

*Please Check for
CHANGE INFORMATION
at the Rear of This Manual*

S-42

OPTICAL SAMPLING HEAD

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INSTRUMENT SERIAL NUMBERS

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

B000000	Tektronix, Inc., Beaverton, Oregon, USA
100000	Tektronix Guernsey, Ltd., Channel Islands
200000	Tektronix United Kingdom, Ltd., London
300000	Sony/Tektronix, Japan
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WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

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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 the manual.



Fig. 1-1. S-42 Sampling Head

TYPE S-42 SPECIFICATION

GENERAL INFORMATION

The Type S-42 is an optical-to-electrical sampling head for use with Tektronix 7000 series oscilloscopes equipped with the 7S11 or 7S12 sampling plug-ins. The optical sampling head can be used to analyze optical signals in the 1000 nm to 1700 nm wavelength range. The pulse response of the measurement system is less than or equal to 55 ps (Full Width Half Maximum) with optical inputs up to 25 mW peak and 5 mW average power.

The Type S-42 also has a Mean Power Meter output which, with the use of a voltmeter, allows mean optical power measurement from 5 nW to 5 mW (–53.0 dBm to +7.0 dBm).

The Type S-42 can be installed directly into a sampling unit or used remotely on an optional 3 foot or 6 foot extender cable. A portion of the signal delivered to the sampling head input is coupled to the sampling unit for use as an internal trigger signal. Use of this trigger pickoff is dependent upon the type of vertical sampling unit and sampling sweep unit used in the system. See the instruction manual for your vertical sampling unit and sampling sweep unit for further information. The vertical deflection factor of the sampling system is labeled at the top of the Type S-42 as x25 micro-Watts/Div. The label refers to the sampling unit Units/Div switch.

NOTE

The characteristics in this section are applicable for an instrument calibrated with ambient temperatures between +20 degrees C and +30 degrees C, and after a 20 minute warm-up. Unless otherwise stated, characteristics apply over an operating temperature range from 0 degrees C to +50 degrees C and to an altitude of 15,000 feet. The performance requirements apply to use with single mode fiber input. Performance may be degraded when used with a multimode fiber input. Supplemental information items are for information only and are not specifications.

**Table 1-1
SPECIFICATIONS**

Pulse Characteristics	Performance Requirements	Supplemental Information
Pulse Response	55 ps maximum (FWHM)	50 ps typical (See Figure 1-2)
Bandwidth (Equivalent)	DC –6.4 GHz (0.35/55 ps)	
Spectral Response	1000 nm to 1700 nm	See Figure 1-3
Noise Equivalent Power	< 42 μ W rms	At 1300 nm
Aberrations	< 30% peak to peak in the first 400 ps after a pulse input	
Linear Response Range	< 25 mW peak power; < 5 mW average power	
Sensitivity	40 mV/mW \pm 20% @ 25° \pm 5° C	At 1300 nm, using 7S11
Power Meter Characteristics	Performance Requirements	Supplemental Information
Spectral Response	1000 nm to 1700 nm	See Figure 1-3
Dynamic Range	5 nW to 5 mW (60 dB)	At 1300 nm
Sensitivity	1 V/mW \pm 20% (Range 1); 1 V/ μ W \pm 20% (Range 2)	At 1300 nm
Linear Response Range	Range 1: \leq 5 μ W mean; \leq 25 mW peak to peak Range 2: \leq 5 mW mean; \leq 25 mW peak to peak	At 1300 nm (range 1), allow for a dc offset when used in humidity greater than 80% r.h.
Maximum Non-destructive Input	10 mW mean 125 mW peak	

Table 1-2
PHYSICAL CHARACTERISTICS

Physical Characteristics	Performance Requirements	Supplemental Information
Weight	Net: 0.4 kg (14 ounces) Shipping: 0.9 kg (2 pounds)	
Dimensions	Length: 6 inches Width : 1.75 inches Height: 2 inches	
Finish	Anodized aluminum front panel, and aluminum and blue-vinyl wrap around the cabinet	

The optical pulse characteristics (Figure 1-2) of the S-42 are measured using a 50 picosecond (FWHM) nominal optical pulse at 1300 ± 20 nanometers, from a laser diode with a single mode ($8/125 \mu\text{m}$) optical fiber pigtail.

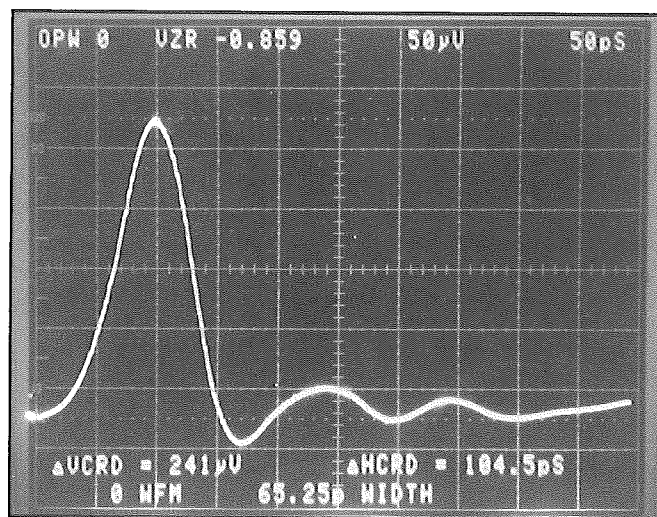


Fig. 1-2. Pulse Response

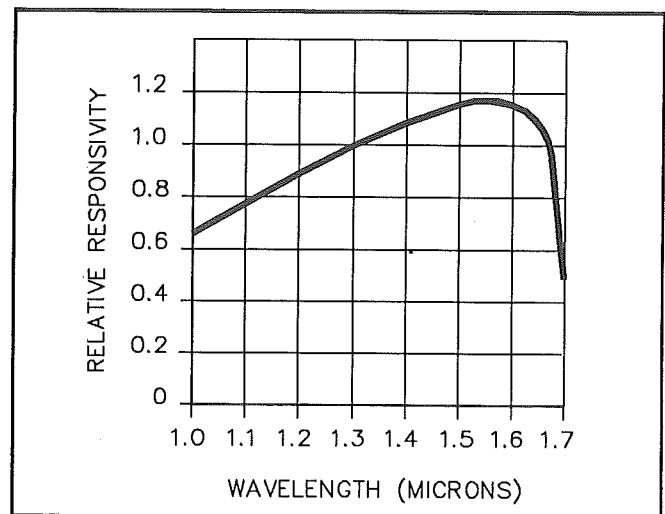


Fig. 1-3. Relative Spectral Response

Table 1-3
ENVIRONMENTAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
Temperature	Operating range: 0 to 50 degrees C Non-operating range: -55 to +75 degrees C	
Humidity	Operating 90 to 95% RH	
Altitude	Non operating 50,000 ft.	
Vibration	Operating 0.38 mm, 10 to 55 Hz, 75 minutes total	
Shock	Operating 30 g, Half sine 11 ms, 18 shocks	
Bench Handling	Operating 45 degrees or 4 inches unit drop test	
Packaged product vibration and shock	The packaged product qualifies under the National Safe Transit Association's Pre-shipment Test Procedures Project 1A-B1. Package drop 30 inches	
E.M.I.	The S-42 qualifies under the test limits specified in FCC Part 15- sub Part J and VDE 0871 class B.	When used with a 7854, option 03, mainframe

OPERATING INSTRUCTIONS

General Information

This section provides the basic information required for operation of the Type S-42 Sampling Head.

The Type S-42 can be used with an extender cable without compromising the response of the measurement system. Signals are applied to the input of the optical sampling head through a single mode FC optical connector located at the center of the front panel.

The S-42 has a linear response to input signals of up to 5 mW mean and 25mW peak. Specifications for the Type S-42 Sampling Head are given in Section 1 of this manual.

Optical attenuators, available from a number of manufacturers, are quite useful in reducing the amplitude of large signals. It is suggested that these be used to analyze optical signals larger than 5 mW mean and 25 mW peak optical power.

NOTE

Other optional accessories available for the S-42 include a series of fiber optic jumper cables with an FC connector on one end and a variety of connectors on the other. These come with appropriate inline adapters that accept commonly used optical connectors. Refer to your Tektronix catalog or contact your local Tektronix Sales Engineer for further information about these optional accessories.

WARNING

Signals in excess of 125 mW peak to peak may destroy the sampling diode bridge.

See the discussion on Sine Wave Signal Measurements later in this section for information on the effect signal amplitude has upon display amplitude accuracy.

Installing the S-42 Optical Sampling Head

Figure 2-1 shows the S-42 installed in a 7S12 TDR/Sampling Unit with a 7854 Oscilloscope. The optical sampling head can be plugged into the sampling unit as shown, or used remotely on a special extender cable. The three- and six-foot extender cables available are identical to those compatible with the Tektronix S-4 Sampling Head. Orders for these cables must include the Tektronix part number; Part No. 012-0124-00 for the three-foot cable and Part No. 012-0125-00 for the six-foot version.

To Insert the S-42 into a Sampling Unit compartment:

1. Carefully slide the S-42 into the designated compartment, so the two plastic guides in the compartment engage the S-42.
2. Push the S-42 completely into the compartment.
3. Turn the locking knob on the S-42 (in the direction indicated on the knob) until tight, to firmly seat the S-42 into the compartment.

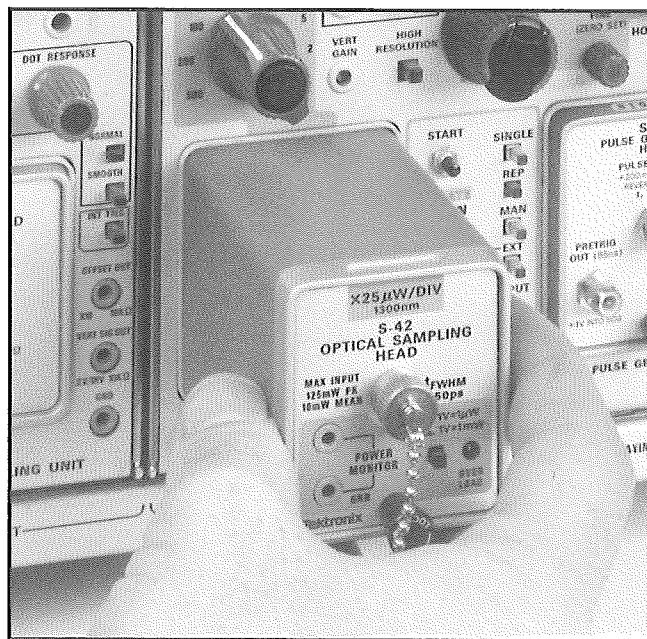


Fig. 2-1. Inserting the S-42 Optical Sampling Head into the 7S12 Sampling Unit.

To remove the S-42 from the compartment, turn the locking knob in the reverse direction until loose, then pull the S-42 unit from the compartment.

To use the S-42 on an extender cable:

1. Loosen the locking knob on the head end of the extender cable by turning it in the direction opposite to that shown on the front panel.
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.
3. Push the head completely into the compartment, and then lock the extender cable head end in place by turning it in the indicated direction.
4. Connect the S-42 to the other end of the extender cable in a similar manner, and turn the latch knob to hold it in place.

To remove the S-42 from the extender cable, turn the latch knob on the front panel of the S-42 to unlock it from the extender cable, and then remove the unit from the cable.

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 unit free.

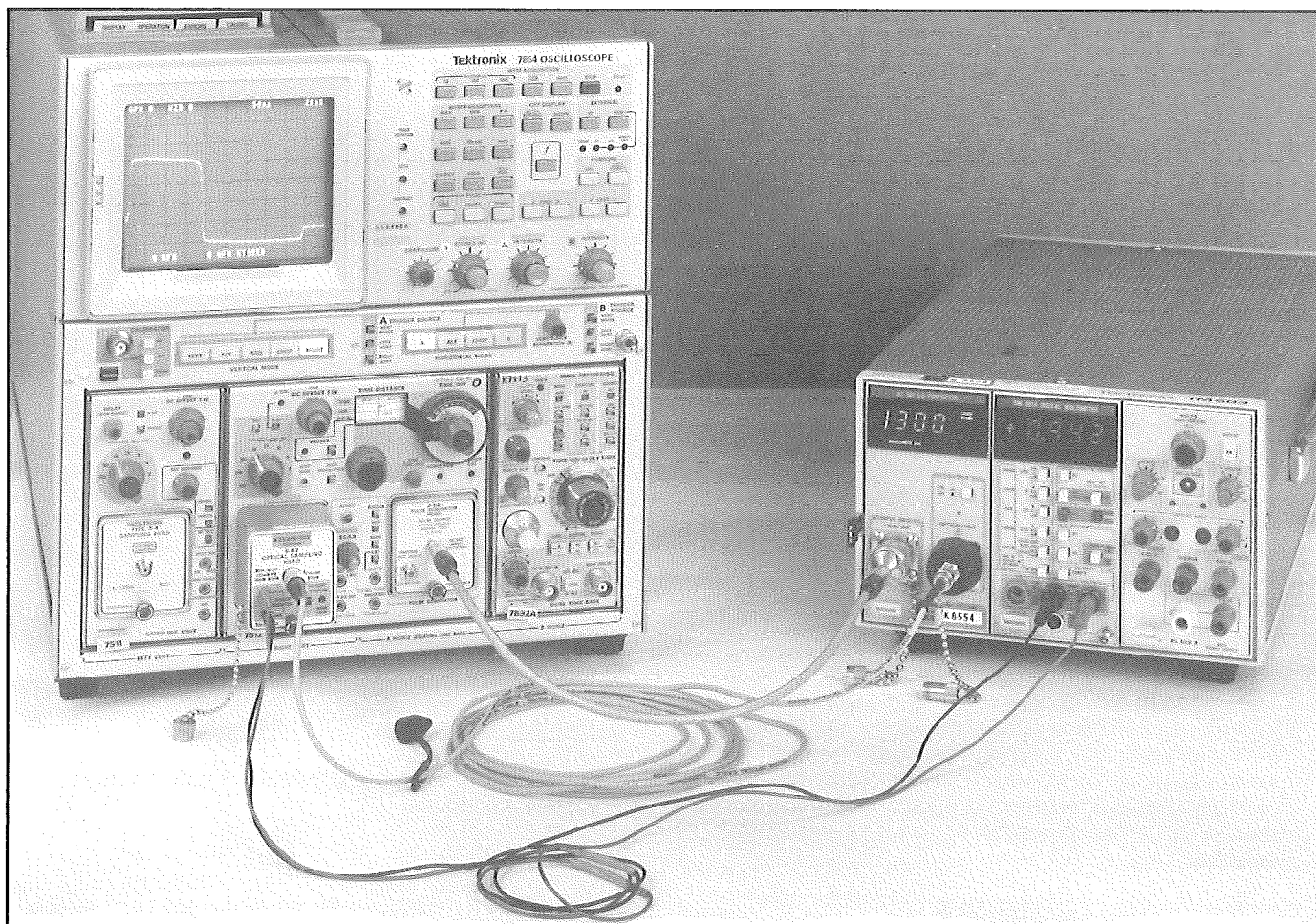


Fig. 2-2. Equipment used during first time operation.

First Time Operation

In addition to the S-42 Optical Sampling Head, this procedure utilizes a S-52 Pulse Generator Head, a 7S12 TDR/Sampling Plug-in Unit, a 7854 Programmable Oscilloscope, an OT503 Electro-Optic Converter as the signal source, and a TM503 Power Unit. See Figure 2-2 for the complete set-up configuration.

Set-up Information

1. With the 7854 Oscilloscope power switch off, insert the 7S12 Sampling Unit into the middle two plug-in slots.
2. Insert the S-52 Pulse Generator into the Pulse Generator compartment of the 7S12. Lock in place with the locking knob.
3. Insert the S-42 Optical Sampler into the Sampling compartment of the 7S12. Lock in place with the locking knob.
4. With the TM503 Power Unit power switch off, insert the OT503 E/O Converter in the left-most compartment until it is fully seated and flush with the opening of the TM503.
5. Connect the S-52 output connector to the 50 ohm input connector of the OT503, using a 2 ns section of flexible 3 mm coaxial/SMA line and a N male to SMA female converter junction.

tion. See cable bending limits discussed under Cable and Accessory Considerations later in this section.

NOTE

Connectors at both ends of the optical cable should be firmly connected to mating connectors or accessories. A good connection is necessary to minimize reflections at the junction of connectors.

6. Connect the Optical Out of the OT503 to the Optical Input of the S-42, using a Diamond to FC multimode fiber optic cable. Be sure the interlock contact ring surrounding the diamond connection of the cable is firmly tightened against the optical out connector on the OT503 so that the two metal pins on the outside of the connector are depressed.

NOTE

The OT503 unit will not function if the two metal pins on the outside of the optical out connector are not shorted together. The simplest way to make sure this occurs is to properly tighten the interlock contact ring around the diamond cable connection against the front panel of the OT503.

7. Plug in the 7854 and TM503 to the power line and set both power switches to On.

8. Allow about five minutes warm up time so the units can reach operating temperature before proceeding.

9. Set instrument controls as follows:

S-42

Range Button 1 V = 1 mW

7S12

Vertical Section

Units/Div 20
Variable Cal
mV/mp mV
DC Offset 10 o'clock
Fine Fully Counter-clockwise
High Resolution Off

Horizontal Section

Time/Distance Fully Clockwise
Fine Fully Clockwise
Time/Div 20 ns
Multiplier x1
Variable Cal
Scan Fully clockwise
Mode Rep
Locate On
Preset Off

7854

Vertical Mode Right
Horizontal Mode A
A Trigger Source Vertical Mode
Stored Int 10 o'clock
Readout 11 o'clock
A Intensity 11 o'clock

10. When the Laser Ready light on the OT503 is on, press the output button to On. The signal should be displayed on the screen of the 7854 Oscilloscope.

11. Adjust the 7854 Intensity control until the trace brightness (free running sweep) is at the desired viewing level. Adjust the readout control.

12. Center the trace on the graticule with the 7S12 DC Offset control. The display should resemble Figure 2-3.

Displaying Risetime

From the above set up, the risetime of the pulse produced by the OT503 triggered with the S-52, can be readily displayed.

1. Turn high resolution on by pressing the high resolution button on the 7S12. Notice that this function averages the signal, reducing a large amount of the extraneous noise.

2. Set the following controls on the 7S12:

Time/Div 1 ns
Time-Distance Approx 0.347 μ s
DC Offset 9 o'clock
Units/Div 10 o'clock
Locate Off

The risetime displayed should be similar to Figure 2-4.

Power Meter Usage

The S-42 Optical Sampling Head is equipped with an optical power meter for monitoring average power using a standard voltmeter. The supplied pair of red and black cables connect the optical power meter outputs of the S-42 to the banana-type connector inputs of any common voltmeter (as in Figure 2-2, for example).

A selector switch on the front panel of the S-42 divides the sensitivity range of the power meter into two sections: one for mW optical input power, and another very sensitive range for optical input signals at the μ W power level.

The maximum electrical output of the power meter is 5 V. The red overload light indicates an optical input too powerful for the power meter in the currently selected power-to-voltage conversion range. If overloading does occur, signal reliability is unpredictable and output signal degradation from the S-42 may result.

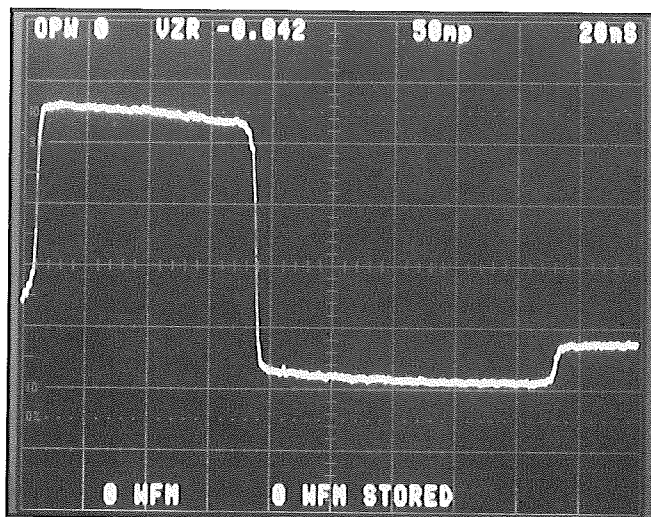


Fig. 2-3. Optical pulse display.

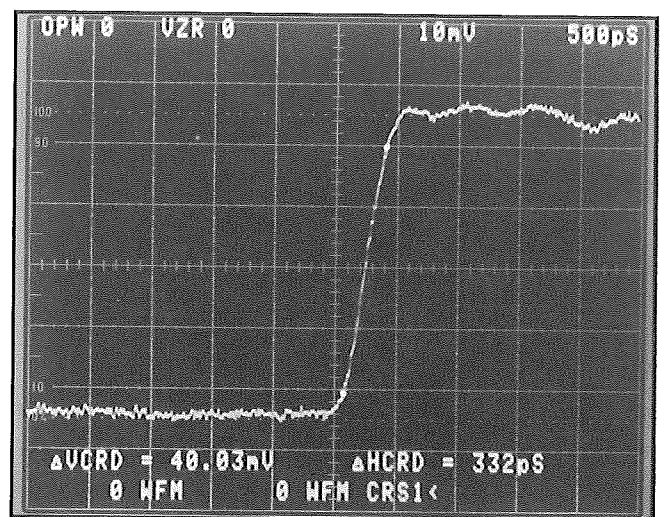


Fig. 2-4. Optical pulse risetime

Pulse Width Measurements

Accurately determining pulse width from an observed display requires that you have accurate knowledge of the position of the 50% points and can take an accurate measure of the horizontal distance between these points. You must also know the timing accuracy of the sampling sweep unit. Switching the sampling sweep unit from one oscilloscope to another requires readjustment of the horizontal gain control on the sampling sweep front panel. See your sampling sweep unit instruction manual for timing accuracy specifications and complete instructions for checking timing.

Displayed Pulse Width and Actual Pulse Width

For the purpose of this discussion, pulse width refers to the Full Width Half Maximum Time as illustrated in Figure 2-5.

Differences in displayed and actual signal pulse width result unless the response time of the sampling system is approximately five times faster than the response time of the signal to be measured. In this discussion, the sampling system is considered to be made up of the sampling head and any optical fiber, connectors or accessories between the signal source and sampling head. Displayed response is dependent upon the response of the sampling head, the response of the pulse generator, and the response of the optical cable between the generator and sampling head. With signals as fast as approximately 250 ps arriving at the Type S-42 input, the displayed pulse width will be close to the actual signal pulse width.

Signals with a pulse width of less than 250 ps can still be analyzed using the Type S-42 Optical Sampling Head. Signal pulse width using formula (2-2) will provide a close approximation of the actual signal width. Figure 2-5 shows a typical displayed response to a short (~50 ps) optical input pulse. Assuming Gaussian shaped pulses, the relationship between the displayed pulse width, signal pulse width, signal path pulse width response and the sampling head pulse width response is shown in formula (2-1).

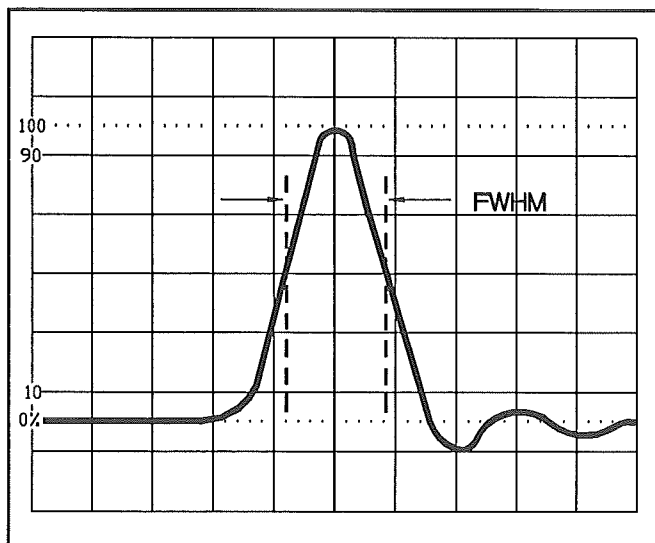


Fig. 2-5. Schematic representation of the S-42 response to a short (~50 ps) optical input pulse, illustrating the Full Width Half Maximum time.

$$T_{FWHM} \text{ (Displayed)} \approx$$

$$\sqrt{(T_{FWHM} \text{ Signal})^2 + (T_{FWHM} \text{ Signal Path})^2 + (T_{FWHM} \text{ Type S-42})^2} \quad (2-1)$$

For example, assuming an input pulse width of 50 ps; 2 meter optical fiber with negligible effect on the signal, and a sampling head with a pulse width of 50 ps:

$$T_{FWHM} \text{ (Displayed)} \approx \sqrt{(50)^2 + (0)^2 + (50)^2} = 71 \text{ ps}$$

To calculate the input pulse width, transpose formula 2-1 as follows:

$$T_{FWHM} \text{ (SIGNAL)} \approx$$

$$\sqrt{(T_{FWHM} \text{ Displayed})^2 - (T_{FWHM} \text{ Type S-42})^2 - (T_{FWHM} \text{ Signal})^2} \quad (2-2)$$

Sine Wave Signal Measurements

The parameters of the Type S-42 are specified using pulse or time domain parameters and nomenclature. The frequency response characteristics of the unit, while not specified, may be used for relative sine wave measurements through its calculated upper 3 dB rolloff point of 6.4 GHz.

Cable and Accessory Considerations

When you are connecting a signal to the Type S-42, it is important that the signal connectors be firmly tightened to reduce losses and to ensure repeatability. The specifications for the Type S-42 given in Section 1 of this manual are valid for use with single mode (8/125 micron) fiber and N.T.T.-compatible, FC/PC type connectors. However, the optical input is lensed and will capture light from a high proportion of the fiber. This makes it possible for you to use the unit with multimode (50/125 micron) fiber and multimode N.T.T.-compatible FC type connectors. There may be some degradation in speed performance when the Type S-42 is used with non-singlemode inputs.

You should also note that, for short fiber links (up to several meters), and semiconductor laser sources, stray modes launched into the fiber cladding may still exist and be collected by the Type S-42 optical unit. This can result in the display of considerable noise on top of the expected optical signal displayed on the cathode-ray tube. To eliminate this noise, mode strip the fiber. To do this, either wrap several turns of the fiber around a suitable size mandril or pass the bare fiber through an index-matched medium.

Also, minimize the number of additional connectors between the signal source and the sampling head. Losses per connection joint may be as high as 1 dB for single-mode, FC/PC type systems.

Tektronix recommends that you use the optical interconnection cables that are listed in the accessories section of this manual. These include inline adapters and adapter cables to convert to alternative connector styles/manufacturers.

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CIRCUIT DESCRIPTION

GENERAL

This section of the manual contains a block diagram description of the Type S-42 Sampling Head followed by a detailed circuit description. Both the block and schematic diagrams are located in Section 8 of this manual.

The Type S-42 is the signal input section of a sampling system, and determines the vertical channel input characteristics.

BLOCK DIAGRAM

Both the Block Diagram and the circuit schematic show the individual Type S-42 circuit assemblies outlined with dashed lines. The Photodiode Assembly generates the electrical signal and is biased from the Photodiode Power Supply board. The remainder of the unit is similar to the Type S-4 Sampling Head — one circuit board is devoted to the generation of the sampling gate strobe pulses (i.e., the Strobe Generator), one to the Sampling Gate, one to the Blow-by and Trigger Pickoff circuit and one to the Preamplifier.

Photodiode Assembly

The Photodiode Assembly converts the high-speed optical signal to an electrical signal.

Photodiode Power Supply

The Photodiode Power Supply board provides electrical biasing for the Photodiode Assembly and maintains the optically generated current for the optical power out socket.

Strobe Generator

The Strobe Generator develops heavy-current (several mA), short-duration, push-pull pulses that drive the Sampling Gate into balanced conduction. Output occurs at the time of each sample when a command pulse arrives from the Strobe Driver circuit of the associated sampling unit. The pulse lasts for a period of about 125 ps and then turns on the Sampling Gate diodes. At the end of the pulses, the diodes turn off very quickly, retaining a portion of the input signal. The Snap-Off diode DGI, and the two clipping lines fix the strobe pulse duration and fall time. The Strobe Generator's parts layout and circuit board construction are carefully controlled to ensure that the proper strobe pulses are sent to the Sampling Gate.

Sampling Gate

The Sampling Gate (called the Sampling Bridge in other Tektronix sampling circuitry) only connects the input signal to the Preamplifier during the short time when each sample is taken. The six diodes, D2A through D2F, form a travelling wave gate. The path that the end of the Strobe Drive pulse travels through the gate determines the step response of the sampler. In other Tektronix sampling bridges, the step response risetime is controlled by the strobe pulse duration. In the Type S-42, the step response risetime is controlled instead

by the length of time it takes the end of the strobe pulse to travel through part of the Sampling Gate.

At the end of each Strobe pulse, part of the input signal is stored temporarily between Sampling Gate diodes and is then fed to the Preamplifier input at a rate much slower than the step response risetime. Only the special travelling wave gate has an electrical environment that is controlled for minimum reflections of fast pulse signals. All circuit parts that pass the sampled error signal to the Preamplifier handle only moderate rate-of-rise signals (see the sampling unit manual section on Basic Sampling Principles for definition of error signal). A special 10X (20 dB) 50 ohm attenuator helps serve as a high-quality, high-frequency termination to the input connector and the 50 ohm environment of the traveling wave gate.

Part of the input signal is continuously passed to the Trigger Amplifier board and the Blow-by and Trigger Pickoff circuit. The signal passes through the 10X attenuator directly to the Trigger Amplifier Board and is terminated with a 50 ohms terminator.

Gate Bias

The Gate Bias circuit applies reverse bias to the Sampling Gate diodes. The Gate Balance circuit and the associated sampling unit DC Offset and Feedback signals control the average voltage of the gate bias. The Sampling Gate output is DC-coupled to the Preamplifier input through a portion of the Gate Bias circuit.

Blow-by and Trigger Pickoff

The primary function of the Blow-by and Trigger Pickoff circuit is to cancel capacitively-coupled unwanted signals that normally bypass the Sampling Gate. These unwanted signals are called blow-by signals.

The Type S-42 special travelling wave Sampling Gate contains two blow-by reducing diodes that minimize the unwanted capacitively-coupled signals. The special Sampling Gate construction and the blow-by circuit cancel all of the unwanted signals that would otherwise distort the oscilloscope sampling display.

The Blow-by and Trigger Pickoff circuit receives an attenuated portion of the input signal and terminates the 10X attenuator located between the Sampling Gate and the Trigger Amplifier Board. The circuit amplifies and inverts the signal and applies it, as a blow-by correction signal, through a small capacitor on the output side of the Sampling Gate blow-by limiting diodes. The Transient Response control adjusts the magnitude of the blow-by correction signal during calibration.

The trigger pickoff function of the Blow-by and Trigger circuit provides an in-phase signal source for internally triggering the sampling sweep unit. Not all channels of the S-42 sampling units couple the trigger pickoff signal to the sampling sweep unit. If the signal is not used, then the sampling unit terminates the output with a 50 ohms terminator, allowing the circuit to remain functional for blow-by correction.

Preamplifier

The Preamplifier circuit amplifies and time-stretches the signal it receives from the Sampling Gate. This signal is a portion of the difference between the feedback combined with the DC offset voltage and the input signal. This error signal is amplified

and AC coupled to the Post Amplifier in the sampling unit. The Preamplifier gain is adjustable so that the overall sampling head and sampling unit loop gain can be set to unity to ensure proper dot response.

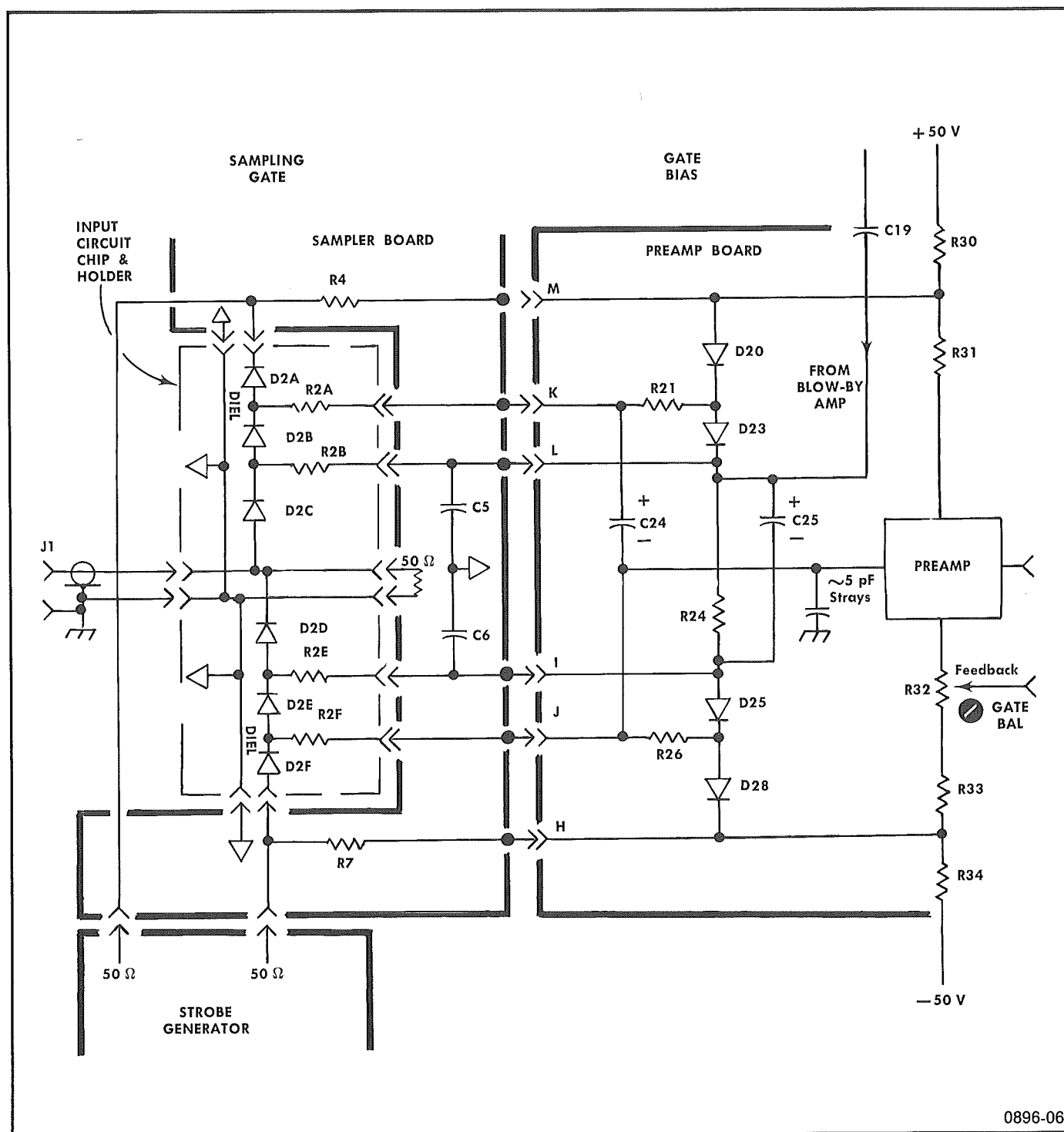


Fig. 3-1. Traveling Wave Sampling Gate and Gate Bias circuit components.

CIRCUIT DESCRIPTION

The main schematic diagram (Section 8) is a useful reference for the following descriptions.

The Type S-42 Sampling Head uses the power supplies of the indicator oscilloscope and associated sampling unit. Two rear connectors interconnect the sampling unit circuits. The following description includes references to circuits in the sampling vertical unit and sampling sweep unit, which form one sampling system. Reference to diagrams and circuit descriptions in the instruction manuals for other sampling units are used to give a full understanding of the circuit relationships.

Photodiode Assembly

The Photodiode Assembly consists of a high-speed photodiode which accepts an optical input from the FC/PC fiber. The electrical output of the assembly is through an SMA connector.

Photodiode Power Supply

The Photodiode Power Supply board generates the necessary biasing for the Photodiode Assembly. The optically generated current is also monitored and fed, in a calibrated form, to the power out sockets. R102 allows the dark current within the Photodiode Assembly to be compensated for at 25 degrees C. R114 is used to calibrate the output and represents the same calibration factor for each Range switch position.

Strobe Generator

The Strobe Generator circuits are located on the right side of the Strobe circuit board. The generator contains two basic circuits: an Avalanche circuit that delivers fast push-pull pulses and the Snap-off diode and clipping lines circuit. Both circuits work together to produce the push-pull strobe pulses that drive the special traveling-wave Sampling Gate through two equal transmission lines. Both sets of circuitry are physically arranged over separate ground planes that are identified on the main schematic diagram. The two ground planes are connected together by R52 and R54, to damp out ringing between the two circuit areas at sample time.

The Avalanche Circuit converts the Strobe Drive pulses from the sampling unit to very fast push-pull pulses that drive the Snap-off diode to non-conduction.

Transformer T75 couples the Strobe Drive pulse to the base and emitter of Avalanche transistor Q69. Two outputs are AC-coupled from Q69: one from the collector and the other from the emitter. The Avalanche Volts control adjusts the collector voltage of avalanche transistor Q69. The typical quiescent voltage at Q69 collector is about +15 volts. This voltage sets the amplitude of the signals that drive the Snap-off diode circuit and assures the normal avalanche action of Q69 when driven by the Strobe Drive signal. Before Avalanche conduction there is a potential of about 60 volts between Q69's collector and emitter.

The negative Strobe Drive pulse is transformed into a hard forward bias signal to Q69. Normal avalanche action is followed by the collector going negative and the emitter going

positive. This fast-rise, push-pull signal is capacitively-coupled to the Snap-off circuit.

The Snap-off Circuit operates as a current switching circuit so that it can apply part of the push-pull Avalanche current signal at snap-off time to the Sampling Gate. The circuit consists of a Snap-off Current Control R57, Q55, Snap-off diode D61, two clipping lines and associated components. Between drive pulses from the Avalanche circuit, the Snap-off diode D61 is forward-biased by the current in Q55. The current value is set by the Snap-off Current control R57. The current in D61 is typically 20 mA. This forward current assures that D61 has many carriers within its junction region.

The push-pull signals from the Avalanche circuit cause D61 junction carriers to reverse direction as a heavy reverse current. This heavy reverse current stops suddenly as all the carriers leave the junction. As the reverse current snaps to a stop, the push-pull avalanche signals are suddenly coupled into the clipping lines by C52 and C54 and sent towards the Sampling Gate by R51-C51 and R53-C53. The fast-rise step which appears at each clipping line input is propagated down the line. About 50 ps later the steps reach the short circuited ends of each clipping line. The step is then reflected, equal in amplitude and opposite in polarity, back to the input end of each clipping line. This cancels the signals moving toward the Sampling Gate. This action delivers a positive Strobe pulse to P53, and a negative Strobe pulse to P51.

The clipping lines have a surge impedance of approximately 10 ohms with a very good short circuit at the shorted ends. The high quality of the short, and the line low impedance cause the reflected signal to stop the Strobe pulses very rapidly. Such rapid ending of the Strobe pulse and the characteristics of the traveling wave Sampling Gate causes each sampling diode to turn off in approximately 10 ps.

R50, which is directly across the lines ends, prevents ringing of the Snap-off diode and the clipping lines. Ringing is also limited to some degree by the two equal resistors R60 and R62 that are in DC-series connection with the Snap-off diode D61. The primary function of R60-R62, however, is to provide a DC path for D61 forward conduction while at the same time allowing the Avalanche signals to pass on into the clipping lines and Sampling Gate. As the Avalanche pulses end and as both the Avalanche and Snap-off circuits recover for another sample, R60-R62 re-establish the correct quiescent charges on C63 and C64. C59 assures a very low impedance AC path for the ground side of R60 so that R60 and R62 will both have the same affect upon the circuit.

Having R51 and R53 in series with the output lines to the Sampling Gate is another technique for minimizing Strobe ringing. The output connectors between the Strobe board and the Sampler board have a 50 ohms characteristic impedance. R51 and R53 raise the Clipping line's 10 ohms impedance drive to 50 ohms to match the characteristic impedance of these output connectors. Thus, at the end of the Strobe pulse, reflections back from the Sampling Gate are reverse terminated. These resistors and the resistors discussed in the preceding paragraph all assure that there is no possibility of double strobing of the Sampling Gate due to ringing of the Strobe Generator circuits.

Circuit Description — S-42 Sampling Head

There are two separate ground planes on the main schematic diagram between the Avalanche and Snap-off circuits. Two resistors connect the two ground plane ends together to damp any natural ringing when the case is off. Ringing can occur without R52 and R54 because the two ground planes are connected together at the instrument front and rear through the Sampler board. Component layout is organized so that the strobe signal ground currents balance to zero at the center of the Sampling Gate, and thus do not contribute unwanted currents to the input signal. The Q69 circuit is capacitively isolated from both ground planes as much as possible, with its primary signal output path being through C63-C64 and C52-C54. There is a small third terminal capacitance to ground between the two windings of T75, but it is not large enough to disturb the balanced drive from Q69 to D61.

Sampling Gate and Gate Bias Circuits

The Sampling Gate consists of six series diodes, D2 A through F, and four resistors all mounted on a ceramic substrate inside the input circuit holder. See Figure 3-1 during the following discussion.

The signal that arrives at J1 travels through the Sampling Gate area to a 3 mm 50 ohm 10X (20 db) attenuator. The output of the attenuator feeds the Blow-by and Trigger Pickoff circuit where it is terminated with a 50 ohm terminator. When not being strobed, D2C and D2D present a very small value of capacitance to the input signal. When the diodes conduct due to Strobe current, the input line is coupled to the traveling wave gate.

Gate Biasing

The Gate Bias circuit controls the quiescent condition of the Sampling Gate. D2A, D2B, D2E and D2F are each reverse biased about 0.5 volts by D20, D23, D25 and D28. D2C and D2D are reverse biased about 1.2 volts each. A total of about 2.45 V is developed across the parallel combination of R24-C25 of the Gate Bias circuit. The Gate Bias circuit receives its current from the two 50 V supplies and R30-R34 of the Gate Balance control circuit. The diodes of the Gate Bias circuit are used as 0.5 V Zener diodes. R2A-R2F with C24 and R2B-R2E with C25 isolate the traveling wave gate segments from the Preamplifier and Bias circuits. R21-R26 conduct DC-bias potentials to the gate, but allow a sampled error signal to drive C24 and the Preamplifier input.

Except for the very short strobed conduction time (about 125 ps), the Sampling Gate diodes do not conduct. A portion of the input signal is coupled through stray capacitances to the Preamplifier input, which disturbs the normal sampling display. This effect is known as blow-by.

Blow-by Correction

The basic risetime of the traveling wave Sampling Gate is 25 ps. In this extremely short interval of time, only a very small amount of charge can be collected in one sample. The small charge collected is called the error signal and is amplified by the Preamplifier and the Sampling Unit circuits. The Preamplifier has a shaped frequency response, suited to amplifying each sample's small charge and delivering a proper error signal to the sampling unit.

It is impossible to build a sampling gate without a path for blow-by displacement currents. These currents cause the Preamplifier to respond to a part of some input signals and distort the display. The Type S-42 Preamplifier responds to signals in the 0.5 to 3 MHz bandpass region. Therefore, Signals much higher or lower in frequency are not amplified. The Blow-by correction amplifier Q10 virtually eliminates those blow-by signals in the Preamplifier bandpass region that do get through the Sampling Gate.

The double differentiation networks that have very fast RC times assure blow-by rejection in the Sampling Gate. These networks are located between the signal input and the Preamplifier. The reverse biased diodes D2C and D2D and their respective resistors to ground (see Fig. 3-1), R2B and R2E, form the first differentiation network. Diodes and resistors D2B, D2E and R21, R26, respectively form the second network. All the Sampling Gate diodes are normally non-conducting and are therefore very small capacitors. The differentiating networks eliminate all but about 5% of the possible blow-by effects. The Blow-by correction amplifier feeds an inverted replica of the input signal into the Sampling Gate output, and a small quantity of charge passes through C19 to cancel most of the remaining blow-by signal.

Traveling Wave Sampling Gate

Push-pull strobe pulses from the Strobe Generator cause the six Sampling Gate diodes to conduct for about 125 ps. While the diodes are conducting, the signal at the input connector propagates down the diode transmission paths as well as toward the 10X attenuator, R3. As the fast-falling end of the

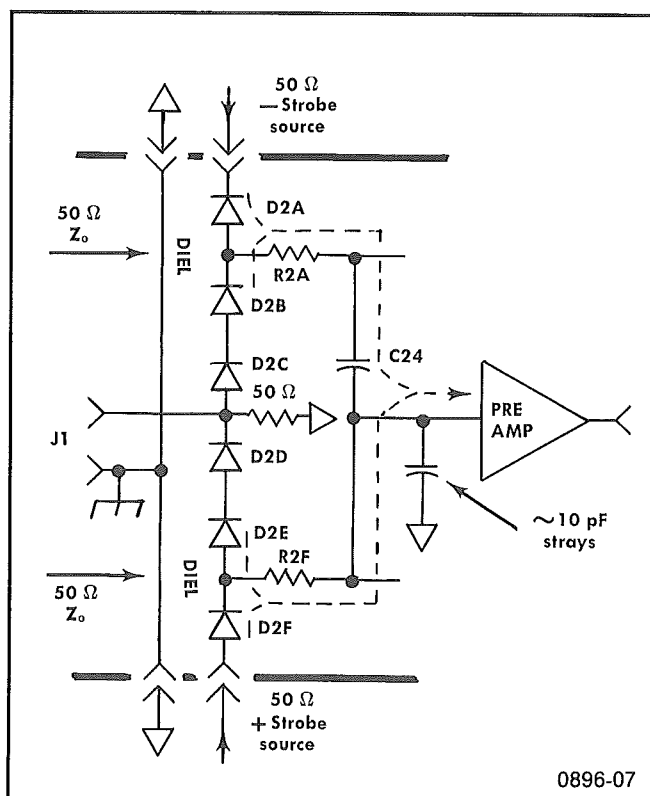


Figure 3-2. Error-signal source and path to Preamplifier shown by dotted lines.

strobe pulse begins to propagate into the diode transmission paths, the diodes are quickly switched off (into reverse bias), one set after another. First, diodes D2A and D2F turn off, then D2B and D2E, and finally D2C and D2D.

The mechanical spacing and thereby the propagation time between sets controls the turn off time of the diode sets. The Sampling Gate risetime is determined by these propagation times, and is thus not heavily influenced by the strobe pulse amplitude or duration.

The sampling process consists of trapping the signal charge between sets of diodes, in particular, between set D2A-D2F and the set D2B and D2F. The risetime is very close to the double transit time between sets.

Once the signal charge trapping process has taken place at the strobe pulse end, the Preamplifier begins to receive the trapped charge by conduction through resistors R2A and R2F (See Fig. 3-2). The Preamplifier input capacitance is much larger than the capacitance of the transmission line segments between the diode sets so almost all of the trapped charge is transferred to the Preamplifier input. The transfer time constant is approximately 10 ns.

Because of the carefully adjusted balance of the plus and minus strobe signals (set by the physical position of R51 and R53 in the Strobe Generator), the Preamplifier receives only the trapped signal charge and nothing from the Strobe Generator.

Preamplifier

The Preamplifier circuit amplifies and time-stretches the error signal pulse from the Sampling Gate, and AC couples it to the Post Amplifier in the associated plug-in unit.

Input transistor Q36 operates as a very high input impedance, high-gain inverting amplifier. Thermistor R38 handles temperature compensation for Q36. A total of 4.4 mA channel current passes from the +50 volt supply through R36, Q36, R38 and R40 to the 50 Volt supply. C39 assures that Q36's AC gain is high, while its DC gain is less than 1.

Q43 and Q46 are connected as an operational amplifier with a very low output impedance at Q46 emitter. C50 couples the output to the 90 ohm input resistance of the Post Amplifier in the sampling unit. R37 and R39 provide temperature compensation to stabilize loop gain. D41 protects the base of Q43 from high negative voltage if Q46 is removed from its socket.

Current in R42 with DC negative feedback by R48 sets the output DC voltage level of the amplifier to 7.3 volts. Negative AC feedback, from the emitter of Q46 through C49 and Gain control R49 to the base of Q43, controls the AC gain of the Preamplifier. Gain control R49 allows the AC feedback to be adjusted, thereby adjusting the gain. The AC gain is adjusted during calibration so that the sampling head sends the correct amplitude output signal to the sampling unit Post Amplifier.

The Type S-42 sampling efficiency is less than 2%. With a low sampling efficiency, the Preamplifier positive and negative signal output impedance must both be low. Q46 assures a low output impedance for positive-going output pulses. D43 assures a low output impedance for negative-going output pulses. D43 conducts only for large negative output signals that fall at a rate faster than the Q46 emitter can follow. The Q46 emitter remains a low output impedance for small negative output signals.

C47 and R46 prevent parasitic oscillations in Q46. C45 and C46 decouple the + 15-volt supply for both the low and high frequency current pulses of Q46.

Blow-by and Trigger Pickoff

The Blow-by and Trigger Pickoff circuits consist of Q10, Q14 and associated components connected as a common-emitter paraphase amplifier. The primary purpose of the circuit is to cancel unwanted high frequency capacitively-coupled signals that bypass the Sampling Gate. Its secondary purpose is to provide a trigger pickoff signal to the sampling unit for internal triggering of the sampling sweep unit.

Input signal to the Blow-by and Trigger Pickoff circuit is a portion of the Type S42 input signal. The signal is fed to the base of Q10 through R3. R11 terminates the 50 ohm impedance of the input and assures that there are no reflections into the input circuit. The output from Q10 collector feeds an AC coupled signal to the output side of the Sampling Gate, cancelling the blow-by signal. The output from Q14 collector feeds a DC coupled trigger pickoff signal to the sampling unit for use by the sampling sweep unit.

Feedback Limiting

The Preamplifier input is the input terminal of an integrating pulse amplifier that includes the sampling unit Post Amplifier, AC amplifier, Memory Gate and Memory Amplifier. Feedback from the Memory Amplifier output is DC coupled to the Type S-42 Preamplifier input through the sampling unit Feedback Attenuator and the Type S-42 Gate Balance control.

As a sample is taken, the error signal is amplified and converted to a DC signal for both the CRT and the feedback that arrives through pins 2 and B of the sampler board. The maximum feedback is limited to approximately ± 1.2 volts by two resistive dividers, D80, and D83. The voltage is limited to prevent excessive feedback voltage from reaching the Sampling Gate when the sampling unit Units/Div switch is changed between positions. Under certain conditions the excessive feedback can cause the Sampling Gate to go into a mode of conduction that holds the CRT beam off screen. By limiting the feedback amplitude, overdriven displays will leave the CRT screen but will return when the overdrive is removed. Without limiting the feedback, an overdrive signal could cause the display to disappear.

PERFORMANCE CHECK AND CALIBRATION

The performance check and calibration for the Type S-42 Sampling Head is a two level procedure. The first level of checking and calibration requires the use of the test equipment listed in Table 4-1 and ensures correct operation of the optical input to the sampling head. For a complete performance check and calibration the unit must be dismantled and electrical tests and adjustments must be performed as detailed in the "Electrical Performance and Calibration" section. These electrical tests require the use of the test equipment listed in Table 4-2. The test equipment specifications given are the minimum acceptable for the particular use of each item. If other test equipment is substituted, it must meet or exceed the stated requirements. All test equipment must be correctly calibrated.

OPTICAL PERFORMANCE CHECK AND CALIBRATION

PRELIMINARY PROCEDURE

I. Setting Up the Equipment

a. Install both 7S11 Sampling Units in the 7854 mainframe left and right vertical compartments. Install the 7T11A Timebase in the 7854 A horizontal compartment.

b. Plug the calibrated S-42 into the left 7S11 and the S-42 under test into the right 7S11 sampling unit. Tighten the locking screws, and turn on the main power.

c. On the 7854, select:

"A" horizontal mode

"right" vertical mode

"scope" CRT display.

d. Switch on the CW laser source. DO NOT ENABLE THE LASER OUTPUT. Connect the laser output to the input of the optical attenuator with the single-mode FC/PC optical cable.

Table 4-1
TEST EQUIPMENT REQUIRED FOR OPTICAL TESTS

Description	Requirements	Example
Oscilloscope Mainframe	For sampling Plug-ins	7854
Sampling Unit	For S-42 Sampling Head	7S11
Sampling Unit	For calibrated S-42	7S11
Sampling Timebase	For use with sampling units	7T11A
Calibrated Detector	Pulse response calibrated $T_{FWHM} \leq 55$ ps	S-42
Digital Multimeter	To monitor optical power	DM501A, DM502A, DM5010
CW Laser Source 1300 nm	For CRT deflection and power meter calibration $\geq 500 \mu W$ output	OT503
Optical Attenuator	Single mode 1300 nm ± 20 nm, 0 to 60 dB	Photodyne 19XT-101J
Optical Power Meter	For CW source calibration FC connector	Photodyne 17XTF
Single mode FC/PC connector- ized optical fiber cable	FC/PC to Diamond 3.5 for use with OT503	174-1385-00
Single mode FC/PC connector- ized optical fiber cable	FC/PC to FC/PC	174-1387-00
2-Way 2mm Plug, Banana	For use with digital multimeter	012-1286-00 and 012-1287-00
Fast Pulse Source	1300 nm ± 20 nm, <25 mW peak, $T_{FWHM} = 50 \pm 20$ ps, 80 ns pretrigger	Optoelectronics, Inc. PLS-20-1300
BNC 50 Ω cable (1 meter)		012-0482-00
BNC female to SMA male		015-1018-00
SMA 20 dB attenuator		015-1003-00
Laser safety glasses	For 1300 nm radiation	

- e. Switch on the pulsed laser source.
- f. Connect the low-level 80 ns pretrigger from the pulsed laser source to the trigger input on the 7T11A using the BNC lead, SMA adaptor, and the 20 dB attenuator.
- g. On the 7T11A, select:
 - "50 Ω EXT" input
 - "X1" trigger amplification
 - "+" slope
 - "sequential" sweep
 - "repetitive" scan
 - scan control fully clockwise
 - "50 ns" sweep range
 - "5 ns/division".
- h. On both 7S11s, set: "+ UP" and "normal" dot response.
- i. Connect the power monitor output (of the S-42 under test) to the digital multimeter using the 2 mm to banana plug leads. Switch on the digital multimeter.
- j. Allow the units to warm up for 20 minutes.

TEST PROCEDURE

1. Zero Light Measurements

Cover the S-42 optical input with a blanking cap and obtain a free running trace on the oscilloscope.

Minimum Detectable Power

Range 1

- a. Set the S-42 to Range 1, 1 V/mW.
- b. Set the Digital Multimeter to the 19.99 mV range.
- c. Check that the multimeter reads less than 1 mV (1 μ W).

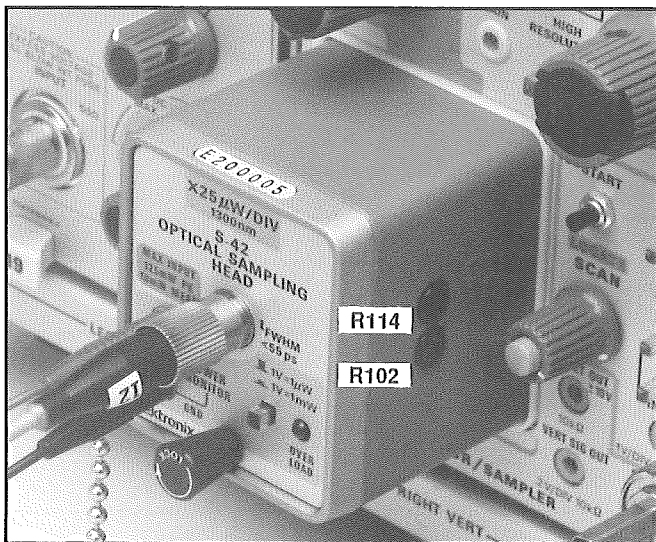


Figure 4-1. Locations of resistors R114 (Gain) and R102 (Offset) used in the adjustment of the optical power sensitivity.

Range 2

- a. Set the S-42 to Range 2, 1 V/ μ W.
- b. Set the Digital Multimeter to the 19.99 mV range.
- c. Check that the Multimeter reads less than 1 mV(1 nW).

The S-42 is initially calibrated for use in a 7S11 plugged into a 7000 Series mainframe operating at an ambient temperature of 25 degrees C. Any temperature deviation may change the dark current from the input Photodiode Assembly and cause the DC offset on the power out of Range 2 to be greater than 1 mV. This can be compensated for by adjusting R102 (see Fig. 4-1).

Screen Displayed Noise

- a. On the 7T11A, set the TIME/DIV to 50 ps/division.
- b. On the right 7S11 (S-42 under test), adjust the dc offset to position the trace on the screen.
- c. On the 7854 keypad, select:
 - WFM ACQUISITION: 100 AVERAGES
 - CRT DISPLAY: STORED
- d. On the waveform calculator, select:
 - 0
 - WFM
 - MEAN
 -
 - RMS
 - 2 5 0
 - *

- e. The RMS noise, displayed at the bottom center of the screen should be less than 42 μ W.

NOTE

The RMS noise is determined by multiplying the zero light signal level by 10 (100 times averaging reduces the noise by a factor of 10), and converting to microwatts by multiplying by 25.

2. CW Light Measurements

- a. Select the smooth dot response and set the 7S11 vertical deflection to 10 units/div.
- b. Adjust the DC offset level to position the trace at the 0% line onscreen.
- c. PUT ON LASER SAFETY GLASSES.
- d. Connect the attenuator output to the optical power meter, using the single-mode FC/PC optical cable.
- e. Enable the CW laser supply and adjust the attenuator to give a power meter reading of 100 μ W.
- f. Disconnect the laser from the power meter and connect it to the S-42 optical input.
- g. LASER SAFETY GLASSES MAY NOW BE REMOVED.

CRT Screen Display Sensitivity

- a. Set the S-42 to Range 1, 1 V/mW.
- b. On the 7854 keypad, select:
WFM ACQUISITION: 100 AVERAGE
CRT DISPLAY: STORED
CURSORS: CRS2-1
- c. Position cursors 1 and 2 on the far left and far right graticule lines, respectively, using the cursor controls (CRS1, CRS2).
- d. On the Waveform calculator, select:
0
WFM
2,
f
>WFM
SCOPE
- g. Turn off the CW laser source.
- h. On the waveform calculator, select:
WFM ACQUISITION: 100 AVERAGE
CRT DISPLAYED: STORED
2
WFM
0
WFM
—
MEAN
- i. The voltage level, displayed on the bottom center of the screen, should be between 3.500m and 4.800m. This corresponds to 25 μ W/division, \pm 20%.

NOTE

Since the fiber link is very short, there may be modal noise on the signal received by the input of the S-42, unless precautions have been taken to ensure this does not occur.

The deflection factor is dependent on the sensitivity of the photodiode and cannot be adjusted.

Power Reading Sensitivity**Range 1 Sensitivity**

- a. Set the Digital Multimeter to the 1.99 V range.
- b. Check that the Multimeter records an output voltage of 100 mV \pm 20% from the S-42.
- c. If the Multimeter reading is outside this range, the sensitivity can be adjusted by removing the top blanking plug and adjusting R114 (see Fig. 4-1).

Overload Indicator

- a. Set the S-42 to Range 2 and check that the Overload LED is illuminated.

NOTE

The Overload LED is illuminated when average input power exceeds 5 mW and 5 μ W on Range 1 and Range 2 respectively. When the LED is illuminated, the displayed trace will no longer give an accurate representation of the optical input signal.

Range 2 Sensitivity

- a. PUT ON LASER SAFETY GLASSES.
- b. Disconnect the optical input to the S-42 and reconnect to the optical power meter.
- c. Increase the attenuation by 20 dB to give a power meter reading of 1 μ W.
- d. Disconnect the optical input from the optical power meter and reconnect it to the S-42 input.
- e. Check that the multimeter reads 1 V \pm 20%.

NOTE

Range 2 cannot be adjusted independently of Range 1.

- f. Switch off the laser and disconnect it from the S-42 input.
- g. LASER SAFETY GLASSES MAY NOW BE REMOVED.

3. Pulse Measurements

- a. Remove the input cover cap from the pulsed laser unit output and connect the output of the laser unit to the calibrated S-42 using a single mode optical fiber. Select left-hand vertical mode.

- b. On the 7854, select:
VERTICAL MODE: LEFT

- c. On the 7T11A, set the TIME/DIV to 5 ns/division.

- d. On the 7S11 containing the calibrated S42, set the vertical gain to the most sensitive range sufficient to produce a 5 division deflection from the pulse.

NOTE

If the pulse height is unknown, no damage can be done to the S-42 by selecting the most sensitive 50 μ W/div range.

- e. Adjust the 7T11A trigger level and the 7S11 dc offset to obtain a trace on the screen.
- f. Adjust the trigger level and the time position to capture the input pulse and position it within the first major division.
- g. Gradually expand the time base to 50 ps/division, adjusting TRIGGER LEVEL and TIME POSITION to position the pulse on the second major division of the graticule. The amplitude should be less than 8 major divisions.

Performance Check and Calibration — S-42 Sampling Head

- h. On the 7854 key pad, select:
WFM ACQUISITION: 100 AVERAGE
CRT DISPLAY: STORED

i. Position cursor 1 on the left-hand side of the pulse on the zero baseline.

j. Position cursor 2 on the peak of the pulse and press the WIDTH button. This will give a readout of the T_{FWHM}(System), shown in picoseconds at the bottom center of the screen.

k. Use the following equation to calculate the approximate T_{FWHM} (Source):

$$T_{FWHM} (\text{Source}) = \sqrt{T_{FWHM} (\text{System})^2 - T_{FWHM} (\text{S-42})^2}$$

l. Move the optical input to the S-42 under test and obtain a value for T (System) as indicated in parts c through j above.

m. Calculate T (S-42) using the equation:

$$T_{FWHM} (\text{S-42}) = \sqrt{T_{FWHM} (\text{System})^2 - T_{FWHM} (\text{Source})^2}$$

n. Check that the value calculated is less than 55 ps.

Table 4-2
TEST EQUIPMENT REQUIRED

Description	Requirements	Example
Oscilloscope Mainframe	For sampling Plug-ins	7000 Series Mainframe
Sampling Plug-in Vertical	For S-42 Sampling Head	7S11 (2 required)
Sampling Plug-in Horizontal	For use with sampling Vertical	7T11A
Test Oscilloscope	DC to 30 MHz, 0.5 V/div vertical sensitivity	2213A
10X probe	For use with test scope	P6120
Signal/Pulse Generator	Pulse rise time 70 ps or less, amplitude approx. 20 mV into 50 ohms. Trigger 180 mV positive going at least 75 ns in advance of pulse with rise time of < 400 ps. Square wave outputs of 1 μs and 1 ns with 100 mV and 1 V amplitude into 50 ohms	Tektronix Type 284 (or equivalent)
Pulse Generator	Rise time 25 ps or less, amplitude ≥ 200 mV into 50 ohms with 180 mV positive going trigger at least 75 ns in advance of the fast pulse	Tektronix Type S-52
Rigid Coax Line 3 mm connectors	Test Procedures	Tektronix Part No. 015-1015-00
GR874 to 3 mm adapter plug		Tektronix Part No. 015-1007-00
GR874 to 3 mm adapter jack		Tektronix Part No. 015-1008-00
50 ohm 2X coaxial attenuator, GR874 connectors		Tektronix Part No. 017-0080-00
Special variable attenuator with GR connectors	Response not guaranteed	Tektronix Part No. 067-0511-00
BNC 50 ohm cable approximately 40 inches long	2 required	Tektronix Part No. 012-0057-01
BNC to BSM cable approximately 18 inches long		Tektronix Part No. 012-0127-00
Special 3 foot extender cable for sampling head		Tektronix Part No. 012-0124-00
Clip lead to BNC adapter		Tektronix Part No. 013-0076-00
DC Bridge	For measuring 50 ohm ± 5 V maximum across 50 ohm resistor accurate within ± 0.5%	
RMS line voltage meter	± 3% at input line voltage range	
Test sampling oscilloscope	For checking strobe kickout	7000 Series with 7T11, 7S11, and a Type S-2 sampling head

Post-Pulse Aberrations

- a. Set CRT DISPLAY to SCOPE and position the pulse peak on the second major division.
- b. Adjust the variable gain and the DC offset to position the pulse baseline on the 0% graticule line and the pulse peak on the 100% graticule line.
- c. Check that the peak-to-peak aberration for the next four divisions is less than $1\frac{1}{2}$ divisions (30%).

ELECTRICAL PERFORMANCE CHECK AND CALIBRATION

The electrical performance check and calibration procedure for the Type S-42 Sampling Head requires the use of the test equipment listed in Table 4-2. The test equipment specifications given are the minimum acceptable for each item. If other test equipment is substituted, it must meet or exceed the stated requirements. All test equipment must be correctly calibrated.

PRELIMINARY PROCEDURE

You must dismantle the Type S-42 unit and remove the Optical Input and Power Supply board before carrying out the electrical check and calibration procedure. Follow the procedure outlined below.

- a. Unscrew the optical input cap from the input connector.
- b. Remove the four nuts on the rear of the unit and slide off the rear panel and the housing.
- c. Unplug the three connectors from the Photodiode Power Supply board at the front of the unit.
- d. Disconnect the Photodiode Assembly from the electrical input of the electrical sampling assembly by unscrewing the SMA connector.
- e. The electrical sampling assembly can now be isolated and tested discretely.

1. Check the 50 ohm DC Input Resistance

- a. With the sampling head separated from the sampling unit, use a DC Resistance Bridge to measure the DC input resistance by connecting one lead to the input connector outer conductor and the other lead to the center conductor.
- b. Ensure that the bridge does not apply more than ± 5 V to the input terminals.
- c. Check that the electrical sampling assembly input resistance is 50 ohms $\pm 5\%$.

2. Setting up the equipment

- a. Assemble the indicator oscilloscope system by placing the Type 7S11 in the right vertical compartment of the indicator oscilloscope and the Type 7T11 in the horizontal compartment. Install an operating sampling head in the Type 7S11 compartment using a remote head extender (see Fig. 4-2).

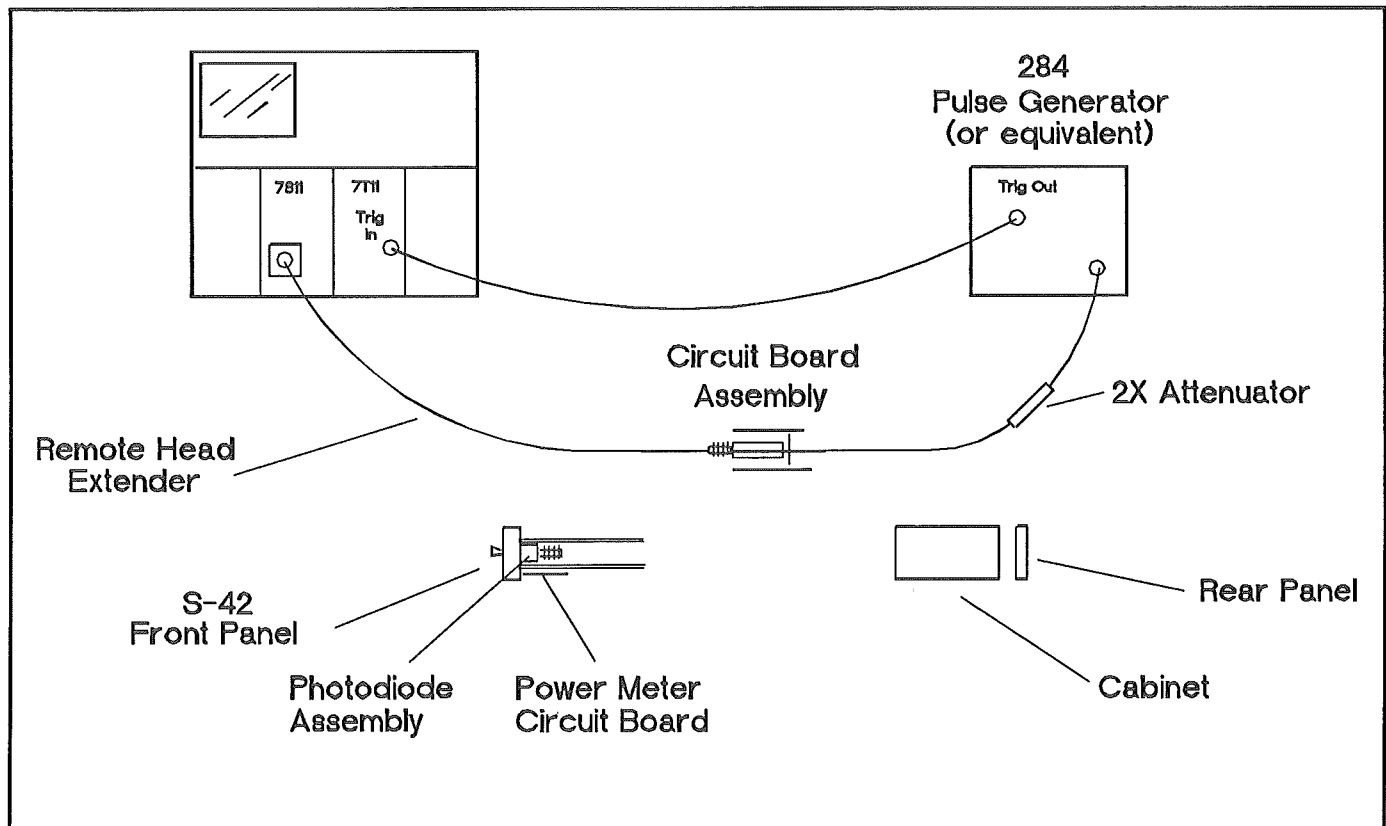


Fig. 4-2. Initial equipment setup.

b. Connect the RMS line-voltage meter to the power mains. Determine that the oscilloscope (and other equipment) input voltage selector is set for the correct value of line voltage. Connect all the equipment to the proper power outlet and turn on the power.

c. Obtain a free-running trace on the indicator oscilloscope and let the equipment warm up for five minutes. After the warm-up period, adjust the Trace Alignment control so the free-run trace is parallel to the graticule lines.

d. Connect the Type 284 Square Wave Output connector to the sampling head input. Use a 5 ns signal delay, 50 ohm coaxial cable with GR 874 connectors. Connect the Type 284 Trigger Output connector to the sampling sweep unit External Trigger input (50 ohm) connector, using a BNC 50 ohm coaxial cable. Set the Type 284 Period at 100 ns Square Wave and the amplitude at 1 volt. Using the Type 284 as both a time and amplitude reference, adjust both the vertical and the horizontal unit screwdriver adjustable Gain controls for proper deflection factor of each unit. Remove the sampling head from the 7S11.

e. Install the electrical sampling assembly onto the special three foot extender cable. Connect the other end of the cable into the 7S11 sampling head compartment. Allow the system to warm up for five minutes.

NOTE

The case should be in place unless access to internal controls is necessary.

f. Set the controls as follows:

Sampling Unit (Both channels)

Dot Response	Midrange
Unit/Div	100
Variable Cal Up	Pushed in
Position	Midrange
DC Offset	0 volts at Offset Out

Sampling Sweep Unit

Scan	Rep
Sequential	Pushed in
Time Div	50 ns
Swp Range	0.5 μ s
Variable	Cal
Time Position controls	Fully clockwise
Trig Sensitivity	Stable Display
Trigger Polarity	+
Trigger Source	Ext
Scan	Mid-range

Type 284

Mode	Square Wave
Period	100 ns
Square Wave Amplitude	1.0 V
Lead Time	75 ns

Test Oscilloscope

Triggering	+ Int, AC
Time/Div	0.2 μ s
Vertical	
With 10X Probe	1.0 V/Div, AC

PERFORMANCE CHECK AND CALIBRATION PROCEDURE

1. Check Ability to Produce a CRT Display

a. Connect the Type 284 Square Wave Output signal to the electrical sampling assembly as shown in Figure 4-2. Use a 2X GR attenuator at the Type 284 Output connector and a GR to 3 mm adapter to the Type S-42 input connector.

b. Check the CRT for a normal square wave display. If the display is normal, proceed to step 3. If there is no display, perform step 2.

2. Check Strobe Operation

a. Remove the extender cable from the sampling head (the indicator oscilloscope power may be left on).

b. Remove the Type S-42 case.

c. Reconnect the extender cable to the Type S-42. Use care to properly align the Trigger Pickoff connector.

d. Check for proper strobe operation by connecting a 10X probe from the test oscilloscope to the emitter of Avalanche transistor Q69. Adjusting the Avalanche Volts control R66 affects the amplitude of the waveforms. Check the waveforms at the collector of Q69 and at the Primary of T75 (Pin E of the Strobe Board). Typical displays are shown in Figure 4-3.

3. Adjust Avalanche Volts and Snap-Off Current

Avalanche Volts control R66 alters the strobe pulse amplitude and risetime. These affect the display noise, balance, and dot transient response. Snap-Off control R57 affects display noise, balance, and strobe kick-out.

a. Disconnect the 2X GR attenuator from the Type 284. Leave the attenuator and adapter attached to the Type S-42.

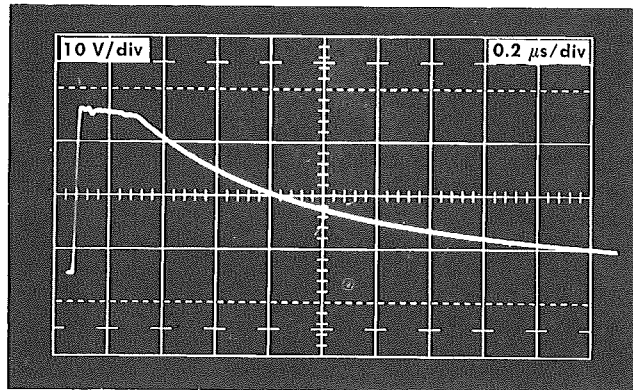
b. Set the Type 7T11 Trigger Sensitivity control for a free-running trace.

c. Set Avalanche volts control R66 (see Fig. 4-4) and Snap-Off Current control R57 to midrange.

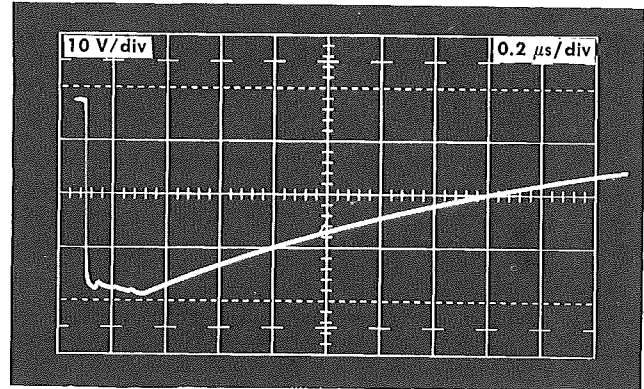
d. Turn the Avalanche volts control R66 clockwise to the free-run position. The trace will become very noisy. Turn R66 counterclockwise about 30 degrees or more from the free-run position.

e. Set Snap-Off Current control R57 for the minimum amount of current to center the trace on the CRT. This will appear as the first nulling as the trace moves on the CRT with clockwise rotation of R57.

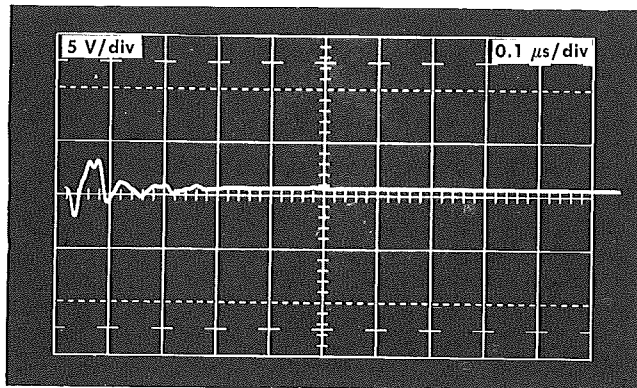
f. Use the fine adjustment controls for maximum loop gain and best dot transient response linearity. Connect the Type 284 Square Wave Output to the Type S-42 Input connector through the 2X attenuator and 3 mm to GR adapter.



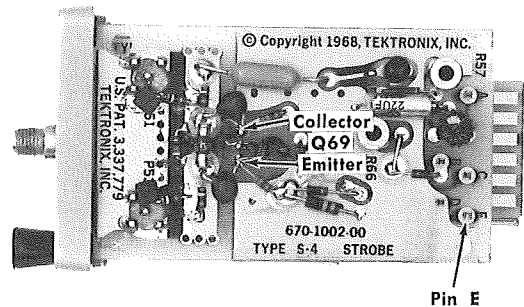
A. Q69 Emitter.



B. Q69 Collector.



C. T75 Primary, Pin E.



D. Test point locations.

0896-09

Fig. 4-3. Typical displays for Q69 operation.

g. Set the sampling sweep unit to INT. TRIG. and the sweep rate to 20 ns/div and obtain a double triggered display. The display may show greater than unity loop gain as a double trace. See Figure 4-6.

h. Set the Avalanche Volts (R66) and the Snap-Off Current (R57) controls for maximum loop gain (two traces on the square wave) and linearity (the difference at upper and lower trace separations should be equal).

i. Disconnect the 2X attenuator from the Type 284 and Optional Type S-42.

4. Check or Adjust Strobe Kickout

NOTE

Strobe kickout must be checked only if the Sampling Gate substrate assembly or Strobe Board have been replaced or if R57, or R66 has been adjusted.

a. Install the extender in the 7S11 and attach the Type S-42. Use a 3 mm to GR adapter to connect the Type S-42 Input connector to the sampling test oscilloscope.

b. Connect the Type 284 Trigger Output to the indicator oscilloscope sampling sweep unit Trigger Input 50 ohm connector with a BNC cable. Set the Type 284 Mode switch to Pulse Output.

c. Connect the 7T11 Pulse Out connector through a BNC cable to the External Trigger Input 50 ohm connector on the sampling test oscilloscope.

d. Set the indicator oscilloscope sampling sweep unit controls as follows:

Time Position	Midrange
Time/Div	5 ns
Range	50 ns
Display Mode	Manual
Manual Scan	Midrange
Trigger Sensitivity	Fully clockwise
Stability	Fully counterclockwise
Polarity	+
Trig	Ext 50 ohm

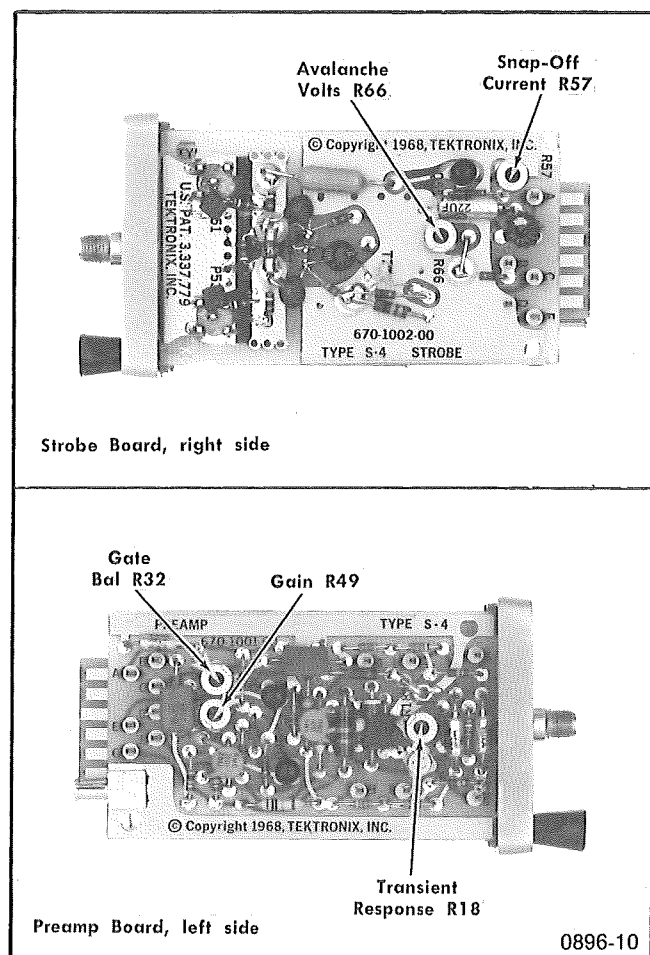


Figure 4-4. Type S-42 internal control locations.

e. Set the sampling test oscilloscope as follows:

Sampling Sweep Unit

Time/Div	5 ns
Time Position	Clockwise
Trigger Source	Ext
Slope	+
Sweep Mode	Ref
Trigger Sensitivity	10 o'clock

Sampling Unit

Millivolts/Div	50
DC Offset	Centered display
Other control	Optional

Adjust the indicator oscilloscope sampling sweeps MANSCAN and TIME POSITION to display kickout on the sampling test oscilloscope.

f. Set the indicator oscilloscope sampling unit Units/Div switch to 2 and rotate the DC Offset control. The sampling test oscilloscope CRT display should show a spike in the ringing portion, positive for counterclockwise rotation and negative for clockwise rotation. This identifies the Strobe kickout. Place the

ringing portion in the first division with the Time Position/control (see Fig. 4-5).

g. Change the sampling test oscilloscope sweep rate to 200 ps/div. Figure 4-5 shows the sampling unit (1) DC Offset control counterclockwise, (2) DC Offset control set for minimum of both strobes, and (3) DC Offset control set clockwise. Set the indicator unit DC Offset control for the minimum amplitude of both strobes.

h. Set the indicator sampling unit Units/Div switch to 100 and check the kickout. Amplitude up to a 50 mv peak is acceptable.

i. Reduce the kickout amplitude by moving the solder point on the clipping lines of R51 or R53. Since the solder points are at ground potential, the CRT display is observed as the lead is heated with a small soldering iron and moved with a soldering tool. Keep the solder points as close to R50 as possible. Figure 4-5 shows the solder points on the clipping lines.

j. Set the sampling test oscilloscope at 1 ns/div.

k. Set the indicator oscilloscope sampling unit Units/Div switch to 2 and the DC Offset control fully clockwise. Check that the kickout occurs within 1.2 ns of the beginning of the ringing portion. If it does not, readjust the Snap-Off Current control to place the kickout within 1.2 ns of the beginning of the ringing. The case on the Type S-42 may change the kickout amplitude from the reading observed with the case off. The desired minimum is with the case in place so you may need to make several attempts to get a correct setting.

5. Adjust Gate Bal

Gate Bal control R32 introduces an internal offset voltage to the feedback loop to cancel normal error signals in the sampling loop, including normal unbalance in the traveling wave gate. R32 is adjusted (with DC Offset at zero) to cancel most of the vertical trace shift as the Units/Div switch setting is changed.

a. Set the sampling unit DC Offset control for zero volts at the Offset Out jack.

b. Observe the trace as the sampling unit Units/Div switch is operated through its ranges and adjust Gate Bal control R32 for no more than one division of vertical shift of the trace. This adjustment varies with changes in the extender cable and when the Type S-42 case is removed or replaced. The Gate Bal control should be readjusted each time the equipment configuration is changed (e.g., the cable is moved or the Type S-42 cover is removed or replaced).

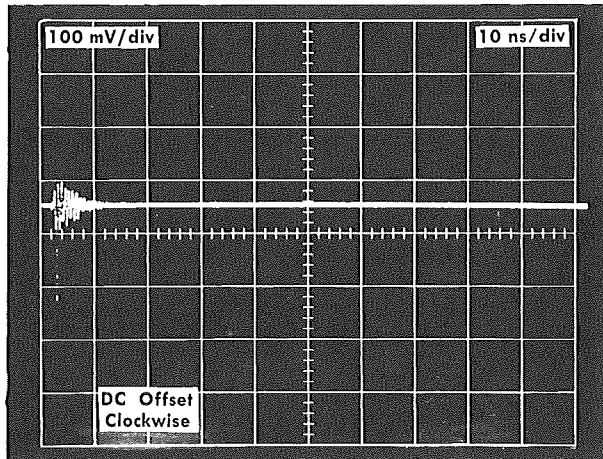
c. Set the sampling unit Units/Div switch to 100.

6. Check Dot Transient Response

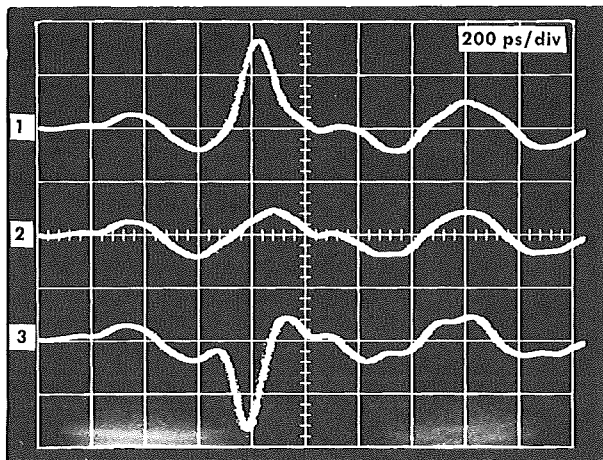
Requirement — Dot will move full amplitude $\pm 5\%$ on any signal up to 500 mV peak-to-peak when the sampling sweep unit is either double triggered or free run.

a. Connect the Type 284 Square Wave Output connector to the Type S-42 input connector with the 2X GR attenuator or variable attenuator and a 3 mm to GR adapter.

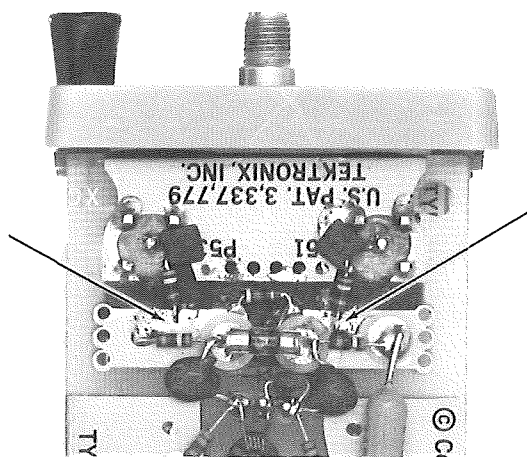
b. Connect the coaxial cable from the Type 284 Square Wave Output to the sampling sweep Trigger Input connector.



A. Locating the ringing portion.



B. DC Offset control for Strobe kickout location.



C. Location of the solder points.

0896-11

Figure 4-5. Strobe kickout from the Type S-42 Input connector.

c. Set the Type 284 Period switch to 100 ns sampling. Set the 7T11 Range switch to .5 μ s, the Time/div to 20 ns.

d. Set the sampling unit Units/Div switch to 100 and free run the sampling sweep unit at 0.5 μ s/div.

e. Set the sampling unit Dot Response so the top of the square wave is at unity loop gain (one trace). The bottom of the square wave can show two traces, but the dot response overshoot or undershoot must not be greater than 5%, or 0.25 major division on the graticule (see Fig. 4-7). If the dot response overshoots or undershoots more than 5%, perform step 7. (Perform step 7 for a complete recalibration.)

7. Adjust Gain

Gain control R49 changes the feedback loop gain.

a. Use the same setup as required in the preceding steps. Set the sampling unit Dot Response control to its electrical midpoint. The electrical midpoint is found by watching the changes in the display with greater or less than unity loop gain and setting the Dot Response control half-way between maximum loop gain and minimum loop gain.

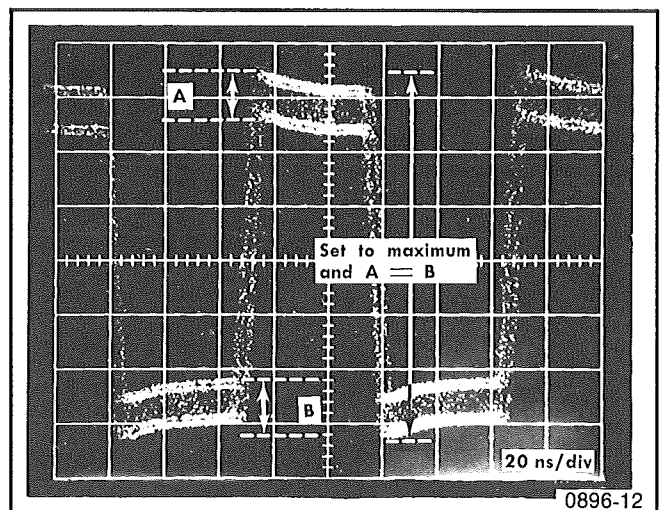
b. Adjust Gain control R49 for unity loop gain as shown in Figure 4-6. Use the fine adjustment of Avalanche Volts control R66 and Snap-Off Current control R57 for the best dot transient response with minimum noise. This may correct a dot response overshoot or undershoot in excess of the 5% tolerance. Sampling gate replacement may cause unbalanced response. See step 4 for adjustment of strobe pickoff resistors R51 and R53.

8. Check Maximum Operating Signal

Voltage Requirement — Signal amplitude up to 1 V peak-to-peak must be displayed without distortion.

a. Connect the Type 284 Square Wave Output to the Type S-42 through a 3 mm to GR adapter and the solid coaxial 3mm line.

b. Connect the Type 284 Trigger Output to the sampling sweep Trigger Input.



0896-12

Figure 4-6. Fine adjustment of Avalanche Volts and Snap-Off Current.

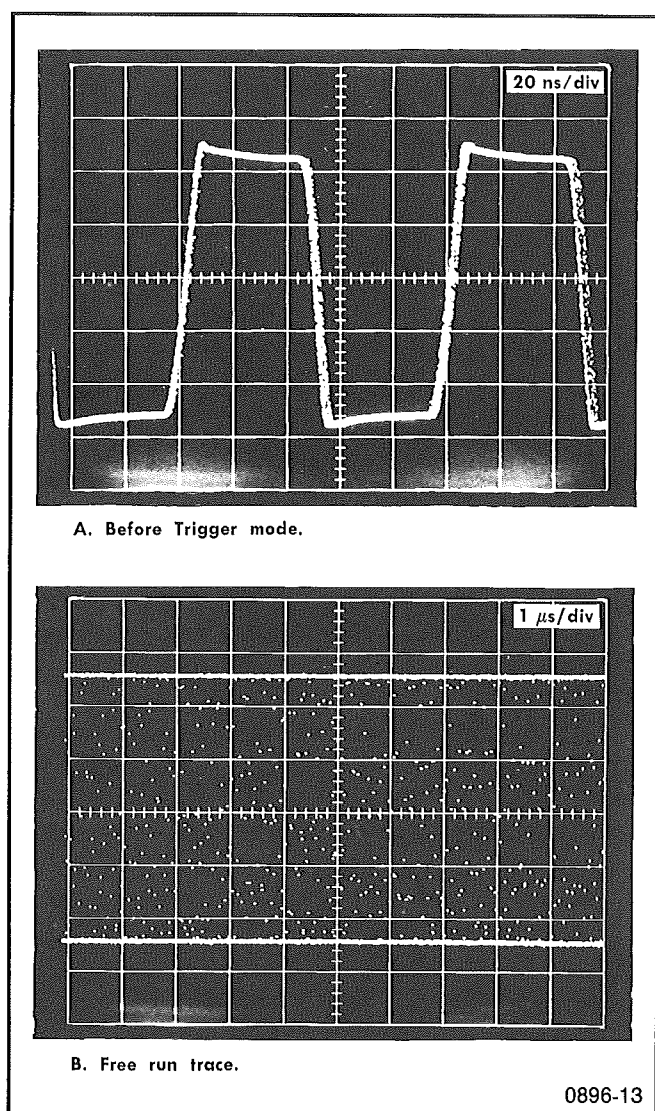


Figure 4-7. Dot Transient Response check.

c. Set the sampling unit Units/Div switch to 20. Set the Type 284 Period switch to 1 μ s and the Amplitude switch to 100mV.

d. Set the sampling sweep unit for a 200 ns/div sweep, and obtain a stable display. Observe the top and bottom portions of the display.

e. Change the Units/Div switch to 200 and the Type 284 Amplitude switch to 1.0 V.

f. Check that the square wave display is not distorted at the top or bottom portions as observed in part d. A distorted Square Wave display may be caused by gate unbalance. Check step 5, Adjust Gate Bal, or replace the substrate assembly. See the Maintenance section.

g. Remove the 3 mm GR adapter and the solid coaxial 3mm line.

9. Check Displayed Noise (Tangential)

NOTE

When making a visual noise reading from a sampling display, the eye interprets a noise value which is neither the RMS nor the peak-to-peak value. Since most observers agree that the displayed noise value is approximately 3 times the RMS value, the Tangential Noise here defined is 3 times the RMS value. (The measurement technique given produces acceptable agreement between various operators as to the instrument's noise value.)

Requirement — Tangential noise will be not greater than 5 mV, measured with the case on the Type S-42.

a. Connect the Type 284 Square Wave Output to the Type S-42 Input connector with the 2X GR attenuator, variable attenuator, and the 3 mm to GR adapter. Set the 284 to 100 mv and a 100 ns period.

b. Set the sampling unit Units/Div switch to 10 and the Variable control to Cal.

c. Set the 7T11 sweep range to 5 μ s, the time/div to .5 μ s sweep and the Trigger Sensitivity control clockwise for free run operation. Disconnect the coaxial cable to the Trigger Input connector.

d. Refer to Figure 4-8 for displays related to the following noise measurement procedure:

(1) Obtain a display of two traces.

(2) Adjust the variable attenuator until the two traces blend together — just to the point at which they appear as one trace.

(3) Change the Type 284 Amplitude switch to 1.0 V, 10 times the signal amplitude. The display now has a tangential deflection factor of 1.5 mV/div.

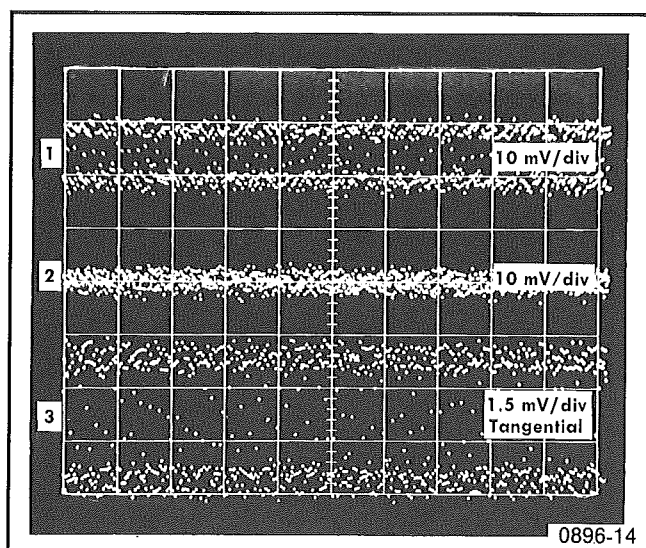


Figure 4-8. Triple exposure of Tangential noise measurement.

Tangential deflection factor per division is equal to the Units/Div setting of 10 mV divided by 2, times 3 divided by 10 = 1.5 mV/div.

The 5 mV tangential display noise limit includes 3.33 graticule divisions (3) in Figure 4-7. Check that the bottom edges of the two traces are not more than 3.33 divisions apart. Waveform(3) measures as 3.6mV tangential noise.

Determining Tangential Noise Deflection Factor:

The noise displays in Figure 4-8 have a noise deflection factor based upon: the signal amplitude, the sampling unit Units/Div setting, the final trace separation (which is twice the RMS noise), and the tangential noise (which is 3 times the RMS noise). The square wave signal amplitude that makes two traces appear as one sets the trace separation to twice the RMS noise. The following procedure permits a noise deflection factor to be determined by dividing the input mV/div deflection factor by 2 (trace separation is 2 times the RMS noise), multiplying by 3 (tangential noise is 3 times the RMS noise) and then dividing by 10 (the signal amplitude change factor).

- e. Disconnect the Type S-42 from the Type 284.

10. Check Risetime

Requirement — The 10% to 90% risetime is equal to or less than 25 ps, displayed as 35 ps or less using the Type S-52 Pulse Generator Head. To measure risetime you must use either a camera or a storage oscilloscope because the dot density must be increased for an accurate display and the sweep becomes too slow for visual interpretation. Install another 7S11 in the left vertical compartment.

- a. Install the Type S-42 in the right 7S11 sampling unit without the extender.
- b. Set the sampling unit Units/Div switch to 100.
- c. Connect the Type S-52 on the extender in the left 7S11 sampling unit. Connect the Pulse Output to the rigid coaxial

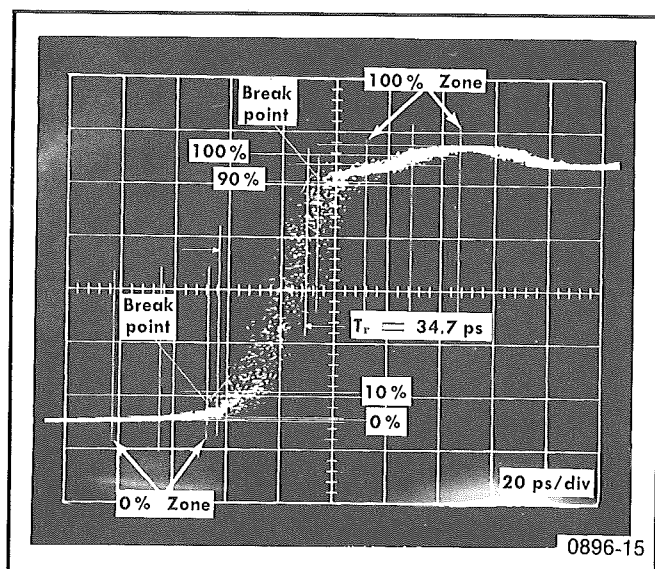


Figure 4-9. Combination of Type S-42 and Type S-52 risetime Measurement.

line and the Type S-42 Input connector. Connect the BSM to BNC cable from the Type S-52 Pretrig Out connector to the sampling sweep unit 50 ohm Trigger Input connector.

d. Set the sampling sweep unit for a 10 ps/div sweep rate. Set the Range switch to 50 ns and the Time/div switch to 10 ps. Center the rising portion of the pulse on the graticule and obtain at least 100 dots per division. Photograph or store the display.

- e. Measure the risetime as follows:

- (1) Mark the reference points at maximum rate of change. The break points are shown in Figure 4-9.

- (2) Mark the centers of the 0% zone and 100% zone, 35 ps from the reference break points, as shown in Figure 4-8 (the specified system risetime is 35 ps).

- (3) Mark the average level of the 0% and 100% zones through the centers of the zones.

- (4) Mark the 10% and 90% points in relation to the 0% and 100% average levels.

- (5) Measure the risetime between the 10% and 90% points.

- f. Check that the risetime is 35 ps or less.

- g. Use the same display and setup for the pulse flatness deviation check, step 11.

11. Check Pulse Flatness Deviation

Requirement — Pulse will deviate from the flat:

First 400 ps after step, -10%, +10% or less, total less than 20% peak to peak;

Between 400 ps and 25 ns after step, 0%, +10% or less, total less than 10% peak to peak;

After 25ns, +2%, -2% or less, total less than 4% peak to peak.

The Type S-52 is used to determine pulse flatness deviation during the first 400 ps and the Type 284 is used after the first 400 ps.

To measure the pulse flatness deviation during the first 400 ps you will need either a camera or a storage oscilloscope. The dot density must be increased for an accurate display and the sweep becomes too slow for visual interpretation.

- a. Use the same setup as in step 10 and set the 100% zone on a graticule line. Change the sampling sweep unit sweep rate to 50 ps/div and Time Position the display so the 90% amplitude point is near the first division on the graticule.

- b. Check that the pulse does not deviate from the 100% level more than +10% or -10% (total of 20% peak-to-peak) during the first 400 ps (see Figure 4-10A). 10% is a half division.

- d. Connect the Type 284 Pulse Output connector to the Type S-42 Input connector through a 3 mm to GR adapter and the 3 mm rigid coaxial line. Set the Type 284 Mode switch to Pulse Output. Connect the Type 284 Trigger Output to the sampling sweep unit 50 ohm Trigger Input connector through a BNC coaxial cable.

e. Set the sampling sweep unit sweep rate to 100 ns/div, the Range switch to 5 μ s, and the Time/div to 100 μ s. Push the random button and obtain a stable display.

f. Use the sampling sweep unit Time Position Control to place the rising portion of the pulse one division from the left edge of the graticule. Set the sampling unit Variable Units/Div control for 5 divisions between the 0% amplitude and the 100% amplitude level. See Figure 4-10B. Use the point 50 ns before the pulse as 0% and the point 500 ns after the pulse as 100%.

g. Change the Units/Div switch (without moving the Variable control) to 20 or a signal amplitude now 4% per division.

h. Position the trace bottom at the 100% amplitude point on the center graticule line (500 ns after pulse rise).

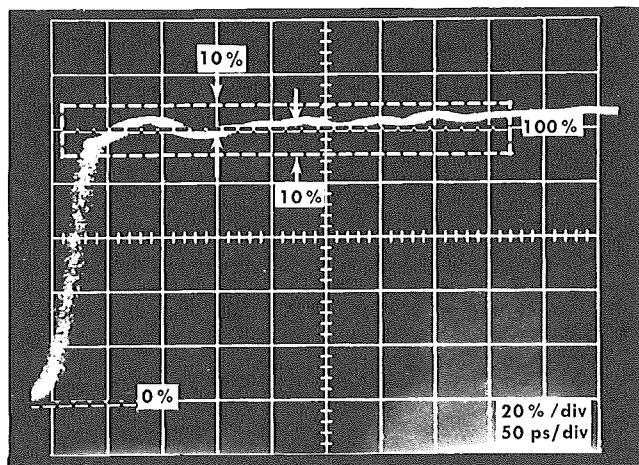
i. Check the pulse flatness deviation from 25 ns after pulse rise through end of the pulse. (The Time Position Control may be used.) See Figure 4-10C.

j. Check that the pulse flatness deviation is not more than +2%, -2% (total of 4% peak to peak). If the deviation is more than specified, perform step 12, Adjust Transient Response.

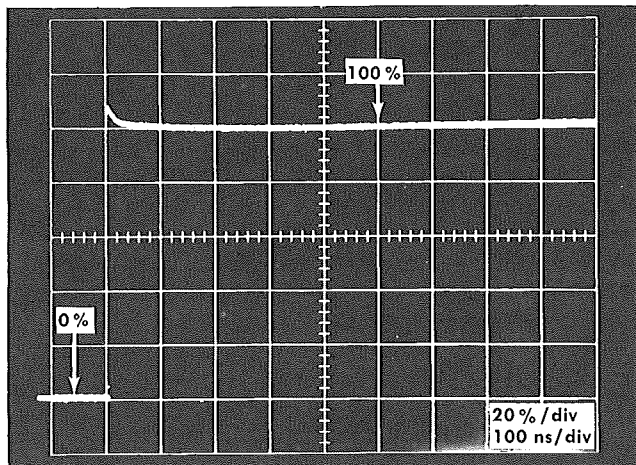
k. Set the sampling sweep unit sweep rate to 5 ns.

l. Reposition the rising portion of the pulse one division from the left edge of the graticule. Check the pulse flatness deviation from 400 ps to 25 ns after the pulse rise. See Figure 4-10D.

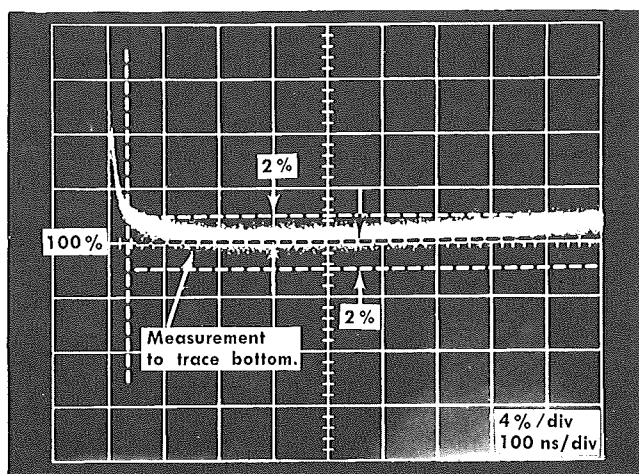
m. Check that the pulse flatness deviation is not more than 0%, +10% (total 10% peak to peak). Use the same setup to perform the Transient Response adjustment. If the pulse flatness deviation is within specifications, disconnect the Type 284 with the rigid coaxial line from the Type S-42 and remove the BNC coaxial cable from the sampling sweep Trigger Input and proceed to step 13.



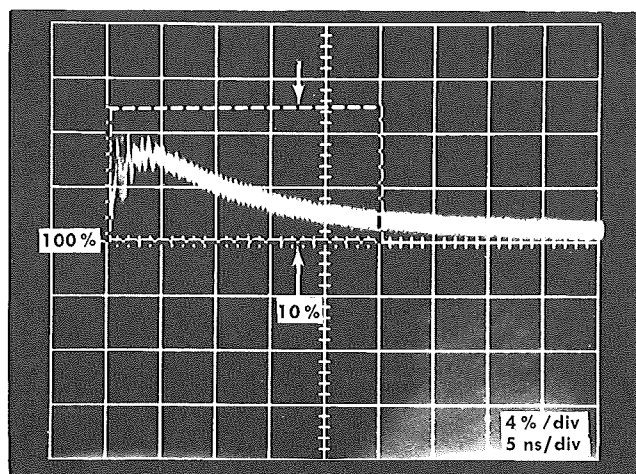
A. Type S-50 for 90% amplitude through 400 ps time interval.



B. Initial amplitude of Type 284 Pulse Output. Before Trigger operation.



C. 25 ns and thereafter time interval.



D. 400 ps through 25 ns time interval.

0896-16

Figure 4-10. Check of pulse flatness deviation.

12. Adjust Transient Response

Transient Response control R18 adjusts the magnitude of the blow-by correction signal; it does not change risetime.

a. Use the same setup as the pulse flatness deviation check, parts d through j.

b. Adjust Transient Response R18 so the pulse flatness does not deviate more than +2% or -2%, total 4% peak to peak, 25 ns after the pulse rise. See Figure 4-10C.

c. Disconnect the Type 284 with the rigid coaxial line from the Type S-42 Input and remove the BNC coaxial cable to the sampling sweep unit Trigger Input connector.

13. Check Baseline Shift With Repetition Rate Change

Requirement—A no signal-trace will not shift more than 10 mV vertically when the sampling sweep unit external trigger rate is changed from 30 Hz to 50 Hz.

a. Use the test oscilloscope as a trigger rate generator. Drive the sampling sweep unit external trigger input with the front panel +Gate signal (+20 volts peak). Connect the +Gate to the Type 7T11 connector and trigger on the - polarity of the signal.

Set the test oscilloscope sweep controls for a free run sweep. To obtain a 30 Hz trigger signal, set the Time/Div

switch to 2 ns and the Variable time/div control to a position in the midrange. To obtain a 50 kHz trigger signal, set the Time/Div switch to 20 μ s and the Variable time/div control to a position in the midrange.

b. Connect the 3 mm to GR adapter and 2X GR attenuator to the Type S-42 Input connector.

c. Set the sampling sweep unit for an external triggered sweep rate of 50 ns/div. This ensures that the shortest trigger circuit holdoff period is obtained and that the triggering rate can follow the external triggering signal repetition rate.

d. Set the sampling unit Units/Div switch to 10. Connect the external trigger rate generator signal to the sampling sweep unit and obtain a triggered sweep at either 30 Hz or 50 kHz repetition rate. Set the sampling unit DC Offset control to place the trace at one of the graticule lines.

e. Change the trigger rate generator through its ranges to the other frequency limit and check that the CRT trace does not move farther than one division up or down.

f. If the trace moves too far, check the avalanche transistor, Q69. This requires starting the procedure at step 1.

g. Disconnect the Trigger Input cable from the test oscilloscope.

MAINTENANCE

Introduction

This section is a maintenance guide for the Type S-42 Sampling Head. Some circuit testing and repair suggestions are included. See the "Circuit Description" section for additional circuit details if there is a problem that is not covered here. Parts ordering, disassembly and reassembly information is also included.

To remove the Type S-42 Sampling Head from its case, loosen the four retaining nuts on the back. Remove the optical blanking plug from the front connector and the two black plugs on the side of the unit. Slide the back off and remove the case by sliding it to the rear. Directions for replacing the case will be found at the end of this section.

To dismantle the optical front end, remove the three plugs which connect to the Photodiode Power Supply board. Take care to note their orientation. Disconnect the SMA connector between the Photodiode Assembly and the input to the sampling gate. You may now remove the front panel and Photodiode Assembly and the Photodiode Power Supply board. Remove the Photodiode Assembly from the front panel by unscrewing the two screws by the front flange on the Photodiode Assembly.

Photodiode Assembly

The Photodiode Assembly is a replacement item and cannot be serviced. Should a fault occur, the entire assembly must be replaced.

Photodiode Power Supply board

The Photodiode Power Supply board is not a serviceable item and must be replaced if a fault occurs.

Parts Removal and Replacement

All parts used in the Type S-42 can be purchased directly through your Tektronix Field Office or Representative. Some standard electronic items can be obtained locally. Replacements for the special parts used in the Type S-42 should be ordered from Tektronix since these parts are either manufactured or selected by Tektronix to satisfy a particular requirement. Before purchasing or ordering, consult the Electrical or Mechanical Parts List to determine the value, tolerance and ratings 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. Parts orientation and lead dress should duplicate those of the original part since many of the components are mounted in a particular way to reduce or control stray capacitance and inductance. After repair, the sampling head may require calibration.

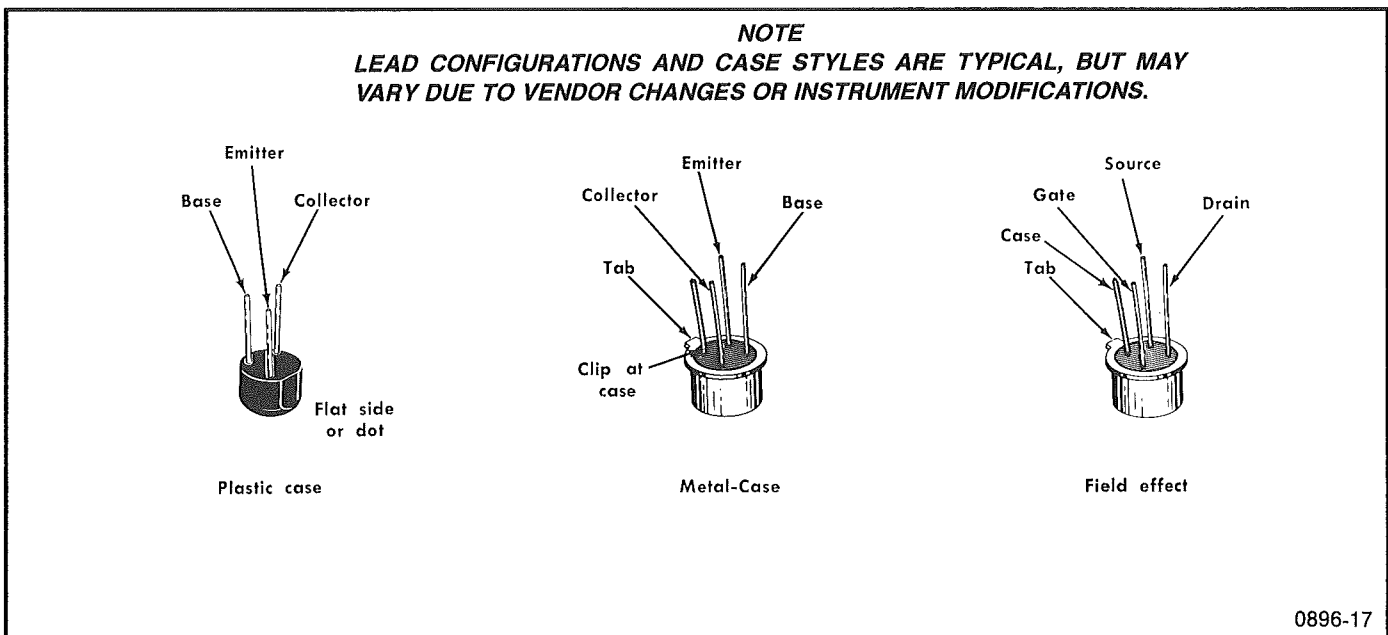


Figure 5-1. Lead configuration of the transistors in a Type S-42

Transistor Replacement. Cut the leads of the replacement transistor to the same length as the faulty transistor and bend the leads as necessary. The lead configurations of the transistors used in the Type S-42 are shown in Figure 5-1. Two transistors on the Trigger Amp circuit board (Q10 and Q14) have soldered leads. Field-effect transistor Q36 mounting has an arrow at the tab position.

Leadless Capacitors. There are leadless ceramic capacitors soldered directly to the circuit board. Care must be taken when replacing these capacitors since they crack easily. You must use electronic grade 60/40 solder or 63/38 solder with good cold-flow characteristics.

Solder a leadless capacitor in place by positioning the part on the board and applying heat to the adjacent board plating. Solder leads to a leadless capacitor by applying heat to the leads. Excess solder on either end of the capacitor can lead to a short circuit.

Removal and Replacement of Snap-off Diodes. The Snap-off diode is mounted in small metal clips, as shown on the circuit board illustration.

Circuit Board Replacement. If a circuit board is damaged and cannot be repaired, the entire assembly including all soldered-on components should be replaced. The part number given in the Mechanical Parts List is for the completely wired board.

The Strobe Board and the Preamp Board are removed by gently pulling outward from the Sampler Board. The Preamp Board holds the pretrigger output connector, P17, and a coaxial cable from the Trigger Amp Board soldered to the junction of R17 and R18. To replace, align the connectors and pin contacts and ease the boards into position. Pin connectors should not protrude beyond the clamps.

Remove the Sampler Board as follows (also see Fig. 5-2).

1. Loosen, but do not remove, the threaded nut on the Input connector with a $\frac{5}{16}$ inch wrench.
2. Loosen the Input connector with a $\frac{7}{32}$ inch wrench. Remove the Input connector with your fingers.
3. Unsolder the -12.2 volt lead to the Trigger Amp Board.
4. Loosen, but do not remove, the $\frac{5}{16}$ inch nut holding the Trigger Amp Board. The Trigger Amp Board is wired to the Sampler Board and to the Preamp Board.
5. Remove the attenuator by unscrewing it from the substrate assembly (right hand thread) and then slide both the attenuator and the Trigger Amp Board to the rear.
6. Remove the substrate assembly by removing the hexagonal screws with a $\frac{3}{64}$ inch Allen wrench. Brace the assembly with your finger as shown in Figure 5-2B. Lift the substrate assembly away from the Sampler Board.

NOTE

Do not touch the gold plated areas on the substrate (visible at the sides). These areas can be contaminated by your natural body oils.

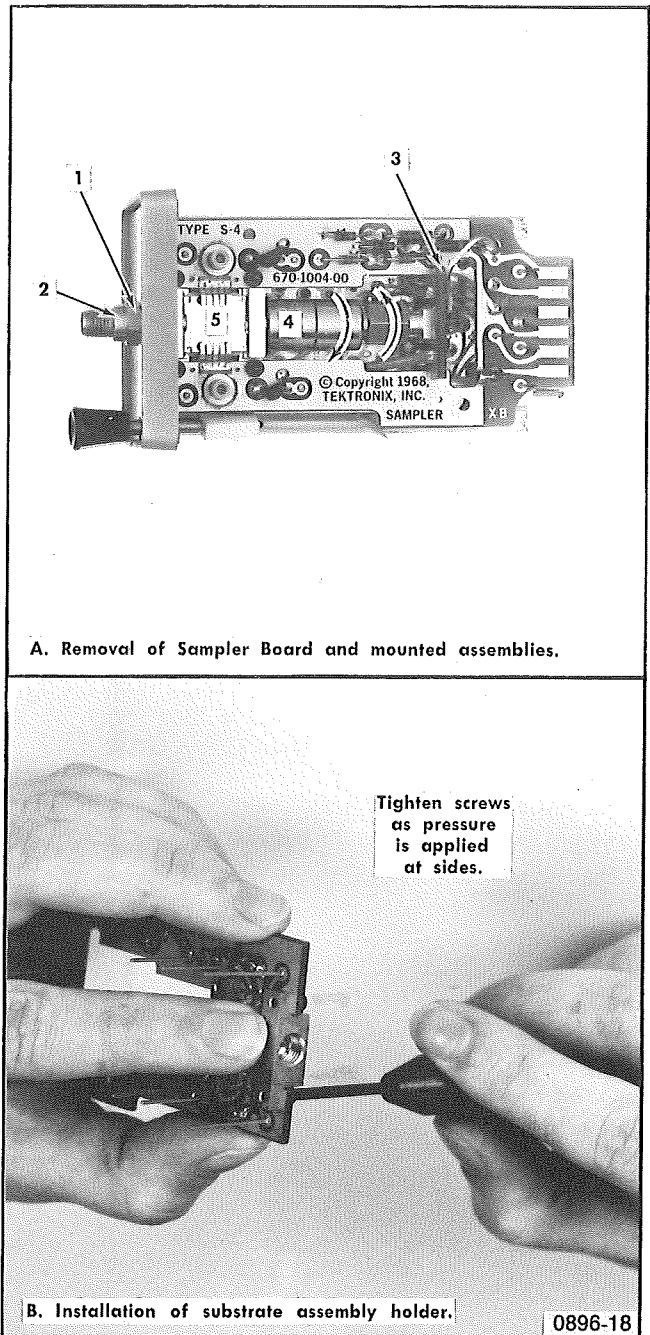


Figure 5-2. Sampler Board removal and reassembly.

Replacement of Sampler Board and Mounted Assemblies

1. Place the substrate assembly on the Sampler Board between the pins, which prevent forward or backward movement. Brace the substrate assembly as you tighten the hexagonal screws approximately half a turn. Apply pressure at the Sampler board sides (see Fig. 5-2B) and tighten the front screws. The substrate should orient itself for best electrical contact. Then tighten the rear screws and release the pressure.

2. Install the attenuator and Trigger Amp Board.
3. Tighten the coupling nut. Solder the -12.2 volt lead to the board. Place the Preamp Board in position.
4. Tighten the Input connector with a $\frac{7}{32}$ inch wrench to 10 in-lbs.

Replacement of the Optical Front End Assembly

1. Attach the photodiode assembly to the front panel with two screws through the front flange.
2. Position the photodiode power supply board so the LED and push-switch align with the openings in the front panel.
3. Slide the front end assembly onto the electrical sampling assembly, and tighten the SMA connector between the photodiode and the sampling gate.
4. Replace the three-way connector onto the lower pins on the photodiode power supply board, ensuring that the smooth side of the connector is uppermost.
5. Replace both of the two-way connectors on the photodiode power supply, with the smooth sides of the connectors up. The photodiode power leads attach to the front pair of pins. The power monitor output leads attach to the rear pair of pins.

Replacing the Sampling Gate substrate assembly or the Strobe Board may cause a system unbalance, resulting in strobe kickout from the Input connector. Correct this condition by resoldering R51 or R53 (possibly both) to a different point on the clipping lines. See the Performance Check/Calibration Procedure.

Checking Sampling Gate Diodes

To make a dynamic check of the condition of the forward characteristics of the sampling gate diodes, follow the procedure outlined in Section 4, step f, of this manual. In this check, the diodes are checked for both + and - strobe pulse conduction. If you do not find either the + or the - strobe pulse in this dynamic check, then further static checks can be performed on the gate, as outlined below. If both strobe polarities are observed, check the other circuits of the sampling head for problems leaving the sampling gate till last.

The Sampling Gate diodes can be specially checked by the use of a transistor characteristic curve tracer, such as the Tektronix Type 576. DO NOT USE AN OHMMETER TO CHECK THE SAMPLING GATE DIODES.

Once you have decided to check the Sampling Gate diodes, refer to Figure 5-3 for both the Sampling Gate circuit and test points used in the procedure listed below. The procedure outlines a method of checking forward conduction in groups of three, and reverse leakage on an individual basis.

1. Remove the sampling head case and the Preamplifier board. Leave the attenuator and Strobe Board in place.
2. Refer to Figure 5-3 for testpoints that must be used for checking D2A, D2B and D2C in one group and D2D, D2E and D2F in a second group. For the first group, attach the curve tracer positive lead to J53. Attach the negative lead of the first group to J51. When checking the second group ground the negative lead. These polarity connections test each group of

three diodes for their forward conduction in the curve tracer first quadrant as shown in Figure 5-4.

3. Set the Type 576 controls:

Vertical Current Collector MA	1 mA/Div
Horizontal Volts/Div Collector Volts	1
Peak Volts	15
Polarity	+
VARIABLE COLLECTOR SUPPLY	For no-load 5 divisions
Dissipation Limiting Resistor	140 ohms
Base Step Generator Controls	Optional, not used
Sloping Panel Controls Grounding Sw	Emitter Grounded
Selector Sw	Left or Right, whichever side has had clip leads attached for the test
Both Position Controls	Dot at Graticule center.

4. Attach two leads to terminals on the Type 576 sloping front panel. Small clip leads or meter leads with banana tips on one end and prongs on the other end will do. Attach one lead to an E connection and the other to the C connection above the E post. Place the selector switch so it points toward the side where the test leads are connected.

5. Connect the E lead to the Sampling Gate terminal J51 and the C lead to ground. The Type 576 display should now look like the first quadrant display in Figure 5-4. If the display shows slightly more than 1.2 volts flat display and then a rising portion as in Figure 5-4, the three diodes D2A, D2B and D2C are operating correctly in the forward direction. Check the other three diodes' forward conduction before measuring either set's reverse leakage.

6. Move the test leads so that the E lead is touching the sampling head ground and the C lead is touching J53. The display should be the same as in the first quadrant of Figure 5-4.

7. To check the reverse leakage of a diode, change the Type 576 controls:

Vertical Current Collector mA	1 μ A
Vertical Position	No-load trace at graticule centerline
Applied Voltage Polarity	-

8. The set up of part 7 gives a vertical deflection factor of 0.001 mA/Div, and will probably include some hum loops as shown in the third quadrant of Figure 5-4.

Connect the leads to check each diode's reverse leakage. Checking reverse leakage of three diodes in series may not give an indication that one is bad. Any one diode that shows discernible leakage (negative movement of Type 576 trace) is cause to reject an entire Sampling Gate assembly. Test points, for all six diodes, are listed in Table 5-1.

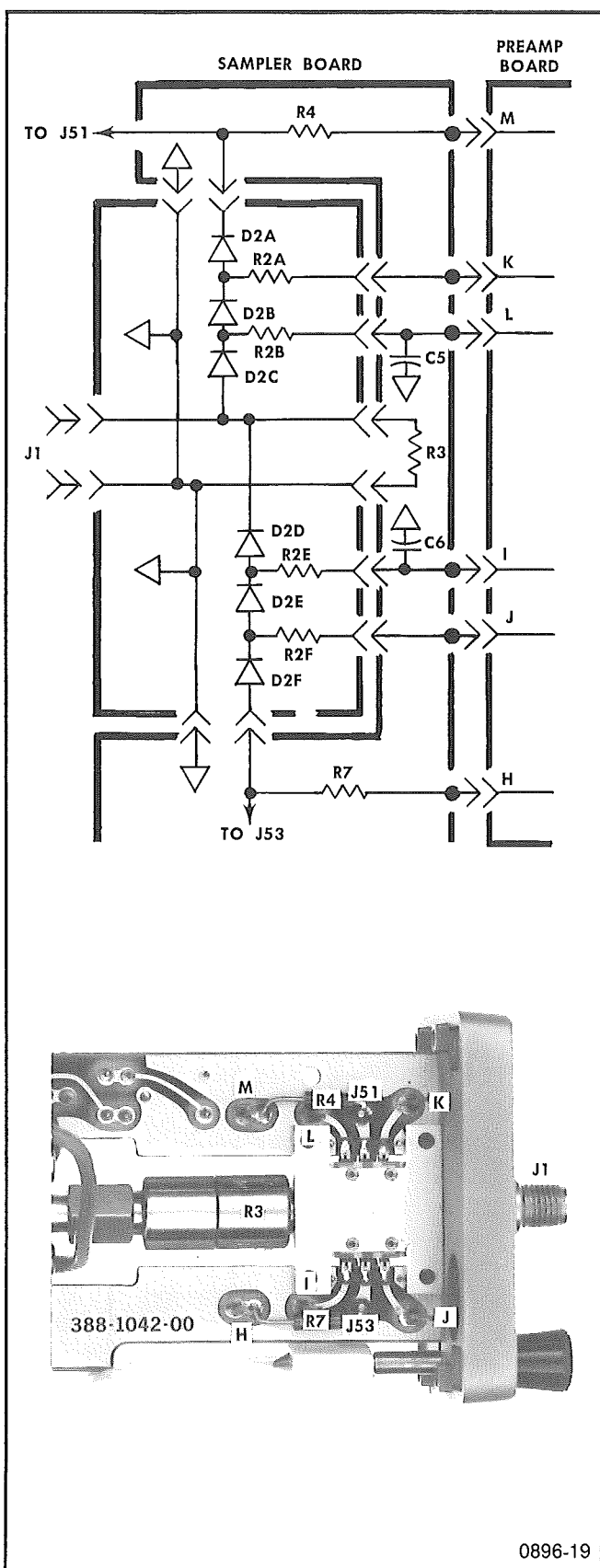


Figure 5-3. Sampling Gate circuit and test points for checking the diodes.

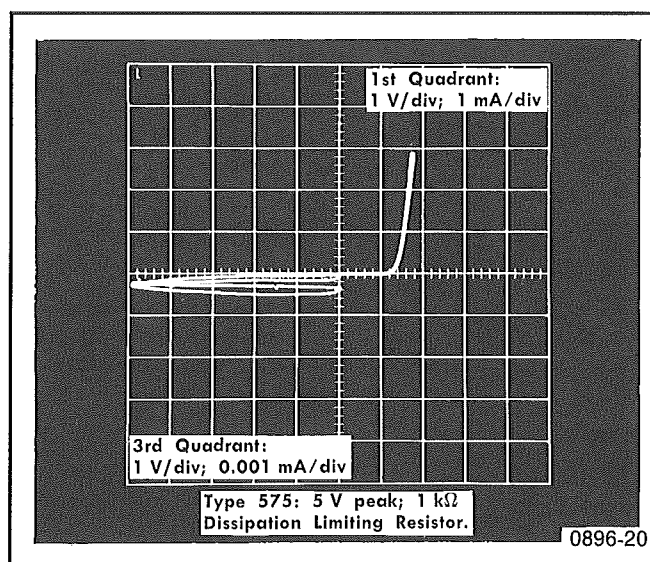


Figure 5-4. Type 576 Characteristic curves of forward and reverse voltage conduction of D2A, D2B and D2C. Do not use more than 5 volts peak.

Table 5-1
Individual Sampling Gate diode test terminals for reverse leakage checking

Diode	Terminals	
	+	-
D2A	J51	K
D2B	K	L
D2C	L	Ground
D2D	Ground	I
D2E	I	J
D2F	J	J53

Replacing the Sampling Head Case

To replace the case on the sampling head, place the body so that the hole in the side aligns with the Gate Bal control at the rear of the Preamp Board. Check that the upper and lower corners of the Preamp and Strobe boards are aligned with the channels in the sampling head body that contain the zigzag springs. Push the body gently forward until it contacts the front panel. In attaching the rear casting, be sure that the hole at one side of the casting fits over the trigger pickoff signal output connector. Secure the four nuts that attach the rear panel.

Repackaging for Shipment

If the Tektronix instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address), 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 with 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.

Major Circuits and Parts Locations

The remainder of this section consists of illustrations of the Type S-42. Major circuit areas are identified. All components mounted on the circuit boards are identified by circuit numbers.

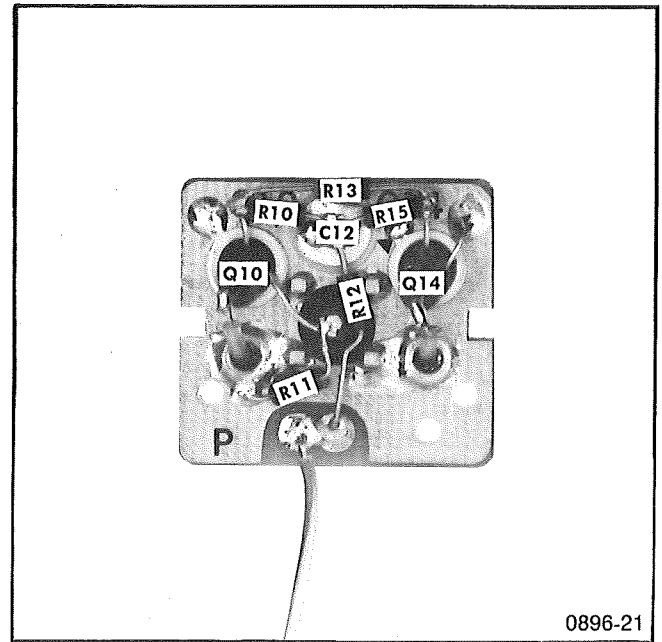
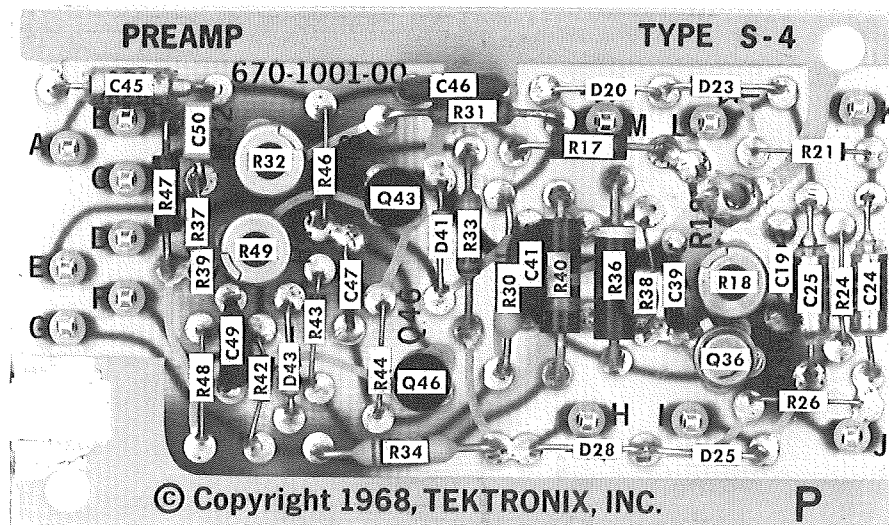


Fig. 5-5. Trigger Amp circuit board.



0896-22

Fig. 5-6. Preamp circuit board.

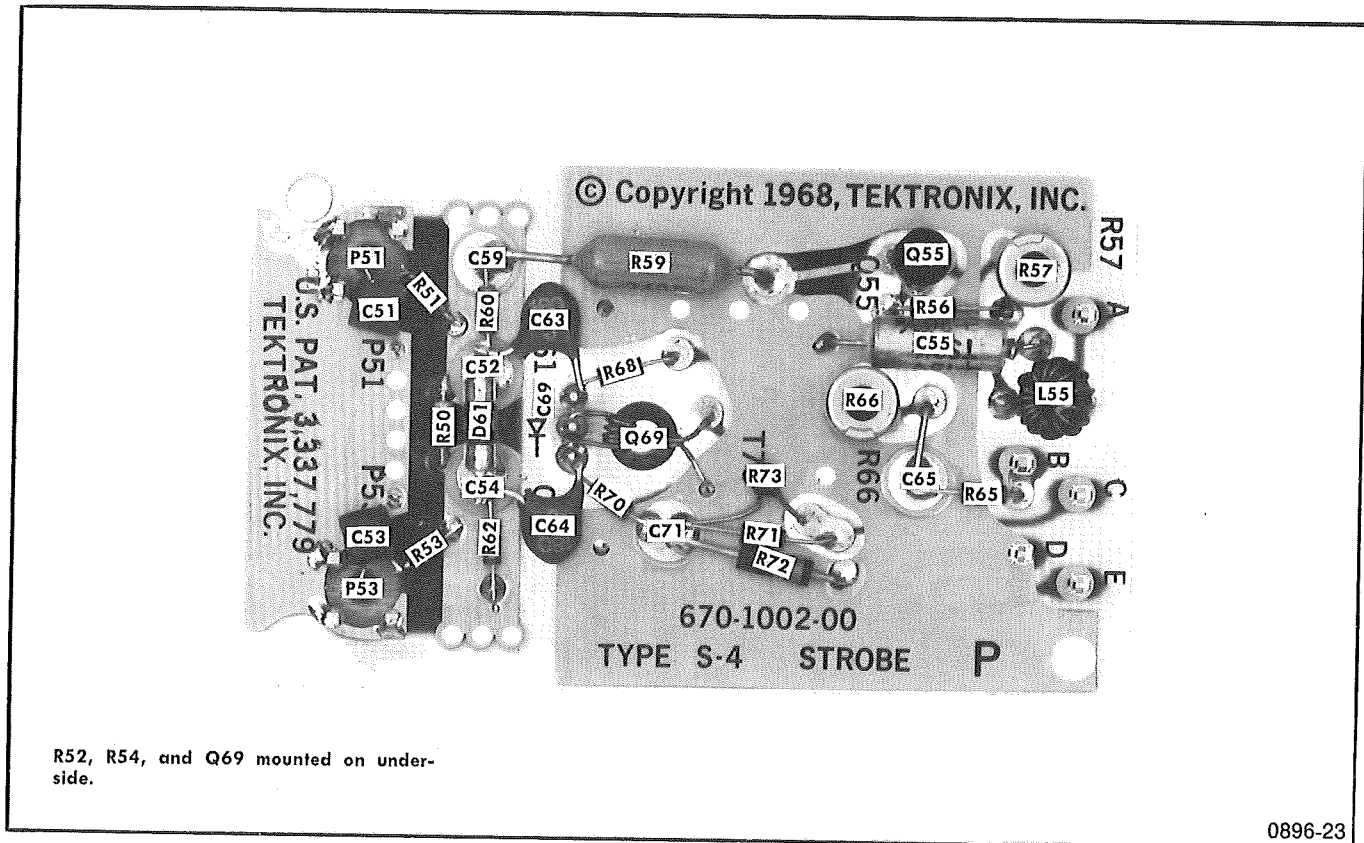
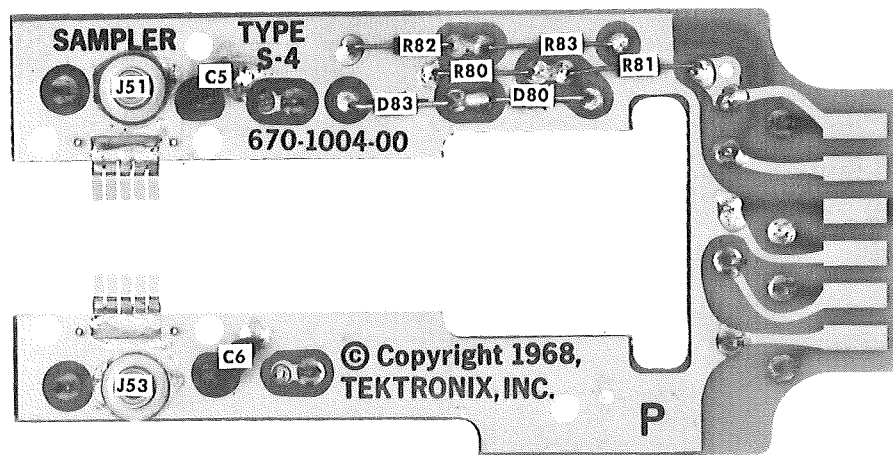


Fig. 5-7. Strobe circuit board.



R4 and R7 mounted on underside.

0896-24

Fig. 5-8. Sampler circuit board.

OPTIONS

There are no options at this time.

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

LIST OF ASSEMBLIES

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

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

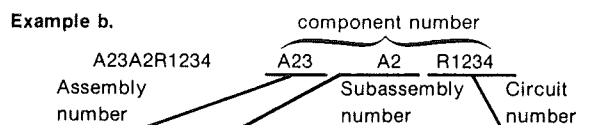
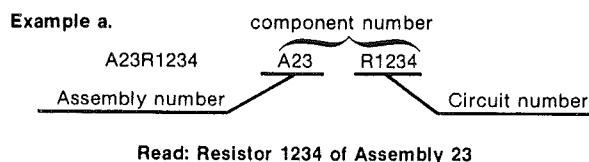
The Mfr. Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names and addresses of manufacturers of components listed in the Electrical Parts List.

ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

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



Read: Resistor 1234 of Subassembly 2 of Assembly 23

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

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

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

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

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

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

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

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

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

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

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

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

Indicates actual manufacturers part number.

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
01121	ALLEN-BRADLEY CO	1201 S 2ND ST	MILWAUKEE WI 53204-2410
03508	GENERAL ELECTRIC CO	W GENESEE ST	AUBURN NY 13021
04222	SEMI-CONDUCTOR PRODUCTS DEPT AVX CERAMICS	19TH AVE SOUTH	MYRTLE BEACH SC 29577
04713	DIV OF AVX CORP MOTOROLA INC	P O BOX 867 5005 E MCDOWELL RD	PHOENIX AZ 85008-4229
05397	SEMICONDUCTOR PRODUCTS SECTOR UNION CARBIDE CORP	11901 MADISON AVE	CLEVELAND OH 44101
07263	MATERIALS SYSTEMS DIV FAIRCHILD SEMICONDUCTOR CORP	10400 RIDGEVIEW CT	CUPERTINO CA 95014
12954	NORTH AMERICAN SALES SUB OF SCHLUMBERGER LTD MS 118 MICROSEMI CORP - SCOTTSDALE	8700 E THOMAS RD P O BOX 1390	SCOTTSDALE AZ 85252
14193	CAL-R INC	P O BOX 1397 1601 OLYMPIC BLVD	SANTA MONICA CA 90406
15454	AMETEK INC	PO BOX 1397 721 N POPLAR ST	ORANGE CA 92668
15801	RODAN DIV FENWAL ELECTRONICS	450 FORTUNE BLVD	MILFORD MA 01759
18203	DIV OF KIDDE INC ENGELMANN MICROWAVE DIV	60 S JEFFERSON RD	WHIPPANY NJ 07981-1001
19701	DIV OF KDI ELECTRONICS INC MEPCO/CENTRALAB	PO BOX 760	MINERAL WELLS TX 76067-0760
24931	A NORTH AMERICAN PHILIPS CO MINERAL WELLS AIRPORT SPECIALTY CONNECTOR CO INC	2100 EARLYWOOD DR PO BOX 547	FRANKLIN IN 46131
32997	BOURNS INC	1200 COLUMBIA AVE	RIVERSIDE CA 92507-2114
50101	TRIMPOT DIV FREQUENCY SOURCES INC	16 MAPLE RD	CHELMSFORD MA 01824-3737
51642	SEMICONDUCTOR DIV SUB OF LORAL CORP	2820 E COLLEGE AVE 8 WHATNEY	STATE COLLEGE PA 16801-7515
57668	CENTRE ENGINEERING INC ROHM CORP	PO BOX 19515 7741 N BUSINESS PARK DR	IRVINE CA 92713
59660	TUSONIX INC	PO BOX 37144 7158 MERCHANT AVE	TUCSON AZ 85740-7144
59821	MEPCO/CENTRALAB		EL PASO TX 79915-1207
71468	A NORTH AMERICAN PHILIPS CO ITT CANNON	666 E DYER RD	SANTA ANA CA 92702
72982	DIV OF ITT CORP		
73138	ERIE SPECIALTY PRODUCTS INC BECKMAN INDUSTRIAL CORP	645 W 11TH ST 4141 PALM ST	ERIE PA 16512 FULLERTON CA 92635
80009	BECKMAN ELECTRONIC TECHNOLOGIES SUB OF EMERSON ELECTRIC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97707-0001
91418	TEKTRONIX INC	EAST PARK AVE PO BOX 339	ATTICA IN 47918
98291	RADIO MATERIALS CORP	40 LINDEMAN DR	TURNBULL CT 06611-4739
	SEAELECTRO CORP BICC ELECTRONICS		

Replaceable Electrical Parts
S-42 Sampling Head

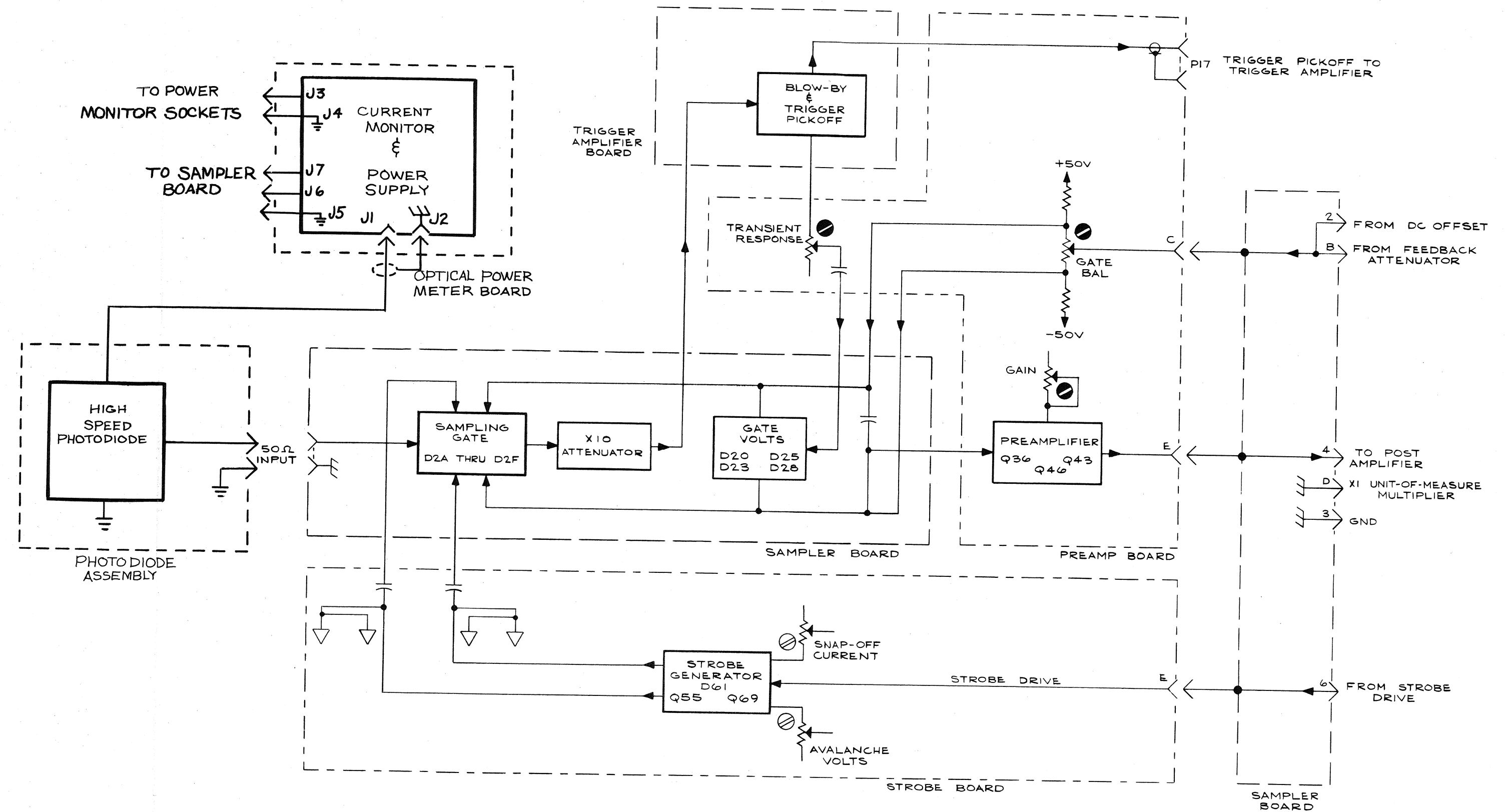
Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Discont	Name & Description	Mfr. Code	Mfr. Part No.
A1	670-1001-00	B010100	B072049	CIRCUIT BD ASSY: PREAMPLIFIER	80009	670-1001-00
A1	670-1001-01	B072050		CIRCUIT BD ASSY: PREAMPLIFIER	80009	670-1001-01
A2	670-1002-00	B010100	B059999	CIRCUIT BD ASSY: STROBE	80009	670-1002-00
A2	670-1002-01	B060000		CIRCUIT BD ASSY: STROBE	80009	670-1002-01
A3	670-1004-00			CIRCUIT BD ASSY: SAMPLER	80009	670-1004-00
A4	670-1003-00			CIRCUIT BD ASSY: TRIGGER TAKEOFF	80009	670-1003-00
A5	671-0934-00			CIRCUIT BD ASSY: POWER METER	80009	671-0934-00
A1	670-1001-00	B010100	B072049	CIRCUIT BD ASSY: PREAMPLIFIER	80009	670-1001-00
A1	670-1001-01	B072050		CIRCUIT BD ASSY: PREAMPLIFIER	80009	670-1001-01
A1C19	283-0136-00			CAP, FXD, CER DI: 10PF, 5%, 50V	51642	A100050-NP0-100J
A1C24	290-0188-00			CAP, FXD, ELCTLT: 0.1UF, 10%, 35V	05397	T322A104K035AS
A1C25	290-0267-00			CAP, FXD, ELCTLT: 1UF, 20%, 35V	05397	T320A105M035AS
A1C39	283-0051-00			CAP, FXD, CER DI: 0.0033UF, 5%, 100V	04222	SR301A332JAA
A1C41	283-0000-00			CAP, FXD, CER DI: 0.001UF, +100-0%, 500V	59660	831-610-Y5U0102P
A1C45	290-0246-00			CAP, FXD, ELCTLT: 3.3UF, 10%, 15V	12954	D3R3EA15K1
A1C46	283-0005-00			CAP, FXD, CER DI: 0.01UF, +100-0%, 250V	04222	SR303E103ZAA
A1C47	283-0066-00			CAP, FXD, CER DI: 2.5PF, +/-0.5PF, 200V	72982	8101-047C0J259D
A1C49	283-0000-00			CAP, FXD, CER DI: 0.001UF, +100-0%, 500V	59660	831-610-Y5U0102P
A1C50	283-0155-00	B010100	B029999	CAP, FXD, CER DI: 0.01UF, 10%, 50V	04222	3418-050C-103K
A1C50	283-0005-00	B030000		CAP, FXD, CER DI: 0.01UF, +100-0%, 250V	04222	SR303E103ZAA
A1D20	152-0333-00			SEMICON DVC, DI: SW, SI, 55V, 200MA, DO-35	07263	FDH-6012
A1D23	152-0333-00			SEMICON DVC, DI: SW, SI, 55V, 200MA, DO-35	07263	FDH-6012
A1D25	152-0333-00			SEMICON DVC, DI: SW, SI, 55V, 200MA, DO-35	07263	FDH-6012
A1D28	152-0333-00			SEMICON DVC, DI: SW, SI, 55V, 200MA, DO-35	07263	FDH-6012
A1D41	152-0141-02			SEMICON DVC, DI: SW, SI, 30V, 150MA, 30V, DO-35	03508	DA2527 (1N4152)
A1D43	152-0141-02			SEMICON DVC, DI: SW, SI, 30V, 150MA, 30V, DO-35	03508	DA2527 (1N4152)
A1Q36	151-1012-00			TRANSISTOR: FET, N-CHAN, SI, TO-72	04713	SFD1012
A1Q43	151-0224-00			TRANSISTOR: NPN, SI, TO-92	04713	SPS6917
A1Q46	151-0224-00			TRANSISTOR: NPN, SI, TO-92	04713	SPS6917
A1R17	315-0152-00			RES, FXD, FILM: 1.5K OHM, 5%, 0.25W	57668	NTR25J-E01K5
A1R18	311-0643-00			RES, VAR, NONW: TRMR, 50 OHM, 0.5W	32997	3329H-L58-500
A1R21	317-0224-00			RES, FXD, CMPSN: 220K OHM, 5%, 0.125W	01121	BB2245
A1R24	317-0393-00			RES, FXD, CMPSN: 39K OHM, 5%, 0.125W	01121	BB3935
A1R26	317-0224-00			RES, FXD, CMPSN: 220K OHM, 5%, 0.125W	01121	BB2245
A1R30	321-0385-00			RES, FXD, FILM: 100K OHM, 1%, 0.125W, TC=TO	19701	5033ED100KOF
A1R31	321-0253-00			RES, FXD, FILM: 4.22K OHM, 1%, 0.125W, TC=TO	19701	5033ED 4K 220F
A1R32	311-0609-00			RES, VAR, NONW: TRMR, 2K OHM, 0.5W	32997	3329H-L58-202
A1R33	321-0253-00			RES, FXD, FILM: 4.22K OHM, 1%, 0.125W, TC=TO	19701	5033ED 4K 220F
A1R34	321-0385-00			RES, FXD, FILM: 100K OHM, 1%, 0.125W, TC=TO	19701	5033ED100KOF
A1R36	301-0912-00			RES, FXD, FILM: 9.1K OHM, 5%, 0.5W	19701	5053CX9K100J
A1R37	317-0390-00			RES, FXD, CMPSN: 39 OHM, 5%, 0.125W	01121	BB3905
A1R38	307-0127-00			RES, THERMAL: 1K OHM, 10%	15801	JB-31J42
A1R39	307-0122-00			RES, THERMAL: 50 OHM, 10%, NTC	14193	1B15-500K
A1R40	301-0103-00			RES, FXD, FILM: 10K OHM, 5%, 0.50W	19701	5053CX10K00J
A1R42	317-0224-00			RES, FXD, CMPSN: 220K OHM, 5%, 0.125W	01121	BB2245
A1R43	317-0223-00			RES, FXD, CMPSN: 22K OHM, 5%, 0.125W	01121	BB2235
A1R44	317-0122-00			RES, FXD, CMPSN: 1.2K OHM, 5%, 0.125W	01121	BB1225
A1R46	317-0101-00			RES, FXD, CMPSN: 100 OHM, 5%, 0.125W	01121	BB1015
A1R47	315-0272-00			RES, FXD, FILM: 2.7K OHM, 5%, 0.25W	57668	NTR25J-E02K7
A1R48	317-0303-00			RES, FXD, CMPSN: 30K OHM, 5%, 0.125W	01121	BB3035
A1R49	311-0607-00	B010100	B072049	RES, VAR, NONW: TRMR, 10K OHM, 0.5W	73138	82-25-2
A1R49	311-0644-00	B072050		RES, VAR, NONW: TRMR, 20K OHM, 0.5W	32997	3329H-G48-203

Replaceable Electrical Parts
S-42 Sampling Head

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Discont	Name & Description	Mfr. Code	Mfr. Part No.
A2	670-1002-00	B010100	B059999	CIRCUIT BD ASSY:STROBE	80009	670-1002-00
A2	670-1002-01	B060000		CIRCUIT BD ASSY:STROBE	80009	670-1002-01
A2C51	283-0154-00			CAP,FXD,CER DI:22PF,5%,50V	04222	SR155A220JAA
A2C52	283-0135-00			CAP,FXD,CER DI:100PF,5%,500V	91418	JK101J501959
A2C53	283-0154-00			CAP,FXD,CER DI:22PF,5%,50V	04222	SR155A220JAA
A2C54	283-0135-00			CAP,FXD,CER DI:100PF,5%,500V	91418	JK101J501959
A2C55	290-0134-00			CAP,FXD,ELCTLT:22UF,20%,15V	05397	T110B226M015AS
A2C59	283-0121-00			CAP,FXD,CER DI:1000PF,20%,200V	91418	5P102M2011958
A2C63	283-0103-00			CAP,FXD,CER DI:180PF,5%,500V	59821	2DDH73L181J
A2C64	283-0103-00			CAP,FXD,CER DI:180PF,5%,500V	59821	2DDH73L181J
A2C65	283-0121-00			CAP,FXD,CER DI:1000PF,20%,200V	91418	5P102M2011958
A2C69	283-0140-00			CAP,FXD,CER DI:4.7PF,+/-0.25PF,50V	72982	8101E003A479C
A2C71	283-0121-00			CAP,FXD,CER DI:1000PF,20%,200V	91418	5P102M2011958
A2D61	152-0335-00	B010100	B059999	SEMICON DVC,DI:SNAP-OFF,SI	80009	152-0335-00
A2D61	152-0335-01	B060000		SEMICON DVC,DI:SRD,SI,35V,1PF,DO-35	50101	GC20279
A2L55	120-0382-00			COIL,RF:210UH,+28%-43%,14 TURNS	80009	120-0382-00
A2P51	131-0582-00			CONN,RCPT,ELEC:SNAP-ON,FEMALE,MODIFIED	98291	52-052-0049
A2P53	131-0582-00			CONN,RCPT,ELEC:SNAP-ON,FEMALE,MODIFIED	98291	52-052-0049
A2Q55	151-0224-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS6917
A2Q69	153-0556-00			TRANSISTOR:NPN,SI,SELECTED	04713	SPS8830
A2R50	317-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.125W	01121	BB4705
A2R51	317-0390-00			RES,FXD,CMPSN:39 OHM,5%,0.125W	01121	BB3905
A2R52	317-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
A2R53	317-0390-00			RES,FXD,CMPSN:39 OHM,5%,0.125W	01121	BB3905
A2R54	317-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
A2R56	317-0271-00			RES,FXD,CMPSN:270 OHM,5%,0.125W	01121	BB2715
A2R57	311-0607-00			RES,VAR,NONW:TRMR,10K OHM,0.5W	73138	82-25-2
A2R59	308-0243-00			RES,FXD,WW:240 OHM,5%,3W	14193	SA31-2400J
A2R60	317-0390-00			RES,FXD,CMPSN:39 OHM,5%,0.125W	01121	BB3905
A2R62	317-0390-00			RES,FXD,CMPSN:39 OHM,5%,0.125W	01121	BB3905
A2R65	317-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
A2R66	311-0644-00			RES,VAR,NONW:TRMR,20K OHM,0.5W	32997	3329H-G48-203
A2R68	317-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.125W	01121	BB3325
A2R70	317-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.125W	01121	BB3325
A2R71	317-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.125W	01121	BB2025
A2R72	315-0124-00			RES,FXD,FILM:120K OHM,5%,0.25W	19701	5043CX120K0J
A2R73	307-0124-00			RES,THERMAL:5K OHM,10%,NTC	15454	1DC502K-220-EC
A2T75	120-0544-00			XFMR,TOROID:	80009	120-0544-00
A3	670-1004-00			CIRCUIT BD ASSY:SAMPLER	80009	670-1004-00
A3C5	283-0047-00			CAP,FXD,CER DI:270PF,5%,500V	59660	0831604Z5F0271J
A3C6	283-0047-00			CAP,FXD,CER DI:270PF,5%,500V	59660	0831604Z5F0271J
A3D80	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3D83	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3J51	131-0391-01			CONN,RCPT,ELEC:SNAP-ON,MALE	98291	051-051-0119-22
A3J53	131-0391-01			CONN,RCPT,ELEC:SNAP-ON,MALE	98291	051-051-0119-22
A3R4	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A3R7	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A3R80	317-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
A3R81	317-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.125W	01121	BB1525
A3R82	317-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
A3R83	317-0182-00			RES,FXD,CMPSN:1.8K OHM,5%,0.125W	01121	BB1825
A4	670-1003-00			CIRCUIT BD ASSY:TRIGGER TAKEOFF	80009	670-1003-00
A4C12	283-0121-00			CAP,FXD,CER DI:1000PF,20%,200V	91418	5P102M2011958

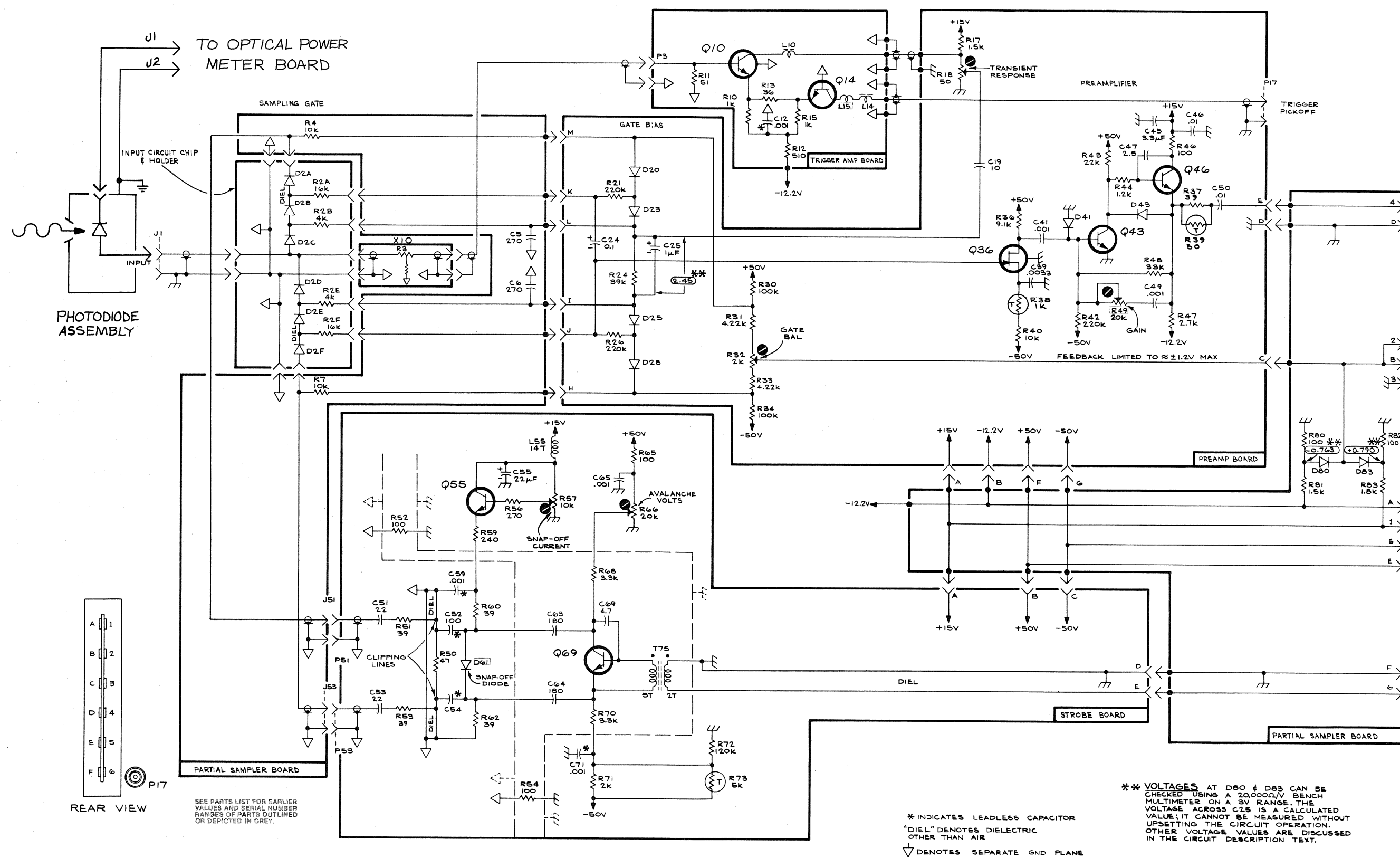
Replaceable Electrical Parts
S-42 Sampling Head

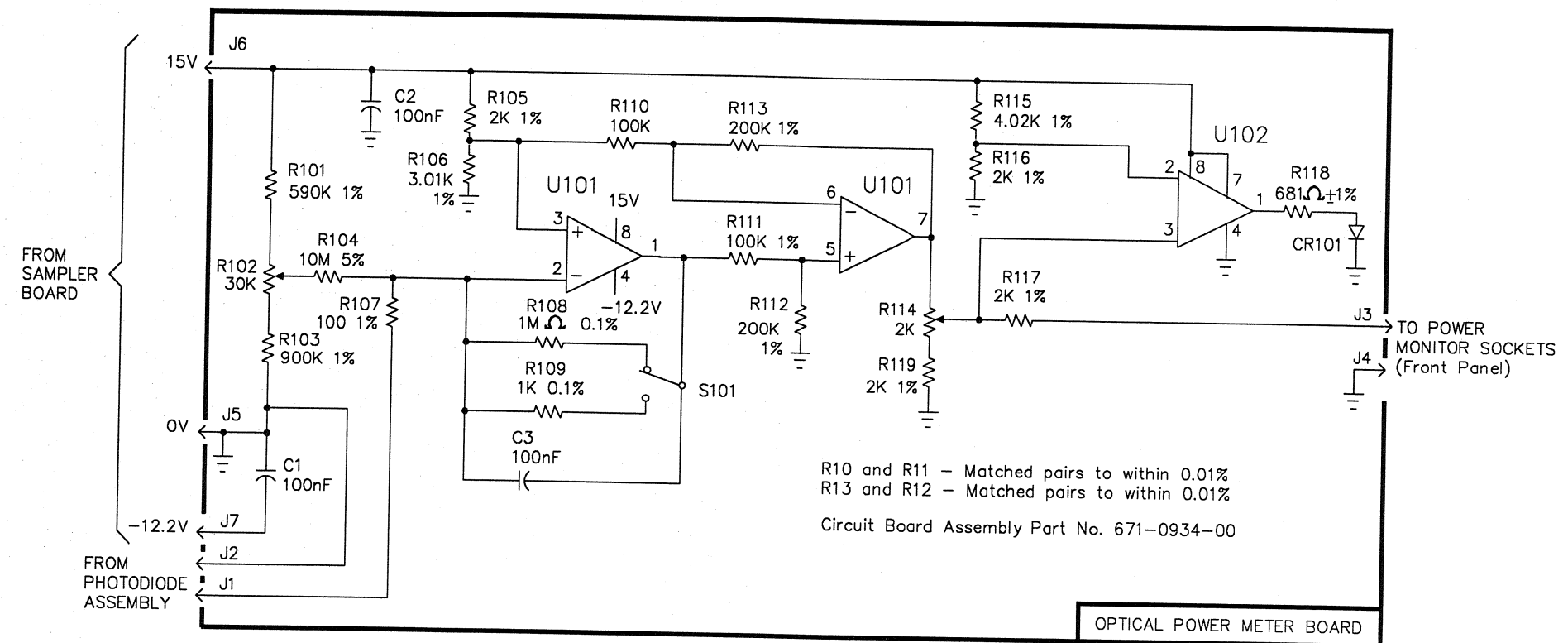
Component No.	Tektronix Part No.	Serial/Assembly No. Effective Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A4L10	276-0543-00	B061638	SHLD BEAD,ELEK:FERRITE	80009	276-0543-00
A4L14	276-0543-00		SHLD BEAD,ELEK:FERRITE	80009	276-0543-00
A4L15	276-0543-00		SHLD BEAD,ELEK:FERRITE	80009	276-0543-00
A4P3	131-0663-00		CONN,RCPT,ELEC:3MM CKT BD MT	24931	39JR162-1
A4P17	131-0565-00		CONN,RCPT,ELEC:SUBMIN COAX,MALE INNER COND (PART OF 175-1042-XX)	71468	DM53742-5001
A4Q10	151-0212-00		TRANSISTOR:NPN,SI,TO-72	04713	SRF 518
A4Q14	151-0212-00		TRANSISTOR:NPN,SI,TO-72	04713	SRF 518
A4R10	317-0102-00		RES,FXD,CMPSN:1K OHM,5%,0.125W	01121	BB1025
A4R11	317-0510-00		RES,FXD,CMPSN:51 OHM,5%,0.125W	01121	BB5105
A4R12	317-0511-00		RES,FXD,CMPSN:510 OHM,5%,0.125W	01121	BB5115
A4R13	317-0360-00		RES,FXD,CMPSN:36 OHM,5%,0.125W	01121	BB3605
A4R15	317-0102-00		RES,FXD,CMPSN:1K OHM,5%,0.125W	01121	BB1025
A5	671-0934-00		CIRCUIT BD ASSY:POWER METER	80009	671-0934-00
AT1	119-0178-00		ATTENUATOR,FXD:50 OHM,DC-18GHZ,FEEDTHRU,10X	18203	28265001
D2	155-0001-00		MICROCKT,DGTL:GATE,SPL PKG	80009	155-0001-00
D101	119-3352-00		PHOTODIODE:IN COMPLETE HOUSING	80009	119-3352-00
J1	131-0631-01		CONN,RCPT,ELEC:SMA JACK TO SPCL END CONFIG (PART OF D2)	24931	39A100-2
R2	-----				
W101	174-1389-00		CA ASSY,SP,ELEC:3 COND,90MM L	80009	174-1389-00
W102	174-1383-00		CA ASSY,SP,ELEC:2 COND,55.0MM L	80009	174-1383-00
W103	174-1384-00		CA ASSY,SP,ELEC:2 COND,55.0MM L	80009	174-1384-00



TYPE S-42 OPTICAL SAMPLING HEAD

BLOCK DIAGRAM





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.

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.

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	<i>Name & Description</i>
---	---	---	---	---	-------------------------------

Assembly and/or Component

Attaching parts for Assembly and/or Component

END ATTACHING PARTS

Detail Part of Assembly and/or Component

Attaching parts for Detail Part

END ATTACHING PARTS

Parts of Detail Part

Attaching parts for Parts of Detail Part

END ATTACHING PARTS

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.

Attaching parts must be purchased separately, unless otherwise specified.

ABBREVIATIONS

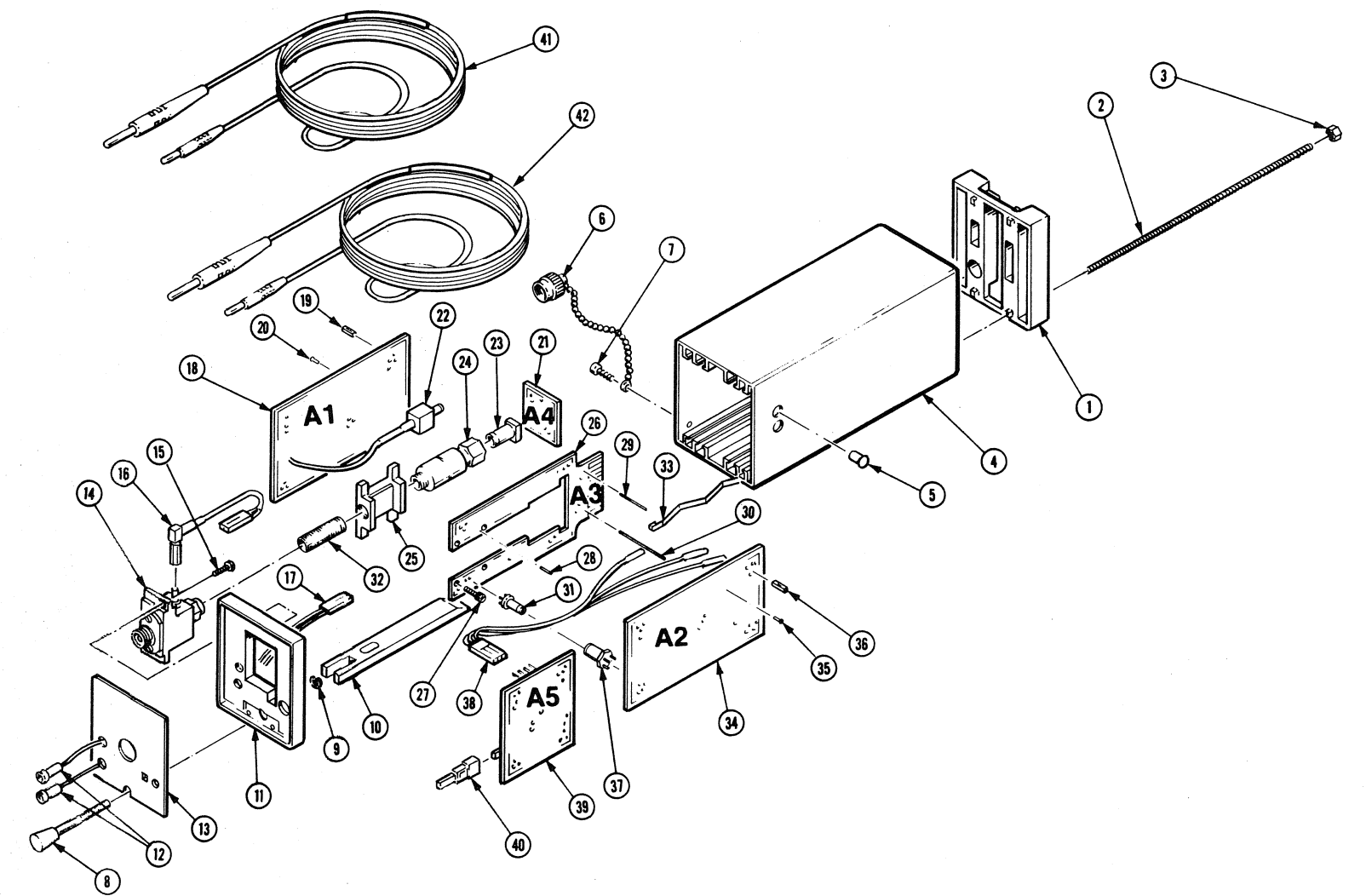
Abbreviations conform to American National Standards Institute Y1.1

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00287	C E M CO INC	99 ROCK AVE	DANIELSON CT 06239-0179
18203	A SPIROL INTERNATIONAL CO	PO BOX 179	
	ENGELMANN MICROWAVE DIV	60 S JEFFERSON RD	WHIPPANY NJ 07981-1001
22526	DIV OF KDI ELECTRONICS INC		
	DU PONT E I DE NEMOURS AND CO INC	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070-3007
24931	DU PONT CONNECTOR SYSTEMS		
	DIV MILITARY PRODUCTS GROUP		
	SPECIALTY CONNECTOR CO INC	2100 EARLYWOOD DR	FRANKLIN IN 46131
79136	WALDES KOHINOOR INC	PO BOX 547	
80009	TEKTRONIX INC	47-16 AUSTEL PLACE	LONG ISLAND CITY NY 11101-4402
		14150 SW KARL BRAUN DR	BEAVERTON OR 97707-0001
		PO BOX 500	
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
98291	SEAELECTRO CORP	40 LINDEMAN DR	TURNBULL CT 06611-4739
	BICC ELECTRONICS		
TK0428	DLB INDUSTRIES		FRESNO CA
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609-3320

Replaceable Mechanical Parts
S-42 Sampling Head

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	386-1337-09		1	PANEL, REAR: (ATTACHING PARTS)	80009	386-1337-09
-2	355-0279-00		4	STUD, PRESSMOUNT: 4-40 X 126MM L, SST	80009	355-0279-00
-3	220-0856-01		4	NUT, PLAIN, HEX: 4-40 X 0.188 HEX, AL (END ATTACHING PARTS)	80009	220-0856-01
-4	437-0391-00		1	CABINET:	80009	437-0391-00
-5	134-0208-00		2	BUTTON, PLUG: NYLON	80009	134-0208-00
-6	200-3658-00		1	COVER, CONNECTOR: FC, W/CHAIN (ATTACHING PARTS) (END ATTACHING PARTS)	80009	200-3658-00
-7	213-0124-00		1	SCREW, TPG, TF: 6-20 X 0.25, TYPE AB, PNH, STL	TK0435	ORDER BY DESCR
-8	384-0687-01		1	KNOB: 1.44 L X 0.125 OD, SST	80009	384-0687-01
-9	354-0350-00		1	RING, RETAINING: EXT E TYPE, U/O 0.094 DIA SFT	79136	5133-9-S-ZD-R
-10	105-1013-00		1	LATCH, STIKE:	80009	105-1013-00
-11	386-5841-00		1	SUBPANEL, FRONT:	80009	386-5841-00
-12	131-0779-00		2	JACK, TIP: U/W 0.08 OD TEST POINT	98291	0168010000208
-13	333-3672-00		1	PANEL, FRONT:	80009	333-3672-00
-14	-----		1	PHOTODIODE: (SEE D101 REPL) (ATTACHING PARTS)		
-15	211-0464-00		2	SCREW, MACHINE: 2M X 5MM L, STL, ZI PL (END ATTACHING PARTS)	80009	211-0464-00
-16	-----		1	CA ASSY, SP, ELEC: (SEE W102 REPL)		
-17	-----		1	CA ASSY, SP, ELEC: (SEE W103 REPL)		
-18	-----		1	CIRCUIT BD ASSY: PREAMP (SEE A1 REPL)		
-19	136-0263-07		13	.SOCKET, PIN TERM: U/W 0.025 SQ PIN	22526	ORDER BY DESCR
-20	136-0252-07		10	.SOCKET, PIN CONN: W/O DIMPLE	22526	75060-012
-21	-----		1	CIRCUIT BD ASSY: TRIG TAKEOFF (SEE A4 REPL)		
-22	175-1042-00		1	.CABLE ASSY, RF: 50 OHM COAX, 3.75 L	80009	175-1042-00
-23	131-0663-00		1	.CONN, RCPT, ELEC: 3MM CKT BD MT	24931	39JR162-1
-24	198-2708-00		1	.WIRE SET, ELEC:	80009	198-2708-00
-25	-----		1	ATTENUATOR, FXD: 50 OHM (SEE AT1 REPL)		
-26	-----		1	MICROCKT, DGT L: GATE (SEE D2 REPL)		
-27	211-0162-00		1	CIRCUIT BD ASSY: SAMPLER (SEE A3 REPL) (ATTACHING PARTS)		
-28	214-1081-00		4	SCREW, MACHINE: 2-56 X 0.188, SCH, SST (END ATTACHING PARTS)	TK0428	ORDER BY DESCR
-29	131-0591-00		4	.PIN, SPRING: 0.187 L X 0.034 OD, SST	00287	031X187MDP
-30	131-0594-00		12	.TERMINAL, PIN: 0.835 L X 0.025 SQ PH BRZ	22526	47332
-31	-----		3	.TERMINAL, PIN: BLACK	22526	47356
-32	131-0631-01		2	.CONN, RCPT, ELEC: (SEE A3J51, J53 REPL)		
-33	131-0632-00		1	.CONN, RCPT, ELEC: SMA JACK TO SPCL END CONFIG	24931	39A100-2
-34	131-4525-00		2	.CONTACT, ELEC: CTR CNDCT, BRASS SIL PL	80009	131-0632-00
-35	136-0252-07		4	CONTACT, ELEC: GND, PHOSPHOR BRONZE,	80009	131-4525-00
-36	136-0263-07		1	CIRCUIT BD ASSY: STROBE (SEE A2 REPL)		
-37	-----		6	.SOCKET, PIN CONN: W/O DIMPLE	22526	75060-012
-38	-----		5	.SOCKET, PIN TERM: U/W 0.025 SQ PIN	22526	ORDER BY DESCR
-39	-----		2	.CONN, RCPT, ELEC: (SEE A2P51, P53 REPL)		
-40	366-1650-00		1	CA ASSY, SP, ELEC: (SEE W101 REPL)		
			1	CIRCUIT BD ASSY: POWER SUPPLY (SEE A5 REPL)		
			1	.PUSH BUTTON: CLEAR, 0.184 X 0.214 X 8.0	80009	366-1650-00
				STANDARD ACCESSORIES		
-41	012-1286-00		1	CABLE, INTCON: 1ML, 2MM JACK TO BANANA, RED	80009	012-1286-00
-42	012-1287-00		1	CABLE, INTCON: 1ML, 2MM JACK TO BANANA,	80009	012-1287-00
	070-7191-00		1	MANUAL, TECH: INSTR, S42	80009	070-7191-00
				OPTIONAL ACCESSORIES		
	012-0124-00		1	CA ASSY, SP, ELEC: 36.0 L U/W S1, S2 AND S3	80009	012-0124-00
	012-0125-00		1	CABLE, INTCON: 72.0 L	80009	012-0125-00
	174-1385-00		1	CA ASSY, FBR OPT: SGL MODE, 2M L, FC/PC DIAMOND 3.5	80009	174-1385-00
	174-1386-00		1	CA ASSY, FBR OPT: SINGLE MODE, 2M L, FC/PC-ST	80009	174-1386-00
	174-1387-00		1	CA ASSY, FBR OPT: SGL MODE, 2M L, FC/PC-FC/PC	80009	174-1387-00
	174-1388-00		1	CA ASSY, FBR OPT: SGL MODE, 2M L, FC/PC-BICONIC	80009	174-1388-00
	174-1497-00		1	CA ASSY, FBR OPT: SINGLE MODE, 2M L	80009	174-1497-00



S-42 Sampling Head

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.

