Colorimetric and Resolution requirements of cameras

Alan Roberts

ADDENDUM 48 : Tests and Settings on a Panasonic GP-US932HAE mini-camera

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 a very brief examination of a Panasonic US932 mini-camera as part of a group test of HDTV mini-cameras. It comprises a camera head with separate lens and separate controller.

The camera is small (37x47x54mm) and weighs 140grammes; the controller is 170x44x229mm and weighs 1.4kg. The specification claims that the camera has 3 CCD sensors (⅓") but gives no indication of the pixel count. Sensitivity is claimed to be F/8 at 2000 lux, about 400ASA. Noise level is quoted as -54dB.

The controller has digital outputs at HDSDI, HDMI and SD-SDI, and analogue composite and component. There are fairly comprehensive menus, allowing a considerable degree of image control.

It has a significant range of operating formats:

- 1080p/50 (only via HDMI)
- 1080i/25
- 1080psf/25
- 720p/50
- 576i/25 (SD)

Power consumption is about 16 watts at 12V DC.

There are no controls on the camera itself. Unfortunately, the camera shows significant response to infra-red illumination.

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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 range, and zero means no alteration to factory setting, not zero effect, and no scales are given in the manuals. For each item, the factory setting is underlined where known. "BBC" recommended settings are in the last column, where appropriate. In some instances, it is possible to alter the menus such that they produce more meaningful numbers.

Settings have been derived and are shown in the "BBC" column. Although the camera has all the options for interlaced and progressive shooting, no attempt has been made to derive a 'film-look' for it, since the menus do not allow sufficient control over the gamma curve to make it worthwhile.

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.

Measurement results are given in section 2, after the menus.

This listing of the menus and contents is complete, but this should not be used as an excuse for not reading the manuals. Video formats are selected by side switches on the control unit rather than via the menus.

1 Menu items

SETUP MENU P1

item	range	comment	BBC
Camera ID		Name the camera, complex sub-menu follows	
ELC		Electronic Light Control=exposure	
Area	All, S circle, M circle, L circle, Manu, Auto	All=while image, Manu=define area by hand, Auto ignores dark parts of the picture	
Peak/ave	1~4~7		
Shutter	Off, 1/120, 1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/10000, Manu	Electronic shutter	
Manu set	2/562~552/562	Manual shutter	
Gain	Off, Auto(L), Auto(H), Manu(L), Manu(H)		
Low	1~10	Manual: Low must be lower than High. Not available when Sens Up is Auto (x2) or higher	
High	1~10		
Sens up	Off, Auto(x2), Auto(x4), Auto(x8), Manu(x2), Manu(x4), Manu(x8)	6dB gain steps, done by lengthening the shutter beyond the field/frame time, blurry pictures	
Output sel	RGB, PpbPr	Analogue output	
HDMI output	YPbPr 422, YpbPr 444, RGB (nor), RGB (enh)		

SETUP MENU P2

item	range	comment	BBC
Scene file	1, 2, 3	3 scene files	
P1 Label			
Dtl mode			
Pattern	1, 2, 3	User defined settings	
Dtl band	1~4	1=low frequency, 4=high	
Dtl level	1~16		
Red dtl	Off, Low, High	Detail enhancement of the red channel!	
Gamma	1~10	Fully to the right=linear	

Knee	<u>Manu</u>, Auto		
Knee point	1~10	Manual knee point	
Black stretch	On, <u>Off</u>	Not when D-range is set to Expand	
D-range	<u>Normal</u>, Expand	Expand 'makes contrasty images more viewable'	
D-range	1~255	Seems to be black-stretch/white crush, not tested	
White clip		Set clip level, uncalibrated	
P2 Label			
Flare comp	On, <u>Off</u>	No other settings for flare compensation	
DNR	<u>Low</u>, High, Off	Digital Noise Reduction	
Matrix	B-Mg, Mg, Mg-R, R, Y-Ye, Ye, Ye-G, G, G-Cy, Cy, Cy-B, B	Automatic. Fill the screen with a colour, select it from the list, then adjust the phase and saturation, see the manual for details	
B phase	-5~+5		
B gain	-5~+5		
User		Fine adjustment in sectors, e.g. -	
Cy/Cy-B phase	-5~+5		
Cy phase	-5~+5		
Cy-B phase	-5~+5		
Cy/Cy-B gain	-5~+5		
Cy gain	-5~+5		
Cy-B gain	-5~+5		
Chroma gain	-5~+5		
Total ped	-5~+5		
File label		Name the camera, complex sub-menu follows	
AWC memory		Auto White Control, refer to the manual	
White bal	<u>AWC</u>, ATW, Manu	AWC is one-shot white balance	
R-gain	-128~+128	Manual settings	
B-gain	-128~+128		
Black bal			
R-ped	-128~+128	Manual settings	
B-ped	-128~+128		
Sync	<u>Int</u>, Ext		
H-phase	-5~+5	External sync phase shift	

SETUP MENU P3   Time code

item	*range*	*comment*	*BBC*
Electric zoom	<u>On</u>, Off	2.5:1 zoom in	
Freeze	<u>On</u>, Off	Enables FREEZE button on controller	
Flip enable	<u>Off</u>, Off (flip), On (flip)	Off (flip) locks it flipped vertically, On (flip) allows panel control	
Mirror enable	<u>Off</u>, Off (mirror), On (mirror), On	Same for horizontal flip	
Status display	On, Off	Shows direction arrows to indicate flip/mirror state	

To perform a factory reset, hold down the Left and Right buttons together for 2 seconds.
To restore all setup menu contents to default state, move to the 'End' line in the menu, then hold down the Freeze and Down buttons together for 2 seconds.

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2   Measurement results

All measurements were made using the HDSDI output. Pictures were displayed on a Sony 32" grade 1 CRT monitor, a waveform monitor, and recorded using proprietary software for analysis.

2.1   Sensitivity

Sensitivity was not measured directly. The specification claims F/8 at 2000 lux, about 400ASA.

2.2   Colour performance

Using a Colorchecker chart, the colour performance was judged to be quite poor and unacceptable for HDTV use. The yellow had a greenish tinge which is common in many. Skin tones were too pink, orange and green colours were highly desaturated. The overall effect is not good. Time spent with the matrix might have improved this, but there were other reasons for not following this route.

Unfortunately, the camera shows significant response to infra-red illumination, which is common in non-broadcast cameras.

Figure 1 Colorchecker chart

2.3   Resolution and aliasing

All testing was done with a circular zone plate test chart having 6 sinusoidally modulated patterns. The six patterns explore luminance and chroma channels on the top row, RGB channels on the bottom row, the samples shown here are each only one quadrant of the luminance (grey scale) pattern. Images were captured uncompressed from the control unit via HDMI converted to HDSDI.

With the detail control set to zero (presumed to mean no effect), the clean resolution appeared to be limited to only 960x540 pixels. Aliases are very apparent above those frequencies, and there are null centres centred precisely at 1920 and 1080. There is a small amount of diagonal aliasing, suggesting that the camera has diagonal precision offset (displacement of the green sensor from red and blue horizontally and vertically), but there is no discernable resolution outside the central clean area of 960x540.
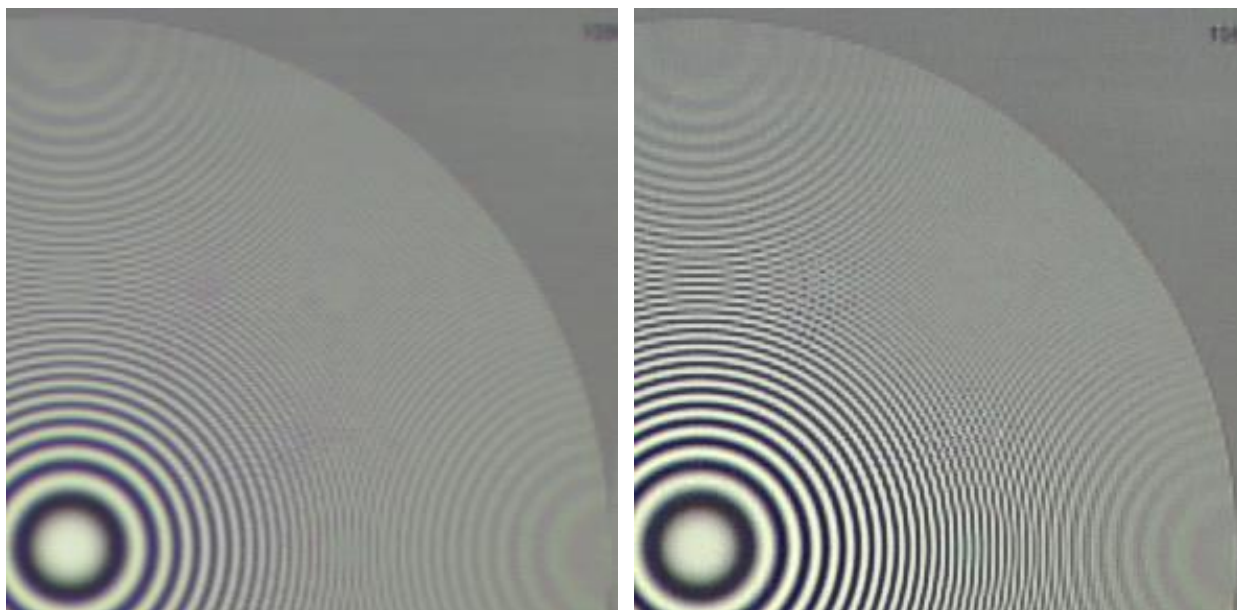
4

Figure 2 Zone plate (a) detail off   **(b) detail Band maximum, level mid**

Detail enhancement did little to help; it enhances the lower frequencies but also emphasises the aliases unacceptably.

2.4   Video Noise

Given the poor colorimetric and resolution performance, it was not thought worthwhile making noise measurements.

2.5   Rolling shutter

The camera has 3 CCD sensors, and therefore should not exhibit any rolling shutter effects.

2.6   Conclusion

The camera performs poorly both in colour and resolution. Under no circumstances could it be deemed acceptable as an HDTV source for broadcasting.