

## Colorimetric and Resolution requirements of cameras

Alan Roberts

### **ADDENDUM 58 : Tests and Settings on a Sony HDC-P1**

**This document is a report of the results of tests that are the precursor of those described in the EBU technical document Tech3335. It is not an endorsement of the product.**

Data for this section is taken from the handbook and examination of a production model (serial number 100197) of the Sony HDC-P1. It is a box-camera, with neither separate control unit nor viewfinder. It has 3 CCD sensors of 1920x1080 pixel dimensions, and can operate at 1080 interlaced or 720 progressive, at both 50 and 59.94Hz. Output is via two HDSDI connections, plus another for SD output via a down-converter.

The unit is medium sized (212x130x86mm excluding the lens), standard B4 mount with F/1.4 optical block, and weighs about 1.7kg. The specification claims sensitivity of F/11, which is normal for this image size and resolution. Apart from its casing, it appears to be very similar to other full-resolution Sony cameras in the broadcast range.

It has two filter wheels, neutrals and colour-corrections, and consumes about 24 watts at 12 volts. Genlock and remote control connectors indicate that it can be integrated into multi-camera production with few problems. There is also automatic correction for chromatic aberration, when used with specific lenses, this was not tested.

There are internal menus for setting the performance, with a structure very similar to that in the HDCAM camcorders. The menus can be accessed directly from the camera head, such that it can then be used without any external controls, or via a remote control, or via an Ethernet connection.

For the test procedures a Canon HJ17ex7.6B lens was used.

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Many of the menu items have little or no effect on image quality. Those that have significant effect are highlighted. The full set of menu items is given for completeness. In boxes with a range of numeric settings, e.g. -99~99, the values indicate the nominal range, and zero means no alteration to factory setting, not zero effect, and no scales are given. For each item, the factory setting is underlined, “BBC” settings are in the last column, where appropriate, and the reasons for the values are given in footnotes throughout the tables where necessary.

Where menus are hierarchical (i.e. one menu item opens another menu page), the items are inset.

“BBC” setting values are given for:

Video {v}

Negative film {f}

Where different values are needed for these settings, they are marked e.g. thus: On{v} Off{f}. Note that the film settings are not intended to reproduce precisely the performance of any particular film stock, merely to give a “look” that is representative of a generic film type.

Settings are only starting points, recommendations. They should not be used rigidly, they are starting points for further exploration. However, they do return acceptable image performance.

Menu items which affect the picture quality, and need attention, are highlighted in the menu tables.

The results of tests are given after the menu settings.

## 1 MENU TABLES

### TOP MENU

User	Go to daily routine settings, 5 pages that can be customised
User menu customise	Customise user menu pages
All	Go to all menu pages
Operation	Settings for shot-by-shot control
Paint	Settings that normally need lab facilities to control properly
Maintenance	Camera maintenance, usually best avoided
File	Load/save reference files etc
Diagnosis	Check status of hardware/software
Service	Keep out of here if at all possible

### OPERATION MENUS

#### OPERATION01 VF DISPLAY

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
EX	<u>On</u> , Off		
Zoom	On, <u>Off</u>		
Disp	<u>Left</u> , Right		
Focus	On, <u>Off</u>	Only when a 'serial' lens is fitted	
ND	<u>On</u> , Off		
CC	<u>On</u> , Off		
5600K	<u>On</u> , Off		
Iris	<u>On</u> , Off		
White	<u>On</u> , Off		
Gain	<u>On</u> , Off		
Shutt	<u>On</u> , Off		
Batt	<u>On</u> , Off		
Talk	<u>On</u> , Off		
Message	<u>All</u> , Wrn, At, Off	Wrn=warnings+, AT=Auto+ higher	

#### OPERATION02 VF MARKER

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Marker	On, <u>Off</u>		
	<u>White</u> , Black, Dot		
Center	On, <u>Off</u>	1=full cross, 2=centre hole, 3=centre, 4=centre with hole	
	<u>1</u> , 2, 3, 4		
Safety zone	On, <u>Off</u>		
	80, <u>90</u> , 92.5, 95%		
Effect	On, <u>Off</u> , Focus	Focus available only for Focus Assist	
Aspect	On, <u>Off</u>		
	16:9, 15:9, 14:9, 13:9, <u>4:3</u>		14:9
Mask	On, <u>Off</u>		
	0~12~15		
Safety	On, <u>Off</u> Area		
	80, <u>90</u> , 92.5, 95%		

#### OPERATION03 VF DETAIL

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
VF Detail	On, <u>Off</u>		
	0~25~100%		
Crisp	-99~ <u>0</u> ~+99		
Frequency	<u>9M</u> , 14M, 18M		
Flicker	On, <u>Off</u>		
Area	<u>100</u> , 70, 60, 50, 40%		
Zoom link	0, 25, 50, 75, <u>100%</u>		
Color detail	On, <u>Off</u>		
	<u>Blue</u> , Red, Yellow		
Peak color	On, <u>Off</u>		
Chroma level	100, 50, <u>25</u> , 0%		

**OPERATION04 FOCUS ASSIST**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Indicator	On, Off, Effect	Effect applies to Effect, VF Marker	
Mode	Box, B&W, Col		
	Bottom, Left, Top, Right		
Level	1~3~5		
	Quick, Smooth		
Gain	0~50~99		
Offset	0~50~99		
Area Marker	On, Off, Aspect	Aspect applies to Safety, VF Marker	
Size	Small, Middle, Large		
Position	Left, Center, Right		
Position H	0~50~99		
Position V	0~50~99		

**OPERATION05 ZEBRA**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Zebra	On, Off		
	1, 2, 1&2		
Zebra1 level	50~70~109%		
Width	0~10~30%		
Zebra2	50~100~109%		

**OPERATION06 CURSOR**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Cursor	On, Off		
	White, Black, Dot		
Box/Cross	Box, Cross		
H Position	0~50~99		
V Position	0~50~99		
Width	0~50~99		
Height	0~50~99		

**OPERATION7 OPERATOR FILE**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Read (MS-CAM)		Execute, copy from stick to camera	
Write (Cam-MS)		Execute, copy from camera to stick	
Preset		Execute, reset to internal memory file	
File ID		Max 16 characters	
Cam mode		Display only	
Date		Display only	

**OPERATIONS8 LENS FILE**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
File	1~17	16 files normally, 17 with a 'serial' lens	
		Lens file name, non-'serial' lenses	
		Stop value, non-'serial' lens	
Center marker		Set the image centre point	
H.Pos	-20~0~+20		
V.Pos	-20~0~+20		
Store		Execute	

**PAINT****PAINT01 SW STATUS**

main controls

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Flare	On, Off		On
Gamma	On, Off		On
Blk gamma	On, Off		On{v} Off{f}
Knee	On, Off		On{v} Off{f}
White clip	On, Off		
Detail	On, Off		On{v} Off{f}
Lvl dep	On, Off		
Skin dtl	On, Off		

Matrix	On, <u>Off</u>	On
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**PAINT02 VIDEO LEVEL**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
White	-99~0~+99	RGB values	
Black	-99~0~+99	RGBM values	
Flare	-99~0~+99	RGB values	
Gamma	-99~0~+99	RGBM values	
V mod	-99~0~+99	RGBM values	
Flare	<u>On</u> , Off		
V.mod	<u>On</u> , Off		
D.shad	On, <u>Off</u>		
Test	<u>Off</u> , Saw, 3step, 10step		

**PAINT03 COLOR TEMP**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
White	-99~0~+99	RGB values	
Auto white bal		Execute, press Enter	
Color temp	0~3200~65535K		
Balance	-99~0~+99		
ATW	On, <u>Off</u>		
Speed	1, 2, 3, <u>4</u> , 5		
Master	-3.0~0.0~+12.0dB		

**PAINT04 GAMMA**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Level	-99~0~+99	RGBM values	0
Coarse	0.35~0.45~0.90		0.45
Table	<u>Standard</u> , Hyper	Same choices as for other Sonys	Standard {v}, Hyper {f}
Standard	1, 2, 3, 4, <u>5</u> , 6, 7	1=camcorder, 2=4.5x, 3=3.5x, 4=SMPTE240M, 5=ITU709, 6=BBC0.4, 7=5x 709	6 {v}
Hyper	1, 2, 3, <u>4</u>	1=325%(100%), 2=460%(100%), 3=325%(109%), 4=460%(109%)	1~4 {f} <sup>1</sup>
Gamma	<u>On</u> , Off		
Test	<u>Off</u> , Saw, 3step, 10step		

**PAINT05 BLACK GAMMA**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Level	-99~0~+99	RGBM values	
Range	Low, L.mid, H.mid, <u>High</u>		
	On, <u>Off</u>		Off <sup>2</sup>
Test	<u>Off</u> , Saw, 3step, 10step		

**PAINT06 SATURATION**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Saturation	-99~0~+99		
	On, <u>Off</u>		
Low key sat	-99~0~+99		
Range	Low, L.mid, H.mid, <u>High</u>		
	On, <u>Off</u>		
Test	<u>Off</u> , Saw, 3step, 10step		

**PAINT07 KNEE**

highlight compression

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Knee point	-99~0~+99	RGBM values	69
Knee slope	-99~0~+99	RGBM values	-87 <sup>3</sup>
Knee	<u>On</u> , Off		
Knee max	On, <u>Off</u>		

<sup>1</sup> Hyper gamma curves 1 and 3 handle 1.5 stops, curves 2 and 4 handle 2.3 stops. Curve 1 and 2 are suitable for line/as-line use in that they clip at 100%, curves 3 and 4 use the full video signal range and thus are suitable only when post-production grading can deal with the over-signal range.

<sup>2</sup> Camera noise levels are rather high, use of Black Gamma, while revealing detail near black, will emphasise noise.

<sup>3</sup> Knee copes with about 1 stop of headroom.

Knee sat	-99~0~+99		
	On, Off		
Auto knee	Off, Auto		
Point limit	-99~0~+99		
Slope	-99~0~+99		
ABS		Toggle between relative and absolute values	

**PAINT08 WHITE CLIP**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
W clip	-99~+99	RGBM values	
	On, Off		
ABS		Toggle between relative and absolute values	

**PAINT09 DETAIL1**

Sharpening only

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Detail	On, Off		On {v}, Off {f}
Level	-99~0~+99		+25 <sup>4</sup>
Limiter M	-99~0~+99		+45
Limiter wht	-99~0~+99		+46
Limiter blk	-99~0~+99		+46
Crisp	-99~0~+99		0
Lvl dep	-99~0~+99		0
ABS		Toggle between relative and absolute values	

**PAINT10 DETAIL2**

Sharpening only

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
H/V ratio	-99~0~+99		-20
Freq	-99~0~+99		+99
Mix ratio	-99~0~+99		0
Knee aperture	-99~0~+99		0
ABS		Toggle between relative and absolute values	

**PAINT11 SD DETAIL1**

Softening only

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
SD detail	On, Off		
Level	-99~0~+99		
Limiter M	-99~0~+99		
Limiter wht	-99~0~+99		
Limiter blk	-99~0~+99		
Crisp	-99~0~+99		
Lvl dep	-99~0~+99		

**PAINT12 SD DETAIL2**

Sharpening only

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
H/V ratio	-99~0~+99		-20
Frequency	-99~0~+99		+99
Detail comb	-99~0~+99		0

**PAINT13 SKIN DETAIL**

Softening only

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Skin dtl	On, Off		
Skin gate	On, Off, Mat	Mat shows when Multi-matrix Gate is on	
Auto hue		Execute, press Enter	
Phase	0~359		
Width	0~29~90		
Sat	-99~-89~+99		
Level	-99~0~+99		
ABS		Toggle between relative and absolute values	

**PAINT14 SD CROSS COLOR**

SD output only

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
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<sup>4</sup> Setting level zero does not mean no effect, in all cases this only means the factory default value. The values given produce better results, but are a strange combination. They may well be suitable for other cameras of the type (e.g. HDC1500, HSC300, PDW700 etc).

Crs col reduce	On, <u>Off</u>	Diagonal filtering	
Level	-99~ <u>0</u> ~+99		
Coring	-99~ <u>0</u> ~+99		

**PAINT15 USER MATRIX**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
R-G	-99~ <u>0</u> ~+99		
R-B	-99~ <u>0</u> ~+99		
G-R	-99~ <u>0</u> ~+99		
G-B	-99~ <u>0</u> ~+99		
B-R	-99~ <u>0</u> ~+99		
B-G	-99~ <u>0</u> ~+99		
Matrix	On, <u>Off</u>		On
Preset	<u>On</u> , Off		On
	SMPTE240M, ITU709, SMPTEwide, NTSC, EBU, ITU601		ITU-709
User	On, <u>Off</u>		
Multi	On, Off		

**PAINT16 MULTI MATRIX**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Phase	<u>0</u> , 23, 45, 68, 90, 113, 135, 158, 180, 203, 225, 248, 270, 293, 315, 338	Colour axis to operate on	
Hue	-99~ <u>0</u> ~+99		
Sat	-99~ <u>0</u> ~+99		
All clear		Execute	
Gate	On, <u>Off</u> , Skin	Skin shows if Gate of Skin Dtl is on	
Matrix	On, <u>Off</u>		On
Preset	<u>On</u> , Off		On
	SMPTE240M, ITU709, SMPTEwide, NTSC, EBU, ITU601		ITU-709
User	On, <u>Off</u>		
Multi	On, <u>Off</u>		

**PAINT17 SHUTTER**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Shutter	On, <u>Off</u>		
	59.94i: <u>1/100</u> , ..., 1/2000 50i: 1/60, ..., 1/2000 59.94P: ..., 1/2000 50p: 1/60, ..., 1/2000	Each plus 1/125, 1/250, 1/500, 1/1000	
ECS freq	59.94i: 60~4300Hz 50i: 50~4700Hz 59.94p: 59.96~4600Hz 50P: 50.03~4600Hz	1400 and 1450 don't do all these formats	

**PAINT18 NOISE SUP**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Noise sup	<u>0</u> ~100%		
	On, <u>Off</u>		

**PAINT16 SCENE FILE**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
1		Select scene file or factory STANDARD. Always load STANDARD first when setting up a camera. Open box indicator to read from camera, filled box indicator to read from stick.	
2			
3			
4			
5			
Standard		Back to standard PAINT data	
Read (MS-cam)		Load 5 scene files from stick	
Write (Cam-MS)		Save 5 scene files to stick	
File ID		16 characters	
Cam code		Display only	
Date		Display only	

## MAINTENANCE

### MAINTENANCE01 AUTO SETUP

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Auto black		Execute	
Auto white		Execute	
Auto level		Execute	
Auto white shading		Execute	
Auto black shading		Execute	
Test	<u>Off</u> , Saw, 3step, 10step		

### MAINTENANCE02 WHITE SHADING

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
V saw	-99~0~+99	RGB values	
V para	-99~0~+99	RGB values	
H saw	-99~0~+99	RGB values	
H para	-99~0~+99	RGB values	
White	-99~0~+99	RGB values	
Auto white shading		Execute	
White shad mode	RGB, <u>RB</u>		

### MAINTENANCE03 BLACK SHADING

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
V saw	-99~0~+99	RGB values	
V para	-99~0~+99	RGB values	
H saw	-99~0~+99	RGB values	
H para	-99~0~+99	RGB values	
Blk set	-99~0~+99	RGB values	
Black	-99~0~+99	RGBM values	
Master gain	-3, <u>0</u> , 3, 6, 9, 12dB		
Auto black shading		Execute	

### MAINTENANCE04 OHB MATRIX

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Phase	<u>0</u> , 23, 45, 68, 90, 113, 135, 158, 180, 203, 225, 248, 270, 293, 315, 338	Degrees around the hue circle	
Hue	-99~0~+99		
Sat	-99~0~+99		
All clear		Execute, reset data	
OHB matrix	On, <u>Off</u>		
Matrix	On, <u>Off</u>		On

### MAINTENANCE05 AUTO IRIS

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Auto iris	On, <u>Off</u>		
Window	<u>1</u> , 2, 3, 4, 5, 6	1=low ⅓, 2=mid, 3=mid ⅓, 4=full, 5=low mid, 6=high ⅓	
Override	-99~+99		
Iris level	-99~0~+99		
APL ratio	-99~+65~+99		
Iris gain	-99~0~+99		
Iris close	On, <u>Off</u>		

### MAINTENANCE06 TALLY

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Front tally	<u>Off</u> , Low, High		
Rear tally	Off, <u>On</u>		
Battery alarm	Off, <u>On</u>		

### MAINTENANCE07 OUTPUT FORMAT

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Current		Show current format	
	<u>1080</u> , 720		



**MAINTENANCE08 DOWN CONVERTER**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
SD aspect	EC, <u>SQ</u>		
Center lock	<u>On</u> , Off		
Crop position	-99~0~+99		
H interpolation	<u>A</u> , B, C, D, E		
V interpolation	<u>A</u> , B, C, D, E		

**MAINTENANCE09 VBS OUT**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Gain	-127~0~+127		
Chroma	<u>On</u> , Off		
Chroma level	-127~0~+127		
Setup	On, <u>Off</u>	Relevant only at 59.94Hz	

**MAINTENANCE10 SDI OUT**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Output	<u>HD-SDI</u> , SD-SDI		

**MAINTENANCE11 IMAGE INVERT**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
H mirror	On, <u>Off</u>		
V mirror	On, <u>Off</u>		
Delay mode	On, <u>Off</u>		

**MAINTENANCE12 GENLOCK**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Genlock	Disable, <u>Enable</u>		
Status		Display only	
Format		Display only	
Phase			
V	-1024~0~+1023		
H	-1683~0~+1683		

**MAINTENANCE13 DATE**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Date/time	<u>yyyy/mm/dd hh:mm</u>	2000 to 2099, a bit optimistic ☺	

**MAINTENANCE14 BATTERY ALARM**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Before end	<u>11.5</u> ~17.0V		
End	<u>11.0</u> ~11.5V		
Battery alarm	<u>On</u> , Off	Flashes front tally	

**MAINTENANCE15 TCP/IP SETTING**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
IP address	<u>0.0.0.0</u> ~255.255.255.255		
Subnet mask	<u>0.0.0.0</u> ~255.255.255.255		
Default gateway	<u>0.0.0.0</u> ~255.255.255.255		
Set		Execute	

**MAINTENANCE16 LAN SETTINGS**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Auto negotiation	<u>On</u> , Off		
Connection speed	10M, <u>100M</u>		
Duplex mode	Half, <u>Full</u>		
Auto mdi/mdix	<u>On</u> , Off		
Set		Execute	

**MAINTENANCE17 CNS SETTINGS**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
CNS mode	<u>Legacy</u> , Bridge, MCS		
CCU no.	0~96		
Master IP address	<u>0.0.0.0</u> ~255.255.255.255		
Set		Execute	

**MAINTENANCE18 NETWORK RESET**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Network reset		All back to factory settings, Execute	

**MAINTENANCE19 COLOR BARS**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Bars	On, <u>Off</u>		
HD bars	16:9 100%, 16:9 75%, ARIB 75%, ARIB 100%, RIB (+I), SMPTE (-I,+Q)		SMPTE
SD bars	<u>Disable</u> , SMPTE, EIA EBU, Full, 95%, NTSC/PAL 100%, Y-C ramp, Y-ramp		

**MAINTENANCE20 OTHERS 1**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Fan mode	Off, <u>Auto1</u> , Auto2, Min, Max	Auto1=normal, Auto2=slow	
V dtl creation	NAM, G, R-G, <u>Y</u>		
Dtl H/V mode	<u>H/V</u> , V only		
Test2 mode	<u>3step</u> , 10step		
White setup mode	AWB, <u>A.LVL</u>		
ALAC	<u>Auto</u> , Off	Auto launches automatic chromatic aberration correction. See the manual for details.	

**MAINTENANCE21 OTHERS 2**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Date type	1 Y/Mn/D, 2 Mn/D, 3 D/M/Y, 4 D/M, <u>5 M/D/Y</u> , 6 M/D	Y=year, Mn=month as number, M=month as text, D=day	
Filter wht mem	On, <u>Off</u>	Store white balance for filter positions	
F no. disp	<u>Control</u> , Return	Where the iris data comes from	

**MAINTENANCE22 OPTION KEY**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Read (MS-cam)		Read Install key from memory stick	
Installed option		Display of installed option cards	

**FILE****FILE01 OPERATOR FILE**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Read (MS-cam)		The usual stuff, doesn't affect pictures	
Write (Cam-MS)			
Preset			
Store preset file			
File ID		Maximum 16 characters	
Cam code		Display only	
Date		Display only	

**FILE02 SCENE FILE**

picture stuff

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
1		The usual stuff, all picture-related	
2			
3			
4			
5			
STORE			
Read (MS-cam)			
Write (cam-MS)			
File ID		Maximum 16 characters	
Cam code		Display only	
Date		Display only	

**FILE03 REFERENCE FILE**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Store file		Store current settings as Reference	

Standard		Reset to Standard	
All preset		Back to factory settings	
Read (MS-cam)			
Write (cam-MS)			
File ID		Maximum 16 characters	
Cam code		Display only	
Date		Display only	

**FILE04 LENS FILE**

lens corrections

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Store file			
No.	<u>1</u> ~17	Only 16 for non'serial' lenses	
Name		Changeable only for non'serial' lens	
F No	F1.0~F1.7~F3.4	Changeable only for non'serial' lens	
Center marker			
H Pos	-20~ <u>0</u> ~+20		
V Pos	-20~ <u>0</u> ~+20		
Store		Execute	

**FILE05 OHB FILE**

sensor file

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Store file		Store offset data for CCDs	

**FILE06 FILE CLEAR**

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Preset operator			
Reference (all)			
10 sec clear	On, <u>Off</u>		
OHB white shad (all)			
OHB black shad			
OHB ND offset			
OHB matrix			
M.S. format		Format the Memory Stick	

# DIAGNOSIS

**DIAGNOSIS01 BOARD STATUS**

Indicators only, no options

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
OHB	Ok, NG		
DPR			
AT			
IF			

**DIAGNOSIS02 PLD VERSION**

Indicators only, no options

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
TG	Vx.xx		
AT			
IF			
DPR1			
DPR2			

**DIAGNOSIS03 ROM VERSION**

Indicators only, no options

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
AT	Vx.xx		
IF			

**DIAGNOSIS04 NET STATUS1**

Indicators only, no options

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Network	OK, NG	Display only	
Link condition	Down, Up		
Connection speed	10M, 100M		
Duplex mode	Half, Full		
MDI/MDIX	MDI, MDIX		
MAC address	xx-xx-xx-xx-xx-xx		

**DIAGNOSIS05 NET STATUS2**

Indicators only, no options

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
IP address	x.x.x.x	Display only	
Subnet mask	x.x.x.x		
Default gateway	x.x.x.x		

**DIAGNOSIS05 SERIAL NO**

Indicators only, no options

<i>item</i>	<i>range</i>	<i>comment</i>	<i>BBC</i>
Model	HDC-P1		
No			

## 2 MEASUREMENTS

All measurements were made at BBC R&D, using a Sony 32" crt Grade 1 HDTV monitor and a digital waveform monitor. Frame files were grabbed via HDSDI for software analysis. Importing recordings into editing software is unreliable because the decoding and transcoding is not fully specified. The lens was a Canon HJ17ex7.6B.

### 2.1 Gamma and Headroom range

The camera has seven 'standard' gamma curves and four 'hyper' gammas. Colour performance, with the ITU.709 gamma curve, was good, although a little over-saturated.

The Hyper-gamma curves are those of the HDWF900R and other Sony cameras, providing for film-like transfer over either 325% or 460% headroom, delivered into either 100% or 109% video signal range. They are known to perform well, there was no need to examine them in this camera.

The Standard curves, also, are those of other cameras, with a few additions. The most important curves are numbers 6 and 7 in the table, ITU.709 and BBC0.4. Since this is a HDTV camera, the 709 curve should be regarded as the normal option, unless there is a specific need to change it to achieve specific picture performance. Since the Hyper-gammas handle headroom well, there is little need to explore the knee function, using Standard curves. Similar knee curves in other Sony cameras can cope with about 2 stops of over-exposure, but in this camera it was not found possible to set values which could cope with more than 1 stop.

### 2.2 Resolution

Resolution was tested using a test card of circular zone plate patterns, calculated for 1920x1080 standard. The zone plate presents a spatial map of all the frequencies the camera should have to deal with, dc and low frequencies in the middle of each pattern, rising to the Nyquist limits horizontally and vertically. The test chart has sinusoidal modulation to avoid sampling problems, and has patterns for luminance, chrominance, R G and B. Only the luminance pattern is presented here, the other patterns revealed no surprises.

#### 2.2.1 Resolution at 1080-line

The camera does not have a progressive mode at 1080-line.

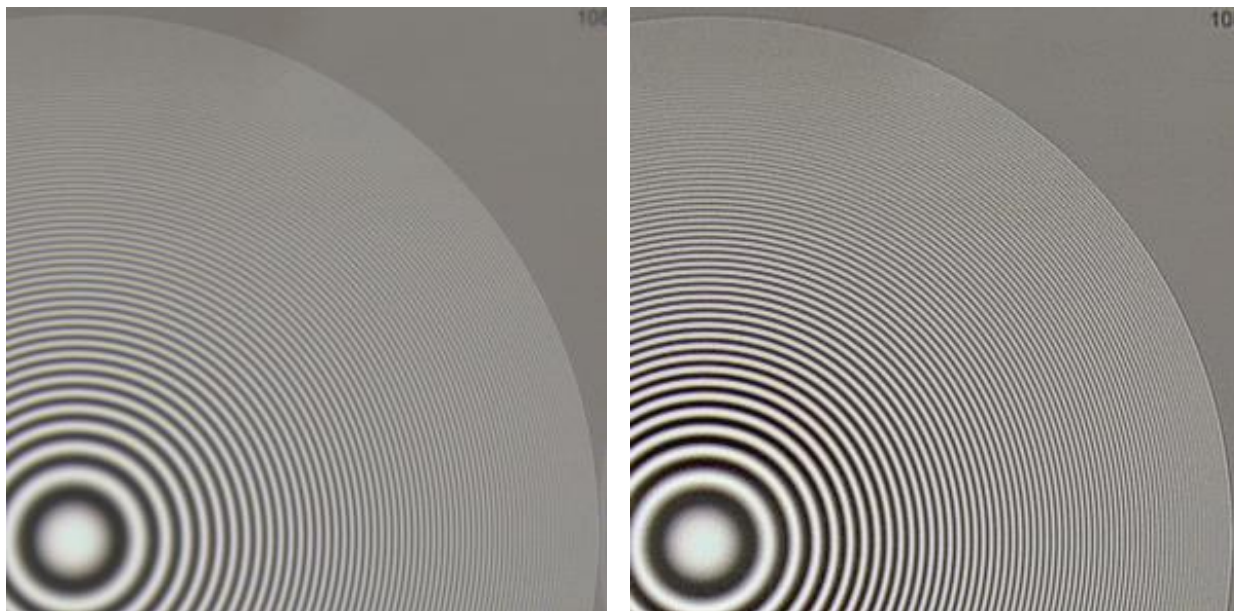


Figure 1 Resolution 1080i (a) detail off

(b) detail on

With detail enhancement switched off, the results for 1080-line interlace are as expected. Horizontal resolution droops gracefully towards the edge of the pattern, as it should do, due to the effect of the optical

horizontal low-pass filter. Vertical resolution also falls, but this time due to the line-pairing implicit in interlaced scanning. There are no null zones or alias patterns visible at all.

As a result, detail enhancement produces no unexpected effects. The values developed for the HDWF900R work well in this camera, but the values given here in the menus seem to do a significantly better job, perhaps they would be good in other cameras as well.

No attempt was made to find ‘film-look’ settings, since the camera does not have a progressive 1080-line mode.

### 2.2.1 Resolution at 720p

There is significant vertical aliasing in the picture, where the higher vertical frequencies have been reversed or folded. This is almost inevitable in any camera, since the conversion to 720p is a standards-conversion, which cannot be done satisfactorily in any camera at an economic price.

Even though the specification claims that the sensors are scanned progressively, it is evident that the progressive images are not properly used in the creation of 720p. If the vertical down-sampling filter were the same as the horizontal down-sampling filter, then there would be no visible aliasing at 720p, but the camera would cost a little more.

Resolution up to the 1280 limit is clean, with little or no aliasing above.

The detail enhancement settings for 1080 work equally well at 720p.

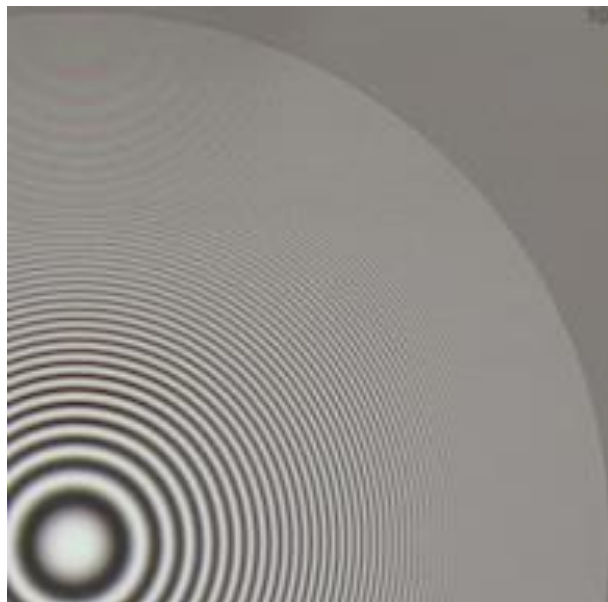


Figure 2 Resolution, 720p, detail off

### 2.2.1 Resolution at SD (576i)

There is significant aliasing in the picture, both horizontally and vertically. The horizontal aliasing is almost acceptable, being at reasonably low level. But the vertical aliasing shows a double folding of the higher frequencies. This hints that the SD output is down-converted via the 720p converter. The camera was set to 1080i for this test, so the 720p down-converter should not have been involved in this operation.

Aliasing at this level is almost inevitable in any camera, since the down-conversion filters used are rarely adequate. It was not possible to find any combination of detail control settings which improved the picture, so the search was abandoned.

Clearly, the SD output should be used only for monitoring, it is not good enough for use as a programme output.



Figure 3 Resolution, SD 576i, detail off

## 2.3 Noise

Noise was measured by exposing the camera to an evenly illuminated white card, and exposure adjusted to get 4 luma values between 10% and 100%. Noise suppression was switched on for this test, since it is the way the camera is most likely to be used. Gain was set to +6dB, and the results compensated accordingly in the calculations, therefore they represent the noise levels at 0dB gain. The grabbed frames were processed with a high-pass filter to remove any residual shading effects. Vignetting was avoided by adjusting the lighting level such that the extremes of the aperture range were not used.

The plot of measured noise versus signal level for 1080i shows that noise in the middle range (where the slope of the gamma curve is unity) is at about -45dB, which is adequate but a little disappointing. This was confirmed by direct observation during the tests, both off-screen and on the waveform monitor. The general shapes of the curves are as expected, since the primary source of noise is the analogue circuitry of the sensor and per-amplifiers, which is non-linearly amplified by the gamma-corrector. Blue noise is a few dB worse than red or green, this is normal.

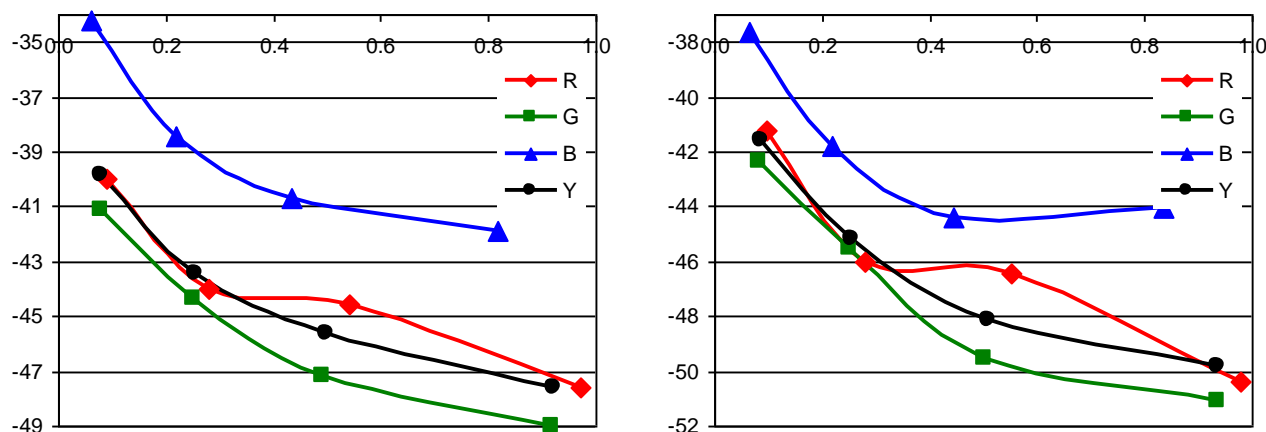


Figure 4 Noise, (a) 1080i

(b) 720p

Noise at 720p is about 3dB lower than for 1080p, primarily due to the reduced video bandwidth.

The noise levels are rather high for a camera with full-resolution  $\frac{2}{3}$ " CCD sensors. Noise suppression has reduces the levels by 2 to 3dB, but there will inevitably be some affect on resolution due to the spatial filtering involved. Studio cameras should normally be capable of noise levels about 10dB better than this, and these high levels mean that the maximum exposure range is only about 10 stops, and that high gain settings should be avoided wherever possible.

## 2.5 Conclusion

The HDC-P1 performs quite well, but is rather noisy. The results are very similar to other Sony cameras, particularly those with CCD sensors and 14-bit processing. The P1 would work well in any production using, for example, the HDC1500.