TEKTRONIX®

7B53A/7B53AN

DUAL TIME BASE

SERVICE

INSTRUCTION MANUAL

Tektronix, Inc. • P.O. Box 500 • Beaverton, Oregon 97005 • Serial No. 700-867

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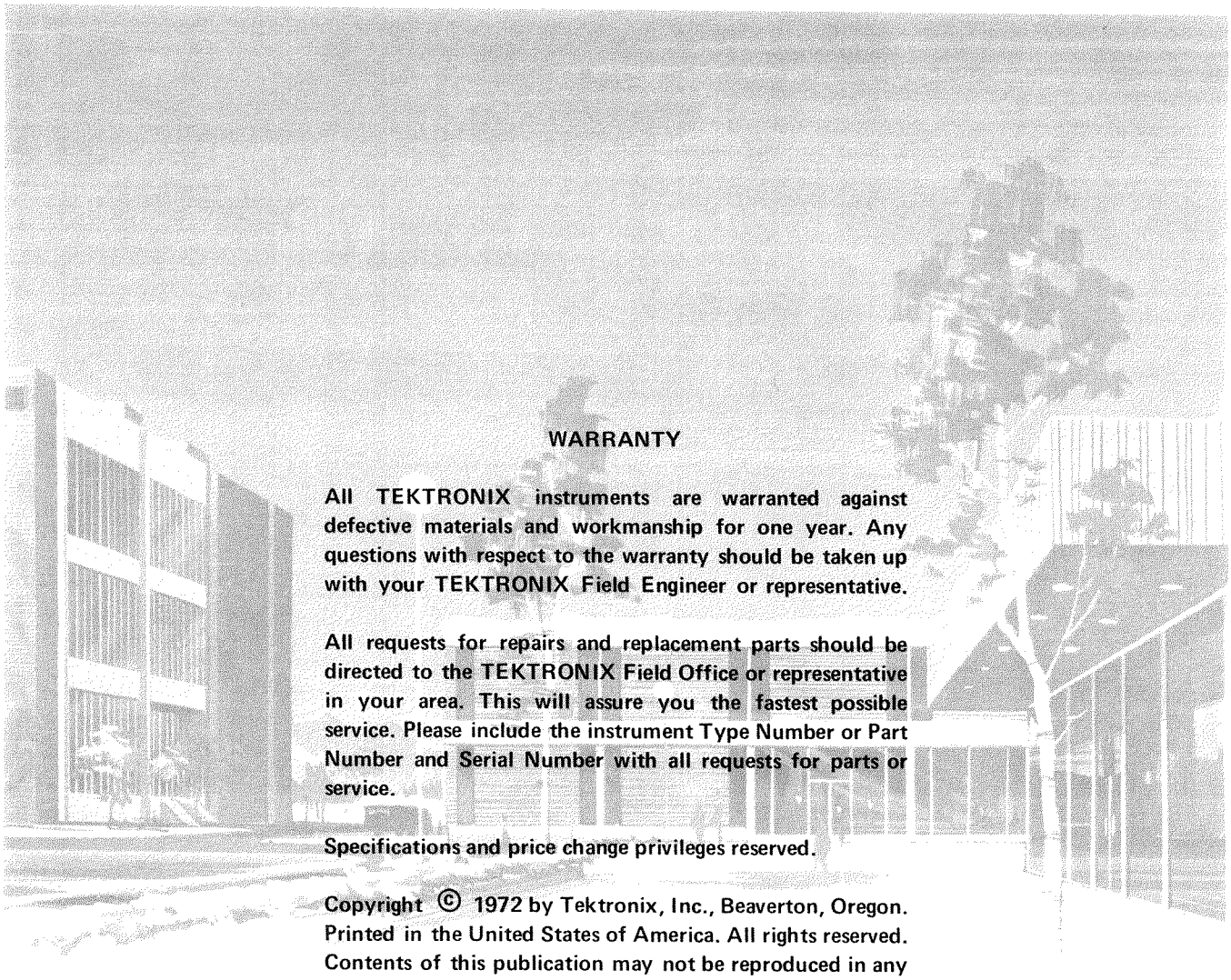

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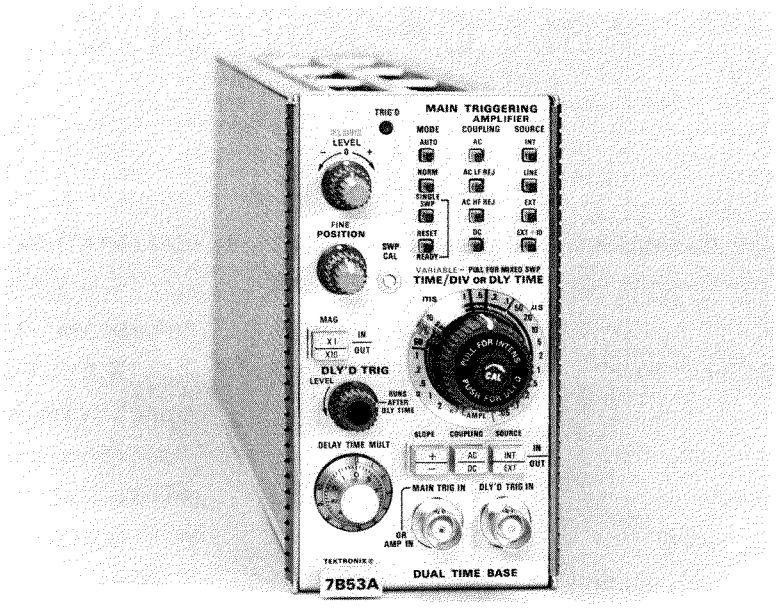
NOTE

Refer to the 7B53A/7B53AN Operators manual for specifications and complete operating instructions.



7B53A/7B53AN Features

The 7B53A and 7B53AN Dual Time Base units provide Main, Intensified, Delayed, and Mixed sweep operation for TEKTRONIX 7000-Series Oscilloscopes. Calibrated sweep rates from 5 s/DIV (5 nanoseconds with X10 magnification) and triggering to 100 megahertz are provided. The 7B53A and 7B53AN are electrically identical except that only the 7B53A is compatible with the alphanumeric readout system provided for 7000-Series Oscilloscopes.

Push-button switches are not illuminated except the "Ready" light.

Other features include 0 to 10 times continuous sweep delay, variable main and delayed sweep rates, and variable main sweep holdoff. Separate triggering controls are provided for main and delayed sweep triggering, and when operating in the AUTO MAIN TRIGGERING MODE, a bright base line is displayed in the absence of a trigger signal. The 7B53A/7B53AN can also be used as an amplifier for X-Y operation.

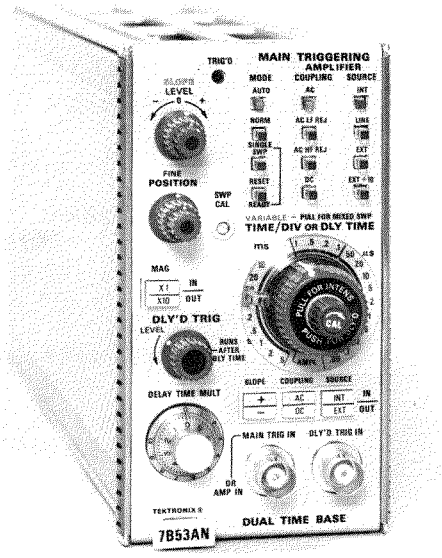


Fig. 1-1. 7B53A/7B53AN Dual Time Base Units.

OPERATING INFORMATION

Brief operating information is given in this section, for more detailed instructions, refer to the 7B53A/7B53AN Operators Manual.

Before operating the 7B53A/7B53AN it is necessary to check the settings of the Variable Selector multi-pin connector (P140) and the Delayed Sweep Gate Out multi-pin connector (P613). The Variable Selector multi-pin connector (P140) determines whether the front-panel VARIABLE control varies main sweep rates, delayed sweep rates, or the main sweep holdoff. The Delayed Sweep Gate Out multi-pin connector (P613) determines whether or not the Delayed Sweep Gate out signal is connected to the front-panel DLY'D TRIG IN connector. Refer to VARIABLE control and Delayed Sweep Gate out information in this section for additional instructions.

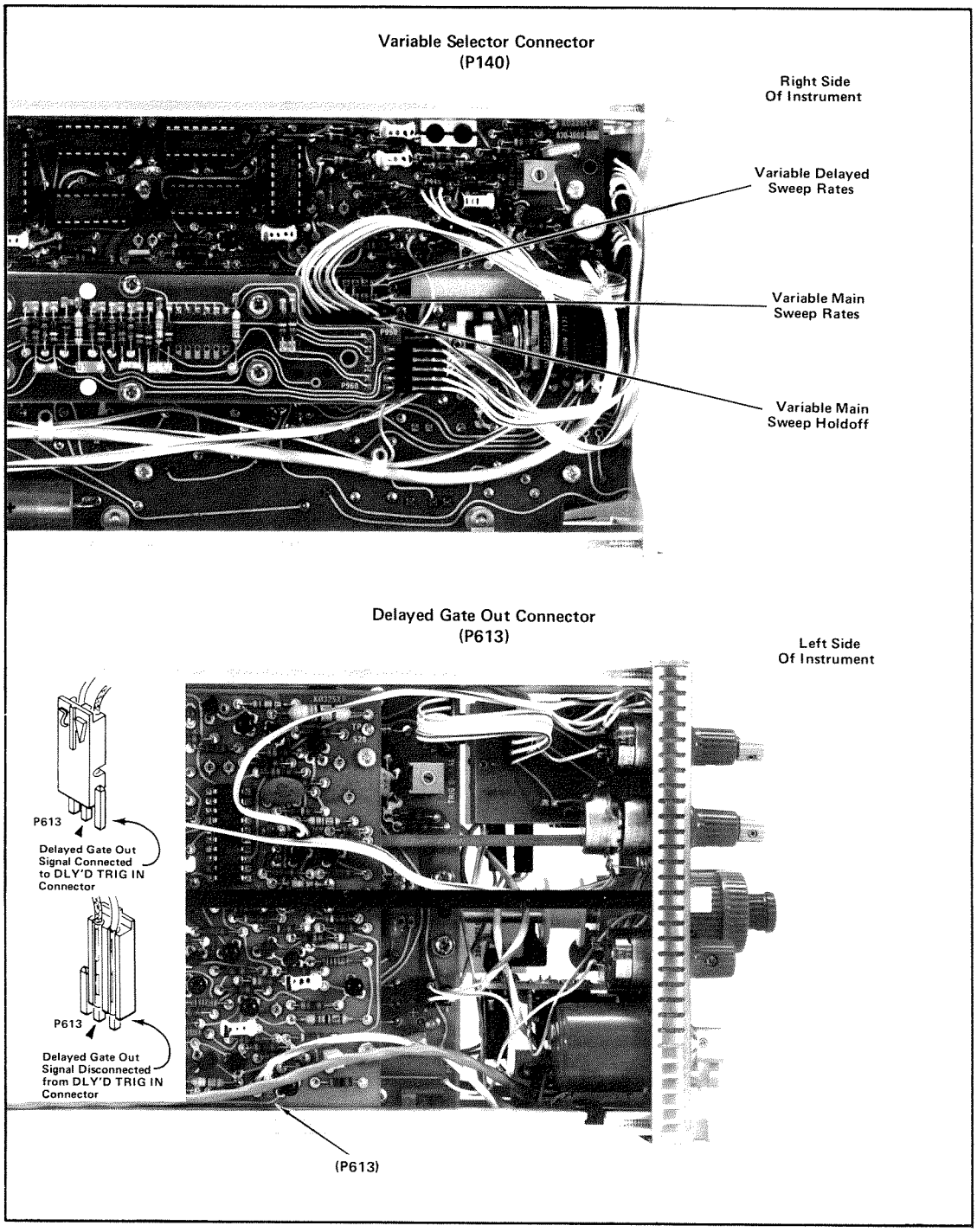


Fig. 1-2. Location of Delayed Sweep Gate Out and Variable Selector multi-pin connectors.

CONTROLS AND CONNECTORS

General

All controls required for the operation of the 7B53A/7B53AN, except the Variable Selector and the Dly'd Sweep Gate Out connector (see Fig. 1-2), are located on the front panel of the instrument. To make full use of the capabilities of this instrument, the operator should be familiar with the function and use of each control. A brief description of the front-panel controls and connectors is given here. More detailed information is given under General Operating Information in the 7B53A/7B53AN Operators Manual. Fig. 1-3 shows the front panel and external controls and connectors of the 7B53A/7B53AN.

(1.) Main Triggering Controls

LEVEL. Selects the amplitude point on the trigger signal where sweep triggering occurs.

SLOPE. Two-position switch permits triggering on the positive-going or negative-going portion of the main triggering signal.

TRIG'D. Light indicates that the main sweep is triggered and will produce a display.

MODE. Pushbutton switches select the operating mode for the main triggering circuits.

COUPLING. Pushbutton switches select the method of coupling the triggering signal to the main triggering circuits.

SOURCE. Pushbutton switches select the source of the main triggering signal.

(2.) Sweep Controls

TIME/DIV OR DLY TIME. Selects the sweep rate of the main sweep generator (see Fig. 1-4).

DLY'D Time/Division. Selects the sweep rate of the delayed sweep generator and selects the MAIN SWP, INTEN, and DLY'D SWP Display Modes (see Fig. 1-4).

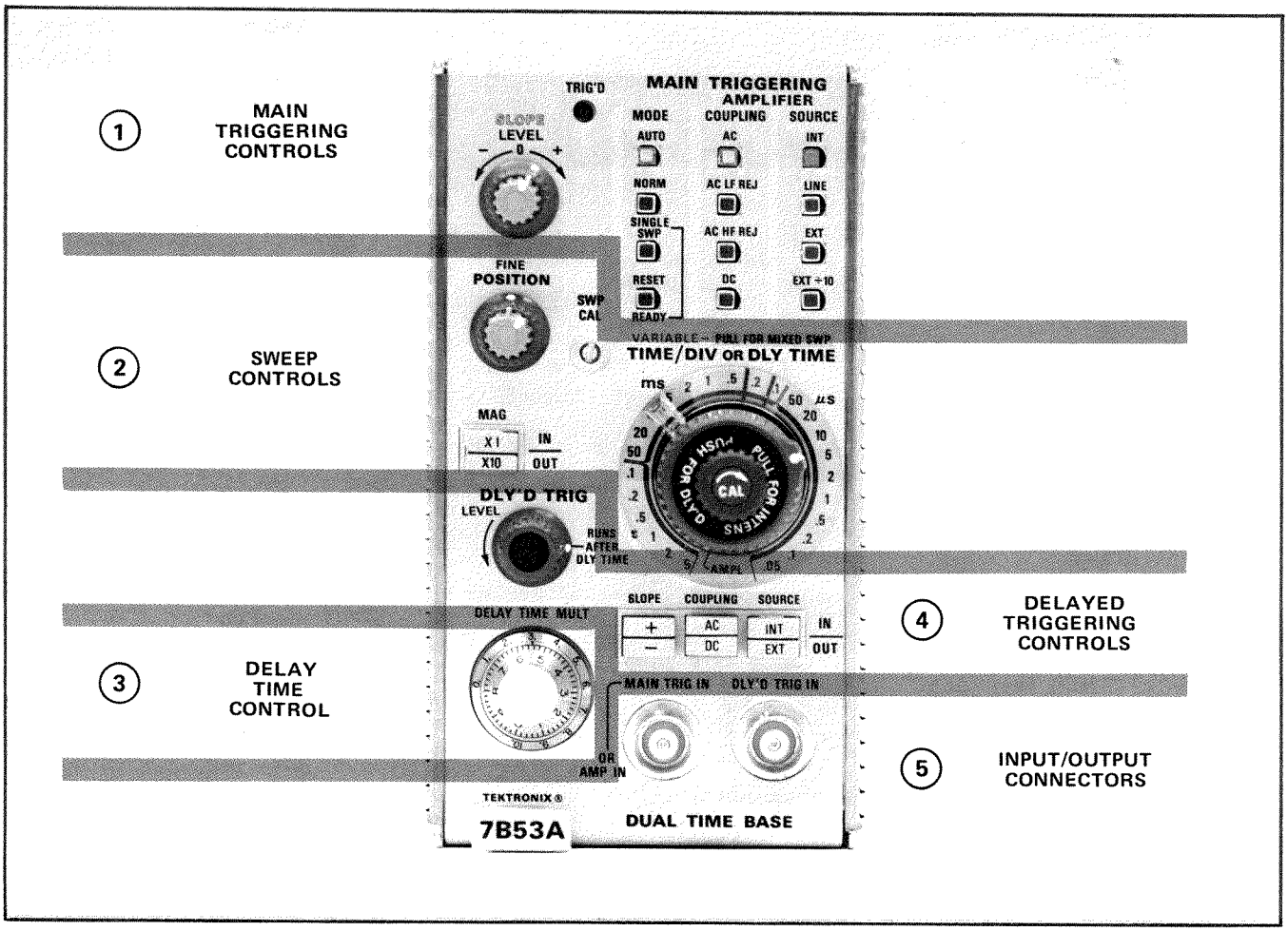


Fig. 1-3. Front-panel controls and connectors.

VARIABLE. Combination switch and control provides variable main sweep rates, variable delayed sweep rates, or variable main sweep holdoff: depending on the connection of the multi-pin connector P140 (internal). The VARIABLE control may also be pulled outward to select the MIXED Display Mode, when operating in the DLY'D SWP Display Mode, see Fig. 1-4.

Variable Sweep Rates: Variable sweep rates for the main or delayed sweep generators may be obtained when P140 is properly connected, see Fig. 1-2. When the front-panel VARIABLE control is rotated out of the detent position, the VARIABLE control is activated for variable sweep rates (uncalibrated).

Variable Holdoff: Variable main sweep holdoff can be obtained when P140 is connected for this function, see Fig. 1-2. When the VARIABLE control is rotated out of the detent position, the holdoff duration may be varied. Variable holdoff is used to provide a stable display of repetitive complex waveforms.

Display Mode. Four display modes can be selected by the following switch settings:

MAIN SWP: The MAIN SWP mode (non-delayed) is selected when the TIME/DIV OR DLY TIME switch and the DLY'D Time/Division switch are locked together at the same sweep rate.

INTEN: The INTEN mode, a function of the main and delayed sweeps, is selected when the DLY'D Time/Division switch is pulled out. In this mode, a portion of the main sweep is intensified during the time that the delayed sweep runs.

DLY'D SWP: The DLY'D SWP mode is selected when the DLY'D Time/Division switch is pulled out, rotated in the INTEN mode for the desired delayed sweep rate, and then pushed in. In this mode, the delayed sweep is displayed at a rate determined by the DLY'D Time/Division switch at the end of each delay period, as determined by TIME/DIV OR DLY TIME switch and the DELAY TIME MULT dial settings.

MIXED: The MIXED mode is selected when the DLY'D SWP mode is selected and the VARIABLE knob is pulled out. In the MIXED mode, the main sweep is displayed on the CRT to a point determined by the DELAY TIME MULT dial; the remainder of the sweep is at the rate determined by the delayed sweep.

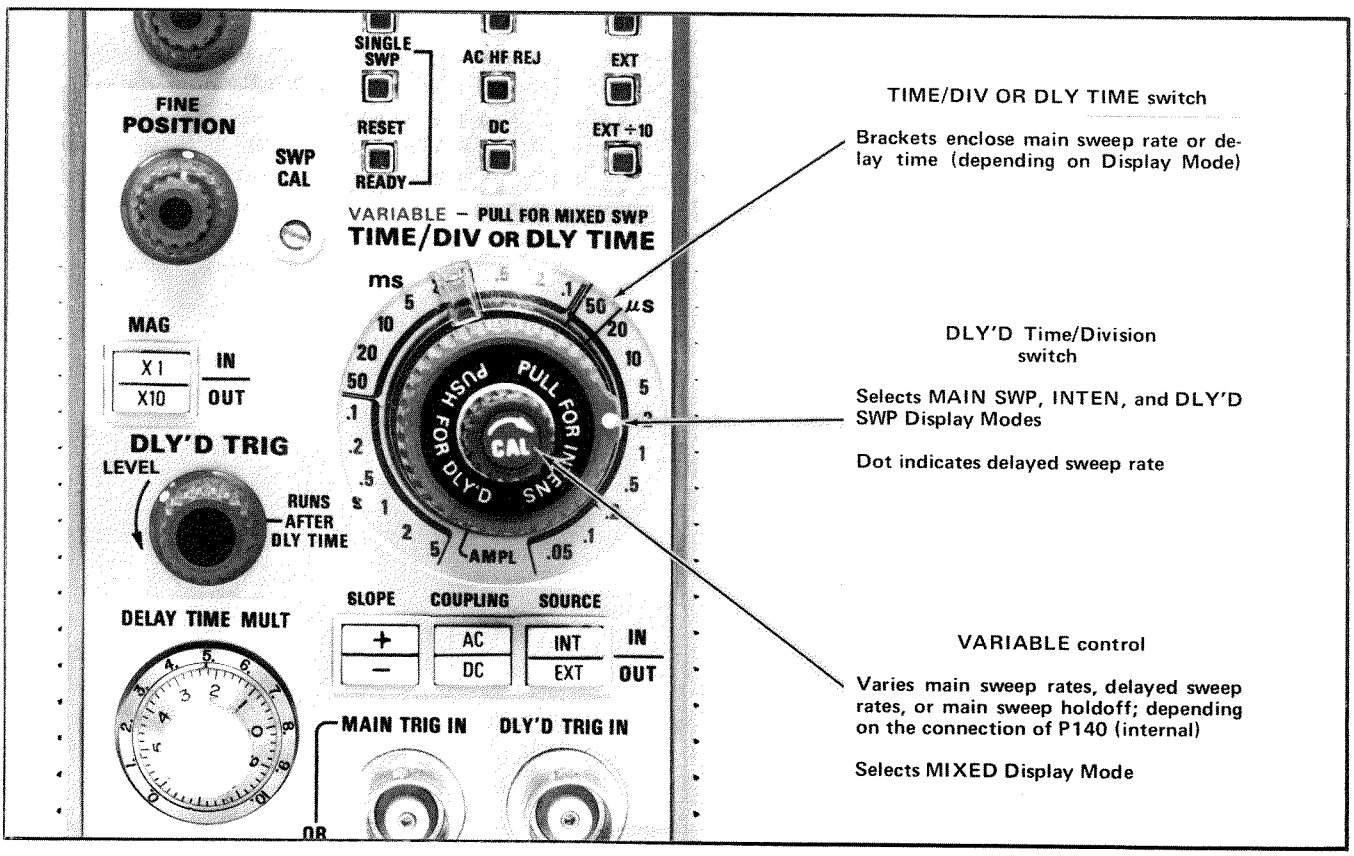


Fig. 1-4. Composite Time/Division switch.

SWP CAL. Screwdriver adjustment to match the gain of the 7B53A/7B53AN to the indicator oscilloscope for calibrated sweep rates.

POSITION. Controls horizontal position of display.

FINE. Provides precise control of horizontal position adjustment.

MAG. Pushbutton switch selects X1 or X10 horizontal magnification.

(3.) Delay Time Control

DELAY TIME MULT. Provides variable sweep delay between 0.00 and 10.0 times the delay time indicated by the TIME/DIV OR DLY TIME switch.

(4.) Delayed Triggering Controls

LEVEL. Selects the RUNS AFTER DLY TIME or Triggerable After Dly Time Modes, and the amplitude point at which the delayed sweep is triggered.

SLOPE. Two-position switch permits triggering on the positive-going or negative-going portion of the delayed triggering signal.

COUPLING. Two-position switch selects the method of coupling the triggering signal to the delayed triggering circuits.

SOURCE. Two-position switch to select the source of the delayed triggering signal.

(5.) Input/Output Connectors

MAIN TRIG IN OR AMP IN. Front-panel BNC connector serves two different input functions.

MAIN TRIG IN: External trigger input for the main triggering circuit. The SOURCE switch for MAIN TRIGGERING must be set to EXT or EXT ÷10 and the TIME/DIV or DLY'D TIME switch set to any position except AMPL.

AMPL: When the TIME/DIV OR DLY'D TIME switch is set to AMPL and the MAIN TRIGGERING SOURCE switch is set to the EXT or EXT ÷10 position, this connector serves as an External Horizontal Input.

DLY'D TRIG IN. Front-panel BNC connector serves two input functions.

DLY'D TRIG IN: When the Delayed Triggering SOURCE switch is set to EXT, this connector serves as an external trigger input for the delayed triggering circuit.

Delayed Sweep Gate Out: When the DLY'D TRIG SOURCE switch is set to INT, P613 is properly connected (see Fig. 1-2), and the delayed sweep generator is running (INTEN, DLY'D SWP, or MIXED Display Mode) the DLY'D TRIG IN connector serves as a Delayed Sweep Gate Output. The Delayed Sweep Gate signal is a rectangular positive-going pulse with approximately 3.0 volts amplitude and pulse width coincident with the delayed sweep.

CIRCUIT DESCRIPTION

Introduction

This section of the manual contains a description of the circuitry used in the 7B53A/7B53AN 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. 2-1, shows interconnection of the basic circuit blocks in the 7B53A/7B53AN. 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 TIME/DIV OR DLY TIME 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 fast-rise, uniform-amplitude pulse to the Main Sweep Start Comparator. Termination of the pulse (or gate) occurs at the rise of Main Sweep Holdoff.

Main Sweep Start Comparator. This circuit is activated by the positive gate from the Main Sweep Trigger. 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. A negative-going gate (coincident with the positive gate) is coupled to the Delayed Sweep Lockout Multi and the Delayed Sweep Start Control.

Main Sawtooth Generator. The main sweep signal is developed by the Main Sawtooth Generator. When a positive gate from the Main Sweep Start Comparator 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.

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 hold off gate is variable, depending on the setting of the TIME/DIV OR DLY TIME 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 Holdoff circuit. 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 TIME/DIV OR DLY TIME switch set for main sweep, this circuit selects the signal from the Main Sawtooth Generator, amplifies the signal, and converts the single-ended input to a push-pull output signal. 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 Delayed Sweep Holdoff circuitry.

Delayed Sweep Trigger. When the DLY'D TRIG LEVEL is set to RUNS AFTER DLY TIME (into switch detent), the output trigger is generated as soon as the delayed gate is applied. If the DLY'D TRIG LEVEL control is in the triggerable mode (out of switch detent), the output trigger is initiated by the next input trigger that occurs after the Delay Gate is applied.

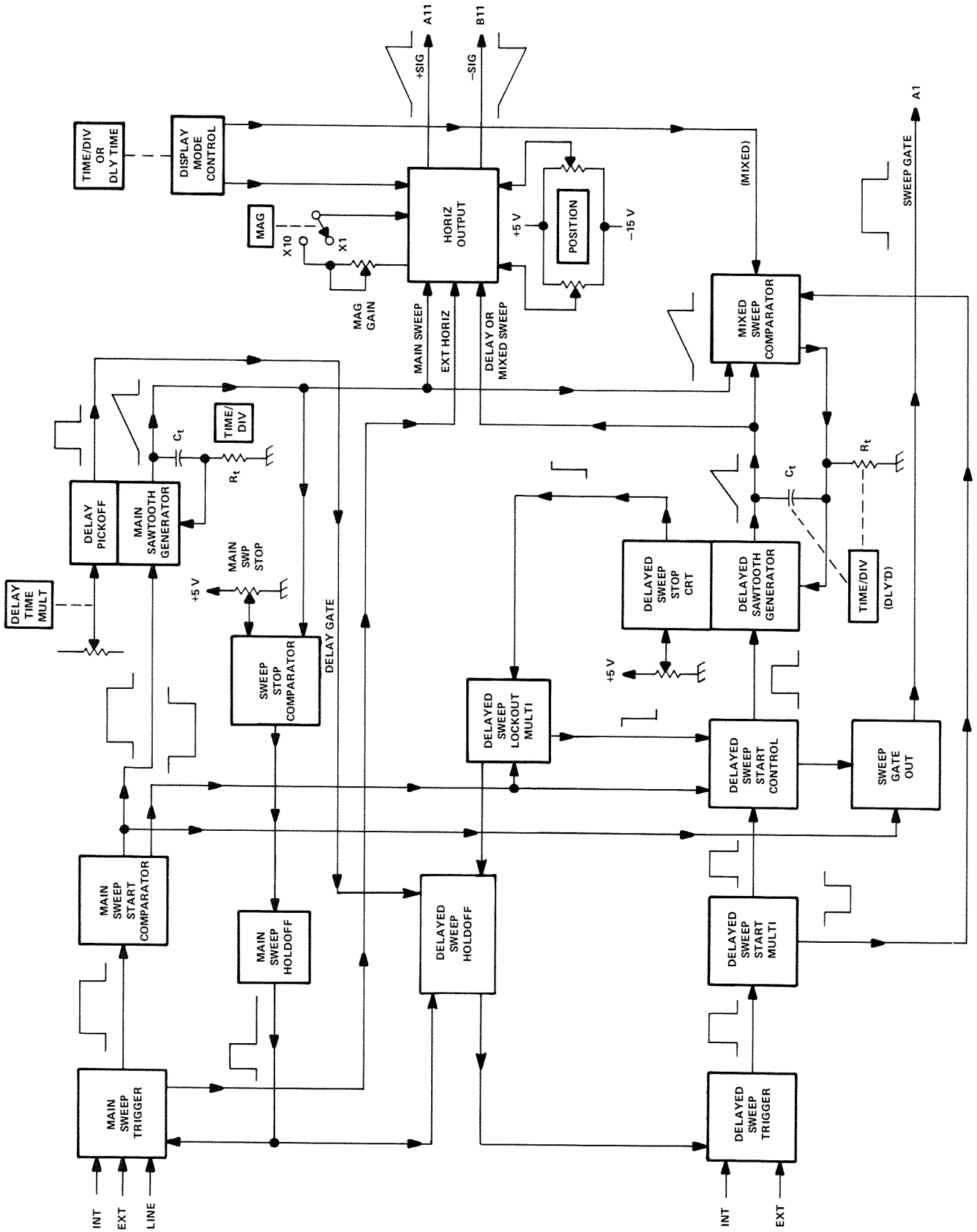


Fig. 2-1. 7B53A/7B53AN Simplified Block Diagram.

The Delayed Sweep Trigger output is a positive gate which is terminated by the Holdoff signal 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 delayed sweep 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 Comparator 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 sweep rate and then, after the selected delay interval, runs at the delayed sweep rate. The main sweep and delayed sweep are initiated as previously described. Operation of other circuit blocks follows.

Mixed Sweep Comparator. This circuit determines whether the delayed sweep generator runs at the main sweep rate or at the delayed sweep rate. Before the delay gate is generated (delay gate generated at delay pickoff as determined by the setting of the DELAY TIME MULT dial) the main sweep sawtooth signal is coupled through the Mixed Sweep Comparator, causing the delayed sweep generator to run at the main sweep rate. The resulting sawtooth signal is coupled to the Horizontal Output stage.

When a positive gate from the Delayed Sweep Trigger is applied to the Delayed Sweep Start Multi (at Delay Pickoff as determined by the DELAY TIME MULT dial setting) a negative gate is generated and coupled to the Mixed Sweep Comparator. This opens the Mixed Sweep Comparator, preventing the Delayed Sweep Generator from running at the main sweep rate. Simultaneously, the Delayed Sweep Generator is released to run at the delayed sweep rate.

Delayed Sweep Lockout Multi. The positive step from the Delayed Sweep Stop circuit 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 TIME/DIV 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 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

General

This section provides a detailed description of the electrical operation and relationship of the circuits in the 7B53A/7B53AN. The theory of operation for circuits unique to this instrument is described in detail in this discussion. Circuits which are commonly used in the electronics industry are not described in detail. If more information is desired in these commonly used circuits, refer to the following text-books.

TEKTRONIX Circuit Concepts Books (order from your local TEKTRONIX Field Office or representatives).

Horizontal Amplifier Circuits, TEKTRONIX Part No. 062-1144-00.

Oscilloscope Trigger Circuits, TEKTRONIX Part No. 062-1056-00.

Sweep Generator Circuits, TEKTRONIX Part No. 062-1098-01.

Phillip Cutler, "Semiconductor Circuit Analysis", McGraw-Hill, New York, 1964.

Lloyd P. Hunter (Ed.), "Handbook of Semiconductor Electronics", second edition, McGraw-Hill, New York, 1962.

Jacob Millman and Herbert Taub, "Pulse, Digital, and Switching Waveforms", McGraw-Hill, New York, 1965.

The main headings in this circuit analysis refer to schematics in the diagrams section with the same name. The sub-headings indicate the individual circuit being described.

MAIN TRIGGER PREAMP ⟨1⟩

The Main Trigger Preamp converts the push-pull internal trigger signal to a single-ended signal and selects the main trigger source and coupling for the Main Trigger Generator. Fig. 2-2 shows a detailed block diagram of the Main Trigger Preamp. The schematic of this circuit is shown on diagram 1 at the rear of this manual.

Trigger Preamp. The push-pull trigger signal from the Vertical Deflection System is converted to a single-ended output by the emitter-coupled stage, Q52-Q61. The output of Q61 drives current gain stage Q66-Q70. The DC level of the output is set by internal Trig DC Bal control, R72.

Input Switching. The MAIN TRIGGERING SOURCE switch, S10, selects the source of the trigger signal. Three trigger sources are available; internal, line, and external. The external signal may also be passed through a ÷ 10 attenuator network.

The MAIN TRIGGERING COUPLING switch, S20, offers a means of attenuating high or low frequency components of the trigger signal. In addition to AC and DC coupling, C23-R23 can be selected to provide low-frequency attenuation and R25-C25-C26 for high-frequency attenuation.

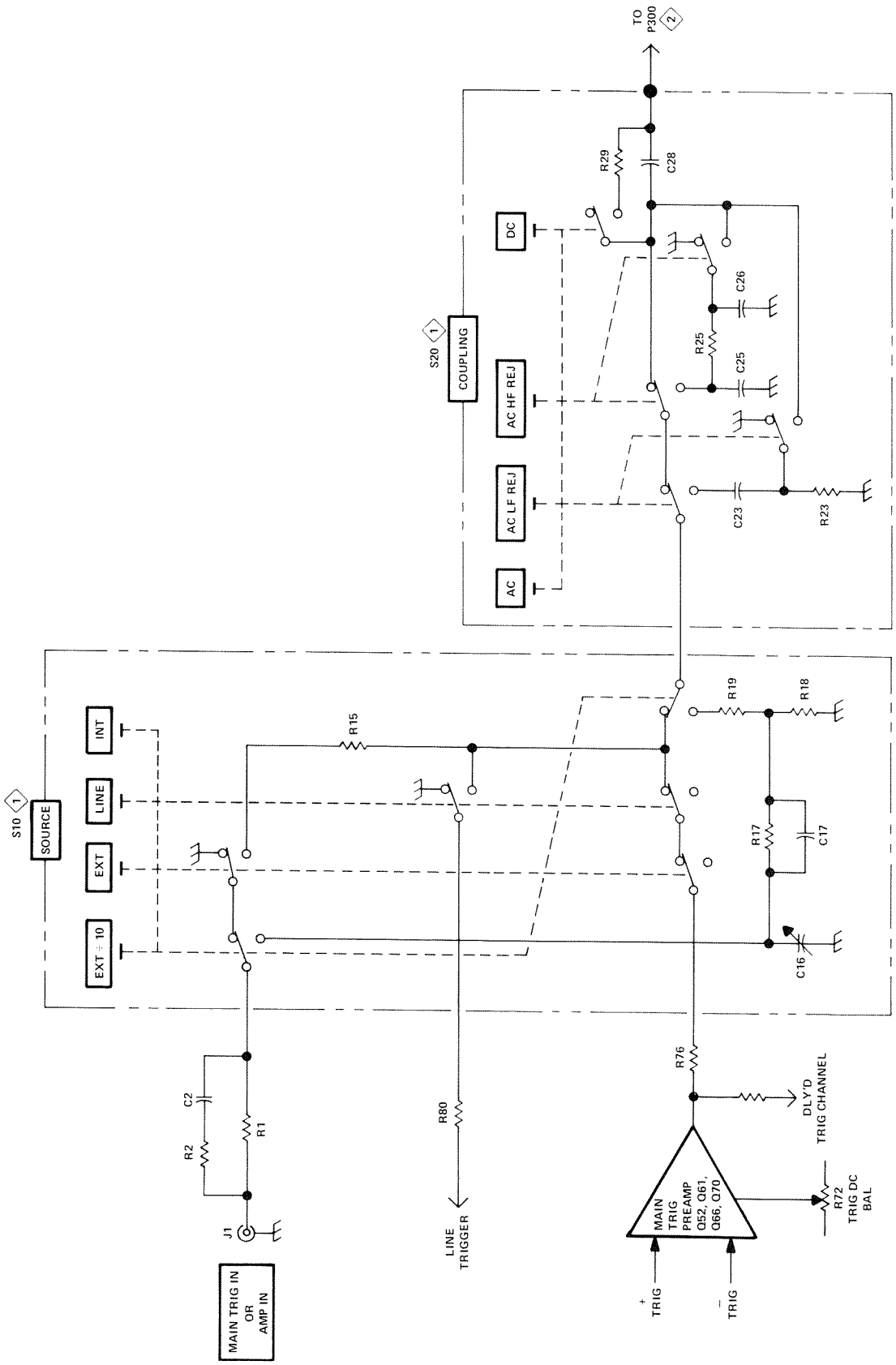


Fig. 2-2. Trigger Preamp and Input Switching Block Diagram.

MAIN TRIGGER GENERATOR ◇2◇

The Main Trigger Generator provides selection of the level and slope where triggering occurs, and supplies a fast-rise pulse to the main sweep start comparator. Fig. 2-3 shows a detailed block diagram of the Main Trigger Generator; the schematic of this circuit is shown on diagram 2 at the rear of this manual.

Input Stage. The input source-follower, Q310, provides a high input impedance for the trigger signal. It also provides isolation between the Main Trigger Generator and the input source. Input protection diode, CR307 protects Q310 from excessive input signals by clamping the gate of the input FET if the input exceeds about −15 volts. The signal at the source of Q310 is passing through emitter-follower Q315 to the base of Q320 in the Slope Comparator, and to the External Horizontal circuit.

Slope Comparator. Q320 and Q322 are connected as a difference amplifier to provide selection of the slope and level at which the sweep is triggered. The reference voltage for the comparator is provided by the LEVEL control, R4, and the Main Trig Level Center control, R333. R333 sets the level at the base of Q322 so that the display is triggered at the 0 volt DC level of the incoming trigger when the LEVEL control is centered. When the MAIN TRIGGERING LEVEL control R4 is set to midrange the base of Q322 is at approximately 0 volts. This corresponds to the 0 volt level at the input of Q320, thus switching the comparator at the 0 volt level of the trigger signal. As the LEVEL control is turned clockwise, the voltage level on the base of Q322 becomes more positive. Now the trigger signal must rise to a more positive level before comparison takes place. The resultant CRT display starts at a more positive point on the displayed signal. When the LEVEL control is turned counterclockwise from 0, the result is the opposite of the above reaction and produces a CRT display which starts at a more negative point along the + slope of the trigger signal.

R326 establishes the emitter current for Q320 and Q322. The transistor with the most positive base, controls conduction of the comparator. For example, assume that the trigger signal from the input stage is positive-going and Q320 is forward-biased. The increased current flow through R326 makes the emitter of Q322 more positive and since the base is held constant by the level control voltage, the current through Q322 decreases. The increased current through Q320 makes the voltage at pin 4 of U350A less positive, and the decrease in current through Q322 makes voltage at pin 10 of U350C more positive. Notice that the signal currents at the collectors of Q320 and Q322 are opposite in phase. The sweep can be triggered from either the positive or negative edge of the input signal. The selection is made by the SLOPE switch S4.

When SLOPE switch S4 is set to +, the voltage between R347 and R346 decreases and activates U350A by providing a low voltage level at pin 5 of U350A. A low level is also applied to pins 6 and 7 of U350B. The low level is inverted by U350B and this high level is applied to pin 11 of U350C. Thus, pin 14 of U350C goes low, as does pin 13 of U350D. Since pin 11 of U350C is high, pin 10 of U350C has no effect. If pin 4 of U350A goes low, pin 2 goes high. Pin 12 of U350D also goes high causing pin 9 of U350D to go high, and the output at pin 3 of inverter U355B to go low. However, if pin 4 of U350A goes high, the process reverses and the output at pin 3 of U355B also goes high. Thus, pin 3 of U355B follows the input at pin 4 of U350A.

When the SLOPE switch S4 is set to −, +5 volts is applied to pin 5 of U350A. Pin 2 goes low, as does pin 12 of U350D. Pin 12 is held low, regardless of what happens at pin 4 of U350A. The +5 volts at pin 5 of U350A is inverted by U350B, which makes pin 11 of U350C go low. Pin 3 of U355B now follows the signal at pin 10 of U350C.

R341, R339, and CR340, (between pin 3 of U355B and pin 4 of U350A), provide regenerative feedback. R343, R342, and CR343 provide regenerative feedback to pin 10 of U350C.

In the reset condition, pin 15 of U375B is low, as is pin 12 of U355D. When a negative pulse is applied to pin 4 of U350A, pin 3 of U355B goes low as well as pin 13 of U355D. Thus, pin 15 of U355D goes high, which sets pin 2 of U375A to the high state and provides the sweep gate output (trigger pulse) through Q382 and pin C to the Main Sweep Start Comparator. At the end of sweep, the positive-going holdoff pulse is coupled to the Sweep Gate Reset circuit through pin B. The high level at the base of Q366 turns it on, causing pin 4 and 5 of U355A to go low coincident with the holdoff pulse. Therefore, pin 2 of inverter U355A goes high, resetting U375A. Pin 2 of U375A goes low, thus terminating the sweep gate.

The high at pin 2 of U355A sets U375B, causing pin 12 of U355D to go high, locking out any trigger pulse during the holdoff period. While pin 12 of U355D is high, pin 15 of U355D will stay low regardless of the state of pin 13 of U355D.

The Trigger Lockout Latch (U375B) can only be reset when the Trig'd Sweep Gate Latch (U375A) is in the reset condition (pin 2 of U375A low, pin 11 of U355C low, and pin 13 of U355D high). Therefore, if pin 13 of U355D is low when the holdoff pulse terminates, U375B will stay set. When pin 13 of U355D goes positive, pin 11 of U355C goes negative causing a positive level at pin 14 of U355C. This positive level resets the trigger lockout latch U375B, causing pin 12 of U355D to go negative, allowing the next negative transition at pin 13 of U355D to set the trigger sweep gate latch U375A. This generates a new sweep gate at pin C.

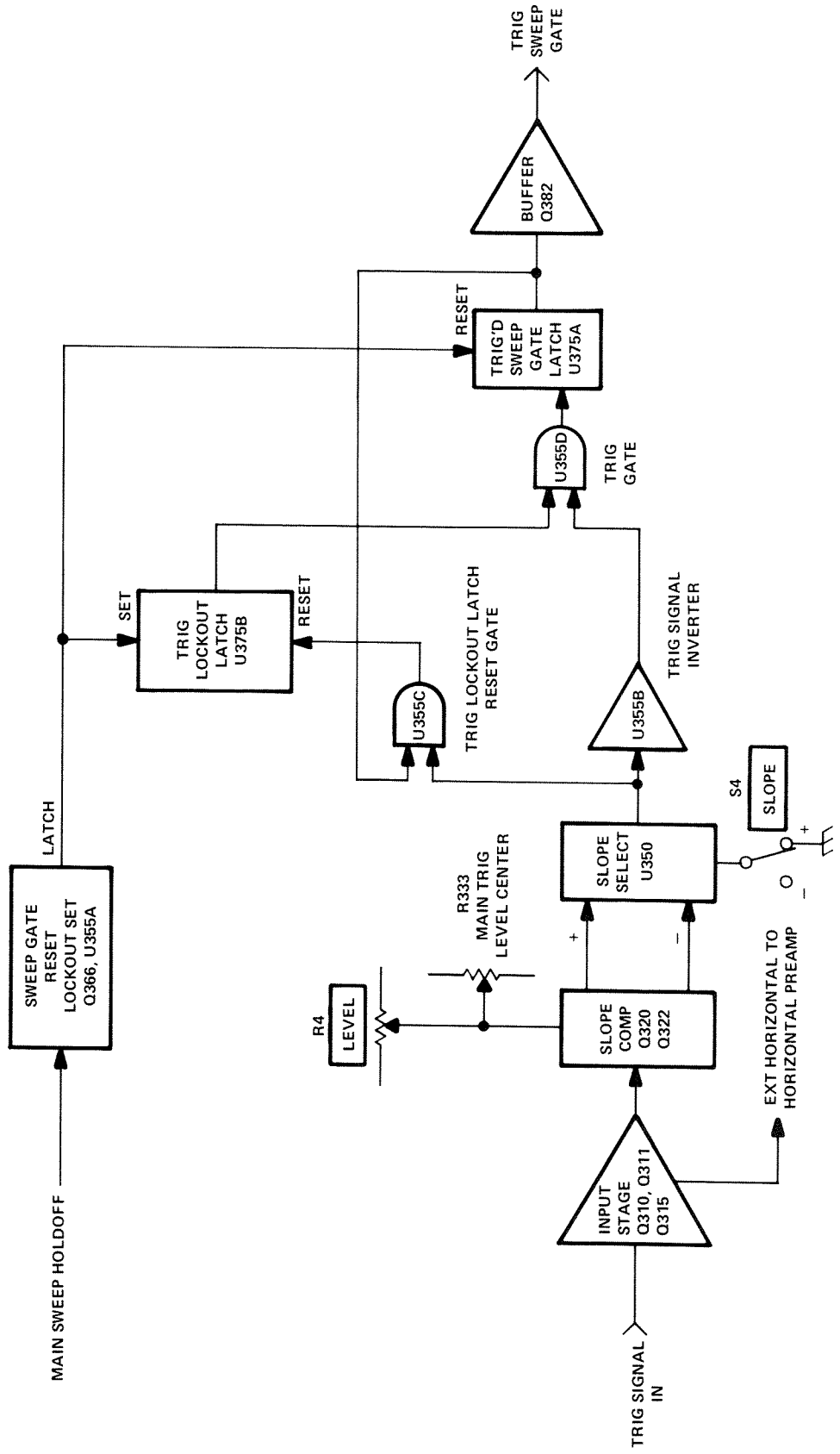


Fig. 2-3. Main Trigger Generator Block Diagram.

MAIN SWEEP GENERATOR ③

The Main Sweep Generator circuit produces a sawtooth voltage which is amplified by the Horizontal Amplifier circuit to provide horizontal sweep deflection on the CRT of the indicator oscilloscope. This output signal is generated on command (trigger pulse) from the Main Trigger Generator. The Main Sweep Generator also produces a Main Sweep Gate pulse coincident with the time that the Main Sweep runs. The Main Gate pulse is processed by the Sweep Gate Out circuit and the indicator oscilloscope for CRT unblanking and Auxiliary Gate output. In addition, the Main Sweep Generator produces several control signals for other circuits within the instrument. Fig. 2-4 shows a detailed block diagram of the Main Sweep Generator and the schematic is shown on diagram 3 at the rear of the manual.

The MAIN TRIGGERING MODE switch allows three modes of operation. When the NORM button is pressed, a sweep is produced only when a trigger pulse is received from the Main Trigger Generator circuit. When the AUTO button is pressed, a sweep is produced as in NORM except that a free-running trace is displayed when a trigger pulse is not present. SINGLE SWP operation is also similar to NORM operation except that the sweep is not recurrent. The RESET button must be pressed to view another trace. The following circuit description is given with the MAIN TRIGGERING MODE switch pressed to NORM. Difference in operation for the other two modes is discussed later.

Main Sweep Start Comparator

Q544, Q547, and Q551 comprise the Main Sweep Start comparator. In the absence of a trigger, Q544 is off and Q547 is held on by the high level from pin 3 of U520. The collector of Q547 is low and this low is coupled through emitter-follower Q551 to pin 1 of U580, thus preventing a sweep. When the Main Trigger Generator supplies a trigger, the positive transition is coupled to the base of Q544. The base of Q544 rises above the level at the base of Q547 and the current through common emitter resistor R545 is diverted from Q547 to Q544. The collector of Q547 rises and the positive step is coupled through emitter-follower Q551. The positive step appears across divider R555/R556 causing pin 1 of U580 to go positive, thus starting the sweep.

Sawtooth Generator

The lower half of the U580 diagram symbol constitutes a Miller Integrator. 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. Q596 prevents high-speed error currents from being coupled into U580 by way of C579 and pin 9.

Sweep Stop Comparator

The Sweep Stop Comparator consists of Q564 and Q568. In the absence of a sawtooth signal at pin 8 of U580, Q568 is conducting and Q564 is held off by the positive level set at its base by R564, the Main Sweep Length adjustment. When the sawtooth voltage at pin 8 of U580 raises the base of Q568 higher than the base of Q564, Q568 turns off and Q564 turns on. The collector of Q564 rises and the positive step is coupled through emitter-follower Q538 to pin 16 of U520 and sweep holdoff begins.

Holdoff Circuit

The Holdoff Circuit consists of pins 8, 10, 16, and 17 of U520 plus R and C time constants selected by the TIME/DIV switch. The holdoff prevents re-triggering the sweep generator until after the sweep timing capacitor(s) has discharged and the sweep circuits are again ready to generate a sweep.

At the end of the sawtooth waveform, a positive step is coupled to pin 16 of U520, by way of the Sweep Stop Comparator as previously described. The positive pulse seen at pin 16 of U520 is coupled internally through U520 to pin 17 and in turn to Q366 in the Main Trigger Generator. The Main Trigger Generator is reset and the output at connector pin C goes low. As a result, Q544 turns off and Q547 turns on. The collector of Q547 drops and the negative step is coupled through emitter-follower Q551, thus ending the sweep.

After a time determined by the timing components at pin 8, internal circuitry within U520 switches pin 17 to its low state, ending the holdoff gate. The Main Trigger Generator is released to generate a trigger signal.

A negative gate coincident with the positive holdoff gate, appears at pin 10 of U520. This negative gate is inverted by Q528 and coupled to the Delayed Sweep Generator for composite holdoff functions.

Trig'd Lamp Driver

When the main sweep gate is high and the sweep is running, the TRIG'D lamp is on. At all other times the lamp is off.

Delay Pickoff

The upper half of the diagram symbol for U580 includes the Delay Pickoff circuitry. Inside U580, 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, R9, determines the point on the main sweep sawtooth at which the comparator switches.

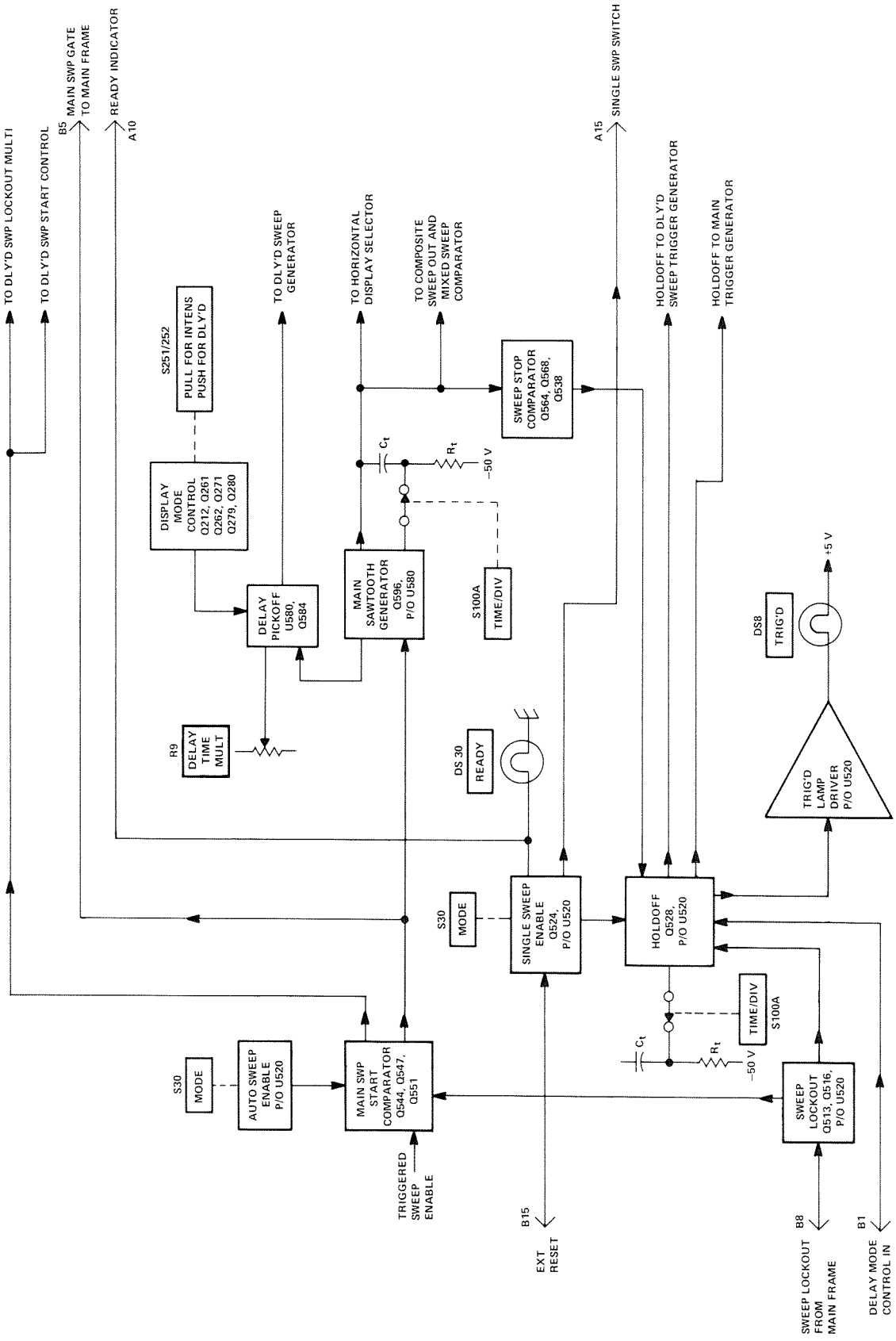


Fig. 2-4. Main Sweep Generator Block Diagram.

When the comparator switches (delay pickoff occurs), a positive gate appears at pin 4 of U580. This gate terminates at the end of the main sweep sawtooth.

The positive-going gate at pin 4 of U580 is coupled through emitter-follower Q584 to the Delayed Sweep Holdoff Generator via Q671.

Auto Triggering Mode

Operation of the Main Sweep Generator circuit in the AUTO position of the MAIN TRIGGERING MODE switch is the same as for NORM position just described when a trigger pulse is applied. However, when a trigger pulse is not present, a free-running reference trace is produced in the AUTO position. This occurs as follows:

The Auto Triggering circuit consists of pins 1, 3, 6, and 19 of U520. When the AUTO button of the MAIN TRIGGERING MODE switch is pressed, a low at pin 19 of U520 enables the Auto Circuit. When a repetitive trigger signal above 30 Hz, and of adequate amplitude is applied to the Main Sweep Start Comparator and pin 1 of U520, the internal Auto Multi at pin 6 of U520 charges towards five volts through C535 and R535, but is discharged by each incoming trigger pulse.

In the absence of a trigger pulse, C535 charges towards +5 V, switching pin 6 to its high state and pin 3 to its low state. Q547 turns off, its collector rises and a high is coupled through emitter follower Q551 to pin 1 of U580, causing the sweep to run.

Single Sweep Operation

Operation of the Main Sweep Generator in the SINGLE SWEEP position of the MAIN TRIGGERING MODE switch is similar to operation in the NORM position as previously described. However, after one sweep has run, all other sweeps are inhibited until the RESET button is pressed. A READY lamp is provided to indicate when the sweep is ready to accept a trigger.

The Single Sweep circuit consists of pins 11, 12, 14, 15, and 17 of U520. For SINGLE SWP operation, the +5 volt supply is applied to pin 12 of U520. The holdoff pulse at pin 17 of U520 goes positive, preventing generation of a sweep. When the RESET button is pressed, pin 15 is momentarily held to ground, pin 17 goes low to allow the Main Trigger Generator to accept a trigger. The holdoff line (pin 17 of U520) stays low until a sweep has been completed. At this time, the holdoff pulse rises at pin 17 and stays in the holdoff state until the RESET button is pressed.

Q524 acts as a switch for the READY lamp. When the holdoff gate at pin 17 is high, preventing the sweep generator from accepting a trigger, pin 11 is high and Q524 and the READY lamp are off. When the RESET button is pressed, the holdoff gate at pin 17 goes low and allows the Main Sweep Generator to accept a trigger. Pin 11 rises and turns on Q524, which provides the current to turn on the READY lamp.

Sweep Lockout

Q513, Q516, Q538, and pins 3, 16, and 18 of U520 comprise the Sweep Lockout circuit. The Sweep Lockout circuit is functional when the 7B53A/7B53AN is installed in the B Horizontal compartment of an indicator oscilloscope which accommodates two horizontal plug-in units, and it is desired to operate in the Alternate Horizontal Mode, or to operate the 7B53A/7B53AN as a delayed sweep unit. Lockout is applied to the 7B53A/7B53AN during the time that the sweep from the associated time base is displayed.

The indicator oscilloscope controls initiation of a sweep by supplying current to the base of Q513 when lockout is required. This current causes a positive step at pin 18 of U520. Pin 3 of U520 steps positive and Q547 turns on. The collector of Q547 falls and the low is coupled through emitter-follower Q551 to pin 1 of U580, thus preventing the sweep. If lockout is initiated while the sweep is running, the leading edge of the lockout pulse is differentiated through C519 and R519, coupled through emitter-follower Q538 and appears as a high at pin 16 of U520. This starts the holdoff cycle. (The holdoff cycle is as described previously.)

Delayed Mode Control

When the 7B53A/7B53AN is installed in the B Horizontal compartment of an indicator oscilloscope with two horizontal compartments, the Delayed Mode Control determines whether the 7B53A/7B53AN operates as an independent time base or as a delayed sweep unit in the triggerable after delay time mode. When approximately +3 to 4.5 volts is present at interface connector B1 (and therefore pin 13 of U520), the Auto Circuit (previously described) is disabled. A sweep can be enabled only by a trigger pulse to the Sweep Start Comparator. During delay time determined by the settings of the delaying sweep unit, sweep lockout (previously described) inhibits the sweep. After delay time, the 7B53A/7B53AN can be triggered. An approximate zero volt level at pin 13 of U520 enables the Auto Circuit, causing the 7B53A/7B53AN to operate as an independent time base.

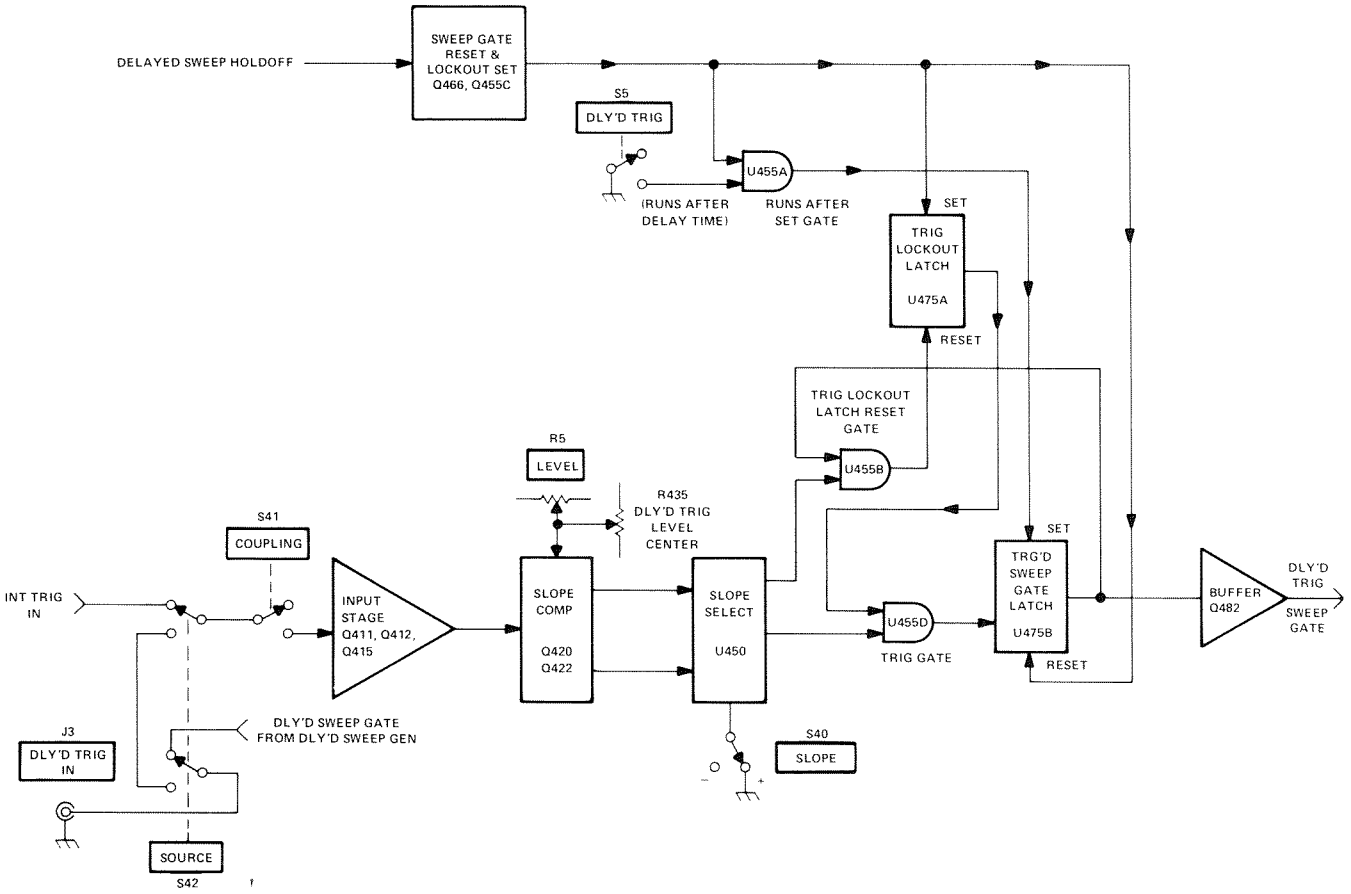


Fig. 2-5. Delayed Trigger Generator Block Diagram.

DELAYED TRIGGER GENERATOR ④

The Delayed Trigger Generator circuitry is essentially the same as the Main Trigger Generator, except for the Runs After Dly Time and Triggerable After Delay Time modes. Therefore, only the circuitry involving these modes will be described. For detailed description of the remaining delayed trigger circuitry, refer to the Main Trigger Generator discussion. Fig. 2-5 shows a detailed block diagram of the Delayed Trigger Generator; the schematic is shown on diagram 4 at the rear of this manual.

When the DLY'D TRIG LEVEL is set to RUNS AFTER DLY TIME, S5 grounds R469 and pin 4 of U455A is forced to the low state. Thus, pin 2 of U455A will follow pin 5, but reversed in polarity. When the holdoff pulse is applied to the base of Q466, pin 4 of U455C goes to the high state, which resets U475B and terminates the sweep gate. When the holdoff pulse terminates, pin 4 of U455C goes to the low state and pin 2 of U455A goes to the high state. This sets U475B which generates a new sweep gate.

When the DLY'D TRIG LEVEL control is in the Triggerable After Dly Time mode, pin 4 of U455A is high and pin 2 is low. Therefore, pin 12 of U475B is also low and the Delayed Trigger Generator operates in the Triggerable After Dly Time mode in a similar way as the Main Trigger Generator operates.

DELAYED SWEEP GENERATOR ⑤

The Delayed Sweep Generator produces a sawtooth voltage which is amplified by the Horizontal Amplifier circuits to provide a delayed sweep CRT display. The sawtooth output voltage is generated on command of the Delayed Trigger Generator. The Delayed Sweep Generator also produces a Delayed Sweep Gate pulse, coincident with the time that the Delayed Sweep Generator runs, to be processed by the Sweep Gate Out circuit and the oscilloscope for CRT unblanking. Fig. 2-6 shows a detailed block diagram of the Delayed Sweep Generator and the schematic is shown on diagram 5 at the rear of the manual.

Dly'd Swp Start Multi

Q603 and Q608 comprise the Dly'd Swp Start Multi. This circuit is connected as a bistable multivibrator, with Q608 normally conducting and Q603 off.

When pin 15 of U475B (Delayed Trigger Generator) switches to its high state, the positive step appears at the base of Q603. This causes the multi to flip, so Q603 is on and Q608 is off, thus causing a positive step through Q610 to pin 1 of U650. Q608 remains in the positive state for the duration of the delay gate. At the end of the delay gate, the Dly'd Swp Start Multi reverts to its original state with Q603 off and Q608 on.

Dly'd Swp Start Control

The Dly'd Swp Start Control circuit includes Q656, Q654 and Q610. This circuit couples a positive gate to pin 1 of U650 (Miller Integrator) to control the period during which a sawtooth is generated.

In all Display Modes except MIXED, Q656 and Q654 are inactive due to the +5 volts applied to the base of Q654, through CR654 and Q280, from the +5 volt supply. When the collector of Q608 (Dly'd Swp Start Multi) goes positive, Q610 couples the positive gate to pin 1 of U650, initiating the generation of the delayed sweep sawtooth.

When operating in the MIXED Display Mode, the anode circuit of CR654 is open. The gate from the Main Swp Start Multi is negative-going at the base of Q654. The resulting current from Q654 forward biases Q610, and a positive gate is coupled to pin 1 of U650.

Mixed Swp Comparator

Q678, Q682, Q684 and Q688 comprise the Mixed Swp Comparator circuit. This circuit determines whether U650 is running at the main sweep or delayed sweep rate.

When the VARIABLE control is pulled for MIXED, Q682 is forward biased. The main sweep sawtooth at the emitter (and thus, the collector) of Q682 is a positive-going ramp. This causes a ramp of increasing current through Q684. During the time that a Delay Gate is not being generated, Q603 (Dly'd Swp Start Multi) is biased off and Q678 is on. In this condition, U650, Q678, Q684 and Q688 form a operational amplifier. The negative-going ramp at the collector of Q684 becomes a positive-going ramp at pin 8 of U650, running at the main sweep rate.

When the Delay Gate is generated, the Delayed Trigger Generator forward biases Q603. The collector current through R684 reverse biases Q678, opening the operational amplifier loop. U650 is released to run at the delayed sweep rate. Therefore, the sawtooth at pin 8 of U650 will first run at the main sweep rate and then change to the delayed sweep rate when the Delay Gate is generated.

Dly'd Swp Stop

Pins 4, 5, and 6 of U650 (plus external circuitry) constitute the Dly'd Swp Stop circuit. The setting of the Dly'd Swp Length adjust (R652) determines the point on the delayed sweep sawtooth at which pin 4 of U650 goes positive.

Dly'd Swp Lockout Multi and Dly'd Swp Holdoff

The operation of the Dly'd Swp Lockout and Holdoff circuits is dependent on the following signals:

1. The Dly'd Swp Stop signal (positive-going) at pin 4 of U650.

2. The Main Sweep Holdoff signal (positive-going) by way of R673.

3. The $\overline{\text{Main Sweep Gate}}$ (positive-going) at the base of Q665 through CR662.

4. The $\overline{\text{Dly Gate}}$ at the base of Q671.

Q659 and Q665 form the Dly'd Swp Lockout Multi. When the Dly'd Swp Stop circuit causes pin 4 of U650 to go positive, Q659 turns on and Q665 turns off, coupling a positive-going holdoff pulse to pin G. At the end of the main sweep, the positive going $\overline{\text{Main Sweep Gate}}$ pulse turns on Q665 and its collector falls. But the positive-going main holdoff pulse through R673 keeps pin G positive. When the main sweep holdoff pulse falls, the level at pin G remains positive, due to the negative going $\overline{\text{Dly Gate}}$ pulse applied to Q671. After the delay time determined by the TIME/DIV OR DLY TIME switch and the DELAY TIME MULT dial, the $\overline{\text{Dly Gate}}$ pulse rises, Q671 turns off, and the holdoff pulse at pin G goes negative.

When operating in the MIXED Display Mode, the Delayed Sweep Stop signal (positive-going) at pin 4 of U650, turns on Q659. The negative step at its collector turns on Q656 and turns off Q654. The resulting negative level at the collector of Q654 is coupled through emitter follower Q610, thus removing the positive level from pin 1 of U650.

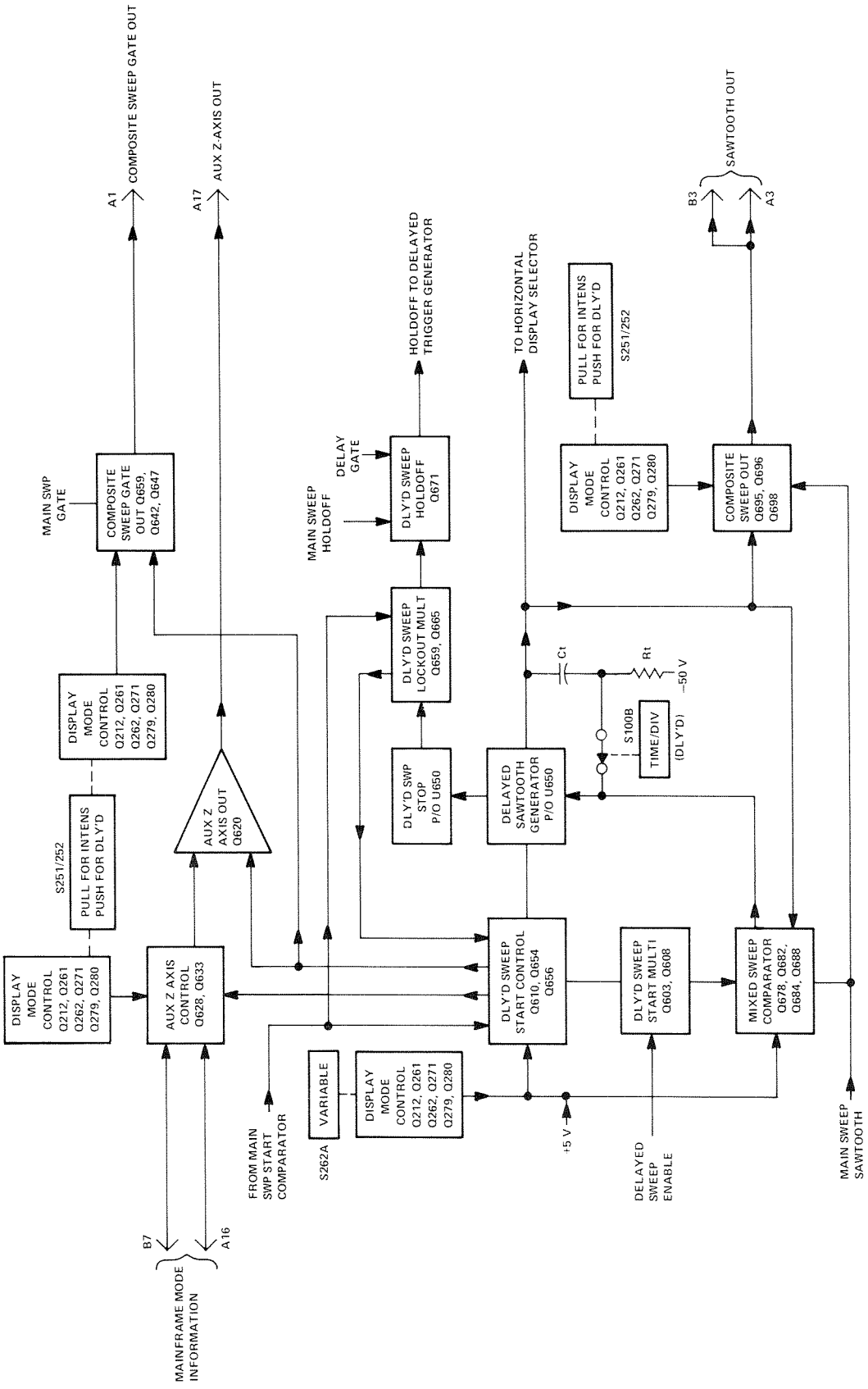


Fig. 2-6. Delayed Sweep Generator Block Diagram.

Composite Swp Out

Q695, Q696 and Q698 form the Composite Swp Out circuit. When the TIME/DIV switch is set for MAIN SWP or INTENS, Q696 is forward biased, coupling the main sweep sawtooth to the base of Q698. Q698 is an emitter-follower stage which couples the signal to output terminals A3 and B3.

If DLY'D or MIXED SWP is selected by the TIME/DIV OR DLY TIME switch, Q695 is forward biased and couples the delayed sweep or mixed sweep sawtooth to the base of Q698.

Q696 and Q698 or Q695 and Q698 (depending on TIME/DIV OR DLY TIME setting) are connected as an operational amplifier, providing a high degree of gain stability.

Composite Swp Gate Out

The Composite Sweep Gate Out circuit includes Q642, Q639 and Q647. The output at the collector of Q647 connects to interface connector pin A1 for use in the indicator oscilloscope. In the AMPL position of the TIME/DIV OR DLY TIME switch, connector A1 is set to approximately +4.3 volts (via CR201) to unblank the CRT.

Q647 serves as the output stage. With the TIME/DIV OR DLY TIME switch set to either MAIN SWP or INTENS, Q642 couples the main sweep gate to the base of Q647. When either DLY'D or MIXED SWP is selected, Q639 is on. The gate signal at the emitter of Q610 (Dly'd Swp Start Control) is coupled to the base of Q647.

Aux Z Axis Control

The Aux Z Axis Control circuit includes Q628 and Q633. This circuit uses the indicator oscilloscope mode and switching levels to determine when the sweep signal from the 7B53A/7B53AN is being displayed on the CRT. Information of this type is normally used only when operating the 7B53A/7B53AN 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 Q633, resulting in a positive level at its emitter.

When the 7B53A/7B53AN is used in a three plug-in indicator oscilloscope and the TIME/DIV OR DLY TIME switch is set to INTENS, Q628 is off and Q633 is forward biased.

Aux Z Axis Out

Q620 is the Aux Z-Axis Out stage. The output at connector DZ is connected to pin A17 on the interface connector and then to the Z-axis circuit in the indicator oscilloscope. A reduction in current through Q620 causes the CRT trace to brighten.

For this description, assume that the 7B53A/7B53AN is used in a three plug-in indicator oscilloscope.

As described under Aux Z Axis Control, when INTENS is selected by the TIME/DIV OR DLY TIME switch, Q633 is turned on. The positive level at the emitter of Q633 reverse-biases CR635, which reduces conduction of Q620. The positive gate appearing at the emitter of Q610 (Dly'd Swp Start Control) during the delayed sweep further reduces current through Q620, causing the CRT trace to intensify beyond the normal level of unblanking.

In all other selections of the TIME/DIV OR DLY TIME switch, Q628 is forward biased through CR285. This turns off Q633, which diverts current through CR635. Q620 is in saturation and the CRT trace brightness is now set by the unblanking signal (Sweep Gate).

HORIZONTAL PREAMP ◈8

The Horizontal Preamp selects the source of the output signal (main or delayed sweep) and supplies an amplified sawtooth signal to the horizontal circuits in the indicator oscilloscope. In addition, this circuit contains the horizontal magnifier circuit and the horizontal positioning network. Fig. 2-7 shows a detailed block diagram of the Horizontal Preamp and the schematic is shown on diagram 8 at the rear of the manual.

Ext Horiz Amp

The Ext Horiz Amp consists of Q734. When the TIME/DIV OR DLY TIME switch is in any setting except AMPL, the +5 volts coupled through CR735 to the base of Q734 holds this transistor off. Therefore, any incoming external horizontal signal is blocked. When the TIME/DIV OR DLY TIME switch is set to AMPL, the +5 volts is removed from the base of Q734 and the output signal is coupled through R734.

Horiz Display Selector

Q724 and U720A, B, C, D, and E comprise the Horiz Display Selector circuitry. Depending upon the setting of the TIME/DIV OR DLY TIME switch, this circuit determines which signal is coupled to the Horiz Out Amp.

When the TIME/DIV OR DLY TIME switch is set to AMPL, U720C 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

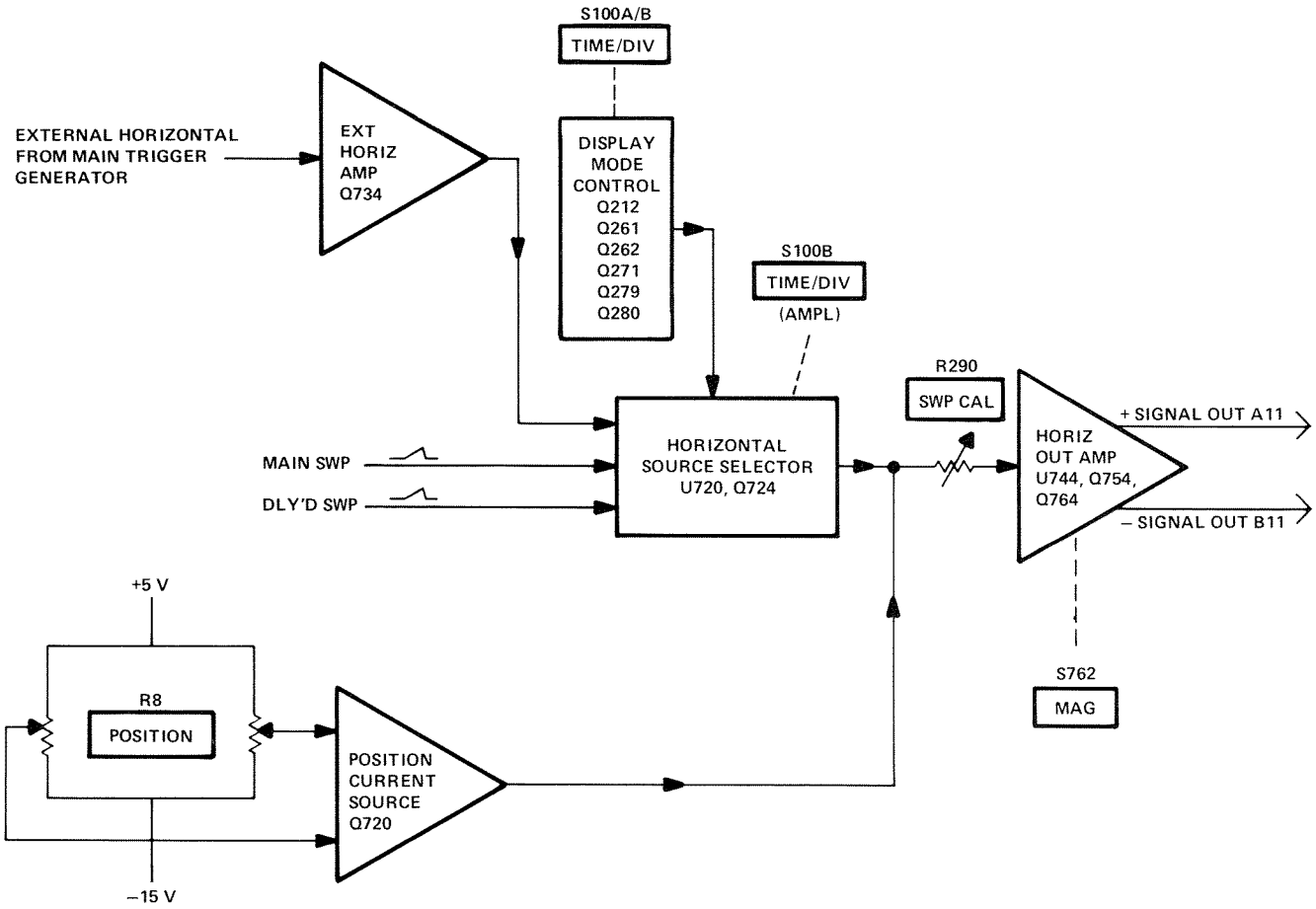


Fig. 2-7. Horizontal Preamp Block Diagram.

Control circuit, assuring that no internally generated sweep signal is coupled through at this time. In all other positions of the TIME/DIV OR DLY TIME switch, +5 volts is connected to the Display Mode Control circuit.

When MAIN SWP or INTENS is selected by the TIME/DIV OR DLY TIME switch, +5 volts is applied to the anode of CR283. This forward biases U720A, which couples the main sweep sawtooth to the Horiz Out Amp. Q724 is also forward biased so that any signal developed by the Delayed Sweep Generator is by-passed to ground (via the –15 volt supply). Any output from the Ext Horiz Amp is coupled to ground through U720D.

When operating in the DLY'D SWP or MIXED Display Mode, +5 volts is applied to the base of U720B through CR265. This forward-biases U720B, which couples the delayed sweep or the mixed sweep signal to the Horiz Out Amp. U720E is also forward biased, coupling the main sweep signal to ground.

Position Amp

The POSITION control R8 sets the bias on Q720, thus setting the DC current coupled to the Horiz Out Amp.

Horiz Out Amp

The Horiz Out Amp includes Q754, Q764, and U744A, B, C, and D. U744B and U744C are connected as an operational amplifier, with R_f being R768 and R_i the Swp Cal adjust, R290.

U744C and U744D form a paraphase amplifier. This stage converts the single-ended input signal 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 MAG X10 button is out, R761 and R762 are connected in parallel with R759 and R766, decreasing the emitter degeneration of the stage. This increases gain of the stage 10 times. The Mag Gain adjust is set to provide a calibrated gain when magnified.

Q754 and U744A set the operating bias for the output stage. Q764 serves as a constant-current source for U744C and U744D.

READOUT SWITCHING ⑦

The Readout Switching circuit consists of switching resistors which signal the oscilloscope readout system of the time-base unit sweep rate. The switching resistors are selected by the Time/Division and X10 MAG switch settings.

Refer to schematic diagram 7, Readout Switching, at the rear of this manual. The numbers 1, 2, or 5 are selected by resistors R940, R907, and R905 for Channel 1 (main sweep); and by resistors R941, R919, and R917 for Channel 2 (delayed sweep). The number of zeros is selected by R934, R911, and R909 for Channel 1; and by resistors R935, R923, and R921 for Channel 2. The time prefix (milli, micro, nano) is selected by resistors R928, R903, and R901 for Channel 1; and by resistors R929, R915, and R913 for Channel 2. Resistors R927 and R925 select the symbol S (seconds) for Channel 1 and resistors R939 and R926 select the symbol S for Channel 2. When the VARIABLE Time/Division control is in the Uncalibrated position, R931 selects the symbol > (greater than) for Channel 1 and R922 selects the symbol > for Channel 2. When the MAG switch is in the X10 position, R943 is switched out of the circuit for Channel 1 and R944 is switched out of the circuit for Channel 2.

MAINTENANCE

Introduction

This section of the manual contains maintenance information for use in preventive maintenance, corrective maintenance, and troubleshooting of the 7B53A/7B53AN.

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 reliability of this instrument. The severity of the environment to which the 7B53A/7B53AN is subjected determines the frequency of maintenance. A convenient time to perform preventive maintenance is preceding recalibration of the instrument.

Cleaning

The 7B53A/7B53AN 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 oscilloscope reduce the amount of dust which reaches the interior of the 7B53A/7B53AN. Operation of the system without the oscilloscope covers in place necessitates more frequent cleaning. When the instrument 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, zylene, acetone, or similar solvents.

Exterior. Loose dust accumulated on the outside of the 7B53A/7B53AN 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 should not be used.

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

Visual Inspection

The 7B53A/7B53AN 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.

Semiconductor Checks

Periodic checks of the transistors, FET's, and IC's used in the 7B53A/7B53AN 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 semiconductors 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 4.

TROUBLESHOOTING

Introduction

The following information is provided to facilitate troubleshooting of the 7B53A/7B53AN. Information contained in other sections of this manual should be used along with the following information to aid in locating the defective component. An understanding of the circuit operation is very helpful in locating troubles. See the Circuit Description in Section 2.

Troubleshooting Aids

Diagrams. Circuit diagrams are given on foldout pages in Section 6. The component number and electrical value of each component in this instrument are shown on the diagrams.

Circuit Boards. Fig. 6-2 (located in the diagrams section) shows the location of the circuit boards within this instrument along with the assembly numbers. The assembly numbers are used on the diagrams to aid in locating the boards. Pictures of the circuit boards are shown in the Diagrams section, on the back of the page opposite the circuit diagram, to aid the cross-referencing between the diagrams and the circuit-board pictures. Each electrical component on the boards is identified by its circuit number as well as the interconnecting wire or connectors. The circuit boards are also outlined on the diagrams with a blue line to show which portions of the circuit are located on a circuit board.

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

Diode Color Code. The cathode end of each glass encased diode is 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 pink brown-gray-green indicates TEKTRONIX Part No. 152-0185-00). The cathode and anode ends of a metal-encased diode can be identified by the diode symbol marked on the body.

Transistor and Integrated Circuit Basing. Fig. 6-1 (located in the diagrams section) illustrates basing configurations for all transistors and integrated circuits used in the 7B53A/7B53AN.

Wiring Color Code. Insulated wire and cable used in the 7B53A/7B53AN is color-coded to facilitate circuit tracing.

Interface Connector Pin Locations. The Interface circuit board couples the 7B53A/7B53AN to the associated oscilloscope. Fig. 3-1 illustrates the locations of pins on the interface connector as shown on the Voltage distribution and Output Connectors schematic in the diagrams section.

Troubleshooting Techniques

This troubleshooting procedure is arranged in an order which checks the simple trouble possibilities first. 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 in this manual or the detailed Operating Instructions in the 7B53A/7B53AN Operators Manual.

2. Check Associated Equipment. Before proceeding with troubleshooting of the 7B53A/7B53AN, 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 (preferably another 7B53A/7B53AN or similar unit). If the trouble persists after substitution, the oscilloscope or vertical plug-in unit should be checked.

3. 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.

4. 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.

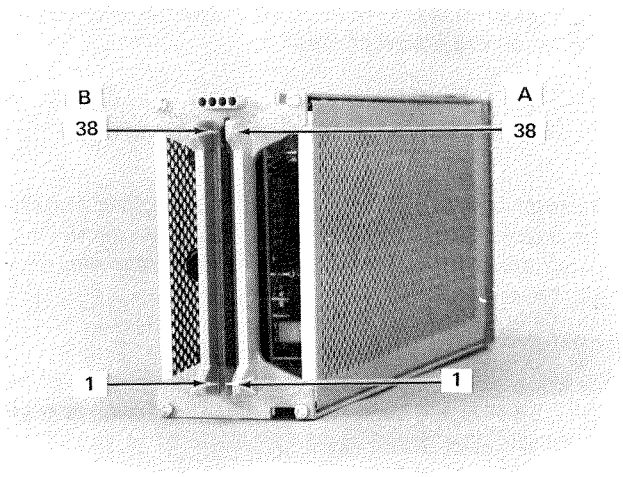


Fig. 3-1. Location of pins on Interface connector.

5. Isolate Trouble to a Circuit. To isolate a trouble to a particular circuit, note the trouble symptom. The symptom often indicates the circuit in which the trouble is located. For example, if stable triggering can be obtained in INT position of the SOURCE switch and cannot be obtained in the EXT or LINE positions, the External Trigger Preamp or Trigger Source Switching circuits are probably at fault. When trouble symptoms appear, use the front-panel controls and the CRT display to isolate the trouble to one circuit. Remember, the amplifier unit or the indicator oscilloscope may be responsible for the trouble. When trouble appears in more than one circuit, check all affected circuits by taking voltage and waveform measurements. Once the defective circuit has been located, proceed with steps 6 and 7 to locate the defective component(s).

6. Check Individual Components. The following procedures describe methods of checking individual components in the 7B53A/7B53AN. Components which are soldered in place are best checked by disconnecting one end. This isolates the measurement from the effects of surrounding circuitry.

a. TRANSISTORS. The best check of transistor operation is actual performance under operating conditions. If a transistor is suspected of being defective, it can 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 TEKTRONIX Type 576).

b. INTEGRATED CIRCUITS. Integrated circuits should not be replaced unless they are actually defective. The best method for checking these devices is by direct substitution with a new component or one which is known to be good. Be sure that circuit conditions are not such that a replacement component might be damaged.

c. 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.

CAUTION

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

d. 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.

e. 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.

f. 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.

7. 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

All electrical and mechanical part replacements for the 7B53A/7B53AN 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.

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

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

Component Replacement

WARNING

Disconnect the equipment from the power source before replacing components.

Semiconductor Replacement. Semiconductor 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.

Replacement devices should be of the original type or a direct replacement. Replace in the same manner as the original. Fig. 6-1 (located in diagram section) shows the lead configurations of the semiconductor devices used in this instrument. When replacing, check the manufacturer's basing diagram for correct basing.

Interconnecting Pin Replacement. Two methods of interconnection are used in this instrument to connect the circuit boards with other boards and components. When the interconnection is made with a coaxial cable, a special end-lead connector plugs into a socket on the board. Other interconnections are made with a pin soldered onto the board. 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 into the board. If the mating connector is on the end of a lead, an end-lead pin connector is used which mates with the interconnecting pin. The following information provides the replacement procedure for the various interconnecting methods.

a. Coaxial-Type End-Lead Connectors

Replacement of the coaxial-type end-lead connectors requires special tools and techniques; only experienced maintenance personnel should attempt replacement of these connectors. It is recommended that the cable or wiring harness be replaced as a unit. For cable or wiring harness part numbers, see the Mechanical Parts List. An alternate method is to refer the replacement of the defective connector to your local TEKTRONIX Field Office or representative.

b. Circuit-Board Pins

NOTE

A circuit-board pin replacement kit including necessary tools, instructions, and replacement pins is available from Tektronix, Inc. Order TEKTRONIX Part No. 040-0542-00.

To replace a pin which is mounted on a circuit board, first disconnect any pin connectors. Then, unsolder the damaged pin and pull it out of the circuit board with a pair of pliers. Be careful not to damage the wiring on the board with too much heat. Ream out the hole in the circuit board with a 0.031-inch drill. Remove the ferrule from the new interconnecting pin and press the new pin into the hole in the circuit board. Position the pin in the same manner as the old pin. Then, solder the pin on both sides of the circuit board. If the old pin was bent at an angle to mate with a connector, bend the new pin to match the associated pins.

c. Circuit Board Pin Sockets

The pin sockets on the circuit boards are soldered to the rear of the board. To replace one of these sockets, first unsolder the pin (use a vacuum-type desoldering

tool to remove excess solder). Then straighten the tabs on the socket and remove it from the hole in the board. Place the new socket in the circuit board hole and press the tabs down against the board. Solder the tabs of the socket to the circuit board, being careful that solder does not flow into the socket.

NOTE

The spring tension of the pin 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 connecting point for spring-loaded probe tips, alligator clips, etc.

d. End-Lead Pin Connectors

The pin connectors used to connect the wires to the interconnecting pins are clamped to the ends of the associated leads. To replace damaged end-lead pin connectors, remove the old pin connector from the end of the lead and clamp the replacement connector to the lead.

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

Switch Replacement. Two types of switches used in the 7B53A/7B53AN are the pushbutton switches and the cam-type switch. The following special maintenance information is provided.

a. PUSHBUTTON SWITCHES. Use the following procedure to replace pushbutton switches:

NOTE

See Mechanical Parts exploded views to aid in pushbutton switch removal.

1. Set the TIME/DIV OR DLY TIME and DLY'D Time/Division switch to AMPL to provide easy access to the setscrew on the clear plastic flange and to facilitate replacement of the Time/Division switch.

2. Loosen the setscrews and remove the LEVEL, SLOPE, POSITION, FINE, VARIABLE, and DLY'D TRIG LEVEL controls. Loosen two setscrews and remove the DLY'D Time/Division knob. Loosen one setscrew and remove the clear plastic flange associated with the TIME/DIV OR DLY TIME switch (setscrew behind the front subpanel).

3. Remove the spring from the 7B53A/7B53AN release latch.

4. Remove front panel to gain access to pushbutton switch mounting screws.

5. Loosen four screws holding the front subpanel to the chassis and the screws holding the switch to be replaced to the front subpanel.

6. Loosen any multi-pin connector(s) associated with the switch being replaced and unsolder leads or components where necessary.

7. When the switch being replaced is clear from external connection, remove the complete switch assembly.

8. To replace the pushbutton switch, reverse the above procedure. Observe the following precautions:

a. Make sure that the clear plastic flange and the DLY'D Time/Division knob are replaced at the same switch position from which they were removed (AMPL).

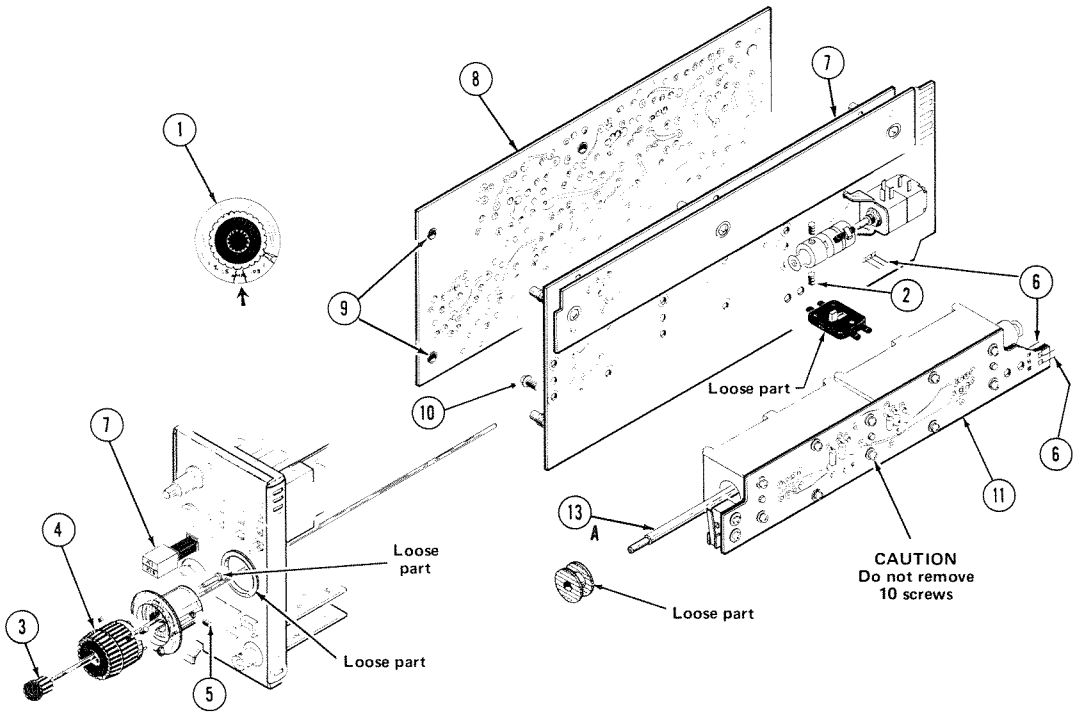
b. When replacing the DLY'D Time/Division knob and the clear plastic flange, slide the plastic flange onto the shaft but do not tighten. Then install the DLY'D Time/Division knob (it takes a little pressure) and tighten in place. Next, push the clear plastic flange (from behind the front subpanel) until it seats properly with the DLY'D Time/Division knob and lock in place. This will prevent backlash between the clear plastic and the DLY'D Time/Division knob as the cam is rotated.

Ⓐ

b. CAM-TYPE SWITCH. The cam switch used in the 7B53A/7B53AN consists of two rotating cams (front portion for TIME/DIV OR DLY TIME and rear portion for DLY'D Time/Division) which mate with contacts on an adjacent Interface circuit board. These contacts are activated by lobes on the cams as the switch is rotated. The switch can be disassembled for inspection, cleaning, repair, or replacement, but it is recommended that the switch be removed from the instrument only as a unit. See Fig. 3-2 for special instructions on cam-switch removal.

CAUTION

Repair of the cam switch should be undertaken only 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 Number 040-0541-00) contains special alignment tools for use in repairing or replacing the switch contacts. For information or assistance on maintenance of the cam switch, contact your local TEKTRONIX Field Office or representative.



1. Set the TIME/DIV OR DLY TIME and DLY'D Time/Division switches to AMPL to provide easy access to the setscrew on the clear plastic flange (rear of front subpanel) and to facilitate replacement of the switches.

2. Loosen two setscrews to allow removal of VARIABLE control shaft (rotate the VARIABLE control as necessary).

3. Remove VARIABLE knob and shaft through front of instrument.

4. Loosen two setscrews and remove DLY'D Time/Division knob.

5. Loosen setscrew (located rear of front subpanel) and remove clear plastic flange.

6. Remove two interconnecting cables from rear of readout board (7B53A only) and one cable from Interface board (rear of cam-switch).

7. Remove MAG switch extension from switch and remove extension through front panel.

8. Remove four interconnecting cables from sweep board.

9. Remove six screws from sweep board and remove sweep board.

10. Remove eight screws holding can-switch assembly to Interface board (six screws 7B53AN).

CAUTION

Do not remove ten screws holding Readout board to cam-switch (7B53A only).

11. Remove cam switch assembly.

12. Follow the procedure as given in the switch repair kit to remove, replace, etc., the contacts on the Interface board.

13. To replace the cam switch, reverse the above procedure. Observe the following precautions:

a. The innerconcentric shaft of the cam switch must be properly aligned for correct switch operation. Insert innerconcentric shaft into rear of cam switch and push all the way in (it may be necessary to rotate shaft slightly). Rotate shaft fully clockwise (as viewed from rear of cam switch) and pull outward to lock into place.

b. When fastening the cam-switch to the Interface board, tighten the screws evenly (recommended torque is three inch pounds).

c. When replacing the sweep board, do not apply must pressure until it is certain that all pins from the Interface board have mated with the connectors on the Sweep board.

d. Make sure that the clear plastic flange and the DLY'D Time/Division knob are replaced at the same switch position from which they were removed (AMPL).

e. When replacing the DLY'D Time/Division knob and the clear plastic flange, slide the flange onto the shaft but do not tighten. Then install the DLY'D Time/Division knob (it takes a little pressure) and tighten in place. Next, push the clear plastic flange (from behind the front sub-panel) until it seats properly with the DLY'D Time/Division knob and lock in place. This will assure no backlash between the DLY'D Time/Division knob and the clear plastic flange as the cam is rotated.

Fig. 3-2. Cam Switch Removal.

CALIBRATION

Introduction

To assure instrument accuracy, check the calibration of the 7B53A/7B53AN 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.

TEKTRONIX Field Service

Tektronix, Inc., provides complete instrument repair and recalibration service at local Field Service Centers and the Factory Service Center. Contact your local TEKTRONIX Field Office or representative for further information.

Using This Procedure

General. This section provides several features to facilitate checking or adjusting the 7B53A/7B53AN. These are:

Index. To aid in locating a step in the Performance Check or Adjustment procedure, an index is given preceding Part I—Performance Check and Part II—Adjustment procedure.

Performance Check. The performance of this instrument can be checked without removing the covers or making internal adjustments by performing only Part I—Performance Check. This procedure checks the instrument against the tolerances listed in the Performance Requirement column of the Specification Section in the 7B53A/7B53AN Operators Manual. Screwdriver adjustments accessible from the outside of the instrument are adjusted as part of the Performance Check procedure. In addition, a cross-reference is provided to the step in Part II—Adjustment which will return the instrument to correct calibration. In most cases, the adjustment step can be performed without changing control settings or equipment connections.

Adjustment Procedure. To return this instrument to correct calibration with the minimum number of steps, perform only Part II—Adjustment. The Adjustment procedure gives the recommended calibration procedure for all circuits in this instrument. Procedures are not given for checks which can be made without removing the covers; see Part I—Performance Check for the procedure for these checks.

Partial Procedure. A partial check or adjustment is often desirable after replacing components, or to improve the adjustment of a portion of the instrument between major recalibrations. To check or adjust only part of the instrument, set the controls as given under Preliminary Control Settings and start with the nearest Equipment Required list preceding the desired portion. To prevent unnecessary recalibration of other parts of the instrument, readjust only if the tolerance given in the CHECK—part of the step is not met. If re-adjustment is necessary, also check the calibration of any steps listed in the INTERACTION—part of the step.

Complete Performance Check/Adjustment. To completely check and adjust all parts of this instrument, perform both Part I and II. Start the complete procedure by adjusting the trigger system as given in the adjustment procedure and follow this with the Performance Check for the same portion (e.g., Trigger System Check). This method will assure that the instrument is both correctly adjusted and performing within all given specifications.

NOTE

All waveforms shown in this section were taken with a TEKTRONIX Oscilloscope Camera System, unless noted otherwise.

TEST EQUIPMENT REQUIRED

General

The following test equipment and accessories, or its equivalent, is required for complete calibration of the 7B53A/7B53AN. Specifications given for the test equipment are the minimum necessary for accurate calibration. Therefore, some of the specifications listed here may be less precise than the actual performance capabilities of the test equipment. All test equipment is assumed to be correctly calibrated and operating within the listed specifications.

The Performance Check and Adjustment procedures are based on this recommended equipment. 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 if more information is needed.

Special Calibration Fixtures

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

Calibration Equipment Alternatives

All of the listed test equipment, or equivalent, is required to completely check and adjust this instrument. The procedures are based on the first item of equipment given as an example of applicable equipment. When other equipment is substituted, control settings or setup might need to be altered to meet the requirements. If the exact item given as an example in the Test Equipment list is not available, first check the specification column to see if any other equipment might suffice. Then check the Usage column to see what this item is used for. If used for a check or adjustment which is of little or no importance to your measurement requirements, the item and corresponding step(s) can be deleted. For example, if only a Performance Check is to be performed, the square-wave generator can be omitted.

TEST EQUIPMENT

Description	Minimum Specifications	Usage	Examples of Applicable Test Equipment
1. Oscilloscope	7000-series oscilloscope mainframe. Bandwidth capability of 100 megahertz required.	Used throughout procedure to provide display.	a. TEKTRONIX 7603 Oscilloscope. b. Any TEKTRONIX 7000-series oscilloscope with 100-megahertz bandwidth (combined with amplifier unit).
2. Amplifier Unit	7A-series amplifier unit. Combined bandwidth of amplifier unit and oscilloscope, 100 megahertz.	Used throughout procedure to provide vertical input to oscilloscope system.	a. TEKTRONIX 7A16A Amplifier. b. TEKTRONIX 7A11 Amplifier.
3. Medium-frequency signal generator	Frequency range, 50 kilohertz and 10 megahertz to 100 megahertz; output amplitude, variable from 15 to 500 millivolts into 50 ohms.	Internal and external triggering checks. Main and delayed trigger DC balance adjustments.	a. TEKTRONIX Type 191 Constant Amplitude Signal Generator. b. General Radio Model 1310B Oscillator with General Radio Type 274 QBJ Adapter to provide BNC output (can be used for trigger DC balance adjustments only).
4. Low-frequency sine-wave generator	Frequency range, variable from 30 hertz to two megahertz; output amplitude, variable from 30 millivolts to four volts into 50 ohms and to 30 volts into one megohm.	Main and delayed triggering checks. Check trigger modes. Check external amplifier gain and bandwidth.	a. General Radio Model 1310B Oscillator with General Radio Type 274 QBJ Adapter to provide BNC output.
5. Square-wave generator	Amplitude, 500 millivolts into 50 ohms; repetition rate, one kilohertz; risetime, less than 12 nanoseconds into 50 ohms.	Main and delayed external trigger input compensation adjustments.	a. TEKTRONIX Type 106 Square-Wave Generator.
6. Time-mark generator	Marker or sine-wave outputs, from five seconds to five nanoseconds; marker accuracy, within 0.1%; amplitude, at least 0.3 volt into 50 ohms.	Sweep timing checks and adjustments. Sweep delay checks and adjustments.	a. TEKTRONIX 2901 Time-Mark Generator. b. TEKTRONIX Type 184 Time-Mark Generator.
7. 10X voltage probe	Compatible with 7A-series amplifier unit. Combined risetime of probe, amplifier, and oscilloscope must be less than 3.5 nanoseconds.	Check line triggering. External trigger input compensation adjustments. Main and delayed-sweep offset adjustments.	a. TEKTRONIX P6053 Probe. b. TEKTRONIX P6054 Probe.
8. Cable	Impedance, 50 ohms; type, RG-58/U; length, 18 inches; connectors, BNC.	Used throughout procedure for signal interconnection.	a. TEKTRONIX Part No. 012-0076-00.
9. Cable (two required)	Impedance, 50 ohms; type, RG-58/U; length, 42 inches; connectors, BNC.	Used throughout procedure for signal interconnection.	a. TEKTRONIX Part No. 012-0057-01.
10. Plug-in extender	Rigid extender for 7000-series plug-in units.	Used throughout adjustment procedure to provide access to internal adjustments and test points.	a. TEKTRONIX Part No. 067-0589-00.
11. T connector	Connectors, BNC.	External trigger checks.	a. TEKTRONIX Part No. 103-0030-00.

TEST EQUIPMENT (cont)

Description	Minimum Specifications	Usage	Examples of Applicable Test Equipment
12. Termination	Impedance, 50 ohms; accuracy, ±2%; connectors, BNC.	Used throughout procedures to terminate 50-ohm BNC cables.	a. TEKTRONIX Part No. 011-0049-01.
13. Adapter	Connectors, GR874 to BNC female.	Internal and external triggering checks. Main and delayed-trigger DC balance adjustments. External trigger input compensation adjustments.	a. TEKTRONIX Part No. 017-0063-00.
14. Input RC Normalizer	Time constant, one megohm times 20 picofarads; connectors, BNC.	External trigger input compensation adjustments.	a. TEKTRONIX Calibration Fixture 067-0538-00.
15. Attenuator	Impedance, 50 ohms; attenuation, 10X; type, feedthrough; accuracy, ±3%; connectors, BNC.	External trigger input compensation adjustments.	a. TEKTRONIX Part No. 011-0059-01.
16. Screwdriver	Three-inch shaft; 3/32-inch bit.	Used to adjust variable resistors.	a. Xcelite R-3323.
17. Low-capacitance screwdriver	1 1/2-inch shaft.	Used to adjust variable capacitors.	a. TEKTRONIX Part No. 003-0000-00.
18. VOM	0-10 volt scale	Used for sweep offset and trigger null adjustment.	a. TEKTRONIX Type 7D13 b. Simpson 262 c. Tripplet 630NA

Preliminary Control Settings

Set test equipment and 7B53A/7B53AN controls as follows (for both Performance Check and Adjustment procedure):

7A16A

Position	Midrange
AC-DC-GND	AC
Polarity	+UP
Volts/Div	50 mV
Variable Volts/Div	(CAL-IN)

7603 Oscilloscope

Vert Mode	Left
Trig Source	Vert Mode
Focus	Adjust for well-defined display
Intensity	Midrange
Graticule Illum	As desired

7B53A/7B53AN

MAIN TRIGGERING	
SLOPE	(+)
MODE	AUTO
COUPLING	AC
SOURCE	INT
DLY'D TRIG	RUNS AFTER
LEVEL	DLY TIME
SLOPE	+
COUPLING	AC
SOURCE	INT
POSITION	Midrange
MAG	X1
TIME/DIV OR DLY'D TIME	20 μs
DLY'D Time/ Division	20 μs (press in for MAIN SWP Display Mode)
VARIABLE	CAL
Variable Selector	MAIN
DELAY TIME MULT	1.00

PART I—PERFORMANCE CHECK

Introduction

The following procedure checks the performance of the 7B53A/7B53AN without removing the side-covers or making internal adjustments. All tolerances given in this procedure are based on the Specification section of the 7B53A/7B53AN Operators Manual.

INDEX TO PART I—PERFORMANCE CHECK

Trigger System Check

Horizontal System Check

Output Signals Check

Preliminary Procedure for Performance Check

NOTE

The performance of this instrument can be checked at any temperature within 0°C to +50°C range unless otherwise stated.

1. Install the 7B53A/7B53AN into the right compartment of the indicator oscilloscope.

2. Install the 7A16A Vertical Amplifier unit into the left vertical compartment.

3. Turn on the oscilloscope and allow at least 20 minutes warmup before proceeding with the Performance Check.

4. Set the equipment controls as given in this section under Preliminary Control Settings.

TRIGGER SYSTEM CHECK

Equipment Required

1. 7603 Oscilloscope
2. 7A16A Amplifier Unit
3. 10X probe
4. Medium-frequency signal generator
5. Low-frequency sine-wave generator
6. GR to BNC female adapter
7. BNC T-connector
8. 42-inch 50-ohm BNC cable
9. 18-inch 50-ohm BNC cable
10. 50-ohm BNC termination

Control Settings

Set the controls as given under Preliminary Control Settings.

1. Check Main and Delayed Internal Triggering Operation

a. Connect the output of the medium-frequency signal generator to the 7A16A Input with a GR-to-BNC female adapter, 50-ohm BNC cable, and 50-ohm BNC termination.

b. Change the following control settings:

MAIN TRIGGERING LEVEL	Set for stable main sweep display
TIME/DIV OR DLY TIME	.1 μs
DLY'D Time/ Division	.1 μs (press in for MAIN SWP Display Mode)

c. Set the medium-frequency signal generator for a 0.3-division display at 10 megahertz.

d. Change the MAIN TRIGGERING MODE switch to NORM.

e. CHECK—Stable CRT display can be obtained with the MAIN TRIGGERING COUPLING switch set to AC, AC LF REJ, and DC for both the positive and negative positions of the MAIN TRIGGERING SLOPE switch (MAIN TRIGGERING LEVEL control may be adjusted as necessary to obtain a stable main sweep display i.e., TRIG'D light on).

f. Change the following control settings:

MAIN TRIGGERING COUPLING	AC
LEVEL	Set for stable main sweep display
TIME/DIV OR DLY TIME	.2 μs
DLY'D Time/ Division	.1 μs (press in for DLY'D SWP Display Mode)
DLY'D TRIG LEVEL	DLY'D SWP TRIGGERABLE

g. CHECK—Stable CRT display can be obtained with DLY'D TRIG COUPLING switch set to AC and DC for both the + and – SLOPE (DLY'D TRIG LEVEL control may be adjusted as necessary to obtain a stable delayed sweep display).

h. Change the following control settings:

MAIN TRIGGERING MODE	AUTO
TIME/DIV OR DLY TIME	.05 μs
DLY'D Time/ Division	.05 μs
MAG	X10

i. Set the medium-frequency generator for a 1.5-division display at 100 megahertz.

j. Set the MAIN TRIGGERING MODE switch to NORM.

k. CHECK—Stable CRT display can be obtained with the COUPLING switch for MAIN TRIGGERING set to AC, AC LF REJ, and DC (MAIN TRIGGERING LEVEL control may be adjusted as necessary to obtain a stable display).

l. Change the following control settings:

MAIN TRIGGERING	
MODE	AUTO
COUPLING	AC
LEVEL	Set for a stable main sweep display
TIME/DIV OR DLY TIME	.1 μs
DLY'D Time/ Division	.05 μs (press in for DLY'D SWP Display Mode)

m. CHECK—Stable CRT display can be obtained with the DLY'D TRIG COUPLING switch set to AC and DC for the + and — SLOPE (DLY'D TRIG LEVEL control may be adjusted as necessary to obtain stable display).

n. Disconnect all test equipment.

2. Check Main and Delayed External Triggering Operation

a. Change the following control settings:

MAIN TRIGGERING	
COUPLING	AC
SOURCE	EXT
DLY'D TRIG	
SOURCE	EXT
COUPLING	AC
MAG	X1
TIME/DIV OR DLY TIME	.1 μs
DLY'D Time/ Division	.1 μs (press in for MAIN SWP Display Mode)

b. Connect the medium-frequency signal generator to the 7A16A Input with a GR-to-BNC female adapter, 50-ohm BNC cable, and BNC T-connector. Connect the output of the T-connector to the 7B53A/7B53AN MAIN TRIG IN connector with a 50-ohm BNC cable and 50-ohm BNC termination.

c. Set the medium-frequency signal generator for a two-division display (100 millivolts) at 10 megahertz.

d. CHECK—Stable CRT display can be obtained with the MAIN TRIGGERING COUPLING switch set to AC, AC LF REJ, and DC for both the + and — SLOPE (MAIN TRIGGERING LEVEL control may be adjusted as necessary to obtain a stable display).

e. Disconnect the 50-ohm cable and termination from the MAIN TRIG IN connector and connect them to the DLY'D TRIG IN connector.

f. Change the following control settings:

MAIN TRIGGERING	
SOURCE	INT
COUPLING	AC
LEVEL	Set for stable main sweep display
TIME/DIV OR DLY TIME	.1 μs
DLY'D Time/ Division	.05 μs (press in for DLY'D SWP Display Mode)
DLY'D TRIG LEVEL	RUNS AFTER DLY TIME

g. Set the medium-frequency signal generator for a two-division display (100 millivolts) at 10 megahertz.

h. Rotate the DLY'D TRIG LEVEL control to the DLY'D SWP TRIGGERABLE position.

i. CHECK—Stable CRT display can be obtained with the DLY'D TRIG COUPLING switch set to AC and DC for both the + and — SLOPE (DLY'D TRIG LEVEL control may be adjusted as necessary to obtain a stable delayed sweep display).

j. Disconnect the 50-ohm cable and termination from the DLY'D TRIG IN connector and connect it to the MAIN TRIG IN connector.

k. Change the following control settings:

	7B53A/7B53AN
MAIN TRIGGERING	
SOURCE	EXT

TIME/DIV OR DLY TIME	.1 μs
DLY'D Time/ Division	.1 μs (press in for MAIN SWP Display Mode)
DLY'D TRIG LEVEL	RUNS AFTER DLY TIME

l. Set the 7A16A Volts/Division switch to .1 V and set the medium-frequency signal generator for a five-division display (500 millivolts) at 10 megahertz. Rotate the MAIN TRIGGERING LEVEL control for a stable main sweep display.

m. Without changing the output amplitude, increase the output frequency of the generator to 100 megahertz.

n. Press and release the MAG switch to X10.

o. CHECK—Stable CRT display can be obtained with the MAIN TRIGGERING COUPLING switch set to AC, AC LF REJ, and DC for both the + and — SLOPE (MAIN TRIGGERING LEVEL control may be adjusted as necessary to obtain a stable display).

p. Disconnect the 50-ohm cable and termination from the MAIN TRIG IN connector and connect it to the DLY'D TRIG IN connector.

q. Change the following control settings:

MAIN TRIGGERING	
SOURCE	INT
LEVEL	Set for stable display
TIME/DIV OR DLY TIME	.1 μs
DLY'D Time/ Division	.05 μs (press in for the DLY'D SWP Display Mode)
MAG	X1

r. Set the medium-frequency signal generator for five divisions (500 millivolts) at 10 megahertz.

s. Without changing the amplitude, increase the output frequency to 100 megahertz.

t. Change the following control settings:

MAG	X10
DLY'D TRIG LEVEL	DLY'D SWP TRIGGERABLE

u. CHECK—Stable CRT display can be obtained with the DLY'D TRIG COUPLING switch set to AC and DC for both the + and — SLOPE (DLY'D TRIG LEVEL control may be adjusted as necessary to obtain a stable delayed sweep display).

v. Disconnect all test equipment.

3. Check Main and Delayed Internal Trigger Jitter

a. Connect the medium-frequency signal generator to the 7A16A Input with a GR-to-BNC female adapter, 50-ohm BNC cable, and 50-ohm BNC termination.

b. Change the following control settings:

MAIN TRIGGERING	
LEVEL	Set for stable display (TRIG'D light on)
DLY'D TRIG	
SOURCE	INT
COUPLING	AC
LEVEL	RUNS AFTER DLY TIME

c. Set the medium-frequency signal generator for a 1.5 division display at 75 megahertz.

d. Rotate the DLY'D TRIG LEVEL control to DLY'D SWP TRIGGERABLE and rotate control for a stable display.

e. CHECK—CRT display for no more than 0.2 division (one-nanosecond) of jitter. Disregard any slow drift.

f. Change the following control settings:

TIME/DIV OR DLY TIME	.05 μs
DLY'D Time/ Division	.05 μs (press in for MAIN SWP Display Mode)
MAIN TRIGGERING LEVEL	Set for stable display

g. CHECK—CRT Display for less than 0.2 division (one-nanosecond) of jitter. Disregard any slow drift.

h. Disconnect all test equipment.

4. Check Main and Delayed Low-Frequency Triggering Operation

a. Connect the low-frequency sine-wave generator to the 7A16A Input with a 50-ohm BNC cable and BNC T-connector. Connect the output of the BNC T-connector to the MAIN TRIG IN connector with a 50-ohm BNC cable and a 50-ohm BNC termination.

b. Change the following control settings:

TIME/DIV OR DLY TIME	10 ms
DLY'D Time/ Division	10 ms (press in for MAIN SWP Display Mode)
MAG	X1

c. Set the low-frequency sine-wave generator for a 0.3-division display at 30 hertz.

d. CHECK—Stable CRT display can be obtained with the MAIN TRIGGERING COUPLING switch set to AC, AC HF REJ, and DC for both the + and — SLOPE (MAIN TRIGGERING LEVEL control may be adjusted as necessary to obtain a stable display).

e. Change the following controls settings:

MAIN TRIGGERING	
COUPLING	AC
LEVEL	Set for stable main sweep display
TIME/DIV OR DLY TIME	10 ms
DLY'D Time/ Division	5 ms (press in for DLY'D SWP Display Mode)
DLY'D TRIG LEVEL	DLY'D SWP TRIGGERABLE

f. CHECK—Stable display can be obtained with the DLY'D TRIG COUPLING switch set to AC and DC for both the + and — SLOPE (DLY'D TRIG LEVEL control may be adjusted as necessary to obtain a stable delayed sweep display).

g. Change the following control settings:

MAIN TRIGGERING	
MODE	AUTO
SOURCE	EXT
TIME/DIV OR DLY TIME	10 ms
DLY'D Time/ Division	10 ms (press in for MAIN SWP Display Mode)
DLY'D TRIG SOURCE	EXT

h. Set the low-frequency sine-wave generator for a one-division display (100 millivolts) at 30 hertz; then return the MAIN TRIGGERING MODE switch to NORM.

i. CHECK—Stable CRT display can be obtained with the MAIN TRIGGERING COUPLING switch set to AC, AC HF REJ, and DC for both the + and — SLOPE (MAIN TRIGGERING LEVEL control may be adjusted as necessary to obtain a stable display).

j. Change the following control settings:

MAIN TRIGGERING	
COUPLING	AC
SOURCE	INT
LEVEL	Set for stable display
TIME/DIV OR DLY TIME	10 ms
DLY'D Time/ Division	5 ms (press in for DLY'D SWP Display Mode)

k. Disconnect the 50-ohm cable and termination from the MAIN TRIG IN connector and place it on the DLY'D TRIG IN connector.

l. CHECK—Stable CRT display can be obtained with the DLY'D TRIG COUPLING switch set to AC and DC for both the + and — SLOPE (DLY'D TRIG LEVEL control may be adjusted as necessary for a stable display).

5. Check Main Triggering AC High-Frequency Reject Operation

a. Change the following control settings:

MAIN TRIGGERING	
MODE	AUTO
COUPLING	AC HF REJ
TIME/DIV OR DLY TIME	20 μs
DLY'D Time/ Division	20 μs (press in for MAIN SWP Display Mode)

b. Set the low-frequency sine-wave generator for a 0.3-division display at 50 kilohertz; then return the MAIN TRIGGERING MODE switch to NORM.

c. CHECK—Stable CRT display can be obtained with the MAIN TRIGGERING LEVEL control.

d. Without changing the output amplitude, set the low-frequency sine-wave generator to one-megahertz.

e. Press and release MAG switch to X10 position.

f. CHECK—Stable CRT display cannot be obtained at any setting of the MAIN TRIGGERING LEVEL control.

6. Check Main Triggering AC Low-Frequency Reject Operation

a. Change the following control settings:

MAIN TRIGGERING	
MODE	AUTO
COUPLING	AC LF REJ
MAG	X1

b. Set the low-frequency sine-wave generator for a 0.3-division display at 30 kilohertz; then return the MAIN TRIGGERING MODE switch to NORM.

c. CHECK—Stable CRT display can be obtained with the MAIN TRIGGERING LEVEL control.

d. Without changing the output amplitude, set the low-frequency sine-wave generator to 60 hertz.

e. Set the TIME/DIV OR DLY TIME and DLY'D Time/Division switches to 2 ms (MAIN SWP Display Mode).

f. CHECK—Stable CRT display cannot be obtained at any setting of the MAIN TRIGGERING LEVEL control.

7. Check Main and Delayed Trigger Level and Slope Operation

a. Change the following control settings:

7A16A	
Volts/Div	1 V

7B53A/7B53AN	
MAIN TRIGGERING	
MODE	AUTO
COUPLING	DC
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	.5 ms (press in for DLY'D SWP Display Mode)
DLY'D TRIG LEVEL	RUNS AFTER DLY TIME

b. Remove the 50-ohm termination from the 7B53A/7B53AN DLY'D TRIG IN connector; then reconnect the cable.

c. Set the low-frequency sine-wave generator for the three-divisions of one kilohertz signal.

d. Rotate the DLY'D TRIG LEVEL control to the DLY'D SWP TRIGGERABLE position.

e. CHECK—Rotate the DLY'D TRIG LEVEL control throughout its range and check that display can be triggered at any point along the positive slope of the waveform. Check that no display exists when the LEVEL control is rotated to either extreme.

f. Set the DLY'D TRIG SLOPE switch to —.

g. CHECK—Rotate the DLY'D TRIG LEVEL control throughout its range and check that display can be triggered at any point along the negative slope of the waveform (indicates DLY'D TRIG LEVEL control range at least + and —1.5 volts). Check that no display exists when the LEVEL control is rotated to either extreme.

h. Change the following control settings:

MAIN TRIGGERING	
MODE	NORM
SOURCE	EXT
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	1 ms (press in for MAIN SWP Display Mode)

i. Disconnect the cable from the DLY'D TRIG IN connector and connect it to the MAIN TRIG IN connector.

Ⓐ

j. CHECK—Rotate the MAIN TRIGGERING LEVEL control and check that all levels can be selected as the main sweep trigger point for both the + and — SLOPE (indicates MAIN TRIGGERING LEVEL control range of at least + and —1.5 volts). Check that no display exists when the LEVEL control is rotated to either extreme.

k. Change the following control setting:

7A16A

Volts/Div	5 V

7B53A/7B53AN

MAIN TRIGGERING SOURCE	EXT ÷10

l. Set the low-frequency sine-wave generator for six-divisions of one-kilohertz signal.

m. CHECK—Rotate to the MAIN TRIGGERING LEVEL control and check that all levels can be selected as the main sweep trigger point for both the + and — SLOPE (indicates MAIN TRIGGERING LEVEL control range of at least + and — 15 volts). Check that no display exists when the LEVEL control is rotated to either extreme.

n. Disconnect all test equipment.

8. Check Main Trigger Modes

a. Set the following control settings:

7A16A

Volts/Div	1 V

7B53A/7B53AN

MAIN TRIGGERING	
MODE	AUTO
COUPLING	AC
SOURCE	INT
TIME/DIV OR DLY TIME	20 μs
DLY'D Time/ Division	20 μs (press in for MAIN SWP Display Mode)

b. Connect the low-frequency sine-wave generator to the 7A16A Input with a 50-ohm BNC cable and 50-ohm BNC termination.

c. Set the low-frequency sine-wave generator for a four-division display at 50 kilohertz.

d. Rotate the MAIN TRIGGERING LEVEL control for a free-running display.

e. Set the MAIN TRIGGERING MODE switch to NORM.

f. CHECK—CRT for no display.

g. Set the MODE switch to AUTO. Rotate the MAIN TRIGGERING LEVEL control so that the display is just triggered.

h. Set the MAIN TRIGGERING MODE switch to NORM.

i. CHECK—CRT for triggered display.

j. Set the low-frequency sine-wave generator for a four-division display at 500 hertz.

k. Change the following control settings:

TIME/DIV OR DLY TIME	2 ms
DLY'D Time/ Division	2 ms (press in for MAIN SWP Display Mode)
MAIN TRIGGERING	
LEVEL	Set for a stable display (TRIG'D light on)
MODE	SINGLE SWP

l. CHECK—CRT for no display.

m. Press the MAIN TRIGGERING RESET button.

n. CHECK—CRT for one sweep as RESET button is pressed (Intensity control on the indicator oscilloscope may need to be varied in order that a single sweep display can be observed).

o. Remove the signal from the 7A16A Input, then press the RESET button.

p. CHECK—CRT for no display and READY light on.

q. Reconnect the signal to the 7A16A Input.

r. CHECK—That one sweep occurs as the signal is applied to the 7A16A and that the READY light is out after the completion of that sweep.

s. Disconnect all test equipment.

9. Check Line Triggering Operation

a. Connect the 10X probe to the 7A16A Input.

b. Change the following control settings:

	7A16A	7B53A/7B53AN
Volts/Div	5 V	
MAIN TRIGGERING		
SOURCE		LINE
MODE		NORM
TIME/DIV OR		
DLY TIME		5 ms
DLY'D Time/		
Division		5 ms (press in for MAIN SWP Display Mode)

c. Connect the X10 probe tip to the same line-voltage source which is connected to the oscilloscope.

d. CHECK—For a stable CRT display that is triggered on the correct slope.

e. Disconnect all test equipment.

HORIZONTAL SYSTEM CHECK

Equipment Required

1. 7603 Oscilloscope
2. 7A16A Amplifier Unit
3. Time-mark generator
4. Low-frequency sine-wave generator
5. 42-inch 50-ohm cable
6. 50-ohm BNC termination

Control Settings

Set the controls as given under Preliminary Control Settings.

NOTE

The tolerances given in steps 10 and 11 are for an ambient temperature range of +15°C to +35°C. If outside this range, see Specifications in the 7B53A/7B53AN Operators manual.

10. Check Main and Delayed Sweep Timing Accuracy and Linearity

a. Connect the marker output of the time-mark generator to the 7A16A Input with the 50-ohm BNC cable and 50-ohm BNC termination.

b. Change the following control settings:

7A16A

Volts/Div	.5 V

7B53A/7B53AN

MAIN TRIGGERING	
MODE	NORM
LEVEL	Set for stable display (TRIG'D light on).

c. CHECK—Using the TIME/DIV OR DLY TIME switch settings and the time-mark generator settings given in Table 4-1, that the main sweep timing over the middle eight graticule divisions is within the tolerances in Table 4-1.

TABLE 4-1

Main Sweep Timing

NOTE

Main sweep timing must be checked when operating in the MAIN SWP or INTEN Display Modes.

7B53A/7B53AN TIME/DIV or DLY TIME	Time Markers	CRT Display (marker/division)	Tolerance MAIN SWP
.05 μs	50 ns	1 (cycle)	±0.24 division
.1 μs	.1 μs	1	
.2 μs	.1 μs	2	
.5 μs	.5 μs	1	±0.16 division
1 μs	1 μs	1	
2 μs	1 μs	2	
5 μs	5 μs	1	
10 μs	10 μs	1	
20 μs	10 μs	2	
50 μs	50 μs	1	
.1 ms	.1 ms	1	
.2 ms	.1 ms	2	
.5 ms	.5 ms	1	
1 ms	1 ms	1	
2 ms	1 ms	2	
5 ms	5 ms	1	
10 ms	10 ms	1	
20 ms	10 ms	2	
50 ms	50 ms	1	
.1 s	.1 s	1	±0.24 division
.2 s	.1 s	2	
.5 s	.5 s	1	
1 s	1 s	1	
2 s	1 s	2	
5 s	5 s	1	

d. CHECK—Using the time-mark generator settings and the TIME/DIV OR DLY TIME and DLY'D Time/Division

switch settings given in Table 4-2, that the delayed sweep timing over the middle eight graticule divisions is within the tolerances in Table 4-2.

TABLE 4-2

Delayed Sweep Timing

NOTE

Delayed sweep timing must be checked when operating in the DLY'D SWP Display Mode.

7B53A/7B53AN				
TIME/DIV or DLY TIME	DLY'D Time/ Division (press in)	Time Markers	CRT Display (markers/ division)	Tolerance DLY'D SWP
.1 μs	.05 μs	50 ns	1 (cycle)	±0.32 division
.2 μs	.1 μs	.1 μs	1	
.5 μs	.2 μs	.1 μs	2	
1 μs	.5 μs	.5 μs	1	
2 μs	1 μs	1 μs	1	
5 μs	2 μs	1 μs	2	
10 μs	5 μs	5 μs	1	
20 μs	10 μs	10 μs	1	
50 μs	20 μs	10 μs	2	
.1 ms	50 μs	50 μs	1	±0.24 division
.2 ms	.1 ms	.1 ms	1	
.5 ms	.2 ms	.1 ms	2	
1 ms	.5 ms	.5 ms	1	
2 ms	1 ms	1 ms	1	
5 ms	2 ms	1 ms	2	
10 ms	5 ms	5 ms	1	
20 ms	10 ms	10 ms	1	
50 ms	20 ms	10 ms	2	
.1 s	50 ms	50 ms	1	
.2 s	.1 s	.1 s	1	±0.32 division
.5 s	.2 s	.1 s	2	
1 s	.5 s	.5 s	1	

e. Set the time-mark generator for one-millisecond markers.

f. Change the following control settings:

TIME/DIV OR DLY TIME	2 ms
DLY'D Time/ Division	1 ms (press in for DLY'D SWP Display Mode)

g. Position the second marker to the second graticule line.

h. CHECK—Fourth marker within 0.12 division (6%) of the fourth vertical line.

i. Position the third marker to the third vertical line.

j. CHECK—Fifth marker within 0.12 division of the fifth vertical line.

k. Continue this check for each two-division portion of the sweep that is within the center eight divisions of the graticule.

l. Set the TIME/DIV OR DLY TIME and DLY'D Time/Division switches to 1 ms (MAIN SWP Display Mode).

m. CHECK—Repeat sweep linearity check given in steps g through k. Check for main sweep linearity within 0.1 division (5%).

n. CALIBRATION—See step 4 of adjustment procedure.

11. Check Main and Delayed Sweep Magnifier Accuracy and Linearity

a. Change the following control settings:

MAG	X10
POSITION	Centered

b. CHECK—Using the TIME/DIV OR DLY TIME switch and the time-mark generator settings given in Table 4-3, the main sweep magnified timing from the 10th to the 90th divisions of the total magnified display.

c. Rotate the MAIN TRIGGERING LEVEL control for a stable display. Using the TIME/DIV OR DLY TIME settings, DLY'D Time/Division settings, and time-mark generator settings given in Table 4-4, check the delayed sweep magnified timing from the 10th to the 90th divisions of the total magnified display.

d. Change the following control settings:

TIME/DIV OR DLY TIME	2 ms
DLY'D Time/ Division	1 ms (press in for DLY'D SWP Display Mode)

e. Set the time-mark generator for 0.1-millisecond markers.

TABLE 4-3

Main Sweep Magnifier Accuracy

NOTE

Main sweep magnifier accuracy must be checked when operating in the MAIN SWP or INTEN Display Modes.

7B53A/7B53AN TIME/DIV OR DLY TIME	Time-Mark Generator	CRT Display Markers/Div	Tolerance SWP
.05 μs	5 ns	1 (cycle)	±0.28 division
.1 μs	10 ns	1 (cycle)	
.2 μs	10 ns	2 (cycles)	
.5 μs	50 ns	1 (cycle)	±0.2 division
1 μs	.1 μs	1	
2 μs	.1 μs	2	
5 μs	.5 μs	1	
10 μs	1 μs	1	
20 μs	1 μs	2	
50 μs	5 μs	1	
.1 ms	10 μs	1	
.2 ms	10 μs	2	
.5 ms	50 μs	1	
1 ms	.1 ms	1	
2 ms	.1 ms	2	
5 ms	.5 ms	1	
10 ms	1 ms	1	
20 ms	1 ms	2	
50 ms	5 ms	1	
.1 s	10 ms	1	±0.28 division
.2 s	10 ms	2	
.5 s	50 ms	1	
1 s	.1 s	1	
2 s	.1 s	2	
5 s	.5 s	1	

f. Position the second displayed marker to the second vertical line of the graticule.

g. CHECK—Fourth displayed marker is within 0.12 division (6%) of the fourth vertical line.

h. Position the third displayed marker to the third vertical line.

i. CHECK—Fifth displayed marker is within 0.12 division of the fifth vertical line.

TABLE 4-4

Delayed Sweep Magnifier Accuracy

NOTE

Delayed Sweep Magnifier Accuracy must be checked when operating in the DLY'D SWP Display Mode.

7B53A/7B53AN TIME/DIV OR DLY TIME	DLY'D Time/ Division (press in)	Time-Mark Generator	CRT Display Markers/Div	Tolerance
.1 μs	.05 μs	5 ns	1 (cycle)	±0.36 division
.2 μs	.1 μs	10 ns	1 (cycle)	
.5 μs	.2 μs	10 ns	2 (cycles)	
1 μs	.5 μs	50 ns	1 (cycle)	±0.28 division
2 μs	1 μs	.1 μs	1	
5 μs	2 μs	.1 μs	2	
10 μs	5 μs	.5 μs	1	
20 μs	10 μs	1 μs	1	
50 μs	20 μs	1 μs	2	
.1 ms	50 μs	5 μs	1	
.2 ms	.1 ms	10 μs	1	
.5 ms	.2 ms	10 μs	2	
1 ms	.5 ms	50 μs	1	
2 ms	1 ms	.1 ms	1	
5 ms	2 ms	.1 ms	2	
10 ms	5 ms	.5 ms	1	
20 ms	10 ms	1 ms	1	
50 ms	20 ms	1 ms	2	
.1 s	50 ms	5 ms	1	
.2 s	.1 s	10 ms	1	±0.36 division
.5 s	.2 s	10 ms	2	
1 s	.5 s	50 ms	1	

j. Continue this check for each two-division portion of the total displayed sweep within the center eight divisions of the graticule.

k. Change the following control settings:

TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	1 ms (press in for MAIN SWP Display Mode)

l. CHECK—Repeat magnified sweep linearity check given in steps f through j. Check for magnified main sweep linearity within 0.1 division (5%).

12. Check Delay Time Multiplier Differential Accuracy.

a. Set the time-mark generator for 1 ms markers.

b. Change the following control settings:

MAG	X1
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/Division	10 μs (press in for DLY'D SWP Display Mode)
MAIN TRIGGERING LEVEL	Set for stable display
DLY'D TRIG	RUNS AFTER DLY TIME

NOTE

The following steps check delay time multiplier accuracy. Two factors must be determined: the maximum error allowable to be within the specification, and the actual error of the measurement.

c. Rotate the DELAY TIME MULT dial to 1.00. If necessary, further rotate the dial to place a 1 ms marker on the CRT. To provide a reference point, position the 1 ms marker to graticule center with the 7B53A/7B53AN POSITION control (See Fig. 4-1). Note the exact DELAY TIME MULT dial setting.

d. Rotate the DELAY TIME MULT dial to major division points from the dial setting noted in part c (e.g. if the DELAY TIME MULT noted in part c is 0.90, major division points will be 1.90, 2.90, 3.90 through 8.90). Check and record the position of each time-marker (with respect to the reference point established at graticule center) at each major division over the center eight divisions. See Fig. 4-1 for error measurement and Fig. 4-2 for typical delay time error figures.

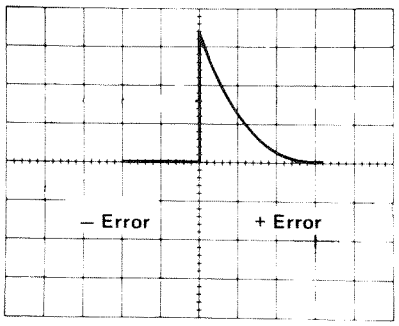
e. CHECK—Scan the figures recorded in step d for all difference readings over the center eight divisions (see Fig. 4-2). Find the maximum error over any one division measurement. Check that it is within the allowable error (see Fig. 4-3).

Example. Refer to the curve in Fig. 4-3 for the 0.5 s/DIV to 1 μs/DIV delay time range. For any one-division measurement the allowable error is 3.7%. At the same delay time range, for any five-division measurement the allowable error is 1.3%.

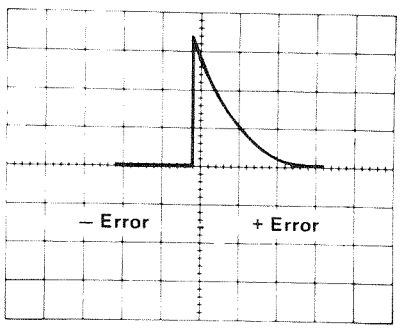
f. CHECK—Scan the figures recorded in step d for difference readings over the center eight divisions of display (see Fig. 4-2). Find the maximum error over any two division measurement, divide by two, and check that it is within the allowable error given in Fig. 4-3.

g. CHECK—Scan the figures recorded in step d for difference readings over the center eight divisions (see Fig. 4-2). Find the maximum error over any four division measurement, divide by four, and check that it is within the allowable error given in Fig. 4-3.

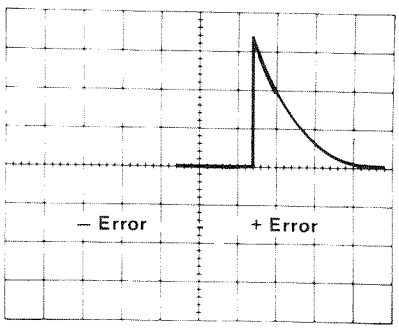
Measurement Error as Viewed from CRT Display



Second time-marker positioned to graticule center for reference.



Time-marker showing −0.2% error.

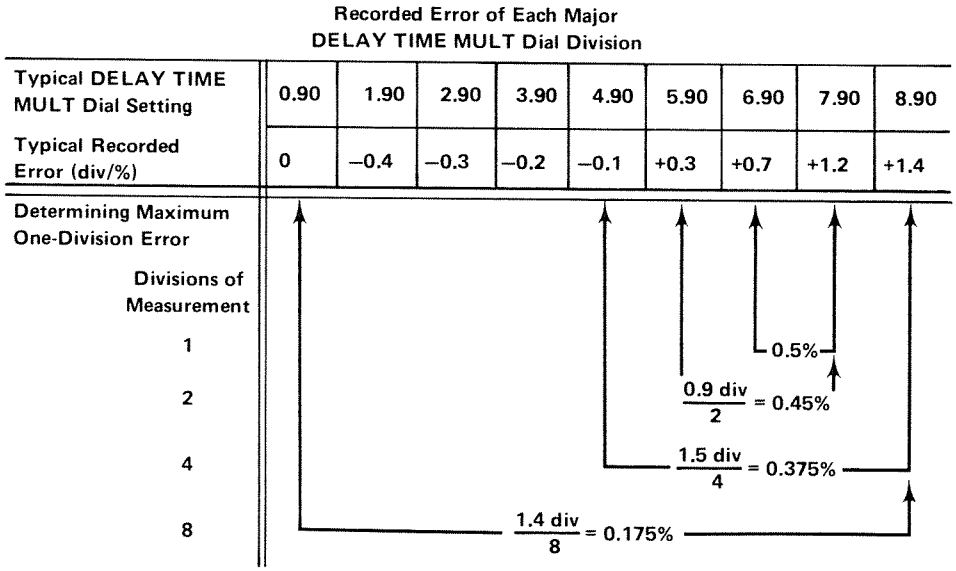


Time-marker showing +1.4% error.

NOTE

With the delayed sweep rate 1/100 of the main sweep rate (e.g. TIME/DIV or DLY TIME switch at 1 ms; DLY'D Time/division switch at 10 μs), each major horizontal graticule division represents 1% error.

Fig. 4-1. Typical delay time error measurement.



NOTE

Percentage figures apply only when delayed sweep rate is 1/100 of the main sweep rate.

Fig. 4-2. Typical Delay Time Error Figures.

h. CHECK—Scan the figures recorded in step d for difference readings over the center eight divisions (see Fig. 4-2). Find the maximum error over an eight-division measurement, divide by eight, and check that it is within the allowable error given in Fig. 4-3.

i. Set the time-mark generator for 10 μs markers.

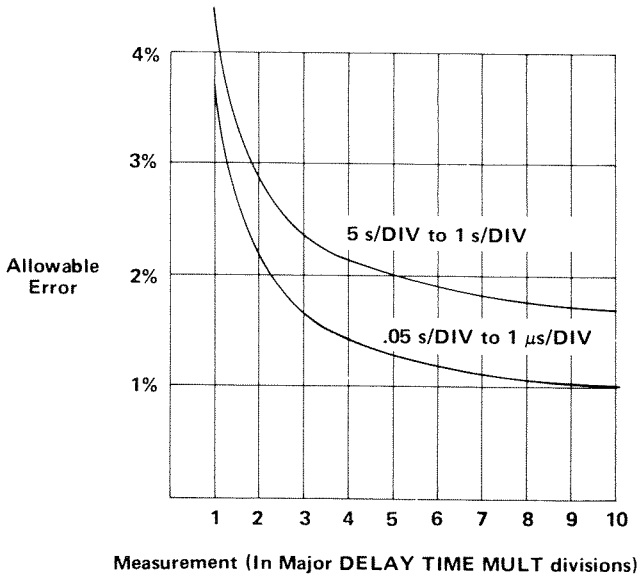


Fig. 4-3. Allowable Delay Time Error.

j. Change the following control settings:

TIME/DIV OR DLY TIME	10 μs
DLY'D Time/ Division	.1 μs (press in for DLY'D SWP Display Mode)
MAIN TRIGGERING LEVEL	Set for stable display

k. Repeat steps c through h.

13. Check Delay-Time Jitter

a. Set the time-mark generator for 1 ms markers.

b. Change the following control settings:

DELAY TIME MULT	1.00
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	0.5 μs (press in for DLY'D SWP Display Mode)
VARIABLE	CAL

c. Position the pulse near the center of the CRT display area with the DELAY TIME MULT dial.

d. CHECK—Jitter in the leading edge of the pulse should not exceed one graticule division (one part in 20,000). Disregard any slow drift.

e. Turn the DELAY TIME MULT dial to about 9.00 and adjust so the pulse is displayed near the center of the CRT display area.

f. CHECK—Jitter on the leading edge of the pulse should not exceed one graticule division.

14. Check Mixed Sweep Operation

a. Change the following control settings:

TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	1 ms (press in for MAIN SWP Display Mode)
DELAY TIME MULT	10.00
MAIN TRIGGERING LEVEL	Set for stable display

b. CHECK—Timing over center eight graticule divisions. Note the error for part d.

c. Change the following settings:

TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	.5 ms (press in for DLY'D SWP Display Mode)
VARIABLE	Pull out for MIXED Display Mode

d. CHECK—Timing over center eight graticule divisions is within 0.16 division (2%) plus the main sweep error noted in part b.

e. Set the DELAY TIME MULT dial to 0.00.

f. Set the time-mark generator for 0.5 ms markers.

g. CHECK—Timing over center eight divisions is within 0.16 division (2%). Position as necessary.

15. Check Main and Delayed Sweep Variable Control Operation

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

b. Change the following control settings:

TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	1 ms (press in for MAIN SWP Display Mode)
MAIN TRIGGERING LEVEL	Set for stable display

c. Position the markers to the far left and right graticule lines with the POSITION control.

d. Turn the VARIABLE control fully counterclockwise.

e. CHECK—CRT display for equal to or less than four division spacing between markers (indicates adequate range for continuously variable sweep rates between calibrated steps).

f. Change the following control settings:

TIME/DIV OR DLY TIME	5 ms
DLY'D Time/ Division	1 ms (press in for DLY'D SWP Display Mode)
Variable Selector (Internal)	Delayed Variable
VARIABLE	CAL

g. Position the markers to the far left and right graticule lines with the POSITION control.

h. Rotate the VARIABLE control fully counterclockwise.

i. CHECK—CRT display for equal to or less than four division spacing between markers (indicates adequate range for continuously variable delayed sweep rates between calibrated steps).

j. Disconnect all test equipment.

16. Check External Amplifier Gain

a. Change the following control settings:

7A16A

AC-DC-GND	DC
Volts/Div	.2 V

7B53A/7B53AN

MAIN TRIGGERING	
MODE	AUTO
SOURCE	EXT
TIME/DIV OR	
DLY TIME	10 μs
DLY'D Time/	
Division	10 μs (press in for MAIN SWP Display Mode)
MAG	X1

b. Connect the low-frequency sine-wave generator to the 7A16A Input with a 50-ohm BNC cable and 50-ohm BNC termination.

c. Set the generator for a four-division display (800 millivolts) at 100 kilohertz.

d. Disconnect the sine-wave generator from the 7A16A and connect it to the 7B53A/7B53AN MAIN TRIG IN OR AMPL connector.

e. Change the TIME/DIV OR DLY TIME switch to AMPL. Rotate the POSITION control to center the display on the graticule.

f. CHECK—CRT horizontal trace length must be eight divisions ±0.8 division.

g. Press the EXT ÷10 button of the MAIN TRIGGERING SOURCE switch.

h. CHECK—CRT horizontal trace length must be 0.8 divisions with ±0.08 division.

i. Set the MAG switch to X10. Rotate the POSITION control to center the display on the graticule.

j. CHECK—CRT horizontal trace length must be eight divisions ±0.8 division.

17. Check External Horizontal Bandwidth

a. Change the following control settings:

MAIN TRIGGERING	
COUPLING	AC
SOURCE	EXT
MAG	X1

b. Set the sine-wave generator to 10 kilohertz and adjust the amplitude for a horizontal trace length of eight divisions.

c. Without changing the amplitude, increase the frequency of the sine-wave generator until the horizontal trace length decreases to 5.6 divisions.

d. CHECK—Sine-wave generator frequency must be two megahertz or greater (upper —3 dB point).

e. Change the MAIN TRIGGERING COUPLING switch to AC LF REJ. Repeat parts b, c, and d.

f. Change the MAIN TRIGGERING COUPLING switch to DC. Repeat parts b, c, and d.

g. Change the MAIN TRIGGERING COUPLING switch to AC HF REJ. Repeat parts b and c.

h. CHECK—Sine-wave generator frequency must be 100 kilohertz or greater (upper —3 dB point).

i. Disconnect all test equipment.

OUTPUT SIGNALS CHECK

Equipment Required	
1. 7603 Oscilloscope	2. 7A16A Amplifier unit
	3. 42-inch 50-ohm BNC cable

18. Check Delayed Sweep Gate Output

a. Set the controls as given under Preliminary Control Settings.

b. Connect a 42-inch 50-ohm BNC cable from the DLY'D TRIG IN connector (delayed-gate output when Delayed Triggering SOURCE switch is set to INT) to the 7A16A input.

c. Set the 7A16A for a deflection factor of one volt/division with DC input coupling.

d. Change the following control settings:

DELAY TIME MULT	5.00
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	.1 ms (pull out for INTEN Display Mode)

e. CHECK–CRT display for positive-going rectangular pulse with the baseline level from zero to one volt and peak-to-peak amplitude of 3.5 volts within 1.4 volts. Check that the top of the pulse is intensified (verifies that delayed-gate pulse is same duration as delayed sweep).

This completes the Performance Check procedure for the 7B53A/7B53AN. If the instrument has met all tolerances given in this procedure, it is correctly calibrated and within the specified tolerances. Disconnect all test equipment.

PART II–ADJUSTMENT

Introduction

The following procedure returns the 7B53A/7B53AN to correct calibration. All limits and tolerances given in this procedure are calibration guides, and should not be interpreted as instrument specifications except as listed in the Performance Requirement column of the Specifications in the 7B53A/7B53AN Operators Manual. The actual operation of the instrument may exceed the given limits or tolerances if the instrument meets the Performance Requirements as checked in Part I–Performance Check of this section.

INDEX TO PART II–ADJUSTMENT

Trigger System Adjustment

Horizontal System Adjustment

Preliminary Procedure for Adjustment

1. Install the Vertical Amplifier unit directly into the left vertical compartment of the oscilloscope.

2. Install the 067-0589-00 plug-in extender into the horizontal compartment.

3. Remove the side covers from the 7B53A/7B53AN and connect the instrument to the plug-in extender.

4. Turn on the oscilloscope and allow at least 20 minutes warmup before proceeding with adjustments.

5. Set the equipment controls as given in this section under Preliminary Control Settings.

6. Refer to Fig. 6-17, adjustment locations, for appropriate test point (TP) locations.

TRIGGER SYSTEM ADJUSTMENT

Equipment Required

1. 7603 Oscilloscope
2. 7A16A Amplifier
3. 10X Probe
4. Medium-frequency signal generator
5. Square-wave generator
6. Plug-in Extender
7. 42-inch 50-ohm BNC Cable
8. 18-inch 50-ohm BNC Cable
9. 50-ohm BNC Termination
10. GR to BNC Female Adapter
11. 50-ohm X10 Attenuator
12. Input RC Normalizer; RC 1 megohm X 20 picofarads
13. VOM

Control Settings

Set the controls as given under Preliminary Control Settings.

NOTE

See Fig. 6-17 (located on pull-out page in rear of diagrams section) for location of trigger system adjustments and test points.

1. Adjust Trigger DC Balance and Main Trigger Level Centering (R72, R333)

a. To establish electrical center, set the 7A16A input coupling switch to GND. Connect a VOM across TP50 and TP59 on the 7B53A/7B53AN. Rotate the 7A16A position control for a 0 V reading on the VOM.

NOTE

Do not move the 7A16A position control until part 1 of this step has been completed.

b. Set the 7A16A input coupling to DC and the 7B53A/7B53AN MAIN TRIGGERING COUPLING switch to DC.

c. Connect the medium-frequency signal generator to the 7A16A Input with a GR-to-BNC female adapter, 50-ohm BNC cable, and 50-ohm BNC termination.

d. Set the medium-frequency signal generator for a one-division display at 50 kilohertz.

e. Set the MAIN TRIGGERING LEVEL control to (0).

f. CHECK–CRT for sweep trigger point (start of sweep) at the electrical center.

g. ADJUST–R72, Trigger DC Balance, for sweep trigger point at CRT electrical center.

h. Change the MAIN TRIGGERING SLOPE switch to – and +. Note the positions of the sweep trigger point with respect to CRT electrical center.

i. Change the MAIN TRIGGERING COUPLING switch to AC.

j. CHECK–Sweep trigger points occur at CRT electrical center or at points equally above and below CRT electrical center of the – and + SLOPE.

k. ADJUST–R333, Main Trigger Level Center, for sweep trigger points equally above and below CRT electrical center for the – and + SLOPE.

l. INTERACTION–Repeat the adjustment of R72, Trigger DC Balance, and R333, Main Trigger Level Center, as necessary.

2. Adjust Delayed Trigger Level Centering (R435)

a. Change the following control settings:

TIME/DIV OR DLY TIME	20 μs
DLY'D Time/ Division	10 μs (press in for DLY'D SWP Display Mode)
DLY'D TRIG LEVEL	RUNS AFTER DLY TIME

b. Rotate the DLY'D TRIG LEVEL control for a stable display with the sweep trigger point at CRT electrical center.

c. Change the DLY'D TRIG SLOPE switch to − and +. Note the positions of the sweep trigger point with respect to CRT electrical center.

d. ADJUST—R435 for sweep trigger points to occur at CRT electrical center or at points equally above and below CRT electrical center for the − and + DLY'D TRIG SLOPE.

e. Disconnect all test equipment.

3. Adjust Main and Delayed External Compensation (C401, C301, C16)

a. Connect the output of the square-wave generator to the 7A16A Input with a GR-to-BNC female adapter, 50-ohm BNC cable, 10X attenuator, 50-ohm termination, and 20 picofarad X 1 megohm Input RC Normalizer.

b. Change the following control settings:

7A16A

Volts/Div	.1 V

7B53A/7B53AN

MAIN TRIGGERING LEVEL	Set for stable display
COUPLING	DC
MAG	X1
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	.5 ms (pull out for INTEN Display Mode)
DLY'D TRIG COUPLING	DC
SOURCE	EXT

c. Set the square-wave generator for a five-division display at one kilohertz.

d. Disconnect the RC Normalizer from the 7A16A Input and connect it to the DLY'D TRIG IN connector.

e. Connect the 10X probe (properly compensated) from the 7A16A Input to TP415.

f. Change the following control settings:

7A16A

Volts/Div	5 mV

7B53A/7B53AN

MAIN TRIGGERING LEVEL	Set for TRIG'D light on
DLY'D Time/ Division	Press in for DLY'D SWP Display Mode
DLY'D TRIG LEVEL	Set for a stable delayed sweep display

g. ADJUST—Dly'd Ext Comp adjustment C401 for best square corner on leading edge of displayed waveform.

h. Disconnect the 10X probe from TP415 and connect it to TP315. Disconnect the RC Normalizer from the DLY'D TRIG IN connector and connect it to the MAIN TRIG IN connector.

i. Change the following control settings:

TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	1 ms (press in for MAIN SWP Display Mode)
MAIN TRIGGERING SOURCE	EXT
LEVEL	Adjust for stable main sweep display

j. ADJUST—Main Ext Comp adjustment C301 for best square corner on leading edge of waveform.

k. Remove the 10X attenuator and connect the 50-ohm termination directly to the Normalizer. Change the MAIN TRIGGERING SOURCE switch to EXT ÷10.

l. ADJUST—EXT ÷10 Input Compensation C16 for best square corner on leading edge of waveform.

m. Disconnect all test equipment.

HORIZONTAL SYSTEM ADJUSTMENT

Equipment Required

1. 7603 Oscilloscope
2. 7A16A Amplifier
3. Time-mark generator
4. 42-inch 50-ohm BNC cable
5. 50-ohm BNC termination
6. 10X probe
7. Plug-in extender
8. VOM

Control Settings

Set the controls as given under Preliminary Control Settings.

NOTE

See Fig. 6-17 (located on pull-out page in rear of diagrams section) for location of horizontal system adjustments and test points.

4. Adjust Main and Delayed Sweep Offset (R592, R675)

a. Change the following control settings:

7A16A

Volts/Div	5 mV

7B53A/7B53AN

TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	1 ms (press in for MAIN SWP Display Mode)
Mode	Normal

b. Connect a VOM between TP580 and ground.

c. ADJUST–R592, Main Sweep Offset, for 0 volts.

d. Change the following control settings:

TIME/DIV OR DLY TIME	2 ms
DLY'D Time/ Division	1 ms (press in for DLY'D SWP Display Mode)

e. Move the test lead from TP580 to TP690.

f. ADJUST–R675, Delayed Sweep Offset, for 0 volts.

g. INTERACTION–Check step 7.

h. Disconnect all test equipment.

5. Adjust SWP CAL (front-panel)

a. Connect the marker output of the time-mark generator to the 7A16A Input with the 50-ohm BNC cable and 50-ohm BNC termination.

b. Set the time-mark generator for one-millisecond markers.

c. Change the following control settings:

7A16A

Volts/Div	.5 V

7B53A/7B53AN

MAIN TRIGGERING LEVEL	Set for stable main sweep display
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	1 ms (press in for MAIN SWP Display Mode)
Mode	Auto

d. CHECK–CRT display for one marker each division between the second and tenth graticule lines (position the display as necessary).

e. ADJUST–Front-panel SWP CAL control (R290) for one marker per division. The second and tenth markers must coincide exactly with their respective graticule lines (Reposition the display slightly with the horizontal POSITION control, if necessary).

6. Adjust Magnified Sweep Gain (R762)

a. Set the time-mark generator for 0.1 millisecond markers.

b. Press and release the MAG switch to X10 (increase the oscilloscope intensity as necessary).

c. CHECK–CRT display for one marker per division between the second and tenth graticule lines.

d. ADJUST–Mag Gain control R762 for one marker per division. The second and tenth markers must coincide exactly with their repsective graticule lines (position the display as necessary with the horizontal POSITION control).

7. Adjust Main and Delayed Sweep Length (R564, R652)

a. Set the time-mark generator for 0.1 and one millisecond markers. Press MAG switch to X1.

b. Rotate the MAIN TRIGGERING LEVEL control for a triggered display. Rotate the POSITION control to position the eleventh one-millisecond marker at the center vertical graticule line (see Fig. 4-4).

c. CHECK–CRT display for sweep length of 10.4 divisions within 0.3 division, as shown by 0.1 to 0.7 division of display to the right of the center vertical graticule line (see Fig. 4-4).

d. ADJUST–Main Swp Length, R564 for four 0.1 millisecond markers to the right of the center vertical graticule line.

e. Change the following control settings:

TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	.1 ms (press in for DLY'D SWP Display Mode)
MAIN TRIGGERING LEVEL	Set for TRIG'D light on
DLY'D TRIG LEVEL	DLY'D SWP TRIGGERABLE

f. Set the time-mark generator for 0.1 millisecond and 10 microsecond markers.

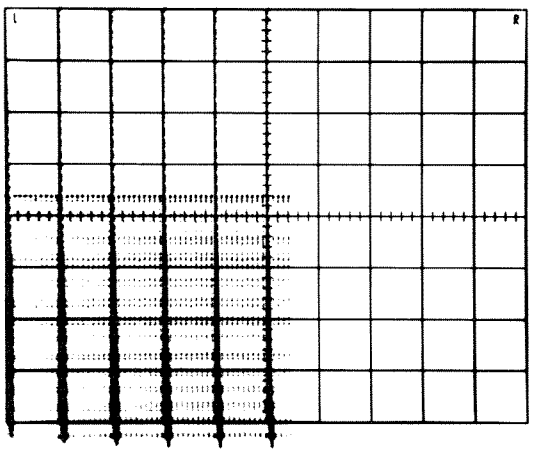


Fig. 4-4. Typical CRT display when checking sweep length.

g. Rotate the DLY'D TRIG LEVEL control for a stable display. Rotate the horizontal POSITION control to position the eleventh 0.1 millisecond marker to the center vertical graticule line.

h. CHECK—CRT display for sweep length of 10.4 divisions within 0.3 division, as shown by 0.1 to 0.7 division of display to the right of the center vertical graticule line.

i. ADJUST—R652, Dly'd Swp Length, for four 10 microsecond markers to the right of the center vertical graticule line.

j. INTERACTION—Check step 4.

8. Adjust Delayed Sweep Start and Delayed Sweep Stop (R576, R572)

a. Set the time-mark generator for one-millisecond markers.

b. Change the following control settings:

7B53A/7B53AN

TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	1 ms (pull out for INTEN Display Mode)
MAIN TRIGGERING LEVEL	Set for stable display
DLY'D TRIG LEVEL	RUNS AFTER DLY TIME

NOTE

Coarse adjustments of the Delayed Start and Delayed Stop controls will be made in the INTEN DISPLAY MODE followed by fine adjustments in the DLY'D SWP DISPLAY MODE.

c. CHECK—With the DELAY TIME MULT dial set to 1.00, check that the intensified sweep starts on the second marker (position as necessary).

d. ADJUST—Dly'd Start, R576, to start the intensified sweep on the second marker.

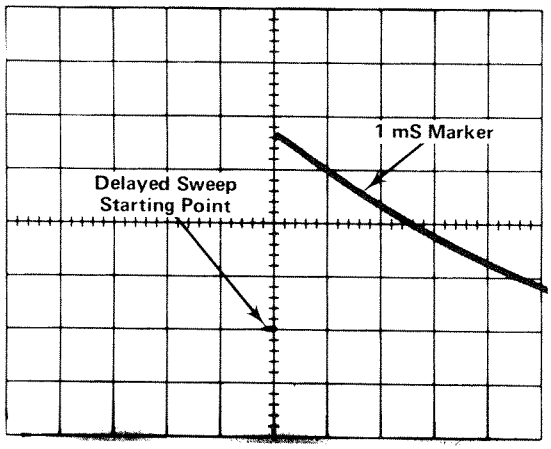
e. CHECK—Rotate the DELAY TIME MULT dial to 9.00 and check that the intensified sweep starts on the tenth marker.

f. ADJUST—Dly'd Stop control R572 to start the intensified sweep on the tenth marker.

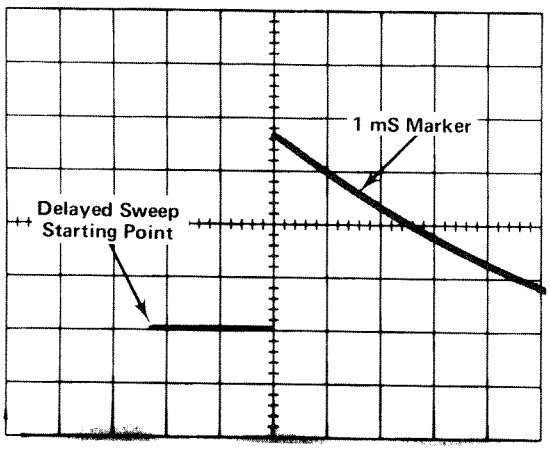
g. Change the following control settings:

TIME/DIV OR DLY TIME	1 ms
DLY'D Time/ Division	10 μs (press in for DLY'D SWP Display Mode)
DELAY TIME MULT	1.00

h. ADJUST—Observe the time-marker and adjust R576 to start the delayed sweep at the bottom of marker (see Fig. 4-5). Use the POSITION control to position the display to the center vertical graticule line. If the marker is not displayed, repeat parts b through d, g, and h.



(A) Correct delayed sweep starting point.



(B) Incorrect delayed sweep starting point.

Fig. 4-5. Typical CRT display for adjustment of Dly'd Sweep Start and Dly'd Sweep Stop.

i. Rotate the DTM to 9.00. Observe the time-marker and adjust R572 to start the delayed sweep at the bottom of marker (see Fig. 4-5). Use the POSITION control to position the display to the center vertical graticule line. If the marker is not displayed, repeat parts b, e, f, g, and i.

j. INTERACTION–Repeat the adjustment of R572 and R576 as necessary.

9. Adjust Main and Delayed Sweep High-Frequency Timing

a. Set the time-mark generator for .1 microsecond markers.

b. Change the following control settings:

TIME/DIV OR DLY TIME	.1 μs
DLY'D Time/ Division	.1 μs
MAIN TRIGGERING LEVEL	Set for stable main sweep display

c. Rotate the POSITION control to align the second .1 microsecond marker with the second vertical graticule line and the tenth .1 microsecond marker with the tenth vertical graticule line.

d. CHECK–CRT display for .1 microsecond marker per division within 0.16 division (2%).

e. ADJUST–Main Swp HF Timing control C594 for one marker each division.

f. Change the following control settings:

TIME/DIV OR DLY TIME	.2 μs
DLY'D Time/ Division	.1 μs (press in for DLY'D SWP Display Mode)
DLY'D TRIG LEVEL	RUNS AFTER DLY TIME

g. Rotate the POSITION control to align the second .1 microsecond marker with the second vertical graticule line and the tenth marker with the tenth vertical graticule line.

h. CHECK–CRT display for .1 microsecond marker each division within 0.24 division (3%).

i. ADJUST–Dly'd Swp HF Timing control C691 for one marker each division. Use the POSITION control as necessary to align the display.

j. Change the following control settings:

TIME/DIV OR DLY TIME	1 μs
DLY'D Time/ Division	.05 μs (press in for DLY'D SWP Display Mode)
MAIN TRIGGERING LEVEL	Set for a stable display

k. Rotate the DELAY TIME MULT dial to 1.00. Rotate the dial as necessary to start the delayed sweep on the second time-marker. Note the exact DELAY TIME MULT dial setting.

l. Set the time-mark generator for 1 microsecond markers.

m. Rotate the DELAY TIME MULT dial exactly 8.00 from the dial setting noted in part k.

n. CHECK–Delayed sweep to start on the tenth time marker.

o. ADJUST–C594, Main HF Timing, to start the delayed sweep on the tenth time-marker.

p. Disconnect all test equipment.

ELECTRICAL PARTS LIST

Replacement parts should be ordered from the Tektronix Field Office or Representative in your area. Changes to Tektronix products give you the benefit of improved circuits and components. Please include the instrument type number and serial number with each order for parts or service.

ABBREVIATIONS AND REFERENCE DESIGNATORS

A	Assembly, separable or repairable	FL	Filter	PTM	paper or plastic, tubular molded
AT	Attenuator, fixed or variable	H	Heat dissipating device (heat sink, etc.)	R	Resistor, fixed or variable
B	Motor	HR	Heater	RT	Thermistor
BT	Battery	J	Connector, stationary portion	S	Switch
C	Capacitor, fixed or variable	K	Relay	T	Transformer
Cer	Ceramic	L	Inductor, fixed or variable	TP	Test point
CR	Diode, signal or rectifier	LR	Inductor/resistor combination	U	Assembly, inseparable or non-repairable
CRT	cathode-ray tube	M	Meter	V	Electron tube
DL	Delay line	Q	Transistor or silicon-controlled rectifier	Var	Variable
DS	Indicating device (lamp)	P	Connector, movable portion	VR	Voltage regulator (zener diode, etc.)
Elect.	Electrolytic	PMC	Paper, metal cased	WW	wire-wound
EMC	electrolytic, metal cased	PT	paper, tubular	Y	Crystal
EMT	electrolytic, metal tubular				
F	Fuse				

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
ASSEMBLIES				
A1	670-2257-00	B010100	B089999	INTERFACE Circuit Board Assembly (7B53A only)
A1	670-2257-02	B090000		INTERFACE Circuit Board Assembly (7B53A only)
A1	670-1863-00	B010100	B019999	INTERFACE Circuit Board Assembly (7B53AN only)
A1	670-1863-01	B120000	B089999	INTERFACE Circuit Board Assembly (7B53AN only)
A1	670-1863-02	B090000		INTERFACE Circuit Board Assembly (7B53AN only)
A2	670-1869-00			SOURCE SWITCH Circuit Board Assembly
A3	670-1868-00			COUPLING SWITCH Circuit Board Assembly
A4	670-1865-01	B010100	B069999	TRIGGER Circuit Board Assembly (7B53A only)
A4	670-1865-02	B070000		TRIGGER Circuit Board Assembly (7B53A only)
A4	670-1865-00	B010100	B019999	TRIGGER Circuit Board Assembly (7B53AN only)
A4	670-1865-01	B020000	B069999	TRIGGER Circuit Board Assembly (7B53AN only)
A4	670-1865-02	B070000		TRIGGER Circuit Board Assembly (7B53AN only)
A5	670-1867-00			MODE SWITCH Circuit Board Assembly
A6	670-1864-00	B010100	B089999	SWEEP Circuit Board Assembly
A6	670-1864-01	B090000		SWEEP Circuit Board Assembly
A7	670-1866-00			DLY'D TRIGGER SWITCH Circuit Board Assembly
A8	670-2258-01			READOUT Circuit Board Assembly (7B53A only)
A9	670-2216-00			SHIELD Circuit Board Assembly
CAPACITORS				
C2	283-0636-00			36 pF, Mica, 100 V, ±0.5 pF
C16	281-0092-00			9-35 pF, Var, Cer
C17	281-0526-00			1.5 pF, Cer, 500 V, ±0.5 pF
C23	281-0549-00			68 pF, Cer, 500 V, 10%
C25	281-0601-00			7.5 pF, Cer, 500 V
C26	281-0628-00			15 pF, Cer, 600 V, 5%
C28	283-0068-00			0.01 µF, Cer, 500 V, +100%-0%
C41	283-0068-00			0.01 µF, Cer, 500 V, +100%-0%
C43[1]	283-0599-00			98 pF, Mica, 500 V, 5%
C51[2]	281-0547-00			2.7 pF, Cer, 500 V, 10%
C51[2]	281-0547-00	XB020000		2.7 pF, Cer, 500 V, 10%
C52	283-0080-00			0.022 µF, Cer, 25 V, +80%-20%
C55	281-0523-00			100 pF, Cer, 350 V, 20%

[1] 7B53A only.
[2] 7B53AN only.

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
CAPACITORS (cont)					
C60[1]		281-0547-00			2.7 pF, Cer, 500 V, 10%
C60[2]		281-0547-00	XB020000		2.7 pF, Cer, 500 V, 10%
C63		283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C64		281-0518-00			47 pF, Cer, 500 V, 20%
C66		283-0080-00			0.022 µF, Cer, 25 V, +80%-20%
C68		283-0080-00			0.022 µF, Cer, 25 V, +80%-20%
C70		283-0080-00			0.022 µF, Cer, 25 V, +80%-20%
C74		283-0080-00			0.022 µF, Cer, 25 V, +80%-20%
C82		283-0080-00			0.022 µF, Cer, 25 V, +80%-20%
C101		290-0523-00			2.2 µF, Elect., 20 V, 20%
C103		283-0010-00	B010100	B049999	0.05 µF, Cer, 50 V
C103		283-0341-00	B050000		0.047 µF, Cer, 100 V, 10%
C134					0.01 µF
C136[3]		295-0156-00			1 µF, Timing Capacitor
C138					10 µF
C141		290-0522-00	B010100	B019999	1 µF, Elect., 50 V, 20%
C141		283-0111-00	B110000		0.1 µF, Cer, 50 V, 20%
C150[3]		295-0156-00			1 µF
C152					0.01 µF, Timing Capacitor
C230		283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C232		283-0178-00			0.1 µF, Cer, 100 V, +80%-20%
C234		283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C236		283-0178-00			0.1 µF, Cer, 100 V, +80%-20%
C238		283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C240		283-0178-00			0.1 µF, Cer, 100 V, +80%-20%
C242		283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C244		283-0178-00			0.1 µF, Cer, 100 V, +80%-20%
C301		281-0178-00			1-4 pF, Var, Plastic
C310		283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C313		281-0542-00	B010100	B129999	18 pF, Cer, 500 V, 10%
C313		281-0605-00	B130000		200 pF, Cer, 500 V
C317		283-0079-00			0.01 µF, Cer, 250 V, 20%
C319		290-0517-00			6.8 µF, Elect., 35 V, 20%
C324		283-0633-00			77 pF, Mica, 100 V, 1%
C330		283-0212-00			2 µF, Cer, 50 V, 20%
C340		281-0513-00			27 pF, Cer, 500 V, 20%
C344		281-0513-00			27 pF, Cer, 500 V, 20%
C347		283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C359[2]		283-0114-00	B010100	B019999X	0.0015 µF, Cer, 200 V, 5%
C363		283-0047-00			270 pF, Cer, 500 V, 5%
C377		281-0504-00			10 pF, Cer, 500 V, 10%
C396		290-0522-00			1 µF, Elect., 50 V, 20%
C401		281-0091-00			2-8 pF, Var, Cer
C411		283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C414		281-0542-00			18 pF, Cer, 500 V, 10%
C417		283-0079-00			0.01 µF, Cer, 250 V, 20%
C419		290-0517-00			6.8 µF, Elect., 35 V, 20%
C424		283-0633-00			77 pF, Mica, 100 V, 1%
C431		283-0212-00			2 µF, Cer, 500 V, 20%
C440		281-0513-00			27 pF, Cer, 500 V, 20%

[1] 7B53A only.
[2] 7B53AN only.
[3] Individual timing capacitors in this assembly must be ordered by the 9-digit part number, letter suffix and tolerance printed on the timing capacitor to be replaced.

Example: _____285-XXXX-XX F-_____

The letter suffix and the tolerance should be the same for all of the timing capacitors in the assembly. C134, C136, C138, C150, C152 furnished as a unit.

ELECTRICAL PARTS LISTS (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
CAPACITORS (cont)					
C444		281-0513-00			27 pF, Cer, 500 V, 20%
C447		283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C459[1]		283-0114-00	B010100	B019999X	0.0015 µF, Cer, 200 V, 5%
C463		283-0047-00			270 pF, Cer, 500 V, 5%
C468		283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C477		281-0523-00			100 pF, Cer, 350 V, 20%
C496		290-0522-00			1 µF, Elect., 50 V, 20%
C506		290-0527-00			15 µF, Elect., 20 V, 20%
C519		281-0523-00			100 pF, Cer, 350 V, 20%
C520		290-0522-00			1 µF, Elect., 50 V, 20%
C527		281-0650-00	XB030000		18 pF, Cer, 200 V, 10%
C533		283-0087-00			300 pF, Cer, 1000 V, 10%
C535		290-0522-00			1 µF, Elect., 50 V, 20%
C551		290-0522-00			1 µF, Elect., 50 V, 20%
C555		281-0504-00			10 pF, Cer, 500 V, 10%
C568		281-0523-00			100 pF, Cer, 350 V, 20%
C572		290-0524-00			4.7 µF, Elect., 10 V, 20%
C578		290-0522-00			1 µF, Elect., 50 V, 20%
C579		283-0003-00			0.01 µF, Cer, 150 V, +80%-20%
C580		290-0522-00			1 µF, Elect., 50 V, 20%
C582		281-0593-00			3.9 pF, Cer, 10%
C589		290-0522-00			1 µF, Elect., 50 V, 20%
C590		281-0523-00			100 pF, Cer, 350 V, 20%
C591		281-0629-00	B010100	B019999	33 pF, Cer, 600 V, 5%
C591		281-0519-00	B020000		47 pF, Cer, 500 V, 10%
C594		281-0166-00			1.9-15 pF, Var, Air
C595		283-0631-00			95 pF, Mica, 100 V, 1%
C610		290-0523-00			2,2 µF, Elect., 20 V, 20%
C611		281-0504-00			10 pF, Cer, 500 V, 10%
C615		283-0051-00	B010100	B059999	0.0033 µF, Cer, 100 V, 5%
C615		283-0000-00	B060000		0.001 µF, Cer, 500 V, +100%-0%
C616		281-0504-00			10 pF, Cer, 500 V, 10%
C618		283-0059-00	XB080000		1 µF, Cer, 25 V, +80%-20%
C637		281-0518-00			47 pF, Cer, 500 V, 20%
C638		281-0518-00			47 pF, Cer, 500 V, 20%
C639		283-0003-00			0.01 µF, Cer, 150 V, +80%-20%
C643		283-0003-00			0.01 µF, Cer, 150 V, +80%-20%
C644		281-0504-00			10 pF, Cer, 500 V, 10%
C647		290-0523-00			2.2 µF, Elect., 20 V, 20%
C650		290-0522-00			1 µF, Elect., 50 V, 20%
C652		283-0003-00			0.01 µF, Cer, 150 V, +80%-20%
C660		281-0504-00			10 pF, Cer, 500 V, 10%
C663		281-0504-00			10 pF, Cer, 500 V, 10%
C677		281-0523-00			100 pF, Cer, 350 V, 20%
C678		281-0518-00			47 pF, Cer, 500 V, 20%
C679		290-0522-00			1 µF, Elect., 50 V, 20%
C680		283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C683		281-0544-00			5.6 pF, Cer, 500 V, 10%
C689		281-0504-00			10 pF, Cer, 500 V, 10%
C690		283-0631-00			95 pF, Mica, 100 V, 1%
C691		281-0166-00			1.9-15.7 pF, Var, Air
C706		283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C708		283-0003-00			0.01 µF, Cer, 150 V, +80%-20%
C710		283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C713		283-0003-00			0.01 µF, Cer, 150 V, +80%-20%

[1] 7B53AN only.

ELECTRICAL PARTS LIST (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
CAPACITORS (cont)				
C716	283-0003-00			0.01 µF, Cer, 150 V, +80%-20%
C718	290-0522-00			1 µF, Elect., 50 V, 20%
C728	283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C731	283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C768	281-0612-00			5.6 pF, Cer, 200 V, +0.5 pF
C800	290-0522-00			1 µF, Elect., 50 V, 20%
C801	290-0529-00	B010100	B049999	47 µF, Elect., 20 V, 20%
C801	290-0134-00	B050000	B119999	22 µF, Elect., 15 V, 20%
C801	290-0162-00	B120000		22 µF, Elect., 35 V
C803	283-0003-00			0.01 µF, Cer, 150 V, +80%-20%
C804	290-0535-00			33 µF, Elect., 10 V, 20%
C806	290-0522-00			1 µF, Elect., 50 V, 20%
C807	290-0529-00	B010100	B049999	47 µF, Elect., 20 V, 20%
C807	290-0134-00	B050000	B119999	22 µF, Elect., 15 V, 20%
C807	290-0162-00	B120000		22 µF, Elect., 35 V
C809	283-0003-00			0.01 µF, Cer, 150 V, +80%-20%
DIODES				
CR31	152-0141-02			Silicon, replaceable by 1N4152
CR109	152-0141-02			Silicon, replaceable by 1N4152
CR182[1]	152-0075-00			Germanium, rpelaceable by GD238 or ED48
CR184[1]	152-0141-02			Silicon, replaceable by 1N4152
CR185[1]	152-0141-02			Silicon, replaceable by 1N4152
CR186[1]	152-0141-02			Silicon, replaceable by 1N4152
CR187[1]	152-0141-02			Silicon, replaceable by 1N4152
CR188[1]	152-0141-02			Silicon, replaceable by 1N4152
CR201	152-0141-02			Silicon, replaceable by 1N4152
CR220	152-0141-02			Silicon, replaceable by 1N4152
CR255	152-0141-02			Silicon, replaceable by 1N4152
CR257	152-0141-02			Silicon, replaceable by 1N4152
CR263	152-0141-02			Silicon, replaceable by 1N4152
CR265	152-0141-02			Silicon, replaceable by 1N4152
CR267	152-0141-02			Silicon, replaceable by 1N4152
CR275	152-0141-02			Silicon, replaceable by 1N4152
CR280	152-0141-02			Silicon, replaceable by 1N4152
CR281	152-0141-02			Silicon, replaceable by 1N4152
CR283	152-0141-02			Silicon, replaceable by 1N4152
CR285	152-0141-02			Silicon, replaceable by 1N4152
CR288	152-0141-02			Silicon, replaceable by 1N4152
CR307	152-0141-02			Silicon, replaceable by 1N4152
CR308[1]	152-0141-02	XB035836		Silicon, replaceable by 1N4152
CR308[2]	152-0141-02	XB134215		Silicon, replaceable by 1N4152
CR340[1]	152-0141-02			Silicon, replaceable by 1N4152
CR340[2]	152-0141-02			Silicon, replaceable by 1N4152
CR343[1]	152-0141-02			Silicon, replaceable by 1N4152
CR343[2]	152-0141-02			Silicon, replaceable by 1N4152
CR361	152-0141-02			Silicon, replaceable by 1N4152
CR365	152-0141-02			Silicon, replaceable by 1N4152
CR409	152-0141-02			Silicon, replaceable by 1N4152
CR410[1]	152-0141-02	XB135836		Silicon, replaceable by 1N4152
CR410[2]	152-0141-02	XB134215		Silicon, replaceable by 1N4152
CR440[1]	152-0141-02			Silicon, replaceable by 1N4152
CR440[2]	152-0141-02			Silicon, replaceable by 1N4152
CR443[1]	152-0141-02			Silicon, replaceable by 1N4152
CR443[2]	152-0141-02			Silicon, replaceable by 1N4152
CR461	152-0141-02			Silicon, replaceable by 1N4152
CR465	152-0141-02			Silicon, replaceable by 1N4152
CR504	152-0141-02			Silicon, replaceable by 1N4152

[1] 7B53A only.
[2] 7B53AN only.

ELECTRICAL PARTS LIST (cont)

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
DIODES (cont)				
CR505	152-0141-02			Silicon, replaceable by 1N4152
CR513	152-0141-02			Silicon, replaceable by 1N4152
CR516	152-0141-02			Silicon, replaceable by 1N4152
CR519	152-0141-02			Silicon, replaceable by 1N4152
CR556	152-0141-02	XB100000		Silicon, replaceable by 1N4152
CR566	152-0141-02			Silicon, replaceable by 1N4152
CR582	152-0075-00			Germanium, replaceable by CD238 or ED48
CR617	152-0141-02			Silicon, replaceable by 1N4152
CR624	152-0141-02			Silicon, replaceable by 1N4152
CR629	152-0141-02			Silicon, replaceable by 1N4152
CR635	152-0141-02			Silicon, replaceable by 1N4152
CR641	152-0141-02			Silicon, replaceable by 1N4152
CR648	152-0141-02			Silicon, replaceable by 1N4152
CR654	152-0075-00			Germanium, replaceable by CD238 or ED48
CR655	152-0141-02	XB080000		Silicon, replaceable by 1N4152
CR661	152-0141-02			Silicon, replaceable by 1N4152
CR662	152-0141-02			Silicon, replaceable by 1N4152
CR677	152-0141-02			Silicon, replaceable by 1N4152
CR678	152-0075-00			Germanium, replaceable by CD238 or ED48
CR686	152-0307-00			Silicon, replaceable by MSD6100
CR695	152-0141-02			Silicon, replaceable by 1N4152
CR697	152-0141-02			Silicon, replaceable by 1N4152
CR717	152-0141-02			Silicon, replaceable by 1N4152
CR728	152-0141-02			Silicon, replaceable by 1N4152
CR731	152-0141-02			Silicon, replaceable by 1N4152
CR735	152-0141-02			Silicon, replaceable by 1N4152
CR736	152-0141-02			Silicon, replaceable by 1N4152
CR743	152-0141-02			Silicon, replaceable by 1N4152
CR752	152-0141-02			Silicon, replaceable by 1N4152
CR776	152-0141-02			Silicon, replaceable by 1N4152
CR777	152-0141-02			Silicon, replaceable by 1N4152
CR901[1]	152-0075-00			Germanium, replaceable by CD238 or ED48
CR903[1]	152-0075-00			Germanium, replaceable by CD238 or ED48
CR905[1]	152-0075-00			Germanium, replaceable by CD238 or ED48
CR907[1]	152-0075-00			Germanium, replaceable by CD238 or ED48
CR909[1]	152-0075-00			Germanium, replaceable by CD238 or ED48
CR911[1]	152-0075-00			Germanium, replaceable by CD238 or ED48
CR913[1]	152-0075-00			Germanium, replaceable by CD238 or ED48
CR915[1]	152-0075-00			Germanium, replaceable by CD238 or ED48
CR917[1]	152-0075-00			Germanium, replaceable by CD238 or ED48
CR919[1]	152-0075-00			Germanium, replaceable by CD238 or ED48
CR921[1]	152-0075-00			Germanium, replaceable by CD238 or ED48
CR923[1]	152-0075-00			Germanium, replaceable by CD238 or ED48
VR320	152-0149-00			Zener, replaceable by 1N961B, 0.4 W, 10 V, 5%
VR420	152-0149-00			Zener, replaceable by 1N961B, 0.4 W, 10 V, 5%
VR570	152-0461-00			Zener, replaceable by 1N821, 0.4 W, 6.2 V, 5%
VR708	152-0227-00			Zener, selected from 1N753A, 0.4 W, 6.2 V, 5%
BULBS				
DS8	150-0048-01			Incandescent, #683, selected
DS30	150-0048-01			Incandescent, #683, selected
CONNECTORS				
J1	131-0955-00			Receptacle, electrical, BNC, female
J3	131-0955-00			Receptacle, electrical, BNC, female

[1] 7B53A only.

ELECTRICAL PARTS LIST (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
INDUCTORS				
L231	120-0382-00			Toroid, 14 turns, single
L235	120-0382-00			Toroid, 14 turns, single
L239	120-0382-00			Toroid, 14 turns, single
L243	120-0382-00			Toroid, 14 turns, single
L330	276-0507-00			Core, ferramic suppressor
L431	276-0507-00			Core, ferramic suppressor
LR580	108-0333-00			0.9 µH (wound on a 160 Ω, 1/4 W, 5% resistor)
LR650	108-0333-00			0.9 µH (wound on a 160 Ω, 1/4 W, 5% resistor)
TRANSISTORS				
Q52	151-0223-00			Silicon, NPN, replaceable by 2N4275
Q61	151-0223-00			Silicon, NPN, replaceable by 2N4275
Q66	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q70	151-0220-00			Silicon, PNP, replaceable by 2N4122
Q212	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q261	151-0341-00	B010100	B049999	Silicon, NPN, replaceable by 2N3565
Q261	151-0302-00	B050000		Silicon, NPN, replaceable by 2N2222A
Q262	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q271	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q279	151-0341-00	B010100	B049999	Silicon, NPN, replaceable by 2N3565
Q279	151-0302-00	B050000		Silicon, NPN, replaceable by 2N2222A
Q280	151-0220-00			Silicon, PNP, replaceable by 2N4122
Q310, Q311	151-1042-00			Silicon, FET, selected from 2N5245, matched pair
Q315	151-0221-00			Silicon, PNP, replaceable by 2N4258
Q320	151-0367-00			Silicon, NPN, replaceable by SKA6516
Q322	151-0367-00			Silicon, NPN, replaceable by SKA6516
Q366	151-0223-00			Silicon, NPN, replaceable by 2N4275
Q382	151-0188-00			Silicon, PNP, replaceable by 2N3906
Q411, Q412	151-1042-00			Silicon, FET, selected from 2N5245, matched pair
Q415	151-0221-00			Silicon, PNP, replaceable by 2N4258
Q420	151-0367-00			Silicon, NPN, replaceable by SKA6516
Q422	151-0367-00			Silicon, NPN, replaceable by SKA6516
Q466	151-0223-00			Silicon, NPN, replaceable by 2N4275
Q482	151-0188-00			Silicon, PNP, replaceable by 2N3906
Q513	151-0188-00			Silicon, PNP, replaceable by 2N3906
Q516	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q524	151-0301-00			Silicon, PNP, replaceable by 2N2907
Q528	151-0221-00			Silicon, PNP, replaceable by 2N4258
Q538	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q544	151-0223-00			Silicon, NPN, replaceable by 2N4275
Q547	151-0223-00			Silicon, NPN, replaceable by 2N4275
Q551	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q560	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q562	151-0188-00			Silicon, PNP, replaceable by 2N3906
Q564	151-0220-00			Silicon, PNP, replaceable by 2N4122
Q568	151-0220-00			Silicon, PNP, replaceable by 2N4122

ELECTRICAL PARTS LIST (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
TRANSISTORS (cont)				
Q584	151-0221-00			Silicon, PNP, replaceable by 2N4258
Q596	151-1004-00			Silicon, FET, selected from 2N4302 or replaceable by U1489
Q603	151-0223-00			Silicon, NPN, replaceable by 2N4275
Q608	151-0223-00			Silicon, NPN, replaceable by 2N4275
Q610	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q620	151-0221-00			Silicon, PNP, replaceable by 2N4258
Q628	151-0192-00			Silicon, NPN, selected from MPS6521
Q633	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q639	151-0223-00			Silicon, NPN, replaceable by 2N4275
Q642	151-0223-00			Silicon, NPN, replaceable by 2N4275
Q647	151-0221-00			Silicon, PNP, replaceable by 2N4258
Q654	151-0221-00			Silicon, PNP, replaceable by 2N4258
Q656	151-0220-00			Silicon, PNP, replaceable by 2N4122
Q659	151-0223-00			Silicon, NPN, replaceable by 2N4275
Q665	151-0223-00			Silicon, NPN, replaceable by 2N4275
Q671	151-0220-00			Silicon, PNP, replaceable by 2N4122
Q678	151-0289-00			Silicon, PNP, replaceable by MM999 or selected from 2N3251
Q682	151-0190-00			Silicon, replaceable by 2N3904 or TE3904
Q684	151-0259-00			Silicon, NPN, selected from 2N3563
Q688	151-0259-00			Silicon, NPN, selected from 2N3563
Q695	151-0216-00			Silicon, PNP, replaceable by MPS6523
Q696	151-0216-00			Silicon, PNP, replaceable by MPS6523
Q698	151-0220-00			Silicon, PNP, replaceable by 2N4122
Q720	151-0192-00			Silicon, NPN, selected from MPS6521
Q724	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q734	151-0219-00			Silicon, PNP, replaceable by 2N4250
Q754	151-0224-00			Silicon, NPN, replaceable by 2N3692
Q764	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
RESISTORS				
R1	323-0452-00			499 kΩ, 1/2 W, 1%
R2[1]	315-0101-00			100 Ω, 1/4 W, 5%
R4[2]	311-1192-00			10 kΩ, Var
R5	311-1322-00			5 kΩ, Var
R8	311-1162-00			2 x 10 kΩ, Var
R9	311-0946-00			50 kΩ, Var
R15	315-0470-00			47 Ω, 1/4 W, 5%
R17	321-0448-00			453 kΩ, 1/8 W, 1%
R18	321-0361-00			56.2 kΩ, 1/8 W, 1%
R19	315-0470-00			47 Ω, 1/4 W, 5%
R23	315-0224-00			220 kΩ, 1/4 W, 5%
R25	315-0333-00			33 kΩ, 1/4 W, 5%
R29	315-0101-00			100 Ω, 1/4 W, 5%
R41	315-0101-00			100 Ω, 1/4 W, 5%

[1]Furnished as a unit with S4.
[2]Furnished as a unit with S5.

ELECTRICAL PARTS LIST (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)				
R42	323-0452-00			499 kΩ, 1/2 W, 1%
R43	315-0101-00			100 Ω, 1/4 W, 5%
R50[1]	321-0071-00			53.6 Ω, 1/8 W, 1%
R52[2]	321-0126-00			200 Ω, 1/8 W, 1%
R52[2]	315-0431-00	B010100	B019999	430 Ω, 1/4 W, 5%
R52[2]	321-0126-00	B020000		200 Ω, 1/8 W, 1%
R54	321-0020-00			15.8 Ω, 1/8 W, 1%
R56	323-0151-00			365 Ω, 1/2 W, 1%
R58	321-0020-00			15.8 Ω, 1/8 W, 1%
R59[1]	321-0071-00			53.6 Ω, 1/8 W, 1%
R60[2]	315-0121-00			120 Ω, 1/4 W, 5%
R60[1]	315-0121-00	XB020000		120 Ω, 1/4 W, 5%
R61[2]	321-0126-00			200 Ω, 1/8 W, 1%
R61[2]	321-0158-00	B010100	B019999	432 Ω, 1/8 W, 1%
R61[2]	321-0126-00	B020000		200 Ω, 1/8 W, 1%
R62	315-0101-00			100 Ω, 1/4 W, 5%
R63	321-0237-00			2.87 kΩ, 1/8 W, 1%
R64	315-0821-00			820 Ω, 1/4 W, 5%
R66	315-0101-00			100 Ω, 1/4 W, 5%
R67	315-0510-00			51 Ω, 1/4 W, 5%
R68	315-0201-00			200 Ω, 1/4 W, 5%
R70	315-0101-00			100 Ω, 1/4 W, 5%
R72	311-1227-00			5 kΩ, Var
R73	321-0324-00			23.2 kΩ, 1/8 W, 1%
R74	321-0210-00			1.5 kΩ, 1/8 W, 1%
R76	315-0510-00			51 Ω, 1/4 W, 5%
R80	315-0472-00			4.7 kΩ, 1/4 W, 5%
R82	315-0101-00			100 Ω, 1/4 W, 5%
R105	315-0103-00			10 kΩ, 1/4 W, 5%
R107	315-0623-00			62 kΩ, 1/4 W, 5%
R109	315-0624-00			620 kΩ, 1/4 W, 5%
R110	325-0082-00			33.51 MΩ, 1 W, 1/10%
R112	325-0081-00			11.17 MΩ, 1/2 W, 1/10%
R114	325-0081-00			11.17 MΩ, 1/2 W, 1/10%
R117	325-0080-00			3.351 MΩ, 1/2 W, 1/10%
R119	323-0789-07			1.117 MΩ, 1/2 W, 1/10%
R121	323-0789-07			1.117 MΩ, 1/2 W, 1/10%
R124	323-0788-07			558.5 kΩ, 1/2 W, 1/10%
R126	323-0787-07			223.4 kΩ, 1/2 W, 1/10%
R128	323-0786-07			111.7 kΩ, 1/2 W, 1/10%
R130	323-0785-07			55.85 kΩ, 1/2 W, 1/10%
R139	315-0510-00			51 Ω, 1/4 W, 5%
R141	315-0101-00			100 Ω, 1/4 W, 5%
R144[3]	311-1321-00			20 kΩ, Var
R146	315-0103-00			10 kΩ, 1/4 W, 5%
R149	315-0510-00			51 Ω, 1/4 W, 5%
R154	323-0785-07			55.85 kΩ, 1/2 W, 1/10%
R156	323-0786-07			111.7 kΩ, 1/2 W, 1/10%
R158	323-0787-07			223.4 kΩ, 1/2 W, 1/10%
R160	323-0788-07			558.5 kΩ, 1/2 W, 1/10%

[1] 7B53A only.
[2] 7B53AN only.
[3] Furnished as a unit with S144.

ELECTRICAL PARTS LIST (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)				
R164	325-0080-00			3.351 MΩ, 1/2 W, 1/10%
R166	323-0789-07			1.117 MΩ, 1/2 W, 1/10%
R168	323-0789-07			1.117 MΩ, 1/2 W,, 1/10%
R170	325-0082-00			33.51 MΩ, 1 W, 1/10%
R172	325-0081-00			11.17 MΩ, 1/2 W, 1/10%
R174	325-0081-00			11.17 MΩ, 1/2 W, 1/10%
R182[1]	315-0133-00			13 kΩ, 1/4 W, 5%
R184[1]	315-0332-00			3.3 kΩ, 1/4 W, 5%
R185[1]	315-0332-00			3.3 kΩ, 1/4 W, 5%
R186[1]	315-0332-00			3.3 kΩ, 1/4 W, 5%
R188[1]	315-0332-00			3.3 kΩ, 1/4 W, 5%
R205	315-0470-00			47 Ω, 1/4 W, 5%
R210	315-0103-00			10 kΩ, 1/4 W, 5%
R211	315-0203-00			20 kΩ, 1/4 W, 5%
R231	315-0101-00			100 Ω, 1/4 W, 5%
R235	315-0101-00			100 Ω, 1/4 W, 5%
R239	315-0101-00			100 Ω, 1/4 W, 5%
R243	315-0101-00			100 Ω, 1/4 W, 5%
R258	315-0103-00	B010100	B049999	10 kΩ, 1/4 W, 5%
R258	315-0272-00	B050000		2.7 kΩ, 1/4 W, 5%
R259	315-0203-00	B010100	B049999	20 kΩ, 1/4 W, 5%
R259	315-0202-00	B050000		2 kΩ, 1/4 W, 5%
R261	315-0203-00			20 kΩ, 1/4 W, 5%
R262	315-0103-00			10 kΩ, 1/4 W, 5%
R263	315-0203-00			20 kΩ, 1/4 W, 5%
R264	315-0203-00			20 kΩ, 1/4 W, 5%
R268	315-0103-00			10 kΩ, 1/4 W, 5%
R269	315-0203-00			20 kΩ, 1/4 W, 5%
R271	315-0104-00			100 kΩ, 1/4 W, 5%
R276	315-0103-00	B010100	B049999	10 kΩ, 1/4 W, 5%
R276	315-0272-00	B050000		2.7 kΩ, 1/4 W, 5%
R277	315-0203-00	B010100	B049999	20 kΩ, 1/4 W, 5%
R277	315-0202-00	B050000		2 kΩ, 1/4 W, 5%
R279	315-0104-00			100 kΩ, 1/4 W, 5%
R280	315-0103-00			10 kΩ, 1/4 W, 5%
R281	315-0203-00			20 kΩ, 1/4 W, 5%
R290	311-1060-00			500 Ω, Var
R301	315-0510-00			51 Ω, 1/4 W, 5%
R303	321-0452-00			499 kΩ, 1/8 W, 1%
R307[1]	315-0512-00	B010100	B135835X	5.1 kΩ, 1/4 W, 5%
R307[2]	315-0512-00	B010100	B134214X	5.1 kΩ, 1/4 W, 5%
R310	315-0511-00			510 kΩ, 1/4 W, 5%
R311	315-0101-00			100 Ω, 1/4 W, 5%
R312	315-0431-00			430 Ω, 1/4 W, 5%
R313	315-0101-00			100 Ω, 1/4 W, 5%
R315	315-0102-00			1 kΩ, 1/4 W, 5%
R317	315-0751-00			750 Ω, 1/4 W, 5%
R320	315-0221-00	B010100	B129999	220 Ω, 1/4 W, 5%
R320	315-0331-00	B130000		330 Ω, 1/4 W, 5%
R322	315-0221-00	B010100	B129999	220 Ω, 1/4 W, 5%
R322	315-0331-00	B130000		330 Ω, 1/4 W, 5%
R325	315-0150-00	B010100	B079999	15 Ω, 1/4 W, 5%
R325	315-0100-00	B070000		10 Ω, 1/4 W, 5%

[1] 7B53A only.

[2] 7B53AN only.

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)					
R326		315-0122-00	B010100	B129999	1.2 kΩ, 1/4 W, 5%
R326		315-0162-00	B130000		1.6 kΩ, 1/4 W, 5%
R328		315-0150-00	BQ10100	B069999	15 Ω, 1/4 W, 5%
R328		315-0100-00	B070000		10 Ω, 1/4 W, 5%
R330		315-0102-00			1 kΩ, 1/4 W, 5%
R332		315-0472-00			4.7 kΩ, 1/4 W, 5%
R333		311-1228-00			10 kΩ, Var
R335		315-0152-00			1.5 kΩ, 1/4 W, 5%
R339[1]		315-0431-00			430 Ω, 1/4 W, 5%
R339[2]		315-0431-00	XB020000		430 Ω, 1/4 W, 5%
R340		315-0201-00			200 Ω, 1/4 W, 5%
R341[1]		315-0242-00			2.4 kΩ, 1/4 W, 5%
R342[1]		315-0431-00			430 Ω, 1/4 W, 5%
R342[2]		315-0431-00	XB020000		430 Ω, 1/4 W, 5%
R343		315-0242-00			2.4 kΩ, 1/4 W, 5%
R344		315-0201-00			200 Ω, 1/4 W, 5%
R345		315-0102-00			1 kΩ, 1/4 W, 5%
R346		315-0511-00			510 Ω, 1/4 W, 5%
R347		315-0331-00			330 Ω, 1/4 W, 5%
R352		317-0271-00			270 Ω, 1/8 W, 5%
R354		317-0271-00			270 Ω, 1/8 W, 5%
R357		317-0271-00			270 Ω, 1/8 W, 5%
R359[1]		317-0271-00			270 Ω, 1/8 W, 5%
R359[2]		317-0102-00	B010100	B019999	1 kΩ, 1/8 W, 5%
R359[2]		317-0271-00	B020000		270 Ω, 1/8 W, 5%
R361		315-0471-00			470 Ω, 1/4 W, 5%
R363		315-0471-00			470 Ω, 1/4 W, 5%
R364		315-0203-00			20 kΩ, 1/4 W, 5%
R366		315-0331-00			330 Ω, 1/4 W, 5%
R367		315-0511-00			510 Ω, 1/4 W, 5%
R374[1]		317-0271-00			270 Ω, 1/8 W, 5%
R375[1]		317-0102-00			1 kΩ, 1/8 W, 5%
R375		317-0102-00			1 kΩ, 1/8 W, 5%
R376		317-0271-00			270 Ω, 1/8 W, 5%
R377		315-0271-00			270 Ω, 1/4 W, 5%
R379		315-0751-00			750 Ω, 1/4 W, 5%
R383		315-0331-00			330 Ω, 1/4 W, 5%
R384		315-0511-00			510 Ω, 1/4 W, 5%
R386		315-0361-00			360 Ω, 1/4 W, 5%
R387		315-0620-00			62 Ω, 1/4 W, 5%
R401		315-0510-00			51 Ω, 1/4 W, 5%
R403		321-0452-00			499 kΩ, 1/8 W, 1%

[1] 7B53A only.
[2] 7B53AN only.

ELECTRICAL PARTS LIST (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)				
R409[1]	315-0512-00	B010100	B135835X	5.1 kΩ, 1/4 W, 5%
R409[2]	315-0512-00	B010100	B134214X	5.1 kΩ, 1/4 W, 5%
R410	315-0511-00			510 Ω, 1/4 W, 5%
R411	315-0101-00			100 Ω, 1/4 W, 5%
R412	315-0101-00			100 Ω, 1/4 W, 5%
R413	315-0431-00			430 Ω, 1/4 W, 5%
R415	315-0102-00			1 kΩ, 1/4 W, 5%
R417	315-0751-00			750 Ω, 1/4 W, 5%
R420	315-0331-00			330 Ω, 1/4 W, 5%
R422	315-0331-00			330 Ω, 1/4 W, 5%
R426	315-0150-00			15 Ω, 1/4 W, 5%
R428	315-0150-00			15 Ω, 1/4 W, 5%
R429	315-0162-00			1.6 kΩ, 1/4 W, 5%
R431	315-0511-00			510 Ω, 1/4 W, 5%
R433	315-0242-00			2.4 kΩ, 1/4 W, 5%
R435	311-1228-00			10 kΩ, Var
R437[1]	315-0751-00			750 Ω, 1/4 W, 5%
R439[2]	315-0431-00			430 Ω, 1/4 W, 5%
R439[2]	315-0431-00	XB020000		430 Ω, 1/4 W, 5%
R440	315-0201-00			200 Ω, 1/4 W, 5%
R441[1]	315-0242-00			2.4 kΩ, 1/4 W, 5%
R442[1]	315-0431-00			430 Ω, 1/4 W, 5%
R442[2]	315-0431-00	XB020000		430 Ω, 1/4 W, 5%
R443	315-0242-00			2.4 kΩ, 1/4 W, 5%
R444	315-0201-00			200 Ω, 1/4 W, 5%
R445	315-0102-00			1 kΩ, 1/4 W, 5%
R446	315-0511-00			510 Ω, 1/4 W, 5%
R447	315-0331-00			330 Ω, 1/4 W, 5%
R452	317-0271-00			270 Ω, 1/8 W, 5%
R454	317-0271-00			270 Ω, 1/8 W, 5%
R457[1]	317-0751-00			750 Ω, 1/8 W, 5%
R459[2]	317-0271-00			270 Ω, 1/8 W, 5%
R459[2]	317-0102-00	B010100	B019999	1 kΩ, 1/8 W, 5%
R459[2]	317-0271-00	B020000		270 Ω, 1/8 W, 5%
R461	315-0471-00			470 Ω, 1/4 W, 5%
R463	315-0471-00			470 Ω, 1/4 W, 5%
R464	315-0203-00			20 kΩ, 1/4 W, 5%
R466	315-0331-00			330 Ω, 1/4 W, 5%
R467	315-0511-00			510 Ω, 1/4 W, 5%
R468	315-0331-00			330 Ω, 1/4 W, 5%
R469	315-0511-00			510 Ω, 1/4 W, 5%
R474[1]	317-0271-00			270 Ω, 1/8 W, 5%
R475[1]	317-0102-00			1 kΩ, 1/8 W, 5%
R475[2]	317-0102-00	XB020000		1 kΩ, 1/8 W, 5%

[1] 7B53A only.
[2] 7B53AN only.

ELECTRICAL PARTS LIST (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)				
R476	317-0271-00			270 Ω, 1/8 W, 5%
R477	315-0271-00			270 Ω, 1/4 W, 5%
R479	315-0751-00			750 Ω, 1/4 W, 5%
R483	315-0331-00			330 Ω, 1/4 W, 5%
R484	315-0511-00			510 Ω, 1/4 W, 5%
R486	315-0361-00			360 Ω, 1/4 W, 5%
R487	315-0620-00			62 Ω, 1/4 W, 5%
R502	315-0512-00			5.1 kΩ, 1/4 W, 5%
R504	315-0393-00			39 kΩ, 1/4 W, 5%
R505	315-0622-00			6.2 kΩ, 1/4 W, 5%
R508	315-0101-00			100 Ω, 1/4 W, 5%
R509	315-0151-00			150 Ω, 1/4 W, 5%
R510	321-0313-00			17.8 kΩ, 1/8 W, 1%
R511	315-0511-00			510 Ω, 1/4 W, 5%
R513	315-0431-00			430 Ω, 1/4 W, 5%
R514	315-0182-00			1.8 kΩ, 1/4 W, 5%
R516	321-0231-00			2.49 kΩ, 1/8 W, 1%
R517	315-0821-00			820 Ω, 1/4 W, 5%
R518	315-0102-00			1 kΩ, 1/4 W, 5%
R519	315-0392-00			3.9 kΩ, 1/4 W, 5%
R520	315-0472-00			4.7 kΩ, 1/4 W, 5%
R521	315-0241-00			240 Ω, 1/4 W, 5%
R522	315-0102-00			1 kΩ, 1/4 W, 5%
R523	315-0102-00			1 kΩ, 1/4 W, 5%
R526	315-0102-00			1 kΩ, 1/4 W, 5%
R527	315-0102-00			1 kΩ, 1/4 W, 5%
R528	315-0391-00			390 Ω, 1/4 W, 5%
R529	315-0822-00			8.2 kΩ, 1/4 W, 5%
R533	315-0104-00			100 kΩ, 1/4 W, 5%
R535	315-0124-00			120 kΩ, 1/4 W, 5%
R539	315-0102-00			1 kΩ, 1/4 W, 5%
R541	315-0331-00			330 Ω, 1/4 W, 5%
R542	315-0270-00			27 Ω, 1/4 W, 5%
R543	315-0620-00			62 Ω, 1/4 W, 5%

ELECTRICAL PARTS LIST (cont)

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)				
R544	315-0241-00			240 Ω, 1/4 W, 5%
R545	323-0192-00			976 Ω, 1/2 W, 1%
R547	321-0146-00			324 Ω, 1/8 W, 1%
R548	315-0151-00			150 Ω, 1/4 W, 5%
R549	315-0332-00			3.3 kΩ, 1/4 W, 5%
R551	315-0331-00			330 Ω, 1/4 W, 5%
R553	315-0152-00			1.5 kΩ, 1/4 W, 5%
R555	315-0202-00			2 kΩ, 1/4 W, 5%
R556	315-0511-00	B010100	B099999X	510 Ω, 1/4 W, 5%
R558	321-0260-00			4.99 kΩ, 1/8 W, 1%
R559	321-0289-00			10 kΩ, 1/8 W, 1%
R561	315-0103-00			10 kΩ, 1/4 W, 5%
R563	315-0202-00			2 kΩ, 1/4 W, 5%
R564	311-1224-00			500 Ω, Var
R565	315-0432-00			4.3 kΩ, 1/4 W, 5%
R566	315-0153-00			15 kΩ, 1/4 W, 5%
R567	315-0272-00			2.7 kΩ, 1/4 W, 5%
R568	315-0471-00			470 Ω, 1/4 W, 5%
R569	315-0202-00			2 kΩ, 1/4 W, 5%
R570	321-0201-00			1.21 kΩ, 1/4 W, 5%
R571	315-0103-00			10 kΩ, 1/4 W, 5%
R572	311-1230-00			20 kΩ, Var
R574	315-0622-00			6.2 kΩ, 1/4 W, 5%
R575	315-0101-00			100 Ω, 1/4 W, 5%
R576	311-1230-00			20 kΩ, Var
R578	315-0103-00			10 kΩ, 1/4 W, 5%
R579	315-0304-00			300 kΩ, 1/4 W, 5%
R581	315-0752-00			7.5 kΩ, 1/4 W, 5%
R582	315-0752-00			7.5 kΩ, 1/4 W, 5%
R583	315-0563-00			56 kΩ, 1/4 W, 5%
R584	315-0202-00			2 kΩ, 1/4 W, 5%
R589	315-0621-00			620 Ω, 1/4 W, 5%
R590	315-0820-00			82 Ω, 1/4 W, 5%
R591	315-0433-00			43 kΩ, 1/4 W, 5%
R592	311-1235-00			100 kΩ, Var
R597	315-0153-00			15 kΩ, 1/4 W, 5%
R601	315-0270-00			27 Ω, 1/4 W, 5%
R603	315-0361-00			360 Ω, 1/4 W, 5%
R604	322-0210-00			1.5 kΩ, 1/4 W, 1%
R606	315-0301-00			300 Ω, 1/4 W, 5%
R607	315-0620-00			62 Ω, 1/4 W, 5%
R608	321-0164-00			499 Ω, 1/8 W, 1%
R609	315-0511-00	XB080000		510 Ω, 1/4 W, 5%
R610	315-0270-00			27 Ω, 1/4 W, 5%
R611	315-0202-00			2 kΩ, 1/4 W, 5%
R612	315-0511-00			510 Ω, 1/4 W, 5%
R613	315-0102-00			1 kΩ, 1/4 W, 5%
R614	315-0102-00	B010100	B059999	1 kΩ, 1/4 W, 5%
R614	321-0148-00	B060000		340 Ω, 1/8 W, 1%

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)					
R615		315-0910-00			91 Ω, 1/4 W, 5%
R616		315-0103-00			10 kΩ, 1/4 W, 5%
R617		315-0683-00			68 kΩ, 1/4 W, 5%
R618		315-0102-00	XB080000		1 kΩ, 1/4 W, 5%
R619		315-0623-00			62 kΩ, 1/4 W, 5%
R621		315-0153-00			15 kΩ, 1/4 W, 5%
R622		315-0102-00			1 kΩ, 1/4 W, 5%
R624		315-0243-00			24 kΩ, 1/4 W, 5%
R626		315-0472-00			4.7 kΩ, 1/4 W, 5%
R627		315-0682-00			6.8 kΩ, 1/4 W, 5%
R628		315-0203-00			20 kΩ, 1/4 W, 5%
R629		315-0103-00			10 kΩ, 1/4 W, 5%
R631		315-0472-00			4.7 kΩ, 1/4 W, 5%
R634		315-0122-00			1.2 kΩ, 1/4 W, 5%
R635		315-0123-00			12 kΩ, 1/4 W, 5%
R637		315-0102-00			1 kΩ, 1/4 W, 5%
R638		315-0202-00			2 kΩ, 1/4 W, 5%
R639		315-0271-00			270 Ω, 1/4 W, 5%
R641		315-0202-00			2 kΩ, 1/4 W, 5%
R642		315-0271-00			270 Ω, 1/4 W, 5%
R644		315-0102-00			1 kΩ, 1/4 W, 5%
R645		315-0202-00			2 kΩ, 1/4 W, 5%
R647		315-0100-00			10 Ω, 1/4 W, 5%
R648		315-0241-00			240 Ω, 1/4 W, 5%
R649		315-0682-00			6.8 kΩ, 1/4 W, 5%
R651		315-0752-00			7.5 kΩ, 1/4 W, 5%
R652		311-1225-00			1 kΩ, Var
R653		315-0752-00			7.5 kΩ, 1/4 W, 5%
R655		315-0201-00	XB080000		200 Ω, 1/4 W, 5%
R657		315-0102-00			1 kΩ, 1/4 W, 5%
R658		315-0302-00			3 kΩ 1/4 W, 5%
R659		315-0471-00			470 Ω, 1/4 W, 5%
R660		315-0362-00			3.6 kΩ, 1/4 W, 5%
R661		315-0302-00			3 kΩ, 1/4 W, 5%
R662		315-0202-00			2 kΩ, 1/4 W, 5%
R663		315-0362-00			3.6 kΩ, 1/4 W, 5%
R665		315-0431-00	B010100	B079999	430 Ω, 1/4 W, 5%
R665		315-0271-00	B080000		270 Ω, 1/4 W, 5%
R666		315-0511-00			510 Ω, 1/4 W, 5%
R668		315-0752-00			7.5 kΩ, 1/4 W, 5%
R669		315-0162-00			1.6 kΩ, 1/4 W, 5%
R670		315-0471-00			470 Ω, 1/4 W, 5%
R672		315-0511-00			510 Ω, 1/4 W, 5%
R673		315-0102-00			1 kΩ, 1/4 W, 5%
R675		311-1235-00			100 kΩ, Var
R676		315-0433-00			43 kΩ, 1/4 W, 5%
R677		315-0820-00			82 Ω, 1/4 W, 5%
R679		315-0621-00			620 Ω, 1/4 W, 5%
R680		315-0103-00			10 kΩ, 1/4 W, 5%
R681		315-0623-00			62 kΩ, 1/4 W, 5%
R682		315-0303-00			30 kΩ, 1/4 W, 5%
R683		315-0102-00			1 kΩ, 1/4 W, 5%
R684		321-0192-00			976 Ω, 1/8 W, 1%
R685		315-0510-00			51 Ω, 1/4 W, 5%

ELECTRICAL PARTS LIST (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)				
R686	301-0133-00			13 kΩ, 1/2 W, 5%
R687	315-0510-00			51 Ω, 1/4 W, 5%
R689	315-0102-00			1 kΩ, 1/4 W, 5%
R690	315-0752-00			7.5 kΩ, 1/4 W, 5%
R691	321-0260-00			4.99 kΩ, 1/8 W, 1%
R692	321-0268-00			6.04 kΩ, 1/8 W, 1%
R693	321-0268-00			6.04 kΩ, 1/8 W, 1%
R694	321-0260-00			4.99 kΩ, 1/8 W, 1%
R695	315-0391-00			390 Ω, 1/4 W, 5%
R696	315-0242-00			2.4 kΩ, 1/4 W, 5%
R697	315-0391-00			390 Ω, 1/4 W, 5%
R698	315-0102-00			1 kΩ, 1/4 W, 5%
R701	321-0222-07			2 kΩ, 1/8 W, 1/10%
R704	321-0222-07			2 kΩ, 1/8 W, 1/10%
R706	315-0103-00			10 kΩ, 1/4 W, 5%
R707	315-0104-00			100 kΩ, 1/4 W, 5%
R710	321-0327-00			24.9 kΩ, 1/8 W, 1%
R711	315-0104-00			100 kΩ, 1/4 W, 5%
R713	321-0452-00			499 kΩ, 1/8 W, 1%
R714	321-0356-00			49.9 kΩ, 1/8 W, 1%
R716	321-0356-00			49.9 kΩ, 1/8 W, 1%
R717	321-0268-00			6.04 kΩ, 1/8 W, 1%
R720	321-0174-00			634 Ω, 1/8 W, 1%
R722	315-0103-00			10 kΩ, 1/4 W, 5%
R723	315-0104-00			100 kΩ, 1/4 W, 5%
R725	321-0327-00			24.9 kΩ, 1/8 W, 1%
R726	315-0104-00			100 kΩ, 1/4 W, 5%
R728	315-0103-00			10 kΩ, 1/4 W, 5%
R729	315-0104-00			100 kΩ, 1/4 W, 5%
R731	315-0273-00			27 kΩ, 1/4 W, 5%
R732	315-0104-00			100 kΩ, 1/4 W, 5%
R734	315-0511-00			510 Ω, 1/4 W, 5%
R736	315-0103-00			10 kΩ, 1/4 W, 5%
R738	321-0225-00			2.15 kΩ, 1/8 W, 1%
R739	321-0132-00			232 Ω, 1/8 W, 1%
R741	321-0260-00			4.99 kΩ, 1/8 W, 1%
R745	315-0621-00			620 Ω, 1/4 W, 5%
R747	321-0207-00			1.4 kΩ, 1/8 W, 1%
R748	321-0186-00			845 Ω, 1/8 W, 1%
R750	321-0220-00			1.91 kΩ, 1/8 W, 1%
R751	321-0236-00			2.8 kΩ, 1/8 W, 1%
R753	315-0912-00			9.1 kΩ, 1/4 W, 5%
R757	321-0164-00			499 Ω, 1/8 W, 1%
R759	321-0148-00			340 Ω, 1/8 W, 1%
R761	321-0057-00			38.3 Ω, 1/8 W, 1%
R762	311-1221-00			50 Ω, Var
R764	308-0300-00			1.75 kΩ, 3 W, WW, 1%
R766	321-0148-00			340 Ω, 1/8 W, 1%
R768	321-0222-07			2 kΩ, 1/8 W, 1/10%
R770	315-0432-00			4.3 kΩ, 1/4 W, 5%
R772	315-0302-00			3 kΩ, 1/4 W, 5%

ELECTRICAL PARTS LIST (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Description
RESISTORS (cont)				
R774[1]	321-0153-00			383 Ω, 1/8 W, 1%
R901[1]	315-0753-00			75 kΩ, 1/4 W, 5%
R903[1]	315-0154-00			150 kΩ, 1/4 W, 5%
R905[1]	321-0344-00			37.4 kΩ, 1/8 W, 1%
R907[1]	315-0154-00			150 kΩ, 1/4 W, 5%
R909[1]	315-0154-00			150 kΩ, 1/4 W, 5%
R911[1]	315-0753-00			75 kΩ, 1/4 W, 5%
R913[1]	315-0753-00			75 kΩ, 1/4 W, 5%
R915[1]	315-0154-00			150 kΩ, 1/4 W, 5%
R917[1]	321-0344-00			37.4 kΩ, 1/8 W, 1%
R919[1]	315-0154-00			150 kΩ, 1/4 W, 5%
R921[1]	315-0753-00			75 kΩ, 1/4 W, 5%
R923[1]	315-0154-00			150 kΩ, 1/4 W, 5%
R925[1]	321-0344-00			37.4 kΩ, 1/8 W, 1%
R926[1]	321-0344-00			37.4 kΩ, 1/8 W, 1%
R928[1]	315-0513-00			51 kΩ, 1/4 W, 5%
R929[1]	315-0513-00			51 kΩ, 1/4 W, 5%
R931[1]	315-0154-00			150 kΩ, 1/4 W, 5%
R932[1]	315-0154-00			150 kΩ, 1/4 W, 5%
R934[1]	315-0753-00			75 kΩ, 1/4 W, 5%
R935[1]	315-0753-00			75 kΩ, 1/4 W, 5%
R937[1]	315-0154-00			150 kΩ, 1/4 W, 5%
R938[1]	315-0154-00			150 kΩ, 1/4 W, 5%
R940[1]	315-0753-00			75 kΩ, 1/4 W, 5%
R941[1]	315-0753-00			75 kΩ, 1/4 W, 5%
R943[1]	315-0154-00			150 kΩ, 1/4 W, 5%
R944[1]	315-0154-00			150 kΩ, 1/4 W, 5%
SWITCHES				
S42[2]				SLOPE
S5[3]				DLY'D TRIG LEVEL
S10[4]	670-1869-00			Pushbutton, SOURCE
S20[4]	670-1868-00			Pushbutton, COUPLING
S30[4]	670-1867-00			Pushbutton, MODE
S40, S41, S42 [4]	260-1133-00			Push-push, DLY'D SLOPE / DLY'D COUPLING / DLY'D SOURCE
S100A,B[4]				Cam assembly, TIME/DIV or DLY TIME / DLY'D TIME/DIVISION
S144[5,6]				
S144A,B[1,5]				

[1] 7B53A only.
[2] Furnished as a unit with R4.
[3] Furnished as a unit with R5.
[4] See Mechanical Parts List for replacement parts.
[5] Furnished as a unit with R144.
[6] 7B53AN only.

ELECTRICAL PARTS LIST (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
SWITCHES (cont)				
S251	260-0960-01			Push-pull INTENSIFIER DLY'D MODE
S252	260-1309-00			Push, SPDT MAIN SWEEP MODE
S262	260-0960-01			Push-pull, MIXED MODE
S762	260-1208-00			Push-push, MAG
INTEGRATED CIRCUITS				
U350	156-0205-00			Quad 2-input positive nor gate, replaceable by MC10102
U355	156-0205-00			Quad 2-input positive nor gate, replaceable by MC10102
U375[1]	156-0204-01			Dual 275 MHz clocked-latch/R-S flip-flop, replaceable by MC1669L
U375[2]	156-0204-00	B010100	B019999	Dual 275 MHz clocked-latch/R-S flip-flop, replaceable by MC1669L
U375[2]	156-0204-01	B020000		Dual 275 MHz clocked-latch/R-S flip-flop, replaceable by MC1669L
U450	156-0205-00			Quad 2-input positive nor gate, replaceable by MC10102
U455	156-0205-00			Quad 2-input positive nor gate, replaceable by MC10102
U475	156-0204-00			Dual 275 MHz clocked-latch/R-S flip-flop, replaceable by MC1669L
U520	155-0049-01			Monolithic, sweep control
U580	155-0042-03			Monolithic, Miller integrator and delay pickoff
U650	155-0042-03			Monolithic, Miller integrator and delay pickoff
U720	156-0048-00			Five NPN-transistor array, replaceable by CA3046
U744	156-0048-00			Five NPN-transistor array, replaceable by CA3046

[1] 7B53A only.
[2] 7B53AN only.

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

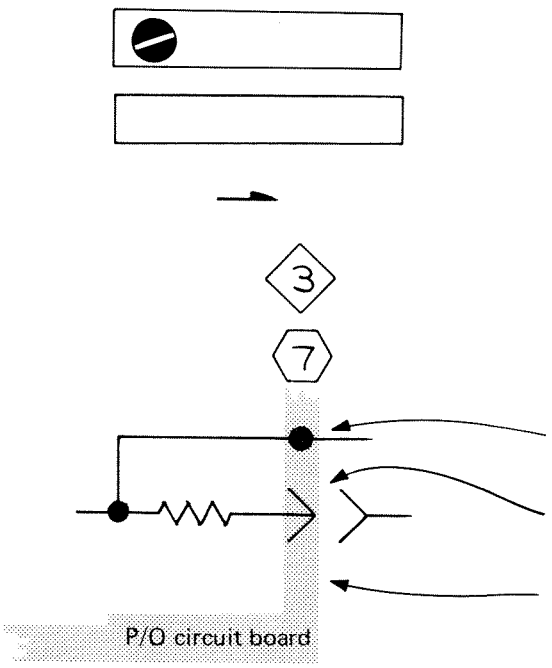
Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).
Resistors = Ohms (Ω)

Symbols used on the diagrams are based on USA Standard Y32.2-1967.

Logic symbology is based on MIL-STD-806B in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following special symbols are used on the diagrams:



External Screwdriver adjustment.

External control or connector.

Clockwise control rotation in direction of arrow.

Refer to diagram number indicated in diamond.

Refer to waveform number indicated in hexagon.

Connection soldered to circuit board.

Connection made to circuit board with interconnecting pin.

Blue tint encloses components located on circuit board.

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

A	Assembly, separable or repairable (circuit board, etc.)
AT	Attenuator, fixed or variable
B	Motor
BT	Battery
C	Capacitor, fixed or variable
CR	Diode, signal or rectifier
DL	Delay line
DS	Indicating device (lamp)
F	Fuse
FL	Filter
H	Heat dissipating device (heat sink, heat radiator, etc.)
HR	Heater
J	Connector, stationary portion
K	Relay
L	Inductor, fixed or variable
LR	Inductor/resistor combination
M	Meter
Q	Transistor or silicon-controlled rectifier
P	Connector, movable portion
R	Resistor, fixed or variable
RT	Thermistor
S	Switch
T	Transformer
TP	Test point
U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
V	Electron tube
VR	Voltage regulator (zener diode, etc.)
Y	Crystal

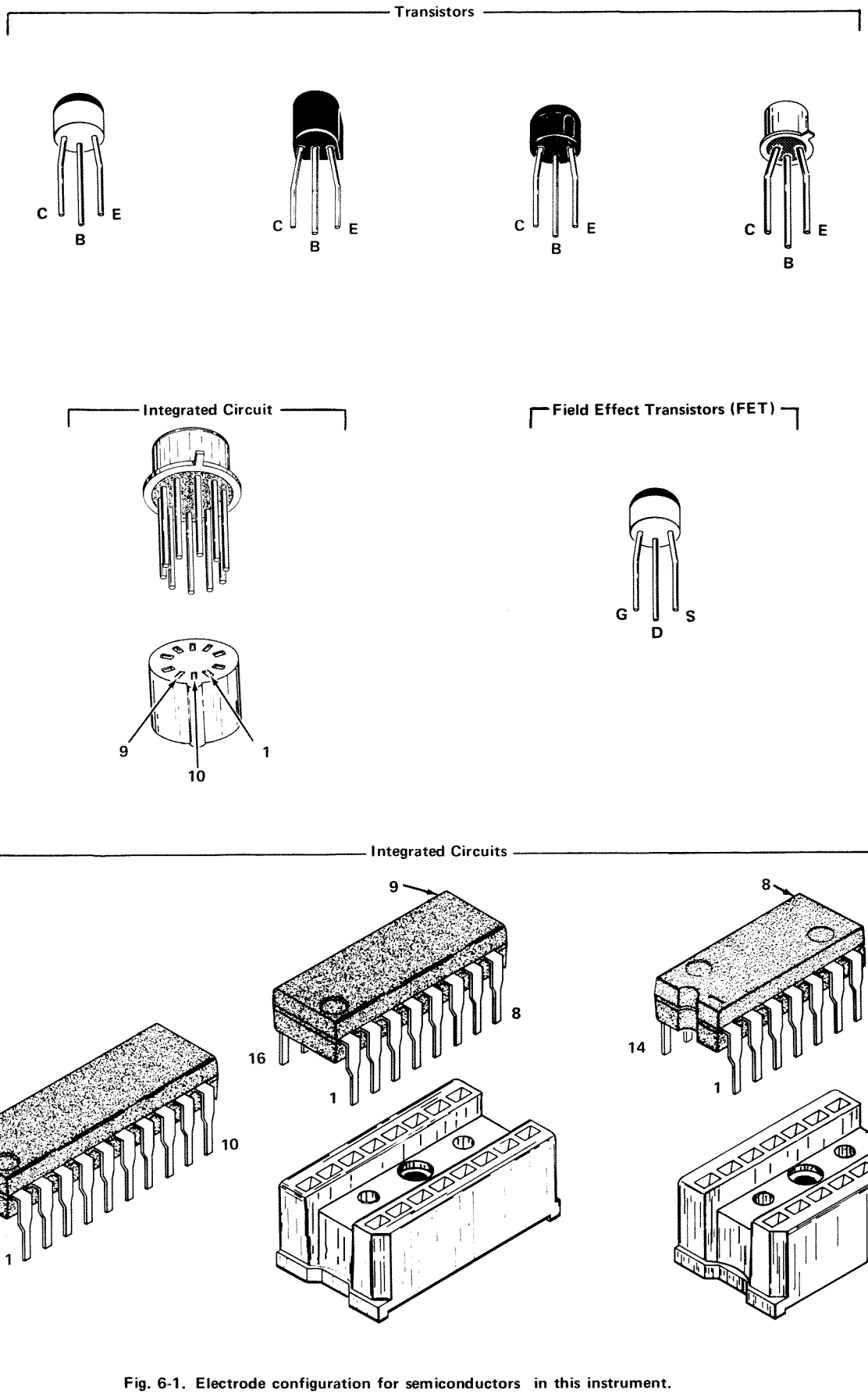


Fig. 6-1. Electrode configuration for semiconductors in this instrument.

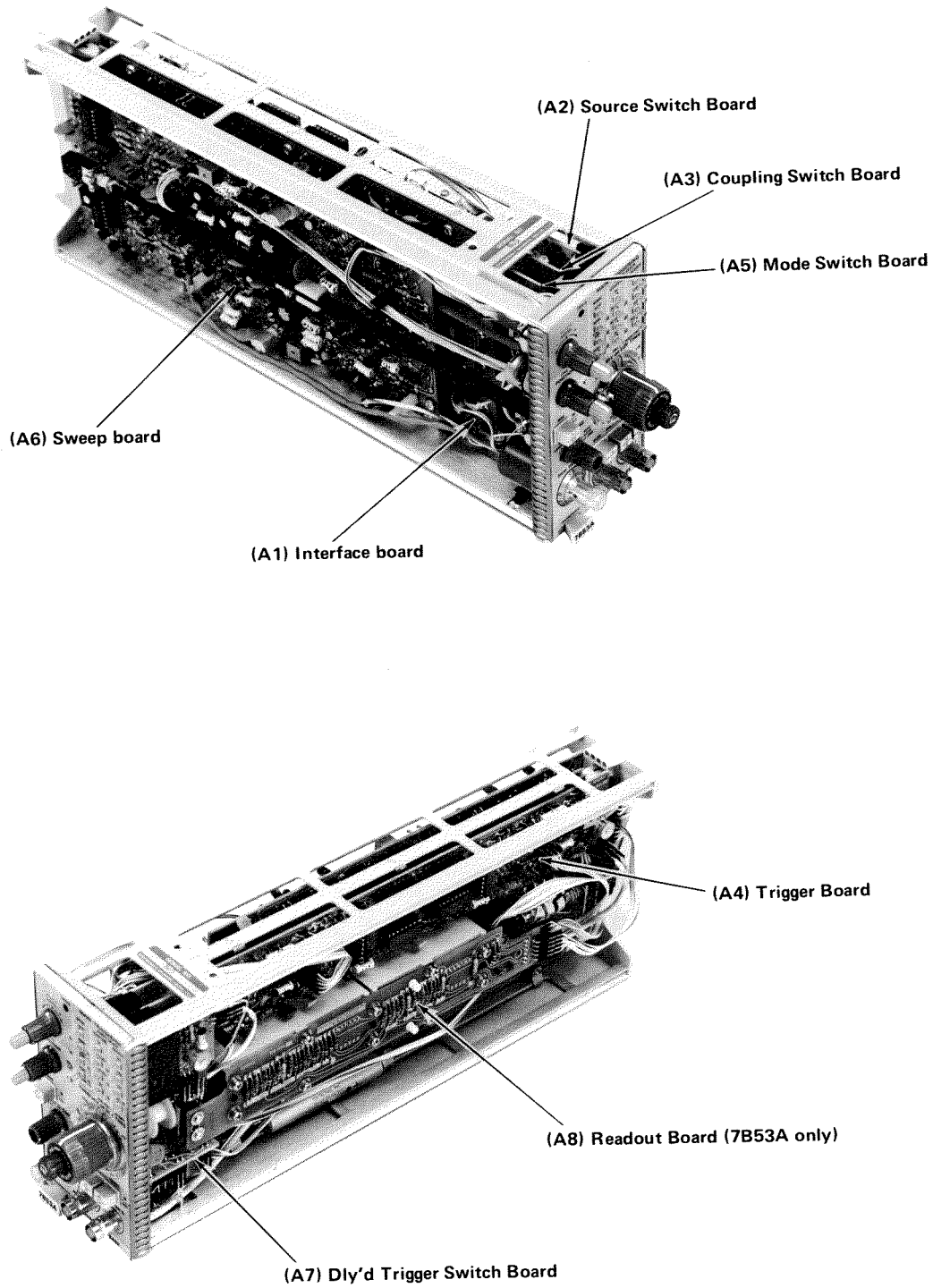


Fig. 6-2. Location of circuit boards in the 7B53A/7B53AN.

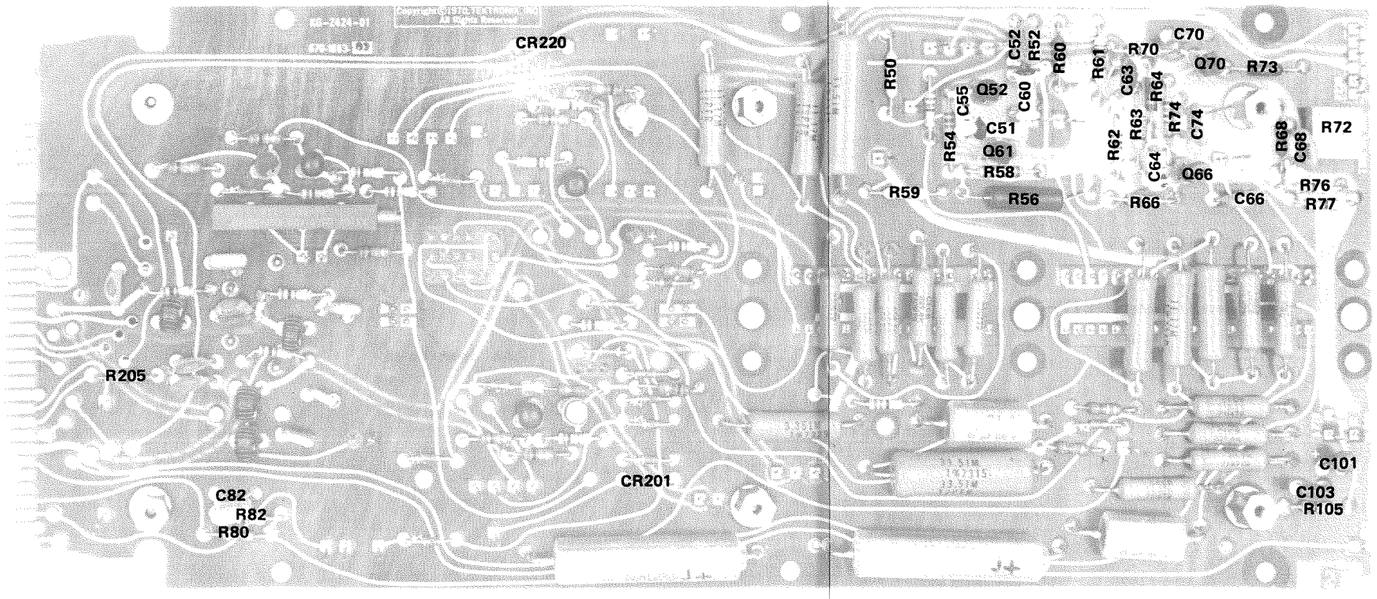


Fig. 6-3A. P/O A1. Partial Interface circuit board, SNB090000 and up.

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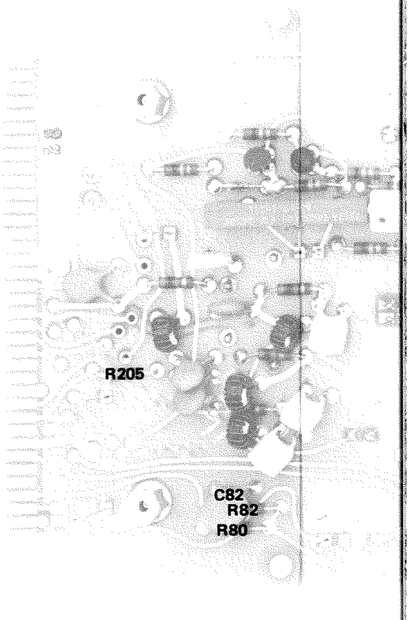


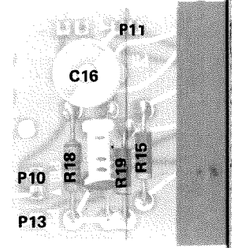
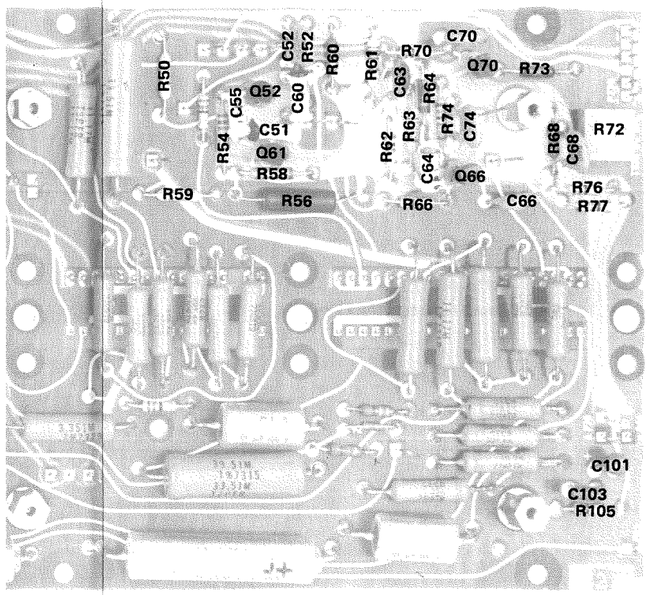


Fig. 6-4. A2. Source Switc



ircuit board, SNB090000 and up.

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C51 } on back
C60 } of board.

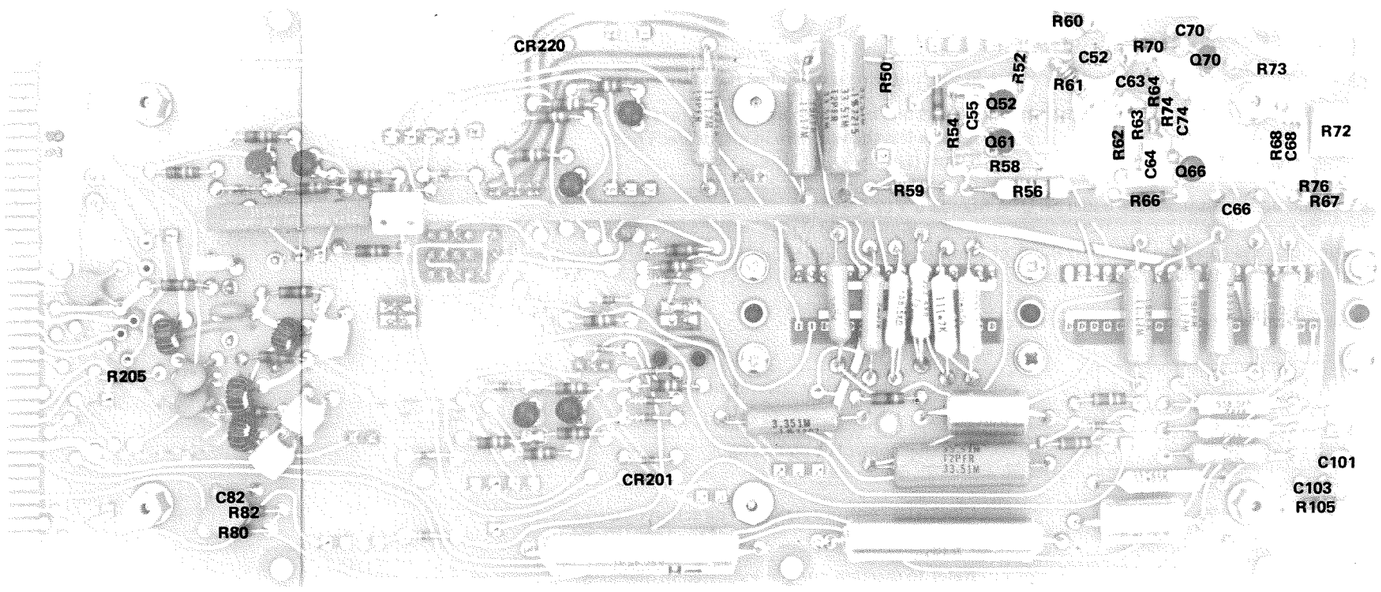

Fig. 6-3B. P/O A1. Partial Interface circuit board, below SNB090000.

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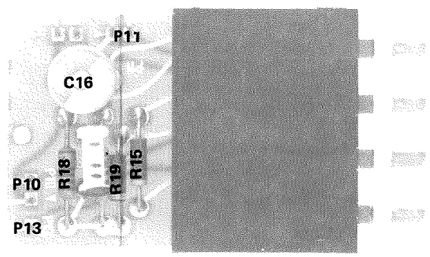

Fig. 6-4. A2. Source Switch circuit board.

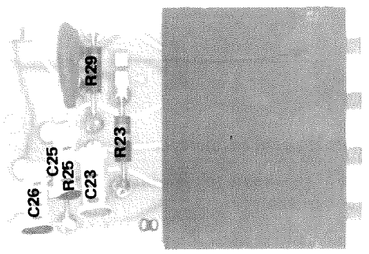

Fig. 6-5. A3. Coupling Switch circuit board.

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VOLTAGES AND WAVEFORMS

The voltages and waveforms shown on this diagram were obtained by using the recommended test equipment and test set-ups listed below.

RECOMMENDED TEST EQUIPMENT

ITEM	SPECIFICATIONS	RECOMMENDED TYPE
Oscilloscope	Frequency response DC to 65 MHz Deflection factor 5 mV to 5 V/Div Input impedance 10 MΩ, 20 pF Sweep rate 500 ns	Tektronix 7603 or 7613 equipped with 7A15A Amplifier and 7B50 Time-Base Unit, or equivalent.
Probe	Fast rise 10X attenuation probe compatible with the vertical amplifier of the test oscilloscope.	Tektronix P6053A, or equivalent.
Voltmeter (Non-loading digital multimeter)	Input impedance 10 MΩ Range 0 – 500 V	Tektronix 7D13 Digital Multimeter (test oscilloscope must have readout system) or Fairchild Model 7050, or equivalent.
Extender	Required for extending the 7B53AN from the mainframe when making waveform and voltage measurements.	Tektronix extender plug-in. Tektronix Part Number 067-0589-00 or Tektronix flexible extender, Tektronix Part Number 067-0616-00, or equivalent.

Voltage Conditions

The 7B53AN Unit under test must be connected to a mainframe separate from the test oscilloscope. No signal is applied for voltage measurements. Voltmeter common is connected to chassis ground.

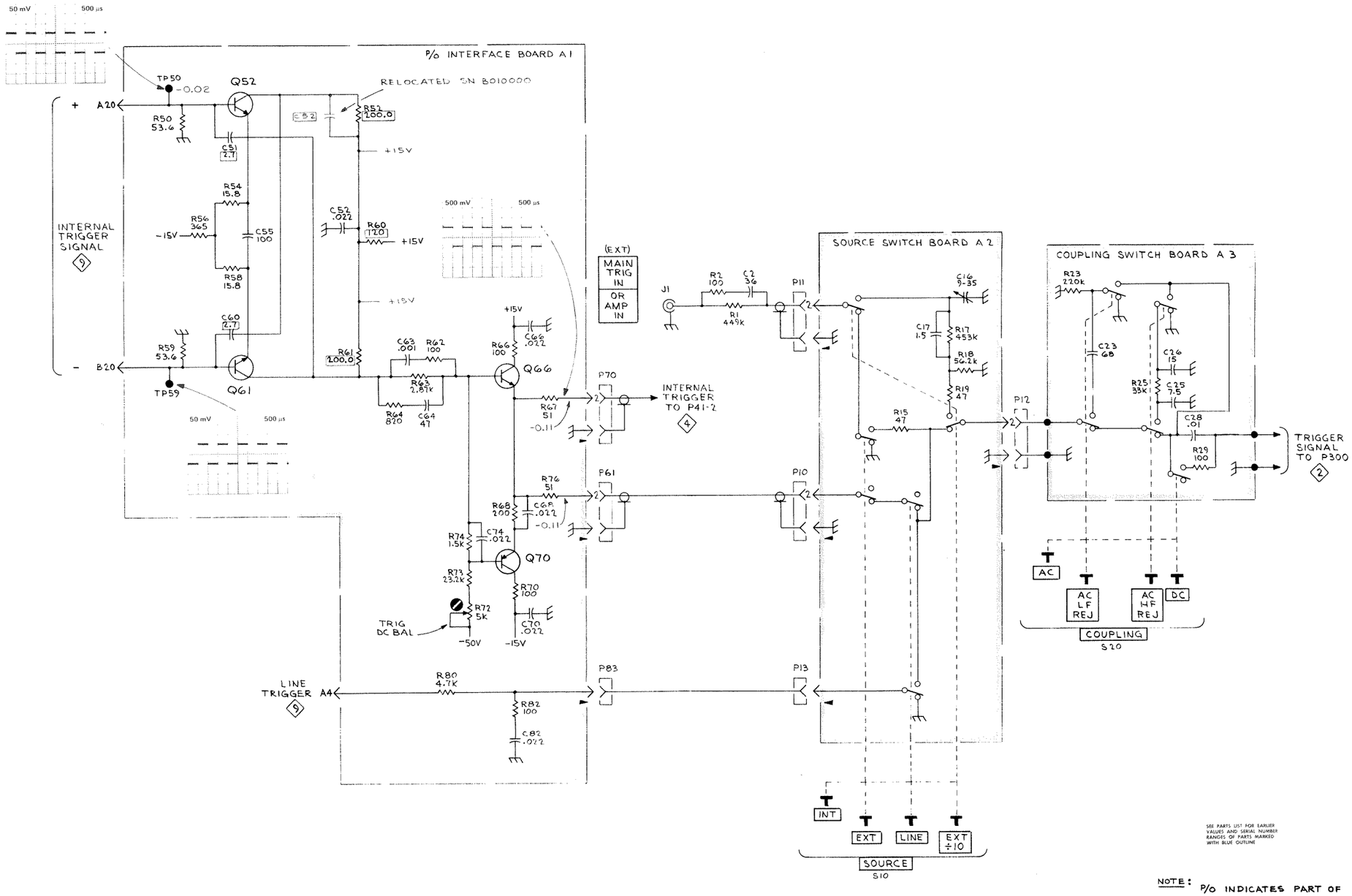
7B53AN Control Settings

MAIN TRIGGERING	
MODE	AUTO
COUPLING	AC
SOURCE	INT
SLOPE	(+)
LEVEL	Control center
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/Division	0.5 ms (press in for DLY'D display mode)
VARIABLE	CAL (pull out for MIXED display mode)
DELAY TIME MULT	5.00
MAG	X1
POSITION	Center display horizontally
DLY'D TRIG	
LEVEL	Control center
SLOPE	(+)
COUPLING	AC
SOURCE	INT

Waveform Conditions

Front panel controls are set the same as for voltage measurements. The test oscilloscope 0.4 Volt calibration signal is applied to the vertical amplifier of the mainframe to which the 7B53AN is connected. The vertical amplifier of the system under test is set for 100 mV/Division. The test oscilloscope is triggered from the calibration signal; vertical input is AC coupled.

Tolerances of voltages and waveforms shown are ±20%.



SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE

NOTE: P/O INDICATES PART OF

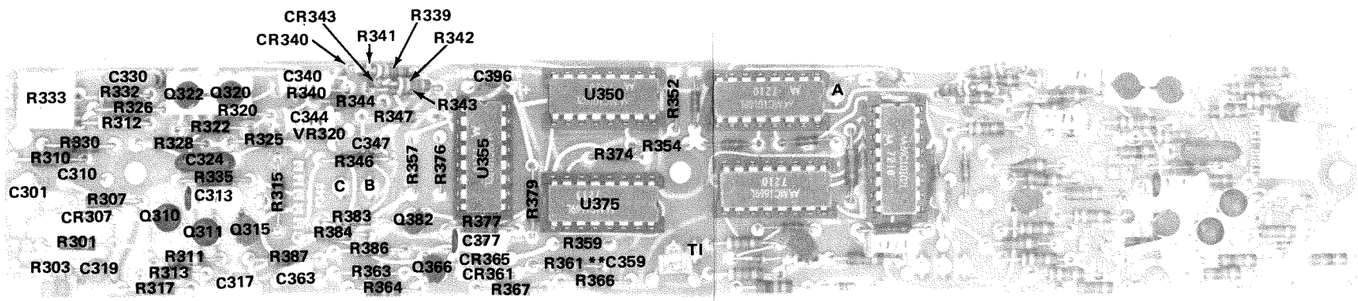


Fig. 6-6. P/O A4. Partial Trigger circuit board.

VOLTAGES AND WAVEFORMS

The voltages and waveforms shown on this diagram were obtained by using the recommended test equipment and test set-ups listed below.

RECOMMENDED TEST EQUIPMENT

ITEM	SPECIFICATIONS	RECOMMENDED TYPE
Oscilloscope	Frequency response DC to 65 MHz Deflection factor 5 mV to 5 V/Div Input impedance 10 MΩ, 20 pF Sweep rate 500 ns	Tektronix 7603 or 7613 equipped with 7A15A Amplifier and 7B50 Time-Base Unit, or equivalent.
Probe	Fast rise 10X attenuation probe compatible with the vertical amplifier of the test oscilloscope.	Tektronix P6053A, or equivalent.
Voltmeter (Non-loading digital multimeter)	Input impedance 10 MΩ Range 0 – 500 V	Tektronix 7D13 Digital Multimeter (test oscilloscope must have readout system) or Fairchild Model 7050, or equivalent.
Extender	Required for extending the 7B53AN from the mainframe when making waveform and voltage measurements.	Tektronix extender plug-in. Tektronix Part Number 067-0589-00 or Tektronix flexible extender, Tektronix Part Number 067-0616-00, or equivalent.

Voltage Conditions

The 7B53AN Unit under test must be connected to a mainframe separate from the test oscilloscope. No signal is applied for voltage measurements. Voltmeter common is connected to chassis ground.

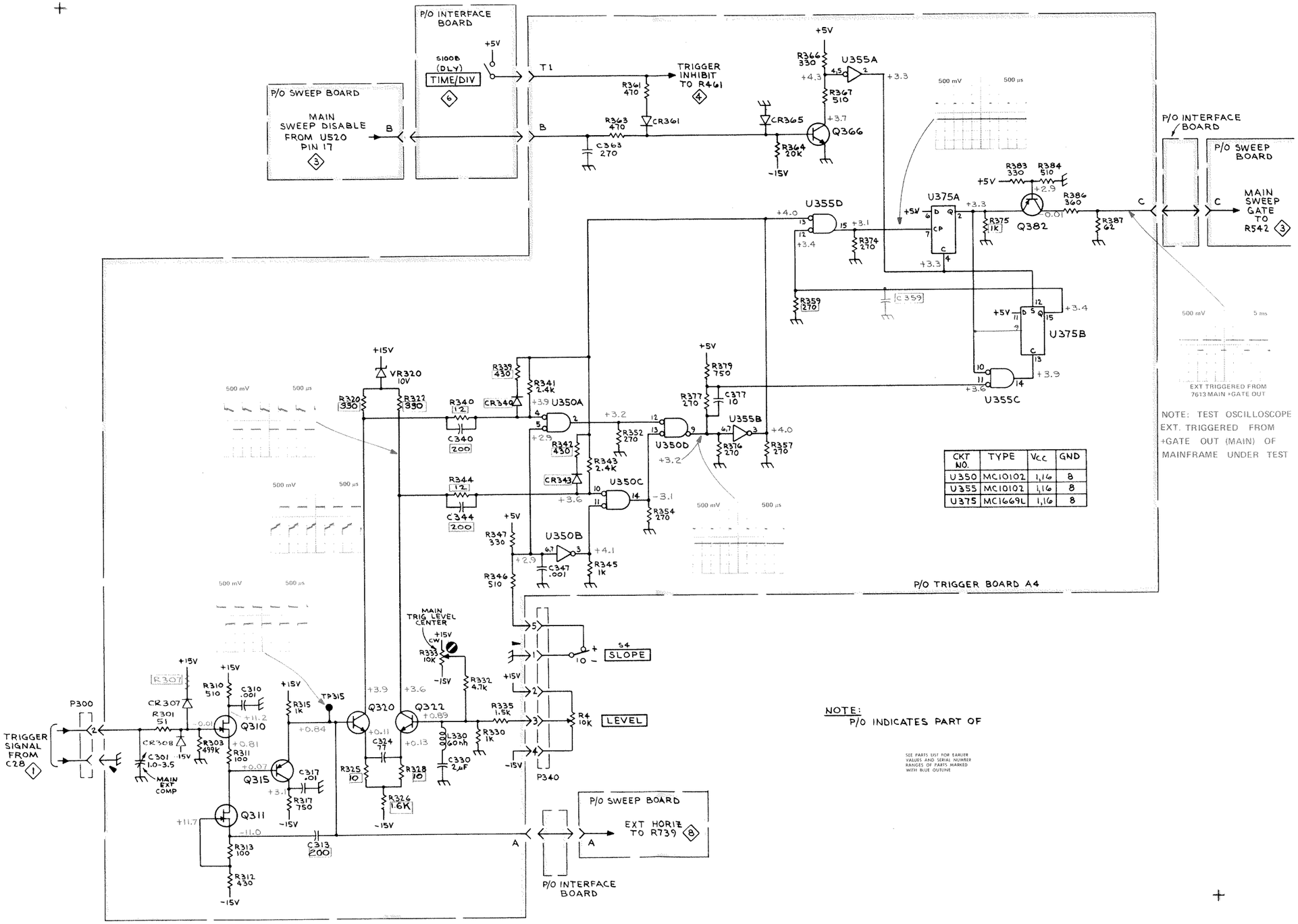
7B53AN Control Settings

MAIN TRIGGERING	
MODE	AUTO
COUPLING	AC
SOURCE	INT
SLOPE	(+)
LEVEL	Control center
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/Division	0.5 ms (press in for DLY'D display mode)
VARIABLE	CAL (pull out for MIXED display mode)
DELAY TIME MULT	5.00
MAG	X1
POSITION	Center display horizontally
DLY'D TRIG	
LEVEL	Control center
SLOPE	(+)
COUPLING	AC
SOURCE	INT

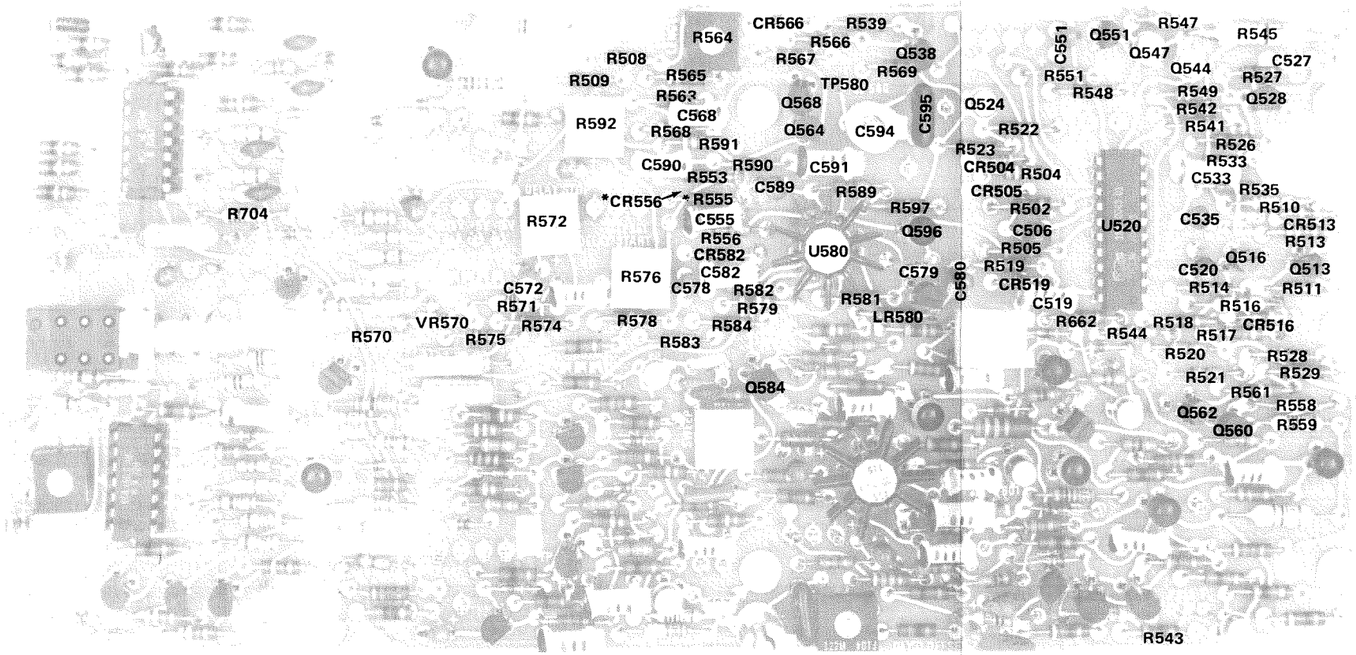
Waveform Conditions

Front panel controls are set the same as for voltage measurements. The test oscilloscope 0.4 Volt calibration signal is applied to the vertical amplifier of the mainframe to which the 7B53AN is connected. The vertical amplifier of the system under test is set for 100 mV/Division. The test oscilloscope is triggered from the calibration signal; vertical input is AC coupled.

Tolerances of voltages and waveforms shown are ±20%.



MAIN TRIGGER GENERATOR 2 mgf 673



*See Parts List for serial number ranges.

Fig. 6-8A. P/O A6. Partial Sweep circuit board, SN B090000 and up.

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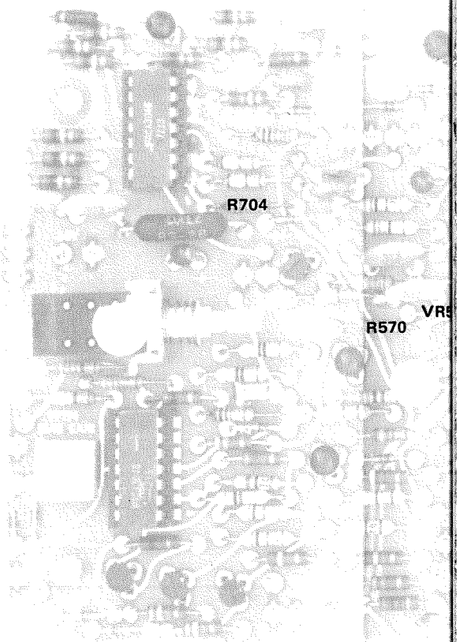
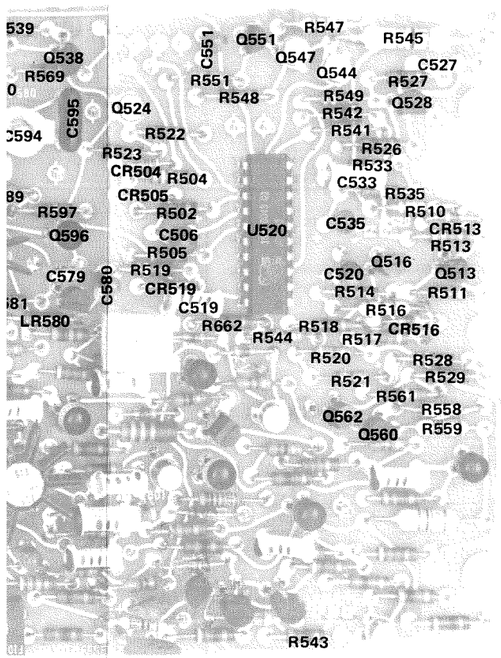


NOTE:
See Fig. 6-3 for location of components not identified here.

**CR3
on re
of boa**



00 and up.

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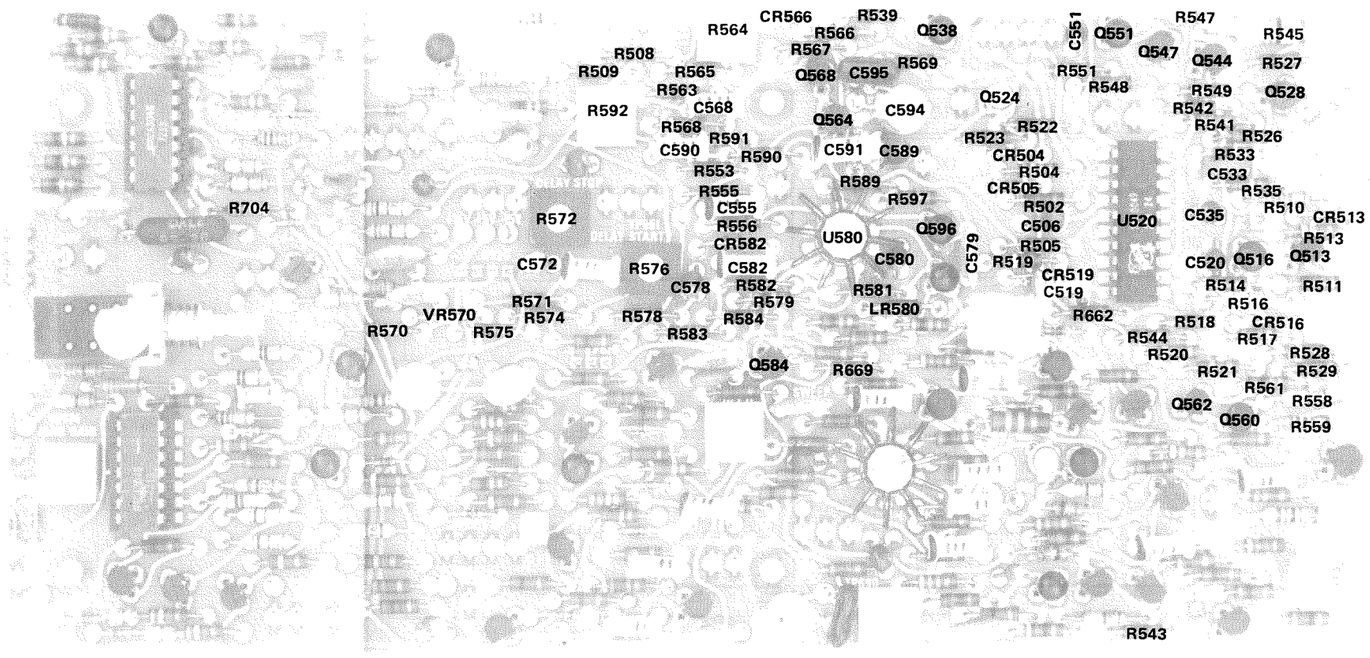
7B53A/7B53AN



NOTE:
See Fig. 6-3 for location of components not identified here.

Fig. 6-8B. P/O A6. Partial Sweep circuit board, below SN B090000.

C527 added to back SN B030000

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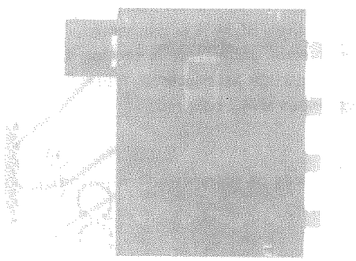

CR31
on rear
of board.

Fig. 6-7. A5. Mode Switch circuit board. Ⓑ

VOLTAGES AND WAVEFORMS

The voltages and waveforms shown on this diagram were obtained by using the recommended test equipment and test set-ups listed below.

RECOMMENDED TEST EQUIPMENT

ITEM	SPECIFICATIONS	RECOMMENDED TYPE
Oscilloscope	Frequency response DC to 65 MHz Deflection factor 5 mV to 5 V/Div Input impedance 10 MΩ, 20 pF Sweep rate 500 ns	Tektronix 7603 or 7613 equipped with 7A15A Amplifier and 7B50 Time-Base Unit, or equivalent.
Probe	Fast rise 10X attenuation probe compatible with the vertical amplifier of the test oscilloscope.	Tektronix P6053A, or equivalent.
Voltmeter (Non-loading digital multimeter)	Input impedance 10 MΩ Range 0 – 500 V	Tektronix 7D13 Digital Multimeter (test oscilloscope must have readout system) or Fairchild Model 7050, or equivalent.
Extender	Required for extending the 7B53AN from the mainframe when making waveform and voltage measurements.	Tektronix extender plug-in. Tektronix Part Number 067-0589-00 or Tektronix flexible extender, Tektronix Part Number 067-0616-00, or equivalent.

Voltage Conditions

The 7B53AN Unit under test must be connected to a mainframe separate from the test oscilloscope. No signal is applied for voltage measurements. Voltmeter common is connected to chassis ground.

7B53AN Control Settings

MAIN TRIGGERING	
MODE	AUTO
COUPLING	AC
SOURCE	INT
SLOPE	(+)
LEVEL	Control center
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/Division	0.5 ms (press in for DLY'D display mode)
VARIABLE	CAL (pull out for MIXED display mode)
DELAY TIME MULT	5.00
MAG	X1
POSITION	Center display horizontally
DLY'D TRIG	
LEVEL	Control center
SLOPE	(+)
COUPLING	AC
SOURCE	INT

Waveform Conditions

Front panel controls are set the same as for voltage measurements. The test oscilloscope 0.4 Volt calibration signal is applied to the vertical amplifier of the mainframe to which the 7B53AN is connected. The vertical amplifier of the system under test is set for 100 mV/Division. The test oscilloscope is triggered from the +GATE OUT (MAIN) of the mainframe under test; vertical input is AC coupled.

Tolerances of voltages and waveforms shown are ±20%.

P/O INTERFACE BOARD

DELAY MODE CONTROL IN B1

SINGLE SWP LOGIC A15

S30 MODE

AUTO

NORM

SINGLE SWP

RESET

READY

A5

P230

P30

MODE SWITCH BOARD

D530

CR31

CR220

R205 47

SS READY INDICATOR A10

SINGLE SWP RESET B15

R502 5.1k

R508 100

R509 150

CR504

CR505

R504 39k

C506 15µF

R505 6.2k

R523 1k

Q524 +4.8

R522 1k

R520 4.7k +0.23

R521 240

R513 430

R517 820

CR513 +0.5

Q513 -0.2

Q516 +0.4

R511 510

R514 1.8k -0.3

CR516

R516 2.49k -15V

R510 17.8k -15V

C519 100 +0.04

CR519

R519 3.9k -0.58

Q538

R518 1k

R539 1k 0V

SWEEP LOCKOUT B8

CE -0.2

MF DELAY MODE

C520 1µF +5V

20

CK 0V 13

CC +0.25 19

CL 0V 12

CH

CJ 0V

18 LOCKOUT IN

16 HOLDOFF START

4 -TD AUTO +5V

1 +TD INPUT

3 +TD AUTO

9

5

R549 3.3k

R541 330

R558 4.99k -5.0

Q560

Q562 -5.0

R559 10k -5.6

R561 10k -15V

R543 62 -MAIN SWP GATE TO Q654 (5)

R544 240 +1.39

+MAIN SWP GATE TO R662 (5)

-0.02

Q544

R542 27

R545 976 -15V

Q547 -0.74

R548 150 -0.15

R553 1.5k -15V

R551 330 +9.1

C551 1µF

Q551 +3.9

MAIN SWEEP GATE FROM R386 (2)

P/O TRIGGER BRD

P/O INTERFACE BOARD

TRIG'D LIGHT 7 +4.8

SWEEP DISABLE 17 -0.06

HOLDOFF OUT +3.9 10

R526 1k

R527 1k +5V

+4.7

Q528

Q527 18

R528 390

R529 8.2k -15V

528 +1.06

HOLDOFF TO R673 (6)

SS MODE

RESET TIMING 14

RESET START 15

R522 1k +4.8 11

READY LIGHT

HOLDOFF TIMING 8 +0.46

R533 100k +15V

C533 300

DL

R105 10k +15V

VARIABLE HOLDOFF FROM R107 (6)

C101 2µF

C103 .05

S100A (MAIN) TIME/DIV (6)

P/O INTERFACE BOARD

U520

AUTO TIMING

R535 120k +5.1

C535 1µF

-TD INPUT 2

P520

+5V

2

1

TRIG'D

DS8

1 V 5 ms

B

MAIN SWEEP DISABLE TO R363 (2)

P/O TRIGGER BOARD

CP

B4 HOLDOFF

2 V 5 ms

AUX SWP GATE B5

P/O INTERFACE BOARD

DLY'D GATE ENABLE (+5V) FROM Q271 (6)

CG

551 +3.2

AUX SWP GATE TO R644 (6)

CR582

+0.51

C582 3.9

R582 7.5k

C555 10

R555 2k

+0.57

CR556

R556

500 mV 5 ms

DA

DELAY TIME MULT

P570

R9 50k

R578 10k

R574 6.2k

R575 100

R576 20k +15V -15V

DELAY START

DELAY STOP

R572 20k

C572 47µF

R579 300k +2.0

C578 1µF

C579 .01

VR570 6.2V

R571 10k

R570 1.21k +15V

LR580 0.9µH

160

C580 1µF

+15V

DELAY CONTROL

DLY'D GATE OUT

SWEEP OUT

DLY'D GATE IN

SWP TIMING

SWEEP OFFSET

SWEEP GATE IN -6.7

U580

R584 2k +2.3

DLY'D GATE TO R669 (6)

Q584 +1.55

R583 56k -15V

R581 7.5k +15V

580 +1.9

MAIN SWEEP TO R694 (5) & R704 (8)

2 V 5 ms

C595 95

C594 1.9-15.7

MAIN HF TIMING

C591 47

R591 43k -0.75

R592 100k

MAIN SWP OFFSET

R590 82

C590 100

C589 1µF

R589 620 -15V

Q596 0V +5V

+0.38

R597 15k -15V

DD

CT

RT -50V

(MAIN) TIME/DIV (6) S100A

P/O INTERFACE BOARD

CR566 -0.58

Q564 +4.8

R563 2k

R566 15k -15V

R564 500

R565 4.3k

MAIN SWP LENGTH

R567 2.7k +15V

+2.6

Q568

C568 100

-12.7

R568 470 -15V

R569 2k +1.9

NOTE: P/O INDICATES PART OF P/O SWEEP BOARD A6

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE.

MAIN SWEEP GENERATOR

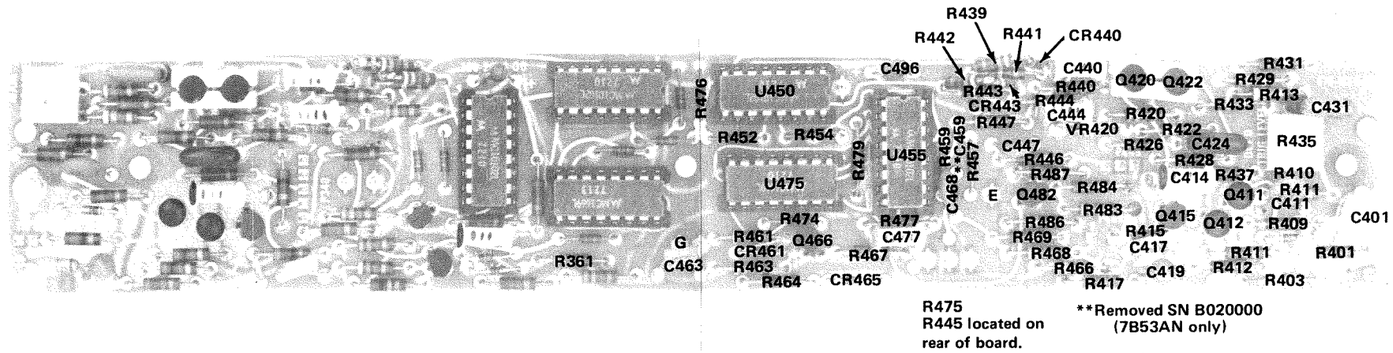

Fig. 6-10. P/O A4. Partial Trigger circuit board.

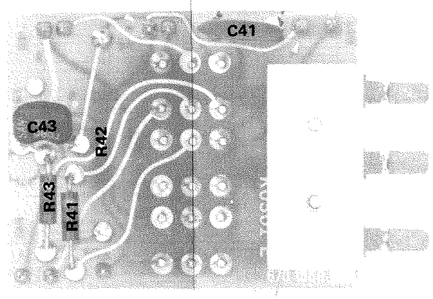

Fig. 6-9. A7. Delayed Trigger Switch circuit board.

VOLTAGES AND WAVEFORMS

The voltages and waveforms shown on this diagram were obtained by using the recommended test equipment and test set-ups listed below.

RECOMMENDED TEST EQUIPMENT

ITEM	SPECIFICATIONS	RECOMMENDED TYPE
Oscilloscope	Frequency response DC to 65 MHz Deflection factor 5 mV to 5 V/Div Input impedance 10 MΩ, 20 pF Sweep rate 500 ns	Tektronix 7603 or 7613 equipped with 7A15A Amplifier and 7B50 Time-Base Unit, or equivalent.
Probe	Fast rise 10X attenuation probe compatible with the vertical amplifier of the test oscilloscope.	Tektronix P6053A, or equivalent.
Voltmeter (Non-loading digital multimeter)	Input impedance 10 MΩ Range 0 – 500 V	Tektronix 7D13 Digital Multimeter (test oscilloscope must have readout system) or Fairchild Model 7050, or equivalent.
Extender	Required for extending the 7B53AN from the mainframe when making waveform and voltage measurements.	Tektronix extender plug-in. Tektronix Part Number 067-0589-00 or Tektronix flexible extender, Tektronix Part Number 067-0616-00, or equivalent.

Voltage Conditions

The 7B53AN Unit under test must be connected to a mainframe separate from the test oscilloscope. No signal is applied for voltage measurements. Voltmeter common is connected to chassis ground.

7B53AN Control Settings

MAIN TRIGGERING	
MODE	AUTO
COUPLING	AC
SOURCE	INT
SLOPE	(+)
LEVEL	Control center
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/Division	0.5 ms (press in for DLY'D display mode)
VARIABLE	CAL (pull out for MIXED display mode)
DELAY TIME MULT	5.00
MAG	X1
POSITION	Center display horizontally
DLY'D TRIG	
LEVEL	Control center
SLOPE	(+)
COUPLING	AC
SOURCE	INT

Waveform Conditions

Front panel controls are set the same as for voltage measurements. The test oscilloscope 0.4 Volt calibration signal is applied to the vertical amplifier of the mainframe to which the 7B53AN is connected. The vertical amplifier of the system under test is set for 100 mV/Division. The test oscilloscope is triggered from the + GATE OUT (MAIN) of the mainframe under test; vertical input is AC coupled.

Tolerances of voltages and waveforms shown are ±20%.

P/O SWEEP BOARD

DLY'D SWEEP HOLDOFF FROM R673 ◇5

P/O INTERFACE BOARD

TRIG INHIBIT FROM T1 ◇2 ◇6

R461 470

CR461

R463 470

C463 270

CR465

R464 20K

-15V

Q466

R466 330

R467 510

U455C

+5V

+3.6

+1.3

+3.7

500 mV 2 ms

P469

(S5) CLOSED ONLY IN RUN AFTER DLY TIME (R5 FULLY CW)

R469 510

C468 .001

R468 330

U455A

+4.6

+3.2

R484 510

R483 330

+3.0

0V

R486 360

Q482

R487 62

U475B

R475 1K

P/O INTERFACE BOARD

E

E DLY'D SWEEP GATE TO R601 ◇5

P/O SWEEP BOARD

U455D

+4.1

R474 270

R459 270

C459

U475A

U455B

+4.2

R479 750

C477 100

+4.0

R477 270

R476 270

R457 750

U450D

U450B

U450A

U450C

R439 430

R441 2.4K

CR440

R440 200

C440 27

+2.0

+2.9

R452 270

R442 430

R443 2.4K

CR443

R444 200

C444 27

+4.1

+3.1

R454 270

R447 330

R446 510

C447 .001

R445 1K

+15V

VR420 10V

R420 330

R422 330

500 mV 500 µs

S42 SOURCE

S41 COUPLING

DLY'D TRIG IN (DLY'D GATE OUT)

P40

EXT

INT

C43 97

R42 499K

R43 100

DLY'D GATE FROM R615 ◇5

P43

P41

INTERNAL TRIGGER FROM P70-2 ◇1

C41 .01

(OUT) EXT

INT (IN)

R41 100

(OUT) DC

AC (IN)

P44

P404

P/O DLY'D TRIG SW BOARD A7

R407

CR407

CR409

R401 51

R403 499K

R410 910

C411 .001

Q411

+11.2

+0.83

R411 100

Q415

+0.1

-4.2

R417 750

C417 .01

Q412

-10.9

-11.6

DLY'D EXT COMP

C401 2-8

R412 100

R413 430

C414 18

R415 1K

TP415

+0.84

-0.07

Q420

Q422

+1.87

+0.44

+4.4

C424 77

L431 60nh

C431 2µF

R426 15

R428 15

R429 1.6K

R433 2.4K

R437 750

R431 510

DLY'D TRIG LEVEL CENTER

R435 10K CW

S40 SLOPE

(GANGED WITH S5)

P445

P45

P49

R5 5K CW LEVEL

P/O DLY'D TRIG SW BOARD A7

P/O TRIGGER BOARD A4

CKT NO.	TYPE	Vcc	GND
U450	MC10102	1,16	8
U455	MC10102	1,16	8
U475	MC1669L	1,16	8

NOTE:
P/O INDICATES PART OF.

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE.

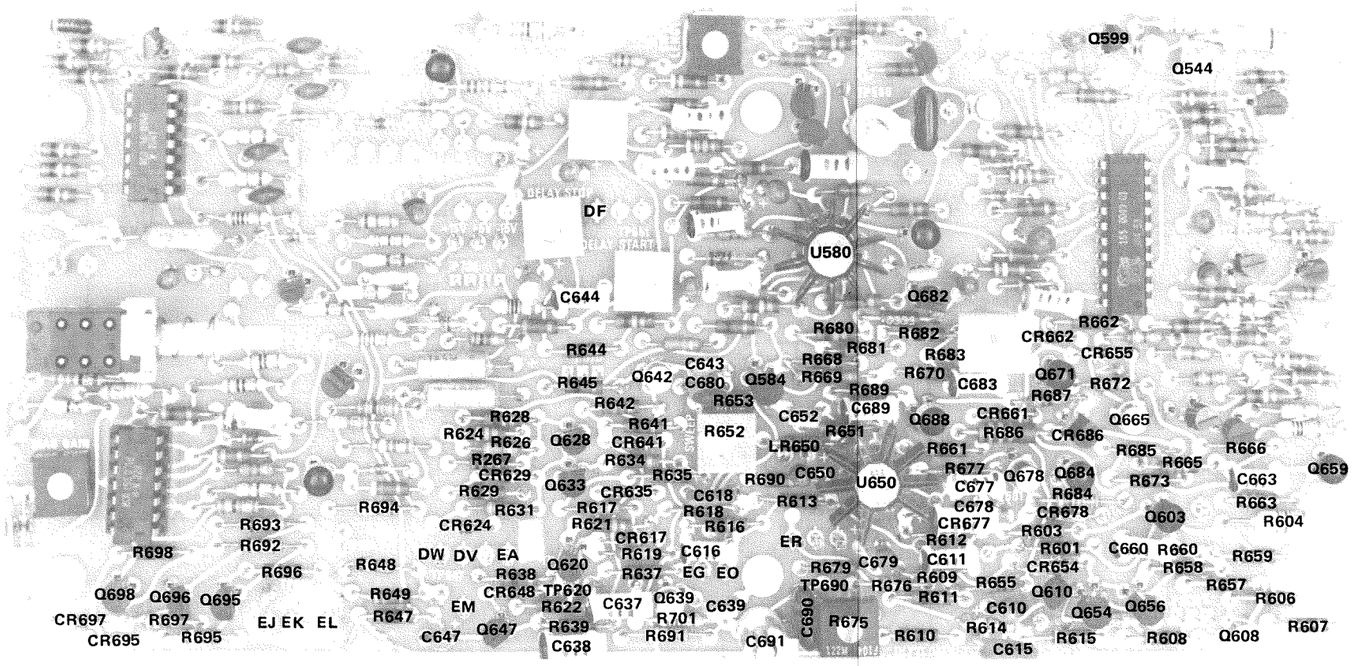

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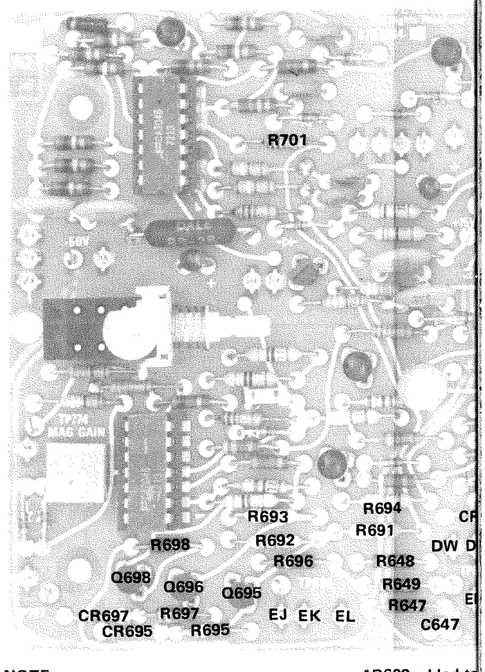
Fig. 6-11A. P/O A6. Partial Sweep circuit board, SNB090000 and up.

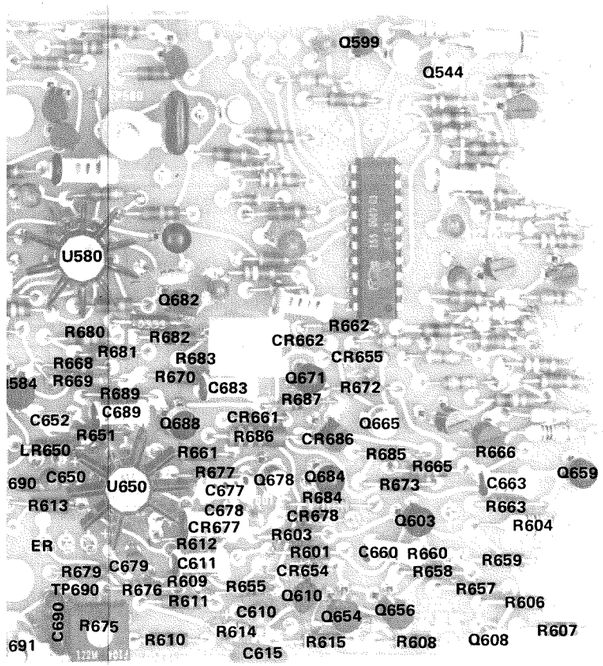


NOTE:

See Fig. 6-3 for location of components not identified here.

*See Part List for serial number ranges.

*R609 added to



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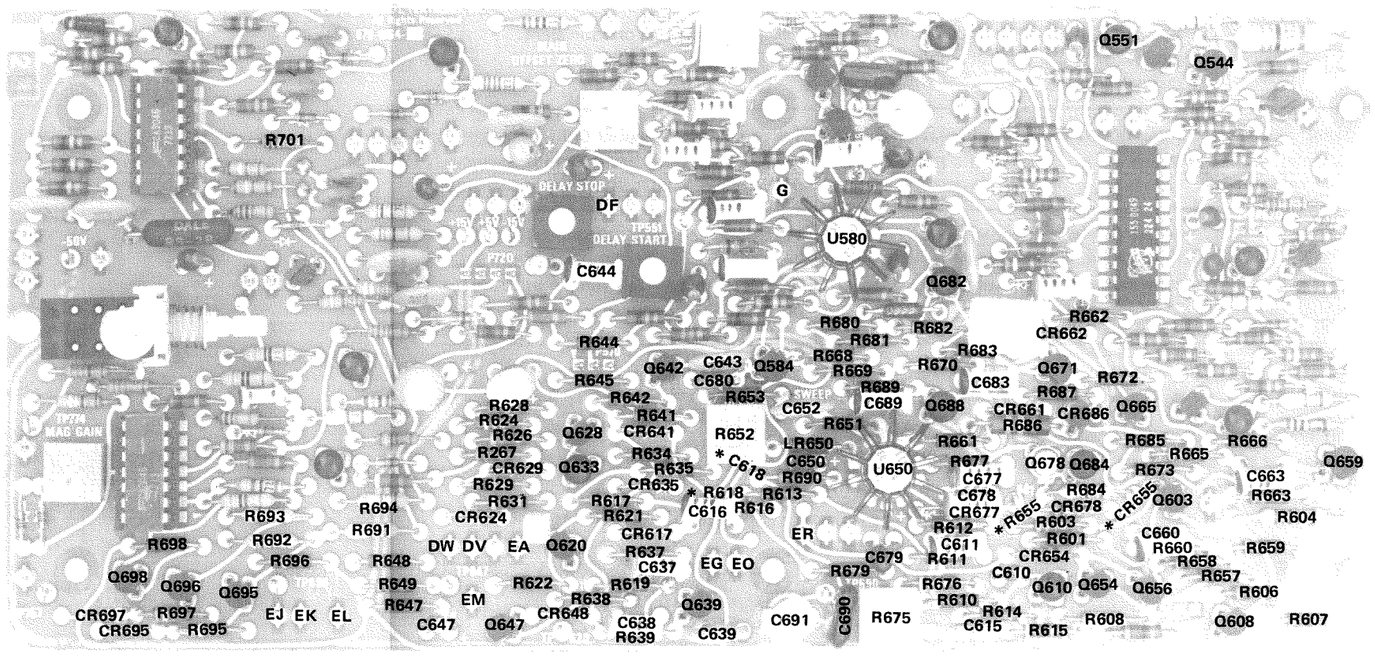
ard, SNB090000 and up.

Ⓐ



NOTE:

See Fig. 6-3 for location of components not identified here.

*See Part List for serial number ranges.

*R609 added to back of board

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Fig. 6-11B. P/O A6. Partial Sweep circuit board, below SNB090000.

Ⓒ

VOLTAGES AND WAVEFORMS

The voltages and waveforms shown on this diagram were obtained by using the recommended test equipment and test set-ups listed below.

RECOMMENDED TEST EQUIPMENT

ITEM	SPECIFICATIONS	RECOMMENDED TYPE
Oscilloscope	Frequency response DC to 65 MHz Deflection factor 5 mV to 5 V/Div Input impedance 10 MΩ, 20 pF Sweep rate 500 ns	Tektronix 7603 or 7613 equipped with 7A15A Amplifier and 7B50 Time-Base Unit, or equivalent.
Probe	Fast rise 10X attenuation probe compatible with the vertical amplifier of the test oscilloscope.	Tektronix P6053A, or equivalent.
Voltmeter (Non-loading digital multimeter)	Input impedance 10 MΩ Range 0 – 500 V	Tektronix 7D13 Digital Multimeter (test oscilloscope must have readout system) or Fairchild Model 7050, or equivalent.
Extender	Required for extending the 7B53AN from the mainframe when making waveform and voltage measurements.	Tektronix extender plug-in. Tektronix Part Number 067-0589-00 or Tektronix flexible extender, Tektronix Part Number 067-0616-00, or equivalent.

Voltage Conditions

The 7B53AN Unit under test must be connected to a mainframe separate from the test oscilloscope. No signal is applied for voltage measurements. Voltmeter common is connected to chassis ground.

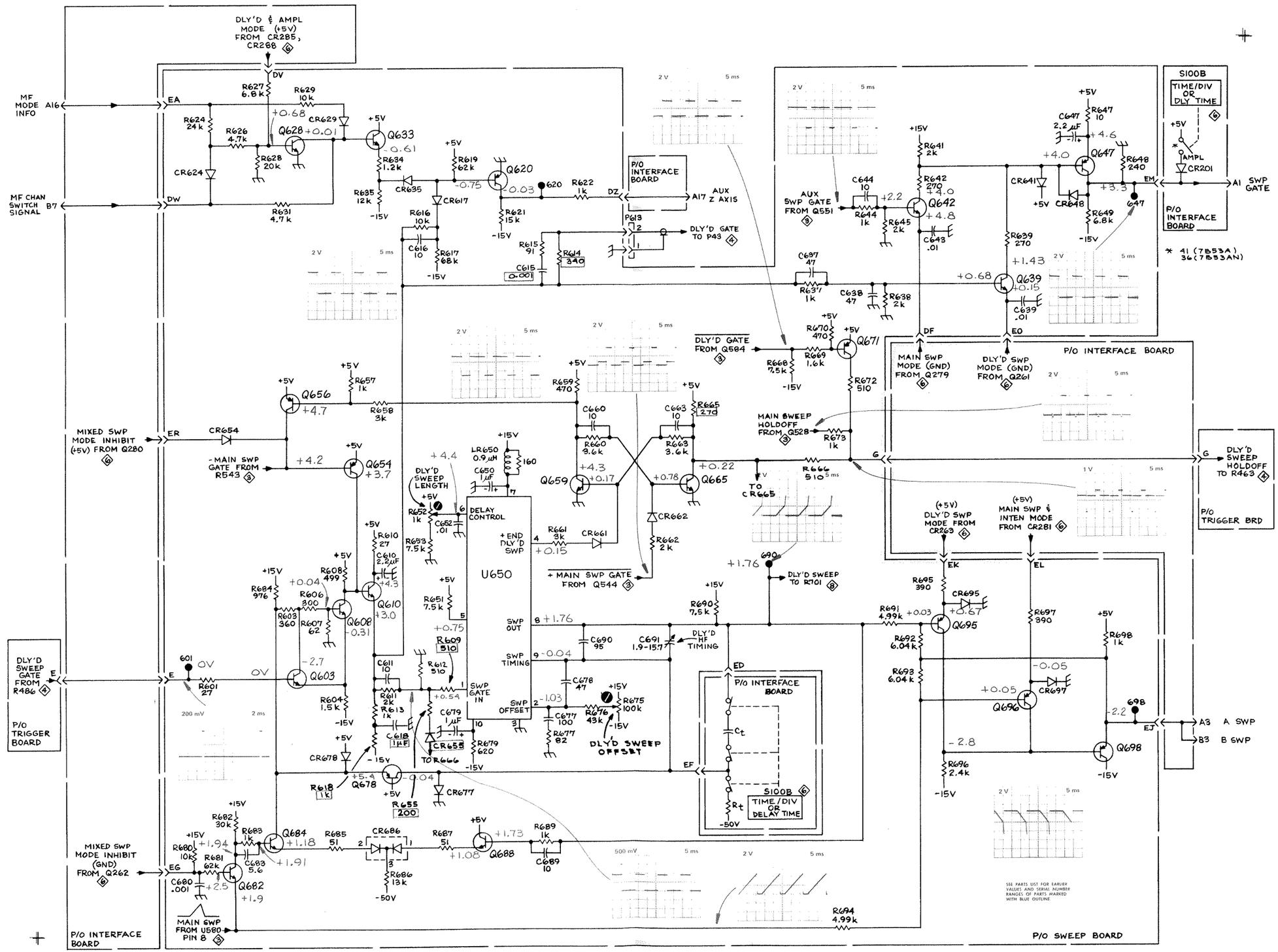
7B53AN Control Settings

MAIN TRIGGERING	
MODE	AUTO
COUPLING	AC
SOURCE	INT
SLOPE	(+)
LEVEL	Control center
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/Division	0.5 ms (press in for DLY'D display mode)
VARIABLE	CAL (pull out for MIXED display mode)
DELAY TIME MULT	5.00
MAG	X1
POSITION	Center display horizontally
DLY'D TRIG	
LEVEL	Control center
SLOPE	(+)
COUPLING	AC
SOURCE	INT

Waveform Conditions

Front panel controls are set the same as for voltage measurements. The test oscilloscope 0.4 Volt calibration signal is applied to the vertical amplifier of the mainframe to which the 7B53AN is connected. The vertical amplifier of the system under test is set for 100 mV/Division. The test oscilloscope is triggered from the + GATE OUT (MAIN) of the mainframe under test; vertical input is AC coupled.

Tolerances of voltages and waveforms shown are ±20%.



NOTE: P/O INDICATES PART OF

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE

DELAYED SWEEP GENERATOR 5

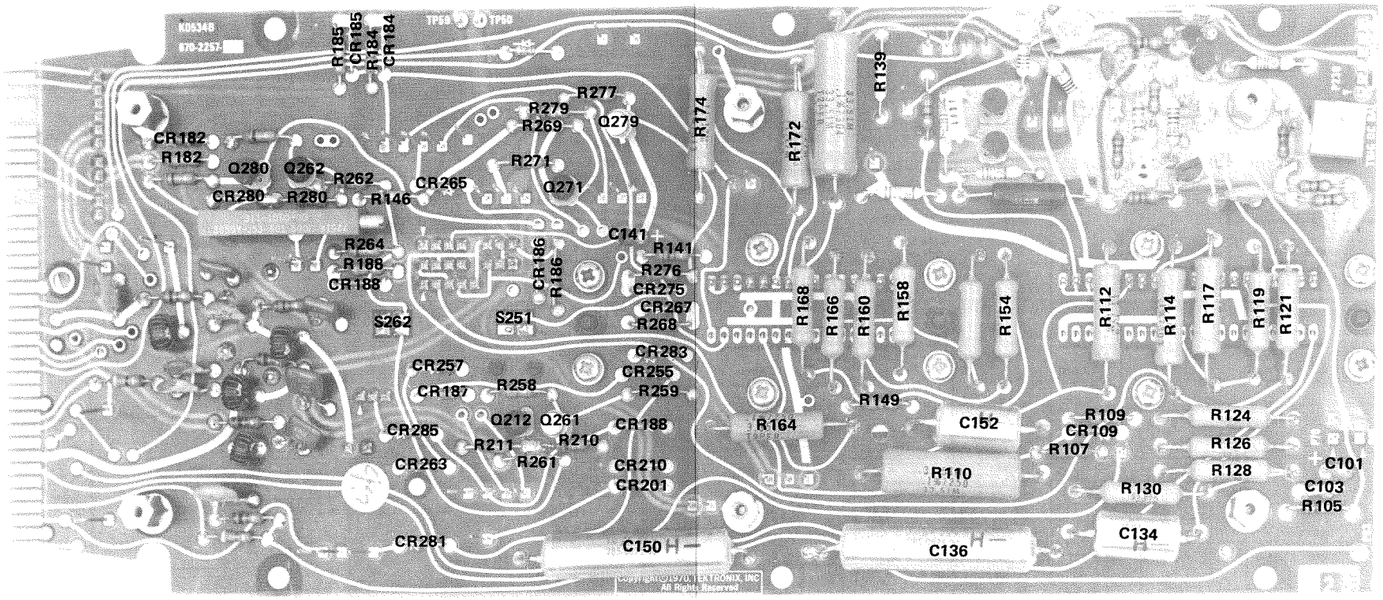


Fig. 6-12. P/O A1. Partial Interface circuit board (7B53A only).

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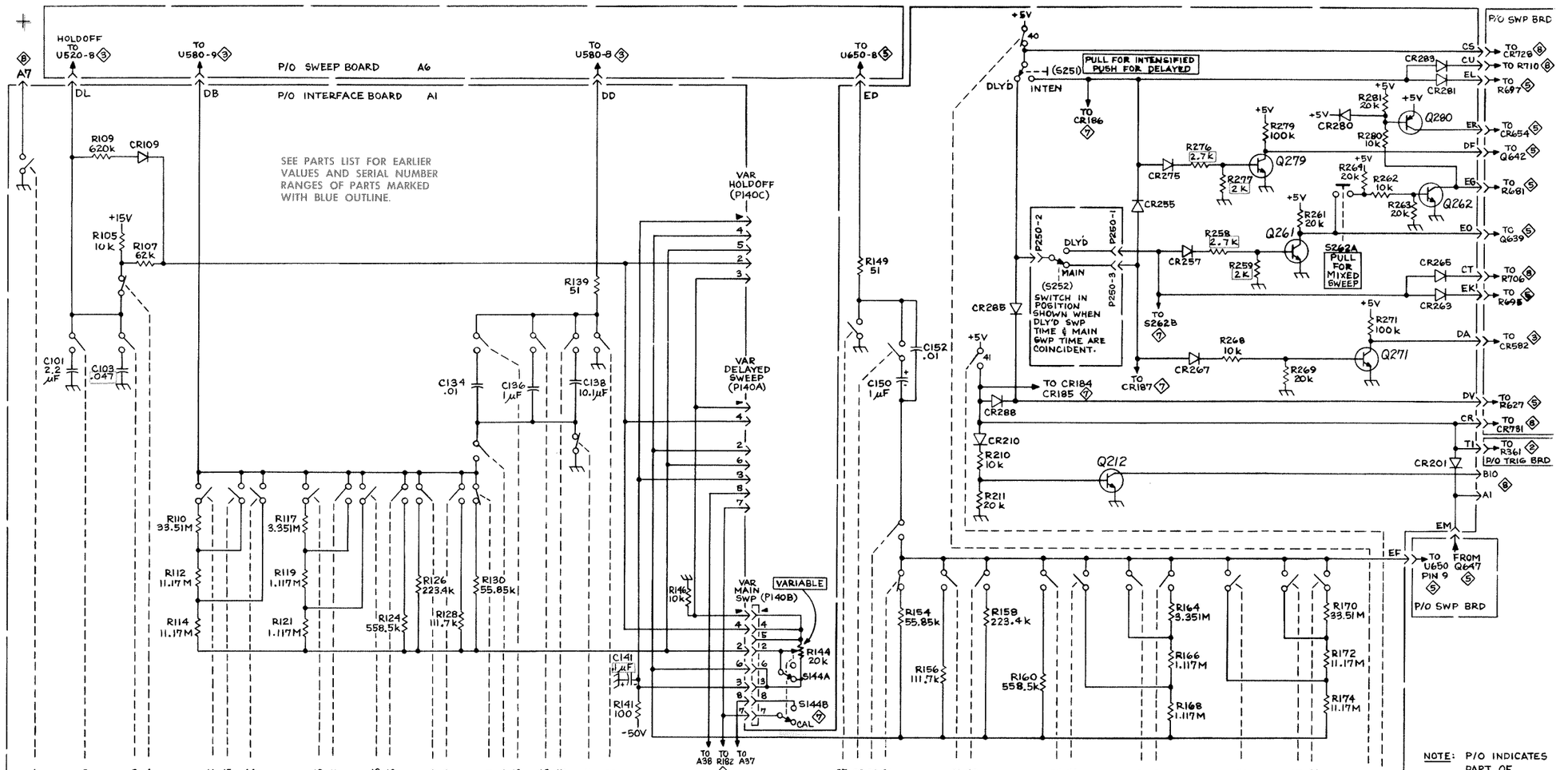


NOTE: P/O INDICATES PART OF.

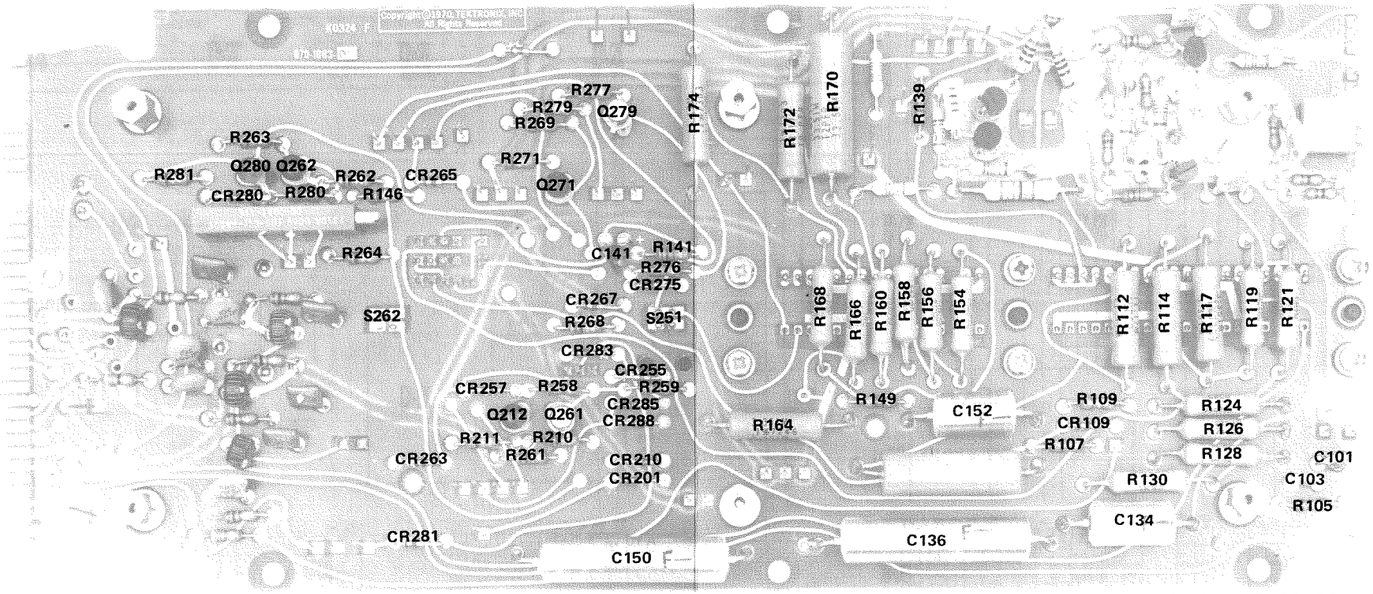


Fig. 6-13. P/O A1. Partial Interface circuit board (7B53AN only).

HOLDOFF TO U620-8 ③ | TO U580-9 ③ | TO U580-8 ③ | TO U650-8 ⑤

P/O SWEEP BOARD A6

P/O INTERFACE BOARD A1

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE.

A7 ⑧ — DL — DB — DD — ED

R109 620k — CR109 — +15V — R105 10k — R107 62k

C101 2.2 µF — C103 .047

C134 .01 — C136 1µF — C138 10.1µF

R139 51

VAR HOLDOFF (P140C)

VAR DELAYED SWEEP (P140A)

R110 33.51M — R112 11.17M — R114 11.17M — R117 3.351M — R119 1.117M — R121 1.117M — R124 558.5k — R126 223.4k — R128 111.7k — R130 55.85k

R146 10k — VAR MAIN SWP (P140B) — VARIABLE — R144 20k — S144A

C141 .1µF — R141 100 — -50V

R149 51 — C152 .01 — C150 1µF

+5V 35 — DLYD — (S251) — INTEN — PULL FOR INTENSIFIED PUSH FOR DELAYED

P250-2 — P250-1 — P250-3 — DLYD — MAIN

(S252) SWITCH IN POSITION SHOWN WHEN DLY'D SWP TIME & MAIN SWP TIME ARE COINCIDENT.

+5V 36 — CR288 — CR285 — CR210 — R210 10k — R211 20k — Q212

S262A PULL FOR MIXED SWEEP — TO S262B ⑦

P/O SWP BRD

CR289 — CS — TO CR728 ⑧

CR281 — CU — TO R710 ⑧

R281 20k — EL — TO R697 ⑤

CR280 — Q280 — ER — TO CR654 ⑤

R279 100k — R280 10k — DF — TO Q642 ⑤

R276 2.7k — CR275 — Q279 — R277 2K

R261 20k — R262 10k — EG — TO R681 ⑤

CR255 — Q262 — R263 20k

R261 20k — EO — TO Q639 ⑤

R258 2.7k — CR257 — Q261 — R259 2K

CR265 — CT — TO R706 ⑧

CR263 — EK — TO R695 ⑥

R271 100k — DA — TO CR582 ③

R268 10k — CR267 — Q271 — R269 20k

DV — TO R627 ⑤

CR — TO CR751 ⑧

TI — TO R361 ② P/O TRIG BRD

CR201 — B10 ⑧ — A1

EM — FROM Q647 ⑤ P/O SWP BRD

EF — TO U650 PIN 9 ⑤ ⑥

R154 55.85k — R156 111.7k — R158 223.4k — R160 558.5k — R164 3.351M — R166 1.117M — R168 1.117M — R170 33.51M — R172 11.17M — R174 11.17M

NOTE: P/O INDICATES PART OF.

1 2 3 4 16 15 14 13 11 12 10 9 8 7 6 19 18 17 5 20 — CW — CCW

.05 .1 .2 .5 1 2 5 10 20 50 .1 .2 .5 1 2 5 10 20 50 .1 .2 .5 1 2 5

µs — ms — s — AMPL

21 22 24 25 26 27 28 34 33 32 31 30 29 35 36

.05 .1 .2 .5 1 2 5 10 20 50 .1 .2 .5 1 2 5 10 20 50 .1 .2 .5 1 2 5

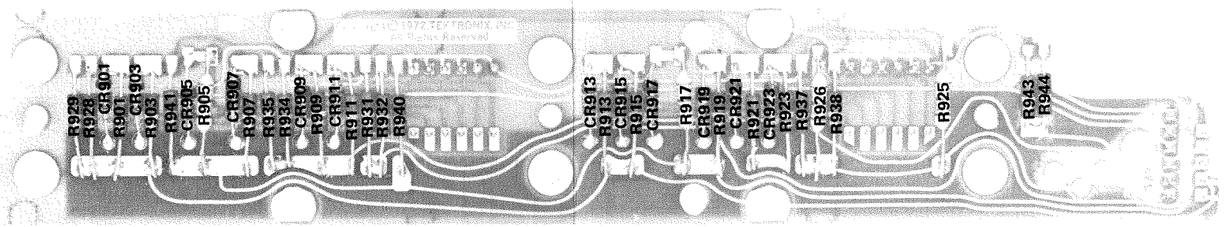
FRONT ← (MAIN TIME/DIV) S100A

SHOWN IN .05 µs POSITION TIME/DIV OR DLY TIME

(DELAYED TIME) S100B → REAR

7B53AN

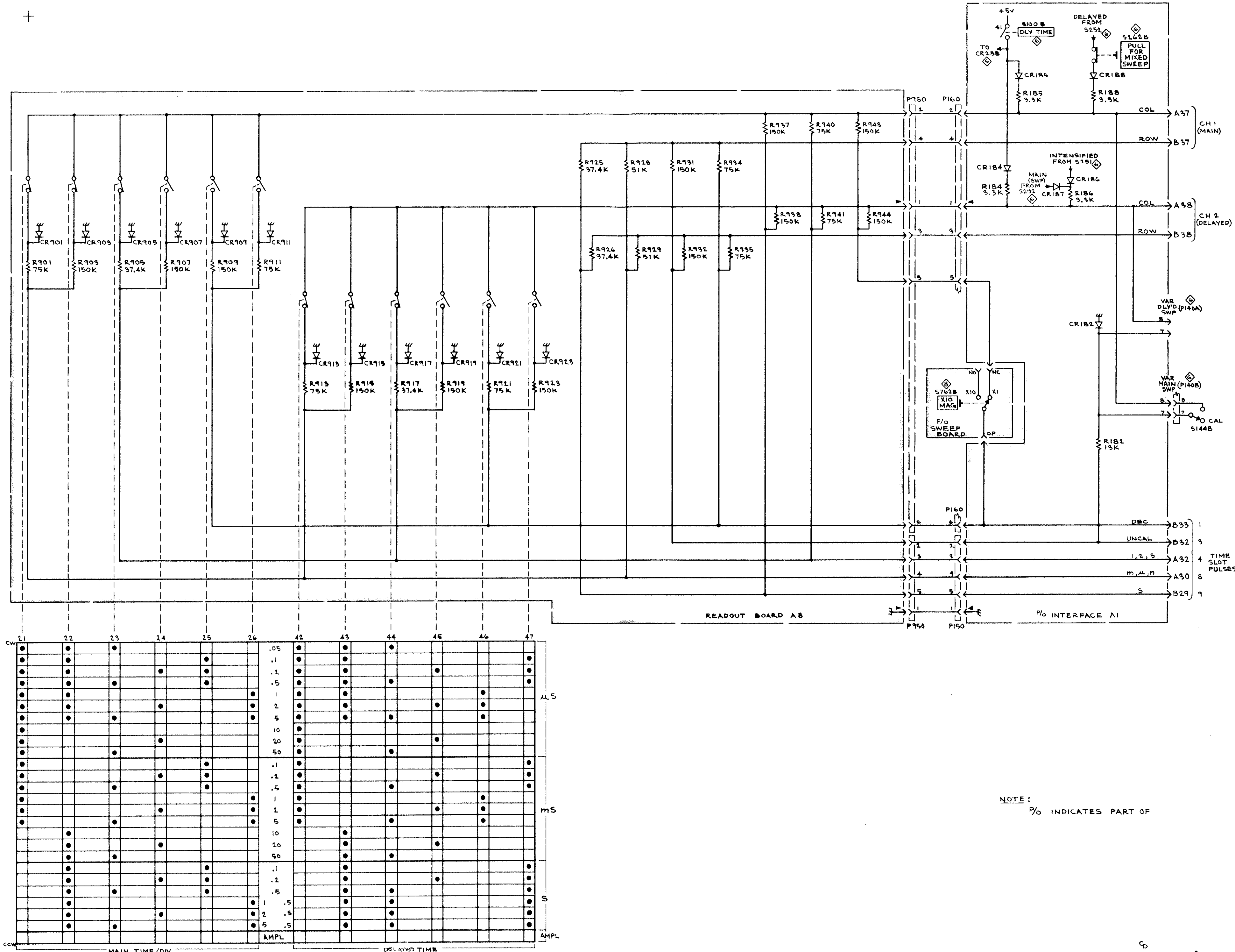
TIMING SWITCHES



NOTE:

See Fig. 6-12 for location of components not identified here.

Fig. 6-14. Readout circuit board (7B53A only). Ⓐ



NOTE:
P/o INDICATES PART OF

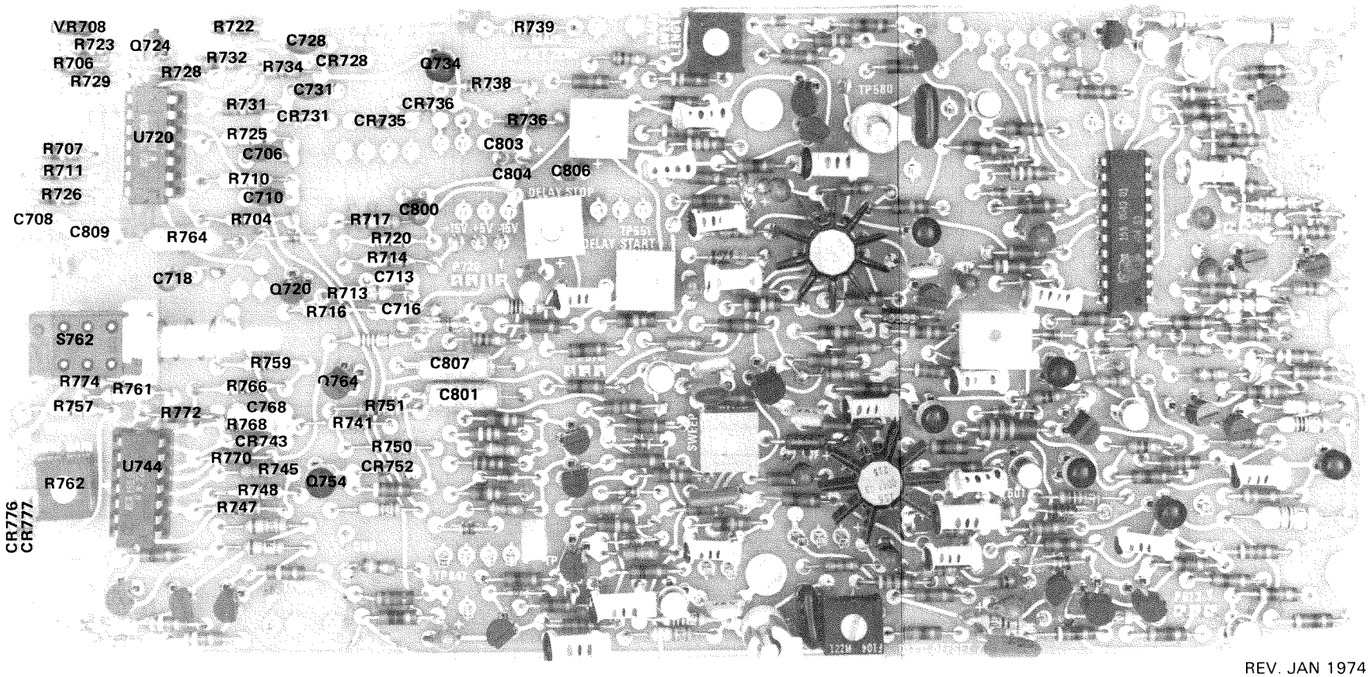


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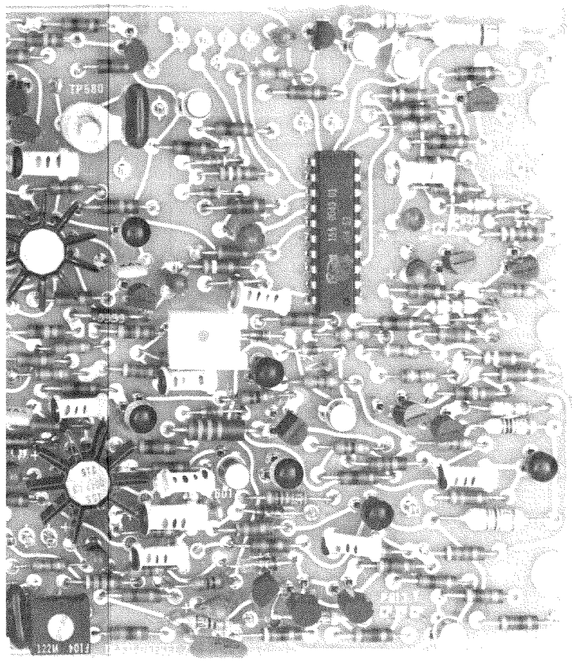
Fig. 6-15A. P/O A6. Partial Sweep circuit board, SNB090000 and up.

Ⓐ

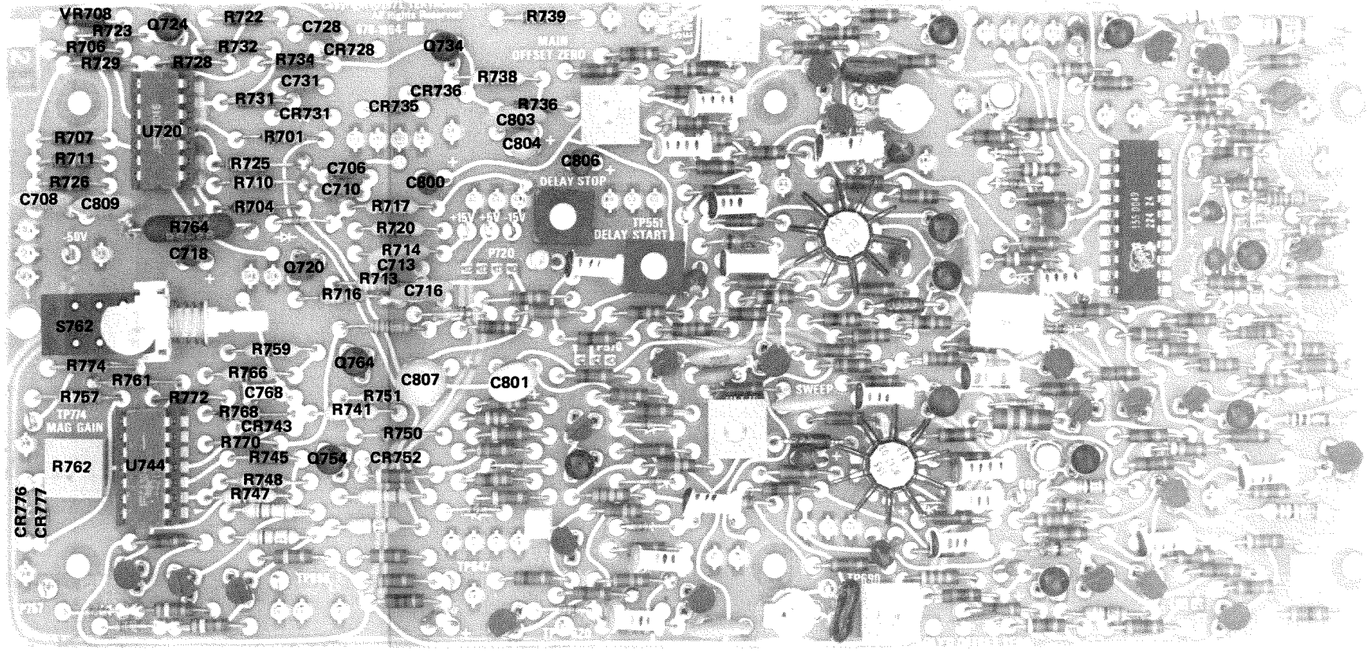
Fig. 6-15B



REV. JAN 1974

IB090000 and up.

Ⓐ



REV. JAN 1974

Fig. 6-15B. P/O A6. Partial Sweep circuit board, below SNB090000.

Ⓑ

VOLTAGES AND WAVEFORMS

The voltages and waveforms shown on this diagram were obtained by using the recommended test equipment and test set-ups listed below.

RECOMMENDED TEST EQUIPMENT

ITEM	SPECIFICATIONS	RECOMMENDED TYPE
Oscilloscope	Frequency response DC to 65 MHz Deflection factor 5 mV to 5 V/Div Input impedance 10 MΩ, 20 pF Sweep rate 500 ns	Tektronix 7603 or 7613 equipped with 7A15A Amplifier and 7B50 Time-Base Unit, or equivalent.
Probe	Fast rise 10X attenuation probe compatible with the vertical amplifier of the test oscilloscope.	Tektronix P6053A, or equivalent.
Voltmeter (Non-loading digital multimeter)	Input impedance 10 MΩ Range 0 – 500 V	Tektronix 7D13 Digital Multimeter (test oscilloscope must have readout system) or Fairchild Model 7050, or equivalent.
Extender	Required for extending the 7B53AN from the mainframe when making waveform and voltage measurements.	Tektronix extender plug-in. Tektronix Part Number 067-0589-00 or Tektronix flexible extender, Tektronix Part Number 067-0616-00, or equivalent.

Voltage Conditions

The 7B53AN Unit under test must be connected to a mainframe separate from the test oscilloscope. No signal is applied for voltage measurements. Voltmeter common is connected to chassis ground.

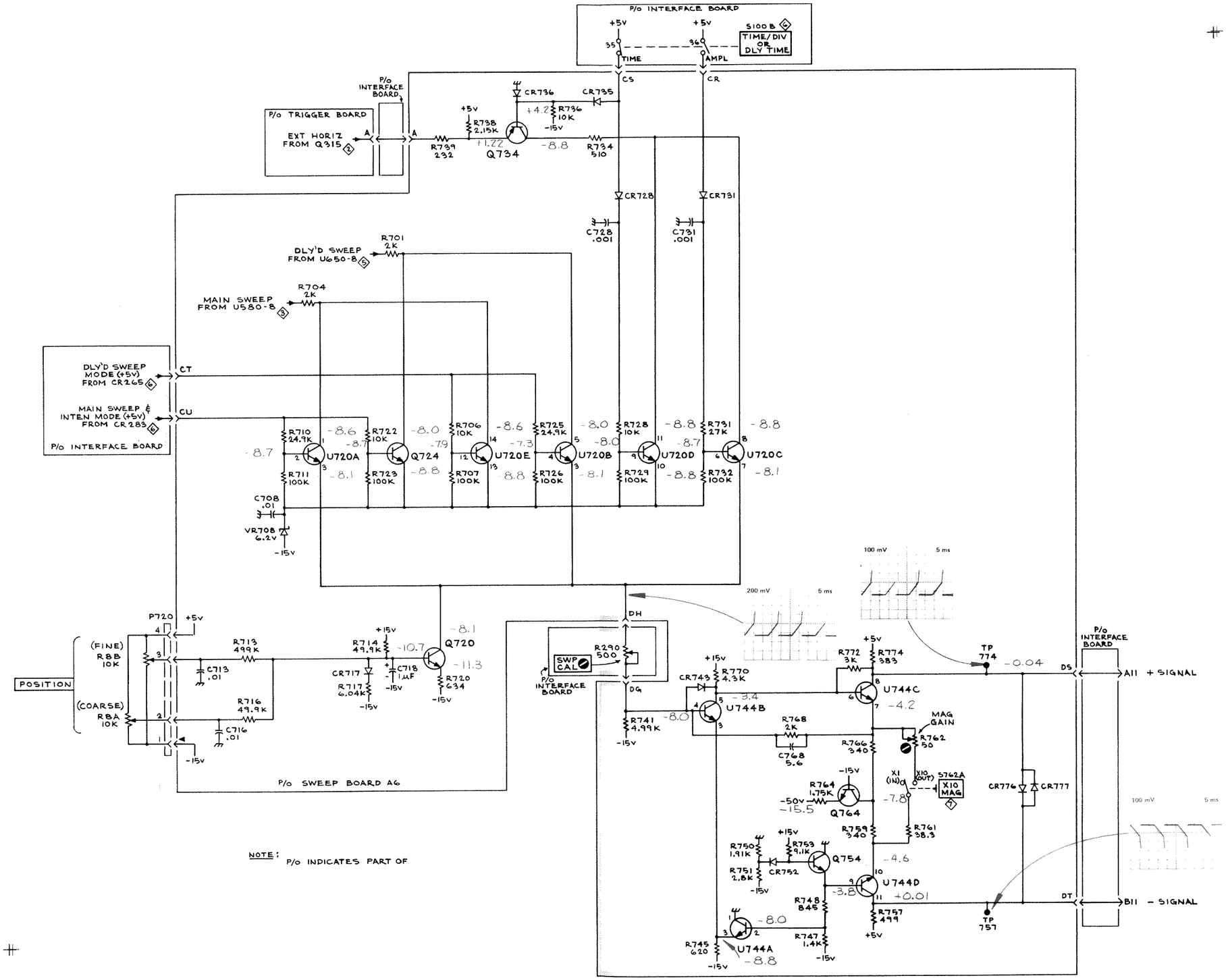
7B53AN Control Settings

MAIN TRIGGERING	
MODE	AUTO
COUPLING	AC
SOURCE	INT
SLOPE	(+)
LEVEL	Control center
TIME/DIV OR DLY TIME	1 ms
DLY'D Time/Division	0.5 ms (press in for DLY'D display mode)
VARIABLE	CAL (pull out for MIXED display mode)
DELAY TIME MULT	5.00
MAG	X1
POSITION	Center display horizontally
DLY'D TRIG	
LEVEL	Control center
SLOPE	(+)
COUPLING	AC
SOURCE	INT

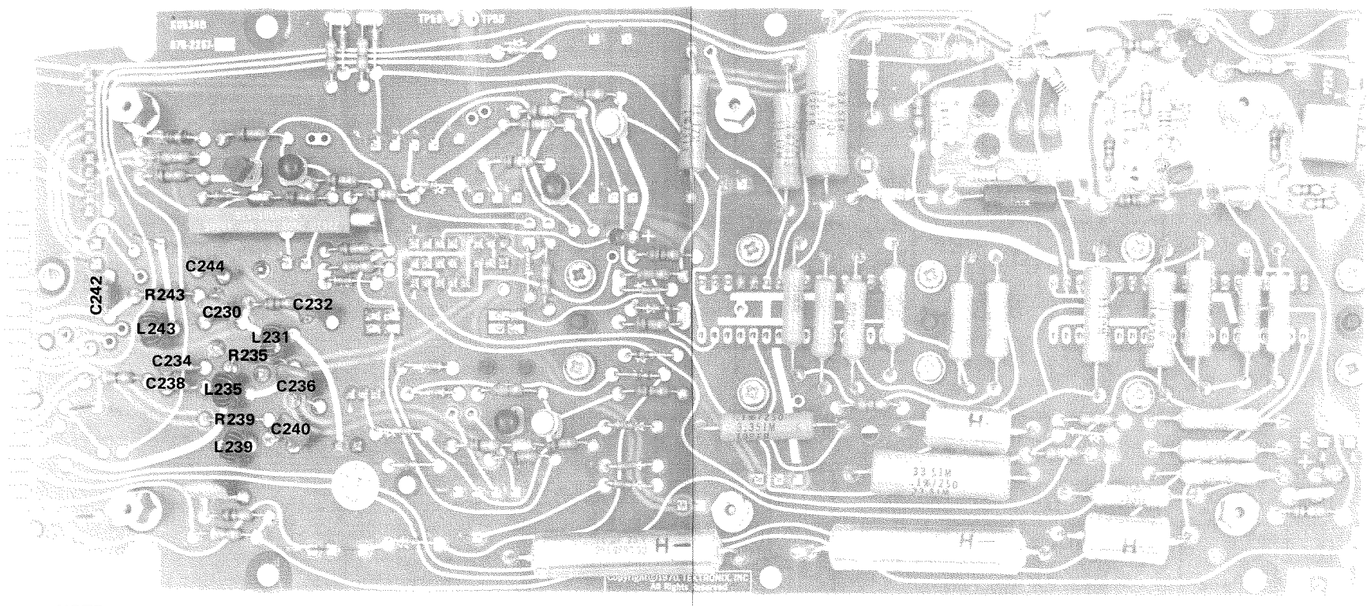
Waveform Conditions

Front panel controls are set the same as for voltage measurements. The test oscilloscope 0.4 Volt calibration signal is applied to the vertical amplifier of the mainframe to which the 7B53AN is connected. The vertical amplifier of the system under test is set for 100 mV/Division. The test oscilloscope is triggered from the + GATE OUT (MAIN) of the mainframe under test; vertical input is AC coupled.

Tolerances of voltages and waveforms shown are ±20%.



NOTE: P/O INDICATES PART OF

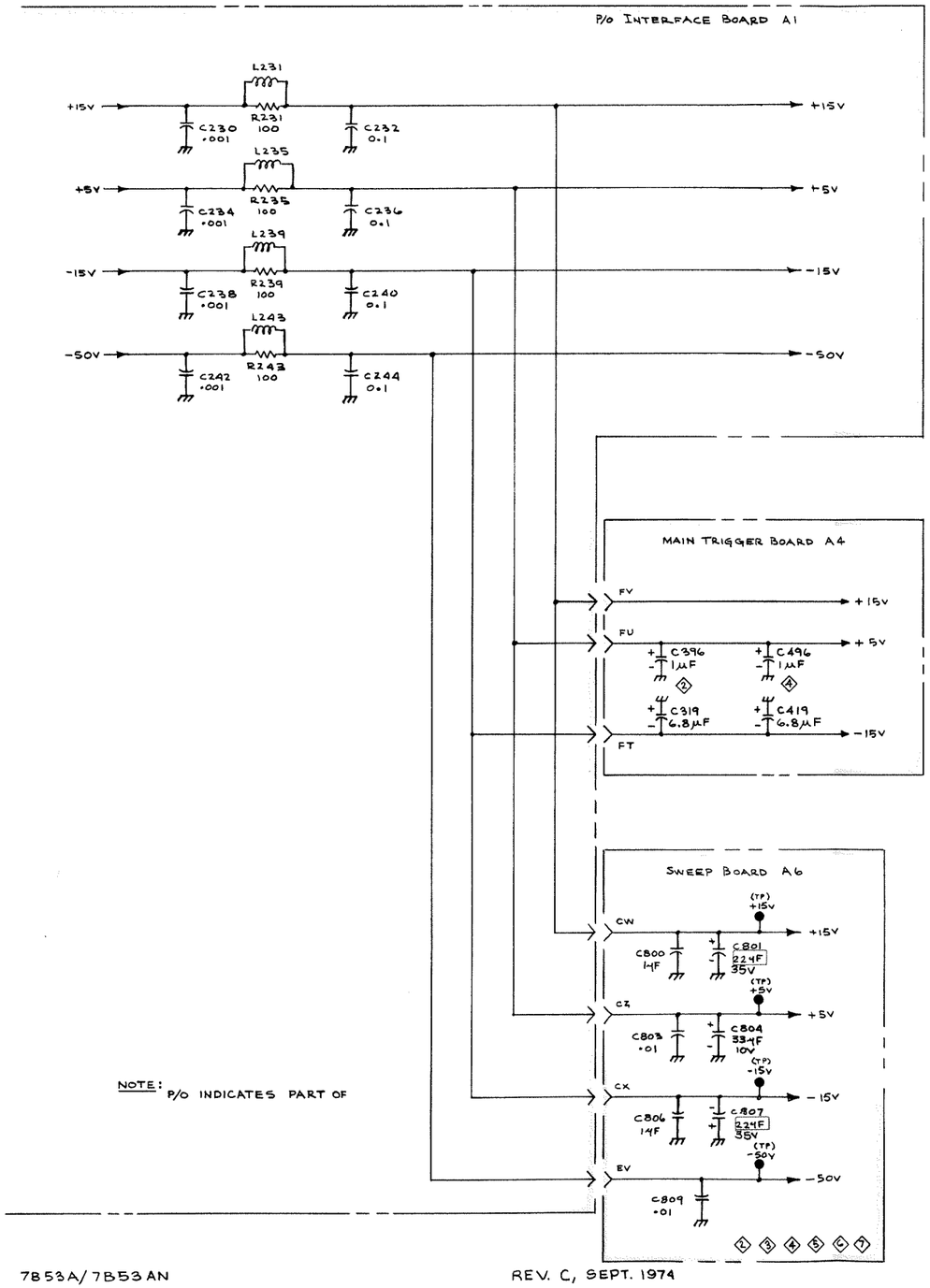


NOTE

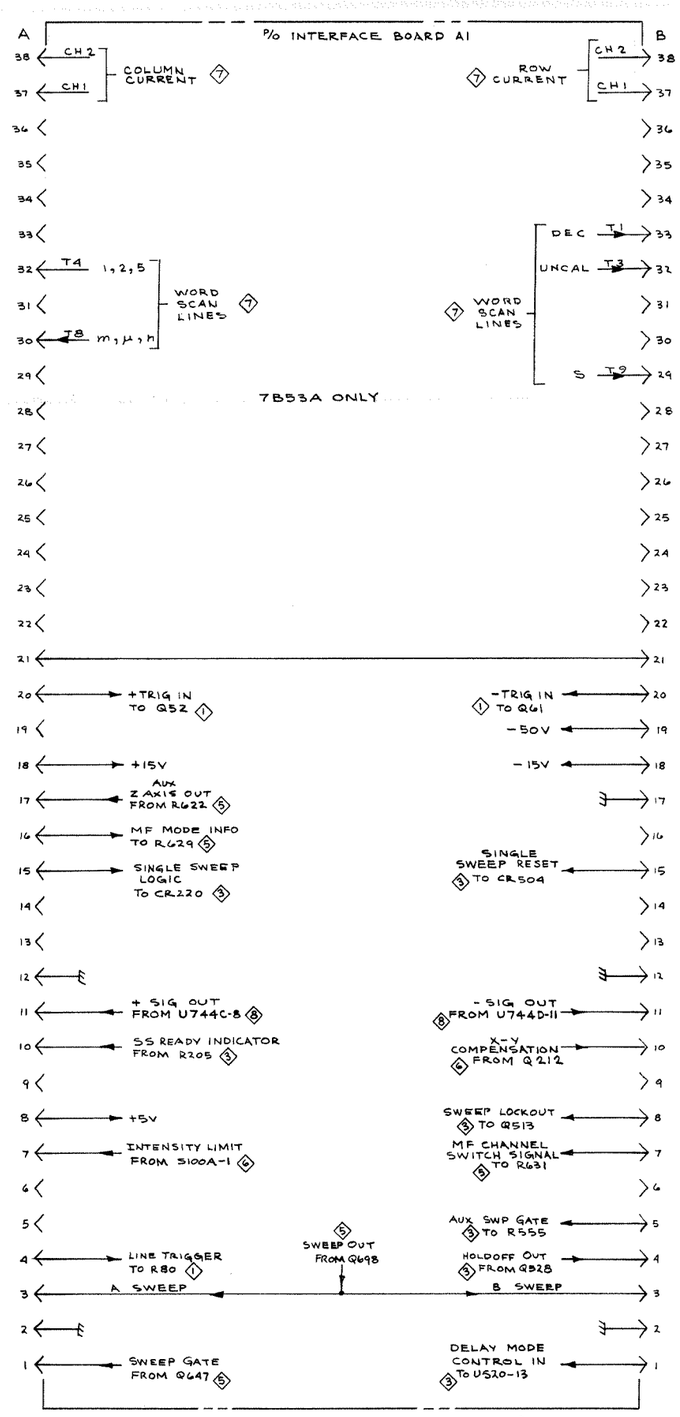
See Fig. 6-15 for components not identified here.

REV. JAN 1974

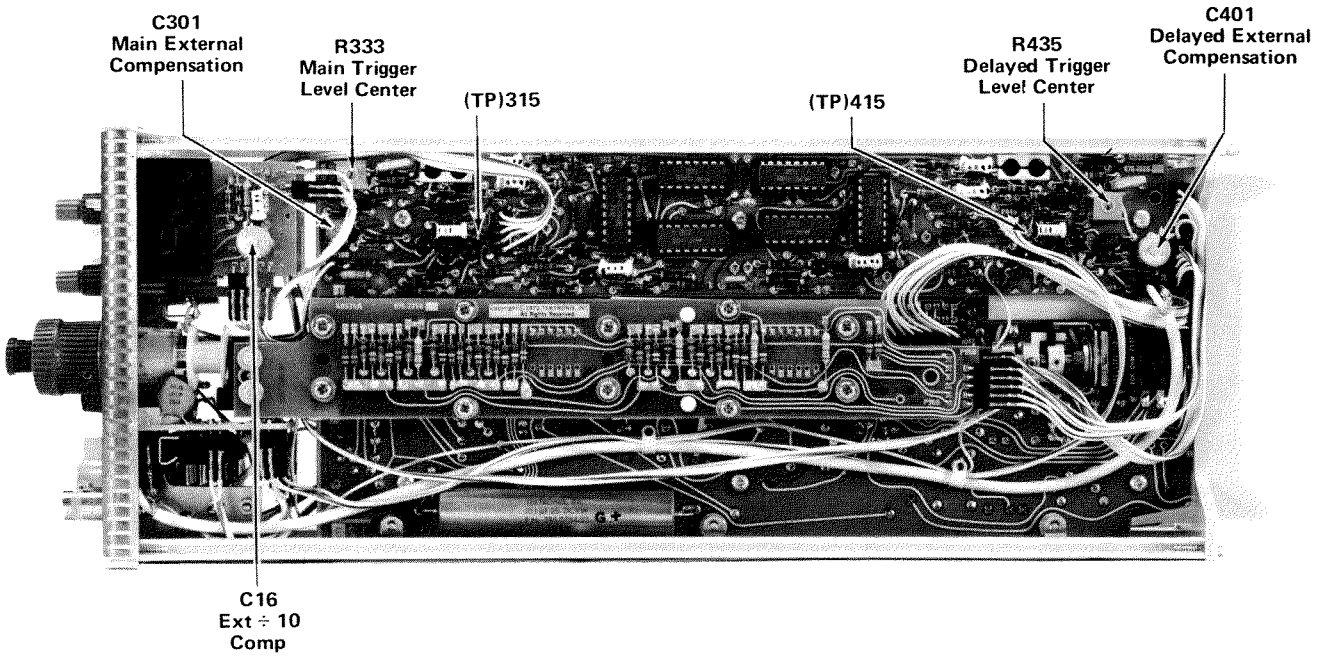
Fig. 6-16. P/O A1. Partial Interface circuit board.



NOTE: P/O INDICATES PART OF



VOLTAGE DISTRIBUTION & OUTPUT CONNECTORS ⑨



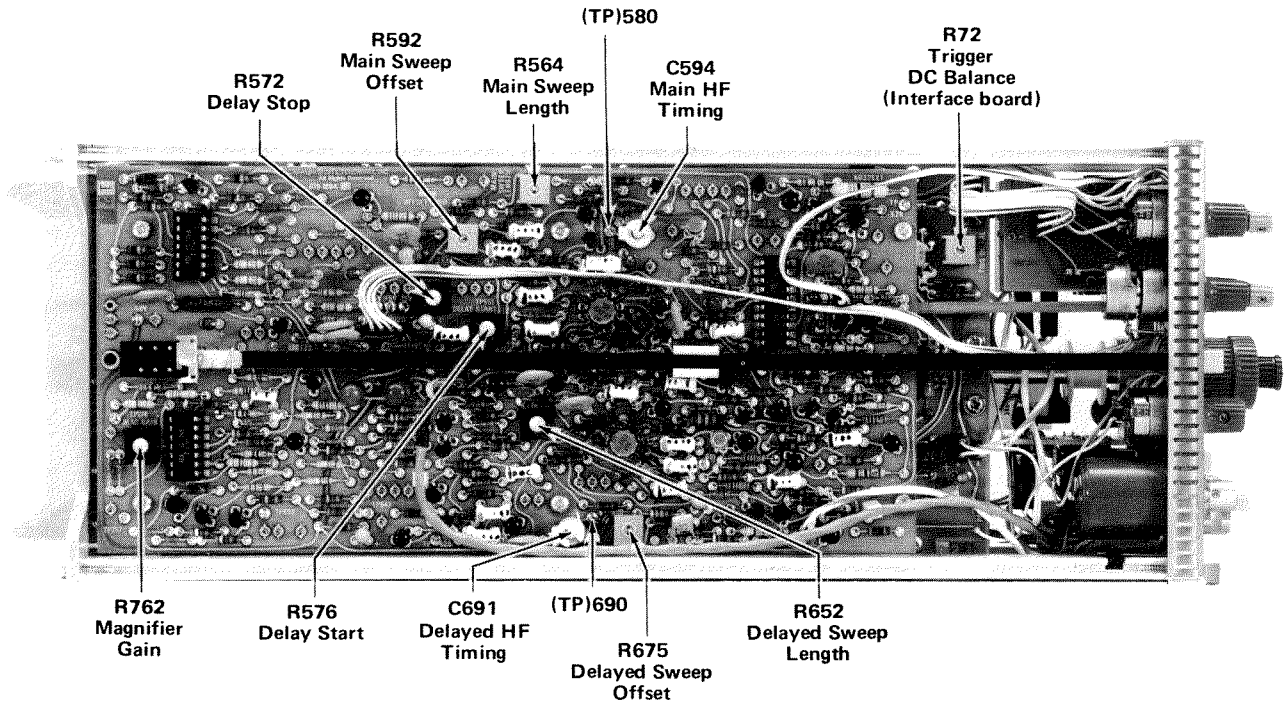


Fig. 6-17. Location of adjustments in the 7B53A/7B53AN.

Ⓐ

MECHANICAL PARTS LIST

Replacement parts should be ordered from the Tektronix Field Office or Representative in your area. Changes to Tektronix products give you the benefit of improved circuits and components. Please include the instrument type number and serial number with each order for parts or service.

ABBREVIATIONS

BHB	binding head brass	h	height or high	OHB	oval head brass
BHS	binding head steel	hex.	hexagonal	OHS	oval head steel
CRT	cathode-ray tube	HHB	hex head brass	PHB	pan head brass
csk	countersunk	HHS	hex head steel	PHS	pan head steel
DE	double end	HSB	hex socket brass	RHS	round head steel
FHB	flat head brass	HSS	hex socket steel	SE	single end
FHS	flat head steel	ID	inside diameter	THB	truss head brass
Fil HB	fillister head brass	lg	length or long	THS	truss head steel
Fil HS	fillister head steel	OD	outside diameter	w	wide or width

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
1-1	366-1391-00			1		KNOB, gray--SLOPE, w/setscrew
-2	366-1077-00			1		KNOB, charcoal--LEVEL
	- - - - - -			-		knob includes:
	213-0153-00			1		SETSCREW, 5-40 x 0.125 inch, HSS
-3	366-1391-00			1		KNOB, gray--FINE, w/setscrew
-4	366-1077-00			1		KNOB, charcoal--POSITION
	- - - - - -			-		knob includes:
	213-0153-00			1		SETSCREW, 5-40 x 0.125 inch, HSS
-5	366-0494-00			1		KNOB, charcoal--DLY'D TRIG LEVEL
	- - - - - -			-		knob includes:
	213-0153-00			1		SETSCREW, 5-40 x 0.125 inch, HSS
-6	366-1405-00			1		KNOB, red--CAL
	- - - - - -			-		knob includes:
	213-0153-00			1		SETSCREW, 5-40 x 0.125 inch, HSS
-7	366-1321-00			1		KNOB, charcoal--TIME/DIV or DLY/TIME
	- - - - - -			-		knob includes:
	213-0153-00			2		SETSCREW, 5-40 x 0.125 inch, HSS
-8	354-0410-00			1		RING, knob skirt
	- - - - - -			-		ring includes:
	213-0153-00			2		SETSCREW, 5-40 x 0.125 inch, HSS
-9	366-1257-93			1		PUSHBUTTON--X1/X10
-10	366-1257-90			1		PUSHBUTTON--+/-
-11	366-1257-91			1		PUSHBUTTON--AC/DC
-12	366-1257-92			1		PUSHBUTTON--INT/EXT
-13	426-0681-00			4		FRAME, pushbutton
-14	358-0378-00			1		BUSHING, sleeve, front panel trim
-15	366-1058-50			1		KNOB, latch (7B53A only)
	366-1058-35			1		KNOB, latch (7B53AN only)
-16	214-1095-00			1		PIN, spring, split
-17	337-1064-04			2		SHIELD, electrical, side
-18	333-1542-02			1		PANEL, front
-19	401-0126-00			1		BEARING, knob skirt
-20	- - - - - -					RESISTOR, variable
	- - - - - -			-		mounting hardware: (not included w/resistor)
-21	331-0247-00			1		DIAL, control

FIGURE 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
1-22	131-0955-00			2	CONNECTOR, coaxial, BNC, female, w/hardware
	- - - - - -			-	mounting hardware for each: (not included w/connector)
-23	210-0590-00			1	NUT, hex., 0.375-32 x 0.438 inch
	210-0012-00			1	WASHER, lock, internal, 0.375 ID x 0.50 inch OD
-24	131-0373-00			1	CONNECTOR, standoff
	- - - - - -			-	mounting hardware: (not included w/connector)
-25	210-0405-00			1	NUT, hex., 2-56 x 0.188 inch
-26	210-0001-00			1	WASHER, lock, internal, 0.092 ID x 0.18 inch OD
-27	337-1317-00			1	SHIELD, electrical
-28	- - - - - -			2	RESISTOR, variable
	- - - - - -			-	mounting hardware for each: (not included w/resistor)
-29	210-0583-00			1	NUT, hex., 0.25-32 x 0.25 inch
-30	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
-31	210-0583-00	B010100	B109999X	1	NUT, hex., 0.25-32 x 0.25 inch
-32	210-0046-00	B010100	B109999X	2	WASHER, lock, internal, 0.261 ID x 0.40 inch OD
	210-0583-00	B110000		1	NUT, hex., 0.25-32 x 0.25 inch
	210-0940-00	B110000		1	WASHER, flat, 0.25 ID x 0.375 OD
-33	- - - - - -			1	CIRCUIT BOARD ASSEMBLY--DELAYED TRIGGER (See A7 elect list)
	- - - - - -			-	circuit board assembly includes:
-34	131-0608-00			8	TERMINAL, pin, 0.50 inch long
	131-0589-00			4	TERMINAL, pin, 0.365 inch long
-35	260-1133-00			1	SWITCH, push, SLOPE, COUPLING, SOURCE
-36	220-0637-00			1	NUT BLOCK
	- - - - - -			-	mounting hardware: (not included w/block)
-37	211-0022-00			2	SCREW, 2-56 x 0.188 inch, PHS
	- - - - - -			-	mounting hardware: (not included w/circuit board assy)
-38	211-0101-00			2	SCREW, 4-40 x 0.25 inch, 100° csk, FHS
-39	- - - - - -			1	CIRCUIT BOARD ASSEMBLY, switch--TRIG SOURCE (See A2 elect list)
	- - - - - -			-	circuit board assembly includes:
-40	131-0589-00			7	TERMINAL, pin, 0.50 inch long
	- - - - - -			-	mounting hardware: (not included w/circuit board assy)
	211-0156-00			2	SCREW, 1-72 x 0.25 inch, 82° csk, FHS
-41	- - - - - -			1	CIRCUIT BOARD ASSEMBLY, switch--
	- - - - - -			-	TRIG COUPLING (see A3 elect list)
	- - - - - -			-	mounting hardware: (not included w/circuit board assy)
-42	211-0156-00			2	SCREW, 1-72 x 0.25 inch, 82° csk, FHS

FIGURE 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description
1-43	- - - - - -			1	CKT BD ASSY, switch--TRIG MODE(See A5 epl)
	- - - - - -			-	circuit board assembly includes:
-44	131-0608-00			6	TERMINAL, pin, 0.365 inch long
	- - - - - -			-	mounting hardware:(not included w/ckt bd assy)
	211-0156-00			2	SCREW, 1-72 x 0.25 inch, 82 deg csk, FHS
-45	200-0935-00			1	CAP., lampholder
-46	378-0602-00			1	LENS, lamp
-47	352-0157-00			1	LAMPHOLDER
-48	386-1447-58			1	SUBPANEL, front
	- - - - - -			-	mounting hardware: (not included w/subpanel)
-49	213-0192-00			4	SCREW, thread forming, 6-32 x 0.50 inch, Fil HS
-50	- - - - - -			1	CKT BOARD ASSY--TRIGGER (See A4 epl)
	- - - - - -			-	circuit board assy includes:
-51	131-0589-00			2	TERMINAL, pin, 0.50 inch long
	131-0608-00			11	TERMINAL, pin, 0.365 inch long
-52	136-0252-04	B010100	B113699	42	SOCKET, pin connector
-53	136-0263-03			9	SOCKET, pin terminal
-54	136-0260-01			6	SOCKET, integrated circuit, 16 pin
-55	200-0945-00			2	COVER, half, temperature stabilizer
-56	200-0945-01			2	COVER, half, temperature stabilizer, threaded
-57	211-0062-00			2	SCREW, 2-56 x 0.312 inch, FHS
-58	214-0579-00			2	TERMINAL, test point
	- - - - - -			-	mounting hardware: (not included w/ckt bd assy)
-59	211-0008-00			3	SCREW, 4-40 x 0.25 inch, PHS
-60	343-0088-00	B010100	B109999	2	CLAMP, cable, snap-on
	343-0088-00	B110000		1	CLAMP, cable, snap-on
-61	348-0235-00			2	SHIELDING GASKET, electrical
-62	105-0076-00			1	RELEASE BAR, latch
-63	214-1280-00			1	SPRING, helical compression
-64	214-1054-00			1	SPRING, flat, latch detent
-65	105-0075-00			1	BODY, latch
	- - - - - -			1	CKT BOARD ASSY--SWEEP(See A6 epl)
	- - - - - -			-	circuit board assy includes:
-67	131-0608-00	B010100	B089999	11	TERMINAL, pin, 0.365 inch long
	131-0608-00	B090000		12	TERMINAL, pin, 0.365 inch long
-68	136-0269-00			2	SOCKET, integrated circuit, 14 pin
-69	136-0252-04	B010100	B113699	140	SOCKET, pin connector
	136-0252-04	B113700		17	SOCKET, pin connector
-70	136-0263-03	B010100	B089999X	15	TERMINAL, test point
	214-0579-00	B090000		16	TERMINAL, test point
-71	136-0241-00	B010100	B089999	2	SOCKET, integrated circuit, 10 pin
	136-0252-04	B090000		20	SOCKET, pin connector
-72	214-0579-00	B010100	B089999	15	TERMINAL, test point
	214-0579-00	B090000		16	TERMINAL, test point
-73	214-1292-00			2	HEATSINK
-74	260-1208-00			1	SWITCH, push--MAG
-75	352-0240-00			1	HOLDER, cable
-76	386-2141-00			1	SUPPORT, extension shaft, plastic
-77	361-0007-00			1	SPACER, plastic
	- - - - - -			-	mounting hardware: (not included w/ckt bd assy)
-78	211-0008-00			6	SCREW, 4-40 x 0.25 inch, PHS

FIGURE 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
1-	672-0049-00	B010100	B089999	1	CIRCUIT BOARD ASSEMBLY--READOUT, INTERFACE (7B53A only)
	672-0049-01	B090000		1	CIRCUIT BOARD ASSEMBLY--READOUT, INTERFACE (7B53A only)
	- - - - - -			-	circuit board assembly includes:
-79	- - - - - -			1	CIRCUIT BOARD ASSEMBLY--READOUT (See A8 Elect list)
	- - - - - -			-	circuit board assembly includes:
-80	131-0590-00			6	TERMINAL, pin, 0.71 inch long
	131-0589-00			5	TERMINAL, pin, 0.50 inch long
	131-0157-00			2	TERMINAL, pin, 0.25 inch long
-81	131-0604-00			12	CONTACT, cam switch (for repair see maintenance section)
	- - - - - -			-	mounting hardware: (not included w/circuit board assembly)
-82	211-0116-00			10	SCREW, sems, 4-40 x 0.312 inch, PHB
-83	260-1309-00			1	SWITCH
	- - - - - -			-	mounting hardware: (not included w/switch)
-84	211-0159-00			2	SCREW, 2-56 x 0.375 inch, PHS
-85	210-0850-00			2	WASHER, flat, 0.093 ID x 0.28 inch OD
-86	220-0619-00			1	NUT PLATE, 2-56 inch threads
-87	200-1440-00			2	COVER
	- - - - - -			-	mounting hardware for each: (not included w/cover)
-88	211-0116-00			2	SCREW, sems, 4-40 x 0.312 inch, PHB
	210-0406-00			2	NUT, hex., 4-40 x 0.188 inch
	376-0129-01			1	COUPLER ASSEMBLY, cam switch
	- - - - - -			-	coupler includes:
	213-0075-00			2	SETSCREW, 4-40 x 0.094 inch, HSS
-90	105-0340-00			1	ACTUATOR, cam switch
	- - - - - -			-	actuator includes:
	213-0022-00			1	SETSCREW, 4-40 x 0.188 inch, HSS
-91	376-0092-01			1	COUPLER HALF, shaft, plastic
	- - - - - -			-	coupler half includes:
	213-0048-00			2	SETSCREW, 4-40 x 0.125 inch, HSS
-92	376-0092-03			1	COUPLER HALF, shaft, plastic
	- - - - - -			-	coupler half includes:
	213-0048-00			2	SETSCREW, 4-40 x 0.125 inch, HSS
	384-1153-00			1	SHAFT, cam switch
-93	384-1153-00			1	SHAFT, extension, 11.61 inches long
-94	214-1630-00	B010100	B139999X	1	DETENT ASSEMBLY, switch
-95	354-0391-00			2	RING, retaining
-96	401-0081-02			2	BEARING, cam switch, front
	- - - - - -			-	mounting hardware for each: (not included w/bearing)
-97	211-0116-00			2	SCREW, sems, 4-40 x 0.312 inch, PHB
-98	210-0406-00			1	NUT, hex., 4-40 x 0.188 inch
-99	131-0963-00			1	CONTACT, electrical, grounding
-100	214-1139-00[2]			-	SPRING, flat, gold
	214-1139-02[2]			-	SPRING, flat, green
	214-1139-03[2]			-	SPRING, flat, red
-101	214-1127-00			4	ROLLER, detent
-102	105-0386-00[1]			1	DRUM ASSEMBLY

[1] 7B53A

[2] Replace only with part bearing the same color code as the original part in your instrument.

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
1-103	401-0115-00			1	BEARING, cam switch, center
	- - - - - -			-	mounting hardware: (not included w/bearing)
	211-0116-00			2	SCREW, sems, 4-40 x 0.312 inch, PHB
	210-0406-00			2	NUT, hex., 4-40 x 0.188 inch
-104	105-0387-00[1]			1	DRUM ASSEMBLY
-105	- - - - - -			-	CKT BOARD ASSY:--MAIN INTERFACE(See A1 epl)
	- - - - - -			-	ckt board assy includes:
-106	131-0608-00			44	TERMINAL, pin, 0.365 inch long
	131-0589-00			2	TERMINAL, pin, 0.46 inch long
	131-0590-00			3	TERMINAL, pin, 0.71 inch long
	131-0592-00			36	TERMINAL, pin, 0.885 inch long
	131-0593-00			6	TERMINAL, pin, feedthru, 1.15 inches long
-107	131-0595-00	B010100	B089999	10	TERMINAL, pin, feedthru, 1.37 inches long
	131-0595-00	B090000		9	TERMINAL, feedthru, 1.37 inches long
	131-0665-00	B090000		1	TERMINAL, feedthru, 0.81 inch long
-108	131-0604-00			35	CONTACT, cam switch (for repair see maint. sect)
-109	136-0252-04	B010100	B113699	30	SOCKET, pin connector
	136-0350-00	B113700		10	SOCKET, 3 pin
	214-0579-00			2	TERMINAL, test point
-110	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
-111	210-0583-00			1	NUT, hex., 0.25-32 x 0.312 inch
-112	210-0046-00			1	WASHER, lock, internal, 0.261 ID x 0.40 inch OD
-113	407-0803-00			1	BRACKET, resistor mounting
-114	129-0308-00			6	POST, hex. 4-40 x 0.188 x 0.465 inch long
-115	129-0339-00			3	POST, stud
-116	260-0960-00			2	SWITCH, slide
-117	- - - - - -			1	RESISTOR, variable
-118	376-0101-00			1	COUPLING, shaft, w/setscrews
-119	384-1120-00			1	SHAFT, extension, 9.86 inches long
	- - - - - -			1	mounting hardware: (not included w/ckt bd assy)
-120	211-0008-00			6	SCREW, 4-40 x 0.25 inch, PHS
-121	211-0105-00			6	SCREW, 4-40 x 0.188 inch, 100 deg csk, FHS
-122	220-0547-01			6	NUT, block
	- - - - - -[2]			1	CKT BOARD ASSY--MAIN INTERFACE (See A1 epl)
	- - - - - -			-	circuit board assy includes:
	131-0595-00	B010100	B089999	8	TERMINAL, feedthru, 1.37 inches long
	131-0595-00	B090000		7	TERMINAL, feedthru, 1.37 inches long
	131-0665-00	B090000		1	TERMINAL, feedthru, 0.81 inch long
	131-0590-00			3	TERMINAL, pin, 0.71 inch long
	131-0589-00			2	TERMINAL, pin, 0.50 inch long
	131-0604-00			35	CONTACT, cam sw (for repair see maint. section)
	131-0608-00			29	TERMINAL, pin, 0.365 inch long
	131-0252-04	B010100	B113699	30	SOCKET, pin connector
	136-0350-00	B113700		10	SOCKET, 3 pin
	214-0579-00			2	TERMINAL, test point
	214-1630-00			1	DETENT ASSEMBLY, switch
	260-0960-00			1	SWITCH, slide
	129-0308-00			6	POST, hex., 4-40 x 0.188 x 0.465 inch long

[1] 7B53A only.
[2] 7B53AN only.

FIGURE 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
	129-0339-00			3		POST, stud
	376-0101-00			1		COUPLING, shaft, w/setscrews
	384-1120-00			1		SHAFT, extension, 9.86 inches long
	- - - - - -			1		RESISTOR, variable
	- - - - - -			-		mounting hardware: (not included w/resistor)
	210-0583-00			1		NUT, hex., 0.25-32 x 0.312 inch
	210-0046-00			1		WASHER, lock, internal, 0.261 ID x 0.40 inch OD
	407-0803-00			1		BRACKET, resistor mounting
	105-0326-00[1]			1		ACTUATOR ASSEMBLY 7B53AN
	- - - - - -			-		actuator assembly includes:
-123	200-1310-00			1		COVER, cam switch
	- - - - - -			-		mounting hardware: (not included w/cover)
-124	211-0008-00			6		SCREW, 4-40 x 0.25 inch, PHS
-125	210-0004-00			6		WASHER, lock, internal
-126	260-1309-00			1		SWITCH, push
	- - - - - -			-		mounting hardware: (not included w/switch)
-127	211-0159-00			2		SCREW, 2-56 x 0.375 inch, PHS
-128	210-0850-00			2		WASHER, flat, 0.093 ID x 0.281 inch OD
-129	220-0619-00			1		NUT PLATE, 2-56 inch threads
-130	354-0391-00			2		RING, retaining
-131	401-0081-02[2]			2		BEARING, front
-132	214-1139-00[2]			-		SPRING, flat, gold
	214-1139-02[2]			-		SPRING, flat, green
	214-1139-03[2]			-		SPRING, flat, red
-133	214-1127-00			4		ROLLER, detent
-134	105-0325-00[1]			1		ACTUATOR, cam switch, front
-135	401-0115-00			1		BEARING, center
-136	105-0324-00[1]			1		ACTUATOR, cam switch, rear
-137	210-0406-00			11		NUT, hex., 4-40 x 0.188 inch
-138	131-0963-00			1		CONTACT, electrical, grounding
	- - - - - -			-		mounting hardware: (not included w/actuator assembly)
-139	211-0116-00			6		SCREW, sems, 4-40 x 0.312 inch, PHB
-140	- - - - - -			1		CIRCUIT BOARD ASSEMBLY--SHIELD (See A9 elect list)
	- - - - - -			-		circuit board assembly includes:
-141	131-0937-00			2		TERMINAL, lug, shield grounding
-142	386-1556-00			1		SUPPORT, circuit board, plastic
-143	214-1597-00			1		ACTUATOR, switch, spool shaped
-144	384-1059-00			1		SHAFT, extension, 6.581 inches long
-145	384-1087-00			1		SHAFT, push, actuator
-146	384-1101-00			1		SHAFT, extension, 4.13 inches long
-147	386-1402-00			1		PANEL, rear
	- - - - - -			-		mounting hardware: (not included w/panel)
-148	213-0192-00			4		SCREW, thread forming, 6-32 x 0.50 inch, Fil HS
-149	361-0326-00			1		SPACER, sleeve, 0.18 ID x 0.25 OD x 0.10 inch long

[1] 7B53AN
[2] Replace only with part bearing the same color code as the original part in your instrument.

FIGURE 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty 1 2 3 4 5	Description
1-150	214-1061-00			1	SPRING, flat, sliding ground
-151	426-0505-11			1	FRAME SECTION, top
-152	426-0499-11			1	FRAME SECTION, bottom
-153	131-0707-00			75	CONNECTOR, terminal
	131-0708-00			6	CONNECTOR, terminal
-154	131-0621-00			4	CONNECTOR, terminal
	131-0622-00			2	CONNECTOR, terminal
	131-0792-00			2	CONNECTOR, terminal
-155	352-0169-00			8	HOLDER, terminal connector, 2 wire (black)
	352-0169-01			1	HOLDER, terminal connector, 2 wire (brown)
-156	352-0198-00			3	HOLDER, terminal connector, 2 wire (black)
-157	352-0161-00			2	HOLDER, terminal connector, 3 wire (black)
	352-0161-02			1	HOLDER, terminal connector, 3 wire (red)
-158	352-0162-00			2	HOLDER, terminal connector, 4 wire (black)
-159	352-0163-00			3	HOLDER, terminal connector, 5 wire (black)
-160	352-0164-00			4	HOLDER, terminal connector, 6 wire (black)
-161	352-0166-00			1	HOLDER, terminal connector, 8 wire (black)
-162	175-0825-00			in	WIRE, electrical, 2 wire ribbon, 11 inches long
-163	175-0826-00			in	WIRE, electrical, 3 wire ribbon, 19 inches long
-164	175-0827-00			in	WIRE, electrical, 4 wire ribbon, 10 inches long
-165	175-0828-00			in	WIRE, electrical, 5 wire ribbon, 13 inches long
-166	175-0829-00			in	WIRE, electrical, 6 wire ribbon, 8.50 inches long
-167	175-0831-00			in	WIRE, electrical, 8 wire ribbon, 6.00 inches long

FIG. 1 EXPLODED

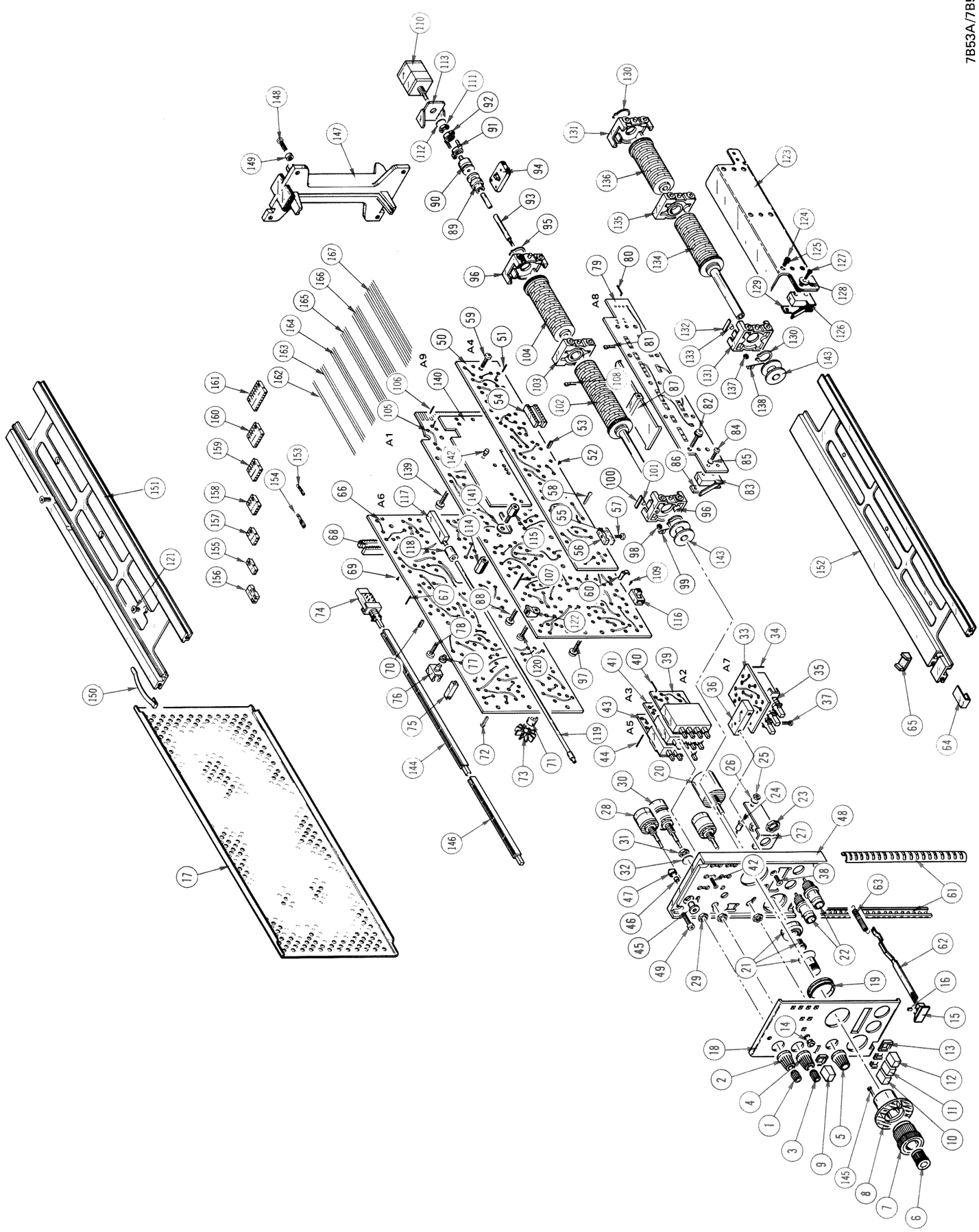


FIG. 2 ACCESSORIES & REPACKAGING

ACCESSORIES

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
2-	070-1252-00			1		MANUAL, operator's
	070-1342-00			1		MANUAL, service

REPACKAGING

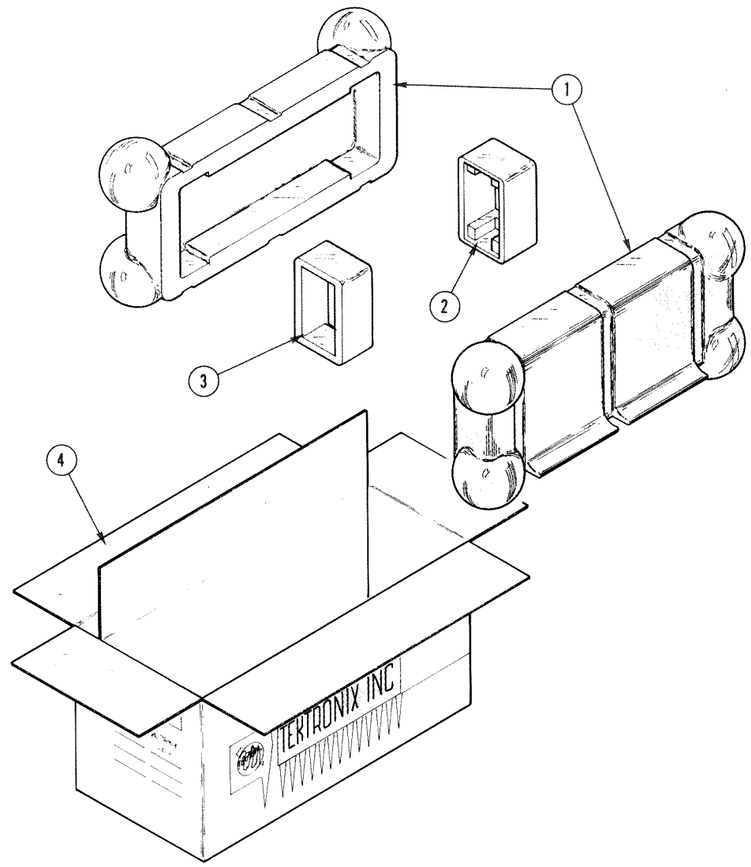


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
2-	065-0125-00			1		CARTON ASSEMBLY
-	----------			-		carton assembly includes:
-1	004-0241-00			2		CASE HALF
-2	004-0242-00			1		END CAP, rear
-3	004-0243-00			1		END CAP, front
-4	004-0748-00			1		CARTON

MANUAL CHANGE INFORMATION

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

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

A single change may affect several sections. Sections of the manual are often printed at different times, so some of the information on the change pages may already be in your manual. Since the change information sheets are carried in the manual until ALL changes are permanently entered, some duplication may occur. If no such change pages appear in this section, your manual is correct as printed.

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MANUAL CHANGE INFORMATION

PRODUCT 7B53A/AN
EFF SN B144430-up

CHANGE REFERENCE M23,084
DATE 12-30-74

CHANGE:	DESCRIPTION

070-1342-00

ELECTRICAL PARTS LIST CHANGE

CHANGE TO:

C340	281-0605-00	200 pF, Cer, 500 V
C344	281-0605-00	200 pF, Cer, 500 V
R340	315-0120-00	12 Ω, 1/4 W, 5%
R344	315-0120-00	12 Ω, 1/2 W, 5%

TEXT CORRECTION

Page 1-11

CHANGE last para, 4th line to read:

rotated clockwise to the CAL position.....

CHANGE 8th line to read:

information). However, when rotated counterclockwise (out of...

Page 2-1, TABLE 2-1, DELAYED SWEEP

CHANGE Supplemental Information to read:

Exclude the first 10 and beyond the 90th division of the magnified sweep when measuring magnified accuracy.