I²C and SPI Protocol Triggering and Decode for Infiniium 8000 and 90000 Series Oscilloscopes

Data sheet

This application is available in the following license variations.

- Order N5391A for a user-installed license
- Order Option 007 for a factory-installed license with new 8000 or 90000 Series oscilloscopes
- Order N5435A Option 006 for a server-based license that works on the 8000, 9000 or 90000 Series oscilloscopes

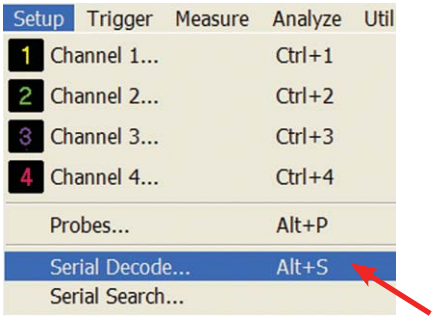
Agilent Technologies

Easily debug and test designs that include I²C or SPI protocols using your Infiniium 90000 or 8000 Series scope

Lower-speed serial bus interfaces such as I²C (inter-integrated circuit) and SPI (serial peripheral interface) are widely used today in electronic designs for chip-to-chip communication. In many designs these serial buses tend to provide content-rich points for debug and test. However, since these protocols transfer bits serially, using a traditional oscilloscope has limitations. Manually converting captured 1's and 0's to protocol requires significant effort, can't be done in real-time, and includes potential for human error. In addition, traditional scope triggers are not sufficient for specifying protocol-level conditions.

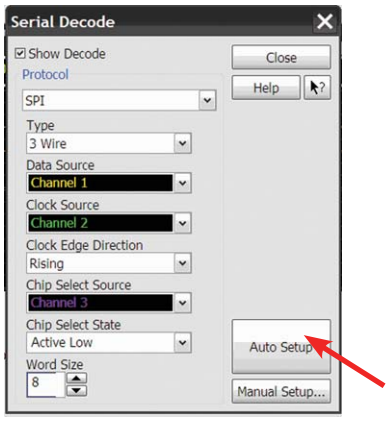
Extend your scope capability with I²C and SPI Triggering and Decode application. This application makes it easy to debug and test designs that include I²C or SPI protocols using your Infiniium 90000 or 8000 Series scope.

- Set up your scope to show I²C or SPI protocol decode in less than 30 seconds.
- Get access to a rich set of integrated protocol-level triggers.
- Save time and eliminate errors by viewing packets at the protocol level.
- Use time-correlated views to quickly troubleshoot serial protocol problems back to their timing or signal integrity root cause.



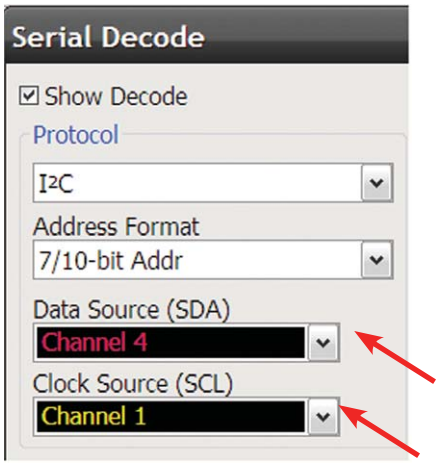
Easy to find

Turn decode on/off in the "Setup" menu. View decode embedded on the waveform display or in the protocol viewer listing window. (See pages 4-5).



30 Second SPI or I²C Setup

Configure your oscilloscope to display protocol decode in under 30 seconds. Use "Auto Setup" to automatically configure sample rate, memory depth and threshold and trigger levels.



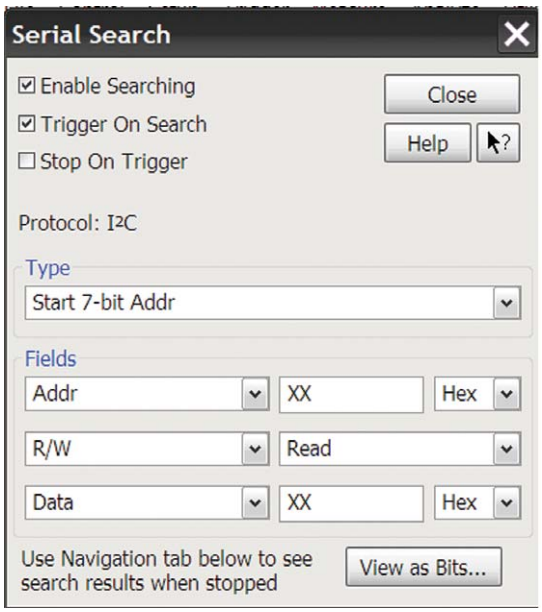
Support for analog channels

Acquire serial buses using any combination of scope channels

I²C and SPI protocol triggering and searching for 90000 Series

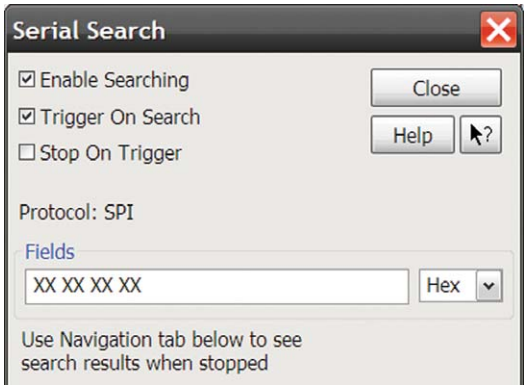
Get access to a rich set of integrated protocol level triggers. The application includes a suite of configurable protocol-level trigger conditions specific to I²C and SPI. The application uses software-based search triggering when serial triggering is selected.

With software-based protocol triggering, the oscilloscope takes signals acquired using either scope or digital channels and reconstructs protocol frames after each acquisition. It then inspects these protocol frames against specified protocol-level trigger conditions and triggers when the condition is met.



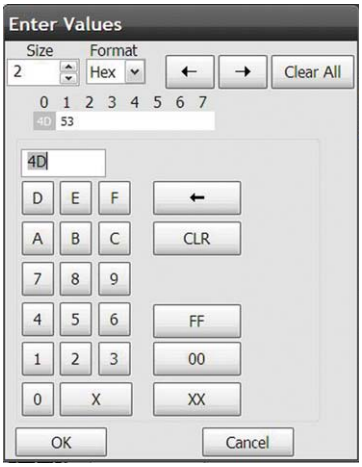
I²C Trigger Setup

Choose a combination of address, read/write, address acknowledge and data values for I²C triggers.



SPI Trigger Setup

Quickly access protocol triggering via the scope's trigger menu. Specify SPI trigger in HEX, binary, or decimal up to 200 bits.



Payload editor

Use the payload editor to specify data values word by word. Operators give additional triggering flexibility.

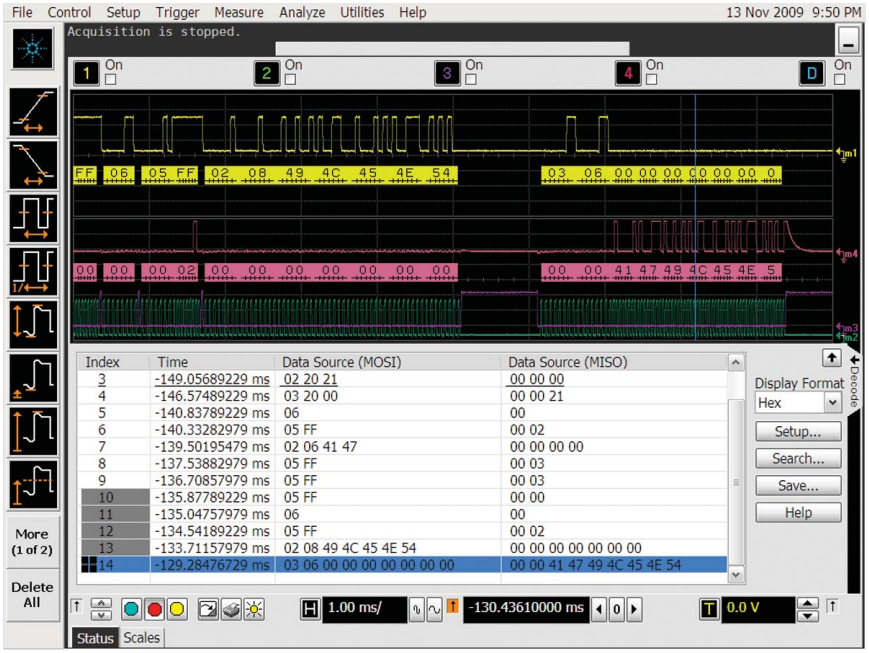
Post-acquisition searching

Search acquired protocol listing using a menu that is identical to the trigger menu.

Quickly find occurrences

Quickly move to next occurrence of a specified event. Jump to the next or previous occurrence of the specified event.

SPI protocol decode for 90000 Series



90000 Series SPI protocol decode with precise time-correlation between waveforms and listing

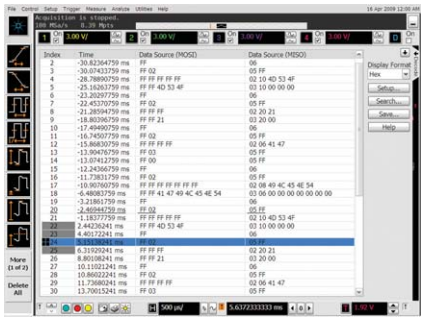
Agilent's SPI protocol viewer includes correlation between the waveforms and the selected packet. The selected packet, highlighted blue row in the listing, is time-correlated with the blue line in the waveform display. Move the blue tracking marker in time through waveforms and the blue bar will automatically track in the packets window. Or, scroll through the packet viewer and highlight a specific packet. The time-correlation tracking marker will move to the associated point in the waveform.

Support for 2, 3, and 4-Wire SPI

The application supports 2-, 3-, and 4-wire SPI. Use digital channels on MSO8000 models to preserve analog channels for simultaneously viewing other signals.

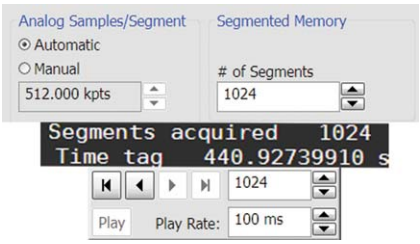
90000 Series SPI decode in waveform area

Utilize the oscilloscope waveform area to display decode information. For SPI, minor ticks indicate clock transitions and major ticks show the beginning and end of each word in the serial packet.



90000 Series full screen SPI listing

Fill the entire display with compact protocol information using the full screen listing. The protocol viewer window shows the index number, time stamp value, and data content for each serial packet in the list. Scroll though all decoded serial packets to find events of interest or errors in the transmission. Data in the listing window can be saved to a .csv or .txt file for off-line analysis or documentation.



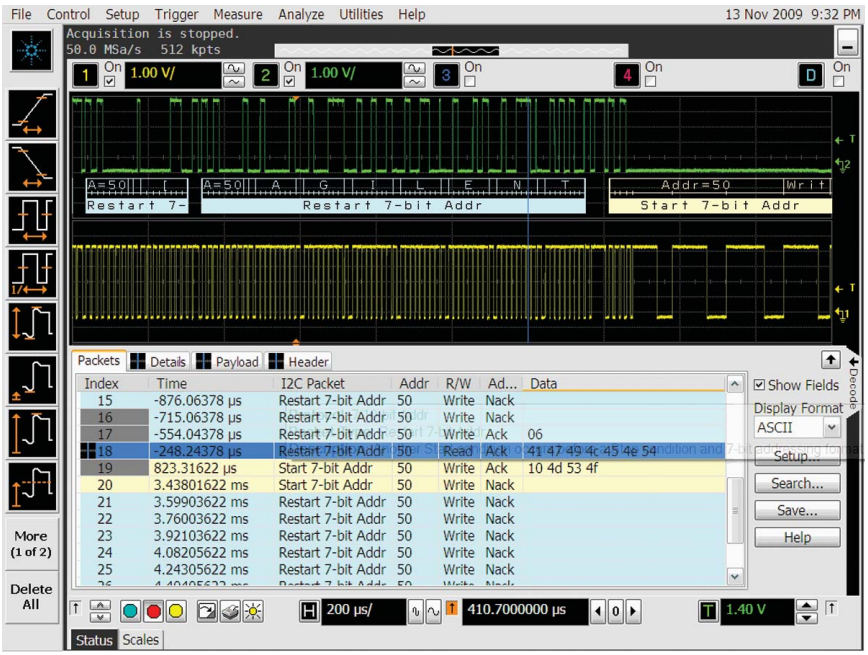
Long Time Captures using Segmented Memory on 90000 Series

Capture seconds to days of serial protocol.

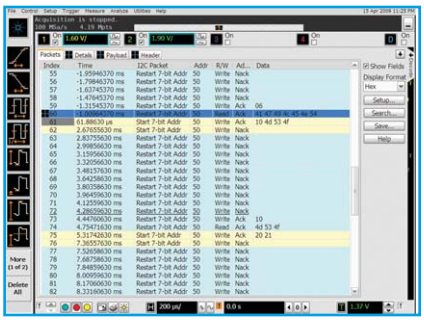
The scope fills memory as each acquisition sees its trigger condition.

Segmented memory uses time tags to track time between segment acquisitions.

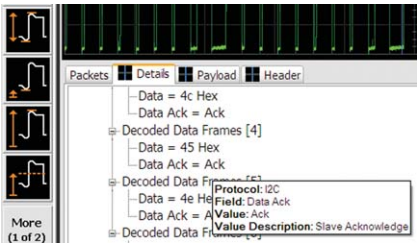
I²C protocol decode on 90000 Series



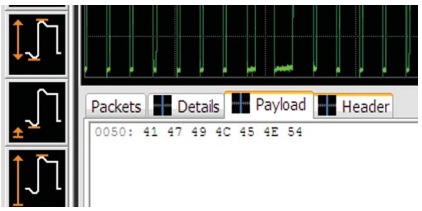
Quickly move between physical and I²C protocol layer information using the time-correlated tracing marker. Display protocol content using embedded decode in the waveform area, Or, see protocol events in a compact listing format using the industry's first scope based multi-tab protocol viewer. For I²C minor tick marks indicate clock transitions. Major tick marks indicate sections of the serial packet such as address, acknowledge, and data.



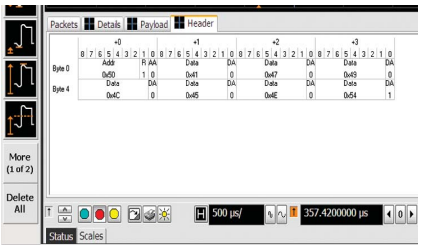
Fill the entire display with compact protocol information. The protocol viewer shows index number, time stamp, and data content for each serial packet. Listing content can be saved to a .csv or .txt file for off-line analysis or documentation. Use search capability to quick navigate through an acquisition.



Details tab breaks the packets into easy-to-read textual fields. Hovering shows additional detail.

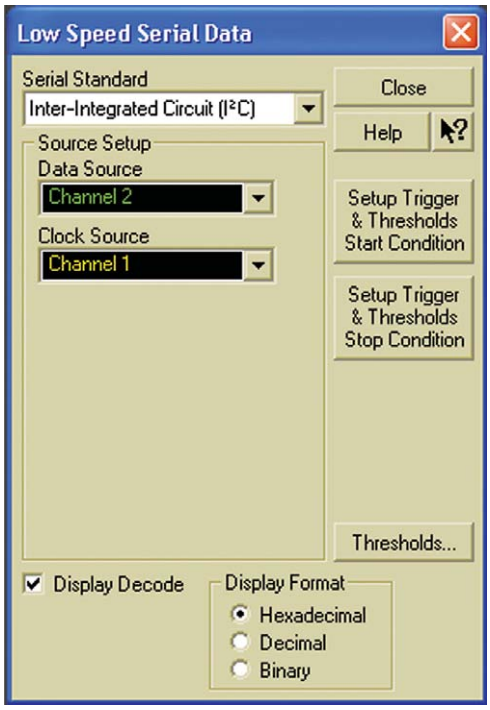


Payload tab shows data carried by the packet in byte-by-byte HEX and ASCI.

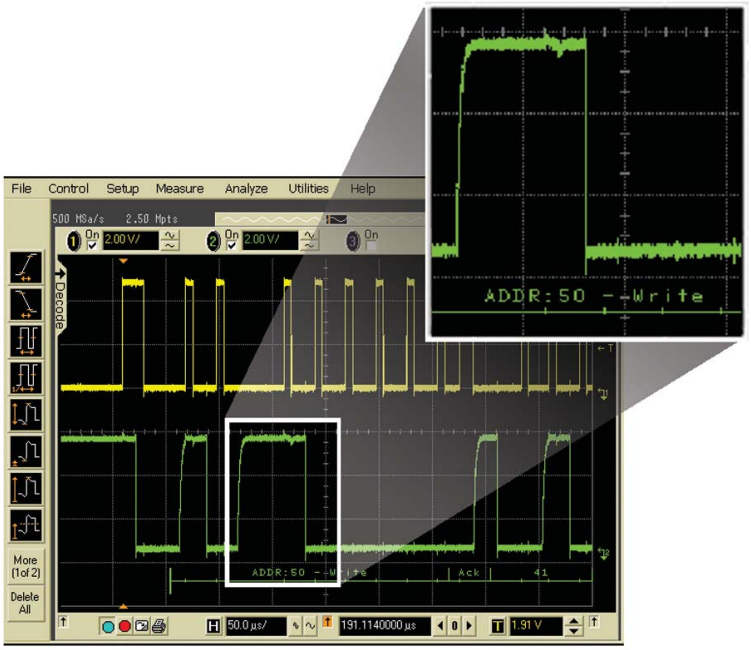


Header tab shows packets in a data book format. Hovering at any field reveals additional detail.

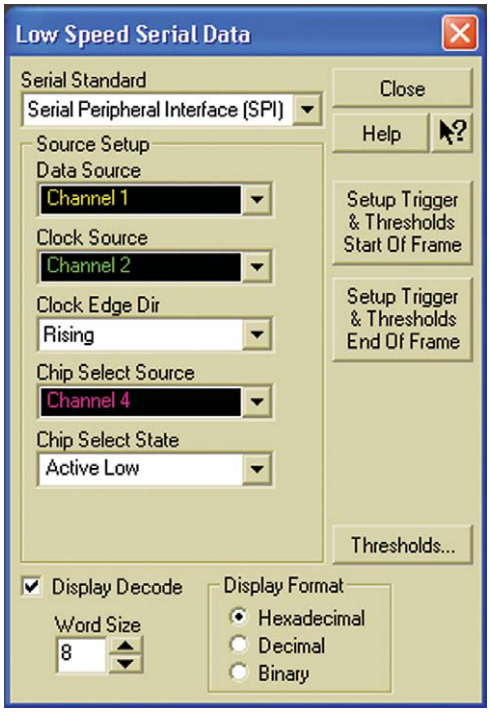
I²C and SPI setup and decode on 8000 Series



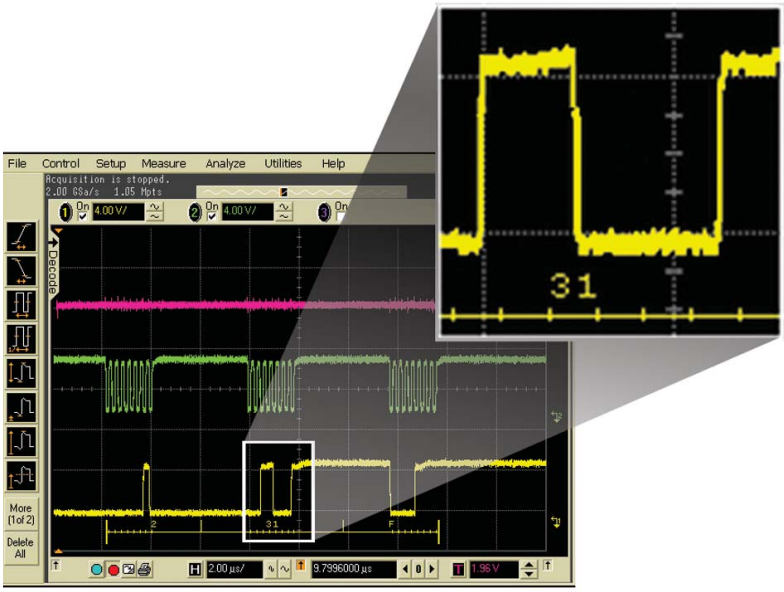
Setup dialog box for I²C



On-screen serial decode of an I2C packet on an Infiniium 8000 Series



Setup dialog box for SPI



On-screen serial decode of a SPI packet with 8000 Series Oscilloscope

I²C specifications and characteristics

I²C source (clock and data)	Analog channels 1, 2, 3, or 4 MSO models can additionally use digital channels D0 to D15 on 8000 series. Any waveform memory
Max clock/data rate	up to 3.4 Mbps (automatic)
Auto Setup on 90000 Series	Automatically configures scope settings for proper I²C decode and protocol triggering
Triggering (SW-based) 90000 Series	Start and re-start 7-bit address Start and re-start 8-bit address Start and re-start 10-bit address Start and re-start 11-bit address Specify value for 3 fields choosing between the following Read or write Address (value in HEX or binary) Address acknowledge Data (up to 20 bytes (specify in HEX, binary, ASCII, or decimal) Operators include: = on 8-bit word boundaries.
8000 Series	Start of frame, error, data frame (specify read/write)

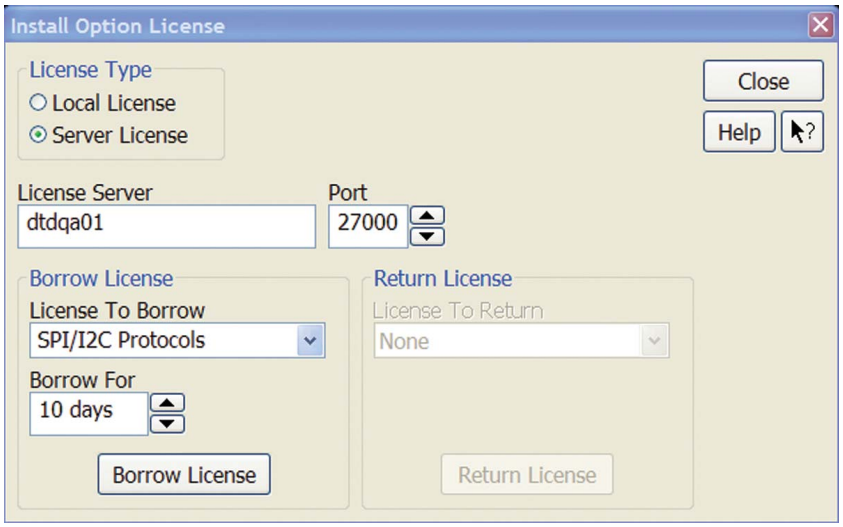
SPI specifications and characteristics

SPI protocols supported	2-wire SPI signals: data source and clock source 3-wire SPI signals: data source, clock source, and chip select source 4-wire SPI signals: data source (MOSI), clock source, chip select source, data source (MISO)
SPI source (all signals)	Analog channels 1, 2, 3, or 4 MSO models can additionally use digital channels D0 to D15 on 8000 Series
Max clock/data rate	Up to 50 Mbps (automatic)
Autoset on 90000 Series	Automatically configures scope settings for proper SPI decode and protocol triggering
Decode word size on 90000 Series	User-selectable from 4 to 32 bits
Decode bit order on 90000 Series	User-selectable LSB or MSB
Triggering (SW-based) 90000 Series	Data length up to 200 bits Number of words * word size < 200 bits Number of words selectable up to 50 Word size selectable from 4 to 32 bits Data operators include: =, OR
8000 Series	Data byte 0 and 1

Ordering information

This application is compatible with all 9000 Series oscilloscope models.

Software applications	Factory-installed node-locked license for new scope purchases	User-installed node-locked license	Server-based license (N5435A option)
I²C/SPI triggering and decode	007	N5391B	006



Sharing the application across multiple instruments? Server-based licensing allows users to borrow an application license for a specified period of time.

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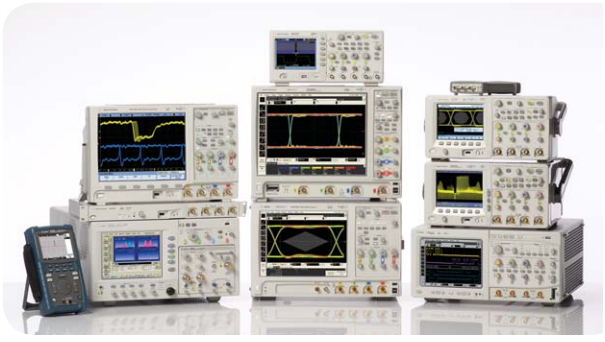

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