CAN, LIN and FlexRay Protocol Triggering and Decode for Infiniium 9000 Series Oscilloscopes

Data sheet

This application is available in the following license variations.

- Order N8803B for a user-installed license
- Order option 008 for a factory-installed license with new 9000 Series oscilloscopes
- Order N5435A option 033 for a server-based license that works on both 9000 and 90000 Series oscilloscopes

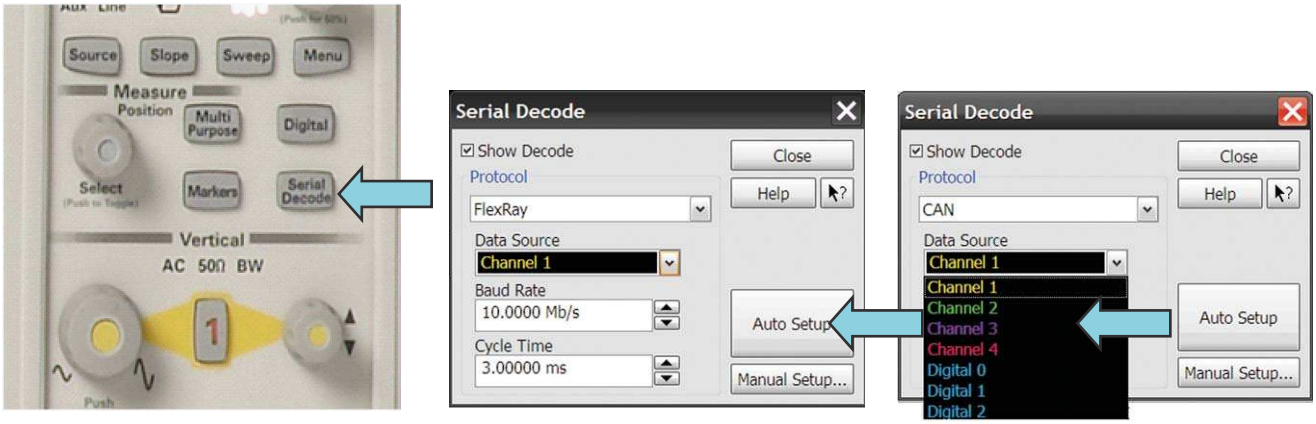
Agilent Technologies

CAN, LIN and FlexRay serial buses

CAN, LIN and FlexRay serial buses are the backbone for communication among many separate controllers, sensors, actuators, and ECUs located throughout automotive and industrial designs. These serial bus interfaces 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. As well, traditional scope triggers are not sufficient for specifying protocol-level conditions.

Extend your scope capability with Agilent's CAN, LIN and FlexRay triggering and decode application. This application makes it easy to debug and test designs that include these buses using your Infiniium 9000 Series oscilloscope.

- Set up your scope to show CAN, LIN or FlexRay 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 via the "Serial Decode" button on the front of 9000 Series scopes or in the "Setup" menu. View decode embedded on the waveform display or in the protocol viewer listing window. (See pages 4-5.)

30 second CAN, LIN or FlexRay Setup

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

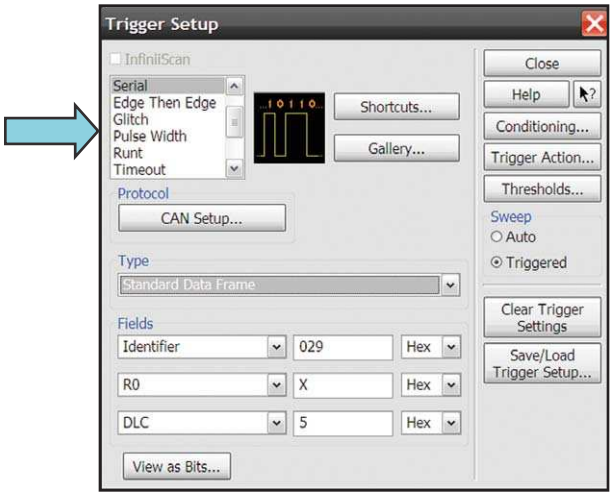
Support for both analog and digital channels

Acquire serial buses using any combination of scope or digital channels. Using digital channels on 9000 Series MSO models preserves analog channels for viewing other time-correlated signals.

CAN, LIN and FlexRay setup and protocol triggering

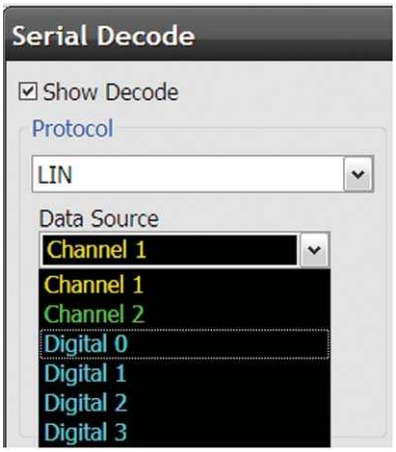
Get access to a rich set of integrated protocol-level triggers. The application includes a suite of configurable protocol-level trigger conditions specific to CAN, LIN and FlexRay. When serial triggering is selected, the application uses software-based triggering.

Hardware-base triggering for CAN, and LIN ensures reliable triggering even on the most infrequent event. The application used SW-base triggering for FlexRay. 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.



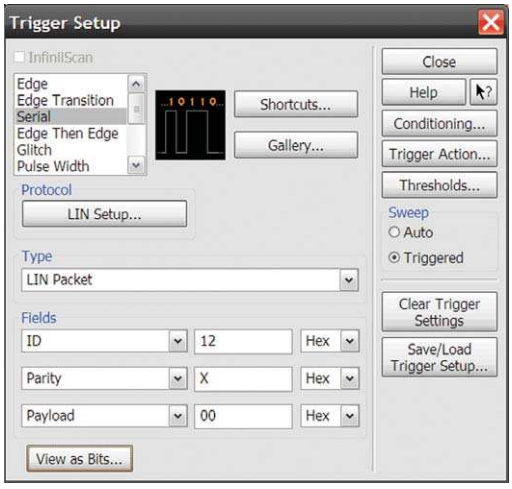
CAN trigger

Quickly set up trigger for a unique frame or error condition.



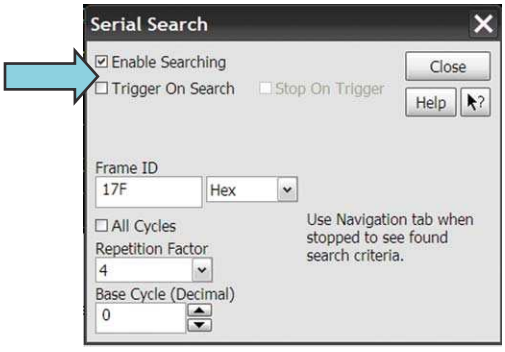
Specify the signal type.

LIN can be acquired with single-ended probes from DSOs or MSOs.



LIN Trigger

For triggering on LIN packets, choose a combination of ID, parity, and payload values.



FlexRay trigger

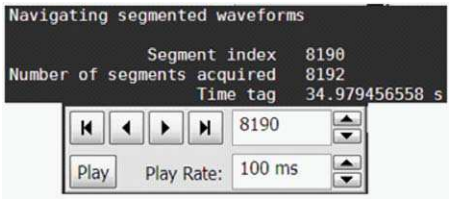
Quickly specify frame ID and repetition factor (optional) for software-based triggering and searching

CAN and LIN protocol decode

Quickly move between physical and CAN 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. For CAN minor tick marks indicate clock transitions. Major tick marks indicate segments of the serial packet such as ID, DLC, CRC, CAN measurements are automatically time-correlated with measurement on other scope channels.

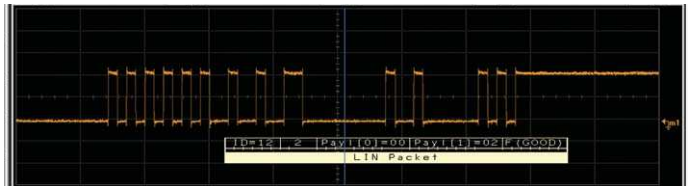
Compact protocol using the full screen listing.

The protocol viewer window shows the index number, time stamp value identifier, packet type, and data values for each CAN packet. Data in the listing window can be saved to a .csv or .txt file for off-line



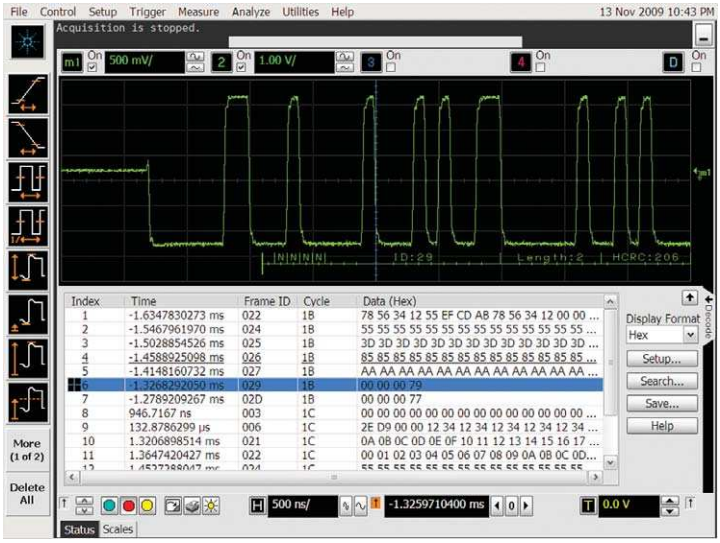
Long time captures using segmented memory

In this example, CAN traffic was captured for near 35 seconds. Segmented memory uses time tags to track time between segment acquisitions.

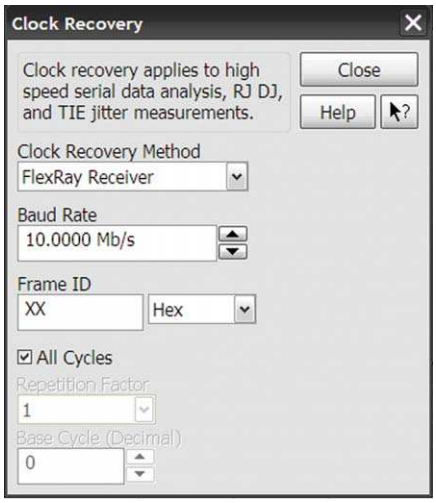


LIN decode embedded in waveform area Utilize the oscilloscope waveform area to display decode information. Minor ticks indicate clock transitions and major ticks show segments within each LIN packet

FlexRay protocol decode



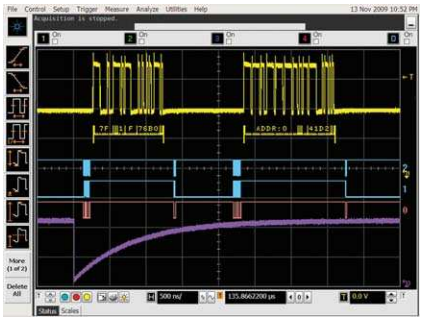
Quickly move between FlexRay physical and protocol layer information using the time-correlated tracing marker. Display protocol content using embedded decode in the waveform area. Or, see protocol events in a compact listing format. Minor tick marks indicate clock transitions. Major tick marks indicate segments of the serial packets.



Solution includes FlexRay receiver clock recovery necessary for protocol decode and triggering.

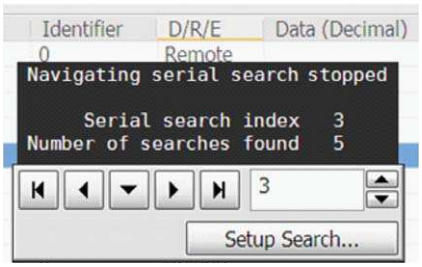
FlexRay Packet Decode

See FlexRay decode in waveform area display, or use the protocol viewer to see in a listing format



Time correlation with other system activity

Protocol measurements are automatically time-correlated with measurements taken on other analog or digital (on MSO models) channels.



Post-acquisition searching

Search acquired protocol listings using a menu that is identical to the trigger menu. Quickly move to next occurrence of a specified event.

CAN, LIN and FlexRay application specifications and characteristics

CAN	
CAN sources	Analog channels 1, 2, 3, or 4 MSO models can additionally use digital channels D0 to D15 Any waveform memories The application relies on probing and trigger/measurement thresholds to properly condition the signal for triggering and decode. Differential probing may be required. MSO channels are single ended and require a minimum 500mV swing around the threshold to differentiate between 1's and 0's
Data rate	100 bp/s up to 1 Mb/s
Signal type	Differential, CAN_L, or CAN_H
Auto setup	Automatically configures scope settings for proper CAN decode and SW-based protocol triggering including memory depth, edge triggering, holdoff, sample rate, and measurement thresholds
Decoded fields	All including extended frame format
Triggering (hardware-based)	Start of frame Data frame (frame containing node data for transmission) user specified value for data byte 0 in hex, binary, or decimal Immediately followed by data byte specified in hex, binary, or decimal Remote frame (frame requesting the transmission of a specific identifier) User specified identifier in hex, binary, or decimal Data or remote frame Error frame (frame transmitted by any node detecting an error)

LIN	
LIN sources	Analog channels 1, 2, 3, or 4 MSO models can additionally use digital channels D0 to D15 Any waveform memories The application relies on probing and trigger/measurement thresholds to properly condition the signal for triggering and decode. Differential probing may be required. MSO channels are single ended and require a minimum 500mV swing around the threshold to differentiate between 1's and 0's
Data rate	2400 bp/s to 626 kb/s
Auto setup	Automatically configures scope settings for proper FlexRay decode and SW-based protocol triggering including memory depth, edge triggering, holdoff, sample rate, and measurement thresholds, and clock recovery.
Decoded fields	All
Triggering (hardware-based)	LIN packets, including user-specified values for ID, parity, and payload wakeup, or errors including: parity, check, sync, frame length, header length or wakeup

FlexRay	
FlexRay sources	Analog channels 1, 2, 3, or 4 MSO models can additionally use digital channels D0 to D15 Any waveform memories The application relies on probing and trigger/measurement thresholds to properly condition the signal for triggering and decode. Differential probing may be required. MSO channels are single ended and require a minimum 500mV swing around the threshold to differentiate between 1's and 0's
Data rate	Up to 20 Mb/s
Cycle time	100 ns up to 100 ms
Auto setup	Automatically configures scope settings for proper FlexRay decode and SW-based protocol triggering including memory depth, edge triggering, holdoff, sample rate, and measurement thresholds, and clock recovery.
Decoded fields	All
Triggering (software-based)	Cycle TSS Any TSS User specified frame ID in hex, decimal, or binary, All cycles Repetition factor of 1, 2, 4, 8, 16, 32, or 64 Base cycle (decimal)

Ordering Information

This application is compatible with all 9000 Series oscilloscope models.

Software applications	Factory-installed option for new scope purchases	User-installed stand-alone product number	Server-based license (N5435A option)
CAN, LIN, and FlexRay triggering and decode	008	N8803B	033

Using multiple scopes?

Server-based licensing allows users to borrow an application for a specified period of time.

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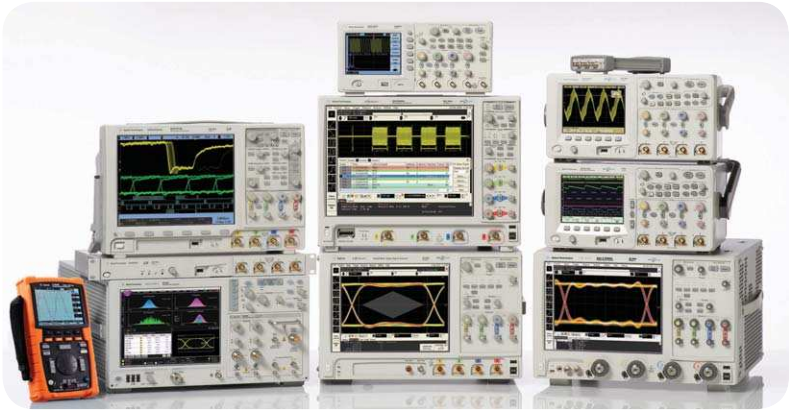

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October 1, 2009

Printed in USA, July 3, 2010
5990-5077EN

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