

CAN, LIN and FlexRay Protocol Triggering and Decode for Infiniium 90000 Series Oscilloscopes

Data sheet



This application is available in the following license variations.

- Order N8803A for a user-installed license
- Order option 008 for a factory-installed license with new 90000 Series oscilloscopes
- Order N5435A option 033 for a server-based license that works on both 9000 and 90000 Series oscilloscopes



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 contentrich 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 90000 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.

Setup	Trigger	Measure	Analyze	Util
1 Ch	annel 1		Ctrl+1	
2 Ch	annel 2		Ctrl+2	
3 Ch	annel 3		Ctrl+3	
4 Ch	annel 4	Ctrl+4		
Pro	obes		Alt+P	
Se	rial Decode	e	Alt+S	
Se	rial Search			

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 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 analog channels

Acquire serial buses using any combination of scope channels.

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.

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.

✓ Enable Searching			Class
Trigger On Search			Close
Stop On Trigger	1		Help ₹?
a stop on myger			
Protocol: CAN			
Type			
Standard Remote F	rame		~
Fields			
Identifier	~	029	Hex 🗸
R0	~	x	Hex
L		L	
DLC	~	X	Hex 🗸
<select field=""></select>		_	
DLC	P	see Vi	ew as Bits
CRC Delimiter			
ACK Slot			
ACK Dolimitor			
ACK Deminiter			

CAN trigger

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

Serial Search	-		-		X
I Enable Searchir	ng			Close	
Trigger On Sea	rch				
Stop On Trigge	r		Пе	ap [T
Protocol: LIN					
Туре					
LIN Packet					~
Fields					
ID	~	XX		Hex	~
Parity	~	X		Hex	~
Payload	~	XX		Hex	~
Use Navigation ta search results wh	b below to en stopped	see	View as	Bits	

LIN Trigger

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

Serial Decode	
Show Decode	Close
CAN	
Data Source	_
Memory 1	~
Data Rate	
125 kb/s	
Sample Point	
60.0%	Auto Setup
Signal Type	
CAN_L 🗸	✓ Manual Setup
Differential	
CAN_L	
CAN_H	

Specify the CAN signal type.

Use single-ended probes or differential probes.



FlexRay trigger

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

CAN and LIN protocol decode

1 On	1.00 V/	On	ms On 2.0	00 V/	A On		
						\wedge	
	manual H H		н нн н		nd M land M have and margare		1
	1d=000	D=4D=AAD=69D= Standard D	E 4 D=29 Data Fra	me	7E=7fN		
Packets	Details Payload	Header					Ŧ
Packets Index	Details Payload	Header CAN Packet	Identifier	DLC	Data	~	▲ Show Fields
Packets Index 8	Details Payload Time -10.5506965 ms	Header CAN Packet Standard Remote Frame	Identifier 07f	DLC 1	Data	^	
Packets Index 8 9	Detais Payload Time -10.5506965 ms -5.7294965 ms	Header CAN Packet Standard Remote Frame Standard Data Frame	Identifier 07f 07f	DLC 1 1	Data	^	Show Fields Display Forma
Packets Index 8 9 <u>10</u>	Details Payload Time -10.5506965 ms -5.7294965 ms <u>4.9035 µs</u>	Header CAN Packet Standard Remote Frame Standard Data Frame Standard Remote Frame	Identifier 07f 07f 0bd	DLC 1 1 8	Data 59	~	
Packets Index 8 9 <u>10</u> 11	Details Payload Time -10.5506965 ms -5.7294965 ms <u>4.9035 µs</u> 2.1902035 ms	Header CAN Packet Standard Remote Frame Standard Data Frame Standard Data Frame Standard Data Frame	Identifier 07f 07f <u>0bd</u> 0bd	DLC 1 1 8 8	Data 59 1539 5085 051d 253	31	Show Fields Display Forma Hex Setup
Packets Index 8 9 <u>10</u> 11 12	Detais Payload Time -10.5506965 ms -5.7294965 ms 4.9035 us 2.1902035 ms 4.0037035 ms	Header CAN Packet Standard Remote Frame Standard Data Frame Standard Data Frame Standard Data Frame Standard Remote Frame	Identifier 07f 07f 0bd 0bd	DLC 1 1 8 8 4	Data 59 1539 5085 051d 253	31	
Packets Index 9 10 11 12 13	Detais Payload Time 10.5506965 ms -5.7294965 ms 4.9035 μs 4.0037035 ms 6.0934035 ms 0.05005 ms	Header CAN Packet Standard Remote Frame Standard Data Frame Standard Remote Frame Standard Remote Frame	Identifier 07f 07f 0bd 0bd 0bd 000	DLC 1 1 8 8 4	Data 59 1539 5085 051d 253 8869 e429	31	Show Fields Display Forma Hex v Setup
Packets Index 8 9 <u>10</u> 11 12 13 14	Detais Payload Time -10.5506965 ms -5.7294965 ms 4.9035 us 2.1902035 ms 4.0037035 ms 6.0034035 ms 8.0558035 ms	Header CAN Packet Standard Remote Frame Standard Data Frame Standard Data Frame Standard Data Frame Standard Remote Frame Extended Remote Frame Extended Remote Frame	Identifier 07f 07f 0bd 0bd 0bd 000 000 000 0296 a95d	DLC 1 1 8 8 4 4 5	Data 59 1539 5085 051d 253 8869 e429	31	Setup
Packets Index 8 9 <u>10</u> 11 12 13 14 15 16	Detais Payload Time -10.5506965 ms -5.7294965 ms 4.9035 us 2.1902035 ms 6.0934035 ms 10.0715035 ms 13.0053025 ms	Header CAN Packet Standard Remote Frame Standard Data Frame Standard Data Frame Standard Data Frame Standard Remote Frame Extended Remote Frame Extended Remote Frame Extended Remote Frame	Identifier 07f 07f 0bd 0bd 000 0296 a95d 0296 a95d 0296 a95d	DLC 1 1 8 8 4 4 5 5	Data 59 1539 5085 051d 253 8869 e429 60 8000 2040	31	Show Fields Display Forma Hex Setup Search
Packets Index 8 9 10 11 12 13 14 15 16 17	Detais Payload Time +10.5506965 ms -5.7294965 ms 4.9035 us 2.1902035 ms 6.0934035 ms 8.0589035 ms 10.1715035 ms 12.0052035 ms 12.0052035 ms	Header CAN Packet Standard Remote Frame Standard Data Frame Standard Data Frame Standard Data Frame Standard Data Frame Extended Data Frame Extended Data Frame Standard Data Frame Standard Data Frame Standard Data Frame	Identifier 07f 07f 0bd 0bd 000 0296 a95d 0296 a95d 07f 07f	DLC 1 8 8 4 4 5 5 1 1	Data 59 1539 5085 051d 253 8869 8429 60 8000 2040 50	31	Show Fields Display Forma Hex Setup Search Save Help
Packets Index 8 9 10 11 12 13 14 15 16 17 18	■ Detais ■ Payload Time -10.5506965 ms -5.7294965 ms 4.9025 us 2.1902035 ms 6.0934025 ms 6.0934025 ms 10.1715035 ms 12.0052035 ms 14.0297025 ms 16.0021035 ms	Header CAN Packet Standard Data Frame Standard Data Frame Standard Data Frame Standard Data Frame Standard Data Frame Standard Data Frame Extended Remote Frame Standard Remote Frame Standard Data Frame Standard Data Frame Standard Remote Frame Standard Remote Frame	Identifier 07f 07f 0bd 0bd 000 000 0296 a95d 0296 a95d 07f 07f 0bd	DLC 1 8 8 4 4 5 5 1 1 1 8	Data 59 1539 5085 051d 253 8869 e429 60 8000 2040 59	31	Show Fields Display Format Hex Setup Search Save Help

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

Navig	ating segmented w	averorm	5
Numbe	Segment r of segments acq Tim	index uired e tag	8190 8192 34.9794 <u>56558 s</u>
	КЧЪЖ	8190	
	Play Play Rate:	100 ms	

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

Ĭ	Acqu	isition	n is stopp	bed.	Andryze	Odifices	Theip					-		15	NOT 2	00910	-
	ml	On 50	0 mV/	2	On 1. ☑	00 V/		3 On				4 Or	9			D]
						A		٨	1	л	pres		,	1	л.,	η	
İ																	
Ī																	
l			hunst	*****	hum +	10101011 1010101	1	1 E	1:59			Leng	th:2		HCRO	:206	
1	In	dex	Time		Fram	e ID Cy	le	Data (He	x)					^			[
L		1	-1.634783	0273 ms	022	1B		78 56 34	12 55	EF CD	AB 78	56 34 1	2 00 00) [Dis	play Fo	n
		2	-1.546796	1970 ms	024	18		55 55 55	55 55	55 55 5	55 55 5	5 55 55	55 55		He	x	
1		3	-1.502885	4526 ms	025	18		3D 3D 3L	05 05	0 3D 3L	0 3D 3I	0 3D 3D	30 30			<i>c</i> .	-
L		4	-1.458892	0722 ms	020	18		55 85 85	85 85	85 85 8	55 85 8	5 85 85	85 85		1	Setup	4
	l a	5	-1.414610	12050 ms	027	10		00.00.00	70	WA AA	~~~~~~	AA AA	~~~ ~~			Search.	
1		7	-1 278920	9267 ms	02D	18	- 1	00 00 00	77							<i>c</i>	
L		8	946.7167	ns	003	10		00 00 00	00 00	00 00 0	00 00 0	0 00 00	00 00			Save	4
		9	132.87862	299 LIS	006	10		2E D9 00	00 12	34 12	34 12	34 12 34	12 34			Help	
		10	1.3206898	8514 ms	021	1C	0	DA OB OC	OD OE	OF 10	11 12	13 14 1	5 16 17				Ĩ
1		11	1.3647420	0427 ms	022	1C	1	00 01 02	03 04	05 06 0	07 08 0	9 0A 0E	3 OC 00)			
	1	17	1 /577789	2047 mc	024	10	101		~~ ~~	~~ ~~ ~			55 55	3			
	Contract of																

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.

Clock Reco	overy	_	_	×
Clock reco	overy applies to h	igh	Clos	e
and TIE ji	tter measuremen	ts.	Help	\ ?
Clock Reco	very Method			
FlexRay R	eceiver	~		
Baud Rate				
10.0000	4b/s			
Frame ID				
XX	Hex	*		
All Cycle	95			
Repetition				
1	~			
Base Cycle	(Decimal)			
0	Y			

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 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.
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 (software-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 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.
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 (software-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 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.
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 90000 Series oscilloscope models.

Software applications	Factory-installed	User-installed	Server-based
	option for new scope	stand-alone product	license
	purchases	number	(N5435A option)
CAN, LIN, and FlexRay triggering and decode	008	N8803A	033

License Type		Close
O Local License		
		Help
license Server D	ort	
dvuga07	27000	
[.	
Borrow License	Return License	
License To Borrow	License To Return	
CAN/FlexRay/LIN Protocol ¥	None	
Borrow For		
10 days		
10 days		

Using multiple scopes?

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



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