



User Guide

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About This Guide

This guide provides information on display features, setting up the display, using the software and technical specifications.

-
-  **WARNING!** Indicates a hazardous situation that, if not avoided, **could** result in death or serious injury.
 -  **CAUTION:** Indicates a hazardous situation that, if not avoided, **could** result in minor or moderate injury.
 -  **IMPORTANT:** Indicates information considered important but not hazard-related (for example, messages related to property damage). A notice alerts the user that failure to follow a procedure exactly as described could result in loss of data or in damage to hardware or software. Also contains essential information to explain a concept or to complete a task.
 -  **NOTE:** Contains additional information to emphasize or supplement important points of the main text.
 -  **TIP:** Provides helpful hints for completing a task.
-



This product incorporates HDMI technology.

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1 Getting Started

Important safety information


A power cord is included with the display. If another cord is used, use only a power source and connection appropriate for this display. For information on the correct power cord set to use with the display, refer to the *Product Notices* in your documentation kit.

 **WARNING!** To reduce the risk of electric shock or damage to the equipment:


- Plug the power cord into an AC outlet that is easily accessible at all times.
- Disconnect power from the computer by unplugging the power cord from the AC outlet.
- If provided with a 3-pin attachment plug on the power cord, plug the cord into a grounded (earthed) 3-pin outlet. Do not disable the power cord grounding pin, for example, by attaching a 2-pin adapter. The grounding pin is an important safety feature.

For your safety, do not place anything on power cords or cables. Arrange them so that no one may accidentally step on or trip over them. Do not pull on a cord or cable. When unplugging from the AC outlet, grasp the cord by the plug.


To reduce the risk of serious injury, read the *Safety & Comfort Guide*. It describes proper workstation setup, and proper posture, health, and work habits for computer users. The *Safety & Comfort Guide* also provides important electrical and mechanical safety information. The *Safety & Comfort Guide* is available on the Web at <http://www.hp.com/ergo>.

 **IMPORTANT:** For the protection of the display, as well as the computer, connect all power cords for the computer and its peripheral devices (such as a display, printer, scanner) to some form of surge protection device such as a power strip or uninterruptible power supply (UPS). Not all power strips provide surge protection; the power strips must be specifically labeled as having this capability. Use a power strip whose manufacturer offers a damage replacement policy so you can replace the equipment, if surge protection fails.

Use the appropriate and correctly sized furniture designed to properly support your HP LCD display.

 **WARNING!** LCD displays that are inappropriately situated on dressers, bookcases, shelves, desks, speakers, chests, or carts may fall over and cause personal injury.

Care should be taken to route all cords and cables connected to the LCD display so that they cannot be pulled, grabbed, or tripped over.

 **NOTE:** This product is suitable for entertainment purposes. Consider placing the display in a controlled luminous environment to avoid interference from surrounding light and bright surfaces that may cause disturbing reflections from the screen.


Product features and components

Features

The LCD (liquid crystal display) has an active matrix, thin-film transistor (TFT) panel. The display features include:

- 78.9 cm (31.1-inch) diagonal viewable area display with 4096×2160 resolution, plus full-screen support for lower resolutions
- Wide color gamut to provide 100% coverage of AdobeRGB, sRGB, and BT.709, 99% of DCI-P3; and 80% of BT.2020
- Ability to accurately remap the color gamut of the display (within the supported color gamut of the panel) to enable the selection of the color space and very accurately set the RGB primaries, white point, and grayscale response for consistent and repeatable colors
- Very high color and luminance stability (with typical use)
- Calibrated color space factory presets for DCI P3 D65, BT.709, BT.2020, sRGB D65, sRGB D50, Adobe RGB D65, and Adobe RGB D50 so the display is ready to use for color-critical applications with minimal setup
- Recalibrateable color presets that allow you to recalibrate to a standard or custom color space by specifying the color primaries, white point, gamma/EOTF, luminance, and name (via StudioCal XML)
- Option to reset to Factory Calibration settings or User Calibration settings to easily restore the display to the factory or user settings
- Built-in support for the X-Rite i1Display Pro, X-Rite i1 Pro, Klein Instruments K10-A, Photo Research PR-6xx/7xx, Colorimetry Research CR-100/CR-250, and Konica Minolta CA-310 measurement devices
- Updatable display firmware to enable HP to quickly and easily provide solutions to identified problems and provide custom solutions
- Four re-assignable front bezel Function buttons to quickly select the most commonly used operations
- Wide viewing angle to allow viewing from a sitting or standing position, or moving from side-to-side
- Adjustable tilt, height, and swivel capabilities
- Removable stand for flexible display panel mounting solutions
- 100 mm integrated VESA mounting
- Two video signal inputs to support DisplayPort digital with one cable provided
- Two video signal inputs to support HDMI digital with one cable provided
- Analog audio output for headphones
- Integrated KVM (Keyboard/Video/Mouse) switch with keyboard-based input switching
- RJ-45 network connector
- Two DreamColor USB ports for connecting a measurement instrument or updating firmware
- Two fast-charging USB 3.0 ports
- USB Type-C port (USB 3.1 Gen1, 5 Gbps) with one USB Type-C cable and one USB Type-C to A cable
- USB 3.0 hub with one upstream port (cable provided) that connects to the computer and four downstream ports that connect to USB devices
- Plug and play capability if supported by your operating system


- Security slot provision on rear of display for optional cable lock
- Cable management feature for placement of cables and cords
- On-Screen Display (OSD) adjustments in several languages for easy setup and screen optimization
- HDCP 2.2 (High-Bandwidth Digital Content Protection) copy protection on all digital inputs
- Software and documentation disc that includes display drivers, product documentation, sample StudioCal XML scripts, and SDK (software development kit) material. These items are also available at <https://support.hp.com/>.


 **NOTE:** For safety and regulatory information, refer to the *Product Notices* in your documentation kit. To locate updates to the user guide for your product, go to <http://www.hp.com/support>. Select **Find your product**, and then follow the on-screen instructions.

Front panel controls

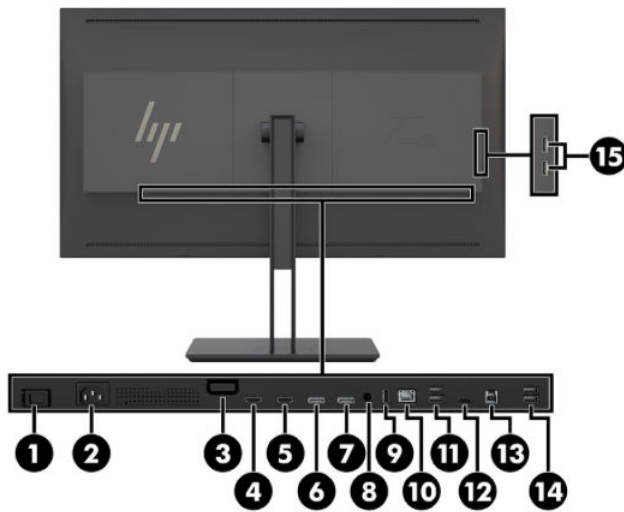














Control	Function
1	<p>Function buttons</p> <p>Use these buttons to navigate through the OSD based on the indicators next to the buttons that are activated while the OSD is open.</p> <p>NOTE: To activate the Function buttons, press any of the buttons so that the button labels appear on the right side of the screen and the button LEDs are lit.</p>
2	<p>Power button</p> <p>Turns the display on or off.</p> <p>NOTE: Be sure the master power switch on the rear of the display is in the ON position to turn on the display.</p>



 **NOTE:** To view an OSD menu simulator, visit the HP Customer Self Repair Services Media Library at <http://www.hp.com/go/sml>.

 **NOTE:** You can adjust the bezel button brightness and change the function of the buttons in the OSD. Refer to [Changing the bezel function buttons on page 38](#) and [Adjusting the bezel button LEDs on page 39](#) for more information.

Rear and side components



Component	Function
1 	Master power switch Turns off all power to the display. NOTE: Putting the switch in the Off position yields the lowest power state for the display when it is not in use.
2 	AC power connector Connects the AC power cord to the display.
3	Stand release latch Releases the stand from the display
4 	HDMI1 Connects an HDMI cable to the display.
5 	HDMI2 Connects an HDMI cable to the display.
6 	DisplayPort 1 Connects a DisplayPort cable to the display.
7 	DisplayPort 2 Connects a DisplayPort cable to the display.
8 	Analog audio out Connects headphones to the display.
9 	KVM keyboard port Connects a keyboard to the display.
10 	RJ-45 network connector Connects a network cable to the display.
11 	DreamColor USB ports Connect a measurement instrument or a USB flash drive for color calibration or firmware update.
12 	USB Type-C upstream port (for host connections) Connects a host device with a Type-C connector.
13 	USB 3.0 upstream port Connects the USB hub cable to the display's USB hub connector and to a host USB port/hub.

Component	Function
14 	USB 3.0 downstream ports Connect optional USB devices to the display.
15 	USB 3.0 downstream ports (side panel) Connect optional USB devices to the display.

Setting up the display

Use caution when setting up the display

CAUTION: To prevent damage to the display, do not touch the surface of the LCD panel. Pressure on the panel may cause nonuniformity of color or disorientation of the liquid crystals. If this occurs the screen will not recover to its normal condition.

To prevent damage to the display, be careful not to put pressure on the colorimeter area (top center of bezel) when transporting the display.

Installing the display stand

CAUTION: Do not touch the surface of the LCD panel. Pressure on the panel may cause non-uniformity of color or disorientation of the liquid crystals. If this occurs the screen will not recover to its normal condition.


The display offers easy mounting and unmounting of the display panel. To mount the panel onto the stand:


1. Lay the display panel facedown on a flat surface covered by a clean, dry cloth.
2. Slide the top of the stand (1) under the upper lip of the recess in the back of the panel.
3. Lower the bottom of the stand's mounting plate (2) into the recess until it snaps into place.



Mounting the display

The display head can optionally be attached to a wall, swing arm, or other mounting fixture.

 **NOTE:** This apparatus is intended to be supported by UL or CSA Listed wall-mount bracket.

 **CAUTION:** This display supports the VESA industry-standard 100 mm mounting holes. To attach a third-party mounting solution to the display, four 4 mm, 0.7 pitch, and 15 mm-long screws are required. Longer screws must not be used because they may damage the display. It is important to verify that the manufacturer's mounting solution is compliant with the VESA standard and is rated to support the weight of the display panel. For best performance, it is important to use the power and video cables provided with the display.

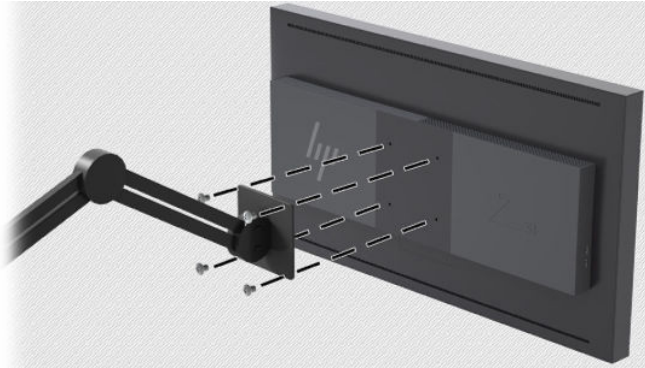
1. Remove the four screws from the VESA holes located on the rear of the display head.



2. Install the included back plate cover over the mounting screws on the rear of the display.




3. To mount the display head directly to a mounting fixture, use the four screws removed from the VESA holes on rear of the display head and install them to attach the mounting device to the rear of the display.



Locating the serial number and product number

The serial number and product number are located on a label on the rear panel of the display head. You may need these numbers when contacting HP about the display.

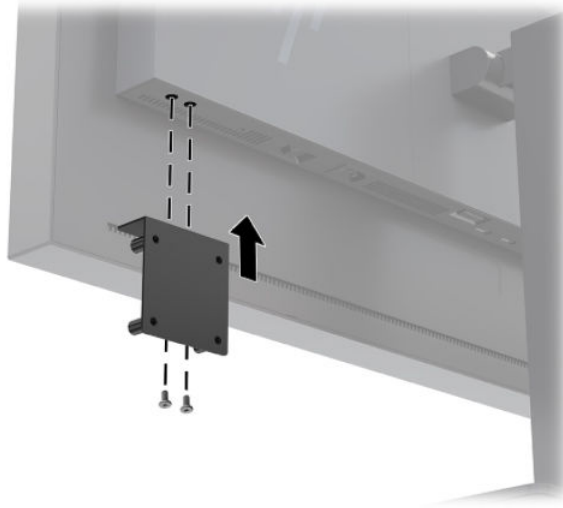
 **NOTE:** You may need to partially pivot the display head to read the label.



Attaching an optional device to the rear of the display

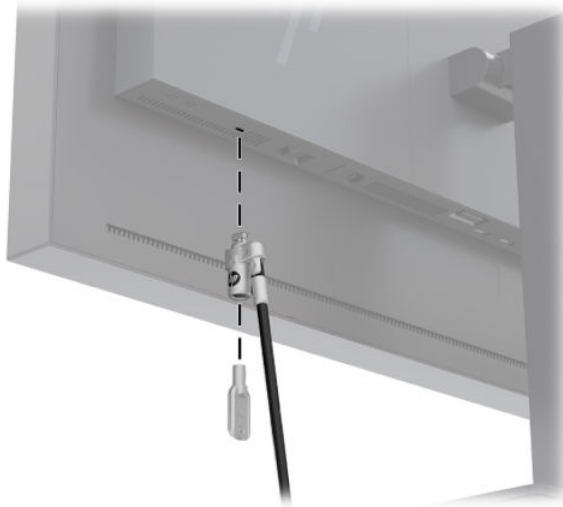
A bracket with four 40mm×40mm VESA standard mounting holes is available that allows you to mount a device such as an SDI or video over ip converter to the rear of the display.

- ▲ Place the bracket against the rear of the display with the screw holes aligned, and then install the screws.




Installing a security cable

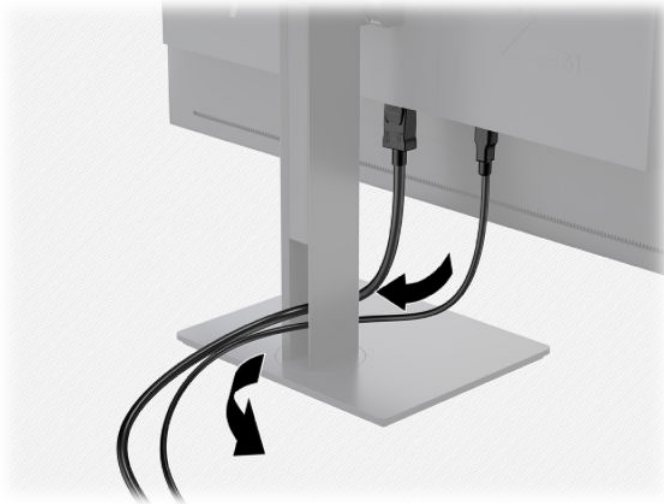
You can secure the display to a fixed object with an optional security cable available from HP.




Connecting the cables


 **NOTE:** The display ships with select cables. Not all cables shown in this section are included with the display.

1. Place the display in a convenient, well-ventilated location near the computer.
2. Before connecting the cables, route the cables through the cable routing hole in the center of the stand.




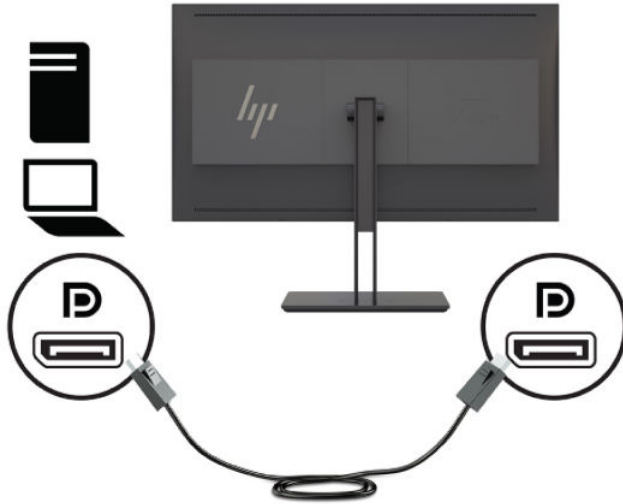
3. Depending on your configuration, connect either the DisplayPort, HDMI, or USB Type-C cable between the computer and the display.

 **NOTE:** The video mode is determined by the video cable used. The display will automatically determine which inputs have valid video signals. The inputs can be selected through the On-Screen Display (OSD) feature by pressing one of the front bezel buttons to activate the buttons, and then press the **Open Menu** button to open the OSD. In the OSD, select **Video Input** and choose the desired input source.


 **IMPORTANT:** USB-C input must be manually selected for a video input. Once USB-C is selected for the video input, auto-scanning of the HDMI and DisplayPort inputs is disabled.

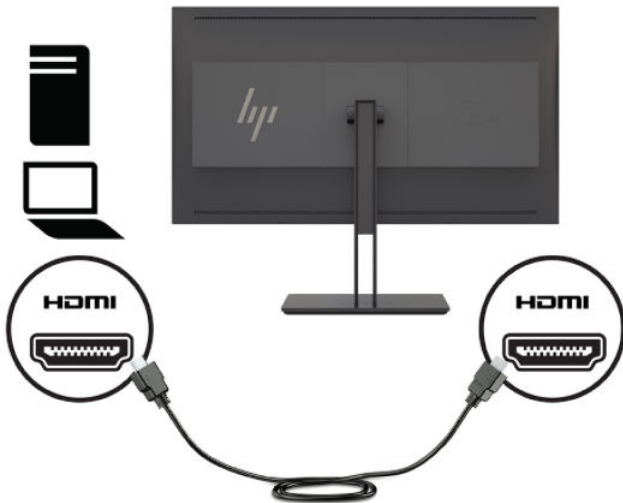
- For DisplayPort digital operation, connect the DisplayPort signal cable to the DisplayPort connector on the rear of the display and the other end to the DisplayPort connector on the computer (cable provided).

 **NOTE:** There are two DisplayPort connections on the rear of the display that allow you to connect two workstations to the display.

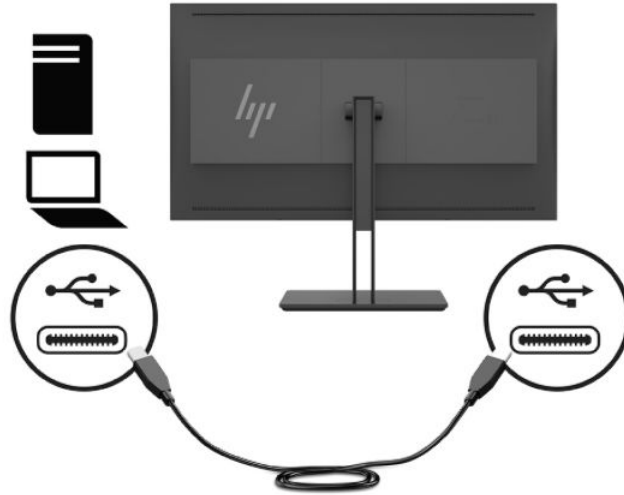


- For HDMI digital operation, connect the HDMI signal cable to the HDMI port on the rear of the display and the other end to the HDMI port on the computer (cable provided).


 **NOTE:** There are two HDMI ports on the rear of the display allowing you to connect two video devices to the display.

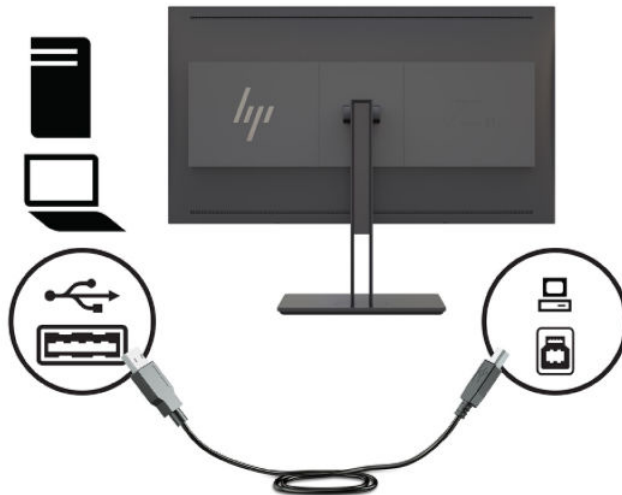


- For USB Type-C digital operation, connect the USB Type-C cable to the USB Type-C connector on the rear of the display and the other end to the USB Type-C connector on the computer (cable provided).




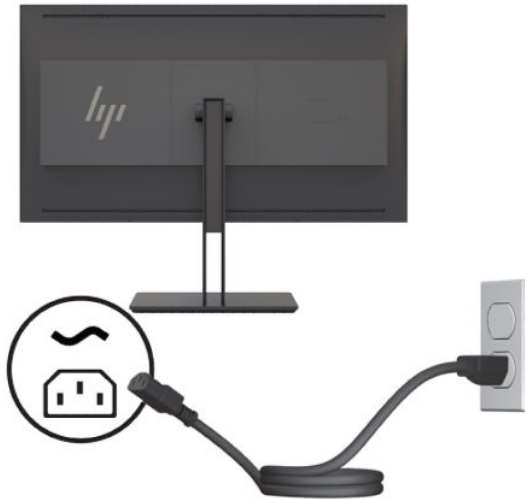
4. Connect one end of the provided USB cable to the USB downstream port on the rear panel of the computer, and the other end to the upstream USB connector on the display.

 **NOTE:** The display supports USB 3.0. For optimal performance, connect the USB cable to a USB 3.0 port on the computer, if available.



5. Connect one end of the power cord to the AC power connector on the back of the display, and the other end to an AC outlet.

 **NOTE:** The master power switch on the rear of the display must be in the On position before pressing the power button on the front of the display.



 **WARNING!** To reduce the risk of electric shock or damage to the equipment:

Plug the power cord into an AC outlet that is easily accessible at all times.

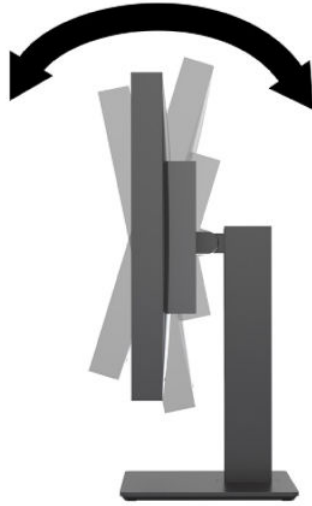
Disconnect power from the computer by unplugging the power cord from the AC outlet.

If provided with a 3-pin attachment plug on the power cord, plug the cord into a grounded (earthed) 3-pin outlet. Do not disable the power cord grounding pin, for example, by attaching a 2-pin adapter. The grounding pin is an important safety feature.

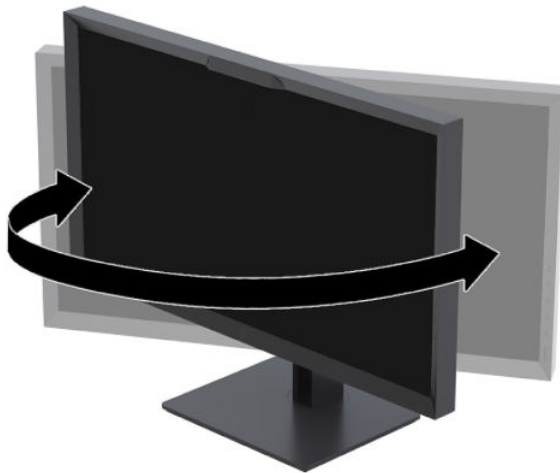
For your safety, do not place anything on power cords or cables. Arrange them so that no one may accidentally step on or trip over them. Do not pull on a cord or cable. When unplugging from the AC outlet, grasp the cord by the plug.

Adjusting the display

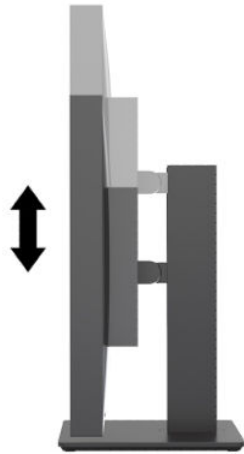
1. Tilt the display's panel forward or backward to set it to a comfortable angle. Ideally the panel surface should be perpendicular to your eyes.



2. Swivel the display to the left or right for the best viewing angle.




3. Adjust the display's height to a comfortable position for your individual workstation. The display's top bezel edge should not exceed a height that is parallel to your eye height. A display that is positioned low and reclined may be more comfortable for users with corrective lenses. The display should be repositioned as you adjust your working posture throughout the work day.




Turning on the display

1. Set the master power switch on the rear of the display to the On position.
2. Press the power button on the computer to turn it on.
3. Press the power button on the front of the display to turn it on.




 **NOTE:** The first time the display is turned on from the master power switch it may take up to 30 seconds before the display responds to the front power button. This is normal and is due to the booting of internal systems.

 **NOTE:** If pressing the power button has no effect, the Power Button Lockout feature may be enabled. To disable this feature, press and hold the display power button for 10 seconds.

When the display is powered on, a status message is displayed for five seconds. The message shows which input is the current active signal, the status of the auto-switch source setting (On or Off; factory default is On), the default source signal (factory default is DisplayPort), the current preset display resolution, and the recommended preset display resolution.

The display automatically scans the signal inputs for an active input and uses that input for the display. If two or more inputs are active, the display will indicate the default input source. If the default source is not one of

the active inputs, then the display will indicate the highest ranking priority input. You can select the input source in the OSD. Press one of the front bezel buttons to activate the buttons, and then press the **Open Menu** button to open the OSD. In the OSD select **Video Input** and choose the desired input source.

 **IMPORTANT:** USB-C input must be manually selected for a video input. Once USB-C is selected for the video input, auto-scanning of the HDMI and DisplayPort inputs is disabled.


HP watermark and image retention policy

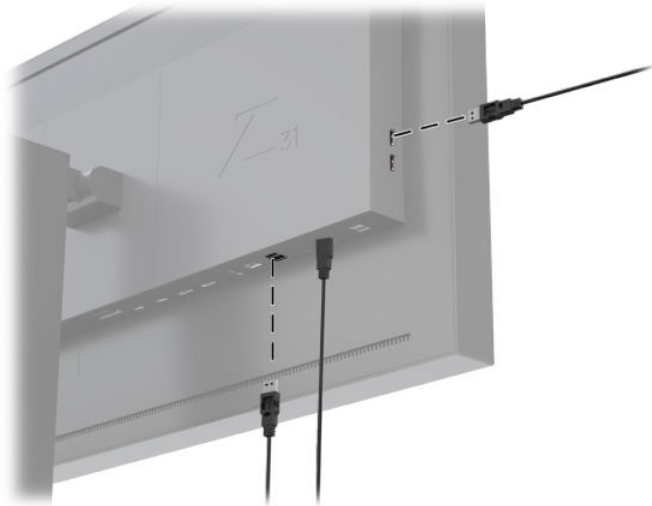
The IPS display models are designed with IPS (In-Plane Switching) display technology which provides ultra-wide viewing angles and advanced image quality. IPS displays are suitable for a wide variety of advanced image quality applications. This panel technology, however, is not suitable for applications that exhibit static, stationary or fixed images for long periods of time without the use of screen savers. These types of applications may include camera surveillance, video games, marketing logos, and templates that are displayed on the screen for a prolonged period of time. Static images may cause image retention damage that could look like stains or watermarks on the display's screen.

Displays in use for 24 hours per day that result in image retention damage are not covered under the HP warranty. To avoid image retention damage, always turn off the display when it is not in use or use the power management setting, if supported on your system, to turn off the display when the system is idle.

Connecting USB devices

There are four downstream USB ports on the display (two on the rear and two on the side).

 **NOTE:** You must connect the USB hub cable (USB Type-B or USB Type-C) from the display to the computer to enable the USB ports on the display.

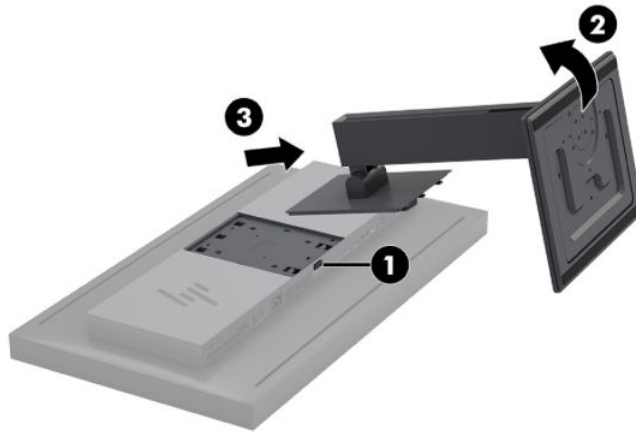


Removing the display stand

You can remove the display head from the stand to install the panel on a wall, a swing arm, or other mounting fixture.

CAUTION: Before beginning to disassemble the display, be sure it is turned off and the power, signal, and network cables are all disconnected. Also disconnect all USB cables connected to the display.

1. Disconnect and remove all cables from the display.
2. Lay the display facedown on a flat surface covered by a clean, dry cloth.
3. Press down on the latch near the bottom center of the display to unlock the stand **(1)**.
4. Swing the bottom of the stand up until the mounting plate clears the recess in the panel **(2)**.
5. Slide the stand out of the recess **(3)**.



2 Using the display

Software and utilities

The disc that comes with the display contains files you can install on the computer.

- an .INF (Information) file
- ICM (Image Color Matching) files (one for each calibrated color space)
- USB Software Development Kit (SDK) for Linux, Windows, and Mac
- sample StudioCal XML scripts



NOTE: The items listed above can be downloaded from the HP display support Web site. For more information, go to [Downloading from the Internet on page 18](#).

The information file

The .INF file defines display resources used by Microsoft Windows operating systems to ensure display compatibility with the computer's graphics adapter.

This display is Microsoft Windows Plug and Play-compatible. It works correctly without installing the .INF file. Plug and Play compatibility requires that the computer's graphic card is VESA DDC2-compliant and that the display connects directly to the graphics card.

The image color matching files

The ICM files are data files that describe the colorimetry of the display. In the case of calibrated displays, they describe the colorimetry of a given color preset. This information includes the preset's calibrated color gamut, grayscale response, and white point. These files are used by the operating system's color management engine—as well as the color management engine built into specialized photography, video, and graphic arts applications—to ensure that colors on-screen are rendered correctly and will be displayed accurately when viewed on the display. While not all programs support the use of these files, HP strongly recommends that you always select or enable the ICM file matching the active color preset to ensure the best image reproduction.



NOTE: The ICM color profile is written in accordance with the International Color Consortium (ICC) Profile Format specification.

Installing the .INF and .ICM files

You can install the .INF and .ICM files from the disc or download them.

Installing from the disc

To install the .INF and .ICM files on the computer from the disc:

1. Insert the disc in the computer optical drive. The disc menu is displayed.
2. View the **HP Display Software Information** file.
3. Select **Install Display Driver Software**.
4. Follow the on-screen instructions.



NOTE: While an .INF file is Windows specific, if you are running macOS or Linux, you may want to install the .ICM files to ensure on-screen color accuracy. These files can be manually copied to your computer. Refer to your host operating system guide for information on where to install these files.

Downloading from the Internet

To download the latest version of .INF and .ICM files from the HP displays support Web site:

1. Go to <http://www.hp.com/support>.
2. Enter the name of your HP product or product number in the **Search all support** box, and then click the search icon.
3. Select from the menu options shown to get your drivers, software, and firmware.
4. Download the software by following the instructions.

Updating the firmware

HP recommends that you check for updated display firmware and install newer firmware if available.



NOTE: By default, the display's internal processor – which is required for firmware updating – is disabled. You must enable the processor before you can update the display firmware. In the OSD select **Management > Internal processor** and choose **Enable** to turn the processor on. If turning on just before attempting to update the firmware, wait approximately one minute for the internal processor to fully boot.

To update the firmware with USB:


1. Check your current firmware version.
 - a. Press any Function button on the front bezel.
 - b. Press the **Open Menu** button to open the OSD.
 - c. Select **Information** to view the current firmware version.




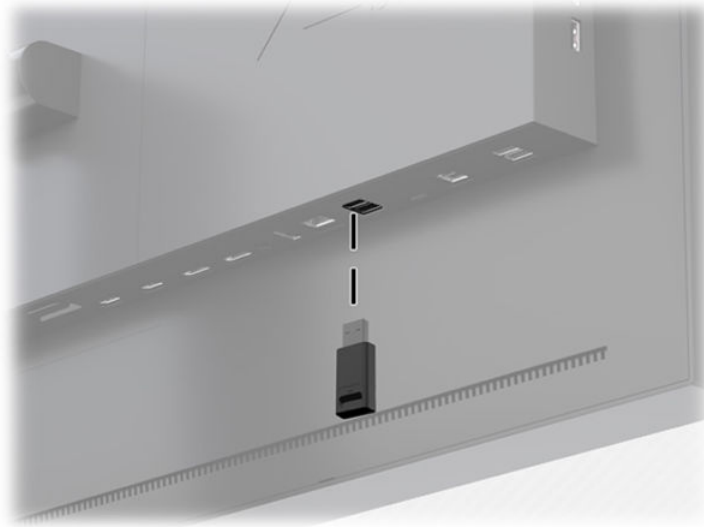
TIP: A bezel Function button shortcut, Display Info, is provided on the fourth bezel button in the display's factory configuration. You can access this information page using this shortcut, unless the bezel button has been reassigned. This information page also indicates whether the internal processor is on or off.

2. Find the latest firmware on the Web.

- a. Go to <http://www.hp.com/support>.
 - b. Enter the name of your HP product or product number in the **Search all support** box, and then click the search icon.
 - c. Select from the menu options shown to get your firmware.
 - d. Check the latest firmware revisions listed for the display to see if it is a newer version than what is currently installed.
 - e. Download the firmware onto a USB flash drive. The following USB drive formats are supported: FAT, FAT32, NTFS.
3. Insert the USB flash drive with the latest firmware into one of the DreamColor USB ports and follow the on-screen instructions to install the firmware.

 **NOTE:** The firmware is distributed as a compressed, signed rar file. Do not decompress the file before installing.


 **CAUTION:** Do not turn off the display during the firmware update.



Selecting a color space preset

The display provides factory calibrated color space presets, suitable for a wide variety of color-critical workflows including visual effects, animation, on-set/dailies viewing, professional photography, product design, print/pre-press, graphic arts, and many others. Seven industry standard color spaces are provided along with the display's native color gamut. The following table provides information on the eight provided standard color spaces.

Preset number	Preset name	Red primary (u'v')	Green primary (u'v')	Blue primary (u'v')	White point	Default gamma or EOTF	Default luminance
0	DCI P3 D65	0.496, 0.526	0.099, 0.578	0.175, 0.158	D65	2.4	100 cd/m ²
1	BT.709	0.451, 0.523	0.125, 0.563	0.175, 0.158	D65	BT.1886	100 cd/m ²
2	BT.2020	0.557, 0.516	0.056, 0.587	0.159, 0.126	D65	BT.1886	100 cd/m ²
3	sRGB D65	0.451, 0.523	0.125, 0.563	0.175, 0.158	D65	sRGB	250 cd/m ²
4	sRGB D50	0.451, 0.523	0.125, 0.563	0.175, 0.158	D50	sRGB	250 cd/m ²
5	Adobe RGB D65	0.451, 0.523	0.076, 0.576	0.175, 0.158	D65	2.2	250 cd/m ²
6	Adobe RGB D50	0.451, 0.523	0.076, 0.576	0.175, 0.158	D50	2.2	250 cd/m ²
7	Native	Panel	Panel	Panel	D65	2.2	250 cd/m ²


 **NOTE:** The factory DCI-P3 preset has a D65 white point, a 100 cd/m² luminance and a Power 2.4 gamma. This differs from the DCI-P3 configuration typically found in cinema projectors (P3 white point, a 48 cd/m² luminance and a Power 2.6 gamma). This is because consultation with visual effect and animation studios determined that the D65/100/2.4 configuration was better suited to the typical artist work environment than the cinema projector configuration.

To select a color space preset:

1. Press any Function button on the front bezel.
2. Press the **Open Menu** button to open the OSD.
3. Select **Color settings** to display the color space configuration screen.
4. Use the **Up/Down** buttons to navigate to the desired color space, and then press the **Select** button to activate it.

Adjusting luminance


Though each preset is calibrated to a specific luminance level, the luminance can be adjusted post-calibration. The luminance range for all calibrated color space presets can be adjusted from 48–250 cd/m².

 **NOTE:** Due to the way LEDs respond to voltage, the further you adjust luminance away from the calibrated value, the less accurate the luminance value reported by the OSD will be. As you move away from the calibrated value, the colorimetry of the white point will shift. HP recommends that you calibrate the display to the desired working luminance. For more information about calibration, see [Display calibration on page 58](#).

To adjust luminance:

1. Press any Function button on the front bezel.
2. Press the **Open Menu** button to open the OSD.

3. Select **Color settings** to display the color space configuration screen.
4. Use the **Up/Down** buttons to navigate to the **Adjust luminance** option, and then press the **Select** button to activate it.
5. Use the **Increase/Decrease** buttons to adjust the luminance to the desired level.

 **NOTE:** The **Adjust luminance** option displays the current luminance value to the right of the menu option.

Understanding image adjustment options

Several special image adjustment options are designed to fit specific workflows in the media and entertainment industry. The following section describes these functions from the perspective of their application in these workflows.

Video signal adjustments

Downstream RGB adjust

In some cases it may be necessary post-calibration to tweak the setup (black) or gain (white) of one or more of the RGB channels in order to visually match another display or projector. These adjustments are positioned downstream of (i.e., after) the color management processing block in the display hardware. These adjustments provide 10-bit precision.

To adjust setup and gain RGB:

1. Press any Function button on the front bezel.
2. Press the **Open Menu** button to open the OSD.
3. Select **Color settings > Downstream RGB adjust**.
4. Use the adjustment settings to adjust Setup and Gain until you achieve the desired color match with the other display device.

Use video levels (64–960)

This option is designed to support the accurate display of “video legal” signals that include footroom below black and headroom above white. These types of signals are typically encountered when working with video signals that conform to the complete ITU-R BT.709 standard. This standard allows for excursions beyond black and white, rather than treating black and white as absolutes.

These signals are typically encountered in the following situations:

- Viewing the HDMI or HD-SDI output from a video capture and playback card such as an AJA Kona or Blackmagic Design DeckLink
- Viewing an image in the Composer/Edit/Preview window in a non-linear video editing program
- Viewing the output of a consumer Blu-Ray/DVD player

In all of these situations the video signal usually includes the BT.709 headroom and footroom. Without this option enabled when viewed in a display, the blacks and shadows are lighter, the whites are darker, and colors have less saturation than the signal actually contains.

When this option is enabled the blacks will be clipped at the 10-bit value of 64 and the whites at the 10-bit value of 960 (for 8-bit, the clipping will occur at the values of 16 and 235). The signal is then remapped to display the signal in the correct visual range.

If you are unsure whether you are using source material with head and footroom, check the application settings or check with someone who can tell you how the source material was captured or rendered. Note that you may need to adjust the lightness of your editing application interface after enabling this setting.

To use video levels:

1. Press any Function button on the front bezel.
2. Press the **Open Menu** button to open the OSD.
3. Select **Image adjustment** to display the adjustment options screen.
4. Use the **Up/Down** buttons to navigate to the **Video legal (64–960)** option then press the **Select** button to select it. The option will be selected when it is active.

Overscan the frame

By default the display shows all pixels in the image, when screening video dailies or an edit revision it may be desirable to view the image in an overscanned mode, similar to how it is viewed on a consumer digital television. The Overscan Frame option will enlarge the image by 5% so that only that portion of the frame within the Action Safe region is displayed. Action Safe is traditionally defined as an area that begins 5% inside the edge of the frame.

To use the Overscan Frame mode:

1. Press any Function button on the front bezel.
2. Press the **Open Menu** button to open the OSD.
3. Select **Image adjustment** to display the adjustment options screen.
4. Use the **Up/Down** buttons to navigate to the **Overscan frame by 5%** option then press the **Select** button to select it. The option will be selected when it is active.

Show only the blue channel

The human is least-sensitive to changes in blue, most compression and encoding algorithms assign the least amount of bandwidth to the blue channel. Because of this, compression/encoding errors are most-easily seen when viewing the blue channel. The display allows the user to view just the blue channel, temporarily turning the red and green channels off, so that the image can be inspected for these errors.

To view only the blue channel:

1. Press any Function button on the front bezel.
2. Press the **Open Menu** button to open the OSD.
3. Select **Image adjustment** to display the adjustment options screen.
4. Use the **Up/Down** buttons to navigate to the **Blue channel only** option then press the **Select** button to select it. The option will be selected when it is active.

Using the aspect ratio management options

The display includes a number of special aspect ratio management options that go far beyond what is typically found in a display. The following section focuses on how these options are integrated into specific workflows.

The “Fill To” options

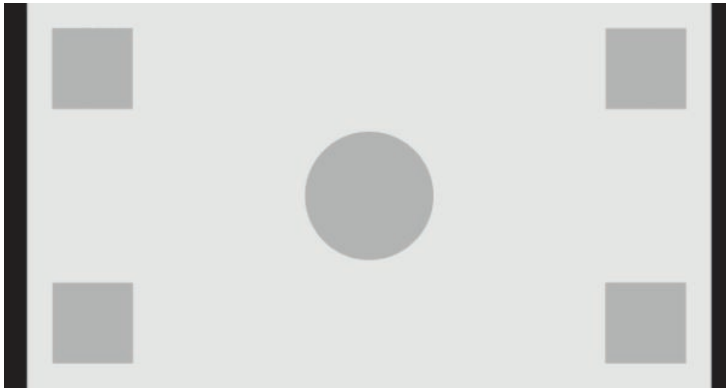
These options determine how the source input is displayed on-screen if its resolution is different from the display’s native resolution of 4096×2160.

Fill to source aspect ratio (proportional)

This option maintains the aspect ratio of the source input, making the image as large as possible, centering it in the display, and using 0% black to fill the unused areas of the screen. For example, a source input that is narrower than 17×9 will be displayed at full height with black bars to the left and right of the source image, and a source input that is wider than 17×9 will be displayed at full width with black bars above and below the source image.

Fill to Source Aspect Ratio is the default and is the option most-suitable to the majority of workflows.

The following illustration shows a the visual result when a 3840×2160 source input is displayed on the display with the Fill to source aspect ratio (proportional) option enabled.

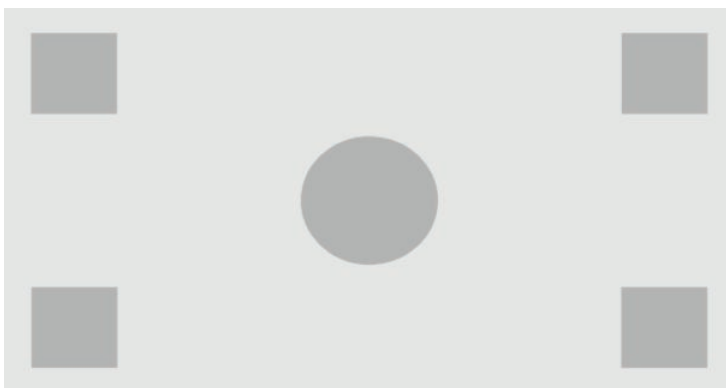


Fill to entire screen (non-proportional)

This option distorts non-17×9 source aspect ratios to force them to fit within the display's 17×9 aspect ratio. The resulting image will take up the entire display and will either be stretched horizontally (for narrower aspect ratios) or vertically (for wider aspect ratios).

Use Fill to Entire Screen if the source aspect ratio is irrelevant and you want the entire screen to be filled, regardless of the distortion that may be caused.

The following illustration shows the visual result when a 3840×2160 source input is displayed on the display with the Fill to entire screen (non-proportional) option enabled. Notice that, as compared to the previous illustration, the circle and squares are stretched horizontally so the image fills the entire 17:9 aspect ratio.



Fill to screen width (proportional)

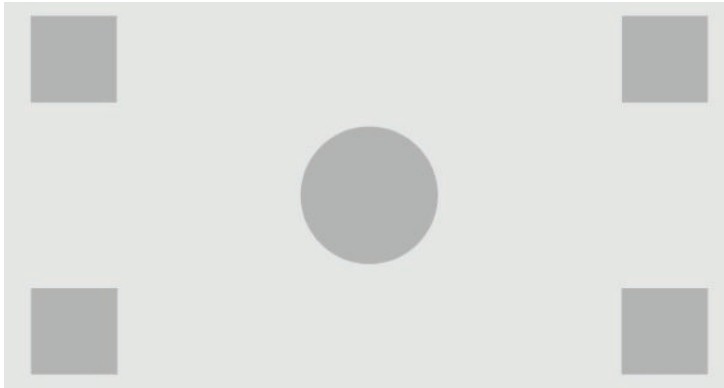
This option is for specific workflows with source video that is narrower than the display's native 17×9 aspect ratio. In some film workflows it is desired to render the animation or visual effects at an Academy or other taller aspect ratio and perform a “center extraction” for widescreen delivery. If enabled, this option will resize the source image so that the width matches the display width. Then the source image is centered vertically

and the top and bottom of the image are cropped off, leaving a 17×9 “center extraction” of the Academy frame. The proportions of the source image are maintained.

TIP: This option is also useful if 17:9 source material has been rendered as letterboxed within a 16:9 aspect ratio source input and you wish to view the original 17:9 image full screen.

The Fill to Screen Width option should be used when vertical center extractions are desired as part of the dailies or review screening process.

The following illustration shows the visual result when a 3840×2160 source input is displayed on the display with the Fill to screen width ratio (proportional) option enabled. Note that, as compared to the previous illustration, the area above and below the outside squares has been cropped out and the image resized to take up the entire 17:9 frame.

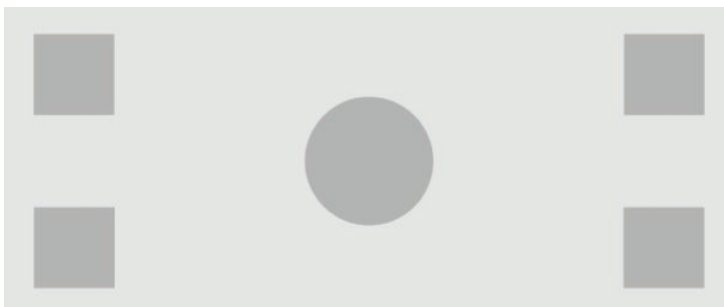


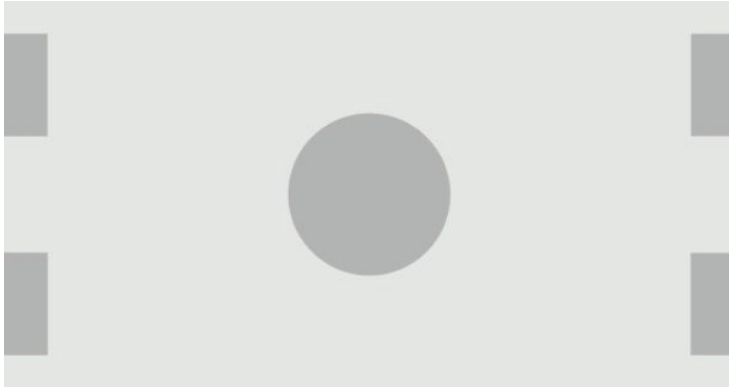
Fill to screen height (proportional)

This option is for specific workflows with source video that is wider than the display’s native 17×9 aspect ratio. In some film workflows it is desired to see a 17×9 horizontal extraction of a wider source aspect ratio. If enabled, this option will resize the source image so that the height matches the display height. Then the source image is centered horizontally and the left and right of the image are cropped off, leaving a 17×9 “center extraction” of the wider frame. The proportions of the source image are maintained.

The Fill to Screen Height option should be used when horizontal center extractions are desired as part of the dailies or review screening process.

The following illustrations show a 4096×1716 source input image and the visual result when that source input is displayed on the display with the Fill to screen height ratio (proportional) option enabled. Notice that the right and left edges of the frame have been cropped out and the image resized to take up the entire 17:9 frame.

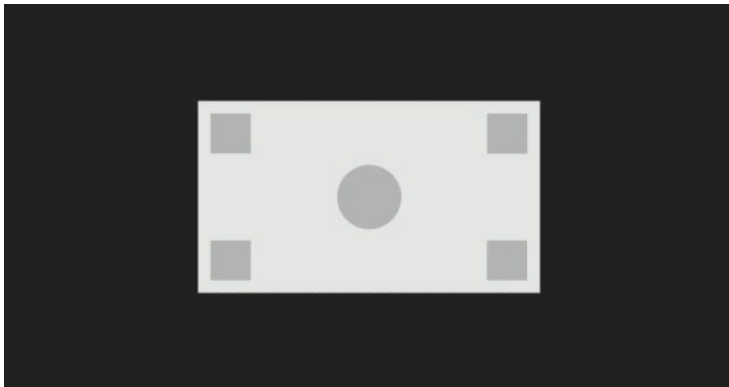




Pixel-for-pixel

This option is for source video that has a lower resolution than the display's native resolution of 4096×2160 and you wish to view the image without any scaling applied. If enabled, this option will display the source input in its native size and fill the remainder of the frame with 0% black.


The following illustration shows the visual result when a 2048×1080 source input is displayed on the display with the Pixel-for-Pixel option enabled.



True 2K pixel mapping

This option is designed to be used if you are working with 2K sources (2048×1080 or 1920×1080) and wish to view them full screen without introducing display scaling artifacts or softening. When enabled, the image will be rescaled using nearest neighbor interpolation, turning one source pixel into four display pixels. The resultant image will exactly represent the pixels in the 2K source signal.

This option is especially helpful if you screen 2K output full screen and be able to make critical assessments of the image.

 **IMPORTANT:** This option is available only with source signals with a resolution of 2048×1080, 1920×1080 or 1280×720 pixels. If using a 1280×720 source signal, each source pixel will be displayed as nine display pixels.

Using the “fill To” options

To change the way the source video is displayed on-screen:

1. Press any Function button on the front bezel.
2. Press the **Open Menu** button to open the OSD.
3. Select **Image adjustment** to display the adjustment options screen.

4. Select **Image scaling** to show the display options.
5. Use the **Up/Down** buttons to navigate to the desired open option then press the **Select** button to select it.



NOTE: The Image scaling menu can be reassigned to a bezel Function button for easy access. Refer to [Changing the bezel function buttons on page 38](#) for instructions on assigning the bezel Function button.

Digital cinema aspect ratio masking

The display supports aspect ratio masking for the two standard aspect ratios, 1.85:1 and 2.39:1, within the DCI image container. When digital cinema masking is enabled, the source signal is masked to only show the pixels within the chosen aspect ratio. The following table lists the active pixels that will be displayed for each image container and aspect ratio.

DCI Container Size	Aspect Ratio	Horizontal Active Pixels	Vertical Active Pixels
4096 × 2160	1.85:1	3996	2160
4096 × 2160	2.39:1	4096	1716
2048 × 1080	1.85:1	1998	1080
2048 × 1080	2.39:1	2048	858

Using the digital cinema aspect ratio masking options

All of the digital cinema display options are located in the OSD on the **Main menu > Image adjustment > Digital Cinema Masking** page. These options are unavailable and the menu option dimmed unless one of the following resolutions is being displayed using the active video input:

- 4096×2160
- 2048×1080

To access the digital cinema masking options:

1. Connect a computer or video device to the display that is configured to output a 4096×2160 or 2048×1080 signal.
2. Press any button on the front bezel.
3. Press the **Open Menu** button to open the OSD.
4. Select **Image adjustment** to display the adjustment options screen.
5. Select **Digital cinema masking** to display the digital cinema options.

The following digital cinema masking options are available.

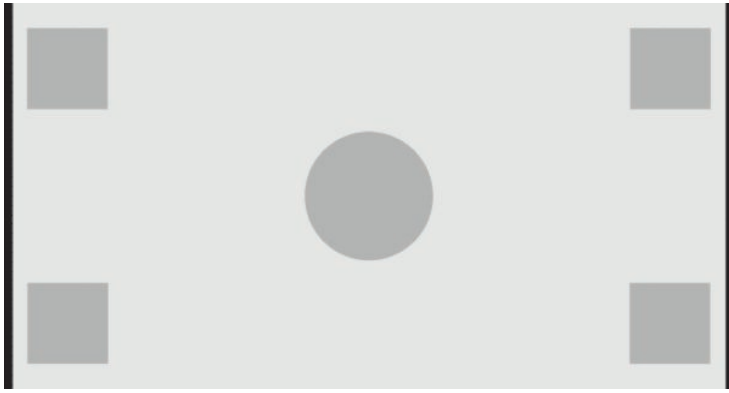
Show entire DCI container

This is the default option and will show the entire 4096×2160 or 2048×1080 frame.

Mask to DCI 1.85:1 aspect ratio

This option masks the left- and right-most 50 pixels of the 4096-wide frame (the left- and right-most 25 pixels for 2048-wide sources). The resultant image is then displayed as specified using the image scaling options described in the previous section.

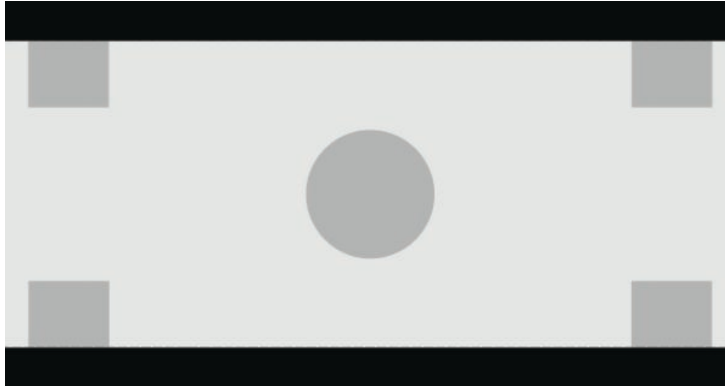
The following illustration shows a DCI source cropped to 1.85:1.



Mask to DCI 2.39:1 aspect ratio

This option masks the top- and bottom-most 222 pixels of the 4096-wide frame (the top- and bottom-most 111 pixels for 2048-wide sources). The resultant image is then displayed as specified using the image scaling options described in the previous section.

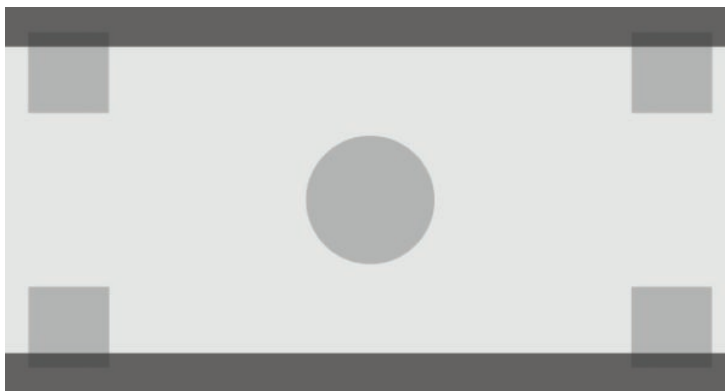
The following illustration shows the a DCI source cropped to 2.39:1.



Show masked region

When this option is enabled, a partially-transparent mask is used instead of an opaque mask. This option is useful, for example to check the topline in a 2.39:1 aspect ratio and see what information may be available, if the headroom needs to be adjusted with reframing.

The following illustration shows the a DCI source cropped to 2.39:1 with the Show masked region option enabled.



Set mask opacity

This option is available when **Show masked region** is active and allows you to specify the amount of opacity applied to the cropped region. Adjust as needed to achieve the desired balance between the active and cropped regions of the frame.

Working with markers

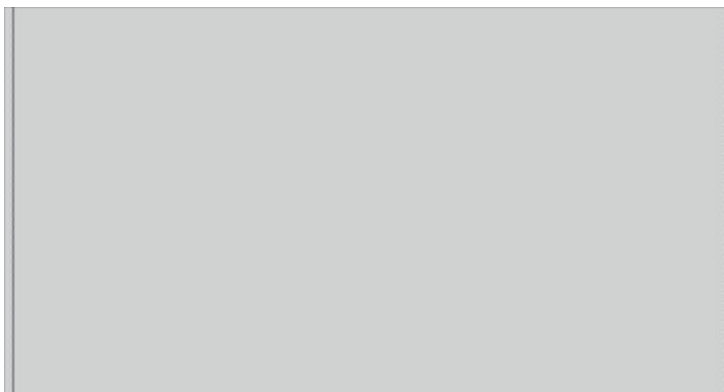
The display includes a full set of marker overlays that can be used to indicate specific areas or regions of the frame. Multiple standard markers are included.

Film aspect ratio markers

Markers are provided for the standard theatrical aspect ratios 1.85:1 and 2.39:1. These markers will place a line at the film aspect ratio edge of both 17:9 (4096×2160 or 2048×1080) and 16:9 (3840×2160, 1920×1080, or 1280×720) source inputs.


In the case of 17:9 source inputs, the lines are positioned at the DCI-defined locations. For 16:9 inputs, the lines are positioned at the mathematical location of these film aspect ratios. This means that a 1.85:1 aspect ratio will use vertical lines for 17:9 source inputs and horizontal lines for 16:9 source inputs.

17:9 source inputs



16:9 source inputs

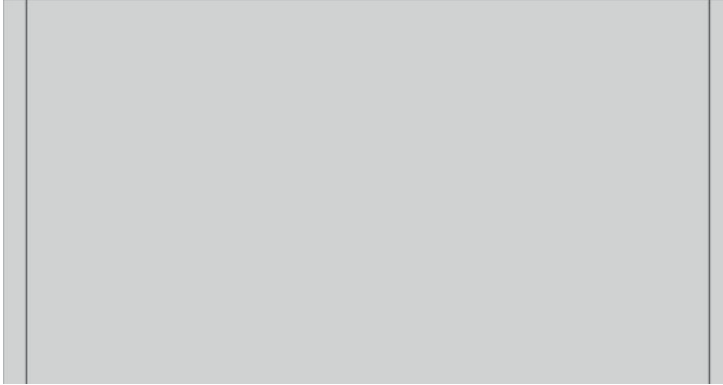


 **NOTE:** Only one film aspect ratio marker can be displayed at once. Therefore, if you have the 1.85:1 aspect ratio marker enabled and you enable the 2.39 aspect ratio marker, the 1.85 aspect ratio marker will be disabled.

16:9 aspect ratio markers

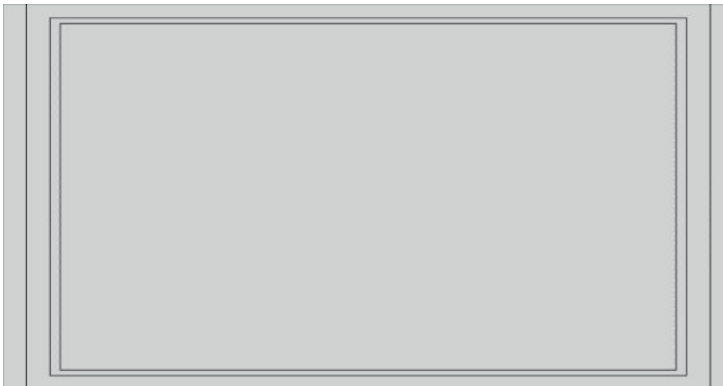
Markers are provided for the 16:9 aspect ratio. These markers support both 17:9 (4096×2160 or 2048×1080) and 16:9 (3840×2160, 1920×1080, or 1280×720) source inputs.

- 16:9 extraction: shows the 16:9 region within the 17:9 frame. This marker is only available when a 17:9 (4096×2160 or 2048×1080) source input is used.



- 16:9 action safe: shows the action safe area within 16:9 as defined by EBU R19, Revision 1. This area is defined as a box 3.5% inward from each edge of the image, or a centered area of 3572×2008 pixels (for 4096×2160 or 3840×2160 source inputs).
- 16:9 title safe: shows the title safe area within 16:9 as defined by EBU R19, Revision 1. This area is defined as a box 5% inward from each edge of the image, or a centered area of 3456×1944 pixels

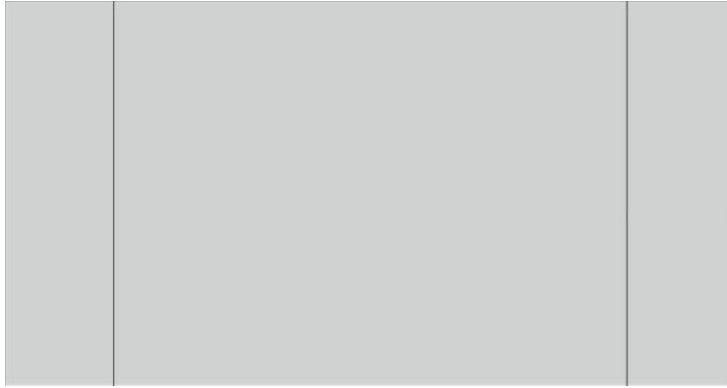
The following illustration shows the 16:9 safe action and safe title markers displayed on-screen.



4:3 aspect ratio markers

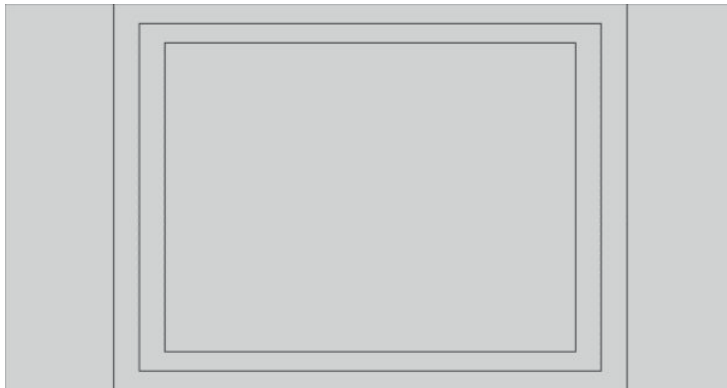
Markers are provided for the 4:3 aspect ratio. These markers support both 17:9 (4096×2160 or 2048×1080) and 16:9 (3840×2160, 1920×1080, or 1280×720) source inputs.

- 4:3 extraction: shows the 4:3 region within the 17:9 or 16:9 frame.



- 4x3 action safe: shows the action safe area within 4x3 as defined by SMPTE RP 218. This area is defined as a box 5% inward from each edge of the image, or a centered area of 2592×1944 pixels (for 4096×2160 or 3840×2160 source inputs).
- 16:9 title safe: shows the title safe area within 16:9 as defined by SMPTE RP 218. This area is defined as a box 10% inward from each edge of the image, or a centered area of 2304×1728 pixels (for 4096×2160 or 3840×2160 source inputs).

The following illustration shows the 16:9 safe action and safe title markers displayed on-screen.

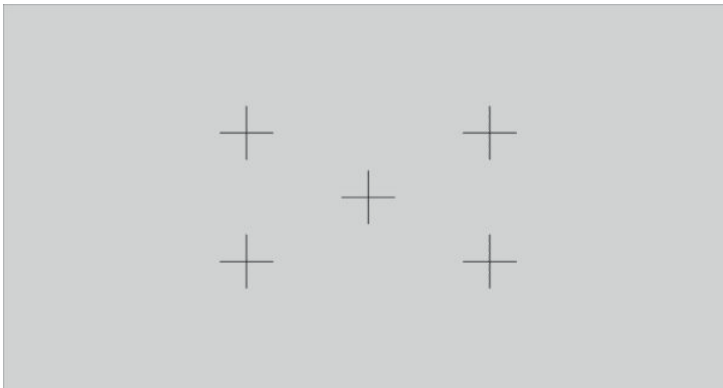


Crosshair markers

Markers are provided to position crosshairs onscreen. These markers support both 17:9 (4096×2160 or 2048×1080) and 16:9 (3840×2160, 1920×1080, or 1280×720) source inputs.

- Center crosshair: provides a crosshair at the center of the screen. The crosshair is 300 pixels wide and 300 pixels high.
- Thirds crosshair: provides four crosshairs, dividing the screen into thirds horizontally and vertically. The crosshairs will be properly positioned for both 17:9 and 16:9 source inputs.

The following illustration shows both the center and thirds crosshair markers for a 17:9 source input.



Marker color

Markers can be defined one of seven different colors:

- White
- Red
- Green
- Blue
- Cyan
- Magenta
- Yellow

Custom markers

The display provides support for the creating of custom markers using XML as part of the StudioCal XML schema. See [Using the StudioCal XML schema on page 72](#) for complete information on the StudioCal XML schema.

Custom markers can include up to 16 lines and each line can have a unique color and line width. (Line widths up to 10 pixels are supported.)

There are four elements associated with custom markers.

Marker element

The StudioCal XML schema allows for the definition of up to ten lines per custom marker. To support this, a marker parent element is used to enclose the information for each marker. This element contains two tags,

an “entries” tag to specify the number of lines in the custom marker and a “product” tag to define the display the markers are designed for.

The “entries” tag supports integer values between 1 and 16. The “product” tag currently supports only one value, “Z31x”.

The element should be structured as follows:

```
<marker_entries="INTEGER, 1-16" product="Z31x">
</marker>
```

Marker info element

The details for each marker line is stored in two elements. Therefore a “marker_info” parent element is used to enclose the details for each marker line. This element does not include any tags.

The element should be structured as follows:

```
<marker_info>
</marker_info>
```

Marker position element

The xy starting and ending positions for each marker line is stored in a single “marker_pos” element. The element contains the following tags:

- **startx:** The line’s x axis starting point. Integer values between 1 and 4096 are supported.
- **endy:** The line’s x axis ending point. Integer values between 1 and 4096 are supported.
- **starty:** The line’s y axis starting point. Integer values between 1 and 2160 are supported.
- **endx:** The line’s y axis ending point. Integer values between 1 and 2160 are supported.

The element should be structured as follows:

```
<marker_pos startx="INTEGER" endx="INTEGER" starty="INTEGER"
endy="INTEGER"/>
```

Marker style element

The width and color for each line is stored in a single “marker_style” element. The element contains the following tags:

- **width:** The line’s width. Integer values between 1 and 10 are supported.
- **color:** The line’s color. The following values are supported:
 - white
 - red
 - green
 - blue
 - cyan
 - magenta
 - yellow


The element should be structured as follows:

```
<marker_style width="INTEGER, 1-10" color="VALUE"/>
```


Custom marker example

The following is an example of a StudioCal XML file showing the usage of the marker tags. The example draws two lines to indicate the 4:3 caption safe area, as defined in EBU R 95.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<studiocal>
  <marker entries="2" product="Z31x">
    <marker_info>
      <marker_pos startx="624" endx="624" starty="0" endy="2160"/>
      <marker_style width="4" color="red"/>
    </marker_info>
    <marker_info>
      <marker_pos startx="3472" endx="3472" starty="0" endy="2160"/>
      <marker_style width="4" color="red"/>
    </marker_info>
  </marker>
</studiocal>
```

 **TIP:** The optical disc included with the display has several pre-built custom markers for you to import into the display or use as a reference to build your own markers.

Using picture-in-picture (PIP) and 2×1 dual split

 **TIP:** To show full-height side-by-side sources, set the display resolution to 2048×2160 in your operating system.

The display supports both PIP, where one source is overlaid over another, and 2×1 dual split, where one source is positioned adjacent to another horizontally. Using 2×1 dual split provides the matrix orientation, two columns by one row.

To use PIP or 2×1 dual split:

1. Connect a secondary input source to the display.
2. Press one of the front bezel buttons to activate the buttons, and then press the **Open Menu** button to open the OSD.
3. In the OSD, select **Split/PIP Control > Enable Split/PIP** and then select either **Picture-in-Picture** or **2×1 dual split**.
4. The display will scan the secondary inputs for a valid input and use that input for the PIP picture. If you want to change the PIP input, select **Assign inputs** in the OSD and select the desired input (**DisplayPort 1**, **DisplayPort 2**, **HDMI 1**, **HDMI 2**, or **USB Type-C**).
5. If you want to change the size of the PIP, select **PIP position and size** in the OSD, and then select either **Maximum**, **Default**, **Minimum**, or **Custom**. At maximum size, the PIP will display pixel-for-pixel all input

formats up to 2048×1080. This is to facilitate using the PIP as a confidence monitor. Please refer to the following section for more information on this usage.

6. If you want to adjust the position of the PIP, select **PIP position and size** in the OSD, and then select either **Top Left**, **Top Right**, **Bottom Left**, **Bottom Right**, or **Custom**.

Adjusting the PIP image

Many of the image adjustments available for the main input are also available for use within the PIP. Refer to [Understanding image adjustment options on page 21](#) and [Digital cinema aspect ratio masking on page 26](#) for further information on these adjustments.

The following adjustments are available within the PIP. None are enabled by default.

Video legal (64–960)

If monitoring a video signal output from a video capture card such as an AJA Kona or Blackmagic Design Decklink, this option should usually be enabled, as video levels are typically used in video post-production workflows.

Overscan to safe action

Use this option if you wish to see how your video output will be displayed on a consumer television. This is especially useful when ensuring that the margins for lower third graphics are correct and nothing will be cut off on a consumer television.

Digital cinema cropping

If you display a 4096×2160 or 2048×1080 input signal as a PIP, you can instruct the display to show either the full DCI container or crop the PIP to either the 1.85:1 or 2.39:1 aspect ratio. If cropping to an aspect ratio, the shape of the PIP will change to the chosen aspect ratio. Black bars will not be visible at the edges of the PIP.

Renaming video inputs

You can rename any of the video inputs. The OSD provides a menu of suggested names, as well as the ability to provide a custom name using a StudioCal XML file.

To rename video inputs:

1. Press any button on the front bezel.
2. Press the **Open Menu** button to open the OSD.
3. Select **Video input > Rename inputs**.
4. Use the **Up/Down** buttons to navigate to the input you want to change, and then press the **Select** button to select it.
5. Use the **Up/Down** buttons to navigate to the desired input, and then press the **Select** button to select it.

Custom video input names

Custom input names can be assigned using XML as part of the StudioCal XML schema. See [Using the StudioCal XML schema on page 72](#) for complete information on the StudioCal XML schema.

Once a custom name has been created for an input it will be available as an option on the Rename inputs menu until a new custom name is assigned or a Factory reset is performed.

There are two elements associated with custom video input names.

Video input element

A unique custom name can be assigned to each video input, allowing you maximum flexibility. To support this, a video input parent element is used to enclose the information for each custom video input name. This element contains one “entries” tag to specify the number of input names in the XML file. The “entries” tag supports integer values between one and five.

The element should be structured as follows:

```
<video_input entries="INTEGER, 1-5">
</video_input>
```

Input info element

The input info element provides contains two tags:

- **input:** The input the custom name will be assigned to. The following values are supported:
 - DisplayPort1
 - DisplayPort2
 - HDMI1
 - HDMI2
 - USB
- **name:** The custom name to be assigned to the input. Names up to 16 characters in length are supported.

The element should be structured as follows:

```
<input_info input="INPUT" name="Custom Name"/>
```

Custom video input name example

The following is an example of a StudioCal XML file showing the usage of the custom video input name elements.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<studiocal>
  <video_input entries="2">
    <input_info input="DisplayPort1" name="HP Z840"/>
    <input_info input="HDMI1" name="AJA Kona"/>
  </video_input>
```

Using the KVM switch

Two USB inputs can be bound to specific video inputs, providing the functionality of a KVM switch. This capability is disabled by default.

The KVM switch function allows you to control two separate computers from the display. For example, one computer may be used as a dedicated workflow device, while the other computer may be used for e-mail, Internet access, and so on.

How to connect computers to the display

Make the following hardware and cable connections from the computers to the display:

1. Connect a keyboard to the dedicated keyboard port on the display. The keyboard port is rotated 90 degrees from the other ports.



NOTE: For more information about the location of the dedicated keyboard port, see [Rear and side components on page 4](#).

2. Connect a mouse and any other USB devices you want to share between the two computers to the any of the other available USB ports on the display.
3. Make a video connection from each computer to the display using video cables (DisplayPort, HDMI, or USB Type-C).
4. Make a data connection from each computer to the display using one USB Type-B to Type-A cable and one USB Type-C to Type-A cable. (If you connected a computer using the USB Type-C connection previously, you will use that same USB Type-C connection for data. No additional connections are required.)



IMPORTANT: When controlling two different computers from the display, make sure the keyboard is connected to the dedicated keyboard port on the display. The keyboard port is rotated 90 degrees from the other ports.

How to bind the USB inputs to the video connections

Use the OSD to configure the display to recognize the computers:

1. Press any button on the front bezel.
2. Press the **Open Menu** button to open the OSD.
3. Select **Video input > USB port binding**.
4. Use the **Up/Down** buttons to navigate to the value you want to assign, and then press the **Select** button.
5. To turn on the KVM: Use the **Up/Down** buttons to navigate to **Bind USB 1 and 2 to specific inputs**, and then press the **Select** button.
6. To set USB 1 (Type-B) or USB 2 (Type-C) bindings:
 - a. Use the **Up/Down** buttons to navigate to the USB-B connection, press the **Select** button, and then choose the appropriate video input to bind to the USB-B connection.
 - b. Use the **Up/Down** buttons to navigate to the USB-C connection, press the **Select** button, and then choose the appropriate video input to bind to the USB-C connection.

To switch between connected computers

- ▲ To switch between connected computers, press the **CTRL + CTRL + Up arrow** key combination on the keyboard connected to the Keyboard port on the display.

On keyboards with LEDs, the Scroll Lock LED will flash after you press the **CTRL + CTRL** key sequence to indicate the switch is in progress.



IMPORTANT: If you are switching between two computers using the KVM switch, HP does not recommend that you connect USB hard drives or flash drives to the USB ports on the display. All display USB ports are switched between the two computers, which means that any data transfer occurring between the computer and the connected USB hard drive or flash drive will be interrupted. In some cases this may cause data loss. Always connect USB hard drives or flash drives directly to the computer if you are using the KVM switch feature.

Customizing bezel buttons

The display provides six buttons on the bezel, the top four of which are customizable function buttons. You can also modify the way the buttons respond to a press as well as the color and display of the LED adjacent to each button.

Changing the bezel function buttons

The four bezel function buttons allow you to quickly access frequently-used menus or commands. A function button can even be made blank to simplify the display interface.

The following menus and commands can be assigned:

- **Color space preset:** Displays the color space preset menu. Use to switch between color space presets. This command is mapped to function button one by default.
- **Adjust luminance:** Allows you to change the display luminance. This command is mapped to function button three by default.
- **Video input select:** Displays a menu of the available video inputs so you can switch to another input, as required. This command is mapped to function button two by default.
- **Next active video input:** Use this command to quickly toggle between active video inputs. An active input is defined as one that is receiving a signal from a computer or other video source.
- **Image scaling:** Opens the Image scaling menu, allowing you to change how an input source is displayed on-screen.
- **Digital cinema region:** Opens a menu allowing you to choose how you want 4096×2160 or 2048×1080 source inputs are displayed. When assigned, this option is grayed out if the source input has a resolution other than 4096×2160 or 2048×1080.
- **Markers:** Opens the Markers menu, allowing you to turn on or off the available markers. This menu applies only to primary source markers and not PIP markers.
- **Video levels (64–960) on / off:** Allows you to quickly switch between full range and reduced range video display. When set to full range this command will be displayed as “Video levels on” and when set to reduced range this command will be displayed as “Video levels off.”
- **Overscan on / off:** Allows you to quickly enable and disable video overscan. When overscan is on, this command will be displayed as “Overscan On” and when overscan is off, this command will be displayed as “Overscan Off.”
- **Blue-only mode on / off:** Allows you to quickly enable and disable blue-only display. When disabled this command will be displayed as “Blue-only on” and when enabled this command will be displayed as “Blue-only off.”
- **Dual split on / off:** Allows you to quickly switch between full-screen and dual split display modes. When in full-screen this command will be displayed as “Dual split on,” and when in dual split this command will be displayed as “Dual split off.”

- **PIP on / off:** Allows you to quickly turn the PIP on and off. When disabled this command will be displayed as “PIP On” and when enabled this command will be displayed as “PIP Off.”
- **Swap primary / secondary:** Use this option to quickly swap the primary and secondary inputs. Use of this option does not require that the PIP be enabled, just that the PIP input be configured. Therefore this option can be used as another method of quickly switching between two inputs.
- **Show display information:** This command will display useful display information including display mode, active color space, display serial number, firmware revision, and backlight hours. This command is mapped to function button four by default.
- **Show color space information:** This command will display useful information about the current color space including the primary coordinates, white point coordinates, and gamma.
- **Test pattern generator:** This command will display a list of built-in test patterns including black, white, medium gray, red, green, and blue.
- **Empty:** This command clears a bezel function key. When selected the label will be blank.

To change the bezel button functions:

1. Press one of the front bezel buttons to display the button labels, and then press the **Open Menu** button to open the OSD.
2. In the OSD, select **Menu and message control > Configure function buttons** and then select one of the available options for the button you want to reconfigure.

Changing the bezel function button mode

By default when any bezel button is pressed a menu appears on the screen to the left of the buttons, indicating the command assigned to each button. When the menu is displayed, you can press the desired button to execute an assigned command. Once you are familiar with the menu configuration you can disable the function button label display and simply press the desired bezel button to execute the desired command. This will only disable the function button label display for the function button commands. Once you have opened the OSD the function labels will display.

To change the bezel function button mode:

1. Press one of the front bezel buttons to display the button labels, and then press the **Open Menu** button to open the OSD. (If you have already switched this mode press on the bottom bezel function button to open the OSD.)
2. In the OSD, select **Menu and message control > Function button mode**, and then select one of the following functions.
 - a. Select **Open button label first** to display the button labels when you press a bezel button.
 - b. Select **Execute command on first press** to instantly execute the assigned command when you press a bezel button.

Adjusting the bezel button LEDs

The bezel button LEDs have an automatic fade-out feature that is active by default. The LEDs will fade after the OSD timeout period. You can change the LED behavior so that they do not fade out and you can also adjust the brightness of the LEDs if the fade-out feature is disabled.

To disable the bezel button fade-out feature:

1. Press one of the front bezel buttons to activate the buttons, and then press the **Open Menu** button to open the OSD.
2. In the OSD, select **Menu and message control > Bezel button auto-fade > Disable (always on)**.

If the bezel button fade-out feature has been disabled (as described above), you can adjust the brightness of the buttons on the front bezel to different levels of ambient lighting.

To change the bezel button brightness:

1. Press one of the front bezel buttons to activate the buttons, and then press the **Open Menu** button to open the OSD.
2. In the OSD, select **Menu and message control > Bezel button brightness**, and then use the adjustment scale to set the buttons to the desired brightness.

You can also change the color of the button LEDs on the front bezel. You can make the button LEDs white or red, or set them to automatically change from white to red when ambient lighting is reduced. Red should be used when operating the display in low-light environments. The white LED color can negatively impact your eye's color sensitivity while red will not.

To change the bezel button color:

1. Press one of the front bezel buttons to activate the buttons, and then press the **Open Menu** button to open the OSD.
2. In the OSD, select **Menu and message control > Bezel button color** and select either **Always white**, **Always red**, or **Switch to red at 70 cd/m²**.

User presets


As the display provides a wide array of features targeted at specific production and post-production workflows, the display provides a means of storing a display configuration and quickly recalling it. User presets allow you to store the configuration of the following display settings.

- Color settings
 - Active color preset
 - Luminance (if changed from the calibrated value)
 - Downstream RGB adjust
- Image adjustment
 - Image scaling
 - Digital cinema masking
 - Markers
 - Video legal
 - Overscan frame
 - Blue channel only
 - Overdrive
 - Deinterlace
 - Cadence detection
- Split/PIP control

- On/off state
- Mode (2×1 dual split or PIP)
- Input assignments
- PIP video options
- PIP digital cinema cropping
- PIP markers
- Menu and message control
 - Configure function buttons

User presets allow you to set up multiple settings for quick and easy recall. For example, if you use your display as a reference display for online finishing, you may have a number of options that you want specifically configured for that use. They may include True 2K pixel mapping, a set of markers for safe action/title plus perhaps a custom marker for bug area hold out and caption safe, and video legal levels on.

A user preset could store all of those settings, so you can easily switch between a standard display configuration and the reference display configuration. Similarly, you could have a separate preset configured for use when working in a cinema aspect ratio for grading, including partially transparent aspect ratio masks and markers. Rather than having to reconfigure the display every time you switch between these different types of jobs, you can store each as a separate user preset.

 **TIP:** You may want to store your preferred default display configuration as a user preset prior to building and storing special workflow user presets.

Creating and saving a user preset

Creating and saving a user preset is easy.


1. Configure the display the way you wish to use for a given workflow scenario. Refer to the list of settings stored by a user preset in the previous section for guidance on which settings are stored.
2. Once you are satisfied with the display configuration, press any of the five buttons on the right side of the front bezel to activate the buttons.
3. Press the **Open Menu** button to open the OSD.
4. Use the **Up/Down** arrows to navigate to **Load/save user preset** and press **Select** to open the submenu.
5. Navigate to the **Save preset** section of the menu and then to the user preset you wish to use to store the display configuration.
6. Press **Select** to save the display configuration as a user preset.

A message will appear to indicate that the user preset has been saved.

Activating a user preset

1. Press any of the five buttons on the right side of the front bezel to activate the buttons.
2. Press the **Open Menu** button to open the OSD.
3. Use the **Up/Down** arrows to navigate to **Load/save user preset** and press **Select** to open the submenu.
4. Navigate to the **Load preset** section of the menu and then to the user preset you wish to load.
5. Press **Select** to load the user preset.

The display will blank for a few seconds while the user preset is loaded. Then a message will appear to indicate that the user preset has been loaded.

 **TIP:** You can map the Load user preset command to one of the function buttons to make it easier to switch between presets. This command displays a menu of the user presets for selection.

Migrating user presets between displays

Once you have configured one or more user presets on a display, you can use StudioCal XML to migrate the user presets from one display to another. This method can also be used to archive a copy of the user preset configuration. See [Using the StudioCal XML schema on page 72](#) for complete information on the StudioCal XML schema.

User presets element

One element is provided to save and load user presets. This element contains one tag, “operation” which supports two values: “save” and “load.” The element should be structured as follows:

```
<user_presets operation="save|load"/>
```

User preset file

When user presets are saved, a file named “Z31x_UserPreset.xml” is written to the attached USB flash drive. This XML file contains all of the user preset information, but is not designed to be human readable or editable. It is strongly recommended that you not modify the values in this file. When the display encounters a StudioCal XML file with a `<user_presets operation="load"/>` element, it looks for the “Z31x_UserPreset.xml” file on the root of the attached USB flash drive. It will then load that file into the display. If the file is not preset an error message will be displayed.

User preset example

The following are examples of StudioCal XML files to save and load user presets.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<studiocal>
  <user_presets operation="save"/>
</studiocal>

<?xml version="1.0" encoding="ISO-8859-1"?>
<studiocal>
  <user_presets operation="load"/>
</studiocal>
```

Automatic input-based presets

While user presets provide the greatest degree of flexibility and control, some display configuration information is automatically stored with each input. If, for example, you always have computer input on DisplayPort 1 and the output from your Blackmagic Design Decklink or AJA Kona card on HDMI 2, the display will automatically store configuration information for each input.

The following settings are automatically stored with each input.

- Color settings

- Active color preset
- Luminance (if changed from the calibrated value)
- Downstream RGB adjust
- Image adjustment
 - Image scaling
 - Digital cinema masking
 - Markers
 - Video legal
 - Overscan frame
 - Blue channel only
 - Overdrive
 - Deinterlace
 - Cadence detection

These automatic input-based presets allow you to toggle back and forth between two inputs and have each one configured specifically as required. This is especially useful when toggling between a computer and a video input, and is primarily designed for this workflow usage.

Navigating the on-screen display menus

Use the On-Screen Display (OSD) to adjust the screen image based on your viewing preferences. To access the OSD, do the following:

1. Press any of the five buttons on the right side of the front bezel to activate the buttons.
2. Press the **Open Menu** button to open the OSD.
3. Use the bezel buttons to navigate, select, and adjust the menu choices. The button labels are variable depending on the menu or sub-menu that is active.



NOTE: OSD menu items that are grayed out are either not supported with the selected video input and settings.

The tables in the following sections list the On-Screen Display (OSD) menu selections and their functional descriptions. Selections that are bolded are the factory default values.

Color settings menu

Level 1	Level 2	Level 3	Level 4
Color settings	<i>Color space preset</i>		
	DCP P3 D65		
	BT.709		
	BT.2020		
	sRGB D65		
	sRGB D50		

Level 1	Level 2	Level 3	Level 4
	Adobe RGB D65		
	Adobe RGB D50		
	Native		
	Low blue light modes	<p><i>Low blue light modes reduce the amount of blue spectral energy emitted by the display. The low blue light modes below use an sRGB gamut and an sRGB gamma. These modes are not color accurate and should not be used for color-critical work.</i></p> <p>Low blue light</p> <p>Night</p> <p>Reading</p> <p>Restore previous color reset</p> <p>Back</p>	
	Adjust luminance	<i>Luminance adjust thermometer</i>	
	Color space preset information	<p>[Current color preset]</p> <p><i>Primaries (u'v' / xy)</i></p> <ul style="list-style-type: none"> • <i>Red: x.xxx x.xxx</i> • <i>Blue: x.xxx x.xxx</i> • <i>Green: x.xxx x.xxx</i> <p><i>White point (u'v' / xy)</i></p> <ul style="list-style-type: none"> • <i>x.xxx x.xxx</i> • <i>Name of white point (ex. D65)</i> <p><i>Gamma (x.x, sRGB, BT.1886)</i></p> <p>Switch coordinate display to xy/ u'v' (allows you to switch the information to display as either CIE 1931 xy or CIE 1976 u'v')</p> <p>Back</p>	
	Reset to last calibration		
	Reset to factory calibration		
	Downstream RGB adjust	<p><i>Red, Green, Blue Setup</i></p> <p><i>Red, Green, Blue Gain</i></p> <p>Reset</p> <p>Back</p>	
	Back		

Video input menu

Level 1	Level 2	Level 3	Level 4
Video input	DisplayPort 1		
	DisplayPort 2		
	HDMI 1		
	HDMI 2		
	USB Type-C		
	Auto-switch source	Enable	
		Disable	
		Back	
	Rename inputs	DisplayPort 1	Workstation 1
		DisplayPort 2	Workstation 2
	HDMI 1	Laptop	
	HDMI 2	Windows system	
	USB Type-C	Linux system	
	Back	macOS system	
		Master	
		Playback	
		Client	
		Custom	
		Reset name to default port name	
		Back	
USB port binding	<i>The two USB inputs can be bound to specific video inputs, providing the functionality of a KVM switch. By default this capability is disabled. How do you want the USB inputs configured?</i>	<i>USB 1 (Type-B) binding</i>	
	USB auto detect	DisplayPort 1	
	Use USB 1 (Type-C) only	DisplayPort 2	
	Use USB 2 (Type-C) only	HDMI 1	
	Bind USB 1 and USB 2 to specific inputs	HDMI 2	
	USB 1 (Type-B) binding	USB Type-C	
	USB 2 (Type-C) binding	Back	
	Back	<i>USB 2 (Type-C) binding</i>	
		DisplayPort 1	
		DisplayPort 2	
		HDMI 1	
		HDMI 2	
		USB Type-C	
		Back	
Back			

Image adjustment menu

Level 1	Level 2	Level 3	Level 4
Image adjustment	Image scaling	Fit to screen aspect ratio (proportional) Fit to screen width (proportional) Fit to screen height (proportional) Fill to 17:9 (non-proportional) Fill to 16:9 (non-proportional) Fill to 1.85:1 (non-proportional) Fill to 2.39:1 (non-proportional) Pixel-for-pixel True 2K pixel mapping Back	
	Digital cinema masking	Show entire DCI container Mask to DCI 1.85:1 aspect ratio Mask to DCI 2.39:1 aspect ratio Show masked region Set masked opacity Back	<i>Opacity adjust thermometer</i>
	Markers	Clear all markers 1.85:1 aspect ratio 2.39:1 aspect ratio 16:9 extraction 16:9 action safe 16:9 title safe 4:3 extraction 4:3 action safe 4:3 tile safe Center crosshair Thirds User (StudioCal)	
		Marker color	<i>Marker color</i> White Red Green

Level 1	Level 2	Level 3	Level 4
			Blue
			Cyan
			Magenta
			Yellow
			Back
		Back	
	Video legal		
	Overscan frame by 5%		
	Show blue channel only		
	Advanced	Overdrive	<i>Overdrive may improve refresh speed and eliminate image smearing, but will cause other features, such as PIP, to be disabled for certain input resolutions.</i>
			Enable
			Disable
			Back
		Deinterlacer	<i>The deinterlacer should be enabled if you are using an interlaced source (such as 1080i). Disable to check for interlace encoding errors in a progressive source.</i>
			Enable
			Disable
			Back
		Cadence detection	<i>The cadence detector will decode film cadences in video rate sources (ex: 2:3 pulldown). Disable to check for cadence errors in the source.</i>
			Enable
			Disable
			Back
	Back		

Split/PIP control menu

Level 1	Level 2	Level 3	Level 4
Split/PIP Control	Enable split/PIP		
	Split/PIP mode		

Level 1	Level 2	Level 3	Level 4
	2×1 dual split		
	Picture-in-picture		
	Assign inputs	<i>Primary (left side)</i>	DisplayPort 1 DisplayPort 2 HDMI 1 HDMI 2 USB Type-C Back
		<i>Secondary (right side)</i>	DisplayPort 1 DisplayPort 2 HDMI 1 HDMI 2 USB Type-C Back
		Swap primary/secondary	
		Back	
	PIP video options	Video legal (64–960) Overscan to safe action Back	
	PIP digital cinema region	Show entire DCI container Crop to DCI 1.85:1 aspect ratio Crop to DCI 2.39:1 aspect ratio Back	
	PIP position and size	<i>Position:</i> Top left Top right Bottom left Bottom right	
		Custom	<i>Use the buttons to fine tune the PIP position. Press back when you are finished.</i>
		<i>Size:</i> Maximum Default Minimum	
		Custom	<i>Use the buttons to fine tune the PIP position.</i>

Level 1	Level 2	Level 3	Level 4
			<i>Press back when you are finished.</i>
		Back	
	Back		

Load/save user preset

Level 1	Level 2	Level 3	Level 4
Load/save user preset	<p><i>User presets are used to load and save the configuration of the color space, image adjustment, and split/PIP control settings.</i></p> <p>Load preset</p> <p>User 1</p> <p>User 2</p> <p>User 3</p> <p>User 4</p> <hr/> <p>Save preset</p> <p>User 1</p> <p>User 2</p> <p>User 3</p> <p>User 4</p> <hr/> <p>Back</p>		

Calibration

Level 1	Level 2	Level 3	Level 4
Calibration	<p>Recalibrate [active preset]</p> <hr/> <p>Configure and calibrate preset</p>	<p>Next</p> <hr/> <p>Back</p>	
	<p>Install StudioCal XML file</p> <hr/> <p>Set calibration schedule</p> <hr/> <p>View calibration schedule</p>	<p><i>The following calibration schedule has been set:</i></p> <p>Frequency: Every [# hours/days/weeks]</p> <p>Calibration time: [Day of week] at [time]</p>	

Level 1	Level 2	Level 3	Level 4
		Cancel calibration schedule	<i>Do you want to cancel the calibration schedule?</i>
			Yes, cancel schedule
			Back
		Back	
	Align internal instrument		
	Export last calibration data		
	Set warm up time	<i>Would you like the display to wake itself up and warm up prior to the start of work?</i>	
		Enable	
		Disable	
		Set time work begins	<i>Please set the time you want the display to be ready for color critical use. The display will power itself on prior to this time to ensure color accuracy when work begins.</i>
			[Time]
			Work days
			Sunday
			Monday
			Tuesday
			Wednesday
			Thursday
			Friday
			Saturday
			Back
		Back	
	Back		

Language menu

Level 1	Level 2	Level 3	Level 4
Language	Deutsch		
	繁體中文		
	簡體中文		
	English		
	Español		
	Français		

Level 1	Level 2	Level 3	Level 4
	Italiano		
	日本語		
	Nederlands		
	Português		

Management menu

Level 1	Level 2	Level 3	Level 4
Management	Auto-sleep mode	<p><i>Do you want the display to go to sleep when there is no active video input? Note: Automated calibration is not possible if the entire display goes to sleep.</i></p> <p>Put the display to sleep</p> <p>Turn off the panel only</p> <p>Back</p>	
	Power on recall	<p><i>Do you want the display to automatically turn back on after an unexpected power failure?</i></p> <p>Enable</p> <p>Disable</p> <p>Back</p>	
	DDC/CI communications	<p><i>Do you want the display to respond to commands issued by the host via DDC/CI?</i></p> <p>Enable</p> <p>Disable</p> <p>Back</p>	
	Auto EDID update	<p><i>Do you want the display to automatically update the EDID when you switch color spaces?</i></p> <p>Enable</p> <p>Disable</p> <p>Back</p>	
	Hot-plug initiate	<p><i>Do you want the display to initiate a Hot-Plug Event when you switch color spaces?</i></p> <p>Enable</p> <p>Disable</p> <p>Back</p>	
	DisplayPort Hot-Plug detection	<p><i>Do you want DisplayPort connections to switch to low</i></p>	

Level 1	Level 2	Level 3	Level 4
		<p><i>power mode when the display sleeps or remain active so the display can respond to communication from the host?</i></p> <p>Low power</p> <p>Always active</p> <p>Back</p>	
	DisplayPort compatibility	<p><i>Not all displays can sync to a DisplayPort 1.2 connection. Do you want DisplayPort input 1 to identify itself as version 1.1 to connected displays?</i></p> <p>DisplayPort 1.2</p> <p>DisplayPort 1.1 compatibility mode</p> <p>Back</p>	
	DisplayPort EDID configuration	<p><i>Depending on your graphics card driver revision, not all display modes may be available to you without switching to a CEA-861 EDID configuration. Do you want to use a Display ID or CEA-861 EDID? Please note that under CEA-861 mode, the default timing will be 3840×2160 due to CEA-861 limitations.</i></p> <p>Display ID (4096×2160 default timing)</p> <p>CEA-861 (3840×2160 default timing)</p> <p>Back</p>	
	USB Type-C configuration	<p><i>How do you want to configure your USB Type-C connection? USB Type-C cannot simultaneously support 4K at a 60Hz refresh rate and USB 3.0.</i></p> <p>4096×2160 60 Hz + USB 2.0 data</p> <p>4096×2160 30 Hz + USB 3.0 data</p> <p>Back</p>	
	USB functionality in sleep	<p><i>How do you want the display USB ports to behave when the display sleeps? If you disable USB hubs during sleep, you will save power, but all devices attached will disconnect from the host when the display sleeps. If you want USB devices to stay connected when the display goes to sleep, enable this option.</i></p> <p>Enable USB ports during sleep</p>	

Level 1	Level 2	Level 3	Level 4
		Disable USB ports during sleep	
		Back	
	Internal processor	<i>Do you want the internal processor to be enabled? The internal processor must be enabled for display calibration, firmware updates, and remote management.</i>	
		Enable	
		Disable	
		Back	
	Date and time settings	[Date]	
		[Time]	
		Set date and time automatically	
		Change date and time	Time widget (xx : XX AM/PM)
			Use 12-hour time
			Use 24-hour time
			Date widget (Month / Day / Year)
			Back
		Set time zone	[Lists all valid time zones]
		Automatically adjust for daylight saving time	
		Back	
	Calibration configuration	Enable calibration	
		Allow use of external instrument	
		Align internal instrument to reference	
		Align instrument position	
		Luminance uniformity	This display features uniformity compensation processing maximum luminance uniformity. This process, however, can reduce the display's contrast ratio. If desired, you can disable uniformity compensation.
			Changing the state (on or off) of uniformity compensation will affect the accuracy of an existing color calibration. For color-critical accuracy, you must recalibrate the display after you change this setting.

Level 1	Level 2	Level 3	Level 4
			Enable luminance uniformity Disable luminance uniformity
		Back	
	Firmware update support	<i>Do you want to allow firmware updates?</i> Enable, via USB or network Enable, via USB only Enable, via network only Disable Back	
	User preset support	<i>Do you want to allow user presets to be saved?</i> Enable Disable Back	
	Remote management services	Enable/disable server	<i>Do you want to enable the internal remote management web server?</i> Enable Disable Back
		IP configuration mode	DHCP Manual IPv4 address: xxx.xxx.xxx.xxx IPv4 subnet mask: xxx.xxx.xxx.xxx IPv4 gateway: xxx.xxx.xxx.xxx MAC address Back
		WS-Management setup	Enable WS-Management Enable WS-identity support Back
		Install client certificate	
		Install server certificate	
		Reset administrator password	

Level 1	Level 2	Level 3	Level 4
		Dashboard security	<p><i>What is required in order to connect to the web dashboard?</i></p> <p>Require password only</p> <p>Require password and client certificate</p> <p>Back</p>
		Back	
	Lock management menu	<p><i>Do you want to lock the Management menu? If locked, it can only be unlocked by holding the second and fourth bezel buttons down for five seconds.</i></p> <p>Lock</p> <p>Unlock</p> <p>Back</p>	
	Factory reset		
	Back		

Menu and message control menu

Level 1	Level 2	Level 3	Level 4
Menu and message control	Menu and message position	Use the buttons to adjust the position of the Menu. Press "Back" when you are finished.	
	Menu and message opacity	<i>Opacity adjust thermometer</i>	
	Menu and message timeout	<i>Timeout adjust thermometer</i>	
	Enable/disable messages	<p>Show info when powering display on</p> <p>Show info when input source changes</p> <p>Show info when color space changes</p> <p>Remind me of the warmup time</p> <p>Notify me when recalibration is due</p> <p>Back</p>	
	Configure function buttons	<p>Function button 1: [Current assignment]</p> <p>Function button 2: [Current assignment]</p>	<p>Color space select</p> <p>Adjust luminance</p> <p>Video input select</p>

Level 1	Level 2	Level 3	Level 4
		Function button 3: [Current assignment]	Switch to next active video input
		Function button 4: [Current assignment]	Aspect ratio display
			Video levels (16–235) On / Off
			Overscan on/off
			Blue-only mode on/off
			Dual split on/off
			Pip on/off
			Swap primary/PIP inputs
			Show display information
			Show color space information
			Load user preset
			Test pattern generator
			Empty (no function)
	Function button mode	Open button label first	
		Execute command on first press	
		Back	
	Bezel button color	Always white	
		Always red	
		Auto-switch to red at 70 cd/m ²	
		Back	
	Bezel button brightness	<i>Brightness adjust thermometer</i>	
	Bezel button auto-fade	Enable (obey menu timeout)	
		Disable (always on)	
		Back	
	Back		

Information

Level 1	Level 2	Level 3	Level 4
Information	<i>Current Input: Current Input</i>		
	<i>Display Mode: Display Mode</i>		
	<i>Color space preset: Color space</i>		
	<i>Luminance: luminance</i>		
	<i>Downstream RGB adjust: On/Off</i>		
	<i>Image scaling: image scaling</i>		

Level 1	Level 2	Level 3	Level 4
	<i>Digital cinema region: digital cinema region</i> <i>Video Legal: On/Off</i> <i>Overscan: On/Off</i> <i>Markers: On/Off</i> <i>Serial Number: serial number</i> <i>Firmware Revision: firmware revision ID</i> <i>Last Calibration: xxxxx hours</i> <i>Backlight Hours: xxxxx hours</i> <i>Internal Processor: On/Off</i> <i>Remote management server: On/Off</i> <i>IPv4 Address: xxx.xxx.xxx.xxx</i>		
	Back		
Factory Reset			

Auto EDID update

By default, the display automatically updates the display EDID when you switch color spaces.

If Auto EDID Update is enabled, the EDID will be updated for all inputs every time you change the active color space preset. If Auto EDID Update is disabled, each input will be set to the factory default values for the Native color space.

You can enable or disable Auto EDID Update in the OSD:

1. Press any of the front bezel buttons on the right side of the front bezel to activate the buttons.
2. Press the **Open Menu** button to open the OSD.
3. In the OSD, select **Management > Auto EDID update** and then select either **Enable** or **Disable**.

3 Display calibration

The display is color critical, so it can be calibrated to meet your production requirements and recalibrated to maintain color accuracy. The display is self-calibrated with all calibration algorithms running internally, so no host-based software is required. The display also includes an integrated XYZ colorimeter, enabling standalone calibration. For those that prefer to use an external instrument, a wide variety of third party measurement instruments are supported. The display's calibration capabilities allow for a large number of different calibration strategies, including on-demand and scheduled automated calibration.

Factory calibration

The display is color calibrated at the factory with seven factory-calibrated color presets designed to provide default configurations for a wide variety of workflows and use cases. All presets can be redefined and calibrated to meet specific requirements. The following table lists the color presets and provides information on their configuration.

Color preset	Red primary (CIE xy)	Green primary (CIE xy)	Blue primary (CIE xy)	White point	Gamma/EOTF	Luminance
DCI-P3 D65	0.680, 0.320	0.265, 0.690	0.150, 0.060	D65	Power 2.4	100 cd/m ²
BT.709	0.640, 0.330	0.300, 0.600	0.150, 0.060	D65	BT.1886	100 cd/m ²
BT.2020	0.708, 0.292	0.170, 0.797	0.131, 0.046	D65	BT.1886	100 cd/m ²
sRGB D65	0.640, 0.330	0.300, 0.600	0.150, 0.060	D65	sRGB	250 cd/m ²
sRGB D50	0.640, 0.330	0.300, 0.600	0.150, 0.060	D65	sRGB	250 cd/m ²
Adobe RGB D65	0.640, 0.330	0.210, 0.710	0.150, 0.060	D65	Power 2.2	250 cd/m ²
Adobe RGB D50	0.640, 0.330	0.210, 0.710	0.150, 0.060	D50	Power 2.2	250 cd/m ²


NOTE: The display ships with a factory default DCI-P3 D65 preset instead of a DCI-P3 Theatrical preset. This means it has a different white point, luminance, and gamma, as compared to Theatrical defaults. This preset definition was made after consultation with major VFX and animation studios determined that this was the more typical configuration used at an artist's desk. However, a DCI-P3 Theatrical preset can be created using calibration commands. In addition, included in StudioCal XML samples on the optical disc provided with the display is a DCI-P3 Theatrical calibration script, which recalibrates the factory DCI-P3 D65 preset as a DCI-P3 Theatrical preset.

Preparing for calibration

User calibration allows you to define a color preset by specifying the calibration targets (primaries, white point, gamma/EOTF, and peak luminance) and then calibrating the preset to the targets. User calibration can be performed many different ways, including selecting options from the on-screen menus or writing a calibration script. We will discuss these methods in detail later in this user guide. For now, let's first establish some fundamentals.

Enabling the internal processor

The display ships with the internal processor disabled. This is done to reduce the display's power consumption to meet the energy consumption requirements for some countries, but calibration cannot be done until the internal processor is turned on.

 **TIP:** To determine if the processor is disabled, look at the Main menu in the OSD. If the Calibration menu is unavailable, the processor is disabled.

To enable the internal processor:

1. Press one of the front bezel buttons to display the button labels, and then press the **Open Menu** button to open the OSD.
2. Select **Management**, and then select **Internal processor**.
3. Select **Enable calibration** to turn the processor on.
4. Press the **Exit** button to close the OSD.

Wait approximately one minute for the processor to fully boot before attempting a calibration.

Enabling calibration and external instruments

By default, calibration is enabled and both internal and external instruments are allowed. This can be changed from the Management menu. If you enabled the internal processor and cannot calibrate, calibration may be disabled on your display.

To enable or disable calibration:

1. Press one of the front bezel buttons to display the button labels, and then press the **Open Menu** button to open the OSD.
2. Select **Management**, and then select **Calibration Configuration**.
3. Select **Enable** to toggle calibration on or off.
4. Press the **Exit** button to close the OSD.

In addition, you can control whether external instruments are allowed for calibration. See [Using external measurement instruments on page 67](#) for more information on external instruments.

To enable or disable the use of external instruments:

1. Press one of the front bezel buttons to display the button labels, and then press the **Open Menu** button to open the OSD.
2. Select **Management**, and then select **Calibration Configuration**.
3. Select **Allow use of external instruments** to toggle external instrument support on or off.
4. Press the **Exit** button to close the OSD.

Calibration environment

The recommended calibration environment varies depending on the instrument you are using for calibration. If you are using the built-in colorimeter or a direct-contact instrument, such as the Klein K10-A or an X-Rite i1Display or i1Pro, HP recommends that you calibrate in dim lighting with no direct light hitting the screen. If you are calibrating using a noncontact instrument, such as a Photo Research spectroradiometer, HP strongly recommends that you calibrate in a completely darkened room or that you use a dark enclosed environment, such as a calibration box.

To calibrate multiple displays, HP recommends that you identify a light-controlled area from which to perform the calibrations. This area should allow for multiple displays to be staged and warmed up prior to calibration. If using an instrument on a fixed tripod, as is common for the Photo Research instruments, HP recommends that you line up one display so that it is properly positioned relative to the instrument, and then mark the table/bench position of the display or use a mounting jig. This allows you to position each display at the proper measurement location.

Calibration frequency

The Advanced IPS panel in the display is quite stable, but the LEDs in all backlights dim gradually over time. As a general rule, you can expect a modern LED panel to dim by approximately 1% of its peak luminance for every 1000 hours of use. Because this display has both blue and red LEDs, the differential dimming of these LEDs can result in a slight color shift. For many uses, though, no color shift is perceived even after 2000 or more hours between calibrations.

As the display has an integrated calibration instrument, you may decide to calibrate more frequently than you might otherwise. The frequency of calibration for your facility should be determined as much by comfort level as anything else. The display can be set to automatically recalibrate on a user-defined schedule, making this recalibration easy to do on a regular basis.

Display warm-up from cold power on

The LEDs used in the display backlight require a period of stabilization before the display is calibrated. HP recommends that the displays be allowed to warm up so that the backlight can stabilize. The display's internal timer is configured to warn you if you attempt to calibrate within 30 minutes of the display being turned on. This warm up time was determined by making timed measurements of the display from cold power on. White point, primaries, and secondaries were measured every minute using a Photo Research PR-740 spectroradiometer. ColorChecker patterns were measured every five minutes, as not all measurements could be completed in one minute with the PR-740.

For your reference, the following table shows the display accuracy, expressed as ΔE_{2000} , at different warm-up times from cold power on.

Warm-up time	White point	Primaries/secondaries	ColorChecker patterns
15 minutes	< 1.5 ΔE_{2000}	< 1.0 ΔE_{2000}	< 1.0 ΔE_{2000}
30 minutes	< 1.0 ΔE_{2000}	< 0.5 ΔE_{2000}	< 0.5 ΔE_{2000}
45 minutes	< 0.5 ΔE_{2000}	< 0.25 ΔE_{2000}	< 0.5 ΔE_{2000}
60 minutes	< 0.25 ΔE_{2000}	< 0.25 ΔE_{2000}	< 0.25 ΔE_{2000}

The display can automatically warm itself up prior to the start of the day to ensure that it is ready for color-critical work the moment the artist sits down at the desk. This option warms the display up for 30 minutes, ensuring that display accuracy will be under 1.0 ΔE_{2000} .

To set the display to automatically warm up:

1. Press one of the front bezel buttons to display the button labels, and then press the **Open Menu** button to open the OSD.
2. Open the **Calibration** menu.
3. Select **Set warm up time**.



IMPORTANT: You must set the internal clock to set a calibration schedule. To set the clock, go to **Management > Time and date settings**.

4. Select **Enable**.
5. Select **Set time work begins**.
6. Set the time and the days of the week to begin display warm up.
7. Press the **Exit** button to close the OSD.

Warm-up mode

To facilitate a bulk calibration workflow where multiple monitors will be calibrated or recalibrated in a single session, the display includes a standalone warm-up mode. This mode allows you to warm up multiple monitors without connecting them to a host computer. The display is warmed up at the luminance specified in the active color preset.

To enable standalone warm-up mode:

1. Connect each display to a power source and ensure that the master power switch on the rear of the display is in the On position. Depending on display configuration, the display may immediately power on when the master power switch is activated.
2. Turn the display on, if necessary, and then off again using the power button on the lower right of the bezel. This first power up boots the internal hardware, while the power off again puts the hardware to sleep.
3. Using the buttons on the lower right bezel, hold the top bezel button down, and then press and release the bottom bezel button. After the bezel lights turn on, release the top bezel button.

The display enters warm-up mode and begins to cycle between full-screen white, red, green, blue, cyan, magenta, and yellow. If an active source device is connected to any of the display inputs, burn-in mode will turn off and be replaced by the source's output. If the source is disconnected, warm-up mode resumes when the source is no longer present.



NOTE: To disable warm-up mode, turn the display on and off using the bezel power button.

Backlight stabilization after luminance change

The display's backlight operates in an "analog-style" DC mode, which means that the voltage to the LEDs changes as the front-of-screen luminance changes. As a result, there is a period of backlight stabilization required when switching from one luminance setting to another. This can impact calibration accuracy. If, for example, the display was warmed up at a 250 cd/m² luminance and a calibration was requested with a luminance of 100 cd/m², the white point calibration could be off by as much as 2.0 ΔE 2000.

The backlight needs time to stabilize at the new luminance level. Measurements performed with the PR-740 spectroradiometer show that the white point accuracy is within 0.002 CIE xy after 10 minutes at the new luminance level and within 0.001 CIE xy after 15 minutes. For best results, HP recommends that you allow the backlight to stabilize at the desired luminance prior to calibration. One way to achieve this is to calibrate to the desired luminance, wait 10 to 15 minutes, then calibrate again at the same luminance. The second calibration will be far more accurate than the first. For this same reason, if switching between presets with dramatically different luminance levels, wait at least 10 minutes before making color critical assessments.

User calibration methods

User calibration is the process of specifying the calibration targets (primaries, white point, gamma/EOTF, and luminance), and then instructing the display to calibrate to those targets. There are three primary methods for user calibration.

- Using an on-screen, menu-driven calibration procedure

This option provides basic calibration choices and is suitable for single-user calibration when standard color space primaries and gammas/EOTFs are desired. An option to recalibrate an existing calibration is also available.

- XML-driven calibration using StudioCal XML

This option provides the greatest calibration flexibility because it allows you to do much more than a standard calibration. StudioCal XML functionality includes the following:

- Custom color preset naming
- Specification of custom color primaries and white point (in CIE xy or CIE u'v')
- Performing a customized validation pass post-calibration
- Overwriting the factory calibration memory store
- Archiving of calibrated LUTs to the USB flash drive

The StudioCal XML schema provides additional functionality beyond calibration. For more information, see [Using the StudioCal XML schema on page 72](#).

- Scheduled automatic recalibration

In addition to the two user-driven methods, the display can be configured to automatically recalibrate on a user-defined schedule.

Menu-driven user calibration

The menu-driven method for user calibration allows you to recalibrate an existing preset or to specify a new configuration for an existing preset. Both are accessed from the Calibration menu.

Recalibration active preset

This option instructs the display to recalibrate the active color preset. The preset is recalibrated using its current calibration targets.

Configure and calibrate preset

Use this option if you wish to define a new calibration preset based on standard gamuts and white points. The menus offer a set of options for each calibration target type.

Color preset

You can select eight presets, all of which are configurable. For example, you can change the Adobe RGB D65 preset into a DCI Cinema preset. The preset will be automatically renamed after calibration to reflect the chosen configuration. The menu lists current names.

Color gamut

This menu provides the following standard gamuts:

- DCI-P3: The industry standard gamut for digital cinema projection
- sRGB/BT.709: The standard gamut for the Internet and for high-definition television
- BT.2020: The target gamut for Ultra HD television. Not all Ultra HD content is mastered in BT.2020
- Adobe RGB: Popular with professional photographers
- BT.601: The standard gamut for Standard Definition television
- Display native gamut: The widest possible gamut, using the native primaries of the display

White point

This menu provides the following standard white points:

- D65: The standard white point for most video productions as well as most computer graphics and design work. It can also be used for film production.
- D50: The standard white point for soft proofing and print production. It is warmer than the D65 white point.
- D55: The traditional white point for film projection. It is the white point of the light output of a film projector's lamp house.
- DCI-P3: The standard white point for a digital cinema projector.

Gamma/EOTF

This menu provides the following options:

- 2.2: A power function 2.2 gamma considered the standard gamma for use in daylight-level environment illumination
- 2.4: A power function 2.4 gamma that was formerly the standard gamma for dim lighting environments. For video work this gamma function has been superseded by the BT.1886 EOTF (electro-optical transfer function)
- 2.6: A power function 2.6 gamma that is the standard gamma for cinema lighting environments with essentially no ambient illumination
- BT.1886: An EOTF that has been defined by the International Telecommunication Union (ITU) as the standard EOTF for professional high-definition video production and finishing
- sRGB: An EOTF based on the power function 2.2 gamma but designed to provide better lower-black representation by transitioning from a curve to a linear function for the lowest grayscale values
- EPD: An EOTF specified in the Society for Information Display Information Display Measurement Standard document with a grayscale function designed for viewing satellite imagery and intended to make dimmer low-contrast objects of interest more easily readable when residing near brighter areas in the image

Luminance

This menu provides the following luminance values as well as the option to select any luminance value between 48 and 250 candelas per square meter (cd/m^2):

- 250 cd/m^2 : The maximum luminance that can be calibrated to in the display
- 100 cd/m^2 : The standard luminance, originally defined by SMPTE, for video online and finishing work
- 120 and 80 cd/m^2 : Two options that provide bracketed values around 100 cd/m^2 , based on the typical environment illumination in VFX studios
- 48 cd/m^2 : The standard front-of-screen illuminance for motion picture presentation, equivalent to 17 fl (footlamberts)

After you have defined the calibration and confirmed the chosen values, calibration begins. The calibration will take approximately 3½ minutes when using the internal instrument. Calibration time may be longer with some external instruments. Do not turn the display off during the calibration process. The preset is given a name based on the calibration targets selected.



NOTE: If an external instrument is connected, you are asked if you want to use the internal or external instrument for calibration measurements. If you choose external, a line-up target is provided on-screen to assist you in positioning the external instrument at the center of the screen.

StudioCal XML calibration

The StudioCal XML calibration method allows you to very precisely specify the calibration targets for a color preset and calibrate up to three calibration presets in a single calibration session. StudioCal XML is an extensible XML schema developed by HP for display calibration and modification. It was first introduced with the HP DreamColor Z27x Studio Display and has been extended to support the additional capabilities of this display. While StudioCal XML files are designed to be compatible between the different HP DreamColor Studio displays, additional commands are available in this display that are not recognized by the Z27x. However, the core calibration schema is designed to be compatible, and in many cases the same XML file can be shared between different DreamColor Studio displays.

Instead of selecting calibration target options from menus, with StudioCal XML you define these targets by using XML objects and tags. The XML code is then saved as a file named StudioCal.xml and is stored on the root of a USB flash drive. Flash drives formatted as FAT, FAT32, and NTFS are supported. See [Using the StudioCal XML schema on page 72](#) to learn how to use the XML schema to write calibration and other types of scripts.

To calibrate using a StudioCal.xml file:

1. Create a file called StudioCal.xml file and copy it to the root (top) directory of a USB flash drive.
2. Insert the USB flash drive into one of the two DreamColor USB ports on the bottom of the display.
3. A message displays asking if you want to use the StudioCal.xml file on the flash drive to calibrate the display.

If a firmware file is also found on the flash drive, the display asks you if you want to use the XML file for calibration or install the firmware update. Select the XML file.

4. If an external instrument is connected, the display asks you if you want to use the internal or external instrument for calibration.

If you select the external instrument, a line-up target is displayed to assist you in positioning the instrument.

Calibration begins and will take approximately 3½ minutes when using the internal instrument. Calibration time may be longer with some external instruments. Do not turn the display off during the calibration process.

Calibration automation


Because the display is designed for color-critical work, it is important that the display remain calibrated, so the display allows you to schedule automated calibration. This calibration can be scheduled at regular intervals based on hours of use, physical weeks, or physical months. You can also specify when this automated calibration takes place, ensuring that it occurs during off-hours and does not interrupt the production process.

Scheduling automated calibrations

Use the Calibration menu to perform calibration scheduling. If you have not set the display's internal clock (**Management > Time and date settings**), the display prompts you to set the clock so that calibrations occur at the correct time.

To schedule automated calibrations:

1. Press any bezel button to display the function button labels.
2. Press the **Open Menu** button to display the main menu.
3. Select **Calibration**.
4. Select **Set calibration schedule**.
You must set the internal clock to set a calibration schedule.
5. Select the amount of time between calibrations, and then select **Next**.
6. Choose the appropriate duration, and then select **Next**.
7. Choose the day of the week to perform the calibration, and then select **Next**.

 **TIP:** Although you can choose any day and time, HP recommends you choose a time when no one is using the display so that production is not interrupted.

8. Set the time of the day to perform the calibration, and then select **Next**.
9. Select **Confirm and Exit**. The clock starts and calibrations run automatically.

Viewing the calibration schedule

Once a calibration schedule has been set, you can check the schedule in **Calibration > View Calibration Schedule**. (If no schedule is set, you will be prompted to set a schedule.) This option also allows you to cancel the calibration schedule.

Using a StudioCal XML file for automation

By default, the calibration process recalibrates the active user preset. If you want a specific preset or presets to be calibrated, you can define them using StudioCal XML and then install the file on the display. This file is then used for calibration automation.

To install a StudioCal XML file:

1. Create a 'StudioCal.xml' file and copy it to the root (top) directory of a USB flash drive.
2. Insert the USB flash drive into one of the DreamColor USB ports on the bottom of the display.
3. Dismiss any calibration or firmware messages that display.
4. Open the **Main Menu**.
5. Select **Calibration**.
6. Select **Install StudioCal XML**.

The display looks for a StudioCal.xml file on the attached USB flash drive.

Once installed, the file will be used for all subsequent automated calibrations.

Accessing automatic calibration validation information

You can request the measurement information from the last automatic calibration, which contains the RGB patterns and the XYZ values measured by the instrument. If a StudioCal XML file was installed and contains validation elements, it also includes the XYZ values measured post-calibration for the validation patterns requested.

To download the data from the last calibration:

1. Insert a USB flash drive into one of the DreamColor USB ports. If the flash drive contains firmware or StudioCal XML files, an on-screen message displays asking if you want to use them. Cancel any menus that display.
2. Open the **Calibration** menu.
3. Select **Export last calibration data**.

The calibration data is written to the inserted USB flash drive.

Aligning the internal colorimeter to an external reference instrument

The built-in XYZ colorimeter was aligned and calibrated at the factory against a Konica Minolta CA-310 instrument. While this alignment may be suitable for your needs, if you are deploying a number of displays, you may want to align the internal colorimeter of those displays to a house reference instrument. Use the Calibration menu for this task. See [Using external measurement instruments on page 67](#) for more information on the supported external instruments.

To align the internal colorimeter to an external reference instrument:

1. Allow the display to warm up for at least 30 minutes.
2. Ensure that the ambient lighting is set at the correct level: dim for a contact instrument and dark for a noncontact instrument.
3. Connect the external instrument to use for alignment. Dismiss any calibration menus that display. If using an X-Rite external instrument, adjust the position of the instrument and cord so they do not interfere with the internal instrument arm's operation.
4. Open the **Calibration** menu.
5. Select **Align internal instrument to reference**.
6. Select **Align instruments**. An alignment target is displayed.
7. Position the external instrument so that it is aligned with the target, and then press the **Start Alignment** button.

The alignment will begin. If an error occurs, the display indicates whether the error occurred with the external or internal instrument. If the error is with the external instrument, check the instrument's configuration and ensure that the ambient lighting is not too bright for the instrument type. If the error is with the internal instrument, you may need to align the internal instrument's position using the provided menu option. This procedure takes about one minute and ensures that the motor start/stop positions are correctly aligned so that the instrument is properly positioned in front of the display.

Automatically warming up the display at start of the day

The Z31x can automatically warm itself up prior to the start of the day to ensure that it is ready for color critical work the moment the artist sits down at their desk. This option warms the display up for 30 minutes, which ensures the display accuracy to be under 1.0 ΔE 2000.

For your reference, the following table shows the display accuracy, expressed as ΔE 2000, at different warm-up times. These warm up times were determined by making timed measurements of the display from cold power on. White point, primaries, and secondaries were measured every minute using a Photo Research PR-740 spectroradiometer. ColorChecker patterns were measured every five minutes, as not all ColorChecker measurements could be completed in one minute with the PR-740.

Warm-up time	White point	Primaries/secondaries	ColorChecker patterns
15 minutes	< 1.5 ΔE 2000	< 1.0 ΔE 2000	< 1.0 ΔE 2000
30 minutes	< 1.0 ΔE 2000	< 0.5 ΔE 2000	< 0.5 ΔE 2000
45 minutes	< 0.5 ΔE 2000	< 0.25 ΔE 2000	< 0.5 ΔE 2000
60 minutes	< 0.25 ΔE 2000	< 0.25 ΔE 2000	< 0.25 ΔE 2000

To set the display to automatically warm up:

1. Open the **Calibration** menu.
2. Choose the **Set warm up time** option and press **Select**.
If the internal clock has not been set, the display will first ask you to set the clock. Enter the correct time and date, set either 12- or 24-hour time, and set the time zone.
3. Choose **Enable** from the menu and press **Select**.
4. Choose **Set time work begins** and press **Select**.
5. Set the time of day that work begins.
6. Set the days of the week that should be considered work days.

The display will only warm itself up on the checked days.

Using external measurement instruments

The display includes a high-precision XYZ colorimeter and also provides native support for many types of measurement instruments, from a low-cost colorimeter to high-end colorimeters and spectroradiometers. These instruments can be used instead of the built-in instrument for calibration. In addition, external instruments can be used to align the internal instrument.

Many of the supported instruments were chosen in consultation with HP's studio partners and represent the instruments they have standardized in their facilities. Some of these instruments require specific configurations or calibrations in order to work properly with the display.

All of these instruments use USB to connect to one of the HP DreamColor USB ports on the display. No host-based software is required for their operation but may be required for instrument configuration and calibration.



IMPORTANT: With all of these instruments it is very important that the measurement instrument be positioned so that it is perpendicular to the face of the display.

Klein Instruments K10 and K10-A colorimeters

These are high-speed, very accurate lightweight devices that support either direct monitor contact or use in a darkened room as a distance unit.

Configuration

Klein K10 and K10-A instruments come from the factory pre calibrated with a display matrix stored as cal file 15. If you have an existing unit, HP strongly recommends that you send your instrument to Klein for recalibration. However, if you are comfortable with building a calibration matrix and have access to a spectroradiometer, you can use the Klein ChromaSurf program to generate your own calibration matrix. HP recommends that you store your custom matrix as cal file 15, which will be loaded by default when the K10-A

is connected to the display. However, using StudioCal.XML you can specify any cal file for use in calibration, allowing you to store a custom matrix in any location.

Usage guidelines

Please note the following tips and guidelines when using the Klein K10-A with the display:

- The display may take up to 10 seconds after instrument connection to display the first calibration menu. This is normal for this instrument because it is USB-powered and must boot up before it can respond.
- Direct contact measurement is recommended using the K-10 SF Lens Hood. This allows you to calibrate the display under typical room lighting (though dimmed lighting is still recommended for best black measurements).

If using distance measurement, HP strongly recommends that you use a completely darkened environment for calibration.

- If necessary, use ChromaSurf to recalibrate the black level prior to calibration. The K10-A should hold its black level calibration for an extended period, but if recalibration is necessary, it is a very quick procedure.

After display calibration, if the display shows the lower grayscale as light gray with little to no shadow definition, then you need to recalibrate the K10-A's black level and recalibrate the display.

Photo Research spectroradiometers

The display supports the majority of Photo Research spectroradiometers, including the following:

- PR-655 SpectraScan
- PR-670 SpectraScan
- PR-680 / PR-680L SpectraDuo
- PR-730 SpectraScan
- PR-740 SpectraScan

The Photo Research instrument must have the USB interface. This is optional on some models but is required for connection to the display. If multiple interfaces are supported by the instrument, the USB communication method must be enabled and active.

Configuration

These instruments contain a wide number of configuration options, all of which can be set using the touchscreen LCD interface on the back of the instrument. The following table lists the recommended configuration for each display.

	PR 655	PR 670	PR 680	PR 680L	PR 730	PR 740
Minimum firmware version	3.12	3.14	3.14	3.14	3.10	3.14-74X
Bandwidth	8 nm	—	—	—	2 nm	2 nm
Aperture	—	1 deg	1 deg	1 deg	1 deg	0.5 deg
Adaptive	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled
Sensitivity	—	Extended	Extended	Extended	Extended	Extended
Speed	—	Normal	Normal	Normal	Normal	Normal

	PR 655	PR 670	PR 680	PR 680L	PR 730	PR 740
Sync	Auto	Auto	Auto	Auto	Auto	Auto
Smart black	—	Disabled	Disabled	Disabled	Disabled	Disabled
Sensor mode	—	—	—	Spectro	—	—

Usage guidelines

Please note the following tips and guidelines when using a Photo Research spectroradiometer with the display:

- The display may take up to five seconds after instrument connection to display the first calibration menu. This is normal for this instrument.
- As this instrument is typically used for noncontact measurements, typically at a distance of one or more feet, it is critically important that all measurements be made in a completely darkened environment.
- Contact measurements can be made using one of the flexible probe options, but care must be taken to properly mount the probe so that it is perpendicular to the display surface.
- For best results, be sure to follow the recommended instrument recalibration schedule.

Konica Minolta CA-310 colorimeter

The Konica Minolta CA-310 is high-speed colorimeter. Designed for both independent measurement and to be driven externally, the instrument comes in two parts: the main body, containing the core logic hardware, and a lightweight measurement probe. The instrument should be connected to the monitor using a USB A to USB B cable.

Configuration

The instrument must be set to xyLv measurement mode. Most critically, as this device is a colorimeter, a user calibration (both white point and matrix) must be performed prior to any display measurements being made. The user calibration can be stored in any memory channel, but that channel must be selected prior to connecting the instrument to the display.

Usage guidelines

Please note the following tips and guidelines when using the Konica Minolta CA-310 with the display:

- The display may take up to ten seconds after instrument connection to display the first calibration menu. This is normal for this instrument.
- Black level (zero) calibration must be performed each time after the instrument is powered on. If calibrating multiple displays, Konica Minolta recommends that zero calibration be performed every hour, especially if calibrating to a low luminance target, such as 48 cd/m².
- Confirm that the instrument has been properly calibrated and the memory channel you calibrated is active.
- Direct contact measurement is recommended using the standard hood. This allows you to calibrate the display under typical room lighting (though dimmed lighting is still recommended for best black measurements).

If using noncontact measurement, the instrument distance can be no more than 30 mm from the display surface. It is also strongly recommended that you use a completely darkened environment for noncontact measurement.

X-Rite i1Pro 2 spectrophotometers

The X-Rite i1Basic Pro 2, i1Photo Pro 2, and i1Publish Pro 2 are low-cost spectrophotometers. If purchasing new for use with the display, HP recommends that you purchase the i1Basic Pro 2, as the i1Photo Pro 2 and i1Publish Pro 2 contain additional software and equipment that are not required for display calibration.

As with the X-Rite i1Display colorimeter, the instrument comes with associated software on an optical disc. HP recommends that you install the software, as it is required to calibrate the instrument before use with the display.

Configuration

The i1Pro 2 should be calibrated prior to use using the X-Rite software. Consult the product user guide for more information.


Usage guidelines

Please note the following tips and guidelines when using the X-Rite i1 Pro 2 with the display:

- The display may take up to 15 seconds after instrument connection to display the first calibration menu. This is normal for this instrument.
- This instrument should be mounted in the included display holder when used with the display. Adjust the counterweight so that the instrument is in contact with the display panel.

X-Rite i1Display Pro colorimeter

X-Rite's i1DisplayPro is a low-cost measurement instrument that is available at retail. While the instrument comes with profiling software on an optical disc, the software does not need to be installed in order to calibrate the display since the i1Display instrument is connected directly to the display.

 **IMPORTANT:** HP strongly recommends against the use of the included X-Rite software with the display, as it will perform a host-based profile of the display and not a full display calibration.

Configuration

No configuration is required for the i1Display Pro instrument. The display will automatically load the required calibration matrix (EDR file) into the instrument when it is connected.

Usage guidelines

Please note the following tips and guidelines when using the X-Rite i1Display Pro with the display:

- The display may take up to five seconds after instrument connection to display the first calibration menu. This is normal for this instrument.
- This instrument should be used in direct connection mode with the counterweight adjusted to maintain the instrument position during calibration.
- HP recommends that calibration be conducted in a dimly lit environment.
- The ambient light filter must be rotated away from the instrument lens prior to measurements being made. If it is left in place, measurement errors will occur.
- The i1Display Pro has an error tolerance for factory calibration of each instrument. Visible calibration differences can occur if a different probe is used for each display. HP strongly recommends that a single i1Display Pro kit be used to calibrate all displays within a facility or workflow.

Colorimetry Research CR-250 spectroradiometer

The Colorimetry Research CR-250 is a low-cost spectroradiometer than can be used as either a contact instrument with the optional rubber hood or as a distance measurement device using an optional viewing system.

Configuration

No configuration is required for the CR-250 instrument.


Usage guidelines

Please note the following tips and guidelines when using the Colorimetry Research CR-250 with the display:

- The display may take up to 15 seconds after instrument connection to display the first calibration menu. This is normal for this instrument.
- If used as a contact instrument, HP recommends calibration in a dim lighting environment.
- If used as a noncontact instrument, HP strongly recommends calibration in a dark environment.


4 Using the StudioCal XML schema

StudioCal XML is an HP-designed XML schema that provides detailed control over the display calibration process. It contains elements and tags that allow you to specify calibration targets for up to three calibration presets, provide custom preset names, and define validation patterns to be measured. It also is used to upload and download calibration LUTs, install custom input names, markers, and user presets, and upload and download the entire display configuration.

 **TIP:** A collection of StudioCal XML files is provided on the optical disc included with the display. They can also be downloaded from www.hp.com. These files can be used directly on the display or as learning tools.

File name and disk format

When a USB drive is inserted into one of the DreamColor USB ports, the display looks for a file named StudioCal.xml, which it uses for calibration.

 **IMPORTANT:** The display does not look for any other XML files, so the naming must be exact. The file name is not case-sensitive.

USB drives containing a StudioCal.xml file may be formatted using FAT16, FAT32, or NTFS.

Declaration

The standard XML declaration statement must be on the first line of the file. All standard encodings are supported, including UTF-8, UTF-16, ISO-8859-1, and so on. It should be structured as follows:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
```

Comments

XML comments are supported and useful to indicate the procedures performed by the XML file. For example, a StudioCal XML file that calibrates the BT.709 color space preset might include the following comment line:

```
<!--BT.709 calibration-->
```

Comments can be placed anywhere within the XML file.

Root element

All StudioCal commands must be enclosed in a <studiocal> root element. The final command in the XML file must be a closing tag for the root element. Therefore, the highest level of a StudioCal XML file is structured as follows:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<studiocal>
</studiocal>
```

Calibration element

The StudioCal XML schema allows for up to three separate calibration presets to be specified. To support this, a calibration element is used to enclose the configuration information for each preset. This element also contains an entries tag that is used to specify the number of presets to be calibrated by the XML file. This tag supports integer values of one, two, or three.

Structure the element as follows:

```
<calibration entries="INTEGER, 1-3">  
</calibration>
```

Calibration info element

The calibration info element is nested within the calibration element and is used to provide the core calibration tags for each preset to be calibrated.

Structure the element as follows:

```
<calibration_info>  
</calibration_info>
```

Core calibration tags

There are three core calibration tags that are contained within a calibration info element. These must be present in any StudioCal XML file used for calibration. However, if the StudioCal XML file is not being used for calibration—for example, if it is being used only to upload a set of LUTs—these commands should not be included.

Preset

This tag is used to specify the color space preset number, preset name, and the type of memory store used to hold the calibration data. The tag and attributes are structured as follows:

```
<preset num="INTEGER" name="ALPHA" store="user|factory"/>
```

num: Specifies the preset memory location. The display has eight preset memory locations, numbered 0 through 7. These presets are presented in the on-screen menus in numerical order from top to bottom. The following table lists the default color space preset names and their preset number.

Preset factory default name	Preset number
DCI-P3 D65	0
BT.709	1
BT.2020	2
sRGB D65	3
sRGB D60	4
Adobe RGB D65	5
Adobe RGB D50	6
Native	7

Only preset numbers 0 through 7 are supported. Any other number will generate a syntax error. HP strongly recommends that the Native preset (preset num 7) be left as native.

name: Specifies the name that is assigned to the preset. This name appears in the on-screen menus. Names can be up to 14 characters in length and may consist of alphanumeric (A–Za–z0–9) characters, a period (.) and a space. All other ASCII characters are converted to periods.

store: Specifies the memory store that will be used and accepts the values “user” or “factory”.

- The factory store is a protected memory location where the factory calibration is stored. When a calibration is written to the factory memory location, the user memory location is also rewritten to match the factory memory location. This location can only be rewritten using StudioCal XML. This option is provided to allow you to store a calibration that can easily be recalled using the “Reset to Factory Calibration” or “Factory Reset” command.
- The user store is the memory location where all menu-driven calibrations are stored. This memory location is not protected and is rewritten when any type of calibration is performed or when a “Factory Calibration” or “Factory Reset” command is issued.



IMPORTANT: Overwriting the factory memory location means that you can no longer restore to the display's original calibration. You will not be able to restore the original calibration if you have a measurement instrument problem. HP recommends that you confirm that the instrument is properly functioning before using the factory memory location.

Target primaries

This primary calibration tag allows you to specify the target color primaries (red, green, blue) and white point, plus the luminance in cd/m^2 using CIE xy or CIE u'v'. Two additional attributes are also supported, as noted below. Unless otherwise noted, all attributes are required. The tag and attributes are structured as follows:

```
<target_primaries rx="FLOAT" ry="FLOAT" gx="FLOAT" gy="FLOAT" bx="FLOAT"
by="FLOAT" wx="FLOAT" wy="FLOAT" wY="INTEGER" use_uv="xy|uv"
external="TRUE|FALSE"/>
```

rx: The CIE x or u' value for the red primary. Supports floating point values from 0.0 to 1.0. Values that position the color primary outside of the CIE locus will generate a calibration error.

ry: The CIE y or v' value for the red primary. Supports floating point values from 0.0 to 1.0. Values that position the color primary outside of the CIE locus will generate a calibration error.

gx: The CIE x or u' value for the green primary. Supports floating point values from 0.0 to 1.0. Values that position the color primary outside of the CIE locus will generate a calibration error.

gy: The CIE y or v' value for the green primary. Supports floating point values from 0.0 to 1.0. Values that position the color primary outside of the CIE locus will generate a calibration error.

bx: The CIE x or u' value for the blue primary. Supports floating point values from 0.0 to 1.0. Values that position the color primary outside of the CIE locus will generate a calibration error.

by: The CIE y or v' value for the blue primary. Supports floating point values from 0.0 to 1.0. Values that position the color primary outside of the CIE locus will generate a calibration error.

wx: The CIE x or u' value for the white point primary. Supports floating point values from 0.0 to 1.0. Values that position the color primary outside of the CIE locus will generate a calibration error.

wv: The CIE y or v' value for the white point primary. Supports floating point values from 0.0 to 1.0. Values that position the color primary outside of the CIE locus will generate a calibration error.

wY: The target luminance, specified in candelas per square meter (cd/m^2). Values from 48–250 cd/m^2 are supported.

use_uv: (optional) Specifies whether CIE xy or CIE u'v' values are provided for the primaries and white point. This attribute accepts the values “xy” or “uv”. If this optional attribute is omitted from the tag, xy values are assumed.

external: This attribute is used in conjunction with the “external_primaries” tag to allow the use of nonsupported measurement instruments. Used as a flag, this attribute supports values of “TRUE” and “FALSE”. It should be set to FALSE unless an external_primaries tag is also included in the StudioCal XML file. Use of this tag is discussed later in this user guide.

Gamma

This tag allows you to specify the gamma or EOTF to use for your color space preset. The tag contains one attribute and is structured as follows:

```
<gamma value="FLOAT|sRGB|BT1886|EPD"/>
```

The value attribute supports the following values:

1.0–3.0: Power function gamma values. Typical values are 2.2, 2.4, and 2.6.

sRGB: Generates an sRGB EOTF per the sRGB standard. This EOTF curve is roughly equivalent to a 2.2 gamma with a linear segment in the lower region.

BT1886: Generates an ITU-R BT.1886 EOTF. This EOTF is designed to more closely represent the desired response for video production and is typically used with the BT.709 and BT.2020 color primaries.

EPD: Generates an Equal Probability of Detection EOTF, as specified in the Society for Information Display Information Display Measurement Standard document. This grayscale function is designed for use when viewing satellite imagery and is intended to make dimmer low-contrast objects of interest more easily readable when residing near brighter areas in the image.

Core calibration tag examples

The following are examples of a StudioCal XML file showing the usage of the core calibration tags. The first example instructs the display to calibrate one preset with BT.709 primaries, a D65 white point, and a BT.1886 gamma. It stores the calibration in the user memory location.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!--BT.709/BT.1886 calibration-->
<studiocal>
  <calibration entries="1">
    <calibration_info>
      <preset num="3" name="BT.709" store="user"/>
      <gamma value="bt1886"/>
      <target_primaries rx="0.640" ry="0.330" gx="0.300" gy="0.600"
        bx="0.150" by="0.060" wx="0.3127" wy="0.329" wY="80"
        external="FALSE"/>
    </calibration_info>
  </calibration>
</studiocal>
```

This second example instructs the display to calibrate two presets, the first with BT.709 primaries, a D65 white point, and a BT.1886 gamma. The second will be calibrated with DCI-P3 primaries, a P3 white point, and a 2.6 gamma. It stores both calibrations in the factory memory location.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!--BT.709/BT.1886 calibration-->
<studiocal>
  <calibration entries="2">
    <calibration_info>
      <preset num="3" name="BT.709" store="factory"/>
      <gamma value="bt1886"/>
      <target primaries rx="0.640" ry="0.330" gx="0.300" gy="0.600"
        bx="0.150" by="0.060" wx="0.3127" wy="0.329" wY="80"
        external="FALSE"/>
    </calibration_info>
    <calibration_info>
      <preset num="5" name="DCI P3" store="factory"/>
      <gamma value="2.6"/>
      <target primaries rx="0.680" ry="0.320" gx="0.265" gy="0.690"
        bx="0.150" by="0.060" wx="0.314" wy="0.351" wY="48"
        use_uv="false" external="false"/>
    </calibration_info>
  </calibration>
</studiocal>
```

ICC profile generation

In some workflows, an ICC profile of the calibrated preset is required. This profile can be generated by using a `save_icc` tag. This tag instructs the display to calculate an ICC profile for the calibrated preset and write it to the USB flash drive containing the StudioCal XML file. Calculating an ICC profile requires that additional measurements be made post-calibration, so calibrations using a spectroradiometer may take significantly longer.

This tag contains one attribute and is structured as follows:

```
<save_icc value="TRUE|FALSE"/>
```

If value is set to TRUE, extended measurements of the lower grayscale are performed. If set to FALSE, the tag is ignored.

This tag must be placed inside the `<calibration_info>` element, along with the core calibration tags. This tag also requires that the `<validation>` tag be included in the XML file and be set to TRUE. See [Validation on page 78](#) for information on the `<validation>` tag.

Generated ICC profiles are named using the convention PRESETNUM-PRESETNAME.ICC. Therefore, a calibration preset with the preset tag `<preset num="3" name="BT.709" store="factory"/>`, is named 3-BT.

709.ICC. Refer to your operating system and/or application documentation for information on where to store these ICC profiles on your computer and activate them.

Optional calibration tags

The following optional tags can be added to the core calibration tags to provide additional capabilities. These optional tags must be placed before the <calibration> element; they cannot be nested inside it. None of these tags are required to be in a StudioCal XML file.

Measurement averaging

This tag allows you to make and average multiple measurements. If you are using a colorimeter for calibration measurements, you may want to make multiple measurements of lower grayscale levels to compensate for the noise inherent in some colorimeters.



NOTE: As spectroradiometers have less low-grayscale noise, this option is not typically used when measuring with those instruments.

The tag contains two attributes and is structured as follows:

```
<average_meas N="INTEGER" use_below_RGB="INTEGER"/>
```

N: The number of measurements to be taken and averaged. Integer values between 2 and 10 are supported.

use_below_RGB: The RGB grayscale value below which you wish to make and average multiple measurements. A single 8-bit value between 1 and 255 is supported.

Set linear segment

This tag allows you to specify a grayscale value at which the gamma will switch from the calculated curve to a pure linear transition to zero. This is designed to allow you to mimic the measured performance of some projectors.

The tag contains one attribute and is structured as follows:

```
<set_linear_section value="INTEGER"/>
```

The value attribute supports 10-bit values between 1 and 1024.

Select Klein cal file

This tag is specific to the Klein K10 and K10-A and allows you to specify any cal file stored in the instrument as the matrix used for measurements. The default cal file for the Z31x is 15 and that is the one calibrated at Klein Instruments, but you may desire to generate your own matrix using ChromaSurf.

This tag contains one attribute and is structured as follows:

```
<klein_cal value="INTEGER"/>
```

The value attribute supports integer values from 0–89.

Contrast ratio limiting

In some workflows—on-screen newsprint, for example—it is desirable to have a contrast ratio lower than the display's native contrast ratio. The display provides a tag for this workflow. The tag has one argument and is structured as follows:

```
<cr_set cr="150"/>
```

cr: Specifies the desired contrast ratio.

When this tag is in the XML file, a 0 black level will be calculated using the the cr and wY values. The result is a calibration with a lower contrast ratio on-screen and a higher black level than would normally be the case. This tag must be placed before the <calibration> element.

Validation

After calibration, the display can be instructed to measure a set of patterns and record the measurements in a text file on the flash drive that contains the StudioCal.xml file.

Validation on/off

This tag allows you to specify whether validation will be performed post-calibration. It is an optional tag and is required only if you want validation to be enabled. It supports an Off state so that you can quickly switch the attribute without removing all validation tags from the StudioCal XML file.

The tag contains one attribute and is structured as follows:

```
<validate_flag value="TRUE|FALSE"/>
```

If the value is set to FALSE all other validation tags in the XML flag are ignored. However, two different behaviors can occur if the value is set to TRUE:

- If the other validation tags are present, the display will read those tags to determine the patterns to be measured.
- If the other validation tags are not present, then the X-Rite ColorChecker patterns are displayed and measured.

Validation pattern parent element

This parent element holds the child elements that will provide the RGB triplets of the patterns to be displayed. It also contains an attribute which allows you to specify the number of patterns that will be measured. Note that as a parent element, a closing tag must be used after the list of child elements.

The tag contains one attribute and is structured as follows:

```
<validation_pattern entries="INTEGER"/>
```

The entries attribute supports values between 1 and 10.

Validation pattern child element

The child element defines the RGB values that will be displayed for each pattern. It contains three elements and is structured as follows:

```
<valid_rgb r="INTEGER" g="INTEGER" b="INTEGER"/>
```

All three attributes accept 8-bit values from 0 to 255.

Validation code example

The following is the XML file shown earlier, this time with the validation tags added. It will display the 100% white, black, red, green, and blue.

```
<?xml version="1.0" encoding="ISO-8859-1"?>  
<!--BT.709/BT.1886 calibration-->
```



```

<studiocal>
  <validate_flag value="TRUE"/>
  <validation_pattern entries="8">
    <valid_rgb r="255" g="255" b="255"/>
    <valid_rgb r="0" g="0" b="0"/>
    <valid_rgb r="255" g="0" b="0"/>
    <valid_rgb r="0" g="255" b="0"/>
    <valid_rgb r="0" g="0" b="255"/>
    <valid_rgb r="0" g="255" b="255"/>
    <valid_rgb r="255" g="0" b="255"/>
    <valid_rgb r="255" g="255" b="0"/>
  </validation_pattern>
  <calibration entries="1">
    <calibration_info>
      <preset num="3" name="BT.709" store="user"/>
      <gamma value="bt1886"/>
      <target primaries rx="0.640" ry="0.330" gx="0.300" gy="0.600"
        bx="0.150" by="0.060" wx="0.3127" wy="0.329" wY="80"
        external="FALSE"/>
    </calibration_info>
  </calibration>
</studiocal>

```

Validation results file

When validation is enabled, a text file is created containing all measurements made during calibration. The filename includes the display serial number and a unique three-digit number. The file is broken into multiple parts, with header lines prefixed with # for each section. Unless otherwise noted, if the section contains measurements the RGB triplets (in 8-bit RGB) and the measurement data (in CIE XYZ) for each pattern is listed.

The following file sections are included:

- **#Calibration Equipment:** List of measurement instruments used for the calibration.
- **#MEAS_NUM:** The number of measurements made when characterizing the display.
- **#MEAS_DATA:** The measurements taken to characterize the display.
- **#PRESET NAME:** The name assigned to the preset.
- **#VALID RGB or #Color Checker:** Defines whether user-supplied patterns or X-Rite Color Checker patterns were used for validation. Following this header are the RGB triplet and post-calibration measurement data for each pattern.

- **#Primary Colors:** Post-calibration measurements of 100% saturation primaries.
- **#Secondary Colors:** Post-calibration measurements of 100% saturation secondaries.
- **#Target Primaries:** The CIE xy values for the desired primaries and white point, and the white point luminance in cd/m².
- **#Calibrated Primaries:** The CIE xy measurements for calibrated primaries and white point, and the white point luminance in cd/m².
- **#Calibrated Secondaries:** The CIE xy measurements for the calibrated secondaries.

LUT archiving, downloading and uploading

StudioCal XML provides three different tags that allow you to save the LUTs to a USB drive or to upload to the display from a USB drive.

Archive LUT

Designed to be used with a calibration, the archive LUT tag instructs the display to download the calibrated LUTs and matrix to the USB flash drive containing the `studiocal.xml` file. The files are stored in a folder and the folder name is assigned as the calibrated preset's name.

The tag contains one attribute and is structured as follows:

```
<archive_lut_flag value="TRUE|FALSE"/>
```

If value is set to `TRUE`, at the end of the calibration the LUTs will be downloaded to the flash drive. If set to `false`, the tag is ignored.

Download LUT

Designed to be used independent of a calibration, the download LUT tag instructs the display to download the calibrated LUTs and matrix to the USB drive containing the `studiocal.xml` file.

Download LUT parent element

This parent element contains an attribute which allows you to specify the number of color presets whose LUTs will be downloaded. Note that as a parent element a closing tag must be used after the list of child elements.

The tag contains one attribute and is structured as follows:

```
<download_lut entries="INTEGER"/>
</download_lut>
```

The `entries` attribute supports values between 1 and 6.

Download LUT child element

The child element defines preset that will be downloaded. It contains two attributes and is structured as follows:

```
<lut_details num="INTEGER" folder="ALPHA"/>
```

num: The preset number you wish to download. Integer values from 0 to 7 are supported.

folder: The name of the folder on the USB flash drive where you wish to store the LUT files. If the folder does not exist on the drive, it is created.

store: Specifies the memory store to be downloaded from and accepts the values “user” or “factory”. The display contains two different memory stores: factory and user.

- The factory store is a protected memory location where the factory calibration is stored. When a calibration is written to the factory memory location, the user memory location is also rewritten to match the factory memory location. This location can only be rewritten using StudioCal XML. This option is provided to allow you to store a calibration that can easily be recalled using the “Reset to Factory Calibration” or “Factory Reset” command.
- The user store is the memory location where all menu-driven calibrations are stored. This memory location is not protected and is rewritten when any type of calibration is performed or if a “Factory Calibration” or “Factory Reset” command is issued.

Download LUT example

The following is an example of a StudioCal XML file that downloads the LUTs for two presets, preset 0 and preset 3.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<studiocal>
  <download_lut entries="2">
    <lut_details num="0" folder="0-GS DCI D65" store="user"/>
    <lut_details num="1" folder="1-GS BT.709" store="user"/>
  </download_lut>
</studiocal>
```

Upload LUT

Designed to be used independent of a calibration, the upload LUT tag instructs the display to load LUT files stored on the attached USB drive and install them into the specified color space preset.

Upload LUT parent element

This parent element contains an attribute which allows you to specify the number of color presets whose LUTs will be uploaded.



NOTE: As a parent element, a closing tag must be used after the list of child elements.

The tag contains one attribute and is structured as follows:

```
<upload_lut entries="INTEGER"/>
</upload_lut>
```

The entries attribute supports values between 1 and 6.

Upload LUT child element

The tag contains four attributes and is structured as follows:

```
<lut_details num="INTEGER" name="ALPHA" folder="ALPHA" store="user|
factory"/>
```

num: The preset number to upload to. Integer values from 0 to 6 are supported.

name: The name of the preset being created. Names can be up to 15 characters in length and may consist of alphanumeric (A–Za–z0–9) characters, a period (.), and a space. All other ASCII characters are converted to periods.

folder: The name of the folder on the USB flash drive where the LUT files are stored.

store: The memory store that will be used and accepts the values “user” or “factory”. The display contains two different memory stores: factory and user.

- The factory store is a protected memory location where the factory calibration is stored. When a calibration is written to the factory memory location, the user memory location is also rewritten to match the factory memory location. This location can only be rewritten using StudioCal.XML. This option is provided to allow you to store a calibration that can easily be recalled using the “Reset to Factory Calibration” or “Factory Reset” command.
- The user store is the memory location where all menu-driven calibrations are stored. This memory location is not protected and is rewritten when any type of calibration is performed or if a “Factory Calibration” or “Factory Reset” command is issued.

Upload LUT example

The following is an example of a StudioCal XML file that uploads the LUTs for preset 6.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<studiocal>
  <upload_lut entries="1">
    <lut_details num="0" name = "GS DCI D65" folder="0-GS DCI D65"
      store="factory"/>
  </upload_lut>
</studiocal>
```

LUT folder structure

A LUT folder must contain three text files. Each file has a name that identifies preset name, preset number, and type of information stored within the file, or “name-num-type.” For example, if the preset name is “BT.709” and the preset number was “2”, then each LUT file name has the prefix “BT.709-2.” The following files are required in a LUT folder:

Name-num-3D.cube: An ASCII text file which conforms to the .cube format. The 3D LUT used by the display is a 17×17×17 cube with 12-bit integer values for each vertex. Documentation for the .cube format is maintained by Adobe and can be found online.

name-num-PostLUT.txt: An ASCII text file which conforms to the 1D ASCII format. The PostLUT used by the display has 1024 entries, with 14-bit integer values for each entry.

The first line of the LUT file is the declaration and indicates the number of LUTs in the file (usually 3, one each for red, green, and blue), the number of entries in each lut, and the bit precision of the LUT values. For example, LUTs downloaded from the display have the following declaration:

```
LUT: 3 1024 14-bit
```

Optional comments may be used to store the color space preset the LUT was generated for, the type of LUT (PreLUT or PostLUT) and the beginning of each channel LUT. The display automatically generates all of these comments to make the LUT file more human-readable. The following is an example of a LUT file:

```
# BT.709 #
```

```

# PostLUT #
# Begin Red #
0
1
...
16344
16383
#Begin Green #
0
1
...
16344
16383
#Begin Blue #
0
1
...
16344
16383
# END #

```

name-num-PresetValue.xml: An XML file with the information to display in the Color space information on-screen menu and pass to the host computer from the EDID. This file is based on the StudioCal XML calibration schema, but uses the <preset_values> root element. A sample preset value file is shown below:

```

<?xml version="1.0" encoding="ISO-8859-1"?>
<preset_values>
  <gamma value= "2.4" />
  <target primaries rx="0.640" ry="0.330" gx="0.300" gy="0.600"
    bx="0.150" by="0.060" wx="0.313" wy="0.329" wY="100"/>
</preset_values>

```

Using non-supported measurement equipment

Though multiple measurement instruments are natively supported by the display, you may want to use another instrument to make adjustments to an existing preset or to create another preset. StudioCal XML supports this option with the <external_primaries> tag. Designed to operate similarly to the recalibration tool built into most Digital Cinema projectors, measurements are made of the native red, green, and blue primaries, and 100% white. This data is then provided to the calibration software using this tag.

There are two caveats to be aware of:

- As only primary and white point measurements are made with the external instrument, a new luminance target cannot be iterated. Therefore, the existing luminance value for the preset you are recalibrating will be used.
- Existing calibration measurement data must be present on the display in order for gamma to be correctly calculated. In most cases, factory data or data from your most-recent calibration with a supported instrument will be sufficient.

```
<external primaries rx="0.675" ry="0.315" gx="0.210" gy="0.705"
bx="0.147" by="0.054" wx="0.3129" wy="0.329"/>
```

The attributes are identical to those in `target_primaries`. As with `target_primaries`, the `use_uv` tag is optional.

Making measurements with non-supported measurement equipment

To facilitate primary and white point measurements, HP recommends that you use the internal test pattern generator. This is because the internal test patterns are always displayed using the display's native gamut. The internal test patterns are not accessible by default, but one of the bezel button function keys can be set to display the pattern generator.

To set a function key to the test pattern generator:

1. Press any bezel button to display the initial button labels, and then choose **Open Menu** to display the main menu.
2. Select **Menu and Message Control**.
3. Select **Configure Function Buttons**.
4. Select the desired function button to display the list of commands that can be mapped.
5. Select **Test Pattern Generator** to assign it to the function button.
6. Press **Exit**.

Once you have mapped the test patterns to a bezel button, you can use that function to display the required patterns. Display the red, green, blue, and white test patterns, and measure them with your instrument. Record the xy or u'v' measurements into an `<external_primaries>` tag in your Studio Cal XML file. Then enter the desired primaries and white point into a `<target_primaries>` tag in the same file.

The following is an example of an external measurements Studio Cal XML file:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<studiocal>
  <calibration entries="1">
    <calibration_info>
      <preset num="0" name="sRGB D65" store="user"/>
      <gamma value="sRGB"/>
      <target_primaries rx="0.640" ry="0.330" gx="0.300" gy="0.600"
bx="0.150" by="0.060" wx="0.3127" wy="0.329" wY="80"
external="FALSE"/>
      <external_primaries rx="0.675" ry="0.315" gx="0.210" gy="0.705"
bx="0.147" by="0.054" wx="0.3129" wy="0.327"/>
    </calibration_info>
  </calibration>
</studiocal>
```

```
</calibration>
</studiocal>
```

When a USB drive is inserted into one of the DreamColor USB ports, the display reads the StudioCal file. You can generate a new color space based on the external measurements. The new color space preset is generated, and the display switches to that preset. With that color space active, you can use the test pattern generator to measure and verify the generated primaries.

Non-calibration elements

While StudioCal XML is primarily used for calibration, it can also be used to set various configurations within the display. For example, it can be used to create a custom marker for on-screen display, move user preset configurations between displays, and archive or move the entire display configuration.

Non-calibration elements cannot be used in an XML that contains calibration elements. However, the root element must be included.

Custom video input names

Custom input names can be assigned using XML as part of the StudioCal XML schema. Once a custom name has been created for an input, it will be available as an option on the **Rename inputs** menu until a new custom name is assigned or a factory reset is performed.

There are two elements associated with custom video input names:

Video input element

A unique custom name can be assigned to each video input. To support this, a video input parent element is used to enclose the information for each custom video input name. This element contains one “entries” tag to specify the number of input names in the XML file. The “entries” tag supports integer values between one and five.

Structure the element as follows:

```
<video_input entries="INTEGER, 1-5">
</video_input>
```

Input info element

The input info element provides contains two tags:

input: The input the custom name is assigned to. The following values are supported:

- DisplayPort1
- DisplayPort2
- HDMI1
- HDMI2
- USB

name: The custom name assigned to the input. Names up to 14 characters in length are supported.

Structure the element as follows:

```
<input_info input="INPUT" name="Custom Name"/>
```

Custom video input name example

The following is an example of a StudioCal XML file showing the usage of the custom video input name elements.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<studiocal>
  <video_input entries="2">
    <input_info input="DisplayPort1" name="HP Z840"/>
    <input_info input="HDMI1" name="AJA Kona"/>
  </video_input>
</studiocal>
```

Custom markers

Custom markers can be created via StudioCal XML. Custom markers can include up to 16 lines, and each line can have a unique color and line width. Line widths up to 10 pixels are supported.

The following elements are associated with custom markers.

Marker parent element

The StudioCal XML schema allows for the definition of up to 16 lines per custom marker. To support this, a marker parent element is used to enclose the information for each marker. This element contains two tags:

entries: Specifies the number of lines in the custom marker.

This tag supports integer values between 1 and 16.

product: Defines the display the markers are designed for.

This tag currently supports only one value: "Z31x".

The element should be structured as follows:

```
<marker entries="INTEGER, 1-16" product="Z31x">
</marker>
```

Marker info parent element

The details for each marker line is stored in two elements. Therefore a "marker_info" parent element is used to enclose the details for each marker line. This element does not include any tags and must be enclosed within a marker parent element.

```
<marker_info>
</marker_info>
```

Marker position element

The xy starting and ending positions for each marker line is stored in a single "marker_pos" element. The element contains the following tags:

startx: The line's x axis starting point. Integer values between 1 and 4096 are supported.

endx: The line's x axis ending point. Integer values between 1 and 4096 are supported.

starty: The line's y axis starting point. Integer values between 1 and 2160 are supported.

endy: The line's y axis ending point. Integer values between 1 and 2160 are supported.

Structure the element as follows:

```
<marker_pos startx="INTEGER" endx="INTEGER" starty="INTEGER"
endy="INTEGER"/>
```

Marker style element

The width and color for each line is stored in a single "marker_style" element. The element contains the following tags:

width: The line's width. Integer values between 1 and 10 are supported.

color: The line's color. The following values are supported:

- white
- red
- green
- cyan
- magenta
- yellow

Structure the element as follows:

```
<marker_style width="INTEGER, 1-10" color="VALUE"/>
```

Custom marker example

The following is an example of a StudioCal XML file showing the usage of the marker tags. The example draws two lines to indicate the 4:3 caption safe area, as defined in EBU R 95.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<studiocal>
  <marker entries="2" product="Z31x">
    <marker_info>
      <marker_pos startx="624" endx="624" starty="0" endy="2160"/>
      <marker_style width="4" color="red"/>
    </marker_info>
    <marker_info>
      <marker_pos startx="3472" endx="3472" starty="0" endy="2160"/>
      <marker_style width="4" color="red"/>
    </marker_info>
  </marker>
</studiocal>
```



TIP: The optical disc included with the display has several pre-built custom markers for you to import into the display or use as a reference to build your own markers.

User presets

Once you have configured one or more user presets on a display, you can use StudioCal XML to migrate the user presets from one display to another. This method can also be used to archive a copy of the user preset configuration.

User presets element

One element is provided to save and load user presets. This element contains one tag, “operation” which supports two values: “save” and “load.” The element should be structured as follows:

```
<user_presets operation="save|load"/>
```

User preset file

When user presets are saved, a file named “Z31x_UserPreset.xml” is written to the attached USB flash drive. This XML file contains all of the user preset information, but is not designed to be human readable or editable. HP strongly recommends that you not modify the values in this file. When the display encounters a StudioCal XML file with a `<user_presets operation="load"/>` element, it looks for the “Z31x_UserPreset.xml” file on the root of the attached USB flash drive. It then loads that file into the display. If the file is not preset, an error message is displayed.

User preset example

The following are examples of StudioCal XML files to save and load user presets.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
```

```
<studiocal>
```

```
  <user_presets operation="save"/>
```

```
</studiocal>
```

```
<?xml version="1.0" encoding="ISO-8859-1"?>
```

```
<studiocal>
```

```
  <user_presets operation="load"/>
```

```
</studiocal>
```

Display settings uploading and downloading

Though Studio Cal XML is primarily designed for calibration-type functions, it is designed to provide additional non-calibration functionality. The `<user_settings>` tag allows you to export a display configuration to an XML file and then load that configuration back to the same display or deploy it to other displays.

This tag was designed to facilitate the “configure, calibrate, and deploy” model used by many large VFX and animation studios. With this tag, IT can configure a single display so that all menus are configured as desired then deploy that configuration onto all other displays in the facility. As this command is not calibration-focused, it cannot be used with calibration-specific tags.

The tag contains two attributes and is structured as follows:

```
<user_settings operation="save|load"/>
```

The operation tag can be set to either “save” or “load.” If set to “save” the display’s configuration is written to a file named “Z31X_UserSettings.xml” on the root of the attached USB drive. If this file already exists on the drive, it is overwritten. Though this file is human-readable it is not designed to be manually edited and as a result the tag attributes are not documented. If an attribute has been changed to a value that is out of range, that attribute is skipped when being loaded into the display.

If set to “load,” the “Z31X_UserSettings.xml” file must be present on the inserted USB drive. It then loads the settings into the display, replacing all existing settings with the new settings. Color space presets, being calibration-based, are not affected by this command.

5 Remote management

The display provides three different methods for remote management:

- Web dashboard: Network-based one-to-one command and control
- WS-Management: IT-level network-based one-to-many manageability using SOAP protocols
- USB API: Host-based one-to-one command and control

The WS-Management and USB API remote management methods are documented in separate documents and are available on the optical disc provided with the display and on www.hp.com. This document provides information on the web dashboard.

The web dashboard requires an Ethernet connection to the display. Before setting up remote management, be sure to connect an Ethernet cable with network connectivity to the display.

Configuring remote management

The remote management configuration is set using the Remote management server options in the **Management** menu.

Turning remote management on

Remote management is disabled by default and must be turned on before being used. The internal processor must also be turned on.

To turn on the processor and remote management:

1. Press one of the front bezel buttons to display the button labels, and then press the **Open Menu** button to open the OSD.
2. Select **Management**, and then select **Internal processor**.
3. Select **Enable** to turn the processor on.
4. Select **Back** to return to the Management menu.
5. Select **Remote management services**.
6. Select **Enable/disable server**.
7. Select **Enable** to turn the remote management server on.
8. Press the **Exit** button to close the OSD.

Checking and setting the display's IP address

When remote management services are turned on and the display is connected to the network, the display will request an IP address from the network's DHCP server. You can confirm that an IP address is assigned via the **Information** menu.

Open the **Display info** menu by pressing one of the five bezel buttons to display the button labels. Then press the **Display Info** button to open the **Information** menu. The IP address is shown at the bottom of the menu. If you do not see an IP address, check the network cabling to ensure that the display is connected to the network.



NOTE: If the bezel button menu assigned by default to **Display Info** has been changed, you can also access the Information menu via the **Main** menu.

You can also assign a static IP address to the display, as follows:

1. Press one of the front bezel buttons to display the button labels, and then press the **Open Menu** button to open the OSD.
2. Select **Management**.
3. Select **Remote management services**, and then press **Select** to open it.
4. Select **IP configuration mode**, and then press **Select** to open it.
5. Choose **Manual**, and then press **Select** to switch to static IP address mode.

The **IPv4 Address**, **Subnet Mask**, and **Gateway** options become active and the cursor jumps to the first entry in the **IPv4 Address**.

6. Use the bezel buttons to enter the required Address, Subnet Mask, and Gateway numbers.

The bezel buttons allow you to increase or decrease the numerical value of entry and move between entries.

7. Press **Back** when you have completed the IP address configuration.

Setting dashboard security

By default, the web dashboard only requires a password. The default password is “DreamColor”, and you can reset it when you first log in to the dashboard. If you forget the password, you can reset it to “DreamColor” from the **Remote management services** menu.

To reset the default password:

1. Press one of the front bezel buttons to display the button labels, and then press the **Open Menu** button to open the OSD.
2. Select **Management**.
3. Select **Remote management services**.
4. Select **Reset administrator password**.
5. Select **OK** to reset the password to ‘DreamColor’.

You can also require the use of user digital certificates. Any properly issued digital certificate works with the display. Certificates require that users connecting to the display know the display password and have the correct certificate stored in their computer.

Additional steps are required to use certificates. You must first request and receive a unique digital certificate, either from your IT department or a certificate authority on the Internet.

Once you have a certificate, install it on the computer you use to connect to the display. Refer to your operating system help or documentation for information on how to install certificates. Then set the display to use certificates, and install the same certificate on the display.

To configure the display to use certificates and to install a certificate on the display:

1. Press one of the front bezel buttons to display the button labels, and then press the **Open Menu** button to open the OSD.
2. Select **Management**.
3. Select **Remote management services**.

4. Select **Dashboard security**.
5. Select **Require password and client certificate** to change the security configuration.
6. Press the **Exit** button to close the OSD.

To install a user certificate on the display:

1. Copy the certificate you installed on your computer onto the root directly of a USB flash drive, and then insert it into one of the two DreamColor USB ports.
2. Press one of the front bezel buttons to display the button labels, and then press the **Open Menu** button to open the OSD.
3. Select **Management**.
4. Select **Remote management services**.
5. Select **Install client certificate**.
6. Press **OK** to install the certificate.

Logging in to the web dashboard for the first time

Once you have configured the dashboard settings, you can log in to the dashboard from a web browser. Any device on the same local network can connect to the display. The first time you connect to the dashboard you need to configure the web site.

To log in to and configure the web dashboard:

1. Open a web browser.
2. Enter the display's IP address in the address bar, and then press **Enter**.

The browser connects to the display and the initial setup screen is displayed.

3. Enter `DreamColor` (the default password) and click **Next**.

If you configured the display to use certificates and used a certificate with an embedded password, enter that password instead. The dashboard prompts you to create a new password.

4. Enter a new password in the **Create new** and **Enter again** fields, and then click **Next**.
5. Enter the display details, and then click **Next**. You must enter values into the display detail fields.

Four fields are provided: **Display name**, **Deployment date**, **Location**, and **ID Asset tag**. Even though you must enter information into these fields at this time, you can change this information at a later date.

6. If desired, create user names and passwords for additional users and click **Add**, or click **Skip** to bypass this option.
7. Click **Done** to complete the initial set up.

The dashboard is now configured for use.

Logging into the web dashboard

To log into the web dashboard:

1. Open a web browser.
2. Enter the display IP address in the address bar, and then press **Enter**.

The browser connects to the display and the dashboard login screen is displayed.

3. Select the appropriate user from the list, and then enter the user's password.
If you did not create users during setup, the Admin user is available.
4. If desired, select **Keep me signed in** to prevent the dashboard from timing out and logging you out.
5. Click **Sign In** to log in to the dashboard.

Navigating the dashboard

After you log in, the Home page of the dashboard provides display information, including asset and current configuration information.

The **Go to** menu allows you to navigate to different display configuration pages.

To navigate to a settings page:

1. Click the **Go to** menu, and then configure the desired settings.
2. Click the **Go** button to display the desired settings.

Each settings page contains all of the options found in the OSD menu, rearranged for ease of access.

These settings use tabs to break the options into logical sections.

The **Markers** tab allows you to import StudioCal XML files into the display. The **Import Marker** button allows you to navigate to the location of the XML file on your local drives and import it on the display. You can also directly import StudioCal XML files for calibration automation, user presets, and so on. Navigate to the relevant configuration page to access these import options.

You can also move between different setting groups by clicking on them on the left half of the screen.

Navigating between the different dashboard sections

The **Go to** menu provides access to the different options within the Monitor Settings section. There are two additional sections available:

- Home: The section displayed when you first log into the display.
- Monitor Profile: Provides access to the display details fields you entered when you first logged into the display.

To switch between the dashboard sections:

1. Click the **DreamColor Remote Access** menu, located at the upper left of the dashboard, to display the section menu.
2. Select the desired section.

Logging out of the dashboard

If you are not logged out when you close the dashboard, you can manually log out of the dashboard session.

To log out of the dashboard:

1. Click the user icon in the upper-right corner of the dashboard to display the user menu.
2. Click **Logout** to log out of the dashboard.
3. Close the browser window to disconnect from the display.

6 Support and troubleshooting

Solving common problems

The following table lists possible problems, the possible cause of each problem, and the recommended solutions.

Problem	Possible Cause	Solution
Screen is blank or video is flashing.	Power cord is disconnected.	Connect the power cord.
	Power button is turned off.	Press the Power button. NOTE: If pressing the Power button has no effect, press and hold the Power button for 10 seconds to disable the Power Button Lockout feature.
	Video cable is improperly connected.	Connect the video cable properly. Refer to Connecting the cables on page 9 for more information.
	System is in sleep mode.	Press any key on the keyboard or move the mouse to inactivate the screen blanking utility.
	Video card is incompatible.	Open the OSD menu and select the Video input menu. Set Auto-switch source to Disable and manually select the input.
Check Video Cable is displayed on the screen.	Display video cable is disconnected.	Connect the appropriate video signal cable between the computer and display. Be sure that the computer power is off while connecting the video cable.
Input Signal Out of Range is displayed on the screen.	Video resolution and/or refresh rate are set higher than what the display supports.	Change the settings to a supported setting (see Preset display resolutions on page 98).
The display is off but it did not seem to enter into a low-power sleep mode.	The display's power saving control is disabled.	Open the OSD menu and select Management , select Auto-sleep mode , and then set auto-sleep to Put the display to sleep .
OSD Lockout is displayed.	The display's OSD Lockout function is enabled.	Press and hold the bottom bezel button on the side panel for 10 seconds to disable the OSD Lockout function.
Power Button Lockout is displayed.	The display's Power Button Lockout feature is enabled.	Press and hold the Power button for 10 seconds to unlock the Power button function.

Button lockouts

When the OSD menu window or Button Labels are not displayed, holding specific buttons down for ten seconds will allow the user to lock out different parts of the OSD's functionality. This is designed primarily as a stopgap measure to prevent inadvertent adjustments. A user can restore the functionality by holding the specific buttons down again for ten seconds.

This functionality is only available when the display is powered and is displaying an active signal. Upon the engage or disengage of a lockout, a message is displayed to the user indicating the lockout engaged or disengaged.

The following table lists the available lockouts and the buttons that must be held down to enable and disable the lockout.

Activation button	Lockout	Notes
Power button	Power lockout	When locked out the soft-power button does not function. The display can still be turned off via the vacation power switch at the bottom of the display.
Bottom menu button	Menu lockout	The Primary OSD cannot be entered. However, any previously-assigned function buttons (such as switch color space or input) are still available to the user. Firmware updates and calibration are still available, unless disabled in the Management menu.
Top menu button	Menu and function lockout	Both the Primary OSD and the function keys are locked out. Firmware updates and calibration are still available, unless disabled in the Management menu.
Second and fourth button	Management menu lockout	The Management menu option is disabled in the Primary OSD main menu.

Product support

For additional information on using your display, go to <http://www.hp.com/support>. Select **Find your product**, and then follow the on-screen instructions.



NOTE: The display user guide, reference material, and drivers are available at <http://www.hp.com/support>.

Here you can do the following:

- Chat online with an HP technician



NOTE: When support chat is not available in a particular language, it is available in English.

- Locate an HP service center

Preparing to call technical support

If you cannot solve a problem using the troubleshooting tips in this section, you may need to call technical support. Have the following information available when you call:

- Display model number and serial number (see [Locating the serial number and product number on page 7](#))
- Purchase date on invoice
- Conditions under which the problem occurred
- Error messages received
- Hardware configuration
- Name and version of the hardware and software you are using

7 Maintaining the display

Maintenance guidelines

To enhance the performance and extend the life of the display:

- Do not open the display cabinet or attempt to service this product yourself. Adjust only those controls that are covered in the operating instructions. If the display is not operating properly or has been dropped or damaged, contact an authorized HP dealer, reseller, or service provider.
- Use only a power source and connection appropriate for this display, as indicated on the label/back plate of the display.
- Be sure the total ampere rating of the products connected to the outlet does not exceed the current rating of the AC outlet, and the total ampere rating of the products connected to the cord does not exceed the rating of the cord. Look on the power label to determine the ampere rating (AMPS or A) for each device.
- Install the display near an outlet that you can easily reach. Disconnect the display by grasping the plug firmly and pulling it from the outlet. Never disconnect the display by pulling the cord.
- Turn the display off when not in use. You can substantially increase the life expectancy of the display by using a screen saver program and turning off the display when not in use.



NOTE: A burned-in image on the display is not covered under the HP warranty.

- Slots and openings in the cabinet are provided for ventilation. These openings must not be blocked or covered. Never push objects of any kind into cabinet slots or other openings.
- Do not drop the display or place it on an unstable surface.
- Do not allow anything to rest on the power cord. Do not walk on the cord.
- Keep the display in a well-ventilated area, away from excessive light, heat, or moisture.
- Never lay the display facedown. Stress on the curvature of the display panel may damage the panel if the display is placed facedown.

Cleaning the display

1. Turn off the display and unplug the power cord from the back of the unit.
2. Dust the display by wiping the screen and the cabinet with a soft, clean antistatic cloth.
3. For more difficult cleaning situations, use a 50/50 mix of water and Isopropyl alcohol.



CAUTION: Spray the cleaner onto a cloth and use the damp cloth to gently wipe the screen surface. Never spray the cleaner directly on the screen surface. It may run behind the bezel and damage the electronics.

CAUTION: Do not use cleaners that contain any petroleum based materials such as benzene, thinner, or any volatile substance to clean the display screen or cabinet. These chemicals may damage the display.

Shipping the display

Keep the original packing box in a storage area. You may need it later if you move or ship the display.

A Technical specifications



NOTE: All specifications represent the typical specifications provided by HP's component manufacturers; actual performance may vary either higher or lower.


For the latest specifications or additional specifications on this product, go to <http://www.hp.com/go/quickspecs/> and search for your specific display model to find the model-specific QuickSpecs.


Display	78.9 cm wide screen	31.1 in wide screen
Type	High-performance IPS	
Tilt	-5° to 20°	
Swivel	-45° to 45°	
Weight		
Without stand	9.9 kg	21.83 lb
With stand	14.61 kg	32.19 lb
Dimensions (including stand)		
Width	73.80 cm	29.06 in
Depth	24.80 cm	9.76 in
Height	56.60 cm	22.38 in
Maximum graphic resolution	4096 x 2160 (60 Hz)	
Pixels pitch	(H) 0.1704 × (V) 0.1704	
Pixels Per Inch (PPI)	149	
Horizontal viewing angle	178°	
Vertical viewing angle	178°	
Brightness (typical)	250 cd/m ²	
Panel active area (w x h)	69.8 x 36.8 cm	
Panel bit depth	True 10-bit (up to 1.07 billion colors)	
Aspect ratio	17:9	
Static contrast ratio		
Typical	1500:1	
Minimum	1200:1	
Environmental requirements temperature:		
Operating temperature	5°C to 35°C	41°F to 95°F
Storage temperature	-20°C to 60°C	-4°F to 140°F
Relative humidity		
Operating	20% to 80% (non-condensing)	
Non-operating	5% to 95%, 38.7° C max wet-bulb	

Altitude:		
Operating	0 m to 5,000 m	0 to 16,400 ft
Storage	0 m to 12,192 m	0 to 40,000 ft
Power source		
100 VAC to 240 VAC 50/60 Hz		
Measured power consumption:		
Full power	260 W	
Typical settings	120 W	
Sleep	0.5 W	
* The display supports customer updatable firmware. These firmware updates may increase power consumption of the display.		
Input terminal		
Two DisplayPort 1.2, two HDMI 2.0, one USB Type-C, one ethernet, one analog audio-out jack, one USB Type-B, two USB 3.0 fast charging, two USB DreamColor, one KVM keyboard		

Preset display resolutions

The display resolutions listed below are the most commonly used modes and are set as factory defaults. This display automatically recognizes these preset modes and they will appear properly sized and centered on the screen.

 **TIP:** If you want to use the PIP feature to show full-height, side-by-side sources, set the display resolution to 2048×2160.

 **IMPORTANT:** In some Windows 10 configurations, using Windows display settings does not correctly change display resolution. To make sure display resolution is changed, use the graphics processor settings user interface. You can check the current display resolution by opening the OSD and selecting **Display Info**. When the display resolution setting is changed, the display briefly goes black, and then the new setting is applied.

Preset	Pixel format	Aspect ratio	Vertical frequency (Hz)
1	640×480	4:3	60(p)
2	720×400	N/A	70(p)
3	800×600	4:3	60.317
4	1024×768	4:3	60.004
5	1280×720	16:9	24(p)
6	1280×720	16:9	30(p)
7	1280×720	16:9	50(p)
8	1280×1024	16:9	60(p)
9	1280×1024	5:4	60(p)
10	1366×768	16:9	60.000
11	1920×1080	16:9	23.976(p)
12	1920×1080	16:9	24(p)

Preset	Pixel format	Aspect ratio	Vertical frequency (Hz)
13	1920×1200	16:9	30(p)
14	1920×1080	16:9	50(i)
15	1920×1080	16:9	50(p)
16	1920×1080	16:9	59.94(i)
17	1920×1080	16:9	59.94(i)
18	1920×1080	16:9	60.000
19	1920×1200	16:10	59.950
20	1920×1200	16:10	59.995
21	2048×1080	17:9	24.000
22	2048×1080	17:9	48.000
23	2048×1080	17:9	60.000
26	3840×2160	16:9	24
27	3840×2160	16:9	25
28	3840×2160	16:9	30
29	3840×2160	16:9	47.952
29	3840×2160	16:9	48
30	3840×2160	16:9	50
31	3840×2160	16:9	60
32	4096×2160	17:9	23.976
33	4096×2160	17:9	24
34	4096×2160	17:9	47.952
35	4096×2160	17:9	48
36	4096×2160	17:9	59.94
37	4096×2160	17:9	60
38	2048×2160	17:18	60

Entering user modes

The video controller signal may occasionally call for a mode that is not preset under the following conditions:

- You are not using a standard graphics adapter.
- You are not using a preset mode.

If this occurs, you may need to readjust the parameters of the display screen by using the on-screen display. Your changes can be made to any or all of these modes and saved in memory. The display automatically stores the new setting, and then recognizes the new mode just as it does a preset mode. In addition to the factory preset modes, there are at least 10 user modes that can be entered and stored.

Energy saver feature

The display supports a reduced power state. The reduced power state will be entered into if the display detects the absence of either the horizontal sync signal or the vertical sync signal. Upon detecting the absence of these signals, the display screen is blanked, the backlight is turned off, and the power light turns amber. When the display is in the reduced power state, the display will utilize <0.5 watts of power. There is a brief warm-up period before the display will return to its normal operating state.

Refer to the computer manual for instructions on setting the energy saver mode (sometimes called power management feature).



NOTE: The above energy saver feature works only when the display is connected to a computer that has energy saver features.


By selecting the settings in the display's Sleep Timer utility, you can also program the display to enter into the reduced power state at a predetermined time. When the display's Sleep Timer utility causes the display to enter the reduced power state, the power light blinks amber.

B Accessibility

HP designs, produces, and markets products and services that can be used by everyone, including people with disabilities, either on a stand-alone basis or with appropriate assistive devices.

Supported assistive technologies

HP products support a wide variety of operating system assistive technologies and can be configured to work with additional assistive technologies. Use the Search feature on your source device that is connected to the display to locate more information about assistive features.

 **NOTE:** For additional information about a particular assistive technology product, contact customer support for that product.

Contacting support

We are constantly refining the accessibility of our products and services and welcome feedback from users. If you have an issue with a product or would like to tell us about accessibility features that have helped you, please contact us at (888) 259-5707, Monday through Friday, 6 a.m. to 9 p.m. Mountain Time. If you are deaf or hard-of-hearing and use TRS/VRS/WebCapTel, contact us if you require technical support or have accessibility questions by calling (877) 656-7058, Monday through Friday, 6 a.m. to 9 p.m. Mountain Time.