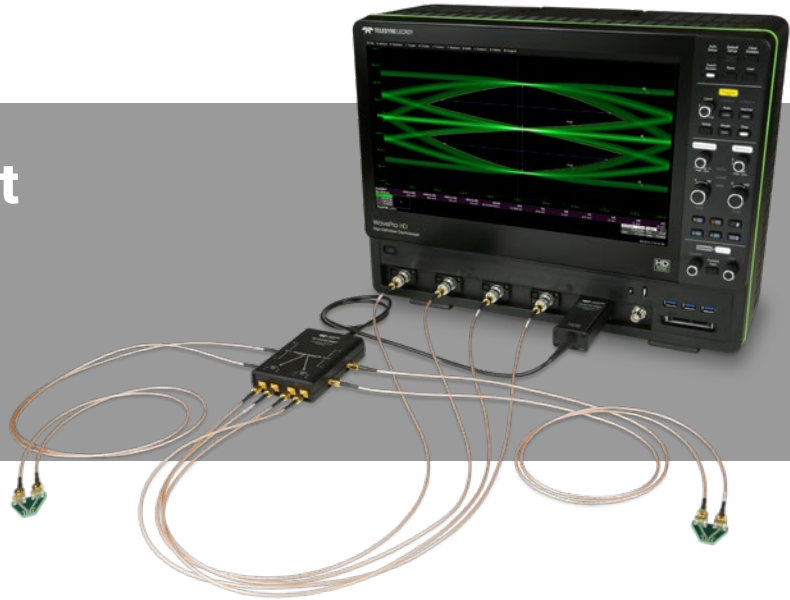# TELEDYNE LECROY
Everywhere**you**look™

Automotive Ethernet
Test Solutions

QPHY-1000Base-T1
QPHY-BroadR-Reach
Auto ENET Debug Toolkit

Key Features

Supports 1 Gb/s and 100 Mb/s
- 1000Base-T1 (IEEE 802.3bp)
- 100Base-T1 (IEEE 802.3bw)
- BroadR-Reach V3.2

Highly automated compliance testing
- Supports all PMA Transmitter Tests
- Report generation with pass/fail results and annotated screenshots
- Unique software clock recovery algorithm for the distortion test which greatly simplifies test setup

Dedicated debug environment
- Debug signal quality link communication issues
- Separate bidirectional traffic with superior signal fidelity
- Characterize system performance with 12 eye diagram measurement parameters

QualiPHY™

Cover all aspects of physical layer Automotive Ethernet testing with compliance testing for 100Base-T1 and 1000Base-T1, a dedicated Automotive Ethernet Debug Toolkit, and an Automotive Ethernet Breakout Test Fixture to easily separate bidirectional link traffic.

Automated Compliance Testing

QualiPHY performs electrical compliance testing of the Physical Media Attachment (PMA) according to the 1000Base-T1, 100Base-T1, and BroadR-Reach specifications. Detailed connection diagrams ensure the proper setup and provide information about the required test pattern for each test. Upon completion of the test session, results are automatically compiled into a comprehensive report including screenshots.

Simplified Distortion Test

To properly perform the Distortion test, the DUT (Device Under Test), disturbing sine wave, and oscilloscope all need to be synchronized. In practice, this is a difficult task since the DUT's TX_TCLK and the test equipment's reference clock are at different frequencies. QualiPHY uses a unique software clock recovery algorithm which enables the test to be completed without requiring a hardware frequency converter board.

Beyond Compliance Testing

The Automotive Ethernet Debug Toolkit provides a dedicated debug environment specifically designed to detect and debug signal quality link communication issues between a Master and Slave that would not be identified during compliance testing. Fully characterize and quantify system performance with a suite of 12 parameters and enable equalization to visualize how the signal appears at the receiver.

Calibrated Signal Separation

The bidirectional nature of an Automotive Ethernet link provides a challenge for analyzing signals with an oscilloscope. The TF-AUTO-ENET separates bidirectional link traffic to independently view signals from the Master and Slave. A built-in calibration routine provides superior signal fidelity compared to alternative approaches.
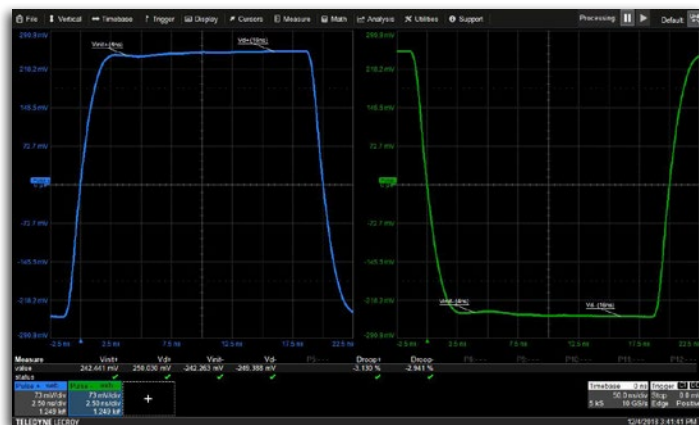
Maximum Transmitter Output Droop — The output droop is calculated on both the "+1" and "-1" symbols in the Test Mode 1 or 6 waveform. The magnitude of the droop is measured with respect to an initial peak value after the zero crossing (Vinit) and the value a defined amount of time after the initial peak value (Vdelay).
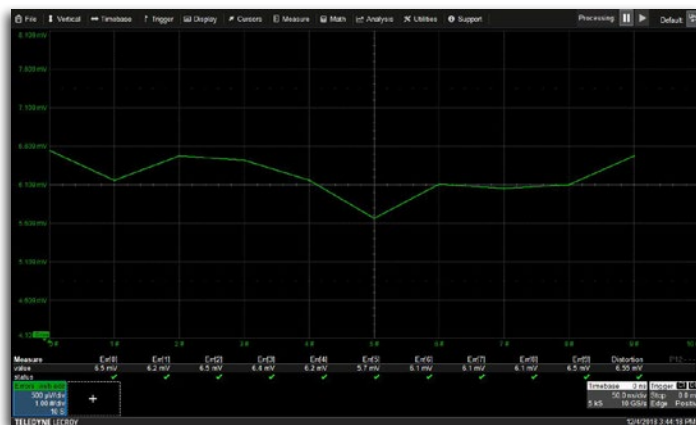
Transmitter Distortion — The peak distortion is determined by capturing output from the DUT while it is in Test Mode 4. The MATLAB script provided in the specification removes the disturbing sine wave and measures peak distortion at equally spaced phases of the symbol period. To pass, the script must report less than 15 mV distortion for 10 records.
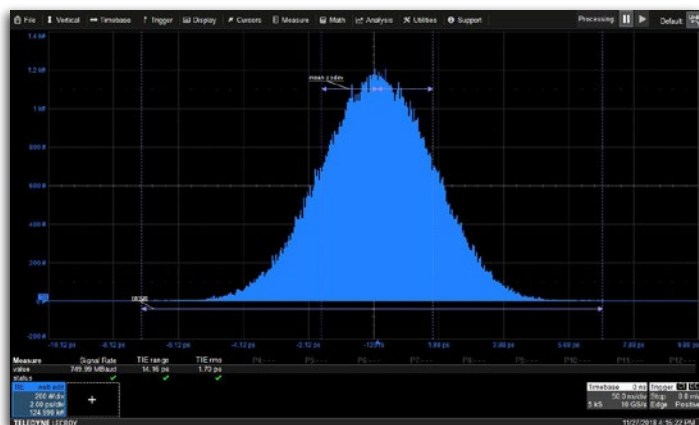

Transmitter Timing Jitter & Transmit Clock Frequency — The Transmitter Timing Jitter and Transmit Clock Frequency are tested while the DUT is in Test Mode 1 or 2. For some tests, the jitter is measured by directly probing the DUT's TX_TCLK.

Transmitter PSD & Peak Differential Output — The Power Spectrum Density (PSD) of the transmitter is tested against the specified limits defined by the mask while the DUT is transmitting Test Mode 5. Using the oscilloscope for the PSD test removes the need to purchase a spectrum analyzer. The Test Mode 5 waveform is also used to test the Peak Differential Output.

PRELIMINARY

DEBUG AND CHARACTERIZE SYSTEM PERFORMANCE
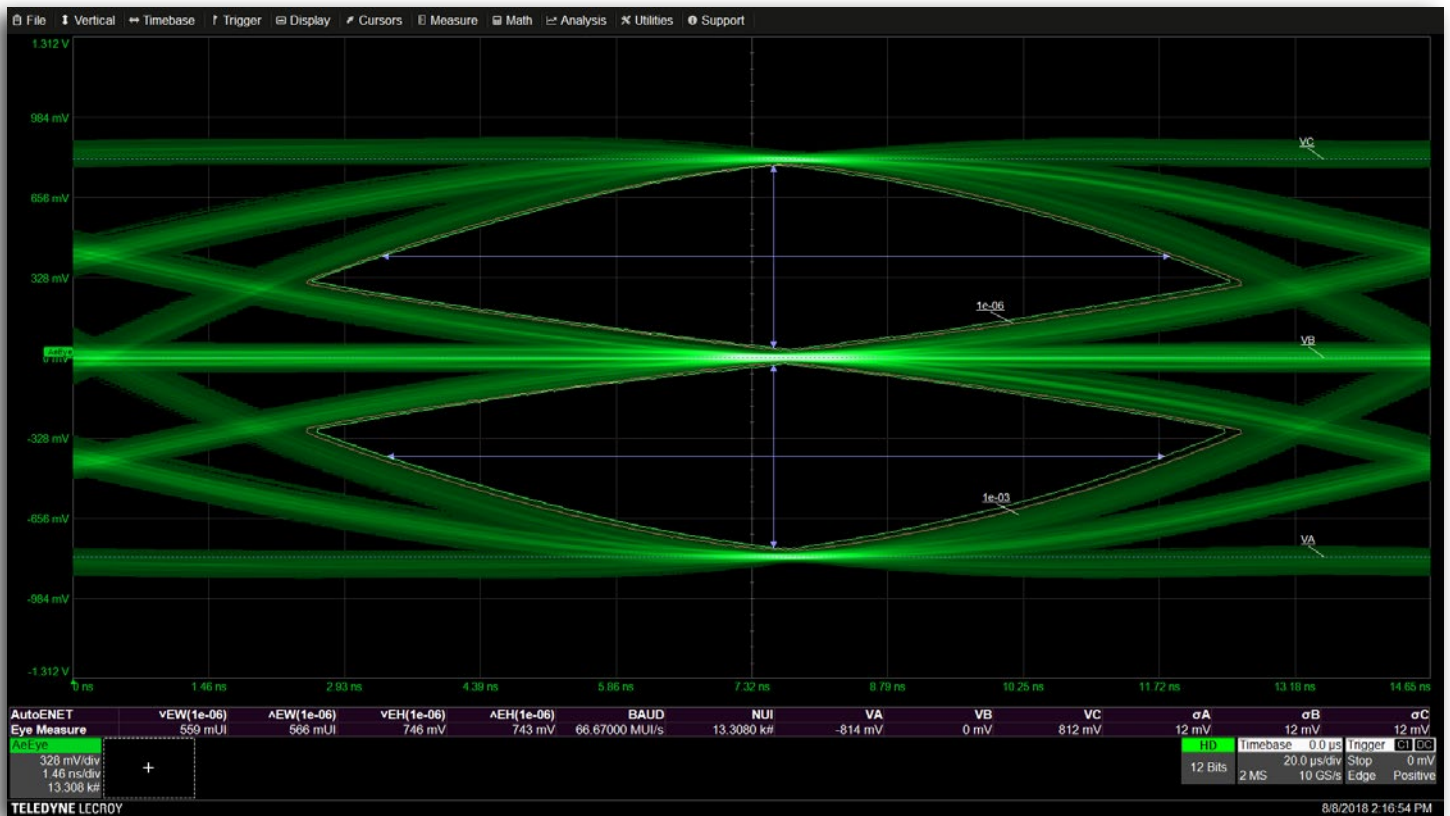
The unique and dedicated Automotive Ethernet Debug Toolkit is designed to detect signal quality communication issues between a Master and Slave that are not identifable during compliance testing.

Calibrated Signal Separation

The TF-AUTO-ENET separates bi-directional link traffic to independently view signals from the Master and Slave. A built-in calibration routine provides superior signal fidelity compared to alternative approaches.

Quantify system performance

Fully characterize and quantify a link's performance using 12 parameters, including eye height and eye width of both the upper and lower eyes. Visually observe system failure rates with customizable BER contours.

Integrated FF Equalization

Enable the FF Equalization to see exactly how the signal appears at the receiver or determine which equalization scheme will be best for opening the eye. Define the number of taps and specific tap weightings or train the equalizer on acquired data.

PRELIMINARY

Compliance Testing

Product Description	Product Code
1000Base-T1 Compliance Software	QPHY-1000Base-T1
100Base-T1 and BroadR-Reach Compliance Software	QPHY-BroadR-Reach

Test Fixture (1000Base-T1 and 100Base-T1/BroadR-Reach)

10/100/1000Base-T Compliance Test Fixture	TF-ENET-B*

Cables and Adpaters

2 x 18 inch SMA to SMA Cable	ENET-2CAB-SMA018 †
2 x BNC to SMA Adapter	ENET-2ADA-BNCSMA †

* Requires user-created "short automotive cable" to attach to RJ45 Input.
† Included with TF-ENET-B.

Recommended 1000Base-T1 Equipment

2.5 GHz, 20 GS/s, 4 Ch, 16 Mpts/Ch DSO with 12.1" WXGA Color Display	WaveRunner 9254
2.5 GHz, 20 GS/s, 4 Ch, 100 Mpts/Ch High Definition Oscilloscope with 15.6" Full HD capacitve touch screen	WavePro 254HD
4 GHz, 5 Vp-p ProBus2 Differential Probe	D420-A-PB2
HD Arbitrary Waveform Generator, 2 Ch, 250 MHz, 16 bit, 128Mpts/Ch, 6 Vpp output	T3AWG3252

Recommended 100Base-T1/BroadR-Reach Equipment

1 GHz, 20 GS/s, 4 Ch, 16 Mpts/Ch DSO with 12.1" WXGA Color Display	WaveRunner 9104
1 GHz, 1.0 pF Active Differential Probe, ±8 V	ZD1000
40 MHz, 1.2 GS/s, 8 Mpts, 2 Ch, 20 Vpp Function/Arbitrary Waveform Generator	T3AFG40

Automotive Ethernet Debug

Product Description	Product Code
100Base-T1 and 1000Base-T1 Debug Toolkit for WaveRunner 9000	WR9K-AUTO-ENET-TOOLKIT
100Base-T1 and 1000Base-T1 Debug Toolkit for WavePro HD	WPHD-AUTO-ENET-TOOLKIT
100Base-T1 and 1000Base-T1 Debug Toolkit for WaveMaster 8 Zi	WM8Zi-AUTO-ENET-TOOLKIT
100Base-T1 and 1000Base-T1 Debug Toolkit for LabMaster 10 Zi	LM10Zi-AUTO-ENET-TOOLKIT
Automotive Ethernet Breakout Test Fixture for 100Base-T1 and 1000Base-T1 Debug. Includes 3-foot SMA-SMA cables (Qty 4), 3-foot SMA-BNC cables (Qty 4) and SMA connector boards (Qty 2)	TF-AUTO-ENET

Auto ENET Debug Specs

Supported Protocols – 100Base-T1/BroadR-Reach and 1000Base-T1

Eye Parameters – Eye Height (upper and lower), Eye Width (upper and lower), Symbol Rate, # of symbols, Mean Levels (+1, 0, -1), RMS at Levels (+1, 0, -1)

Eye Contours – 2 customizable BER levels displayed on the eye diagram

FF Equalization – Define up to 20 tap weightings or automatically train on acquired signal

1000Base-T1 Test Coverage

Maximum Transmitter Output Droop

Transmitter Distortion (with and without access to Tx_TCLK)

Master Transmitter Timing Jitter

Slave Transmitter Timing Jitter

MDI Transmitter Timing Jitter

Transmitter Power Spectral Density

Transmitter Peak Differential Output

Transmitter Clock Frequency

BroadR-Reach/100Base-T1 Test Coverage

Maximum Transmitter Output Droop

Transmitter Distortion (with and without access to Tx_TCLK)

Transmitter Timing Master Jitter

Transmitter Timing Slave Jitter

Transmitter Power Spectral Density

Transmitter Peak Differential Output*

Transmitter Clock Frequency

*Not defined in the BroadR-Reach V3.2 Spec

QualiPHY™

Compliance Testing

QualiPHY is designed to reduce the time, effort, and specialized knowledge needed to perform compliance testing on high-speed serial buses.

- Support for 100Base-T1 and 1000Base-T1
- Guides the user through each test setup
- Compares each measured value with the applicable specification limits
- Fully documents all results
- QualiPHY helps the user perform testing the right way — every time!

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1-800-5-LeCroy
teledynelecroy.com

Local sales offices are located throughout the world.
Visit our website to find the most convenient location.