INSTRUCTION MANUAL

Serial Number 307

TYPE 3B2 TIME BASE

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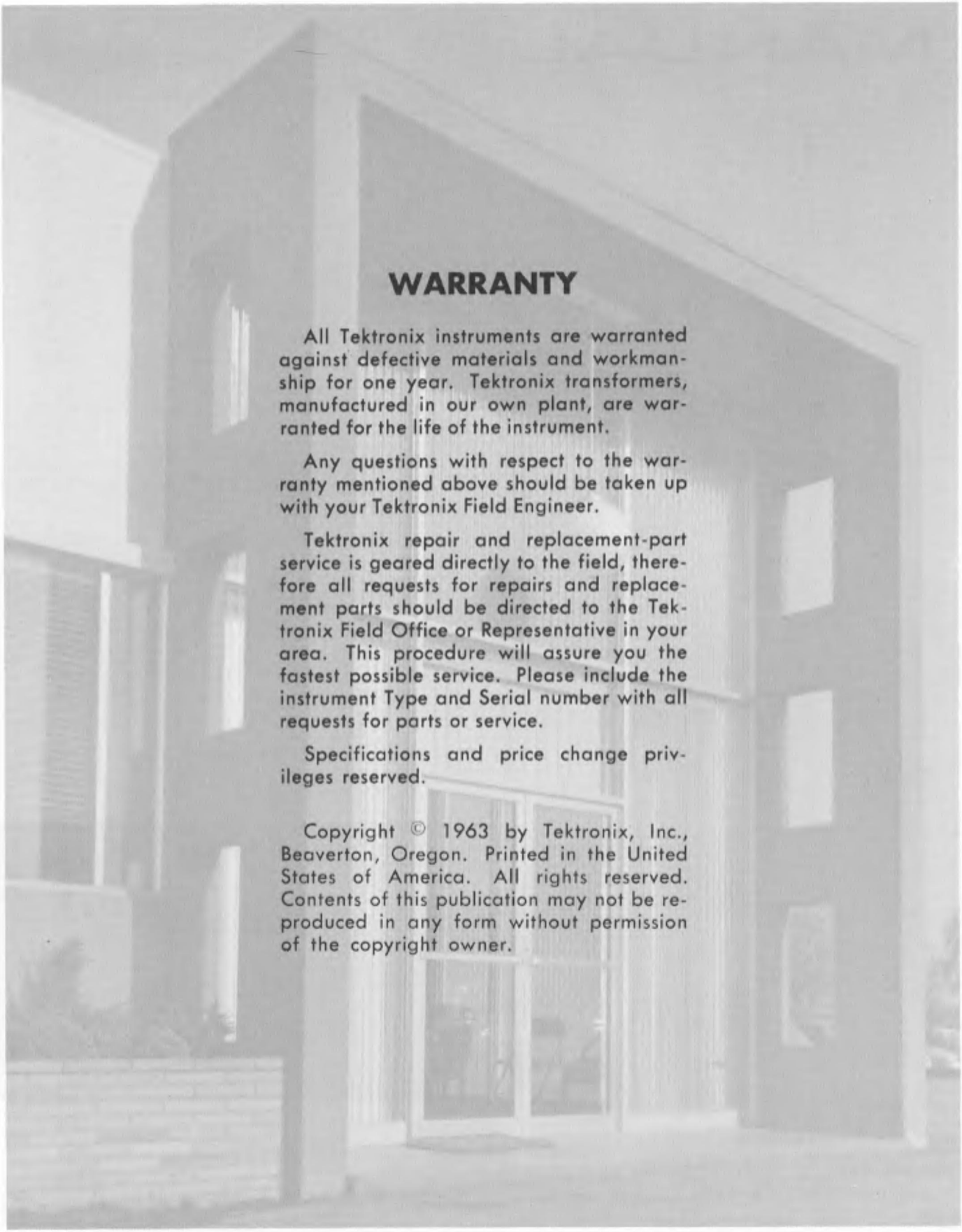

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CONTENTS

A list of abbreviations and symbols used in this manual will be found on page 7-1.

The Type 3B2 Time Base

SECTION 1
CHARACTERISTICS

General Information

The Type 3B2 Time Base Unit is used to generate sweeps for the Type 560-Series oscilloscopes. The sweeps may be initiated immediately by the trigger pulses or they may be delayed a selected time (from 5 μsec to 10.5 sec) after the trigger pulses. The unit provides outputs for digital unit displays as well as the usual analog displays. The unit can be used with any of the Type 560-Series oscilloscopes except the Types 560, 565, and RM565.

Sweep Rates

Sweeps from 2 μsec/div to 1 sec/div in 18 calibrated steps. Accurate to ±3%.

Delay Time

A 6-position delay-time switch and precision dial multiplier provide sweep delay from 5 μsec to 10.5 sec. Accurate to 1.0%.

Triggering Modes

Ac slow, ac fast, or dc coupled: + or — slope, internal, line, or external source.

Trigger Signal Requirements

Internal Triggering: Minimum signal amplitude of 2 minor divisions on the crt.

External Triggering: 0.5-volt minimum signal.

Trigger Frequency

Dc to 30 mc. (Internal trigger frequency limited to 500 kc when used with Type 3A2 Dual-Trace Amplifier plug-in unit.)

Internal Clock

Clock pulses for the digital readout unit are supplied from a 1-mc crystal-controlled oscillator. Frequency tolerance is ±0.01%.

Sweep Gate Out: +15-volt signal.

Delayed Trigger Out: +6-volt pulse ≈ 0.5-μsec width.

Jitter: Less than 1:20,000.

Mechanical

Construction: Aluminum-alloy chassis.

Finish: Photo-etched, anodized panel.

Weight: 5 lbs.

NOTES

SECTION 2

OPERATING INSTRUCTIONS

Introduction

This section describes the operation of the front-panel controls and provides step-by-step instructions for displaying a signal. Measurements that can be made with the Type 3B2 are described in the Applications section of this manual.

NOTE

If delay time is changed from long-delay to short-delay operation, it may take up to 10 seconds for the circuits to stabilize and function properly at the new setting.

FUNCTION OF CONTROLS AND CONNECTORS

TRIGGER LEVEL — Sets the voltage point on the slope of the trigger waveform at which the trigger pulse is generated. Sweep free runs in the clockwise detent (FREE RUN) position.

COUPLING — DC: The trigger signal passes directly to the trigger circuits from the source.

AC SLOW: Only ac component of trigger signal passes to the trigger circuits. Dc is blocked by capacitor.

AC FAST: Only high-frequency component of ac-trigger signal passes to the trigger circuits.

SLOPE — +: Trigger pulse is generated on the rising portion of the trigger signal.

—: Trigger pulse is generated on the falling portion of the trigger signal.

SOURCE — INT: Trigger-signal source is output of the companion amplifier unit.

LINE: Trigger-signal source is the line voltage.

EXT: Trigger-signal source is signal applied to the EXT TRIG IN connector.

EXT TRIG IN — Connector used to connect an external trigger signal for the trigger circuits.

SWEEP DELAY — IN: After the trigger pulse occurs, the start of the sweep is delayed by the time selected by the DELAY TIME switch and dial.

OUT: Sweep initiated immediately by the trigger pulse; no delay between the trigger pulse and start of the sweep.

DELAY TIME — A 6-position switch for fixed delay times from 1 sec to 10 μsec (multiplier dial set at 1.00). Multiplier dial provides increments between 0.50 and 10.50 times switch setting. For example, if the switch is set at 10 μs, and the dial at 4.93, delay time would be 4.93 times 10 μsec or 49.3 μsec.

DEL'D TRIG OUT — Connector with an output pulse that can be delayed to occur after the trigger pulse by the time set on the DELAY TIME switch and dial. The pulse has an amplitude of about 6 volts with a width of about 0.5 μsec and can be used to trigger external equipment.

SWEEP + GATE OUT — Connector with a +15-volt gate output pulse. Pulse length is the same as sweep length.

POSITION — Control that moves the display horizontally.

SWEEP CAL — Screwdriver adjustment that compensates for variations in deflection-plate sensitivity between oscilloscopes.

TIME/DIV — An 18-position switch that sets the calibrated sweep rate of the display.

DIGITAL RESOLUTION — Red knob concentric with the TIME/DIV switch. When the digital unit displays time measurements, this control selects the digital resolution pulses used between 10 msec and 0.1 μsec. (Some digital units may not use 0.1 μsec.) Also selects proper decimal and units of measure for the digital display.

FIRST-TIME OPERATION

The following steps should help you become familiar with the instrument operation. The front-panel controls and connectors, their use, and the expected results are described.

Insert the Type 3B2 into the right-hand (X-axis) opening of a Tektronix Type 567 Readout Oscilloscope. Use a Type 3A2 Dual-Trace Amplifier plug-in unit in the left-hand (Y-axis) opening.

1. Preset the Type 3B2 controls as follows:

LEVEL	0
COUPLING	DC
SLOPE	+
SOURCE	INT
SWEEP DELAY	OUT
POSITION	Centered
TIME/DIV	2 mSEC
DIGITAL RESOLUTION	1 mS

2. Connect a cable from the oscilloscope calibrator 5-volt jack to the Channel 1 input of the Type 3A2 plug-in. Set the Type 3A2 VOLTS/DIV switch to 1, and adjust the Type 3B2 LEVEL control for a stable display.

3. Turn the LEVEL control slowly clockwise. Notice that the trace disappears, then returns when the control switches to the FREE RUN position.

4. Return the LEVEL control toward center until the trace locks in. Note that the display starts at either the bottom or top of a pulse. Set the SLOPE switch to the opposite polarity; the display will reverse and start opposite to the previous condition.

5. Connect another cable from the 5-volt calibrator jack to the EXT TRIG IN connector. Set the SOURCE switch to EXT.

6. Repeat steps 3 and 4. Notice that the trigger controls work the same as for internal trigger signals except the LEVEL control adjustment may be more critical. External trigger signals are used in certain applications, and these are explained later in the text.

7. Adjust the trigger controls for a steady display. Set the DELAY TIME switch to 10 ms and the multiplier dial to 1.00. Set the SWEEP DELAY switch to IN. The display should move 2 divisions (10 msec) to the left.

8. Turn the multiplier dial back and forth; the display should move across the crt.

9. Turn the multiplier dial until the leading edge of a pulse is just to the right of the extreme left graticule line. Next, turn the TIME/DIV switch to .1 mSEC. The leading edge of the pulse should be expanded across the crt.

Triggering

The choice of triggering depends on the signal you want to see. For example, if the display starts on the leading edge and you want to start on the trailing edge, set the SLOPE switch to the opposite position.

Both the AC SLOW and AC FAST positions of the COUPLING switch reject any dc component in the trigger signal. Use AC SLOW for signal frequencies above 5 cps. Use AC FAST to trigger on the high-frequency component of a composite signal. The DC position of the COUPLING switch can be used from dc to 500 kc. (Dc to 30 mc with external triggering, or with a higher bandpass vertical amplifier.) The DC position must be used with signals that change slowly, such as a slow-rising sawtooth. The LEVEL control can be set to trigger the sweep a any voltage point on these slow-rising signals.

For most applications, internal triggering will do. However, external triggering should be used when signals are checked at several points within a device, such as in point-to-point troubleshooting. With this method, the trigger controls do not have to be adjusted for each point check. Line triggering can be used for frequencies that are multiples of the line frequency. An internal ac voltage (60 cps*) is connected to the trigger circuit when the SOURCE switch is placed to LINE.

SWEEP CAL Adjustment

This front-panel screwdriver adjustment sets the gain of the horizontal output amplifier. The gain should be checked whenever the Type 3B2 is used with a different oscilloscope, since the deflection-plate sensitivity may not be the same. It should also be checked whenever the vertical amplifier plug-in unit is changed, since the power-supply loading may be affected.

There are two methods for adjusting the gain of the horizontal output amplifier. One uses the oscilloscope calibrator signal (60 cps); the other the digital readout unit.

Oscilloscope Calibrator Method

1. Set the Type 3B2 TIME/DIV switch to 5 mSEC.

2. Apply a 5-volt signal from the oscilloscope calibrator to the Channel 1 input of the vertical amplifier.

3. Adjust the trigger controls on the Type 3B2 for a stable display. There should be exactly 3 cycles of calibrator signal across the 10 divisions of the graticule; if not, adjust the front-panel SWEEP CAL control.

Digital Readout Method

1. Set the vertical amplifier input-coupling switch to GND. Set the Type 3B2 TIME/DIV switch to 1 mSEC, and adjust the trigger controls for a free-running sweep.

2. Set the digital unit controls as follows:

MODE	TIME
TIMING START	MANUAL
TIMING STOP	MANUAL
RESOLUTION	UNSCALED (MAX)

3. Adjust the TIMING START and TIMING STOP controls on the digital unit for a readout of 0800.

4. Adjust the SWEEP CAL control on the Type 3B2 to make the Start-to-Stop intensified zone of the display exactly 8 horizontal divisions wide.

* Depends on line frequency.

SECTION 3

APPLICATIONS

Introduction

Since the Type 3B2 can be used with a digital readout unit, many applications are described in the digital readout unit instruction manual. However, in cases where the Type 3B2 is used without a digital readout unit, the following applications may be helpful.

Time Measurements

The Type 3B2 has calibrated sweeps so that any horizontal distance on the crt represents a definite time interval. Thus, the time interval between points on a display can be measured (within 3%) by counting the horizontal graticule divisions between the points to be measured and multiplying this by the setting of the TIME/DIV switch. However, for more precise measurements, the following method may be used.

1. Set the SWEEP DELAY switch to IN, and set the DELAY TIME switch to a position where the multiplier dial will move the display slowly across the crt.

2. Use a vertical graticule line as a reference and move the display with the multiplier dial until one of the points to be measured is on the reference line. Note the dial reading.

3. Move the display with the multiplier dial until the second point is on the reference line. Again read the dial. Subtract the larger number from the smaller, and multiply the difference by the setting of the DELAY TIME switch. The product is the time between the points.

Frequency Measurements

Time measurements may also be used for frequency measurements. Since frequency and time are reciprocal functions, the frequency of any signal is the reciprocal of the period (time) of 1 cycle. For example, if the time for 1 cycle is 2 msec, the frequency is 500 cps.

With any sweep rate, the number of cycles displayed across 10 divisions of the graticule depends on the frequency of the waveform.

To measure frequency, proceed as follows:

1. Set the TIME/DIV switch to display several cycles of the waveform.

2. Count the number of cycles across 10 divisions of the graticule.

3. Divide this number by 10 times the TIME/DIV switch setting. This is the frequency of the waveform.

Sweep delay can also be used to measure frequency as follows:

1. Measure the time length of 1 cycle as described under "Time Measurements".

2. The reciprocal of step 1 is the frequency.

Phase-Shift Measurement

To measure the phase difference between two sine waves, proceed as follows:

1. Connect each signal to a separate input channel on the dual-trace amplifier. Adjust the Type 3B2 to display at least 1 cycle.

2. Set the dual-trace amplifier for chopped-mode operation triggered from Channel 1.

3. Use the DELAY TIME switch and multiplier dial to measure the time of 1 cycle.

4. Similarly, measure the horizontal time difference between the same points on the Channel 1 and 2 displays.

5. Divide the time measured in step 4 by the time measured in step 3, and multiply the result by 360°. This is the phase difference between the two sine waves.

Nonrepetitive Pulse Displays

In a device where a trigger pulse occurs and a return pulse occurs at a later time, delayed sweep should be used.

For example, assume a trigger pulse occurs in a system, and five seconds later a return pulse occurs. Also assume that the duration of the return pulse is 5 msec. With an oscilloscope sweep length of 10 seconds, the return pulse would probably be just visible. With delayed sweep, the pulse can be examined in detail by using the following technique:

1. Set the TIME/DIV switch to 1 SEC, and adjust the trigger controls for a display. The pulse to be examined should occur at the graticule centerline.

2. Set the SWEEP DELAY switch to IN, the DELAY TIME switch to 1s, and the multiplier dial to 5.00.

3. Set the TIME/DIV switch to 1 mSEC. The return pulse will be displayed in a single sweep, 5 seconds after the initial trigger pulse. The pulse can then be photographed, if desired.

NOTES

SECTION 4

CIRCUIT DESCRIPTION

General Information

A block diagram of the Type 3B2 is shown in Fig. 4-1. The Type 3B2 Time Base Unit contains a Trigger Generator, Delay Generator, Sweep Generator, and a Clock Pulse Generator.

The Trigger Generator accepts a signal from one of three sources and converts it (regardless of shape) into a string of fast-rise constant-amplitude pulses that pass to the Delay Generator (see Fig. 4-1).

Usually, not all the pulses passing to the Delay Generator are used. Gating signals prevent pulses from entering the gated multivibrator circuit while the delay-ramp generator or sweep-ramp generator are producing a ramp voltage. Each pulse that enters the multivibrator switches the circuit to produce a square wave. The square wave is coupled to the SWEEP DELAY switch through an integrator that produces a nondelayed trigger pulse. The square wave also passes to the delay-ramp generator. With each square-wave input, the ramp generator produces an output ramp with a rate of rise that depends on the DELAY TIME switch setting. The ramp output is applied to one side of the delay comparator which has a voltage (set by the DELAY TIME dial) on the other side. When the rise of the delay ramp equals the voltage set by the DELAY TIME dial, the comparator switches and a delayed trigger pulse is generated. The delayed trigger pulse passes to the DEL'D TRIG OUT connector and to the SWEEP DELAY switch.

The Delay Generator produces trigger pulses for the Sweep Generator. If the SWEEP DELAY switch is set to OUT, the pulses are not delayed; if set to IN, the pulses are delayed by an amount determined by both the delay-ramp rate of rise (set by the DELAY TIME switch) and the value of the comparison voltage (set by the DELAY TIME dial).

Each trigger pulse passing to the Sweep Generator triggers one sweep. With each trigger pulse, the sweep multivibrator passes a square wave to the sweep-ramp generator producing a ramp that passes to the output amplifier and on to the crt. The Sweep Generator also supplies sweep and + gate signals for the digital unit.

The Clock Pulse Generator operates independently of the other circuits in the Type 3B2. The outputs to the digital unit are controlled by the DIGITAL RESOLUTION switch that determines which of five clock-pulse frequencies is used in the digital unit. The DIGITAL RESOLUTION switch selects the signals needed for setting the decimal point and unit of measure displayed in the digital unit.

TRIGGER GENERATOR

SOURCE switch SW3 selects one of three triggering sources (see foldout schematic): INT (internal triggering), LINE (internal triggering from the line frequency), and EXT (triggering from a signal applied to the EXT TRIG IN connector).

COUPLING switch SW5 selects the type of coupling in the input circuit of the trigger generator. In the DC position, the Trigger Generator can be triggered with a very slowly changing dc level. The two AC positions of SW5 block the dc and very low-frequency ac components of the trigger signal. The AC FAST position uses a high-pass network to trigger on only the high-frequency component of a signal that contains both high and low frequencies.

V13 is a cathode follower that isolates the input from the remaining sweep trigger circuitry. B10 is a neon lamp that protects V13 from excessive input voltage. The output of V13 passes through diode D15 to SLOPE switch SW19 and then to sweep trigger comparator Q24 and Q34. The position of SLOPE switch SW19 determines the connections to the base of Q24 and Q34 and thus determines whether the circuit responds to the negative- or positive-going portion of the input signal.

The signal is applied to one base of the comparator circuit, and an adjustable dc voltage (set by the LEVEL control R23) is applied to the opposite base. Without a signal input, Q34 is turned off. When the signal input reaches a value in excess of the value set by the LEVEL control, Q34 turns on and switches D35 rapidly to its high-voltage state to generate the trigger pulse.

To understand the operation of the comparator circuit, assume that the SLOPE switch is set at + and the LEVEL control is set for about +4 volts. This places +4 volts on the base of Q24. With no input signal present, the base of Q34 normally rests at about +2.2 volts. Under these voltage conditions Q34 will be turned on, and Q24 will be turned off. Q34 turns off when the incoming signal arrives at its base and becomes more positive than the +4 volts on the base of Q24. When Q34 turns off, tunnel diode D35 switches rapidly to its higher-voltage state. The fast transient generated by D35 is coupled to Q44. From Q44 the signal is transformer coupled to the delay generator circuit.

DELAY GENERATOR

The Delay Generator consists of a gated multivibrator circuit, a Miller runup circuit, a delay comparator, and a delayed-trigger generator. The delay generator circuit is always in operation, although it has no affect on the sweep generator when the SWEEP DELAY switch is set to OUT.

Incoming pulses from the Trigger Generator are coupled to the gated multivibrator through T51. The multivibrator is switched only by pulses arriving when Q123 is able to conduct and D55 is set to its low-voltage state. Any pulse arriving under different conditions will not affect the circuit. The output of the multivibrator (collector of Q64) is a negative-going square wave.

Delay Ramp Starts

With D55 set to its low-voltage state, Q64 is not conducting and its collector voltage is high. The incoming pulse switches D55 to its high-voltage state; Q64 is turned on to

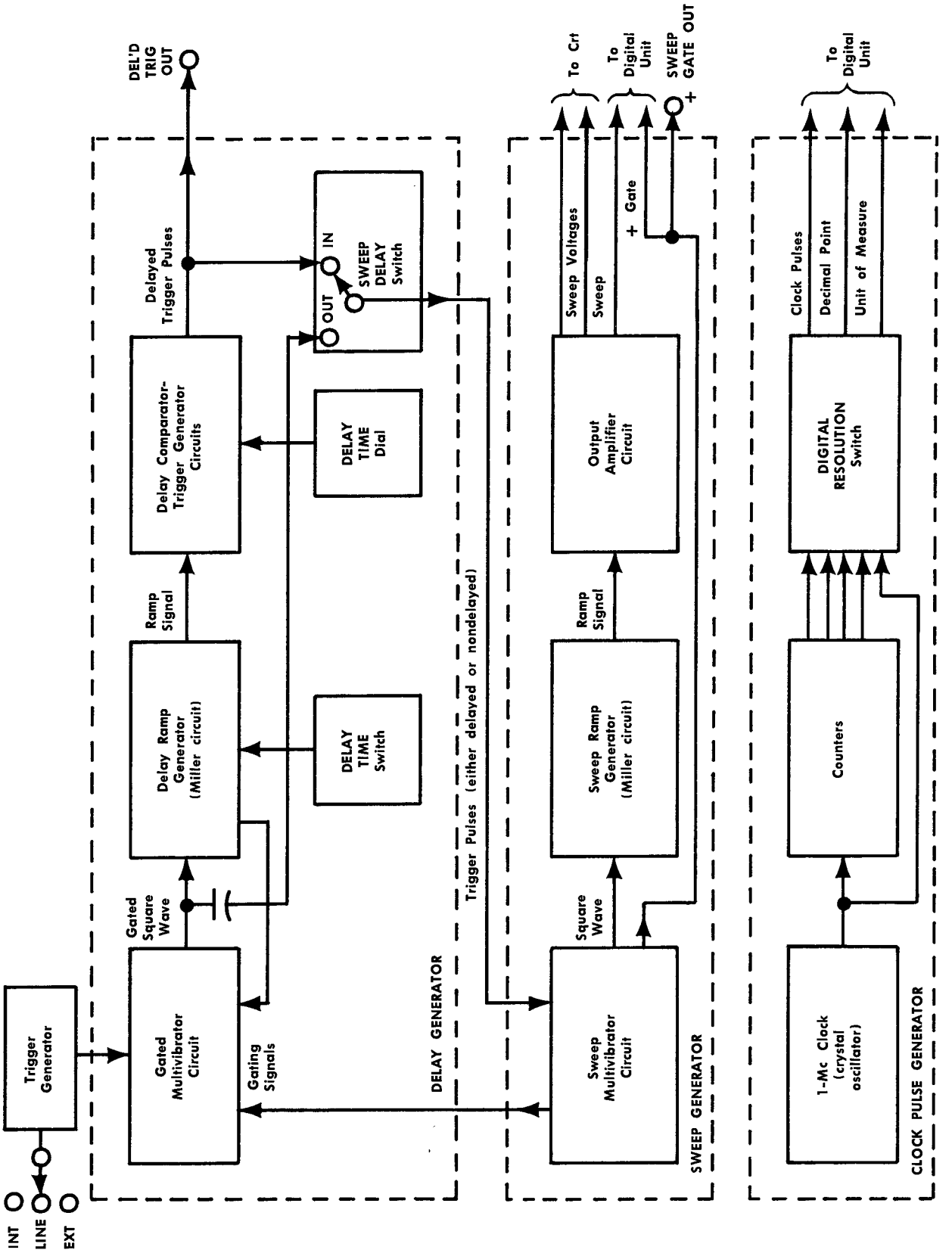


Fig. 4-1. Type 3B2 block diagram.

saturation and continues to conduct until the multivibrator is reset. When Q64 goes into saturation, its collector moves negative to produce a negative signal that passes to SWEEP DELAY switch SW170 and to the Miller circuit.

As long as the Miller circuit has a negative input, it generates a delay-ramp signal. Such a negative input turns off disconnect diode V72, and Miller capacitor C80 starts charging through timing resistor R80. As C80 charges, the grid voltage of Miller tube V91A moves in a negative direction. However, as this happens, the plate of V91A goes positive and the positive change is coupled through cathode follower V91B to the upper plate of C80. This increasing voltage on C80 serves to keep the charging current of C80 constant, thus providing a linear rather than exponential voltage change across C80 and at the cathode of V91B. Therefore, the output of the Miller circuit (V91B cathode) is a linear ramp that passes on to the delay-comparator circuit and back to the gated multivibrator.

Delay Ramp Stops

The Miller ramp is coupled to the gated multivibrator through D99 to the base of Q123. When the ramp exceeds +15 volts, Q123 is back biased and turns off (emitter cannot exceed +15 volts because of D116). When Q123 turns off, it ends the ramp by switching D55 to its low-voltage state which turns Q64 off. With Q64 off, its collector moves positive. This positive change brings disconnect diode V72 into conduction and Miller capacitor C80 discharges, thus stopping the delay ramp rise.

At times, the sweep produced on the crt may end before the delay ramp reaches +15 volts to stop the delay ramp rise. When this occurs, the delay generator reset signal turns the delay ramp off. This reset signal is coupled through R115 and C115 to the emitter of Q123. When the reset signal goes negative at the end of the crt sweep, the negative pulse formed turns Q123 off and thus stops the delay-ramp rise.

The next delay ramp cannot be started by a pulse from the trigger generator until Q123 is allowed to conduct so that D55 can be switched back to its high-voltage state. As long as the ramp signal to Q123 through D99 is +15 volts or greater, Q123 will not conduct. However, when the ramp stops, the signal reduces and will allow Q123 to conduct. Two other signals, however, can prevent Q123 from conducting. One signal, the negative trigger lockout, is applied to the emitter of Q123 through D114 to prevent conduction during the time the Sweep Generator produces sweep voltages for the crt. The second signal, from the holdoff circuit, appears at D98 to keep Q123 from conducting for a short time after the sweep is generated to allow the Sweep Generator circuits to stabilize before the next sweep is started.

The holdoff-circuit signal applies back bias to D98 to hold Q123 cut off. D98 is back biased through D96 and D97 with positive charges on holdoff capacitors C100 and C270. When the positive charges on the holdoff capacitors discharge to a low level, D98 is forward biased to allow Q123 to conduct.

Holdoff capacitor C270 is charged by the positive ramp produced in the Sweep Generator and is discharged at the end of the ramp. Holdoff capacitor C100 is charge to —12.2 volts through R103 as the delay ramp starts. When the delay ramp stops with SWEEP DELAY switch SW170 set to IN, Q103 conducts bringing one end of C100 to ground and C100 provides a positive charge of about 10 volts at D96 (+12.2 volts minus the negative starting voltage of the ramp). Thus, with the SWEEP DELAY switch set to IN, the holdoff signal from C100 is a minimum of +10 volts and may be increased depending on the value of delay-ramp voltage generated. With the SWEEP DELAY switch set to OUT, C100 remains connected to —12.2 volts through R103 and in some cases may never be charged to a positive value by the delay ramp. Any positive charges developed on C100 are discharged at the end of the delay ramp.

Delayed-Trigger Pulse Generator

The linear ramp output of the delay Miller circuit at pin 8 of V91B is applied to the grid of voltage comparator V134A. A variable dc voltage, set by DELAY TIME control R149, is on the other grid of the comparator (V134B). During quiescence, V134A is cut off and V134B is conducting. As the delay Miller circuit starts running up, the grid of V134A gets progressively more positive. When the ramp voltage on the grid of V134A reaches and exceeds the voltage on the grid of V134B, the comparator circuit switches states (V134A conducts and V134B turns off). As the current falls, V134B switches D135 to its low-voltage state. The switching signal of D135 is coupled directly to the base of Q164 where it is amplified. The amplified signal is the delayed-trigger pulse coupled to the DEL'D TRIG OUT connector through Q174 and to the SWEEP DELAY switch.

The amount of delay produced by the delay circuit depends on how long it takes for the delay Miller circuit to run up to the voltage set by the DELAY TIME control. Hence, this time can be changed either by varying the rate of rise of the delay Miller circuit with DELAY TIME switch SW80, or by varying the comparator switching voltage with DELAY TIME control R149.

V138 in the delay comparator circuit supplies a relatively constant current to V134 to permit V134 to operate linearly over a wide range. V149 regulates the voltage supplied to the DELAY TIME control to increase the stability of the delay circuit.

SWEEP GENERATOR

The sweep generator operation starts with a trigger pulse input from the Delay Generator. The incoming trigger turns Q214 on. When Q214 turns on, tunnel diode D215 switches to its high-voltage state. When D215 switches, Q224 turns on. This, in turn, places a more-negative voltage on the plates of disconnect diode V252. With the disconnect diodes turned off, Miller capacitor C260 starts charging through timing resistor R260. When C260 starts charging, the control grid of Miller tube V261A attempts to move negative. With its grid moving negative, the plate of V261A moves positive. This positive change is coupled through a cathode follower and back to the upper plate of Miller capacitor C260. This increasing voltage across the Miller capacitor serves to keep the charging current of C260 constant—thus providing a linear rather than exponential voltage change across C260 and at the cathode of V261B.

The Miller circuit stops running up and resets when D271 becomes forward biased and transistor Q273 becomes back biased. The exact point where this occurs is set by SWEEP LENGTH control R268. When Q273 turns off, tunnel diode D215 resets to its low-voltage state. At the same time, Q224 turns off, causing disconnect diode V252 to conduct and discharge Miller capacitor C260. Also, the positive change on the collector of Q224 is coupled to emitter follower Q233.

After the Miller capacitor is discharged, Q273 is brought into conduction and supplies the proper amount of current (about 4.1 ma) to make D215 triggerable.

TIME/DIV switch SW260 selects the resistors and capacitors used to set the sweep rate and holdoff period for the Sweep Generator. Transistors Q233 and Q244 supply sweep-gating signals to the Delay Generator and various points in the indicator unit as well as to the companion vertical plug-in unit.

The output of the Miller circuit (pin 8 of V261B) couples to the horizontal output amplifier through R301 and R303. The sweep takeoff for the digital unit is also at this point.

The output amplifier is a cathode-coupled paraphase amplifier with fixed gain. SWEEP CAL potentiometer R303 varies the amplitude of the sawtooth at the input of the output amplifier. Positioning is accomplished by changing the dc level on the grid of V314B with potentiometer R319 (POSITION control).

CLOCK PULSE GENERATOR

This circuit develops the clock-pulse signals used in the digital readout unit. The circuit also contains the DIGITAL RESOLUTION switch used to select time measurement units for the digital display unit.

The clock (Q490) is a crystal-controlled 1-mc oscillator. The signal from the collector of Q490 couples through C492 to the base of Q494. This transistor is an over-driven amplifier that produces pulses at 1-μsec intervals. These pulses are coupled to the DIGITAL RESOLUTION switch and to the first Counter board.

There are four Counter boards. Each board is a divide-by-ten device; that is, for every ten pulses in, there is one pulse out. Thus, with the output of one counter fed to the next, four successive divisions-by-ten occur. Outputs from the clock, and from the counters provide pulses at intervals of 1 μsec, 10 μsec, 0.1 msec, 1 msec, and 10 msec. Each of these outputs is connected to the DIGITAL RESOLUTION switch where it selects which of the five pulse intervals is sent to the digital unit.

With the DIGITAL RESOLUTION switch in the .1 μS position, pin 16 of P22 is connected to the 1-MC clock oscillator. This signal may pass from pin 16 to the digital unit where it can be used to generate pulses with 0.1-μsec intervals. Note, however, that not all digital units can use this signal.

The DIGITAL RESOLUTION switch also selects the position of the decimal point and unit of measure (S, MS, μS) when the digital unit is displaying time measurements. When the digital unit displays time measurements, pin 24 of P22 in the Type 3B2 is connected to ground. This ground is then used to light the S unit of measure through D287 and through the DIGITAL RESOLUTION switch to light the correct decimal point and additional unit of measure.

COUNTER BOARDS

Each of the four counter boards consists of a divide-by-two circuit followed by a divide-by-five circuit. The divide-by-two circuit is a bistable multivibrator that produces one output pulse for each two input pulses. The divide-by-five circuit contains three bistable multivibrators that produce an output pulse for each five input pulses. Divide-by-ten operation is accomplished by coupling the output of one divider circuit to the input of the other.

Each bistable multivibrator has two transistors and must set in one of two states. One state has the first transistor on with the second off. The other state has the first transistor off with the second on. The multivibrator is switched from one state to the other by a positive pulse applied through diodes to the bases of the transistors. The positive pulse switches the "on" transistor off which forces the "off" transistor on.

Q405 and Q415 are the two transistors in the divide-by-two multivibrator. When the instrument is turned on, the circuit will settle in one state; for example, Q415 turned on, and Q405 turned off. Diode D402 is highly back biased while D412 is slightly back biased. The positive-going portion of the input pulse from pin 6 is coupled through C407 and C417, and will find a path through D412, but be blocked by D402. This positive pulse through D412 turns Q415 off. When this happens, the collector of Q415 becomes more negative, and this change coupled to the base of Q405, turns Q405 on. Thus, the multivibrator has changed state. The multivibrator changes state again when the next input pulse finds a path through D402 to turn Q405 off. Each input pulse from pin 6 changes the state of the divide-by-two circuit.

Each time Q415 turns on, its collector moves in a positive direction and generates the positive input pulse for the next multivibrator.

In the cycle of operation of the divide-by-five circuit, Q465 turns on with one input pulse, turns off with the next input pulse, and then remains off for three input pulses before it turns on again. Thus, Q465 turns from off to on once for every five input pulses and turns from 'on' to 'off' once for every five input pulses. When Q465 switches from off to on, it generates the positive output pulse coupled to the digital unit through pin 4. When Q465 switches from on to off, Q475 switches on and generates the positive input pulse coupled to the next counter board through pin 11.

Each of the three multivibrators in the divide-by-five circuit operate the same as the one in the divide-by-two circuit. The only difference is that each time a digital unit pulse is generated (when Q465 turns on), a reset pulse through D430 and D450 turns Q435 and Q455 from on to off for divide-by-five operation.

SECTION 5

MAINTENANCE

PREVENTIVE MAINTENANCE

Visual Inspection

The Type 3B2 should be inspected occasionally for such visual defects as poor connections, broken or damaged ceramic strips, improperly seated tubes or transistors, and heat-damaged parts. The remedy for most visual defects is obvious; however, particular care must be taken if heat-damaged parts are detected. Overheating can be caused by other, less apparent troubles in the circuit. For this reason, it is essential to determine the actual cause of overheating before the parts are replaced; otherwise, the damage may be repeated.

Recalibration

The Type 3B2 is a stable instrument and should provide many hours of trouble-free operation. To maintain measurement accuracy, however, we suggest a calibration check after each 500 hours of operation (or every six months if used intermittently). Complete calibration instructions are contained in Section 6 of this manual. The calibration procedure includes steps which will help check for proper operation of various circuits. Minor troubles not apparent during regular operation will often be revealed during calibration. Also, major troubles in the instrument can often be isolated or eliminated by calibrating the instrument.

PARTS REMOVAL AND REPLACEMENT

General Information

Removal or replacement procedures for most parts in the instrument are obvious. However, some parts require special procedures. Removal and replacement of these parts are discussed in the following paragraphs.

Many components in the instrument are mounted in a particular way to reduce stray inductance and capacitance. Therefore, carefully install replacement components to duplicate lead length, lead dress, and location of the original component.

After replacing any electrical components, be sure to check the calibration of the instrument. Components of the same type may exhibit slightly different characteristics, and may affect calibration.

Tubes and Transistors

Tubes or transistors should not be replaced unless they are actually defective. If tubes or transistors are removed and found to be acceptable, be sure to return them to their original sockets. This will avoid recalibration because of different tube or transistor characteristics.

The best way to check a tube or transistor is by substitution. That is, replace the suspected tube or transistor with one of the same type that you know is good. Then, check to see if the instrument operates properly. If not, return the original tube or transistor to its socket.

Wafer Switches

Individual wafers are normally not replaced in the switch assemblies. If one wafer is defective, the entire switch assembly should be replaced. Switches can be ordered from Tektronix either wired or unwired.

The wafer switches shown on the schematics are coded to indicate the position of the wafer on the switch. The wafers are numbered from front to rear (i.e., the number 1 wafer is always closest to the front panel). The letters F and R indicate the front or rear of the wafer. For example, a code designation of 3R means the rear side of the third wafer from the front panel.

Soldering Precautions

In the production of Tektronix instruments, a silver-bearing solder is used to establish a bond to the ceramic terminal strips. This bond may be broken by repeated use of ordinary tin-lead solder, and by excessive heating of the terminal strip with a soldering iron. Occasional use of ordinary solder is permissible if applied with moderate heat. For general repair work, however, solder used for the ceramic strips should contain about 3% silver. If this type of solder is not available locally, it may be purchased directly from Tektronix in one-pound rolls (part number 251-514).

A wedge-shaped tip on the soldering iron is best for soldering or unsoldering parts on the ceramic strips. This type of tip allows you to apply heat directly to the solder-slot on the strip, reducing the overall heating affect. Use as little heat as possible to establish a good solder bond.

The following procedure is recommended for soldering and unsoldering short-lead components: (1) Use long-nose pliers for a heat sink. Attach the pliers between the component and the point where the heat is applied. (2) Use a hot soldering iron for a short time. (3) Carefully manipulate the leads to prevent lead or insulation damage. (4) Use only a small amount of solder; just enough to make a good bond.

Ceramic Terminal Strips

To remove a ceramic terminal strip, first unsolder all leads and components connected to it. The pry the strip, with yokes attached, out of the chassis. The spacers may come out with the yokes; if not, they can be pulled out separately. If they are not damaged, the spacers may be used with the new strip assembly.

Another way to remove a strip from from the chassis is to use diagonal cutters to cut off one side of each yoke holding the strip. This frees the strip, and the remainder of the yokes can then be pulled free of the chassis with a pair of pliers. Ceramic strips are supplied with yokes attached so it is not necessary to salvage the old yokes.

After removing a damaged strip and yoke assembly, place the spacers into the holes in the chassis and insert the yokes into the spacers. Be sure the yokes are completely seated in the spacers. If necessary, us a soft-faced mallet to tap the yokes into the spacers. Fig. 5-1 shows the assembled ceramic strip.

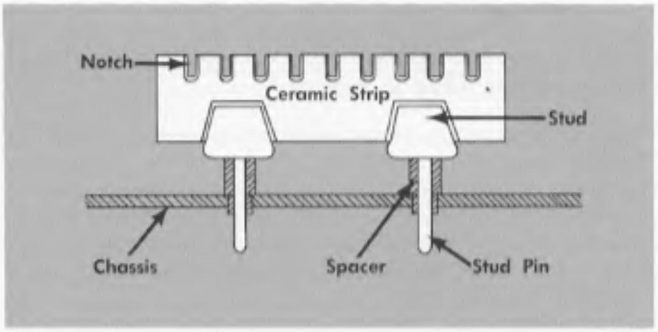


Fig. 5-1. Ceramic strip assembly.

Test Points

The test points shown on the schematics simplify reference to particular locations in the circuitry. Each test point is indicated by a number at its location in the circuit. Physical location of the test points are shown in Fig. 5-2.

TROUBLESHOOTING

General Information

If trouble develops in the Type 3B2, first check for proper control settings. A control set to the wrong position may produce an apparent trouble symptom. Improper calibration can also cause faulty operation. By attempting to calibrate the instrument, trouble may be isolated to a given circuit; if the trouble is due to improper calibration, the trouble will be corrected.

Unusual troubles can be caused by a failure in one of the oscilloscope power supplies. This should be considered any time the instrument fails to operate properly. The oscilloscope manual contains information for checking power supply voltages.

If you suspect that a tube or transistor in the instrument is defective, replace it with good tube or transistor of the same type. Then check to see if the trouble symptom is eliminated. If not, the original tube or transistor is probably good, and should be returned to its original socket.

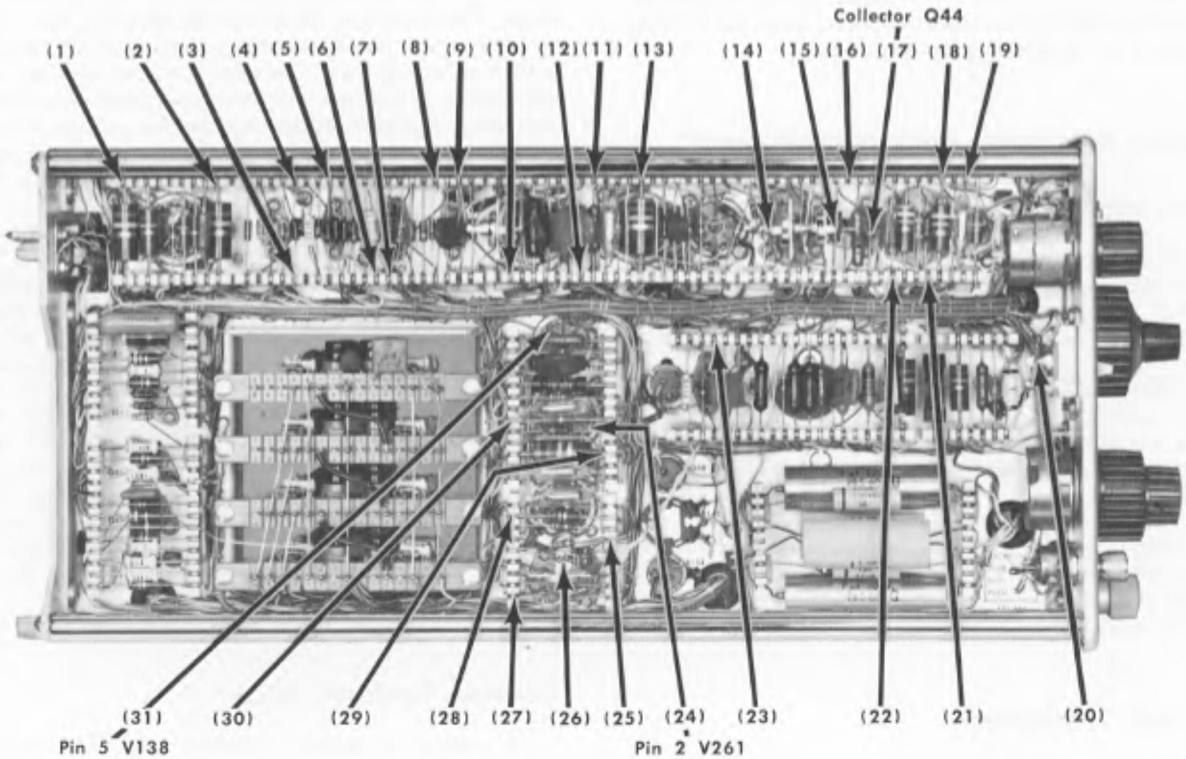


Fig. 5-2. Type 3B2 test point locations.

SECTION 6

CALIBRATION

Introduction

This section contains a series of performance checks in addition to calibration adjustments. If the Type 3B2 fails a performance check, the trouble should be corrected before continuing with this procedure.

PERFORMANCE CHECKS

Insert the Type 3B2 into the center plug-in compartment of the Type 567 Readout Oscilloscope. Use a Type 3A2 in the left-hand compartment and the Type 6R1 Digital Unit in the right-hand compartment.

Connect a jumper cable from the 0.5-volt calibrator output to the Channel 1 input, and adjust the controls for a stable display (internally triggered) of several cycles of the calibrator signal.

1. Triggering Controls

a. Turn the LEVEL control throughout its range and check for stable triggering. Set to FREE RUN (detent position); the sweep should free run.

b. Center the LEVEL control. The display should remain stable in all positions of the COUPLING switch.

c. Set the SLOPE switch to be opposite position. The start of the display should invert.

d. Set the SOURCE switch to LINE; the display should remain triggered. Set the SOURCE switch to EXT, and connect another cable from the 0.5-volt calibrator output to the EXT TRIG IN connector. The display should remain stable.

2. TIME/DIV Switch

a. Set the LEVEL control to FREE RUN (detent position). Turn the TIME/DIV switch to each of its 18 positions, and check for a display at each position.

3. DELAY TIME and Multiplier

a. Set the SWEEP DELAY switch to IN.

b. Turn the DELAY TIME switch to each position, and check for a display on the crt.

c. Set the DELAY TIME switch to 10 ms, and turn the multiplier dial. The display should move across the crt.

4. Clock, Decimal Point, and Unit of Measure

a. Set TIME/DIV to 1 mSEC, SWEEP DELAY to OUT, and DIGITAL RESOLUTION to 10 μSEC.

b. Set the Type 6R1 MODE switch to TIME, and use the manual Timing Start and Stop controls to measure 8 major divisions on the graticule. The readout should be about 08.00MS

c. Turn the TIME/DIV and DIGITAL RESOLUTION switches to each of the following positions and note the correct readout.

TIME/DIV	DIGITAL RESOLUTION	Readout (Approx.)
1 SEC	10 mS	08.00S
.5 SEC	10 mS	04.00S
.2 SEC	10 mS	01.60S
.1 SEC	1 mS	0800.MS
50 mSEC	1 mS	0400.MS
20 mSEC	1 mS	0160.MS
10 mSEC	0.1 mS	080.0MS
5 mSEC	0.1 mS	040.0MS
2 mSEC	0.1 mS	016.0MS
1 mSEC	10 μS	08.00MS
.5 mSEC	10 μS	04.00MS
.2 mSEC	10 μS	01.60MS
.1 mSEC	1 μS	0800.μS
50 μSEC	1 μS	0400.μS
20 μSEC	1 μS	0160.μS
10 μSEC	1 μS	0080.μS*
5 μSEC	1 μS	0040.μS*
2 μSEC	1 μS	0016.μS*

***The Type 6R1 may not follow with the TIME/DIV switch set to 10, 5, or 2 μSEC.**

This completes the performance checks.

CALIBRATION

The checks and adjustments described following should be made at regular intervals. Although a check may show that a circuit is within tolerance, it is good practice to reset each adjustment to its optimum position. See Fig. 6-1 for the location of the internal adjustments.

Equipment Required

1. Time-mark generator with markers at 1, 5, and 10 multiples from 1 μsec to 1 sec. Tektronix Type 180A Time-Mark Generator recommended.

2. Test oscilloscope with at least a 1-mc bandwidth and 0.05-volt vertical sensitivity.

3. Two Tektronix 560-Series plug-in extensions, Tektronix Part No. 013-034.

4. Insulated screwdriver, such as Jaco No. 125, Tektronix Part No. 003-000.

Insert the two plug-in extensions into the center compartment of the Type 567, and plug the Type 3B2 into the extensions. Turn the instrument on and allow at least 5 minutes for warmup.

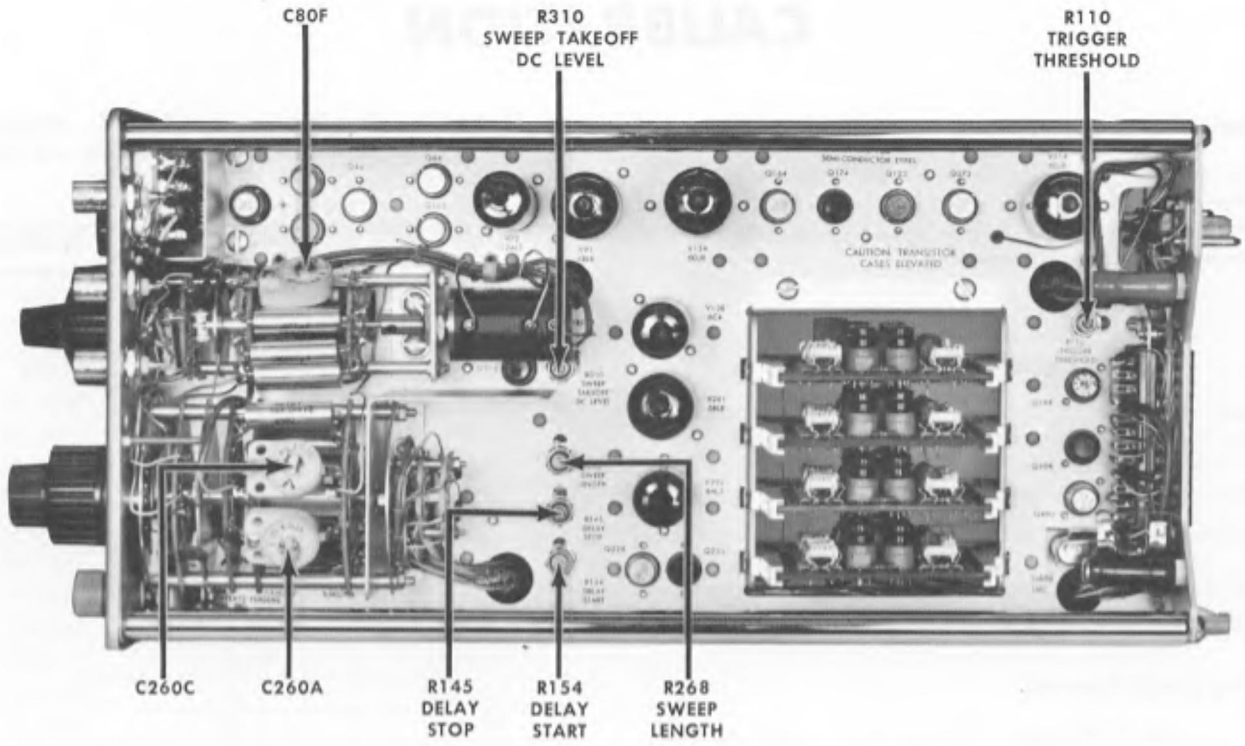


Fig. 6-1. Type 3B2 internal adjustment locations.

Preset the front-panel controls as follows

POSITION	Midrange
SWEEP DELAY	OUT
TIME/DIV	1 mSEC
DELAY TIME	1 ms
Multiplier Dial	0.50
TRIGGER:	
LEVEL	FREE RUN
COUPLING	AC SLOW
SLOPE	+
SOURCE	INT
DIGITAL RESOLUTION	.1 mS

Adjustment Procedure

1. Trigger Threshold

With the trigger LEVEL set at FREE RUN (detent position), adjust the TRIGGER THERESHOLD control (R110) until the sweep just free runs steadily. Turn the LEVEL control out of the FREE RUN position; the trace should disappear.

2. Sweep Calibration

Connect the time-mark generator to the Channel 1 input, and display 1-msec time marks. Set the Type 3B2 TIME/DIV switch to 1 mSEC and adjust the SWEEP CAL control (front-panel screwdriver adjustment) for 1 marker per major graticule division.

3. Sweep Length

With the same setup as in step 2, set the SWEEP LENGTH control (R268) for 10.5 major divisions of display. Use the POSITION control to move the right-hand time mark 1 division to the left. The tail of the display should be ½ division to the right of this mark.

4. Normal Sweep Rates

Use the settings of the Type 3B2 TIME/DIV switch and the time marks listed in Table 6-1, and make the adjustments and checks indicated.

NOTE

The timing error for all sweep rates must be within 3% (1.2 minor graticule divisions). Timing checks are made over 8 major graticule divisions between the 1st and 9th division lines.

TABLE 6-1

TIME/DIV Switch Setting	Time Marks	Adjust/Check	Marks/Div
20 μSEC	10 μsec	C260C	2
10 μSEC	10 μsec	check	1
5 μSEC	5 μsec	check	1
2 μSEC	1 μsec	C260A	2
50 μSEC	50 μsec	check	1
.1 mSEC	100 μsec	check	1
.2 mSEC	100 μsec	check	2
.5 mSEC	500 μsec	check	1
1 mSEC	1 msec	check	1
2 mSEC	1 msec	check	2
5 mSEC	5 msec	check	1
10 mSEC	10 msec	check	1
20 mSEC	10 msec	check	2
50 mSEC	50 msec	check	1
.1 SEC	100 msec	check	1
.2 SEC	100 msec	check	2
.5 SEC	500 msec	check	1
1 SEC	1 sec	check	1

5. Delay Start and Stop

Set the TIME/DIV switch to .2 mSEC and apply 1-msec markers from the time-mark generator. Use the POSITION control to set the middle marker on the graticule vertical centerline. Set the DELAY TIME switch to 1 ms, the multiplier dial to 1.00 and the SWEEP DELAY switch to IN. Adjust the DELAY START control (R154) so the middle marker is on the graticule centerline. Turn the multiplier dial to 9.00, and adjust the DELAY STOP control (R145) so the 9th marker is on the graticule centerline. Due to interaction of these controls, it may be necessary to repeat this step several times until the 1st and 9th time marks are exactly on the centerline.

6. 10-μsec Delay Sweep Rate

Set the TIME/DIV switch to 2 μSEC, and apply 10-μsec time marks. Set the DELAY TIME switch to 10 μs, and the multiplier dial to 1.00. Use the POSITION control to position the middle time mark on the graticule centerline. Turn the multiplier dial to 9.00 and adjust C80F so the time mark is exactly on the graticule centerline.

7. Delay Sweep Rates

Use the TIME/DIV switch settings and time marks listed in Table 6-2. For each setting of the TIME/DIV switch, set the multiplier dial to 1.00, and position the time mark on the graticule centerline. Then check each major division (2.00, 3.00, etc.) for time-mark alignment between 1.00 and 9.00. The timing error should not exceed 1% (±4 minor divisions on multiplier dial).

TABLE 6-2

TIME/DIV Switch Setting	Time Marks	DELAY TIME Switch Setting
20 μSEC	100 μsec	.1 ms
2 mSEC	10 msec	10 ms
20 mSEC	100 msec	.1 s
.2 SEC	1 sec	1 s

8. Sweep Takeoff Dc Level

Turn the trigger LEVEL control fully counterclockwise (no sweep). Connect the dc voltmeter to the pin of the SWEEP TAKEOFF DC LEVEL control (R310) to which the coaxial lead is soldered. Adjust the SWEEP TAKEOFF DC LEVEL control for zero volts.

NOTES

SECTION 7
PARTS LIST AND SCHEMATICS

PARTS ORDERING INFORMATION

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

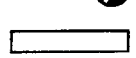
Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information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

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

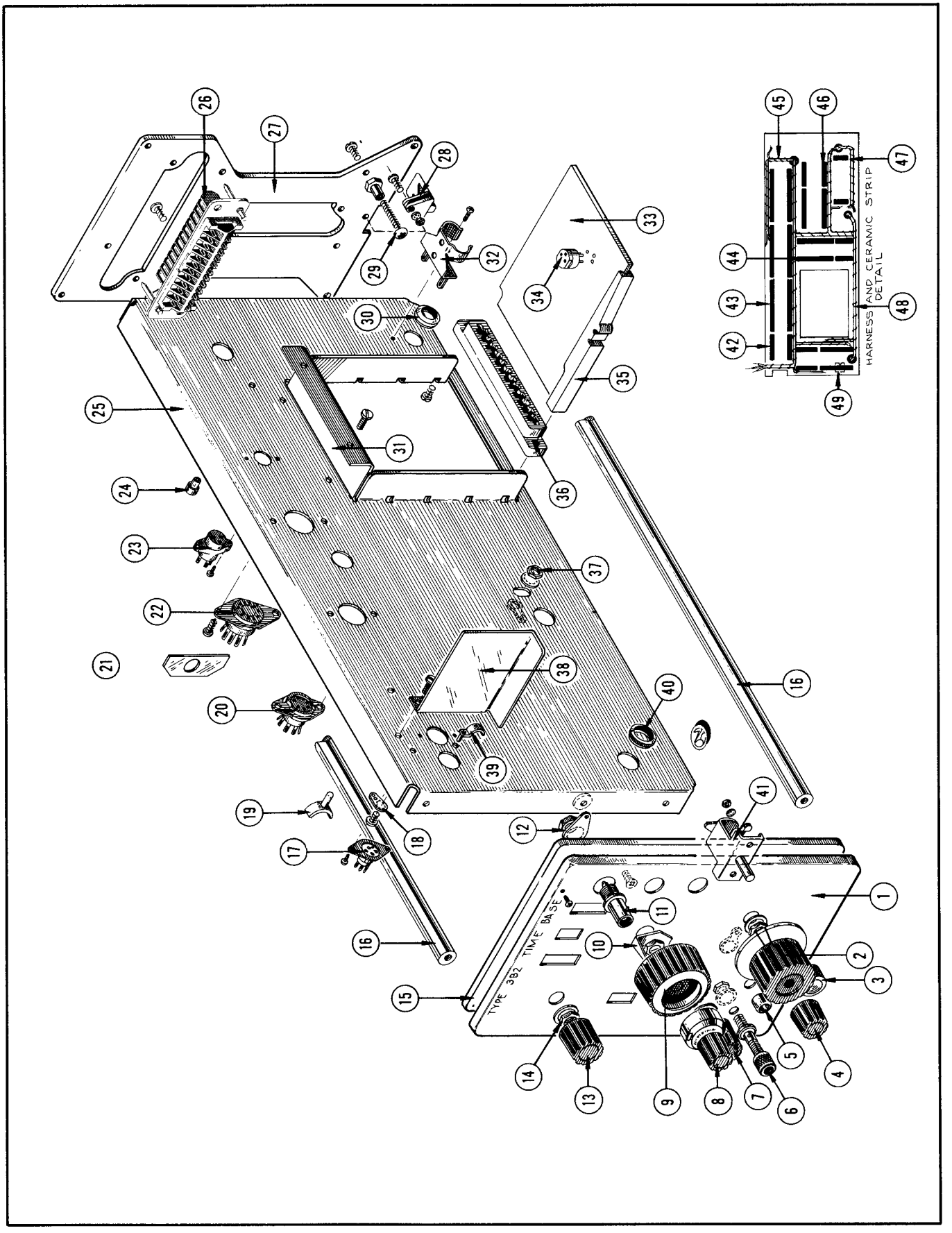
ABBREVIATIONS AND SYMBOLS

a or amp	amperes
BHS	binding head steel
C	carbon
cer	ceramic
cm	centimeter
comp	composition
cps	cycles per second
crt	cathode-ray tube
CSK	counter sunk
dia	diameter
div	division
EMC	electrolytic, metal cased
EMT	electroyltic, metal tubular
ext	external
f	farad
F & I	focus and intensity
FHS	flat head steel
Fil HS	fillister head steel
g or G	giga, or 10^9
Ge	germanium
GMV	guaranteed minimum value
h	henry
hex	hexagonal
HHS	hex head steel
HSS	hex socket steel
HV	high voltage
ID	inside diameter
incd	incandescent
int	internal
k or K	kilohms or kilo (10^3)
kc	kilocycle
m	milli, or 10^{-3}
mc	megacycle
mm	millimeter
meg or M	megohms or mega (10^6)
met.	metal
μ	micro, or 10^{-6}
n	nano, or 10^{-9}
Ω	ohm
OD	outside diameter
OHS	oval head steel
p	pico, or 10^{-12}
PHS	pan head steel
piv	peak inverse voltage
plstc	plastic
PMC	paper, metal cased
poly	polystyrene
Prec	precision
PT	paper tubular
PTM	paper or plastic, tubular, molded
RHS	round head steel
rms	root mean square
sec	second
Si	silicon
S/N	serial number
t or T	tera, or 10^{12}
TD	toroid
THS	truss head steel
tub.	tubular
v or V	volt
Var	variable
w	watt
w/	with
w/o	without
WW	wire-wound

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number.
000X	Part removed after this serial number.
*000-000	Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, or reworked or checked components.
Use 000-000	Part number indicated is direct replacement.
	Internal screwdriver adjustment.
	Front-panel adjustment or connector.

EXPLODED VIEW



EXPLODED VIEW

REF. NO.	PART NO.	SERIAL NO. EFF.	SERIAL NO. DISC.	QTY.	DESCRIPTION
1	333-735			1	PANEL, front
	.....			.	Mounting Hardware: (not included)
	213-088			1	SCREW, thread forming, 4-40 x 1/4 inch PHS phillips
2	366-208			1	KNOB, TIME/DIV., large charcoal w/skirt
	.....			.	Includes:
	213-004			1	SCREW, set, 6-32 x 3/16 inch HSS
3	366-109			1	KNOB, plug-in securing
	.....			.	Includes:
	213-005			1	SCREW, set, 8-32 x 1/8 inch HSS
4	366-081			1	KNOB, DIGITAL RESOLUTION, small red
	.....			.	Includes:
	213-004			1	SCREW, set, 6-32 x 3/16 inch HSS
5	358-075			1	BUSHING, pot mounting
6	129-035			1	POST, binding, assembly
	.....			.	Consisting of:
	355-507			1	STEM, adapter
	200-103			1	CAP
	210-455			1	NUT, hex, 1/4-28 x 3/8 inch
	210-046			1	LOCKWASHER, internal, .400 OD x .261 inch ID
7	366-148			1	KNOB, POSITION, small charcoal
	.....			.	Includes:
	213-004			1	SCREW, set, 6-32 x 3/16 inch HSS
8	331-101			1	DIAL, w/charcoal knob
9	366-217			1	KNOB, DELAY TIME, large charcoal
	.....			.	Includes:
	213-004			2	SCREW, set, 6-32 x 3/16 inch HSS
10	210-258			1	LUG, pot index
11	131-106			3	CONNECTOR, chassis mount, BNC
	.....			.	Mounting Hardware For Each: (not included)
12	210-413			1	NUT, hex, 3/8-32 x 1/2 inch
	210-255			1	LUG, solder, 3/8 inch
13	366-148			1	KNOB, LEVEL, small charcoal
	.....			1	Includes:
	213-004			1	SCREW, set, 6-32 x 3/16 inch HSS
14	.....			.	Mounting Hardware For Each Pot:
	210-413			1	NUT, hex, 3/8-32 x 1/2 inch
	210-840			1	WASHER, .390 ID x 9/16 inch OD
	210-013			1	LOCKWASHER, internal, 3/8 x 11/16 inch
15	387-732			1	PLATE, front subpanel
16	384-566	100	159	4	ROD, frame, spacing
	384-615	160		4	ROD, frame, spacing
	.....			.	Mounting Hardware For Each: (not included)
	212-044			1	SCREW, 8-32 x 1/2 inch RHS phillips
17	136-101			1	SOCKET, 5 pin tube
	.....			.	Mounting Hardware: (not included)
	213-055			2	SCREW, thread cutting, 2-56 x 3/16 inch PHS phillips
18	210-201			7	LUG, solder, SE 4
	.....			.	Mounting Hardware For Each: (not included)
	213-044			1	SCREW, thread cutting, 5-32 x 3/16 inch PHS phillips
19	426-121			1	MOUNT, toroid, nylon
	.....			.	Mounting Hardware: (not included)
	361-007			1	SPACER, nylon, .063 inch

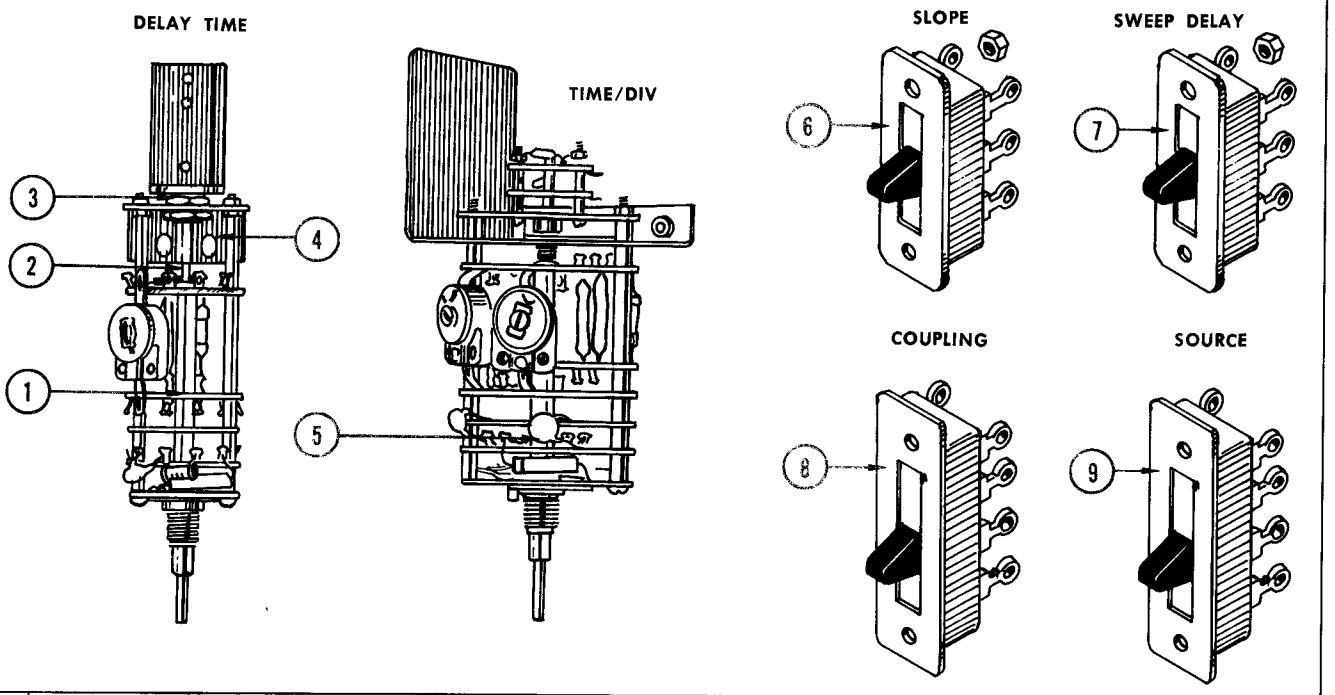
EXPLODED VIEW *(Cont'd.)*

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
20	136-0008-00			3	SOCKET, STM7G
	- - - - - -			-	Mounting Hardware For Each: (not included)
	213-0044-00			2	SCREW, thread cutting, 5-32 x 3/16 inch PHS phillips
21	441-0534-00			4	CHASSIS, tunnel diode
22	136-0015-00			4	SOCKET, STM9G
	- - - - - -			-	Mounting Hardware For Each: (not included)
	213-0044-00			2	SCREW, thread cutting, 5-32 x 3/16 inch PHS phillips
23	136-0161-00	100	209	15	SOCKET, 3 pin transistor
	136-0181-00	210		15	SOCKET, 3 pin transistor
	- - - - - -			-	Mounting Hardware For Each: (not included)
	213-0113-00	100	209	2	SCREW, thread cutting, 2-56 x 5/16 inch PHS phillips
	354-0234-00	210		1	RING, locking, transistor socket
24	348-0031-00			3	GROMMET, poly snap-in
25	441-0466-00			1	CHASSIS
	- - - - - -			-	Mounting Hardware: (not included)
	211-0538-00			3	SCREW, 6-32 x 5/16 inch FHS phillips
	211-0504-00			3	SCREW, 6-32 x 1/4 inch BHS
26	131-0149-00			2	CONNECTOR, chassis mounted, 24 contact
	- - - - - -			-	Mounting Hardware For Horizontal Connector:
	211-0008-00			2	SCREW, 4-40 x 1/4 inch BHS
	210-0201-00			2	LUG, solder, SE 4
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
	- - - - - -			-	Mounting Hardware For Vertical Connector:
	211-0016-00			2	SCREW, 4-40 x 5/8 inch RHS
	166-0032-00			2	TUBE, spacer, 5/16 inch
	210-0201-00			1	LUG, solder, SE 4
	210-0004-00			1	LOCKWASHER, internal, #4
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
27	387-0595-00			1	PLATE, rear frame
28	351-0037-00			1	GUIDE, plug-in, delrin
	- - - - - -			-	Mounting Hardware: (not included)
	211-0013-00			1	SCREW, 4-40 x 3/8 inch RHS
	210-0004-00			1	LOCKWASHER, internal, #4
	210-0406-00			1	NUT, hex, 4-40 x 3/16 inch
29	- - - - - -			-	Mounting Hardware For Each Resistor:
	211-0544-00			1	SCREW, 6-32 x 3/4 inch THS phillips
	210-0478-00			1	NUT, hex, 5-10 watt resistor
	211-0507-00			1	SCREW, 6-32 x 5/16 inch BHS
30	348-0004-00			1	GROMMET, 3/8 inch
31	337-0561-00			1	SHIELD, counter
	- - - - - -			-	Mounting Hardware: (not included)
	211-0504-00			2	SCREW, 6-32 x 1/4 inch BHS
32	136-0153-00			1	SOCKET, crystal
	- - - - - -			-	Mounting Hardware: (not included)
	211-0079-00			1	SCREW, 2-56 x 3/16 inch PHS phillips
	210-0001-00			1	LOCKWASHER, internal, #2
	210-0405-00			1	NUT, hex, 2-56 x 3/16 inch
33	670-0028-00			1	BOARD, counter
	- - - - - -			-	Includes:
34	136-0183-00			8	SOCKET, transistor
35	351-0059-00			8	GUIDE, circuit board
	- - - - - -			-	Mounting Hardware For Each: (not included)
	211-0504-00			1	SCREW, 6-32 x 1/4 inch BHS

EXPLODED VIEW *(Cont'd.)*

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
36	136-0148-00			4	SOCKET, 15 pin circuit board
	- - - - - -			-	Mounting Hardware For Each: (not included)
	211-0014-00			2	SCREW, 4-40 x 1/2 inch BHS
37	- - - - - -			-	Mounting Hardware For Miniature Pots:
	210-0583-00			5	NUT, hex, 1/4-32 x 5/16 inch
	210-0046-00			4	LOCKWASHER, internal, .400 OD x .261 inch ID
	210-0223-00			4	LUG, solder, 1/4 inch
38	337-0556-00			1	SHIELD, delay time
	- - - - - -			-	Mounting Hardware: (not included)
	211-0504-00			2	SCREW, 6-32 x 1/4 inch BHS
39	343-0088-00			2	CLAMP, cable, 1/8 inch
40	348-0005-00			5	GROMMET, 1/2 inch
41	214-0052-00			1	FASTENER, pawl right w/stop
	- - - - - -			-	Mounting Hardware: (not included)
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
	210-0004-00			2	LOCKWASHER, internal, #4
42	124-0148-00			8	STRIP, ceramic, 7/16 inch x 9 notches
	- - - - - -			-	Each includes:
	355-0046-00			2	STUD, nylon
	- - - - - -			-	Mounting Hardware For Each: (not included)
	361-0009-00			2	SPACER, nylon, .313 inch
43	124-0145-00			8	STRIP, ceramic, 7/16 inch x 20 notches
	- - - - - -			-	Each includes:
	355-0046-00			2	STUD, nylon
	- - - - - -			-	Mounting Hardware For Each: (not included)
	361-0009-00			2	SPACER, nylon, .313 inch
44	124-0147-00			4	STRIP, ceramic, 7/16 inch x 13 notches
	- - - - - -			-	Each Includes:
	355-0046-00			2	STUD, nylon
	- - - - - -			-	Mounting Hardware For Each: (not included)
	361-0009-00			2	SPACER, nylon, .313 inch
45	179-0700-00			1	CABLE HARNESS, chassis
46	124-0149-00			2	STRIP, ceramic, 7/16 inch x 7 notches
	- - - - - -			-	Each Includes:
	355-0046-00			2	STUD, nylon
	- - - - - -			-	Mounting Hardware For Each: (not included)
	361-0009-00			2	SPACER, nylon, .313 inch
47	179-0702-00			1	CABLE HARNESS, delay time
48	179-0701-00			1	CABLE HARNESS, time/div
49	124-0118-00			1	STRIP, ceramic, 7/16 inch x 1 notch
	- - - - - -			-	Includes:
	355-0046-00			1	STUD, nylon
	- - - - - -			-	Mounting Hardware: (not included)
	361-0007-00			1	SPACER, nylon, .063 inch
					STANDARD ACCESSORIES
	070-0355-00			2	MANUAL, instruction (not shown)

SWITCHES



REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
1	262-0540-00			1	SWITCH, DELAY TIME, wired
	- - - - - -			-	Includes:
	260-0499-00			1	SWITCH, unwired
2	384-0247-00			1	ROD, extension
	213-0075-00			2	SCREW, set, 4-40 x 3/32 inch
3	210-0413-00			2	NUT, hex, 3/8-32 x 1/2 inch
4	406-0883-00			1	BRACKET, pot
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
	210-0004-00			2	LOCKWASHER, internal, #4
	- - - - - -			-	Mounting Hardware: (not included)
	210-0413-00			1	NUT, hex, 3/8-32 x 1/2 inch
	210-0012-00			1	LOCKWASHER, internal, 3/8 x 1/2 inch
	211-0504-00			2	SCREW, 6-32 x 1/4 inch BHS
	210-0803-00			2	WASHER, 6L x 3/8 inch
5	262-0541-00			1	SWITCH, TIME/DIV., wired
	- - - - - -			-	Includes:
	260-0498-00			1	SWITCH, unwired
	- - - - - -			-	Mounting Hardware: (not included)
	210-0413-00			1	NUT, hex, 3/8-32 x 1/2 inch
	210-0840-00			1	WASHER, .390 ID x 9/16 inch OD
	210-0012-00			1	LOCKWASHER, internal, 3/8 x 1/2 inch
6	260-0447-00			1	SWITCH, SLOPE, slide
	- - - - - -			-	Mounting Hardware: (not included)
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
7	260-0447-00			1	SWITCH, SWEEP DELAY, slide
	- - - - - -			-	Mounting Hardware: (not included)
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
8	260-0450-00			1	SWITCH, COUPLING, slide
	- - - - - -			-	Mounting Hardware: (not included)
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
9	260-0450-00			1	SWITCH, SOURCE, slide
	- - - - - -			-	Mounting Hardware: (not included)
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch

ELECTRICAL PARTS

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Description			S/N Range
		Bulbs			
B10	150-027	Neon, NE-23			
B93	150-027	Neon, NE-23			
B262	150-027	Neon, NE-23			
B263	150-027	Neon, NE-23			
B265	150-027	Neon, NE-23			
		Capacitors			

Tolerance ±20% unless otherwise indicated.

Tolerance of all electrolytic capacitors as follows (with exceptions):

3V — 50V = —10%, +250%
51V — 350V = —10%, +100%
351V — 450V = —10%, +50%

C4	283-068	.01 μf	Cer		500 v	
C5	281-523	100 pf	Cer		350 v	
C9	281-578	18 pf	Cer		500 v	5%
C35	283-566	100 pf	Mica		500 v	5%
C37	283-026	.2 μf	Cer		25 v	
C39	281-536	.001 μf	Cer		500 v	10%
C55	283-547	625 pf	Mica		500 v	10%
C56	283-026	.2 μf	Cer		25 v	
C80A	*295-067†	1 μf	Timing Series			
C80B		.1 μf				
C80C		.01 μf				
C80D		.001 μf				
C80E	281-574	82 pf	Cer		500 v	10%
C80F	281-010	4.5-25 pf	Cer	Var		
C92	283-003	.01 μf	Cer		150 v	
C100A	285-576	1 μf	PTM		100 v	10%
C100B	285-622	.1 μf	PTM		100 v	
C100C	285-569	.01 μf	PTM		200 v	
C100D	283-065	.001 μf	Cer		100 v	5%
C100E	281-580	470 pf	Cer		500 v	10%
C115	Use 281-0605-00	200 pf	Cer		500 v	
C125	281-524	150 pf	Cer		500 v	
C134	283-003	.01 μf	Cer		150 v	
C135	283-547	625 pf	Mica		500 v	10%
C137	Use 285-0622-00	.1 μf	PTM		100 v	
C142	Use 285-0622-00	.1 μf	PTM		100 v	
C147	283-057	.1 μf	Cer		200 v	
C152	283-059	1 μf	Cer		25 v	

†C80A,B,C,D furnished as a unit with C260E,F,G,H.

Capacitors *(Cont'd.)*

Ckt. No.	Tektronix Part No.	Description				S/N Range
C161	283-001	.005 μf	Cer		500 v	
C169	283-003	.01 μf	Cer		150 v	
C175	283-000	.001 μf	Cer		500 v	
C182	281-517	39 pf	Cer		500 v	10%
C183	283-003	.01 μf	Cer		150 v	
C189	283-003	.01 μf	Cer		150 v	
C214	281-524	150 pf	Cer		500 v	
C215	283-547	625 pf	Mica		500 v	10%
C216	283-026	.2 μf	Cer		25 v	
C236	281-525	470 pf	Cer		500 v	
C248	281-516	39 pf	Cer		500 v	10%
C260A	281-010	4.5-25 pf	Cer	Var		
C260B	281-505	12 pf	Cer		500 v	10%
C260C	281-010	4.5-25 pf	Cer	Var		
C260D	281-574	82 pf	Cer		500 v	10%
C260E	*295-067†	.001 μf	Timing Series			
C260F		.01 μf				
C260G		.1 μf				
C260H		1 μf				
C265	283-000	.001 μf	Cer		500 v	
C270A	285-569	.01 μf	PTM		200 v	
C270B	285-622	.1 μf	PTM		100 v	
C270C	285-576	1 μf	PTM		100 v	10%
C270D	283-065	.001 μf	Cer		100 v	5%
C270E	283-051	.0033 μf	Cer		100 v	5%
C289	281-536	.001 μf	Cer		500 v	10%
C296	283-002	.01 μf	Cer		500 v	
C320	283-059	1 μf	Cer		25 v	
C482	283-059	1 μf	Cer		25 v	
C483	283-026	.2 μf	Cer		25 v	
C485	281-549	68 pf	Cer		500 v	10%
C486	281-536	.001 μf	Cer		500 v	10%
C492	281-516	39 pf	Cer		500 v	10%

Diodes

D15	*152-061	Silicon	Tek Spec
D24	*152-075	Germanium	Tek Spec
D34	*152-075	Germanium	Tek Spec
D35	152-081	Tunnel TD-2 2.2 ma	
D52	*152-075	Germanium	Tek Spec

†C260E,F,G,H furnished as a unit with C80A,B,C,D.

Diodes *(Cont'd.)*

Ckt. No.	Tektronix Part No.	Description	S/N Range
D55	152-093	Tunnel 1N3716 4.7 ma	
D92	152-091	Zener 1N982 75 v	
D95	*152-061	Silicon Tek Spec	
D96	*152-061	Silicon Tek Spec	
D97	*152-061	Silicon Tek Spec	
D98	*152-061	Silicon Tek Spec	
D99	*152-061	Silicon Tek Spec	
D112	*152-075	Germanium Tek Spec	
D114	*152-075	Germanium Tek Spec	
D116	*152-075	Germanium Tek Spec	
D135	152-081	Tunnel TD-2 2.2 ma	
D215	152-093	Tunnel 1N3716 4.7 ma	
D244	*152-061	Silicon Tek Spec	
D245	*152-061	Silicon Tek Spec	
D246	*152-075	Germanium Tek Spec	
D270	*152-061	Silicon Tek Spec	
D271	*152-061	Silicon Tek Spec	
D273	*152-075	Germanium Tek Spec	
D285	*152-107	Silicon Replaceable by 1N647	
D286	*152-107	Silicon Replaceable by 1N647	
D287	*152-107	Silicon Replaceable by 1N647	
D289	152-025	Germanium 1N634	
D332	152-031	Zener 1N718A 15 v	

Inductors

L35	*108-146	5 μh	

Transistors

Q24	151-084	2N1225	
Q34	151-084	2N1225	
Q44	*151-062	Selected from TIN101	
Q64	*151-062	Selected from TIN101	
Q103	151-069	2N1304	
Q123	*151-087	Selected from 2N1131	
Q164	*151-062	Selected from TIN101	
Q174	*151-054	Selected from 2N1754	
Q214	*151-054	Selected from 2N1754	
Q224	*151-062	Selected from TIN101	
Q233	151-076	2N2048	
Q244	*151-059	Selected from 2N1893	
Q273	151-071	2N1305	
Q490	151-069	2N1304	
Q494	*151-054	Selected from 2N1754	

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

Ckt. No.	Tektronix Part No.		Description				S/N Range
R9	301-105	1 meg	½ w			5%	
R10	301-275	2.7 meg	½ w			5%	
R12	316-101	100 Ω	¼ w				
R14	303-243	24 k	1 w			5%	
R16	301-623	62 k	½ w			5%	
R17	315-103	10 k	¼ w			5%	
R23†	311-398	5 k		Var		LEVEL	
R29	303-393	39 k	1 w			5%	
R35	309-345	225 Ω	½ w		Prec	1%	
R37	316-101	100 Ω	¼ w				
R44	302-563	56 k	½ w				
R52	315-202	2 k	¼ w			5%	
R53	302-104	100 k	½ w				100-229X
R56	316-470	47 Ω	¼ w				
R59	316-823	82 k	¼ w				
R60	316-331	330 Ω	¼ w				
R64	316-332	3.3 k	¼ w				
R67	316-332	3.3 k	¼ w				
R68	302-683	68 k	½ w				
R80A	309-399	7.5 meg	½ w		Prec	1%	
R80B	309-399	7.5 meg	½ w		Prec	1%	
R80C	309-017	1.5 meg	½ w		Prec	1%	
R89	316-101	100 Ω	¼ w				
R91	306-683	68 k	2 w				
R93	316-224	220 k	¼ w				
R94	316-101	100 Ω	¼ w				
R97	309-100	10 k	½ w		Prec	1%	
R99	310-066	18 k	1 w		Prec	1%	
R100	316-184	180 k	¼ w				
R103	316-222	2.2 k	¼ w				
R104	316-273	27 k	¼ w				
R110	311-110	100 k		Var		TRIGGER THRESHOLD	
R111	306-103	10 k	2 w				
R115	316-152	1.5 k	¼ w				
R121	309-354	45 k	½ w		Prec	1%	
R123	309-036	18 k	½ w		Prec	1%	
R124	315-102	1 k	¼ w			5%	
R125	316-104	100 k	¼ w				
R131	316-101	100 Ω	¼ w				
R134	309-118	4.23 k	½ w		Prec	1%	
R136	309-043	82 k	½ w		Prec	1%	

†Ganged with SW23. Furnished as a unit.

Resistors *(Cont'd.)*

Ckt. No.	Tektronix Part No.		Description				S/N Range
R137	309-231	16.69 k	½ w		Prec	1%	
R138	316-101	100 Ω	¼ w				
R139	309-270	3.92 k	½ w		Prec	1%	
R141	316-101	100 Ω	¼ w				
R142	316-103	10 k	¼ w				
R144	Use 305-433	43 k	2 w			5%	
R145	311-159	20 k		Var		DELAY STOP	
R147	323-273	6.81 k	½ w		Prec	1%	
R149	311-351	50 k		Var	WW	DELAY TIME	
R151	319-053	1.82 k	¼ w		Prec	1%	
R152	309-354	45 k	½ w		Prec	1%	
R154	311-329	50 k		Var		DELAY START	
R163	309-100	10 k	½ w		Prec	1%	
R164	316-222	2.2 k	¼ w				
R165	316-184	180 k	¼ w				
R171	316-105	1 meg	¼ w				
R172	316-822	8.2 k	¼ w				
R174	316-332	3.3 k	¼ w				
R175	316-332	3.3 k	¼ w				
R183	316-471	470 Ω	¼ w				
R189	316-271	270 Ω	¼ w				
R204	316-102	1 k	¼ w				
R206	316-102	1 k	¼ w				
R213	316-332	3.3 k	¼ w				
R214	316-102	1 k	¼ w				
R216	316-470	47 Ω	¼ w				
R219	316-823	82 k	¼ w				
R220	316-331	330 Ω	¼ w				
R224	316-332	3.3 k	¼ w				
R227	316-332	3.3 k	¼ w				
R228	302-683	68 k	½ w				
R233	316-182	1.8 k	¼ w				
R235	301-563	56 k	½ w			5%	
R236	301-392	3.9 k	½ w			5%	
R237	316-332	3.3 k	¼ w				
R238	315-472	4.7 k	¼ w			5%	
R244	308-213	25 k	7 w		WW	5%	
R245	303-472	4.7 k	1 w			5%	
R247	302-393	39 k	½ w				
R248	302-153	15 k	½ w				
R249	302-273	27 k	½ w				
R259	316-101	100 Ω	¼ w				
R260A	309-017	1.5 meg	½ w		Prec	1%	
R260B	309-386	1 meg	½ w		Prec	1%	
R260C	309-386	1 meg	½ w		Prec	1%	

Resistors *(Cont'd.)*

Ckt. No.	Tektronix Part No.		Description			S/N Range
R260D	309-023	2 meg	½ w		Prec 1%	
R260E	309-095	10 meg	½ w		Prec 1%	
R260F	309-095	10 meg	½ w		Prec 1%	
R261	306-683	68 k	2 w			
R263	316-105	1 meg	¼ w			
R265	316-473	47 k	¼ w			
R266	316-101	100 Ω	¼ w			
R267	301-682	6.8 k	½ w		5%	
R268	311-310	5 k		Var	SWEEP LENGTH	
R269	303-183	18 k	1 w		5%	
R272	316-473	47 k	¼ w			
R273	315-622	6.2 k	¼ w		5%	
R274	315-162	1.6 k	¼ w		5%	
R296	316-152	1.5 k	¼ w			
R301	301-153	15 k	½ w		5%	
R303	311-086	2.5 k	½ w	Var	SWEEP CAL	
R304	302-182	1.8 k	½ w			
R306	316-101	100 Ω	¼ w			
R308	315-432	4.3 k	¼ w		5%	
R309	315-105	1 meg	¼ w		5%	
R310	311-326	10 k		Var	SWEEP TAKEOFF DC LEVEL	
R314	305-563	56 k	2 w		5%	
R316	303-273	27 k	1 w		5%	
R318	323-636	50 k	½ w		Prec 1%	
R319	311-011	5 k		Var	POSITION	
R320	309-316	4.75 k	½ w		Prec 1%	
R321	316-101	100 Ω	¼ w			
R324	305-563	56 k	2 w		5%	
R330	301-151	150 Ω	½ w		5%	
R331	301-151	150 Ω	½ w		5%	
R332	308-066	4.5 k	5 w		WW 5%	
R337	301-910	91 Ω	½ w		5%	
R339	308-120	2.5 k	5 w		WW 5%	
R482	307-051	2.7 Ω	½ w		5%	
R489	302-563	56 k	½ w			
R490	302-153	15 k	½ w			
R493	302-103	10 k	½ w			
R494	302-152	1.5 k	½ w			
R496	302-391	390 Ω	½ w			

Switches

	Unwired	Wired		
SW3	260-450		Slide	SOURCE
SW5	260-450		Slide	COUPLING
SW19	260-447		Slide	SLOPE

Switches *(Cont'd.)*

Ckt. No.	Tektronix Part No. Unwired	Wired	Description		S/N Range
SW23†	311-398			FREE RUN	
SW80	260-499	*262-540	Rotary	DELAY TIME	
SW170	260-447		Slide	SWEEP DELAY	
SW260 } SW280 }	260-498	*262-541	Rotary	TIME/DIV DIGITAL RESOLUTION	

Transformers

T51	*120-277	Toroid 2-8 turn winding

Electron Tubes

V13	154-323	6CW4
V72	154-038	12AL5
V91	154-278	6BL8
V134	154-187	6DJ8
V138	154-029	6C4
V149	154-370	ZZ1000
V252	154-016	6AL5
V261	154-278	6BL8
V314	154-187	6DJ8

Crystal

Y489	158-014	1 MC

COUNTER CIRCUIT BOARD (4)

Ckt. No.	Tektronix Part No.	Description	Model No.
	Use *670-028	Complete Board	

Capacitors

C404	283-076	27 pf	Cer	500 v	10%
C407	281-518	47 pf	Cer	500 v	
C414	283-076	27 pf	Cer	500 v	10%
C417	281-518	47 pf	Cer	500 v	
C424	283-076	27 pf	Cer	500 v	10%

†Ganged with R23. Furnished as a unit.

Capacitors *(Cont'd.)*

Ckt. No.	Tektronix Part No.	Description				Model No.
C427	281-518	47 pf	Cer	500 v		
C434	283-076	27 pf	Cer	500 v	10%	
C437	281-518	47 pf	Cer	500 v		
C444	283-076	27 pf	Cer	500 v	10%	
C447	281-518	47 pf	Cer	500 v		
C454	283-076	27 pf	Cer	500 v	10%	
C457	281-518	47 pf	Cer	500 v		
C464	283-076	27 pf	Cer	500 v	10%	
C467	281-518	47 pf	Cer	500 v		
C468	281-523	100 pf	Cer	350 v		
C474	283-076	27 pf	Cer	500 v	10%	
C477	281-518	47 pf	Cer	500 v		

Diodes

D402	*152-075	Germanium	Tek Spec
D412	*152-075	Germanium	Tek Spec
D422	*152-075	Germanium	Tek Spec
D430	*152-075	Germanium	Tek Spec
D432	*152-075	Germanium	Tek Spec
D442	*152-075	Germanium	Tek Spec
D450	*152-075	Germanium	Tek Spec
D452	*152-075	Germanium	Tek Spec
D462	*152-075	Germanium	Tek Spec
D472	*152-075	Germanium	Tek Spec

Transistors

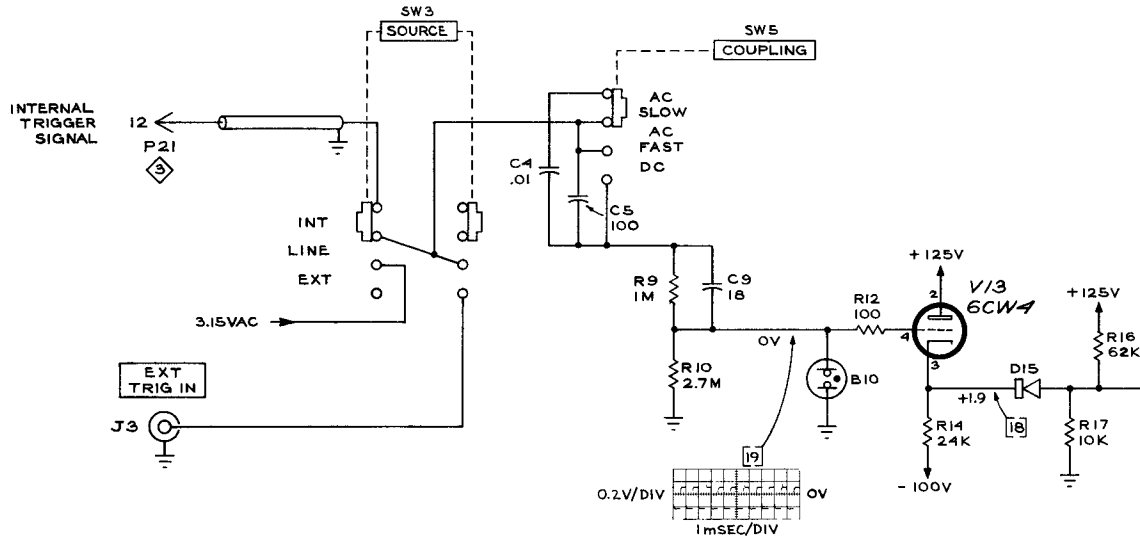
Q405	*151-054	Selected from 2N1754
Q415	*151-054	Selected from 2N1754
Q425	*151-054	Selected from 2N1754
Q435	*151-054	Selected from 2N1754
Q445	*151-054	Selected from 2N1754
Q455	*151-054	Selected from 2N1754
Q465	*151-054	Selected from 2N1754
Q475	*151-054	Selected from 2N1754

Resistors

R401	316-563	56 k	1/4 w	
R402	316-103	10 k	1/4 w	
R404	315-183	18 k	1/4 w	5%
R405	315-242	2.4 k	1/4 w	5%
R411	316-563	56 k	1/4 w	

Resistors *(Cont'd.)*

Ckt. No.	Tektronix Part No.		Description	Model No.
R412	316-103	10 k	1/4 w	
R414	315-183	18 k	1/4 w	5%
R415	315-242	2.4 k	1/4 w	5%
R421	316-563	56 k	1/4 w	
R422	316-103	10 k	1/4 w	
R424	315-183	18 k	1/4 w	5%
R425	315-242	2.4 k	1/4 w	5%
R431	316-563	56 k	1/4 w	
R432	316-103	10 k	1/4 w	
R434	315-183	18 k	1/4 w	5%
R435	315-242	2.4 k	1/4 w	5%
R441	316-563	56 k	1/4 w	
R442	316-103	10 k	1/4 w	
R444	315-183	18 k	1/4 w	5%
R445	315-242	2.4 k	1/4 w	5%
R451	316-563	56 k	1/4 w	
R452	316-103	10 k	1/4 w	
R454	315-183	18 k	1/4 w	5%
R455	315-242	2.4 k	1/4 w	5%
R461	316-563	56 k	1/4 w	
R462	316-103	10 k	1/4 w	
R464	315-183	18 k	1/4 w	5%
R465	315-202	2 k	1/4 w	5%
R466	315-391	390 Ω	1/4 w	5%
R468	316-103	10 k	1/4 w	
R469	316-473	47 k	1/4 w	
R471	316-563	56 k	1/4 w	
R472	316-103	10 k	1/4 w	
R474	315-183	18 k	1/4 w	5%
R475	315-242	2.4 k	1/4 w	5%



IMPORTANT:

ALL CIRCUIT VOLTAGES WERE OBTAINED WITH A 20,000Ω/V VOM. ALL READINGS ARE IN VOLTS.

VOLTAGE & WAVEFORM AMPLITUDE MEASUREMENTS ARE NOT ABSOLUTE. THEY MAY VARY BETWEEN INSTRUMENTS AS WELL AS WITHIN THE INSTRUMENT ITSELF DUE TO NORMAL MANUFACTURING TOLERANCES AND TRANSISTOR AND VACUUM TUBE CHARACTERISTICS.

ACTUAL PHOTOGRAPHS OF WAVEFORMS ARE SHOWN.

TEST SCOPE TRIGGERED -EXT FROM 3B2 SWEEP +GATE OUT UNLESS OTHERWISE NOTED

3B2 TRIGGERED EXT WITH 1KC, 0.5V P-P SQUARE WAVE APPLIED

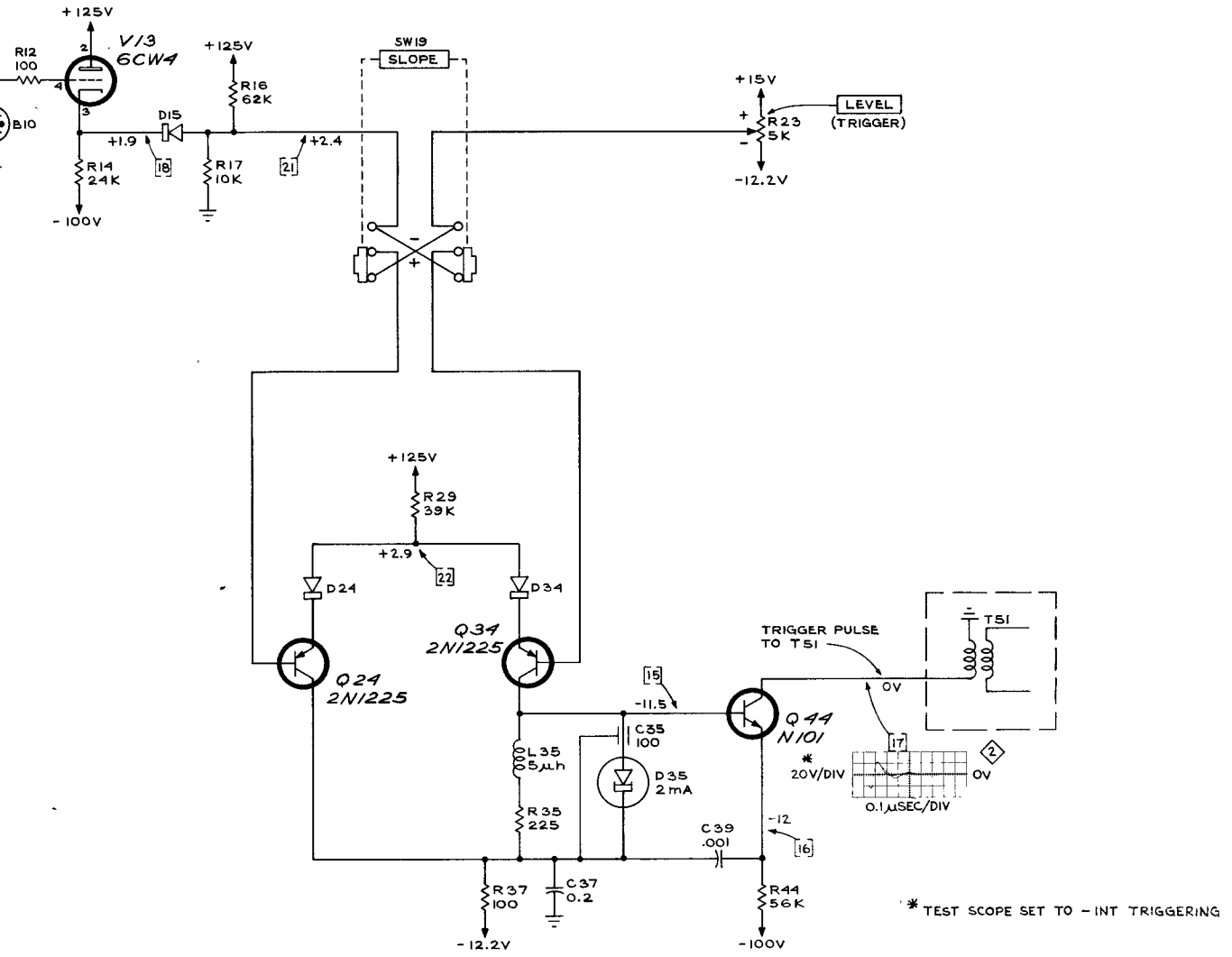
TYPE 3B2 CONTROL SETTINGS FOR ALL MEASUREMENTS ARE AS FOLLOWS:

TRIGGER	
LEVEL	Centered
COUPLING	AC SLOW
SLOPE	+
SOURCE	EXT
DELAY	
SWEEP DELAY	OUT
DELAY TIME	1mSX50
SWEEP	
TIME/DIV	.2 mS

REFERENCE DRAWINGS

2 DELAY GENERATOR

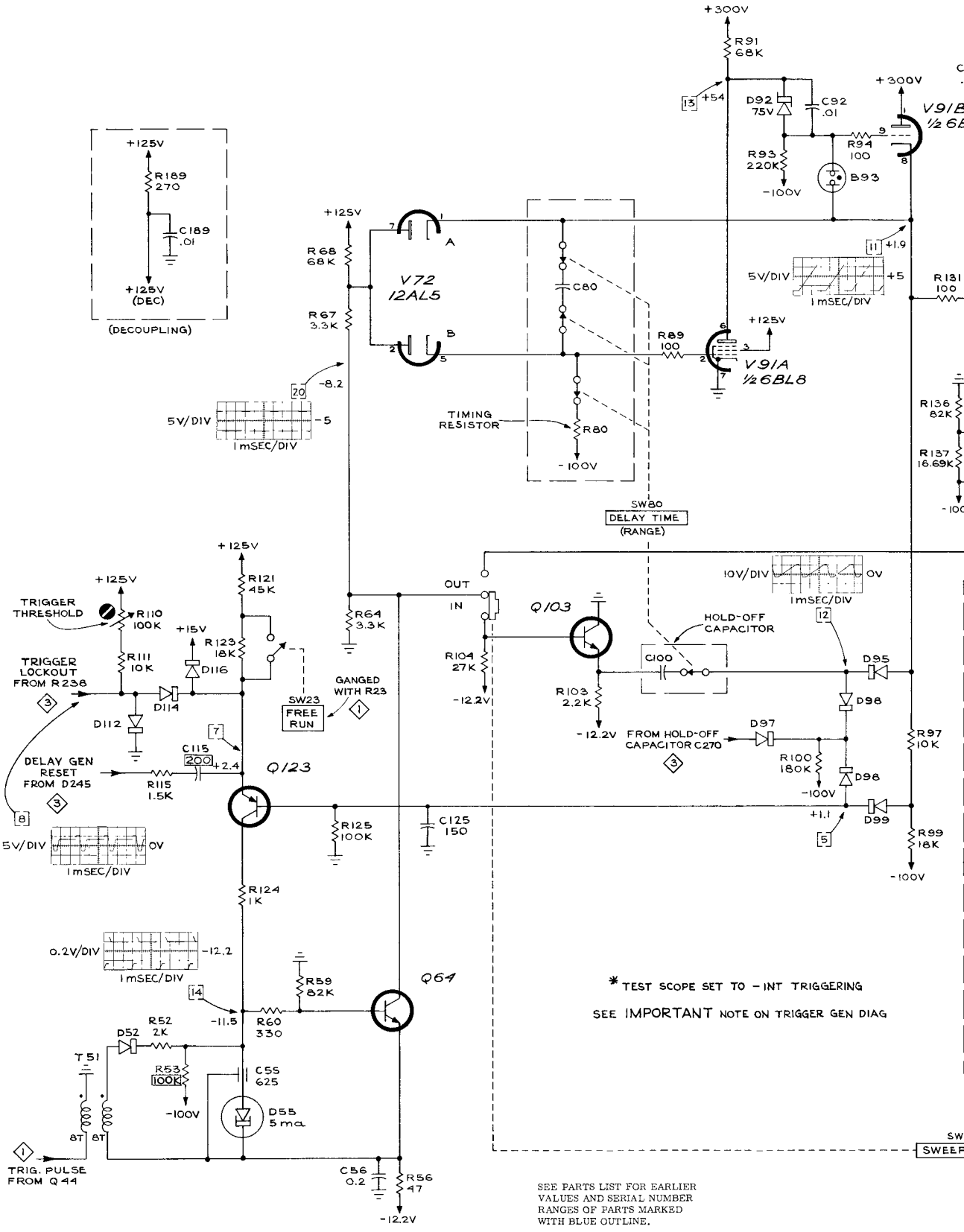
3 SWEEP GENERATOR



CMD
963

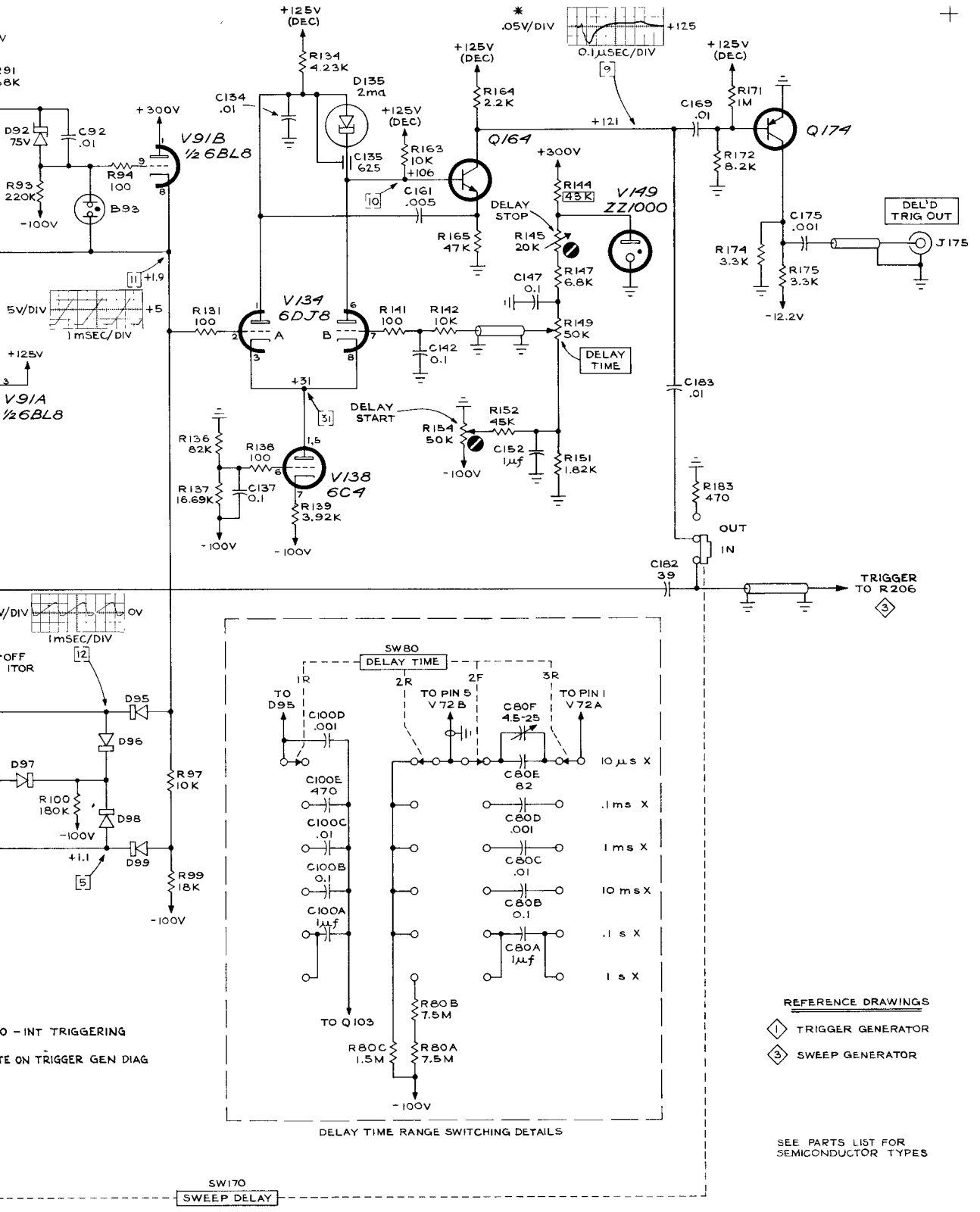
TRIGGER GENERATOR

A1



TYPE 3B2 PLUG-IN

D



CMD 665

D

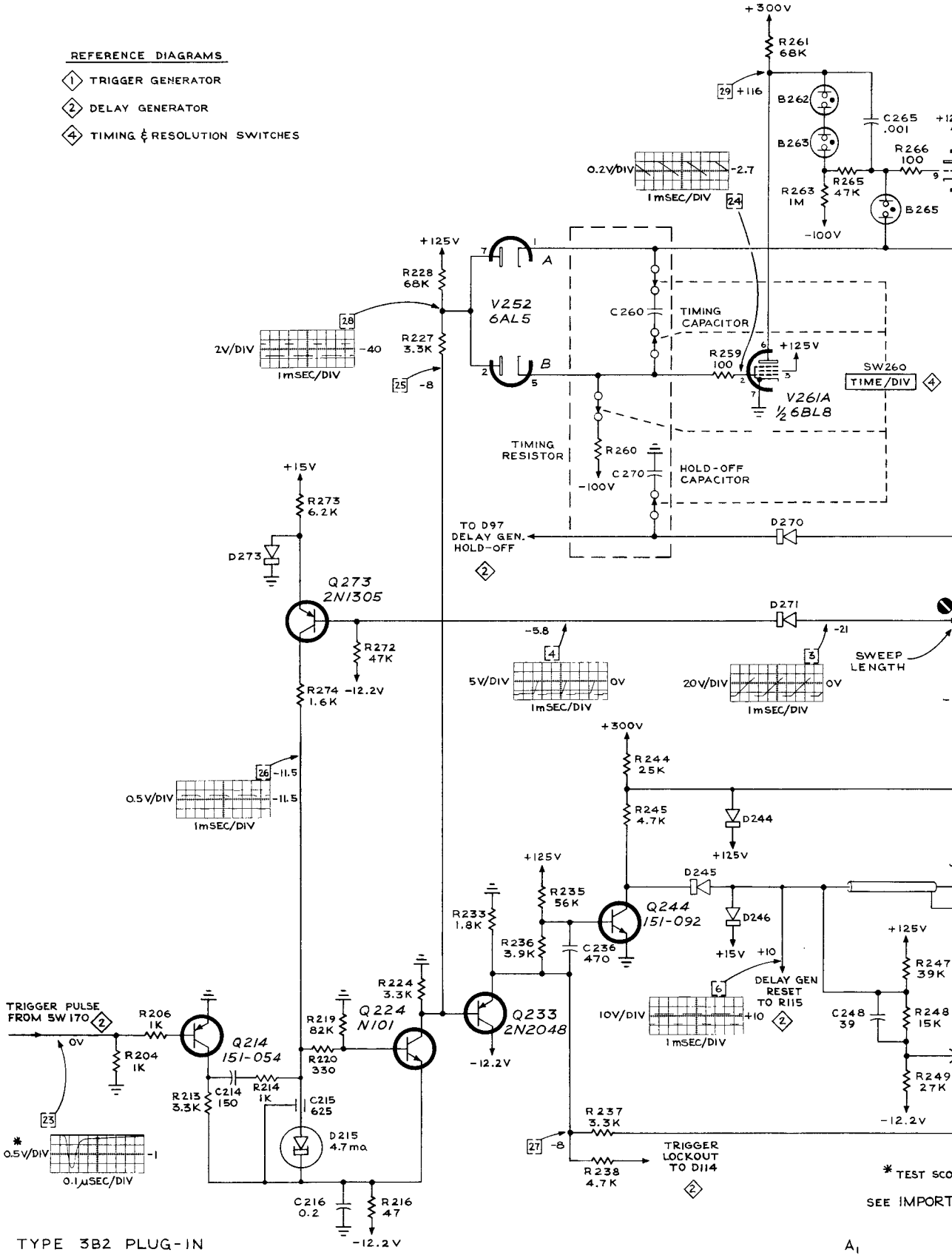
DELAY GENERATOR

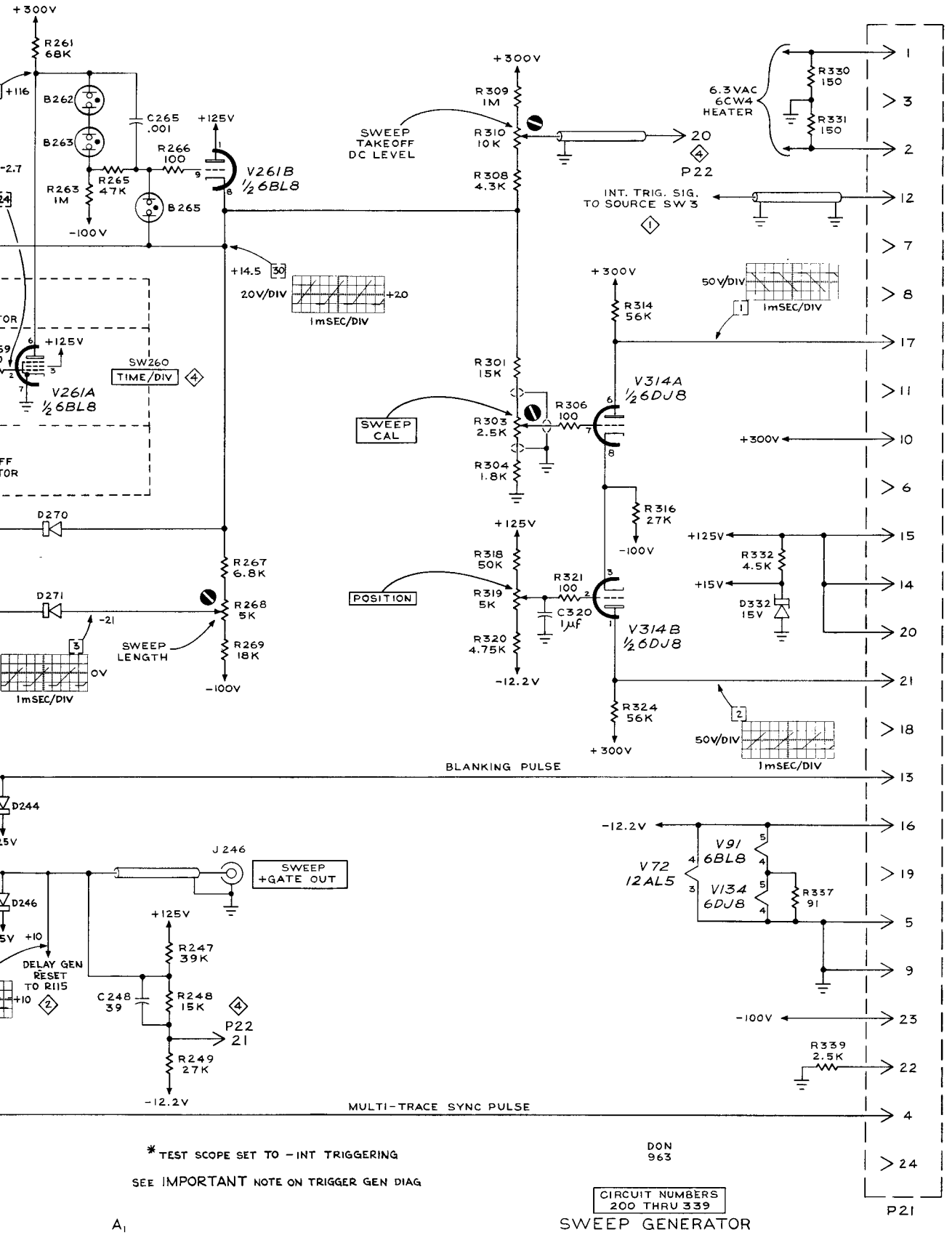
REFERENCE DIAGRAMS

1 TRIGGER GENERATOR

2 DELAY GENERATOR

4 TIMING & RESOLUTION SWITCHES





*TEST SCOPE SET TO -INT TRIGGERING

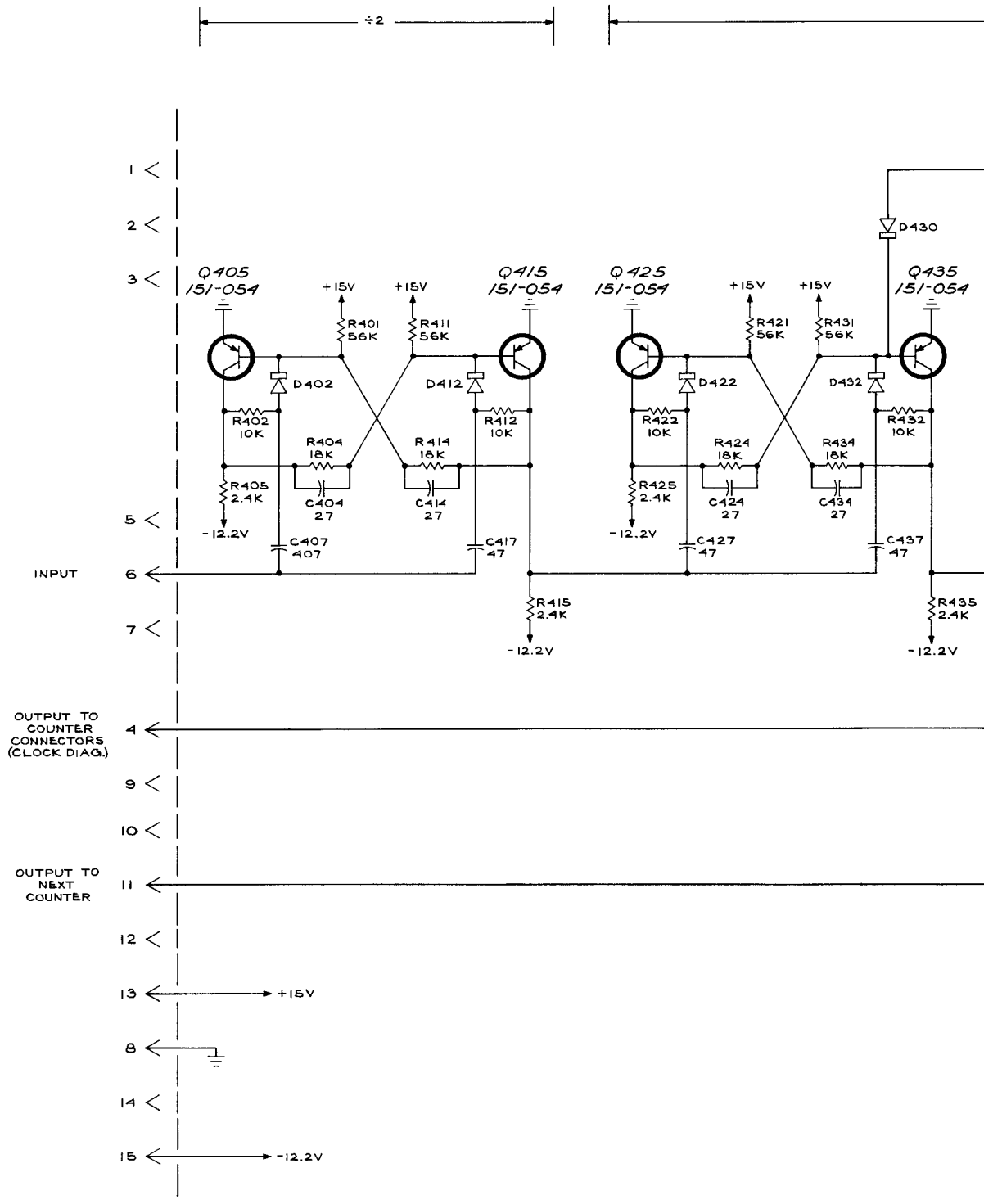
SEE IMPORTANT NOTE ON TRIGGER GEN DIAG

DON 963

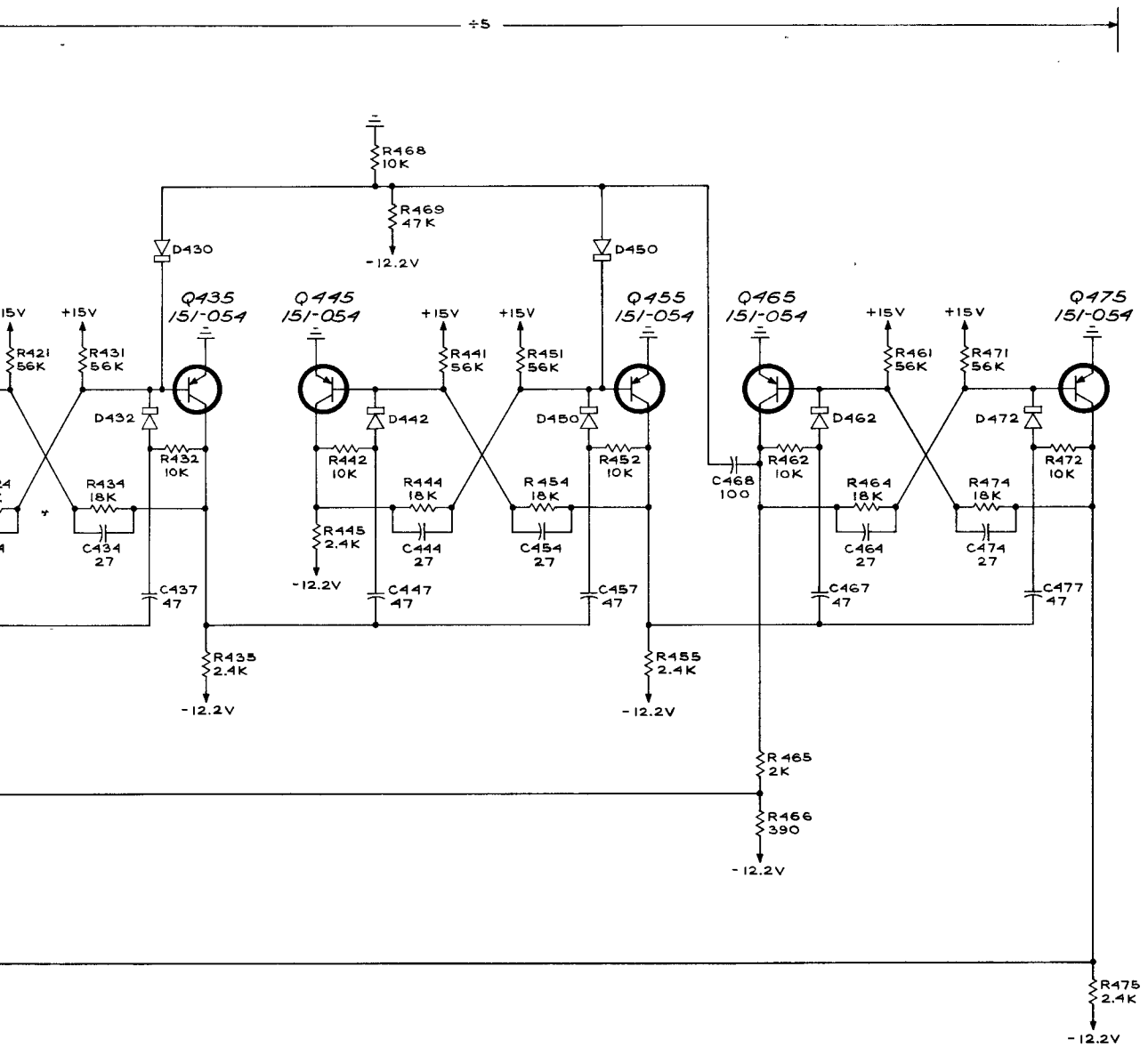
CIRCUIT NUMBERS 200 THRU 339

A1

SWEEP GENERATOR



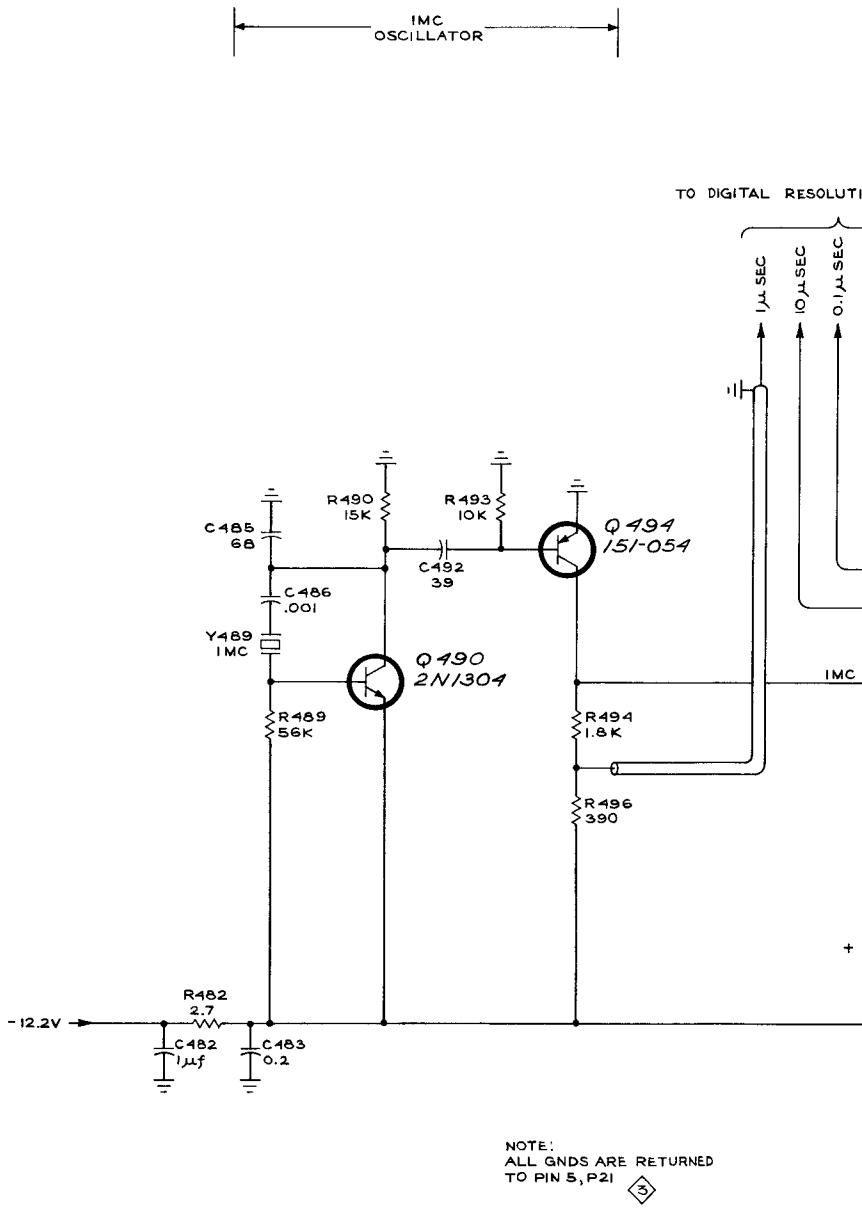
TYPE 3B2 PLUG-IN



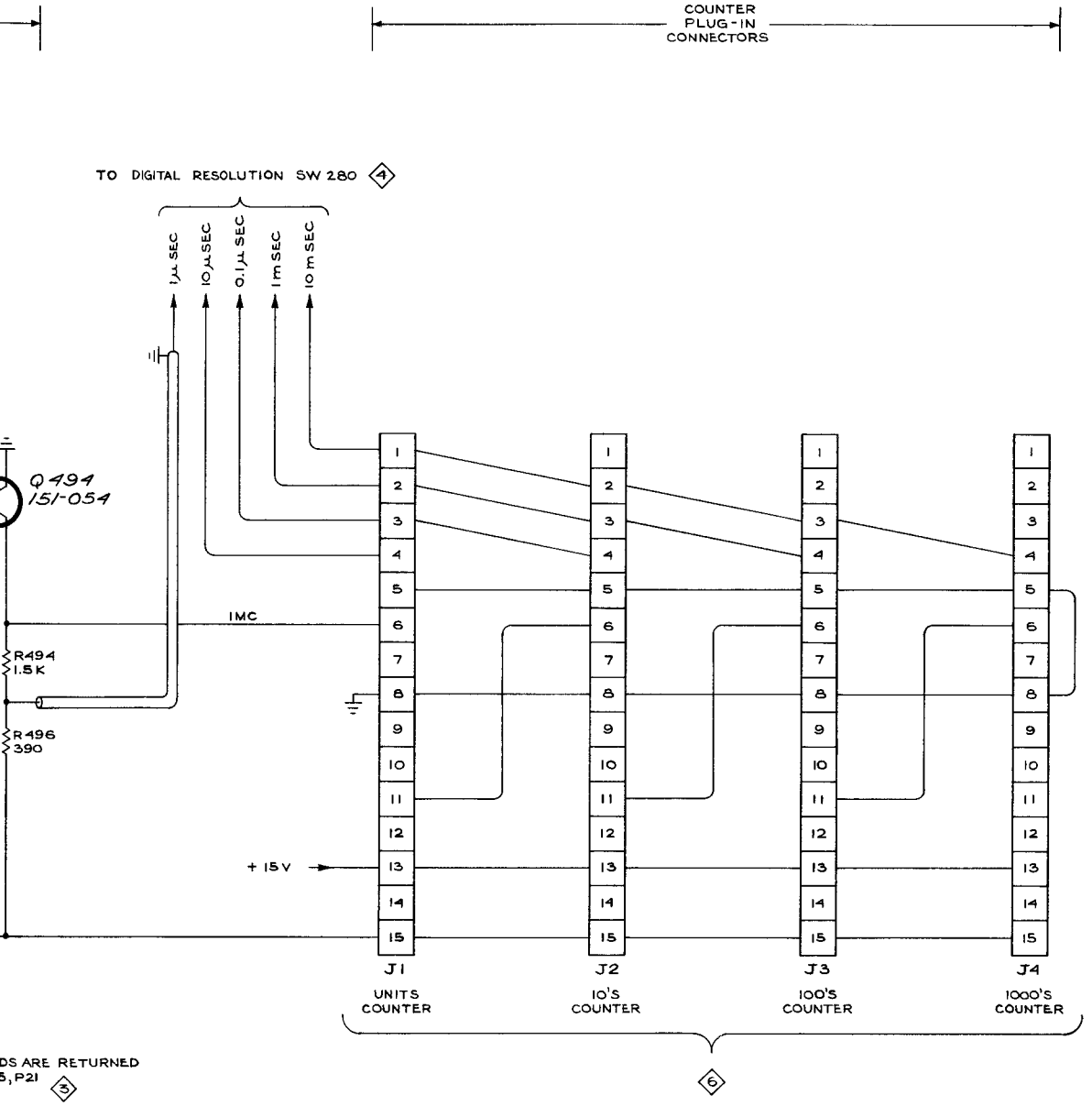
CMD
963

COUNTER

A



TYPE 3B2 PLUG-IN



REFERENCE DRAWINGS

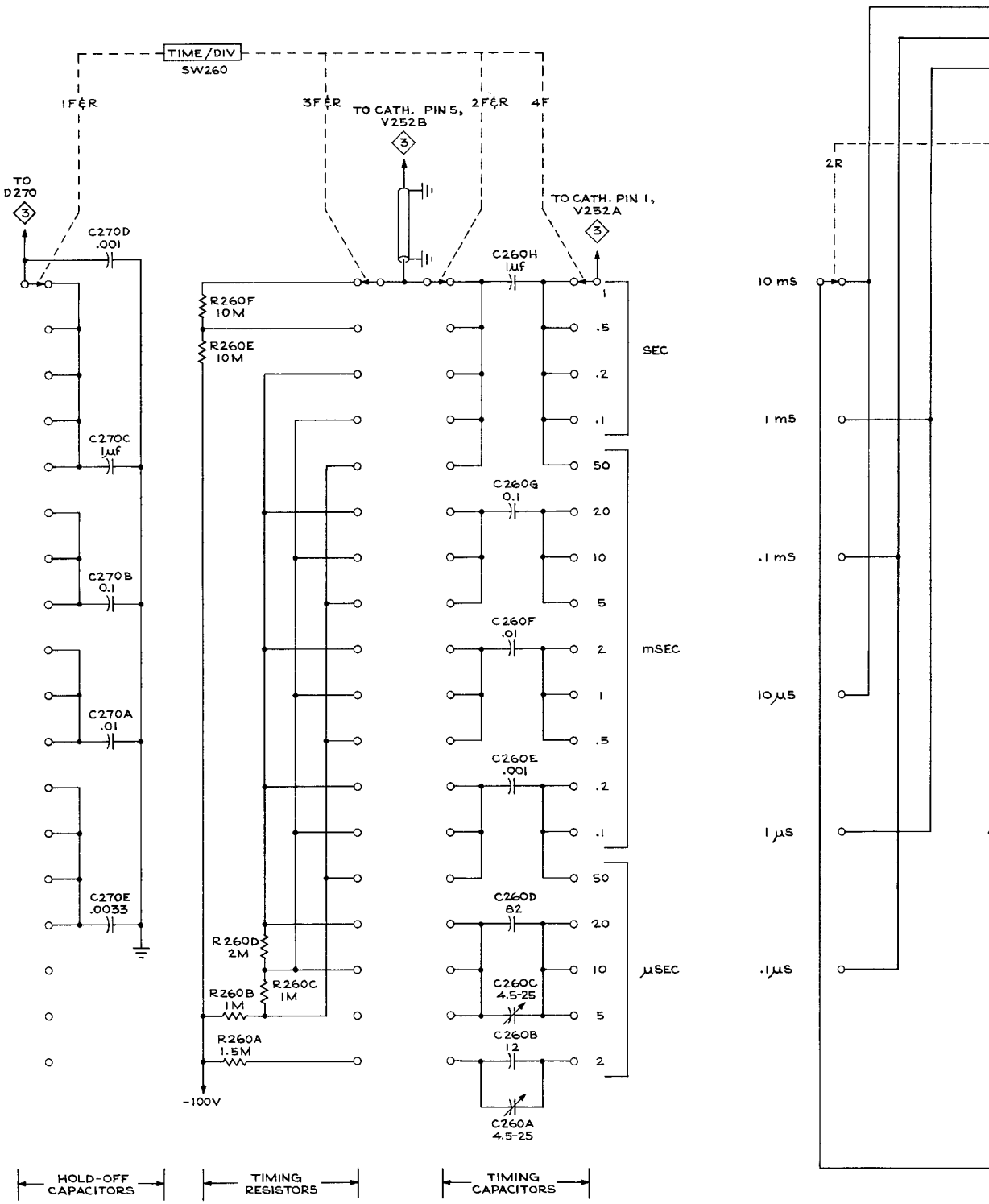
3 SWEEP GENERATOR

4 TIMING & RESOLUTION SWITCHES

6 COUNTER

CMD
963

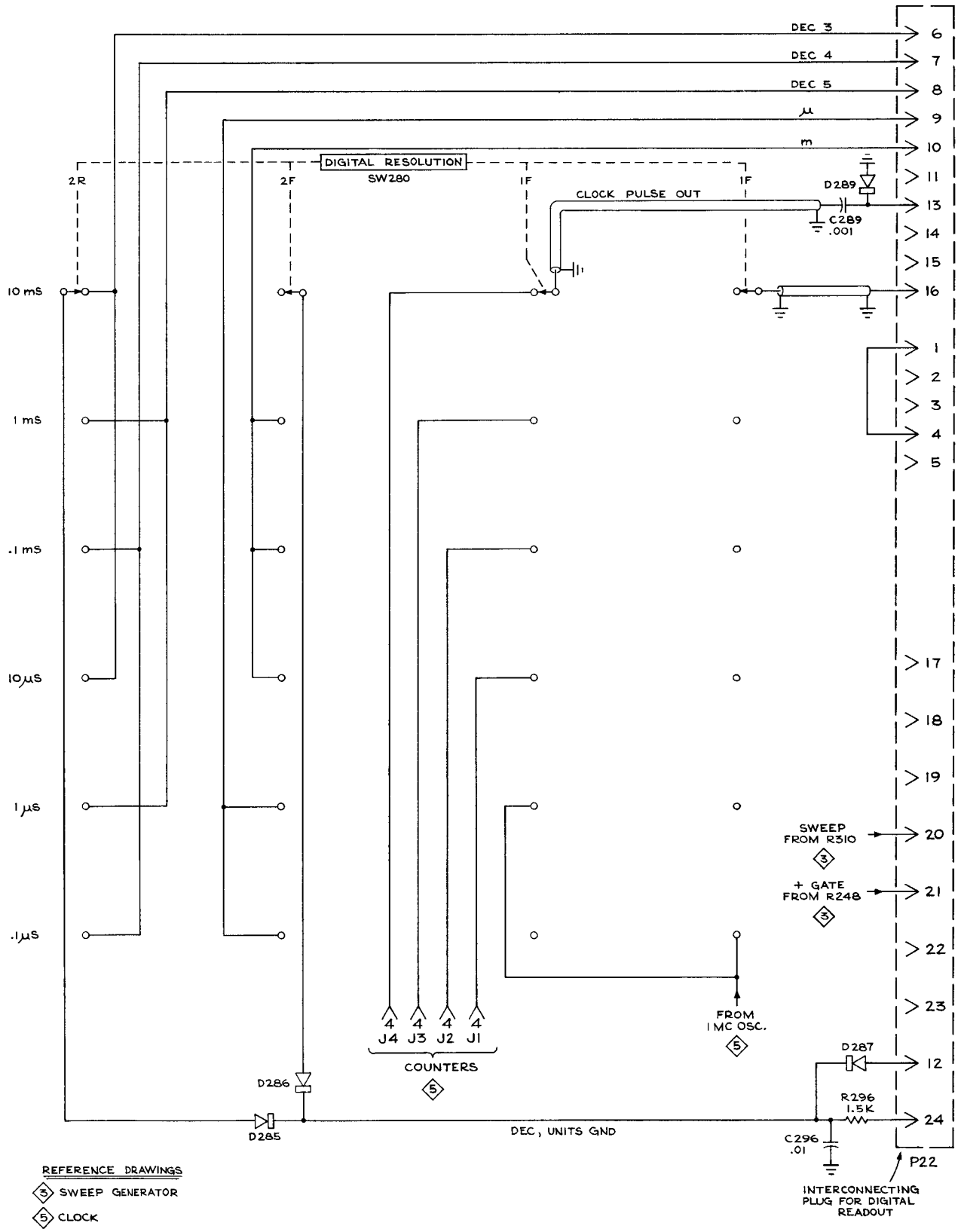
CLOCK



REFERENCE DRAWINGS

3 SWEEP GENERATOR

5 CLOCK



TIMING & RESOLUTION SWITCHES

DON 963

A1

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. If it does not, your manual is correct as printed.

PARTS LIST CORRECTION

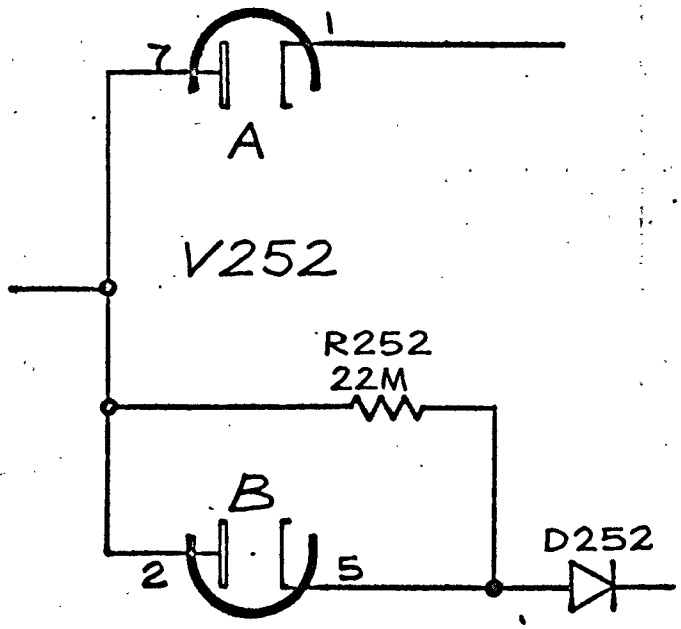
CHANGE TO:

Q123	151-0188-00	2N3906		
R52	316-0471-00	470 Ω	1/4 W	10%

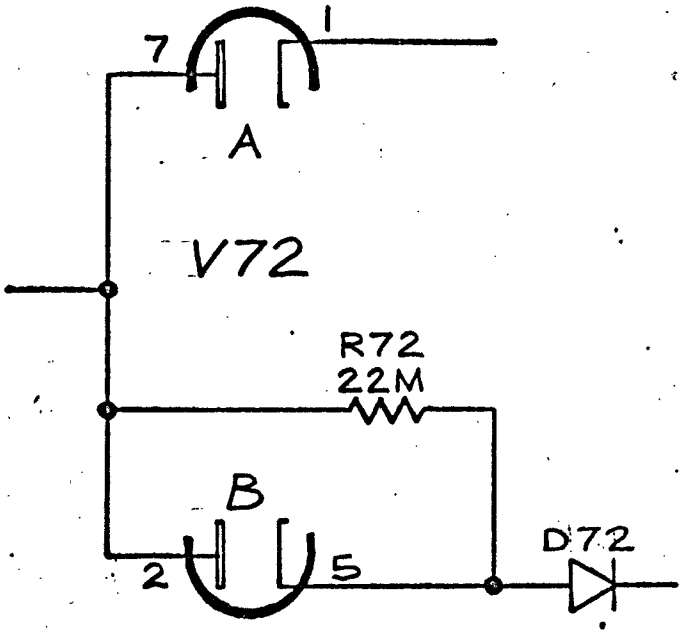
ADD:

R72, R252	316-0226-00	22 MΩ	1/4 W	10%

SCHEMATIC CORRECTION



PARTIAL SWP GEN. DIAG.



PARTIAL DELAY GEN. DIAG.