INSTRUCTION MANUAL

Serial Number _____

7B52

DUAL

TIME BASE

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

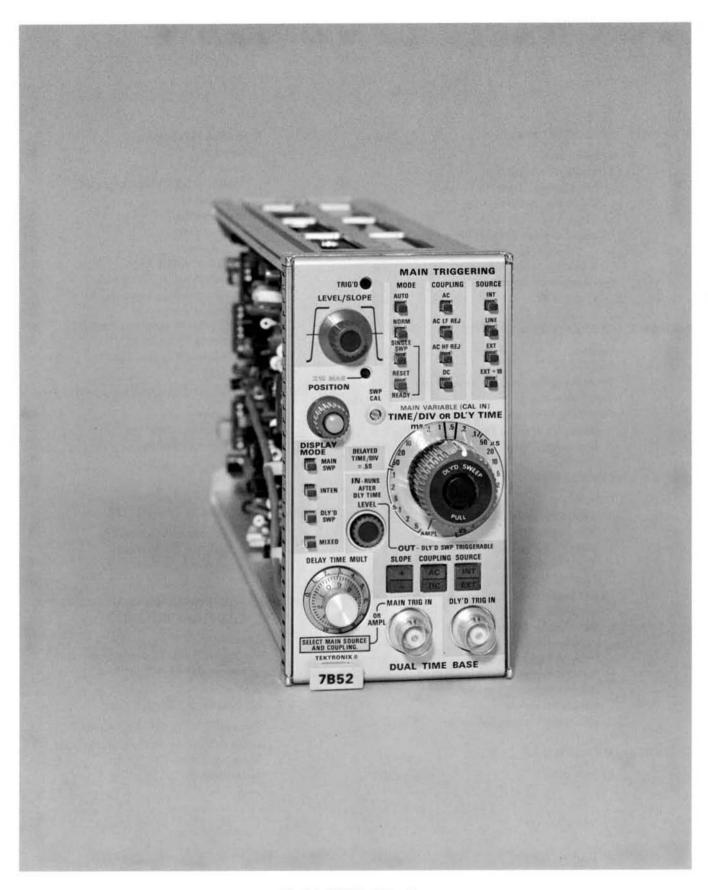


Fig. 1-1. 7B52 Dual Time Base.

SECTION 1 SPECIFICATION

Change information, if any, affecting this section will be found at the rear of this manual.

Introduction

The 7B52 Dual Time Base is designed specifically for use with the 7503 Indicator Oscilloscope; however, it is compatible with all 7000-Series Indicator Oscilloscopes. The 7B52 features calibrated sweeps from 5 s/div to 50 ns/div (0.5 s/div to 5 ns/div with X10 Magnification), triggering to 100 MHz, and four display modes. Other features include lighted pushbutton switches, 0 to 10 times continuous sweep delay, bright base line in AUTO mode in absence of adequate triggering signals, and an AMPL position for X-Y operation.

Display modes include MAIN SWEEP, INTENSIFIED SWEEP, DELAYED SWEEP, and MIXED SWEEP. In the MIXED mode, the Main Sweep is displayed to a point selected by the DELAY TIME MULT, after which the sweep rate is determined by DLY'D SWEEP setting. This mode permits sweep magnification of any point on the normal (Main) sweep selected by the DELAY TIME MULT control.

ELECTRICAL CHARACTERISTICS

The Performance Check procedure given in Section 5 provides a convenient method of checking performance of this instrument. The following electrical characteristics apply over a calibration interval of 1000 hours or six months (whichever occurs first) at an ambient temperature of 0°C to +50°C, unless otherwise noted. Warmup time for given accuracy is 20 minutes. The instrument must be operating in a calibrated indicator oscilloscope for given accuracy.

TABLE 1-1
MAIN SWP Electrical Characteristics

| Characteristic | Performance Requirement Measured in 7500-Series Oscilloscope | | | | |
|--|---|------------------|--------------|------------------|--|
| Differential Sweep Accuracy ¹ | | | | | |
| Time Interval | +15°C t | o +35°C | 0°C to +50°C | | |
| Center 8 Divisions | Unmag | Mag ² | Unmag | Mag ² | |
| 50 ms/Div to .5 μs/Div | 2% | 2.5% | 3% | 4% | |

¹The term "Differential Sweep" refers to Sweep display measured over the center 8 divisions of the graticule.

TABLE 1-1 (cont)

| Characteristic | Performance Requirement | | | | |
|--|---|----------------|-------------------|----|--|
| 5 s/Div to .1 s/Div and .2 μs/Div to .05 μs/Div | 3% | 3.5% | 4% | 5% | |
| Any two Divisions within Center 8 Divisions | | 6 of rement | 7% of measurement | | |
| Sweep Rate MAIN VARIABLE Range | Continuously variable between cali brated sweep rates. Extends sweep rate to at least 12.5 s/Div. | | | | |
| Sweep Length | 10.4 Divisions within 0.3 Division at 1 ms/Div. (Adjusted at this rate.) 10.0 to 13.0 Divisions at all other sweep rates. | | | | |
| Sweep Holdoff Time | | | | | |
| 5 s/Div to 10 μs/Div | 1 times the TIME/DIV switch setting or less. | | | | |
| 5 μs/Div to .05 μs/Div | 2.5 µs or less | | | | |
| Normal/Mag Registration | Within 0.5 Division. | | | | |

TABLE 1-2
DLY'D SWP Electrical Characteristics

| Characteristic | Perf | ormance | Requiren | equirement | |
|--|---|------------------|--------------|------------------|--|
| Differential Sweep Accuracy ¹ | Measured in 7500-Series Oscilloscope | | | | |
| Time Interval | +15°C to +35°C | | 0°C to +50°C | | |
| Center 8 Divisions | Unmag | Mag ² | Unmag | Mag ² | |
| 50 ms/Div to .5 μs/Div | 3% | 3.5% | 4% | 5% | |

²Measure Mag accuracies between first and ninth segment of unmagnified sweep.

TABLE 1-2 (cont)

| Characteristic | Performance Requirement | | | | |
|---|--|-------------------------|-------------------|----------|--|
| .5 s/Div to .1 s/Div and .2 μs/Div to .05 μs/Div | 4% | 4.5% | 5% | 6% | |
| Any two Divisions within Center 8 Divisions | 6% of measurement | | 8% of measurement | | |
| Sweep Length | 10.4 Divisions within 0 at 1 ms/Div. | | thin 0.3 | Division | |
| | 10.0 to 13 Divisions at all other sweep rates. | | | | |
| Sweep Holdoff Time | | ned by M tch setting | | P TIME/ | |

TABLE 1-3
Triggering Electrical Characteristics

| Characteristic | Performance | Performance Requirement | | | | |
|-----------------------------|---|-------------------------|---------|--|--|--|
| Trigger Sensitivity | | | | | | |
| | Triggering | Mini | Minimum | | | |
| Coupling ³ | Frequency | Sig | gnal | | | |
| | Range | Req | uired | | | |
| | | INT | EXT | | | |
| AC | 30 Hz-10 MHz | 0.3 Div | 150 mV | | | |
| | 10 MHz-100 MHz | 1.5 Div | 750 mV | | | |
| AC LF REJ ⁴ | 30 kHz-10 MHz | 0.3 Div | | | | |
| (Main Only) | 150 kHz-10 MHz | | 150 mV | | | |
| | 10 MHz-100 MHz | 1.5 Div | 750 mV | | | |
| AC HF REJ (Main Only) | 30 Hz-50 kHz | 0.3 Div | 150 mV | | | |
| DC | DC - 10 MHz | 0.3 Div | 150 mV | | | |
| | 10 MHz-100 MHz | 1.5 Div | 750 mV | | | |
| Single Sweep (Main Only) | Triggering requirements same as Main Sweep. When triggered, sweep generator produces 1 sweep. | | | | | |
| Internal Trigger Jitter | 1 ns or less at 75 | MHz. | | | | |

 $^{^3}$ On Internal Triggering Only, the specified upper -3 dB frequency of the Vertical System replaces any frequencies in the above table when the number in the table is greater than the upper -3 dB frequency of the indicator oscilloscope Vertical Amplifier.

TABLE 1-3 (cont)

| Characteristic | Performance Requirement |
|--------------------------------------|--|
| External Trigger Input | |
| Maximum Input Voltage | 500 volts (DC plus peak AC). 500 volts (peak-to-peak AC to 1 kHz or less). |
| Input Resistance | 1 megohm within 2%. |
| Input Capacitance | 20 picofarad within 2 picofarad. |
| Level Range | |
| EXT | At least $+3.5$ volts to -3.5 volts. |
| EXT ÷ 10 (Main Only) | At least +35 volts to -35 volts. |
| Auto Bright Base Line (Main Only) | Sweep free-runs in absence of triggering signal in AUTO. |

TABLE 1-4

Mixed Sweep, Variable Time Delay
Electrical Characteristics

| Characteristic | Performance Requirement | | |
|--------------------------------|---|--|--|
| Mixed Sweep | | | |
| Sweep Accuracy | 2% plus measured MAIN SWP error Exclude following portions of Mixed Sweep; first 0.5 Divisions of Main Sweep and 0.2 Division or 0.1 μs, whichever is greater, after transition of Main Sweep to Dly'd Sweep. | | |
| Variable Time Delay | | | |
| Differential Delay Accuracy | | | |
| Center 8 Divisions | | | |
| 5 s/Div to 1 s/Div | Within 2% | | |
| .5 s/Div to 1 μs/Div | Within 1% | | |
| Multiplier Linearity | Within 0.2% of full scale (1 minor division). | | |
| Jitter | 1 part or less in 20,000 of 10 times the TIME/DIV switch setting. | | |

 $^{^4}$ Will not trigger on sine waves of 3 Divisions or less internal, or 1.5 volts external, below 120 Hz.

TABLE 1-5
Amplifier Electrical Characteristics

| Characteristic | Performance Requirement | | | | |
|--------------------|--|-------------|--|--|--|
| Deflection Factor | | | | | |
| EXT, X10 MAG | 10 millivolts/division within 10% | | | | |
| EXT | 100 millivolts/division within 10%. | | | | |
| EXT ÷ 10 | 1 volt/division within 10%. | | | | |
| Frequency Response | System -3 dB points in 75-Se Oscilloscope | | | | |
| | Lower –3 dB | Upper –3 dB | | | |
| AC | 40 Hz | 2 MHz | | | |
| AC LF REJ | 16 kHz | 2 MHz | | | |
| AC HF REJ | 40 Hz 100 kH | | | | |
| DC | DC | 2 MHz | | | |

TABLE 1-6
ENVIRONMENTAL CHARACTERISTICS

This instrument will meet the electrical characteristics given over the following environmental limits.

| Characteristic | Performance Requirement |
|----------------|---|
| Altitude | |
| Non-Operating | To 50,000 feet and -55°C. |
| Transportation | Qualified under National Safe Transit Committee test procedure 1A, category II. |

NOTES

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SECTION 2 OPERATING INSTRUCTIONS

Change information, if any, affecting this section will be found at the rear of this manual.

General

The 7B52 Dual Time Base Unit is designed specifically for use with Tektronix 7500-Series Indicator Oscilloscopes having one horizontal plug-in compartment; however, it is compatible with all Tektronix 7000-Series Indicator Oscilloscopes. To effectively use the 7B52, its operation and capabilities should be known. This section describes the operation of the front-panel controls, gives first-time and general operating information, lists some basic applications and tells how to make the instrument compatible with all 7000-Series oscilloscopes.

Installation

The 7B52 is designed to operate in the horizontal plug-in compartment of the oscilloscope. The 7B52 can also be installed in a vertical plug-in compartment to provide a sweep that runs vertically on the CRT. However, when used in this manner, there is no retrace blanking or internal triggering provisions, and the unit may not meet the specifications given in Section 1. The instructions in this manual are written for use of the 7B52 in the horizontal plug-in compartment.

Before proceeding with installation, it is necessary to set two internal 7B52 switches which provide proper triggering

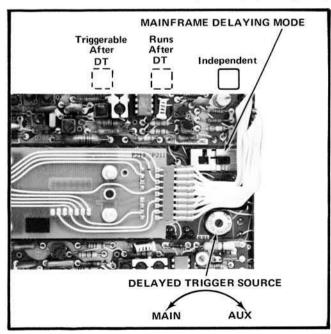


Fig. 2-1. Location of DELAYED TRIGGER SOURCE and MAIN-FRAME DELAYING MODE switches.

signals from within or to the indicator oscilloscope mainframe. The DELAYED TRIGGER SOURCE and MAIN-FRAME DELAYING MODE switches perform these functions; see Fig. 2-1. Table 2-1 lists the SOURCE and MODE switch positions for using the 7B52 in any 7000-Series Indicator Oscilloscope.

TABLE 2-1

| | Indicator Oscilloscope and Horizontal Plug-In Compartment Used | | | | | | |
|---|--|--|-------------------------------|--|--|--|--|
| Switch Position | 7503 | 7504-7704 A HORIZ | 7504-7704 B HORIZ | | | | |
| DELAYED TRIGGER SOURCE MAIN | Horizontal Trig Selector | A Horizontal Trig Selector | B Horizontal Trig Selector | | | | |
| AUX | Left Vertical Signal | B Horizontal Trig Selector | A Horizontal Trig Selector | | | | |
| MAIN- FRAME DELAYING MODE | | | | | | | |
| Independent (Rear) ¹ | Normal | Normal | Normal | | | | |
| Runs After (Center) ² | | Delaying Swp (B Horizontal Runs After Delay Interval) | ***** | | | | |
| Triggerable After (Front) ² | ****** | Delaying Swp (B Horizontal Triggerable After Delay Interval) | ***** | | | | |

¹Switch must be in this position to obtain intensified sweep.

 $^{^2\,\}mathrm{Functional}$ only when 7B52 is placed in A HORIZ compartment of 7504 or 7704.

Operating Instructions-7B52

To install the 7B52 into a plug-in compartment, push it in until it fits firmly into the compartment. To remove, pull the release latch (see Fig. 2-2) to disengage the unit from the indicator oscilloscope and pull it out of the plug-in compartment. Even though the horizontal gain of the indicator oscilloscope is standardized to minimize adjustment when inserting plug-ins, the sweep calibration of the 7B52 should be checked. The procedure for checking the unit is given under Sweep Calibration Check in the First-Time Operating Instructions of this section.



Fig. 2-2. Location of release latch.

FRONT-PANEL CONTROLS and CONNECTORS

General

All controls required for the operation of the 7852 are located on the front panel of the unit (see Fig. 2-3) with the exception of the internal DELAYED TRIGGER SOURCE and MAIN-FRAME DELAYING MODE switches. To make full use of the capabilities of this instrument, the operator should be familiar with the function and use of each of these controls. A detailed description of the front-panel controls and connectors is given here.

Main Triggering Controls

LEVEL/SLOPE

The LEVEL/SLOPE control determines whether the trigger circuit responds on the positive-going or negative-going portion of the trigger signal. When the indicator line on the outer ring of the LEVEL/SLOPE control is to the left of center, the display starts on the positive-going portion of the waveform (notice positive-going waveform symbol to left of control). To the right of center, the display starts on the negative-going portion

of the waveform (notice negativegoing waveform symbol). When several cycles of a signal appear in the display, the selection of the trigger slope is often unimportant. However, if only a certain portion of a cycle is to be displayed, correct setting of the LEVEL/SLOPE control is important to provide a display which starts on the desired slope of the input signal.

The LEVEL/SLOPE control determines the voltage level on the trigger signal at which the display is triggered, as well as selecting the trigger slope. The center knob of the LEVEL/SLOPE control provides about a 3:1 reduction in relation to the outer indicator ring, to allow precise level selection. This control can also be turned throughout the complete 360° rotation to allow continuous triggering over the selected slope. When the LEVEL/ SLOPE control is set to the line on either the positive-going or negative-going waveform symbol the sweep is triggered near the zero-volt level of the trigger signal (AC coupled only). As the LEVEL/ SLOPE control is rotated away from the zero line, the displayed waveform starts at a point corresponding to the position of the indicator line on the associated slope waveform symbol. For example, if the LEVEL/SLOPE control is turned clockwise from the zero line on the positive-going slope symbol, the displayed waveform starts at a more positive level.

Before setting the triggering level, select the TRIGGERING MODE, COUPLING and SOURCE. Then adjust the LEVEL/SLOPE control so the displayed waveform starts at the desired point. The triggering slope can be changed at any time by rotating the LEVEL/SLOPE control to the corresponding point on the other slope waveform symbol.

TRIG'D LAMP

The TRIG'D lamp provides a convenient indication of the condition of the trigger circuits. If the MAIN

TRIGGERING MODE, COUPLING, and SOURCE switches are correctly set and a suitable trigger signal is applied, the TRIG'D lamp is on. Under certain conditions, the TRIG'D lamp may be off, indicating that the sweep is not triggered. The cause might be a misadjustment of the LEVEL/SLOPE control, incorrectly set COUPLING or SOURCE switches, low trigger

signal amplitude, or a trigger signal repetition rate outside the acceptable frequency range. This feature can be used as a general indication of correct triggering. It is particularly useful when setting up the trigger circuits when a trigger signal is available without a display on the CRT. It also indicates that this unit is correctly triggered when operating as a DLY'D SWEEP.

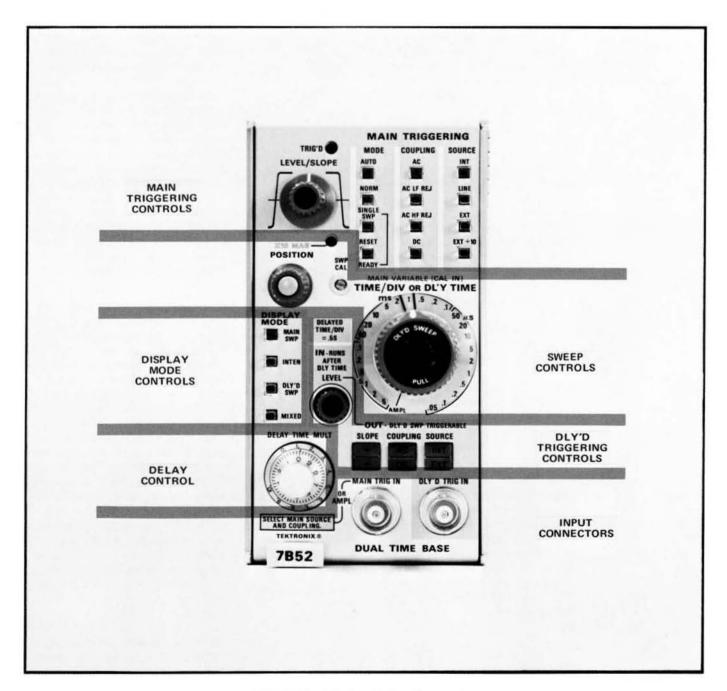


Fig. 2-3. Front-Panel controls and connectors.

Operating Instructions-7B52

MODE

The pushbuttons located under the MODE title select the mode in which the sweep is triggered. The selected mode in which the sweep is triggered. The selected mode is indicated by a lighted pushbutton.

AUTO

When the AUTO pushbutton is illuminated, a triggered display is presented with the correct setting of the LEVEL/SLOPE control whenever an adequate trigger signal is applied. The range of the LEVEL/SLOPE control in this mode is ±8 vertical divisions. The TRIG'D light indicates when the display is triggered.

When the trigger repetition rate is below about 30 hertz (or outside the frequency range selected by the COUPLING switch) or when the trigger signal is inadequate, the sweep free-runs at the sweep rate indicated by the TIME/DIV or DL'Y TIME switch to produce a reference trace (TRIG'D light off). When an adequate trigger signal is again applied, the free-running condition ends and a triggered display is proesented. When the LEVEL/ SLOPE control is at a setting outside the amplitude range of the trigger signal, the sweep also freeruns at the sweep rate indicated by the TIME/DIV or DLY TIME switch. This type of free-running display can be useful to measure only the maximum peak-to-peak amplitude of a signal without observing the waveshape (such as in bandwidth measurements).

NORM

When the NORM pushbutton is pressed, a triggered display is presented with the correct setting of the LEVEL/SLOPE control whenever an adequate trigger signal is applied. The range of the LEVEL/SLOPE control in this mode is ±8 vertical divisions. The TRIG'D light indicates when the display is triggered.

The NORM trigger mode must be used to produce triggered displays with trigger repetition rates below

30 hertz. When the LEVEL/SLOPE control is at a setting outside the amplitude range of the trigger signal, when the trigger repeition rate is outside the frequency range selected by the COUPLING switch, or when the trigger signal is inadequate, there is no trace (TRIG'D light is off).

SINGLE SWP

Non-repetitive, random signals can be displayed in the single-sweep mode by first obtaining the best possible display in the NORM MODE with a signal which is about the same amplitude and frequency as the random signal. Then without changing the other TRIGGERING controls, press the SINGLE SWP pushbutton. When ready for the random signal, press the RESET-READY pushbutton. The RESET-**READY** pushbutton remains lighted to indicate that the unit has been reset and is ready to produce a sweep. The light goes out after the random signal triggers the unit. To prepare the unit for another singlesweep display, press the RESET-READY pushbutton again.

When using the single-sweep mode to photograph waveforms, the graticule must 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 RESET-READY pushbutton only once for each waveform unless the signal is completely symmetrical. Otherwise, multiple waveforms may appear on the film. For random signals, the camera lens can be left open until the random signal triggers the unit (RESET-READY pushbutton lighted). Further information on photographic techniques is given in the camera instruction manual.

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. A stable display can often be obtained under these circumstances by using the single-sweep feature of this unit. The SINGLE SWP MODE is also useful to photograph non-repetitive or unstable displays.

To obtain a single-sweep display of a repetitive signal, first obtain the best possible display in the NORM MODE. Then without changing the other TRIGGERING controls, press the SINGLE SWP pushbutton. When ready to view the singlesweep display press the RESET-READY PUSHBUTTON. A single trace is presented each time the RESET-READY pushbutton is pressed (as long as the repetitive signal remains connected to the system and TRIGGERING controls are correctly set) and further sweeps cannot be presented until the RESET-READY pushbutton is pressed again. If the displayed signal is a complex waveform composed of pulses of varying amplitude, successive single-sweep displays may not start at the same point of the waveform. To avoid confusion due to the CRT persistence, allow the display to decay before pressing the RESET-READY pushbutton 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 using a viewing hood as recommended in the indicator instruction manual.

COUPLING

The pushbuttons located below the COUPLING title selects the method in which the trigger signal is connected to the trigger circuits. The selected coupling is indicated by a lighted pushbutton. Each position permits selection or rejection of the frequency components of the trigger signal which trigger the sweep. Fig. 2-4 graphically illustrates the band of frequencies covered by each position of the COUPLING switch.

AC

In the AC position of the COU-PLING switch, the DC component

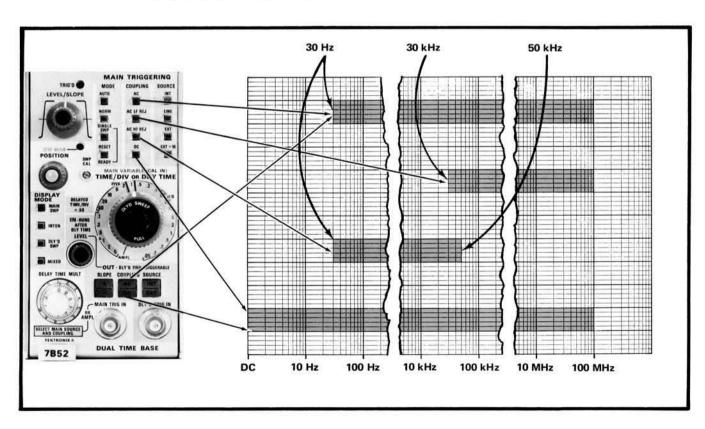


Fig. 2-4. Frequency range of each COUPLING switch position.

of the trigger signal is blocked. 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 DC level, one of the remaining COUPLING switch positions will provide a better display.

The triggering point in the AC position depends upon the average voltage level of the trigger signal. If the trigger signal occurs randomly, the average voltage level will vary, causing the triggering point to vary also. This shift of the triggering point may be enough so it is impossible to maintain a stable display. In such cases, use DC coupling.

AC LF REJ

In the AC LF REJ position, DC is rejected and low-frequency trigger signals below about 30 kilohertz are attenuated. Therefore, the sweep is triggered only by the higherfrequency 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 (with dual-trace vertical or slaved triggering operation for dual-vertical unit operation).

AC HF REJ

The AC HF REJ position 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 for providing a stable display of the low-frequency components.

DC

DC COUPLING can be used to provide stable triggering with low-frequency signals which would be

attenuated in the other modes, or with low-repetition rate signals. It can also be used to trigger the sweep when the trigger signal reaches a DC level selected by the setting of the LEVEL/SLOPE control. When using internal triggering, the setting of the vertical unit position control affects the DC triggering point.

SOURCE

The pushbuttons located below the SOURCE title select the source of the trigger signal which is connected to the trigger circuits. The selected source is indicated by a lighted pushbutton.

INT

In the INT position of the SOURCE switch, the trigger signal is derived from the associated vertical unit. Further selection of the internal trigger signal may be provided by the associated vertical unit or indicator oscilloscope; see the instruction manuals for these instruments for information. For most applications, the INT-SOURCE position can be used. However, some applications require special triggering which cannot be obtained in the INT-SOURCE position. In such cases LINE- or EXT-SOURCE must be used.

LINE

The LINE position of the SOURCE switch connects a sample of the power-line voltage, to which the indicator oscilloscope is connected, 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.

EXT

An external signal connected to the MAIN TRIG IN connector can be used to trigger the sweep in the EXT-SOURCE position. 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

too low in amplitude for correct triggering or contains signal components on which it is not desired to trigger, 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 under test can be connected to the MAIN 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.

EXT ÷ 10

Operation in the EXT ÷ 10 position is the same as described for EXT except that the external signal is attenuated 10 times. Attenuation of high-amplitude external trigger signals is desirable to broaden the range of the LEVEL/SLOPE control.

Sweep Controls

TIME/DIV or DL'Y TIME

The TIME/DIV or DL'Y TIME switch provides 25 calibrated sweep rates ranging from .05 μ s/div to five seconds/div. The MAIN VARIABLE control must be in the CAL position (locked in) and the X10 MAG switch must be off (locked in) for the indicated sweep rate.

DLY'D SWEEP

The DLY'D SWEEP switch provides 22 calibrated sweep rates ranging from .05 μ s to .5 second.

With DISPLAY MODE switch at INTEN or DLY'D SWP, pull out on the DLY'D SWEEP switch and rotate clockwise.

MAIN VARIABLE

The MAIN VARIABLE control incorporates a two-position switch to determine whether the sweep rate is calibrated or uncalibrated. When the knob is in the inward position, the MAIN VARIABLE is inoperative and the sweep rate is calibrated. When pressed and released, the MAIN VARIABLE knob

moves outward to activate the MAIN VARIABLE control for uncalibrated rates, A calibrated rate may be obtained at any position of the MAIN VARIABLE control by pressing in and locking. This feature is useful when a specific uncalibrated sweep rate has been obtained and it is desired to switch between this uncalibrated sweep rate and a calibrated sweep rate.

The MAIN VARIABLE control allows the sweep rate in each TIME/DIV switch position to be reduced to at least the sweep rate of the next adjacent switch position. This provides an overall uncalibrated variable sweep range from 50 ns/div to about 12.5 seconds/division.

POSITION

The POSITION control provides horizontal positioning of the CRT display.

SWP CAL

The SWP CAL control is a screwdriver adjustment to set the amplitude of the output sawtooth waveform.

X10 MAG

The X10 MAG switch expands the sweep ten times. The center division of the unmagnified display is the portion visible on the CRT in magnified form. Equivalent length of the magnified sweep is 100 divisions.

Display Mode Controls

MAIN SWP

The MAIN SWP selects sweep rates as determined by the TIME/DIV switch.

INTEN

This is one of the delayed sweep functions. In INTEN mode, a portion of the main sweep is intensified during the time that delayed sweep is in operation as determined by DLY'D SWEEP. (MAIN FRAME DELAYING MODE switch must be in Independent position.)

Operating Instructions-7B52

DLY'D SWP

One of the delayed sweep functions. In DLY'D SWP, the delayed sweep is displayed at the end of each delay period as determined by the DL'Y TIME and DELAY TIME

MULT control settings.

SOURCE

Pushbutton switch to select trigger

source.

INT (in): Trigger signal obtained

from vertical unit.

EXT (out): Trigger signal obtained

from DLY'D TRIG IN connector.

MIXED SWP

Main and delayed sweep function. In MIXED SWP position, the main sweep is displayed on the CRT to the point determined by the DE-LAY TIME MULT control, followed by the delayed sweep.

Input Connectors

MAIN TRIG IN

BNC input connector for external

triggering signal.

Delay Control

DELAY TIME MULT The DELAY TIME MULT (DTM)

provides variable delay of 0 to 10 times the basic delay time selected by the DL'Y TIME switch.

AMPL IN

BNC input connector for external

signal. TIME/DIV or DL'Y TIME switch must be in AMPL and the MAIN TRIGGERING SOURCE switch must be set for EXT or EXT

÷ 10.

Dly'd Triggering Controls

DLY'D LEVEL

Two position switch actuated by the LEVEL control. At the 'IN' position, the LEVEL, SLOPE, COUPLING, and SOURCE switches are inoperative. However, the DLY'D Sweep will run after DI'y time as determined by the DL'Y TIME switch and setting of the DELAY TIME MULT control. In the 'OUT' position, the LEVEL, SLOPE, COUPLING, and SOURCE switches are operative. In this condition, the DIy'd Sweep is triggerable.

DLY'D TRIG IN

BNC input connector for external dly'd triggering signal. DLY'D LEVEL control must be out and the DLY'D SOURCE switch must

be set for EXT.

SLOPE

Pushbutton switch to select either positive or negative slope of de-

layed trigger.

Amplifier

In some applications, it is desirable to display one signal vs. another (X-Y) rather than against time. The AMPL position of the TIME/DIV or DL'Y TIME switch, in conjunction with a signal applied to the AMPL IN connector, provides a means of applying this signal to the horizontal amplifier. The correct MAIN TRIGGERING COUPLING and SOURCE switches must be selected to correspond to the the signal applied to the AMPL IN

connector.

Two modes of external hoirzontal operation are provided. When the MAIN TRIGGERING SOURCE switch is set to EXT or EXT ÷ 10 positions, external horizontal deflection is provided by the signal applied to the AMPL IN connector. The signal coupling provided by the COUPLING switch can be used to select or reject components of the

external horizontal signal.

COUPLING

Pushbutton switch to select either AC (in) or DC (out) coupling.

AC: Rejects DC and attenuates AC signals below about 20 Hz. Accepts signals between 30 Hz and 100

MHz.

DC: Accepts all triggers between

DC and 100 MHz.

The external horizontal deflection factor is approximately 100 mV/div in EXT and 1 V/div in EXT \div 10 positions of the SOURCE switch.

TEST SETUP CHART

General

Fig. 2-5 shows the front panel of the 7B52. This chart can be reproduced and used as a gest setup record for special measurements, applications, or produces; or it may be used as a training aid for familiarization with this instrument.

FIRST-TIME OPERATING INSTRUCTIONS

Sweep Calibration Check

Whenever the 7B52 is inserted into a plug-in compartment of an indicator oscilloscope other than the one in which it was originally calibrated, the sweep calibration must be checked and readjusted if necessary. Set the two internal switches (see Installation this section), install the 7B52 into the plug-in compartment of an indicator oscilloscope, and allow at least 20 minutes warmup before proceeding with the following:

- 1. Connect a 1 kHz calibrator signal from the indicator oscilloscope Cal Out connector via a 50 ohm BNC coaxial cable to the Input connector on the Vertical plug-in unit.
- 2. Set the 7B52 TIME/DIV or DL'Y TIME switch to 1 ms, press the DISPLAY MODE MAIN SWP switch and press the MAIN TRIGGERING AUTO, AC, and INT switches.
- 3. Set the Vertical plug-in unit for a CRT display amplitude of 2 to 4 divisions using DC coupling.
- 4. Rotate the LEVEL/SLOPE control for a triggered display.
- 5. Check the CRT display for one complete cycle of calibrator signal for each major division. (See Fig. 5-2 of PERFORMANCE CHECK/CALIBRATION procedure.)
- 6. Adjust SWP CAL (a front-panel screwdriver adjustment) for exactly 1 complete cycle of calibrator signal for each major division on the CRT. Use only the center 8 graticule divisions.

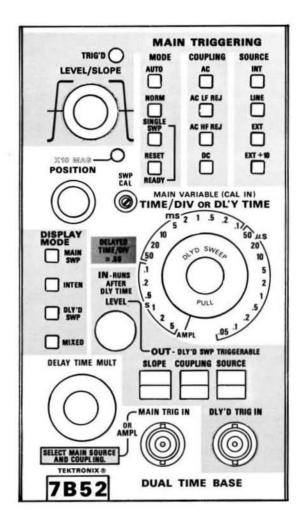
First-Time Operation

Use the following first time operating procedure to become acquainted with the 7B52. For a complete descrip-

tion of each control and connector, refer to CONTROLS and CONNECTORS in this section.

- 1. Complete parts 1 through 6 of the Sweep Calibration Check.
- 2. Rotate the LEVEL/SLOPE control and note that the CRT display is triggered on the positive slope of the display with LEVEL/SLOPE on +, free-runs with LEVEL/SLOPE control at top and bottom, and triggers on the negative slope of the display with LEVEL/SLOPE on —. Also, check that the TRIG'D lamp is on with triggered display.
- 3. Press the MAIN TRIGGERING NORM switch and repeat part 2. Note that the CRT display is the same, except when the LEVEL/SLOPE control is at the top and at the bottom. At these two positions, there should be no CRT display.
- 4. Press the MAIN TRIGGERING SINGLE SWP switch and rotate the LEVEL/SLOPE control 360°. Note that there is no CRT display. Return the LEVEL/SLOPE control to 0/+.
- 5. Observing the CRT, press the MAIN TRIGGERING READY switch. Note that there is one sweep each time the READY switch is pressed.
- 6. Disconnect the Calibrator signal from the Vertical unit Input connector and press the MAIN TRIGGERING READY switch. Note that no sweep occurs, but the READY switch light is on.
- 7. Observing the CRT, connect the Calibrator signal to the Vertical unit Input connector. Note that one sweep occurs and at the end of the sweep the READY light is out.
- 8. Press the MAIN TRIGGERING AUTO switch and rotate the LEVEL/SLOPE control for a triggered display. Rotate the POSITION control throughout its range. Note that the display moves left and right across the CRT. Position the start of the CRT display to the fifth vertical graticule line (see Fig. 5-2 in PERFORMANCE CHECK/CALIBRATION procedure).
- 9. Press in the X10 MAG switch and release. Note that the display still starts near the fifth vertical line on the CRT. Rotate the POSITION control to start the display on the zero vertical line. Note that the display now consists of one cycle of the Calibrator signal rather than 10 cycles. The rate of the displayed signal is the resultant of dividing the TIME/DIV switch setting by 10.

7B52 TEST SET-UP CHART



| NOTES: | | | |
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Fig. 2-5, 7B52 Test Setup Chart.

- 10. Lock the X10 MAG switch in (off).
- 11. Pull out on the DLY'D SWEEP switch and rotate clockwise to .1 ms. Press the DISPLAY MODE INTEN switch. Note that a normal sweep (Main Sweep) with an intensified portion (Dly'd Sweep) is displayed on the CRT. Rotate the DELAY TIME MULT (DTM) control and note that the intensified portion of the display is controlled by the DTM.
- 12. Release the DLY'D LEVEL control and rotate it from one end of rotation to the other (it is assumed that the DLY'D SLOPE, COUPLING, and SOURCE switches are locked in: +, AC, and INT). Note that rotation of the DLY'D LEVEL control controls the triggering of the intensified portion. Rotate the DTM, and observe that one complete revolution is required to move the intensified sweep one division on the CRT as compared with rotating the DTM in part 11. Lock in the DLY'D LEVEL control and set the DTM to 5-00.
- 13. Note the starting position of the intensified portion. It should start at the fifth vertical line on the CRT. Note the length of the intensified portion. It should be one division, or one complete cycle of Calibrator signal. The starting position of the intensified sweep is determined by the resultant of multiplying the DL'Y TIME switch setting (same as TIME/DIV) and the DTM dial setting. The length of the intensified portion is determined by the setting of the DLY'D SWEEP switch setting.
- 14. Press the DISPLAY MODE DLY'D SWP switch. Note that the CRT display now consists of one cycle of Calibrator signal. This is also the intensified portion observed in part 13, and gives the same result as obtained in part 9. The advantage of this mode over the one used in part 9 is that any cycle of the Calibrator signal may be viewed in a magnified form by merely rotating the DTM control. (Rotate the DTM to verify.) Return the DTM to 5-00.

15. Press the DISPLAY MODE MIXED switch. Note that the CRT display now consists of 5 complete cycles of normal sweep (Main Sweep) and 1/2 cycle of Dly'd sweep. Note also that the 1/2 cycle starts at the fifth vertical line. Under the above conditions, the first 5 cycles of Calibrator signal are presented at a rate of 1 ms (setting of TIME/DIV switch), the Dly'd sweep starts 5 ms after the Main sweep (DTM dial setting times the DL'Y TIME switch setting), and the Dly'd sweep is running at a rate of .1 ms (setting of DLY'D SWEEP switch).

NOTE

See the Specification section for any deviation in the settings listed above.

- 16. Rotate the DTM and note that, again, any portion of the Calibrator signal may be viewed.
- 17. Disconnect the Calibrator signal from the Vertical Unit Input connector and reconnect it to the AMPL (MAIN TRIG IN) connector. Set the TIME/DIV or DL'Y TIME and DLY'D SWEEP switches to AMPL and press the MAIN TRIGGERING EXT switch. Note that the CRT display now consists of two dots separately by approximately 4 major divisions.
- 18. Press the MAIN TRIGGERING EXT ÷ 10 switch. Note that the CRT display now consists of two horizontal dots separately by approximately .4 divisions.

This completes the First-Time Operation. It should be remembered different signal inputs require different 7B52 control settings, but the procedure for viewing these signals is essentially the same as given in this procedure.

SECTION 3 CIRCUIT DESCRIPTION

Change information, if any, affecting this section will be found at the rear of this manual.

Introduction

This section of the manual contains a description of the circuitry used in the 7B52 Dual Time Base. The description begins with a discussion of the major circuit functions using a simplified block diagram.

SIMPLIFIED BLOCK DIAGRAM

The Simplified Block Diagram, Fig. 3-1, shows interconnection of the basic circuit blocks in the 7B52. In some cases, such as the Main Sweep Trigger, the block includes a number of separate circuits. The individual circuits are discussed in detail later in this section.

Main Sweep Mode

When the DISPLAY MODE switch is set to select MAIN SWP, operation is as follows:

Main Sweep Trigger. This block includes circuitry for selecting the trigger source, type of coupling, triggering mode, and point on the trigger signal where triggering occurs. Also, regardless of the trigger signal shape or amplitude (within specification), this circuitry provides a fastrise, uniform-amplitude pulse to the Main Sweep Start Multi. Termination of the pulse (or gate) occurs at the rise of Main Sweep Holdoff.

Main Sweep Start Multi. This circuit is activated by the positive gate from the Main Sweep Trigger block. The output signal coupled to the Main Sawtooth Generator is a positive gate with the same duration as the sweep. This gate is also coupled to the Sweep Gate Out block. A negative-going gate (coincident with the positive gate) is coupled to the Delayed Sweep Lockout Multi and the Delayed Sweep Start Control blocks.

Main Sawtooth Generator. The main sweep signal is developed by the Main Sawtooth Generator. When a positive gate from the Main Sweep Start Multi is applied, a sawtooth waveform is generated. The sawtooth duration is determined by the positive gate duration. Rate of change of the sawtooth is set by Ct and Rt, selected by the TIME/DIV switch.

Sweep Stop Comparator. One side of this comparator is driven by the main sweep sawtooth signal, and the other side is set by the Main Swp Stop adjustment. When the sawtooth waveform passes through the setting of the Main Swp Stop adjustment, the output of the Sweep Stop Comparator switches to a positive level. This positive step is applied to the Main Sweep Holdoff and via a small capacitance to the Main Sweep Start Multi. This resets the Main Sweep Start Multi so that it is ready to receive another trigger signal.

Main Sweep Holdoff. This circuit develops a gate which is used to prevent generation of a trigger signal until the sweep circuits have stabilized after a sweep. The positive step from the Sweep Stop Comparator initiates the positive holdoff gate. The duration of the holdoff gate is variable, depending on the setting of the TIME/DIV switch. Holdoff timing capacitors are separate from sweep timing capacitors. Holdoff is longer for slower sweep rates.

Output from the Main Sweep Holdoff is coupled to the Main Sweep Trigger and the Delayed Sweep Trigger blocks. A trigger signal cannot be generated during the holdoff interval. The holdoff serves to reset the trigger circuits so that they are ready to receive an input trigger signal after holdoff.

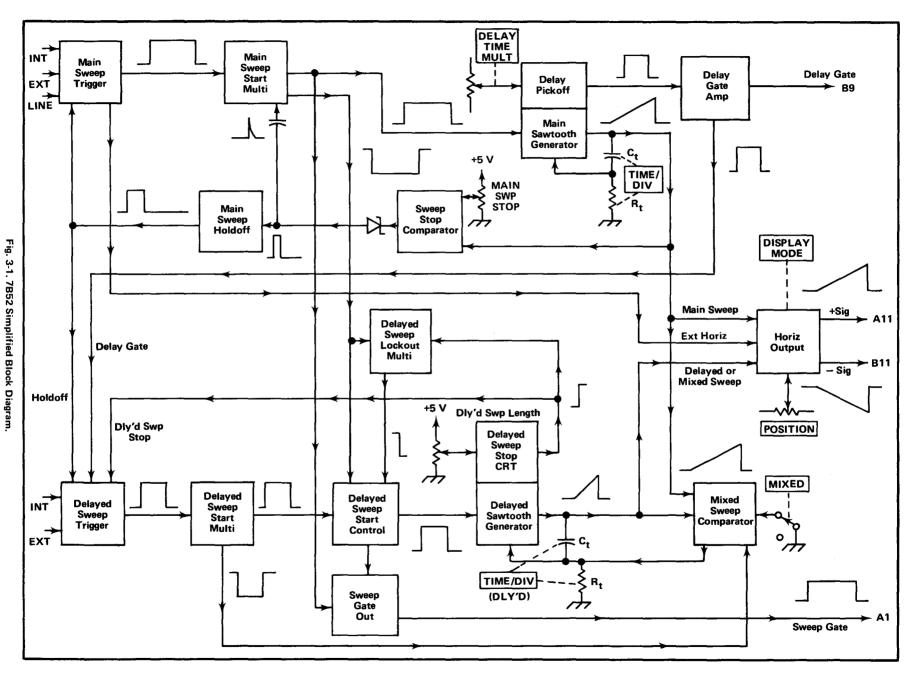
Horiz Output. The Horiz Output block includes the Ext Horiz Amp, Position Amp, Horiz Display Selector, and Horiz Out Amp circuits.

With the DISPLAY MODE switch set to MAIN SWP, this block selects the signal from the Main Sawtooth Generator, amplifies the signal, and converts the single-ended input to a push-pull output signal. A DC positioning level is also applied to this block.

Delayed Sweep Mode

To generate the delayed sweep, the Main Sawtooth Generator must first be gated on (see Main Sweep Mode).

Delay Pickoff. This circuit supplies a positive gate which starts when the main sawtooth signal passes through the level selected by the DELAY TIME MULT control. The gate ends with the main sawtooth signal. The output signal is coupled to the Delay Gate Amp.



Delay Gate Amp. The positive gate from the Delay Pick-off circuit is coupled through the Delay Gate Amp to the Delayed Sweep Trigger block. Also, a negative-going Delay Gate signal is coupled to connector B9 when the internal Mainframe Delaying Mode switch (S59) is set to any position other than "Independent" and the DISPLAY MODE switch is in any selection other than MAIN SWP.

Delayed Sweep Trigger. When the Delayed Trigger LEVEL is pushed in, the output trigger is generated as soon as the Delay Gate signal is applied. If the LEVEL control is out, the output trigger is initiated by the next input trigger after the Delay Gate is applied.

The Delayed Sweep Trigger output is a positive gate which is terminated by the Holdoff signal and/or the positive step from the Delayed Sweep Stop circuit. The positive output gate is coupled to the Delayed Sweep Start Multi.

Delayed Sweep Start Multi. The signal from the Delayed Sweep Trigger causes the Delayed Sweep Start Multi to flip so that a positive gate is coupled to the Delayed Sweep Start Control, and a negative gate is applied to the Mixed Sweep Comparator. The output gates are the same in duration as the positive gate from the Delayed Sweep Trigger.

Delayed Sweep Start Control. For DLY'D SWP mode of operation the Delayed Sweep Start Control serves to couple the positive gate from the Delayed Sweep Start Multi to the Delayed Sawtooth Generator and the Sweep Gate Out.

Input signals from the Main Sweep Start Multi and the Delayed Sweep Lockout Multi are not effective in this mode.

Delayed Sawtooth Generator. The delayed sweep signal is developed by the Delayed Sawtooth Generator. The sawtooth is generated during the time that a positive gate is applied from the Delayed Sweep Start Control. Rate of change of the sawtooth is set by Ct and Rt, selected by the TIME/DIV (Dly'd) switch.

The sawtooth output signal is coupled to the Mixed Sweep Comparator and the Horiz Output circuits.

Delayed Sweep Stop Circuit. A positive step occurs at the output of the Delayed Sweep Stop circuit when the delayed sawtooth passes through the level selected by the Dly'd Swp Length adjustment. This step is coupled to the Delayed Sweep Trigger and the Delayed Sweep Lockout Multi.

Mixed Sweep Mode

In this mode of operation, the sweep is first running at the MAIN SWP rate and then, after the selected delay interval, runs at the DLY'D SWP rate. The main sweep and delayed sweep are initiated as previously described. Operation of other circuit blocks follows.

Mixed Sweep Comparator. This circuit determines which sweep signal is coupled to the Horiz Output stage. First, the main sweep sawtooth is coupled through the Mixed Sweep Comparator and the Delayed Sawtooth Generator to the Horiz Output stage. These stages perform as an operational amplifier during the time that the main sweep is being displayed.

When a positive gate from the Delayed Sweep Trigger is applied to the Delayed Sweep Start Multi, a negative gate is generated and coupled to the Mixed Sweep Comparator. This opens the Mixed Sweep Comparator circuit, preventing the main sweep sawtooth from being coupled to the Horiz Output circuit.

Simultaneously, the positive gate from the Delayed Sweep Start Multi is coupled through the Delayed Sweep Start Control to the Delayed Sawtooth Generator. The delayed sweep sawtooth is generated and coupled to the Horiz Output stage.

Delayed Sweep Lockout Multi. The positive step from the Delayed Sweep Stop Ckt is inverted by the Delayed Sweep Lockout Multi and coupled to the Delayed Sweep Start Control, thus turning off the Delayed Sawtooth Generator.

Sweep Gate Out. Depending on the selection of the DISPLAY MODE switch, this stage couples the positive gate from either the Main Sweep Start Multi or the Delayed Sweep Start Control to connector A1. The Sweep Gate signal serves to unblank the CRT in the Indicator Oscilloscope during the sweep.

External Horiz Input

When the TIME/DIV switch is set to AMPL, part of the Main Sweep Trigger circuitry becomes the Horiz Input Amp. An external signal connected to the MAIN TRIG IN or AMPL input is amplified and then coupled to the Horiz Output stage. The main and delayed sawtooth generators are disabled to prevent intensity modulation of the CRT trace by the unblanking waveforms.

CIRCUIT OPERATION

Introduction

The following circuit analysis of the 7B52 describes the operation of the various circuits in detail. The main headings (followed by a number enclosed in a diamond) refer to diagrams with the same name and number. The sub-headings indicate the individual circuit being described.

On the circuit diagrams, each individual circuit is outlined by a shaded border and the designation of each circuit is indicated within each outline.

The main block diagram in the last section of the manual shows interconnection between circuits.

MAIN TRIGGER PREAMP (1)



The Main Trigger Preamp serves to select trigger source and coupling for the Main Trigger Generator. Also, when the TIME/DIV OR DL'Y TIME control is set to AMPL, the External Trigger Preamp becomes an amplifier for horizontal input signals.

The circuit may be considered as consisting of four elements as follows: (a) Trigger Source Switching, which includes U330, Q342 and Q344; (b) External Trigger Preamp or External Input Amplifier, consisting of Q308, Q312 and Q316; (c) Balanced-to-Single-Ended Converter, consisting of Q352, Q354 and Q358; and (d) Trigger Coupling, which includes Q362, Q364 and Q366.

Trigger Source Switching

U330 receives trigger inputs from pins 2 and 15 for internal triggering and from pin 7 for external trigger signals. Pin 4 of U330 determines which input signal is selected by means of a digital signal (voltage level). A "low" on pin 4 activates pins 2 and 15 for internal triggering, while a "high" on pin 4 switches U330 to activate pins 7 and 10 for external triggering.

To further examine U330, let us assume that pin 4 is low, activating pins 2 and 15 (internal triggering). This input is a relatively high impedance differential configuration. Pin 15 receives the positive-going trigger signal and pin 2 is the negative-going input. The inputs are biased at the center of their dynamic range, and signal-limiting in the trigger pickoff circuitry (in the indicator oscilloscope) assures that the inputs will not be driven into cutoff nor saturation. R336 and R337 terminate the internal trigger signal from the indicator oscilloscope. The analog current source for internal triggering is Q342, via pins 1 and 16.

The switch output current appears at pins 12 and 13. A positive-going signal at pin 15 will cause an increase in current into pin 13 and out through pin 16, R341, Q342 and R343. Simultaneously, the negative-going signal at pin 2 causes a decrease in current into pin 12 and out through pin 1, R342, Q342 and R343. The net result is that the total current through pins 12 and 13 and through Q342 and R343 remains constant.

External Trigger Preamp or Horizontal Input Amplifier

This circuit includes Q308, Q312 and Q316. The SOURCE switch (S7) at the input selects internal, external or line signals for triggering. The external trigger (or horizontal input) signal may be attenuated to one-tenth amplitude by selecting EXT ÷ 10. R13 and R14 (paralleled by R302) form a 10:1 attenuator.

The input impedance for the trigger (or amplifier) input is 1 megohm, consisting primarily of R5 and R302. This resistor pair also causes a 2X attenuation of the input signal as seen at the gate of Q308.

C301 serves to compensate the input stage and C10 compensates the 10X attenuator.

CR303 and CR305 protect Q308 from excessive input signal by clamping the gate if the signal at the input connector exceeds approximately + or -2.5 volts. The signal at the source of Q308 is coupled through emitter-follower Q312 to the base of Q316. Q316 is another emitterfollower which drives U330. The signal at pin 7 of U330 is terminated in approximately 50 ohms by R319 to preserve the high-frequency characteristics.

R330 sets the DC level at pin 10 of U330, which is the negative side of the external trigger differential input. This serves to match the DC balance of the external trigger input of U330 to that of the internal trigger input.

Balanced-to-Single-Ended Converter

Q352, Q354 and Q358 convert the balanced (push-pull) output of U330 to a single-ended signal at the emitter of Q358.

The trigger signal through U330 causes a decrease in current into pin 12 from R350 and R354 and an increase in current into pin 13 from R351. This would normally cause the voltage at pin 12 to swing in a positive direction, while pin 13 goes in a negative direction. However, the current through R350 and R354 actually increases due to the feedback via R355 and Q354, causing the voltage at pin 12 to

swing negative along with pin 13. Q354 is connected as a diode and is enclosed in the same heat-sink with Q352, providing good DC stability.

Trigger Coupling

When DC coupling is selected by the front-panel COUPLING switch, Q362 is turned on by the +15 V supply through R18, S6 and R361 to the base. The triggering signal is then coupled through R359 and Q362 to the base of Q402 (on Main Trigger Generator diagram).

Q364 is turned on when AC coupling is selected. The triggering signal then passes through Q364 and C364 to the base of Q402. For AC LF REJ coupling, Q364 is off and the triggering signal is coupled through C362 and C364, attenuating low-frequency signals.

For AC HF REJ coupling, both Q364 and Q366 are turned on. The high-frequency components are coupled through C367 and Q366 to ground, while the desired triggering component is coupled through Q364 and C364 (as in AC coupling).

MAIN TRIGGER GENERATOR (2)



The Main Trigger Generator diagram includes the Slope Selector and Level Comparator, Trigger TD and Driver, Auto Multi, Auto Drive, TRIG'D Lamp Driver and Main Trigger Generator circuits. Operation of the individual circuits follows.

Slope Selector and Level Comparator

Q402, Q404, Q408, Q416, Q418 and Q428 comprise the Slope Selector and Level Comparator circuit.

Q402 and Q404 are connected as a differential comparator. The reference voltage for the comparator is selected by the setting of the LEVEL control, R2. The Main Trig. Level Center adjustment, R410, sets the level at the base of Q404 so that the sweep is triggered at the 0 volt point of the incoming trigger when the LEVEL control is set to the center of the positive or negative slope region. The LEVEL control varies the voltage on the base of Q404 to select the point on the trigger signal where triggering occurs.

Q408 and R408 establish the emitter current for Q402 and Q404. Prior to the arrival of a trigger signal, with the LEVEL control set to the center of the positive or negative slope, Q402 and Q404 are passing equal currents.

Let us assume that a positive-going signal is applied to the MAIN TRIG IN connector and that the LEVEL/SLOPE control is set to center on the positive slope. The signal at the MAIN TRIG IN connector is inverted by the Main Trigger Preamp, appearing at the base of Q402 as a negative going signal. This will cause a decrease in current through Q402, and because of the common emitter source (Q408 and R408), the current through Q404 will increase.

The decreased collector current of Q402 biases Q418 in a reverse direction, while Q416 becomes more forward biased due to the increased current through Q404.

With the SLOPE switch (S2) in the + position, the cathode of CR424 is grounded, forward biasing CR424, which reverse biases CR423. At the same time, the base of Q428 is at ground and Q428 is off. This causes CR421 to be reverse biased and CR422 is forward biased through Q416. An increased current is applied through Q416 and CR422 to the Trigger TD and Driver circuit. (See Fig. 3-2.)

When the SLOPE switch is set to the — position, Q428 and CR421 are forward biased and CR422 is reverse biased. CR424 is reverse biased and CR423 is forward biased so that current flows through Q418 and CR423 to the Trigger TD and Driver circuit.

Trigger TD and Driver

The Trigger TD stage shapes the output of the comparator to provide a trigger pulse with a fast leading edge.

Tunnel diode CR430 is quiescently biased so that it is in its low-voltage state. Increased trigger current from Q416 and CR422 or Q418 and CR423 through R432, L432 and CR430 causes CR430 to switch to the high-voltage state. The resulting fast-rise positive step is coupled through emitter-follower Q434 to C441, C451 and C461 in the Auto Multi and Main Trigger Generator circuits.

Auto Multi

The Auto Multi circuit includes Q442 and Q448. When no trigger signal is applied, this circuit causes a current path in the Auto Drive circuit which turns on the output tunnel diode in the Main Trigger Generator after each holdoff gate. This enables a recurrent sweep with a repetition rate which increases with selected sweep rate, providing a bright reference trace when the trigger signal is absent or of insufficient amplitude.

When no trigger is applied, Q442 is off and C443 is charged to a positive level (at the collector of Q442) determined by R442, R701 and R702. The base of Q702 is more positive than the base of Q704, so Q704 is conducting.

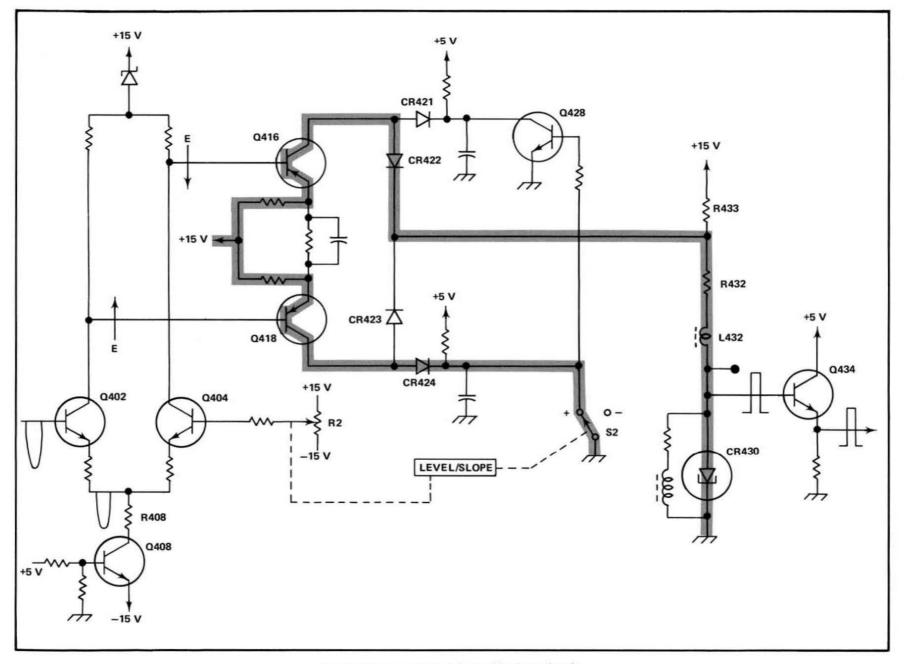


Fig. 3-2. Trigger current path for positive slope triggering.

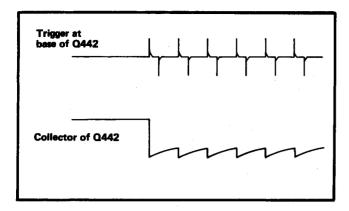


Fig. 3-3. Auto Multi input and output waveforms with trigger signal applied.

When a trigger is applied, Q442 and Q448 operate as an emitter-coupled monostable multi¹. Q442 is momentarily turned on by the positive transition coupled through C441.

The collector of Q442 drops and C443 discharges through R444, turning off Q448. This holds Q442 on for a period determined by the charging time-constant of C443. If the trigger signal has a repetition rate of 20 Hz or greater, Q442 stays on. (See Fig. 3-3.)

With Q442 on, Q702 is also conducting and Q704 is off.

TRIG'D Lamp Driver

During the time that Q442 is on, the increased drop across R442 forward biases Q702. This turns on Q710 which drives the TRIG'D lamp, DS2. The resulting discharge of C711 keeps DS2 illuminated between trigger pulses except at very low repetition rates.

Auto Drive

The Auto Drive circuit supplies additional current to the Main Trigger Generator to drive the output tunnel diode to its high-voltage state for automatically restarting the sweep after each holdoff interval if trigger signals are not available.

As described under Auto Multi, Q704 is conducting when AUTO mode is selected and no trigger signal is applied. CR41 and CR42 are off, so Q706 is also off. The current through Q704 flows through R706 and CR706, supplying the additional current to the output tunnel diode, CR475.

¹Millman and Taub, "Pulse and Digital Circuits", McGraw-Hill, New York, 1956, pp. 187-190.

When NORM or SINGLE SWEEP are selected by the MODE switch, S5, Q706 is forward biased via R707 and CR41 or CR42 respectively. This diverts any current from Q704, permitting normal triggering.

Main Trigger Generator

The Main Trigger Generator includes Q454, Q466, CR470 and CR475. The function of this circuit is to supply a fast-rise trigger signal to the Main Sweep Start Multi. For normal triggering, this signal is developed after receipt of a fast-rise transition from the Trigger TD and Driver stage, except during holdoff. In the AUTO mode of triggering with no trigger applied, CR475 is switched to the high state (forming a trigger) by current from the Auto Drive circuit. This is prevented from occurring during retrace by the holdoff signal.

For the following description of operation, assume that the MODE switch is set to NORM and that a trigger signal is applied to the MAIN TRIG IN connector.

The positive-going transition at the emitter of Q434 is coupled through C441, causing the TRIG'D lamp, DS2, to be energized as previously described.

CR470 and CR475 are both in their high states until the hold off signal switches them to low state. The holdoff signal is a positive pulse which forward biases both Q454 and Q466. When these transistors are forward biased, they divert current from CR475 and CR470 which causes the tunnel diodes to switch to low state.

The next trigger after holdoff appears as a positive transition at C451 and C461. The positive transition, coupled through R461 and R462 causes CR470 to switch to its high state. This higher level, through R472, brings CR475 up to near its switching current. The positive transition is also coupled through C451 and R451; and after 3.5 ns of delay, through R474 to CR475. The short delay assures that CR470 has had time to switch to its high state, arming CR475 before arrival of the switching signal at CR475. This prevents extraneous noise from prematurely activating CR475. CR475 then switches to its high state. The fast-rise positive trigger from CR475 is coupled to the Main Sweep Start Multi, Q722/Q726.

MAIN SWEEP GENERATOR (3)

The Main Sweep Generator diagram includes 12 associated circuits as follows: (a) Main Sweep Start Multi, (b) Sawtooth Generator, (c) Delay Pickoff, (d) Sweep Stop Comparator, (e) Holdoff Circuit, (f) Delayed Mode Control, (g) Lockout Amp, (h) Reset Multi, (i) Sweep Lockout

Circuit Description-7B52

Multi, (j) Delay Gate Amp, (k) Ready Lamp Driver, and (l) Delay-Time Readout Drive.

For the following descriptions, unless stated otherwise, assume that a recurrent triggering signal is applied and that MAIN SWP is selected for DISPLAY MODE.

Main Sweep Start Multi

Q722, Q726 and Q730 comprise the Main Sweep Start Multi. Q722 and Q726 are connected as a bistable multivibrator. With no trigger signal applied, Q722 is off and Q726 is on.

When the Main Trigger Generator supplies a trigger, the positive transition is coupled to the base of Q722, causing Q722 to conduct. The current is diverted from Q726 to Q722. The collector of Q726 rises and the positive step is coupled through emitter-follower Q730. The positive step appears across divider R746/R747, causing pin 1 of U750 to go positive.

Sawtooth Generator

The lower half of the diagram symbol for U750 constitutes a Miller Integrator². When pin 1 is positive, a linear sawtooth (positive-going) is generated and appears at pin 8. The timing components, Rt and Ct connected to pins 8 and 9 determine the rate of change of the sawtooth waveform.

Sweep Stop Comparator

The Sweep Stop Comparator consists of U834A and U834B connected as a comparator. U834B is normally conducting, with its base level set by R835, the Main Sweep Stop adjustment. The resulting level at the common emitter connection reverse biases U834A.

The sawtooth signal from the Sawtooth Generator is coupled to the base of U834A. When the base of U834A rises above the level set at the base of U834B, the current through the common emitter resistor (R836) is diverted from U834B to U834A.

The collector of U834B rises, VR832 and C833 couple this positive step to the collector of Q722 (Main Sweep Start Multi) and through divider R725/R726 to the base of Q726. This forward biases Q726, which diverts current from Q722. The collector of Q726 drops to near zero volts and this level is coupled through Q730 to pin 1 of U750, terminating the sawtooth output signal.

²Millman & Taub, pp 540-548.

Since Q726 is conducting, Q722 becomes reverse biased and its collector rises. This rise reinforces the rise coupled through C833 and is coupled to the base of U834E.

Holdoff Circuit

The Holdoff Circuit consists of U834C, U834D and U834E plus R and C time constants selected by the TIME/DIV switch. The holdoff prevents retriggering the sweep generator until after the sweep timing capacitor(s) has discharged and sweep circuits are again ready to generate a sweep.

At the end of the sawtooth waveform, the resulting positive level at the output of the Sweep Stop Comparator is coupled to the base of U834E, as previously mentioned. This forward biases U834E and the collector current starts charging C843 and C841 or C842 (depending on setting of the TIME/DIV switch). U834C becomes reverse biased and the positive step at its collector is coupled through emitter-follower U834D. The positive step at the emitter of U834D is the holdoff gate signal. The holdoff gate is coupled to the Delayed Sweep Lockout Multi and through R785 and CR875 to the Main Trigger Generator, preventing generation of a trigger signal. This, in turn, prevents the Main Sweep Start Multi from initiating a sweep.

The positive impulse at the base of U834E is of short duration, having been coupled from the collector of Q722 through a small capacitance, C833. Therefore, when the RC time-constant in the collector of U834E has charged, U834C becomes forward biased. The drop at the collector of U834C is coupled through U834D, ending the holdoff gate. The Main Trigger Generator is released to generate a trigger signal.

Delay Pickoff

The upper half of the diagram symbol for U750 includes the Delay Pickoff circuitry. Inside U750, the main sweep sawtooth signal is applied to one side of a comparator circuit. Pin 6 is connected to the other side of the comparator. The setting of the DELAY TIME MULTIPLIER control, R19, determines the point on the main sweep sawtooth at which the comparator switches.

When the comparator switches (delay pickoff occurs), a positive gate appears at pin 4 of U750. This gate terminates at the end of the main sweep sawtooth.

Delay Gate Amp

The positive-going gate at pin 4 of U750 is coupled through emitter-follower Q762 to the Delayed Trigger Generator.

When S59 (see Display Mode Switching diagram) is set to either Runs After DT or Triggerable After DT and the DISPLAY MODE is set to any mode except MAIN SWP, approximately +5 volts is applied to the emitter of Q764. This enables Q764, and the positive gate at the emitter of Q762 is coupled through Q764, appearing as a negative-going gate at TP764. If S59 is set to Independent and/or the DISPLAY MODE is set to MAIN SWP, the emitter of Q764 is at ground level. Q764 is reverse biased and will not pass the delay gate signal.

Delay-Time Readout Drive

U736A, B, C, D and E are connected as a non-inverting amplifier. The voltage selected by the DELAY TIME MULTIPLIER control appears at the emitter of U736C, the output of this circuit.

This output is not used in present instruments, but is intended for use with future indicator oscilloscopes.

Reset Multi

The Reset Multi consists of U794C and U794D, connected as a monostable multivibrator. This stage is used to permit manual reset of the Sweep Lockout Multi when SINGLE SWP is selected by the MAIN TRIGGERING MODE switch.

With SINGLE SWP mode selected, +5 volts is applied to R826 (collector of U794D) and U794D is forward biased via R821, CR822 and CR823. When the front-panel RESET switch is pressed, the base of U794D momentarily goes to near zero volts. The collector of U794D rises, and the positive step is coupled through C827, forward biasing CR827. At the same time, the rise at the collector of U794D forward biases U794C. The drop at the collector of U794C causes C822 to start discharging, holding U794D in a reverse bias state until C822 has sufficiently discharged. Then, U794D again becomes forward biased and its collector drops, completing the cycle of operation.

Sweep Lockout Multi

U794A, U794B and Q798 comprise the Sweep Lockout Multi. This circuit permits external control of the initiation of a sweep by applying a positive level as holdoff to the Main Trigger Generator when no sweep is desired. The sweep can be held off under control of the single sweep reset, by means of an externally applied "sweep lockout"

signal, or as directed by an external Delayed Mode Control signal.

U794A and U794B are connected as a bistable multivibrator for normal operation. Q798 is forward biased by the positive level through R806 and CR807 to the emitter. This forward biases U794A, causing its collector to be near zero volts. The holdoff line is released, under control of the Holdoff Circuit.

In SINGLE SWEEP operation, the +5 volt supply is removed from the emitter circuit of Q798, reverse biasing U794A. The holdoff line goes positive, preventing generation of a sweep. When the RESET button is pressed, CR827 becomes forward biased for a short interval. This forward biases U794A, releasing the holdoff line. The Sweep Lockout Multi stays in this state until a sweep has been completed and the Holdoff Circuit generates the positive-level holdoff signal.

This positive level is coupled to the base of U794B via R787, C787 and CR789. The Sweep Lockout Multi reverts to its original state, with U794B on and U794A off, ready for the next RESET signal.

Lockout Amp

The Lockout Amp works in conjunction with the Delayed Mode Control circuit to allow the 7B52 to be controlled by another time base and perform as a delayed sweep unit. The Lockout Amp circuit includes Q42, Q44, Q818 and U794E.

Q42 and Q44 are connected as an operational amplifier. The input signal (Swp Lockout) at the base of Q42 is a positive gate during lockout. The positive gate is inverted by the operational amplifier, appearing as a negative gate at the base of Q818. The collector of Q818 rises and this positive level is coupled through CR817 to the holdoff line, preventing the initiation of a sweep. Q818 and U794E are connected as a comparator. When Q818 is biased off, U794E becomes forward biased.

Delayed Mode Control

The Delayed Mode Control circuit consists of Q804 and Q812. In response to the appropriate input signal, this circuit either biases the Swp Start TD (Main Trigger Generator) near the switching point so that a trigger can initiate a sweep, or biases the Swp Start TD at the high state so that a

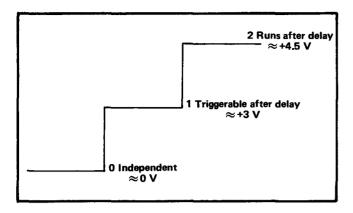


Fig. 3-4. Typical control levels into Delayed Mode Control circuit.

sweep is initiated immediately. Fig. 3-4 illustrates typical control signals coupled to the base of Q804.

When the input signal is at the 0 V level, Q804 is off and the 7B52 operates as an independent time base. If approximately +3 volts is applied to the base of Q804, Q812 conducts sufficient current to bias the Swp Start TD to just below the switching level so that a trigger signal applied to the TD will initiate a sweep. When the input level is approximately +4.5 volts, the current through Q812 biases the Swp Start TD at the high state, initiating a sweep immediately.

During the time that a Swp Lockout gate is applied to the Lockout Amp, the forward biasing of U794E causes Q812 to be reverse biased. This will prevent conduction of Q812 regardless of input signals to the Delayed Mode Control circuit.

Ready Lamp Driver

When the 7B52 is used in the SINGLE SWP mode, the READY lamp serves to indicate when the sweep is ready to accept a trigger signal. +5 volts is applied to the emitter of Q782, the Ready Lamp Driver, only when the MAIN TRIGGERING MODE switch is set to SINGLE SWP.

With no trigger signal applied, pressing the RESET button forward biases U794A (Sweep Lockout Multi). The collector of U794A is low, forward biasing Q782 which activates the READY lamp, DS5. The next trigger signal initiates a sweep, followed by a holdoff gate from the Holdoff Circuit. The positive-level holdoff is coupled through R782 and R783, reverse biasing Q782. The READY lamp is extinguished and remains in this state until the RESET button is pressed again.

DELAYED TRIGGER PREAMP (4)



The Delayed Trigger Preamp is very similar to the Main Trigger Preamp (previously described), so only those portions that are different will be described in detail. The purpose of this circuitry is to select trigger source and coupling of the signal driving the Delayed Trigger Generator.

Dly'd Trigger Source Switching

U530 performs the function of selecting either the Dly'd Internal Trig Amp or the DIv'd External Trig Amp as the source of trigger. When pin 4 of U530 is positive, pins 7 and 10 are activated and an external trigger must be applied to the DLY'D TRIG IN connector. When pin 4 is low (near ground), pins 2 and 15 are active and an internal trigger source is selected.

Dly'd Internal Trig Amp

Q24, Q26, Q34 and Q36 are connected as a push-pull amplifier with approximately unity gain. Negative feedback is employed on each side to assure stability.

S21 (Internal Trigger Selector) selects either the normal internal trigger source, which is the same as that applied to the Main Trigger Preamp; or the auxiliary trigger source, which may supply a triggering signal from a different plugin amplifier than that which is triggering the main time base. This switch is not a front-panel control, but is located internally.

Dly'd External Trig Amp

Q508, Q512 and Q516 comprise the DIV'd External Trig Amp. This circuit is identical with the Main External Trigger Preamp. The amplifier provides a current gain and is terminated by R519 at pin 10 of U530.

Balance-to-Single-Ended Converter

This circuit includes Q552, Q554 and Q558. Except for minor differences in component values, the circuitry is identical with the Balanced-to-Single-Ended Converter in the Main Trigger Preamp. The output signal at the emitter of Q558 is inverted from the signal at the DLY'D TRIG IN connector.

Dly'd Trigger Coupling

When the COUPLING switch (S17) is set to DC, Q562 is forward biased via R56 and R561. The trigger signal is direct coupled between the emitter of Q558 and the base of Q602 (Slope Selector and Level Comparator). If the

3-10

COUPLING switch is set to AC, Q562 is reverse biased and the trigger signal is coupled through C562.

DELAYED TRIGGER GENERATOR (5)



The Delayed Trigger Generator circuitry is essentially the same as the Main Trigger Generator, except there is no provision for automatic mode of triggering. Therefore, only the circuits that are different will be described in detail. For a detailed description of the rest of the circuitry, please refer to the Main Trigger Generator.

Slope Selector and Level Comparator

This circuit consists of Q602, Q604, Q616, Q618 and Q628. Operation is identical with the Slope Selector and Level Comparator on the Main Trigger Generator diagram.

When the input signal at the base of Q602 passes through the level set at the base of Q604, an increase in current occurs at the output.

Trigger TD

The Trigger TD is CR630. The increased current caused by applying a trigger to the Slope Selector and Level Comparator circuit is coupled through R632 and CR630, switching CR630 to its high state.

Delayed Trigger Generator

The Delayed Trigger Generator circuit includes Q654, Q666, Q862, CR670 and CR675. Operation of the tunnel diodes, CR670 and CR675 is identical to operation of the TD's in the Main Trigger Generator.

If the DLY'D LEVEL control is pushed in. S15 is in the "open" position and current through R871, CR655 and R674 to the Sweep Start TD (CR675) biases CR675 just below the switching level. When the Delay Gate is generated (at the Trigger Pickoff), the positive step at the junction of CR866 and CR869 forward biases Q862. This increases current through the Sweep Start TD, causing it to switch to the high state. This occurs immediately upon arrival of the Delay Gate, without need for a delayed trigger input.

When the DLY'D LEVEL control is in the "out" position (DLY'D SWP TRIGGERABLE), S15 is closed, forward biasing CR71. Q954 becomes forward biased and Q862 is reverse biased. The static current through CR675 is at a low level. Q862 becomes forward biased upon arrival of the Delay Gate signal at its emitter (via CR866). The resulting current biases the Sweep Start TD to just below the switching level. A trigger signal from the Trigger TD then causes the Sweep Start TD to switch to the high state.

The Dly'd Swp Holdoff coupled to the bases of Q654 and Q666 prevents the Sweep Start TD from switching until after the main sweep has occurred.

DELAYED SWEEP GENERATOR (6)



The Delayed Sweep Generator diagram includes 11 associated circuits as follows: (a) Dly'd Swp Start Control, (b) Dly'd Swp Start Multi, (c) Dly'd Swp Stop Circuit, (d) Dly'd Swp Lockout Multi, (e) Dly'd Swp Holdoff, (f) Composite Swp Comparator, (g) Dly'd Sawtooth Generator, (h) Composite Swp Out, (i) Composite Swp Gate Out, (j) Aux Z Axis Control, and (k) Aux Z Axis Out.

For the following descriptions, unless stated otherwise. assume that the DISPLAY MODE is DLY'D SWP, the DLY'D LEVEL is pushed in (Runs After Delay) and the main sweep is running recurrently.

Dly'd Swp Start Multi

Q882 and Q886 comprise the Dly'd Swp Start Multi. This circuit is connected as a bistable multivibrator, with Q886 normally conducting and Q882 off.

When the Sweep Start TD switches to its high state, the positive step appears at the base of Q882. This causes the multi to flip, with Q882 on and Q886 off. The collector of Q886 goes positive. The Sweep Start TD is held in its high state for the duration of the Delay Gate. At the end of the Delay Gate, the Dly'd Sweep Start Multi reverts to its original state with Q882 off and Q886 on.

Dly'd Swp Start Control

The Dly'd Swp Start Control circuit includes Q902, Q904 and Q906. This circuit serves to couple a positive gate to pin 1 of U930 (Miller Integrator) to control the period during which a sawtooth is generated.

In all selections of the DISPLAY MODE switch except MIXED, Q902 and Q904 are inactive due to reverse bias current via CR901, S12 and the +5 volt supply. When the collector of Q886 (Dly'd Swp Start Multi) goes positive, Q906 couples the positive gate to pin 1 of U930, initiating the generation of a delayed sawtooth. At the end of the Delay Gate, the collector of Q886 drops. This ends the positive gate to pin 1 of U930, terminating the delayed sawtooth.

When the DISPLAY MODE switch is set to MIXED. CR901 anode circuit is open. The gate from the Main Swp Start Multi is negative-going at the base of Q904. The

Circuit Description-7B52

resulting current from Q904 forward biases Q906, and a positive gate is coupled to pin 1 of U930.

Mixed Swp Comparator

Q888, Q892, Q896 and Q898 comprise the Mixed Swp Comparator circuit. This circuit determines whether U930 is running up at the main sweep or delayed sweep rate.

With the DISPLAY MODE switch set to MIXED, Q892 is forward biased. The main sweep sawtooth at the emitter (and thus, the collector) of Q892 is a positive-going ramp. This causes a ramp of increasing current through Q896. During the time that a Delay Gate is not being generated, Q882 (Dly'd Swp Start Multi) is biased off and Q888 is on. In this condition, U930, Q888, Q896 and Q898 form an operational amplifier. The negative-going ramp at the collector of Q896 becomes a positive-going ramp at pin 8 of U930, running up at the main sweep rate.

When the Delay Gate is generated, the Delayed Trigger Generator forward biases Q882. The collector current through R888 reverse biases Q888, opening the operational amplifier loop. U930 is released to run up at the delayed sweep rate. Therefore, the sawtooth at pin 8 of U930 will first run up at the main sweep rate and then change to the delayed sweep rate when the Delay Gate is generated.

Dly'd Swp Stop Circuit

The upper half of the diagram symbol for U930 constitutes the Dly'd Swp Stop Circuit. The setting of the Dly'd Sweep Length adjust (R930) determines the point on the delayed sawtooth at which pin 4 of U930 will go positive.

Dly'd Swp Lockout Multi

Q942 and Q944 form the Dly'd Swp Lockout Multi. This circuit serves to terminate the delayed sweep as determined by the setting of the Dly'd Sweep Length adjust. When pin 4 of U930 goes positive, Q942 becomes forward biased. The negative-going step at the collector of Q942 forward biases Q902 (Dly'd Swp Start Control circuit). Q904 and Q906 become reverse biased, dropping the level at pin 1 of U930 and terminating the sweep.

Dly'd Swp Holdoff

The Dly'd Swp Holdoff circuit includes Q954. The hold-off gate at connector G is a composite of the positive gate from the Dly'd Swp Lockout Multi, the Main Swp Holdoff Gate via R952, and, when the DLY'D LEVEL control is set to DLY'D SWP TRIGGERABLE, the positive level set by Q954.

With the DLY'D LEVEL control set to DLY'D SWP TRIGGERABLE, Q954 is forward biased until the Delay Gate is generated. This pulls up the holdoff line to prevent the Sweep Start TD from switching to its high state with a trigger signal until after the Delay Gate is generated.

Composite Swp Out

Q962, Q966 and Q968 form the Composite Swp Out circuit. When the DISPLAY MODE switch is set to MAIN SWP or INTEN, Q966 is forward biased, coupling the main sweep sawtooth to the base of Q968. Q968 is an emitter-follower stage which couples the signal to output terminals A3 and B3.

If DLY'D SWP or MIXED is selected by the DISPLAY MODE switch, Q962 is forward biased and couples the delayed sweep or mixed sweep sawtooth to the base of Q968.

Q966 and Q968 or Q962 and Q968 (depending on DISPLAY MODE setting) are connected as an operational amplifier, providing a high degree of gain stability.

Aux Z Axis Control

The Aux Z Axis Control circuit includes Q984 and Q988. This circuit uses indicator oscilloscope mode and switching levels to determine when the sweep signal from the 7B52 is being displayed on the CRT. Information of this type is normally used only when operating the 7B52 in a four plug-in indicator oscilloscope.

Typical levels to cause the Aux Z Axis Control to intensify the CRT are +5 volts at terminal A16 and -0.6 volt at terminal B7. This forward biases Q988, resulting in a positive level at the emitter.

When the 7B52 is used in a three plug-in indicator oscilloscope and the DISPLAY MODE is set to INTEN, Q984 is off and Q988 is forward biased.

Aux Z Axis Out

Q992 is the Aux Z Axis Out stage. The output at connector DZ is connected to pin A17 on the interface connector and thence to the Z axis circuit in the indicator oscilloscope. A reduction in current through Q992 causes the CRT trace to brighten.

For this description, assume that the 7B52 is used in a three plug-in indicator oscilloscope.

As described under Aux Z Axis Control, when INTEN is selected by the DISPLAY MODE switch, Q988 is turned on. The positive level at the emitter of Q988 reverse biases CR991, which reduces conduction of Q992. The positive gate appearing at the emitter of Q906 (Dly'd Swp Start Control) during the delayed sweep further reduces current through Q992, causing the CRT trace to intensify beyond the normal level of unblanking.

In all other selections of the DISPLAY MODE switch, Q984 is forward biased through CR66. This turns off Q988, which diverts current through CR991. Q992 is in saturation and the CRT trace brightness is now set by the unblanking signal (Sweep Gate).

Composite Swp Gate Out

The Composite Sweep Gate Out circuit includes Q922, Q924 and Q928. The output at connector EM connects to interface connector pin A1 and is used to produce unblanking signals in the indicator oscilloscope. It is also used by the oscilloscope as the + gate output signal, and is selectable for producing the calibrator signal. A level of approximately +4 volts at connector AI unblanks the CRT. In the AMPL position of the TIME/DIV (DL'Y) switch, connector A1 is set to approximately +4.3 volts (via CR100).

Q928 serves as the output stage. With the DISPLAY MODE switch set to either MAIN SWP or INTEN, Q922 couples the main sweep gate to the base of Q928. When either DLY'D SWP or MIXED is selected by the DISPLAY MODE switch, Q924 is on. The gate at the emitter of Q906 (Dly'd Swp Start Control) is coupled to the base of Q928.

HORIZONTAL PREAMP (8)

The Horizontal Preamp diagram includes the Ext Horiz Amp, Horiz Display Selector, Position Amp, and Horiz Out Amp circuits.

Ext Horiz Amp

The Ext Horiz Amp consists of Q1004 and Q1006, connected as an operational amplifier³ The output signal, inverted from the input at connector A, is coupled through R1007.

Horiz Display Selector

Q1024 and U1020A, B, C, D and E comprise the Horiz Display Selector circuitry. Depending on the setting of the DISPLAY MODE switch or the TIME/DIV (DL'Y) switch, this circuit determines which signal is coupled to the Horiz Out Amp.

When the TIME/DIV (DL'Y) switch is set to AMPL, U1020C is forward biased and couples the signal from the Ext Horiz Amp to the Horiz Out Amp. Simultaneously, +5 volts is disconnected from the DISPLAY MODE switch, assuring that no internally generated sweep signal is coupled through at this time. In all other positions of the TIME/DIV (DL'Y) switch, +5 volts is connected to the DISPLAY MODE switch.

When MAIN SWP or INTEN is selected by the DISPLAY MODE switch, +5 volts is applied to the anode of CR111 or CR110 respectively. This forward biases U1020A, which couples the main sweep sawtooth to the Horiz Out Amp. Q1024 is also forward biased so that any signal developed by the Delayed Sweep Generator is bypassed to ground (via the -15 volt supply). Any output from the Ext Horiz Amp is coupled to ground through U1020D.

If the DISPLAY MODE switch is set to DLY'D SWP or MIXED, +5 volts is applied to the anode of CR108 or CR107 respectively. This forward biases U1020B, which couples the delayed sweep or the mixed sweep signal to the Horiz Out Amp. U1020E is also forward biased, coupling the main sweep signal to ground.

Position Amp

The POSITION control, R8, sets the bias on Q1014, thus setting the DC current coupled to the Horiz Out Amp.

Horiz Out Amp

The Horiz Out Amp includes Q1038, Q1046 and U1034A, B, C and D. U1034B and U1034C are connected as an operational amplifier, with R_f being R1052 and R_i the Swp Cal adjust, R60.

U1034C and U1034D form a paraphase amplifier. This stage converts the single-ended input signal from U1034B to a push-pull output signal which is necessary to drive the horizontal output stage in the indicator oscilloscope.

This stage also provides the X10 magnification and Mag Gain adjustment. When the X10 MAG switch is activated, R1045 and R1055 are connected in parallel with R1046 and R1056, decreasing the emitter degeneration of the stage. This increases gain of the stage 10 times. The Mag Gain adjust sets the degeneration to provide a calibrated

³Operational Amplifiers and Their Applications, Tektronix, Inc., Beaverton, Oregon 1965, Part No. 070-0526-00.

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gain when magnified. A contact of K1055 completes the circuit for the X10 MAG indicator lamp when the X10 MAG switch is activated.

Q1038 and U1034A set the operating bias for the output stage. Q1046 serves as a long-tailed (constant-current) source for U1034C and U1034D.

TIME/DIV READOUT SWITCHING (9)



This diagram consists of switching resistors and a set of contacts operated by the TIME/DIV and X10 MAG switches. Also, when the DISPLAY MODE switch is set to DLY'D SWP or MIXED, a logic level is applied to connector B35 to enable simultaneous readout of the main and delayed sweep rates.

SECTION 4 MAINTENANCE

Change information, if any, affecting this section will be found at the rear of this manual.

Introduction

This section of the manual contains maintenance information for use in preventive maintenance, troubleshooting, and corrective maintenance of the 7B52.

PREVENTIVE MAINTENANCE

General

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 this instrument. The severity of the environment to which the 7B52 is subjected determines the frequency of maintenance. A convenient time to perform preventive maintenance is preceding recalibration of the instrument.

Cleaning

The 7B52 should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket and prevents efficient heat dissipation. It may also provide an electrical conduction path.

The covers of the indicator oscilloscope minimize the amount of dust which reaches the interior of the 7B52. Operation of the system without the indicator covers in place necessitates more frequent cleaning. When the 7B52 is not in use, it should be stored in a protected location such as a dust-tight cabinet.

CAUTION

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

Exterior. Loose dust accumulated on the outside of the 7B52 can be removed with a soft cloth or small paint brush. The paint brush is particularly useful for dislodging dirt on

and around the front-panel controls. Dirt which remains can be removed with a soft cloth dampened in a mild detergent and water solution. Abrasive cleaners can not be used.

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

Visual Inspection

The 7B52 should be inspected occasionally for such defects as broken connections, broken or damaged circuit boards, improperly seated transistors or relays, 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 a recurrence of the damage.

Transistor, FET, and Integrated Circuit Checks

Periodic checks of the transistors, FET's and IC's used in the 7B52 are not recommended. The best indication of performance is the actual operation of the device in the circuit. Performance of the circuits is thoroughly checked during recalibration; substandard transistors, FET's and IC's will usually be detected at that time.

Recalibration

To ensure accurate measurements, check the calibration of this instrument each 1000 hours of operation or every six months if used infrequently. In addition, replacement of components may necessitate recalibration of the affected circuits. Calibration instructions are given in Section 5.

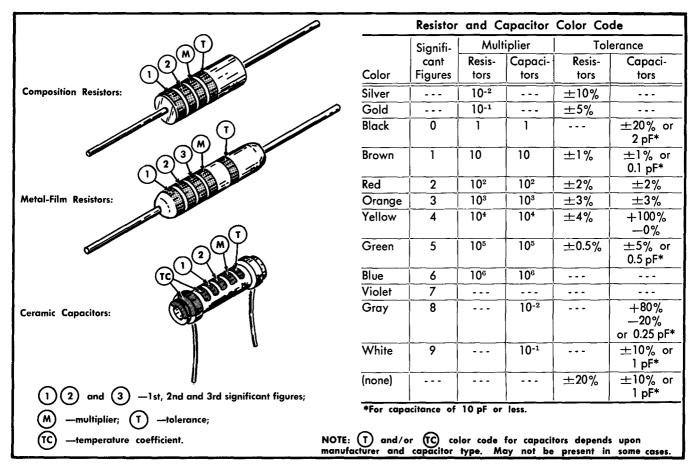


Fig. 4-1. Color-code for resistors and ceramic capacitors.

TROUBLESHOOTING

Introduction

The following information is provided to facilitate troubleshooting of the 7B52. 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 if very helpful in locating troubles. See the Circuit Description section.

Troubleshooting Aids

Diagrams. Circuit diagrams are given on foldout pages in Section 7. The component number and electrical value of each component in this instrument are shown on the diagrams.

Circuit Boards. All circuit boards are shown in Fig. 4-3 through Fig. 4-7. All components are shown and should be used along with the diagrams in Section 7.

Switch Cam Identification. Switch cam numbers shown on the diagrams indicate the position of the cam in the complete switch assembly. The cams are numbered from the front, or mounting end of the switch, toward the rear.

Resistor Color Code. In addition to the brown composition resistors, some metal-film resistors and some wirewound resistors are used in the 7B52. The resistance value of a wire-wound resistor is printed on the body of the component. The resistance values of composition resistors and metal-film resistors are color-coded on the components (some metal-film resistors may have the value printed on the body) with EIA color code. The color code is read starting with the stripe nearest the end of the resistor. Composition resistors have four stripes which consist of two significant figures, a multiplier, and a tolerance value; see Fig. 4-1. Metal-film resistors have five stripes consisting of three significant figures, a multiplier, and a tolerance value.

Capacitor Markings. The capacitance values of common disc capacitors and small electrolytics are marked in microfarads on the side of the component body. The white ceramic capacitors used in the 7B52 are color-coded in picofarads using a modified EIA code (see Fig. 4-1).

Diode Color Code. The cathode end of each glassencased diode is identified by a stripe, a series of stripes, or a dot. For most silicon or germanium diodes with a series of stripes, the color code also indicates the type of diode or identifies the Tektronix Part Number using the resistor color-code system (e.g., a diode color-coded blue-or pinkbrown-gray-green indicates Tektronix Part Number 152-0185-00). The cathode and anode ends of a metal encased diode can be identified by the diode symbol marked on the body.

Troubleshooting Equipment

The following equipment is useful for troubleshooting the 7B52.

1. Transistor Tester

Description: Tektronix Type 576 Transistor-Curve Tracer or equivalent.

Purpose: To test semiconductors used in this instrument.

2. Volt-ohmmeter

Description: 20,000 ohm/volt. 0-500 volts DC. Accurate within 3%.

Purpose: To measure voltages and resistance.

3. Test Oscilloscope

Description: DC to 100 MHz frequency response, 5 millivolts to 5 volts/ division. Use a 10X probe.

Purpose: To check waveforms in the instrument.

4. Plug-In Extender

Description: Rigid plug-in extender, Tektronix Part No. 067-0589-00.

Purpose: Permits operation of the 7B52 outside the plug-in compartment of the indicator oscilloscope for better accessibility during troubleshooting.

Troubleshooting Techniques

This troubleshooting procedure is arranged in an order which checks the simple trouble possibilities before proceeding with extensive troubleshooting. The first few checks ensure proper connection, operation, and calibration. 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 following the replacement procedures given under Corrective Maintenance.

- 1. Check Control Settings. Incorrect control settings can indicate a trouble that does not exist. If there is any question about the correct function or operation of any control, see the Operating Instructions section.
- 2. Check Associated Equipment. Before proceeding with troubleshooting of the 7B52, check that the equipment used with this instrument is operating correctly. Check that the signal is properly connected and that the probe (if used) is not defective. The indicator oscilloscope and vertical plug-in unit can be checked for proper operation by substituting another time-base unit which is known to be operating properly (perferably another 7B52 or similar unit). If the trouble persists after substitution, the indicator oscilloscope and/or vertical plug-in unit should be checked.
- 3. Check Instrument Calibration. Check the calibration of this instrument, or the affected circuit if the trouble exists in one circuit. The apparent trouble may only be a result of misadjustment and may be corrected by calibration. Complete calibration instructions are given in the Calibration section.
- 4. Visual Check. Visually check the portion of the instrument in which the trouble is located. Many troubles can be located by visual indications such as unsoldered connections, broken wires, damaged components, etc.
- 5. Isolate Trouble to a Circuit. To isolate a trouble to a circuit, note the trouble symptom. The symptom often indicates the circuit in which the trouble is located. For example, if normal triggering can be obtained in EXT mode but cannot be obtained in INT mode, the trigger preamp or the input coupling circuit is probably at fault. When the trouble symptoms appear, use the front-panel controls and the CRT display to try to isolate the trouble to one circuit. When the trouble appears in more than one circuit, check all affected circuits by taking voltage and waveform readings. Once the defective circuit has been located, proceed with steps 6 and 7 to locate the defective component(s).
- 6. Check Voltage and Waveforms. Often the defective components can be located by checking for the correct voltage or waveform in the circuit. Typical voltages and waveforms are given on the diagrams.



Do not clamp probe to pin connectors, as this may break or damage the connectors.

NOTE

Voltages and waveforms given on the diagrams are not absolute and may vary between instruments. To obtain operating conditions similar to those used for voltages and waveforms, see the first diagram page.

- 7. Check Individual Components. The following procedures describe methods of checking individual components in the 7B52. Components which are soldered in place are best checked by disconnecting one end. This isolates the measurement from the effects of surrounding circuitry.
 - a. RELAY. The eight pin relay used in the 7B52 is symmetrical and may be replaced in its socket facing either direction. This relay, which is plugged into the circuit board, may be removed and checked. Use an ohmmeter to check the 600 ohm resistance. The relay may also be actuated by placing +15 volts across the coil. The internal connections are printed on the body of the relay.
 - b. TRANSISTORS. The best check of transistor operation is actual performance under operating conditions. If a transistor is suspected of being defective, it can best be checked by substituting a new component or one which 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 (such as a Tektronix Type 576).
 - c. FET and IC's. FET and IC's should not be replaced unless they are actually defective. The best method for checking these devices is by direct substitution. Refer to 7b above for circuit conditions.
 - d. DIODES. A diode can be checked for an open or shorted condition by measuring the resistance between terminals. With an ohmmeter scale having an internal source of between 800 millivolts and 3 volts, the resistance should be very high in one direction and very low when the leads are reversed.



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

e. RESISTORS. Resistors can be checked with an ohmmeter. Check the 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 the specified value.

- f. 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.
- g. CAPACITORS. A leaky or shorted capacitor can best be detected by checking the resistance with an ohmmeter on the highest scale. Do not exceed the voltage rating of the capacitor. The resistance should be high after initial charge of the capacitor. An open capacitor can best be detected with a capacitance meter or by checking whether the capacitor passes AC signals.
- 8. Repair and Readjust the Circuit. If any defective parts are located, follow the replacement procedures given in this section. Be sure to check the performance of any circuit that has been repaired, or that has had any electrical components replaced.

CORRECTIVE MAINTENANCE

General

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

Obtaining Replacement Parts

Standard Parts. All electrical and mechanical part replacements for the 7B52 can be obtained through your local 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, it is important to remember that the physical size and shape of a component may affect the performance in the instrument, particularly at high frequencies. All replacement parts should be direct replacements unless it is known that a different component will not adversely affect instrument performance.

Special Parts. In addition to the standard electronic components, some special parts are used in the 7B52. These parts are manufactured or selected by Tektronix, Inc. to meet specific performance requirements, or are manufactured for Tektronix, Inc. in accordance with out specifications. These special parts are indicated in the parts list by an asterisk preceding the part number. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. Order all special parts directly from your local Tektronix Field Office or representative.

Ordering Parts. When ordering replacement parts from Tektronix, Inc., include the following information.

- 1. Instrument Type.
- 2. Instrument Serial Number.
- A description of the part (if electrical, include circuit number).
 - 4. Tektronix Part Number.

Soldering Techniques

WARNING

Disconnect the instrument from the power source before soldering.

Circuit Boards. The components mounted on the circuit boards in the 7B52 can be replaced using normal circuit board soldering techniques. Keep the following points in mind when soldering on the circuit boards.

- 1. Use a pencil-type soldering iron with a power rating from 15 to 30 watts.
- 2. Apply heat from the soldering iron to the junction between component and circuit board.
- Heat-shunt the lead of the component by means of a pair of long-nose pliers.
- 4. Avoid excessive heating of the junction with the circuit board, as this could separate the circuit board wiring from the laminate.

- 5. Use electronic grade 60-40 tin-lead solder.
- 6. Clip off any excess lead length extending beyond the circuit board, and clean off any residual flux with a flux-removing solvent. Be careful that the solvent does not remove any printing from the circuit board.

Metal Terminals. When soldering metal terminals (e.g., switch terminals, potentiometer, etc.), use 60-40 tin-lead solder and a 15 to 50 watt soldering iron. Observe the following precautions when soldering metal terminals:

- 1. Apply only enough heat to make the solder flow freely.
- 2. Apply only enough solder to form a solid connection. Excess solder may impair the function of the part.
- 3. If a wire extends beyond the solder joint, clip off the excess.
- 4. Clean the flux from the solder joint with a flux-removing solvent.

Component Replacement

WARNING

Disconnect the equipment from the power source before replacing components.

Relay Replacement. The relay in the 7B52 is manufactured by Tektronix, Inc. If the relay fails, a replacement may be ordered from your local Tektronix Field Office or representative. The eight-pin DPDT relay may be replaced in its socket either direction, as this relay is symmetrical.

Transistor, FET, and IC Replacement. Active devices used in this instrument should not be replaced unless actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement may affect the calibration of this instrument. When replaced, check the operation of that part of the instrument which may be affected.

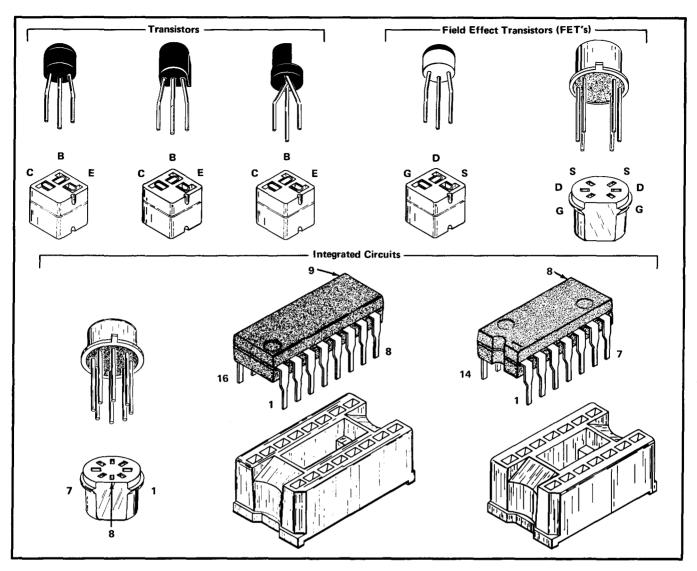


Fig. 4-2. Electrode configuration of transistors, FETs and integrated circuits used in this instrument.

Replacement devices should be of the original type or a direct replacement. Remount in the same manner as the original. Fig. 4-2 shows the lead configurations of the active devices used in this instrument. When replacing, check the manufacturer's basing diagram for correct basing.

Interconnecting Pins and Pin Socket Replacement. Two types of mating connectors are used for these interconnecting pins. If the mating connector is mounted on a plug-on circuit board, a special socket is soldered onto the board. If the mating connector is on the end of a lead, a pin connector is used to mate with the interconnecting pin. The following information provides the replacement procedure for the various types of pins and pin sockets.

a. Circuit Board Pins. To replace a pin which is mounted on a circuit board, first disconnect any pin connectors. Un-

solder the damaged pin and pull it out of the circuit board. Press the new pin into the hole in the circuit board so the ferrule on the pin is centered in the hole in the board. (Notice that the ferrule is not centered on the pin; be sure the replacement pin is positioned in the same manner as the original.) Solder the pin on both sides of the circuit board. If the pin was bent at an angle to mate with a connector, bend the new pin to match the associated pins. The inside radius of this bend should not be less than 0.025-inch.

b. Circuit Board Pin Sockets. The pin sockets on the circuit boards are soldered to the rear of the board. To replace the sockets, first unsolder the socket (use a vacuum-type desoldering tool to remove excess solder). Straighten the tabs on the socket to remove it from the hole in the circuit board. Place the new socket in the circuit board hole and press the tabs down against the board. Solder the socket tabs to the circuit board.

NOTE

The spring tension of the terminal sockets ensures a good connection between the circuit board and the pin. This spring tension can be destroyed by using the pin sockets as a connection point for spring-loaded probe tips, alligator clips, etc.

c. End-Lead Pin Connectors. The pin connectors used to connect the wires to the circuit board pins are clamped to the ends of the associated leads. To replace a damaged pin connector, first remove the old pin connector from the end of the lead. Clamp the new pin connector to the end of the lead. Some of the pin connectors are grouped together and mounted in a plastic holder. These connectors are removed and re-installed as a unit. To provide correct orientation of this multi- connector when it is replaced, an arrow is moulded into the plastic housing of the multi-pin connector and a matching arrow is stamped on the circuit board.

Switch Replacement. Two types of switches are used in the 7B52. The pushbutton switches and the cam-type switch should be replaced as a unit if damaged. The following special maintenance information is provided for the cam-type and pushbutton switches.



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

a. Cam-Type Switch. The cam-type switch (TIME/DIV or DL'Y TIME and DLY'D SWEEP) consists of two rotating cams (front portion for TIME/DIV or DL'Y TIME and the rear portion for DLY'D SWEEP), which are turned by front-panel knobs, and contacts which are mounted on adjacent circuit boards (Readout and Interface). These contacts are actuated by lobes on the cam as it is turned. The switch can be disassembled for inspection, cleaning, repair, or replacement; it is recommended that the switch be removed from the instrument as a unit only. The following procedure should be followed.

NOTE

See Mechanical Parts exploded views for switch breakdown.

Removal and replacement of switch contacts on Readout board:

- 1. Remove J211 and J212 (brown and red wire connectors) located on the end of the Readout board.
- 2. Remove the 10 Phillips head screws holding the Readout board.
- 3. Lift the Readout board up and away from the top of the cam switch.

NOTE

With the readout board removed, the cam will be exposed from the top and may be cleaned, at this time by rotating the associated front-panel knobs.

- 4. Follow the procedure as given in the switch repair kit to remove, replace, etc., the contacts on the bottom side of the Readout board.
- 5. To replace the Readout board, reverse the above procedure, being sure to tighten the screws evenly.

Removal and replacement of switch contacts on Interface

- 1. Remove the front-panel knobs and ring associated with the switch. See the Mechanical exploded view, items 6, 7, and 8.
- 2. Remove J211 and J212 (brown and red wire connectors) located on the end of the Readout board.
- 3. Remove J114 (yellow wire connector) from the Interface board. (This connector is located directly below J211 and J212.)
- 4. Disconnect J755 (green wire connector) on the Sweep board.
- 5. Completely loosen the 6 screws holding the Sweep board.
- Carefully lift the sweep board from the instrument; do not bend the pins from the interface board to the sweep board.

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- 7. Remove the 10 Phillips head screws holding the cam switch to the Interface board. (Hold the cam switch while removing the screws.)
 - 8. Remove the cam switch from the 7B52.
- 9. Follow the procedure as given in the switch repair kit to remove, replace, etc., the contacts on the Interface board.
- 10. To replace the cam switch, reverse the above procedure.



When replacing the 10 screws, tighten evenly. When replacing the Sweep board, do not apply much pressure until it is certain all pins from the Interface board have mated with the connectors on the Sweep board.

NOTE

When replacing the front-panel knobs and ring associated with the cam switch, slide the ring onto the shaft, but do not tighten. Then, install the large knob (it takes a little pressure) and tighten in place. Next, push the ring (from behind front-panel) until it seats properly with the large knob and lock in place. This will insure no backlash between the knob and ring as the cam is rotated.

b. Pushbutton Switches. For removal of pushbutton switches refer to the exploded views in the Mechanical Parts Diagram. The front panel and sub-panels must be removed.

Light Bulb Replacement. To replace the light bulbs, follow the above procedure to remove the switches (push-button). Remove the screw and cover from the back of the switch to expose the light bulb. Unsolder the two leads and remove the light bulb. Cut the leads of the replacement light bulb to the same length as the old bulb. Place insulating sleeves over the leads and replace the new bulb in the exact position of the old bulb.

Reassemble by reversing the procedure for removing the bulbs and switches.

Instrument Repackaging

If the 7B52 is to be shipped for long distances by commercial means of transportation, it is recommended that the instrument be repackaged in the original manner for maximum protection. The original shipping carton should be saved and used for this purpose. Repackaging information and/or new shipping cartons can be obtained from Tektronix, Inc. Contact your local Tektronix Field Office or representative.

NOTE

The plug-in should not be shipped installed in an indicator oscilloscope. The oscilloscope packaging material is not designed to protect plug-ins. See the Mechanical Diagrams for proper packaging of the 7B52.

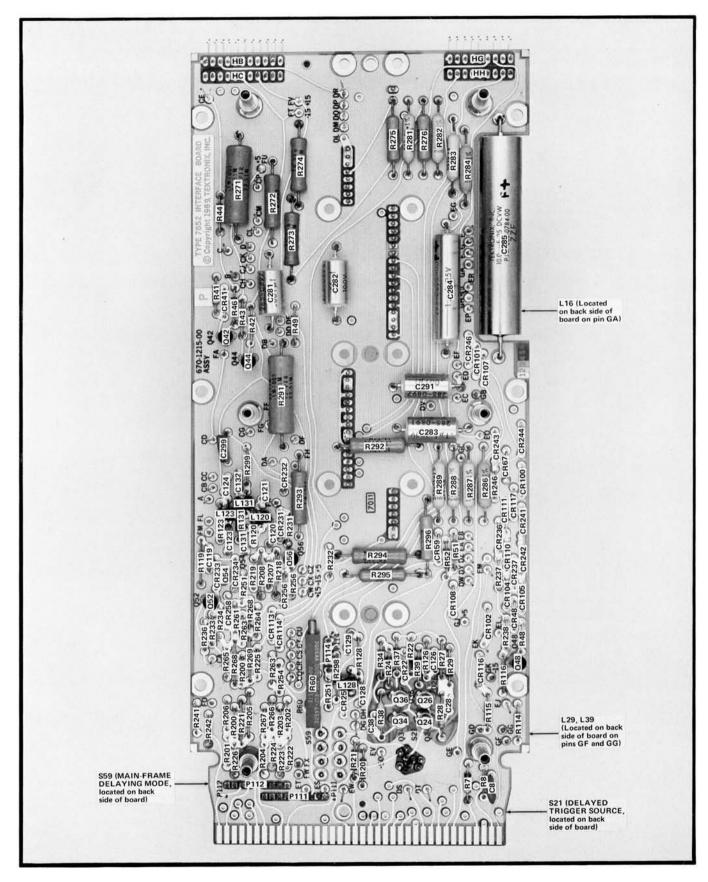


Fig. 4-3. 7B52 INTERFACE BOARD showing component locations.

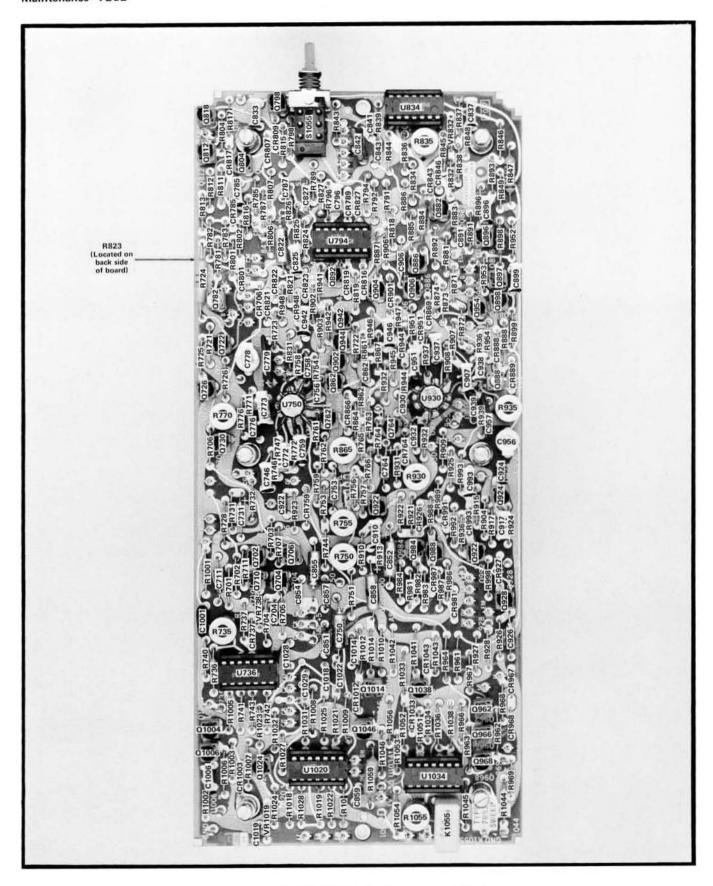


Fig. 4-4. 7B52 SWEEP BOARD showing component locations.

4-10

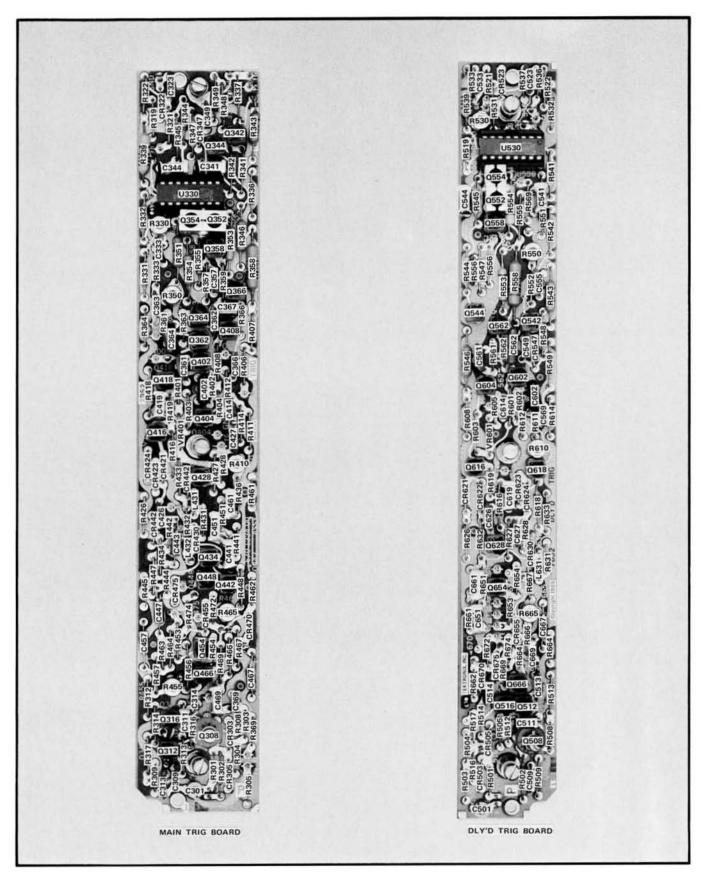


Fig. 4-5. 7B52 MAIN TRIG BOARD (left) and DLY'D TRIG BOARD (right) showing component locations.

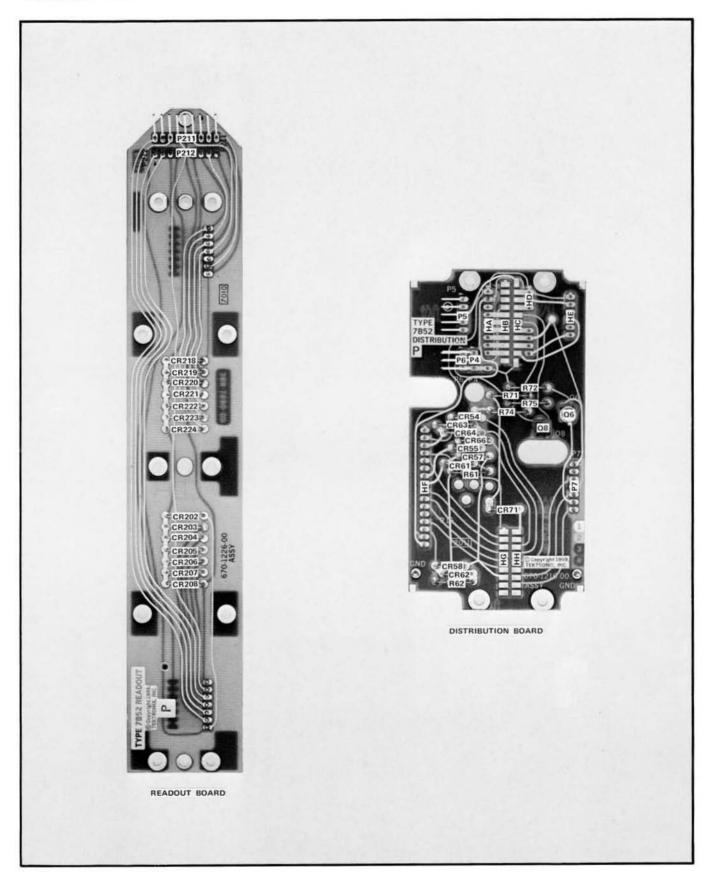


Fig. 4-6. 7B52 READOUT BOARD (left) and DISTRIBUTION BOARD (right) showing component locations.

4-12

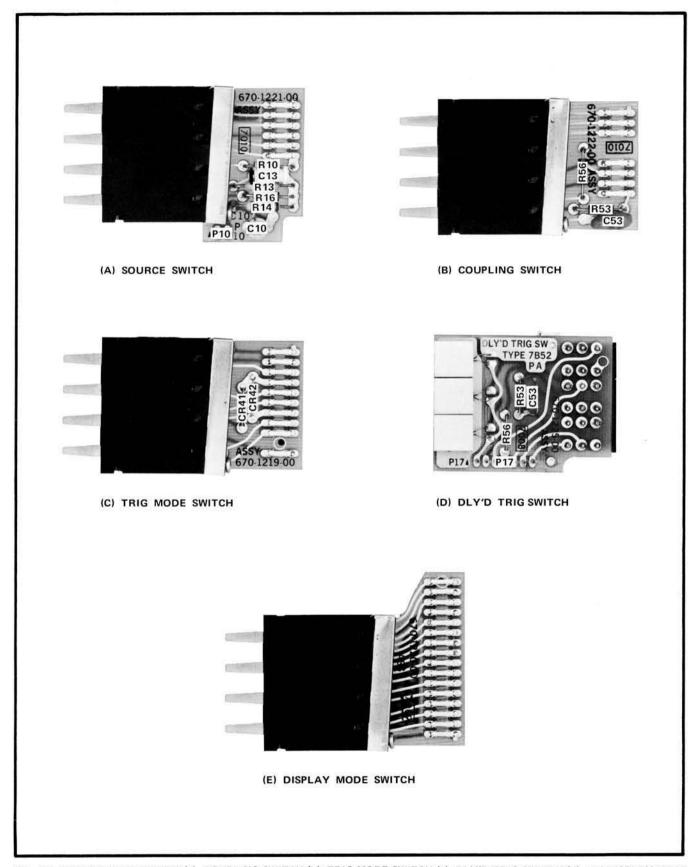


Fig. 4-7. 7B52 SOURCE SWITCH (a), COUPLING SWITCH (b), TRIG MODE SWITCH (c), DLY'D TRIG SWITCH (d), and DISPLAY MODE SWITCH (e) showing component locations. (There are no components on the DISPLAY MODE SWITCH, see (e).

SECTION 5 PERFORMANCE CHECK/CALIBRATION

Change information, if any, affecting this section will be found at the rear of this manual.

Introduction

To assure instrument accuracy, check the calibration of the 7B52 every 1000 hours of operation, or every six months if used infrequently. Before complete calibration, thoroughly clean and inspect this instrument as outlined in the Maintenance section.

As an aid to the calibration of the instrument, a Short-Form Procedure is given prior to the complete procedure. To facilitate instrument calibration for the experienced calibrator, the Short-Form Procedure lists the calibration adjustments necessary for each step and the applicable tolerances. This procedure also includes the step number and title as listed in the complete Performance Check/Calibration Procedure, and the page number on which each step occurs. This procedure can be reproduced and used as a permanent record of instrument calibration.

The complete Performance Check/Calibration Procedure can be used to check instrument performance without removing the covers or making internal adjustments, by performing all except the ADJUST part of each step. Screwdriver adjustments which are accessible without removing the covers are adjusted as part of the Performance Check Procedure.

Completion of each step in the complete Performance Check/Calibration procedure insures that this instrument meets the electrical specifications given in Section 1. Where possible, instrument performance is checked before an adjustment is made. For best overall instrument performance when performing a complete calibration, make each adjustment to the exact setting, even if the CHECK is within the allowable tolerance.

NOTE

All waveforms shown in this procedure were taken with a Tektronix Oscilloscope Projected Graticule Camera System. Limits, tolerances and waveforms are given as calibration guides and should not be interpereted as instrument specifications unless actually given in the Specification section of this manual.

A partial calibration is often desirable after replacing components, or to touch up the adjustment of a particular circuit between major recalibrations. To prevent unneces-

sary recalibration of other parts of the instrument, readjust only if the result noted in the CHECK part of the step is not within listed tolerance. If readjustment is necessary, also check the calibration of any steps listed in the INTER-ACTION part of the step.

TEST EQUIPMENT REQUIRED

General

The following test equipment and accessories, or their equivalents, are required for complete calibration of the 7B52. Specifications given are those necessary for accurate calibration. Therefore, some of the recommended equipment may have specifications better than those given. All test equipment is assumed to be correctly calibrated and operating within the given specifications. If equipment is substituted, it must meet or exceed the specifications given here.

Special Tektronix calibration fixtures are used in this procedure only where they facilitate calibration. These special calibration fixtures are available from Tektronix, Inc. Order by part number through your local Tektronix Field Office or representative.

TEST EQUIPMENT

- 1. Oscilloscope Mainframe with readout. Tektronix 7503 (7504 or 7704)¹ Oscilloscope.
- 2. Amplifier. Bandwidth, 90 MHz; deflection factor, 5 volts to less than 50 millivolts. Tektronix 7A16.
- 3. ¹Time-Base. Compatible with Tektronix 7000-Series Oscilloscope. A 7B50 was used for this procedure.
- 4. Constant amplitude sine-wave generator. Reference frequency, 50 kHz; frequency range, 10 MHz to 100 MHz; output amplitude, variable from 150 millivolts to 5 volts. Tektronix Type 191 Constant-Amplitude Signal Generator.

¹Required only if steps 26 and 27 are performed.

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- Square-wave generator. Frequency, 1 kHz; risetime,
 nanoseconds or less at 0.5 volts. Tektronix Type 106
 Square-Wave Generator.
- 6. Time-mark generator. Marker outputs, five seconds to 100 nanoseconds; marker accuracy, within 0.1%. Tektronix 2901 or Type 184 Time-Mark Generators. (A Tektronix 2901 was used for this procedure.)
- 7. Low-frequency sine-wave generator. Frequency range, 20 hertz to greater than 50 kilohertz; output amplitude, 150 millivolts to 5 volts. For example, General Radio Model 1310-A Oscillator.
 - 8. Plug-in extender. Tektronix Part No. 067-0589-00.
- 9. Input RC Normalizer. Time Constant, 1 megohm times 20 picofarads; connectors, BNC. Tektronix calibration fixture 067-0538-00.
- 10. 10X Voltage Probe. Attenuation, 10X within 3%; connector, BNC; input compensation, adjustable to allow compensation with amplifiers having input capacitance of 15 to 24 picofarads. Tektronix P6053 Voltage Probe.
- 11. Termination. Impedance, 50 ohm; type, feed-through; connectors, BNC; accuracy, ±3%. Tektronix Part No. 011-0049-01. (Supplied with Tektronix 2901 Time-Mark Generator.)
- 12. Attenuator. Impedance, 50 ohm; attenuation, 10X; type, feedthrough; connectors, BNC; accuracy, $\pm 3\%$. Tektronix Part No. 011-0059-01.
- 13. Adapter. Connector, BNC-T. Tektronix Part No. 103-0030-00.
- 14. Adapter. Connectors, GR to BNC Female. Tektronix Part No. 017-0063-00.
- 15. Coaxial Cables (two required). Impedance, 50 ohm; length, 42 inches; connectors, BNC. Tektronix Part No. 012-0057-01. (Supplied with Tektronix 2901 Time-Mark Generator.)
- 16. Dual Input Cable. Connectors, BNC. Tektronix Calibration Fixture 067-0525-00.

| 17. Adjustment tools | Tektronix Part No. |
|--|-----------------------|
| a. Handle. Nylon for use with 003-0334-00 insert. | 003-0307-00 |
| b. Insert. Nylon, for use with 003-0307-00 handle. | 003-0334-00 |
| c. Screwdriver. 3/32-inch bit width, 3/32-inch diameter round shank 5 inches long with a plastic | 003-0192-00 |

SHORT FORM PROCEDURE

handle.

| 7B52 Serial No. | |
|---|-------------|
| Calibration Date | |
| Calibration Technician | |
| Check/Adjust MAIN TRIGGERING (R350, R330, R410, R465, and R455) See complete procedure. | Page 5-6 |
| CorrectIncorrect | |
| 2. Check/Adjust DLY'D TRIGGERING (R550, R630, R618, R865, and R665) See complete procedure. | Page 5-8 |
| CorrectIncorrect | |
| 3. Check Level Control Ranges | Page 5-9 |
| 8 divisions of 50 kHz sine-wave applied to 7 | 'A16 Input. |
| Rotation of LEVEL/SLOPE control will level of display as sweep trigger point. | select any |
| CorrectIncorrect | |

4. (Calibration Procedure Only) Adjust EXT Page 5-9 Compensation (C501, C301, and C10)

5 divisions of 1 kHz square-wave signal applied to MAIN TRIG IN-DLY'D TRIG IN

DLY'D SWP—Adjust C501 for best square corner on leading edge of square wave at TP516.

MAIN SWP—Adjust C301 for best square corner on leading edge of square wave at TP316.

Adjust C10 for best square wave at TP316 with MAIN TRIGGERING SOURCE switch at EXT ÷10.

| Correct | Incorrect |
|---------|-----------|
|---------|-----------|

| 5. | Check Trigger Bandwidth | Page 5-10 | 11. Check/Adjust Main and Dly'd Sweep Page 5-13 Length (R835 and R930) |
|-----|--|--------------|---|
| | See Complete Procedure | | - |
| | CorrectIncorrect | | .1 and 1 ms markers applied to 7A16 Input |
| 6. | Check Trigger Jitter | Page 5-10 | MAIN SWP—Adjust RR835 for a sweep length of 10.4 div at 1 ms. |
| | 1.5 divisions of 75 MHz sine-wave on CRT MAIN and DLY'D TRIG IN) | (750 mV to | Check for a sweep length of 10 to 13 divisions in all other positions. |
| | Check for no more than 1 ns of jitter. | | DLY'D SWP-Adjust R930 for a sweep length of 10.4 div at .1 ms. |
| | CorrectIncorrect | | Check for a sweep length of 10 to 13 divisions in all other positions. |
| 7. | Check Trigger Modes | Page 5-11 | CorrectIncorrect |
| | 4 divisions of 50 MHz sine-wave to 7A16 Inp | out | 12. Check Position Range Page 5-14 |
| | Check for proper triggering in AUTO, N SINGLE SWP. | NORM and | 1 ms markers applied to 7A16 Input |
| | CorrectIncorrect | | Check that rotation of POSITION control will position a 10.4 division display completely to the left and right |
| 8. | Check/Adjust SWP CAL (R60) | Page 5-12 | of CRT center. CorrectIncorrect |
| | 1 ms markers applied to 7A16 Input | | Correct |
| | Adjust R60 for 1 ms marker each vertical lin | e. | 13. Check Variable Sweep Range Page 5-14 |
| | Check—timing accuracy is within 5% over a isions within the center eight divisions. | ny two div- | 10 ms markers applied to 7A16 Input |
| | CorrectIncorrect | | Check for 2 major divisions or less between 10 ms markers as the MAIN VARIABLE control is rotated fully counterclockwise with TIME/DIV at 2 ms. |
| 9. | Check/Adjust Mag Sweep Gain (R1055) | Page 5-13 | CorrectIncorrect |
| | .1 ms markers applied to 7A16 Input | | 44 OL 1/4 II - 115 Ti : Para E 14 |
| | Adjust R1055 for one .1 ms marker each ve MAG switch on). | ertical (X10 | 14. Check/Adjust HF Timing Page 5-14 (C778 and C956) 1 µs markers applied to 7A16 Input |
| | Check-timing accuracy is within 5% over ar isions within the center eight divisions. | ny two div- | MAIN SWP—Adjust C778 for one 1 μs marker each major division. |
| | CorrectIncorrect | | Check that timing accuracy is within 5% over any two divisions within the center eight divisions. |
| 10. | Check Mag Registration | Page 5-13 | DLY'D SWP-Adjust C956 for one µs marker each major division. |
| | .5 ms markers applied to 7A16 Input | | · |
| | Check for no more than 0.5 div of horizont ment of the .5 ms marker as the X10 MA | | Check that timing accuracy is within 6% over any two divisions within the center eight divisions. |

switched off.

Correct____Incorrect____

Check that timing accuracy is within 6% over any two divisions within the center eight divisions with the X10

MAG switch on.

Performance Check/Calibration-7B52

| | MAIN SWP—Check that timing accuracy is within 5% over any two divisions within the center eight divisions with the X10 MAG switch on. | | Check Delay Time Jitter Page 5-19 1 ms markers applied to 7A16 |
|------------------|---|-----|--|
| | CorrectIncorrect | | Check that jitter is less than 1 division with TIME/DIV switch at 1 ms and DLY'D SWEEP at .5 μ s. |
| 15. | Check Mag Swp Timing Accuracy Page 5-15 | | CorrectIncorrect |
| | See Complete Procedure | | |
| | CorrectIncorrect | 22. | Check Mixed Sweep Page 5-19 |
| 16. | Check Sweep Timing Accuracy Page 5-16 | | 1 ms markers applied to 7A16 Input |
| | See Complete Procedure | | Check—Mixed sweep timing accuracy is within 2% plus error of Main Sweep over the center eight divisions of |
| CorrectIncorrect | | | the CRT. See the Specification section. |
| | | | CorrectIncorrect |
| 17. R93 | Check/Adjust Sweep Offset (R730 and Page 5-16 35) | 23. | Check External Amplifier Gain Page 5-19 |
| | No signal applied. (X10 Probe to TP779 or TP995) | | 4 divisions of 100 kHz signal applied to MAIN TRIG IN. |
| | Main Swp and DLY'D SWP-Each sweep must start within 1 major division of the other. | | Check for horizontal trace length of 8 div within 10% in EXT. |
| | MAIN SWP—Adjust R730 to start display at CRT center (10X probe to TP779) | | Check for horizontal trace length of 0.8 div within 10% in EXT $\div 10.$ |
| | DLY'D SWP—Adjust R935 to start display at CRT center (10X probe to TP995) | | Check for horizontal trace length of 8 div within 10% EXT \div 10 with X10 MAG switch on. |
| | CorrectIncorrect | | CorrectIncorrect |
| | Check/Adjust Dly'd Start and Dly'd Page 5-17 p (R755 and R750) | 24. | Check External Bandwidth Page 5-20 |
| | See Complete Procedure | | See Complete Procedure. |
| | CorrectIncorrect | | CorrectIncorrect |
| 19. | Check Delay Time Mult Accuracy Page 5-17 | 25. | Check Line Triggering Page 5-20 |
| | 1 ms markers applied to 7A16 | | AC (60 Hz) to 7A16 Input |
| | Check that DELAY TIME MULT control is accurate to within 0.2% between 9-00 and 1-00. | | Check that the LEVEL/SLOPE control will cause proper triggering of the display with the MAIN TRIGGERING SOURCE switch at LINE. |
| | CorrectIncorrect | | CorrectIncorrect |
| 20. | Check Delay Time Accuracy Page 5-17 | | |
| | See Complete Procedure. | | (Optional) Check Mainframe Delaying Page 5-20 de Selector Switch |
| | Correct Incorrect | | See Complete Procedure. |

27. (Optional) Check Delayed Trigger Page 5-21 Source Selector Switch

See Complete Procedure.

General

The following procedure is arranged so the 7B52 can be calibrated with the least interaction of adjustments and reconnection of equipment. A photo of all test equipment, adapters, cables, etc., required for the complete Performance Check/Calibration is given to aid in identification of the necessary equipment used in the following steps; see Fig. 5-1. The control settings continue from the preceding step(s) unless noted otherwise.

The following procedure uses the equipment listed under Test Equipment Required. If other equipment is substituted, control settings or calibration setup may need to be altered to meet the requirements of the equipment used. Detailed operating instructions for the test equipment are not given in this procedure. Refer to the instruction manual for the test equipment used.

NOTE

This instrument should be calibrated to an ambient temperature of $+25^{\circ}C$, $\pm 5^{\circ}C$ for best overall accuracy. If the temperature is outside the given range, see Section One for the applicable tolerances.

Procedure

1. Set all test equipment and the 7B52 controls as follows:

7A16 Control Settings

| Position | Midrange |
|-----------|----------|
| AC-GND-DC | GND |
| Polarity | + Up |
| Bandwidth | Full |
| Volts/Div | .5 V |

Variable (Volts/Div) Locked In (off)

7503 Indicator Oscilloscope Settings

Vertical N

Vertical Mode Left
Trigger Source Left Vert
Focus Midrange
Intensity CCW
Control Illum Low

Readout As desired
Graticule Illum CCW
Beam Finder Normal
Calibrator Off
Rate Any

7B52 Control Settings

LEVEL/SLOPE Midrange (between 0/+ and 0/-)

MAIN TRIGGERING

MODE **AUTO** COUPLING AC SOURCE INT **POSITION** Midrange X10 MAG Locked in (off) **DISPLAY MODE** MAIN SWP TIME/DIV or DLY TIME 20 µs **DLY'D SWEEP** 10 us MAIN VARIABLE Locked in (CAL)

DLY'D TRIGGERING

LEVEL OUT, mechanical midrange

SLOPE In (+)
COUPLING In (AC)
SOURCE In (INT)
DELAY TIME MULT 1-00

- 2. (Performance Check Only) Install the 7B52 directly into the right compartment of the 7503 Indicator Oscilloscope.
- 3. (Calibration Procedure Only) Install the 067-0589-00 Plug-In Extender into the right compartment of the 7503 Indicator Oscilloscope.
- 4. (Calibration Procedure Only) Remove the side covers from the 7B52 and connect the 7B52 to the 067-0589-00 Plug-In Extender.
- 5. Turn on the 7503 Indicator Oscilloscope and allow at least 20 minutes warmup before proceeding with the Performance Check/Calibration procedure.

NOTE

During this procedure, whenever a particular 7852 switch is pressed, that switch should light up. Also, the CRT readout should always indicate the correct setting of the TIME/DIV or DL'Y TIME, DLY'D SWEEP, and MAIN VARIABLE switches. No further reference will be made to these conditions, but they must be checked.

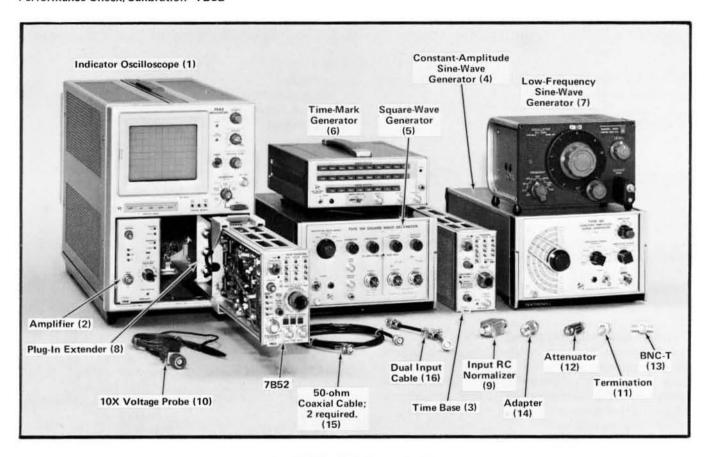


Fig. 5-1. Test equipment required for the Performance Check/Calibration Procedure.

1. Check/Adjust MAIN TRIGGERING (R350, R330, R410, R465, and R455)

- a. Adjust the 7503 Indicator Oscilloscope Intensity, Focus, and Graticule Illum controls for a well defined and focused display (trace) on the CRT (Indicator Oscilloscope Cathode Ray Tube).
- b. From the Type 191 Constant Amplitude Signal Generator (set for 50 kHz), connect a GR to BNC Female adapter, BNC-T adapter and two BNC 50 ohm coaxial cables; connect one cable to the 7A16 Input connector and the other to the 7B52 MAIN TRIG IN connector.

NOTE

With equipment connected as above, all amplitude settings of the Type 191 Amplitude control must be measured on the CRT.

c. CHECK—Using the 7A16 Position control, position the trace to CRT center; sweep must free-run in AUTO mode (indicated by trace).

- d. Press the 7A16 AC switch and the 7B52 MAIN TRIG-GERING NORM switch.
 - e. CHECK-CRT for no display and TRIG'D lamp out.

NOTE

If part e is incorrect, set R465 and R455 to midrange. Complete all checks and adjustments listed in this step.

- f. Rotate the 7B52 LEVEL/SLOPE control (towards 0/+) for a triggered display.
- g. Set the Type 191 for an amplitude as measured on the CRT of 0.3 division, and rotate the 7A16 Position control to center this 0.3 division display about the graticule center horizontal line.
- h. Note the position of the sweep trigger point (start of display) with respect to CRT center.

- i. Press the 7B52 MAIN TRIGGERING DC switch.
- j. CHECK—CRT for a triggered display with the position of the sweep trigger the same as noted in part h.
- k. ADJUST-R350, located on Main Trig board, for a triggered display with position of sweep trigger point the same as noted in part h.
- Repeat the above adjustment as necessary until the position of sweep trigger point remains the same in either AC or DC.
- m. Press the MAIN TRIGGERING DC switch. Repeat parts f, g, and h.
 - n. Press the MAIN TRIGGERING EXT switch.
- o. CHECK-CRT for triggered display with position of sweep trigger the same as noted in part h.
- p. ADJUST-R330 for a triggered display with position of sweep trigger point the same as noted in part h.
- q. Repeat the above adjustment as necessary until the position of sweep trigger point remains the same in either INT or EXT.
- r. Press the 7B52 MAIN TRIGGERING AUTO, AC, and INT switches. Set the LEVEL/SLOPE control to 0/+.
 - s. Repeat parts g and h.
- t. CHECK-CRT display should trigger (sweep starts) at CRT center.
 - u. ADJUST-R410 to trigger the display at CRT center.
 - v. Rotate the LEVEL/SLOPE control to 0/-.
- w. CHECK-CRT display should trigger (sweep starts) at CRT center.
- x. Repeat the adjustment in part u as necessary until sweep triggering occurs at CRT center with the LEVEL/ SLOPE control set to 0/+ and/or 0/-.

NOTE

If sweep triggering cannot be set to CRT center at both O/+ and O/— settings of the LEVEL/SLOPE control, adjustment may be made so that triggering occurs at points equally above (O/+) and below (O/—) CRT center. In no case should sweep triggering occur more than one minor division above CRT center when in O/+, nor more than one minor division below in O/—.

- y. Rotate the LEVEL/SLOPE control midrange between 0/+ and 0/-.
 - z. CHECK-CRT for free-running display.
 - aa. Press the MAIN TRIGGERING NORM switch.
 - ab. CHECK-CRT for no display.
- ac. ADJUST—R455 to a point where the sweep free-runs in AUTO mode, and stops running in NORM. Rotate the control about 10° clockwise past this point.
- ad. Press the MAIN TRIGGERING AUTO switch, set the frequency of the Type 191 to 100 MHz, and adjust the amplitude control for a display amplitude of 1.5 divisions on the CRT.
- ae. Set the 7B52 TIME/DIV or DLY TIME to .1 μ s, DLY'D SWEEP to .05 μ s, and release the X10 MAG switch. Rotate the LEVEL/SLOPE control for a triggered display.
- af. CHECK—CRT display should be triggered and TRIG'D lamp must be on. There must be no defocusing of the sine-wave peaks.

NOTE

Defocusing of sine-wave peaks indicates that a slight adjustment of R465 may be necessary. Defocusing of sine-wave slopes is the result of trigger jitter (if any) and should be disregarded at this time.

- ag. Observing the CRT display, slowly rotate the frequency control of the Type 191 toward 42 MHz.
- ah. CHECK—CRT display for no double triggering of the display or free-running of the display as the frequency of the Type 191 is decreased from 100 MHz towards 42 MHz.

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- ai. (Calibration Procedure Only) Rotate the frequency control of the Type 191 to 100 MHz, then slowly towards 42 MHz until the first double triggering or free-running display occurs.
- aj. ADJUST-R465 for a single triggered display with little or no defocusing of the sine-wave peaks.

NOTE

The adjustment of R465 may interact with the adjustment of R455 (see part ac). Press the MAIN TRIGGERING NORM switch, lock in the X10 MAG switch and repeat parts y through aj.

2. Adjust DLY'D TRIGGERING (R550, R630, R618, R865, and R665)

- a. Set the 7A16 and 7B52 controls and switches as given preceding Step 1.
- b. Disconnect the 50 ohm coaxial cable from the MAIN TRIG IN connector and reconnect it to the DLY'D TRIG IN connector.
 - c. Set the Type 191 to 50 kHz.
- d. Press the 7A16 AC switch, adjust the Type 191 for 0.3 division CRT display; rotate the LEVEL/SLOPE control for a triggered display.
 - e. Press the 7B52 DISPLAY MODE INTEN switch.
- f. CHECK-Observing the CRT display, rotate the DLY'D LEVEL control for an intensified sweep (Dly'd Sweep triggered).

NOTE

If part f is incorrect, adjust R865 for an intensified trace and set R665 to midrange. Complete all checks and adjustments listed in this step.

g. Note position of Dly'd Sweep trigger point (start of intensified display) with respect to CRT Vertical center.

NOTE

For better viewing of the intensified sweep, reduce the oscilloscope intensity control. Another method is to press the DISPLAY MODE DLY'D SWP switch and view only the Dly'd Sweep (intensified display).

- h. Release the DLY'D COUPLING AC/DC (DC) switch.
- i. CHECK—CRT intensified sweep should be triggered with position of sweep trigger point the same as noted in part q.
- j. ADJUST—R550 for triggered display with position of trigger point as noted in part g.
- k. Repeat the adjustment as necessary until the Dly'd Sweep trigger point as noted in part g is the same for either position of the DLY'D COUPLING AC or DC switch. Return the COUPLING switch to DC.
 - I. Release the DLY'D SOURCE INT/EXT (EXT) switch.
- m. CHECK—CRT display; intensified sweep should be triggered with the position of the trigger point the same as noted in part g.
- n. ADJUST-R630 for triggered display with the position of the trigger point the same as noted in part g.
- o. Repeat the adjustment as necessary until the trigger point as noted in part g is the same for either position of the DLY'D SOURCE INT or EXT switch position. Return the SOURCE switch to INT.
- p. Check or set the DLY'D TRIGGERING switches to +, AC, and INT.
- q. Release the MAIN TRIGGERING INT switch (the CRT display will free run with no buttons depressed), adjust the Type 191 for 0.3 division on the CRT and rotate the 7A16 Position control to center the display above and below CRT center. Set the 7B52 DLY'D LEVEL control to midrange. Press the MAIN TRIGGERING INT switch.
- r. CHECK—CRT for triggered display, and note position of sweep trigger point with respect to CRT center.
- s. ADJUST-R618 for a triggered display with the sweep trigger point at or near CRT center.
 - t. Release the DLY'D SLOPE (-) switch.
- u. CHECK—CRT for triggered display, with the position of the sweep trigger point at CRT center, below CRT center by the same amount the trigger point was above CRT center in part r.

- v. Release the MAIN TRIGGERING INT switch (CRT display will free run with no buttons depressed), set the Type 191 to 100 MHz and adjust the amplitude for 1.5 divisions on the CRT. Set the TIME/DIV or DL'Y TIME switch to .1 μ s, DLY'D SWEEP switch to .05 μ s, and release the X10 MAG switch.
- w. Press the MAIN TRIGGERING INT switch, the DIS-PLAY MODE MAIN SWP switch and rotate the LEVEL/ SLOPE control for a triggered display.
- x. Press the DISPLAY MODE INTEN switch and rotate the DLY'D LEVEL control for a triggered display.
- y. CHECK-CRT display should be triggered. There should be no defocused peaks of the displayed sinewave.

NOTE

Defocus of sine-wave peaks indicates that slight adjustment of R865 may be necessary. Defocus of sinewave slope(s) is the result of trigger jitter.

- z. Observing the CRT display, slowly rotate the frequency control of the Type 191 towards 42 MHz.
- aa. CHECK-CRT for no double triggering, or free running display as the frequency is decreased towards 42 MHz.
- ab. (Calibration Procedure Only) Rotate the frequency control of the Type 191 to 100 MHz. Then, decrease it until the first double triggering or free running display occurs.
 - ac. ADJUST-R655 for triggered display.
- ad. Rotate the DLY'D LEVEL control to either extreme of rotation.
 - ae. CHECK-CRT for no display.
- af. ADJUST-R865 for no display with the LEVEL control at either extreme of rotation.

NOTE

The adjustments of R865 and R655 may interact. Repeat the above checks and adjustments as necessary until all requirements are met.

3. Check Level Control Ranges

- a. Set the 7B52 TIME/DIV or DLYY TIME to 20 $\mu s,$ DLY'D SWEEP to 10 $\mu s,$ X10 MAG switch in (off) and the DISPLAY MODE to DLY'D SWP.
- b. Set the Type 191 to 50 kHz and adjust the output amplitude control for an 8 division display on the CRT.
- c. CHECK-Rotate the DLY'D LEVEL control and check that all levels of the display may be selected as the sweep trigger point. Check for no display with the LEVEL control at either end of rotation.
- d. Repeat part c with all possible combinations of the DLY'D SLOPE, COUPLING, and SOURCE switches.
 - e. Press the DISPLAY MODE MAIN SWP switch.
- f. CHECK—Rotate the LEVEL/SLOPE control and check that all levels of the display may be selected as the sweep trigger point, and that the slope corresponds to the markings on the 7B52 front-panel.
- g. Repeat part f with all possible combinations of the MAIN TRIGGERING COUPLING (AC or DC only) and SOURCE (INT or EXT only) switches.
 - h. Disconnect all test equipment and connections.

4. (Calibration Procedure Only) Adjust Ext Compensation (C501, C301, and C10)

a. Set the 7A16 and 7B52 controls and switches as given preceding Step 1 with the following exceptions:

7A16 AC-GND-DC switch to DC and Volts/Div switch to .1 V.

7B52 MAIN TRIGGERING COUPLING switch to DC; LEVEL/SLOPE control to 0/+; TIME/DIV or DL'Y TIME switch to 1 ms; DLY'D SWEEP switch .5 ms; DLY'D COUPLING switch to DC; and the DLY'D SOURCE switch to EXT.

b. Connect a 1 kHz square wave from the Type 106 Hi-Amplitude output via a GR to BNC Female adapter, 50 ohm coaxial cable, 10X attenuator, 50 ohm feed-thru-line termination and a 20 pF Normalizer to the 7A16 Input connector.

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- c. Adjust the Type 106 amplitude control for a 5 div display of 1 kHz squarewave on the CRT.
- d. Disconnect the 20 pF Normalizer from the 7A16 Input connector and reconnect it to the 7B52 DLY'D TRIG IN connector. Connect a properly compensated 10X probe from the 7A16 Input connector to TP516; set the 7A16 Volts/Div switch to 5 mV.
- e. Press the DISPLAY MODE DLY'D SWP switch and rotate the DLY'D LEVEL control for a triggered display.
- f. ADJUST-C501 for the best square corner on the leading edge of the square wave.
- g. Disconnect the 10X probe from TP516 and connect it to TP316.
- h. Press the MAIN TRIGGERING EXT switch, DIS-PLAY MODE MAIN SWP switch, and connect the 20 pF Normalizer to the MAIN TRIG IN connector.
- i. ADJUST-C301 for the best square corner on the leading edge of the square wave.
- j. Disconnect the 10X attenuator; press the MAIN TRIG-GERING EXT ÷10 switch.
- k. ADJUST-C10 for the best square corner on the leading edge of the square wave.
- I. Disconnect the 20 pF Normalizer, 50 ohm termination, coaxial cable, GR to BNC Female adapter and the Type 106. Disconnect the 10X probe from TP316 and the 7A16 Input connector.

5. Check Trigger Bandwidth

- a. (Calibration Procedure Only) Disconnect the 7B52 from the 067-0589-00 Plug-In Extender and the Extender from the Indicator Oscilloscope. Then, install the 7B52 into the right compartment of the oscilloscope. Change the 7A16 from the left compartment of the indicator oscilloscope and install it in the center compartment.
- b. Set the 7A16 and 7B52 controls and switches as given preceding Step 1 with the following exceptions:

7A16 AC-GND-DC switch to AC.

7B52 TIME/DIV or DL'Y TIME switch to 10 ms and DLY'D SWEEP switch to 5 ms.

- c. Connect a 30 Hz sine-wave from a low frequency generator via a 50 ohm coaxial cable and a Dual Input Cable to the 7A16 Input and 7B52 MAIN TRIG IN connectors. Set the amplitude control for a 0.3 division CRT display.
- d. Rotate the LEVEL/SLOPE control for a triggered dis
 - e. CHECK-TRIG'D lamp is on.
- f. Using Table 5-1 as a guide, check all conditions listed. Use the 7B52 TIME/DIV switch as necessary for optimum viewing of the display.

NOTE

When checking DIy'd Trigger bandwidth, change the input cable to the DLY'D TRIG IN connector and keep the DLY'D SWEEP switch one position faster than the TIME/DIV or DL'Y TIME switch setting. Use the DLY'D LEVEL control and DLY'D SWP.

- g. Disconnect the low frequency sine-wave generator.
- h. From the Type 191 Constant Amplitude Signal Generator, connect a GR to BNC Female adapter and the 50 ohm cable disconnected in part g.
- i. Set the frequency of the Type 191 to 10 MHz and adjust the amplitude control for a 0.3 division CRT display.
- j. CHECK—Using the control settings given in Table 5-2, check for stable triggering, and check that the TRIG'D lamp is on as listed. Note that the amplitude has been increased at 100 MHz.

6. Check Trigger Jitter

- a. Set the Type 191 to 75 MHz and check that the CRT amplitude is 1.5 Div.
- b. Press the 7B52 MAIN TRIGGERING AUTO, AC and EXT switches and check that DLY'D Triggering is in AC and EXT.

5-10

TABLE 5-1

| | 7B | 52 | | | | | |
|-----------|--------|----------|--------|-----------|-------------------|------------------|---------|
| Main S | weep | Dly'd | Sweep | Low Fred | Low Frequency Gen | | TRIGT |
| Coupling | Source | Coupling | Source | Frequency | Amplitude | Triggering | Lamp on |
| AC | Int | AC | Int | 30 Hz | 0.3 Div_ | Yes | Yes |
| AC | Ext | AC | Ext | 30 Hz | 150 mV | Yes | Yes |
| AC LF REJ | Ext | | | 30 Hz | 150 mV | No | No |
| AC LF REJ | Int | | | 30 Hz | 0.3 Div | No | No |
| AC HF REJ | Int | | | 30 Hz | 0.3 Div | Yes | Yes |
| AC HF REJ | Ext | | | 30 Hz | 150 mV | Yes | Yes |
| DC | Ext | DC | Ext | 30 Hz | 150 mV | Yes | Yes |
| DC | Int | DC | Int | 30 Hz | 0.3 Div | Yes | Yes |
| AC LF REJ | Int | | | 30 kHz | 0.3 Div | Yes | Yes |
| AC HF REJ | Int | | | 50 kHz | 0.3 Div | Yes | Yes |
| AC HF REJ | Ext | | | 50 kHz | 150 mV | Yes | Yes |
| AC LF REJ | Ext | | | 150 kHz | 150 mV | Yes | Yes |
| AC LF REJ | Ext | | | 120 Hz | (No | Trigger with 1.5 | |

TABLE 5-2

| | 78 | 352 | | | | | |
|-----------|--------|------------|--------|-----------|-----------|----------------------|---------|
| Main S | weep | Dly'd | Sweep |] Тур | e 191 | Stable Triggering | TRIG'D |
| Coupling | Source | Coupling | Source | Frequency | Amplitude | | Lamp on |
| DC | Ext | DC | Ext | 10 MHz | 150 mV | Yes | Yes |
| DC | Int | DC | Int | 10 MHz | 0.3 Div | Yes | Yes |
| AC LF REJ | Int | | | 10 MHz | 0.3 Div | Yes | Yes |
| AC LF REJ | Ext | | | 10 MHz | 150 mV | Yes | Yes |
| AC | Ext | AC | Ext | 10 MHz | 150 mV | Yes | Yes |
| AC | Int | AC | Int | 10 MHz | 0.3 Div | Yes | Yes |
| AC | Int | AC | Int | 100 MHz | 1.5 Div | Yes | Yes |
| AC | Ext | AC | Ext | 100 MHz | 750 mV | Yes | Yes |
| AC LF REJ | Ext | | | 100 MHz | 750 mV | Yes | Yes |
| AC LF REJ | Ext | | | 100 MHz | 1.5 Div | Yes | Yes |
| DC | int | DC | Int | 100 MHz | 1.5 Div | Yes | Yes |
| DC | Ext | DC | Ext | 100 MHz | 750 mV | Yes | Yes |

- c. Set the 7B52 TIME/DIV or DL'Y TIME switch to .05 μ s and release the X10 MAG switch.
- d. Rotate the LEVEL/SLOPE control or DLY'D LEVEL control (depending upon connection to EXT TRIG IN connectors, and which DISPLAY MODE switch is pressed) for a triggered display.
- e. CHECK—CRT display for no more than 0.2 div (1 ns) of jitter. Disregard any slow drift.
- f. Change the Dual Input Cable to the other EXT TRIG IN connector and press the corresponding DISPLAY MODE switch.

g. Repeat parts d and e.

7. Check Trigger Modes

- a. Press the 7B52 MAIN TRIGGERING INT switch and the DISPLAY MODE MAIN SWP switch.
- b. Set the Type 191 to 50 MHz and adjust the amplitude for a 4 div display on the CRT.
- c. CHECK—For proper triggering with the LEVEL/SLOPE control at 0/+ and 0/-. Check for a free running display with the LEVEL/SLOPE control near the top and near the bottom.

- d. Press the 7B52 MAIN TRIGGERING NORM switch.
- e. CHECK—For proper triggering with the LEVEL/SLOPE control at 0/+ and 0/—. Check for no trace with the LEVEL/SLOPE control near the top and near the bottom.
- f. Set the 7B52 TIME/DIV or DL'Y TIME switch to 10 μs and lock the X10 MAG switch in. Set the Type 191 to 50 kHz and adjust the amplitude for a four division display. Adjust the 7B52 LEVEL/SLOPE control for a stable display.
- g. Press the 7B52 MAIN TRIGGERING SINGLE SWP switch.
 - h. CHECK-CRT for no display.
 - i. Press the 7B52 RESET switch.
- j. CHECK—CRT for one sweep as the RESET switch is pressed.
- k. Remove the signal from the 7A16 Input connector. Then, press the 7B52 RESET switch.
 - 1. CHECK-CRT for no display and READY light on.
 - m. Reconnect the signal to the 7A16 Input connector.
- n. CHECK—CRT for one sweep as the signal is applied to the 7A16.
- o. CHECK-READY light is out after the completion of one sweep.
 - p. Disconnect all test equipment and connections.

8. Check/Adjust SWP CAL (R60)

- a. (Calibration Procedure Only) Remove the 7B52 and the 7A16 from the Indicator Oscilloscope. Then, install the 7A16 into the left vertical compartment and the 067-0589-00 Plug-in Extender into the horizontal compartment, Connect the 7B52 to the Extender.
- b. Set the 7A16 and 7B52 controls and switches as given preceding Step I with the following exceptions:

7A16 AC-GND-DC switch to DC.

7B52 TIME/DIV or DL'Y TIME and DLY'D SWEEP switches to 1 ms, DLY'D LEVEL switch locked in, and the LEVEL/SLOPE control at 0/+.

- c. Apply 1 ms markers from the 2901 Time-Mark Generator via a 50 ohm coaxial cable and a 50 ohm termination to the 7A16 Input connector.
- d. CHECK—CRT display for one 1 ms marker each major division between the first and ninth divisions; see Fig. 5.2

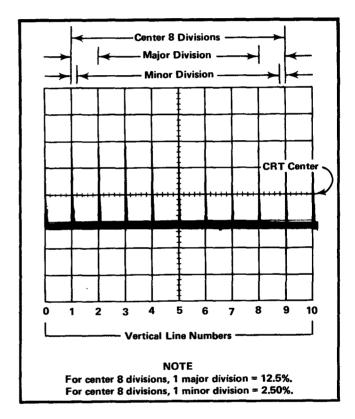


Fig. 5-2. Typical CRT display showing correct sweep calibration. Also, various terms used in this procedure with regard to the graticule.

NOTE

Unless otherwise noted, use the center eight divisions when checking or adjusting timing.

e. (Performance Check and Calibration procedure) ADJUST—SWP CAL control, R60 (located on the 7B52 front-panel), for one 1 ms marker each major division. Use the POSITION control as necessary to align the display with the vertical lines.

f. CHECK—Timing accuracy is within 5% (2 minor divisions) over any two major divisions within the center eight divisions.

9. Check/Adjust Mag Swp Gain (R1055)

- a. Set the 2901 for .1 ms markers.
- b. Release the 7852 X10 MAG switch.
- c. CHECK-CRT display for one .1 ms marker for each major division between the first and ninth divisions.
- d. ADJUST-Mag Gain control, R1055, for one .1 ms marker for each division. Use the POSITION control as necessary to align the display.
- e. CHECK—Timing accuracy is within 5% (2 minor divisions) over any two major divisions within the center eight divisions.
 - f. INTERACTION-Step 10 must be checked.

10. Check Mag Registration

- a. Set the 7B52 TIME/DIV or DL'Y TIME switch to .1 ms and the 2901 for .5 ms markers.
- b. Observing the CRT display, rotate the POSITION control to align the display as shown in Fig. 5-3a. (Center the second .5 ms marker on the fifth vertical line.)

NOTE

Do not move the POSITION control until the completion of part d.

- c. Without disturbing the setting of the POSITION control, lock the X10 MAG switch in.
- d. CHECK—Position of second .5 ms marker must be within 0.5 major division of the fifth vertical line; see Fig. 5-3b.

11. Check/Adjust Main and Dly'd Sweep Length (R835 and R930)

a. Set the 7B52 TIME/DIV or DL'Y TIME switch to 1 ms.

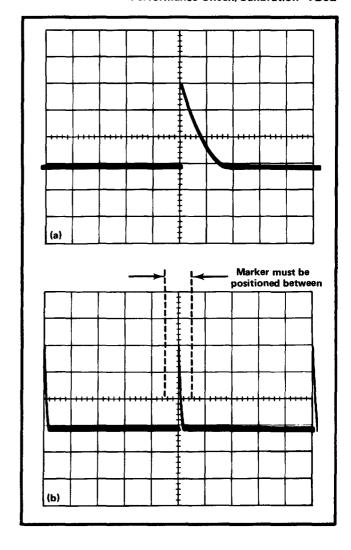


Fig. 5-3. Typical CRT display showing Mag Registration. (a) X10 MAG (b) Normal

- b. Set the 2901 for .1 and 1 ms markers.
- c. Rotate the LEVEL/SLOPE control for a triggered display. Then, rotate the POSITION control to position the eleventh 1 ms marker on the fifth vertical line.
- d. CHECK—CRT display sweep length for 10.4 divisions within 0.3 division; see Fig. 5-4. (There should be between one and seven .1 ms markers past the eleventh 1 ms marker.)
- e. ADJUST-Main Swp Length control, R835, for four .1 ms markers past the eleventh 1 ms marker.

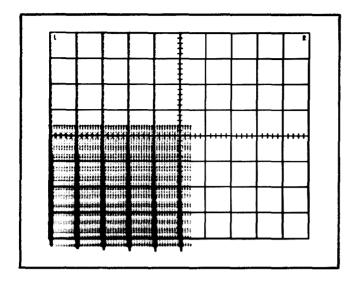


Fig. 5-4. Typical CRT display when checking sweep length.

- f. Rotate the TIME/DIV switch through all positions.
- g. CHECK—CRT display for a sweep length of 10 to 13 divisions at each setting of the TIME/DIV switch. Return the TIME/DIV switch to 1 ms.
- h. Set the 7B52 DLY'D SWEEP switch to .1 ms and press the DLY'D SWP switch.
 - i. Set the 2901 for .1 ms and 10 us markers.
- j. Rotate the LEVEL/SLOPE control for a triggered display. Then, rotate the POSITION control to position the eleventh .1 ms marker on the fifth vertical line.
- k. CHECK-CRT display sweep length for 10.4 divisions within 0.3 division. (There should be between one and seven 10 μ s markers past the eleventh .1 ms marker.)
- I. ADJUST-Dly'd Swp Length control, R930, for four 10 µs markers past the eleventh .1 ms marker.
- m. Rotate the DLY'D SWEEP switch through all positions.
- n. CHECK—CRT display for a sweep length of 10 to 13 divisions at each setting of the DLY'D SWEEP switch.

12. Check Position Range

a. Return the DLY'D SWEEP switch to 1 ms, press the MAIN SWP switch, set the 2901 for 1 ms markers and rotate the LEVEL/SLOPE control for a triggered display.

- b. Rotate the POSITION control fully clockwise.
- c. CHECK-CRT display must start to right of the fifth vertical line.
 - d. Rotate the POSITION control fully counterclockwise.
- e. CHECK-CRT display must end to the left of the fifth vertical line.

13. Check Variable Sweep Range

- a. Set the 2901 for 10 ms markers.
- b. Set the 7B52 TIME/DIV switch to 2 ms. Then, rotate the LEVEL/SLOPE control for a triggered display and the POSITION control to center the display on the CRT.
- c. Release the MAIN VARIABLE control and rotate it fully counterclockwise.
- d. CHECK-CRT display for no more than 2 major divisions between the 10 ms markers. (This indicates adequate range of continuously variable sweep between calibrated steps.)

14. Check/Adjust Sweep HF Timing (C778 and C956)

- a. Set the 2901 for 1 µs markers.
- b. Set the 7B52 TIME/DIV or DLYY TIME and DLY'D SWEEP switches to 1 μ s. Lock the MAIN VARIABLE switch in and rotate the LEVEL/SLOPE control for a triggered display.
- c. Observing the CRT display, rotate the POSITION control to align the second 1 μ s marker with the first vertical line and the tenth 1 μ s marker with the ninth vertical line.
- d. CHECK—CRT display for one 1 µs marker each major division within 2% (0.8 minor division).
- e. ADJUST-Main Swp HF Timing control, C778, for one 1 µs marker each vertical line. Use the POSITION control as necessary to align the display.
- f. CHECK—Timing accuracy is within 5% (2 minor divisions) over any two major division interval within the center eight divisions.

- g. Press the DLY'D SWP switch and reposition the display as in part c.
- h. CHECK—CRT display for one 1 μ s marker each major division within 3% (1.2 minor divisions).
- i. ADJUST-Dly'd Swp HF Timing control, C956, for one 1 µs marker each major division. Use the POSITION control as necessary to align the display.
- j. CHECK—Timing accuracy is within 6% (2.4 minor divisions) over any two major division interval within the center eight divisions.
 - k. Set the 2901 for .1 µs markers.
 - I. Release the 7B52 X10 MAG switch.
- m. CHECK-CRT display for one .1 μ s marker each major division within 3.5% (1.4 minor divisions).

- n. CHECK—Timing accuracy is within 6% (2.4 minor divisions) over any two major division interval within the center eight divisions.
 - o. Press the MAIN SWP switch.
- p. CHECK-CRT display for one .1 µs marker each major division within 2.5% (1 minor division).
- q. CHECK—Timing accuracy is within 5% (2 minor divisions) over any two major division interval within the center eight divisions.

15. Check Mag Swp Timing Accuracy

a. Using Table 5-3 as a guide, check that magnified timing accuracy over the center eight division is within the listed tolerance.

TABLE 5-3

| 7B52 | 2 | 2901 | CRT Display | Tolerance (n | Tolerance (minor divisions) | |
|--------------------------|----------------|--------------|---------------------------|--------------|-----------------------------|--|
| TIME/DIV or DL'Y TIME | DLY'D SWEEP | Markers | Markers (or cycle)/Div | MAIN SWP | DLY'D SWP | |
| 5 s | | .5 s | 1 | ±1.6 | | |
| 2 s | | .1 s | 2 | ±1.6 | | |
| 1 s | | .1 s | 1 | ±1.6 | | |
| .5 s | .5 s | 50 ms | 1 | ±1.0 | ±1.8 | |
| .2 s | .2 s | 10 ms | 2 | ±1.0 | ±1.8 | |
| .1 s | .1 s | 10 ms | 1 | ±1.0 | ±1.8 | |
| 50 ms | 50 ms | 5 ms | 1 | ±1.0 | ±1.4 | |
| 20 ms | 20 ms | 1 ms | 2 | ±1.0 | ±1.4 | |
| 10 ms | 10 ms | 1 ms | 1 | ±1.0 | ±1.4 | |
| 5 ms | 5 ms | .5 ms | 1 | ±1.0 | ±1.4 | |
| 2 ms | 2 ms | .1 ms | 2 | ±1.0 | ±1.4 | |
| I ms | 1 ms | .1 ms | 1 | ±1.0 | ±1.4 | |
| .5 ms | .5 ms | 50 μs | 1 | ±1.0 | ±1.4 | |
| .2 ms | .2 ms | 10 μs | 2 | ±1.0 | ±1.4 | |
| .1 ms | .1 ms | 10 μs | 1 | ±1.0 | ±1.4 | |
| 50 μs | 50 μs | 5 μs | 1 | ±1.0 | ±1.4 | |
| 20 μs | 20 μs | 1 μs | 2 | ±1.0 | ±1.4 | |
| 10 μs | 10 μs | 1 μs | 1 | ±1.0 | ±1.4 | |
| 5 μs | 5 μs | .5 μs | 1 | ±1.0 | ±1.4 | |
| 2 μs | 2 μs | .1 μs | 2 | ±1.0 | ±1.4 | |
| 1 μs | 1 μs | .1 µs | 1 | ±1.0 | ±1.4 | |
| .5 μs | . 5 μs | 50 ns | 1 (cycle) | ±1.0 | ±1.4 | |
| .2 μs | .2 µs | 20 ns | 1 (cycle) | ±1.6 | ±1.8 | |
| .1 μs | .1 μs | 10 ns | 1 (cycle) | ±1.6 | ±1.8 | |
| .05 μs | .05 μs | 10 ns | 1/2 (cycle) | ±1.6 | ±1.8 | |

Use the single sweep mode for 5, 2 and 1 second rates.

16. Check Sweep Timing Accuracy

- a. Lock in the 7B52 X10 MAG switch.
- b. Using Table 5-4 as a guide check that the sweep timing accuracy over the center eight divisions of the display are within the listed tolerance.
- c. Disconnect the 50 Ω termination and coaxial cable from the 7A16 Input.

17. Check/Adjust Sweep Offset (R730 and R935)

a. Set the 7A16 and 7B52 controls and switches as given preceding Step I with the following exceptions:

7A16 Volts/Div switch to 5 mV.

7B52 TIME/DIV or DL'Y TIME, and DLY'D SWEEP switches to 1 ms; press the MAIN TRIGGERING AC switch and lock in the DLY'D LEVEL controls.

- b. Observing the CRT display, rotate the 7A16 Position control to position the display to CRT center (0 volts ground) and the 7B52 POSITION control to start the display on the fifth vertical line.
 - c. Press the DLY'D SWP switch.
- d. CHECK—CRT trace must start at the fifth vertical line within one division. (Typically less except for highest sweep rates.)

NOTE

For Performance Check, proceed to step 18.

TABLE 5-4

| 7 B52 | | 2901 CRT Display | CRT Display | Tolerance (minor divisions) | | |
|--------------------------|----------------|------------------|-------------|-----------------------------|--------------|--|
| TIME/DIV or DL'Y TIME | DLY'D SWEEP | Markers | Markers/Div | MAIN SWP | DLY'D SWP | |
| .05 μs | .05 μs | .1 μs | 1/2 | ±1.2 | ±1.6 | |
| .1 μs | .1 μs | .1 μs | 1 | ±1.2 | ±1.6 | |
| .2 μs | .2 μs | .1 μs | 2 | ±1.2 | ±1.6 | |
| .5 μs | .5 μs | .5 μs | 1 | ±0.8 | ±1.2 | |
| 1 μs | 1 µs | 1 μs | 1 | ±0.8 | ±1.2 | |
| 2 μs | 2 μs | 1 μs | 2 | ±0.8 | ±1.2 | |
| 5 μs | 5 μs | 5 μs | 1 | ±0.8 | ±1.2 | |
| 10 μs | 10 μs | 10 μs | 1 | ±0.8 | ±1.2 | |
| 20 μs | 20 μs | 10 μs | 2 | ±0.8 | ±1.2 | |
| 50 μs | 50 μs | 50 μs | 1 | ±0.8 | ±1.2 | |
| .1 ms | .1 ms | .1 ms | 1 | ±0.8 | ±1.2 | |
| .2 ms | .2 ms | .1 ms | 2 | ±0.8 | ±1.2 | |
| .5 ms | .5 ms | .5 ms | 1 | ±0.8 | ±1.2 | |
| 1 ms | 1 ms | 1 ms | 1 | ±0.8 | ±1.2 | |
| 2 ms | 2 ms | 1 ms | 2 | ±0.8 | ±1.2 | |
| 5 ms | 5 ms | 5 ms | 1 | ±0.8 | ±1.2 | |
| 10 ms | 10 ms | 10 ms | 1 | ±0.8 | ±1.2 | |
| 20 ms | 20 ms | 10 ms | 2 | ±0.8 | ±1.2 | |
| 50 ms | 50 ms | 50 ms | 1 | ±0.8 | ±1.2 | |
| .1 s | .1 s | .1 s | 1 | ±0.8 | ±1.6 | |
| .2 s | .2 s | .1 s | 2 | ±0.8 | ±1.6 | |
| .5 s | .5 s | .5 s | 1 | ±0.8 | ±1.6 | |
| 1 s | | 1 s | 1 | ±1.2 | | |
| 2 s | | 1 s | 2 | ±1.2 | | |
| 5 s | | 5 s | 1 | ±1.2 | | |

Use the single sweep mode for 1, 2 and 5 second rates.

- e. Connect a 10X probe from the 7A16 Input to TP779.
- f. Press the MAIN SWP switch and the 7A16 DC coupling switch.
- g. ADJUST—Main Offset Zero control, R730, to start the display at CRT center (0 volts ground, reference established in part b).
- h. Disconnect the 10X probe from TP779 and reconnect it to TP995.
 - i. Press the DLY'D SWP switch.
- j. ADJUST-Dly'd Offset Zero control, R935, to start the display at CRT center (0 volts ground, reference established in part b).
- k. Disconnect the 10X probe from TP995 and the 7A16 Input; press the MAIN SWP switch; press the 7A16 GND coupling switch.
 - I. Repeat parts b, c, and d.

18. Check/Adjust Dly'd Start and Dly'd Stop (R755 and R750)

- a. Connect the 2901, set for 1 ms markers, to the 7A16 Input (DC coupled at .5 V/Div) via a 50 ohm coaxial cable and a 50 ohm termination.
- b. Press the 7B52 INTEN switch and rotate the LEVEL/ SLOPE control for a triggered display.
- c. Observing the CRT display, rotate the DELAY TIME MULT control to 1-00.
- d. CHECK—CRT intensified sweep should start on the second 1 ms marker.
- e. ADJUST-Dly'd Start control, R755, to start the intensified sweep on the second 1 ms marker.
- f. Observing the CRT display, rotate the DELAY TIME MULT control to 9-00.
- g. CHECK—CRT intensified sweep should start on the tenth 1 ms marker.

- h. ADJUST-Dly'd Stop control, R750, to start the intensified sweep on the tenth 1 ms marker.
 - i. Set the 2901 for .1 and 1 ms markers.
- j. Set the 7B52 DLY'D SWEEP switch to 10 μ s, the DELAY TIME MULT control to 1-00 and press the DLY'D SWP switch.
- k. CHECK—CRT display should be as shown in Fig. 5-5a within 1%. Use the POSITION control to position the display to the fifth vertical line.

NOTE

Fig. 5-5b and c show maximum error.

- I. ADJUST-Dly'd Start control, R755, for a display as shown in Fig. 5-5a.
- m. Press the INTENS switch and rotate the DELAY TIME MULT control to set the intensified trace on the tenth 1 ms marker.
 - n. Press the DLY'D SWP switch.
- o. CHECK—CRT display should be as shown in Fig. 5-5a within 1%, except the DELAY TIME MULT control will be at 9-00.
- p. ADJUST-Dly'd Stop control, R750, for a display as shown in Fig. 5-5a.

19. Check Delay Time Multiplier Accuracy

- a. Set the 7B52 DELAY TIME MULT control near 8-00 so the ninth marker begins at the start of the delayed sweep. (Use INTEN mode to locate marker.)
- b. CHECK—The DELAY TIME MULT control deviation from 8-00 is within 0.2% (2 minor division of the inner DELAY TIME MULT dial).
- c. Repeat this check at each major dial division of the DELAY TIME MULT control between 1-00 and 9-00.

20. Check Delay Time Accuracy

a. Set the 7B52 DELAY TIME MULT control near 1-00.

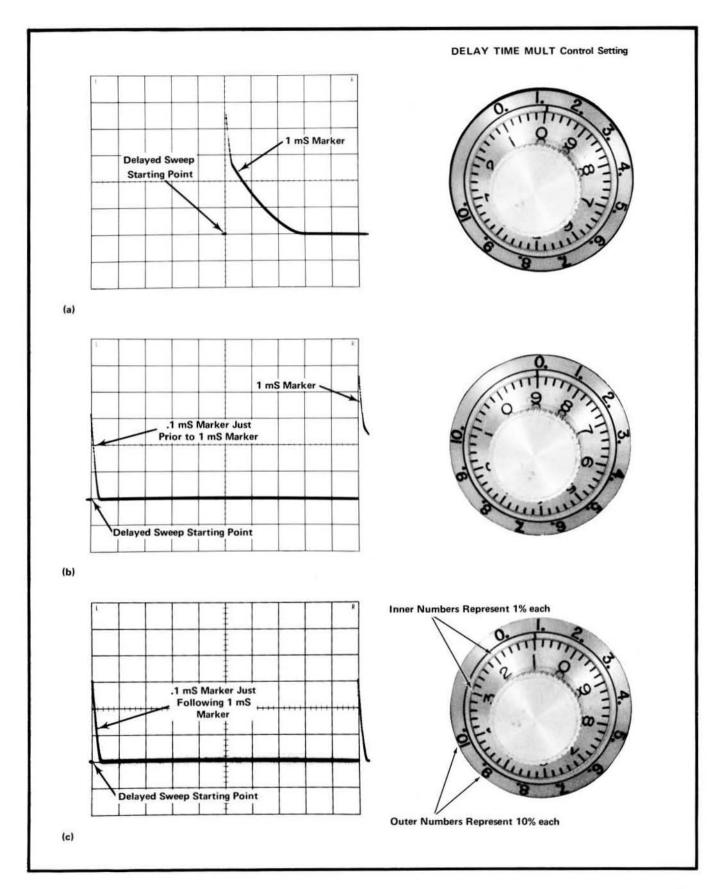


Fig. 5-5. Typical CRT display obtained in DLY'D SWP (a) delayed sweep adjusted (b) delayed sweep 1% slow and (c) delayed sweep 1% fast.

TABLE 5-5

| 7B52 TIME/DIV or DLY'D DL'Y TIME SWEEP | | 2901 Markers | Allowable Error | | |
|--|--------------|-----------------|--------------------|--|--|
| 1 μs | .1 μs | 1 μs | 0.8 div | | |
| 2 μs | .1 µs | 1 μs | 0.8 div | | |
| 5 μs | .5 μs | 5 μs | 0.8 div | | |
| 10 μs | 1 μs | 10 μs | 0.8 div | | |
| 20 μs | 1 μs | 10 μs | 0.8 div | | |
| 50 μs | 5 µs | 50 μs | 0.8 div | | |
| .1 ms | 10 μs | .1 ms | 0.8 div | | |
| .2 ms | 10 μs | .1 ms | 0.8 div | | |
| .5 ms | 50 μs | .5 ms | 0.8 div | | |
| 10 ms | 1 ms | 10 ms | 0.8 div | | |
| 20 ms | 1 ms | 10 ms | 0.8 div | | |
| 50 ms | 5 ms | 50 ms | 0.8 div | | |
| .1 s | 10 ms | .1 s | 0.8 div | | |
| .2 s | 10 ms | .1 s | 0.8 div | | |
| .5 s | 50 ms | .5 s | 0.8 div | | |
| 1 s | .1 s | 1 s | 1.6 div | | |
| 2 s | .1 s | 1 s | 1.6 div | | |
| 5 s | .5 s | 5 s | 1.6 div | | |

b. CHECK—Using the settings given in Table 5-5, check that the delay time accuracy is within the given tolerance. First set the DELAY TIME MULT control near 1-00. Adjust the DELAY TIME MULT control until the second marker starts at the beginning of the delayed (B) sweep; note the deviation from 1-00. Next, set the DELAY TIME MULT control near 9-00 and adjust until the tenth marker starts at the beginning of the delayed sweep; note the deviation from 9-00. Subtract the first reading from the second reading. The difference must be no greater than eight divisions plus the allowable error given in Table 5-5.

21. Check Delay Time Jitter

- a. Set the 7B52 TIME/DIV or DL'Y TIME switch to 1 ms, DLY'D SWEEP switch to .5 µs and rotate the DELAY TIME MULT control to about 10-00.
 - b. Set the 2901 for 1 ms markers.
- c. Position the eleventh 1 ms marker near the center of the CRT graticule with the DELAY TIME MULT control.
- d. CHECK—Jitter on leading edge of the pulse does not exceed 1 major division (1 part in 20,000 of 10 times the TIME/DIV switch setting). Disregard any slow drift across the CRT.

22. Check Mixed Sweep

- a. Press the 7B52 MAIN SWP switch, set the DELAY TIME MULT control to 10-00, DLY'D SWEEP to .5 ms and rotate the POSITION control to align the markers with the CRT vertical lines.
- b. Note timing accuracy over the center eight divisions of the CRT.
 - c. Press the 7B52 DISPLAY MODE MIXED switch.
- d. CHECK—Mixed sweep timing accuracy must be within 2% (0.8 division) plus the error noted in part b within the center eight divisions of the CRT.
- e. Rotate the DELAY TIME MULT control to 5-00 and the POSITION control to align the second marker with the first vertical line.
- f. CHECK—Deviation of seventh marker from the eighth vertical line must be within 2% plus the error noted in part b.
 - g. Disconnect all test equipment.

23. Check External Amplifier Gain

a. Set the 7A16 and 7B52 controls and switches as given preceding Step 1 with the following exceptions:

7A16 AC-GND-DC switch to DC and the Volts/Div switch to .2 V.

7B52 TIME/DIV or DLY TIME, and DLY'D SWEEP switches to 10 µs, MAIN TRIGGERING SOURCE to EXT, and the DLY'D LEVEL control locked in.

- b. Connect a low frequency sine-wave generator to the 7A16 Input connector; set the frequency to 100 kHz and adjust the amplitude for a 4 div display (800 mV) on the CRT.
- c. Disconnect the sine-wave generator from the 7A16 Input and reconnect it to the AMPL IN connector (MAIN TRIG IN); set the TIME/DIV or DLY TIME, and DLY'D SWEEP switches to AMPL.
- d. CHECK—CRT horizontal trace length; must be 8 div within 10% (.8 major division). Rotate the POSITION control to use the center eight divisions.

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- e. Press the MAIN TRIGGERING EXT ÷10 switch.
- f. CHECK-CRT horizontal trace length; must be .8 major division within 10% (0.4 minor division).
 - g. Release the X10 MAG switch.
- h. CHECK-CRT horizontal trace length; must be 8 div within 10% (.8 major division). Rotate the POSITION control to use the center eight divisions.

24. Check External Bandwidth

- a. Press the 7B52 MAIN TRIGGERING EXT and AC switches; lock the X10 MAG switch in.
- b. Set the sine-wave generator to 10 kHz and adjust the amplitude for a horizontal trace length of 8 div.
- c. Increase the frequency of the sine-wave generator until the horizontal length decreases to 5.6 div.
- d. CHECK—Sine-wave generator frequency must be 2 MHz or greater (upper -3 dB point).
- e. Decrease the frequency of the sine-wave generator until the horizontal trace length is again 8 div. Then, decrease the frequency until the length is 5.6 div.
- f. CHECK—Sine-wave generator frequency must be 40 Hz or less (lower -3 dB point).
- g. Using the procedure in parts b through f, check the upper and lower bandwidths listed in Table 5-6.

TABLE 5-6

| 7B52 COUPLING | BANDWID | BANDWIDTH LIMITS | | | |
|----------------------|-------------------|----------------------|--|--|--|
| Switch Setting | Lower -3 dB Point | Upper -3 dB Point | | | |
| AC LF REJ | 16 kHz | 2 MHz | | | |
| AC HF REJ | 40 Hz | 100 kHz | | | |
| DC | DC | 2 MHz | | | |

25. Check Line Triggering

a. Set the 7A16 and 7B52 controls and switches as given preceding Step 1 with the following exceptions:

7A16 AC-GND-DC switch to AC and Volts/Div switch to .1 V.

7B52 TIME/DIV or DL'Y TIME, and DLY'D SWEEP switches to 5 ms; press the MAIN TRIGGERING LINE switch, and lock in the DLY'D LEVEL control.

- b. Connect a 10X probe from the 7A16 Input connector to interface connector A3 (plug-in compartment at the rear of the 7B52).
- c. CHECK-For stable triggering of the proper polarity at 0/+ and 0/- of the LEVEL/SLOPE control.
- d. Disconnect all test equipment. Remove the plug-in extender (Calibration Procedure Only) and install the 7B52 directly into the right compartment of the 7503.

NOTE

If a Tektronix 7704 or 7504 indicator oscilloscope is available, proceed to step 26.

26. (Optional) Check Mainframe Delaying Mode Selector Switch (S59)

- a. Install a 7B50 Time-Base Unit into the B Horiz compartment of the 7705 or 7704 indicator oscilloscope and set the 7B50 front-panel controls and switches as follows: Press the Triggering Auto, AC, and Int switches, Display Mode Time Base switch and the Sweep Magnifier X1 switch; set the Level/Slope control to 0/+ and the Time/Div switch to 20 μs .
- b. Install a Vertical Plug-In Unit into the Left or Right Vert compartment of the indicator oscillloscope. Set the Volts/Div switch to .5 V and press the DC coupling switch.
- c. Set the indicator oscilloscope for proper Left or Right Vertical Mode Triggering, Horizontal Mode switch to Alt, and press the A and B Trigger Source Left or Right Vert switches (depending into which vertical compartment the Vertical Unit is installed).
- d. Press the 7B52 MAIN TRIGGERING AUTO, AC, and INT switches and the DISPLAY MODE MAIN SWP switch; set the LEVEL/SLOPE control to 0/+, the TIME/DIV or DL'Y TIME and DLY'D SWEEP switches to 2switch to INDEPENDENT (rear position; see Fig. 2-1) and the INTERNAL DELAYED TRIGGER SOURCE selector switch to MAIN. Then, install the 7B52 into the A Horiz compartment of the indicator oscilloscope.

- e. Adjust the indicator oscilloscope viewing controls for well defined CRT displays. (There will be two traces.)
- f. From the Type 191 output connector, connect a 50 kHz signal via a 50 ohm coaxial cable and 50 ohm termination to the Vertical Input connector. Adjust the output amplitude of the generator for a CRT display amplitude of 3 divisions each sweep. (Use the indicator oscilloscope Trace Separation control to separate the sweeps if necessary.)
- g. Observing the CRT display, operate the 7B52 and 7B50 front-panel controls.
- h. CHECK-Each time base should operate independently.
- i. Remove the 7B52 from the indicator and set the internal MAINFRAME DELAYING MODE selector switch to RUNS AFTER DT (center position; see Fig. 2-1). Re-install the 7B52 into the indicator oscilloscope.
- j. Press the 7B52 DISPLAY MODE INTEN switch and set the TIME/DIV or DL'Y TIME and DLY'D SWEEP switches to 2 μ s.
- k. Observing the CRT displays, perform the following: rotate the 7B52 and 7B50 LEVEL/SLOPE controls; rotate the TIME/DIV switches (always keep the 7B50 Time/Div switch setting at least one switch setting faster than the TIME/DIV setting of the 7B52); rotate the DELAY TIME MULT control (DTM).
- I. CHECK—Rotation of 7B52 LEVEL/SLOPE control will determine sweep triggering of both displays; setting of 7B52 TIME/DIV switch determines the rate of the normal sweep only, and setting of 7B50 Time/Div switch determines the length of intensified portion of normal sweep and the rate of the Delayed Sweep; rotation of 7B52 DTM control will permit any portion of the normal sweep to be intensified and delayed.
- m. Remove the 7B52 from the indicator oscilloscope and set the internal MAINFRAME DELAYING MODE selector switch to TRIGGERABLE AFTER DT (front position; see Fig. 2-1). Re-install the 7B52 in the indicator oscilloscope.
 - n. Repeat part k.
- o. CHECK-Rotation of 7B52 LEVEL/SLOPE control will determine sweep triggering of normal sweep only and rotation of 7B50 Level/Slope control will determine the

triggering point of the intensified portion of the normal sweep and the Delayed Sweep. Rotation of TIME/DIV switches affects CRT displays as in part I; one complete revolution of the DTM will permit only that portion of the intensified display of the normal sweep to be displayed which is controlled by the setting of the 7B50 Level/Slope control.

p. Remove the 7B52 from the indicator oscilloscope and set the internal MAINFRAME DELAYING MODE selector switch to INDEPENDENT.

27. (Optional) Check Internal Delayed Trigger Source Selector Switch (S21)

- a. Remove the 7B50 from the indicator oscilloscope B Horiz Compartment. Press the Horizontal Mode A switch and the A and B Trigger Source Left or Right Vert switches. (A and B Trigger Source switch setting is determined by the compartment used for the Vertical Unit.)
- b. Install the 067-0589-00 Plug-In Extender into the indicator oscilloscope A Horiz compartment, and the 7B52 on the extender.
- c. Press the 7B52 MAIN TRIGGERING AUTO, AC, and INT switches and DISPLAY MODE INTEN switch. Release the DLY'D LEVEL control, set the TIME/DIV or DL'Y TIME switch to 20 μ s, set the DLY'D SWEEP switch to 5 μ s, and rotate the DELAY TIME MULT control to 5-00.
- d. Observing the CRT display, rotate the LEVEL/SLOPE control to trigger the normal, and the DLY'D LEVEL control to trigger the intensified portion of the normal sweep.
- e. CHECK—Triggering of intensified portion of the normal sweep is controlled by DLY'D LEVEL control, indicating that delayed trigger source is the indicator oscilloscope A Horiz Trig Selector.
- f. Switch the INTERNAL DELAYED TRIGGER SOURCE selector switch to AUX (see Fig. 2-1).
 - g. Repeat part d.
- h. Press the indicator oscilloscope B Trigger Source switch for the compartment opposite the one used for the Vertical Unit.
- Observing the CRT display, rotate the DLY'D LEVEL control.

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- j. CHECK—CRT for no intensified display, indicating that the delayed trigger source is the indicator oscilloscope B Horiz Trig Selector.
- k. Remove the extender and 7B52 from the A Horiz compartment of the indicator oscilloscope and re-install them in the B Horiz compartment.
- I. Press the indicator oscilloscope Horizontal Mode B switch and the A and B Trigger Source Left or Right Vert switches. (A and B Trigger source switch setting is determined by compartment used for the Vertical Unit.)
 - m. Repeat part d.
- n. Press the indicator oscilloscope A Trigger Source switch for the compartment opposite the one used for the Vertical Unit.

- o. Observing the CRT display, rotate the DLY'D LEVEL control.
- p. CHECK—CRT for no intensified display, indicating that the delayed trigger source is the indicator oscilloscope A Horiz Trig Selector.
- q. Switch the INTERNAL DELAYED TRIGGER SOURCE selector switch to MAIN (see Fig. 2-1).
- r. Observing the CRT display, rotate the DLY'D LEVEL control.
- s. CHECK—Triggering of intensified portion of the normal sweep is controlled by the DLY'D LEVEL control, indicating that delayed trigger source is the indicator oscilloscope B Horizontal Trig Selector.

5-22

PARTS LIST ABBREVIATIONS

BHB binding head brass int internal

BHS binding head steel lg length or long

cap. capacitor met. metal

mtg hdw mounting hardware ceramic cer OD outside diameter composition comp OHB oval head brass connector conn OHS oval head steel **CRT** cathode-ray tube

CKI carnode-ray rube
P/O part of

csk countersunk

PHB pan head brass

DE double end

PHS pan head steel

dia diameter plstc plastic

div division PMC paper, metal cased

elect. electrolytic poly polystyrene
EMC electrolytic, metal cased prec precision

EMT electrolytic, metal tubular PT paper, tubular

ext external PTM paper or plastic, tubular, molded

F & I focus and intensity RHB round head brass
FHB flat head brass RHS round head steel

FHS flat head steel SE single end
Fil HB fillister head brass SN or S/N serial number

Fil HS fillister head steel S or SW switch

h height or high TC temperature compensated

hex. hexagonal THB truss head brass

HHB hex head brass thk thick

HHS hex head steel THS truss head steel

HSB hex socket brass tub. tubular
HSS hex socket steel var variable

ID inside diameter w wide or width inc incandescent WW wire-wound

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial or model number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

SPECIAL NOTES AND SYMBOLS

| ×000 | Part first added at this serial number |
|-----------------|---|
| $00 \times$ | Part removed after this serial number |
| *000-0000-00 | Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, Inc., or reworked or checked components. |
| Use 000-0000-00 | Part number indicated is direct replacement. |

INDEX OF ELECTRICAL PARTS LIST

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SECTION 6 ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | | Description | | |
|---|---|------------------------------|--|--------------------------------|----------------|--------------------|
| | | СНА | ASSIS | | | |
| | | Ви | lbs | | | |
| DS2 DS8 | *150-0048-01 *150-0048-01 | | Incandescent # Incandescent # | 683, selected 683, selected | | |
| | | | | | | |
| | | Сара | icitors | | | |
| Tolerance ±20 | 0% unless otherwise | indicated. | | | | |
| C4 C51 | 283-0636-00 283-0636-00 | | 36 pF 36 pF | Mica Mica | 500 V 500 V | ±0.5 pl ±0.5 pl |
| | | Conn | ectors | | | |
| J16 J18 | 131-0955-00 131-0955-00 | | Receptacle, electrical, BNC, female Receptacle, electrical, BNC, female | | | |
| | | | | | | |
| | | Resi | stors | | | |
| Resistors are fi | xed, composition, ± | 10% unless otherwise indic | ated. | | | |
| R2 ¹ R4 R5 R8 R15 ² | 311-1063-00 317-0510-00 322-0610-00 311-1059-00 311-1068-00 | | 5 kΩ, Var 51 Ω 500 kΩ 10 kΩ, Var 5 kΩ, Var | 1/8 W 1/4 W | Prec | 5% 1% |

50 $k\Omega,\ Var$

51 Ω

500 $k\Omega$

1/8 W 1/4 W

Prec

¹Furnished as a unit with \$2.

311-0946-00

317-0510-00

322-0610-00

5% 1%

R19

R51

R52

²Ganged with \$15.

CHASSIS (cont)

| | Tektronix | Serial/A | Aodel No. | | |
|-------------------------------------|----------------------------|----------|-----------|-------------|--|
| Ckt. No. | Part No. | Eff | Disc | Description | |
| | | | Switches | | |
| | Wired or Unwired | | | | |
| S2 ³ S15 ⁴ | 311-1063-00 260-0516-00 | • | Push | | |

INTERFACE Circuit Board Assembly

*670-1215-00

Complete Board

| | Capacitors | | | | | | | |
|--|---|---|---------------------------------|---|----------------------------------|--|--|--|
| Tolerance ± | :20% unless otherwise indicated. | | | | | | | |
| C6 C28 C38 C119 C120 | 283-0080-00 283-0185-00 283-0185-00 283-0003-00 283-0000-00 | $0.022~\mu F$ $2.5~p F$ $2.5~p F$ $0.01~\mu F$ $0.001~\mu F$ | Cer Cer Cer Cer | 25 V 50 V 50 V 150 V 500 V | +80%—20% 5% 5% | | | |
| C121 C123 C124 C126 C128 | 283-0178-00 283-0000-00 283-0178-00 283-0178-00 283-0000-00 | 0.1 μ F 0.001 μ F 0.1 μ F 0.1 μ F 0.001 μ F | Cer Cer Cer Cer Cer | 100 V 500 V 100 V 100 V 500 V | +80%-20% +80%-20% +80%-20% | | | |
| C129 C131 C132 | 283-0178-00 283-0000-00 283-0178-00 | 0.1 μ F 0.001 μ F 0.1 μ F | Cer Cer Cer | 100 V 500 V 100 V | +80%-20% +80%-20% | | | |
| C281 C282 C283 C284 C285 C291 | *295-0136-00 | 0.001 μF 0.01 μF 0.1 μF 1 μF 10 μF 0.001 μF | Mai | ched set | | | | |
| C299 | 283-0164-00 | 2.2 μF | Cer | 25 V | | | | |

³Furnished as a unit with R2.

⁴Ganged with R15.

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | Description | | | | | | |
|---|--|--|---|--|--|--|--|--|--|
| Semiconductor Device, Diodes | | | | | | | | | |
| CR22 CR41 CR48 CR59 CR67 | 152-0141-02 *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 | Silicon Silicon Silicon Silicon | 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 | | | | | | |
| CR100 CR101 CR102 CR104 CR105 | *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 | Silicon Silicon Silicon Silicon | Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 | | | | | | |
| CR107 CR108 CR110 CR111 CR113 | *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 | Silicon Silicon Silicon Silicon | Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 | | | | | | |
| CR114 CR116 CR117 CR231 CR232 | *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 | Silicon Silicon Silicon Silicon | Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 | | | | | | |
| CR233 CR234 CR237 CR241 CR242 | *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 | Silicon Silicon Silicon Silicon | Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 | | | | | | |
| CR243 CR244 CR246 CR251 CR256 | *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 | Silicon Silicon Silicon Silicon | Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 | | | | | | |
| CR258 | *152-0185-00 | Silicon | Replaceable by 1N4152 | | | | | | |
| | | | | | | | | | |
| | | Inductors | | | | | | | |
| L16 L29 L39 L120 L123 | 276-0507-00 276-0507-00 276-0507-00 *120-0382-00 *120-0382-00 | Core, f Core, f Toroid, | erramic suppressor erramic suppressor erramic suppressor 14 turns, single 14 turns, single | | | | | | |
| L128 L131 | *120-0382-00 *120-0382-00 | | 14 turns, single 14 turns, single | | | | | | |

Electrical Parts List—7B52

| Ckt. No. | Tektronix Part No. | Serial/Model 1 Eff | No. Disc | Desc | ription | |
|---|---|-----------------------|--|---|--|----------------------------|
| | | | Transistors | | | |
| Q24 ⁵ Q26 Q34 ⁶ Q36 Q42 | *153-0584-00 *151-0230-00 *153-0584-00 *151-0230-00 151-0220-00 | | Silicon Silicon Silicon Silicon Silicon | NPN NPN NPN | TO-105 Selected from TO-105 Selected from TO-105 Selected from TO-105 Selected from TO-18 2N4122 | RCA 40235 RCA 40235 |
| Q44 Q48 Q54 Q56 | 151-0220-00 *151-0190-01 *151-0190-01 *151-0190-01 | | Silicon Silicon Silicon Silicon | NPN NPN | TO-18 2N4122 TO-106 Tek Spec TO-106 Tek Spec TO-106 Tek Spec | |
| | | | Resistors | | | |
| Resistors are f | ixed, composition, \pm | :10% unless otherwis | e indicated. | | | |
| R6 R7 R20 R21 R22 | 317-0101-00 315-0472-00 315-0511-00 315-0511-00 315-0102-00 | | 100 Ω 4.7 kΩ 510 Ω 510 Ω 1 kΩ | 1/8 W 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% 5% |
| R24 R27 R28 R29 R34 | 315-0751-00 315-0302-00 321-0164-00 315-0270-00 315-0751-00 | | 750Ω $3 k\Omega$ 499Ω 27Ω 750Ω | 1/4 W 1/4 W 1/8 W 1/4 W 1/4 W | Prec | 5% 5% 1% 5% 5% |
| R37 R38 R39 R41 R42 | 315-0302-00 321-0164-00 315-0207-00 315-0431-00 315-0362-00 | | 3 kΩ 499 Ω 27 Ω 430 Ω 3.6 kΩ | 7/4 W 1/8 W 1/4 W 1/4 W 1/4 W | Prec | 5% 1% 5% 5% 5% |
| R43 R44 R46 R48 R49 | 315-0751-00 315-0751-00 315-0102-00 317-0472-00 315-0470-00 | | 750 Ω 750 Ω 1 kΩ 4.7 kΩ 47 Ω | 1/4 W 1/4 W 1/4 W 1/8 W 1/4 W | | 5% 5% 5% 5% |
| R58 R59 R60 R114 R115 | 315-0101-00 315-0201-00 311-1060-00 315-0102-00 315-0332-00 | | 100 Ω 200 Ω 500 Ω, Var 1 kΩ 3.3 kΩ | 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% |

⁵Furnished as a matched pair with Q34.

⁶Furnished as a matched pair with Q24.

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | Descrip | tion |
|--------------------------------------|---|---|---|---------------------------------|
| | | Resistors (cont) | | |
| R116 R119 R120 R123 R126 | 315-0273-00 321-0356-00 315-0101-00 315-0101-00 315-0270-00 | 27 kΩ 49.9 k 100 Ω 100 Ω 27 Ω | Ω ½ W '/ ₄ W | Prec 5% 5% 5% 5% |
| R128 R131 R200 R201 R202 | 315-0101-00 315-0101-00 317-0154-00 317-0753-00 317-0513-00 | 100 Ω 100 Ω 150 kΩ 75 kΩ 51 kΩ | 7/ ₄ W 1/ ₈ W 1/ ₈ W | 5% 5% 5% 5% 5% |
| R203 R204 R205 R206 R207 | 317-0154-00 317-0753-00 321-0344-00 317-0154-00 317-0154-00 | 150 kΩ 75 kΩ 37.4 k 150 kΩ 150 kΩ | Ω ½ W Ω ½ W Ω ½ W | 5% 5% Prec 1% 5% 5% |
| R208 R218 R219 R220 R221 | 321-0371-00 321-0371-00 317-0154-00 317-0154-00 321-0344-00 | 71.5 k 71.5 k 150 k 150 k 37.4 k | Ω ½ W 2 ½ W 2 ½ W | Prec 1% Prec 1% 5% Prec 1% |
| R222 R223 R224 R225 R226 | 317-0154-00 317-0753-00 317-0513-00 317-0154-00 317-0753-00 | 150 kΩ 75 kΩ 51 kΩ 150 kΩ 75 kΩ | 1/ ₈ W 1/ ₈ W | 5% 5% 5% 5% 5% |
| R231 R232 R233 R234 R237 | 317-0332-00 317-0332-00 317-0154-00 317-0113-00 317-0104-00 | 3.3 kΩ 3.3 kΩ 150 kΩ 11 kΩ 100 kΩ | 1/8 W 1/8 W 1/8 W | 5% 5% 5% 5% 5% |
| R238 R241 R242 R246 R251 | 317-0203-00 317-0272-00 317-0272-00 317-0512-00 317-0133-00 | 20 kΩ 2.7 kΩ 2.7 kΩ 5.1 kΩ 13 kΩ | 1/ ₈ W | 5% 5% 5% 5% 5% |
| R253 R254 R256 R258 | 317-0154-00 317-0154-00 317-0154-00 317-0133-00 | 150 kΩ 150 kΩ 150 kΩ 13 kΩ | 2 ⅓ W | 5% 5% 5% 5% |
| | | | | |

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | | Descript | ion | |
|--------------------------------------|---|------------------------------|--|---|--------------------------------------|---|
| R261 R262 R263 R264 R265 | 317-0753-00 317-0753-00 317-0154-00 317-0154-00 317-0154-00 | | 75 kΩ 75 kΩ 150 kΩ 150 kΩ 150 kΩ | 1/8 W 1/8 W 1/8 W 1/8 W 1/8 W | | 5% 5% 5% 5% 5% |
| R266 R267 R268 R269 R271 | 317-0513-00 317-0513-00 321-0344-00 321-0344-00 325-0082-00 | | 51 kΩ 51 kΩ 37.4 kΩ 37.4 kΩ 33.51 MΩ | 1/8 W 1/8 W 1/8 W 1/8 W 1 W | Prec Prec Prec | 5% 5% 1% 1% 1/10% |
| R272 R273 R274 R275 R276 | 325-0081-00 325-0081-00 325-0080-00 323-0789-07 323-0789-07 | | 11.17 ΜΩ 11.17 ΜΩ 3.351 ΜΩ 1.117 ΜΩ 1.117 ΜΩ | 1/ ₂ W 1/ ₂ W 1/ ₂ W 1/ ₂ W 1/ ₂ W | Prec Prec Prec Prec Prec | 1/10% 1/10% 1/10% 1/10% 1/10% |
| R281 R282 R283 R284 R286 | 323-0788-07 323-0787-07 323-0786-07 323-0785-07 323-0785-07 | | 558.5 kΩ 223.4 kΩ 111.7 kΩ 55.8 kΩ 55.8 kΩ | 1/2 W 1/2 W 1/2 W 1/2 W 1/2 W | Prec Prec Prec Prec Prec | 1/10% 1/10% 1/10% 1/10% 1/10% |
| R287 R288 R289 R291 R292 | 322-0786-07 323-0787-07 323-0788-07 325-0082-00 325-0081-00 | | 111.7 kΩ 223.4 kΩ 558.5 kΩ 33.51 MΩ 11.17 MΩ | 1/2 W 1/2 W 1/2 W 1 W 1/2 W | Prec Prec Prec Prec Prec | 1/10% 1/10% 1/10% 1/10% 1/10% |
| R293 R294 R295 R296 R298 | 325-0081-00 325-0080-00 323-0789-07 323-0789-07 321-0289-00 | | 11.17 ΜΩ 3.351 ΜΩ 1.117 ΜΩ 1.117 ΜΩ 10 kΩ | 1/2 W 1/2 W 1/2 W 1/2 W 1/8 W | Prec Prec Prec Prec Prec | 1/10% 1/10% 1/10% 1/10% 1% |
| R299 | 315-0101-00 | | 100 Ω | ⅓ W | | 5% |
| | | Switch | nes | | | |
| S21 S59 | Wired or Unwired 260-1050-00 260-0984-00 | | Rotary Slide | | | ER SELECTOR AYING MODE |
| | 200 070 1 00 | | <u>.</u> | 7701 | | |

DISTRIBUTION Circuit Board Assembly

| Ckt. No. | Tektronix Part No. | Serial/Model No | o. Disc | Description | |
|--------------------------------------|--|----------------------|---|---|-------------------------------------|
| | *670-1216-00 | | Complete | Board | |
| | | Semicondo | uctor Device, Diodes | | |
| CR54 CR55 CR57 CR58 CR61 | *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 | | Silicon Silicon Silicon Silicon Silicon | Replaceable Replaceable Replaceable Replaceable Replaceable | by 1N4152 by 1N4152 by 1N4152 |
| CR62 CR63 CR64 CR66 CR71 | *152-0185-00 152-0079-00 152-0079-00 *152-0185-00 *152-0185-00 | | Silicon Germanium Germanium Silicon Silicon | Replaceable HD1841 HD1841 Replaceable Replaceable | by 1N4152 |
| | | | Transistors | | |
| Q6 Q8 | 151-0301-00 151-0188-00 | | Silicon Silicon | PNP TO-18 2N29 PNP TO-92 2N39 | |
| | | | Resistors | | |
| Resistors are | fixed, composition, \pm | 10% unless otherwise | indicated. | | |
| R61 R62 R71 R72 R74 | 315-0332-00 315-0431-00 315-0202-00 315-0102-00 315-0303-00 | | 3.3 kΩ 430 Ω 2 kΩ 1 kΩ 30 kΩ | 1/ ₄ W 1/ ₄ W 1/ ₄ W 1/ ₄ W 1/ ₄ W | 5% 5% 5% 5% 5% |
| | | | | | |
| | | SWEEP Circ | cuit Board Assemb | oly | |
| | *670-1217-00 | | Complete | Board | |
| | | | Capacitors | | |
| Tolerance ± | =20% unless otherwise | indicated. | | | |
| C704 C711 C731 C746 C750 | 283-0111-00 290-0136-00 290-0136-00 281-0504-00 290-0305-01 | | 0.1 μF 2.2 μF 2.2 μF 10 pF 3 μF | Cer 50 V Elect. 20 V Elect. 20 V Cer 500 V Elect. 150 V | 10% 10% |

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | | Descrip | tion | |
|--------------------------------------|---|------------------------------|---|---------------------------------------|--|-------------------------|
| | | Capacitors | (cont) | | | |
| C753 C756 C758 C759 C764 | 290-0267-00 283-0204-00 283-0059-00 281-0593-00 290-0136-00 | | $\begin{array}{l} 1 \; \mu { m F} \\ { m 0.01} \; \mu { m F} \\ 1 \; \mu { m F} \\ 3.9 \; { m pF} \\ 2.2 \; \mu { m F} \end{array}$ | Elect. Cer Cer Cer Elect. | 35 V 50 V 25 V 500 V 20 V | +80%-20% 10% |
| C772 C773 C776 C778 C779 | 281-0523-00 281-0629-00 283-0059-00 281-0166-00 283-0251-00 | | 100 pF 33 pF 1 μF 1.9-15.7 pF, Var 87 pF | Cer Cer Cer Air Cer | 350 V 600 V 25 V 250 V 500 V | 5% +80%-20% 5% |
| C785 C787 C796 C822 C825 | 281-0579-00 283-0150-00 281-0523-00 290-0301-00 281-0504-00 | | 21 pF 650 pF 100 pF 10 μF 10 pF | Cer Cer Cer Elect. Cer | 500 V 200 V 350 V 20 V 500 V | 5% 5% 10% 10% |
| C827 C833 C837 C841 C842 | 283-0000-00 281-0562-00 281-0504-00 283-0249-00 283-0194-00 | | 0.001 μF 39 pF 10 pF 0.068 μF 4.7 μF | Cer Cer Cer Cer Cer | 500 V 500 V 500 V 50 V 50 V | 10% 10% |
| C843 C851 C852 C854 C855 | 283-0195-00 283-0059-00 290-0134-00 283-0111-00 290-0297-00 | | 680 pF 1 μ F 22 μ F 0.1 μ F 39 μ F | Cer Cer Elect. Cer Elect. | 50 V 25 V 15 V 50 V 10 V | 10% +80%—20% |
| C857 C858 C859 C862 C891 | 283-0059-00 290-0134-00 283-0111-00 283-0080-00 283-0000-00 | | 1 μF 22 μF 0.1 μF 0.022 μF 0.001 μF | Cer Elect. Cer Cer Cer | 25 V 15 V 50 V 25 V 500 V | +80%-20% +80%-20% |
| C896 C899 C906 C907 C910 | 281-0544-00 281-0504-00 290-0136-00 281-0504-00 281-0504-00 | | 5.6 pF 10 pF 2.2 μF 10 pF 10 pF | Cer Cer Elect. Cer Cer | 500 V 500 V 20 V 500 V 500 V | 10% 1% 10% 10% |
| C917 C922 C924 C926 C930 | 281-0518-00 283-0111-00 283-0111-00 290-0136-00 283-0111-00 | | 47 pF 0.1 μF 0.1 μF 2.2 μF 0.1 μF | Cer Cer Cer Elect. Cer | 500 V 50 V 50 V 20 V 50 V | |

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | | Descrip | otion | |
|---|--|------------------------------|---|---------------------------------|--|----------------------------------|
| | | Capacitors | (cont) | | | |
| C932 C937 C938 C939 C942 | 283-0059-00 281-0523-00 281-0518-00 283-0059-00 281-0504-00 | | 1 μF 100 pF 47 pF 1 μF 10 pF | Cer Cer Cer Cer Cer | 25 V 350 V 500 V 25 V 500 V | +80% -20% $+80% -20%$ $10%$ |
| C946 C951 C956 C957 C993 | 281-0504-00 281-0523-00 281-0166-00 283-0251-00 281-0504-00 | | 10 pF 100 pF 1.9-15.7 pF, Var 87 pF 10 pF | Cer Cer Air Cer Cer | 500 V 350 V 250 V 500 V 500 V | 10% 5% 10% |
| C1001 C1006 C1014 C1018 C1019 | 281-0512-00 281-0572-00 283-0059-00 283-0000-00 283-0111-00 | | 27 pF 6.8 pF 1 μF 0.001 μF 0.1 μF | Cer Cer Cer Cer Cer | 500 V 500 V 25 V 500 V 50 V | 10% ±0.5 pl +80%—20% |
| C1022 C1028 C1029 | 283-0000-00 283-0000-00 283-0000-00 | | 0.001 μ F 0.001 μ F 0.001 μ F | Cer Cer Cer | 500 V 500 V 500 V | |
| | | Semiconductor De | evice, Diodes | | | |
| CR706 CR737 VR738 CR759 CR764 | *152-0185-00 *152-0185-00 152-0278-00 *152-0075-00 *152-0185-00 | | Silicon Silicon Zener Germanium Silicon | Rep 1 N Tek | blaceable by blaceable by 4372A 400 i Spec blaceable by | 1N4152 mW, 3V, 5% |
| CR785 CR789 CR801 CR807 CR809 | *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 | | Silicon Silicon Silicon Silicon Silicon | Rep Rep Rep | blaceable by blaceable by blaceable by blaceable by blaceable by | 1N4152 1N4152 1N4152 |
| CR816 CR817 CR819 CR821 CR822 | *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 | | Silicon Silicon Silicon Silicon Silicon | Rep Rep Rep | placeable by placeable by placeable by placeable by placeable by | 1N4152 1N4152 1N4152 |
| CR823 CR827 VR832 CR845 CR846 | *152-0185-00 *152-0185-00 152-0127-00 *152-0185-00 *152-0185-00 | | Silicon Silicon Zener Silicon Silicon | Rep 1 N Rep | placeable by placeable by 755A 400 m placeable by placeable by | 1N4152 W, 7.5 V, 5% 1N4152 |

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | D | escription |
|--|--|------------------------------|---|---|
| | | Semiconductor Device, | Diodes (cont) | |
| CR866 CR869 CR888 CR889 CR897 | *152-0075-00 *152-0185-00 *152-0075-00 *152-0185-00 152-0307-00 | | Germanium Silicon Germanium Silicon Silicon | Tek Spec Replaceable by 1N4152 Tek Spec Replaceable by 1N4152 Dual signal |
| CR901 CR926 CR927 CR944 CR948 | *152-0075-00 *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 | | Germanium Silicon Silicon Silicon Silicon | Tek Spec Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 |
| CR951 CR967 CR968 CR981 CR987 | *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 | | Silicon Silicon Silicon Silicon Silicon | Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 |
| CR991 CR993 CR1003 CR1012 CR1016 | *152-0185-00 *152-0185-00 152-0141-02 *152-0185-00 *152-0185-00 | | Silicon Silicon Silicon Silicon Silicon | Replaceable by 1N4152 Replaceable by 1N4152 1N4152 Replaceable by 1N4152 Replaceable by 1N4152 |
| VR1019 CR1033 CR1043 | 152-0227-00 *152-0185-00 *152-0185-00 | | Zener Silicon Silicon | 1N753A 400 mW, 6.2 V, 5% Replaceable by 1N4152 Replaceable by 1N4152 |
| | | Relay | | |
| K1055 | *148-0034-00 | | Armature, dpdt, 15 V [| OC . |
| | | Transista | ors | |
| Q702 Q704 Q706 Q710 Q722 | 151-0221-00 151-0220-00 *151-0192-00 *151-0192-00 151-0223-00 | | Silicon PNP Silicon PNP Silicon NPN Silicon NPN Silicon NPN | TO-18 2N4258 TO-18 2N4122 TO-92 Replaceable by MPS 6521 TO-92 Replaceable by MPS 6521 TO-18 2N4275 |
| Q726 Q730 Q762 Q764 Q782 | 151-0223-00 *151-0190-01 151-0221-00 151-0221-00 151-0301-00 | | Silicon NPN Silicon NPN Silicon PNP Silicon PNP Silicon PNP | TO-18 2N4275 TO-106 Tek Spec TO-18 2N4258 TO-18 2N4258 TO-18 2N2907 |

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | Description | |
|------------------|-----------------------|----------------------------------|-----------------------------|--------------------|
| CKI. 140. | 1011 110. | | · | *** |
| | | Transistors (cont) | | |
| Q798 | 151-0220-00 | Silicon | PNP TO-18 2N41 | 22 |
| Q804 | *151-0190-01 | Silicon | NPN TO-106 Tek | Spec |
| Q812 | 151-0220-00 | Silicon | PNP TO-18 2N41 | 22 |
| Q818 | *151-0190-01 | Silicon | NPN TO-106 Tek | |
| Q862 | 151-0220-00 | Silicon | PNP TO-18 2N41 | 22 |
| Q882 | 151-0223-00 | Silicon | NPN TO-18 2N42 | 75 |
| Q886 | 151-0223-00 | Silicon | NPN TO-18 2N42 | |
| Q888 | *151-0289-00 | Silicon | PNP TO-18 Tek S | |
| Q892 | *151-0190-01 | Silicon | NPN TO-106 Tek | |
| Q896 | *151-0259-00 | Silicon | NPN TO-106 Selec | cted from 2N3563 |
| Q898 | *151-0259-00 | Silicon | NPN TO-106 Selec | cted from 2N3563 |
| Q902 | 151-0220-00 | Silicon | PNP TO-18 2N41 | |
| Q904 | 151-0221-00 | Silicon | PNP TO-18 2N42 | |
| Q906 | *151-0190-01 | Silicon | NPN TO-106 Tek | Spec |
| Q922 | 151-0223-00 | Silicon | NPN TO-18 2N42 | 7 5 |
| Q924 | 151-0223-00 | Silicon | NPN TO-18 2N42 | 75 |
| Q928 | 151-0221-00 | Silicon | PNP TO-18 2N42 | 58 |
| Q942 | 151-0223-00 | Silicon | NPN TO-18 2N42 | 75 |
| Q944 | 151-0223-00 | Silicon | NPN TO-18 2N42 | |
| Q954 | 151-0220-00 | Silicon | PNP TO-18 2N41 | 22 |
| Q962 | *151-0216-00 | Silicon | PNP TO-92 Replo MPS 6523 | ceable by MOT |
| Q966 | *151-0216-00 | Silicon | | ceable by MOT |
| Q968 | 151-0220-00 | Silicon | PNP TO-18 2N41 | 22 |
| Q984 | *151-0192-00 | Silicon | | ceable by MPS 6521 |
| Q988 | *151-0190-01 | Silicon | NPN TO-106 Tek | |
| Q992 | 151-0221-00 | Silicon | PNP TO-18 2N42 | |
| Q1004 | *151-0219-00 | Silicon | | ceable by 2N4250 |
| Q1006 | 151-0224-00 | Silicon | NPN TO-18 2N36 | |
| Q1014 | *151-0192-00 | Silicon | | ceable by MPS 6521 |
| Q1024 | *151-0190-01 | Silicon | NPN TO-106 Tek | Spec |
| Q1038 | 151-0224-00 | Silicon | NPN TO-18 2N36 | |
| Q1046 | *151-0190-01 | Silicon | NPN TO-106 Tek | Spec |
| | | | • | |
| | | Resistors | | |
| Resistors are fi | xed, composition, ± | :10% unless otherwise indicated. | | |
| R701 | 315-0154-00 | 150 kΩ | 1/ ₄ W | 5% |
| R702 | 315-0223-00 | 22 kΩ | ¹/₄ W | 5% |
| R703 | 315-0332-00 | 3.3 kΩ | ¹/₄ W | 5% |
| R704 | 321-0285-00 | 9.09 kΩ 21.5 kΩ | 1/8 W Prec | 1 % 1 % |
| R705 | 321-0321-00 | | ¹/ ₈ W Prec | |

| Ckt. No. | Tektronix Part No. | Serial/Model Eff | No. Disc | | Descript | tion | |
|--------------------------------------|---|---------------------|---------------|---|--|--------------|----------------------------|
| | | | Resistors (co | ont) | | | |
| R706 R707 R711 R721 R722 | 315-0561-00 315-0472-00 315-0200-00 315-0270-00 315-0620-00 | | , | 560 Ω 4.7 kΩ 20 Ω 27 Ω 62 Ω | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% |
| R723 R724 R725 R726 R728 | 315-0241-00 323-0192-00 315-0241-00 315-0620-00 321-0146-00 | | | 240 Ω 976 Ω 240 Ω 62 Ω 324 Ω | 1/4 W 1/2 W 1/4 W 1/4 W 1/8 W | Prec Prec | 5% 1% 5% 5% 1% |
| R731 R732 R735 R736 R737 | 315-0331-00 315-0152-00 311-0836-00 321-0335-00 315-0564-00 | | | 330 Ω 1.5 kΩ 5 kΩ, Var 30.1 kΩ 560 kΩ | 1/ ₄ W 1/ ₄ W 1/ ₈ W 1/ ₄ W | Prec | 5% 5% 1% 5% |
| R740 R741 R742 R743 R744 | 315-0274-00 315-0184-00 315-0104-00 315-0433-00 315-0103-00 | | 1 | 270 kΩ 180 kΩ 100 kΩ 43 kΩ 10 kΩ | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% 5% |
| R746 R747 R750 R751 R753 | 315-0202-00 315-0511-00 311-0813-00 321-0387-00 315-0103-00 | | | 2 kΩ 510 Ω 25 kΩ, Var 105 kΩ 10 kΩ | 1/4 W 1/4 W 1/8 W 1/4 W | Prec | 5% 5% 1% 5% |
| R754 R755 R756 R757 R758 | 315-0304-00 311-0840-00 315-0103-00 315-0101-00 315-0101-00 | | : | 300 kΩ 20 kΩ, ,Var 10 kΩ 100 Ω 100 Ω | 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% |
| R759 R761 R762 R763 R764 | 315-0752-00 315-0563-00 315-0202-00 315-0511-00 315-0751-00 | | | 7.5 kΩ 56 kΩ 2 kΩ 510 Ω 750 Ω | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% 5% |
| R765 R766 R770 R771 R772 | 315-0271-00 315-0682-00 311-0831-00 315-0433-00 315-0201-00 | | - | 270 Ω 6.8 kΩ 100 kΩ, Var 43 kΩ 200 Ω | 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% 5% |

| Ckt. No. | Tektronix Part No. | Serial/Model Eff | No. Disc | Description | |
|--|--|---------------------|--|--|----------------------------|
| | | F | Resistors (cont) | | |
| R776 R781 R782 R783 R785 | 315-0621-00 315-0621-00 315-0132-00 315-0621-00 315-0751-00 | | 620 Ω 620 Ω 1.3 kΩ 620 Ω 750 Ω | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | 5% 5% 5% 5% 5% |
| R787 R789 R791 R792 R794 | 315-0102-00 315-0472-00 315-0471-00 315-0362-00 315-0471-00 | | 1 kΩ 4.7 kΩ 470 Ω 3.6 kΩ 470 Ω | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | 5% 5% 5% 5% |
| R796 R798 R801 R802 R804 | 315-0362-00 315-0102-00 315-0472-00 315-0512-00 315-0102-00 | | 3.6 kΩ 1 kΩ 4.7 kΩ 5.1 kΩ 1 kΩ | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | 5% 5% 5% 5% |
| R806 R807 R811 R812 R813 | 315-0102-00 315-0102-00 315-0162-00 315-0332-00 315-0751-00 | | 1 kΩ 1 kΩ 1.6 kΩ 3.3 kΩ 750 Ω | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | 5% 5% 5% 5% |
| R815 R816 R817 R818 R819 | 315-0102-00 315-0102-00 315-0102-00 315-0302-00 315-0153-00 | | 1 kΩ 1 kΩ 1 kΩ 3 kΩ 15 kΩ | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | 5% 5% 5% 5% |
| R821 R823 R824 R825 R826 R827 | 315-0103-00 315-0154-00 315-0102-00 315-0103-00 315-0102-00 315-0472-00 | | 10 kΩ 150 kΩ 1 kΩ 10 kΩ 1 kΩ 4.7 kΩ | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | 5% 5% 5% 5% 5% |
| R831 R832 R834 R835 R836 | 315-0471-00 315-0272-00 315-0432-00 311-0704-00 315-0132-00 | | $470~\Omega$ 2.7 kΩ $4.3~\mathrm{k}\Omega$ 500 Ω , Var $1.3~\mathrm{k}\Omega$ | 1/4 W 1/4 W 1/4 W 1/4 W | 5% 5% 5% 5% |
| R837 R838 R839 R843 R844 | 315-0752-00 315-0152-00 315-0511-00 315-0512-00 315-0333-00 | | 7.5 kΩ 1.5 kΩ 510 Ω 5.1 kΩ 33 kΩ | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | 5% 5% 5% 5% 5% |

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | | Descrip | tion | |
|--------------------------------------|---|------------------------------|---|---|--------------|----------------------------|
| | | Resistors (| (cont) | | | |
| R845 R846 R847 R848 R849 | 315-0152-00 315-0682-00 322-0205-00 321-0164-00 315-0152-00 | | 1.5 kΩ 6.8 kΩ 1.33 kΩ 499 Ω 1.5 kΩ | 1/4 W 1/4 W 1/4 W 1/8 W 1/4 W | Prec Prec | 5% 5% 1% 1% 5% |
| R861 R862 R854 R865 R867 | 315-0302-00 315-0202-00 315-0101-00 311-0827-00 315-0151-00 | | 3 kΩ 2 kΩ 100 Ω 250 Ω, Var 150 Ω | 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% |
| R871 R872 R873 R874 R881 | 315-0102-00 315-0302-00 315-0752-00 315-0162-00 315-0270-00 | | 1 kΩ 3 kΩ 7.5 kΩ 1.6 kΩ 27 Ω | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% |
| R883 R884 R885 R886 R887 | 315-0361-00 322-0210-00 315-0301-00 315-0620-00 321-0164-00 | | 360 Ω 1.5 kΩ 300 Ω 62 Ω 499 Ω | 1/4 W 1/4 W 1/4 W 1/4 W 1/8 W | Prec Prec | 5% 1% 5% 5% 1% |
| R888 R891 R892 R893 R896 | 321-0194-00 315-0103-00 315-0623-00 315-0303-00 315-0102-00 | | 1.02 kΩ 10 kΩ 62 kΩ 30 kΩ 1 kΩ | 1/8 W 1/4 W 1/4 W 1/4 W 1/4 W | Prec | 1 % 5 % 5 % 5 % |
| R898 R899 R902 R903 R906 | 301-0133-00 315-0102-00 315-0102-00 315-0302-00 315-0270-00 | | 13 kΩ 1 kΩ 1 kΩ 3 kΩ 27 Ω | 1/ ₂ W 1/ ₄ W 1/ ₄ W 1/ ₄ W 1/ ₄ W | | 5% 5% 5% 5% 5% |
| R907 R908 R909 R910 R913 | 315-0202-00 315-0511-00 315-0752-00 315-0102-00 315-0202-00 | | 2 kΩ 510 Ω 7.5 kΩ 1 kΩ 2 kΩ | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% |
| R915 R917 R921 R922 R923 | 315-0102-00 315-0202-00 315-0202-00 315-0271-00 315-0104-00 | | 1 kΩ 2 kΩ 2 kΩ 270 Ω 100 kΩ | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% |

| Ckt. No. | Tektronix Part No. | Serial/Model Eff | No. Disc | | Descrip | tion | |
|--------------------------------------|---|---------------------|-------------|--|---|----------------------|---------------------------------|
| | | | Resistors (| cont) | | | |
| R924 R925 R926 R927 R928 | 315-0271-00 315-0104-00 315-0100-00 315-0241-00 315-0682-00 | | | 270 Ω 100 kΩ 10 Ω 240 Ω 6.8 kΩ | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% 5% |
| R930 R931 R932 R933 R935 | 311-0732-00 315-0752-00 315-0101-00 315-0752-00 311-0831-00 | | | $\begin{array}{l} 1 \; k\Omega, \; \text{Var} \\ 7.5 \; k\Omega \\ 100 \; \Omega \\ 7.5 \; k\Omega \\ 100 \; k\Omega, \; \text{Var} \end{array}$ | 1/ ₄ W 1/ ₄ W 1/ ₄ W | | 5% 5% 5% 5% 5% |
| R936 R937 R939 R941 R942 | 315-0433-00 315-0201-00 315-0621-00 315-0471-00 315-0362-00 | | | 43 kΩ 200 Ω 620 Ω 470 Ω 3.6 kΩ | 1/ ₄ W 1/ ₄ W 1/ ₄ W 1/ ₄ W 1/ ₄ W | | 5% 5% 5% |
| R944 R945 R946 R947 R948 | 315-0302-00 315-0431-00 315-0362-00 315-0511-00 315-0202-00 | | | 3 kΩ 430 Ω 3.6 kΩ 510 Ω 2 kΩ | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% 5% |
| R951 R952 R953 R954 R961 | 315-0102-00 315-0102-00 315-0511-00 315-0391-00 321-0260-00 | | | 1 kΩ 1 kΩ 510 Ω 390 Ω 4.99 kΩ | 1/ ₄ W 1/ ₄ W 1/ ₄ W 1/ ₄ W 1/ ₈ W | Prec | 5% 5% 5% 1% |
| R962 R963 R964 R966 R967 | 321-0268-00 321-0268-00 321-0260-00 315-0242-00 315-0391-00 | | | 6.04 kΩ 6.04 kΩ 4.99 kΩ 2.4 kΩ 390 Ω | 1/8 W 1/8 W 1/8 W 1/4 W 1/4 W | Prec Prec Prec | 1 % 1 % 1 % 5 % 5 % |
| R968 R969 R981 R982 R983 | 315-0391-00 315-0102-00 315-0243-00 315-0472-00 315-0682-00 | | | 390 Ω 1 kΩ 24 kΩ 4.7 kΩ 6.8 kΩ | 1/ ₄ W 1/ ₄ W 1/ ₄ W 1/ ₄ W 1/ ₄ W | | 5% 5% 5% 5% |
| R984 R986 R987 R988 R989 | 315-0203-00 315-0472-00 315-0103-00 315-0122-00 315-0123-00 | | | 20 kΩ 4.7 kΩ 10 kΩ 1.2 kΩ 12 kΩ | 1/ ₄ W 1/ ₄ W 1/ ₄ W 1/ ₄ W 1/ ₄ W | | 5% 5% 5% 5% |

| Ckt. No. | Tektronix Part No. | Serial/Model Eff | No. Disc | Descript | ion | |
|--|--|---------------------|--|--|--------------------------------------|----------------------------------|
| | | | Resistors (cont) | | | |
| R992 R993 R994 R996 R998 | 315-0683-00 315-0103-00 315-0623-00 315-0153-00 315-0102-00 | | 68 kΩ 10 kΩ 62 kΩ 15 kΩ 1 kΩ | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% 5% |
| R1001 R1002 R1003 R1005 R1006 | 321-0298-00 315-0623-00 315-0751-00 315-0392-00 321-0335-00 | | 12.4 kΩ 62 kΩ 750 Ω 3.9 kΩ 30.1 kΩ | 1/8 W 1/4 W 1/4 W 1/4 W 1/8 W | Prec | 1 % 5 % 5 % 5 % 1 % |
| R1007 R1008 R1009 R1010 R1012 | 321-0193-00 321-0222-07 321-0222-07 321-0356-00 321-0268-00 | | 1 kΩ 2 kΩ 2 kΩ 49.9 kΩ 6.04 kΩ | 1/ ₈ W 1/ ₈ W 1/ ₈ W 1/ ₈ W | Prec Prec Prec Prec Prec | 1% 1/10% 1/10% 1% 1% |
| R1014 R1016 R1018 R1019 R1021 R1022 | 321-0174-00 315-0561-00 315-0103-00 315-0104-00 321-0327-00 315-0104-00 | | 634 Ω 560 Ω 10 kΩ 100 kΩ 24.9 kΩ 100 kΩ | 1/ ₈ W 1/ ₄ W 1/ ₄ W 1/ ₄ W 1/ ₈ W 1/ ₄ W | Prec Prec | 1% 5% 5% 5% 1% 5% |
| R1023 R1024 R1025 R1026 R1027 | 315-0103-00 315-0104-00 321-0327-00 315-0104-00 315-0103-00 | | 10 kΩ 100 kΩ 24.9 kΩ 100 kΩ 10 kΩ | 1/4 W 1/4 W 1/8 W 1/4 W 1/4 W | Prec | 5% 5% 1% 5% 5% |
| R1028 R1031 R1032 R1033 R1034 | 315-0104-00 315-0273-00 315-0104-00 321-0260-00 315-0621-00 | | 100 kΩ 27 kΩ 100 kΩ 4.99 kΩ 620 Ω | 1/ ₄ W 1/ ₄ W 1/ ₄ W 1/ ₈ W 1/ ₄ W | Prec | 5% 5% 5% 1% 5% |
| R1036 R1038 R1041 R1042 R1043 | 321-0186-00 321-0207-00 321-0220-00 321-0236-00 315-0912-00 | | 845 Ω 1.4 kΩ 1.91 kΩ 2.8 kΩ 9.1 kΩ | 1/8 W 1/8 W 1/8 W 1/8 W 1/4 W | Prec Prec Prec Prec | 1 % 1 % 1 % 1 % 5 % |
| R1044 R1045 R1046 R1051 R1052 | 321-0164-00 321-0057-00 321-0148-00 315-0432-00 321-0222-00 | | 499 Ω 38.3 Ω 340 Ω 4.3 kΩ 2 kΩ | 1/8 W 1/8 W 1/8 W 1/4 W 1/8 W | Prec Prec Prec | 1% 1% 1% 5% 1% |

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | | Descript | tion | |
|-------------------------|---|------------------------------|---|--|------------|----------|
| | | Resistors | (cont) | | | |
| R1053 R1054 R1055 | 315-0302-00 321-0153-00 311-0886-00 | | $3~\mathrm{k}\Omega$ $383~\Omega$ $50~\Omega$, Var | 1/ ₄ W 1/ ₈ W | Prec | 5% 1% |
| R1056 R1059 | 321-0148-00 308-0300-00 | | 340 Ω 1.75 kΩ | ¹/ ₈ W 3 W | Prec WW | 1% 1% |
| | | Swit | ch | | | |
| | Wired or Unwired | | | | | |
| S1055 | 260-1132-00 | | Push-pull | 10 X | (MAG | |
| | | Integrated | Circuits | | | |
| U736 U750 | 156-0048-00 *155-0042-00 | | Linear Replaced Miller integrator | | CA3046 | |
| U794 | 156-0048-00 | | Linear Replacea | | CA3046 | |
| U834 | 156-0048-00 | | Linear Replacea | ible by RCA (| | |
| U930 | *155-0042-00 | | Miller integrator | r | | |
| U1020 | 156-0048-00 | | Linear Replacea | ble by RCA C | CA3046 | |
| U1034 | 156-0048-00 | | Linear Replacea | | | |
| | | | | | | |

DELAYED TRIGGER Circuit Board Assembly

*670-1218-00

Tolerance ±20% unless otherwise indicated.

Complete Board

Capacitors

| | | | | ,- | |
|--|---|---------------------------------|---|---|--------------------------------------|
| 10% | 100 V 500 V 200 V 500 V 500 V | Cer Cer Cer Cer Cer | 5-25 pF, Var 0.001 μF 10 pF 0.001 μF 0.001 μF | 281-0123-00 283-0000-00 281-0613-00 283-0000-00 283-0000-00 | C501 C509 C511 C513 C514 |
| +80%-20% +80%-20% ±0.6 pF ±0.6 pF +80%-20% | 25 V 100 V 500 V 500 V 25 V | Cer Cer Cer Cer | $0.022~\mu F$ $0.1~\mu F$ $12~p F$ $12~p F$ $0.022~\mu F$ | 283-0080-00 283-0178-00 281-0508-00 281-0508-00 283-0080-00 | C523 C533 C541 C544 C549 |

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | Description | | | | |
|----------|-----------------------|------------------------------|--|--|--|--|--|
| | . Capacitors (cont) | | | | | | |
| C552 | 283-0080-00 | 0.022 μF | Cer 25 V +80%—20% | | | | |
| C556 | 283-0000-00 | 0.001 μF | Cer 500 V | | | | |
| C561 | 283-0080-00 | 0.022 μF | Cer 25 V +80%—20% | | | | |
| C562 | 283-0194-00 | 4.7 μF | Cer 50 V | | | | |
| C569 | 283-0178-00 | 0.1 μF | Cer 100 V +80%—20% | | | | |
| C602 | 283-0633-00 | 77 pF | Mica 100 V 1% Cer 50 V Cer 500 V Cer 25 V +80%—20% Cer 25 V +80%—20% | | | | |
| C614 | 283-0212-00 | 2 μF | | | | | |
| C619 | 281-0562-00 | 39 pF | | | | | |
| C626 | 283-0080-00 | 0.022 μF | | | | | |
| C627 | 283-0080-00 | 0.022 μF | | | | | |
| C651 | 281-0513-00 | 27 pF | Cer 500 V | | | | |
| C661 | 281-0513-00 | 27 pF | Cer 500 V | | | | |
| C667 | 290-0136-00 | 2.2 μF | Elect. 20 V | | | | |
| C669 | 281-0613-00 | 10 pF | Cer 200 V 10% | | | | |
| | | Semiconductor Device, Diodes | : | | | | |
| CR503 | *152-0185-00 | Silicon | Replaceable by 1N4152 | | | | |
| CR505 | *152-0185-00 | Silicon | Replaceable by 1N4152 | | | | |
| CR523 | *152-0185-00 | Silicon | Replaceable by 1N4152 | | | | |
| CR547 | *152-0185-00 | Silicon | Replaceable by 1N4152 | | | | |
| VR601 | 152-0226-00 | Zener | 1N751A 400 mW, 5.1 V, 5% | | | | |
| CR621 | *152-0185-00 | Silicon | Replaceable by 1N4152 | | | | |
| CR622 | *152-0185-00 | Silicon | Replaceable by 1N4152 | | | | |
| CR623 | *152-0185-00 | Silicon | Replaceable by 1N4152 | | | | |
| CR624 | *152-0185-00 | Silicon | Replaceable by 1N4152 | | | | |
| CR630 | 152-0140-01 | Tunnel | 8 pF, 10 mA | | | | |
| CR655 | *152-0185-00 | Silicon | Replaceable by 1N4152 | | | | |
| CR670 | 152-0140-01 | Tunnel | 8 pF, 10 mA | | | | |
| CR675 | 152-0140-01 | Tunnel | 8 pF, 10 mA | | | | |
| | | Inductor | | | | | |
| 1631 | *108-0420-00 | 60 nH | | | | | |
| | | Transistors | | | | | |
| Q508A,B | 151-1011-00 | Silicon | FET N channel, junction type, dual PNP TO-18 2N4258 NPN TO-18 2N4275 NPN TO-92 Replaceable by MPS 6521 NPN TO-92 Replaceable by MPS 6521 | | | | |
| Q512 | 151-0221-00 | Silicon | | | | | |
| Q516 | 151-0223-00 | Silicon | | | | | |
| Q542 | *151-0192-00 | Silicon | | | | | |
| Q544 | *151-0192-00 | Silicon | | | | | |

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | | Des | criptio | n | | |
|--------------------------------------|---|------------------------------|--|---|-------------------------|--|-------------|-----------------------|
| | | Transistors | (cont) | | | | | |
| Q552 Q554 Q558 Q562 Q602 | 151-0221-00 151-0221-00 151-0223-00 151-0207-00 151-0223-00 | | Silicon Silicon Silicon Silicon Silicon | PNP PNP NPN NPN NPN | TO-18 TO-18 TO-98 | 2N4258 2N4258 2N4275 2N3415 2N4275 | | |
| Q604 Q616 Q618 Q628 Q654 | 151-0223-00 151-0221-00 151-0221-00 151-0207-00 151-0223-00 | | Silicon Silicon Silicon Silicon Silicon | NPN PNP PNP NPN NPN | TO-18 TO-18 TO-98 | 2N4275 2N4258 2N4258 2N3415 2N4275 | | |
| Q666 | 151-0223-00 | | Silicon | NPN | TO-18 | 2N4275 | | |
| Resistors are fixed | , composition, \pm | Resistor | | | | | | |
| R501 R502 R503 R504 R505 | 317-0221-00 321-0452-00 317-0562-00 317-0202-00 317-0682-00 | | 220 Ω 499 kΩ 5.6 kΩ 2 kΩ 6.8 kΩ | 1/8 W 1/8 W 1/8 W 1/8 W 1/8 W | , | Prec | 1 5 5 | % % % % % |
| R508 R509 R512 R513 R514 | 317-0511-00 315-0101-00 317-0102-00 315-0202-00 317-0510-00 | | 510 Ω 100 Ω 1 kΩ 2 kΩ 51 Ω | 1/8 W 1/4 W 1/8 W 1/4 W 1/8 W | , | | 5 5 5 | % 5% 5% 5% |
| R516 R517 R519 R521 R522 | 317-0751-00 317-0820-00 317-0510-00 317-0392-00 315-0183-00 | | 750 Ω 82 Ω 51 Ω 3.9 kΩ 18 kΩ | 1/8 W 1/8 W 1/8 W 1/8 W 1/4 W | , | | 5 5 5 | % % % % |
| R530 R531 R532 R533 R536 | 311-0634-00 321-0199-00 321-0239-00 317-0510-00 317-0511-00 | | 500 Ω , Var 1.15 k Ω 3.01 k Ω 51 Ω | 1/8 W 1/8 W 1/8 W 1/8 W | • | Prec Prec | 1 5 | %%%%% |
| R537 R539 R541 R542 R543 | 317-0511-00 322-0212-00 321-0113-00 321-0113-00 322-0195-00 | | 510 Ω 1.58 kΩ 147 Ω 147 Ω 1.05 kΩ | 1/8 W 1/4 W 1/8 W 1/8 W 1/4 W | | Prec Prec Prec Prec | 1 1 1 | % % % % |

| Ckt. No. | Tektronix Part No. | Serial/Model Eff | No. Disc | · · · · · · · · · · · · · · · · · · · | Descrip | tion | |
|--------------------------------------|---|---------------------|-------------|--|---|--------------------------------------|---------------------------------|
| | | | Resistors | (cont) | | | |
| R544 R545 R546 R547 R548 | 321-0113-00 321-0113-00 322-0195-00 321-0314-00 321-0199-00 | | | 147 Ω 147 Ω 1.05 kΩ 18.2 kΩ 1.15 kΩ | 1/8 W 1/8 W 1/4 W 1/8 W 1/8 W | Prec Prec Prec Prec Prec | 1 % 1 % 1 % 1 % 1 % |
| R549 R550 R551 R552 R553 | 321-0228-00 311-0622-00 322-0173-00 315-0470-00 322-0239-00 | | | $2.32~\mathrm{k}\Omega$ $100~\Omega$, Var $619~\Omega$ $47~\Omega$ $3.01~\mathrm{k}\Omega$ | 1/8 W 1/4 W 1/4 W 1/4 W | Prec Prec Prec | 1% 1% 5% 1% |
| R554 R555 R556 R558 R561 | 322-0170-00 321-0205-00 315-0101-00 323-0197-00 317-0303-00 | | | 576 Ω 1.33 kΩ 100 Ω 1.1 kΩ 30 kΩ | 1/ ₄ W 1/ ₈ W 1/ ₄ W 1/ ₂ W 1/ ₈ W | Prec Prec | 1% 1% 5% 1% 5% |
| R562 R569 R601 R602 R603 | 317-0222-00 315-0270-00 315-0101-00 317-0150-00 315-0101-00 | | | $\begin{array}{c} 2.2 \text{ k}\Omega \\ 27 \Omega \\ 100 \Omega \\ 15 \Omega \\ 100 \Omega \end{array}$ | 1/8 W 1/4 W 1/4 W 1/8 W 1/4 W | | 5% 5% 5% 5% |
| R605 R608 R610 R611 R612 | 317-0150-00 315-0162-00 311-0607-00 315-0203-00 315-0123-00 | | | 15 Ω 1.6 kΩ 10 kΩ, Var 20 kΩ 12 kΩ | 1/8 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% |
| R614 R616 R618 R619 R626 | 315-0222-00 321-0193-00 321-0193-00 317-0300-00 315-0622-00 | | | 2.2 kΩ 1 kΩ 1 kΩ 30 Ω 6.2 kΩ | 1/ ₄ W 1/ ₈ W 1/ ₈ W 1/ ₈ W 1/ ₄ W | Prec Prec | 5% 1% 1% 5% 5% |
| R627 R628 R631 R632 R633 | 315-0622-00 317-0302-00 317-0330-00 315-0101-00 315-0202-00 | | | 6.2 kΩ 3 kΩ 33 Ω 100 Ω 2 kΩ | 1/ ₄ W 1/ ₈ W 1/ ₈ W 1/ ₄ W | | 5% 5% 5% 5% |
| R651 R653 R654 R661 R662 | 317-0470-00 317-0471-00 317-0302-00 317-0470-00 317-0470-00 | | | 47 Ω 470 Ω 3 kΩ 47 Ω 47 Ω | 1/8 W 1/8 W 1/8 W 1/8 W 1/8 W | | 5% 5% 5% 5% |

6-20

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | Description | |
|----------------------|--|------------------------------|-------------|----------------|
| | | Resistors (cont) | | |
| R663 R664 R665 | 317-0471-00 317-0302-00 311-0634-00 | 470 Ω 3 kΩ 500 Ω | 2 | 5% 5% |
| R666 R667 | 31 <i>7</i> -0821-00 31 <i>7</i> -0201-00 | 820 c 200 c | 2 ½ W | 5% 5% |
| R669 R672 R674 | 317-0391-00 317-0201-00 317-0470-00 | 390 Ω 200 Ω 47 Ω | , • | 5% 5% 5% |
| | | Integrated Circuit | | |
| U530 | *155-0022-00 | Mono | plithic | |

TRIGGER MODE SWITCH Circuit Board Assembly

| *670- | 121 | 9-00 |
|-------|-------|------|
| 0/0- | 1 4 1 | 7-00 |

Complete Board

| | | Bulbs | |
|------------|----------------------------------|---|--|
| DS4 DS5 | *150-0057-01 *150-0093-01 | Incandescent, 7153AS Incandescent, T³/₄, 5 \ | 15,, selected /, selected |
| CD.C | *150.0105.00 | Semiconductor Device, Diodes | |
| CR5 CR6 | *152-0185-00 *152-0185-00 | Silicon Silicon | Replaceable by 1N4152 Replaceable by 1N4152 |
| | Mind on United | Switch | |
| \$57 | Wired or Unwired *670-1219-00 | Pushbutton | MODE |

⁷See Mechanical Parts List for replacement parts.

DISPLAY MODE SWITCH Circuit Board Assembly

| | | | | | • | |
|------------------|----------------------------|------------------------------|-------------------------|---|-------------|----------------------|
| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | | Des | cription | |
| | *670-1220-00 | | Complete | Board | | |
| | | Bulb | | | | |
| DS12 | *150-0057-01 | | Incandescent | , 7153AS15, | selected | |
| | | Switch | | | | |
| | Wired or Unwired | Swiici | • | | | |
| S12 ⁸ | *670-1220-00 | | Pushbutton | | DISPLAY M | ODE |
| | | | | | | |
| | | SOURCE SWITCH Circu | it Board A | ssembly | | |
| | *670-1221-00 | | Complete | Board | | |
| | | Bulb | | | | |
| DS7 | *150-0057-01 | | Incandescent, | 7153AS15, | selected | |
| | | Capacito | ors | | | |
| Tolerance ± | :20% unless otherwise | indicated. | | | | |
| C10 C13 | 281-0123-00 281-0661-00 | | 5-25 pF, Var 0.8 pF | Ce Ce | | |
| | | | | | | |
| | | Resisto | rs | | | |
| Tolerance ± | 20% unless otherwise | indicated. | | | | |
| R10 R13 | 315-0470-00 321-0448-00 | | 47 Ω 453 kΩ | 1/4 W 1/8 W | / / Proc | 5% 1% |
| R14 | 321-0361-00 | | $56.2~\mathrm{k}\Omega$ | 78 VV 1/ ₈ VV 1/ ₄ VV | Prec Prec | 5% 1% 1% 5% |
| R16 | 315-0470-00 | | 47 Ω | ¹/₄ W | , | 5% |
| | Switch | | | | | |
| | Wired or Unwired | | | | | |
| S7 ⁸ | *670-1221-00 | | Pushbutton | | SOURCE | |

⁸See Mechanical Parts List for replacement parts.

COUPLING SWITCH Circuit Board Assembly

| | • | COPLING SWITC | n Circuit boara | Assembly | | |
|----------------------|---|--------------------------|-------------------------------|--|-------------------------|----------|
| Ckt. No. | Tektronix Part No. | Serial/Model No Eff D | isc | Descrip | tion | |
| | *670-1222-00 | | Complete | e Board | | |
| | | | Bulb | | | |
| DS6 | *150-0057-01 | | Incandescer | nt, 7153AS15, selec | ted | |
| | | | Capacitor | | | |
| Tolerance ± | 20% unless otherwise | indicated. | | | | |
| C17 | 283-0068-00 | | 0.01 μF | Cer | 500 V | |
| | | | Resistors | | | |
| Resistors are | fixed, composition, \pm | 10% unless otherwise | indicated. | | | |
| R17 R18 | 315-0101-00 315-0101-00 | | 100 Ω 100 Ω | 1/ ₄ W 1/ ₄ W | | 5% 5% |
| | | | Switch | | | |
| | Wired or Unwired | | | | | |
| S6° | *670-1222-00 | | Pushbutton | COI | JPLING | |
| | | MAIN TRIGGER | Circuit Board A | ssembly | | |
| | *670-1224-00 | | Complete | e Board | | |
| | | | Capacitors | | | |
| Tolerance ±2 | 20% unless otherwise i | ndicated. | | | | |
| C301 C309 | 281-0122-00 283-0000-00 | | 2.5-9 pF, Va 0.001 μF | Cer | 100 V 500 V | |
| C311 C313 C314 | 281-0613-00 283-0000-00 283-0000-00 | | 10 pF 0.001 μF 0.001 μF | Cer Cer Cer | 200 V 500 V 500 V | 10% |
| | | | | | | |

⁹See Mechanical Parts List for replacement parts.

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | | Descrip | tion | |
|---|---|------------------------------|--|--|--|--|
| Capacitors (cont) | | | | | | |
| C323 C333 C341 C344 C349 | 283-0080-00 283-0178-00 281-0511-00 281-0511-00 283-0080-00 | | 0.022 μ F 0.1 μ F 22 pF 22 pF 0.022 μ F | Cer Cer Cer Cer Cer | 25 V 100 V 500 V 500 V 25 V | +80%-20% +80%-20% 10% 10% +80%-20% |
| C357 C361 C362 C363 C364 | 283-0080-00 283-0080-00 283-0051-00 283-0080-00 283-0194-00 | | $\begin{array}{l} 0.022~\mu \mathrm{F} \\ 0.022~\mu \mathrm{F} \\ 0.0033~\mu \mathrm{F} \\ 0.022~\mu \mathrm{F} \\ 4.7~\mu \mathrm{F} \end{array}$ | Cer Cer Cer Cer Cer | 25 V 25 V 100 V 25 V 50 V | +80%-20% +80%-20% 5% +80%-20% |
| C366 C367 C369 C402 C414 | 283-0080-00 283-0169-00 283-0178-00 283-0633-00 283-0212-00 | | 0.022 μF 0.022 μF 0.1 μF 77 pF 2 μF | Cer Cer Cer Mica Cer | 25 V 200 V 100 V 100 V 50 V | +80%-20% 10% +80%-20% 1% |
| C419 C426 C427 C441 C443 | 281-0516-00 283-0080-00 283-0080-00 281-0518-00 290-0263-00 | | 39 pF $0.022~\mu\text{F}$ $0.022~\mu\text{F}$ $47~\text{pF}$ $2.7~\mu\text{F}$ | Cer Cer Cer Cer Elect. | 500 V 25 V 25 V 500 V 15 V | 10% +80%-20% +80%-20% |
| C447 C451 C457 C461 C467 | 290-0267-00 281-0513-00 290-0246-00 281-0513-00 290-0136-00 | | 1 μF 27 pF 3.3 μF 27 pF 2.2 μF | Elect. Cer Elect. Cer Elect. | 35 V 500 V 15 V 500 V 20 V | 10% |
| C469 | 281-0525-00 | | 470 pF | Cer | 500 V | |
| | | Semiconductor Dev | ico Diodos | | | |
| CR303 CR305 CR323 CR347 VR401 | *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 152-0226-00 | Semiconductor Dev | Silicon Silicon Silicon Silicon Zener | Rep Rep Rep | laceable by laceable by laceable by laceable by 751A 400 m | 1N4152 1N4152 |
| CR421 CR422 CR423 CR424 CR430 | *152-0185-00 *152-0185-00 *152-0185-00 *152-0185-00 152-0140-01 | | Silicon Silicon Silicon Silicon Tunnel | Rep Rep Rep | laceable by laceable by laceable by laceable by 5, 10 mA | 1N4152 1N4152 |
| CR442 CR455 CR470 CR475 | *152-0185-00 *152-0185-00 152-0140-00 152-0140-00 | | Silicon Silicon Tunnel Tunnel | Repl 8 pF | aceable by aceable by , 10 mA , 10 mA | |

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| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | | Description | |
|--------------------------------------|--|-------------------------------|---|--|----------------------|
| | | Induct | ors | | |
| L431 L432 | *108-0420-00 276-0507-00 | | 60 nH Core, ferra | mic suppressor | |
| | | Transis | tors | | |
| Q308 | 151-1011-00 | | Silicon | FET, N channel, junction type, dual | |
| Q312 Q316 Q342 Q344 | 151-0221-00 151-0223-00 *151-0192-00 *151-0192-00 | | Silicon Silicon Silicon Silicon | PNP TO-18 2N4258 NPN TO-18 2N4275 Replaceable by MPS 6521 Replaceable by MPS 6521 | |
| Q352 Q354 Q358 Q362 Q364 | 151-0221-00 151-0221-00 151-0223-00 151-0207-00 151-0207-00 | | Silicon Silicon Silicon Silicon Silicon | PNP TO-18 2N4258 PNP TO-18 2N4258 NPN TO-18 2N4275 NPN TO-98 2N3415 NPN TO-98 2N3415 | |
| Q366 Q402 Q404 Q408 Q416 | 151-0207-00 151-0223-00 151-0223-00 151-0207-00 151-0221-00 | | Silicon Silicon Silicon Silicon | NPN TO-98 2N3415 NPN TO-18 2N4275 NPN TO-18 2N4275 NPN TO-98 2N3415 PNP TO-18 2N4258 | |
| Q418 Q428 Q434 Q442 Q448 | 151-0221-00 151-0207-00 *151-0259-00 151-0223-00 151-0223-00 | | Silicon Silicon Silicon Silicon Silicon | PNP TO-18 2N4258 NPN TO-98 2N3415 NPN TO-106 Selected from 2 NPN TO-18 2N4275 NPN TO-18 2N4275 | N3563 |
| Q454 Q466 | 151-0223-00 151-0223-00 | | Silicon Silicon | NPN TO-18 2N4275 NPN TO-18 2N4275 | |
| | | Resista | ors | | |
| Resistors are fi | xed, composition, \pm | 10% unless otherwise indicate | ed. | | |
| R301 R302 R303 R304 R305 | 317-0221-00 321-0452-00 317-0562-00 317-0202-00 317-0682-00 | | 220 Ω 499 kΩ 5.6 kΩ 2 kΩ 6.8 kΩ | 1/ ₈ W 1/ ₈ W Prec 1/ ₈ W 1/ ₈ W 1/ ₈ W | 5% 1% 5% 5% |
| R308 R309 R312 R313 R314 | 317-0511-00 317-0101-00 315-0102-00 315-0202-00 315-0510-00 | | 510 Ω 100 Ω 1 kΩ 2 kΩ 51 Ω | 1/8 W 1/8 W 1/4 W 1/4 W 1/4 W | 5% 5% 5% 5% |

| Ckt. No. | Tektronix Part No. | Serial/Model Eff | No. Disc | | Descrip | tion | |
|--------------------------------------|---|---------------------|---------------|---|---|--------------------------------------|----------------------------|
| | | | Resistors (co | nt) | | | |
| R316 R317 R319 R321 R323 | 315-0751-00 315-0820-00 315-0510-00 315-0392-00 315-0183-00 | | 8 5 3 | 50 Ω 2 Ω i1 Ω .9 kΩ 8 kΩ | 1/4 W 1/4 W 1/4 W 1/4 W 1/4 W | | 5% 5% 5% 5% |
| R330 R331 R332 R333 R336 | 311-0634-00 321-0199-00 321-0239-00 315-0510-00 321-0072-00 | | 1 3 5 | 00 Ω, Var .15 kΩ .01 kΩ 1 Ω 4.9 Ω | 1/8 W 1/8 W 1/4 W 1/8 W | Prec Prec | 1% 1% 5% 1% |
| R337 R339 R341 R342 R343 | 321-0072-00 322-0212-00 321-0113-00 321-0113-00 322-0195-00 | | 1 1 1 | 4.9 Ω .58 kΩ 47 Ω 47 Ω .05 kΩ | 1/8 W 1/4 W 1/8 W 1/8 W | Prec Prec Prec Prec Prec | 1% 1% 1% 1% |
| R344 R345 R346 R347 R348 | 321-0113-00 321-0113-00 322-0195-00 321-0314-00 321-0199-00 | | 1 1 1 | 47 Ω 47 Ω .05 kΩ 8.2 kΩ .15 kΩ | 1/ ₈ W 1/ ₈ W 1/ ₄ W 1/ ₈ W 1/ ₈ W | Prec Prec Prec Prec Prec | 1% 1% 1% 1% 1% |
| R349 R350 R351 R353 R354 | 321-0228-00 311-0522-00 322-0175-00 322-0239-00 322-0172-00 | | 1 6 3 | 2.32 kΩ 00 Ω, Var 49 Ω 6.01 kΩ 04 Ω | 1/8 W 1/4 W 1/4 W 1/4 W | Prec Prec Prec Prec | 1% 1% 1% 1% |
| R355 R357 R358 R359 R361 | 321-0211-00 315-0101-00 323-0197-00 315-0510-00 317-0303-00 | | 1 1 5 | .54 kΩ 00 Ω .1 kΩ 11 Ω 0 kΩ | 1/8 W 1/4 W 1/2 W 1/4 W 1/8 W | Prec Prec | 1% 5% 1% 5% 5% |
| R363 R364 R366 R369 R401 | 317-0303-00 315-0222-00 317-0103-00 317-0270-00 315-0101-00 | | 2 1 2 | 30 kΩ .2 kΩ 0 kΩ 7 Ω 00 Ω | 1/8 W 1/4 W 1/8 W 1/8 W 1/4 W | | 5% 5% 5% 5% 5% |
| R402 R403 R404 R406 R407 | 317-0150-00 315-0101-00 317-0150-00 315-0203-00 315-0102-00 | | 1 1 2 | 5 Ω 00 Ω 5 Ω 0 kΩ kΩ | 1/8 W 1/4 W 1/8 W 1/4 W 1/4 W | | 5% 5% 5% 5% 5% |

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | Description | |
|--------------------------------------|---|---|---|--|
| | | Resistors (cont) | | |
| R408 R410 R411 R412 R414 | 315-0162-00 311-0607-00 315-0203-00 315-0123-00 315-0222-00 | $1.6~{ m k}\Omega$ $10~{ m k}\Omega$, Var $20~{ m k}\Omega$ $12~{ m k}\Omega$ $2.2~{ m k}\Omega$ | 1/ ₄ W 5% | |
| R416 | 321-0193-00 | 1 kΩ | 1/8 W Prec 1 % 1/8 W Prec 1 % 1/8 W 5 % 1/4 W 5 % 1/4 W 5 % 5 % 5 % | |
| R418 | 321-0193-00 | 1 kΩ | | |
| R419 | 317-0300-00 | 30 Ω | | |
| R426 | 315-0622-00 | 6.2 kΩ | | |
| R427 | 315-0622-00 | 6.2 kΩ | | |
| R428 | 317-0302-00 | 3 kΩ | 1/8 W 5% 1/8 W 5% 1/4 W 5% 1/4 W 5% 1/4 W 5% | |
| R431 | 317-0360-00 | 36 Ω | | |
| R432 | 315-0101-00 | 100 Ω | | |
| R433 | 315-0202-00 | 2 kΩ | | |
| R434 | 315-0331-00 | 330 Ω | | |
| R436 | 315-0202-00 | 2 kΩ | 1/4 W 5% 1/8 W 5% | |
| R41 | 317-0301-00 | 300 Ω | | |
| R442 | 317-0303-00 | 30 kΩ | | |
| R444 | 317-0183-00 | 18 kΩ | | |
| R445 | 317-0131-00 | 130 Ω | | |
| R447 | 315-0101-00 | 100 Ω | 1/4 W 5% 1/4 W 5% 1/8 W 5% 1/4 W 5% 1/8 W 5% | |
| R448 | 315-0152-00 | 1.5 kΩ | | |
| R451 | 317-0470-00 | 47 Ω | | |
| R453 | 315-0471-00 | 470 Ω | | |
| R454 | 317-0202-00 | 2 kΩ | | |
| R455 | 311-0634-00 | 500 Ω, Var | 1/8 W Prec 1 % 1/4 W 5 % 1/8 W 5 % 1/8 W 5 % | |
| R456 | 321-0204-00 | 1.3 kΩ | | |
| R457 | 315-0101-00 | 100 Ω | | |
| R461 | 317-0470-00 | 47 Ω | | |
| R462 | 317-0470-00 | 47 Ω | | |
| R463 R464 R465 R466 R467 | 317-0202-00 315-0471-00 311-0634-00 315-0821-00 315-0201-00 | 2 kΩ 470 Ω 500 Ω, Var 820 Ω 200 Ω | 1/8 W 5% 1/4 W 5% 1/4 W 5% 1/4 W 5% | |
| R469 | 315-0391-00 | 390 Ω | 1/ ₄ W 5% | |
| R472 | 317-0201-00 | 200 Ω | 1/ ₈ W 5% | |
| R474 | 317-0470-00 | 47 Ω | 1/ ₈ W 5% | |
| Integrated Circuit | | | | |
| U330 | *155-0022-00 | Monolithic | | |

DELAYED TRIGGER SWITCH Circuit Board Assembly

| Ckt. No. | Tektronix Part No. | Serial/Model Eff | No. Disc | | Descript | ion | |
|-------------------------|--|---------------------|---------------|-------------------------------------|--|----------------------|----------|
| | *670-1225-00 | | | Complete | Board | | |
| | | | Bulb | s | | | |
| DS16 DS17 DS18 | *150-0048-01 *150-0048-01 *150-0048-01 | | | Incandescent, | , #683, selected , #683, selected , #683, selected | | |
| | | | Capac | itor | | | |
| Tolerance : | ±20% unless otherwise | indicated. | | | | | |
| C53 | 283-0068-00 | | | 0.01 μF | Cer | 500 V | |
| | | | Resista | ors | | | |
| Resistors ar | e fixed, composition, \pm | 10% unless otherw | vise indicate | ed. | | | |
| R53 R56 | 317-0101-00 317-0101-00 | | | 100 Ω 100 Ω | ¹/ ₈ W ¹/ ₈ W | | 5% 5% |
| | | | Switch | nes | | | |
| 61 () | Wired or Unwired | | | | cı o | .Dr | |
| \$16 \$17 \$18 | 260-1133-00 | · | | Push-push | | UPLING JRCE | |
| | | DEADOUT | Cirrents I | | .LL. | | |
| | */70.100/.00 | READOUT | Circuit | Board Assen | _ | | |
| | *670-1226-00 | | | Complete | Boara | | |
| | | Semico | nductor D | evice, Diodes | | | |
| CR202 CR203 | *152-0075-00 *152-0075-00 | | | Germanium Germanium | Tek Tek | Spec Spec | |
| CR204 CR205 CR206 | *152-0075-00 *152-0075-00 *152-0075-00 | | | Germanium Germanium Germanium | Tek Tek | Spec Spec Spec | |
| - | | | | | | 1 * | |

READOUT Circuit Board Assembly (cont)

| Ckt. No. | Tektronix Part No. | Serial/Model No. Eff Disc | | Description | |
|----------|-----------------------|------------------------------|-----------------|-------------|--|
| | | Semiconductor Device | , Diodes (cont) | | |
| CR207 | *152-0075-00 | | Germanium | Tek Spec | |
| CR208 | *152-0075-00 | | Germanium | Tek Spec | |
| CR218 | *152-0075-00 | | Germanium | Tek Spec | |
| CR219 | *152-0075-00 | | Germanium | Tek Spec | |
| CR220 | *152-0075-00 | | Germanium | Tek Spec | |
| CR221 | *152-0075-00 | | Germanium | Tek Spec | |
| CR222 | *152-0075-00 | | Germanium | Tek Spec | |
| CR223 | *152-0075-00 | | Germanium | Tek Spec | |
| CR224 | *152-0075-00 | | Germanium | Tek Spec | |

INTERFACE READOUT Circuit Board Assembly

*672-0411-00

Complete Board

Resistor

Resistors are fixed, composition, $\pm 10\%$ unless otherwise indicated.

R1110

311-1017-01

20 kΩ, Var

Switches

| | Wired or Unwired | | |
|--------------------|------------------|---------------|---------------|
| S10A ¹¹ | *672-0411-00 | Cam | TIME/DIV |
| S10B ¹¹ | *672-0411-00 | Cam | DL'Y TIME |
| S11 ¹² | 311-1017-01 | Main Variable | DELAYED SWEEP |

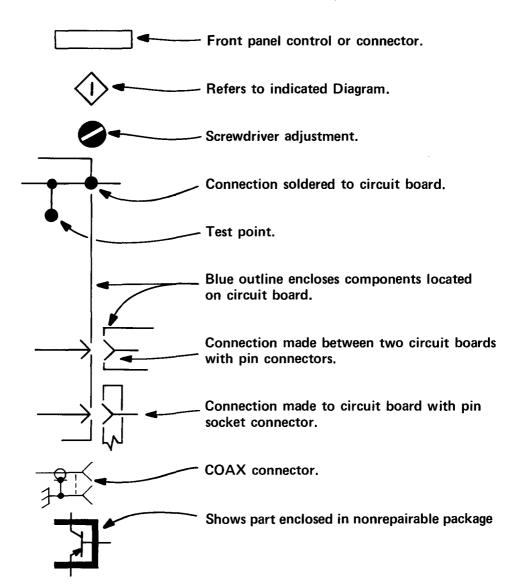
¹⁰Furnished as a unit with \$11.

¹¹See Mechanical Parts List for replacement parts.

¹²Furnished as a unit with R11.

SECTION 7 DIAGRAMS MECHANICAL and REPACKAGING PARTS ILLUSTRATIONS

The following special symbols are used in the Diagrams for this manual:



VOLTAGE AND WAVEFORM TEST CONDITIONS

Voltage measurements and waveform photographs were obtained under the following conditions unless otherwise noted on the individual diagrams.

A 7504 Oscilloscope and a Tektronix C-12 Oscilloscope camera were used to obtain the waveform photographs. The 7504 served to power the 7852 while simultaneously supplying the waveform display (with time and amplitude readout) for photographs. (Readout on photographs has been enlarged to aid in reading.)

7504 Oscilloscope

| FOCUS | Optimum |
|---------------------|------------|
| INTENSITY (both) | As desired |
| CALIBRATOR controls | As is |
| VERTICAL MODE | LEFT |
| HORIZONTAL MODE | Α |
| A TRIGGER SOURCE | RIGHT VERT |
| B TRIGGER SOURCE | RIGHT VERT |
| CONTROL ILLUM | As desired |
| READOUT | As desired |

7A13 (LEFT VERT Compartment) With 10X Probe, Test Vertical Amplifier

| +INPUT | DC (Connect 10X Probe) |
|--------|------------------------|
| -INPUT | Vc |
| | |

BW FULL
VOLTS/DIV As shown on waveform.

COMPARISON VOLTAGE As shown for centerline on waveform.

7A16 (RIGHT VERT Compartment)

| POLARITY | +UP |
|-----------|---|
| BANDWIDTH | FULL |
| AC-GND-DC | DC |
| VOLTS/DIV | 1 |
| MIDLIT | • |

INPUT Connected to 1 kHz sinewave oscillator set for a 6

division display. A General Radio Type 1310-A was used for waveform photo-

graphs.

0/+

7B51 (A HORIZ Compartment)

| TRIGGERING | | |
|------------|----------|--|
| MODE | P-P AUTO | |
| COUPLING | AC | |
| SOURCE | INT | |
| MAGNIFIER | X1 | |

LEVEL/SLOPE

TIME/DIV As shown on waveform.

B DELAY MODE INDEPENDENT

7B52 (B HORIZ Compartment)

| MAIN TRIGGERING | |
|-----------------|--------------|
| LEVEL/SLOPE | 0/+ |
| MODE | AUTO |
| COUPLING | AC |
| SOURCE | INT |
| X10 MAG | Off |
| DISPLAY MODE | MIXED |
| DL'Y TIME | .5 ms |
| DLY'D SWEEP | 50 μs |

DLY'D TRIGGERING

LEVEL OUT-Centered

SLOPE +
COUPLING AC
SOURCE INT
DELAY TIME MULT 5.00

| Voltmeter |
|-----------|
| |

| igital | Multimeter |
|--------|------------|
| į | igital |

Input Impedance 1 kM Ω on the 0-1.5 V

range.

10 $M\Omega$ on the higher

ranges.

Accuracy 0.1%

Ranges 0-1.5 V, 0-15 V, 0-150 V,

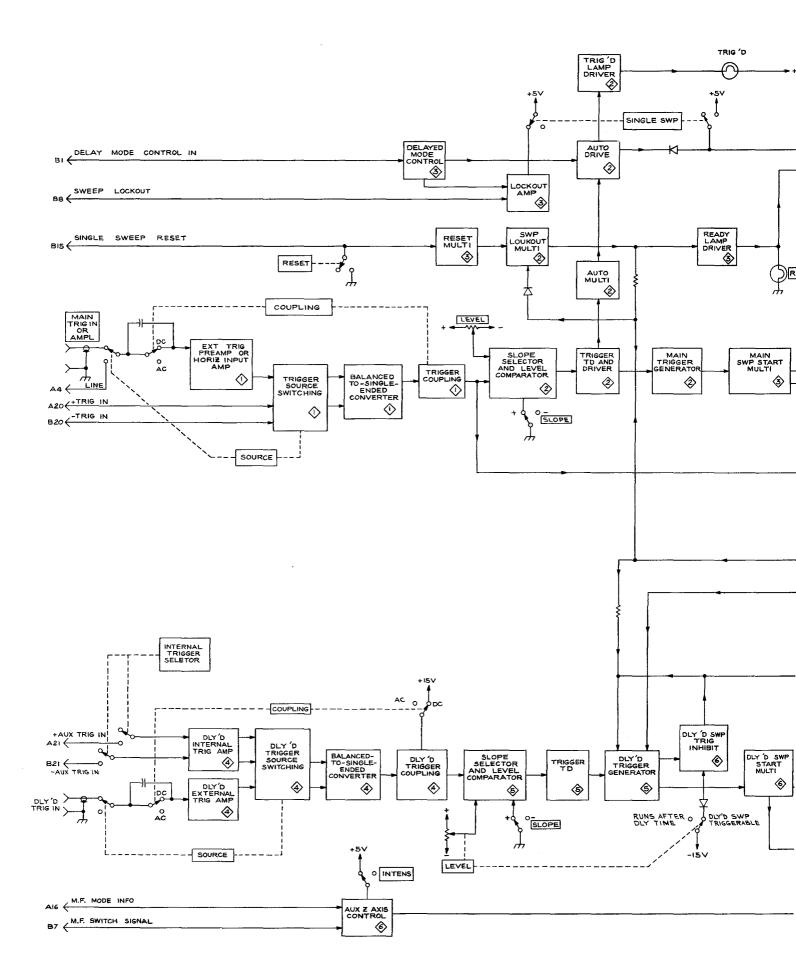
and 0-1 kV.

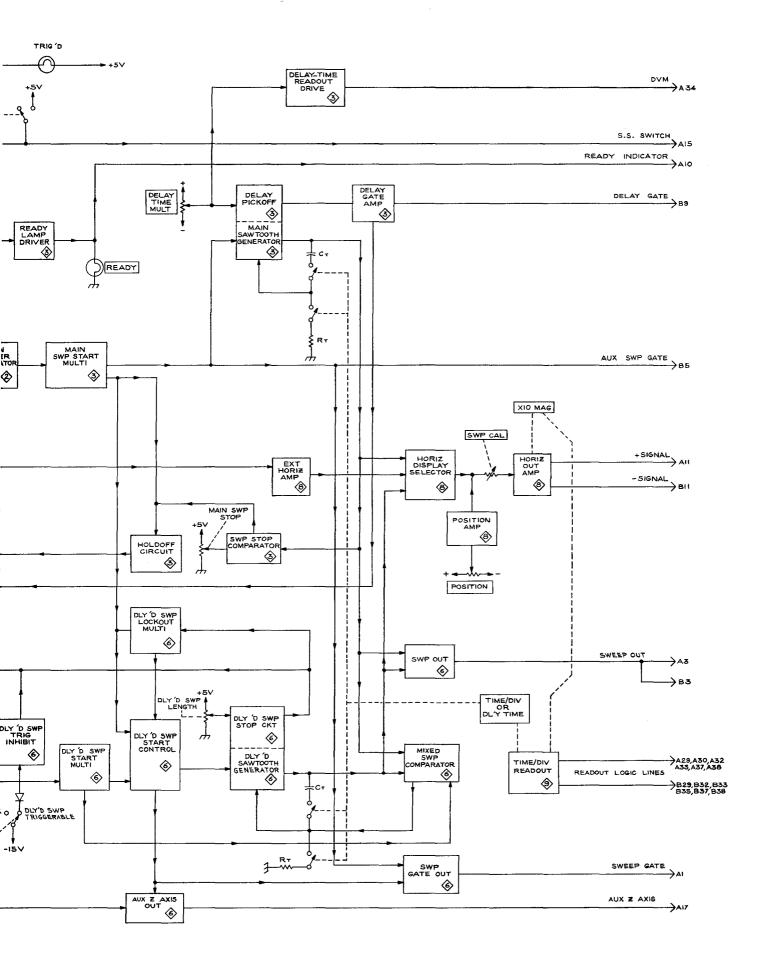
Type used for voltages Fairchild Model 7050 Digi-

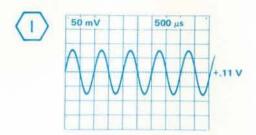
on diagrams tal Multimeter.

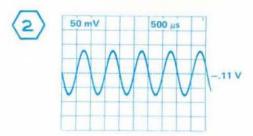
Voltages and Waveforms on the diagrams (shown in blue) are not absolute and may vary between instruments because

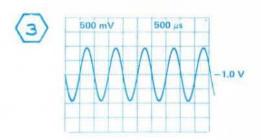
of component tolerances and internal calibration.

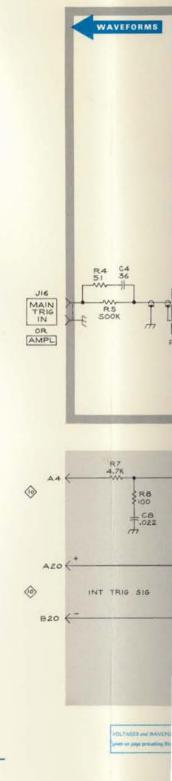




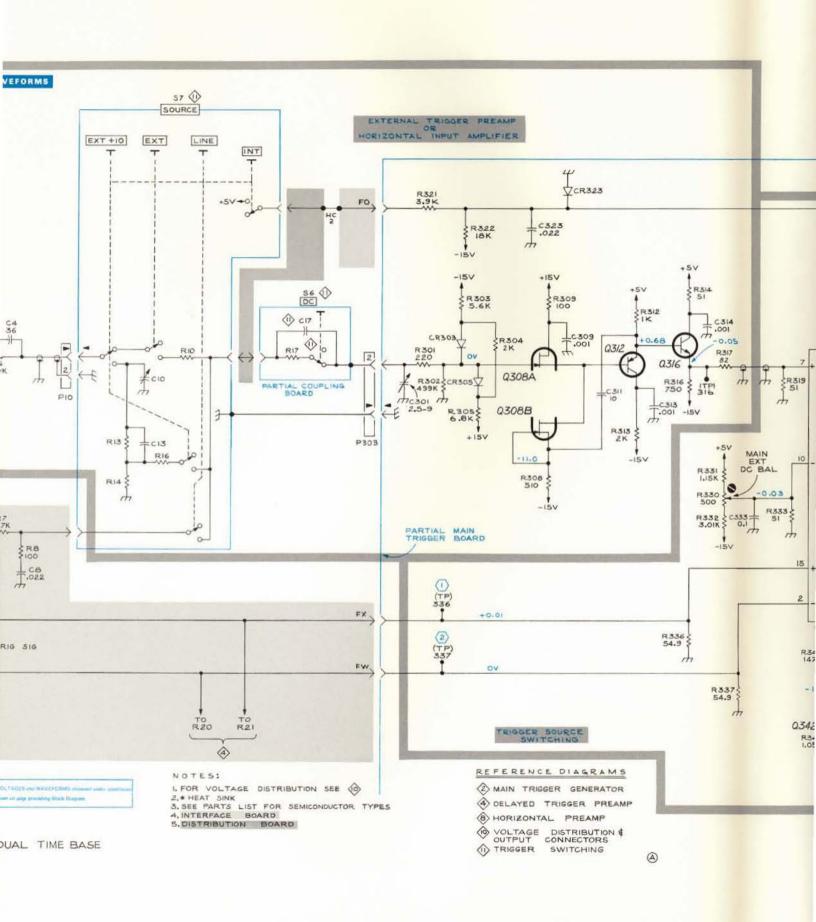


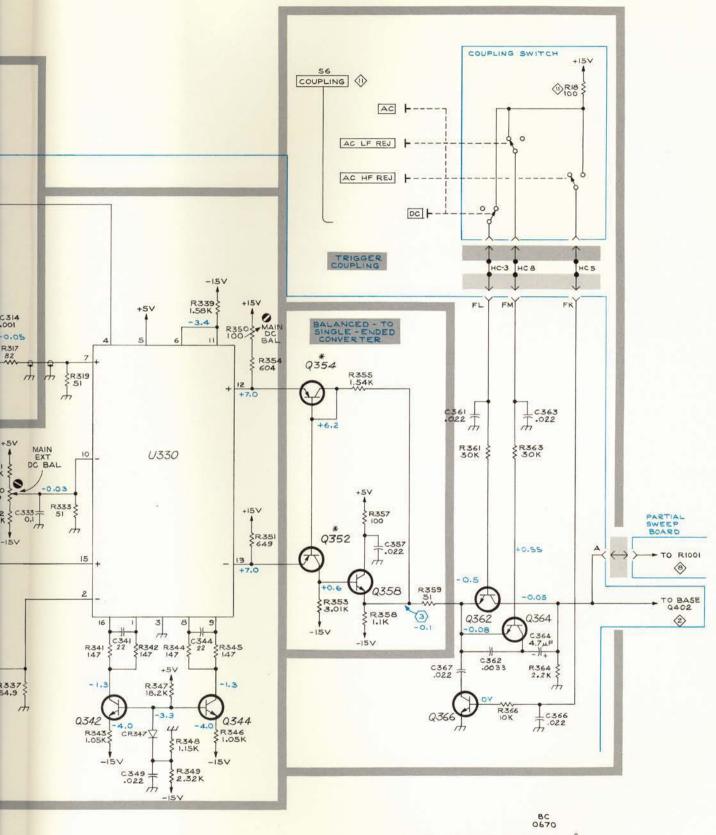




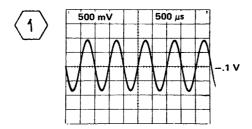


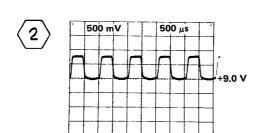
7852 DUAL TIM

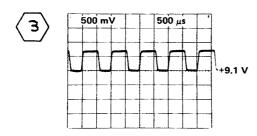


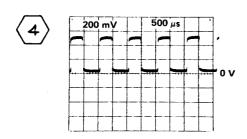


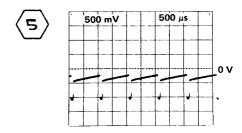
MAIN TRIGGER PREAMP

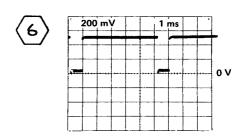


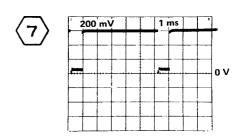


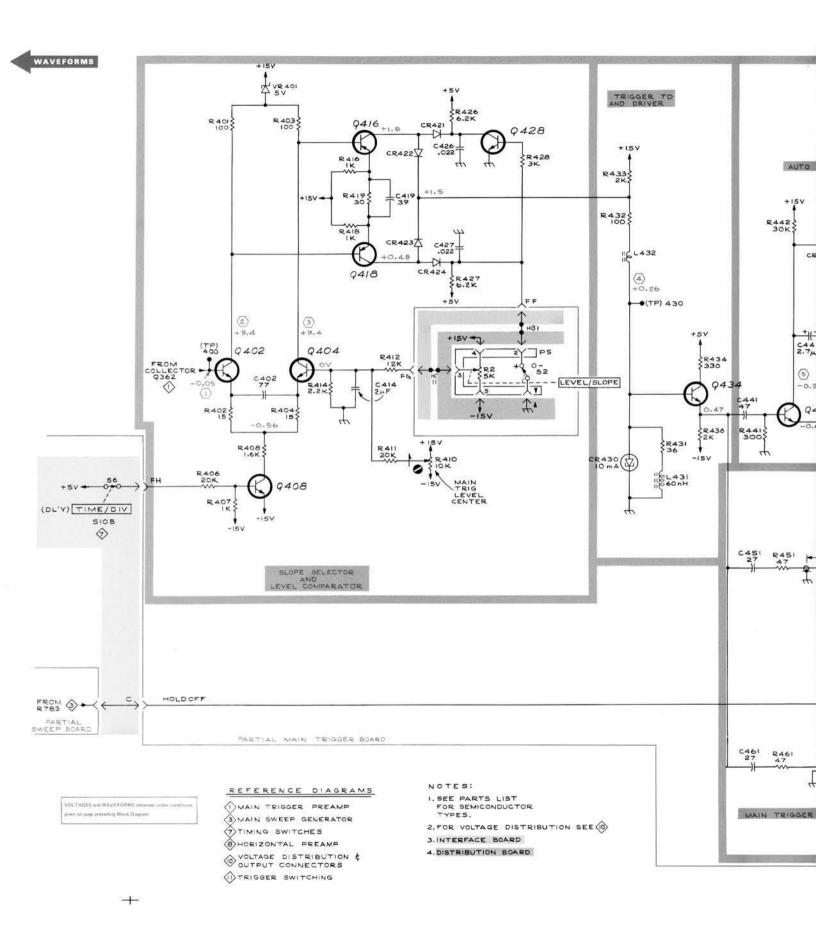


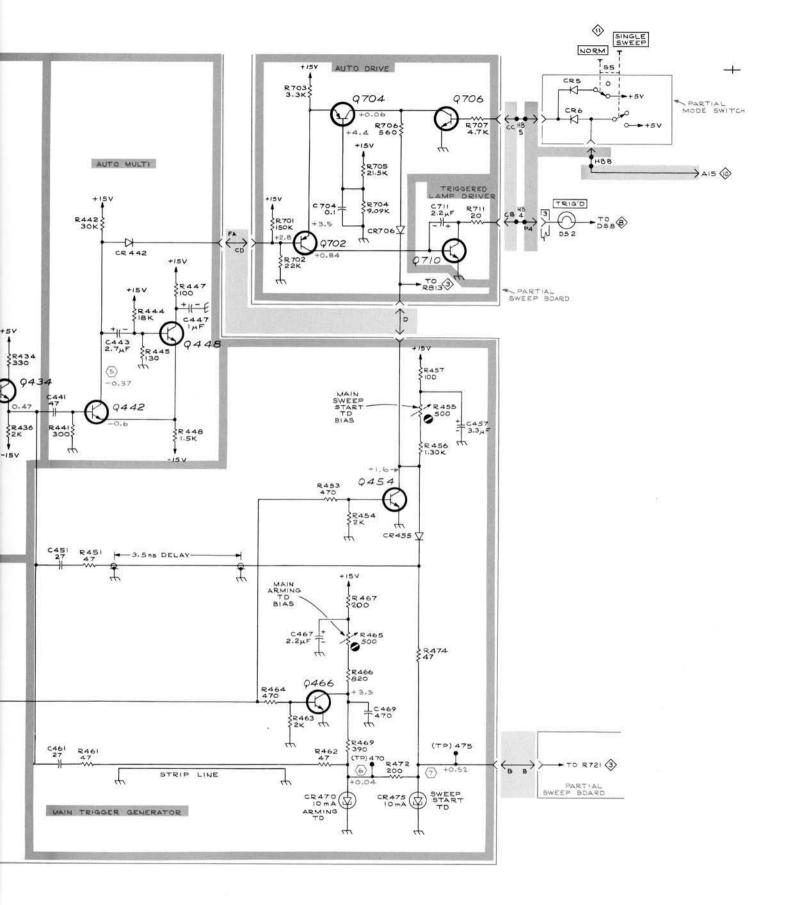




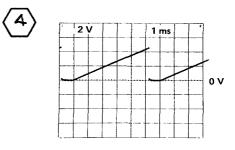


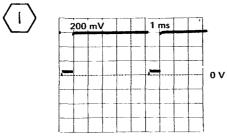


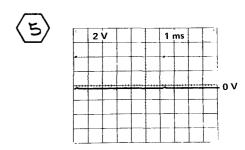


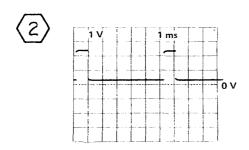


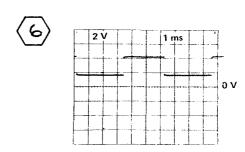


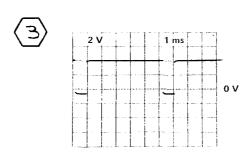


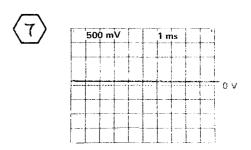


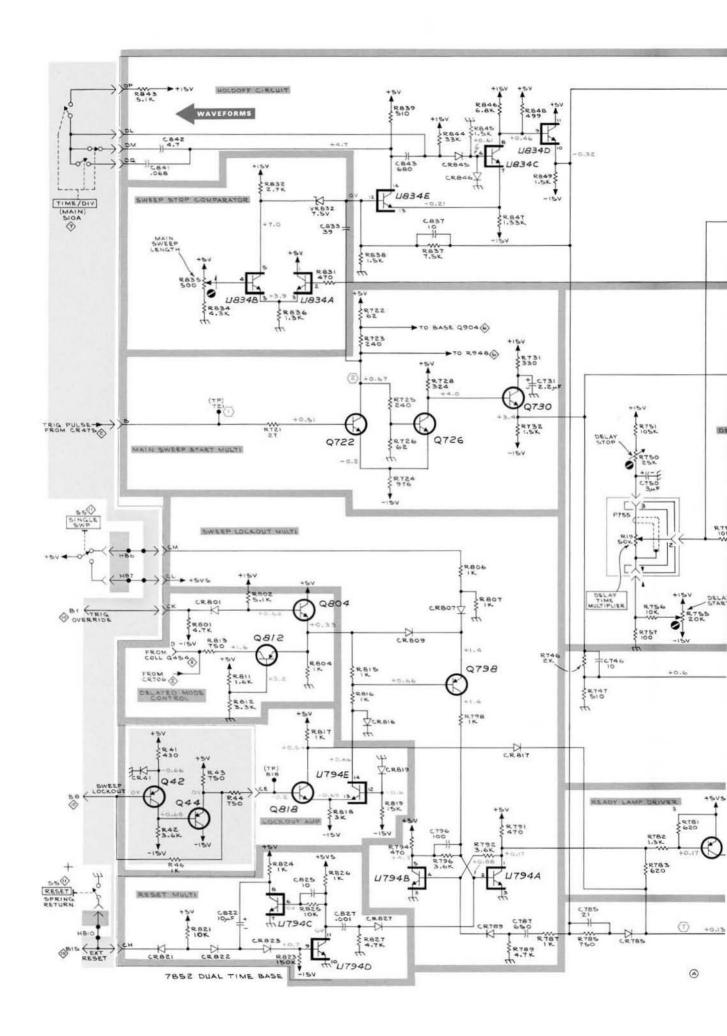




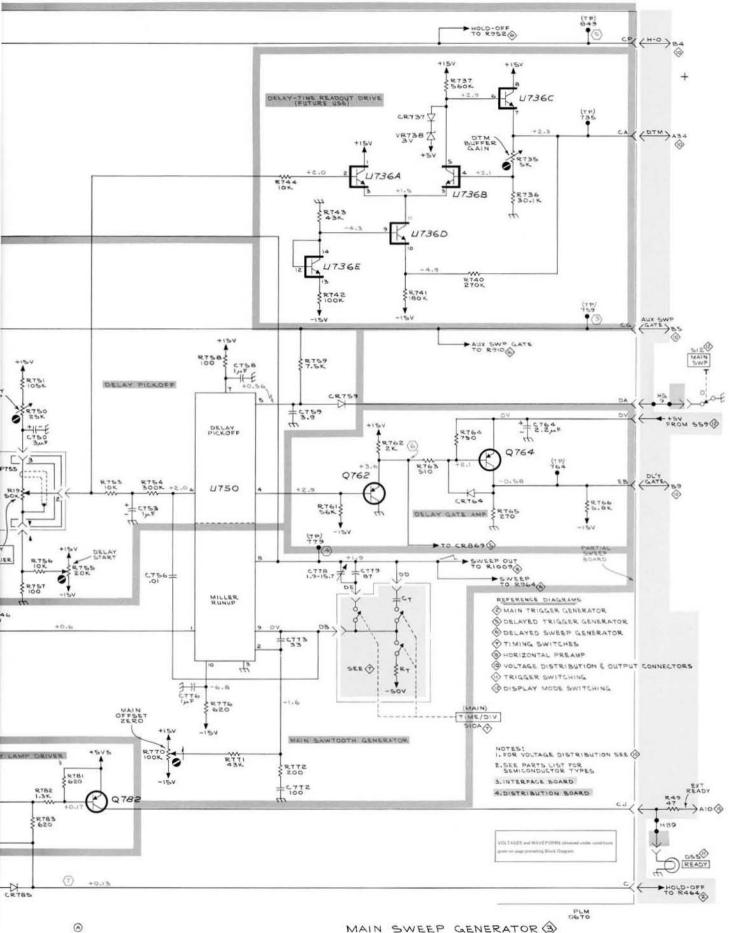


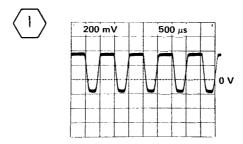


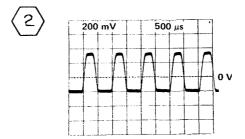


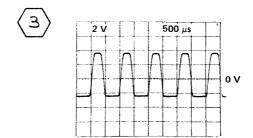


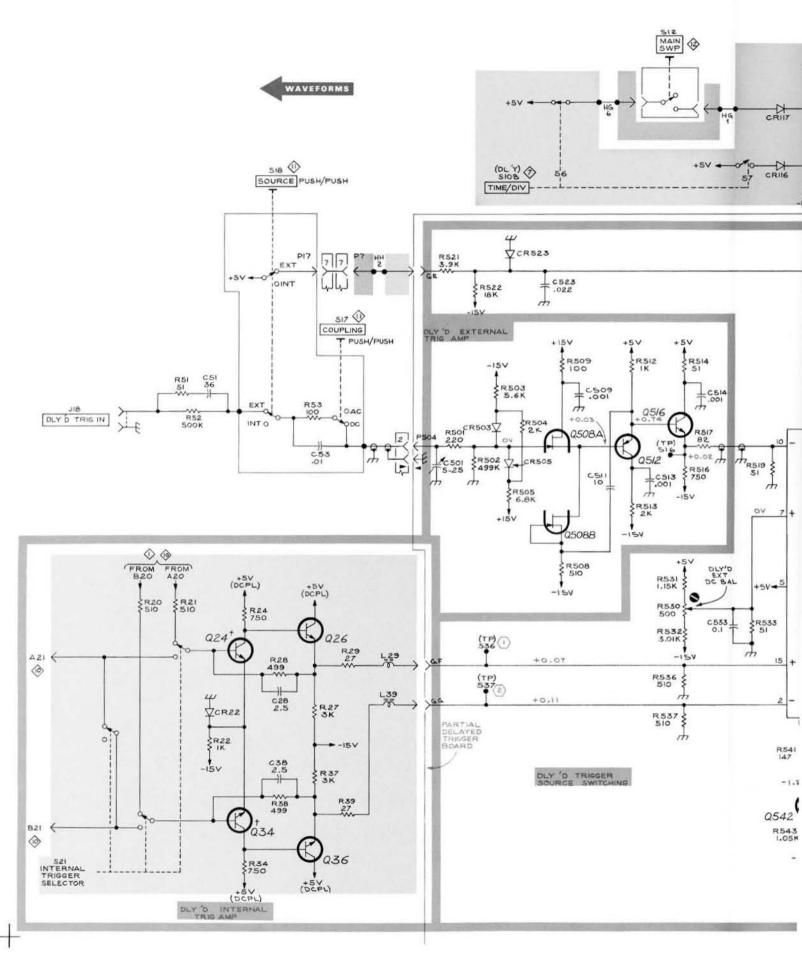


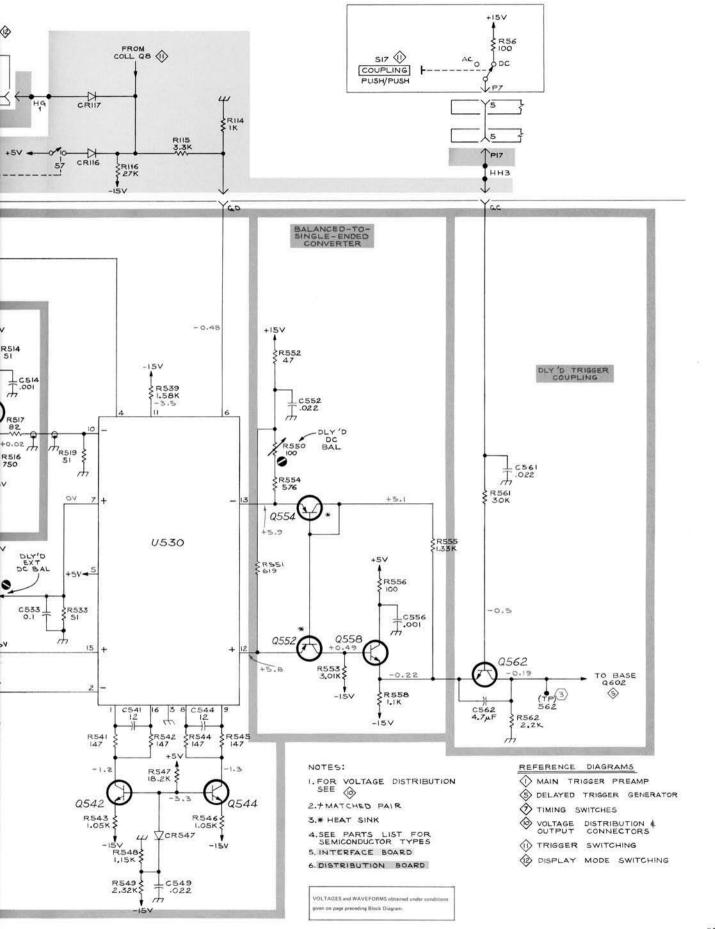


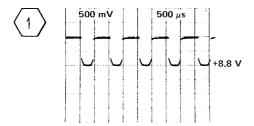


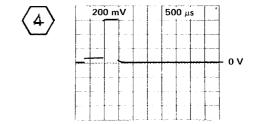


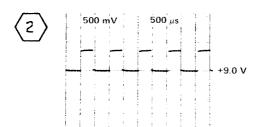


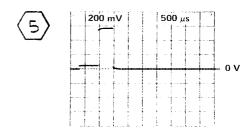


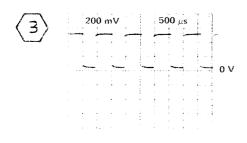


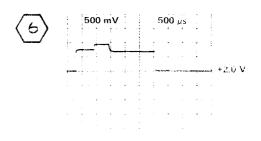


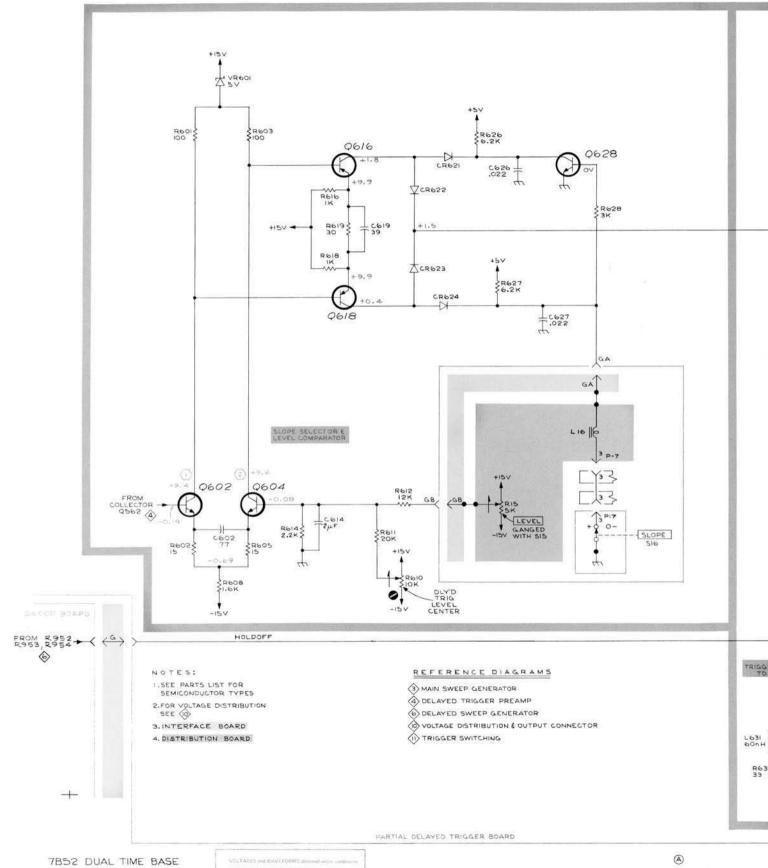






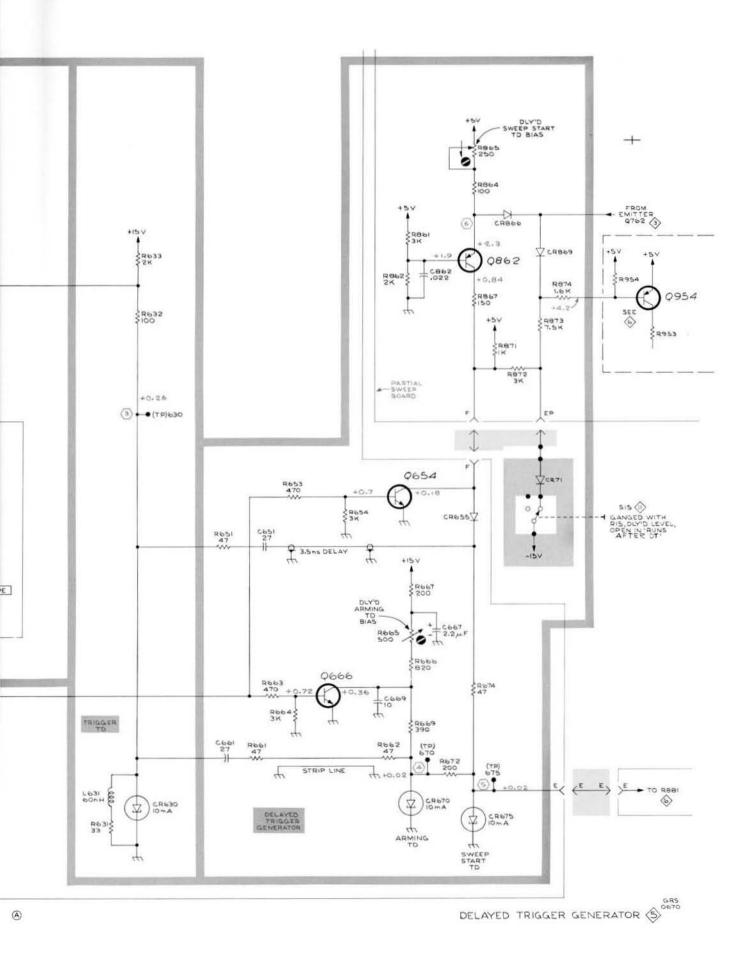


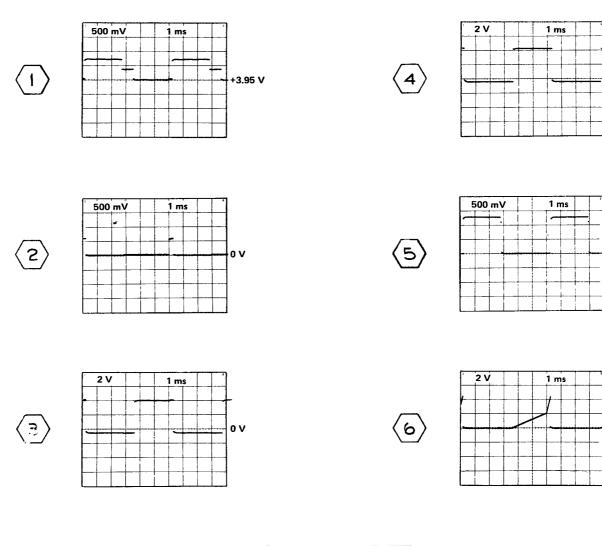




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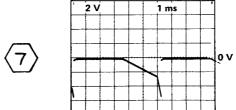


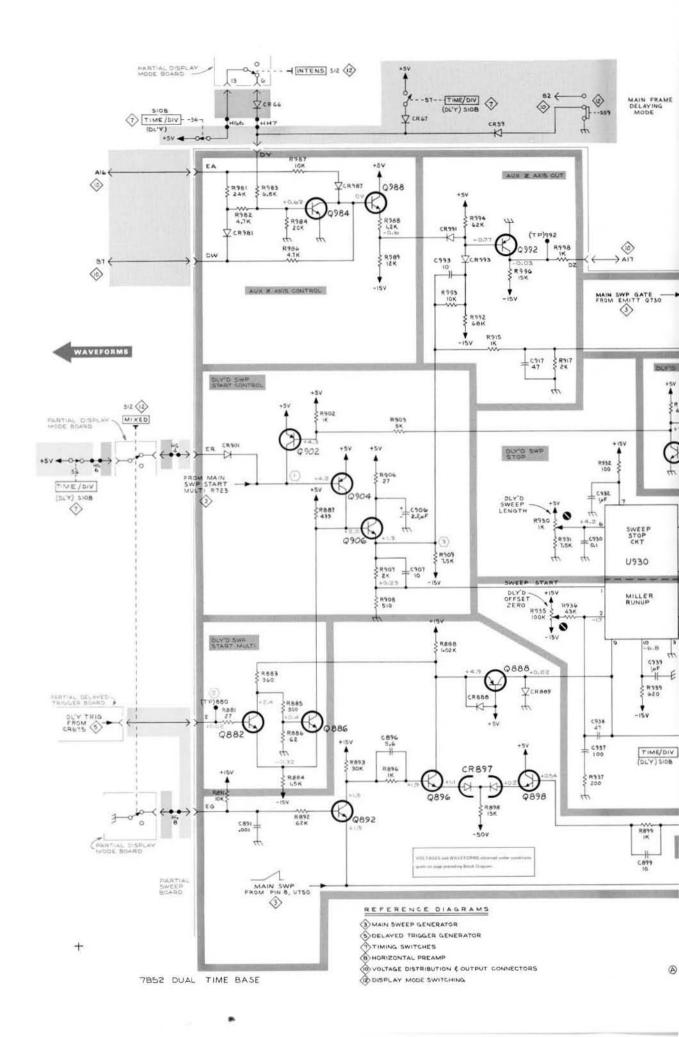


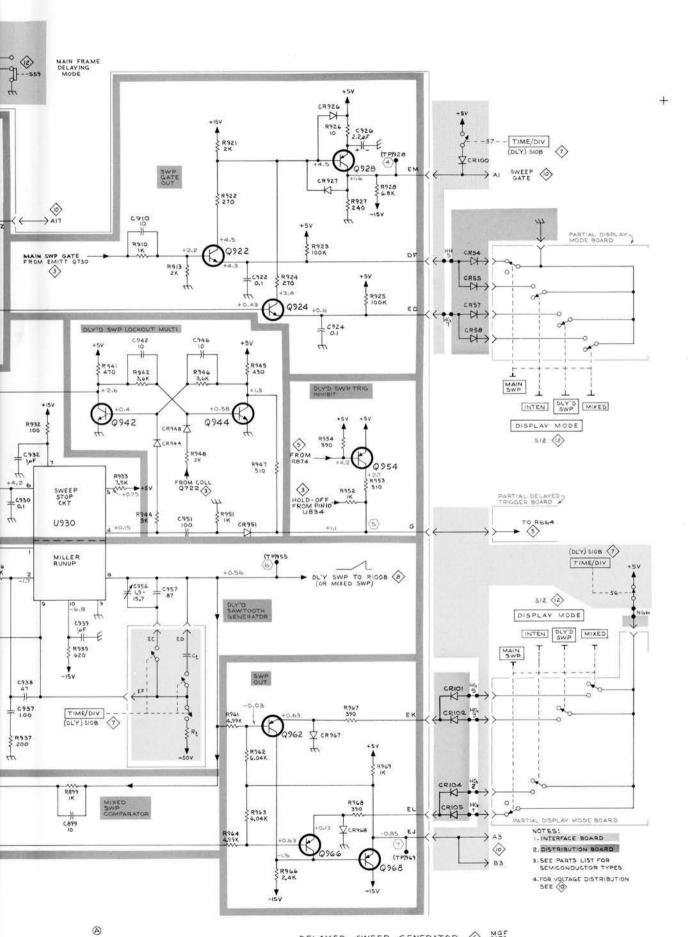
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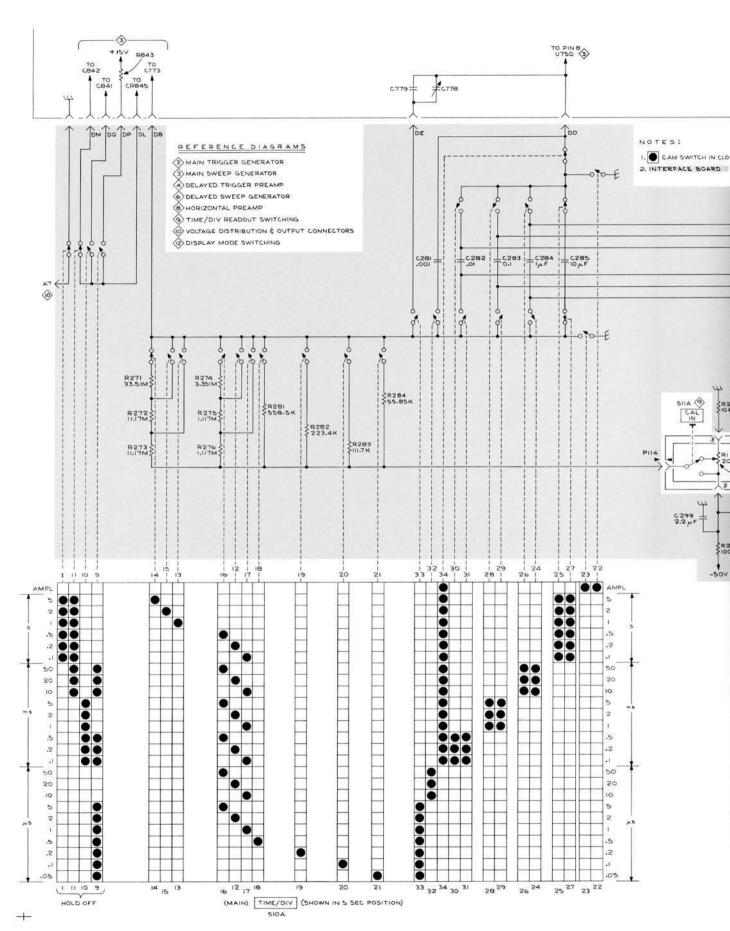
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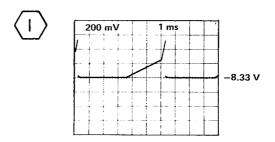


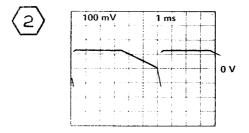


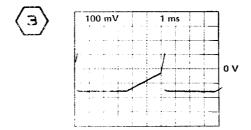


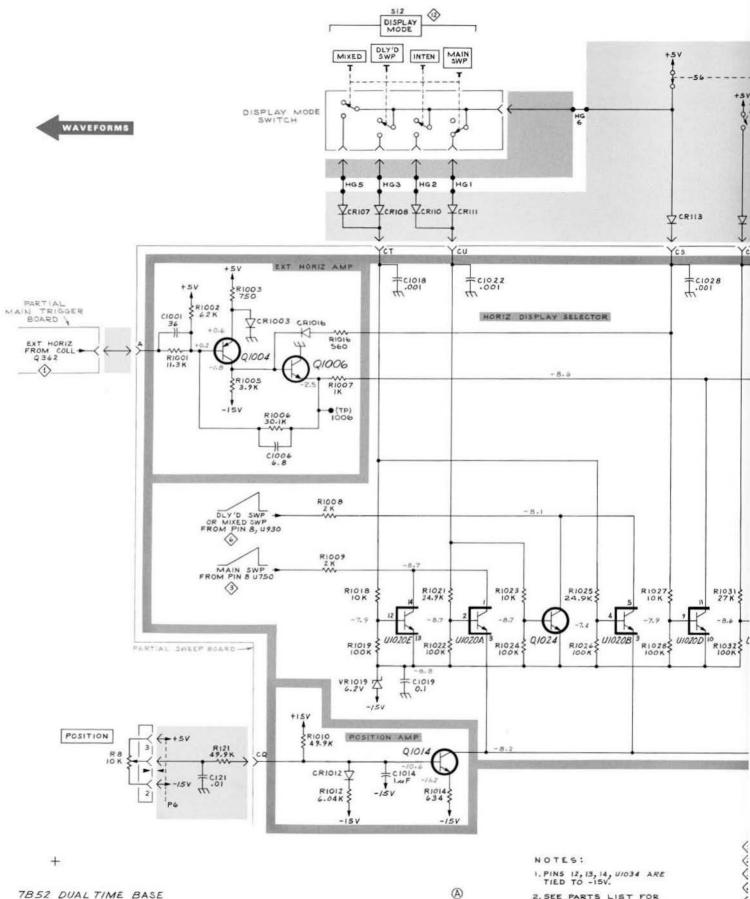












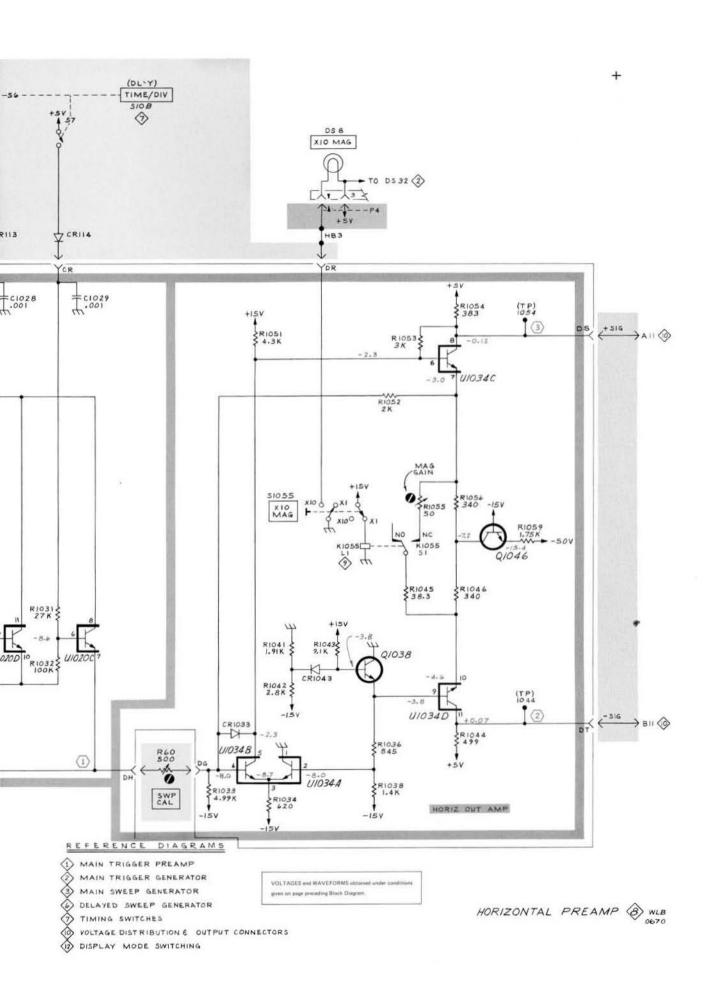
7852 DUAL TIME BASE

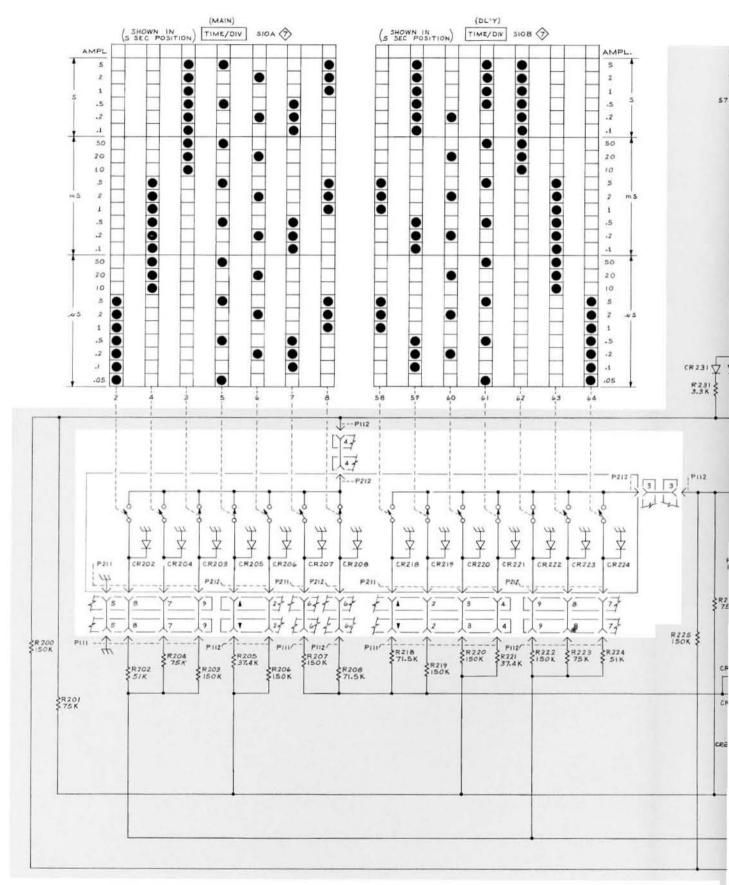
2. SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

3. INTERFACE BOARD

4. DISTRIBUTION BOARD







REFERENCE DIAGRAMS

TIMIMG SWITCH

B HORIZONTAL PREAMP

OUTPUT CONNECTORS

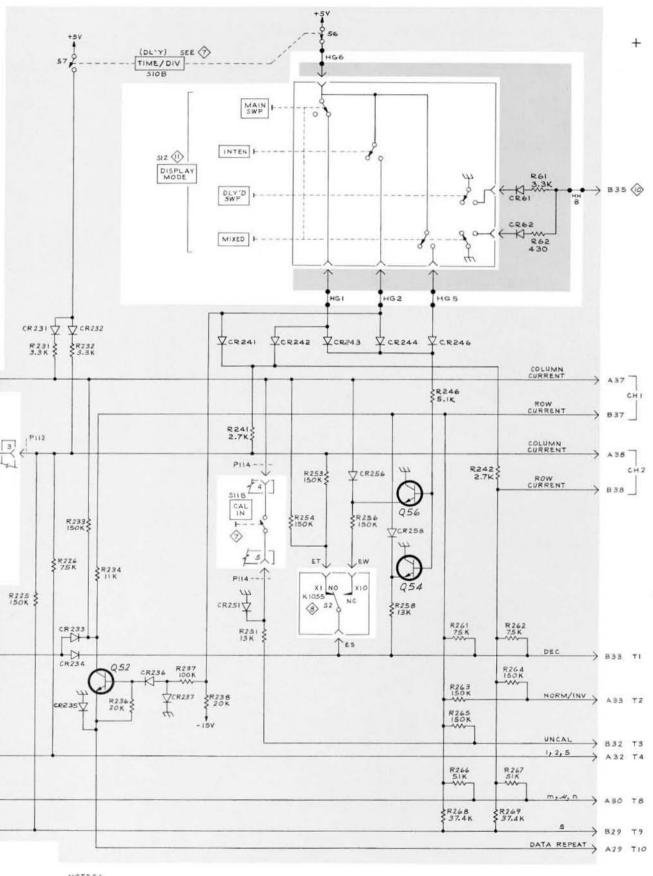
TRIGGER SWITCHING

+

7852 DUAL TIME BASE

(A)





NOTES

DENOTES CAM SWITCH IN

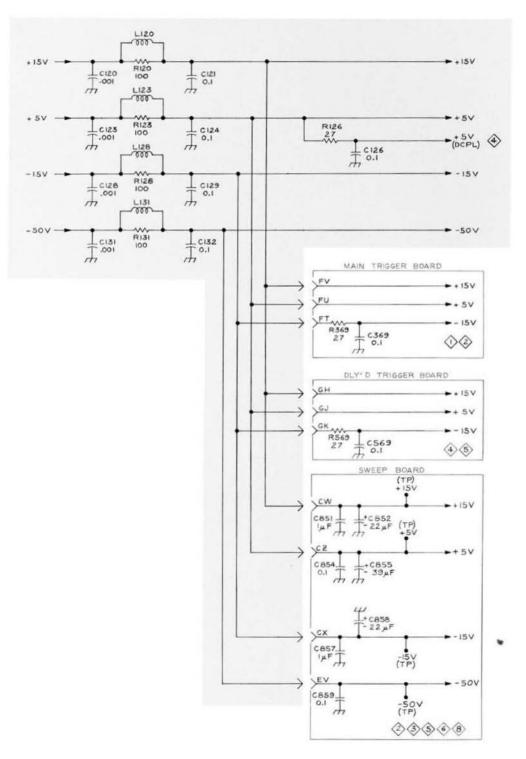
CLOSED POSITION.

SEE PARTS LIST FOR SEMICONDUCTOR
TYPES

INTERFACE BOARD

4 DISTRIBUTION BOARD

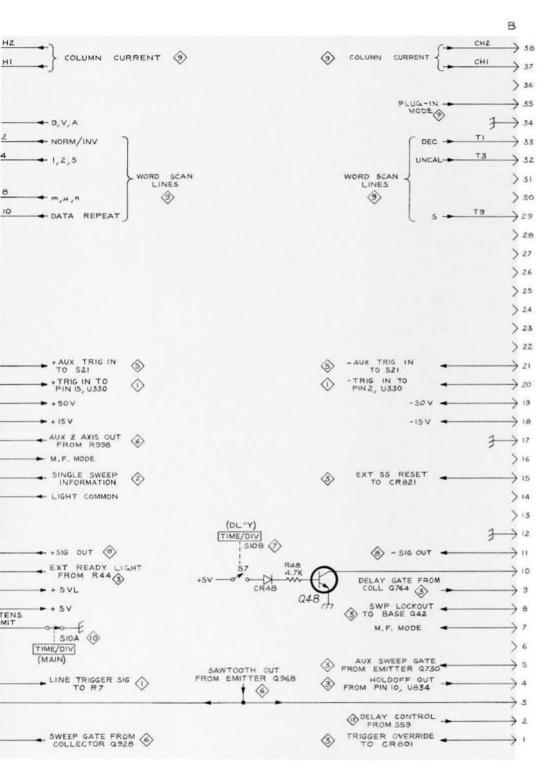
TIME/DIV READOUT SWITCHING 9 WLB



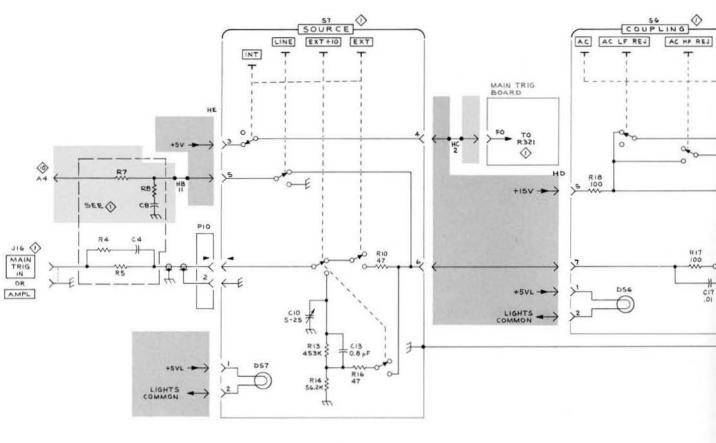
А CHZ 38 (36 (35 (32 6 31 (TB TIO 29 6 28 (27 (26 (25 (24 (23 (22 (19 6 - LIG 13 (12 4 INTENS LIMIT 6 (TIME/D (MAIN) LIN 3 4

NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES
2.INTERFACE BOARD

+



T FOR OR TYPES DARD

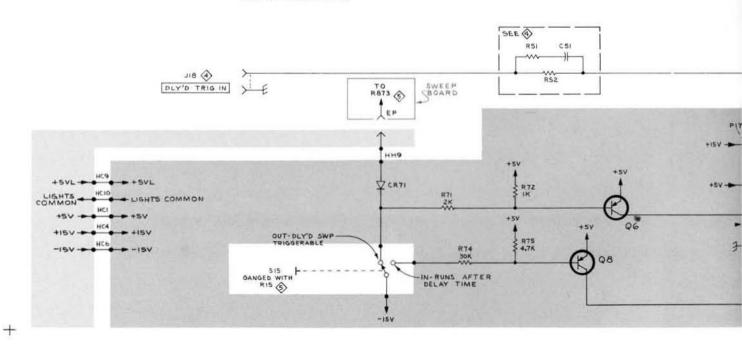


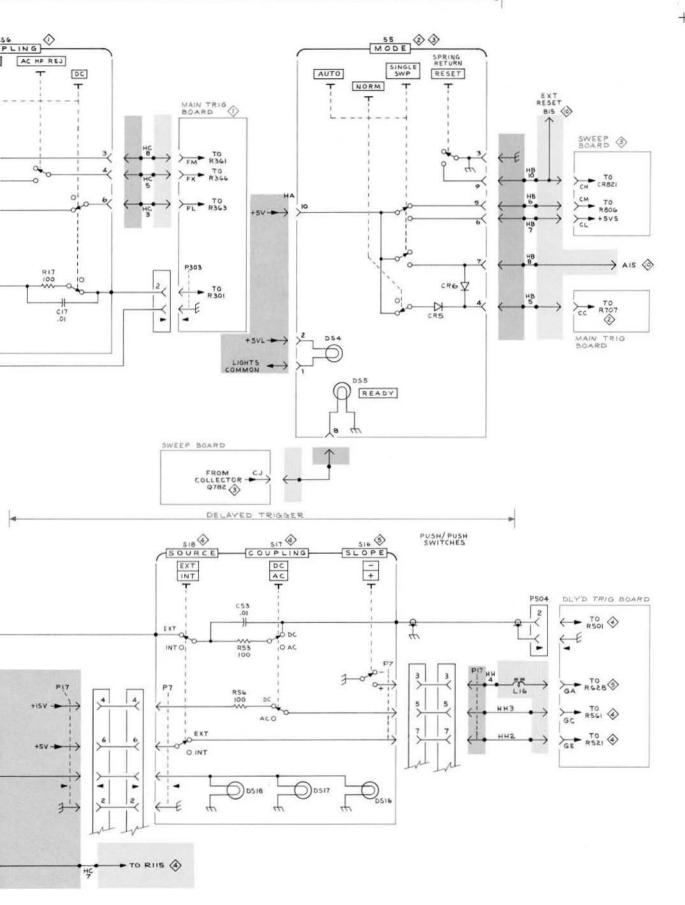
NOTES:

- . SEE PARTS LIST FOR SEMICONDUCTOR TYPES
- 2. INTERFACE BOARD
- 3. DISTRIBUTION BOARD

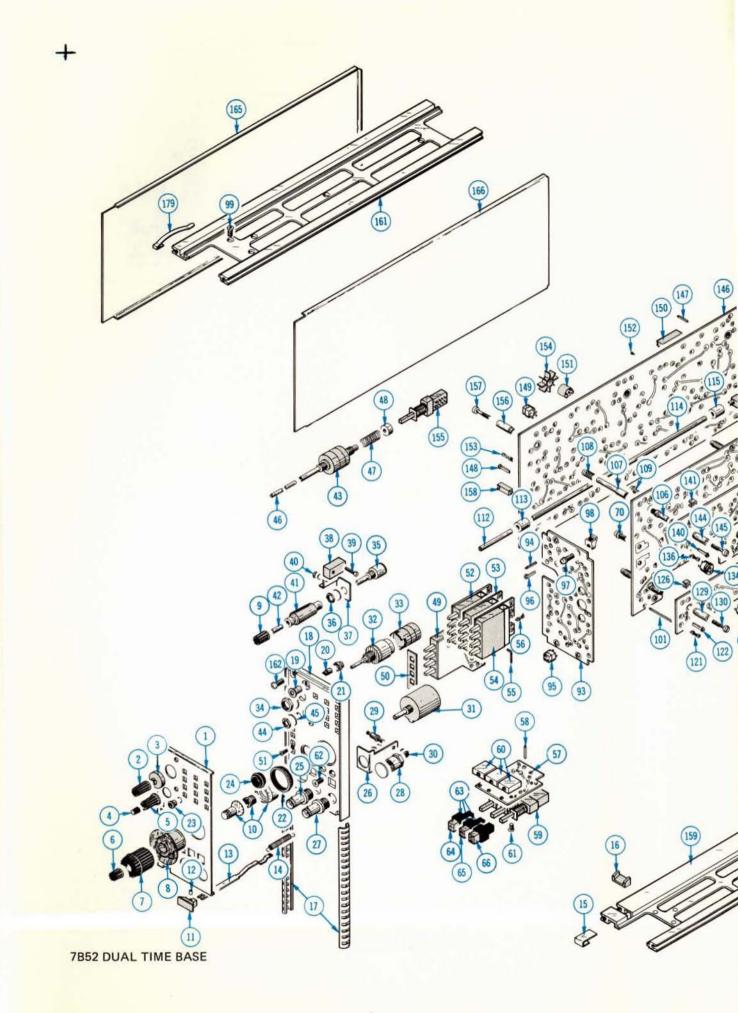
REFERENCE DIAGRAMS

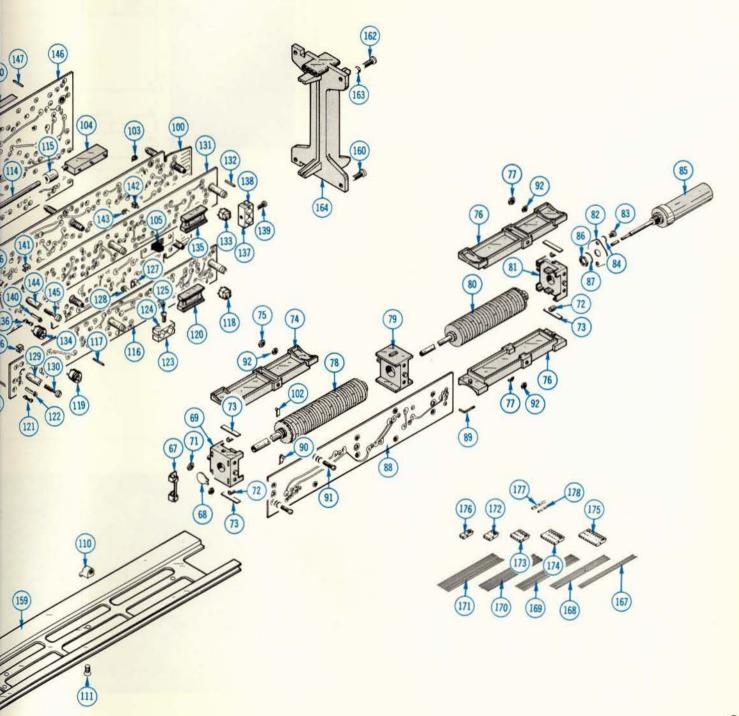
- MAIN TRIGGER PREAMP
- MAIN TRIGGER GENERATOR
- MAIN SWEEP GENERATOR
- DELAYED TRIGGER PREAMP
- S DELAYED TRIGGER GENERATOR
- OUTPUT CONNECTORS

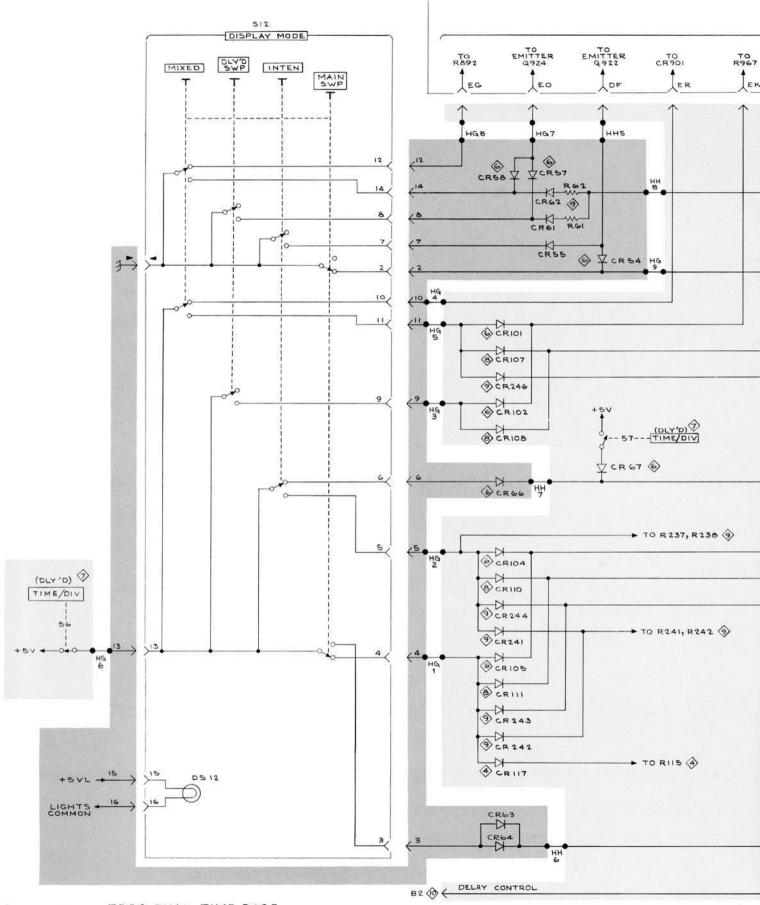


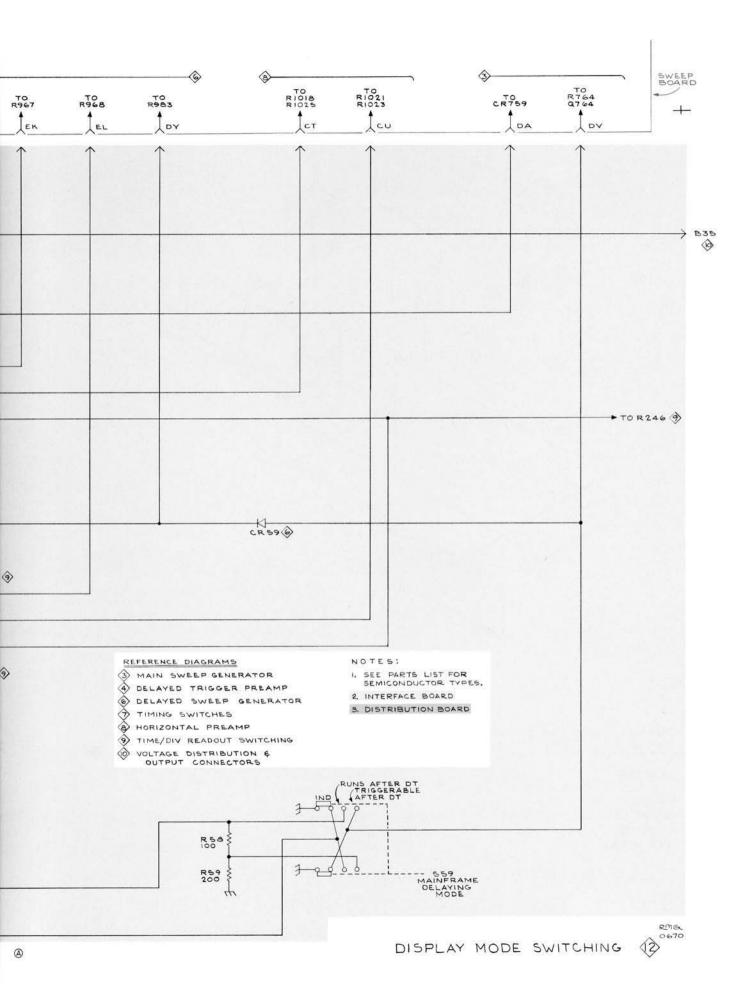


ER

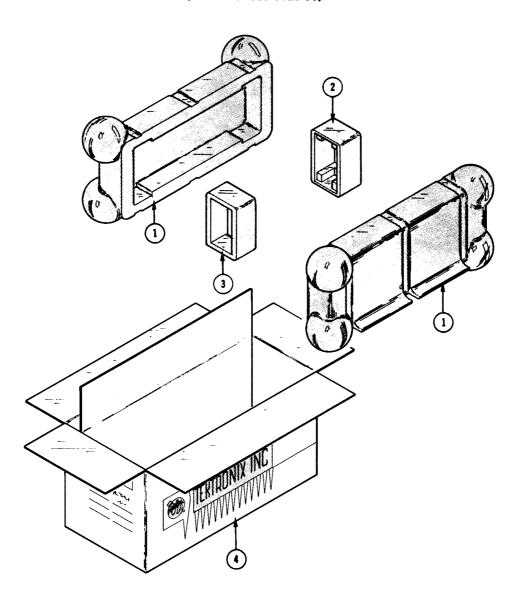








CARTON ASSEMBLY (Part No. 065-0125-00)



رھ

| | Tektronix Part No. | Serial/Model Eff | No. Disc | Q t y | 1 2 3 4 5 | Description |
|----|-----------------------|---------------------|-------------|-------------|--------------------|-------------|
| 2- | 065-0125-00 | | | 1 | ASSEMBLY, carton | |
| 2- | 003-0123-00 | | | | assembly includes: | |
| , | 004 0043 00 | | | 2 | CASE HALF | |
| -1 | 004-0241-00 | | | 2 | CASE HALF | |
| -2 | 004-0242-00 | | | 1 | END CAP, rear | |
| -3 | 004-0243-00 | | | 1 | END CAP, front | |
| -4 | 004-0748-00 | | | 1 | CARTON | |

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations which appear either on the back of the diagrams or on pullout pages immediately following the diagrams of the instruction manual.

INDENTATION SYSTEM

This mechanical parts list is indented to indicated item relationships. Following is an example of the indentation system used in the Description column.

Assembly and/or Component
Detail Part of Assembly and/or Component
mounting hardware for Detail Part
Parts of Detail Part
mounting hardware for Parts of Detail Part
mounting hardware for Assembly and/or Component

Mounting hardware always appears in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation.

Mounting hardware must be purchased separately, unless otherwise specified.

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial or model number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

ABBREVIATIONS AND SYMBOLS

For an explanation of the abbreviations and symbols used in this section, please refer to the page immediately preceding the Electrical Parts List in this instruction manual.

INDEX OF MECHANICAL AND REPACKAGING PARTS ILLUSTRATIONS

| Title | | | Location | (reverse | side | of) |
|--------|---|-------------|--------------|-----------|------|-----|
| Figure | 1 | Exploded | Trigger | Switching | Diag | ram |
| Figure | 2 | Repackaging | Display Mode | Switching | Diag | ram |

SECTION 8 MECHANICAL PARTS LIST

FIGURE 1 EXPLODED

| Fig. 8 | | Serial/Model | NIa | Q | |
|------------|----------------------------|--------------|------|--------|---|
| No. | Tektronix Part No. | Eff | Disc | t y | Description 1 2 3 4 5 |
| 1-1 | 333-1308-00 | | | 1 | PANEL, front |
| -2 | 366-1064-00 | | | i | KNOB, gray—LEVEL/SLOPE |
| | | | | - | knob includes: |
| | 213-0153-00 | | | 1 | SETSCREW, 5-40 x 0.125 inch, HSS |
| -3 | 354-0342-00 | | | 1 | RING, knob skirt |
| -4 | 366-1059-00 | | | 1 | KNOB, gray—X10 MAG |
| -5 | 366-1213-00 | | | 1 | KNOB, gray—POSITION |
| | | | | - | knob includes: |
| | 213-0153-00 | | | 1 | SETSCREW, 5-40 x 0.125 inch, HSS |
| -6 | 366-1168-00 | | | 1 | KNOB, red—MAIN VARIABLE (CAL IN) |
| | | | | - | knob includes: |
| _ | 213-0153-00 | | | 1 | SETSCREW, 5-40 x 0.125 inch, HSS |
| -7 | 366-1219-00 | | | 1 | KNOB, gray—TIME/DIV, DLY TIME |
| | | | | - | knob includes: |
| _ | 213-0153-00 | | | 1 | SETSCREW, 5-40 x 0.125 inch, HSS |
| -8 | 354-0383-00 | | | 1 | RING, knob skirt |
| | 010 0150 00 | | | - | ring includes: |
| _ | 213-0153-00 | | | 1 | SETSCREW, 5-40 x 0.125 inch, HSS |
| -9 | 366-1023-00 | | | 1 | KNOB, gray—DLY TIME LEVEL |
| | 010 01 50 00 | | | - | knob includes: |
| 10 | 213-0153-00 | | | Ţ | SETSCREW, 5-40 x 0.125 inch, HSS |
| -10 | 331-0247-00 | | |] | DIAL, control |
| -11 | 366-1058-14 | | |] | KNOB, latch |
| -12 | 214-1095-00 | | |] | PIN, spring, split |
| -13 -14 | 105-0076-00 | | | 1 | RELEASE BAR, latch |
| -14 | 214-1280-00 214-1054-00 | | | i | SPRING, helical compression |
| -16 | 105-0075-00 | | | i | SPRING, flat, latch detent BODY, latch |
| -10 | 348-0235-00 | | | 2 | SHIELDING GASKET |
| -18 | 386-0447-39 | | | 1 | SUBPANEL, front |
| -19 | 352-0157-00 | | | 2 | HOLDER, lamp |
| -20 | 378-0602-00 | | | 2 | LENS, lamp |
| -21 | 200-0935-00 | | | 2 | CAP, lamp holder |
| -22 | 401-0080-00 | | | ī | BEARING, knob skirt |
| -23 | 358-0378-00 | | | i | BUSHING, sleeve, front panel trim |
| -24 | 358-0408-00 | | | i | BUSHING, sleeve |
| -25 | 131-0955-00 | | | 1 | CONNECTOR, coaxial, BNC, female, w/hardware |
| 2 | | | | _ | mounting hardware: (not included w/connector) |
| | 210-0012-00 | | | 1 | WASHER, lock, internal, 0.375 ID x 0.50 inch OD |
| -26 | 337-1317-00 | | | 1 | SHIELD, electrical |

| Fig. & Index No. | Tektronix Part No. | Serial/Model Eff | No. Disc | Q † y | Description 1 2 3 4 5 |
|------------------------|---|---------------------|-------------|-------------|--|
| 1-27 | 131-0955-00 | | | 1 | CONNECTOR, coaxial, BNC, female w/hardware |
| -28 | 210-0012-00 220-0581-00 | | | - 1 1 | mounting hardware: (not included w/connector) WASHER, lock, internal, 0375 ID x 0.50 inch OD NUT, sleeve, 0.375-32 x 0.437 inch long |
| -29 | 131-0373-00 | | | 1 | CONNECTOR, standoff mounting hardware: (not included w/connector) |
| -30 | 210-0001-00 210-0405-00 | | | 1 | WASHER, lock, internal, #2 NUT, hex., 2-56 x 0.188 inch |
| -31 | | | | 1 | RESISTOR, variable |
| -32 -33 | 214-1235-00 | | | - 1 1 | resistor includes: DRIVE, turns reduction RESISTOR, variable |
| -34 | 210-0978-00 210-0590-00 | | | - 1 1 | mounting hardware: (not included w/resistor) WASHER, flat, 0.375 ID x 0.50 inch OD NUT, hex., 0.375-32 x 0.438 inch |
| -35 | | | | 1 | RESISTOR, variable mounting hardware: (not included w/resistor) |
| -36 | 210-0583-00 210-0046-00 | | | 1 | NUT, hex., 0.25-32 x 0.312 inch WASHER, lock, internal, 0.261 ID x 0.40 inch OD |
| -37 | 407-0749-00 | • | | 1 | BRACKET, component mounting |
| -38 | 260-0516-00 | | | 1 | SWITCH, sensitive—DELAYED LEVEL mounting hardware: (not included w/switch) |
| -39 | 211-0159-00 210-0001-00 | | | 2 | SCREW, 2-56 x 0.375 inch, PHS WASHER, lock, internal, #2 |
| -40 | 210-0405-00 | | | 2 | NUT, hex., 2-56 x 0.188 inch |
| -41 | 214-1190-00 | | | 1 | EXTENDER-RETRACTER, knob extender-retracter includes: |
| -42 -43 | 213-0075-00 213-0140-00 384-1009-00 | | | 1 1 1 | SETSCREW, 4-40 x 0.094 inch, HSS SETSCREW, 2-56 x 0.094 inch, HSS SHAFT, extension, 0.56 inch long RESISTOR, variable |
| -44 -45 | 210-0583-00 210-0940-00 | | | - 1 1 | mounting hardware: (not included w/resistor) NUT, hex., 0.25-32 x 0.312 inch WASHER, flat, 0.25 ID x 0.375 inch OD |
| .5 | 210-0046-00 | | | i | WASHER, lock, internal, 0.261 ID x 0.40 inch OD |
| -46 -47 -48 | 384-1004-00 214-1353-00 214-1355-00 | | | 1 1 1 | SHAFT, extension, 2.25 inches long SPRING, helical compression ACTUATOR, switch |

| Fig. & Index No. | Tektronix Part No. | Serial/Model Eff | No. Disc | Q t y | Description 1 2 3 4 5 |
|------------------------|----------------------------|---------------------|-------------|-------------|--|
| 1-49 | 670-1220-00 | | | 1 | CIRCUIT BOARD ASSEMBLY—DISPLAY MODE |
| | 136-0328-02 | | | - 16 | circuit board assembly includes: SOCKET, terminal pin |
| -50 | 255-0375-01 | | | ft | PLASTIC STRIP, switch alignment, 1.20 inches long |
| 50 | 380-0155-00 | | | ï | HOUSING, light |
| | | | | - | mounting hardware: (not included w/housing) |
| | 213-0181-00 | | | ì | SCREW, thread forming, #2 x 0.375 inch, PHS |
| | | | | - | mounting hardware: (not included w/circuit board assembly) |
| -51 | 211-0156-00 | | | 2 | SCREW, 1-72 x 0.25 inch, 82° csk, FHS |
| -52 | 670-1219-00 | | | 1 | CIRCUIT BOARD ASSEMBLY—TRIGGER MODE |
| | | | | - | circuit board assembly includes: |
| | 136-0328-02 | | | 10 | SOCKET, terminal pin |
| | 255-0375-01 | | | ft | PLASTIC STRIP, switch alignment, 1.20 inches long |
| | 380-0155-01 | | | 1 | HOUSING, light, 4 button, special |
| | 213-0181-00 | | | - 1 | mounting hardware: (not included w/housing) SCREW, thread forming, #2 x 0.375 inch, PHS |
| | 213-0101-00 | | | <u>'</u> | mounting hardware: (not included w/circuit board assembly) |
| | 211-0156-00 | | | 2 | SCREW, 1-72 x 0.25 inch, 82° csk, FHS |
| -53 | 670-1222-00 | | | 1 | CIRCUIT BOARD ASSEMBLY—TRIGGER COUPLING |
| | | | | - | circuit board assembly includes: |
| | 136-0328-02 | | | 7 | SOCKET, terminal pin |
| | 255-0375-01 380-0155-00 | | | ft 1 | PLASTIC STRIP, switch alignment, 1.20 inches long HOUSING, light |
| | | | | <u>'</u> | mounting hardware: (not included w/housing) |
| | 213-0181-00 | | | 1 | SCREW, thread forming, #2 x 0.375 inch, PHS |
| | | | | - | mounting hardware: (not included w/circuit board assembly) |
| | 211-0156-00 | | | 2 | SCREW, 1-72 x 0.25 inch, 82° csk, FHS |
| -54 | 670-1221-00 | | | 1 | CIRCUIT BOARD ASSEMBLY—TRIGGER SOURCE |
| | | | | - | circuit board assembly includes: |
| -55 | 131-0589-00 | | | 2 | TERMINAL, pin, 0.50 inch long |
| -56 | 136-0328-02 | | | 6 | SOCKET, terminal pin |
| | 255-0375-01 | | | ft | PLASTIC STRIP, switch alignment, 1.20 inches long |
| | 380-0155-00 | | | 1 | HOUSING, light |
| | 212 0101 00 | | | 1 | mounting hardware: (not included w/housing) |
| | 213-0181-00 | | | 1 | SCREW, thread forming, #2 x 0.375 inch, PHS mounting hardware: (not included w/circuit board assembly) |
| | 211-0156-00 | | | 2 | SCREW, 1-72 x 0.25 inch, 82° csk, FHS |
| | | | | | • |

| Fig. & Index No. | Tektronix Part No. | Serial/Model Eff | No. Disc | Q † y | Description |
|------------------------|----------------------------|---------------------|-------------|-------------|---|
| | | | | | |
| 1-57 | 670-1225-00 | | | 1 | CIRCUIT BOARD ASSEMBLY—DELAYED TRIGGER circuit board assembly includes: |
| | 388-1589-00 | | | 1 | CIRCUIT BOARD |
| -58 | 131-0608-00 | | | ż | TERMINAL, pin, 0.365 inch long |
| -59 | 260-1133-00 | | | í | SWITCH, push, set of 3—SLOPE, COUPLING, SOURCE |
| -60 | 352-0239-00 | | | 3 | LAMPHOLDER |
| 00 | | | | - | mounting hardware for each: (not included w/lampholder) |
| -61 | 213-0098-00 | | | 2 | SCREW, 0-80 x 0.125 inch, FHS |
| | | | | - | mounting hardware: (not included w/circuit board assembly) |
| -62 | 211-0541-00 | | | 3 | SCREW, 6-32 x 0.25 inch, 100° csk, FHS |
| -63 | 380-0200-00 | | | 3 | HOUSING, pushbutton |
| -64 | 366-1214-03 | | | 1 | KNOB, push— + & — |
| -65 | 366-1214-02 | | | 1 | KNOB, push—AC-DC |
| -66 | 366-1214-01 | | |] | KNOB, push—INT-EXT |
| | 672-0411-00 | | | 1 | CIRCUIT BOARD ASSEMBLY—INTERFACE READOUT |
| , , | 101 00/0 00 | | | - | circuit board assembly includes: |
| -67 -70 | 131-0963-00 | | |] | CONTACT, electrical, grounding |
| -68 -69 | 354-0195-00 401-0081-02 | | | 1 | RING, retaining |
| -07 | | | | - | BEARING, cam switch, front mounting hardware: (not included w/bearing) |
| -70 | 211-0116-00 | | | 2 | SCREW, sems, 4-40 x 0.312 inch, PHB |
| -71 | 210-0591-00 | | | 2 | NUT, hex., 4-40 x 0.188 inch |
| | | | | _ | |
| -72 | 214-1127-00 | | | 4 | ROLLER, detent |
| -73 | 214-1139-00 ¹ | | | - | SPRING, flat, gold |
| | 214-1139-02 ¹ | | | - | SPRING, flat, green |
| | 214-1139-03 ¹ | | | - | SPRING, flat, red |
| -74 | 200-1116-00 | | | 2 | COVER, cam switch, front |
| | 011 0117 00 | | | - | mounting hardware for each: (not included w/cover) |
| -75 | 211-0116-00 210-0591-00 | | | 1 | SCREW, sems, 4-40 x 0.312 inch, PHB NUT, hex., 4-40 x 0.188 inch |
| -73 | 210-0371-00 | | | • | 1401, 11ex., 4-40 x 0.100 mcn |
| -76 | 200-1115-00 | | | 2 | COVER, cam switch, rear |
| | | | | - | mounting hardware for each: (not included w/cover) |
| | 211-0116-00 | | | 1 | SCREW, sems, 4-40 x 0.312 inch, PHB |
| -77 | 210-0591-00 | | | Ī | NUT, hex., 4-40 x 0.188 inch |
| <i>-7</i> 8 | 105-0189-00 | | | 1 | DRUM, cam switch, front |
| <i>-7</i> 9 | 401-0083-00 | | | 1 | BEARING, cam switch, center |
| | | | | - | mounting hardware: (not included w/bearing) |
| | 211-0116-00 | | | 2 | SCREW, sems, 4-40 x 0.312 inch, PHB |
| | 210-0591-00 | | | 2 | NUT, hex., 4-40 x 0.188 inch |
| -80 | 105-0187-00 | | | ī | DRUM, cam switch, rear |
| -81 | 401-0081-01 | | | i | BEARING, cam switch, rear |
| | | | | - | mounting hardware: (not included w/bearing) |
| | 211-0116-00 | | | 2 | SCREW, sems, 4-40 x 0.312 inch, PHB |
| | 210-0591-00 | | | 2 | NUT, hex., 4-40 x 0.188 inch |
| | 354-0391-00 | | | 1 | RING, retaining |
| | | | | • | · , · · · · · · · · · · · · · · · · · · |

¹Replace only with part bearing the same color as the original part in your instrument.

| Fig. & Index No. | Tektronix Part No. | Serial/Model N Eff [| Q lo. t Disc y | Description 1 2 3 4 5 |
|------------------------|----------------------------|-------------------------|----------------------|--|
| 1-82 | 386-1792-00 | | 1 | PLATE, variable resistor mounting |
| | | | - | mounting hardware: (not included w/plate) |
| -83 | 211-0087-00 | | 2 | SCREW, 2-56 x 0.188 inch, PHS |
| -84 | 210-0001-00 | | 2 | WASHER, lock, internal, #2 |
| -85 | | | 1 | RESISTOR, variable |
| | | | - | mounting hardware: (not included w/resistor) |
| -86 | 210-0583-00 | | 1 | NUT, hex., 0.25-32 x 0.312 inch |
| -87 | 210-0046-00 | | 1 | WASHER, lock, internal, 0.261 ID x 0.40 inch OD |
| -88 | 670-1226-00 | | 1 | CIRCUIT BOARD ASSEMBLY—READOUT |
| | | | - | circuit board assembly includes: |
| | 388-1590-00 | | 1 | CIRCUIT BOARD |
| 00 | 131-0589-00 | | 9 | TERMINAL, pin, 0.50 inch long |
| -89 | 131-0787-00 | | 8 | TERMINAL, pin, 0.65 inch long |
| -90 | 131-0604-00 | | 14 | CONTACT, electrical, spring |
| 01 | 011 0100 00 | | - | mounting hardware: (not included w/circuit board assembly) |
| -91 -92 | 211-0182-00 | | 10 10 | SCREW, sems, 2-56 x 0.312 inch, PHB |
| -92 | 210-0405-00 | | 10 | NUT, hex., 2-56 x 0.188 inch |
| -93 | 670-1216-00 | | 1 | CIRCUIT BOARD ASSEMBLY—DISTRIBUTION |
| | 000 1570 00 | | - | circuit board assembly includes: |
| 0.4 | 388-1570-00 | | 1 | CIRCUIT BOARD |
| -94 | 131-0589-00 | | 47 | TERMINAL, pin, 0.50 inch long |
| | 131-0590-00 131-0608-00 | | 3 7 | TERMINAL, pin, 0.665 inch long TERMINAL, pin, 0.365 inch long |
| -95 | 136-0220-00 | | 2 | SOCKET, transistor, 3 pin, square |
| -96 | 214-0579-00 | | 2 | PIN, test point |
| -70 | | | - | mounting hardware: (not included w/circuit board assembly) |
| -97 | 211-0116-00 | | 4 | SCREW, sems, 4-40 x 0.312 inch, PHB |
| -98 | 220-0547-01 | | 4 | NUT BLOCK |
| -99 | 211-0105-00 | | 4 | SCREW, 4-40 x 0.188 inch, 100° csk, FHS |
| -100 | 670-1215-00 | | 1 | CIRCUIT BOARD ASSEMBLY—INTERFACE |
| | | | - | circuit board assembly includes: |
| | 388-1569-00 | | 1 | CIRCUIT BOARD |
| | 131-0589-00 | | 20 | TERMINAL, pin, 0.50 inch long |
| | 131-0590-00 | | 23 | TERMINAL, pin, 0.665 inch long |
| | 131-0608-00 | | 22 | TERMINAL, pin, 0.365 inch long |
| | 131-0591-00 | | 20 | TERMINAL, pin, 0.835 inch long |
| -101 | 131-0595-00 | | 7 | TERMINAL, pin, 1.37 inches long |
| | 131-0592-00 | | 55 | TERMINAL, pin, 0.885 inch long |
| | 131-0604-00 | | 50 | CONTACT, electrical, spring |
| | 136-0350-00 | | 9 | SOCKET, transistor, 3 pin, low profile |
| | 240 0004 00 | | 1 | RESISTOR, variable |
| | 260-0984-00 | | 1 | SWITCH, slide—DELAY CLUDE POST, lock, 0.45, inch long |
| | 351-0185-00 351-0186-00 | | 6 | GUIDE-POST, lock, 0.65 inch long GUIDE-POST, lock, 0.84 inch long |
| | 214-1140-00 | | 12 | SPRING, helical compression |
| -100 | | | - | mounting hardware: (not included w/circuit board assembly) |
| -109 | 211-0116-00 | | 6 | SCREW, sems, 4-40 x 0.312 inch, PHB |
| | 220-0547-00 | | 6 | NUT BLOCK |
| | 211-0105-00 | | 6 | SCREW, 4-40 x 0.188 inch, 100° csk, FHS |
| | | | - | , |

| Fig & Index No. | Tektronix Part No. | Serial/Model Eff | No. Disc | Q t y | Description 1 2 3 4 5 |
|-----------------------|-----------------------|---------------------|-------------|-------------|--|
| 1-112 | 384-1008-00 | | | 1 | SHAFT, extension, 1.50 inches long |
| | 376-0029-00 | | | 1 | COUPLING, shaft, 0.128 ID x 0.312 inch OD |
| | 384-1007-00 | | | 1 | SHAFT, extension, plastic, 9 inches long |
| | 376-0101-00 | | | 1 | COUPLING, shaft, 0.375 inch long |
| | 670-1218-00 | | | 1 | CIRCUIT BOARD ASSEMBLY—DELAYED TRIGGER |
| | | | | - | circuit board assembly includes: |
| | 388-1572-00 | | | 1 | CIRCUIT BOARD |
| -117 | 131-0608-00 | | | 2 | TERMINAL, pin, 0.365 inch long |
| | 136-0220-00 | | | 15 | SOCKET, transistor, 3 pin, square |
| | 136-0235-00 | | | ī | SOCKET, transistor, 6 pin |
| | 136-0260-01 | | | 1 | SOCKET, integrated circuit, 16 contact |
| | 136-0263-03 | | | 13 | SOCKET, pin, terminal |
| | 214-0579-00 | | | 9 | PIN, test point |
| | 200-0945-01 | | | i | COVER, half, transistor temperature stabilizer |
| | 200-0945-00 | | | 1 | COVER, half, transistor temperature stabilizer |
| | 211-0062-00 | | | i | SCREW, 2-56 x 0.312 inch, PHS |
| | 352-0203-00 | | | 8 | HOLDER, cable, double, plastic |
| | 352-0213-00 | | | i | HOLDER, coaxial, double, grounding |
| | 352-0238-00 | | | 2 | HOLDER, coaxial, single, grounding |
| | 361-0238-00 | | | 3 | SPACER, sleeve, 0.34 inch long |
| | 211-0155-00 | | | 3 | SCREW, relieved shank, 4-40 x 0.375 inch |
| | 670-1224-00 | | | ī | CIRCUIT BOARD ASSEMBLY—MAIN TRIGGER |
| , | | | | | circuit board assembly includes: |
| | 388-1578-00 | | | 1 | CIRCUIT BOARD |
| -132 | 131-0608-00 | | | 2 | TERMINAL, pin, 0.365 inch long |
| | 136-0220-00 | | | 21 | SOCKET, transistor, 3 pin, square |
| | 136-0235-00 | | | 1 | SOCKET, transistor, 6 pin |
| | 136-0260-01 | | | i | SOCKET, integrated circuit, 16 contact |
| | 136-0263-03 | | | 1 <i>7</i> | SOCKET, pin, terminal |
| | 200-0945-01 | | | 'n | COVER, half, transistor temperature stabilizer |
| | 200-0745-00 | | | i | COVER, half, transistor temperature stabilizer |
| | 211-0062-00 | | | i | SCREW, 2-56 x 0.312 inch, PHS |
| | 214-0579-00 | | | 10 | PIN, test point |
| | 352-0213-00 | | | 7 | HOLDER, cable, double, plastic |
| | 352-0228-00 | | | 3 | HOLDER, cable, single, plastic |
| | 352-0238-00 | | | 4 | HOLDER, coaxial, single, grounding |
| | 361-0238-00 | | | 3 | SPACER, sleeve, 0.34 inch long |
| | 211-0155-00 | | | 3 | SCREW, relieved shank, 4-40 x 0.375 inch |
| | 670-1217-00 | | | ĭ | CIRCUIT BOARD ASSEMBLY—SWEEP |
| -140 | 0/0-121/-00 | | | | circuit board assembly includes: |
| | 388-1571-00 | • | | 1 | CIRCUIT BOARD |
| _1 <i>4</i> 7 | 131-0608-00 | | | 3 | TERMINAL, pin, 0.365 inch long |
| | 214-0579-00 | | | 24 | PIN, test point |
| | 136-0220-00 | | | 43 | SOCKET, transistor, 3 pin, square |
| | 136-0241-00 | | | 2 | SOCKET, integrated circuit, 10 contact |
| | 136-0269-00 | | | 5 | SOCKET, integrated circuit, 14 contact |
| | 136-0252-01 | | | 8 | SOCKET, integrated circuit, 14 confider SOCKET, pin connector, 0.178 inch long |
| | 136-0263-03 | | | 62 | SOCKET, pin connector, 0.176 men tong |
| | 214-1292-00 | | | 2 | HEAT SINK, transistor |
| -154 | Z14-1Z7Z-UU | | | 2 | LIEVI SILAN' HARISION |

| Fig. & Index No. | Tektronix Part No. | Serial/Model Eff | No. Disc | Q † y | Description 1 2 3 4 5 |
|------------------|-----------------------|---------------------|-------------|-------------|---|
| 1-155 | 260-1132-00 | | | 7 | SWITCH, push, X10 MAG |
| | 361-0238-00 | | | 6 | SPACER, sleeve, 0.34 inch long |
| | 211-0155-00 | | | 6 | SCREW, relieved shank, 4-40 x 0.375 inch |
| | 352-0240-00 | | | 2 | HOLDER, cable, plastic |
| | 426-0499-11 | | | 1 | FRAME SECTION, bottom |
| - | | | | - | mounting hardware: (not included w/frame section) |
| -160 | 213-0192-00 | | | 4 | SCREW, thread forming, 6-32 x 0.50 inch, Fil HS |
| -161 | 426-0505-11 | | | 1 | FRAME SECTION, top |
| | | | | - | mounting hardware: (not included w/frame section) |
| -162 | 213-0192-00 | | | 4 | SCREW, thread forming, 6-32 x 0.50 inch, Fil HS |
| -163 | 361-0326-00 | | | 1 | SPACER, sleeve, 0.10 inch long |
| -164 | 386-1402-00 | | | 1 | PANEL, rear |
| -165 | 337-1064-00 | | | 1 | SHIELD, electrical, left |
| | 337-1320-00 | | | 1 | SHIELD, electrical, right |
| -167 | 175-0826-00 | | | ft | WIRE, electrical, 3 wire ribbon, 6.75 inches long |
| | 175-0828-00 | | | ft | WIRE, electrical, 5 wire ribbon, 6.75 inches long |
| -169 | 175-0830-00 | | | ft | WIRE, electrical, 7 wire ribbon, 2.50 inches long |
| -1 <i>7</i> 0 | 175-0831-00 | | | ft | WIRE, electrical, 8 wire ribbon, 3.50 inches long |
| -1 <i>7</i> 1 | 175-0832-00 | | | ft | WIRE, electrical, 9 wire ribbon, 3.25 inches long |
| -1 <i>7</i> 2 | 352-0161-04 | | | 1 | HOLDER, terminal connector, 3 wire (yellow) |
| | 352-0161-05 | | | 1 | HOLDER, terminal connector, 3 wire (green) |
| | 352-0161-06 | | | 1 | HOLDER, terminal connector, 3 wire (blue) |
| -1 <i>7</i> 3 | 352-0163-04 | | | 1 | HOLDER, terminal connector, 5 wire (yellow) |
| | 352-0163-05 | | | 1 | HOLDER, terminal connector, 5 wire (green) |
| | 352-0165-07 | | | 2 | HOLDER, terminal connector, 7 wire (violet) |
| -1 <i>7</i> 5 | 352-0167-01 | | | 2 | HOLDER, terminal connector, 9 wire (brown) |
| | 352-0167-02 | | | 2 | HOLDER, terminal connector, 9 wire (red) |
| | 352-0169-00 | | | 1 | HOLDER, terminal connector, 2 wire (black) |
| | 352-0169-03 | | | 1 | HOLDER, terminal connector, 2 wire (orange) |
| 3 -9 | 352-0169-04 | | | 1 | HOLDER, terminal connector, 2 wire (yellow) |
| | 131-0707-00 | | (| 59 | TERMINAL, connector |
| | 131-0708-00 | | | 4 | TERMINAL, connector |
| -1/9 | 214-1061-00 | | | 1 | SPRING, flat, sliding ground |
| | | | CTANIN | 4 D.P. | ACCECCODIFC |

STANDARD ACCESSORIES

070-1043-00

2 MANUAL, instruction (not shown)



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