

# **DPR-100 Production Test Command specification**

**Rev. 1.7**

CONFIDENTIAL

## Revision history

<b>Rev.</b>	<b>Date</b>	<b>Author</b>	<b>Description</b>
1.0	07.05.2009	MDe	First version
1.1	22.06.2009	MDe	Added some audio status commands
1.2	20.10.2009	MDe	PT_AUX_LEVEL command added
1.3	26.03.2010	MDe	PT_AUX_LEVEL calibration table added
1.4	24.03.2011	MDe	DPCD and EDID rd/wr commands added
1.5	10.12.2011	MDe	Typos corrected
1.6	23.01.2012	MDe	Several commands added
1.7	14.08.2013	SG	Added MSA LOG feature related commands

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## 1. Acronyms and abbreviations

CTS	Compliance Test System
DP	DisplayPort
DPRX	DP Receiver
DPTX	DP Transmitter
DUT	Device Under Test
GUI	Graphical User Interface
I2C	Inter Integrated Circuit bus
LL	Link Layer
PC	Personal Computer
PTCMD	Production Test Command(s)
TBD	To Be Defined
TE	Test Equipment
USB	Universal Serial Bus

## 2. General

The DPR-100 is a DisplayPort Test Equipment build around the DPRX chip and communicating with a host PC through a USB interface. The USB interface is seen by the host PC as a virtual RS232 interface (virtual COM port). For its operation as production line tester a special set of RS232 commands is used: the Production Test Commands (shortly PTCMDs).

Please note that the same functionality is implemented and available also on the UFG-04-DP frame grabber. In the following, all references to the DPR-100 are also valid for the UFG-04-DP.

Production Test Commands can be issued by the host using a predefined 115200 Baud rate, 8 bits data, no parity and no handshake format. Every time the DPR-100 receives a command, it replies back to host with an acknowledge message or with an error message.

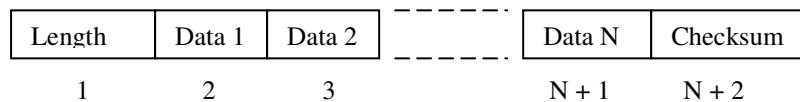
For instance:

HOST		DPR-100
Sends "SET_4_LANES"	→	
	←	Replies "ACK"
Sends "SET_LOW_BITRATE"	→	
	←	Replies "ACK"
Sends "SET_6_LANES"	→	
	←	Replies "NACK" (error)

The host must always wait for the DPR-100 reply before issuing the next command.

## 3. Command syntax

All commands are always formatted in the following way:



- *Length* is the total number of bytes included in the command (N+2).
- *Checksum* is the 2's complement of the sum of all command bytes from 1 to N+1.

For instance the command:

**0x04 0x71 0x1D 0x6E**

means:

0x04 = length (command made of 4 bytes)  
 0x71 = data byte 1  
 0x1D = data byte 2  
 0x6E = checksum

Checksum:

0x04 + 0x71 + 0x1D = 0x92  
 NOT(0x92) + 1 = 0x6D + 1 = 0x6E (2's complement of 0x92)

Commands sent from the host to the DPR-100 are called **Requests**. Commands sent from the DPR-100 back to the host are called **Replies**.

## 4. PTCMD Requests

### 4.1. PT\_EDID\_READ

Offset	Length	Description
0	1	0x07 (length)
1	1	0x72
2	1	0x16 (PT_EDID_READ)
3	1	Segment number (0, 1...)
4	1	Offset (0 – 255, bytes)
5	1	Number of bytes to read (1 – 128)
6	1	Checksum

Reads a number of EDID bytes. A Segment is 256 bytes long. Max 128 bytes can be read for each request.

Replies:

PT\_EDID\_READ  
NACK

### 4.2. PT\_EDID\_WRITE

Offset	Length	Description
0	1	Length (7 + N)
1	1	0x72
2	1	0x17 (PT_EDID_WRITE)
3	1	Segment number (0, 1...)
4	1	Offset (0 – 255, bytes)
5	1	Number of bytes to write (1 – 128)
6	N	EDID data
6+N	1	Checksum

Writes a number of EDID bytes. A Segment is 256 bytes long. Max 128 bytes can be written for each request.

Replies:

ACK  
NACK

### 4.3. PT\_DPCD\_READ

Offset	Length	Description
0	1	0x06 (length)
1	1	0x72
2	1	0x1A (PT_DPCD_READ)
3	2	Address
5	1	Checksum

Reads a single byte from the DPCD memory.

Replies:

PT\_DPCD\_READ  
NACK

#### 4.4. PT\_DPCD\_WRITE

Offset	Length	Description
0	1	0x07 (length)
1	1	0x72
2	1	0x1B (PT_DPCD_WRITE)
3	2	Address
5	1	Data
6	1	Checksum

Writes a single byte to the DPCD memory.

Replies:

ACK  
NACK

#### 4.5. PT\_FW\_VER

Offset	Length	Description
0	1	0x04 (length)
1	1	0x72
2	1	0x1C (PT_SER_NUM)
3	1	0x6E (Checksum)

Gets the TE current firmware version.

Replies:

PT\_FW\_VER  
NACK

#### 4.6. PT\_SER\_NUM

Offset	Length	Description
0	1	0x04 (length)
1	1	0x72
2	1	0x1D (PT_SER_NUM)
3	1	0x6D (Checksum)

Gets the TE serial number.

Replies:

PT\_SER\_NUM  
NACK

#### 4.7. PT\_AUX\_LEVEL

Offset	Length	Description
0	1	0x05 (length)
1	1	0x72
2	1	0x1E (PT_AUX_LEVEL)
3	1	Level (0x00 – 0xFF)
4	1	Checksum

Sets the output voltage level for the AUX channel. The relationship of the parameter value and the achieved output voltage is indicative and according to the following table:

Level	Voltage swing (mVpp)
4	30
8	70
11	90
16	140
24	220
32	300
40	370
48	460
64	620
80	790
96	960
128	1270
160	1580

Replies:

ACK  
NACK

#### 4.8. PT\_SET\_CAPAB

Offset	Length	Description
0	1	0x07 (length)
1	1	0x72
2	1	0xA0 (PT_SET_CAPAB)
3	1	MAX_LANES (1, 2 or 4)
4	1	MAX_RATE (0x06 or 0x0B)
5	1	FLAGS
6	1	Checksum

Defines the capabilities of the DP sink TE.

FLAGS:

bit 7: 0 = normal framing, 1 = enhanced framing

Replies:

ACK  
NACK

#### 4.9. PT\_LINK\_STATUS

Offset	Length	Description
0	1	0x04 (length)
1	1	0x72
2	1	0xA1 (PT_LINK_STATUS)
3	1	0xE9 (Checksum)

Gets the current DP link status.

Replies:

PT\_LINK\_STATUS  
NACK

#### 4.10. PT\_MS\_ATTR

Offset	Length	Description
0	1	0x04 (length)
1	1	0x72
2	1	0xA2 (PT_MS_ATTR)
3	1	0xE8 (Checksum)

Gets the current Main Stream Attributes



Replies:

PT\_MS\_ATTR  
NACK

#### 4.11. PT\_HDCP\_STATUS

Offset	Length	Description
0	1	0x04 (length)
1	1	0x72
2	1	0xA3 (PT_HDCP_STATUS)
3	1	0xE7 (Checksum)

Gets the current Main Stream Attributes.

Replies:

PT\_HDCP\_STATUS  
NACK

#### 4.12. PT\_VID\_CRC

Offset	Length	Description
0	1	0x04 (length)
1	1	0x72
2	1	0xA4 (PT_VID_CRC)
3	1	0xE6 (Checksum)

Gets the CRC of the currently received video image.

Note: this command can take up to 500 ms to return a reply!

Replies:

PT\_VID\_CRC  
NACK

#### 4.13. PT\_HPD\_PULSE

Offset	Length	Description
0	1	0x06 (length)
1	1	0x72
2	1	0xA5 (PT_HPD_PULSE)
3	1	Time (ms) LSB
4	1	Time (ms) MSB
5	1	Checksum

Deasserts (i.e. resets to logical zero) the HPD signal for a given time duration.

- If Time = 0, HPD is deasserted indefinitely.
- If Time = 0xFFFF, HPD is asserted indefinitely.
- Otherwise, HPD is asserted, then deasserted for the given time (in milliseconds) and then asserted back.

Please, note that the ACK/NACK reply is returned immediately and not after the command has been completely executed. Relevant DPCD locations are zeroed only if Time=0 or Time>2.

Replies:

ACK  
NACK

#### 4.14. PT\_ERR\_CNT

Offset	Length	Description
0	1	0x05 (length)
1	1	0x72
2	1	0xA6 (PT_ERR_CNT)
3	1	1 = reset counters 0 = read counters
4	1	Checksum

Returns the current error count since counter were last reset.

Replies:

PT\_ERR\_CNT  
NACK

#### 4.15. PT\_AUDIO\_RX\_STATUS

Offset	Length	Description
0	1	0x04 (length)
1	1	0x72
2	1	0xA7 (PT_AUDIO_RX_STATUS)
3	1	0xE3 (Checksum)

Queries the current audio status.

Replies:

PT\_AUDIO\_RX\_STATUS  
NACK

#### 4.16. PT\_SD\_PKT

Offset	Length	Description
0	1	0x04 (length)
1	1	0x72
2	1	0xA8 (PT_SD_PKT)
3	1	0xE2 (Checksum)

Queries the received Secondary Data Packets.

Replies:

PT\_SD\_PKT  
NACK

#### 4.17. PT\_EVT\_CTRL

Offset	Length	Description
0	1	0x05 (length)
1	1	0x72
2	1	0xA9 (PT_EVT_CTRL)
3	1	Control: Bit 0 - MS_ATTR_LOG_EN Bits 7:1 - reserved
4	1	Checksum

Enables sources of various system events

Replies:

ACK  
NACK

## 4.18. PT\_EVT\_STS

Offset	Length	Description
0	1	0x04 (length)
1	1	0x72
2	1	0xAA (PT_EVT_STS)
3	1	0xE0 (Checksum)

Get current events status.

Replies:

PT\_EVT\_STS  
NACK

## 4.19. PT\_MS\_ATTR\_LOG

Offset	Length	Description
0	1	0x05 (length)
1	1	0x72
2	1	0xAB (PT_MS_ATTR_LOG)
3	1	Number of MS_ATTR blocks to read
4	1	Checksum

Gets Main Stream Attributes from the log buffer

Replies:

PT\_MS\_ATTR\_LOG  
NACK

## 5. PTCMD Replies

### 5.1. ACK

Offset	Length	Description
0	1	0x04 (length)
1	1	0x72
2	1	0x0C (ACK)
3	1	0x7E (Checksum)

### 5.2. NACK

Offset	Length	Description
0	1	0x04 (length)
1	1	0x72
2	1	0x0B (NACK)
3	1	0x7F (Checksum)

### 5.3. PT\_EDID\_READ

Offset	Length	Description
0	1	Length (4 + N)
1	1	0x72
2	1	0x16 (PT_EDID_READ)
3	N	EDID data
3+N	1	Checksum

### 5.4. PT\_DPCD\_READ

Offset	Length	Description
0	1	0x05 (length)
1	1	0x72
2	1	0x1A (PT_DPCD_READ)
3	1	Data read
4	1	Checksum

## 5.5. PT\_FW\_VER

Offset	Length	Description
0	1	0x07 (length)
1	1	0x72
2	1	0x1C (PT_FW_VER)
3	1	Major
4	1	Minor
5	1	Revision
6	1	Checksum

## 5.6. PT\_SER\_NUM

Offset	Length	Description
0	1	0x0C (length)
1	1	0x72
2	1	0x1D (PT_SER_NUM)
3	8	Serial number
11	1	Checksum

## 5.7. PT\_LINK\_STATUS

Offset	Length	Description
0	1	0x11 (length)
1	1	0x72
2	1	0xA1 (PT_LINK_STATUS)
3	1	LANE0_1_STATUS
4	1	LANE2_3_STATUS
5	1	L0 voltage swing (0, 1, 2, 3)
6	1	L1 voltage swing (0, 1, 2, 3)
7	1	L2 voltage swing (0, 1, 2, 3)
8	1	L3 voltage swing (0, 1, 2, 3)
9	1	L0 pre-emphasis (0, 1, 2, 3)
10	1	L1 pre-emphasis (0, 1, 2, 3)
11	1	L2 pre-emphasis (0, 1, 2, 3)
12	1	L3 pre-emphasis (0, 1, 2, 3)
13	1	Lane count (0, 1, 2 or 4)
14	1	0x06 = low bitrate 0x0A = high bitrate
15	1	0 = normal framing 1 = enhanced framing
16	1	Checksum

LANE0\_1\_STATUS:  
coding as DPCD location 0x202

LANE2\_3\_STATUS:  
coding as DPCD location 0x203

Voltage swing:  
0 = 400 mVpp  
1 = 600 mVpp  
2 = 800 mVpp  
3 = 1.2 Vpp

Pre-emphasis:  
0 = 0 dB  
1 = 3.5 dB  
2 = 6 dB  
3 = 9.5 dB

## 5.8. PT\_MS\_ATTR

Offset	Length	Description
0	1	0x17 (length)
1	1	0x72
2	1	0xA2 (PT_MS_ATTR)
3	1	FLAGS
4	1	MISC_0
5	1	MISC_1

6	1	HTOTAL LSB
7	1	HTOTAL MSB
8	1	HSTART LSB
9	1	HSTART MSB
10	1	HACT LSB
11	1	HACT MSB
12	1	HSWIDTH LSB
13	1	HSWIDTH MSB
14	1	VTOTAL LSB
15	1	VTOTAL MSB
16	1	VSTART LSB
17	1	VSTART MSB
18	1	VACT LSB
19	1	VACT MSB
20	1	VSWIDTH LSB
21	1	VSWIDTH MSB
22	1	Checksum

Current value of Main Stream Attributes

**FLAGS:**

- bit 0: 0 = no video (attributes invalid) 1 = active video
- bit 1: 0 = stable video 1 = unstable video

**MISC\_0:**

- bit 0: clock type: 0 = asynchronous 1 = synchronous
- bit 2:1: component format: 00=RGB, 01=YCbCr422, 10=YCbCr444
- bit 3: dynamic range: 0=VESA, 1=CEA
- bit 4: colorimetry: 0 = ITU-R BT601-5 1 = ITU-R BT709-5
- bit 7:5: bits per color:
  - 000 = 6 bits
  - 001 = 8 bits
  - 010 = 10 bits
  - 011 = 12 bits
  - 100 = 16 bits

**MISC\_1:**

- bit 0: 0 = progressive 1 = interlaced

**HSWIDTH MSB:**

- bit 6:0: HS WIDTH MSB
- bit 7: polarity: 0 = positive 1 = negative

**VSWIDTH MSB:**

- bit 6:0: VS WIDTH MSB
- bit 7: polarity: 0 = positive 1 = negative

## 5.9. PT\_HDCP\_STATUS

Offset	Length	Description
0	1	0x06 (length)
1	1	0x72
2	1	0xA3 (PT_HDCP_STATUS)
3	1	0 = not authenticated 1 = authenticated
4	1	0x00
5	1	Checksum

Current status of HDCP authentication.

## 5.10. PT\_VID\_CRC

Offset	Length	Description
0	1	0x0A (length)
1	1	0x72
2	1	0xA4 (PT_VID_CRC)

3	1	CRC RED LSB
4	1	CRC RED MSB
5	1	CRC GREEN LSB
6	1	CRC GREEN MSB
7	1	CRC BLUE LSB
8	1	CRC BLUE MSB
9	1	Checksum

CRC of the currently received video image. All the CRC values reset to zero means that a reliable value couldn't be read.

### 5.11. PT\_ERR\_CNT

Offset	Length	Description
0	1	0x0C (length)
1	1	0x72
2	1	0xA6 (PT_ERR_CNT)
3	1	Lane 0 error count LSB
4	1	Lane 0 error count MSB
5	1	Lane 1 error count LSB
6	1	Lane 1 error count MSB
7	1	Lane 2 error count LSB
8	1	Lane 2 error count MSB
9	1	Lane 3 error count LSB
10	1	Lane 3 error count MSB
11	1	Checksum

For each lane, the counter values go from 0 to 0x7FFF max.

### 5.12. PT\_AUDIO\_RX\_STATUS

Offset	Length	Description
0	1	0x11 (length)
1	1	0x72
2	1	0xA7 (PT_AUDIO_RX_STATUS)
3	1	IN_STATE
4	1	IN_CH_COUNT
5	1	IN_SAMPLE_SIZE
6	1	IN_SAMPLE_FREQ LSB
7	1	IN_SAMPLE_FREQ
8	1	IN_SAMPLE_FREQ
9	1	IN_SAMPLE_FREQ MSB
10	1	ACS BYTE 0
11	1	ACS BYTE 1
12	1	ACS BYTE 2
13	1	ACS BYTE 3
14	1	ACS BYTE 4
15	1	ACS BYTE 5
16	1	Checksum

IN\_STATE: Input state

bit 1:0: 00 = no input signal, 01 = unlocked, 10 = locked.

IN\_CH\_COUNT: Input channel count (0 – 8).

IN\_SAMPLE\_SIZE: Input sample size (bits, 16 – 24).

IN\_SAMPLE\_FREQ: Input sample frequency (in Hz, 32-bit wide, little endian).

ACS: Input Audio Channel Status (IEC-60958 / IEC-61937)

ACS[0]:

bit 1:0: standard 00 = "IEC-60958-3" 01 = "IEC-60958-4"  
 10 = "IEC-61937" 11 = "SMPTE-337M"

ACS[0]:

bit 0: use. 0 = consumer, 1 = professional  
 bit 1: coding. 0 = LPCM, 1 = compressed  
 bit 2: copyright. 0 = yes, 1 = no

- bit 7:6: mode (0 – 3)
- ACS[1]:  
bit7:0: Category code (0 – 0xFF).
- ACS[2]:  
bit3:0: Source number (0 – 15)  
bit7:4: Channel number (0 – 15)
- ACS[3]:  
Bit5:4: Clock accuracy ( 0 = Level II, 1 = Level I, 2 = Level III,  
3 = Interface frame rate not matched to sample frequency)

If IN\_STATE(1:0) is different from “locked”, the rest of the status data is invalid.

If ACS[0] bits 1:0 are different from 00 and 10, only the standard used and ACS[0-5] raw hex data should be displayed (channel count, sample size and sampling frequency are invalid too).

### 5.13. PT\_SD\_PKT

Offset	Length	Description
0	1	0x25 (length)
1	1	0x71 (UG command ID)
2	1	0xA8 (PT_SD_PKT)
3	1	STATUS
4	1	TYPE
5	1	ID
6	1	VERSION
7	1	SIZE
8	28	DATA
36	1	Checksum

STATUS:

- 0 = no packets available
- 1 = one packet available, returned with this reply
- 2 = one packet returned with this reply, more packets available

TYPE:

- 0x04 Extended Packet (EXT)
- 0x81 Vendor Specific Infoframe (VSI)
- 0x82 Auxiliary Video Infoframe (AVI)
- 0x83 Source Product Description (SPD)
- 0x84 Audio Infoframe (AIF)
- 0x85 MPEG source (MPG)

ID: packet ID

VERSION: packet version

SIZE: packet size (number of data bytes, 1- 28)

DATA: 28 data bytes

### 5.14. PT\_EVT\_STS

Offset	Length	Description
0	1	0x05 (length)
1	1	0x72
2	1	0xAA (PT_EVT_STS)
3	1	Status: Bit 0 - MS_ATTR_LOG_EVENT Cleared by PT_MS_ATTR_LOG request Bits 7:1 - reserved
4	1	Checksum

Read status updates of the monitored events.

## 5.15. PT\_MS\_ATTR\_LOG

Offset	Length	Description
0	1	Length (6 + N*23)
1	1	0x72
2	1	0xAB (PT_MS_ATTR_LOG)
3	1	Bits 6:0 – number of remaining MS_ATTR blocks in log buffer Bit 7 – log buffer overflow
4	1	Number of read MS_ATTR (N) blocks
5	N*23	MS_ATTR blocks
5+N*23	1	Checksum

### MS\_ATTR:

0	4	Timestamp (ms)
4	1	FLAGS
5	1	MISC_0
6	1	MISC_1
7	1	HTOTAL LSB
8	1	HTOTAL MSB
9	1	HSTART LSB
10	1	HSTART MSB
11	1	HACT LSB
12	1	HACT MSB
13	1	HSWIDTH LSB
14	1	HSWIDTH MSB
15	1	VTOTAL LSB
16	1	VTOTAL MSB
17	1	VSTART LSB
18	1	VSTART MSB
19	1	VACT LSB
20	1	VACT MSB
21	1	VSWIDTH LSB
22	1	VSWIDTH MSB

Get Main Stream Attributes stored in LOG buffer.