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User Manual

Tektronix

SD-51
Trigger Head

070–7338–01

Please check for change information at the rear of this manual.

First Printing: May 1993

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Instrument Serial Numbers

Each instrument manufactured by Tektronix has a serial number on a panel insert or tag, or stamped on the chassis. The first letter in the serial number 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:

B010000	Tektronix, Inc., Beaverton, Oregon, USA
E200000	Tektronix United Kingdom, Ltd., London
J300000	Sony/Tektronix, Japan
H700000	Tektronix Holland, NV, Heerenveen, The Netherlands

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

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Introduction

The SD-51 Trigger Head converts high-frequency input signals into stable trigger pulses for use with the 11800 Series Digital Sampling Oscilloscopes and the CSA 803 Series Communication Signal Analyzers. The SD-51 can be installed in the 11800 Series Digital Sampling Oscilloscopes, the SM-11 Multi-Channel Unit, and the CSA 803 Series Communications Signal Analyzers. A block diagram of the SD-51 is presented in Figure 1.

The SD-51 Trigger Head provides the following features:

- Ability to trigger the 11800 Series and CSA 803 Series instruments on high-frequency signals in the 1 GHz to 20 GHz range.
- A stable trigger output in the range of 60 to 110 kHz depending on the input signal frequency.
- A front panel SYNC control to synchronize the internal oscillator with an input signal.
- Less than 6 ps total RMS jitter with input signals from 5 GHz to 20 GHz for the instrument and an SD-24 TDR/Sampling Head.
- Precision 3.5 mm connectors.
- Can be operated on a flexible extender cable to reduce the input cable length.

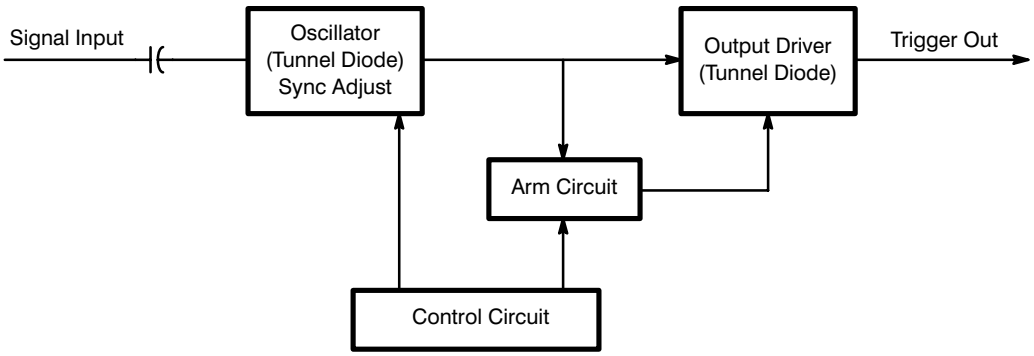


Figure 1: Block Diagram of the SD-51 Trigger Head

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Safety

Terms in Manuals

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

Terms on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

Symbols in Manuals



Static Sensitive Devices

Symbols on Equipment



DANGER
High Voltage



Protective
ground (earth)
terminal



ATTENTION
Refer to
manual

Grounding the Instrument

The sampling head is grounded through the instrument. To avoid electric shock, make sure that the instrument is plugged into a properly wired receptacle where earth ground has been verified by a qualified service person. Without the protective ground, all parts of the instrument and the sampling head are shock hazards. This includes knobs and controls that may appear to be insulators.

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Do Not Operate in Explosive Atmospheres

The sampling head provides no explosion protection from static discharges or arcing components. Do not operate the instrument in an atmosphere of explosive gases.

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Electrostatic Discharge

Circuitry in the trigger head is susceptible to damage from electrostatic discharge and from overdrive signals. Operate the instrument only in a static-controlled environment. Be sure to discharge to ground any electrostatic charge that may be present on a cable before attaching the cable to the head.



To prevent damage to the sampling head, install short-circuit terminators on the trigger head connectors when you remove a sampling head from the instrument. Be sure to store the head in a static-free container, such as the shipping container. When you move the trigger head from one instrument to another, use a static-free container to carry the head.

Always use a wrist strap (provided with your instrument) when handling trigger and sampling heads or making connections.

Be sure to follow the other precautions described in the manuals accompanying your instrument to guard against electrostatic damage to the trigger and sampling heads or instrument.

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Connector Care

The front of the trigger head has two precision 3.5 mm connectors, one for the input signal and one for the trigger output. These are high-precision connectors with a closer mechanical tolerance than standard SMA cables. Never attach a cable to a trigger head connector if the cable has a worn or damaged connector because the trigger head connector can be damaged.

Use extra care when attaching or removing a cable from the connectors. Turn only the nut, not the cable. When attaching a cable to a sampling head connector, align the connectors carefully before turning the nut. Use light finger pressure to make this initial connection. Then tighten the nut lightly with a wrench.

For best repeatability and to prolong the life of both connectors, use a torque wrench and tighten the connection to the range of 7–10 lb-in (79–112 N-cm).

If the trigger head connectors will receive heavy use, such as in a production environment, you should use an adapter (such as a connector saver) installed on the trigger head connector to make connection to the device under test.

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Installing the Trigger Head

The SD-51 Trigger Head fits into the front panel of a compatible instrument, such as the 11800 Series Digital Sampling Oscilloscopes or CSA 803 Series Communications Analyzers. Figure 2 shows the front panel of the 11801B Digital Sampling Oscilloscope, the CSA 803A Communications Signal Analyzer, and the locations of the sampling head compartments. The SD-51 can be installed on a flexible extender cable (Tektronix part 012−1220−00) to reduce the length of the signal input cable.

CAUTION

To prevent damage to the trigger head or instrument, never install or remove a trigger or sampling head when the mainframe power is on.

At least one sampling head must be installed with the SD-51 in order for the instrument to sample high-frequency signals.

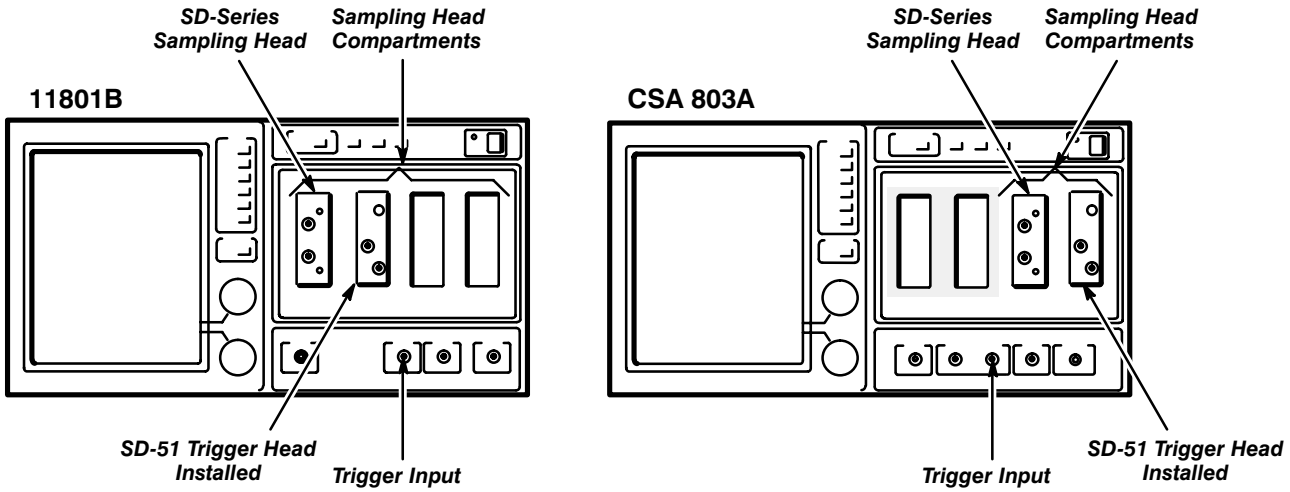


Figure 2: Trigger Head Installed in an 11801B and a CSA 803A

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To install the trigger head, first power-off the instrument. Then place the trigger head in a compartment and slowly push it in with firm pressure. Once the head is seated, turn the lock-down screw clockwise on the trigger head to tighten the head into place. See Figure 3.

CAUTION

To prevent damage to the trigger head or instrument, never install or remove a trigger head when the mainframe power is on.

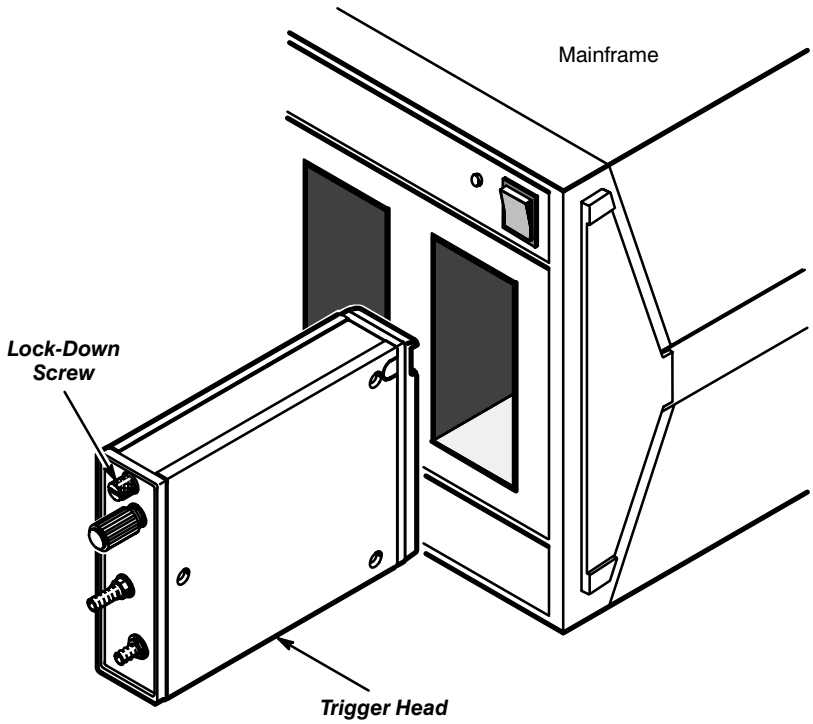


Figure 3: Installing a Trigger Head in an Instrument

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Using the Trigger Head

Figure 4 shows the front panel of the SD-51 Trigger Head and identifies the knob and connectors.

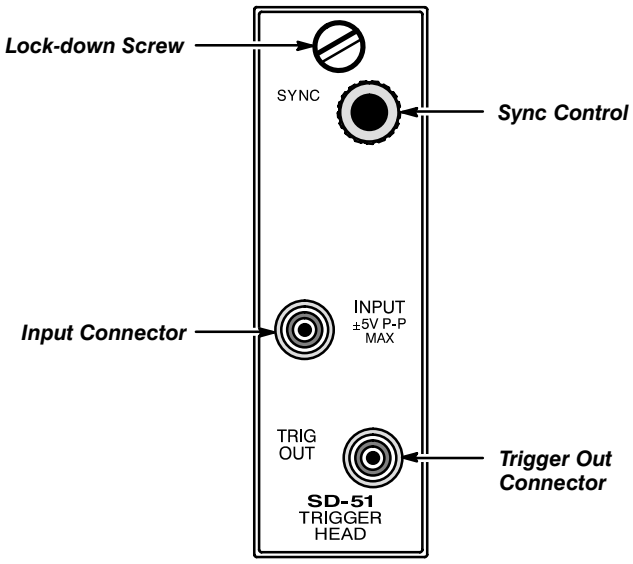


Figure 4: SD-51 Trigger Head Front Panel

The SD-51 Trigger Head is controlled entirely from the front panel; it is not remotely programmable. The front panel controls are:

- The SYNC knob at the top synchronizes the trigger output with the input signal.
- The INPUT connector receives the signal that you want converted into a useful trigger signal.
- The TRIG OUT supplies the trigger signal output that will be connected to the Trigger Input of the 11800 Series Oscilloscope or CSA 803 Series Communications Signal Analyzer.

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Signal Connectors

The INPUT and TRIG OUT signal connectors are precision 3.5 mm connectors that are mechanically compatible with the SMA standard. Follow precautions stated under Connector Care when connecting any cables or adapters.

Connecting an Input Signal

Connect a 1 GHz to 20 GHz signal that you wish to trigger on to the INPUT connector. The setup diagram on page 15 shows you how to use a power divider to split a high-frequency signal so that you can trigger on and display the signal.

The input impedance is 50 Ω open termination in parallel with approximately 1 pF capacitance. Amplitude of the input signal is limited to $\pm 5\ V_{p\text{-}p}$ with a minimum sensitivity of 100 $mV_{p\text{-}p}$.



Applying a voltage outside the range $\pm 5\ V_{p\text{-}p}$ can result in damage to the input circuit. Use a wrist strap to prevent electrostatic damage to the trigger or sampling head and instrument.

The input tunnel diodes used in the trigger head are susceptible to damage from overdrive signals and electrostatic discharge. Never apply a voltage outside the range of $\pm 5\ V_{p\text{-}p}$. Operate the SD-51 only in a static-controlled environment.

The input tunnel diodes produce a kickback burst on the input signal that is typically 180 $mV_{p\text{-}p}$ or less. If this low level pulse burst appears to affect your signal sources, connect a 5× attenuator between the signal source and the SD-51 INPUT connector. This will greatly reduce the kickback burst effect.

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Connecting to Trigger Out

The TRIG OUT connector provides a trigger pulse that can be synchronized with the input signal. The output pulse is typically 200 mV into a 50 Ω load with a time between pulses of 9 µs to 15 µs, depending on the input signal frequency. The trigger pulse is preceded by a low amplitude 200 MHz burst that reflects the internal oscillator frequency.

Freerunning Mode

The SD-51 Trigger Head will produce a stable output trigger signal even when no input signal is present. This unsynchronized operation is called freerunning. The output signal will freerun whenever the input signal amplitude falls below 100 mV_{p-p}. If freerunning occurs because of a low amplitude input signal, your instrument will indicate proper triggering but the displayed trace will be unstable. When freerunning, the trigger pulses occur approximately every 12 µs.

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SYNC Adjustment

To make the SYNC adjustment, perform the following steps:

☐ **Step 1:** Connect a 1 to 20 GHz signal to the SD-51 INPUT connector.

☐ **Step 2:** Connect the TRIG OUT signal from the SD-51 Trigger Head to the Trigger Input of the instrument mainframe.

☐ **Step 3:** Set the instrument trigger parameters as follows:

Trigger	Setting
Source	External
Level	100 mV
Mode	Normal
External Attenuate	×1
Slope	+
External Coupling	DC

☐ **Step 4:** To synchronize the trigger output signal with the input signal, rotate the SYNC knob left or right to achieve the most stable trace display. (The SYNC knob has ten full rotations of travel.) You may want to readjust the instrument trigger settings.

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Setup Example

For this example, you will need an 11800 Series or CSA 803 Series instrument with at least one sampling head and an SD-51 Trigger Head installed. Also, you will need:

- four SMA cables; three female-female and one male-male (TRIG OUT to instrument Trigger Input connection)
- one SMA power divider (Tektronix part 015−1014−00)
- one 5× attenuator (Tektronix part 015−1002−00)
- a signal generator, such as the Tektronix SG 504, capable of producing a signal in the 1 GHz to 20 GHz range with 1 V to 50 V amplitude. The power divider and 5× attenuator reduce the signal level at the SD-51 input by ten.

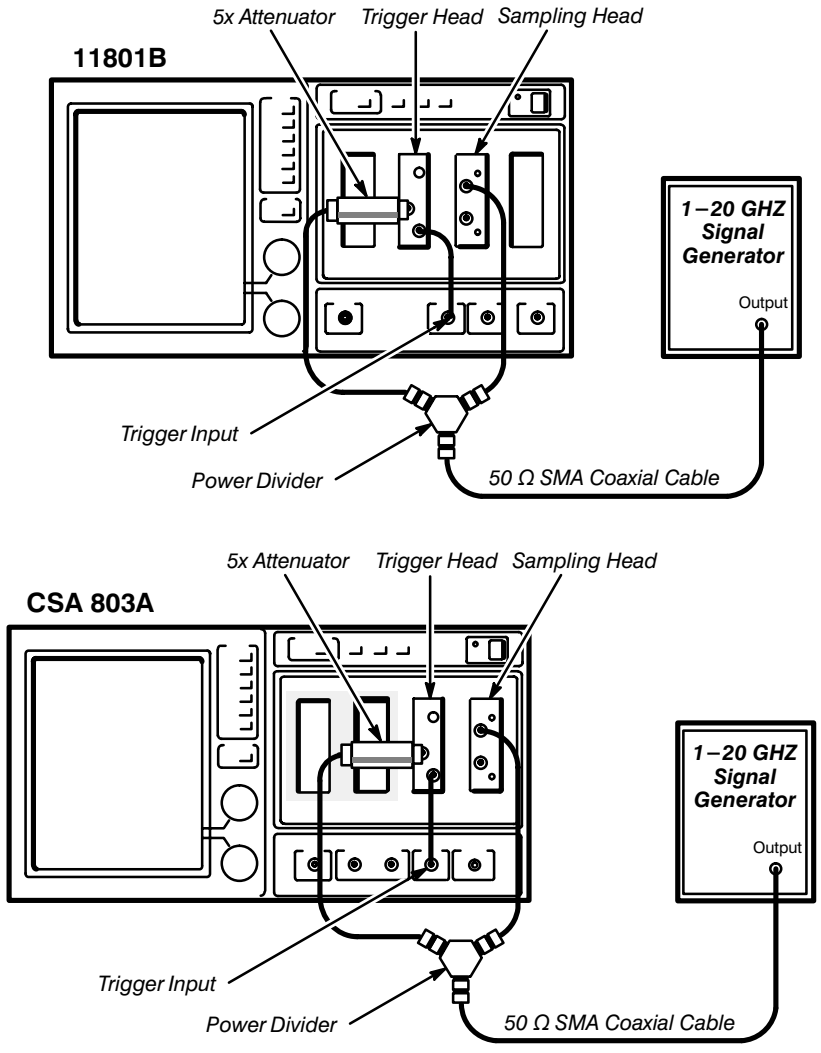


Figure 5: Connections for Example

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CAUTION

To prevent damage to the trigger or sampling head and instrument, never install or remove a trigger or sampling head when the mainframe power is on.

Connect your equipment as shown in Figure 5, then proceed.

☐ **Step 1:** Initialize the instrument (press the UTILITY button and touch **Initialize**).

☐ **Step 2:** Set the signal generator to the desired frequency.

☐ **Step 3:** Press the TRIGGER button on the instrument and set the following trigger parameters:

Trigger	Setting
Source	External
Level	100 mV
Mode	Normal
External Attenuate	×1
Slope	+
External Coupling	DC

☐ **Step 4:** Press the SELECT CHANNEL button for the sampling head input channel that is connected to the power divider.

You will see a trace on the display but it may not be properly triggered.

☐ **Step 5:** Synchronize the trigger output signal with the input signal by rotating the SYNC knob left or right to achieve the most stable display.

☐ **Step 6:** You may want to readjust the instrument trigger level with **Fine** selected for the most stable display.

☐ **Step 7:** Adjust the display sizes and positions to show a useful trace.

For information on displaying and adjusting traces, refer to the *User Manual* for your instrument and the sampling head.

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Specifications

Table 1: Input/Output Electrical Specifications

Characteristics	Specifications
Signal Input	
Bandwidth	1 to 20 GHz typical
Minimum Sensitivity	100 mV_{p-p} into 50 Ω
Maximum (Non-destructive) Signal Voltage	5.0 V_{p-p}
Termination Impedance	50 Ω open termination paralleled by 1 pF, typical
Kickout Pulse Amplitude	180 mV peak, typical
Trigger Output	
Amplitude	200 mV into 50 Ω, typical
RMS Jitter with Valid Input	
5 GHz to 20 GHz	6 ps including instrument mainframe and SD-24 jitter
1 GHz to 5 GHz	7 ps including instrument mainframe and SD-24 jitter

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Glossary

Channel
A place to connect a signal or attach a network or transmission line to sampling heads. Also, the smallest component of a trace expression.

Channel Number
The number assigned to a specific signal input connector. The top channel of the left-most sampling head compartment of the instrument mainframe is always mainframe channel 1, regardless of any repositioning or omission of sampling heads.

Initialize
Setting the instrument mainframe to a completely known, default condition.

Internal Clock
A trigger source that is synchronized with the Calibrator signal.

Setting
The state of the front panel and system at a given time.

Trigger
An electrical event that initiates acquisition of a trace as specified by the time base.

Waveform
The visible representation of an input signal or combination of signals. Identical to trace.

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