTACT SAFETY CONTROLLED	80009	263-0016-00
S50	263-0015-00			SWITCH PB ASSY:3 LATCHING, 7.5 MM	80009	263-0015-00
S60	-----			(PART OF R60)		
S205	263-0015-01			SWITCH PB ASSY:3 LATCHING, 7.5MM, 5 CONTACT	80009	263-0015-01
S230	263-0016-01			SWITCH PB ASSY:3 LCH & 1 CANC, 7.5MM, 5 CONT	80009	263-0016-01
S435	260-1771-00			SWITCH, PUSH:1 BUTTON, 2 POLE, SLOPE	31918	ORDER BY DESCR
S800	263-1134-00			SW CAM ACTR AS: TIME/CM	80009	263-1134-00
T35	120-0444-00			XFMR, TOROID:	80009	120-0444-00
U35	156-0067-02			MICROCKT, LINEAR: OPNL AMPL, SELECTED	02735	85147
U55	156-0158-00			MICROCKT, LINEAR: BIPOLAR, DUAL OPNL AMPL	04713	MC1458P1/MC1458U
U65	155-0126-00			MICROCKT, LINEAR: TRIGGER AMPLIFIER	80009	155-0126-00
U75	156-0158-00			MICROCKT, LINEAR: BIPOLAR, DUAL OPNL AMPL	04713	MC1458P1/MC1458U
U85	155-0109-01			MICROCKT, LINEAR: MONOLITHIC TRIG	80009	155-0109-01
U220	155-0049-01	B010100	B052214	MICROCKT, DGTL: W/LOCKOUT DSBL FCTN	80009	155-0049-01
U220	155-0049-02	B052215		MICROCKT, DGTL: SWEEP CONT, W/LOCKOUT DISABLE	80009	155-0049-02
U250	156-0118-03			MICROCKT, DGTL: 1 DUAL J-K FF, BURN-IN	01295	SN74S112JP4
U416	156-0067-02	B010100	B095560	MICROCKT, LINEAR: OPNL AMPL, SELECTED	02735	85147
U416	156-0067-00	B095561		MICROCKT, LINEAR: BIPOLAR, OPNL AMPL	04713	MC1741CP1
U530	156-0158-00	B010100	B091399	MICROCKT, LINEAR: BIPOLAR, DUAL OPNL AMPL	04713	MC1458P1/MC1458U
U530	156-0158-00	B091400		MICROCKT, LINEAR: BIPOLAR, DUAL OPNL AMPL	04713	MC1458P1/MC1458U
U556	156-0158-00	B010100	B091399	MICROCKT, LINEAR: BIPOLAR, DUAL OPNL AMPL	04713	MC1458P1/MC1458U
U556	156-0158-00	B091400		MICROCKT, LINEAR: BIPOLAR, DUAL OPNL AMPL	04713	MC1458P1/MC1458U
U608	156-0686-00	B010100	B088749	MICROCKT, LINEAR: MOS, OPNL AMPL	02735	CA3130S
U608	156-1149-00	B088750	B091399	MICROCKT, LINEAR: OPERATIONAL AMP, JFET INPUT	27014	LF351N/GLEA134
U608	156-1149-01	B091400		MICROCKT, LINEAR: OPERATION AMP JFET INPUT	27014	AL160307
U626	156-0067-02	B010100	B088749	MICROCKT, LINEAR: OPNL AMPL, SELECTED	02735	85147
U626	156-0105-00	B088750	B091399	MICROCKT, LINEAR: OPNL AMPL	01295	LM301AP
U626	156-0105-00	B091400		MICROCKT, LINEAR: OPNL AMPL	01295	LM301AP
U662	156-0113-03	B010100	B088749	MICROCKT, DGTL: QUAD 2 INP NAND GATE, SCRN	01295	SN74L00NP3
U662	156-0030-03	B088750		MICROCKT, DGTL: QUAD 2 INPUT NAND GATE, SCRN	18324	N7400(NB OR FB)
U682	156-0041-05			MICROCKT, DGTL: DUAL D FLIP FLOP SCRN	01295	SN7474NP3
U686	155-0090-00	B010100	B059999	MICROCKT, DGTL: 4 DECADE COUNTER	80009	155-0090-00
U686	155-0171-00	B060000	B088749	MICROCKT, DGTL: 4 DECADE COUNTER	80009	155-0171-00
U686	155-0185-00	B088750		MICROCKT, INTFC: ML 4 DECADE DGTL VOLTMETER	80009	155-0185-00
U698	156-0041-05			MICROCKT, DGTL: DUAL D FLIP FLOP SCRN	01295	SN7474NP3
U722	156-0686-00	B010100	B093999	MICROCKT, LINEAR: MOS, OPNL AMPL	02735	CA3130S
U722	156-1149-00	B094000		MICROCKT, LINEAR: OPERATIONAL AMP, JFET INPUT	27014	LF351N/GLEA134
U842	156-0067-02	B010100	B095560	MICROCKT, LINEAR: OPNL AMPL, SELECTED	02735	85147
U842	156-0067-00	B095561		MICROCKT, LINEAR: BIPOLAR, OPNL AMPL	04713	MC1741CP1
VR314	152-0168-00			SEMICON DVC, DI: ZEN, SI, 12V, 5%, 0.4W, DO-763B	14552	T0331689
VR644	152-0280-00	B088750		SEMICON DVC, DI: ZEN, SI, 6.2V, 5%, 0.4W, DO-7 OR DO-35	04713	1N753A
VR728	152-0226-00			SEMICON DVC, DI: ZEN, SI, 5.1V, 5%, 0.4W, DO-7	04713	SZ12262RL

Replaceable Electrical Parts - 7B85

Component No.	Tektronix Part No.	Serial/Assembly No. Effective    Dscont	Name & Description	Mfr. Code	Mfr. Part No.
W1	131-0566-00	B094000	BUS, CONDUCTOR: DUMMY RES, 0.094 OD X 0.225 L	24546	OMA 07



# REPLACEABLE MECHANICAL PARTS

## 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 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.

## SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number  
00X Part removed after this serial number

## FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

## 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.

```

1 2 3 4 5           Name & Description
Assembly and/or Component
Attaching parts for Assembly and/or Component
    --- * ---
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
    --- * ---
Parts of Detail Part
Attaching parts for Parts of Detail Part
    --- * ---
  
```

Attaching Parts always appear 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. The separation symbol --- \* --- indicates the end of attaching parts.

**Attaching parts must be purchased separately, unless otherwise specified.**

## ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

## ABBREVIATIONS

#	INCH NUMBER SIZE	ELECTRN	ELECTRON	IN	INCH	SE	SINGLE END
ACTR	ACTUATOR	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ADPTR	ADAPTER	ELECTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICOND	SEMICONDUCTOR
ALIGN	ALIGNMENT	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
AL	ALUMINUM	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
ASSEM	ASSEMBLED	EOPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSY	ASSEMBLY	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ATTEN	ATTENUATOR	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
AWG	AMERICAN WIRE GAGE	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVING
BD	BOARD	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BRKT	BRACKET	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SQ	SQUARE
BRS	BRASS	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BRZ	BRONZE	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BSHG	BUSHING	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
CAB	CABINET	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAP	CAPACITOR	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CER	CERAMIC	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CHAS	CHASSIS	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CKT	CIRCUIT	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
COMP	COMPOSITION	HEX SOC	HEXAGONAL SOCKET	RCPT	RECEPTACLE	TPG	TAPPING
CONN	CONNECTOR	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
COV	COVER	HLEXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
CPLG	COUPLING	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CRT	CATHODE RAY TUBE	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W/	WITH
DEG	DEGREE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DWR	DRAWER	IDENT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
		IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

## CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
07707	USM CORP SUB OF EMHART INDUSTRIES INC USM FASTENER DIV	510 RIVER RD	SHELTON CT 06848-4517
08261	SPECTRA-STRIP AN ELTRA CO	7100 LAMPSON AVE	GARDEN GROVE CA 92642
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS DIV MILITARY PRODUCTS GROUP	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070-3007
22599	AMERACE CORP ESNA DIV	15201 BURBANK BLVD SUITE C	VAN NUYS CA 91411-3532
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701-3737
56878	SPS TECHNOLOGIES INC AEROSPACE & INDUSTRIAL PRODUCTS DIV	HIGHLAND AVE	JENKINTOWN PA 19046
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
77900	ILLINOIS TOOL WORKS SHAKEPROOF DIV	ST CHARLES RD	ELGIN IL 60120
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIV	ST CHARLES ROAD	ELGIN IL 60120
79136	WALDES KOHINOOR INC	47-16 AUSTEL PLACE	LONG ISLAND CITY NY 11101-4402
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
87308	FARLEY METALS INC SOUTHERN SCREW DIV	BARKLEY RD P O BOX 1360	STATESVILLE NC 28677-9774
91260	CONNOR SPRING AND MFG CO A SLOSS AND BRITTAN INC CO	1729 JUNCTION AVE	SAN JOSE CA 95112
92101	SCHULZE MFG	50 INGOLD RD	BURLINGAME CA 94010-2206
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61108-5181
TK0392	NORTHWEST FASTENER SALES INC	7923 SW CIRRRUS DRIVE	BEAVERTON OR 97005-6448
TK0433	PORTLAND SCREW CO	6520 N BASIN	PORTLAND OR 97217-3920
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609-3320
TK0507	O HARA METAL PRODUCTS CO	542 BRANNAN ST	SAN FRANCISCO CA 94107
TK0858	STAUFFER SUPPLY CO (DIST)	810 SE SHERMAN	PORTLAND OR 97214
TK1326	NORTHWEST FOURSLLIDE INC	18224 SW 100TH CT	TUALATIN OR 97062

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Discnt	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	337-1064-04	B010100	B094499	2	SHIELD,ELEC:SIDE FOR PLUG-IN UNIT	80009	337-1064-04
	337-1064-12	B094500		2	SHIELD,ELEC:SIDE FOR PLUG-IN UNIT	80009	337-1064-12
-2	366-1391-02			1	KNOB:LT GY,0.081 ID X 0.28 OD X 0.32 H	80009	366-1391-02
	213-0725-00			1	.SETSCREW:3-48 X 0.094,STL	56878	ORDER BY DESCR
-3	366-1319-02			1	KNOB:GY,0.079 ID X 0.28 OD X 0.32 H	80009	366-1319-02
	213-0725-00			1	.SETSCREW:3-48 X 0.094,STL	56878	ORDER BY DESCR
-4	366-1077-00			2	KNOB:GRAY W/SETSCREW	80009	366-1077-00
	213-0153-00			2	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-5	366-1189-00			2	KNOB:GY,0.127 ID X 0.5 OD X 0.531	80009	366-1189-00
	213-0153-00			2	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-6	366-1058-67			1	KNOB:GRAY,7885 (ATTACHING PARTS)	80009	366-1058-67
-7	214-1095-00			1	PTN,SPRING:0.187 L X 0.094 OD,STL,CD PL (END ATTACHING PARTS)	22599	52-022-094-0187
-8	366-1023-01			1	KNOB:GY,0.127 ID X 0.392 OD X 0.531 H	80009	366-1023-01
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-9	366-1166-00			1	KNOB:RED,0.127 ID X 0.392 OD X 0.4 H	80009	366-1166-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-10	366-1103-00			1	KNOB:GY,0.252 ID X 1.095 OD X 0.79 H	80009	366-1103-00
	213-0153-00			2	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-11	366-1023-01			1	KNOB:GY,0.127 ID X 0.392 OD X 0.531 H	80009	366-1023-01
-12	366-1257-93			1	PUSH BUTTON:SIL GY,X1 X10	80009	366-1257-93
-13	366-1559-00			1	PUSH BUTTON:SIL GY,0.18 SQ X 0.43	80009	366-1559-00
-14	426-0681-00			1	FRAME,PUSH BTN:	80009	426-0681-00
-15	426-1072-00			1	FRAME,PUSH BTN:SILVER GRAY PLSTC	80009	426-1072-00
-16	131-1315-01			1	CONN,RCPT,ELEC:BNC,FEMALE	80009	131-1315-01
-17	105-0076-02	B010100	B092229	1	RELEASE BAR,LCH:PLUG-IN UNIT	80009	105-0076-02
	105-0076-04	B092230		1	RELEASE BAR,LCH:PLUG-IN UNIT	80009	105-0076-04
-18	214-1280-00			1	SPRING,HLCPS:0.14 OD X 1.126 L,TWIST LOOP	91260	ORDER BY DESCR
-19	333-1836-00	B010100	B085809	1	PANEL,FRONT:	80009	333-1836-00
	333-1836-01	B085810		1	PANEL,FRONT:	80009	333-1836-01
-20	378-0074-00			14	REFLECTOR,LIGHT:PUSH BUTTON	80009	378-0074-00
-21	366-1650-00			14	PUSH BUTTON:CLEAR,0.184 X 0.214 X 8.0	80009	366-1650-00
-22	351-0469-00			2	GUIDE,PUSH BTN:4 BUTTON	80009	351-0469-00
-23	351-0469-01			2	GUIDE,PUSH BTN:3 BUTTON	80009	351-0469-01
-24	200-0935-00			4	BASE,LAMPHOLDER:0.29 OD X 0.19 L,BK PLSTC	80009	200-0935-00
-25	-----			1	LAMP,LED:2.0 VOLTS,GREEN(SEE CR220 REPL)		
-26	-----			1	LAMP,LED:2.2 VOLTS,YELLOW(SEE CR232 REPL)		
-27	352-0157-00			2	LAMPHOLDER:(1)T-2 UNBASED,WHITE	80009	352-0157-00
-28	-----			1	RESISTOR,VAR:(SEE R60 REPL) (ATTACHING PARTS)		
-29	210-0583-00			1	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL (END ATTACHING PARTS)	73743	2X-20319-402
-30	-----			1	RESISTOR,VAR:(SEE R410/R415 REPL) (ATTACHING PARTS)		
-31	210-0583-00			2	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
-32	210-0046-00			1	WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL (END ATTACHING PARTS)	77900	1214-05-00-0541C
-33	-----			2	RESISTOR,VAR:(SEE R520 AND R530 REPL) (ATTACHING PARTS)		
-34	210-0583-00			4	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
-35	210-0046-00			2	WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL (END ATTACHING PARTS)	77900	1214-05-00-0541C
-36	-----			1	RESISTOR,VAR:(SEE R210 REPL) (ATTACHING PARTS)		
-37	210-0583-00			2	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
-38	210-0046-00			3	WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL (END ATTACHING PARTS)	77900	1214-05-00-0541C
-39	-----			1	RESISTOR,VAR:(SEE R295 REPL) (ATTACHING PARTS)		
-40	210-0583-00			1	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
-41	210-0046-00			1	WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL (END ATTACHING PARTS)	77900	1214-05-00-0541C
-42	-----			1	RESISTOR,VAR:(SEE R705 REPL) (ATTACHING PARTS)		
-43	210-0046-00			1	WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL	77900	1214-05-00-0541C
-44	129-0290-00	B010100	B095250	1	SPCR,POST:0.635 L,0.25-32 THRU,AL,0.312 HEX	80009	129-0290-00

Replaceable Mechanical Parts - 7B85

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Discnt	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-	129-0252-00	B095251		1	SPCR, POST:0.471 L, 0.25-32 THRU, AL, 0.312 HEX	80009	129-0252-00
-45	358-0342-00			1	BSHG, MACH THD:0.25-32 X 0.159 0.352 L	80009	358-0342-00
-46	210-0046-00			1	WASHER, LOCK:0.261 ID, INTL, 0.018 THK, STL (END ATTACHING PARTS)	77900	1214-05-00-0541C
-47	348-0235-00			2	SHLD GSKT, ELEK:FINGER TYPE, 4.734 L	92101	ORDER BY DESCR
-48	348-0067-00			1	GROMMET, PLASTIC:GRAY, ROUND, 0.252 ID	80009	348-0067-00
-49	386-3256-00			1	SUBPANEL, FRONT: (ATTACHING PARTS)	80009	386-3256-00
-50	213-0192-00	B010100	B090000	4	SCREW, TPG, TF:6-32 X 0.5, SPCL TYPE, FILH, STL	87308	ORDER BY DESCR
	213-0793-00	B090001		4	SCREW, TPG, TF:6-32 X 0.4375, TAPTITE, FILH (END ATTACHING PARTS)	83486	239-006-406043
-51	386-3440-00			1	LT CNDCT, PB ILL:3 BUTTON, 7.5MM SPACING	80009	386-3440-00
-52	131-1820-00			5	CONN, PLUG, ELEC:CKT BD, 5 CONTACT MALE	22526	65306-002
-53	384-1382-00			7	EXTENSION SHAFT:1.09 L, OFFSET, MLD PLSTC	80009	384-1382-00
-54	214-1054-00			1	SPRING, FLAT:0.825 X 0.322, SST	TK1326	ORDER BY DESCR
-55	105-0075-00			1	BOLT, LATCH:	80009	105-0075-00
-56	214-1061-00			1	CONTACT, ELEC:GROUNDING, CU BE	80009	214-1061-00
-57	337-2253-00	B010100	B088749	1	SHIELD, ELEC:DVM BOARD (ATTACHING PARTS)	80009	337-2253-00
-58	211-0008-00	B010100	B088749	4	SCREW, MACHINE:4-40 X 0.25, PNH, STL (END ATTACHING PARTS) SHIELD INCLUDES:	93907	ORDER BY DESCR
-59	129-0124-00			3	.SPACER, POST:0.148 L, 4-40 THRU, BRS, 0.218 OD	80009	129-0124-00
-60	131-0993-00	B010100	B088749	1	BUS, CONDUCTOR:SHUNT ASSEMBLY, BLACK	22526	65474-005
-61	-----			1	CKT BOARD ASSY:DVM(SEE A4 REPL) (ATTACHING PARTS)		
-62	211-0008-00			3	SCREW, MACHINE:4-40 X 0.25, PNH, STL (END ATTACHING PARTS) CKT BOARD ASSY INCLUDES:	93907	ORDER BY DESCR
-63	136-0252-07	B010100	B088749	105	.SOCKET, PIN CONN:W/O DIMPLE	22526	75060-012
	136-0252-07	B088750		41	.SOCKET, PIN CONN:W/O DIMPLE	22526	75060-012
-64	131-0608-00	B010100	B088749	10	.TERMINAL, PIN:0.365 L X 0.025 BRZ GLD PL	22526	48283-036
-65	263-0015-01			1	.SWITCH PB ASSY:3 LATCHING, 7.5MM, 5 CONTACT	80009	263-0015-01
-66	343-0495-03	B010100	B088749	5	.CLIP, SWITCH:FRONT, 7.5MM X 3 UNIT	80009	343-0495-03
	343-0495-03	B088750		1	.CLIP, SWITCH:FRONT, 7.5MM X 3 UNIT (ATTACHING PARTS)	80009	343-0495-03
-67	210-3033-00			3	.EYELET, METALLIC:0.059 OD X 0.156 L, BRS (END ATTACHING PARTS)	07707	SE-25
-68	343-0499-03	B010100	B090499	1	.CLIP, SWITCH:REAR, 7.5MM X 3 UNIT	80009	343-0499-03
	343-0499-12	B090500		1	.CLIP, SWITCH:REAR, 7.5MM X 3 UNIT (ATTACHING PARTS)	80009	343-0499-12
-69	210-3033-00			3	.EYELET, METALLIC:0.059 OD X 0.156 L, BRS (END ATTACHING PARTS)	07707	SE-25
-70	136-0514-00	B010100	B088749	3	.SKT, PL-IN ELEK:MICROCIRCUIT, 8 DIP	09922	D1LB8P-108
	136-0514-00	B088750		4	.SKT, PL-IN ELEK:MICROCIRCUIT, 8 DIP	09922	D1LB8P-108
-71	136-0260-02			1	.SKT, PL-IN ELEK:MICROCIRCUIT, 16 DIP	09922	D1LB16P-108T
-72	214-0579-00			1	.TERM, TEST POINT: BRS CD PL	80009	214-0579-00
-73	136-0269-02	B010100	B088749	3	.SKT, PL-IN ELEK:MICROCIRCUIT, 14 DIP	09922	D1LB14P-108T
	136-0269-02	B088750		1	.SKT, PL-IN ELEK:MICROCIRCUIT, 14 DIP	09922	D1LB14P-108T
-74	136-0263-04			10	.SOCKET, PIN TERM:U/W 0.025 SQ PIN	22526	75377-001
-75	131-0589-00	B010100	B088749	22	.TERMINAL, PIN:0.46 L X 0.025 SQ PH BRZ	22526	48283-029
	131-0589-00	B088750		30	.TERMINAL, PIN:0.46 L X 0.025 SQ PH BRZ	22526	48283-029
	136-0634-00	B088750	B092491	1	.SKT, PL-IN ELEK:MICROCIRCUIT, 20 DIP	09922	D1LB20P-108
	136-0752-00	B092492		1	.SKT, PL-IN ELEK:MICROCIRCUIT, 20 DIP	09922	D1LB20P-108
	131-0566-00	B088750		1	.BUS, CONDUCTOR:DUMMY RES, 0.094 OD X 0.225 L	24546	OMA 07
-76	-----			1	CKT BOARD ASSY:TRIGGER(SEE A2 REPL) (ATTACHING PARTS)		
-77	211-0008-00			2	SCREW, MACHINE:4-40 X 0.25, PNH, STL (END ATTACHING PARTS) CKT BOARD ASSY INCLUDES:	93907	ORDER BY DESCR
-78	263-0016-00			1	.SWITCH PB ASSY:4 LATCHING, 7.5 MM, 5 CONTACT .SAFETY CONTROLLED	80009	263-0016-00
-79	263-0015-00			2	.SWITCH PB ASSY:3 LATCHING, 7.5 MM	80009	263-0015-00
-80	343-0495-04			1	.CLIP, SWITCH:FRONT, 7.5MM X 4 UNIT (ATTACHING PARTS)	80009	343-0495-04
-81	210-3050-00			3	.EYELET, METALLIC:0.059 OD X 0.218 L, BRS	80009	210-3050-00
	210-3033-00			1	.EYELET, METALLIC:0.059 OD X 0.156 L, BRS (END ATTACHING PARTS)	07707	SE-25

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-82	343-0499-04	B010100	B090499	1	.CLIP,SWITCH:REAR,7.5MM X 4 UNIT	80009	343-0499-04
	343-0499-13	B090500		1	.CLIP,SWITCH:7.5MM X 4 UNIT (ATTACHING PARTS)	80009	343-0499-13
-83	210-3050-00			3	.EYELET,METALLIC:0.059 OD X 0.218 L,BRS	80009	210-3050-00
	210-3033-00			1	.EYELET,METALLIC:0.059 OD X 0.156 L,BRS (END ATTACHING PARTS)	07707	SE-25
-84	343-0495-03			1	.CLIP,SWITCH:FRONT,7.5MM X 3 UNIT	80009	343-0495-03
-85	343-0499-03			1	.CLIP,SWITCH:REAR,7.5MM X 3 UNIT	80009	343-0499-03
-86	263-0010-01			1	.SWITCH PB ASSY:1 PUSH,7.5 MM,1 CONTACT	80009	263-0010-01
-87	343-0495-01			1	.CLIP,SWITCH:FRONT,7.5MM X 1 UNIT (ATTACHING PARTS)	80009	343-0495-01
				1	.EYELET,METALLIC:0.059 OD X 0.156 L,BRS (END ATTACHING PARTS)	07707	SE-25
-88	210-3033-00			1	.CLIP,SWITCH:REAR,7.5MM X 1 UNIT (ATTACHING PARTS)	80009	343-0499-01
-89	343-0499-01			1	.EYELET,METALLIC:0.059 OD X 0.156 L,BRS (END ATTACHING PARTS)	07707	SE-25
-90	210-3033-00			1	.CLIP,SWITCH:REAR,7.5MM X 1 UNIT (ATTACHING PARTS)	80009	343-0499-01
-91	131-0608-00			5	.EYELET,METALLIC:0.059 OD X 0.156 L,BRS (END ATTACHING PARTS)	07707	SE-25
-92	131-1003-00			3	.TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	22526	48283-036
-93	136-0252-04	B010100	B069999	21	.CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
	136-0252-04	B070000		24	.SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
-94	214-0579-00			2	.SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
-95	136-0634-00	B010100	B092491	1	.TERM,TEST POINT:BRS CD PL	80009	214-0579-00
	136-0752-00	B092492		1	.SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P-108
-96	136-0514-00	B010100	B092491	3	.SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P-108
-97	136-0260-02	B010100	B092491	3	.SKT,PL-IN ELEK:MICROCIRCUIT,8 DIP	09922	DILB8P-108
	136-0729-00	B092492		1	.SKT,PL-IN ELEK:MICROCIRCUIT,8 DIP	09922	DILB8P-108
-98	214-0973-00			1	.SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP	09922	DILB16P-108T
-99	136-0263-04			1	.HEAT SINK,XSTR:TO-92,CU BE CD PL	80009	214-0973-00
	136-0263-07			10	.SOCKET,PIN TERM:U/W 0.025 SQ PIN	22526	75377-001
-100	386-1402-02	B010100	B079999	1	.SOCKET,PIN TERM:U/W 0.025 SQ PIN	22526	ORDER BY DESCR
	386-1402-00	B080000	B096200	1	PANEL,REAR:	80009	386-1402-02
	386-5466-00	B096201		1	PANEL,REAR: (ATTACHING PARTS)	80009	386-1402-00
-101	213-0192-00	B010100	B090000	4	PANEL,REAR:	80009	386-5466-00
	213-0793-00	B090001		4	SCREW,TPG,TF:6-32 X 0.5,SPCL TYPE,FILH,STL	87308	ORDER BY DESCR
-102	361-0326-00			1	SCREW,TPG,TF:6-32 X 0.4375,TAPTITE,FILH	83486	239-006-406043
-103	384-1100-00			1	SPACER,SLEEVE:0.1 L X 0.18 ID,AL (NO LONGER USED) (END ATTACHING PARTS)	80009	361-0326-00
-104	384-1292-00			1	EXTENSION SHAFT:6.215 L X 0.187 SQ,PLASTIC	80009	384-1100-00
-105	129-0198-00			5	EXTENSION SHAFT:2.417 L,GL FILLED NYLON	80009	384-1292-00
-106	211-0008-00			5	SPCR,POST:0.75 L,4-40 EA END,BRS,0.188 HEX (ATTACHING PARTS)	80009	129-0198-00
-107	204-0683-00			5	SCREW,MACHINE:4-40 X 0.25,PNH,STL (END ATTACHING PARTS)	93907	ORDER BY DESCR
	672-0540-00	B010100	B094870	1	CONN BODY,RCPT:5 FEMALE PV CONTACTS	22526	65058-001
	672-0540-01	B094871	B095373	1	CIRCUIT BD ASSY:TIME/CM	80009	672-0540-00
	672-0540-02	B095374		1	CIRCUIT BD ASSY:TIME/CM	80009	672-0540-01
-108	211-0008-00			6	CIRCUIT BD ASSY:TIME/CM (ATTACHING PARTS)	80009	672-0540-02
-109	384-1417-00			1	SCREW,MACHINE:4-40 X 0.25,PNH,STL (END ATTACHING PARTS)	93907	ORDER BY DESCR
-110	213-0299-00			1	CKT BOARD ASSY INCLUDES: .EXTENSION SHAFT:10.275 L X 0.125 OD,AL (ATTACHING PARTS)	80009	384-1417-00
-111	200-1362-00			2	.SETSCREW:4-40 X 0.125,STL (END ATTACHING PARTS)	TK0433	ORDER BY DESCR
-112	211-0244-00	B010100	B090929	3	.COVER,CAM SW:30 ELEMENTS (ATTACHING PARTS)	80009	200-1362-00
-113	211-0292-00	B090930		3	.SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL	TK0858	211-0244-00
	210-0406-00			3	.SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
-114	-----			1	.NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL (END ATTACHING PARTS)	73743	12161-50
-115	211-0244-00	B010100	B090929	4	.CKT BOARD ASSY:READOUT(SEE A3 REPL) (ATTACHING PARTS)	TK0858	211-0244-00
-116	211-0292-00	B090930		4	.SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL	TK0858	211-0244-00
	211-0008-00			1	.SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01

Replaceable Mechanical Parts - 7885

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-					..(END ATTACHING PARTS)		
					..CKT BOARD ASSEMBLY INCLUDES:		
-117	131-0604-00			13	..CONTACT,ELEC:CKT BD SW,SPR,CU BE	80009	131-0604-00
-118	136-0263-04			3	..SOCKET,PIN TERM:U/W 0.025 SQ PIN	22526	75377-001
-119	131-0589-00			10	..TERMINAL,PIN:0.46 L X 0.025 SQ PH BRZ	22526	48283-029
-120	131-0963-00			1	..CONTACT,ELEC:GROUNDING,PH BRZ,W/BRACKET	TK0507	ORDER BY DESCR
					..SW CAM ACTR AS:TIME/CM(SEE S800 REPL)		
					..(ATTACHING PARTS)		
-121	211-0244-00	8010100	B090929	4	..SCR,ASSEM WSHR:4-40 X 0.312,PNH STL	TK0858	211-0244-00
	211-0292-00	8090930		4	..SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
					..(END ATTACHING PARTS)		
					..ACTR ASSY INCLUDES:		
-122	210-0406-00			3	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
-123	214-1139-03			2	..SPRING,FLAT:0.885 X 0.156 CU BE RED CLR	80009	214-1139-03
-124	214-1752-00			2	..ROLLER,DETENT:0.125 OD X 0.16,SST	80009	214-1752-00
-125	401-0180-00			1	..BEARING,CAM SW:FR & REAR,0.80 & 0.83 DIA	80009	401-0180-00
	214-1139-00	8091100		1	..SPRING,FLAT:0.885 X 0.156 CU BE GLD CLR	80009	214-1139-00
	214-1139-02	8091100		1	..SPRING,FLAT:0.885 X 0.156 CU BE GRN CLR	80009	214-1139-02
					..(ATTACHING PARTS)		
-126	354-0390-00			1	..RING,RETAINING:BASIC EXT,U/O 0.375 DIA SFT	79136	5100-37-ZD
					..(END ATTACHING PARTS)		
-127	384-0878-08			1	..SFT,CAM SW:4.964 L X 0.248 OD OUTER CNCTRC	80009	384-0878-08
-128	105-0696-00			1	..ACTUATOR,CAM SW:TIME/CM,FRONT	80009	105-0696-00
-129	210-0406-00			2	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
-130	401-0178-01			1	..BEARING,CAM SW:CENTER REAR	80009	401-0178-01
-131	-----			1	..SWITCH,PUSH:(SEE S435 REPL)		
-132	361-0411-00			2	..SPACER,PUSH SW:0.109 L,BLUE POLYCARBONATE	80009	361-0411-00
-133	352-0274-00			1	..HOLDER,TERMINAL:8 SQUARE PINS	80009	352-0274-00
-134	131-0593-00			3	..TERMINAL,PIN:1.15 L X 0.025 SQ BRS TIN PL	22526	47334
-135	351-0180-00			1	..GUIDE,SLIDE SW:SWITCH ACTUATOR	80009	351-0180-00
-136	129-0570-00			1	..SPCR,POST:0.976,4-40 INT ENDS,BRS,0.188 HEX	80009	129-0570-00
					..(ATTACHING PARTS)		
-137	211-0008-00			1	..SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					..(END ATTACHING PARTS)		
-138	214-1136-00			1	..ACTUATOR,SL SW:VARIABLE CAL	80009	214-1136-00
-139	214-1190-00			1	..CPLG,SHAFT,RGD:0.125 OD TO 0.125 OD,AL	80009	214-1190-00
-140	-----			1	..RESISTOR,VAR:(SEE R725 REPL)		
					..(ATTACHING PARTS)		
-141	213-0239-00			1	..SETSCREW:3-48 X 0.062,STL	80009	213-0239-00
-142	210-0583-00			1	..NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
-143	210-0046-00			1	..WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL	77900	1214-05-00-0541C
					..(END ATTACHING PARTS)		
-144	407-0803-00			1	..BRACKET,ELEC SW:BRASS	80009	407-0803-00
-145	136-0252-07			5	..SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
-146	131-1003-00			2	..CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
-147	352-0196-00			2	..HOLDER,RESISTOR:PANEL MOUNT,DELTRIN	80009	352-0196-00
-148	263-0016-01			1	..SWITCH PB ASSY:3 LCH & 1 CANC,7.5MM,5 CONT	80009	263-0016-01
-149	-----			1	..CKT BOARD ASSY:INTERFACE(SEE A1 REPL)		
-150	343-0495-04	8010100	B093999	1	..CLIP,SWITCH:FRONT,7.5MM X 4 UNIT	80009	343-0495-04
					..(ATTACHING PARTS)		
-151	210-3033-00	8010100	B093999	4	..EYELET,METALLIC:0.059 OD X 0.156 L,BRS	07707	SE-25
					..(END ATTACHING PARTS)		
-152	343-0499-04	8010100	B090499	1	..CLIP,SWITCH:REAR,7.5MM X 4 UNIT	80009	343-0499-04
	343-0499-13	8090500	B093999	1	..CLIP,SWITCH:7.5MM X 4 UNIT	80009	343-0499-13
					..(ATTACHING PARTS)		
-153	210-3033-00	8010100	B093999	4	..EYELET,METALLIC:0.059 OD X 0.156 L,BRS	07707	SE-25
					..(END ATTACHING PARTS)		
-154	131-0608-00	8010100	B093999	48	..TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	22526	48283-036
	131-0608-00	8094000		51	..TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	22526	48283-036
-155	214-0579-00	8010100	B093999	3	..TERM,TEST POINT:BRS CD PL	80009	214-0579-00
	214-0579-00	8094000		1	..TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-156	136-0514-00	8010100	B092491	3	..SKT,PL-IN ELEK:MICROCIRCUIT,8 DIP	09922	D1LB8P-108
	136-0727-00	8092492	B093999	3	..SKT,PL-IN ELEK:MICROCKT,8 CONTACT	09922	D1LB8P-108
	136-0263-07	8094000		10	..SOCKET,PIN TERM:U/W 0.025 SQ PIN	22526	ORDER BY DESCR
-157	136-0634-00	8010100	B092491	1	..SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP	09922	D1LB20P-108
	136-0752-00	8092492		1	..SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP	09922	D1LB20P-108
-158	136-0263-04			25	..SOCKET,PIN TERM:U/W 0.025 SQ PIN	22526	75377-001
-159	136-0252-04			144	..SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Discont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-160	131-0604-00			29	.CONTACT,ELEC:CKT BD SW,SPR,CU BE	80009	131-0604-00
-161	131-0566-00			5	.BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
	131-0604-00	8094000		5	.CONTACT,ELEC:CKT BD SW,SPR,CU BE	80009	131-0604-00
	210-0261-00	8050000		1	.TERMINAL,LUG:0.14 ID,PLAIN,BRASS	91260	ORDER BY DESCR
-162	220-0547-01			6	NUT BLOCK:4-40 X 0.282,NI SIL NP (ATTACHING PARTS)	80009	220-0547-01
-163	211-0105-00			1	SCREW,MACHINE:4-40 X 0.188,FLH,100 DEG (END ATTACHING PARTS)	TK0435	ORDER BY DESCR
-164	426-0505-11			1	FR SECT,PLUG-IN:TOP	80009	426-0505-11
-165	426-0499-11			1	FR SECT,PLUG-IN:BOTTOM	80009	426-0499-11
-166	131-0707-00			31	CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL	22526	47439-000
-167	352-0169-00			2	HLDR,TERM CONN:2 WIRE,BLACK	80009	352-0169-00
-168	352-0161-07			1	HLDR,TERM CONN:3 WIRE,VIOLET	80009	352-0161-07
-169	352-0162-00			1	HLDR,TERM CONN:4 WIRE,BLACK	80009	352-0162-00
	352-0162-04			1	HLDR,TERM CONN:4 WIRE,YELLOW	80009	352-0162-04
-170	352-0163-05			1	HLDR,TERM CONN:5 WIRE,GREEN	80009	352-0163-05
	352-0163-06			1	HLDR,TERM CONN:5 WIRE,BLUE	80009	352-0163-06
-171	175-0825-00			AR	CABLE,SP,ELEC:2,26 AWG,STRD,PVC JKT,RBN	80009	175-0825-00
-172	175-0828-00			AR	CABLE,SP,ELEC:5,26 AWG,STRD,PVC JKT,RBN	08261	111-2699-955
	175-0826-00			AR	CABLE,SP,ELEC:3,26 AWG,STRD,PVC JKT,RBN	80009	175-0826-00
	198-2309-00			1	WIRE SET,ELEC:	80009	198-2309-00
	131-0707-00			63	.CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL	22526	47439-000
	352-0161-05			1	.HLDR,TERM CONN:3 WIRE,GREEN	80009	352-0161-05
	352-0162-05			2	.HLDR,TERM CONN:4 WIRE,GREEN	80009	352-0162-05
-173	352-0165-06			2	.HLDR,TERM CONN:7 WIRE,BLUE	80009	352-0165-06
-174	352-0167-07			2	.HLDR,TERM CONN:9 WIRE,VIOLET	80009	352-0167-07
-175	352-0168-00			2	.HLDR,TERM CONN:10 WIRE,BLACK	80009	352-0168-00
-176	175-0827-00			AR	.CABLE,SP,ELEC:4,26 AWG,STRD,PVC JKT,RBN	08261	111-2699-954
-177	175-0830-00			AR	.CABLE,SP,ELEC:7,26 AWG,STRD,PVC JKT,RBN	08261	111-2699-972
-178	175-0832-00			AR	.CABLE,SP,ELEC:9,26 AWG,STRD,PVC JKT,RBN	08261	111-2699-956
	175-0833-00			AR	.CABLE,SP,ELEC:10,26 AWG STRD,PVC JKT,RBN	08261	111-2699-970
STANDARD ACCESSORIES							
	070-1960-00			1	MANUAL,TECH:OPERATOR	80009	070-1960-00
	070-1961-01			1	MANUAL,TECH:INSTR,7885	80009	070-1961-01

# DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

## Symbols and Reference Designators

Electrical components shown on the diagrams are in the following units unless noted otherwise:

- Capacitors = Values one or greater are in picofarads (pF).  
Values less than one are in microfarads (μF).
- Resistors = Ohms (Ω).

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The overline on a signal name indicates that the signal performs its intended function when it goes to the low state.

Abbreviations are based on ANSI Y1.1-1972.

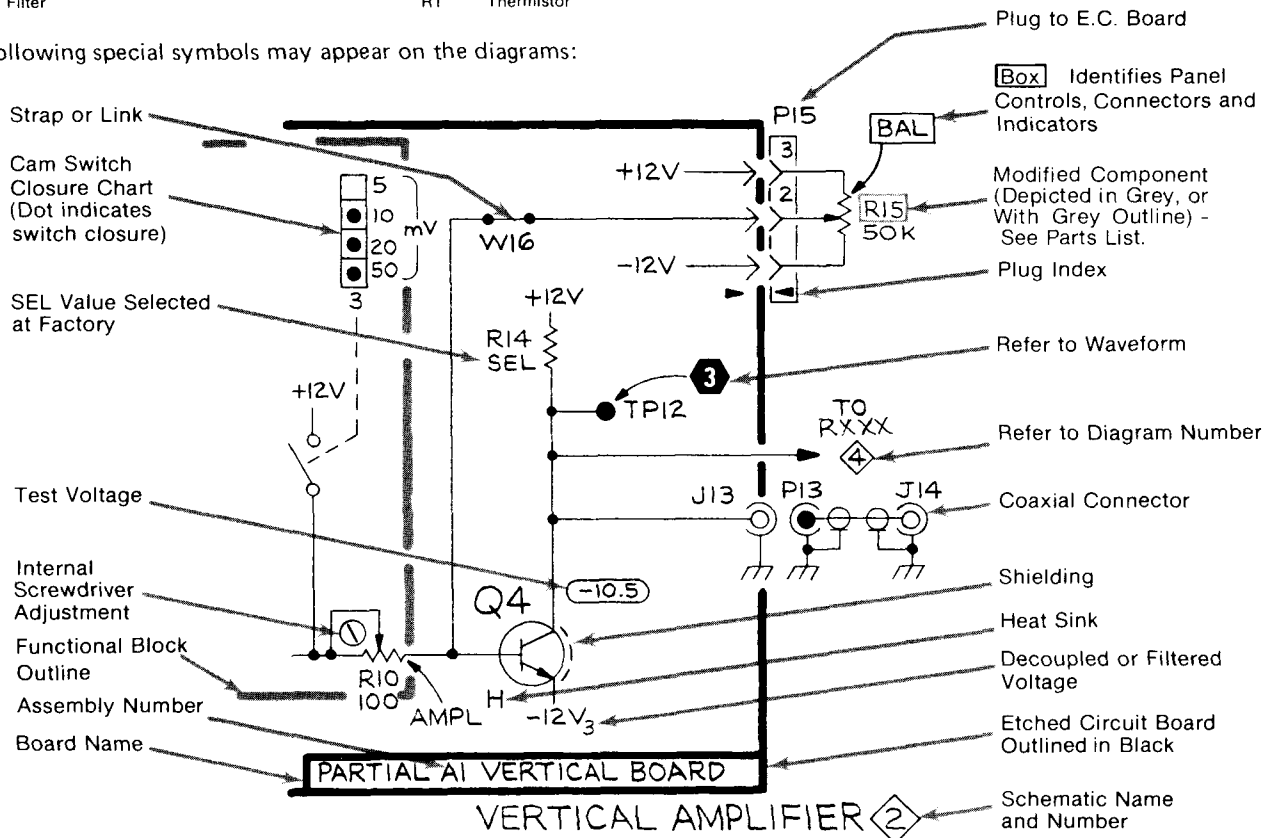
Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

- Y14.15, 1966 Drafting Practices.
- Y14.2, 1973 Line Conventions and Lettering.
- Y10.5, 1968 Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

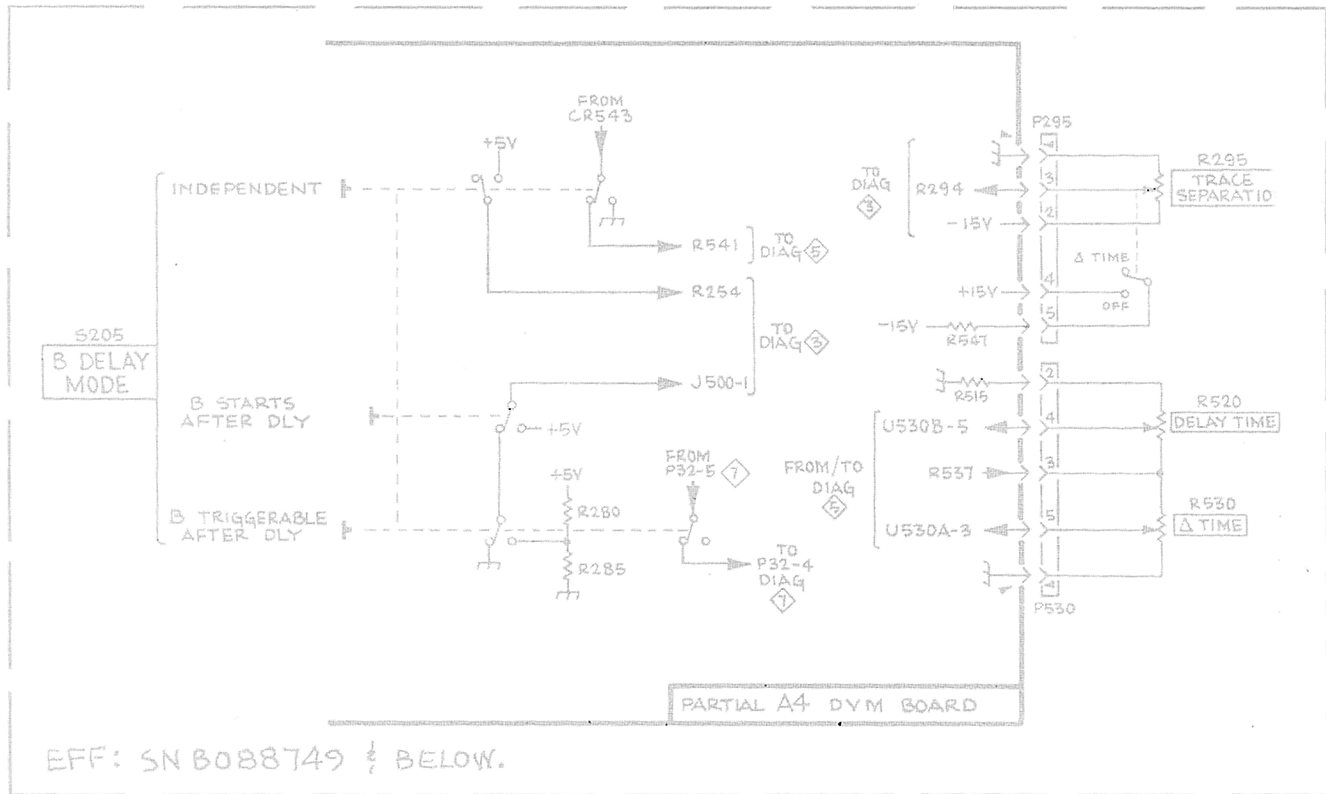
The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

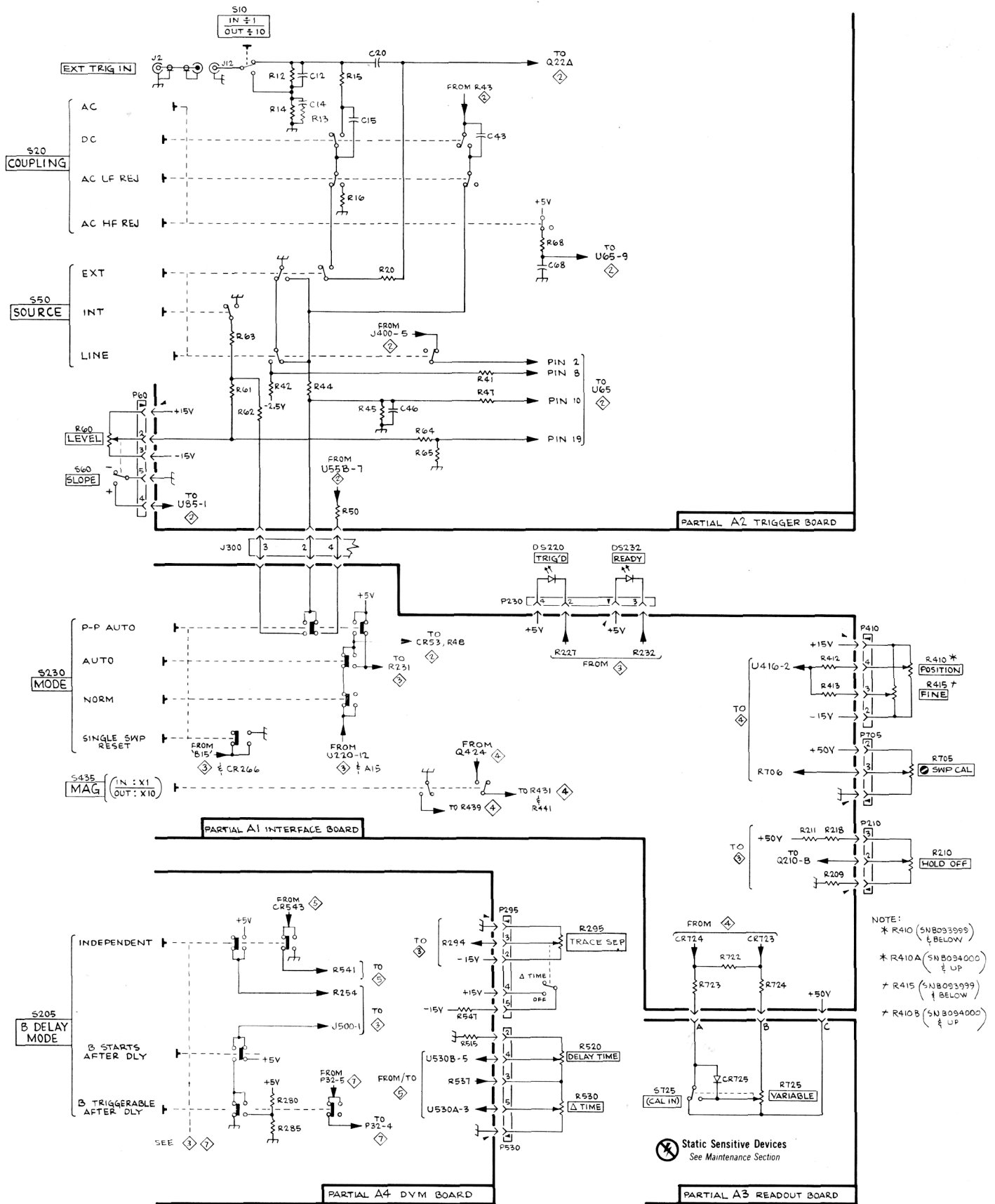
A	Assembly, separable or repairable (circuit board, etc)	H	Heat dissipating device (heat sink, heat radiator, etc)	S	Switch or contactor
AT	Attenuator, fixed or variable	HR	Heater	T	Transformer
B	Motor	HY	Hybrid circuit	TC	Thermocouple
BT	Battery	J	Connector, stationary portion	TP	Test point
C	Capacitor, fixed or variable	K	Relay	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
CB	Circuit breaker	L	Inductor, fixed or variable	V	Electron tube
CR	Diode, signal or rectifier	M	Meter	VR	Voltage regulator (zener diode, etc.)
DL	Delay line	P	Connector, movable portion	W	Wirestrap or cable
DS	Indicating device (lamp)	Q	Transistor or silicon-controlled rectifier	Y	Crystal
E	Spark Gap, Ferrite bead	R	Resistor, fixed or variable	Z	Phase shifter
F	Fuse	RT	Thermistor		
FL	Filter				

The following special symbols may appear on the diagrams:









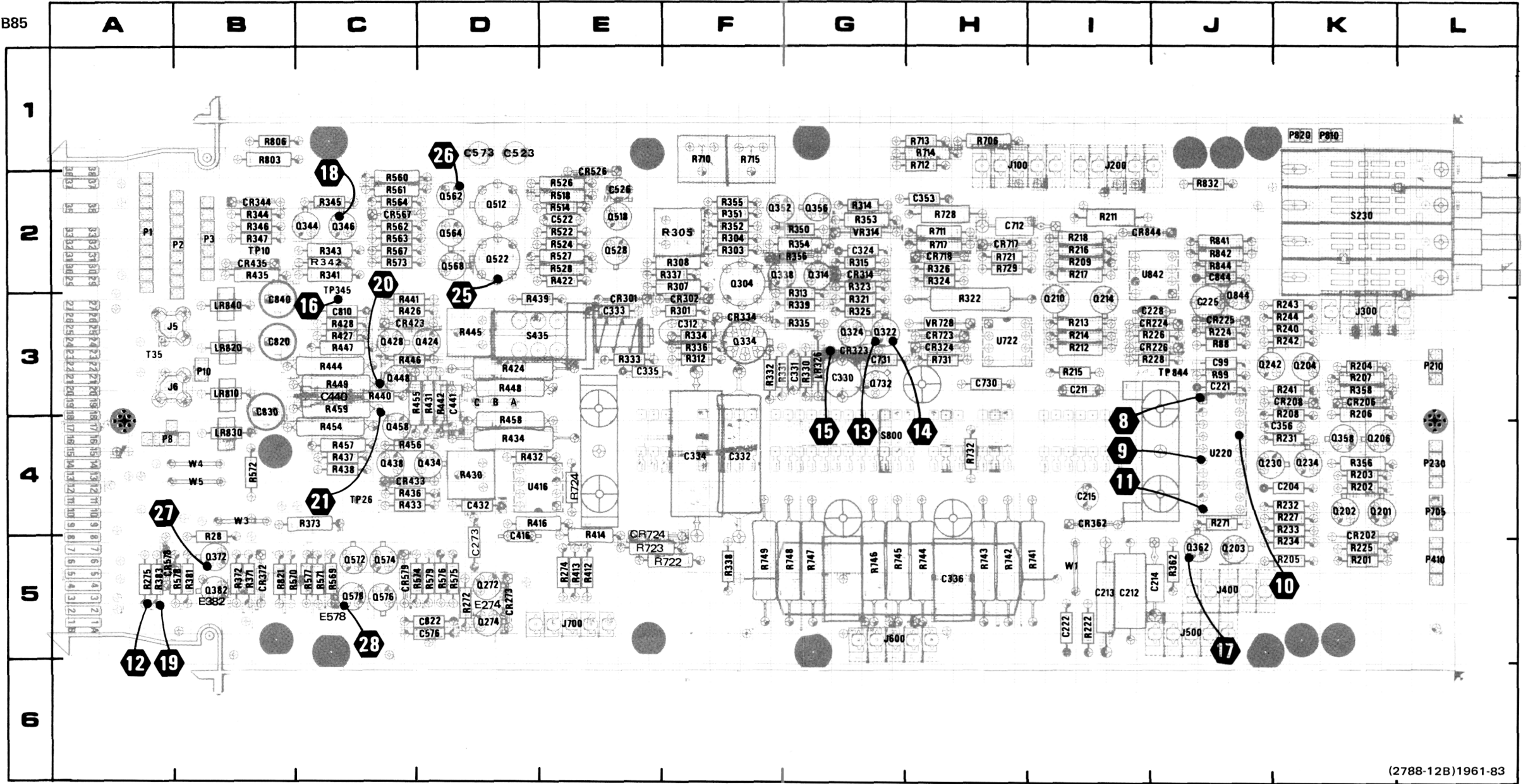


Fig. 8-1A. A1-Interface circuit board assembly (SN B094000 & up).

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C99	3J	CR724	4E	Q568	2D	R337	2F	R567	2C
C204	4K	CR844	2I	Q572	5C	R338	5F	R569	5C
C211	3I	E274	5D	Q574	5C	R339	2G	R570	5B
C212	5I	E382	5B	Q576	5C	R341	2C	R571	5C
C213	5I	E587	5C	Q578	5C	R342	2C	R572	4B
C214	5J	J5	3A	Q732	2G	R343	2C	R573	2C
C215	4I	J6	3A	Q844	2J	R344	2B	R574	5C
C221	3J	J100	1H	R28	4B	R345	2C	R575	5D
C222	5I	J200	1I	R88	3J	R346	2B	R576	5D
C225	3J	J300	3K	R99	3J	R347	2B	R577	5C
C228	3J	J400	5J	R201	5K	R350	2G	R578	5B
C273	5D	J500	5J	R202	4K	R351	2F	R579	5D
C312	3F	J600	5G	R203	4K	R352	2F	R706	1H
C324	2G	J700	5E	R204	3K	R353	2G	R710	1F
C330	2G	LR326	2G	R205	5K	R354	2G	R711	2H
C331	2G	LR810	3B	R206	3K	R355	2F	R712	1H
C332	4F	LR820	3B	R207	3K	R356	4K	R713	1H
C333	3E	LR830	4B	R208	3K	R358	3K	R714	1H
C334	4F	LR840	3B	R209	2I	R362	5J	R715	1F
C335	3E	P1	2A	R211	2I	R371	5B	R717	2H
C336	5H	P2	2B	R212	3I	R372	5B	R721	2H
C353	2H	P3	2B	R213	3I	R373	4C	R722	5E
C356	4K	P8	4A	R214	3I	R381	5B	R723	5E
C416	4D	P10	3B	R215	3I	R383	5A	R724	4E
C432	4D	P210	3L	R216	2I	R412	5E	R728	2H
C440	3C	P230	4L	R217	2I	R413	5E	R729	2H
C441	3D	P410	5L	R218	2I	R414	4E	R731	3H
C522	2E	P705	4L	R222	5I	R416	4D	R732	4H
C523	1D	P810	1K	R224	3J	R422	2E	R741	5I
C526	2E	P820	1K	R225	5K	R424	3D	R742	5H
C573	1D	Q201	4K	R226	3J	R426	3C	R743	5H
C576	5D	Q202	4K	R227	4K	R427	3C	R744	5H
C712	2H	Q203	5J	R228	3J	R428	3C	R745	5G
C730	3H	Q204	3K	R231	4K	R430	4D	R746	5G
C731	2G	Q206	4K	R232	4K	R431	3D	R747	5G
C810	3C	Q210	2I	R233	4K	R432	4D	R748	5G
C820	3B	Q214	2I	R234	5K	R433	4C	R749	5F
C822	5D	Q230	4J	R240	3K	R434	4D	R803	1B
C830	3B	Q234	4K	R241	3K	R435	2B	R806	1B
C840	3B	Q242	3J	R242	3K	R436	4C	R821	5B
C844	2J	Q272	5D	R243	3K	R437	4C	R832	2J
C4206	3K	Q274	5D	R244	3K	R438	4C	R841	2J
C4301	3E	Q304	2F	R255	5K	R439	3D	R842	2J
CR202	4K	Q314	2G	R271	4J	R440	3C	R844	2J
CR206	3K	Q322	2G	R272	5D	R441	3C	S230	2K
CR208	3K	Q324	2G	R274	5E	R442	3D	S435	3D
CR224	3J	Q334	3F	R275	5A	R444	3C	S800	4G
CR225	3J	Q338	2F	R301	3F	R445	3D		
CR226	3J	Q344	2C	R303	2F	R446	3C	T35	3A
CR273	5D	Q346	2C	R304	2F	R447	3C		
CR301	3E	Q352	2F	R305	2F	R448	3D	TP10	2B
CR302	3F	Q356	2G	R307	2F	R449	3C	TP26	4C
CR314	2G	Q362	5J	R308	2F	R454	4C	TP345	2C
CR323	2G	Q372	5B	R312	3F	R455	3C	TP844	3J
CR324	3H	Q382	5B	R313	2G	R456	4C		
CR334	3F	Q424	3D	R314	2G	R457	4C	U220	4J
CR344	2B	Q428	3C	R315	2G	R458	4D	U416	4D
CR356	2G	Q434	4D	R321	2G	R459	3C	U722	3H
CR362	4I	Q438	4C	R322	2H	R514	2E	U842	2I
CR372	5B	Q448	3C	R323	2G	R518	2E		
CR423	3C	Q458	4C	R324	2H	R522	2E	VR314	2G
CR433	4C	Q512	2D	R325	2G	R524	2E	VR728	3H
CR435	2B	Q518	2E	R326	2H	R526	2E		
CR526	2E	Q522	2D	R330	2G	R527	2E	W1	5I
CR567	2C	Q528	2E	R331	3F	R528	2E	W3	4B
CR578	5A	Q562	2D	R332	3F	R560	2C	W4	4B
CR579	5C	Q564	2D	R333	3E	R561	2C	W5	4B
CR717	2H			R334	3F	R562	2C		
CR718	2H			R335	2G	R563	2C		
CR723	3H			R336	3F	R564	2C		

## VOLTAGE AND WAVEFORM CONDITIONS

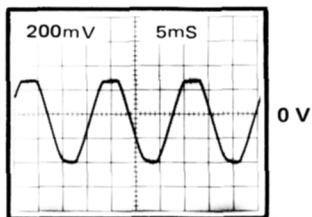
The voltages and waveforms shown were obtained with the 7B85 controls set as follows:

TIME/DIV, 1 ms; VARIABLE (CAL IN), knob in; MAG, X1 (button in); HOLD OFF, fully counterclockwise; SWP CAL, midranged; POSITION, midranged; TRIGGERING: LEVEL, midranged; MODE, P-P AUTO; COUPLING, AC; SOURCE, LINE; SLOPE, +. B DELAY MODE, B STARTS AFTER DLY; DELAY TIME, fully counterclockwise;  $\Delta$  TIME, fully clockwise; TRACE SEP, fully counterclockwise.

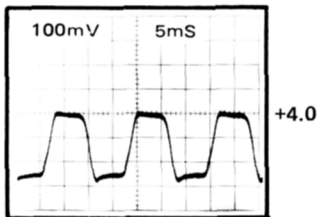
**Voltage Conditions.** The voltages shown on the diagram were obtained using a digital multimeter with a  $10\text{ M}\Omega$  input impedance (Tektronix DM 501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

**Waveform Conditions.** The waveforms shown below were obtained using a test oscilloscope system with  $10\text{ M}\Omega$  input impedance and at least 60 MHz bandwidth (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with 10X probe).

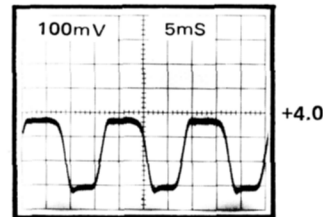
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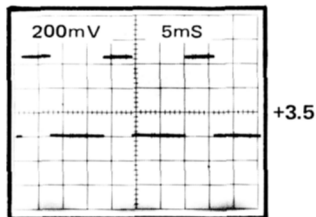
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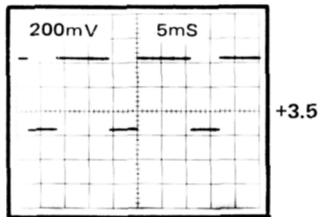
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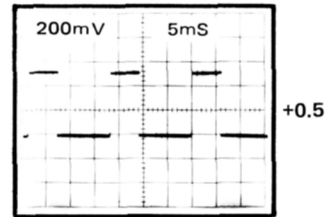
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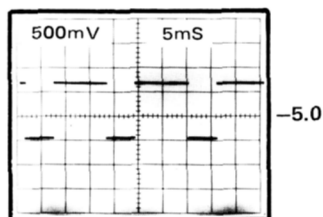
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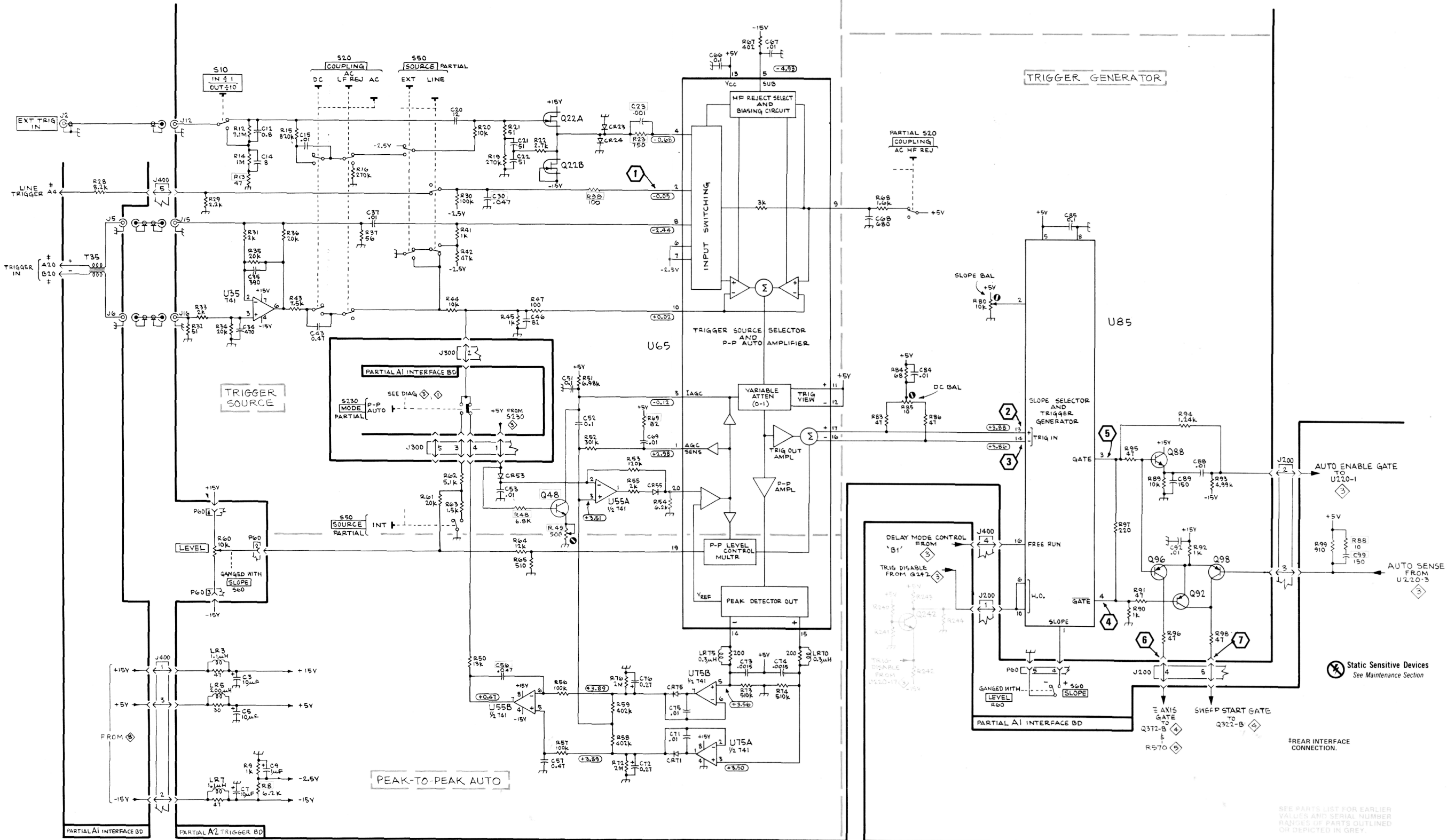


6



7





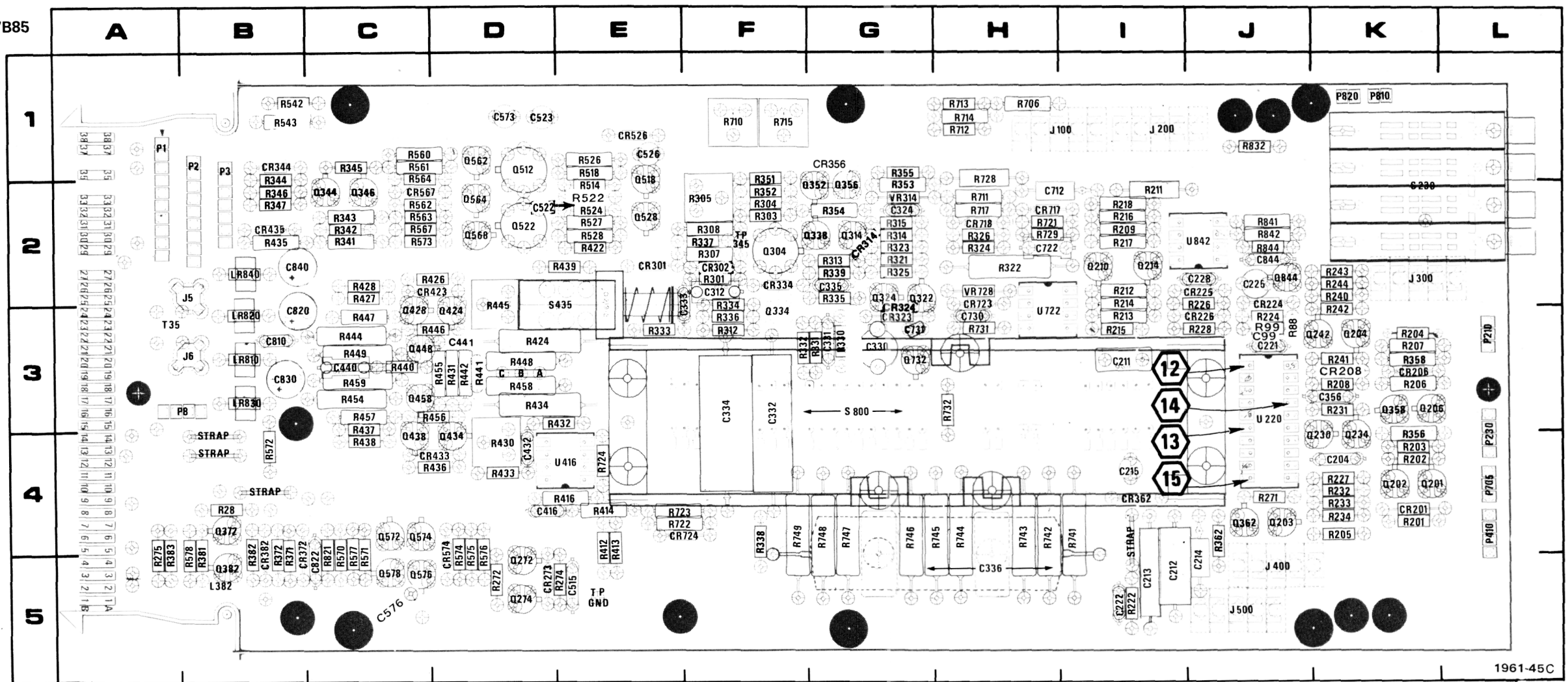


Figure 8-1B. A1—Interface circuit board assembly (SN B093999 & below).

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD		
C99*	3J	C526	1E	CR356	1G	LR840	2B	Q338	2G	Q844	2J	R232	4K	R330	3G	R382	4B	R448	3D	R575	4D	R749	4F
C204	4K	C571	3G	CR362	4I	P1	1A	Q344	2C	R28	4B	R233	4K	R331	3G	R383	4A	R449	3C	R576	4D	R821	5C
C211	3I	C573	1D	CR372	4B	P2	1B	Q346	2C	R28	4B	R234	4K	R332	3F	R412	4E	R454	3C	R577	5C	R832	1J
C212	5I	C576*	5C	CR382	4B	P3	1B	Q352	2G	R88	3J	R240	2K	R333	3E	R413	4E	R455	3D	R578	4B	R841	2J
C213	5I	C712	2H	CR423	2D	P8	3B	Q356	2G	R99	3J	R241	3K	R334	3F	R414	4E	R456	3D	R706	1H	R842	2J
C214	5J	C722	2H	CR433	4D	P210	3L	Q358	3K	R201	4K	R242	3K	R335	2G	R416	4E	R457	3C	R710	1F	R844	2J
C215	4I	C730	3H	CR435	2B	P230	4L	Q362	4J	R202	4K	R243	2K	R336	3F	R422	2E	R458	3D	R711	2H	S230	2K
C221	3J	C810	3B	CR526	1E	P410	4L	Q372	4B	R203	4K	R244	2K	R337	2F	R424	3D	R459	3C	R712	1H	S435	2E
C222	5I	C820	3B	CR567	2C	P705	4L	Q372	4B	R204	3K	R271	4J	R338	4F	R426	2D	R514	2E	R713	1H	S800	3G
C225	2J	C822	5C	CR574	4D	P810	1K	Q382	5B	R205	4K	R272	5D	R339	2G	R427	2C	R518	1E	R714	1H		
C228	2J	C830	3B	CR717	2H	P820	1K	Q424	3D	R206	3K	R274	5E	R341	2C	R428	2C	R522	2E	R715	1F	T35	3A
C312	2F	C830	3B	CR718	2H	Q201	4K	Q428	3C	R207	3K	R275	4A	R342	2C	R430	4D	R524	2E	R717	2H		
C324	2G	C844	2J	CR723	2H	Q202	4K	Q434	4D	R208	3K	R301	2F	R343	2C	R431	3D	R526	1E	R721	2H	TP345	2F
C330	3G	CR201	4K	CR724	4E	Q203	4J	Q438	4C	R209	2I	R303	2F	R344	1B	R432	3E	R527	2E	R722	4E		
C331	3G	CR202	3K	J5	2B	Q204	3K	Q448	3C	R211	2I	R304	2F	R345	1C	R433	4D	R528	2E	R723	4E	U220	3J
C332	3F	CR206	3K	J6	3B	Q206	3K	Q458	3C	R212	2I	R305	2F	R346	2B	R434	3D	R529	2E	R724	4E	U416	4E
C333	3F	CR208	3K	J100	1I	Q210	2I	Q512	1D	R213	3I	R307	2F	R347	2B	R435	2B	R542	1B	R728	1H	U722	3H
C334	3F	CR208	3K	J200	1I	Q210	2I	Q518	1E	R214	2I	R308	2F	R351	1F	R436	4D	R543	1B	R729	2H	U842	2J
C335	2G	CR224	2J	J300	2K	Q214	2I	Q522	2D	R215	3I	R312	3F	R352	2F	R437	3C	R560	1C	R731	3H		
C336	5H	CR225	2J	J400	5J	Q230	4K	Q528	2E	R216	2I	R313	2G	R353	2G	R438	4C	R562	2C	R732	3H	VR314	2G
C356	3K	CR273	5D	J500	5J	Q242	3K	Q562	1D	R217	2I	R314	2G	R354	2G	R439	2E	R563	2C	R741	4I	VR728	2H
C381	3G	CR301	2E	L274	5A	Q272	5D	Q564	2D	R218	2I	R315	2G	R355	1G	R440	3C	R564	1C	R742	4H		
C416	4D	CR302	2F	L382	5B	Q274	5D	Q568	2D	R222	5I	R321	2G	R356	4K	R441	3D	R567	2C	R743	4H		
C432	4D	CR314*	2G			Q304	2F	Q572	4C	R224	3J	R322	2H	R358	3K	R442	3D	R570	5C	R744	4H		
C440	3C	CR323	3G	LR326	3G	Q314	2G	Q574	4C	R226	2J	R323	2G	R362	4J	R444	3C	R571	5C	R745	4H		
C515	5E	CR324*	3G	LR810	3B	Q322	2G	Q576	5C	R227	4K	R324	2H	R371	4B	R445	2D	R572	4B	R746	4G		
C522	2E	CR334	2F	LR820	3B	Q324	2G	Q578	5C	R228	3J	R325	2G	R372	4B	R446	3D	R573	2C	R747	4G		
C523	1D	CR344	1B	LR830	3B	Q334	3F	Q732	3G	R231	3K	R326	2H	R381	4B	R447	3C	R574	4D	R748	4G		

\*See Parts List for serial number ranges.

†Located on back of board.

⊗ Static Sensitive Devices  
See Maintenance Section

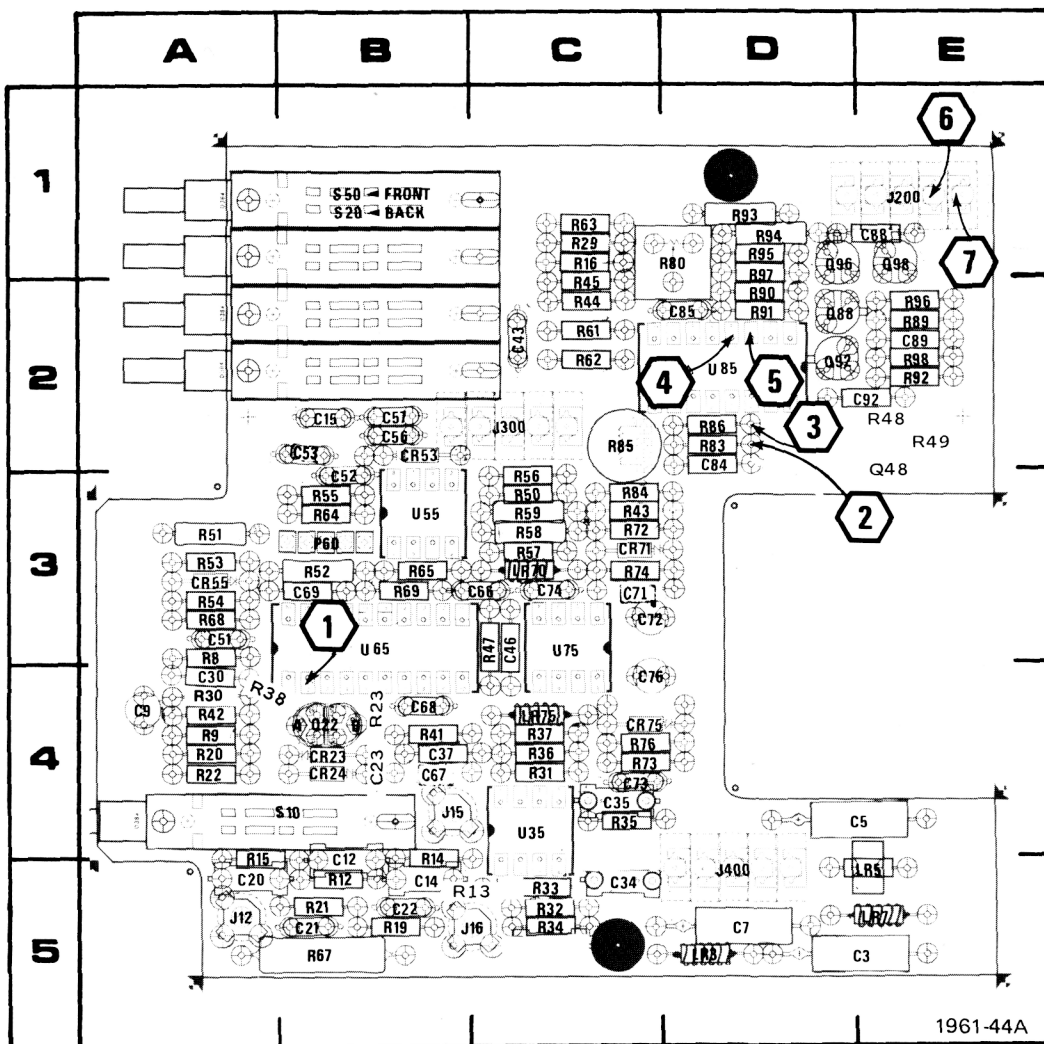
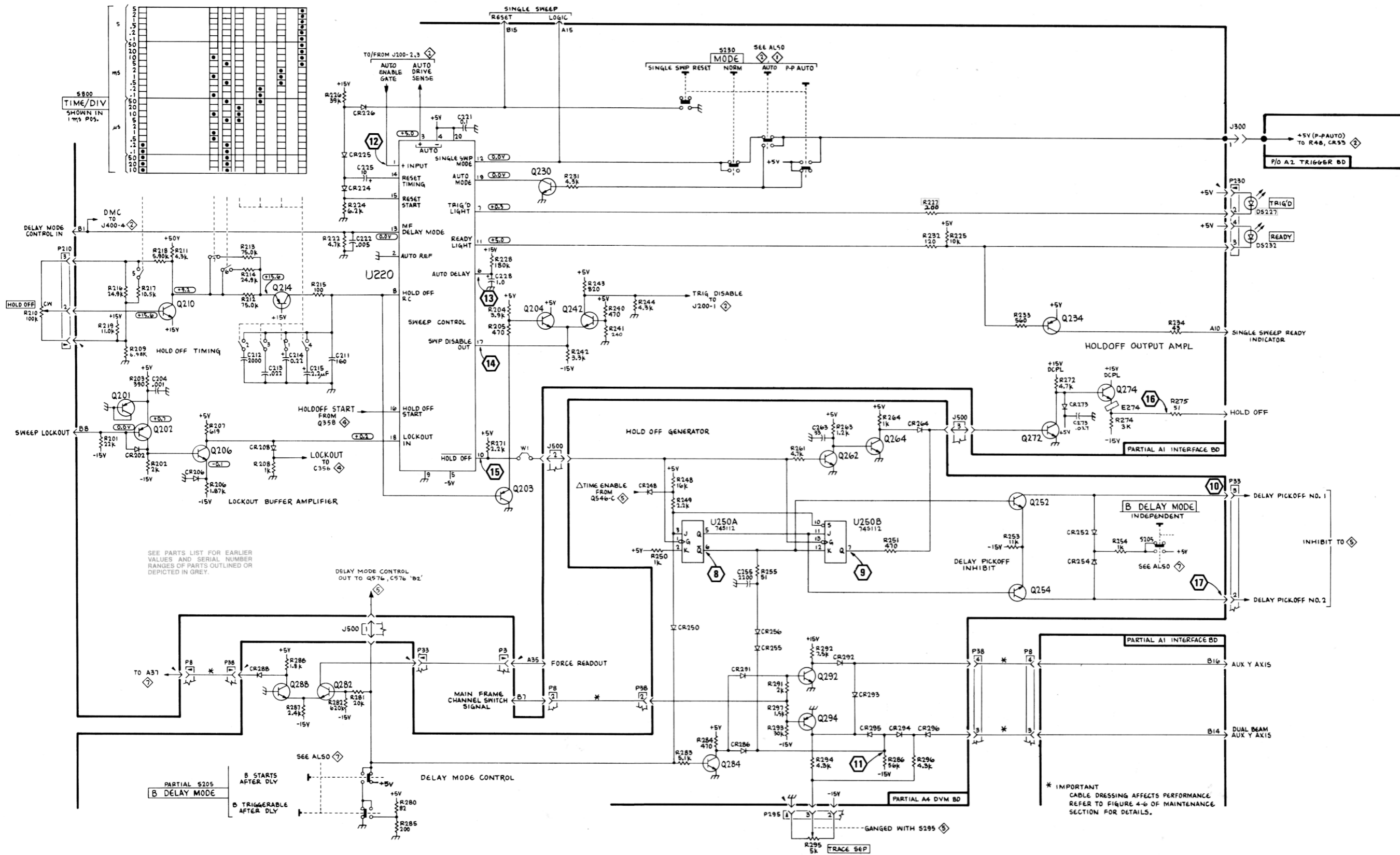


Figure 8-2. A2—Trigger circuit board assembly.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C3	5E	C69	3B	LR3	5D	R21	5B	R85	2C		
C5	4E	C71	3C	LR5	5E	R22	4A	R86	2D		
C7	5D	C73	4C	LR7	5E	R23*	4B	R52	3B	R89	2E
C9	4A	C74	3C	LR70	3C	R29	1C	R53	3A	R90	2D
C12	5B	C76	4C	LR75	4C	R30	4A	R54	3A	R91	2D
C14	5B	C77	1E			R31	4C	R55	3B	R92	2E
C15	2B	C84	2D	P60	3B	R32	5C	R56	3C	R93	1D
C20	5A	C85	2D			R33	5C	R57	3C	R94	1D
C21	5B	C88	1E	Q22	4B	R34	5C	R58	3C	R95	1D
C22	5B	C89	2E	Q48*	2E	R35	4C	R59	3C	R61	2C
C23*	4B	C92	2E	Q88	2D	R36	4C	R62	1C	R63	1C
C30	4A			Q92	2D	R37	4C	R64	3B	R63	1C
C34	5C	CR23	4B	Q96	1D	R38*†	4B	R65	3B	R64	3B
C35	4C	CR24	4B	Q98	1E	R41	4B	R65	3B	R65	3B
C37	4B	CR53	2B			R42	4A	R67	5B	R66	3A
C43	2C	CR55	3A	R8	3A	R43	3C	R67	5B	R67	3B
C46	3C	CR71	3C	R9	4A	R44	2C	R68	3A	R68	3A
C51	3A	CR75	4C	R12	5B	R45	2C	R69	3B	R69	3B
C52	3B			R13*	5C	R47	3C	R72	3C	R72	3C
C53	2B	J12	5A	R14	5B	R48*	2E	R73	4C	R73	4C
C56	2B	J15	4B	R15	5A	R49*	2E	R74	3C	R74	3C
C57	2B	J16	5C	R16	1C	R50	3C	R76	4C	R76	4C
C66	3C	J200	1E	R19	5B	R51	3A	R80	1D	R80	1D
C67	4B	J300	2C	R20	4A			R83	2D	R83	2D
C68	4B	J400	5D					R84	3C	R84	3C





SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.

DELAY MODE CONTROL OUT TO Q576, C976 'B2'

PARTIAL S205  
B DELAY MODE  
B STARTS AFTER DLY  
B TRIGGERABLE AFTER DLY

\* IMPORTANT. CABLE DRESSING AFFECTS PERFORMANCE. REFER TO FIGURE 4-6 OF MAINTENANCE SECTION FOR DETAILS.





## VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the 7B85 controls set as follows:

TIME/DIV, 1 ms; VARIABLE (CAL IN), knob in; MAG, X1 (button in); HOLD OFF, fully counterclockwise; SWP CAL, midranged; POSITION, midranged; TRIGGERING: LEVEL, midranged; MODE, P-P AUTO; COUPLING, AC; SOURCE, LINE; SLOPE, +. B DELAY MODE, B STARTS AFTER DLY; DELAY TIME, fully counterclockwise;  $\Delta$  TIME, fully clockwise; TRACE SEP, fully counterclockwise.

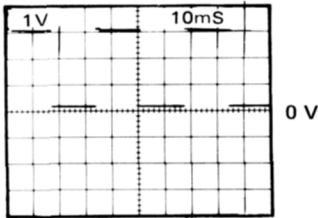
**Voltage Conditions.** The voltages shown on the diagram were obtained using a digital multimeter with a 10 M $\Omega$  input impedance (Tektronix DM 501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

**Waveform Conditions.** The waveforms shown below were obtained using a test oscilloscope system with 10 M $\Omega$  input impedance and at least 60 MHz bandwidth (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with 10X probe).

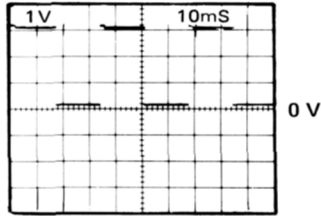
### NOTE

Some voltages and waveforms were measured with the Digital Voltmeter board removed.

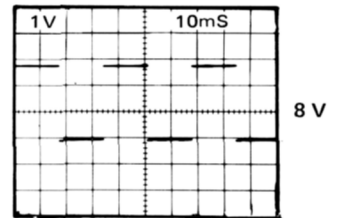
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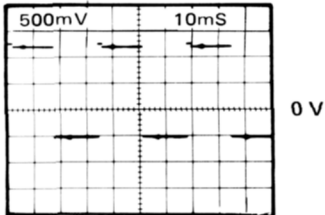
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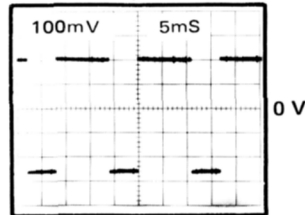
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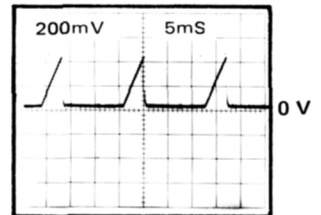
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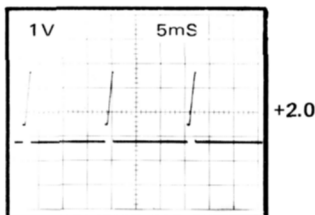
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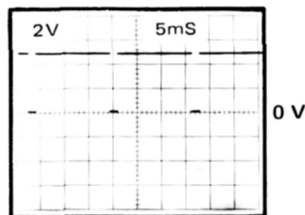
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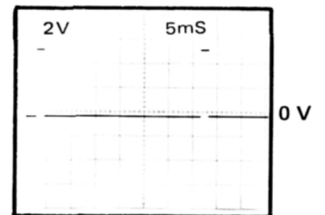
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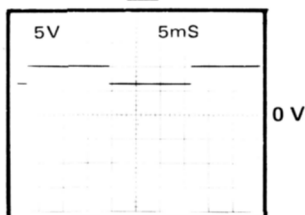
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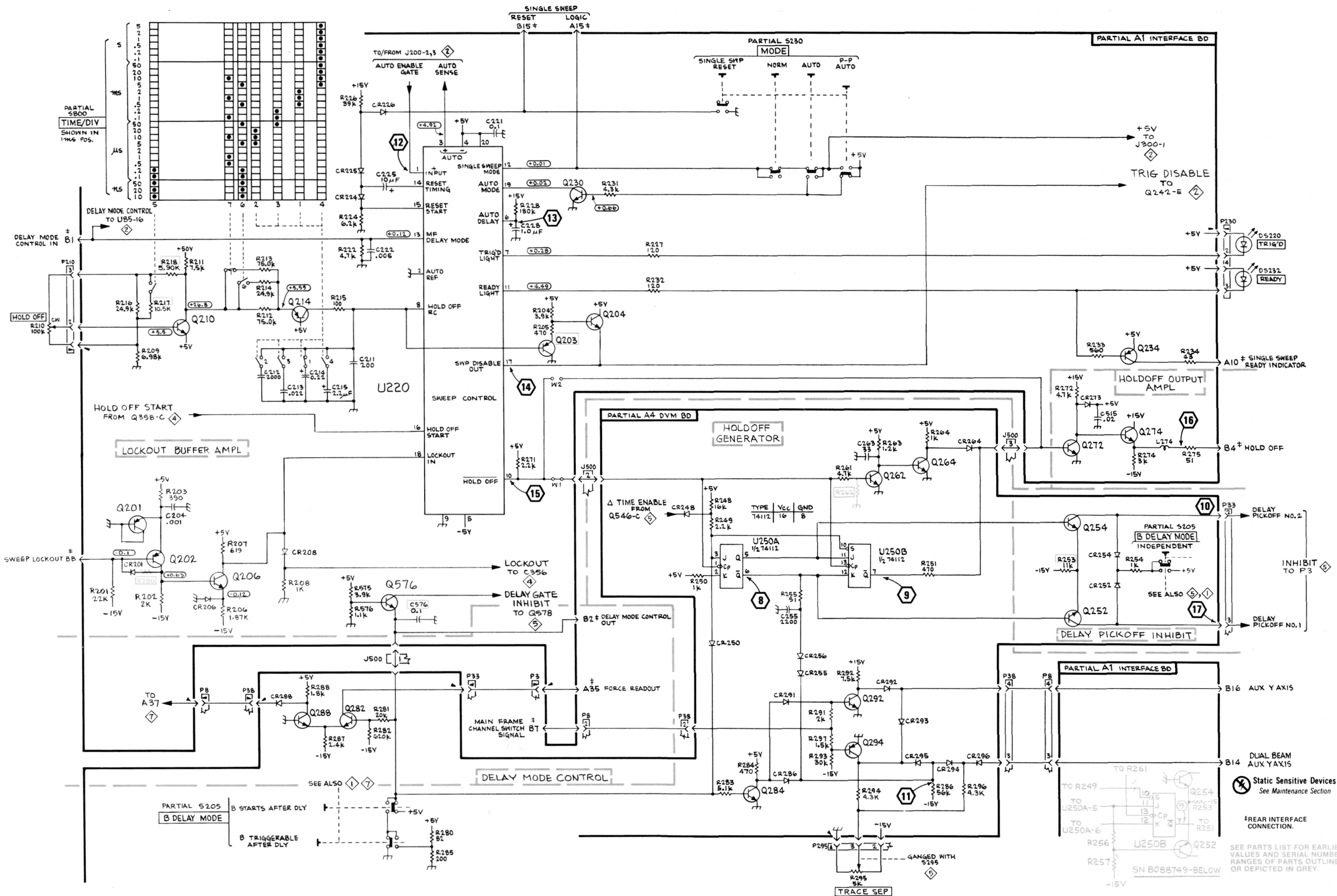


16



17





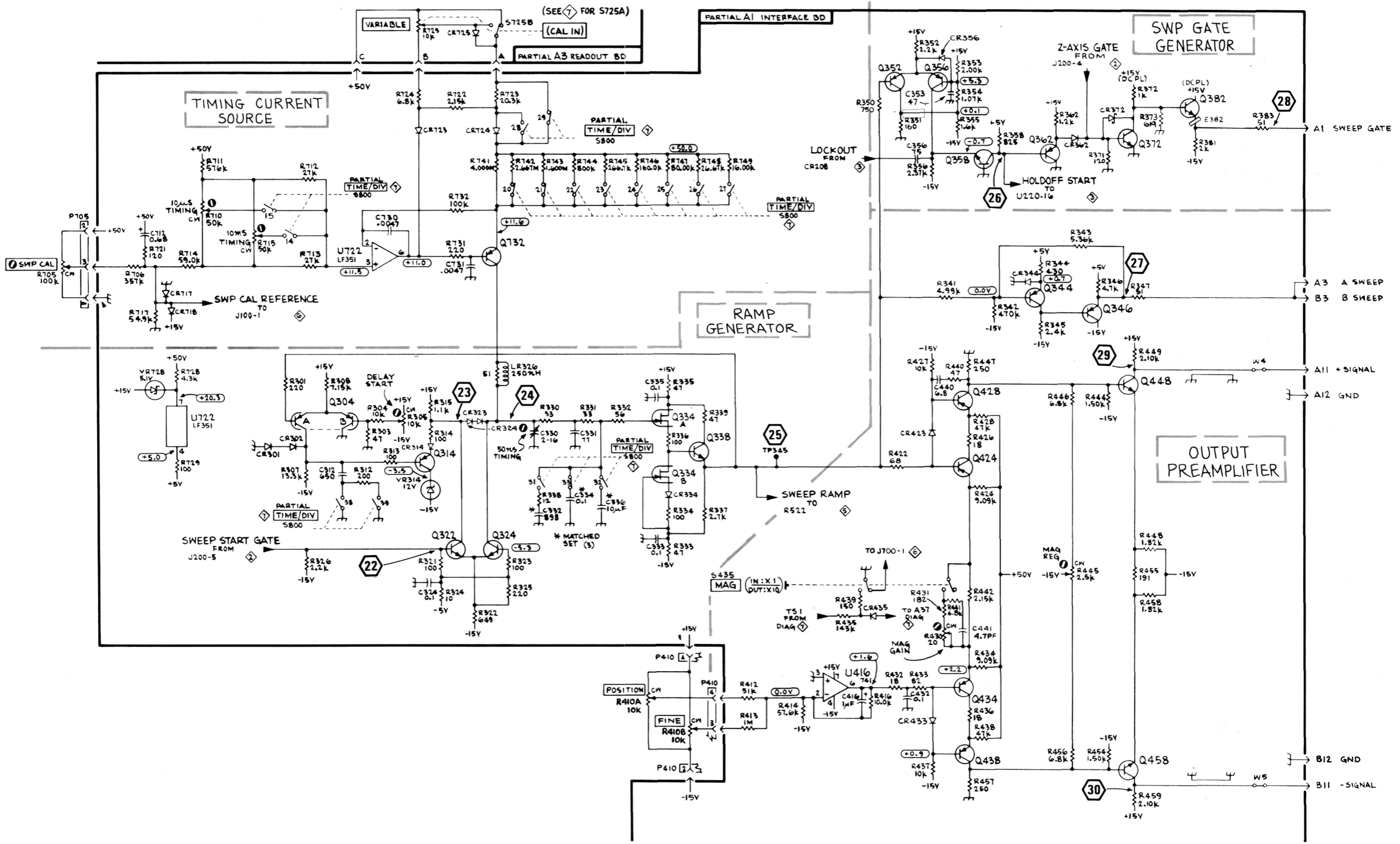
⊗ Static Sensitive Devices  
See Maintenance Section

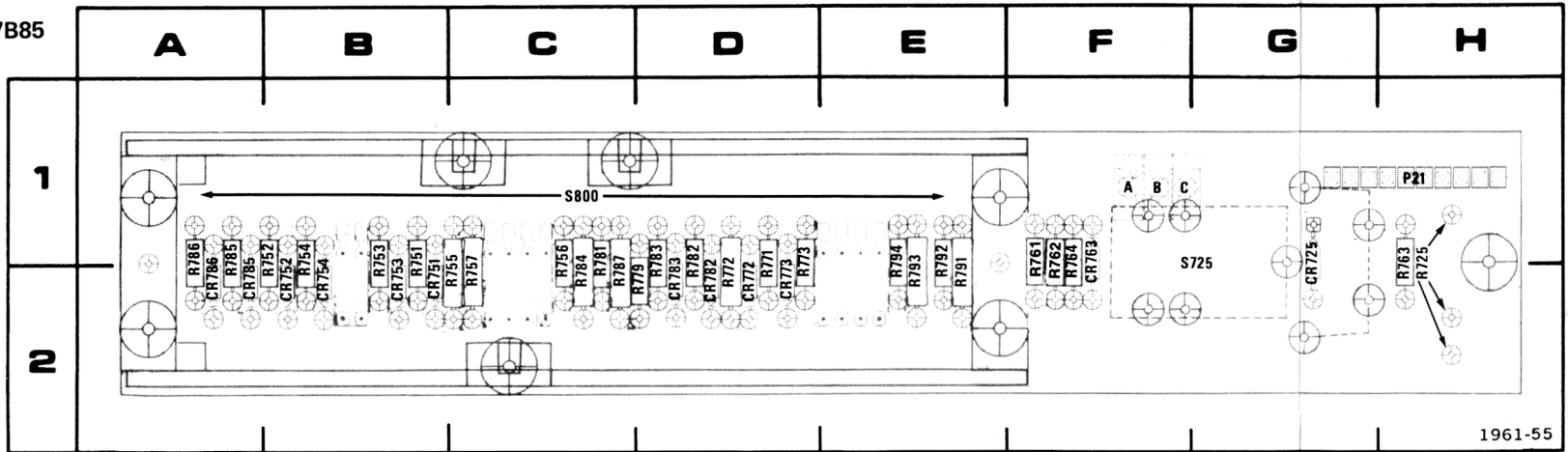
\* REAR INTERFACE CONNECTION.

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.

TRACE SEP

SN B088749-BELOW





1961-55

Fig. 8-4. A3-Readout circuit board assembly.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
CR725	1C	R751	2B	R782	2D
CR751	2B	R752	2B	R783	2D
CR752	2B	R753	2B	R784	2C
CR753	2B	R754	2B	R785	2A
CR754	2B	R755	2C	R786	2A
CR763	2F	R756	2C	R787	2C
CR772	2D	R757	2C	R791	2E
CR773	2D	R761	2F	R792	2E
CR782	2D	R762	2F	R793	2E
CR783	2D	R763	2H	R794	2E
CR785	2A	R764	2F		
CR786	2A	R771	2D	S725	2C
		R772	2D	S800	1C
P21	1H	R773	2D		
		R779	2D		
R725	2H	R781	2D		

## VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the 7B85 controls set as follows:

TIME/DIV, 1 ms; VARIABLE (CAL IN), knob in; MAG, X1 (button in); HOLD OFF, fully counterclockwise; SWP CAL, midranged; POSITION, midranged; TRIGGERING: LEVEL, midranged; MODE, P-P AUTO; COUPLING, AC; SOURCE, LINE; SLOPE, +. B DELAY MODE, B STARTS AFTER DLY; DELAY TIME, fully counterclockwise;  $\Delta$  TIME, fully clockwise; TRACE SEP, fully counterclockwise.

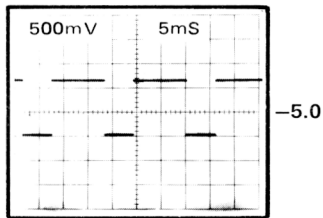
**Voltage Conditions.** The voltages shown on the diagram were obtained using a digital multimeter with a 10 M $\Omega$  input impedance (Tektronix DM 501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

**Waveform Conditions.** The waveforms shown below were obtained using a test oscilloscope system with 10 M $\Omega$  input impedance and at least 60 MHz bandwidth (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with 10X probe).

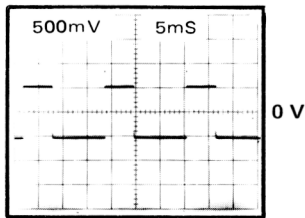
### NOTE

Some voltages and waveforms were measured with the Digital Voltmeter board removed.

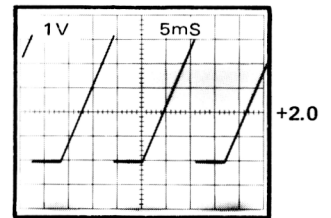
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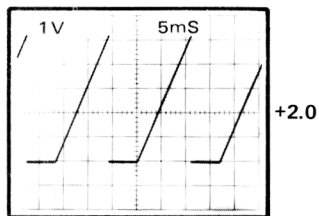
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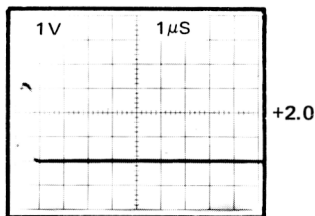
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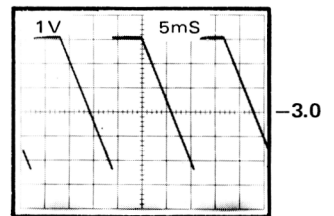
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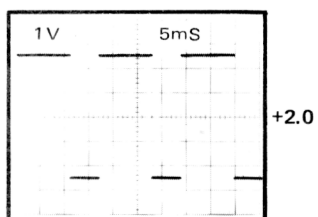
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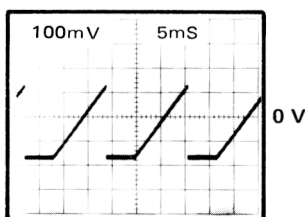
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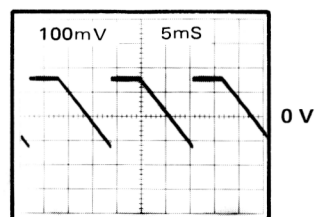
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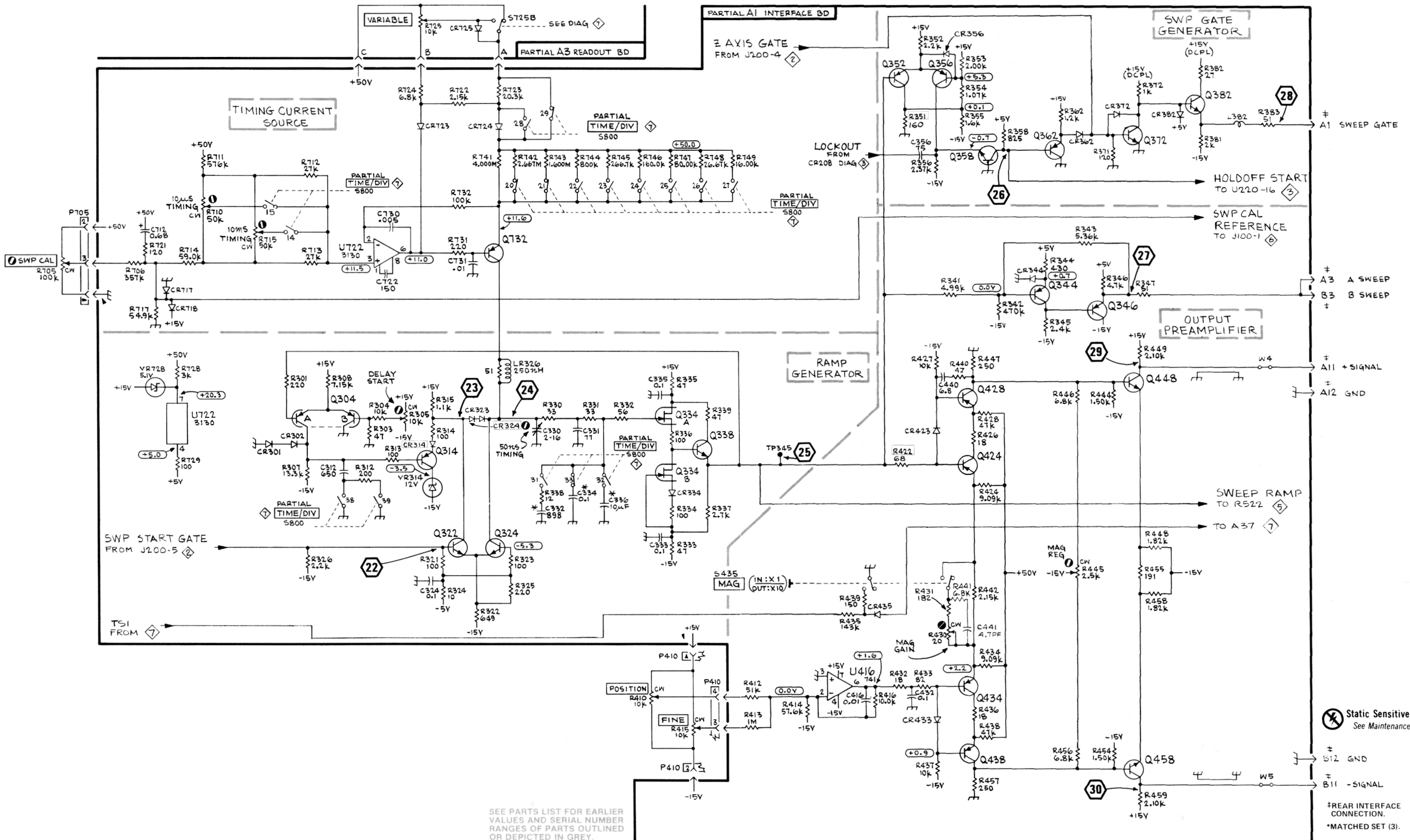
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30



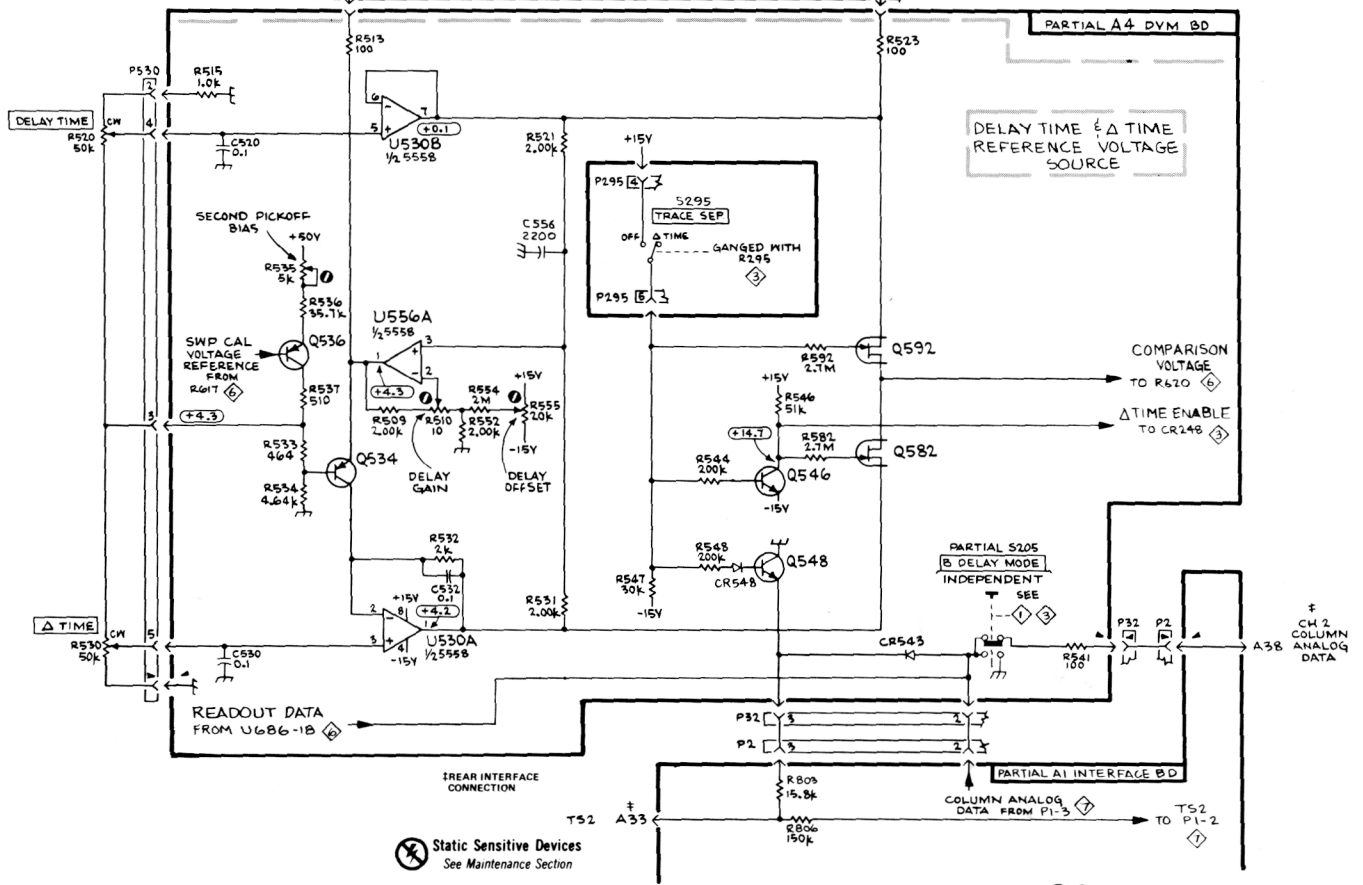
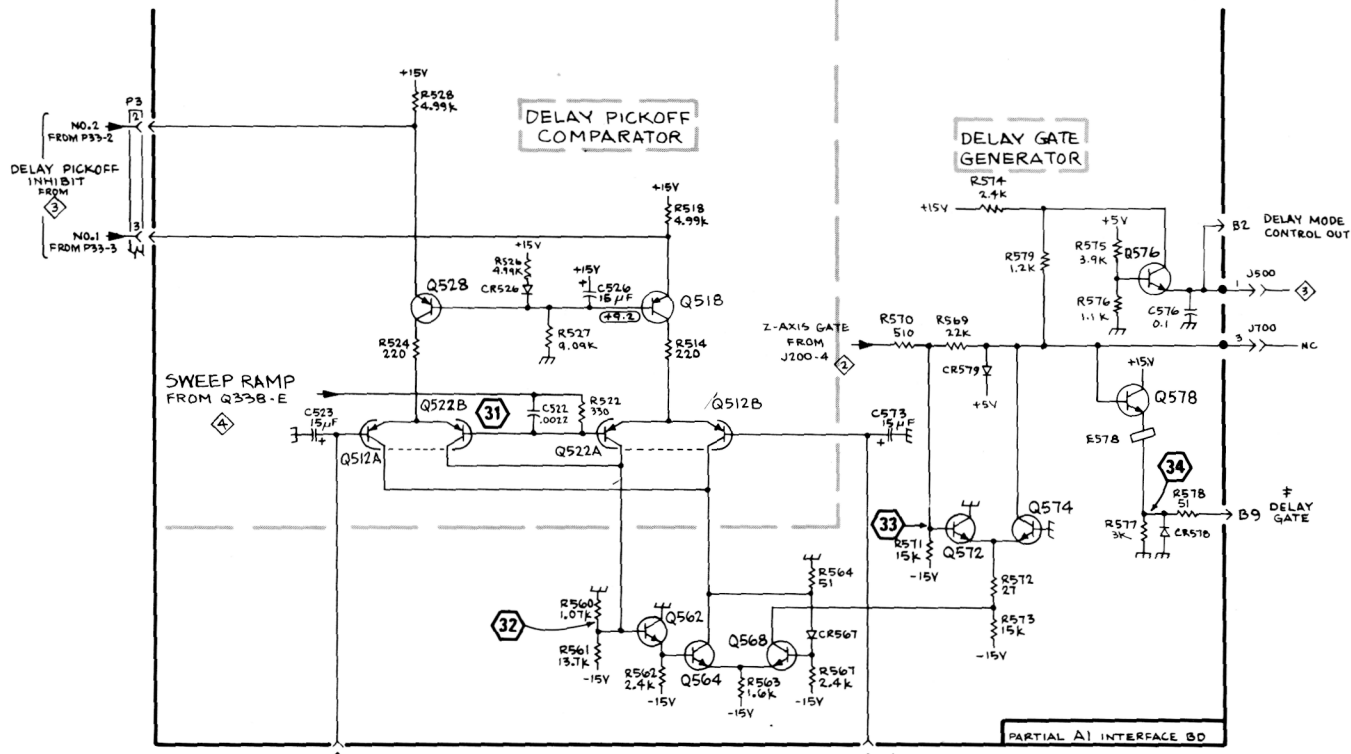




⊗ Static Sensitive Devi  
See Maintenance Sect

⊕ B12 GND  
⊕ B11 - SIGNAL  
⊕ REAR INTERFACE CONNECTION.  
⊕ MATCHED SET (3).

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.



## VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the 7B85 controls set as follows:

TIME/DIV, 1 ms; VARIABLE (CAL IN), knob in; MAG, X1 (button in); HOLD OFF, fully counterclockwise; SWP CAL, midranged; POSITION, midranged; TRIGGERING: LEVEL, midranged; MODE, P-P AUTO; COUPLING, AC; SOURCE, LINE; SLOPE, +. B DELAY MODE, B STARTS AFTER DLY; DELAY TIME, fully counterclockwise;  $\Delta$  TIME, fully clockwise; TRACE SEP, fully counterclockwise.

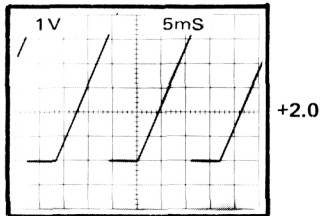
**Voltage Conditions.** The voltages shown on the diagram were obtained using a digital multimeter with a 10 M $\Omega$  input impedance (Tektronix DM 501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

**Waveform Conditions.** The waveforms shown below were obtained using a test oscilloscope system with 10 M $\Omega$  input impedance and at least 60 MHz bandwidth (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with 10X probe).

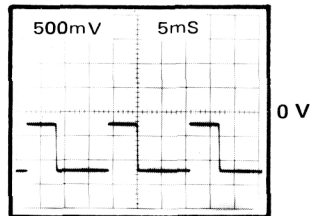
### NOTE

Some voltages and waveforms were measured with the Digital Voltmeter board removed.

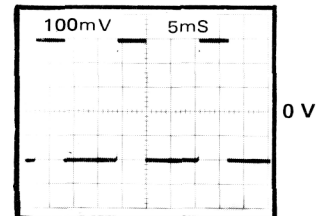
31



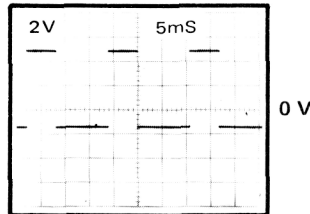
32

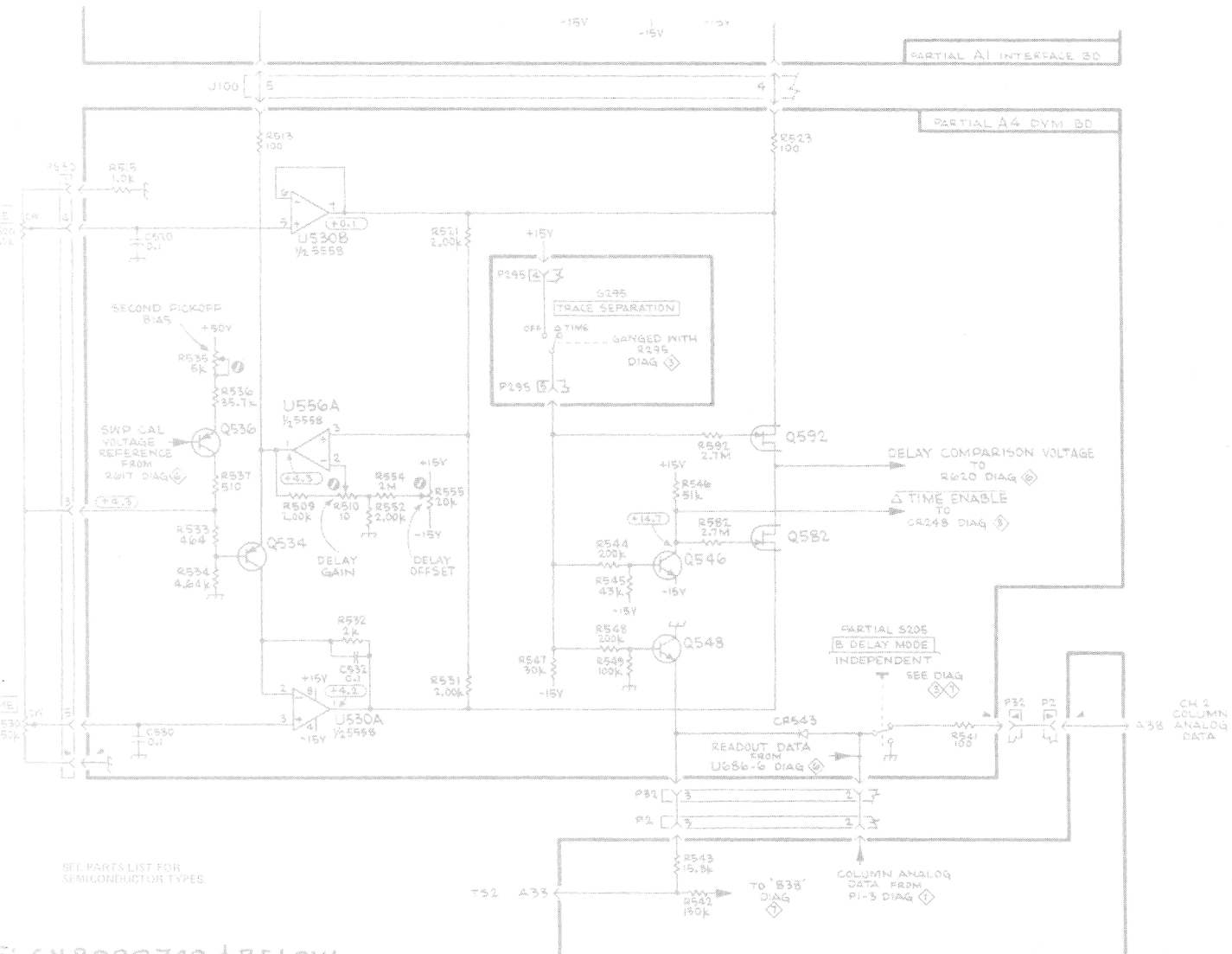


33



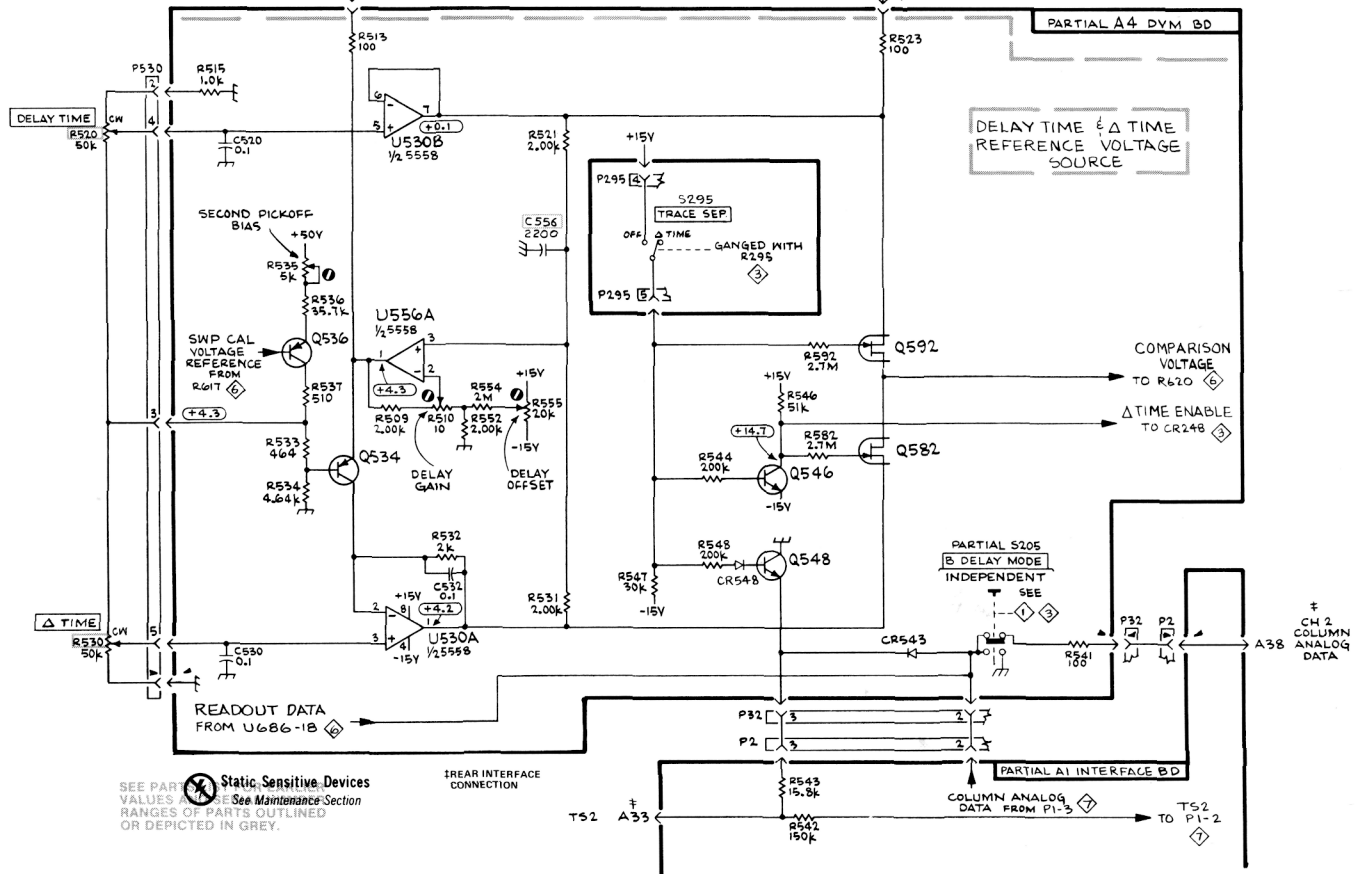
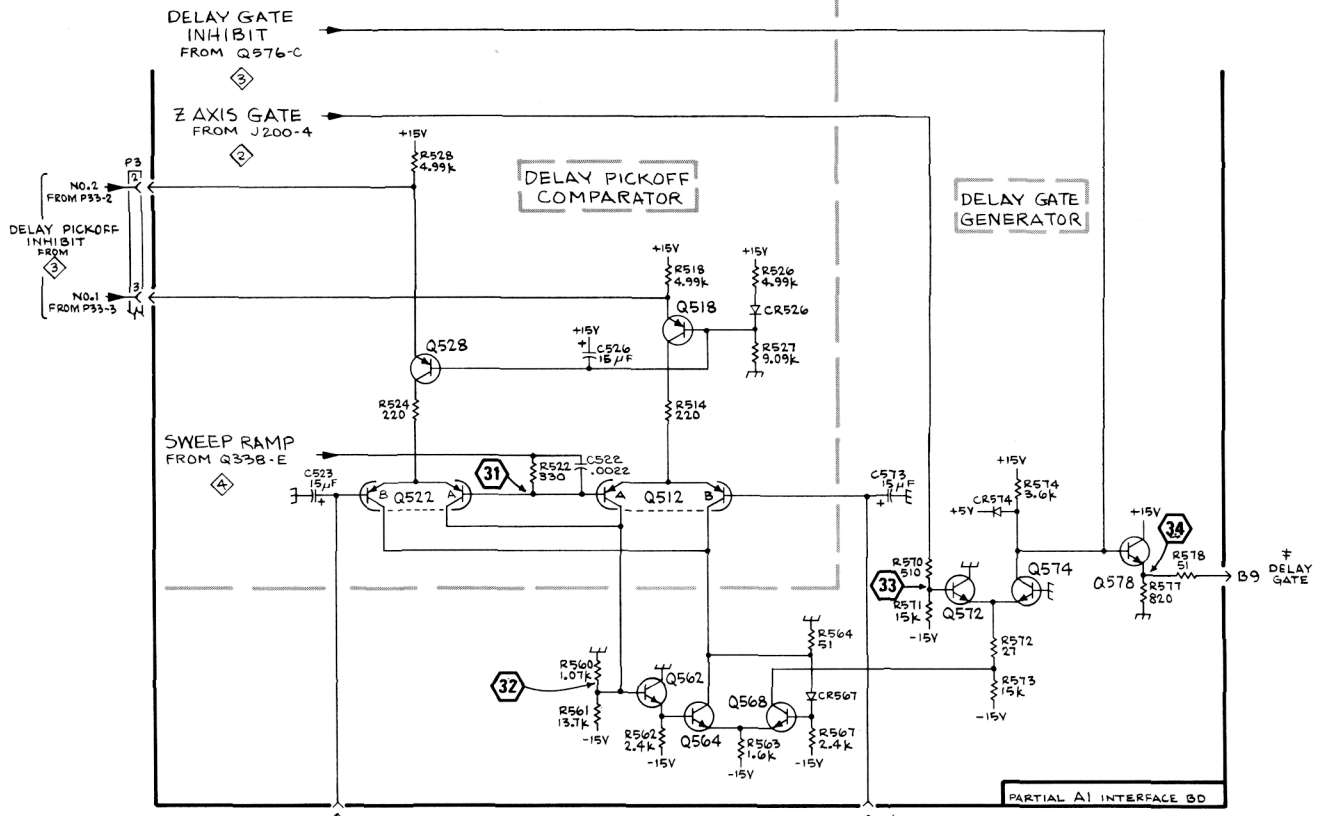
34





SEE PARTS LIST FOR SEMICONDUCTOR TYPES

F: SNB088749 & BELOW.



SEE PART 10 Static Sensitive Devices  
VALUES. See Maintenance Section  
RANGES OF PARTS OUTLINED  
OR DEPICTED IN GREY.

REAR INTERFACE CONNECTION

1961-64  
REV MAY 1987

PICKOFF AMPLIFIERS  
AND  
DELAY GATE GENERATOR  
(SN 8093999 & BELOW)

## VOLTAGE AND WAVEFORM CONDITIONS

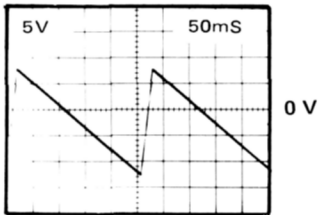
The voltages and waveforms shown were obtained with the controls set as follows:

TIME/DIV, 1 ms; VARIABLE (CAL IN), knob in; MAG X1 (button in); HOLD OFF, fully counterclockwise; SWP CAL, midranged; POSITION, midranged; TRIGGERING: LEVEL, midranged; MODE, AUTO; COUPLING, AC; SOURCE, EXT; SLOPE, +; EXT TRIG IN, IN (1 M $\Omega$ ); B DELAY MODE, B STARTS AFTER DLY; DELAY TIME, fully counterclockwise; TIME, fully clockwise; TRACE SEP, fully counterclockwise.

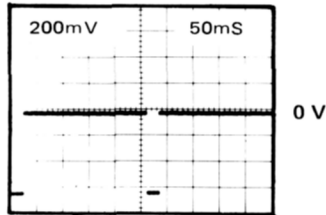
**Voltage Conditions.** The voltages shown on the diagram were obtained using a digital multimeter with a 1 M $\Omega$  input impedance (Tektronix DM 501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with readout equipped, series oscilloscope).

**Waveform Conditions.** The waveforms shown below were obtained using a test oscilloscope system with 1 M $\Omega$  input impedance and at least 15 MHz bandwidth (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with 10X probe). A 4 volt, 1 kHz square wave signal was fed to the EXT TRIG IN connector.

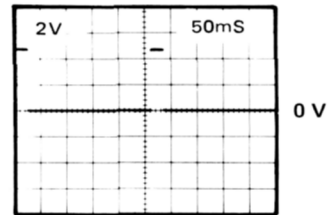
35



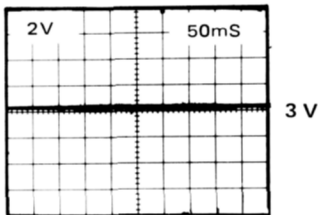
36



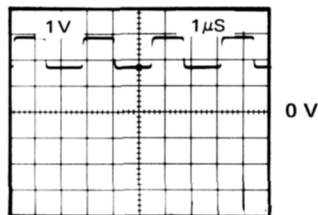
37



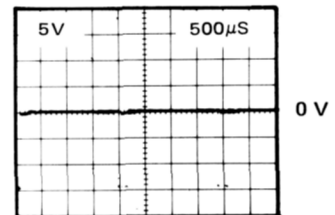
38



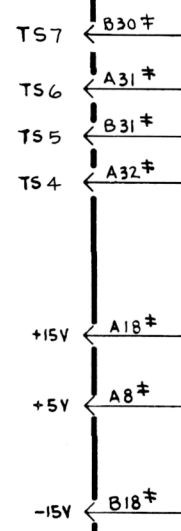
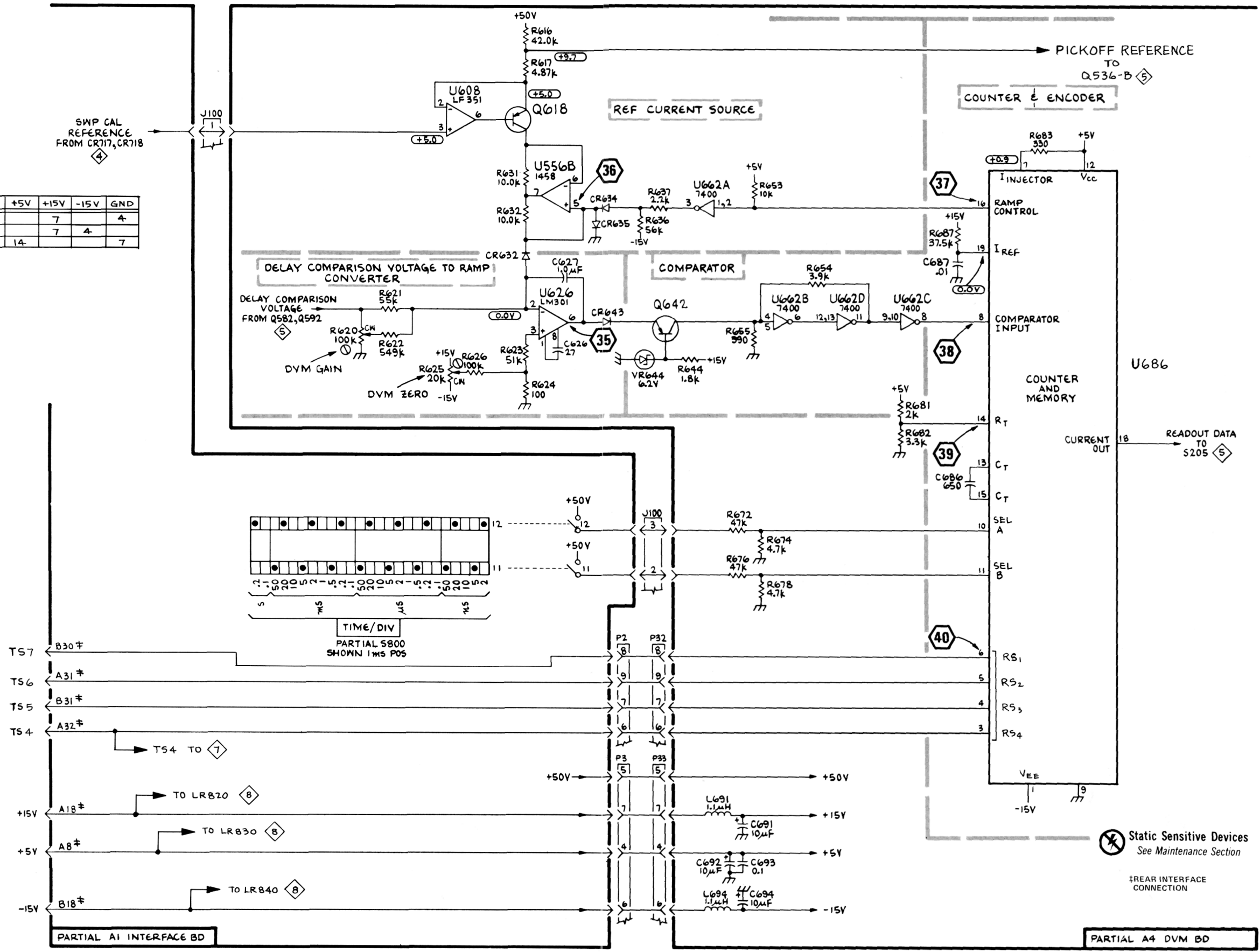
39



40



	+5V	+15V	-15V	GND
U608		7		4
U626		7	4	
U662	14			7



PARTIAL A4 DVM BD

## VOLTAGE AND WAVEFORM CONDITIONS

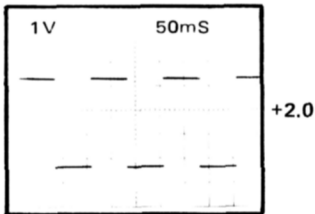
The voltages and waveforms shown were obtained with the 7B85 controls set as follows:

TIME/DIV, 1 ms; VARIABLE (CAL IN), knob in; MAG, X1 (button in); HOLD OFF, fully counterclockwise; SWP CAL, midranged; POSITION, midranged; TRIGGERING: LEVEL, midranged; MODE, P-P AUTO; COUPLING, AC; SOURCE, LINE; SLOPE, +. B DELAY MODE, B STARTS AFTER DLY; DELAY TIME fully counterclockwise;  $\Delta$  TIME, fully clockwise; TRACE SEP, fully counterclockwise.

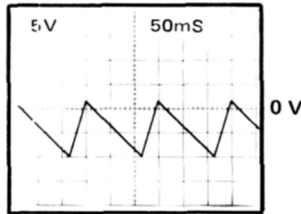
**Voltage Conditions.** The voltages shown on the diagram were obtained using a digital multimeter with a 10 M $\Omega$  input impedance (Tektronix DM 501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

**Waveform Conditions.** The waveforms shown below were obtained using a test oscilloscope system with 10 M $\Omega$  input impedance and at least 60 MHz bandwidth (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with 10X probe).

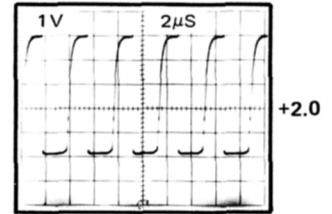
41



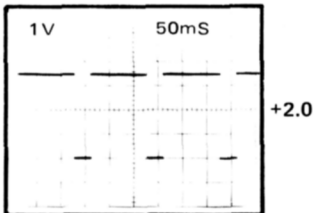
41



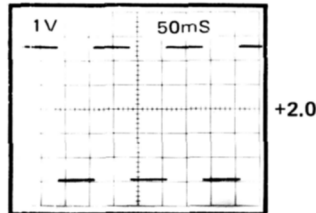
43



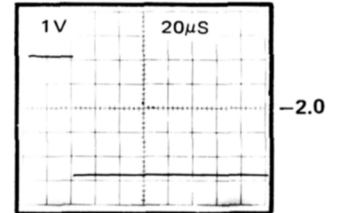
44



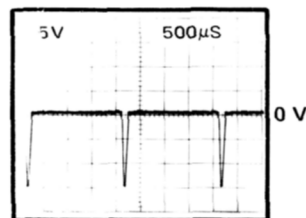
45



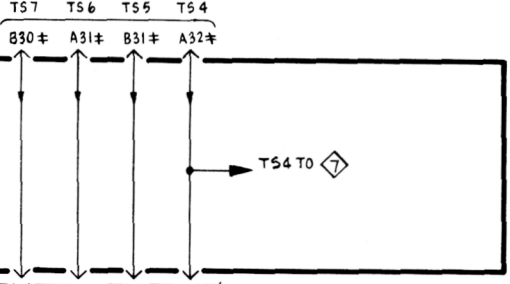
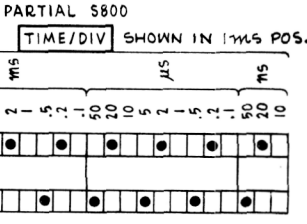
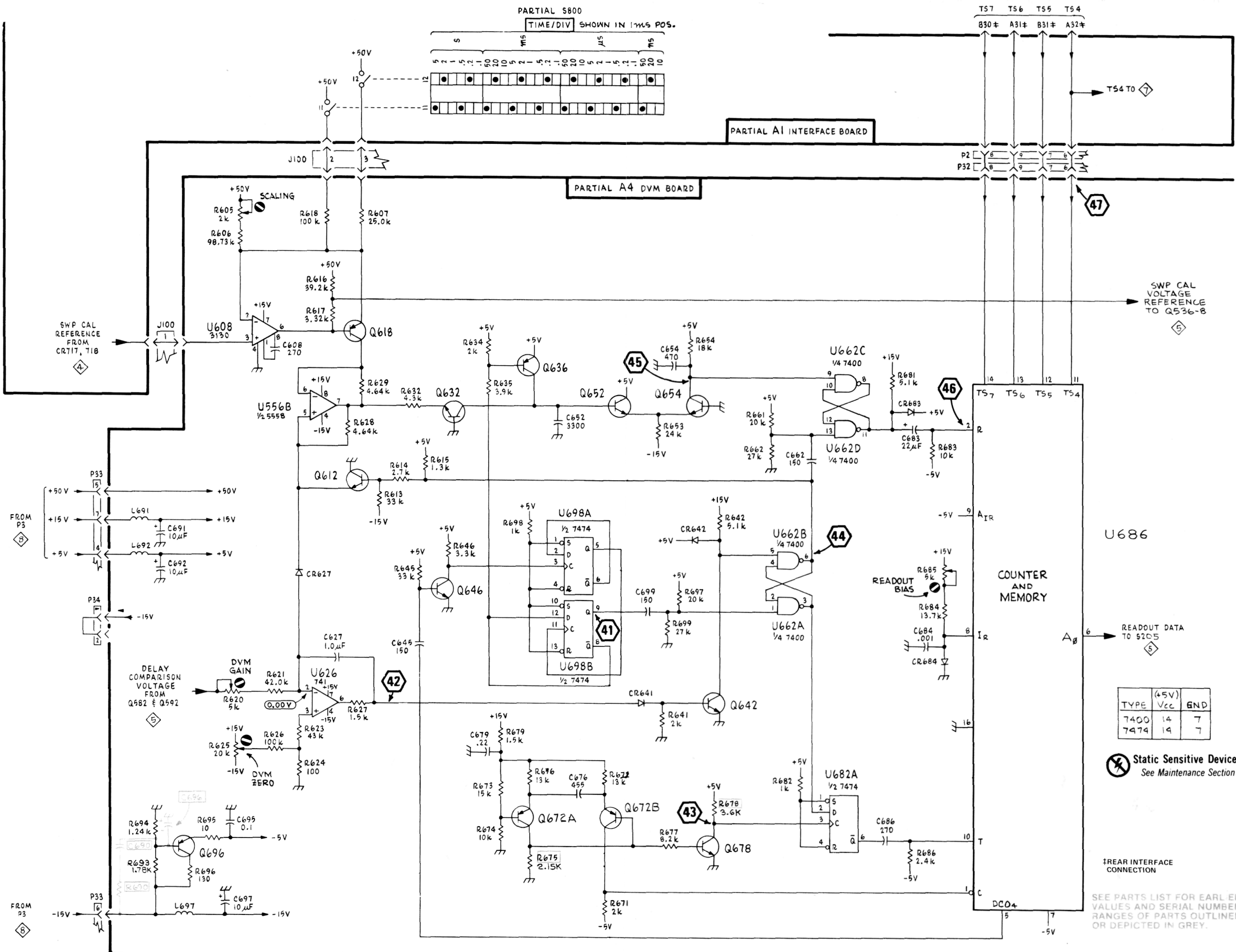
46



47

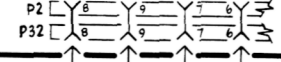






PARTIAL A1 INTERFACE BOARD

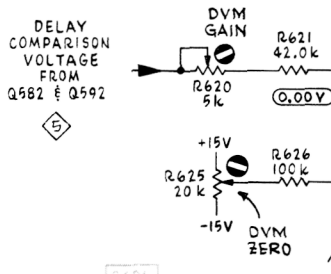
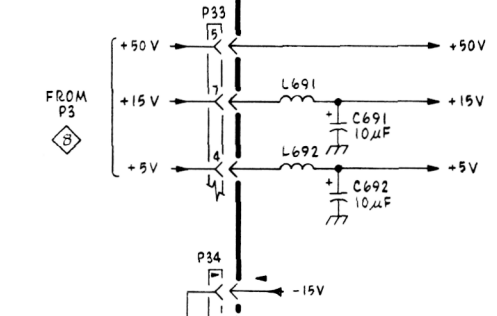
PARTIAL A4 DVM BOARD



47

SWP CAL VOLTAGE REFERENCE TO Q536-B

SWP CAL REFERENCE FROM CR717, 718



U686

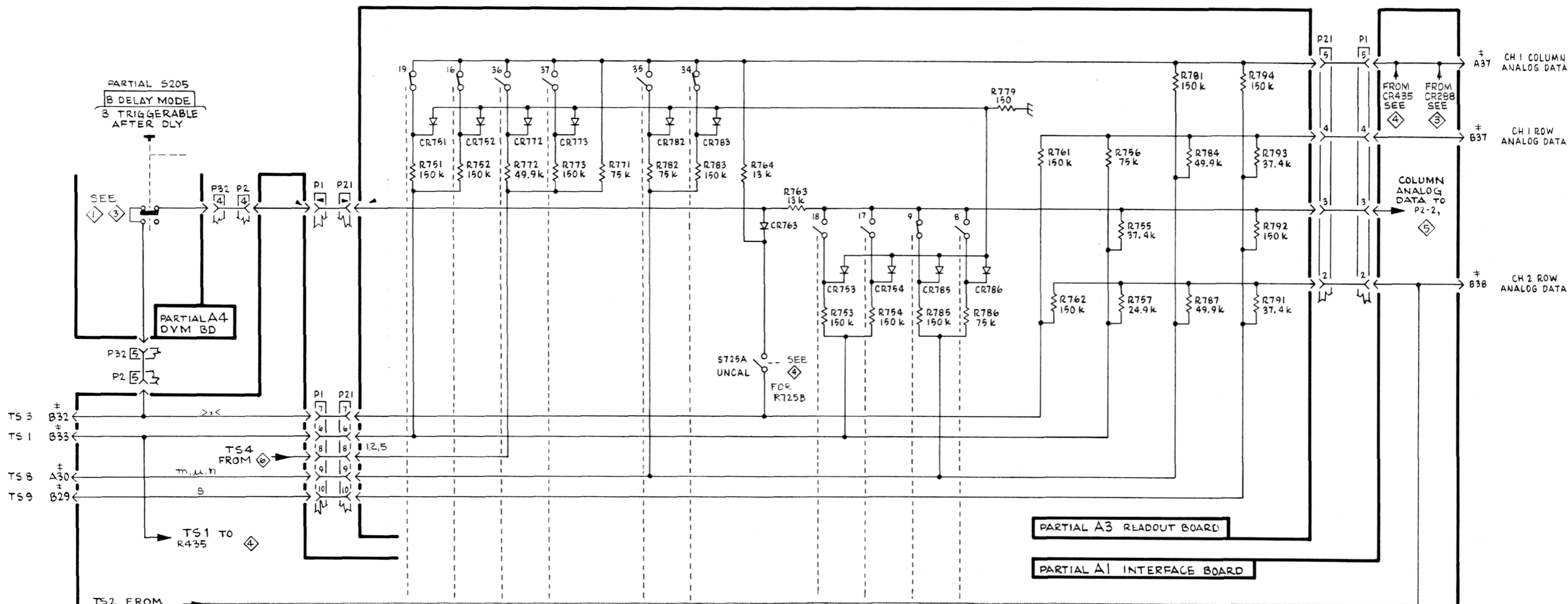
COUNTER AND MEMORY

TYPE	(+5V) V <sub>CC</sub>	GND
7400	14	7
7474	14	7

Static Sensitive Devices See Maintenance Section

FRONT INTERFACE CONNECTION

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.



TS 3 B32  
 TS 1 B33  
 TS 8 A30  
 TS 9 B29

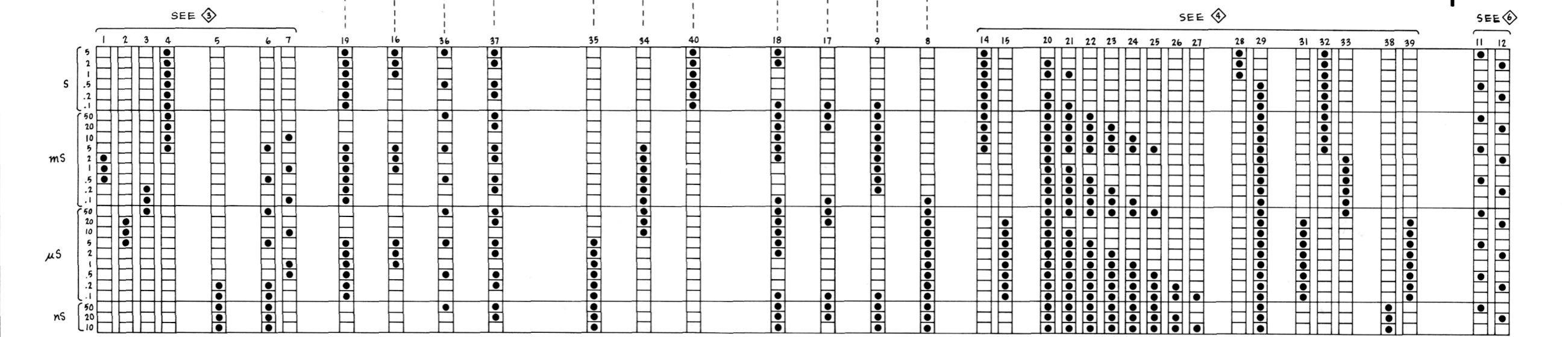
TS 4 FROM  
 m.u.n  
 S

TS 1 TO R435

TS 2 FROM  
 R806 (SNB094000 & UP)  
 R542 (SNB093999 & BELOW)

W3

INTENSITY LIMIT A7



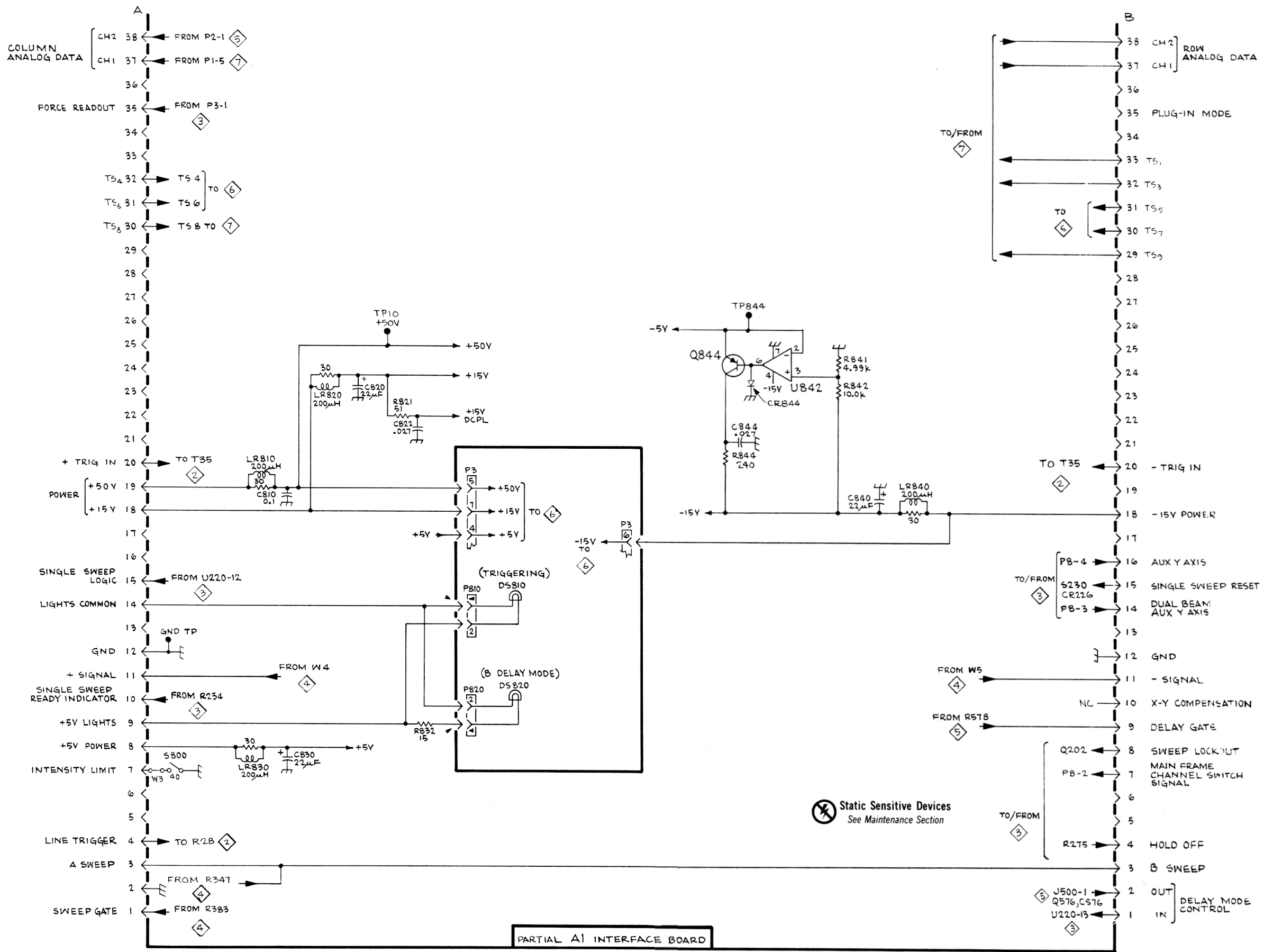
PARTIAL A1 INTERFACE BOARD

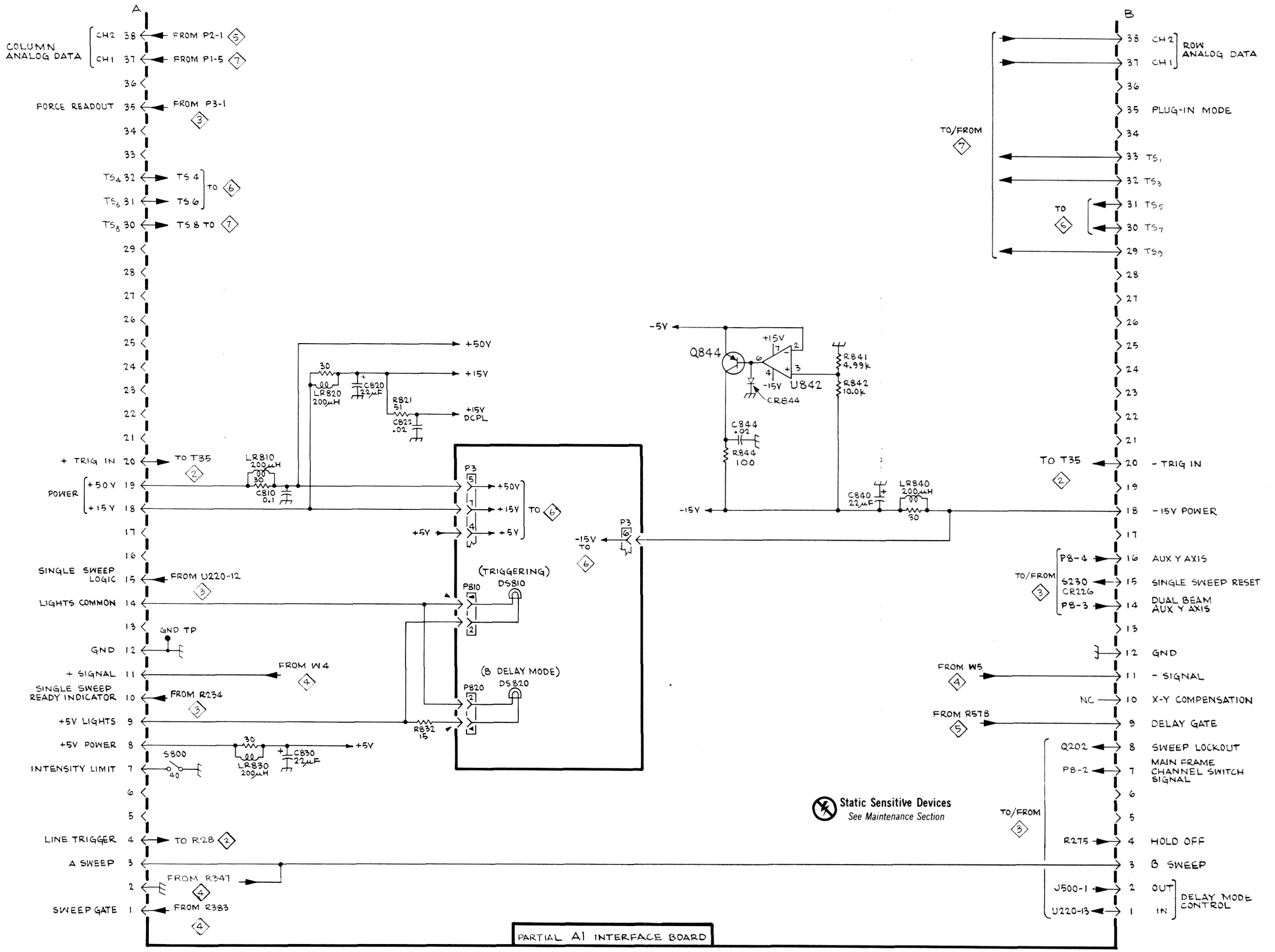
S800  
 TIME/DIV  
 SHOWN IN 1ms POS.

INDICATES SWITCH CLOSED

Static Sensitive Devices  
 See Maintenance Section

REAR INTERFACE CONNECTION





PARTIAL A1 INTERFACE BOARD

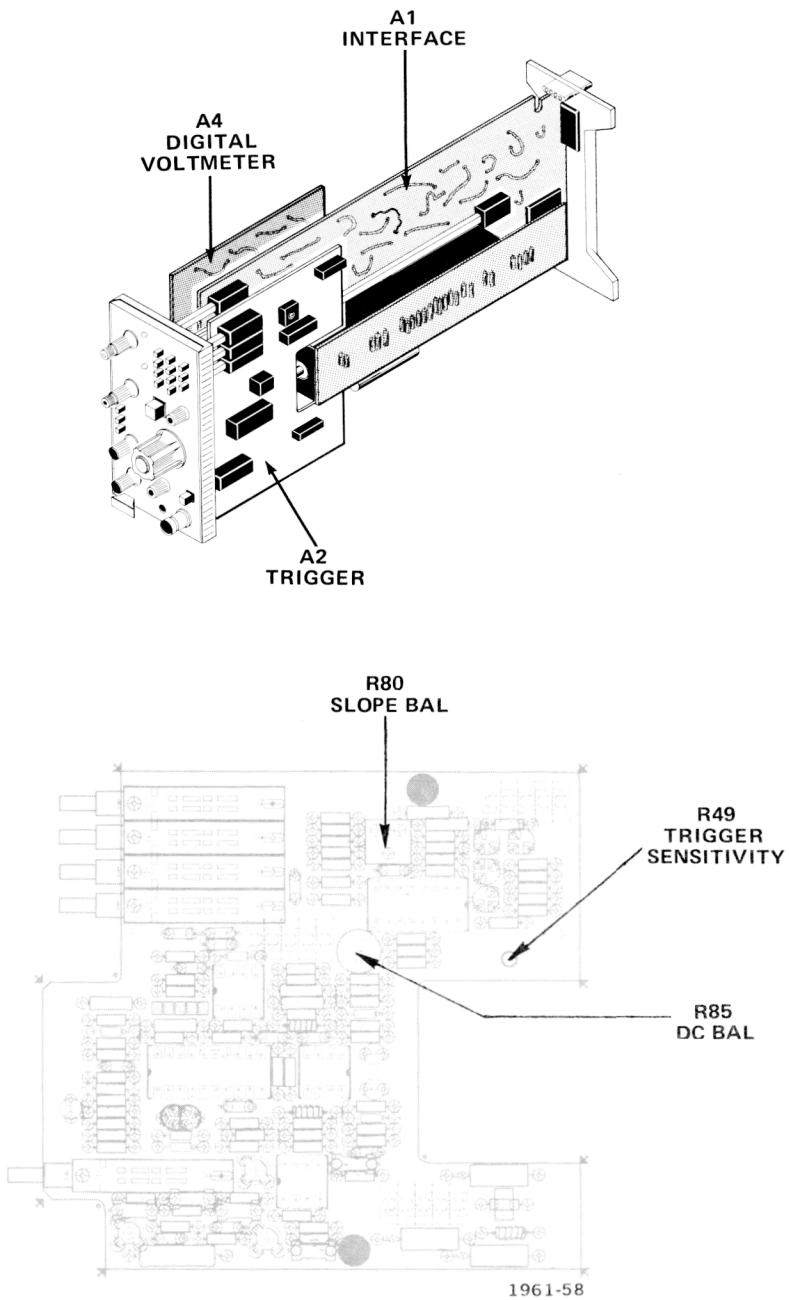


Fig. 8-6. Location of Triggering adjustments.

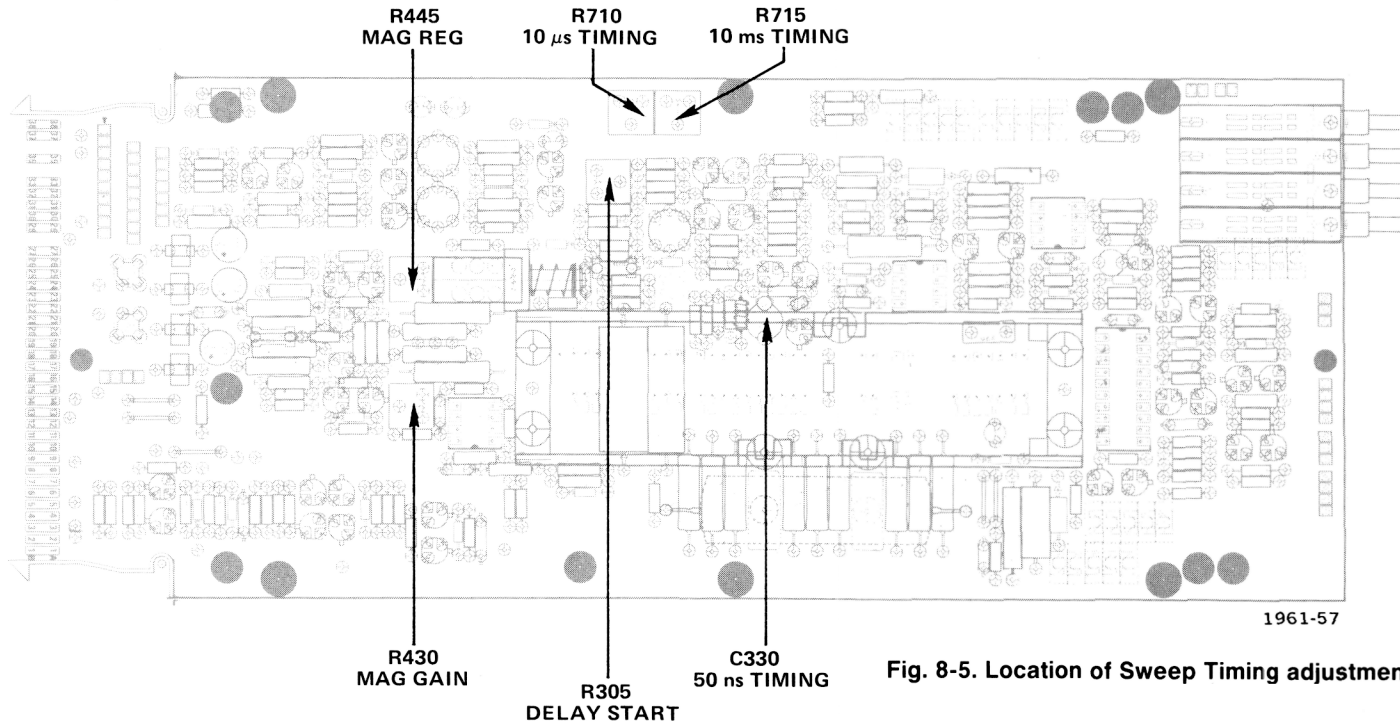


Fig. 8-5. Location of Sweep Timing adjustments.

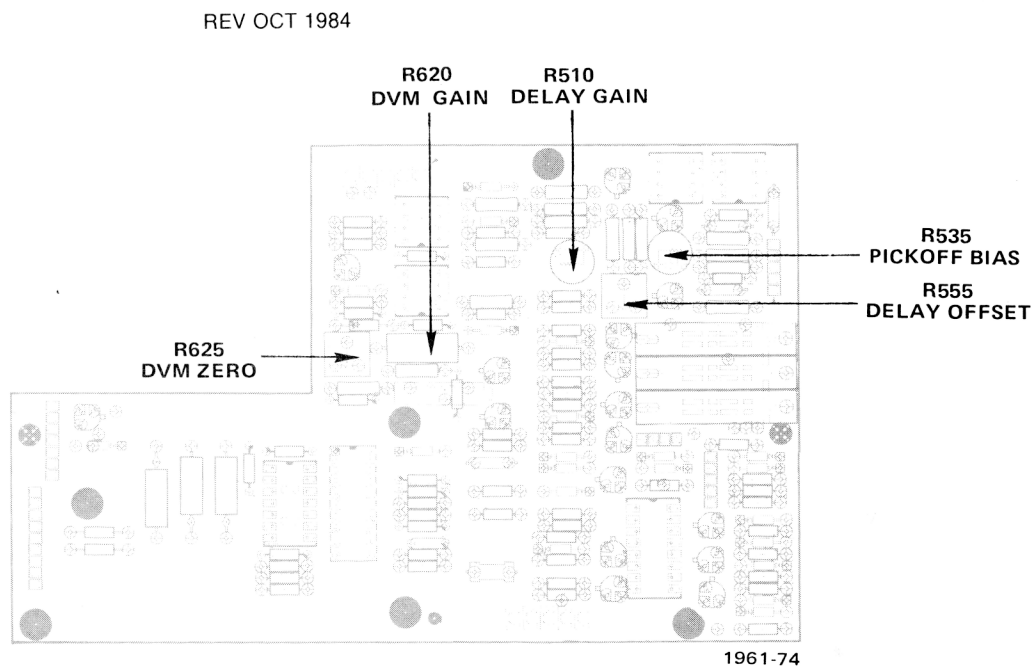


Fig. 8-7A. Location of Digital Voltmeter adjustments (SN B088750 & up).

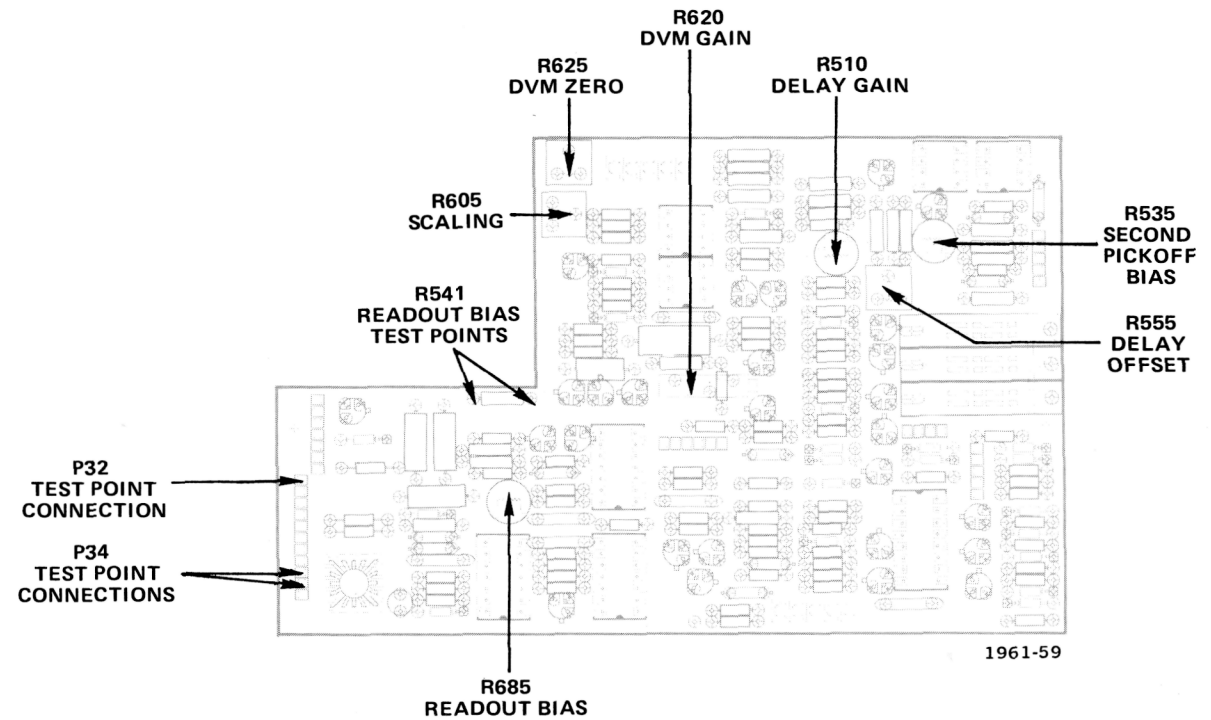
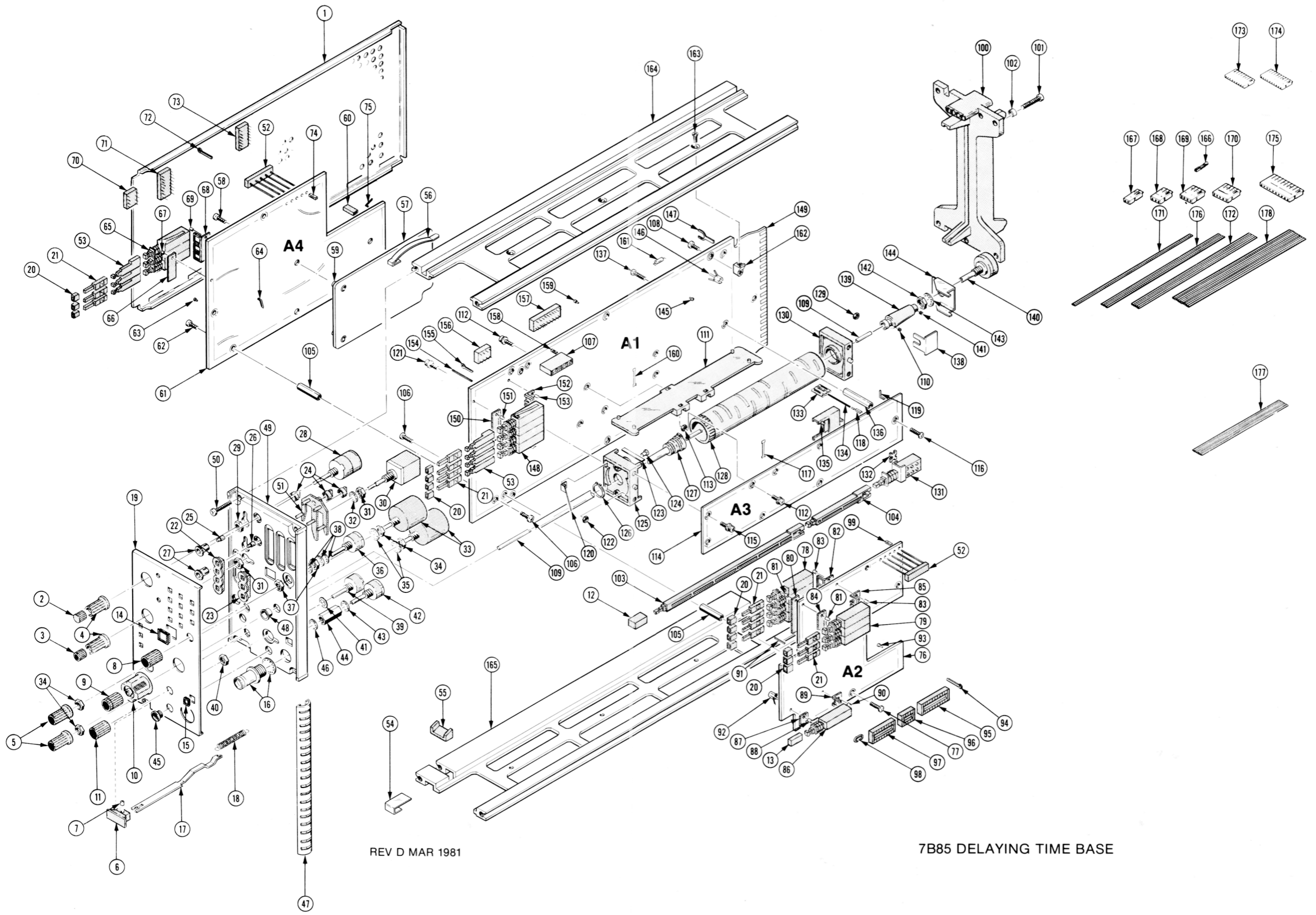


Fig. 8-7B. Location of Digital Voltmeter adjustments (SN B088749 & below).



REV D MAR 1981

7B85 DELAYING TIME BASE

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff      Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
	070-1960-00		1						MANUAL, TECH: OPERATORS	80009	070-1960-00
	070-1961-01		1						MANUAL, TECH: INSTRUCTION	80009	070-1961-01