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quantumdata[™] 780E Video Generator / Protocol Analyzer for HDMI, DisplayPort & HDBaseT



Key Features

- HDMI, HDBaseT and DisplayPort (DP optional on 780E p/n 00-00251) input and output ports for testing both source and display devices as well as cables and distribution networks
- Test Ultra High Definition video products supporting 4K resolutions up to 600 MHz for HDMI
- Video pattern and format library with programmable settings
- HDR Lab test pattern pack and Dolby Vision test image for testing HDR on HDMI Ultra HD TVs
- Protocol tests for digital video sources and displays
- Protocol logging application auxiliary channel analyzer (ACA) enables real time monitoring of EDID exchanges, HDCP (including HDCP 2.2) and HDMI SCDC, DisplayPort Aux Chan link training transactions and CEC messages (for HDMI)
- Passive protocol logging between a source and a sink is also optionally supported on HDMI ports
- Interface to color calibration software packages CalMan and ChromaPure
- Report File Creation feature provides HTML formatted report of tests performed

Important Note: There are two models of the 780E Video Generator/Analyzer. The initial 780E model (part number 00-00243) offers HDMI, DisplayPort and HDBaseT as standard interfaces. The newer 780E model (part number 00-00251) introduced in August of 2018, offers HDMI and HDBaseT interfaces as standard but with the DisplayPort interfaces optionally activated through a software license (part number 95-00172). This second, newer 780E model is offered at a lower price.

The Teledyne LeCroy quantumdata 780E Video Generator / Protocol Analyzer for HDMI, DisplayPort and HDBaseT Testing offers a wide array of benefits to engineers in R&D as well as professional A/V installers in the field for testing HDMI, HDBaseT and DisplayPort devices. The portable size and user-friendly touch screen interface provide convenience to complement the rich feature set. Because the 780E instrument is equipped with both input and output ports, engineers and proA/V integrators can run a variety of video, audio and protocol tests on digital video sources, displays, distribution equipment and cables. The user interface design and test functions greatly reduce time to insight whether running tests on distinct devices or entire digital video distribution networks.

Diagnose and Troubleshoot

The 780 models provide an at-a-glance status bar on the bottom of the 7" in touch screen. The status bar provides basic information about what the instrument is transmitting to a display and what it is receiving from a source. The instruments can run guick video audio and protocol tests on individual sources, displays, repeaters, distribution gear as well as cables. Protocol tests include tests for EDID, HDCP authentication-1.4 & 2.2-infoframes and timing data. You can place the 780E at any point in a video distribution network and run tests upstream toward the source while emulating a display (or sink). Or you can run tests downstream while emulating a source. Generator reports to demonstrate test series completion.

Ease of Use

The 780E's large color touch screen provides ease of use and quick status information. The rich set of routine tests and diagnostic tests are accessible with just a few touch clicks. You can quickly configure settings on the outputs. A rich command set, available either through USB or RS-232 serial ports, supports automated testing.

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SOURCE & NETWORK DIAGNOSTIC TEST FEATURES

View Incoming Video & Data

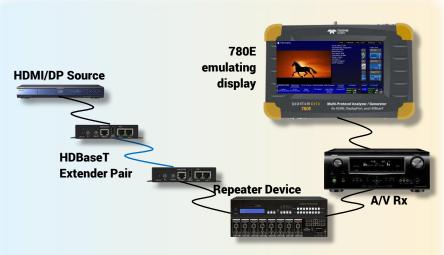
The 780E status bar provides essential information about the incoming video. The Video Display Test shows the incoming video and essential video and audio metadata. Both provide guick time to insight when conducting routine tests or diagnosing interoperability problems.

Test Response to EDIDs

Many interoperability problems are related to EDIDs. 780E enables you to emulate any EDID to test a source's response. You can use commercial EDIDs or test EDIDs with specific video and audio support. Test with EDIDs with known anomalies or grab an EDID from a UHD TV for future testing.

View Aux Channel Transactions

Complex interoperability problems require visibility into the auxiliary channel. You can monitor HDMI and HDBaseT Display Data Channel data to view EDID, HDCP SCDC (HDMI) and CEC (HDMI) transactions. Also view DisplayPort link training logs on the Aux Channel. Check details of each transaction and distribute to colleagues and subject matter experts.



Example Source Test Setup

Verify Cable / Network (Loop)

The 780E enables you to test distribution equipment to verify integrity of extenders, repeaters, matrix switches and distribution amps. You can test individual devices or entire networks including digital video cables.

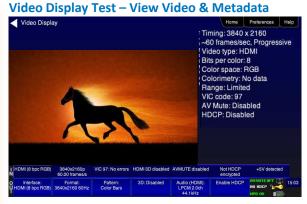
HDBaseT

Verify Video at Far End

The 780E supports testing of installed distribution networks from the far-end at the display.



Example Network Test Setup



Format Analyzer – View Metadata & Timing

<	Format Analyz	zer				Home	Preferences	Help
	Read Errors: None	Total: Active Frame Scant HSYN HSYN VSYN VSYN HSYN	type: Displat 4400 x 2250 : 3840 x 216 es/sec: 60.00 type: Progres IC delay: 176 C delay: 8 C delay: 8 C width: 10 IC polarity: + C polarity: +) 60 ssive 6	Color Pixels Video (3840 @ 59 AV M	er comp.: 8 r space: RG rimetry: No s repeated o ID code (1 0 x 2160 p .94Hz/60H ute Status: P: Not encr	GB data 0 times VIC): 97 Iz 16:9) Not muted	
ň	DP (8 bpc RGB)	3840x2160p 60.00 frames/s	VIC 97: No errors	HDMI 3D disabled	AVMUTE disabled	Not HDCP encrypted	+5V detected	
ß	Interface: DP (8 bpc RGB) 3	Format: 3840x2160 60Hz	Pattern: PGCwrgb	3D: Disabled	Audio (Disabled): LPCM 2.0ch	Enable HDCP		21:01

Cable Test (HDBaseT) - Verify Networks/Cables

Cable Test			Home	Reports Menu	Preferences	Help
Test Wire Test Repeater Test Remote PRN Frame Capture Frame Compare Test Remote HDBaseT Number of Frames 100 150 +100 Reset +100	+5v: PASS 2160,930 (8 bits) 1080,960 (12 bit 1080,960 (8 bits) 720,960 (8 bits) 480,960 (8 bits) Hot.Plug: PASS CEC: Rx PASS DDC: PASS	s): 0 errors): 0 errors 0 errors 0 errors	Firmua Operati Cable k HDBar HDBT Firmua Cable k Cable k Firmua Cable k Cable k Cable k HDBas Cable k HDBas Cable k HDBas Cable k HDBas HDBTd	bT Tx Local Info: to Version: 130900 n Mode: HDBase ongth estimated to evice connected 1 version: 130900 ISE): -2209, -21d6 Version: 130900 SE): -2209, -22d6 version: 130900 SE): -2209, -22d6 version: 130900 SE): -2209, -22d6 version: 130900 n Mode: HDBase ongth estimated to node: HDBase ongth estimated to	T be <20 meters b < 20 meters b < 20 meters b < 20 meters to X: VS100RX C00 (20140701) A, 21dB, 21dB to 20 meters C00 (201407701) A, 22dB, 22dB T be <20 meters to a<20 meters to	
HDBaseT (12 bpc 720x480p 60.0 RGB) frames/s	0 VIC 2: No errors	HDMI 3D disabled	AVMUTE disabled	Not HDCP encrypted	+5V detected	
Interface: Format: HDBaseT (8 bpc 720x480 60Hz RGB)	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz	Enable HDCP	AVHUTEOFF	14

Verify Distribution Network from Far End

Cable Test			Home	Reports Menu	Preferences	Help
Test Wire	+5v: PASS					
Test Repeater	1920 x 2160p: 10 frames com					
Test Remote PRN	To hames com	pareu.				
Frame Capture						
Frame Compare						
Test Remote HDBaseT						
-100 Number of Frames -100 150 +100 -10 Reset +10						
HDMI (12 bpc 720x480p 60.00 RGB) trames/s	VIC 2: No errors	HDMI 3D disabled	AVMUTE disabled	Not HDCP encrypted	+5V detected	
Interlace: Format: HDMI (8 bpc RGB) 720x480 60Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP		14:20

SINK (DISPLAY) TEST & DIAGNOSTIC FEATURES

Verify Video

Select from CEA and VESA formats or create custom formats including 4K resolutions for UHD testing. Use the test pattern library to verify specific video display elements. Set bit depth, pixel encoding, colorimetry and sampling parameters. Use industry standard patterns for color calibration. Scroll bitmaps to test motion artifacts.

Verify EDID Contents

Many interoperability problems are EDID related. View EDID contents of a connected display to verify audio and video capabilities (including HDR elements). Verify the structure of an EDID and check for compliance.

Verify Audio

Verify audio on displays or audio systems using programmable LPCM test tones. Set sampling rate, bit depth, amplitude and number of channels. Select Dolby and DTS compressed audio clips including Dolby TrueHD & DTS Master Audio.

Select Video Formats



EDID Verification Test

EDID Test	Home	T.2020 C RGB
Read EDID	EDID Summary: Header is OK. All checksums OK. EDID Ver. 1.3	
Load EDID	HDMI: Yes (PA 1.0.0.0, 36, 30 bit color, 3D supported)	olor Dep
Save EDID		8 bpc
Compare	Speakers: [RLC/RRC RL/RR FC LFE FL/FR] PCM 8 ch., [32 44.1 48 88.2 96 176.4 192] kHz @ [16 20 24] N AC-3 8 ch., [32 44.1 48] kHz, max rate 640 kHz	HDBase signa
Use on Rx	DTS 8 ch [44 1 48] kHz max rate 1536 kHz V	DBaseT RGB
Auto-EDID Te	DTS-HD 8 ch., [44.1 48 88.2 96 176.4 192] kHz est MAT (MLP) 8 ch., [44.1 48 88.2 96 192] kHz	
	1840x2160p Unknown HDMI3D disabled AVMUTE disabled HDCP disabled	+5V det

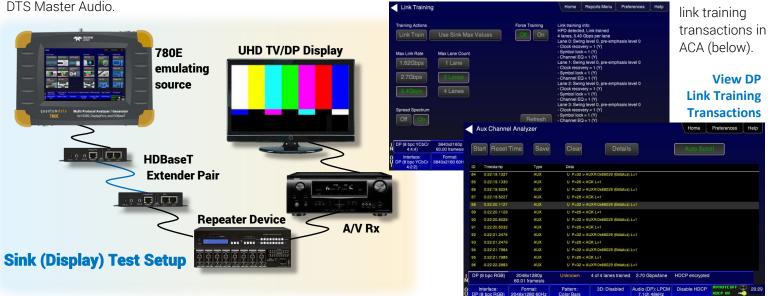
NEW! Test HDR on an Ultra HD TV

You can verify an Ultra HD TVs HDR capabilities with optional HDR pattern packs: 1) HDR Lab (below) and 2) Dolby Vision. HDR Lab includes HDR Test Patterns and selected HDR Still Picture reference images. Dolby Vision test image verifies embedded HDR metadata.



Verify DisplayPort Link Training

Verify DP link training using a variety of settable parameters. Specify link rate, number of lanes, voltage swing and preemphasis. Or allow link training based on a display's capabilities (below). View



Configure DP

Link Training

Verify HDCP Authentication

HDCP authentication problems occur in complex digital video distribution networks. Use the HDCP test to quickly check HDCP 1.3/1.4 and HDCP 2.2 authentication. Enabling and disabling HDCP can quickly reveal the nature of an interoperability problem. Monitor the HDCP transactions during the HDCP test using the Aux Channel Analyzer.

Aux Channel Analyzer (ACA)

Aux Channe	l Analyzer				Home Pre	ferences Help	J					
Start	Save	Clear	Details		Auto Scroll			HD	CP Aut			_
					HDCP Out	out Test			Home	Reports Menu	Preferences	Help
Timestamp	Туре	Data										
0:04:37.6282	DDC	U HDCP MASTER -	SLAVE I2C Request	R/]								
							1					
							Disable		ver ID = 0x05E7AC	243B6		
									os = 0x020000 ()			
							Auto-Restart	Authe	ntication, locality cl	heck and key ex	change succeed	ied.
					HDCP Ve	arsion 1.x	2.2					
0:04:41.8954	DDC	U HDCP_SLAVE >	MASTER 12C HDCP Ret	sponso								
0:04:43.2121	HPD	U Tx/U Port Faling E	dge		HDCP 2.2 Stream	Туре Туре	0 Тура	e 1				
		U Tx/U Port Rising E										
0:04:44.8017		U EDID MASTER ->	SLAVE I2C E-EDID Se	gment 0								
0:04:44.8021	DDC	U EDID MASTER ->	SLAVE I2C Request O	ffsot 0								
0:04:44.8024		UEDID SLAVE -> N	ASTER I2C Response									
HDMI (8 bpc RGB)	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	Result: PASS							
HDMI (8 bpc RGB)	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz								
					HDMI (12 bpc N RGB)	3840x2160p 30.00 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	HDCP 2.2 encrypted	+5V detected	
					O Interface:	Format:	Pattern:	3D: Disabled	Audio (HDMI):	Disable HDCP		14:03

SPECIFICATIONS

HDMI	
Version	HDMI 2.0b
Standard Formats	VESA (DMT, CVT-R, CVT), CEA
Connector	(1) Type A Tx; (1) Type A Rx
Protocol	HDMI, DVI
Video Colorimetry	ITU-R BT.601-5, ITU-R BT.709-5, BT.2020 (YCbCr)
Video Max Pixel Rate	600MHz (6.00 Gbps/channel TMDS rate); 18Gbps aggregate data rate
	8, 10, 12, 16 bits per component (bpc)
Color Depths	(deep color: 10 bpc up to 480MHz; 12 bpc up to 400MHz; 16 bpc up to 300MHz)
Video Encoding / Sampling	RGB, YCbCr; 4:4:4, 4:2:2, 4:2:0
HDCP	Versions 1.4 and 2.2
Audio Formats	LPCM, Dolby (DD, DD+, TrueHD), DTS (ES, HD, Master Audio)
Audio LPCM Settings	Sampling rates (32 – 192 kHz); Bits per sample (16, 20, 24)
HDBaseT	
Version	HDBaseT 1.0
Standard Formats	VESA (DMT, CVT-R, CVT), CEA
Connector	(1) 8P8C (RJ-45) Tx; (1) RJ-45 Rx
Video Colorimetry	ITU-R BT.601-5, ITU-R BT.709-5
Video Max Pixel Rate	300MHz (NEWi including support for Long Reach mode)
Color Depths	8, 10, 12 bits
Video Encoding / Sampling	RGB, YCbCr; 4:4:4, 4:2:2, 4:2:0
HDCP	Version 1.4
Audio Formats	LPCM, Dolby (DD, DD+, TrueHD), DTS (ES, HD, Master Audio)
Audio LPCM Settings	Sampling rates (32 – 192 kHz); Bits per sample (16, 20, 24)
	o/n 00-00251; standard with 780E p/n 00-00243)
Version	DisplayPort 1.2a
Standard Formats	VESA (DMT, CVT-R, CVT), CEA
Connector	(1) Standard Tx; (1) Standard Rx
Link rates / Lanes	1.62, 2.70, 5.40 Gbps Link Rates; 1, 2, 4 Lanes
Color Depths	6, 8, 10, 12, 16 bits
Video Encoding/Sampling Modes	RGB, YCbCr; 4:4:4, 4:2:2
HDCP	Versions 1.3 and 2.2
Audio Formats / LPCM Settings	8 Ch. LPCM; Sampling rates (32 – 192 kHz); Bits per sample (16, 20, 24)
Digital Audio	
Connectors	Optical (JIS FOS); SPDIF (RCA)
Audio Formats	LPCM, Dolby (DD, DD+), DTS (ES, HD)
Audio LPCM Settings	Sampling rates $(32 - 192 \text{ kHz})$; Bits per sample $(16, 20, 24)$
Options	
Auto EDID Test	Run automated EDID test on source devices
Cable Test	Test digital video cables and video distribution networks
ACA Monitor	Monitor aux channel transactions emulating a source or sink or passively
Report File Creation	Provides HTML formatted report of tests performed
HDR Lab & Dolby Vision	Optional test patterns for testing HDR on HDMI Ultra HD TVs
	optional test patterns for testing FDR of FDMill offia FD 175
Instrument	
AC Adapter	100-240 VAC, 47-63Hz
Weight	3.25 LBS; 1.47 Kg
Embedded Display	800 (H); x 480 (V) resolution; 24 bit RGB color.
Dimensions	Height: 2.7 in. (6.98 cm) Width: 9.75 in. (24.76 cm) Depth: 6 in. (15.24 cm)
Command Line Control	USB Type B, RS-232
Environmental	Operating Temp: 32 to 104 (F); 0 to 40 (C)
File Access	USB Type B (command line / file transfer; SD card (upgrades/file transfer)
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