HDA125
High-speed Digital Analyzer

Key Features

- 12.5 GS/s sampling rate for 80ps timing accuracy
- 3 GHz leadset for capturing digital signals up to 6 Gb/s
- Precise timing synchronization via Teledyne LeCroy LBUS for medium- and high-bandwidth oscilloscopes
  - WaveMaster 8Zi family
  - WavePro 7Zi family
  - WaveRunner 6Zi
  - HDO9000
- SYNC connection to LabMaster oscilloscopes
  - Create the highest-bandwidth mixed-signal solution available - up to 100 GHz analog bandwidth!
- USB 3.1 for fast data transfer
- Unique QuickLink probing system
  - Differential solder-in tips with 9-inch lead simplify access to difficult test points
  - Ultra low loading for superior performance
  - 8 GHz bandwidth tips are compatible with both HDA digital leadset and Teledyne LeCroy WaveLink differential analog probes for unmatched acquisition flexibility

The HDA125 transforms your Teledyne LeCroy oscilloscope into the highest-performance, most flexible mixed-signal solution for high-speed digital debug and evaluation. With 12.5 GS/s digital sampling rate on 18 input channels, and the revolutionary QuickLink probing solution allowing seamless transitions from digital to high-bandwidth analog acquisitions, validation of challenging interfaces such as DDR4 has never been simpler or more comprehensive.

Complete Embedded System Debug
Modern embedded systems increasingly utilize high-speed digital buses, posing new and evolving challenges to validation and debug engineers. While analog signal-integrity characterization is a critical part of this process, the ability to decode and trigger on related digital buses is becoming a vital capability. The HDA125 High-speed Digital Analyzer addresses this need with the most flexible solution available.

Enhanced DDR Debug
Teledyne LeCroy already offers the industry’s only dedicated DDR Debug Toolkit, designed to simplify challenging memory interface validation. Adding the HDA125 allows the DDR command bus to be directly acquired and integrated into the analysis, enabling advanced command triggering and sophisticated, searchable bus state viewing.
The HDA125 High-speed Digital Analyzer is a key building block in the most powerful, flexible mixed-signal test system available. It integrates seamlessly with Teledyne LeCroy oscilloscopes and probing solutions for an unprecedented level of full-system visibility.

1. **12.5 GS/s digital acquisition**
   With 80ps between samples, the HDA125 provides the high sample rate and precise timing accuracy required to capture today’s high-speed embedded signals.

2. **3 GHz digital leadset**
   The HDA-DLS leadsets connect the HDA125 to Teledyne LeCroy’s unique QuickLink probe tips via low-profile 4- and 5-way comparator “pods”. Leadsets are available in 18-channel and 9-channel models.

3. **QuickLink probe tips**
   8 GHz differential probe tips with 9-inch lead length provide easy access to challenging test points. Tips are inexpensive, allowing an entire DUT to be equipped cost-effectively.

4. **Precise synchronization**
   The HDA125 synchronizes natively with Teledyne LeCroy oscilloscopes using either the LBUS or ChannelSync interface, enabling precise timebase synchronization and simple cross-triggering.
5. **USB 3.1 data transfer**
Data transfer from the HDA125 is accomplished via a USB 3.1 interface to maintain oscilloscope responsiveness.

6. **Digital waveform display**
Digital waveforms acquired by the HDA125 appear directly on the oscilloscope’s display, fully time-correlated with the scope’s high-bandwidth analog traces.

7. **Bus decodes**
Combine multiple digital traces into a single decoded bus display, for easy readability and more efficient use of screen space.

8. **Digital triggering**
Trigger the oscilloscope on parallel bus states (clocked or un-clocked) from the HDA125.

9. **Simplified analog probing**
The included 8 GHz QuickLink probe tips can be connected to Teledyne LeCroy WaveLink probes using adapters. This flexibility allows an entire DUT to be equipped with one kind of tip, making testing quicker and easier.

10. **Enhanced DDR debug**
The HDA125 enables acquisition of DDR command bus signals, adding significant functionality to Teledyne LeCroy’s unique DDR Debug Toolkit.
High-speed Sampling with Superior Sensitivity
The HDA125 samples 18 input signals at 12.5 GS/s, for accurate characterization of the fastest signals. But sample rate is only half the story - high-speed embedded systems testing often poses very challenging signal amplitude conditions. The High-speed Digital Analyzer meets these challenges with ultra-low probe loading and industry-leading sensitivity (150 mV minimum signal swing). The most precise threshold settings are ensured with a unique hysteresis adjustment capability, and three times better threshold accuracy than competing mixed-signal instruments.

Acquisition Synchronization and Cross-triggering
The HDA125 connects to Teledyne LeCroy oscilloscopes using an LBUS or ChannelSync interface, enabling the digital channels to be acquired with the same timebase accuracy and triggering synchronization as a built-in mixed-signal solution. A USB 3.1 interface provides high-speed transfer of the acquired digital data to the oscilloscope. And the modular design allows you to better leverage your investment by sharing digital capability between existing instruments.

Enhance Existing Oscilloscope Capabilities
The HDA125 allows you to add high-speed digital acquisition and analysis capabilities to your existing laboratory oscilloscopes - no need to update the entire instrument just to add new functionality. WaveMaster 8 Zi, WavePro 7 Zi, WaveRunner 6 Zi, and HDO9000 family instruments are supported using Teledyne LeCroy’s LBUS interface. Or connect the HDA125 to the LabMaster family of modular oscilloscopes using the ChannelSync interface to create the highest-bandwidth mixed signal solutions available.
Command Bus Capture for Full Interface Visibility

Basic debugging and validation of embedded DDR interfaces typically involves analysis of the analog properties of the clock, data (DQ) and strobe (DQS) signals - and Teledyne LeCroy's DDR analysis tools are established industry leaders in this application. But when validation tasks become more complex and problems require deeper insight, the ability to trigger on, acquire and visualize the state of the DDR command bus is invaluable. The HDA125 brings command bus acquisition to Teledyne LeCroy's already comprehensive toolset, providing the ultimate in memory bus analysis capability.

Analyze Bus Activity

The HDA125 enables the unique “bus view” feature of the DDR Debug Toolkit, which brings Teledyne LeCroy's advanced bus analysis feature set to bear on DDR analysis. View bus activity in tabular form, and move time-correlated views to a desired event with the touch of a button. Search for specific events and bus states within the acquired record. Intuitive color overlays and annotations make it easy to identify areas of interest in the acquired analog waveforms.

Trigger on DDR Commands

The ability to trigger on specific states of the command bus becomes an invaluable tool for quick understanding of DDR signal quality. The HDA125’s logic triggering combines with the DDR Debug Toolkit’s intuitive setup and intelligent software cross-triggering to provide the ultimate DDR triggering system. Persistence maps of read and write bursts provide an easy and fast means of identifying subtle signal-quality problems for further investigation.
ULTIMATE PROBING FLEXIBILITY

The QuickLink probe tip system was designed from the ground up to be compatible with both the HDA125 High-speed Digital Analyzer system, and with Teledyne LeCroy’s WaveLink series of differential analog probes. This cross-connection ability allows you to equip your system under test with QuickLink tips at all desired test points, and swap connections between digital and analog acquisition systems as needed.

High Signal Fidelity
When connected to a WaveLink analog probe, QuickLink tips provide 8 GHz of bandwidth and a flat, well-controlled frequency response. When used for digital acquisitions with the HDA125, they support 3 GHz bandwidth with industry-leading sensitivity. In both cases, high input impedance ensures minimal loading of the system under test.

Easy to connect
Unlike other “consumable” probe tip solutions which rely on tiny, delicate tips located very close to the device under test, the QuickLink solder-in tip has an integral 9-inch lead. This effectively relocates your test point to a more convenient location, making testing more reliable by eliminating torque and other forces on the solder joints.

Cost-effective
QuickLink solder-in tips are low-cost, making it easy to equip multiple test points and DUTs, and eliminating time-consuming re-soldering of connectors.
## SPECIFICATIONS

### HDA125

<table>
<thead>
<tr>
<th>Input Channels</th>
<th>18 (with HDA-DLS-18QL), 9 (with HDA-DLS-09QL)</th>
</tr>
</thead>
</table>

#### Vertical System (when using HDA-DLS-xxQL)

<table>
<thead>
<tr>
<th>Threshold Setting</th>
<th>±5V, settable per channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>User-defined Threshold Resolution</td>
<td>5mV</td>
</tr>
<tr>
<td>Maximum Input Voltage (non-destruct)</td>
<td>±15V on any single ended input ±15V max differential</td>
</tr>
<tr>
<td>Threshold Accuracy</td>
<td>±(25mV + 3% of threshold setting)</td>
</tr>
<tr>
<td>Input Dynamic Range</td>
<td>±10V on any single ended input ±7.5V max differential</td>
</tr>
<tr>
<td>Minimum Input Voltage Swing</td>
<td>150 mV p-p</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>QL-SI tips: 110 kΩ, 0.12pF differential</td>
</tr>
<tr>
<td>Digital Bandwidth</td>
<td>3 GHz</td>
</tr>
<tr>
<td>User Defined Hysteresis Range</td>
<td>50mV - 600mV</td>
</tr>
<tr>
<td>User Defined Hysteresis Resolution</td>
<td>5mV</td>
</tr>
</tbody>
</table>

#### Acquisition System

<table>
<thead>
<tr>
<th>Maximum Sample Rate</th>
<th>12.5 GS/s</th>
</tr>
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<tbody>
<tr>
<td>Maximum Input Bit Rate</td>
<td>6 Gb/s</td>
</tr>
<tr>
<td>Maximum Acquisition Memory</td>
<td>256 MS (depending on configuration and acquisition settings of connected oscilloscope)</td>
</tr>
<tr>
<td>Minimum Detectable Pulse Width</td>
<td>167ps</td>
</tr>
<tr>
<td>Channel-to-Channel Skew</td>
<td>±160ps</td>
</tr>
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</table>

#### Trigger System

<table>
<thead>
<tr>
<th>Trigger Types</th>
<th>Edge, digital pattern, digital state (clocked pattern)</th>
</tr>
</thead>
</table>

#### Interface

<table>
<thead>
<tr>
<th>Acquisition/trigger Synchronization</th>
<th>Teledyne LeCroy LBUS (HDA125-xx-LBUS) or ChannelSync (HDA125-xx-SYNC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Transfer</td>
<td>USB 3.1 Gen1 (compatible with USB 2 hosts)</td>
</tr>
<tr>
<td>Reference Clock</td>
<td>10 MHz reference clock in/out (not required to synchronize with oscilloscope when using LBUS)</td>
</tr>
</tbody>
</table>

#### Power Requirements

<table>
<thead>
<tr>
<th>Voltage</th>
<th>12 VDC</th>
</tr>
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<tbody>
<tr>
<td>Max Power Consumption</td>
<td>60 W</td>
</tr>
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</table>

#### Environmental

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Operating: 5°C to 40°C, Non-Operating: -40°C to 70°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity</td>
<td>Operating: 5% to 90% RH (non-condensing), 75% RH Max above 30°C, 45% RH Max above 40°C Non-Operating: 5% to 95% relative humidity (non-condensing) as tested per MIL-PRF-28800F</td>
</tr>
</tbody>
</table>

#### Physical

<table>
<thead>
<tr>
<th>Dimensions (HWD)</th>
<th>57 mm H x 215 mm W x 272 mm D (including connectors and feet)</th>
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</thead>
<tbody>
<tr>
<td>Weight (HDA125 only)</td>
<td>1.4 kg (3.0 lbs)</td>
</tr>
<tr>
<td>Shipping Weight</td>
<td>5.5 kg (12.0 lbs)</td>
</tr>
<tr>
<td>HDA-DLS-xxQL Leadset Length</td>
<td>1023 mm (40.27&quot;)</td>
</tr>
</tbody>
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#### Certifications


Included in complete HDA125 System: | HDA125-18-LBUS | HDA125-09-LBUS | HDA125-18-SYNC | HDA125-09-SYNC |
--- | --- | --- | --- | --- |
HDA125: High-speed digital analyzer | 1 | 1 | 1 | 1 |
HDA-DLS-18QL: 18-channel Digital Leadset | 1 | – | 1 | – |
HDA-DLS-09QL: 9-channel Digital Leadset | – | 1 | – | 1 |
Soft Carrying Case for Digital Leadset and accessories | 1 | 1 | 1 | 1 |
QuickLink Solder-in Tips (QL-SI) | 18 | 9 | 18 | 9 |
LBUS Cable | 1 | 1 | – | – |
SYNC cable | – | – | – | 1 |
BNC Cable | – | – | 1 | 1 |
USB 3.1 Cable | 1 | 1 | 1 | 1 |
Power Cable | 1 | 1 | 1 | 1 |
PCF200 Deskew Fixture | 1 | 1 | 1 | 1 |
Replacement tip resistors | 10 | 5 | 10 | 5 |
Adhesive pads | 40 | 20 | 40 | 20 |
QuickLink tip labels | 40 | 20 | 40 | 20 |

Product Description

**High-speed Digital Analyzer Systems**

12.5 GS/s High-speed Digital Analyzer with 18-channel QuickLink leadset (HDA-DLS-18QL) and connection cables for LBUS-equipped oscilloscopes | HDA125-18-LBUS |
12.5 GS/s High-speed Digital Analyzer with 9-channel QuickLink leadset (HDA-DLS-09QL) and connection cables for LBUS-equipped oscilloscopes | HDA125-09-LBUS |
12.5 GS/s High-speed Digital Analyzer with 18-channel QuickLink leadset (HDA-DLS-18QL) and connection cables for ChannelSync-equipped oscilloscopes | HDA125-18-SYNC |
12.5 GS/s High-speed Digital Analyzer with 9-channel QuickLink leadset (HDA-DLS-09QL) and connection cables for ChannelSync-equipped oscilloscopes | HDA125-09-SYNC |

**Replacement Parts, QuickLink Probe Tips, and Accessories**

18 channel QuickLink leadset for HDA125 - includes 18 QuickLink Solder-in tips, 2 packs of 5 replacement tip resistors, and carrying case | HDA-DLS-18QL |
9 channel QuickLink leadset for HDA125 - includes 9 QuickLink Solder-in tips, 1 pack of 5 replacement tip resistors, and carrying case | HDA-DLS-09QL |
9-pack of replacement QuickLink Solder-in tips | QL-SI-9PACK |
Single replacement QuickLink Solder-in tip | QL-SI-1PACK |
Replacement tip resistors for QuickLink Solder-in tips (pack of 5) | PKxx0-SI |
Quantity 1 Package of Black Adhesive Pads (10/pkg) and Quantity 1 Package of White Adhesive Pads (10/pkg) | Dxx0-PT-TAPE |

**Optional Accessories**

QuickLink Adapter for use with Dxx30 amplifiers | Dxx30-QL |
QuickLink Adapter for use with Dxx20 amplifiers | Dxx20-QL |
QuickLink Adapter for use with Dxx10 amplifiers | Dxx10-QL |

Customer Service

Teledyne LeCroy oscilloscopes and probes are designed, built, and tested to ensure high reliability. In the unlikely event you experience difficulties, our digital oscilloscopes are fully warranted for three years and our probes are warranted for one year. This warranty includes:

- No charge for return shipping
- Long-term 7-year support
- Upgrade to latest software at no charge