



Version 1.1a

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WARNINGS, READ



Calibration DVD software and test patterns such as the GetGray Digital Video Calibration DVD software are designed for professional, experienced display calibrators. The test patterns contained in the GetGray Digital Video Calibration software are accurate to the best of the authors' knowledge. It is the user's sole responsibility to verify to their own satisfaction that the software meets their needs.

Failure to use this or any calibration disc or software properly could result in damage to a display device. For example, some display technologies are susceptible to "screen burn in" where portions of the display are permanently affected or damaged; this "screen burn in" can happen on a variety of devices and can be caused by static images such as those included on calibration DVDs being displayed for extended periods.

There may be other display problems or damage that can be caused by the use or misuse of test patterns. **DO NOT USE THIS DISC UNLESS YOU KNOW HOW TO AVOID ANY DAMAGE OF ANY KIND TO THE DISPLAY DEVICE** when using test patterns. Damages caused by use or misuse of this DVD software is the sole responsibility of the user.



Calibration of a display device may require access to the device's "service menu". **Do not enter a service menu** unless you are a qualified service technician. When a technician must make changes to a service menu, we strongly recommend to **always** write down the device's initial settings before making changes. Failure to do so could make it impossible to revert to the factory settings.

The instructions herein do not advocate accessing any service menu of any device for any reason. Only those fully qualified should make any adjustments to any display device. Non-qualified user adjustments may cause irrevocable harm to the device.

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Introduction

Welcome to the GetGray Digital Video Calibration DVD (GetGray DVD). **If you have not read the License agreement and Warnings, STOP, read them now to avoid damage to a device.**

This disc was born out of a desire to have a single disc that had only the most commonly used patterns for fundamental video device calibration, that is as accurate as physically possible, all in one place and in an easy to navigate DVD.

At the time of the creation of the GetGray DVD, technicians and consumers had a very limited number of calibration discs they can purchase and use. One popular consumer level disc is widely reputed to have slightly inaccurate colors in the test patterns. Another popular disc is often criticized by users for being difficult to navigate and is lacking a complete set of gray patterns. Some test discs included test patterns with "Blacker than Black" and "Whiter than White" patterns, and others did not. None of the non-professional level options had all of the core patterns that the GetGray DVD has in one place. Professional level disc sets do usually have complete pattern sets, but they are very expensive and as such rule themselves out for many users, professional and non-professional alike. The available choices mentioned contain a myriad of patterns to check every aspect of any type of display device, but are often heavily geared toward CRT based displays. Many of those patterns require very expensive test equipment such as oscilloscopes and the technical training to use them. Many patterns on those discs allow tests to reveal shortcomings of a display, but in many cases there is nothing a calibrator could do about the shortcoming once it is known. A much smaller subset of patterns are all that is actually necessary or used in basic fixed pixel (digital) device calibration. Furthermore, for those using consumer level discs, they often find themselves forced to use multiple discs to get the desired combination of patterns they prefer to use. One disc set may have below black test patterns, and another may have a more desirable gray pattern navigation, or a more complete set of gray window patterns.

The GetGray DVD takes care of those issues by:

- Providing very simple navigation
- Providing an intuitive pattern layout
- Providing a bare-bones but fundamentally complete set of patterns for fixed pixel devices
- Providing dead perfect primary, secondary, and gray pattern colors.
- Being very affordable

The GetGray DVD includes a number of test screens to enable the accurate adjustment of a device's gray scale and color performance. A properly set grayscale will yield the most uniform picture and the maximum contrast that the display is capable of. The color test patterns permit the adjustment of the color performance and color tracking.

Test patterns are provided to work with available automated or semi-automated colorimetric measuring tools. There are also patterns that can be used to measure or adjust ANSI contrast, ANSI Lumen output, Y/C delay, overscan, image alignment, sharpness, RGB clipping, and Lip-Sync.

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Color test patterns include an animated pattern to set the Color (Saturation) and Tint (Hue). Color patterns. Color patterns include SMPTE style color bars and a Multi-Level Color Bar pattern. Finally, the Belle Nuit general-purpose test pattern is provided to get a quick look at several parameters on one test screen.

In addition to the patterns above, a user with proper calibration equipment will be able to take advantage of a thorough compliment of Gray scale patterns, primary and secondary color patterns.

The GetGray DVD is meant to put ONLY the fundamental video patterns that would be used by someone using a colorimeter in one easy to use place and with correct, color accurate patterns. It includes the core patterns for a technical hobbyist to make the fundamental measurements for Brightness, Contrast, Color, and Tint. All of the color patterns on the disc were created in RGB color space, converted to digital YCbCr format and level verified, before encoding to mpeg for DVD. This ensured no color shifts by the encoding process. The patterns were verified literally at the binary level in YCbCr which is what's on a DVD.

The GetGray DVD is suitable for use with all popular colorimeter devices including:

- **Progressive Labs CA-6X** colorimeter. This DVD supports the automatic grayscale measurement protocol of the *CA-6X* and *Optic One* devices. AKA:
- **Ovation Multimedia OpticOne** colorimeter by Ovation Multimedia
- **Datacolor Colorfacts Professional**
- **Accucal i1 Pro DCS** spectroradiometer package
- **Datacolor SpyderTV**

Questions & Answers:

Q: Who can make use of the GetGray DVD?

A: Anyone who knows how to calibrate. Also, several of the patterns are useful without special calibration equipment and may be used by technically inclined consumers (depending on the display). The GetGray DVD has:

Excellent contrast and brightness patterns

Several styles of color/tint adjustment patterns to suit the users preference

Basic geometry alignment pattern

Y/C delay pattern (if the device supports user adjustment of Y/C delay)

Standard style colorbar patterns for visual checking

Grayscale ramps for visual checking of the grayscale accuracy

Color ramps for visually checking individual RGB color clipping

Patterns that can be used by a less technical user to determine if a professional calibration is necessary.

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Q: Will the GetGray DVD have the fundamental patterns a novice or someone without a color-measuring instrument can use?

A: Yes, for brightness, contrast, and Color/Tint, which are the fundamental display adjustments. Other than those, a novice should not be adjusting their display. They can however look at the gray ramps and other patterns to determine if the device is in need of a professional calibration.

Q: Can the GetGray DVD be used to calibrate my CRT display?

A: It cannot be used to accurately calibrate a CRT display. For example, it has neither the convergence patterns to adjust RGB guns, nor any type of blooming pattern **required** to adjust contrast on a CRT. This disc was designed for a digital device like a LCD or DLP. **This DVD is intended for fixed pixel displays and does not contain some of the necessary test patterns for CRT based displays.**

Q: Does the GetGray DVD have user-friendly video instructions on the disc explaining what each pattern is and how to use it?

A: No, it does not. Other than this document, there are no instructions. This document is not meant to be a tutorial either. The "instructions" in this document are just reminders to calibrators or suggestions on pattern usage. This disc is primarily designed for those who know how to use the patterns. For such people, on-disc how-to videos are just "in the way" and are something to navigate around. The GetGray DVD is not meant to address any such needs such as a "dummies guide to home theater" or calibration in general. This does not mean that the disc has no useful information for a technically inclined user; see other Q&A's.

Q: Can I get direct technical support from the author?

A: No, but a wealth of information can be found on the Internet in places such as the AVS forum's calibration sub-forum (see Appendix A - Resources). There, one can find information or ask questions on the usage of calibration discs.

Q: Can a novice figure out how to calibrate their display on their own?

A: Whether or not a novice can use the disc depends on their technical skills and the particular display. No one should make advanced adjustments to a display unless they fully understand what they are doing and are properly qualified. Help for novices on making basic adjustments (brightness, contrast, color, tint) using calibration patterns can be obtained from several Internet forums such as the AVS forum. Basic settings such as brightness and contrast should be able to be performed by any technically inclined user. Details on how to adjust displays, and the tools available to measure and adjust displays can be obtained from a number of Internet sources as well.

Q: Can I use the GetGray DVD to calibrate my audio or surround sound equipment?

A: No, other than the lip-sync test, it will not provide audio calibration sections. The GetGray DVD does not have an audio calibration section. For audio system tuning see Appendix A - Resources, for a recommended audio calibration disc

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Navigation: While other calibration DVD's may show a pattern for a fixed (often too short) interval, most patterns on this disc are designed to "stick". That is, once a pattern is selected, it will remain on the screen allowing the calibrator to continue to use the pattern without having to press pause. To exit a pattern or pattern sequence, the user must press the MENU key on their DVD player or remote. Use NEXT, and PREVIOUS to change patterns within pattern sequences. Note: some DVD players require 2 successive PREVIOUS presses to back up. Use the Arrow keys and the ENTER keys to navigate the menus.



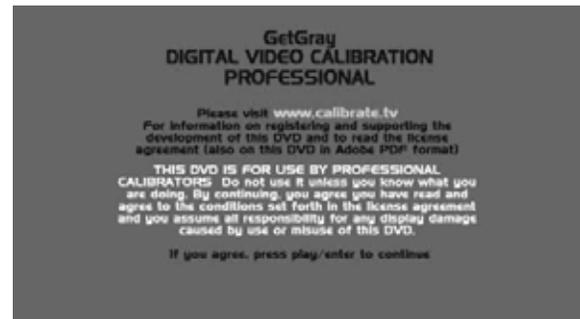
LEAVING ANY CALIBRATION DVD UNATTENDED ON A FIXED PIXEL DEVICE COULD CAUSE PERMANENT SCREEN BURN DEPENDING ON THE TIME AND DEVICE TYPE. DO NOT LEAVE PATTERNS ON THE DISPLAY FOR EXTENDED PERIODS IF THE DEVICE IS SUCEPTABLE TO SCREEN BURN.

Patterns and Usage: Before using this calibration tool, warm up the device (20 minutes minimum) with normal moving video, to stabilize all internal temperatures. Failure to do so may result in an inaccurate calibration and unsatisfactory results.

When calibrating a device it is NOT recommended to use a universal remote programmed to control both the DVD player and the device being calibrated. It is recommend that the respective device's independent factory remotes (or equivalent) be used instead. This will allow the DVD to be navigated while simultaneously making display-setting changes (without having to switch modes/screens back and forth on a universal remote).

The **opening** screen includes the DVD version number and verification that the user agrees to the software license. It only appears on disc startup. Read, understand and agree to the license and warning in this document before continuing.

Press ENTER, or NEXT, on the DVD remote, to advance to the Main Menu.



The GetGray DVD is authored in 16:9 aspect ratio although it may be used on a 4:3 aspect display if the display or DVD player is set to squeeze the image and display the images without letterbox or pillar-box black bars. The main menu screen's gray background should fill the display.

The **Main Menu** provides quick access to all of the submenus and patterns included on this disk. Submenus are only one level deep to ease navigation.





Throughout this document the term “digital levels” refer to digital RGB. For example digital 16 means R=G=B=16. DVD’s actually contain Digital information as YCbCr, but for simplicity and easier reading this documents uses RGB digital levels to describe the pattern information.

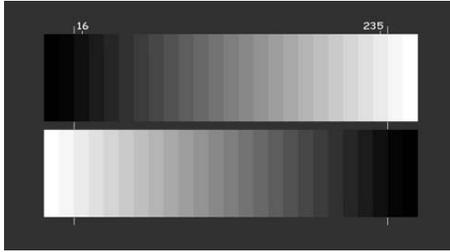
Brightness & Contrast

Brightness and contrast are probably the most important and fundamental adjustments that can be made to a display. They are so common, and so often used, these patterns are accessed directly from the main DVD menu. Brightness and contrast also referred to as black level and white level, respectively, determine your display’s contrast ratio settings. Increasing the device's contrast ratio, in general, increases the device's perceived picture quality. The ratio is the essentially the intensity difference between the brightest white and the darkest black the display can produce. This disc contains several patterns to properly set the Brightness (black level) and Contrast (white level). An improperly adjusted brightness or contrast setting can cause a display’s detail to be "crushed/clipped” out of dark material (e.g. wrinkles in a black suit disappear to black) or "crushed/clipped" out of bright material (e.g. details in clouds disappear making them look like one uniform white blob). On the other hand, brightness set too high can make dark material look gray; contrast set too low can make white material look dim; and the overall picture look flat or washed out (loss of details in dark and white areas of the picture).

This disc assumes the display, DVD, and the entire video chain is set to display "video levels". Some devices are set to interpret digital colors at "PC levels" where digital RGB levels extend from 0 to 255 with 0 being black. Powerpoint presentations from a PC are an example of this. DVD's are not encoded at PC levels; they are encoded using video levels. "PC Levels", “encoded YCbCr”, and "Video Levels" are subjects beyond the scope of this document.

In short "Video levels" means the display interprets digital 16 as black, and digital 235 as white. Additionally, many but not all displays and/or DVD devices can display levels called "below black" or "above white". Some devices "clip" any video information in those ranges (below digital level 16 or above digital level 235). These devices may have control settings to allow display of “below black” and/or "above white" (read your device manuals). Although DVD's are created with "video levels" (levels 16-235), some DVD's may contain video information that falls outside the video level limits. The GetGray DVD is encoded to intentionally contain below black and above white information, to enable the calibrator to have full visual information when calibrating. Some calibrators prefer to adjust so a display shows some "below black" information and/or some "above white" information. The author recommends no below black, and possibly 1 step above white, but this is just a personal calibrators preference. Showing some above white information for example may reveal some bright white details (i.e. in bright sky clouds that may have otherwise been clipped). Strictly technically speaking, **not** showing information outside of 16-235 is correct.

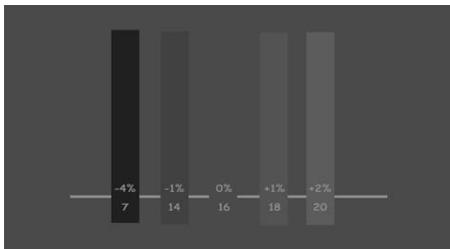
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5% Step Gray Ramps: 5% Step Gray Ramps pattern may be the single most informative about a displays settings to an experienced calibrator. A great deal can be seen from displaying a stepped gray ramp. The 5% stepped ramp includes 20 steps of gray from digital level 16 (**reference black**) to digital level 235 (**reference white**). The ramp also includes bars with digital levels 5% above reference white, 5% below reference black, and levels 1 (**maximum black**) and 254 (**maximum white**). The pattern is designed with mirrored ramps to accommodate various displays on screen menus (OSDs) so you can see a full ramp no matter where the OSD appears.

The 5% step ramp gives an idea of how a display handles the full range of the gray scale including below black and above white information. There are tick marks indicating the level 16 and the level 235 bars to delineate the video level range (16 = 0% = reference black; 235 = 100% = reference white). If adjusted properly, the gray ramp should show all the gray bars in the video level range with clear divisions between them. Typically, depending on the calibrator's preference, one should not see distinct bars outside the marked video level boundaries; those areas should appear the same level as the labeled boundary bars 16 & 235 (e.g. the bar labeled "16", the -5% next lower level bar and the last, darkest level bar should look all appear one color of black). If you do see distinct bars beyond the black or white video levels area, then the device is displaying below black or above white information. The gray ramp can be used for a quick check of brightness and contrast settings, as well as color shifts in the devices grayscale. All the bars should appear as some shade of gray with no bars looking like they have a color tint.

Press NEXT to move to the next pattern OR press MENU to return to the main menu.



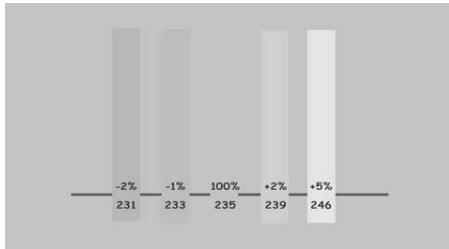
Brightness: The Brightness Adjustment's test pattern image is shown left (modified in this manual so the 5 black bars can be seen on most computer monitors. The actual pattern is much darker). This test pattern is used for adjusting the brightness (black level) of a display. It includes 5 bars at the dark end of the gray spectrum, centered about **reference black**. The background of this pattern as well as the center (invisible) bar is **reference black** (0% amplitude, digital level 16).

To use the brightness pattern, first adjust the ambient lighting in the room. Ambient lighting should be very low or off for critical viewing and maximum contrast. Some calibrators prefer to use indirect low ambient lighting (bias lighting) depending on the room, display size, etc. Lights should be set as they will be when the device is used. More than one set of parameters for different lighting conditions may be programmed if the display allows it. One setup for lights up, and one for lights off for example. Many displays have separate setting memories to accomplish this.

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Using the Brightness control of the display, adjust up or down until the below black bars (-1%, -4%) just disappear, this is the correct setting (some calibrators prefer 1 notch toward showing below black). If the device will not display the below black bars, an alternate procedure is to adjust the brightness control brighter until the +1% bar just disappears, then lower the brightness until the 1% bar reappears.

Press NEXT to move to the next pattern, MENU to return to the menu.



Contrast: The Contrast Adjustment's test pattern image is shown at the left (it has been modified in this document so the 5 white bars can be seen on most computer monitors. The pattern will normally look brighter on the actual display). This test pattern is used to adjust the contrast (white level) of your display. It includes 5 bars at the white end of the gray spectrum, centered about **reference white**.

The background of this pattern is **reference white** (100% amplitude, digital level 235).

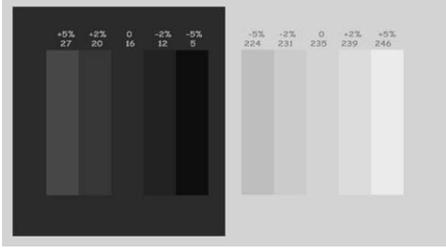
Usage of the contrast pattern is similar to the brightness pattern. Using the Contrast control of the display, adjust up or down until the above white bars (+2%, +5%) just disappear into the background this is the correct setting (some calibrators prefer 1 notch toward showing above white). If the device will not display the above white bars, an alternate procedure is to lower the contrast until the -1% bar just disappears, then raise the contrast until the -1% bar is visible. When adjusting contrast you also want to watch for color shifts. Some bulb-based devices will "run out" of a primary color used in producing white causing a color shift in white if the contrast is too high. Normally this is undesirable.



The **Brightness** (Black Level) and **Contrast** (White Level) adjustments are interactive. In order to get correct settings, it is necessary go back and forth between the test patterns a few times, in order to converge on the proper adjustment of both. Start this process with the Brightness (Black Level) settings.

Press NEXT to move to the next pattern, PREVIOUS to back up, MENU to return to the menu.

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Dual Levels: The levels test pattern shown left (also adjusted to display properly in this document) is an **alternative** to the previous separate brightness and contrast patterns. This pattern puts the elements of both of the two previous patterns onto one screen. What is important to note here is this pattern has a 50% average picture level (APL) so overall the image is much brighter than the darker

brightness pattern (and darker than the brighter contrast pattern). The higher APL will make the darker bars more difficult to see. Using this pattern to adjust brightness and contrast may result in a slightly higher black level. The results achieved with this pattern may not yield as high a contrast ratio compared to the previous Brightness and Contrast patterns, on some displays. Some calibrators prefer adjusting brightness using a higher APL pattern such as this one. This pattern is provided for that purpose. The backgrounds of the two halves are reference black (digital level 16) and reference white (digital level 235), respectively. The levels and amplitudes of the individual bars are labeled. There are tradeoffs, using a dark pattern for brightness adjustment vs. this higher APL pattern, which are beyond the scope of this document.



Setting Brightness and Contrast properly works toward displaying the maximum contrast ratio (CR). The calibrator has to determine which patterns provide the best gray scale.

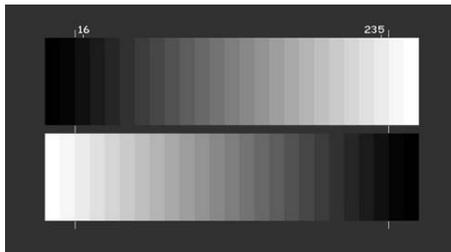
Press NEXT to LOOP TO THE BEGINNING of this sequence, MENU to return to the menu.

Gray Patterns

The **Gray Patterns** submenu is accessed from the main menu. Gray is made up from the correct proportions of the primaries Red, Blue, and Green. The grayscale patterns are designed for use with colorimeter instruments to accurately measure a displays individual RGB outputs at the corresponding level of gray. They are also used to adjust the color temperature (i.e. D65) of the grays. Color temperature is the color of gray with D65 being typically desirable. A discussion of color temperature is beyond the scope of this document. A user **without** a colorimeter can look at the patterns to see if the gray patterns are "tinted" with some color indicating improper gray settings. Ramps are the generally best pattern for this broad look. Tinting would indicate the possible need of a professional calibration requiring instrumentation.



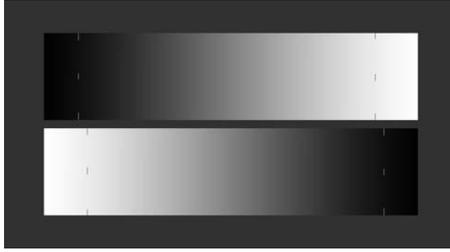
5% Step Ramp: This is the same ramp provided in the Brightness and Contrast section of the DVD. It is repeated here for user convenience. The 5% stepped ramp includes 20 steps of gray from digital level 16 (**reference black**) to digital level 235 (**reference white**). The ramp also includes bars with digital levels 5% above reference white, 5% below reference black, and levels 1 (**maximum black**) and 254 (**maximum white**).



The 5% step ramp gives an idea of how a display handles the full range of the gray scale including below black and above white information. There are tick marks indicating the level 16 and level 235 bars to delineate the video level range (16 = 0% = reference black; 235 = 100% = reference white). If adjusted properly, the gray ramp should show all the gray bars in the video level range with clear divisions between them. Typically, depending on the calibrator's preference, one should not see distinct bars outside the marked video level boundaries; those areas should appear the same level as the labeled boundary bars 16 & 235 (e.g. the bar labeled "16", the -5% next lower level bar and the last, darkest level bar should look all appear one color of black). If you do see distinct bars beyond the black or white video levels area, then the device is displaying below black or above white information. The gray ramp can be used for a quick check of brightness and contrast settings, as well as color shifts in the devices grayscale. All the bars should appear as some shade of gray with no bars looking like they have a color tint.

Press MENU to return to the menu

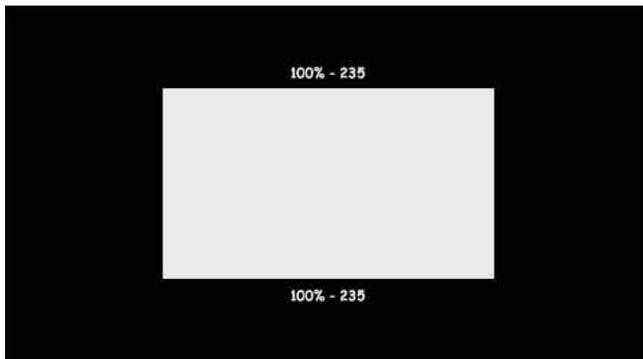
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Gradient Ramp: The gradient ramp is similar to the 5% step ramp except it displays all gradations from black to white in digital 1 increments. It also has tick marks to indicate the bounds of video levels. This ramp can show how smooth your device can display all the shades of gray. Again, this ramp should show no signs of color tint or banding.

Press MENU to return to the menu

Gray Window Patterns: Gray "window" style patterns are provided as the primary gray test patterns by design. Full window patterns can cause undesirable side effects when calibrating a display. Bright levels for example can cause room reflections, which can interfere with the measurement accuracy of an instrument. Full field patterns should only be used when a specific need dictates their use (e.g. instrumentation requirement, dynamic iris calibration, etc.).



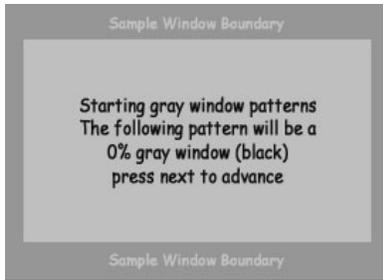
These test patterns are somewhat self-explanatory and can be navigated with the **NEXT** button. Each window is labeled above and below with the % amplitude of gray it represents and the actual digital level used to produce the gray pattern. Percentages represent amplitude, or the % intensity above reference black, where reference black is 0% and reference white is 100%. This is NOT necessarily the same as IRE,

which should generally be 7.5IRE for reference black and 100IRE for reference white. See **APPENDIX B** for more information on gray pattern % Amplitude vs. IRE. The gray window patterns have a background of digital 1, Maximum Black.

30/80% and 20/80% sequences: These are sequences of a 30% (or 20%) gray window followed by an 80% gray window. These selections will loop between the 2 window patterns until **MENU** is pressed. These sequences are designed to allow a calibrator using a colorimeter to adjust the RGB gains and bias settings at 30% (or 20%) and 80% to achieve the desired color temperature (i.e. D65) at these levels. This is often the starting point for setting a grayscale by getting the "curve" in the ballpark at these 2 levels before doing a full grayscale test/adjustment.

Press NEXT to advance and loop between the 2 gray window patterns, MENU to exit the repeating sequence to the menu.

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10% Gray Windows: This is a sequence of gray windows in 10% amplitude increments. The sequence starts with an informational window telling the user the next pattern will be a black (0% level 16) window pattern (blown up, left). This information window includes a sample window area showing the boundaries of the upcoming window pattern. The sample window area is shown to assist in the placement of a colorimeter instrument prior to the start of the first actual pattern, which is dark, making placement difficult. This sequence is designed for a rough grayscale measurement run. Note that the 10% sequence ends with a 75% Gray window pattern. This 75% pattern matches the amplitude level of color window patterns and is useful in some software applications that ask for a 75% measurement at the end of a grayscale run (e.g. *il Pro DCS*).

Press NEXT to move to the next pattern, PREVIOUS to back up, MENU to return to the menu.

5% Gray Windows: The 5% sequence is identical to the 10% sequence except it is in 5% amplitude increments from 0% to 100%. The 5% step gray windows are designed for a finer granulation grayscale measurement.

Press NEXT to move to the next pattern, PREVIOUS to back up, MENU to return to the menu.



5% Gray Auto Windows: Similar to the standard 5% Gray Window sequence. Unlike the standard 5% sequence, this "automatic" sequence shows each pattern for 5 seconds, provides a 1000Hz tone, waits 1 second, and then advances to the next pattern. This sequence will work with colorimeter software such as the Progressive Labs CA-6X, which will "listen" for the tones and completely automate the grayscale measurement process. The extra 1-second after the tone is to

allow a human to have the reflex time to manually take a measurement with a non-automatic colorimeter. This allows a semi-automatic run for software that does not auto-measure by tones. This pattern starts with a similar informational screen including a sample window boundary, and a message that says the sequence is ready to start. Once the user presses **NEXT** on that screen, the gray window pattern display starts at 0% amplitude and continues in increments of 5% to 100%.



If the display has an auto iris or auto gain function, consult the manufacturers documentation or other reliable sources for proper iris settings when calibrating this type device. Windowed patterns like those on this DVD may present limitations in calibration of devices with auto-irises (Dynamic Iris = DI) enabled. Future revisions may include additional gray level test patterns to facilitate detailed calibration of DI enabled displays. These will be added if the requisite patterns can be defined and their use properly specified.

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10% Full Field Gray Patterns: These Full field patterns are provided for the sake of completeness and should only be used when a specific need dictates their use (e.g. instrumentation requirement, dynamic iris calibration, etc.). These patterns should be used with care, since they can result in false information due to room reflections or possible errors due to device limitations. The amount of light from the screen, or display surface, that can reflect off the room walls increases directly as the APL (average picture level) increases. These reflections will impact the apparent brightness of the image and could contaminate any measurements that are made, causing an incorrect colorimeter reading.



The patterns are a sequence of gray windows in 10% amplitude increments from 0% to 100%. The sequence starts with an informational window telling the user the next pattern will be a 0% gray (**reference black**) window pattern (at left). A colorimeter instrument may be centered on the image prior to the start of the first actual pattern.

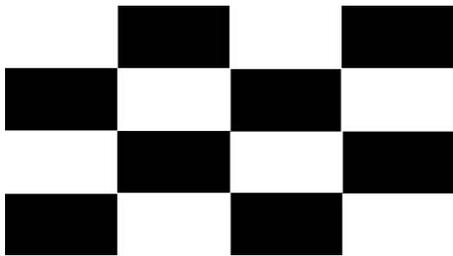


Each window is labeled above and below with the % amplitude of gray it represents and the actual digital level used to produce the gray pattern (shown left). The percentages represent % amplitude, or the % intensity above reference black, where reference black is 0% and reference white is 100%.

Press NEXT to move to the next pattern, PREVIOUS to back up, MENU to return to the menu.

Contrast Measurements

The last 4 items on the Gray Patterns menu are designed to measure ANSI Contrast Ratio, On-Off Contrast Ratio, and Lumen output. Each of these measurements requires a light meter. See *Appendix A* for possible light meters suitable for this measurement. These measurements are often used in publicized reviews and one may want to know how a device compares in both contrast ratio and measured light output. Advanced users often quote these 2 items as a criterion to decide on upgrades so the tools are provided here to enable proper measurement.



ANSI Contrast: ANSI contrast refers to a specific method used to measure a displays contrast performance when light and dark material is on the screen at the same time. "ANSI contrast" is an item often used to describe a display's performance. The patterns necessary to measure ANSI contrast are included here. There are 2 checkerboard patterns; one is an inverse of the other (it is white where the complimentary pattern is black).

To measure standard ANSI contrast, use a light meter and take a measurement in the center of all 16 "boxes" of the pattern. Add the white measurements together for total white and divide by 8 to get the average white level. Do the same with the black measurements, to get the average black level. Divide average white by average black to get the ANSI contrast ratio. You can use either of the 2 checkerboard patterns for this measurement.

A well-respected technical reviewer for a popular home theater publication uses a method he refers to as the "**Modified ANSI Contrast Ratio**". The reasons for this method have to do with reducing room interactions with the measurement among other things, the details of which are beyond the scope of this document. For this method, you will need both checkerboard patterns. For this method, ONLY the inner 4 squares are used on each checkerboard pattern. On checkerboard #1, measure and record the 2 inner white and 2 inner black squares. Use **NEXT** to advance to Checkerboard #2. On checkerboard #2, measure and record the 2 inner white and 2 inner black squares. As in the ANSI method, average the white measurements, average the black measurements, and divide average white by average black to get the "modified ANSI contrast ratio".

Press NEXT to move to the next pattern, PREVIOUS to back up, MENU to return to the menu.

ON-OFF Contrast ratio: Another measurement of contrast ratio is the On-Off ratio. This is the measurement of the ratio between a full black screen and a full white screen. This Contrast Ratio is typically higher than the ANSI contrast ratio (dark and light being displayed at the same time). One may choose to use the ANSI measurement method (measuring at several locations on the screen) to get an ANSI style On-Off, or a simple On-Off by measuring black and white at the screen center. The patterns used for ON-OFF measurement are the Maximum Black and Maximum White patterns.

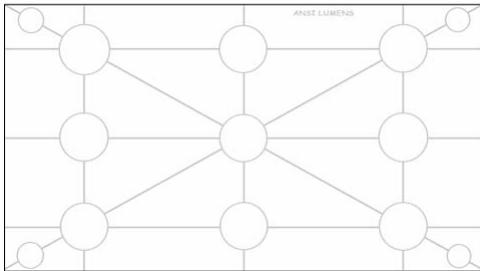
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Maximum Black and Maximum White: These 2 patterns are unlabeled full field black and white patterns. These patterns are encoded as black (digital R=G=B=1) and white (digital R=G=B=254), well below **reference black**, and well above **reference white**, thus their names "Maximum". These patterns are designed for use as the black and white patterns to measure the On-Off contrast ratio as previously described.



The "Maximum Black" and "Maximum White" patterns are encoded as digital levels 1 and 254 respectively. This is intentional. The author's opinion is that, for contrast ratios, one is interested in the absolute maximum black and white a display can obtain, the minimums and maximums. The display should be adjusted and calibrated prior to this measurement for accurate results. If a calibrator had adjusted a display to show some "below black" information, and the Max Black pattern was at digital 16 (reference black), then the test image displayed would not be as black as possible. Similarly, if the calibrator set the display to show some "above white" information, and the test pattern was at digital 235 (reference white), instead of 254, the image displayed would not be as bright as possible. If the display's Contrast and Brightness are set so no above-white or below-black information is displayed, these patterns will produce images on the display that will be no different than a reference black (level 16) and/or reference white (level 235) pattern. If the display is set to allow some below black and/or some above white material, then these "maximum level" patterns will account for that and the measurement will reflect the true On-Off (maximum/minimum) Contrast Ratio, as calibrated.

Press PREVIOUS to back up, NEXT or MENU to return to the menu.



ANSI Lumens: ANSI Lumens is the measurement of the average lumen output of a device measured in specific locations across the display's screen. This measurement requires a light meter. An ANSI Lumen pattern is provided. This pattern is meant for locating only. It has circles drawn in the locations where measurements are to be taken. The actual measurements are done on the maximum white pattern.

Use the ANSI Lumen pattern to position the light meter's sensor. Forward to the full white pattern and take a measurement. Back up to the ANSI Lumen pattern and reposition. Repeat until all measurements are taken. Average the measurements to arrive at the ANSI Lumen value. For a quick test, the locating pattern itself may be used for measuring if the light reading sensor will fit completely in the circle. The ANSI Lumens pattern's background is encoded as **maximum white**, digital 254.

Press NEXT to move to the next pattern, PREVIOUS to back up, MENU to return to the menu.

Color Patterns

The **Color Patterns** menu provides access to each color pattern. These tests are used to set the Color adjustment (Saturation), and Tint adjustment (Hue) of your display.

The first 4 items in the Color Patterns menu are linked in a single sequence. You can access them directly from the menu, OR you can use the **NEXT** button to advance from "Color & Tint" through "Y/C delay"



The "75% Windows" and "100% Windows" patterns, at the end of the menu, are separate sequences.



Color & Tint: The Color and Tint test pattern is the basic pattern to set a display's Color (also called Saturation) and Tint (also called Hue). This is a variation of the ubiquitous SMPTE style colorbar patterns which can be more difficult to use for this purpose. This pattern's color elements are at 75% amplitude on a maximum Black background

To use the Color and Tint Pattern, you must block all colors except blue when viewing the pattern. This is usually accomplished by viewing the display through a blue filter¹. Alternatively, one may be able to turn off all color output except blue².

 ¹ **Blue Filter** See *Appendix A* **for How and where to obtain suitable Blue Filters**

 ² Advanced scalers and some display devices allow the calibrator to "cut" or **turn off all colors except blue**. The Lumagen HDP is an example of such a device. Turning off all color channels except Blue is a superior method and is in lieu of using a filter. Unplugging the "blue" cable from a component cable set **does not** cut blue and will NOT work.

To adjust, locate the display's "Color" or "Saturation" control. While looking through the blue filter (or with only blue displayed), look at the parts of the pattern that are blue and white, adjust the Color control so the levels of the blue area and the levels of the white area look the same. The blinking part of the blue and white animated pattern will be difficult to see when adjusted perfectly. Many displays will not adjust perfectly, and for those, one should adjust until the levels are as close as possible.

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One tip for performing a Color and Tint adjustment is non-glasses wearers can use reading glasses to "blur" the image while looking through the filter. Or glasses wearers can remove their glasses. The point is to blur the image making it easier for many to see when the white and blue areas are closest.

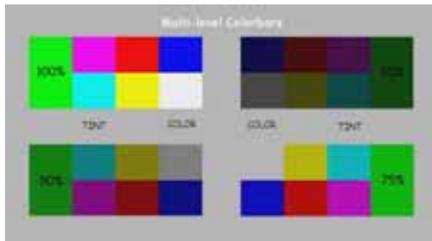
Locate the displays "Tint" or "Hue" control. Similar to the Color adjustment, look at the Magenta/Cyan portions of the "Color & Tint" pattern and adjust the Tint so the Magenta and Cyan areas appear to be the same level.

Like the Brightness and Contrast adjustments, repeat the Color and Tint adjustments until both are as close as possible. One may affect the other.



The **Color & Tint** adjustments are interactive but should not affect the gray scale performance. On the other hand the grayscale adjustments can sometimes affect color settings. Because of this, it is generally recommended gray scale adjustment be made prior to Color and Tint. Or repeat Color and Tint after Grayscale adjustments.

Press NEXT to move to the next pattern, PREVIOUS to back up, MENU to return to the menu.

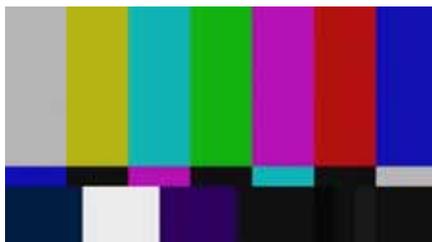


Multi-Level Color Bars: The Multi-level colorbar pattern includes the primary and secondary colors arranged in pairs. This pattern is also designed for viewing through filters or with colors "turned off". Some devices color-decoders work well at 75% levels but are inaccurate at other levels. The multi-level colorbar pattern can be used to adjust devices color and tint to the best levels through each range of

luminance, balancing the error so it as equal as possible across the range.

Most calibrators do not use this pattern for adjustment. It is included here primarily as a check to see if the color decoder performance is correct across different amplitude levels.

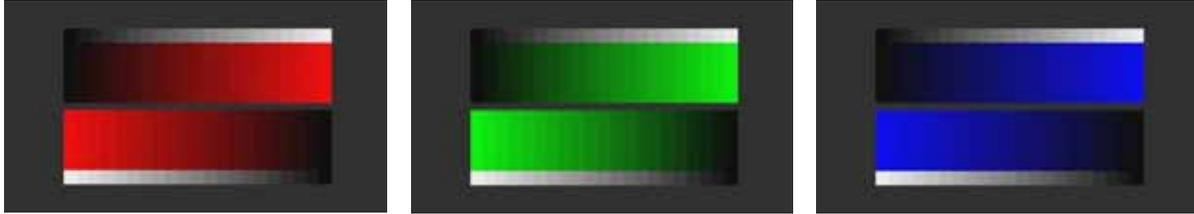
Press NEXT to move to the next pattern, PREVIOUS to back up, MENU to return to the menu.



SMPTE Style Color Bars: The SMPTE style Color Bars are included on this DVD for completeness. Many calibrators are used to this ubiquitous pattern and it's arrangement since it is old and exists on virtually every calibration pattern set. Some highly experienced calibrators claim the ability to adjust colors by sight on this pattern. Experienced calibrators used to seeing the "correct" colors on this pattern can often tell if a displays colors "look" correct at a glance.

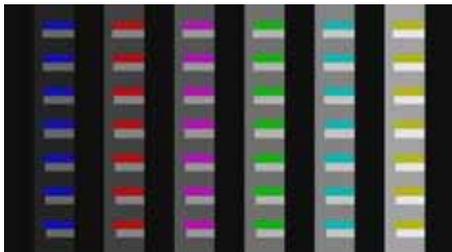
Press NEXT to move to the next pattern, PREVIOUS to back up, MENU to return to the menu.

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Color Ramps: The Color Ramps can be used to verify the linearity of the display's color performance and to check for RGB clipping. Bulb based displays often "run out" of a particular color (e.g. red). This will be reflected in a color ramp where the upper ends of the ramp blend together and don't show individual bars. The Color Ramps also include a corresponding gray scale ramp for comparison. The color ramp's bars are in 5% steps from 0% to 100% amplitude.

Press **NEXT** to move to the next pattern, **PREVIOUS** to back up, **MENU** to return to the menu.



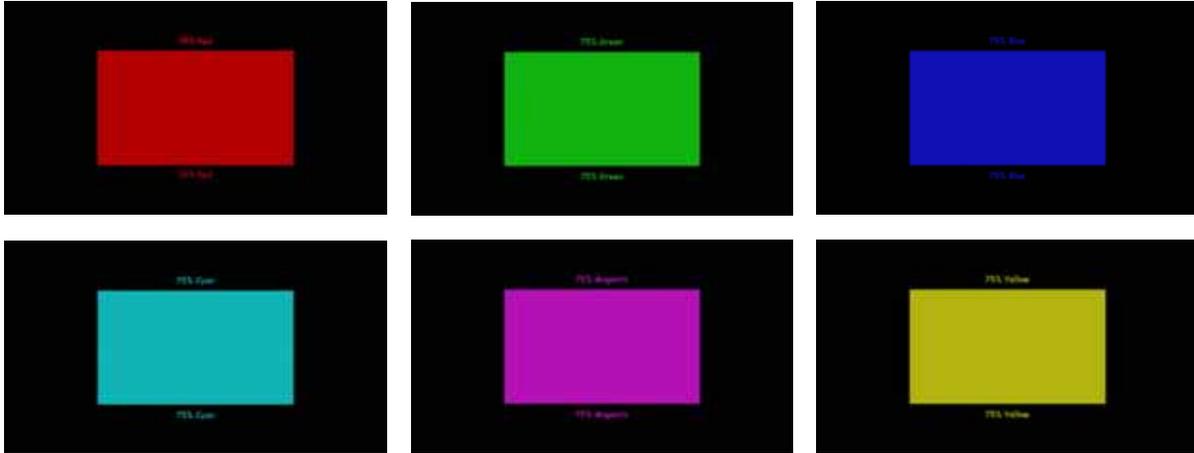
Y/C Delay: The Y/C Delay test pattern has six columns of 7 rows of color/gray bars. The color bars have a variable horizontal shift from their corresponding gray bars. In the middle row (row 4) the color and gray bars should be perfectly lined up. If your display shows the color/gray lined up in another row, then it is exhibiting Y/C delay. Some displays, scalars, or DVD players provide user level access to the Y/C delay adjustment. For devices that allow this adjustment, use this pattern to correct any Y/C delay by aligning the color bar on row 4 (middle row).



Some display's Y/C delay adjustment (if any) could be located in the service menu area. Only qualified service personnel should access the service menu area. Also, a one-pixel, or less, error is usually not adjustable on your display or with your equipment (if you are using an external scaler/de-interlacer).

Press **NEXT** or **MENU** to return to the menu.

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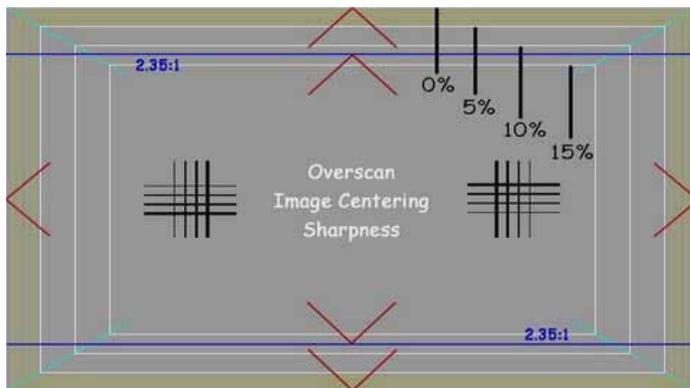


75% and 100% Color Windows (75% Pictured above): The Color windows are 6 window patterns with the complete set of primary colors (Red, Green, Blue) and secondary colors (Cyan, Magenta, and Yellow) at 75% (and 100%) amplitude levels. These are provided to allow measurement of these primary and secondary colors using a colorimeter. For displays that allow primary color adjustments, these patterns are suitable for that adjustment using a properly calibrated colorimeter instrument. Like the gray windows patterns, the color patterns are "window" patterns to minimize room reflection interactions and to prevent overdriving video circuits. Full screen windows have high APL (average picture level), which can over-drive some display electronics. Similarly, 100% patterns can be affected from limits in electronics or from limits in bulb based devices. It is recommended 75% amplitude patterns be used for adjustments, but 100% patterns are provided for completeness.

While using the Color Window Patterns, press NEXT to move to the next pattern, PREVIOUS to back up, MENU to return to the menu. NEXT on the last pattern will return you to the Color Menu.

Miscellaneous Patterns

The **Miscellaneous Patterns** menu selection contains the rest of the test patterns that don't fit in the other test group categories. These tests include patterns useful for checking the overall accuracy and some general performance characteristics of your display.



Alignment/Overscan/Sharpness: This screen is designed to allow the user to do several adjustments. One purpose is to adjust the alignment of a projector to its screen. Projectors, scalers and other devices allow the adjustment of the image position and size relative to the display screen. This pattern includes border outlines and red chevrons to assist in setting the screen size and centering the material in the display. The native

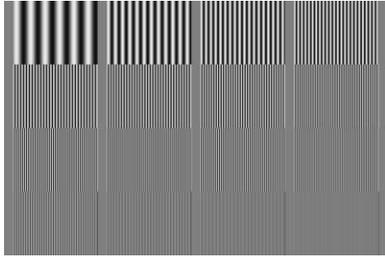
aspect for this test pattern is 16:9 however since the screen border indicators are percentages this pattern may be used on a 4:3 aspect display IF the display is set to fill the entire screen with the DVD material (no letterbox/pillar-box bars). Typically, modern, digital displays have very little overscan or image cropping. The DVD does however provide overscan indicator outlines for 5%, 10% and 15%. There are also 1% through 4% subdivisions (yellow outlines), which are more useful with modern displays. Use the chevrons (dark red) for quick image centering adjustments. For displays or scalers that provide an adjustable anamorphic stretch mode, the inner "2.35:1" lines (in blue) and 2.35:1 chevrons may be used while in anamorphic stretch mode to align and adjust that type of material.

This pattern also includes a pair of hatch patterns to adjust a display's sharpness setting. Sharpness should be set so the vertical lines do not display any "ringing". Ringing may look like faint lines that form on the edges or between the black bars. Setting sharpness too low may make the black bars look blurry.

 Edge enhancement (if recorded on the DVD) has a similar appearance and can also be reduced with the Sharpness control (or by activating a NR control, if available). There is no edge enhancement in the GetGray DVD patterns.

Press MENU to return to the menu.

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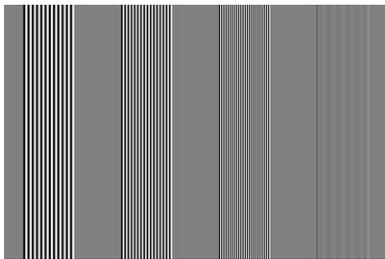


Frequency Bursts: Frequency bursts are designed for use with scopes but they can also be used to inspect the resolution of your display. Note that these patterns are encoded in a 4:3 aspect ratio but may display as 16:9 depending on how your display or DVD player responds to the aspect ratio flags. They may not look correct if displayed as 16:9. The first burst pattern consists of 16 patterns that are sine waves in the following sequence:

Row 1 = 0.5 MHz, 1.0 MHz, 1.5 MHz, 2.0 MHz,
Row 2 = 2.5 MHz, 2.75 MHz, 3.0 MHz, 3.25 MHz,
Row 3 = 3.5 MHz, 3.75 MHz, 4.0 MHz, 4.2 MHz,
Row 4 = 4.4 MHz, 5.0 MHz, 5.5 MHz, 6.0 MHz.

This pattern may be used to verify or check sharpness. Apparent color changes in the 16 areas of this pattern should be smooth and consistent. The horizontal transition between the different frequency groups (i.e. between 4.2MHz and 6.0MHz) should be well defined and not look like a checkerboard at the edge.

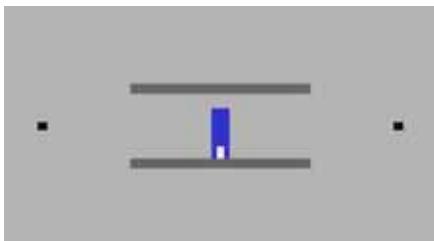
Press NEXT to advance to the second frequency burst or MENU to return to menu



The second burst pattern consists of square waves at 1.6875 MHz, 2.25 MHz, 3.375 MHz, and 6.75 MHz. Also encoded in a 4:3 aspect ratio, and should be displayed as 4:3.

These patterns can also be used to check the sharpness control; there should be no ringing or edge effects on these patterns. The right hand lines of the second (6.75 MHz square waves) lines should be clear, sharp, and well defined also, since the signals are well within the bandwidth capability of high quality digital video.

Press NEXT to return to the menu or BACK to return to the previous pattern.

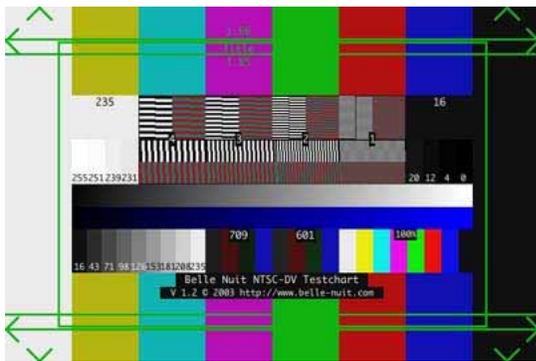


Lip-Sync: Modern high-resolution digital video devices have a lot of work to do before displaying an image. Before displaying the video material, they may have to deinterlace it, scale it, and process it for noise reduction. Meanwhile the audio is delivered digitally to the AV equipment without any additional processing or delay. Depending on the equipment this often causes the video to lag the audio by small amounts (milli-seconds). Some end-users are more sensitive to this than others. It is usually noticed when people on video are speaking and their mouth movements do not coincide with the sound of their voice, thus the name lip-sync. Many modern AV receivers, processors, and even stand-alone devices now provide a control to add an adjustable delay, to the audio, to enable the user to "sync" the audio by delaying it by the same amount the video is getting delayed by the video processing circuits. This can be difficult to sense and adjust using normal moving video

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material. This pattern is designed to allow the adjustment of the lip-sync adjustment more easily by providing a clear pattern with a predictable interval. The blue bar moves up and down and when the moving blue bar touches a gray bar a "click" is sounded. This click should happen at the instant the bars touch. If it does not, use the lip-sync adjustment of the AV device (if available) to adjust the audio delay. In addition to the blue bar moving and touching, two other things happen at the instant of touch to aid in detecting the correct moment for the click: 1) the tip of the blue bar will blink white as shown in the sample frame above. The only video frame that contains the white tip is the one that is touching the bar. 2) Simultaneously, two black "dots" blink on each side of the screen. Once the adjustment is close, one can concentrate on the two dots to verify the click is in sync with their blink. This pattern is encoded at a 16:9 aspect ratio.

Press NEXT or MENU to return to the menu



Belle-Nuit General Purpose pattern: This excellent general-purpose test pattern is used here with permission of the author. This pattern was designed for use with a waveform scope but it contains a great deal of information including color, grayscale, above white and below black information, gray ramps, etc. It has resolution patches at markers 4 through 1, in order of increasing vertical resolution. On a typical HD monitor with good quality deinterlacing, you should be able to see all of the resolution patches

with clear detail. If the entire video device chain is set up properly, and is displaying the full resolution, then there should be no blur or flickering in these areas.

Overscan lines & arrowheads are also included on this pattern. This pattern is flagged for 4:3 aspect ratio; since that is the format it was authored in. It may or may not display correctly in 16:9 depending on the DVD player or display settings.

Press NEXT or MENU to return to the menu

Disc Information and Credits

The final item accessed from the main menu is the disc information. This is a set of 4 windows with information including how, why, and where to get a legal version of the DVD. It also includes a list of people who helped make this disc either directly or indirectly. Advance through these 4 windows using the DVD NEXT key.

Appendix A - Resources

Blue filters & filter sets: Blue filters are available from a variety of sources. Listed below are several options as of the writing of this document:

1. **THX[®] glasses. Highly recommended.** THX[®] offers a pair of blue "glasses" for use with their consumer DVDs. These glasses are produced in cardboard glasses form like those provided with 3-D movies. These work very well since you can wear them, completely freeing your hands. These glasses are available by ordering directly from the THX[®] website (Contact THX[®] or see the DVD->THX Optimizer[®] section at www.thx.com). "Free" plus shipping and handling charges.

2. Photographic quality **Deep Blue Tricolor 47B** filters:

a. 3x3", #LEB47B3 from www.adorama.com

b. 3x3", #LE47B33 from www.bhphotovideo.com ~\$15.00

3. Other calibration discs may include a Blue Filter. Those filters are of course suitable for use with any calibration disc, including this one. Filters or replacement filters may be available for users of Videoessential's Digital Video Essentials[®] products or Ovation Multimedia's Avia[®] Products for a small mailing charge. Check their websites for details.

4. Lee Filters. These are films using in the theatrical lighting industry and are usually available at a local stage or theater supply shop. The proper Lee Filter colors are::

Tokyo Blue = #071

Primary Red = #106

Primary Green = #139

The Lee Filter Tokyo Blue, #071, filter is identical to the blue filters used in the THX[®] glasses

5. From the author. The GetGray DVD author may have sets of Lee filters available. See the website for details.

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Light Meters:

AEMC CA813 (technician-hobbyist level) ~\$160 (www.aemc.com) www.repaircalibration.com

Minolta T10 Illuminance Meter (Professional) ~\$900 www.konicaminolta.com

Minolta LS-100 (Professional) ~\$3200 www.konicaminolta.com

LightSpex and Photo Research \$Very, very expensive

Colorimeter Equipment

Progressive Labs: CA-6X also sold as Ovation Multimedia's Optic One

www.progressivelabs.net

Datacolor: *Colorfacts* and *Spyder* www.datacolor.com

Accucal: *i1 Pro DCS* (interfaces with *Gretag McBeth EyeOne Pro*) www.accucal.com

Calman: Bill Blackwells excellent and affordable software interface to the economical Spyder2 colorimeter. www.calman.tv

Video Processing and Display Performance Testing: HQV Benchmark DVD by Silicon Optix. HIGHLY RECOMMENDED – www.hqv.com. The GetGray DVD does not include Display performance testing patterns by design. A superior disc for objective video processing logic quality testing including deinterlacing and scaling testing is the HQV Benchmark DVD. This is an inexpensive disc and includes a variety of tests including a "scorecard". Each test is explained for what to look for as good or bad to assist in "scoring" a display.

Audio Calibration: The Get Gray DVD does not have an audio calibration section. The author recommends an inexpensive commercial disc dedicated to audio calibration, and put together by Rives Audio, a company that specializes in this task. Visit: www.rivesaudio.com for information. The Rives Audio Test CD is an audio calibration disc designed and calibrated for use with the inexpensive Radio Shack Sound Pressure Level meter. The CD has tones adjusted specifically to that inexpensive instruments behavior. The home theater calibrator will obtain superior results when performing an audio calibration using the Rives Audio CD.

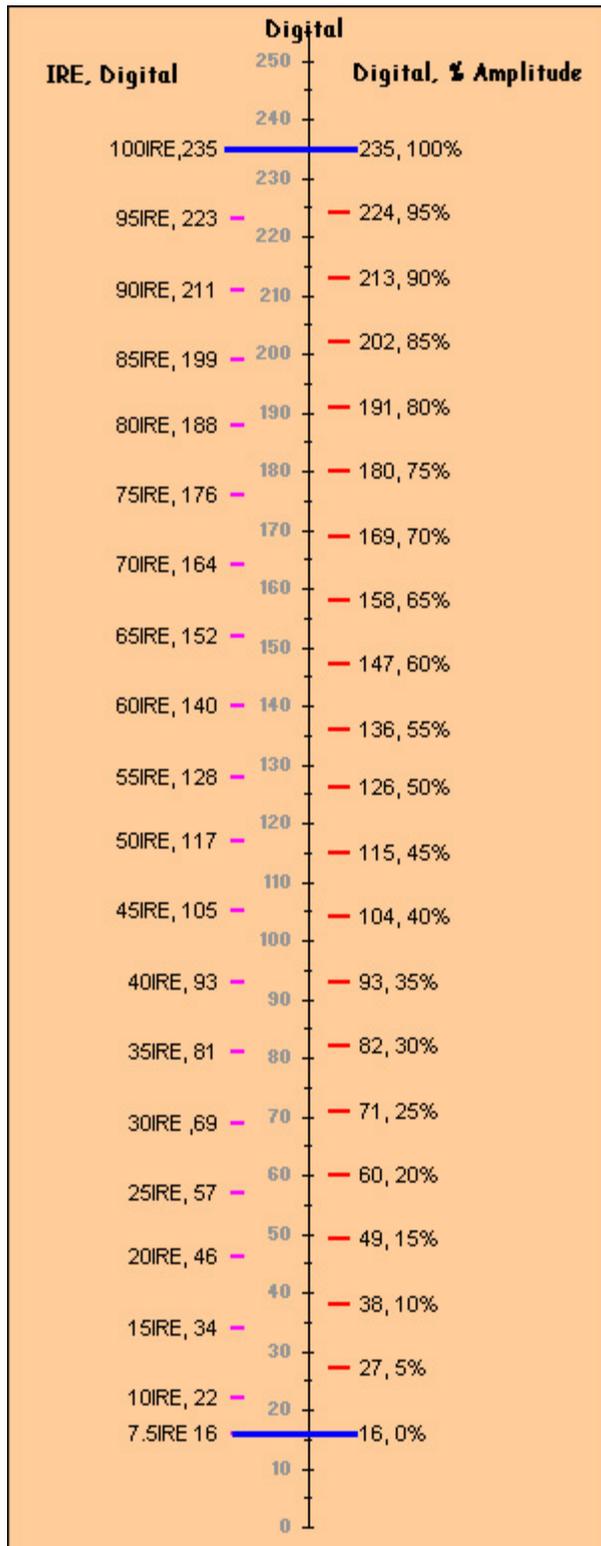
Supporting Internet Forums or Links:

AVS Forum (Audio Video Science Forum) www.avforums.com (Calibration sub-forum)

GetGray DVD home Page www.calibrate.tv

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Appendix B - Gray Pattern % Amplitude vs. IRE



The GetGray DVD provides gray patterns in units of % amplitude. This is the same as provided by signal generators like the popular Accupel.

Sometimes IRE and % amplitude are used interchangeably, which can be incorrect. While they are similar, they are usually not the same. They are both used to measure or represent the luminance or brightness of the image being displayed. It is important to set calibration software to use the correct units. Not knowing can cause calculated gamma errors. Grayscale calibration will be unaffected. IRE can have what is called “setup” or not. If it has setup, 7.5IRE is the brightness of Reference Black. In this case, 7.5IRE and 0% amplitude are equal.

The chart on the left lists the relationship between digital levels, % amplitude, and IRE (with setup). The left column lists IRE in 5IRE steps starting with 7.5IRE (reference black) along with the corresponding digital level. The center column is the digital RGB level. The right column shows % Amplitude in 5% steps along with the corresponding digital level.

From this chart, one can see, particularly at lower levels, IRE is very different in brightness from the same % amplitude value. As each approaches reference white (235) their actual brightness gets closer. For example, 30IRE is very different in brightness from 30% Amplitude. 30IRE is digital 69 where 30% amplitude is digital 82, a significantly brighter gray. So 30IRE is **not equal** to 30%.

IF IRE has no setup, 0IRE is reference black, and IRE and % Amplitude coincide. But this is not the norm, IRE usually includes setup.

The setup, rational for use, and the basis of the IRE scale is beyond the scope of this document.