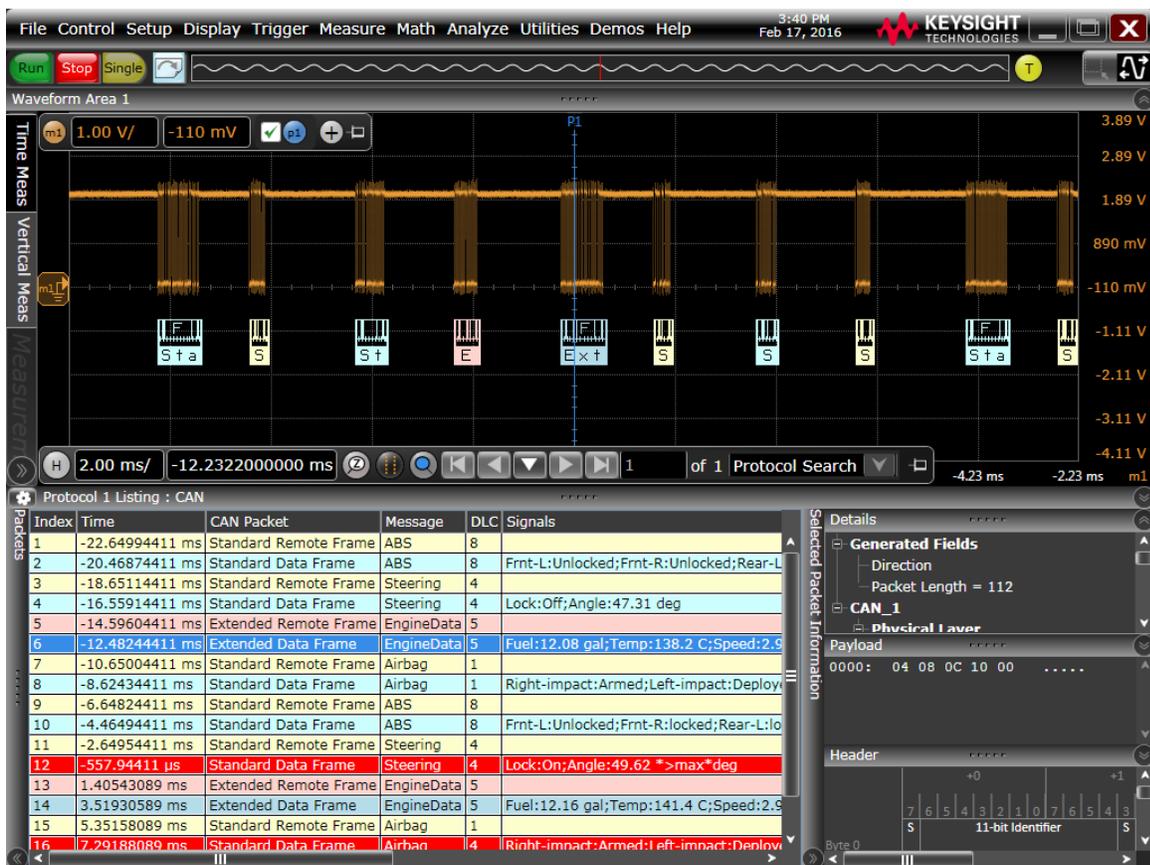


# Keysight N8803C

## CAN, LIN, FlexRay, and CAN-FD Protocol Triggering and Decode Software

Data Sheet



Unlocking Measurement Insights

This application is available in the following license variations:

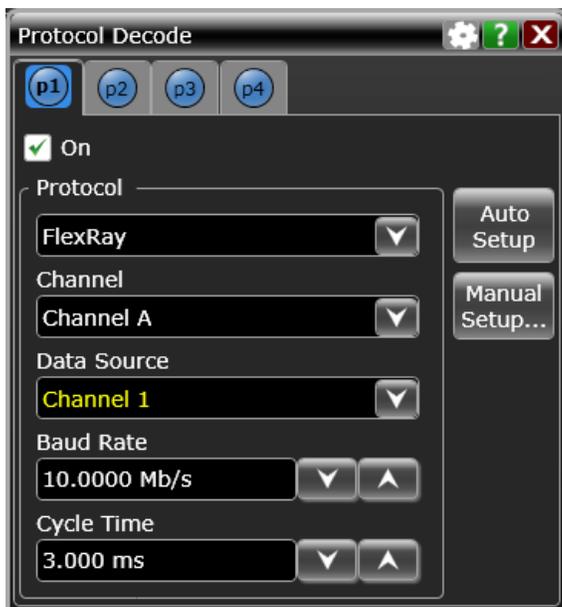
- Order N8803C-1FP for a user-installed license
- Order N8803C-2FP for upgrade from N8803A/B version
- Order N8803C-1TP for transportable license for new user
- Order N8803C-2TP for upgrade from N8803A/B transportable license to transportable N8803C license
- Order N5435A Option 103 for a server-based license

## CAN, LIN, FlexRay, and CAN-FD Serial Buses

Keysight Technologies, Inc. oscilloscope automotive options help electronic system designers test and debug the physical layer of automotive serial buses faster. CAN, LIN, FlexRay, and CAN-FD 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 1s and 0s to protocol requires significant effort, cannot be done in real-time, and includes potential for human error. Also, traditional oscilloscope triggers are not sufficient for specifying protocol-level conditions.

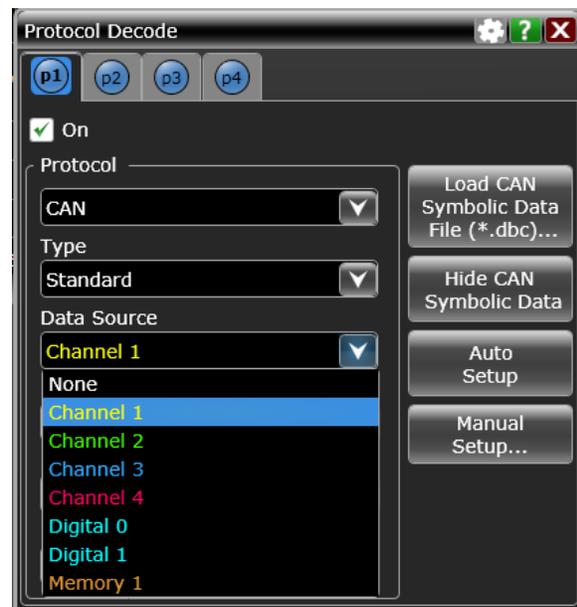
Extend your oscilloscope capability with Keysight's N8803C CAN, LIN, FlexRay, and CAN-FD protocol triggering and decode application. This software makes it easy to debug and test designs that include these buses using your Infiniium oscilloscope.

- Set up your oscilloscope to show CAN(FD), LIN, or FlexRay protocol decode in less than 30 seconds
- Get access to a rich set of integrated protocol-level software 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
- With the CAN-dbc symbolic trigger and decode capability, engineers can now test the physical layer of this differential bus at a higher abstraction level



### 30 second CAN(FD), 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, trigger levels, and clock recovery for FlexRay.

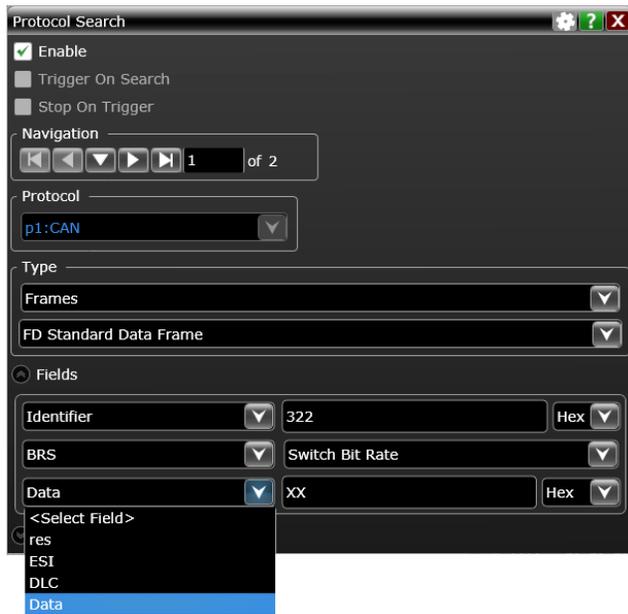


### Support for both analog and digital channels

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

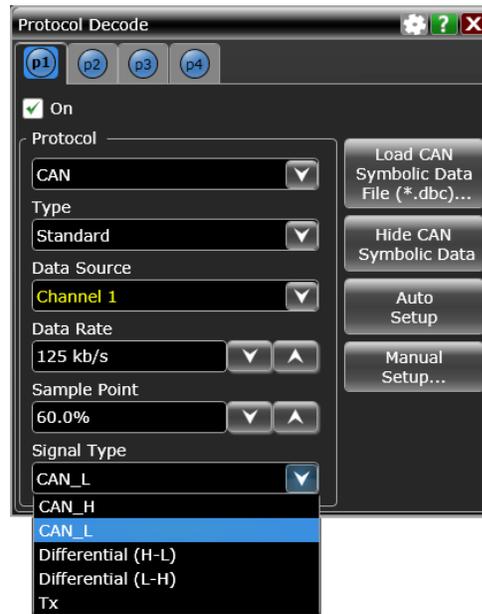
## CAN(FD), LIN, and FlexRay Setup and Protocol Triggering

Get access to a rich set of integrated software protocol-level triggers. The application includes a suite of configurable protocol-level trigger conditions specific to CAN, LIN, FlexRay, and CAN-FD. When serial triggering is selected, the application uses software-based triggering or hardware-based serial triggering. With protocol triggering, the oscilloscope takes signals acquired using either a 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.



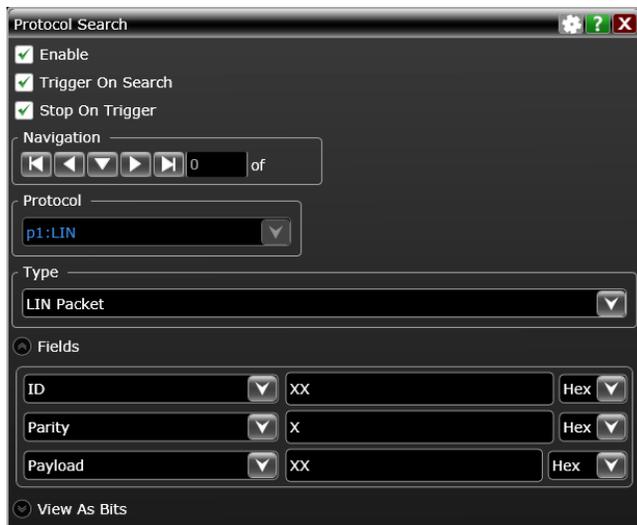
### CAN-FD trigger

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



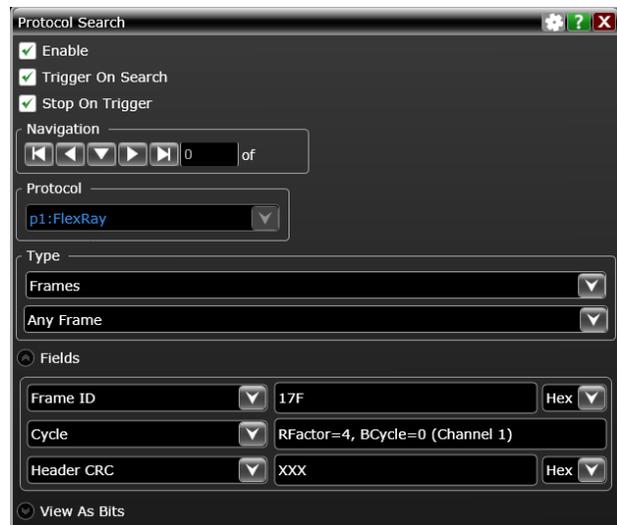
### Specify the CAN signal type

Use single-ended probes or differential probes.



### LIN trigger

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

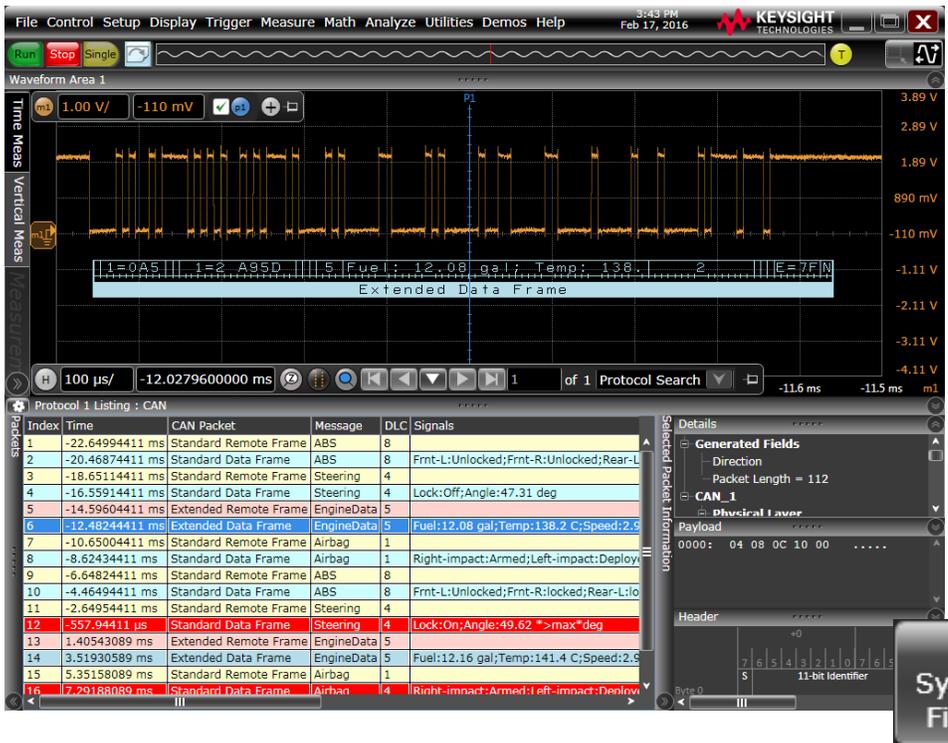


### FlexRay trigger

Quickly specify frame ID and repetition factor (optional) for triggering and searching.

1. Infiniium S-Series supports CAN, LIN, and CAN-FD hardware-based serial trigger, not FlexRay. Infiniium 9000-Series supports CAN, LIN as hardware-based serial trigger, not FlexRay and CAN-FD.

## CAN and CAN FD Protocol Decode



Quickly move between physical and CAN-FD 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. Along with CAN interface innovation, CAN-FD will replace legacy CAN bus line. With N8803C protocol decoder, up to 10 Mbps CAN-FD signals also can be decoded with time-correlated tracking marker.

Message	DLC	Signals
ABS	8	
ABS	8	Frnt-L:Unlocked;Frnt-R:Unlocked;Rear-L:locked;Rear-R:Unlocked;FL-Pressure:111.9 psi;FR-Pressure:111.9 psi
Steering	4	
Steering	4	Lock:Off;Angle:47.31 deg
EngineData	5	
EngineData	5	Fuel:12.08 gal;Temp:138.2 C;Speed:2.9000 krpm
Airbag	1	
Airbag	1	Right-impact:Armed;Left-impact:Deployed;Rear-impact:Deployed;Frwd-impact:Armed
ABS	8	
ABS	8	Frnt-L:Unlocked;Frnt-R:locked;Rear-L:locked;Rear-R:locked;FL-Pressure:118.8 psi;FR-Pressure:118.8 psi
Steering	4	
Steering	4	Lock:On;Angle:49.62 *->max*deg
EngineData	5	
EngineData	5	Fuel:12.16 gal;Temp:141.4 C;Speed:2.9000 krpm
Airbag	1	
Airbag	4	Right-impact:Armed;Left-impact:Deployed;Rear-impact:Deployed;Frwd-impact:Deployed
ABS	8	

Import industry-standard .dbc files for symbolic triggering and decode. Message and signal values are displayed on the listing and in the waveform in symbolic format, making it easier to understand the oscilloscope capture.

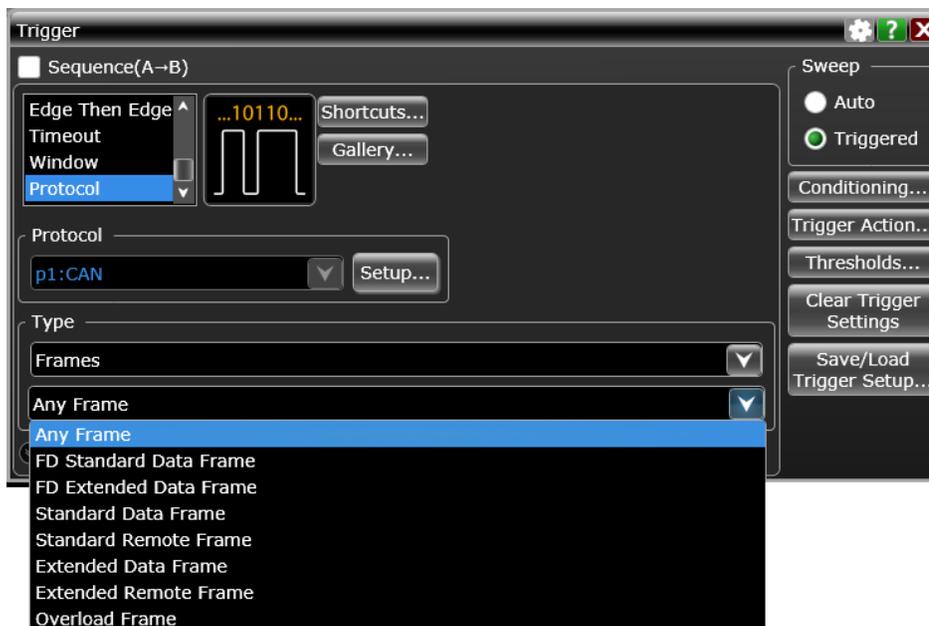
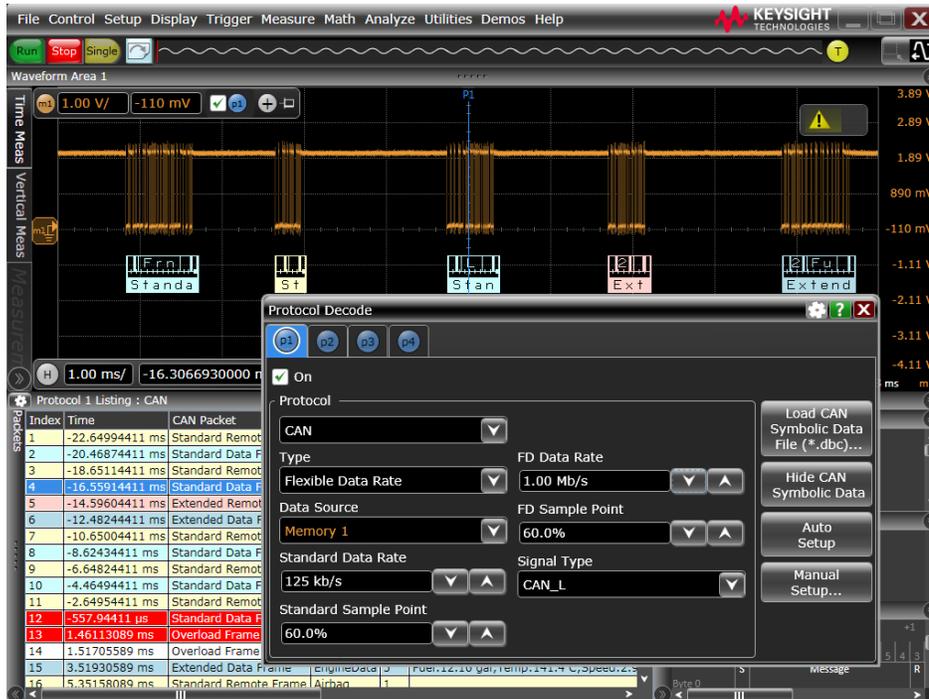


### Long time captures using segmented memory

In this example, CAN traffic was captured for near 42 seconds. Segmented memory uses time tags to track time between segment acquisitions.

## CAN-FD (Flexible Data-rate) Protocol Decode

CAN-FD protocol decode supports the new CAN (ISO 11898-1) specification, so that it will decode up to 10 Mbps FD data rate, while supporting standard CAN data rate for control part. FD data rate support from 1 Mbps and Infinium S-Series supports hardware-based serial triggering on CAN-FD signals so you can get the packet you want to see. This trigger supports frame, and bit-specific options such as BRS, CRC ESI, and errors.



## FlexRay and LIN Protocol Decode



**Clock Recovery**

Clock recovery applies to protocol decode, real time eye, serial data analysis, Rj/Dj, and TIE jitter measurements.

Clock Recovery Applies To

All Waveforms  Individual Waveforms Clock Recovery Source: Channel 1

Preset: Custom

Clock Recovery Method: FlexRay

Baud Rate: 10.0000 Mb/s

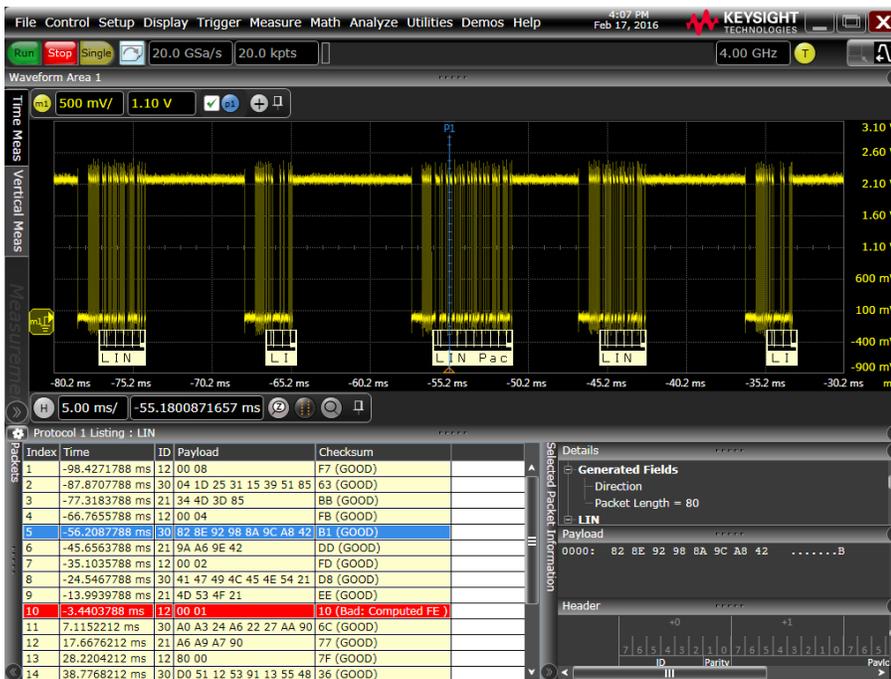
Frame ID: XX Dec

All Cycles

Repetition Factor: 1

Base Cycle (Decimal): 0

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.



**Protocol Search**

Enable

Trigger On Search

Stop On Trigger

Navigation: 1 of 6

Protocol: p1:LIN

### LIN decode embedded in waveform area

Use the oscilloscope waveform area to display decode information.

## CAN, LIN, FlexRay, and CAN-FD Application Specifications and Characteristics

<b>CAN</b>	
CAN sources	Analog channels 1, 2, 3, or 4 MSO models can additionally use digital channels D0 to D15 (V-Series not supported) 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 500 mV swing around the threshold to differentiate between 1s and 0s
Standard data rate	100 b/s up to 1 Mb/s
CAN-FD data rate	1 Mb/s up to 10 Mb/s
Signal type	Differential (L-H), CAN_L, or CAN_H, Tx
Auto setup	Automatically configures scope settings for proper CAN decode and protocol triggering including memory depth, edge triggering, holdoff, sample rate, and measurement thresholds
Decoded fields	All including extended frame format
Triggering	<ul style="list-style-type: none"> <li>- All frames</li> <li>- Standard data frame</li> <li>- Standard remote frame</li> <li>- Extended data frame</li> <li>- Extended remote frame</li> <li>- Errors</li> <li>- FD standard data frame</li> <li>- FD extended data frame</li> </ul>
.dbc support	Import of industry-standard .dbc files for symbolic trigger and decode Maximum number of messages = 256
<b>LIN</b>	
LIN sources	Analog channels 1, 2, 3, or 4 MSO models can additionally use digital channels D0 to D15 (V-Series not supported) 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 500 mV swing around the threshold to differentiate between 1s and 0s
Data rate	2400 b/s to 625 kb/s
Auto setup	Automatically configures scope settings for proper LIN decode and protocol triggering including memory depth, edge triggering, holdoff, sample rate, and measurement thresholds
Decoded fields	All. Supports LIN versions 1.3, 2.0, and 2.1
Triggering	LIN packets, including user-specified values for ID, parity, and payload Wakeup (9000 and S-Series only) Errors including: parity, check, sync, frame length, header length, and wakeup
<b>FlexRay</b>	
FlexRay sources	Analog channels 1, 2, 3, or 4 MSO models can additionally use digital channels D0 to D15 (V-Series not supported) 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 500 mV swing around the threshold to differentiate between 1s and 0s
Data rate	Up to 20 Mb/s
Cycle time	100 ns up to 100 ms
Auto setup	Automatically configures scope settings for proper LIN decode and protocol triggering including memory depth, edge triggering, holdoff, sample rate, measurement thresholds, and clock recovery
Decoded fields	All
Triggering	<ul style="list-style-type: none"> <li>- Any frame</li> <li>- Startup frames</li> <li>- Sync frames</li> <li>- Normal frames</li> <li>- Null frames</li> <li>- NOT null frames</li> <li>- Errors include BAD header CRC, BAD frame CRC, and unknown packet</li> </ul>

## Ordering Information

This application is compatible with Infiniium oscilloscope models below.

Application software <sup>1</sup>			9000 Series	S-Series	90000 Series	V-Series	Z-Series
CAN, LIN, FlexRay, and CAN-FD protocol triggering and decode software	Fixed	Factory-installed	N/A	DSOS000-097	DSO90000-093	DSOV000-099	DSOZ000-099
		User-installed	N8803C-1FP				
		Upgrade from N8803A/B	N8803C-2FP				
	Floating	Transportable	N8803C-1TP				
		Transportable (upgrade from N8803A/B)					
	Sever-based	N5435A-103					

1. Requires Infiniium 5.60 or above.

## Probing CAN and FlexRay Differential Serial Buses

Keysight offers a wide range of differential active probes for various bandwidth and dynamic range applications. Table 1 shows the differential probes that Keysight recommends for CAN and FlexRay.

Table 1. Recommended probes for differential buses

Differential bus (max bit rate)		N2791A (25-MHz bandwidth)		N2818A (200-MHz bandwidth)
CAN (up to 10 Mb/s)	✓	Standard CAN	✓	CAN-FD
FlexRay (10 Mb/s)			✓	

If you need to connect to DB9-SubD connectors on your differential CAN and/or FlexRay bus, Keysight also offers the CAN/FlexRay DB9 probe head (part number 0960-2926). This differential probe head is compatible with both the N2791A and N2818A differential active probes and allows you to easily connect to your CAN and/or FlexRay differential bus. For more information about Keysight’s probing solutions, refer to the Infiniium Series Oscilloscope Probes and Accessories data sheet (publication number 5968-7141EN).



Keysight's N2818A 200-MHz differential active probe.



Keysight N2791A 25-MHz differential active probe.



[www.axistandard.org](http://www.axistandard.org)

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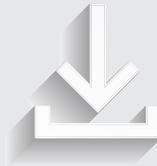
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