



AccuPel DVG-5000 Digital Video Calibration Generator

User Manual
5/3/12

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AccuPel DVG-5000 Digital Video Calibration Generator

User Manual

Version 1.2

Safety Information

- Do not expose the DVG-5000 to rain or moisture. Do not operate the DVG-5000 with the covers removed.
- Use only the supplied power module. Route power cords so they will not be stepped on or pinched by anything placed on or against them.
- Keep the DVG-5000 away from wet locations such as bathtubs, sinks, wet basements or swimming pools.
- Unplug the DVG-5000 before cleaning. Use a damp cloth for cleaning. Do not use cleaning fluids or aerosols, which could enter the unit and cause damage, fire or electrical shock.
- Do not attempt to calibrate or service this unit. Never remove the covers. Disconnect it and contact Display Calibrations, LLC directly for service.

Introduction

The AccuPel DVG-5000 Digital Video Calibration Generator is a professional test equipment device exclusively for commercial or industrial calibration and testing of video displays or video processors.

22 Versatile 2D Digital Video Formats with 4 Output Signal Types

The DVG-5000 produces 22 2D digital video formats compliant with CEA-861-E including:

- 480i/p
- 576i/p
- 720p50/59.94/60
- 1080i50/59.94/60
- 1080p23.98sf/24sf
- 1080p23.98/24/25
- 1080p29.97/30
- 1080p47.95/48
- 1080p/50/59.94/60

All 22 formats are available with YCbCr 4:4:4, YCbCr 4:2:2, RGB-Video, and RGB-PC signal output for compatibility with HDMI[®] and DVI inputs.

33 Additional 3D Digital Video Formats (Optional Feature)

The DVG-5000 3D Option produces 33 additional 3D signal formats. Each 3D signal format is a combination of an industry-standard 3D structure (Frame Packing, Side-by-Side (Half), or Top-and-Bottom) and a specific video format (e.g. 1080p24). All 3D formats that industry-conforming display devices are required to accept are included, plus additional 3D formats used for Blu-ray Disc playback and cable and satellite broadcast distribution.

Frame Packing	Side-by-Side (Half)	Top-and-Bottom
(8 Formats)	(14 Formats)	(11 Formats)
1080p23.98/24	1080i59.94/60	1080p23.98/24
720p59.94/60	1080i50	720p59.94/60
720p50	1080p23.98/24	720p50
1080p29.97/30	720p59.94/60	1080p59.94/60
1080p25	720p50	1080p29.97/30
	1080p59.94/60	1080p50
	1080p29.97/30	1080p25
	1080p50	
	1080p25	

All DVG-5000 2D test patterns are available in all 33 3D video formats. All 3D formats are available in 10-bit native (and 8-bit native) YCbCr 4:2:2, and Deep Color (10-bit native) and 8-bit native YCbCr 4:4:4, RGBVideo, and RGB-PC output modes. A special interactive 3D Crosstalk Measurement Test Pattern is also included. Left eye and right eye images can also be viewed separately or together on all test patterns.

Separate High-Precision 10-Bit & 8-Bit Signal Values

To provide maximum accuracy, Luma and Chroma values for ITU Rec. 601 (SD) and ITU Rec. 709 (HD) are computed using 64-bit double-precision floating-point math and then rounded to 8-bit and 10-bit values.

Separate 10-bit and 8-bit component video values are stored for all 115 standard patterns to eliminate accuracy errors that occur when rounding, truncating, or dithering 10-bit output values to create 8-bit output values.

RGB-Video, RGB-PC, and YCbCr 4:4:4 10-bit video values are output by selecting the 30-bit or 36-bit Deep Color output modes. Users can also select 10-bit or 8-bit YCbCr 4:2:2 (20-bit/16-bit) output.

Maximum Accuracy Direct-Drive Digital (D3) Pattern Generation

For maximum timing accuracy and minimum jitter all video patterns, digital sync, and timing signals are generated using individual low-noise, high-stability, precision crystal oscillators for standard-definition, 59.94 Hz high-definition, and 50/60 Hz high-definition video formats.

A proprietary AccuPel pattern and timing generation IC directly drives the HDMI digital video output transmitter with 30-bit and 24-bit RGB/YCbCr video values depending on output signal type. There is no digital signal truncation, dithering, or color-matrix conversion in the 30-bit or 24-bit digital video path that would reduce bit-level accuracy. No clock synthesizers, format converters, or frame buffers are used to ensure maximum signal timing accuracy.

Easy-to-Use Infrared Remote Control

A 41-key IR remote control is standard to provide maximum standalone ease of use. Dedicated keys are provided to directly select each Output mode, Format mode, Pattern Group, and specific Luma values within Groups. There are also dedicated keys to move forward or backward within Groups or Patterns. Pattern switching is virtually instantaneous because patterns are not loaded from ROM or flash memory. A user defined Pattern List provides another easy way to switch between favorite patterns. Single key pushes will store or delete up to 10 patterns in the Pattern List, and move forward or backward through the Pattern List.

The IR remote control also provides keys to enter user-defined Luma and Color values, select special features, and to navigate the On-Screen-Display (OSD) menus. Detailed documentation for the IR remote control can be downloaded from <http://www.accupel.com>.

OSD Menus

OSD (On-Screen-Display) menus provide access to advanced features, including:

- the ability to specify user defined Luma and Color values in percent or as 10-bit values via the USB interface
- change output bit-depth
- blank individual R/G/B/Y/Cb/Cr output channels
- modify color-encoding
- set power-up default modes
- configure the USB interface, and more options.

USB Control Interface

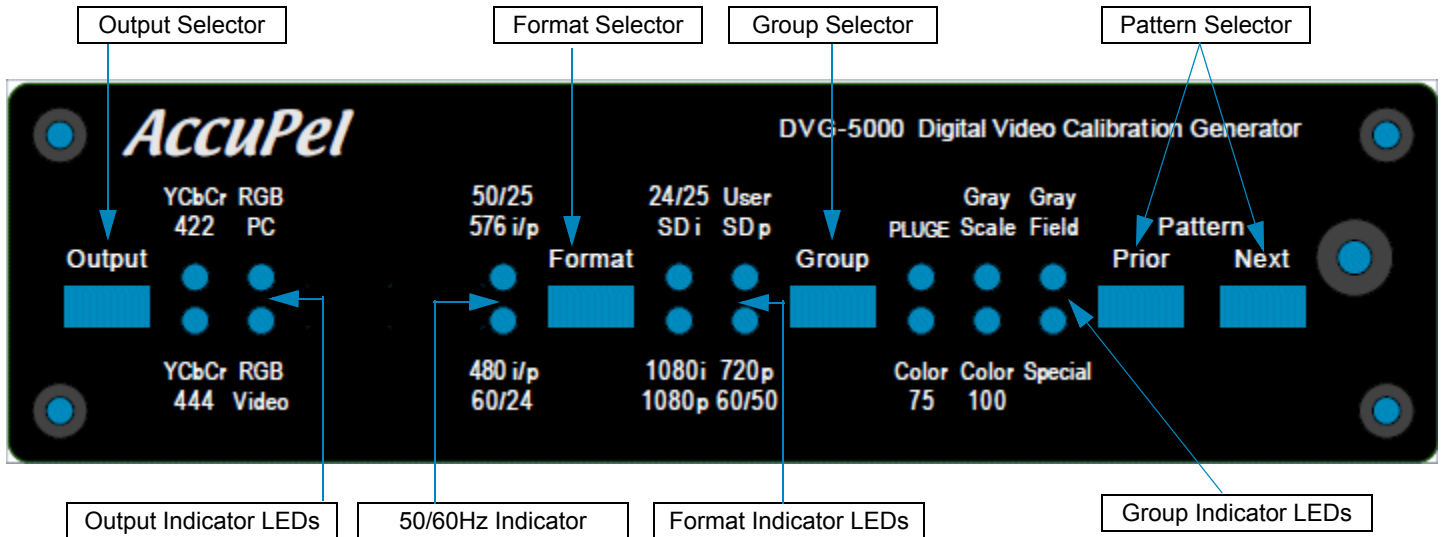
The USB Control Interface provides full operation of all DVG-5000 functions, including direct selection of every pattern. Detailed documentation for the USB Interface can be downloaded from <http://www.accupel.com>.

Front Panel Controls

LED Indicators

Each time power is applied to the DVG-5000 the PLUGE, Gray Scale, and Gray Field LEDs will illuminate in sequence for about 4 seconds as the generator is initialized.

The inactive Format LEDs blink once when any IR remote control command is received. A rapidly blinking LED indicates that an IR remote control numeric key is expected next (e.g. after Pat# key for direct selection by % value). Any slowly blinking LED indicates that a special feature mode is active (e.g. Slow Edges).



Output Selector

The Output button selects the type of digital video signals produced by the DVG-5000.

YCbCr 4:4:4 signals
RGB-Video signals
YCbCr 4:2:2 signals
RGB-PC signals

Output Indicator LEDs

- YCbCr 444 – YCbCr 4:4:4 signals. *
- RGB Video – RGB-Video signals. *
- YCbCr 422 – YCbCr 4:2:2 signals. *
- RGB PC – RGB-PC signals. **

* Y,R,G,B 64-940 (10-bit) or 16-235 (8-bit), black (0%) to reference white (100%) -7% to 109% total valid range (used in Ramps, High-GS mode, etc.) Cb, Cr 64-960 (10-bit) or 16-240 (8-bit)

** R,G,B 0-1023 (10-bit) or 0-255 (8-bit), black (0%) to reference white (100%)

50/60Hz Selection

50 Hz / 60 Hz Selection

Select 50 Hz modes by pressing and holding the Format button for about 1 second. When the 50 Hz LED illuminates release the Format button. If you continue to hold the Format button the 50 Hz/60 Hz modes will alternate once per second. The 60 Hz LED is illuminated for both 59.94 and 60 Hz formats (selectable in the OSD menu).

*480i, 480p, 576i,
576p, 720p, 1080i,
1080p formats*

Format Selector

Press and release the Format button to change the video format in the following order—1080i, 720p, SD i, SD p, 1080p60(50), 1080p24(25), and a 1080p User selectable format (when 60 Hz is enabled). SD i (SD p) is the standard-definition interlaced (progressive) format—480i(p) in the 60 Hz mode (automatically set to 59.94 Hz), and 576i(p) in the 50 Hz mode.

The 1080p User format can be selected in the OSD Defaults menu to produce 1080p24sf, 1080p30, or 1080p48. All formats can also be selected directly using the IR remote control or the USB control interface.

Format Indicator LEDs

The SD i LED indicates 480i when the 480i/p LED is illuminated, and 576i when the 576i/p LED is illuminated. Similarly, the SD p LED indicates 480p and 576p.

The 1080p LED and one other LED that indicates the 1080p frame rate (60/50/24/25/User) will be illuminated simultaneously to indicate 1080p formats.

Group Selector

The Group button selects a group of patterns. Repeatedly pressing and releasing the Group button circulates through the pattern groups.

Press and hold the Gray Scale Button when the Gray Scale LED is illuminated to cycle from GS to Low-GS to High-GS and back to GS groups.

*8 pattern groups
113 basic patterns*

Group Indicator LEDs

Color 75 - 16 calibration patterns that include color bars and primary, complementary, and gray color windows and color fields at 75% signal levels. User-defined color values can be specified in the OSD User Level/Color menu.

Color 100 - 16 calibration patterns that include color bars and primary, complementary, and gray color windows and color fields at 100% signal levels. User-defined color values can be specified in the OSD User Level/Color menu.

Special - 14 patterns for calibrating or evaluating overscan, horizontal and vertical size, geometry, convergence, contrast, sharpness, banding, and detail enhancement. User-defined checkerboard luma values can be specified in the OSD User Level/Checkerboard menu.

PLUGE - 12 patterns for adjusting black-level, contrast, and color temperature.

Gray Scale - 3 Groups of 14 patterns each for measuring and adjusting linearity, color temperature, gamma, and grayscale tracking. The default group includes 14 patterns with 0%-100% luma values in 10% increments. The Low-GS group includes 14 patterns with 0% to 10% luma values in 1% increments, and the High-GS group includes 14 patterns with 100% to 109% luma values in 0.9% increments. The Low-GS and High-GS groups can be selected from the IR remote control. User-defined window luma values can also be specified in the OSD User Level/Window menu.

Gray Field - 15 patterns for measuring and adjusting full-field uniformity, color temperature, gamma, and grayscale tracking using full-field patterns. User defined full-field luma values can be specified in the OSD User Level/Field menu.

*Gray Scale Window
& Gray Field Values
(binary code)*

Gray Scale Window & Gray Field Values

When the Gray Scale window or Gray Field patterns are changed (from the front panel or the IR remote control) the PLUGE, Color 75, Color 100, and Special LEDs

Front Panel Controls

temporarily produce a binary code that represents the luma value of the window of field. The binary code persists for about 1 second and will then disappear.

Grayscale Window/Field			PLUGE LED	Color 75 LED	Color 100 LED	Special LED
Normal	Low-GS	High-GS	Binary Code Bit 3	Binary Code Bit 2	Binary Code Bit 1	Binary Code Bit 0
10	1	100.9				On
20	2	101.8			On	
30	3	102.7			On	On
40	4	103.6		On		
50	5	104.5		On		On
60	6	105.4		On	On	
70	7	106.3		On	On	On
80	8	107.2	On			
90	9	108.1	On			On
100	10	109.0	On		On	

Gray Scale Window & Gray Field Values (text display)

The LED binary display is for the benefit of users connected to devices other than displays. The OSD Pattern Information provides a direct on-screen text display of the window or field luma value.

Prior & Next Pattern Selector Buttons

Selects the next or prior pattern in the current pattern group.

On Screen Display (OSD)

Pattern Information

Each time a pattern is changed the name of the pattern, which includes important signal identification information, is displayed on-screen for a short duration. The duration can be selected in the OSD Misc menu (approximately 0.25, 0.5, 1.0, 1.5, or 2.0 seconds), and the duration can be saved as a power-up default value. Press the **Info** button on the remote control to display the pattern information continuously. Press the **Info** button again to resume the default display period.

CIE xyY values are shown on the Info line for windows and fields in the Color75 and Color100 pattern groups. The CIE x,y and Y (luminance relative to an equal amplitude gray color) values are defined by the Color Gamut of applicable HD or SD standards, and can be used as target values to adjust a Color Management System (CMS). It can be advantageous to calibrate a display to have selectable Color Gamuts for the same signal format, therefore the target Color Gamut for HD, SD 60 Hz, and SD 50 Hz signals can be changed in the Misc menu. The Color Gamut selection changes only the CIE xyY target values for the display, and does not affect the generator's output signals.

OSD Menu System

The OSD Menu is produced in all digital output signal formats. The OSD Menu provides additional features such as:

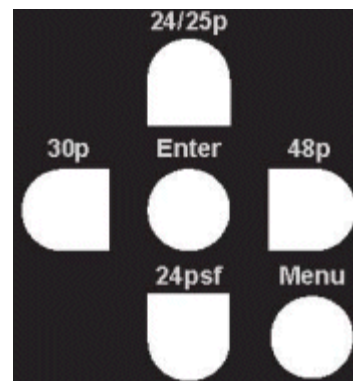
- user-defined luma values and colors
- selectable RGB and YCbCr individual channel blanking (set to the black level)
- advanced signal parameters (YCbCr color-encoding, 59.94/60 Hz frame rates HDMI 10-bit and 12-bit Deep Color YCbCr 4:2:2 bit-depth and filtering, Digital Sync Polarity)
- AVI InfoFrame parameters
- USB port control
- user-defined generator power-up default modes.

OSD Menu Navigation

Press the **Menu** button to display the OSD window, which is organized into three columns. The left column of the OSD window currently lists seven menus—User Level, Output, Sync, Misc, USB Port, Defaults, and AVI InfoFrame. Use the cursor keys to highlight (green text) the desired menu, and then move into the middle column and highlight a menu item. The current status of each highlighted menu item is shown in the right column. To change a setting move into the right column and highlight one of the alternative settings that will be listed in that column. In most cases it is not necessary to press the Enter key unless "Enter" appears in the right column. In that case highlight "Enter" and press the remote control Enter key to proceed.

Press the **Menu** button to turn the OSD menu on or off. The highlighted (green text) cursor position in the OSD menu is maintained when the menu is turned on or off, so it is easy to turn the menu off when making measurements or adjusting a calibration setting, and then turn it back on again to make additional changes to the same menu item.

Menu items that are not applicable to the current signal output type are dimmed and not accessible in the menu. For instance, the YCbCr 4:2:2 Filter selection menu item is not accessible unless the YCbCr 4:2:2 output mode is active.



OSD Menus

User Level

- | | |
|---------------------|--|
| Field | Set a user-defined integer luma % value for the User Field in the Gray Field group. Select Factory and press Enter to restore the original 100% User Field. Select "Cancel" and press Enter to leave the menu without making any change. |
| Window | Set a user-defined integer luma % value for the User Window in the Gray Scale group. Select Factory and press Enter to restore the original 100% User Window. Select "Cancel" and press Enter to leave the menu without making any change. |
| Checkerboard | Set a user-defined integer luma % value for the User Checkerboard and User Inverse Checkerboard in the Special group. Select Factory and press Enter to restore the original 50% User Checkerboards. Select "Cancel" and press Enter to leave the menu without making any change. |
| Color | Set user-defined integer R, G, B % values for the User Window and User Field in the Color 75 and Color 100 groups. The equivalent YCbCr values will automatically be calculated for both ITU Rec. 601 (SD) and ITU Rec. 709 (HD) when using or switching to those output types. The "White" bars in the color bar patterns are also changed to allow comparison with other known colors. Select Factory and press Enter to restore the original 75% gray and 100% white colors. Select "Cancel" to leave the menu without making any change. |

The IR Remote Control manual has more information about entering User values.

10-bit Field, Window, Checkerboard, and Color User values can also be entered using the USB interface. For additional 10-bit command formats, refer to the [Appendix 1: USB Interface on page 26](#).

Output

Channels	Enable/disable any combination of RGB or YCbCr output signal channels. This allows you to create red, green, blue, yellow, cyan, or magenta RGB geometry, linearity, and ramp patterns, or produce Y (luma) only signals for the color bar patterns. The former can be especially useful for adjusting convergence in displays with separate RGB convergence controls.
Color Enc	Select standard YCbCr HD/SD ITU Rec. 709/Rec. 601 color-matrix encoding, or reverse the encoding (HD/SD Rec. 601/Rec. 709). This is particularly useful to quickly verify correct display color decoding visually.
HD V Rate	Select 59.94 or 60.00 Hz field/frame rate for HD signals.
HDMI/DVI	Select HDMI or DVI output. Some older video monitors and computer monitors will not display HDMI protocol signals.
Deep Color	Select 8-bit RGB/YCbCr 4:4:4 digital signals, or RGB/YCbCr 4:4:4 Deep Color 10-bit or 12-bit signal output. Only available when HDMI signal output is also selected.
422 Filer	Select YCbCr 4:2:2 signal filtering On or Off. When Off is selected the Cb/Cr signals are decimated from 4:4:4 to 4:2:2 signals without filtering. Only available when YCbCr 4:2:2 signal output is active.
422 Bits	Select 8-bit or 10 bit YCbCr digital video output signals. Only available when YCbCr 4:2:2 signal output is active.

Sync

HD std +	Select positive or negative HD digital sync. HD standard is positive.
SD std -	Select positive or negative SD digital sync. SD standard is negative.
Position - Change Hsync (+/- 99 pixels) and Vsync (+/- 15 lines) position. Use with overscan pattern to measure H & V overscan precisely in pixels and lines. Use Pos, Neg, and SoG keys to increment, decrement, and zero (reset) sync position.	



NOTE: Some displays don't use sync signals to position the video frame and Sync Position will have no or unpredictable effect on those displays. Some displays use Hsync position to determine the Cb/Cr phase for YCbCr 4:2:2 signals and changing Hsync Position will alter color on those displays.

Misc

Info	Serial number and options information.
Disp Time	Selects the time duration that pattern names are displayed when switching patterns. The IR remote control INFO key will continuously display pattern names if desired.
Gamut HD	Select Rec709, SMPTE-C, or EBU. Changes the CIE xyY target values shown on the OSD Color75/Color100 Pattern Info line for HD (1080i/p, 720p) signals to the color gamut defined by the selected standard. The default standard is ITU Rec. 709. This setting has no effect on generator signals.
Gamut SD60	Select Rec709, SMPTE-C, or EBU. Changes the CIE xyY target values shown on the OSD Color75/Color100 Pattern Info line for SD 60 Hz (480i/p) signals to the color gamut defined by the selected standard. The default standard is SMPTE-C. This setting has no effect on generator signals.
Gamut SD50	Select Rec709, SMPTE-C, or EBU. Changes the CIE xyY target values shown on the OSD Color75/Color100 Pattern Info line for SD 50 Hz (576i/p) signals to the color gamut defined by the selected standard. The default standard is EBU. This setting has no effect on generator signals.

USB Port

USB Baud	Baud Rate selection.
USB Flow	Flow control selection.

Defaults (Power Up)

60/50 Hz	Power up in 60 Hz or 50 Hz output formats mode.
USB Baud	Power up baud rate.
User Format	Power up with front panel User Format set to output 1080p24sf, 1080p30, or 1080p48.
Disp Time	Power up with the pattern name display duration set to 0.25, 0.5, 1.0, 1.5, or 2.0 seconds.
Save Items	Save all of the above power up default items to non-volatile memory.

*(AVI) InfoFrame**

Output	Auto or manual selection of the Output Signal Type parameter (Auto, Off, RGB, YCbCr 4:2:2, YCbCr 4:4:4).
Color Enc	Auto or manual selection of the YCbCr color encoding parameter (Auto, Off, Rec. 601, Rec. 709).

On Screen Display (OSD)

Levels	Auto or manual selection of the Output Signal Levels parameter (Auto, Off, Video, PC).
Format	Auto or manual selection of the Output Signal Format parameter (Auto, Off).
Pixel Rep	Auto or manual selection of the Output Signal Pixel Replication parameter (Auto, 1x, 2x).

* Only available when HDMI is selected

3D Mode (DVG-5000 Optional Feature)

For more information about the 3D Mode menus and special Crosstalk test pattern, refer to [Appendix 2: IR Remote Control Functions on page 34](#).

Structure	Select 3D Off (2D), 3D Frame Packing, 3D Side-by-Side (Half), or 3D Top-and-Bottom Structure video signals.
Blank Eye	Select None, Left or Right. Blanks the left or right eye image for all 3D signals.
Infoframe	Select 3D CEA-861 Vendor Specific Infoframe On or Off.
Crosstalk	Select Crosstalk to produce a special test pattern and menu to measure the amount of 3D crosstalk between left eye and right eye images as seen through 3D glasses.

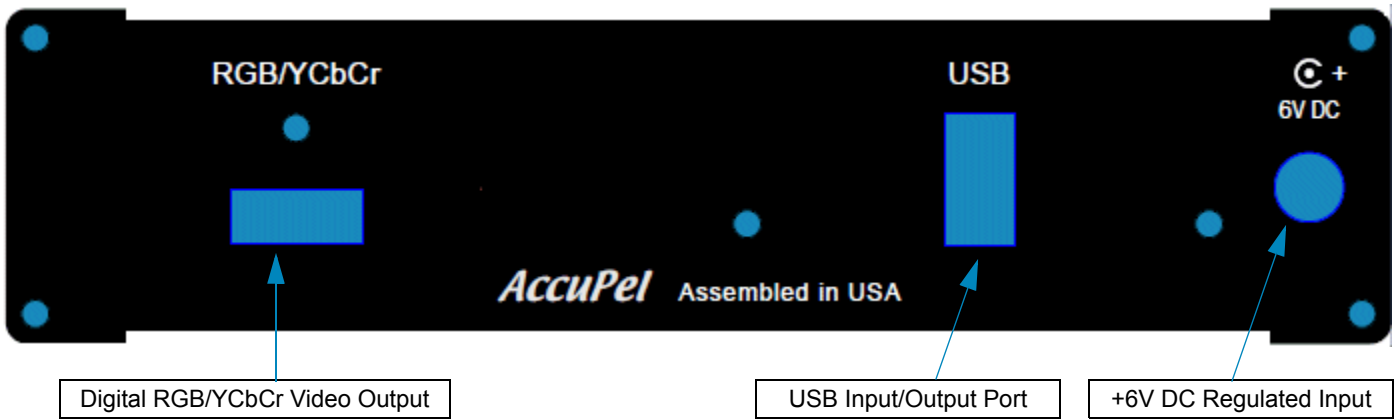
Selected Remote Control Functions

Please read the IR Remote Control chapter for a complete discussion of additional remote control features including how to enter User Luma & Color Levels, and User Pattern Lists.

- | | |
|------------------------|---|
| Edge | Selects Fast or Slow digital video edge transitions. The Slow Edge mode changes the edge transition rate of the DVG-5000 signals to a rate chosen specifically for each video format. The currently selected Output LED will blink slowly when the Slow Edge mode is enabled. |
| ALT Gray Scale* | Press this button combination to select or alternate between 0%-10% Low-GS (Gray Scale) patterns and 100%-109% High-GS patterns. Press the Gray Scale button only to return to the 0%-100% Gray Scale patterns. The Gray Scale LED will blink slowly when the Low-GS or High-GS mode is enabled. |
| Mute | This button produces a 0% black field. Press any button on the remote control (including Mute) to restore the previous pattern. |
| Func Mute | Press this button combination to alternate between HDMI and DVI output modes if the OSD menu is not visible on some displays in the HDMI (default) output mode. This is normally only the case on older video displays and computer monitors with DVI only inputs that may be incompatible with HDMI protocols. |

*100%-109% patterns are not available for RGB-PC signals because the maximum signal amplitude is 100% (digital 255 or 1023) for RGB PC signals.

Rear Panel I/O



Digital RGB/YCbCr Video Output

The HDMI connector provides RGB-Video, RGB-PC, YCbCr 4:4:4, or YCbCr 4:2:2 digital video signals. A passive HDMI to DVI output adapter or cable can be used to connect to DVI inputs.

USB Input/Output Port

USB input/output. Use a Type A to Type A USB cable to connect the DVG-5000 to a computer. Requires a DVG-5000 USB driver that can be downloaded from <http://www.accupel.com>. (See the DVG-5000 USB Interface manual for details.)

+6V DC Regulated Input

Use the supplied DVG-5000 6V DC regulated power module only. Use of any other power module invalidates the DVG-5000 warranty.

Test Patterns

Color 75 Group

- **75% Tri-split Color Bars** – Check or adjust Color Saturation and Hue controls by matching color bars while individually viewing each primary color. (Use display controls to enable single primary colors, or view through color filters.) Similar to SMPTE Color Bars, but offset and split for easier use.
- **75% Color Bars** - Standard Color Bars at 75% levels.
- **75% Color Windows** – Primary, complementary, and gray windows provide accurate CIE color measurements by using the same screen area.
- **75% Color Fields** – Primary, complementary, and gray fields to measure color field uniformity and chroma noise.

Color 100 Group

- **100% Tri-split Color Bars** – Check or adjust Color Saturation & Hue at 100% levels.
- **100% Color Bars** - Standard Color Bars at 100% levels.
- **100% Color Windows** - Primary, complementary, and gray windows provide accurate CIE color measurements by using the same screen area.
- **100% Color Fields** - Primary, complementary, and gray fields to measure color field uniformity and chroma noise.
- **User Color** - Replaces 75% and 100% gray colors in both Color 75 and Color 100 group patterns to provide easy comparison with other standard colors.

Special Group

- **Low APL Overscan** - Measure/adjust overscan and corner/edge geometry, convergence, and focus. 0% luma background. 0%-7% horizontal and vertical overscan lines in 1% intervals.
- **High APL Overscan** - Measure/adjust overscan and corner/edge geometry, convergence, and focus. 100% luma background. 0%-7% horizontal and vertical overscan lines in 1% intervals.
- **Cross-Hatch** - Low APL pattern to measure geometry & convergence.
- **Inverse Cross-Hatch** - High APL pattern for geometry & convergence.
- **Dual Needle Pulse** – Adjust CRT Contrast. Measure short-term CRT high-voltage stability and check for CRT Scan Velocity Modulation.
- **Color Pixel Multiburst** - Adjust chroma-luma delay and signal peaking (Sharpness/Detail Controls). Red/cyan, black/white, and blue/yellow bursts.
 - 1080p* - 5,4,3,2,1 pixel bursts - 14.85, 18.56, 24.75, 37.13, 74.25 MHz
 - 1080i/p* & *720p* - 5,4,3,2,1 pixel bursts - 7.43, 9.28, 12.38, 18.56, 37.13 MHz
 - 480p* & *576p* – 5,4,3,2,1 pixel bursts - 2.70, 3.38, 4.50, 6.75, 13.5 MHz
 - 480i* & *576i* – 5,4,3,2,1 2x pixel bursts - 1.35, 1.69, 2.25, 3.38, 6.75 MHz
- **Luma Pixel Multiburst** - Adjust signal peaking (Sharpness/Detail Controls).
 - 1080p* - 5,4,3,2,1 pixel bursts - 14.85, 18.56, 24.75, 37.13, 74.25 MHz

1080i/p & 720p - 5,4,3,2,1 pixel bursts - 7.43, 9.28, 12.38, 18.56, 37.13 MHz

480p & 576p - 5,4,3,2,1 pixel bursts - 2.70, 3.38, 4.50, 6.75, 13.5 MHz

480i & 576i - 5,4,3,2,1 2x pixel bursts - 1.35, 1.69, 2.25, 3.38, 6.75 MHz

- **CrossHair** - Check centering and edge artifacts on lines.
- **Sharpness** - 1,2,3,4,5 pixel-width black vertical lines, 1,2,3,4,5 pixel-height (480p/576p/720p/1080p) or 2,4,6,8,10 (480i/576i/1080i) pixel-height black horizontal lines. 50% background. Adjust Sharpness and Detail Enhancement.
- **4x4 100% Checkerboard/Inverse** - Measure ANSI & modified-ANSI contrast ratio at 100% luma levels.
- **4x4 User Level Checkerboard/Inverse** - Measure ANSI & modified-ANSI contrast ratio at multiple luma levels.
- **Linearity Ramps**
8-bit (top) and 10-bit (bottom) Ramps.
1080i/p, 720p 1x, 2x, 4x pixel replication 8-bit Ramps, 1x 10-bit Ramps.
480i/p, 576i/p 1x, 2x pixel replication 8-bit Ramps, 1x 10-bit up/down Ramp.

PLUGE Group

- **0% APL PLUGE** - Calibrate black level and measure black level stability at 0% Average Picture Level. +/- 4% stripes, 0% background.
- **Precision PLUGE 11d-21d** - Calibrate black level with split stepped-bar pattern from 8-bit digital level 11 to digital level 21 in 1 LSB steps. Black (digital 16) is center bar.
- **Precision PLUGE 6d-26d** - Calibrate black level with split stepped-bar pattern from 8-bit digital level 6 to digital level 26, in 2 LSB steps. Black (digital 16) is center bar.
- **25% APL PLUGE** - Calibrate black level and measure black level stability at 25% Average Picture Level. +/- 4% stripes, 0%/50% split background.
- **50% APL PLUGE with 98%/102% PLUGE** - Calibrate black level and Contrast (for LCoS/LCD/DLP displays), and measure black level stability at 50% APL. +/- 4% & 98%/102% stripes, 0%/100% split background.
- **25%, 50%, 75%, 100% Windows w/PLUGE** - Calibrate color temperature & grayscale tracking. +/- 4% PLUGE pattern to ensure black level doesn't shift while adjusting grayscale tracking.
- **100% Window with 98%/100% PLUGE** - Calibrate color temperature & grayscale tracking. +/- 4% PLUGE pattern to ensure black level doesn't shift, and 98%/100% vertical bars to ensure peak-white level doesn't clip while adjusting grayscale tracking on LCoS/LCD/DLP displays.
- **50/100% Window with PLUGE** - Check 100% window size for CRT blooming while adjusting Contrast. +/- 4% PLUGE to maintain black-level setting.
- **98%/102% WRGB Clipping PLUGE** - Check for White, Red, Green, or Blue clipping with 98%/102% WRGB Bars against 100% background with YCbCr or RGB signals.

Gray Scale Groups

- **10-Step Vertical Gray Scale Linearity** - Check grayscale tracking and color temperature.

0%-100% in 10% steps
Low-GS 0%-10% in 1% steps
High-GS 100%-109% in 0.9% steps.

- **10-Step Split Vertical Gray Scale Linearity** - Check grayscale tracking and color temperature.
0%-100% in 10% steps
Low-GS 0%-10% in 1% steps
High-GS 100%-109% in 0.9% steps.
- **10-Step Horizontal Gray Scale Linearity** - Check grayscale tracking and color temperature.
0%-100% in 10% steps
Low-GS 0%-10% in 1% steps
High-GS 100%-109% in 0.9% steps.
- **GS User** – 10, 20, 30, 40, 50, 60, 70, 80, 90, 100%
Low-GS User – 1, 2, 3, 4, 5, 6, 7, 8, 9, 10%
High-GS User – 100.9, 101.8, 102.7, 103.6, 104.5, 105.4, 106.3, 107.2, 108.1, 109.0%
Windows w/PLUGE - Calibrate color temperature, grayscale, and gamma. PLUGE bars ensure black level doesn't shift while adjusting grayscale tracking. The background of the High-GS windows is 100% luma to examine a display's ability to differentiate levels near 100%.

Gray Field Group

- **100%, 0% Gray Field** - Measure full-field (on-off, 0%/100%) contrast ratio.
- **25%, 50%, 75% Gray Fields** - Measure flat field uniformity.
- **User Luma Level Field** – Enter luma value in OSD User Level menu.
- **10–90% Gray Fields** - Measure flat field uniformity, and calibrate gamma and grayscale tracking with full-field output levels.

Characteristics

Picture Formats (59.94 & 60.00 Hz based)

1080p59.94/60 (per SMPTE 274M CEA 861-E)	1920 x 1080 Pixels - Progressive Active Picture Area 2200 x 1125 Pixels - Progressive Total Frame 148.35164 (148.5/1.001) / 148.5 MHz Pixel Clock Rates 59.94 Hz / 60.00 Hz Frame Rates
1080p47.95/48 (per SMPTE 274M CEA 861-E)	1920 x 1080 Pixels - Progressive Active Picture Area 2750 x 1125 Pixels - Progressive Total Frame 148.35164 (148.5/1.001) / 148.5 MHz Pixel Clock Rates 47.95 Hz / 48.00 Hz Frame Rates
1080p29.97/30 (per SMPTE 274M CEA 861-E)	1920 x 1080 Pixels - Progressive Active Picture Area 2200 x 1125 Pixels - Progressive Total Frame 74.17582 (74.25/1.001) / 74.25 MHz Pixel Clock Rates 29.97 Hz / 30.00 Hz Frame Rates
1080p23.976 /24 (per SMPTE 274M CEA 861-E)	1920 x 1080 Pixels - Progressive Active Picture Area 2750 x 1125 Pixels - Progressive Total Frame 74.17582 (74.25/1.001) / 74.25 MHz Pixel Clock Rates 23.98 Hz / 24.00 Hz Frame Rates
1080p23.976/24sf (per SMPTE 274M CEA 861-E)	1920 x 1080 Pixels - Segmented Frame Active Picture Area 2750 x 1125 Pixels - Segmented Total Frame 74.17582 (74.25/1.001) / 74.25 MHz Pixel Clock Rates 23.98 Hz / 24.00 Hz Frame Rates
1080i59.94/60 (per SMPTE 274M CEA 861-E)	1920 x 1080 Pixels - Interlaced Active Picture Area 2200 x 1125 Pixels - Interlaced Total Frame 74.17582 (74.25/1.001) / 74.25 MHz Pixel Clock Rates 59.94 Hz / 60.00 Hz Frame Rates
720p59.94/60 (per SMPTE 296M CEA 861-E)	1280 x 720 Pixels Progressive Active Picture Area 1650 x 750 Pixels - Progressive Total Frame 74.17582 (74.25/1.001) / 74.25 MHz Pixel Clock Rates 59.94 Hz / 60.00 Hz Frame Rates
480p (per CEA 861-E)	720 x 480 Pixels - Progressive Active Picture Area 858 x 525 Pixels - Progressive Total Frame 27 MHz Pixel Clock Rates 59.94 Hz (60/1.001) Frame Rates
480i (per CEA 861-E)	1440 x 480 Pixels Interlaced Active Picture Area 1716 x 525 Pixels - Interlaced Total Frame 27 MHz Pixel Clock Rates 59.94 Hz (60/1.001) Field Rates, 29.97 Hz (30/1.001) Frame Rates

Picture Formats (50.00 Hz based)

1080p50 (per SMPTE 274M CEA 861-E)	1920 x 1080 Pixels - Progressive Active Picture Area 2640 x 1125 Pixels - Progressive Total Frame 148.50000 MHz Pixel Clock Rate 50.00 Hz Frame Rate
1080p25 (per SMPTE 274M CEA 861-E)	1920 x 1080 Pixels - Progressive Active Picture Area 2640 x 1125 Pixels - Progressive Total Frame 74.25000 MHz Pixel Clock Rate 25.00 Hz Frame Rate

1080i50 (per SMPTE 274M CEA 861-E)	1920 x 1080 Pixels - Interlaced Active Picture Area 2640 x 1125 Pixels - Interlaced Total Frame 74.25000 MHz Pixel Clock Rate 50.00 Hz Frame Rate
720p50 (per SMPTE 296M CEA 861-E)	1280 x 720 Pixels Progressive Active Picture Area 1980 x 750 Pixels - Progressive Total Frame 74.25000 MHz Pixel Clock Rate 50.00 Hz Frame Rate
576p (per CEA 861-E)	720 x 576 Pixels - Progressive Active Picture Area 864 x 625 Pixels - Progressive Total Frame 27 MHz Pixel Clock Rate 50.00 Hz Frame Rate
576i (per CEA 861-E)	1440 x 576 Pixels Interlaced Active Picture Area 1728 x 625 Pixels - Interlaced Total Frame 27 MHz Pixel Clock Rate 50.00 Hz Field Rate, 25.00 Hz Frame Rate

3D Mode 33 Structure/Formats Included (Optional Feature)

3D Structures	R60-Required Format 60Hz Displays Must Accept R50-Required Format 50Hz Displays Must Accept
Frame Packing	1080p23.98/24 720p59.94/60
8 Formats	720p50 1080p29.97/30 1080p25
Side-by-Side (Half)	1080i59.94/60 1080i50
14 Formats	1080p23.98/24 720p59.94/60 720p50 1080p59.94/60 1080p29.97/30 1080p50 1080p25
Top-and-Bottom	1080p23.98/24 720p59.94/60
11 Formats	720p50 1080p59.94/60 1080p29.97/30 1080p50 1080p25

Output Formats

RGB-Video	8-bit R/G/B 16-235 (0%-100%) 109% maximum 10-bit Deep Color R/G/B 64-940 (0%-100%) 109% maximum
RGB-PC	8-bit R/G/B 0-255 (0%-100%), 100% maximum 10-bit Deep Color R/G/B 0-1023 (0%-100%), 100% maximum
YCbCr 4:4:4	8-bit Y 16-235 (0%-100%) 109% maximum 8-bit Cb/Cr 16-240 10-bit Deep Color Y 64-940 (0%-100%) 109% maximum 10-bit Deep Color Cb/Cr 64-960

YCbCr 4:2:2 8-bit Y 16-235 (0%-100%) 109% maximum
8-bit Cb/Cr 16-240
10-bit Y 64-940 (0%-100%) 109% maximum
10-bit Cb/Cr 64-960

Calibration Patterns (115 Patterns)

- Color 75 (16)**
 - 75% Color Bars & 75% Tri-Split Bars
 - User Color Window/Field
 - 75% Red/Green/Blue/Cyan/Magenta/Yellow/Gray Window
 - 75% Red/Green/Blue/Cyan/Magenta/Yellow/Gray Field
- Color 100 (16)**
 - 100% Color Bars & 100% Tri-Split Bars, User Color Window/Field
 - 100% Red/Green/Blue/Cyan/Magenta/Yellow/Gray Window
 - 100% Red/Green/Blue/Cyan/Magenta/Yellow/Gray Fields
- Special (14)**
 - H/V % Overscan
 - Inverse H/V % Overscan
 - 16:9 Crosshatch
 - 16:9 Inverse Crosshatch
 - Dual Needle Pulse
 - Color Multi-burst
 - Luma Multi-burst
 - CrossHair
 - Sharpness
 - Checkerboard
 - Inverse Checkerboard
 - User Checkerboard
 - User Inverse Checkerboard
 - 8/10-bit Linearity Ramps
- PLUGE (12)**
 - $\pm 4\%$ PLUGE with 0%
 - 25%, 50% Average Picture Level
 - Precision PLUGE 11d-21d Split Stepped-Bars
 - Precision PLUGE 6d-26d Split Stepped-Bars
 - 25%, 50%, 75%, 100% Gray Windows with $\pm 4\%$ PLUGE
 - 100% Gray Window with ± 4 IRE, 98%/100% PLUGE
 - 50%/100% Split Gray Window with $\pm 4\%$, 98%/100% PLUGE

**Gray Scale
(14)**

- 0-100 (0-10) (0-109)* % 10-step Vertical Linearity
- Low Gray Scale (14) 0-100 (0-10) (0-109)* % 10-step Split Vertical Linearity
- High Gray Scale (14) 0-100 (0-10) (0-109)* % 10-step Horizontal Linearity
- User, 10,20,30,40,50,60,70,80,90,100% Windows with $\pm 4\%$ PLUGE
- User, 1,2,3,4,5,6,7,8,9,10% Windows with $\pm 4\%$ PLUGE
- User, 100.9,101.8,102.7,103.6,104.5,105.4,106.3,107.2, 108.1, 109.0% Windows with $\pm 4\%$ PLUGE *

* High-GS mode not applicable for RGB-PC signals

**Gray Field
(15)**

- 100% 0%, 25%, 50%, 75% Gray Fields
- User Level Gray Field, 10,20,30,40,50,60,70,80,90% Gray Fields

Video Output Connector

YCbCr, RGB HDMI connector - R/Cr, G/Y, B/Cb, Pixel Clock (225 MHz max)

Control Interfaces

USB Type A connector, full interface control of all functions

IR Sensor Front panel infrared receiver provides full control of all functions (IR remote control included)

Power Supply

- Power: 100-240 VAC, 50/60 Hz (+/- 3 Hz), less than 3 watts
- Size: 6.5" (W) x 1.75" (H) x 4.5" (D)
- Weight: Approximately 2 lbs.

Limited Warranty

DISPLAY CALIBRATIONS, LLC warrants that its AccuPel products will be free of defects in workmanship and material and conform substantially to published specifications under normal use and service. This warranty is made to the first purchaser of the products and extends for twelve (12) months from the date of sale. The warranty does not apply to products damaged as a result of accident, misuse, neglect, alteration, improper installation, unusual physical or electrical stress or unauthorized repair. No products may be returned to Display Calibrations without its consent. If requested by Display Calibrations, purchaser agrees to provide proof of purchase and to return defective products to Display Calibrations, transportation charges prepaid. Display Calibrations only liability with respect to products that do not meet the foregoing warranty, and for which appropriate transportation arrangements have been made, will be to repair or, at Display Calibrations option, replace defective products or portions thereof.

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Display Calibrations, LLC
11140 Rockville Pike, 296
Rockville, MD 20852
<http://www.accupel.com>

Appendix 1: USB Interface

USB Control Port

The USB Interface provides complete control of all DVG-5000 functions. The DVG-5000 USB Control Port provides easy connectivity with the many computers that no longer provide RS-232 connectors. The DVG-5000 USB port emulates an RS-232 interface to provide easy compatibility with common PC or Macintosh terminal programs such as HyperTerminal, and provides compatibility with previous RS-232 based software written to control AccuPel Video Generators. RS-232 emulation also provides a serial control interface that is easily accessible from software development tools for users that write their own custom control programs.

USB Driver

USB Driver

To use the DVG-5000 USB port you must first download and install a USB Driver on your computer. PC and Mac USB drivers are available from the AccuPel web site. Full instructions for installing the driver are included with the download. You may then connect the DVG-5000 to a computer using a USB cable with Type A Male connectors on both ends.

Serial Protocol

Serial Protocol

The USB port emulates an RS-232 connection, so the computer (controller) must be set to the proper Com Port protocols when using the USB port. The computer should be set to 8 bits, no parity, and 1 stop bit. It must also be set to match the DVG-5000 baud rate, which can be selected from 9600 baud to 230.4K baud in the OSD menu. DTS/RTS, Xon/Xoff, or no flow control can be selected for the USB port.



NOTE: It is often easier to start with a slow baud rate (e.g. 19200 baud) and no flow control when initially setting up a connection. The higher baud rates of the DVG-5000 are primarily for use when adding new features through firmware updates. Slower baud rates (e.g. 19200 or 9600 baud) are perfectly adequate in normal use.

AccuPel HDG-4000/HDG-3000 Compatibility

Programs previously written for the AccuPel HDG-4000 or HDG-3000 Video Generators will work with all features that are common to the DVG-5000.

Serial Command Syntax

DVG-5000 Command Syntax

The DVG-5000 accepts ASCII text commands. Each command is 2 to 12 characters in length and must be followed by a carriage return (CR) character (ASCII 13). You may not send multiple commands with a single CR. Partial command strings are not valid.

Capital and non-capital characters are accepted, i.e. a = A, B= b.

All spaces and line feed (LF) characters are ignored.

“OK” Message

Confirmation and Error Messages

The DVG-5000 will return “OK” (without quotes), followed by CRLF (ASCII 13, ASCII 10), after executing each valid serial interface command.

“ER” Message

If the DVG-5000 receives an unrecognized character string of 12 characters or less it will return “ER” followed by the unrecognized character string, followed by CRLF. If more than 12 characters are received only the first 12 chars are returned in the error message, and the remaining characters are discarded.

Query Commands**Query Commands**

Query commands end with a question mark (?). Query commands return one or more text strings (each 14 characters maximum), each followed by a CRLF. “OK” followed by CRLF will be returned after the last text string.

To avoid a possible buffer overrun when sending multiple Query commands, wait for the “OK” response before sending the next Query command.

USB Interface Command Tables

DVG-5000 commands are shown in the Command column of the following tables. The Legacy column shows equivalent commands from previous HDG-4000 or HDG-3000 Video Generators that will still be executed by the DVG-5000, and also commands that have no DVG-5000 function but for software compatibility will still be accepted without returning an ER (error) message. The Legacy commands will be depreciated.

Output Commands

Output	Command	Legacy	Notes
Output Types	YCbCr444	YPbPr	Digital YCbCr 4:4:4 signals.
	RGBVideo	RGB	Digital RGB-video level signals (levels: 16-235 or 64-940 for 0%-100%)
	YCbCr422	YPbPrs	Digital YCbCr 4:2:2 signals
	RGBPC		Digital RGB-PC level signals (levels: 0-255 or 0-1023 for 0%-100%)
	DVIModeOn		DVI Mode will turn on, HDMI mode will turn off
	DVIModeOff		DVI Mode will turn off, HDMI mode will turn on
	YCC422B8		YCbCr 4:2:2 8-bit mode
	YCC422B10		YCbCr 4:2:2 10-bit mode
	YCC422FOn		YCbCr 4:2:2 Decimation Filter on
	YCC422FOff		YCbCr 4:2:2 Decimation Filter off
	DeepColor8		Deep Color mode off – 8-bit 4:4:4 video *
	DeepColor10		Deep Color mode on – 10-bit 4:4:4 video *
	DeepColor12		Deep Color mode on – 12-bit 4:4:4 video *
			* command Ignored in DVI or YCbCr422 modes
		YC	No function, but will not return ER
		CVBS	No function, but will not return ER

Format Commands

Formats	Command	Legacy	Notes
2D Formats	480i		
	480p		
	720p60	720p	Produces 720p59.94 or 720p60
	1080i60	1080i	Produces 1080i59.94 or 1080i60
	1080p24		Produces 1080p23.98 or 1080p24
	1080p24sf		Produces 1080p23.98sf or 1080p24sf
	1080p30		Produces 1080p29.97 or 1080p30
	1080p48		Produces 1080p47.95 or 1080p48
	1080p60		Produces 1080p59.94 or 1080p60
	576i		
	576p		
	720p50		
	1080i50		
	1080p25		
	1080p50		
HD Frame/Field Rate	HDFR59.94 HDFR60.00		59.94 based field/frame rates (default) 60.00 based field/frame rates
3D Frame Packing Formats	1080p24		
	1080p30		
	720p60		
	1080p25		
	720p50		
3D Side-by-Side (Half) Formats	1080i60		Produces 1080i59.94 or 1080i60
	1080p24		Produces 1080p23.98 or 1080p24
	1080p30		Produces 1080p29.97 or 1080p30
	1080p60		Produces 1080p59.94 or 1080p60
	720p60		Produces 720p59.94 or 720p60
	1080i50		Produces 1080p59.94 or 1080p60
	1080p50		
	1080p25		
3D Top-Bottom Formats	720p50		
	1080p24		Produces 1080p23.98 or 1080p24
	1080p30		Produces 1080p29.97 or 1080p30
	1080p60		Produces 1080p59.94 or 1080p60
	720p60		Produces 720p59.94 or 720p60
	1080p50		
	1080p25		
HD Frame/Field Rate	720p50		
	HDFR59.94 HDFR60.00		59.94 based field/frame rates (default) 60.00 based field/frame rates
	3D Frame Blanking	BlankNone BlankLeft BlankRight	Blank Left Eye Frame Blank Right Eye Frame

Group Commands

Groups	Command	Legacy	Notes
Groups	Color75		These commands are usually not needed. Send Pattern commands instead.
	Color100		
	Special		
	PLUGE		
	Grayscale		Selects NormalGS, LowGS, or HighGS
	Grayfield		
Grayscale	NormalGS	LowIREOff	10% - 100% Grayscale patterns (default)
Sub-Group	LowGS	LowIREOn	1% - 10% Grayscale patterns
Selection	HighGS		100% - 109% Grayscale patterns

Pattern Commands

Groups	Command	Legacy	Notes
Color75	SplitCB75		Split 75% Color Bars
	CB75		75% Color Bars
	RedW75	Red75	75% Red Window
	GreenW75	Green75	75% Green Window
	BlueW75	Blue75	75% Blue Window
	YellowW75	Yellow75	75% Yellow Window
	CyanW75	Cyan75	75% Cyan Window
	MagentaW75	Magenta75	75% Magenta Window
	WhiteW75	White75	75% White Window
	RedF75		75% Red Field
	GreenF75		75% Green Field
	BlueF75		75% Blue Field
	YellowF75		75% Yellow Field
	CyanF75		75% Cyan Field
	MagentaF75		75% Magenta Field
	WhiteF75		75% White Field
	UColorWin		User Color Window
Color 100	SplitCB100		Split 100% Color Bars
	CB100		100% Color Bars
	RedW100		100% Red Window
	GreenW100		100% Green Window
	BlueW100		100% Blue Window
	YellowW100		100% Yellow Window
	CyanW100		100% Cyan Window
	MagentaW100		100% Magenta Window
	WhiteW100		100% White Window
	RedF100	Red100	100% Red Field
	GreenF100	Green100	100% Green Field
	BlueF100	Blue100	100% Blue Field
	YellowF100	Yellow100	100% Yellow Field
	CyanF100	Cyan100	100% Cyan Field

Pattern Commands

Groups	Command	Legacy	Notes
	MagentaF100	Magenta100	100% Magenta Field
	WhiteF100	White100	100% White Field
	UColorField		User Color Field
Special	Overscan		Overscan
	InvOverscan		1% Lines Inverse Overscan
	XHatch		1% Lines Crosshatch
	InvXHatch		Inverse Crosshatch
	NeedlePulse		Dual Needle Pulses
	CMultiBurst		Color Pixel Multiburst
	MultiBurst		Pixel Multiburst
	CrossHair		Cross Hair and 4:3 Sizing
	Sharpness		Sharpness & Detail Enhancement
	CheckerBrd		Checkerboard
	InvChkerBrd		Inverse Checkerboard
	UCheckerBd		User Checkerboard
	UInvChkerBd		User Inverse Checkerboard
	RampsMulti1		Multiple Ramps type 1
		CBandwidth	No function, but will not return ER
PLUGE	PLUGE0		0%/0%, 0% APL, +/-4% PLUGE
	PLUGE11-21		Split Stepped-Bars 11d-21d, 16d black
	PLUGE 6-26		Split Stepped-Bars 6d-26d, 16d black
	PLUGE50		0%/50%, 25% APL, +/-4% PLUGE
	PLUGE100		0%/100%, 50% APL, +1-4%, 98/102% PLUGE
	PLUGEW25		25% Window, +1-4% PLUGE
	PLUGEW50		50% Window, +/-4% PLUGE
	PLUGEW75		75% Window, +1-4% PLUGE
	PLUGEW100		100% Window, +1-4% PLUGE
	PLUGEW10098		100% Window, +1-4%, 98/100% PLUGE
	PLUGEW10050		100%/50% Window, +/-4%, 98/100% PLUGE
	PLUGE98102		98%/102% Clipping Bars on 100% WRGB
Gray Scale	GSVert		10-step Vertical Grayscale Bars
	GSSplitVert		10-step Split Vertical Grayscale Bars
	GSHoriz		10-step Horizontal Grayscale Bars
	GSUser		User Value Grayscale Window
	GS10		10%, 1%, or 100.9% Grayscale Window
	GS20		20%, 2%, or 101.8% Grayscale Window
	GS30		30%, 3%, or 102.7% Grayscale Window
	GS40		40%, 4%, or 103.6% Grayscale Window
	GS50		50%, 5%, or 104.5% Grayscale Window
	GS60		60%, 6%, or 105.4% Grayscale Window
	GS70		70%, 7%, or 106.3% Grayscale Window
	GS80		80%, 8%, or 107.2% Grayscale Window
	GS90		90%, 9%, or 108.1% Grayscale Window
	GS100		100%, 10%, or 109% Grayscale Window
			Use NormalGS, LowGS, or HighGS command to select 10%-100%, 1%-10%, or 100%-109%.
Gray Field	GF100		100% Gray Field
	GF0		0% Gray Field
	GF25		25% Gray Field

Pattern Commands

Groups	Command	Legacy	Notes
	GF50a		50% Gray Field - first occurrence in group
	GF75		75% Gray Field
	GFUser		User Value Gray Field
	GF10		10% Gray Field
	GF20		20% Gray Field
	GF30		30% Gray Field
	GF40		40% Gray Field
	GF50		50% Gray Field
	GF60		60% Gray Field
	GF70		70% Gray Field
	GF80		80% Gray Field
	GF90		90% Gray Field

Sync Commands

Sync Modes	Command	Legacy	Notes
HD HV Sync	NegDHDSync		Negative Digital HV HD sync
	PosDHDSync		Positive Digital HV HD sync (std mode)
SD HV Sync	NegDSDSync		Negative Digital HV SD sync (std mode)
	PosDSDSync		Positive Digital HV SD sync
		BiHDYSync	No function, but will not return ER
		TriHDYSync	No function, but will not return ER
		BiHDGSync	No function, but will not return ER
		TriHDGSync	No function, but will not return ER
		HVCOff	No function, but will not return ER
		SoG	No function, but will not return ER
		NegASync	No function, but will not return ER
		PosASync	No function, but will not return ER
		NormHDHVPos	No function, but will not return ER
		SyncPosFall	No function, but will not return ER
		SMPTEHDHVPos	No function, but will not return ER
		SyncPosRise	No function, but will not return ER
		SyncDel+5	No function, but will not return ER
		SyncDel0	No function, but will not return ER
		SyncDel-5	No function, but will not return ER
		VTngOff	No function, but will not return ER
		VTngOn	No function, but will not return ER

Legacy Commands

Command	Legacy	Notes
	CVBSYC0	No function, but will not return ER
	CVBSYC7 5	No function, but will not return ER
	CVBSCBW0 65	No function, but will not return ER
	CVBSCBW10	No function, but will not return ER
	CVBSCBW13	No function, but will not return ER
	CVBSCBW20	No function, but will not return ER
	CVBSCBW30	No function, but will not return ER
	YCCBW065	No function, but will not return ER
	YCCBW10	No function, but will not return ER
	YCCBW13	No function, but will not return ER
	YCCBW20	No function, but will not return ER
	YCCBW30	No function, but will not return ER

User Values Commands

User Value Commands	Command	Legacy	Notes
User Field Value	UvalField		Send command, wait for OK, send integer % text value from 0 to 109 ex "UvalField" (CR), ["OK"], "65"(CR)
User Window Value	UvalWindow		Send command, wait for OK, send integer % text value from 0 to 109 ex "UvalWindow"(CR), ["OK"], "83"(CR)
User Checkerboard Value	UvalChkrBd		Send command, wait for OK, send integer % text value from 0 to 109 ex. "UvalChkrBd"(CR), ["OK"], "70"(CR)
User R Color Value	UvalColorR		Send command, wait for OK, send integer % text value from 0 to 109 ex "UvalColorR"(CR), ["OK"], "80"(CR)
User G Color Value	UvalColorG		Send command, wait for OK, send integer % text value from 0 to 109 ex "UvalColorG"(CR), ["OK"], "60"(CR)
User B Color Value	UvalColorB		Send command, wait for OK, send integer % text value from 0 to 109 ex "UvalColorB"(CR), ["OK"], "40"(CR)
User Factory Value	UvalColorF		Restores User Color75 Window to 75% gray, User Color100 Field to 100% white
User Field 10-bit Value	UField10		Send command, wait for OK, send 10-bit value from 4 to 1019 (0-100% = 64-940)
User Window 10-bit Value	UWindow10		Send command, wait for OK, send 10-bit value from 4 to 1019 (0-100% = 64-940)
User Checkerboard 10-bit Value	UChkrBd10		Send command, wait for OK, send 10-bit value from 4 to 1019 (0-100% = 64-940)
User R Color 10-bit Value	UColorR10		Send command, wait for OK, send 10-bit value from 4 to 1019 (0-100% = 64-940)
User G Color 10-bit Value	UColorG10		Send command, wait for OK, send 10-bit value from 4 to 1019 (0-100% = 64-940)
User B Color 10-bit Value	UColorB10		Send command, wait for OK, send 10-bit value from 4 to 1019 (0-100% = 64-940)

Special Features Commands

Special Features	Command	Legacy	Notes
Enable Channels	ChGBR		All channels enabled
	ChG		G or Y channel only enabled
	ChB		B or Pb channel only enabled
	ChR		R or Pr channel only enabled
	ChGB		G/B or Y/Pb channels only enabled
	ChGR		G/R or Y/Pr channels only enabled
	ChBR		B/R or Pb/Pr channels only enabled
YCbCr	CMatrixStd		Standard color matrix encoding (default)
Color Matrix Encoding	CMatrixRev		Reverse Standard color matrix encoding
Edge Transition	FastEdge	YFilterOff	Fast video edges (default)
	SlowEdge	YFilterOn	Slower video edges
			Output LEDs will blink when slow edge mode is enabled
Mute	MuteOn MuteOff		Produces black screen
Reset	ResetAll		Resets all settings to power up state

USB Port Commands

Flow Control	Command	Legacy	Notes
USB Flow	USBFlowNo		None
Control	USCFlowXP		Xon/Xoff Flow Control
	USBFlowCTSP		CTS/RTS Flow Control (default)
		RS232FlowNo	No function, but will not return ER
		RS232FlowXP	No function, but will not return ER

Query Commands

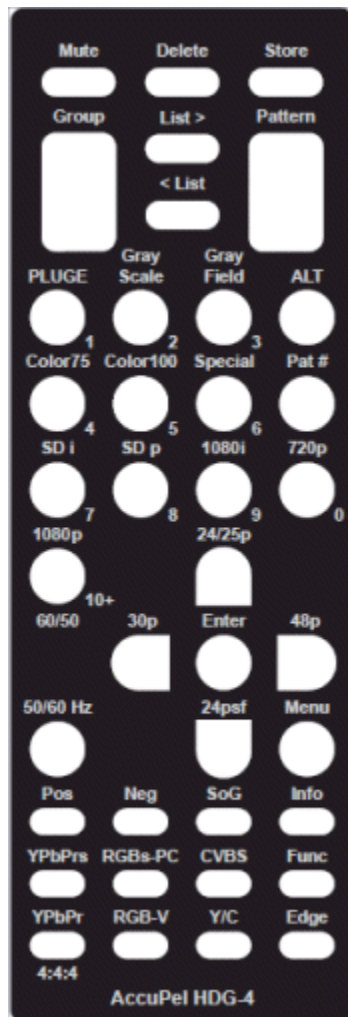
Query Commands	Command	Legacy	Notes
	Ver?		Returns software version number
	ID?		Returns DVG-5000 serial number

Appendix 2: IR Remote Control Functions

The AccuPel HDG-4 IR (Infrared) Remote Control provides selection of all calibration patterns, signal settings, and special modes of the AccuPel DVG-5000 Digital Video Calibration Generator. It is also used to navigate and select settings in the DVG-5000 On-Screen Display (OSD) menu.

The DVG-5000 inactive Format LEDs flash each time an IR remote control command is received. A rapidly blinking LED indicates that an IR remote control numeric key is expected next (e.g. after Pat# key for direct selection by % value). A slowly blinking LED indicates that a special feature mode is active (e.g. Slow Edges).

Output Selection



Directly select the Output type for digital video signals.

- YPbPr 4:4:4 - Selects YCbCr 4:4:4 digital video signals. *
- YPbPrs - Selects YCbCr 4:2:2 digital video signals. *
- RGB-V - Selects RGB-Video digital video signals. *
- RGBs-PC - Selects RGB-PC digital video signals. **

* Y,R,G,B 64-940 (10-bit) or 16-235 (8-bit), black (0%) to reference white (100%) -7% to 109% total valid range (used in Ramps, High-GS mode, etc.)
Cb,Cr 64-960 (10-bit) or 16-240 (8-bit)

** R,G,B 0-1023 (10-bit) or 0-255 (8-bit), black (0%) to reference white (100%)

- Y/C - Not applicable to DVG-5000.
- CVBS - Not applicable to DVG-5000.

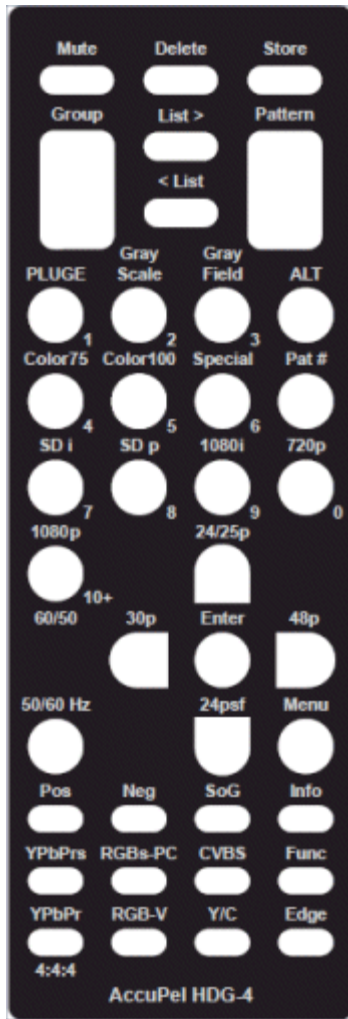
Sync Selection

Pos, Neg, SoG – Used with Sync/Position OSD Menu item to increment, decrement, and reset (zero) the Hsync and Vsync positions.



NOTE: HV sync polarity for digital signals is set according to the EIA/CEA-861-E standard. But the digital HV sync polarity can be overridden in the OSD Sync menu.

Format Selection



Use this feature to select the desired scan rate.

- **50/60 Hz** – Selects 50 Hz or 60/48/30/24 Hz
- **(59.94/47.95/29.97/23.98 Hz)** generator formats. The selected mode is displayed on the front panel Format LEDs.
- **SD i** – Selects 480i (59.94 Hz) or 576i (50 Hz) signals.
- **SD p** – Selects 480p (59.94 Hz) or 576p (50 Hz) signals.
- **1080i** – Selects 1080i59.94, 1080i60, or 1080i50 signals.
- **720p** – Selects 720p59.94, 720p60, or 1080i50 signals.
- **1080p (60/50)** – Selects 1080p59.94, 1080p60, or 1080p50 signals.
- **ALT 24/25p** – Selects 1080p23.98, 1080p24, or 1080p25 signals.
- **ALT 24psf** – Selects 1080p23.98sf or 1080p24sf (segmented frame) signals.
- **ALT 30p** – Selects 1080p29.97 or 1080p30 signals.
- **ALT 48p** – Selects 1080p47.95 or 1080p48 signals.

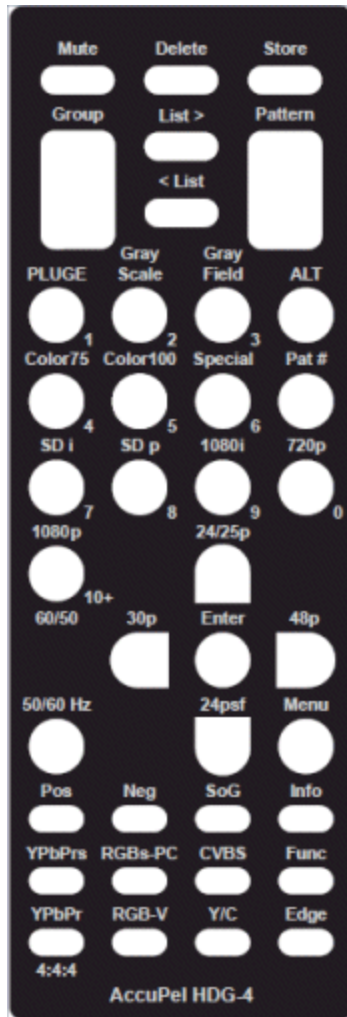


NOTE: North American standard formats are based on 59.94 Hz (60/1.001 Hz), which is the power-up default state of the DVG- 5000. You may select 59.94 or 60.00 Hz HD formats in the OSD menu. The 59.94 mode produces the 23.98p, 23.98psf, 29.97p, and 47.95p formats (more precisely they are 24/1.001, 30/1.001, and 48/1.001 respectively).



NOTE: 1080p formats are indicated on the DVG-5000 front panel by illuminating the 1080p LED and the 60/50, 24/25, or User LED. The 24psf, 30p, and 48p modes illuminate the User Format LED.

Pattern Selection



Sequential Group & Pattern Selection

Group

Press the top of the Group rocker key to move forward to the next pattern Group. Press the bottom of the Group rocker key to move backward to the previous pattern group.

Pattern

Press the top of the Pattern rocker key to move to the next pattern in the current pattern group. Press the bottom of the Pattern rocker key to move to the previous pattern in the current pattern group.

Direct Group & Pattern Selection

Color75, Color100, Special, PLUGE, Gray Scale, Gray Field -Directly select one of the 6 major pattern groups.

ALT Gray Scale – Press this key combination to select or alternate between 0%-10% Low-GS (Gray Scale) patterns and 100%-109% High-GS patterns. Press the Gray Scale key only to return to the default 0%-100% Gray Scale patterns. The Gray Scale LED will blink slowly when the Low-GS or High-GS mode is enabled.

Pat

Press the Pat # key followed by a numeric key (0-10) to directly select a pattern in the current pattern group. The active Group LED will flash rapidly while waiting for a numeric key to be pressed. Press any other key to cancel the Pat # entry process.

This function is useful to quickly select a specific grayscale window or field value in the Gray Scale or Gray Field group. Pat# 1 selects the 10% window/field, Pat# 2 selects the 20% window/field, ... Pat# 10 selects the 100% window. (Pat# 0 selects the User Value window/field.) When the 1%-10% Gray Scale pattern group is enabled, Pat# 1 selects the 1% window, Pat# 2 selects the 2% window, etc. The Pat # table on the next page shows the pattern #'s for all groups.

User-Defined Pattern List



Up to 10 patterns can be stored in the user-defined pattern list.

The user-defined pattern list is stored in the DVG-5000 and is discarded if the power is disconnected.

Store - The currently displayed pattern is stored in the user-defined pattern list.

Delete - The currently displayed pattern is deleted from the user-defined pattern list.

List > - The next pattern in the user-defined pattern list becomes the current pattern.

< List - The previous pattern in the user-defined pattern list becomes the current pattern.



NOTE: 100%-109% patterns are not available for RGB-PC signals because the maximum signal amplitude for RGB PC signals is 100% (digital 255 or digital 1023).



NOTE: The background of the High-GS windows is 100% luma to examine a display's ability to differentiate levels near 100%.

Pat # Table

Group						
Pat #	Color75	Color100	Special	PLUGE	Gray Scale	Gray Field
0	75% Split Color Bars	100% Split Color Bars	Overscan	0% APL PLUGE	User 100 (10) (90) % Window w/PLUGE	User 100% Gray Field
1	75% Color Bars	100% Color Bars	Inverse Overscan	Precision PLUGE 11-21	10 (1) (100.9) % Window w/PLUGE	10% Gray Field
2	75% Red Window	100% Red Window	Crosshatch	Precision PLUGE 6-26	20 (2) (101.8) % Window w/PLUGE	20% Gray Field
3	75% Green Window	100% Green Window	Inverse Cross-hatch	25% APL PLUGE	30 (3) (102.7) % Window w/PLUGE	30% Gray Field
4	75% Blue Window	100% Blue Window	Dual Needle Pulse	50% APL PLUGE	40 (4) (103.6) % Window w/PLUGE	40% Gray Field
5	75% Yellow Window	100% Yellow Window	Color Multi-burst	25% Window w/PLUGE	50 (5) (104.5) % Window w/PLUGE	50% Gray Field
6	75% Cyan Window	100% Cyan Window	Multi-burst	50% Window w/PLUGE	60 (6) (105.4) % Window w/PLUGE	60% Gray Field
7	75% Magenta Window	100% Magenta Window	Cross Hair	75% Window w/PLUGE	70 (7) (106.3) % Window w/PLUGE	70% Gray Field
8	User 75% Gray Window	User 100% Gray Window	Sharpness	100% Window w/PLUGE	80 (8) (107.2) % Window w/PLUGE	80% Gray Field
9	75% Red Field	100% Red Field	100% / 0% Checkerboard	100%Window w/ 98% PLUGE	90 (9) (108.1) % Window w/PLUGE	90% Gray Field
10	75% Green Field	100% Green Field	100% / 0% Inv Checkerboard	50/100 % Window w/PLUGE	100 (10) (109) % Window w/PLUGE	100% Gray Field

Other Functions

Edge

Selects Fast or Slow digital video edge transitions. The Slow Edge mode changes the edge transition rate of the DVG-5000 signals to a rate chosen specifically for each video format. The currently selected Output LED will blink slowly when the Slow Edge mode is enabled.

Mute

This key produces a 0% black field. Press any key on the remote control (including Mute) to restore the previous pattern.

Func

Press and release Func key prior to a second key to select additional functions and shortcuts. Any second key not assigned a Func combination cancels the Func key.

Func Func

Cancels the Func key.

Func '8'

Enables 8-bit signals in YCbCr 4:2:2 Output mode, or 8-bit signals for all 4:4:4 (YCbCr 4:4:4, RGB-Video, RGB-PC) Output modes. Status is shown in OSD menu.

Func '10'

Enables 10-bit signals in YCbCr 4:2:2 Output mode, or 10-bit Deep Color signals for all 4:4:4 (YCbCr 4:4:4, RGB-Video, RGB-PC) Output modes. Status is shown in OSD menu

Func Edge

Alternates between YCbCr 4:2:2 decimation filter on and off. Status is shown in OSD menu

Func Mute

Press this key sequence to alternate between HDMI[®] and DVI output modes if the OSD menu is not visible on some displays in the HDMI (default) output mode. This is normally only the case on older video displays and computer monitors with DVI only inputs that may be incompatible with HDMI protocols.

On Screen Display (OSD) Systems

Pattern Information

Each time a pattern is changed the name of the pattern, which includes important signal identification information, is displayed on screen for a short duration. The duration can be selected in the OSD Misc menu (approximately 0.25, 0.5, 1.0, 1.5, or 2.0 seconds), and the duration can be saved as a power-up default value.

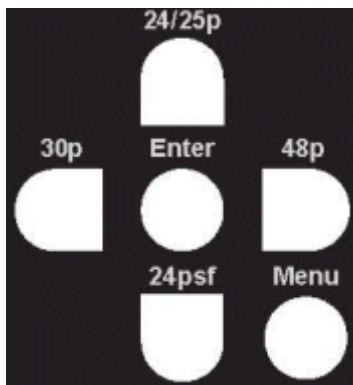
CIE xyY values are shown on the Info line for windows and fields in the Color75 and Color100 pattern groups. The CIE x,y and Y (luminance relative to an equal amplitude gray color) values are defined by the Color Gamut of applicable HD or SD standards, and can be used as target values to adjust a Color Management System (CMS). It can be advantageous to calibrate a display to have selectable Color Gamuts for the same signal format, therefore the target Color Gamut for HD, SD 60 Hz, and SD 50 Hz signals can be changed in the Misc menu. The Color Gamut selection changes only the CIE xyY target values for the display, and does not affect the generator's output signals.

Info – Press the Info key on the remote control to display the pattern information continuously. Press the Info key again to resume the default display period.

OSD Menu System

The OSD Menu is produced in all digital output signal formats. The OSD Menu provides additional features such as user-defined luma values and colors, selectable RGB and YCbCr individual channel blanking (set to the black level), advanced signal parameters (YCbCr color-encoding, 59.94/60 Hz frame rates, HDMI 10-bit and 12-bit Deep Color, YCbCr 4:2:2 bit-depth and filtering, Digital Sync Polarity), AVI InfoFrame parameters, USB port control, and the ability to specify generator power-up default modes.

OSD Menu Navigation



Press the **Menu** button to display the OSD window, which is organized into three columns. The left column of the OSD window currently lists seven menus:

- User Level
- Output
- Sync
- Misc
- USB Port
- Defaults
- AVI InfoFrame

Use the cursor keys to highlight (green text) the desired menu, and then move into the middle column and highlight a menu item. The current status of each highlighted menu item is shown in the right column. To change a setting move into the right column and highlight one of the alternative settings that will be listed in that column. In most cases it is not necessary to press the **Enter** key unless “Enter” appears in the right column. In that case highlight **Enter** and press the remote control **Enter** key to proceed.

Press the **Menu** key to turn the OSD menu on or off. The highlighted (green text) cursor position in the OSD menu is maintained when the menu is turned on or off, so it is easy to turn the menu off when making measurements or adjusting a calibration setting, and then turn it back on again to make additional changes to the same menu item.

Menu items that are not applicable to the current signal output type are dimmed and not accessible in the menu. For instance, the YCbCr 4:2:2 Filter selection menu item is not accessible unless the YCbCr 4:2:2 output mode is active.

OSD Menus

User Level

Field

Use the numeric [0-9] keys followed by the Enter key to enter a luma integer value from 0-109% for the User Field in the Gray Field group. To restore the original 100% User Field select Factory and press Enter. Select “Cancel” and press Enter to leave the menu without making any change.

Window

Use the numeric [0-9] keys followed by the Enter key to enter a luma integer value from 0-109% for the User Window in the Gray Scale group. To restore the original 100% User Window select Factory and press Enter.

Select "Cancel" and press Enter to leave the menu without making any change.

Checkerboard

Use the numeric [0-9] keys followed by the Enter key to enter a luma integer value from 0-109% for the User Checkerboard and User Inverse Checkerboard in the Special group. To restore the original 50% Checkerboard luma value select Factory and press Enter. Select "Cancel" and press Enter to leave the menu without making any change.

Color

Use the Up and Down cursor keys to select the R, G, or B entry field. Use the numeric [0-9] keys to enter R, G, or B integer values from 0-109%. Press the Enter key to enter the R, G, B values as the new color of the User Window and User Field in the Color 75 and Color 100 groups. The "White" bars in the color bar patterns are also changed to allow comparison with other known colors. To restore the original 75% gray and 100% white colors select Factory and press Enter. Select "Cancel" to leave the menu without making any change.



NOTE: After you enter the value changing process you can only exit that process by completing a value entry, by highlighting Factory and pressing Enter to reset the value(s), or by highlighting Cancel and pressing Enter. After you Cancel or Enter a new value, a "Change" option is highlighted in the menu.

Press **Enter** to repeat the User value entry process, or press the left cursor key to move to another menu item.



NOTE: As you enter digits the digits shift to the left. Press zeros to clear a mis-typed number without using Cancel to exit the menu.

10-bit Field, Window, Checkerboard, and Color User values can also be entered with the USB interface.

Output

Channels

Enable/disable any combination of RGB or YCbCr output signal channels. This allows you to create red, green, blue, yellow, cyan, or magenta RGB geometry, linearity, and ramp patterns, or produce Y (luma) only signals for the color bar patterns. The former can be especially useful for adjusting convergence in displays with separate RGB convergence controls.

Color Enc

Select standard YCbCr HD/SD ITU Rec. 709/Rec. 601 color-matrix encoding, or reverse the encoding (HD/SD Rec. 601/Rec. 709). This is useful to quickly verify correct display color decoding visually.

HD V Rate

Select 59.94 or 60.00 Hz field/frame rates for HD signals.

HDMI/DVI

Select HDMI or DVI output. Some older video monitors and computer monitors will not display HDMI protocol signals.

Deep Color

Select 8-bit RGB/YCbCr 4:4:4 digital signals, or RGB/YCbCr 4:4:4 Deep Color 10-bit or 12-bit signal output. Only available when HDMI signal output is also selected.

422 Filter

Select YCbCr 4:2:2 signal filtering On or Off. When Off is selected the Cb/Cr signals are decimated from 4:4:4 to 4:2:2 signals without filtering. Only available when YCbCr 4:2:2 signal output is active.

422 Bits

Select 8-bit or 10 bit YCbCr digital video output signals. Only available when YCbCr 4:2:2 signal output is active.

Sync

HD std +

Select positive or negative HD digital sync. HD standard is positive.

SD std -

Select positive or negative SD digital sync. SD standard is negative.

Position

Change Hsync (+/- 99 pixels) and Vsync (+/- 15 lines) position. Use with overscan pattern to measure H & V overscan precisely in pixels and lines. Use Pos, Neg, and SoG keys to increment, decrement, and zero (reset) sync position.



NOTE: Some displays don't use sync signals to position the video frame and Sync Position will have no or unpredictable effect on those displays. Some displays use Hsync position to determine the Cb/Cr phase for YCbCr 4:2:2 signals and changing Hsync Position will alter color on those displays.

Misc

Info

Serial number and options information.

Disp Time

Selects the duration of pattern name display. The IR remote control INFO key will continuously display pattern names if desired.

Gamut HD

Select Rec709, SMPTE-C, or EBU. Changes the CIE xyY target values shown on the OSD Color75/Color100 Pattern Info line for HD (1080i/p, 720p) signals to the color gamut defined by the selected standard. The default standard is ITU Rec. 709. This setting has no effect on generator signals.

Gamut SD60

Select Rec709, SMPTE-C, or EBU. Changes the CIE xyY target values shown on the OSD Color75/Color100 Pattern Info line for SD 60 Hz (480i/p) signals to the color gamut defined by the selected standard. The default standard is SMPTE-C. This setting has no effect on generator signals.

Gamut SD50

Select Rec709, SMPTE-C, or EBU. Changes the CIE xyY target values shown on the OSD Color75/Color100 Pattern Info line for SD 50 Hz (576i/p) signals to the color gamut defined by the selected standard. The default standard is EBU. This setting has no effect on generator signals.

USB Port

USB Baud

Baud rate selection.

USB Flow

Flow control selection.

Defaults (Power up)

60/50 Hz

Power up in 60 Hz or 50 Hz output formats mode.

USB Baud

Power up baud rate.

User Format

Power up with front panel User Format set to select 1080p24sf, 1080p30, or 1080p48.

Disp Time

Power up with the pattern name display duration set to 0.25, 0.5, 1.0, 1.5, or 2.0 seconds.

Save Items

Save all of the above power up default items to non-volatile memory.

(AVI) InfoFrame (HDMI only)

Output

Auto or manual selection of the Output Signal Type parameter (Auto, Off, RGB, YCbCr 4:2:2, YCbCr 4:4:4).

Color Enc

Auto or manual selection of the YCbCr color encoding parameter (Auto, Off, Rec. 601, Rec. 709).

Levels

Auto or manual selection of the Output Signal Levels parameter (Auto, Off, Video, PC).

Format

Auto or manual selection of the Output Signal Format parameter (Auto, Off).

Pixel Rep

Auto or manual selection of the Output Signal Pixel Replication parameter (Auto, 1x, 2x).



NOTE: The AVI InfoFrame menu allows product designers and expert users to troubleshoot display or video processor problems by temporarily disabling or sending an “incorrect” InfoFrame parameter to determine if a device is ignoring a particular parameter or executing it incorrectly. For example, if a display is decoding standard-definition YCbCr signals with the wrong color matrix the user can change the InfoFrame Color Enc parameter to determine whether the display responds to the parameter at all, and if so how it responds to different parameter values.

3D Mode (Optional Feature)

Structure

Select 3D Off (2D), 3D Frame Packing, 3D Side-by-Side (Half), or 3D Top-and-Bottom Structure video signals. The Structure is also shown at the bottom-right corner of the OSD Menu.

The DVG-5000 provides 33 3D structure/video-format combinations, including all 3D display-required formats. A complete list of the provided 3D structure-format combinations is included in the DVG-5000 specification pages.

After a 3D structure (e.g. Frame Packing) is selected only valid video formats (e.g. 1080p24) for that 3D structure can be enabled. If the current DVG-5000 video format is not one of the provided video formats for the selected 3D structure, the generator will automatically switch to a valid video format. Pressing the front panel Format button will skip over formats that are not provided for the selected 3D structure. Invalid formats selected by the IR remote control will be ignored. A unique USB command is also available for each valid 3D structure and video format combination. For more information, refer to [Format Commands on page 28](#)).

No standard-definition 3D formats are provided. Therefore, to return to a standard-definition format (480i/p or 576i/p) the user must first select 3D Off in the Structure menu to return to the 2D mode.

Blank Eye

Select None, Left or Right. Blanks the left or right eye image for all 3D signals. This can be used to identify or troubleshoot faulty 3D processing by a display or processor.

Infoframe

Select Infoframe On or Off. A CEA-861 Vendor Specific Infoframe is normally sent from the DVG-5000 to the display (or video processor) to identify the video signal’s 3D Structure. A 3D display, or a 3D compatible processor, uses the Infoframe information to correctly process and/or display 3D signals.

Side-by-Side (Half) and Top-and-Bottom 3D structure signals contain both left eye and right eye halfhorizontal-resolution or half-vertical-resolution images respectively in a single 2D compatible video frame. Therefore, if the Infoframe is turned off, a 3D display will simultaneously show the half-resolution left-eye and right-eye images in a single 2D image frame, unless the display’s manual controls are used to select a corresponding 3D display mode.

However, most 3D displays automatically sense 3D Frame Packing structure signals without using the Infoframe. Therefore it’s usually not possible to view the left and right eye images of 3D Frame Packing signals within a 2D frame even though the Infoframe is turned off.

2D Displays will simultaneously display the left-eye and right-eye images of the 2D frame-compatible Side-bySide (Half) and Top-and-Bottom 3D structure signals, however the Infoframe may need to be turned off else the display may report that an invalid signal is being received. Most 2D displays are not compatible with the unusual video frame formats used for Frame Packing signals and therefore will report that an invalid signal is being received.

Crosstalk

Select Crosstalk to produce a special test pattern to measure the amount of 3D crosstalk between left eye and right eye images as seen through 3D glasses. The amount of crosstalk is a function of both the 3D display and its 3D glasses.

A menu is displayed below the special Crosstalk test pattern that includes the following menu items (and the calculated value of Xtalk %):

Level	(xx)%	Xtalk x.xx%
Color	(Gray, Red, Green, Blue)	
Mode	(L to R, R to L)	
Window	(Match, 100%, Xtalk)	
Gamma	(1.5-3.0)	

Select the menu items with the **Up/Down** keys. Select the item values with the **Left/Right** keys.

Exit the Crosstalk Pattern/Menu by pressing the **Menu** key.

Using the Crosstalk Pattern and Menu

The special Crosstalk pattern is a 100% signal level Window Frame surrounding two 0% (black) windows ("boxes"). The Window Frame is produced in only the left or right eye's image (e.g. left eye). But because of crosstalk the Window Frame appears at a lower brightness in the opposite eye's image (e.g. right eye).

Level%

While looking through only one eye (e.g. right eye) with 3D glasses, the video signal Level and therefore the corresponding brightness of the boxes in that eye's image (e.g. right eye) can be adjusted until the box brightness matches the Window Frame's crosstalk brightness. Hence, the Equivalent Crosstalk Level (ECL) can be determined for Left to Right Crosstalk.

Mode

We can also reverse the procedure (L to R, R to L) to determine the ECL for Right to Left Crosstalk. Differences between Left to Right ECL and Right to Left ECL can be expected because of differences in the 3D glasses left eye and right eye extinction ratios, and other effects of the display technology.

Color

It can be somewhat difficult to determine the best brightness match because of grayscale color shifts between the Window Frame crosstalk and the boxes. Crosstalk may also vary with spectral color. For those reasons the test pattern color can be set to Gray, Red, Green, or Blue.

Gamma

While ECL can be useful as a simple metric for 3D crosstalk, it doesn't express crosstalk as a percentage of image brightness because it doesn't take into account display gamma. Displays with the same ECL will have different percentage amounts of visible crosstalk if they have different gamma curves. In addition the ECL expressed as a percentage of 100% signal level is numerically large and somewhat misleadingly. For instance, if the ECL is 20%, the actual Crosstalk luminance per-

centage (Xtalk %) is 2.9% for a display with a gamma of 2.2. Therefore, the Xtalk % is calculated based on display gamma, which can be selected by the user.

Window

The Match setting is used to display the Window Frame test pattern, which when matched produces the calculated Xtalk % based on the display's gamma value. However, the display gamma at the crosstalk Level may not be accurately known, and the user may wish to measure the Xtalk % directly. The 100% and Xtalk settings display the 100% video level and the matching Xtalk Level as full windows so the luminance (Y) can be measured directly from the display. $Xtalk \% = Y(Xtalk) / Y(100\%)$.



NOTE: The 100% and Xtalk windows are displayed as left and right eye images respectively for the L to R Mode (and visa-versa for the R to L Mode) to produce the same luminance levels used in the Match mode. At low frame rates (e.g. 1080p24) the increased flicker may create problems for some luminance measurement devices. You can reduce the flicker and double the light output for LCD or DLP displays by displaying the 100% and Xtalk windows in both left and right eye images by pressing the Func - Y/C key sequence after selecting 100% and Xtalk. However, the increased light output could produce limiting on the 100% window in some 3D plasma display panels.



WARNING: Always use CAUTION when displaying any test patterns. Static patterns, particularly bright patterns, can produce permanent image retention ("burn-in") on some display products. 3D display products may be more susceptible to image retention than other display products. Consult your display manufacturer for guidance BEFORE using test patterns from any device.



TIP: Always display patterns for the minimum amount of time necessary to make measurements or adjustments. The Mute button produces a black field and blanks menus.

3D Func Key Shortcuts

Func `1`

Enables 2D mode (cancels 3D modes).

Func `4`

Enables 3D Frame Packing Structure mode. Automatically selects a valid 3D Frame Packing format if the current format is not a valid Frame Packing format.

Func `5`

Enables 3D Side-by-Side (Half) Structure mode. Automatically selects a valid 3D Side-by-Side (Half) format if the current format is not a valid Side-by-Side (Half) format.

Func `6`

Enables 3D Top-and-Bottom Structure mode. Automatically selects a valid 3D Top-Bottom format if the current format is not a valid Top-and-Bottom format.

Func YPbPr

Press this key sequence to blank the 3D LEFT eye image in any 3D Structure mode.

Func RGB-V

Press this key sequence to blank the 3D RIGHT eye image in any 3D Structure mode.

Func Y/C

Press this key sequence to cancel left or right eye image blanking in any 3D Structure mode.