Oscilloscope Selection Tip 8:
Serial Bus Applications

Part 8 of a 12-part series

Tip 8 *Select a scope that can trigger on and decode serial buses to help you debug your designs faster.*

Agilent's InfiniiVision 2000, 3000 and 4000 X-Series oscilloscopes provide a broad range of serial bus analysis options with hardware-based protocol decoding.

Serial buses such as I^{2}C, SPI, RS232/UART, CAN, etc., are pervasive in many of today's digital and mixed-signal designs. Verifying proper bus communication along with analog signal quality measurements requires using an oscilloscope. Many engineers and technicians verify serial bus communication with an oscilloscope using a technique known as "visual bit counting". But this manual method of decoding a serial bus can be time consuming and prone to errors. However, many of today's DSOs and MSOs have optional built-in serial bus protocol decode and triggering capabilities. If your designs include serial bus technology, then selecting a scope that can decode and trigger on these buses can be a significant time-saver to help you debug your systems faster.

Most scopes on the market today that have serial bus analysis capabilities utilize software-based decoding techniques. With software-based decoding, waveform and decode-update rates tend to be slow (sometimes seconds per update). This is especially true when using scopes with deep memory, which is often required to capture multiple packetized serial bus signals. And when analyzing multiple serial buses simultaneously, software techniques can make protocol-specific decode update rates even slower.

Agilent's InfiniiVision Series oscilloscopes utilize hardware-based decoding to provide virtual real-time updates. Faster decoding with hardware-based technology enhances scope usability, and more importantly, the probability of capturing infrequent serial communication errors.

Figure 1 shows an example of an Agilent 3000 X-Series oscilloscope capturing and decoding a CAN (Controller Area Network) serial bus, which is commonly used in many automotive and industrial machinery applications, including medical diagnostics equipment. Below the waveform is the time-correlated decode trace that shows the contents of a single packet/frame of data. The upper half of the scope's display shows the "lister" display, which provides decoded information in a more familiar tabular format; like a traditional protocol analyzer. The lister display can also be used to search and automatically navigate to specific packets of interest.
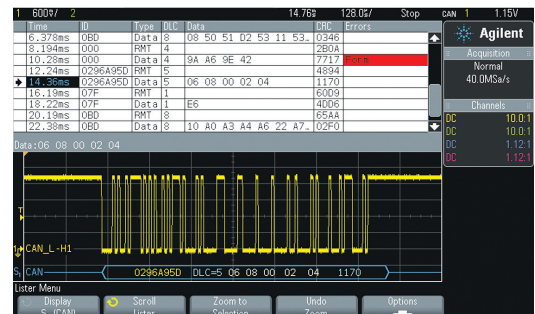

Figure 1: Triggering on and decoding a CAN serial bus using an Agilent 3000 X-Series oscilloscope.

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Figure 2: Eye-diagram mask test on an ARINC 429 serial bus using an Agilent 3000 X-Series oscilloscope.

In addition to triggering on and decoding serial buses, it is often necessary to perform eye-diagram mask test measurements on serial bits. This is especially important for higher speed differential buses and/or buses that communicate over a long network. With an eye-diagram display, all serial bits are overlaid and compared to a pass/fail mask based on published industry physical layer standards/specifications. Figure 2 shows an example of an eye-diagram mask measurement on an ARINC 429 serial bus, which is commonly used in many of today's commercial aircraft. With a mask test rate of up to 200,000 waveforms/sec, the scope quickly captures return-to-zero (RZ) bits that exhibit insufficient amplitude as shown by the traces color-coded in red.

Serial bus analysis capabilities available in Agilent's InfiniiVision X-Series Oscilloscopes

If you are in the market today to purchase your next oscilloscope, Agilent Technologies' newest 2000, 3000 and 4000 X-Series oscilloscopes come in various bandwidth models ranging from 70 MHz up to 1.5 GHz. Available on these scopes is a broad range of serial bus protocol analysis options:

Serial Bus Analysis Capabilities	X-Series Availability		
Description	2000X	3000X	4000X
CAN/LIN decode and trigger	DSOX2AUTO	DSOX3AUTO	DSOX4AUTO
I²C/SPI decode and trigger	DSOX2EMBD	DSOX3EMBD	DSOX4EMBD
RS232/UART decode and trigger	DSOX2COMP	DSOX3COMP	DSOX4COMP
FlexRay decode and trigger	-	DSOX3FLEX	DSOX4FLEX
I²S audio decode and trigger	-	DSOX3AUDIO	DSOX4AUDIO
MIL-STD 1553 / ARINC429 decode and trigger	-	DSOX3AERO	DSOX4AERO
USB low- and full-speed decode and trigger	-	-	DSOX4USBFL
USB hi-speed decode and trigger	-	-	DSOX4USBH*

* Available on 1.5 GHz models only

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Agilent's combination of product reliability and three-year warranty coverage is another way we help you achieve your business goals: increased confidence in uptime, reduced cost of ownership and greater convenience.

To learn more about Agilent's InfiniiVision X-Series oscilloscopes and mixed signal oscilloscopes, go to
www.agilent.com/find/scope

Product specifications and descriptions in this document subject to change without notice.

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