



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

**7B87
TIME BASE
WITH
PRETRIGGER
ACQUIRE CLOCK**

INSTRUCTION MANUAL

**Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97077


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Product Group 42**

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INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert, tag,
or stamped on the chassis. The first number or letter
designates the country of manufacture. The last five digits
of the serial number are assigned sequentially and are
unique to each instrument. Those manufactured in the
United States have six unique digits. The country of
manufacture is identified as follows:

| | |
|---------|---|
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| 300000 | Sony/Tektronix, Japan |
| 700000 | Tektronix Holland, NV, Heerenveen, The Netherlands |

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WARNING

THE REMAINING PORTION OF THIS TABLE OF CONTENTS
LISTS SERVICING INSTRUCTIONS. THESE SERVICING
INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL
ONLY. TO AVOID ELECTRICAL SHOCK, DO NOT PERFORM
ANY SERVICING OTHER THAN THAT CALLED OUT IN THE
OPERATING INSTRUCTIONS UNLESS QUALIFIED TO DO
SO.

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OPERATORS SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

TERMS

IN THIS MANUAL

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

AS MARKED ON EQUIPMENT

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

SYMBOLS

IN THIS MANUAL



Static-Sensitive Devices.



This symbol indicates where applicable cautionary or other information is to be found.

AS MARKED ON EQUIPMENT



DANGER—High voltage.



Protective ground (earth) terminal.



ATTENTION—refer to manual.

WARNINGS

POWER SOURCE

This product is intended to operate in a mainframe connected to a power source that will not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the mainframe power cord is essential for safe operation.

GROUNDING THE PRODUCT

This product is grounded through the grounding conductor of the mainframe power cord. To avoid electrical shock, plug the mainframe power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the grounding conductor in the mainframe power cord is essential for safe operation.

DANGER ARISING FROM LOSS OF GROUND

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating), can render an electric shock.

DO NOT OPERATE IN EXPLOSIVE ATMOSPHERES

To avoid explosion, do not operate this product in an atmosphere of explosive gases unless it has been specifically certified for such operation.

DO NOT OPERATE PLUG-IN UNIT WITHOUT COVERS

To avoid personal injury, do not operate this product without covers or panels installed. Do not apply power to the plug-in unit via a plug-in extender.

SERVICING SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary

DO NOT SERVICE ALONE

Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present.

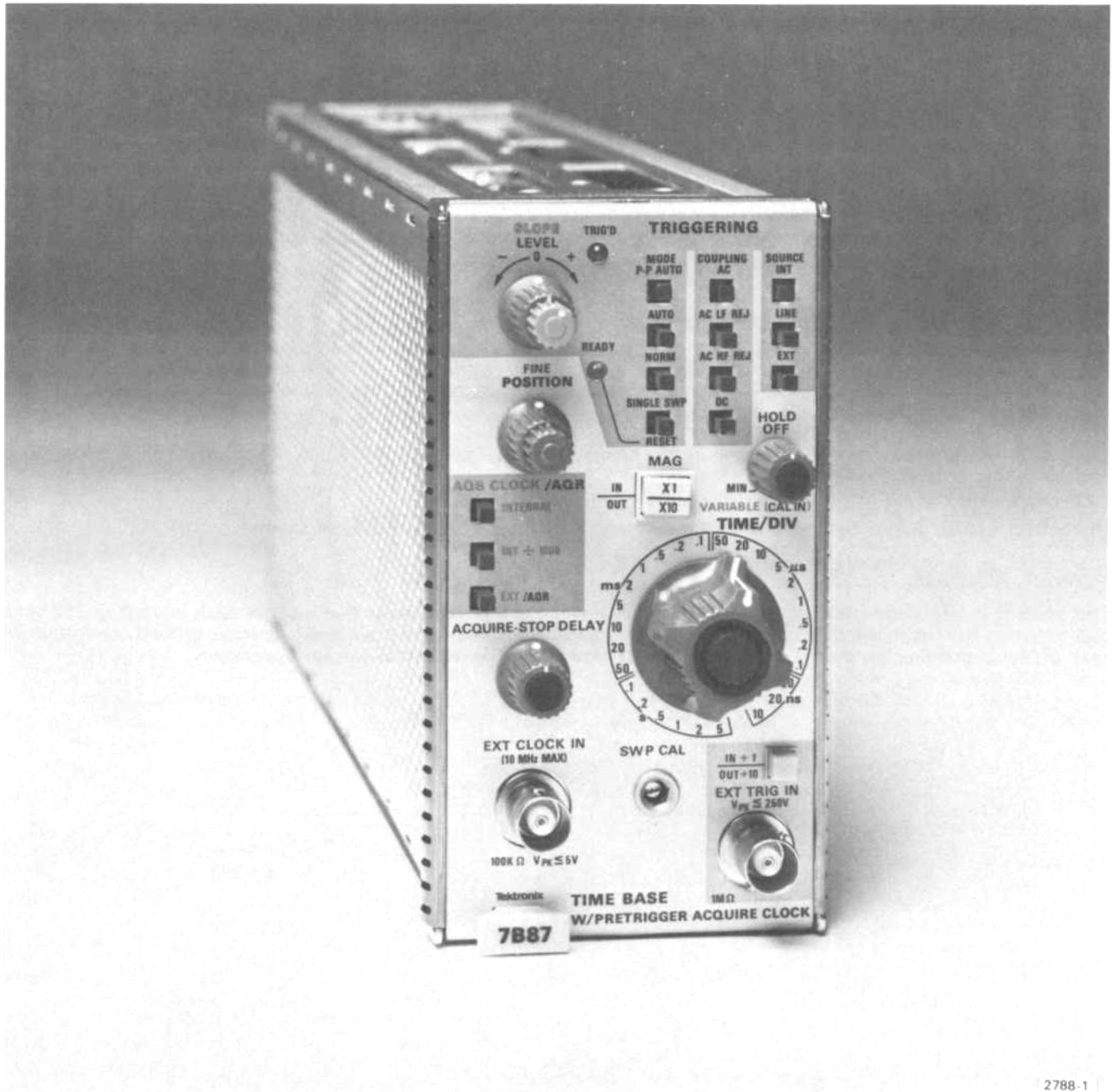
USE CARE WHEN SERVICING WITH POWER ON

Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections and components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.

POWER SOURCE

This product is intended to operate in a mainframe connected to a power source that will not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the mainframe power cord is essential for safe operation.



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7B87 FEATURES

The 7B87 Time-Base unit Pretrigger Acquire Clock provides calibrated sweep rates from 5 seconds to 10 nanoseconds and triggering to 400 megahertz for 7000-Series Oscilloscopes. A X10 Magnifier increases each sweep rate by a factor of 10 and a VARIABLE TIME/DIV control provides continuously-variable sweep rates between calibrated steps. Variable holdoff 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. The 7B87 can be operated as an independent time base or as a delayed-sweep unit with a companion delaying time-base unit. Sweep mode is determined by the companion delaying time base.

The 7B87 also features an internally-generated clock and an external clock input for sequential single sweep acquisition when operating in a 7000-series digitizing oscilloscope. The frequency range of the internally generated clock is 20.48 mHz (millihertz) to 20.48 MHz as determined by the TIME/DIV, X10 MAG, and INT ÷ 1000 switches. Also, an ACQUIRE-STOP DELAY function varies delay pickoff, and therefore pretrigger time, in compatible digitizing plug-in oscilloscopes. The portion of the oscilloscope real-time display between the triggering event and the end of delay time is intensified. The exact delay time is displayed on the crt readout.

OPERATING INSTRUCTIONS

The 7B87 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.

INSTALLATION

The time-base unit operates in the horizontal plug-in compartment of the mainframe. When used for single sweep acquisition with a Tektronix 7000-series digitizing oscilloscope (7854) the 7B87 must be installed in the B horizontal 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, Specification.

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, first turn the power off, then pull the release latch (see Fig. 1-1) to disengage the unit from the mainframe, 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. Figure 1-2 shows and 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.

SETUP PROCEDURE

1. Install the time-base unit in the A horizontal compartment of the mainframe.
2. Install an amplifier plug-in unit in a vertical compartment.
3. Set the time-base unit controls as follows:

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

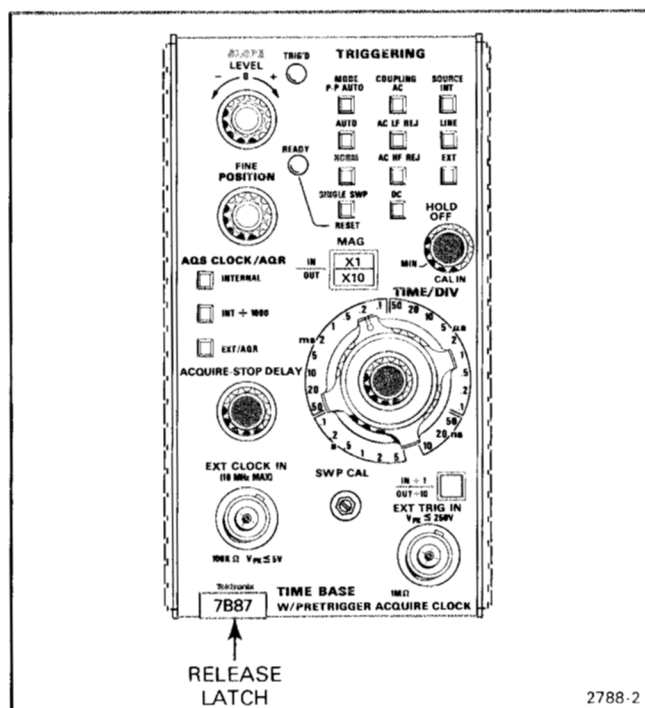


Figure 1-1. Location of release latch.

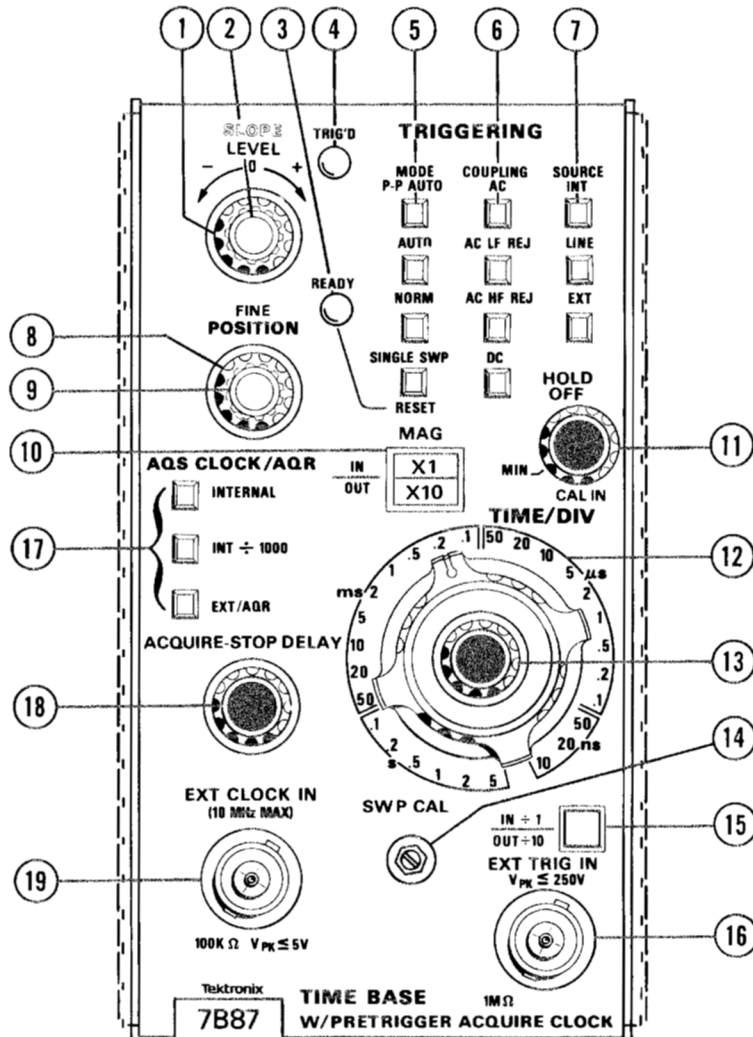


Figure 1-2. Front-panel controls, connectors, and indicators.

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 circuit.
- ⑥ **COUPLING Pushbuttons**—Selects the method of coupling the trigger signal to triggering circuit.
- ⑦ **SOURCE**—Selects source of the trigger signal.

SWEEP

- ⑧ **POSITION Control**—Provides horizontal positioning.
- ⑨ **FINE Control**—Provides precise horizontal positioning.
- ⑩ **MAG Pushbutton**—Selects magnified X10 or unmagnified sweep.
- ⑪ **HOLD OFF Control**—Permits hold off period to be varied to improve trigger stability on repetitive, complex waveforms.
- ⑫ **TIME/DIV Selector**—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.

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.

PRETRIGGER ACQUIRE CLOCK

- ⑰ **AQS (acquire single-shot) CLOCK/AQR (acquire repetitive)**—Selects the source of clock pulses from the 7B87 to the 7854 digitizing plug-in oscilloscope (7B87 must be installed in B horizontal compartment of companion oscilloscope mainframe).
- ⑱ **ACQUIRE-STOP DELAY Control**—A variable delay gate function that allows pretrigger time to be varied in compatible 7000-series digitizing oscilloscopes. Exact delay time is displayed on oscilloscope crt readout.
- ⑲ **EXT CLOCK IN Connector**—Provides input for external TTL clock signals.

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

Operating Instructions—7B87

4. Turn on the mainframe 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-volt, 1-kilohertz 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 milliseconds/division). 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).

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 hold-off 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 which 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-volt, 1-kilohertz 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 reconnected to the amplifier unit input.

PRETRIGGER ACQUIRE CLOCK FUNCTIONS

NOTE

The following procedure must be performed with the 7B87 installed in the B horizontal compartment of a Tektronix 7854 Oscilloscope.

1. Install the 7B87 in the 7854 Oscilloscope B horizontal compartment and install an amplifier unit in the mainframe left vertical compartment. Turn on oscilloscope power. See Tektronix 7854 Oscilloscope Operators Manual for detailed operating information.

2. Set the time-base unit controls as follows:

SLOPE (+)
 MODE AUTO
 COUPLING AC
 SOURCE INT
 POSITION Midrange
 TIME/DIV 1 ms
 VARIABLE Calibrated (CAL IN)
 HOLDOFF MIN (fully counterclockwise)
 MAG X1 (pushed in)
 AQS CLOCK/AQR INTERNAL
 ACQUIRE STOP DELAY Midrange

3. Set the 7854 vertical and horizontal modes to display the plug-in units and set WFM ACQUISITION to SCOPE. Set the intensity and focus for a well-defined, intensified display.

4. Connect the 0.4-volt, 1-kilohertz signal from the mainframe calibrator to the amplifier unit input.

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

6. Set the TRIGGERING MODE to NORM and adjust the LEVEL control for a stable display (TRIG'D light on).

7. Rotate the ACQUIRE-STOP DELAY control fully counterclockwise. Notice that delay-time readout (located in the lower right-hand corner of the crt) is near 0.2 ms. (Zero delay time means that the acquired signal occurred prior to the triggering event.)

8. Rotate the ACQUIRE-STOP DELAY control until the delay-time readout is approximately 4 ms. Notice that the first four divisions of squarewave display are intensified. The 4 ms intensified display relates to four divisions of post-trigger in the subsequent single-sweep display. Therefore, the remaining 6 divisions in the subsequent display would be pre-trigger (see Fig. 1-3).

NOTE

Four divisions of intensified display at 1 ms/div relates to delay-time readout of approximately 4 ms.

9. Set the amplifier unit input coupling switch to off or ground. Set the 7B87 to SINGLE SWEEP MODE and press the RESET pushbutton so that READY light is on.

10. Set the 7854 to Stored CRT Display and then to Acquire Single-Shot Waveform Acquisition (AQS).

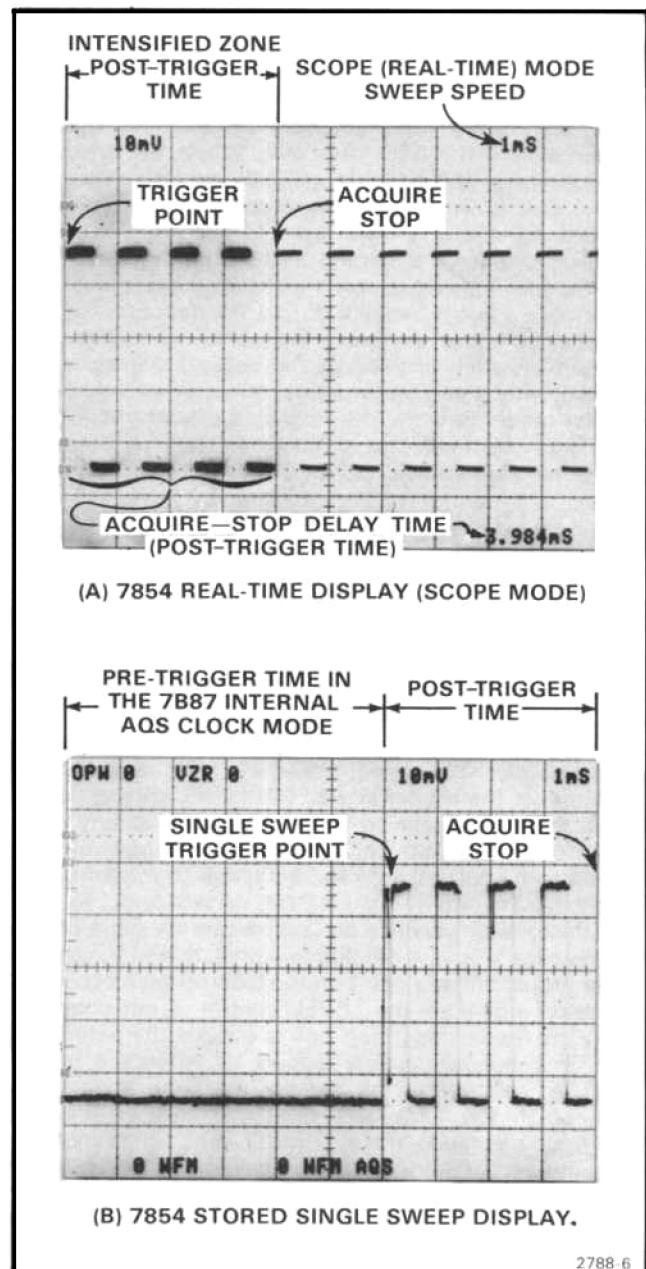


Figure 1-3. Single Sweep Acquisition.

11. To trigger the single-sweep display, set the amplifier unit input coupling to dc. Triggering occurs when the amplifier coupling switch is set to dc. The first six milliseconds of the display is pretrigger. (Noise in the Stored Single Sweep may be displayed at the Single Sweep Trigger Point as a result of the coupling switch contact closure.)

GENERAL OPERATING INFORMATION

TRIGGERING SWITCH LOGIC

The MODE, COUPLING, and SOURCE pushbuttons of the TRIGGERING switches are arranged in a sequence which places the most-often used position at the top of each series of pushbuttons. With this arrangement, a stable display can usually be obtained by pressing the top pushbuttons: 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 pushbutton 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 also 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 base-line, 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 about 30 hertz. When the TRIG'D light is off, no trace is displayed.

SINGLE-SWEEP OPERATION. The 7B87 single-sweep function can be used with both digitizing and non-digitizing oscilloscopes. A discussion of each follows:

Non-Digitizing Oscilloscope 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 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 display 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 camera shutter can be left open until the signal triggers the unit. Further information on photographic techniques is given in the appropriate camera instruction manual.

Single-Sweep Acquisition Using a 7B54 Oscilloscope. The ACQUIRE-STOP DELAY control and AQS CLOCK switches function only with the 7B87 installed in the 7B54 Oscilloscope B Horiz compartment. The 7B54 requires a sequential clock signal to acquire a single-sweep display; this is provided by the 7B87 time-base unit with the AQS CLOCK/AQR clock switch in the INTERNAL or INT \div 1000 positions or externally through the EXT CLOCK IN, when in the EXT/AQR position.

Table 1-1 shows the internal clock frequencies at different TIME/DIV switch settings, at X10 MAG settings and at the INTERNAL and INT \div 1000 settings of the AQS CLOCK/AQR switches.

The AQS CLOCK/AQR switches select three clock operating modes:

1. INTERNAL—The clock is generated internally, with the clock frequency determined by the TIME/DIV and MAG settings (see Table 1-1).

The ACQUIRE-STOP DELAY control varies the allocation of pretrigger and post-trigger time in the subsequent stored single-sweep display. The post-trigger portion is intensified in the real-time display and the exact time is displayed by CRT readout (see Fig. 1-3).

NOTE

Occasionally, when using the 7B87/7B54, the first point of single-shot acquired (AQS) waveform will be displayed at the end of the trace (extreme right) and will appear that the waveform has made a transition on the last point. To determine if the last point is erroneous, check that the first and last points have nearly the same vertical value at any setting of the 7B87 ACQUIRE-STOP DELAY control.

2. INT \div 1000—In this AQS CLOCK mode the internal clock frequency is divided by 1,000 (see Table 1-1). The real-time display is the same as the internal mode with the intensified zone and associated ACQUIRE-STOP DELAY readout corresponding to post-trigger time in the subsequent stored single-sweep display.

TABLE 1-1
TIME/DIV Setting Relationship To
7B87 Internal Acquire Clock Rep Rate

| TIME/DIV | MAG | | X1 \div 1000 | X10 \div 1000 |
|------------|-----------|-----------|----------------|-----------------|
| | X1 | X10 | | |
| 5 s | 20.48 Hz | 204.8 Hz | .02048 Hz | .2048 Hz |
| 2 s | 51.2 Hz | 512 Hz | .0512 Hz | .512 Hz |
| 1 s | 102.4 Hz | 1024 Hz | .1024 Hz | 1.024 Hz |
| .5 s | 204.8 Hz | 2.048 kHz | .2048 Hz | 2.048 Hz |
| .2 s | 512 Hz | 5.12 kHz | .512 Hz | 5.12 Hz |
| .1 s | 1.024 kHz | 10.24 kHz | 1.024 Hz | 10.24 Hz |
| 50 ms | 2.048 kHz | 20.48 kHz | 2.048 Hz | 20.48 Hz |
| 20 ms | 5.12 kHz | 51.2 kHz | 5.12 Hz | 51.2 Hz |
| 10 ms | 10.24 kHz | 102.4 kHz | 10.24 Hz | 102.4 Hz |
| 5 ms | 20.48 kHz | 204.8 kHz | 20.48 Hz | 204.8 Hz |
| 2 ms | 51.2 kHz | 512 kHz | 51.2 Hz | 512 Hz |
| 1 ms | 102.4 kHz | 1.024 MHz | 102.4 Hz | 1.024 kHz |
| .5 ms | 204.8 kHz | 2.048 MHz | 204.8 Hz | 2.048 kHz |
| .2 ms | 512 kHz | 5.12 MHz | 512 Hz | 5.12 kHz |
| .1 ms | 1.024 MHz | 10.24 MHz | 1.024 kHz | 10.24 kHz |
| 50 μ S | 2.048 MHz | 20.48 MHz | 2.048 kHz | 20.48 kHz |
| 20 μ S | 5.12 MHz | | 5.12 kHz | |
| 10 μ S | 10.24 MHz | | 10.24 kHz | |

Operating Instructions—7B87

The AQS stored single-sweep display is effectively 1000 times slower than the real-time display; however, the ACQUIRE-STOP DELAY time (post-trigger time) remains unchanged and becomes insignificant compared to the digitized sweep. Therefore, the stored single-sweep display is for practical purposes all pretrigger.

NOTE

During single-shot acquisition with an external clock input the 7854 may not necessarily sample one data point for each clock pulse, as shown below:

| P/W (Points/ Waveform) | Clock Pulses Required |
|---------------------------|--------------------------|
| 1024 | 1 |
| 512 | 2 |
| 256 | 4 |
| 128 | 8 |

3. EXT/AQR (EXT CLOCK IN)—This mode connects the external TTL compatible clock signal, applied to the front-panel EXT CLOCK IN connector, to the companion digitizing oscilloscope mainframe (7854).

The real-time display is the same as the internal mode with the intensified zone and associated ACQUIRE-STOP DELAY readout corresponding to post-trigger time in the subsequent stored single-sweep display. When the AQS (acquire single-shot) display is stored, the ACQUIRE-STOP DELAY time is as displayed on the readout but the effective TIME/DIV of the display changes at a rate determined by the frequency of the external clock signal. The resulting TIME/DIV for the stored single-sweep display acquired in the external clock mode can be determined by the following formula:

$$\text{EXT TIME/DIV} = 102.4 \times \text{External Clock Period}$$

or

$$102.4 \times \frac{1}{\text{EXT CLOCK FREQUENCY}}$$

NOTE

The 7854 may not return from the acquire single-shot (AQS) mode if the acquire-stop occurs before the memory is filled once. This is most noticeable at slow sweep speeds, especially in the internal $\div 1000$ clock mode. When the 7854 AQS button is pressed, the 7854 begins to sample the waveform and fill the memory. The acquire-stop signal occurs at a set interval after the 7B87 is triggered; this interval is the acquire-stop delay time. If the acquire-stop is generated before the 7854 has filled the memory once (one digital sweep) the 7854 will not recognize it, and the system will keep on digitizing.

When the 7854 is used for non-single-sweep acquisition (AQR), the 7B87 clock should be disabled by selecting the EXT/AQR pushbutton and removing any connection from the EXT CLOCK IN connector. This prevents the 7B87 clock signal from interfering with the 7854 acquisition mode.

To obtain a stored single-sweep display of a repetitive signal with a 7854 digitizing oscilloscope, first obtain a real-time display (7854 set to Scope CRT Display Mode) in the NORM TRIGGERING MODE. Then select the portion of pretrigger and post-trigger desired for the subsequent stored single-sweep display with the ACQUIRE-STOP DELAY control. The displayed intensified zone relates to the portion of the single-sweep displayed after the single-sweep trigger event (post-trigger) and the non-intensified zone relates to the portion of single-sweep displayed before the single-sweep trigger event

occurs (pretrigger—see Fig. 1-3). The exact amount of the post-trigger display is indicated by the CRT readout. Then, without changing other triggering controls, select the single-sweep mode by pressing the SINGLE SWP RESET pushbutton. Set the 7854 to the Stored CRT Display mode and to the AQS (acquire single-shot) WFM Acquisition mode. When the AQS button is pressed, the 7854 will respond by lighting the "Busy" LED and blanking the entire screen. Arm the single-sweep function by pressing the SINGLE SWP RESET pushbutton again. After the trigger event occurs, the stored waveform will be displayed on screen. A single stored trace is displayed each time the 7854 AQS function is selected and the 7B87 SINGLE SWP RESET pushbutton is pressed.

If an Error message is displayed at the bottom of the CRT, the 7B87 clock is running faster than the 7854 can digitize, and the single sweep will not be acquired. To remedy this error condition, select a slower TIME/DIV setting and re-acquire the single-sweep display until the Error message disappears and the single-sweep display is stored. If the 7854 does not return from the "Busy" state or if it is desired to abort the AQS before the trigger event has occurred, press Stop Ext Acquire button on the 7854 rear panel.

TRIGGER COUPLING

The TRIGGERING COUPLING pushbuttons 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 which triggers the sweep.

AC. AC COUPLING blocks the dc component of the trigger signal. Signals with low-frequency components below about 30 hertz 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 a 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 about 30 kilohertz. 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.

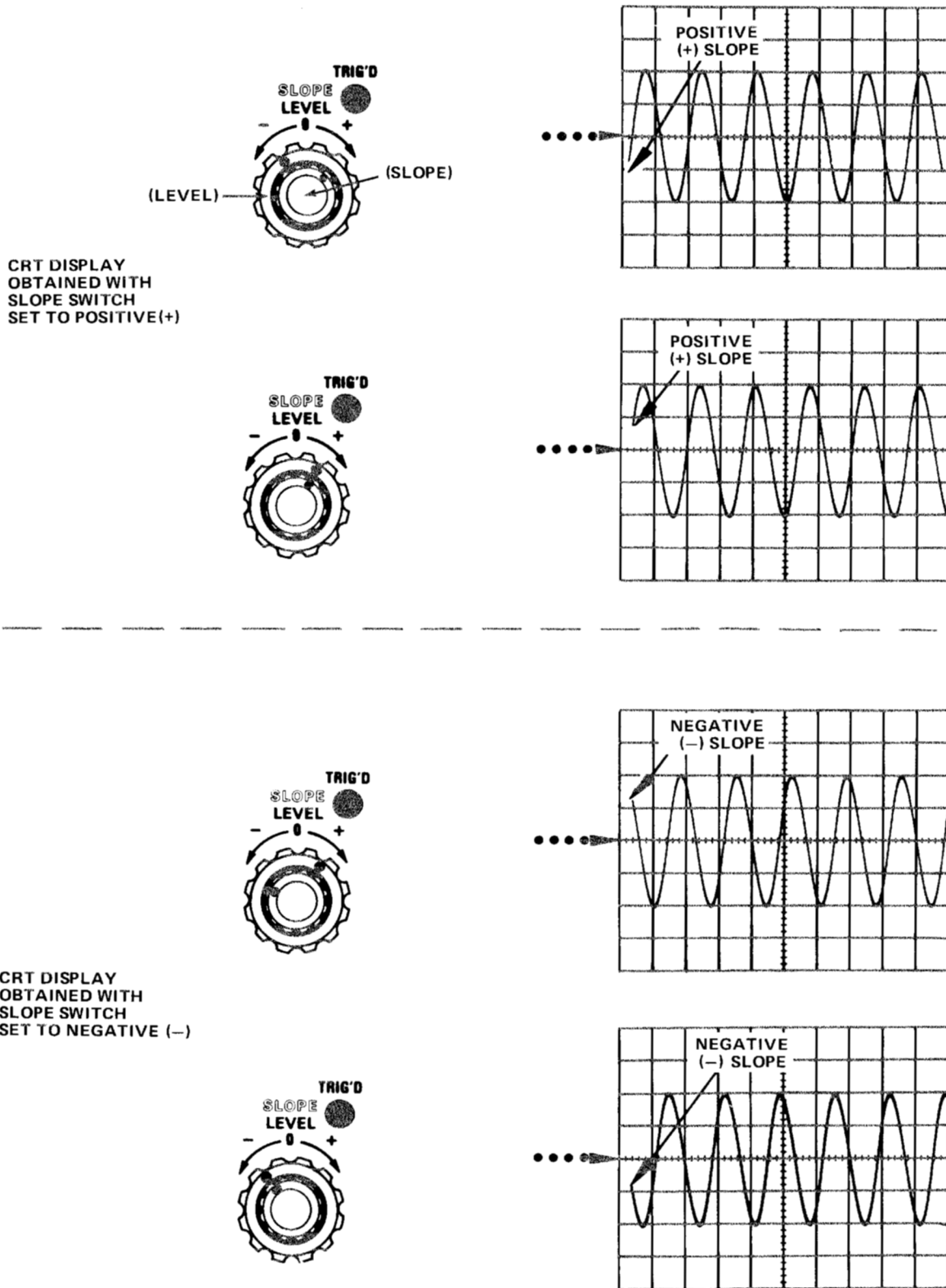
AC HF REJ. AC HF REJ COUPLING passes all low-frequency signals between about 30 hertz and 50 kilohertz. Dc is rejected and signals outside the above range are attenuated. When triggering from complex waveforms, this position is useful to provide a stable display of the low-frequency components.

DC. DC COUPLING can be used to provide stable triggering from low-frequency signals which 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 pushbuttons select the source of the trigger signal which is connected to the trigger circuits.

INTERNAL. The INT position causes the 7B87 to trigger on 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 which cannot be obtained in the INT position. In such cases, the LINE or EXT positions of the SOURCE switches must be used.



C1958-7

Figure 1-4. Effect of LEVEL control and SLOPE switch on crt display.

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

The $\div 10$ pushbutton 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. 1-4). 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 necessary to provide a display that starts on the desired slope of the input signal.

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 1-4 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.

HORIZONTAL SWEEP RATES

The TIME/DIV switch provides calibrated sweep rates from 5 seconds/division to 10 nanoseconds/division 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 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 MEASUREMENT

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. 1-5). 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.

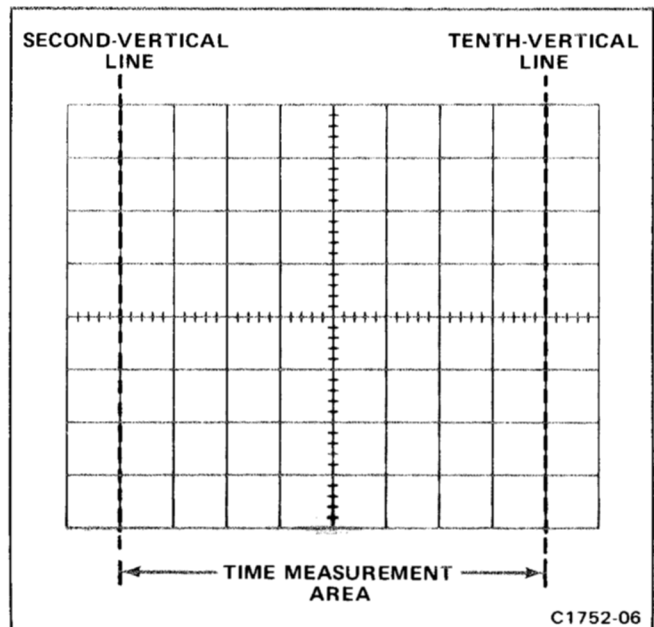


Figure 1-5. Area of graticule used for most accurate time measurements.

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. 1-6). The equivalent length of the

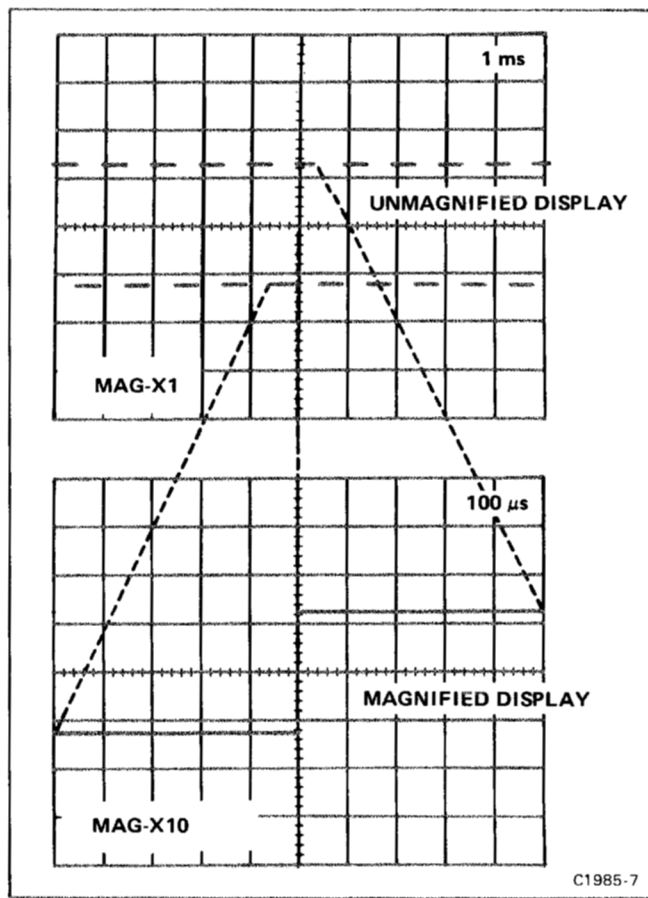


Figure 1-6. Operation of sweep magnifier.

magnified sweep is more than 100 divisions; any 10-division 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.

MAINFRAME OPERATING MODES

The time-base unit can be operated either as an independent time base in any Tektronix 7700-, 7800-, or 7900-series oscilloscope mainframe, or as a delayed-sweep unit in those mainframes that have two horizontal compartments. A companion delaying time-base unit is required for delayed-sweep operation. Refer to the delaying time-base unit instruction manual for additional information.

APPLICATIONS

The following information describes procedures and techniques for making basic time measurements with the time-base unit installed in a Tektronix 7700-, 7800-, or 7900-series oscilloscope. These procedures provide enough detail to enable the operator to adapt them to other related time measurements. Contact your Tektronix Field Office or representative for assistance in making measurements that are not described in this manual.

TIME-INTERVAL MEASUREMENTS

Since the sweep rate and the horizontal distance (in divisions) that the sweep travels across the graticule in a calibrated-sweep oscilloscope system is a function of time, the time interval between any two points on a waveform can be accurately measured. The following procedures provide methods to measure some of the more common time-related definable characteristics of a waveform such as period, frequency, rise time, fall time, and pulse width. The procedure for each of these measurements is essentially the same, except for the points between which the measurements are made. The time interval between any two selected points on a displayed waveform can be measured with basically the same technique.

PERIOD AND FREQUENCY MEASUREMENTS

Perform the following procedure to measure the period and determine the frequency of a displayed waveform:

1. Install the time-base unit in a mainframe horizontal compartment (either A or B Horiz in a four-compartment mainframe).
2. Connect the signal to be measured to the vertical unit input.
3. Set the mainframe Horizontal and Vertical Mode switches to display the time base and vertical units. (Check that the time base VARIABLE (CAL IN) control is pushed in and the HOLD OFF control is in the MIN position.)

4. Set the TRIGGERING switches and LEVEL control for a stable display (see General Operating Information for selecting proper triggering).

5. Set the vertical deflection factor and position control for about a 5-division display, vertically centered on the graticule.

6. Set the TIME/DIV switch and POSITION control for 1 complete cycle displayed within the center 8 graticule divisions as shown in Figure 1-7.

7. Measure the horizontal distance in divisions over 1 complete cycle of the displayed waveform (see Fig. 1-7).

8. Multiply the horizontal distance measured in step 7 by the TIME/DIV switch setting. (Divide the answer by 10 if sweep magnification is used.)

Example: Assume that the horizontal distance over 1 complete cycle is 7 divisions, and the TIME/DIV switch setting is 0.1 ms (see Fig. 1-7).

Using the formula:

$$\text{Period} = \frac{\text{Horizontal distance (divisions)} \times \text{TIME/DIV setting}}{\text{Magnification}}$$

Substituting values:

$$\text{Period} = \frac{7 \times 0.1 \text{ ms}}{1} = 0.7 \text{ millisecond}$$

9. Determine the frequency of the displayed waveform obtained in steps 1 through 8 by taking the reciprocal of the period of 1 cycle.

Example: Assume that the period of the displayed waveform is 0.7 millisecond.

Using the formula:

$$\text{Frequency} = \frac{1}{\text{Period}}$$

Substituting values:

$$\text{Frequency} = \frac{1}{0.7 \text{ ms}} = 1.43 \text{ kilohertz}$$

RISE-TIME AND FALL-TIME MEASUREMENTS

Perform the following procedure to measure the rise time and fall time of a displayed waveform:

1. Install the time-base unit in a mainframe horizontal compartment (either A or B Horiz in a four-compartment mainframe).

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

3. Set the mainframe Horizontal and Vertical Mode switches to display the time base and the vertical unit. (Check that the time base VARIABLE (CAL IN) control is pushed in and the HOLD OFF control is in the MIN position.)

4. Set the TRIGGERING switches and LEVEL control for a stable display (see General Operating Information for selecting proper triggering).

5. Set the vertical deflection factor and position control for a vertically-centered display with an exact number of divisions of amplitude.

6. Set the TIME/DIV switch and POSITION control to display the rising or falling portion of the waveform within the center 8 graticule divisions as shown in Figure 1-8 (see General Operating Information in this section for discussion of timing measurement accuracy).

7. Determine rise time or fall time by measuring the horizontal distance in divisions between the point on the rising or falling portion of the waveform that is 10% and the point that is 90% of the total display amplitude (see Fig. 1-8).

NOTE

The left edge of the oscilloscope graticule is scribed with 0, 10, 90, and 100% lines for convenience when measuring rise time or fall time. To use this feature, adjust the vertical deflection factor and position control to fit the display between the 0 and 100% graticule lines. Then measure the horizontal distance between the points where the waveform crosses the 10% and 90% graticule lines.

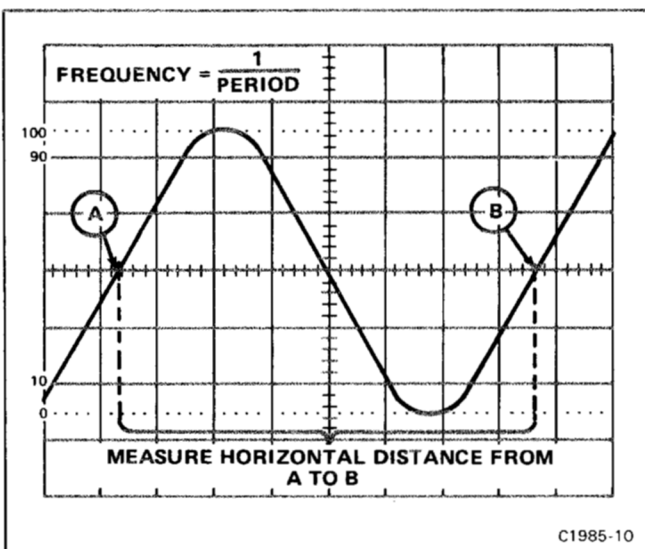


Figure 1-7. Measuring the period and determining the frequency of a displayed waveform.

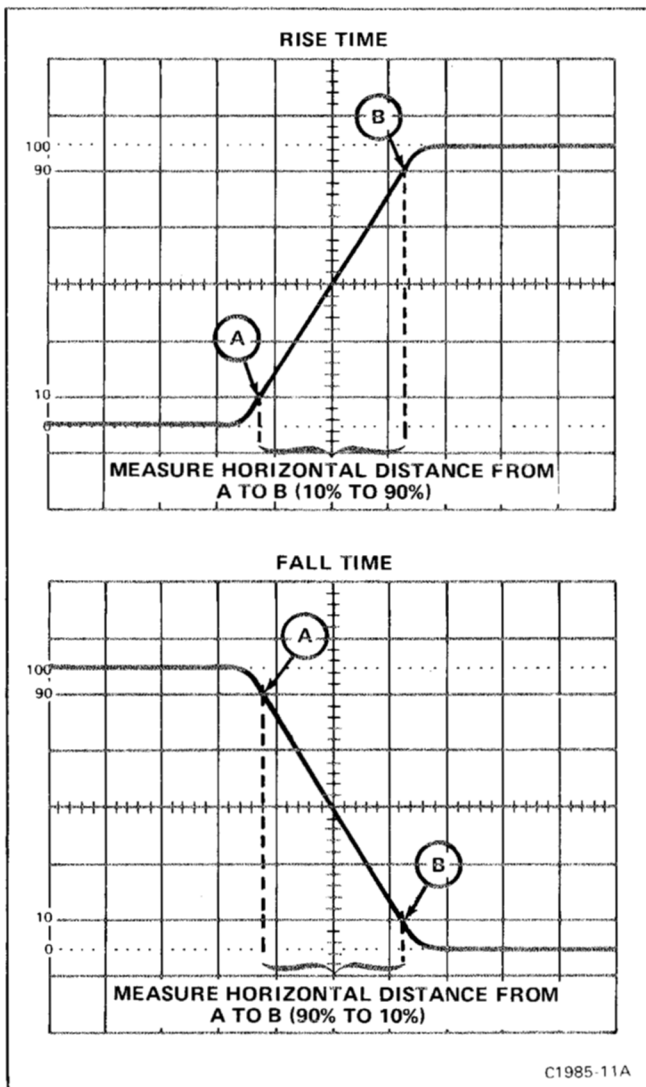


Figure 1-8. Measuring the rise time and fall time of a displayed waveform.

8. Multiply the horizontal distance measured in step 7 by the TIME/DIV switch setting. (Divide the answer by 10 if sweep magnification is used.)

Example: Assume that the horizontal distance from the 10 to 90% points is 2.5 divisions and the TIME/DIV switch setting is $.1 \mu\text{s}$ (see Fig. 1-8).

Using the formula:

$$\text{Rise Time} = \frac{\text{Horizontal distance (divisions)} \times \text{TIME/DIV setting}}{\text{Magnification}}$$

Substituting values:

$$\text{Rise Time} = \frac{2.5 \times 0.1 \mu\text{s}}{1} = 0.25 \text{ microsecond}$$

PULSE WIDTH MEASUREMENTS

Perform the following procedure to measure the pulse width of a displayed waveform:

1. Install the time-base unit in a mainframe horizontal compartment (either A or B Horiz in a four-compartment mainframe).
2. Connect the signal to be measured to the vertical unit input.
3. Set the mainframe horizontal- and vertical-mode switches to display the time base and vertical unit. (Check that the time base VARIABLE (CAL IN) control is pushed in and the HOLD OFF control is in the MIN position.)
4. Set the TRIGGERING switches and LEVEL control for a stable display (see General Operating Information for selecting proper triggering).
5. Set the vertical deflection factor and position control for about a 5-division pulse, vertically centered on the graticule.
6. Set the TIME/DIV switch and POSITION control for 1 complete pulse displayed within the center 8 graticule divisions as shown in Figure 1-9.
7. Measure the horizontal distance in divisions between the 50% amplitude points of the displayed pulse (see Fig. 1-9).
8. Multiply the horizontal distance measured in step 7 by the TIME/DIV switch setting. (Divide the answer by 10 if sweep magnification is used).

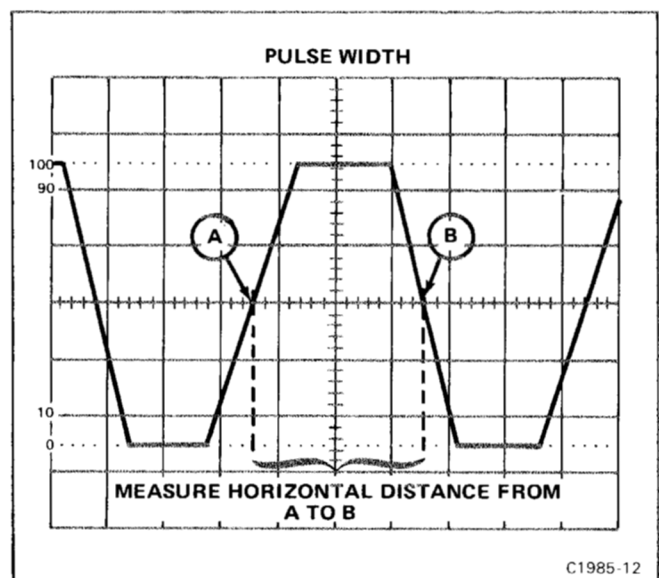


Figure 1-9. Measuring the pulse width of a displayed waveform.

Example: Assume that the horizontal distance between the 50% amplitude points is 3 divisions, and the TIME/DIV switch setting is 0.1 ms (see Fig. 1-9).

Using the formula:

$$\text{Pulse Width} = \frac{\text{Horizontal distance (divisions)} \times \text{TIME/DIV setting}}{\text{Magnification}}$$

Substituting values:

$$\text{Pulse Width} = \frac{3 \times 0.1 \text{ ms}}{1} = 0.3 \text{ millisecond}$$

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 | | | |
|--|--|------|--------------|------|
| SWEEP GENERATOR | | | | |
| 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. | | | |
| Sweep Accuracy ¹ (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 | +15° to +35° C | | 0° to +50° C | |
| | Unmag | Mag | Unmag | Mag |
| 5 s/Div to 1 s/Div | 4.0% | 5.0% | 5.0% | 6.0% |
| 0.5 s/Div to 0.1 μs/Div | 1.5% | 2.5% | 2.5% | 3.5% |
| 50 ns/Div to 10 ns/Div | 2.5% | 4.0% | 3.5% | 5.0% |
| Excluded Portions of Sweep | | | | |
| Start of Sweep | First 10 ns in 7100, 7800, and 7900-series mainframes. First 20 ns in 7700-series mainframes. First 50 ns in all other 7000-series mainframes. | | | |
| End of Sweep | Beyond 10 th div unmagnified. Beyond 100 th 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. | | | |
| Position Range | | | | |
| POSITION Controls Fully Clockwise | Start of sweep must be to the right of graticule center at 1 ms/div. | | | |
| POSITION Controls Fully Counterclockwise | End of sweep must be to the left of graticule center at 1 ms/div. | | | |

¹The fastest calibrated sweep rate is limited by some mainframes.

TABLE 2-1 (CONT)
Electrical Characteristics

| Characteristic | Performance Requirement | | |
|---|---|------------------------------------|-----------------|
| SWEEP GENERATOR (CONT) | | | |
| Trigger Holdoff Time | | | |
| Minimum Holdoff Setting | | | |
| 5 s/Div to 1 μ s/Div | 2 times TIME/DIV setting or less. | | |
| 0.5 μ /Div to 10 ns/Div | 2.0 μ s or less. | | |
| Variable Holdoff Range | Extends holdoff time through at least 2 sweep lengths for sweep rates of 20 ms/div or faster. | | |
| TRIGGERING | | | |
| Triggering Sensitivity from Repetitive Signal (Auto, Norm and Single Sweep Modes) | Triggering Frequency Range ² | Minimum Triggering Signal Required | |
| Coupling | | 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 ³ | 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 ⁴ | 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 Ω 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 | 0.5 div | 125 mV |
| | 50 MHz to 400 MHz | 1.5 div | 375 mV |
| Low Frequency Response | At least 50 Hz | 2.0 div | 500 mV |

²The 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.

³Will not trigger on sine waves at or below 60 Hz when amplitudes are less than 8 divisions internal or 3 volts external.

⁴The Triggering Frequency Range for DC COUPLING applies to frequencies above 30 Hz when operating in the AUTO TRIGGERING MODE.

TABLE 2-1 (CONT)
Electrical Characteristics

| Characteristic | Performance Requirement |
|--|---|
| PRETRIGGER ACQUIRE CLOCK | |
| Internal Acquire (AQS) Clock Frequency | 20.48 mHz (millihertz) to 20.48 MHz as determined by the TIME/DIV X10 MAG, and INT ÷ 1000 switches. |
| Accuracy (INTERNAL and INT ÷ 1000) | 0.1%. |
| Range | |
| INTERNAL (X1 MAG) | 18 steps in a 1-2-5 sequence from 20.48 Hz to 10.24 MHz. |
| INTERNAL (X10 MAG) | X10 magnifier increases frequency by a factor of 10 to a maximum of 20.48 MHz (16 steps to 50 μ s/Div setting). |
| INT ÷ 1000 (X1 MAG) | 18 steps in a 1-2-5 sequence from 20.48 mHz (millihertz) to 10.24 kHz. |
| INT ÷ 1000 (X10 MAG) | X10 magnifier increases frequency by a factor of 10 to a maximum of 20.48 kHz (16 steps to 50 μ s/Div setting). |
| External Clock Input (EXT/AQR) | Front-panel bnc connector. |
| Maximum Input Voltage | 5 V pk. |
| Input Characteristic | 100 k Ω within 5%. |
| Threshold Voltage | TTL compatible. |
| Maximum Input Frequency | 10 MHz. |
| BNC to Interface Delay | 0.5 μ s or less. |
| Acquire Stop Delay | |
| Range | 0.2 or less to at least 9.9 times TIME/DIV setting. |
| Jitter (5 s/div to 10 μ s/div) | 0.02% of TIME/DIV setting or less. |
| Delay Accuracy (+15° C to +35° C) | |
| 0.5 s/Div to 10 μ s/Div | Within 0.5% of measurement plus 5% of TIME/DIV setting. |

TABLE 2-2
Mainframe Horizontal Compatibility

| Mainframe | Operating Conditions | Symptom | Cause |
|-------------------|--|---|--|
| 7844 | When the B Horizontal compartment is displayed by both Beam 1 and Beam 2, a 7B87 in the A Horizontal compartment will terminate the B sweep display at the end of the A sweep. | The B sweep display may be shortened or disappear as determined by the 7B87 ACQUIRE-STOP DELAY control. | 7000-Series Mainframes with four plug-in compartments have interface connection A16 HI in the A Horizontal compartment and A16 LO in the B Horizontal compartment. In the 7844, the state of A16 is switchable as determined by the selection of Beam 1 or Beam 2 display. |
| 7844 Option 21 | | Fully Compatible. | |

TABLE 2-3
Environmental Characteristics

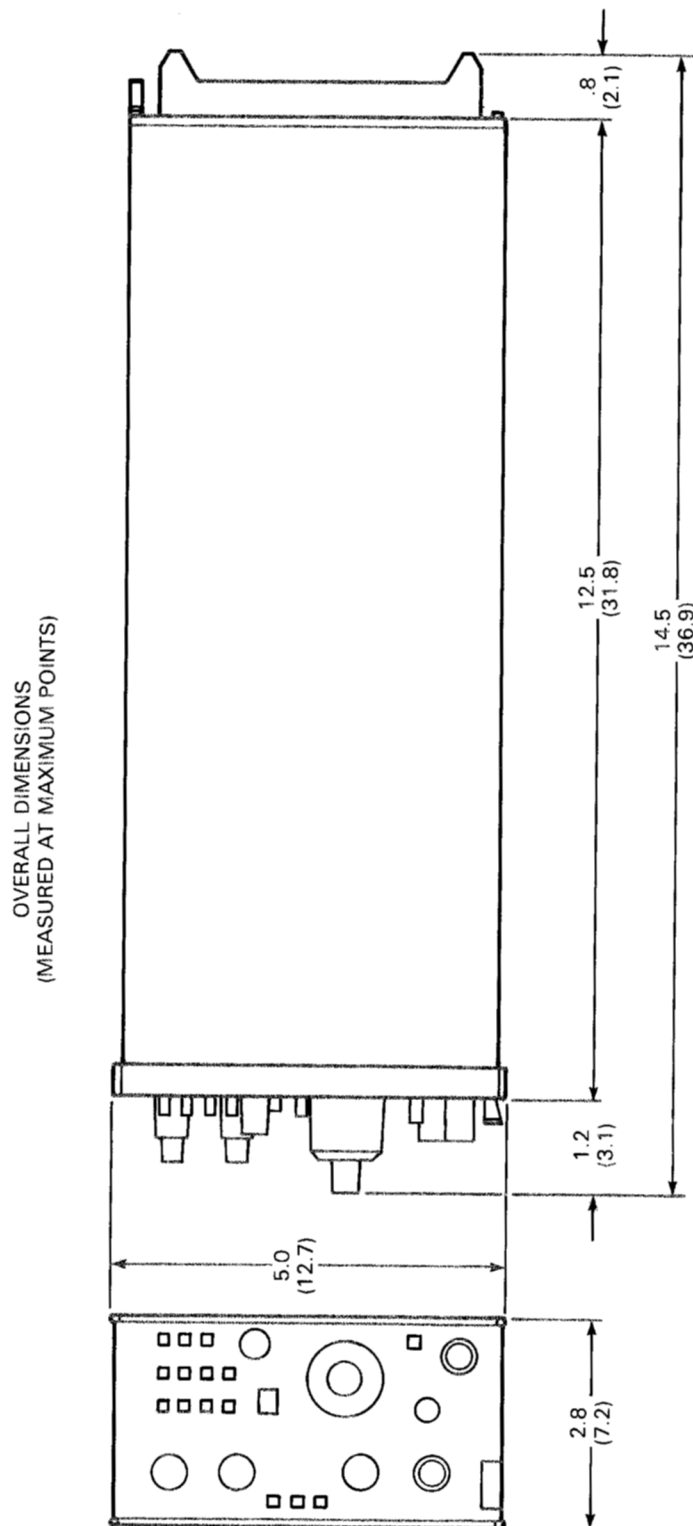
| |
|--|
| Refer to the Specification section of the associated mainframe manual. |
|--|

TABLE 2-4
Physical Characteristics

| Characteristic | Information |
|----------------|--|
| Net Weight | Approximately 2.6 pounds (1.2 kilogram). |
| Dimensions | See Figure 2-1, dimensional drawing. |

STANDARD ACCESSORIES

| | |
|------------|--------------------|
| 1 ea | Instruction Manual |
|------------|--------------------|



NOTE: Dimensions are given with top figure in inches and bottom figure in centimeters.

Figure 2-1. 7B87 dimensional drawing.

THEORY OF OPERATION

This section of the manual describes the circuitry used in the 7B87 Time-Base. The description begins with a discussion of the instrument, using the block diagram shown in Figure 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 7B87 before the individual circuits are discussed in detail. A basic block diagram is shown in Figure 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 provides 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 which 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 Amplifier and the Delay Gate Generator in the 7B87. The Sweep Generator also generates a Sweep Gate pulse which unblanks the mainframe crt.

PICKOFF AMPLIFIER AND DELAY GATE GENERATOR

The Pickoff Amplifier and Delay Gate Generator circuits produce a delay gate when the sawtooth signal from the sweep generator reaches the level set by the ACQUIRE-STOP DELAY control. The ACQUIRE-STOP DELAY control

determines where the intensified zone ends. The Delay Gate signal enables the companion delayed time-base unit.

LOGIC

The Logic circuit determines the acquire mode (acquire single-shot, AQS; or acquire repetitive, AQR) of the 7B87. The 7B87 can operate independently or as a delayed time base. The Logic circuit also determines the trigger mode and generates the holdoff signal for the mainframe.

DIGITAL VOLTMETER

The Digital Voltmeter circuit converts the delay comparison voltage, from the ACQUIRE-STOP DELAY control, to a calibrated delay time readout on the crt. The readout indicates the time between the start of the sweep and the end of the intensified zone.

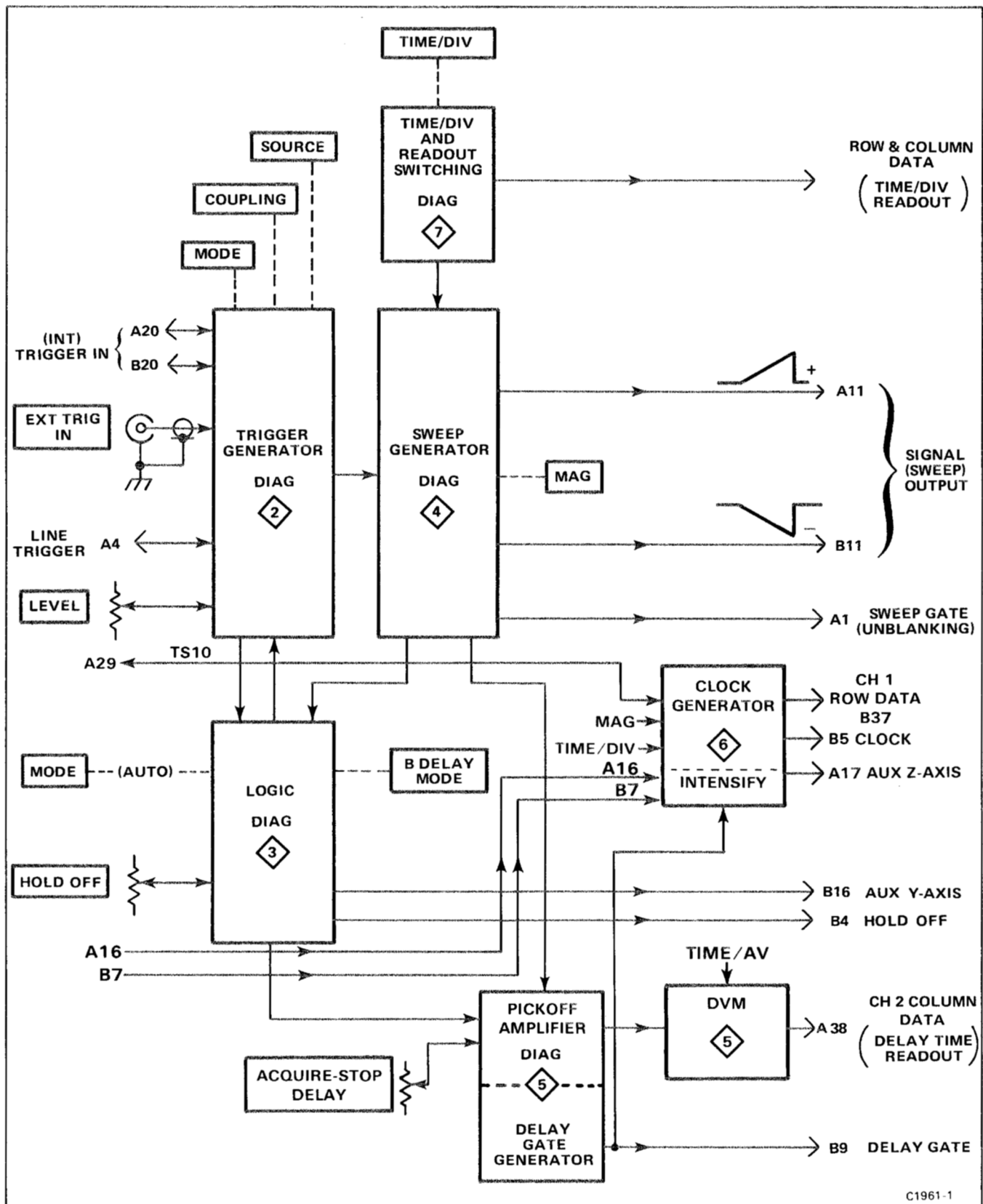
CLOCK GENERATOR

The Clock Generator produces three signals for the mainframe: (1) the Clock pulse, (2) the channel 1 Row Data for the 7854 mainframe, and (3) the Aux Z-Axis signal which intensifies the display.

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, names the 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 section.



C1961-1

Figure 3-1. Basic block diagram of the 7B87 Delaying Time Base Unit.



FRONT-PANEL DISTRIBUTION

The Front-Panel Distribution diagram shows the interconnections between front-panel functions (controls, connectors, and indicators) and circuit boards in the 7B87.



TRIGGER GENERATOR

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 occur on either the positive or negative slope of the waveform. The triggering signal source may come from the signal being displayed (INT), and external source (EXT), or a sample of the power-line voltage (LINE). Figure 3-2 is a block diagram of the Trigger Generator.

EXTERNAL SOURCE

The external trigger signal is connected to the Trigger Generator through EXT TRIG IN connector J2. When released, push-button switch S10 provides 10 times attenuation of the external trigger input signal.

When SOURCE switch (S50) is set to EXT and the COUPLING control set to AC, external signals below approximately 16 kilohertz are coupled through R15, C15 and R20 to Q22. Triggering signals above 16 kilohertz 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 protect the input by clamping it within a diode drop of ground (approximately 0.7 volt).

INTERNAL AND LINE SOURCE

The internal trigger signal from the vertical channel(s) 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 kilohertz are coupled through C37 directly into the Trigger Source Selector and Amplifier stage (U65 pin 8). Internal trigger signals with frequencies below 16 kilohertz 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 connects 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) selects the triggering signal source from the signal being displayed (INT), an external source (EXT), or a sample of the power line voltage (LINE).

The trigger source is selected by SOURCE switch S50. 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).

High-frequency reject coupling is provided in the Trigger Source Selector stage. When the AC HF REJ push button is pressed, R68, 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 3 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 off-set 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 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 establish the range of the front-panel LEVEL control. Peak Detector signal amplitude depends 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

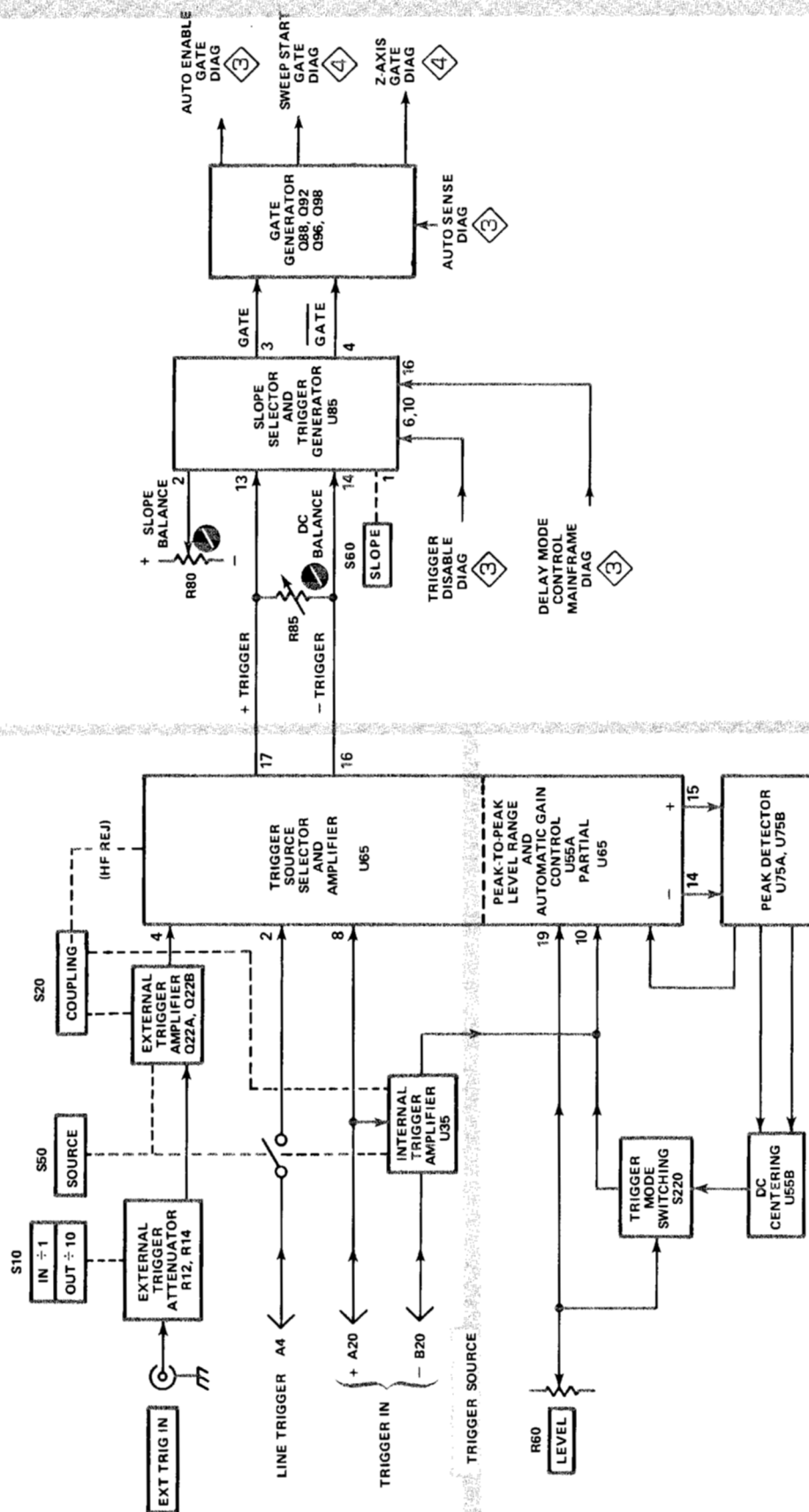


Figure 3-2. Detailed block diagram of Trigger Generator.

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 increases 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 millivolts peak-to-peak (at U65 pins 16 and 17) regardless of the trigger input signal amplitude. The level of the peak-detected signal from R58-59 is sensed by a feedback amplifier stage (U55A and pins 1 and 20 of U65). When the peak detected signal is above the Automatic Gain Control threshold (resulting from approximately 2 divisions of internal trigger signal or approximately 50 millivolts of 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 trigger occurs on the positive- 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 In signal (to U85 pin 16) functions only when the unit is operating as a delayed sweep in the B Horizontal compartment of a mainframe with 2 horizontal compartments. When the unit is operating in the "independent" or "triggerable after delay" modes (as determined by the delaying sweep time-base unit in the A horizontal compartment), there is no effect on the Trigger Generator circuits. However, when the unit is operating in the "B starts after delay" mode, a high 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 the emitter of Q242.

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 high 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 and Z-axis gate (unblanking) to the Sweep Generator circuit (diagram 4). Figure 3-3 shows the timing of the Gate Generator Functions.

When an adequate trigger signal is applied to U85 pins 13 and 14, it produces high and low levels, respectively, at its pin 3 and pin 4 outputs.

The high level from U85 pin 3 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 Logic circuit (diagram 3) sets the Auto Sense line at J200-3 high, turning off Q98. Simultaneously, the low level at U85 pin 4 gates comparator Q96-Q92. The collector of Q92 rises high to provide a Sweep Start Gate at J200-5 and the collector of Q96 falls low to provide a Z-Axis Gate (unblanking) at J200-4.

In the absence of a trigger output at U85 pins 13 and 14, pin 3 is set low and pin 4 is set high. The low 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 low-level Auto Sense pulse through J200-3 to the base of Q98. The low level gates the comparator (Q98 and Q96). The collector of Q98 of Q96 falls low 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. Figure 3-4 is a block diagram for the Logic circuit.

SWEEP MODES

Integrated circuit U220 controls the Norm, Auto, and Single Sweep Modes and also generates control signals. P-P Auto operation is described in the Trigger Generator circuit description (diagram 2).

Normal Mode

The Norm Mode is provided when U220 pin 12 is low. 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.

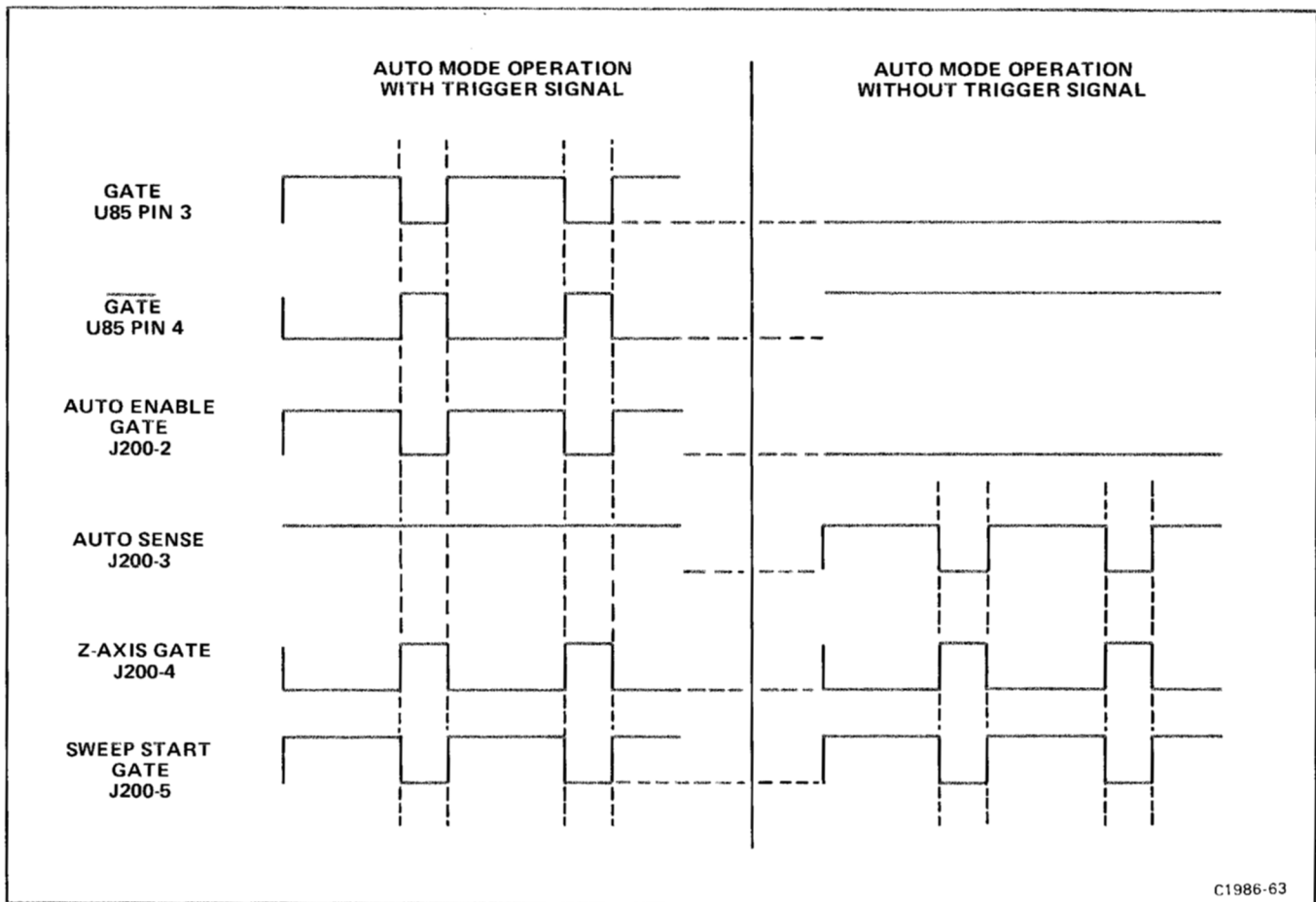


Figure 3-3. Timing diagram for Gate Generator stage (Q92, Q96, Q98).

Auto Mode

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

A high level from MODE switch S230 is inverted by Q230 to set U220 pin 19 low, which selects AUTO MODE operation. In the presence of a trigger pulse from the Trigger Generator (diagram 2), a high 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 low 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 the sweep is inhibited until the SINGLE SWP RESET button is pressed. The READY light indicates that the sweep is ready to accept a trigger.

After completion of one sweep, the Holdoff Start pulse at U220 pin 16 causes the Swp Disable Out at pin 17 to rise high. A high level at U220 pin 12 initiates single sweep operation and holds the sweep disable out at U220 pin 17 after completion of the sweep. Momentary contact of the RESET push button places a low 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 Holdoff Start pulse (high) 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 17 high and the Hold Off signal at pin 10 low for the duration of the hold-off cycle. Hold-off timing (U220 pin 8) is provided by capacitors C211 through C215, and resistors R212 through R214. Transistors Q203 and Q204 prevent the Swp Disable Out

pulse at U220 pin 17 from falling low until the timing capacitors have discharged. Transistors Q212 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 Sweep Lockout pulse (high) may be initiated at interface connector pin B8 by mainframe switching functions. A high level, coupled from interface connector B8 through the Lockout Buffer Amplifier Q202 and Q206 to the Lockout input at U220 pin 18, initiates a Swp Disable pulse at U220 pin 17, thereby disabling the sweep. The Lockout pulse (high) 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 OUTPUT AMPLIFIER

The Hold Off Output Amplifier inverts and amplifies the Hold Off signal from U220 for the mainframe.

Transistor Q272 inverts the Hold Off signal from U220 to provide a high level when hold off is present. The inverted signal is coupled through emitter follower Q274 to interface connector B4.



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 comparator (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. Figure 3-5 is a block diagram of the Sweep Generator.

TIMING CURRENT SOURCE

The Timing Current Source stages generate a constant current for the Ramp Generator stages (see Figure 3-5).

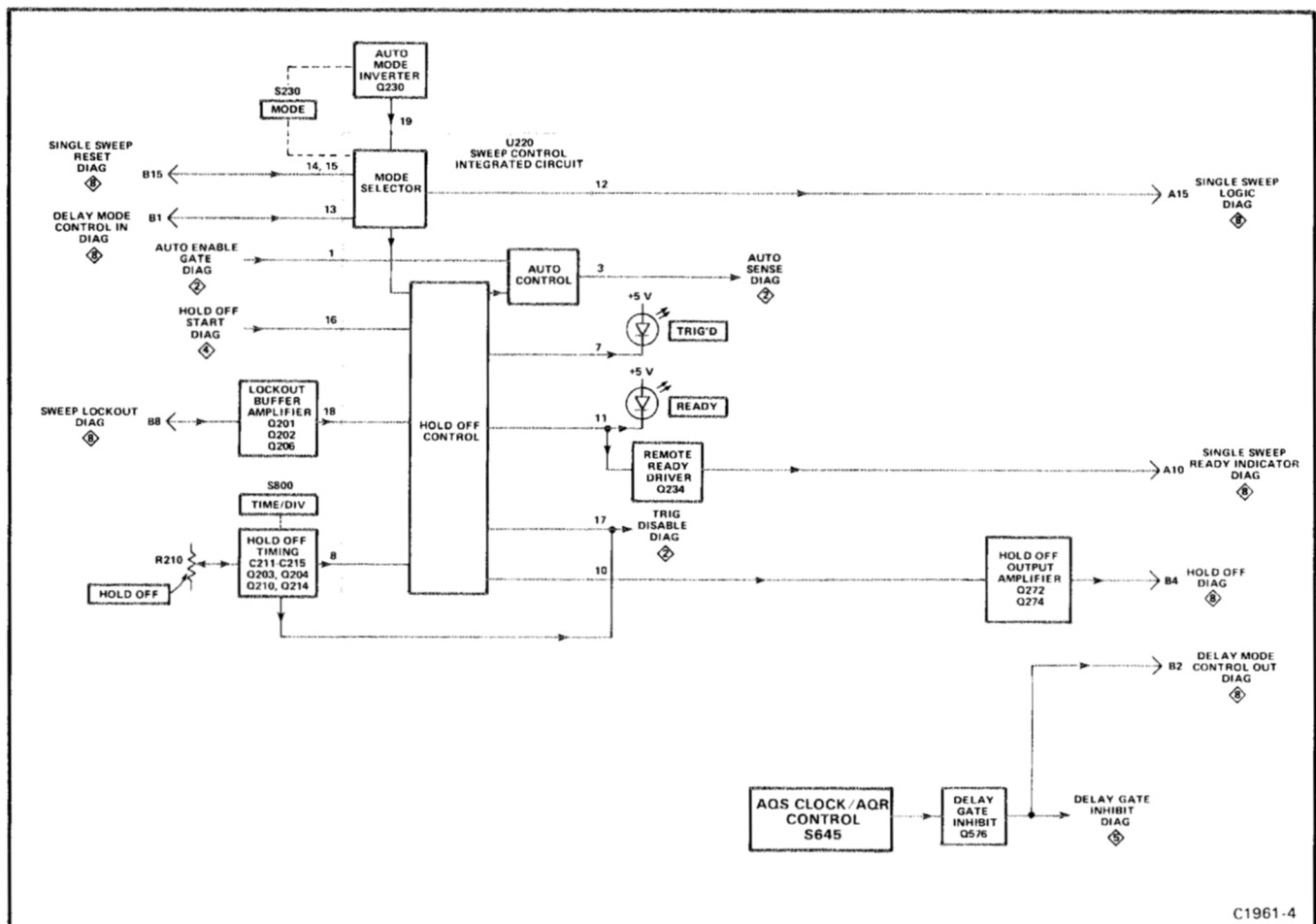


Figure 3-4. Detailed block diagram of Logic circuit.

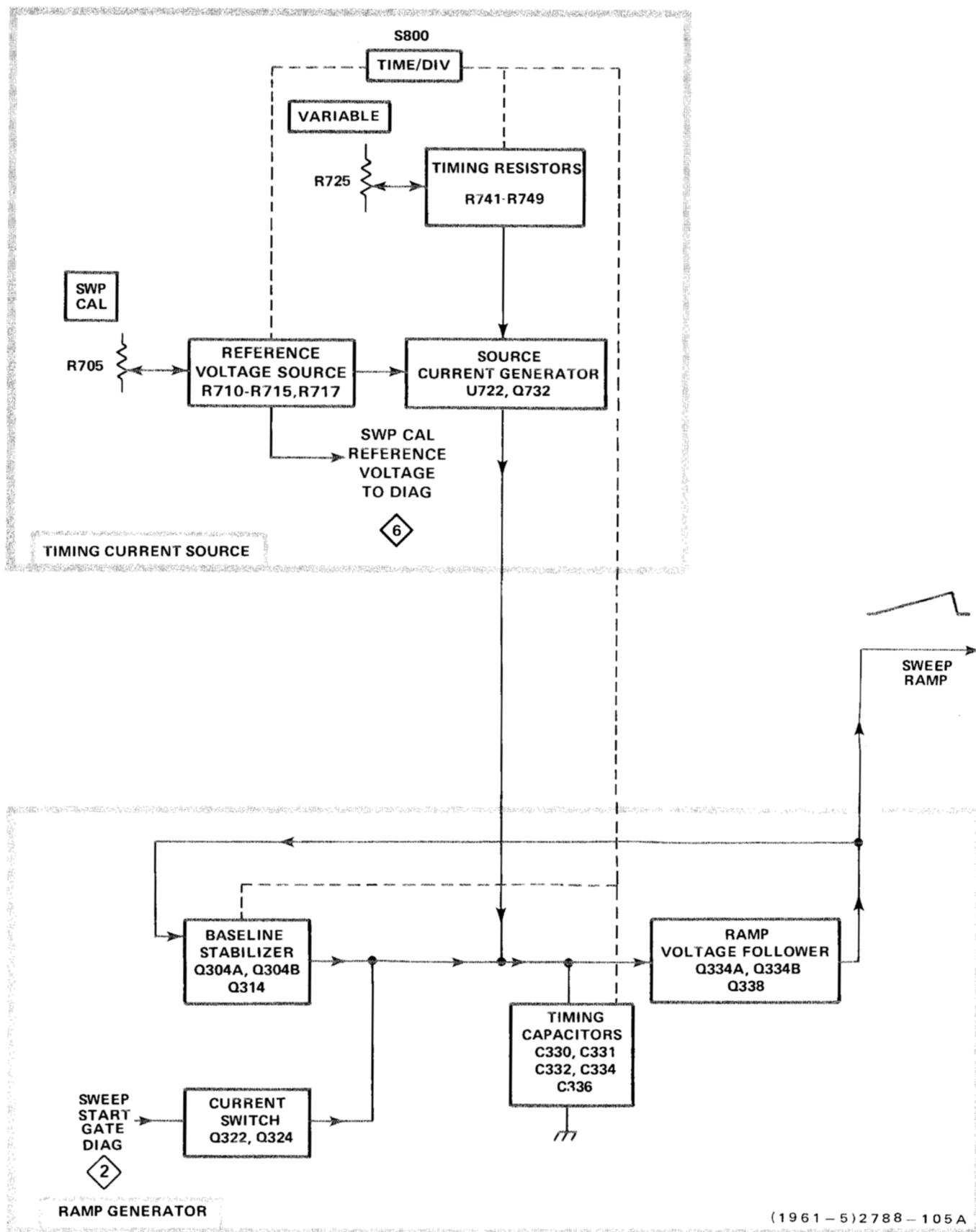


Figure 3-5. Detailed block diagram of Sweep Generator.

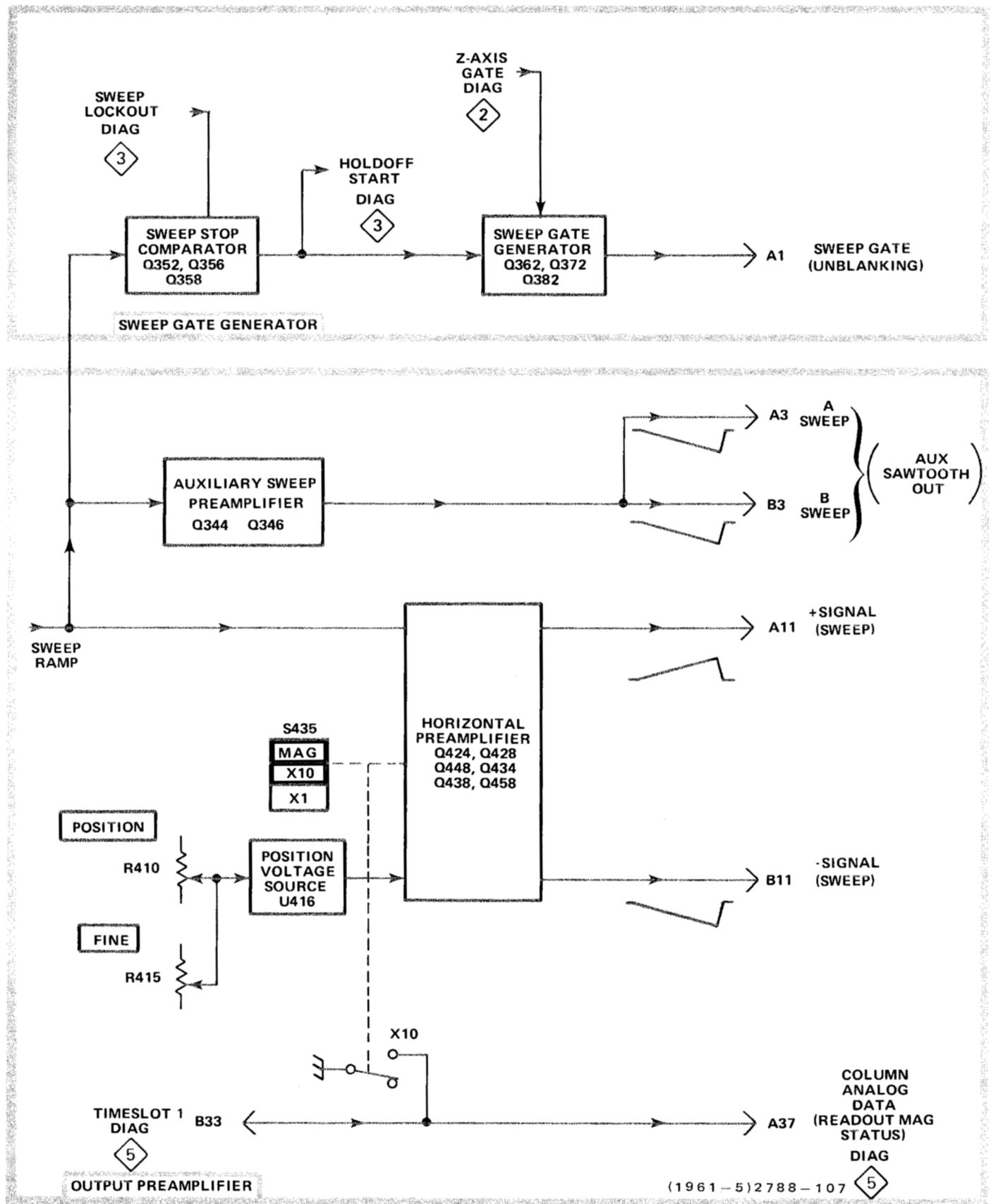


Figure 3-5 (cont). Detailed block diagram of Sweep Generator.

Theory of Operation—7B87

A Reference Voltage Source is established by the +50 volt supply and R710, R711, 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 Q732 to the Timing Resistors (R741 through R749). Timing current is the result of the voltage 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 Preamplifier and Sweep Gate Generator stages, and for delay pickoff in the Logic DVM (diagram 5). Refer to Figure 3-5.

Upon the arrival of a high-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 Preamplifier, Sweep Stop Comparator, Delay-Time Comparator, and Baseline Stabilizer stages.

When the Sweep Start Gate is low, 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 (via 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 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.

HORIZONTAL PREAMPLIFIER

The Horizontal Preamplifier 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 Figure 3-5.

The sweep ramp voltage from Q338 is coupled to the Horizontal Preamplifier stage at the base of Q424. Transistors 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 Q448 and Q458 provide final amplification and connect the sweep signal to the mainframe.

The MAG switch, S435, increases the Horizontal Preamplifier 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 to produce 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 Preamplifier 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. Transistors 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, at interface pin A1, for the Z-Axis system of the mainframe. When the sweep is displayed, the crt is unblanked (gate level high). The sweep is blanked (gate level low) between sweeps. Refer to Figure 3-5.

The sweep ramp is applied to the Sweep Stop Comparator stage. A reference voltage is set at the base of Q356. When the ramp voltage exceeds the reference voltage, Q352 turns off and Q356 couples a high 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 low at the start of the sweep. This low level turns off Q372. The resultant high-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 high level from the Sweep Stop Comparator stage turns Q362 off and Q372 on. The resultant low is coupled through emitter follower Q382 to the mainframe for sweep blanking.



DELAY TIME COMPARATOR AND DELAY GATE GENERATOR

The Delay Time Comparator (DTC) produces a signal that goes positive when the sweep voltage is more positive than the delay comparison voltage from the ACQUIRE-STOP DELAY control. The DTC consists of Q512B and Q522A. (Q512A and Q522B are not used because +5V turns off Q528 via R529.) The DTC operates at sweep speeds from 5 s to 10 μ s/Div. At sweep speeds above 10 μ s/Div, a low level from Q607 (diagram 6) turns Q518 off. When Q518 is turned off, the DTC does not function,

and no Delay Gate occurs. Unity-gain buffer U535A couples the voltage from the ACQUIRE-STOP DELAY control to the comparator. When the Sweep Ramp voltage at the base of Q522A exceeds the reference voltage from U535A, Q522A shuts off and Q512B turns on. Because Q522A is turned off, the low level at its collector turns off Q564, the input of Schmitt trigger pair Q564-Q568. With Q564 turned off, Q568 conducts a greater current through Q574.

The Delay Gate Generator (DGG) produces the Delay Gate signal in response to the output of the Delay Time Comparator and the Z-Axis Gate line. The DGG consists of Q572 and Q574.

The Delay Gate starts when a low-logic level on the Z-Axis Gate line turns Q572 off. When Q572 is shut off, Q574 conducts all the current from Q568, which is off because the Sweep Ramp voltage is lower than the voltage from the ACQUIRE-STOP DELAY control. This causes Q574's collector voltage to produce a positive transition, which is the leading edge of the Delay Gate. When the Sweep Ramp voltage exceeds the voltage from the ACQUIRE-STOP DELAY control, Q522A turns off and Q512B turns on. This causes the Schmitt trigger transistor Q568 to conduct a greater current through

Q574, whose collector voltage falls and forms the trailing edge of the Delay Gate. Emitter-follower Q578 applies the Delay Gate to pin B9 of the Interface Board's edge connector. Figure 3-6 shows the timing of the events that form the Delay Gate Signal.

If the 7B87 is in the A Horiz plug-in compartment and the INTERNAL AQS CLOCK/AQR button is pressed, S645 grounds the Delay Mode line. The Delay Mode line turns on Q576, which saturates and removes the collector voltage from Q574. In this situation the Delay Gate line stays at a low-logic level. This permits a time base in the B Horiz plug-in compartment to operate independently.

DIGITAL VOLTMETER

The Digital Voltmeter circuit converts the Delay Comparison Voltage, determined by the ACQUIRE-STOP DELAY front-panel control, to an accurate time measurement which is displayed on the crt by the mainframe readout system. The schematic for the Digital Voltmeter circuit is shown on diagram 5.

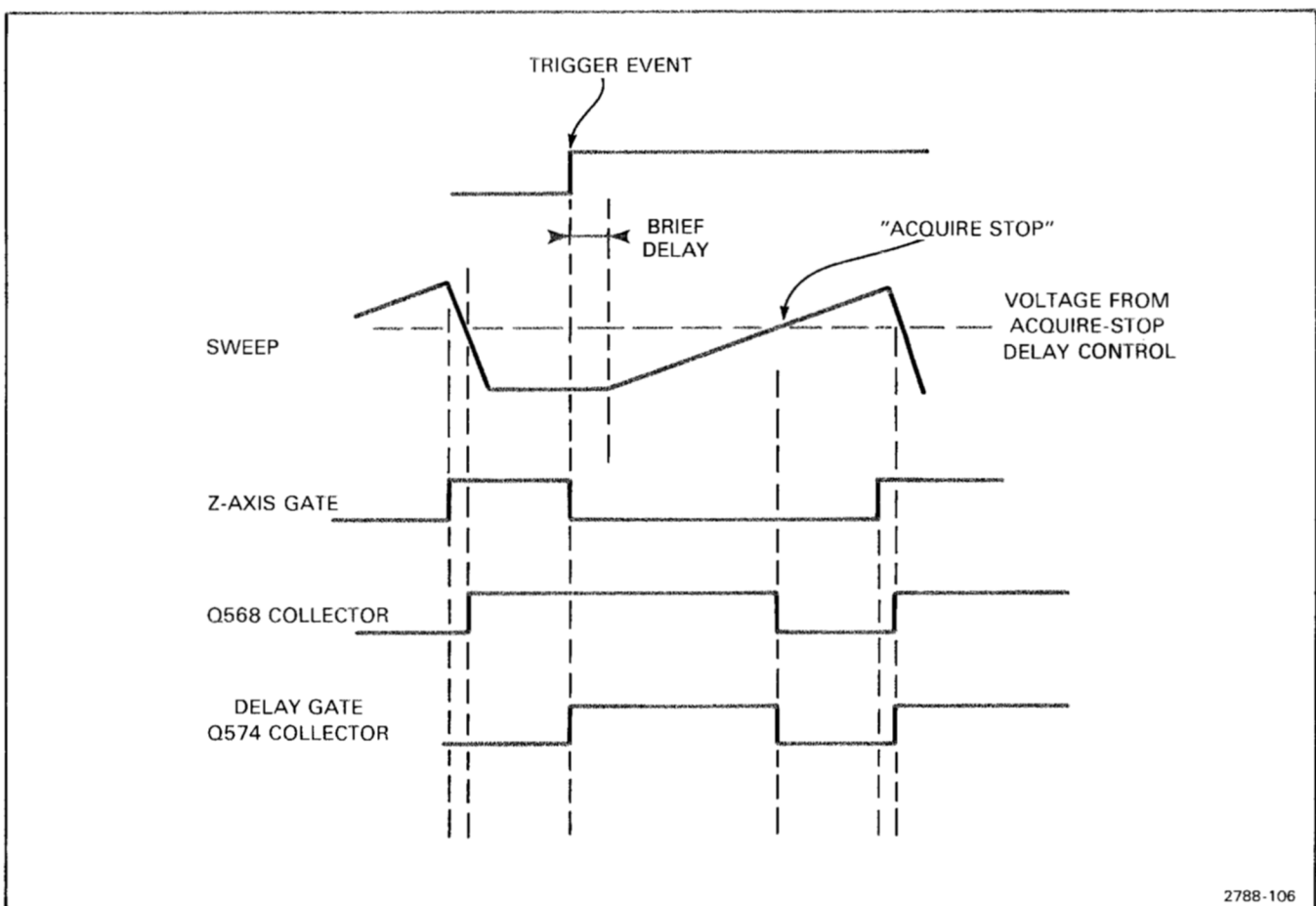


Figure 3-6. Timing of events that form the Delay Gate signal.

DELAY COMPARISON VOLTAGE-TO-RAMP CONVERTER

The Delay Comparison Voltage-to-Ramp Converter, U547, develops a negative-going ramp at CR552's anode. The current that flows through R537 and R539 (delay comparison current, determined by the ACQUIRE-STOP DELAY front-panel control) is integrated by U547 and C547 to form 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 U590) diode CR547 turns on and adds reference current to the delay comparison current. This reference current polarity is opposite to the delay comparison current and at least 10 times greater. Therefore, the output of U547 becomes a positive-going ramp. When the positive-going ramp reaches about 7 volts, the Comparator stage switches and the Ramp control turns off CR547. The output of U547 becomes a negative-going ramp, completing the cycle.

The DVM Zero adjustment, R550, provides a dc offset current to set the quiescent operating level of the Delay Comparison. Voltage to Ramp Converter. Scaling adjustment R538 allows for calibration of the delay comparison current.

COMPARATOR

The Comparator circuitry drives the comparator input of U590. When the output of U547 rises to about 7 volts, it forward biases CR552, which turns on Q552. Inverters U556B and U566D provide rapid latchup of the positive-going signal from Q552 and U556C applies it to the comparator input of U590.

REFERENCE CURRENT SOURCE

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 INVERTER

The Reference Current Inverter acts as a current "mirror" to produce an equivalent current in opposite polarity. Thus, current flowing through R546 is reversed as it flows through R547. Reversing current flow allows U547 to sum the reference current with the delay comparison current.

The ramp control output of U590 controls the reference current switching. A high on pin 16 of U590 causes a low at U556A's output, which reverse biases CR555. This causes U535 to forward-bias CR547 and allows reference current to flow from the summing node at pin 2 of U547. A low at pin 16 of U590 forward-biases CR555, turning off CR547 and routing the reference current away from U547's summing node.

COUNTER AND ENCODER

The Counter and Encoder circuit consists essentially of a four-decade counter with a multiplexer and associated circuitry.

An integration cycle of 100,000 counts begins with the ramp control (pin 16) going high and starting 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 increment until a transition occurs on the comparison input (pin 8) signaling that the counters contain the desired digital output which is a direct function of the delay comparison voltage. 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 U590's select lines, pins 3, 4, 5, and 6. The output appears at pin 18 as a current which varies from 0 ma to 1 ma in 100 μ a steps.

Integrated circuit U590 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 or 11 allows U590 to determine if it should be dividing by two or by five. An absence of voltage at both pins is interpreted as "divide by one."



CLOCK GENERATOR

The Clock board generates a Clock signal for digitizing mainframes such as the 7854. Diagram 6 depicts the circuitry on the Clock board. There are 10 groups of circuitry on diagram 6, as follows:

1. Control Logic. The Control Logic generates the signals that operate the X1-X10 Multiplexer.
2. Oscillator. The Oscillator produces a 20.48-MHz signal that serves as the reference for the Clock Generator.
3. First Divider. The First Divider produces outputs of 10.24, 5.12, 2.048, and 1.024 MHz and 512 kHz for the X1-X10 multiplexer.
4. X1-X10 Multiplexer. The X1-X10 Multiplexer selects its output based on the position of the MAG X1-X10 control.
5. Decade Divider. The Decade Divider furnishes five inputs to the Internal Clock Multiplexer. It produces the five inputs by dividing the output of the X1-X10 Multiplexer by 10, 100, 1,000, and 100,000.
6. Internal Clock Multiplexer. The Internal Clock Multiplexer selects one of the outputs of the Decade Divider as the input to the Output Clock Multiplexer.

7. Output Clock Multiplexer. The Output Clock Multiplexer selects the output of the Internal Clock Multiplexer, the Internal Clock divided by 1000, or the signal from the EXT CLOCK IN connector to be the "acquire clock" signal.

8. Intensify Circuit. The Intensify Circuit causes the mainframe to intensify the display between sweep start and the point selected by the ACQUIRE-STOP DELAY control.

9. External Clock Buffer. The External Clock Buffer is a high-impedance source follower which ensures that the 7B87 will not load the external signal source.

10. AQS CLOCK/AQR Switches. The AQS CLOCK/AQR switches control the Output Clock Multiplexer and the Intensify circuit.

CONTROL LOGIC

The Control Logic (CL) circuit produces a select input for Output Multiplexer U660, and enable inputs for X1 multiplexer U638 and X10 multiplexer U637. The CL circuit consists of U621A, U622A, B, C and D, and U623B, C and D.

When section 18 or 35 of TIME/DIV switch S800 is closed, U621A will be active and apply a high-logic level to multiplexer U660's pin 15 input. One or both of sections 18 and 35 is closed from 5s to 50 μ s/div, and from 2 μ s to 50 μ s/div. Because of this, U621A applies a high-logic level to U660's pin 15 input at all TIME/DIV settings except 20, 10, and 5 μ s, and 20 and 10 ns.

Gates U622A, B, C and D and U623B, C and D are wired so that they provide low-logic levels to the enable inputs of: a) X1 multiplexer U638 from 5s to 10 μ s/div when the MAG button is set to X1, and b) X10 multiplexer U637 from 5s to 50 μ s/div when the MAG button is set to X10. Table 3-1 is a truth table that gives details of this operation.

When the TIME/DIV switch is set between 5 s and 10 μ s/Div, section 1 of S800 turns Q607 off. The high level output of Q607 permits the Delay Time Comparator (diagram 5) to operate. At settings between 5 μ s and 10 ns/Div, Q607 is turned on, producing a low output level that disables the Delay Time Comparator.

OSCILLATOR

The Oscillator generates a 20.48-MHz signal that serves as the reference for the clock-generating circuitry. Gates U621B and C and crystal Y626 form the Oscillator.

The Oscillator has two enable inputs, which are connected to the TIME/DIV switch, via U622D, and to the AQS CLOCK/AQR switch. Both enable inputs must be at high-logic levels to allow oscillation.

When the TIME/DIV switch (S800) is set from 5 s to 10 μ s/Div, section 11 is closed. The ground from S800 section 11 causes U622D to assert a high-logic level to U621B's pin 5 input, which enables the oscillator.

When the AQS CLOCK/AQR control is set to INTERNAL or INT \div 1000, R646 applies a high-logic level to U621C's pin 10 input. When the AQS CLOCK/AQR control is set

TABLE 3-1
Truth Table, TIME/DIV Setting vs. Strokes for U637 and U638

| | MAG | U622C | Outputs | | U622A | U623C | Strobe for U637 (U623D) | Strobe for U638 (U623B) |
|------------------------|-----|-------|----------------|-------|-------|-------|-------------------------|-------------------------|
| | | | U622D | U622B | | | | |
| 5s to 50 μ s | L | L | H | H | L | H | H | L ¹ |
| 20 & 10 μ s | L | H | H ¹ | H | L | H | H | L ¹ |
| 5 μ s | L | H | L | H | H | L | H | H |
| 2 μ s to 50ns | L | L | L | H | H | L | H | H |
| 20ns, 10ns | L | H | L | H | H | L | H | H |
| 5s to 50 μ s | H | L | H | H | L | H | L ² | H |
| 20 μ s, 10 μ s | H | H | H | L | H | L | H | H |
| 5 μ s | H | H | L | L | H | L | H | H |
| 2 μ s to 50ns | H | L | L | H | H | L | H | H |
| 20ns, 10 ns | H | H | L | L | H | L | H | H |

¹Operates from 5s to 10 μ s/div, in X1 MAG.

²Operates from 5s to 50 μ s/div, in X10 MAG.

TABLE 3-2
Selected Inputs or X1 and X10 Multiplexers

| Setting of TIME/DIV | X1 MAG | | X10 MAG | |
|------------------------|--------------------------------|---------|--------------------------------|------------|
| | Selected Multiplexer Input | | Selected Multiplexer Input | |
| | U638 | U660 | U637 | U660 |
| | Frequency of Clock (pin B5) | | Frequency of Clock (pin B5) | |
| 5 s | 20.48 Hz | ÷ 2 D0 | ÷ 1 D5 | ÷ 1 E2,3,6 |
| 2 s | 51.2 Hz | ÷ 4 D2 | ÷ 2 D1 | ÷ 10 E13 |
| 1 s | 102.4 Hz | ÷ 10 D5 | ÷ 4 D3 | ÷ 100 E5 |
| .5 s | 204.8 Hz | ÷ 20 D1 | ÷ 10k E15 | ÷ 1k E1 |
| .2 s | 512 Hz | ÷ 40 D3 | ÷ 100k E7 | ÷ 100k E7 |
| .1 s | 1.024 kHz | | | |
| 50 ms | 2.048 kHz | | | |
| 20 ms | 5.12 kHz | | | |
| 10 ms | 10.24 kHz | | | |
| 5 ms | 20.48 kHz | | | |
| 2 ms | 51.2 kHz | | | |
| 1 ms | 102.4 kHz | | | |
| .5 ms | 204.8 kHz | | | |
| .2 ms | 512 kHz | | | |
| .1 ms | 1.024 MHz | | | |
| 50 μs | 2.048 MHz | | | |
| 20 μs | 5.12 MHz | | | |
| 10 μs | 10.24 MHz | | | |

The acquire Clock does not run above 10 μ s in X1 MAG, or above 50 μ s in X10 MAG.

5 μ s
2 μ s
1 μ s
.5 μ s
.2 μ s
.1 μ s
50 ns
20 ns
10 ns

to EXT/AQR, S645 grounds the enable line and stops the oscillator.

FIRST DIVIDER

The First Divider (FD) receives the reference frequency from the oscillator and divides it to form five sub-frequencies (10.24, 5.12, 2.56, and 1.28 MHz, and 512 kHz). The FD consists of U635 and U636.

Counter U635 receives the 20.48-MHz reference frequency on its A input and produces a half-frequency output (10.24 MHz). The 10.24-MHz signal clocks counter U636, which provides signals at one-half (5.12 MHz) and one-fifth (2.048 MHz) the 10.24-MHz input frequency.

The 2.048-MHz output from U636 clocks U635's B input, and U635 provides signals at one-half (1.024 MHz) and one-fourth (512 kHz) the 2.048-MHz input.

X1-X10 MULTIPLEXER

The X1-X10 Multiplexer selects the input frequency designated by the levels on its A, B and C inputs. The circuit consists of X1 multiplexer U638, X10 multiplexer U637 and gate U621D. Table 3-2 shows which inputs the X1, X10 and Internal Clock multiplexers select for each setting of the TIME/DIV control.

DECADE DIVIDER

The Decade Divider (DD) receives the output of the X1-X10 Multiplexer, and from it provides five submultiple frequencies to the Internal Clock Multiplexer. The DD consists of counters U651, U652, U653 and U654.

Counters U651, U652 and U653 divide the output of the X1-X10 Multiplexer and furnish the $\div 10$, $\div 100$, $\div 1$ k, $\div 10$ k and $\div 100$ k signals to the Internal Clock Multiplexer.

Counter U654 receives the $\div 10$ signal from U653, and divides it by 100 to form the $\text{Int} \div 1000$ input for the output Clock Multiplexer.

INTERNAL CLOCK MULTIPLEXER

The Internal Clock Multiplexer receives the outputs of the Decade Divider, and selects the one designated by the outputs of the TIME/DIV switch as the Internal Clock. One-of-sixteen multiplexer U660 is the Output Clock Multiplexer. Table 3-2 shows which inputs U660 selects for each setting of the TIME/DIV control.

OUTPUT CLOCK MULTIPLEXER

The Output Clock Multiplexer receives the Internal Clock, the $\text{Int} \div 1000$ clock, and the Ext Clock signals and selects one of them to be the output Clock signal. Multiplexer U655, Q663, Q667 and Q671 form the Output Multiplexer.

The AQS CLOCK/AQR switch, S645, controls pins 10 and 11 of U655, and causes U655 to select one of its three inputs. Table 3-3 shows the three positions of S645 and the resulting output of multiplexer U655.

Transistors Q663, Q667 convert the TTL output of U655 to a level suitable for the mainframe.

INTENSIFY CIRCUIT

The Intensify circuit produces the Aux Z Axis signal, which intensifies the display via the mainframe's z-axis amplifier, when:

- The 7B87 is in the B Horiz plug-in compartment, and
- The Display B (pin B7) line is at a high-logic level.

If the Display B line is at a low-logic level when the 7B87 is in the B Horiz plug-in compartment, or if the 7B87 is in the A Horiz plug-in compartment, the Intensify circuit does not produce the Aux Z-Axis signal.

Although the 7B87 is not called a "delaying" time base, its "acquire stop" signal is identical to the Delay Gate in a delaying time base, and its delay-mode operation is the same. That is, the Delay Gate in the 7B87 has two functions—it sets the boundaries of the acquisition time in a digitizing mainframe, such as the 7854, and operates

TABLE 3-3
Operation of Output Multiplexer U655

| S645 AQS CLOCK/AQR | U655 Select Inputs | | Output of U655 |
|-----------------------|--------------------|--------|----------------------------|
| | Pin 11 | Pin 10 | |
| INTERNAL | L | H | Internal Clock |
| INT $\div 1000$ | H | H | Internal Clock $\div 1000$ |
| EXT/AQR | H | L | External Clock |

Theory of Operation—7B87

like the Delay Gate of a delaying time base. By setting the voltage on the Delay Mode line, the three AQS CLOCK/AQR pushbuttons, INTERNAL, $\text{INT} \div 1000$, and EXT/AQR, cause operating modes that correspond to Independent, B Starts After Dly, and B Triggerable After Dly, respectively (if the 7B87 is in the A Horiz plug-in compartment). The Delay Mode line controls Q576 and Q574. The voltage on the Delay Mode line, that goes to pin B2, is 0 V, +5.0 V, and +3.6 V, respectively, when the INTERNAL, INT divided by 1000, or EXT/AQR button is pressed.

7B87 IN A HORIZ PLUG-IN COMPARTMENT

INTERNAL BUTTON PRESSED

A low-logic level on the Delay Mode line turns on Q576 (refer to diagram 5), which saturates and removes the collector voltage from Q574. Without collector voltage, Q574 produces no Delay Gate signal. Transistor Q678 controls intensification in response to the voltage on pin A16. When the 7B87 is in the A Horiz plug-in compartment pin A16 will be at +5 V. Intensification then cannot occur because Q678 and Q680 keep Q681 turned off. When Q681 is off, its output turns off Q687, which prevents Q574 (diagram 5) from producing the Delay Gate. Either of these events will prevent a Delay Gate from occurring in the A Horiz compartment with the INTERNAL button pressed; one would be sufficient. When there is no Delay Gate there is no Aux Z-Axis signal and no intensification.

7B87 IN B HORIZ PLUG-IN COMPARTMENT

INTERNAL BUTTON PRESSED

A low-logic level on the Delay Mode line turns off Q576 (refer to diagram 5). The pin A16 input is at ground, which turns off Q680 via Q678, and Q680 turns on Q681. The output of Q681 turns on Q687, which has two effects:

- It supplies collector voltage for Q574 via R687, and
- If the Display B line is at a high-logic level, it turns on Q691 via R688.

Transistor Q691 conducts current from the mainframe, which intensifies the display.

When the TIME/DIV control is set to 10 μs or faster, +5 V turns on CR677 via R611. This clamps the emitter of Q691 to about +3.4 V, which turns it off and prevents intensification.

External Clock Buffer

The External Clock Buffer receives the signal from the EXT CLOCK IN connector, buffers it, and applies it to the Output Clock Multiplexer. The External Clock Buffer consists of Q642, Q643 and U623A.

Source-follower Q642 and current source Q643 present a high impedance to the input signal. Inverter U623A applies an inverted, TTL version of the Ext Clock In signal to multiplexer U655. Diodes CR641 and CR642 limit the voltage at Q642's gate to the -0.6 V to +5.6 V range.

AQS CLOCK/AQR Switches

The AQS CLOCK/AQR Switches control the Output Clock Multiplexer, activate the Delay Mode line for the Intensify circuit, and insert different resistances in the Ch 1, Analog Data Row line.

Two sections of S645, operated by the INTERNAL and EXT/AQR buttons, control the select lines for multiplexer U655. When a button is released, that switch's output line will be at a high-logic level; and when a button is pressed that switch's output line will be at a low-logic level. When the EXT/AQR line is pressed, the low-logic level on the output line stops the Oscillator.

Two sections of S645 select the voltages on the Delay Mode line, which are:

| Button Pressed | Voltage on Delay Mode Line |
|------------------------|----------------------------|
| INTERNAL | gnd |
| $\text{INT} \div 1000$ | +5 V |
| EXT/AQR | +3.5 V |

Acquire Clock Mode

When the 7B87 is in the B Horiz plug-in compartment, the current in the TS10 line indicates the Acquire Clock Mode, as follows:

TABLE 3-4
Current in CH1 Readout Line vs
Acquire Clock Mode, During TS10

| Acquire Clock Mode | Current | |
|-----------------------------|----------|-------------|
| | CH 1 Row | CH 2 Column |
| Internal | 0.1 mA | 0 mA |
| $\text{Internal} \div 1000$ | 0.2 mA | 0 mA |
| External | 0.3 mA | 0 mA |

When the 7B87 is installed in the B Horiz plug-in compartment, the information during TS10 is used by a digitizing mainframe (such as the 7854) to sense the 7B87's clock mode.



TIME/DIVISION AND READOUT SWITCHING

The Readout Switching circuits provide sweep rate and delay time information to the mainframe readout system. Readout circuitry appears 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 alpha-numeric 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 3-5.

ACQUIRE-STOP DELAY TIME READOUT

The Acquire-Stop delay time is displayed on Channel 2 (bottom of graticule) corresponding to the plug-in compartment where the 7B87 is installed. The Acquire-Stop delay time is selected by the ACQUIRE-STOP DELAY control, R535, as explained in the Delay Line Comparator 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 3-5. Numerical scaling for delay time readout (1, 2, 5 sequence) is explained in the Digital Voltmeter description (diagram 3).



INTERFACE CONNECTIONS AND POWER SUPPLY

The Interface Connectors connect control signals and power supply voltages between the mainframe and the time-base.

The Power Supply derives supply voltages from the mainframe supplies for power requirements unique to this instrument. Additional voltage regulation is also provided within the 7B87.

TABLE 3-5
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, R754, 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 6 |
| m, μ , n | TS-8 | Defines the prefix which 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 |
| Δ | TS-2 | Indicates differential delay- time measurement. | | R542, R543 5 |
| blank space | TS-10 | Indicates Acquire Clock Mode by magnitude of "now current". (Used by 7854 mainframe.) | R645, R647 | |

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 occasionally be removed 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 dirt which remains 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 (1 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 003-0342-01. General Electric Versilube® silicone grease should be applied sparingly so that the lubricant does not get on the contacts. Refer to Figure 4-1 for lubrication instructions.

SEMICONDUCTOR CHECKS

Periodic checks of the semiconductors 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.

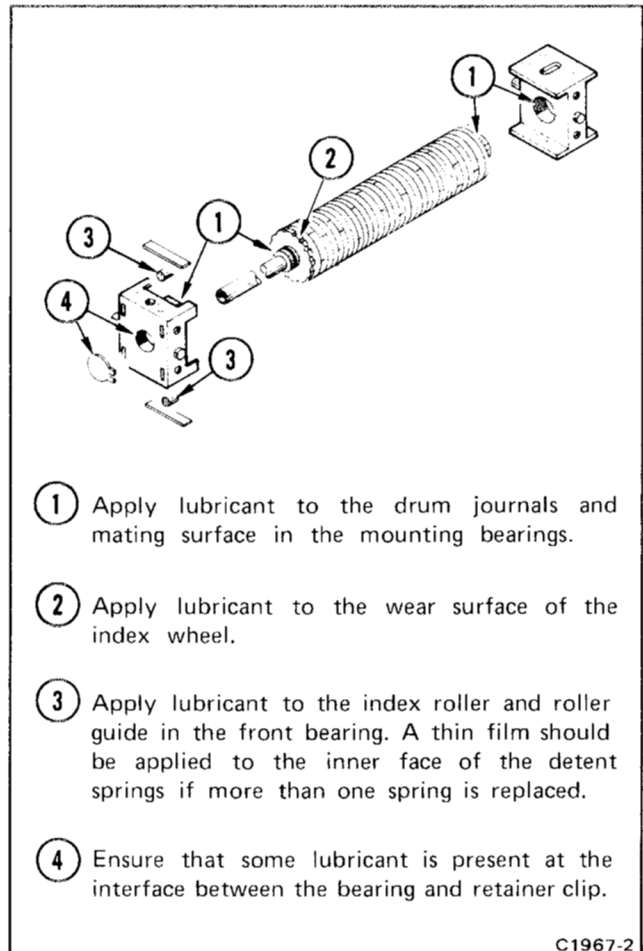


Figure 4-1. Lubrication procedure for a typical cam switch.

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 is shown on the diagrams. Components that are mounted on circuit boards are outlined on the diagrams with a heavy black line.

VOLTAGES AND WAVEFORMS

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

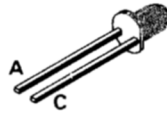
Typical operating waveforms are shown next to the diagram where they were measured. Each waveform is numbered to locate on the diagram the point where the waveform was taken. Waveform Conditions given on the diagram page list the test equipment used and the front-panel control status necessary to obtain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

CIRCUIT-BOARD ILLUSTRATIONS

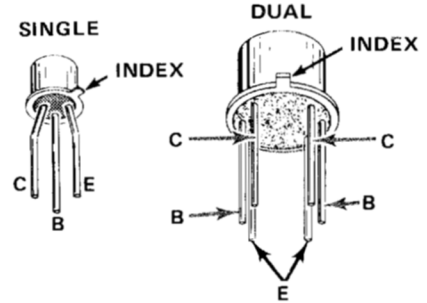
Circuit-board illustrations are shown on the foldout page preceding the associated diagram. Each board-mounted electrical component is identified by its circuit number, as are interconnecting wires and connectors.



[SIGNAL DIODE]

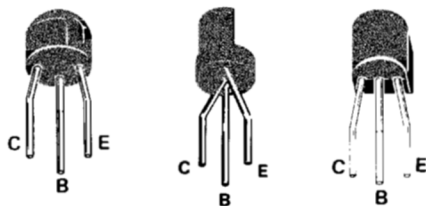


[LIGHT EMITTING DIODE (L.E.D.)]



[METAL CASE TRANSISTORS]

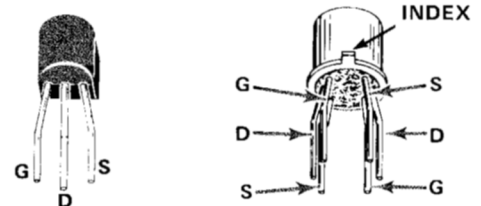
NOTE
LEAD CONFIGURATIONS AND CASE STYLES ARE TYPICAL, BUT MAY VARY DUE TO VENDOR CHANGES OR INSTRUMENT MODIFICATIONS.



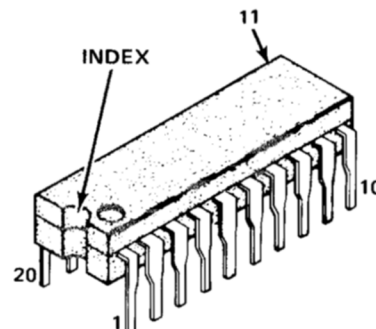
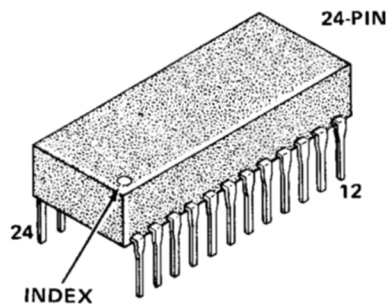
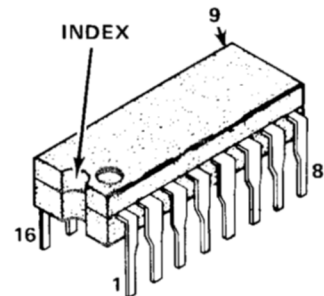
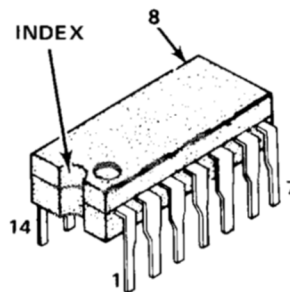
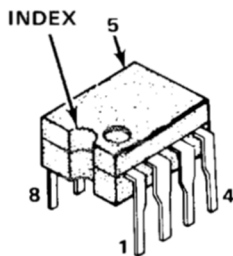
[PLASTIC CASE TRANSISTORS]



[PLASTIC CASE FETS]



[DUAL METAL CASE FET]



[INTEGRATED CIRCUITS]

(1986-66)2788-51B

Figure 4-2. Semiconductor lead configuration.

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).

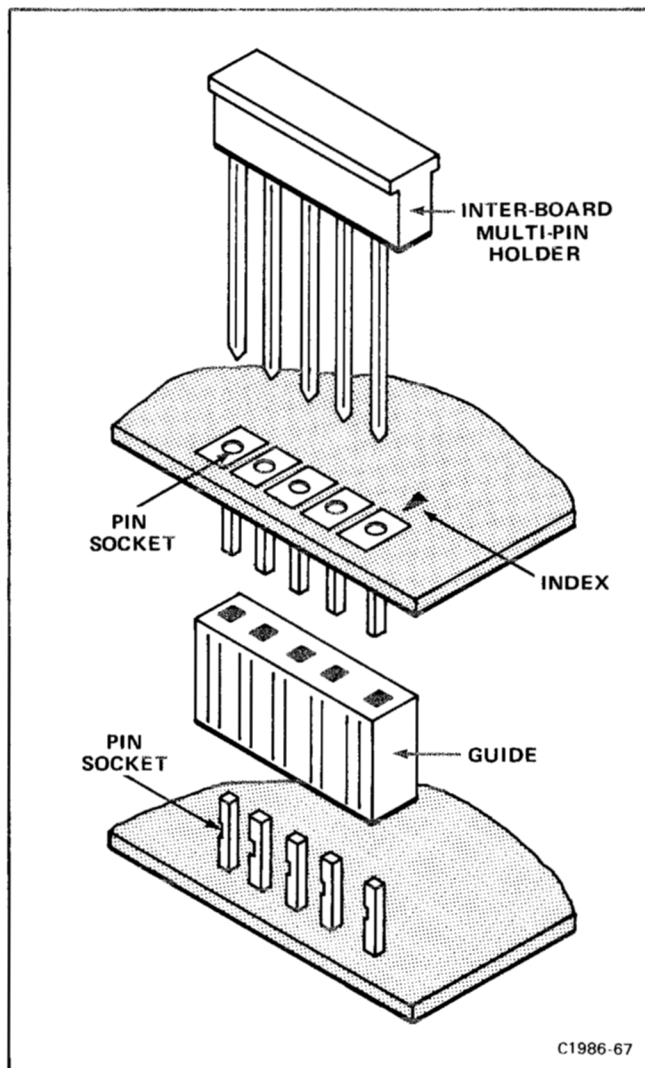


Figure 4-3. Inter-board multi-pin connector assembly.

WIRING COLOR CODE

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

SEMICONDUCTOR LEAD CONFIGURATIONS

Figure 4-2 illustrates the lead 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 lead configuration diagram. All transistor sockets in this instrument are wired for the standard lead configuration used for metal-case transistors.

INTER-BOARD PIN CONNECTOR IDENTIFICATION

The inter-board pin connector sockets are installed on circuit boards, in groups of 5 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 Figure 4-4. Each group of pins is identified by its corresponding J

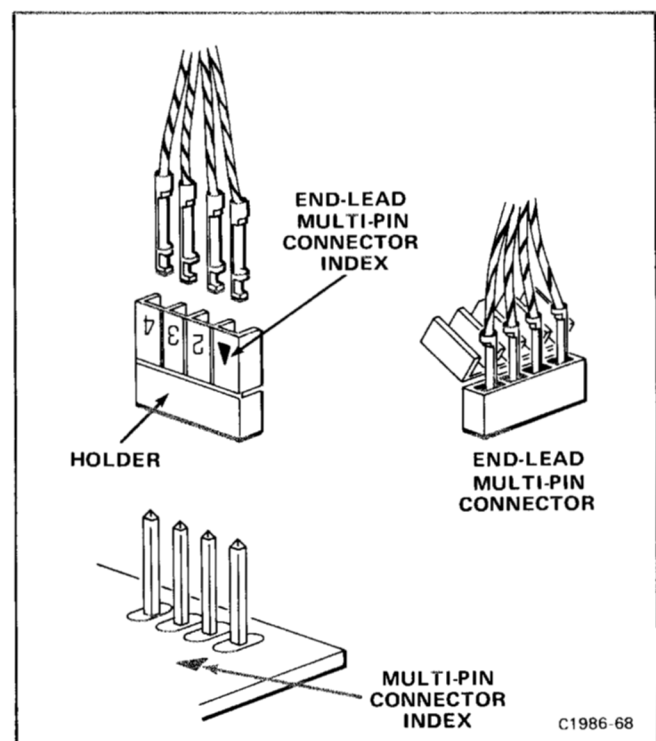


Figure 4-4. End-lead multi-pin connector assembly.

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 Interface Connectors and Power Supply 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.

STATIC-SENSITIVE DEVICES

CAUTION

Static discharge can damage any semiconductor component in this instrument.

This instrument contains electrical components that are susceptible to damage from static discharge. See Table 4-1 for relative susceptibility of various classes of semiconductors. Static voltage of 1 kV to 30 kV are common in unprotected environments.

Observe the following precautions to avoid damage.

TABLE 4-1
Relative Susceptibility to Static Discharge Damage

| Semiconductor Classes | Relative Susceptibility Levels ¹ |
|---|---|
| MOS or CMOS microcircuits or discretes, or linear microcircuits with MOS inputs. (Most sensitive) | 1 |
| ECL | 2 |
| Schottky signal diodes | 3 |
| Schottky TTL | 4 |
| High-frequency bipolar transistors | 5 |
| JFETs | 6 |
| Linear Microcircuits | 7 |
| Low-power Schottky TTL | 8 |
| TTL (Least sensitive) | 9 |

¹Voltage equivalent for levels:

1 = 100 to 500 V 4 = 500 V 7 = 400 to 1000 V (est.)

2 = 200 to 500 V 5 = 400 to 600 V 8 = 900 V

3 = 250 V 6 = 600 to 800 V 9 = 1200 V

(Voltage discharged from a 100 pF capacitor through a resistance of 100 ohms.)

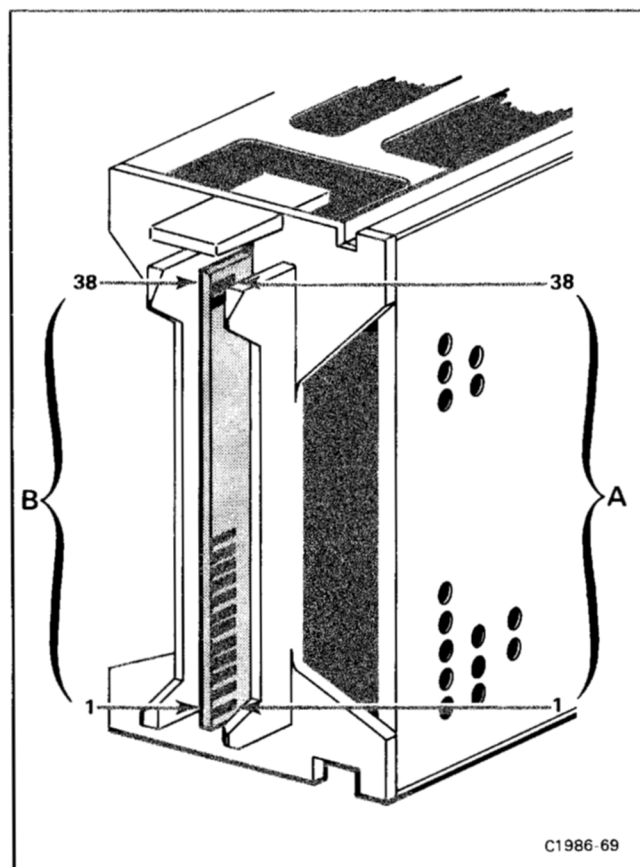


Figure 4-5. Location of pin numbers on Interface connector.

1. Minimize handling of static-sensitive components.
2. Transport and store static-sensitive components or assemblies in their original containers, on a metal rail or on conductive foam. Label any package that contains static-sensitive assemblies or components.
3. Discharge the static voltage from your body by wearing a wrist strap while handling these components. Servicing static-sensitive assemblies or components should be performed only at a static-free work station by qualified service personnel.
4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.
5. Keep the component leads shorted together whenever possible.
6. Pick up components by the body, never by the leads.
7. Do not slide the components over any surface.
8. Avoid handling components in areas that have a floor or work-surface covering capable of generating a static charge.

9. Use a soldering iron that is connected to earth ground.
10. Use only special anti-static suction type or wick type desoldering tools.

TROUBLESHOOTING EQUIPMENT

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

Transistor Tester

Description: Dynamic-type tester.

Purpose: Test semiconductors.

Recommended Tektronix types: 576 Curve Tracer, 577/177 Curve Tracer system, 7CT1N Curve Tracer unit and a 7000-series oscilloscope system, or a 5CT1N Curve Tracer unit and a 5000-series oscilloscope.

Multimeter

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

Purpose: Check voltage and resistance.

Test Oscilloscope

Description: Frequency response, dc to 100 megahertz minimum; deflection factor, 5 millivolts to 5 volts/division. A 10X, 10 megohm voltage probe should be used to reduce circuit loading.

Purpose: Check operating waveforms.

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 Operating Instructions, 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) that may cause instrument malfunction. The 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 diagrams section at the rear of the 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.

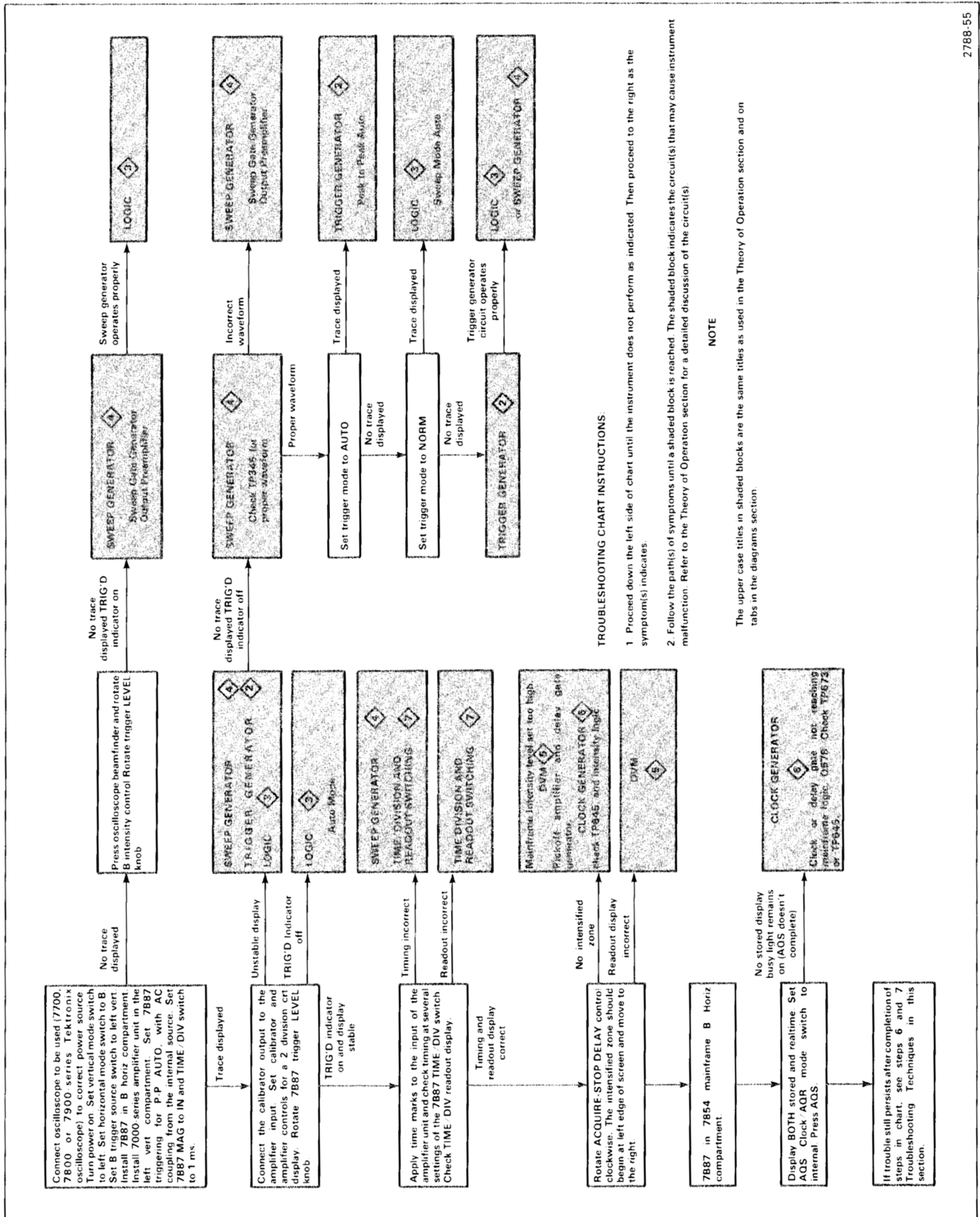


Figure 4-6. 7B87 troubleshooting chart.

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.

CAUTION

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

Transistors. 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 not 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 test clip. This device also serves as an extraction tool. The lead configuration for the semiconductors used in this instrument are shown in Figure 4-2, and also on a pullout page in the front of the diagrams section.

CAUTION

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 having a low internal source current, such as the R X 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 a metal-encased diode 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).

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.

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, first refer to parts list, then to the 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-watt pencil-type soldering iron with a 1/8-inch wide, wedge-shaped tip. A higher wattage soldering iron may separate the printed wiring from its base material. Keep the tip properly tinned for best heat transfer to the solder joint. 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-watt 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.

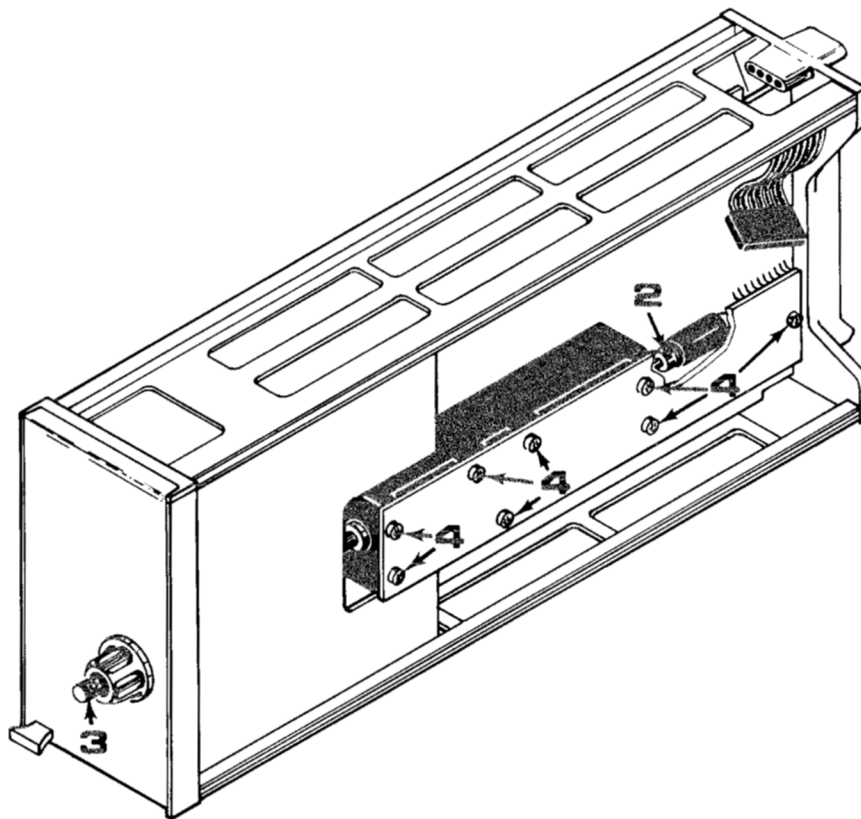
The exploded-view drawing associated with the Replaceable Mechanical Parts list may be helpful in the

removal or disassembly of individual components or subassemblies. Component location 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.

A3-READOUT CIRCUIT BOARD. To remove the circuit board, follow the procedure given in Figure 4-7.



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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Figure 4-7. Readout board removal procedure.

A2-TRIGGER CIRCUIT BOARD. To remove the circuit board:

1. Remove 3 inter-board multi-pin connectors (see Fig. 4-3 for identification).
2. Remove 2 screws from circuit board.
3. Lift rear of circuit board away from frame and slide board to the rear until pushbutton switches are clear of the front panel.
4. Note wire color on single-conductor shielded cables (see Fig. 4-8) and connector to which each is attached.
5. Disconnect cables from back of circuit board.

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

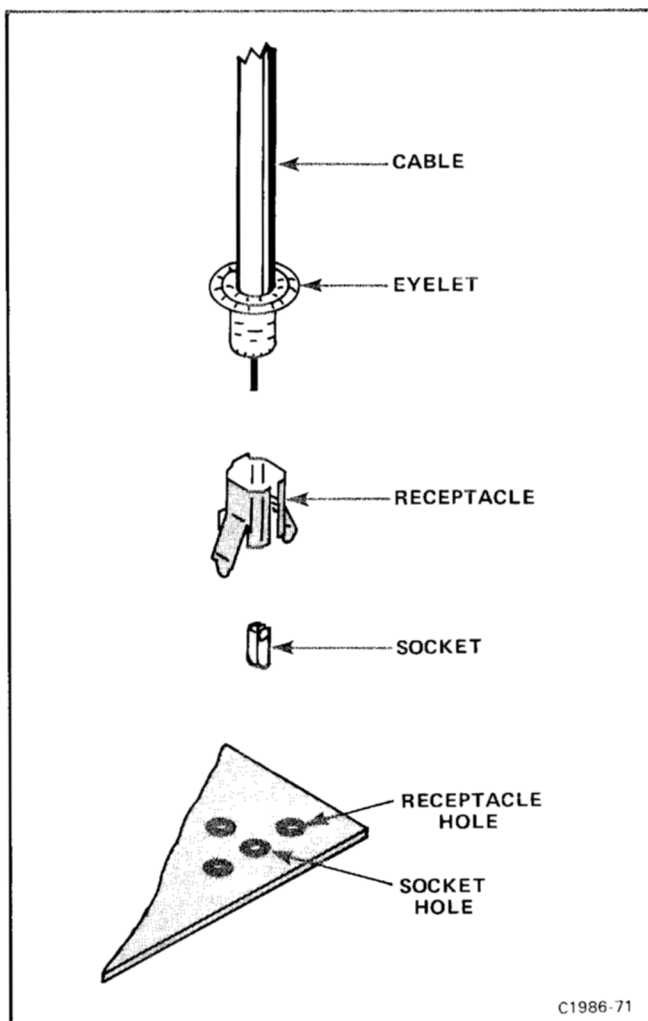


Figure 4-8. Coaxial end-lead connector assembly.

A4-CLOCK CIRCUIT BOARD. To remove the circuit board:

1. Note color of multi-pin connectors (see Fig. 4-4 for identification) and P numbers to which each attach. Disconnect all multi-pin connectors from board.
2. Remove 4 inter-board multi-pin connectors shown in Figure 4-9. See Figure 4-3 for identification.
3. Remove 4 screws that secure circuit board as shown in Figure 4-9.
4. Lift rear of circuit board away from the frame and slide board to the rear until pushbutton switches are clear of front panel.
5. Disconnect coaxial end-lead connector from bottom of board (see Fig. 4-8 for identification). Remove board from instrument.

6. Remove remaining 5 screws to detach aluminium shield.

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

A1-INTERFACE CIRCUIT BOARD. To remove circuit board:

1. Remove Trigger and Clock circuit boards using procedures given previously.
2. Set TIME/DIV knob to 2 ms position and VARIABLE TIME/DIV knob to expose the set screw.
3. With hex-key wrench, loosen set screws in both knobs. Remove knobs from shafts.
4. Note color of multi-pin connectors (see Fig. 4-4 for identification) and P numbers to which each connect. Disconnect all multi-pin connectors from board.
5. Remove 4 screws that secure gray plastic rear panel to instrument frame.
6. Remove 6 screws that secure perimeter of board to instrument frame.
7. Remove Interface circuit board through rear of instrument.

To install the Interface circuit board:

1. Guide TIME/DIV switch shaft through hole in front-panel.
2. Install 6 screws that secure perimeter of board to instrument frame.

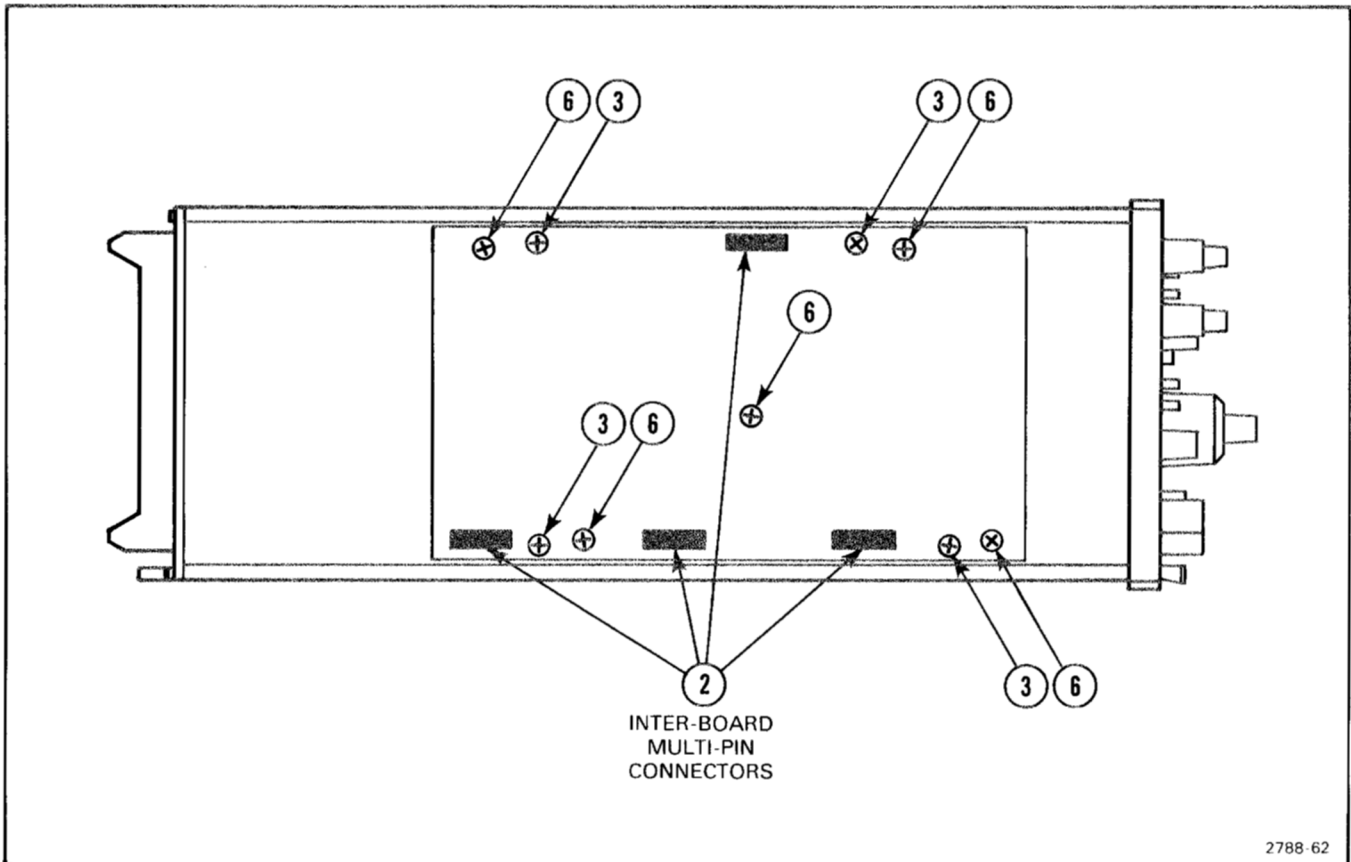


Figure 4-9. Location of securing screws and inter-board multi-pin connectors on clock circuit board.

3. Install gray plastic rear panel with 4 securing screws.
4. Replace TIME/DIV knob on shaft. Align knob index with 2 ms position; then, tighten 2 set screws on knob.
5. Replace VARIABLE knob and tighten set screw.
6. Replace all cables as noted during removal procedure.
7. Replace Trigger and Clock circuit boards.

SWITCHES

Two types of switches are used in this instrument. Contact alignment and spacing are critical to the operation of the pushbutton 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 Figure 4-10 for special instructions on cam switch removal.

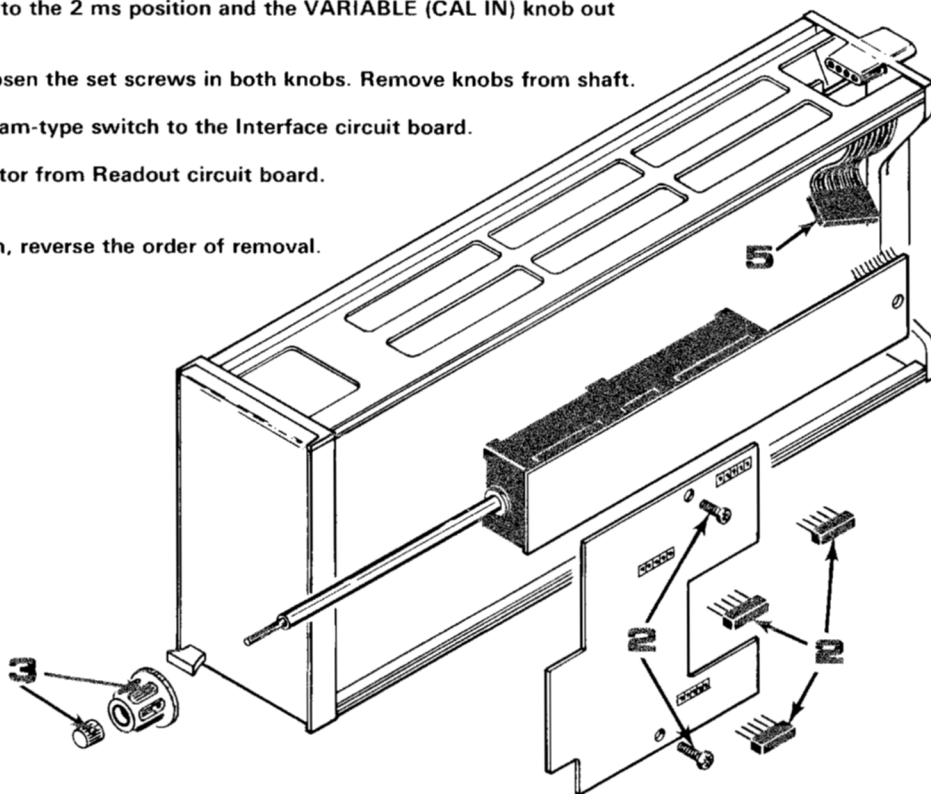
CAUTION

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 040-0541-00) which 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.

REMOVE CAM-TYPE SWITCH ASSEMBLY AS FOLLOWS:

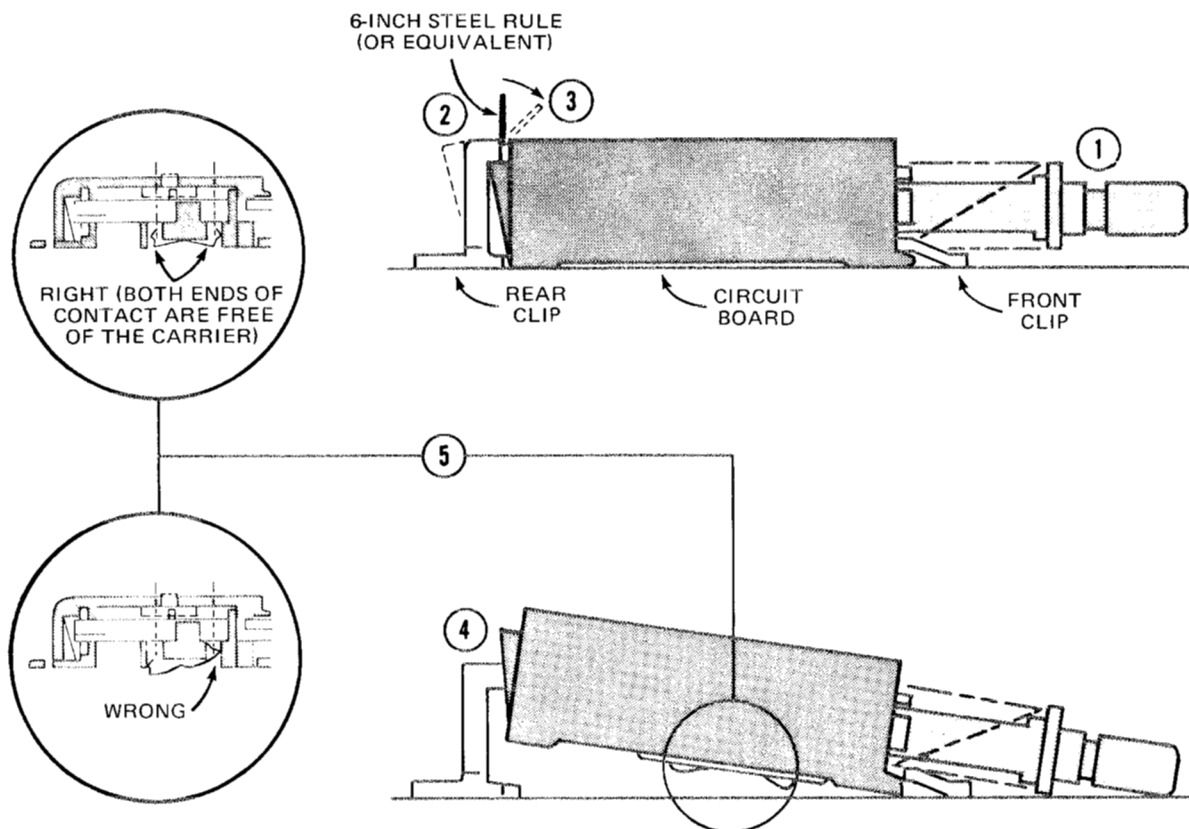
1. Remove clock circuit board (see procedure in text).
2. Remove Trigger circuit board as follows:
 - a. Remove the 3 inter-board multi-pin connectors.
 - b. Remove 2 screws from circuit board.
 - c. Lift rear of board away from frame and slide toward rear of instrument.
 - d. Note wire color of single-conductor shielded cables and connector to which each attach. Then, disconnect cables.
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 reinstall the cam-type switch, reverse the order of removal.



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Figure 4-10. Cam switch removal procedure.



- 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.

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Figure 4-11. Removal procedure for typical pushbutton switch.

PUSHBUTTON SWITCHES. Removal and replacement instructions for pushbutton switches are shown in Figure 4-11.

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 that part of the instrument which 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 manufacturer's lead configuration diagram. All transistor sockets in this instrument are wired for the standard lead configuration used for metal-case transistors. 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 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 which mates with the interconnecting pin soldered into the board (Fig. 4-4). When the interconnection is made between adjacent boards, an inter-board 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 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

CAUTION

All circuit boards in this instrument, except the Readout circuit board, 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 connection to the center conductor(s); only experienced maintenance personnel should attempt repair on these boards.

A circuit-board pin replacement kit including the necessary tools, instructions, and replacement pins is available from Tektronix, Inc. Order Tektronix part 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 which is 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. 4-12) 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 Figure 4-13. Note lead wire color coding and LED lead configuration. Unsolder wire leads and remove LED from the cap. Solder the replacement LED and lead wires to the socket cap as noted previously. Install the cap in the sleeve.

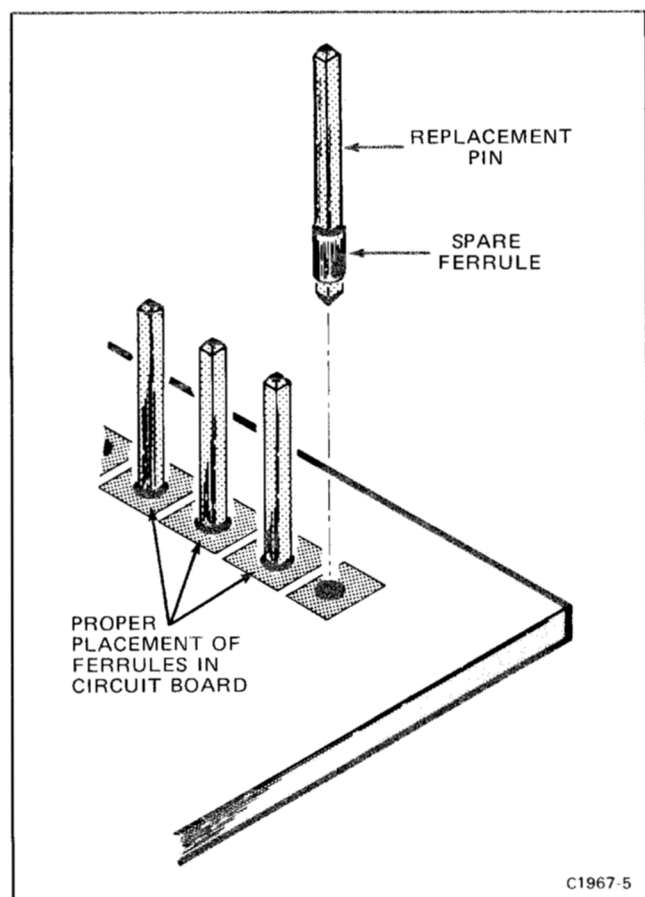


Figure 4-12. Exploded view of circuit-board pin and ferrule.

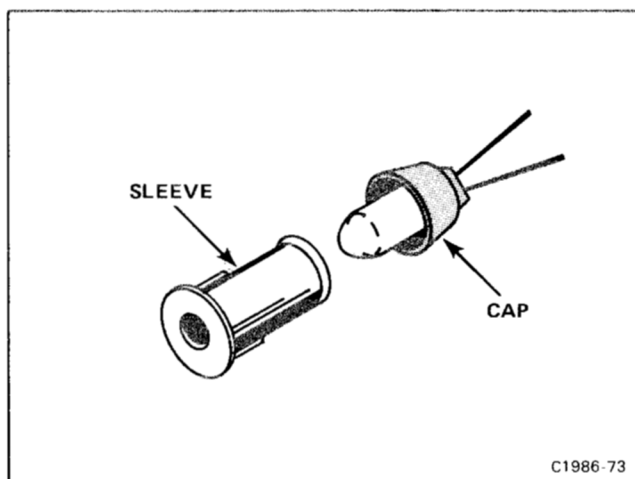


Figure 4-13. Front-panel light socket assembly.

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. 4-13), 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 corrugated cardboard carton having inside dimensions of no less than six inches more than the instrument dimensions; this will allow for cushioning. The shipping carton test strength for this instrument is 200 lbs.
2. Surround the instrument with polyethylene sheeting to protect the finish of the instrument.
3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between carton and instrument, allowing three inches on all sides.
4. Seal carton with shipping tape or industrial stapler.

PERFORMANCE CHECK AND ADJUSTMENT

This section contains information necessary to perform a complete instrument performance check and adjustment. Limits given in the procedure are adjustment guides and should not be interpreted as performance requirements unless preceded by a check mark ✓. Where possible, instrument performance is checked before an adjustment is made.

PRELIMINARY INFORMATION

ADJUSTMENT INTERVAL

To maintain instrument accuracy, check the performance of the 7B87 every 1000 hours of operation, or every 6 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. A check mark ✓ preceding a CHECK indicates that the limit given is a performance requirement specified in Section 2, Specification.

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 which precedes 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 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 column. 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 |
|--------------------------------------|---|--|---|
| 1. Oscilloscope Mainframe | Tektronix 7000-series; bandwidth, 400 MHz with 2 horizontal plug-in compartments. | Provides a display for unit under test. | a. TEKTRONIX 7854 Oscilloscope system. |
| 2. Amplifier Plug-in Units | Tektronix 7A-series; bandwidth, 400 MHz; deflection factor, 10 mV to 0.5 V. | Provides vertical input to oscilloscope mainframe. | a. TEKTRONIX 7A16A Amplifier and 7A19 Amplifier plug-in units. |
| 3. Time-Base Plug-in Unit | Sweep rate, 5 μ s/division. | Provides a delayed trace for the Delay Time Accuracy check and adjustments. | a. TEKTRONIX 7B80 Time Base plug-in unit. b. TEKTRONIX 7B85 Delaying Time Base plug-in unit. |
| 4. Test Oscilloscope | Bandwidth, dc to 50 MHz; minimum deflection factor, 1 volt/division; accuracy, within 3%. | Provides a means to check the internal and external clock signal amplitudes. | a. TEKTRONIX 465 Oscilloscope with P6105 probe. |
| 5. Frequency Counter | Range, 20.00 Hz to 20.48 MHz; accuracy, within 0.02%. | Provides a means to check the internal and external clock frequencies. | a. TEKTRONIX DC 504 Counter/Timer, with power module. |
| 6. Pulse Generator | Frequency, 10 MHz; output, square wave; Amplitude, 5 V (0 to peak) into 100 K Ω . | External clock input check. | a. TEKTRONIX PG 501 Pulse Generator with power module. |
| 7. High-Frequency Signal Generator | Frequency, 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. b. Wavetek 1002 Sweep/Signal Generator. |
| 8. Medium-Frequency Signal Generator | Frequency, 50 MHz; output amplitude range, 50 mV to 125 mV. | Medium-frequency triggering checks. | a. TEKTRONIX SG 503 Leveled Sine Wave Generator. |
| 9. Low-Frequency Sine-Wave Generator | Frequency, 30 Hz to 50 kHz; output amplitude, variable from 50 mV to 3 V into 50 Ω . | Low-frequency triggering checks and adjustments. | a. TEKTRONIX FG 503 Function Generator with power module. b. General Radio 1310-B Oscillator. |
| 10. Time-Mark Generator | Marker outputs, 2 ns to 5 s; accuracy within 0.1%. | Sweep timing 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. |

TABLE 5-1 (CONT)
Test Equipment

| Description | Minimum Specifications | Purpose | Examples of Applicable Test Equipment |
|---------------------------------|---|--|---|
| 11. Digital Multi-meter | Ranges, 200 K and 2 M Ω ; accuracy, within 1%. | Special readout encoding check. | a. TEKTRONIX DM 501 Digital Multimeter, with power module. |
| 12. 1X Probe | Compatible with frequency counter being used (see item 5, frequency counter). | Provides signal connection from frequency Counter. | a. TEKTRONIX P6028 probe. b. TEKTRONIX P6101 probe. |
| 13. Plug-In Extender | Tektronix 7000-series extender. | Provides access to internal adjustments and test points. | a. Tektronix Part 067-0589-00 Calibration Fixture. |
| 14. Coaxial Cables (2 required) | Impedance, 50 Ω ; type RG 58/U; length, 18 inches; connectors, BNC. | Provides signal interconnections. | a. Tektronix Part 012-0057-01. |
| 15. T Connector | Connectors, BNC. | External trigger and adjustments. | a. Tektronix Part 103-0030-00. |
| 16. Attenuators | 2X and 10X; impedance 50 Ω . | Attenuate signals. | a. Tektronix Part 011-0069-02 (2X) Tektronix Part 011-0059-02 (10X). |
| 17. Termination | Impedance, 50 Ω ; accuracy, within 2%; connectors, BNC. | Magnified sweep timing check. | a. Tektronix Part 011-0049-01. |
| 18. Screwdriver | 3-inch shaft, 3/32-inch bit. | Adjustments. | a. Xcelite R-3323. |

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PRELIMINARY PROCEDURE

1. Install a 7A16A Amplifier unit in the left vertical compartment, and a 7A19 Amplifier unit in the right vertical compartment of the oscilloscope mainframe.
2. Install the 067-0580-00 plug-in extender in the B horizontal compartment of the mainframe. Remove the side covers and install the 7B87 in the plug-in extender.
3. Set the mainframe vertical mode switch to display the left vertical unit and the horizontal mode switch to display the B horizontal unit. Set the mainframe intensity controls fully counterclockwise and set the trigger source switches to vertical mode.
4. 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.

✓ Performance Requirement check; see introductory information.

A. TRIGGERING SYSTEM

Equipment Required: (Refer to Table 5-1, Test Equipment.)

- | | |
|---------------------------------------|-----------------------|
| 1. Oscilloscope mainframe. | 7. 50-ohm cables (2). |
| 2. Amplifier plug-in units. | 8. BNC T connector. |
| 3. Low-frequency sine-wave generator. | 9. 2X attenuator. |
| 4. Medium-frequency signal generator. | 10. 10X attenuator. |
| 5. High-frequency signal generator. | |
| 6. Plug-in extender. | |

BEFORE YOU BEGIN, see **TEST POINT AND ADJUSTMENT LOCATIONS** in the Diagrams section.

CONTROL SETTINGS

Set the 7B87 controls as follows:

TRIGGERING

MODE P-P AUTO
COUPLING AC
SOURCE INT

SWEEP

POSITION Midrange
TIME/DIV 20 μ s
VARIABLE IN (calibrated)
MAG X1
HOLD OFF MIN

A1. ADJUST DC BALANCE AND SLOPE BALANCE (R85, R80)

- Connect the low-frequency sine-wave generator to the amplifier unit input with a 50-ohm cable.
- Set the oscilloscope mainframe intensity and focus controls for the desired display.
- Set the low-frequency sine-wave generator and the amplifier unit deflection factor for a 0.3-division display at 50 kilohertz. Center the display vertically.
- Set the TRIGGERING LEVEL control to approximately 0 (midrange) and TRIGGERING SLOPE to (+).

✓ **Performance Requirement check;** see introductory information.

- Check for a stable display with TRIG'D light on.
- ADJUST**—R85 (DC Balance) for a stable crt display.
- Set the SLOPE switch to (–) and check for a stable display.
- ADJUST**—R80 (Slope Balance) for a stable display.
- Check for a stable display when the SLOPE switch is set to (+) and (–).
- 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.

✓ A2. CHECK TRIGGERING MODES

- Set the low-frequency sine-wave generator and the amplifier unit deflection factor for approximately a 2-division display.
- CHECK**—For a stable display at all LEVEL control settings (P-P AUTO MODE).
- Set the TRIGGERING MODE to AUTO.

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- ✓ d. **CHECK**—Set the TRIGGERING LEVEL control for a stable display (TRIG'D light on).
- ✓ e. **CHECK**—For a free-running display with TRIG'D light off when the TRIGGERING LEVEL control is set fully clockwise and fully counterclockwise.
- f. Set the TRIGGERING MODE to NORM.
- ✓ g. **CHECK**—Set the TRIGGERING LEVEL control for a stable display (TRIG'D light on).
- ✓ h. **CHECK**—For no display (TRIG'D light off) when the TRIGGERING LEVEL control is set fully clockwise and fully counterclockwise.
- i. Set the TRIGGERING LEVEL control for a stable display (TRIG'D light on).
- j. Set the TRIGGERING MODE to SINGLE SWP and the SOURCE to EXT.
- ✓ k. **CHECK**—Press the SINGLE SWP RESET pushbutton and check that the READY light is on.
- ✓ l. **CHECK**—Rotate the oscilloscope intensity control clockwise slightly and check for one sweep and that the READY light is out after completion of that sweep when the INT SOURCE push button is pressed.
- m. 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-ohm cable and T connector. Connect the output of the T Connector to the amplifier unit input with an 18-inch 50-ohm cable.
- b. Set the 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 volts/division. Set the low-frequency sine-wave generator for a 6-division display (3 volts) at 1 kilohertz.
- ✓ 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 volts). Check that the display is not triggered at either end of the LEVEL control rotation.
- ✓ e. **CHECK**—Change the TRIGGERING LEVEL to (–) and repeat part d for the negative slope of the waveform.

✓ Performance Requirement check; see introductory information.

A4. ADJUST TRIGGERING SENSITIVITY (R49)

- a. Set the TRIGGERING LEVEL control to 0. Set the TRIGGERING MODE to NORM, and SOURCE to INT.
 - b. Set the amplifier unit deflection factor to 50 millivolts/division. Set the low-frequency sine-wave generator for a 5-division display (250 millivolts) at 1 kilohertz.
 - c. Set the amplifier unit deflection factor to 1 volt/division (0.25 division). Set the TRIGGERING LEVEL control for a stable display.
 - d. **ADJUST**—R49 (Trigger Sensitivity) for a stable crt display.
 - e. Set the amplifier unit deflection factor to 2 volts/division (0.125 division). Set the TRIGGERING LEVEL control for a stable display (stable display may not be possible).
 - f. **ADJUST**—R49 (Trigger Sensitivity) to a setting that provides a visible trace, but the display remains unstable.
 - g. Repeat part c of this step.
 - h. Set the amplifier unit deflection factor to 5 volts/division (0.05 division).
 - ✓ i. **CHECK**—rotate the TRIGGERING LEVEL control throughout its range and check for no trace (one displayed sweep will occur when control passes the midrange point).
- ### ✓ A5. CHECK EXTERNAL TRIGGERING SENSITIVITY
- a. Remove the 7B87 and plug-in extender; then install the 7B87 directly into the B horizontal compartment. Set the amplifier unit deflection factor for 10 millivolts/division. Set the low-frequency sine-wave generator for a 5-division display (50 millivolts) at 30 hertz.
 - b. Set TRIGGERING SLOPE to (+) MODE to NORM, TIME/DIV to 20 ms, and set the LEVEL control for a stable display.
 - ✓ c. **CHECK**—Set the TRIGGERING MODE to AUTO and check for a stable display (TRIG'D light on) with the COUPLING pushbutton set to:
 - 1. AC
 - 2. AC HF REJ
 - 3. DC(Set TRIGGERING LEVEL control as necessary).

- ✓ d. **CHECK**—Change the TRIGGERING SLOPE to (–) and repeat part c.

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

f. Set the amplifier unit deflection factor for 0.1 volt/division and the low-frequency sine-wave generator for a 5-division display (500 millivolts) at 50 hertz.

- ✓ 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 millivolts/division and the low-frequency sine-wave generator for a 2.5-division display (125 millivolts) at 200 hertz. 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 medium-frequency signal generator to the T connector.

l. Set the 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 millivolts/division and the medium-frequency signal generator for a 5 division display (50 millivolts) at 50 megahertz.

- ✓ 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 TRIGGERING LEVEL control as necessary.)

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

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

- ✓ **Performance Requirement check; see introductory information.**

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

1. AC
2. DC

- ✓ r. **CHECK**—Set the SLOPE to (+) and repeat part q.

s. Disconnect the medium-frequency sine-wave generator and T-connector from the left vertical plug-in unit. Connect the high-frequency signal generator through the T-connector to the right vertical plug-in unit.

t. Set the mainframe vertical mode switch to display the right vertical plug-in unit.

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

- ✓ v. **CHECK**—Set the 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 the high-frequency signal generator for a 5-division display (250 millivolts) at 400 megahertz. Set the TRIGGERING MODE to AUTO and the SLOPE to (+).

- ✓ x. **CHECK**—For a stable display (TRIG'D light on) with the COUPLING switch set to:

1. AC
2. AC LF REJ
3. DC

(Set TRIGGERING LEVEL control as necessary.)

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

✓ **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.

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

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

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

1. AC
2. AC HF REJ
3. DC

(Set TRIGGERING LEVEL control as necessary.)

- ✓ f. **CHECK**—Change the TRIGGERING SLOPE to (–) and repeat part e.

g. Set the 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 hertz.

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

1. AC
2. DC

- ✓ j. **CHECK**—Set the SLOPE 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 hertz. 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 medium-frequency signal generator to the amplifier unit input.

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

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

- ✓ p. **CHECK**—For a stable display (TRIG'D light on) with the COUPLING switch set to:

1. AC
2. AC LF REJ
3. DC

(Set TRIGGERING LEVEL control as necessary.)

- ✓ q. **CHECK**—Set the SLOPE to (–) and repeat part p.

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

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

1. AC
2. DC

- ✓ t. **CHECK**—Set the SLOPE to (+) and repeat part s.

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

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

- ✓ w. **CHECK**—Set the 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.

x. Set the TRIGGERING MODE to AUTO and SLOPE to (+).

- ✓ y. **CHECK**—For a stable display (TRIG'D light on) with the COUPLING switch set to:

1. AC
2. AC LF REJ
3. DC

(Set TRIGGERING LEVEL control as necessary.)

- ✓ z. **CHECK**—Set the SLOPE to (–) and repeat part y.

✓ Performance Requirement check; see introductory information.

✓ **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 nanosecond) of jitter.

✓ **A8. CHECK LINE TRIGGERING**

a. Remove all signal connections.

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

✓ c. **CHECK**—Set the 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.

✓ Performance Requirement check; see introductory information.

B. HORIZONTAL/AQS SYSTEM

Equipment Required: (Refer to Table 5-1, Test Equipment.)

- | | |
|-----------------------------|-------------------------|
| 1. Oscilloscope mainframe. | 8. Digital multimeter. |
| 2. Test oscilloscope. | 9. Plug-in extender. |
| 3. Amplifier plug-in units. | 10. 1X probe. |
| 4. Time-base plug-in unit. | 11. 50-ohm cables (2). |
| 5. Time-mark generator. | 12. 50-ohm termination. |
| 6. Frequency counter. | |
| 7. Pulse generator. | |

BEFORE YOU BEGIN, see **TEST POINT AND ADJUSTMENT LOCATIONS** in the Diagrams section.

CONTROL SETTINGS

Set the 7B87 controls as follows:

TRIGGERING

MODE AUTO
SLOPE +
COUPLING AC
SOURCE INT

SWEEP

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

B1. SET BASIC SWEEP CALIBRATION

a. Remove the 7B87 from the oscilloscope mainframe and install the plug-in extender in the A horizontal compartment. Then, install the 7B87 in the plug-in extender. Install a time base in the B horizontal compartment. Set the horizontal mode switch to display the A horizontal plug-in compartment.

b. Connect the time-mark generator to the amplifier unit input with a 50-ohm cable. Set the time-mark generator for 1-millisecond markers. Set the mainframe intensity and focus for the desired display.

c. Set the LEVEL control for a stable display (TRIG'D light on). Set the amplifier unit for approximately a 2-division display centered vertically on the graticule.

d. Set the front-panel SWP CAL adjustment for exactly 1 marker/ division over the center 8 divisions (position as necessary).

✓ B2. CHECK SWEEP LENGTH AND POSITIONING RANGE

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

✓ b. **CHECK**—That the end of sweep is beyond 9.2 graticule divisions (indicates sweep length of at least 10.2 divisions).

c. Set the POSITION and FINE controls fully clockwise.

✓ d. **CHECK**—The start of sweep must be to the right of graticule center.

e. Set the POSITION and FINE controls fully counterclockwise.

✓ f. **CHECK**—The end of sweep must be to the left of graticule center.

✓ **Performance Requirement check;** see introductory information.

✓ B3. CHECK/ADJUST MAGNIFIER GAIN AND REGISTRATION (R430,R445)

a. Set the time-mark generator for 0.1-millisecond 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/division over the center 8 divisions of display (position as necessary).

d. **ADJUST**—R430 (Mag Gain) for 1 marker/division over the center 8 divisions of display.

e. Set the time-mark generator for 0.5-millisecond 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 division.

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-millisecond markers.

c. Press the VARIABLE control in 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 3 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.

✓ Performance Requirement check; see introductory information.

B5. ADJUST 50 ns SWEEP TIMING (C330)

a. Set the TIME/DIV switch to 50 ns and set the time mark generator for 50-nanosecond markers.

b. Check for 1 marker/division over the center 8 divisions of display (position as necessary).

c. **ADJUST**—C330 (50 ns Timing) for 1 marker/division over the center 8 divisions of display (position as necessary).

✓ B6. CHECK INTERNAL CLOCK FREQUENCY RANGES

a. Set the 7B87 TIME/DIV switch to 10 μ s.

b. Connect the frequency counter 1X probe tip to TP673 and the ground lead to the GND test point.

✓ c. **CHECK**—That the clock frequency is 10.240 MHz, within the limits of 10.230 to 10.250 MHz. Check that the repetition rate output for each TIME/DIV switch setting is approximately the same as that shown in Table 5-2.

d. Set the AQS CLOCK/AQR switch to INT \div 1000, the TIME/DIV switch to 50 μ s, and the MAG switch to X1 (in).

TABLE 5-2
Acquire Clock Repetition Rate Output

| TIME/DIV Setting | MAG X1 (Button In) | MAG X10 (Button Out) |
|------------------|--------------------|----------------------|
| 10 μ s | 10.24 MHz | — |
| 20 μ s | 5.12 MHz | — |
| 50 μ s | 2.048 MHz | 20.48 MHz |
| .1 ms | 1.024 MHz | 10.24 MHz |
| .2 ms | 512.0 kHz | 5.12 MHz |
| .5 ms | 204.8 kHz | 2.048 MHz |
| 1 ms | 102.4 kHz | 1.024 MHz |
| 2 ms | 51.2 kHz | 512.0 kHz |
| 5 ms | 20.48 kHz | 204.8 kHz |
| 10 ms | 10.24 kHz | 102.4 kHz |
| 20 ms | 5.12 kHz | 51.2 kHz |
| 50 ms | 2.048 kHz | 20.48 kHz |
| .1 s | 1.024 kHz | 10.24 kHz |
| .2 s | 512.0 Hz | 5.12 kHz |
| .5 s | 204.8 Hz | 2.048 kHz |
| 1 s | 102.4 Hz | 1.024 kHz |
| 2 s | 51.2 Hz | 512.0 Hz |
| 5 s | 20.48 Hz | 204.8 Hz |

Performance Check and Adjustment—7B87

- ✓ e. **CHECK**—That the repetition rate is 2.048 kHz, within the limits of 2.045 to 2.050 kHz.

✓ B7. CHECK EXTERNAL CLOCK INPUT

- a. Set the AQS CLOCK/AQR switch to EXT/AQR.

b. Connect a +5 volt (0 to peak), 10 MHz signal from the pulse generator to the 7B87 EXT CLOCK IN connector. The frequency counter probe and ground lead must remain on TP673 and TP644.

- ✓ c. **CHECK**—That the external clock output repetition rate is 10 MHz.

B8. ADJUST DELAY START AND PICKOFF BIAS (R305, R530)

a. Set the B horizontal time-base unit time/div switch to 5 μ s/div, and the triggering to + slope, auto, ac, int. Set the AQS CLOCK/AQR switch to INT \div 1000, and the TIME/DIV switch to 1 ms.

b. Connect the time-mark generator to the amplifier unit input with a 50-ohm cable. Set the time-mark generator to display 0.2 millisecond markers with an amplitude of about 1-division. Align every fifth marker with the vertical graticule lines using the 7B87 POSITION control.

c. Set the mainframe horizontal mode to alternate, and adjust the intensity and focus for the desired display.

d. Position the start of the B horizontal trace to the left graticule edge. Rotate the ACQUIRE-STOP DELAY control fully counterclockwise.

e. Check that the intensified zone is on the second time marker, and the rising edge of the delayed sweep marker is at the start of the delayed sweep trace.

f. **ADJUST**—R305 (Delay Start) to position the intensified zone to the 2nd time marker on the delaying sweep trace and the rising edge of the delayed sweep marker to the start of the delayed sweep trace.

g. Rotate the ACQUIRE-STOP DELAY control fully clockwise.

h. Set the time-mark generator for 1 millisecond markers.

i. Check that the intensified zone is on the 11th time marker.

j. **ADJUST**—R530 (Pickoff Bias) to position the intensified zone to the 11th marker and the rising edge of the delayed sweep marker to 5 divisions (25 μ s) from the start of the delayed sweep.

- ✓ Performance Requirement check; see introductory information.

k. **INTERACTION**—Repeat parts b through j until the intensified zone is on the 2nd (0.2 ms) and 11th (1 ms) markers when the ACQUIRE-STOP DELAY is rotated fully counterclockwise and fully clockwise.

B9. ADJUST DVM ZERO AND SCALING (R550, R538)

a. Set the ACQUIRE-STOP DELAY control fully counterclockwise.

b. Check that the channel 2 readout indicates 0.200 ms.

c. **ADJUST**—R550 (DVM Zero) for a channel 2 readout display of exactly 0.200 ms.

d. Rotate the ACQUIRE-STOP DELAY control fully clockwise.

e. Check that the channel 2 readout indicates 9.995 ms.

f. **ADJUST**—R538 (Scaling) for a channel 2 readout of exactly 9.995 ms.

g. **INTERACTION**—Repeat parts a through f until the channel 2 readout indicates 0.200 ms (ACQUIRE-STOP DELAY control fully counterclockwise), and 9.995 ms (ACQUIRE-STOP control fully clockwise).

h. Rotate the ACQUIRE-STOP DELAY control to position the intensified zone on the 2nd time marker and position horizontally the rising edge of the delayed time marker (reference point) to the first graticule line.

i. Progressively check each time marker using the above reference point and note the readout count display as shown in Table 5-3.

TABLE 5-3
Delay Time Linearity

| Marker | Readout Count | Within |
|--------|---------------|-------------|
| 2 | 1.000 | 0.990-1.010 |
| 3 | 2.000 | 1.985-2.015 |
| 4 | 3.000 | 2.980-3.020 |
| 5 | 4.000 | 3.975-4.025 |
| 6 | 5.000 | 4.970-5.030 |
| 7 | 6.000 | 5.975-6.025 |
| 8 | 7.000 | 6.980-7.020 |
| 9 | 8.000 | 7.985-8.015 |
| 10 | 9.000 | 8.990-9.010 |

B10. ADJUST 10 μ s AND 10 ms SWEEP TIMING (R710, R715)**NOTE**

The 50 ns timing has been previously checked or adjusted in step B5.

a. Set the time mark generator for 10 μ s time markers.

b. Set the TIME/DIV switch to 10 μ s, and the delayed time base sweep rate for 50 ns.

c. Rotate the ACQUIRE-STOP DELAY control for a channel 2 readout of approximately 9.7 μ s; further adjust the control to align the rising portion of the delayed sweep marker with the center vertical graticule line. Note the exact channel 2 readout value and add 80.00 to that amount.

d. Rotate the ACQUIRE-STOP DELAY control clockwise to the amount calculated in part c.

e. **ADJUST**—R710 (10 μ s Timing) to align the rising portion of the delayed sweep marker with the center vertical graticule line.

f. **INTERACTION**—Repeat parts c through e until interaction is eliminated.

g. Set the time mark generator for 10 ms markers.

h. Set the TIME/DIV switch to 10 ms, the delayed time base sweep rate to 50 μ s/div, and the oscilloscope mainframe horizontal mode to chop.

i. Rotate the ACQUIRE-STOP DELAY control to display a channel 2 readout of approximately 9.7 ms; further adjust the control to align the rising portion of the delayed sweep marker with the center vertical graticule line. Note the exact channel 2 readout value and add 80.000 to that amount.

j. Rotate the ACQUIRE-STOP DELAY control clockwise to the amount calculated in part i.

k. **ADJUST**—R715 (10 ms Timing) to align the rising portion of the delayed sweep marker with the center vertical graticule line.

l. **INTERACTION**—Repeat parts i through k until interaction is eliminated.

✓ B11. CHECK DELAY TIME ACCURACY

a. Remove the 7B87 and plug-in extender from the A horizontal compartment. Then, install the 7B87 directly in the A horizontal compartment.

TABLE 5-4
Acquire-Stop Delay Accuracy

| 7B87 TIME/DIV | 7B80 Time Base Sweep Rate | Time Mark Generator | Channel 2 Readout Display | | |
|------------------|---------------------------------|------------------------|----------------------------|-----------------------------|----------------------------|
| | | | 2nd Delayed Time Marker | 10th Delayed Time Marker | Differential Time Delay |
| 10 μ s | .1 μ s | 10 μ s | 9.45-10.55 | 89.10-90.90 | 79.57-80.43 |
| 20 μ s | .2 μ s | 20 μ s | 18.9-21.1 | 178.2-181.8 | 158.9-161.1 |
| 50 μ s | .5 μ s | 50 μ s | 47.2-52.8 | 445.5-454.5 | 397.7-402.3 |
| .1 ms | 1 μ s | .1 ms | 94.5-105.5 | 891.0-909.0 | 795.7-804.3 |
| .2 ms | 2 μ s | .2 ms | 0.189-0.211 | 1.782-1.818 | 1.589-1.611 |
| .5 ms | 5 μ s | .5 ms | 0.472-0.528 | 4.455-4.545 | 3.977-4.023 |
| 1 ms | 10 μ s | 1 ms | 0.945-1.055 | 8.910-9.090 | 7.957-8.043 |
| 2 ms | 20 μ s | 2 ms | 1.89-2.11 | 17.82-18.18 | 15.89-16.11 |
| 5 ms | 50 μ s | 5 ms | 4.72-5.28 | 44.55-45.45 | 39.77-40.23 |
| 10 ms | .1 ms | 10 ms | 9.45-10.55 | 89.10-90.90 | 79.57-80.43 |
| 20 ms | .2 ms | 20 ms | 18.9-21.1 | 178.2-181.8 | 158.9-161.1 |
| 50 ms | .5 ms | 50 ms | 47.2-52.8 | 445.5-454.5 | 397.7-402.3 |
| .1 s | 1 ms | .1 s | 94.5-105.5 | 891.0-909.0 | 795.7-804.3 |
| .2 s | 2 ms | .2 s | 0.189-0.211 | 1.782-1.818 | 1.589-1.611 |
| .5 s | 5 ms | .5 s | 0.472-0.528 | 4.455-4.545 | 3.977-4.023 |

✓ Performance Requirement check; see introductory information.

Performance Check and Adjustment—7B87

b. Set the time-mark generator for 10 μ s markers. Set the TIME/DIV switch to 10 μ s and the companion time-base unit for a 0.1 μ s/division sweep rate (unmagnified).

c. Position the display for 1 marker/division over the center 8 divisions of intensified display.

d. Position the start of the delayed sweep to the left graticule edge. Then set the ACQUIRE-STOP DELAY control to start the first intensified zone on the second time marker, and the rising portion of the delayed time marker to the start of the delayed sweep.

✓ e. **CHECK**—That the channel 2 readout indicates 10.00 μ s within 09.45 to 10.55 μ s.

f. Rotate the ACQUIRE-STOP DELAY control to position the intensified zone on the 10th marker and the rising portion of the delayed time marker to the start of the delayed sweep.

✓ g. **CHECK**—That the channel 2 readout indicates 90.00 μ s within 89.10 to 90.90 μ s.

✓ h. **CHECK**—Follow the procedure outlined in parts c through g and check the ACQUIRE-STOP DELAY accuracy as given in Table 5-4.

✓ B12. CHECK SWEEP TIMING

NOTE

The tolerances given 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. Remove the 7B87 and plug-in extender from the mainframe; then install the 7B87 directly into the B horizontal compartment.

b. Set the POSITION controls to midrange and TRIGGERING MODE to NORM.

✓ c. **CHECK**—Using the TIME/DIV setting and time-mark generator settings from Table 5-5, check sweep accuracy for 1 time mark/division 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.

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/division, over the center eight divisions of display, to the tolerances given in Table 5-5.

✓ **Performance Requirement check; see introductory information.**

TABLE 5-5
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 μ s | .1 μ s | Within 0.12 div |
| .2 μ s | .2 μ s | Within 0.12 div |
| .5 μ s | .5 μ s | Within 0.12 div |
| 1 μ s | 1 μ s | Within 0.12 div |
| 2 μ s | 2 μ s | Within 0.12 div |
| 5 μ s | 5 μ s | Within 0.12 div |
| 10 μ s | 10 μ s | Within 0.12 div |
| 20 μ s | 20 μ s | Within 0.12 div |
| 50 μ s | 50 μ 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 |

✓ B13. CHECK MAGNIFIED SWEEP TIMING

NOTE

The tolerances in Table 5-6 are for an ambient temperature range of +15° to +35° C. If outside this range, see the Specification section for applicable tolerances.

a. Center the display horizontally on the graticule. 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-ohm cable and 50-ohm termination.

TABLE 5-6
Magnified Sweep Timing

| TIME/DIV | Time Markers | Tolerance (+ 15° to 35° C) |
|------------|--------------|-------------------------------|
| 10 ns | 2 ns | ¹ Within 0.32 div |
| 20 ns | 2 ns | Within 0.32 div |
| 50 ns | 5 ns | Within 0.32 div |
| .1 μ s | 10 ns | Within 0.2 div |
| .2 μ s | 20 ns | Within 0.2 div |
| .5 μ s | 50 ns | Within 0.2 div |
| 1 μ s | .1 μ s | Within 0.2 div |
| 2 μ s | .2 μ s | Within 0.2 div |
| 5 μ s | .5 μ s | Within 0.2 div |
| 10 μ s | 1 μ s | Within 0.2 div |
| 20 μ s | 2 μ s | Within 0.2 div |
| 50 μ s | 5 μ s | Within 0.2 div |
| .1 ms | 10 μ s | Within 0.2 div |
| .2 ms | 20 μ s | Within 0.2 div |
| .5 ms | 50 μ 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 |

¹ Check for 1 time-marker in 2 divisions over the center eight divisions.

✓ Performance Requirement check; see introductory information.

✓ B14. CHECK SPECIAL READOUT ENCODING

- Remove the 7B87 from the oscilloscope mainframe.
- Set the AQS CLOCK/AQR switch to INTERNAL.
- Connect the digital multimeter between pins A29 and B37 on the plug-in rear interface connector. Refer to Figure 4-5 in the Maintenance section for the location of pin numbers on the interface connector.
- ✓ **CHECK**-The resistance should measure 150 k Ω , within the limits of 142.5 to 172.5 k Ω .
- Set the AQS CLOCK/AQR switch to INT \div 1000.
- ✓ **CHECK**-The resistance should measure 75 k Ω , within the limits of 71.25 to 78.75 k Ω .
- Set the AQS CLOCK/AQR switch to EXTERNAL.
- ✓ **CHECK**-The resistance should measure 50 k Ω , within the limits of 47.5 to 54.1 k Ω .

This completes the Performance Check and Adjustment procedure.

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.

LIST OF ASSEMBLIES

A list of assemblies can be found at the beginning of the Electrical Parts List. The assemblies are listed in numerical order. When the complete component number of a part is known, this list will identify the assembly in which the part is located.

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

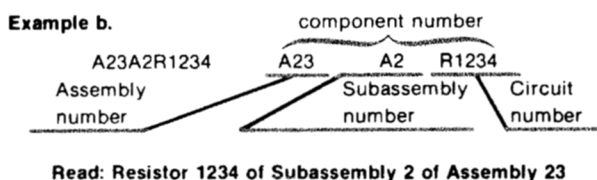
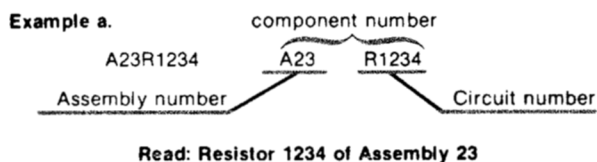
The Mfr. Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names and addresses of manufacturers of components listed in the Electrical Parts List.

ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:



Only the circuit number will appear on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly number. Assembly numbers are also marked on the mechanical exploded views located in the Mechanical Parts List. The component number is obtained by adding the assembly number prefix to the circuit number.

The Electrical Parts List is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts, precedes assembly A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are located at the end of the Electrical Parts List.

TEKTRONIX PART NO. (column two of the Electrical Parts List)

Indicates part number to be used when ordering replacement part from Tektronix.

SERIAL/MODEL NO. (columns three and four of the Electrical Parts List)

Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

NAME & DESCRIPTION (column five of the Electrical Parts List)

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.

MFR. CODE (column six of the Electrical Parts List)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

MFR. PART NUMBER (column seven of the Electrical Parts List)

Indicates actual manufacturers part number.

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

| Mfr. Code | Manufacturer | Address | City, State, Zip Code |
|-----------|--------------------------------------|----------------------------|---------------------------|
| 00853 | SANGAMO NESTON INC | SANGAMO RD | PICKENS SC 29671 |
| | SANGAMO CAPACITOR DIV | P O BOX 128 | |
| 01121 | ALLEN-BRADLEY CO | 1201 SOUTH 2ND ST | MILWAUKEE WI 53204 |
| 01295 | TEXAS INSTRUMENTS INC | 13500 N CENTRAL EXPRESSWAY | DALLAS TX 75265 |
| | SEMICONDUCTOR GROUP | P O BOX 225012 M/S 49 | |
| 02111 | SPECTROL ELECTRONICS CORP | 17070 E GALE AVE | CITY OF INDUSTRY CA 91749 |
| | SUB OF CARRIER CORP | P O BOX 1220 | |
| 02114 | AMPEREX ELECTRONIC CORP | 5083 KINGS HWY | SAUGERTIES NY 12477 |
| | FERROXCUBE DIV | | |
| 02735 | RCA CORP | ROUTE 202 | SOMERVILLE NJ 08876 |
| | SOLID STATE DIVISION | | |
| 03508 | GENERAL ELECTRIC CO | N GENESEE ST | AUBURN NY 13021 |
| | SEMI-CONDUCTOR PRODUCTS DEPT | | |
| 04222 | AVX CERAMICS DIV OF AVX CORP | 19TH AVE SOUTH | MYRTLE BEACH SC 29577 |
| | | P O BOX 867 | |
| 04713 | MOTOROLA INC | 5005 E MCDOWELL RD | PHOENIX AZ 85008 |
| | SEMICONDUCTOR GROUP | | |
| 05397 | UNION CARBIDE CORP MATERIALS SYSTEMS | 11901 MADISON AVE | CLEVELAND OH 44101 |
| | DIV | | |
| 07263 | FAIRCHILD CAMERA AND INSTRUMENT CORP | 464 ELLIS ST | MOUNTAIN VIEW CA 94042 |
| | SEMICONDUCTOR DIV | | |
| 07716 | TRM INC | 2850 MT PLEASANT AVE | BURLINGTON IA 52601 |
| | TRM ELECTRONICS COMPONENTS | | |
| | TRM IRC FIXED RESISTORS/BURLINGTON | | |
| 12697 | CLAROSTAT MFG CO INC | LOWER WASHINGTON ST | DOVER NH 03820 |
| 14301 | ANDERSON ELECTRONICS INC | 310 PENN ST | HOLLIDAYSBURG PA 16648 |
| 14552 | MICRO/SEMICONDUCTOR CORP | 2830 S FAIRVIEW ST | SANTA ANA CA 92704 |
| 18324 | SIGNETICS CORP | 811 E ARQUES | SUNNYVALE CA 94086 |
| 19396 | ILLINOIS TOOL WORKS INC | 900 FOLLIN LANE S E | VIENNA VA 22180 |
| | PAKTRON DIVISION | | |
| 19701 | MEPCO/ELECTRA INC | P O BOX 760 | MINERAL WELLS TX 76067 |
| | A NORTH AMERICAN PHILIPS CO | | |
| 21847 | TRM MICROWAVE INC | 825 STEWART DR | SUNNYVALE CA 94086 |
| | SUB OF TRM INC | | |
| 24546 | CORNING GLASS WORKS | 550 HIGH ST | BRADFORD PA 16701 |
| 27014 | NATIONAL SEMICONDUCTOR CORP | 2900 SEMICONDUCTOR DR | SANTA CLARA CA 95051 |
| 31918 | ITT SCHADOM INC | 8081 WALLACE RD | EDEN PRAIRIE MN 55343 |
| 32293 | INTERSIL INC | 10900 N TANTAU AVE | CUPERTINO CA 95014 |
| 32997 | BOURNS INC | 1200 COLUMBIA AVE | RIVERSIDE CA 92507 |
| | TRIMPOT DIV | | |
| 50434 | HEWLETT-PACKARD CO OPTOELECTRONICS | 640 PAGE MILL RD | PALO ALTO CA 94304 |
| | DIV | | |
| 51642 | CENTRE ENGINEERING INC | 2820 E COLLEGE AVE | STATE COLLEGE PA 16801 |
| 51984 | NEC AMERICA INC | 2741 PROSPERITY AVE | FAIRFAX VA 22031 |
| 54473 | MATSUSHITA ELECTRIC CORP OF AMERICA | ONE PANASONIC WAY | SECAUCUS NJ 07094 |
| 56289 | SPRAGUE ELECTRIC CO | 87 MARSHALL ST | NORTH ADAMS MA 01247 |
| 57668 | ROHM CORP | 16931 MILLIKEN AVE | IRVINE CA 92713 |
| 58361 | GENERAL INSTRUMENT CORP | 3400 HILLVIEW AVE | PALO ALTO CA 94304 |
| | OPTOELECTRONICS DIV | | |
| 58854 | GTE PRODUCTS CORP | 60 BOSTON ST | SALEM MA 01970 |
| | LIGHTING PRODUCTS GROUP | | |
| 59660 | TUSONIX INC | 2155 N FORBES BLVD | TUCSON, ARIZONA 85705 |
| 74970 | JOHNSON E F CO | 299 10TH AVE S W | MASECA MN 56093 |
| 75042 | TRM INC | 401 N BROAD ST | PHILADELPHIA PA 19108 |
| | TRM ELECTRONIC COMPONENTS | | |
| | IRC FIXED RESISTORS PHILADELPHIA DIV | | |
| 80009 | TEXTRONIX INC | 4900 S W GRIFFITH DR | BEAVERTON OR 97077 |
| | | P O BOX 500 | |
| 91637 | DALE ELECTRONICS INC | P O BOX 609 | COLUMBUS NE 68601 |

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective | Discont | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|-----------------------|----------------------------------|---------|--|--------------|---------------|
| A1 | ----- | | | CKT BOARD ASSY:INTERFACE (REPLACEABLE AS A UNIT WITH 672-0829-XX) | | |
| A2 | 670-4181-01 | | | CIRCUIT BD ASSY:TRIGGER | 80009 | 670-4181-01 |
| A3 | 670-4183-00 | | | CIRCUIT BD ASSY:READOUT | 80009 | 670-4183-00 |
| A4 | 670-6184-00 | 8010100 | 8023314 | CIRCUIT BD ASSY:CLOCK | 80009 | 670-6184-00 |
| A4 | 670-6184-01 | 8023315 | | CIRCUIT BD ASSY:CLOCK | 80009 | 670-6184-01 |

Replaceable Electrical Parts - 7B87

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective | Discont | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|--------------------|-------------------------------|---------|---|-----------|------------------|
| A1 | | | | CKT BOARD ASSY: INTERFACE (REPLACEABLE AS A UNIT WITH 672-0829-XX) | | |
| A1C99 | 281-0786-00 | | | CAP,FXD,CER DI:150PF,10%,100V | 04222 | MA101A151KAA |
| A1C204 | 281-0772-00 | | | CAP,FXD,CER DI:4700PF,10%,100V | 04222 | MA201C472KAA |
| A1C211 | 283-0672-00 | | | CAP,FXD,MICA DI:200PF,1%,500V | 00853 | 0155F2010F0 |
| A1C212 | 283-0555-00 | | | CAP,FXD,MICA DI:2000PF,1%,500V | 00853 | 0195F202F0 |
| A1C213 | 285-0683-00 | | | CAP,FXD,PLASTIC:0.022UF,5%,100V | 19396 | 223J01PT485 |
| A1C214 | 290-0269-00 | | | CAP,FXD,ELCTLT:0.22UF,5%,35V | 05397 | T320A224J035AS |
| A1C221 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A1C222 | 281-0772-00 | | | CAP,FXD,CER DI:4700PF,10%,100V | 04222 | MA201C472KAA |
| A1C225 | 290-0536-00 | | | CAP,FXD,ELCTLT:10UF,20%,25V TANTALUM | 05397 | T368B106M025AS |
| A1C228 | 290-0534-00 | | | CAP,FXD,ELCTLT:1UF,20%,35V | 05397 | T368A105M035AZ |
| A1C273 | 281-0815-00 | | | CAP,FXD,CER DI:0.027UF,20%,50V | 04222 | MA205C273MAA |
| A1C312 | 283-0691-00 | | | CAP,FXD,MICA DI:650PF,1%,300V | 00853 | 0153F651F0 |
| A1C324 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A1C333 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A1C335 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A1C353 | 281-0763-00 | | | CAP,FXD,CER DI:47PF,10%,100V | 04222 | MA101A470KAA |
| A1C356 | 283-0616-00 | | | CAP,FXD,MICA DI:75PF,5%,500V | 00853 | 0155E750J0 |
| A1C416 | 290-0534-00 | | | CAP,FXD,ELCTLT:1UF,20%,35V | 05397 | T368A105M035AZ |
| A1C432 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A1C440 | 281-0616-00 | | | CAP,FXD,CER DI:6.8PF,+/-0.5PF,200V | 59660 | 374-018-COH06890 |
| A1C441 | 281-0592-00 | | | CAP,FXD,CER DI:4.7PF,+/-0.5PF,500V | 59660 | 301-000COHO-4790 |
| A1C522 | 283-0119-00 | | | CAP,FXD,CER DI:2200PF,5%,200V | 59660 | 855-XXXY5E0222J |
| A1C523 | 290-0527-00 | | | CAP,FXD,ELCTLT:15UF,20%,20V | 05397 | T368B156M020AS |
| A1C526 | 290-0527-00 | | | CAP,FXD,ELCTLT:15UF,20%,20V | 05397 | T368B156M020AS |
| A1C573 | 290-0527-00 | | | CAP,FXD,ELCTLT:15UF,20%,20V | 05397 | T368B156M020AS |
| A1C576 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A1C712 | 290-0420-00 | | | CAP,FXD,ELCTLT:0.68UF,20%,75V | 05397 | T110A684M075AS |
| A1C730 | 281-0772-00 | | | CAP,FXD,CER DI:4700PF,10%,100V | 04222 | MA201C472KAA |
| A1C731 | 281-0772-00 | | | CAP,FXD,CER DI:4700PF,10%,100V | 04222 | MA201C472KAA |
| A1C810 | 281-0775-00 | 8010100 | 8023285 | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A1C810 | 283-0167-00 | 8023286 | | CAP,FXD,CER DI:0.1UF,10%,100V | 04222 | 3430-100C-104K |
| A1C820 | 290-0745-00 | | | CAP,FXD,ELCTLT:22UF,+50-10%,25V | 54473 | ECE-A25V22L |
| A1C822 | 281-0815-00 | | | CAP,FXD,CER DI:0.027UF,20%,50V | 04222 | MA205C273MAA |
| A1C830 | 290-0745-00 | | | CAP,FXD,ELCTLT:22UF,+50-10%,25V | 54473 | ECE-A25V22L |
| A1C840 | 290-0745-00 | | | CAP,FXD,ELCTLT:22UF,+50-10%,25V | 54473 | ECE-A25V22L |
| A1C844 | 281-0815-00 | | | CAP,FXD,CER DI:0.027UF,20%,50V | 04222 | MA205C273MAA |
| A1CR202 | 152-0153-00 | | | SEMICONO DVC,DI:SM,SI,10V,50MA,.00-7 | 07263 | F07003 |
| A1CR206 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR208 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR224 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR225 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR226 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR273 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR301 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR302 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR314 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR323 | 152-0322-00 | | | SEMICONO DVC,DI:SCHOTTKY BARRIER,SI,15V | 21847 | A2X600 |
| A1CR324 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR334 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR344 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR356 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR362 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR372 | 152-0322-00 | | | SEMICONO DVC,DI:SCHOTTKY BARRIER,SI,15V | 21847 | A2X600 |
| A1CR423 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR433 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR435 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A1CR526 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective | Discont | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|-----------------------|----------------------------------|---------|--|--------------|-----------------|
| A1CR567 | 152-0141-02 | | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A1CR578 | 152-0141-02 | | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A1CR579 | 152-0141-02 | | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A1CR717 | 152-0141-02 | | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A1CR718 | 152-0141-02 | | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A1CR723 | 152-0141-02 | | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A1CR724 | 152-0141-02 | | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A1CR844 | 152-0141-02 | | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A1E274 | 276-0507-00 | | | SHLD BEAD,ELEK:FERRITE | 02114 | 56-590-658/38 |
| A1E382 | 276-0507-00 | | | SHLD BEAD,ELEK:FERRITE | 02114 | 56-590-658/38 |
| A1E578 | 276-0507-00 | | | SHLD BEAD,ELEK:FERRITE | 02114 | 56-590-658/38 |
| A1LR810 | 108-0537-00 | | | COIL,RF:FIXED,200UH | 80009 | 108-0537-00 |
| A1LR820 | 108-0537-00 | | | COIL,RF:FIXED,200UH | 80009 | 108-0537-00 |
| A1LR830 | 108-0537-00 | | | COIL,RF:FIXED,200UH | 80009 | 108-0537-00 |
| A1LR840 | 108-0537-00 | | | COIL,RF:FIXED,200UH | 80009 | 108-0537-00 |
| A1Q201 | 151-0221-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS246 |
| A1Q202 | 151-0325-00 | | | TRANSISTOR:PMP,SI,TO-92,SEL | 80009 | 151-0325-00 |
| A1Q203 | 151-0220-00 | 8010100 | 8011049 | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS8867 |
| A1Q203 | 151-0216-00 | 8011050 | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS8803 |
| A1Q204 | 151-0223-00 | | | TRANSISTOR:NPN,SI,TO-92 | 04713 | SPS8026 |
| A1Q206 | 151-0223-00 | | | TRANSISTOR:NPN,SI,TO-92 | 04713 | SPS8026 |
| A1Q210 | 151-0273-00 | | | TRANSISTOR:SELECTED | 03508 | X16E3616 |
| A1Q214 | 151-0220-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS8867 |
| A1Q230 | 151-0302-00 | | | TRANSISTOR:NPN,SI,TO-18 | 04713 | ST899 |
| A1Q234 | 151-0301-00 | | | TRANSISTOR:PMP,SI,TO-18 | 04713 | ST898 |
| A1Q242 | 151-0223-00 | | | TRANSISTOR:NPN,SI,TO-92 | 04713 | SPS8026 |
| A1Q272 | 151-0223-00 | | | TRANSISTOR:NPN,SI,TO-92 | 04713 | SPS8026 |
| A1Q274 | 151-0223-00 | | | TRANSISTOR:NPN,SI,TO-92 | 04713 | SPS8026 |
| A1Q304 | 151-0354-00 | | | TRANSISTOR:PMP,SI,TO-78 | 32293 | ITS-1200-A |
| A1Q314 | 151-0220-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS8867 |
| A1Q322 | 151-0367-00 | | | TRANSISTOR:NPN,SI,X-55 | 04713 | SPS 8811 |
| A1Q324 | 151-0367-00 | | | TRANSISTOR:NPN,SI,X-55 | 04713 | SPS 8811 |
| A1Q334 | 151-1036-00 | | | TRANSISTOR:FET,N-CHAN,SI,TO-71 | 80009 | 151-1036-00 |
| A1Q338 | 151-0437-00 | 8010100 | 8011049 | TRANSISTOR:SELECTED | 07263 | S038704 |
| A1Q338 | 151-0127-00 | 8011050 | | TRANSISTOR:NPN,SI,TO-18 | 04713 | SL6073A |
| A1Q344 | 151-0220-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS8867 |
| A1Q346 | 151-0220-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS8867 |
| A1Q352 | 151-0221-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS246 |
| A1Q356 | 151-0221-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS246 |
| A1Q358 | 151-0223-00 | | | TRANSISTOR:NPN,SI,TO-92 | 04713 | SPS8026 |
| A1Q362 | 151-0221-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS246 |
| A1Q372 | 151-0223-00 | | | TRANSISTOR:NPN,SI,TO-92 | 04713 | SPS8026 |
| A1Q382 | 151-0367-00 | | | TRANSISTOR:NPN,SI,X-55 | 04713 | SPS 8811 |
| A1Q424 | 151-0220-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS8867 |
| A1Q428 | 151-0325-00 | | | TRANSISTOR:PMP,SI,TO-92,SEL | 80009 | 151-0325-00 |
| A1Q434 | 151-0220-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS8867 |
| A1Q438 | 151-0325-00 | | | TRANSISTOR:PMP,SI,TO-92,SEL | 80009 | 151-0325-00 |
| A1Q448 | 151-0472-00 | | | TRANSISTOR:NPN,SI,TO-92 | 51984 | NE41632B |
| A1Q458 | 151-0472-00 | | | TRANSISTOR:NPN,SI,TO-92 | 51984 | NE41632B |
| A1Q512 | 151-0354-00 | | | TRANSISTOR:PMP,SI,TO-78 | 32293 | ITS-1200-A |
| A1Q518 | 151-0410-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS6765 |
| A1Q522 | 151-0354-00 | | | TRANSISTOR:PMP,SI,TO-78 | 32293 | ITS-1200-A |
| A1Q528 | 151-0410-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS6765 |
| A1Q562 | 151-0223-00 | | | TRANSISTOR:NPN,SI,TO-92 | 04713 | SPS8026 |
| A1Q564 | 151-0223-00 | | | TRANSISTOR:NPN,SI,TO-92 | 04713 | SPS8026 |
| A1Q568 | 151-0223-00 | | | TRANSISTOR:NPN,SI,TO-92 | 04713 | SPS8026 |
| A1Q572 | 151-0223-00 | | | TRANSISTOR:NPN,SI,TO-92 | 04713 | SPS8026 |
| A1Q574 | 151-0223-00 | | | TRANSISTOR:NPN,SI,TO-92 | 04713 | SPS8026 |
| A1Q576 | 151-0223-00 | | | TRANSISTOR:NPN,SI,TO-92 | 04713 | SPS8026 |

Replaceable Electrical Parts - 7B87

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|--------------------|--------------------------------------|--|-----------|-----------------|
| A1Q578 | 151-0190-00 | | TRANSISTOR:NPN,SI,T0-92 | 80009 | 151-0190-00 |
| A1Q844 | 151-0301-00 | | TRANSISTOR:PMP,SI,T0-18 | 04713 | ST898 |
| A1R28 | 315-0822-00 | | RES,FXD,CMPSN:8.2K OHM,5%,0.25W | 19701 | 5043CX8K200J |
| A1R88 | 315-0100-00 | | RES,FXD,CMPSN:10 OHM,5%,0.25W | 19701 | 5043CX10RR00J |
| A1R99 | 315-0911-00 | | RES,FXD,CMPSN:910 OHM,5%,0.25W | 57668 | NTR25J-E910E |
| A1R201 | 315-0223-00 | | RES,FXD,CMPSN:22K OHM,5%,0.25W | 19701 | 5043CX22K00J92U |
| A1R202 | 315-0202-00 | | RES,FXD,CMPSN:2K OHM,5%,0.25W | 57668 | NTR25J-E 2K |
| A1R203 | 315-0391-00 | | RES,FXD,CMPSN:390 OHM,5%,0.25W | 57668 | NTR25J-E390E |
| A1R204 | 315-0392-00 | | RES,FXD,CMPSN:3.9K OHM,5%,0.25W | 57668 | NTR25J-E03K9 |
| A1R205 | 315-0471-00 | | RES,FXD,CMPSN:470 OHM,5%,0.25W | 57668 | NTR25J-E470E |
| A1R206 | 321-0219-00 | | RES,FXD,FILM:1.87K OHM,1%,0.125W,TC=TO | 07716 | CEAD18700F |
| A1R207 | 321-0173-00 | | RES,FXD,FILM:619 OHM,1%,0.125W,TC=TO | 07716 | CEAD619R0F |
| A1R208 | 315-0102-00 | | RES,FXD,CMPSN:1K OHM,5%,0.25W | 57668 | NTR25JE01K0 |
| A1R209 | 321-0274-00 | | RES,FXD,FILM:6.98K OHM,1%,0.125W,TC=TO | 19701 | 5043ED6K980F |
| A1R211 | 301-0752-00 | | RES,FXD,CMPSN:7.5K OHM,5%,0.5W | 19701 | 5053CX7K500J |
| A1R212 | 321-0373-00 | | RES,FXD,FILM:75.0K OHM,1%,0.125W,TC=TO | 19701 | 5033ED75K00F |
| A1R213 | 321-0373-00 | | RES,FXD,FILM:75.0K OHM,1%,0.125W,TC=TO | 19701 | 5033ED75K00F |
| A1R214 | 321-0689-00 | | RES,FXD,FILM:24.9K OHM,0.5%,0.125W,TC=TO | 91637 | MFF18166249010 |
| A1R215 | 315-0101-00 | | RES,FXD,CMPSN:100 OHM,5%,0.25W | 57668 | NTR25J-E 100E |
| A1R216 | 321-0689-00 | | RES,FXD,FILM:24.9K OHM,0.5%,0.125W,TC=TO | 91637 | MFF18166249010 |
| A1R217 | 321-0291-00 | | RES,FXD,FILM:10.5K OHM,1%,0.125W,TC=TO | 80009 | 321-0291-00 |
| A1R218 | 321-0267-00 | | RES,FXD,FILM:5.90K OHM,1%,0.125W,TC=TO | 19701 | 5033ED5K900F |
| A1R222 | 315-0472-00 | | RES,FXD,CMPSN:4.7K OHM,5%,0.25W | 57668 | NTR25J-E04K7 |
| A1R224 | 315-0622-00 | | RES,FXD,CMPSN:6.2K OHM,5%,0.25W | 19701 | 5043CX6K200J |
| A1R225 | 315-0103-00 | | RES,FXD,CMPSN:10K OHM,5%,0.25W | 19701 | 5043CX10K00J |
| A1R226 | 315-0393-00 | | RES,FXD,CMPSN:39K OHM,5%,0.25W | 57668 | NTR25J-E390J |
| A1R227 | 315-0121-00 | | RES,FXD,CMPSN:120 OHM,5%,0.25W | 19701 | 5043CX120R0J |
| A1R228 | 315-0184-00 | | RES,FXD,CMPSN:180K OHM,5%,0.25W | 19701 | 5043CX180K0J |
| A1R231 | 315-0432-00 | | RES,FXD,CMPSN:4.3K OHM,5%,0.25W | 57668 | NTR25J-E04K3 |
| A1R232 | 315-0121-00 | | RES,FXD,CMPSN:120 OHM,5%,0.25W | 19701 | 5043CX120R0J |
| A1R233 | 315-0561-00 | | RES,FXD,CMPSN:560 OHM,5%,0.25W | 19701 | 5043CX560R0J |
| A1R234 | 315-0430-00 | | RES,FXD,CMPSN:43 OHM,5%,0.25W | 19701 | 5043CX43R00J |
| A1R240 | 315-0471-00 | | RES,FXD,CMPSN:470 OHM,5%,0.25W | 57668 | NTR25J-E470E |
| A1R241 | 315-0241-00 | | RES,FXD,CMPSN:240 OHM,5%,0.25W | 19701 | 5043CX240R0J |
| A1R242 | 315-0332-00 | | RES,FXD,CMPSN:3.3K OHM,5%,0.25W | 57668 | NTR25J-E03K3 |
| A1R243 | 315-0821-00 | | RES,FXD,CMPSN:820 OHM,5%,0.25W | 19701 | 5043CX820R0J |
| A1R244 | 315-0432-00 | | RES,FXD,CMPSN:4.3K OHM,5%,0.25W | 57668 | NTR25J-E04K3 |
| A1R271 | 315-0222-00 | | RES,FXD,CMPSN:2.2K OHM,5%,0.25W | 57668 | NTR25J-E02K2 |
| A1R272 | 315-0472-00 | | RES,FXD,CMPSN:4.7K OHM,5%,0.25W | 57668 | NTR25J-E04K7 |
| A1R274 | 315-0302-00 | | RES,FXD,CMPSN:3K OHM,5%,0.25W | 57668 | NTR25J-E03K0 |
| A1R275 | 315-0510-00 | | RES,FXD,CMPSN:51 OHM,5%,0.25W | 19701 | 5043CX51R00J |
| A1R301 | 315-0221-00 | | RES,FXD,CMPSN:220 OHM,5%,0.25W | 57668 | NTR25J-E220E |
| A1R303 | 315-0470-00 | | RES,FXD,CMPSN:47 OHM,5%,0.25W | 57668 | NTR25J-E47E0 |
| A1R304 | 315-0103-00 | | RES,FXD,CMPSN:10K OHM,5%,0.25W | 19701 | 5043CX10K00J |
| A1R305 | 311-1228-00 | | RES,VAR,NONWM:TRMR,10K OHM,0.5W | 32997 | 3386F-T04-103 |
| A1R307 | 321-0301-00 | | RES,FXD,FILM:13.3K OHM,1%,0.125W,TC=TO | 07716 | CEAD13301F |
| A1R308 | 321-0275-00 | | RES,FXD,FILM:7.15K OHM,1%,0.125W,TC=TO | 07716 | CEAD71500F |
| A1R312 | 315-0201-00 | | RES,FXD,CMPSN:200 OHM,5%,0.25W | 57668 | NTR25J-E200E |
| A1R313 | 315-0101-00 | | RES,FXD,CMPSN:100 OHM,5%,0.25W | 57668 | NTR25J-E 100E |
| A1R314 | 315-0101-00 | | RES,FXD,CMPSN:100 OHM,5%,0.25W | 57668 | NTR25J-E 100E |
| A1R315 | 315-0112-00 | | RES,FXD,CMPSN:1.1K OHM,5%,0.25W | 19701 | 5043CX1K100J |
| A1R321 | 315-0101-00 | | RES,FXD,CMPSN:100 OHM,5%,0.25W | 57668 | NTR25J-E 100E |
| A1R322 | 323-0175-00 | | RES,FXD,FILM:649 OHM,1%,0.5W,TC=TO | 75042 | CECT0-6490F |
| A1R323 | 315-0101-00 | | RES,FXD,CMPSN:100 OHM,5%,0.25W | 57668 | NTR25J-E 100E |
| A1R324 | 315-0100-00 | | RES,FXD,CMPSN:10 OHM,5%,0.25W | 19701 | 5043CX10RR00J |
| A1R325 | 315-0221-00 | | RES,FXD,CMPSN:220 OHM,5%,0.25W | 57668 | NTR25J-E220E |
| A1R326 | 315-0222-00 | | RES,FXD,CMPSN:2.2K OHM,5%,0.25W | 57668 | NTR25J-E02K2 |
| A1R333 | 315-0470-00 | | RES,FXD,CMPSN:47 OHM,5%,0.25W | 57668 | NTR25J-E47E0 |
| A1R334 | 315-0101-00 | | RES,FXD,CMPSN:100 OHM,5%,0.25W | 57668 | NTR25J-E 100E |

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|-----------------------|---|--|--------------|-----------------|
| A1R335 | 315-0470-00 | | RES,FXD,CMPSN:47 OHM,5%,0.25M | 57668 | NTR25J-E47E0 |
| A1R336 | 315-0101-00 | | RES,FXD,CMPSN:100 OHM,5%,0.25M | 57668 | NTR25J-E 100E |
| A1R337 | 315-0272-00 | | RES,FXD,CMPSN:2.7K OHM,5%,0.25M | 57668 | NTR25J-E02K7 |
| A1R338 | 315-0120-00 | | RES,FXD,CMPSN:12 OHM,5%,0.25M | 57668 | NTR25J-R12 |
| A1R339 | 315-0470-00 | | RES,FXD,CMPSN:47 OHM,5%,0.25M | 57668 | NTR25J-E47E0 |
| A1R341 | 321-0260-00 | | RES,FXD,FILM:4.99K OHM,1%,0.125M,TC=T0 | 19701 | 5033ED4K990F |
| A1R342 | 315-0474-00 | | RES,FXD,CMPSN:470K OHM,5%,0.25M | 19701 | 5043CX470K0J92U |
| A1R343 | 321-0263-00 | | RES,FXD,FILM:5.36K OHM,1%,0.125M,TC=T0 | 07716 | CEAD53600F |
| A1R344 | 315-0431-00 | | RES,FXD,CMPSN:430 OHM,5%,0.25M | 19701 | 5043CX430R0J |
| A1R345 | 315-0242-00 | | RES,FXD,CMPSN:2.4K OHM,5%,0.25M | 57668 | NTR25J-E02K4 |
| A1R346 | 315-0472-00 | | RES,FXD,CMPSN:4.7K OHM,5%,0.25M | 57668 | NTR25J-E04K7 |
| A1R347 | 315-0510-00 | | RES,FXD,CMPSN:51 OHM,5%,0.25M | 19701 | 5043CX51R00J |
| A1R350 | 315-0751-00 | | RES,FXD,CMPSN:750 OHM,5%,0.25M | 57668 | NTR25J-E750E |
| A1R351 | 315-0161-00 | | RES,FXD,CMPSN:160 OHM,5%,0.25M | 57668 | NTR25J-E 160E |
| A1R352 | 315-0222-00 | | RES,FXD,CMPSN:2.2K OHM,5%,0.25M | 57668 | NTR25J-E02K2 |
| A1R353 | 321-0222-07 | | RES,FXD,FILM:2.0K OHM,0.1%,0.125M,TC=T9 | 19701 | 5033RE2K000B |
| A1R354 | 321-0196-00 | | RES,FXD,FILM:1.07K OHM,1%,0.125M,TC=T0 | 07716 | CEAD10700F |
| A1R355 | 315-0162-00 | | RES,FXD,CMPSN:1.6K OHM,5%,0.25M | 19701 | 5043CX1K600J |
| A1R356 | 321-0229-00 | | RES,FXD,FILM:2.37K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED2K37F |
| A1R358 | 321-0185-00 | | RES,FXD,FILM:825 OHM,1%,0.125M,TC=T0 | 07716 | CEAD825R0F |
| A1R362 | 315-0122-00 | | RES,FXD,CMPSN:1.2K OHM,5%,0.25M | 57668 | NTR25J-E01K2 |
| A1R371 | 315-0121-00 | | RES,FXD,CMPSN:120 OHM,5%,0.25M | 19701 | 5043CX120R0J |
| A1R372 | 315-0102-00 | | RES,FXD,CMPSN:1K OHM,5%,0.25M | 57668 | NTR25J-E01K0 |
| A1R373 | 321-0173-00 | | RES,FXD,FILM:619 OHM,1%,0.125M,TC=T0 | 07716 | CEAD619R0F |
| A1R381 | 315-0202-00 | | RES,FXD,CMPSN:2K OHM,5%,0.25M | 57668 | NTR25J-E 2K |
| A1R383 | 315-0510-00 | | RES,FXD,CMPSN:51 OHM,5%,0.25M | 19701 | 5043CX51R00J |
| A1R412 | 315-0513-00 | | RES,FXD,CMPSN:51K OHM,5%,0.25M | 57668 | NTR25J-E51K0 |
| A1R413 | 315-0105-00 | | RES,FXD,CMPSN:1M OHM,5%,0.25M | 19701 | 5043CX1M000J |
| A1R414 | 321-0362-00 | | RES,FXD,FILM:57.6K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED57K60F |
| A1R416 | 321-0289-03 | | RES,FXD,FILM:10.0K OHM,0.25%,0.125M,TC=T2 | 07716 | CEAC10001C |
| A1R422 | 315-0680-00 | | RES,FXD,CMPSN:68 OHM,5%,0.25M | 57668 | NTR25J-E68E0 |
| A1R424 | 323-0285-00 | | RES,FXD,FILM:9.09K OHM,1%,0.5M,TC=T0 | 19701 | 5053RD9K090F |
| A1R426 | 315-0180-00 | | RES,FXD,CMPSN:18 OHM,5%,0.25M | 19701 | 5043CX18R00J |
| A1R427 | 315-0103-00 | | RES,FXD,CMPSN:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| A1R428 | 315-0473-00 | | RES,FXD,CMPSN:47K OHM,5%,0.25M | 57668 | NTR25J-E47K0 |
| A1R430 | 311-1423-00 | | RES,VAR,NOHNM:TRMR,20 OHM,0.5M | 32997 | 3386F-T04-200 |
| A1R431 | 321-0122-00 | | RES,FXD,FILM:182 OHM,1%,0.125M,TC=T0 | 19701 | 5033ED182R0F |
| A1R432 | 315-0180-00 | | RES,FXD,CMPSN:18 OHM,5%,0.25M | 19701 | 5043CX18R00J |
| A1R433 | 315-0820-00 | | RES,FXD,CMPSN:82 OHM,5%,0.25M | 57668 | NTR25J-E82E0 |
| A1R434 | 323-0285-00 | | RES,FXD,FILM:9.09K OHM,1%,0.5M,TC=T0 | 19701 | 5053RD9K090F |
| A1R435 | 321-0400-00 | | RES,FXD,FILM:143K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED143K0F |
| A1R436 | 315-0180-00 | | RES,FXD,CMPSN:18 OHM,5%,0.25M | 19701 | 5043CX18R00J |
| A1R437 | 315-0103-00 | | RES,FXD,CMPSN:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| A1R438 | 315-0473-00 | | RES,FXD,CMPSN:47K OHM,5%,0.25M | 57668 | NTR25J-E47K0 |
| A1R439 | 315-0151-00 | | RES,FXD,CMPSN:150 OHM,5%,0.25M | 57668 | NTR25J-E150E |
| A1R440 | 315-0470-00 | | RES,FXD,CMPSN:47 OHM,5%,0.25M | 57668 | NTR25J-E47E0 |
| A1R441 | 315-0682-00 | | RES,FXD,CMPSN:6.8K OHM,5%,0.25M | 57668 | NTR25J-E06K8 |
| A1R442 | 321-0225-06 | | RES,FXD,FILM:2.15K OHM,0.25%,0.125M,T=T9M1 | 07716 | CEAE21500C |
| A1R444 | 322-0210-00 | | RES,FXD,FILM:1.50K OHM,1%,0.25M,TC=T0 | 75042 | CEBT0-1501F |
| A1R445 | 311-1276-00 | | RES,VAR,NOHNM:TRMR,2.5K OHM,0.5M | 32997 | 3386F-T04-252 |
| A1R446 | 315-0682-00 | | RES,FXD,CMPSN:6.8K OHM,5%,0.25M | 57668 | NTR25J-E06K8 |
| A1R447 | 321-0928-00 | | RES,FXD,FILM:250 OHM,1%,0.125M,TC=T0 | 91637 | MFF18160250R0C |
| A1R448 | 322-0218-00 | | RES,FXD,FILM:1.82K OHM,1%,0.25M,TC=T0 | 75042 | CEBT0-1821F |
| A1R449 | 322-0224-00 | | RES,FXD,FILM:2.10K OHM,1%,0.25M,TC=T0 | 19701 | 5043RD2K100F |
| A1R454 | 322-0210-00 | | RES,FXD,FILM:1.50K OHM,1%,0.25M,TC=T0 | 75042 | CEBT0-1501F |
| A1R455 | 321-0124-00 | | RES,FXD,FILM:191 OHM,1%,0.125M,TC=T0 | 07716 | CEAD191R0F |
| A1R456 | 315-0682-00 | | RES,FXD,CMPSN:6.8K OHM,5%,0.25M | 57668 | NTR25J-E06K8 |
| A1R457 | 321-0928-03 | | RES,FXD,FILM:250 OHM,0.25%,0.125M,TC=T2 | 91637 | MFF18160250R0C |
| A1R458 | 322-0218-00 | | RES,FXD,FILM:1.82K OHM,1%,0.25M,TC=T0 | 75042 | CEBT0-1821F |

Replaceable Electrical Parts - 7B87

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective Dscnt | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|--------------------|-------------------------------------|--|-----------|-----------------|
| A1R459 | 322-0224-00 | | RES,FXD,FILM:2.10K OHM,1%,0.25M,TC=T0 | 19701 | 5043R02K100F |
| A1R514 | 315-0221-00 | | RES,FXD,CMPNS:220 OHM,5%,0.25M | 57668 | NTR25J-E220E |
| A1R518 | 321-0260-00 | | RES,FXD,FILM:4.99K OHM,1%,0.125M,TC=T0 | 19701 | 5033E04K990F |
| A1R522 | 315-0331-00 | | RES,FXD,CMPNS:330 OHM,5%,0.25M | 57668 | NTR25J-E330E |
| A1R524 | 315-0221-00 | | RES,FXD,CMPNS:220 OHM,5%,0.25M | 57668 | NTR25J-E220E |
| A1R526 | 321-0260-00 | | RES,FXD,FILM:4.99K OHM,1%,0.125M,TC=T0 | 19701 | 5033E04K990F |
| A1R527 | 321-0285-00 | | RES,FXD,FILM:9.09K OHM,1%,0.125M,TC=T0 | 07716 | CEA090900F |
| A1R528 | 321-0260-00 | | RES,FXD,FILM:4.99K OHM,1%,0.125M,TC=T0 | 19701 | 5033E04K990F |
| A1R560 | 321-0196-00 | | RES,FXD,FILM:1.07K OHM,1%,0.125M,TC=T0 | 07716 | CEA010700F |
| A1R561 | 321-0302-00 | | RES,FXD,FILM:13.7K OHM,1%,0.125M,TC=T0 | 07716 | CEA0 13701F |
| A1R562 | 315-0242-00 | | RES,FXD,CMPNS:2.4K OHM,5%,0.25M | 57668 | NTR25J-E02K4 |
| A1R563 | 315-0102-00 | | RES,FXD,CMPNS:1K OHM,5%,0.25M | 57668 | NTR25J-E01K0 |
| A1R564 | 315-0510-00 | | RES,FXD,CMPNS:51 OHM,5%,0.25M | 19701 | 5043CX51R00J |
| A1R567 | 315-0242-00 | | RES,FXD,CMPNS:2.4K OHM,5%,0.25M | 57668 | NTR25J-E02K4 |
| A1R569 | 315-0223-00 | | RES,FXD,CMPNS:22K OHM,5%,0.25M | 19701 | 5043CX22K00J92U |
| A1R570 | 315-0511-00 | | RES,FXD,CMPNS:510 OHM,5%,0.25M | 19701 | 5043CX510R0J |
| A1R571 | 315-0153-00 | | RES,FXD,CMPNS:15K OHM,5%,0.25M | 19701 | 5043CX15K00J |
| A1R572 | 315-0270-00 | | RES,FXD,CMPNS:27 OHM,5%,0.25M | 19701 | 5043CX27R00J |
| A1R573 | 315-0153-00 | | RES,FXD,CMPNS:15K OHM,5%,0.25M | 19701 | 5043CX15K00J |
| A1R574 | 315-0242-00 | | RES,FXD,CMPNS:2.4K OHM,5%,0.25M | 57668 | NTR25J-E02K4 |
| A1R575 | 315-0392-00 | | RES,FXD,CMPNS:3.9K OHM,5%,0.25M | 57668 | NTR25J-E03K9 |
| A1R576 | 315-0112-00 | | RES,FXD,CMPNS:1.1K OHM,5%,0.25M | 19701 | 5043CX1K100J |
| A1R577 | 315-0302-00 | | RES,FXD,CMPNS:3K OHM,5%,0.25M | 57668 | NTR25J-E03K0 |
| A1R578 | 315-0510-00 | | RES,FXD,CMPNS:51 OHM,5%,0.25M | 19701 | 5043CX51R00J |
| A1R579 | 315-0122-00 | | RES,FXD,CMPNS:1.2K OHM,5%,0.25M | 57668 | NTR25J-E01K2 |
| A1R706 | 321-0438-00 | | RES,FXD,FILM:357K OHM,1%,0.125M,TC=T0 | 07716 | CEA035702F |
| A1R710 | 311-1232-00 | | RES,VAR,NONNM:TRMR,50K OHM,0.5M | 32997 | 3386F-T04-503 |
| A1R711 | 321-0458-00 | | RES,FXD,FILM:576K OHM,1%,0.125M,TC=T0 | 07716 | CEA057602F |
| A1R712 | 315-0273-00 | | RES,FXD,CMPNS:27K OHM,5%,0.25M | 57668 | NTR25J-E27K0 |
| A1R713 | 315-0273-00 | | RES,FXD,CMPNS:27K OHM,5%,0.25M | 57668 | NTR25J-E27K0 |
| A1R714 | 321-0363-00 | | RES,FXD,FILM:59.0K OHM,1%,0.125M,TC=T0 | 07716 | CEA059001F |
| A1R715 | 311-1232-00 | | RES,VAR,NONNM:TRMR,50K OHM,0.5M | 32997 | 3386F-T04-503 |
| A1R717 | 321-0360-00 | | RES,FXD,FILM:54.9K OHM,1%,0.125M,TC=T0 | 19701 | 5033E054K90F |
| A1R721 | 315-0121-00 | | RES,FXD,CMPNS:120 OHM,5%,0.25M | 19701 | 5043CX120R0J |
| A1R722 | 321-0225-06 | | RES,FXD,FILM:2.15K OHM,0.25%,0.125M,T=T9MI | 07716 | CEA021500C |
| A1R723 | 321-0642-00 | | RES,FXD,FILM:20.3K OHM,0.25%,0.125M,T=T9 | 91637 | MFF1816C20301C |
| A1R724 | 315-0682-00 | | RES,FXD,CMPNS:6.8K OHM,5%,0.25M | 57668 | NTR25J-E06K8 |
| A1R728 | 301-0432-00 | | RES,FXD,CMPNS:4.3K OHM,5%,0.5M | 19701 | 5053CX4K300J |
| A1R729 | 315-0101-00 | | RES,FXD,CMPNS:100 OHM,5%,0.25M | 57668 | NTR25J-E 100E |
| A1R731 | 315-0221-00 | | RES,FXD,CMPNS:220 OHM,5%,0.25M | 57668 | NTR25J-E220E |
| A1R741 | 323-0810-07 | | RES,FXD,FILM:4 MEG OHM,0.1%,0.5M,TC=T9 | 24546 | NE65E40048 |
| A1R742 | 323-0809-07 | | RES,FXD,FILM:2.667MEG OHM,0.1%,0.5M,TC=T9 | 19701 | 5053RE2M667B |
| A1R743 | 323-1500-07 | | RES,FXD,FILM:1.6MEG OHM,0.1%,0.5M,TC=T2 | 24546 | NE65E16048 |
| A1R744 | 323-0620-07 | | RES,FXD,FILM:800K OHM,0.1%,0.5M,TC=T9 | 24546 | NE65E80038 |
| A1R745 | 323-0806-07 | | RES,FXD,FILM:266.7K OHM,0.1%,0.5M,TC=T9 | 24546 | ADVISE |
| A1R746 | 323-1404-07 | | RES,FXD,FILM:160K OHM,0.1%,0.5M,TC=T9 | 24546 | NE65E16038 |
| A1R747 | 323-0805-07 | | RES,FXD,FILM:80.0K OHM,0.1%,0.5M,TC=T9 | 24546 | NE65E80028 |
| A1R748 | 323-0802-07 | | RES,FXD,FILM:26.67K OHM,0.1%,0.5M,TC=T9 | 07716 | CECE266718 |
| A1R749 | 323-1308-07 | | RES,FXD,FILM:16.0K OHM,0.1%,0.5M,TC=T9 | 24546 | NE65E16028 |
| A1R803 | 321-0308-00 | | RES,FXD,FILM:15.8K OHM,1%,0.125M,TC=T0 | 07716 | CEA0 15801F |
| A1R806 | 315-0154-00 | | RES,FXD,CMPNS:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A1R821 | 315-0510-00 | | RES,FXD,CMPNS:51 OHM,5%,0.25M | 19701 | 5043CX51R00J |
| A1R832 | 315-0150-00 | | RES,FXD,CMPNS:15 OHM,5%,0.25M | 19701 | 5043CX15R00J |
| A1R841 | 321-0260-00 | | RES,FXD,FILM:4.99K OHM,1%,0.125M,TC=T0 | 19701 | 5033E04K990F |
| A1R842 | 321-0289-03 | | RES,FXD,FILM:10.0K OHM,0.25%,0.125M,TC=T2 | 07716 | CEAC10001C |
| A1R844 | 315-0241-00 | | RES,FXD,CMPNS:240 OHM,5%,0.25M | 19701 | 5043CX240R0J |
| A1S435 | 260-1771-00 | | SMITCH,PUSH:1 BUTTON,2 POLE,SLOPE | 31918 | ORDER BY DESCR |
| A1T35 | 120-0444-00 | | XFMR,TOROID: | 80009 | 120-0444-00 |
| A1U220 | 155-0049-02 | | MICROCKT,DGTL:SWEEP CONTROL,M/LOCKOUT | 80009 | 155-0049-02 |

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|-----------------------|--|--|--------------|----------------|
| A1U416 | 156-0067-02 | | MICROCKT, LINEAR: OPNL AMPL, SELECTED | 02735 | 85147 |
| A1U722 | 156-1149-00 | | MICROCKT, LINEAR: OPERATIONAL AMP, JFET INPUT | 27014 | LF351N/GLEA134 |
| A1U842 | 156-0067-02 | | MICROCKT, LINEAR: OPNL AMPL, SELECTED | 02735 | 85147 |
| A1VR314 | 152-0168-00 | | SEMICON DVC, DI: ZEN, SI, 12V, 5%, 0.4M, DO-763B | 14552 | T0331689 |
| A1VR728 | 152-0226-00 | | SEMICON DVC, DI: ZEN, SI, 5.1V, 5%, 0.4M, DO-7 | 04713 | SZ12262RL |
| A1N1 | 131-0566-00 | | BUS, COND: DUMMY RES, 0.094 00 X 0.225 L | 24546 | OMA 07 |
| A1N2 | 131-0566-00 | | BUS, COND: DUMMY RES, 0.094 00 X 0.225 L | 24546 | OMA 07 |
| A1N3 | 131-0566-00 | | BUS, COND: DUMMY RES, 0.094 00 X 0.225 L | 24546 | OMA 07 |
| A1N4 | 131-0566-00 | | BUS, COND: DUMMY RES, 0.094 00 X 0.225 L | 24546 | OMA 07 |
| A1N5 | 131-0566-00 | | BUS, COND: DUMMY RES, 0.094 00 X 0.225 L | 24546 | OMA 07 |

Replaceable Electrical Parts - 7B87

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|--------------------|--------------------------------------|--|-----------|------------------|
| A2 | 670-4181-01 | | CIRCUIT 80 ASSY:TRIGGER | 80009 | 670-4181-01 |
| A2C3 | 290-0748-00 | | CAP,FXD,ELCTLT:10UF,+50-10%,25V | 54473 | ECE-BIEV100S |
| A2C5 | 290-0748-00 | | CAP,FXD,ELCTLT:10UF,+50-10%,25V | 54473 | ECE-BIEV100S |
| A2C7 | 290-0748-00 | | CAP,FXD,ELCTLT:10UF,+50-10%,25V | 54473 | ECE-BIEV100S |
| A2C9 | 290-0534-00 | | CAP,FXD,ELCTLT:1UF,20%,35V | 05397 | T368A105M035AZ |
| A2C12 | 281-0661-00 | | CAP,FXD,CER DI:0.8PF,+/-0.1PF,500V | 59660 | 0301-080COK08088 |
| A2C14 | 281-0503-00 | | CAP,FXD,CER DI:8PF,+/-0.5PF,500V | 59660 | 301-000C0H0-8090 |
| A2C15 | 283-0005-00 | | CAP,FXD,CER DI:0.01UF,+100-0%,250V | 04222 | SR303E103ZAA |
| A2C20 | 281-0505-00 | | CAP,FXD,CER DI:12PF,10%,500V | 59660 | 301-000C0G0-120K |
| A2C21 | 283-0299-00 | | CAP,FXD,CER DI:51PF,5%,500V | 51642 | 200-500-NP0-510J |
| A2C22 | 283-0299-00 | | CAP,FXD,CER DI:51PF,5%,500V | 51642 | 200-500-NP0-510J |
| A2C23 | 281-0812-00 | | CAP,FXD,CER DI:1000PF,10%,100V | 04222 | MA101C102KAA |
| A2C30 | 281-0813-00 | | CAP,FXD,CER DI:0.047UF,20%,50V | 05397 | C412C473M5V2CA |
| A2C34 | 281-0525-00 | | CAP,FXD,CER DI:470PF,+/-94PF,500V | 59660 | 301000X5U471M |
| A2C35 | 281-0551-00 | | CAP,FXD,CER DI:390PF,10%,500V | 59660 | 301-000X5P0-391K |
| A2C37 | 281-0773-00 | | CAP,FXD,CER DI:0.01UF,10%,100V | 04222 | MA201C103KAA |
| A2C43 | 283-0203-00 | | CAP,FXD,CER DI:0.47UF,20%,50V | 04222 | SR305SC474MAA |
| A2C46 | 281-0792-00 | | CAP,FXD,CER DI:82PF,10%,100V | 04222 | MA101A820KAA |
| A2C51 | 283-0111-00 | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| A2C52 | 283-0111-00 | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| A2C53 | 283-0773-00 | | CAP,FXD,MICA DI:578 PF,1%,300V | 00853 | D153F5780F0 |
| A2C56 | 283-0341-00 | | CAP,FXD,CER DI:0.047UF,10%,100V | 04222 | 3430100C473K |
| A2C57 | 283-0203-00 | | CAP,FXD,CER DI:0.47UF,20%,50V | 04222 | SR305SC474MAA |
| A2C65 | 283-0005-00 | | CAP,FXD,CER DI:0.01UF,+100-0%,250V | 04222 | SR303E103ZAA |
| A2C66 | 283-0111-00 | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| A2C67 | 281-0773-00 | | CAP,FXD,CER DI:0.01UF,10%,100V | 04222 | MA201C103KAA |
| A2C68 | 283-0195-00 | | CAP,FXD,CER DI:680PF,5%,50V | 04222 | SR205A681JAA |
| A2C69 | 281-0773-00 | | CAP,FXD,CER DI:0.01UF,10%,100V | 04222 | MA201C103KAA |
| A2C71 | 281-0773-00 | | CAP,FXD,CER DI:0.01UF,10%,100V | 04222 | MA201C103KAA |
| A2C72 | 290-0580-00 | | CAP,FXD,ELCTLT:0.27UF,20%,50V | 05397 | T368A274M050AZ |
| A2C73 | 283-0114-00 | | CAP,FXD,CER DI:1500PF,5%,200V | 59660 | 805-534-Y500152J |
| A2C74 | 283-0114-00 | | CAP,FXD,CER DI:1500PF,5%,200V | 59660 | 805-534-Y500152J |
| A2C75 | 281-0773-00 | | CAP,FXD,CER DI:0.01UF,10%,100V | 04222 | MA201C103KAA |
| A2C76 | 290-0580-00 | | CAP,FXD,ELCTLT:0.27UF,20%,50V | 05397 | T368A274M050AZ |
| A2C84 | 281-0773-00 | | CAP,FXD,CER DI:0.01UF,10%,100V | 04222 | MA201C103KAA |
| A2C85 | 283-0111-00 | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| A2C88 | 281-0773-00 | | CAP,FXD,CER DI:0.01UF,10%,100V | 04222 | MA201C103KAA |
| A2C89 | 281-0786-00 | | CAP,FXD,CER DI:150PF,10%,100V | 04222 | MA101A151KAA |
| A2C92 | 281-0773-00 | | CAP,FXD,CER DI:0.01UF,10%,100V | 04222 | MA201C103KAA |
| A2C99 | 281-0786-00 | | CAP,FXD,CER DI:150PF,10%,100V | 04222 | MA101A151KAA |
| A2CR23 | 152-0141-02 | | SEMICON DVC,DI:5M,SI,30V,150MA,30V,00-35 | 03508 | DA2527 (1N4152) |
| A2CR24 | 152-0141-02 | | SEMICON DVC,DI:5M,SI,30V,150MA,30V,00-35 | 03508 | DA2527 (1N4152) |
| A2CR53 | 152-0141-02 | | SEMICON DVC,DI:5M,SI,30V,150MA,30V,00-35 | 03508 | DA2527 (1N4152) |
| A2CR55 | 152-0141-02 | | SEMICON DVC,DI:5M,SI,30V,150MA,30V,00-35 | 03508 | DA2527 (1N4152) |
| A2CR71 | 152-0141-02 | | SEMICON DVC,DI:5M,SI,30V,150MA,30V,00-35 | 03508 | DA2527 (1N4152) |
| A2CR75 | 152-0141-02 | | SEMICON DVC,DI:5M,SI,30V,150MA,30V,00-35 | 03508 | DA2527 (1N4152) |
| A2LR3 | 108-0543-00 | | COIL,RF:FIXED,1.1UH | 80009 | 108-0543-00 |
| A2LR5 | 108-0537-00 | | COIL,RF:FIXED,200UH | 80009 | 108-0537-00 |
| A2LR7 | 108-0543-00 | | COIL,RF:FIXED,1.1UH | 80009 | 108-0543-00 |
| A2LR70 | 108-0328-00 | | COIL,RF:FIXED,0.3UH | 80009 | 108-0328-00 |
| A2LR75 | 108-0328-00 | | COIL,RF:FIXED,0.3UH | 80009 | 108-0328-00 |
| A2Q22 | 151-1042-00 | | SEMICON DVC SE:FET,SI,T0-92 | 04713 | SPF627M2 |
| A2Q48 | 151-0190-00 | | TRANSISTOR:NPN,SI,T0-92 | 80009 | 151-0190-00 |
| A2Q88 | 151-0223-00 | | TRANSISTOR:NPN,SI,T0-92 | 04713 | SPS8026 |
| A2Q92 | 151-0221-00 | | TRANSISTOR:PMP,SI,T0-92 | 04713 | SPS246 |
| A2Q96 | 151-0221-00 | | TRANSISTOR:PMP,SI,T0-92 | 04713 | SPS246 |
| A2Q98 | 151-0342-00 | | TRANSISTOR:PMP,SI,T0-92 | 07263 | S035928 |
| A2R8 | 315-0622-00 | | RES,FXD,CMPSN:6.2K OHM,5%,0.25W | 19701 | 5043CX6K200J |
| A2R9 | 315-0102-00 | | RES,FXD,CMPSN:1K OHM,5%,0.25W | 57668 | NTR25JED1K0 |

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|-----------------------|---|--|--------------|---------------|
| A2R12 | 315-0915-00 | | RES,FXD,CMPSN:9.1M OHM,5%,0.25M | 01121 | C89155 |
| A2R13 | 317-0470-00 | | RES,FXD,CMPSN:47 OHM,5%,0.125M | 01121 | B84705 |
| A2R14 | 315-0105-00 | | RES,FXD,CMPSN:1M OHM,5%,0.25M | 19701 | 5043CX1W000J |
| A2R15 | 315-0824-00 | | RES,FXD,CMPSN:820K OHM,5%,0.25M | 19701 | 5043CX820K0J |
| A2R16 | 315-0274-00 | | RES,FXD,CMPSN:270K OHM,5%,0.25M | 57668 | NTR25J-E270K |
| A2R19 | 315-0274-00 | | RES,FXD,CMPSN:270K OHM,5%,0.25M | 57668 | NTR25J-E270K |
| A2R20 | 315-0103-00 | | RES,FXD,CMPSN:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| A2R21 | 315-0510-00 | | RES,FXD,CMPSN:51 OHM,5%,0.25M | 19701 | 5043CX51R00J |
| A2R22 | 315-0272-00 | | RES,FXD,CMPSN:2.7K OHM,5%,0.25M | 57668 | NTR25J-E02K7 |
| A2R23 | 315-0751-00 | | RES,FXD,CMPSN:750 OHM,5%,0.25M | 57668 | NTR25J-E750E |
| A2R29 | 315-0222-00 | | RES,FXD,CMPSN:2.2K OHM,5%,0.25M | 57668 | NTR25J-E02K2 |
| A2R30 | 315-0104-00 | | RES,FXD,CMPSN:100K OHM,5%,0.25M | 57668 | NTR25J-E100K |
| A2R31 | 315-0202-00 | | RES,FXD,CMPSN:2K OHM,5%,0.25M | 57668 | NTR25J-E 2K |
| A2R32 | 315-0510-00 | | RES,FXD,CMPSN:51 OHM,5%,0.25M | 19701 | 5043CX51R00J |
| A2R33 | 315-0202-00 | | RES,FXD,CMPSN:2K OHM,5%,0.25M | 57668 | NTR25J-E 2K |
| A2R34 | 315-0203-00 | | RES,FXD,CMPSN:20K OHM,5%,0.25M | 57668 | NTR25J-E 20K |
| A2R35 | 315-0203-00 | | RES,FXD,CMPSN:20K OHM,5%,0.25M | 57668 | NTR25J-E 20K |
| A2R36 | 315-0203-00 | | RES,FXD,CMPSN:20K OHM,5%,0.25M | 57668 | NTR25J-E 20K |
| A2R37 | 315-0560-00 | | RES,FXD,CMPSN:56 OHM,5%,0.25M | 57668 | NTR25J-E56E0 |
| A2R38 | 317-0101-00 | | RES,FXD,CMPSN:100 OHM,5%,0.125M | 01121 | B81015 |
| A2R41 | 315-0102-00 | | RES,FXD,CMPSN:1K OHM,5%,0.25M | 57668 | NTR25J-E01K0 |
| A2R42 | 315-0473-00 | | RES,FXD,CMPSN:47K OHM,5%,0.25M | 57668 | NTR25J-E47K0 |
| A2R43 | 315-0752-00 | | RES,FXD,CMPSN:7.5K OHM,5%,0.25M | 57668 | NTR25J-E07K5 |
| A2R44 | 315-0103-00 | | RES,FXD,CMPSN:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| A2R45 | 315-0102-00 | | RES,FXD,CMPSN:1K OHM,5%,0.25M | 57668 | NTR25J-E01K0 |
| A2R47 | 315-0101-00 | | RES,FXD,CMPSN:100 OHM,5%,0.25M | 57668 | NTR25J-E 100E |
| A2R48 | 315-0682-00 | | RES,FXD,CMPSN:6.8K OHM,5%,0.25M | 57668 | NTR25J-E06K8 |
| A2R49 | 311-1564-00 | | RES,VAR,NONNM:TRMR,500 OHM,0.5M | 32997 | 3352T-CK5-501 |
| A2R50 | 315-0133-00 | | RES,FXD,CMPSN:13K OHM,5%,0.25M | 19701 | 5043CX13K00J |
| A2R51 | 321-0274-00 | | RES,FXD,FILM:6.98K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED6K980F |
| A2R52 | 321-0431-00 | | RES,FXD,FILM:301K OHM,1%,0.125M,TC=T0 | 07716 | CEA030102F |
| A2R53 | 315-0124-00 | | RES,FXD,CMPSN:120K OHM,5%,0.25M | 19701 | 5043CX120K0J |
| A2R54 | 315-0622-00 | | RES,FXD,CMPSN:6.2K OHM,5%,0.25M | 19701 | 5043CX6K200J |
| A2R55 | 315-0202-00 | | RES,FXD,CMPSN:2K OHM,5%,0.25M | 57668 | NTR25J-E 2K |
| A2R56 | 315-0104-00 | | RES,FXD,CMPSN:100K OHM,5%,0.25M | 57668 | NTR25J-E100K |
| A2R57 | 315-0104-00 | | RES,FXD,CMPSN:100K OHM,5%,0.25M | 57668 | NTR25J-E100K |
| A2R58 | 321-0443-00 | | RES,FXD,FILM:402K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED402K0F |
| A2R59 | 321-0443-00 | | RES,FXD,FILM:402K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED402K0F |
| A2R61 | 315-0203-00 | | RES,FXD,CMPSN:20K OHM,5%,0.25M | 57668 | NTR25J-E 20K |
| A2R62 | 315-0512-00 | | RES,FXD,CMPSN:5.1K OHM,5%,0.25M | 57668 | NTR25J-E05K1 |
| A2R63 | 315-0152-00 | | RES,FXD,CMPSN:1.5K OHM,5%,0.25M | 57668 | NTR25J-E01K5 |
| A2R64 | 315-0123-00 | | RES,FXD,CMPSN:12K OHM,5%,0.25M | 57668 | NTR25J-E12K0 |
| A2R65 | 315-0511-00 | | RES,FXD,CMPSN:510 OHM,5%,0.25M | 19701 | 5043CX510R0J |
| A2R67 | 323-0155-00 | | RES,FXD,FILM:402 OHM,1%,0.5M,TC=T0 | 75042 | CECT0-4020F |
| A2R68 | 315-0162-00 | | RES,FXD,CMPSN:1.6K OHM,5%,0.25M | 19701 | 5043CX1K600J |
| A2R69 | 315-0820-00 | | RES,FXD,CMPSN:82 OHM,5%,0.25M | 57668 | NTR25J-E82E0 |
| A2R72 | 315-0205-00 | | RES,FXD,CMPSN:2M OHM,5%,0.25M | 01121 | C82055 |
| A2R73 | 315-0514-00 | | RES,FXD,CMPSN:510K OHM,5%,0.25M | 19701 | 5043CX510K0J |
| A2R74 | 315-0514-00 | | RES,FXD,CMPSN:510K OHM,5%,0.25M | 19701 | 5043CX510K0J |
| A2R76 | 315-0205-00 | | RES,FXD,CMPSN:2M OHM,5%,0.25M | 01121 | C82055 |
| A2R80 | 311-1228-00 | | RES,VAR,NONNM:TRMR,10K OHM,0.5M | 32997 | 3386F-T04-103 |
| A2R83 | 315-0470-00 | | RES,FXD,CMPSN:47 OHM,5%,0.25M | 57668 | NTR25J-E47E0 |
| A2R84 | 315-0680-00 | | RES,FXD,CMPSN:68 OHM,5%,0.25M | 57668 | NTR25J-E68E0 |
| A2R85 | 311-1594-00 | | RES,VAR,NONNM:TRMR,10 OHM,0.5M | 32997 | 3352T-1-100 |
| A2R86 | 315-0470-00 | | RES,FXD,CMPSN:47 OHM,5%,0.25M | 57668 | NTR25J-E47E0 |
| A2R89 | 315-0103-00 | | RES,FXD,CMPSN:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| A2R90 | 315-0102-00 | | RES,FXD,CMPSN:1K OHM,5%,0.25M | 57668 | NTR25J-E01K0 |
| A2R91 | 315-0470-00 | | RES,FXD,CMPSN:47 OHM,5%,0.25M | 57668 | NTR25J-E47E0 |
| A2R92 | 315-0102-00 | | RES,FXD,CMPSN:1K OHM,5%,0.25M | 57668 | NTR25J-E01K0 |

Replaceable Electrical Parts - 7B87

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|-----------------------|--|---|--------------|------------------|
| A2R93 | 321-0260-00 | | RES,FXD,FILM:4.99K OHM,1%,0.125W,TC=TO | 19701 | 5033ED4K990F |
| A2R94 | 321-0202-00 | | RES,FXD,FILM:1.24K OHM,1%,0.125W,TC=TO | 24546 | NA5501241F |
| A2R95 | 315-0470-00 | | RES,FXD,CMPSN:47 OHM,5%,0.25W | 57668 | NTR25J-E47E0 |
| A2R96 | 315-0470-00 | | RES,FXD,CMPSN:47 OHM,5%,0.25W | 57668 | NTR25J-E47E0 |
| A2R97 | 315-0221-00 | | RES,FXD,CMPSN:220 OHM,5%,0.25W | 57668 | NTR25J-E220E |
| A2S10 | 263-0010-01 | | SMITCH PB ASSY:1 PUSH,7.5 MM,1 CONTACT | 80009 | 263-0010-01 |
| A2S20 | 263-0016-00 | | SMITCH PB ASSY:4 LATCHING,7.5 MM,5 CONTACT SAFETY CONTROLLED | 80009 | 263-0016-00 |
| A2S50 | 263-0015-00 | | SMITCH PB ASSY:3 LATCHING,7.5 MM | 80009 | 263-0015-00 |
| A2U35 | 156-0067-02 | | MICROCKT,LINEAR:OPNL AMPL,SELECTED | 02735 | 85147 |
| A2U55 | 156-0158-00 | | MICROCKT,LINEAR:DUAL OPNL AMPL | 04713 | MC1458P1/MC1458U |
| A2U65 | 155-0126-00 | | MICROCKT,LINEAR:TRIGGER AMPLIFIER | 80009 | 155-0126-00 |
| A2U75 | 156-0158-00 | | MICROCKT,LINEAR:DUAL OPNL AMPL | 04713 | MC1458P1/MC1458U |
| A2U85 | 155-0109-01 | | MICROCKT,LINEAR:MONOLITHIC TRIG | 80009 | 155-0109-01 |

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective Dscont. | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|-----------------------|--|--|--------------|-----------------|
| A3 | 670-4183-00 | | CIRCUIT BD ASSY:READOUT | 80009 | 670-4183-00 |
| A3CR725 | 152-0141-02 | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A3CR751 | 152-0141-02 | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A3CR752 | 152-0141-02 | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A3CR753 | 152-0141-02 | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A3CR754 | 152-0141-02 | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A3CR763 | 152-0141-02 | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A3CR772 | 152-0141-02 | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A3CR773 | 152-0141-02 | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A3CR782 | 152-0141-02 | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A3CR783 | 152-0141-02 | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A3CR785 | 152-0141-02 | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A3CR786 | 152-0141-02 | | SEMICON DVC,DI:SM,SI,30V,150MA,30V,DO-35 | 03508 | DA2527 (1N4152) |
| A3R751 | 315-0154-00 | | RES,FXD,CMPSN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A3R752 | 315-0154-00 | | RES,FXD,CMPSN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A3R753 | 315-0154-00 | | RES,FXD,CMPSN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A3R754 | 315-0154-00 | | RES,FXD,CMPSN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A3R755 | 321-0344-00 | | RES,FXD,FILM:37.4K OHM,1%,0.125M,TC=TO | 19701 | 5033ED 37K40F |
| A3R756 | 315-0753-00 | | RES,FXD,CMPSN:75K OHM,5%,0.25M | 57668 | NTR25J-E75K0 |
| A3R757 | 321-0327-00 | | RES,FXD,FILM:24.9K OHM,1%,0.125M,TC=TO | 07716 | CEAD24901F |
| A3R761 | 315-0154-00 | | RES,FXD,CMPSN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A3R762 | 315-0154-00 | | RES,FXD,CMPSN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A3R763 | 315-0133-00 | | RES,FXD,CMPSN:13K OHM,5%,0.25M | 19701 | 5043CX13K00J |
| A3R764 | 315-0133-00 | | RES,FXD,CMPSN:13K OHM,5%,0.25M | 19701 | 5043CX13K00J |
| A3R771 | 315-0753-00 | | RES,FXD,CMPSN:75K OHM,5%,0.25M | 57668 | NTR25J-E75K0 |
| A3R772 | 321-0356-00 | | RES,FXD,FILM:49.9K OHM,1%,0.125M,TC=TO | 19701 | 5033ED49K90F |
| A3R773 | 315-0154-00 | | RES,FXD,CMPSN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A3R779 | 315-0151-00 | | RES,FXD,CMPSN:150 OHM,5%,0.25M | 57668 | NTR25J-E150E |
| A3R781 | 315-0154-00 | | RES,FXD,CMPSN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A3R782 | 315-0753-00 | | RES,FXD,CMPSN:75K OHM,5%,0.25M | 57668 | NTR25J-E75K0 |
| A3R783 | 315-0154-00 | | RES,FXD,CMPSN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A3R784 | 321-0356-00 | | RES,FXD,FILM:49.9K OHM,1%,0.125M,TC=TO | 19701 | 5033ED49K90F |
| A3R785 | 315-0154-00 | | RES,FXD,CMPSN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A3R786 | 315-0753-00 | | RES,FXD,CMPSN:75K OHM,5%,0.25M | 57668 | NTR25J-E75K0 |
| A3R787 | 321-0356-00 | | RES,FXD,FILM:49.9K OHM,1%,0.125M,TC=TO | 19701 | 5033ED49K90F |
| A3R791 | 321-0344-00 | | RES,FXD,FILM:37.4K OHM,1%,0.125M,TC=TO | 19701 | 5033ED 37K40F |
| A3R792 | 315-0154-00 | | RES,FXD,CMPSN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A3R793 | 321-0344-00 | | RES,FXD,FILM:37.4K OHM,1%,0.125M,TC=TO | 19701 | 5033ED 37K40F |
| A3R794 | 315-0154-00 | | RES,FXD,CMPSN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |

Replaceable Electrical Parts - 7B87

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective | Discont | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|--------------------|-------------------------------|---------|---|-----------|-----------------|
| A4 | 670-6184-00 | 8010100 | 8023314 | CIRCUIT 80 ASSY:CLOCK | 80009 | 670-6184-00 |
| A4 | 670-6184-01 | 8023315 | | CIRCUIT 80 ASSY:CLOCK | 80009 | 670-6184-01 |
| A4C535 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4C536 | 283-0211-00 | | | CAP,FXD,CER DI:0.1UF,10%,200V | 04222 | SR406C104KAA |
| A4C540 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4C541 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4C547 | 285-0809-00 | | | CAP,FXD,PLASTIC:1UF,10%,50V | 56289 | LP66A1A105K |
| A4C552 | 281-0762-00 | 8010100 | 8023314 | CAP,FXD,CER DI:27PF,20%,100V | 04222 | MA101A270MAA |
| A4C556 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4C559 | 281-0773-00 | | | CAP,FXD,CER DI:0.01UF,10%,100V | 04222 | MA201C103KAA |
| A4C583 | 283-0691-00 | | | CAP,FXD,MICA DI:650PF,1%,300V | 00853 | 0153F651FD |
| A4C622 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4C625 | 281-0775-00 | 8010121 | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4C626 | 281-0811-00 | 8010100 | 8010120 | CAP,FXD,CER DI:10PF,10%,100V | 04222 | MA101A100KAA |
| A4C627 | 281-0762-00 | 8010100 | 8010120 | CAP,FXD,CER DI:27PF,20%,100V | 04222 | MA101A270MAA |
| A4C631 | 290-0748-00 | | | CAP,FXD,ELCTLT:10UF,+50-10%,25V | 54473 | ECE-8IEV100S |
| A4C632 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4C633 | 290-0748-00 | | | CAP,FXD,ELCTLT:10UF,+50-10%,25V | 54473 | ECE-8IEV100S |
| A4C634 | 290-0748-00 | | | CAP,FXD,ELCTLT:10UF,+50-10%,25V | 54473 | ECE-8IEV100S |
| A4C641 | 281-0770-00 | | | CAP,FXD,CER DI:1000PF,20%,100V | 04222 | MA101C102MAA |
| A4C642 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4C643 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4C655 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4C660 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4C661 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4C663 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4C668 | 281-0775-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 04222 | MA205E104MAA |
| A4CR544 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A4CR547 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A4CR552 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A4CR554 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A4CR555 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A4CR640 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A4CR641 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A4CR677 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A4CR678 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A4CR679 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A4CR680 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A4CR691 | 152-0322-00 | | | SEMICONO DVC,DI:SCHOTTKY BARRIER,SI,15V | 21847 | A2X600 |
| A4CR695 | 152-0141-02 | | | SEMICONO DVC,DI:SM,SI,30V,150MA,30V,00-35 | 03508 | 0A2527 (1N4152) |
| A4L631 | 108-0543-00 | | | COIL,RF:FIXED,1.1UH | 80009 | 108-0543-00 |
| A4L632 | 108-0537-00 | | | COIL,RF:FIXED,200UH | 80009 | 108-0537-00 |
| A4L634 | 108-0543-00 | | | COIL,RF:FIXED,1.1UH | 80009 | 108-0543-00 |
| A4LR626 | 108-0797-00 | 8010121 | | COIL,RF:FIXED,2.45UH | 80009 | 108-0797-00 |
| A4Q531 | 151-0410-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS6765 |
| A4Q545 | 151-0410-00 | | | TRANSISTOR:PMP,SI,TO-92 | 04713 | SPS6765 |
| A4Q552 | 151-0301-00 | | | TRANSISTOR:PMP,SI,TO-18 | 04713 | ST898 |
| A4Q607 | 151-0190-00 | | | TRANSISTOR:NPN,SI,TO-92 | 80009 | 151-0190-00 |
| A4Q642 | 151-1042-00 | | | SEMICONO DVC SE:FET,SI,TO-92 | 04713 | SPF627M2 |
| A4Q643 | ----- | | | (PART OF Q642) | | |
| A4Q663 | 151-0192-00 | | | TRANSISTOR:SELECTED | 04713 | SPS8801 |
| A4Q667 | 151-0192-00 | | | TRANSISTOR:SELECTED | 04713 | SPS8801 |
| A4Q671 | 151-0192-00 | | | TRANSISTOR:SELECTED | 04713 | SPS8801 |
| A4Q678 | 151-0192-00 | | | TRANSISTOR:SELECTED | 04713 | SPS8801 |
| A4Q680 | 151-0192-00 | | | TRANSISTOR:SELECTED | 04713 | SPS8801 |
| A4Q681 | 151-0192-00 | | | TRANSISTOR:SELECTED | 04713 | SPS8801 |
| A4Q687 | 151-0188-00 | | | TRANSISTOR:PMP,SI,TO-92 | 80009 | 151-0188-00 |
| A4Q691 | 151-0192-00 | | | TRANSISTOR:SELECTED | 04713 | SPS8801 |
| A4Q695 | 151-0192-00 | | | TRANSISTOR:SELECTED | 04713 | SPS8801 |

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective | Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|--------------------|-------------------------------|---------|--|-----------|------------------|
| A4R523 | 315-0101-00 | | | RES,FXD,CMPN:100 OHM,5%,0.25M | 57668 | NTR25J-E 100E |
| A4R529 | 315-0102-00 | | | RES,FXD,CMPN:1K OHM,5%,0.25M | 57668 | NTR25JE01K0 |
| A4R530 | 311-1560-00 | | | RES,VAR,NONW:TRMR,5K OHM,0.5M | 32997 | 3352T-1-502 |
| A4R531 | 321-0340-00 | | | RES,FXD,FILM:34.0K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED34K00F |
| A4R532 | 315-0511-00 | | | RES,FXD,CMPN:510 OHM,5%,0.25M | 19701 | 5043CX510R0J |
| A4R533 | 315-0512-00 | | | RES,FXD,CMPN:5.1K OHM,5%,0.25M | 57668 | NTR25J-E05K1 |
| A4R536 | 315-0101-00 | | | RES,FXD,CMPN:100 OHM,5%,0.25M | 57668 | NTR25J-E 100E |
| A4R537 | 321-0360-00 | | | RES,FXD,FILM:54.9K OHM,1%,0.125M,TC=T0 | 19701 | 5033ED54K90F |
| A4R538 | 311-1336-00 | | | RES,VAR,NONW:TRMR,100K OHM,0.5M | 02111 | 43P104T672 |
| A4R539 | 321-0995-00 | | | RES,FXD,FILM:549K OHM,1%,0.125M,TC=T0 | 24546 | NA5505493F |
| A4R540 | 315-0100-00 | | | RES,FXD,CMPN:10 OHM,5%,0.25M | 19701 | 5043CX10RR00J |
| A4R541 | 315-0100-00 | | | RES,FXD,CMPN:10 OHM,5%,0.25M | 19701 | 5043CX10RR00J |
| A4R544 | 321-0820-06 | | | RES,FXD,FILM:42K OHM,0.25%,0.125M,TC=T9 | 19701 | 5033RE42K00C |
| A4R545 | 321-0259-00 | | | RES,FXD,FILM:4.87K OHM,1%,0.125M,TC=T0 | 07716 | CEAD48700F |
| A4R546 | 321-0289-00 | | | RES,FXD,FILM:10.0K OHM,1%,0.125M,TC=T0 | 19701 | 5033ED10K0F |
| A4R547 | 321-0289-00 | | | RES,FXD,FILM:10.0K OHM,1%,0.125M,TC=T0 | 19701 | 5033ED10K0F |
| A4R548 | 315-0513-00 | | | RES,FXD,CMPN:51K OHM,5%,0.25M | 57668 | NTR25J-E51K0 |
| A4R549 | 315-0101-00 | | | RES,FXD,CMPN:100 OHM,5%,0.25M | 57668 | NTR25J-E 100E |
| A4R550 | 311-1230-00 | | | RES,VAR,NONW:TRMR,20K OHM,0.5M | 32997 | 3386F-T04-203 |
| A4R551 | 315-0104-00 | 8010100 | 8023314 | RES,FXD,CMPN:100K OHM,5%,0.25M | 57668 | NTR25J-E100K |
| A4R551 | 315-0823-00 | 8023315 | | RES,FXD,CMPN:82K OHM,5%,0.25M | 57668 | NTR25J-E82K |
| A4R552 | 315-0182-00 | | | RES,FXD,CMPN:1.8K OHM,5%,0.25M | 57668 | NTR25J-E1K8 |
| A4R553 | 315-0391-00 | | | RES,FXD,CMPN:390 OHM,5%,0.25M | 57668 | NTR25J-E390E |
| A4R554 | 315-0392-00 | | | RES,FXD,CMPN:3.9K OHM,5%,0.25M | 57668 | NTR25J-E03K9 |
| A4R555 | 315-0222-00 | | | RES,FXD,CMPN:2.2K OHM,5%,0.25M | 57668 | NTR25J-E02K2 |
| A4R556 | 315-0563-00 | | | RES,FXD,CMPN:56K OHM,5%,0.25M | 19701 | 5043CX56K00J |
| A4R557 | 315-0103-00 | | | RES,FXD,CMPN:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| A4R558 | 315-0331-00 | | | RES,FXD,CMPN:330 OHM,5%,0.25M | 57668 | NTR25J-E330E |
| A4R559 | 321-1651-04 | | | RES,FXD,FILM:37.5K OHM,0.1%,0.125M,TC=T2 | 91637 | MFF1816037501B |
| A4R581 | 315-0202-00 | | | RES,FXD,CMPN:2K OHM,5%,0.25M | 57668 | NTR25J-E 2K |
| A4R582 | 315-0332-00 | | | RES,FXD,CMPN:3.3K OHM,5%,0.25M | 57668 | NTR25J-E03K3 |
| A4R591 | 315-0101-00 | | | RES,FXD,CMPN:100 OHM,5%,0.25M | 57668 | NTR25J-E 100E |
| A4R606 | 307-0542-00 | | | RES,NTMK,FXD,FI:(5)10K OHM,5%,0.125M | 01121 | 106A1030R706A103 |
| A4R607 | 315-0103-00 | | | RES,FXD,CMPN:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| A4R608 | 315-0512-00 | | | RES,FXD,CMPN:5.1K OHM,5%,0.25M | 57668 | NTR25J-E05K1 |
| A4R611 | 315-0102-00 | | | RES,FXD,CMPN:1K OHM,5%,0.25M | 57668 | NTR25JE01K0 |
| A4R621 | 315-0473-00 | | | RES,FXD,CMPN:47K OHM,5%,0.25M | 57668 | NTR25J-E47K0 |
| A4R622 | 315-0203-00 | | | RES,FXD,CMPN:20K OHM,5%,0.25M | 57668 | NTR25J-E 20K |
| A4R623 | 315-0473-00 | | | RES,FXD,CMPN:47K OHM,5%,0.25M | 57668 | NTR25J-E47K0 |
| A4R624 | 315-0203-00 | | | RES,FXD,CMPN:20K OHM,5%,0.25M | 57668 | NTR25J-E 20K |
| A4R626 | 315-0751-00 | | | RES,FXD,CMPN:750 OHM,5%,0.25M | 57668 | NTR25J-E750E |
| A4R627 | 315-0751-00 | | | RES,FXD,CMPN:750 OHM,5%,0.25M | 57668 | NTR25J-E750E |
| A4R640 | 315-0104-00 | | | RES,FXD,CMPN:100K OHM,5%,0.25M | 57668 | NTR25J-E100K |
| A4R641 | 315-0104-00 | | | RES,FXD,CMPN:100K OHM,5%,0.25M | 57668 | NTR25J-E100K |
| A4R642 | 315-0100-00 | | | RES,FXD,CMPN:10 OHM,5%,0.25M | 19701 | 5043CX10RR00J |
| A4R643 | 315-0100-00 | | | RES,FXD,CMPN:10 OHM,5%,0.25M | 19701 | 5043CX10RR00J |
| A4R644 | 315-0103-00 | | | RES,FXD,CMPN:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| A4R645 | 315-0154-00 | | | RES,FXD,CMPN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A4R646 | 315-0103-00 | | | RES,FXD,CMPN:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| A4R647 | 315-0753-00 | | | RES,FXD,CMPN:75K OHM,5%,0.25M | 57668 | NTR25J-E75K0 |
| A4R648 | 315-0820-00 | | | RES,FXD,CMPN:82 OHM,5%,0.25M | 57668 | NTR25J-E82E0 |
| A4R649 | 315-0201-00 | | | RES,FXD,CMPN:200 OHM,5%,0.25M | 57668 | NTR25J-E200E |
| A4R660 | 315-0471-00 | | | RES,FXD,CMPN:470 OHM,5%,0.25M | 57668 | NTR25J-E470E |
| A4R663 | 315-0510-00 | | | RES,FXD,CMPN:51 OHM,5%,0.25M | 19701 | 5043CX51R00J |
| A4R664 | 321-0169-00 | | | RES,FXD,FILM:562 OHM,1%,0.125M,TC=T0 | 07716 | CEAD562R0F |
| A4R667 | 321-0239-00 | | | RES,FXD,FILM:3.01K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED3K010F |
| A4R668 | 321-0237-00 | | | RES,FXD,FILM:2.87K OHM,1%,0.125M,TC=T0 | 07716 | CEAD 28700F |
| A4R669 | 321-0218-00 | | | RES,FXD,FILM:1.82K OHM,1%,0.125M,TC=T0 | 19701 | 5033ED1K82F |
| A4R671 | 315-0510-00 | | | RES,FXD,CMPN:51 OHM,5%,0.25M | 19701 | 5043CX51R00J |

Replaceable Electrical Parts - 7B87

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective | Discont | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|--------------------|-------------------------------|---------|---|-----------|------------------|
| A4R672 | 301-0102-00 | | | RES,FXD,CMPSN:1K OHM,5%,0.50M | 01121 | EB1025 |
| A4R673 | 315-0510-00 | | | RES,FXD,CMPSN:51 OHM,5%,0.25M | 19701 | 5043CX51R00J |
| A4R677 | 315-0102-00 | | | RES,FXD,CMPSN:1K OHM,5%,0.25M | 57668 | NTR25JE01K0 |
| A4R678 | 315-0202-00 | | | RES,FXD,CMPSN:2K OHM,5%,0.25M | 57668 | NTR25J-E 2K |
| A4R680 | 315-0103-00 | | | RES,FXD,CMPSN:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| A4R681 | 315-0153-00 | | | RES,FXD,CMPSN:15K OHM,5%,0.25M | 19701 | 5043CX15K00J |
| A4R682 | 315-0302-00 | | | RES,FXD,CMPSN:3K OHM,5%,0.25M | 57668 | NTR25J-E03K0 |
| A4R683 | 315-0302-00 | | | RES,FXD,CMPSN:3K OHM,5%,0.25M | 57668 | NTR25J-E03K0 |
| A4R684 | 315-0102-00 | | | RES,FXD,CMPSN:1K OHM,5%,0.25M | 57668 | NTR25JE01K0 |
| A4R687 | 315-0162-00 | | | RES,FXD,CMPSN:1.6K OHM,5%,0.25M | 19701 | 5043CX1K600J |
| A4R688 | 315-0203-00 | | | RES,FXD,CMPSN:20K OHM,5%,0.25M | 57668 | NTR25J-E 20K |
| A4R689 | 315-0154-00 | | | RES,FXD,CMPSN:150K OHM,5%,0.25M | 57668 | NTR25J-E150K |
| A4R692 | 315-0104-00 | | | RES,FXD,CMPSN:100K OHM,5%,0.25M | 57668 | NTR25J-E100K |
| A4R694 | 315-0102-00 | | | RES,FXD,CMPSN:1K OHM,5%,0.25M | 57668 | NTR25JE01K0 |
| A4R695 | 315-0103-00 | | | RES,FXD,CMPSN:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| A4S645 | 263-0015-02 | | | SWITCH PB ASSY:3 LCH,7.5MM,6 CONTACTS | 80009 | 263-0015-02 |
| A4U535 | 156-0158-00 | | | MICROCKT,LINEAR:DUAL OPNL AMPL | 04713 | MC1458P1/MC1458U |
| A4U545 | 156-1149-01 | | | MICROCKT,LINEAR:OPERATION AMP JFET INPUT | 27014 | AL160307 |
| A4U547 | 156-0105-02 | 8010100 | 8023314 | MICROCKT,LINEAR:OPNL AMPL,SELECTED | 01295 | LM301AJG4 |
| A4U547 | 156-1149-01 | 8023315 | | MICROCKT,LINEAR:OPERATION AMP JFET INPUT | 27014 | AL160307 |
| A4U556 | 156-0382-02 | | | MICROCKT,DGTL:QUAD 2 INP NAND GATE BURN | 18324 | N74LS00NB |
| A4U590 | 155-0185-00 | | | MICROCKT,INTFC:ML 4 DECADE DGTL VOLTMETER | 80009 | 155-0185-00 |
| A4U621 | 156-0180-04 | | | MICROCKT,DGTL:QUAD 2 INP NAND GATE, | 18324 | N74S00(NB OR FB) |
| A4U622 | 156-0382-02 | | | MICROCKT,DGTL:QUAD 2 INP NAND GATE BURN | 18324 | N74LS00NB |
| A4U623 | 156-0721-02 | | | MICROCKT,DGTL:QUAD ST 2-INP NAND GATES,SCRN | 01295 | SN74LS132NP3 |
| A4U635 | 156-0646-02 | | | MICROCKT,DGTL:4-BIT BINARY CNTR,SCRN | 04713 | SN74LS93NDS |
| A4U636 | 156-0656-02 | | | MICROCKT,DGTL:DECADE COUNTER,SCRN | 01295 | SN74LS90NP3 |
| A4U637 | 156-0994-00 | | | MICROCKT,DGTL:8 INPUT DATA SEL/MUX | 04713 | 74LS151(N OR J) |
| A4U638 | 156-0994-00 | | | MICROCKT,DGTL:8 INPUT DATA SEL/MUX | 04713 | 74LS151(N OR J) |
| A4U651 | 156-0910-02 | | | MICROCKT,DGTL:DUAL DECADE COUNTER,SCRN | 01295 | SN74LS390N3 |
| A4U652 | 156-0910-02 | | | MICROCKT,DGTL:DUAL DECADE COUNTER,SCRN | 01295 | SN74LS390N3 |
| A4U653 | 156-0910-02 | | | MICROCKT,DGTL:DUAL DECADE COUNTER,SCRN | 01295 | SN74LS390N3 |
| A4U654 | 156-0910-02 | | | MICROCKT,DGTL:DUAL DECADE COUNTER,SCRN | 01295 | SN74LS390N3 |
| A4U655 | 156-0994-00 | | | MICROCKT,DGTL:8 INPUT DATA SEL/MUX | 04713 | 74LS151(N OR J) |
| A4U660 | 156-0299-02 | | | MICROCKT,DGTL:TTL,16-BIT DATA SELECTOR | 18324 | N74150(NB OR FB) |
| A4VR552 | 152-0217-00 | | | SEMICOND DVC,01:ZEN,SI,8.2V,5%,0.4M,00-7 | 04713 | SZG20 |
| A4W627 | 131-0566-00 | 8010121 | | BUS,COND:DUMMY RES,0.094 OHM X 0.225 L | 24546 | OWA 07 |
| A4Y626 | 158-0203-00 | | | XTAL UNIT,QTZ:20.48MHZ,0.01%,SERIES | 14301 | X#1943 |

| Component No. | Tektronix Part No. | Serial/Assembly No. Effective Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---------------|-----------------------|---|--|--------------|----------------|
| C211 | 283-0672-00 | | CAP,FXD,MICA D1:200PF,1%,500V | 00853 | D155F2010F0 |
| C215 | 290-0523-00 | | CAP,FXD,ELCTLT:2.2UF,20%,20V | 05397 | T368A225M020AS |
| C330 | 281-0166-00 | | CAP,VAR,AIR D1:1.9-15.7 PF,250V | 74970 | 187-0109-055 |
| C331 | 283-0633-00 | | CAP,FXD,MICA D1:77PF,1%,100V | 00853 | D155E770F0 |
| C332 | 295-0172-00 | | CAP SET,MATCHED:0.1UF,10UF,898PF,MATCHED | 80009 | 295-0172-00 |
| C334 | 295-0172-00 | | CAP SET,MATCHED:0.1UF,10UF,898PF,MATCHED | 80009 | 295-0172-00 |
| C336 | ----- | | (PART OF C332) | | |
| DS220 | 150-1029-00 | | LT EMITTING D10:GREEN,565MM,35MA | 58361 | Q6480/MV5274C |
| DS232 | 150-1033-00 | | LT EMITTING D10:AMBER,585MM,40MA MAX | 50434 | HLMP 1401 |
| DS810 | 150-0048-01 | | LAMP,INCAND:5V,0.06A,#683,AGED & SEL | 58854 | 683A515 |
| DS820 | 150-0048-01 | | LAMP,INCAND:5V,0.06A,#683,AGED & SEL | 58854 | 683A515 |
| J2 | 131-1315-01 | | CONN,RCPT,ELEC:BNC,FEMALE | 80009 | 131-1315-01 |
| J640 | 131-1315-01 | | CONN,RCPT,ELEC:BNC,FEMALE | 80009 | 131-1315-01 |
| L326 | 108-0271-00 | | COIL,RF:FIXED,235NH | 80009 | 108-0271-00 |
| Q732 | 151-0410-00 | | TRANSISTOR:PNP,SI,T0-92 | 04713 | SP56765 |
| R60 | 311-1192-00 | | RES,VAR,NONWH:PNL,10K OHM,1M,M/5M | 12697 | 381-CH39695 |
| R210 | 311-0467-00 | | RES,VAR,NONWH:PNL,100K OHM,0.5M | 01121 | N77058 |
| R330 | 315-0330-00 | | RES,FXD,CMPSN:33 OHM,5%,0.25M | 19701 | 5043CX33R00J |
| R331 | 315-0330-00 | | RES,FXD,CMPSN:33 OHM,5%,0.25M | 19701 | 5043CX33R00J |
| R332 | 315-0560-00 | | RES,FXD,CMPSN:56 OHM,5%,0.25M | 57668 | NTR25J-E56E0 |
| R410 | 311-1781-00 | | RES,VAR,NONWH:PNL,10K OHM,10%,0.5M | 12697 | 388CM40913 |
| R534 | 321-0193-00 | | RES,FXD,FILM:1K OHM,1%,0.125M,TC=TO | 19701 | 5033ED1K00F |
| R535 | 311-1889-00 | | RES,VAR,NH:PNL,50K OHM,2M | 32997 | 35415-458-503 |
| R705 | 311-0467-00 | | RES,VAR,NONWH:PNL,100K OHM,0.5M | 01121 | N77058 |
| R725 | 311-1590-00 | | RES,VAR,NONWH:PNL,10K OHM,1M,COMPOSITION | 12697 | CM40256 |
| R732 | 315-0104-00 | | RES,FXD,CMPSN:100K OHM,5%,0.25M | 57668 | NTR25J-E100K |
| S60 | ----- | | (PART OF R60) | | |
| S230 | 263-0016-01 | | SWITCH PB ASSY:3 LCH & 1 CANC,7.5MM,5 CONT | 80009 | 263-0016-01 |
| S725 | 214-1136-00 | | ACTUATOR,SL SM:VARIABLE CAL | 80009 | 214-1136-00 |
| S800 | 263-1181-00 | | SM CAM ACTR AS:TIME/CM | 80009 | 263-1181-00 |

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 (μ F).
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.

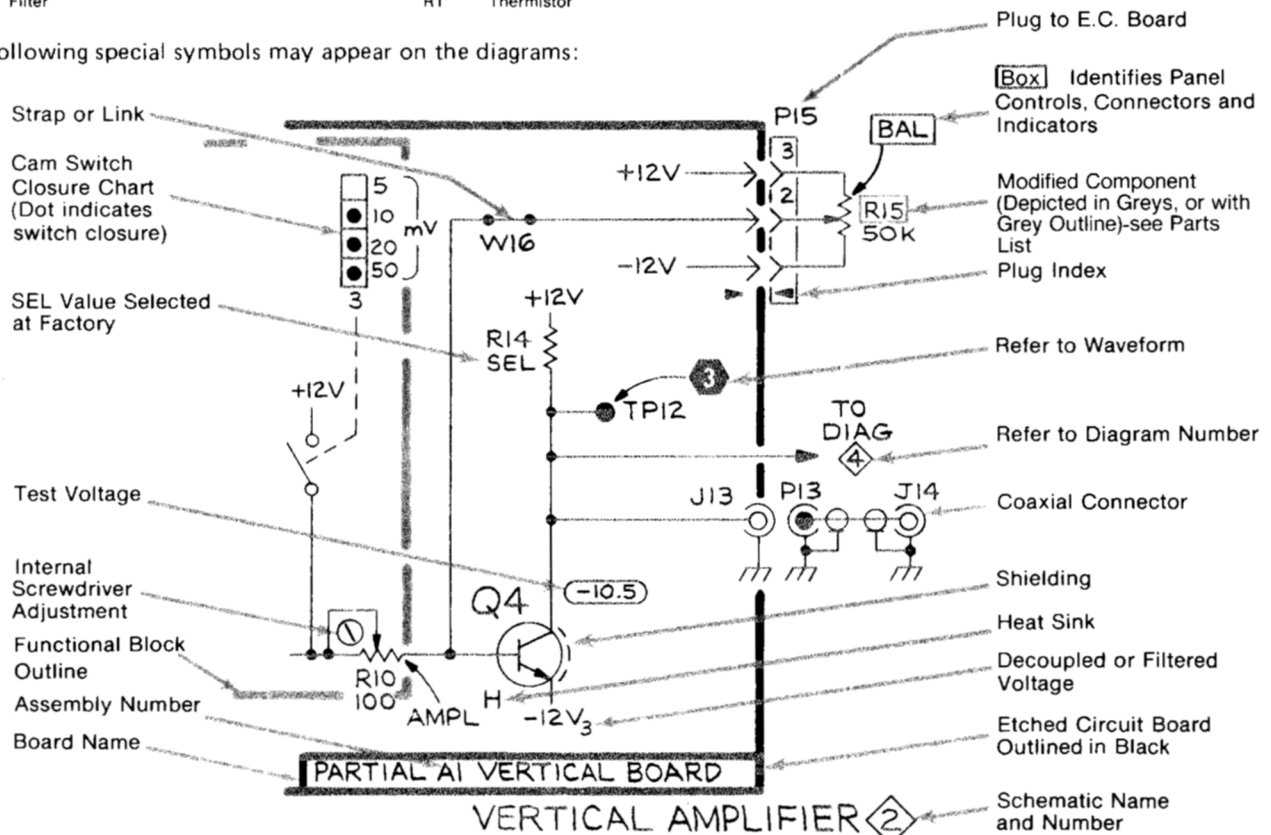
Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

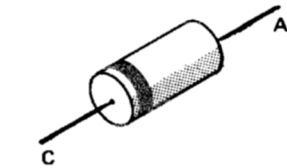
Y14.15, 1966 Drafting Practices.
Y14.2, 1973 Line Conventions and Lettering.
Y10.5, 1968 Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

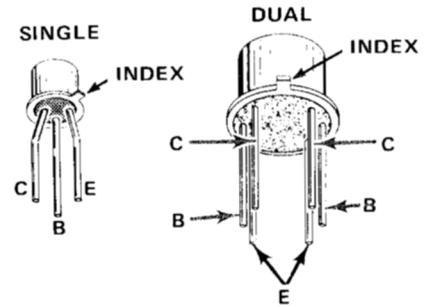
| | | | | | |
|----|--|----|---|----|--|
| A | Assembly, separable or repairable (circuit board, etc) | H | Heat dissipating device (heat sink, heat radiator, etc) | S | Switch or contactor |
| AT | Attenuator, fixed or variable | HR | Heater | T | Transformer |
| B | Motor | HY | Hybrid circuit | TC | 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) | O | 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:

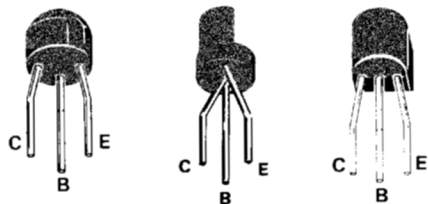
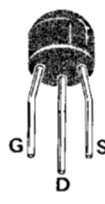
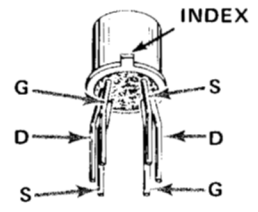
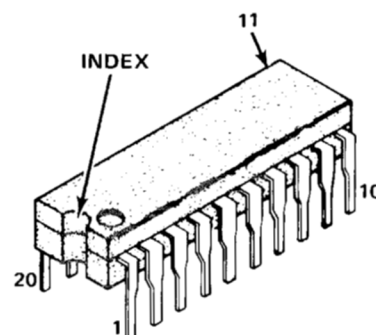
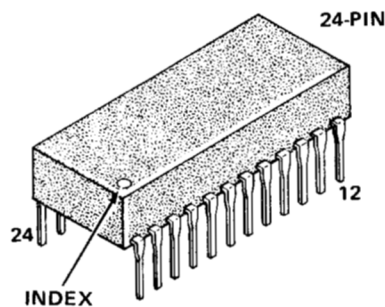
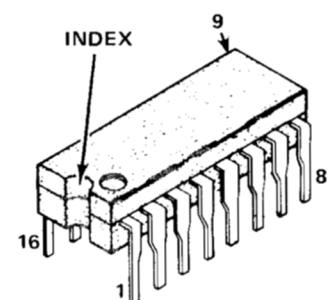
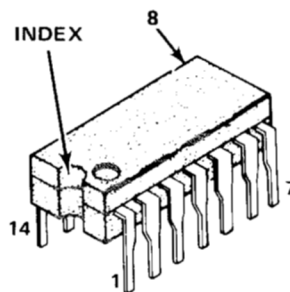
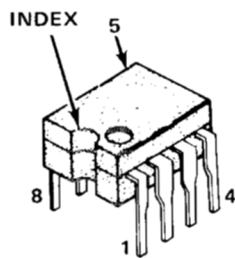




[SIGNAL DIODE]

[LIGHT EMITTING
DIODE (L.E.D.)][METAL CASE
TRANSISTORS]

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

[PLASTIC CASE
TRANSISTORS][PLASTIC CASE
FETS][DUAL METAL
CASE FET]

[INTEGRATED CIRCUITS]

(1986-66)2788-51B

Figure 8-1. Semiconductor Lead Configurations.

REV SEP 1981

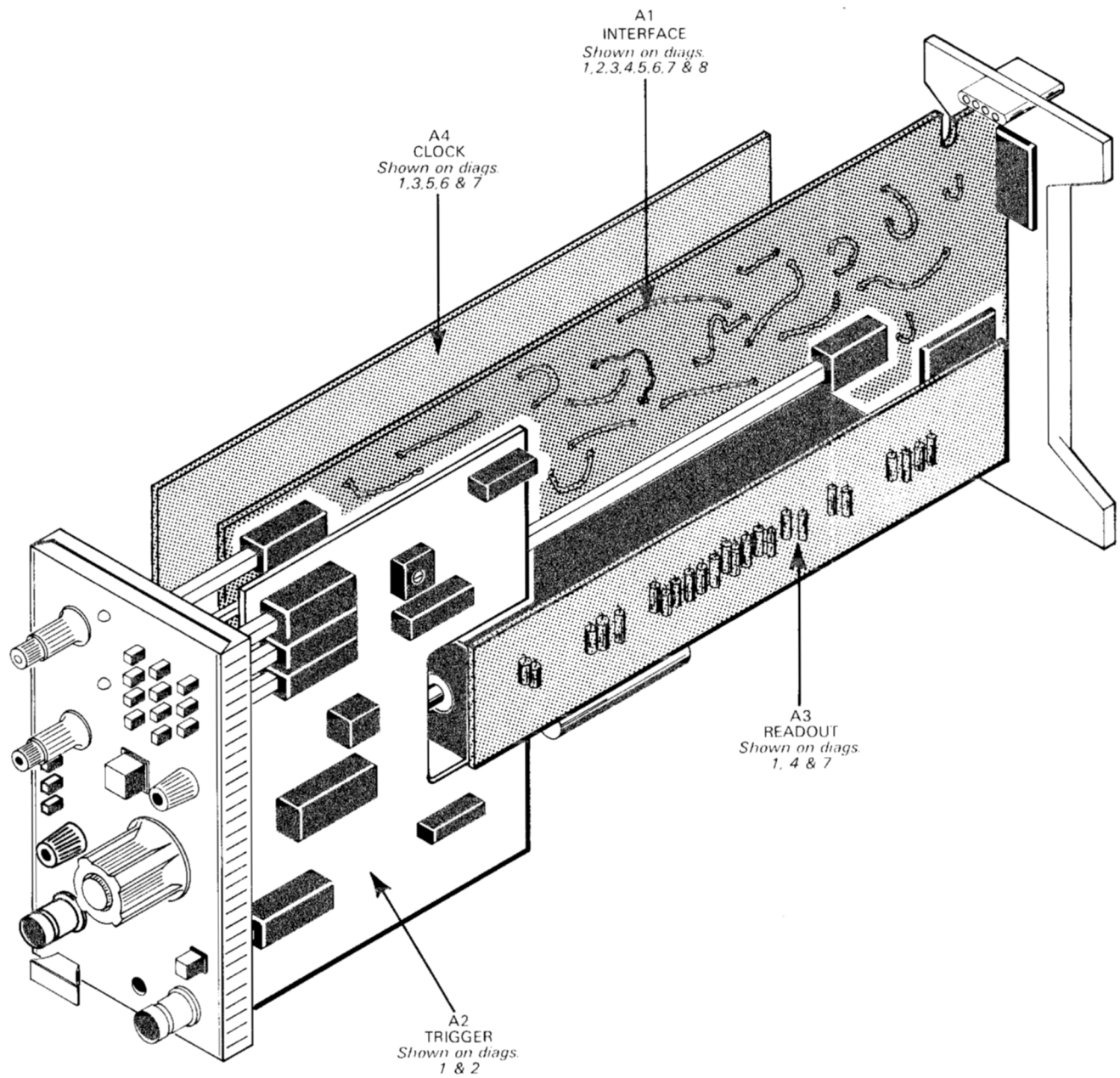
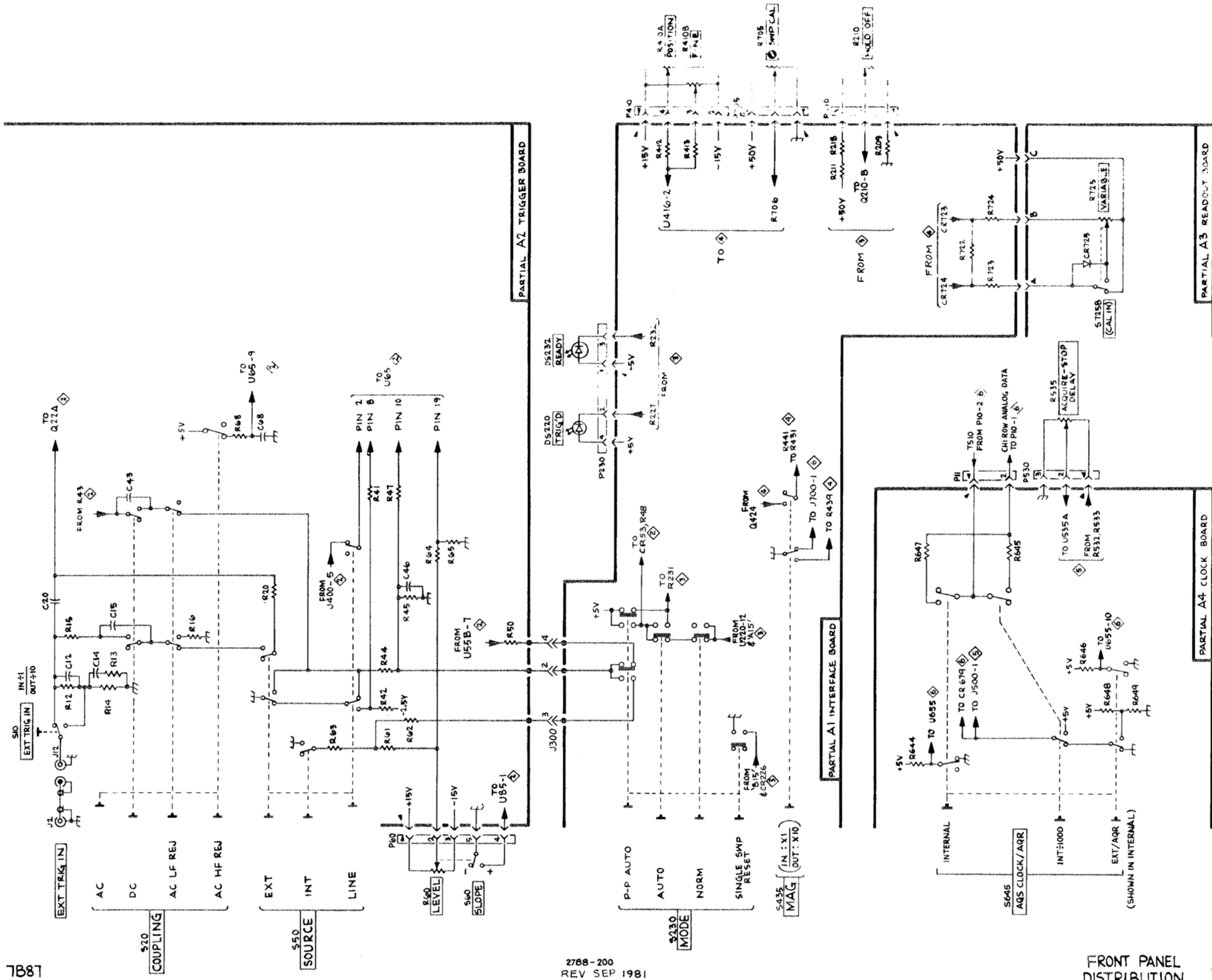


Figure 8-2. Locations of circuit boards in the 7B87.



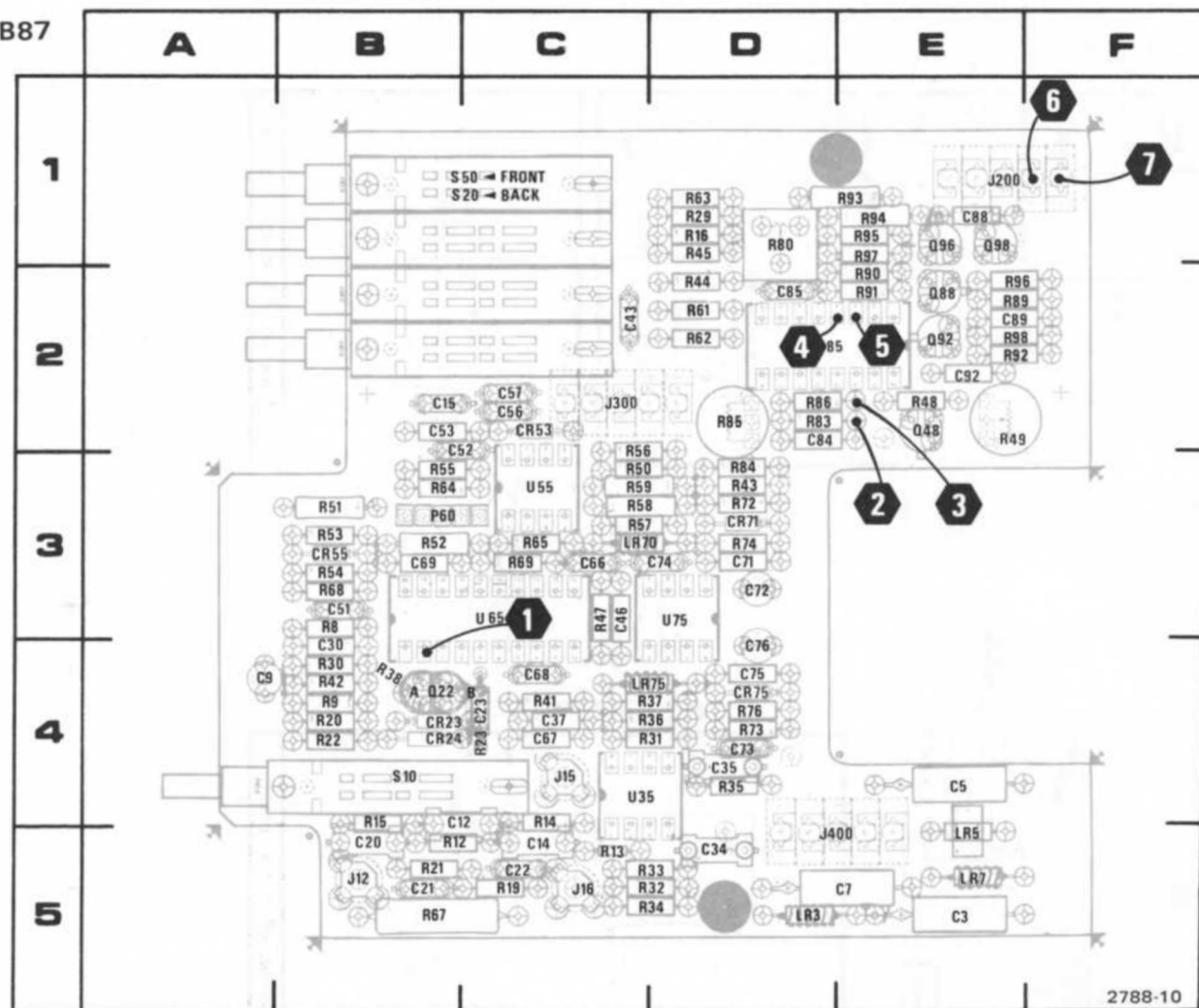
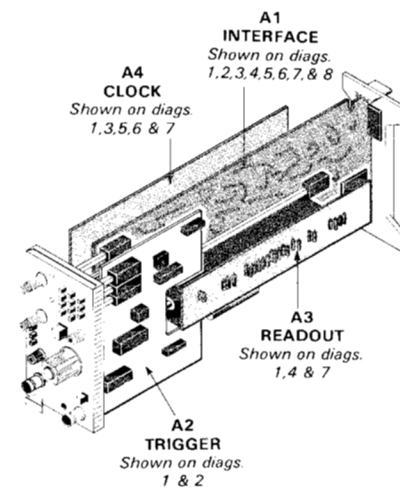


Figure 8-3. A2-Trigger circuit board assembly.

REV SEP 1981

| CKT NO | GRID COORD | CKT NO | GRID COORD | CKT NO | GRID COORD | CKT NO | GRID COORD |
|--------|------------|--------|------------|--------|------------|--------|------------|
| C3 | 5E | C92 | 2E | R15 | 4B | R62 | 2D |
| C5 | 4E | | | R16 | 1D | R63 | 1D |
| C7 | 5E | CR23 | 4B | R19 | 5C | R64 | 3B |
| C9 | 4A | CR24 | 4B | R20 | 4B | R65 | 3C |
| C12 | 4B | CR53 | 2C | R21 | 5B | R67 | 5B |
| C14 | 5C | CR55 | 3B | R22 | 4B | R68 | 3B |
| C15 | 2B | CR71 | 3D | R23 | 4C | R69 | 3C |
| C20 | 5B | CR75 | 4D | R29 | 1D | R72 | 3D |
| C21 | 5B | | | R30 | 4B | R73 | 4D |
| C22 | 5C | J12 | 5B | R31 | 4D | R74 | 3D |
| C23 | 4C | J15 | 4C | R32 | 5D | R76 | 4D |
| C30 | 4B | J16 | 5C | R33 | 5D | R80 | 1D |
| C34 | 5D | J200 | 1E | R34 | 5D | R83 | 2D |
| C35 | 4D | J300 | 2C | R35 | 4D | R84 | 3D |
| C37 | 4C | J400 | 5D | R36 | 4D | R85 | 2D |
| C43 | 2C | | | R37 | 4D | R86 | 2D |
| C46 | 3C | LR3 | 5D | R38 | 4B | R89 | 2E |
| C51 | 3B | LR5 | 5E | R41 | 4C | R90 | 2E |
| C52 | 2B | LR7 | 5E | R42 | 4B | R91 | 2E |
| C53 | 2B | LR70 | 3C | R43 | 3D | R92 | 2E |
| C56 | 2C | LR75 | 4D | R44 | 2D | R93 | 1E |
| C57 | 2C | | | R45 | 1D | R94 | 1E |
| C66 | 3C | P60 | 3B | R47 | 3C | R95 | 1E |
| C67 | 4C | | | R48 | 2E | R96 | 2E |
| C68 | 4C | Q22 | 4B | R49 | 2E | R97 | 1E |
| C69 | 3B | Q48 | 2E | R50 | 3C | R98 | 2E |
| C71 | 3D | Q88 | 2E | R51 | 3B | | |
| C72 | 3D | Q92 | 2E | R52 | 3B | S10 | 4B |
| C73 | 4D | Q96 | 1E | R53 | 3B | S20 | 1C |
| C74 | 3D | Q98 | 1E | R54 | 3B | S50 | 1C |
| C75 | 4D | | | R55 | 3B | | |
| C76 | 4D | R8 | 3B | R56 | 2C | U35 | 4C |
| C84 | 2D | R9 | 4B | R57 | 3C | U55 | 3C |
| C85 | 2D | R12 | 5B | R58 | 3C | U65 | 3C |
| C88 | 1E | R13 | 5C | R59 | 3C | U75 | 3D |
| C89 | 2E | R14 | 4C | R61 | 2D | U85 | 2D |



VOLTAGE AND WAVEFORM CONDITIONS

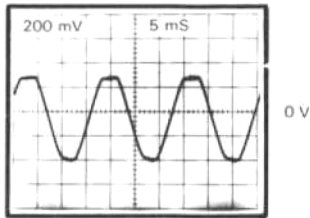
The voltages and waveforms shown were obtained with the 7B87 installed in the B HORIZ compartment and controls set as follows:

TIME/DIV, 1 ms; VARIABLE (CAL IN), knob in; MAX, X1 (button in); HOLD OFF, fully counterclockwise; SWP CAL, midranged; POSITION, midranged; TRIGGERING: LEVEL, midranged; MODE, P-P AUTO; COUPLING, AC; SOURCE, LINE; SLOPE, +; ACQUIRE-STOP DELAY, counterclockwise.

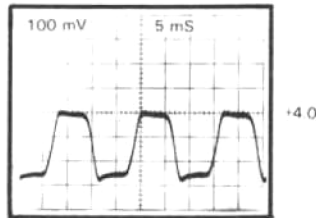
Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 M Ω input impedance (Tektronix DM 501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 10 M Ω input impedance and at least 60 MHz bandwidth (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with 10X probe).

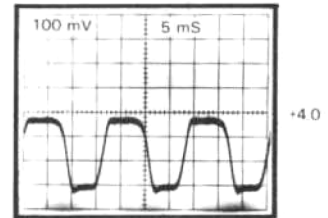
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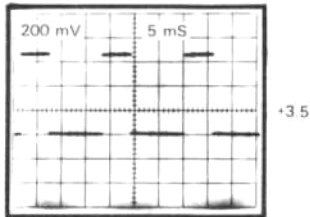
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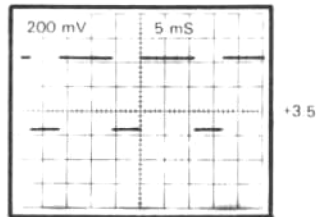
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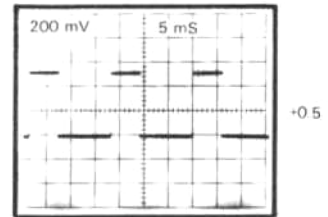
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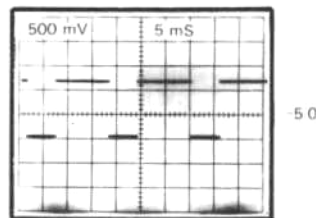
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7





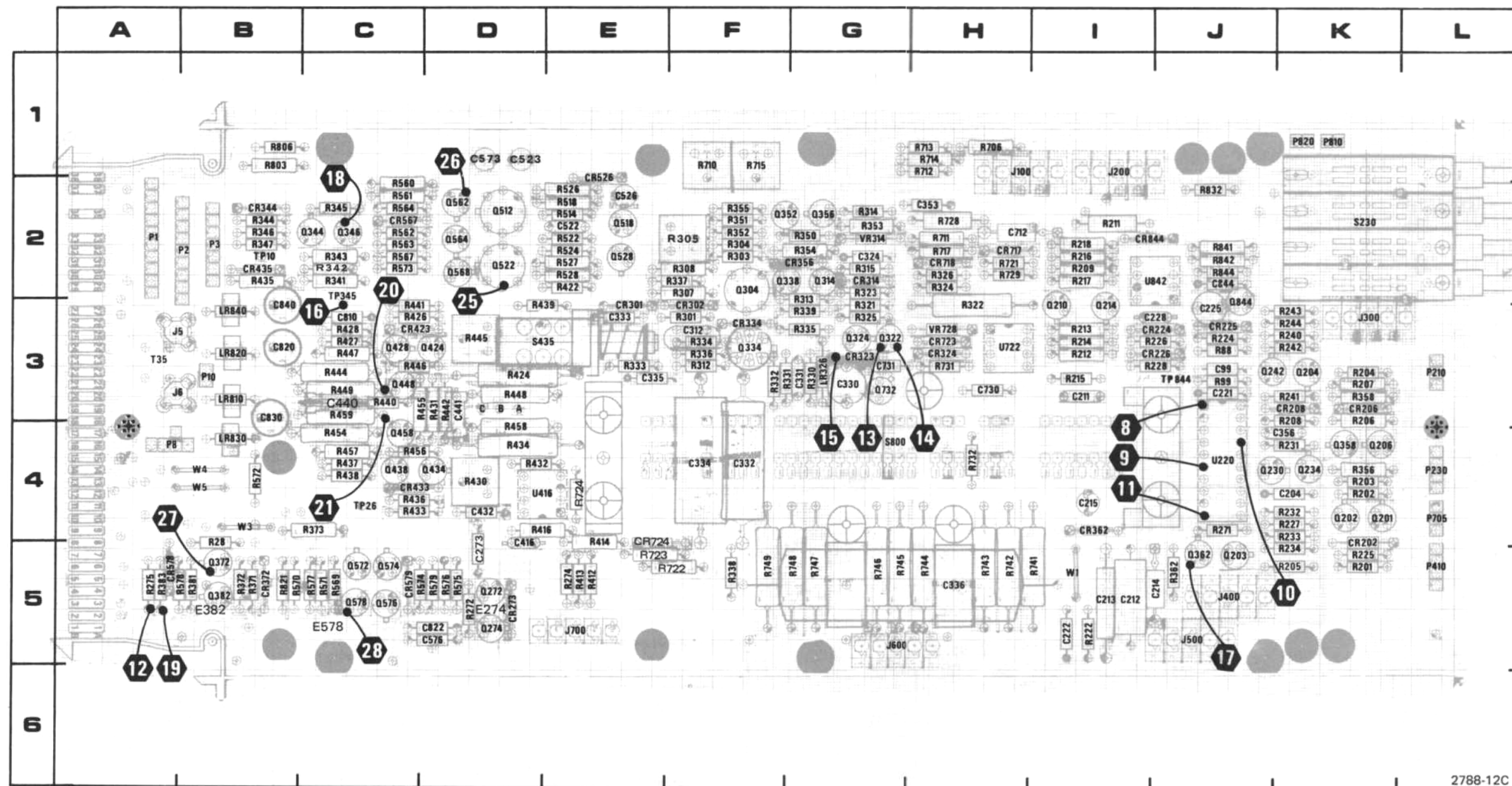
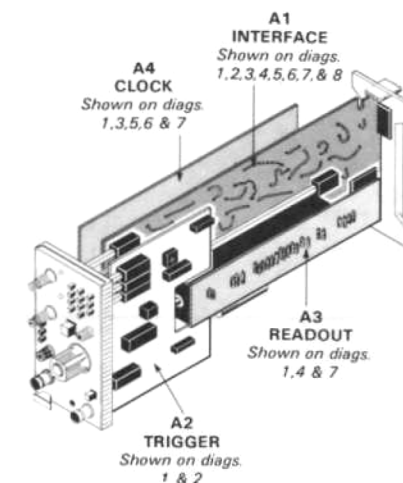


Figure 8-4. A1-Interface circuit board assembly.



2788-12C

| CKT NO | GRID COORD | CKT NO | GRID COORD | CKT NO | GRID COORD | CKT NO | GRID COORD | CKT NO | GRID COORD |
|-----------|---------------|-----------|---------------|-----------|---------------|-----------|---------------|-----------|---------------|
| C99 | 3J | CR844 | 2I | Q568 | 2D | R337 | 2F | R567 | 2C |
| C204 | 4K | E274 | 5D | Q572 | 5C | R338 | 5F | R569 | 5C |
| C211 | 3I | E278 | 5C | Q574 | 5C | R339 | 2G | R570 | 5B |
| C212 | 5I | E382 | 5B | Q576 | 5C | R341 | 2C | R571 | 5C |
| C213 | 5I | | | 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 | | | R345 | 2C | R575 | 5D |
| C222 | 5I | J200 | 1I | R28 | 4B | R346 | 2B | R576 | 5D |
| C225 | 3J | J300 | 3K | R88 | 3J | R347 | 2B | R577 | 5C |
| C228 | 3J | J400 | 5J | R99 | 3J | R350 | 2G | R578 | 5B |
| C273 | 5D | J500 | 5J | R201 | 5K | R351 | 2F | R579 | 5D |
| C312 | 3F | J600 | 5G | R202 | 4K | R352 | 2F | R706 | 1H |
| C324 | 2G | J700 | 5E | R203 | 4K | R353 | 2G | R710 | 1F |
| C330 | 2G | | | R204 | 3K | R354 | 2G | R711 | 2H |
| C331 | 2G | LR326 | 2G | R205 | 5K | R355 | 2F | R712 | 1H |
| C332 | 4F | LR810 | 3B | R206 | 3K | R356 | 4K | R713 | 1H |
| C333 | 3E | LR820 | 3B | R207 | 3K | R358 | 3K | R714 | 1H |
| C334 | 4F | LR830 | 4B | R208 | 3K | R362 | 5J | R715 | 1F |
| C335 | 3E | LR840 | 3B | R209 | 2I | R371 | 5B | R717 | 2H |
| C336 | 5H | | | R211 | 2I | R372 | 5B | R721 | 2H |
| C353 | 2H | P1 | 2A | R212 | 3I | R373 | 4C | R722 | 5E |
| C356 | 4K | P2 | 2B | R213 | 3I | R381 | 5B | R723 | 5E |
| C416 | 4D | P3 | 2B | R214 | 3I | R383 | 5A | R724 | 4E |
| C432 | 4D | P8 | 4A | R215 | 3I | R412 | 5E | R728 | 2H |
| C440 | 3C | P10 | 3B | R216 | 2I | R413 | 5E | R729 | 5F |
| C441 | 3D | P210 | 3L | R217 | 2I | R414 | 4E | R731 | 3H |
| C522 | 2E | P230 | 4L | R218 | 2I | R416 | 4D | R732 | 4H |
| C523 | 1D | P410 | 5L | R222 | 5I | R422 | 2E | R741 | 5I |
| C526 | 2E | P705 | 4L | R224 | 3J | R424 | 3D | R742 | 5H |
| C573 | 1D | P810 | 1K | R225 | 5K | R426 | 3C | R743 | 5H |
| C576 | 5D | P820 | 1K | R226 | 3J | R427 | 3C | R744 | 5H |
| C712 | 2H | | | R227 | 4K | R428 | 3C | R745 | 5G |
| C730 | 3H | Q201 | 4K | R228 | 3J | R430 | 4D | R746 | 5G |
| C731 | 2G | Q202 | 4K | R231 | 4K | R431 | 3D | R747 | 5G |
| C810 | 3C | Q203 | 5J | R232 | 4K | R432 | 4D | R748 | 5G |
| C820 | 3B | Q204 | 3K | R233 | 4K | R433 | 4C | R749 | 5F |
| C822 | 5D | Q206 | 4K | R234 | 5K | R434 | 4D | R803 | 1B |
| C830 | 3B | Q210 | 2I | R240 | 3K | R435 | 2B | R806 | 1B |
| C840 | 3B | Q214 | 2I | R241 | 3K | R436 | 4C | R821 | 5B |
| C844 | 2J | Q230 | 4J | R242 | 3K | R437 | 4C | R832 | 2J |
| C4206 | 3K | Q234 | 4K | R243 | 3K | R438 | 4C | R841 | 2J |
| C4301 | 3E | Q242 | 3J | R244 | 3K | R439 | 3D | R842 | 2J |
| CR202 | 4K | Q272 | 5D | R255 | 5K | R440 | 3C | R844 | 2J |
| CR206 | 3K | Q274 | 5D | R271 | 4J | R441 | 3C | S230 | 2K |
| CR208 | 3K | Q304 | 2F | R272 | 5D | R442 | 3D | S435 | 3D |
| CR224 | 3J | Q314 | 2G | R274 | 5E | R444 | 3C | S800 | 4G |
| CR225 | 3J | Q322 | 2G | R275 | 5A | R445 | 3D | | |
| CR226 | 3J | Q324 | 2G | R301 | 3F | R446 | 3C | T35 | 3A |
| CR273 | 5D | Q334 | 3F | R303 | 2F | R447 | 3C | | |
| CR301 | 3E | Q338 | 2F | R304 | 2F | R448 | 3D | TP10 | 2B |
| CR302 | 3F | Q344 | 2C | R305 | 2F | R449 | 3C | TP26 | 4C |
| CR314 | 2G | Q346 | 2C | R307 | 2F | R454 | 4C | TP345 | 2C |
| CR323 | 2G | Q352 | 2F | R308 | 2F | R455 | 3C | TP844 | 3J |
| CR324 | 3H | Q356 | 2G | R312 | 3F | R456 | 4C | | |
| CR334 | 3F | Q358 | 4K | R313 | 2G | R457 | 4C | U220 | 4J |
| CR344 | 2B | Q362 | 5J | R314 | 2G | R458 | 4D | U416 | 4D |
| CR356 | 2G | Q372 | 5B | R315 | 2G | R459 | 3C | U722 | 3H |
| CR362 | 4I | Q382 | 5B | R321 | 2G | R514 | 2E | U842 | 2I |
| CR372 | 5B | Q424 | 3D | R322 | 2H | R518 | 2E | | |
| CR423 | 3C | Q428 | 3C | R323 | 2G | R522 | 2E | VR314 | 2G |
| CR433 | 4C | Q434 | 4D | R324 | 2H | R524 | 2E | VR728 | 3H |
| CR435 | 2B | Q438 | 4C | R325 | 2G | R526 | 2E | | |
| CR526 | 2E | Q448 | 3C | R326 | 2H | R527 | 2E | W1 | 5I |
| CR567 | 2C | Q458 | 4C | R330 | 2G | R528 | 2E | W3 | 4B |
| CR578 | 5A | Q512 | 2D | R331 | 3F | R560 | 2C | W4 | 4B |
| CR579 | 5C | Q518 | 2E | R332 | 3F | R561 | 2C | W5 | 4B |
| CR717 | 2H | Q522 | 2D | R333 | 3E | R562 | 2C | | |
| CR718 | 2H | Q528 | 2E | R334 | 3F | R563 | 2C | | |
| CR723 | 3H | Q562 | 2D | R335 | 2G | R564 | 2C | | |
| CR724 | 4E | Q564 | 2D | R336 | 3F | | | | |

VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the 7B87 installed in the B HORIZ compartment and 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, +; ACQUIRE-STOP DELAY, counterclockwise.

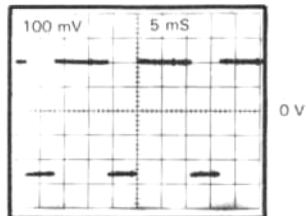
Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 M Ω input impedance (Tektronix DM 501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 10 M Ω input impedance and at least 60 MHz bandwidth (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with 10X probe).

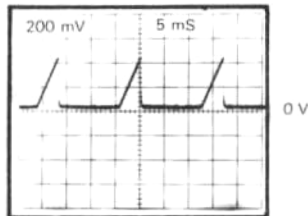
NOTE

Some voltages and waveforms were measured with the Clock board removed.

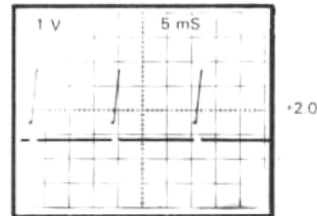
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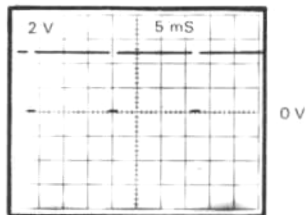
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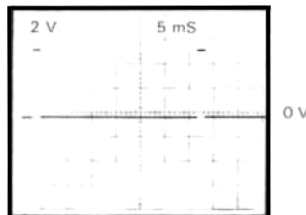
10



11



12



VOLTAGE AND WAVEFORM CONDITIONS

The voltages and waveforms shown were obtained with the 7B87 installed in the B HORIZ compartment and 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, +; ACQUIRE—STOP DELAY, counterclockwise.

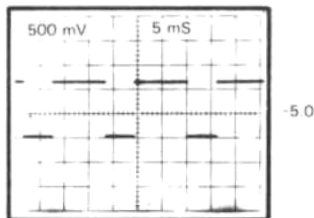
Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 M Ω input impedance (Tektronix DM 501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 10 M Ω input impedance and at least 60 MHz bandwidth (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with 10X probe).

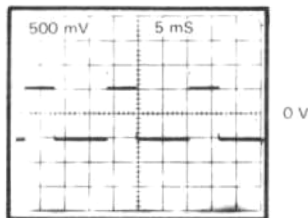
NOTE

Some voltages and waveforms were measured with the Clock board removed.

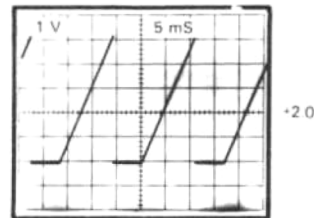
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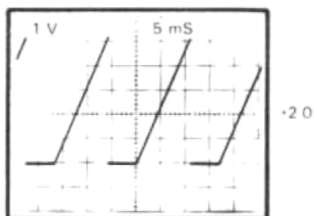
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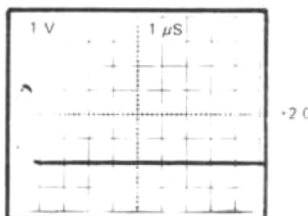
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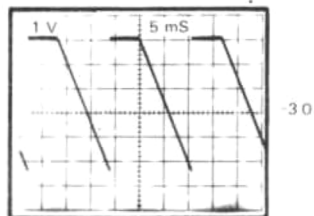
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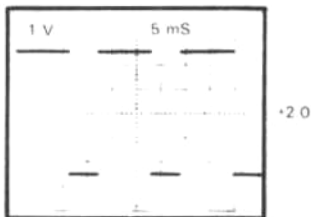
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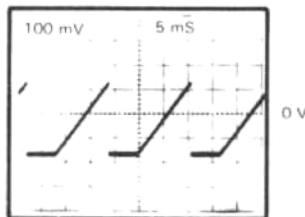
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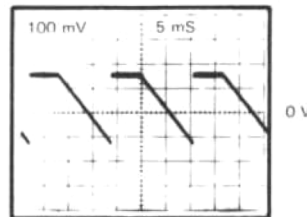
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21



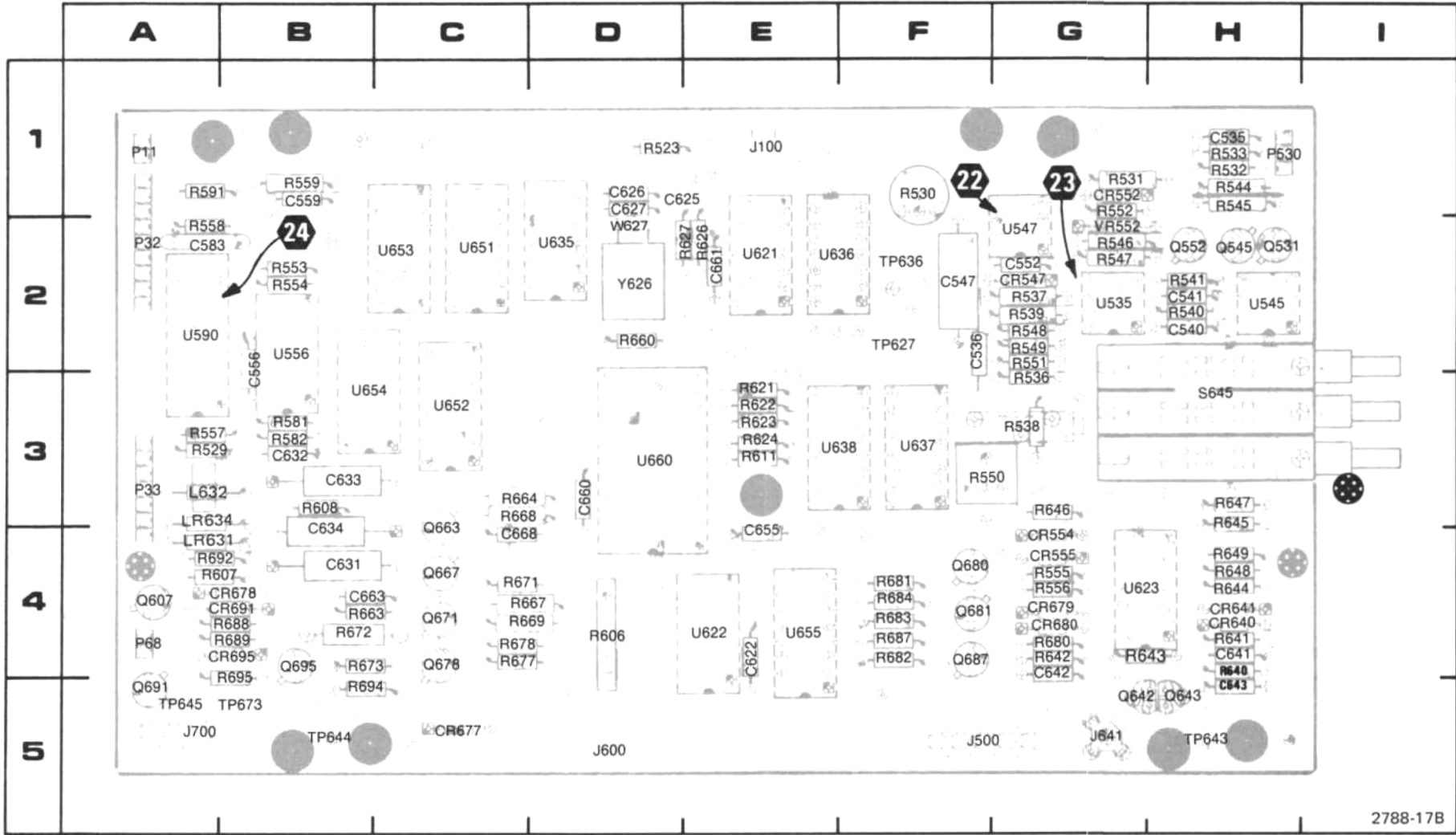
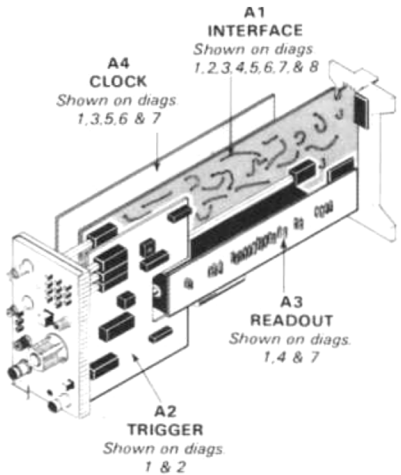


Figure 8-5. A4—Clock circuit board assembly

REV AUG 1985



| CKT NO | GRID COORD | CKT NO | GRID COORD | CKT NO | GRID COORD | CKT NO | GRID COORD |
|--------|------------|--------|------------|--------|------------|--------|------------|
| C535 | 1H | P11 | 1A | R591 | 1A | U535 | 2G |
| C536* | 2F | P32 | 2A | R606 | 4D | U545 | 2H |
| C540 | 2H | P33 | 3A | R607 | 4B | U547 | 2G |
| C541 | 2H | P68 | 4A | R608 | 3B | U556 | 2B |
| C547 | 2F | P530 | 1H | R611 | 3E | U590 | 2A |
| C552* | 2G | | | R621 | 3E | U621 | 2E |
| C556 | 2B | Q522 | 2H | R622 | 3E | U622 | 4E |
| C559 | 1B | Q531 | 2H | R623 | 3E | U623 | 4G |
| C583 | 2A | Q545 | 2H | R624 | 3E | U635 | 2D |
| C622 | 4E | Q607 | 4A | R626 | 2E | U636 | 2E |
| C625* | 1E | Q642 | 5G | R627 | 2E | U637 | 3F |
| C626 | 1D | Q643 | 5H | R630 | 1F | U638 | 3F |
| C627* | 1D | Q663 | 3C | R640 | 4H | | |
| C631 | 4B | Q667 | 4C | R641 | 4H | U651 | 2C |
| C632 | 3B | Q671 | 4C | R642 | 4G | U652 | 3C |
| C633 | 3B | Q678 | 4C | R643 | 4H | U653 | 2C |
| C634 | 4B | Q680 | 4F | R644 | 4H | U654 | 3B |
| C641 | 4H | Q681 | 4F | R645 | 3H | U655 | 4E |
| C642 | 4G | Q687 | 4F | R646 | 3G | U660 | 3D |
| C643 | 5H | Q691 | 5A | R647 | 3H | | |
| C655 | 4E | Q695 | 4B | R648 | 4H | VR552 | 2G |
| C660 | 3D | | | R649 | 4H | | |
| C661 | 2E | R523 | 1D | R660 | 2D | Y626 | 2D |
| C663 | 4B | R529 | 3A | R663 | 4B | W627* | 1D |
| C668 | 4C | R530 | 1F | R664 | 3C | | |
| | | R531 | 1G | R667 | 4C | | |
| | | R532 | 1H | R668 | 3C | | |
| | | R533 | 1H | R669 | 4C | | |
| | | R536 | 3G | R671 | 4C | | |
| | | R537 | 2G | R672 | 4B | | |
| | | R538 | 3G | R673 | 4B | | |
| | | R539 | 2G | R677 | 4C | | |
| | | R540 | 2H | R678 | 4C | | |
| | | R541 | 2H | R680 | 4G | | |
| | | R544 | 1H | R681 | 4F | | |
| | | R545 | 1H | R682 | 4F | | |
| | | R546 | 2G | R683 | 4F | | |
| | | R547 | 2G | R684 | 4F | | |
| | | R548 | 2G | R687 | 4F | | |
| | | R549 | 2G | R688 | 4B | | |
| | | R550 | 3F | R689 | 4B | | |
| | | R551 | 2G | R692 | 4A | | |
| | | R552 | 1G | R694 | 5B | | |
| | | R553 | 2B | R695 | 4B | | |
| | | R554 | 2B | | | | |
| | | R555 | 4G | S645 | 3H | | |
| | | R556 | 4G | | | | |
| | | R557 | 3A | TP627 | 2F | | |
| | | R558 | 2A | TP636 | 2F | | |
| | | R559 | 1B | TP643 | 5H | | |
| | | R581 | 3B | TP644 | 5B | | |
| | | R582 | 3B | TP645 | 5A | | |
| | | | | TP673 | 5B | | |

*See Parts List for serial number ranges.

**Located on back of board.

VOLTAGE AND WAVEFORM CONDITIONS

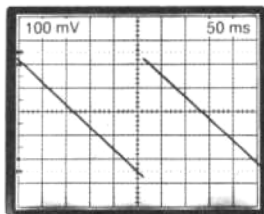
The voltages and waveforms shown were obtained with the 7B87 installed in the B HORIZ compartment and controls set as follows:

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 Ω); ACQUIRE-STOP DELAY, counterclockwise.

Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 1 M Ω input impedance (Tektronix DM 501 Digital Multimeter or Tektronix 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

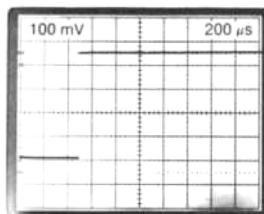
Waveform Conditions. The waveforms shown below were obtained using a test oscilloscope system with 10 M Ω input impedance and at least 60 MHz bandwidth (Tektronix 7603 Oscilloscope, 7B53A Time Base, and 7A13 Differential Comparator equipped with 10X probe). A 4 volt, 1 kHz square wave signal was fed to the EXT TRIG IN connector.

22



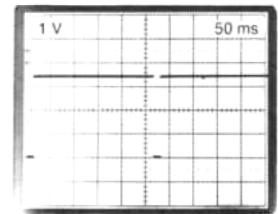
+ 9.37 V offset

23



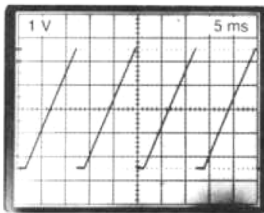
- 0.42 V

24



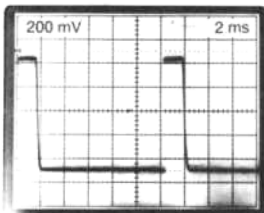
+ 2.0 V

25



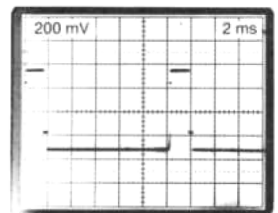
+ 2.6 V

26



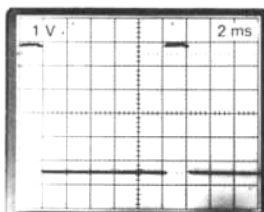
- 0.66 V

27

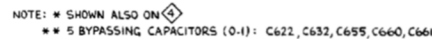


0 V

28



+ 1.8 V



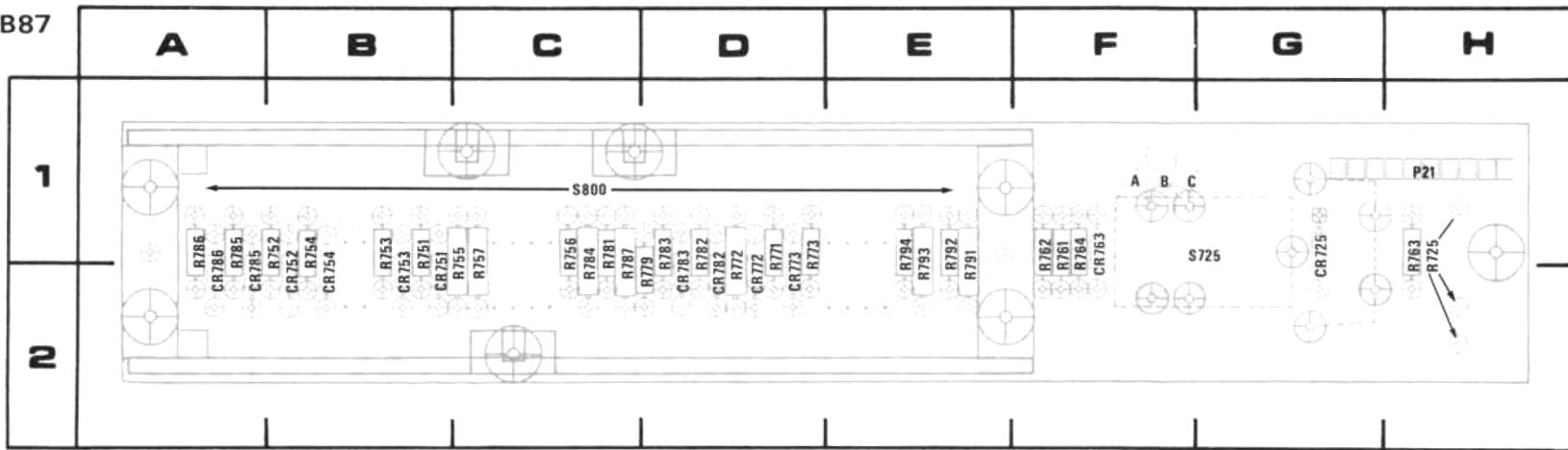
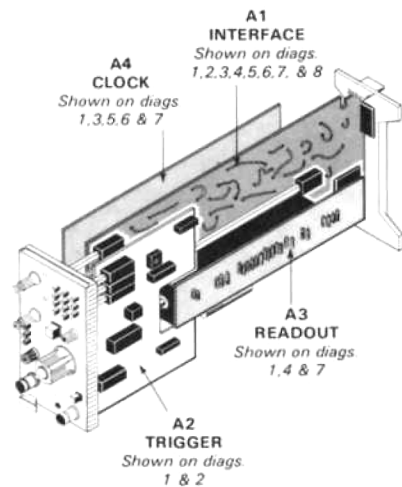
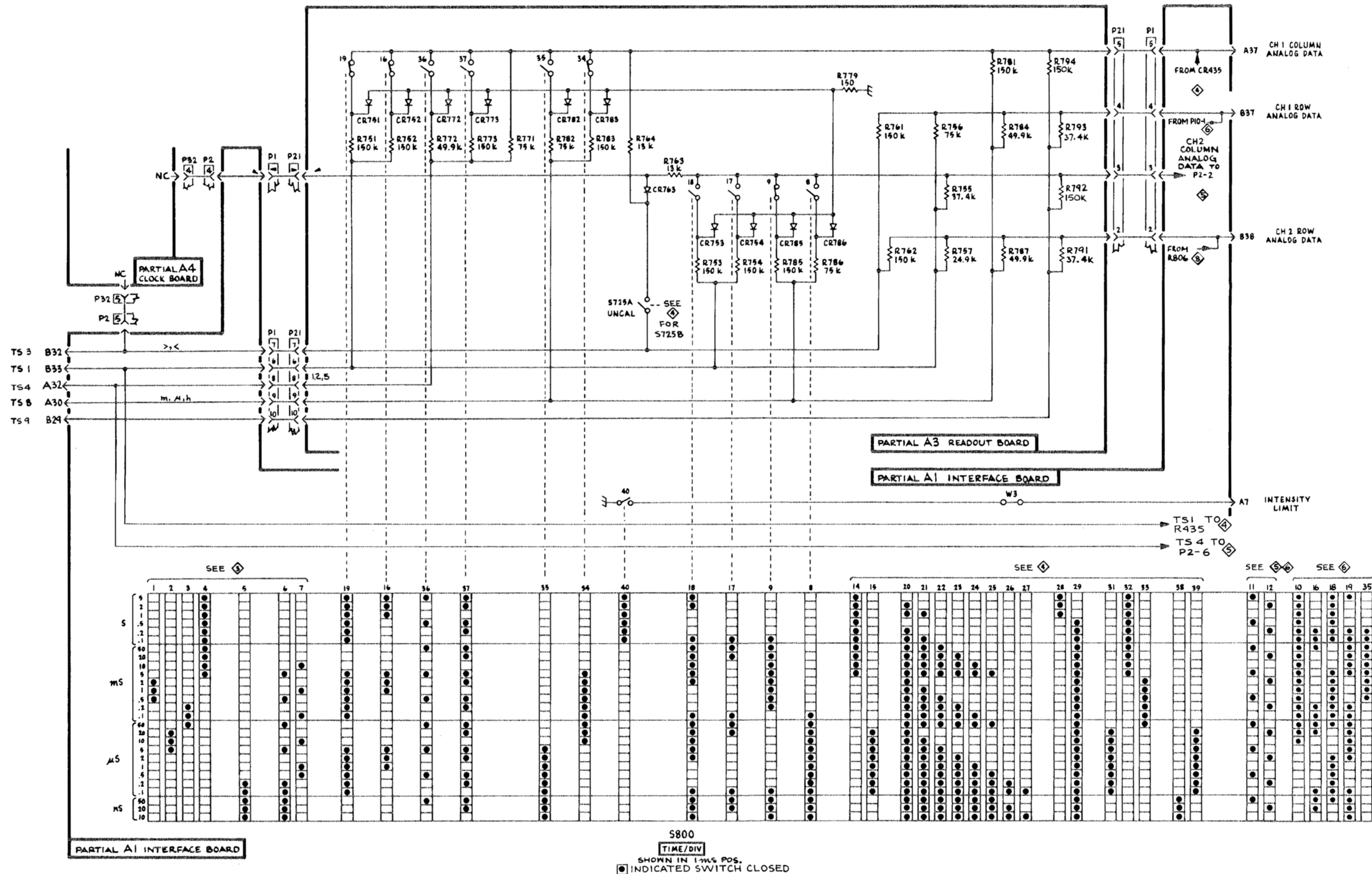


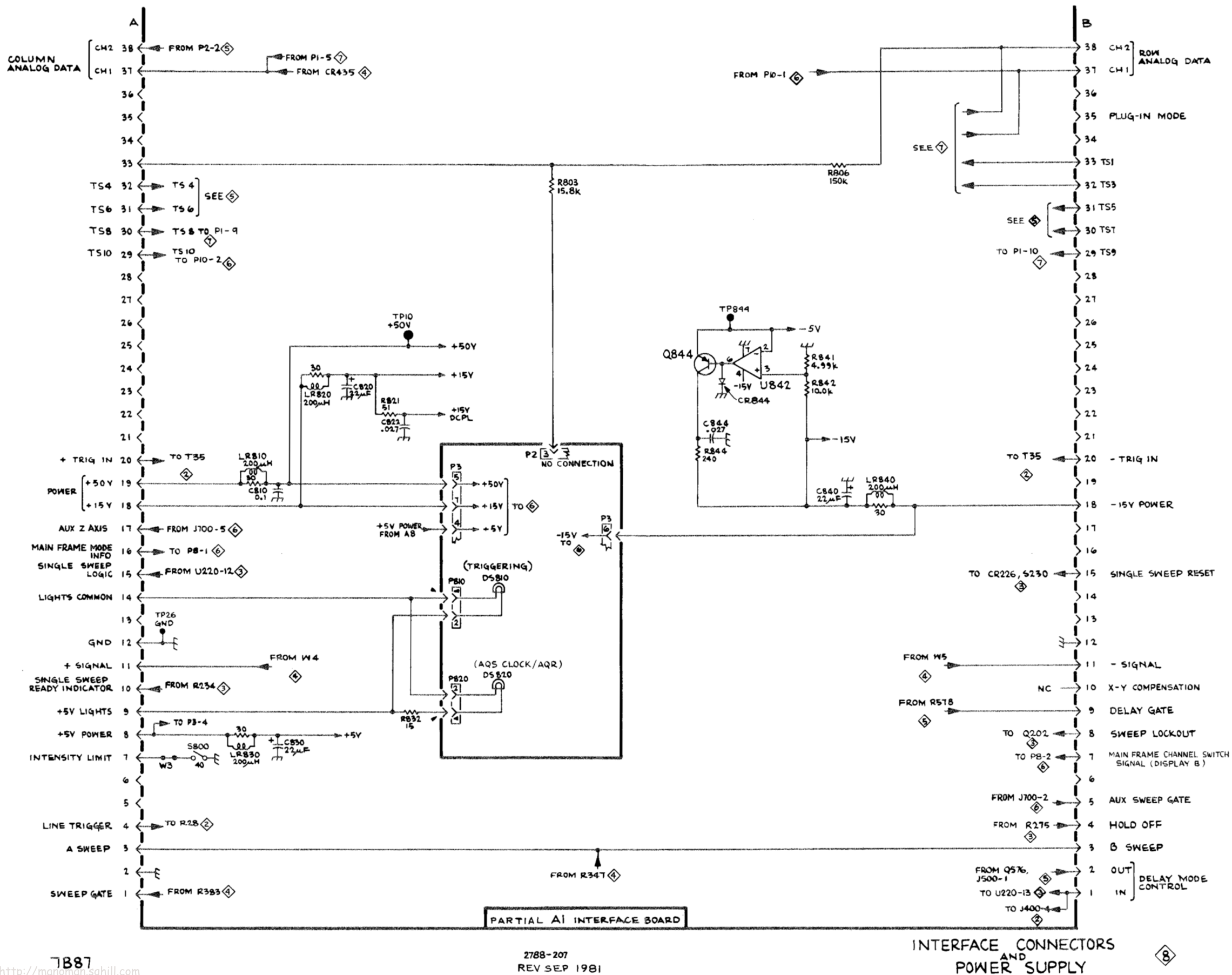
Figure 8-6. A3—Readout circuit board assembly.

REV SEP 1981

| CKT NO | GRID COORD | CKT NO | GRID COORD |
|--------|------------|--------|------------|
| CR725 | 1G | R757 | 1C |
| CR751 | 2B | R761 | 1F |
| CR752 | 2B | R763 | 1H |
| CR753 | 2B | R764 | 1F |
| CR754 | 2B | R771 | 1D |
| CR763 | 1F | R772 | 1D |
| CR772 | 2D | R773 | 1D |
| CR773 | 2D | R779 | 2D |
| CR782 | 2D | R781 | 1C |
| CR783 | 2D | R782 | 1D |
| CR785 | 2A | R783 | 1D |
| CR786 | 2A | R784 | 1C |
| | | R785 | 1A |
| P21 | 1H | R786 | 1A |
| | | R787 | 1C |
| R725 | 1H | R791 | 1E |
| R751 | 1B | R792 | 1E |
| R752 | 1B | R793 | 1E |
| R752 | 1F | R794 | 1E |
| R753 | 1B | | |
| R754 | 1B | S725 | 1G |
| R755 | 1C | S800 | 1C |
| R756 | 1C | | |







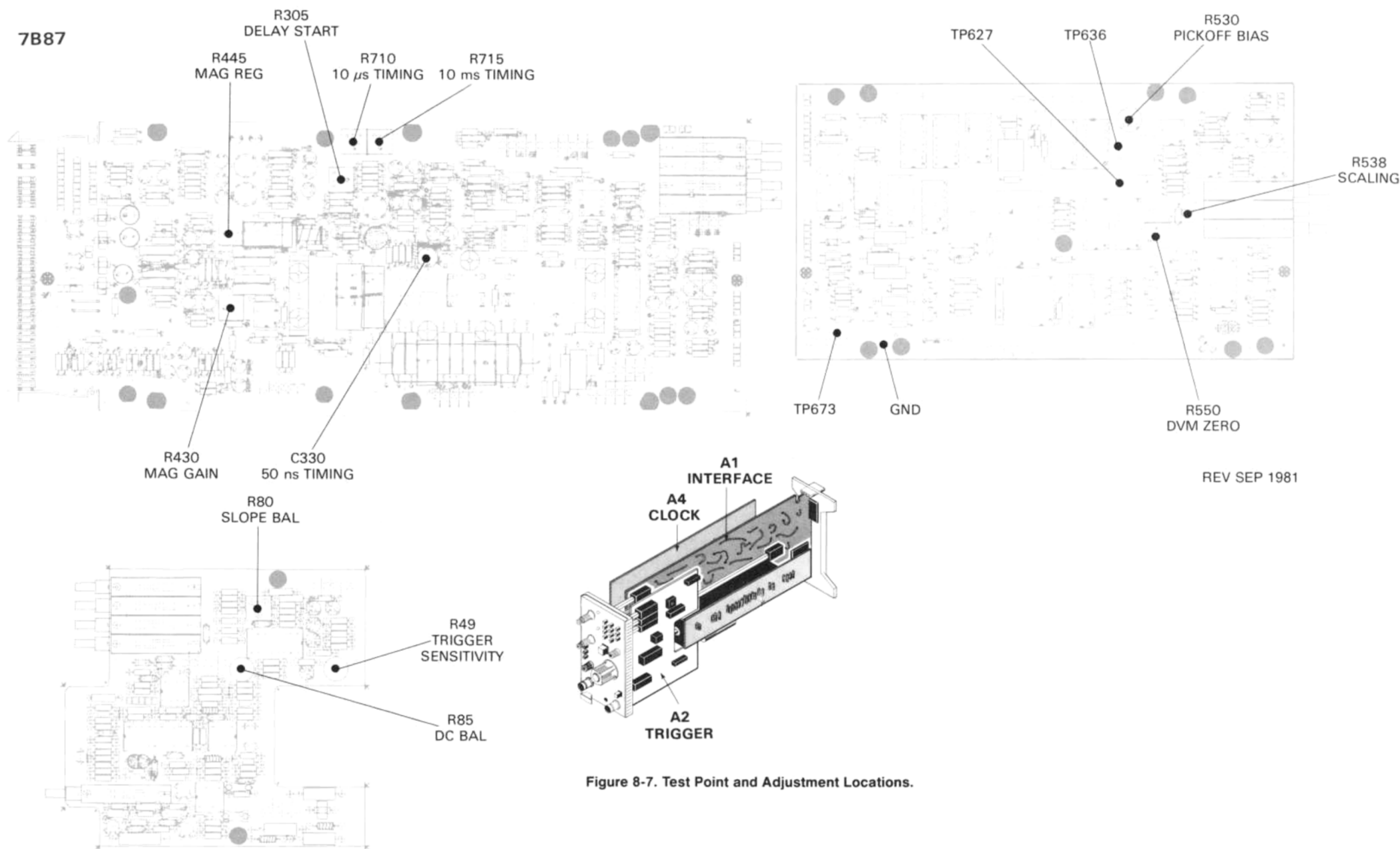


Figure 8-7. Test Point and Adjustment Locations.

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 | ELECTRN | IN | INCH | SE | SINGLE END |
| # | ELEC | INCAND | INCANDESCENT | SECT | SECTION |
| ACTR | ELCTLT | INSUL | INSULATOR | SEMICON | SEMICONDUCTOR |
| ADPTR | ELEM | INTL | INTERNAL | SHLD | SHIELD |
| ALIGN | EPL | LPHLDR | LAMPHOLDER | SHLDR | SHOULDERED |
| AL | EQPT | MACH | MACHINE | SKT | SOCKET |
| ASSEM | EXT | MECH | MECHANICAL | SL | SLIDE |
| ASSY | FIL | MTG | MOUNTING | SLFLKG | SELF-LOCKING |
| ATTEN | FLEX | NIP | NIPPLE | SLVG | SLEEVEING |
| AWG | FLH | NON WIRE | NOT WIRE WOUND | SPR | SPRING |
| BD | FLTR | OBD | ORDER BY DESCRIPTION | SQ | SQUARE |
| BRKT | FR | OD | OUTSIDE DIAMETER | SST | STAINLESS STEEL |
| BRS | FSTNR | OVH | OVAL HEAD | STL | STEEL |
| BRZ | FT | PH BRZ | PHOSPHOR BRONZE | SW | SWITCH |
| BSHG | FXD | PL | PLAIN or PLATE | T | TUBE |
| CAB | GSKT | PLSTC | PLASTIC | TERM | TERMINAL |
| CAP | HDL | PN | PART NUMBER | THD | THREAD |
| CER | HEX | PNH | PAN HEAD | THK | THICK |
| CHAS | HEX HD | PWR | POWER | TNSN | TENSION |
| CKT | HEX SOC | RCPT | RECEPTACLE | TPG | TAPPING |
| COMP | HLCPS | RES | RESISTOR | TRH | TRUSS HEAD |
| CONN | HLEXT | RGD | RIGID | V | VOLTAGE |
| COV | HV | RLF | RELIEF | VAR | VARIABLE |
| CPLG | IC | RTNR | RETAINER | W/ | WITH |
| CRT | ID | SCH | SOCKET HEAD | WSHR | WASHER |
| DEG | IDENT | SCOPE | OSCILLOSCOPE | XFMR | TRANSFORMER |
| DWR | IMPLR | SCR | SCREW | XSTR | TRANSISTOR |

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

| Mfr. Code | Manufacturer | Address | City, State, Zip Code |
|--------------|--|-------------------------------------|---------------------------|
| 01536 | TEXTRON INC CAMCAR DIV SEMS PRODUCTS UNIT | 1818 CHRISTINA ST | ROCKFORD IL 61108 |
| 07707 | USM CORP SUB OF EMHART INDUSTRIES INC USM FASTENER DIV | 510 RIVER RD | SHELTON CT 06484 |
| 08261 | SPECTRA-STRIP AN ELTRA CO | 7100 LAMPSON AVE | GARDEN GROVE CA 92642 |
| 09922 | BURNDY CORP | RICHARDS AVE | NORMAL CT 06852 |
| 22526 | DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS | 30 HUNTER LANE | CAMP HILL PA 17011 |
| 22599 | AMERACE CORP ESNA DIV | 15201 BURBANK BLVD SUITE C | VAN NUYS CA 91411 |
| 24546 | CORNING GLASS WORKS | 550 HIGH ST | BRADFORD PA 16701 |
| 27238 | BRISTOL INDUSTRIES | 630 E LAMBERT RD P O BOX 630 | BREA CA 92621 |
| 71159 | BRISTOL SOCKET SCREW CO | | WATERBURY CT |
| 73743 | FISCHER SPECIAL MFG CO | 446 MORGAN ST | CINCINNATI OH 45206 |
| 74445 | HOLLO-KROME CO | 31 BROOK ST | WEST HARTFORD CT 06110 |
| 77900 | SHAKEPROOF DIV OF ILLINOIS TOOL WORKS | SAINT CHARLES RD | ELGIN IL 60120 |
| 78189 | ILLINOIS TOOL WORKS INC SHAKEPROOF DIVISION | ST CHARLES ROAD | ELGIN IL 60120 |
| 79136 | MALDES KOHINOOR INC | 47-16 AUSTEL PLACE | LONG ISLAND CITY NY 11101 |
| 80009 | TEKTRONIX INC | 4900 S W GRIFFITH DR P O BOX 500 | BEAVERTON OR 97077 |
| 83385 | MICRODOT MANUFACTURING INC GREER-CENTRAL DIV | 3221 W BIG BEAVER RD | TROY MI 48098 |
| 83486 | ELCO INDUSTRIES INC | 1101 SAMUELSON RD | ROCKFORD IL 61101 |
| 85471 | BOYD INDUSTRIAL RUBBER DIV OF A B BOYD CO | 2527 GRANT AVE | SAN LEANDRO CA 94579 |
| 87308 | N L INDUSTRIES INC N L FASTENERS | BARKLEY RD P O BOX 1360 | STATESVILLE NC 28677 |
| 93907 | TEXTRON INC CAMCAR DIV | 600 18TH AVE | ROCKFORD IL 61101 |
| TK0507 | O HARA METAL PRODUCTS CO | 542 BRANNAN ST | SAN FRANCISCO CA 94107 |

| Fig. & Index No. | Tektronix Part No. | Serial/Assembly No. Effective Dscont | Qty | 12345 | Name & Description | Mfr. Code | Mfr. Part No. |
|------------------------|-----------------------|---|---------|-------|---|--------------|------------------|
| 1-1 | 337-1064-04 | 8010100 | 8022299 | 2 | SHIELD,ELEC:SIDE FOR PLUG-IN UNIT | 80009 | 337-1064-04 |
| | 337-1064-12 | 8022300 | 2 | 2 | SHIELD,ELEC:SIDE FOR PLUG-IN UNIT | 80009 | 337-1064-12 |
| -2 | 366-1391-02 | | 1 | 1 | KNOB:LT GY,0.081 ID X 0.28 OD X 0.32 H | 80009 | 366-1391-02 |
| | 213-0075-00 | | 1 | 1 | .SETSCREW:4-40 X 0.094,STL | 74445 | ORDER BY DESCR |
| -3 | 366-1077-00 | | 2 | 2 | KNOB:GRAY W/SETSCREW | 80009 | 366-1077-00 |
| | 213-0246-00 | | 2 | 2 | .SETSCREW:5-40 X 0.094,STL | 71159 | ORDER BY DESCR |
| -4 | 366-1319-02 | | 1 | 1 | KNOB:GY,0.079 ID X 0.28 OD X 0.32 H | 80009 | 366-1319-02 |
| | 213-0075-00 | | 1 | 1 | .SETSCREW:4-40 X 0.094,STL | 74445 | ORDER BY DESCR |
| -5 | 426-0681-00 | | 1 | 1 | FRAME,PUSH BTN: | 80009 | 426-0681-00 |
| -6 | 366-1189-00 | | 1 | 1 | KNOB:GY,0.127 ID X 0.5 OD X 0.531 | 80009 | 366-1189-00 |
| | 213-0246-00 | | 1 | 1 | .SETSCREW:5-40 X 0.094,STL | 71159 | ORDER BY DESCR |
| -7 | 366-1023-01 | | 1 | 1 | KNOB:GY,0.127 ID X 0.392 OD X 0.531 H | 80009 | 366-1023-01 |
| | 213-0246-00 | | 1 | 1 | .SETSCREW:5-40 X 0.094,STL | 71159 | ORDER BY DESCR |
| -8 | 366-1166-00 | | 1 | 1 | KNOB:RED,0.127 ID X 0.392 OD X 0.4 H | 80009 | 366-1166-00 |
| | 213-0246-00 | | 1 | 1 | .SETSCREW:5-40 X 0.094,STL | 71159 | ORDER BY DESCR |
| -9 | 366-1103-00 | | 1 | 1 | KNOB:GY,0.252 ID X 1.095 OD X 0.79 H | 80009 | 366-1103-00 |
| | 213-0153-00 | | 2 | 2 | .SETSCREW:5-40 X 0.125,STL BK OXO,HEX SKT | 27238 | ORDER BY DESCR |
| -10 | 426-1072-00 | | 1 | 1 | FRAME,PUSH BTN:SILVER GRAY PLSTC | 80009 | 426-1072-00 |
| -11 | 366-1058-79 | | 1 | 1 | KNOB:GRAY,7887 (ATTACHING PARTS) | 80009 | 366-1058-79 |
| -12 | 214-1095-00 | | 1 | 1 | PIN,SPRING:0.187 L X 0.094 OD,STL,CO PL | 22599 | 52-022-094-0187 |
| -13 | 105-0076-02 | 8010100 | 8021475 | 1 | RELEASE BAR,LCH:PLUG-IN UNIT | 80009 | 105-0076-02 |
| | 105-0076-04 | 8021476 | 1 | 1 | RELEASE BAR,LCH:PLUG-IN UNIT | 80009 | 105-0076-04 |
| -14 | 214-1280-00 | | 1 | 1 | SPRING,HLCPS:0.14 OD X 1.126 L,TWIST LOOP, MUSIC WIRE (END ATTACHING PARTS) | 80009 | 214-1280-00 |
| -15 | 333-1213-17 | | 1 | 1 | PANEL,FRONT: (ATTACHING PARTS) | 80009 | 333-1213-17 |
| -16 | 358-0342-00 | | 1 | 1 | BSHG,MACH THD:.25-32X.159 ID,AL ANOZ,.352 (END ATTACHING PARTS) | 80009 | 358-0342-00 |
| -17 | 352-0157-00 | | 2 | 2 | LAMPHOLDER:(1)T-2 UNBASED,WHITE | 80009 | 352-0157-00 |
| -18 | 351-0469-00 | | 2 | 2 | GUIDE,PUSH BTN:4 BUTTON | 80009 | 351-0469-00 |
| -19 | 351-0469-01 | | 2 | 2 | GUIDE,PUSH BTN:3 BUTTON | 80009 | 351-0469-01 |
| -20 | ----- | | 2 | 2 | CONN,RCPT,ELEC:BNC,FEMALE(SEE J2,J640 REPL) | | |
| -21 | 348-0235-00 | | 2 | 2 | SHLD GSKT,ELEK:FINGER TYPE,4.734 L | 92101 | ORDER BY DESCR |
| -22 | ----- | | 1 | 1 | RESISTOR,VAR:(SEE R705 REPL) | | |
| -23 | 129-0290-00 | | 1 | 1 | SPACER,POST:0.635 L,0.25-32 THRU,AL,0.312 | 80009 | 129-0290-00 |
| -24 | 210-0046-00 | | 2 | 2 | WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL | 77900 | 1214-05-00-0541C |
| -25 | 348-0067-00 | | 1 | 1 | GROMMET,PLASTIC:GRAY,ROUND,0.252 ID | 80009 | 348-0067-00 |
| -26 | ----- | | 1 | 1 | RESISTOR,VAR:(SEE R210 REPL) (ATTACHING PARTS) | | |
| -27 | 210-0583-00 | | 2 | 2 | NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CO PL | 73743 | 2X-20319-402 |
| -28 | 210-0046-00 | | 3 | 3 | WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL (END ATTACHING PARTS) | 77900 | 1214-05-00-0541C |
| -29 | 366-1257-93 | | 1 | 1 | PUSH BUTTON:STL GY,X1 X10 | 80009 | 366-1257-93 |
| -30 | 384-1292-00 | | 1 | 1 | EXTENSION SHAFT:2.417 L,GL FILLED NYLON | 80009 | 384-1292-00 |
| -31 | 384-1100-00 | | 1 | 1 | EXTENSION SHAFT:6.215 L X 0.187 SQ,PLASTIC | 80009 | 384-1100-00 |
| -32 | ----- | | 1 | 1 | RESISTOR,VAR:(SEE R535 REPL) (ATTACHING PARTS) | | |
| -33 | 210-0583-00 | | 2 | 2 | NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CO PL | 73743 | 2X-20319-402 |
| -34 | 210-0046-00 | | 1 | 1 | WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL (END ATTACHING PARTS) | 77900 | 1214-05-00-0541C |
| -35 | 386-3440-00 | | 1 | 1 | LT CNDCT,PB ILL:3 BUTTON,7.5MM SPACING | 80009 | 386-3440-00 |
| -36 | 386-3439-00 | | 1 | 1 | LT CNDCT,PB ILL:10 BUTTON,7.5MM SPACING | 80009 | 386-3439-00 |
| -37 | 200-0935-00 | | 4 | 4 | BASE,LAMPHOLDER:0.29 OD X 0.19 L,BK PLSTC | 80009 | 200-0935-00 |
| -38 | ----- | | 1 | 1 | RESISTOR,VAR:(SEE R415 REPL) (ATTACHING PARTS) | | |
| -39 | 210-0583-00 | | 2 | 2 | NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CO PL | 73743 | 2X-20319-402 |
| -40 | 210-0046-00 | | 1 | 1 | WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL (END ATTACHING PARTS) | 77900 | 1214-05-00-0541C |
| -41 | ----- | | 1 | 1 | RESISTOR,VAR:(SEE R410 REPL) (ATTACHING PARTS) | | |
| -42 | 210-0583-00 | | 1 | 1 | NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CO PL | 73743 | 2X-20319-402 |
| -43 | 210-0046-00 | | 1 | 1 | WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL (END ATTACHING PARTS) | 77900 | 1214-05-00-0541C |
| -44 | 386-4181-00 | | 1 | 1 | SUBPANEL,FRONT: (ATTACHING PARTS) | 80009 | 386-4181-00 |

Replaceable Mechanical Parts - 7B87

| Fig. & Index No. | Tektronix Part No. | Serial/Assembly No. Effective Dscont | Qty | 12345 Name & Description | Mfr. Code | Mfr. Part No. |
|------------------------|-----------------------|---|-----|--|--------------|----------------|
| 1-45 | 213-0192-00 | 8010100 | 4 | SCREW,TPG,TF:6-32 X 0.5,SPCL TYPE,FILH,STL | 87308 | ORDER BY DESCR |
| | 213-0793-00 | 8010390 | 4 | SCREW,TPG,TF:6-32 X 0.4375,TAPTITE,FILH (END ATTACHING PARTS) | 83486 | 239-006-406043 |
| -46 | 378-0074-00 | | 7 | REFLECTOR,LIGHT:PUSH BUTTON | 80009 | 378-0074-00 |
| -47 | 366-1650-00 | | 14 | PUSH BUTTON:CLEAR,0.184 X 0.214 X 8.0 | 80009 | 366-1650-00 |
| -48 | 131-1820-00 | | 7 | CONN,PLUG,ELEC:CKT 80,5 CONTACT MALE | 22526 | 65306-002 |
| -49 | 384-1382-00 | | 7 | EXTENSION SHAFT:1.09 L,OFFSET,MLO PLSTC | 80009 | 384-1382-00 |
| -50 | ----- | | 1 | CKT BOARD ASSY:CLOCK(SEE A4 REPL) (ATTACHING PARTS) | | |
| -51 | 211-0008-00 | | 9 | SCREW,MACHINE:4-40 X 0.25,PNH,STL (END ATTACHING PARTS) CKT BOARD ASSY INCLUDES: | 93907 | ORDER BY DESCR |
| -52 | ----- | | 1 | .SWITCH PB ASSY:(SEE S205 REPL) | | |
| -53 | 343-0495-03 | | 1 | .CLIP,SWITCH:FRONT,7.5MM X 3 UNIT (ATTACHING PARTS) | 80009 | 343-0495-03 |
| -54 | 210-3033-00 | | 3 | .EYELET,METALLIC:0.059 00 X 0.156 L,BRS (END ATTACHING PARTS) | 07707 | SE-25 |
| -55 | 343-0499-03 | | 1 | .CLIP,SWITCH:REAR,7.5MM X 3 UNIT (ATTACHING PARTS) | 80009 | 343-0499-03 |
| -56 | 210-3033-00 | | 3 | .EYELET,METALLIC:0.059 00 X 0.156 L,BRS (END ATTACHING PARTS) | 07707 | SE-25 |
| -57 | 136-0252-07 | | 37 | .SOCKET,PIN CONN:W/O DIMPLE | 22526 | 75060-012 |
| -58 | 131-0566-00 | | 1 | .BUS,COND:DUMMY RES,0.094 00 X 0.225 L | 24546 | OMA 07 |
| -59 | 136-0263-04 | | 20 | .SOCKET,PIN TERM:U/M 0.025 SQ PIN | 22526 | 75377-001 |
| -60 | 253-0176-00 | | 1 | .TAPE,PRESS SENS:VINYL FOAM,0.5 X 0.062, | 85471 | ORDER BY DESCR |
| -61 | 214-0579-00 | | 6 | .TERM,TEST POINT: | 80009 | 214-0579-00 |
| -62 | 136-0634-00 | 8010100 | 1 | .SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP | 09922 | 01LB20P-108 |
| | 136-0752-00 | 8021628 | 1 | .SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP | 09922 | 01LB20P-108 |
| -63 | 131-0589-00 | | 22 | .TERMINAL,PIN:0.46L X 0.025 SQ BRZ GLD PL | 22526 | 48283-029 |
| -64 | 131-1003-00 | | 1 | .CONN,RCPT,ELEC:CKT BD MT,3 PRONG | 80009 | 131-1003-00 |
| | 131-0566-00 | 8010121 | 2 | .BUS,COND:DUMMY RES,0.094 00 X 0.225 L | 24546 | OMA 07 |
| -65 | 337-2671-00 | 8010100 | 1 | SHIELD,ELEC:CLOCK | 80009 | 337-2671-00 |
| | 337-2671-01 | 8010576 | 1 | SHIELD,ELEC:CLOCK | 80009 | 337-2671-01 |
| -66 | 366-1559-00 | | 1 | PUSH BUTTON:SIL GY,0.18 SQ X 0.43 | 80009 | 366-1559-00 |
| -67 | ----- | | 1 | CKT BOARD ASSY:TRIGGER(SEE A2 REPL) (ATTACHING PARTS) | | |
| -68 | 211-0008-00 | | 2 | SCREW,MACHINE:4-40 X 0.25,PNH,STL (END ATTACHING PARTS) CKT BOARD ASSY INCLUDES: | 93907 | ORDER BY DESCR |
| -69 | ----- | | 1 | .SWITCH PB ASSY:(SEE S20 REPL) | | |
| -70 | ----- | | 1 | .SWITCH PB ASSY:(SEE S50 REPL) | | |
| -71 | 343-0495-04 | | 1 | .CLIP,SWITCH:FRONT,7.5MM X 4 UNIT (ATTACHING PARTS) | 80009 | 343-0495-04 |
| -72 | 210-3050-00 | | 3 | .EYELET,METALLIC:0.059 00 X 0.218 L,BRS | 07707 | SE-27 |
| -73 | 210-3033-00 | | 1 | .EYELET,METALLIC:0.059 00 X 0.156 L,BRS (END ATTACHING PARTS) | 07707 | SE-25 |
| -74 | 343-0495-03 | | 1 | .CLIP,SWITCH:FRONT,7.5MM X 3 UNIT | 80009 | 343-0495-03 |
| -75 | 343-0499-04 | 8010100 | 1 | .CLIP,SWITCH:REAR,7.5MM X 4 UNIT | 80009 | 343-0499-04 |
| | 343-0499-13 | 8010600 | 1 | .CLIP,SWITCH:7.5MM X 4 UNIT (ATTACHING PARTS) | 80009 | 343-0499-13 |
| -76 | 210-3050-00 | | 3 | .EYELET,METALLIC:0.059 00 X 0.218 L,BRS | 07707 | SE-27 |
| -77 | 210-3033-00 | 8010100 | 1 | .EYELET,METALLIC:0.059 00 X 0.156 L,BRS | 07707 | SE-25 |
| | 343-0499-12 | 8010600 | 1 | .CLIP,SWITCH:FRONT,7.5MM X 3 UNIT (END ATTACHING PARTS) | 80009 | 343-0499-12 |
| -78 | 343-0499-03 | 8010100 | 1 | .CLIP,SWITCH:REAR,7.5MM X 3 UNIT | 80009 | 343-0499-03 |
| | 343-0499-12 | 8010600 | 1 | .CLIP,SWITCH:FRONT,7.5MM X 3 UNIT | 80009 | 343-0499-12 |
| -79 | 136-0263-04 | | 15 | .SOCKET,PIN TERM:U/M 0.025 SQ PIN | 22526 | 75377-001 |
| -80 | 136-0260-02 | 8010100 | 1 | .SKT,PL-IN ELEK:MICROCKT,16 DIP,LOW CL | 09922 | 01LB16P-108T |
| | 136-0729-00 | 8021628 | 1 | .SKT,PL-IN ELEK:MICROCKT,16 CONTACT | 09922 | 01LB16P-108T |
| -81 | 136-0514-00 | 8010100 | 3 | .SKT,PL-IN ELEK:MICROCIRCUIT,8 DIP | 09922 | 01LB8P-108 |
| | 136-0727-00 | 8021628 | 3 | .SKT,PL-IN ELEK:MICROCKT,8 CONTACT | 09922 | 01LB8P-108 |
| -82 | 136-0634-00 | 8010100 | 1 | .SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP | 09922 | 01LB20P-108 |
| | 136-0752-00 | 8021628 | 1 | .SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP | 09922 | 01LB20P-108 |
| -83 | 214-0579-00 | | 2 | .TERM,TEST POINT: | 80009 | 214-0579-00 |
| -84 | ----- | | 1 | .SWITCH PB ASSY:(SEE S10 REPL) | | |
| -85 | 343-0499-01 | | 1 | .CLIP,SWITCH:REAR,7.5MM X 1 UNIT (ATTACHING PARTS) | 80009 | 343-0499-01 |

| Fig. & Index No. | Tektronix Part No. | Serial/Assembly No. Effective | Discont | Qty | 12345 Name & Description | Mfr. Code | Mfr. Part No. |
|------------------------|-----------------------|----------------------------------|---------|-----|--|--------------|------------------|
| 1-86 | 210-3033-00 | | | 1 | .EYELET,METALLIC:0.059 00 X 0.156 L,BRS (END ATTACHING PARTS) | 07707 | SE-25 |
| -87 | 214-0973-00 | | | 1 | .HEAT SINK,XSTR:T0-92,CU BE CO PL | 80009 | 214-0973-00 |
| -88 | 343-0495-01 | | | 1 | .CLIP,SWITCH:FRONT,7.5MM X 1 UNIT (ATTACHING PARTS) | 80009 | 343-0495-01 |
| -89 | 210-3033-00 | | | 1 | .EYELET,METALLIC:0.059 00 X 0.156 L,BRS (END ATTACHING PARTS) | 07707 | SE-25 |
| -90 | 136-0252-07 | | | 24 | .SOCKET,PIN CONN:M/O DIMPLE | 22526 | 75060-012 |
| -91 | 131-1003-00 | | | 3 | .CONN,RCPT,ELEC:CKT 80 MT,3 PRONG | 80009 | 131-1003-00 |
| -92 | 131-0608-00 | | | 5 | .TERMINAL,PIN:0.365 L X 0.025 BRZ GLO PL | 22526 | 48283-036 |
| -93 | 129-0198-00 | | | 4 | .SPACER,POST:0.75 L,4-40 EA END,BRS,0.188 (ATTACHING PARTS) | 80009 | 129-0198-00 |
| -94 | 211-0008-00 | | | 4 | .SCREW,MACHINE:4-40 X 0.25,PNH,STL (END ATTACHING PARTS) | 93907 | ORDER BY DESCR |
| -95 | 204-0683-00 | | | 7 | .CONN BODY,RCPT:5 FEMALE PV CONTACTS | 22526 | 65058-001 |
| -96 | 386-1402-00 | | | 1 | .PANEL,REAR: (ATTACHING PARTS) | 80009 | 386-1402-00 |
| -97 | 213-0192-00 | 8010100 | 8010389 | 4 | .SCREW,TPG,TF:6-32 X 0.5,SPCL TYPE,FILH,STL | 87308 | ORDER BY DESCR |
| | 213-0793-00 | 8010390 | | 4 | .SCREW,TPG,TF:6-32 X 0.4375,TAPTITE,FILH (END ATTACHING PARTS) | 83486 | 239-006-406043 |
| | 672-0829-00 | 8010100 | 8023285 | 1 | .CIRCUIT BD ASSY:TIME/CM | 80009 | 672-0829-00 |
| | 672-0829-01 | 8023286 | | 1 | .CIRCUIT BD ASSY:TIME/CM (ATTACHING PARTS) | 80009 | 672-0829-01 |
| -98 | 211-0008-00 | | | 6 | .SCREW,MACHINE:4-40 X 0.25,PNH,STL (END ATTACHING PARTS) | 93907 | ORDER BY DESCR |
| -99 | 200-1362-00 | | | 2 | .CKT BOARD ASSY INCLUDES: .COVER,CAM SW:30 ELEMENTS (ATTACHING PARTS) | 80009 | 200-1362-00 |
| -100 | 211-0244-00 | 8010100 | 8010670 | 6 | .SCR,ASSEM MSHR:4-40 X 0.312,PNH STL | 01536 | ORDER BY DESCR |
| | 211-0292-00 | 8010671 | | 6 | .SCR,ASSEM MSHR:4-40 X 0.29,PNH,BRS | 78189 | 51-040445-01 |
| -101 | 210-0406-00 | | | 6 | .NUT,PLAIN,HEX:4-40 X 0.188,BRS CO PL (END ATTACHING PARTS) | 73743 | 12161-50 |
| -102 | ----- | | | 1 | .CKT BOARD ASSY:READOUT(SEE A3 REPL) (ATTACHING PARTS) | | |
| -103 | 211-0008-00 | | | 1 | .SCREW,MACHINE:4-40 X 0.25,PNH,STL | 93907 | ORDER BY DESCR |
| -104 | 211-0244-00 | 8010100 | 8010670 | 7 | .SCR,ASSEM MSHR:4-40 X 0.312,PNH STL | 01536 | ORDER BY DESCR |
| | 211-0292-00 | 8010671 | | 7 | .SCR,ASSEM MSHR:4-40 X 0.29,PNH,BRS (END ATTACHING PARTS) | 78189 | 51-040445-01 |
| -105 | 131-0604-00 | | | 13 | .CKT BOARD ASSY INCLUDES: .CONTACT,ELEC:CKT 80 SW,SPR,CU BE | 80009 | 131-0604-00 |
| -106 | 131-0589-00 | | | 10 | .TERMINAL,PIN:0.46L X 0.025 SQ BRZ GLO PL | 22526 | 48283-029 |
| -107 | 136-0263-04 | | | 3 | .SOCKET,PIN TERM:U/M 0.025 SQ PIN | 22526 | 75377-001 |
| -108 | ----- | | | 1 | .RESISTOR,VAR:(SEE R725 REPL) (ATTACHING PARTS) | | |
| -109 | 210-0583-00 | | | 1 | .NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CO PL | 73743 | 2X-20319-402 |
| -110 | 210-0046-00 | | | 1 | .WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL (END ATTACHING PARTS) | 77900 | 1214-05-00-0541C |
| -111 | 407-0803-00 | | | 1 | .BRACKET,ELEC SW:BRASS | 80009 | 407-0803-00 |
| -112 | 351-0180-00 | | | 1 | .GUIDE,SLIDE SW:SWITCH ACTUATOR | 80009 | 351-0180-00 |
| -113 | 214-1136-00 | | | 1 | .ACTUATOR,SL SW:VARIABLE CAL | 80009 | 214-1136-00 |
| -114 | 214-1190-00 | | | 1 | .CPLG,SHAFT,RGO:0.125 OD TO 0.125 OD,AL | 80009 | 214-1190-00 |
| -115 | 129-0570-00 | | | 1 | .SPACER,POST:0.976 L,4-40 INT EA END,0.188 (ATTACHING PARTS) | 80009 | 129-0570-00 |
| -116 | 211-0008-00 | | | 1 | .SCREW,MACHINE:4-40 X 0.25,PNH,STL (END ATTACHING PARTS) | 93907 | ORDER BY DESCR |
| -117 | 131-0593-00 | | | 3 | .TERMINAL,PIN:1.15 L X 0.025 SQ BRS TIN | 22526 | 47354 |
| -118 | 352-0274-00 | | | 1 | .HOLDER,TERMINAL:8 SQUARE PINS | 80009 | 352-0274-00 |
| -119 | ----- | | | 1 | .SWITCH,PUSH:(SEE R435 REPL) | | |
| -120 | 361-0411-00 | | | 2 | .SPACER,PUSH SW:0.109 L,BLUE POLYCARBONATE | 80009 | 361-0411-00 |
| -121 | 136-0252-07 | | | 5 | .SOCKET,PIN CONN:M/O DIMPLE .ACTR ASSY,CAM S:(SEE S800 REPL) (ATTACHING PARTS) | 22526 | 75060-012 |
| -122 | 211-0244-00 | 8010100 | 8010670 | 4 | .SCR,ASSEM MSHR:4-40 X 0.312,PNH STL | 01536 | ORDER BY DESCR |
| | 211-0292-00 | 8010671 | | 4 | .SCR,ASSEM MSHR:4-40 X 0.29,PNH,BRS (END ATTACHING PARTS) | 78189 | 51-040445-01 |
| -123 | 210-0406-00 | | | 7 | .ACTUATOR ASSY INCLUDES: .NUT,PLAIN,HEX:4-40 X 0.188,BRS CO PL | 73743 | 12161-50 |

Replaceable Mechanical Parts - 7B87

| Fig. & Index No. | Tektronix Part No. | Serial/Assembly No. Effective Dscont | Qty | 12345 | Name & Description | Mfr. Code | Mfr. Part No. |
|------------------------|-----------------------|---|-----|-------|---|--------------|----------------|
| 1-124 | 214-1139-03 | | 2 | .. | ..SPRING,FLAT:0.885 X 0.156 CU BE RED CLR | 80009 | 214-1139-03 |
| -125 | 214-1752-00 | | 2 | .. | ..ROLLER,DETENT:0.125 00 X 0.16,SST | 80009 | 214-1752-00 |
| | 214-1139-00 | 8010900 | 1 | .. | ..SPRING,FLAT:0.885 X 0.156 CU BE GLD CLR | 80009 | 214-1139-00 |
| | 214-1139-02 | 8010900 | 1 | .. | ..SPRING,FLAT:0.885 X 0.156 CU BE GRN CLR | 80009 | 214-1139-02 |
| -126 | 401-0180-00 | | 1 | .. | ..BEARING,CAM SM:FR & REAR,0.8 & 0.83 DIA | 80009 | 401-0180-00 |
| | 214-1139-00 | 8010900 | 1 | .. | ..SPRING,FLAT:0.885 X 0.156 CU BE GLD CLR | 80009 | 214-1139-00 |
| | 214-1139-02 | 8010900 | 1 | .. | ..SPRING,FLAT:0.885 X 0.156 CU BE GRN CLR | 80009 | 214-1139-02 |
| | | | | .. | ..(ATTACHING PARTS) | | |
| -127 | 354-0390-00 | | 1 | .. | ..RING,RETAINING:BASIC EXT,U/O 0.375DIA SFT | 79136 | 5100-37-Z0 |
| | | | | .. | ..(END ATTACHING PARTS) | | |
| -128 | 384-0878-08 | | 1 | .. | ..SHAFT,CAM SM:4.964 L X 0.248 00 OUTER CON | 80009 | 384-0878-08 |
| | | | | .. | ..CENTRIC W/DRIVER | | |
| -129 | 105-0826-00 | | 1 | .. | ..ACTUATOR,CAM SM:TIME/CM,DRUM | 80009 | 105-0826-00 |
| -130 | 401-0178-04 | | 1 | .. | ..BEARING,CAM SM:CENTER/REAR | 80009 | 401-0178-04 |
| -131 | 352-0196-00 | | 2 | .. | ..HOLDER,RESISTOR:PANEL MOUNT,DELRI | 80009 | 352-0196-00 |
| -132 | 131-0963-00 | | 1 | .. | ..CONTACT,ELEC:GROUNDING,PH BRZ,M/BRACKET | TK0507 | ORDER BY DESCR |
| -133 | 384-1417-00 | | 1 | .. | ..EXTENSION SHAFT:10.275 L X 0.125 00,AL | 80009 | 384-1417-00 |
| -134 | | | 1 | .. | ..SWITCH PB ASSY:(SEE S230 REPL) | | |
| -135 | | | 1 | .. | ..CKT BOARD ASSY:INTERFACE(SEE A1 REPL) | | |
| | | | | .. | ..(REPLACEABLE AS A UNIT WITH 672-0829-XX) | | |
| -136 | 136-0634-00 | 8010100 | 1 | .. | ..SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP | 09922 | 01L820P-108 |
| | 136-0752-00 | 8021628 | 1 | .. | ..SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP | 09922 | 01L820P-108 |
| -137 | 343-0495-04 | | 1 | .. | ..CLIP,SWITCH:FRONT,7.5MM X 4 UNIT | 80009 | 343-0495-04 |
| | | | | .. | ..(ATTACHING PARTS) | | |
| -138 | 210-3033-00 | | 4 | .. | ..EYELET,METALLIC:0.059 00 X 0.156 L,BRS | 07707 | SE-25 |
| | | | | .. | ..(END ATTACHING PARTS) | | |
| -139 | 343-0499-04 | 8010100 | 1 | .. | ..CLIP,SWITCH:REAR,7.5MM X 4 UNIT | 80009 | 343-0499-04 |
| | 343-0499-13 | 8010600 | 1 | .. | ..CLIP,SWITCH:7.5MM X 4 UNIT | 80009 | 343-0499-13 |
| | | | | .. | ..(ATTACHING PARTS) | | |
| -140 | 210-3033-00 | | 4 | .. | ..EYELET,METALLIC:0.059 00 X 0.156 L,BRS | 07707 | SE-25 |
| | | | | .. | ..(END ATTACHING PARTS) | | |
| -141 | 136-0514-00 | 8010100 | 3 | .. | ..SKT,PL-IN ELEK:MICROCIRCUIT,8 DIP | 09922 | 01L88P-108 |
| | 136-0727-00 | 8021628 | 3 | .. | ..SKT,PL-IN ELEK:MICROCKT,8 CONTACT | 09922 | 01L88P-108 |
| -142 | 136-0263-04 | | 35 | .. | ..SOCKET,PIN TERM:U/M 0.025 SQ PIN | 22526 | 75377-001 |
| -143 | 131-0604-00 | | 32 | .. | ..CONTACT,ELEC:CKT 80 SM,SPR,CU BE | 80009 | 131-0604-00 |
| -144 | 214-0579-00 | | 5 | .. | ..TERM,TEST POINT: | 80009 | 214-0579-00 |
| -145 | 136-0252-07 | 8010100 | 137 | .. | ..SOCKET,PIN CONN:M/O DIMPLE | 22526 | 75060-012 |
| | 136-0252-07 | 8011050 | 134 | .. | ..SOCKET,PIN CONN:M/O DIMPLE | 22526 | 75060-012 |
| -146 | 131-0566-00 | | 4 | .. | ..BUS,COND:DUMMY RES,0.094 00 X 0.225 L | 24546 | OMA 07 |
| -147 | 131-0608-00 | | 48 | .. | ..TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL | 22526 | 48283-036 |
| -148 | 131-1003-00 | | 2 | .. | ..CONN,RCPT,ELEC:CKT 80 MT,3 PRONG | 80009 | 131-1003-00 |
| -149 | 214-1054-00 | | 1 | .. | ..SPRING,FLAT:0.825 X 0.322,SST | 80009 | 214-1054-00 |
| -150 | 105-0075-00 | | 1 | .. | ..BOLT,LATCH: | 80009 | 105-0075-00 |
| -151 | 220-0547-01 | | 6 | .. | ..NUT BLOCK:4-40 X 0.282,NI SIL NP | 80009 | 220-0547-01 |
| | | | | .. | ..(ATTACHING PARTS) | | |
| -152 | 211-0101-00 | | 6 | .. | ..SCREW,MACHINE:4-40 X 0.250,FLH,100 DG,STL | 83385 | ORDER BY DESCR |
| | | | | .. | ..(END ATTACHING PARTS) | | |
| -153 | 426-0499-11 | | 1 | .. | ..FR SECT,PLUG-IN:BOTTOM | 80009 | 426-0499-11 |
| -154 | 214-1061-00 | | 1 | .. | ..CONTACT,ELEC:GROUNDING,CU BE | 80009 | 214-1061-00 |
| -155 | 426-0505-11 | | 1 | .. | ..FR SECT,PLUG-IN:TOP | 80009 | 426-0505-11 |
| | 198-4213-00 | | 1 | .. | ..WIRE SET,ELEC: | 80009 | 198-4213-00 |
| -156 | 131-0707-00 | | 60 | .. | ..CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL | 22526 | 47439-000 |
| -157 | 175-0825-00 | | AR | .. | ..CABLE,SP,ELEC:2,26 AWG,STRO,PVC JKT,RBN | 80009 | 175-0825-00 |
| -158 | 175-0830-00 | | AR | .. | ..CABLE,SP,ELEC:7,26 AWG,STRO,PVC JKT,RBN | 08261 | 111-2699-972 |
| -159 | 175-0832-00 | | AR | .. | ..CABLE,SP,ELEC:9,26 AWG,STRO,PVC JKT,RBN | 08261 | 111-2699-956 |
| -160 | 175-0833-00 | | AR | .. | ..CABLE,SP,ELEC:10,26 AWG,STRO,PVC JKT,RBN | 08261 | 111-2699-970 |
| -161 | 352-0169-01 | | 2 | .. | ..HLDR,TERM CONN:2 WIRE,BROWN | 80009 | 352-0169-01 |
| | 352-0169-08 | | 2 | .. | ..HLDR,TERM CONN:2 WIRE,GRAY | 80009 | 352-0169-08 |
| -162 | 352-0165-03 | | 2 | .. | ..HLDR,TERM CONN:7 WIRE,ORANGE | 80009 | 352-0165-03 |
| -163 | 352-0167-02 | | 2 | .. | ..HLDR,TERM CONN:9 WIRE,RED | 80009 | 352-0167-02 |
| -164 | 352-0168-00 | | 2 | .. | ..HLDR,TERM CONN:10 WIRE,BLACK | 80009 | 352-0168-00 |
| | 198-4214-00 | | 1 | .. | ..WIRE SET,ELEC: | 80009 | 198-4214-00 |
| | 131-0707-00 | | 26 | .. | ..CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL | 22526 | 47439-000 |
| | 175-0825-00 | | AR | .. | ..CABLE,SP,ELEC:2,26 AWG,STRO,PVC JKT,RBN | 80009 | 175-0825-00 |
| -165 | 175-0826-00 | | AR | .. | ..CABLE,SP,ELEC:3,26 AWG,STRO,PVC JKT,RBN | 80009 | 175-0826-00 |
| -166 | 175-0827-00 | | AR | .. | ..CABLE,SP,ELEC:4,26 AWG,STRO,PVC JKT,RBN | 08261 | 111-2699-954 |
| -167 | 175-0828-00 | | AR | .. | ..CABLE,SP,ELEC:5,26 AWG,STRO,PVC JKT,RBN | 08261 | 111-2699-955 |

| Fig. & Index No. | Tektronix Part No. | Serial/Assembly No. | | Qty | 12345 | Name & Description | Mfr. | |
|------------------------|-----------------------|---------------------|---------|-----|-------|-------------------------------|-------|---------------|
| | | Effective | Discont | | | | Code | Mfr. Part No. |
| 1- | 352-0163-06 | | | 1 | | .HLDR,TERM CONN:5 WIRE,BLUE | 80009 | 352-0163-06 |
| | 352-0169-00 | | | 2 | | .HLDR,TERM CONN:2 WIRE,BLACK | 80009 | 352-0169-00 |
| -168 | 352-0161-00 | | | 1 | | .HLDR,TERM CONN:3 WIRE,BLACK | 80009 | 352-0161-00 |
| | 352-0161-05 | | | 1 | | .HLDR,TERM CONN:3 WIRE,GREEN | 80009 | 352-0161-05 |
| | 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 |
| | | | | | | STANDARD ACCESSORIES | | |
| | 070-2788-00 | | | 1 | | MANUAL,TECH: INSTR | 80009 | 070-2788-00 |

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

Date: 2/10/1986

Change Reference: M57812

Product: 7B87 Time Base

Manual Part No.: 070-2788-00

DESCRIPTION Manual Insert for Product Group 42

These changes are effective at serial number B023665.

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

| | | |
|--------|-------------|--|
| A1 | ----- | CKT BOARD ASSY:INTERFACE (REPLACEABLE AS A UNIT WITH 672-0829-02) |
| A1R227 | 315-0201-00 | RES.,FXD,FILM:200 OHM,5%,0.25W |
| DS220 | 150-1078-00 | LT EMITTING DIO:GREEN,565NM,20MA |

DIAGRAM CHANGES

SECTION 8 DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

LOGIC



Change R227 from 120 to 200. R227 is located in the center-right portion of the schematic.