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Technical Sales

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Detailed Specifications

For user manuals and dimensional drawings, visit the product page resources tab on ni.com.

Last Revised: 2014-11-06 07:15:01.0

NI PXIe-1491

HDMI Audio, Video, and Picture Quality Analyzer



- HDCP-encrypted Full HD (1080p60) video including 3D content and 8 channels of digital audio
- Protocol analysis tools for CEC, EDID, HPD, ARC
- Additional breakouts for HEC and monitor output
- Includes NI Video Measurement Suite (VMS) software for analysis of test patterns, timing, and InfoFrames
- Configurable test steps within NI TestStand designed for automated applications
- NI recommends NI PQA for automated, objective picture quality analysis

Overview

The NI PXIe-1491 HDMI analyzer analyzes audio, video, and communication channel protocols for multimedia devices such as set-top boxes, Blu-ray players, smartphones, tablets, infotainment centers, A/V encoders and switches, medical devices, and military A/V equipment. Using industry-leading video analysis software from NI, the NI PXIe-1491 delivers the tools for quickly developing high-throughput, automated multimedia test systems. Specific features include the ability to test up to 1080p/60Hz video and 7.1 surround sound digital audio from a content source as well as CEC, EDID, InfoFrame, ARC, and HEC. The included NI Video Measurement Suite (NI VMS) is a versatile set of video analysis and generation test solutions across validation and production test. Also, you can add NI Picture Quality Analysis (PQA) software to measure perceived quality with metrics that are closely correlated to human perception. You implement this in real time to eliminate slow, offline processing. With these tools, you can replace subjective human operators with high-throughput, objective, and reproducible test systems. The NI PXIe-1491 offers easy-to-use graphical user interfaces, more than 100 measurements on the HDMI protocol, and A/V quality that is optimized for automated test. High test throughput, coverage for design and production requirements, and low costs ensure a reduced overall cost of ownership for high-performance digital video test.

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Application and Technology

HDMI Video Signal Measurements With NI VMS

When used with NI VMS software, the NI PXIe-1491 acts as a waveform analyzer. You can acquire a single video containing common test patterns such as colorbars, ramps, multibursts, and sweeps and then analyze the horizontal lines using advanced signal processing algorithms included in NI VMS software. To ensure optimal execution speed, the system acquires one frame of video and takes several measurements on the acquired frame on lines or patterns defined by the user. Measurement time thus becomes a function of computation time and not the acquisition time, creating a system that benefits from multicore computing.

Easy-to-Use Software Interfaces for Fast Development

NI VMS software provides three different ways to develop an application for HDMI test:

1. Interactive stand-alone application (.exe) for debugging and nonautomated applications

2. Custom step types for NI TestStand for quickly configuring automated measurements and limits
3. LabVIEW API for creating custom applications

The analyzer supports Full High-Definition (1080p60) video, including 3D and HDCP-encrypted content, and deep color (36-bit/pixel) content.

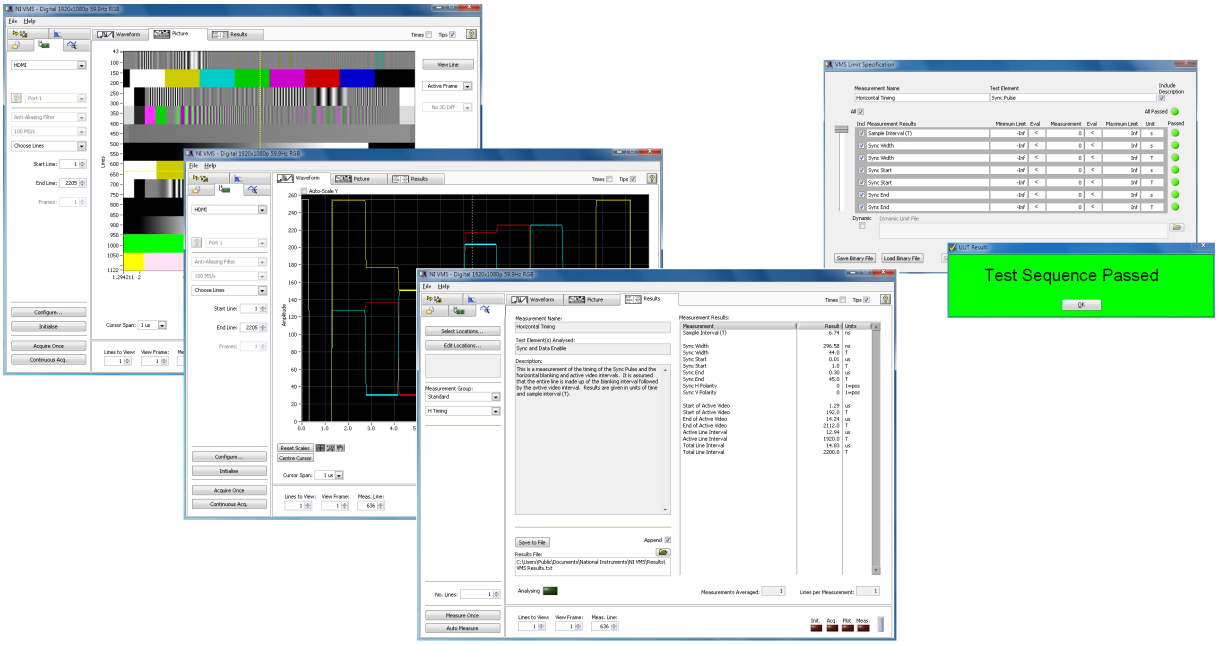


Figure 1. NI VMS software provides several ways of viewing video signal information such as the active picture (top), horizontal line waveform (middle), and measurement results (bottom). Also included is a Limits Editor (right) to create pass/fail tests for all measurements.

NI VMS offers a complete set of video measurements for analyzing high-definition HDMI video:

Amplitude and Timing	
Channel delay	Delays between the 3 channels
Color bars	Bar amplitudes and errors
Edge finder	Number of edges found Low and high levels Amplitude and center Bar width Rise and fall times

Group delay and frequency response (SinX)/X	Group delay gain
Horizontal timing	Sync width, start, and end Sync polarity: H and V Active video: start and end Active line interval Total line interval
K-factor	K 2T K-pulse bar Pulse/bar ratio and error Pulse amplitude Pulse width (HAD)
Level meter (single-point/two-point differential)	Amplitude levels: Y, U, V, or R,G,B Frequency Location/time
Line frequency	Line frequency Line period Frame frequency Sample frequency
Noise Spectrum	
Noise spectrum	Noise level, dB_{rms} and mV_{rms} Peak noise level and frequency Noise band start and stop
Linear Distortion	
Multiburst	Flag amplitudes Packet amplitudes Packet frequencies Amplitude difference
Sweep	Amplitudes Frequencies Amplitude difference
Short-time distortion	Bar amplitude and width Rise time, preshoot, overshoot, settling time Fall time, preshoot, undershoot, settling time
Nonlinear Distortion	

Nonlinearity	Nonlinearity Step nonlinearity errors
Signal Information	
Signal information	Frame rate Pixel width and height Progressive or interlaced Bits per pixel RGB or YUV 4:4:4 or 4:2:2 Encryption or not

Table 1. NI VMS offers a complete set of video measurements for analyzing high-definition HDMI video.

Picture Quality Analysis

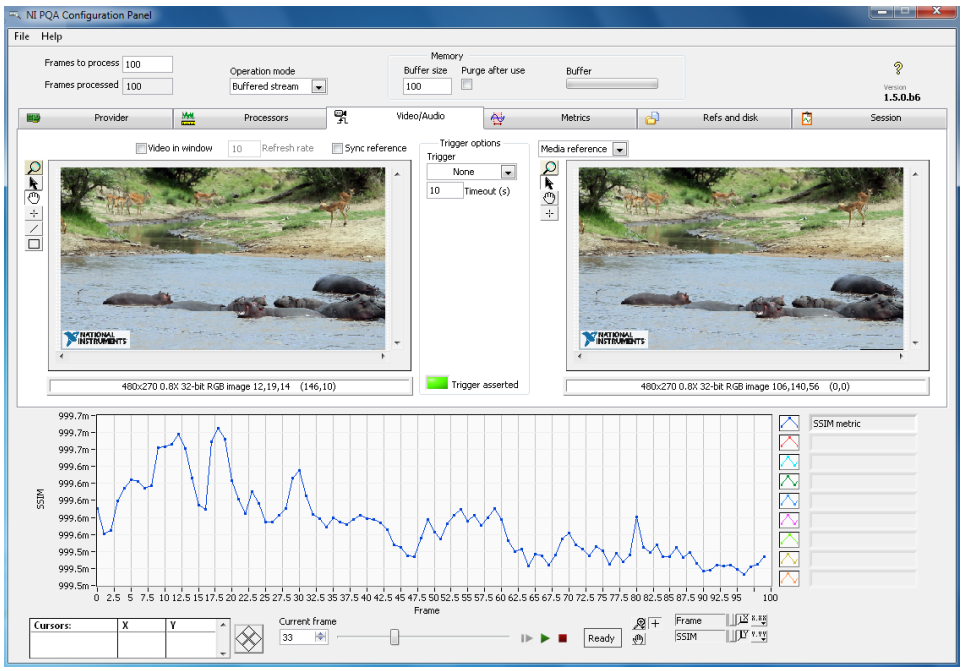


Figure 2. NI Picture Quality Analysis is running the structural similarity index metric (SSIM) algorithm on an incoming test content stream.

NI Picture Quality Analysis (NI PQA) software is an add-on to the NI PXIe-1491 that analyzes HDMI video and audio streams for overall quality. Using high-performance reference tests, you can remove the doubt of operator inspection and test products in a fraction of the time.

Referenced Versus Nonreferenced Tests and Triggering

NI PQA can perform referenced or nonreferenced measurements. For referenced tests, you can acquire a reference stream from a "golden" device and either compare measurement results (known as **reduced-reference**) or perform a pixel-to-pixel comparison between reference and test streams (known as **full-reference**). NI PQA provides multiple triggering to synchronize the reference and test streams including region of interest (ROI) intensity, optical character recognition (OCR), pattern matching, and a user-defined trigger VI, which you can use for hardware triggering or other custom triggering.

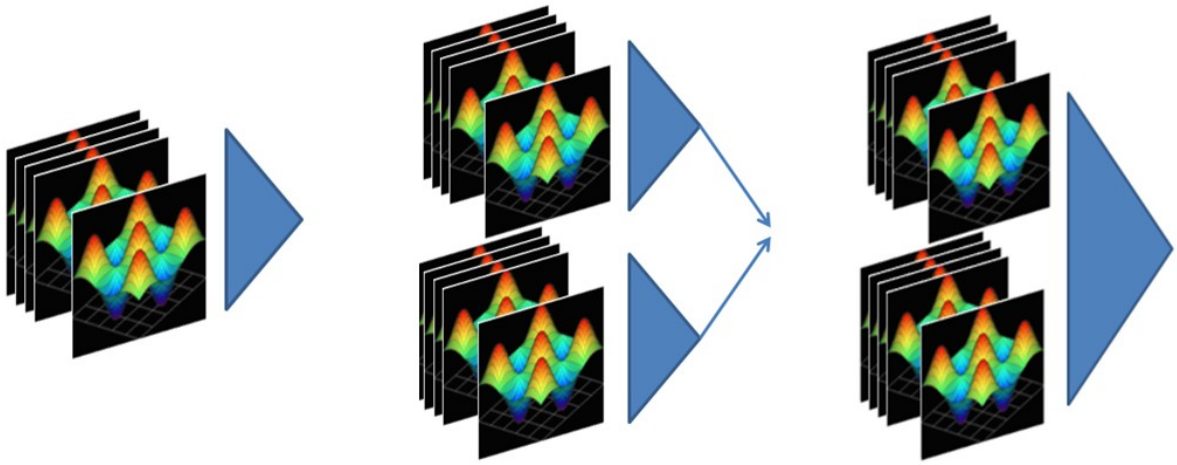


Figure 3. You can perform picture quality analysis with three methods: 1. nonreferenced test where the video stream is unknown or unrepeatable (left), 2. reduced reference test where measurements made on a reference stream are compared to measurements made on a test stream (middle), and 3. pixel-to-pixel comparison between test and reference streams, known as a full reference test (right).

Types of Measurements

NI PQA offers three types of measurements to cover a variety of application requirements:

1. **Defect-specific** measurements identify key defects in audio or video quality such as blockiness, audio drops, and stuck frames. (See a full list of measurements in Table 2).
2. **Total picture quality**, or perceptual video quality, measurements perform a full-reference measurement to create an overall score for the video quality. The most common total picture quality measurement is peak signal-to-noise ratio, or PSNR, which uses the mean-squared error (MSE) calculation. NI PQA also provides a differential mean opinion score (DMOS) based on the complex wavelet-structural similarity (CW-SSIM) index developed by Dr. Albert Bovik and the team at The University of Texas Laboratory for Image and Video Engineering (LIVE). CW-SSIM has proven to highly correlate with perceived quality, making it a strong alternative to operator inspection.
3. The **user-defined** measurement helps you apply custom analysis algorithms to the acquired A/V signals. This measurement is supported only for non-HDCP encrypted video signals due to HDCP regulations.

PQA Measurements:

- Blockiness
- MTF Contrast
- Dropped/Stuck Frames
- Checkers
- Gradient
- Color Levels
- Pattern Match
- Mean Squared Error
- Optical Character Recognition
- Test Delay
- Audio Sound Pressure Level (SPL)
- Singe Tone FRF and THD
- Audio/Video Sync (Lip Sync)
- Peak Signal-to-Noise Ratio (PSNR)
- Structural Similarity Index Metric (SSIM)
- User-Defined

Processor Recommendations

When analyzing high-definition A/V signals such as 1080p60, measurements must be performed as fast as possible since high-definition content can quickly fill any buffer. The NI PQA measurements use NI LabVIEW multicore computing to optimize computational performance.

For applications that require 1080p 24Hz (or similar bandwidth such as 1080i60 or 720p60), National Instruments recommends the NI PXIe-8135 quad-core embedded controller.

For applications that require 1080p 60Hz analysis, NI recommends using an external PC based on the Intel i7 980x processor with the NI PXIe-PCIe8371 kit (or NI PXIe-PCIe8372 if using a RAID system) for real-time tests. The 1080p 60Hz applications that require only a few seconds of analysis, such as production test, can use the NI PXIe-8135 quad-core embedded controller. NI experts can help you design the best configuration for your application by reviewing test requirements or application goals.

HDMI Audio Signal Measurements With NI AudioMASTER

The NI Digital Audio Analyzer is a software add-on to the NI PXIe-1491 that includes NI AudioMASTER software. The NI PXIe-1491 can acquire 2- to 8-channel embedded audio at sample rates up to 192 kHz including HDCP-encrypted audio.

Easy-to-Use Software Interfaces

NI AudioMASTER software provides an easy-to-use software interface to quickly configure HDMI audio measurements. With the NI AudioMASTER custom test step in NI TestStand, you can select measurements, configure limits, and process HDMI audio signals.

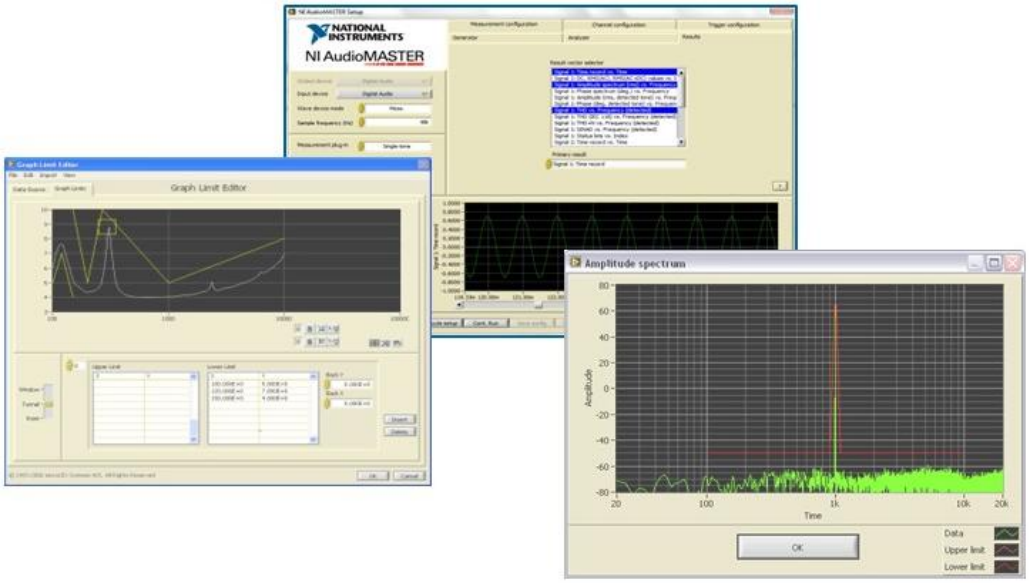


Figure 4. Using the NI Digital Audio Analyzer, you can analyze all embedded channels in the HDMI signal. NI AudioMASTER software has high-performance measurements for analyzing single tones, multitones, amplitude sweeps, frequency sweeps, and more to test not only functionality but also audio quality.

NI AudioMASTER provides a complete set of audio measurements for analyzing HDCP-encrypted HDMI embedded audio. You can apply any set of measurements to all channels of the embedded audio.

HDMI Signal Type:

- Amplitude Sweep
- Coherent Sweep
- Multiple Pure Tones
- Multi-Tone
- Polarity
- Single-Tone
- Step Response
- Waveform Analyzer

HDMI Signal Measurements

- Tone Frequency (Hz)
- Tone Amplitude
- Tone Phase (Deg)
- DC
- Broadband RMS
- THD
- THD+N
- SINAD
- Dynamic Range (SNR)
- Spectrum (RMS)
- Amplitude Spectrum (RMS)
- Phase Spectrum (Deg)
- Status Bits
- Octave Band (1/n) RMS
- Time Record
- Channel Phase Difference
- Channel Amplitude Difference

HDMI 1.4 Protocol Analysis: InfoFrames, CEC, DDC, and HPD

You also can use the NI PXIe-1491 to test HDMI 1.4 protocols including InfoFrames, CEC messaging, EDID emulation, and HPD events to ensure successful interoperability with other HDMI devices.

InfoFrame Measurements, CEC Messaging, EDID Emulation, and HPD Events

NI VMS software provides built-in measurements to verify that InfoFrame content is being generated correctly by the device under test (DUT). Supported InfoFrames include Audio InfoFrame, AVI InfoFrame, HDMI InfoFrame, MPEG InfoFrame, SPD InfoFrame, VBI InfoFrame, and General Parameters.

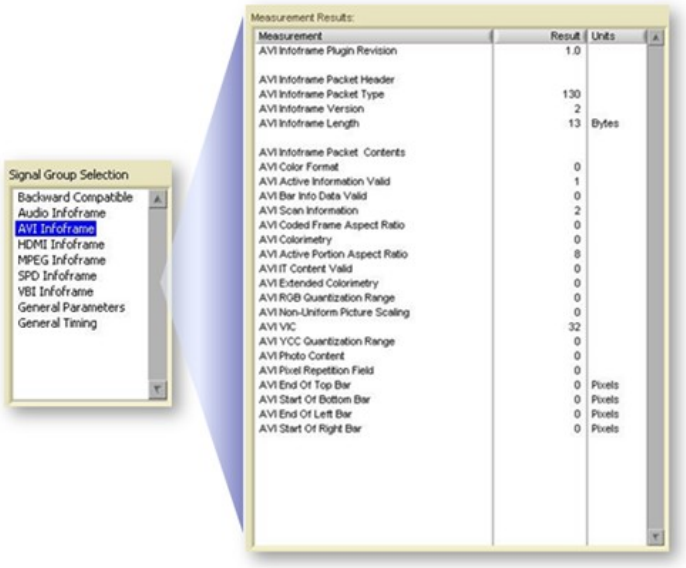


Figure 5. The NI PXIe-1491 measures InfoFrame packet bytes.

The NI CEC Analyzer utility is included with the NI PXIe-1491 to send and receive CEC messages from the DUT. The utility supports CEC Version 1.3 and 1.4 messaging protocols and can be used to force a DUT into specific action states, query current states, or analyze CEC implementation. The NI CEC Analyzer utility comes as a stand-alone application (.exe) and includes a LabVIEW API for automated measurements.

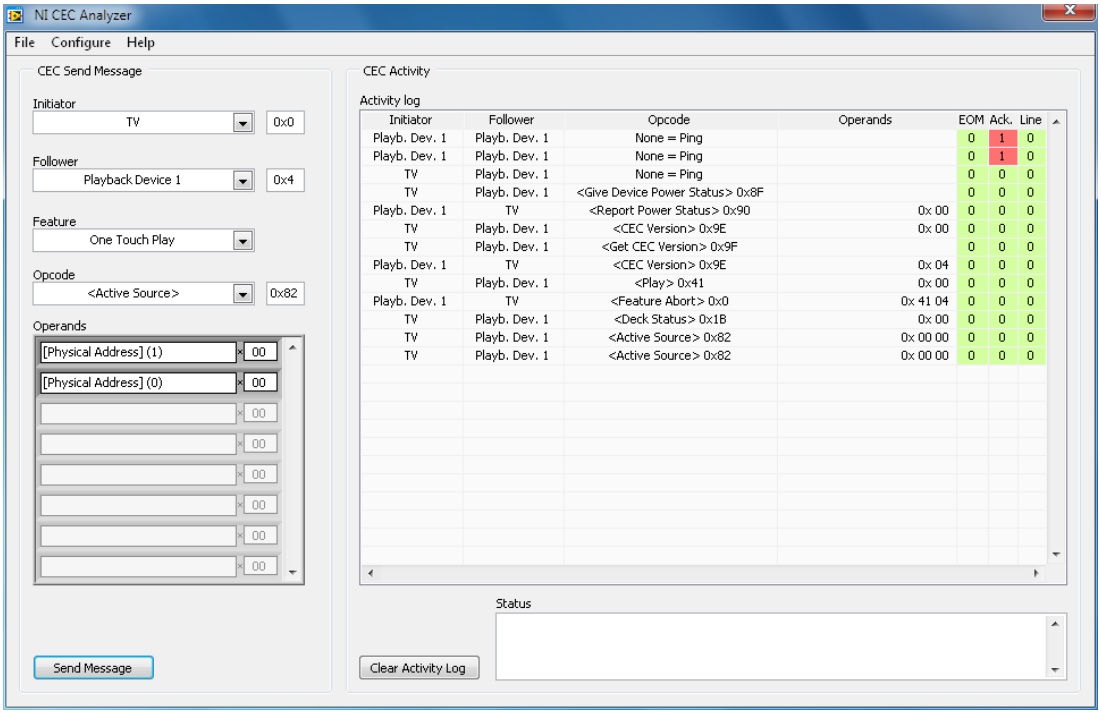
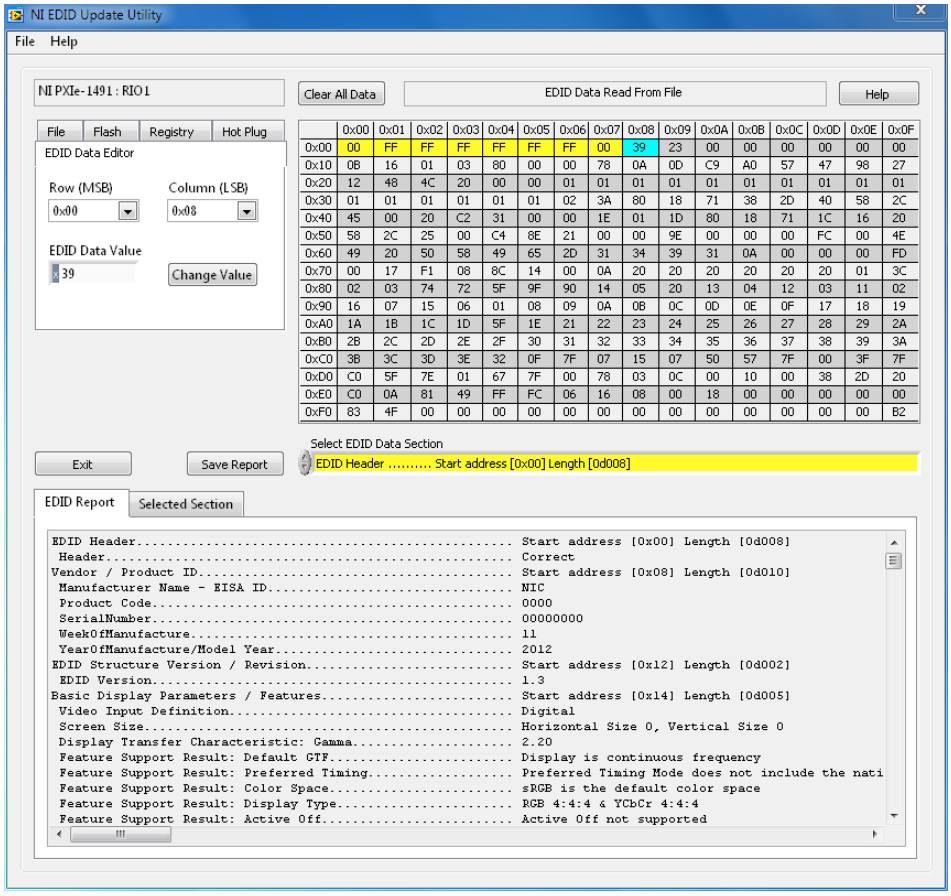


Figure 6. The NI CEC Analyzer utility generates CEC messages and receives and analyzes responses from the DUT.

The NI EDID Update utility is also included with the NI PXIe-1491 to programmatically load new EDID tables onto the analyzer, allowing it to simulate different models of HDTVs or other displays. With EDID emulation, you can better guarantee interoperability with nearly any HDMI-capable device.

One of the most well-known features of HDMI 1.4 is 3D video, which requires in-depth testing on EDID negotiations and InfoFrames to ensure 3D capabilities are negotiated properly. The NI PXIe-1491 supports a variety of 3D formats including Frame Packing, Side-by-Side Full, and Side-by-Side Half. For other 3D implementations, NI can work with you to ensure the NI PXIe-1491 supports your application.

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	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07	0x08	0x09	0x0A	0x0B	0x0C	0x0D	0x0E	0x0F
0x00	00	FF	FF	FF	FF	FF	FF	00	39	23	00	00	00	00	00	00
0x10	0B	16	01	03	80	00	00	78	0A	0D	C9	A0	57	47	98	27
0x20	12	48	4C	20	00	00	01	01	01	01	01	01	01	01	01	01
0x30	01	01	01	01	01	01	02	3A	80	18	71	38	2D	40	58	2C
0x40	45	00	20	C2	31	00	00	1E	01	1D	80	18	71	1C	16	20
0x50	58	2C	25	00	C4	8E	21	00	00	9E	00	00	00	FC	00	4E
0x60	49	20	50	58	49	65	2D	31	34	39	31	0A	00	00	00	FD
0x70	00	17	F1	08	8C	14	00	0A	20	20	20	20	20	20	01	3C
0x80	02	03	74	72	5F	9F	90	14	05	20	13	04	12	03	11	02
0x90	16	07	15	06	01	08	09	0A	0B	0C	0D	0E	0F	17	18	19
0xA0	1A	1B	1C	1D	5F	1E	21	22	23	24	25	26	27	28	29	2A
0xB0	2B	2C	2D	2E	2F	30	31	32	33	34	35	36	37	38	39	3A
0xC0	3B	3C	3D	3E	32	0F	7F	07	15	07	50	57	7F	00	3F	7F
0xD0	C0	5F	7E	01	67	7F	00	78	03	0C	00	10	00	38	2D	20
0xE0	C0	0A	81	49	FF	FC	06	16	08	00	18	00	00	00	00	00
0xF0	83	4F	00	00	00	00	00	00	00	00	00	00	00	00	00	B2

Figure 7. With the NI EDID Update utility, you can load new EDID tables to the NI PXIe-1491 to simulate various display settings or force negotiation errors.

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Support and Services

System Assurance Programs

NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at ni.com/advisor to find a system assurance program to meet your needs.

Calibration

NI measurement hardware is calibrated to ensure measurement accuracy and verify that the device meets its published specifications. To ensure the ongoing accuracy of your measurement hardware, NI offers basic or detailed recalibration service that provides ongoing ISO 9001 audit compliance and confidence in your measurements. To learn more about NI calibration services or to locate a qualified service center near you, contact your local sales office or visit ni.com/calibration.

Technical Support

Get answers to your technical questions using the following National Instruments resources.

- **Support** - Visit ni.com/support to access the NI KnowledgeBase, example programs, and tutorials or to contact our applications engineers who are located in NI sales offices around the world and speak the local language.
- **Discussion Forums** - Visit forums.ni.com for a diverse set of discussion boards on topics you care about.
- **Online Community** - Visit community.ni.com to find, contribute, or collaborate on customer-contributed technical content with users like you.

Repair

While you may never need your hardware repaired, NI understands that unexpected events may lead to necessary repairs. NI offers repair services performed by highly trained technicians who quickly return your device with the guarantee that it will perform to factory specifications. For more information, visit ni.com/repair.

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Training and Certifications

The NI training and certification program delivers the fastest, most certain route to increased proficiency and productivity using NI software and hardware. Training builds the skills to more efficiently develop robust, maintainable applications, while certification validates your knowledge and ability.

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- **On-site training at your facility** - an excellent option to train multiple employees at the same time.
- **Online instructor-led training** - lower-cost, remote training if classroom or on-site courses are not possible.
- **Course kits** - lowest-cost, self-paced training that you can use as reference guides.
- **Training memberships** and training credits - to buy now and schedule training later.

Visit ni.com/training for more information.

Extended Warranty

NI offers options for extending the standard product warranty to meet the life-cycle requirements of your project. In addition, because NI understands that your requirements may change, the extended warranty is flexible in length and easily renewed. For more information, visit ni.com/warranty.

OEM

NI offers design-in consulting and product integration assistance if you need NI products for OEM applications. For information about special pricing and services for OEM customers, visit ni.com/oem.

Alliance

Our Professional Services Team is comprised of NI applications engineers, NI Consulting Services, and a worldwide National Instruments Alliance Partner program of more than 700 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit ni.com/alliance.

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Detailed Specifications

NI PXIe-1491Specifications

This document lists specifications for the NI PXIe-1491 (NI 1491) high-definition multimedia interface (HDMI).

Specifications are warranted under the following conditions: you have installed software support for the NI 1491. Install one of the following software applications to automatically install software support for the NI 1491: NI Picture Quality Analysis (PQA) 1.5 or later, NI Video Measurement Suite (VMS) 3.2 or later, or NI AudioMASTER 6.3 or later.

Note The features and functions of the NI 1491 depend on the software support you install.

Specifications describe the warranted, traceable product performance over ambient temperature ranges of 0 ºC to 55 ºC, unless otherwise noted.

Typical values describe useful product performance beyond specifications that are not covered by warranty and do not include guardbands for measurement uncertainty or drift. Typical values may not be verified on all units shipped from the factory. Unless otherwise noted, typical values cover the expected performance of units over ambient temperature ranges of 23 °C ± 5 °C with a 90% confidence level, based on measurements taken during development or production.

Nominal values (or supplemental information) describe additional information about the product that may be useful, including expected performance that is not covered under Specifications or Typical values. Nominal values are not covered by warranty.

Specifications are subject to change without notice. For the most recent NI 1491 specifications, visit ni.com/manuals.

Caution Refer to the *Read Me First: Safety and Electromagnetic Compatibility* document for important safety and electromagnetic compatibility information. To obtain a copy of this document online, visit ni.com/manuals and search for the document title.

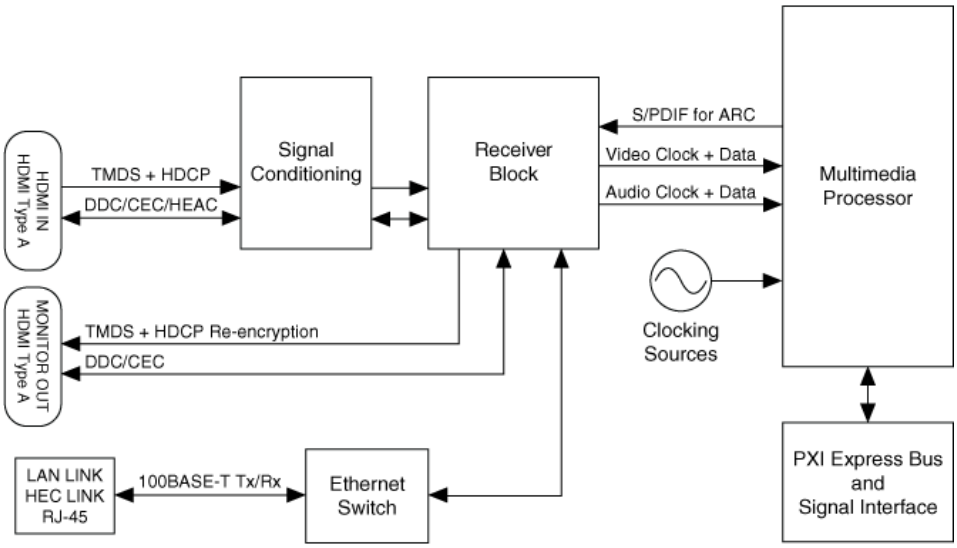
To access documentation for the software applications that support the NI 1491, navigate to **Start»All Programs»National Instruments»<*Application*>»Documentation**, where ***<Application>*** stands for NI Picture Quality Analysis (PQA) 1.5 or later, NI Video Measurement Suite (VMS) 3.2 or later, or NI AudioMASTER 6.3 or later, depending on which applications you have installed.

Caution To ensure the specified EMC performance, operate this product only with HDMI-compliant cables and accessories.

Hardware Block Diagram

The following figure shows the hardware block diagram of the NI 1491.

Figure 1. NI 1491Hardware Block Diagram



HDMI Input (HDMI IN connector)	
HDMI functions[1]	Video, audio, CEC, ARC, HEC, HPD
TMDS clock rate[2]	25 MHz to 225 MHz
Video clock rate	25 MHz to 165 MHz
Maximum resolution[3]	
60 Hz (HDTV)	1080p
30 Hz (3D HDTV)	1080p
60 Hz UXGA graphics	1600 × 1200
Color depth	8 bits to 12 bits per color channel[4]
Chroma formats	
RGB	4:4:4
YCbCr	4:4:4 or 4:2:2
Audio channels[5]	8-channel LPCM or encoded audio
Audio sample rate	32 kHz to 192 kHz
ARC channels	2
ARC sample rates	32, 44.1, or 48 kHz
ARC sample rate accuracy, typical	35 ppm
HEC data rate, nominal	100 Mbps

Note To reduce the capabilities of the NI 1491 as presented to the HDMI source, use the NI EDID Update Utility. For example, you might want to do so in order to match the HDMI capabilities of the NI 1491 to those of a device under test.

Monitor Output (MONITOR OUT connector)	
Function[6]	Repeater
Source	HDMI IN connector
HDMI functions	Video, audio
Video Triggers	
Trigger type	Start

Sources	Immediate, PXI_TRIG<0..7>
Detection	Immediate, PXI_TRIG<0..7>
Detection start	Edge (rising or falling)
Minimum detectable pulse width	64 ns
Destinations[7]	PXI_TRIG<0...7>
Audio Triggers	
Trigger type	Start
Sources	Immediate, PXI_TRIG<0..7>, or Audio channel <0..7>
Detection[8]	
Audio channel	Level crossing
PXI_TRIG<0..7>	Edge (rising or falling)
Minimum detectable pulse width	64 ns
Destinations[9]	PXI_TRIG<0...7>
Software	
Driver software	The NI 1491 is supported through application software. When you install the software support, you are prompted to install any drivers required by the software.
Application software	Install one of the following software applications to automatically install software support for the NI 1491: NI Picture Quality Analysis (PQA) 1.5 or later, NI Video Measurement Suite (VMS) 3.2 or later, or NI AudioMASTER 6.3 or later.
Application development environments	Depending on software support, you can program the NI 1491 in LabVIEW or Microsoft Visual C++.
Testing sequence environment	Depending on software support, you can program the NI 1491 in NI TestStand.
Test panel	National Instruments Measurement & Automation Explorer (MAX) provides device verification for the NI 1491.

Note Refer to the *NI PXIe-1491 Getting Started Guide* for more information about software support for the environments in which you can program the NI 1491.

Power	
+3.3 VDC	2.3 A
+12 VDC	2.4 A
+5 V_{aux}	None
Total power	30 W
Dimensions and Weight	
Dimensions	3U, One Slot, PXI Express Module 21.6 × 2.0 × 13.0 cm (8.5 × 0.8 × 5.1 in.)
Weight	208 g (7.3 oz)
Front Panel Connectors and Indicators	

This section describes the connectors and LED indicators on the NI 1491.

Figure 2. NI 1491 Front Panel

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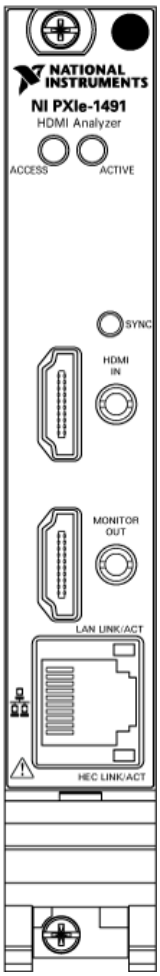


Table 1. NI 1491 Front Panel Connectors

Connector	Function(s)
HDMI IN	HDMI-compliant input. Depending on software support, supports audio return channel (ARC) and Ethernet over
MONITOR OUT	HDMI-compliant repeater output from HDMI IN connector.
HEC/LAN	Provides 100BASE-T access to HEC from HDMI IN connector path. Does not serve as an end-point ad

Table 2. NI 1491 Front Panel LEDs

LED	Indications
ACCESS	Indicates the following basic hardware statuses of the module: ▪ OFF—The module is not yet functional or detected a problem with a power rail. ▪ AMBER—The module is being accessed. Accessed means that the device setup registers are being written to in order to control the device. ▪ GREEN—The device is ready to be programmed. ▪ RED—The device exceeded approved operating temperature and thermal shutdown occurred.
ACTIVE	Indicates the following active states: ▪ OFF—The device is not armed, triggered, or acquiring a waveform. ▪ AMBER—The device is armed and waiting for a trigger. ▪ GREEN—The device received a Reference trigger. A green LED also indicates that the device is acquiring a waveform. ▪ RED—The device detected an error. You must use the application software to access the device to determine the cause of the error. The LED remains red until the error condition is removed.
SYNC	Indicates the following states for the selected input: ▪ OFF—No valid input signal from the source is detected, or the device is not yet in an operational state. ▪ GREEN—The device detected a valid input signal from the source.
LAN LINK/ACT	Indicates the following states for the selected input: ▪ GREEN—There is a link over the Ethernet cable, but there is no active communication. ▪ BLINKING GREEN—There is active communication over the Ethernet cable.
HEC LINK/ACT	Indicates the following states for the selected input: ▪ YELLOW—The device is not yet functional, or there is a link over the HDMI cable, but there is no active communication. ▪ BLINKING YELLOW—There is active communication over the HDMI cable.

Environment	
Maximum altitude	2,000 m (at 25 °C ambient temperature)
Pollution Degree	2

Indoor use only.

Operating Environment

Ambient temperature range	0 °C to 55 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)
Relative humidity range	10% to 90%, noncondensing (Tested in accordance with IEC-60068-2-56.)

Storage Environment

Ambient temperature range	-40 °C to 70 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)
Relative humidity range	5% to 95%, noncondensing (Tested in accordance with IEC-60068-2-56.)
Operational shock	30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F)
Random vibration	
Operating	5 Hz to 500 Hz, 0.3 g_{rms}
Nonoperating	5 Hz to 500 Hz, 2.4 g_{rms} (Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

Compliance and Certifications

Safety

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note For UL and other safety certifications, refer to the product label or the Online Product Certification section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia, and New Zealand (per CISPR 11), Class A equipment is intended for use only in heavy-industrial locations.

Note Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.

Note For EMC declarations and certifications, refer to the Online Product Certification section.

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

To obtain product certifications and the DoC for this product, visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial not only to the environment but also to NI customers.

For additional environmental information, refer to the *NI and the Environment* web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

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Waste Electrical and Electronic Equipment (WEEE)



EU Customers At the end of the product life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste Electrical and Electronic Equipment, visit ni.com/environment/weee.htm.

RoHS



National Instruments(RoHS)National InstrumentsRoHS ni.com/environment/rohs_china(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

[1] This feature depends on the software support you install for the NI 1491.

[2] The TMDS clock rate is higher than the video clock rate for deep color video formats.

[3] The actual resolution in 3D depends on the 3D mode. Higher frame rates are possible for lower spatial resolutions.

[4] Deep color video is 10 bits or 12 bits per channel.

[5] Depending on software support, you can program this feature.

[6] The HDMI monitor output provides the content of the selected input, from the HDMI IN connector. The video format and frame rate for the monitor output are the same as for the input.

[7] 200 ns pulse width, typical.

[8] This feature depends on the software support you install for the NI 1491. Depending on support, you can program the level and hysteresis.

[9] 200 ns pulse width, typical.

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