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S-52
PULSE GENERATOR HEAD

INSTRUCTION MANUAL

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

070-1101-01
Product Group 42

Serial Number ____________

First Printing AUG 1971
Revised SEP 1985

INSTRUMENT SERIAL NUMBERS

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

B000000	Tektronix, Inc., Beaverton, Oregon, USA
100000	Tektronix Guernsey, Ltd., Channel Islands
200000	Tektronix United Kingdom, Ltd., London
300000	Sony/Tektronix, Japan
700000	Tektronix Holland, NV, Heerenveen, The Netherlands

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

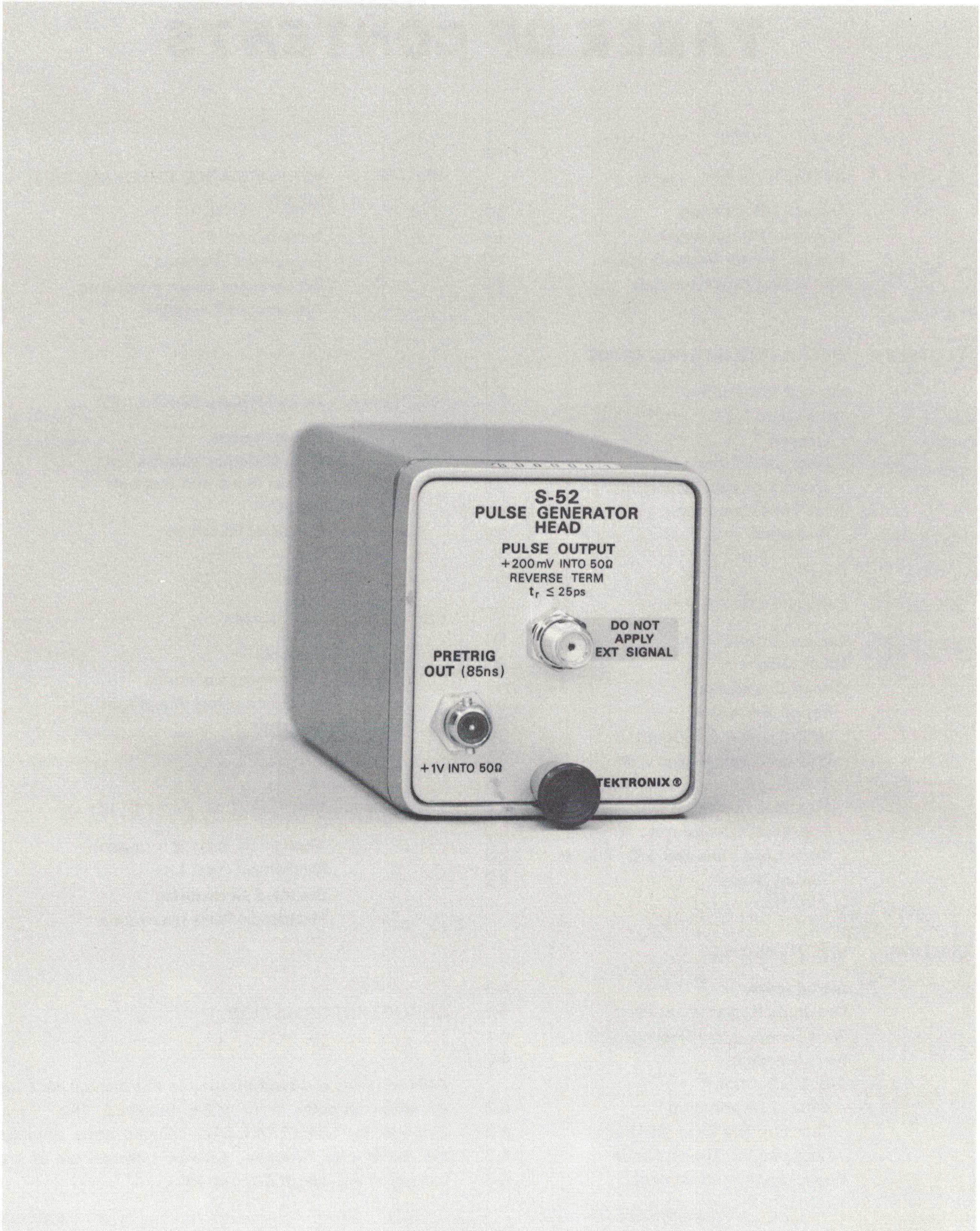


Fig. 1-1. S-52 Pulse Generator Head.

SECTION 1
SPECIFICATION

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

General Information

The S-52 Pulse Generator Head provides a step pulse output for use with fast rise sampling oscilloscope systems. The S-52, which provides a pretrigger output signal and a fast positive pulse output signal at 50 Ω impedance, is also useful with Time Domain Reflectometry (TDR) systems.

The pretrigger output signal is available from front and rear connectors. When the S-52 is installed in the 7S12 TDR unit, the pulse output trigger time is controlled by the TDR unit. When installed in other sampling units, the internal pretrigger lead time is about 85 ns.

Operating power for the S-52 is obtained when the unit is installed into the sampling head compartment (or connected via an interconnecting cable) of Tektronix sampling instruments such as the 7S12, 7S11, Types 3S2, 3S5, or 3S6. The S-52 can also be powered from the Type 285 Power Supply.

Electrical Characteristics

The following characteristics apply over an ambient temperature range of 0°C to +50°C after a 10 minute warmup, for an S-52 calibrated at a temperature between +20°C and +30°C. The required operating voltages are applied to the S-52 when it is connected or installed into the sampling head compartment or powered by a sampling head power supply.

ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirement	Supplemental Information
PULSE OUTPUT		
Risetime into 50 Ω	25 ps or less	
Amplitude into 50 Ω	At least 200 mV, positive going	
Aberrations	+7%, −7%, total of 10% P-P within the first 1.8 ns of the step edge with the reference level at 1.8 ns from the step edge; +2%, −2%, total of 4% P-P after the first 2.5 ns with the reference level at 3.0 μs from the step edge.	
Pulse Duration	At least 350 ns	
Period	16 μs within 2 μs for SN B070390 and up. 8.3 μs within 0.8 μs for SN B070389 and below.	
Baseline Level	55 mV to 120 mV terminated in 50 Ω	
Source Impedance		50 Ω, nominal
PRETRIG OUT (Front Panel)		
Amplitude into 50 Ω	At least 1.0 V, positive-going	
Rise Rate	600 mV/ns	
Pulse Duration	4 ns within 2 ns	

Characteristic	Performance Requirement	Supplemental Information
Pretrigger to Pulse Output Time	85 ns within 5 ns	
Pretrigger to Pulse Output Jitter	10 ps or less (With 7S11, 7T11, and 7000-series oscilloscope system, excluding the sampling oscilloscope jitter)	
Pretrigger Out (Rear Panel)		
Amplitude into 50 Ω	At least 1.0 V, positive-going	
Rise Rate	600 mV/ns	
Pulse Duration	4 ns within 2 ns	
PULSE OUTPUT Display Jitter	10 ps or less (With 7S12, S-6, and 7000-series oscilloscope system)	

ENVIRONMENTAL CHARACTERISTICS

Temperature		
Non-operating		−40°C to +65°C
Operating		0°C to +35°C
Altitude		
Non-operating		To 50,000 feet
Operating		To 15,000 feet
Vibration (Non-operating)		15 minutes along each axis at 0.015 inch. Vary the frequency from 10 to 55 to 10 Hz in 1-minute sweeps. Three minutes at any resonant point or at 55 Hz.
Shock (Non-operating)		Two shocks each of 500 g's (2 ms duration), 750 g's (1 ms duration) and 1000 g's (0.5 ms duration), in each direction and along each major axis for a total of 36 shocks.
Transportation		Meets National Safe Transit Committee type of test when packaged as shipped by factory.

MECHANICAL CHARACTERISTICS

Characteristics	Description
Finish	Anodized aluminum front panel, extruded aluminum blue-vinyl painted cabinet with aluminum castings front and rear.
Weight	Approximately 8 oz.
Dimensions	
Height	About 2 inches
Width	About 1 3/4 inches
Length	About 4 inches

STANDARD ACCESSORIES

The accessories supplied with the S-52 Pulse Generator Head are listed in Section 8 Mechanical Parts List.

NOTES

SECTION 2
OPERATING INSTRUCTIONS

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

General Information

This section of the manual provides the basic information required to operate the S-52 Pulse Generator Head. It also includes installation and first time operation instructions.

The S-52 may be powered by any Tektronix instrument having a sampling head compartment, such as the Tektronix 7S12, 7S11, or Types 3S2, 3S5, 3S6, or 286; or, the unit may be powered separately by a Tektronix Type 285 Power Supply. The S-52 may be connected to a head compartment by one of two accessory extender cables. This permits short-length coaxial cables to be used between the PULSE OUTPUT connector and the load.

The pretrigger output pulse allows a sequential sampling system to display the main pulse without using a delay line in the signal path. The pretrigger pulse is available at both the rear and the front panel connectors.

The S-52 is normally used with the Tektronix 7S12 Time Domain Reflectometry (TDR) unit. When the S-52 is used with the Tektronix 7S12, the pretrigger to pulse output time is determined by the 7S12.

The S-52 is also useful with other Tektronix sampling instruments.

INSTALLATION

General

Since the S-52 Pulse Generator Head can be powered by Tektronix instruments containing sampling compartments or sampling head extender cables, many combinations of instruments are possible. Three installations are shown in Fig. 2-1. Part (A) shows the S-52 installed in the pulse generator compartment of the Tektronix 7S12 TDR Sampling Unit. The 7S12 can be used in any 7000-series oscilloscope. Part (B) shows the S-52 installed in the Channel B compartment of the Type 3S2 Sampling Unit. This leaves Channel A of the sampling unit available to operate a sampling head. Part (C) shows the S-52 installed in the head compartment of the 285 Power Supply.

With (A), (B), or (C) method of installation, the S-52 can be plugged into the sampling unit or power supply as shown, or operated remotely on a special extender cable. Three and six foot extender cables are available. Order the three foot extender cable by Tektronix Part No. 012-0124-00, or the six foot extender cable by Tektronix Part No. 012-0125-00. Contact your local Tektronix Field Engineer or Representative for price and availability of these optional accessories.

Head Installation

To insert the S-52 into a compartment of the sampling unit or power supply, proceed as follows:

1. Pull the latch knob outward from the front panel (the latch knob will push out normally when the unit is inserted, if the knob is left free to move).

2. Insert the unit slowly into the compartment, so the two plastic guides enter the rear connector opening.

3. Push the S-52 completely into the compartment.

4. Push the latch knob to lock the unit in place.

To remove the S-52 from the compartment, pull the latch knob away from the front panel, then pull the unit from the compartment.

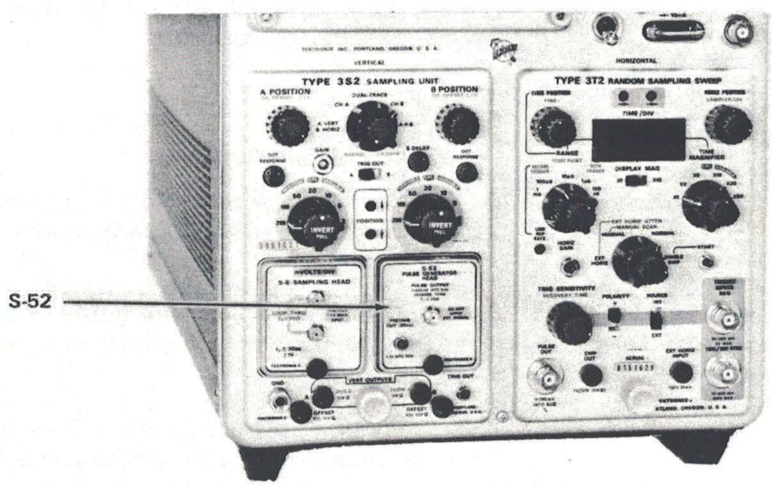
Extender Cable Installation

To use the S-52 on an extender cable, install as follows:

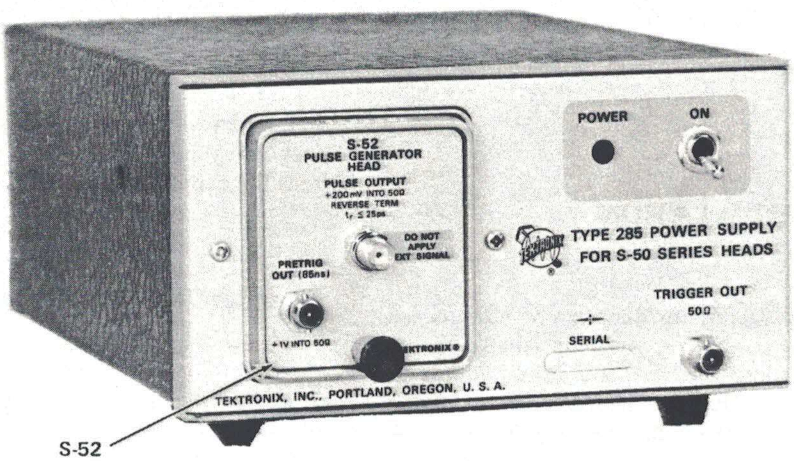
1. Pull the latch knob located on the head end of the extender outward from the panel (the latch knob will push out normally when the extender is inserted if the knob is free to move).

2. Insert the extender cable head end slowly into the desired compartment in the sampling unit so the two plastic guides in the compartment engage the unit.

(A) Installed in a Pulse Generator Compartment



(B) Installed in a Type 3S2 Sampling Head Compartment



(C) Installed in Type 285 Power Supply Compartment

Fig. 2-1. S-52 Installation information.

3. Push the head completely into the compartment.

4. Push the latch knob to lock the extender cable head end in place.

5. Connect the S-52 to the other end of the extender cable in a similar manner, and set the latch knob to hold it in place.

6. To remove the S-52 from the extender cable, pull the latch knob on the front panel of the S-52, and remove the unit from the extender cable.

7. To remove the extender cable head from the sampling unit compartment, pull the latch knob outward from the front of the panel, then pull the extender cable free.

Powering the S-52 with the Type 285 Power Supply allows both channels of a dual-trace sampling unit (such as the Type 3S2) to be used for sampling heads.

FIRST TIME OPERATION

This First Time Operation uses a Type 564B with Types 3T2, 3S2, S-6, and S-52 as shown in Fig. 2-1B. If you are using equipment shown in Fig. 2-1A, follow the First Time Operation information given in the 7S12 instruction manual.

Substitute equipment for the First Time Operation can include any Tektronix 560 Series oscilloscope with a 3S-series dual trace sampling unit containing one sampling head, and 3T-series sampling time base unit.

Procedure

1. With the Type 564B Power Switch off, insert a Tektronix Type 3S2 Sampling Unit into the vertical compartment (left) and a Tektronix Type 3T2 Random Sampling Unit into the horizontal plug-in compartment.

2. Insert the S-6 into Channel A (left) of the Type 3S2, leaving the latch free to move. Once the S-6 is seated, push the latch to lock it in place.

3. Insert the S-52 into Channel B (right) of the Type 3S2, leaving the latch free to move. Once the S-52 is seated, push the latch to lock it in place.

4. Connect the S-52 PULSE OUTPUT through a 50 Ω semi-rigid cable, 6 inch (Tektronix Part No. 015-1017-01), to the S-6 Loop Thru input (lower) connector (carefully form the semi-rigid cable to make this connection).

NOTE

Connectors at both ends of the coaxial cable should be firmly connected to mating connectors or accessories. Tighten slightly more than finger tight using a 5/16 inch wrench. A good connection is necessary to minimize reflections at the junction of connectors.

Terminate the Loop Thru (upper) connector in 50 Ω (3 mm termination, Tektronix Part No. 015-1004-00), using an adapter (Tektronix Part No. 015-1011-00).

5. Connect the S-52 PRETRIG OUT to the 50 Ω Trigger Input of the Type 3T2, using a BSM to BNC 50 Ω coaxial cable (Tektronix Part No. 012-0128-00, 10 inch length).

6. Set the Type 564 Intensity control fully counterclockwise.

7. Connect the Type 564 to the power line and set the Power switch to On.

8. Set the instrument controls as follows:

Type 564

Upper and Lower Screen	Non-store

Type 3S2

Display Mode	CH A
Normal-Smooth	Normal
Horiz. Plug-In Compatibility (behind front panel)	Sampling, 3T-Series
Channel A controls	
Position	Midrange
DC Offset	Midrange (5 turns from one end)
Units/Div	100
Variable	Cal
Invert	Pushed In
Dot Response	Midrange
Channel B controls	Optional

Type 3T2

Time Position	Fully Clockwise
Horiz Position	Midrange

Samples/DIV (behind front panel)	Variable	
Samples/Div	9 o'clock position	
Display Mode	Normal	
Start Point	With Trigger	
Range	100 ns	
Display Mag	X1	10 ns/div
Time Magnifier	X1	
Variable	Cal	
Trigger Source	Ext	
Trigger Sensitivity	Fully clockwise	
Recovery Time	Centered	
Trig Polarity	(+)	

10. After a five minute warmup time, set the Type 564 Intensity control for normal trace brilliance. Adjust Astigmatism and Focus controls for best focus.

11. Center the trace on the graticule with the Type 3S2 DC Offset control.

12. Adjust the Type 3T2 Trigger Sensitivity control for a stable triggered display of the S-52 output pulse leading edge (about 200 mV amplitude). Change the Type 3T2 Time Magnifier to X20 (500 ps/div). Use the Time Position control to position the leading edge to the left side of the display. Use the Type 3S2 DC Offset control to position the top of the pulse at the graticule centerline. See Fig. 2-2.

13. Remove the 50 Ω termination from the S-52 Loop Thru output (upper) connector and note that the pulse amplitude increases by about two times.

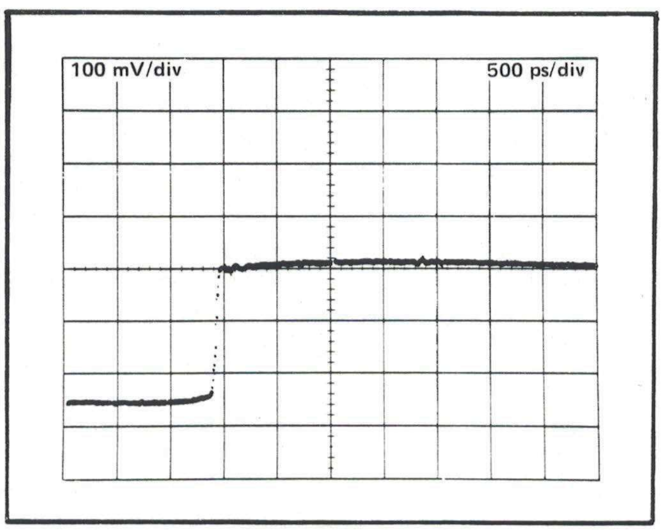


Fig. 2-2. PULSE OUTPUT leading edge (50 Ω terminated).

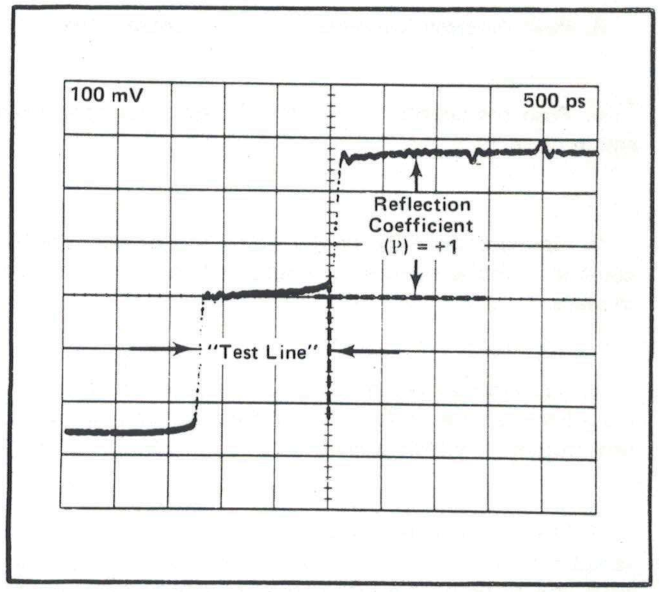


Fig. 2-3. Display with unterminated "Test Line".

14. Add a short length of 50 Ω coaxial cable to the same connector. (This example uses a 500 ps, 50 Ω, semi-rigid coaxial cable with a length of about 4 inches). See Fig. 2-3. The open line shows a reflection coefficient (ρ) of about +1.

15. Terminate the end of the "Test Line" in 50 Ω. A precision termination firmly connected to mating connectors at the end of the "Test Line" will allow a minimum reflection at the termination point. Fig. 2-4 shows a reflection due to a loose connector.

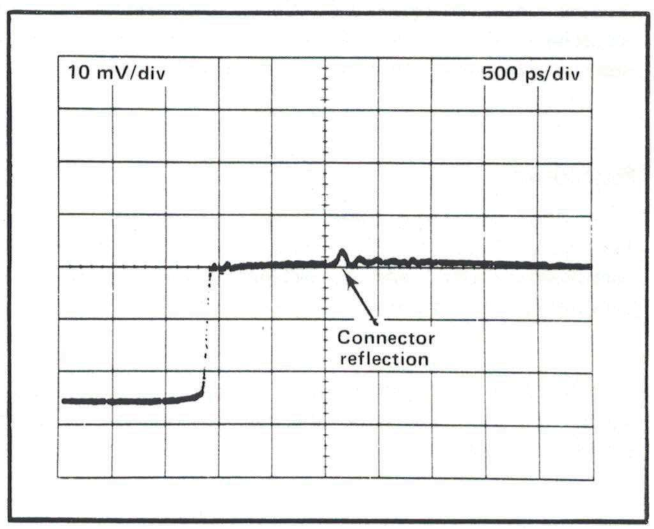


Fig. 2-4. Display with "Test Line" showing a reflection due to an incorrectly installed termination.

With a fixed pretrigger lead time in the S-52, the Type 3T2 Time Position control allows the start of the time window to be set over the operating range of the control. The time per division is set by the Time Magnifier and the Display Magnifier. Use the DC Offset and the mV/Div controls on the Type 3S2 to obtain the desired vertical deflection factor and offset voltage. The S-52 is useful to analyze reflections in coaxial cable up to about 150 feet.

Using the S-52 in the 7S12 TDR Unit, the lead time is calibrated in the 7S12 for time and distance.

NOTES

SECTION 3
CIRCUIT DESCRIPTION

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

General Information

This section of the manual contains the electrical description of the S-52 Pulse Generator Head circuits.

The S-52 requires +15 V and −12.2 V input power. The input power is obtained when the instrument is connected to the pulse generator compartment connector of a TDR Sampling unit, to one compartment connector of a sampling unit, or to the Type 285 Power Supply.

Refer to the schematic diagram in Section 7 of the manual as necessary when using the Circuit Description.

BLOCK DIAGRAM

The Block Diagram, Figure 3-1 shows the major circuit blocks of the S-52. When the S-52 is used with the 7S12 TDR Sampling Unit, the pulse generator trigger and the inhibit voltage are provided from the 7S12 to the 85 ns Lead Time and the T.D. Trigger block. A brief description of each block follows, starting with the 0.5 μs Period Generator block.

The Period Generator block contains a free-running oscillator with a period of about 0.5 μs. The positive output excursion of the Period Generator drives the BCD Counter.

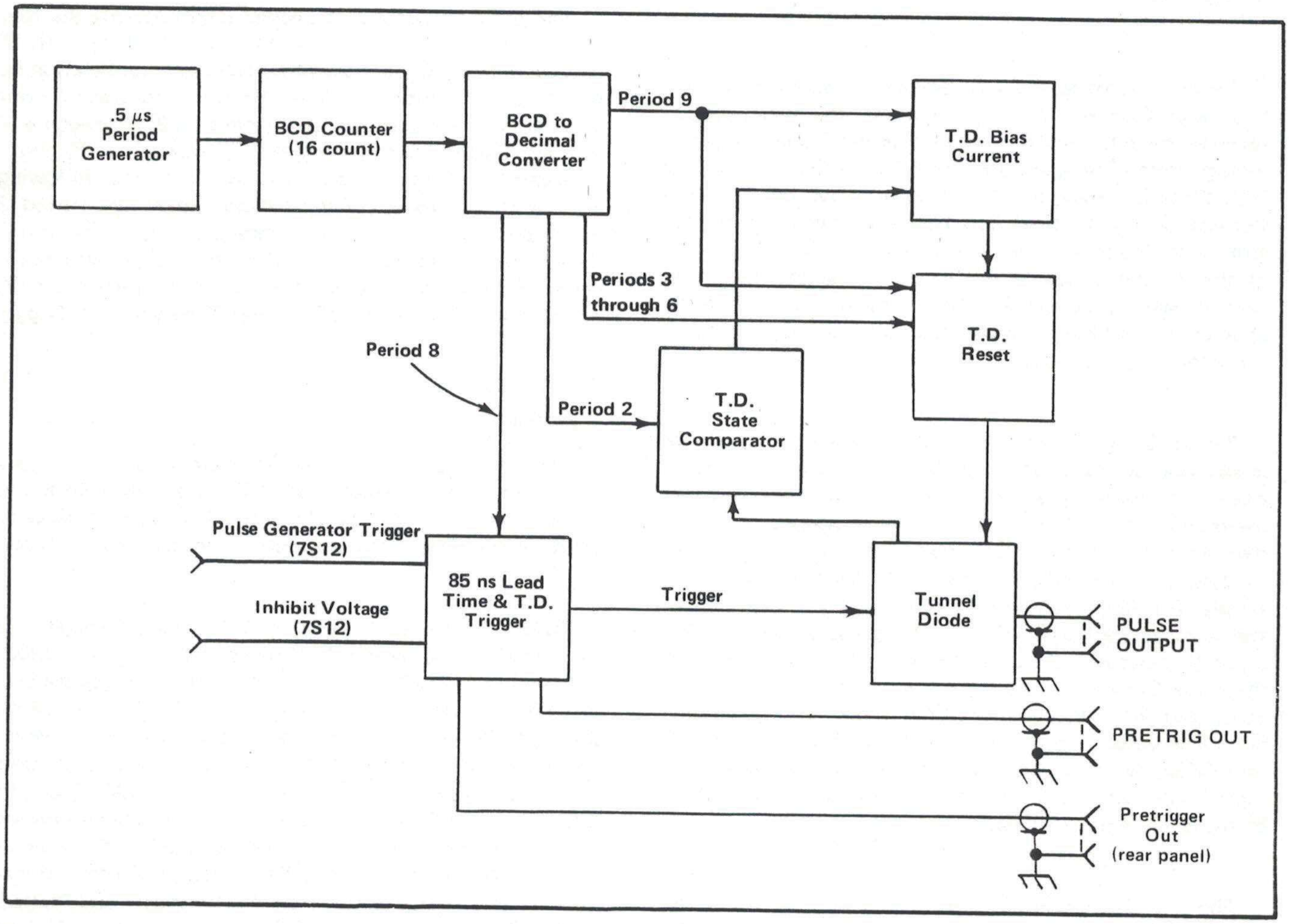


Fig. 3-1. S-52 Block Diagram.

The BCD Counter (16 count) is driven from the Period Generator and produces BCD signals to the BCD to Decimal Converter.

With the 16 count input signals (16 periods), the BCD to Decimal Converter produces negative output signals occuring at periods 2, 3 through 6, 8 and 9. Period 2 signal drives the T.D. (tunnel diode) State Comparator. Periods 3 through 6 signal drives the T.D. Reset. Period 8 signal drives the 85 ns Lead Time and T.D. Trigger circuits. Period 9 signal drives the T.D. State Comparator.

Periods 3 through 6 signal to the T.D. Reset circuit resets the Tunnel Diode. In the absence of any signal during period 7, the circuit applies the bias current from the T.D. Bias Current circuit to arm the Tunnel Diode. After the pretrigger and PULSE OUTPUT occur (at period 8), the period 9 signal causes the T.D. Reset circuit to reset the Tunnel Diode and the T.D. Bias Current circuit, reducing the available arming bias current. This low arming bias is applied to the Tunnel Diode by the T.D. Reset circuit in the absence of any input signal during periods 6 and 10 through 16.

Period 2 signal to the T.D. State Comparator allows the T.D. Bias Current circuit to increase the bias (applied through the T.D. Reset) until the Tunnel Diode changes to its high state. The high state of the Tunnel Diode drives the T.D. State Comparator. This in turn causes the T.D. Bias Current circuit to hold this new bias current, used for arming the Tunnel Diode during period 7. (This high state of the Tunnel Diode, useful to determine the next reset current value, produces a pulse at the output; but in the absence of a pretrigger signal, this signal output is not useful as the output pulse.)

Period 8 signal from the BCD to Decimal Converter drives the 85 ns Lead Time & T.D. Trigger circuits to initiate a positive pretrigger signal to the front and rear panel connectors of the S-52. The circuit operates in one of two ways: (A) if the S-52 is used in the 7S12, the Inhibit Voltage from the 7S12 inhibits the trigger flow within the circuit. The 7S12 uses the Pretrigger Out signal (rear panel), and supplies the Pulse Generator Trigger to the circuit. The delay time between the S-52 Pretrigger Out (rear panel) and the Pulse Generator Trigger back to the S-52 is set by the 7S12; and (B) in the absence of the Inhibit Voltage and the Pulse Generator Trigger signal (if the S-52 is not used with the 7S12), the internally connected trigger flow drives the T.D. Trigger circuits producing a trigger signal, delayed by 85 ns, to the Tunnel Diode.

The PULSE OUTPUT signal is produced after the Tunnel Diode arming bias is applied during period 7 by the T.D. Reset, and the Tunnel Diode is triggered in period 8 from the 85 ns Lead Time & T.D. Trigger circuit. The Trigger signal causes the Tunnel Diode to change to its high state. The PULSE OUTPUT signal ends when the Tunnel Diode is reset by the T.D. Reset at the start of period 9.

CIRCUIT DESCRIPTION

Period Generator

The Period Generator consists of U30E and associated components. The generator is connected as a colpitts oscillator with a period of about 0.5 μs. The positive-going output signal at U30E collector drives the BCD Counter, U10 pin 14.

BCD Counter (16 Count)

The BCD Counter (U10) is a 4 bit binary counter connected to provide divide by 2, 4, 8, and 16 outputs to drive the BCD to Decimal Converter U20.

BCD to Decimal Converter

The BCD to Decimal Converter (U20) accepts the four outputs from the BCD counter to pins 15 (÷2), 14 (÷4), 13 (÷8), and 12 (÷16), and converts each BCD combination up to 10 (out of a total of 16) to its decimal equivalent. Four decimal output signals are used from pins 2, 3 through 6, 9 and 10. These occur at periods 2, 3 through 6, 8, and 9 respectively. These output signals drive the following circuits to control the Tunnel Diode operation. Period 2 signal drives the T.D. State Comparator circuit. Periods 3 through 6 and Period 9 signals drive the T.D. Reset circuit. Period 9 signal also drives the T.D. Bias Current circuit. Period 8 signal drives the 85 ns Lead Time and T.D. Trigger circuit.

T.D. Reset

The input signal to the T.D. Reset circuit are the periods 3 through 6 and 9 signals from U20 pins 3 through 6 and 10. The output, from the Q86 and Q88 circuit, operates to apply or disconnect the bias current to the Tunnel Diode.

Periods 3 through 6 signal at U20 pins 3 through 6 (a low signal during period 1) through R32 turns on U30C. Conduction of U30C turns on Q80, which changes the bias of Q86 and Q88, so that Q86 is on and Q88 is off. With Q88 off, the Tunnel Diode current path is open, which resets the Tunnel Diode. Then in the absence of any input signals during period 7, the states of U30C, Q80, Q86, and Q88 are reversed, with Q88 on. Q88 applies the current set by Q90 in the T.D. Bias Current circuit to the Tunnel Diode. This current arms the Tunnel Diode. Further operations of this circuit occur after the pretrigger and PULSE OUTPUT of period 8. Period 9 signal (a low signal during period 9) couples through CR21 and R32 to turn on U30C.

As in periods 3 through 6, the conduction of U30C turns on Q80, which changes the bias of Q86 and Q88 so that Q86 is on and Q88 is off. With Q88 off, the Tunnel Diode current path is open, which resets the Tunnel Diode. Then in the absence of any input signals in period 10, the states of U30C, Q80, Q86, and Q88 are reversed, with Q88 on. Q88 applies a reduced current to the Tunnel Diode. This reduced current is set by Q90 in the T.D. Bias Current circuit.

T.D. Bias Current

The input signals to the T.D. Bias Current circuit are the period 9 signal at U20 pin 10, and the output of the T.D. State Comparator circuit at Q74 collector. The output supplies bias current to the T.D. Reset circuit at the emitters of Q86 and Q88.

Period 9 signal at U20 pin 10 (a low signal during period 9) couples through CR26 and R38 turns on U30D. Conduction of U30D discharges C90 through CR91 to a voltage set by CR93. C90 charge path through R90, CR90, and R74 is open, by the conduction of Q74 in the T.D. State Comparator circuit. This reverse biases CR90. With the voltage across C90 low, current in Q90 is reduced. This reduces the bias current to the T.D. Reset circuit at the emitters of Q86 and Q88. Further operations of the T.D. Bias Current circuit occur after the reduced bias is applied to the Tunnel Diode (by Q88) in period 10, and Q74 in the T.D. State Comparator circuit is reverse biased in period 2. With Q74 off at the start of period 2, CR90 turns on and C90 charges, with the charge path through R74, CR90, and R90. As C90 charges, current through Q90 increases, which increases the bias current through Q88 to the Tunnel Diode. The Tunnel Diode bias current is increased until the Tunnel Diode changes to its high state, which turns on Q74. Q74 reverse biases CR90 and the charge on C90 is held (except for a very small Q90 base current through R90) to control the arming bias current in period 7. Trig Level control R90 sets the arming bias current to a value below the peak current for the Tunnel Diode. This allows an adjustment for Trigger level requirements.

T.D. State Comparator

The input signals to the T.D. State Comparator circuit are the period 2 signal at U20 pin 5, and the Tunnel Diode voltage coupled through R75 to Q74 base. The output of the comparator at Q74 collector drives the T.D. Bias Current circuit.

Period 2 signal at U20 pin 5 (a low signal during period 2) couples through CR28 to turn off U30B. With U30B off, current through R26 turns on Q72. Conduction of Q72 turns off Q74. This allows C90 in the T.D. Bias Current circuit to charge until the Tunnel Diode changes to its high state. The Tunnel Diode voltage across R75 turns on Q74 to terminate C90 charge, and holds Q74 on for the remainder of period 2.

85 ns Lead Time & T.D. Trigger

The circuit is driven by the Period 8 signal from U20 pin 9. If the S-52 is used with the 7S12, two additional inputs provided by the 7S12 are the Inhibit Voltage and the Pulse Generator Trigger signal.

When period 8 signal at U20 pin 9 (a low signal during period 8) goes low, the negative-going signal reverse biases U30A. CR40 is reverse biased, which allows Q40 to turn on. Q40 drives Q50 with positive feedback via C40 to produce a fast rise positive signal at Q50 collector. This signal is coupled through C54 and CR54 to Pretrig output connector P52 on the rear panel, and also through C52 to the PRETRIG OUT connector on the front panel.

U10 pin 9 is coupled through CR30 to the collector of U30A to prevent operation during period 5.

Also in the absence of the Inhibit Voltage and Pulse Generator Trigger (the S-52 is not used with the 7S12), the fast rise positive signal at Q50 collector couples through C60 to turn on Q60. With Q60 on, its collector goes low, causing the charge on C62 to forward bias CR66 through L62 and LR64. Operation of L62, LR64, R64 and C66 keeps CR66 forward biased for about 85 ns. At the end of the 85 ns period, CR66 (a snap-off diode) opens and causes a fast positive pulse through C65, R65-R68, and the 2 mil diameter lead wire inductor to the Tunnel Diode. C60 is set during calibration for proper delay.

When the S-52 is used with the 7S12 TDR Unit, the Inhibit Voltage from the rear connector pin 5 forward biases CR60 and keeps Q60 turned on, preventing the internal trigger signal at Q50 collector from having any effect on Q60. The 7S12 is driven by the Pretrig output signal at P52 and produces a Pulse Generator Trigger Signal to the rear connector pin 2. The delay from the Pretrig output signal time to the Pulse Generator is determined by the 7S12. Before the Pulse Generator Trigger Signal occurs, a negative voltage is applied to pin 2, (from the 7S12) coupled through LR64 to forward bias snap-off diode CR66. Then the Pulse Generator Trigger signal, a positive signal, reverse biases CR66, which causes a fast positive pulse through C65, R65-R68, and the 2 mil diameter lead wire inductor to trigger the Tunnel Diode.

Tunnel Diode

The Tunnel Diode reset current is set by the T.D. Reset Current circuit, and applied by the T.D. Reset circuit through R88, R65, R68 and the 2 mil diameter connecting wire inductor. When the Tunnel Diode is triggered, it changes from its low state to its high state, thus initiating the PULSE OUT signal. The end of the PULSE OUT signal is determined by the T.D. Reset circuit (period 9) when the Tunnel Diode changes back to its low state.

NOTES

SECTION 4 MAINTENANCE

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

Introduction

This section is a maintenance guide for the S-52 Pulse Generator Head. Information is included for parts ordering, parts removal and replacement, disassembly and assembly.

Obtaining Replacement Parts

All parts used in the S-52 can be purchased directly through your local Tektronix Field Office or representative. However, replacement for standard electronic items can be obtained locally. Consult the Electrical or Mechanical Parts List to determine the value, tolerance and rating required.

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance at high frequencies. After repair, the S-52 Pulse Generator Head may require re-calibration.

Parts Removal and Replacement

Housing and Rear Panel. To remove the S-52 from its housing, loosen the four retaining screws on the rear panel. Slide the rear panel off, and remove the housing by sliding it to the rear. With the housing and rear panel removed, the unit can be connected to an extender cable for access to adjustment controls and circuit test points for calibration. Two lengths of extender cables are available from your local Tektronix Field Office or representative. Order by Tektronix Part No. 012-0124-00 for the three-foot length and Tektronix Part No. 012-0125-00 for the six-foot length extender cable.

To install the S-52 in its housing, align the upper and lower corners of each side circuit board with the channels in the sampling head body which contain the zigzag springs. Push the S-52 gently into the housing until it contacts the front panel. Be sure that the white plastic pawl in the locking knob is properly aligned as the S-52 is slid into the housing. Attach the rear casting, making sure that the hole on one side fits over the pretrigger signal output connector. Insert the four long mounting bolts and tighten them securely. To ensure that the mounting bolts align with the front panel, hold the S-52 in its normal horizontal position; start the lower bolts, then turn the S-52 over and start the remaining two bolts.

Circuit Boards. To remove the Timing board (on the instrument right side) gently pull the board outward from the Control board.

To remove the Trigger board (on the instrument left side) gently pull the board outward from the Control board. To remove the trigger coaxial lead from the front panel, use a 5/16 inch end wrench to hold the nut located behind the front panel. Then use a 9/32 inch end wrench to remove the coaxial cable retaining nut. Once this nut is removed, gently pull the coaxial cable, together with the connector center pin, from the connector. Remove the connector shell, by first loosening the nut located behind the front panel with the 5/16 inch end wrench. To install the Trigger board, reverse the procedure. (When inserting the coaxial cable, be sure that the outer braid is not shorted to the center conductor).

For most maintenance on the Control board, it is not necessary to remove it from the front panel. If necessary to remove the board, carefully unsolder the two mil diameter tunnel diode connecting wire soldered to a wire connector post near the lower allen head screw holding the circuit board in place. Remove the two allen head screws holding the control board in place and remove the board. To install the Control board, reverse the procedure. Be sure the two spiral pins are flush with the connector holder before tightening the 5/16 inch allen screws. Also use extreme care in soldering the 2 mil diameter wire to the wire connector post.

Tunnel Diode CR69. Do this replacement in a clean, flat work area, since the tunnel-diode is easily lost due to its small size. Keep foreign material away from the diode when it is exposed. The tunnel diode is located behind the front panel directly behind the PULSE OUTPUT connector.

1. Remove the knurled screw from the back of the block connected to the front panel while the screw is pointed upward, to prevent the loss of the tunnel diode, or the spring underneath the tunnel diode. The tunnel diode and the spring are contained in the knurled hollow screw, and they will separate from the screw. See Fig. 4-1.

2. Carefully check that the 2 mil diameter wire is properly soldered to the center pin resistor (R69 assembly). Also see that the wire is properly aligned so that it will not

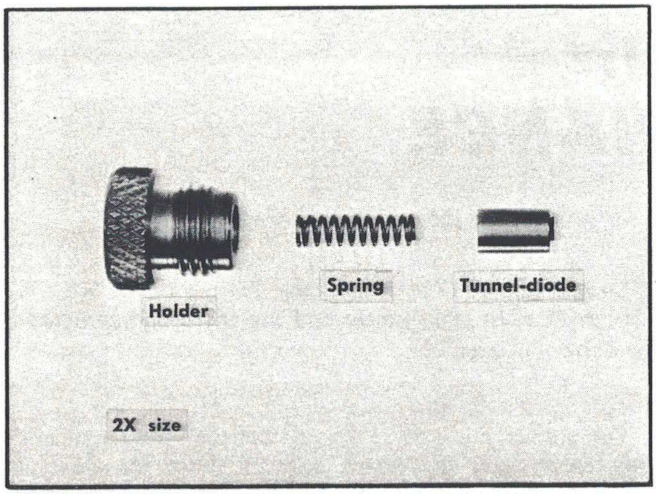


Fig. 4-1. Tunnel Diode assembly showing the spring and tunnel diode separated from the knurled hollow screw.

touch the metal block or ground when the tunnel diode assembly is inserted in the next step.

3. Insert the new tunnel diode assembly, which contains the tunnel diode, spring, and the knurled hollow screw into the block connected to the front panel while the screw is pointed upward. Tighten the knurled screw until the tunnel diode is properly seated.

R69 Assembly. R69 is part of the center conductor of the input connector assembly. To replace the assembly, use the following procedure.

1. Remove the tunnel diode assembly according to the instructions under the heading "Tunnel Diode CR69".

2. Carefully unsolder the two mil diameter wire (connected to R69) from the two 2.7 Ω resistors.

CAUTION

Do not check Tunnel Diode CR69 with an ohmmeter or curve tracer. Its duty cycle capabilities and the power dissipation may be exceeded. Also, before inserting a new Tunnel Diode, check that the circuit is operating properly.

3. Use a 5/16 inch wrench to remove the nut on the PULSE OUTPUT connector on the front panel. Remove the block assembly with the control board from the front panel.

4. Use a 7/32 inch end wrench to remove the connector and resistor (R69) from the block assembly.

5. To install, reverse the procedure. Be sure to position the 2 mil diameter wire in a position so it will not be twisted when the connector assembly is installed into the block.

Parts Locations

Photos of the Timing, Control and Trigger circuit boards with the component locations are shown in Section 7. The Mechanical Parts Illustration in Section 8 shows locations of the mechanical parts.

TROUBLESHOOTING

General Information

As an aid to troubleshooting, use the troubleshooting conditions listed on the schematic diagram page in Section 7. First, determine whether the sampling unit or Power supply is providing the proper power to the S-52. The waveform conditions are given using the Pretrig Out pulse to trigger the test oscilloscope. If necessary, use the internal triggering (if no Pretrig Out signal) to isolate the inoperative circuit. Information about checking the Snap-off Diode and the Tunnel Diode follows. Note that the Tunnel Diode waveforms and also the Tunnel Diode troubleshooting waveforms are shown in Section 7.

Checking the Snap-Off Diode

The delay time of the trigger pulse is caused by the proper operation of the Snap-off diode CR66 in the trigger circuit. By using a Sampling Oscilloscope, the Leadtime control C60 allows the adjustment of the delay to 85 ns. For troubleshooting, a real time oscilloscope can be used to check the voltage across the diode. The waveform shown in Fig. 4-2 was taken using a P6053 10X probe, 7A16 Ampli-

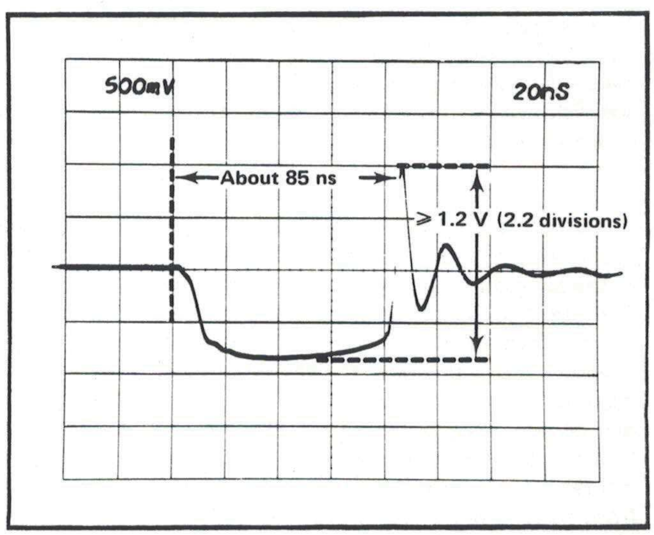


Fig. 4-2. Snap-off Diode CR66 troubleshooting waveform.

fier, 7B50 Time Base, and 7504 Oscilloscope. The S-52 is used on an extender and powered from a Type 285 Power Supply. If the S-52 is powered from the Pulse Generator compartment of the 7S12, the waveform will be different and the check will not be valid.

The Snap-off diode is mounted in small metal clips on the Trigger board at the left side of S-52. The diode is marked with a dot on the cathode end which is ungrounded.

Checking the Tunnel Diode

Tunnel Diode CR69 should not be checked with an ohmmeter or curve tracer, as its duty cycle capabilities and power dissipation may be exceeded. The following steps should be taken to check CR69.

1. Check the PULSE OUT, using the troubleshooting waveforms shown in Section 7. Using the troubleshooting conditions given with the waveforms, check that the Pulse OUT display is similar to the normal condition shown in waveform 14A.

2. If the PULSE OUT display is similar to 14B waveform (open) or 14C (T.D. does not turn on), CR69 is defective.

NOTE

Waveforms were taken at point 13 and 14 with conditions as follows:

(A) Normal, Waveform 13A and 14A.

(B) Possible open T.D., Waveform 13B and 14B.

(C) T.D. not changing state, Waveform 13C and 14C.

Each of these conditions should indicate defective CR69, however, check that the knurled screw holding the Tunnel Diode is tightened properly, and that the 2 mil diameter lead wire to R69 is not shorted.

REPACKAGING FOR SHIPMENT

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

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

Surround the instrument with polyethylene sheeting to protect the finish of the instrument. Obtain a carton of corrugated cardboard of the correct carton strength and having inside dimensions of no less than six inches more than the instrument dimensions. Cushion the instrument by tightly packing three inches of dunnage or urethane foam between carton and instrument, on all sides. Seal carton with shipping tape or industrial stapler.

The carton test strength for your instrument is 200 pounds.

NOTES

SECTION 5
PERFORMANCE CHECK ADJUSTMENT

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

Introduction

This section of the manual contains the Performance Check and the Adjustment Procedure. When the Performance Check Procedure is completed, the instrument is checked to the "Performance" information given in Section 1. The tolerance and waveforms given in the Adjustment Procedure should be considered only as adjustment guides and not as instrument specifications.

Equipment Required

The following test equipment, or its equivalent, is required for both the Performance Check and the Adjustment Procedure of the S-52. All test equipment must be calibrated. If other equipment is substituted, it must meet or exceed the limits stated in the equipment list.

1. Test oscilloscope Tektronix 7000-Series (7504 used in this procedure), required for use with plug-in units, items 2, 3, and 4.

2. Sampling Unit, Tektronix 7S11.

3. Sampling Time Base, Tektronix 7T11.

4. TDR Sampling Unit, Tektronix 7S12.

5. Sampling Head, S-6.

6. Type 285 Power Supply for S-50 Series Heads.

7. Sampling Head Extender, 3-foot. Tektronix Part No. 012-0124-00.

8. 50 Ω coaxial cable, semi-regid 1 ns, Tektronix Part No. 015-1023-00.

9. 50 Ω coaxial cable, 3 mm, U-shaped, semi-rigid. Tektronix Part No. 015-1017-01.

10. 50 Ω coaxial cable, 750 ps signal delay, 3 mm, semi-rigid. Tektronix Part No. 015-1017-00.

11. Two 50 Ω coaxial cables, 18-inch, RG58, BSM Female to BNC Male. Tektronix Part No. 012-0127-00.

12. 50 Ω coaxial cable, 18-inch with BNC connectors. Tektronix Part No. 012-0076-00.

13. Three Adapters 3 mm Male to BNC Female. Tektronix Part No. 015-1018-00.

14. Adapter, BSM Male to BNC Female. Tektronix Part No. 103-0036-00.

15. 50 Ω termination, 3 mm. Tektronix Part No. 015-1004-00.

16. 5X attenuator, BNC. Tektronix Part No. 011-0060-02.

PERFORMANCE CHECK PROCEDURE

Introduction

The Performance Check provides a means of rapidly checking the S-52 without adjusting any internal controls. Failure to meet any of the requirements given in the procedure indicates a need for internal checks or adjustments, and the user should refer to the Adjustment Procedure in this section.

Partial Performance Check

Less than the complete performance check may be desired if the S-52 is used with the 7S12 and the S-6 exclusively. For example, the front panel PRETRIG OUT is not used in normal operation of the 7S12, S-6, and S-52. For this partial performance check, refer to steps 8 through 11.

Preliminary Procedure

a. Install the 7S11 with the S-6 Sampling Head in the Right Vert compartment and the 7T11 in the A Horiz compartment of the 7504 Oscilloscope.

b. Install the S-52 Pulse Generator Head in the Type 285 Power Supply.

c. Set the controls as follows:

7504 Indicator Oscilloscope

A Intensity	CCW
B Intensity	CCW
Vertical Mode	Right
Horizontal Mode	A

7S11 with S-6

Delay	Midrange
+Up	Pushed in
DC Offset ±1 V and Fine	Midrange
mVolts/Div	100
Variable	Pushed in
Dot Response	Midrange
Normal	Pushed in

7T11

Time Position and Fine	Fully clockwise
Random	Pushed in
Sweep Range	.5 μs
Time/Div	20 ns
Variable	Pushed in
Scan	Midrange
Rep	Pushed in
Slope +	Pushed in
Trig Level	Midrange
Stability	Fully clockwise
Trig Amp X1	Pushed in
50 Ω2 V Max	Pushed in

d. Turn the Type 285 and the Oscilloscope power on. After about a five minute warmup time, advance the A Intensity until a free-running trace is observed. Center the trace on the CRT with the 7S11 DC Offset control.

1. Check PRETRIG OUT (Front Panel) Amplitude and Duration

a. Connect the Type 285 Trigger Out through a BSM to BNC coaxial cable (18 inch) and BNC to 3 mm adapter to the 7T11 Trig Input. Connect the S-52 PRETRIG OUT signal through a BSM to BNC coaxial cable (18 inch), a BNC 5X attenuator and a BNC to 3 mm adapter to S-6 Loop Thru (lower) connector. Terminate the upper Loop Thru connector with a 3 mm 50 Ω termination.

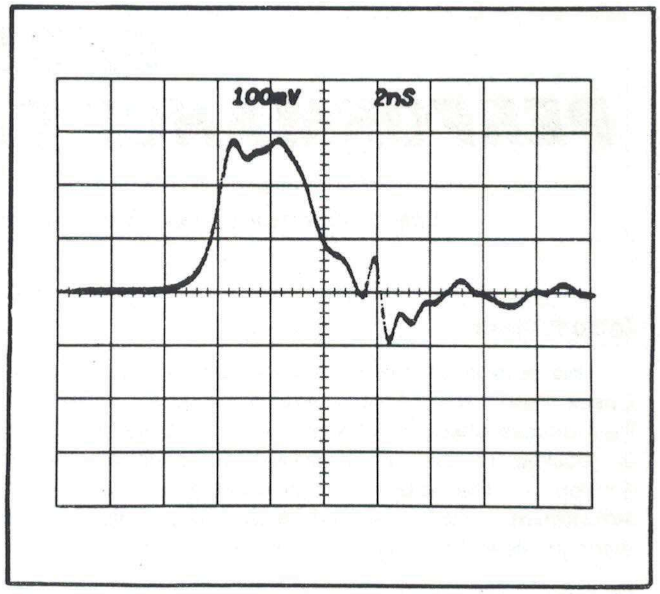


Fig. 5-1. Pretrigger Out.

b. Set the 7T11 Trig Level for a stable display and use the Time Position control to position the PRETRIG OUT display to the left edge of the graticule. Change the 7T11 Time/Div to 2 ns for a display of the PRETRIG OUT signal. See Fig. 5-1.

c. Check the PRETRIG OUT amplitude to be at least one volt positive-going.

d. Check the PRETRIG OUT duration at the 50% amplitude point to be 4 ns within 2 ns.

2. Check PRETRIG OUT (Front Panel) Rise Rate

a. Change the 7T11 Time/Div to 500 ps. Set the 7S11 mV/Div to 50. Use the Time Position control to position the rising portion of the PRETRIG OUT signal on the CRT.

b. Check that a portion of the rise is greater than 600 mV (2.4 divisions) in 1 ns. See Fig. 5-2.

3. Check Pretrigger Out (Rear Panel) Amplitude and Duration

a. Interchange the two trigger cables to the S-6 and S-52 front panel connectors.

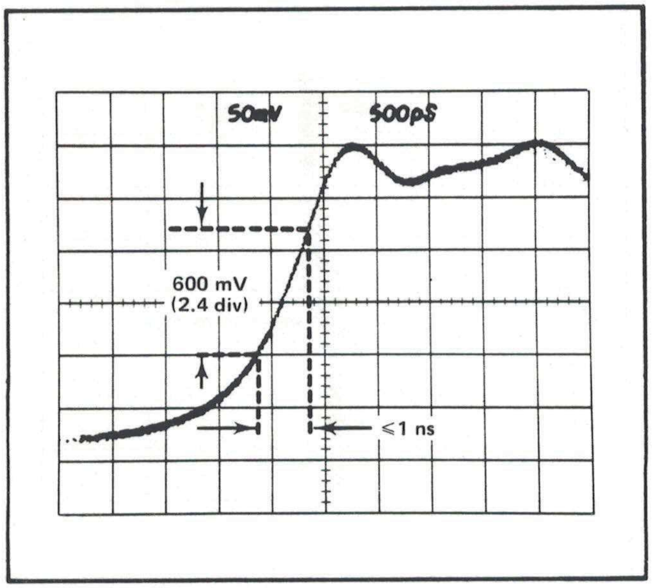


Fig. 5-2. Waveform of Pretrigger Out leading edge showing Rise Rate. (5X attenuator used in signal path.)

b. Change the following controls:

7S11	
mV/Div	100
7T11	
Sweep Range	.5 μs
Time/Div	20 ns

c. Set the 7T11 Trig Level for a stable display and use the Time Position control to position the Pretrigger Out display to the left edge of the graticule. Change the 7T11 Time/Div to 2 ns for a display of the Pretrigger Out signal. See Fig. 5-1.

d. Check the Pretrigger Out amplitude to be at least one volt positive-going.

e. Check the Pretrigger Out duration at the 50% amplitude point to be 4 ns within 2 ns.

4. Check Pretrigger Out (Rear Panel) Rise Rate

a. Change the 7T11 Time/Div to 500 ps. Set the 7S11 mV/Div to 50. Use the Time Position control to position the rising portion of the Pretrigger Out signal on the CRT.

b. Check any portion of the rise to be greater than 600 mV (2.4 divisions) in 1 ns. See Fig. 5-2.

5. Check PRETRIG OUT to PULSE OUTPUT Time Interval

a. Remove the coaxial cable from between the Type 285 Trigger Out connector and the 5X attenuator.

b. Remove the coaxial cable from the S-52 PRETRIG OUT connector and connect it to the Type 285 Trigger Out connector.

c. Install BSM to BNC female and 3 mm to BNC female adapters on the S-52 connectors, and connect a BNC coaxial cable from the S-52 PRETRIG OUT connector to the 5X attenuator on the S-6.

d. Change the 7T11 Time/Div to 10 ns. Set the 7S11 mV/Div to 100 mV. Use the Time Position control to position the rising portion of the PRETRIG OUT display to the left edge of the graticule.

e. Remove the coaxial cable from the PRETRIG OUT connector and connect the cable to the PULSE OUTPUT connector of the S-52. Do not adjust any controls.

f. Check the position of the leading edge of the displayed PULSE OUTPUT signal to be 85 ns within 5 ns from the left edge of the graticule. See Fig. 5-3.

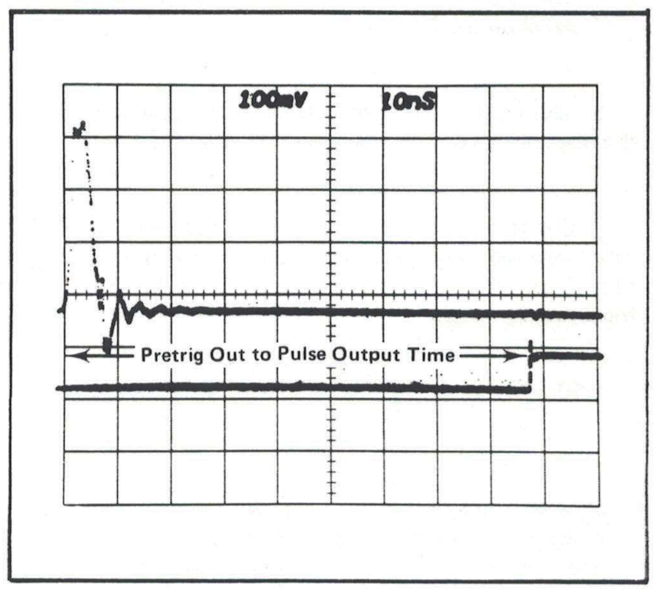


Fig. 5-3. Double exposure photo showing the PRETRIG OUT to PULSE OUTPUT time interval.

6. Check PRETRIG OUT to PULSE OUTPUT Jitter

a. Remove the cables, adapters and attenuator from the S-52, the Type 285 Trigger Out and the S-6 lower input connectors.

b. Install a Sampling Head Extender cable between the Type 285 and the S-52.

c. Connect a 750 ps, 3 mm, semi-rigid coaxial cable (Tektronix Part No. 015-1017-00) from the S-52 PULSE OUTPUT to the S-6 lower input.

d. Connect the BSM to BNC coaxial cable from the 7T11 Trig Input connector to the S-52 PRETRIG OUT connector.

e. Change the following controls:

7T11

Sequential	Pushed in
Sweep Range	50 ns
Time/Div	5 ns
Time Position	Fully clockwise

f. Set the 7T11 Trig Level for a stable display of the leading edge of the PULSE OUTPUT signal. Change the Time/Div to 200 ps, and use the Time Position control to position the leading edge to the center of the graticule.

g. Use the DC Offset to center the display vertically, and change the mV/Div to 10. Then change the 7T11 Time/Div to 20 ps, and use the Time Position control to position the center portion of the leading edge of the PULSE OUTPUT signal on the CRT.

h. Determine the displayed jitter by observing 90% of the dot density on the rising portion. See Fig. 5-4.

i. Check that the displayed jitter is not more than 14 ps. The maximum displayed jitter value was calculated by using the 10 ps jitter for the 7T11 and 10 ps for S-52 in the following formula:

$$\text{Displayed jitter} = \sqrt{(\text{S-52 jitter})^2 + (\text{7T11 jitter})^2}$$

NOTE

If the displayed jitter exceeds 14 ps, determine whether the sampling system is operating properly (see the 7T11 manual if necessary), and select a Trig Level setting that will produce the least jitter. The S-52 displayed jitter with the 7S12 is checked in step 11.

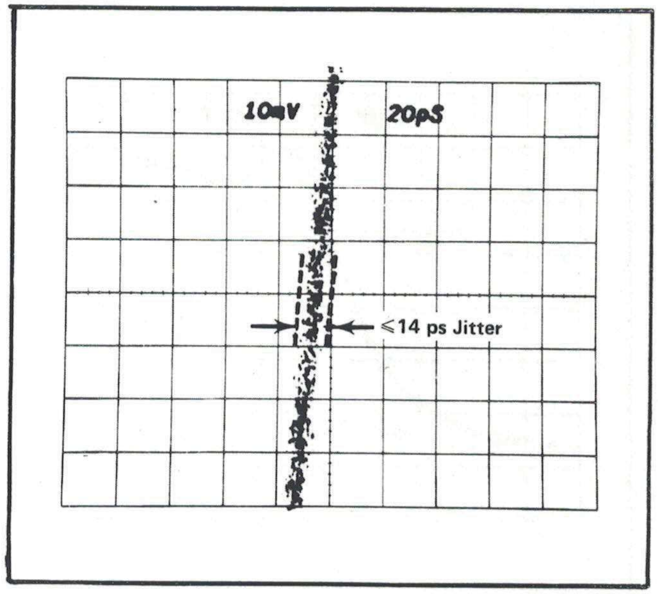


Fig. 5-4. Typical waveform to observe jitter in step 6.

7. Check PULSE OUTPUT Period

a. Change the following controls:

7S11

mV/Div	100

7T11

Sweep Range	50 μs
Time/Div	1 μs (SN B070390-up. 2 μs)
Scan	9 o'clock position

b. Set the 7T11 Trig Level control for a stable display and use the Time Position control to display two pulses. Note that the desired pulses have the wider top, and are not preceded by a sharply rising foot. See Fig. 5-5.

c. Check that the PULSE OUTPUT period is 8.3 μs within 0.8 μs for SN B070389 and below. 16 μs within 2 μs SN B070390 and up.

8. Check PULSE OUTPUT Duration, Amplitude and Baseline Level

a. Set the 7S11 mV/Div switch at 50 and the 7T11 Time/Div switch at .2 μs.

b. Adjust the 7T11 Time Position control to place the pulse on the CRT. See Fig. 5-6.

c. Check that the PULSE OUTPUT duration is at least 350 ns.

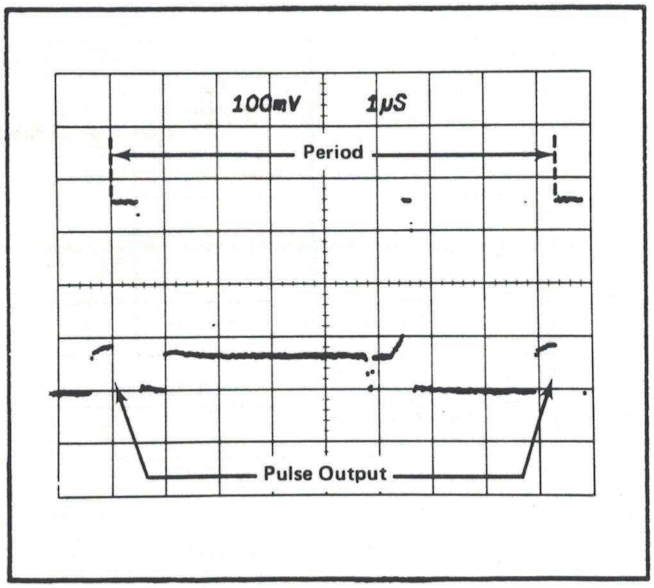


Fig. 5-5. Waveform showing PULSE OUTPUT period SN B070389 and below.

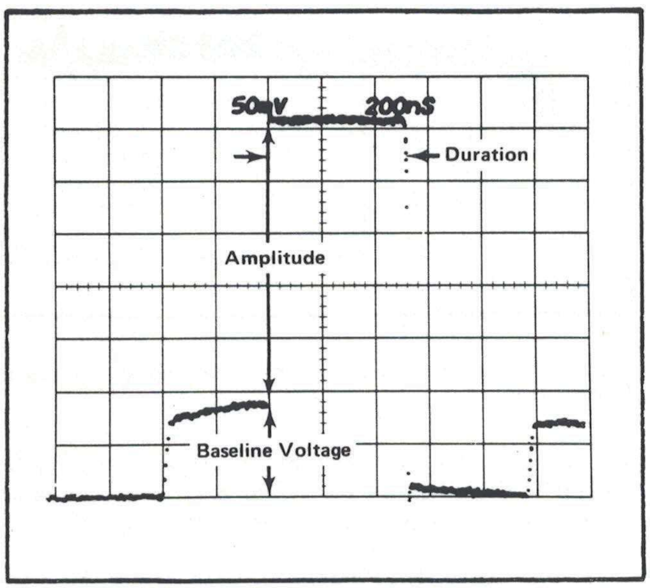


Fig. 5-6. Waveform showing PULSE OUTPUT duration, amplitude and baseline level.

d. Check that the PULSE OUTPUT amplitude from the baseline level to the pulse top is at least 200 mV.

e. Check that the baseline level (the voltage prior to the displayed PULSE OUTPUT signal) is between 55 mV and 120 mV.

f. Remove the connections to the S-52, S-6 and the 7T11 and remove the 7S11 and the 7T11 from the oscilloscope.

9. Check PULSE OUTPUT Risetime

a. Install a 7S12 in the two center compartments of the oscilloscope and install the S-6 in the Sampling compartment and the S-52 in the Pulse Generator compartment of the 7S12.

b. Connect the U-shaped semi-rigid coaxial line (Tektronix Part No. 015-1017-01) from the S-52 PULSE OUTPUT connector to the S-6 lower input connector. The S-6 upper connector is terminated with 50 Ω.

c. Set the controls as follows:

7S12

mρ	Push in
mρ/Div	200
mρ/Div Variable	Release
Time-Distance multiplier	X.1
Time/Div	20 ps
Time-Distance dial	0
Rep	Push in
Scan	Clockwise
DC Offset	Display step
Fine (Zero Set)	Display step

d. Adjust the mρ/DIV Variable control so that the 0% and the 100% levels of the incident pulse are 5 div apart. Use the following procedure to locate the 0% (100% is in parenthesis) level for the incident pulse. This procedure is necessary whenever a level is not clearly defined.

1. Find the knee reference point at the start (end) of the step where the rate of change of the slope is maximum (the radius of curvature is least). See Fig. 5-7 for this waveform.

2. At a distance of one risetime before (after) the knee reference point in step 1, place the center of a zone which is one risetime in width. The S-6, S-52 and 7S12 system risetime is 35 ps.

3. Determine the average level of the waveform within the zone and use it for the 0% (100%) reference level.

e. Check that the system displayed incident pulse risetime from the 10% level to the 90% level is 35 ps or less.

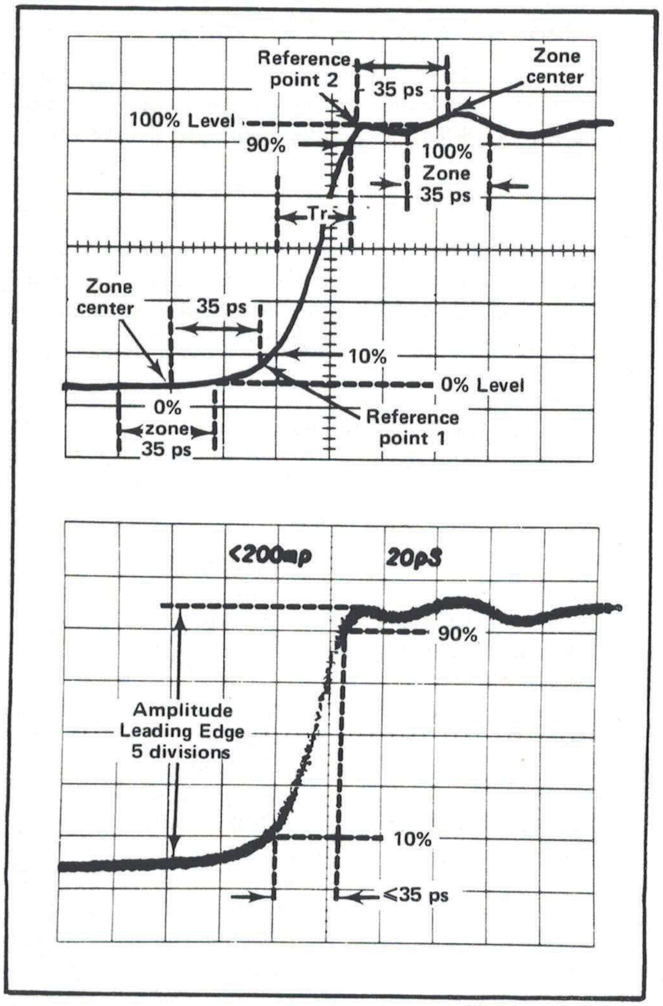


Fig. 5-7. Risetime measurement (T_r) information (upper) and typical risetime display (lower). Note that Reference point 1 and 2 are selected at the corners where the rate of change of the slope is maximum (where the radius of curvature is least).

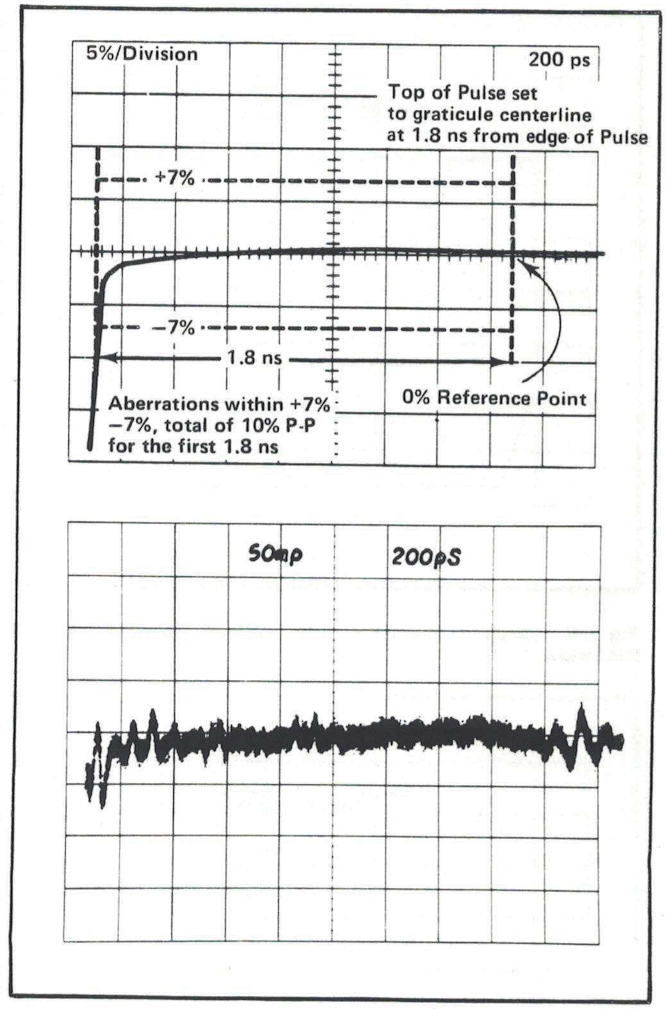


Fig. 5-8. First 1.8 ns aberrations information (upper) and typical display (lower).

NOTE

This displayed risetime is given for the system consisting of the S-6 and S-52 and setup as given. This system risetime is faster than the calculated risetime (39 ps) using the S-6 risetime as 30 ps and the S-52 as 25 ps in the following formula:

$$T_r(displayed) = \sqrt{T_r^2\ (S\text{-}52) + T_r^2\ (S\text{-}6)}$$

10. Check PULSE OUTPUT Aberrations

a. Change the Time/Div to 200 ps. Use the Time Distance knob to position the leading edge of the PULSE OUTPUT to the center of the CRT. Then set the mρ/Div Variable control for a 5 division display amplitude.

b. Change the mρ/Div to 50. With the Time Distance knob, position the leading edge of the PULSE OUTPUT to the left side of the CRT. Use the DC Offset control to set the top of the pulse (at the 1.8 ns point from the pulse leading edge) to the center graticule line (see Fig. 5-8).

c. Check that the aberrations are within +7%, −7%, total of 10% within 1.8 ns of the step edge.

d. Set the Time-Distance Multiplier at X1, the Time/Div switch at 50 ns and turn the Time-Distance and Fine (Zero Set) controls fully clockwise.

e. Place the top of the pulse on the graticule centerline. Use the portion of the pulse that is 300 ns (6 div) from the start of the pulse for the reference level.

f. Set the Time-Distance Multiplier at X.1 and the Time/Div switch at 500 ps. Adjust the Time-Distance control to position the point which is 2.5 ns from the start of the pulse at the graticule center. See Fig. 5-9.

g. Check that the aberrations are within +2%, −2%, total of 4% after 2.5 ns.

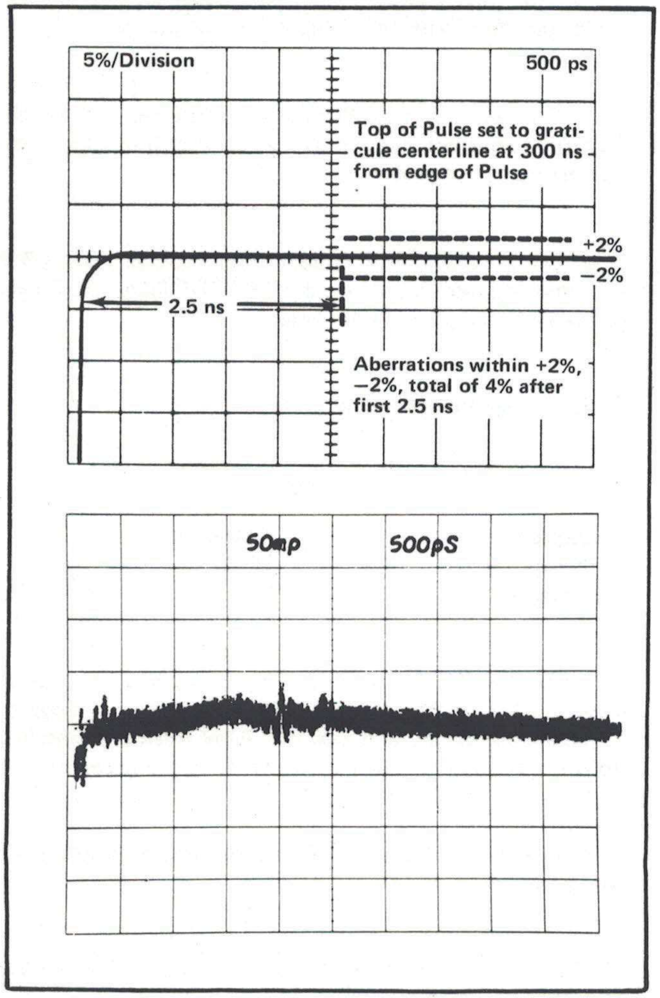


Fig. 5-9. Aberrations after the first 2.5 ns information (upper) and typical display (lower).

11. Check Display Jitter

a. Change the mρ/Div to 20 and set the Time/Div switch at 20 ps.

b. Use the DC Offset and the Time Distance knob to center the middle portion of the PULSE OUTPUT leading edge on the CRT. See Fig. 5-4 for a similar display.

c. Check that the jitter is less than 10 ps.

ADJUSTMENT PROCEDURE

Introduction

The Adjustment Procedure contains all the adjustments required in the instrument. Troubleshooting information is contained in the Maintenance Section and the Diagrams Section. All S-52 controls are shown in the Diagrams section on the circuit board callouts.

Partial Adjustment

Less than the complete Adjustment Procedure may be desired if the S-52 is used with the 7S12 and S-6 exclusively. Perform this partial procedure as follows:

a. Remove the S-52 from its housing and install it onto the Sampling Head Extender.

b. Omit step 1 (Adjustment Procedure following); C60 is not used when the S-52 is operated with the 7S12.

c. In place of step 2, use the setup and display used in the Performance Check step 11, and adjust Trig Level R90 for minimum jitter.

d. If tunnel diode CR69 has been replaced, a change in the length of the 2 mil diameter lead wire to the tunnel diode may be required. To check and/or adjust this lead wire, set up the display as given in the Performance Check step 10 (Check PULSE OUTPUT Aberrations). Then follow adjustment step 3 parts c through e.

Preliminary Procedure

1. Assemble the equipment as follows: Install the 7S11 with the S-6 Sampling Head (equipment list item 2) into the right vertical compartment, and the 7T11 (item 3) into the A Horiz compartment of the 7504 Indicator Oscilloscope (item 1). Install the Sampling Head Extender (item 7) into the Type 285 Power Supply.

2. Remove the S-52 from its housing (see the Maintenance Section), and install it onto the Sampling Head Extender.

3. Set the controls as follows:

7504 Indicator Oscilloscope

A Intensity	CCW
B Intensity	CCW
Vertical Mode	Right
Horizontal Mode	A

7S11 with Type S-6 Sampling Head (Right vertical plug-in compartment)

Delay	Midrange
+Up	Pushed in
DC Offset ±1 V and Fine	Midrange
mVolts/Div	100
Variable	Pushed in
Dot Response	Midrange
Normal	Pushed in

7T11
(A horizontal plug-in compartment)

Time Position and Fine	Fully clockwise
Random	Pushed in
Sweep Range	.5 μs
Time/Div	5 ns
Variable	Pushed in
Scan	Midrange
Rep	Pushed in
Slope +	Pushed in
Trig Level	Midrange
Stability	Fully clockwise
Trig Amp X1	Pushed in
50 Ω 2 V Max	Pushed in

4. Turn on the Type 285 and the Oscilloscope power. After about five minutes warmup, advance the A Intensity until a free-running trace is observed. Center the trace on the CRT with the 7S11 DC Offset control.

1. Adjust Leadtime C60

a. Connect the Type 285 Trigger Out through a BSM to BNC coaxial cable (18 inch) and a BNC to 3 mm adapter to the 7T11 Trig Input. Connect the S-52 PRETRIG OUT signal through BSM to BNC adapter, a BNC coaxial cable, a 5X attenuator, a BNC to 3 mm adapter to S-6 Loop Thru (lower) connector. Terminate the upper Loop Thru connector with a 50 Ω termination.

b. Set the 7T11 Trig Level control for a stable display of the PRETRIG OUT signal.

c. Change the 7T11 Time/Div to 10 ns and use the Time Position control to position the rising portion of the PRETRIG OUT display to the left edge of the graticule. See Fig. 5-3.

d. Without moving the position, trigger controls, or other setup conditions, install a BNC to 3 mm adapter to the S-52 PULSE OUTPUT connector; change the BNC cable connector from the BNC to BSM adapter (at the PRETRIG OUT connector) to the BNC to 3 mm adapter connected to the PULSE OUTPUT connector.

e. Adjust C60 to position the leading edge of the displayed PULSE OUTPUT 85 ns from the left edge of the graticule. Refer to Fig. 5-3.

2. Adjust Trig Level R90

a. Disconnect the connectors from the S-52. Remove the 5X attenuator and the BNC to 3 mm adapter from the S-6 Loop Thru (lower) connector. Disconnect the trigger cable from the Type 285 Trigger Out connector.

b. Connect the S-52 PULSE OUTPUT signal through a 750 ps semi-rigid coaxial cable to the S-6 Loop Thru (lower) input connector.

c. Use a BSM to BNC coaxial cable (18-inch) and a BNC to 3 mm adapter to connect the S-52 PRETRIG OUT signal to the 7T11 Trig Input connector.

d. Change the following controls:

7T11

Sequential	Pushed in
Sweep Range	50 ns
Time/Div	1 ns

e. Set the 7T11 Trig Level for a stable display of the leading edge of the PULSE OUTPUT signal. Change the Time/Div to 50 ps, and use the Time Position control to position the leading edge to the center of the graticule.

f. Adjust Trig Level R90 for minimum jitter on the rising portion.

3. Adjust 2 Mil Diameter Lead Wire (To Tunnel Diode)

NOTE

This step may be required only when tunnel diode CR69 has been replaced (For CR69 replacement and troubleshooting information see the Maintenance Section.)

a. Change the following controls:

7T11

Sweep Range	50 μs
Time/Div	200 ps

7S11

mV/Div	50

b. Adjust the 7S11 mV/Div Variable control for a 5 division display. Change the 7S11 mV/Div to 10, and use the DC Offset control to position the top of the pulse to the graticule centerline. See Fig. 5-8 for aberration display information.

c. Delete the balance of this step if the aberrations are within +2%, −10%, total of 10% within 1.8 ns of the pulse step (with reference point 1.8 ns from step), including the first 50 ps which is effective in this adjustment.

d. If the first 50 ps of the pulse shows an overshoot or undershoot, turn the Type 285 power off, remove the timing board, and use a small soldering iron to reduce or increase the length of the 2 mil diameter lead wire. See the terminal board parts location photo for the location of the lead wire.

CAUTION

Due to the small diameter of the wire, care must be taken in soldering the 2 mil diameter wire to parallel resistors R65-R68. After soldering, visually check that the 2 mil wire is not shorted to chassis ground.

e. Install the timing board, turn the Type 285 power on, and observe the first 50 ps of the pulse top. Repeat part d until the first 50 ps of the pulse is within the aberration limits given in part c.

NOTES

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

ACTR	ACTUATOR
ASSY	ASSEMBLY
CAP	CAPACITOR
CER	CERAMIC
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
ELCTLT	ELECTROLYTIC
ELEC	ELECTRICAL
INCAND	INCANDESCENT
LED	LIGHT EMITTING DIODE
NONWIR	NON WIREWOUND
PLSTC	PLASTIC
QTZ	QUARTZ
RECP	RECEPTACLE
RES	RESISTOR
RF	RADIO FREQUENCY
SEL	SELECTED
SEMICOND	SEMICONDUCTOR
SENS	SENSITIVE
VAR	VARIABLE
WW	WIREWOUND
XFMR	TRANSFORMER
XTAL	CRYSTAL

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC. SEMICONDUCTOR GROUP	P.O. BOX 5012	DALLAS, TX 75222
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK	SYRACUSE, NY 13201
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD,PO BOX 20923	PHOENIX, AZ 85036
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
22229	SOLITRON DEVICES, INC., SEMICONDUCTOR GROUP	8808 BALBOA AVENUE	SAN DIEGO OPERS, CA 92123
32159	WEST-CAP ARIZONA	2201 E. ELVIRA ROAD	TUCSON, AZ 85706
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
50101	GHZ DEVICES, INC.	16 MAPLE ROAD	SOUTH CHELMSFORD, MA 01824
51642	CENTRE ENGINEERING INC.	2820 E COLLEGE AVENUE	STATE COLLEGE, PA 16801
51984	NEC AMERICA INC. RADIO AND TRANSMISSION DIV.	2990 TELESTAR CT. SUITE 212	FALLS CHURCH, VA 22042
56289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
57668	R-OHM CORP.	16931 MILLIKEN AVE.	IRVINE, CA 92713
59660	TUSONIX INC.	2155 N FORBES BLVD	TUCSON, AZ 85705
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73899	JFD ELECTRONICS COMPONENTS CORP.	PINETREE ROAD	OXFORD, NC 27565
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601
95275	VITRAMON, INC.	P O BOX 544	BRIDGEPORT, CT 06601

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-1320-00	B010100	B079999	CKT BOARD ASSY:TIMING	80009	670-1320-00
A1	670-1320-01	B080000	B091449	CKT BOARD ASSY:TIMING	80009	670-1320-01
A1	670-1320-02	B091450		CKT BOARD ASSY:TIMING	80009	670-1320-02
A2	670-1319-00	B010100	B079999	CKT BOARD ASSY:TD CONTROL	80009	670-1319-00
A2	670-1319-01	B080000		CKT BOARD ASSY:TD CONTROL	80009	670-1319-01
A3	670-1321-00	B010100	B079999	CKT BOARD ASSY:TRIGGER	80009	670-1321-00
A3	670-1321-01	B080000	B099999	CKT BOARD ASSY:TRIGGER	80009	670-1321-01
A3	670-1321-02	B100000		CKT BOARD ASSY:TRIGGER	80009	670-1321-02
C9	283-0182-00			CAP.,FXD,CER DI:51PF,5%,400V	72982	8121N400A510J
C10	283-0065-00			CAP.,FXD,CER DI:0.001UF,5%,100V	59660	0835-591Y5EO102J
C11	283-0065-00			CAP.,FXD,CER DI:0.001UF,5%,100V	59660	0835-591Y5EO102J
C40	281-0616-00			CAP.,FXD,CER DI:6.8PF,+/-0.5PF,200V	59660	374-018-C0H0689D
C44	283-0186-00			CAP.,FXD,CER DI:27PF,5%,50V	59660	811A058C0G0270J
C52	283-0069-00			CAP.,FXD,CER DI:15PF,20%,50V	51642	A150050NPU150M
C54	283-0069-00			CAP.,FXD,CER DI:15PF,20%,50V	51642	A150050NPU150M
C60	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C60	----- -----			(A2 ONLY)		
C60	281-0123-00	B010100	B099999	CAP.,VAR,CER DI:5-25PF,100V	59660	518-000A5-25
C60	----- -----			(A3 ONLY)		
C60	281-0158-00	B100000		CAP.,VAR,CER D1:7-45PF,50V	73899	DVJ-5006
C60	----- -----			(A3 ONLY)		
C62	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
C65	283-0181-00	B010100	B079999	CAP.,FXD,CER DI:1.8PF,10%,100V	59660	8101B121COKO189B
C65	283-0320-00	B080000		CAP.,FXD,CER DI:1PF,50V,LEADLESS	95275	VJ0805A1R0C-H
C66	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	56289	273C11
C87	283-0028-00			CAP.,FXD,CER DI:0.0022UF,20%,50V	59660	0805585Y5SO222M
C90	283-0065-00	B010100	B069999	CAP.,FXD,CER DI:0.001UF,5%,100V	59660	0835-591Y5EO102J
C90	283-0114-00	B070000		CAP.,FXD,CER DI:0.0015UF,5%,200V	59660	805534Y5DO152J
C101	283-0203-00			CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131M058Z5U0474M
C102	283-0203-00			CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131M058Z5U0474M
C103	283-0203-00			CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131M058Z5U0474M
C105	283-0203-00			CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131M058Z5U0474M
C107	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	56289	273C11
C109	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	56289	273C11
CR10	152-0141-02	B060000		SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR21	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR40	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR54	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR60	152-0233-00			SEMICOND DEVICE:SILICON,85V,100MA	07263	FDH1986
CR62	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR63	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR66	152-0252-00	B010100	B079999	SEMICOND DEVICE:SILICON,SNAP-OFF	80009	152-0252-00
CR66	152-0252-01	B080000		SEMICOND DEVICE:	50101	GC-2534-15
CR69	153-0040-00	B010100	B080779	SEMICOND DEVICE:	80009	153-0040-00
CR69	153-0040-01	B080780		SEMICOND DEVICE:DIODE HOLDER ASSY	80009	153-0040-01
CR90	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR91	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR93	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
J50	----- -----			(A2 ONLY)		
J60	131-0631-00			CONN,RCPT,ELEC:3MM TYPE FEMALE	22229	2992-6012

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
L10	108-0317-00	B010100	B069999	COIL,RF:FIXED,15UH	32159	71501M
L10	108-0395-00	B070000		COIL,RF:64UH	80009	108-0395-00
L62	108-0088-00			COIL,RF:FIXED,3.35UH	80009	108-0088-00
LR64	108-0299-00			COIL,RF:	80009	108-0299-00
P52	----- -----			(A2 ONLY)		
Q32	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q40	151-0269-00	B010100	B069999	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	51984	41632BD
Q40	151-0441-01	B070000		TRANSISTOR:SILICON,NPN	80009	151-0441-01
Q50	151-0271-00			TRANSISTOR:SILICON,PNP	04713	SPS8236
Q60	151-0269-00	B010100	B069999	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	51984	41632BD
Q60	151-0441-01	B070000		TRANSISTOR:SILICON,NPN	80009	151-0441-01
Q72	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q74	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q80	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q86	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q88	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q90	151-0254-00			TRANSISTOR:SILICON,NPN	03508	X38L3118
R9	317-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.125W	01121	BB2415
R10	317-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.125W	01121	BB2025
R12	317-0432-00	B010100	B091449	RES.,FXD,CMPSN:4.3K OHM,5%,0.125W	01121	BB4325
R12	317-0302-00	B091450		RES.,FXD,CMPSN:3K OHM,5%,0.125W	01121	BB3025
R20	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R22	317-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.125W	01121	BB7525
R26	317-0153-00	B010100	B079999	RES.,FXD,CMPSN:15K OHM,5%,0.125W	01121	BB1535
R26	317-0133-00	B080000		RES.,FXD,CMPSN:13K OHM,5%,0.125W	01121	BB1335
R27	317-0511-00	B010100	B079999	RES.,FXD,CMPSN:510 OHM,5%,0.125W	01121	BB5115
R27	317-0202-00	B080000		RES.,FXD,CMPSN:2K OHM,5%,0.125W	01121	BB2025
R28	317-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.125W	01121	BB7525
R30	317-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.125W	01121	BB4325
R31	317-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.125W	01121	BB2025
R32	317-0621-00			RES.,FXD,CMPSN:620 OHM,5%,0.125W	01121	BB6215
R33	317-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.125W	01121	BB7525
R34	317-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.125W	01121	BB2235
R35	317-0912-00			RES.,FXD,CMPSN:9.1K OHM,5%,0.125W	01121	BB9125
R36	317-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.125W	01121	BB1035
R37	317-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.125W	01121	BB2425
R38	317-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.125W	01121	BB2015
R40	317-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.125W	01121	BB3035
R42	317-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.125W	01121	BB1035
R44	317-0513-00			RES.,FXD,CMPSN:51K OHM,5%,0.125W	01121	BB5135
R50	317-0623-00			RES.,FXD,CMPSN:62K OHM,5%,0.125W	01121	BB6235
R52	317-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.125W	01121	BB8225
R53	317-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.125W	01121	BB5115
R54	317-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.125W	01121	BB2425
R56	317-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.125W	01121	BB3015
R59	317-0271-00	B100000		RES.,FXD,CMPSN:270 OHM,5%,0.125W	01121	BB2715
R60	317-0823-00	B050000		RES.,FXD,CMPSN:82K OHM,5%,0.125W	01121	BB8235
R60	----- -----			(A2 ONLY)		
R60	317-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.125W	01121	BB1035
R60	----- -----			(A3 ONLY)		

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R62	317-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.125W	01121	BB8225
R64	317-0431-00	B080000		RES.,FXD,CMPSN:430 OHM,5%,0.125W	01121	BB4315
R64	----- -----			(A2 ONLY)		
R64	317-0360-00			RES.,FXD,CMPSN:36 OHM,5%,0.125W	01121	BB3605
R64	----- -----			(A3 ONLY)		
R65	317-0027-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.125W	01121	BB2R705
R66	317-0101-00	B010100	B079999	RES.,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
R67	317-0680-00			RES.,FXD,CMPSN:68 OHM,5%,0.125W	01121	BB6805
R68	317-0027-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.125W	01121	BB2R705
R69	131-1023-02			CONTACT,ELEC:	80009	131-1023-02
R71	317-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.125W	01121	BB3615
R72	317-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.125W	01121	BB2225
R74	317-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.125W	01121	BB2225
R75	317-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.125W	01121	BB1035
R80	321-0202-00			RES.,FXD,FILM:1.24K OHM,1%,0.125W	91637	MFF1816G12400F
R81	317-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.125W	01121	BB7515
R83	321-0185-00			RES.,FXD,FILM:825 OHM,1%,0.125W	91637	MFF1816G825R0F
R85	317-0161-00			RES.,FXD,CMPSN:160 OHM,5%,0.125W	01121	BB1615
R86	321-0185-00			RES.,FXD,FILM:825 OHM,1%,0.125W	91637	MFF1816G825R0F
R87	317-0121-00			RES.,FXD,CMPSN:120 OHM,5%,0.125W	01121	BB1215
R88	317-0047-00			RES.,FXD,CMPSN:4.7 OHM,5%,0.125W	01121	BB47G5
R89	321-0224-00			RES.,FXD,FILM:2.1K OHM,1%,0.125W	91637	MFF1816G21000F
R90	311-1279-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	32997	3329W-L58-501
R91	321-0047-00			RES.,FXD,FILM:30.1 OHM,1%,0.125W	91637	MFF1816G30R10F
R96	301-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.50W	01121	EB2215
R97	301-0271-00	B010100	B069999	RES.,FXD,CMPSN:270 OHM,5%,0.50W	01121	EB2715
R97	301-0221-00	B070000		RES.,FXD,CMPSN:220 OHM,5%,0.50W	01121	EB2215
R98	317-0430-00	B010100	B069999	RES.,FXD,CMPSN:43 OHM,5%,0.125W	01121	BB4305
R98	317-0300-00	B070000		RES.,FXD,CMPSN:30 OHM,5%,0.125W	01121	BB3005
R103	317-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
R105	317-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
R106	317-0162-00			RES.,FXD,CMPSN:1.6K OHM,5%,0.125	01121	BB1625
R107	317-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.125W	01121	BB2715
R108	317-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.125W	01121	BB3315
R109	308-0236-00			RES.,FXD,WW:85 OHM,5%,3W	91637	CW2B-B85R00J
U10	156-0101-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	01295	SN74L93(N OR J)
U20	156-0111-00			MICROCIRCUIT,DI:SGL BCD-TO-DEC DEC/DRIVER	80009	156-0111-00
U30	156-0048-00			MICROCIRCUIT,LI:FIVE NPN TRANSISTOR ARRAY	02735	CA3046
VR109	152-0279-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	04713	SZG35010RL
W66	131-0566-00	B080000		BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0

SECTION 7
DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

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

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

Resistors = Ohms (Ω).

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The overline on a signal name indicates that the signal performs its intended function when it goes to the low state.

Abbreviations are based on ANSI Y1.1-1972.

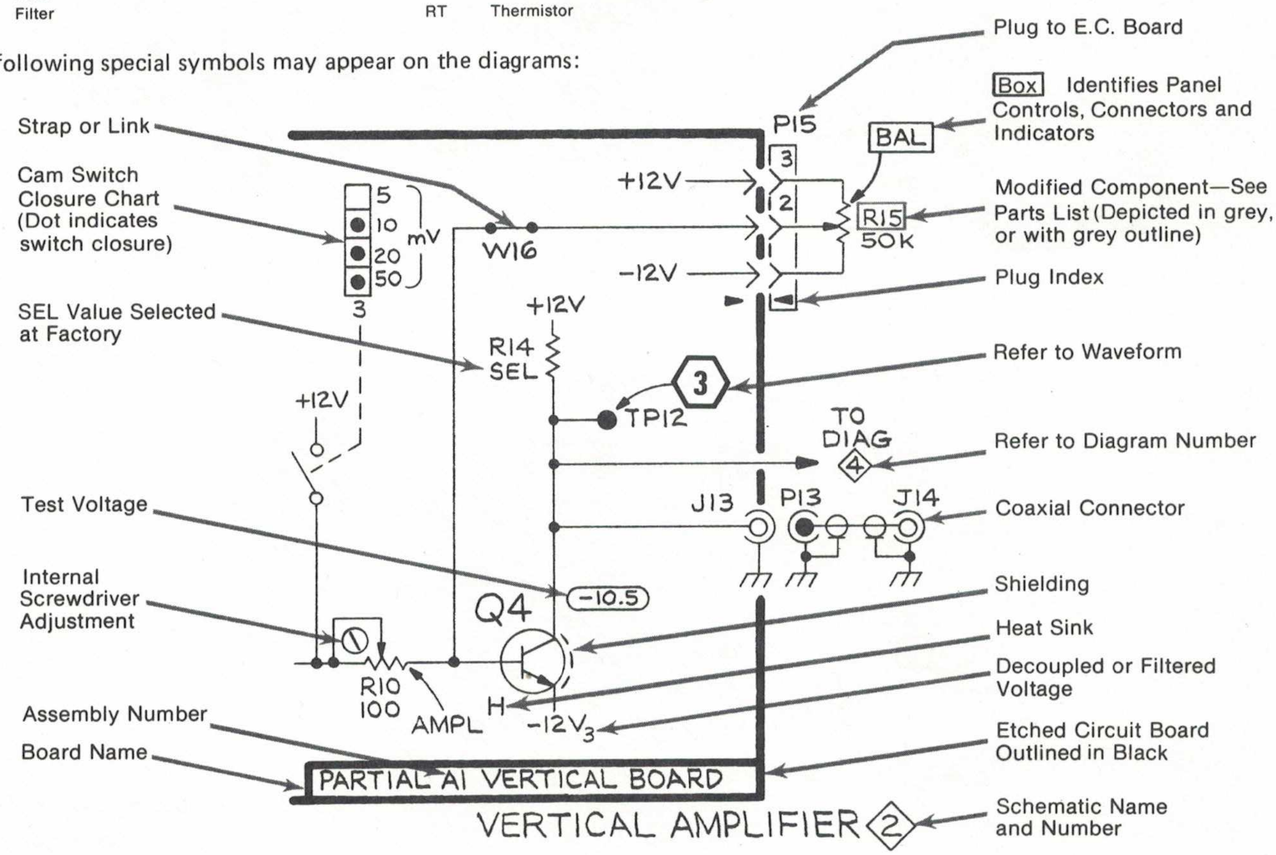
Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

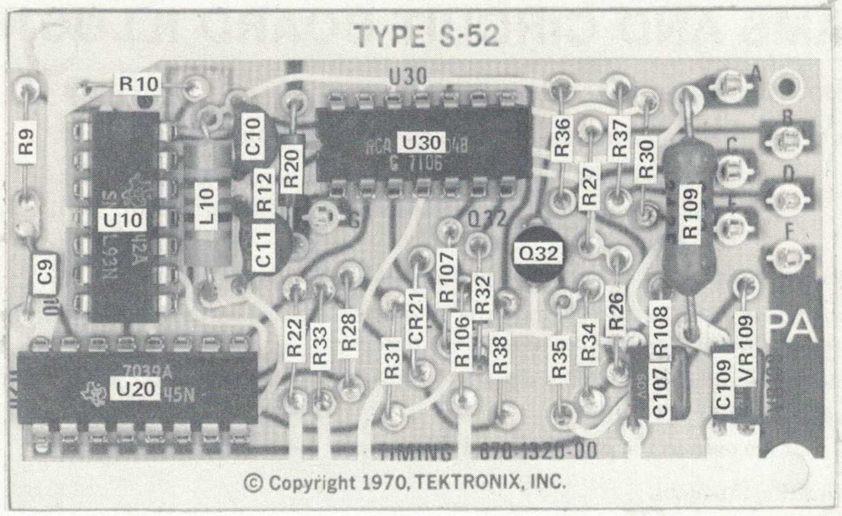
Y14.15, 1966	Drafting Practices.
Y14.2, 1973	Line Conventions and Lettering.
Y10.5, 1968	Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

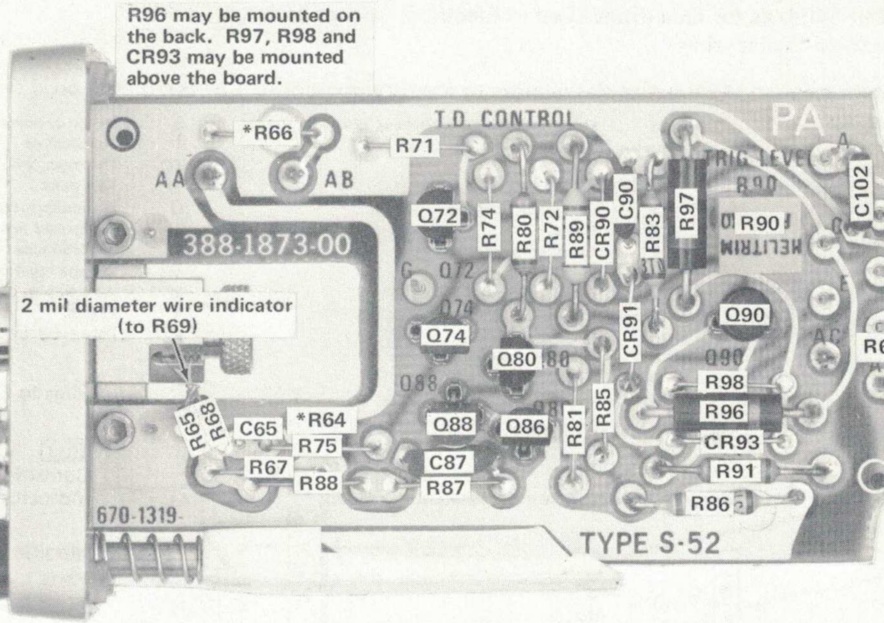
The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

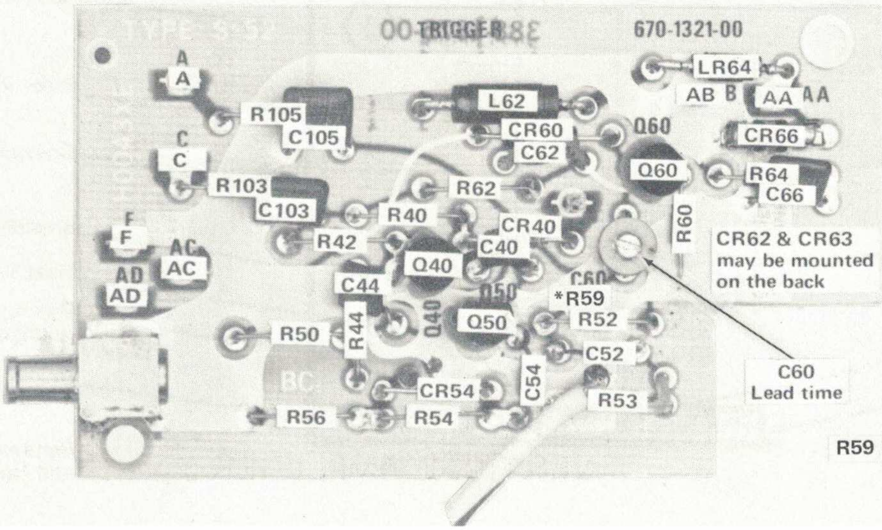
A	Assembly, separable or repairable (circuit board, etc)
AT	Attenuator, fixed or variable
B	Motor
BT	Battery
C	Capacitor, fixed or variable
CB	Circuit breaker
CR	Diode, signal or rectifier
DL	Delay line
DS	Indicating device (lamp)
E	Spark Gap, Ferrite bead
F	Fuse
FL	Filter
H	Heat dissipating device (heat sink, heat radiator, etc)
HR	Heater
HY	Hybrid circuit
J	Connector, stationary portion
K	Relay
L	Inductor, fixed or variable
M	Meter
P	Connector, movable portion
Q	Transistor or silicon-controlled rectifier
R	Resistor, fixed or variable
RT	Thermistor
S	Switch or contactor
T	Transformer
TC	Thermocouple
TP	Test point
U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
V	Electron tube
VR	Voltage regulator (zener diode, etc.)
W	Wirestrap or cable
Y	Crystal
Z	Phase shifter

The following special symbols may appear on the diagrams:







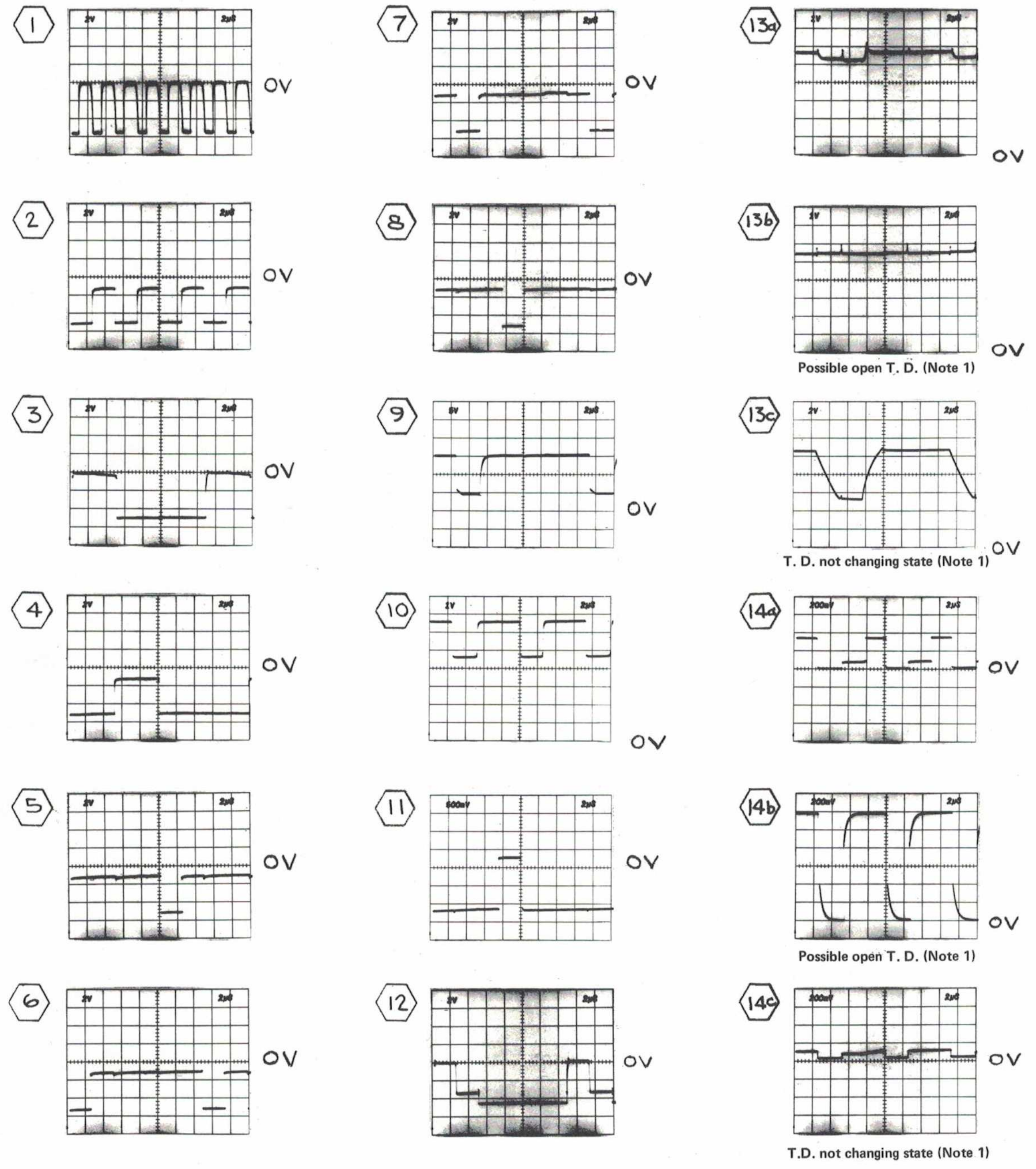


R59 Located on back of board.

*See Parts List for serial number ranges.

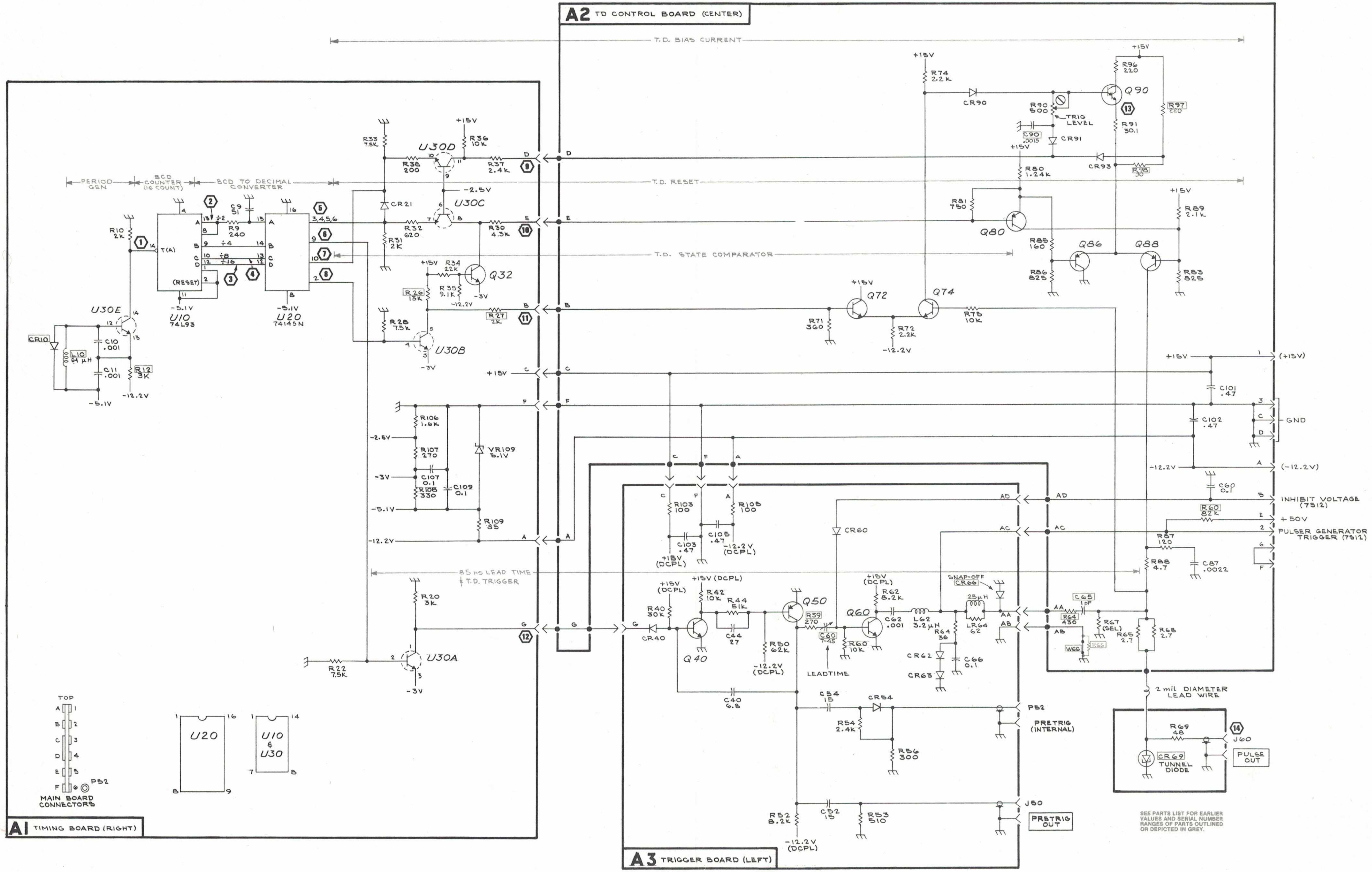
Troubleshooting Conditions

Power is obtained from Type 285 Power Supply, or sampling head compartment. Use a sampling Head Extender so that the S-52 case can be removed. Trigger the Test Oscilloscope from the Pretrig Out pulse to show time relationship.



Note 1. See Troubleshooting information in Section 4

Troubleshooting waveforms were obtained with 7A12, 7B70, and 7704. Signals for waveforms #14 was coaxially connected and 50 Ω terminated, and all others were connected with P6053 10 X probe with a short ground lead. DC coupling was used for all waveforms.



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REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

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

1 2 3 4 5 — Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
- - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
- - - * - - -

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH	ELCTRN	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICOND	SEMICONDUCTOR
ADPTR	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
AL	ALUMINUM	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
ATTEN	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVING
AWG	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BD	BOARD	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SQ	SQUARE
BRKT	BRACKET	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BRS	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BRZ	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
BSHG	BUSHING	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAB	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CAP	CAPACITOR	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHAS	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
CKT	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	RCPT	RECEPTACLE	TPG	TAPPING
COMP	COMPOSITION	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
CONN	CONNECTOR	HLEXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
COV	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CPLG	COUPLING	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W/	WITH
CRT	CATHODE RAY TUBE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DEG	DEGREE	IDENT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
DWR	DRAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000AH	STANDARD PRESSED STEEL CO., UNBRAKO DIV.	8535 DICE ROAD	SANTA FE SPRINGS, CA 90670
00287	C.E.M. COMPANY, INC.	24 SCHOOL	DANIELSON, CT 06239
00779	AMP, INC.	P.O. BOX 3608	HARRISBURG, PA 17105
22229	SOLITRON DEVICES, INC., SEMICONDUCTOR GROUP	8808 BALBOA AVENUE	SAN DIEGO OPERS, CA 92123
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
74868	BUNKER-RAMO CORP., THE AMPHENOL RF DIV.	33 E. FRANKLIN ST.	DANBURY, CT 06810
79136	WALDES, KOHINOOR, INC.	47-16 AUSTEL PLACE	LONG ISLAND CITY, NY 11101
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83486	ELCO INDUSTRIES, INC.	1103 SAMUELSON ROAD	ROCKFORD, IL 61101
T0175	UNITED MICROWAVE PRODUCTS, INC.	1805 W. 205TH ST #303	TORRANCE, CA 90501

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
-1	386-1337-13	B010100	B091809	1	PANEL,REAR:	80009	386-1337-13
	386-1337-09	B091810		1	PANEL,REAR:	80009	386-1337-09
					***************(ATTACHING PARTS)***********		
-2	211-0141-00			4	SCREW,MACHINE:4-40 X 3.250,PNH,SST	83486	ORD BY DESCR
					************(END ATTACHING PARTS)*********		
-3	380-0233-00			1	HSG,SAMPLING HD:ALUMINUM	80009	380-0233-00
-4	131-0555-00			4	CONTACT,ELEC:GROUNDING,PH BRZ ALBALOY PL	80009	131-0555-00
-5	----- -----			1	CKT BOARD ASSY:TIMING(SEE A1 REPL)		
-6	136-0252-07			47	.SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
-7	136-0263-03	B010100	B080696	7	.SOCKET,PIN TERM:FOR 0.025 INCH SQUARE PIN	00779	85864-2
	136-0263-04	B080697		7	.SOCKET,PIN TERM:FOR 0.025 INCH SQUARE PIN	22526	75377-001
-8	----- -----			1	CKT BOARD ASSY:TD CONTROL(SEE A2 REPL)		
-9	131-0594-00			4	.POST,BDG,ELEC:BLACK	22526	47356
-10	136-0252-07			18	.SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
-11	214-1081-00			2	.PIN,SPRING:0.187 L X 0.034 OD,SST	00287	031X187MDP
					*********(ATTACHING PARTS FOR BOARD)******		
-12	211-0162-00			2	SCREW,MACHINE:2-56 X 0.188 INCH,SCH,SST	000AH	ORD BY DESCR
					************(END ATTACHING PARTS)*********		
-13	333-1396-00			1	PANEL,FRONT:	80009	333-1396-00
-14	386-1338-09			1	SUBPANEL,FRONT:	80009	386-1338-09
-15	----- -----			1	CKT BOARD ASSY:TRIGGER(SEE A3 REPL)		
-16	136-0263-03	B010100	B080696	8	.SOCKET,PIN TERM:FOR 0.025 INCH SQUARE PIN	00779	85864-2
	136-0263-04	B080697		8	.SOCKET,PIN TERM:FOR 0.025 INCH SQUARE PIN	22526	75377-001
-17	136-0252-01			9	.CONTACT,ELEC:0.178 INCH LONG	00779	1-332095-2
-18	344-0108-00	B010100	B079999	2	.CLIP,ELECTRICAL:FOR 0.045" OD SEMICOND D	80009	344-0108-00
-19	175-1264-00			1	.CABLE ASSY,RF:50 OHM,COAX,1.5 L	80009	175-1264-00
	352-0133-00			1	.RTNR,ELEC CONN:BRASS ALBALOY	80009	352-0133-00
-20	175-1039-00			1	.CABLE ASSY,RF:50 OHM,COAX,3.5 L	80009	175-1039-00
-21	131-0741-00			1	CONNECTOR BLOCK:	80009	131-0741-00
-22	131-0631-00	B010100	B102089	1	CONN,RCPT,ELEC:3MM TYPE FEMALE	22229	2992-6012
	131-0631-01	B102090		1	CONN,RCPT,ELEC:SMA JACK TO SPCL END CONFIG	T0175	ORD BY DESCR
					***************(ATTACHING PARTS)***********		
-23	220-0531-02			1	NUT,PLAIN,HEX.:0.25-36 X 0.312 INCH,STL	80009	220-0531-02
					************(END ATTACHING PARTS)*********		
	----- -----			1	SEMICOND DEVICE:(SEE CR69 REPL)		
-24	213-0194-00			1	.THUMBSCREW:0.25-36 X 0.203,BRASS	80009	213-0194-00
-25	214-1073-01			1	.SPRING,HLCPS:0.088 OD X 0.312 L,SST	80009	214-1073-01
-26	131-1023-02			1	.CONTACT,ELEC:	80009	131-1023-02
-27	131-0579-00			1	.CONNECTOR,RCPT,:MALE	74868	46475-1050
-28	384-0687-00	B010100	B039999	1	KNOB:1.44 L X 0.125 OD,SST,W/KNO	80009	384-0687-00
-29	214-1226-01	B010100	B039999	1	SPRING,HLCPS:0.18 OD X 0.44 INCH LONG	80009	214-1226-01
-30	105-0066-00	B010100	B039999	1	STRIKE,LATCH:SAMPLING HEAD	80009	105-0066-00
	105-0338-00	B040000		1	LATCH ASSEMBLY:SAMPLING HEADS	80009	105-0338-00
	354-0163-00			1	.RING,RETAINING:TRUARC,CAD PLATE	79136	5133-12MD
	384-0687-01			1	.KNOB:1.44 L X 0.125 OD,SST	80009	384-0687-01
	105-0336-00			1	.STRIKE,CATCH:	80009	105-0336-00

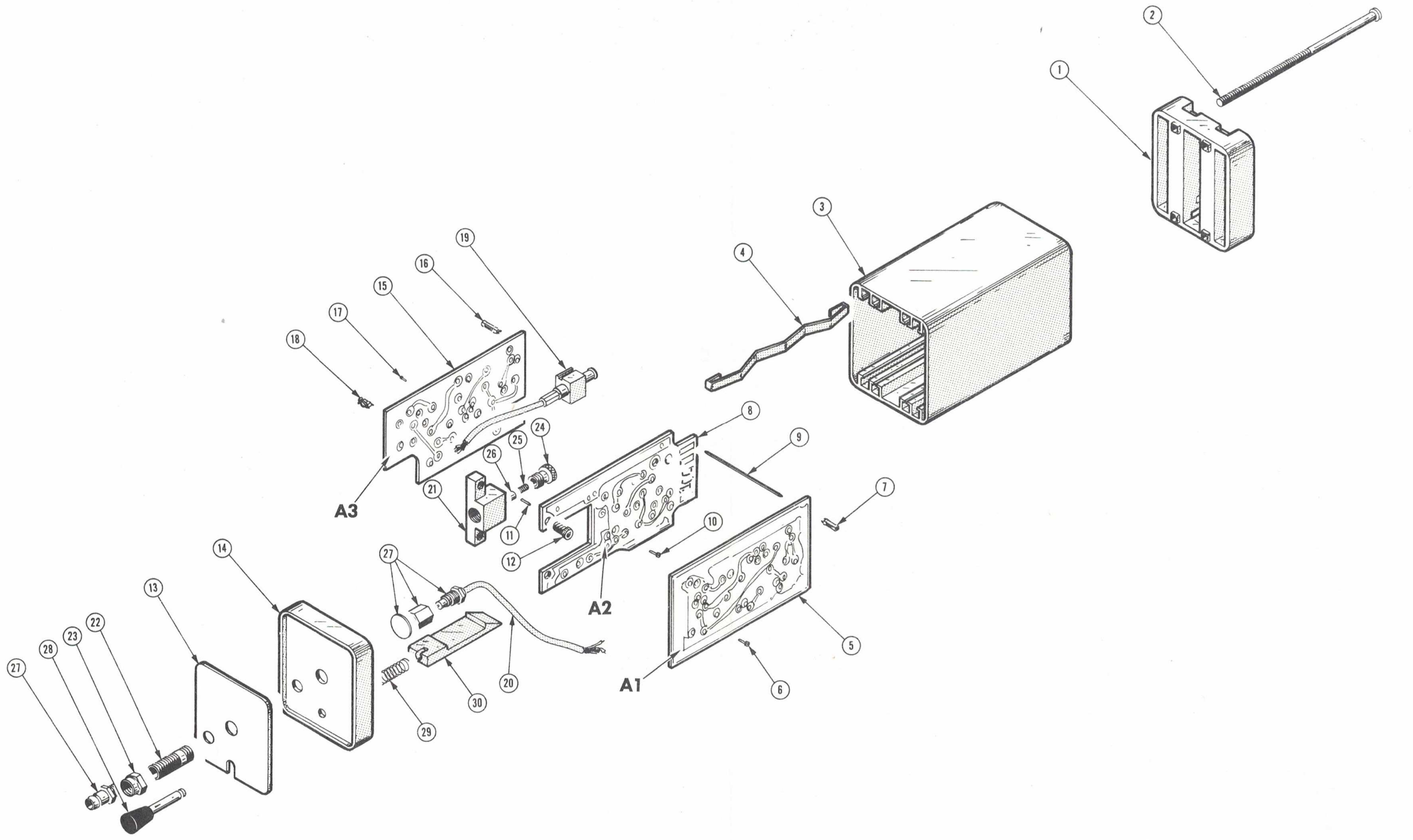

FIG. 1 EXPLODED

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
	015-1023-00			1	DELAY LINE,ELEC:50 OHM,1NS	80009	015-1023-00
	070-1101-01			1	MANUAL,TECH:INSTRUCTION(NOT SHOWN)	80009	070-1101-01

ACCESSORIES

MANUAL CHANGE INFORMATION

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

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

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