

## quantumdata<sup>™</sup> 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 DDC and DisplayPort aux channel
- 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.

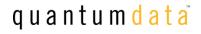
The Teledyne LeCroy quantumdata 780E Video Generator / Protocol Analyzer for HDMI, DisplayPort and HDBaseT Testing offers a wide array of benefits to engineers in R&D as well as professional A/V installers in the field for testing HDMI, HDBaseT and DisplayPort devices. The portable size and user-friendly 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 780E 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 quick 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.



## **SOURCE & NETWORK DIAGNOSTIC TEST FEATURES**

## View Incoming Video & Data

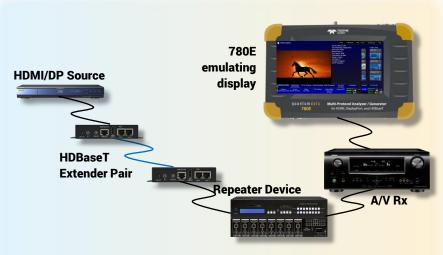
The 780E status bar provides essential information about the incoming video. The Video Display Test shows the incoming video and essential video and audio metadata. Both provide quick *time to insight* when conducting routine tests or diagnosing interoperability problems.

## **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.
 Video Display Test – View Video & Metadata



**Example Source Test Setup** 

### Verify Cable / Network (Loop)

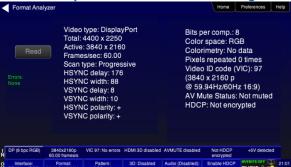
The 780E enables you to test distribution equipment to verify integrity of extenders, repeaters, matrix switches and distribution amps. You can test individual devices or entire networks including digital video cables.

### Verify Video at Far End

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



### Format Analyzer – View Metadata & Timing

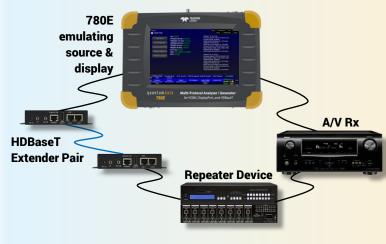


#### Cable Test (HDBaseT) - Verify Networks/Cables

Cable Test			Home	Reports Menu	Preferences	Help
Test Wire Test Repeater Test Remote PRN Frame Capture Frame Compare Test Remote HDBaseT	+5v: PASS 2160p30 (8 bits) 1080p60 (12 bit 1080p60 (8 bits) 720p60 (8 bits): 480p60 (8 bits): Hot Plug: PASS DDC: PASS	s): 0 errors ): 0 errors : 0 errors : 0 errors : 0 errors	HDBas Firmwa Coperal HDBas HDBas Eror (M Operal Cable I HDBas Firmwa Eror (M Operal Cable I	Tx Local Into: reversion: 13090 on Mode: HDBase ength estimated to stimute the stimute the stimute the stimute the stimute the stimute the reversion: 13090 ASE): -2245, -2245 ength estimated to reversion: 13090 ASE): -2245, -2245 on Mode: HDBase ength estimated to re Tx Remote Into	C10 (2014/07/01) aT b b e < 20 meters ;; to b e < 20 meters ;; to Tx: V\$100RX (C00 (2014/07/01) aT b b e < 20 meters C00 (2014/07/01) a, -2208, -2208 aT b b e < 20 meters	
-100 150 +100 -10 Reset +10			Firmwa Operati	device connected t re Version: 13090 on Mode: HDBase ength estimated to	C10 (2014/07/01) T	
HDBaseT (12 bpc 720x480p 60.0 RGB) frames/s	00 VIC 2: No errors	HDMI 3D disabled	AVMUTE disabled	Not HDCP encrypted	+5V detecte	d
Interface: Format: HDBaseT (8 bpc 720x480 60H. 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 con					
Test Remote PRN	To traines con	ipareu.				
Frame Capture						
Frame Compare						
Test Remote HDBase	т					
	100					
HDMI (12 bpc 720x480p RGB) frame		HDMI 3D disabled	AVMUTE disabled	Not HDCP encrypted	+5V detected	
Interface: Form HDMI (8 bpc RGB) 720x480		3D: Disabled	Audio (HDMI): LPCM 2.0ch	Enable HDCP		14:20



**Example Network Test Setup** 

# **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	BT.2020 RGE									
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 ) Manufacturer/Product: QDI 30730										
Save EDID	Pref. Native Timing: 3840x2160 30.00Hz SVDs: 480i 480p 576i 576p 720p 1080i 1080p 1080p24	8 bp									
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] AC-3 8 ch., [32 44.1 48] kHz. max rate 640 kHz	HDBase sign									
Use on Rx	DTS 8 ch., [44.1 48] kHz, max rate 1536 kHz Dolby DD+ 8 ch., [44.1 48] kHz DTS-HD 8 ch., [44.1 48 88.2 96 176.4 192] kHz	HDBaseT RGE									
Auto-EDID Test	MAT (MLP) 8 ch., [44.1 48 88.2 96 176.4 192] KHz										
HDMI (8 bpc RGB) 3840x 30.00 fr		1 +5V de									

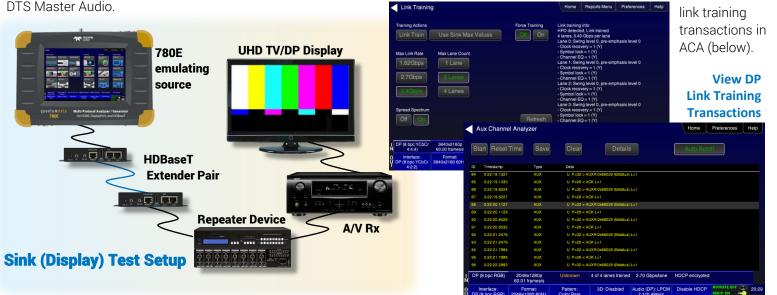
### **NEW!** Test HDR on an Ultra HD TV

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 Prefe	erences H	alp						
Start	Save	Clear	Details			Auto Scroll HDCP Outp	out Test			HD	CP Aut	Reports Menu	Preferences	est Help
Timestamp	Туре	Data												
0:04:37.6282	DDC	U HDCP MASTER ->	SLAVE I2C Request [	Br]										
							_							
								Dis	able	Recei	ver ID = 0x05E7AC	43B6		
		U HDCP_SLAVE > 1	ASTER I2C HDCP Ret					100000			os = 0x020000 ()			
		U HDCP MASTER ->						Auto-F		Authe	ntication, locality cl	neck and key ex	change succeed	ed.
		U HDCP_SLAVE > F	ASTER I2C HDCP Ret											
		U HDCP MASTER ->	SLAVE I2C Request [			HDCP Ver	rsion	.x	2.2					
0:04:41.8954	DDC		ASTER I2C HDCP Ret						-					
0:04:43.2121	HPD	U Tx/U Port Falling E			Ĥ	DCP 2.2 Stream 1	Type Ty							
0:04:44.6678		U Tx/U Port Rising Ed							- JPC					
0:04:44.8017	DDC		SLAVE I2C E-EDID Se	oment 0										
0:04:44.8021	DDC		SLAVE I2C Request O											
0:04:44.8024	DDC		ASTER I2C Response											
0.04.44.8024	000	O EDID SERVE 9 M	Na TEN 120 Nosponso											
HDMI (8 bpc RGB) N	3840x2160p 30 frames/s	HDMI_VIC 1: No errors	HDMI 3D disabled	AVMUTE disabled	[ '	lesult: PASS								
0 Interface: U HDMI (8 bpc RGB) T	Format: 3840x2160 30Hz	Pattern: Pseudo Random	3D: Disabled	Audio (HDMI): LPCM 2.0ch 48kHz				110				11000000		_
					Ň	HDMI (12 bpc RGB)	3840x216 30.00 frame		IL_VIC 1: No errors	HDMI3D disabled	AVMUTE disabled	HDCP 2.2 encrypted	+5V detected	
					0	Interface:	Format:		Pattern:	3D: Disabled	Audio (HDMI):	Disable HDCP	AVMUTEOFF	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						
Color Depths	8, 10, 12, 16 bits per component (bpc)						
·	(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)						
DisplayPort (optional with 780E p/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 (ÉS, HD)						
Audio LPCM Settings	Sampling rates (32 – 192 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						
Instrument	optional test patterns for testing hibron hibbin on and hib hvs						
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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