

# Colorimetric and Resolution requirements of cameras

Alan Roberts

## **ADDENDUM 52 : Tests and Settings on an Ikegami HDS V10 camcorder**

A one-day assessment was made on a sample of the V10 camcorder (serial number AA63081E), a single-standard HDTV camcorder fitted with a Canon HA17x7.6 HD lens. It appears to be made in two versions, one with 1920x1080 CCD sensors, another with 1280x720 CCD sensors. There was no marking on the camera body to identify the version on test, but it operated at 1080-line, 720 options were not available on the tested unit. SD performance was not tested.

Recordings are onto GF PAK modules. Power consumption is rather high, the specification claims 28 watts, but the plate on the camera stated '5.6 amps at 11~17 volts', implying more like 55 watts. The tested camera ran hot to the touch. It is also rather heavy, at 4.5kG.

Physically, it resembles many other camcorders, the familiar Digibeta size and layout, but it has a large lcd side panel with touch-screen controls for menu control. It has the usually BNC connectivity found on such cameras. It also has many features which make it suitable for multi-camera use in studio or location shooting. A full paper manual was available, but there was insufficient time during the test to absorb much of it other than the contents of the menus.

The camera has one filter wheel, carrying neutrals. Colour balancing is performed electronically.

Noise performance was not very good for a camera with 1920x1080 sensors.

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Many menu items have little or no effect on the image. Those that do so are highlighted, default values are bracketed where known. The full menus are given for completeness. Where two values are given {f} denotes film use, {v} video. The photographic speed of the camera is about the same as an equivalent SD camera, sensitivity is claimed as F/11 at 2000 lux, tests did not contradict this. Using conventional gamma and knee settings, about 2 stops of overexposure (about 400%) is possible. Noise level is claimed as 58dB, and the total exposure range is estimated as about 10 stops. However, the camera noise performance does not appear to be so good, measurements were rather disappointing, details are given in the measurements section at the end of this document.

The menus are organised hierarchically, which is indicated by inseting menu items in the following tables. Default values for entries (factory settings) are underlined.

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.

Although the camera does not shoot in progressive or psf modes, settings for a film look (f) have been derived. There are also settings for video (v) and news (n) in the menus. Menu items which affect image quality and require setting are highlighted.

This document should not be used as a substitute for reading the manual.

## 1 Menus and settings, touch screen

### USER MENU

| <i>Item</i> | <i>Range</i> | <i>description</i>                      | <i>BBC</i> |
|-------------|--------------|---|------------|
|             |              | Select up to 20 items for the User menu |            |

### USER DATA SELECT

| <i>Item</i>  | <i>Range</i> | <i>description</i>         | <i>BBC</i> |
|--------------|--------------|----------------------------|------------|
| Current Data |              | Up to 10 sets of User Data |            |
| Data Save    |              |                            |            |
| Data Rename  |              |                            |            |

### META DATA SELECT

| <i>Item</i>     | <i>Range</i>       | <i>description</i>                   | <i>BBC</i> |
|-----------------|--------------------|--------------------------------------|------------|
| Current Data    |                    | Up to 5 sets of Meta data            |            |
| Rename          |                    |                                      |            |
| Power On Erase  | <u>Off</u> , On    | Clears Meta Data on Power Up         |            |
| Initialise      | Cancel, Ok         | Resets all Meta data                 |            |
| Change Bin Mode | <u>Manu</u> , Sync | Sync makes Bins/Clips from Meta info |            |
| Auto Clip memo  | On, <u>Off</u>     |                                      |            |

### SW ASSIGN

| <i>Item</i>    | <i>Range</i>  | <i>description</i>                                     | <i>BBC</i> |
|----------------|---|--|------------|
| P.Func0        | <u>VF DTL</u> Level, Scene File, VF Display Mode, Step Gain, Fine Step Gain, Black Str/Prs, Master ped, Master Black Gamma, Super Knee, Fine DtlL, Audio Ch3 Level, Audio Ch4 Level, No entry   |  |            |
| P.Func1        | Retro Loop, Time Lapse, Anime, Pakloop, Hyper Gain +30, Hyper Gain +42, Hyper Gain +54, Hi-light Dtl, Soft DtlL, Skin Dtl, Color Corr, Color Sat, 5600K, Scene 1~Scene 6, Iris_ Corr, Iris++ Corr, Rec Trig, Ret Trg, Thumbnail, R Tally In, G Tally In, No Entry | Default: 1=5600K, 2=Retro Loop, 3=No Entry, 4=No Entry |            |
| P.Func2        |   |  |            |
| P.Func3        |   |  |            |
| P.Func Help    | <u>On</u> , Off   |  |            |
| Gain Sw (Low)  | -3, <u>0</u> , +3, +6, +9, +12, +18, +24, +30dB   | 1  | -3dB       |
| Gain Sw (Mid)  | 0, +3, <u>+6</u> , +9, +12, +18, +24, +30, +42dB  |  | 0dB        |
| Gain Sw (High) | +3, +6, +9, <u>+12</u> , +18, +24, +30, +42, +54dB  |  | +6dB       |
| Handle Sw      | <u>Rec/Ret</u> , Zoom, Focus, No entry  |  |            |
| Zoom Speed     | 1~100   |  |            |
| Focus Speed    | 1~100   |  |            |
| Ret Sw         | <u>Preview/Shot</u> , Ret   |  |            |
| Lens VTR Sw    | <u>Rec</u> , No Entry   |  |            |

### VF SETTING

| <i>Item</i>      | <i>Range</i>                        | <i>description</i>  | <i>BBC</i> |
|------------------|-------------------------------------|---|------------|
| VF Display Mode  | Off, <u>1</u> , 2                   | Amount of stuff shown, 1=markers/TC/variables, 2=everything |            |
| VF Dtl Lvl       | 1~ <u>20</u> ~100                   | Level of viewfinder sharpening                              |            |
| <b>VF MARKER</b> |                                     |   |            |
| Safety Area      | <u>Action</u> , Title               | Action=90%, Title=80%                                       |            |
| Safety Aspect    | 16:9, 15:9, 14:9, 13:9, <u>4:3</u>  |   | 14:9       |
| Safety Marker    | Off, <u>On</u>                      |   |            |
| Center Marker    | <u>Off</u> , On                     |   |            |
| Frame Marker     | <u>Off</u> , On                     |   |            |
| Frame Aspect     | <u>16:9</u> , 15:9, 14:9, 13:9, 4:3 |   | 16:9       |

<sup>1</sup> Noise level is rather high in this camera, so low gain should be used wherever possible.

|                        |                              |                                       |  |
|------------------------|------------------------------|---------------------------------------|--|
| Side Mask              | <u>Off</u> , On              | Darkens image outside frame marker    |  |
| Marker/Char Lvl        | 1~ <u>80</u> ~100            | Brightness for characters and markers |  |
| Side Mask Lvl          | 1~ <u>50</u> ~100            |                                       |  |
| <b>VF ! INDICATOR</b>  |                              |                                       |  |
| AWB Off                | <u>On</u> , Off              |                                       |  |
| Lens Ext               | <u>On</u> , Off              |                                       |  |
| Manual Knee            | <u>On</u> , Off              |                                       |  |
| Skin Dtl               | <u>On</u> , Off              |                                       |  |
| Shutt/Sup-V            | On, <u>Off</u>               |                                       |  |
| A.Iris Corr            | <u>On</u> , Off              |                                       |  |
| VF Display Sel         |                              | Show the lot to help selection        |  |
| <b>ZEBRA INDICATOR</b> |                              |                                       |  |
| Zebra 1 Detect         | 30~ <u>100</u> ~109%         |                                       |  |
| Zebra 1 Ind            | On, <u>Off</u>               |                                       |  |
| Zebra 2 Detect         | 30~ <u>70</u> ~109%          |                                       |  |
| Zebra 2 Ind            | <u>On</u> , Off              |                                       |  |
| Focus Value            | No Disp, <u>Meter</u> , Feet |                                       |  |
| Remote Menu Disp       | <u>On</u> , Off              | Add V/F items to RMC panel display    |  |
| Playback Video         | <u>Yes</u> , No              | Allows playback video in the V/F      |  |

## BIN SETTING

| <i>Item</i> | <i>Range</i> | <i>description</i>                    | <i>BBC</i> |
|-------------|--------------|---------------------------------------|------------|
| Active Bin  |              | Bin names show in sequence, press SET |            |
| New Bin     |              |                                       |            |
| Bin Rename  |              |                                       |            |

## CAMERA SETTING

| <i>Item</i>         | <i>Range</i>                   | <i>description</i>                             | <i>BBC</i>                |
|---------------------|--------------------------------|--|---------------------------|
| <b>VIDEO ADJUST</b> |                                |  |                           |
| <b>PED</b>          |                                |  |                           |
| Master ped          | -100~ <u>0</u> ~+100           |  |                           |
| R.Ped               | -100~ <u>0</u> ~+100           |  |                           |
| G.Ped               | -100~ <u>0</u> ~+100           |  |                           |
| B.Ped               | -100~ <u>0</u> ~+100           |  |                           |
| Adjust Clr          |                                | Resets adjustments to zero                     |                           |
| <b>FLARE</b>        |                                |  |                           |
| Flare On/Off        | Off, <u>On</u>                 |  |                           |
| Master Flare        | -100~ <u>0</u> ~+100           |  |                           |
| R.Flare             | -100~ <u>0</u> ~+100           |  |                           |
| G.Flare             | -100~ <u>0</u> ~+100           |  |                           |
| B.Flare             | -100~ <u>0</u> ~+100           |  |                           |
| Adjust Clr          |                                | Resets adjustments to zero                     |                           |
| <b>GAMMA</b>        |                                |  |                           |
| Step Gamma          | <u>0.45</u> , 0.4, 0.35, Off   |  | 0.45                      |
| Master Gamma        | -100~ <u>0</u> ~+100           |  |                           |
| R.Gamma             | -100~ <u>0</u> ~+100           |  |                           |
| G.Gamma             | -100~ <u>0</u> ~+100           |  |                           |
| B.Gamma             | -100~ <u>0</u> ~+100           |  |                           |
| Cine Gamma Mode     | <u>Normal</u> , Cine 1, Cine 2 | Unusual gamma curves, see measurements section | Normal (v,n),<br>Cine (f) |
| Adjust Clr          |                                | Resets adjustments to zero                     |                           |
| <b>BLACK GAMMA</b>  |                                |  |                           |
| Black Gamma On/Off  | <u>Off</u> , On                |  |                           |
| Master Black Gamma  | -100~ <u>0</u> ~+100           |  |                           |
| R.Blk Gamma         | -100~ <u>0</u> ~+100           |  |                           |
| G.Blk Gamma         | -100~ <u>0</u> ~+100           |  |                           |
| B.Blk Gamma         | -100~ <u>0</u> ~+100           |  |                           |
| Adjust Clr          |                                | Resets adjustments to zero                     |                           |
| <b>KNEE</b>         |                                |  |                           |
| Knee On/Off         | <u>On</u> , Off                |  | On                        |
| Auto Knee On/Off    | <u>On</u> , Off                |  | On (n), Off (v,f)         |

| <i>Item</i>            | <i>Range</i>                               | <i>description</i>           | <i>BBC</i>              |
|------------------------|--|------------------------------|-------------------------|
| Auto Knee Point        | -100~0~+100                                |                              |                         |
| Auto Knee Slope        | -100~+0.3~+100                             |                              |                         |
| Manual Knee Point      | -100~0~+100                                |                              | 0                       |
| Manual Knee Slope      | -100~0~+100                                |                              | 0                       |
| Super Knee             | Low, Mid, High, <u>Off</u>                 | Retains colour in highlights |                         |
| Smooth Knee            | <u>Off</u> , Type1, Type2, Type3           | Smooths out the join         |                         |
| Adjust Clr             |  | Resets adjustments to zero   |                         |
| <i>GAIN</i>            |  |                              |                         |
| R.Gain                 | -100~0~+100                                |                              |                         |
| G.Gain                 | -100~0~+100                                |                              |                         |
| B.Gain                 | -100~0~+100                                |                              |                         |
| Adjust Clr             |  | Resets adjustments to zero   |                         |
| Shockless Step Gain    | 0.3sec, 0.5, 0.7, 1, 1.5, 2,<br><u>Off</u> |                              |                         |
| <i>WHITE CLIP</i>      |  |                              |                         |
| White Clip On/Off      | <u>On</u> , <u>Off</u>                     |                              |                         |
| R.White Clip           | -100~0~+100                                |                              |                         |
| G.White Clip           | -100~0~+100                                |                              |                         |
| B.White Clip           | -100~0~+100                                |                              |                         |
| Adjust Clr             |  | Resets adjustments to zero   |                         |
| <i>DTL ADJUST</i>      |  |                              |                         |
| Dtl                    | <u>On</u> , <u>Off</u>                     |                              | On                      |
| Dtl Lvl                | -100~+0.4~+100                             |                              | 0 (v), +15 (n), -21 (f) |
| Skin Dtl               | <u>Off</u> , <u>On</u>                     |                              |                         |
| Auto Hue Detect        | <u>On</u> , <u>Off</u>                     | Skin colour                  |                         |
| Skin Dtl Lvl           | -100~0~+100                                |                              |                         |
| Soft Dtl               | <u>On</u> , <u>Off</u>                     |                              |                         |
| <i>SOFT DTL ADJUST</i> |  |                              |                         |
| White Sup              | -100~0~+100                                | Positive-going edges         |                         |
| Black Sup              | -100~0~+100                                | Negative-going edges         |                         |
| Adjust Clr             |  | Resets adjustments to zero   |                         |
| Fine Dtl Bal           | 1~4~8                                      | Negative-going edges         |                         |
| Hi-Light Dtl           | <u>Off</u> , <u>On</u>                     | Detail in highlights         |                         |
| Dtl V Filter           | <u>On</u> , <u>Off</u>                     | Vertical detail filter       |                         |
| Adjust Clr             |  | Resets adjustments to zero   |                         |
| <i>COLOR ADJUST</i>    |  |                              |                         |
| Matrix Sel             | <u>Off</u> , 1, 2, 3                       | Three adjustable matrices    |                         |
| <i>MATRIX ADJUST</i>   |  |                              |                         |
| R-G                    | -100~0~+100                                |                              |                         |
| R-B                    | -100~0~+100                                |                              |                         |
| G-R                    | -100~0~+100                                |                              |                         |
| G-B                    | -100~0~+100                                |                              |                         |
| B-R                    | -100~0~+100                                |                              |                         |
| B-G                    | -100~0~+100                                |                              |                         |
| Color Corr             | <u>Off</u> , <u>On</u>                     |                              |                         |
| <i>COLOR CORR ADJ</i>  |  |                              |                         |
| R Sat                  | -100~0~+100                                |                              |                         |
| R.Hue                  | -100~0~+100                                |                              |                         |
| Mg.Sat                 | -100~0~+100                                |                              |                         |
| Mg.Hue                 | -100~0~+100                                |                              |                         |
| B.Sat                  | -100~0~+100                                |                              |                         |
| B.Hue                  | -100~0~+100                                |                              |                         |
| Cy.Sat                 | -100~0~+100                                |                              |                         |
| Cy.Hue                 | -100~0~+100                                |                              |                         |
| G.Sat                  | -100~0~+100                                |                              |                         |
| G.Hue                  | -100~0~+100                                |                              |                         |
| Yl.Sat                 | -100~0~+100                                |                              |                         |
| Yl.Hue                 | -100~0~+100                                |                              |                         |
| Color Sat              | <u>Off</u> , <u>On</u>                     |                              |                         |
| Color Sat Lvl          | -100~0~+100                                |                              |                         |
| Adjust Clr             |  | Resets adjustments to zero   |                         |

| <i>Item</i>           | <i>Range</i>                                | <i>description</i>   | <i>BBC</i> |
|-----------------------|---|--|------------|
| <b>ABB/AWB MODE</b>   |   |  |            |
| AWB With A.Iris       | <u>On</u> , Off                             | Switch off Auto Iris when Black Balancing                                    |            |
| Shockless AWB         | Off, 0.3sec, 0.5, 0.7, <u>1</u> , 1.5, 2sec |  |            |
| Filter AWB Mem        | <u>Off</u> , On                             | Store AWB data for each CC filter setting                                    |            |
| AWB Reference         | <u>Off</u> , On                             | Allows driving the reference point (see Reference Set)                       |            |
| AWB Detect Area       | <u>Wide</u> , Spot                          | Wide=whole picture, Spot=centre  |            |
| Detect Area Marker    | <u>Off</u> , On                             |  |            |
| Reference Set         | <u>AWB</u> , ABB, Cancel                    | AWB=remember current white as AWB ref, ABB=remember current black as ABB ref |            |
| ABS Mode              | <u>Normal</u> , APS, P Only                 | Normal=correct saw/para, P=Peak Shading, APS=both                            |            |
| Auto White Shading    |   |  |            |
| Auto Black Shading    |   |  |            |
| <b>AUTO IRIS SET</b>  |   |  |            |
| Iris Set Mode         | Off, <u>On</u>                              |  |            |
| Iris Level Set        | -100~ <u>-40</u> ~+100                      | Iris aim point   |            |
| Peak Ratio Set        | -100~ <u>0</u> ~+100                        | Peak/mean, + for bright, - for dark  |            |
| Iris Gain             | <u>1</u> ~100                               | Response sensitivity   |            |
| Iris Limit            | F22, F20, F18, <u>F16</u>                   | Don't go below about F/11 for best performance, any lens                     | F16        |
| Lens Adjust           | <u>Off</u> , F2.8, F16                      | For tweaking lens voltages   |            |
| Iris Pattern          | <u>0</u> , 1, 2, 3, 4                       | 0=full screen, 1=lower ¾, 2=top ¾, 3=middle, 4=4:3                           |            |
| <b>LENS SELECT</b>    |   |  |            |
| File                  | <u>Off</u> , On                             | 8 lens files   |            |
| Number                | 1~8   |  |            |
| Name                  |   | Enter a name   |            |
|                       |   | Reports name from a 'serial' lens  |            |
| Auto Sel              | <u>Off</u> , On                             |  |            |
| Set Mode              | <u>Off</u> , On                             |  |            |
| <b>SCENE FILE</b>     |   |  |            |
| Current Number        | <u>Off</u> , 1~8                            |  |            |
| Store Scene           | 1~8   |  |            |
| <b>MONI OUT</b>       |   |  |            |
| Output Signal         | SD SDI, <u>HDSDI</u> , Off                  |  |            |
| Playback Video        | <u>Yes</u> , No                             | Allow playback to monitor output   |            |
| Char Ind              | Off, <u>On</u>                              | Add V/F stuff to monitor output  |            |
| Level                 | 1~ <u>100</u>                               | Video level of V/F stuff   |            |
| Marker Ind (HD)       | Off, <u>On</u>                              | Only in HD mode  |            |
| Level                 | 1~ <u>100</u>                               |  |            |
| Zebra Ind (HD)        | On, <u>Off</u>                              | Only in HD mode  |            |
| Level                 | 1~ <u>80</u> ~100                           |  |            |
| <b>SDI OUT</b>        |   |  |            |
| Output Signal         | SD SDI, <u>HDSDI</u> , Off                  |  |            |
| Playback Video        | <u>Yes</u> , No                             | Allow playback to SDI/HDSDI  |            |
| Char Ind              | Off, <u>On</u>                              |  |            |
| Level                 | 1~ <u>100</u>                               |  |            |
| Marker Ind (HD)       | Off, <u>On</u>                              |  |            |
| Level                 | 1~ <u>100</u>                               |  |            |
| Zebra Ind (HD)        | On, <u>Off</u>                              |  |            |
| Level                 | 1~ <u>80</u> ~100                           |  |            |
| <b>BARS TITLE/MDO</b> |   |  |            |
| Display               | <u>Off</u> , On                             | Add title to bars  |            |
| Position              | Right, <u>Left</u>                          |  |            |
| Title                 |   | Set the title  |            |
| Bars Mode             | Normal, <u>Multi</u>                        | Normal=SMPTE   |            |
| <b>OTHERS</b>         |   |  |            |
| Pwr On AWB Off Clr    | <u>Yes</u> , No                             |  |            |
| Menu Cursor           | <u>Next</u> , Stay                          |  |            |
| Access LED            | <u>Enable</u> , Disable                     |  |            |

## AUDIO SETTING

| <i>Item</i>    | <i>Range</i>               | <i>description</i>                 | <i>BBC</i> |
|----------------|----------------------------|------------------------------------|------------|
| Front Mic +48V | Off, <u>On</u>             |                                    |            |
| Front Mic Lvl  | <u>-40</u> , -60dBu        |                                    |            |
| Ch1 Volume     | <u>Enable</u> , Disable    |                                    |            |
| Ch2 Volume     | <u>Enable</u> , Disable    |                                    |            |
| Front Volume   | 1, 2, 3, 4                 |                                    |            |
| Ch3 AGC        | <u>Off</u> , On            |                                    |            |
| Ch4 AGC        | <u>Off</u> , On            |                                    |            |
| Ch3 Lvl        | 1~ <u>100</u>              |                                    |            |
| Ch4 Lvl        | 1~ <u>100</u>              |                                    |            |
| Ch1/2 AGC Mode | Stereo, <u>Mono</u>        | Stereo locks channel AGCs together |            |
| Ch3/4 AGC Mode | Stereo, <u>Mono</u>        | Stereo locks channel AGCs together |            |
| Ch1 Mic LCF    | On, <u>Off</u>             | Wind cut filter                    |            |
| Ch2 Mic LCF    | On, <u>Off</u>             |                                    |            |
| Ch3 Mic LCF    | On, <u>Off</u>             |                                    |            |
| Ch4 Mic LCF    | On, <u>Off</u>             |                                    |            |
| Ch1 Mic Limit  | On, <u>Off</u>             |                                    |            |
| Ch2 Mic Limit  | On, <u>Off</u>             |                                    |            |
| Ch3 Mic Limit  | On, <u>Off</u>             |                                    |            |
| Ch4 Mic Limit  | On, <u>Off</u>             |                                    |            |
| Rear Mic1 Lvl  | <u>-40</u> , -60dBu        |                                    |            |
| Rear Mic2 Lvl  | <u>-40</u> , -60dBu        |                                    |            |
| Wireless Mode  | <u>Mono</u> , Stereo       |                                    |            |
| Output Select  | <u>Ch1/Ch2</u> , Ch3/Ch4   |                                    |            |
| Test Tone      | <u>With Bars</u> , On, Off |                                    |            |
| Moni Mix Mode  | <u>Mix</u> , Stereo        |                                    |            |
| Audio Sampling | <u>24bit</u> , 16bit       |                                    |            |

## RECORDER SETTING

| <i>Item</i>          | <i>Range</i>                                    | <i>description</i>  | <i>BBC</i> |
|----------------------|---|---|------------|
| Rec Source           | <u>Camera</u> , Ext SDI                         | Recording from external SDI is not available on EU models |            |
| <i>REC FORMAT</i>    |   |   |            |
| HD Video Compression | <u>MPEG2-100</u> , MPEG2-50                     | 100Mb/s=I-frame, 50=Long GoP                              |            |
| SD Video Compression | MPEG2-50, MPEG2-40, <u>MPEG2-30</u>             |   |            |
| Audio Sampling       | 16bit, <u>24bit</u>                             |   |            |
| Rec Mode             | <u>Normal</u> , Retro, T Lapse, Anime, Pak Loop |   |            |
| <i>RETRO LOOP</i>    |   |   |            |
| Retro Loop Length    | <u>5</u> ~25sec                                 | Video cache   |            |
| Retro Tally Blink    | <u>On</u> , Off                                 |   |            |
| <i>TIME LAPSE</i>    |   |   |            |
| Rec Length           | 1F~10F  |   |            |
| Interval             | hh:mm:ss:ff                                     | Enter values  |            |
| During Time          | hh:mm:ss:ff                                     | Enter values  |            |
| Number Of Times      | 1~10  |   |            |
| Anime Length         | 1F~10F  | Animation recording, frames                               |            |
| Pak Loop             | 5min~Pak remain-1min                            |   |            |
| Rec Tally            | <u>R Tally</u> , G Tally                        |   |            |
| <i>TIME CODE</i>     |   |   |            |
| DF/NDF               | DF, NDF   | Relevant only for shooting at 59.94, 29.97, 23.98         |            |
| User Bit             | User, Date                                      |   |            |
| User Bit Set         |   |   |            |
| TC Out               | TCG, <u>TCG/TCR</u>                             |   |            |

## SYSTEM SETTING

| <i>Item</i>         | <i>Range</i>              | <i>description</i>                            | <i>BBC</i>   |
|---------------------|---------------------------|---|--|
| <b>SCAN FORMAT</b>  |                           |   |  |
| Format              | 1080                      | 1080/59.94i, 1080/50i,<br>480/59.94i, 576/50i | Different options depending on the camera version, i.e. sensor resolutions |
|                     | 720                       | 720/59.94p, 720/50p,<br>480/59.94i, 576/50i   |  |
| SD Aspect           | <u>Squeeze</u> , Side Cut |   |  |
| <b>TIME SETTING</b> |                           |   |  |
| Date                | **/**/**                  |   |  |
| Time                | **:**:**                  |   |  |
| Time Zone Select    | GMT+12~GMT+13             |   |  |

## MAINTENANCE

| <i>Item</i>                    | <i>Range</i>   | <i>description</i>  | <i>BBC</i> |
|--------------------------------|--|---|------------|
| <b>GENLOCK</b>                 |  |   |            |
| H Phase                        | -100~ <u>0</u> ~+100   |   |            |
| <b>AUDIO</b>                   |  |   |            |
| Headroom Sel                   | <u>20dB</u> , 18dB   |   |            |
| Rear Line 1 Level              | <u>0</u> , +4dB  |   |            |
| Rear Line 2 Level              | <u>0</u> , +4dB  |   |            |
| Audio Out Level                | <u>0</u> , +4dB  |   |            |
| <b>BATTERY SETTING</b>         |  |   |            |
| Battery Type Sel               | Anton NiCd, Anton LiIon, IDX NiCd, IDX LiIon, IDX NiMh1, IDX NiMh2, Others |   |            |
| Warning Level                  | 11.0~ <u>13.0</u> ~15.0  |   |            |
| Power Off Level                | 11.0~ <u>12.0</u> ~14.9  | Switch-off voltage for Others setting                                       |            |
| <b>WARNING ALARM</b>           |  |   |            |
| Warn Front Tally               | <u>On</u> , Off  |   |            |
| Warn Back Tally                | <u>On</u> , Off  |   |            |
| Alarm Beep Mode                | <u>On</u> , Off  | Beeps until Set is pressed  |            |
| <b>PAK MAINTENANCE</b>         |  |   |            |
| Pak Initialize                 | Ok, Cancel   | Format a storage GF Pak   |            |
| Pak Repair                     | Ok, Cancel   | Accidental power-off can wreck a Pak, this attempts to salvage it           |            |
| ROM Version                    |  | Software versions for Camera CPU, recorder CPU, Codec, and processing FPGAs |            |
| <b>WORKING TIME</b>            |  |   |            |
| Working Time                   |  | Show total working time from new  |            |
| Sub Time                       |  | Show working time since last reset  |            |
| Sub Time Clear                 |  | Reset   |            |
| Fan Control                    | <u>Auto</u> , Sslow, Slow, Mid, Fast                                       |   |            |
| Temperature Level              |  | Report only, internal temperature   |            |
| <b>CPU SYSTEM CONT</b>         |  |   |            |
| Semi remote Mode               | <u>On</u> , <u>Off</u>   |   |            |
| User Menu Edit                 |  | Add stuff to the User Menu  |            |
| <b>PRESET FILE LOAD</b>        |  |   |            |
| File Select                    | <u>Engineer</u> , Factory  |   |            |
| Load Start                     |  |   |            |
| <b>ENGINEER SET FILE RENEW</b> |  |   |            |
| Data Renew Mode                |  | Overwrite the Engineer file   |            |
| <b>AUTO DPC</b>                |  |   |            |
| DPC                            | <u>On</u> , Off  | Defective Pixel Correction  |            |
| Detect Mode                    | <u>Wht+Blk</u> , Wht, Blk  | Search for white or black pixels  |            |
| Sample Area Set                |  | Box marker for search   |            |
| Auto DPC                       |  | Do it   |            |
| DPC Effect Check               | Ok, Cancel   | Check what it's done  |            |
| DPC Clear                      | Ok, Cancel   | Reset the stored data   |            |



| <i>Item</i>            | <i>Range</i>    | <i>description</i>                       | <i>BBC</i> |
|------------------------|-----------------|--|------------|
| <b>LENS</b>            |                 |  |            |
| Lens Serial I/F        | <u>On</u> , Off | Allow lens communication with the camera |            |
| Fibre Extension Mode   | <u>On</u> , Off | Allow gunlock with fibre extension       |            |
| Camera ID Setup        |                 | Enter a name                             |            |
| <b>FIRMWARE UPDATE</b> |                 |  |            |
| Firmware Ver.          |                 | Show current firmware versions           |            |
| Data select            |                 | Update firmware from USB device          |            |
| Bluetooth Setting      |                 |  |            |

## **USB MEMORY**

| <i>Item</i>    | <i>Range</i> | <i>description</i>      | <i>BBC</i> |
|----------------|--------------|-------------------------|------------|
| User Data Load |              | Copy User File from USB |            |
| User Data Save |              | Copy to USB             |            |
| Meta Data Load |              |                         |            |
| Text File Load |              |                         |            |

## 2 Measurement results

### 2.1 Colour performance

Assessments were made visually, using Colorchecker charts as usual. Colour performance was acceptable, no issues arose.

#### 2.1.1 Gamma curves

There is no explanation of the gamma curves in the camera, and no sawtooth test signal was found, therefore measurements were taken using standard reflectance cards (Kodak Gray). Each card has a reflectance of 18% on one side, 90% on the other, a ratio of exactly 5:1. Therefore, when exposing to get peak white from the 90% side, the 18% side presents a 20% reflectance which can be compared with the calculated values for standard curves.

For identical illumination and lens settings, the results are shown in Table 1. The ‘Normal’ curve is a close match to the BBC 0.4 law (0.505 for 20% exposure). Cine 1 causes under-exposure by about 0.8 stops, and after compensating for that, the 20% exposure value is 0.459, a reasonable match to the ITU Rec.709 curve (0.434 for 20% exposure). Cine 2 cause under-exposure of about 2.5 stops, and after allowance for that, the 20% exposure value is also 0.459. Clearly, both the Cine curves are actually ITU.709 gamma curves, the only differences being the degree of under-exposure.

|        | ‘18%’ | ‘90%’ |
|--------|-------|-------|
| Normal | 0.492 | 0.999 |
| Cine 1 | 0.376 | 0.819 |
| Cine 2 | 0.324 | 0.706 |

#### 2.1.2 Gamma knee

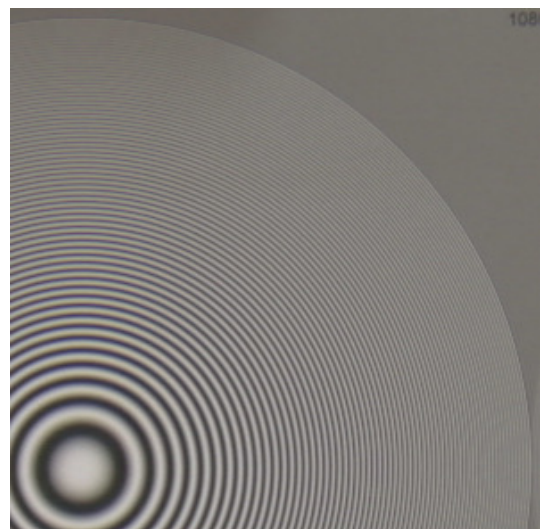
The manual knee function is not calibrated in the menus. Measurements showed that setting the knee point to -80 produced a knee break at 100% video level, point 0 set a knee at 95%, and +120 made a break point at about 75%. Without a proper camera test signal it was not easy to derive optimum slope settings, but over-exposure of about 2 stops was found to be possible using the knee, although the default settings result in only about ¼ stop overexposure.

The Super Knee and Smooth Knee functions were superficially tested, they both worked.

### 2.2 Resolution

A HDTV zone plate chart was used. This contains six circular patterns which fully explore the spatial frequency performance of the camera, up to 1920x1080 pixels per width and height. Three patterns are grey-scale for testing luma performance, three more are coloured for examining chroma resolution or other colour filtering, and two for chroma channels. Modulation is cosine rather than square wave. Each pattern is a “phase space” map of the possible frequencies that the camera can be expected to deal with, reaching 1920 pixels/picture width (960 cycles) horizontally, and 1080 lines/picture height (540 cycles) vertically.

Figure 1 shows a single quadrant of one grey-scale pattern; for this exposure, the camera detail enhancement was turned off, so this is the native performance of the camera. There are no visible alias patterns, apart from a faint one centred on 1080 lines (top of the pattern) and another centred on 1920 pixels (right of the pattern). This confirms that the sensors are 1920x1080, and that the optical spatial filtering is perhaps not quite strong enough. The clean horizontal resolution indicates that there is no “precision offset” of the green from red and blue sensors, a common technique to enhance resolution in cameras. This is very encouraging.



**Figure 1 resolution, detail off**

It is clear that the horizontal resolution is a little better than the vertical, not unusual in an interlaced camera, but it hints that the interlacing process is happening very early in the camera, probably on the CCDs themselves.

There were no alias patterns resulting from frequencies beyond the limits of 1920x1080 video.

### 2.2.1 Detail enhancement

For a film look (not possible in this camera at 1080-line because it does not, appear to support the normal psf format at 1080i), detail can simply be set to -21 (Fig. 2), and the results will be a good match to super-16 film. However, for a 35mm look, a little enhancement would be a good idea, setting level to zero should be acceptable, since setting to zero does not mean no enhancement, only the factory default level.

Since the native resolution is very clean, it is possible to use rather more detail enhancement than usual. Figure 3 shows a setting with detail level +15. Clearly, the outer edge of the chart is a little too sharpened, and the enhancement has generated a faint vertical alias through third-harmonic distortion, but the setting could be good for a “news look”.

However, any more extreme enhancement should be used with care, since it has emphasised the noise somewhat, and since there is no noise slicer control in the menus, there is no way to avoid emphasising noise.

### 2.3 Noise performance

Measurements were made by exposing the camera to a plain white card, evenly lit, highly defocused. The camera gain was set to 0dB and exposure was set to generate video signals at 4 levels over the signal range. Data files were saved to a data store via HDSDI. Software analysis was then used to convert the files to BMP format, and to measure the rms noise levels in each file, using specialised software. The detail enhancement Level was set to 0, factory default level.

The results are rather odd. In a normal camera, the noise level should be directly related to the slope of the gamma curve, and therefore noise at black should be about 17dB worse than at white. In this camera, noise at black is 4dB better than noise at white. Clearly, there is some odd signal processing taking place in this camera. It is not unusual to have a slight rise in noise near white, perhaps due to shot noise, but that would not normally be greater than 1dB, whereas this camera has noise rising by 2dB near white. One possible cause for the rise near white is electronic noise reduction, reducing noise at lower levels.

The dramatic drop in noise near black can have a number of possible causes, e.g. noise reduction by spatial low-pass filtering, or performing gamma-correction in analogue circuitry before the colour matrix. Since gamma-correction in analogue would have to be performed using parametric amplifiers (where the gain is a

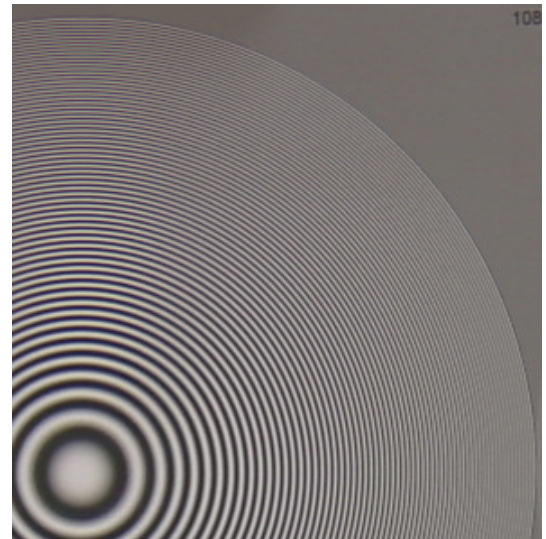


Figure 2 Resolution, detail=-21

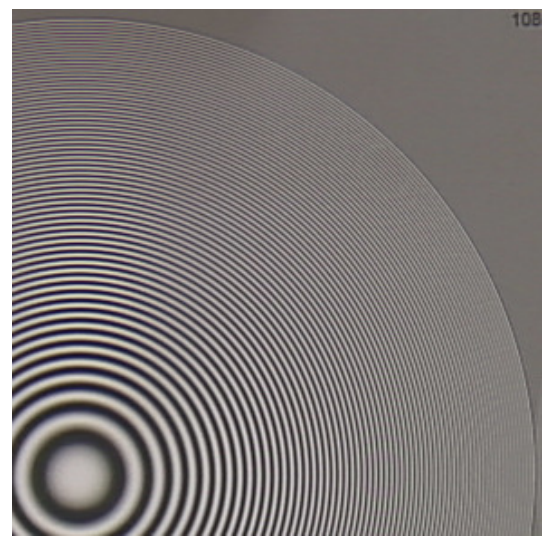


Figure 3 Resolution, detail=+15

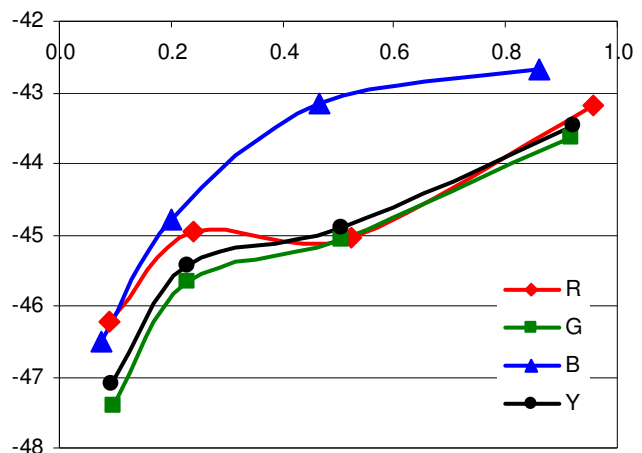


Figure 4 Noise levels

function of the signal level), it is conceivable that such amplifiers have a low gain-bandwidth product, resulting in a significant lowering of resolution as the gain rises near black.

The ITU.709 gamma curve has zero slope (i.e. unity gain) at about mid-grey. Therefore, taking the measured noise value at mid-grey should return the noise value when gamma correction is off (i.e. linear), and this is the normally-quoted value for a camera. In this case, the linear noise is about -45.2dB, which is about 10dB worse than that of the best cameras available for HDTV.

Since the noise performance is relatively poor, it was not investigated any further.

## **2.4 Conclusion**

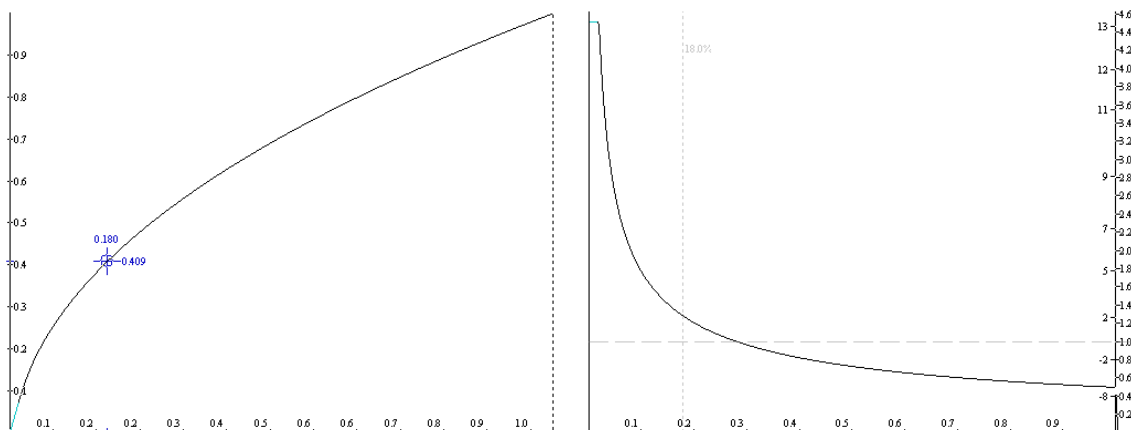
Resolution at HDTV 1080 is good, but noise performance is poor. Also, it has no progressive mode, which is required by many productions. Also, it is unusually heavy, and runs hot.

# Thomson/GV DMC1000 Infinity

## Second tests at Kingswood Warren, April 4 2008

### 1. Noise levels at 0dB gain.

| File | Video level | Noise level |
|------|-------------|-------------|
| 2    | 0.930       | -42.24dB    |
| 3    | 0.464       | -45.57dB    |
| 4    | 0.237       | -45.97dB    |
| 5    | 0.086       | -43.06dB    |



Noise performance usually follows the slope of the gamma curve, since noise is generated mostly in the analogue front end of the camera. Although the gamma curve selected in the camera was called “CCIR” it is probably intended to be that of ITU.R-BT 709 (left-hand plot).

Thus the noise levels for these four measurement points should be expected to follow the log of the slope, so at 93%, the noise should be about 5.8dB lower than at 27.8%, where the slope of the gamma curve is unity. Also, at 8.6% the noise should be about 5.5dB higher. However, the measurements vary only by about 3.5dB instead of 11dB, implying that some noise is being generated after the gamma corrector. This is unusual, and rather surprising.

The “safety check” is to measure the noise at high gain, to discriminate between front-end and processing noises.

### 2. Noise levels at 12dB gain

| File | Video level | Noise at +12dB | Equivalent noise at 0dB |
|------|-------------|----------------|-------------------------|
| 6    | 0.900       | 36.86dB        | 48.86dB                 |
| 7    | 0.461       | 38.50dB        | 50.50dB                 |
| 8    | 0.246       | 36.83dB        | 48.83dB                 |
| 9    | 0.117       | 33.45dB        | 45.45dB                 |

Noise at +12dB is considerable, and the distribution is a little greater than at 0dB gain. The right-hand column removes the effect of the 12dB gain and predicts the noise at 0dB; the values are significantly different from those measured at 0dB, and this confirms that noise is being added after gamma-corrections.

The camera’s noise specification is for -54dB, it misses that figure by at least 8.5dB at 0dB gain.

### 3. Noise levels in linear mode

One measurement was taken with gamma-correction switched off and 12dB gain.

| File | Video level | Noise at +12dB | Noise at 0dB |
|------|-------------|----------------|--------------|
| 10   | 0.546       | 36.65dB        | 48.65dB      |

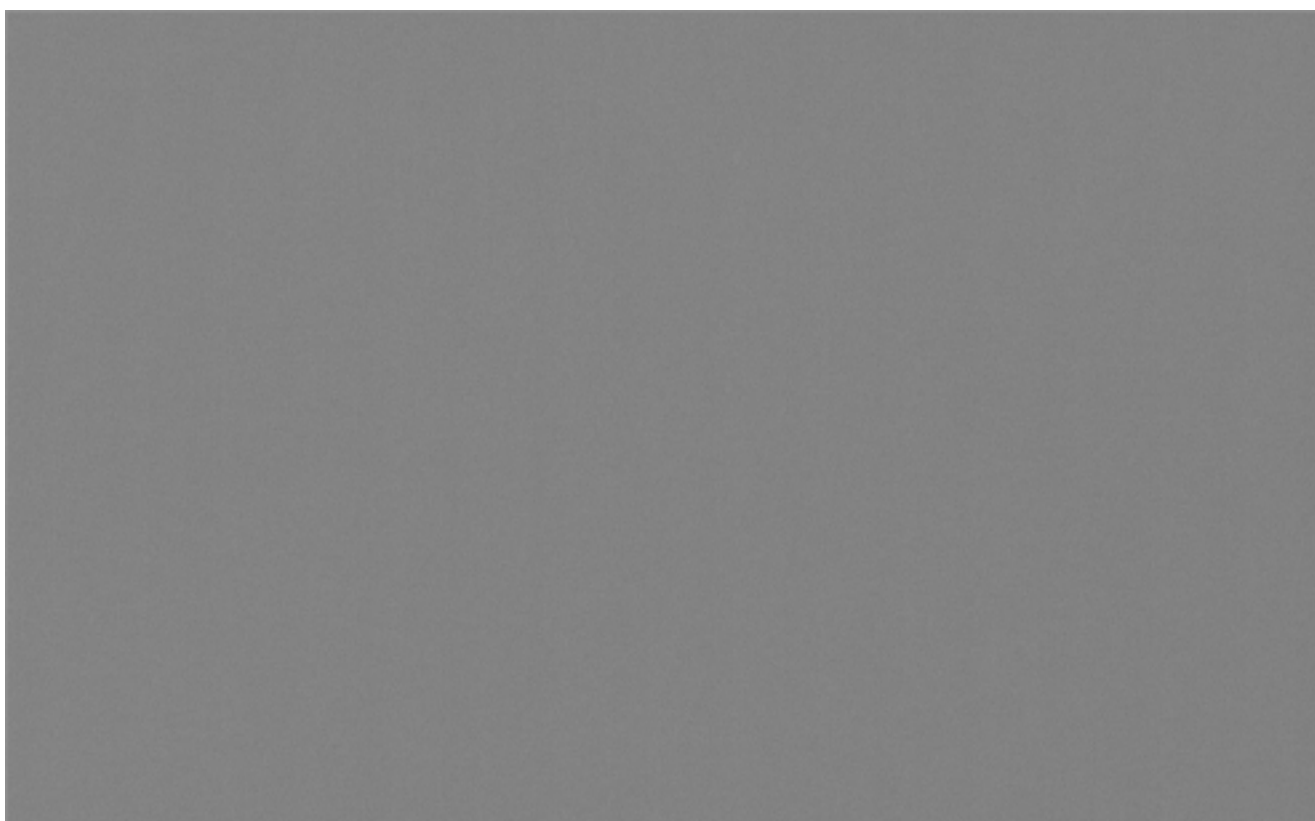
The result is very close to the value derived with gamma-correction, at 25% signal level. This is good confirmation that the gamma curve is not doing anything unexpected.

#### 4. Noise at high temperature

There was a hint of fixed-pattern noise in the video output at high gain, so the camera was allowed to heat up such that the sensors reached 63°C. A final measurement was then made at +12dB gain. This time, instead of using only the luma (Y) channel, the signal was fully decoded into RGB using ITU-709 a chroma re-sampling filter and decoding equations. This is the same process that I used for decoding the Macbeth Chart image file. For all the other noise measurements, I have used only the luma (Y') channel because the noise was visually fairly neutral when viewed on a Sony 36" HD CRT monitor. However, for investigating such an extreme condition, it is a good idea to see what is happening in the RGB channels as well. The disadvantage is that processing takes a lot longer.

|      | Levels |       |       | Noise  |        |        |
|------|--------|-------|-------|--------|--------|--------|
| File | R      | G     | B     | R      | G      | B      |
| 11   | 0.418  | 0.452 | 0.800 | -33.98 | -35.85 | -25.53 |

There is some visible vertical patterning, but the level is very low. It is most visible in the luma channel, the chroma channels do not seem to have it at all.



It is difficult to see in this sample (495x307 pixels cropped from the centre), but it is rather more visible when the camera is panned across a plain image. Even at this level it might be a problem in some productions. There was no evidence of the pattern at normal temperatures, but it could well be significant on difficult scenes (low video level, plain background, slow pan).

#### 5. Conclusion

Noise levels are lower than was measured in the first tests, by about 7dB. However, the noise is still 9dB short of the specification's claim of 54dB. Based on these tests, this is still the most noisy HDTV camera measured so far. Only the Panasonic HDX400 has similar noise levels, and that camera has been dropped by the BBC. Indeed, it was the visible noise from the HDX900 that started me measuring noise levels in cameras.

For comparison, the HPX500 noise level is consistently about 3dB lower, and the HPX 3000 is about 2dB less noisy. The Varicam is 1dB more noisy, but that camera is “allowed” because of its unique features.

It seems that noise is generated within the digital part of the camera, after gamma-correction, because noise distribution does not follow the slope of the gamma curve; quite possibly, it is the low-level fixed pattern noise that is polluting the head noise and so returning excessive noise levels.